

Jeep®

Wrangler/YJ

Workshop manual

M.R.280

BODYWORK



**AUTHENTIC
RESTORATION™
PRODUCT**

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MARCH, 1986

U.S.A./Canada Edition

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RECORDING I.S. NOTES

Ruled boxes for recording pertinent I.S. Notes and other service information are provided along the outer edge of each page in the manual. The filing instructions at the end of each I.S. Note specify the page an I.S. Note is to be recorded on. This provides a convenient reference to service updates and/or revisions affecting the information on the page.

SPECIAL TOOLS

Special tools needed for the service operations described in this manual are listed at the beginning of each chapter. The tools are also listed in the appropriate section of each chapter.

WIRING DIAGRAMS

Wiring diagrams are printed separately and should be filed in the pocket at the back of the

plastic binder. The diagrams provide the location of electrical components on the vehicle and how they are connected and/or wired.

SAFETY NOTES

Cautions and Warnings are used throughout this manual. They relate to critical operations involving personal safety or potential component damage. Cautions are used whenever component damage could occur if service procedures are not followed. Warnings are used when procedures must be followed explicitly for personal safety. Use extreme care and adhere to stated procedures when involved in such operations.

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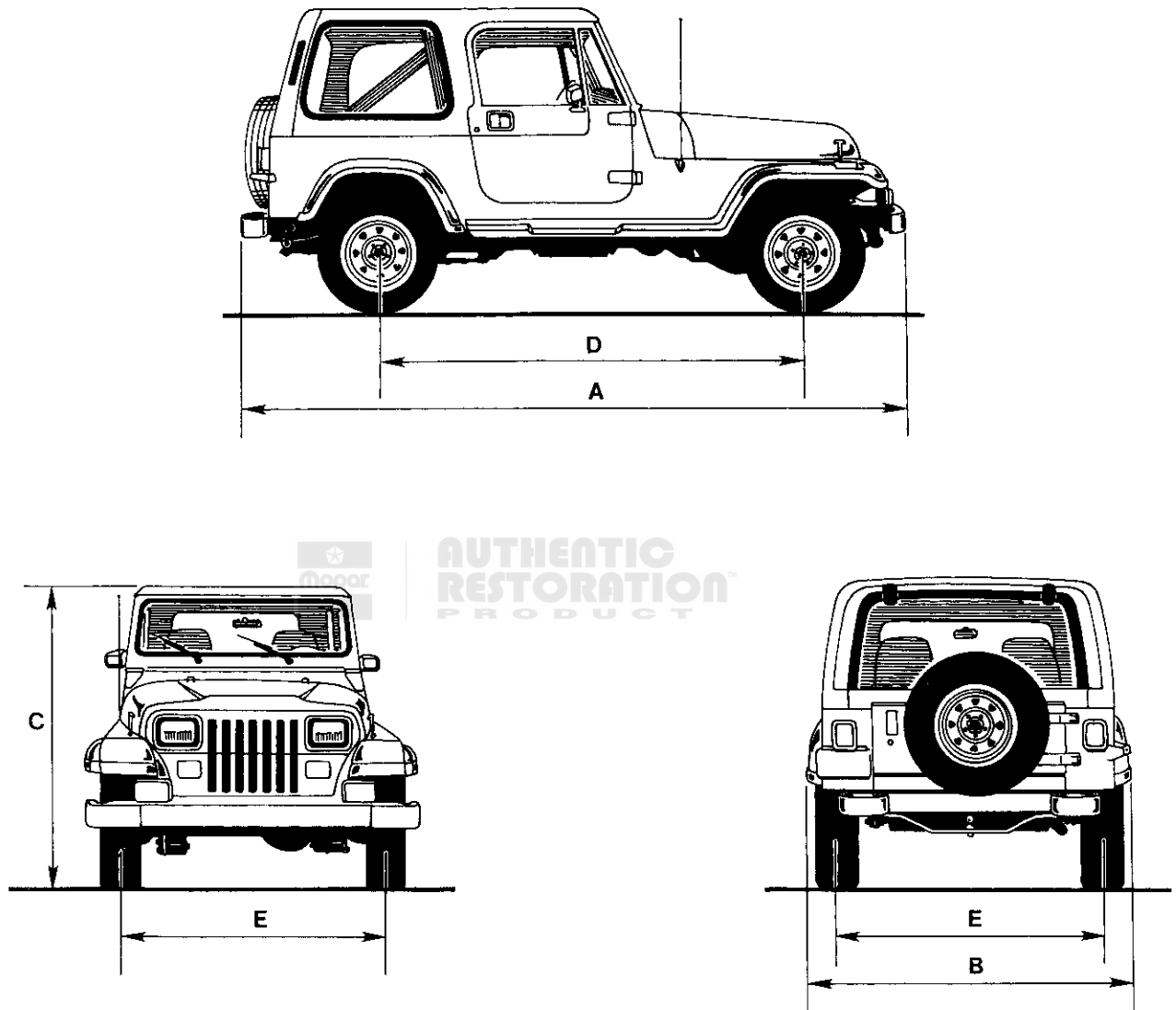
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	GENERAL SPECIFICATIONS	
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DIMENSIONS



A	Overall length with Polyspare with Conventional Spare	386 cm (152 in.) 388.9 cm (153 in.)
B	Overall width	167.6 cm (66 in.)
C	Overall height (empty)	
	Open Body	172.7 cm (68 in.)
	Soft Top	N/A
D	Hard Top	175.2 cm (69 in.)
D	Wheelbase	237 cm (93.4 in.)
E	Front/Rear track	147.3 cm (58 in.)

	GENERAL SPECIFICATIONS	
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DIMENSIONS (CONTD.)

Head Room (Hard Top):

Driver front seat..... 102.1 cm (40.2 in.)
 Passenger front seat..... 101.6 cm (40.0 in.)
 Rear seat..... 102.9 cm (40.5 in.)

Leg Room:

Driver front seat..... 100.3 cm (39.5 in.)
 Passenger front seat..... 100.6 cm (39.6 in.)
 Rear seat..... 88.9 cm (35.0 in.)

Shoulder Room:

Front 134.8 cm (53.1 in.)
 Rear 143.0 cm (56.3 in.)

Hip Room:

Front 134.8 cm (53.1 in.)
 Rear 91.4 cm (36.0 in.)

Usable Cargo Volume:

Rear seat folded
 1.2 cubic meters (43.2 cubic feet)
 Rear seat removed
 1.5 cubic meters (53.4 cubic feet)
 Rear cargo area
 0.35 cubic meters (12.5 cubic feet)

Ground Clearance:

Rear axle to ground * 20.8 cm (8.18 in.)
 (running clearance)

Skid plate to ground * 24.0 cm (9.45 in.)
 (minimum running clearance)

* With P215/75R15 tires.

Wheelbase: 237.2 cm (93.4 in.)

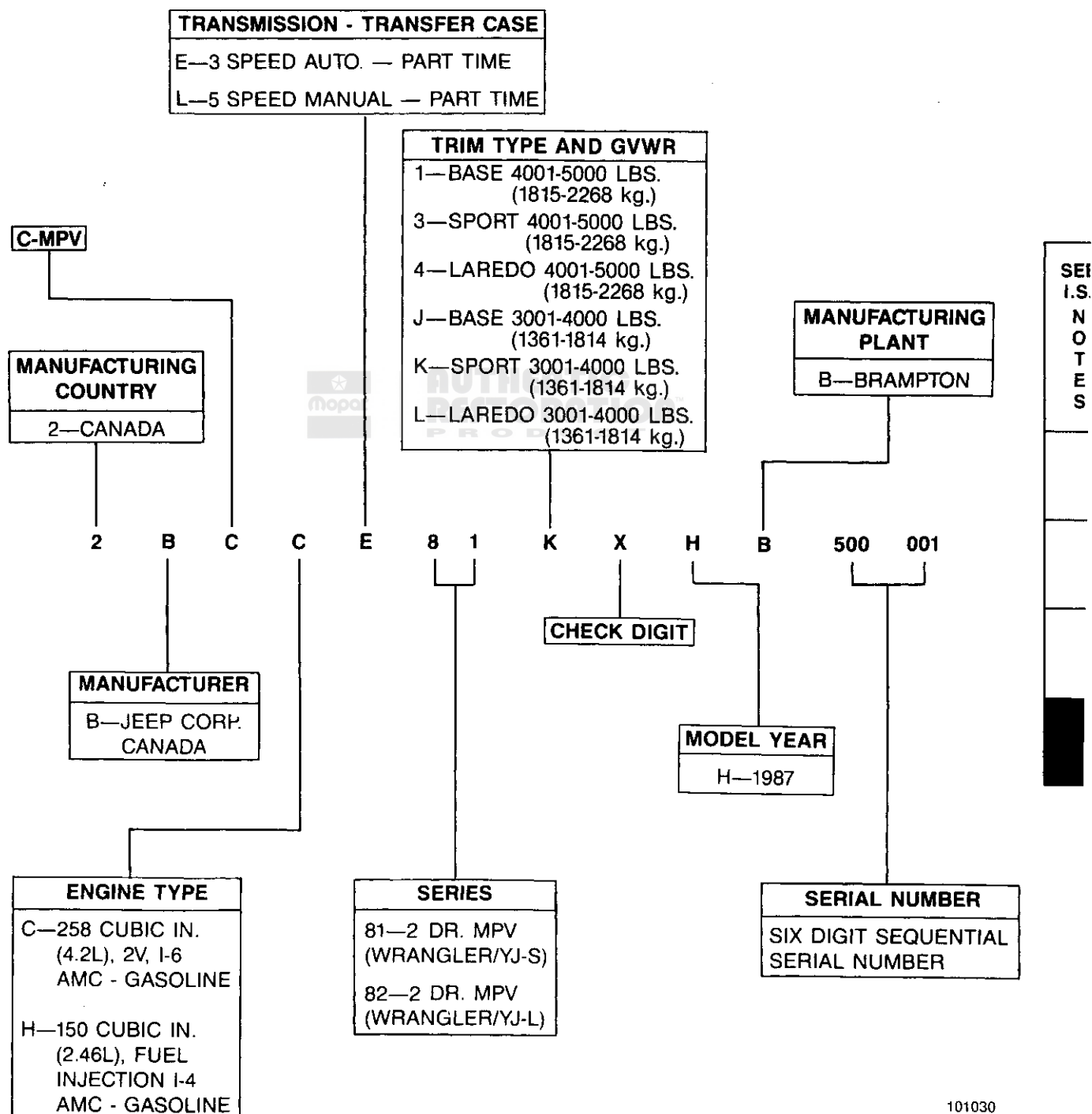
Maximum GVWR ... 1882 kilograms (4150 lbs.)

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	GENERAL SPECIFICATIONS	
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VEHICLE IDENTIFICATION NUMBER (VIN)

The vehicle identification number (VIN) is located on the left side of the instrument panel at the base of the windshield. The VIN chart explains the code characters.



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	GENERAL SPECIFICATIONS	
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SAFETY CERTIFICATION LABEL

A safety certification label is attached to all Wrangler/YJ models. The label indicates that the vehicle conforms to Federal motor vehicle safety certification standards. The label is located on the driver door pillar.

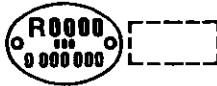
 MFD. BY JEEP CORPORATION		DATE	THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE
GVWR.	WITH RIMS AT	TIRES	
GAWR. FRT.	WITH RIMS AT	P.S.I. COLD TIRES	
GAWR. RP		P.S.I. COLD	
VEHICLE IDENTIFICATION NUMBER			TYPE
			SF5363927

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	GENERAL SPECIFICATIONS	
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VEHICLE IDENTIFICATION PLATE

The metal identification plate is attached to the radiator support. The plate displays the VIN, paint code, trim code, fabrication sequence number, and vehicle equipment code (e.g. 49-State, Canada, California, high altitude).

POWERTRAIN AVAILABILITY

SERIES	ENGINE	TRANSMISSION	TRANSFER CASE	AXLE RATIO (STD./OPT.)
80 (Wrangler/YJ)	2.46L (150 cu.in.) In Line 4-Cyl.	5-SPD. MAN.	207	4.10
	4.2L (258 cu.in.) In Line 6-Cyl.	5-SPD. MAN. 3-SPD. AUTO.	207	3.08/3.55

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	GENERAL SPECIFICATIONS	
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FUEL-FLUIDS-LUBRICANTS

Engine	I-4-1V 2.46 liter (150 cu. in.) I-6-2V 4.2 liter (258 cu. in.)	API "SF" Classification 10W-30, 10W-40, 20W-40 Above $\pm 32^{\circ}\text{F}$ (0°C) 10W-30, 10W-40 Above 0°F (-18°C) 5W-30* Below 0°F (-18°C) *Must not be used above 60°F (15.5°C)
Oil Filter	I-4 2.46L I-6 4.2L	Metric thread M20 x 1.5 P/N 8933 003 509
Transmission	999 Auto BA10/5 Man. AX 5 Man.	Use AMC/Jeep/Renault automatic transmission fluid or equivalent Dexron® II fluid. Use AMC/Jeep/Renault gear lubricant, or equivalent 75W-90 (API GL-5) lubricant.
Transfer Case	207	Use only AMC/Jeep/Renault automatic transmission fluid or equivalent Dexron® II fluid.
Axle	Front/Rear	Use AMC/Jeep/Renault gear lubricant or equivalent SAE 75W-90, API GL-5 quality gear lubricant.
Brake Fluid	All 	Use AMC/Jeep/Renault brake fluid or equivalent identified as FMVSS 116 DOT-3 and SAE J-17034. CAUTION: Use recommended brake fluid only.
Engine Coolant	All	Use AMC/Jeep/Renault all season antifreeze (or equivalent ethylene glycol-based antifreeze) containing Alugard 340-2™ and clean water in a 50/50 mixture.
Fuel	All	Unleaded with AKI octane rating of at least 87.
Clutch Hydraulic Reservoir		Use AMC/Jeep/Renault brake fluid P/N 8982 200 215, or equivalent identified as FMVSS 116 DOT-3 and SAE J-1703. CAUTION: Use recommended brake fluids only.
Power Steering Pump		Use AMC/Jeep/Renault power steering fluid or equivalent.
Steering Linkage, Ball Joints, Propeller Shafts, Cardan Joints, Wheel Bearings		Use AMC/Jeep/Renault all purpose lubricant or equivalent lithium base chassis lubricant.
Parking Brake Pedal Mechanism		Use AMC/Jeep/Renault white spray grease or equivalent.
Manual Steering Gear		Use AMC/Jeep/Renault all purpose lubricant or an equivalent lithium base chassis lubricant.

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	GENERAL SPECIFICATIONS	
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FLUID CAPACITIES

Capacities (Approximate Refill)	U.S. Measure	Imperial Measure	Metric Measure
Engine Oil: 2.46 liter I-4 (with or without filter change) 4.2 liter I-6 (with or without filter change)	4.0 quarts	3.33 quarts	3.78 liters
	6.0 quarts	5.0 quarts	5.7 liters
Cooling System: (includes coolant overflow bottle) 2.46 liter I-4 4.2 liter I-6	9.0 quarts	7.5 quarts	8.5 liters
	10.5 quarts	8.7 quarts	9.9 liters
Transmission: BA10/5 Man. AX5 Man. 999 Auto.	3.5 pints	2.9 pints	1.7 liters
	7.0 pints	5.8 pints	3.3 liters
	17.0 pints	14.0 pints	8.0 liters
Transfer Case: Model 207	4.5 pints	3.74 pints	2.13 liters
Axles: Front/Rear	2.5 pints	2.1 pints	1.2 liters
Fuel Tank (approx. cap.) Standard Tank Optional Tank	15.0 gallons	12.6 gallons	57.0 liters
	20.0 gallons	16.8 gallons	75.5 liters

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	GENERAL SPECIFICATIONS	
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ADHESIVES AND SEALERS

Adhesives/Sealers/Cleaners	Purpose
Loctite 242 (Medium strength)	Prevents loosening of bolts, nuts, screws. Does not require re-application every time fasteners are loosened and tightened.
Loctite 271 (High strength)	Locks bolts, nuts, screws. Must be reapplied if fastener is loosened.
Loctite 290 or Wick n' Lock (Medium strength, penetrating)	Prevents loosening of fasteners, adjustment screws, etc. Can be applied after fastener is seated.
Loctite Superbonder	For quick bonding of non-porous materials (glass, metal, rubber, vinyl and plastics).
Permatex Gasket Remover	For removal of gaskets and cleaning gasket surfaces.
AMC/Jeep Gasket-In-A-Tube or Perfect Seal RTV Sealant	For use wherever RTV-Type sealant is specified.

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	GENERAL TOWING-BREAKDOWN RECOVERY	
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TOWING SAFETY PRECAUTIONS

Secure all loose or protruding parts of a damaged vehicle.

Lift the end of a vehicle being towed a minimum of 4-inches off the road surface. Be sure the opposite end of the vehicle also has adequate ground clearance.

Use safety chains at all times. The chains must be independent of the tow truck lifting and towing attachments.

Do not allow any portion of the lifting or towing attachments to bear against the fuel tank of the vehicle being towed.

Do not go under the vehicle after it has been raised by the lifting and towing attachments.

Do not allow anyone to ride in a vehicle being towed.

Follow all State and local laws regarding tow speeds, warning lights, and nighttime illumination.

Do not attempt a towing operation that could jeopardize the operator, bystanders, or other motorists.

Do not exceed a towing speed of 48 km/h (30 mph).

Avoid towing distances of more than 24 km (15 miles) whenever possible.

Use towing dollies or a car hauler-type wrecker whenever the vehicle is locked and the ignition key is not available. Use dollies or a hauler-type wrecker whenever transmission, transfer case or axle damage is suspected.

Never attach tow chains or a tow sling to the bumper, steering linkage, universal joints or propeller shaft.

FRONT TOWING

CAUTION: Use tow chains with T-hooks for attachment to the frame rails. Do not use J-hooks under any circumstances.

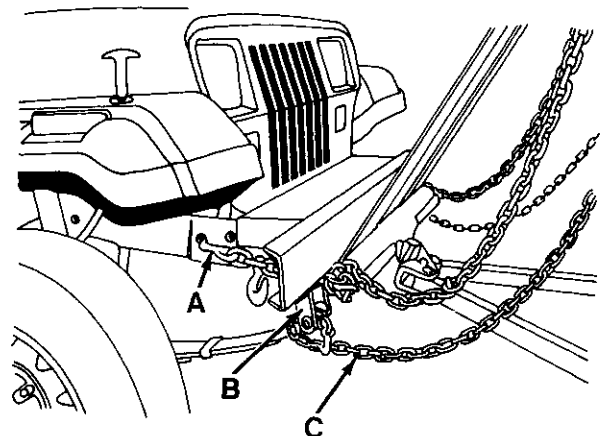
Attach the T-hooks (A) to the slots in the front end of each frame rail.

Position each chain over the top of each front spring shackle (B).

Double wrap each chain.

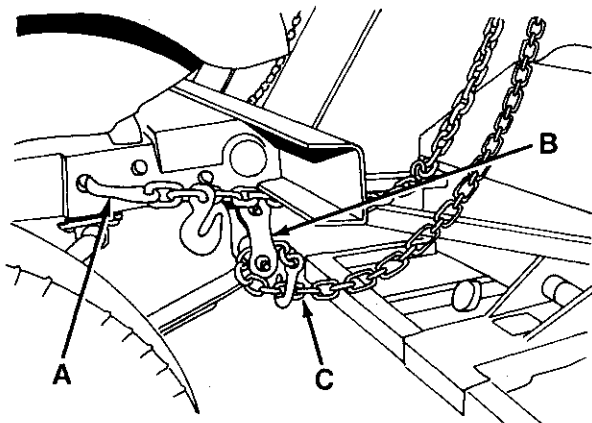
Position the tow bar under the front bumper.

Attach the safety chains (C) to the lower half of the front spring shackles.



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	GENERAL TOWING-BREAKDOWN RECOVERY	
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Shift the transmission and transfer case into Neutral.

Raise and tow the vehicle at a maximum speed of 48 km/h (30 mph). Keep towing distance under 24 km (15 miles) whenever possible.

REAR TOWING

Use wheel lift equipment only when rear towing is necessary. This is the only recommended method of rear towing Wrangler/YJ models.

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	GENERAL LIFTING METHODS	
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FLOOR JACK-SAFETY STANDS-HOIST

Normal shop lifting equipment may be used to raise and support Wrangler/YJ models during service operations.

Floor Jack-Safety Stands

Position floor jacks or safety stands under the frame rails. Place the jack or safety stand lifting pad on the frame rail just ahead of the rear spring shackle, or just behind the front spring shackle. Be sure the jack or stand is positioned on a level section of the frame rail.

CAUTION: To avoid damaging the vehicle, do not raise the vehicle with a floor jack positioned under the axle tubes, body sheet metal, steering linkage components, propeller shafts, engine/transmission oil pans, or fuel tank. Use the recommended lift points only.

Hoist

Wrangler/YJ models can be raised with the following type of hoist:

- Swiveling arm hoist.
- Ramp-type (drive-on) hoist.
- Wheel lift, twin post hoist.

NOTE: If a swiveling arm hoist is being used, be sure the lifting pads are positioned at the same frame rail locations recommended for floor jack-safety stand usage.

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	GENERAL DRIVELINE LUBRICATION	
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LUBRICANT CHANGE AND INSPECTION INTERVALS

Recommended lubricant change and inspection intervals for the engine, transmission, transfer case and axles are as follows:

Engine Oil

Change engine oil at 12 000 km (7,500 mile) intervals.

Check engine oil level at every fuel fill. Correct level is between the Add and Full marks on the engine dipstick.

Refer to the Recommended Fuel-Liquids-Lubricants section in this chapter for recommended engine oil grade and viscosity.

Manual Transmission Lubricant

Change manual transmission lubricant at 48 000 km (30,000 mile intervals).

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep gear lubricant or an equivalent SAE 75W-90, API Grade GL-5 gear lubricant for top off or refill purposes.

Automatic Transmission Fluid and Filter

Change the automatic transmission fluid and filter at 48 000 km (30,000 mile) intervals.

Check fluid level every 12 000 km (7,500 miles). Correct fluid level is between the Add and Full marks on the transmission dipstick.

Check the fluid level with the engine running and the transmission in Park position. The fluid must be at normal operating temperature to ensure an accurate reading.

Use Jeep automatic transmission fluid or an equivalent Dexron® II fluid only.

Transfer Case Lubricant

Change transfer case lubricant at 48 000 km (30,000 mile) intervals.

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep automatic transmission fluid or an equivalent Dexron® II fluid only.

Axle Lubricant

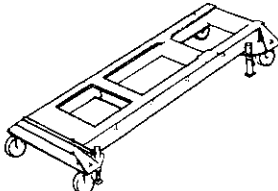
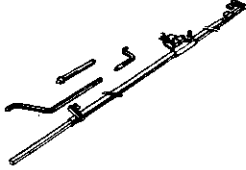
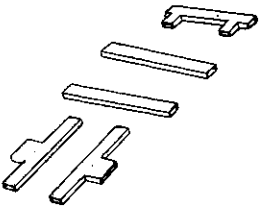
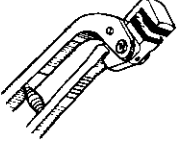
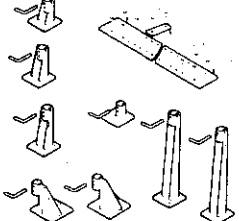
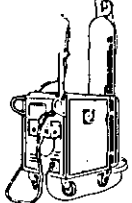
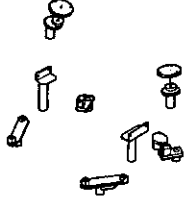
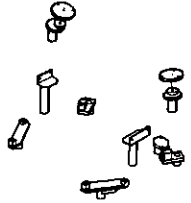
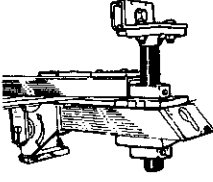
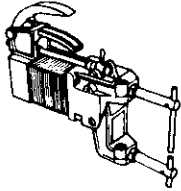
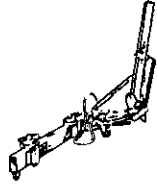
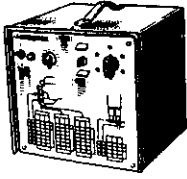
Change front and rear axle lubricant at 48 000 km (30,000 mile) intervals.

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep gear lubricant or an equivalent SAE 75W-90, API Grade GL-5 gear lubricant for top off or refill purposes.

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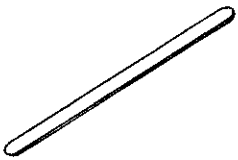
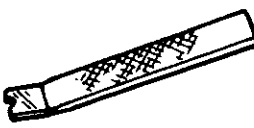
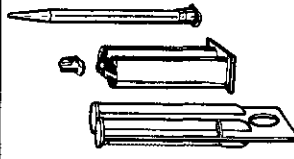
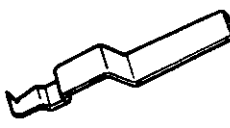
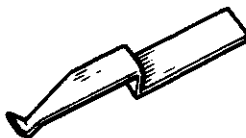
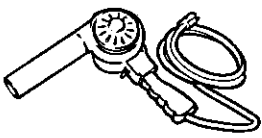
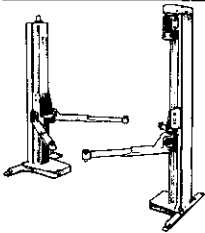
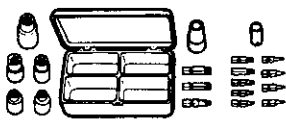
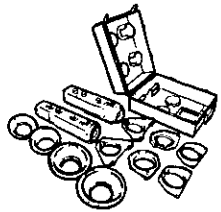
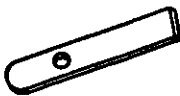
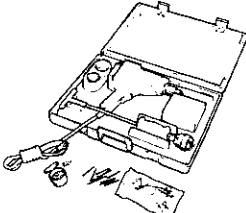
	GENERAL BODY INFORMATION TOOLS	
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	JIG BENCH Ref: Celette MUF 7 908.3152 Address: 2725 West 5th North Street Summerville, SC 29483 Telephone Number: (803) 875-1241		TRAMMEL GAUGE Ref: Car. 759-02
	MODULAR CROSSMEMBERS Ref: Celette 955.900		MANUAL FLANGING TOOL Ref: Controlled Systems 205-0005 Address: 2862 Kew Drive Windsor, Ontario Canada N8T3C6 Telephone Number: (519) 948-4822
	SET OF MZ TOWERS Ref: Celette MZ 450		MIGWELDER Ref: Controlled Systems SAM
	SET OF TOPS Ref: Celette 488.300		DIE GRINDER Ref: CP 9108 Address: Chicago Pneumatic 5500 Eighteen Mile Road Sterling Heights, MI 48078 Telephone Number: (313) 268-7400
	COMPLEMENTARY SET OF TOPS FOR 388.300 Ref: Celette 488.309		SPHERICAL CARBIDE CUTTER Ref: Chicago Pneumatic C-127.828
	ROCKER PANEL CLAMPS Ref: Celette 976.900		SPOTWELDER ARO Ref: N179 Ref: CD912 Address: Falstrom Welding Products Falstrom Court P.O. Box 118 Passaic, NJ 07055 Telephone Number: (201) 777-0013
	STRAIGHTENING FRAME Ref: Cellette Cobra 3 953 9051		WELDER MASTER CONTROL Ref: Falstrom Welding Products ARO CD 912

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	GENERAL BODY INFORMATION TOOLS	
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	BODY-SOLDER 33% Tin, 67% Lead		MOLDING REMOVAL TOOL Ref: Kent Moore J-21104-B
	DOOR PANEL BONDING-KIT: Ref: 3M 08109 USA/Canada		MOLDING REMOVAL TOOL Ref: Kent Moore J-21549-5
	AUTOMIX APPLICATOR GUN Ref: 3M 08190		MOLDING REMOVAL TOOL Ref: Kent Moore J-21549-3
	UNDERBODY APPLICATOR GUN Ref: 3M 08997		TRIM PAD Ref: Kent Moore J-24595-B
	HEAT GUN Ref: J-25070 Address: Kent Moore (USA) 29784 Little Mack Roseville, MI 48066-2298 Telephone Number: (313) 774-9500 Address: Kent Moore (Canada) 5466 Timberlea Blvd. Mississauga, Ontario Canada L4W2T7 Telephone Number: (416) 624-6295		CLEAR FLOOR BODY LIFT Ref: HH70A Hans Hougard Address: 510 N Bloomington St Streator IL 61364 Telephone Number: (815) 673-5546
	TORX BIT SET Ref: Kent Moore J-25359-C		HEADLAMP AIMER Ref: Kent Moore J-25300-A
	PLOW BLADE Ref: Kent Moore J-24851		Ref: DENT PULLER Auto House of Switzerland Address: 1109 Holman Houston, TX 77004 Telephone Number: (713) 523-2369



TOOLS



SEE I.S. N O T E S			
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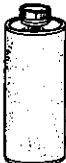
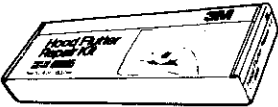
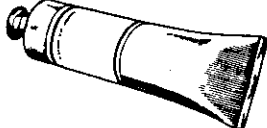
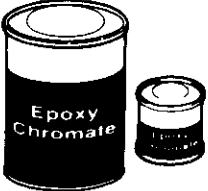
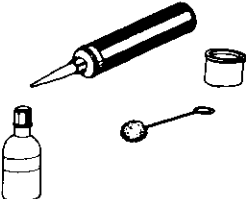


GENERAL BODY INFORMATION

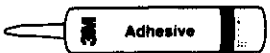
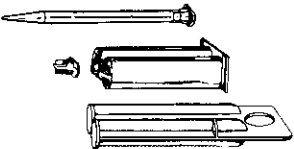
PRODUCTS



SEE
I.S.
NOTES

	SILICONE SEALER AMC Part Number 812 5154 USA 320 9439 Canada		UNDERBODY PROTECTION: 3M Ref: 08664 USA Ref: 88641 Canada
	SEALANT: 3M Ref: 08646 USA Ref: 86464 Canada		STRUCTURAL ADHESIVE REPAIR KIT: 3M Ref: 08105 USA and Canada
	WEATHERSTRIP ADHESIVE: 3M Ref: 08001 USA Ref: 80010 Canada		EPOXY CHROMATE Ref: Ditzler DP-40/401 DuPont 6155/6165
	RELEASE AGENT: 3M Ref: 08931 USA		ANTI-CORROSION SPRAY: 3M Ref: 08892 US and Canada
	ADHESIVE SPRAY: 3M Ref: 08090 USA Ref: 80648 Canada		BUTYL TAPE Ref: 3M 08612 US and Canada Ref: 812 6527 AMC
	GENERAL PURPOSE ADHESIVE REMOVER: 3M Ref: 08984 USA and Canada		ADHESIVE SEALANT: 3M Ref: 08109 US and Canada
	WINDOW URETHANE INSTALLATION KIT KENT INDUSTRIES Ref: Ureset 212 USA - Canada		STONE CHIP PROTECTION Ref: Ditzler DX-54

	GENERAL BODY INFORMATION		
	PRODUCTS		

	ADHESIVE: 3M Ref: 08105 US and Canada		
	SEAM SEALANT: 3M Ref: 08646 US Ref: 86464 Canada		
	DOOR PANEL BONDING-KIT: Ref: 3M 08109 USA/Canada		
	 		

SEE I.S. NOTES	



GENERAL

METRIC-DECIMAL CONVERSION TABLES



inch-pounds to newton meters

lb. in.	N·m	lb. in.	N·m	lb. in.	N·m	lb. in.	N·m	lb. in.	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

newton meters to inch-pounds

N·m	lb. in.	N·m	lb. in.	N·m	lb. in.	N·m	lb. in.	N·m	lb. in.
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	18.2	161.0904
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	18.4	162.8606
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	18.6	164.6308
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	18.8	166.4010
3	26.5534	7	61.9579	11	97.3624	15	132.7669	19	168.1712
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	19.2	169.9414
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	19.4	171.7116
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	19.6	173.4818
3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	19.8	175.2520
4	35.4045	8	70.8090	12	106.2135	16	141.6180	20	177.0222

foot-pounds to newton meters

lb. ft.	N·m	lb. ft.	N·m	lb. ft.	N·m	lb. ft.	N·m	lb. ft.	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	113.8886
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2444
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	130.1584
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5142
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8700
19	25.7605	39	52.8769	59	79.9933	79	107.1096	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

newton meters to foot-pounds

N·m	lb. ft.	N·m	lb. ft.	N·m	lb. ft.	N·m	lb. ft.	N·m	lb. ft.
1	0.7376	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	64.9054
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	54.5796	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

100	135.5818	300	406.7454	500	677.9090	700	949.0726	900	1220.2362
110	149.1400	310	420.3036	510	691.4672	710	962.6308	910	1233.7943
120	162.6982	320	433.8618	520	705.0254	720	976.1900	920	1247.3525
130	176.2563	330	447.4199	530	718.5835	730	989.7471	930	1260.9107
140	189.8145	340	460.9781	540	732.1417	740	1003.3053	940	1274.4689
150	203.3727	350	474.5363	550	745.6999	750	1016.8635	950	1288.0271
160	216.9309	360	488.0945	560	759.2581	760	1030.4216	960	1301.5852
170	230.4891	370	501.6527	570	772.8163	770	1043.9798	970	1315.1434
180	244.0472	380	515.2108	580	786.3744	780	1057.5380	980	1328.7016
190	257.6054	390	528.7690	590	799.9326	790	1071.0962	990	1342.2598
200	271.1636	400	542.3272	600	813.4908	800	1084.6544	1000	1355.8180
210	284.7218	410	555.8854	610	827.0490	810	1098.2125	1010	1369.3762
220	298.2800	420	569.4436	620	840.6072	820	1111.7707	1020	1382.9344
230	311.8381	430	583.0017	630	854.1653	830	1125.3289	1030	1396.4926
240	325.3963	440	596.5599	640	867.7235	840	1138.8871	1040	1410.0508
250	338.9545	450	610.1181	650	881.2817	850	1152.4453	1050	1423.6090
260	352.5127	460	623.6763	660	894.8399	860	1166.0034	1060	1437.1672
270	366.0709	470	637.2345	670	908.3981	870	1179.5616	1070	1450.7254
280	379.6290	480	650.7926	680	921.9562	880	1193.1198	1080	1464.2836
290	393.1872	490	664.3508	690	935.5144	890	1206.6780	1090	1477.8418

100	73 7562	300	221 2686	500	368 7810	700	516 2935	900	663 8059
110	81 1318	310	228 6443	510	376 1567	710	523 6691	910	671 1815
120	88 5075	320	236 0199	520	383 5323	720	531 0447	920	678 5571
130	95 8831	330	243 3955	530	390 9079	730	538 4203	930	685 9328
140	103 2587	340	250 7711	540	398 2835	740	545 7959	940	693 3084
150	110 6343	350	258 1467	550	405 6592	750	553 1716	950	700 6840
160	118 0099	360	265 5223	560	413 0348	760	560 5472	960	708 0596
170	125 3856	370	272 8980	570	420 4104	770	567 9228	970	715 4352
180	132 7612	380	280 2736	580	427 7860	780	575 2984	980	722 8108
190	140 1368	390	287 6492	590	435 1616	790	582 6741	990	730 1865
200	147 5124	400	295 0248	600	442 5372	800	590 0497	1000	737 5621
210	154 8880	410	302 4005	610	449 9129	810	597 4253	1100	774 4022
220	162 2637	420	309 7761	620	457 2885	820	604 8009	1150	811 3183
230	169 6393	430	317 1517	630	464 6641	830	612 1765	1150	848 1964
240	177 0149	440	324 5273	640	472 0397	840	619 5522	1200	885 0745
250	184 3905	450	331 9029	650	479 4154	850	626 9278	1250	921 9526
260	191 7661	460	339 2786	660	486 7910	860	634 3034	1300	958 8307
270	199 1418	470	346 6542	670	494 1667	870	641 6790	1350	995 7088
280	206 5174	480	354 0298	680	501 5422	880	649 0546	1400	1032 5869
290	213 8930	490	361 4054	690	508 9178	890	656 4302	1500	1069 3431



GENERAL



METRIC-DECIMAL CONVERSION TABLES

inch to mm

in	mm	in	mm	in	mm	in	mm	in	mm
01	254	21	5334	41	10414	61	15494	81	20574
02	508	22	5588	42	10668	62	15748	82	20828
03	762	23	5842	43	10922	63	16002	83	21082
04	1016	24	6096	44	11176	64	16256	84	21336
05	1270	25	6350	45	11430	65	16510	85	21590
06	1524	26	6604	46	11684	66	16764	86	21844
07	1778	27	6858	47	11938	67	17018	87	22098
08	2032	28	7112	48	12192	68	17272	88	22352
09	2286	29	7366	49	12446	69	17526	89	22606
10	2540	30	7620	50	12700	70	17780	90	22860
11	2794	31	7874	51	12954	71	18034	91	23114
12	3048	32	8128	52	13208	72	18288	92	23368
13	3302	33	8382	53	13462	73	18542	93	23622
14	3556	34	8636	54	13716	74	18796	94	23876
15	3810	35	8890	55	13970	75	19050	95	24130
16	4064	36	9144	56	14224	76	19304	96	24384
17	318	37	9398	57	14478	77	19558	97	24638
18	4572	38	9652	58	14732	78	19812	98	24892
19	4826	39	9906	59	14986	79	20066	99	25146
20	5080	40	10160	60	15240	80	20320	100	25400

mm to inch

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	100	03937

fraction to decimal
inch to mm

Frac	Inches	Dec	mm	Frac	Inches	Dec	mm
1/64		015625	3969	33/64		515625	13 0969
1/32		031250	7938	17/32		531250	13 4938
3/64		046875	11906	35/64		546875	13 8906
1/16		062500	15875	9/16		562500	14 2875
5/64		078125	19844	37/64		578125	14 6844
3/32		093750	23812	19/32		593750	15 0812
7/64		109375	27781	39/64		609375	15 4781
1/8		125000	31750	5/8		625000	15 8750
9/64		140625	35719	41/64		640625	16 2719
5/32		156250	39688	21/32		656250	16 6688
11/64		171875	43656	43/64		671875	17 0656
3/16		187500	47625	11/16		687500	17 4625
13/64		203125	51594	45/64		703125	17 8594
7/32		218750	55562	23/32		718750	18 2562
15/64		234375	59531	47/64		734375	18 6531
1/4		250000	63500	3/4		750000	19 0500
17/64		265625	67469	49/64		765625	19 4469
9/32		281250	71438	25/32		781250	19 8437
19/64		296875	75406	51/64		796875	20 2406
5/16		312500	79375	13/16		812500	20 6375
21/64		328125	83344	53/64		828125	21 0344
11/32		343750	87312	27/32		843750	21 4312
23/64		359375	91281	55/64		859375	21 8281
3/8		375000	95250	7/8		875000	22 2250
25/64		390625	99219	57/64		890625	22 6219
13/32		406250	103188	29/32		906250	23 0188
27/64		421875	107156	59/64		921875	23 4156
7/16		437500	111125	15/16		937500	23 8125
29/64		453125	115094	61/64		953125	24 2094
15/32		468750	119062	31/32		968750	24 6062
31/64		484375	123031	63/64		984375	25 0031
1/2		500000	127000	1		1.000000	25 4000

1	03937	21	82677	41	161417	61	240157	81	318897
2	07874	22	86614	42	165354	62	244094	82	322834
3	11811	23	90551	43	169291	63	248031	83	326771
4	15748	24	94488	44	173228	64	251968	84	330708
5	19685	25	98425	45	177165	65	255905	85	334645
6	23622	26	102362	46	181102	66	259842	86	338582
7	27559	27	106299	47	185039	67	263779	87	342519
8	31496	28	110236	48	188976	68	267716	88	346456
9	35433	29	114173	49	192913	69	271653	89	350393
10	39370	30	118110	50	196850	70	275590	90	354330
11	43307	31	122047	51	200787	71	279527	91	358267
12	47244	32	125984	52	204724	72	283464	92	362204
13	51181	33	129921	53	208661	73	287401	93	366141
14	55118	34	133858	54	212598	74	291338	94	370078
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16	62992	36	141732	56	220472	76	299212	96	377952
17	66929	37	145669	57	224409	77	303149	97	381889
18	70866	38	149606	58	228346	78	307086	98	385826
19	74803	39	153543	59	232283	79	311023	99	389763
20	78740	40	157480	60	236220	80	314960	100	393700

SEE
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	DETACHABLE COMPONENTS GENERAL DESCRIPTION	
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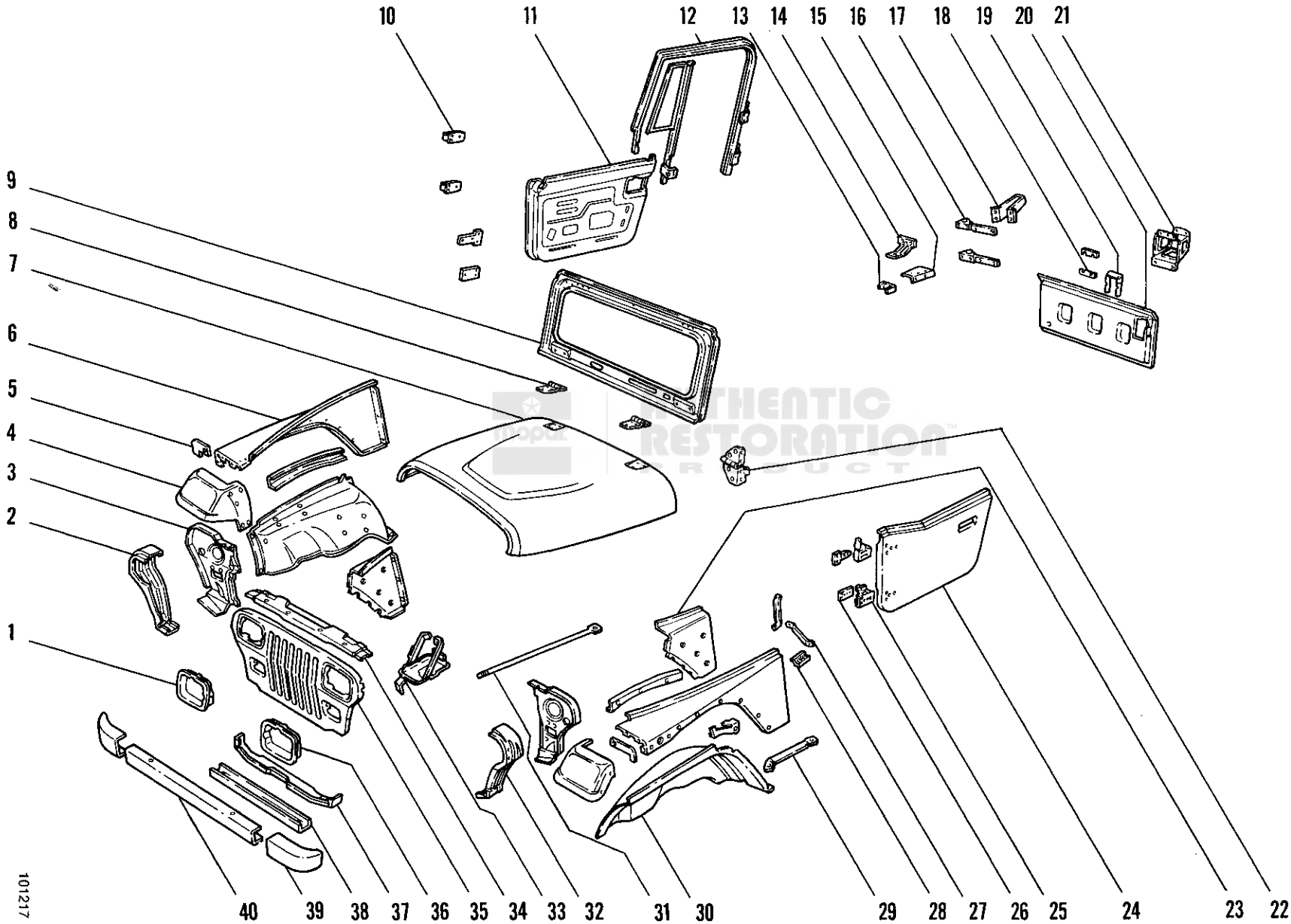
GENERAL INFORMATION

The following illustration shows the components that are detachable from the Wrangler/YJ body.



SEE I.S. NOTES

SEE I.S. NOTES



- | | |
|--|---|
| 1. Headlamp Bezel - RH | 21. Bracket Spare Tire Mounting Assembly |
| 2. Side Radiator Guard | 22. Windshield Hinge Assembly |
| 3. Side Radiator Back Panel | 23. Panel Splash Apron To Front Fender |
| 4. Panel Front Fender Front | 24. Door Assembly (Soft Top) |
| 5. Bracket Fender Reinforcement | 25. Lower Door Hinge Reinforcement |
| 6. Front Fender | 26. Lower Door Hinge Reinforcement |
| 7. Hood | 27. Support Splash Apron To Bracket Hinge |
| 8. Hood Hinge Assembly | 28. Bracket Front Fender |
| 9. Windshield Panel | 29. Front Fender Bracket |
| 10. Door Hinge Assembly | 30. Splash Apron Front Fender |
| 11. Door Assembly (Hard Top) | 31. Tie Rod |
| 12. Door Frame Assembly | 32. Side Radiator Back Panel |
| 13. Tailgate Hinge Brace Reinforcement | 33. Battery Tray Assembly |
| 14. Tailgate Hinge Upper Reinforcement | 34. Crossmember Top Radiator Guard |
| 15. Tailgate Hinge Lower Reinforcement | 35. Radiator Panel |
| 16. Hinge Assembly | 36. Front Crossmember Cover Support |
| 17. Bracket Spare Tire Stop | 37. Bottom Radiator Guard Panel |
| 18. Tapping Plate Tailgate Hinge | 38. Headlamp LH |
| 19. Bracket Tailgate Latch | 39. Bumper Side Extension |
| 20. Tailgate Assembly | 40. Front Bumper |

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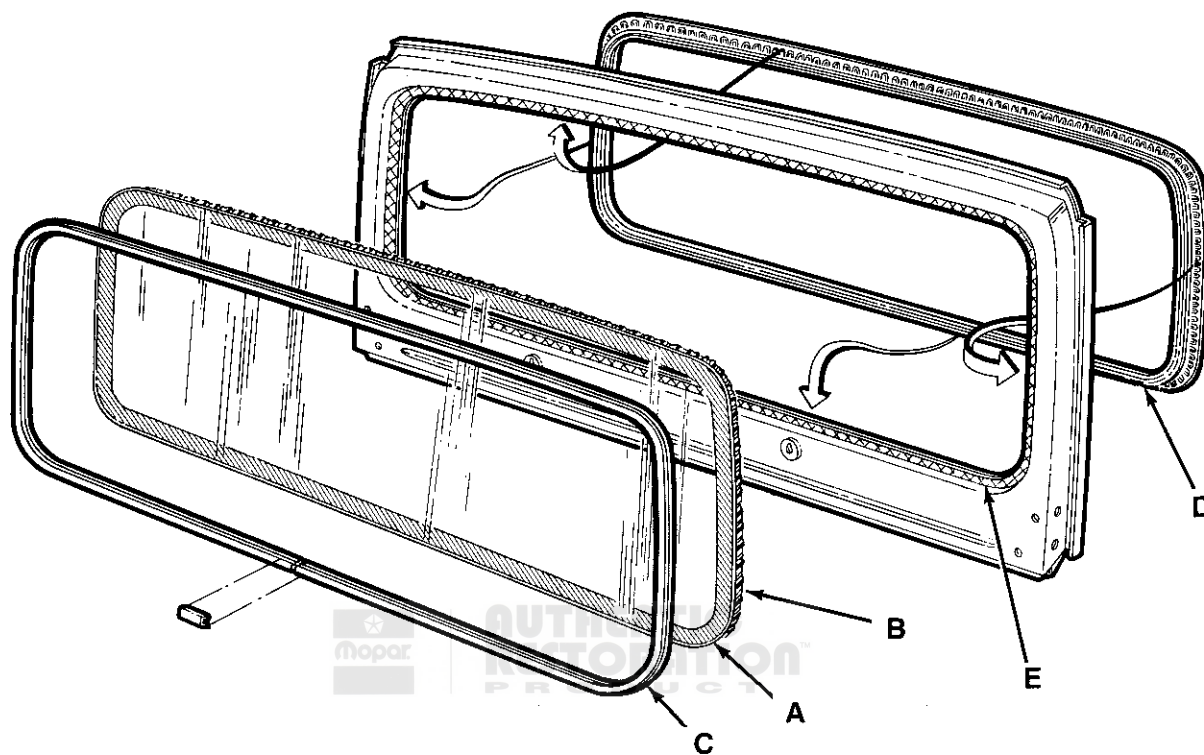
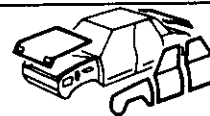
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DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT



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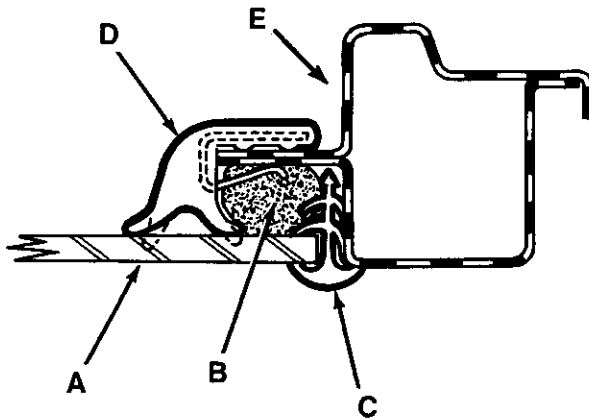
- A. Glass
- B. Urethane
- C. Windshield Reveal Molding
- D. Garnish Molding
- E. Windshield Frame

101219



DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT



101220

GENERAL INFORMATION

The one-piece windshield is constructed of two sheets of laminated glass.

The windshield glass (A) is bonded to the windshield frame (E) with urethane adhesive (B) to conform to Federal Motor Vehicle Safety Standards and to provide structural support and to provide glass retention.

WINDSHIELD REMOVAL/INSTALLATION PROCEDURES

Although the windshield removal procedure is common, there are two installation procedures.

● Short procedure

● Extended procedure

Short procedure

This procedure is recommended when the windshield is removed intact and the body windshield opening does not require repairs.

After the glass has been removed, a controlled amount of adhesive is applied to the pinchweld flanges and used as a base for the replacement glass.

Extended Procedure

This procedure is recommended when there is considerable loss of adhesion between the original adhesive material and the body windshield opening, or when the body windshield opening requires repair.

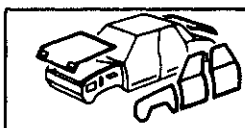
All adhesive material must be removed from the pinchweld flanges.

Removal

Remove the reveal molding cap (A).

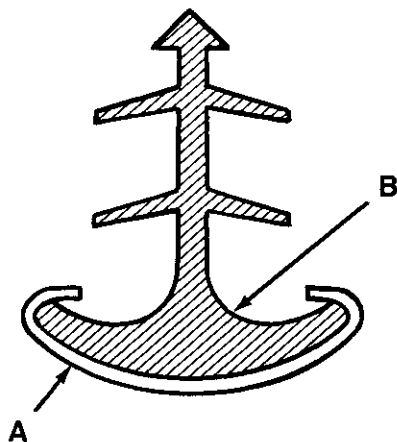
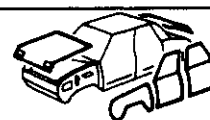
Remove the reveal molding (B).

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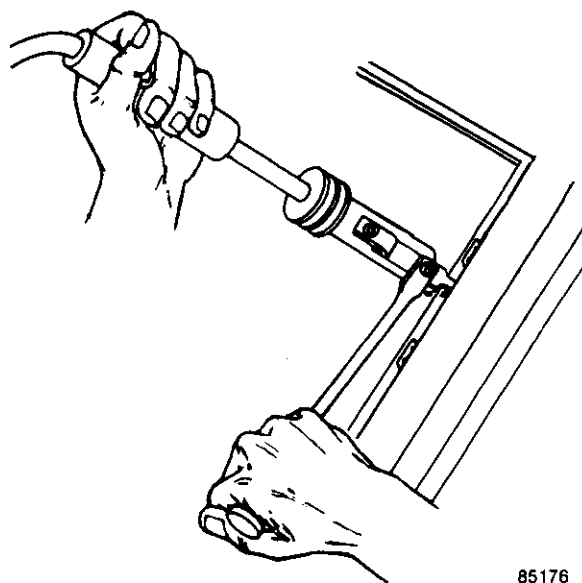


DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT



101221



85176

SEE I.S. NOTES

NOTE: The windshield removal procedure is common to both installation procedures with one exception. If the short procedure is to be used, care must be taken during windshield removal to ensure that an even, uniform bead of adhesive remains on the body for the replacement glass.

Cover the area adjacent (interior and exterior) to the body windshield opening with protective covering to avoid paint damage and additional cleanup.

CAUTION: Do not allow the electric knife blade to remain stationary during the cutting operation. Excessive heat can cause permanent softening of the adhesive material.

Insert a electric hot knife under the edge of glass and cut the adhesive material as close to the inside surface of the glass as possible.

Installation

Short Procedure

When a replacement windshield is installed, a replacement rear view mirror bracket must be installed if the replacement windshield is not equipped with one.

Refer to the bracket installation procedure in this chapter or to the instruction sheet included with the windshield bracket kit.

Inspect the reveal molding retaining clips.

Clean the old sealant from the windshield opening with Kent Acrysol.

Clean the glass with glass cleaner.

CAUTION: Do not use glass cleaner that contains silicone.



DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT



Apply a smooth, continuous bead of adhesive material around the entire perimeter of the windshield opening flange.

Use the tape strips as guides and carefully position the glass in the body windshield opening.

Press the glass to wet-out or set the adhesive material.

Use care to avoid excessive squeeze-out of the adhesive material.

Install the windshield reveal moldings and remove the masking tape from the inside surface of the glass.

Install all the remaining components and clean the vehicle.

Refer to the replacement procedure and install the inside rearview mirror bracket and mirror.

WARNING: The door windows must remain open during the adhesive curing period.

Extended Procedure — Installation

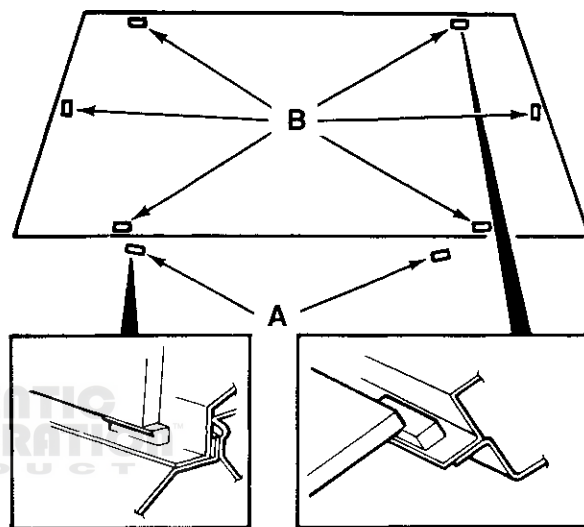
Remove the windshield (refer to the removal procedure).

CAUTION: The interior garnish molding must be replaced due to the urethane that remains on the molding from the original installation.

Remove the original urethane from the body opening around the perimeter of the opening (a layer of urethane approximately 0.5 mm (0.02 in) to 1 mm (0.04 in) thick can be left on the pinchweld flange).

NOTE: If a sheet metal component is being refinished, it should be prepared for painting as described in Chapter T of this manual.

Install the lower support spacers (A) and the standoff spacers (B).



85179

Place the windshield glass in the body window opening and support it on the spacers.

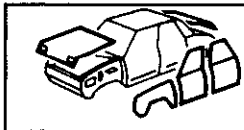
When the windshield glass is properly positioned in the body opening, place strips of masking tape on the glass at the lower support spacers to provide the exact locating references for permanently installing the glass.

Cut the tape at the top edge, remove the glass and place it either on a bench covered with a protective covering or in a holding fixture.

Glass Preparation

Clean the glass with glass cleaner.

SEE
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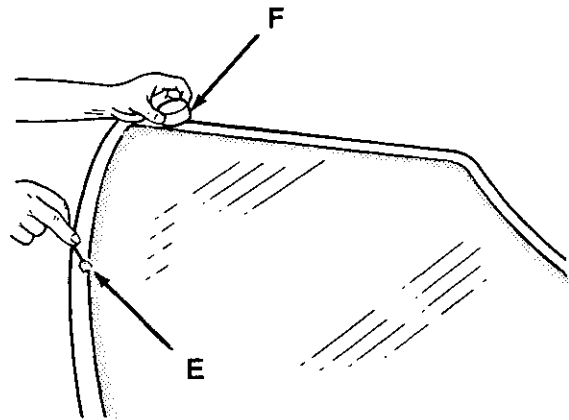
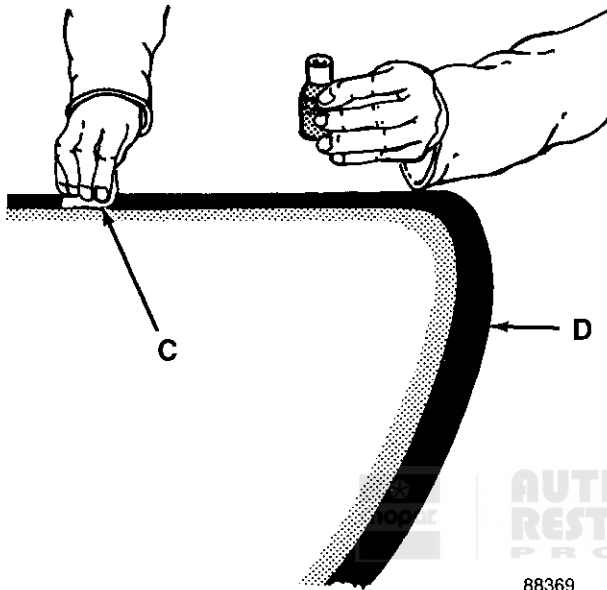
DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT

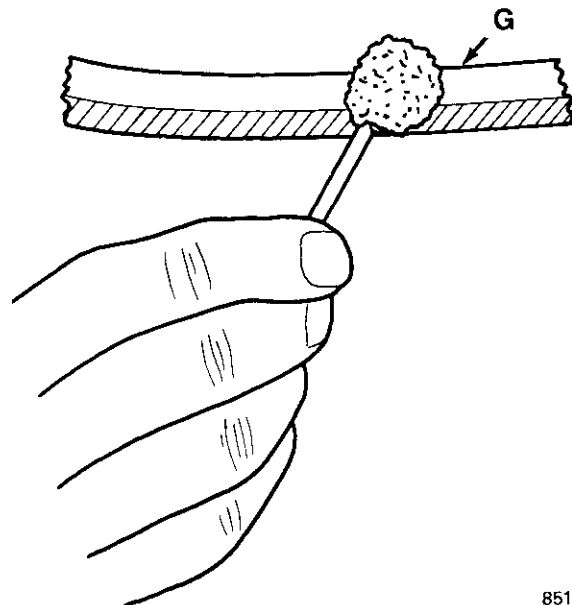


NOTE: Do not use glass cleaner that contains silicone.

Use a isopropyl alcohol dampened cloth to clean (C) the inside of the glass (D).



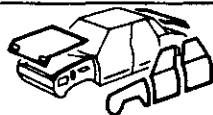
NOTE: If the pinchweld flange has been repainted, prime the pinch weld flange with primer and allow it to dry for ten minutes.



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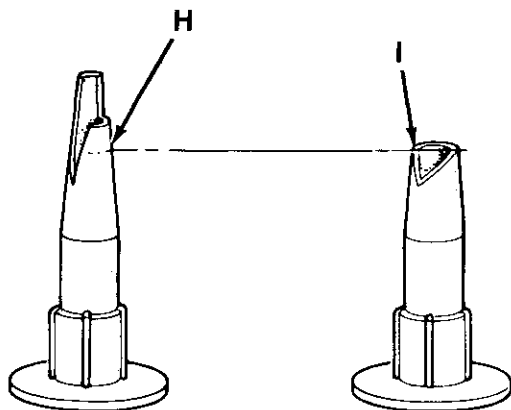
Use a dauber (E) to apply the primer (F) around the entire perimeter of the glass (G).

Allow the primer to dry for ten minutes.



DETACHABLE COMPONENTS

WINDSHIELD REPLACEMENT



85181

Modify the adhesive cartridge nozzle (H) to look like (I) so it will produce a 3.18 mm (.125 in) bead of urethane.

Apply a 3.18 mm (.125 in) around the perimeter opening pinchweld.

Use the tape strips as guides and carefully set the windshield glass in the body opening.

Visually check to insure that full contact is made between the glass and the urethane bead.

Press the glass to wet-out or set the urethane but avoid excessive squeeze-out.

Install the reveal molding and remove the masking tape from the inside surface of the glass.

Install a new interior garnish molding.

CAUTION: Install the garnish molding as soon as possible because the urethane will begin to cure soon after it is applied.

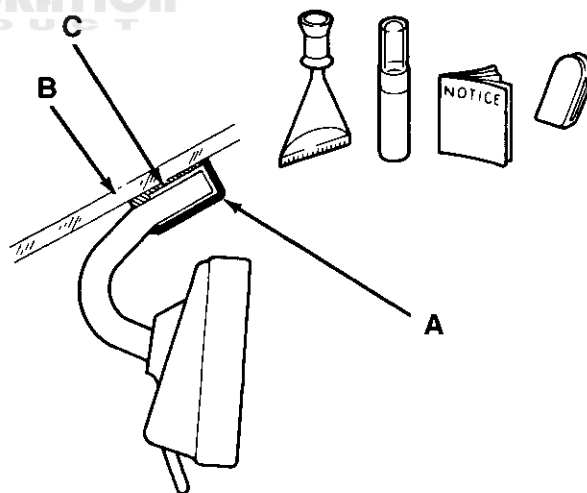
Clean the vehicle with a cloth dampened with a solvent such as acrysol.

When the installation is complete, allow the vehicle to set for 2-3 hours to allow the urethane to initially cure. For the next twenty-four hours, do not close the vehicle doors unless a window is open slightly to release the pressure from inside the vehicle.

INTERIOR REAR VIEW MIRROR

Installation

The interior rearview mirror bracket (A) is bonded to the windshield (B) with an adhesive (C).



85182

Use Loctite 312 (P/N 8124901) **only** to bond the mirror bracket.

Clean the windshield (B) and mirror bracket (A) with trichlorethylene (or a similar solvent) and allow to dry.

SEE
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	DETACHABLE COMPONENTS WINDSHIELD REPLACEMENT	
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Place the mirror bracket on the inside of the windshield at the installation location and mark around the perimeter of the bracket to provide a guide for attaching it to the glass.

Apply the activator to the glass at the bonding area and allow a few minutes for drying.

Apply an even coat of adhesive (C) to the bracket.

Immediately place the mirror bracket on the glass and hold it firmly for at least one minute (or more).

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DETACHABLE COMPONENTS

TAILGATE

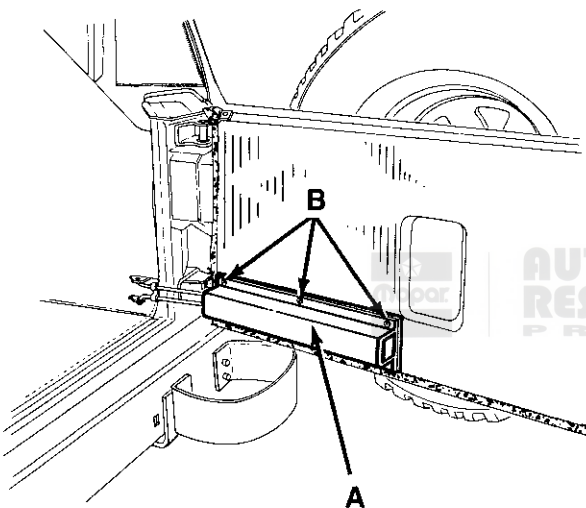


REPLACEMENT

Removal-Tailgate Assembly

Open the tailgate.

Remove the tailgate stop swing cover (A) by removing the screws (B) at the outer edge of the cover.



101222

Using a screwdriver, pry out the retainer spacer (C) that holds the spring (D) in the bracket (E).

Apply pressure on the spring (D) to release the spring from the bracket (E).

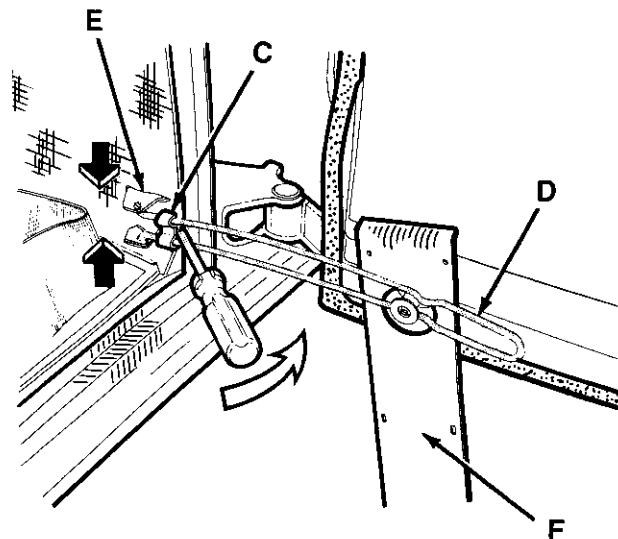
Remove the spring.

Remove the plastic isolator (F).

Close the tailgate.

Remove tailgate hinge screws using a Torx bit T-40.

Disengage the latch and remove the tailgate.



101223

Installation-Tailgate Assembly

Position and align the tailgate in the body opening and engage the latches.

Install the hinge attaching screws.

Adjustment-Tailgate Assembly

Loosen the hinge-to-body attaching screws and align the tailgate to the body opening. Tighten the hinge attaching screws.

Hinge Replacement-Tailgate

Remove the hinge attaching screws using a Torx bit T-40 and remove the hinge.

Prepare and paint the new hinge to match the body.

Lubricate the hinge with 3M 4-Way spray lubricant or equivalent.

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	DETACHABLE COMPONENTS TAILGATE	
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Position the hinge on the body and install the screws.

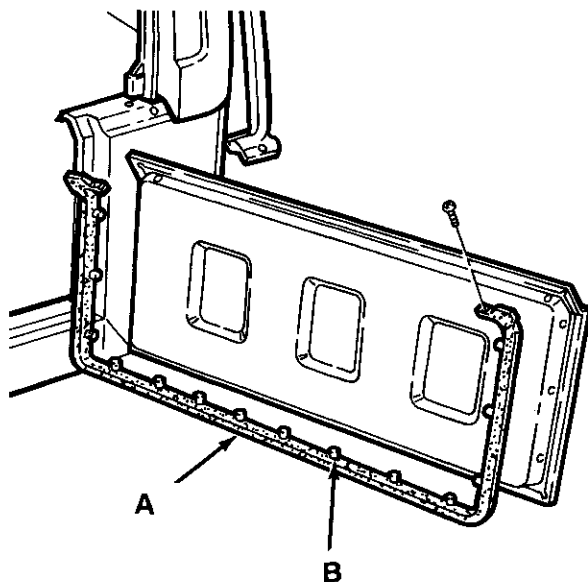
Position the tailgate and install the hinge-to-tailgate screws.

Rubber Seal Replacement-Tailgate

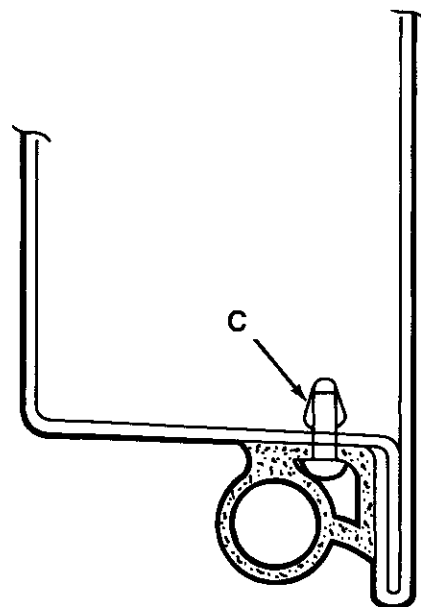
Removal

The tailgate rubber seal (A) is made of molded latex rubber foam and has a smooth skin on the outside.

Plastic retaining clips (B) retain the seal to the tailgate. Barbs on the retaining clips (C) contract when inserted into the holes in the tailgate and expand when they exit on the inside of the tailgate.



101224



101225

When servicing the seal, use a dampened cloth to clean any dirt from the seal.

Remove the screw from the end of the seal.

Carefully remove the seal from the retaining clips.

NOTE: It is not necessary to remove the retaining clips to remove the seal.

Replace any clips that have been damaged or distorted.

Installation

Remove the dust and dirt from the seal, tailgate and body surface.

Install the seal on the retaining clips and install the screw that retains the end of the seal.

CAUTION: Do not use graphite, brake fluid or wax on the seal.

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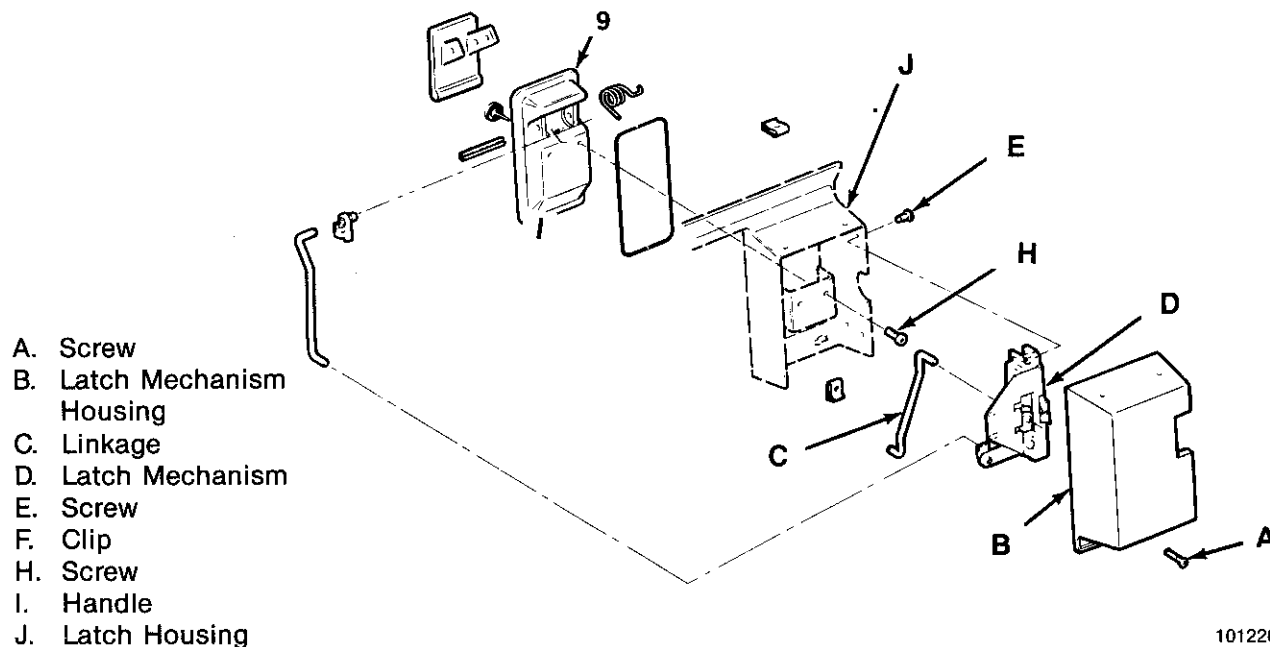


DETACHABLE COMPONENTS

TAILGATE



Latch Mechanism-Tailgate



101226

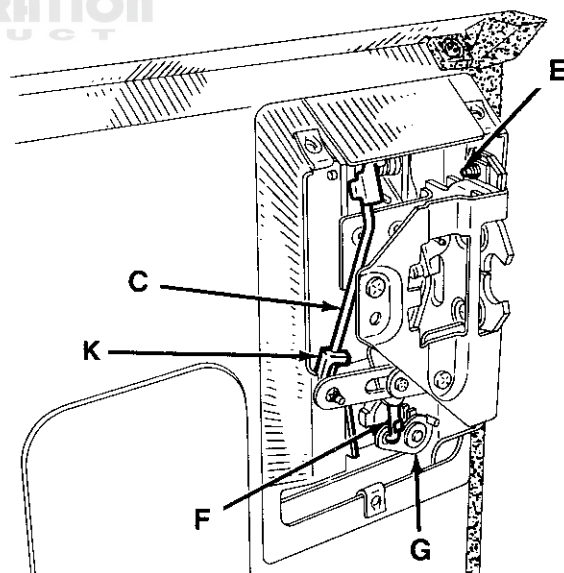
Removal

Open the tailgate and remove the screws (A) from the latch mechanism housing (B).

Disconnect the linkage (C) by removing clip (K).

Remove the latch-to-tailgate screws (E).

Remove the retaining clip (F) from the lock cylinder (G).



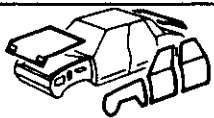
101228

Remove the handle (I) by removing screw (H).

Disengage the handle from the tailgate panel latch mechanism housing (J).

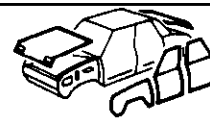
Remove the latch mechanism (D) from the tailgate housing.

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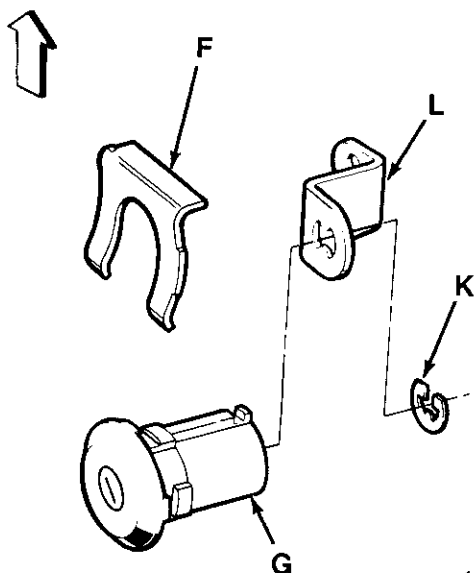


DETACHABLE COMPONENTS

TAILGATE



LOCK CYLINDER-TAILGATE



101229



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Remove the plastic cover (B).

Remove retaining clip (F).

Disengage the lock cylinder (G).

Remove clip (K) from the lock cylinder (G) and disengage it from lever (L).

Installation

Inspect all the plastic retaining clips and replace any that have been broken or damaged.

Assemble and install the lock cylinder in the reverse order.

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Removal

Open the tailgate.



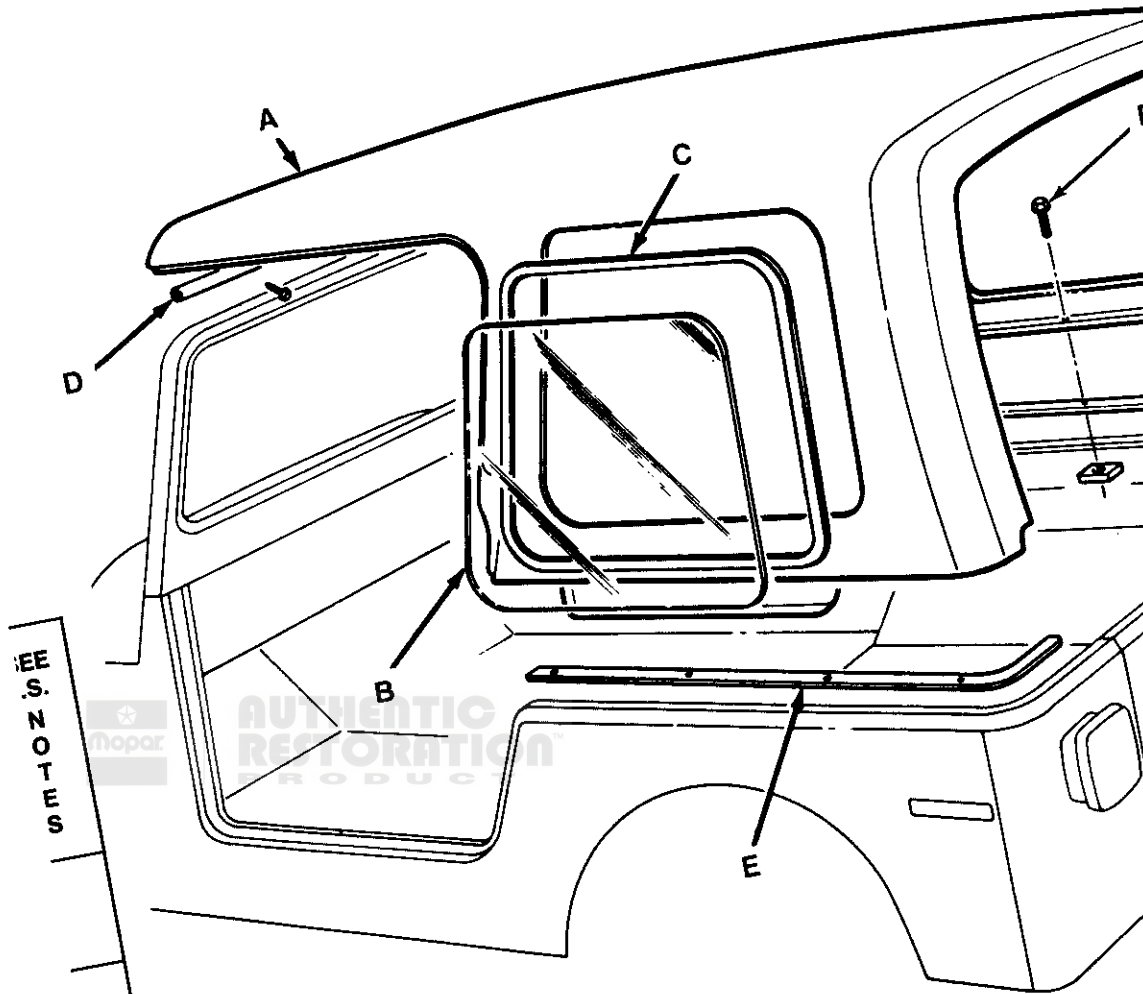
GENERAL INFORMATION

A lightweight, removable hard top enclosure is optional for the Wrangler/YJ models. This enclosure is constructed of compressed molded

fiberglass and is painted with a special spatter paint.

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SE I.S NOTES



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- A. Hard Top Enclosure
- B. Glass
- C. Reveal Molding
- D. Seal
- E. Seal
- F. Screw



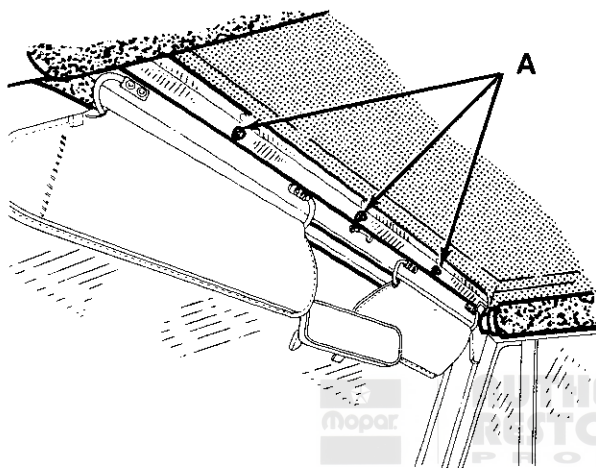
DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



HARD TOP ENCLOSURE — REMOVAL

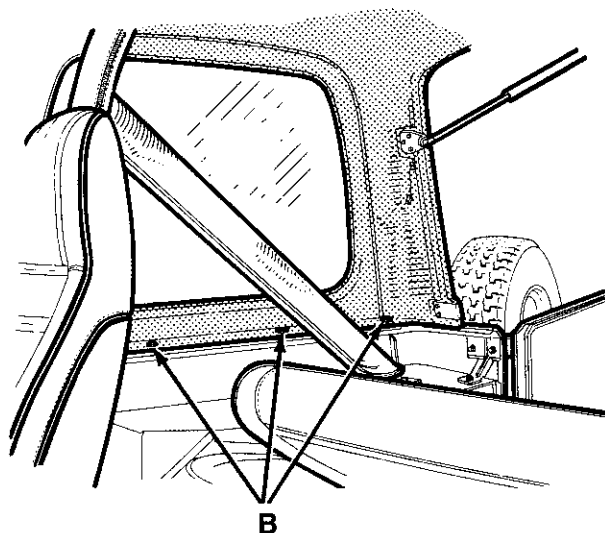
CAUTION: When removing the hardtop enclosure, avoid damaging the foam sealer located between the hardtop enclosure and the body panels.



101279

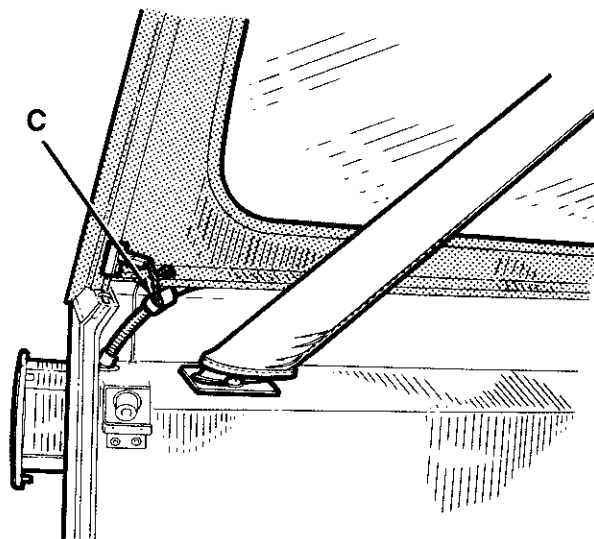
Remove the screws (A) attaching the hardtop enclosure to the windshield frame.

Remove the nuts, washers and screws (B) attaching the hardtop enclosure to the rear body panels.



101280

Disconnect the dome lamp and/or rear window defogger (C), if equipped.



101281

Remove the hardtop enclosure from the vehicle.

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DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



HARD TOP ENCLOSURE — INSTALLATION

Inspect the tabular windshield seal, bonded to the hardtop enclosure, for damage. Replace it if necessary.

Carefully position the hardtop enclosure on the vehicle.

CAUTION: When installing the hardtop enclosure, avoid damaging the foam sealer installed between the hardtop enclosure and the body panels.

Install the screws, washers and nuts attaching the hardtop enclosure to the body panels.

Connect the dome lamp, if equipped.

Install the screws attaching the hardtop enclosure to the windshield frame.

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HARD TOP ENCLOSURE REPAIR

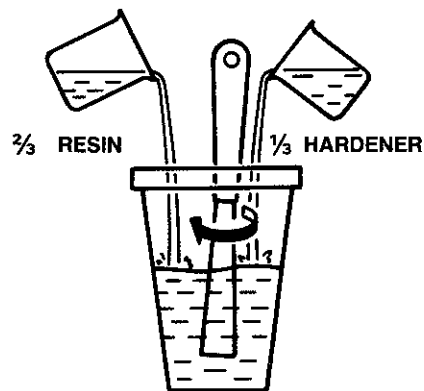
General Information

The following material will be required to repair the hardtop:

- fiberglass mat or cloth
- fiberglass resin and hardener
- structural adhesive (3M brand or equivalent)
- glazing putty
- aluminum foil

- plastic spreader

FIBERGLASS RESIN



101282

Hole Repair

Use a grinder to remove the paint and to outline the damaged area.

Use a grade 24 disc for the initial grinding.

Follow up with a grade 50 disc to prevent coarse scratches from showing up in the final finish.

NOTE: If there are any cracks extending from the hole it will be necessary to stop-drill the crack(s) using a 3.18-mm (1/8-in) drill bit.

Position a fiberglass mat or cloth on the repair area, cut out the piece, allow a 2.54 cm (1 in) extension beyond the damaged area.

Clean the damaged area.

Place the fiberglass on a piece of aluminum foil.



DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



Pour the fiberglass resin into a clean container.

Mix the appropriate amount of the hardener with the resin, according to the manufacturer's instructions.

Apply the resin mixture to both sides of the fiberglass cloth.

Lay the fiberglass and aluminum foil over the repair area, on the outside. With the plastic spreader, use firm pressure to remove the air bubbles. Allow the resin to cure.

Remove the aluminum foil from the cured resin.

Smooth the area to contour using a 50 grit disc.

Apply plastic filler to complete the repair, and finish the area with 80 grit paper.

Repeat the previous step on the inside at the top.

Featheredge the repaired area.

Prime the repaired area with Ditzler Epoxy Chromemate Primer (DP-40/401).

Apply primer surface.

Sand the area for paint preparation; reprime if necessary.

Prepare the area for color coat.

Color coat (refer to Chapter T, Paint and Trim).

Fracture Repair

Use a grinder to remove the paint, from both sides, and to outline the damaged area.

Stop-drill the crack(s) using a 3.18-mm (1/8-in) drill bit.

Bevel the edges of the crack(s) on both sides, using a rotary file.

NOTE: The edges should be beveled on the inside and outside of the enclosure to ensure sufficient surface area for good bonding.

Complete the process as above.

Textured Paint

To duplicate the texture on the enclosure, one of the following paint kits will be necessary:

- paint repair kit (white) part no. 8997320
- paint repair kit (black) part no. 8997319
- paint repair kit (honey) part no. 8982 200 234

LIFT GATE GLASS

Removal

Disconnect the rear window defogger.

WARNING: Never remove the supports with the liftgate closed. The support cylinders are filled with high pressure gas and can cause personal injury or damage the vehicle if removed with the liftgate closed. Once removed, do not try to dismantle or repair the cylinder.

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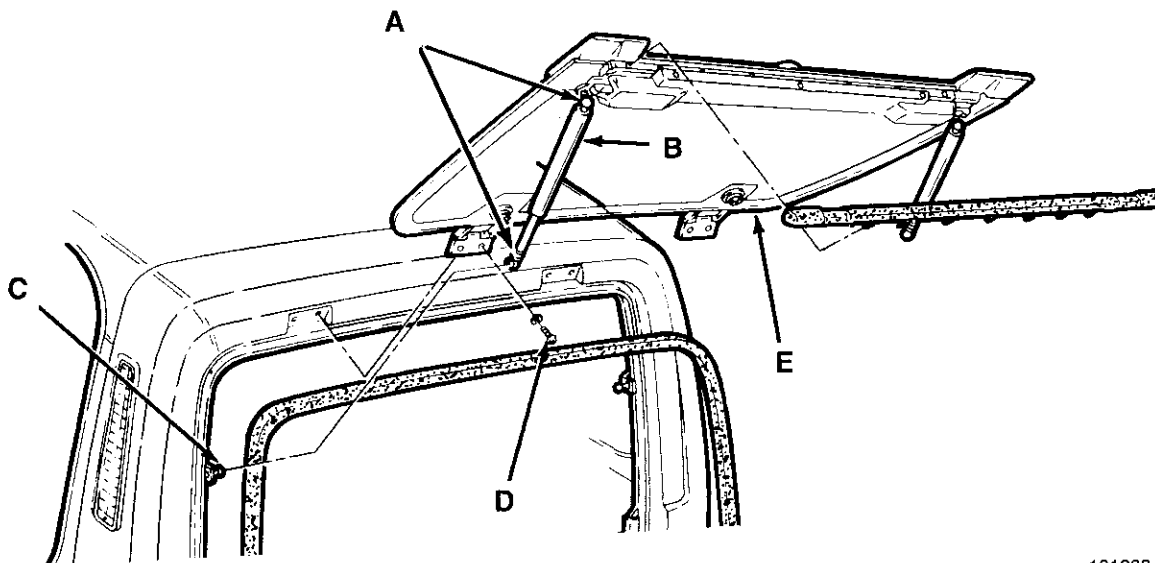


DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



Remove the liftgate support retaining clips (A) from both ends of the support (B).



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Pull the support cylinder off the ball stud (C).

Remove the liftgate hinge-to-top enclosure screws (D).

Remove the liftgate (E).

Installation

Install the liftgate and hinge screws (D).

Adjust the liftgate to fit the body opening.

Tighten the hinge screws.

Position the liftgate support cylinders on the ball studs.

Install the retainer clips.

Connect the rear window defogger.

DOORS — SOFT TOP

Disassembly

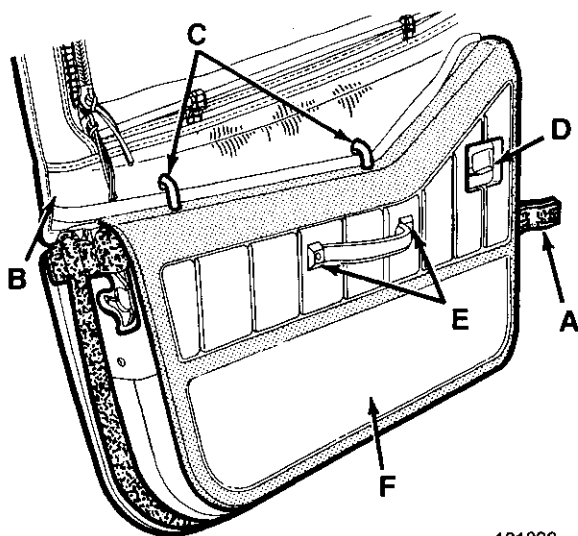
Open the door.

Disconnect the restraint strap (A).



DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



101230

Remove the window (B) by releasing the soft top-to-door snaps and pulling the window assembly up and out of the door.

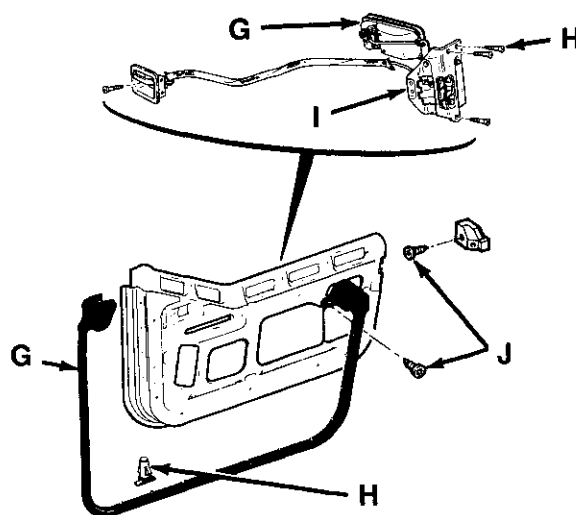
Turn the window retaining sleeves (C) 1/4 turn to the left and pull them up and out of the door.

Remove the door handle (D).

Remove the assist handle (E).

Remove the trim panel (F) by releasing the clips around the edge of the trim panel.

Remove the screw from the outside door handle (G), disconnect the linkage and remove the handle.



101231

Remove the door latch mechanism screws (H).

Remove the door latch assembly (I) with the latch-to-handle linkage.

Remove the weatherstrip retaining screws (J) and carefully remove the weatherstrip from the retaining clips.

NOTE: Leave the weatherstrip retaining clips in the door.

Remove the door hinge-to-body screws and remove the door.

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NOTES



DETACHABLE COMPONENTS

HARD TOP ENCLOSURE



Assembly

Position the door on the vehicle and install the hinge-to-body screws.

Install the weatherstrip on the retaining clips and install the screw at each end.

Position the latch-to-handle linkage and door latch and install the screws.

Install the trim panel.

Position the outside door handle, connect the linkage and install the retaining screws.

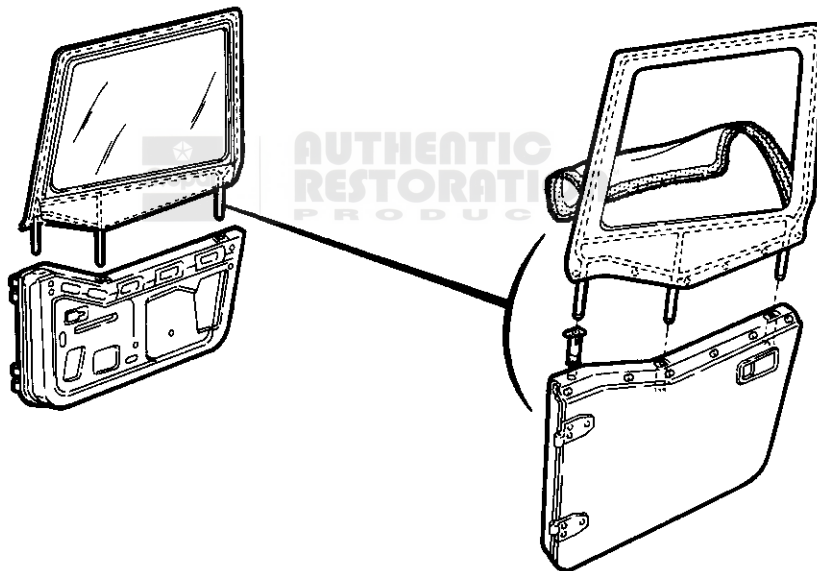
Connect the linkage to the inside door handle and install the door handle.

Install the assist handle.

Install the window retaining sleeves.

Install the window assembly.

Attach the restraint strap.



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GENERAL INFORMATION

The WRANGLER/YJ instrument panel is constructed of formed sheet metal and is attached to the cowl/dash panel.

The crash pad is attached to the instrument panel and standard equipment on all WRANGLER/YJ models.



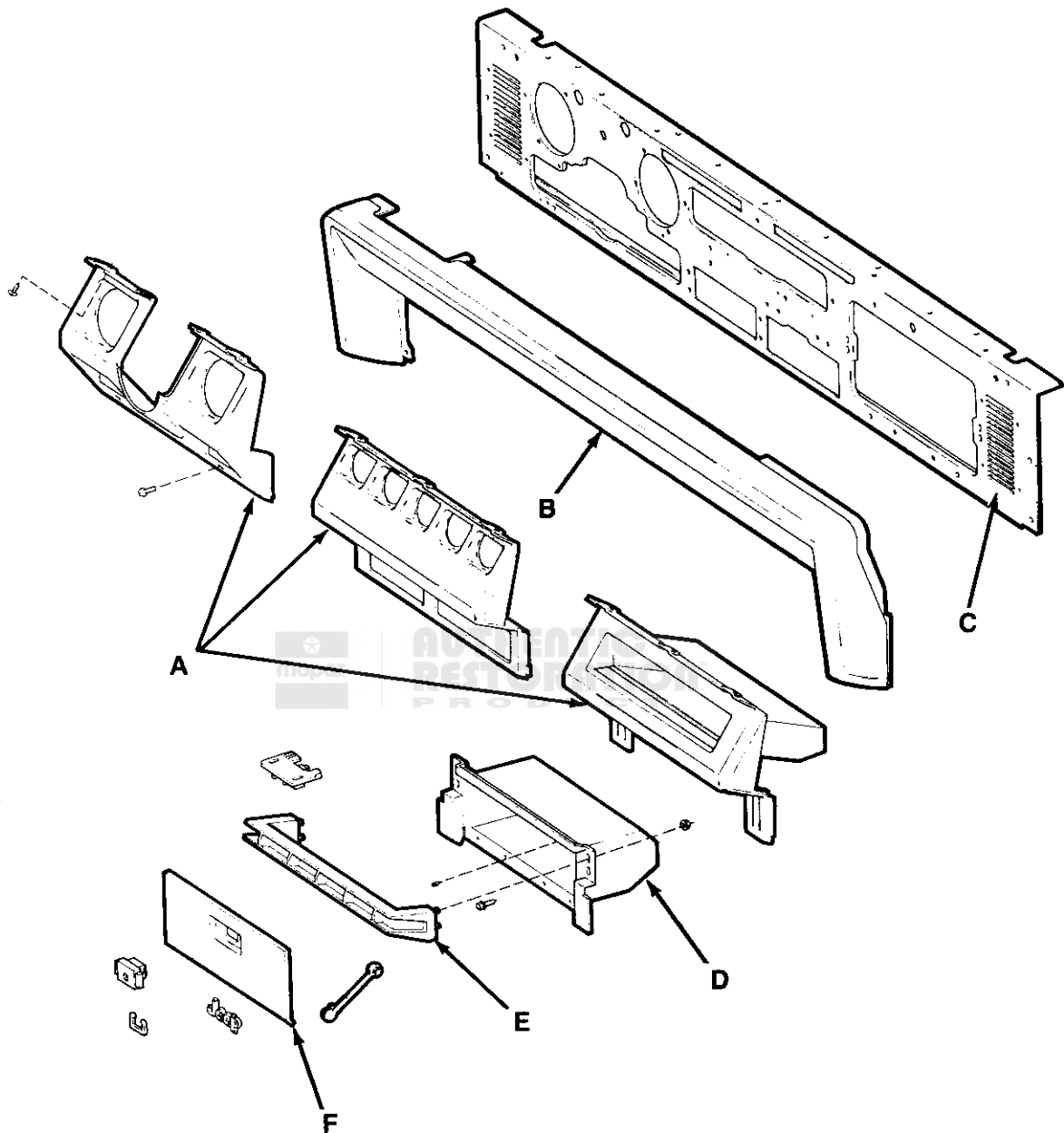
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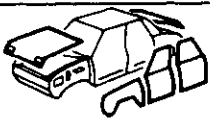
DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



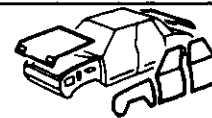
SEE
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NOTES

- A. Instrument Cluster Bezel
- B. Crash Pad
- C. Dash Panel
- D. Glove Box
- E. Assist Handle
- F. Glove Box Door



DETACHABLE COMPONENTS

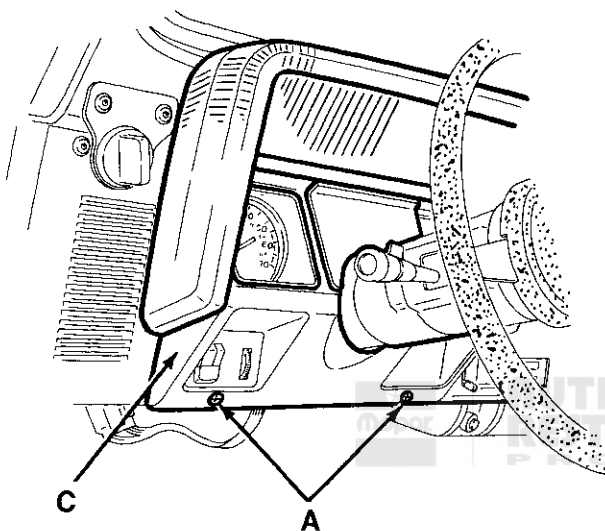
INSTRUMENT PANEL AND COMPONENTS



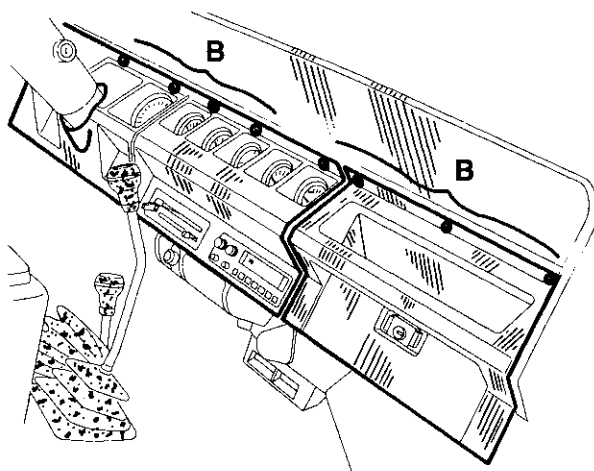
INSTRUMENT CLUSTER BEZEL

Removal

Remove the instrument cluster bezel attaching screws (A) and (B) and remove the bezel (C).



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Installation

Position the bezel on the cluster and install the retaining screws.

GLOVE BOX

Door and Hinge Removal

The glove box door-hinge mounting holes are elongated to allow adjustment. The hinge screws may be loosened and the door moved in the desired direction to best fit the door opening.

Remove the hinge-to-instrument panel attaching screws.

Remove the door and hinge assembly.

Door and Hinge Installation

Position the door and hinge assembly on the instrument panel.

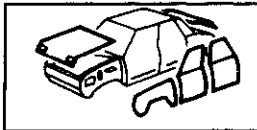
Install the hinge-to-instrument panel attaching screws.

Adjust the door.

Striker Adjustment

The glove box door lock striker is attached to the instrument panel opening with sheet metal

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NOTES



DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



screws. The striker can be moved in or out for door closing adjustment.

Glove Box Removal

Remove the glove box-to-instrument panel attaching screws.

Remove the striker.

Remove the assist handle.

Pull the glove box out of the instrument panel opening.

Glove Box Installation

Position the glove box in the opening.

Install the glove box-to-instrument panel attaching screws.

Install the assist handle.

Install and adjust the striker.

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INSTRUMENT PANEL AND COMPONENTS



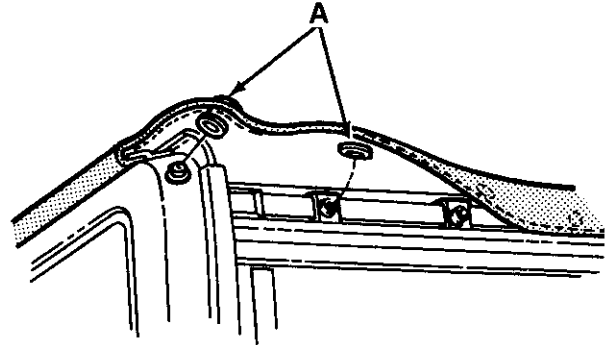
DASH PANEL

Removal

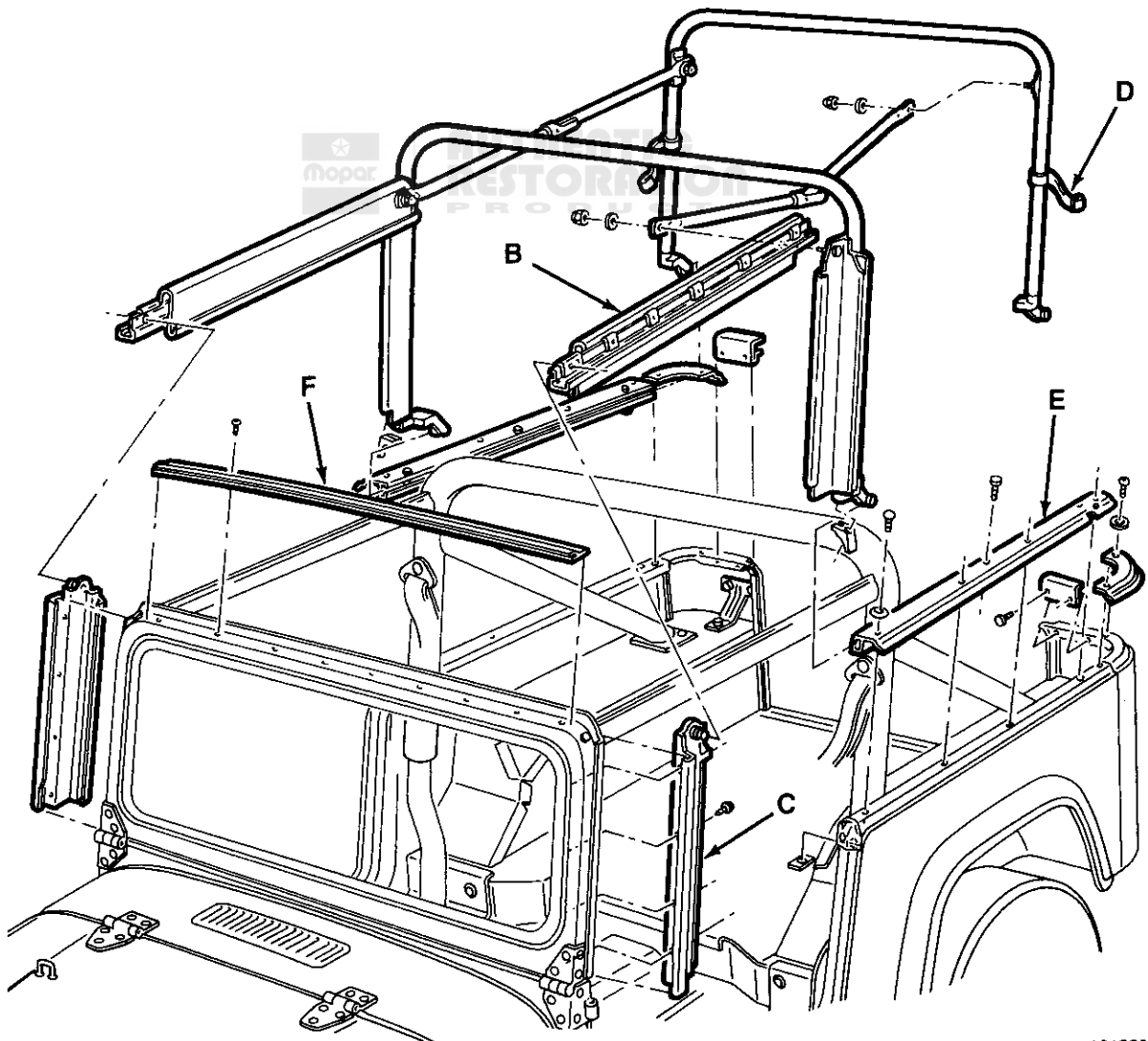
If equipped with a soft top:

Disconnect the snaps at the outer edge of the top and at the front corners as shown (A).

Disconnect the upper door frame (B) from the front door flange (C).

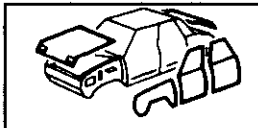


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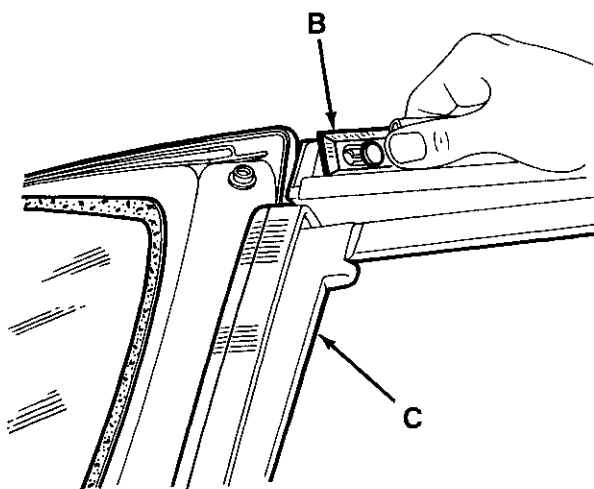
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DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



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Unfasten the snaps at the rear support (D).

Lay the rear support forward.

Unsnap the top from the side rail retainer (E).

Disconnect the top from the windshield retainer (F).

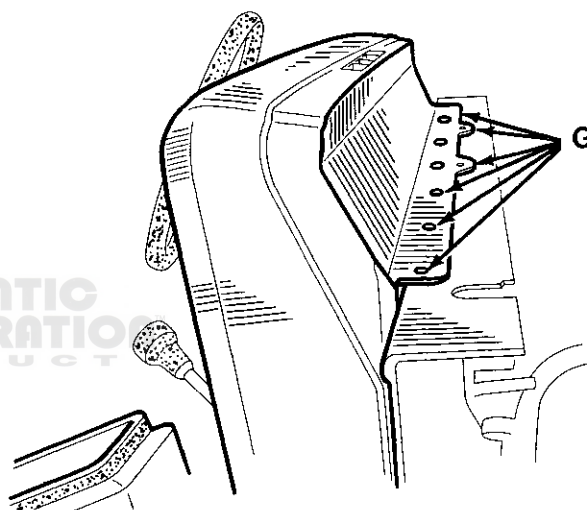
Remove the windshield-to-instrument panel retainers and lay the windshield forward onto the hood.

Disconnect the battery negative cable.

Remove the instrument cluster bezel.

Remove the assist handle, glove box door, hinge and box assembly.

Remove the screws attaching the crash pad (G) to the instrument panel.



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Remove the crash pad.

NOTE: If equipped with air conditioning, remove the screws attaching the evaporator assembly to the instrument panel and lower the evaporator assembly.

Remove the screws attaching the steering column bezel to the dash panel. Remove the bezel.



DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



Disconnect the emergency brake bracket from the dash panel.

Disconnect the speedometer cable.

Disconnect the heater control cables from the damper door levers.

Place the automatic transmission shift lever in Park.

Remove the steering wheel.

Remove the automatic transmission shift lever, if equipped.

Drive out the roll pin attaching the shift lever to the shift bowl and remove the shift lever

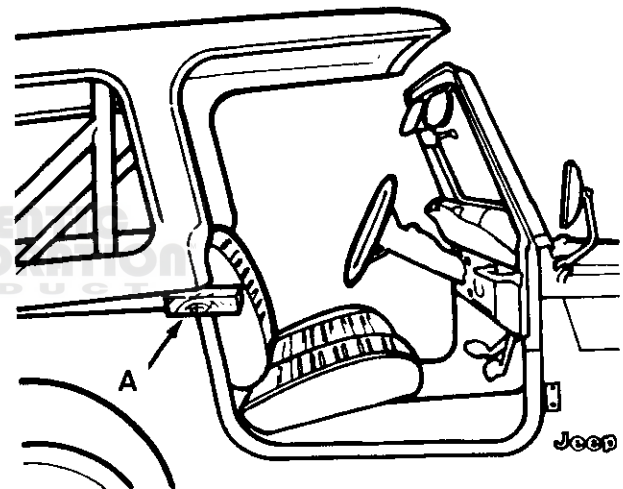
Remove the instrument panel-to-dash panel attaching screws and remove the instrument panel.

Removal

If equipped with a hard top enclosure:

Remove the hardware attaching the enclosure to the windshield and rear quarter panels.

Support the enclosure with a wooden block (A).



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Remove the windshield retaining hardware and fold the windshield down onto the hood.

Disconnect the battery negative cable.

Remove the instrument cluster bezel.

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DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



Remove the glove box door, hinge and box assembly.

Remove the screws attaching the crash pad (G) to the instrument panel.

Remove the crash pad.

NOTE: If equipped with air conditioning, remove the screws attaching the evaporator assembly to the instrument panel and lower the evaporator assembly.

Remove the screws attaching the steering column bezel to the instrument panel. Remove the bezel.

Disconnect the emergency brake bracket from the instrument panel.

Disconnect the speedometer cable.

Disconnect the heater control cables from the damper door levers.

Disconnect all electrical connections.

Place the automatic transmission shift lever in Park.

Remove the steering wheel.

Remove the automatic transmission shift lever, if equipped.

Drive out the roll pin attaching the shift lever to the shift bowl and remove the shift lever.

Remove the instrument panel-to-dash panel attaching screws and remove the dash panel.

Installation

Position the instrument panel and install the attaching screws.

Install the shift lever, if removed.

Install the steering wheel.

Connect all electrical connections.

Connect the heater control cables.

Connect the speedometer cable.

Install the emergency brake bracket.

Install the steering column bezel.

Position the air conditioning evaporator, if equipped and install the retaining screws.

Position the crash pad and install the retaining screws.

Install the glove box, hinges and door.

Install the instrument cluster bezel.

Connect the battery.

If equipped with a hard top enclosure:

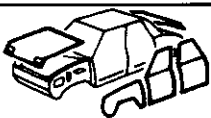
Position the windshield in the upright position and install the attaching hardware.

Remove the wooden block supporting the enclosure and install the attaching hardware.

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DETACHABLE COMPONENTS

INSTRUMENT PANEL AND COMPONENTS



If equipped with a soft top:

Position the windshield in the upright position and install the attaching hardware.

Insert the soft top into the retainer on the top of the windshield.

Snap the top at the side rails.

Move the rear support to the upright position.

Install the soft top at the rear supports and lock the snaps.

Connect the upper door frame to the front door flange.

Connect the snaps at the outer edge of the top and at the front corners.



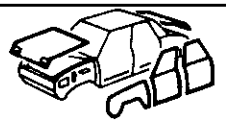
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DETACHABLE COMPONENTS

FENDERS



FRONT FENDERS

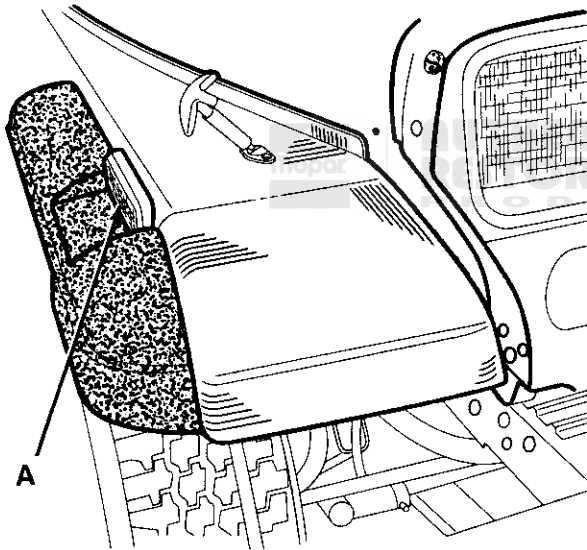
Removal

Remove or disconnect all components attached to the fender apron.

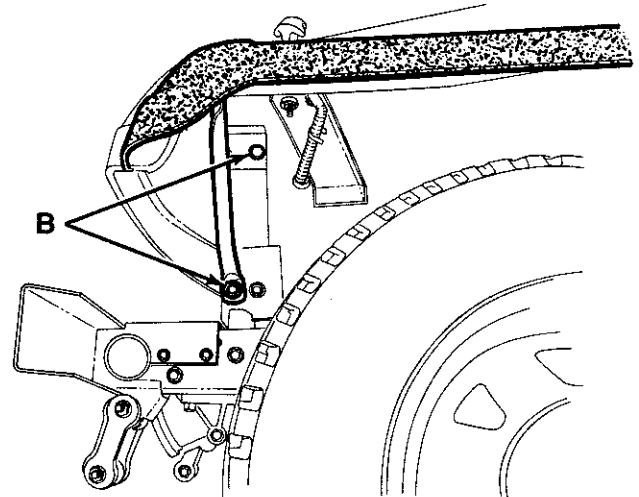
Disconnect the side marker lamp (A).

Disconnect the antenna, if required.

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Remove the radiator-to-grille panel bolts, washers and nuts (B).

Remove the bolts and washers attaching the fender and brace to the cowl panel.

Pull the fender outward and lift it from the vehicle.

Installation

Position the fender and brace and install the attaching bolts and washers.

Install the fender-to-radiator grill attaching bolts, washers and nuts.

Connect the side marker lamp.

Connect the antenna, if equipped.

Install all components removed from the fender apron.



DETACHABLE COMPONENTS

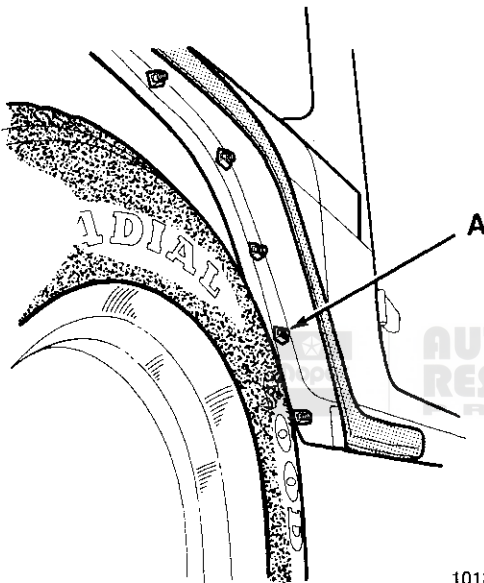
FENDERS



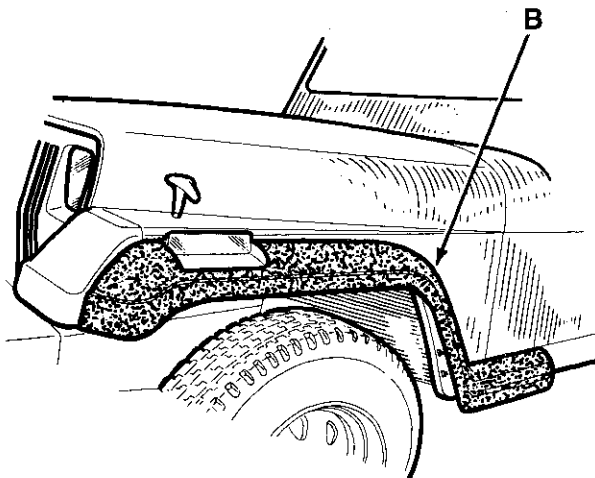
FENDER EXTENSIONS

Removal

Remove the screws (A) attaching the reinforcements and fender extension (B) to the fender.



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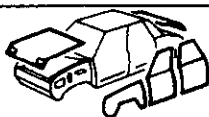
Remove the reinforcements and fender extension from the fender.

Installation

Position the fender extension and reinforcements on the fender.

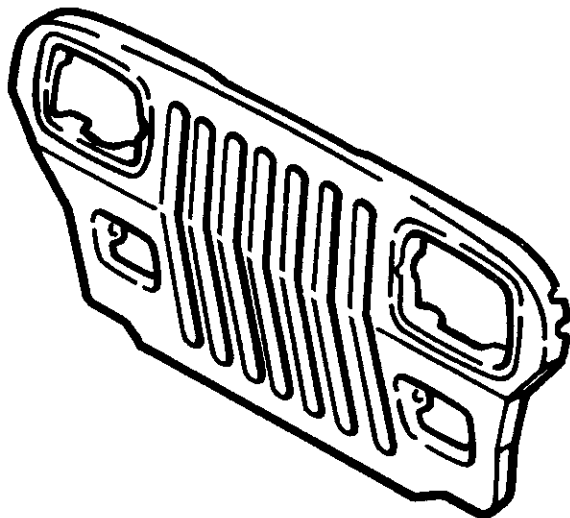
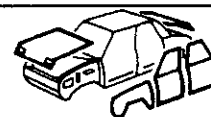
Install the screws.

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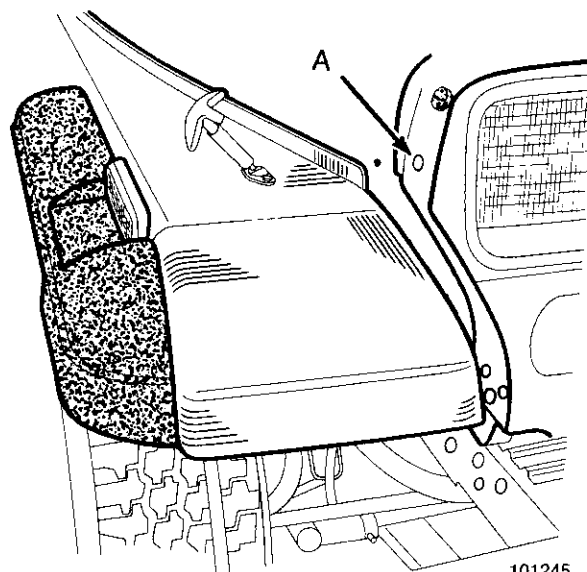


DETACHABLE COMPONENTS

RADIATOR GRILLE



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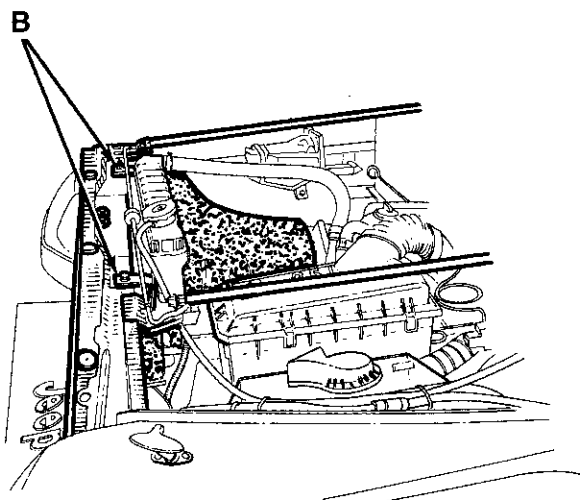
REMOVAL

Remove the front crossmember cover, if equipped.

Remove the screws and washers attaching the radiator and shroud to the radiator grille guard panel.

Remove the bolts and washers attaching the grille guard panel to the fenders (A).

Remove the radiator grille-to-frame cross-member holddown assembly. Note the sequence of the parts removal.



101246

Loosen the nuts attaching the two radiator support rods to the radiator grille guard support brackets (B).

Remove the rods from the brackets.



DETACHABLE COMPONENTS

RADIATOR GRILLE



Tilt the grille panel forward and disconnect the electrical wiring at the head lamp sealed beam unit and parking lamp assembly.

If equipped with air conditioning, proceed as follows:

- discharge the air conditioning system
- disconnect the air conditioning high pressure hose at the sight glass connection and cap the hose and sight glass fitting to prevent the entry of dirt and moisture
- disconnect the air conditioning high pressure hose at the fitting on the compressor and cap the hose and the compressor fitting to prevent the entry of dirt and moisture
- lift the radiator grille panel from the vehicle

INSTALLATION

Install the double-back tape along the bottom on the backside of the applique.

Position the grille applique over the grille assembly and press along the bottom.

CAUTION: Screws are installed into well nuts; do not overtighten.

Install the screws and bumpers.

Connect and position the headlamp and body assemblies.

Install the retaining screws.

Install the headlamp doors.

Position and connect the parking lamp assemblies.

Install the parking lamp retaining screws.

Close the hood.

Install the front crossmember cover, if equipped.

GRILLE APPLIQUE

General

The chrome grille applique is installed over the grille assembly requiring the use of well nuts and screws, as well as using the headlight and parking light attaching screws to retain the applique.

Removal

Raise the hood.

Remove the headlamp bezels.

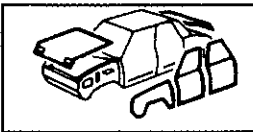
Remove the headlamp body retaining screws.

Disconnect and remove the headlamp and body assemblies.

Remove the parking lamp retaining screws.

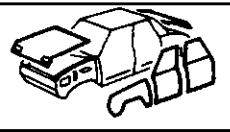
Disconnect and remove the parking lamp assemblies.

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DETACHABLE COMPONENTS

RADIATOR GRILLE



Remove the front crossmember cover, if equipped.

Remove the screws and bumpers across the top of the radiator grille.

Remove the grille applique.

Remove the double back tape along the bottom of the applique.

Installation

Install the double-back tape along the bottom on the backside of the applique.

Position the grille applique over the grille assembly and press along the bottom.

CAUTION: Screws are installed into the well nuts; do not overtighten.

Install the screws and bumpers.

Connect and position the headlamp and body assemblies.

Install the retaining screws.

Install the headlamp bezels.

Position and connect the parking lamp assemblies.

Install the parking lamp retaining screws.

Close the hood.

Install the front crossmember cover, if equipped.

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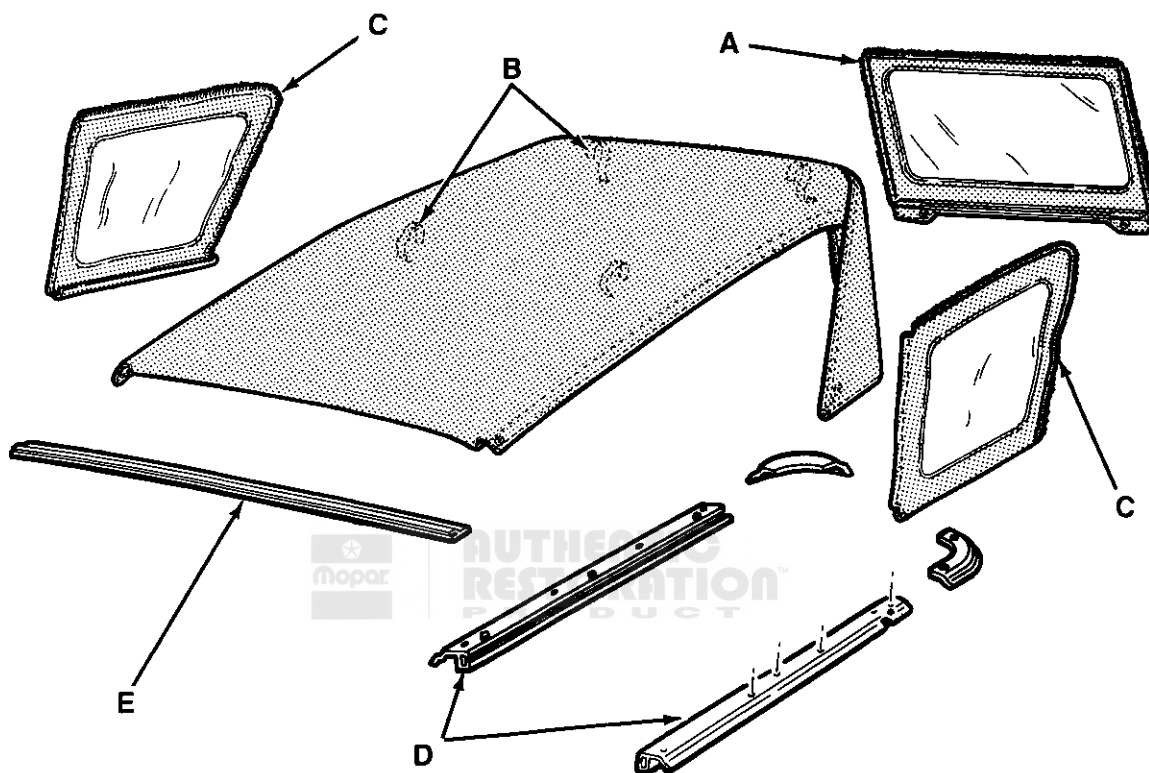


DETACHABLE COMPONENTS

SOFT TOP



REMOVAL AND INSTALLATION



- A. Rear Curtain
- B. Top Fabric
- C. Side Curtain
- D. Bottom Side Rails
- E. Front Retainer

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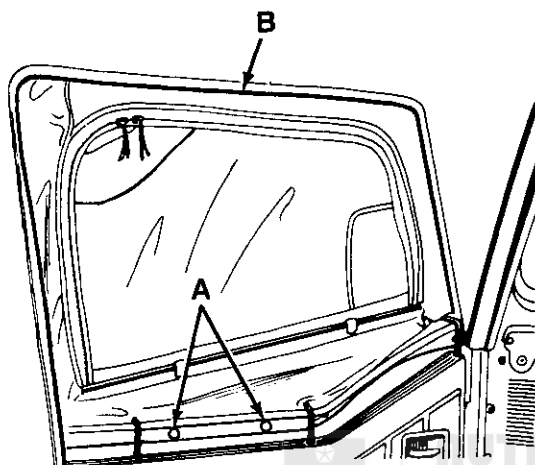
DETACHABLE COMPONENTS

SOFT TOP



Removal

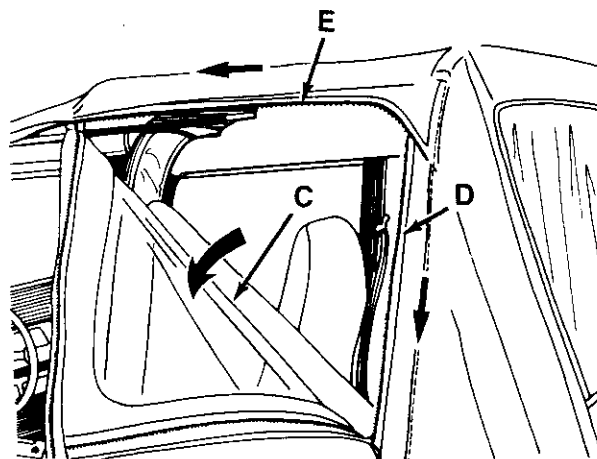
To remove the fabric upper section of the doors, unsnap the snaps (A) and lift the section (B) from the door.



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Unzip the side window curtains (C): first the rear zipper (D), then the top zipper (E).



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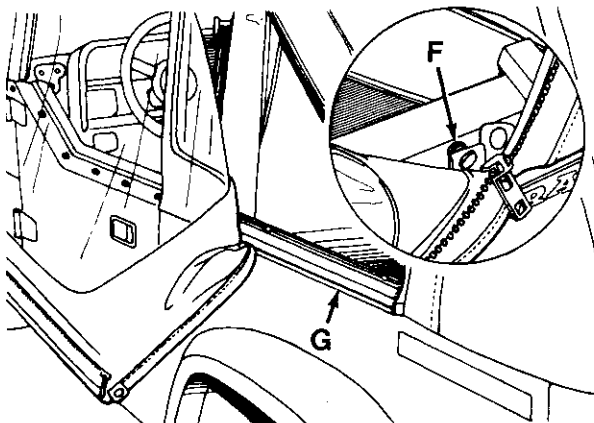


DETACHABLE COMPONENTS

SOFT TOP

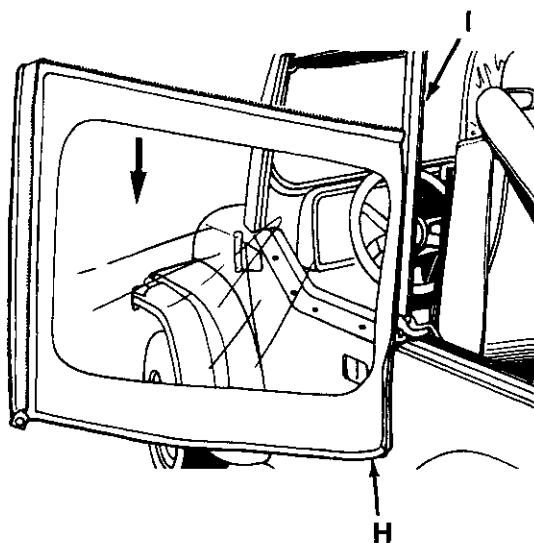


Unsnap the interior snap tab (F) and pull the bottom edge of each side curtain out of the bottom side rail (G).



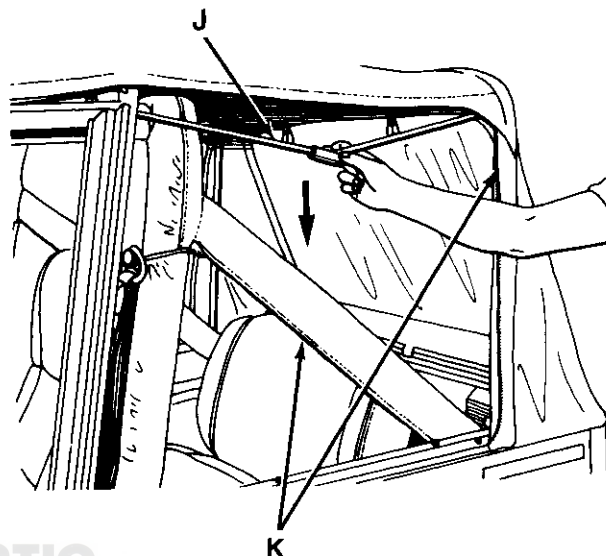
101320

Slide the front edge of the side curtain (H) down, removing it from the retainer (I) on the front support bar.



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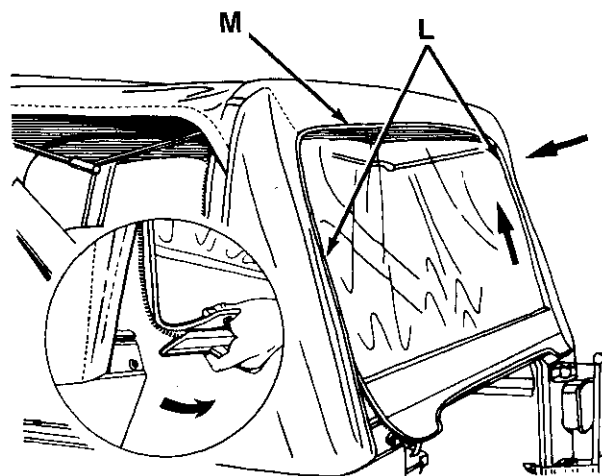
Pull down the spreader bar (J) to release the tension between the front and rear support bars (K).



101322

Open the tailgate. Unzip the two vertical zippers on the rear window curtain (L).

Unzip the zipper (M) at the top of the rear window.



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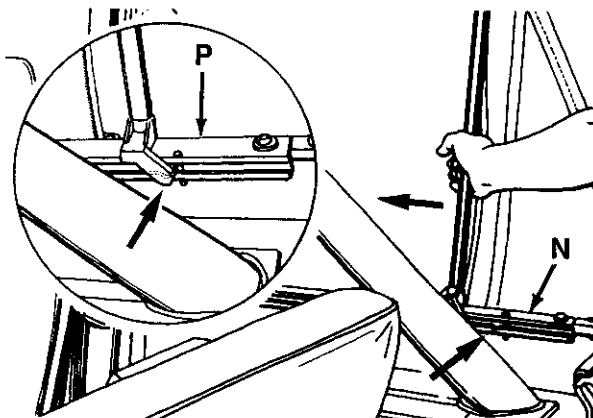


DETACHABLE COMPONENTS

SOFT TOP



Push the bottom of the rear support bows (N) forward 3-5 cm (1-2 inches) out of the notch in the side rails (P).



Disconnect the straps holding the top to the front and rear support bows and remove the top.

Slide the lock on the drip rail forward, then pull the drip rail off the lock pin on the windshield. Repeat this procedure on the opposite side.

Slide the front support bow out of the side rail and remove the support bows and spreader assembly.

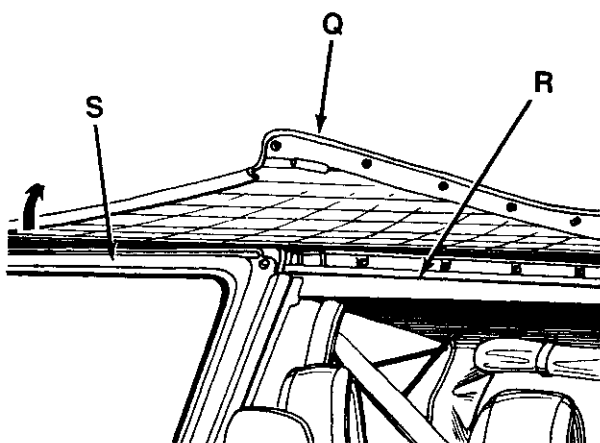
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Disconnect the top (Q) from the drip rails (R) above the doors. Then pull the top from the retainer along the upper edge of the windshield frame (S).

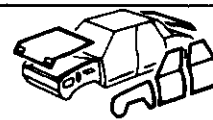


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DETACHABLE COMPONENTS

SOFT TOP



Installation

Position the support bows and spreader assembly, leaving the spreader assembly in the collapsed position .

Install the drip rails.

Position the top and connect the straps that hold the top to the support rails.

Install the front edge of the top in the retainer on the upper edge of the drip rail.

Snap the top down at the front corners and along the drip rails above the doors.

Position the rear window and zip the top and then the side zippers.

Close the tail gate and insert the bottom edge of the rear curtain into the retaining channel. Fasten the side snaps.

Spread the spreader bar to apply pressure to the top.

Install the side curtains.

Position the fabric section of the side doors and fasten the snaps along the bottom edge.



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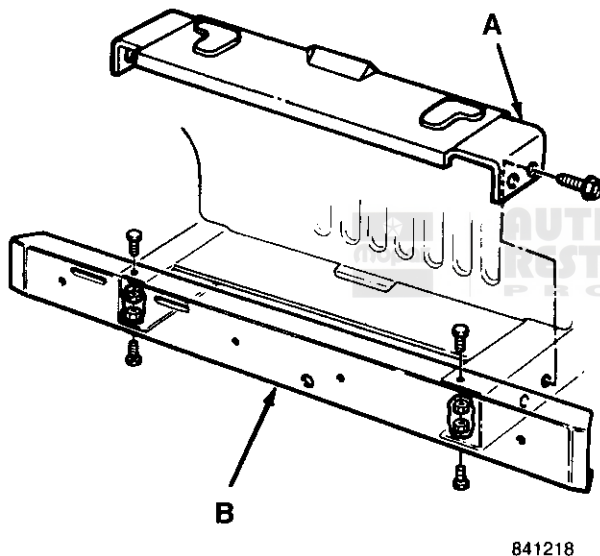
BUMPERS



GENERAL INFORMATION

Front bumpers on the Wrangler/YJ models are a one-piece construction. When a vehicle is equipped with a rear mounted spare, two separate bumperettes are used.

All Wrangler/YJ models are equipped with a front crossmember cover (A) which covers the area between the grille panel and front bumper rail (B).



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FRONT BUMPERS

Removal

Disconnect and remove the fog lamps, if equipped.

Remove the nuts and bolts from the bumper extensions and remove the extensions.

Remove the nuts and bolts attaching the front bumper rail to the frame.

Installation

Position the front bumper on the frame extension.

Install the bolts and nuts attaching the front bumper rail to the frame extension.

Install the bumper extensions.

Install the fog lamps, if equipped.

FRONT CROSSMEMBER COVER

Removal

Remove the nuts and bolts attaching the front crossmember cover to the frame extensions.

Remove the front crossmember cover from the frame extensions.

Installation

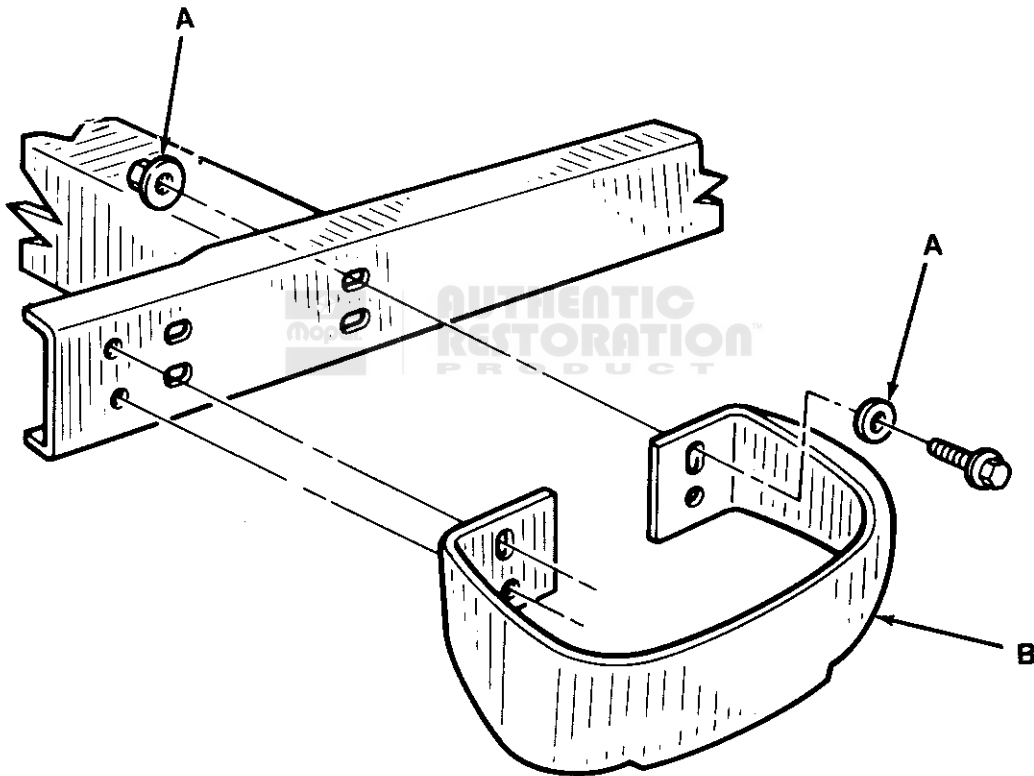
Position the front crossmember cover on the frame extensions.

Install the bolt and nuts attaching the front crossmember cover to the frame extensions.

REAR BUMPERS

Removal

Remove the nuts and bolts (A) attaching the rear bumperettes (B) to the vehicle frame.



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	DETACHABLE COMPONENTS BUMPERS	
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Remove the rear bumperettes from the vehicle frame.

Installation

Position the rear bumperettes on the vehicle frame.

Install the bolts and nuts attaching the rear bumperettes to the vehicle frame.

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DETACHABLE COMPONENTS

HOOD



GENERAL

The Wrangler/YJ hood consists of an outer flanged panel with inner U-channels welded at the front and rear of the hood panel.

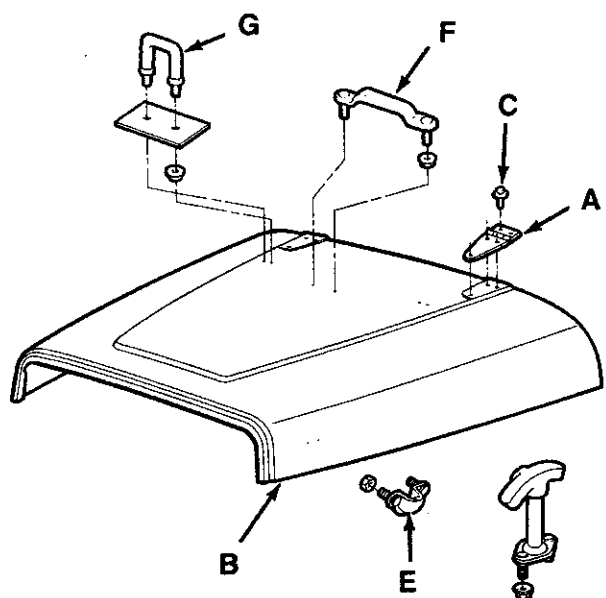
REMOVAL AND DISASSEMBLY

Mark the position of the hinges (A) on their respective mounting panels before removing the hood.

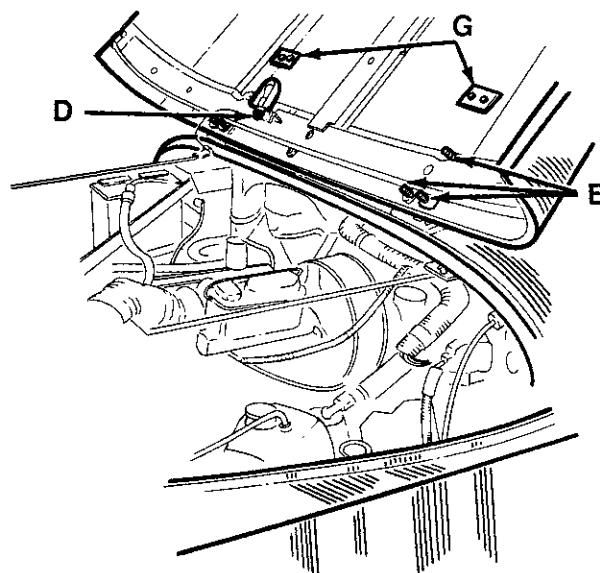
Disconnect the hood light harness.

Detach the hood panel (B) from the hinges by removing the attaching screws, lockwashers and flat washers (C).

Disassembly of the Wrangler/YJ hood is accomplished by removing the hood insulation, hood light (D), hood side catch brackets (E), footman loop (F) and windshield bumpers (G).



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ASSEMBLY AND INSTALLATION

Finger-tighten the related component parts and assemblies to the hood panel.

Position the hood panel assembly and align the hinges with scribe marks on the respective mounting panels. Tighten all the attaching screws. Connect the hood light harness.

Check the hood alignment. Adjust if necessary.

ALIGNMENT

The hood hinge mounting holes are oversized to permit adjustment when aligning the hood.

Loosen the hinge mounting screws slightly on one side and tap the hinge in the opposite direction that the hood is to be moved.

Tighten the screws.

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	DETACHABLE COMPONENTS	
	HOOD	

Repeat the procedure on the opposite hinge.

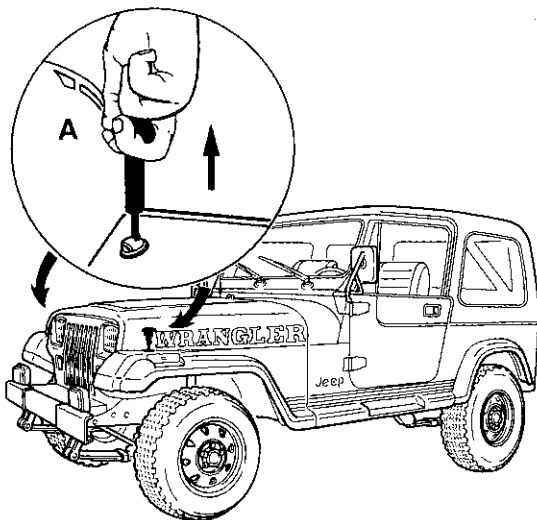
HOOD LOCK

The Wrangler/YJ hood is secured to the front fenders by two hood retaining latches (A).

To release, pull the latches straight up and turn slightly at the end of travel.

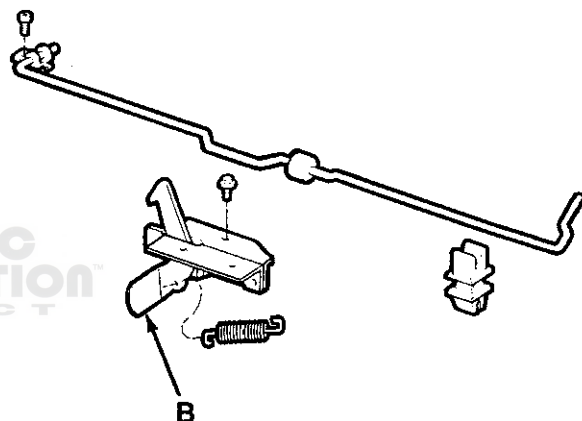
The hood now may be raised with the release of the safety catch (B) by inserting fingers between the grille bars to the right of center and by pulling to the left on the catch.

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101330

Secure the hood in the raised position, remove the prop rod from its retaining clip and insert the free end into the prop rod bracket.



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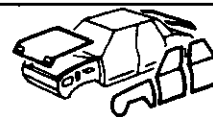
HOOD BUMPER

The hood bumpers on Wrangler/YJ models are located across the top of the radiator grille guard and are not adjustable.



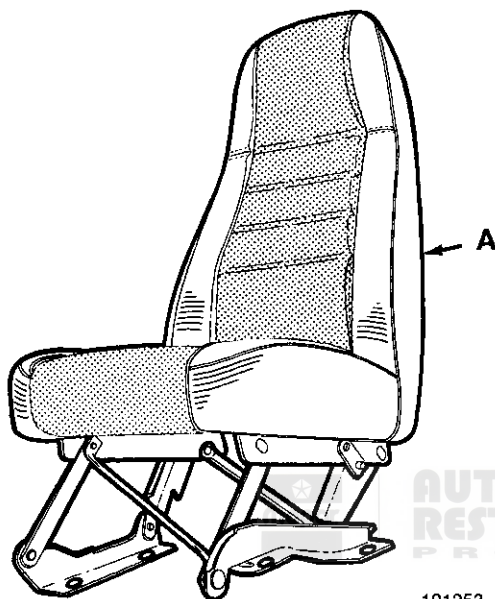
DETACHABLE COMPONENTS

SEAT ASSEMBLIES



FRONT SEATS

General



Bucket seats (A) are standard on Wrangler/YJ models.

A folding support for the bucket seats on Wrangler/YJ models allows the whole seat to move forward for easier entry to the rear area.

The fore-and-aft seat adjuster mechanism for the front Wrangler/YJ seats has a turnbuckle to allow for slight dimensional variances during production assembly of the seats and seat support components. The turnbuckle permits the seat sliding and latching components to be adjusted for trouble-free operation.

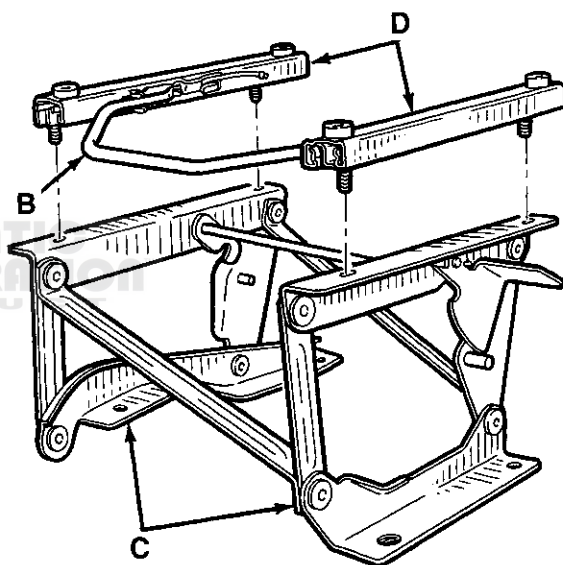
The seat belts utilize quick-release buckle latches.

The seats are removed by unfastening the supports and braces (C) from the floorpan.

The left front seat frame attaches to the seat slides (D) and the seat slides, in turn, attach to braces or supports which are fastened to the floorpan.

The seat may be locked in the full forward position, or every 12.7 mm (1/2 in) toward the full rear position, for a distance of approximately 12.7 cm (5 in).

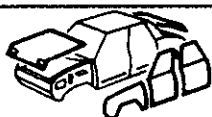
The right front seat is not adjustable fore-and-aft.



Removal

Remove the screws attaching the supports and braces (C) to the floorpan.

Remove the seat assembly from the vehicle.



DETACHABLE COMPONENTS

SEAT ASSEMBLIES



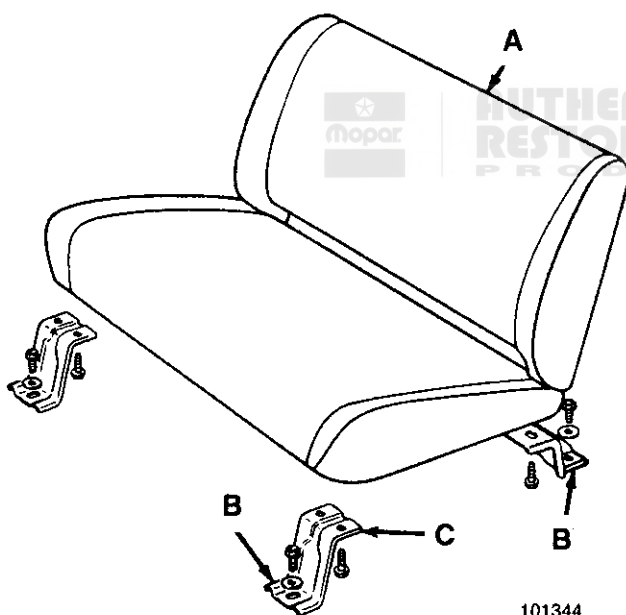
Installation

Position the seat assembly in the vehicle.

Install the screws attaching the supports and braces to the floorpan. Tighten the screws.

REAR SEAT

The rear seat assembly (A) is mounted by bolts (B) to supports (C) which, in turn, are secured to the floorpan of the vehicle by bolts.



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Removal

Remove the bolts attaching the rear seat assembly to the floorpan.

Remove the rear seat assembly from the vehicle.

Installation

Position the rear seat assembly in the vehicle.

Install the bolts attaching the rear seat assembly to the floorpan.

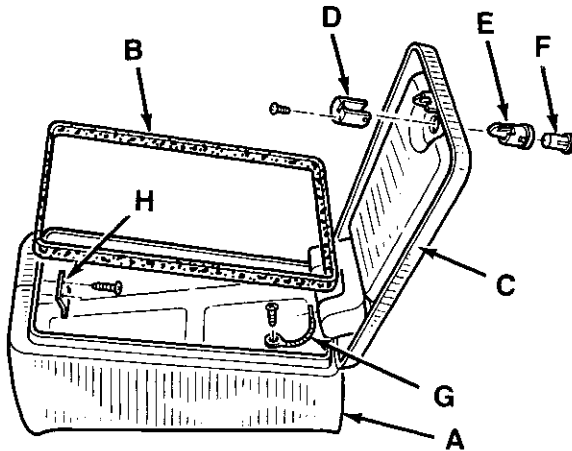
FLOOR CONSOLE

The beverage container type floor console (A) is fabricated from molded plastic material.



DETACHABLE COMPONENTS

SEAT ASSEMBLIES



- | | |
|-------------|-------------|
| A. Console | E. Lock |
| B. Seal | F. Cylinder |
| C. Cover | G. Cable |
| D. Retainer | H. Striker |

101256

The floor console cover is provided with a lock and two depressions designed to hold beverage containers. The bottom of the floor console is equipped with a hole, in the rear, allowing ice water to drain onto the ground.

The oval head key is utilized to lock and unlock the cover.

Removal

Open the console cover.

Remove the screws attaching the console to the floorpan.

Remove the console assembly from the vehicle.

Installation

Position the console assembly in the vehicle.

Align the drain hole with the hole in the floorpan and install the attaching screws.

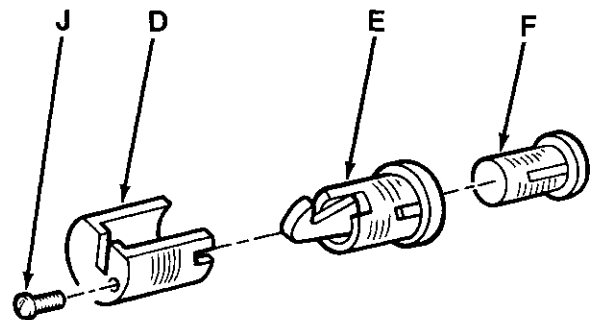
Close and latch the console cover.

Console Cover Seal

The console cover seal (B) is attached to the console. The foam seal may be replaced after opening the cover.

Console Cover Lock

Lock Cylinder Removal

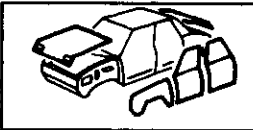


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Open the console cover (C).

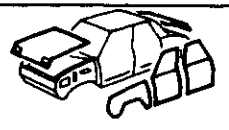
Remove the screw attaching the retainer (D) to the lock (E). Remove the retainer from the lock.

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DETACHABLE COMPONENTS

SEAT ASSEMBLIES



Remove the lock, cylinder (F) and key as a unit from the cover.

Lock Cylinder Installation

Manually set the latch to simulate the closed cover position.

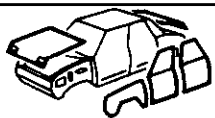
Insert the key and cylinder (F) into the lock (E) and turn clockwise. Release the latch and remove the key.

Position the assembled lock (E) in the cover (C) and install the retainer (D) and attaching screw (J).

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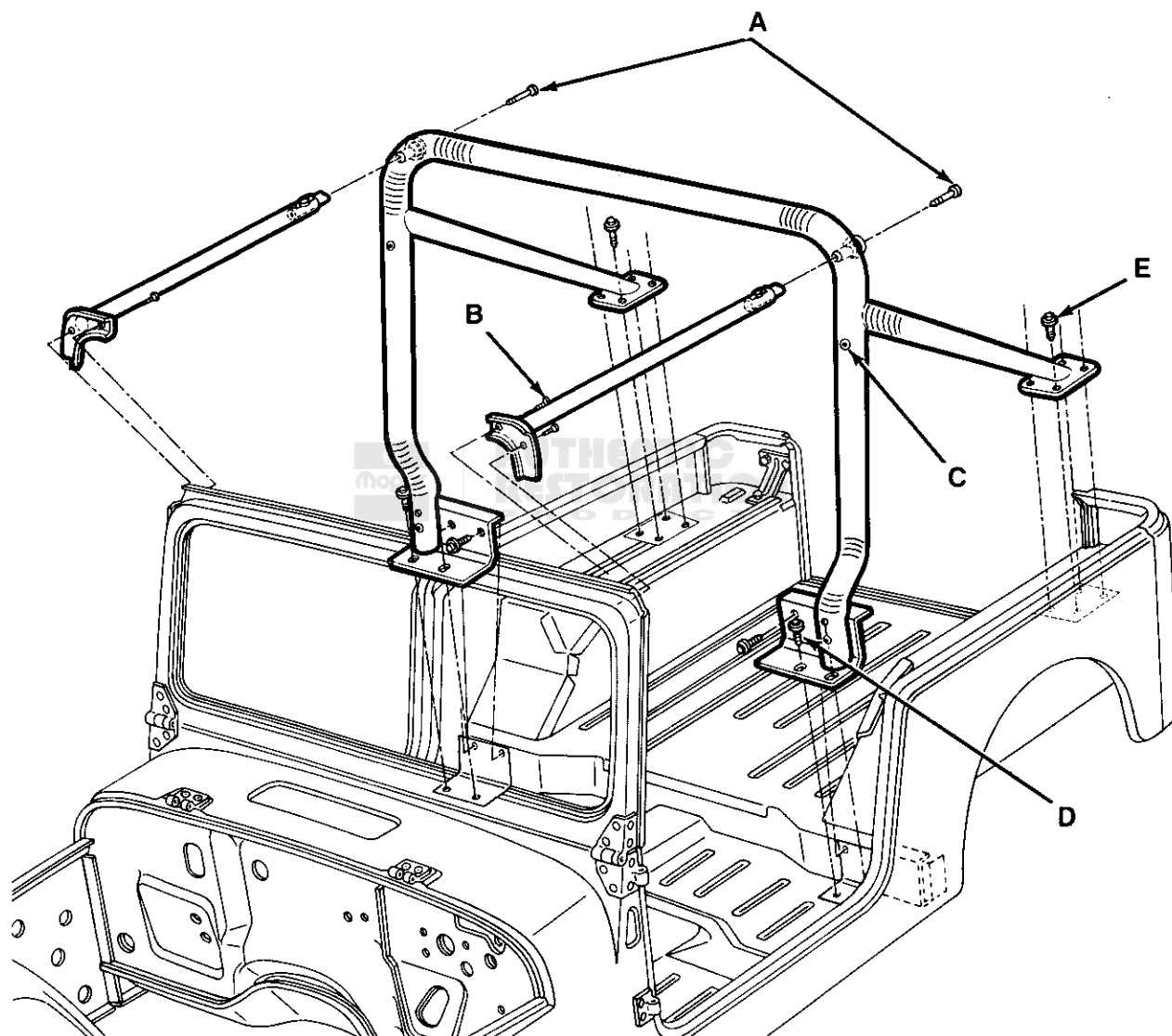
DETACHABLE COMPONENTS

ROLL BAR



REMOVAL

Remove the soft top or hard top enclosure as described in the appropriate section of this chapter.



101345

Remove the screws (A) from the roll bar end of the extension bars.

Remove the screws from the windshield end of the extension bars (B) and remove the extension bars.



DETACHABLE COMPONENTS

ROLL BAR



Disconnect the seat belts at the roll bar anchor point (C).

Remove the screws securing the roll bar to the floor pan at the front and rear anchor points (D) (E) and remove the roll bar.

INSTALLATION

Apply sealant to the areas in the wheelhouse and on the floor pan where the roll bar sets.

Position the roll bar in the vehicle and tighten the retaining screws with 60-90 N•M (44-66 ft.-lbs) torque.

Position the seat belts at the roll bar anchor point and tighten the retaining screws with 43-62 N•m (32-46 ft. lbs) torque.

Position the roll bar extensions and install and torque the retaining screws with 43-62 N•m. (31-45 ft.-lbs) torque.

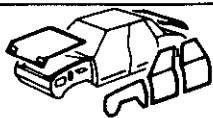
Install the extension bars.

Install the soft top or top enclosure as described in this manual.

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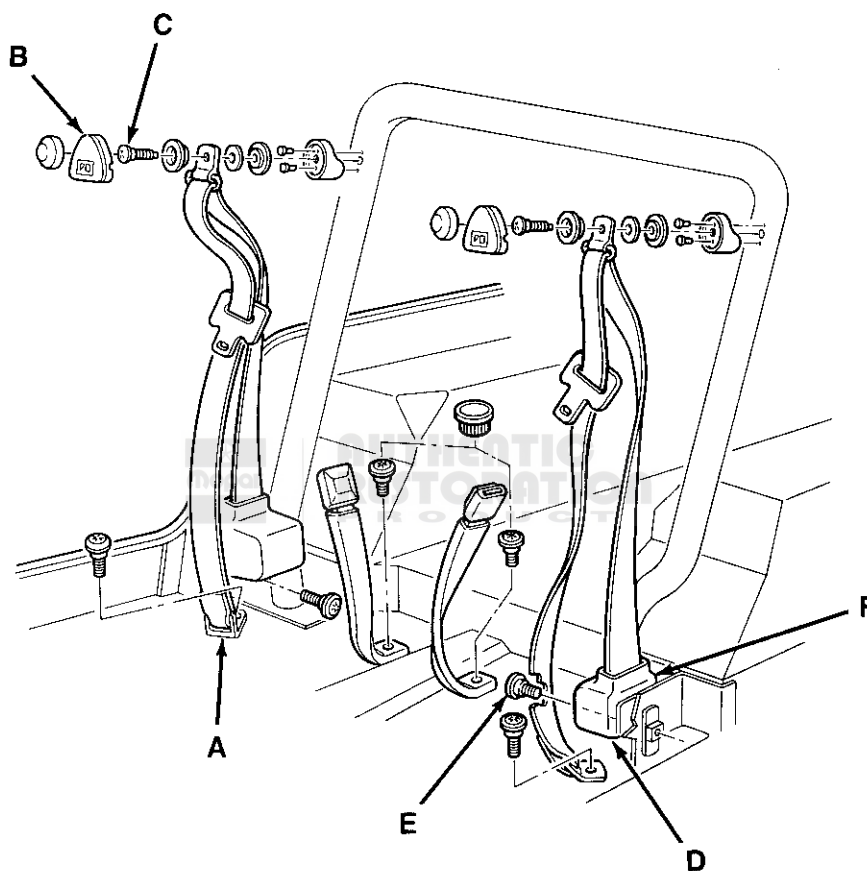
DETACHABLE COMPONENTS

SEAT BELTS



REMOVAL

Remove the seat belt anchor bolt (A).



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Remove the seat belt.

Remove the shoulder belt guide cover (B) from the guide, if equipped.

Remove the guide bolt (C).

Obtain access to the seat belt retractors by removing the trim covers (D).

Remove the anchor bolts from the seat belt retractors (E).

	DETACHABLE COMPONENTS SEAT BELTS	
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Remove the seat belt retractor (F).

INSTALLATION

Inspect the seat belt material for evidence of wear, cuts or fraying.

Replace as required.

Install the seat belt and seat belt retractor anchor bolts. Tighten with 34-47 N•m (25-35 ft-lbs) torque.

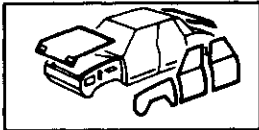
Position the shoulder belt guide on the B-pillar or roll bar and install the bolt.

Install the shoulder belt guide cover.

Install the seat belt retractor trim cover.

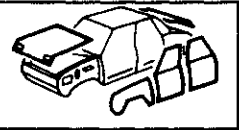
SEE
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DETACHABLE COMPONENTS

CARPET



REAR FLOOR CARPET

The rear floor carpet is held in position by the seats, center console, seat belts, sill plates and other components.

When removing and installing the rear floor carpet, it may be necessary to remove and install the above items.

FRONT FLOOR CARPET

On Wrangler/YJ models the front floor carpet is held in position by velcro strips.

When replacing the front floor carpet, position the carpet in the vehicle and cut the openings in the carpet using a sharp knife or razor blade for such things as the floor shifter, if equipped.

REAR COMPARTMENT CARPET

On Wrangler/YJ models the rear compartment carpet is held in position with glue and velcro strips.

The replacement carpet may require some modifications to accommodate these items.

WHEELHOUSE CARPET

On Wrangler/YJ models the wheelhouse carpet is held in position by glue and velcro strips.

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	SEALING	
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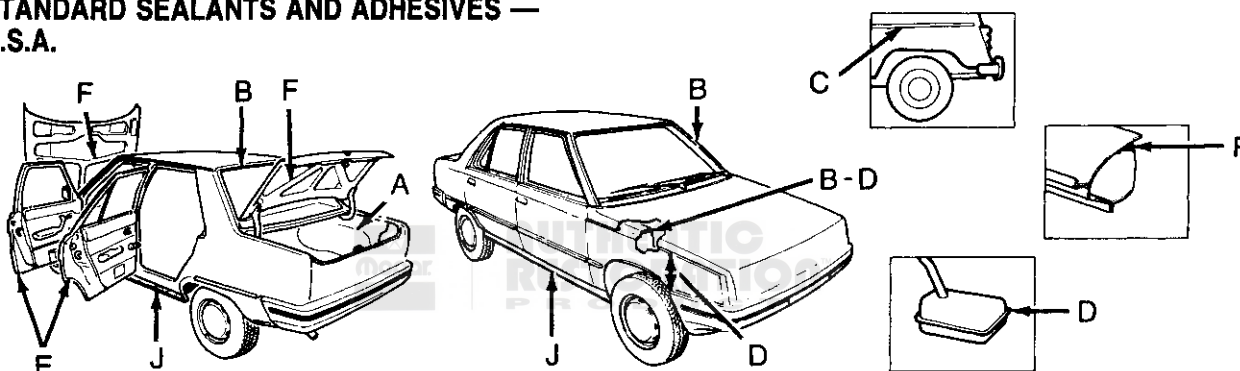
	SEALING SEALANT APPLICATION	
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GENERAL INFORMATION

After a repair is made on a welded component, every effort should be made to duplicate the sealant protection that was applied at the factory using the available approved aftermarket materials.

Through knowledge of the body panel structures is essential before attempting a sealing operation.

STANDARD SEALANTS AND ADHESIVES — U.S.A.



	Application	AMC-Renault Classification	3M	Kent	Crest	Ditzler
A	Sealer for all permanent joints (welded, riveted, etc...) For interior or exterior usage. This sealer may be painted when dry.	297	08646(W) 08648(B) 08656	CSS4-10280	CJ-(W) CJ-(B) BJ	
B	Windshield sealer for rubber to glass	306	08511 08513	GMI-10220	BL-R	
C	Sealer for windows, sunroof installation	307	08509	BGI-10255	BPP-Primer CBB-Sealer	
D	Thumbable sealer strip-calk (permanent joints)	503	08575(W) 08578(B)	SPI-10310(B) SP4-10320(W)	XSB(B) XSG(W)	
E	Door skin flange kit *	512	08109			
F	Metal to metal adhesive hood, roof anti-flutter	514	08105			
J	Anti-road grit (stone ship protection for the bottom of the body, the fender interior, exterior quarter panel, underbody.	561		BRU-50005		DX54

Application	Part Number
Undercoating sealer	3M 08864
Window urethane installation kit	URESET 212 KENT INDUSTRIES

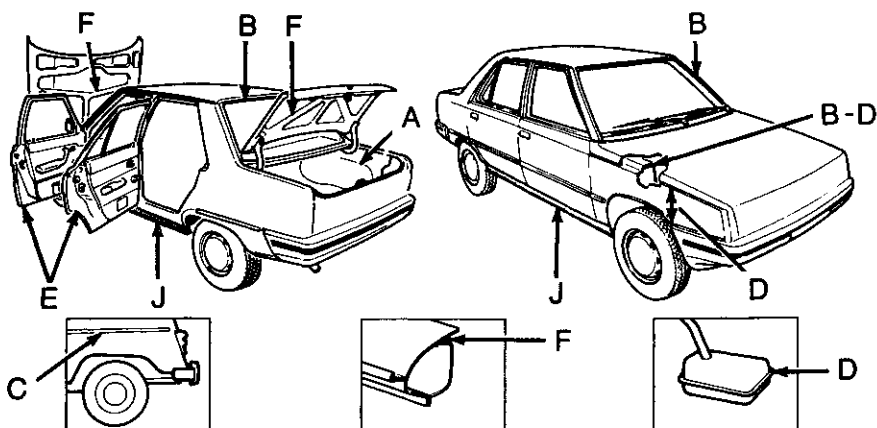
* Door skin gun applicator 3M part number 08190

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	SEALING SEALANT APPLICATION	
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STANDARD SEALANTS AND ADHESIVES — CANADA

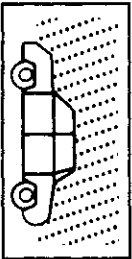
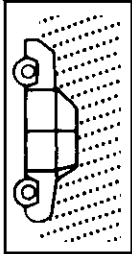


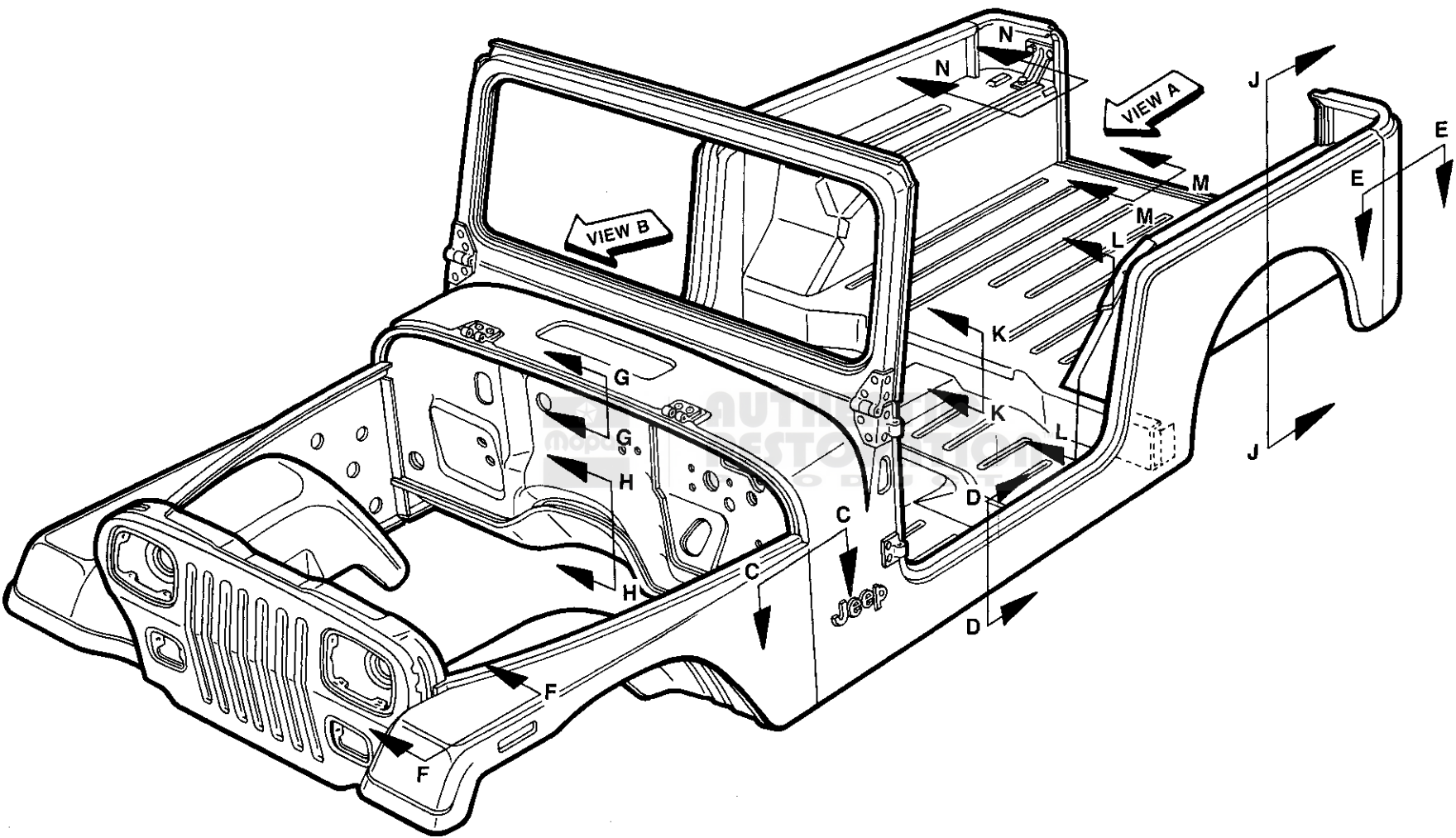
	Application	AMC-Renault Classification	3M	Kent	Crest	Ditzler
A	Sealer for all permanent joints (welded, riveted, etc...) For interior or exterior usage. This sealer may be painted when dry.	297	86464(W) 86480(B)	CSS4-10280		
B	Windshield sealer for rubber to glass	306		GMI-10220		
C	Sealer for windows, sunroof installation	307	08509	BGI-10255		
D	Thumbable sealer strip-calk (permanent joints)	503	08575(W) 08578(B)	SPI-10310(B) SP4-10320(W)		
E	Door skin flange kit *	512	08109			
F	Metal to metal adhesive hood, roof anti-flutter	514	08015			
J	Anti-road grit (stone ship protection for the bottom of the body, the fender and rear quarter panel)	561		BRU-50005		DX54

Application	Part Number
Undercoating sealer	3M 08864
Window urethane installation kit	URESET 212 KENT INDUSTRIES

* Door skin gun applicator 3M part number 08190

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	SEALING SEALANT APPLICATION	
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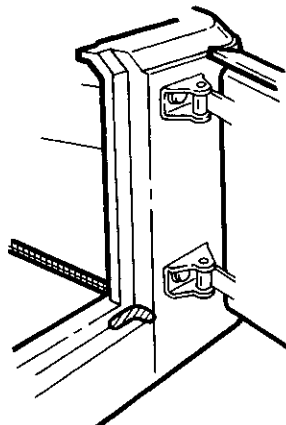
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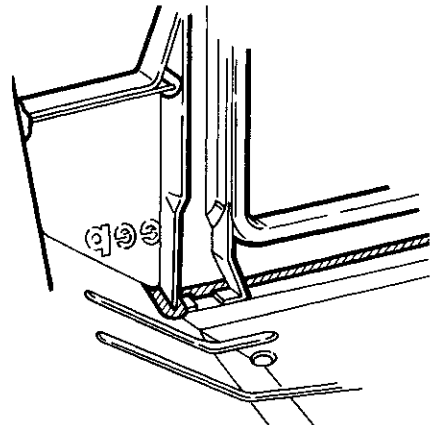
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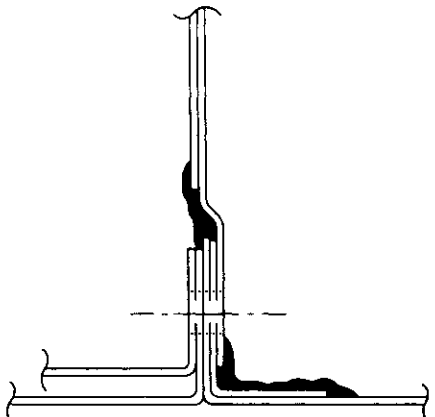
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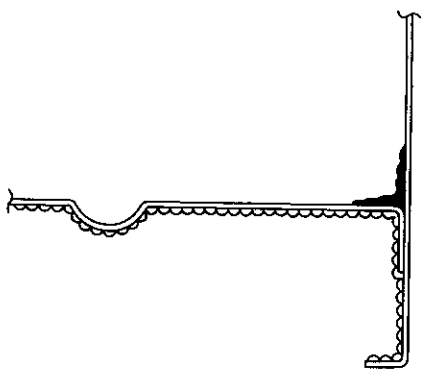
VIEW A



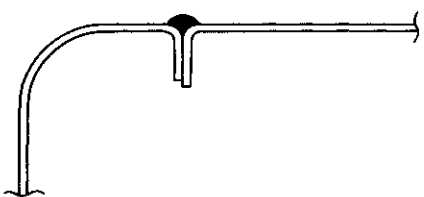
VIEW B



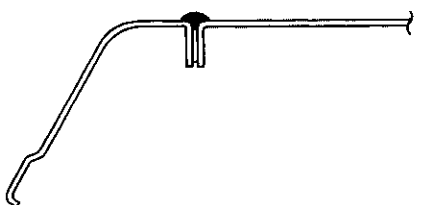
SECTION CC



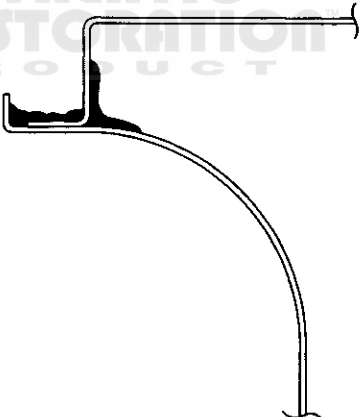
SECTION DD



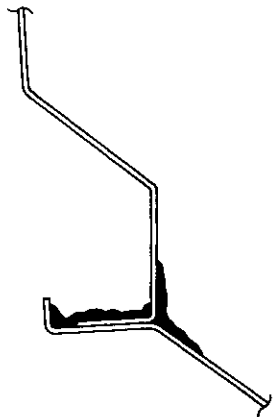
SECTION EE



SECTION FF



SECTION GG



SECTION HH



Seam sealer classification 297

Stone chip protection.

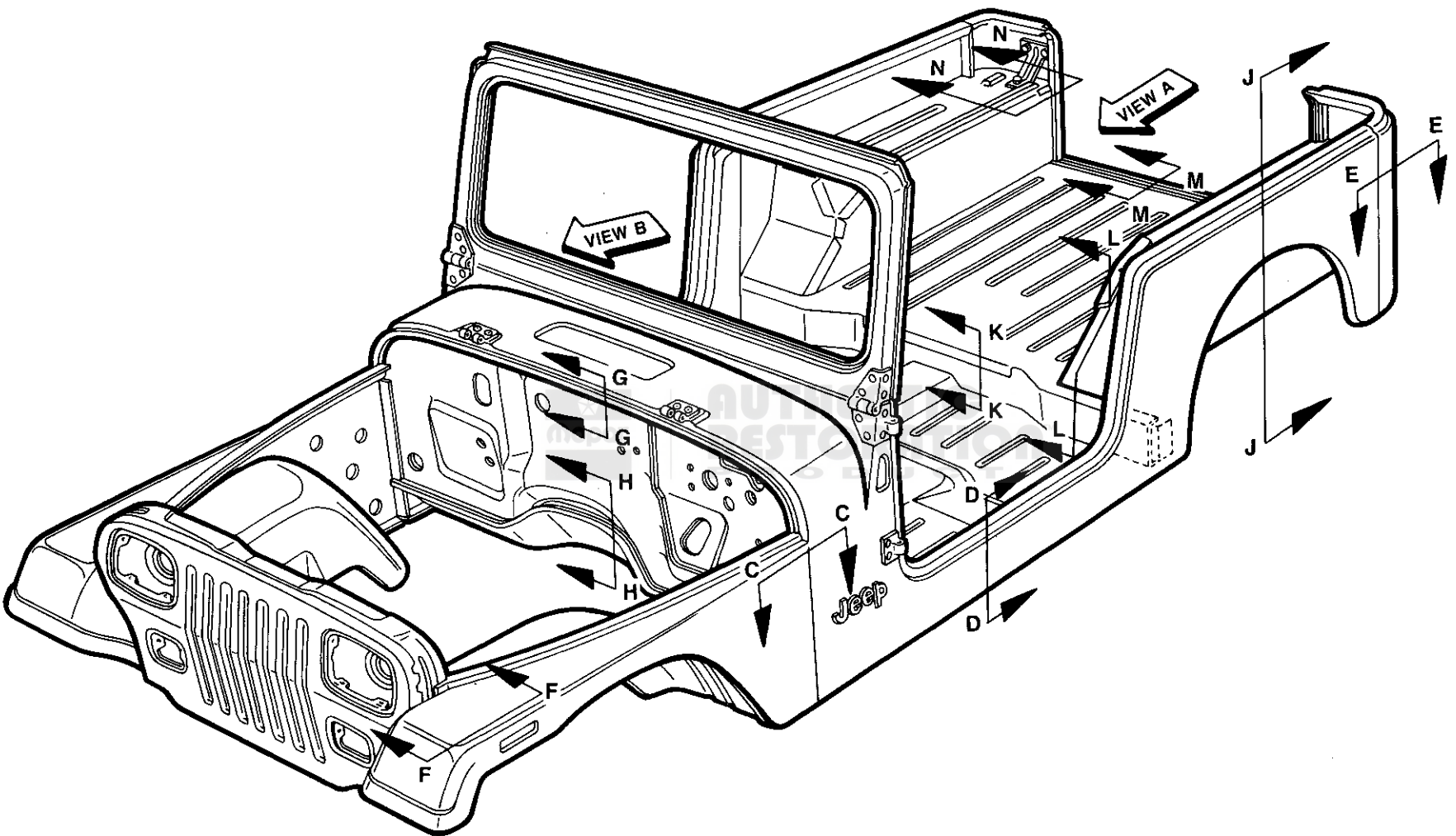


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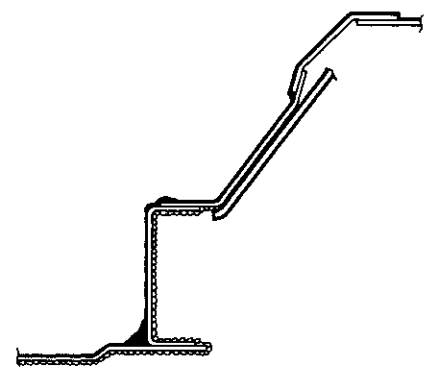
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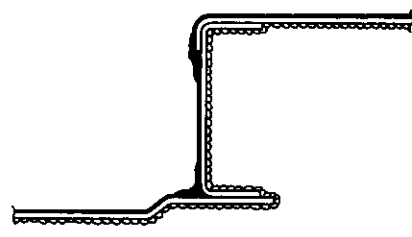
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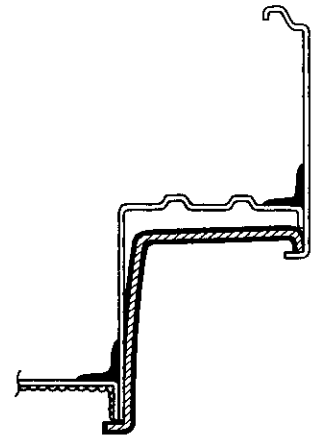
SEE I.S. NOTES



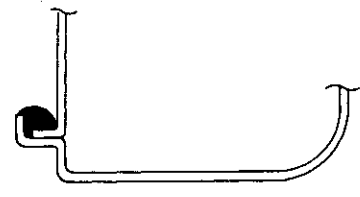
SECTION LL



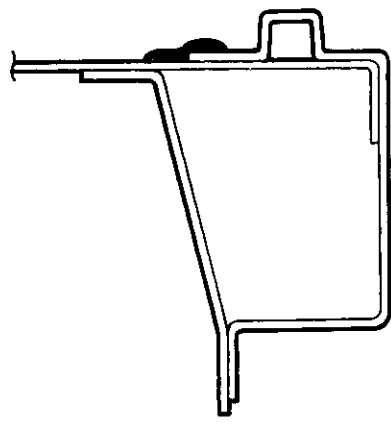
SECTION KK



SECTION JJ



SECTION NN



SECTION MM

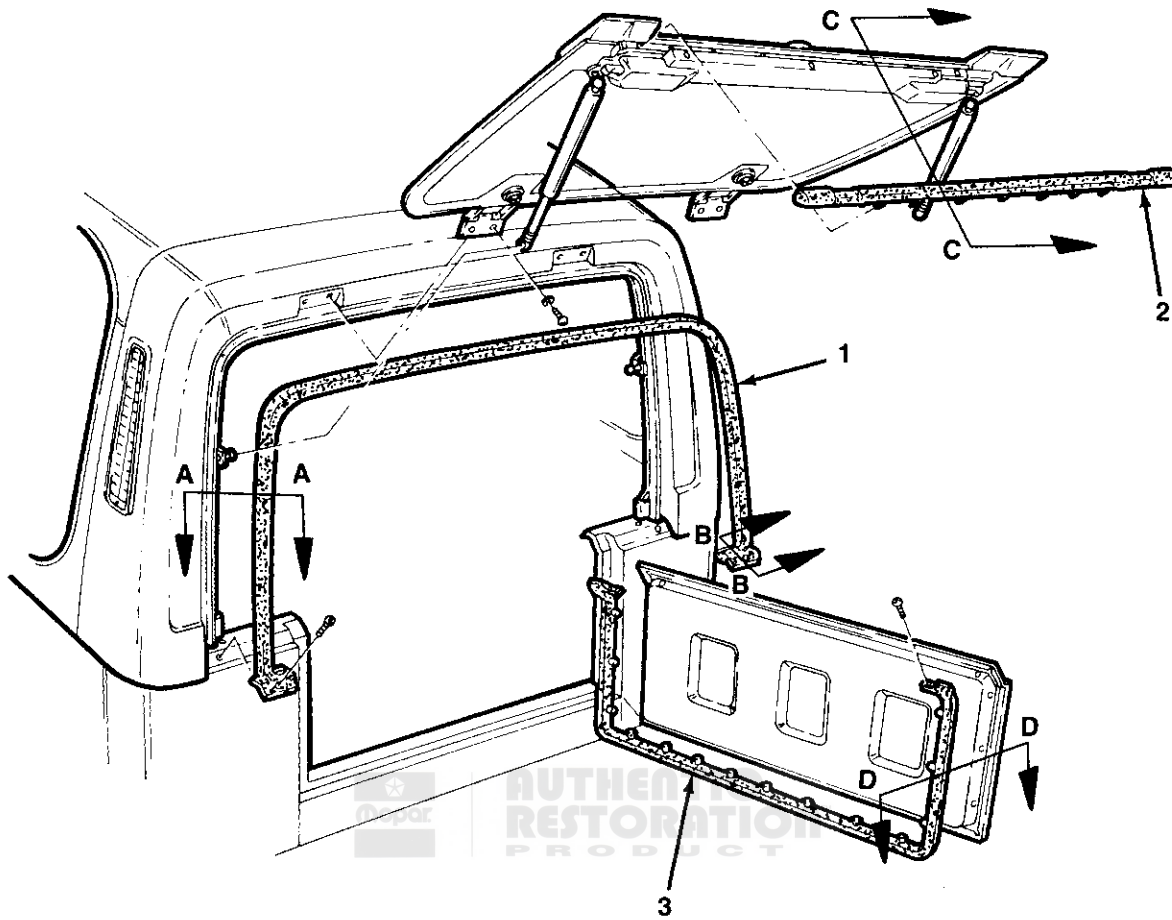
-  Seam sealer classification 297
-  Stone chip protection
-  Wheel house liner.



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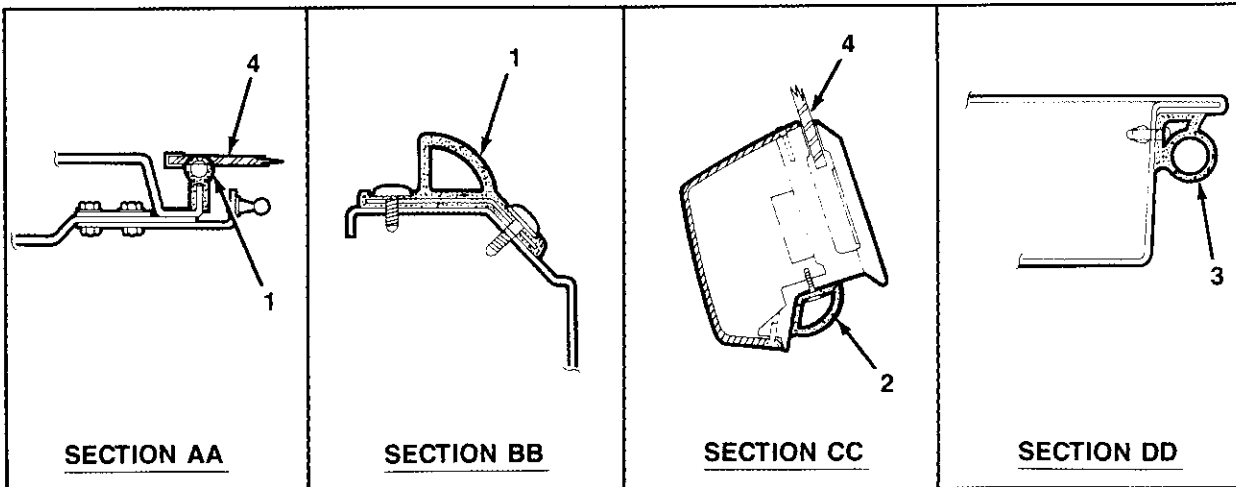
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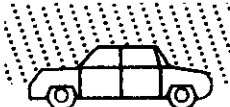
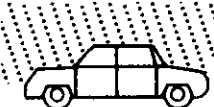


1. BODY WEATHERSTRIP TO LIFTGATE GLASS
2. WEATHERSTRIP LIFTGATE GLASS TO TAILGATE
3. WEATHERSTRIP TAILGATE TO BODY
4. LIFTGATE GLASS

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	SEALING SEALANT APPLICATION	
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VEHICLE EXTERIOR WIND NOISE DIAGNOSIS

General Information

Exterior wind noise caused by loose or un-seated moldings, trim, vibrating grille components, etc., can be hard to diagnose.

The most common exterior wind noise is generally called a **tea kettle whistle** and it is usually caused by air flowing under instead of around or over a molding.

Road Test

There is no method available to simulate the air flow that causes exterior wind noise, therefore a road test is usually necessary.

Take along a roll of tape to help isolate the problem areas as they are located during the road test.

It is usually helpful to have an assistant either drive the vehicle or search for the source(s) of the noise.

Road test the vehicle with the front windows closed and then open to determine for sure that the wind noise is originating from the outside of the vehicle.

Also, drive the vehicle in all directions because the prevailing wind could influence the level of the wind noise.

Try to determine from which area(s) of the vehicle the wind noise is originating:

- grille area
- hood bezel
- fender flares
- body side molding
- windshield reveal molding

Apply masking tape to the suspected area(s) and road test the vehicle.

If the wind noise still exists, apply additional strips of tape to the suspected area(s) until the wind noise is located.

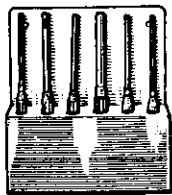
If a large area has been covered with masking tape, continue the road test and progressively remove the strips of masking tape until the source of the noise is isolated.

Align and tighten the molding or fill the gap(s) with sealant.

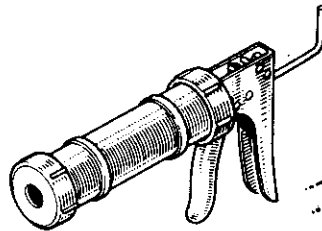
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	SEALING WATER LEAK DIAGNOSIS AND REPAIR	
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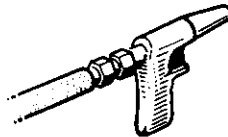
BASIC WATER LEAK TOOLS AND PRODUCTS



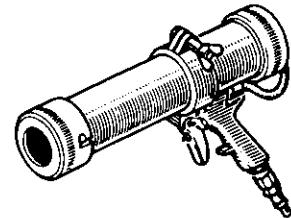
Punch



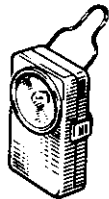
Manual Gun Applicator



Air Blower



Pneumatic Air Gun Applicator



Flashlight



Mirror



Dolly



Tape



Plug

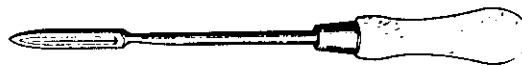


Knife



Scissors

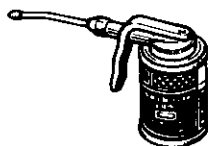
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Scraper



Water Hose



Sealant and Glue



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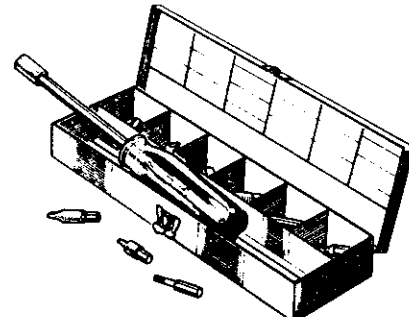
307



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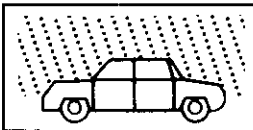


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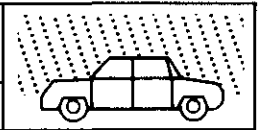
Screwdriver Kit

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SEALING

WATER LEAK DIAGNOSIS AND REPAIR



WATER LEAK DIAGNOSIS

The successful resolution of a water leak is dependent on three conditions:

- accurate diagnosis based on careful visual inspection and water testing
- correct sealing methods and equipment
- use of correct sealing material

Visual Inspection

An accurate diagnosis is the important first step in correcting water leaks.

The visual exterior inspection should cover the vehicle exterior as well as the interior. It should include removal of the seats, carpeting, floor mats, and trim from suspected leak areas to check for water tracking. Tracking will usually indicate leak direction and help pinpoint the source.

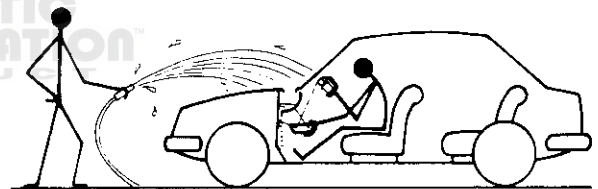
The vehicle exterior should be carefully examined for:

- misaligned doors, windows, hardtop, tailgate
- missing, loose or damaged weatherstripping
- missing or loose grommets in doors, floorpan or engine compartment dash panel
- gaps in the sealed seams or lack of sealer
- hollow spotwelds in gutters and welded seams

Water Test

The next diagnostic step is the water test which should be performed by two technicians for best results. In this situation, one man sprays the vehicle exterior with water while the other inspects the interior for leak sources.

For the best results, use a garden hose with water pressure of 27 to 42 psi (2-3 bars).

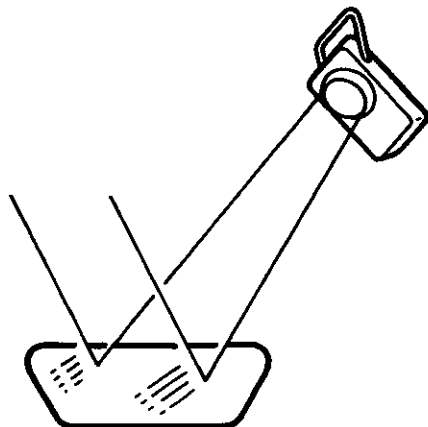


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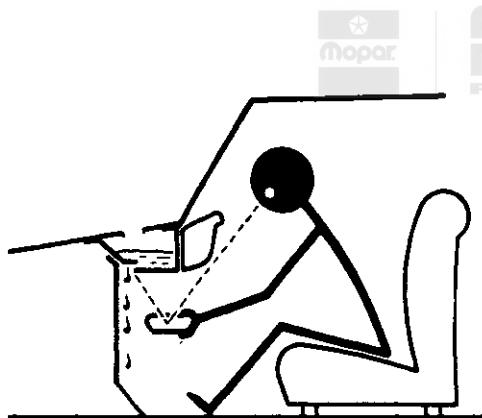
The technician inside the vehicle should have a flashlight and a mirror to search for the source of the leak. The mirror can be used for reflecting light into dark corners and observing otherwise inaccessible places.

SEE
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	SEALING WATER LEAK DIAGNOSIS AND REPAIR	
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The method of spraying the vehicle is critical to accurate diagnosis. Random spraying may miss

the leak source. The spray pattern must be through and methodical.

The best method is the spray zone method which divides the vehicle into five separate zones as shown below. Start at the lowest zone and work upward through each of the zones.

DIAGNOSTIC TIPS

Water leaks are traced in a reverse direction (e.g., from the wet area back to the source).

Use the zone spray method. Start at the bottom of the vehicle and work upward. This method allows the elimination of each potential leak area in stages.

Do not assume that a water leak has only one source. A single water leak may have as many as three sources.

Seal each leak source as soon as it is located and respray the same zone. This checks the repair and will reveal any additional leaks in the same zone.

Do not apply the water stream directly against window seams or fresh air vents. This may create temporary and false leaks that can hinder accurate diagnosis.

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WELDED COMPONENTS



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WELDED COMPONENTS

BODY AND FRAME COMPONENTS



BODY CONSTRUCTION

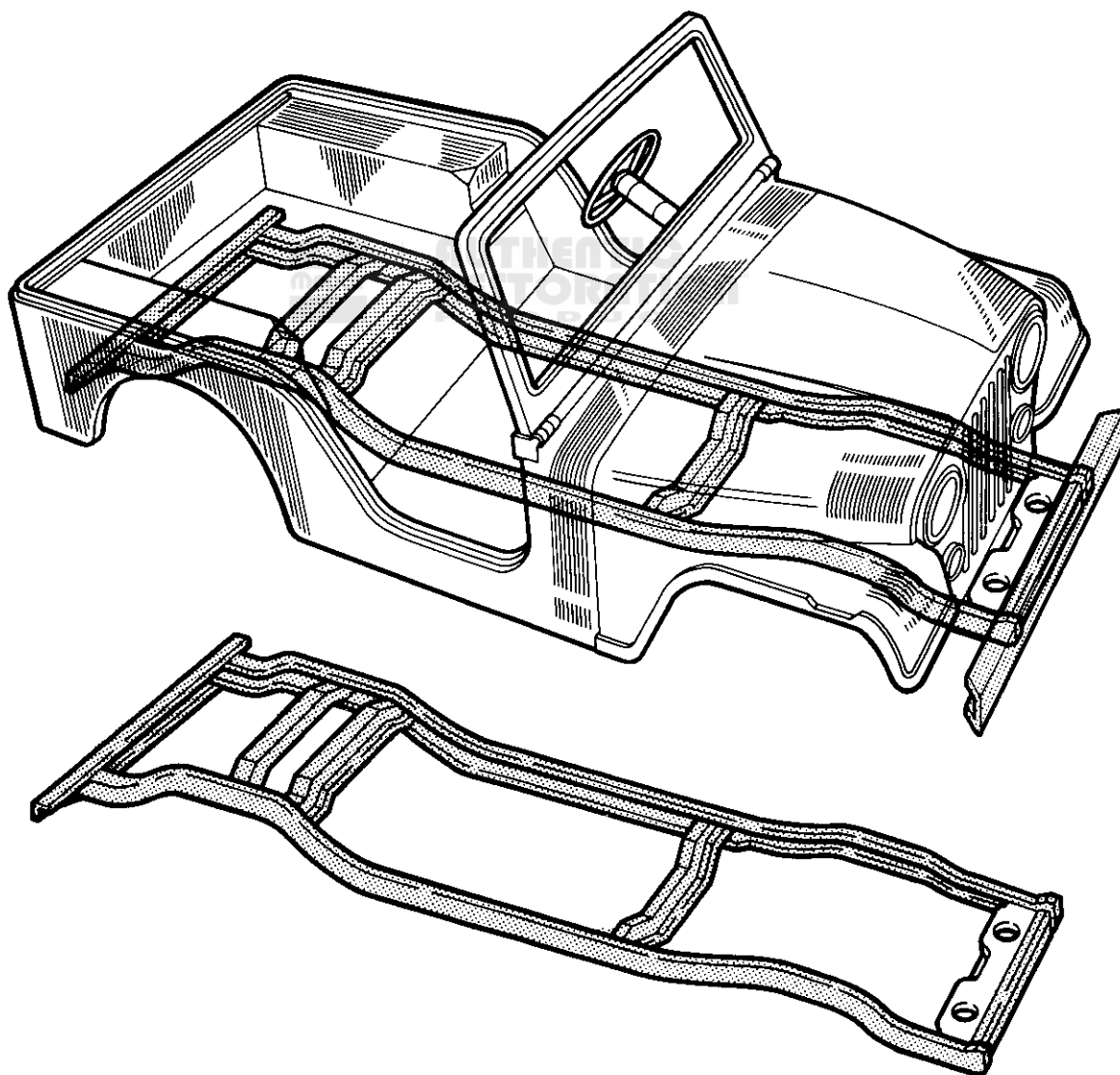
General

Jeep vehicles are of all-steel construction, with insulated body mounting points that provide a secure attachment to the chassis frame.

All major body panels are of heavy-gauge steel, reinforced, flanged and welded. The bodies are completely detachable from the chassis unit and are insulated from the frame by body spacers placed between the body and frame and held in position with body bolts.

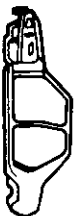
Spacers are located between the body and chassis mounting points to insulate against vibrations and road noises.

Periodic inspection is necessary to determine the condition of the body spacers and hold-down bolts. Worn, loose or fatigued spacers permit the body to settle, causing body lean or possible interference between the floorpan and various chassis components.

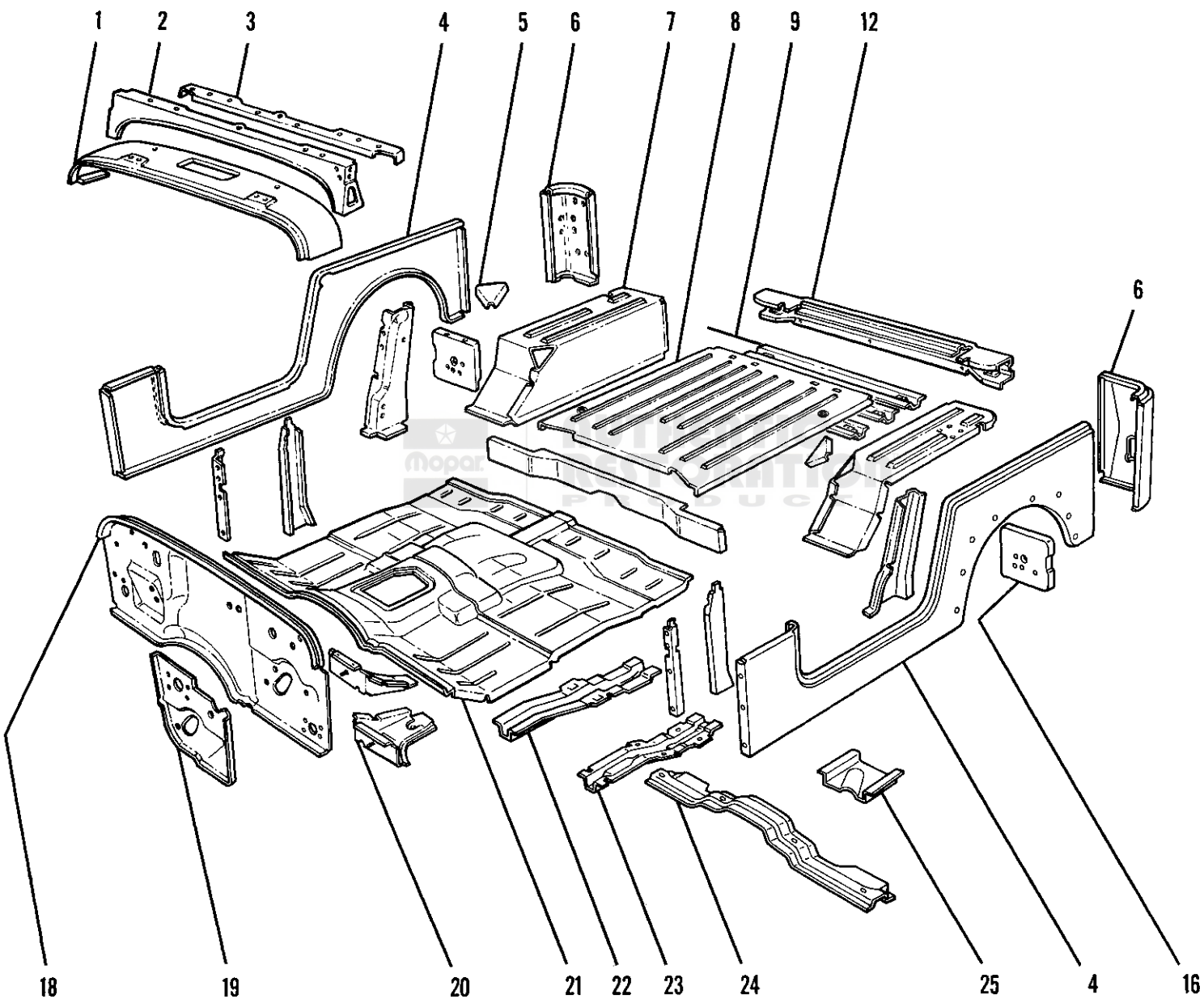


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WELDED COMPONENTS BODY AND FRAME COMPONENTS



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- 101390
1. PANEL - COWL - FRONT
 2. PANEL - COWL - REAR
 3. REINF. - COWL PANEL REAR
 4. PANEL - BODY SIDE - RT. - LT.
 5. FILLER - WHEELHOUSE TOP - RT. - LT.
 6. PANEL - REAR CORNER RT. - LT.
 7. PANEL WHEELHOUSE RT. - LT.
 8. FLOOR PAN REAR
 9. ASS'Y - CROSS SILL - RR. FLOOR - R.R.
 10. ASS'Y - CROSS SILL - RR. FLOOR PAN
 11. ASS'Y - CROSS SILL - RR. FLOOR - FRONT
 12. PANEL - BODY REAR CROSSMEMBER
 13. REINF. - SIDE PANEL RT. - LT.
 14. PILLAR COWL RT. - LT.

15. SUPPORT ASS'Y - BODY SIDE PANEL RT. - LT.
16. SPARE WHEEL CARRIER BODY BRACKET
17. RISER - ASS'Y FRONT TO REAR FLOOR
18. PANEL - DASH
19. REINF. - ASS'Y DASH PANEL
20. BRACKET BODY HOLD DOWN FRONT RT. - LT. ASS'Y
21. FLOOR PAN FRONT
22. STRAINER ASS'Y LONGTDNL. - IN BOARD
23. STRAINER ASS'Y - LONGTDNL. - OUT BOARD
24. CROSSMEMBER - FRONT FLOOR
25. HEAT SHIELD TAILPIPE



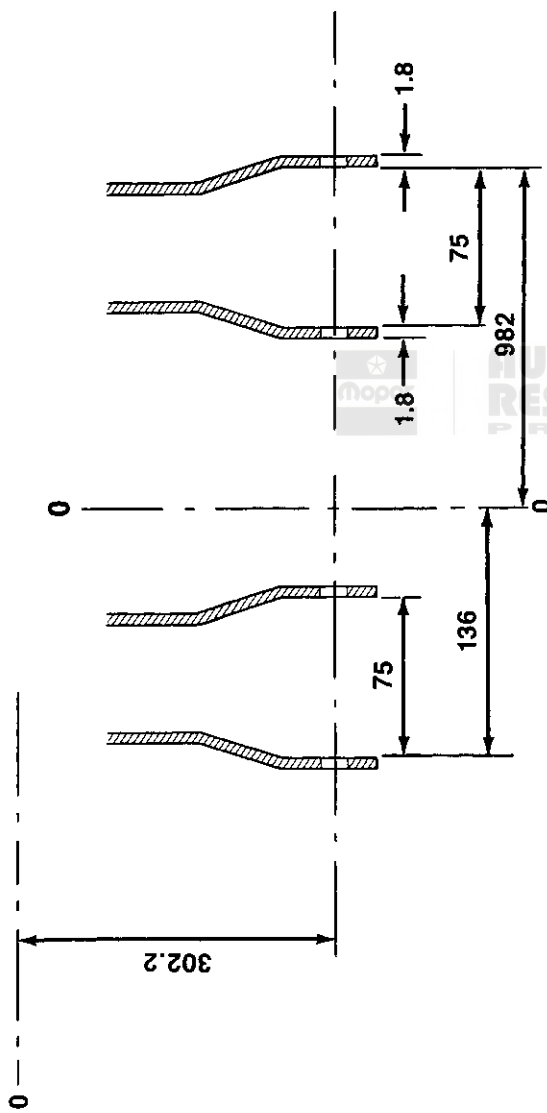
WELDED COMPONENTS **BODY AND FRAME COMPONENTS**



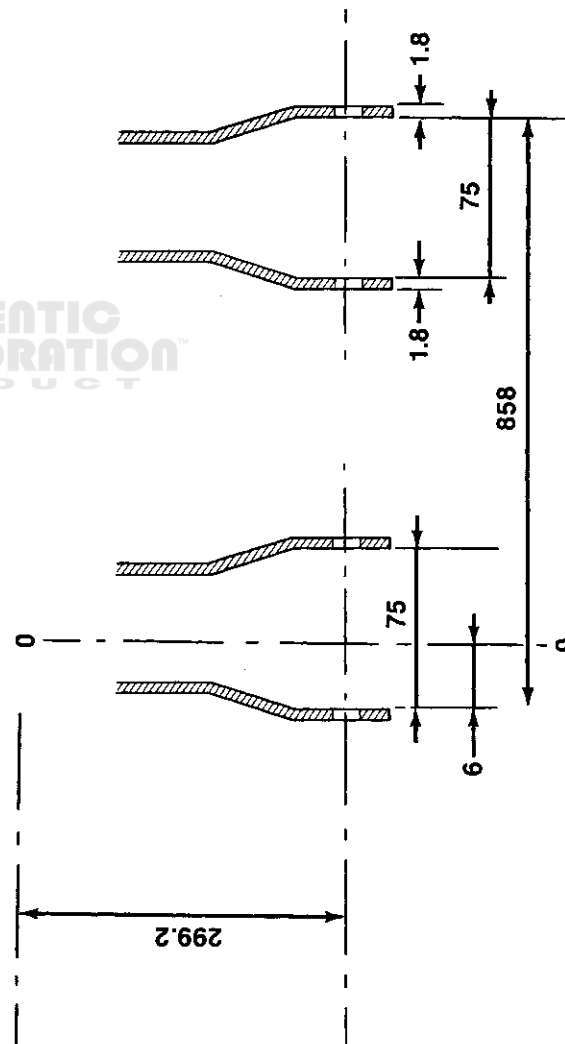


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	WELDED COMPONENTS FRAME SPECIFICATIONS	
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REAR LEAF SPRING FRONT MOUNTING LOCATION B



FRONT LEAF SPRING REAR MOUNTING LOCATION A

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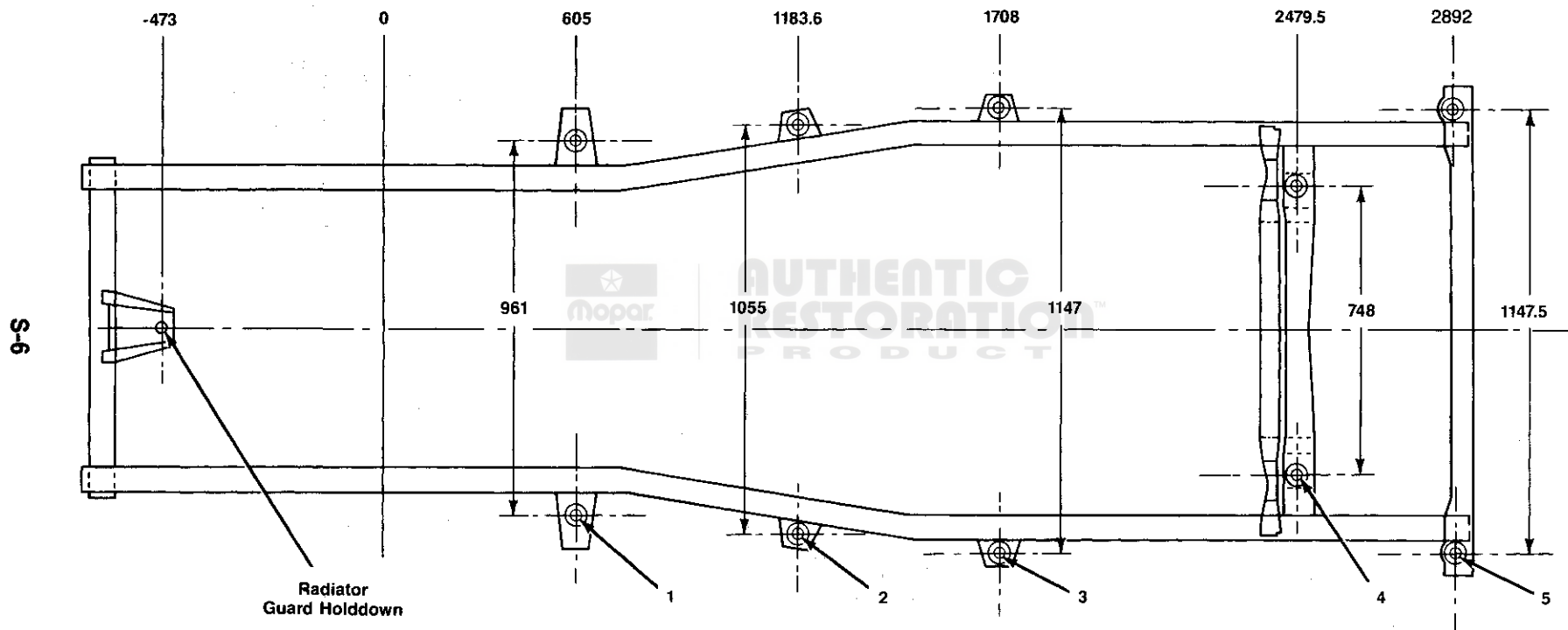
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BODY HOLDDOWN SPECIFICATIONS



SECTION

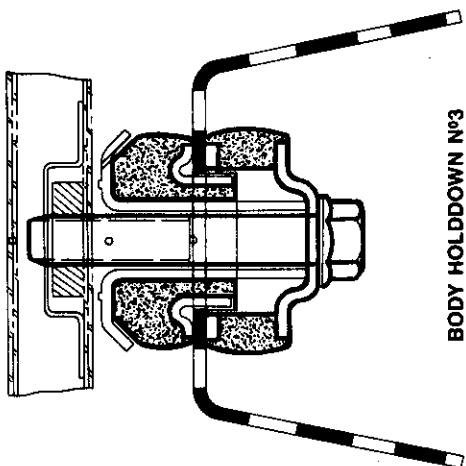
BODY HOLDDOWN MOUNTING POINTS



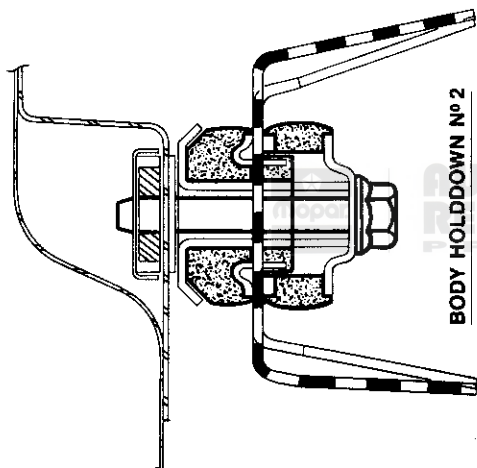


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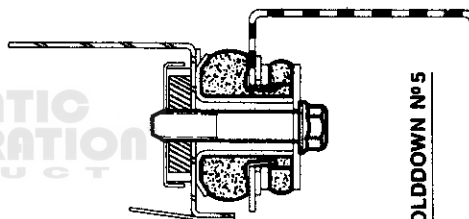
BODY HOLDDOWN SPECIFICATIONS



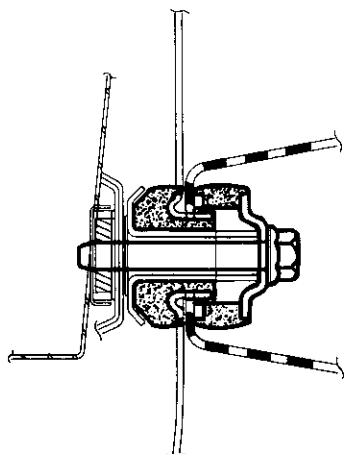
BODY HOLDDOWN N°3



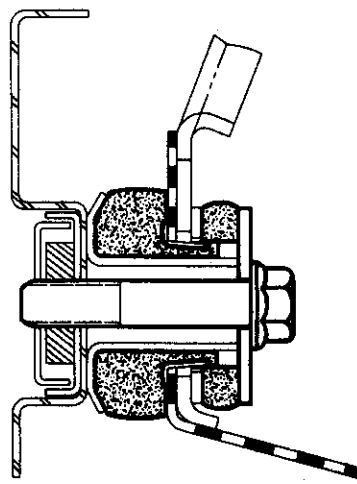
BODY HOLDDOWN N°2



BODY HOLDDOWN N°5

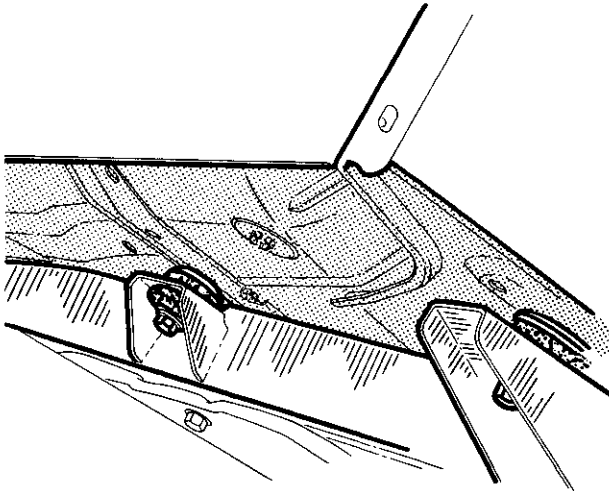


BODY HOLDDOWN N°1



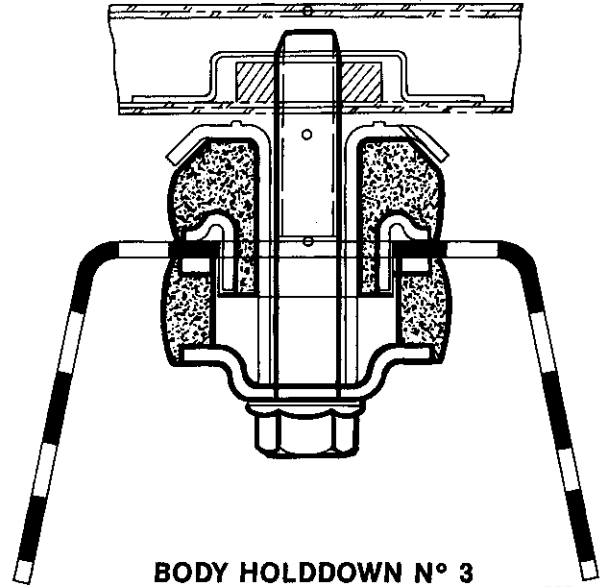
BODY HOLDDOWN N°4

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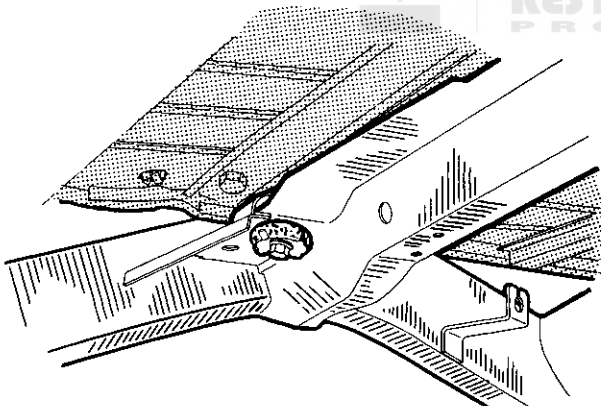
BODY HOLDDOWN N° 1 AND 2

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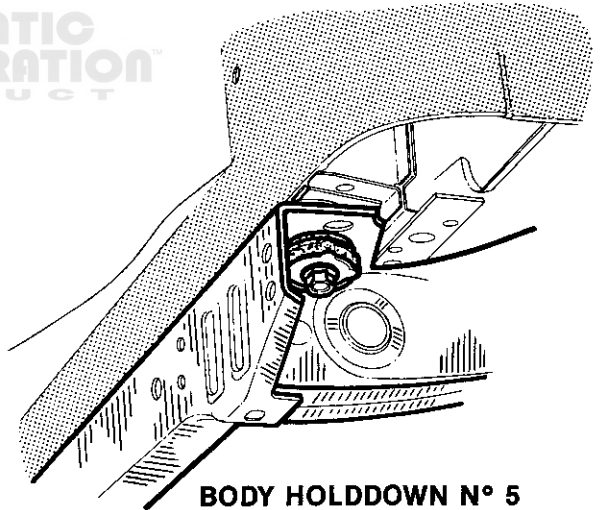
BODY HOLDDOWN N° 3

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BODY HOLDDOWN N° 4

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BODY HOLDDOWN N° 5

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NOTES

BODY DAMAGE INSPECTION AND MEASUREMENTS

An inspection and several measurements must be completed before any body repairs are initiated.

Visual Inspection

Walk slowly around the vehicle and visually inspect for damage.

Inspect at every body location and note all damage even if some of it appears to be minor.

Inspect for the following:

- alignment of the external sheet metal
- bends or buckles in the floor pan
- crushed or bent sillmember(s)
- alignment of the body structure
- alignment of the frame structure



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FRAME CONSTRUCTION

The frame is the foundation and structural center of the vehicle. In addition to carrying the load, it mounts and supports the power unit

while maintaining the correct relationship and alignment of the power train. This relationship assures normal functioning of the units and freedom from excessive wear, stress and strain. The frame is constructed of heavy-channel steel side rails and crossmembers.

The crossmembers maintain the proper positions of the side rails in direct relationship to

each other, providing maximum resistance to torsional twist and strains.

FRAME ALIGNMENT DIAGNOSIS

There are three methods for checking frame alignment:

- Trammel Gauge — for a quick check
- Self-Centering Gauges — for estimating and repair
- Jig Bench — for estimating and repair



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WELDED COMPONENTS

BODY REPAIR INFORMATION



TRAMMEL GAUGE — DIAGNOSIS

The trammel gauge is primarily used for diagnosis, but can be used for longitudinal and diagonal measurements during a straightening operation. Using the trammel gauge, cross measurement will indicate the amount of bow or side sway. Measuring the length indicate any smash or sag.

CHECKING BY COMPARING PARALLEL LENGTHS AND DIAGONAL LENGTHS

This is a comparative check between body or frame sections that are parallel or diagonal. The diagonals must be checked and compared as

well as the parallels to ensure alignment accuracy.

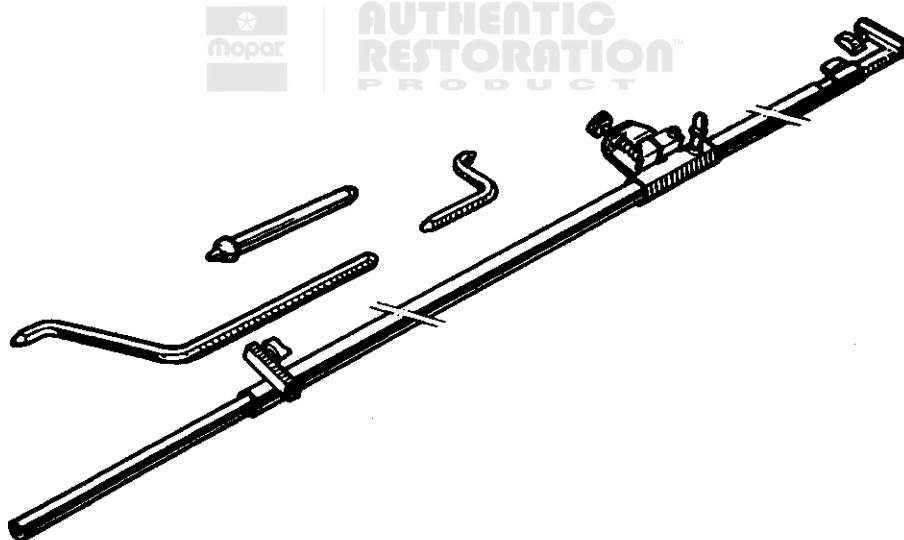
HOW TO USE THE TRAMMEL GAUGE

Place the vehicle on a two post hoist.

Insert the straight pointer with the stepped tip into one of the floor frame jiggling holes.

NOTE: For the particle check in progress, select the most suitable shape of pointer for the other end of the gauge.

Keep the trammel gauge as parallel to the vehicle frame as possible and use the shortest pointers possible for each check.



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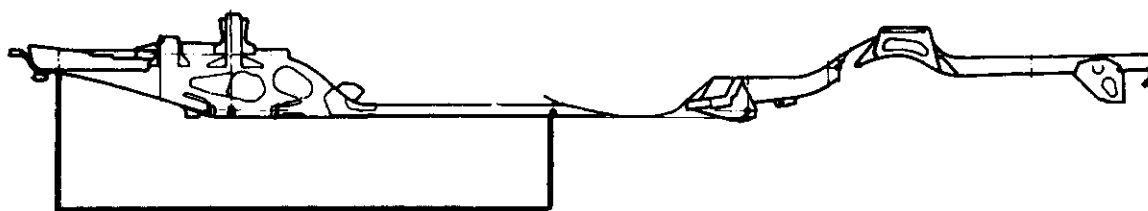


WELDED COMPONENTS

BODY REPAIR INFORMATION



INCORRECT SETUP



CORRECT SETUP

101398

Compare the length of one side to the opposite side of the frame. Do not disturb the pointers or the set length of the trammel gauge.



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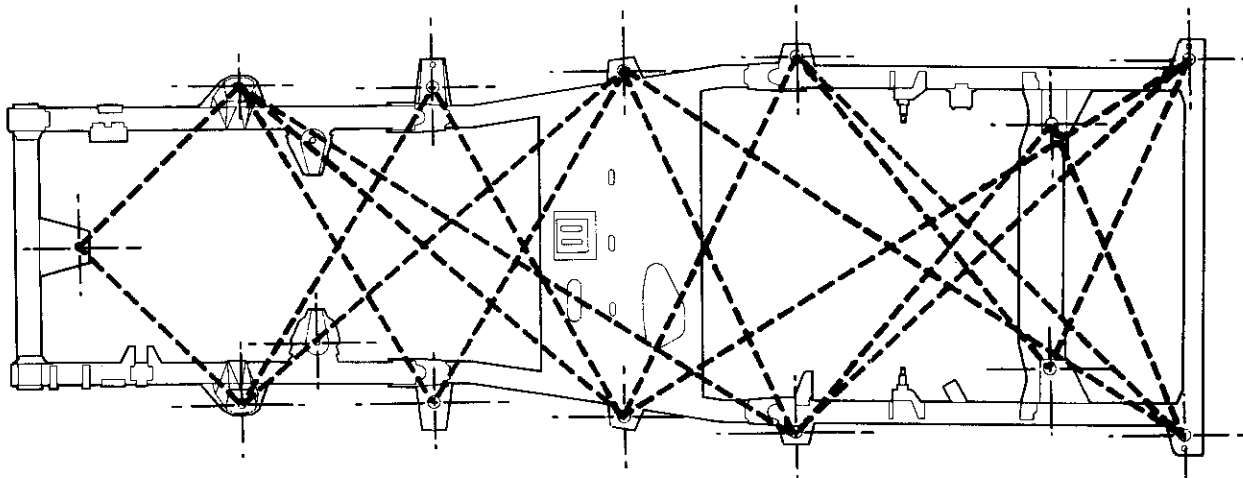


WELDED COMPONENTS

BODY REPAIR INFORMATION



FRAME DIAGONAL COMPARISON MEASURING POINTS

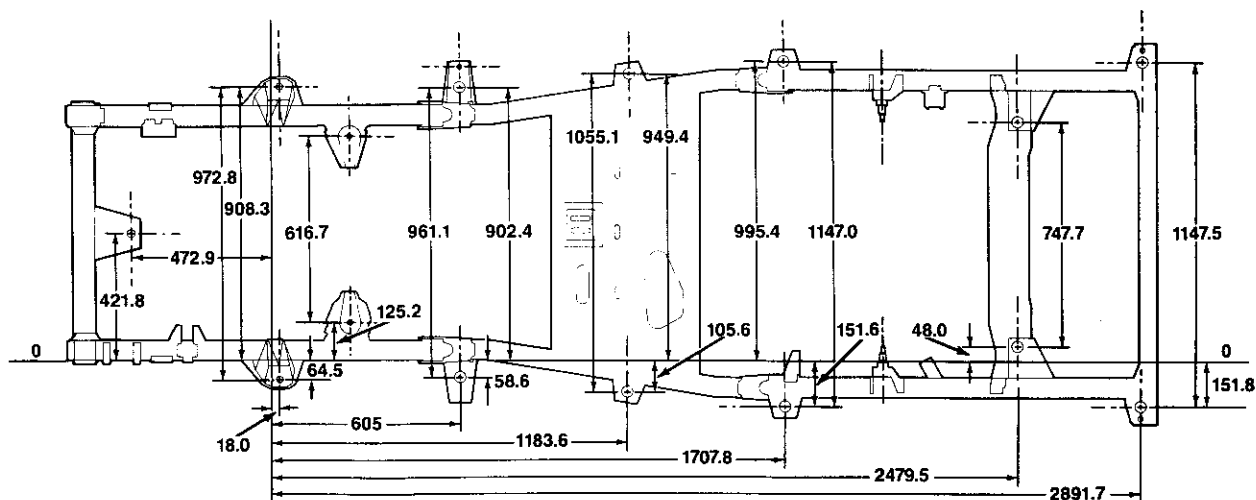


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FRAME WIDTH AND MEASURING POINTS

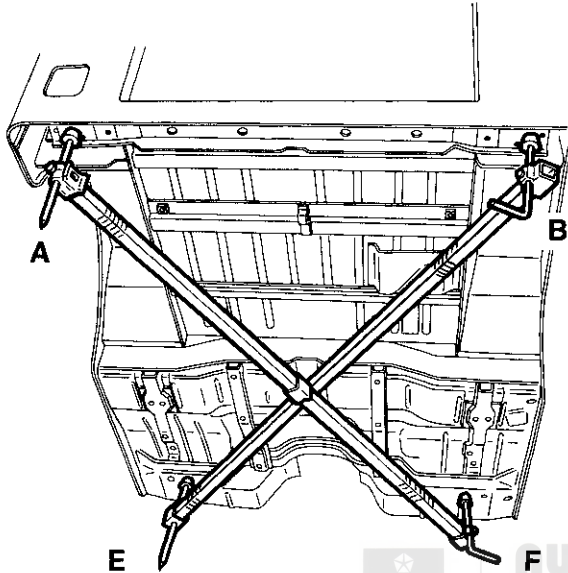


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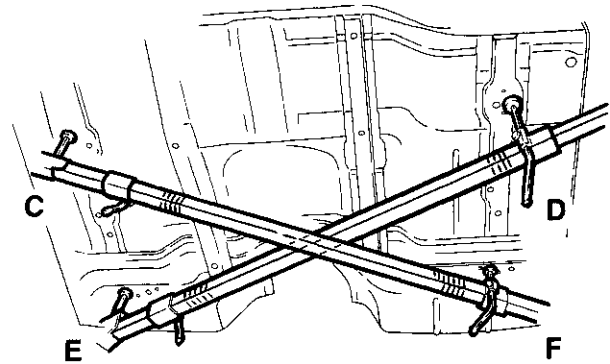
BODY MOUNTING POINTS

Diagonal Measurements Comparison and Length and Width Location



$$AF = BE$$

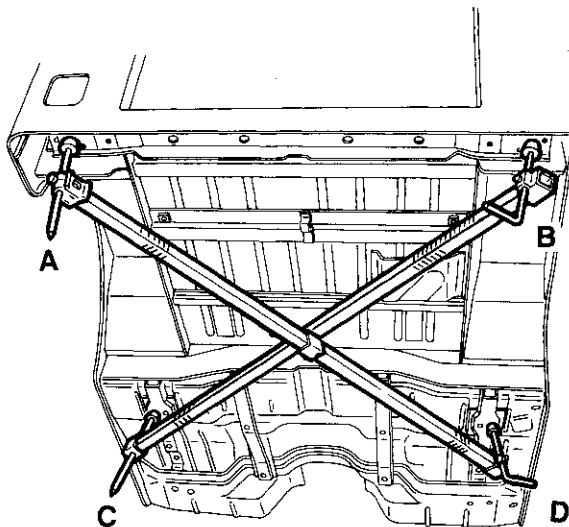
101401



$$CF = DE$$

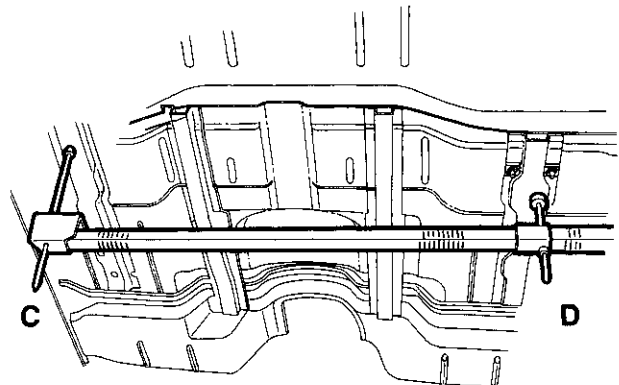
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$$AD = BC$$

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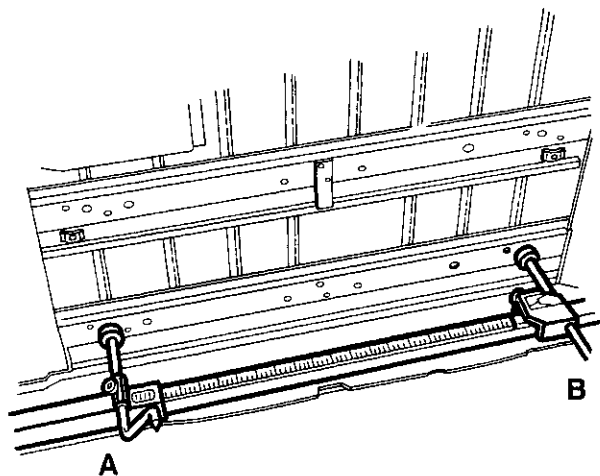
CD WIDE COTATION

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WELDED COMPONENTS

BODY REPAIR INFORMATION



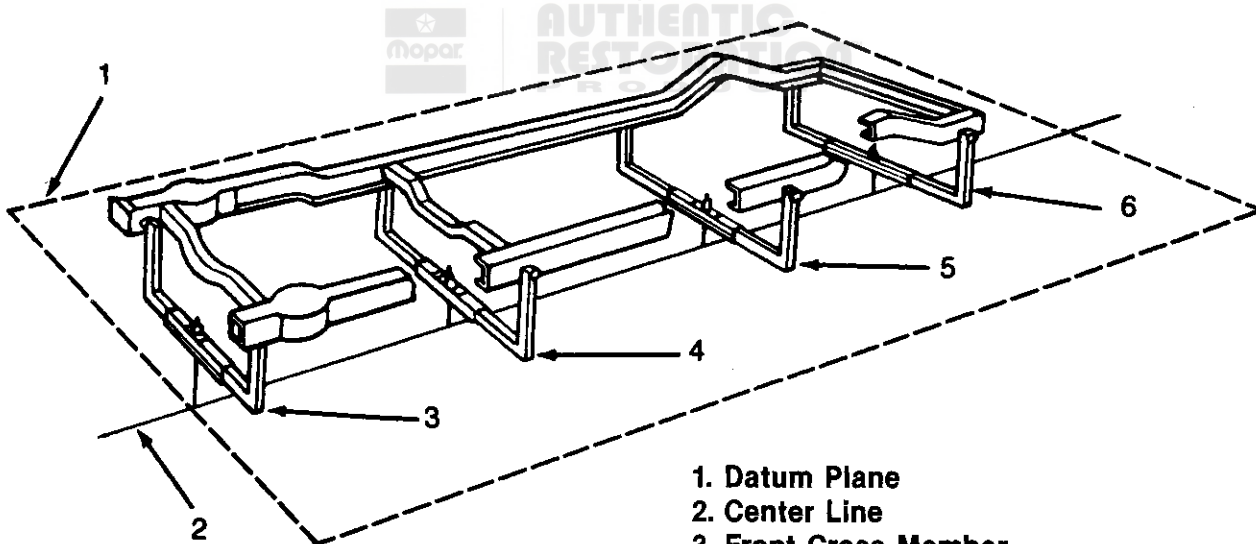
AB WIDE COTATION

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SELF CENTERING GAUGES

NOTE: The following is an example of self-centering gauge alignment showing the sight pins in line to establish the centerline.

These gauges are designed to determine the datum plane and centerline of the vehicle to assist in straightening operations.



1. Datum Plane
2. Center Line
3. Front Cross Member
4. Rear Front Suspension Mounting Point
5. Front Rear Suspension Mounting Point
6. Rear Cross Member

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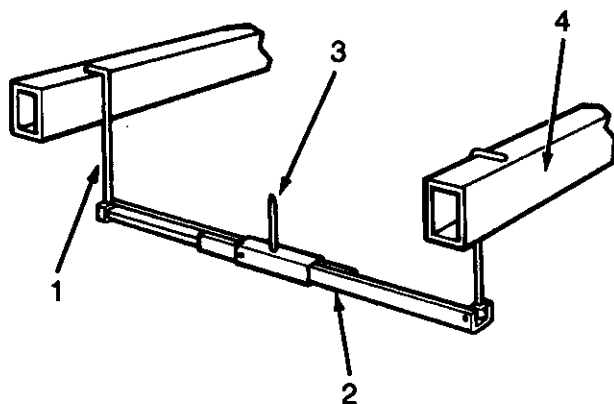


WELDED COMPONENTS

BODY REPAIR INFORMATION



Self-Centering Gauge



1. Adjustable Hanger
2. Lower Bar Centering for Width
3. Sighting Pin
4. Frame Rail

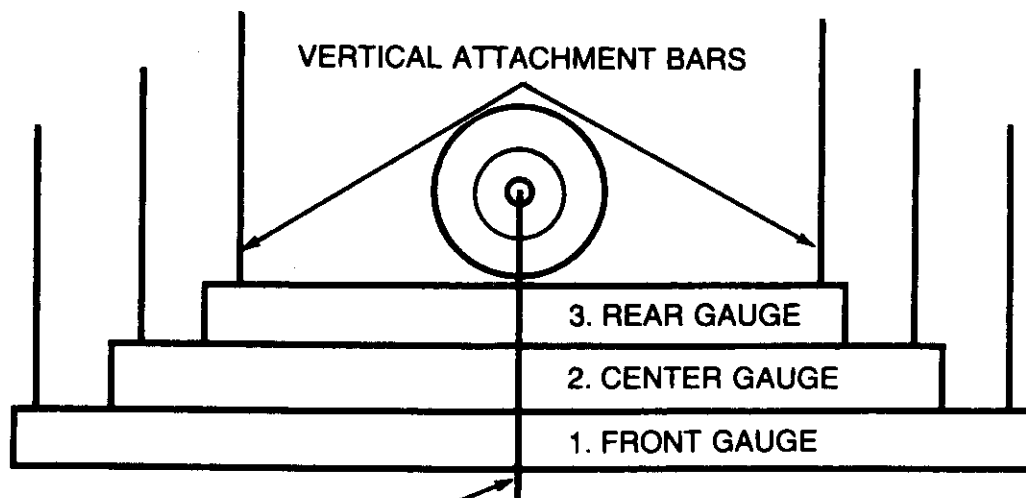
- The self-centering gauge consists of three major components:
- adjustable hanger — used to set the height of the gauge depending on the location of the mounting and help from the datum plane
- sighting pin — used to determine the center-line of the vehicle
- lower bar — self centering for width to form the datum plane and centerline



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SIGHT PINS LINE UP WITH EACH OTHER, THUS CENTER LINE IS ESTABLISHED.

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WELDED COMPONENTS

BODY REPAIR INFORMATION



SELF-CENTERING ALIGNMENT GAUGES

Alignment gauges show misalignment by projecting alignment points of the frame into a line-of-sight that can be read by the technician. A thorough understanding of the information shown by the gauges will enable the technician to diagnose damage and misalignment quickly and accurately.

Gauges have two sliding horizontal bars which remain parallel as they move inward and outward. This inward or outward action permits adjustment to any width for installation on various areas of the vehicle. Once the gauges are hung in place, the horizontal bars will be parallel to that portion of the frame that they are attached. This permits the technician to "read" that area relative to an adjacent area.

Gauges are equipped with center pins that are designed to remain in the center of the gauge regardless of the width of the horizontal bar. This allows for a true centerline throughout the length of the vehicle.

Each gauge accommodates two vertical scales. These scales can be adjusted vertically to assure that the horizontal bars accurately reflect the true position of the parts to which they are attached. This allows all structural misalignments to be read - centerline, level and datum.

CENTER LINE AND DATUM LINE

Before laying out a mechanical drawing, it is necessary for the drafter to establish a reference line from which to start. This is accomplished by establishing a centerline or a datum line. In fact the centerline or datum line will exist only on paper.

Consequently, when installing gauges, it is simply a matter of using the reference points and measurements to establish proper gauge heights or location.

FRAME ALIGNMENT

Before any attempt is made to read the frame alignment gauges, it is important that the technician fully understand the definition of correct alignment.

Structural alignment gauges should be installed in such a way that the line of sight reading can easily be read by the technician.

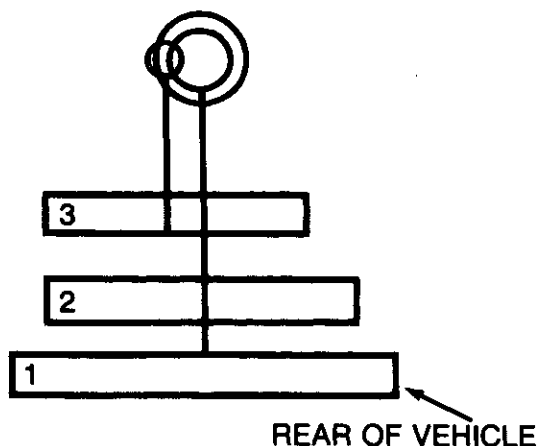
If the gauges are installed properly on a straight frame, all gauges will be parallel, on the same plane and the center pins will align.

Also remember that correct frame alignment must include correct length and width measurements through the entire frame.

FRAME CONDITIONS

The following examples are of sight pin alignment using the self-centering gauges.

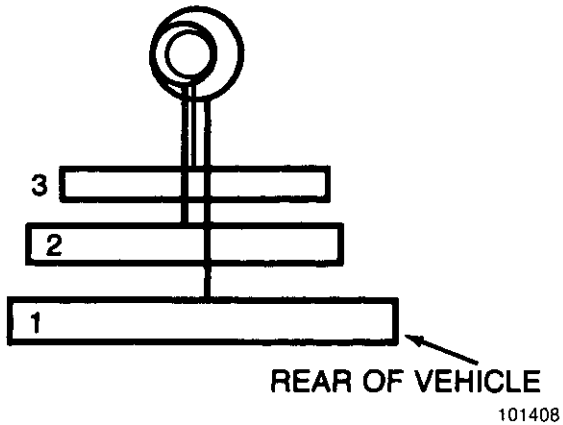
Front Side Sway



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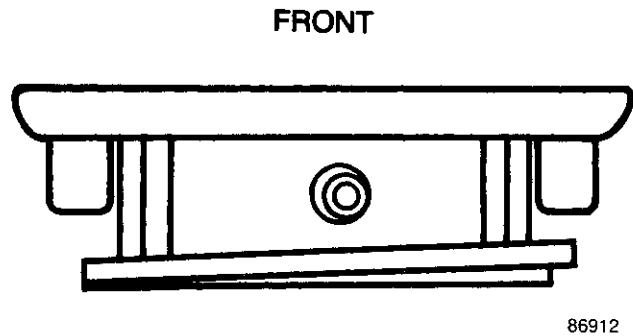
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Center Side Sway



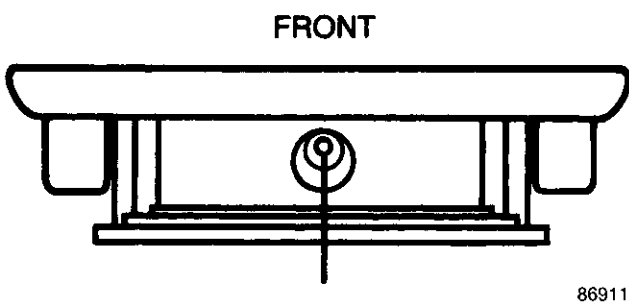
Frame Kick-Up

In a kick-up condition the sight pins are out of line and the centering bars are not parallel or horizontal.



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Frame Sag



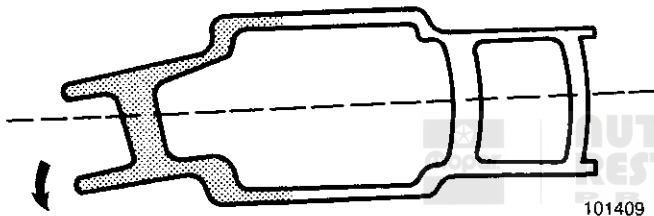
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	WELDED COMPONENTS BODY REPAIR INFORMATION	
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MISALIGNMENT IN THE CENTERLINE

Sway

Any misalignment to the frame centerline will indicate the presence of a sway condition. This is a lateral misalignment in either the front or rear ssection relative to the center section of the vehicle.

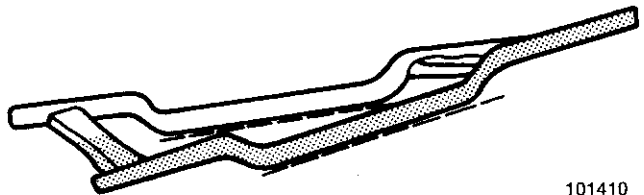


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OUT OF LEVEL CONDITION

Twist

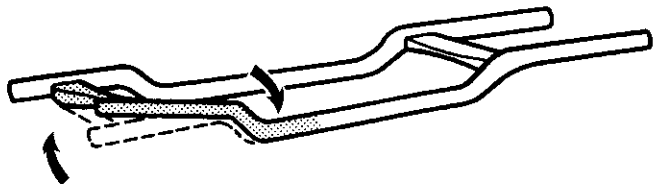
Any out of level condition detected within the center section of the vehicle is termed "twist".



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DOWN AT THE COWL

This is a vertical misalignment in the front section resulting from a front end collision.

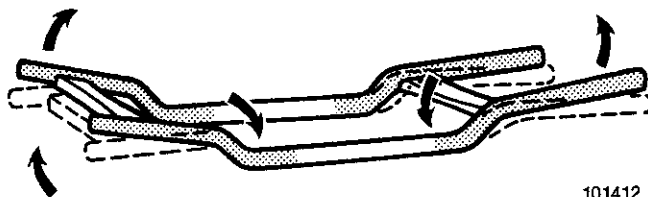


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SAG CONDITION

A vertical misalignment between both the front rear section and the center of the vehicle is referred to as a sag condition. If a sag is present, the center section will be lower than the misaligned front or rear section.



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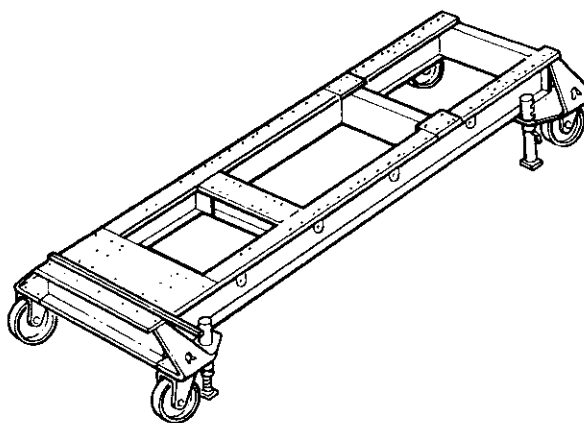
FRAME STRAIGHTENING

A bent or twisted frame may be straightened using a frame straightening machine, provided the extent of the misalignment is not excessive. Use of self-centering and trammel gauges or jig bench is necessary to maintain accuracy.

CAUTION: When welding frame components, use only a M.I.G. welder to prevent damaging the frame.

REPAIR JIG BENCH (CELETTE MUF 7)

The Celette MUF 7 repair jig bench is available with interchangeable crossmembers and fixtures.



100445

The bench is equipped with casters for mobility.

Leveling

To ensure accuracy, a repair jig bench must be leveled before repair operations are started.

A level is supplied with the jig bench for this purpose.

Loosen the locknuts on the adjustment leg (C).

NOTE: The other three legs are used only in conjunction with floor-mounted straightening/pulling equipment. When involved in this type of operation, lower the legs enough to remove the weight from the casters prior to leveling the bench.



WELDED COMPONENTS

BODY REPAIR INFORMATION



Wipe the front and rear machined surfaces clean with a shop towel.

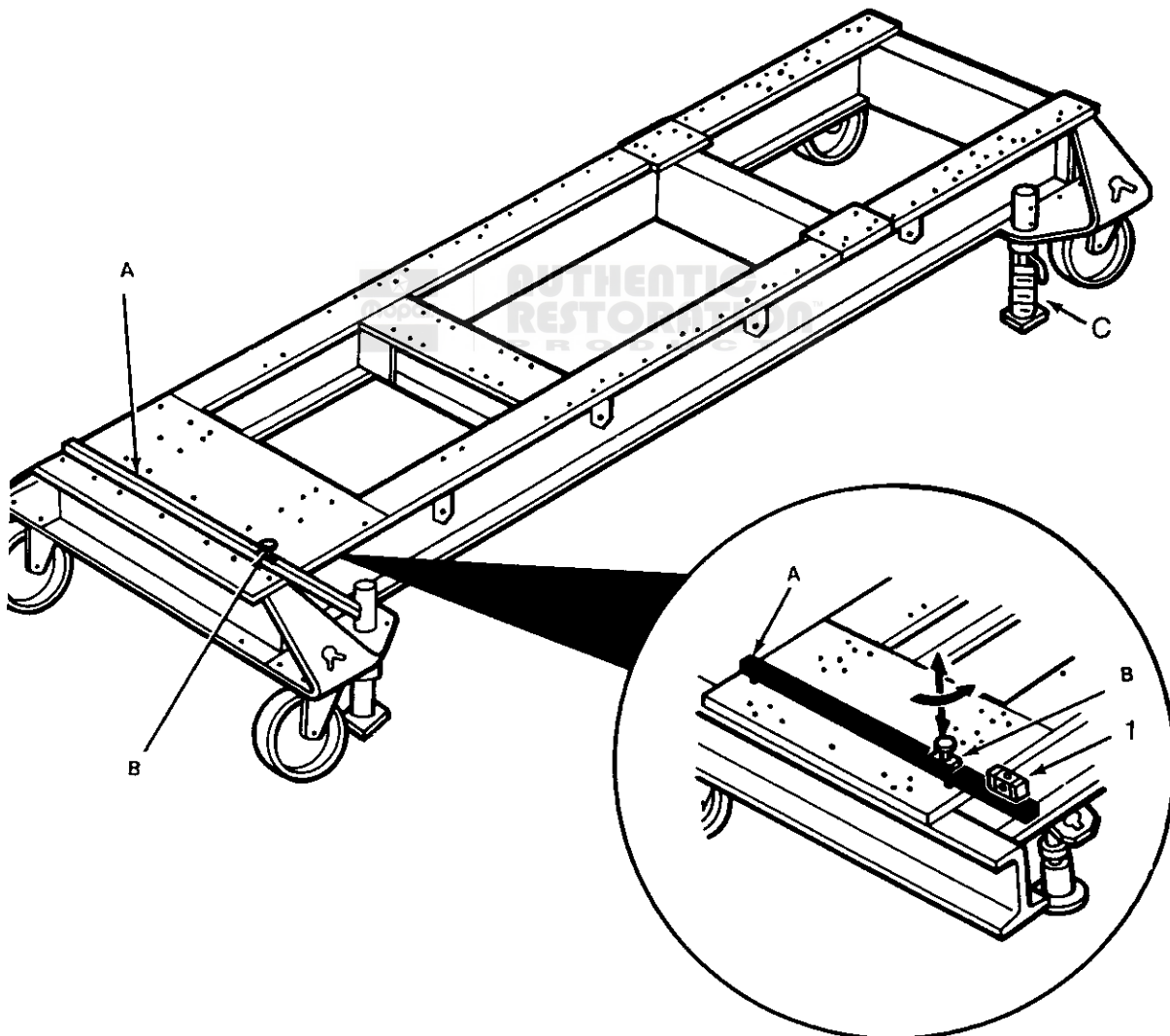
Place the level (1) on the machined surface at the front of the bench.

Move the level to the machined surface at the rear of the bench.

The level must be at the adjustable leg (C) side of the bench.

NOTE: Place the level on the adjustable leg (C) side of the bench.

Turn the adjustment screw (B) until the level bubble is centered between the two graduations.



SEE
I.S.
NOTES

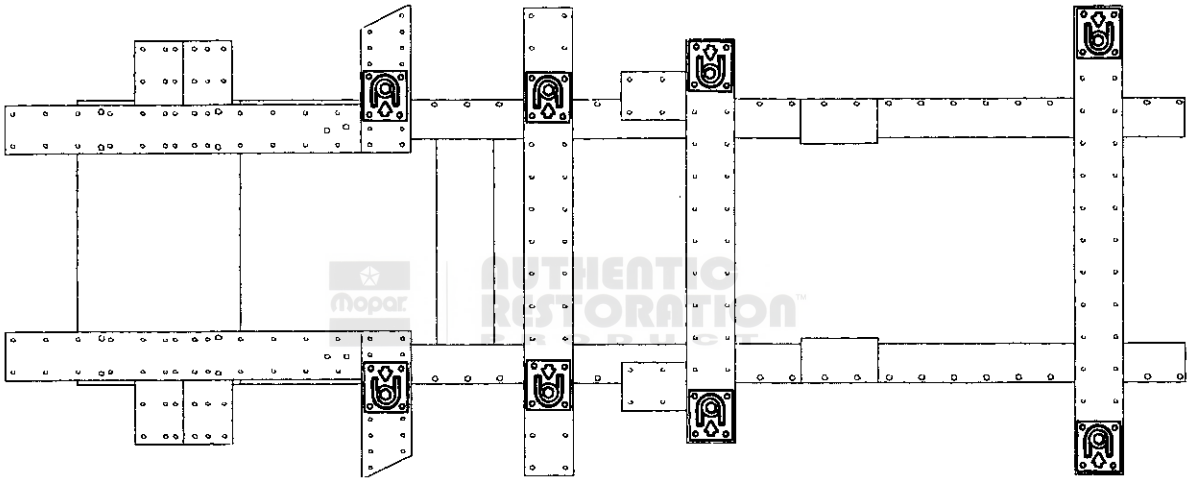
100448

Raise or lower the adjustment leg (C) until the bubble is centered between the two graduations.

Tighten the locknut on the adjustment leg.

Install the required crossmembers and fixtures on the bench.

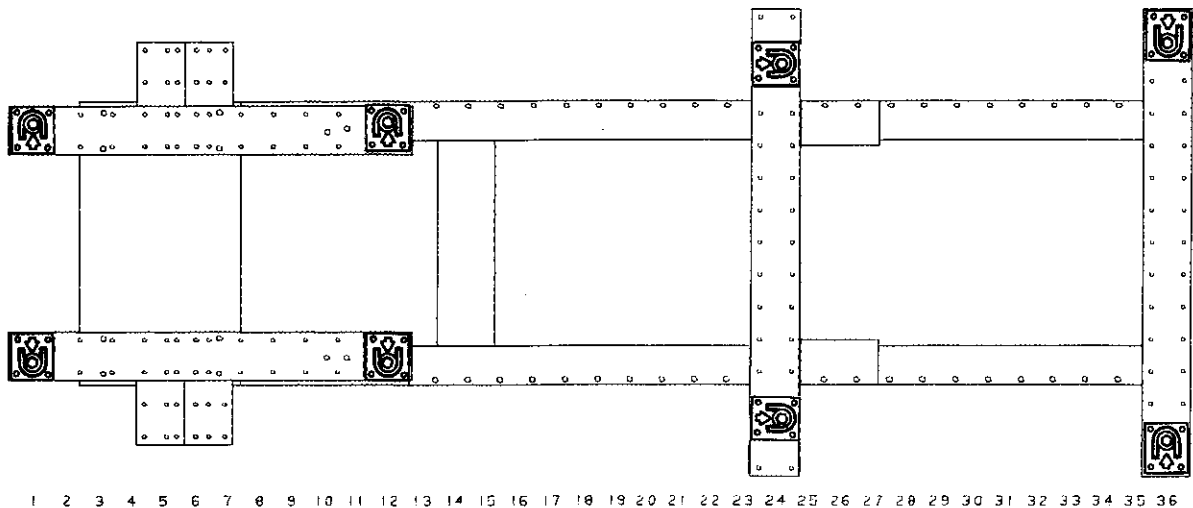
REPAIR JIG BENCH CROSSMEMBER LOCATIONS FOR BODY CONTROL ON THE CELETTE BENCH



SEE
I.S.
NOTES

101413

REPAIR JIG BENCH CROSSMEMBER LOCATIONS FOR FRAME CONTROL ON THE CELETTE BENCH



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36



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101414

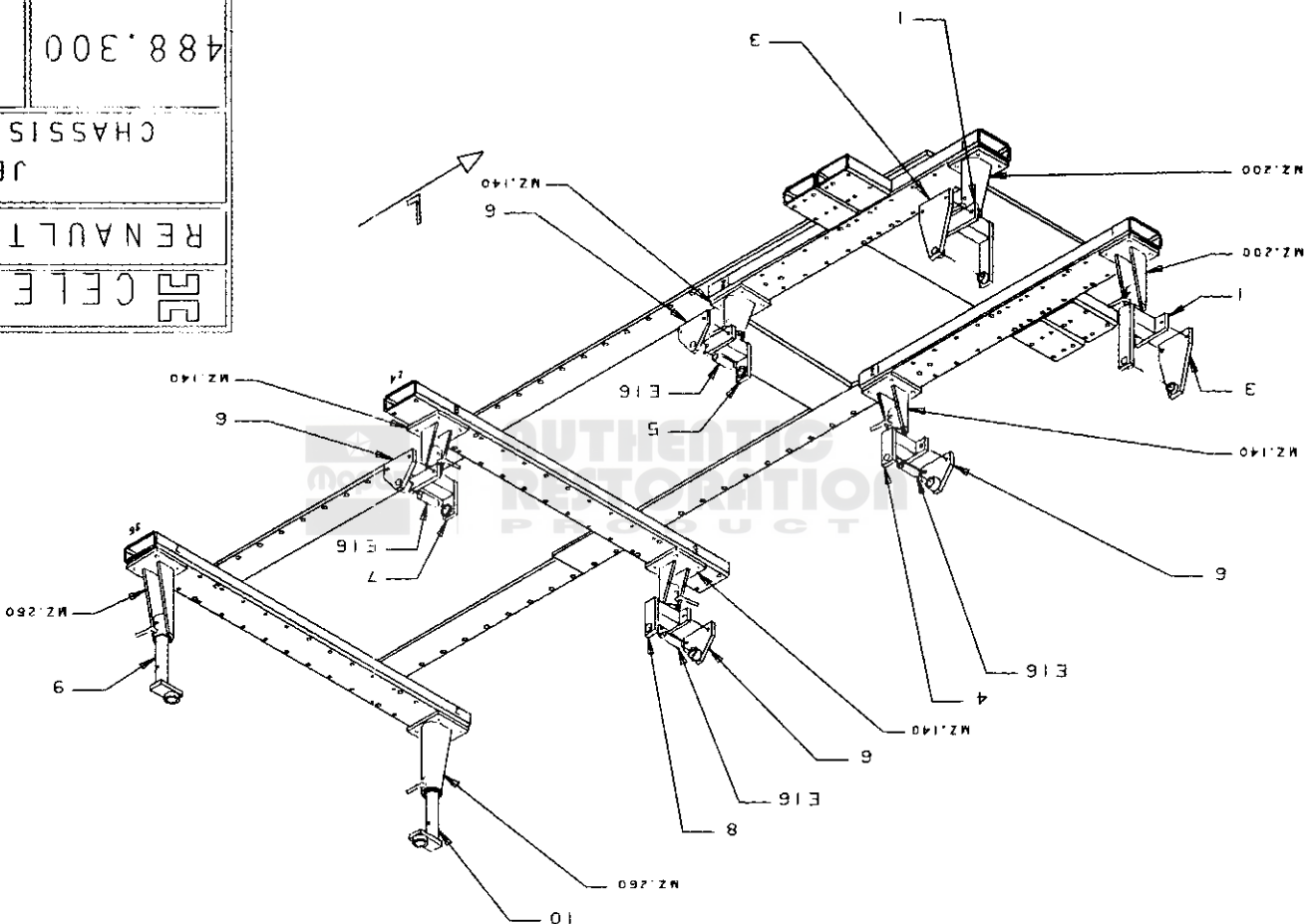
SEE I.S. NOTES



WELDED COMPONENTS BODY REPAIR INFORMATION



MOUNTING TOPS - 488.300 FOR FRAME CONTROL



SEE
I.S.
NOTES

REP	REFERENCE	POS	NR	M.7
1	488.701	4.5	1	200
2	488.702	4.5	1	200
3	488.703	2.7	2	140
4	488.704	3.2	1	140
5	488.705	3.2	1	140
6	488.706	1.3	4	140
7	488.707	3.2	1	140
8	488.708	3.2	1	140
9	488.709	3.4	1	260
10	488.710	0.1	4	260

REP	REFERENCE	POS	NR	M.7
1	488.701	4.5	1	200
2	488.702	4.5	1	200
3	488.703	2.7	2	140
4	488.704	3.2	1	140
5	488.705	3.2	1	140
6	488.706	1.3	4	140
7	488.707	3.2	1	140
8	488.708	3.2	1	140
9	488.709	3.4	1	260
10	488.710	0.1	4	260

| RENAULT-AMC | CHASSIS - FRAME | 488.300 | 01-28-86 | 441-D-3A |

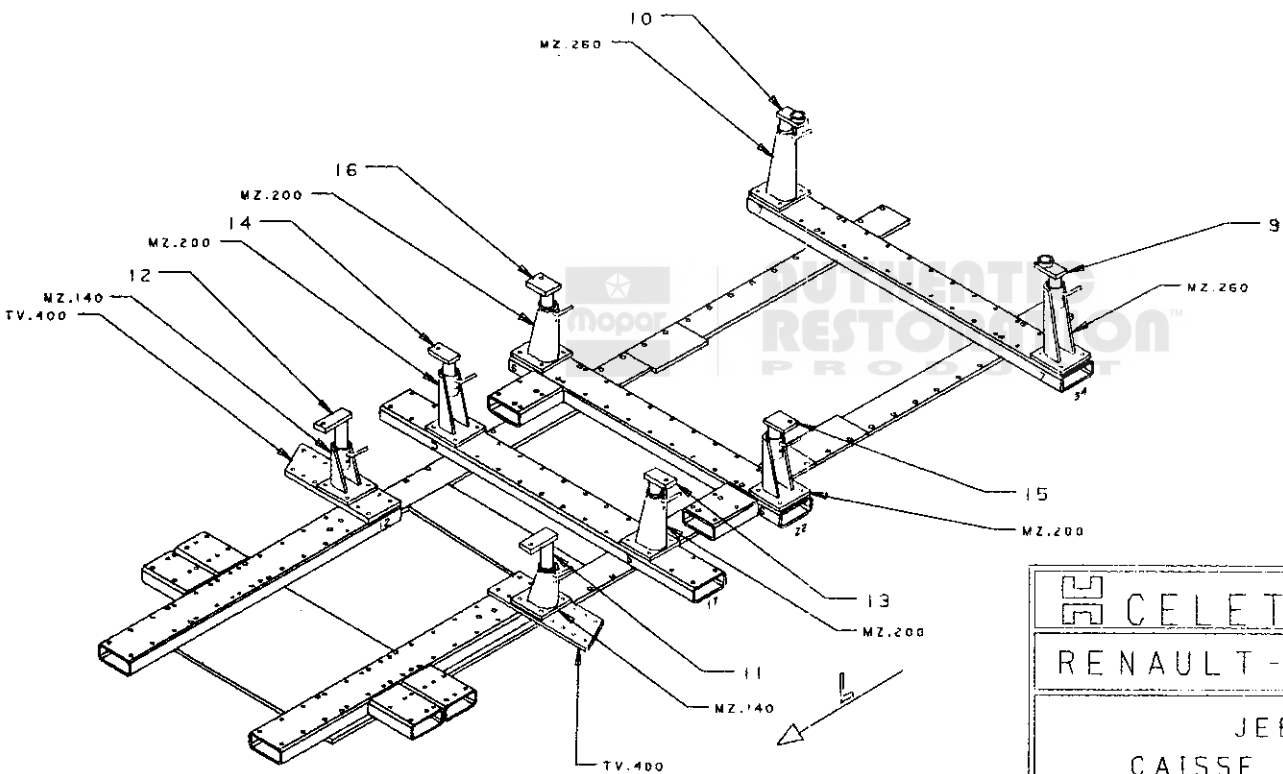


WELDED COMPONENTS BODY REPAIR INFORMATION



COMPLEMENTARY SET OF MOUNTING TOPS 488.309 FOR BODY CONTROL

REF.	REFERENCE	PDS	NB	M.L.
11	488.711	2.9	1	140
12	488.712	2.9	1	140
13	488.713	1.7	1	200
14	488.714	1.7	1	200
15	488.715	2.0	1	200
16	488.716	2.0	1	200



CELETTE VIENNE FRANCE	
RENAULT-AMC	
ROUGE ROSSA ROT REC	
JEEP CAISSE - BODY	
488.309	COMPLEMENT AU COMPLEMENTO ALL ZUSATZ ZU COMPLEMENTARY SET TO
488.300	
13	01-28-86 441-D-3B



WELDED COMPONENTS BODY REPAIR INFORMATION



THE CELETTE MZ SYSTEM

A new generation of jig fixtures has been introduced by Celette to simplify and reduce the equipment cost.

Description:

The tops when fitted and pinned into the MZ towers will allow repairing or rebuilding with, "positive checking" and all the advantages of traditional fixtures or integral beams. Also, the traditional beams remain unchanged and will continue to be useful in the future.

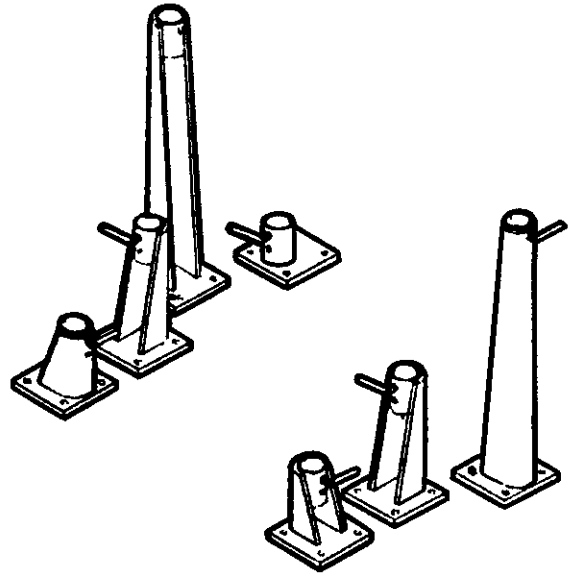
Universal MZ 450 Tower Kit

Contents:

- 6 MZ 80 Towers
- 4 MZ 140 Towers
- 4 MZ 200 Towers
- 4 MZ 260 Towers
- 1 MZ 601 Towers
- 1 MZ 602 Towers
- 1 MZ 141 Towers
- 1 MZ 142 Towers
- 1 MZ 400 Towers

Note: The towers listed above can be used on all types and makes of vehicles.

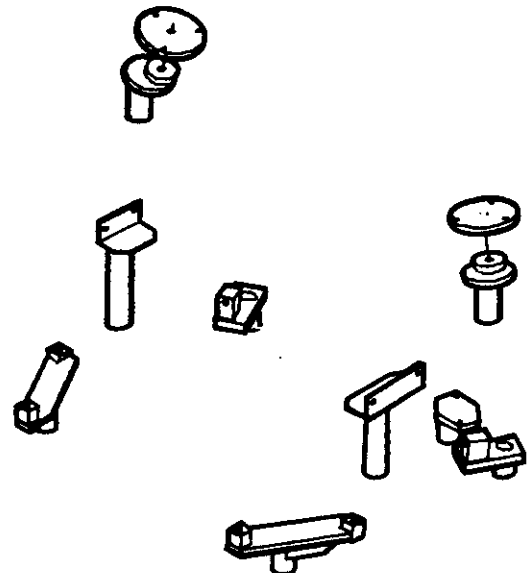
MZ Towers



101417

MZ SPECIALIZED TOPS

The following specialized tops fit onto the MZ towers.



101418

SEE
I.S.
NOTES



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WELDED COMPONENTS

BODY REPAIR INFORMATION

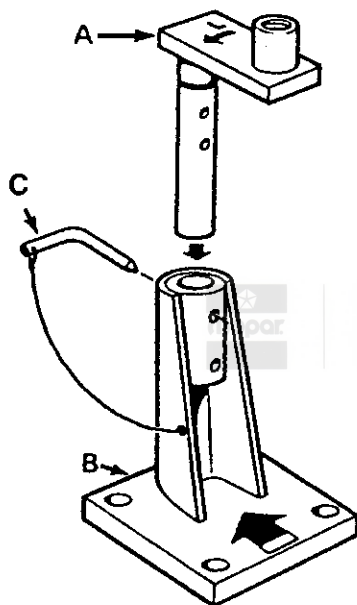


Utilization:

Specialized tops, such as (A) shown, each fit into a particular MZ tower and have a letter that indicates which side it is supposed to fit.

R = Right side

L = Left side



90493

When the top is being installed, the arrow must point to the front of the vehicle.

Each top is stamped with information indicating which top it is and which vehicle it is designed for.

Tower (B) is positioned as indicated with the arrow pointing in the direction shown on the drawings supplied with the individual tops. The sleeve in the tower is designed to accept of the specific tops. The L-pin (C) prevents the top from turning when in use.

Construction Features of the MZ Tower and Top Assemblies:

- precision machining for accurate readings
- removeable tops that can be removed and placed back into position during use and diagnosis
- top locking features designed for locking the MZ assemblies during diagnosis and repair procedures
- vertical pushing of panels is possible with certain tops when used with 4-ton Celette hydraulic rams

Repair Procedures

The repair procedures contained in this chapter describe how to repair and replace welded body components.

They are intended only to provide general guidelines and may be altered if it will assist the technician to expedite the repairs.

There are certain components in each vehicle, however, that must not be cut or completely replaced without using special precautions to preserve the safety characteristics (integrity) of the vehicle.

It is **NOT** advisable to:

- heat a sillmember to straighten it
- cut (section) a side member or pillar and their inner panels along the same line (i.e., offset cutting will improve the strength of the repair)

SEE
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- submit a vehicle that is positioned on a repair jig bench to hydraulic traction (pull or push) without correctly anchoring the vehicle

CAUTION: The only recommended methods of welding these members are MIG and spot welding.

WELDING PROCEDURES

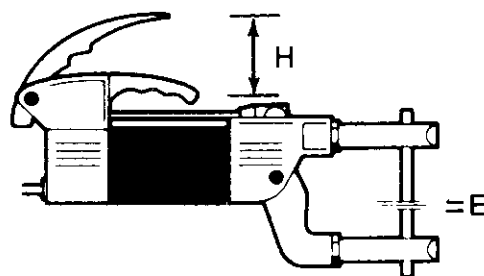
WARNING: Ensure that safety goggles are worn during **ALL** welding operations.

Electric Spot Welding

Spot welding is a function of pressure, current (amps) and time.

Pressure Adjustment

The pressure adjustment (H) is controlled by distance (E).



87433

The distance (E) is determined by the thickness (minimum) of the metal being welded.

Use a feeler gauge to adjust the distance (E).

After adjusting the distance, test the pressure adjustment (H) with sample sections of sheet metal that has the same thickness as the body members that are to be welded.

Current and Time Adjustments

NOTE: To test the adjustments, use sample sections of sheet metal that is the same thickness as the body components to be welded.

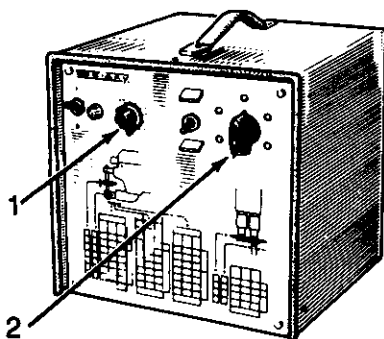
Initially place the power/current (amps) adjustment control (1) at position 1 and gradually increase the current until excessive arcing occurs, then decrease the current one position.

Increase the time adjustment control (2) until the correct spotweld diameter is obtained.

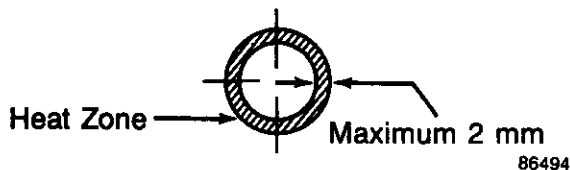
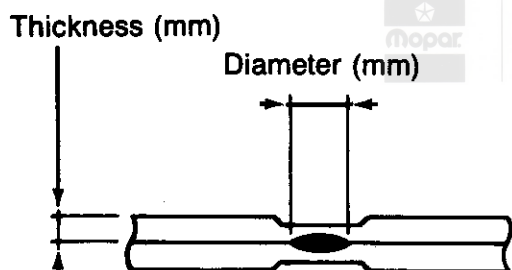
Refer to the chart.



WELDED COMPONENTS **BODY REPAIR INFORMATION**



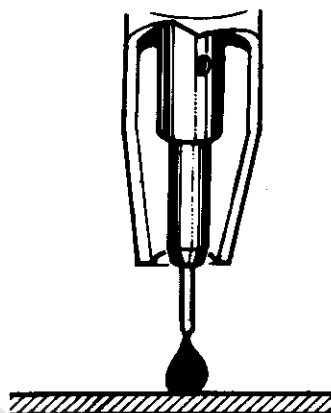
SPOTWELDS							
Thickness (mm)	0.6	0.7	0.8	1	1.1	1.3	1.5
Diameter (mm)	4.5	5	5	5.5	5.5	6	6.5



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MIG Welding

Seam (Continuous) Welding



85170

Position the intensity (amps) control at an estimated value that is based on the thickness of the panels to be welded.

Testing may be necessary to determine the correct wire speed that will produce a uniform bead.

Determine the weld penetration and adjust the intensity (amps) accordingly.

The wire speed may require an additional fine adjustment after the intensity (amps) is correctly adjusted.

To control the heat transfer, the following method of MIG seam welding should be used:

- apply a series of overlapping spotwelds

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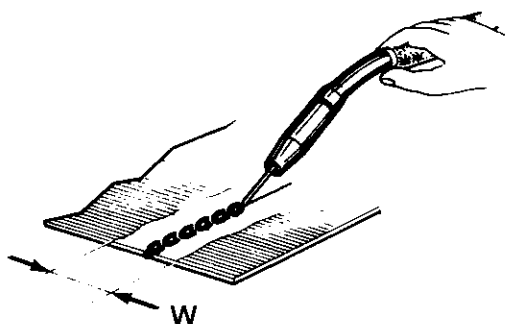


WELDED COMPONENTS

BODY REPAIR INFORMATION



- the time interval between each weld should be 4 to 5 seconds to maintain a heat zone with a minimum distance of 10 mm (0.4 in)
- $W = 10 \text{ mm (0.4 in)}$

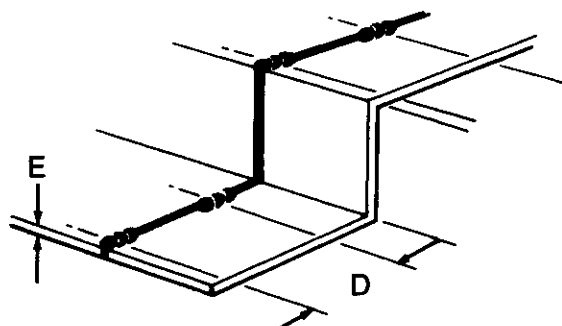


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- $D = 30 \times E$



85124B

SEE
I.S.
NOTES

Stitch Welding

Increase the amount of intensity (amps) by one graduation in comparison to the MIG seam (continuous) welding adjustment.

For degreased steel, the stitch weld distance interval (D) can be calculated according to the following formula:

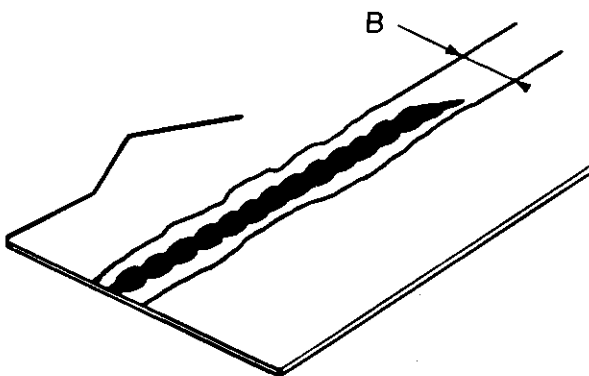
The stitch weld time interval should be 4 to 5 seconds between each bead.

The stitch weld time must be determined by testing samples that are the same thickness as the vehicle body components to be welded:

- stitch weld = weld time + time interval
- The blue (heat) zone (B) should be less than 10 mm (0.4 in) wide.



WELDED COMPONENTS **BODY REPAIR INFORMATION**



85125A

A stitch weld can be controlled by any one of the following:

- weld time + manual time interval
- automatic weld time + manual time interval
- fully automatic

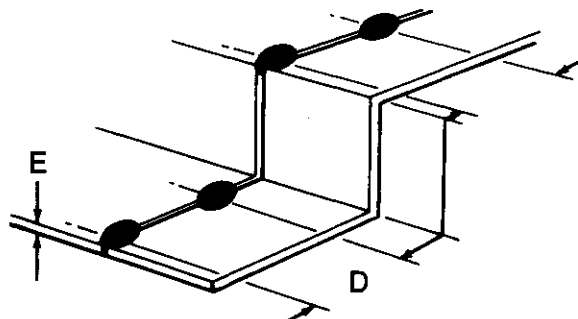
NOTE: To avoid complicated adjustments, manual stitch welding is recommended.

Tack Welding

The adjustments are the same as for MIG seam (continuous) welding except the intensity (amps) is slightly increased to cause arcing.

When tack welding a butt joint, the distance (D) between any two welds is determined by:

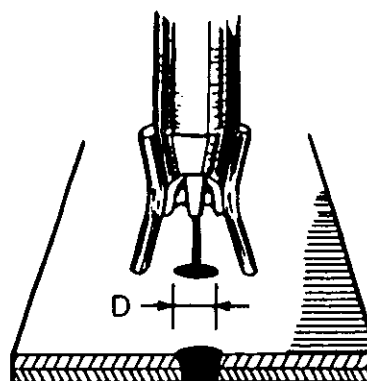
- $D = 30 \times E$



85124

Plug Welding

A 4-mm (0.16-in) diameter hole (D) must be either drilled or punched in one of the sections that is to be welded.



85125B

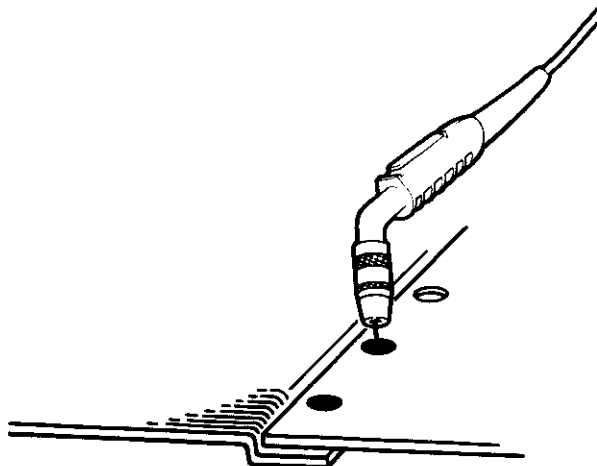
Test welds should be used to obtain a flat spot.

SEE
I.S.
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WELDED COMPONENTS

BODY REPAIR INFORMATION



100434

MIG plug welding should be used to produce OEM quality spotwelds when the area to be welded is not accessible to a spot welder.

Spot welding is recommended for replacement of many of the panels on a unibody vehicle.

Spot welding can be used to effectively duplicate OEM quality welding.

HIGH STRENGTH STEEL (HSS)



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Welding

Standard, coated and lightweight high strength steel (HSS) are all used for the construction of unibody vehicles.

High strength steel (HSS) is also used for the sillmembers.

CAUTION: Do **NOT** arc weld high strength steel (HSS).

MIG plug or seam (continuous) welding is recommended for replacement of high strength steel (HSS) members.



WELDED COMPONENTS

BODY REPAIR INFORMATION



Repairing

High strength steel (HSS) is adversely affected by heat.

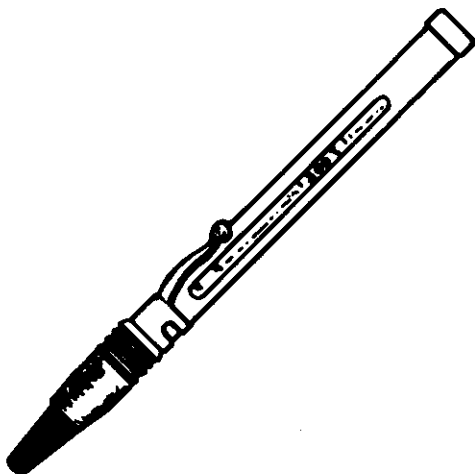
The application of heat must be strictly controlled during a straightening operation.

Use the following time guides when heating high strength steel (HSS):

- 361° to 427°C (700° to 800°F) — maximum of two hours
- 538°C (1,000°F) — less than one minute

CAUTION: Once the maximum temperature and time limits have been reached, the application of any additional heat will cause disruption of the molecular structure and reduce the strength of the steel.

To assist in monitoring the temperature of a repair area, use a temperature indicating crayon.



84559

REPLACEMENT PROCEDURES

Spotweld Removal

Removing spotwelds from the welded members of a vehicle body is a intricate operation.

Chisel or Snips

Using a chisel or snips to remove spotwelds causes distortion and tears the mating surfaces of the panels.

The damaged mating surfaces must be welded, straightened and smoothed before the replacement member is placed in position.

SEE
I.S.
NOTES



WELDED COMPONENTS

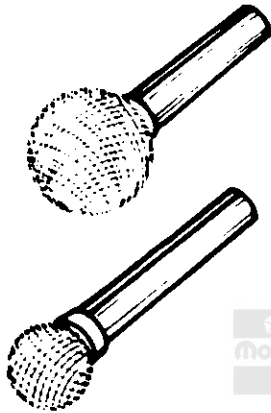
BODY REPAIR INFORMATION



Spherical Cutter

Spherical cutters can be used to remove spotwelds quickly without damaging the mating surfaces.

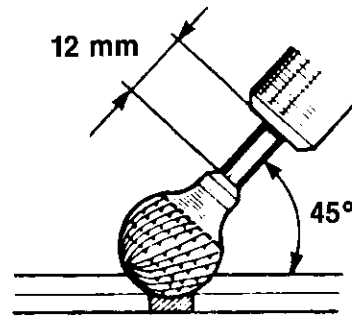
There is no necessity for grinding because the weld is removed by the cutter.



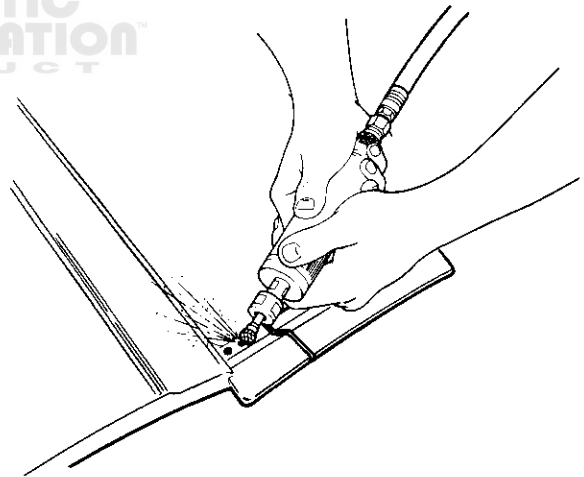
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NOTE: Ensure that approximately 12 mm (15/32 in) of stem remains after inserting the spherical cutter into a drill. For best results, position the cutter at a 45° angle.



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NOTES

WELDING SYMBOL CHART



CHISEL CUT



MIG SEAM WELDING



SAW CUT
(USE A PNEUMATIC SAW)



BODY SOLDER APPLICATION
(70% LEAD, 30% TIN)



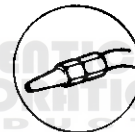
GRINDING SEAM WELD



MIG STITCH WELDING



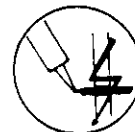
SPOTWELD REMOVAL
(USE A SPHERICAL
TUNGSTEN CARBIDE BIT)



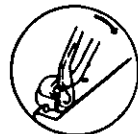
OXYACETYLENE-BRAZING



GRINDING (USE A 7-IN OR 9-IN
24 GRIT DISC)



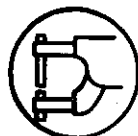
WELD-THRU SEALANT (THIS
SEALANT, WHICH IS A CON-
DUCTOR, INSERTED BETWEEN
TWO PANELS BEFORE WELD-
ING, ENSURES A WATERTIGHT
ATTACHMENT AND PREVENTS
SPOTWELD CORROSION)



WELD FLANGE REMOVAL



SEAM SEALANT



SPOTWELD (USE A
COMPRESSION-TYPE
RESISTANCE SPOTWELDER)



MIG PLUGWELDING

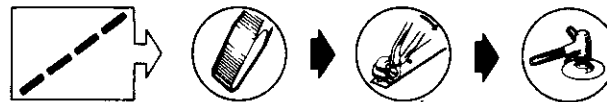
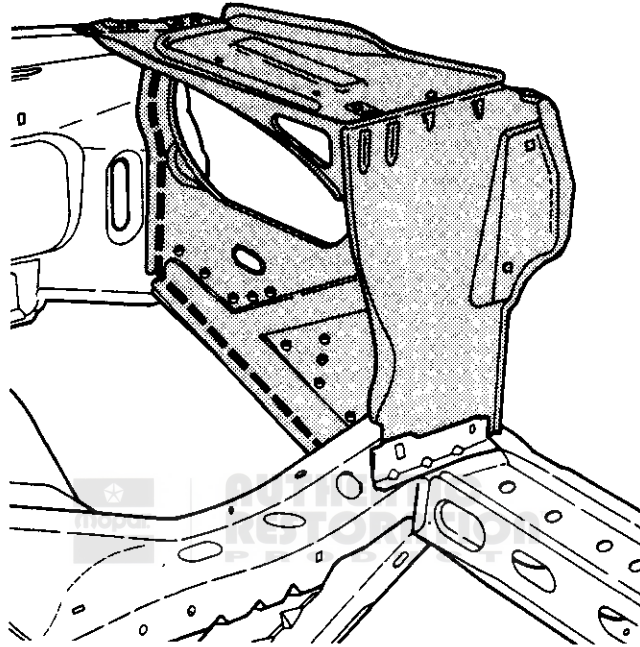


STRUCTURAL SEALANT

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Symboled Procedures

The following illustrations provide examples of the use of the symbols that will be used to describe the various replacement and repair procedures listed within this chapter.



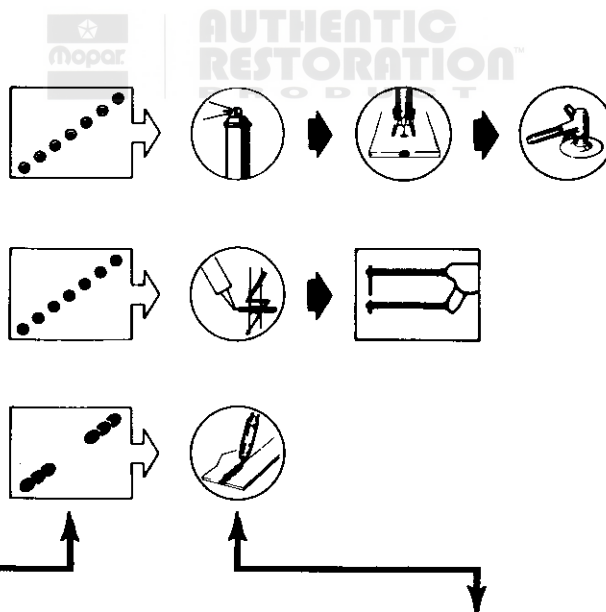
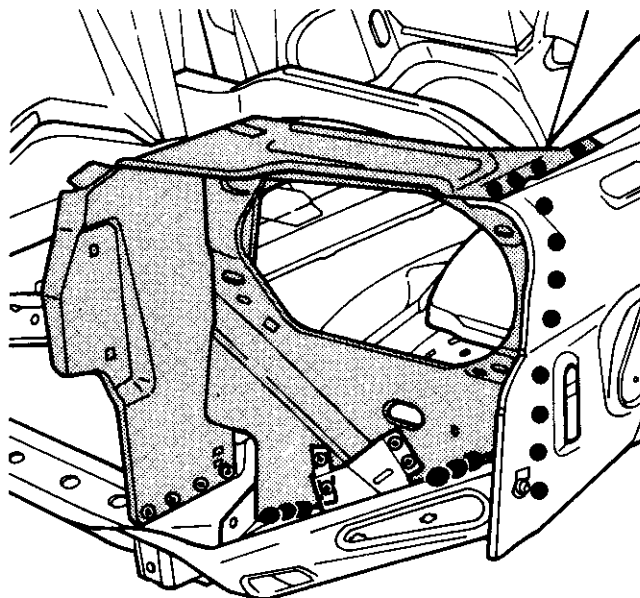
Operation Symbol
Indicates the type of operation that is required.

Tool Symbols
Indicates the tools and materials required for the operation.

NOTE: The grinding should not be done until after the damaged component has been removed from the vehicle.

SEE
S.S.
NOTES

INSTALLATION OPERATION EXAMPLE



Operation Symbol
Indicates the type of operation that is required.

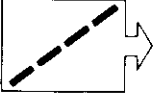
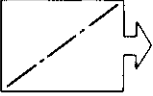
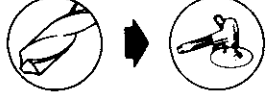
Tool Symbols
Indicates the tools and materials required for the operation.

NOTE: A zinc-based sealant (electric spotwelding) or a zinc-based primer (MIG spotwelding) must be applied to the metal prior to welding.

SEE
I.S.
NOTES

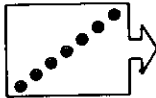
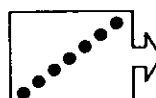
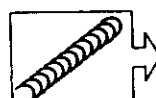
The following illustrations contain the actual symbols that will be used to describe the various replacement and repair procedures listed within this chapter.

REMOVAL/CUTTING PROCEDURES

Operations	Tools and Materials	Descriptions
		Chisel Cut Weld Flange Removal Grinding Smooth
		Basic Saw Cut
		Grind Cut Grinding Smooth
		Overlap Saw Cut
		Drilling Spotwelds Grinding Smooth
		Spherical Carbide Cut Grinding Smooth

100439

INSTALLATION/WELDING PROCEDURES

<u>OPERATIONS</u>	<u>TOOLS</u>	<u>DESCRIPTIONS</u>
	  	MIG Seam Welding Grinding Smooth Body Solder Application
		MIG Stitch Welding
	  	Zinc-based Primer Application MIG Plug Welding Grinding Smooth
	 	Weld-thru Sealant* Application Spotwelding
	 	Oxyacetylene Welding

*The weld-thru sealant is an electrical conductor that is applied between panels to ensure a water tight attachment and prevent corrosion.

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	WELDED COMPONENTS BODY REPAIR INFORMATION	
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SEALING PROCEDURES

OPERATIONS

TOOLS

DESCRIPTIONS



Undercoating
Stone-Chip Protection



Seam Sealer Application



Structural Adhesive Application

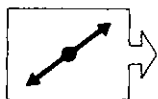
100441

ANTI-CORROSION PROCEDURES

OPERATIONS

TOOLS

DESCRIPTIONS



Anti-Corrosion Protective
Material Application



Touch-Up Paint
Application

100442

SEE
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NOTES

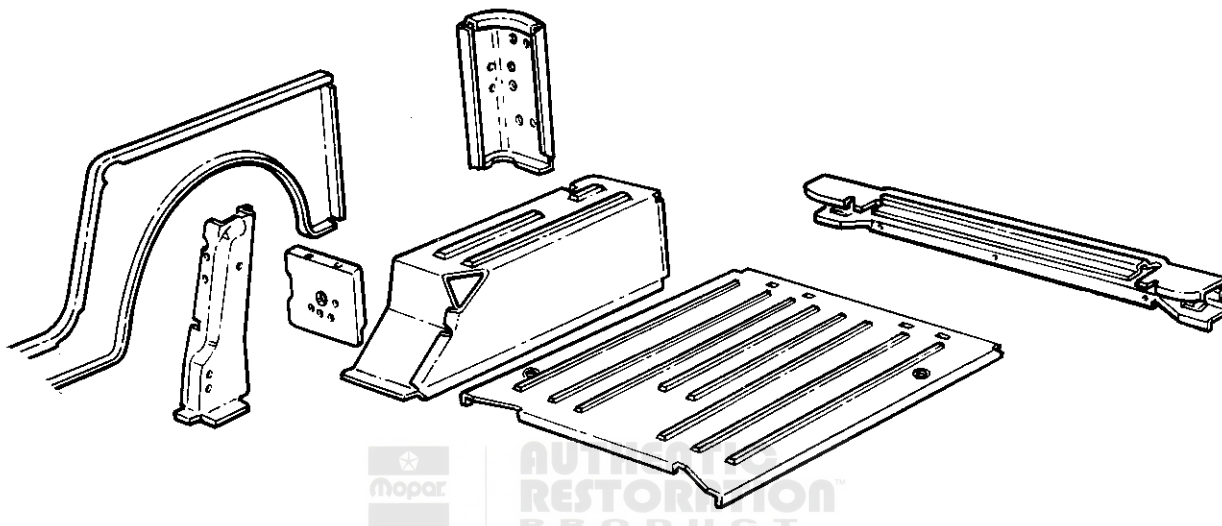


WELDED COMPONENTS REAR CORNER COLLISION REPAIR



GENERAL

Depending on the extent of the damage, it may be advantageous to remove the body from the frame.



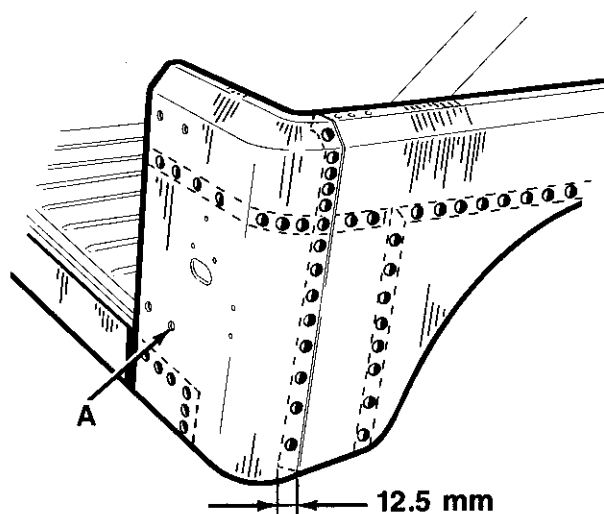
101421

REAR CORNER PANEL REMOVAL

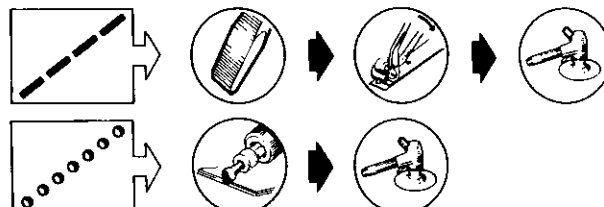
Remove the rear corner panel detachable components as necessary.

Refer to Chapter — Detachable Components

Remove the corner panel (A) as shown.



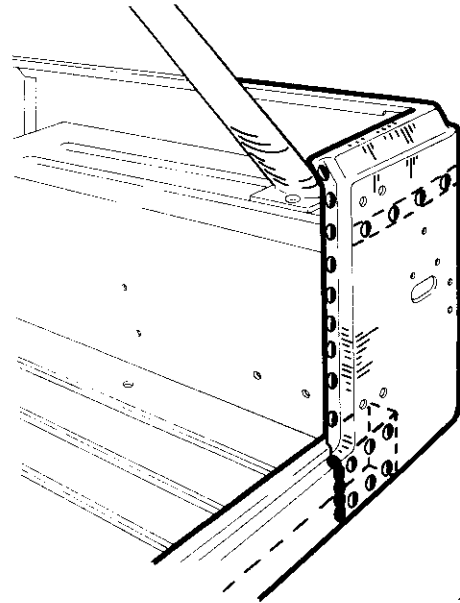
101422



SEE
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NOTES

	WELDED COMPONENTS REAR CORNER COLLISION REPAIR	
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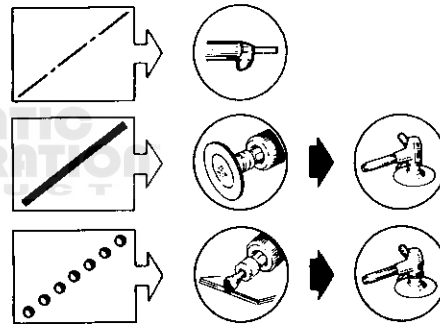
NOTE: To remove the spotwelds, attaching the corner panel to the side panel, cut the corner panel 12.5 mm (1/2 in) from the seam of the side panel.



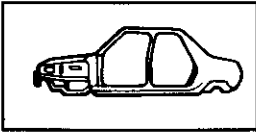
101423



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PRODUCT

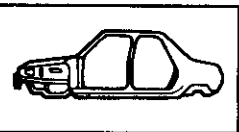


SEE
S.
NOTES



WELDED COMPONENTS

REAR CORNER COLLISION REPAIR

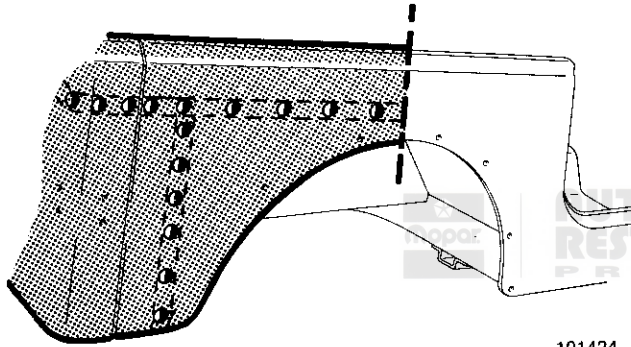


REAR SIDE PANEL REMOVAL

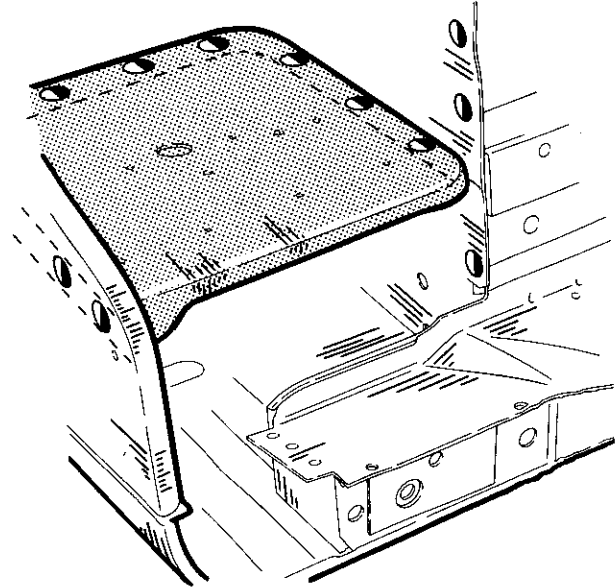
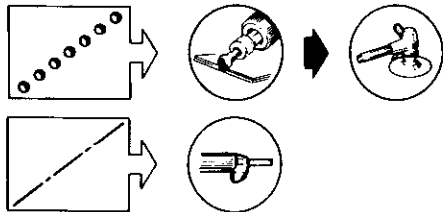
Remove the trim and detachable components from the rear side panel as necessary.

Refer to Chapter P — Detachable Components.

Remove the damaged section of the side panel.



101424



101425



SEE
I.S.
NOTES



WELDED COMPONENTS

REAR CORNER COLLISION REPAIR

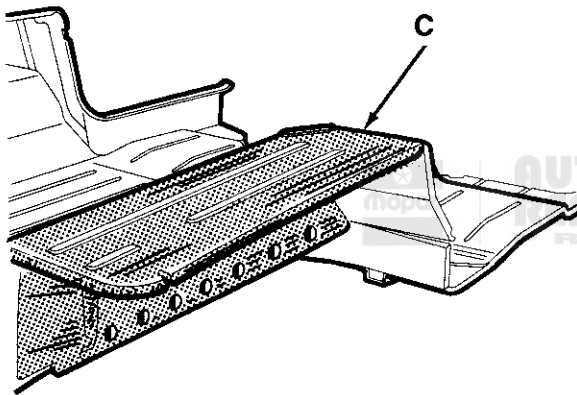


WHEELHOUSE REMOVAL

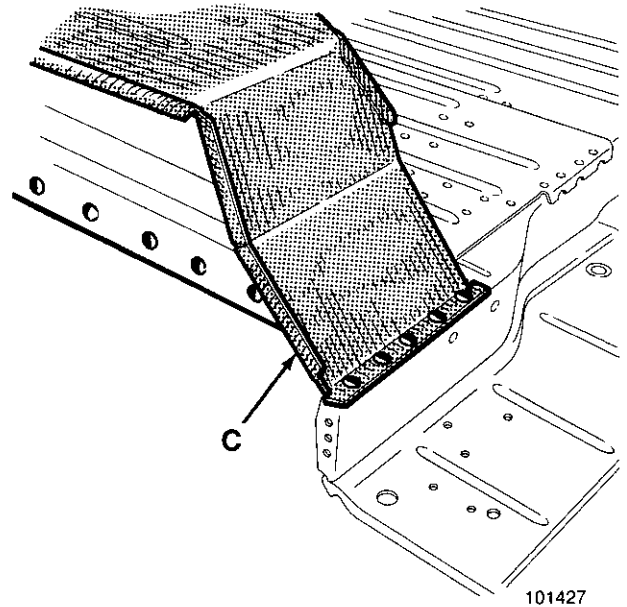
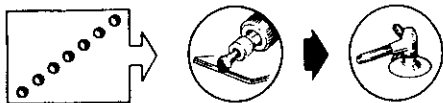
Remove the interior trim and other components as necessary.

Refer to Chapter P — Detachable Components.

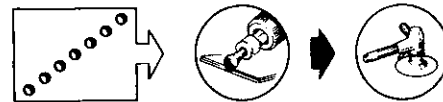
Remove the wheelhouse (C) as shown.



101426



101427



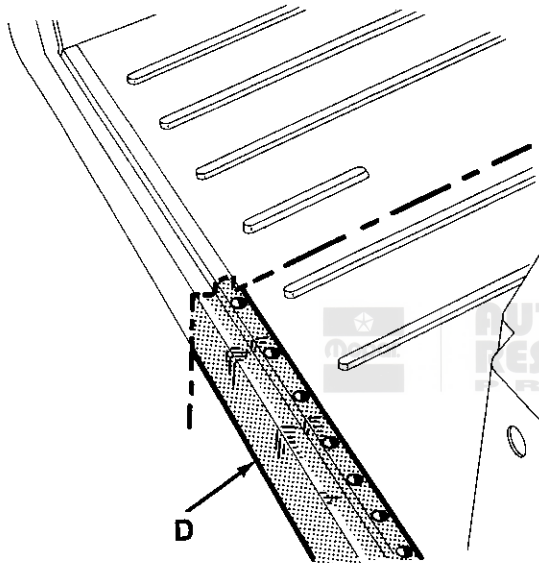
SEE
S.S.
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CROSSMEMBER REMOVAL

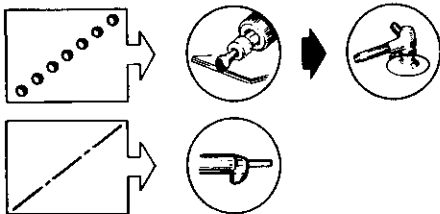
Remove the interior trim and other components as necessary.

Refer to Chapter P — Detachable Components.

Remove the crossmember (D) as necessary to replace the damaged section as shown.



101428

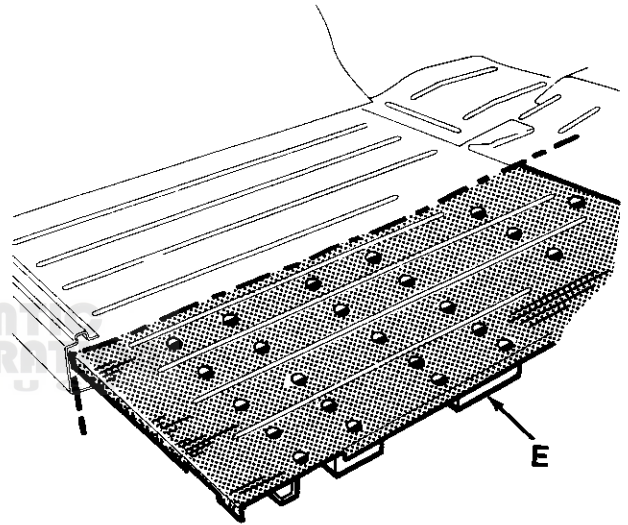


REAR FLOOR PAN REMOVAL

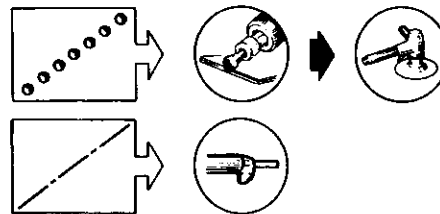
Remove the trim and detachable components from the rear floor pan (E) as necessary.

Refer to Chapter P — Detachable Components.

Remove the spotwelds as necessary to replace the damaged section as required.



101429



SEE I.S. NOTES



WELDED COMPONENTS

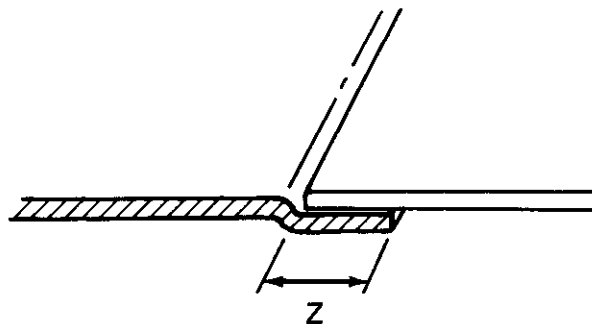
REAR CORNER COLLISION REPAIR



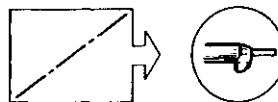
REAR FLOOR PAN — INSTALLATION PREPARATION

Saw cut the replacement floor pan so that the replacement section is 25mm (1 in) larger than the floor pan section.

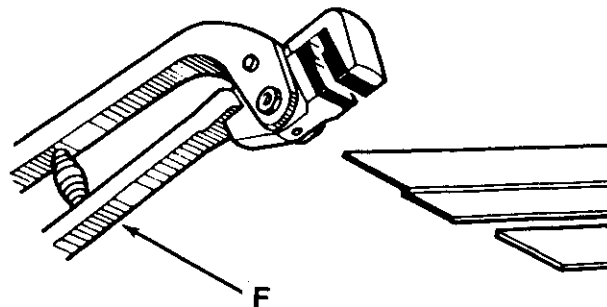
NOTE: The additional size (Z) for the section may vary according to the width of the flange tool.



100609



Use a flange tool (F) to flange the mating edge of the remaining original floor pan section (G).



78001

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NOTES

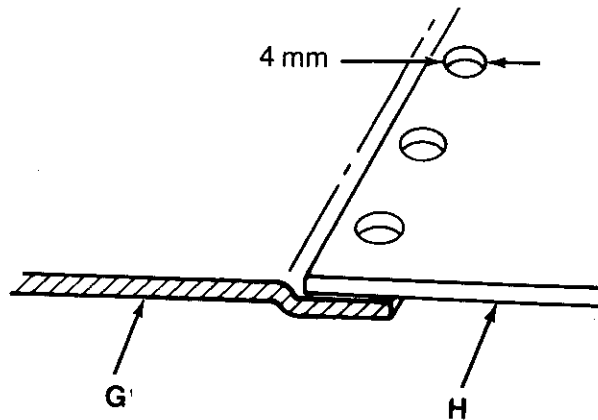


WELDED COMPONENTS

REAR CORNER COLLISION REPAIR



Drill a series of 4mm (0.15 in) diameter holes spaced 36mm (.15 in) apart, along the mating edge of the replacement floor pan section (H).



100610



Remove the primer from the areas to be welded on the replacement floor pan section.

FLOOR PAN — INSTALLATION PREPARATION

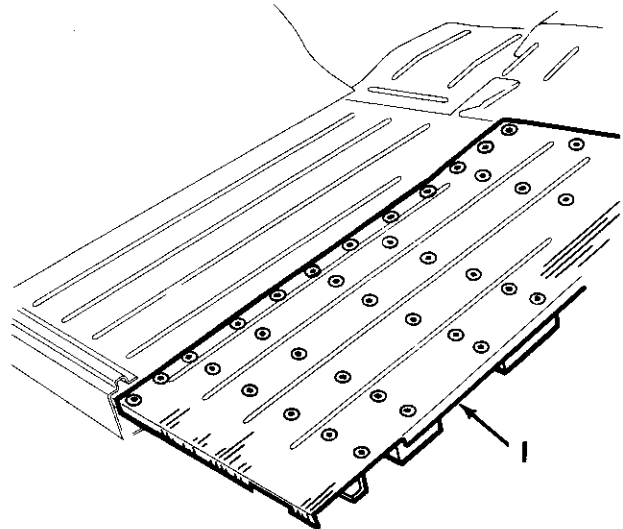
Apply anti-corrosion sealant/primer to the areas to be welded:

- spotwelds - weld through the sealant
- MIG welders - weld through zinc-based primer

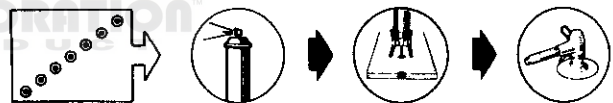
INSTALLATION - FLOOR PAN

Position the replacement floor pan section (I) and secure it for welding with locking pliers.

Weld the replacement floor pan into place as shown.



101430



REAR CROSSMEMBER — INSTALLATION PREPARATION

Cut a section from a replacement crossmember to fit in place of the damaged section.

Apply anti-corrosive sealant/primer to the areas to be welded:

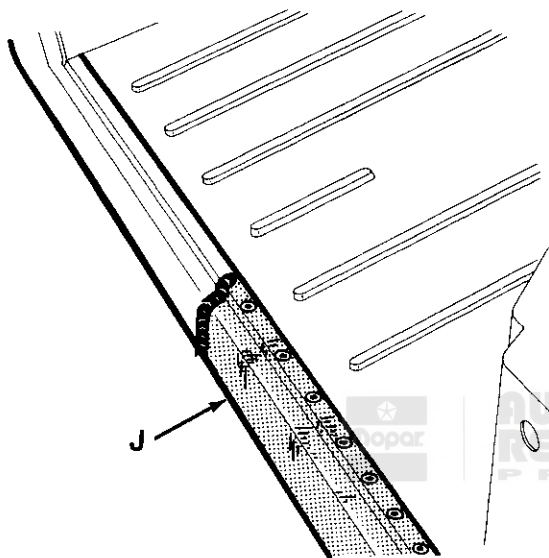
- spotwelds - weld through the sealant
- MIG plugwelds - weld through the zinc based primer

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I.S.
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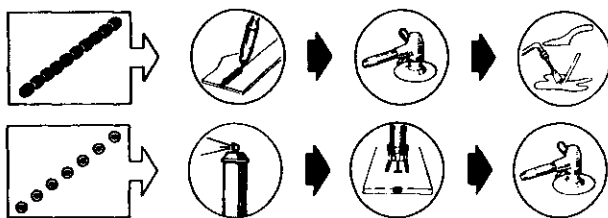
REAR CROSSMEMBER — INSTALLATION

Place the crossmember section (J) in position and retain it with locking pliers.

MIG weld the replacement crossmember section as shown.



101431



Sealing

Seal the repaired area as necessary.

Refer to Chapter R — SEALING

WHEELHOUSE — INSTALLATION PREPARATION

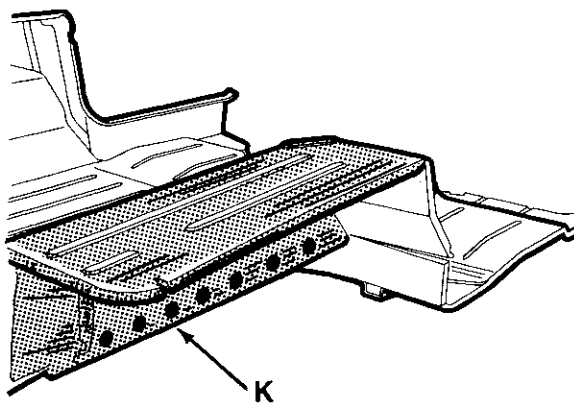
Apply anti-corrosive sealant/primer to the areas to be welded:

- spotwelds - weld through the sealant
- MIG plugwelds - weld through the zinc based primer

WHEELHOUSE — INSTALLATION

Place the wheelhouse section (K) in position and retain it with locking pliers.

Spotweld weld the replacement wheelhouse section as shown.



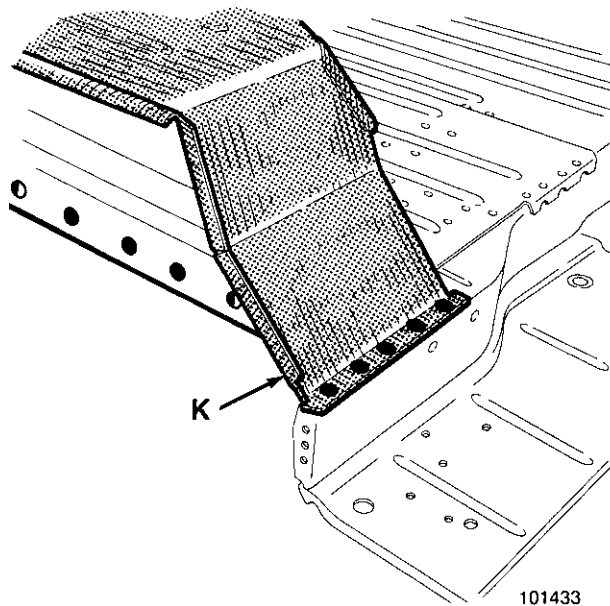
101432





WELDED COMPONENTS

REAR CORNER COLLISION REPAIR



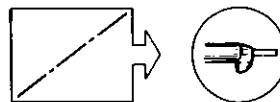
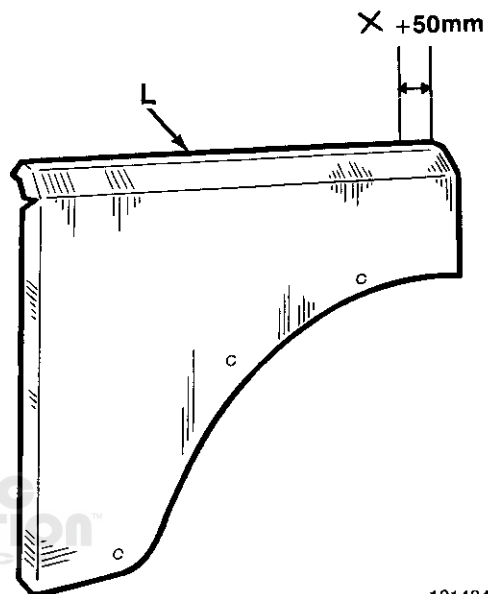
Sealing

Seal the repaired area as necessary.

Refer to Chapter R — SEALING

SIDE PANEL — INSTALLATION/PREPARATION

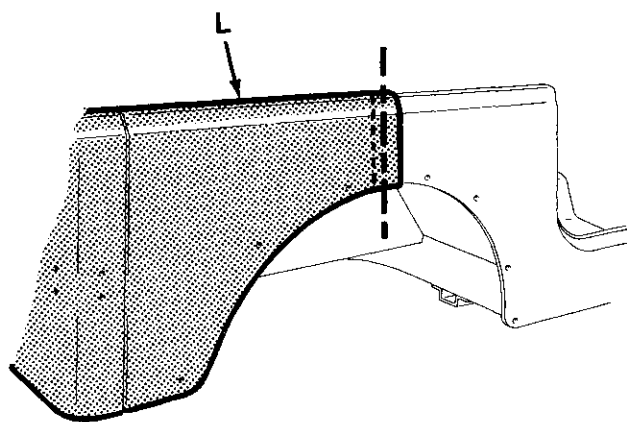
Saw cut the replacement side panel (L) so it is approximately 50mm (2 in) larger than the damaged side panel section.



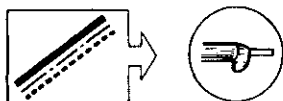
SEE
I.S.
NOTES

	WELDED COMPONENTS REAR CORNER COLLISION REPAIR	
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Position the replacement side panel on the vehicle and retain it with locking pliers.



101435



To insure a good butt weld, saw cut the replacement side panel and the original side panel at the same time.

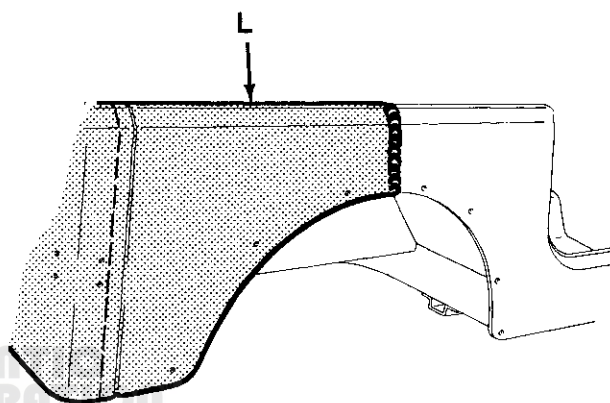
Remove the replacement side panel section and apply anti-corrosion sealant/primer to the areas to be welded:

- spotwelds - weld through the sealant
- MIG plugwelds - weld through the zinc-based primer

SIDE PANEL INSTALLATION

Position the replacement side panel and secure it for welding with locking pliers.

Weld the replacement panel to the side reinforcement bracket, wheelhouse and floor pan as shown.



101436



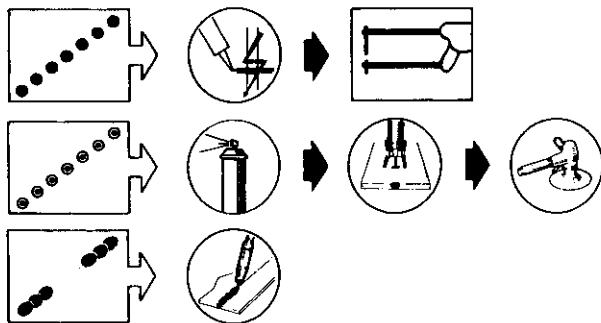
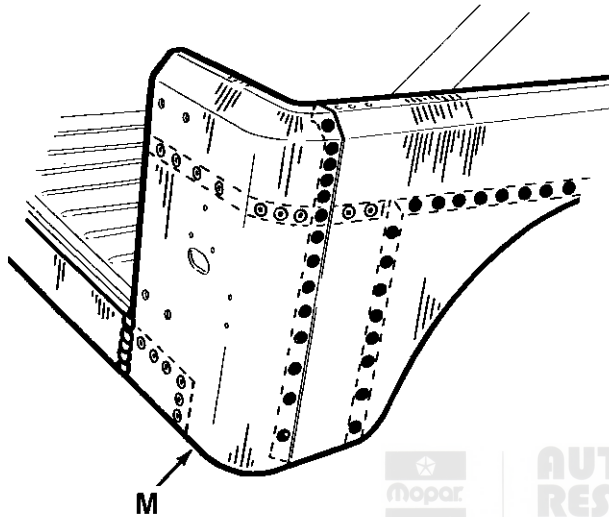
Sealing

Refer to Chapter P — SEALING

SEE I.S. NOTES

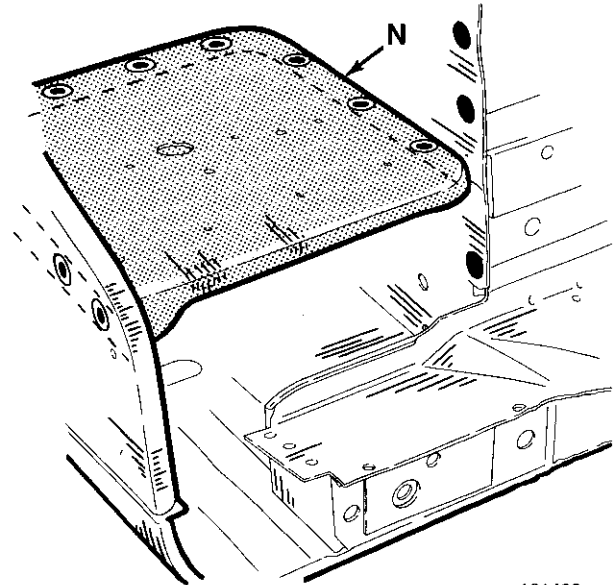
CORNER PANEL INSTALLATION

Place the replacement corner panel section (M) in position and secure it with locking pliers.

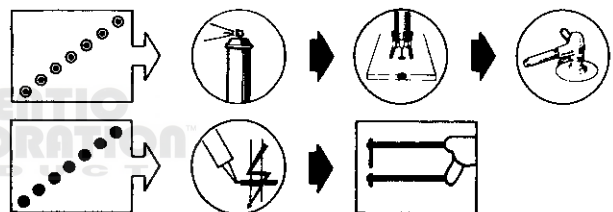


Weld the replacement corner panel section to the side panel and wheelhouse flange (N) and rear crossmember (P) as shown.

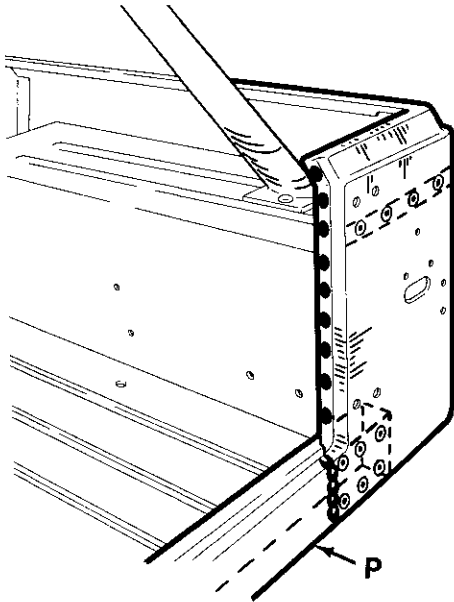
NOTE: It may be easier to fasten the corner panel to the side before installing the side panel.



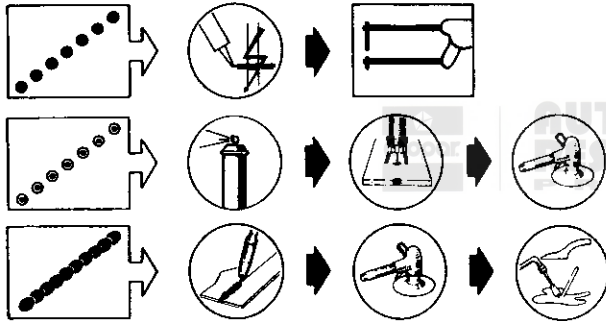
101438



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I.S.
NOTES



101439



CORROSION PROTECTION/PAINTING

Refinish the repaired area and vehicle as necessary.

Refer to Chapter T - PAINT AND TRIM

Apply anti-coating protection as necessary.

Refer to Chapter R - SEALING

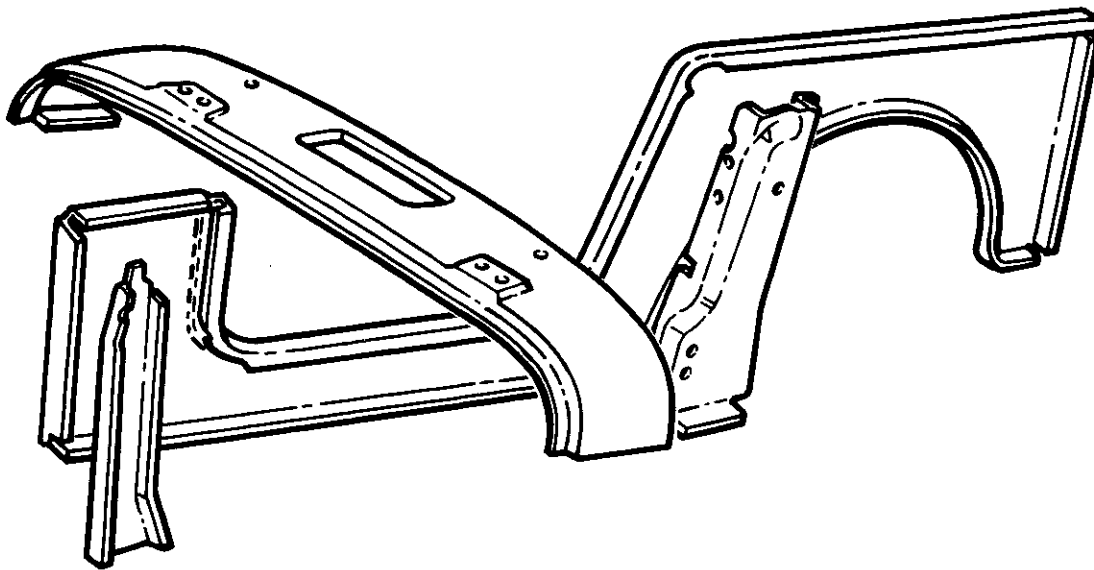
Install all detachable components and trim removed to facilitate this repair.

SEE
I.S.
NOTES



WELDED COMPONENTS

FRONT SIDE PANEL COLLISION REPAIR



101440

FRONT SIDE PANEL REPLACEMENT

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PRODUCT

Remove the door and hinges.

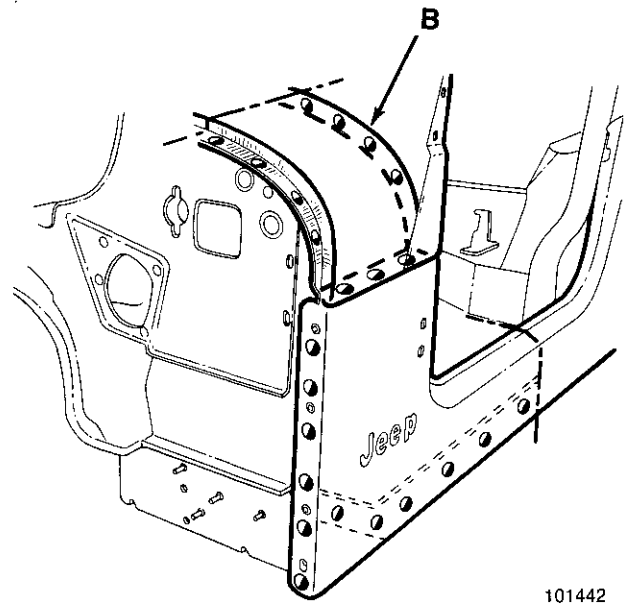
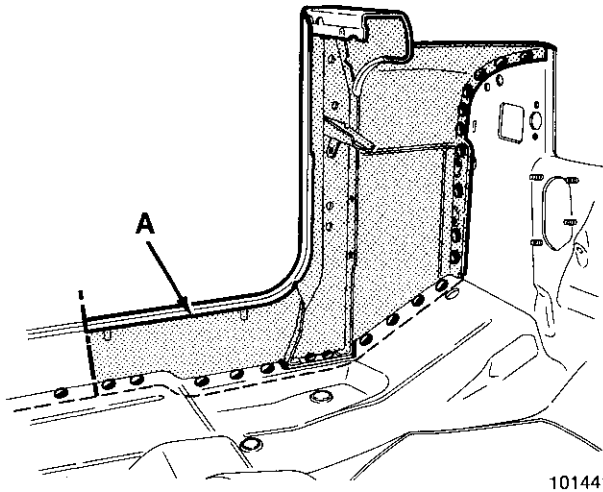
Remove the fender, windshield and instrument/dash panel as necessary.

Remove any detachable components that are in the damaged area. Refer to Chapter P — DETACHABLE COMPONENTS.

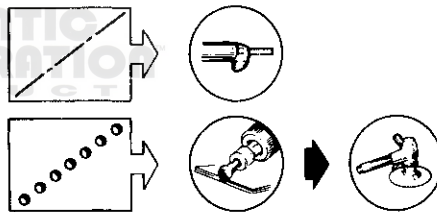
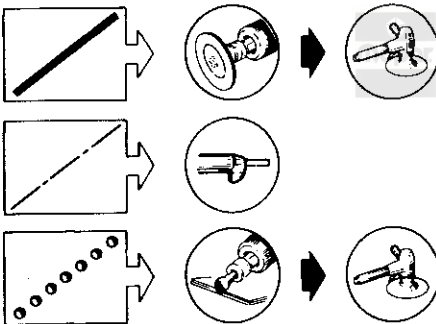
Remove the damaged portion of the side panel (A) and cowl panel (B) as shown.

SEE
I.S.
NOTES

	WELDED COMPONENTS FRONT SIDE PANEL COLLISION REPAIR	
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NOTES



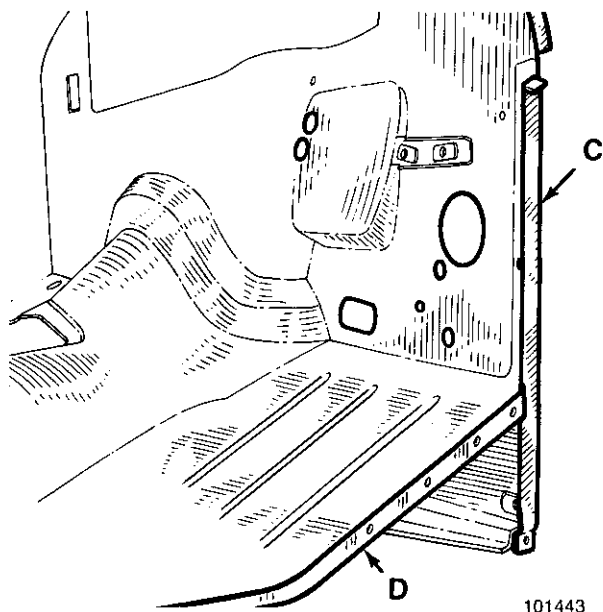
FRONT SIDE PANEL — INSTALLATION/ PREPARATION

Straighten the dash panel (C) and floor panel (D) as required.

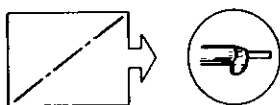
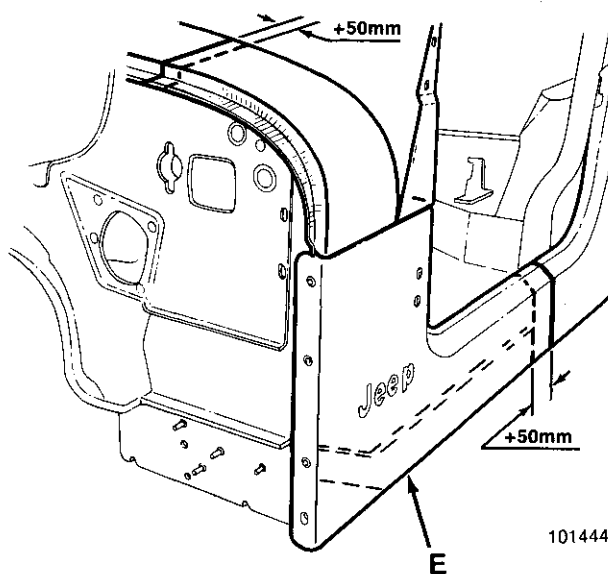


WELDED COMPONENTS

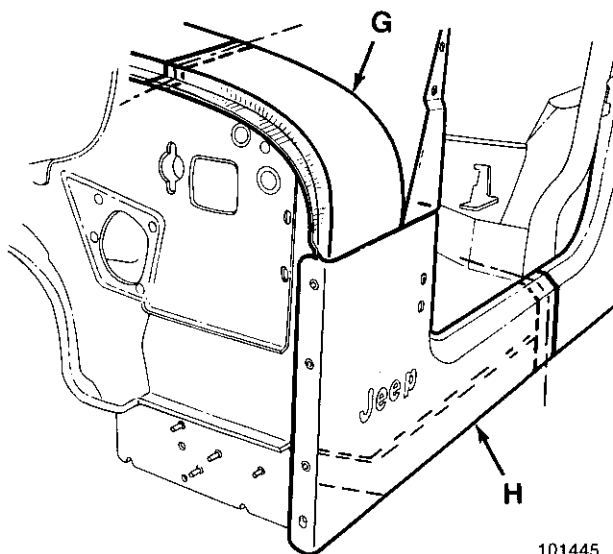
FRONT SIDE PANEL COLLISION REPAIR



Cut the replacement side panel (E) and cowl panel (F) 50mm (2 in) longer than the space they are to fit in.



Retain the replacement panels (G) and (H) in position with locking pliers.



Saw cut the replacement section and the original panel at the same time to insure a proper fit for butt welding. Repeat this procedure as necessary on the other edges of the replacement panel where it overlaps the original panel.

Remove the replacement panel and apply anti-corrosion protective primer to the areas to be welded:

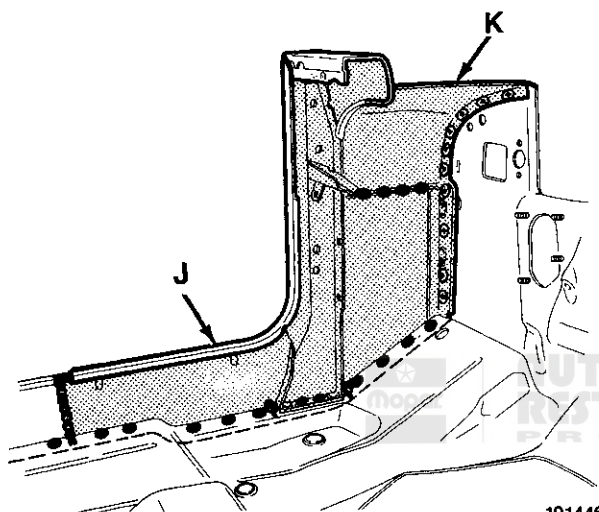
- spotwelds - weld through the sealant
- MIG plugwelds - weld through the zinc based primer

SEE
I.S.
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FRONT SIDE PANEL — INSTALLATION

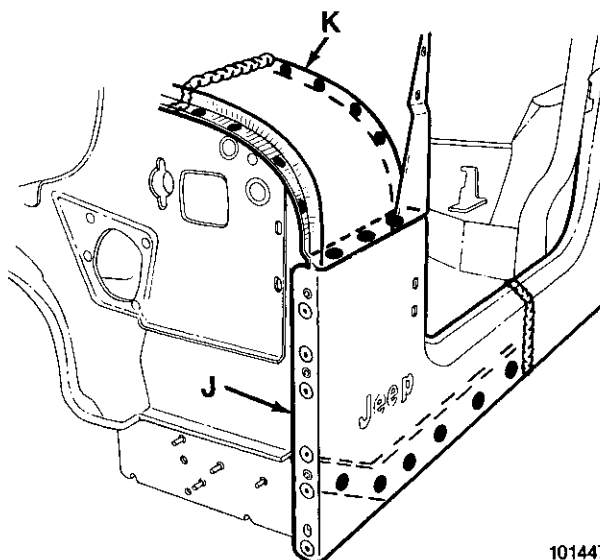
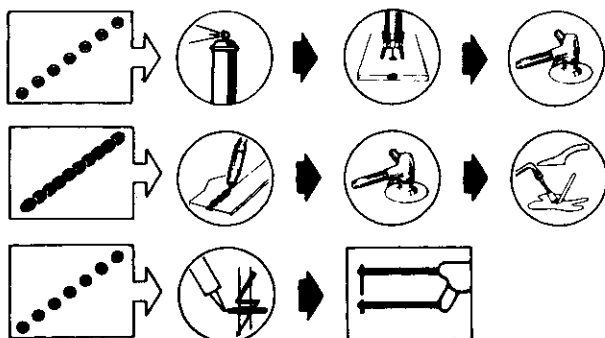
Position the replacement panels (J) and (K) and lock them into position with locking pliers.

Apply body solder to the butt welds and adjacent areas and finish to a smooth contour.

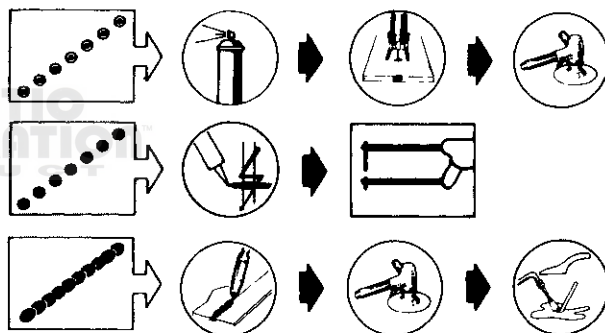


101446

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I.S.
NOTES



101447



Apply body seam sealant as necessary.

Install the hinges and doors and all other detachable components that were removed.

Refer to Chapter P — DETACHABLE COMPONENTS.

Sealing

Refer to Chapter R — SEALING.

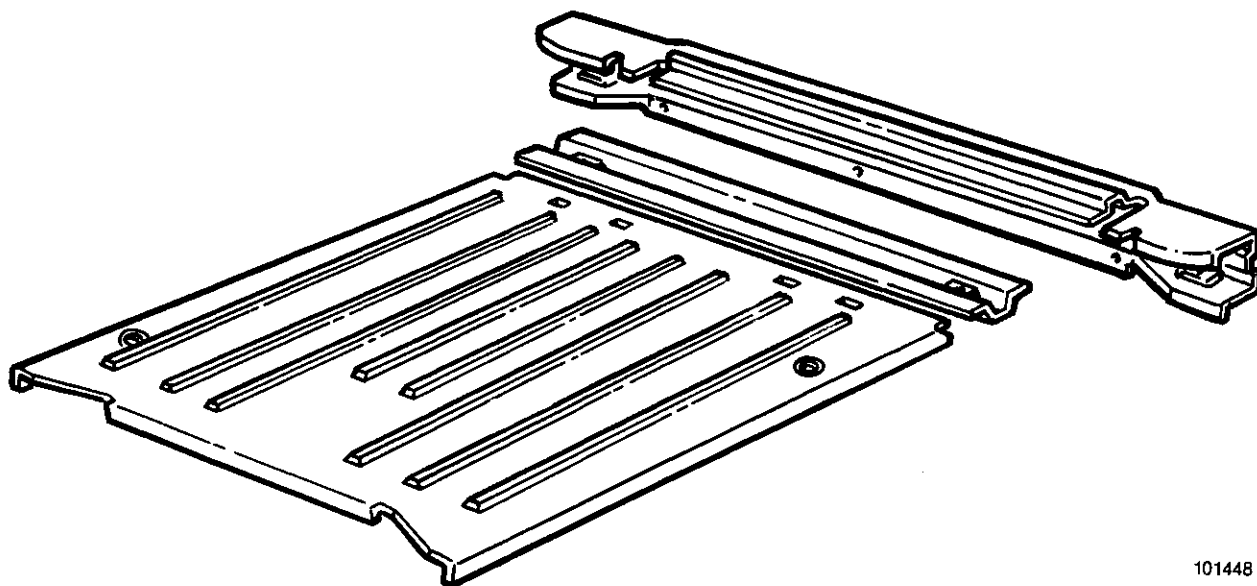
Corrosion Protection - Painting

Refer to Chapter T — PAINT AND TRIM



WELDED COMPONENTS

REAR BODY COLLISION REPAIRS



101448

GENERAL

Depending on the extent of the damage, it may be advantageous to remove the body from the frame.

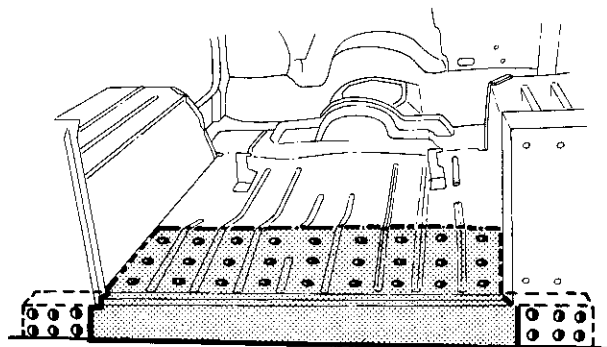
NOTE: The extent of the damage will determine the size of the section that will be removed.

REAR FLOOR PAN CROSSMEMBER — REMOVAL

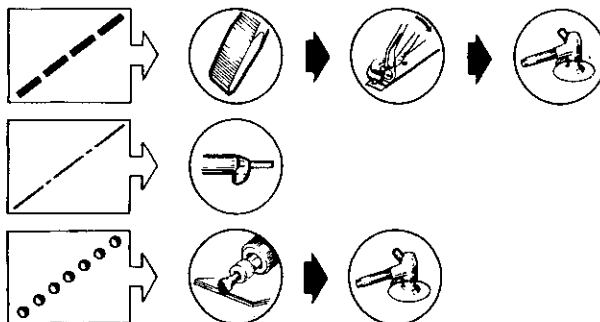
Remove the detachable components and trim as necessary.

Refer to Chapter P — DETACHABLE COMPONENTS.

Remove the spotwelds from the damaged floor pan (A) and crossmember (B) and cut as shown.



101449

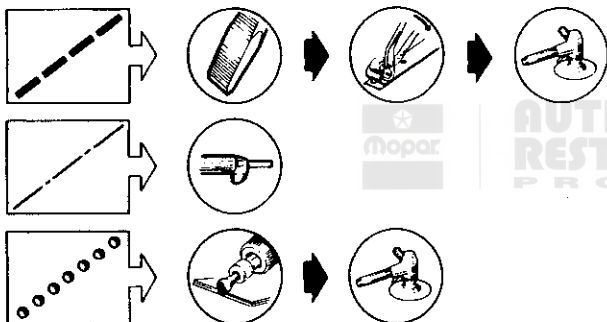
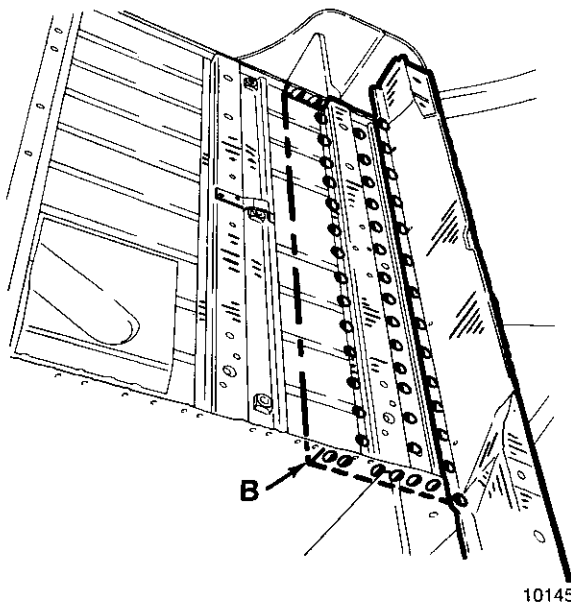


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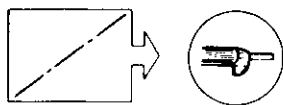
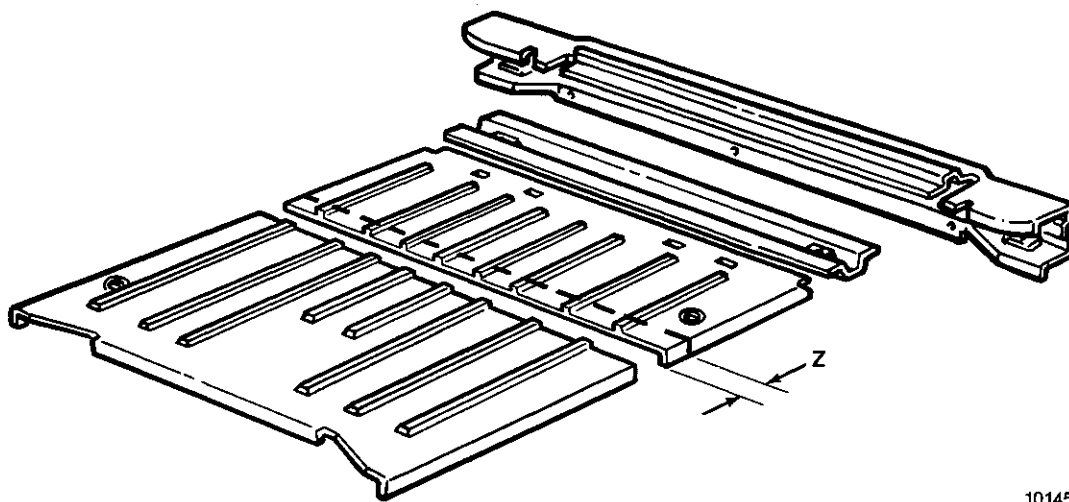
WELDED COMPONENTS

REAR BODY COLLISION REPAIRS



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I.S.
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REAR FLOOR PAN CROSSMEMBER — INSTALLATION/PREPARATION





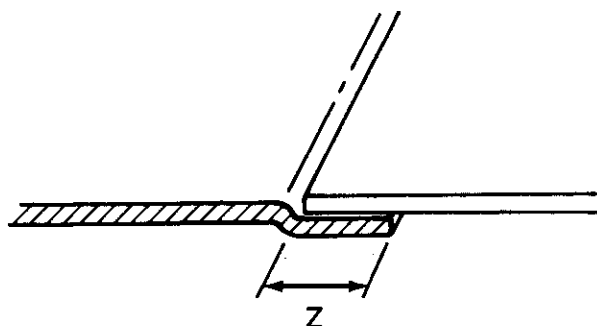
WELDED COMPONENTS

REAR BODY COLLISION REPAIRS



If required, straighten the floor pan reinforcements.

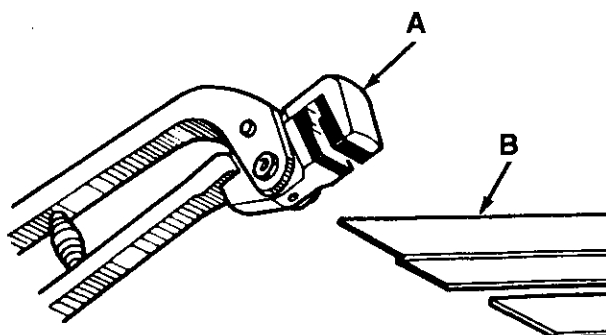
NOTE: The additional size (Z) for the section may vary according to the width of the flange tool.



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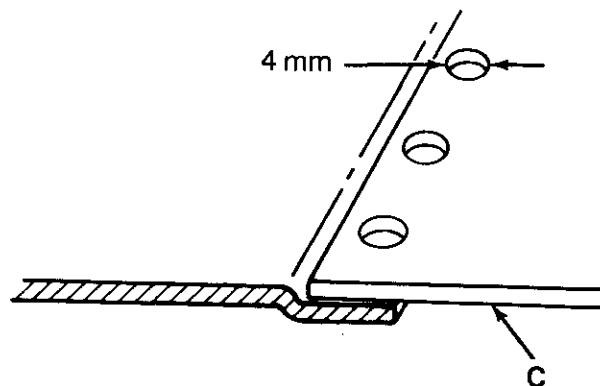
100609

Use a flange tool (A) to flange the mating edge of the remaining original floor pan section (B).



101452

Drill a series of 4mm (0.15 in) diameter holes spaced 36mm (.15 in) apart, along the mating edge of the replacement floor pan section (C).



100610

Remove the primer from the areas to be welded on the replacement floor pan section.

Remove the primer from the areas to be welded on the replacement floor pan section.

REAR FLOOR PAN — INSTALLATION PREPARATION

Apply anti-corrosion sealant/primer to the areas to be welded:

- spotwelds - weld through the sealant
- MIG welders - weld through zinc-based primer

SEE
I.S.
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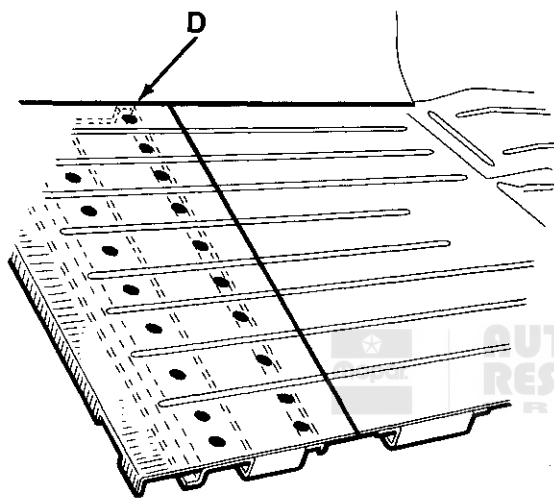
WELDED COMPONENTS **REAR BODY COLLISION REPAIRS**



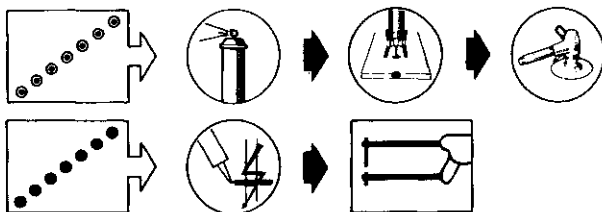
REAR FLOOR PAN — INSTALLATION

Position the floor pan reinforcements on the floor pan and spotweld them into place.

Position the replacement floor pan section (D) in place and spot weld it into position.

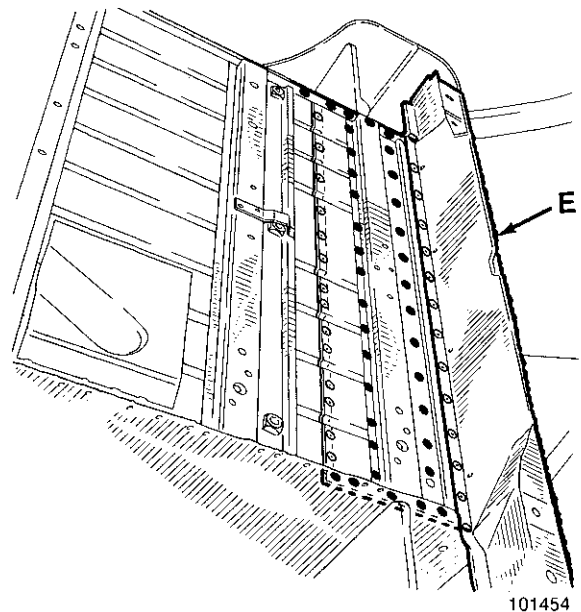


101453

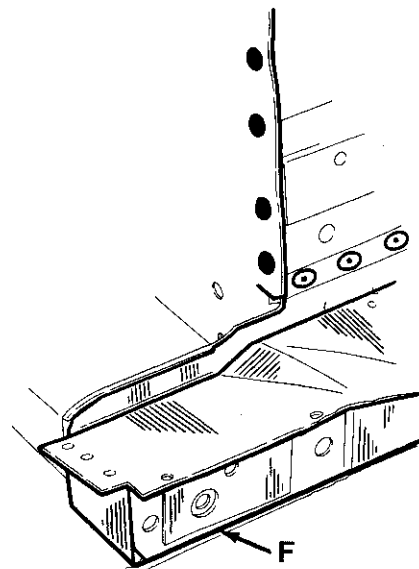
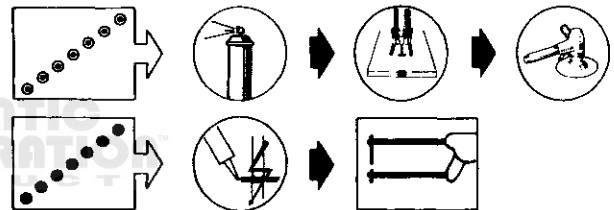


Place the rear crossmember (E) and (F) into position and retain it with locking pliers.

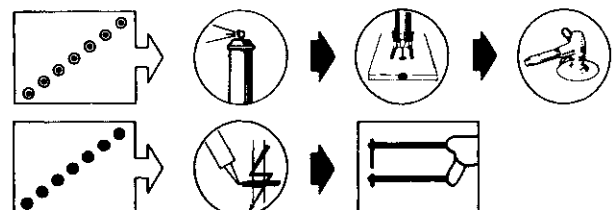
Weld the crossmember into position as shown.



101454



101455



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I.S.
NOTES



WELDED COMPONENTS

REAR BODY COLLISION REPAIRS



Apply body solder to the mating edges of the floor pan sections and finish to a smooth contour.

Apply body seam sealant as necessary.

Sealing

Seal the body as necessary.

Refer to Chapter R — SEALING.

Corrosion Protection - Painting

Refinish the repaired components and adjoining surfaces as necessary.

Refer to Chapter T — PAINT AND TRIM

Detachable Components

Refer to Chapter P — DETACHABLE COMPONENTS.

Install all detachable components and trim removed to facilitate this repair.



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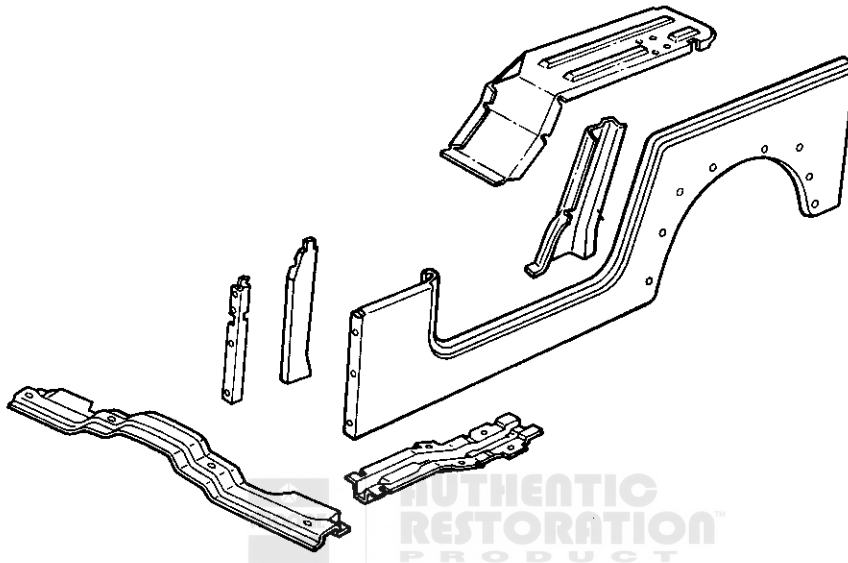
WELDED COMPONENTS

SIDE BODY COLLISION REPAIR



GENERAL

Depending on the extent of the damage, it may be advantageous to remove the body from the frame.



101456

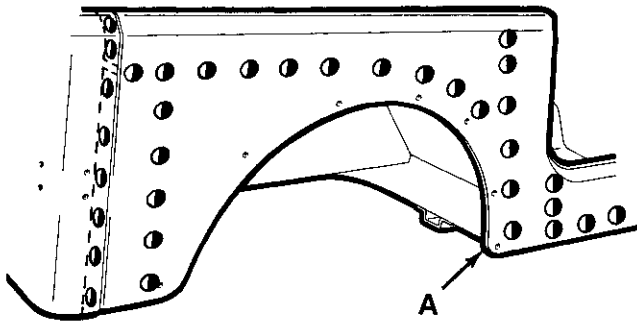
SEE
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NOTES

FRONT SIDE BODY PANEL REMOVAL

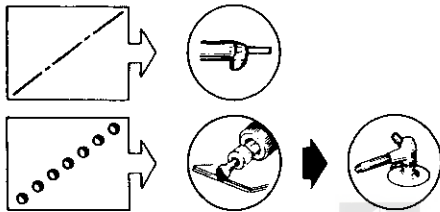
Remove the side panel detachable components as necessary.

Refer to Chapter — Detachable Components

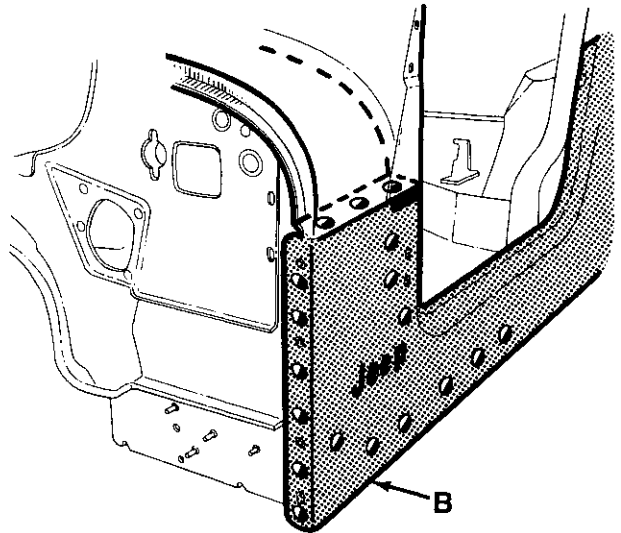
Remove the damaged sections from the side panel (A) and (B) as shown.



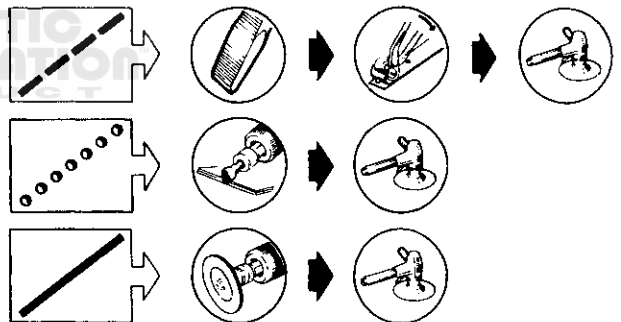
101457



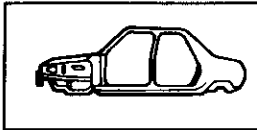
AUTHENTIC
RESTORATION
PRODUCT



101458



SEE
I.S.
NOTES

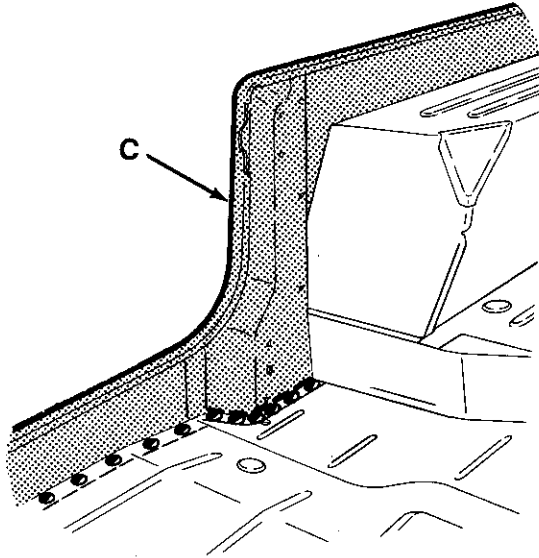


WELDED COMPONENTS

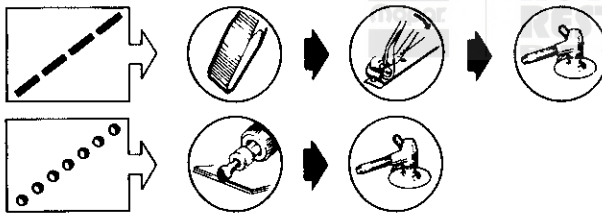
SIDE BODY COLLISION REPAIR



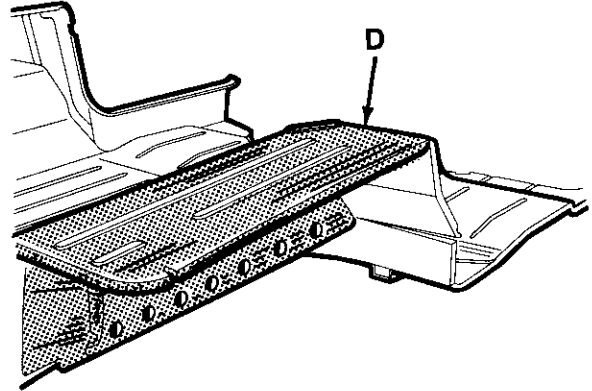
Remove the body side reinforcement B-pillar panel (C) as necessary.



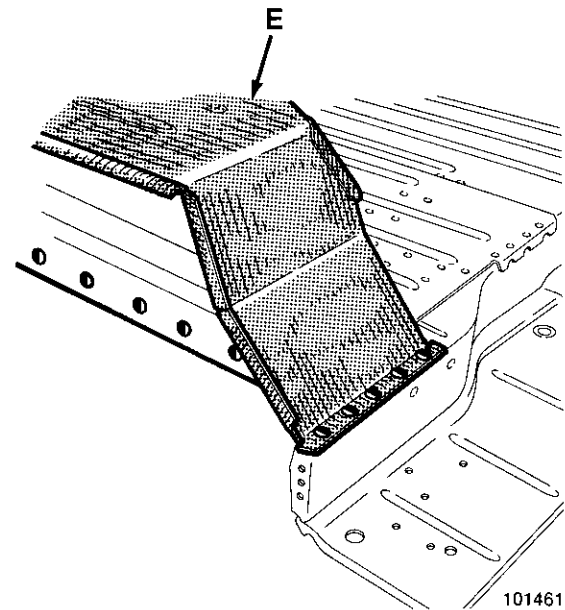
101459



Remove the wheelhouse panel (D) and (E) as necessary.



101460



101461



SEE
NOTES

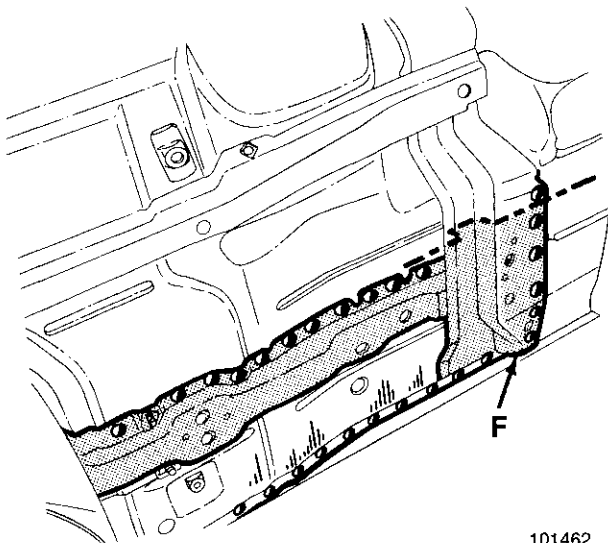


WELDED COMPONENTS

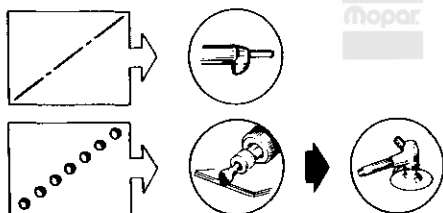
SIDE BODY COLLISION REPAIR



Remove the front floor pan crossmember (F) as necessary.



101462



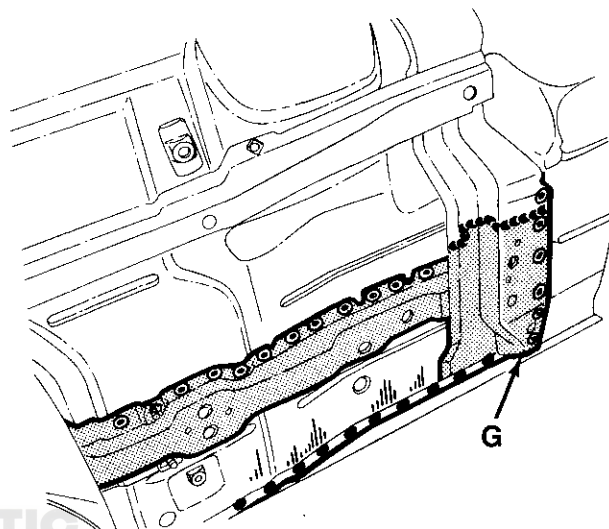
Straighten the floor pan as required.

INSTALLATION/PREPARATION

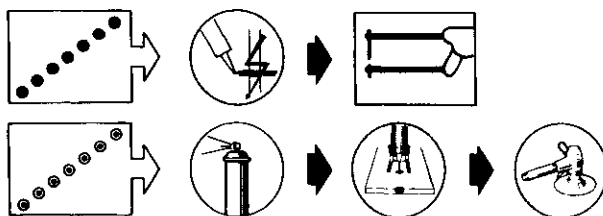
Saw cut a section from the replacement cross-member to replace the section removed.

INSTALLATION

Position the replacement crossmember section (G) and weld it in place as shown.



101463

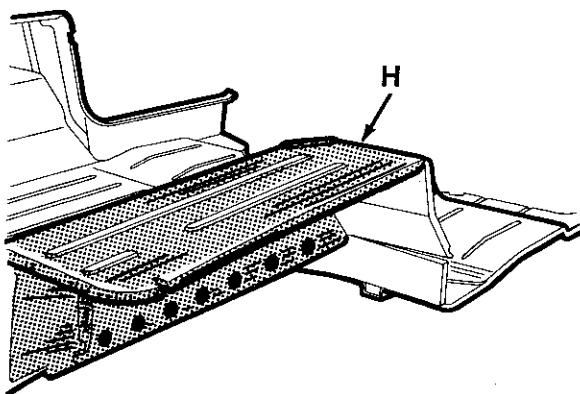


SEE
I.S.
NOTES

	WELDED COMPONENTS SIDE BODY COLLISION REPAIR	
---	--	---

Position the replacement wheelhouse panel (H) and secure it with locking pliers.

Weld the replacement wheelhouse panel into place as shown.



**AUTHENTIC
RESTORATION**
PRODUCT

101464

SEE
S.S.
NOTES





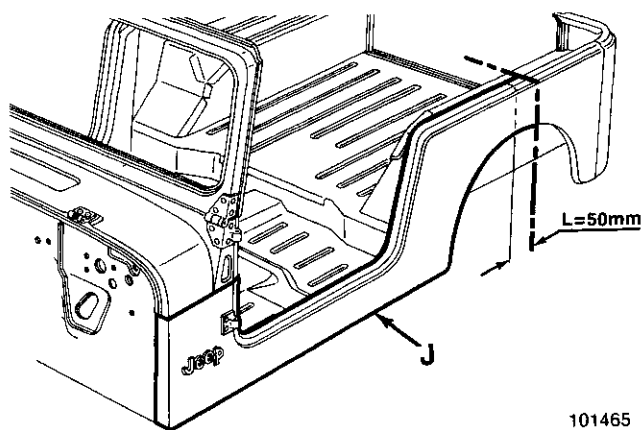
WELDED COMPONENTS

SIDE BODY PANEL COLLISION REPAIR

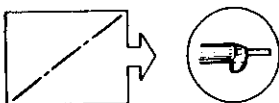


INSTALLATION/PREPARATION

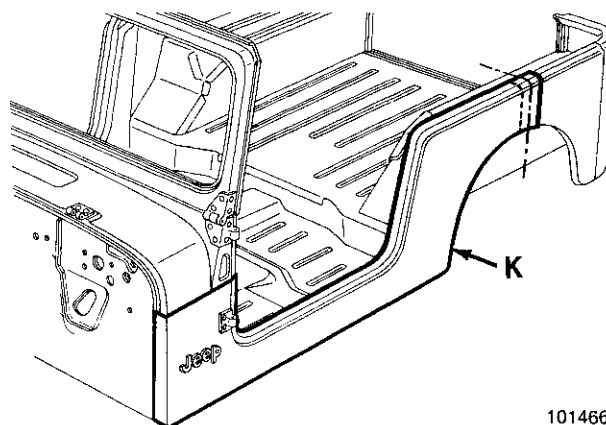
Cut the replacement side panel (J) 50mm (2 in) longer than the space it is to fit in.



101465



Retain the replacement panel (K) in position with locking pliers.



101466



Saw cut the replacement section and the original panel at the same time to insure a proper fit for butt welding.

Remove the replacement panel from the vehicle.

Remove the primer from the areas to be welded on the replacement panel.

Apply anti-corrosion protective primer to the areas to be welded:

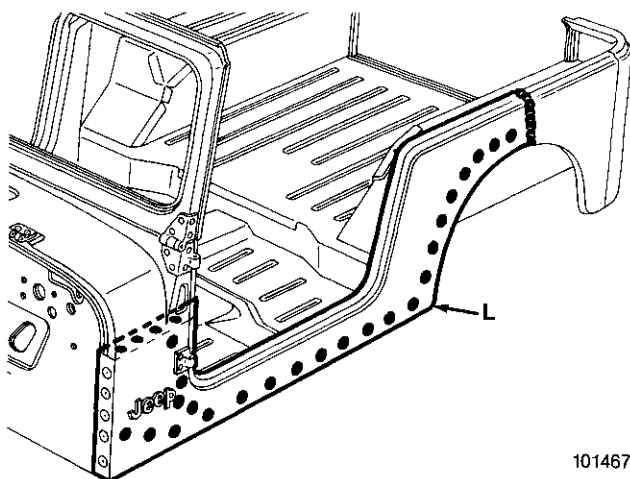
- spotwelds - weld through the sealant
- MIG plugwelds - weld through the zinc based primer

SEE
I.S.
NOTES

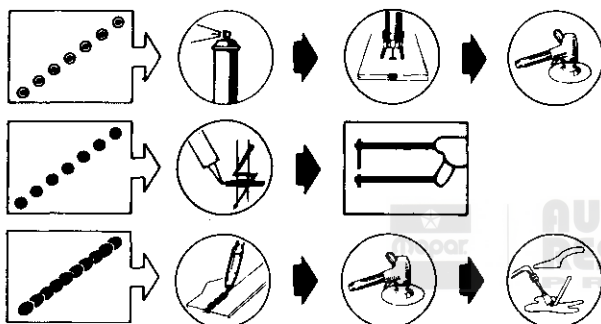


WELDED COMPONENTS

SIDE BODY PANEL COLLISION REPAIR



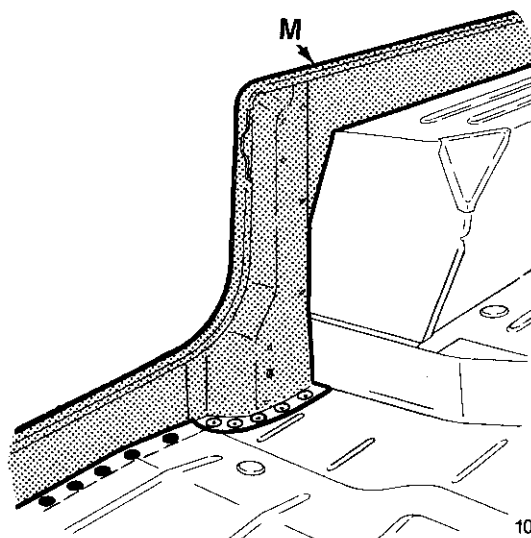
101467



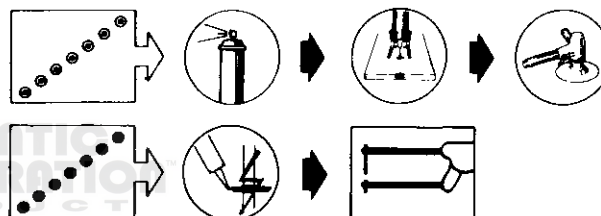
INSTALLATION

Place the replacement panel (L) in the installed position and retain it with locking pliers.

Weld the replacement panel in (M) position as shown.



101468



Apply body solder to the butt weld and finish the existing contours.

Sealing

Refer to Chapter R — SEALING.

Corrosion Protection/Painting

Refinish the quarter panel and vehicle body as necessary.

Refer to Chapter T — PAINT AND TRIM.

Install all remaining detachable components that were removed.

SEE
S.
NOTES

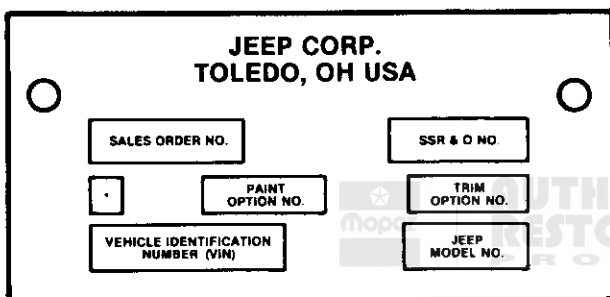
	PAINT AND TRIM	
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VEHICLE IDENTIFICATION PLATE		GENERAL INFORMATION	18
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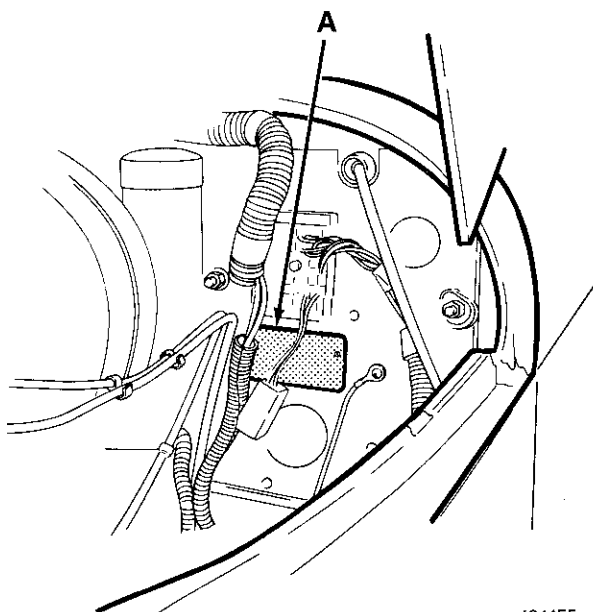
	PAINT AND TRIM	
	PAINT AND TRIM COLOR IDENTIFICATION	

VEHICLE IDENTIFICATION PLATE LOCATION

A metal vehicle identification plate is affixed to the left-hand side of the dash panel (A). The plate shows the Sales Order Number, the Vehicle Identification Number (VIN), Special Sales Request & Order (SSR&O) Number, Paint Option Number, Trim Option Number, and the Jeep Model Number.



84199



101155

PAINT OPTION NUMBER

The Paint Option Number is embossed on the Vehicle Identification Plate.

Paint cannot be purchased through the Parts Distribution System. All colors are available from Ditzler, DuPont, Sherwin Williams and Rinsed Mason jobbers.

Option No. 999 indicates special paint. To obtain information on special paint, contact your Jeep Parts Distribution Center and provide the Vehicle Identification Number (VIN).

TRIM OPTION NUMBER

The Trim Option Number is embossed on the Vehicle Identification Plate. Consult your Jeep Parts Catalog for trim ordering procedures. Special trim is indicated by Trim Option No. 999. To obtain information on special trim, contact your Jeep Parts Distribution Center and provide the Vehicle Identification Number (VIN).

SOURCES

Refinish Paint

Paint vender code information is available from your local paint distributor, the M.R. 171 manual and the current Paint Information Chart poster (See the sample chart on the next page).

SEE
I.S.
NOTES



PAINT AND TRIM

PAINT AND TRIM COLOR IDENTIFICATION



100720

The paint vendor code information in the M.R. 171 manual and the Paint Information Chart is revised annually.

The following colors are being introduced on the 1987 Wrangler/YJ and will be included in the next revision.

Touch Up Paint

Refer to the current AMC/Jeep/Renault Accessory Catalog for:

- exterior spray colors
- exterior brush top applicators
- interior spray colors

SEE
I.S.
NOTES

PAINT CODE & COLOR		DITZLER		DUPONT		RINSHED MASON		SHERWIN WILLIAMS		SIKKENS	
CODE	COLOR	CODE	FACTORY PACKAGE	CODE	FACTORY PACKAGE	CODE	FACTORY PACKAGE	CODE	FACTORY PACKAGE	CODE	FACTORY PACKAGE
			LAC. EN.		LAC. EN.		LAC. EN.		LAC. EN.		LAC. EN.
BE	Colorado Red	72812	✓	B8694	• •	17253	✓ ✓	36318	• •	BE	✓
2B	Sun Yellow	3467	✓ ✓	B8277	• •	12841	✓ ✓	32257	• ✓	2B	✓

• — FACTORY PACKAGE ✓ — INTERMIX ONLY



PAINT AND TRIM

PAINT AND TRIM COLOR IDENTIFICATION



AMC-JEEP-RENAULT PAINT INFORMATION

BODY COLORS		PAINT MANUFACTURER'S CODE AND FACTORY PACKAGE AVAILABILITY										MODEL APPLICATION													
		DITZLER		DUPONT				RINSHED MASON				SHERWIN WILLIAMS ACME/ROGERS				F150	F250	F350	F400	F500	F600	F700	F800	F900	F1000
PAINT CODE AND NAME		CODE	FACTORY PACKAGE		CODE	FACTORY PACKAGE		CODE	FACTORY PACKAGE		CODE	FACTORY PACKAGE		F150	F250	F350	F400	F500	F600	F700	F800	F900	F1000		
CODE	COLOR		LAC.	EN.		LAC.	EN.		LAC.	EN.		LAC.	EN.											LAC.	EN.
P1	Classic Black	9300	X	X	99	X	X	A946	X	X	1738 33756 ^a	X	X	X ^a	X ^a			X	X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
9B	Olympic White	3107 3700 ^a	•	•	45701	•	•	9867	•	•	30146 34734 ^a	X	X	X ^a	X ^a			X	X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
2A	Mist Silver Metallic	3466	•	•	B8276	•	•	12840	✓	✓	32385	X	•					X							
2D	Deep Night Blue	3469	•	•	B8279	•	•	12843	•	•	32251	X	•						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
3B	Sebring Red	3592	•	•	B8372	•	•	13327	✓	✓	34733	X	X	X ^a	X ^a				X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
3C	Garnet Metallic	3593 ^a	•	•	B8374 ^a	✓	•	13328 ^a	•	•	32862 ^a	X	X						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
3D	Sterling Silver Metallic	3594 ^a	•	•	B8375 ^a	•	•	13329 ^a	•	•	32863 ^a	X	X	X ^a	X ^a				X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
3P	Garnet Metallic	3599	•	•	B8373	•	•	13334	✓	✓	32867	X	•					X							
4A	Autumn Brown Metallic	3622	•	•	B8450	•	•	14190	✓	✓	33810	•	•					X							
4B	Mocha Brown Metallic	3623	•	•	B8451	•	•	14191	✓	✓	33792	•	•					X							
4D	Champagne Metallic	3625 ^a	•	•	B8453 ^a	•	•	14193 ^a	✓	✓	33811 ^a	✓	•						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
4M	Charcoal Metallic	3618 ^a	•	•	B8459 ^a	•	•	14199 ^a	•	•	33732 ^a	X	X						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
5A	Light Blue Metallic	3694 ^a	•	•	B8593 ^a	•	•	15225 ^a	•	•	34342 ^a	X	X	X ^a	X ^a										
5B	Medium Green Metallic	3693 ^a	•	•	B8408 ^a	•	•	15226 ^a	•	•	34346 ^a	X	X	X ^a	X ^a										
5C	Red Metallic	3695 ^a	•	•	B8594 ^a	•	•	15227 ^a	•	•	34750 ^a	X	X	X ^a	X ^a										
5D	Dark Honey Metallic	3696 ^a	•	•	B8595 ^a	•	•	15228 ^a	✓	✓	34751 ^a	✓	•						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
5E	Dark Brown Metallic	3697 ^a	•	•	B8596 ^a	•	•	15229 ^a	✓	✓	34347 ^a	✓	•							X ^a	X ^a	X ^a	X ^a	X ^a	
5H	Medium Blue Metallic	3698	•	•	B8597	•	•	15230	✓	✓	34440	✓	•					X							
5J	Dark Blue Metallic	3699	•	•	B8598	•	•	15231	✓	✓	34441	✓	•					X							
6V	Sunshine Yellow	2827	✓	✓	44119	✓	✓	2889	✓	✓	L10Y-3712	✓	•							X					
AA	Dark Pewter Metallic	3825 ^a	•	•	B8677 ^a	•	•	A16270 ^a	✓	✓	35351 ^a	X	X	X ^a											
AB	Beige	3826 ^a	•	•	B8678 ^a	•	•	A16271	✓	✓	35455 35352 ^a	X	X	X ^a	X ^a			X			X ^a	X ^a	X ^a	X ^a	X ^a
AC	Gold Metallic	3827 ^a	•	•	B8679 ^a	•	•	A16272 ^a	✓	✓	35353 ^a	X	X	X ^a	X ^a										
AH	Mica Blue Metallic	3807 ^a	•	•	C8519 ^a	•	•	A16273 ^a	✓	✓	35282 ^a	X	X	X ^a											
AJ	Medium Blue Metallic	3828 ^a	•	•	B8680	•	•	A16274 ^a	✓	✓	35354 ^a	✓	✓						X ^a	X ^a	X ^a	X ^a	X ^a	X ^a	
116	Aurore Metallic	72731 ^a	✓	✓	L8435 ^a	✓	✓	14511 ^a	✓	✓	34844 ^a	✓	✓					• ^a							
348	White	90343	✓	✓				15626			35636	✓	✓					•	O						
620	Silver Metallic	33364 ^a	✓	✓	K7833 ^a	✓	✓	10900 ^a	✓	✓	30373 ^a	✓	✓					X ^a	O ^a						
694	Black	9448 ^a	✓	✓	99L ^a	✓	✓	12198 ^a	✓	✓	33756 ^a	X	X					O ^a							
705	Red	72156	✓	✓	43827	✓	✓	8671	✓	✓	7239	✓	✓												
721	Bordeaux	51153	✓	✓	K8121	✓	✓	14373	✓	✓	34455	✓	✓					X							
733	Red	71988	✓	✓	34010	✓	✓				J4-5448	✓	✓					O							

WHEEL COLORS																							
71R76	Silver Metallic										L11A-3182	✓		X	X								
82J49	Silver										32438	✓						X	X				
85J21	Gold	25522	✓	✓	D8536	✓	✓				35235	✓	✓					X	X				

ACCENT COLORS																							
76R19	Medium Gloss Black	9434	✓	✓	B8260	✓	✓	12060	✓	✓	7669	✓	✓	X	X	X	X	X	X	X	X	X	X

NOTE: a — Base Coat - Clear Coat Color
X — Available in U.S. and Canada
• — Available in U.S. Only
O — Available in Canada Only
✓ — Factory package not available. Refer to paint supplier intermix formula.

GENERAL INFORMATION

Color matching can be accomplished by the use of several different techniques.

The techniques are as follows:

- gun technique, including reduction (thinner) and air pressure
- tinting
- blending

Gun Technique

A color can be changed to be either lighter or darker by using one of the following methods.

Lighten (drier):

- thinner/reducer (more reduction)
- higher air pressure
- greater gun distance

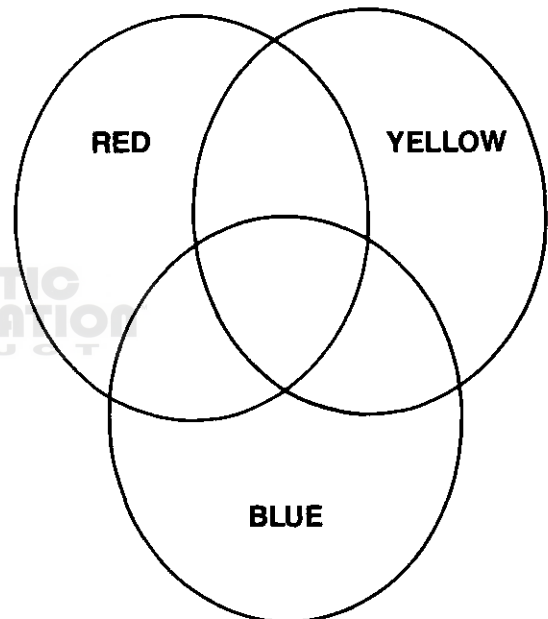
Darker (wetter):

- thinner/reducer (less reduction)
- lower air pressure
- less gun distance

Tinting Technique

The tinting technique usually requires more experience than the gun technique.

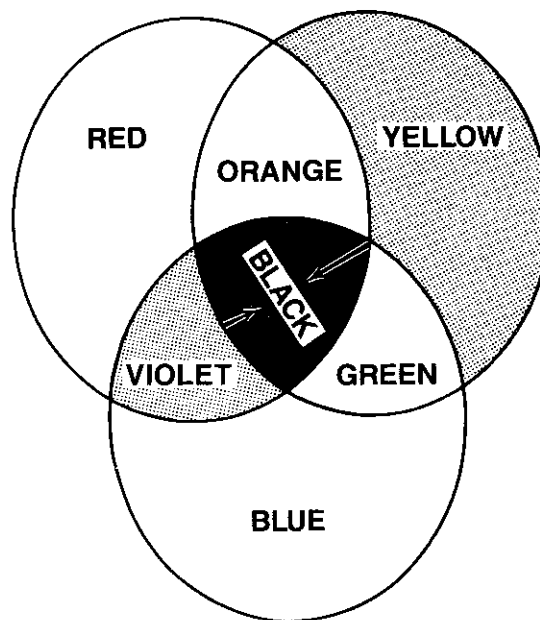
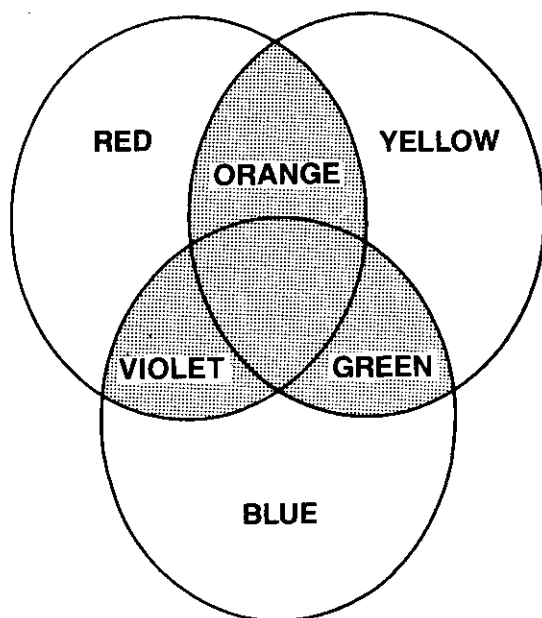
Tinting is based on the primary color concept that is described in the following illustrations.



PRIMARY COLORS

R = RED	}	CANNOT BE MADE BY MIXING
Y = YELLOW		
B = BLUE		

SEE
I.S.
NOTES



SECONDARY COLORS

O = ORANGE
 G = GREEN
 V = VIOLET

} MADE BY MIXING
PRIMARY COLORS

NEUTRAL COLORS

WHITE
 BLACK
 METALLIC FLAKE

84220 B

MIX EXAMPLES

Red + Blue = Violet + Yellow = Black
 Red + Yellow = Orange + Blue = Black
 Blue + Yellow = Green + Red = Black

84220 C

When using the tinting technique, the type of light that is used for illumination will affect color matching accuracy.

Refer to the following chart for additional information.

SEE
I.S.
NOTES

	PAINT AND TRIM		
	COLOR MATCHING		

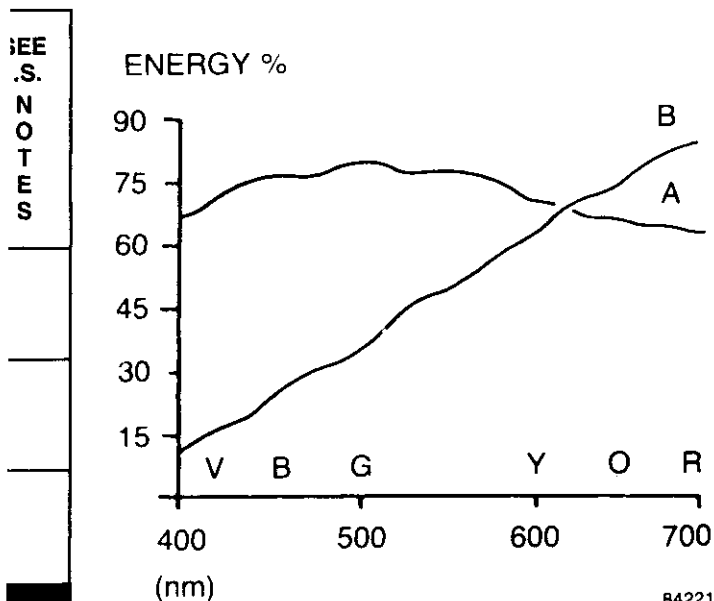
THE EFFECT OF DIFFERENT LIGHTING ON COLOR

DAYLIGHT	Tungsten Filament Lamp	Sodium Discharge Lamp	Mercury Discharge Lamp
WHITE	Slightly Yellow	Light Yellow	Bluish White
YELLOW	Orange Yellow	Yellow	Greenish Yellow
GREEN	Greyish Green	Brownish Yellow	Deeper Green
BLUE	Greyish Blue	Dark Brown or Black	Deep Violet Blue
RED	Slightly Orange	Brown	Dark Brown

84219

Illuminant (A) closely resembles white light and is used as a standard illumination for color matching.

Illuminant (B) represents incandescent tungsten illumination.



A color can be broken down into three areas; coloration, brightness or tone and purity:

- coloration — determined by pigments (refer to the color chart)

- brightness or tone — generally can be adjusted by changing the aluminum content in metallic colors

NOTE: When adjustments are made, refer to the paint formula information for the aluminum type and size.

- purity — black or white variation

Blending Technique

Blending is a common technique for color matching.

This technique is generally used if the proper color cannot be obtained by using the other techniques described above.

Blending is used to eliminate the variation in color when there are two very similar colors located on adjacent body panels.

	PAINT AND TRIM	
	COLOR MATCHING	

Procedure

Complete repair to the damaged area and prepare the surface for paint.

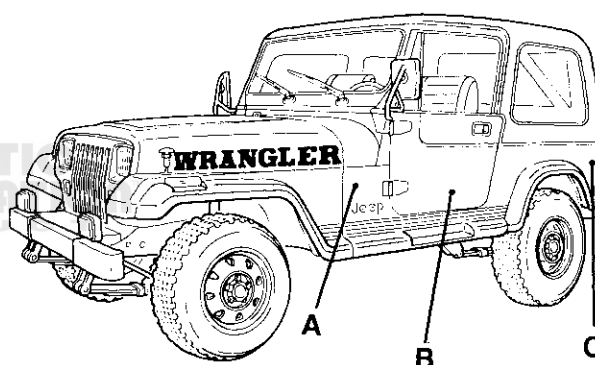
Sand the the adjacent panels with 600 grit wet or dry sandpaper.

Clean the sanded areas with a wax and grease removal solution (e.g., Ditzler DX-330, DuPont Prep-Sol or an equivalent product).

Tack the areas to be sprayed.

Blend the paint into the adjacent body panels and overlap each coat slightly more than the previous coat.

Once the proper blending and color appearance is obtained, clear coat the complete panels (A, B and C).



101157

	PAINT AND TRIM	
SANDPAPER		

STANDARDS

Refer to the Abrasive Grades chart for the abrasive standards for color sanding prior to color coating.

Abrasives

Abrasive recommendations for sanding prior to color coating.

	Hand Wet-Sand	Hand (No-Fill Type) Dry-Sand	Machine-Sand
Alkyd Enamel	360-Grit or Finer	280-Grit or Finer	220-Grit or Finer
Acrylic Enamel	360-Grit or Finer	280-Grit or Finer	220-Grit or Finer
Polyurethane Enamel	360-Grit or Finer	280-Grit or Finer	220-Grit or Finer
Acrylic Lacquer	400-Grit or Finer	320-Grit or Finer	280-Grit or Finer
Acrylic Urethane	400-Grit or Finer	320-Grit or Finer	280-Grit or Finer
Polyurethane	360-Grit or Finer	280-Grit or Finer	220-Grit or Finer

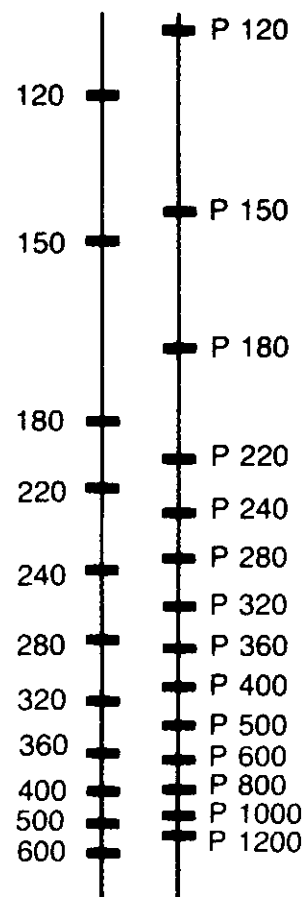
84208

Normally, the American Abrasive Standards provide sufficient information but, because the F.E.P.A. Standards (European) have been recently introduced, a correlation chart is provided below.

SEE I.S. NOTES

SANDPAPER

American Standards F.E.P.A. Standards (European)



85791

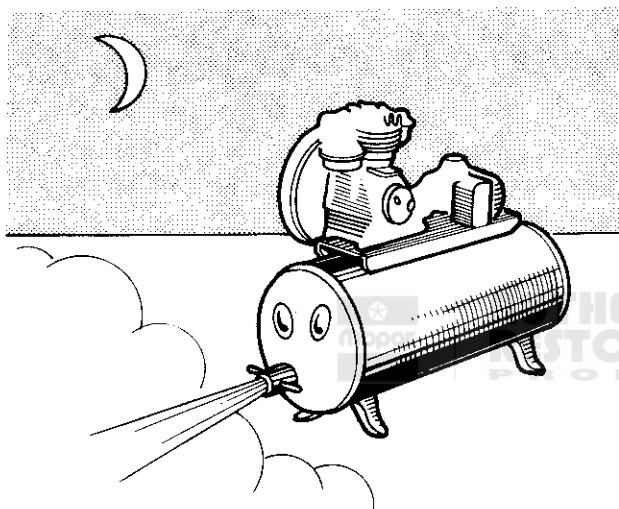
Refer to the chart and note that:

- P 600 abrasive grade sandpaper in the European Standards (F.E.P.A.) correlates to a 360 abrasive grade sandpaper in the American Standards
- P 1200 abrasive grade sandpaper (500-600 American Standards) would be used to obtain the extremely fine sanding required for dual coat finishes

PRECAUTIONS

Air Compressor

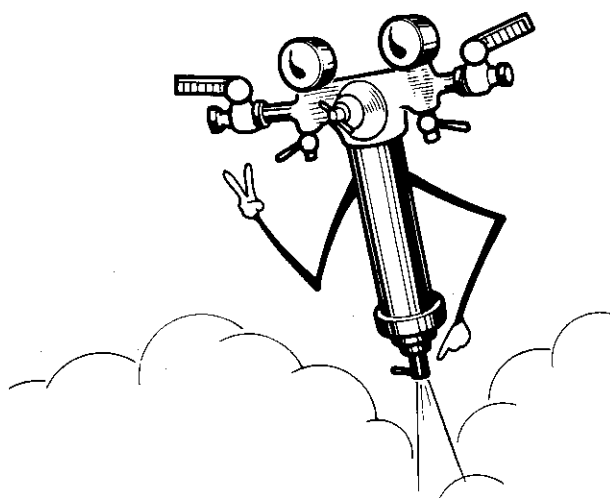
Undesirable impurities (e.g., small quantities of water and oil) can be avoided if the air tank is purged at the end of each day.



86363

Distributor Air Filters

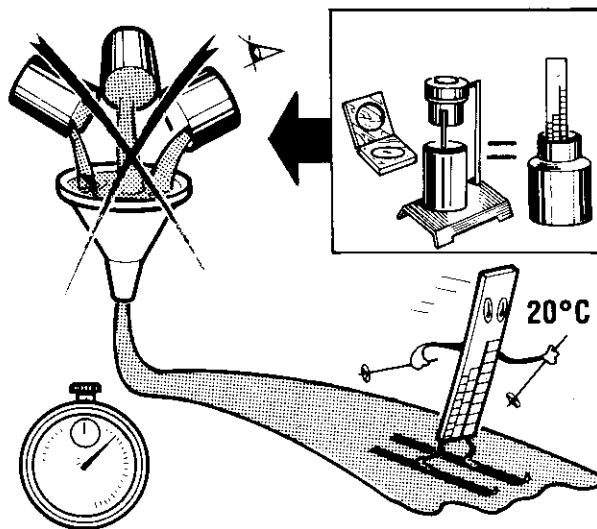
The distributor air filters must be purged two times per day to eliminate impurities that cause paint blistering and lack of luster.



86364

Ingredients and Quantities

The ingredient and quantity instructions provided by the paint vendor must be closely observed to prevent paint runs, orange peel and pitting.



86367

SEE
I.S.
NOTES



PAINT AND TRIM

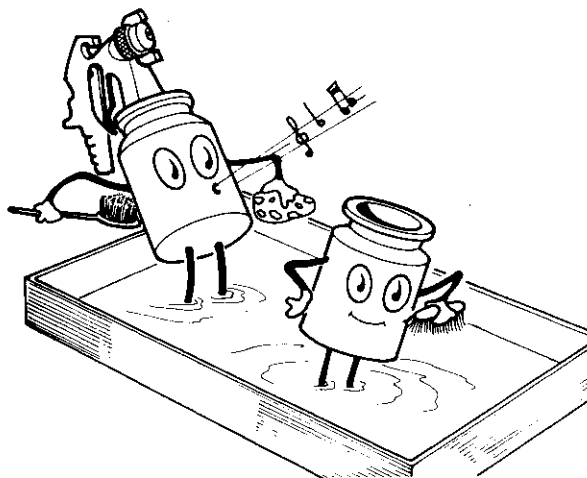
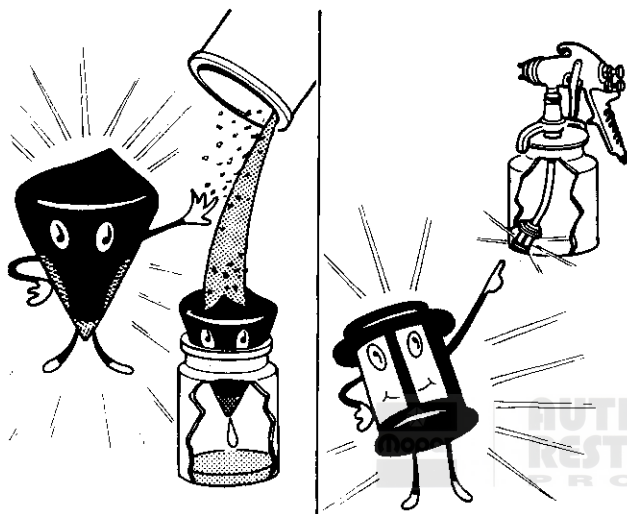
EXTERIOR REFINISHING



Paint Filtering

Filter the paint after thinning it to remove impurities (i.e., dust).

The spray gun must have a filter.



Air Pressure

The air pressure should be adjusted to compensate for:

- hose length
- hose diameter
- air leaks

SEE
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NOTES

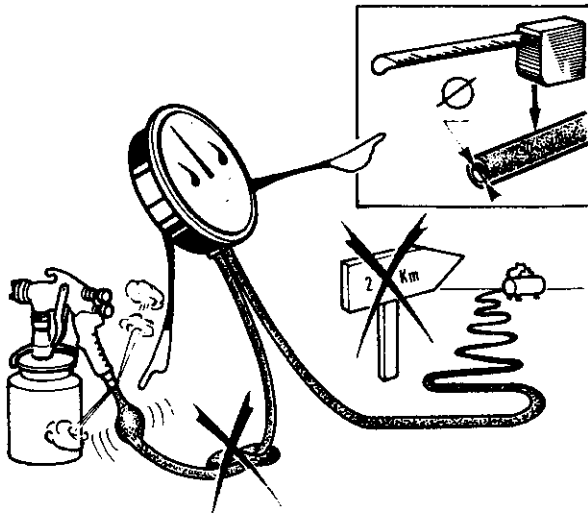
Equipment Cleaning

The spray gun and associated equipment must always be clean to avoid spraying contaminated paint, imperfect coloring and other undesirable results.

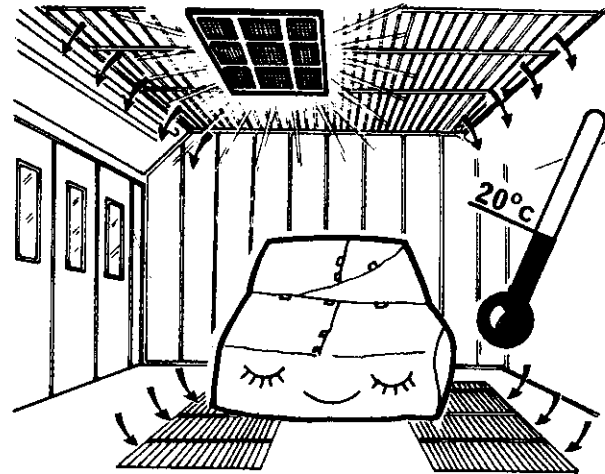


PAINT AND TRIM

EXTERIOR REFINISHING



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Environment



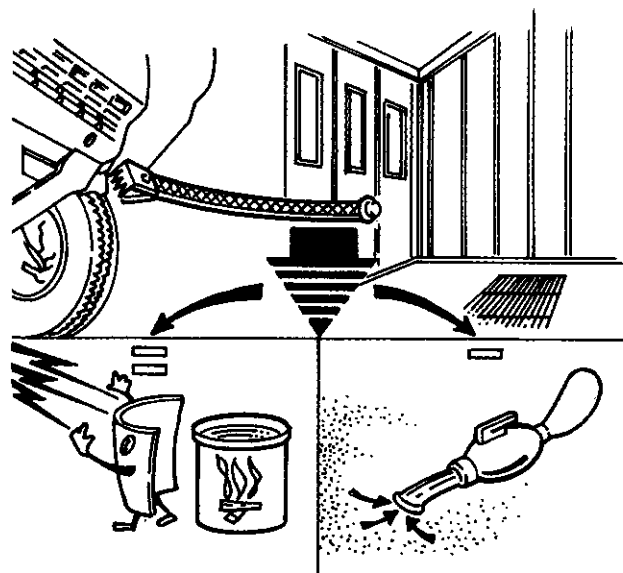
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Clean spray booth filters will assure the proper downward airflow (0.3 m/s or 1 ft/s) and the elimination of dust.

For good paint application and coat tension, the spray booth temperature must be maintained at a close vicinity of 20°C (68°F).

Vehicle Grounding

The vehicle must be grounded (i.e., at the same voltage potential as the spray booth) to assure a safe working condition and to minimize the attraction of dust particles.



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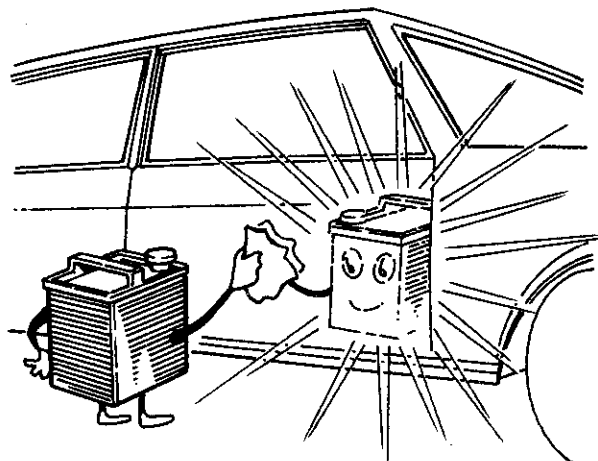
SEE
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NOTES

	PAINT AND TRIM EXTERIOR REFINISHING	
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Surface Preparation

For good paint adherence, the surfaces to be painted must free of rub down material, silicone and oil or grease.

It is essential to use a good quality degreaser to remove oil and grease.



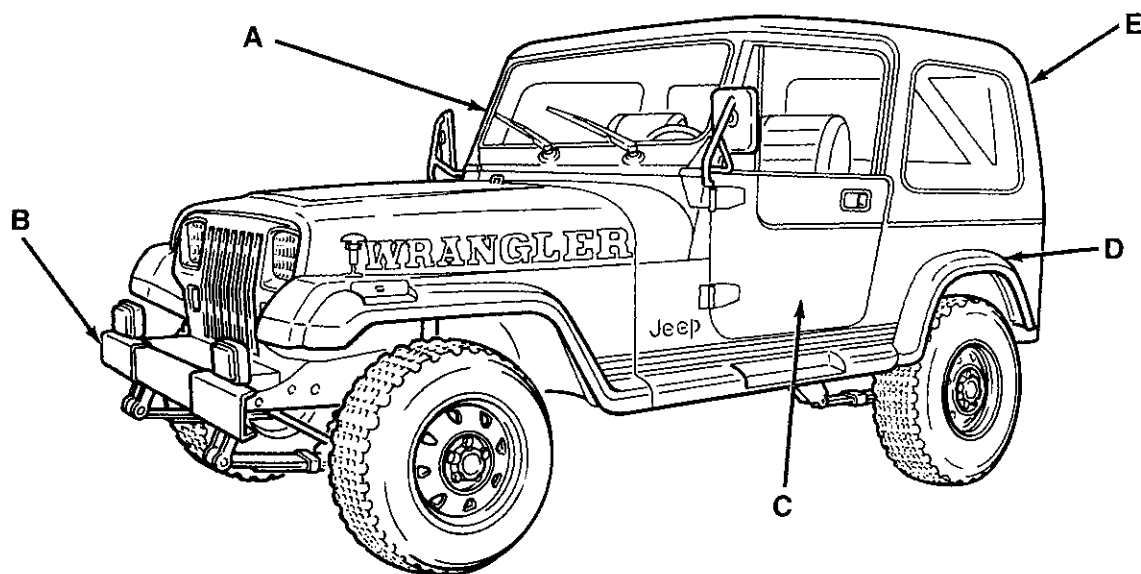
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BODY COMPONENT MATERIALS

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NOTES



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A - Reveal Molding — Anodized Aluminum

B - Bumper — Painted Anodized Aluminum

C - Body Shell — Steel Substrate

D - Wheelwell Flares — TPO

E - Roof — Sheet Molded Compound

MASKING PROCEDURE FOR PAINT APPLICATION

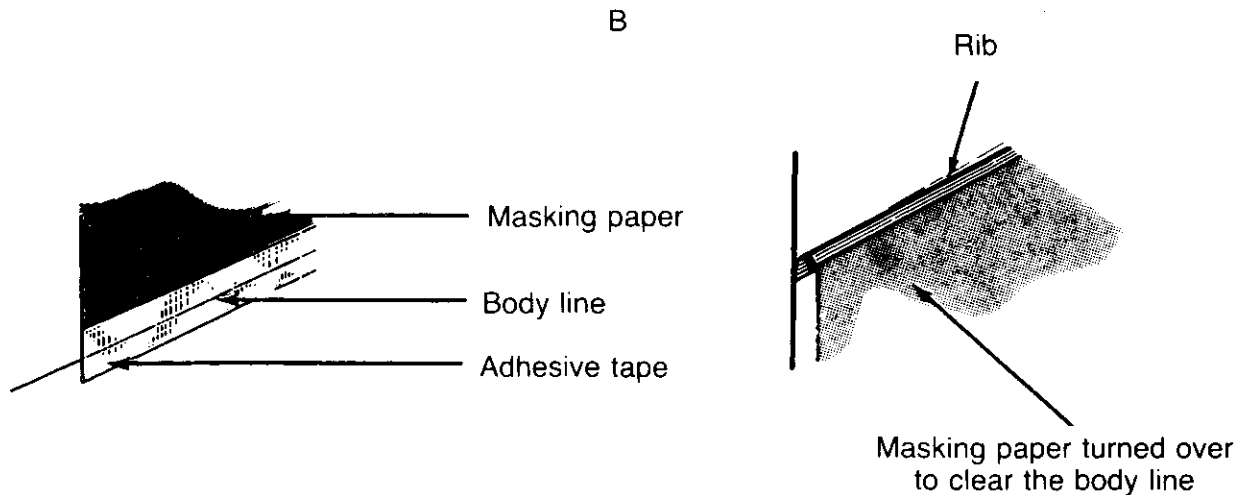
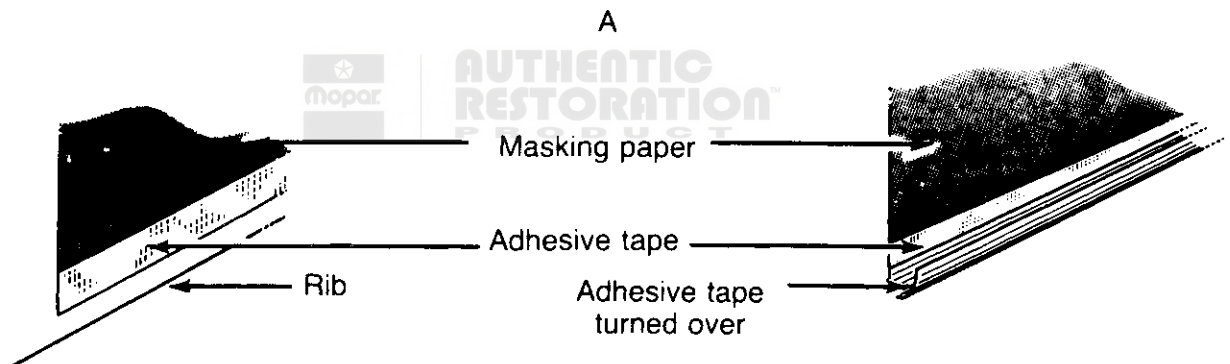
Preparation For Partially Refinishing A Body Panel

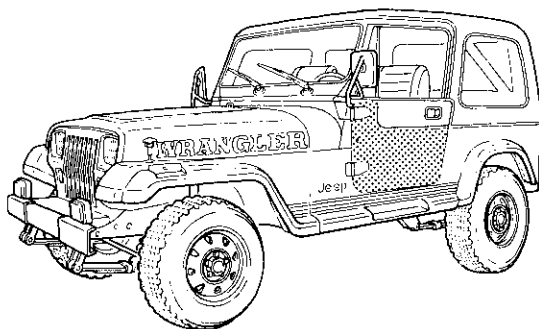
Prepare the repaired area for painting.

Two methods are recommended for masking off a body panel in preparation for painting between two body panel lines:

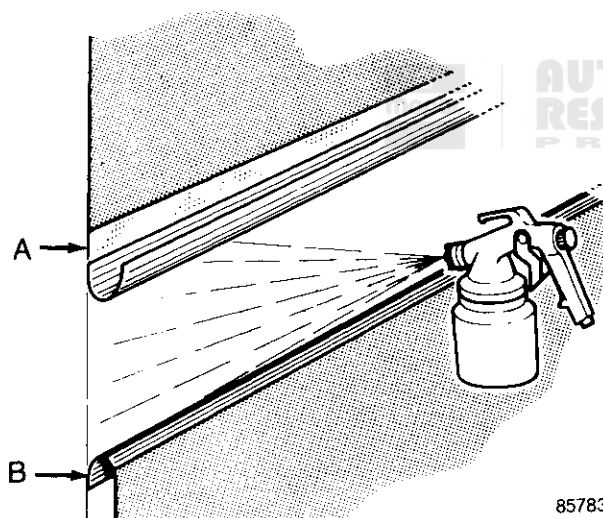
- with the adhesive tape turned over (A)
- with the adhesive tape and masking paper turned over (B)

NOTE: It is advisable to remove the masking along the edges when using the turned-over-tape method if the vehicle is to be placed in the paint oven.





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A - Adhesive turned up

B - Adhesive tape and masking paper turned over

Refinishing A Repaired Welded Body Panel

After the metal repair is completed, remove the paint from the repaired area with a grinder.

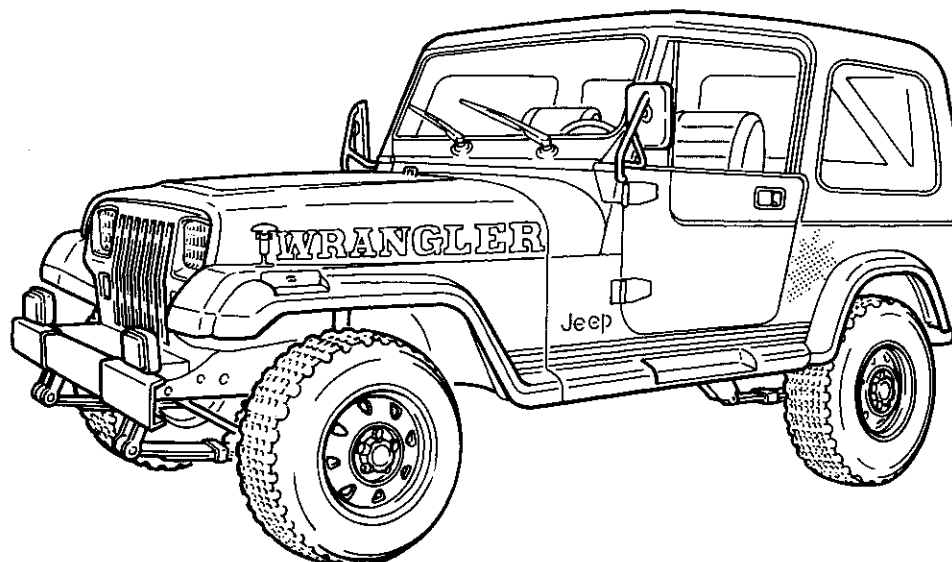
Apply body filler as required and finish to obtain the proper contour.

Wash the repaired area with soap and water.

Next, wash the repaired area with solvent (e.g., Ditzler DX-330, Sikkens M-600 or an equivalent product).

Feather edge the broken paint areas with a dual-action sander.

Clean the repaired area with DuPont 3812 Enamel Reducer or an equivalent product.



101163

Mask off the surrounding areas.

Apply a wash primer (e.g., Sikkens Washfiller 580, Ditzler Epoxy Chromate Primer DP40/401 or an equivalent product) to the repaired area.

NOTE: Depending on the condition of the steel substrate, phosphate conditioning may be necessary.

Apply a high-build primer surfacer according to the instructions printed on the container.

Block sand the repaired area and apply a second application of primer surfacer.

Prepare the repaired area for application of the top coat (i.e., sand, clean and tack wipe).

Apply the top coat.

NOTE: The clearcoat process requires a base coat of high-pigment content and a clearcoat.

REFINISHING A REPLACEMENT DETACHABLE BODY PANEL

E-Dip Panels

Sand the surface of the replacement or repaired panel with 400 grit wet or 360 grit dry paper, or scuff with a 3M Scotch pad.

Clean the surface area with a wax and grease remover solution (e. g., Ditzler DX-300 or Sikkens M-600)

NOTE: If the panel was repaired and large areas of bare metal are exposed, apply a wash primer (e.g., Sikkens Washfiller 580). The wash primers have excellent adhesion and corrosion resistant qualities when compared to conventional lacquer primers.

Sand the primed panels with 400-500 grit wet or dry sandpaper and prepare the surface for top coating.

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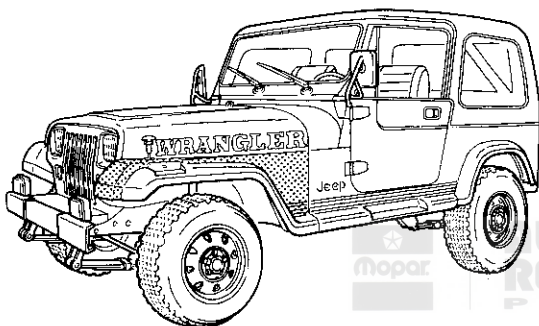
PAINT AND TRIM

EXTERIOR REFINISHING



Next, apply a primer to the entire exterior surface of the panel and prepare the surface of the panel for enamel (i.e., smooth, clean and tack the surface).

Clean the replacement panel surface with solvent (e.g., Ditzler DX-330, Sikkens M-600 or an equivalent product).



101164

Scuff sand the panel with 400 grit sandpaper.

A 3M Scotch Pad can be used for areas with limited accessibility.

After sanding, clean the panel a second time with solvent (e.g., DuPont 3812 Enamel Reducer or an equivalent product).

Tack wipe and prime the bare metal areas with Ditzler DP40/401 Epoxy Chromate Primer, Sikkens Washfiller 580 or an equivalent product).

Apply a high-build primer to the entire panel surface and prepare for application of the top coat (i.e., sand, clean and tack).

Apply the top coat.

FINISHING A WELDED REPLACEMENT BODY PANEL

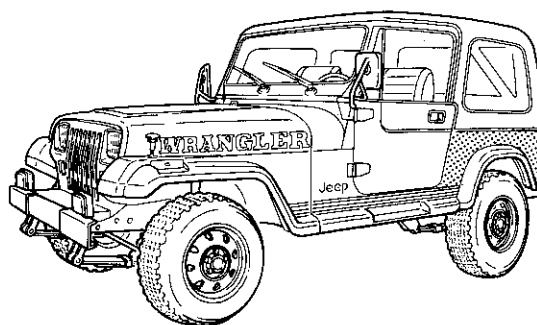
Wash the replacement panel with SOAP AND WATER.

Next, wash the repaired area with solvent (e.g., Ditzler DX-330, Sikkens M-600 or an equivalent product).

If necessary, feather edge any broken paint areas with a dual-action sander.

Scuff sand the panel with 400 grit sandpaper.

Clean the panel with DuPont 3812 Enamel Reducer or an equivalent product.



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Tack wipe and apply a wash primer (e.g., Sikkens Washfill 580, Ditzler Epoxy Chromate Primer DP40/401 or an equivalent product) on the panel.

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	PAINT AND TRIM EXTERIOR REFINISHING	
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Apply a high-build primer surfacer on the panel according to the instructions printed on the container.

Block sand the panel and apply a second application of primer surfacer.

Apply the top coat.

REFINISHING MOLDINGS AND WHEELS

WARNING: Ensure that there is adequate ventilation and avoid breathing the vapor or spray mist. The use of a fresh-air supplied respirator is recommended. Wear the respirator for the entire time of spraying and until all vapor and mist have dissipated.

Exterior Reveal Moldings (Anodized Or Non-Anodized Aluminum)

Remove the existing paint (to bare metal) from the moldings with chemical stripper.

Apply Alumiprep 33 (Ditzler DX-533) to the moldings according to the manufacture's instructions.

Apply Alodine 1201 (Ditzler DX-503) to the moldings according to the manufacture's instructions.

Apply Ditzler DP 40/401 Epoxy Chromate Primer to the moldings.

Apply a semi-gloss black top coat on the moldings.

Slightly scuff moldings with a scratch pad or 400 grit wet or dry sand paper to enhance adhesion.

Apply wax and grease remover (e.g., Ditzler DX-330 or Sikkens M-600) to clean the moldings.

Apply an acid etching wash primer (e.g., Sikkens Wash Primer).

NOTE: Acid etching wash primers provide superior adhesion and also eliminates the metal prep step.

Apply a semi-gloss black top coat on the molding.

Aluminum Wheels

Remove the coating from the wheel with a chemical stripper.

Apply Alumiprep 33 (Ditzler DX-533) to the wheel.

Apply Alodine 1001 (Ditzler DX-501) to the wheel.

NOTE: Apply Alodine 1001 to a wheel that will be color coated as well as one that will be clearcoated only.

Apply Ditzler DP-40/401 Epoxy Chromate Primer to the surface areas that will be color coated.

Apply the color coat, if applicable, to the wheel.

Apply Ditzler DAU75 Urethane Clearcoat to the wheel.

NOTE: Coat the entire wheel, including the outer edge.



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	PAINT AND TRIM	
	REFINISHING PLASTIC COMPONENTS	

GENERAL INFORMATION

Plastic Identification

International identification code letters are molded on the back side of major plastic components to identify the type of plastic.

The following information explains the code letters:

- **ABS** — Acrylonitrile Butadiene Styrene (flexible or hard) is used for grilles, headlamp doors and instrument panels
- **ABS/PVC** — Vinyl is used for crash pads
- **EPDM** — Ethylene Propylene Diene Monomer is used for bumper impact strips
- **PA** — Polyamide (Nylon) is used for exterior finish trim panels
- **PC** — Polycarbonate (Lexan) is used for grilles, instrument panel components and lenses
- **PPO** — Polyphenylene Oxide (Noryl) is used for chrome grilles, headlamp doors, bezels and ornaments
- **PE** — Polyethylene is used for fender inner panels, interior trim panels, valances and spoilers
- **PP** — Polypropylene is used for interior kick panels, hard plastic trim, fender aprons, radiator shrouds and certain heater/evaporator housings

- **PUR** — Polyurethane (Thermoset) is used for bumper covers
- **TPUR** — Polyurethane (Thermoplastic) is used for soft filler panels, bumper covers, gravel deflectors and soft bezels
- **PVC** — Polyvinyl Chloride (Vinylite) is used for upholstery and interior trim
- **SAN** — Styrene Acrylonitrile is used for instrument panel gauge lenses
- **TPR** — Thermoplastic Rubber is used for valance panels and filler panels
- **UP** — Polyester Unsaturated is used for fiberglass panels, grille openings and body fillers

Plastic Classification

Plastics are divided into two major groups according to the chemical nature of their molecular chains:

- thermoplastics (reversible processing)
- thermosets (irreversible processing)

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	PAINT AND TRIM		
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CHARACTERISTICS MATERIAL	THERMOPLASTICS	THERMOSETS
Action of Heat	• Softened, then fused	• Drop in viscosity, then hardened
General Characteristics	• flexibility • can be stretched without breaking	• very rigid • good resistance to heat • less creep

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MATERIAL	APPLICATIONS	PLASTIC TYPE
THERMOPLASTICS	• Instrument panels • air intake grilles • radiator grilles • door handles	ABS
	• protective strips • bumpers • spoilers • interior trim	PPO, EPDM
THERMOSETS	• hard-top (roofs) • bumpers	UP
	• instrument panels • armrests	PUR

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The repair feasibility of thermoplastic and thermoset plastic components depends on the extent of the damage and is normally limited only by the cost of the repair.

The repair cost should not exceed the cost of a replacement component.

Plastic Reinforcements

Plastic material is usually reinforced with fiber.

The characteristics of the composite material becomes more significant as the percentage of fiber is increased.

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	PAINT AND TRIM		
	REFINISHING PLASTIC COMPONENTS		

CHARACTERISTICS / FIBERS	GLASS	CARBON
ADVANTAGES	• very good price/performance ratio • easy to work	• very good breakage, pull, and compression performance • elasticity
DISADVANTAGES	• average mechanical performances	• high price • delicate to work • low resistance to impact
MAJOR APPLICATIONS	• industrial equipment • auto body components • naval construction • buildings	• aerospace • aeronautics • professional sports

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REFINISHING PLASTIC EXTERIOR COMPONENTS (SMC)

WARNING: Ensure that there is adequate ventilation and avoid breathing the vapor or spray mist. The use of a fresh-air supplied respirator is recommended. Wear the respirator for the entire time of spraying and until all vapor and mist have dissipated.

Replacement Hard Top Panel (SMC)

Wash the replacement panel with denatured alcohol.

Scuff sand the panel surface area with a double-action sander and 240 grit sandpaper or use 320 wet or dry sandpaper.

Clean the panel surface area with a wax and grease removal solution (Ditzler DX-330, Sik-kens M-600 or an equivalent product).

Tack and prime the panel surface area with Ditzler DP 40/401 Epoxy Chromate Primer according to the manufacture's instructions.

Apply a primer surfacer and prepare the panel surface area for paint (i.e., sand, clean and tack).

Apply the top coat to the panel surface area.

NOTE: If the top has been repaired and the texture has been removed, an additive such as Ditzler DX-1507 can be added to the paint and sprayed on the repaired area to produce the textured appearance.

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	REFINISHING PLASTIC COMPONENTS	

Fender Flares

Clean the surface area with a wax and grease removal solution (Ditzler DX-330, Sikkens M-600 or an equivalent product).

Scuff sand the surface area with 400 wet or 320 dry sandpaper.

Apply a propylene primer (AMC P/N 899 3756 or Ditzler DX-800) to the surface area.

NOTE: Prime the entire surface area of replacement flares.

Apply the top coat of acrylic enamel mixed with a flex agent according to the manufacture's instructions.

NOTE: The flex agent is a modifier that gives the enamel elastomeric properties.

REFINISHING PLASTIC INTERIOR TRIM COMPONENTS

WARNING: Ensure that there is adequate ventilation and avoid breathing the vapor or spray mist. The use of a fresh-air supplied respirator is recommended. Wear the respirator for the entire time of spraying and until all vapor and mist have dissipated.

Refinishable plastic interior trim components are divided into three general types:

- polypropylene plastic (PP)

- acrylonitrile butadiene styrene plastic (ABS)

- vinyl (ABS/PVC)

It is important that the type of plastic be correctly identified so that the corresponding component can be refinished satisfactorily.

If the plastic component does not have molded identification code letters, the following tests enable the type of plastic to be identified so that the proper refinishing procedures and materials can be used.

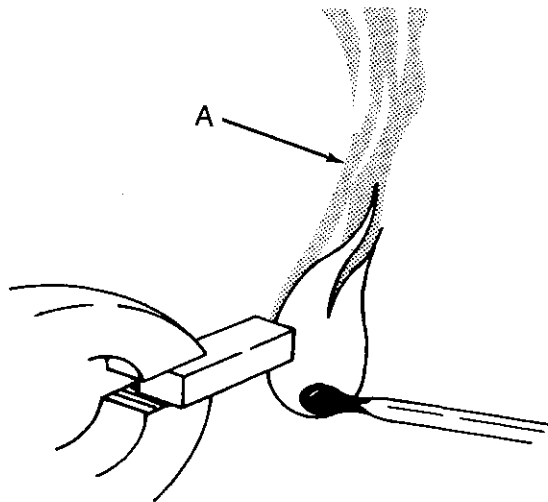
Test For Polypropylene (PP) And Acrylonitrile Butadiene Styrene (ABS) Plastic

To determine if a component is PP or ABS plastic, use the following burn test:

- remove a sliver of the plastic from the back-side or unseen surface of the component to be tested with a sharp knife
- hold the sliver of plastic with needlenose pliers and ignite the plastic
- observe the burning plastic closely

When burning, PP plastic has a clear blue flame that has a yellow tip and no readily visible smoke (A).

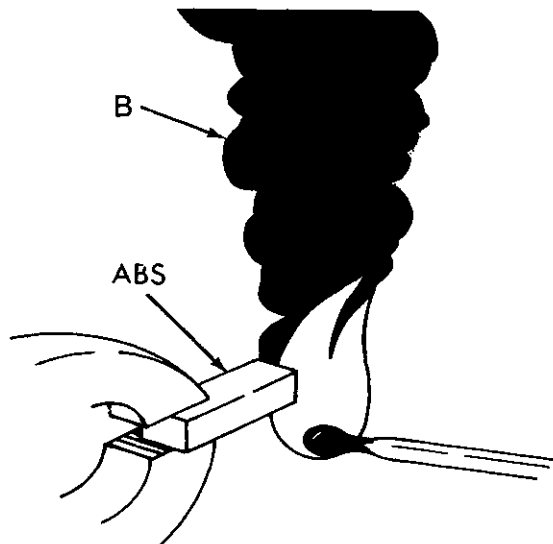
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When extinguished, polypropylene plastic will emit white smoke that has a paraffin wax odor.

When burning, ABS plastic has an orange flame and highly visible black, sooty smoke (B) that hangs temporarily in the air.



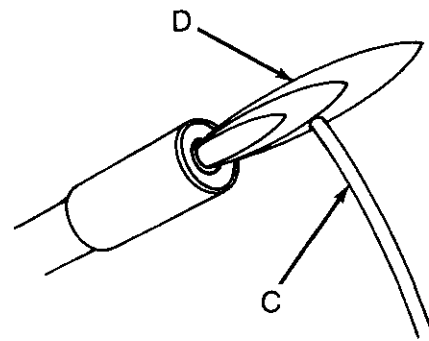
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Test For Vinyl (ABS/PVC)

To determine if a component that is to be refinished is vinyl or not, use the following copper wire test:

- heat a copper wire (C) with a propane torch until the wire glows (a red color)
- touch the heated copper wire to the backside or unseen surface of the component to be tested in a manner so as to retain some of the liquid plastic on the wire
- return the copper wire (C) with the liquid plastic to the flame and observe it

When burning (D), vinyl will have a green, turquoise and blue flame.



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A flame with these colors indicates that the component being tested is vinyl.

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	REFINISHING PLASTIC COMPONENTS		

Refinishing ABS Plastic Components

ABS plastics does not require a primer.

AMC/JEEP/RENAULT Interior Spray Paint or spray paint from a local supplier will adhere satisfactorily to ABS plastic.

Scuff sand the surface of the component that is to be painted.

Clean the surface of the component with a wax and grease removal solution (e.g., Ditzler DX-330, DuPont Prep-Sol or an equivalent product).

Color coat the surface of the component with a semi- or low-gloss lacquer.

NOTE: Apply only enough paint to provide proper concealment of the natural color to avoid wash-out of the grain effect, if applicable.

Refinishing PP Plastic Components

CAUTION: It is essential that the component be primed first with a coat of AMC/JEEP/RENAULT Aerosol Polypropylene Primer (or an equivalent product) according to the instructions printed on the container. Failure to use the required primer as instructed will result in the color coat lifting or peeling.

Painting polypropylene plastic components involves the use of a special primer.

Because polypropylene (PP) plastic is rigid, it can be color coated after priming with the appropriate interior spray paint color (plastic and vinyl) or lacquer.

Clean the component with either DuPont Prep-Sol, Ditzler Acryli-Clean or an equivalent product.

Apply either a thin coat of polypropylene primer according to the instructions printed on the container or Ditzler DPX-800 polypropylene primer according to the manufacture's instructions.

NOTE: Ensure that the primer application covers all the edges to assure proper color coat adhesion.

Allow the primer to dry completely.

Apply an appropriate color coat of interior spray paint and allow to air dry before installing the component.

Refinishing Vinyl Components

Clean the component surface area with Ditzler UK-403 Vinyl Cleaner (or an equivalent product).

Apply Ditzler UK-405 Vinyl Conditioner (or an equivalent product) to the component surface area.

Apply Ditzler UCV-Vinyl Color (or an equivalent product) to the component surface area according to the manufacture's instructions.

NOTE: Instrument panels must be sprayed with Ditzler UCV-69 Low-Gloss Clear Coat to reduce gloss.

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CHART OF COMMON REFINISH MATERIALS

PURPOSE OF PRODUCT	DUPONT TRADE NAME	PRODUCT IDENTITY	RINSHED-MASON TRADE NAME	PRODUCT IDENTITY	DITZLER TRADE NAME	PRODUCT IDENTITY	SHERWIN-WILLIAMS TRADE NAME	PRODUCT IDENTITY	AMERICAN SIKKENS TRADE NAME	PRODUCT IDENTITY
1. Dissolves silicone, wax, oil, tar, etc.	Prep-Sol Prep-Sol II	3919-S 3929-S	Pre-Kleano	900	Acryli-Clean	DX-330	Sher-Will-Clean	R7K156	Wax & Grease Remover	M-800
2. Cleans and etches steel; light zinc phosphate coating	Metal Conditioner	5717-S	Metal Conditioner	801	Metal Prep #79 (Amchem Co.)	DX-579	Dual-Etch	W4K263		
3. Acidic cleaner for aluminum; removes light oil or grease film and oxidation	Step A Cleaner	225-S	Metal Conditioner	801	Alumiprep #33 (Amchem Co.)	DX-533	Dual-Etch	W4K263		
4. Coats steel and aids adhesion; heavy zinc phosphate coating	Steel Conversion Coating	224-S			Galvaprep SG	DX-520	Met-L-Mate	W4K289		
5. Conditions aluminum for corrosion resistance and adhesion of paint systems	Step B Conversion Coating	226-S			Alodine #1001 (Clear) Alodine #1201 (Opaque) (Amchem Co.)	DX-501 DX-503				
6. Etches galvanized steel; phosphate coating	Galvanized Iron & Zinc Conversion Coating	227-S	Galvanized & Zinc Conditioner	802	Galvaprep SG	DX-520				
7. Chromate primer . . . can be used under lacquer coats; must be followed by primer-surfacer	Acrylic Chromate Primer (Green)	215-S			Epoxy Chromate Primer (primer-surfacer optional)	DP-40/401 (Refer to item #14)	Zinc Chromate Primer	E2Y36		
8. Zinc phosphate, chromate primer. Can be used under any top coat and over any non-flexible substrate	Variprime Self-Etching Primer (Metal conditioning not necessary)	615-S 616-S			Epoxy Chromate Primer	DP-40/401				
9. Primes bare steel and fills surface irregularities; should not exceed 2 mils film build to avoid cracking and splitting	Hi-Speed Primer-Surfacer (Platinum) (Dk. Gray) (Red Oxide) Multi-Purpose Primer-Surfacer (Gray) (Red Oxide) Fill 'N' Sand Primer-Surfacer (Gray)	30-S 70-S 80-S 100-S 110-S 131-S	Primer-Surfacer (Gray) (Dk. Gray) (Red Oxide) (R.F.U. Gray) Acrylic Primer-Surfacer (Gray) (Red)	APS 423 APS 428 APS 422 899 832 831	Primer-Surfacer (Light Gray) (Dark Gray) (Red Oxide) Kondar Primer-Surfacer (Gray) Acrylic Fast Build (Red)	DZL-32 DZL-34 DZL-72 DZ-3 DZ-7	Super Combo (Light Gray) (Dark Gray) (Red Oxide) Ultra-Fill (Light Gray) (Red Oxide)	P2A32 P2A40 P2N39 P2A43 P2N44	Autoflex Wash Filler Autoflex Wash Primer	580
10. Undercoat system for best adhesion to aluminum	Variprime (Green) or 225-S and 226-S followed with Multi-Purpose Primer-Surfacer (Gray) (Red Oxide) or Fill 'N' Sand Acrylic Lacquer Primer-Surfacer (Gray)	615-S/ 616-S 100-S 110-S 131-S	Zip Primer (Green) (Metal conditioning not necessary) or Metal Conditioner followed with Acrylic Primer-Sealer (Add Acrylic Primer- Surfacer if filling is required) (Gray) (Red)	834 801 PS-19 or 870 R.F.U. 832 831	DX-533 and DX-503 followed with Epoxy Chromate Primer and/or Kondar Primer-Surfacer (Gray) Acrylic Fast Build (Red)	DP-40/401 DZ-3 DZ-7	Dual-Etch followed with Ultra-Fill (Light Gray) (Red Oxide)	W4K263 P2A43 P2N44	Metaflex Wash Primer WR	
11. Undercoat system for best adhesion to galvanized metal	Variprime (Green) or 5717-S and 227-S followed with Multi-Purpose Primer- Surfacer (Gray) (Red Oxide) or Fill 'N' Sand Acrylic Lacquer Primer-Surfacer (Gray)	615-S/ 616-S 100-S 110-S 131-S	Zip Primer (Green) (Metal conditioning not necessary) or Galvanized Conditioner followed with Acrylic Primer-Surfacer (Gray) (Red)	834 802 832 831	DX-579 and DX-520 followed with Epoxy Chromate Primer and Kondar Primer-Surfacer (if required)	DP40/401 DZ-3	Wash Primer followed with Ultra-Fill (Light Gray) (Red Oxide)	E2G973 P2A43 P2N44	Metaflex Wash Primer WR	

CHART OF COMMON REFINISH MATERIALS

PURPOSE OF PRODUCT	DuPONT TRADE NAME	PRODUCT IDENTITY	RINSHED-MASON TRADE NAME	PRODUCT IDENTITY	DITZLER TRADE NAME	PRODUCT IDENTITY	SHERWIN-WILLIAMS TRADE NAME	PRODUCT IDENTITY	AMERICAN SIKKENS TRADE NAME	PRODUCT IDENTITY
12. Lacquer base putty to fill scratches or rough spots too deep to be filled with primer-surfacer — requires sealing with primer-surfacer	Spot-N-Glaze (Platinum) (Red Oxide)	2286-S 2288-S	Green Stuff Putty (Green) Red Stuff Glazing Putty (Red)	74 76	Spot Putty (for deep fill) Red Putty (glaze & fill)	DFL-1 DFL-17	E-Zee Red Putty Glazing Dark Gray Putty Glazing & Spot Putty (Light Gray)	D3R7 D3A2737 D3A2747	Kombi Plamuur	
13. Improves adhesion of repair acrylic lacquer over O.E.M. acrylic lacquer; reduces sand scratch swelling; prevents swelling of surfacer feather edge; good hold-out	Hi-Speed Sealer (Clear) Acrylic Sealer (Clear) Velvaseal Acrylic Lacquer Sealer (can be sanded) (Neutral Cream) (Neutral Red)	22-S 1980-S 1984-S 1985-S	Acrylic Lacquer Sealer (Gray) R.F.U.	PS-19 870	Duracryl Sealer (Clear) (Gray)	DL-1947 DL-1970	Acrylic Lacquer Sealer (Gray)	P1A38		
14. Improves adhesion of acrylic lacquer to O.E.M. enamel top coats	Clear Mid-Coat Adhesion Promoter	222-S	Adhesion Sealer (Clear)	811	Bonding Clear	DSX-1900	Tie-Coat Sealer	P1C48		
15. Primer sealer for use under acrylic enamel top coats	Non-Sanding Primer- Sealer (Dark Gray) (Red Oxide) (Light Gray)	1696-S 1697-S 1858-S	Acrylic Primer Sealer	PS-19 PS-21 870 R.F.U.	Satin Prime Ferrochrome	DPE-1338 DPE-1202	Jet Seal (Gray) (Red Oxide)	E2A28 E2R27	Autocryl Sealer Transparent	①
16. Sealer for acrylic lacquer under acrylic enamel top coats	Acrylic Sealer (Clear) Velvaseal Acrylic Lacquer Sealer (Neutral Cream) (Neutral Red)	1980-S 1984-S 1985-S	Miracryl 2 Sealers	PS-19 PS-21 870 R.F.U.	Del-Seal	DAS-1980	Barrier Coat Sealer	E2A52		
17. Top coat color, together with undercoats, provides protection and beauty	"Lucite" (Acrylic Lacquer) "Centari" (Acrylic Enamel) (See Color Chart)	Code # & "L" Suffix Code # & "A" Suffix	"Alpha-Cryl" (Acrylic Lacquer) Miracryl 2 (Acrylic Enamel) (See Color Chart)	"A" Prefix & Code # "M" Prefix & Code #	"Duracryl" (Acrylic Lacquer) "Deltron" (Acrylic Urethane) (See Color Chart)	DDL & Code # DAU & Code #	S-W Acrylic Lacquer Acrylyd Acrylic Enamel (See Color Chart)	34L10-L11 35F10-F11	Autobase Met. Autocryl*	
18. A ready-to-use mist coat material (clear acrylic lacquer and thinner); can be used in metallic color control (MCC) system	Lucite Uniforming Finish	300-S	Color Blender	890	Duracryl Buffer Coat	DXA-100	Acrylic Lacquer Harmonizer Spot Blend	T1C296 T1C259		
19. Clear acrylic lacquer; used as base in color formulation — can be used in clear form for exterior refinishing and color matching	Clear Coat Acrylic Lacquer	380-S	Clear Acrylic (Gloss) Base Coat Clear	827 727	Clear Acrylic (Gloss)	DCA-468	Acrylic Mixing Clear Acrylic Lacquer Clear	T1C324 T1C275		
20. Urethane clear for use over acrylic lacquer or with Base Coat/Clear Coat System — must be catalyzed	*Polyurethane Enamel Clear	580-S/ *582-S	*2K Urethane Clear	893/ *894	*Delclear Acrylic Urethane (for Acrylic Lacquer) *Duracryl Polyurethane Clear (for BC/CC use)	DAU-75/ *DXR-80 DBL-420/ *DBL-421	*Urethane Clear for Lacquer	T1C276/ *V6V376	Autocryl Clear*	
21. Urethane clear for use over enamel base coat colors	*"Centari" Acrylic Urethane Clear	780-S/ *782-S	*Acrylic Urethane Clear Urethane Catalyst	MC-1000 *894	*Del-Glo	DAU-82/ *DAU-2	*Urethane Clear Enamel *Polasol	V2V398/ *V6V241		
22. Urethane hardener for acrylic enamel — improves gloss	*"Centari" Acrylic Enamel Gloss Hardener (Overall Refinish) (Spot Repair)	*793-S *792-S	*MH-1 Hardener *MH-2 Hardener *Super Gloss	*MH-1 *MH-2 *818	*Delthane (Overall Refinish) (Spot Repair)	*DXR-80 *DXR-79	*Polasol Plus *Spot Repair Hardener	*V6V247 *V6V292		

* Use under urethane enamels and base coat/clear coat systems.

* Contains isocyanates — use recommended respiratory protection.

NOTE: Follow paint manufacturer's directions and observe all warnings on material container labels.

101173



CHART OF COMMON REFINISH MATERIALS

PURPOSE OF PRODUCT		DuPONT TRADE NAME	PRODUCT IDENTITY	RINSHED-MASON TRADE NAME	PRODUCT IDENTITY	DITZLER TRADE NAME	PRODUCT IDENTITY	SHERWIN-WILLIAMS TRADE NAME	PRODUCT IDENTITY	AMERICAN SIKKENS TRADE NAME	PRODUCT IDENTITY
THINNERS AND REDUCERS											
EVAPORATION	DESCRIPTION										
23. Fast	Acrylic Lacquer Thinner	Lo-Temp Thinner (for spot repair only from 55°-85°F.)	3613-S	Non-Penetrating Thinner	PNT-48	Non-Penetrating Thinner	DTL-151	Non-Penetrating Lacquer Thinner	R7K205		
24. Med-Fast	Acrylic Lacquer Thinner	General Purpose Thinner (for spot and panel repair 60°-70°F.)	3608-S	Utility Thinner	PNT-62	Utility Thinner	DTL-16	Dual 214	R7K214		
	Acrylic Enamel Reducer	"Centari" Acrylic Enamel Reducer (overall 55°-65°F.) (spot, panel & overall BC/CC 55°-85°F.)	8034-S	Miracryl 2 Reducer	MS-5	Deltron Acrylic Urethane Reducer	DTU-501	Gloss Guard Spot & Panel Reducer	R7K227	Autocryl Non-Stop	②
25. Medium	Acrylic Lacquer Thinner	Mid-Temp Thinner (for spot & panel repairs 65°-75°F.)	3661-S	All Purpose Thinner	PNT-88	All Purpose Thinner	DTL-876	Dual M.F.	R7K248	Autobase Met. Thinner	③
	Acrylic Enamel Reducer	"Centari" Acrylic Enamel Reducer (overall 60°-75°F.) (spot & panel 80° & up) (overall BC/CC 75°-85°F.)	8022-S	Miracryl 2 Reducer	MS-6	Deltron Acrylic Urethane Reducer	DTU-504	Gloss Guard Fast Reducer	R7K211	Autocryl Standard	②
26. Slow	Acrylic Lacquer Thinner	Hi-Gloss Thinner (for spot & panel repair 70° & up) (overall 55°-75°F.)	3602-S			Extra High Gloss Thinner	DTL-105	Dual 203	R7K203	Autobase Met. Thinner Slow	③
	Acrylic Enamel Reducer	"Centari" Acrylic Enamel Reducer (overall 70°-90°F.) (overall BC/CC 85°F. & up)	8093-S	Miracryl 2 Reducer	MS-7	Deltron Acrylic Urethane Hot Weather Reducer	DTU-505	Gloss Guard Hot Weather Reducer	R7K212	Autocryl M 3/68	②
27. Extra-Slow	Acrylic Lacquer Thinner	High Performance Thinner (for large area & overall repair 70°F. & up)	3696-S	High Gloss Thinner (also specified to reduce Miracryl 2 base coat color in BC/CC application)	PNT-90			Dual 6231	R7K6231		
	Acrylic Enamel Reducer	"Centari" Acrylic Enamel Reducer (overall 90°F. & up)	8096-S	Miracryl 2 Reducer	MS-8			Gloss Guard Wet Edge Reducer	R7K244	Autocryl APS	②
28. Retarder (May be used to slow down above thinners and reducers)	Acrylic Lacquer Retarder	Retarder	3979-S	Retarder	883	Retarder	DTX-1140	Universal Retarder	R7K6251		
	Acrylic Enamel Retarder	Retarder	8100-S								
29. Prevents fish-eyes in acrylic lacquer		Fish-Eye Eliminator	FEE 1, 2, 5 & 10	Fish-Eye Eliminator	803	Fish-Eye Preventor	DX-66	Sila-Check	V3K265		
30. Prevents fish-eyes in catalyzed enamels		Paint Additive	259-S	Fish-Eye Eliminator	809	Fish-Eye Preventor	DX-77	The Leveler	V3K780	Anti Silicon	
31. Fast cutting hand compound		Rubbing Compound (White)	101-S	Rubbing Compound (Red)	851	Rubbing Compound (Red)	DRX-45	White Lightning	D1T13		
32. Fast cutting hand compound		Rubbing Compound (Orange)	202-S	Rubbing Compound (White)	853	Rubbing Compound (White)	DRX-55	Lacquer Fast Cut (Orange)	D1T271		
33. Light cutting hand compound		Rubbing Compound (White)	606-S	Rubbing Compound (White)	852	Rubbing Compound (White)	DRX-25	Synthetic Enamel Compound	D1T273	Commandant #4	
34. Machine polishing compound (use with #2 or #5 carpet pad)		Rubbing Compound (Orange)	303-S	Rubbing Compound (White) (Beige)	854 858	Rubbing Compound (White) Final Buff	DRX-16 DRX-10	Zip-Sheen	D1T122		

② Use with Sikkens Acrylic Urethane only.
③ Use with Sikkens Metabase Met. only.

*Contains Isocyanates — use recommended respiratory protection.
NOTE: Follow paint manufacturer's directions and observe all warnings on material container labels.



CHART OF COMMON REFINISH MATERIALS

PURPOSE OF PRODUCT	DUPONT TRADE NAME	PRODUCT IDENTITY	RINSHED-MASON TRADE NAME	PRODUCT IDENTITY	DITZLER TRADE NAME	PRODUCT IDENTITY	SHERWIN-WILLIAMS TRADE NAME	PRODUCT IDENTITY	AMERICAN SIKKENS TRADE NAME	PRODUCT IDENTITY
35. Flattening compound for use with acrylics to reduce gloss; results in smooth surface	Flattening Compound	4528-S	Flattig Concentrate	850	Flattig Agent	DX-265	EL-4 Flattig Base	T1F270	Matpasta	
36. Polyester body filler — fills areas too deep for putty	Lightweight Body Filler Creme Hardener Body Filler Creme Hardener	211-S 203-S 212-S 204-S			Lightweight Body Filler White Body Filler Alum-A-Lead (Powder) (Resin)	DX-4 DX-999 DX-701 DX-702	Sherwin-Williams Lightweight Body Filler	D3A135	Polykit Polystop LP	
37. Primer for polypropylene plastic	Polypropylene Primer	329-S	Polypropylene Primer	864	Polypropylene Primer	DPX-800	Plastic Primer	P3C24	Plastoflex Primer PO	
38. Refinish system for all flexible plastic exterior parts	*Lucite Flexible Additive/ Color *Dexlar Flexible Finish	*355-S 365-B with color # "B" suffix & *792-S Hardener	*Acrylic Lacquer Urethane Catalyst Flex Agent/Color (used also with Miracryl 2)	*891	Flexible Additive/Color *Flexative/Color Elastomeric Primer	DX-1798 *DX-369 DPX-844	Acrylic Flex Additive/Color *Multi-Flex/Color	V2V297 *V2V299	Plastoflex	
39. Chip resistant material applied to low body panels prior to top coats	123 Vinyl Lacquer (Black) (White)	310-S 330-S	*Stone Protector & Flex Agent	*891	Road Guard	DX-54	Vinyl Gravel Guard	G1W295	OTO Bodycoat	

*Contains isocyanates — use recommended respiratory protection.
NOTE: Follow paint manufacturer's directions and observe all warnings on material container labels.

ADDITIONAL AMERICAN SIKKENS PRODUCTS

PURPOSE OF PRODUCT	PRODUCT	PRODUCT IDENTITY
Cure topcoats faster	Accelerator 883	
Improve topcoat gloss	Gloss Resin Autocryl	
Repair basecoat/clearcoat	Basefix	
Heavy filling (polyester)	Polysurfacer	
Heavy filling urethane	Autocryl 3+1	
Urethane primer-surfacer	Autocryl filler	
Reducer for cold weather	Temp-o-Actif	
Reducer for heated booths	Temp-o-Actif 2	
Flex additive for topcoats	Elast-o-Actif	
Reduce static	Anti static	

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	PAINT AND TRIM	
	CORROSION PROTECTION	

GENERAL INFORMATION

Jeep vehicles undergo several anti-corrosion processes during manufacture.

The anti-corrosion processes are:

- phosphate rinse
- E-dip (cathathonic primer)
- intermediate primer
- base coat
- clear coat

In addition, many exterior panels are either single or double-sided galvanized and aluminum wax is applied to most of the vehicle interior.

Sealants are also applied to several critical areas of the vehicle during manufacture, therefore, after vehicle body repair, the sealants must be replaced.

After repair, when applicable, a sealant must also be applied to the joints and seams for corrosion protection.

Corrosion protective material can be injected inside hollow sections of the vehicle via strategically located 8-mm (0.31-in) diameter holes that are punched during manufacture.

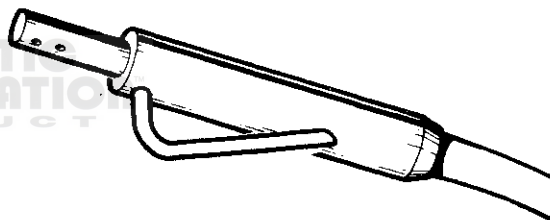
The holes are plugged with plastic plugs.

NOTE: If necessary, additional holes can be drilled for the purpose of injecting corrosion protective material.

Equipment

An air-operated spray gun and several types of nozzles are required for application of the corrosion protective material.

A vertical nozzle should be used for boxed-in sections (e.g., door interiors, crossmembers, sillmembers and rocker panels).

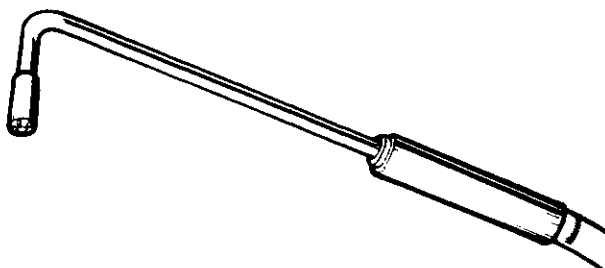


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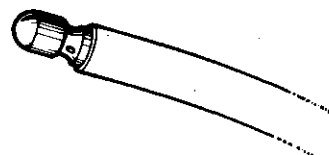
An angled nozzle should be used for hoods, liftgates and the engine compartment.

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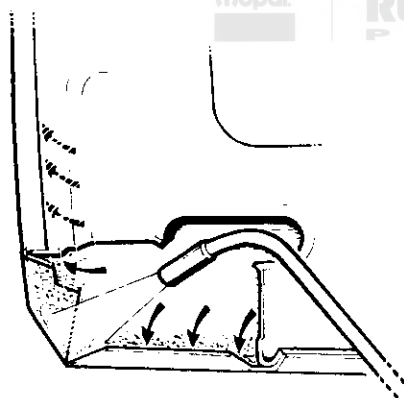


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NOTE: Aerosol spray cans of Rust Fighter-I (3M 08892, US and Canada) can be used if spray equipment is not available.



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A flexible nylon nozzle should be used for inner fender panels and quarter panels.

PROTECTIVE MATERIAL APPLICATION

Vehicle Interior

Anti-corrosion wax should be applied to the interior side of repaired or replaced panels.

NOTE: Ensure that a generous amount of wax is applied to all welded areas.

Vehicle Underbody

After an underbody component has been repaired or replaced, corrosion protective material must be applied.

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PAINT AND TRIM

CORROSION PROTECTION



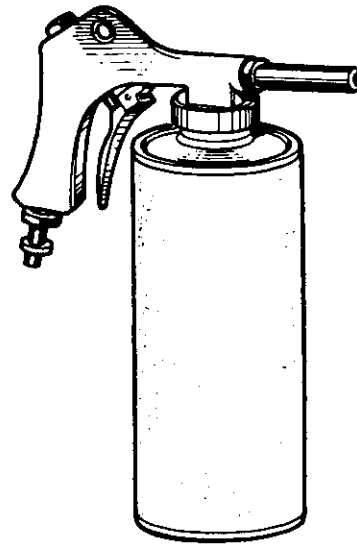
Refer to the following basic guidelines for applying protective material:

- mask the area that is to be protected
- apply Ditzler Metal Prep DX-579 (or an equivalent conditioner) to all bare metal surfaces, if applicable
- prime the repaired area with an epoxy chromate primer (e.g., Ditzler DP 40/401) or a wash primer (e.g., DuPont 615/616S)

Use a 3M Shutz Body Gun (08997, US and Canada) to apply the corrosion protective material:

- 3M 08664 (US)
- 3M 88641 (Canada)

- Kent Ind. BRU-50005



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	PAINT AND TRIM	
	EXTERIOR DECALS	

GENERAL INFORMATION

The exterior decals and stripes are durable, weather-resistant vinyl and have a pressure-sensitive adhesive backing.

The pressure-sensitive adhesive backing is protected by a paper cover that is removed during installation.

The outward side (or face) of the stripes and decals is covered with an easy-release paper for protection during shipment and storage.

This paper should be removed after installation.

REPAIR

Small nicks or scratches can be touched-up with paint in the same manner as painted surfaces.

The proper color match can be obtained by mixing small amounts of appropriate paint colors and then applied to the damaged area of the decal or stripe.

To remove air bubbles, pierce them with a sharp needle or pin.

Force the trapped air out through the hole and press the decal or stripe firmly against the body panel.

It may be necessary to preheat the body panel slightly with heat gun to soften the adhesive.

Heat may also be used to remove small wrinkles and other irregularities.

REPLACEMENT

Preparation

The temperature of the service area should be between 18°C and 32°C (65°F and 90°F).

Decals or stripes should not be replaced if the temperature is below 18°C (65°F).

The following equipment and materials are necessary for a professional installation:

- woodgrain and stripe removal solution — 3M or an equivalent product
- adhesive removal solution — 3M or an equivalent product
- liquid detergent — Joy, Vel or an equivalent product
- wax and silicone removal solution — 3M General Purpose Adhesive Cleaner, Xylol, or an equivalent product
- isopropyl (rubbing) alcohol
- squeegee — 10 to 13 cm (4 to 5 in) wide, plastic or hard rubber
- Heat gun or an infrared heat lamp with an extension cord
- clean wiping cloths or paper towels
- sharp knife, single-edged razor blade, or an X-ACTO knife
- scissors

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PAINT AND TRIM

EXTERIOR DECALS



- dry 200 grit sandpaper
- sharp needle or pin
- grease pencil

Removal

Clean any repair surfaces, adjacent panels and openings as required.

Remove parts overlapping the decal on affected panel.

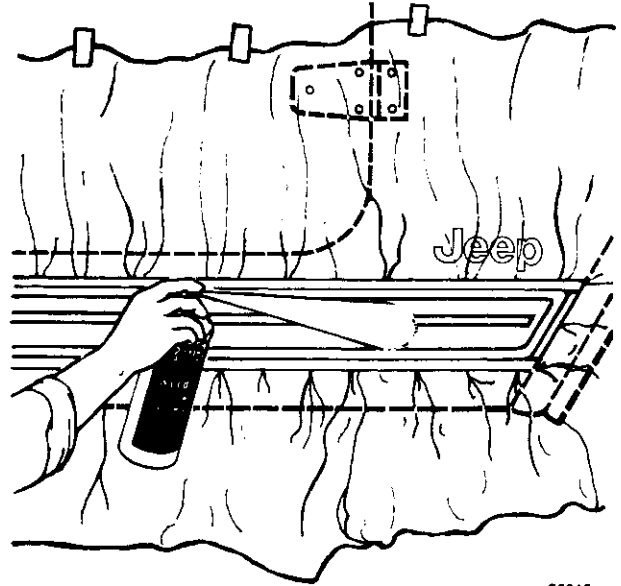
Mask off the area surrounding decal.

Scuff sand the complete decal with 360 grit wet-or-dry sandpaper. Avoid cutting through the vinyl and reclean the surfaces.

WARNING: Use 3M Woodgrain and Stripe Remover, or equivalent, in a well-ventilated area only. Observe manufacture's warnings printed on the label.

CAUTION: Woodgrain and Stripe Remover from 3M is designed for use on acrylic enamel surfaces only.

Spray 3M Woodgrain and Stripe Remover, or equivalent, on flange area first. Spray entire decal to be removed.



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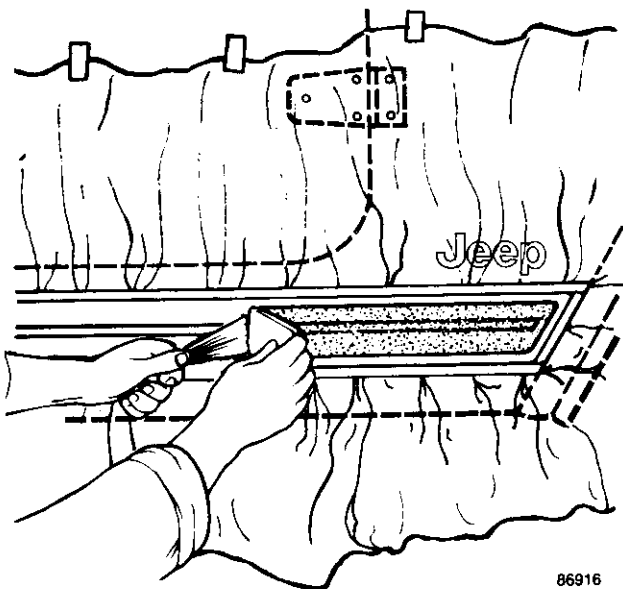
Allow the remover to remain on the decal for approximately 15 minutes.

After the allotted time, peel the decal away from the flange areas. Then, start in one corner and peel the decal away from the panel. If there is any difficulty in peeling the decal/overlay away from the panel, use a squeegee to assist in removing.

Scrape all of the 3M Woodgrain and Stripe Remover from the surface before proceeding.

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	PAINT AND TRIM	
	EXTERIOR DECALS	

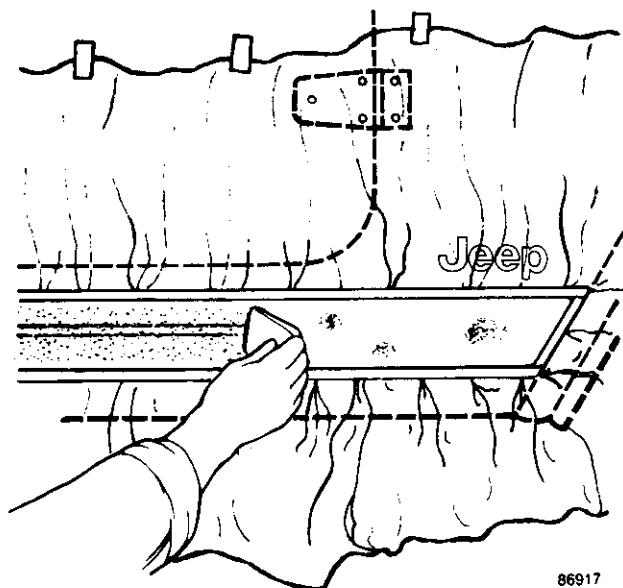


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After the decal is removed, spray the panel using 3M Adhesive Remover, or equivalent, to remove any remaining adhesive.

NOTE: Allow the remover to work on the adhesive surface for three to five minutes.

After five minutes, use a squeegee to remove adhesive residue.



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NOTE: If some adhesive is difficult to remove, spray additional remover on troublesome spots. Wait approximately two minutes and squeegee remaining spots. Repeat as necessary.

Remove the masking tape and paper.

Wash the entire panel with 3M General Purpose Adhesive Cleaner, or equivalent. If any spots of adhesive remain on the panel, hard rubbing during washdown will remove them.

Installation

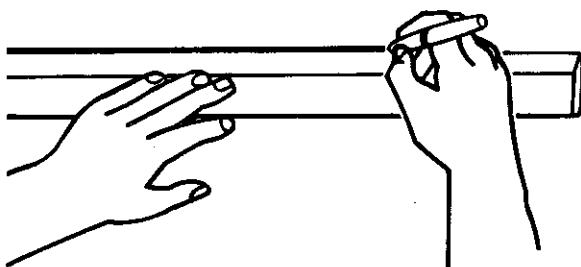
Clean the painted surface with 3M General Purpose Adhesive Cleaner, or equivalent. Wipe the surface with a clean cloth and allow to dry.

NOTE: Freshly painted surfaces must be thoroughly dry prior to installing decals. Residual solvents in fresh paint may cause the decal to blister.

Position the decal on the panel surface and mark its position with a grease pencil. Be sure that a 12.7 mm (1/2-in) excess is allowed to be wrapped around the door and fender areas, if necessary.

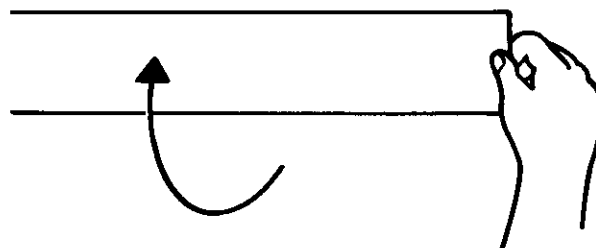
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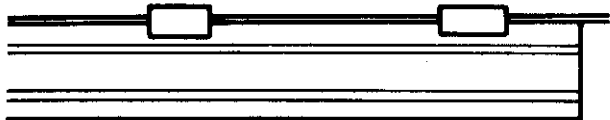
Position the decal on the panel and hold it in place with small strips of masking tape. Be sure the decal is aligned with decal on the adjacent panels.



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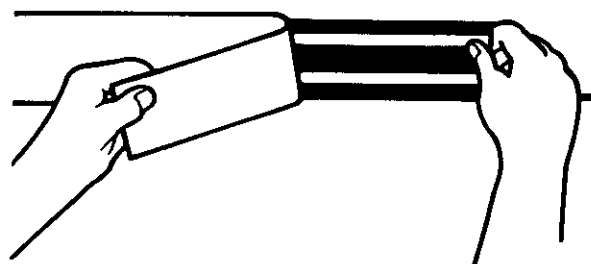
Remove approximately six inches of the paper backing from one end.

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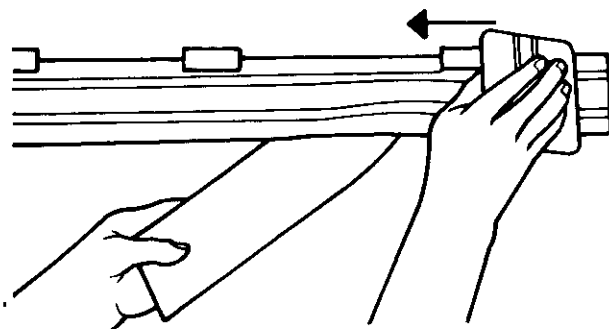
Lift the decal using masking tape as hinges.



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NOTE: To avoid pre-adhesion or stretching of the decal, do not remove more than six inches of paper backing at one time.

Fold the decal back to the aligned position. With firm strokes, squeegee decal to the panel while removing the paper backing.



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Where possible, extend the decal 12.7 mm (1/2 in) beyond corners or edges and wrap firmly using finger pressure and the squeegee. Avoid trapping air in these areas.

Remove the easy-release paper from the face of the decal (if applicable).

Inspect the decal installation using reflected light to detect any irregularities that may have developed during installation. Remove all air or moisture bubbles.

Install any previously removed parts and clean the vehicle as required.

Installation of Intricate Decals

For large, intricately shaped decals, the following procedure will simplify installation.

The use of wetting solution aids in the installation of intricate decals. Prepare a supply of wetting solution by thoroughly mixing two or three

teaspoons of detergent (Joy, Vel, or equivalent) in 3.78 liters (1 gallon) of water.

NOTE: DO NOT USE SOAP. Too much detergent will reduce the effectiveness of the bond.

Place the decal on a clean, flat surface with the paper backing side up. Bend the corner of decal toward the decorative face side, and with flick of a finger, separate the paper backing from the decal. Hold the decal firmly to the surface of table and remove the paper backing. In hot, humid conditions, a slight jerking motion will aid in removing the paper backing.

CAUTION: Always remove the paper backing from the decal, never the decal from the backing as stretching may result.

NOTE: Hold the decal in the corners when removing the paper backing as fingerprints will adversely affect the adhesion.

Using a clean sponge, apply ample wetting solution to the decal adhesive and the panel surface. The wetting solution permits ease of movement of the decal while positioning it on the panel surface.

Immediately apply the wetted decal to the panel surface. Apply the wetting solution to the decorative face of the decal to allow the squeegee to slip during application.

Squeegee a short section of the decal at the center. Lift the right or left side of the decal, position it straight and close to the panel, and squeegee toward the lifted edge. Avoid stretching the decal at the lifted end. Squeegee outward from center with firm, overlapping strokes.

- Lift the upper area of the decal (up to bonded area) and, working upward from the bonded section at the center, squeegee the decal into place.

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- Lift the lower area of decal (up to bonded area) and, working downward from section at the center, squeegee the decal into place.

NOTE: If a wrinkle is trapped during the squeegee operations, stop immediately. Carefully lift

affected section. Align the section to the panel and remove the wrinkle.



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SEE I.S. NOTES

Jeep®

Wrangler/YJ

Workshop manual

M.R.279

MECHANICAL



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MARCH, 1986

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RECORDING I.S. NOTES

Ruled boxes for recording pertinent I.S. Notes and other service information are provided along the outer edge of each page in the manual. The filing instructions at the end of each I.S. Note specify the page an I.S. Note is to be recorded on. This provides a convenient reference to service updates and/or revisions affecting the information on the page.

SPECIAL TOOLS

Special tools needed for the service operations described in this manual are listed at the beginning of each chapter. The tools are also listed in the appropriate section of each chapter.

WIRING DIAGRAMS

Wiring diagrams are printed separately and should be filed in the pocket at the back of the

plastic binder. The diagrams provide the location of electrical components on the vehicle and how they are connected and/or wired.

SAFETY NOTES

Cautions and Warnings are used throughout this manual. They relate to critical operations involving personal safety or potential component damage. Cautions are used whenever component damage could occur if service procedures are not followed. Warnings are used when procedures must be followed explicitly for personal safety. Use extreme care and adhere to stated procedures when involved in such operations.



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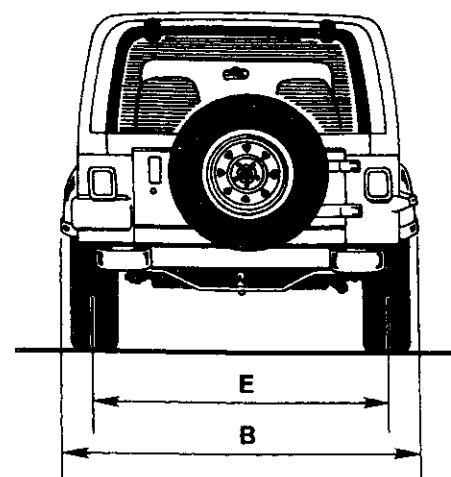
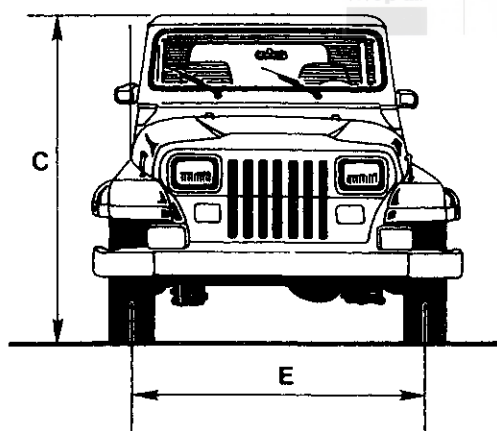
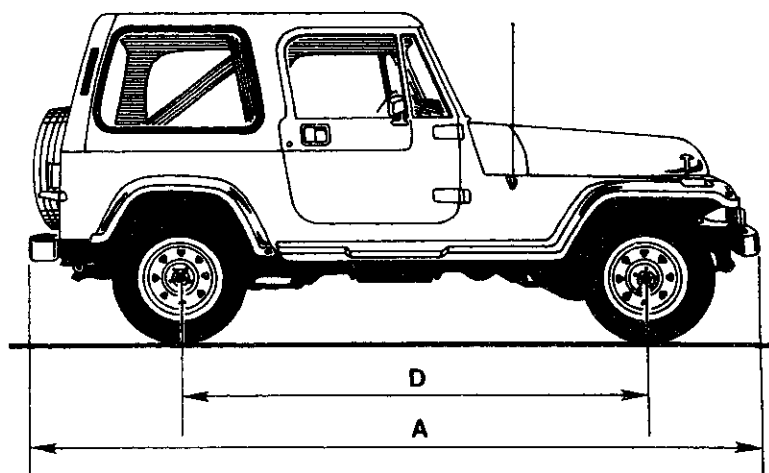
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	GENERAL SPECIFICATIONS	
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DIMENSIONS



A	Overall length with Polyspare	386 cm (152 in.)
	with Conventional Spare	388.9 cm (153 in.)
B	Overall width	167.6 cm (66 in.)
C	Overall height (empty)	
	Open Body	172.7 cm (68 in.)
	Soft Top	N/A
	Hard Top	175.2 cm (69 in.)
D	Wheelbase	237 cm (93.4 in.)
E	Front/Rear track	147.3 cm (58 in.)

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	GENERAL SPECIFICATIONS	
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DIMENSIONS (CONTD.)

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Head Room (Hard Top):

Driver front seat..... 102.1 cm (40.2 in.)
 Passenger front seat..... 101.6 cm (40.0 in.)
 Rear seat..... 102.9 cm (40.5 in.)

Leg Room:

Driver front seat..... 100.3 cm (39.5 in.)
 Passenger front seat..... 100.6 cm (39.6 in.)
 Rear seat..... 88.9 cm (35.0 in.)

Shoulder Room:

Front 134.8 cm (53.1 in.)
 Rear 143.0 cm (56.3 in.)

Hip Room:

Front 134.8 cm (53.1 in.)
 Rear 91.4 cm (36.0 in.)

Usable Cargo Volume:

Rear seat folded
 1.2 cubic meters (43.2 cubic feet)
 Rear seat removed
 1.5 cubic meters (53.4 cubic feet)
 Rear cargo area
 0.35 cubic meters (12.5 cubic feet)

Ground Clearance:

Rear axle to ground * 20.8 cm (8.18 in.)
 (running clearance)

Skid plate to ground * 24.0 cm (9.45 in.)
 (minimum running clearance)
 * With P215/75R15 tires.

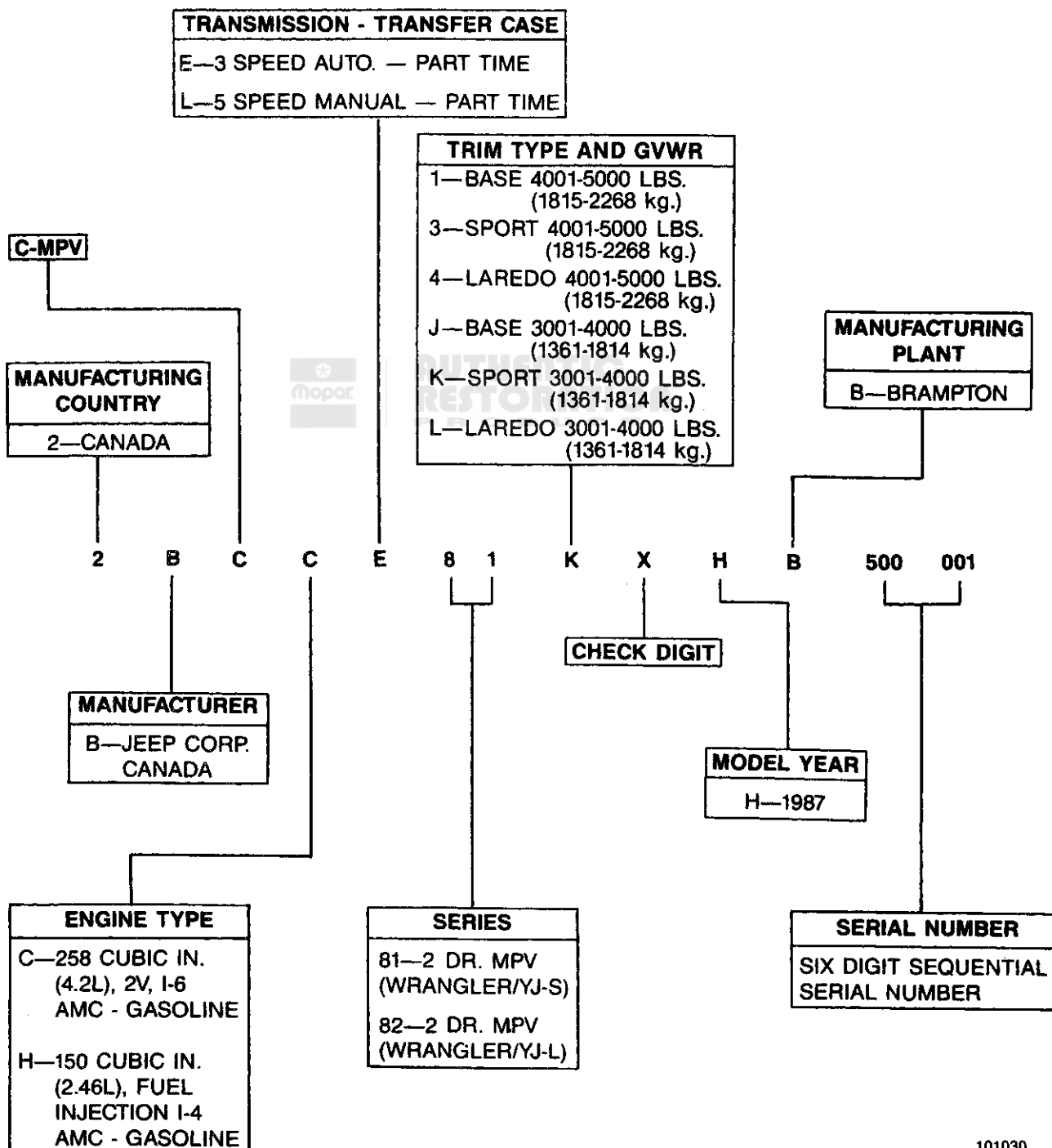
Wheelbase: 237.2 cm (93.4 in.)

Maximum GVWR ... 1882 kilograms (4150 lbs.)

	GENERAL SPECIFICATIONS	
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VEHICLE IDENTIFICATION NUMBER (VIN)

The vehicle identification number (VIN) is located on the left side of the instrument panel at the base of the windshield. The VIN chart explains the code characters.



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	SPECIFICATIONS	

SAFETY CERTIFICATION LABEL

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A safety certification label is attached to all Wrangler/YJ models. The label indicates that the vehicle conforms to Federal motor vehicle safety certification standards. The label is located on the driver door pillar.

 MFD. BY JEEP CORPORATION			DATE	THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE VEHICLE IDENTIFICATION NUMBER TYPE SF5383927
GVWR	WITH RIMS AT WITH RIMS AT	TIRES		
GAWR. FRT.		P.S.I. COLD		
GAWR. RP		TIRES		
		P.S.I. COLD		

	GENERAL	
	SPECIFICATIONS	

VEHICLE IDENTIFICATION PLATE

The metal identification plate is attached to the radiator support. The plate displays the VIN, paint code, trim code, fabrication sequence number, and vehicle equipment code (e.g. 49-State, Canada, California, high altitude).



POWERTRAIN AVAILABILITY

SERIES	ENGINE	TRANSMISSION	TRANSFER CASE	AXLE RATIO (STD./OPT.)
80 (Wrangler/YJ)	2.46L (150 cu.in.) In Line 4-Cyl.	5-SPD. MAN.	207	4.10
	4.2L (258 cu.in.) In Line 6-Cyl.	5-SPD. MAN. 3-SPD. AUTO.	207	3.08/3.55

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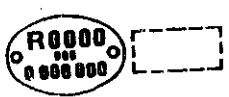
GENERAL SPECIFICATIONS



FUEL-FLUIDS-LUBRICANTS

Engine	I-4-1V 2.46 liter (150 cu. in.) I-6-2V 4.2 liter (258 cu. in.)	API "SF" Classification 10W-30, 10W-40, 20W-40 Above $\pm 32^{\circ}\text{F}$ (0°C) 10W-30, 10W-40 Above 0°F (-18°C) 5W-30* Below 0°F (-18°C) *Must not be used above 60°F (15.5°C)
Oil Filter	I-4 2.46L I-6 4.2L	Metric thread M20 x 1.5 P/N 8933 003 509
Transmission	999 Auto BA10/5 Man. AX5 Man.	Use AMC/Jeep/Renault automatic transmission fluid or equivalent Dexron® II fluid. Use AMC/Jeep/Renault gear lubricant, or equivalent 75W-90 (API GL-5) lubricant.
Transfer Case	207	Use only AMC/Jeep/Renault automatic transmission fluid or equivalent Dexron® II fluid.
Axle	Front/Rear	Use AMC/Jeep/Renault gear lubricant or equivalent SAE 75W-90, API GL-5 quality gear lubricant.
Brake Fluid	All	Use AMC/Jeep/Renault brake fluid or equivalent identified as FMVSS 116 DOT-3 and SAE J-1703 CAUTION: Use recommended brake fluid only.
Engine Coolant	All	Use AMC/Jeep/Renault all season antifreeze (or equivalent ethylene glycol-based antifreeze) containing Alugard 340-2™ and clean water in a 50/50 mixture.
Fuel	All	Unleaded with AKI octane rating of at least 87.
Clutch Hydraulic Reservoir		Use AMC/Jeep/Renault brake fluid P/N 8982 200 215, or equivalent identified as FMVSS 116 DOT-3 and SAE J-1703. CAUTION: Use recommended brake fluids only.
Power Steering Pump		Use AMC/Jeep/Renault power steering fluid or equivalent.
Steering Linkage, Ball Joints, Propeller Shafts, Cardan Joints, Wheel Bearings		Use AMC/Jeep/Renault all purpose lubricant or equivalent lithium base chassis lubricant.
Parking Brake Pedal Mechanism		Use AMC/Jeep/Renault white spray grease or equivalent.
Manual Steering Gear		Use AMC/Jeep/Renault all purpose lubricant or an equivalent lithium base chassis lubricant.

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	GENERAL SPECIFICATIONS	
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FLUID CAPACITIES

Capacities (Approximate Refill)	U.S. Measure	Imperial Measure	Metric Measure
Engine Oil: 2.46 liter I-4 (with or without filter change) 4.2 liter I-6 (with or without filter change)	4.0 quarts	3.33 quarts	3.78 liters
	6.0 quarts	5.0 quarts	5.7 liters
Cooling System: (includes coolant overflow bottle) 2.46 liter I-4 4.2 liter I-6	9.0 quarts	7.5 quarts	8.5 liters
	10.5 quarts	8.7 quarts	9.9 liters
Transmission: BA10/5 Man. AX5 Man. 999 Auto.	3.5 pints	2.9 pints	1.7 liters
	7.0 pints	5.8 pints	3.3 liters
	17.0 pints	14.0 pints	8.0 liters
Transfer Case: Model 207	4.5 pints	3.74 pints	2.13 liters
Axles: Front/Rear	2.5 pints	2.1 pints	1.2 liters
Fuel Tank (approx. cap.) Standard Tank Optional Tank	15.0 gallons	12.6 gallons	57.0 liters
	20.0 gallons	16.8 gallons	75.5 liters

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	GENERAL SPECIFICATIONS	
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ADHESIVES AND SEALERS

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Adhesives/Sealers/Cleaners	Purpose
Loctite 242 (Medium strength)	Prevents loosening of bolts, nuts, screws. Does not require re-application every time fasteners are loosened and tightened.
Loctite 271 (High strength)	Locks bolts, nuts, screws. Must be reapplied if fastener is loosened.
Loctite 290 or Wick n' Lock (Medium strength, penetrating)	Prevents loosening of fasteners, adjustment screws, etc. Can be applied after fastener is seated.
Loctite Superbonder	For quick bonding of non-porous materials (glass, metal, rubber, vinyl and plastics).
Permatex Gasket Remover	For removal of gaskets and cleaning gasket surfaces.
AMC/Jeep Gasket-In-A-Tube or Perfect Seal RTV Sealant	For use wherever RTV-Type sealant is specified.

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	GENERAL TOWING-BREAKDOWN RECOVERY	
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TOWING SAFETY PRECAUTIONS

Secure all loose or protruding parts of a damaged vehicle

Lift the end of a vehicle being towed a minimum of 4-inches off the road surface. Be sure the opposite end of the vehicle also has adequate ground clearance.

Use safety chains at all times. The chains must be independent of the tow truck lifting and towing attachments.

Do not allow any portion of the lifting or towing attachments to bear against the fuel tank of the vehicle being towed.

Do not go under the vehicle after it has been raised by the lifting and towing attachments.

Do not allow anyone to ride in a vehicle being towed.

Follow all State and local laws regarding tow speeds, warning lights, and nighttime illumination.

Do not attempt a towing operation that could jeopardize the operator, bystanders, or other motorists.

Do not exceed a towing speed of 48 km/h (30 mph).

Avoid towing distances of more than 24 km (15 miles) whenever possible.

Use towing dollies or a car hauler-type wrecker whenever the vehicle is locked and the ignition key is not available. Use dollies or a hauler-type wrecker whenever transmission, transfer case or axle damage is suspected.

Never attach tow chains or a tow sling to the bumper, steering linkage, universal joints or propeller shaft.

FRONT TOWING

CAUTION: Use tow chains with T-hooks for attachment to the frame rails. Do not use J-hooks under any circumstances.

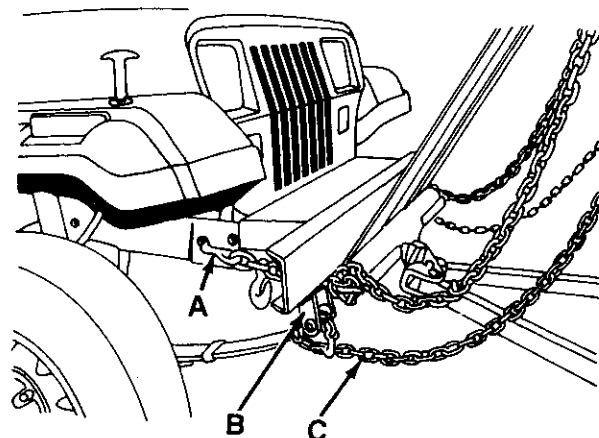
Attach the T-hooks (A) to the slots in the front end of each frame rail.

Position each chain over the top of each front spring shackle (B).

Double wrap each chain.

Position the tow bar under the front bumper.

Attach the safety chains (C) to the lower half of the front spring shackles.



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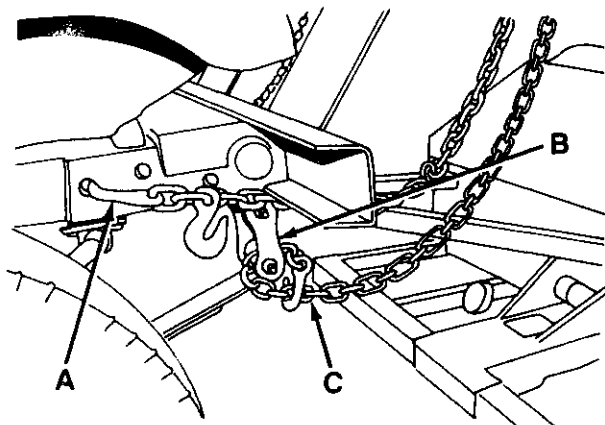


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TOWING-BREAKDOWN RECOVERY



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Shift the transmission and transfer case into Neutral.

Raise and tow the vehicle at a maximum speed of 48 km/h (30 mph). Keep towing distance under 24 km (15 miles) whenever possible.

REAR TOWING

Use wheel lift equipment only when rear towing is necessary. This is the only recommended method of rear towing Wrangler/YJ models.

	GENERAL LIFTING METHODS	
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FLOOR JACK-SAFETY STANDS-HOIST

Normal shop lifting equipment may be used to raise and support Wrangler/YJ models during service operations.

Floor Jack-Safety Stands

Position floor jacks or safety stands under the frame rails. Place the jack or safety stand lifting pad on the frame rail just ahead of the rear spring shackle, or just behind the front spring shackle. Be sure the jack or stand is positioned on a level section of the frame rail.

CAUTION: To avoid damaging the vehicle, do not raise the vehicle with a floor jack positioned under the axle tubes, body sheet metal, steering linkage components, propeller shafts, engine/transmission oil pans, or fuel tank. Use the recommended lift points only.

Hoist

Wrangler/YJ models can be raised with the following type of hoist:

- Swiveling arm hoist.
- Ramp-type (drive-on) hoist.
- Wheel lift, twin post hoist.

NOTE: If a swiveling arm hoist is being used, be sure the lifting pads are positioned at the same frame rail locations recommended for floor jack-safety stand usage.

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LUBRICANT CHANGE AND INSPECTION INTERVALS

Recommended lubricant change and inspection intervals for the engine, transmission, transfer case and axles are as follows:

Engine Oil

Change engine oil at 12 000 km (7,500 mile) intervals.

Check engine oil level at every fuel fill. Correct level is between the Add and Full marks on the engine dipstick.

Refer to the Recommended Fuel-Liquids-Lubricants section in this chapter for recommended engine oil grade and viscosity.

Manual Transmission Lubricant

Change manual transmission lubricant at 48 000 km (30,000 mile intervals).

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep gear lubricant or an equivalent SAE 75W-90, API Grade GL-5 gear lubricant for top off or refill purposes.

Automatic Transmission Fluid and Filter

Change the automatic transmission fluid and filter at 48 000 km (30,000 mile) intervals.

Check fluid level every 12 000 km (7,500 miles). Correct fluid level is between the Add and Full marks on the transmission dipstick.

Check the fluid level with the engine running and the transmission in Park position. The fluid must be at normal operating temperature to ensure an accurate reading.

Use Jeep automatic transmission fluid or an equivalent Dexron® II fluid only.

Transfer Case Lubricant

Change transfer case lubricant at 48 000 km (30,000 mile) intervals.

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep automatic transmission fluid or an equivalent Dexron® II fluid only.

Axle Lubricant

Change front and rear axle lubricant at 48 000 km (30,000 mile) intervals.

Check lubricant level every 12 000 km (7,500 miles). Correct lubricant level is to the bottom edge of the fill plug hole.

Use Jeep gear lubricant or an equivalent SAE 75W-90, API Grade GL-5 gear lubricant for top off or refill purposes.



GENERAL

METRIC-DECIMAL CONVERSION TABLES



Inch-pounds to newton meters

lb in	N·m	lb in	N·m	lb in	N·m	lb in	N·m	lb in	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

newton meters to inch-pounds

N·m	lb in	N·m	lb in	N·m	lb in	N·m	lb in	N·m	lb in
2	1 7702	42	37 1747	82	72 5792	122	107 9837	162	143 3882
4	3 5404	44	38 9449	84	74 3494	124	109 7539	164	145 1584
6	5 3107	46	40 7152	86	76 1197	126	111 5242	166	146 9287
8	7 0809	48	42 4854	88	77 8899	128	113 2944	168	148 6989
10	8 8511	50	44 2556	90	79 6601	130	115 0646	170	150 4691
12	10 6213	52	46 0258	92	81 4303	132	116 8348	172	152 2393
14	12 3916	54	47 7961	94	83 2006	134	118 6051	174	154 0096
16	14 1618	56	49 5663	96	84 9708	136	120 3753	176	155 7798
18	15 9320	58	51 3365	98	86 7410	138	122 1455	178	157 5500
20	17 7022	60	53 1067	100	88 5112	140	123 9157	180	159 3202
22	19 4725	62	54 8770	102	90 2815	142	125 6860	182	161 0904
24	21 2427	64	56 6472	104	92 0517	144	127 4562	184	162 8606
26	23 0129	66	58 4174	106	93 8219	146	129 2264	186	164 6308
28	24 7831	68	60 1876	108	95 5921	148	130 9966	188	166 4010
30	26 5534	70	61 9579	110	97 3624	150	132 7669	190	168 1712
32	28 3236	72	63 7281	112	99 1326	152	134 5371	192	169 9414
34	30 0938	74	65 4983	114	100 9028	154	136 3073	194	171 7116
36	31 8640	76	67 2685	116	102 6730	156	138 0775	196	173 4818
38	33 6342	78	69 0388	118	104 4433	158	139 8478	198	175 2520
40	35 4045	80	70 8090	120	106 2135	160	141 6180	200	177 0222

foot-pounds to newton meters

lb ft	N·m	lb ft	N·m	lb ft	N·m	lb ft	N·m	lb ft	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 5560	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 0420	96	130 1584
17	23 0489	37	50 1653	57	77 2816	77	104 3980	97	131 5142
18	24 4047	38	51 5211	58	78 6374	78	105 7538	98	132 8700
19	25 7605	39	52 8769	59	79 9933	79	107 1096	99	134 2260
20	27 1164	40	54 2327	60	81 3491	80	108 4654	100	135 5820

newton meters to foot-pounds

N·m	lb ft	N·m	lb ft	N·m	lb ft	N·m	lb ft	N·m	lb ft
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 9054
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 5796	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

100	135 5818	300	406 7454	500	677 9090	700	949 0726	900	1220 2362
110	149 1400	310	420 3036	510	691 4672	710	962 6308	910	1233 7943
120	162 6982	320	433 8618	520	705 0254	720	976 1900	920	1247 3525
130	176 2563	330	447 4199	530	718 5835	730	989 7471	930	1260 9107
140	189 8145	340	460 9781	540	732 1417	740	1003 3053	940	1274 4689
150	203 3727	350	474 5363	550	745 6999	750	1016 8635	950	1288 0271
160	216 9309	360	488 0945	560	759 2581	760	1030 4216	960	1301 5852
170	230 4891	370	501 6527	570	772 8163	770	1043 9798	970	1315 1434
180	244 0472	380	515 2108	580	786 3744	780	1057 5380	980	1328 7016
190	257 6054	390	528 7690	590	799 9326	790	1071 0962	990	1342 2598
200	271 1636	400	542 3272	600	813 4908	800	1084 6544	1000	1355 8180
210	284 7218	410	555 8854	610	827 0490	810	1098 2125	1050	1423 6089
220	298 2800	420	569 4436	620	840 6072	820	1111 7707	1100	1491 3998
230	311 8381	430	583 0017	630	854 1653	830	1125 3289	1150	1559 1907
240	325 3963	440	596 5599	640	867 7235	840	1138 8871	1200	1626 9816
250	338 9545	450	610 1181	650	881 2817	850	1152 4453	1250	1694 7725
260	352 5127	460	623 6763	660	894 8399	860	1166 0034	1300	1762 5634
270	366 0709	470	637 2345	670	908 3981	870	1179 5616	1350	1830 3543
280	379 6290	480	650 7926	680	921 9562	880	1193 1198	1400	1898 1452
290	393 1872	490	664 3508	690	935 5144	890	1206 6780	1500	2033 7270

100	73 7562	300	221 2686	500	368 7810	700	516 2935	900	663 8059
110	81 1318	310	228 6443	510	376 1567	710	523 6691	910	671 1815
120	88 5075	320	236 0199	520	383 5323	720	531 0447	920	678 5571
130	95 8831	330	243 3955	530	390 9079	730	538 4203	930	685 9328
140	103 2587	340	250 7711	540	398 2835	740	545 7959	940	693 3084
150	110 6343	350	258 1467	550	405 6592	750	553 1716	950	700 6840
160	118 0099	360	265 5223	560	413 0348	760	560 5472	960	708 0596
170	125 3856	370	272 8980	570	420 4104	770	567 9228	970	715 4352
180	132 7612	380	280 2736	580	427 7860	780	575 2984	980	722 8108
190	140 1368	390	287 6492	590	435 1616	790	582 6741	990	730 1865
200	147 5124	400	295 0248	600	442 5372	800	590 0497	1000	737 5621
210	154 8880	410	302 4005	610	449 9129	810	597 4253	1050	774 4402
220	162 2637	420	309 7761	620	457 2885	820	604 8009	1100	811 3183
230	169 6393	430	317 1517	630	464 6641	830	612 1765	1150	848 1964
240	177 0149	440	324 5273	640	472 0397	840	619 5522	1200	885 0745
250	184 3905	450	331 9029	650	479 4154	850	626 9278	1250	921 9526
260	191 7661	460	339 2786	660	486 7910	860	634 3034	1300	958 8307
270	199 1418	470	346 6542	670	494 1667	870	641 6790	1350	995 7080
280	206 5174	480	354 0298	680	501 5422	880	649 0546	1400	1032 5863
290	213 8930	490	361 4054	690	508 9178	890	656 4302	1450	1069 3446



GENERAL

METRIC-DECIMAL CONVERSION TABLES



Inch to mm

in	mm	in	mm	in	mm	in	mm	in	mm
01	25.4	21	533.4	41	1041.4	61	1549.4	81	2057.4
02	50.8	22	558.8	42	1066.0	62	1574.8	82	2082.8
03	76.2	23	584.2	43	1092.2	63	1602.2	83	2108.2
04	101.6	24	609.6	44	1117.6	64	1625.6	84	2133.6
05	127.0	25	635.0	45	1143.0	65	1651.0	85	2159.0
06	152.4	26	660.4	46	1168.4	66	1676.4	86	2184.4
07	177.8	27	685.8	47	1193.8	67	1701.8	87	2209.8
08	203.2	28	711.2	48	1219.2	68	1727.2	88	2235.2
09	228.6	29	736.6	49	1244.6	69	1752.6	89	2260.6
10	254.0	30	762.0	50	1270.0	70	1778.0	90	2286.0
11	279.4	31	787.4	51	1295.4	71	1803.4	91	2311.4
12	304.8	32	812.8	52	1320.8	72	1828.8	92	2336.8
13	330.2	33	838.2	53	1346.2	73	1854.2	93	2362.2
14	355.6	34	863.6	54	1371.6	74	1879.6	94	2387.6
15	381.0	35	889.0	55	1397.0	75	1905.0	95	2413.0
16	406.4	36	914.4	56	1422.4	76	1930.4	96	2438.4
17	431.8	37	939.8	57	1447.8	77	1955.8	97	2463.8
18	457.2	38	965.2	58	1473.2	78	1981.2	98	2489.2
19	482.6	39	990.6	59	1498.6	79	2006.6	99	2514.6
20	508.0	40	1016.0	60	1524.0	80	2032.0	100	2540.0

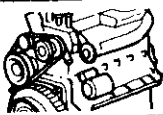
mm to inch

mm	in	mm	in	mm	in	mm	in	mm	in
01	0.0039	21	0.00827	41	0.01614	61	0.02402	81	0.03189
02	0.0079	22	0.00866	42	0.01654	62	0.02441	82	0.03228
03	0.0118	23	0.00906	43	0.01693	63	0.02480	83	0.03268
04	0.0157	24	0.00945	44	0.01732	64	0.02520	84	0.03307
05	0.0197	25	0.00984	45	0.01772	65	0.02559	85	0.03346
06	0.0236	26	0.01024	46	0.01811	66	0.02598	86	0.03386
07	0.0276	27	0.01063	47	0.01850	67	0.02638	87	0.03425
08	0.0315	28	0.01102	48	0.01890	68	0.02677	88	0.03465
09	0.0354	29	0.01142	49	0.01929	69	0.02717	89	0.03504
10	0.0394	30	0.01181	50	0.01969	70	0.02756	90	0.03543
11	0.0433	31	0.01220	51	0.02008	71	0.02795	91	0.03583
12	0.0472	32	0.01260	52	0.02047	72	0.02835	92	0.03622
13	0.0512	33	0.01299	53	0.02087	73	0.02874	93	0.03661
14	0.0551	34	0.01339	54	0.02126	74	0.02913	94	0.03701
15	0.0591	35	0.01378	55	0.02165	75	0.02953	95	0.03740
16	0.0630	36	0.01417	56	0.02205	76	0.02992	96	0.03780
17	0.0669	37	0.01457	57	0.02244	77	0.03032	97	0.03819
18	0.0709	38	0.01496	58	0.02283	78	0.03071	98	0.03858
19	0.0748	39	0.01535	59	0.02323	79	0.03110	99	0.03898
20	0.0787	40	0.01575	60	0.02362	80	0.03150	100	0.03937

fraction to decimal Inch to mm

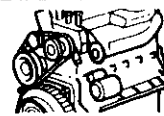
Frac	Inches	Dec	mm	Frac	Inches	Dec	mm
1/64		0.015625	396.9	33/64		0.515625	13.0969
1/32		0.031250	793.8	17/32		0.531250	13.4938
3/64		0.046875	1190.6	35/64		0.546875	13.8906
1/16		0.062500	1587.5	9/16		0.562500	14.2875
5/64		0.078125	1984.4	37/64		0.578125	14.6844
3/32		0.093750	2381.2	19/32		0.593750	15.0812
7/64		0.109375	2778.1	39/64		0.609375	15.4781
1/8		0.125000	3175.0	5/8		0.625000	15.8750
9/64		0.140625	3571.9	41/64		0.640625	16.2719
5/32		0.156250	3968.8	21/32		0.656250	16.6688
11/64		0.171875	4365.6	43/64		0.671875	17.0656
3/16		0.187500	4762.5	11/16		0.687500	17.4625
13/64		0.203125	5159.4	45/64		0.703125	17.8594
7/32		0.218750	5556.2	23/32		0.718750	18.2562
15/64		0.234375	5953.1	47/64		0.734375	18.6531
1/4		0.250000	6350.0	3/4		0.750000	19.0500
17/64		0.265625	6746.9	49/64		0.765625	19.4469
9/32		0.281250	7143.8	25/32		0.781250	19.8437
19/64		0.296875	7540.6	51/64		0.796875	20.2406
5/16		0.312500	7937.5	13/16		0.812500	20.6375
21/64		0.328125	8334.4	53/64		0.828125	21.0344
11/32		0.343750	8731.2	27/32		0.843750	21.4312
23/64		0.359375	9128.1	55/64		0.859375	21.8281
3/8		0.375000	9525.0	7/8		0.875000	22.2250
25/64		0.390625	9921.9	57/64		0.890625	22.6219
13/32		0.406250	10318.8	29/32		0.906250	23.0188
27/64		0.421875	10715.6	59/64		0.921875	23.4156
7/16		0.437500	11112.5	15/16		0.937500	23.8125
29/64		0.453125	11509.4	61/64		0.953125	24.2094
15/32		0.468750	11906.2	31/32		0.968750	24.6062
31/64		0.484375	12303.1	63/64		0.984375	25.0031
1/2		0.500000	12700.0	1		1.000000	25.4000

1	0.3937	21	0.82677	41	1.61417	61	2.40157	81	3.18897
2	0.7874	22	0.86614	42	1.65354	62	2.44094	82	3.22834
3	1.1811	23	0.90551	43	1.69291	63	2.48031	83	3.26771
4	1.5748	24	0.94488	44	1.73228	64	2.51968	84	3.30708
5	1.9685	25	0.98425	45	1.77165	65	2.55905	85	3.34645
6	2.3622	26	1.02362	46	1.81102	66	2.59842	86	3.38582
7	2.7559	27	1.06299	47	1.85039	67	2.63779	87	3.42519
8	3.1496	28	1.10236	48	1.88976	68	2.67716	88	3.46456
9	3.5433	29	1.14173	49	1.92913	69	2.71653	89	3.50393
10	3.9370	30	1.18110	50	1.96850	70	2.75590	90	3.54330
11	4.3307	31	1.22047	51	2.00787	71	2.79527	91	3.58267
12	4.7244	32	1.25984	52	2.04724	72	2.83464	92	3.62204
13	5.1181	33	1.29921	53	2.08661	73	2.87401	93	3.66141
14	5.5118	34	1.33858	54	2.12598	74	2.91338	94	3.70078
15	5.9055	35	1.37795	55	2.16535	75	2.95275	95	3.74015
16	6.2992	36	1.41732	56	2.20472	76	2.99212	96	3.77952
17	6.6929	37	1.45669	57	2.24409	77	3.03149	97	3.81889
18	7.0866	38	1.49606	58	2.28346	78	3.07086	98	3.85826
19	7.4803	39	1.53543	59	2.32283	79	3.11023	99	3.89763
20	7.8740	40	1.57480	60	2.36220	80	3.14960	100	3.93700

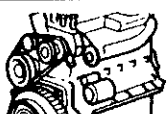


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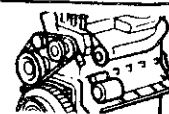


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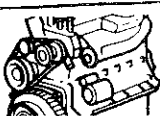
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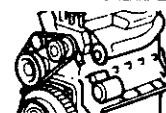
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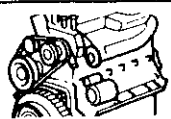


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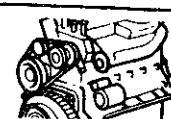


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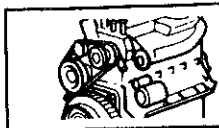
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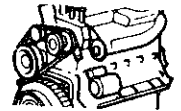
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ENGINES

GENERAL INFORMATION



GENERAL INFORMATION

The 2.46 liter (150 CID) four-cylinder engine and the 4.2 liter (258 CID) six-cylinder engine are in-line, lightweight, overhead valve engines.

Both engines are designed for unleaded fuel.

The cylinder heads have dual quench-type combustion chambers that create turbulence and fast burning of the air/fuel mixture, which results in good fuel economy.

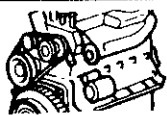
The cylinders in the four-cylinder engine are numbered 1 through 4 from front to rear. The firing order is 1-3-4-2.

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within five main bearings and the camshaft rotates within four line-bored bearings.

The cylinders in the six-cylinder engine are numbered 1 through 6 from front to rear. The firing order is 1-5-3-6-2-4.

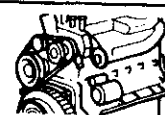
The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within seven main bearings and the camshaft rotates within four line-bored bearings.

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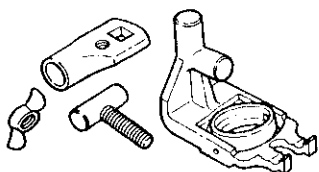
SPECIAL TOOLS

Reference Number	Description
ET 501	CEC Fuel Feedback Tester
J-5601	Piston Ring Compressor
J-5959-4	Extension Rod & C-Clamp Dial Indicator
J-8520	Dial Indicator Set
J-9789-D	Universal Carburetor Gauge Set
J-10174-01	Carburetor Main Jet Remover
J-21791-01	Vibration Damper Remover
J-21884	Hydraulic Valve Tappet Remover/Seal Installer
J-22248	Timing Chain Cover Alignment/Seal Installer
J-22534-01	Valve Spring Compressor
J-22794	14mm Airhold Coupling
J-23600-B	Belt Tension Gauge
J-23738-A	Hand Operated Vacuum Pump
J-24460-01	Radiator Cap and Cooling System Tester

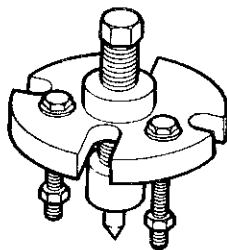
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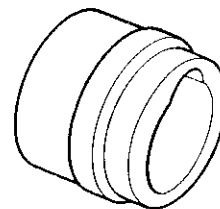
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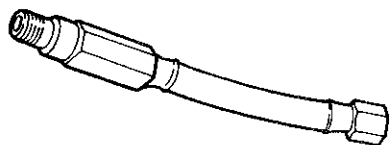
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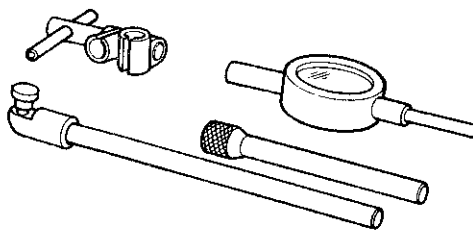
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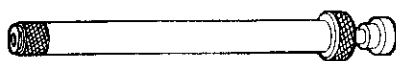
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J-22794



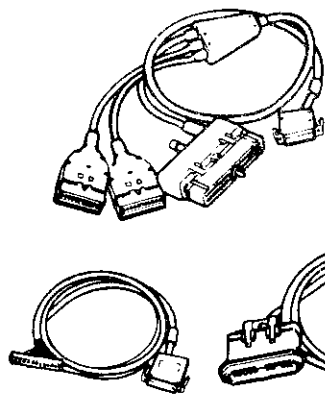
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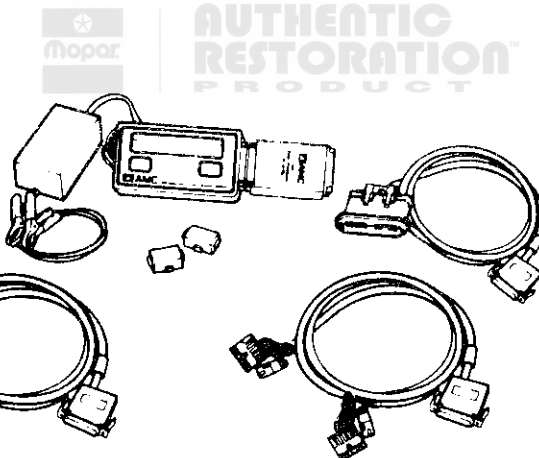
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J-5601



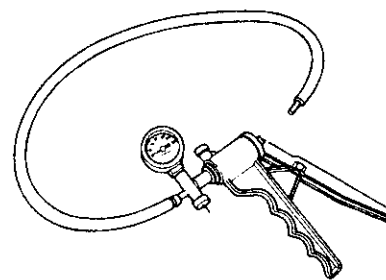
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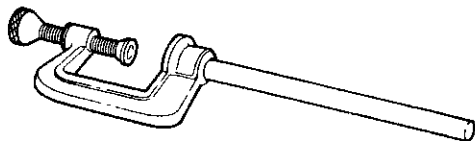
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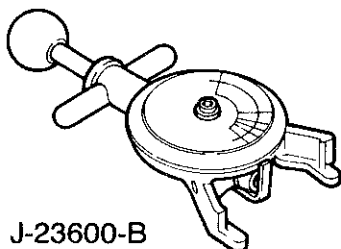
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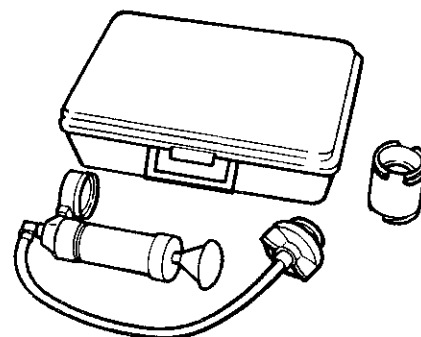
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J-5959-4

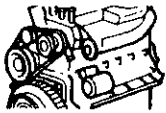


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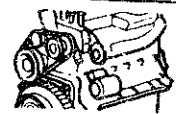
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EMISSION CONTROL COMPONENTS – SIX CYLINDER ENGINE

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Engine and Carb.		Series																									
Transmission		Pulse Air Injection																									
Air Control Valve (Downstream)		Pulse Air Check Valve (Upstream)																									
Pulse Air Check Valve (Downstream)		Pulse Air Check Valve (Upstream)																									
Air Control Valve (Upstream)		Air Switch Solenoid																									
Catalytic Converter		Coolant Temp. Switch (Intake Manifold Heater)																									
EGR Valve		EGR TVS																									
Canister Purge/ EGR CTO Valve Temp.		TAC Type																									
TAC Type		TAC TVS																									
TAC Delay Valve (R) and Check Valve		Ignition Elect. Spark Retard																									
Carb. Vent to Canister		Electric Choke																									
SOLE-VAC Idle Control		Thermal Electric Switch (TES)																									
Oxygen Sensor		Microprocessor																									
Vacuum Switch Assembly		PCV System																									
PCV Solenoid		Control Valve																									
Coolant Temperature Switch		Knock Sensor																									

V – Vacuum
F – Forward
R – Reverse

TVS – Thermal Vacuum Switch
EGR – Exhaust Gas Recirculation
CTO – Coolant Temperature Override

TAC – Thermostatically Controlled Air Cleaner
PCV – Positive Crankcase Ventilation

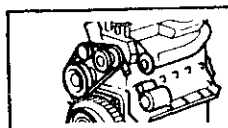


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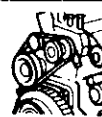
COMPONENT	OPERATING RANGE SPECIFICATION
Coolant Temperature Switch	135°F (57°C)
Manifold Heater Switch	160°F (71°C)
Thermal Electric Switch	50°F (10°C) 65°F (18°C)
4-inch Hg. Switch	4-inch vacuum and less
10-inch Hg. Switch	10-inch vacuum and greater
Wide Open Throttle Switch	15° from W.O.T.
Closed Throttle Switch	At closed throttle
Knock Sensor	5550 Hz.
Altitude Jumper	4000-foot elevation and above

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ENGINES

GENERAL SERVICE AND DIAGNOSIS



DIAGNOSIS PROCEDURES

General Information

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine tune-ups.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

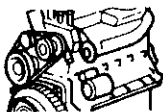
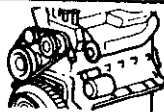
Refer to the Service Diagnosis – Mechanical chart and the Service Diagnosis – Performance chart for possible causes and corrections of malfunctions. On four-cylinder models, refer to INJ. R.. (G) service manual for fuel injection diagnosis.



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Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts.

Information concerning additional tests and diagnosis is provided within the Diagnosis With A Scope Analyzer, Cylinder Compression Pressure Test, Cylinder Combustion Pressure Leakage Test, Cylinder Head Gasket Failure Diagnosis and Intake Manifold Leakage Diagnosis.

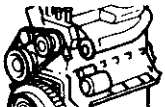
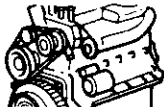
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Service Diagnosis – Mechanical

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS	(1) Fuel pump gasket broken or improperly seated. (2) Cylinder head cover RTV sealant broken or improperly seated. (3) Oil filler cap leaking or missing. (4) Oil filter gasket broken or improperly seated. (5) Oil pan side gasket broken, improperly seated or opening in RTV sealant. (6) Oil pan front oil seal broken or improperly seated. (7) Oil pan rear oil seal broken or improperly seated. (8) Timing case cover oil seal broken or improperly seated. (9) Excess oil pressure because of restricted PCV valve. (10) Oil pan drain plug loose or has stripped threads. (11) Rear oil gallery plug loose.	(1) Replace gasket. (2) Replace sealant; inspect cylinder head cover sealant flange and cylinder head sealant surface for distortion and cracks. (3) Replace cap. (4) Replace oil filter. (5) Replace gasket or repair opening in sealant; inspect oil pan gasket flange for distortion. (6) Replace seal; inspect timing case cover and oil pan seal flange for distortion. (7) Replace seal; inspect oil pan rear oil seal flange; inspect rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove. (8) Replace seal. (9) Replace PCV valve. (10) Repair as necessary and tighten. (11) Use appropriate sealant on gallery plug and tighten.

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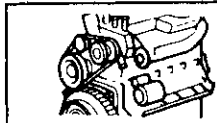
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Service Diagnosis – Mechanical (Continued)

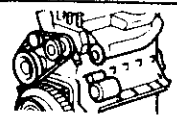
Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS (Continued)	(12) Rear camshaft plug loose or improperly seated. (13) Distributor base gasket damaged.	(12) Seat camshaft plug or replace and seal, as necessary. (13) Replace gasket.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high. (2) Oil with wrong viscosity being used. (3) PCV valve stuck closed. (4) Valve stem oil deflectors (or seals) are damaged, missing, or incorrect type. (5) Valve stems or valve guides worn. (6) Poorly fitted or missing valve cover baffles. (7) Piston rings broken or missing. (8) Scuffed piston. (9) Incorrect piston ring gap. (10) Piston rings sticking or excessively loose in grooves. (11) Compression rings installed upside down. (12) Cylinder walls worn, scored, or glazed. (13) Piston ring gaps not properly staggered. (14) Excessive main or connecting rod bearing clearance.	(1) Drain oil to specified level. (2) Replace with specified oil. (3) Replace PCV valve. (4) Replace valve stem oil deflectors. (5) Measure stem-to-guide clearance and repair as necessary. (6) Replace valve cover. (7) Replace broken or missing rings. (8) Replace piston. (9) Measure ring gap, repair as necessary. (10) Measure ring side clearance, repair as necessary. (11) Repair as necessary. (12) Repair as necessary. (13) Repair as necessary. (14) Measure bearing clearance, repair as necessary.
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.

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GENERAL SERVICE AND DIAGNOSIS

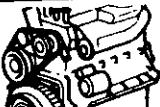
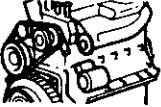


Service Diagnosis – Mechanical (Continued)

Condition	Possible Cause	Correction
NO OIL PRESSURE (Continued)	(2) Oil pressure gauge, warning lamp or sending unit inaccurate. (3) Oil pump malfunction. (4) Oil pressure relief valve sticking.	(2) Refer to Oil Pressure Gauge or Warning Lamp. (3) Refer to Oil Pump. (4) Remove and inspect oil pressure relief valve assembly.
	(5) Oil passages on pressure side of pump obstructed. (6) Oil pickup screen or tube obstructed. (7) Loose oil inlet tube.	(5) Inspect oil passages for obstructions. (6) Inspect oil pickup for obstructions. (7) Tighten or seal inlet tube.
LOW OIL PRESSURE	(1) Low oil level. (2) Inaccurate gauge, warning lamp or sending unit. (3) Oil excessively thin because of dilution, poor quality, or improper grade. (4) Excessive oil temperature. (5) Oil pressure relief spring weak or sticking. (6) Oil inlet tube and screen assembly has restriction or air leak. (7) Excessive oil pump clearance. (8) Excessive main, rod, or camshaft bearing clearance.	(1) Add oil to correct level. (2) Refer to Oil Pressure Gauge or Warning Lamp. (3) Drain and refill crankcase with recommended oil. (4) Correct cause of overheating engine. (5) Remove and inspect oil pressure relief valve assembly. (6) Remove and inspect oil inlet tube and screen assembly. (Fill inlet tube with lacquer thinner to locate leaks.) (7) Measure clearances; refer to Oil Pump. (8) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper oil viscosity. (2) Oil pressure gauge or sending unit inaccurate.	(1) Drain and refill crankcase with correct viscosity oil. (2) Refer to Oil Pressure Gauge.

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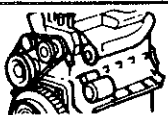
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Service Diagnosis – Mechanical (Continued)

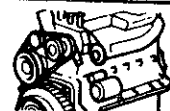
Condition	Possible Cause	Correction
HIGH OIL PRESSURE (Continued)	(3) Oil pressure relief valve sticking closed.	(3) Remove and inspect oil pressure relief valve assembly.
MAIN BEARING NOISE	(1) Insufficient oil supply. (2) Main bearing clearance excessive. (3) Bearing insert missing. (4) Crankshaft end play excessive. (5) Improperly tightened main bearing cap bolts. (6) Loose flywheel or drive plate. (7) Loose or damaged vibration damper.	(1) Inspect for low oil level and low oil pressure. (2) Measure main bearing clearance, repair as necessary. (3) Replace missing insert. (4) Measure end play, repair as necessary. (5) Tighten bolts with specified torque. (6) Tighten flywheel or drive plate attaching bolts. (7) Repair as necessary.
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply. (2) Carbon build-up on piston. (3) Bearing clearance excessive or bearing missing. (4) Crankshaft connecting rod journal out-of-round. (5) Misaligned connecting rod or cap. (6) Connecting rod bolts tightened improperly.	(1) Inspect for low oil level and low oil pressure. (2) Remove carbon from piston crown. (3) Measure clearance, repair as necessary. (4) Measure journal dimensions, repair or replace as necessary. (5) Repair as necessary. (6) Tighten bolts with specified torque.
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive (scuffed piston). (2) Cylinder walls excessively tapered or out-of-round.	(1) Measure clearance and examine piston. (2) Measure cylinder wall dimensions, rebore cylinder.

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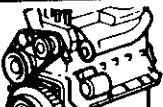
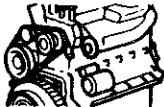


Service Diagnosis – Mechanical (Continued)

Condition	Possible Cause	Correction
PISTON NOISE (Continued)	(3) Piston ring broken. (4) Loose or seized piston pin. (5) Connecting rods misaligned. (6) Piston ring side clearance excessively loose or tight. (7) Carbon build-up on piston is excessive.	(3) Replace all rings on piston. (4) Measure piston-to-pin clearance, repair as necessary. (5) Measure rod alignment, straighten or replace. (6) Measure ring side clearance, repair as necessary. (7) Remove carbon from piston.
VALVE ACTUATING COMPONENT NOISE	(1) Insufficient oil supply. (2) Push rods worn or bent. (3) Rocker arms or pivots worn. (4) Foreign objects or chips in hydraulic tappets. (5) Excessive tappet leak-down. (6) Tappet face worn. (7) Broken or cocked valve springs. (8) Stem-to-guide clearance excessive. (9) Valve bent. (10) Loose rocker arms. (11) Valve seat runout excessive.	(1) Check for: (a) Low oil level. (b) Low oil pressure. (c) Plugged push rods. (d) Wrong hydraulic tappets. (e) Restricted oil gallery. (f) Excessive tappet to bore clearance. (2) Replace worn or bent push rods. (3) Replace worn rocker arms or pivots. (4) Clean tappets. (5) Replace valve tappet. (6) Replace tappet; inspect corresponding cam lobe for wear. (7) Properly seat cocked springs; replace broken springs. (8) Measure stem-to-guide clearance, repair as required. (9) Replace valve. (10) Tighten bolts with specified torque. (11) Regrind valve seat/valves.

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Service Diagnosis—Mechanical (Continued)

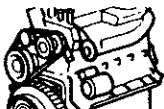
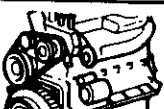
Condition	Possible Cause	Correction
VALVE ACTUATING COMPONENT NOISE (Continued)	(12) Missing valve lock.	(12) Install valve lock.
	(13) Push rod rubbing or contacting cylinder head.	(13) Remove cylinder head and remove obstruction in head.
	(14) Excessive engine oil (four-cylinder engine).	(14) Correct oil level.

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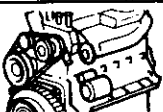
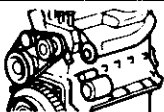
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Service Diagnosis – Performance (Carbureted Models)

Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY)	(1) Binding linkage, choke valve or choke piston. (2) Restricted choke vacuum diaphragm. (3) Improper fuel level. (4) Dirty, worn or faulty needle valve and seat. (5) Float sticking. (6) Faulty fuel pump. (7) Incorrect choke cover adjustment. (8) Inadequate choke unloader adjustment. (9) Faulty ignition coil. (10) Improper spark plug gap. (11) Incorrect ignition timing. (12) Incorrect valve timing.	(1) Repair as necessary. (2) Clean passages. (3) Adjust float level. (4) Repair as necessary. (5) Repair as necessary. (6) Replace fuel pump. (7) Adjust choke cover. (8) Adjust choke unloader. (9) Test and replace as necessary. (10) Adjust gap. (11) Adjust timing. (12) Check valve timing; repair as necessary.
ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed. (2) Incorrect ignition timing. (3) Improper feedback system operation. (4) Improper fast idle cam adjustment. (5) Faulty EGR valve operation. (6) Faulty PCV valve air flow.	(1) Adjust curb or fast idle speed. (2) Adjust timing to specification. (3) Refer to Feedback System Diagnosis. (4) Adjust fast idle cam. (5) Test EGR system and replace as necessary. (6) Test PCV valve and replace as necessary.

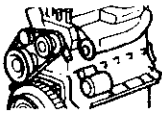
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Service Diagnosis – Performance (Continued)

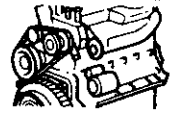
Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(7) Choke binding. (8) Faulty TAC vacuum motor or valve. (9) Air leak into manifold vacuum. (10) Improper fuel level. (11) Faulty distributor rotor or cap. (12) Improperly seated valves. (13) Incorrect ignition wiring. (14) Faulty ignition coil. (15) Restricted air vent or idle passages. (16) Restricted air cleaner. (17) Faulty choke vacuum diaphragm.	(7) Locate and eliminate binding condition. (8) Repair as necessary. (9) Inspect manifold vacuum connections and repair as necessary. (10) Adjust fuel level. (11) Replace rotor or cap. (12) Test cylinder compression, repair as necessary. (13) Inspect wiring and correct as necessary. (14) Test coil and replace as necessary. (15) Clean passages. (16) Clean or replace air cleaner filter element. (17) Repair as necessary.
FAULTY LOW-SPEED OPERATION	(1) Restricted idle transfer slots. (2) Restricted idle air vents and passages. (3) Restricted air cleaner. (4) Improper fuel level. (5) Faulty spark plugs. (6) Dirty, corroded, or loose ignition secondary circuit wire connections. (7) Improper feedback system operation. (8) Faulty ignition coil high voltage wire. (9) Faulty distributor cap.	(1) Clean transfer slots. (2) Clean air vents and passages. (3) Clean or replace air cleaner filter element. (4) Adjust fuel level. (5) Clean or replace spark plugs. (6) Clean or tighten secondary circuit wire connections. (7) Refer to Feedback System Diagnosis. (8) Replace ignition coil high voltage wire. (9) Replace cap.
FAULTY ACCELERATION	(1) Improper accelerator pump stroke. (2) Incorrect ignition timing. (3) Inoperative pump discharge check ball or needle.	(1) Adjust accelerator pump stroke. (2) Adjust timing. (3) Clean or replace as necessary.

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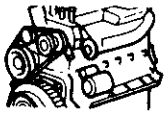
GENERAL SERVICE AND DIAGNOSIS



Service Diagnosis – Performance (Continued)

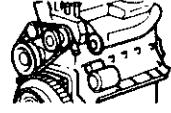
Condition	Possible Cause	Correction
FAULTY ACCELERATION (Continued)	(4) Worn or damaged pump diaphragm or piston.	(4) Replace diaphragm or piston.
	(5) Leaking carburetor main body cover gasket.	(5) Replace gasket.
	(6) Engine cold and choke set too lean.	(6) Adjust choke cover.
	(7) Improper metering rod adjustment (BBD Model carburetor).	(7) Adjust metering rod.
	(8) Faulty spark plug(s).	(8) Clean or replace spark plug(s).
	(9) Improperly seated valves.	(9) Test cylinder compression, repair as necessary.
	(10) Faulty ignition coil.	(10) Test coil and replace as necessary.
	(11) Improper feedback system operation.	(11) Refer to Feedback System Diagnosis.
FAULTY HIGH SPEED OPERATION	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor centrifugal advance mechanism.	(2) Check centrifugal advance mechanism and repair as necessary.
	(3) Faulty distributor vacuum advance mechanism.	(3) Check vacuum advance mechanism and repair as necessary.
	(4) Low fuel pump volume.	(4) Replace fuel pump.
	(5) Wrong spark plug air gap or wrong plug.	(5) Adjust air gap or install correct plug.
	(6) Faulty choke operation.	(6) Adjust choke cover.
	(7) Partially restricted exhaust manifold, exhaust pipe, catalytic converter, muffler, or tailpipe.	(7) Eliminate restriction.
	(8) Restricted vacuum passages.	(8) Clean passages.
	(9) Improper size or restricted main jet.	(9) Clean or replace as necessary.
	(10) Restricted air cleaner.	(10) Clean or replace filter element as necessary.
	(11) Faulty distributor rotor or cap.	(11) Replace rotor or cap.
	(12) Faulty ignition coil.	(12) Test coil and replace as necessary.
	(13) Improperly seated valve(s).	(13) Test cylinder compression, repair as necessary.
	(14) Faulty valve spring(s).	(14) Inspect and test valve spring tension, replace as necessary.
	(15) Incorrect valve timing.	(15) Check valve timing and repair as necessary.

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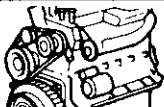
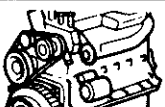
GENERAL SERVICE AND DIAGNOSIS



Service Diagnosis – Performance (Continued)

Condition	Possible Cause	Correction
FAULTY HIGH SPEED OPERATION (Continued)	(16) Intake manifold restricted.	(16) Remove restriction or replace manifold.
	(17) Worn distributor shaft.	(17) Replace shaft.
	(18) Improper feedback system operation.	(18) Refer to Feedback System Diagnosis.
MISFIRE AT ALL SPEEDS	(1) Faulty spark plug(s).	(1) Clean or replace spark plug(s).
	(2) Faulty spark plug wire(s).	(2) Replace as necessary.
	(3) Faulty distributor cap or rotor.	(3) Replace cap or rotor.
	(4) Faulty ignition coil.	(4) Test coil and replace as necessary.
	(5) Primary ignition circuit shorted or open intermittently.	(5) Troubleshoot primary circuit and repair as necessary.
	(6) Improperly seated valve(s).	(6) Test cylinder compression, repair as necessary.
	(7) Faulty hydraulic tappet(s).	(7) Clean or replace tappet(s).
	(8) Improper feedback system operation.	(8) Refer to Feedback System Diagnosis.
	(9) Faulty valve spring(s).	(9) Inspect and test valve spring tension, repair as necessary.
	(10) Worn camshaft lobes.	(10) Replace camshaft.
	(11) Air leak into manifold.	(11) Check manifold vacuum and repair as necessary.
	(12) Improper carburetor adjustment.	(12) Adjust carburetor.
	(13) Fuel pump volume or pressure low.	(13) Replace fuel pump.
	(14) Blown cylinder head gasket.	(14) Replace gasket.
	(15) Intake or exhaust manifold passage(s) restricted.	(15) Pass chain through passage(s) and repair as necessary.
	(16) Incorrect trigger wheel installed in distributor.	(16) Install correct trigger wheel.
POWER NOT UP TO NORMAL	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor rotor.	(2) Replace rotor.
	(3) Trigger wheel loose on shaft.	(3) Reposition or replace trigger wheel.
	(4) Incorrect spark plug gap.	(4) Adjust gap.
	(5) Faulty fuel pump.	(5) Replace fuel pump.

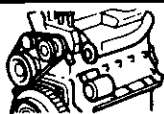
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Service Diagnosis – Performance (Continued)

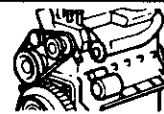
Condition	Possible Cause	Correction
POWER NOT UP TO NORMAL (Continued)	(6) Incorrect valve timing. (7) Faulty ignition coil. (8) Faulty ignition wires. (9) Improperly seated valves. (10) Blown cylinder head gasket. (11) Leaking piston rings. (12) Worn distributor shaft. (13) Improper feedback system operation.	(6) Check valve timing and repair as necessary. (7) Test coil and replace as necessary. (8) Test wires and replace as necessary. (9) Test cylinder compression and repair as necessary. (10) Replace gasket. (11) Test compression and repair as necessary. (12) Replace shaft. (13) Refer to Feedback System Diagnosis.
INTAKE BACKFIRE	(1) Improper ignition timing. (2) Faulty accelerator pump discharge. (3) Defective EGR CTO valve. (4) Defective TAC vacuum motor or valve. (5) Lean air/fuel mixture.	(1) Adjust timing. (2) Repair as necessary. (3) Replace EGR CTO valve. (4) Repair as necessary. (5) Check float level or manifold vacuum for air leak. Remove sediment from bowl.
EXHAUST BACKFIRE	(1) Air leak into manifold vacuum. (2) Faulty air injection diverter valve. (3) Exhaust leak.	(1) Check manifold vacuum and repair as necessary. (2) Test diverter valve and replace as necessary. (3) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing. (2) Distributor centrifugal or vacuum advance malfunction. (3) Excessive combustion chamber deposits. (4) Air leak into manifold vacuum. (5) Excessively high compression. (6) Fuel octane rating excessively low.	(1) Adjust timing. (2) Inspect advance mechanism and repair as necessary. (3) Remove with combustion chamber cleaner. (4) Check manifold vacuum and repair as necessary. (5) Test compression and repair as necessary. (6) Try alternate fuel source.

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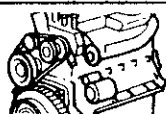


Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
PING OR SPARK KNOCK (Continued)	(7) Sharp edges in combustion chamber. (8) EGR Valve not functioning properly.	(7) Grind smooth. (8) Test EGR System and replace as necessary.
SURGING (AT CRUISING TO TOP SPEEDS)	(1) Low carburetor fuel level. (2) Low fuel pump pressure or volume. (3) Metering rod(s) not adjusted properly (BBD Model Carburetor). (4) Improper PCV valve air flow. (5) Air leak into manifold vacuum. (6) Incorrect spark advance. (7) Restricted main jet(s). (8) Undersize main jet(s). (9) Restricted air vents. (10) Restricted fuel filter. (11) Restricted air cleaner. (12) EGR valve not functioning properly. (13) Improper feedback system operation.	(1) Adjust fuel level. (2) Replace fuel pump. (3) Adjust metering rod. (4) Test PCV valve and replace as necessary. (5) Check manifold vacuum and repair as necessary. (6) Test and replace as necessary. (7) Clean main jet(s). (8) Replace main jet(s). (9) Clean air vents. (10) Replace fuel filter. (11) Clean or replace air cleaner filter element. (12) Test EGR System and replace as necessary. (13) Refer to Feedback System Diagnosis.

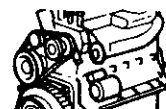
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SCOPE ANALYZER DIAGNOSIS – IGNITION SYSTEM TESTER

A scope analyzer is an ignition system tester that provides a means for quick and accurate diagnosis of ignition system performance problems.

All phases of the ignition cycle are displayed graphically on an oscilloscope (cathode ray tube) as they occur during engine operation.

The manufacturers of scope analyzer equipment provide descriptions of the test procedures that are possible with their equipment. This manual is not intended to describe all the possible uses of scope analyzer equipment, but to illustrate a typical display of the Solid State Ignition (SSI) system.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

NOTE: Ensure the battery is completely charged and the starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

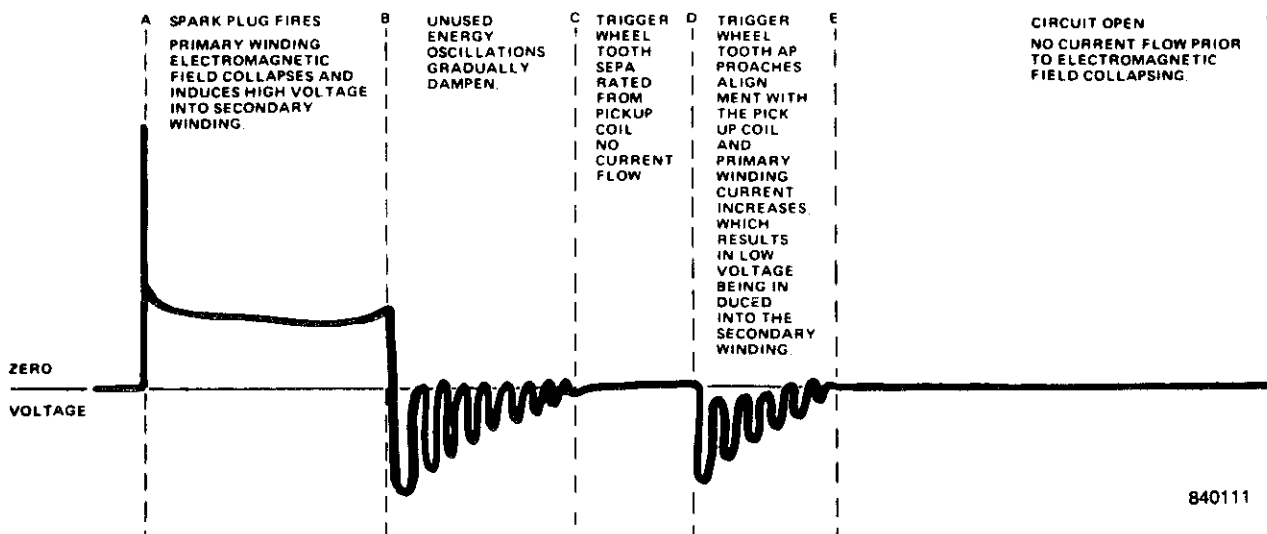
Clean the spark plug recesses with compressed air.

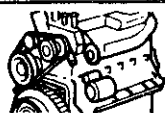
Remove the spark plugs.

Secure the throttle in the wide-open position.

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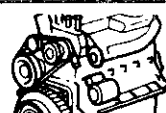
SSI SYSTEM





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GENERAL SERVICE AND DIAGNOSIS



Insert a compression pressure gauge and rotate the engine with the starter motor for three revolutions.

Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

Refer to the Specifications chart for the correct engine compression pressures.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will ascertain exhaust and intake valve leaks (improper seating), leaks between adjacent cylinders or into the water jacket, or any causes for combustion/compression pressure loss.

WARNING: Do not remove the radiator cap with the system hot and under pressure because serious burns from coolant can occur.

Check the coolant level and fill as required. Do not install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Position the carburetor fast idle speed adjustment screw on the top step of the fast idle cam.

Calibrate the tester according to the manufacturer's instructions.

NOTE: The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1 379 kPa (200 psi) maximum, and 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions.

NOTE: While testing, listen for pressurized air escaping through the carburetor, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25 percent leakage. For example, at 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

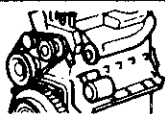
A leaking cylinder head gasket usually results in a loss of power, loss of coolant and engine misfire.

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

A cylinder head gasket leaking between two adjacent cylinders is indicated by a loss of power and/or engine misfire.

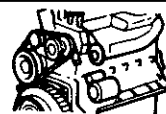
A cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

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Cylinder-to-Cylinder Leakage Test

To determine if a cylinder head gasket is leaking between any two adjacent cylinders, follow the procedures outlined in Cylinder Compression Pressure Test.

NOTE: A cylinder head gasket leaking between two adjacent cylinders will result in approximately a 50 to 70 percent reduction in compression pressure (in comparison to the other cylinders) in the two affected cylinders.

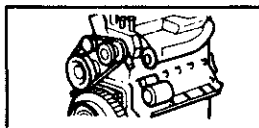
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Cylinder Combustion Pressure Leakage Test

Cylinder Combustion Pressure Leakage Test Diagnosis

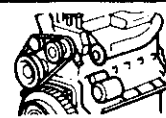
Condition	Possible Cause	Correction
AIR ESCAPES THROUGH CARBURETOR/THROTTLE BODY	(1) Intake valve not seated properly.	(1) Refer to Valve Reconditioning – MOT. 2.46L or MOT. 4.2L.
AIR ESCAPES THROUGH TAILPIPE	(1) Exhaust valve not seated properly.	(1) Refer to Valve Reconditioning – MOT. 2.46L or MOT. 4.2L.
AIR ESCAPES THROUGH RADIATOR	(1) Head gasket leaks or crack in cylinder block.	(1) Remove cylinder head and inspect.
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	(1) Head gasket leaks or crack in cylinder block or head between adjacent cylinders.	(1) Remove cylinder head and inspect.
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	(1) Stuck or broken piston ring(s); cracked piston; worn rings and/or cylinder wall.	(1) Inspect for broken ring(s) or piston. Measure ring gap and cylinder diameter, taper, and out-of-round.

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Cylinder-to-Water Jacket Leakage Test

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

Remove the radiator cap.

Start the engine and allow it to warm up until the thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

If bubbles are not visible, install a radiator pressure tester and pressurize the coolant system.

If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

Apply engine oil to the exposed gasket area (EDGE) between the manifold and the cylinder head.

If oil is forced into the manifold and if smoke is visible from the exhaust tailpipe, the manifold has an air leak.

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

Intake Manifold Exterior Leak Diagnosis

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

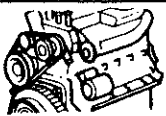
Start the engine.

Open the acetylene valve of an oxyacetylene torch. Do not ignite.

Pass the torch tip over the exposed gasket area (EDGE) between the manifold and the cylinder head.

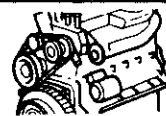
If the engine speed increases, the manifold has an air leak.

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ENGINE TUNE-UP PROCEDURES



GENERAL INFORMATION

An engine tune-up is recommended every 48 000 km (30,000 mi). A tune-up ensures the engine is operating as efficiently and economically as it was designed to operate. Also, it ensures that undesirable exhaust and fuel system emission to the atmosphere are within the limits defined by regulations.

For convenience, when performing a tune-up, the necessary services are grouped together by either major assembly or system.

DRIVE BELTS

Inspect the belts for defects such as fraying and cracks.

Test the belt tension. Belt tension testing, adjustment, arrangements and tension specifications are listed in the Cooling Systems section.

VACUUM HOSES AND FITTINGS

Inspect the vacuum hose fittings for looseness and corrosion. Inspect the hoses for brittleness and cracks.

Thoroughly inspect the hose ends that are slipped onto nipples.

Engine performance may be adversely affected by air leaks into such unlikely places as the heater and air conditioner control vacuum hoses or the power brake booster vacuum hose.

IGNITION SYSTEM

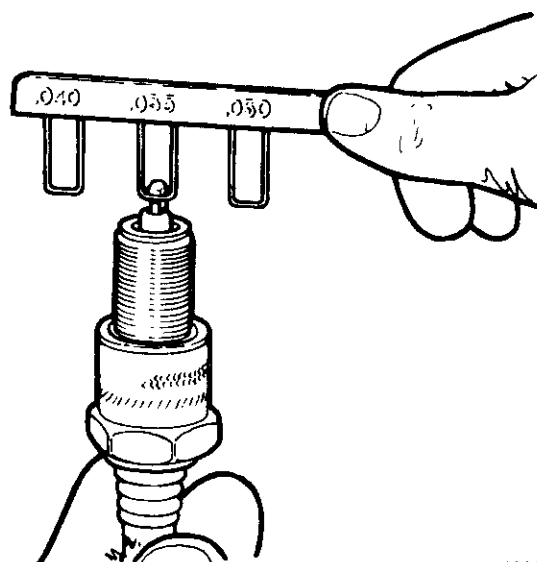
Spark Plugs

Remove and examine the spark plugs for burned electrodes and fouled, cracked or broken porcelain insulators.

Retain the plugs arranged in the order in which they were removed from the engine. A specific plug displaying an abnormal condition indicates that a problem exists in the cylinder from which it was removed.

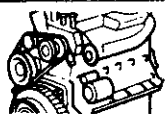
Replace the plugs at the interval recommended in the Engine Maintenance Schedule. Plugs with less engine mileage may be cleaned and reused in some circumstances. Refer to Spark Plug Condition.

After cleaning, file the center electrode tip flat with a point file. Adjust the gap (SEPARATION) between the electrodes to the specified dimension.



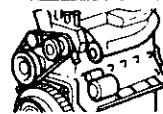
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ENGINE TUNE-UP PROCEDURES



Always use a torque wrench when installing the spark plugs. Distortion from overtightening will change the plug electrode gap. For all engines, tighten the plugs with 9.5 - 20 N·m (7 - 15 ft-lbs) torque.

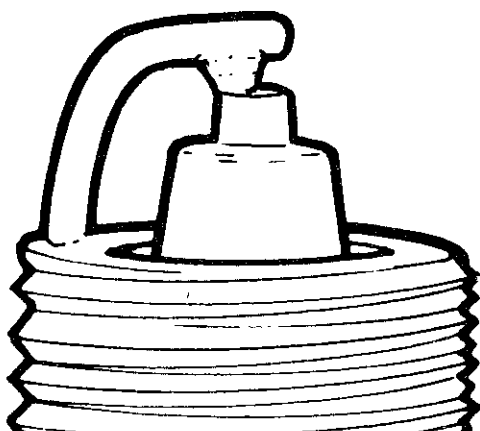
Spark Plug Condition

Compare the spark plug condition with the illustrated examples and the following descriptions.

Spark Plug Condition – Electrode Gap Bridging

Electrode gap bridging can result from loose deposits in the combustion chamber.

LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED.



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Fluffy deposits may accumulate on the plug electrodes during stop-and-go driving.

When the engine is suddenly operated with a high torque load, this material can liquefy and bridge the gap (i.e., short circuit the electrodes).

Spark Plug Condition – Scavenger Deposits

Fuel scavenger deposits may be white or yellow.

LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED.



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They may appear to be harmful, but this is a normal appearance caused by chemical additives in certain fuels.

Such additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies.

Notice that the accumulation of deposits on the ground (side) electrode and shell area may be heavy, but the material is easily removed.

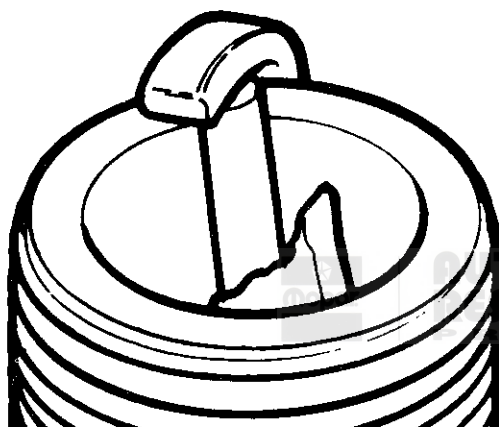
Spark plugs with this type of deposit can be considered normal in condition and can be cleaned using standard procedures.

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Spark Plug Condition – Chipped Electrode Insulator

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap.

PLUGS WITH THIS CONDITION MUST BE REPLACED.



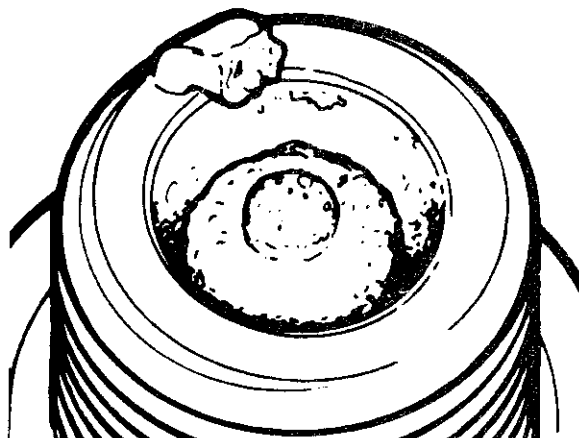
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Under certain conditions, severe detonation can also separate the insulator from the center electrode.

Spark Plug Condition – Pre-ignition Damage

Pre-ignition damage is caused by excessive engine temperature. First the center electrode liquefies, and somewhat later, the ground (side) electrode.

PLUGS WITH THIS CONDITION MUST BE REPLACED.

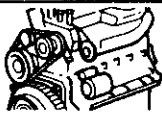


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The Insulators appear relatively clean of deposits.

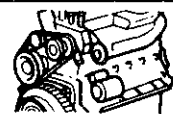
Determine if the spark plug has the correct heat range rating, if the ignition timing is overadvanced or if other conditions are causing engine overheating.

NOTE: The heat range rating refers to the operating temperature of a particular type spark plug. Spark plugs are designed to operate within specific temperature ranges depending upon the thickness and length of the center electrode porcelain insulator.



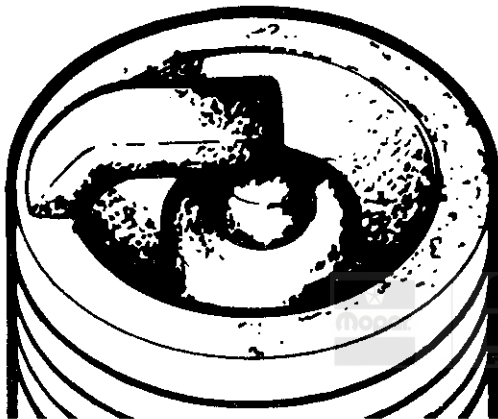
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ENGINE TUNE-UP PROCEDURES



Spark Plug Condition – Cold Fouling/Carbon Fouling

The deposits that cause cold fouling are basically carbon. **LOW MILEAGE PLUGS IN THIS CONDITION MAY BE CLEANED.**



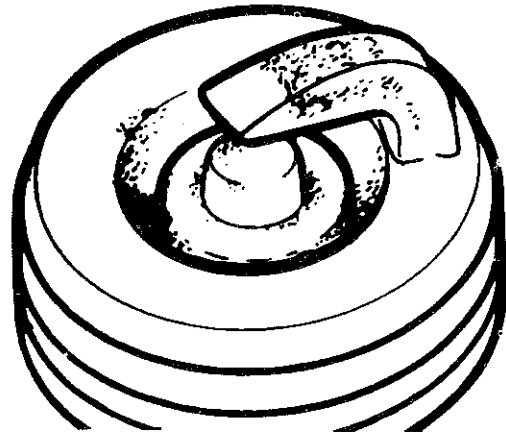
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A dry, black appearance of one or two plugs in a set may be caused by sticking valves or faulty spark plug wires.

Cold (carbon) fouling of the entire set may be caused by a clogged air cleaner or a faulty carburetor choke.

Spark Plug Condition – Spark Plug Overheating

Overheating is indicated by a white or gray electrode insulator that also appears blistered. **PLUGS IN THIS CONDITION MUST BE REPLACED.**



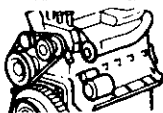
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The increase in electrode gap will be considerably in excess of 0.025mm per 1 609 km (0.001 in. per 1000 mi) of engine operation. This suggests that a spark plug with a cooler heat range rating should be used.

Overadvanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

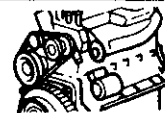
NOTE: Fuel refiners in several parts of the United States have introduced a manganese compound additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust-colored deposit. This rust color may be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance is not affected by MMT deposits.

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ENGINE TUNE-UP PROCEDURES



Spark Plug and Ignition Coil Wires

To remove the wires from the spark plugs, twist the rubber protector boot approximately 1/2 turn to break the seal.

Grasp the boot and pull it away from the plug with a constant force.

Do not pull on the wire itself because this will damage the conductor and terminal connection.

To remove the wires from the distributor cap or ignition coil tower, loosen the boot first, then grasp the upper part of the boot and the wire and gently pull straight up.

Spark Plug Wire Test

Do not puncture the spark plug wires with a probe while performing any test. This may cause a separation in the conductor.

The preferred method is to remove the suspected wire and use an ohmmeter to determine if the resistance is correct for the length of the particular wire.

Refer to the Spark Plug and Coil Wire Resistance Values chart.

Spark Plug and Coil Wire Resistance Values

Cm (Inches)	Ohms
0-38 (0-15)	3,000-10,000
38-63 (15-25)	4,000-15,000
63-90 (25-35)	6,000-20,000
over 90 (Over 35)	8,000-25,000

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When installing the spark plug wires and the ignition coil high voltage wire, ensure that mechanically tight connections are made at the spark plugs, distributor cap towers and ignition coil tower.

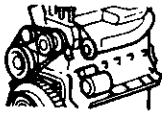
The wire protector boots at the spark plugs, distributor cap towers and coil tower must also fit tightly.

A partially seated wire terminal creates an air separation (resistance) in the high voltage circuit and the resulting arcing will cause terminal corrosion and wire conductor damage.

When replacing spark plug wires, route the wires correctly and secure them within the proper retainers.

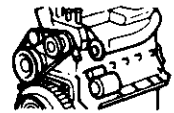
Failure to route the wires properly can result in radio ignition noise and cross ignition of the plugs, or short circuit the wires to ground.

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ENGINE TUNE-UP PROCEDURES



Ignition Coil

Always test a suspected malfunctioning ignition coil while installed in the vehicle. Because a coil may break down only after it has reached normal operating temperature, it is important that the coil be at normal operating temperature, when tested.

If using an ignition coil tester (not an ohmmeter), perform the tests according to the instructions provided by the manufacturer of the equipment.

Refer to the Ignition Systems section within Chapter C for additional information.

Distributor

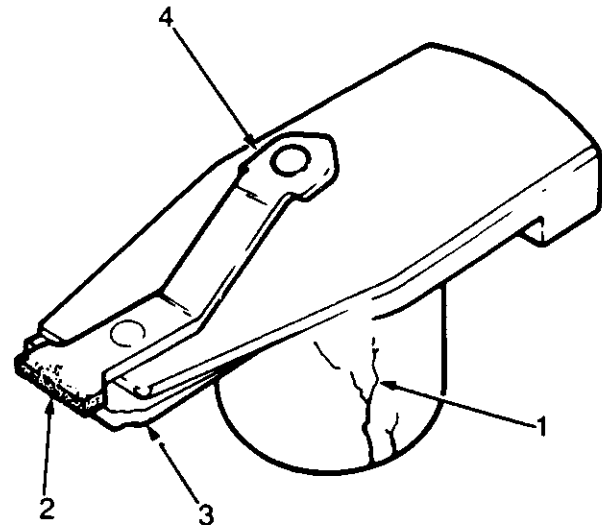
The distributor is the Solid State Ignition (SSI) type.

Other than cap and rotor inspection, there is no scheduled maintenance for the distributor.

Refer to the Ignition Systems section within Chapter C for distributor service procedures.

Distributor Rotor Inspection

Visually inspect the rotor for cracks (1), evidence of corrosion (2) and the effects of arcing on the metal tip, and evidence of mechanical interference with the cap (3).



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A small quantity of silicone dielectric compound is applied to the rotor tips during manufacture to reduce radio ignition noise and interference.

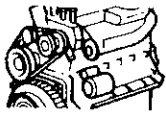
After a few thousand miles of engine operation, this compound becomes charred. This is normal. Do not scrape the residue from the rotor tip.

Inspect the spring (4) for insufficient tension.

Replace a rotor displaying any adverse condition.

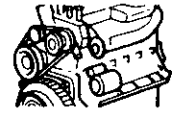
Coat the tip of the replacement rotor with AMC Silicone Dielectric Compound, or equivalent.

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ENGINES

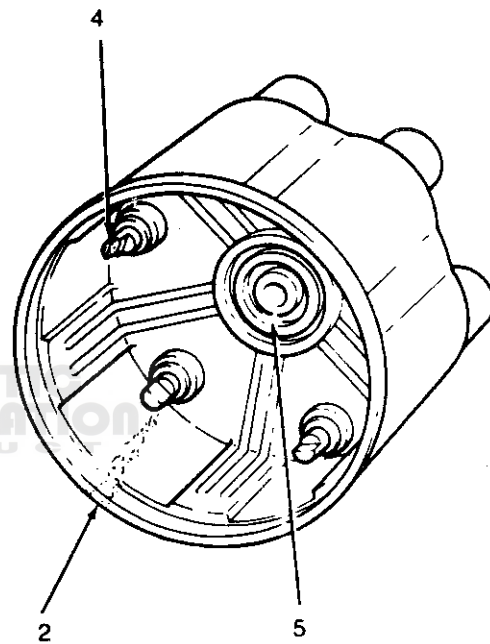
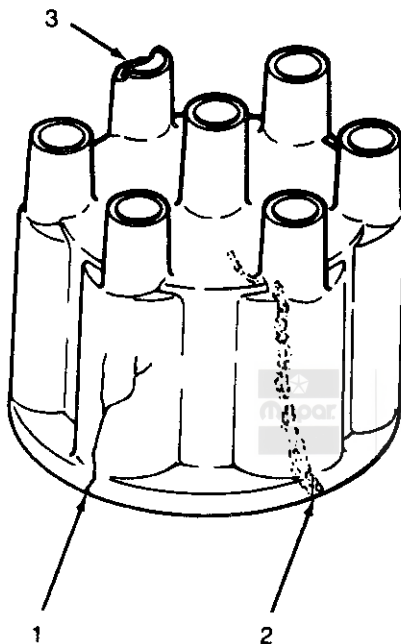
ENGINE TUNE-UP PROCEDURES



Distributor Cap Inspection

Remove the distributor cap and clean it with a clean, dry cloth. Visually inspect for cracks (1), carbon paths (2), broken towers (3), charred or eroded terminals (4) and a damaged rotor button (5). Replace any cap that has any of these discrepancies.

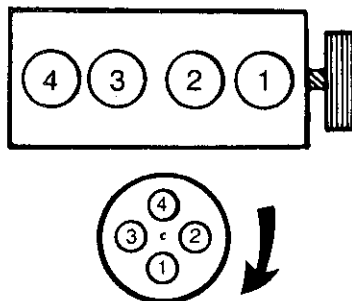
When replacing a cap, transfer one ignition wire at a time to the replacement cap. If necessary, refer to the Distributor Wiring Diagram.



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Four-Cylinder Firing Order

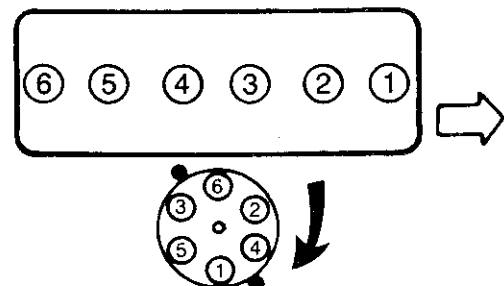
Firing Order
1 - 3 - 4 - 2



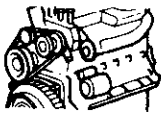
83132A

Six-Cylinder Firing Order

Firing Order
1 - 5 - 3 - 6 - 2 - 4

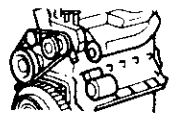


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ENGINES

ENGINE TUNE-UP PROCEDURES



Ensure each wire is installed in the tower corresponding to the tower from which it was removed. Insert the wire terminals firmly into the towers.

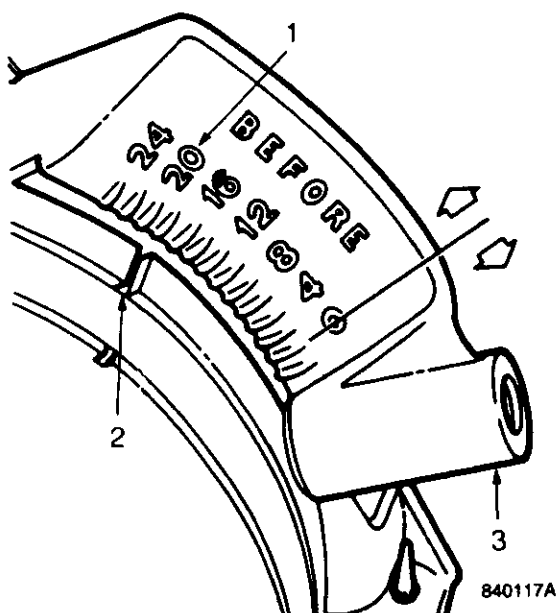
Replace the cap if the terminal ends inside the cap are excessively eroded (4).

The vertical face of the terminal end will have some evidence of erosion from normal operation.

Examine the terminal ends for evidence of mechanical interference with the rotor tip.

Ignition System Timing

Six-cylinder engines have a graduated timing degree scale (1) located on the timing case cover that is used for reference when timing the ignition system.



A milled index notch (2) in the vibration damper is used to align the No. 1 cylinder ignition

position of the crankshaft with the correct timing degree mark on the graduated scale.

Magnetic Timing Probe

Six-cylinder engines have a magnetic timing probe socket (3) integral with the timing degree scale for use with a special magnetic timing probe.

This special probe detects the milled notch on the vibration damper. The probe is inserted through the probe socket until it contacts the vibration damper.

Ignition timing can then be obtained from a meter or computer printout, depending on the type of equipment being used.

The probe socket is located at 9.5° ATDC, and the equipment is calibrated to compensate for this location.

Do not use the timing probe socket as a reference to check the ignition timing when using a conventional timing light.

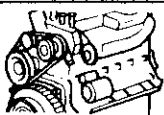
Ignition Timing Procedure – 4.2 Liter (258 CID) (Six-Cylinder Engine)

The ignition timing can be adjusted according to the following primary timing procedure.

Set the parking brake. Shift automatic transmissions to PARK and manual transmissions to the NEUTRAL position.

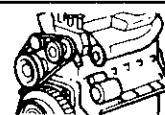
Start the engine and allow it to attain normal operating temperature. Ensure that the A/C is turned OFF, if equipped.

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With the ignition switch OFF, connect an ignition timing light and a calibrated, expanded scale tachometer.

NOTE: If the timing light has an adjustable advance control feature, turn the control to the OFF position.

Disconnect the 4-in. and 10-in. Hg (CEC System) vacuum switch assembly wire connector (located at the top of the cylinder head cover).

Disconnect and plug the distributor vacuum advance hose.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

Start the engine.

Increase the engine speed to 1600 rpm and check the ignition timing. If necessary, adjust the timing to the specification listed on the Emission Control Information label. Also, refer to the ignition advance curve illustrations.

Tighten the distributor hold-down clamp and verify that the ignition timing is correct.

Turn the engine OFF and remove the timing light and tachometer.

Connect the No. 1 spark plug wire, if disconnected. Connect the hose to the distributor vacuum advance mechanism. Connect the wire connector to the vacuum switch assembly.

The ignition timing can also be adjusted according to the following alternate procedure.

The Alternate Timing Procedure does not require that the engine speed be increased to 1600 rpm.

Set the parking brake.

Shift automatic transmissions to PARK and manual transmissions to the NEUTRAL position.

Start the engine and allow it to attain normal operating temperature. Ensure that the A/C is turned to the OFF position, if equipped.

With the ignition switch OFF, connect an ignition timing light and a calibrated, expanded scale tachometer.

NOTE: If the timing light has an adjustable advance control feature, turn the control to the OFF position.

Disconnect the 4-in. Hg vacuum switch hose (located at the top of the cylinder head cover) and plug the hose opening.

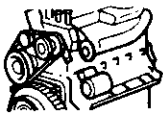
NOTE: The 4-in. Hg vacuum switch has black and red wires connected to it.

Disconnect the distributor vacuum advance hose and connect the hose to the 4-inch Hg vacuum switch.

Disconnect the knock sensor wire connector and connect the wire connector to the cylinder block (GROUND) with a jumper wire.

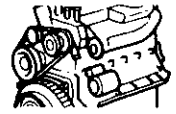
NOTE: Grounding the knock sensor wire connector prevents electromagnetic interference (EMI) from causing erroneous reactions by the FFB system micro computer unit (MCU).

Start the engine.



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ENGINE TUNE-UP PROCEDURES



WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

With the engine at idle speed, check the timing. If necessary, adjust the timing one degree higher than the specification listed on the Emission Control Information label. Also, refer to the ignition advance curve illustrations.

NOTE: With the alternate timing procedure, the basic timing must be one degree higher than the specification listed on the Emission Control Information label. For example, if the timing specification is listed as $6^{\circ} \pm 2^{\circ}$ at 1600 rpm, the alternate procedure requires $7^{\circ} \pm 2^{\circ}$ at idle speed.

Distributor Advance Mechanism Testing – Six-Cylinder ONLY

Centrifugal Advance Test

Set the parking brake. Shift automatic transmissions to PARK and manual transmissions to NEUTRAL.

Start the engine and allow it to attain normal operating temperature. Ensure that the A/C is turned OFF, if equipped.

With the ignition switch OFF, disconnect the three-wire connector from the 4-in. and 10-in. Hg vacuum switch assembly.

Disconnect and plug the vacuum hose connected to the distributor vacuum advance mechanism.

Connect a timing light between the No. 1 spark plug and wire.

Connect the timing light power wire connectors according to the manufacturer's instructions.

Connect a calibrated, expanded scale tachometer to the coil negative (TACH) terminal.

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.

Start the engine and slowly increase the speed while observing the timing mark and index with the timing light.

The ignition timing should advance smoothly as the engine speed increases. Refer to the ignition advance curve illustrations.

If the ignition timing advances unevenly, check and repair the centrifugal advance mechanism.

Connect the distributor vacuum advance hose and the vacuum switch assembly three-wire connector.

Remove the timing light and connect the No. 1 cylinder spark plug wire.

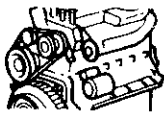
Remove the tachometer.

Vacuum Advance Test – Six-Cylinder ONLY

Set the parking brake. Shift automatic transmissions to PARK and manual transmissions to the NEUTRAL position.

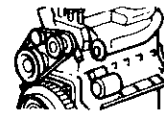
Start the engine and allow it to attain normal operating temperature. Ensure that the A/C is turned OFF, if equipped.

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With the ignition switch OFF, disconnect the three-wire connector from the 4-in. and 10-in. vacuum switch assembly.

Disconnect and plug the vacuum hose connected to the distributor vacuum advance mechanism.

Connect Hand Operated Vacuum Pump J-23738-A, or equivalent, to the distributor vacuum advance mechanism.

Connect a timing light between the No. 1 spark plug and wire.

Connect the timing light power wire connectors according to the manufacturer's instructions.

Connect a calibrated, expanded scale tachometer to the coil negative (TACH) terminal.

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.

Start the engine.

Increase the engine speed and apply 60.9 kPa (18-in. Hg) vacuum.

Observe the ignition timing degree scale and index with the timing light.

The ignition timing should advance smoothly. Refer to the ignition advance curve illustrations.

NOTE: A defective FFB system MCU or ignition system ECU can alter the ignition timing.

Remove the timing light and tachometer. Connect the spark plug wire.

Distributor Advance Mechanism Testing – OFF-Engine – Six-Cylinder ONLY

The distributor ignition advance may also be tested with the distributor removed from the engine. Follow the distributor test equipment manufacturer's instructions.

The information provided within the ignition advance curve illustrations is for on-engine testing.

If the distributor ignition advance is being tested with a distributor tester, convert the information within the ignition advance curves from engine rpm to distributor rpm and from engine degrees to distributor degrees:

Distributor RPM

Divide the engine rpm by 2 to obtain the distributor rpm.

Distributor Degrees Advance

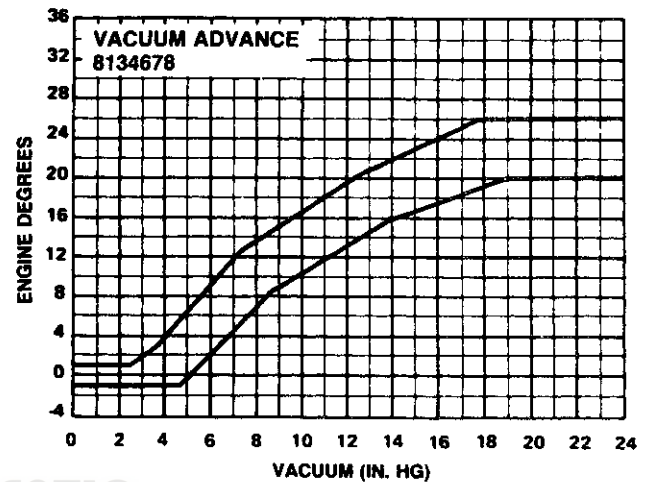
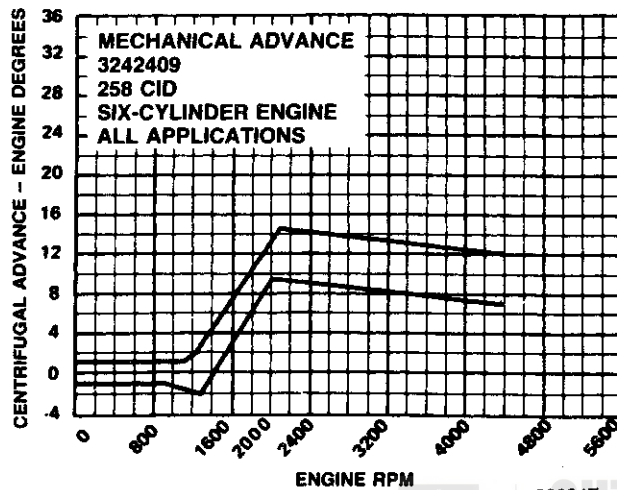
Divide the engine degrees advance by 2 to obtain the distributor degrees advance.

For example, if the ignition advance curve indicates 8 - 12 degrees advance at 2000 rpm, the corresponding on-tester specifications would be 4 - 6 degrees advance at 1000 rpm.

NOTE: The specified kPa (in. Hg) of vacuum is the same, regardless if the test is on-engine or off-engine.

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Distributor Ignition Advance Curves – Six-Cylinder Engine



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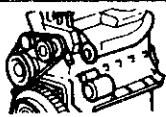
TUNE-UP SPECIFICATIONS

SEE I.S. NOTES

Engine Displacement Carburetion and Application	Series and Model	Trans.	Initial Timing BTDC at 1600 RPM With Vacuum Advance Hose Disconnected and Plugged and Vacuum Switch Assembly 3-Wire Connector Disconnected	Curb Idle Speed - RPM (Auto. in Drive, Manual in Neutral)	Sole-Vac Idle Speed (Auto. in Drive, Manual in Neutral)		Distributor Model Number	Vacuum Advance Mechanism	Centrifugal Degrees Advance at 2000 RPM	Vacuum Advance	Spark Plug Type and Gap
			Set To	Set To	Vacuum Actuator Energized	Holding Solenoid Energized					
258 2V 49 State	81 82	M	9° ± 2°	680	1100	900	3242409	8134678	7.5-12.5	Refer to Distributor Curves	Champion RFN14LY (Alternate FN14LY) 0.85 mm (0.035 in) Gap 0.84 to 0.97 mm (0.033 to 0.038 in)
		A	9° ± 2°	600	900	900					
258 2V Calif.	81 82	M	9° ± 2°	680	1100	800					
		A	9° ± 2°	600	900	800					
258 2V High Alt.	81 82	M	16 ± 2	700 ± 70	1100	900					
		A	16 ± 2	650 ± 70	900	800					

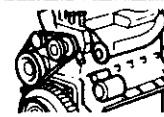



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ENGINE TUNE-UP PROCEDURES



FUEL SYSTEM

General Information

The fuel system depends on hoses and tubing to route liquid fuel, fuel vapor and vacuum.

Fuel vapor leaks and air leaks into the vacuum hoses and fittings upset the operation of the engine and may reduce the effectiveness of the emission control devices.

Liquid fuel leaks not only waste fuel but also create a fire hazard.

Carefully inspect the hoses and fuel pipes for cracks, dents, corrosion and abnormal bends.

Inspect the fittings for corrosion and looseness.

Inspect the fuel tank for leaks caused by loose mounting straps, broken seams, dents or corrosion.

Inspect the filler neck grommets and hoses for the proper condition.

Air Cleaner

Replace the dry-type air cleaner filter element during each tune-up. Under extreme engine operating conditions, more frequent replacement is recommended.

Fuel Filter

All Jeep vehicles have two fuel filters:

- The in-tank filter is designed to be maintenance-free.

- The in-line filter located between the fuel pump and the carburetor/throttle body requires periodic replacement.

The fuel filter is located on the left frame rail on TBI models.

When installing a replacement filter, ensure the fuel return nipple is positioned above the filter (Six-Cylinder ONLY).

CARBURETOR IDLE SPEED ADJUSTMENTS

General Information

NOTE: Idle mixture adjustments **ARE NOT REQUIRED** as a normal service adjustment.

The engine and related systems must be operating properly before performing the idle speed adjustments.

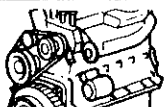
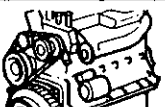
WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or the fan. Do not wear loose clothing.

Fast Idle Speed Adjustment – Six-Cylinder Engine

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.

Adjust the fast idle speed with the engine at normal operating temperature and the EGR valve vacuum hose disconnected and plugged.

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Connect a calibrated, expanded scale tachometer and observe it for the adjustment.

Position the fast idle speed adjustment screw in contact with and against the shoulder of the second step of the fast idle cam.

Refer to the Specifications chart and the Vehicle Emission Control Information label located under the hood. Adjust the engine speed to the correct rpm. Adjust by turning the fast idle speed adjustment screw.

Disconnect the tachometer.

Idle Speed Adjustment – Six-Cylinder Engine

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.

Connect a calibrated, expanded scale tachometer to the ignition coil negative (TACH) terminal.

Start and allow the engine to attain normal operating temperature.

The carburetor choke and intake manifold heater must be off. This occurs when the engine coolant heats to approximately 71°C (160°F).

NOTE: When adjusting the idle speed, place manual transmissions in the NEUTRAL position and automatic transmissions in DRIVE. Turn all accessories off.

WARNING: Set the parking brake firmly. Do not accelerate the engine.

NOTE: Adjust the idle speeds to the specifications listed on the engine compartment emission label.

Sole-Vac Vacuum Actuator Adjustment

Disconnect and plug the vacuum hose to the sole-vac vacuum actuator.

Disconnect the sole-vac electrical connector.

Connect an external vacuum source to the vacuum actuator and apply 10-15 inches (Hg.) of vacuum.

Open throttle for **AT LEAST 3.0 SECONDS (1200 rpm)**; then, close the throttle.

Set the speed using the vacuum actuator adjustment screw on the throttle lever to obtain specified rpm.

Disconnect the external vacuum source.

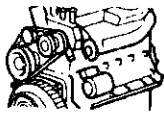
Reconnect the sole-vac vacuum hose and electrical connector.

Sole-Vac Holding Solenoid Adjustment

NOTE: The sole-vac vacuum actuator adjustment should **ALWAYS PRECEDE** the sole-vac solenoid adjustment.

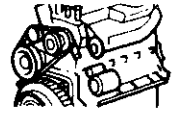
Disconnect and plug the vacuum hose to the sole-vac vacuum actuator.

Disconnect the sole-vac electrical connector.



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Energize the sole-vac holding solenoid with either of the following methods:

- Apply battery voltage (+ 12V) to the solenoid, or
- Reconnect the sole-vac electrical connector and turn on the rear window defogger; or, turn on the air conditioner with the compressor disconnected.

Open throttle for **AT LEAST 3.0 SECONDS (1200 rpm)** to allow the sole-vac holding solenoid to fully extend.

Set the speed using the 1/4-in hex-head adjustment screw on the end of the sole-vac unit to obtain the specified rpm.

Reopen the throttle above 1200 rpm to insure the correct holding position; and, reset speed if necessary.

Reconnect the vacuum hose to the sole-vac actuator.

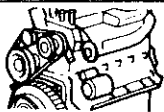
Reconnect the sole-vac electrical connector, if disconnected.

Curb Idle Speed Adjustment

Open throttle for **AT LEAST 3.0 SECONDS (1200 rpm)**; then, close throttle.

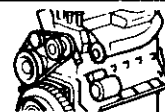
Set the speed using the curb idle adjustment screw on the throttle lever to obtain specified rpm. (Automatic transmission in DRIVE with parking brake applied).

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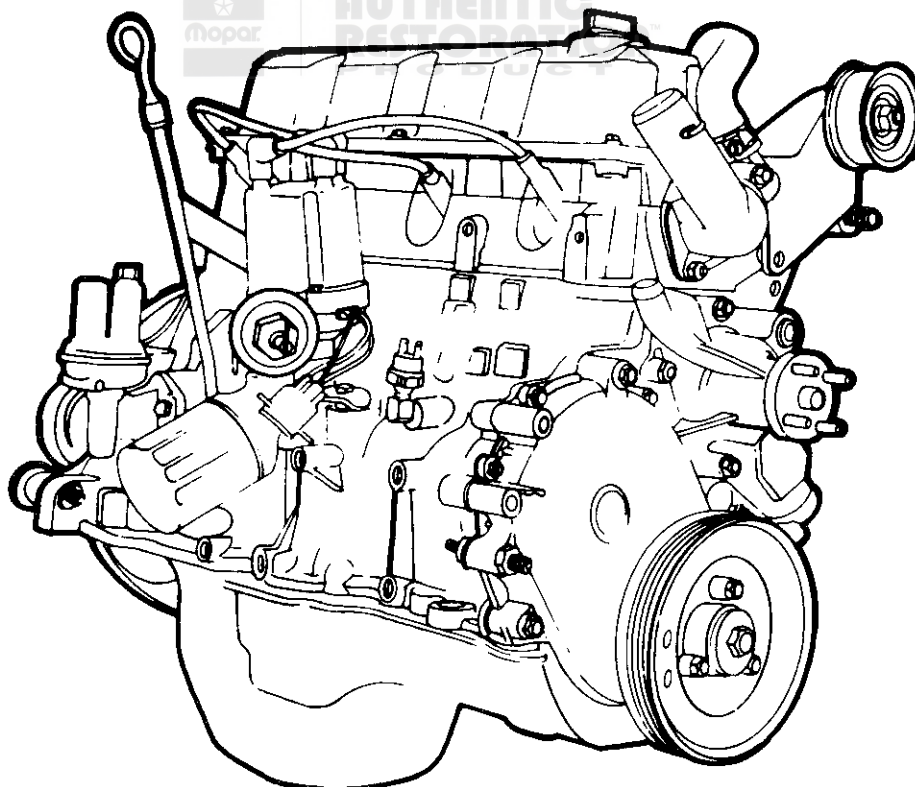
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



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Engine	Displacement	Bore mm (in)	Stroke mm (in)	Comp. Ratio	Injection System	Oil Capacity
In-Line 4-Cylinder	2.46L 150 CID	98 (3.876)	80 (3.188)	9.2:1	Throttle Body	4.0 qts. 3.8L 3.3 imp qts. (w/wo filter change)

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	ENGINES 2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	
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GENERAL INFORMATION

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No. 3 and No. 4 cylinders.

The numbers of the code identify the YEAR, MONTH and DAY in which the engine was built.

The fourth character code letter identifies the cubic inch displacement, throttle body injection, and compression ratio.



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Engine Build Date Code Explanation

EXAMPLE: 709H28

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character* (Engine Type)	5th and 6th Characters (Day)
7 - 1987 8 - 1988	01 - 12	H	01 - 31

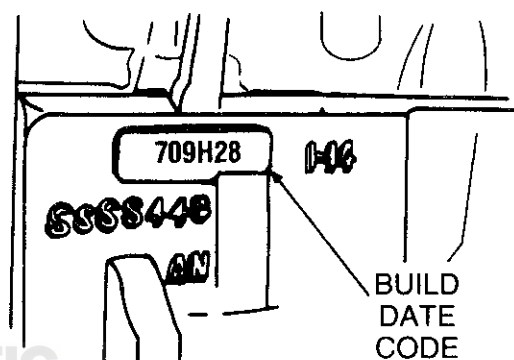
Letter Code*	CID	Fuel Injection	Compression Ratio
H	150	Renix TBI	9.2:1

The example code identifies a 2.46 liter (150 CID) engine with a throttle body injection, 9.2:1 compression ratio, and built on September 28, 1987.

60257B

NOTE: Engines built for sale in Georgia and Tennessee have an additional, nonrepeating number located on the right side of the engine above the build date code .

Example: Kenosha-Built
E-1197277 or
W-1207177



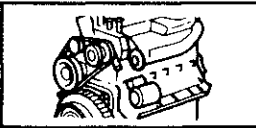
83101A

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Component Letter Codes – Oversize/Undersize

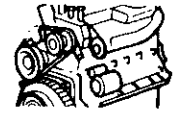
Some engines may be built with oversize or undersize components such as:

- oversize cylinder bores,
- undersize crankshaft main bearing journals,
- undersize connecting rod journals or oversize camshaft bearing bores.



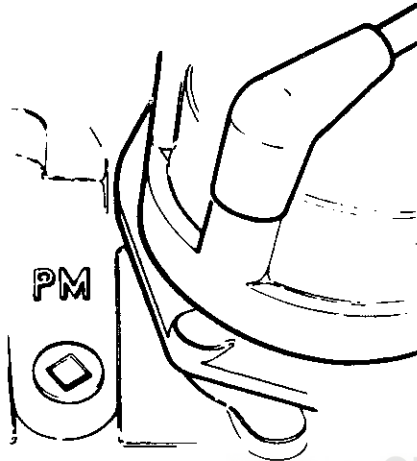
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



These engines are identified by a letter code (1) stamped on a boss (2) between the rear of the block and distributor .

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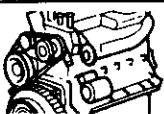
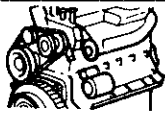
The letters are decoded as follows .

Oversize or Undersize Components Letter Code

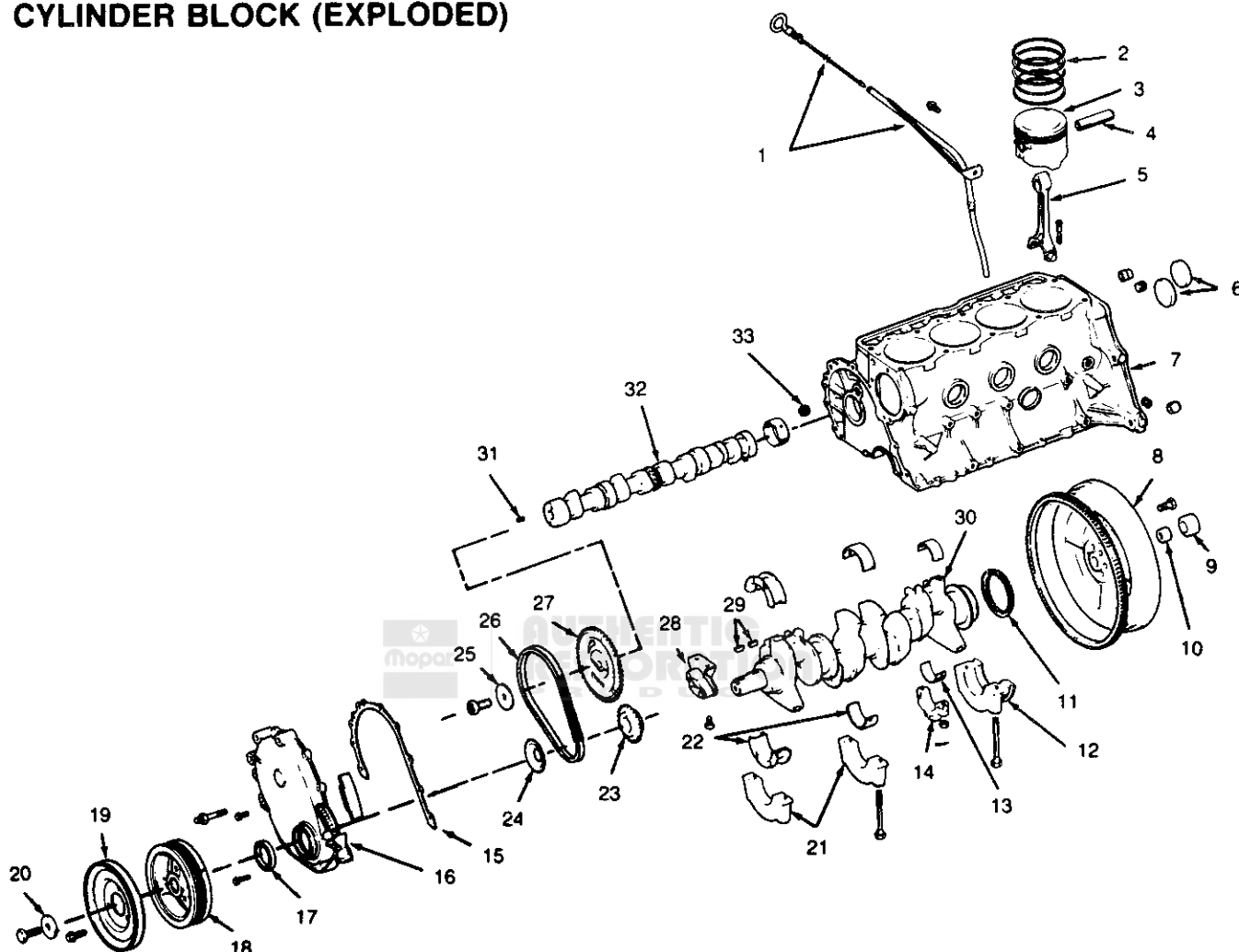
Code Letter	Definition	
B	All cylinder bores	0.254mm (0.010-inch) oversize
M	All crankshaft main bearing journals	0.254mm (0.010-inch) undersize
P	All connecting rod bearing journals	0.254mm (0.010-inch) undersize
C	All camshaft bearing bores	0.254mm (0.010-inch) oversize

Example: The code letters PM indicate that the crankshaft main bearing journals and connecting rod journals are 0.254mm (0.010-inch) undersize.

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	ENGINES 2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	
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FOUR-CYLINDER ENGINE – CYLINDER BLOCK (EXPLODED)

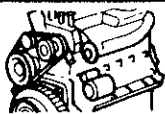


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1. Oil Level Gauge (Dipstick) and Tube
2. Ring Set
3. Piston
4. Pin Set
5. Connecting Rod
6. Plugs
7. Cylinder Block
8. Flywheel and Ring Gear (W/Manual Transmission)
9. Pilot Bushing (With Manual Transmission)
10. Bushing Oil Wick (With Manual Transmission)

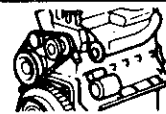
11. Main Bearing Cap Seal Kit (Rear)
12. Main Bearing Cap (Rear)
13. Connecting Rod Bearing
14. Connecting Rod Bearing Cap
15. Gasket
16. Timing Case Cover
17. Seal
18. Vibration Damper
19. Vibration Damper Pulley
20. Washer

21. Main Bearing Caps
22. Main Bearings
23. Crankshaft Sprocket
24. Oil Shedder (Slinger)
25. Washer
26. Timing Chain
27. Camshaft Sprocket
28. Timing Chain Tensioner
29. Keys
30. Crankshaft
31. Pin
32. Camshaft
33. Oil Channel Plug

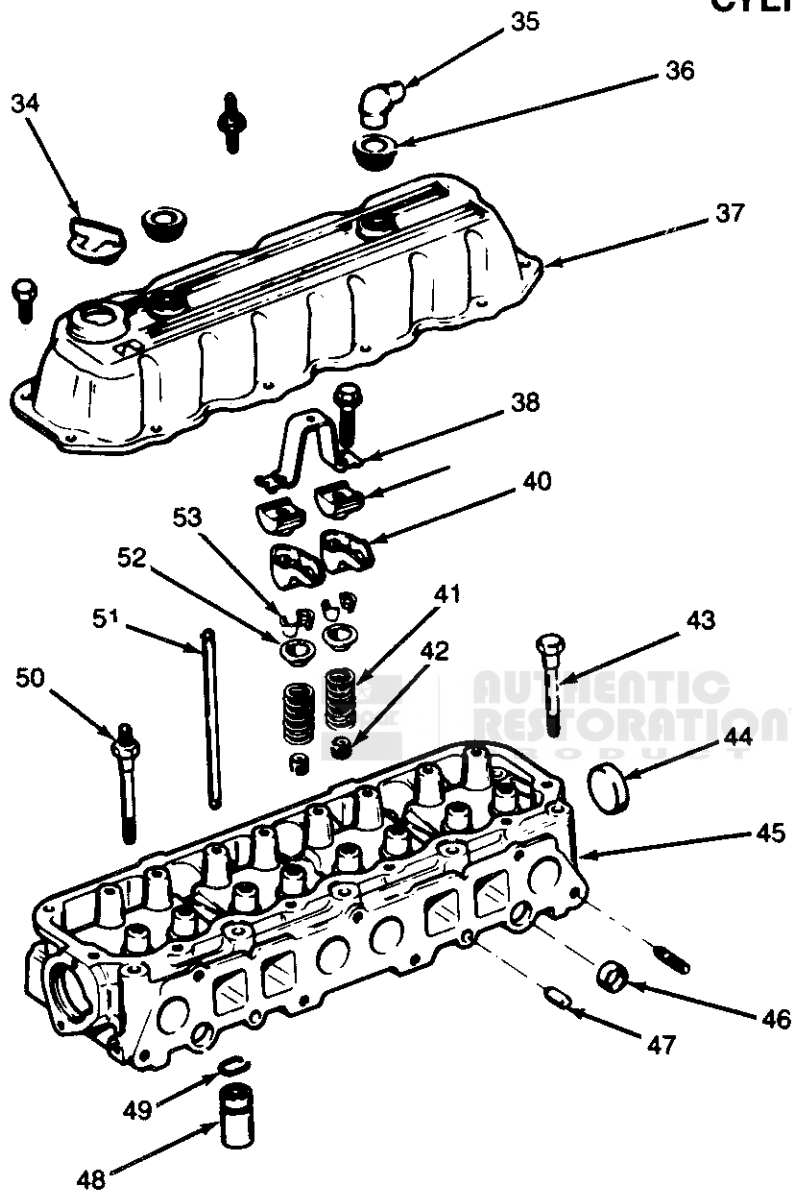


ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



FOUR-CYLINDER ENGINE — CYLINDER HEAD (EXPLODED)

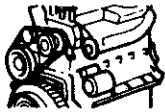
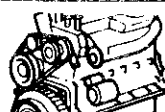


- 34. Oil Filler Cap
- 35. Ventilation Valve
- 36. Grommet
- 37. Cylinder Head (Rocker) Cover
- 38. Bridge
- 39. Pivot
- 40. Rocker Arm

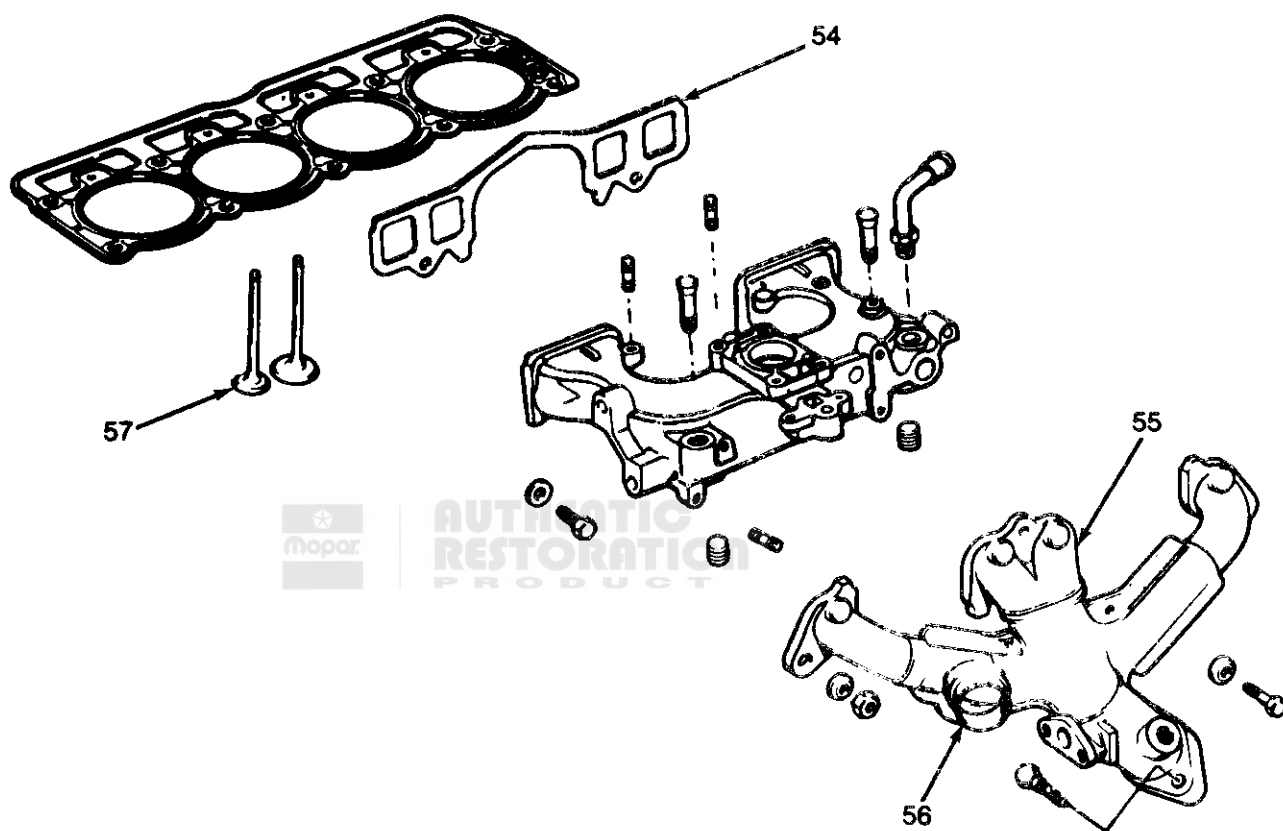
- 41. Valve Spring
- 42. Oil Deflector
- 43. Cylinder Head Bolt
- 44. Cylinder Head Core Plug
- 45. Cylinder Head
- 46. Plug

- 47. Dowel Pin
- 48. Tappet
- 49. Snap Ring
- 50. Cylinder Head Stud
- 51. Push Rod
- 52. Retainer
- 53. Valve Locks

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	ENGINES 2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	
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FOUR-CYLINDER ENGINE — CYLINDER HEAD (EXPLODED)



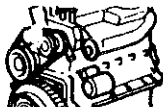
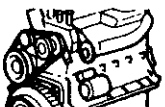
54. Intake Manifold Gasket

55. Exhaust Manifold

56. Heat Stove

57. Valve(s)

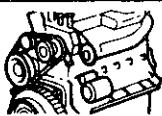
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	2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	

TORQUE SPECIFICATIONS

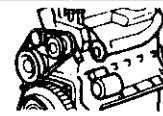
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Component	Service Set-To Torque	Service Recheck Torque
Alternator Pivot Bolt or Nut	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Alternator Adjusting Bolt	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Alternator Mounting Bracket-to-Engine	38 N·m (28 ft-lbs)	27-48 N·m (25-35 ft-lbs)
Alternator Mounting Bolt-to-Head	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Block Heater Nut	1.8 N·m (16 in-lbs)	1.5-2.1 N·m (14-19 in-lbs)
Camshaft Sprocket Screw	108 N·m (80 ft-lbs)	95-136 N·m (70-100 ft-lbs)
Carburetor Hold-Down Nuts	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Coil Bracket-to-Chassis	9.6 N·m (85 in-lbs)	6.7-10.1 N·m (60-90 in-lbs)
Connecting Rod Bolt Nuts	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Cylinder Head Capscrews	115 N·m (85 ft-lbs)	108-122 N·m (80-90 ft-lbs)
Cylinder Head Cover Nuts	6.2 N·m (55 in-lbs)	5-8.5 N·m (45-75 in-lbs)
Crankshaft Pulley-to-Damper	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Clutch Housing Spacer-to-Block Screws	16 N·m (12 ft-lbs)	12-20 N·m (9-15 ft-lbs)
Clutch Housing-to-Block Screws	75 N·m (55 ft-lbs)	96-84 N·m (48-62 ft-lbs)
Dipstick Tube Bracket Bolt-to-Cylinder Block	19 N·m (14 ft-lbs)	13-24 N·m (10-18 ft-lbs)
Distributor Clamp Bracket Screw	18 N·m (13 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Drive Plate-to-Converter Screw	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)



ENGINES

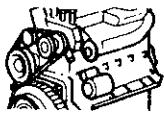
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



TORQUE SPECIFICATIONS (Continued)

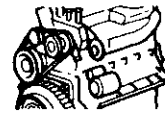
Component	Service Set-To Torque	Service Recheck Torque
EGR Valve Tube Nuts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
EGR Valve	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Exhaust Manifold Bolts	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust Pipe-to-Manifold Bolts	31 N·m (23 ft-lbs)	27-35 N·m (20-26 ft-lbs)
Fan and Hub Assembly Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Flywheel-to-Crankshaft Bolts	68 N·m + 60° (50 ft-lbs + 60°)	
Front Crossmember-to-Sill	88 N·m (65 ft-lbs)	75 N·m min (55 ft-lbs min)
Front Support Bracket-to-Cylinder Block	61 N·m (45 ft-lbs)	48-73 N·m (36-54 ft-lbs)
Front Support Cushion-to-Engine Mount (Thru-Bolt))	65 N·m (48 ft-lbs)	55-75 N·m (41-55 ft-lbs)
Front Support Cushion-to-Sill Bracket	40 N·m (30 ft-lbs)	23-47 N·m (17-35 ft-lbs)
Fuel Supply Tube-to-Throttle Body – 4-Cyl. (TBI)	18 N·m (13 ft-lbs)	15-22 N·m (11-16 ft-lbs)
5/16-in Inverted Flare Nut	18 N·m (13 ft-lbs)	15-22 N·m (11-16 ft-lbs)
Intake Manifold Coolant Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Intake Manifold Screws	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Main Bearing Capscrews	108 N·m (80 ft-lbs)	95-115 N·m (70-85 ft-lbs)
Oil Filter Adapter	65 N·m (48 ft-lbs)	57-75 N·m (42-55 ft-lbs)
Oil Level Sensor in Oil Pan	33 N·m (25 ft-lbs)	27-40 N·m (20-30 ft-lbs)
Oil Pan Drain Plug	34 N·m (25 ft-lbs)	27-41 N·m (20-30 ft-lbs)
Oil Pan Screws – 1/4-in – 20	9 N·m (7 ft-lbs)	7-15 N·m (5-11 ft-lbs)
Oil Pan Screws – 5/16-in – 18	15 N·m (11 ft-lbs)	12-20 N·m (9-15 ft-lbs)
Oil Pump Cover Screws	8 N·m (70 in-lbs)	7-11 N·m (60-100 in-lbs)
Oil Pump Attaching Screws (Short)	14 N·m (10 ft-lbs)	11-18 N·m (8-13 ft-lbs)
Oil Pump Attaching Screws (Long)	23 N·m (17 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Oxygen Sensor	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)

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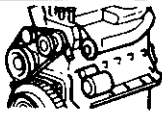
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



TORQUE SPECIFICATIONS (Continued)

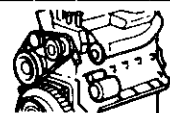
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Component	Service Set-To Torque	Service Recheck Torque
Power Steering Pump Adapter Screw	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Power Steering Pump Bracket Screw	38 N·m (28 ft-lbs)	27-48 N·m (20-35 ft-lbs)
Power Steering Pump Mounting Screw	38 N·m (28 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump Pressure Hose Nut	52 N·m (38 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Power Steering Pump Pulley Nut	79 N·m (58 ft-lbs)	54-88 N·m (40-65 ft-lbs)
Rear Crossmember-to-Side Sill Nut	41 N·m (30 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Rear Support Bracket-to-Transmission Bolts	45 N·m (33 ft-lbs)	37-51 N·m (27-38 ft-lbs)
Rear Support Cushion-to-Bracket Bolts	43 N·m (32 ft-lbs)	34-52 N·m (25-38 ft-lbs)
Rear Support Cushion-to-Crossmember Bolts	19 N·m (14 ft-lbs)	16-22 N·m (12-16 ft-lbs)
Rocker Arm Assembly-to-Cylinder Head Bolts	26 N·m (19 ft-lbs)	22-35 N·m (16-26 ft-lbs)
Spark Plug	37 N·m (27 ft-lbs)	30-45 N·m (22-33 ft-lbs)
Starter Motor-to-Cylinder Block Bolts	45 N·m (33 ft-lbs)	38-51 N·m (28-38 ft-lbs)
Tensioner Bracket-to-Cylinder Block Bolt	19 N·m (14 ft-lbs)	13-20 N·m (10-18 ft-lbs)
Throttle Body-to-Intake Manifold Attaching Nuts	21 N·m (16 ft-lbs)	19-24 N·m (14-18 ft-lbs)
Timing Case Cover-to-Block Screws	7 N·m (5 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Timing Case Cover-to-Block Studs	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Torque Converter Drive Plate-to-Crankshaft Bolts	54 N·m + 60° (40 ft-lbs) + 60°	
Thermostat Housing Bolt	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Vibration Damper Bolt (Lubricated)	108 N·m (80 ft-lbs)	95-135 N·m (70-100 ft-lbs)
Water Pump Bolt	18 N·m (13 ft-lbs)	13-24 N·m (10-18 ft-lbs)



ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



SPECIFICATIONS

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Type	In Line, OHV, 4-Cylinder	
Bore	3.876	98.45
Stroke	3.188	80.97
Displacement	150 cu. in.	2.46 liter
Compression Ratio	9.2:1	
Compression Pressure	155-185 psi	1068-1275 kpa
Maximum Variation Between Cylinders	30 psi	206 kpa
Firing Order	1-3-4-2	
Taxable Horsepower	24.04 bhp	17.9 kw
Fuel	Unleaded	
Camshaft		
Tappet Clearance	zero lash (hyd.) tappets	
End Play	zero (engine operation)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 max	0.03 max
Cam Lobe Lift	265	6.73
Valve Lift	424	10.7
Intake Valve Timing		
Opens	12° BTDC	
Closes	258° ATDC	
Exhaust Valve Timing		
Opens	236° BTDC	
Closes	34° ATDC	
Valve Overlap	46°	
Intake Duration	270°	
Exhaust Duration	270°	
Connecting Rods		
Total Weight (less bearings)	657-665 grams	
Total Length (center-to-center)	6.123-6.127	155.52-155.62
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2080-2.2085	56.08-56.09
Bearing Clearance	0.001-0.003	0.03-0.08
	0.0015-0.002	0.044-0.05
	Preferred)	Preferred)

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Side Clearance	0.010-0.019	0.001 per mm
Maximum Twist	0.001 per in	0.025 per mm
Maximum Bend	0.005 per in	0.005 per mm

Crankshaft

End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 2	1.271-1.273	32.28-32.33
No. 3-4	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025	0.03-0.06
	(0.002	(0.051
	Preferred)	Preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013

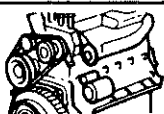
Cylinder Block

Deck Height	9.337-9.343	237.15-237.31
Deck Clearance	0.020	0.508
	(below deck)	(below deck)
Cylinder Bore Diameter (standard)	3.8751-3.8775	98.42-98.48
Maximum Taper	0.001	0.025
Maximum Out-of-Round	0.001	0.025
Tappet Bore Diameter	0.9055-0.9065	23.00-23.025
Cylinder Block Flatness	0.011-0.002/6.0	0.03-25-0.05/152

Cylinder Head

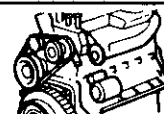
Combustion Chamber Volume	49.9-52.9 cc	
Valve Arrangement	E-I-E-E-I-E	
Valve Guide ID (Integral)	0.313-0.314	7.95-7.97
Valve Stem-to-Guide Clearance	0.001-0.003	0.02-0.07
Intake Valve Seat Angle	44° 30'	
Exhaust Valve Seat Angle	44° 30'	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.011-0.002/6.0	0.03-25-0.05/152

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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



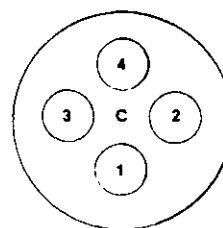
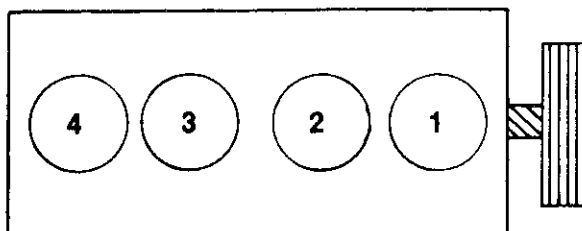
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	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Lubrication System		
Engine Oil Capacity	4 qts w/o filter change	3.8 liters w/o filter change
Normal Operating Pressure	13 psi at 600 rpm 37.75 psi (max.) at 1600 + rpm	89.6 kpa at 600 rpm 255.1-517.1 kpa (max.) at 1600 + rpm
Oil Pressure Relief	75 psi (max.)	517.1 kpa (max.)
Gear-to-Body Clearance (Radial)	0.002-0.004 (0.002 Pref.)	0.051-0.102 (0.051 Pref.)
Gear End Clearance, Plastigage	0.002-0.006 (0.002 Pref.)	0.051-0.152 (0.051 Pref.)
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 Pref.)	0.1016-0.2032 (0.1778 Pref.)
Pistons		
Weight (less pin)	1.24-1.25 lbs	563-567 grams
Piston Pin Bore Centerline-to-Piston Top	1.651-1.655	41.94-42.04
Piston-to-Bore Clearance	0.0009-0.0017 (0.0012-0.0013 Preferred)	0.023-0.043 (0.030-0.033 Preferred)
Piston Ring Gap Clearance — Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance — Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance		
No. 1 Compression	0.0017-0.0032 (0.0017 Pref.)	0.043-0.081 (0.043 Pref.)
No. 2 Compression	0.0017-0.0032 (0.0017 Pref.)	0.043-0.081 (0.043 Pref.)
Oil Control	0.001-0.008 (0.003 Pref.)	0.03-0.20 (0.08 Pref.)
Piston Ring Groove Height		
Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80

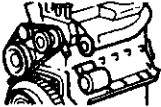
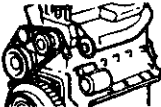
	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Piston Ring Groove Diameter		
No. 1 and No. 2	3.456-3.461	87.78-87.90
Oil Control	3.445-3.455	87.50-87.75
Piston Pin Bore Diameter	0.9308-0.9313	23.624-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Piston-to-Pin Clearance	0.0003-0.0005 (Loose 0.0005 Preferred)	0.008-0.013 (Loose 0.013 Preferred)
Piston Pin-to-Connecting Rod	2000 lbs./f Press-fit	8.9 kN Press-fit
Rocker Arms, Push Rods and Tappets		
Rocker Arm Ratio		1.6:1
Push Rod Length	9.640-9.660	244.856-245.364
Push Rod Diameter	0.312-0.315	7.92-8.00
Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05
Valves		
Valve Length		
(Tip-to-Gauge Dim. Line)	4.822-4.837 Int 4.837-4.852 Exh	122.47-122.85 122.85-123.24
Valve Stem Diameter	0.311-0.312	7.89-7.98
Stem-to-Guide Clearance	0.001-0.003	0.02-0.05
Intake Valve Head Diameter	1.905-1.915	48.38-48.6
Intake Valve Face Angle		44°
Exhaust Valve Head Diameter	1.495-1.505	37.97-38.6
Exhaust Valve Face Angle		44°
Maximum Allowable Removed for Tip Refinishing	0.010	0.25
Valve Springs		
Free Length	1.82	46.22
Spring Tension		
Valve Closed	66-74 lbs at 1.625	294-329 N at 41.28
Valve Open	205-220 lbs at 1.200	912-979 N at 30.48
Inside Diameter	0.948-0.968	24.08-24.5

Engine Firing Order

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	ENGINES 2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	
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SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly (short block) may be installed whenever the original cylinder block is defective or damaged beyond repair. It consists of the cylinder block, piston and rod assemblies and crankshaft.

NOTE: The camshaft must be procured separately and installed before the engine is installed in the vehicle.

NOTE: For identification, short engine assemblies have the letter S stamped on the same machined surface where the build date code is stamped for complete engine assemblies.

Installation includes the transfer of components from the defective or damaged original engine.

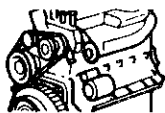
Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this chapter.

ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine and at the rear between the transmission extension housing and the rear support crossmember.

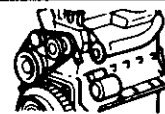
Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

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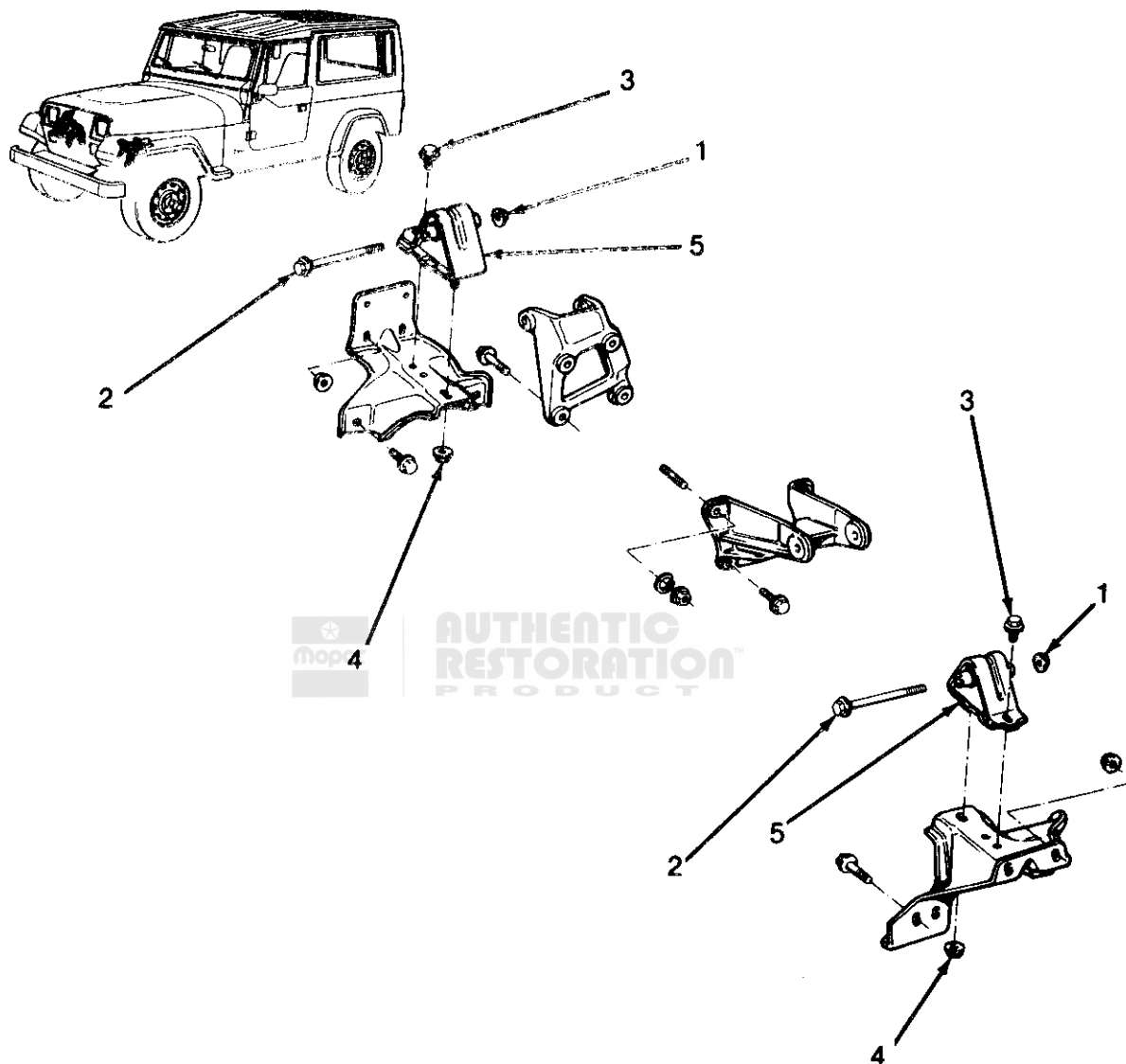
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



ENGINE MOUNT COMPONENTS

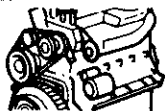
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- 1. Thru-Bolt Nut
- 2. Thru-Bolt
- 3. Mount Retaining Bolt

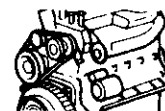
- 4. Mount Retaining Nut
- 5. Engine Mount

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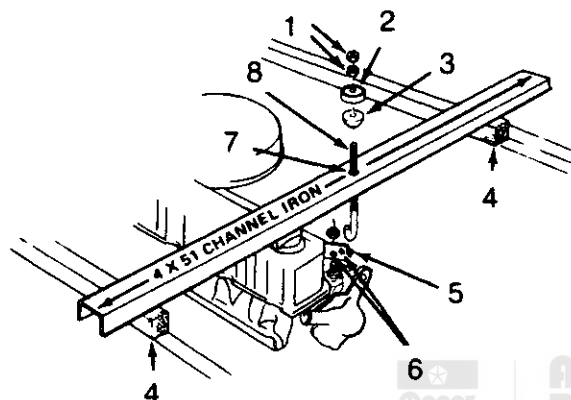
ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



ENGINE HOLDING FIXTURE

If it is necessary to remove the front engine mounts and front crossmember to perform service such as engine mount replacement, an engine holding fixture may be fabricated as illustrated.



- | | |
|-----------------------------------|-----------------------------|
| 1 - 9/16-Inch - 12 Nuts | 5 - 1 1/4-Inch Angle Iron |
| 2 - Upper Trunnion Bearing | 6 - 1/2-Inch Holes |
| 3 - Pivot or Sleeve | 7 - 1-Inch Hole |
| 4 - 2 x 2 x 6-Inch Hardwood Block | 8 - 9/16-Inch - 12 Trunnion |

41883

ENGINE REMOVAL

The engine is removed separate from the transmission.

WARNING: The coolant in a recently operated engine is hot and pressurized. Release the pressure before removing the radiator draincock and cap.

Remove the radiator draincock and radiator cap to drain the coolant.

NOTE: Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

Mark the hinge locations on the hood panel for alignment reference during installation.

Remove the engine compartment lamp, if equipped, and remove the hood.

Disconnect the battery cable clamps and remove the battery.

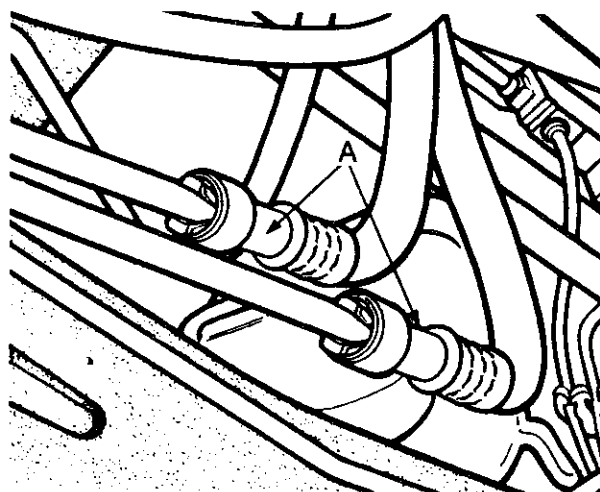
Disconnect the wire connectors from the alternator.

Disconnect the ignition coil and distributor wire connectors.

Disconnect the oil pressure sender wire connector.

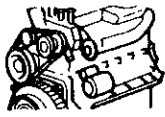
Disconnect the wires at the starter motor solenoid and injection wire harness connector.

Disconnect the fuel pipes at the fuel line quick connect couplings (A) at left inner fender panel.



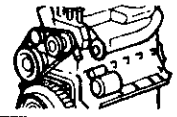
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



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Disconnect the engine ground strap.

Remove the air cleaner.

Disconnect the vacuum purge hose at the fuel vapor canister tee.

Disconnect the idle speed actuator wire connector.

Disconnect the throttle cable and remove it from the bracket.

Disconnect the throttle rod at the bellcrank.

Disconnect the oxygen (O₂) sensor wire connector.

Disconnect the upper and lower radiator hoses at the radiator.

Disconnect the coolant hoses from the rear of the intake manifold and thermostat housing.

Remove the fan shroud screws.

Remove the radiator attaching screws.

Remove the radiator and fan shroud.

Remove the fan and spacer or Tempatrol fan assembly.

Install a 5/16 × 1/2-inch SAE capscrew through the fan pulley into the water pump flange to maintain the pulley and water pump in alignment when the crankshaft is rotated.

Remove the power brake vacuum check valve from the booster, if equipped.

If equipped with power steering:

- disconnect the power steering hoses from the fittings at the steering gear
- drain the power steering pump reservoir and cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system

Lift the vehicle and support it with support stands.

Remove the starter motor.

Remove the flywheel housing access cover.

Remove the engine mount cushion-to-bracket screws.

Disconnect the exhaust pipe from the manifold.

Remove the upper flywheel housing bolts and loosen the bottom bolts.

Lower the vehicle.

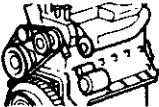
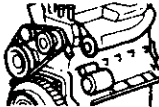
Attach a lifting device to the engine.

Raise the engine off the front supports.

Place a support stand under the flywheel housing.

Remove the remaining flywheel housing bolts.

Lift the engine out of the engine compartment.

	ENGINES 2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	
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ENGINE INSTALLATION

Lower the engine into the engine compartment.

NOTE: For easier installation, it may be useful to remove the engine mount cushions from the engine mount brackets as an aide for alignment of the engine-to-transmission.

Insert the transmission shaft into the clutch spline.

Align the flywheel housing with the engine; install and tighten the flywheel housing lower bolts finger tight.

Install the engine mount cushions, if removed.

Remove the support stand from beneath the flywheel housing.

Lower the engine and mount cushions onto the brackets. Ensure the bolt holes are aligned. Install the bolts and tighten with the specified torque.

Remove the engine lifting device.

Raise and support the vehicle.

Attach the exhaust pipe to the manifold. Install and tighten the nuts.

Install the flywheel housing access cover.

Install the remaining flywheel housing screws.

Install the starter motor and connect the cable.

Lower the vehicle to the floor.

Connect the cooling system hoses and tighten the clamps.

Connect the hoses to the power steering gear.

Remove the pulley-to-water pump flange alignment capscrew and install the fan and spacer or Tempatrol fan assembly.

Tighten the drive belts according to the specifications listed in the Cooling Systems section.

Install the fan shroud and radiator.

Connect the throttle valve rod and retainer.

Connect the throttle cable and install the rod.

Install the throttle valve rod spring.

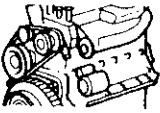
Connect the oxygen (O₂) sensor wire connector.

Install the vacuum hose and check valve on the brake booster.

Connect the coolant temperature sensor wire connector.

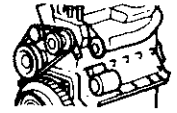
Connect the idle speed actuator wire connector.

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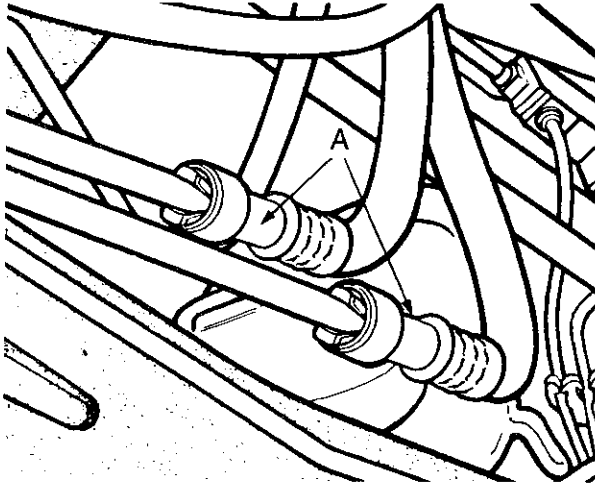
ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Connect the fuel inlet and return hoses at the quick-connect fuel lines (A).

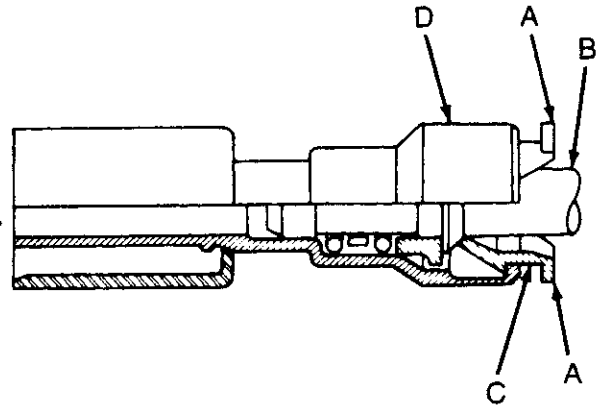
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Before connecting the quick-connect fuel lines, replace the O-rings.

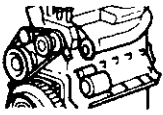


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Replace the O-ring using the Coupling Repair Kit, P/N 8983 502 745, as follows:

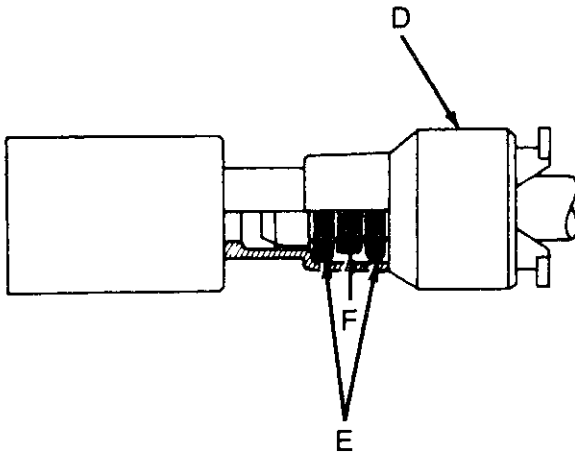
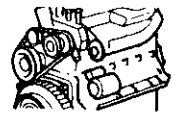
- Remove the two O-rings (E) and the spacer (F) from the fitting (D).

NOTE: This can be done by using a paper clip or piece of wire bent in an "L" shape.



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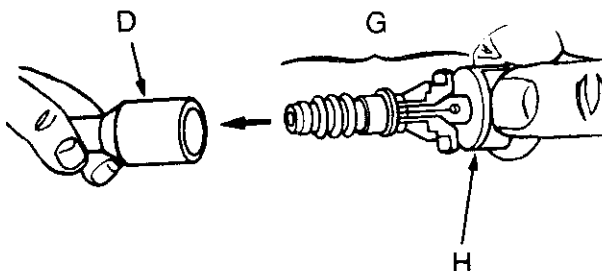
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



100485A

Remove the retainer from the fuel tube and discard the O-rings, the spacer, and the retainer.

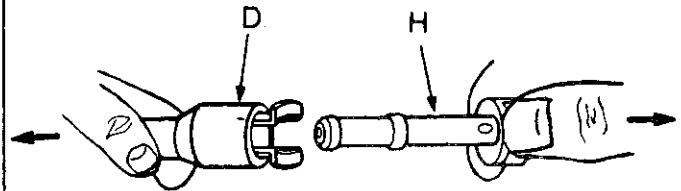
- Install the retainer assembly (G) by pushing the assembly into the quick-connect fitting (D) until a "click" is heard.



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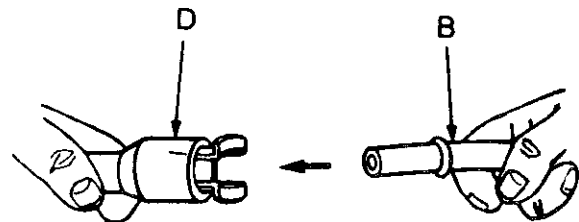
- Grasp the disposable plug (H) and remove it from the fitting (D).

NOTE: By removing ONLY the plastic plug (H), the O-rings spacer, and retainer will remain in the fitting.



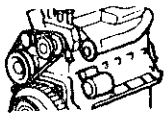
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- Push the fuel line (B) into the fitting (D) until a "click" is heard and the connection is complete.



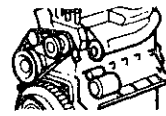
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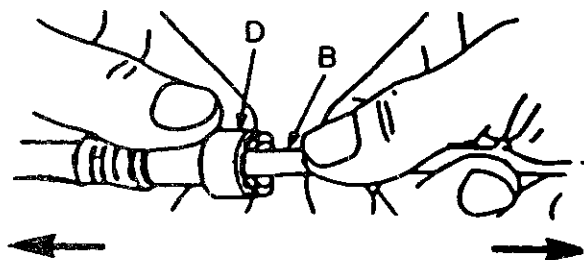


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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Verify that the quick-connect fitting assembly fits securely over the fuel lines by giving the fuel lines a firm tug.



Connect all fuel injection wire connections.

Install the engine ground strap.

Connect the ignition coil wire connector.

Fill the cooling system with coolant.

NOTE: Remove the coolant temperature sending unit to permit air to escape from the block. Install the coolant temperature sending unit when the system is filled.

Fill the power steering pump reservoir with fluid.

Install the battery and connect the battery cables.

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.

Start the engine and inspect for leaks. Check the automatic transmission fluid level. Stop the engine and check the coolant and the fluid levels. Add coolant and fluid as required.

Install the air cleaner bonnet to the throttle body.

Install and adjust the hood.

Connect the underhood lamp, if equipped.

CYLINDER HEAD COVER

Cylinder Head Removal

Remove the air cleaner and the PCV valve molded hose.

Disconnect the PCV valve from the grommet in the cylinder head cover.

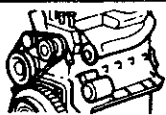
Disconnect the PCV shutoff valve vacuum hose.

Remove all the necessary vacuum and air hoses to provide clearance for the cylinder head cover.

Remove the cylinder head cover retaining screws.

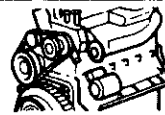
Detach the cover from the cylinder head by separating the RTV sealant with a putty knife or razor blade.

Do not pry the cover upward until the seal has been completely broken.

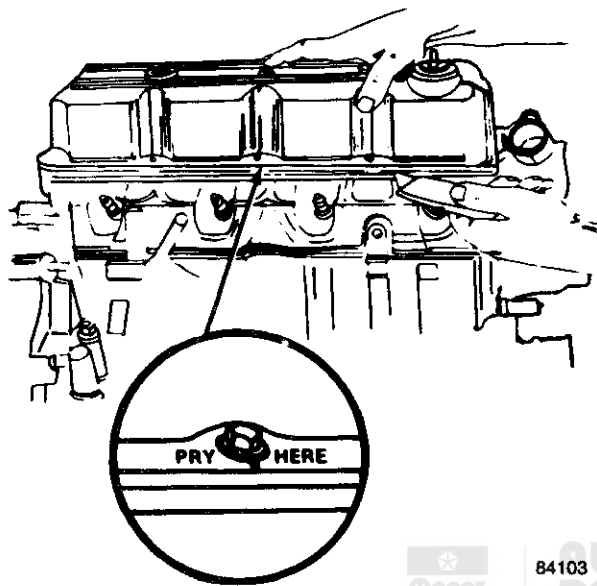


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Pry the cover up at the pry ramps that are identified by the words **PRY HERE**.



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Inspect the cylinder head cover for cracks.

Cylinder Head Cover Installation

Either a standard gasket or a room temperature vulcanizing (RTV) silicone rubber sealant may be used for cylinder head cover installation.

Use AMC Gasket-in-a-Tube, or equivalent, for a formed-in-place gasket.

Remove the original sealant (or gasket and adhesive) from the sealing surface area of the cylinder head and cover.

Thoroughly clean the sealing surfaces on the cylinder head and cover.

Apply a 3mm (1/8-in) bead of RTV sealant along the entire length of the cylinder head sealing surface.

Before the sealant begins to cure, position the cover on the cylinder head.

Do not allow the sealant to come into contact with the rocker arms or other valve assembly components.

Install the cylinder head cover retaining screws and tighten the screws with 6.2 N·m (55 in-lbs) torque.

Reposition and/or connect all the air and vacuum hoses that were moved for cover removal clearance.

Connect the PCV valve and the PCV shutoff valve hose.

Install the air cleaner and hoses.

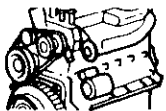
VALVES AND ACTUATING COMPONENTS

Rocker Arm Assembly Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

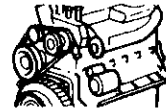
Remove the two capscrews (1) at each bridge (2) and pivot (3) assembly. Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.

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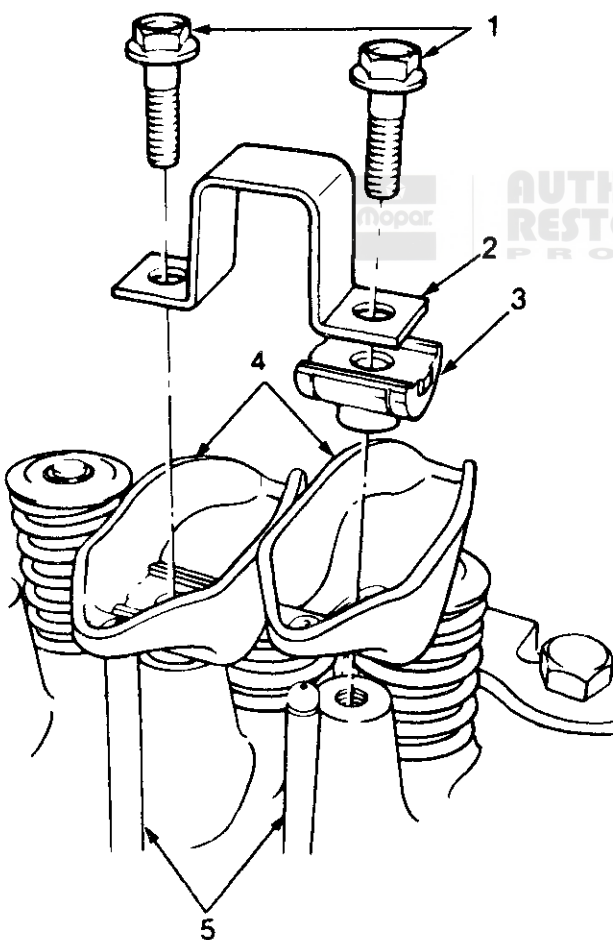
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Remove the bridges, pivots and corresponding pairs of rocker arms (4) and place them on the bench in the same order as removed.

Remove the push rods (5) and place them on the bench in the same order as removed.



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Rocker Arm Assembly Cleaning and Inspection

Clean all the components with cleaning solvent and use compressed air to blow out the oil passages in the rocker arms and push rods.

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted or excessively worn.

Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.

Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace it and inspect the corresponding hydraulic tappet for excessive wear.

A wear pattern along the length of the push rod is not normal. Inspect the cylinder head for obstruction if this condition exists.

Rocker Arm Assembly Installation

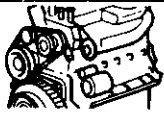
Install the push rods in their original locations. Ensure that the bottom end of each push rod is centered in the tappet plunger cap seat.

Install the rocker arms, pivots and bridge above each cylinder from where they were originally removed.

Loosely install the capscrews through each bridge.

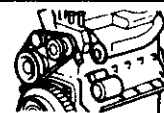
At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten with 26 N·m (19 ft-lbs) torque.

Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.



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Hydraulic Valve Tappets Removal

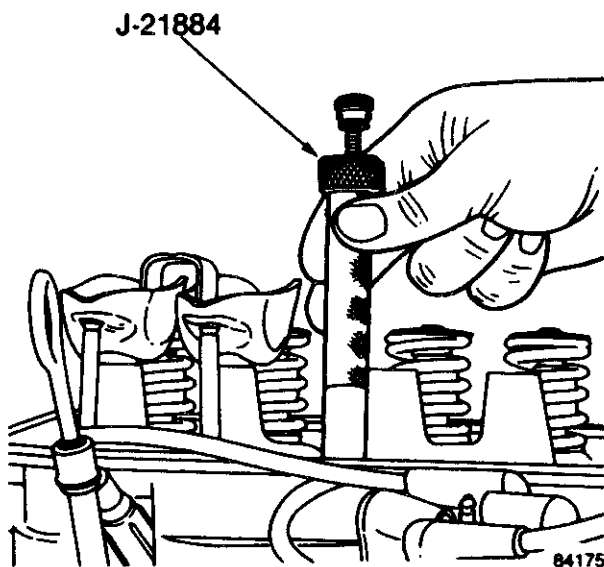
Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the bridge and pivot assemblies and rocker arms by removing the two capscrews at each bridge. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

Remove the push rods.

NOTE: Retain all the components in the same order as removed to facilitate installation in the original positions.

Remove the tappets through the push rod openings in the cylinder head with Hydraulic Valve Tappet Removal and Installation Tool, J-21884.



Retain the tappets in the same order as removed to facilitate installation in the original locations.

NOTE: It is not necessary to charge the tappet assemblies with engine oil. They will charge themselves within a very short period of engine operation.

Hydraulic Valve Tappets Installation

Dip each tappet assembly in AMC Engine Oil Supplement (EOS), or equivalent.

Use Hydraulic Valve Tappet Removal and Installation Tool J-21884 to install each tappet in the same bore from where it was originally removed.

Install the push rods in their original locations.

Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges.

Pour the remaining EOS over the entire valve actuating assembly.

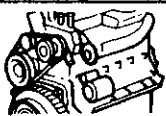
NOTE: The EOS must remain with the engine oil for at least 1 609 km (1,000 mi) but need not be drained until the next scheduled oil change.

Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

Valve Springs and Oil Deflector Removal

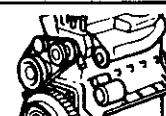
NOTE: This procedure is for the removal of valve springs and oil deflectors with the cylinder head installed on the cylinder block. Refer to Valve Removal in the MOT. 2.46L manual for the procedure if the cylinder head is removed from the cylinder block.

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Each valve spring is held in place around the valve stem by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews (1), bridge (2) and pivot (3) assembly and rocker arms (4) for access to each valve spring to be removed. Alternately loosen each capscrew one turn at a time to avoid damaging the bridge.

Remove the push rods (5).

NOTE: Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed.

Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.

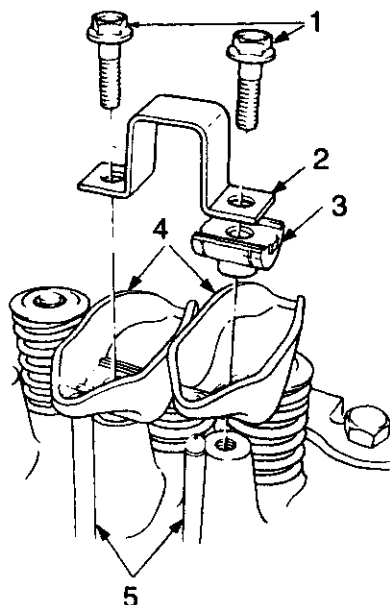
Install a 14mm (1/2-in) (thread size) air hose adapter in the spark plug hole.

NOTE: An adapter can be constructed by welding an air hose connection to the body of a spark plug with the porcelain removed.

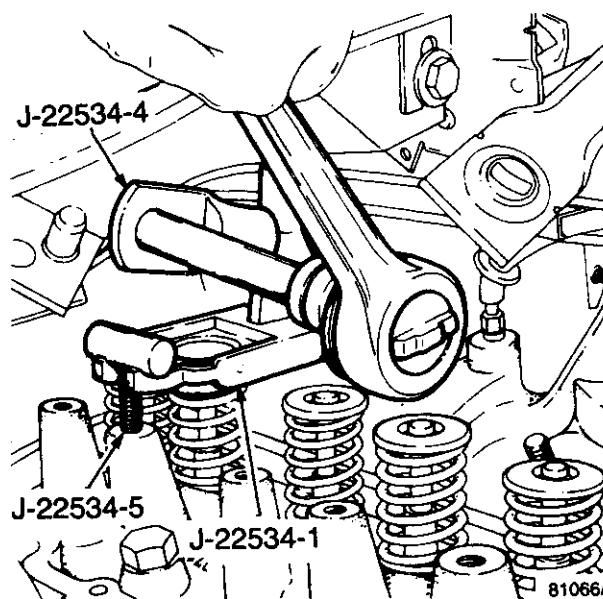
Connect an air hose to the adapter and maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats.

NOTE: For vehicles equipped with an air conditioner, use a flexible air adapter when servicing the No. 1 cylinder.

Use Valve Spring Compressor Tool J-22534-01 to compress the spring and remove the locks.



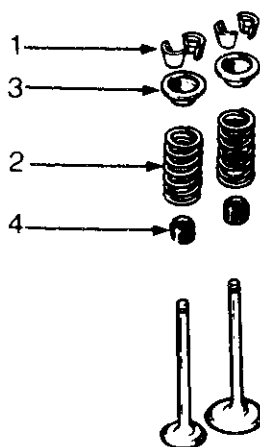
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Remove the valve spring (2) and retainer (3).

Remove the valve stem oil deflector (4).



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Valve Spring and Oil Deflector Installation

CAUTION: Install the deflector (4) carefully to prevent damage from the sharp edges of the valve spring lock groove.

Use an 11mm (7/16-in) deep socket and small hammer to gently tap the oil deflector (4) onto the valve stem.

Install the valve spring (2) and retainer (3).

Compress the valve spring with Valve Spring Compressor Tool J-22534-01 and insert the

valve locks (1). Release the spring tension and remove the tool.

NOTE: Tap the spring from side-to-side to ensure that the spring is seated properly on the cylinder head.

Disconnect the air hose. Remove the adapter from the spark plug hole and install the spark plug.

Repeat the procedure for each remaining valve spring to be removed.

Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

Install the rocker arms, pivots and bridge at their original location.

Tighten the bridge capscrews alternately, one turn at a time, to avoid damaging the bridge.

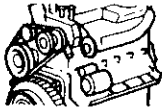
Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

Measuring the Cam Lobe Lift

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

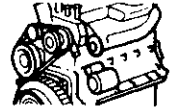
Remove the bridge and pivot assemblies and rocker arms. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges. Disconnect the spark plug wire connectors and remove the spark plugs.

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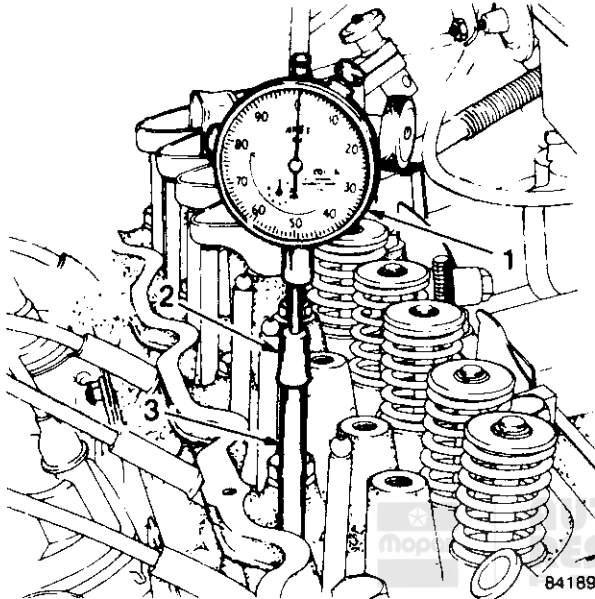


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Install a dial indicator (1) with a piece of rubber tubing (2) between the dial indicator plunger and the push rod (3). Use Dial Indicator Set J-8520 or equivalent.



Rotate the crankshaft until the heel of the cam lobe (push rod in the down position) is under the valve tappet. Set the dial indicator pointer at zero.

Rotate the crankshaft until the push rod is at its maximum upward position.

Note the travel distance on the dial indicator. Refer to the Specifications chart for the correct cam lobe lift.

Repeat the procedure for each remaining cam lobe.

Install the rocker arms and bridge and pivot assemblies. Alternately tighten the capscrews at each bridge, one turn at a time, to avoid damaging the bridges.

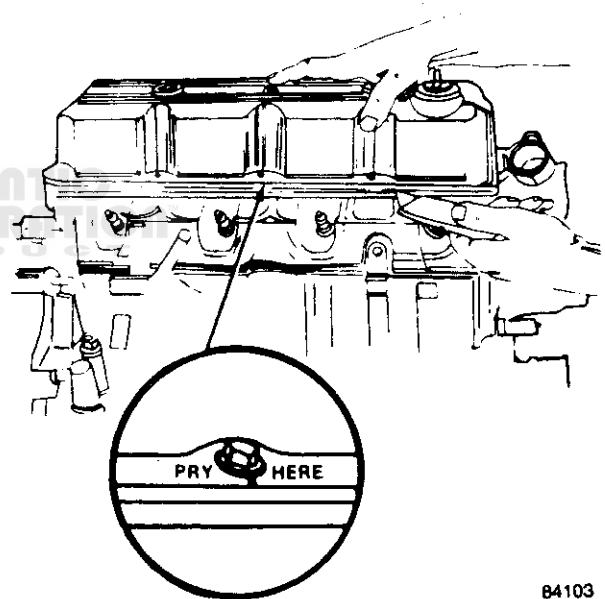
Install the spark plugs and connect the wire connectors.

Install the cylinder head cover. Refer to the installation procedure.

Valve Timing

Disconnect the spark plug wire connectors and remove the spark plugs.

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.



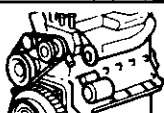
Remove the bridge and pivot assembly and rocker arms from above the No. 1 cylinder.

Rotate the crankshaft until No. 4 piston is at top dead center (TDC) on the compression stroke.

Rotate the crankshaft counterclockwise (viewed from the front of the engine) 90 degrees.

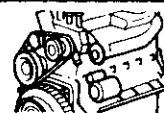
Install Dial Indicator Set J-8520 (or equivalent) on the end of the No. 1 cylinder intake valve

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push rod. Use rubber tubing to secure the stem on the push rod.

Set the dial indicator pointer at zero.

Rotate the crankshaft clockwise (viewed from the front of the engine) until the dial indicator pointer indicates 0.305mm (0.012-in) travel distance (lift).

The timing notch index on the vibration damper should be aligned with the TDC mark on the timing degree scale.

If the timing notch is more than 13mm (1/2-in) away from the TDC mark in either direction, the valve timing is incorrect.

If the valve timing is incorrect, the cause may be a broken camshaft pin. It is not necessary to replace the camshaft because of pin failure. A spring pin is available for service replacement.

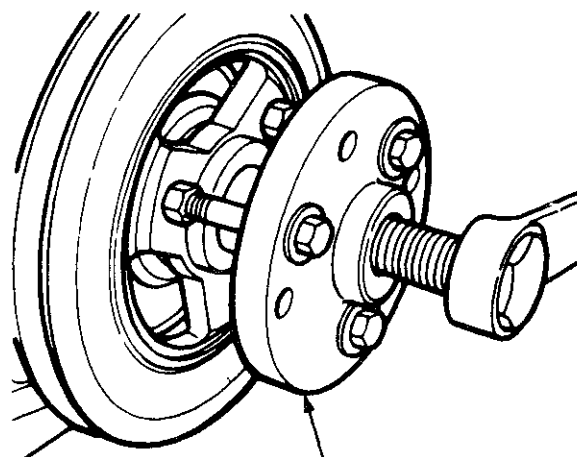
VIBRATION DAMPER AND PULLEY REMOVAL

Remove the drive belt(s).

Remove the retaining bolts and separate the vibration damper pulley from the vibration damper.

Remove the vibration damper retaining bolt and washer.

Use Vibration Damper Removal Tool J-21791-01 to remove the damper from the crankshaft.



J-21791-01

84179

VIBRATION DAMPER AND PULLEY INSTALLATION

With the key in position, align the key slot in the vibration damper hub with the crankshaft key and tap the damper onto the end of the crankshaft.

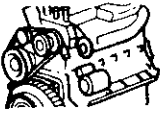
Install the vibration damper retaining bolt and washer. Tighten the bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two 5/16 × 1½ inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley and retaining bolts. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

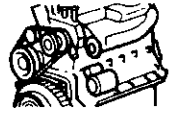
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

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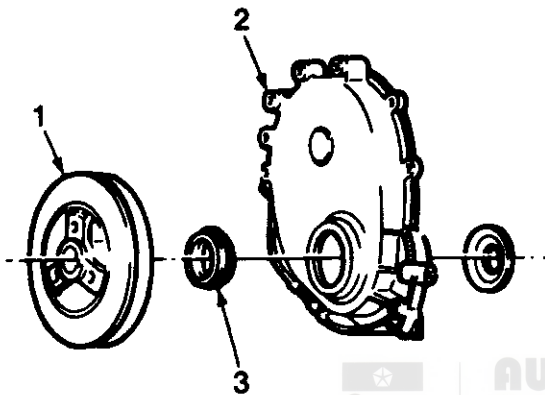
ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



TIMING CASE COVER REMOVAL

Remove the drive belt(s), engine fan and hub assembly, fan shroud, vibration damper and pulley (1), and key.



84180

Remove the oil pan-to-timing case cover screws and cover-to-cylinder block bolts.

Remove the timing case cover (2), crankshaft oil seal and gasket from the cylinder block.

Cut off the oil pan side gasket end tabs flush with the front face of the cylinder block and remove the gasket tabs.

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

Pry the crankshaft oil seal (3) from the timing case cover with a large pry tool.

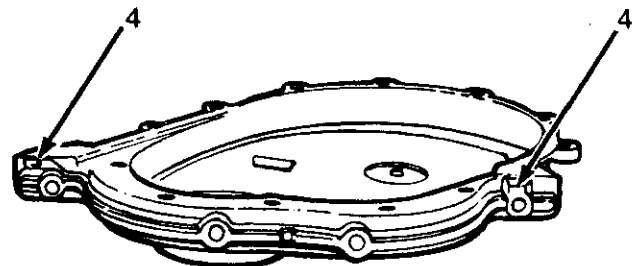
TIMING CASE COVER INSTALLATION

Apply sealing compound (Perfect Seal, or equivalent) to both sides of the replacement timing case cover gasket and position the gasket on the cylinder block.

Cut the end tabs (4) off of the replacement timing cover gasket corresponding to those cut off the original gasket.

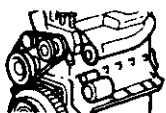
Coat the front seal end tab recesses generously with RTV sealant (AMC Gasket-In-A-Tube, or equivalent) and position the seal on the timing case cover.

Apply engine oil to the seal-oil pan contact surface.



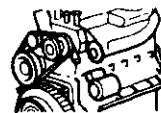
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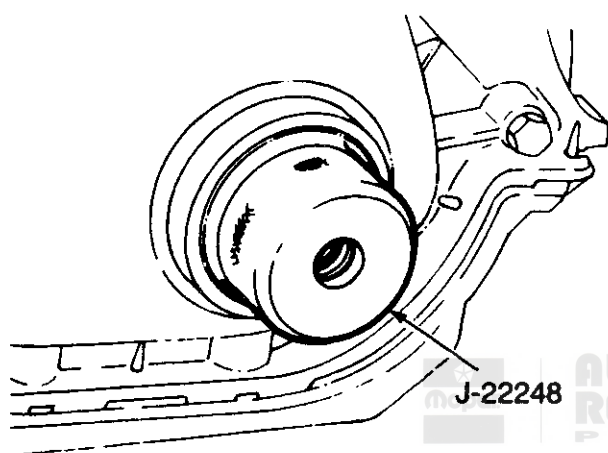
ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Position the timing case cover on the cylinder block.

Place Timing Case Cover Alignment/Seal Installer J-22248, or equivalent, in the cover crankshaft opening.



64182

Install the cover-to-cylinder block bolts and the oil pan-to-cover screws.

Tighten the cover-to-cylinder block bolts with 7 N·m (5 ft-lbs) torque and the oil pan-to-cover screws with 13 N·m (11 ft-lbs) torque.

Remove the cover alignment tool and position a replacement oil seal on the tool with the seal lip facing outward.

Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft with engine oil.

Position J-22248 with seal over the end of the crankshaft. Insert J-22248. Install seal into timing chain cover by gently tapping with a rubber or plastic mallet.

Tighten the nut against the tool until the tool contacts the cover.

Remove the tools and apply a light film of engine oil on the vibration damper hub contact surface of the seal.

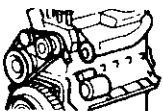
With the key inserted in the keyway on the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two $5/16 \times 1\frac{1}{2}$ inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

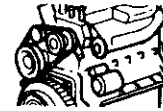
Install the engine fan and hub assembly.

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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Install the fan shroud.

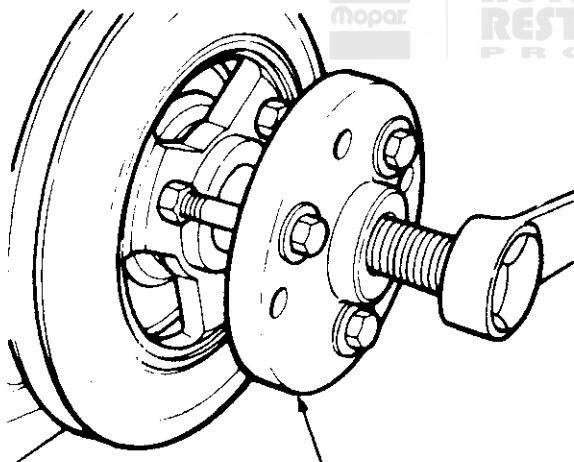
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Crankshaft (Front) Oil Seal Replacement – Cover Installed

Remove the drive belt(s) and fan shroud.

Remove the vibration damper with remover J-21791-01.

Remove the vibration damper and key.



J-21791-01

84179

Remove the crankshaft oil seal with Timing Cover Oil Seal Remover Tool J-9256, or equivalent.

Position a replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool J-22248 with the seal lip facing outward.

Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft oil seal contact surface with engine oil.

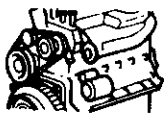
Position J-22248 with seal over end of crankshaft. Insert tool J-22248.

Install seal into timing chain cover by gently tapping with rubber or plastic mallet.

Remove J-22248.

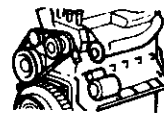
Remove the tool.

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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

With the key inserted in the keyway on the crankshaft, install the vibration damper, washer and bolt.

Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two $5/16 \times 1\frac{1}{2}$ inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

TIMING CHAIN REMOVAL

NOTE: The timing chain tensioner reduces noise and prolongs timing chain life. In addition, it compensates for slack in a worn or stretched chain and helps to maintain the correct valve timing.

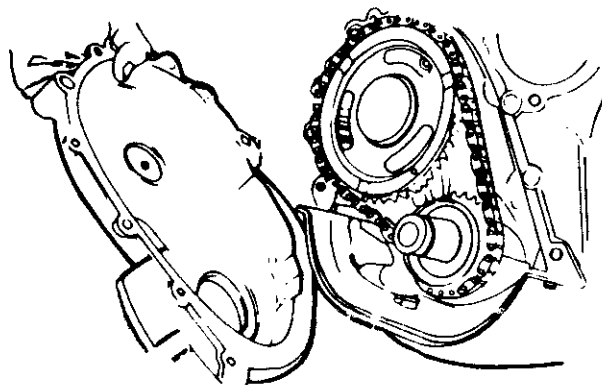
Remove the fan and shroud.

Remove the drive belt(s).

Remove the crankshaft vibration damper and pulley.

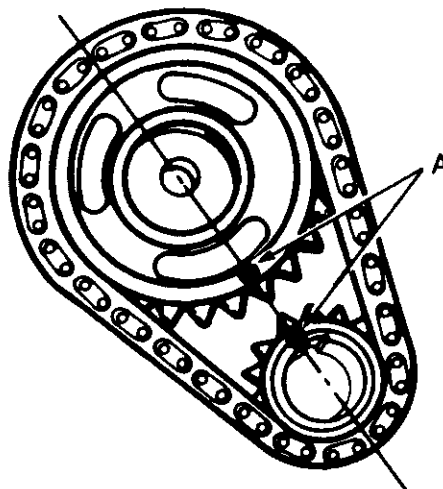
Remove the timing case cover. Refer to the removal procedure.

Remove the crankshaft oil slinger.



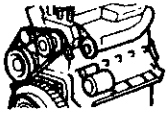
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Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).



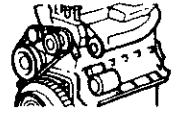
84184

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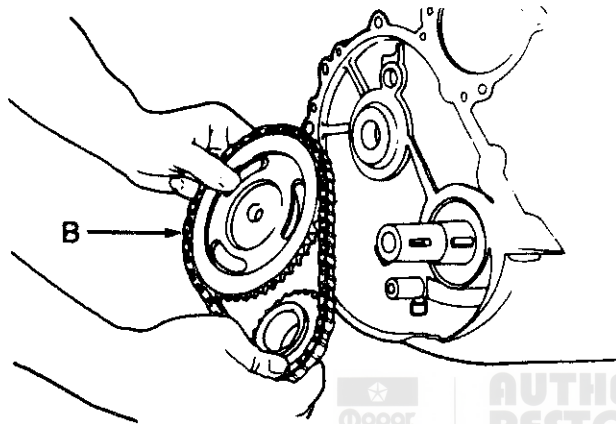
ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Remove camshaft sprocket retaining bolt.

Remove the sprockets and chain as an assembly (B).

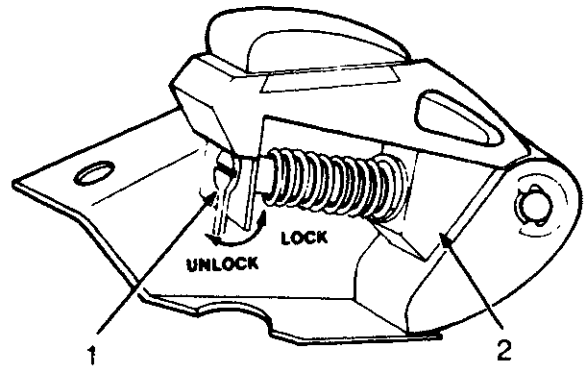


84185

TIMING CHAIN INSTALLATION

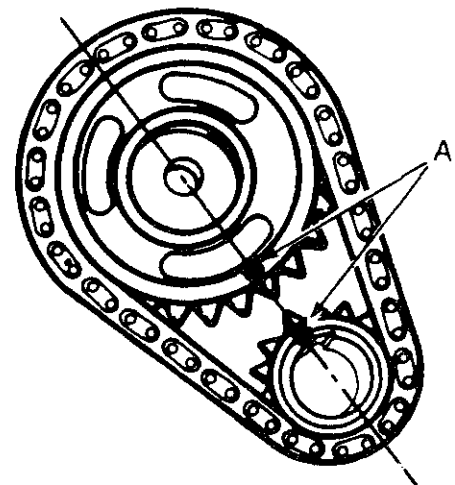
Turn the tensioner lever (1) to the unlocked (DOWN) position.

Pull the tensioner block (2) toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the locked (UP) position.



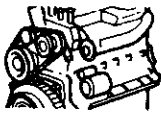
84186

Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks (A) aligned.



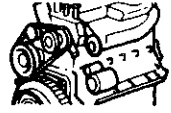
84184

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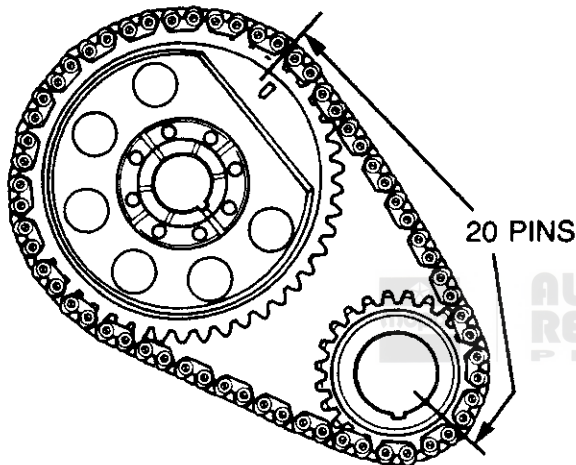


ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



NOTE: To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position. Count the number of chain pins between the timing marks on both sprockets. There must be 20 pins.



41937A

Tighten the camshaft sprocket bolt with 108 N·m (80 ft-lbs) torque.

Release the timing chain tensioner lever.

Install the crankshaft oil slinger.

Install the timing case cover. Refer to the installation procedure.

Install the vibration damper on the crankshaft.

Lubricate and tighten the damper bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two 5/16 × 1½ inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the vibration damper pulley.

Install the drive belt(s) on the pulleys and tighten. Refer to the Cooling Systems section for the specifications.

Install the fan and shroud.

Tighten the fan assembly nuts with 24 N·m (18 ft-lbs) torque.

CAMSHAFT PIN REPLACEMENT

Disconnect the battery negative cable.

WARNING: Do not loosen the radiator draincock with the system hot and pressurized because serious burns from coolant can occur.

Drain the radiator.

NOTE: Do not waste reusable coolant. Drain the coolant into a clean container.

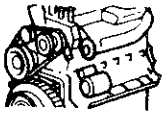
Remove the fan and shroud.

Remove the radiator attaching screws. Disconnect the overflow tube, radiator hoses and automatic transmission fluid cooler pipes, if equipped.

Remove the radiator.

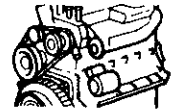
Remove the drive belt(s).

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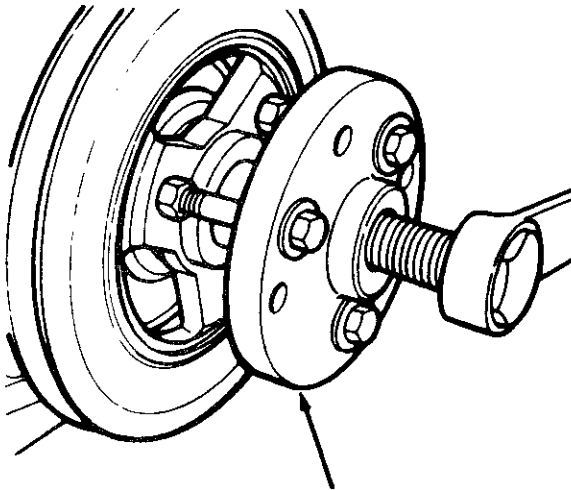


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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Remove the crankshaft vibration damper and pulley.



J-21791-01

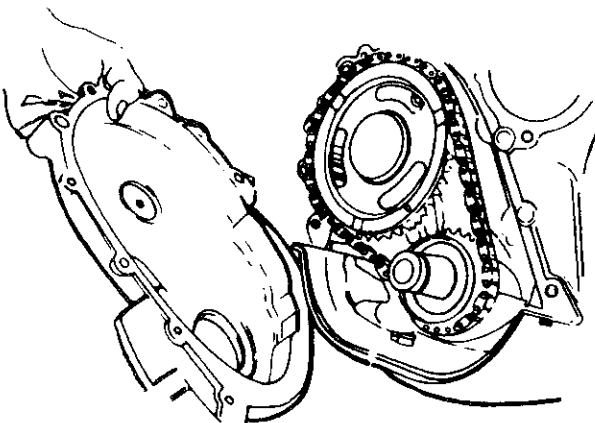
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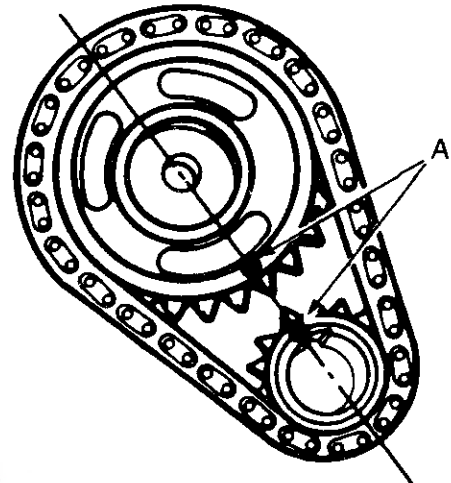
Remove the timing case cover. Refer to the removal procedure.

Remove the crankshaft oil slinger.



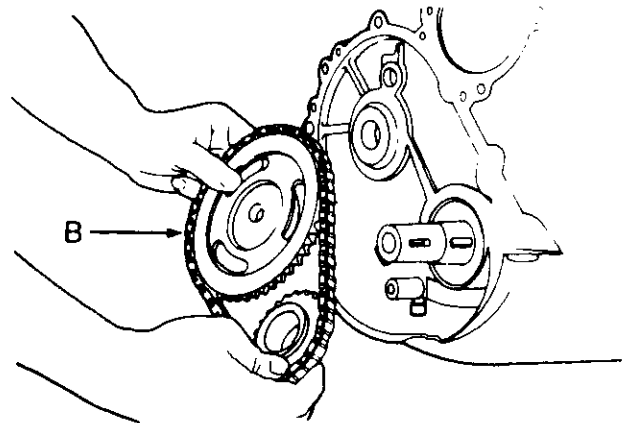
84874

Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).

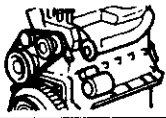


84184

Remove the camshaft sprocket bolt, sprockets and chain as an assembly (B).

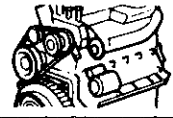


84185



ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



CAUTION: The following procedure must be accomplished to prevent the camshaft from damaging the rear camshaft plug during pin installation.

Insert a suitable tool into the fuel pump opening and wedge it against the side of the opening and the camshaft to prevent camshaft movement.

Inspect the damaged camshaft pin.

If the broken pin is a spring type pin, remove it by inserting a self-tapping screw into it and carefully pulling it from the camshaft.

CAUTION: Ensure that the exact center is located when center-punching the pin.

If the broken pin is a dowel-type pin, center-punch it.

CAUTION: Cover the open oil pan area to prevent metal chips from entering the pan.

Drill into the pin center with a 4mm (5/32-in) drill bit.

Turn a self-tapping screw into the drilled pin hole and carefully pull the pin from the camshaft.

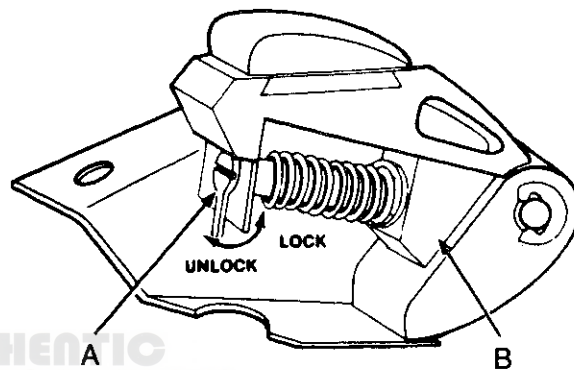
Clean the camshaft pin hole.

Compress the center of the replacement spring pin with vise grips.

Carefully drive the pin into the camshaft until it is seated.

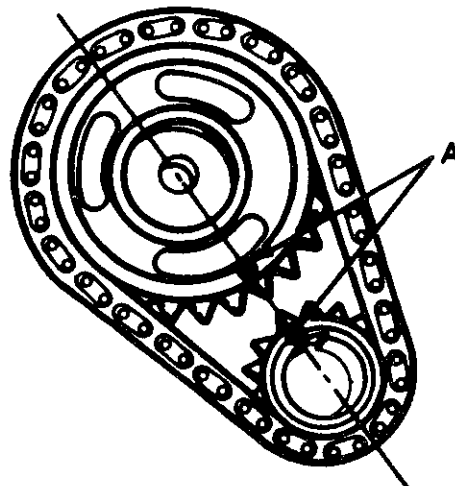
Turn the tensioner lever (A) to the unlocked (DOWN) position .

Pull the tensioner block (B) toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the locked (UP) position .



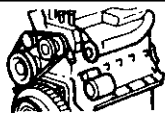
84186

Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks (A) aligned .



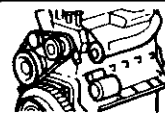
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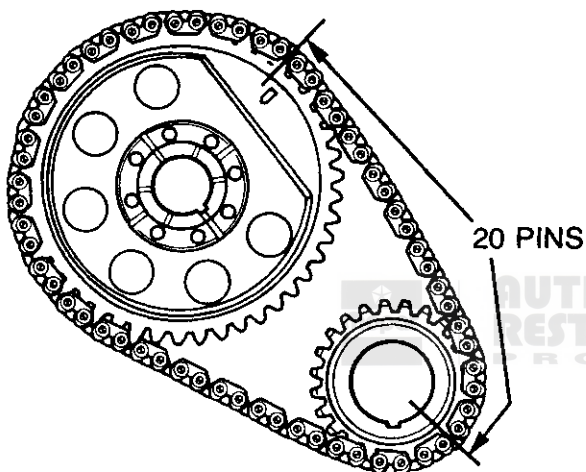
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NOTE: To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position. Count the number of chain pins between the timing marks on both sprockets. There must be 20 pins.



41937A

Tighten the camshaft sprocket bolt with 108 N·m (80 ft-lbs) torque.

Remove the tool wedged in the fuel pump opening.

Check the valve timing. Refer to the timing procedure.

Install the crankshaft oil slinger.

Pry the crankshaft oil seal from the timing case cover with a large pry tool and clean the cover.

Install the timing case cover and a replacement crankshaft oil seal. Refer to the installation procedure.

With the key inserted in the keyway on the crankshaft, install the vibration damper, washer and bolt.

Lubricate and tighten the damper bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two 5/16 × 1 1/2 inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the vibration damper pulley.

Install the drive belts on the pulleys and tighten. Refer to the Cooling Systems section for the specifications.

Install the radiator. Connect the radiator hoses. Fill the cooling system.

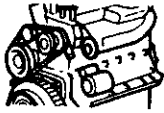
Install the fan and shroud.

Tighten the fan assembly nuts with 24 N·m (18 ft-lbs) torque.

Connect the battery negative cable.

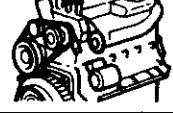
CAMSHAFT REMOVAL

WARNING: The coolant in a recently operated engine is hot and pressurized. Release the pressure before removing the draincock, cap and drain plugs.



ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Drain the cooling system.

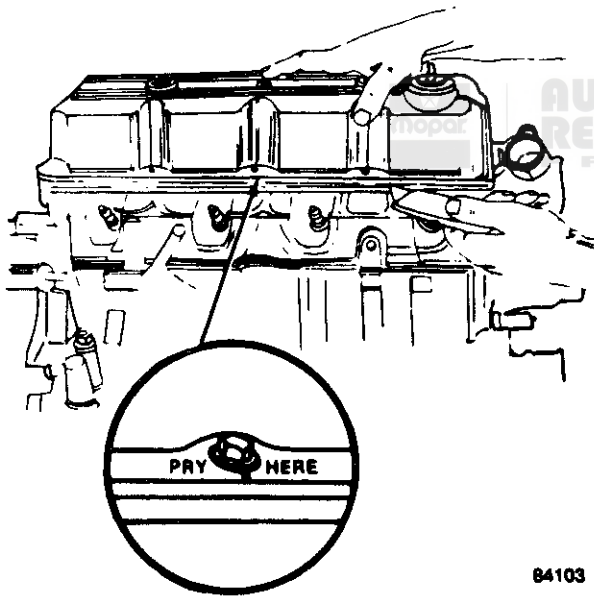
NOTE: Do not waste reusable coolant. Drain the coolant into a clean container.

Remove the radiator.

Remove the drive belt(s).

Remove the distributor and ignition wires.

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

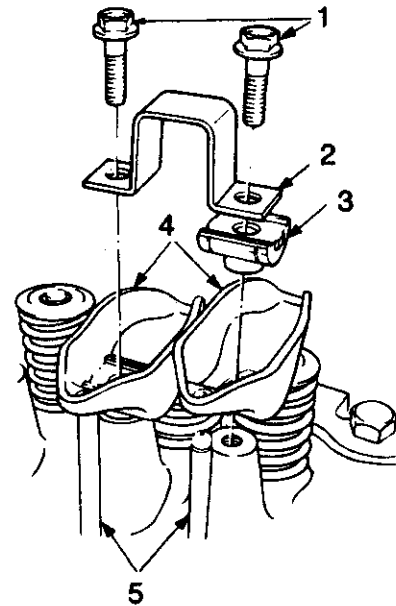


84103

Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4). Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

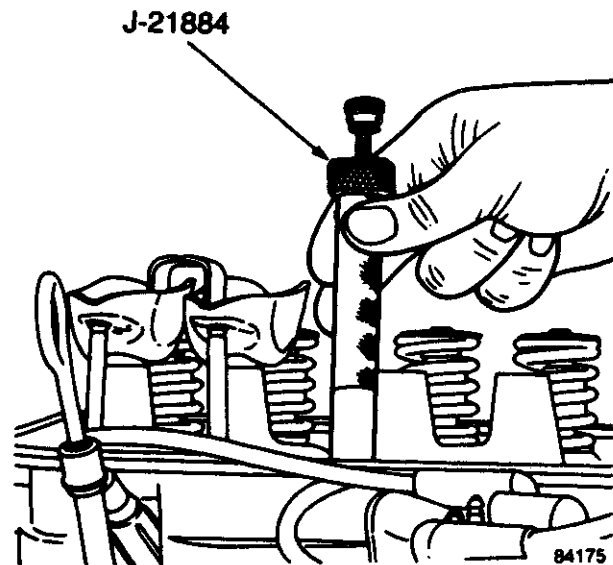
Remove the push rods (5).

NOTE: Position all components on a work bench in the same order as removed to facilitate installation in the original positions.



84174

Remove the tappets using Hydraulic Valve Tappet Remover J-21884. Refer to the removal procedure.

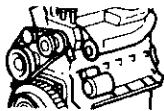


84175

Remove the pulley (if applicable), vibration damper and timing case cover. Refer to Timing Case Cover Removal.

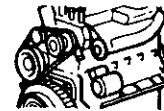
Remove the crankshaft oil slinger.

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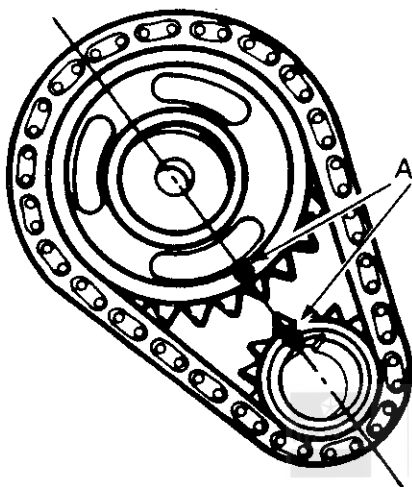
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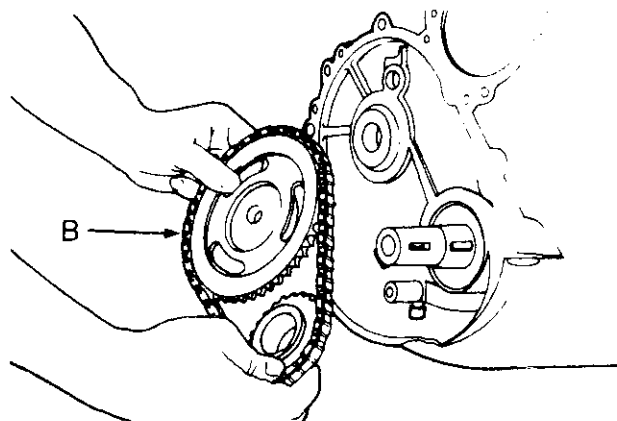
Remove the camshaft sprocket retaining bolt.

Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).



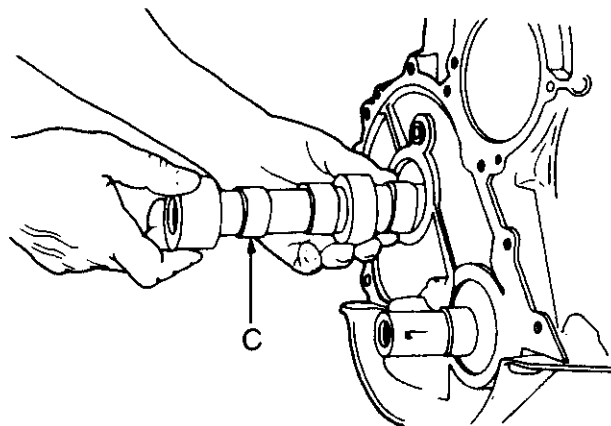
84184

Remove the timing chain and sprockets as an assembly (B).



84185

Remove the camshaft (C).



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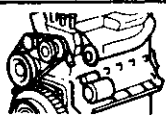
CAMSHAFT INSTALLATION

Lubricate the camshaft with AMC Engine Oil Supplement (EOS), or equivalent.

Install the camshaft carefully to prevent damaging the camshaft bearings.

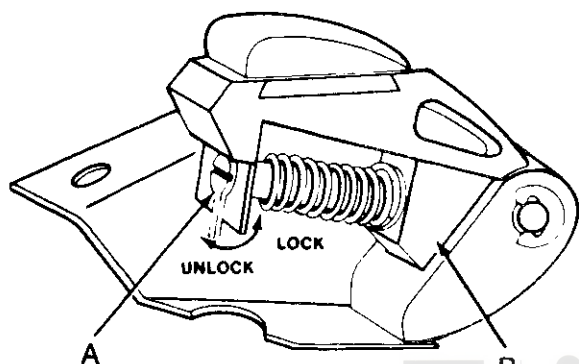
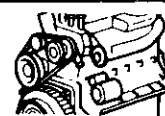
Turn the tensioner lever (A) to the unlocked (DOWN) position.

Pull the tensioner block (B) toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the locked (UP) position.



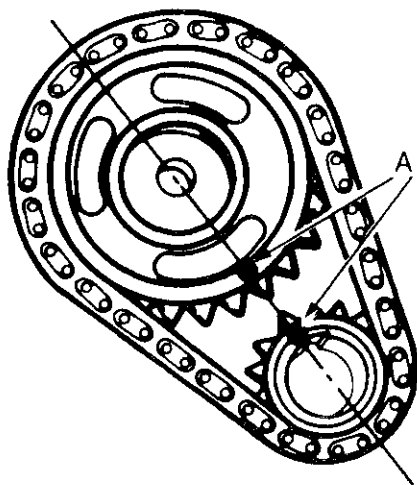
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



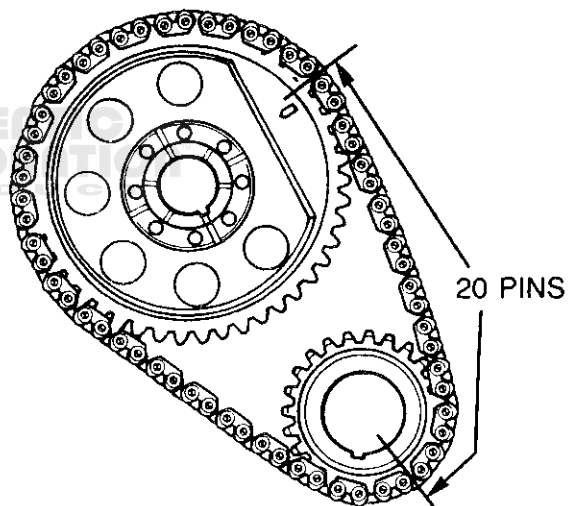
84186

Install the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks (A) aligned.



84184

NOTE: To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position. Count the number of chain pins between the timing marks on both sprockets. There must be 20 pins.



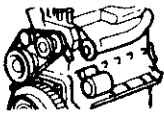
41937A

Install the camshaft sprocket retaining bolt and tighten with 108 N·m (80 ft-lbs) torque.

Install the crankshaft oil slinger.

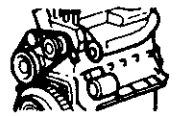
Release the timing chain tensioner by turning the tensioner lever (A) to the unlocked (DOWN) position.

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Install the timing case cover and a replacement oil seal. Refer to Timing Case Cover Installation.

With the key inserted in the keyway on the crankshaft, install the vibration damper, washer and bolt.

Lubricate and tighten the damper bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt tightening torque value is attained, the crankshaft can be prevented from turning by placing two $5/16 \times 1\frac{1}{2}$ inch bolts into the damper pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

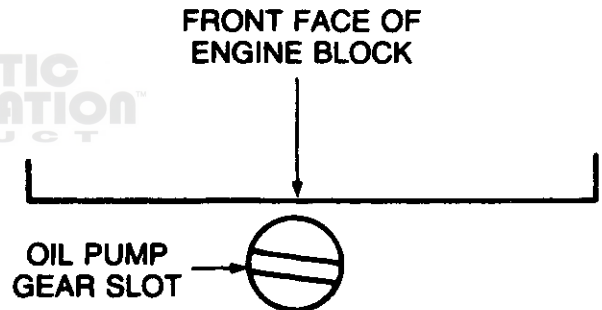
Install the damper pulley.

Install the fan assembly and shroud.

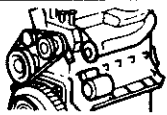
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Install the distributor, distributor cap and ignition wires by rotating engine No. 1 cylinder piston until it is at Top Dead Center (TDC) in the compression stroke.

Using a flat blade screwdriver, rotate the oil pump gear so that the gear slot on the oil pump shaft is slightly past the 3 o'clock position.

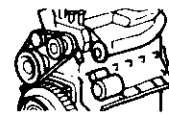


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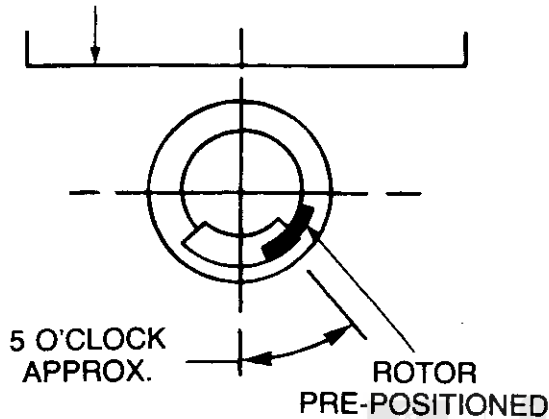
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



With the distributor cap removed, install the distributor with the rotor located at the 5 o'clock position.

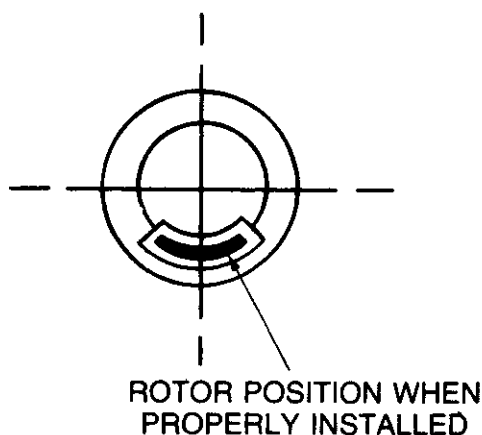
FRONT FACE OF
ENGINE BLOCK



100420

When the distributor is fully engaged in its correct location, the rotor should be at the 6 o'clock position.

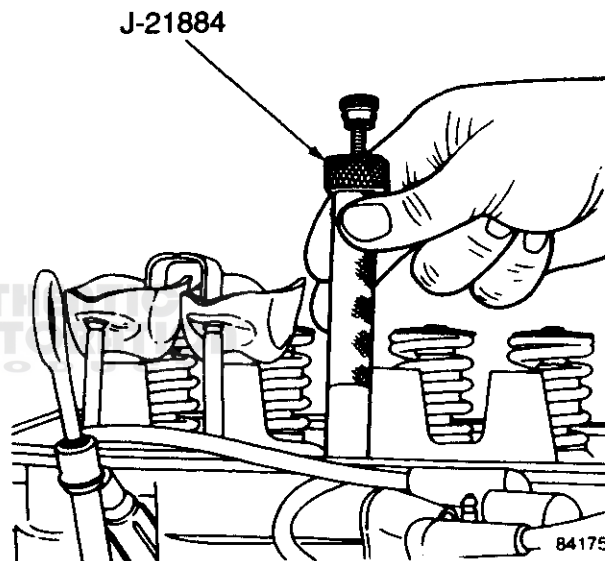
FRONT FACE OF
ENGINE BLOCK



100421

WARNING: If the distributor is not installed correctly, or, if it is removed later, then the complete installation procedure must be repeated.

Install the tappets using Hydraulic Valve Tappet Installer J-21884.



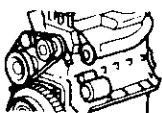
Install the push rods.

Install the rocker arms and bridge and pivot assemblies. Tighten each of the two capscrews for each bridge alternately, one turn at a time, to avoid damaging the bridge.

NOTE: Lubricate the hydraulic valve tappets and all valve actuating components with AMC Engine Oil Supplement (EOS), or equivalent, during installation. The EOS must remain with the engine oil for at least 1 609 km (1,000 mi) but need not be drained until the next scheduled oil change.

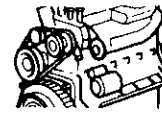
Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

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Install the radiator, connect the hoses and fill the cooling system to the specified level. Refer to the Cooling Systems section.

Check the ignition timing and adjust as necessary.

INTAKE MANIFOLD REMOVAL

NOTE: It is necessary to remove the throttle body assembly from the intake manifold before the manifold is removed. After removing the throttle body assembly from the intake manifold, it may be set to one side with the vacuum hoses still attached.

WARNING: If the engine has been recently operated, use care to prevent scalding by hot coolant. The system is pressurized.

Remove the radiator cap and draincock to drain the coolant.

NOTE: Do not waste reusable coolant. If the coolant is acceptable for reuse, drain it into a clean container.

Disconnect the fuel inlet and return hoses. Disconnect the ISA motor wire connector.

Disconnect the coolant hoses from the intake manifold.

Disconnect the throttle cable from the bellcrank.

Disconnect the PCV valve vacuum hose from the intake manifold.

Remove the vacuum advance CTO valve vacuum hoses, if equipped.

Disconnect the coolant temperature sensor wire connector (located on the intake manifold).

Disconnect the vacuum hose from the EGR valve.

Remove the throttle body assembly and set to one side.

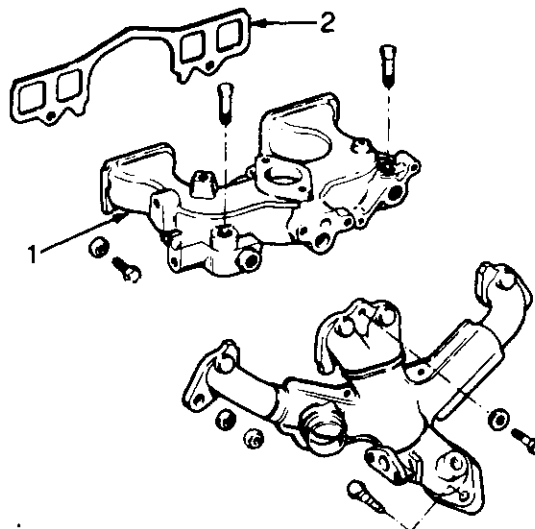
Remove the power steering mounting bracket, if equipped.

Detach the power steering pump and set aside, if equipped. Do not remove the hoses.

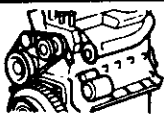
Disconnect the throttle valve linkage, if equipped with an automatic transmission.

Disconnect the EGR valve tube from the intake manifold.

Remove the intake manifold attaching screws, nuts and clamps. Remove the intake manifold (1). Discard the gasket (2).

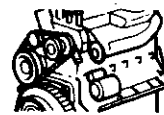


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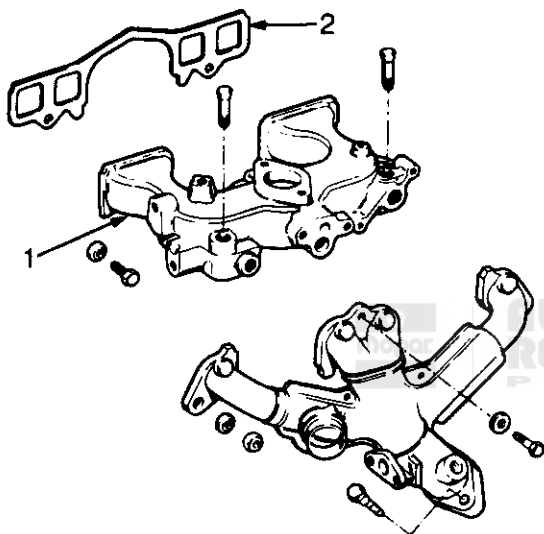
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Clean the mating surfaces of the manifold and cylinder head.

NOTE: If the manifold is being replaced, ensure all the fittings etc., are transferred to the replacement manifold.



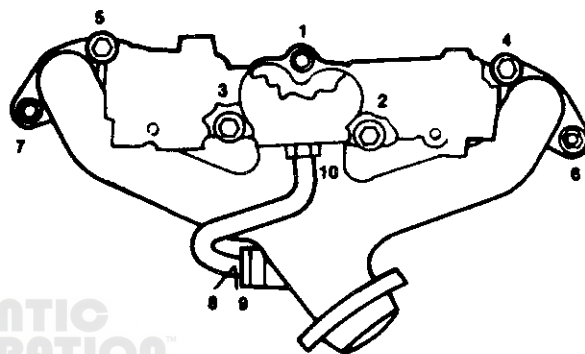
84177A

INTAKE MANIFOLD INSTALLATION

Position the replacement intake manifold gasket (2) on the cylinder head and install the intake manifold (1).

Install the remaining attaching hardware.

Tighten all the bolts and nuts according to the sequence depicted in the illustration. Tightening torque is 31 N·m (23 ft-lbs).



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Install the vacuum hoses.

Install the throttle body studs and replacement gaskets.

Install the throttle body.

Connect the linkage and hoses.

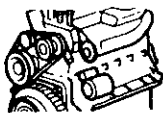
Tighten the throttle body mounting nuts with 19 N·m (14 ft-lbs) torque.

Connect the fuel pipe and air horn vent hose to the carburetor.

Connect the ISA motor wire connector.

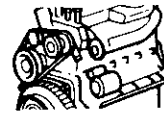
Install the power steering pump mounting bracket, if removed.

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Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Connect the coolant temperature sensor wire.

Connect the EGR valve tube to the intake manifold.

Connect the coolant hoses to the intake manifold.

Connect the vacuum hose to the EGR valve.

Connect the throttle cable and the PCV valve hose.

Connect the throttle valve rod retainer and spring.

Install the air cleaner.

Refill the cooling system with coolant.

If replacement coolant is being used, ensure the mixture of antifreeze and low mineral content water is acceptable for the climate.

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.

Start the engine and inspect for leaks. Repair as necessary.

EXHAUST MANIFOLD REMOVAL

Remove the intake manifold. Refer to the Intake Manifold Removal procedure.

Disconnect the EGR valve tube.

Disconnect the exhaust pipe from the exhaust manifold.

Disconnect the oxygen (O₂) sensor wire connector.

Remove the sensor from the exhaust pipe.

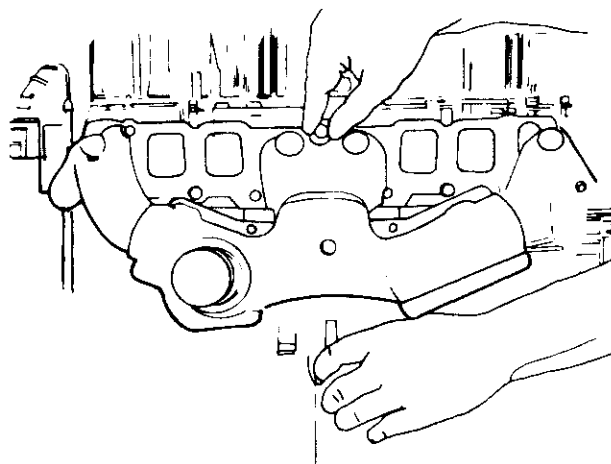
Remove the nuts from the end studs.

Remove the exhaust manifold.

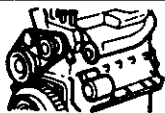
Clean the mating surfaces of the cylinder head and the exhaust manifold (if the original manifold is to be installed).

EXHAUST MANIFOLD INSTALLATION

Position the exhaust manifold over the end studs on the cylinder head.

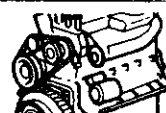


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Install the nuts on the end studs finger-tight.

Clean the threads in the bore for the oxygen (O₂) sensor.

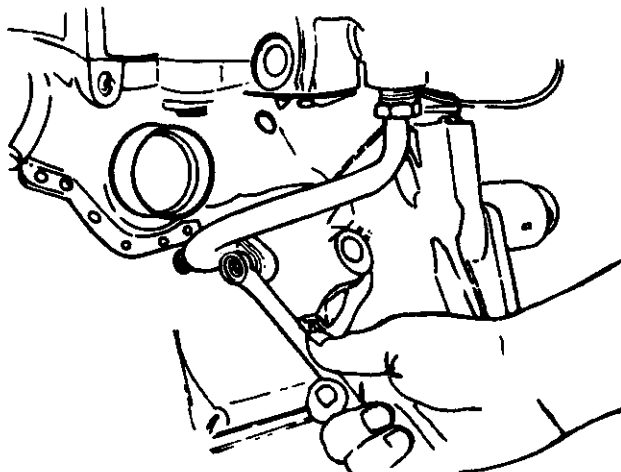
Apply antiseize compound to the oxygen (O₂) sensor threads.

Install the oxygen sensor and connect the wire connector. Tighten the sensor with 48 N-m (35 ft-lbs) torque.

Connect the exhaust pipe to the exhaust manifold. Tighten the nuts with 31 N-m (23 ft-lbs) torque.

Install the intake manifold. Refer to Intake Manifold Installation for the procedure.

Install the EGR valve tube.



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CYLINDER HEAD REMOVAL

Disconnect the battery negative cable.

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

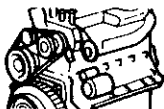
Drain the coolant and disconnect the hoses at the thermostat housing.

Remove the air cleaner.

Remove the cylinder head cover (1). Refer to Cylinder Head Cover Removal for the procedure

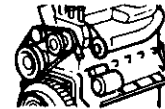
Remove the rocker arms (2) and bridge (3) and pivot (4) assemblies. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges .

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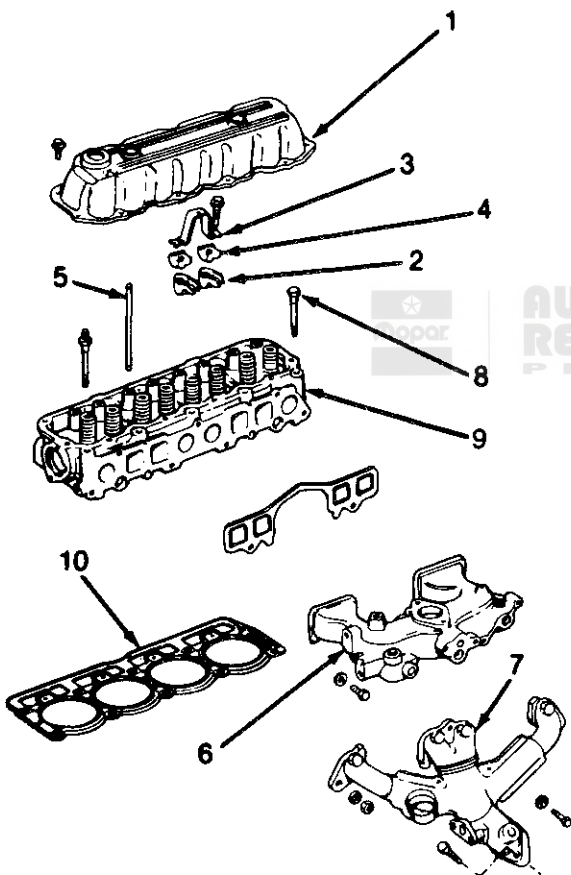
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Remove the push rods (5).

NOTE: Retain the push rods, bridges, pivots and rocker arms in the same order as removed to facilitate installation in the original locations.

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Disconnect the power steering pump bracket. Set the pump and bracket aside. Do not disconnect the hoses.

Remove the intake (6) and exhaust (7) manifolds from the cylinder head.

Remove the intake manifold gasket. Refer to Intake and Exhaust Manifold Removal for the procedures.

Disconnect the ignition wire connectors and remove the spark plugs.

Disconnect the temperature sending unit wire connector and battery negative cable.

Remove the cylinder head bolts (8), cylinder head (9) and gasket (10).

CYLINDER HEAD CLEANING AND INSPECTION

Thoroughly clean the machined surfaces on the cylinder head and block. Remove all gasket material and cement.

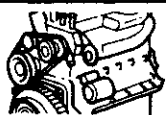
Remove any carbon deposits from the combustion chambers and from the top of the pistons.

Use a straightedge and feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to the Specifications chart.

CYLINDER HEAD INSTALLATION

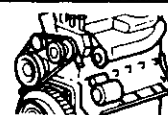
If the cylinder head is to be replaced and the original valves used, measure the valve stem diameter.

Only standard size valves can be used with a service replacement cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems.



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Remove all carbon buildup and reface the valves as outlined in the MOT. 2.46L manual.

Install the valves in the cylinder head with replacement valve stem oil deflectors. Refer to the MOT. 2.46L manual.

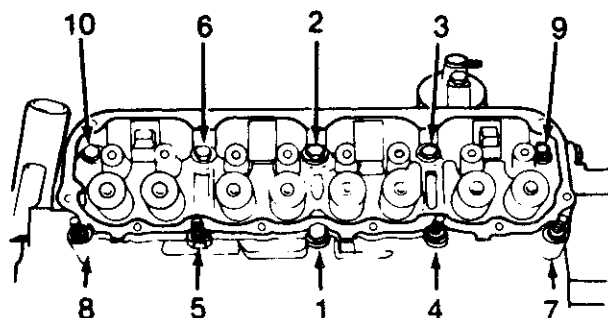
Transfer all the attached components from the original cylinder head that are not included with the replacement cylinder head.

CAUTION: Do not install the temperature sending unit until the system is filled with coolant. This permits trapped air to escape from the cylinder block and head. Refer to the air vent procedure described in the Cooling Systems section when refilling the system.

CAUTION: Do not apply sealing compound on the cylinder head and block gasket surfaces. Do not allow sealing compound to enter the cylinder bore.

Apply an even coat of Perfect Seal sealing compound, or equivalent, to both sides of the replacement cylinder head gasket and position the gasket on the cylinder block with the word TOP facing up.

Install the cylinder head. Tighten the bolts in the sequence illustrated with 115 N·m (85 ft-lbs) torque .



83126A

NOTE: The cylinder head gasket is made of aluminum-coated embossed steel and does not require that the cylinder head bolts be retightened.

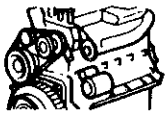
NOTE: Coat the threads of the stud bolt in the No. 8 sequence position with Loctite 592 sealant (or equivalent) and tighten with 102 N·m (75 ft-lbs) torque .

Connect the battery negative cable.

Install the spark plugs and connect the ignition wire connectors.

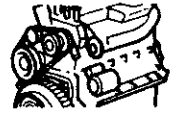
Install the intake and exhaust manifolds. Use the correct tightening sequence. Refer to Intake Manifold Installation and Exhaust Manifold Installation for the procedures.

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Install the alternator belt and adjust the tension. Refer to the Cooling systems section.

Install the power steering bracket and pump, if equipped. Adjust the belt tension. Refer to the Cooling Systems section.

NOTE: Refer to the Cooling Systems section for all drive belt adjustment procedures.

Install the push rods in their original locations.

Install the rocker arms and the bridge and pivot assemblies at their original locations. Loosely install the capscrews for each bridge and tighten alternately, one turn at a time, to avoid damaging the bridge.

Tighten the capscrews with 26 N·m (19 ft-lbs) torque.

Install the cylinder head cover. Refer to the installation procedure.

Connect the hoses to the thermostat housing and fill the cooling system to the specified level. Refer to the Cooling Systems section.

Install the temperature sensor unit and connect the wire connector.

Connect the fuel lines. Refer to O-ring replacement procedure in the Fuel Section.

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.

Operate the engine with the radiator cap off.

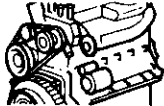
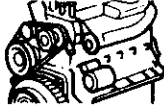
Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

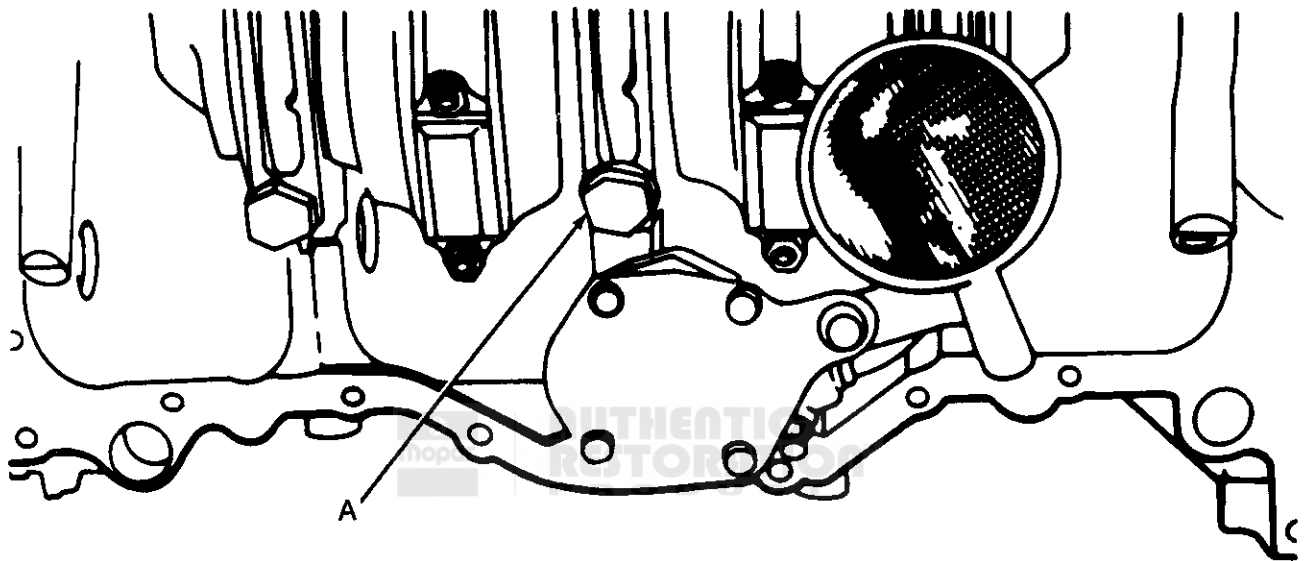
Install the air cleaner.

LUBRICATION SYSTEM

NOTE: A gear-type oil pump is located at the underside of the cylinder block opposite the No. 3 main bearing (A).

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Oil Pan Removal

Raise and support the vehicle at the side sills.

Drain the engine oil.

Remove the starter motor.

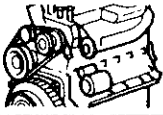
Remove the flywheel housing access cover.

Remove the oil pan screws.

Remove the oil pan by sliding it to the rear.

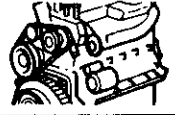
Oil Pan Cleaning

Clean the gasket and seal surfaces. Remove all sludge and grime from the oil pan sump.



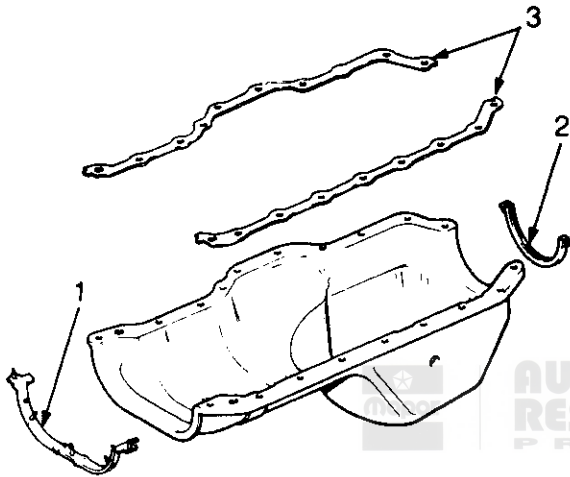
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Oil Pan Installation

Install a replacement oil pan front seal (1) on the timing case cover and apply a generous amount of RTV sealant (AMC Gasket-in-a-Tube, or equivalent) to the recesses in the tab ends.



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NOTE: Either one of two sealing methods may be used. An RTV sealant such as AMC Gasket-in-a-Tube, or equivalent, may be used instead of a gasket. If a gasket is used, coat both sides with a quick drying adhesive such as AMC Spray-a-Gasket, or equivalent.

Coat the inside curved surface of the replacement oil pan rear seal (2) with soap. Apply a generous amount of RTV sealant to the gasket contacting surface of the seal end tabs.

Install the seal (2) in the recess of the rear main bearing cap. Ensure it is fully seated.

Cement the replacement oil pan side gaskets (3) into position on the cylinder block.

Apply a generous amount of RTV sealant to the end tabs of the gaskets.

Apply engine oil to the oil pan contacting surface of the front and rear oil pan seals.

NOTE: Tighten the 1/4-20 oil pan screws with 9 N·m (7 ft-lbs) torque and tighten the 5/16-18 oil pan screws with 15 N·m (11 ft-lbs) torque.

Install the oil pan. Tighten the screws and the drain plug securely.

Install the starter motor.

Install the flywheel housing access cover.

Raise the vehicle.

Remove the sill supports.

Lower the vehicle.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put hands near the pulleys, belts or fan. Do not wear loose clothing.

Fill the oil pan with engine oil to the specified level. Start the engine and inspect for leaks.

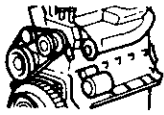
Oil Pump Removal

NOTE: Oil pump removal or replacement will not affect the distributor ignition timing because the distributor drive gear remains in mesh with the camshaft gear.

Drain the engine oil.

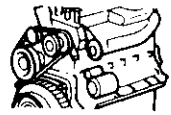
Remove the oil pan. Refer to Oil Pan Removal.

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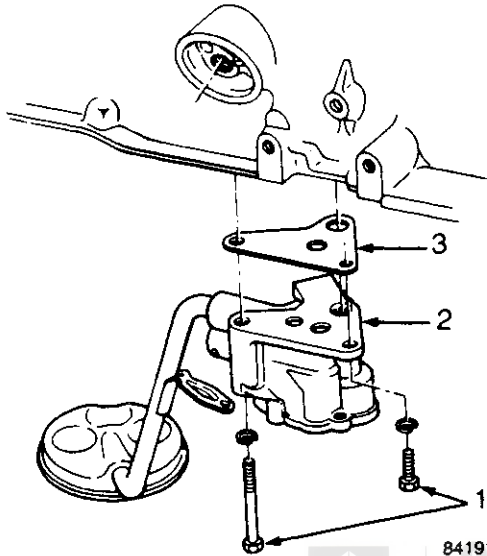


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Remove the oil pump retaining screws (1), oil pump (2) and gasket (3).



CAUTION: Do not disturb the position of the oil inlet tube and strainer assembly attached to the pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

Oil Pump Installation

NOTE: To ensure self-priming of the oil pump, fill the pump with petroleum jelly before installing the oil pump cover. Do not use grease.

Apply a bead of Loctite 515 sealant, or equivalent, and install the pump cover. Tighten the cover screws with 8 N·m (70 in-lbs) torque.

NOTE: Rotate the gears to ensure that a binding condition does not exist before installing the oil pump.

Install the oil pump (2) with a replacement gasket (3). Tighten the short screw with 14 N·m (10 ft-lbs) torque and the long screw with 23 N·m (17 ft-lbs) torque.

Install the oil pan with replacement gaskets and seals. Refer to Oil Pan Installation.

Fill the oil pan with replacement engine oil to the specified level.

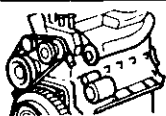
Oil Pump Overhaul

NOTE: Refer to MOT 2.46L manual for the oil pump overhaul procedure.

Oil Pressure Gauge

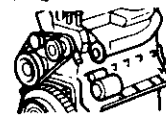
Refer to Chapter C – Electrical for operation, diagnosis and replacement of the oil pressure gauge.

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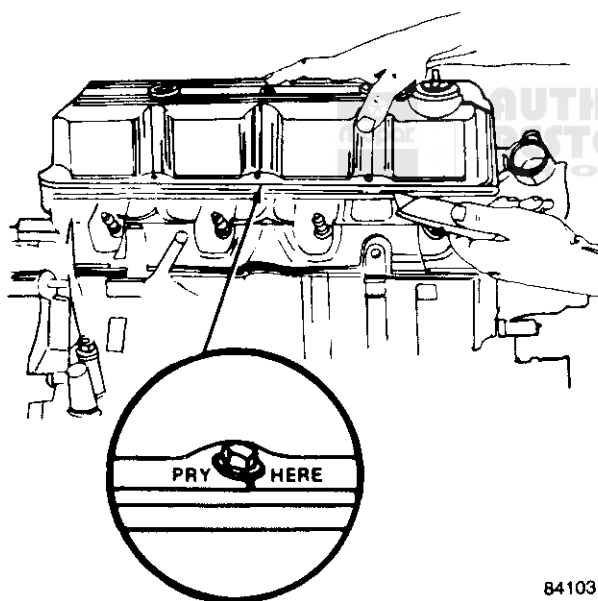


PISTONS AND CONNECTING RODS ASSEMBLY REPLACEMENT

NOTE: The following procedure is used to service the piston and connecting rod assemblies with the engine installed in the vehicle.

PISTONS AND CONNECTING RODS ASSEMBLY REMOVAL

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

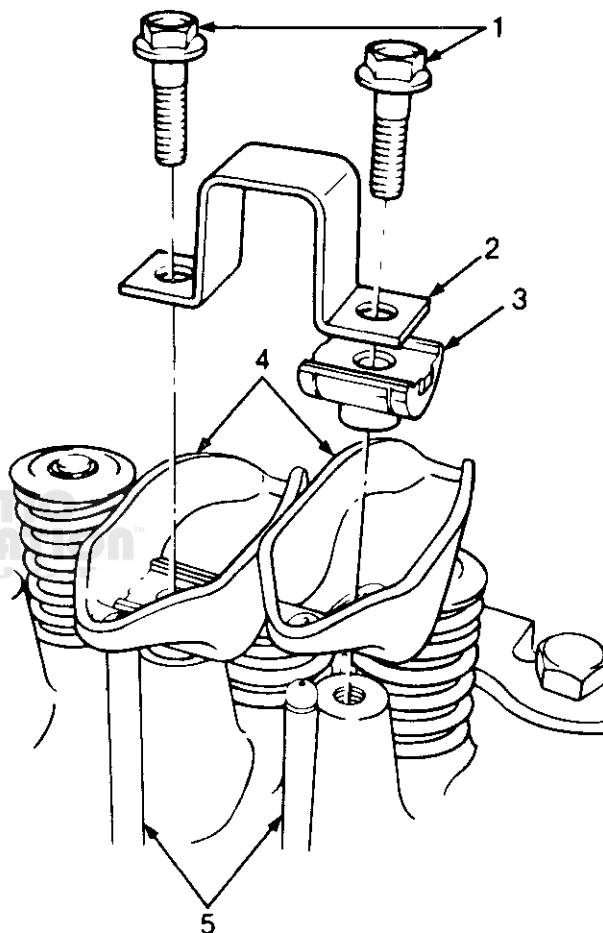


84103

Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4).

CAUTION: Alternately loosen the capscrews, one turn at a time, to avoid damaging the bridges.

Remove the push rods (5).

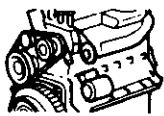


84174

NOTE: Retain the bridge and pivot assemblies, rocker arms and push rods in the order removed to facilitate installation at their original locations.

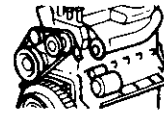
Remove the spark plugs.

Remove the intake manifold, gasket, exhaust manifold, cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.



ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE

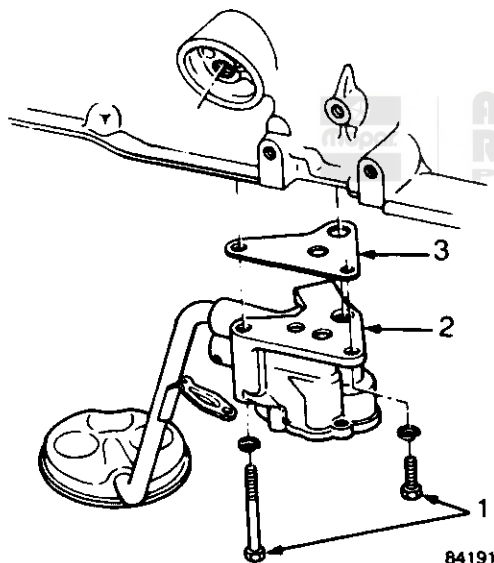


Position the connecting rods and pistons two at a time near the bottom of the stroke and use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

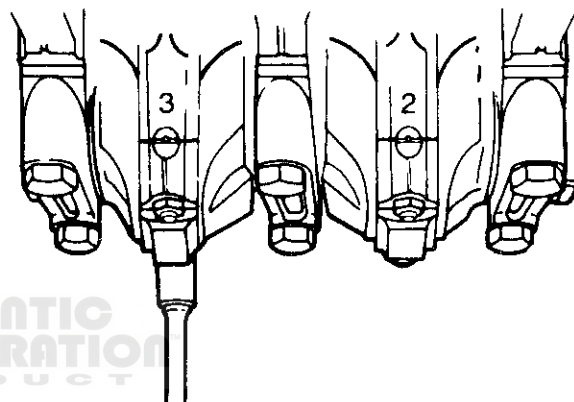
Drain the engine oil.

Remove the oil pan, gaskets and seals. Refer to Oil Pan Removal for the procedure.

Remove the bolts (1), oil pump (2) and gasket (3).



Remove the connecting rod bearing caps and bearing inserts. Retain them in the same order as removed to facilitate installation at their original locations. Refer to the bearing removal procedure.

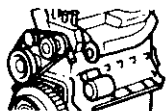


83115

NOTE: The connecting rods and caps are stamped with the corresponding cylinder number.

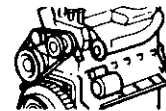
CAUTION: Ensure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during removal.

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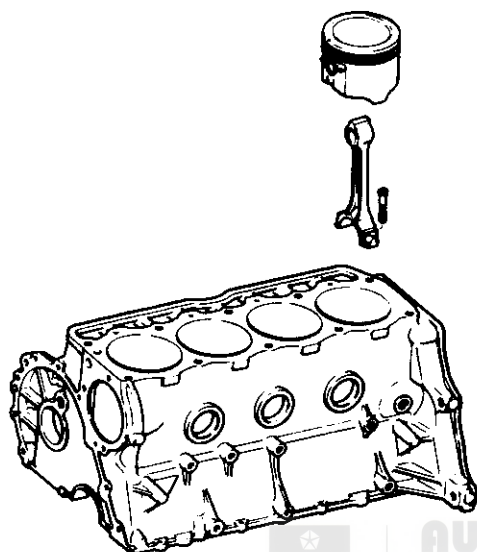
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Remove the connecting rod and piston assemblies through the top of the cylinder bores.

Use Piston Ring Compressor J-5601 to install the connecting rod and piston assemblies from the top of the cylinder bores. Ensure that the arrow on each piston top points to the front of the engine.

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84194

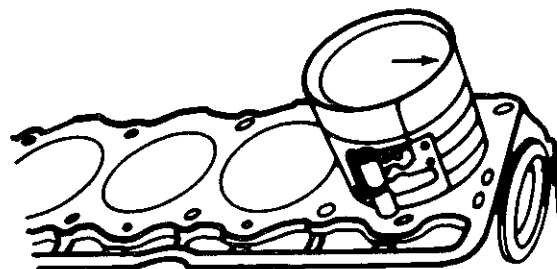
PISTONS AND CONNECTING RODS ASSEMBLY INSTALLATION

Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean, lint-free cloth.

Install the piston rings on the pistons, if removed. Refer to the MOT. 2.46L manual for the procedure.

Lubricate the pistons and rings with clean engine oil.

CAUTION: Ensure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during installation.

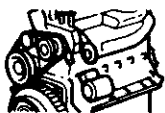


84195

NOTE: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons point to the front of the engine.

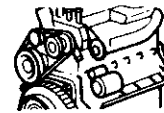
Raise and support the vehicle.

Install the connecting rod bearing caps and inserts at their original locations. Refer to Connecting Rod Bearings Installation for the procedure.

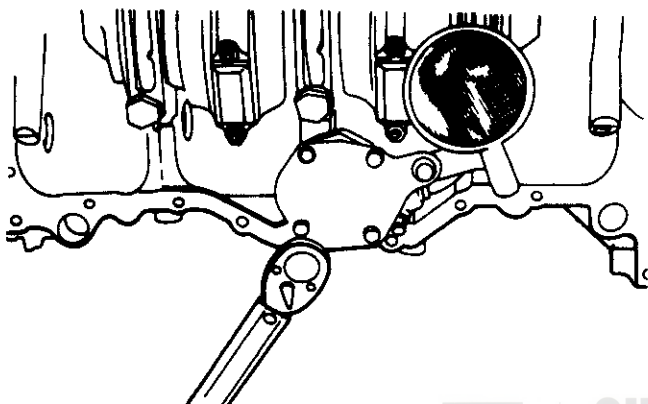


ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE

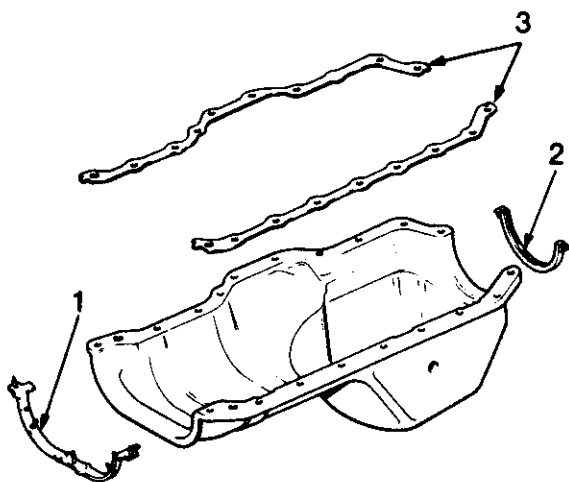


Install the oil pump with a replacement gasket. Refer to Oil Pump Installation for the procedure.



83121

Install the oil pan with replacement seals (1 and 2) and gaskets (3).

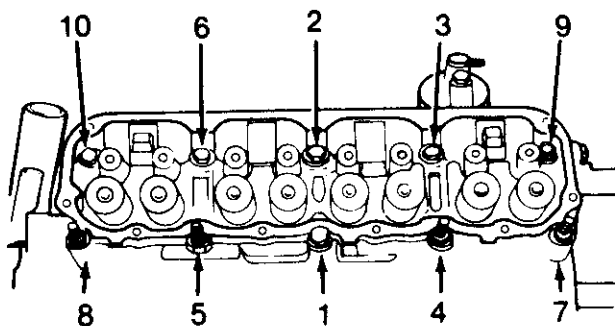


84190

Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

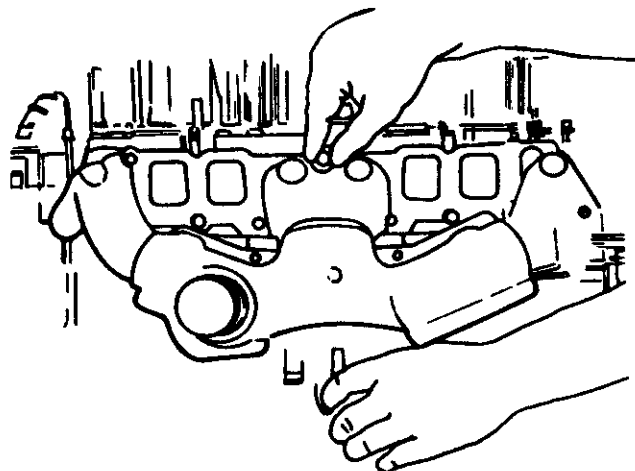
Lower the vehicle.

Install a replacement gasket and the cylinder head. Refer to Cylinder Head Installation for the procedure.



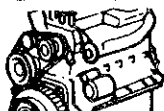
83126

Install the exhaust manifold, a replacement gasket and the intake manifold. Refer to the installation procedures.



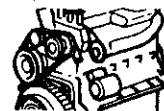
83128

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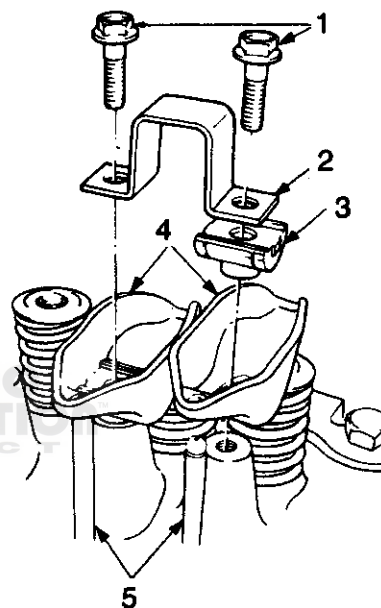
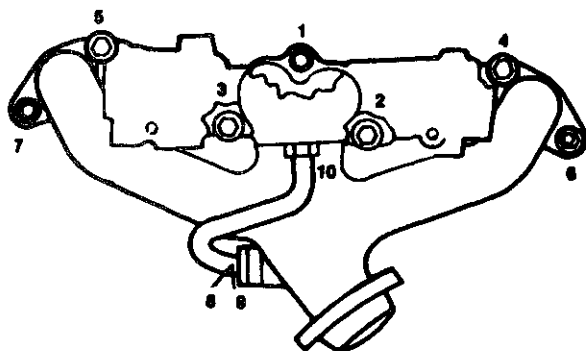
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



Tighten the mounting bolts to 31 N-m (23 ft-lbs) torque using the torque sequence outlined.

Install the push rods (5), rocker arms (4), bridge (2) and pivot (3) assemblies, and capscrews (1).

CAUTION: Alternately tighten the capscrews at each bridge, one turn at a time, to avoid damaging the bridges.



Install the EGR tube assembly.

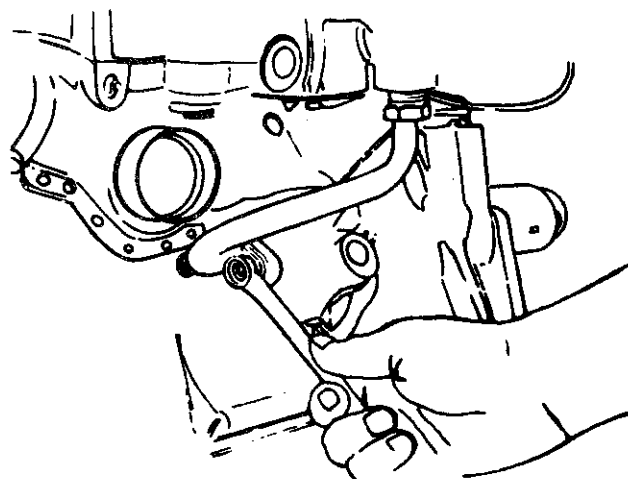
Install the cylinder head cover. Refer to the installation procedure.

Install the spark plugs.

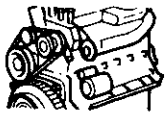
Fill the oil pan with engine oil to the FULL MARK on the dipstick.

PISTON PIN REMOVAL, INSPECTION, INSTALLATION

Refer to the MOT. 2.46L manual for the removal, inspection and installation procedures.

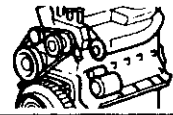


83130



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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE

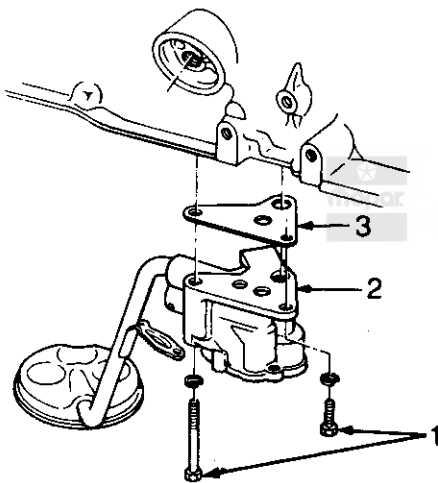


CONNECTING ROD BEARINGS REMOVAL

Drain the engine oil.

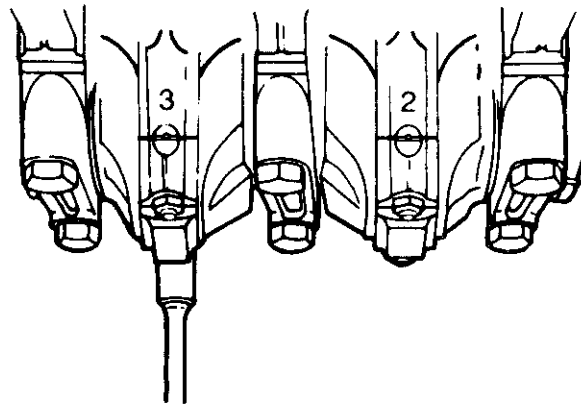
Remove the oil pan, seals and gaskets. Refer to Oil Pan Removal for the procedure.

Remove the bolts (1), oil pump (2) and gasket (3). Refer to Oil Pump Removal for the procedure.



84191

Rotate the crankshaft as required to position two of the connecting rods at a time at the bottom of the stroke.



83115

Remove the connecting rod bearing caps. Remove the lower bearing inserts. Remove the upper bearing inserts by rotating/sliding them out of the connecting rods.

NOTE: Do not intermix the bearing caps. Each connecting rod and its bearing cap are stamped with the corresponding cylinder number on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

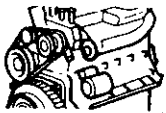
CONNECTING ROD BEARINGS INSPECTION

Refer to the MOT. 2.46L manual for the inspection procedure.

Measuring Bearing-to-Journal Clearance with Plastigage

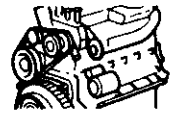
Refer to the MOT. 2.46L manual for the procedure.

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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



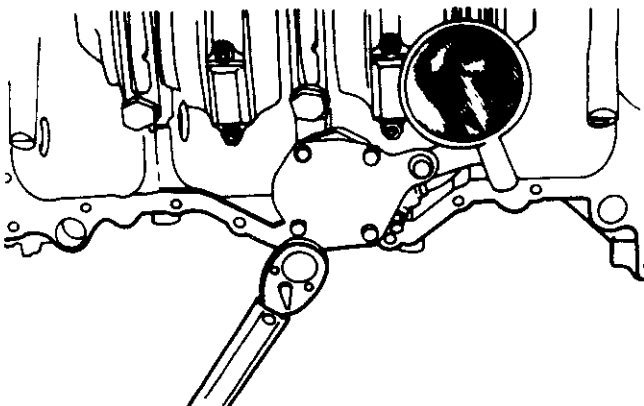
CONNECTING ROD BEARINGS INSTALLATION

Lubricate the bearing surface of each insert with clean engine oil.

CAUTION: Use care when rotating the crankshaft with the bearing caps removed. Ensure that the connecting rod bolts do not accidentally come into contact with the crankshaft journals and scratch the surface. Bearing failure would result. Short pieces of rubber hose, slipped over the connecting rod bolts, will provide protection during installation.

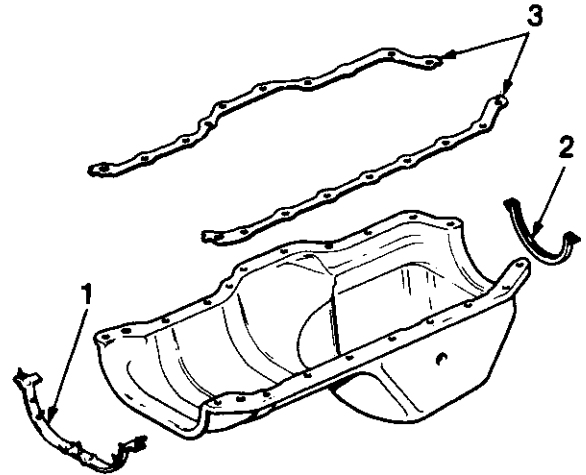
Install the connecting rods, bearing inserts and caps around the journals and secure them with the retaining nuts. Tighten with 45 N·m (33 ft-lbs) torque.

Install the oil pump with a replacement gasket. Refer to the installation procedure.



83121

Install the oil pan with replacement gaskets (3) and seals (1 and 2). Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.



84190

Fill the crankcase with engine oil to the **FULL MARK** on the dipstick.

PISTON REPLACEMENT AND SERVICING

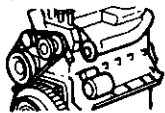
Refer to the MOT. 2.46L manual for piston replacement and servicing procedures.

CRANKSHAFT REPLACEMENT

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible.

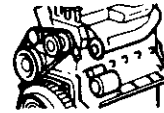
CRANKSHAFT REMOVAL AND INSTALLATION

Refer to the MOT. 2.46L manual for removal and installation procedures.



ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



CRANKSHAFT MAIN BEARINGS REMOVAL

Remove the spark plugs.

Disconnect the battery cables.

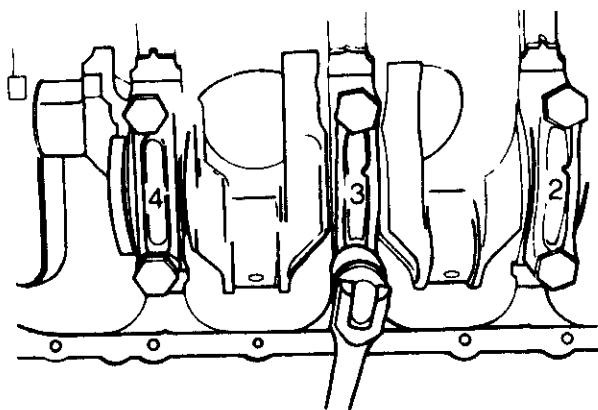
Raise and support the vehicle.

Drain the engine oil.

Remove the oil pan. Refer to Oil Pan Removal for the procedure.

Remove the oil pump. Refer to Oil Pump Removal for the procedure.

Remove the first main bearing cap and lower insert.



83116

Remove the lower bearing insert from the bearing cap.

Remove the upper bearing insert by loosening all of the other bearing caps and inserting a small cotter pin tool in the crankshaft journal oil hole.

Bend a cotter pin as illustrated to fabricate the tool.

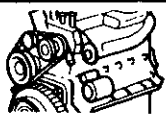
NOTE: A tongue depressor may also be used to remove the bearing insert.



84192

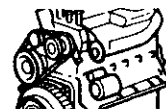
With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab.

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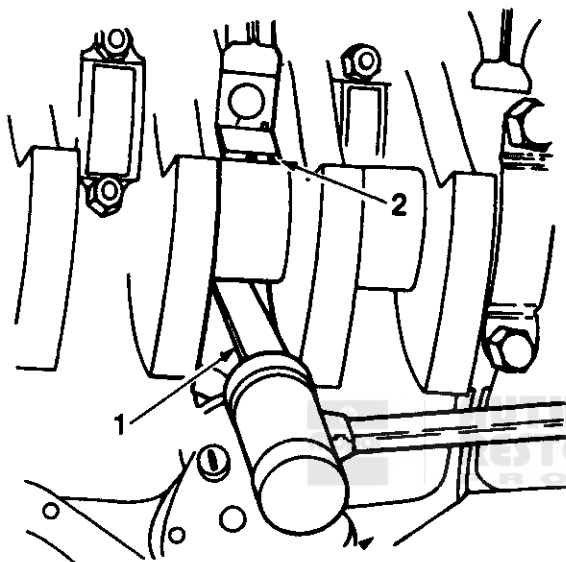


ENGINES

2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



NOTE: Because there is no hole in the No. 3 main journal, use a tongue depressor (1) or similar soft-faced tool to remove the bearing insert (2). After moving the insert approximately 25mm (1-in), it can be removed by applying pressure under the tab.



84193

Using the same procedure described above, remove (as necessary) the remaining bearing inserts one at a time for inspection.

Measuring Main Bearing-to-Journal Clearance with Plastigage (Crankshaft Installed)

Refer to the MOT. 2.46L manual for the procedure.

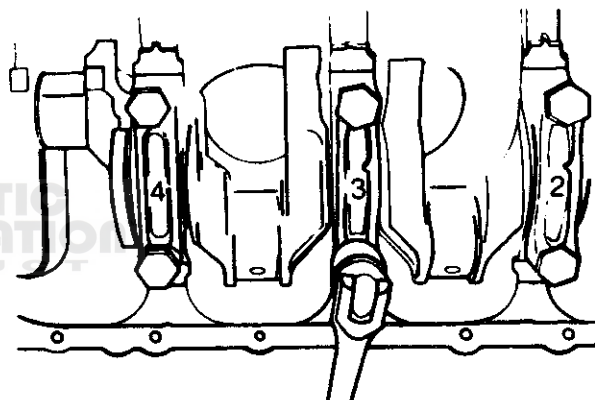
CRANKSHAFT MAIN BEARINGS INSTALLATION

Lubricate the bearing surface of the inserts with engine oil.

Loosen all the main bearing caps. Install the main bearing upper insert.

Install the main bearing cap and lower insert.

Tighten the bolts with 54 N·m (40 ft-lbs) torque. Then, tighten with 95 N·m (70 ft-lbs) torque. Finally, tighten with 108 N·m (80 ft-lbs) torque.



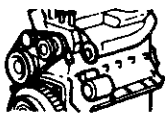
83116

Rotate the crankshaft after tightening each main bearing cap to ensure that the crankshaft rotates freely.

NOTE: When installing a crankshaft kit (crankshaft plus bearing inserts), measure each bearing-to-journal clearance with Plastigage to ensure a proper fit.

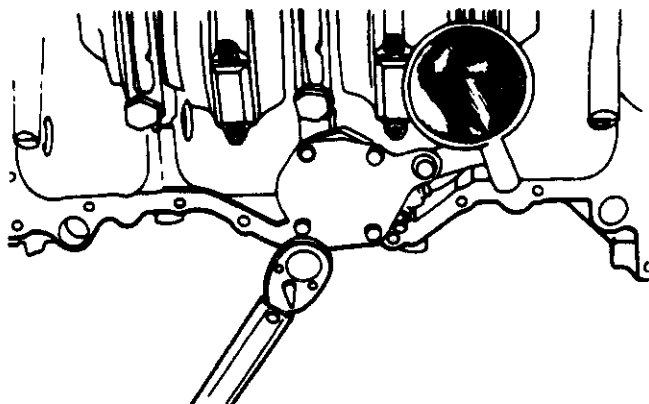
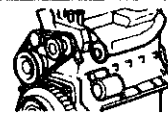
Install the oil pump with a replacement gasket. Refer to Oil Pump Installation for the procedure.

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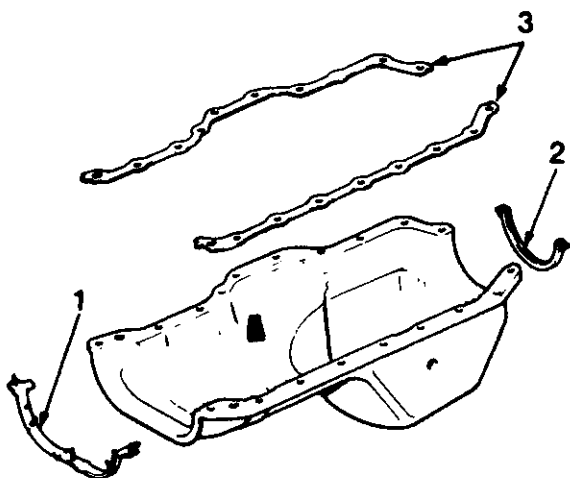
2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



83121

Install the oil pan with replacement seals (1 and 2) and gaskets (3).

Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.



84190

Fill the oil pan with engine oil to the **FULL MARK** on the dipstick.

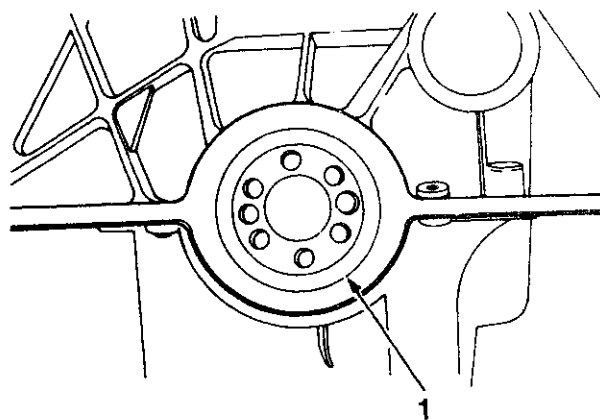
REAR MAIN BEARING OIL SEAL REMOVAL

The crankshaft rear main bearing oil seal is a one-piece, single-lip seal that fits tightly between the cylinder block and the crankshaft.

NOTE: When replacing the rear main oil seal, the transmission must be removed. Refer to the applicable transmission removal procedure.

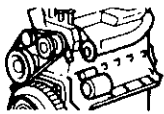
Remove the flywheel or converter drive plate.

Remove the seal (1) from the crankshaft flange by prying around the crankshaft flange.



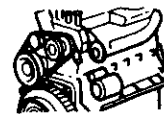
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2.46 LITER (150 CID) FOUR-CYLINDER ENGINE



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REAR MAIN BEARING OIL SEAL INSTALLATION

Coat the inner lip of the replacement rear main bearing seal (1) with engine oil.

Carefully insert the seal (1) into place and gently tap it flush with the cylinder block with a rubber or plastic mallet.

Install the converter drive plate or flywheel with replacement bolts. Refer to the converter drive plate/flywheel removal and installation procedure.

Install the transmission. Refer to the applicable installation procedure.

FLYWHEEL/DRIVE PLATE AND RING GEAR REMOVAL

The ring gear can be replaced **ONLY** for engines with a manual transmission.

The ring gear is welded to the converter drive plate and balanced for engines with an automatic transmission.

If defective, the entire drive plate and ring gear assembly must be replaced for engines with automatic transmissions.

NOTE: Before removing the drive plate or flywheel, the transmission **MUST BE REMOVED**. Refer to the applicable transmission removal procedure.

Remove the transmission.

Remove the converter drive plate or flywheel.

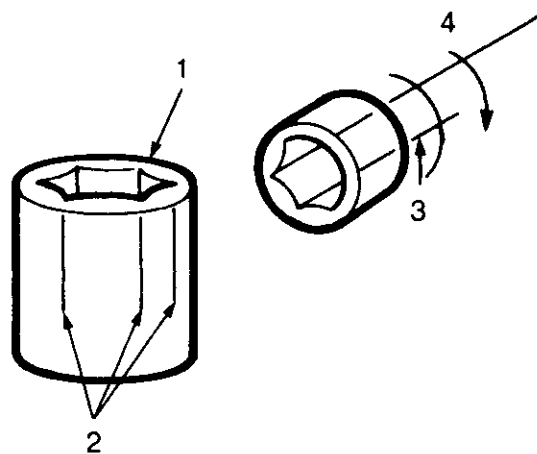
FLYWHEEL/DRIVE PLATE AND RING GEAR INSTALLATION

Install the converter drive plate or flywheel with replacement bolts.

Tighten the converter drive plate bolts with 54 N·m (40 ft-lbs) plus 60° torque.

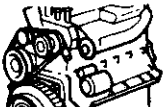
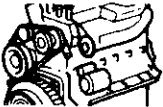
Tighten the flywheel bolts with 68 N·m (50 ft-lbs) plus 60° torque.

NOTE: A 19mm (3/4-in) (1) hex socket wrench should be permanently marked every 60° (2) on the outer circumference in line with the hex points as illustrated. This tool will assist in applying the correct tightening torque to the bolts.



840138

After all the bolts have been pre-tightened with the specified torque, place the specially marked socket wrench over each bolt.

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	2.46 LITER (150 CID) FOUR-CYLINDER ENGINE	

Use a pencil to draw a small mark (3) on the surface of the flywheel or converter drive plate reinforcing ring.

The pencil mark should be in line with one of the 60° marks on the socket wrench.

Tighten each bolt until the next 60° mark (4) on the socket wrench is aligned with the pencil mark on the flywheel or drive plate.

Install the transmission. Refer to the applicable installation procedure.

RING GEAR REPLACEMENT

Position the flywheel on an arbor press with steel blocks equally spaced under the ring gear.

Press the flywheel down through the ring gear.

NOTE: The ring gear can also be removed by breaking it with a chisel.

Apply heat to expand the inside diameter of the replacement ring gear.

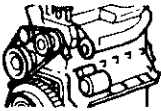
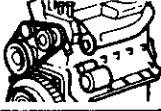
Press the flywheel into the replacement ring gear.

NOTE: For engines equipped with a manual transmission, the flywheel is balanced as an individual component and also as part of the crankshaft assembly. Do not attempt to duplicate the original flywheel balance holes when installing a service replacement flywheel. Service replacement flywheels are balanced during manufacture and do not require additional balancing.

CYLINDER BLOCK OVERHAUL

Refer to the MOT. 2.46L manual.

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	ENGINES	
	4.2 LITER (258 CID) SIX-CYLINDER ENGINE	

GENERAL INFORMATION

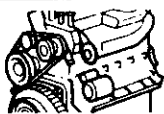
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Engine	Displacement	Bore mm (in)	Stroke mm (in)	Comp. Ratio	Carburetor	Oil Capacity
6-Cylinder	4.2L 258 CID	95.25 (3.75)	98.93 (3.895)	9.2:1	2-Venturi	3.8L 4.0 qts. 3.3 imp qts. (w/o filter change)

86348K

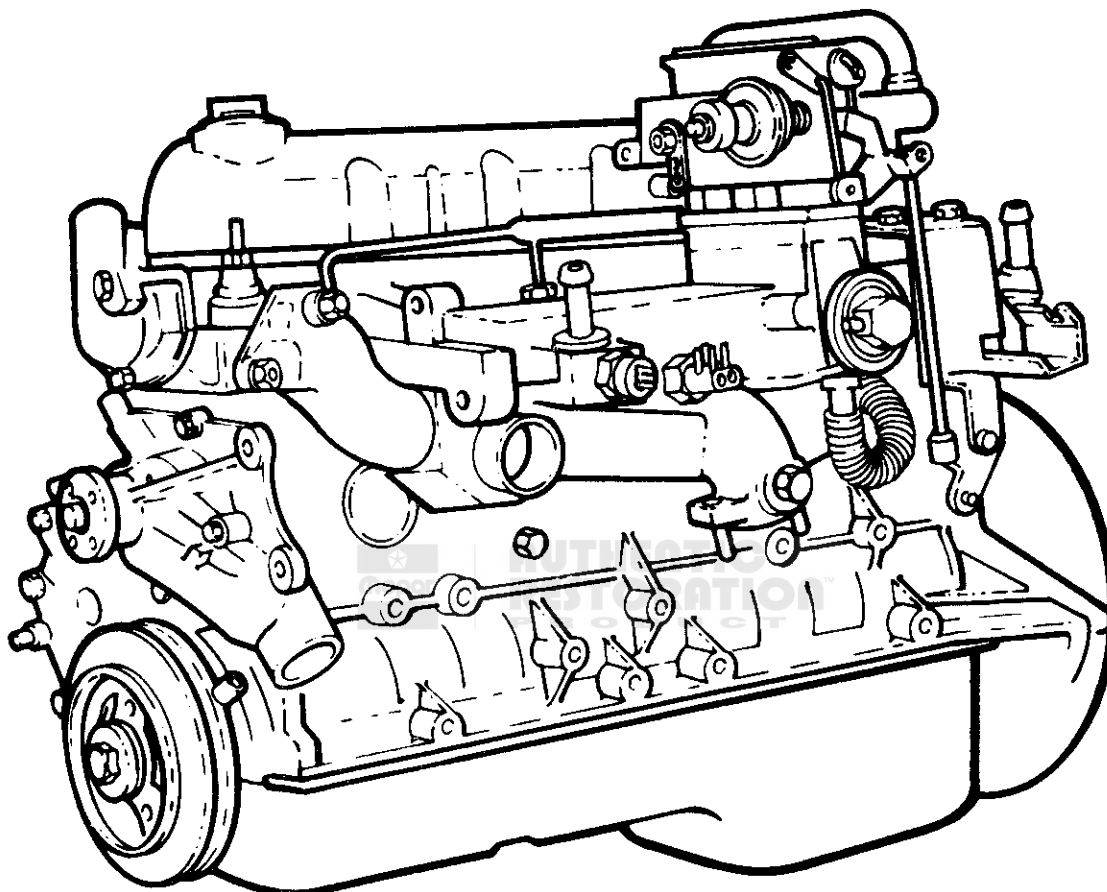
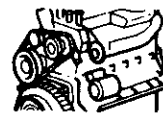


**AUTHENTIC
RESTORATION™
PRODUCT**



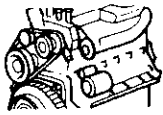
ENGINES

4.2 LITER (258 CID) SIX-CYLINDER ENGINE



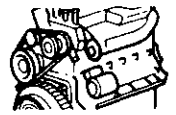
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ENGINES

4.2 LITER (258 CID) SIX-CYLINDER ENGINE



ENGINE IDENTIFICATION

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No. 2 and No. 3 cylinders.

The numbers in the code identify the year, month and day that the engine was built.

The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

Engine Build Date Code Explanation

EXAMPLE: 604C09

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
6 - 1986	01 - 12	C	01 - 31

Letter Code	CID	Carburetor	Compression Ratio
C	258	2V	9.2:1

The example code identifies a 4.2 liter (258 CID) engine with a 2V carburetor and 9.2:1 compression ratio that was built on April 9, 1986.

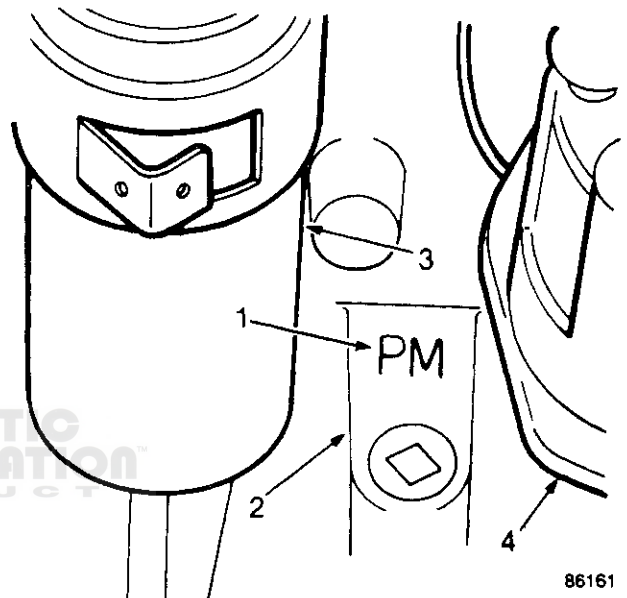
60257C

Oversize or Undersize Components

Some engines may be built with oversize or undersize components such as: oversize cylinder bores, undersize crankshaft main

bearing journals, undersize connecting rod journals or oversize camshaft bearing bores.

These engines are identified by a letter code (1) stamped on a boss (2) between the ignition coil (3) and the distributor (4).



86161

The letters are decoded in the following chart.

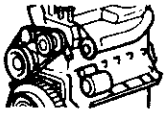
Oversize or Undersize Components Letter Code

Code Letter	Definition	
B	All cylinder bores	0.254mm (0.010-inch) oversize
M	All crankshaft main bearing journals	0.254mm (0.010-inch) undersize
P	All connecting rod bearing journals	0.254mm (0.010-inch) undersize
C	All camshaft bearing bores	0.254mm (0.010-inch) oversize

Example: The code letters PM indicate that the crankshaft main bearing journals and connecting rod journals are 0.254mm (0.010-inch) undersize.

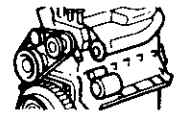
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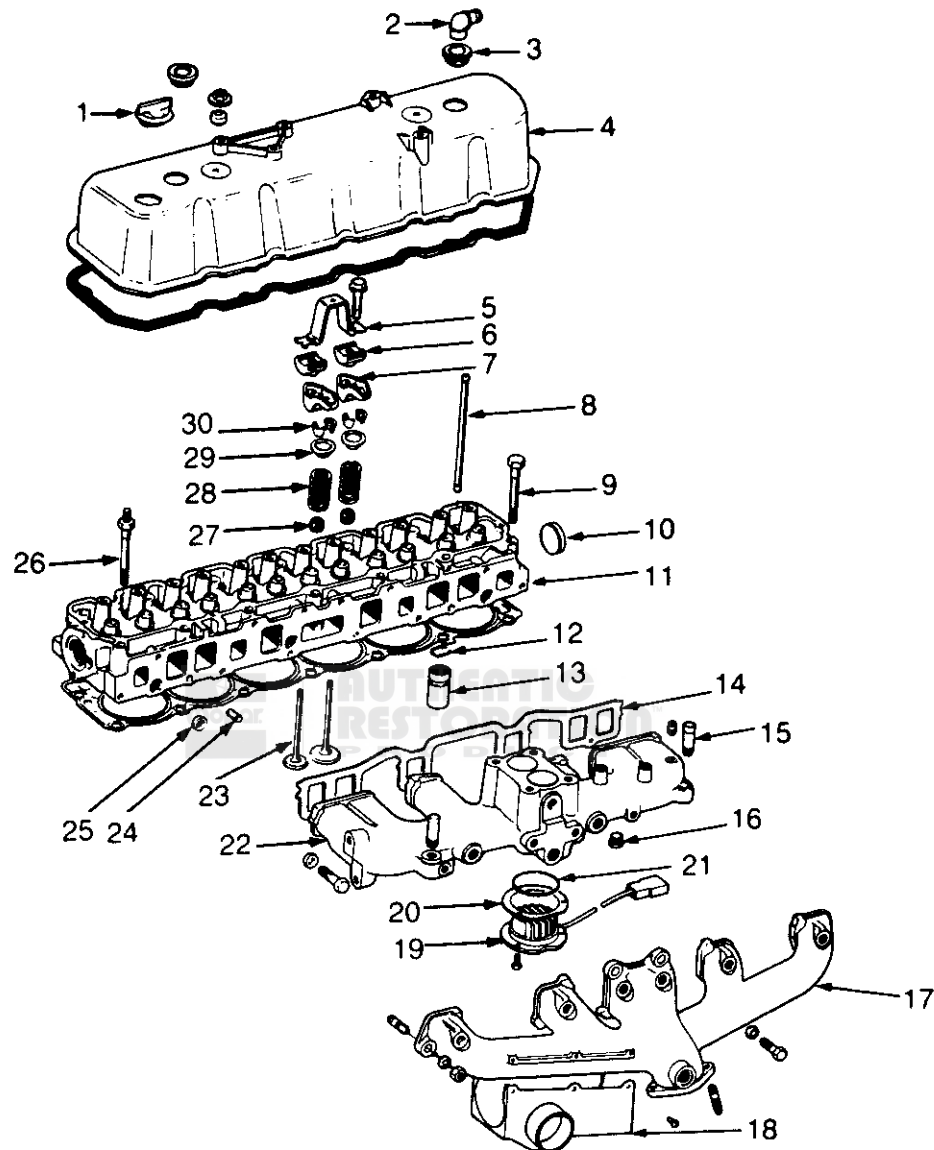


ENGINES

4.2 LITER (258 CID) SIX-CYLINDER ENGINE



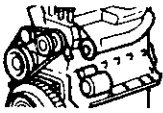
SIX-CYLINDER ENGINE ASSEMBLY — CYLINDER HEAD



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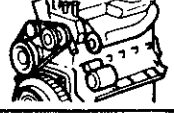
- | | |
|----------------------------------|-----------------------------|
| 1 - Oil Filler Cap | 16 - Plug |
| 2 - Ventilation Valve | 17 - Exhaust Manifold |
| 3 - Grommet | 18 - Heat Stove |
| 4 - Cylinder Head (Rocker) Cover | 19 - Intake Manifold Heater |
| 5 - Bridge | 20 - Gasket |
| 6 - Pivot | 21 - O-Ring |
| 7 - Rocker Arm | 22 - Intake Manifold |
| 8 - Push Rod | 23 - Valve |
| 9 - Cylinder Head Bolt | 24 - Dowel Pin |
| 10 - Cylinder Head Core Plug | 25 - Plug |
| 11 - Cylinder Head | 26 - Cylinder Head Stud |
| 12 - Snap Ring | 27 - Oil Deflector |
| 13 - Tappet | 28 - Valve Spring |
| 14 - Intake Manifold Gasket | 29 - Retainer |
| 15 - Hose Fitting | 30 - Valve Locks |

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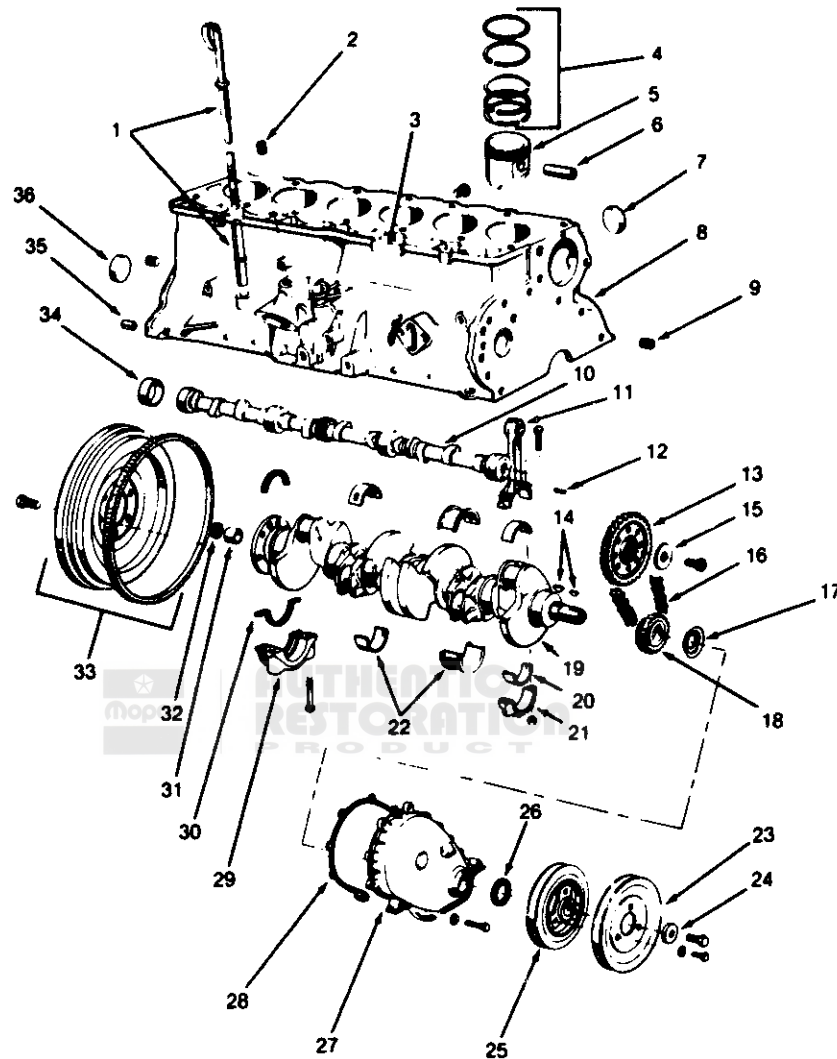


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



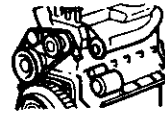
SIX CYLINDER ENGINE ASSEMBLY — CYLINDER BLOCK



- | | |
|---|--|
| 1 - Oil Level Gauge (Dipstick) and Tube | 20 - Connecting Rod Bearing |
| 2 - Oil Filter By-Pass Plug | 21 - Connecting Rod Bearing Cap |
| 3 - Build Date Code Location | 22 - Main Bearings |
| 4 - Ring Set | 23 - Vibration Damper Pulley |
| 5 - Piston | 24 - Washer |
| 6 - Pin Set | 25 - Vibration Damper |
| 7 - Plug | 26 - Seal |
| 8 - Cylinder Block | 27 - Timing Case Cover |
| 9 - Oil Channel Plug | 28 - Gasket |
| 10 - Camshaft | 29 - Main Bearing Cap (Rear) |
| 11 - Connecting Rod | 30 - Main Bearing Cap Seal Kit (Rear) |
| 12 - Pin | 31 - Pilot Bushing (with Manual Transmission) |
| 13 - Camshaft Sprocket | 32 - Bushing Oil Wick (with Manual Transmission) |
| 14 - Keys | 33 - Flywheel and Ring Gear (with Manual Transmission) |
| 15 - Washer | 34 - Bearing Set |
| 16 - Timing Chain | 35 - Dowel |
| 17 - Oil Shedder (Slinger) | 36 - Plug |
| 18 - Crankshaft Sprocket | |
| 19 - Crankshaft | |

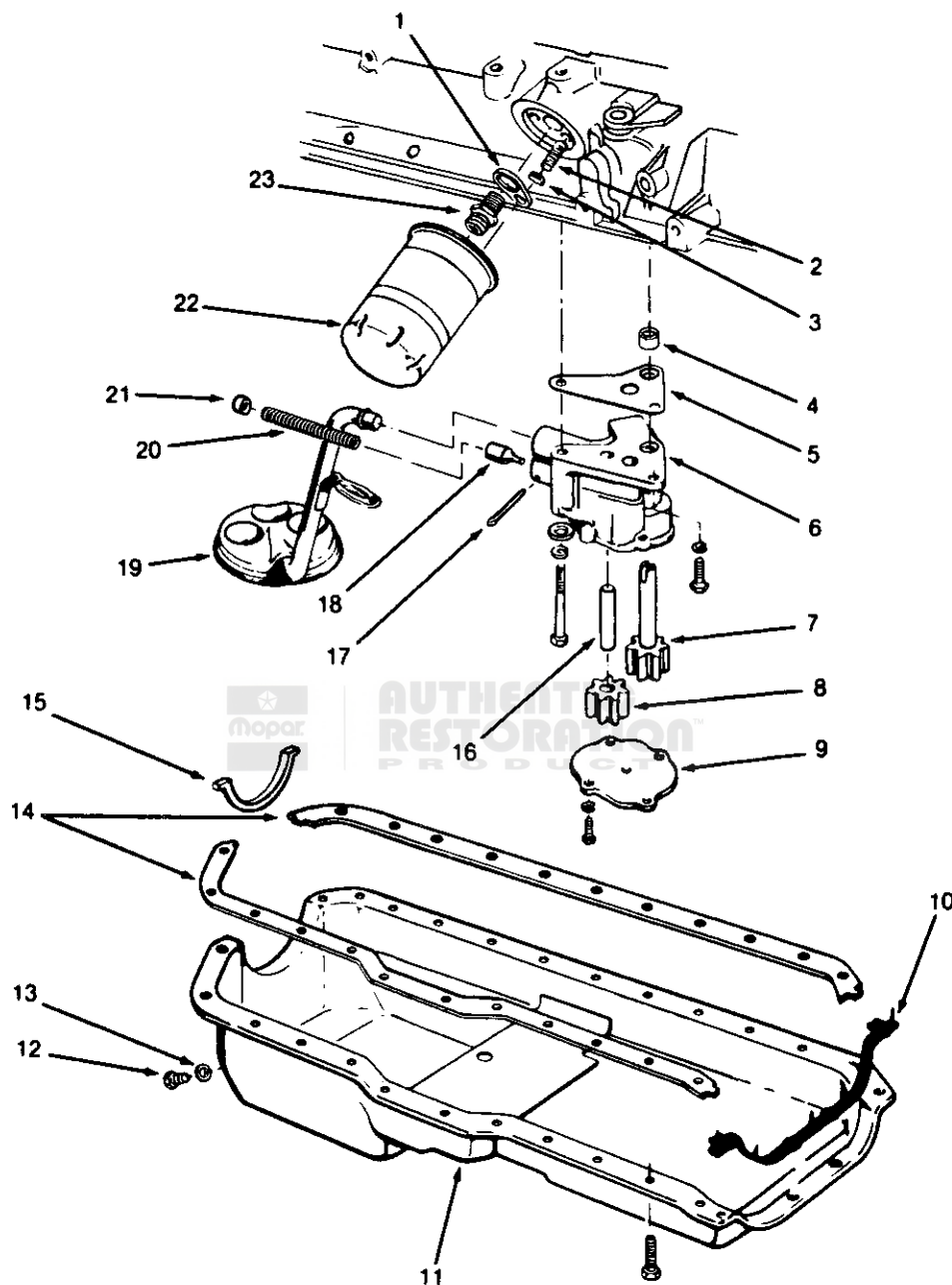
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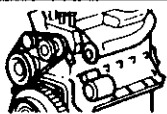
4.2 LITER (258 CID) SIX-CYLINDER ENGINE

SIX CYLINDER ENGINE ASSEMBLY — OIL PAN AND PUMP



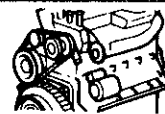
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- | | |
|---------------------------------------|--|
| 1 - Oil Filter By-Pass Valve Retainer | 13 - Oil Pan Drain Plug Gasket |
| 2 - Oil Filter By-Pass Valve Spring | 14 - Oil Pan Gasket Set |
| 3 - Oil Filter By-Pass Valve | 15 - Oil Pan-to-Bearing Cap Seal |
| 4 - Dowel Pin | 16 - Oil Pump Idler Gear Shaft |
| 5 - Oil Pump-to-Cylinder Block Gasket | 17 - Cotter Pin |
| 6 - Oil Pump Body | 18 - Release Valve Plunger |
| 7 - Oil Pump Drive Shaft and Gear | 19 - Oil Pump Strainer and Inlet Tube Assembly |
| 8 - Oil Pump Idler Gear | 20 - Oil Pump Release Valve Spring |
| 9 - Oil Pump Cover | 21 - Valve Spring Release Cap |
| 10 - Oil Pan Timing Case Cover Seal | 22 - Oil Filter Element |
| 11 - Oil Pan | 23 - Oil Filter By-Pass Connector |
| 12 - Oil Pan Drain Plug | |



ENGINES

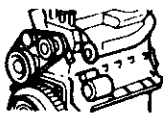
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



TORQUE SPECIFICATIONS

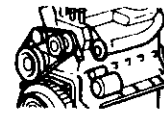
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Component	Service Set-To Torque	Service Recheck Torque
A/C Compressor Bracket-to-Engine	34 N·m (25 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Alternator Pivot Bolt or Nut	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Alternator Adjusting Bolt	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Mounting Bracket-to-Engine	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Alternator Mounting Bolt-to-Head	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Block Heater Nut	2 N·m (20 in-lbs)	2-3 N·m (17-25 in-lbs)
Camshaft Sprocket Bolt	108 N·m (80 ft-lbs)	95-122 N·m (70-90 ft-lbs)
Carburetor Hold-Down Nuts	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Coil Bracket-to-Cylinder Head Bolt	19 N·m (14 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Connecting Rod Bolt Nuts	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Cylinder Head Capscrews	115 N·m (85 ft-lbs)	108-122 N·m (80-90 ft-lbs)
Cylinder Head Cover Nuts	3.2 N·m (28 in-lbs)	2.8-3.5 N·m (25-31 ft-lbs)
Cylinder Head Cover Screws	6.2 N·m (55 in-lbs)	5.0-8.5 N·m (45-75 ft-lbs)
Clutch Cover-to-Flywheel Bolts	54 N·m (40 ft-lbs)	47-61 N·m (35-45 ft-lbs)
Crankshaft Pulley-to-Damper Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Clutch Housing-to-Transmission	38 N·m (28 ft-lbs)	33-43 N·m (24-32 ft-lbs)
Clutch Housing-to-Block Screws (Bottom)	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Clutch Housing-to-Block Screws (Top)	37 N·m (27 ft-lbs)	30-41 N·m (22-30 ft-lbs)
Distributor Clamp Bracket Screw	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Drive Plate-to-Converter Screw	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)
EGR Valve Tube Nuts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
EGR Valve Bolts	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Engine Front Cushion-to-Sill Bracket Bolts	40 N·m (30 ft-lbs)	23-47 N·m (17-35 ft-lbs)
Engine Front Cushion-to-Engine Mounting Bracket	65 N·m (48 ft-lbs)	55-75 N·m (41-55 ft-lbs)
Exhaust Manifold Bolts	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust Pipe-to-Manifold Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Fan and Hub Assembly Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Flywheel or Drive Plate-to-Crankshaft Bolts	142 N·m (105 ft-lbs)	129-156 N·m (95-115 ft-lbs)



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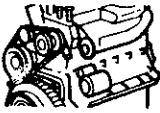
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



TORQUE SPECIFICATIONS (Continued)

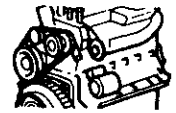
Component	Service Set-To Torque	Service Recheck Torque
Front Cushion Mounting Bracket-to-Block Bolts	61 N·m (45 ft-lbs)	48-73 N·m (36-54 ft-lbs)
Fuel Pump Screws	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Idle Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idle Pulley Bearing Shaft-to-Bracket Nut	45 N·m (33 ft-lbs)	38-52 N·m (28-38 ft-lbs)
Intake Manifold Coolant Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Intake Manifold Heater Screws	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Intake Manifold Screws	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Main Bearing Capscrews	108 N·m (80 ft-lbs)	101-115 N·m (75-85 ft-lbs)
Oil Filter Adapter	65 N·m (48 ft-lbs)	57-75 N·m (42-55 ft-lbs)
Oil Pan Drain Plug	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Oil Pan Screws – 1/4 in – 20	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Oil Pan Screws – 5/16 in – 18	15 N·m (11 ft-lbs)	12-18 N·m (5-11 ft-lbs)
Oil Pump Cover Screws	8 N·m (70 in-lbs)	7-9 N·m (60-80 in-lbs)
Oil Pump Attaching Screws (Short)	14 N·m (10 ft-lbs)	11-18 N·m (8-13 ft-lbs)
Oil Pump Attaching Screws (Long)	23 N·m (17 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Oxygen Sensor	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)
Power Steering Pump Adapter Screw	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Power Steering Pump Bracket Screw	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Power Steering Pump Mounting Screw	38 N·m (28 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump Pressure Hose Nut	52 N·m (38 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Power Steering Pump Pulley Nut	79 N·m (58 ft-lbs)	54-88 N·m (40-65 ft-lbs)
Pulse Air Tube-to-Catalytic Converter Fitting	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Pulse Air Tube-to-Front Exhaust Pipe Fitting	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Rear Skid Plate-to-Side Sill Nut	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)

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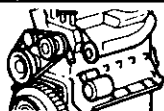
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



TORQUE SPECIFICATIONS (Continued)

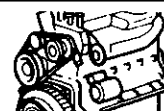
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Component	Service Set-To Torque	Service Recheck Torque
Rear Engine Cushion Adapter-to-Transmission Bolts	81 N·m (60 ft-lbs)	75-88 N·m (55-65 ft-lbs)
Rear Engine Cushion-to-Adapter Bracket	81 N·m (60 ft-lbs)	75-88 N·m (55-65 ft-lbs)
Rear Cushion-to-Skid Plate	40 N·m (30 ft-lbs)	23-47 N·m (17-35 ft-lbs)
Rocker Arm Assembly-to-Cylinder Head Bolts	26 N·m (19 ft-lbs)	18-34 N·m (13-25 ft-lbs)
Spark Plug	37 N·m (27 ft-lbs)	30-45 N·m (22-33 ft-lbs)
Starter Motor-to-Cylinder Block Bolts	45 N·m (33 ft-lbs)	38-51 N·m (28-38 ft-lbs)
Timing Case Cover-to-Block Screws	7 N·m (5 ft-lbs)	5-11 N·m (4-8 ft-lbs)
Timing Case Cover-to-Block Studs	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Torque Converter Drive Plate-to-Crankshaft Bolts	54 N·m (40 ft-lbs)	
Thermostat Housing Bolt	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Vibration Damper Bolt (Lubricated)	108 N·m (80 ft-lbs)	95-122 N·m (70-90 ft-lbs)
Water Pump Bolt	18 N·m (33 ft-lbs)	12-24 N·m (9-18 ft-lbs)



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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



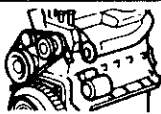
SPECIFICATIONS

Six-Cylinder Engine Specifications

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified		(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Type	In-Line, OHV, Six-Cylinder		Connecting Rods		
Bore	3.75	95.25	Total Weight (less bearings)	695-703 grams	
Stroke	3.895	98.93	Total Length (center-to-center)	5.873-5.877	149.17-149.28
Displacement	258 cubic inches	4.2 liter	Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Compression Ratio	8.6:1		Connecting Rod Bore		
Compression Pressure	120-150 psi	827-1034 kPa	(less bearings)	2.2085-2.2080	56.09-56.08
Maximum Variation Between			Bearing Clearance	0.001-0.003	0.03-0.08
Cylinders	30 psi	206 kPa		(0.0015-0.002	(0.044-.05
Firing Order	1-5-3-6-2-4			preferred)	preferred)
Taxable Horsepower	33.75 Bhp	25.2 kW	Side Clearance	0.010-0.019	0.25-0.48
Fuel	unleaded		Maximum Twist	0.001 per inch	0.025 per
					25.4 mm
Camshaft			Maximum Bend	0.0005	0.0127 per
Fuel Pump Eccentric Diameter	1.615-1.625	41.02-41.28		per inch	25.4 mm
Tappet Clearance	Zero Lash (hydraulic tappets)		Crankshaft		
End Play	Zero (engine operating)		End Play	0.0015-0.0065	0.038-0.165
Bearing Clearance	0.001-0.003	0.025-0.076	Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Bearing Journal Diameter			Main Bearing Journal Width		
No. 1	2.029-2.030	51.54-51.56	No. 1	1.086-1.098	27.58-27.89
No. 2	2.019-2.020	51.28-51.31	No. 3	1.271-1.273	32.28-32.33
No. 3	2.009-2.010	51.03-51.05	No. 2-4-5-6-7	1.182-1.188	30.02-30.18
No. 4	1.999-2.000	50.78-50.80	Main Bearing Clearance	0.001-0.0025	0.03-0.06
Base Circle Runout	0.001 (max)	0.03 (max)		(0.002	(0.051
Cam Lobe Lift	0.253	6.43		preferred)	preferred)
Valve Lift	0.405	10.29			
Intake Valve Timing			Connecting Rod Journal		
Opens	9° BTDC		Diameter	2.0934-2.0955	53.17-53.23
Closes	73° ABDC		Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Exhaust Valve Timing			Maximum Out-of-Round		
Opens	57° BBDC		(All Journals)	0.0005	0.013
Closes	25° ATDC		Maximum Taper (All Journals)	0.0005	0.013
Valve Overlap	34°		Cylinder Block		
Intake Duration	262°		Deck Height	9.487-9.493	240.97-241.12
Exhaust Duration	262°		Deck Clearance	0.0148	0.376
				(below block)	(below block)

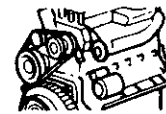
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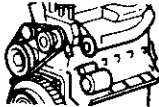
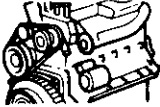
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Six-Cylinder Engine Specifications (Continued)

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NOTES

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified		(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Cylinder Block (cont'd.)					
Cylinder Bore Diameter (standard)	3.7501-3.7533	95.253-95.334	Piston Ring Side Clearance		
Maximum Taper	0.001	0.025	No. 1 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Maximum Out-of-Round	0.001	0.025	No. 2 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Tappet Bore Diameter	0.9055-0.9065	23.000-23.025	Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Cylinder Block Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)			
Cylinder Head					
Combustion Chamber Volume	64.45-67.45cc		Piston Ring Groove Height		
Valve Arrangement	EI-IE-IE-EI-EI-IE		Compression (both)	0.0795-0.0805	2.019-2.045
Valve Guide ID (Integral)	0.3735-0.3745	9.487-9.512	Oil Control	0.188-0.1895	4.78-4.80
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08	Pistong Ring Groove Diameter		
Intake Valve Seat Angle	30°		No. 1 and No. 2	3.324-3.329	84.43-84.56
Exhaust Valve Seat Angle	44.5°		Oil Control	3.329-3.339	84.56-84.81
Valve Stem Width	0.040-0.080	1.02-1.52	Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Valve Seat Runout	0.0025	0.064	Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Cylinder Head Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)	Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Lubrication System					
Engine Oil Capacity	4 quarts (Add 1 quart with filter change)	3.8 liters (Add 0.9 liter with filter change)	Piston-to-Pin Connecting Rod	2000 lbf press-fit	8.9kN press-fit
Normal Operating Pressure	13 psi at 600 rpm, 37-75 psi (max) at 1800 + rpm	89.6 kPa at 600 rpm, 255.1-517.1 kPa (max) at 1800 + rpm	Rocker Arms, Push Rods and Tappets		
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)	Rocker Arm Ratio	1.6:1	
Gear-to-Body Clearance (Radial)	0.002-0.004 (.002 preferred)	0.051-0.102 (.051 preferred)	Push Rod Length	9.640-9.660	244.856-245.364
Gear End Clearance, Plastigage	0.002-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)	Push Rod Diameter	0.312-0.315	7.92-8.00
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)	Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
			Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05
Pistons					
Weight (less pin)	510-514 grams		Valves		
Piston Pin Bore Centerline- to-Piston Top	1.851-1.855	41.94-42.04	Valve Length (Tip-to-Gauge Dim. Line)	4.7895-4.8045	121.653-122.034
Piston-to-Bore Clearance	0.0009-0.0017 (0.0012-0.0013 preferred)	0.023-0.043 (0.030-0.033 preferred)	Valve Stem Diameter	0.3715-0.3725	9.436-9.462
Piston Ring Gap Clearance - Compression (both)	0.010-0.020	0.25-0.51	Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Piston Ring Gap Clearance - Oil Control Steel Rails	0.010-0.025	0.25-0.84	Intake Valve Head Diameter	1.782-1.792	45.26-45.52
			Intake Valve Face Angle	29°	
			Exhaust Valve Head Diameter	1.401-1.411	35.59-35.84
			Exhaust Valve Face Angle	44°	
			Maximum Allowable Removed for Tip Refinishing	0.010	0.25
			Valve Springs		
			Free Length	1.99 approx.	50.55 approx.
			Spring Tension		
			Valve Closed	64.72 lbf at 1.786	285-320N at 45.4
			Valve Open	188-202 lbf at 1.411	836-898N at 35.84
			Inside Diameter	0.948-0.968	24.08-24.59

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SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly (short block) may be installed whenever the original cylinder block is defective or damaged beyond repair.

It consists of a cylinder block, piston and rod assemblies and crankshaft.

NOTE: The camshaft must be procured separately and installed before the engine is installed in the vehicle.

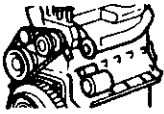
NOTE: For identification, short engine assemblies have the letter S stamped on the same machined surface where the build date code is stamped for complete engine assemblies.

Installation includes the transfer of components from the defective or damaged original engine.

Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this manual and the MOT. 4.2L manual.

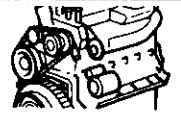
SEE I.S. NOTES





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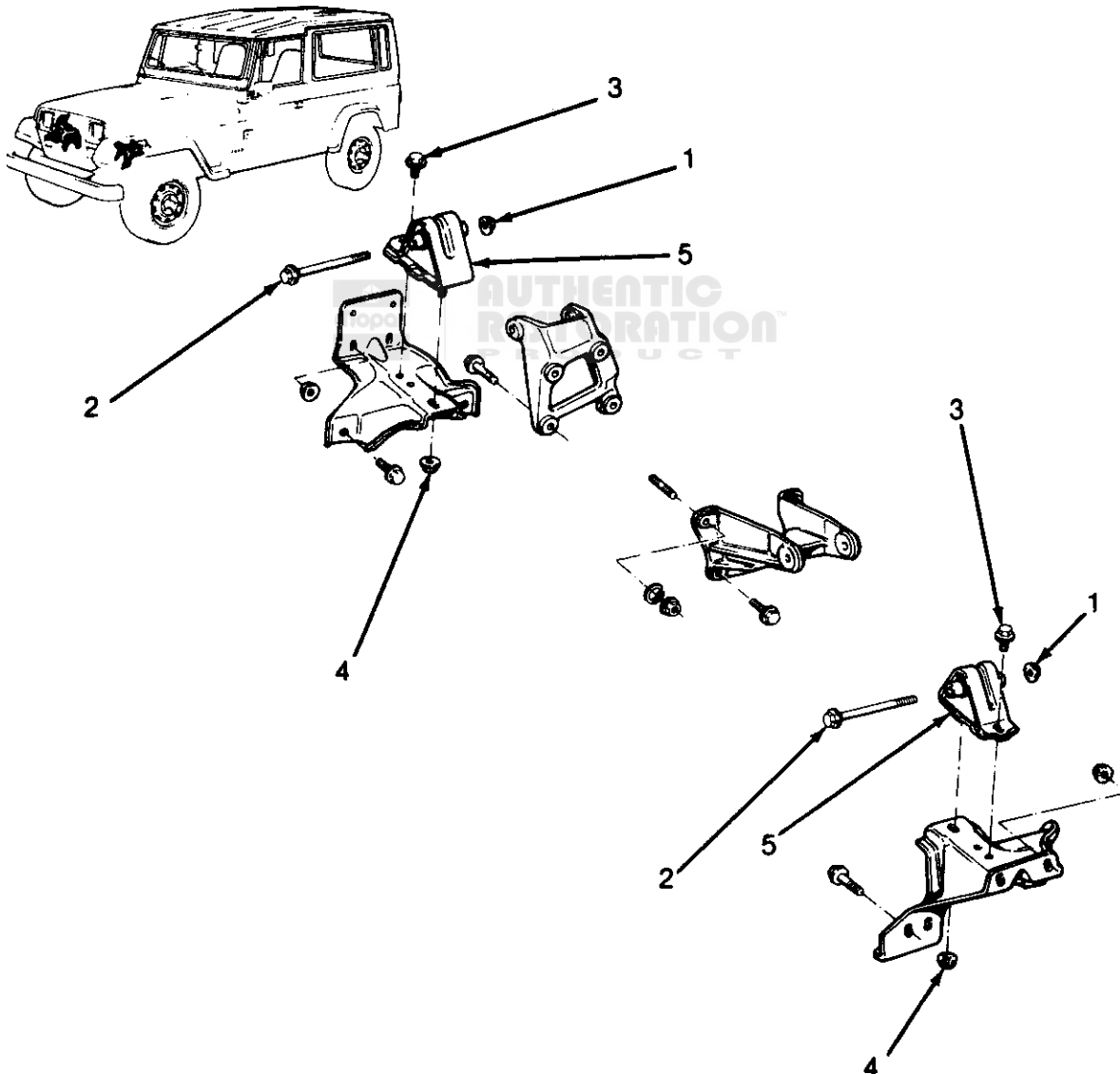
ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine and at the rear between the transmission adapter housing and the rear support crossmember.

Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

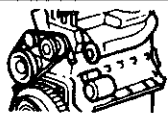
CAUTION: Before raising the engine, remove the screws that attach the fan shroud to the radiator to prevent damage to the shroud by the fan.

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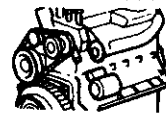
- 1. Through Bolt Nut
- 2. Through Bolt
- 3. Mount Retaining Bolt

- 4. Mount Retaining Nut
- 5. Engine Mount



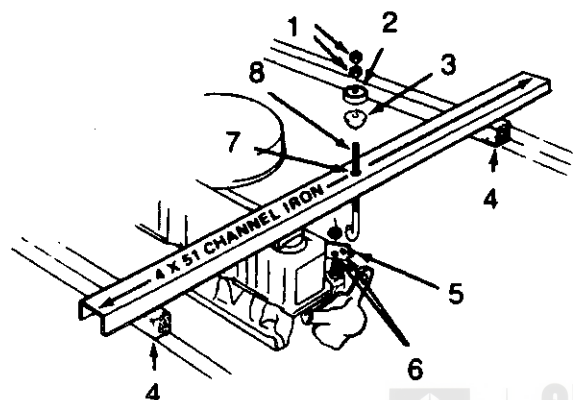
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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



ENGINE HOLDING FIXTURE

If it is necessary to remove the front engine mounts and front crossmember to perform service such as oil pan removal, an engine holding fixture may be fabricated as illustrated.



- | | |
|-----------------------------------|-----------------------------|
| 1 - 9/16-Inch - 12 Nuts | 5 - 1/4-Inch Angle Iron |
| 2 - Upper Trunnion Bearing | 6 - 1/2-Inch Holes |
| 3 - Pivot or Sleeve | 7 - 1-Inch Hole |
| 4 - 2 x 2 x 6-Inch Hardwood Block | 8 - 9/16-Inch - 12 Trunnion |

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ENGINE REMOVAL

The engine is removed separated from the transmission.

WARNING: The coolant in a recently operated engine is hot and pressurized. Release the pressure before removing the radiator draincock and cap.

Remove the radiator draincock and radiator cap and drain the coolant.

NOTE: Do not waste reusable coolant. If the solution is clean, drain it into a clean container for reuse.

Mark the hinge locations on the hood panel for alignment reference during installation.

Remove the engine compartment lamp, if equipped, and remove the hood.

Disconnect the battery cable clamps and remove the battery.

Disconnect the wire connectors from the alternator.

Disconnect the ignition coil and distributor wire connectors.

Disconnect the oil pressure sender wire connector.

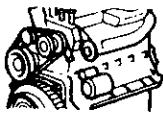
Remove the vacuum switch assembly bracket from the cylinder head cover.

Disconnect the front fuel pipe from the fuel pump and insert a plug to prevent entry of foreign objects.

Disconnect the engine ground strap.

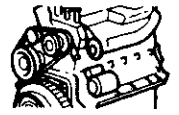
Remove the right front engine support cushion-to-bracket nut from the thru-bolt.

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If equipped with air conditioning:

- remove the service valve covers and front-seat the valves
- loosen the nut attaching the low pressure service valve to the compressor head
- discharge the compressor
- remove the service valve and cap the compressor port and service valve

NOTE: Refer to Chapter L – Heating And Air Conditioning for additional information pertaining to the A/C system.

Remove the air cleaner.

Disconnect the vacuum purge hose at the fuel vapor canister tee.

Disconnect the TAC system vacuum hose at the intake manifold.

Disconnect the idle speed control solenoid wire connector.

Disconnect the fuel return hose from the fuel filter.

Disconnect the carburetor bowl vent hose from the fuel vapor canister.

Disconnect the throttle cable and remove it from the bracket.

Disconnect the throttle valve rod, if equipped.

Disconnect the throttle rod at the bellcrank.

Disconnect the carburetor stepper motor wire connector.

Disconnect the oxygen sensor wire connector.

Disconnect the coolant temperature sender wire connector.

Disconnect the upper and lower radiator hoses at the radiator.

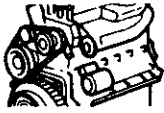
Disconnect the coolant hoses from the rear of the intake manifold and thermostat housing.

Remove the fan shroud screws.

Disconnect the automatic transmission fluid cooler pipe fittings from the radiator, if equipped.

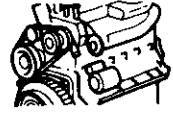
Remove the radiator attaching screws. Remove the radiator and fan shroud.

Remove the fan and spacer or Tempatrol fan assembly.



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Install a 5/16 × 1/2-inch SAE capscrew through the fan pulley into the water pump flange to maintain the pulley and water pump in alignment when the crankshaft is rotated.

Remove the power brake vacuum check valve from the booster, if equipped.

If equipped with power steering:

- disconnect the power steering hoses from the fittings at the steering gear
- drain the pump reservoir and cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system

Remove the automatic transmission filler tube bracket screw, if equipped.

Lift the vehicle and support it with support stands.

Remove the starter motor.

If equipped with an automatic transmission:

- remove the converter housing access cover
- mark the converter and drive plate location for installation reference and remove the converter-to-drive plate bolts
- rotate the crankshaft for access to each bolt

- remove the exhaust pipe support brace from the converter housing (this brace also supports the inner end of the transmission linkage)

If equipped with a manual transmission:

- remove the flywheel housing access cover screws

Remove the left engine mount cushion-to-bracket nut from the thru-bolt.

Disconnect the exhaust pipe from the manifold.

Remove the upper converter (or flywheel) housing bolts and loosen the bottom bolts.

Lower the vehicle.

Remove the A/C compressor idler pulley and mounting bracket, if equipped.

Attach a lifting device to the engine.

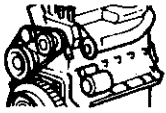
Raise the engine and remove motor mount thru-bolts.

Place a support stand under the converter (or flywheel) housing.

Remove the remaining converter (or flywheel) housing bolts.

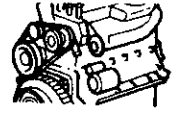
Lift the engine out of the engine compartment.

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ENGINE INSTALLATION

Lower the engine into the engine compartment.

If equipped with a manual transmission:

- insert the transmission shaft into the clutch spline
- align the flywheel housing with the engine
- install and tighten the flywheel housing lower bolts

If equipped with an automatic transmission:

- align the transmission torque converter housing with the engine
- loosely install the converter housing lower bolts
- install the next-higher bolt and nut on each side
- tighten all four bolts

Remove the support stand from beneath the converter (or flywheel) housing.

Lower the engine into the mount cushions. Ensure the bolt holes are aligned and insert the motor mount thru-bolts.

Install the thru-bolt nuts and tighten with the specified torque.

Lift the vehicle and position supports at the front frame rails.

Install the seal and attach the exhaust pipe to the manifold. Install and tighten the nuts with the specified torque.

If equipped with a manual transmission:

- install the flywheel housing access cover

If equipped with an automatic transmission:

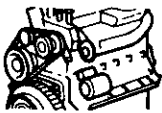
- install the converter-to-drive plate bolts (turn the crankshaft for access to each bolt hole)
- ensure the installation reference marks are aligned
- install the converter housing access cover
- install the exhaust pipe support

Install the remaining converter or flywheel housing screws.

Install the starter motor and connect the cable.

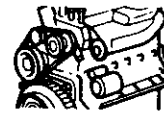
Lower the vehicle.

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Remove the engine lifting device.

Install the A/C compressor idler pulley and mounting bracket, if removed.

Connect the cooling system hoses and tighten the clamps.

Connect the hoses to the power steering gear.

Remove the pulley-to-water pump flange alignment capscrew and install the fan and spacer or Tempatrol fan assembly.

Tighten the drive belts according to the specifications listed in the Cooling Systems section.

Install the fan shroud and radiator.

Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped.

Connect the throttle valve rod and retainer. Connect the throttle cable and install the rod. Install the throttle valve rod spring.

Connect the carburetor wire connectors.

Connect the oxygen sensor wire connector.

Install the vacuum hose and check valve on the brake booster.

Connect the coolant temperature sender wire connector.

Connect the idle speed control solenoid wire connector.

Connect the carburetor bowl vent hose to the canister tee.

Connect the fuel return hose to the fuel filter.

Install the transmission filler tube bracket screw (automatic transmission only).

Install the vacuum switch assembly bracket.

Remove the plug and connect the fuel pipe to the fuel pump.

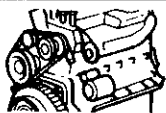
Connect the alternator wire connectors.

Install the engine ground strap.

Connect the oil pressure sender wire connector.

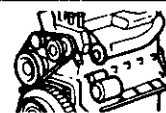
Connect the ignition system wire connectors.

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If equipped with air conditioning:

- connect the compressor clutch wire
- connect the service valve to the port with replacement seals
- lubricate and tighten the nut with 38 N·m (28 ft-lbs) torque
- purge the compressor of air
- back-seat the service valves and install the covers

NOTE: Refer to Chapter L – Heating and Air Conditioning for additional information pertaining to the A/C system.

Fill the cooling system with coolant.

NOTE: Remove the coolant temperature sending unit to permit air to escape from the cylinder block. Install the coolant temperature sending unit when the system is filled.

Fill the power steering pump reservoir with fluid.

Install the battery and connect the battery cables.

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.

Start the engine and inspect for leaks.

Check the automatic transmission fluid level.

Stop the engine and check the coolant and engine oil levels. Fill to the specified level if necessary.

Install the air cleaner and connect the vacuum hose.

Connect the purge hose to the canister.

Install and adjust the hood. Connect the underhood lamp, if equipped.

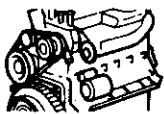
CYLINDER HEAD COVER REMOVAL

Disconnect the battery negative cable.

Remove the air cleaner and the PCV molded hose.

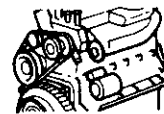
Disconnect the distributor vacuum advance hose at the distributor.

Disconnect the fuel pipe at the fuel pump. Rotate the pipe as necessary to provide clearance for the cylinder head cover removal/installation.



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Remove the PCV valve from the cylinder head cover grommet and disconnect the PCV shut-off valve vacuum hose.

Remove the vacuum switch and bracket assembly from the cylinder head cover.

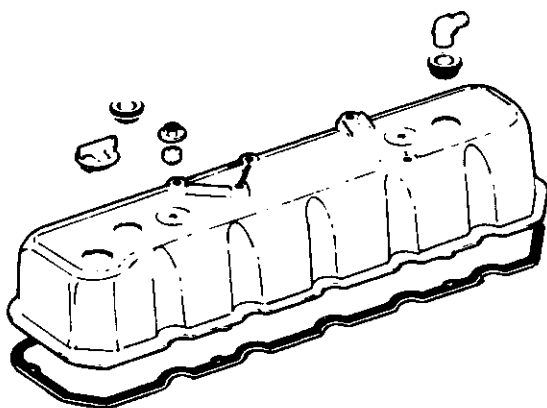
Remove all the necessary vacuum and air hoses to provide clearance for the cylinder head cover removal/installation.

NOTE: Identify and tag the hoses for installation reference.

Remove the cylinder head cover retaining nuts.

Detach the cover from the cylinder head by breaking the silicone rubber seal with a putty knife or razor blade. Do not attempt to pry the cover up until the seal has been completely broken.

Rotate the cylinder head cover toward the passenger side and remove the cover.



CYLINDER HEAD COVER INSTALLATION

Remove the original sealer from the cover flange sealing surface and inspect the cover. Replace the cover if it is cracked or damaged in any way.

If a replacement cover is installed, transfer the PCV valve grommet and oil filler cap from the original cover to the replacement cover.

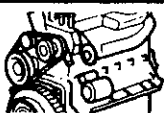
Remove any original sealer from the cover sealing surface of the cylinder head and clean the surface using AMC Fabric Cleaner, or equivalent.

Remove all residue from the sealing surface using a clean, dry cloth.

Apply General Electric SS 4004 primer, or equivalent, to the cover sealing surface on the cylinder head. Allow 10 - 15 minutes for the primer to set-up.

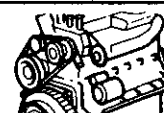
CAUTION: The following step involves the application of AMC Gasket-In-A-Tube silicone sealer. For an effective seal, it is required that the sealer be no more than 12 months old at the time of use. Before using the sealer, check the date code stamped on the crimped seam at the tube bottom or on the sealer carton. The two character letter code can be deciphered using the Sealer Date Code Chart.

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Sealer Date Code Chart

First Character Is Year of Manufacture	Second Character Is Month of Manufacture
K - 1980	A - January
A - 1981	B - February
B - 1982	C - March
C - 1983	D - April
D - 1984	E - May
E - 1985	F - June
F - 1986	G - July
G - 1987	H - August
H - 1988	J - September
J - 1989	K - October
K - 1990	M - November
	N - December

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Apply a 3mm (1/8-in) diameter bead of AMC Gasket-In-A-Tube, or equivalent, silicone sealer to the sealing surfaces on the cylinder head and cylinder head cover. Allow approximately five minutes for the sealer to set-up.

CAUTION: Avoid any time delay between the sealer set-up and cover installation. The sealer can become tack-free in 10 - 15 minutes, which will reduce its adhesive qualities.

Install replacement seals on the cylinder head cover attaching studs. Ensure that the studs are clean before installing the seals.

Install the cylinder head cover on the cylinder head as soon as the primer and sealer have set-up. Do not allow the sealer to contact the valve actuating or other components. Avoid smearing the sealer.

Install and tighten the cylinder head cover nuts with 3 N·m (28 in-lbs) torque.

NOTE: If the cover nuts are not the locking-type, replace them with lock-nuts.

Install and tighten the cover retaining screws to 6.2 N·m (55 in-lbs) torque.

Connect the fuel pipe and the distributor vacuum advance hose.

Reposition and/or connect all the air and vacuum hoses that were moved for cover removal clearance.

Connect the PCV valve and the PCV shutoff valve hose.

Install the air cleaner and hoses.

Connect the battery negative cable.

Check the engine oil and add if necessary.

NOTE: It is recommended that the sealer be allowed to cure for approximately one to two hours before starting the engine.

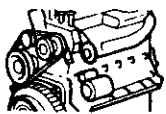
VALVES AND ACTUATING COMPONENTS

Rocker Arm Assembly Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

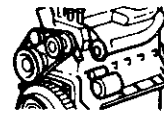
Remove the two capscrews (1) at each bridge (2) and pivot (3) assembly. Alternately loosen the capscrews, one turn at a time, to avoid damaging the bridges.

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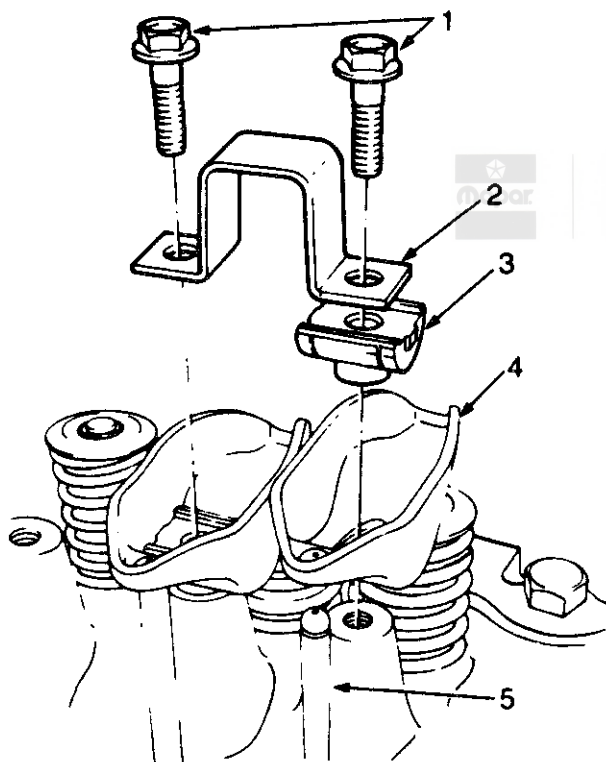
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Remove the bridges, pivots and corresponding pairs of rocker arms (4) and place them on a bench in the same order as removed.

Remove the push rods (5) and place them on a bench in the same order as removed.



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Rocker Arm Assembly Cleaning and Inspection

Clean all the components with cleaning solvent and use compressed air to blow out the oil passages in the rocker arms and push rods.

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted or excessively worn.

Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.

Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace the push rod and inspect the corresponding hydraulic tappet.

A wear pattern along the length of the push rod is not normal. Inspect the cylinder head for obstruction if this condition exists.

Rocker Arm Assembly Installation

Install the push rods in their original locations. Ensure that the bottom end of each push rod is centered in the tappet plunger cap seat.

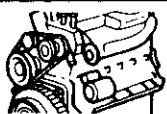
Install the rocker arms, pivots and bridge above each cylinder from where they were originally removed.

Loosely install the capscrews through each bridge.

At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten with 26 N·m (19 ft·lbs) torque.

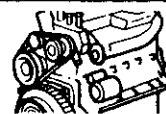
Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

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Hydraulic Valve Tappets Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

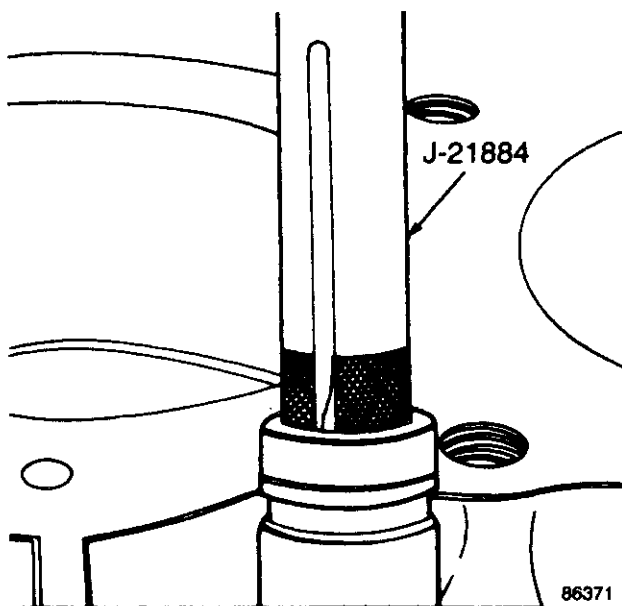
Remove the bridge and pivot assemblies and rocker arms by removing the two capscrews at each bridge. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

Remove the push rods.

NOTE: Retain all the components in the same order as removed to facilitate installation at the original positions.

Remove the intake and exhaust manifolds, cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.

Remove the tappets (A) through the push rod openings in the cylinder block with Hydraulic Valve Tappet Removal and Installation Tool J-21884, or equivalent.



Retain the tappets in the same order as removed to facilitate installation at the original positions.

Hydraulic Valve Tappets Installation

NOTE: It is not necessary to charge the tappets with engine oil. They will charge themselves within a very short period of engine operation.

Dip each tappet in AMC Engine Oil Supplement (EOS), or equivalent.

Use Hydraulic Valve Tappet Removal and Installation Tool J-21884, or equivalent, to install each tappet in the same bore from where it was originally removed.

Install the exhaust and intake manifolds, cylinder head and gasket. Refer to Cylinder Head Installation for the procedure.

Install each push rod in the same location from where removed.

Install the rocker arms and bridge and pivot assemblies at their original locations.

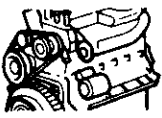
Loosely install the capscrews through each bridge. Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges.

Pour the remaining EOS over the entire valve actuating assembly.

NOTE: The EOS must remain with the engine oil for at least 1,609 km (1,000 mi) but need not be drained until the next scheduled oil change.

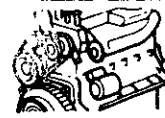
Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

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Valve Spring and Oil Deflector Removal

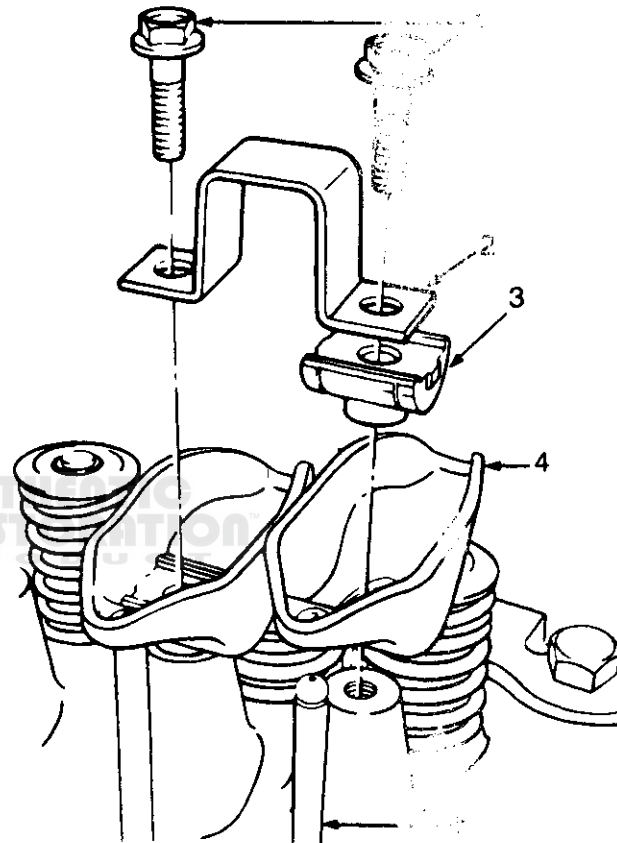
NOTE: The following procedure is for the removal of the valve springs and oil deflectors with the cylinder head installed on the cylinder block. For the valve removal procedure with the cylinder head removed, refer to the MOT. 4.2L manual.

The valve spring is held in place around the valve stem by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

Remove the cylinder head cover and gasket. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews (1), bridge (2) and pivot assembly (3), and rocker arms (4). Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

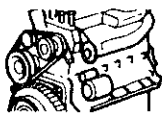
Remove the push rods (5).



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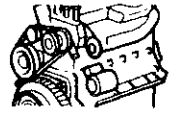
NOTE: Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed to facilitate installation at their original locations.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



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Remove the spark plug adjacent to the cylinder below the valve springs to be removed.

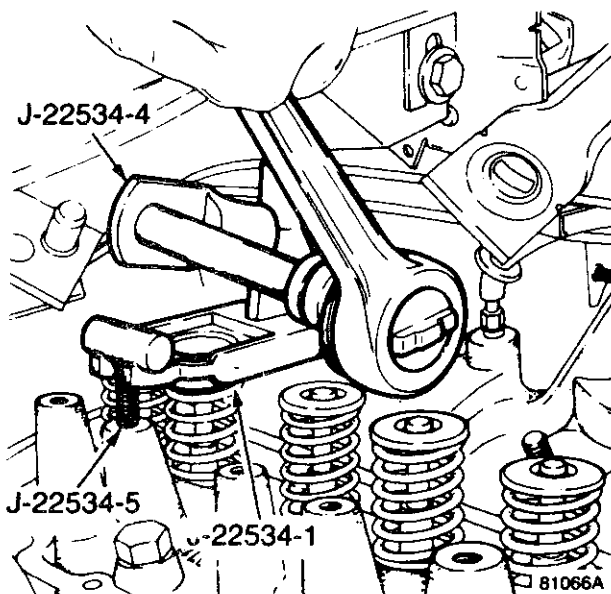
Install a 14mm (thread size) air adapter (J-22794 or equivalent) in the spark plug hole.

NOTE: An adapter can be constructed by welding an air hose connection to the body of a spark plug with the porcelain removed.

Connect an air hose to the adapter and maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats.

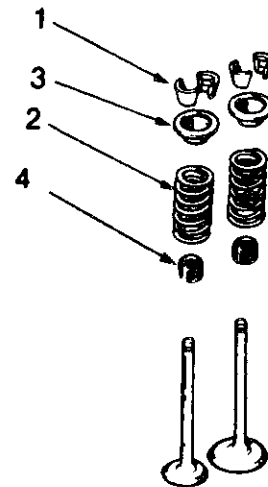
NOTE: For vehicles equipped with air conditioning, use a flexible air adapter when servicing the No. 1 cylinder.

Use Valve Spring Compressor Tool Set J-22534 to compress the spring and remove the locks (1).



Remove the valve spring (2) and retainer (3).

Remove the valve stem oil deflector (4).



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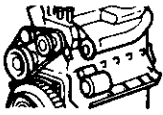
Valve Spring and Oil Deflector Installation

CAUTION: Install the deflector carefully to prevent damage from the sharp edges of the valve spring lock grooves.

Use an 11mm (7/16-in) deep socket wrench and small hammer to gently tap the oil deflector (4) onto the valve stem.

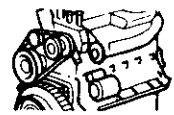
Install the valve spring (2) and retainer (3).

Compress the valve spring with Valve Spring Compressor Tool Set J-22534 and insert the valve locks (1). Release the spring tension and remove the tool.



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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



NOTE: Tap the spring from side-to-side to ensure that the spring is seated properly on the cylinder head.

Disconnect the air hose. Remove the adapter from the spark plug hole and install the spark plug.

Install the push rods. Ensure the bottom end of each push rod is centered in the plunger cap seat of the hydraulic valve tappet.

Install the rocker arms, pivots and bridge at their original location.

Tighten the bridge capscrews alternately, one turn at a time, to avoid damaging the bridge.

Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

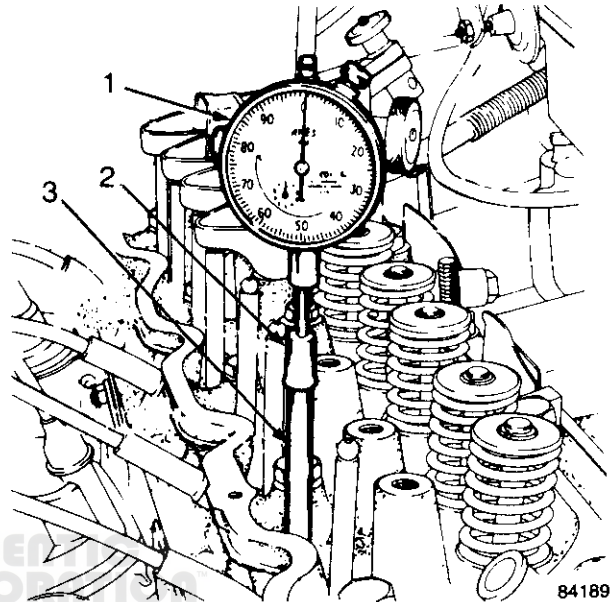
Cam Lobe Lift Measurement

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews, bridge and pivot assemblies, and rocker arms. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

Remove the spark plugs.

Install a dial indicator (1) with a piece of rubber tubing (2) between the dial indicator plunger and the push rod (3).



Rotate the crankshaft until the heel of the cam lobe (push rod in the down position) is under the valve tappet. Set the dial indicator pointer at zero.

Rotate the crankshaft until the push rod is at its maximum upward position. Note the travel distance on the dial indicator. Refer to the Specifications chart for the correct cam lobe lift.

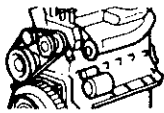
Repeat the procedure for each cam lobe.

Valve Timing

Disconnect the spark plug wires and remove the spark plugs.

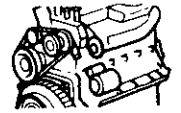
Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



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Remove the capscrews, bridge and pivot assembly, and rocker arms from above the No. 1 cylinder.

Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

Rotate the crankshaft until the No. 6 piston is at top dead center (TDC) on the compression stroke.

Rotate the crankshaft counterclockwise (viewed from the front of the engine) 90 degrees.

Install a dial indicator (J-8520 or equivalent) on the end of the No. 1 cylinder intake valve push rod. Use rubber tubing to secure the indicator stem on the push rod.

Set the dial indicator pointer at zero.

Rotate the crankshaft clockwise (viewed from the front of the engine) until the dial indicator pointer indicates 0.305mm (0.012-in) travel distance (lift).

The timing notch index on the vibration damper should be aligned with the TDC mark on the timing degree scale.

If the timing notch is more than 13mm (1/2-in) away from the TDC mark in either direction, the valve timing is incorrect.

If the valve timing is incorrect, the cause may be a broken camshaft pin. It is not necessary to replace the camshaft because of pin failure. A spring pin is available for service replacement.

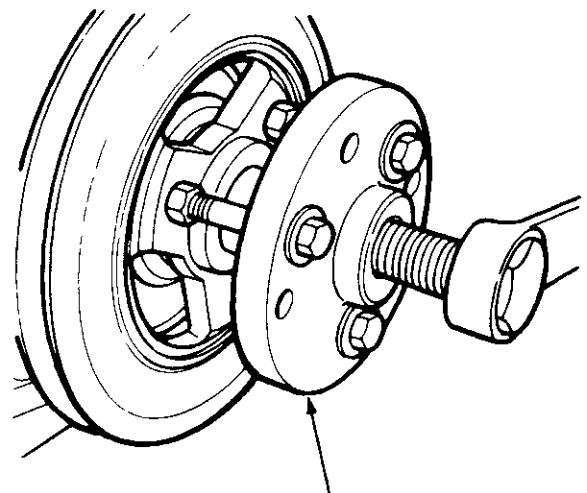
CRANKSHAFT VIBRATION DAMPER AND PULLEY REMOVAL

Remove the drive belt(s).

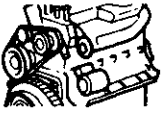
Remove the retaining bolts and separate the vibration damper pulley (V-belt ONLY) from the vibration damper.

Remove the vibration damper retaining bolt and washer.

Use the Vibration Damper Removal Tool J-21791-01 to remove the damper from the crankshaft.

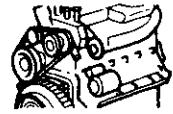


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CRANKSHAFT VIBRATION DAMPER AND PULLEY INSTALLATION

With the key in position, align the key slot of the vibration damper hub with the crankshaft key and tap the damper onto the crankshaft.

Install the vibration damper retaining bolt and washer. Tighten the bolt with 108 N·m (80 ft-lbs) torque.

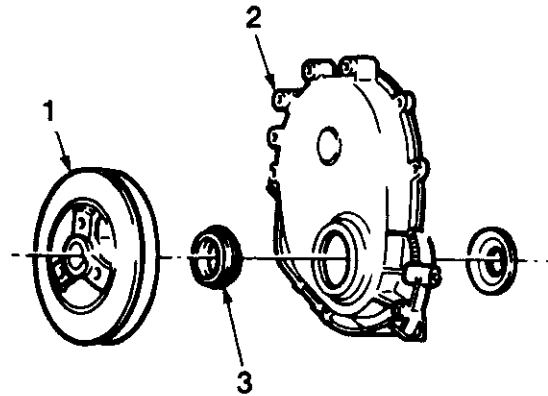
NOTE: If the crankshaft turns before the damper bolt torque value is attained, the crankshaft can be prevented from turning by placing two $5/16 \times 1\frac{1}{2}$ -inch bolts into the damper front pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley (V-belt only) and retaining bolts. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

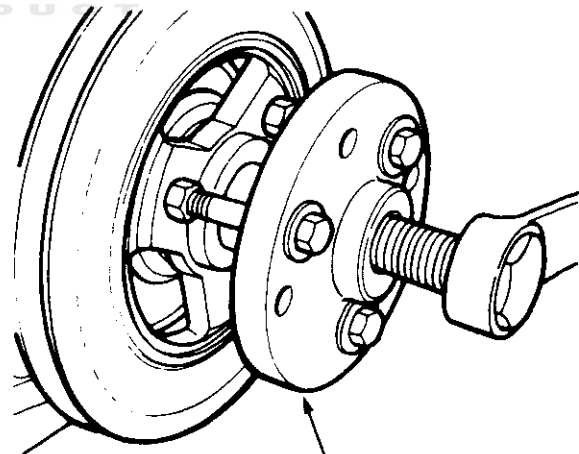
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

TIMING CASE COVER REMOVAL

Remove the drive belt(s), engine fan and hub assembly, fan shroud, vibration damper (1), pulley, and key. Refer to Vibration Damper Removal.



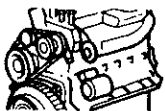
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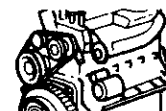
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Remove the A/C compressor and alternator bracket assembly, if equipped. Refer to Chapter L – Heating and Air Conditioning for additional information pertaining to the A/C system.

Remove the oil pan-to-timing case cover screws and cover-to-cylinder block bolts.

Remove the timing case cover (2), front seal and gasket from the engine.

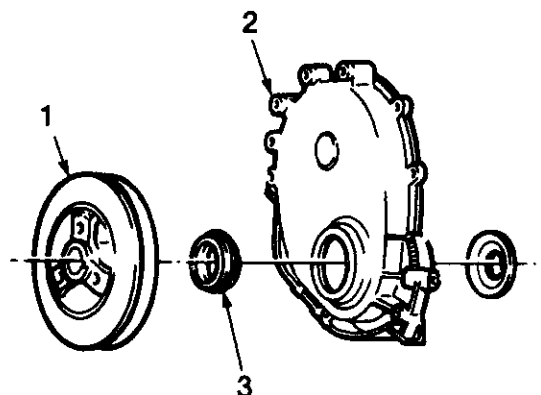
Cut off the oil pan side gasket end tabs flush with the front face of the cylinder block. Remove the gasket tabs.

Clean the timing case cover, oil pan, and cylinder block gasket surfaces.

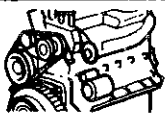
Remove the crankshaft oil seal (3) from the timing case cover.

Remove the timing case cover. Refer to the removal procedure.

Remove the oil seal from the timing case cover.

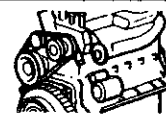


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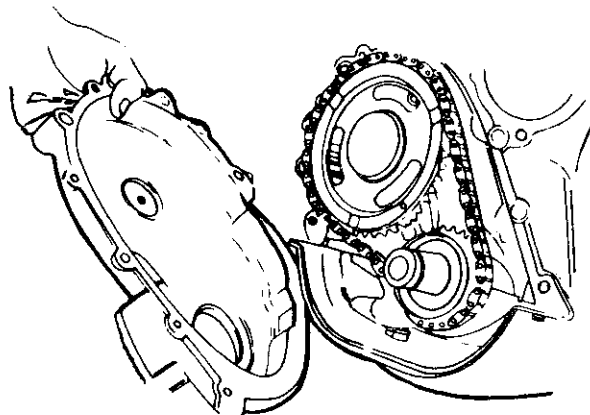
TIMING CASE COVER INSTALLATION

Apply sealing compound (Perfect Seal, or equivalent) to both sides of the replacement timing case cover gasket and position the gasket on the cylinder block.

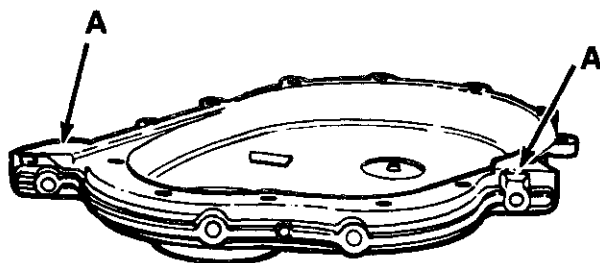
Cut the end tabs (A) off of the replacement timing cover gasket corresponding to those cut off the original gasket.

Coat the front cover end tab recesses generously with RTV sealant (AMC Gasket-In-A-Tube, or equivalent) and position the seal on the timing case cover. Apply engine oil to the seal-oil pan contact surface.

Position the timing case cover on the cylinder block.

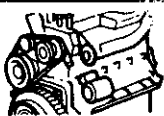


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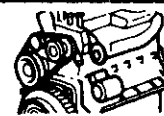
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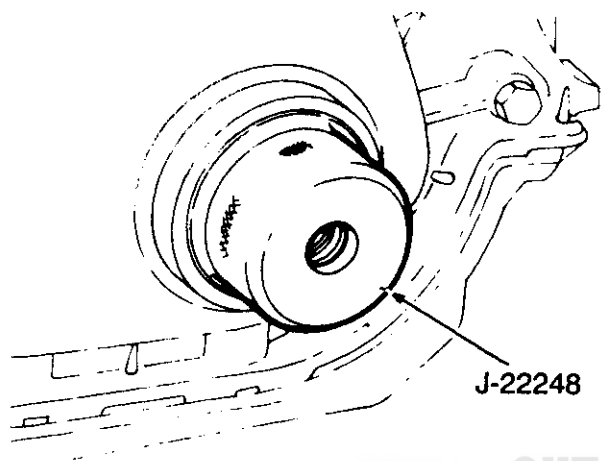
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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



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Place Timing Case Cover Alignment and Seal Installation Tool J-22248 in the crankshaft opening of the cover.



Install the cover-to-cylinder block bolts and the oil pan-to-cover screws.

Tighten the cover-to-cylinder block bolts with 7 N·m (5ft-lbs) torque and the oil pan-to-cover screws with 13 N·m (11 ft-lbs) torque.

Remove the cover alignment tool and position the replacement oil seal on the tool with the seal lip facing outward.

Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft with engine oil.

Position J-22248 with seal over end of crankshaft. Insert tool J-22248.

Install seal into the timing chain cover by gently tapping with rubber or plastic mallet.

Remove the tools and apply a light film of engine oil on the vibration damper hub contact surface of the seal.

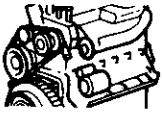
With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.

Install the A/C compressor and alternator bracket assembly.

Install the damper pulley, if removed. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

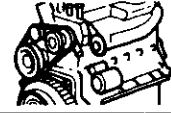
Install the engine fan and hub assembly. Install the fan shroud.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.



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TIMING CHAIN REMOVAL

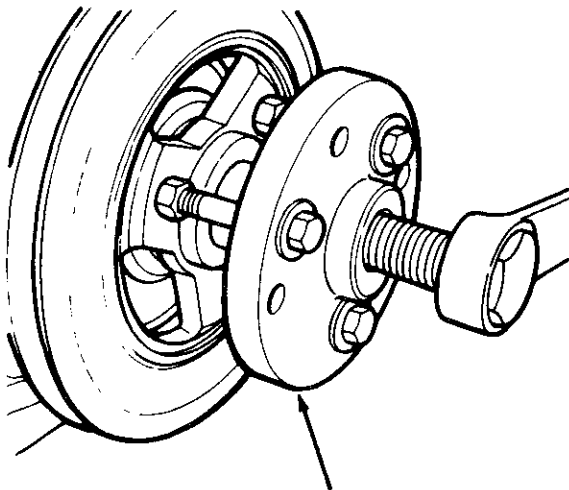
NOTE: Installation of the timing chain with the timing marks on the crankshaft and camshaft sprockets properly aligned ensures correct valve timing. A worn or stretched timing chain will adversely affect valve timing. If the timing chain deflects more than 12.7mm (1/2-in) replace it. The correct timing chain has 48 pins. A chain with more than 48 pins will cause excessive slack.

Remove the drive belt(s).

Remove the engine fan and hub (or Tempatrol fan) assembly.

Remove the vibration damper pulley (V-belt drive only).

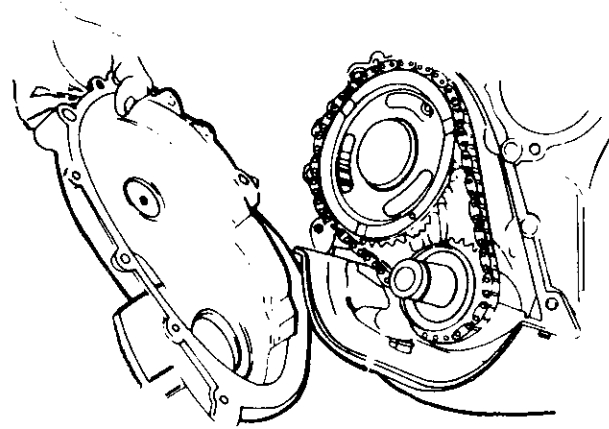
Remove the vibration damper. Refer to the removal procedure.



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Remove the timing case cover. Refer to the removal procedure.

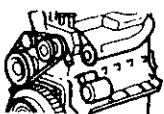


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Remove the oil seal from the timing case cover.

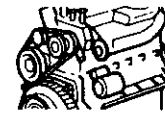
Remove the camshaft sprocket retaining bolt and washer.

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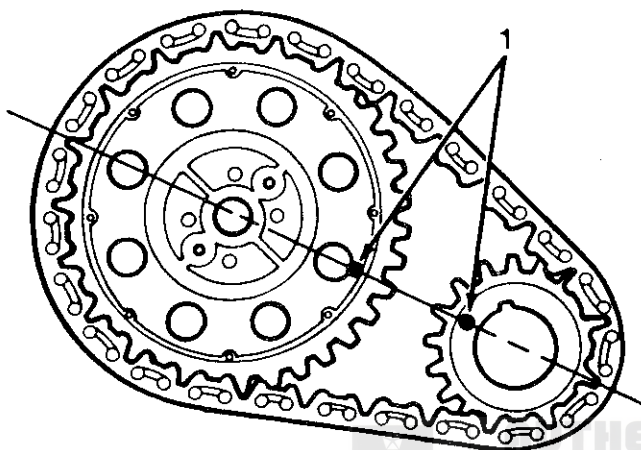
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



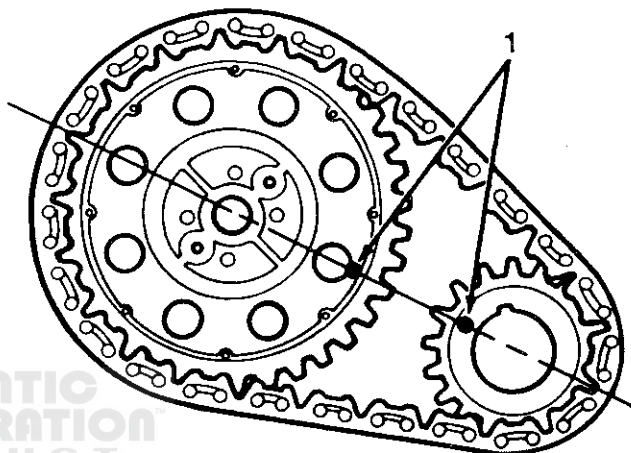
Rotate the crankshaft until the zero timing mark on the crankshaft sprocket (1) is closest to and on the centerline with the timing mark on the camshaft sprocket (1).

TIMING CHAIN INSTALLATION

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks (1) aligned.



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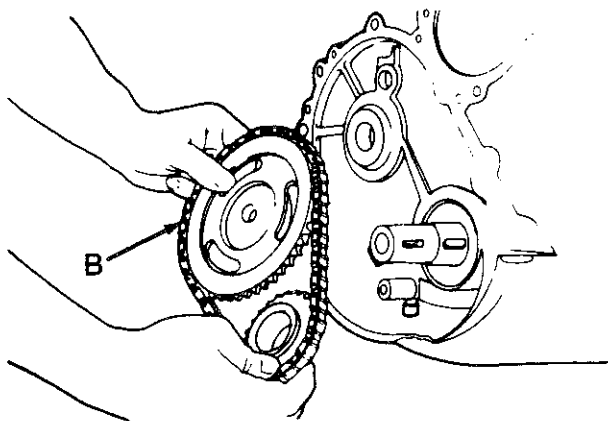
Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly (B).

Disassemble the chain and sprockets.

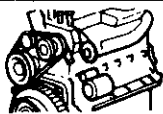
With the key in the keyway on the crankshaft, install the assembly on the crankshaft and camshaft.

Install the camshaft sprocket retaining bolt and washer and tighten with 108 N·m (80 ft-lbs) torque.

NOTE: To verify the correct installation of the timing chain, turn the crankshaft to locate the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position. Count the number of chain pins between the timing marks (2) on both sprockets. There must be 15 pins.

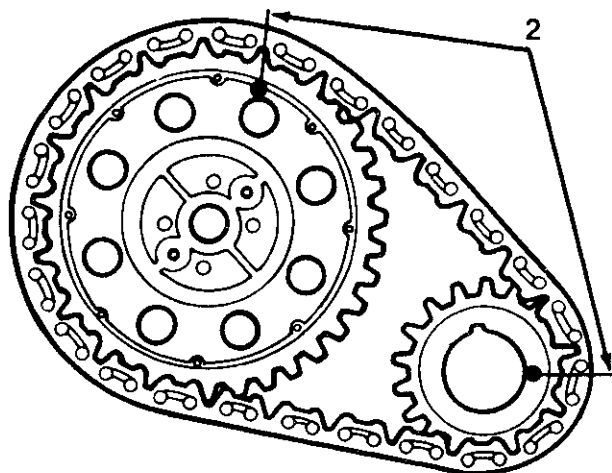
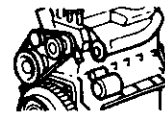


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE

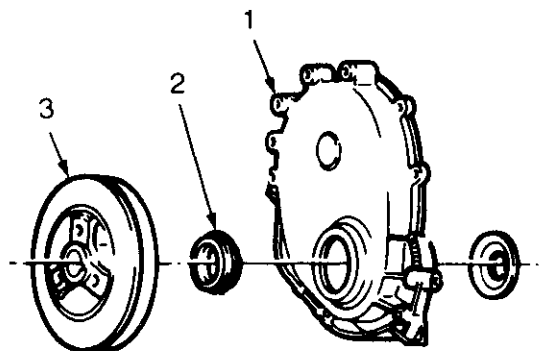


86211

Install the crankshaft oil slinger.

Install the timing case cover (1) and replacement oil seal (2). Refer to Timing Case Cover Installation.

With the key in the keyway on the crankshaft, install the vibration damper (3), washer and bolt. Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.



84180A

Install the damper pulley (if removed). Tighten the bolts with 27 N·m (20 ft-lbs) torque.

Install the engine fan and hub (or Tempatrol fan) assembly.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

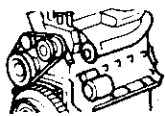
CAMSHAFT REMOVAL

WARNING: The coolant in a recently operated engine is hot and pressurized. Release the pressure before removing the draincock, cap and drain plugs.

NOTE: Do not waste reusable coolant. If the solution is clean, drain it into a clean container for reuse.

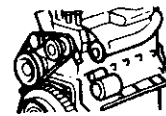
Drain the cooling system.

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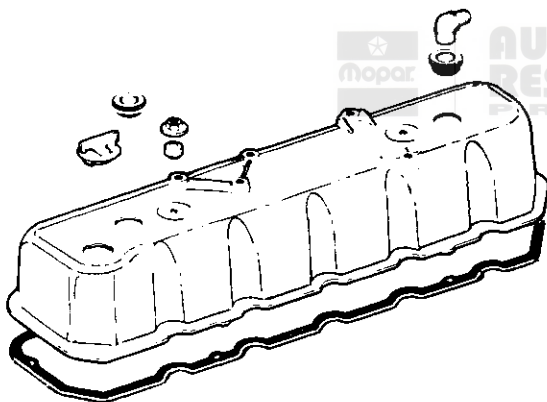


Remove the radiator.

Remove the air conditioner condenser and receiver/drier assembly as a charged unit, if equipped. Refer to Chapter L – Heating and Air Conditioning for additional information pertaining to the A/C system.

Remove the distributor and ignition wires.

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

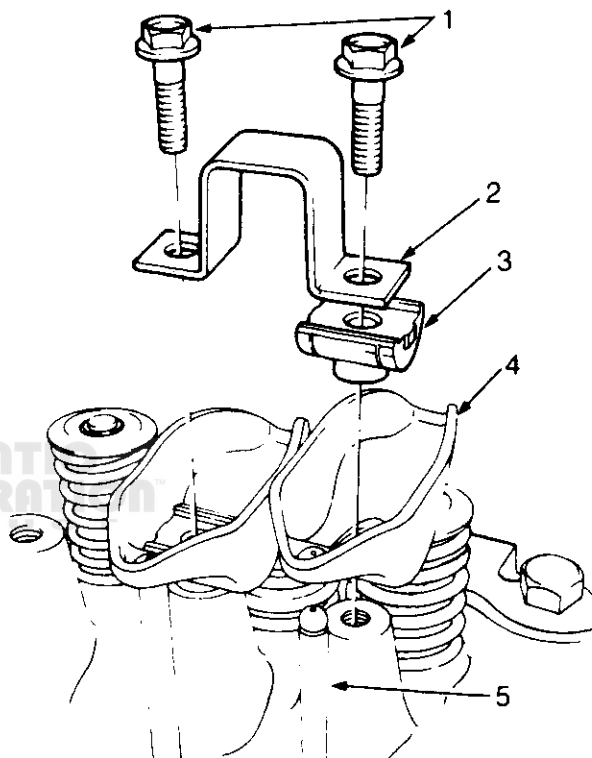


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Remove the capscrews (1), bridge (2) and pivot (3) assemblies, and rocker arms (4).

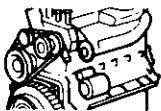
Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

Remove the push rods (5).



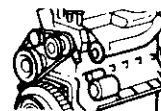
86162

NOTE: Position all components on a work bench in the same order as removed to facilitate installation at the original locations.

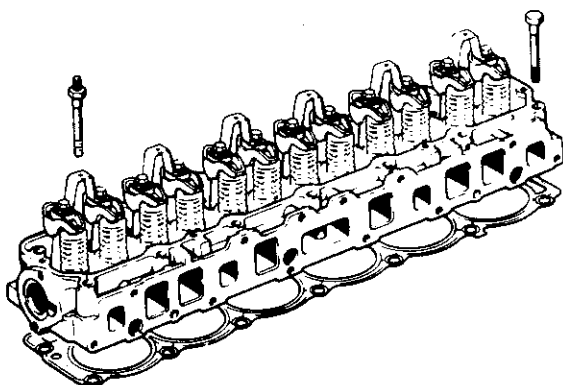


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



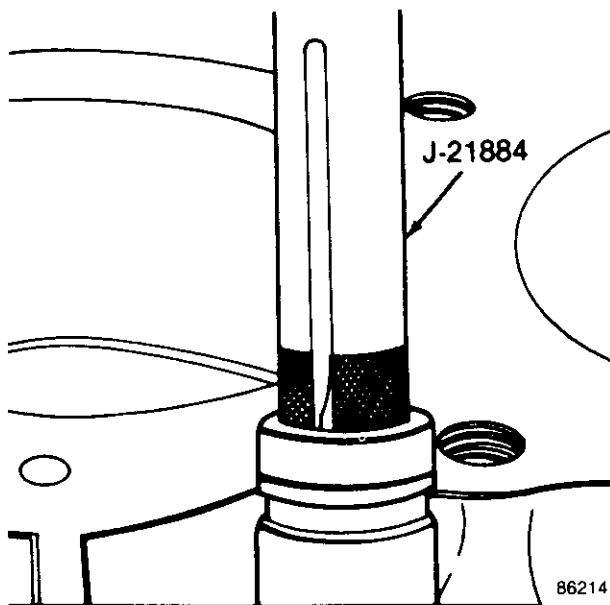
Remove the cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.



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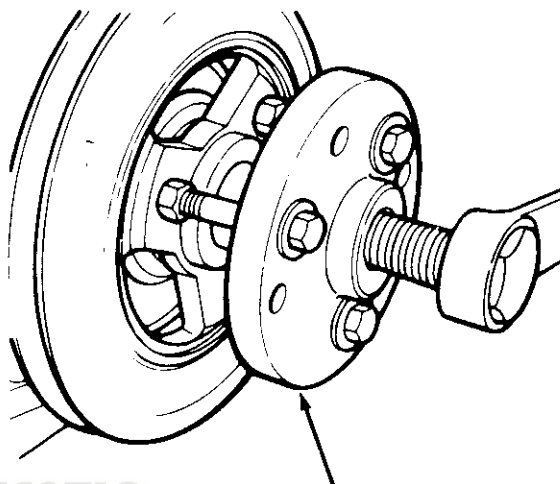
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RESTORATION
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Remove the hydraulic valve tappets using special tool J-21884.



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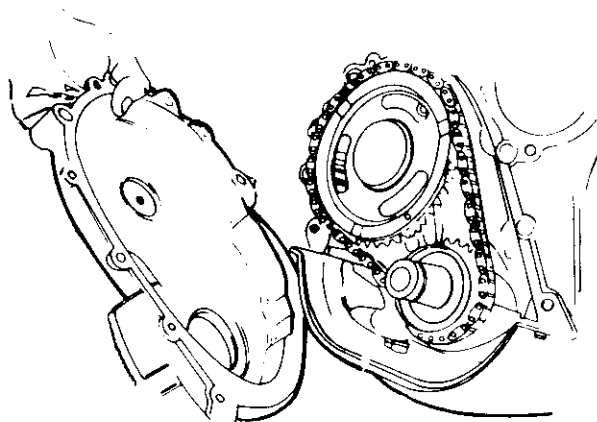
Remove the vibration damper using special tool J-21791-01. Refer to the removal procedure.



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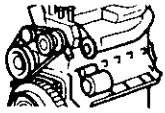
84179

Remove the timing case cover. Refer to Timing Case Cover Removal.



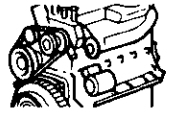
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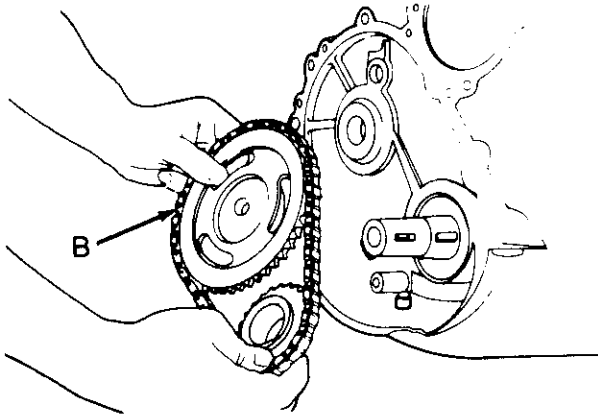
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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Remove the timing chain and sprockets as an assembly (B). Refer to Timing Chain Removal.

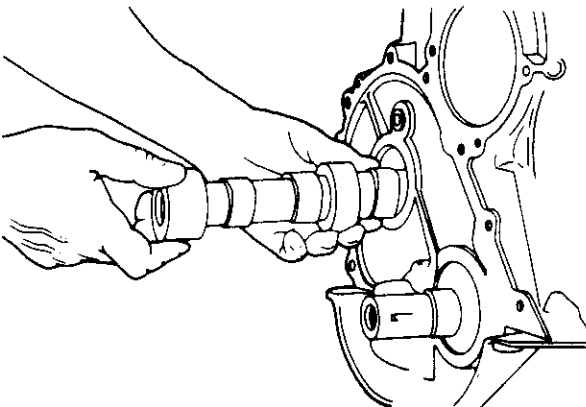
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Remove the front bumper and/or grille as required.

Remove the camshaft .



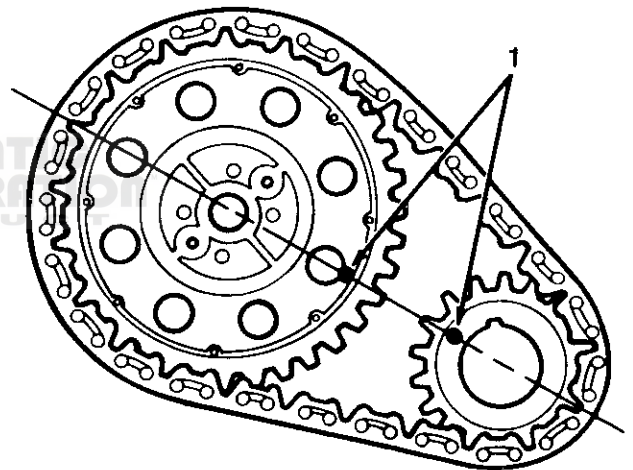
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CAMSHAFT INSTALLATION

Lubricate the camshaft with AMC Engine Oil Supplement (EOS), or equivalent.

Install the camshaft carefully to prevent damaging the camshaft bearings.

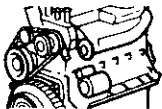
Install the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks (1) aligned. Refer to Timing Chain Installation for the procedure .



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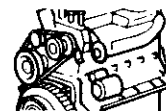
Install the camshaft sprocket retaining bolt and tighten with 108 N·m (80 ft-lbs) torque.

Install the crankshaft oil slinger.



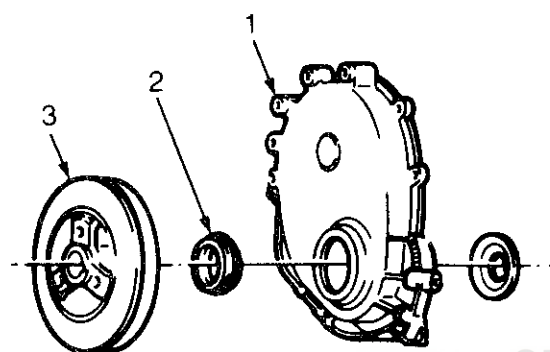
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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Install the timing case cover (1) with a replacement oil seal (2). Refer to Timing Case Cover Installation for the procedure.

Install the vibration damper (3).



84180A

Install the damper pulley, if removed.

Install the fan assembly and shroud.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Install the fuel pump.

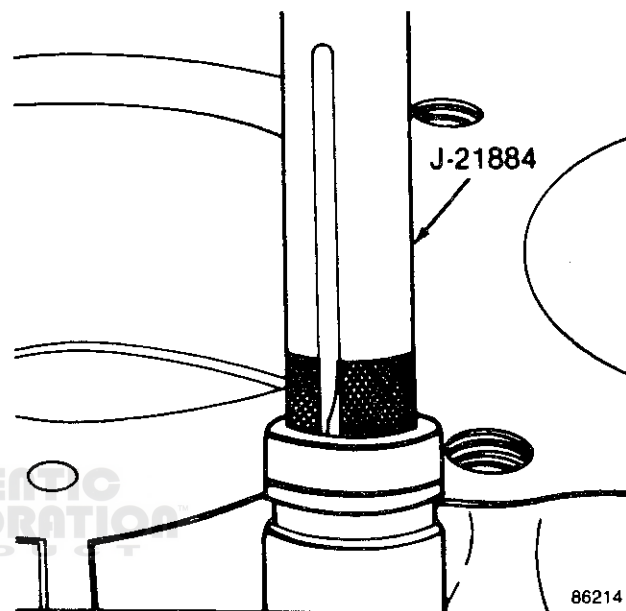
Rotate the crankshaft until the No. 1 piston is at the TDC position on the compression stroke.

Install the distributor, cap and ignition wires.

NOTE: Install the distributor so that the rotor is aligned with the No. 1 cylinder spark plug

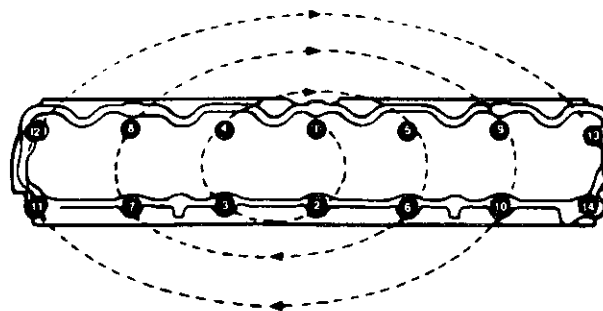
terminal on the cap when the distributor housing is fully seated on the cylinder block.

Install the hydraulic valve tappets with special tool J-21884.



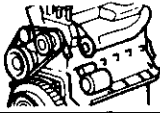
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Install the cylinder head. Refer to Cylinder Head Installation for the procedure.



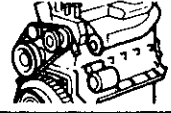
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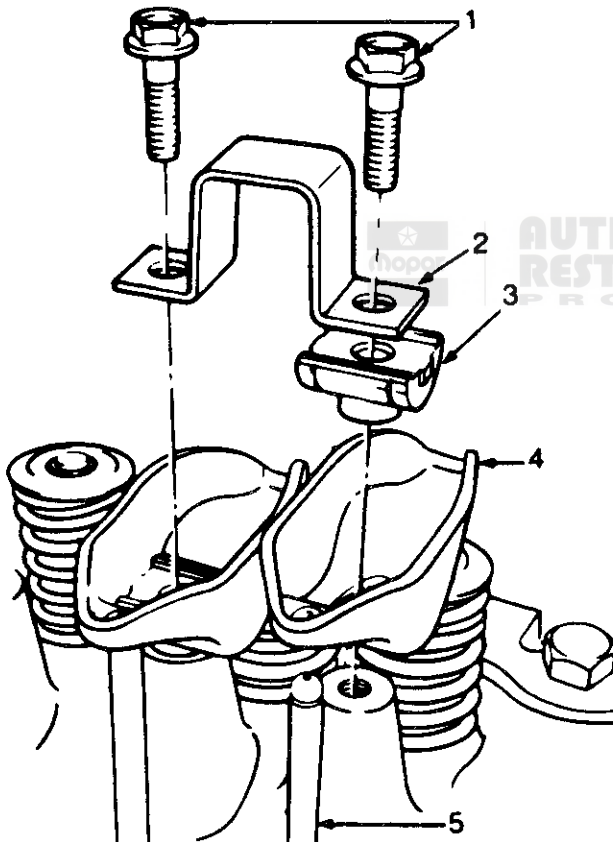
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Install the push rods (1).

Install the rocker arms (2) and pivot (3) and bridge (4) assemblies. Tighten each of the two capscrews (5) for each bridge alternately, one turn at a time, to avoid damaging the bridge.

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NOTE: Lubricate the hydraulic valve tappets and all valve actuating components with AMC Engine Oil Supplement (EOS), or equivalent, during installation. The EOS must remain with the engine oil for at least 1 609 km (1,000 mi) but need not be drained until the next scheduled oil change.

Install the cylinder head cover. Refer to Cylinder Head Cover Installation for the procedure.

Install the A/C condenser and receiver/drier assembly, if equipped. Refer to Chapter L – Heating and Air Conditioning for additional information pertaining to the A/C system.

CAUTION: Both service valves must be opened before the air conditioning system is operated.

Install the radiator, connect the hoses and fill the cooling system to the specified level. Refer to the Cooling Systems section.

Check the ignition timing and adjust as necessary.

Install the grille and bumper, if removed.

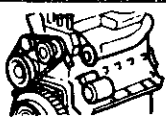
Camshaft Pin Replacement

Disconnect the battery negative cable.

WARNING: Do not loosen the radiator draincock with the system hot and pressurized because serious burns from coolant can occur.

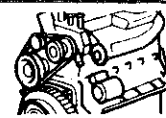
Drain the radiator.

NOTE: Do not waste reusable coolant. Drain the coolant into a clean container.



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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Remove the fan and shroud.

Disconnect the radiator overflow tube, radiator hoses, automatic transmission fluid cooler pipes (if equipped).

Remove the radiator.

If equipped with air conditioning:

- remove the A/C compressor drive belt idler pulley
- disconnect and remove the alternator

CAUTION: Do not loosen or disconnect any air conditioner system fittings. Move the condenser and receiver/drier aside as a complete assembly.

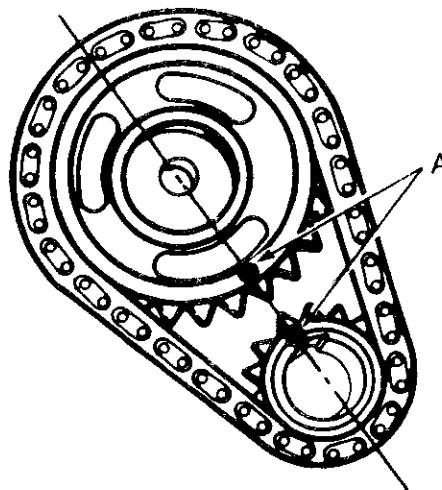
- remove the A/C condenser attaching bolts and move the condenser and receiver/drier assembly up and out of the way

Remove the drive belt(s).

Remove the crankshaft vibration damper and pulley. Refer to the removal procedure.

Remove the timing case cover. Refer to the removal procedure.

Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).

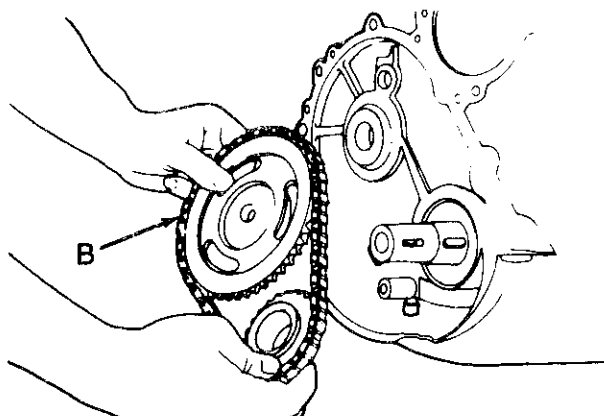


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Remove camshaft sprocket retaining bolt.

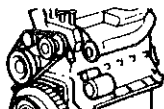
Remove the crankshaft oil slinger.

Remove the sprockets and chain as an assembly (B).



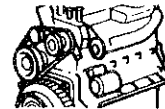
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CAUTION: The following procedural step must be accomplished to prevent the camshaft from damaging the rear camshaft plug during pin installation.

Remove the fuel pump. Insert a suitable tool into the fuel pump opening and wedge the tool against the side of the opening and the camshaft to prevent camshaft movement.

Inspect the damaged camshaft pin.

If the pin is a spring-type pin, remove the broken pin by inserting a self-tapping screw into the pin and carefully pulling the pin from the camshaft.

If the pin is a dowel-type pin, center-punch it.

CAUTION: Ensure the exact center is located when center-punching the pin.

CAUTION: Cover the opened oil pan area to prevent metal chips from entering the pan.

Drill into the pin center with a 4mm (5/32-in) drill bit.

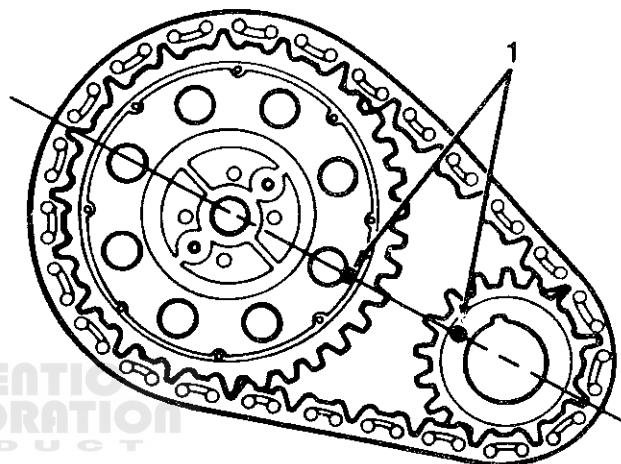
Insert a self-tapping screw into the drilled pin and carefully pull the pin from the camshaft.

Clean the camshaft pin hole.

Compress the center of the replacement spring pin with vise grips.

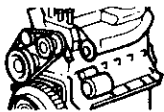
Carefully drive the pin into the camshaft pin hole until it is seated.

Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks (1) aligned.



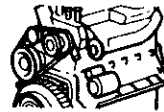
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NOTE: To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position.

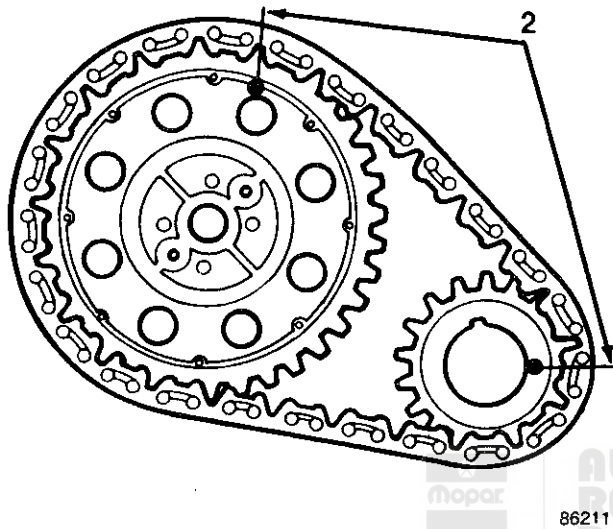


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Count the number of chain pins between the timing marks (2) on both sprockets. There must be 15 pins.



Install the crankshaft oil slinger.

Tighten the camshaft sprocket bolt with 108 N·m (80 ft-lbs) torque.

Remove the tool wedged in the fuel pump opening. Install the fuel pump. Tighten the pump bolts with 22 N·m (16 ft-lbs) torque and connect the fuel pipes.

Check the valve timing. Refer to the timing procedure.

Remove the timing case cover gaskets and seal and clean the cover.

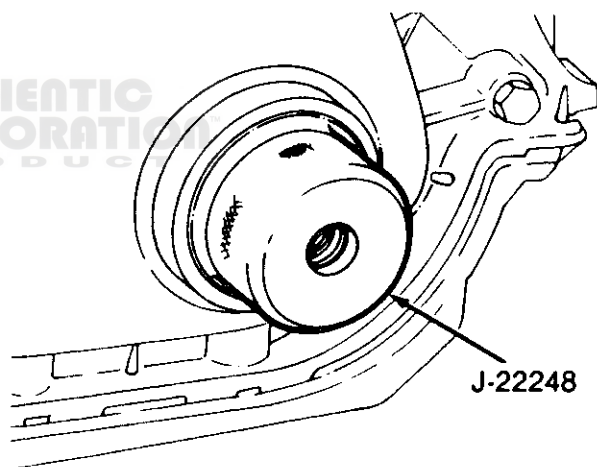
Position replacement oil pan tab gaskets on the oil pan and use RTV sealant to hold them in place.

Coat both sides of the replacement timing case cover gasket with gasket sealer. Apply a 3mm (1/8-in) bead of RTV sealant to the joint formed at the oil pan and cylinder block.

Loosen the front four oil pan bolts three turns to allow oil pan movement during the timing case cover installation.

Position the timing case cover on the engine.

Place Timing Case Cover Alignment and Seal Installation Tool J-22248 in the crankshaft opening in the cover.

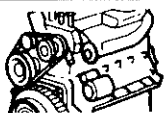


Install and tighten the oil pan and timing case cover screws.

NOTE: Tighten the 1/4-20 oil pan screws with 9 N·m (7 ft-lbs) torque and the 5/16-18 oil pan screws with 15 N·m (11 ft-lbs) torque.

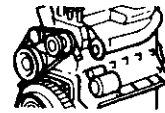
Remove the cover alignment tool and place a replacement oil seal on the tool with the lip facing outward.

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Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Position the tool and seal in the timing case cover crankshaft opening.

Position J-22248 with seal over end of crankshaft. Insert tool J-22248.

Install seal into timing chain cover by gently tapping with rubber or plastic mallet.

Remove the tool and install the vibration damper on the crankshaft.

Lubricate and tighten the damper bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt torque value is attained, the crankshaft can be prevented from turning by placing two 5/16 × 1½ inch bolts into the damper front pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley, if applicable.

If equipped with air conditioning:

- install the A/C compressor drive belt idler pulley
- install the alternator
- install the A/C condenser and receiver/drier assembly

Install the drive belt(s) on the pulleys and tighten. Refer to the Cooling Systems section for the specifications and procedures.

Install the radiator. Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped. Fill the cooling system.

Install the fan and shroud.

Tighten the fan assembly nuts with 24 N·m (18 ft-lbs) torque.

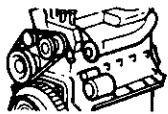
Connect the battery negative cable.

INTAKE MANIFOLD REMOVAL

NOTE: It is necessary to remove the carburetor from the intake manifold before the manifold is removed. After removing the carburetor from the intake manifold, it may be set to one side with the vacuum hoses still attached.

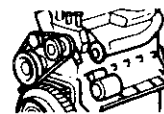
WARNING: If the engine has been recently operated, use care to prevent scalding by hot coolant. The system is pressurized.

Remove the radiator cap and draincock to drain the coolant.



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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



NOTE: Do not waste reusable coolant. If the coolant is acceptable for reuse, drain it into a clean container.

Remove the air cleaner. Disconnect the fuel pipe, carburetor air horn vent hose, idle speed control vacuum hose and wire connector.

Disconnect the coolant hoses from the intake manifold.

Disconnect the throttle cable from the bellcrank.

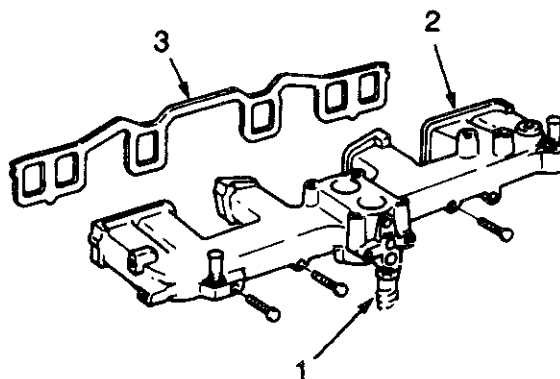
Disconnect the PCV valve vacuum hose from the intake manifold.

Remove the vacuum advance CTO valve vacuum hoses.

Disconnect the CEC system coolant temperature sender wire connector (located on the intake manifold).

Disconnect the vacuum hose from the EGR valve.

Disconnect the intake manifold electric heater (1) wire connector.



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Remove the carburetor and set to one side.

Remove the power steering mounting bracket, if equipped.

Detach the power steering pump and set aside, if equipped. Do not remove the hoses.

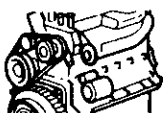
Remove the A/C compressor drive belt idler pulley assembly from the cylinder head, if equipped.

Disconnect the throttle valve linkage, if equipped with an automatic transmission.

Disconnect the EGR valve tube (1) from the intake manifold.

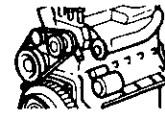
Remove the intake manifold attaching screws, nuts and clamps. Remove the intake manifold (2). Discard the gasket (3).

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Clean the mating surfaces on the manifold and cylinder head.

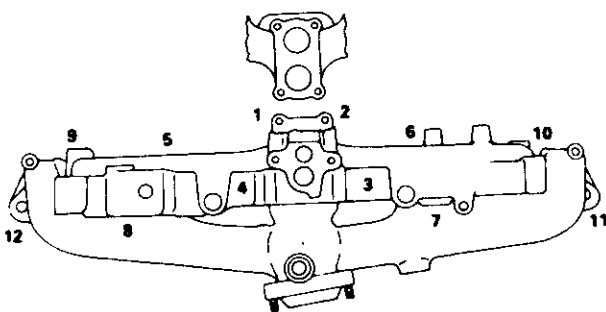
NOTE: If the manifold is being replaced, ensure all the fittings, etc. are transferred to the replacement manifold.

INTAKE MANIFOLD INSTALLATION

Position a replacement intake manifold gasket (3) on the cylinder head and install the intake manifold (2).

Install the remaining attaching hardware.

Tighten all the bolts and nuts according to the sequence illustrated. Tightening torque is 31 N·m (23 ft-lbs).



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Install the vacuum hoses.

Install the carburetor studs, replacement gaskets and spacer.

Install the carburetor and connect the linkage and hoses.

Tighten the carburetor mounting nuts with 19 N·m (14 ft-lbs) torque.

Connect the fuel pipe and air horn vent hose to the carburetor.

Connect the idle speed control vacuum hose and wire connector.

Connect the choke heater wire connector.

Install the A/C compressor drive belt idler pulley assembly, if removed.

Install the power steering pump mounting bracket, if removed.

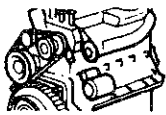
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Install the vacuum advance CTO valve vacuum hoses.

Connect the following wire connectors:

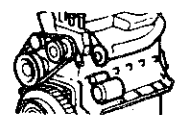
- CEC (feedback) system coolant temperature sender
- electric intake manifold heater

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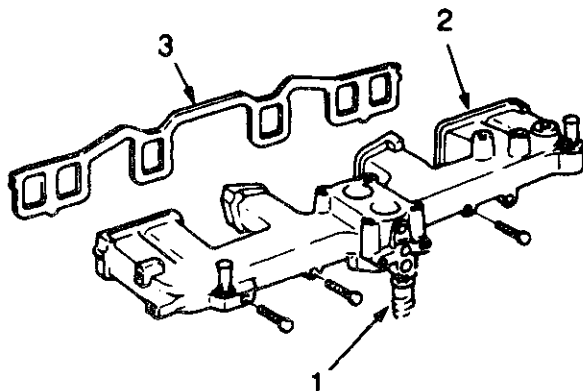


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Connect the EGR valve tube (1) to the intake manifold.



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Connect the coolant hoses to the intake manifold.

Connect the vacuum hose to the EGR valve.

Connect the throttle cable and the PCV valve hose. Connect the throttle valve rod retainer and spring.

Install the air cleaner.

Refill the cooling system with coolant.

If replacement coolant is being used, ensure that the mixture of antifreeze and low mineral content water is acceptable for the climate.

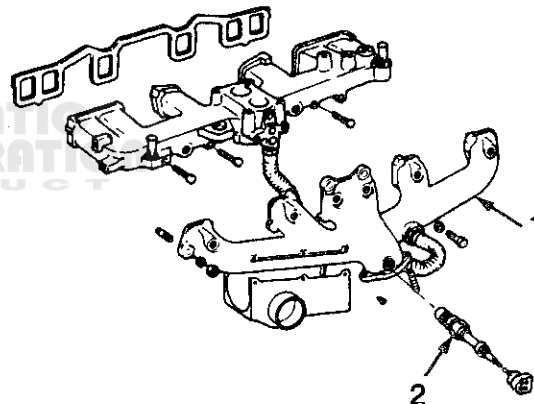
WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and inspect for leaks. Repair as necessary.

EXHAUST MANIFOLD REMOVAL

Remove the intake manifold. Refer to Intake Manifold Removal for the procedure.

Disconnect the exhaust pipe from the exhaust manifold (1).



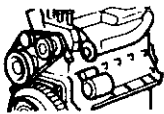
86318

Disconnect the oxygen sensor wire connector and remove the sensor (2) from the exhaust manifold.

Remove the nuts from the end studs and remove the exhaust manifold.

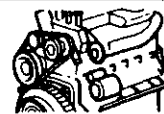
Clean the mating surfaces of the cylinder head and the manifold if the original manifold is to be installed.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



EXHAUST MANIFOLD INSTALLATION

Position the exhaust manifold over the end studs on the cylinder head.

Install the nuts finger-tight on the end studs.

Clean the threads in the bore for the oxygen (O₂) sensor.

Apply antiseize compound to the oxygen (O₂) sensor threads.

Install the oxygen sensor and connect the wire connector. Tighten the sensor with 47 N·m (35 ft-lbs) torque.

Connect the exhaust pipe to the exhaust manifold. Tighten the nuts with 28 N·m (23 ft-lbs) torque.

Install the intake manifold. Refer to Intake Manifold Installation for the procedure.

Install the EGR valve tube.

CYLINDER HEAD REMOVAL

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

Drain the coolant and disconnect the hoses at the thermostat housing.

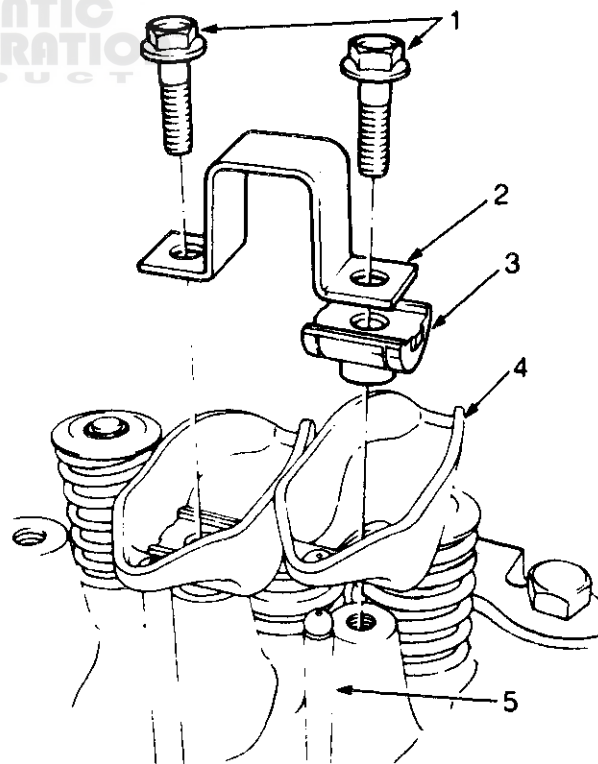
Remove the air cleaner.

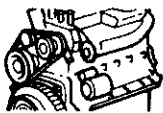
Remove the fuel pipe and vacuum advance hose.

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4). Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.

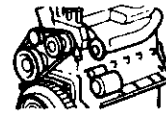
Remove the push rods (5).





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NOTE: Retain the push rods, bridges, pivots and rocker arms in the same order as removed to facilitate installation in the original locations.

Disconnect the power steering pump bracket. Set the pump and bracket aside. Do not disconnect the hoses.

Remove the intake and exhaust manifolds from the cylinder head. Refer to Intake and Exhaust Manifold Removal for the procedures.

If equipped with air conditioning, perform the following:

- remove the air conditioner compressor drive belt idler pulley bracket from the cylinder head
- loosen the alternator drive belt and remove the alternator bracket-to-cylinder head mounting screw

NOTE: The serpentine drive belt tension is released by loosening the alternator.

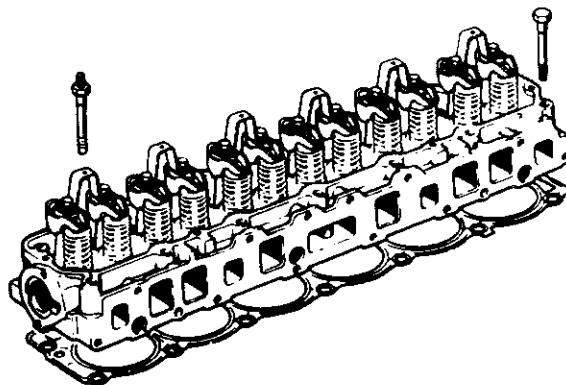
- remove the bolts from the A/C compressor mounting bracket and set the compressor aside

Disconnect the ignition wires and remove the spark plugs.

Disconnect the temperature sending unit wire connector and battery negative cable.

Remove the ignition coil and bracket assembly.

Remove the cylinder head bolts, cylinder head and gasket.



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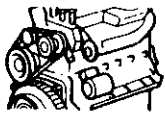
EXHAUST MANIFOLD CLEANING AND INSPECTION

Thoroughly clean the machined surfaces on the cylinder head and block. Remove all gasket material and cement.

Remove any carbon deposits from the combustion chambers and the top of the pistons.

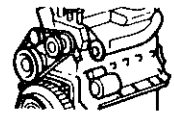
Use a straightedge and feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to the Specifications chart.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



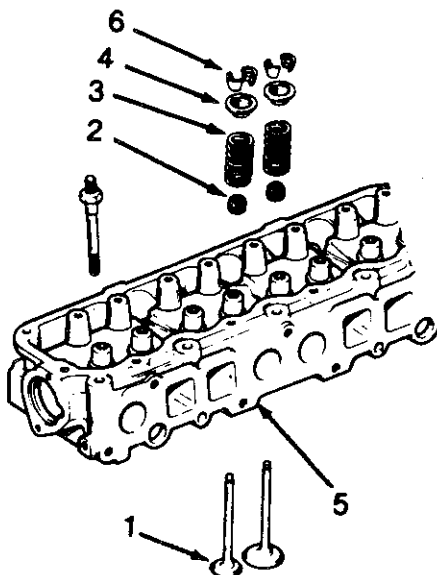
EXHAUST MANIFOLD INSTALLATION

If the cylinder head is to be replaced and the original valves used, measure the valve stem diameter.

Only standard size valves can be used with a service replacement cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems.

Remove all carbon buildup and reface the valves as outlined in the MOT. 4.2L manual.

Install the valves (1) in the cylinder head (5) with replacement valve stem oil deflectors (2). Install the valve springs (3), retainers (4) and the valve locks (6). Refer to the MOT. 4.2L manual.



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Transfer all attached components from the original cylinder head that are not included with the replacement cylinder head.

Do not install the temperature sending unit until the system is filled with coolant.

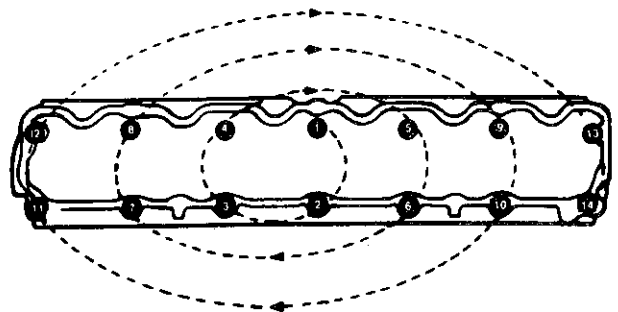
This permits trapped air to escape from the cylinder block and head. Refer to the air vent procedure described in the Cooling Systems section when refilling the system.

CAUTION: Do not apply sealing compound on the cylinder head and block gasket surfaces. Do not allow sealing compound to enter the cylinder bore.

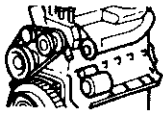
Apply an even coat of Perfect Seal sealing compound, or equivalent, to both sides of the replacement cylinder head gasket and position the gasket on the cylinder block with the word TOP facing up.

Install the cylinder head. Tighten the bolts in the sequence illustrated with 115 N·m (85 ft-lbs) torque.

NOTE: The cylinder head gasket is made of aluminum-coated embossed steel and does not require the head bolts to be retightened.

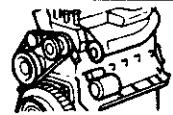


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



NOTE: Coat the threads of the stud bolt in the No. 11 sequence position with LOCTITE 592 sealant (or equivalent). Tighten with 102 N-m (75 ft-lbs) torque.

Connect the battery negative cable.

Install the ignition coil and bracket assembly.

Install the spark plugs and connect the ignition wires.

Attach the air conditioner compressor mounting bracket to the cylinder head, if removed.

Install the intake and exhaust manifolds. Use the correct tightening sequence. Refer to Intake and Exhaust Manifold Installation for the procedures.

Install the alternator bracket screw on the head. Install the alternator belt and adjust the tension. Refer to the Cooling Systems section.

Install the power steering bracket and pump. Adjust the belt tension. Refer to the Cooling Systems section.

NOTE: Refer to the Cooling Systems section for all drive belt (including serpentine) adjustment procedures.

Install the push rods in the order removed.

Install the rocker arms and the bridge and pivot assemblies in the order removed. Loosely install the capscrews for each bridge and tighten alternately, one turn at a time, to avoid damaging the bridges.

Tighten the capscrews with 26 N-m (19 ft-lbs) torque.

Install the cylinder head cover. Refer to the installation procedure.

Connect the hoses to the thermostat housing and fill the cooling system to the specified level. Refer to the Cooling Systems section.

NOTE: The automatic transmission throttle linkage and cable must be adjusted after completing the cylinder head installation. Refer to Chapter F – Automatic Transmission.

Install the temperature sending unit and connect the wire connector.

Connect the fuel pipe and vacuum advance hose.

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.

Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

Install the air cleaner.

LUBRICATION SYSTEM – Oil Pan Removal

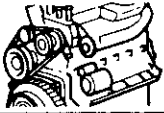
Lock the steering wheel.

Raise and support the vehicle at the side sills.

Drain the engine oil.

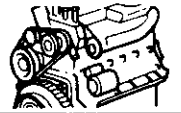
Remove the starter motor.

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ENGINES

4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Remove the flywheel/torque converter housing access cover.

Remove the oil pan screws.

Remove the oil pan by sliding it to the rear.

Cement the replacement oil pan side gaskets (2) into position on the cylinder block.

Apply a generous amount of RTV sealant to the end tabs of the gaskets.

Coat the inside curved surface of the replacement oil pan rear seal (3) with soap.

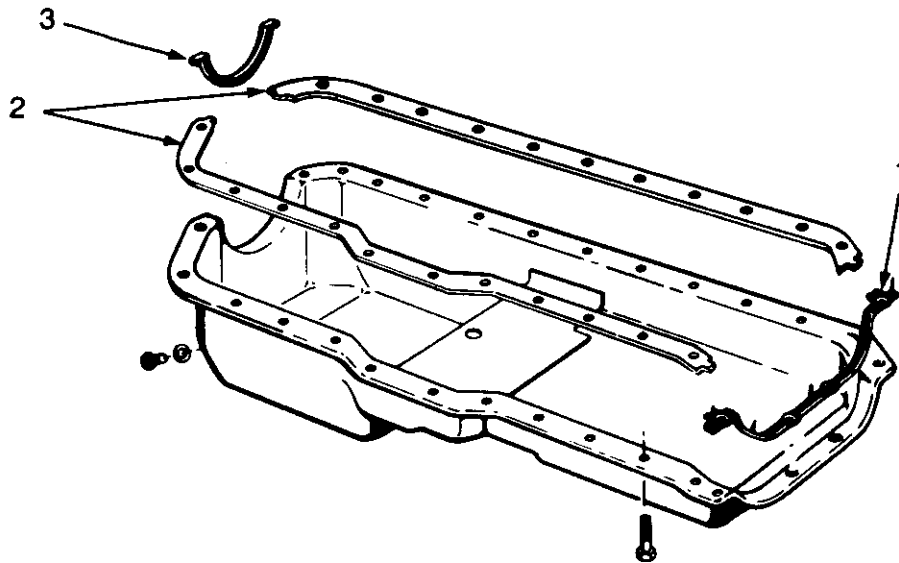
LUBRICATION SYSTEM – Oil Pan Installation

Clean the gasket and seal surfaces. Remove all sludge and grime from the oil pan sump.

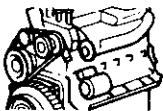
Apply a generous amount of RTV sealant to the gasket contacting surface of the seal end tabs.

Install a replacement oil pan front seal (1) on the timing case cover and apply a generous amount of RTV sealant (AMC Gasket-in-a-Tube, or equivalent) to the recesses in the tab ends.

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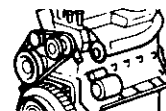


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Install the seal in the recess of the rear main bearing cap. Ensure that it is fully seated.

NOTE: Either one of two sealing methods may be used. An RTV sealant such as AMC Gasket-in-a-Tube, or equivalent, may be used instead of a gasket. If a gasket is used, coat both sides with a quick drying adhesive such as AMC Spray-a-Gasket, or equivalent.

Apply engine oil to the oil pan contacting surface of the front and rear oil pan seals.

NOTE: Tighten the 1/4-20 oil pan screws with 9 N·m (7 ft-lbs) torque and tighten the 5/16-18 oil pan screws with 15 N·m (11 ft-lbs) torque.

Install the oil pan. Tighten the screws and the drain plug securely.

Install the starter motor.

Install the flywheel/torque converter housing access cover.

Raise the vehicle and remove the sill supports and jack. Lower the vehicle.

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.

Fill the oil pan with engine oil to the specified level. Start the engine and inspect for leaks.

LUBRICATION SYSTEM – Oil Pump Removal

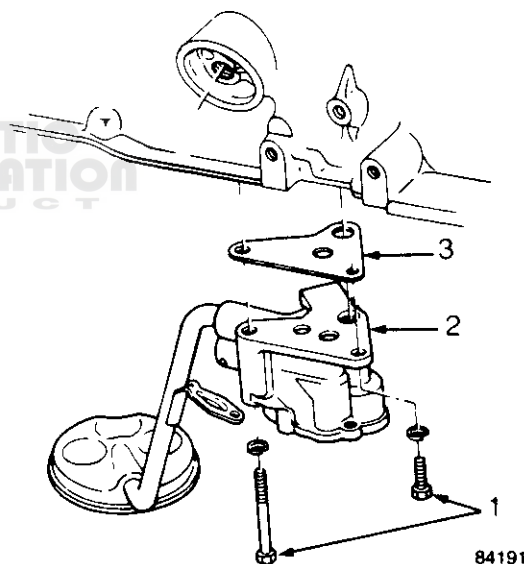
NOTE: A gear-type oil pump is mounted at the underside of the cylinder block opposite the No. 4 main bearing.

NOTE: Oil pump removal or replacement will not affect the distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

Drain the engine oil.

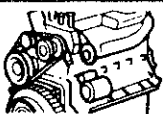
Remove the oil pan. Refer to Oil Pan Removal for the procedure.

Remove the oil pump retaining screws (1), oil pump (2) and gasket (3).



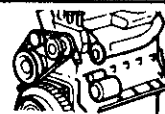
CAUTION: Do not disturb the position of the oil inlet tube and strainer assembly in the pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



LUBRICATION SYSTEM – Oil Pump Installation

NOTE: To ensure self-priming of the oil pump, fill the pump with petroleum jelly before installing the oil pump cover. Do not use grease.

Install the oil pump with a replacement gasket. Tighten the short screws with 14 N·m (10 ft-lbs) torque and the long screws with 23 N·m (17 ft-lbs) torque.

NOTE: Rotate the gears to ensure that a binding condition does not exist before installing the oil pump.

Install the oil pan with replacement gaskets and seals. Refer to Oil Pan Installation for the procedure. Fill the oil pan with replacement engine oil to the specified level.

LUBRICATION SYSTEM – Oil Pump Overhaul

Refer to the MOT. 4.2L manual for the oil pump overhaul procedure.

LUBRICATION SYSTEM – Oil Pressure Gauge

Refer to Chapter C – Electrical for operation, diagnosis and replacement of the oil pressure gauge.

PISTONS AND CONNECTING RODS ASSEMBLY REPLACEMENT

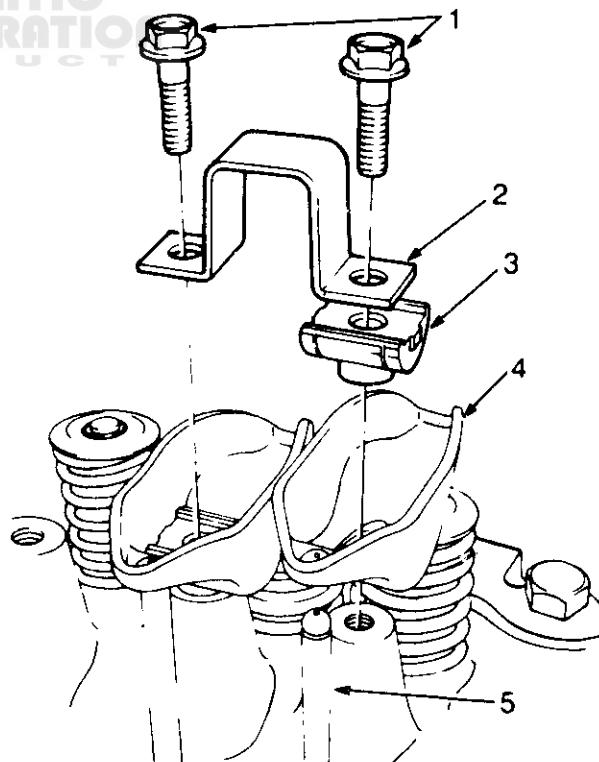
NOTE: The following procedure is for servicing the piston and connecting rod assemblies with the engine installed.

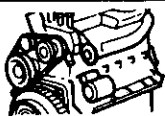
PISTONS AND CONNECTING RODS ASSEMBLY REMOVAL

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4). Alternately loosen the capscrews, one turn at a time, to avoid damaging the bridge.

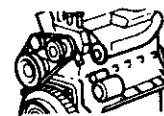
Remove the push rods (5).



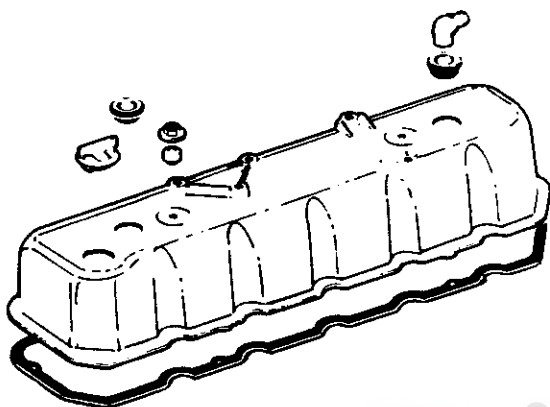


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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Remove the cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.



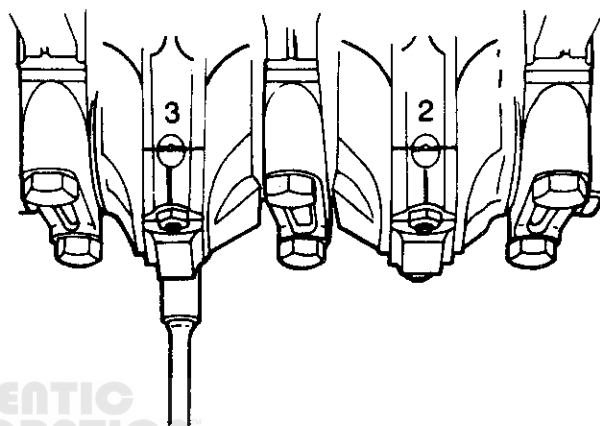
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Position the pistons one at a time near the bottom of the stroke and use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

Drain the engine oil.

Remove the oil pan, gasket and seals. Refer to Oil Pan Removal for the procedure.

Remove the connecting rod bearing caps and inserts. Retain them in the same order as removed to facilitate installation in the original location.

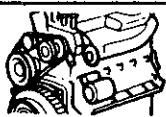


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NOTE: The connecting rods and caps are stamped with the corresponding cylinder number.

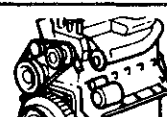
CAUTION: Ensure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the connecting rod bolts, will provide protection during removal.

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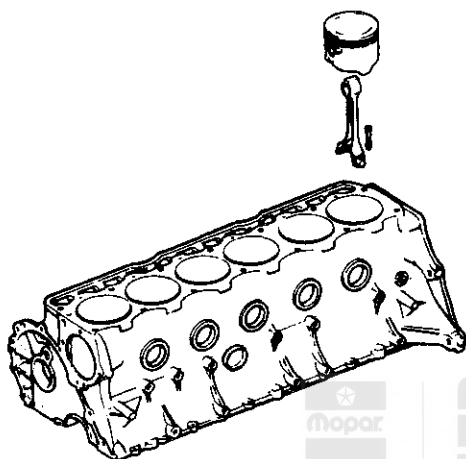
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



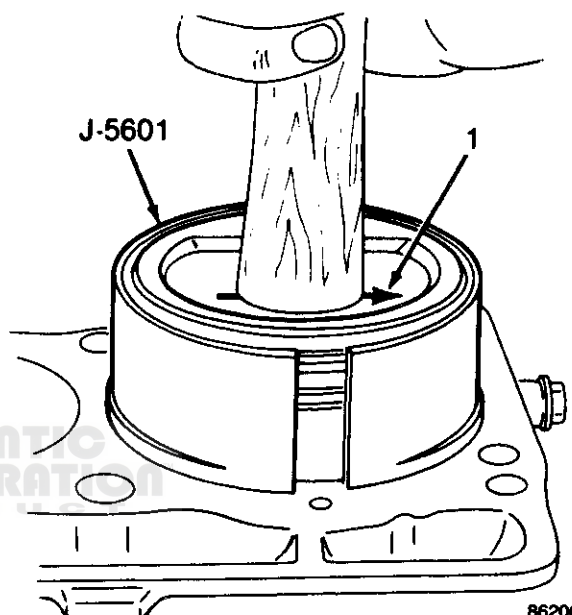
Remove the connecting rod and piston assemblies through the top of the cylinder bores.

Use piston ring compressor tool J-5601 to install the connecting rod and piston assemblies from the top of the cylinder block. Ensure the arrow (1) on the piston top points to the front of the engine.

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PISTONS AND CONNECTING RODS ASSEMBLY INSTALLATION

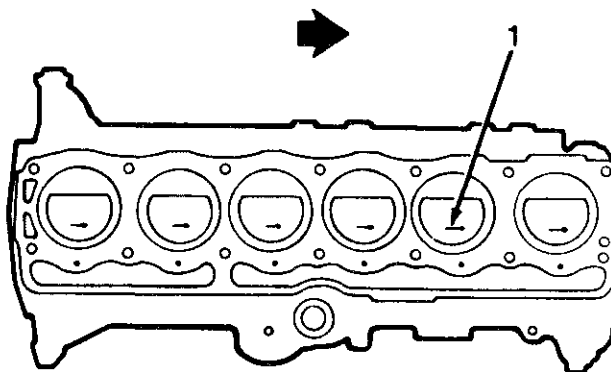
Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean, lint-free cloth.

Install replacement piston rings on the pistons, if necessary. Refer to the MOT. 4.2L manual for the procedure.

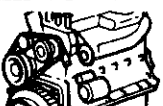
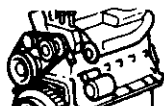
Lubricate the pistons and rings with clean engine oil.

CAUTION: Ensure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the connecting rod bolts, will provide protection during installation.

NOTE: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.



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	ENGINES 4.2 LITER (258 CID) SIX-CYLINDER ENGINE	
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Install the connecting rod bearing caps and inserts in the same order as removed. Refer to Connecting Rod Bearings Installation for the procedure.

Install the oil pan using replacement gaskets and seals. Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

Fill the oil pan with engine oil to the **FULL MARK** on the dipstick.

Install the gasket and cylinder head. Refer to Cylinder Head Installation for the procedure.

Piston Pins Removal/Installation

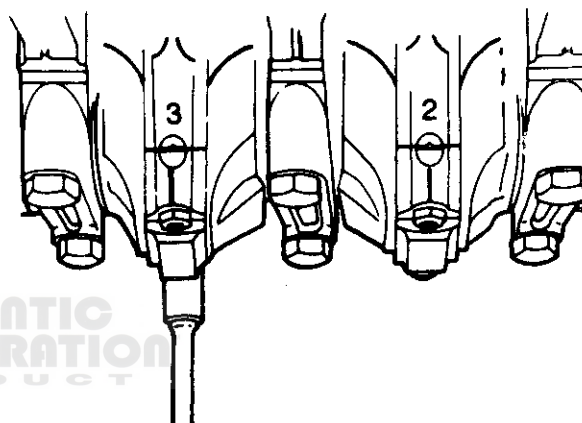
Refer to the MOT. 4.2L manual for the removal and installation procedure.

Connecting Rod Bearings Removal

Drain the engine oil.

Remove the oil pan, seals and gaskets. Refer to Oil Pan Removal for the procedure.

Rotate the crankshaft as required to position two of the connecting rods at a time at the bottom of the stroke.



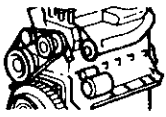
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Remove the connecting rod bearing cap
Remove the lower bearing insert.

Remove the upper bearing insert by rotating sliding it out of the connecting rod.

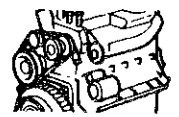
NOTE: Do not intermix the bearing caps. Each connecting rod and its bearing cap are stamped with the corresponding cylinder number on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



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Connecting Rod Bearings Inspection

Refer to the MOT. 4.2L manual for the procedure.

Bearing-to-Journal Clearance Measuring (with Plastigage)

Refer to the MOT. 4.2L manual for the procedure.

Connecting Rod Bearings Installation

Lubricate the bearing surface of each insert with clean engine oil.

CAUTION: Use care when rotating the crankshaft with the bearing caps removed. Ensure that the connecting rod bolts do not accidentally come into contact with the crankshaft journals and scratch the surface. Bearing failure would result. Short pieces of rubber hose, slipped over the connecting rod bolts, will provide protection during installation.

Install the connecting rod, bearing inserts and cap around the journal and secure with the retaining nuts. Tighten with 45 N·m (33 ft-lbs) torque.

Install the oil pan using the replacement gaskets and seals. Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

Fill the crankcase with engine oil to the specified level.

Piston Replacement/Servicing

For piston replacement and servicing procedures, refer to the MOT. 4.2L manual.

CRANKSHAFT REPLACEMENT

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible.

CRANKSHAFT REMOVAL/INSTALLATION

Removal and installation procedures are described in the MOT. 4.2L manual.

Crankshaft Main Bearings Removal

Drain the engine oil.

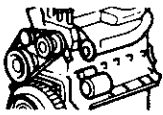
Remove the oil pan. Refer to Oil Pan Removal for the procedure.

Remove the main bearing cap and lower insert.

Remove the lower insert from the bearing cap.

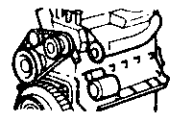
Remove the upper insert by loosening all of the other bearing caps and insert a small cotter pin tool in the crankshaft journal oil hole.

Bend the cotter pin as illustrated to fabricate the tool. A tongue depressor may also be used to remove the bearing insert.



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4.2 LITER (258 CID) SIX-CYLINDER ENGINE

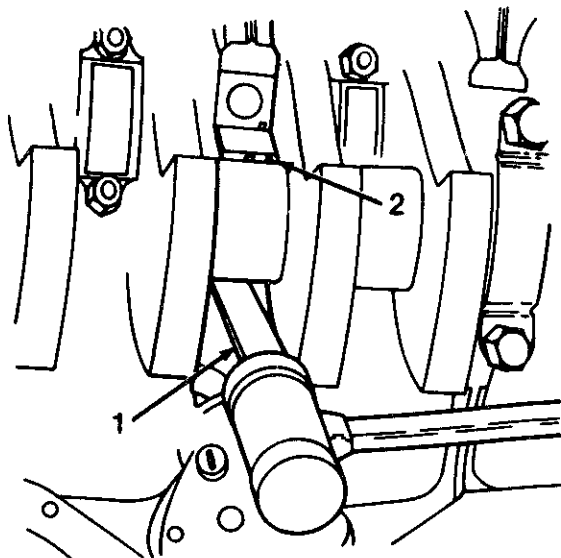


With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab.



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NOTE: Because there is no hole in the No. 4 main journal, use a tongue depressor (1) or similar soft-faced tool to remove the bearing insert (2). After moving the insert approximately 25mm (1-in) it can be removed by applying pressure under the tab.



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Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

Measuring Main Bearing-to-Journal Clearance (with Plastigage) (Crankshaft Installed)

Refer to the MOT. 4.2L manual for the procedure.

Crankshaft Main Bearings Installation

Lubricate the bearing surface of each insert with engine oil.

Loosen all the main bearing caps. Install the removed main bearing upper insert(s).

Install the main bearing cap(s) and lower insert(s).

Tighten all the bolts with 54 N·m (40 ft-lbs) torque. Then tighten with 95 N·m (70 ft-lbs) torque. Finally, tighten with 108 N·m (80 ft-lbs) torque.

Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

NOTE: When installing a crankshaft kit (crankshaft plus bearing inserts), measure each bearing-to-journal clearance with Plastigage to ensure proper fit.

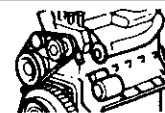
Install the oil pump. Refer to Oil Pump Installation for the procedure.

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4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Install the oil pan with replacement gaskets and seals. Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

Fill the oil pan with engine oil to the FULL MARK on the dipstick.

Crankshaft Front Oil Seal Replacement (Cover Not Removed)

Remove the drive belts and fan shroud.

Remove the vibration damper pulley, if equipped (V-belt drive only).

Remove the vibration damper and key with Tool J-21791. Refer to the removal procedure.

Remove the oil seal with Timing Cover Oil Seal Remover Tool J-9256, or equivalent.

Position the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool J-22248 with the seal lip facing outward

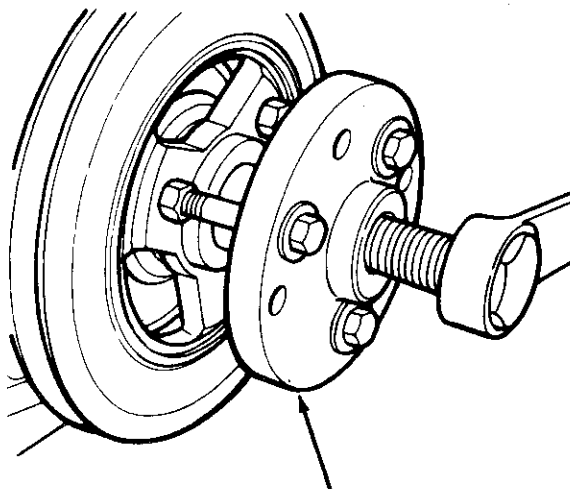
Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft with engine oil.

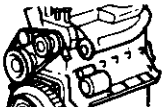
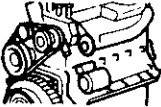
Position J-22248 with seal over end of crankshaft. Insert tool J-22248.

Install seal into timing chain cover by gently tapping with rubber or plastic mallet.

Remove J-22248.



J-21791-01

	ENGINES 4.2 LITER (258 CID) SIX-CYLINDER ENGINE	
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Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

With the key inserted in the keyway on the crankshaft, install the vibration damper, washer and bolt.

Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.

NOTE: If the crankshaft turns before the damper bolt torque value is attained, the crankshaft can be prevented from turning by placing two $5/16 \times 1\frac{1}{2}$ inch bolts into the damper front pulley holes and wedging a bar between them. Rotate the bar until it contacts the frame member to prevent the crankshaft from turning.

Install the damper pulley, if removed. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Rear Main Bearing Oil Seal Replacement

When replacing the rear main oil seal, the transmission must be removed. Refer to the applicable transmission removal procedure.

NOTE: The crankshaft rear main bearing oil seal is a two-piece, single-lip neoprene seal. The upper half of the seal fits tightly between the cylinder block and the crankshaft. The lower half of the seal fits tightly between the bearing cap and the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

Rear Main Bearing Oil Seal Removal

Remove the flywheel or converter drive plate. Refer to the removal procedure. Mark the drive plate before removal for installation reference.

Remove the oil pan. Refer to Oil Pan Removal for the procedure.

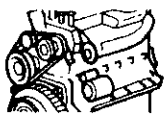
Remove the rear main bearing cap and discard the lower half of the seal.

Loosen all the remaining main bearing caps.

Tap the upper half of the seal with a brass drift and hammer until it protrudes out far enough to permit pulling it out from around the crankshaft.

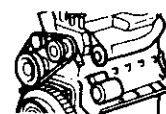
Discard the upper half of the seal.

Clean the rear main bearing cap thoroughly. Remove all the sealant.



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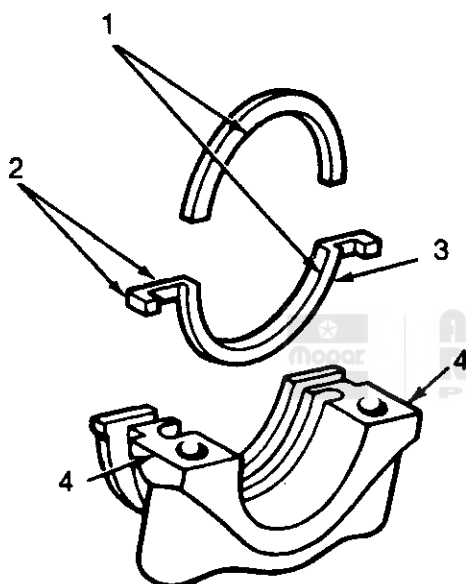
4.2 LITER (258 CID) SIX-CYLINDER ENGINE



Rear Main Bearing Oil Seal Installation

Wipe the crankshaft seal surface area clean and apply a thin coat of engine oil.

Coat the lip on both halves of the replacement rear main bearing seal (1) with engine oil.



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Insert the upper half of the replacement seal into cylinder block and around the crankshaft.

NOTE: The seal lip faces inward toward the front of the engine.

Coat both sides of the replacement lower seal end tabs (2) with RTV sealant (AMC Gasket-in-a-Tube, or equivalent). Do not apply sealant to the lip of the seal.

Coat the outer curved surface of the lower half of the replacement seal (3) with liquid soap.

Position the lower half of the replacement seal into the bearing cap recess and seat it firmly.

Coat both chamfered edges on the bearing cap (4) with RTV sealant (AMC Gasket-in-a-Tube, or equivalent).

CAUTION: Do not apply sealant to the cylinder block-to-bearing cap mating surface because this will alter the bearing-to-journal clearance.

Install the rear main bearing cap.

Tighten all the main bearing caps with 108 N·m (80 ft-lbs) torque.

Install the oil pan with replacement gaskets and seals. Refer to Oil Pan Installation for the procedure.

Fill the oil pan to the FULL MARK on the dipstick.

Install the converter drive plate or flywheel with replacement bolts. Refer to the converter drive plate/flywheel installation procedure.

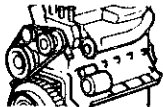
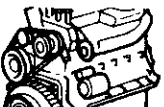
Install the transmission. Refer to the applicable installation procedure.

Flywheel/Drive Plate and Ring Gear Replacement

The ring gear can be replaced only on engines with a manual transmission. The ring gear is welded to and balanced as part of the converter drive plate on engines with automatic transmissions.

If defective, the entire drive plate and ring gear assembly must be replaced for engines with automatic transmissions.

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Ring Gear Replacement (Manual Transmission)

Position the flywheel on an arbor press with steel blocks equally spaced under the ring gear.

Press the flywheel down through the ring gear.

NOTE: The ring gear can also be removed by breaking with a chisel.

Apply heat to expand the inside diameter of the replacement ring gear.

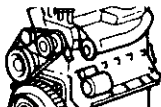
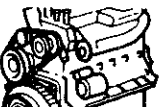
Press the flywheel into the replacement ring gear.

NOTE: For engines equipped with a manual transmission, the flywheel is balanced as an individual component and also as part of the crankshaft assembly. Do not attempt to duplicate the original flywheel balance holes when installing a service replacement flywheel. Service replacement flywheels are balanced during manufacture and do not require additional balancing.

CYLINDER BLOCK DISASSEMBLY/ASSEMBLY

Refer to the MOT. 4.2L manual for disassembly/assembly procedures.

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	ENGINES COOLING SYSTEMS	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Alternator Adjustment Bolt Four-Cylinder Engine Six-Cylinder Engine	24 N·m (18 ft-lbs) 24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs) 20-27 N·m (15-20 ft-lbs)
Alternator Pivot Bolt/Nut Four-Cylinder Engine Six-Cylinder Engine	38 N·m (28 ft-lbs) 38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs) 27-47 N·m (20-35 ft-lbs)
Pulley-to-Vibration Damper Bolts Four-Cylinder Engine Six-Cylinder Engine	27 N·m (20 ft-lbs) 27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs) 20-34 N·m (15-25 ft-lbs)
Cylinder Block Heater T-Type Compression Type	2 N·m (20 in-lbs) 14 N·m (10 ft-lbs)	2-3 N·m (17-25 in-lbs) 11-18 N·m (8-13 ft-lbs)
Fan and Pulley-to-Hub Bolts Four- and Six-Cylinder Engines	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
A/T Fluid Cooler Pipe Flared Fitting Nuts	34 N·m (25 ft-lbs)	20-41 N·m (15-30 ft-lbs)
A/T Fluid Cooler Pipe Radiator Fitting	20 N·m (15 ft-lbs)	14-41 N·m (10-30 ft-lbs)
Power Steering Pump Adjustment Bolt Six-Cylinder Engine	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump Pivot Bolt Six-Cylinder Engine	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump-to- Bracket Nuts Four-Cylinder Engine	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Thermostat Housing Four- and Six-Cylinder Engines	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Water Pump Mounting Bolts Four- and Six-Cylinder Engines	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Tensioner Bracket-to-Cylinder Block Bolt	19 N·m (14 ft-lbs)	13-20 N·m (10-15 ft-lbs)
Vibration Damper Bolt (Lubricated)	108 N·m (80 ft-lbs)	95-135 N·m (70-100 ft-lbs)

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	ENGINES COOLING SYSTEMS	
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SPECIFICATIONS

Cooling System Specifications

	Four- and Six-Cylinder Engine (w/V-Belt)	Six-Cylinder Engine (w/Serpentine Belt)
Radiator Cap Relief Pressure	96.5 kPa (14 psi)	96.5 kPa (14 psi)
Thermostat Rating		
Must be Open 0.076 mm (0.003 inch).....	90°C (195°F)	90°C (195°F)
Fully Open.....	103°C (218°F)	103°C (218°F)
Water Pump Type	Centrifugal	Centrifugal
Drive.....	V-Belt	Serpentine Belt
Radiator Type.....	Downflow Tube and Spacer	Downflow Tube and Spacer
Cooling System Capacities	Refer to Cooling System Capacities Chart	
Fan.....	Refer to Cooling System Components Chart	
Drive Belt		
Angle of V.....	38°	Serpentine Belt 6 40° Ribs
Width-top of Groove	9.7 – 12.7 mm (0.38 – 0.50 in.)	
Type (Plain or Cogged)	Cogged	

SEE I.S. NOTES



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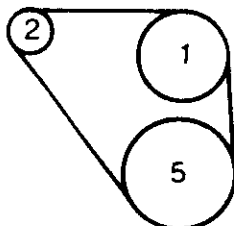
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Engine Drive Belt Tension

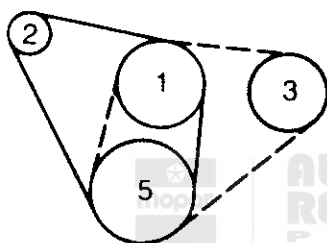
	Initial Newtons New Belt	Initial Pounds-Force New Belt	Reset Newtons Used Belt	Reset Pounds-Force Used Belt
V-TYPE BELT				
Air Conditioner – All Engines	533-712	120-160	400-512	90-115
Alternator and Fan – All Engines.....	533-712	120-160	400-512	90-115
Power Steering – All Engines.....	533-712	120-160	400-512	90-115
SERPENTINE DRIVE BELT – All Engines	800-890	180-200	623-712	140-160

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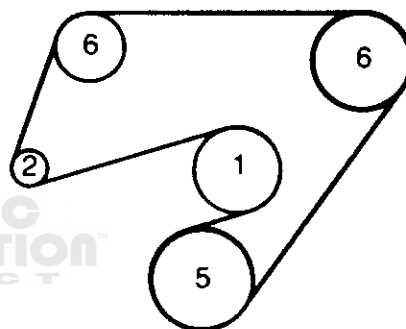
ENGINE DRIVE BELT ARRANGEMENTS



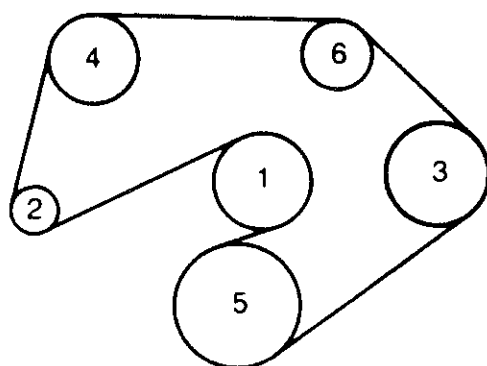
FOUR- AND SIX-CYLINDER ENGINE WITH
ALTERNATOR



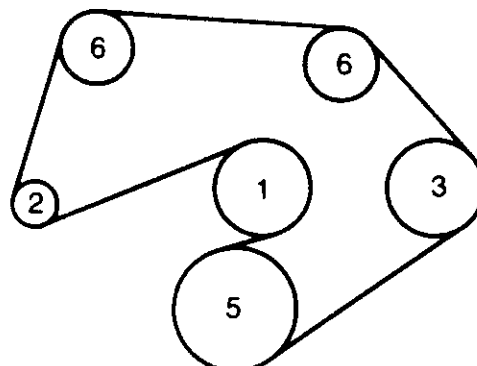
FOUR- AND SIX-CYLINDER ENGINE WITH
ALTERNATOR AND POWER STEERING PUMP



SIX-CYLINDER ENGINE WITH SERPENTINE
DRIVE AND ALTERNATOR (CALIFORNIA ONLY)

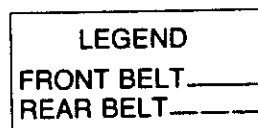


SIX-CYLINDER ENGINE WITH SERPENTINE
DRIVE, ALTERNATOR, A/C COMPRESSOR
AND POWER STEERING PUMP
(CALIFORNIA AND 49-STATE)

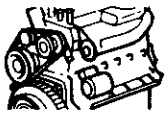


SIX-CYLINDER ENGINE WITH SERPENTINE
DRIVE, ALTERNATOR AND POWER STEERING
PUMP (CALIFORNIA ONLY)

1. Water Pump
2. Alternator
3. Power Steering Pump
4. A/C Compressor
5. Drive Pulley
6. Idler Pulley

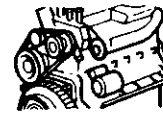


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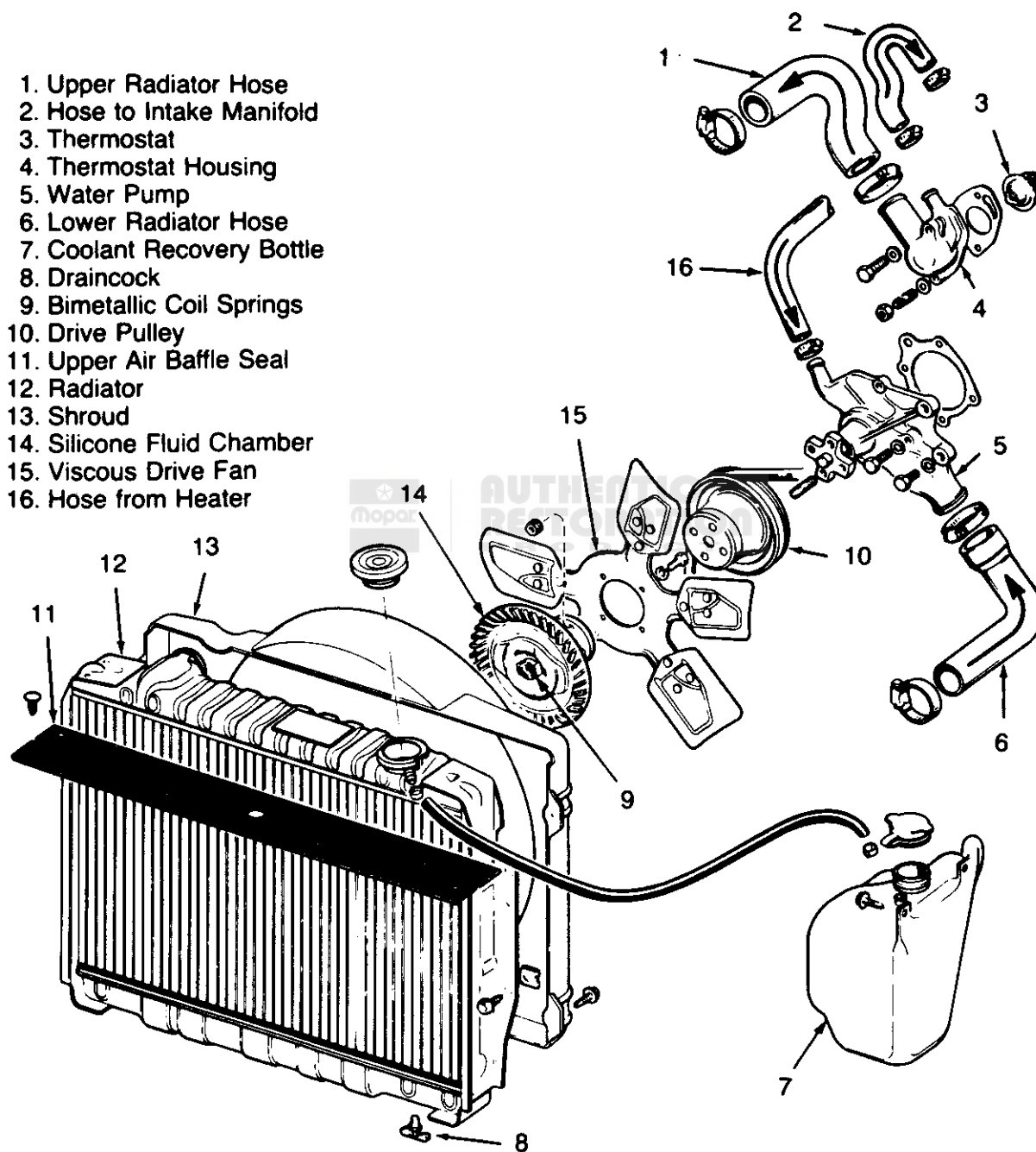
ENGINES

COOLING SYSTEMS

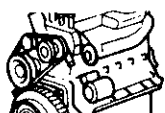


COOLING SYSTEM COMPONENTS

1. Upper Radiator Hose
2. Hose to Intake Manifold
3. Thermostat
4. Thermostat Housing
5. Water Pump
6. Lower Radiator Hose
7. Coolant Recovery Bottle
8. Draincock
9. Bimetallic Coil Springs
10. Drive Pulley
11. Upper Air Baffle Seal
12. Radiator
13. Shroud
14. Silicone Fluid Chamber
15. Viscous Drive Fan
16. Hose from Heater

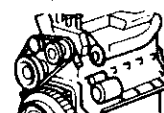


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COOLANT

Maintain the coolant at the specified level with a mixture of ethylene glycol-based antifreeze (containing ALUGARD 340™) and low mineral content water.

CAUTION: The antifreeze mixture should always be maintained to satisfy local climatic requirements, or 44 percent, whichever is greater. 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. For example, 100 percent antifreeze freezes at -22°C (-8°F). In addition, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water. The antifreeze concentration **MUST ALWAYS** be a minimum of 44 percent, year-round and in all climates. If the percentage is lower, engine parts may be eroded by cavitation.

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

Coolant Level – Without Coolant Recovery System

When the engine is cold, the coolant level should be 38 - 51mm (1½ to 1¼-in) below the radiator filler neck sealing surface.

When the engine is at normal operating temperature, it should be 13 - 25mm (½ to 1/8-in) below the sealing surface.

WARNING: When the engine is hot, removing the radiator cap can cause coolant to spray out and scald the hands, body and face. If it is necessary to check the level, allow the engine to idle for a few moments. Use a heavy rag or towel wrapped over the cap and turn the cap slowly to

the first notch to relieve the pressure. Then push down to disengage the locking tabs and remove the cap. If the engine is overheated, operate it above curb idle speed for a few moments with the hood up, then shut the engine OFF and let it cool 15 minutes before removing the cap. The pressure can also be reduced during cooldown by spraying the radiator with cool water.

Coolant Level – With Coolant Recovery System

The coolant level in the recovery bottle should be checked only with the engine at normal operating temperature. It should be between the FULL and ADD marks on the coolant recovery bottle.

NOTE: Do not add coolant unless the level is below the ADD mark with the engine at normal operating temperature.

When adding coolant during normal maintenance, add only to the recovery bottle, not to the radiator.

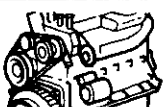
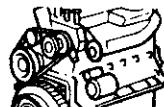
NOTE: Remove the radiator cap only for testing or when refilling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which causes corrosion.

Coolant Draining

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

NOTE: If equipped with a coolant recovery system, do not remove the radiator cap when draining the coolant from the recovery bottle. Open the radiator draincock and when the bottle is empty, remove the radiator cap. The coolant

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need not be removed from the bottle unless the system is being refilled with a fresh mixture.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with system hot and under pressure because serious burns from coolant can occur.

Drain the coolant from the radiator by loosening the draincock on the bottom tank.

For four-cylinder engines, drain the cylinder block by removing the drain plug at the left-rear of the cylinder block.

For six-cylinder engines, drain the coolant from the cylinder block by removing the two drain plugs located on the left side of the cylinder block.

NOTE: The plugs may have been replaced by one or two CTO valves.

Coolant Replacement

Before filling, tighten the radiator draincock and all the cylinder block drain plugs. Add the proper mixture of coolant to satisfy the local climatic requirements for freeze and cooling protection.

CAUTION: The antifreeze concentration must always be a minimum of 44 percent, year-round and in all climates. If the percentage is lower, engine parts may be eroded by cavitation.

Fill the radiator to the correct coolant level. For vehicles with a coolant recovery system, fill the radiator to the top and install the radiator cap. Add sufficient coolant to the recovery bottle to raise the level to the FULL mark.

After refilling the system, or when air pockets are suspected, purge the cooling system of excess air.

Air Purging From the Cooling System

Trapped air will hamper or stop coolant flow, or cause burping of engine coolant out of the radiator overflow tube (if not equipped with coolant recovery).

Move the heater control to the HEAT position and the heater temperature control to the full WARM or HIGH position.

For vehicles without a coolant recovery system, purge the air by operating the engine (with a properly filled cooling system) with the radiator cap off until the coolant has completely circulated throughout the engine, or until normal operating temperature is attained.

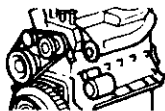
Add coolant, if necessary, and install the radiator cap.

For vehicles with a coolant recovery system, fill the system with coolant and operate the engine with all coolant caps in place. After the coolant has reached the normal operating temperature, shut the engine OFF and allow it to cool. Add coolant to the recovery bottle as necessary.

NOTE: This procedure may have to be repeated several times to maintain the correct coolant level at normal operating temperature.

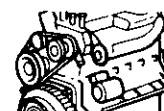
NOTE: With some vehicles, it may be necessary to remove a heater hose to provide an escape for trapped air when filling the system.

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Coolant Freezing Point Test

Check the coolant freezing point, or freeze protection, with an antifreeze hydrometer to determine the protection level.

Coolant Removal from Crankcase

If coolant leaks into the lubricating system, it will clog the oil passages and cause the pistons to seize. Severe damage to the engine will result.

If coolant has leaked into the lubricating system, locate the source of the coolant leak(s), such as a faulty head gasket or a cracked cylinder block, and make the necessary repairs. After repairing the source of the leak(s), use AMC Crankcase Cleaner, or equivalent, to flush the engine.

WATER PUMP

Water Pump Pulley Removal

Disconnect the fan shroud from the radiator, if equipped.

Loosen all the drive belts routed around the water pump pulley.

Remove the fan or Tempatrol drive attaching screws.

Remove the fan and spacer or Tempatrol fan and drive. Remove the shroud. Refer to Fan Replacement.

Remove the pulley.

Water Pump Pulley Installation

Install the pulley.

Position the fan, spacer (or Tempatrol fan and drive) and shroud.

Install the attaching screws and tighten.

Install and tighten the belts. Refer to Drive Belt Adjustments.

Install the shroud attaching screws and tighten.

Water Pump Removal

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The WATER PUMP IS SERVICED ONLY AS A COMPLETE ASSEMBLY.

NOTE: Do not waste reusable coolant. If the solution is clean and being drained only to service the cooling system, drain it into a clean container for reuse.

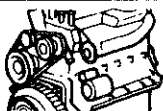
WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from coolant can occur.

The following procedure applies to all vehicles with or without power steering and air conditioning.

Drain the cooling system. Observe the WARNING and NOTE stated above.

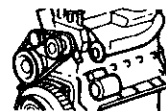
Disconnect the radiator and heater hoses from the pump.

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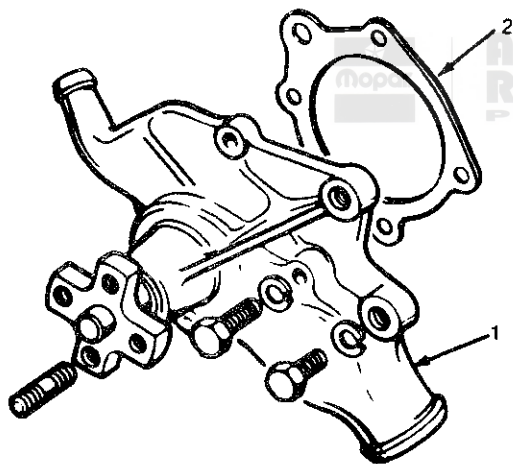
Remove the drive belt(s).

Remove the fan shroud attaching screws (if equipped) from the radiator.

Remove the fan assembly and remove the fan shroud. Refer to Fan Replacement.

NOTE: With some vehicles, fan removal may be easier if the fan shroud is rotated 1/2 turn.

Remove the water pump (1) and gasket (2).



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Water Pump Installation

Before installing the pump, clean the gasket mating surfaces. If the original pump is to be installed, remove any deposits and other foreign material from the impeller cavity. Inspect the cylinder block surface for erosion or other faults.

Install the replacement gasket (2) and water pump (1). Tighten the bolts with 18 N·m (13 ft-lbs) torque. Rotate the shaft by hand to ensure it turns freely.

Position the shroud against the front of the engine, if removed, and install the fan assembly. Tighten the screws with 24 N·m (18 ft-lbs) torque.

Install the fan shroud (if equipped) on the radiator.

Install the drive belt(s) and tighten to the specified tension. Test the belt tensions with Tension Gauge J-23600, or equivalent, (J-23600-B for serpentine belts). Refer to Drive Belt Adjustments.

Connect the hoses to the water pump.

Slowly fill the system with coolant. Use the correct mixture.

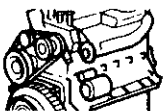
WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Operate the engine with the heater control valve open (in the HEAT position) and the radiator cap off until the thermostat opens to purge air from the cooling system.

Check the coolant level and add as required.

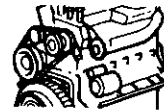
Install the radiator cap.

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Water Pump Tests

Loose Impeller Test

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

Drain the cooling system.

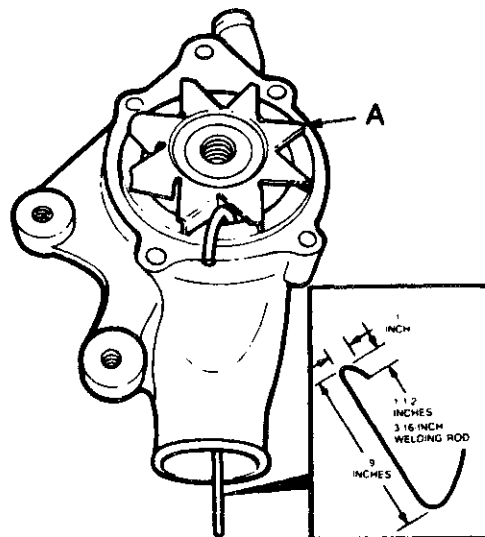
Loosen the fan belt.

Disconnect the lower radiator hose from the water pump.

Bend a stiff clothes hanger or welding rod as illustrated.

Position the rod in the water pump inlet and attempt to hold the impeller while turning the fan blades.

If the impeller (A) is loose and can be held with the rod while the fan blades are turning, the pump is defective. If the impeller turns, the pump is OK.



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NOTE: If equipped with a Tempatrol fan, turn the water pump shaft with a breaker bar and socket attached to a mounting flange nut.

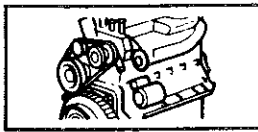
Connect the hose and install the coolant, or proceed with further repairs.

Inlet Restriction Inspection

Inadequate heater performance may be caused by a casting restriction in the water pump heater hose inlet.

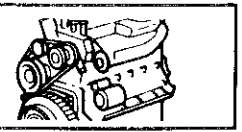
NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the cooling system, drain the coolant into a clean container for reuse.

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WARNING: Do not loosen the radiator drain-cock with the system hot and pressurized because serious burns from the coolant can occur.

Drain sufficient coolant from the radiator to decrease the level below the water pump hose inlet.

Remove the heater hose.

Inspect the inlet for casting flash or other restrictions.

NOTE: Remove the pump from the engine before removing any restrictions to prevent contamination of the cooling system with debris. Refer to Water Pump Removal.

INTAKE MANIFOLD

Coolant Flow Test

If a restricted coolant flow is suspected, perform the following test procedure.

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not loosen the radiator drain-cock with the system hot and pressurized because serious burns from the coolant can occur.

Drain sufficient coolant from the radiator to decrease the level below the intake manifold and remove the coolant hoses from the front and rear fittings on the intake manifold.

Install a 30cm (12-in) length of 16mm (5/8-in) inside diameter (ID) heater hose on the intake manifold front fitting and place the funnel in the hose.

The funnel must have a minimum outlet size of 9.5mm (3/8-in) inside diameter (ID).

Fill a clean container with 1.89L (1/2 gallon) of water.

Begin pouring the water into the funnel and, with a time device in view, time the water flow through the manifold when the water starts flowing down the funnel.

Continue pouring the water into the funnel until the container is empty, and continue timing the water flow until the funnel is empty.

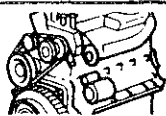
If the water flows through the intake manifold coolant passage in 25 seconds or less, the flow interval is correct and the passage is not restricted.

If the water takes longer than 25 seconds to flow through the intake manifold, inspect the manifold coolant inlet for casting flash or other restrictions. Correct as necessary and proceed to the next step.

Check the length of the hose fitting extending into the intake manifold coolant passages. The extension must not be so excessive in length that the coolant flow is restricted. Replace the fitting if the length is excessive.

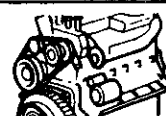
If the intake manifold coolant passages are restricted and cannot be cleared, replace the intake manifold. Refer to the replacement procedure in this chapter.

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HOSES

Rubber hoses route coolant to and from the radiator, intake manifold and heater core. If equipped with an A/C system, a coolant control valve is located inline with the heater core inlet and outlet hoses to control coolant flow to the heater core when the A/C system is in operation.

NOTE: The radiator lower hose for all engines is spring-reinforced to prevent collapse caused by water pump suction at moderate and high engine speeds.

Hose Inspection

Inspect the hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed or swell excessively when the system is pressurized.

In areas where specific routing clamps are not provided, ensure that the hoses are positioned with sufficient clearance from the exhaust manifold and pipe, fan blades, drive belts and sway bars. Otherwise, improperly positioned hoses will be damaged, resulting in coolant loss and overheating.

When performing a hose inspection, inspect the radiator lower hose for proper position and condition of the spring.

THERMOSTAT REMOVAL

An arrow or the words **TO RAD** is stamped on the thermostat to indicate the proper installed position.

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

WARNING: Do not loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

NOTE: Do not waste reusable coolant. If the solution is clean and being drained only to service the cooling system, drain the coolant into a clean container for reuse.

Drain the coolant from the radiator until the level is below the thermostat housing.

Remove the radiator upper hose and intake manifold hose, thermostat housing, gasket and thermostat.

THERMOSTAT CLEANING

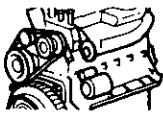
Clean the gasket mating surfaces.

THERMOSTAT INSTALLATION

Install a replacement thermostat, gasket and the housing.

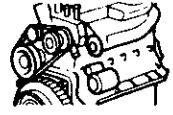
NOTE: Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

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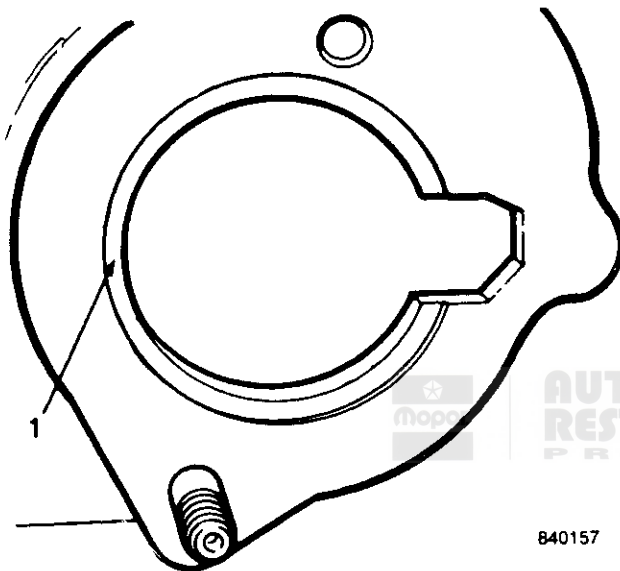


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CAUTION: Observe the recess in the cylinder head and position the thermostat in the groove (1). Next, install the replacement gasket and thermostat housing. Tightening the housing unevenly or with the thermostat out of its recess will result in a cracked housing.



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Tighten the housing bolts with 18 N·m (13 ft-lbs) torque.

Install the radiator upper hose and intake manifold hose.

Ensure that the radiator draincock is tightly closed.

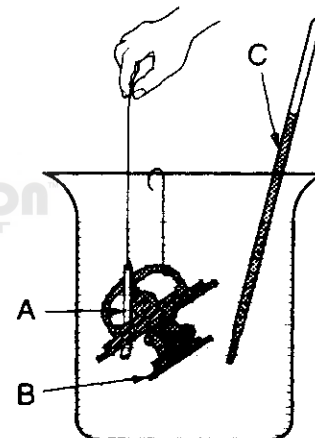
Fill the cooling system to the correct level with the required coolant mixture. Refer to Coolant.

THERMOSTAT TESTING

Remove the thermostat. Refer to Thermostat Removal.

Insert a 0.076mm (0.003-in) feeler gauge, with a wire or string attached, between the thermostat valve and seat.

WARNING: Antifreeze is poisonous. Keep out of the reach of children.



A - Feeler Gauge
B - Thermostat
C - Thermometer

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Submerge the thermostat in a container of pure antifreeze and suspend it so that it does not touch the sides or the bottom of the container.

Suspend a thermometer in the antifreeze so that it does not touch the container.

WARNING: Do not breathe the vapor. Ensure the test area is properly ventilated.

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Heat the antifreeze.

Apply a slight tension on the feeler gauge while the antifreeze is heated. When the valve opens the feeler gauge will slip free from the valve. Note the temperature. Refer to the Thermostat Calibrations chart. If defective, replace the thermostat.

Install the thermostat. Refer to Thermostat Removal.

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Thermostat Calibrations

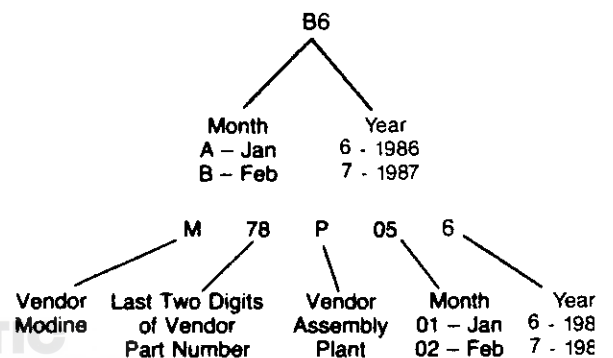
	4- and 6-Cylinder
Must Be Open 0.076 mm (0.003-inch)	90°C (195°F)
Must Be Fully Open	103°C (218°F)

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RADIATOR IDENTIFICATION

Radiators are identified by a Jeep part number and the vendor build code number embossed on the upper tank.

Radiator Identification



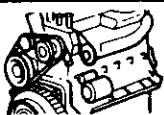
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RADIATOR MAINTENANCE

NOTE: To test a radiator for leaks or pressure loss, refer to Cooling System Leakage Tests

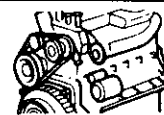
The radiator should be free from any obstruction of airflow. This includes bugs, clogged bug screens, leaves, mud, emblems, flags, fog (driving lamps, improperly mounted license plates, large nonproduction bumper guards) or collision damage.

NOTE: Remove dirt and other debris by blowing compressed air from the engine side of the radiator through the cooling fins.



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COOLING SYSTEMS



Any one of several faults or defects can affect radiator operation:

- bent or damaged cooling tubes
- corrosion deposits restricting coolant flow
- cooling tubes restricted because of improper soldering

Repair damaged tubes that affect proper operation. Coolant leaks can be detected by applying 21-34 kPa (3-5 psi) of air pressure to the radiator while it is submerged in water. Repair the leak holes with solder. Clean clogged radiators with solvent or by reverse flushing. Refer to Cooling System Maintenance.

RADIATOR REMOVAL

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

Position a drain pan under the radiator and remove the draincock. Observe the **WARNING** above.

Remove the radiator cap.

Disconnect the radiator upper hose.

Disconnect the coolant recovery hose, if equipped.

Remove the fan shroud screws, if equipped.

Remove the radiator top attaching screws.

Disconnect the radiator lower hose.

Disconnect and plug the transmission fluid cooler pipes, if equipped with an automatic transmission.

Remove the radiator bottom attaching screws.

Remove the radiator.

Install the replacement radiator.

Install the radiator attaching screws.

Position the fan shroud and install the screws, if equipped.

Install the draincock.

Remove the plugs and connect the transmission fluid cooler pipes, if equipped.

Connect the radiator lower hose with a replacement clamp.

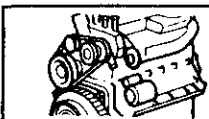
Connect the radiator upper hose with a replacement clamp.

Install the coolant. Use the correct mixture. Refer to Coolant.

Connect the coolant recovery hose, if equipped.

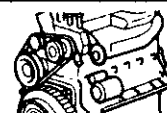
Install the radiator cap.

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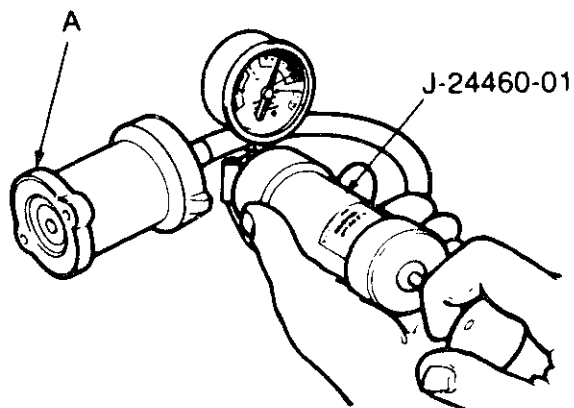
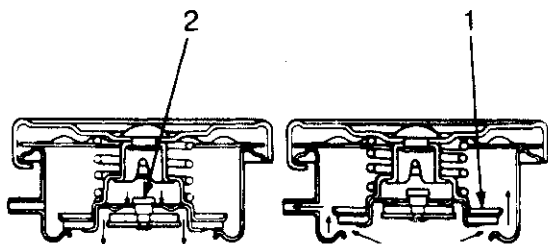
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COOLING SYSTEMS



Radiator Pressure Cap

The radiator pressure cap consists of a pressure valve (1) and a vacuum valve (2).



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Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 82.7 - 103.4 kPa (12 - 15 psi).

NOTE: The cap is satisfactory when the pressure holds steady or holds within the 82.7 - 103.4 kPa (12 - 15 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

Radiator Pressure Cap Testing

Remove the cap from the radiator.

Ensure that the seating surfaces are clean.

Moisten the rubber gasket with water and install the cap (A) on tester J-24460-01.

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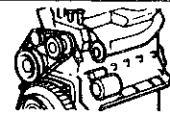
AUTHENTIC
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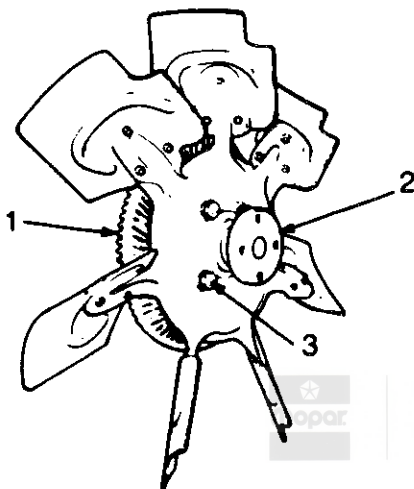
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FAN REMOVAL

There are several types of metal fans available for all engines. Most engines with a standard cooling system use a four-bladed rigid fan. Certain engines are fitted with standard equipment multi-bladed viscous drive (Tempatrol) fans.



- 1 - Silicone Fluid Chamber
- 2 - Mounting Flange
- 3 - Fan Blade Attaching Bolts (4)

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Fan blade assemblies are balanced within 0.25 ounce and should not be altered in any way. Replace a damaged or bent fan. Do not attempt repair. Refer to the Cooling System Components chart for fan applications.

CAUTION: Fans are designed to be compatible with certain applications only. Do not attempt to increase the cooling capacity by installing a fan not intended for a given engine. Fan or water pump damage and noise may result.

Disconnect the fan shroud from the radiator, if equipped.

Remove the belt(s).

Remove the attaching nuts and remove the fan and drive as a unit.

Remove the fan shroud.

Tempatrol Drive Unit/Fan Blade Unit Removal

The Tempatrol drive unit should be replaced if there is an indication of a fluid leak, noise or if roughness is detected when turning by hand. If the drive cannot be turned by hand, or if the leading edge of the fan can be moved more than 6.35mm (1/4-in) front to rear, replace the drive unit.

If it is necessary to replace either the Tempatrol fan blade unit or the drive unit separately, use the following procedure.

CAUTION: Engines equipped with a serpentine (single) drive belt have a reverse rotating water pump and viscous (Tempatrol) fan drive assembly. The components are identified by the words "REVERSE" stamped on the cover of the viscous drive and inner side of the fan, and "REV" cast into the water pump body. Do not install components that are intended for non-serpentine drive belts.

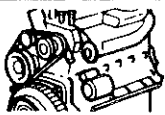
CAUTION: To prevent silicone fluid from draining into the fan drive bearing and contaminating the lubricant, do not place the Tempatrol fan unit on the work bench with the rear mounting flange down.

Remove the bolts attaching the fan blade unit to the drive unit.

Tempatrol Drive Unit/Fan Blade Unit Installation

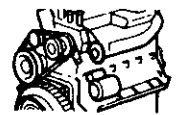
Attach the replacement unit. Tighten the bolts with 24 N·m (18 ft-lbs) torque.

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FAN INSTALLATION

Position the fan shroud, if equipped.

Install the fan attaching nuts and tighten.

Install the belt(s) and tighten to the specified tension. Refer to Drive Belt Adjustments.

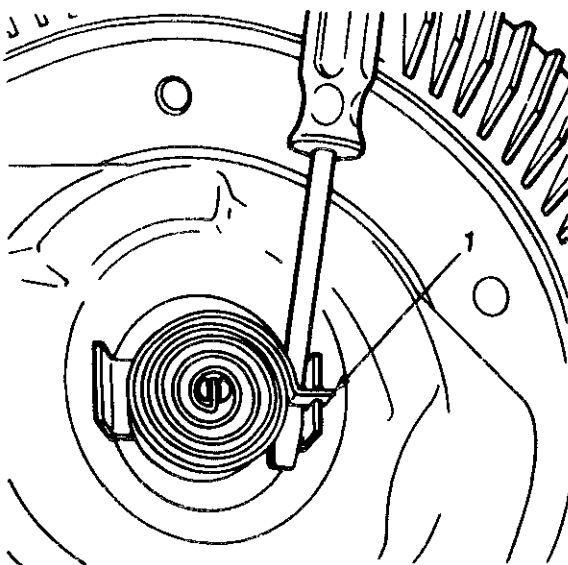
Install the shroud attaching screws and tighten, if removed.

Tempatrol Fan Test

In an engine overheating situation, the Tempatrol drive unit can be statically tested for proper operation by observing the movement of the bimetallic spring coil and shaft.

To test, disconnect the end of the bimetallic spring coil (1) from the slot and rotate it counterclockwise until a stop is felt.

NOTE: Do not force beyond the stop.



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The gap between the end of the coil and the clip on the housing should be approximately 13mm (1/2-in). Replace the unit if the shaft does not rotate with the coil. After testing, connect the end of the coil in the slot.

Dynamic Test

CAUTION: Ensure there is adequate fan blade clearance before drilling.

Drill 3.18mm (1/8-in) diameter hole in the top center of the fan shroud.

CAUTION: Ensure there is adequate clearance from the fan blades.

Insert a dial thermometer, -18°C - 105°C (0°F - 220°F) with a 20mm (8-in) stem, or equivalent, through the hole in the shroud.

Connect a tachometer and ignition timing light (to be used as strobe light). Refer to Ignition System Timing procedures.

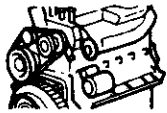
Block the air flow through the radiator by securing a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and ensure the air flow is blocked.

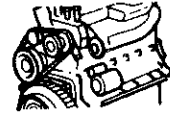
NOTE: Ensure the air conditioner, if equipped, is turned off.

CAUTION: The cooling system must be in good condition prior to performing the test to ensure against excessively high coolant temperature.

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.

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Start the engine and operate at 2400 RPM with the timing light (strobe light) aimed at the fan blades.

Within ten minutes the air temperature indicated on dial thermometer should be 88°C (190°F).

Satisfactory operation of the fan drive requires that it engage before or at 88°C (190°F).

Engagement is distinguishable by a definite increase in the audible fan air flow noise. The timing light will also indicate an increase in the speed of fan.

When the air temperature reaches 88°C (190°F), remove the plastic sheet.

Satisfactory operation of the Tempatrol fan requires the air temperature to drop 11°C (20°F) or more. A definite decrease of audible fan air flow noise should be noticed.

Replace the fan assembly if defective.

FAN SHROUD

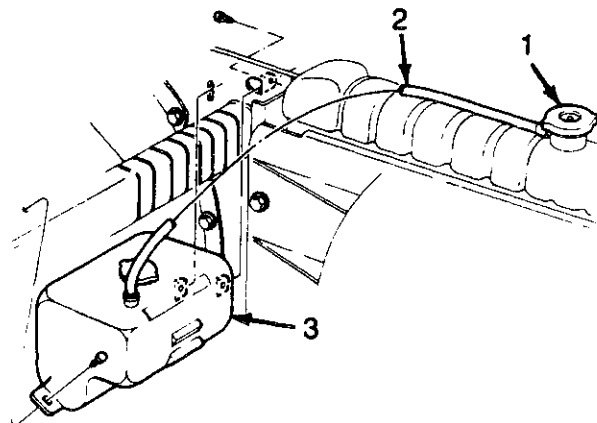
In some extreme situations, the engine fan blades may contact the shroud. An examination for proper engine mounting should isolate the problem. If not, examine the shroud position.

To compensate for normal engine movement, loosen the shroud attaching screws and reposition the shroud to prevent the fan-to-shroud contact. Inspect the fan for bent blades and replace the fan if necessary.

COOLANT RECOVERY SYSTEM

The coolant recovery system consists of a special pressure radiator cap (1), an overflow

tube (2) and a plastic coolant recovery bottle (3).



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Coolant Recovery Bottle Removal

Remove the tube from the radiator filler neck fitting.

Remove the bottle from the front wheelhouse panel.

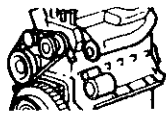
Pour the coolant into a clean container for reuse.

Remove the tube from the bottle.

Coolant Recovery Bottle Installation

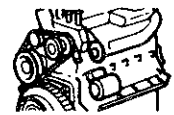
Install the tube in a replacement bottle and clamp the tube to the bottle with a replacement clamp.

Install the bottle on the front wheelhouse panel.



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Connect the tube to the radiator filler neck fitting and secure with a clamp.

Install coolant in the bottle. Ensure the tube is submerged in the coolant.

CYLINDER BLOCK HEATER REMOVAL

NOTE: A factory-installed cylinder block heater is optional. It consists of a 600W, 120V heater element fitted into a core plug hole in the cylinder block, a power cord and nylon straps (placed in the glove box for installation when it is necessary to use the heater).

Drain the coolant from the engine.

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

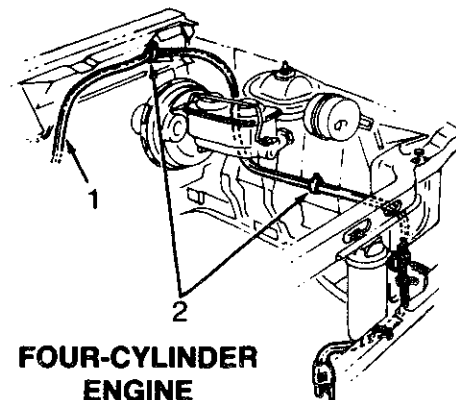
WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.

CYLINDER BLOCK HEATER INSTALLATION

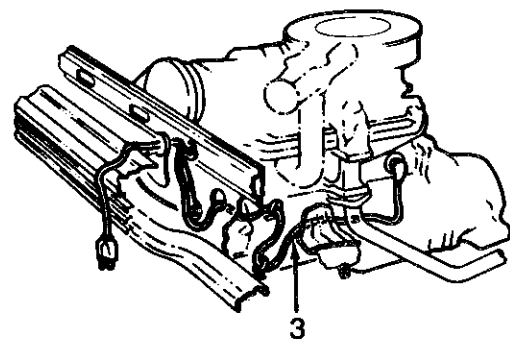
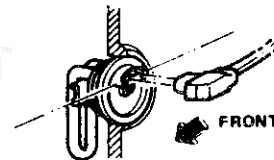
A factory-installed cylinder block heater is optional. It consists of a 600W, 120V heater element fitted into a core plug hole in the cylinder block, a power cord and nylon straps (placed in the glove box for installation when it is necessary to use the heater).

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from the coolant can occur.



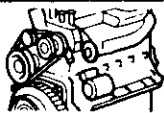
FOUR-CYLINDER
ENGINE



SIX-CYLINDER
ENGINE

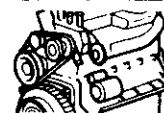
- 1 - To the Heater
- 2 - Route the Cord Through the Harness Clips
- 3 - Route the Cord Between the Engine Mount and Cylinder Block

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Drain the coolant from the engine. Observe the NOTE and WARNING above.

CAUTION: Use care when tightening the cylinder block heater attaching parts. Improper tightening may damage the seal or allow the heater to loosen, resulting in coolant loss and engine damage.

Remove the core plug and install the cylinder block heater. Tighten the T-bolt type with 2.3 N·m (20 in-lbs) torque. Tighten the compression nut-type with 14 N·m (10 ft-lbs) torque.

From the front of the vehicle, route the female heater end of the power cord through the hole in the front panel, along the wire harness and connect it to the cylinder block heater.

Use the nylon tie straps furnished to secure the cord to the wire harness and to the inside of the grille. Allow the cord to extend outside of the grille.

Refill the radiator with coolant.

COOLING SYSTEM MAINTENANCE

CAUTION: The cooling system normally operates at 82.7 - 103.4 kPa (12 - 15 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Engine Flushing

Remove the thermostat housing and thermostat. Install the thermostat housing.

Disconnect the upper radiator hose from the radiator and attach the flushing gun to the hose.

Disconnect the lower radiator hose from the water pump and attach a leadaway hose to the water pump inlet fitting.

CAUTION: If equipped with an A/C system, ensure that the control is in the A/C or MAX A/C position. This will prevent coolant with scale and other deposits from entering the heater core.

Connect the water supply hose and air supply hose to the flushing gun.

Allow the engine to fill with water.

When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the leadaway hose.

Remove the leadaway hose, flushing gun, water supply hose and air supply hose.

Remove the thermostat housing and install the thermostat.

Install the thermostat housing with a replacement gasket. Refer to Thermostat Replacement.

Connect the radiator hoses.

Refill the cooling system with the correct antifreeze/water mixture.

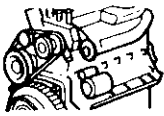
Solvent Cleaning

In some instances, the use of a radiator cleaner (AMC Radiator Kleen, or equivalent) before flushing will soften scale and other deposits and aid the flushing operation.

CAUTION: Ensure that the instructions on the container are followed.

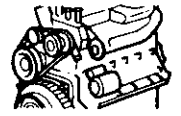
Radiator Reverse Flushing

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Disconnect the radiator hoses from the radiator fittings.

Attach a section of radiator hose to the radiator bottom outlet fitting and insert the flushing gun.

Connect a water supply hose and air supply hose to the flushing gun. Note the excess pressure CAUTION.

Allow the radiator to fill with water.

When the radiator is filled, apply air in short blasts, allowing the radiator to refill between blasts.

Continue this reverse flushing until clean water flows out through radiator upper fitting. If flushing fails to clear the radiator cooling tube passages, have the radiator cleaned more extensively by a radiator repair shop.

Transmission Fluid Cooler Repairs

Because of the high pressure applied to the fluid cooler, do not attempt conventional soldering to repair fractures/holes. All repairs must be silver-soldered or brazed.

Core Plugs

Prior to HOT TANKING for cylinder block cleaning, remove the casting flash causing hot spots or coolant flow blockage.

Remove the core plugs with a hammer, chisel and pry tool.

Apply a sealer to the edges of the replacement plugs and position the plugs with the lip toward the outside of the cylinder block. Install with a hammer and suitable tool. Refer to the Core Plug Sizes chart.

Core Plugs

Engine	Location	Diameter	
		mm	In
Four-Cylinder	Head	22	0.875
	Head (Rear)	51	2.0
	Block (3 on Side)	51	2.0
	Block (1 on Rear)	44	1.75
Six-Cylinder	Head (3 Left Side)	22	0.875
	Head (Rear)	51	2.0
	Block (3 Left Side, 1 Rear)	51	2.0

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COOLING SYSTEM DIAGNOSIS

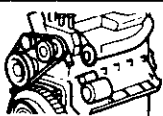
If the cooling system requires frequent addition of coolant to maintain the correct level, inspect all components and hose connections in the cooling system for evidence of leakage.

Perform the inspection with the cooling system cold. Small leaks, which may appear as dampness or dripping, can easily escape detection if they are rapidly evaporated by engine heat.

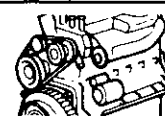
Telltale stains of a grayish white or rusty color, or dye stains from antifreeze, may appear at connecting joints (e.g., water pump, thermostat housing and cylinder head) in the cooling system.

These stains are almost always a sure indication of small leaks, though there may appear to be no defects.

Air may be drawn into the cooling system through incomplete sealing at the water pump



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shaft seal or through incomplete sealing in the coolant recovery system.

Combustion pressure may be forced into the cooling system through a fracture in the cylinder head gasket, though the passage is too small to allow coolant to enter the combustion chamber.

NOTE: Immediately after shutdown, the engine enters a condition known as heat soak. This is

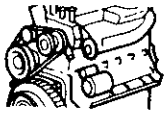
caused by the cooling system being inoperative while the engine temperature is still high. If the coolant temperature rises above the boiling point, expansion and pressure may push some coolant out of the radiator overflow tube. If this does not occur frequently, it is considered normal.

Refer to the applicable diagnosis chart for specific cooling system faults.

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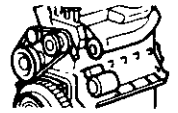
Service Diagnosis

Condition	Possible Cause	Correction
HIGH TEMPERATURE GAUGE INDICATION - OVERHEATING	(1) Coolant level low.	(1) Replenish coolant.
	(2) Fan belt loose.	(2) Adjust fan belt tension.
	(3) Radiator hose(s) collapsed.	(3) Replace hose(s).
	(4) Radiator airflow blocked.	(4) Remove restriction (bug screen, fog lamps, etc.)
	(5) Faulty radiator cap.	(5) Replace radiator cap.
	(6) Ignition timing incorrect.	(6) Adjust ignition timing.
	(7) Idle speed low.	(7) Adjust idle speed.
	(8) Air trapped in cooling system.	(8) Purge air.
	(9) Heavy traffic driving.	(9) Operate at fast idle in neutral intermittently to cool engine.
	(10) Incorrect cooling system component(s) installed.	(10) Install proper component(s).
	(11) Faulty thermostat.	(11) Replace thermostat.



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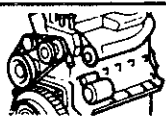
COOLING SYSTEMS



Service Diagnosis (Continued)

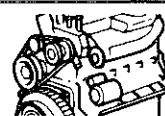
Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION—OVERHEATING (Continued)	(12) Water pump shaft broken or impeller loose.	(12) Replace water pump.
	(13) Radiator tubes clogged.	(13) Flush radiator.
	(14) Cooling system clogged.	(14) Flush system.
	(15) Casting flash in cooling passages.	(15) Repair or replace as necessary. Flash may be visible by removing cooling system components or removing core plugs.
	(16) Brakes dragging.	(16) Repair brakes.
	(17) Excessive engine friction.	(17) Repair engine.
	(18) Antifreeze concentration over 68%.	(18) Lower antifreeze concentration percentage.
	(19) Missing air seals.	(19) Replace air seals.
	(20) Faulty gauge or sending unit.	(20) Repair or replace faulty component.
	(21) Loss of coolant flow caused by leakage or foaming.	(21) Repair or replace leaking component, replace coolant.
LOW TEMPERATURE INDICATION—UNDERCOOLING COOLANT LOSS—BOILOVER	(22) Viscous fan drive failed.	(22) Replace unit.
	(1) Thermostat stuck open.	(1) Replace thermostat.
	(2) Faulty gauge or sending unit.	(2) Repair or replace faulty component.
	Refer to Overheating Causes in addition to the following items.	
	(1) Overfilled cooling system.	(1) Reduce coolant level to proper specification.
	(2) Quick shutdown after hard (hot) run.	(2) Allow engine to run at fast idle prior to shutdown.
	(3) Air in system resulting in occasional "burping" of coolant.	(3) Purge system.
	(4) Insufficient antifreeze allowing coolant boiling point to be too low.	(4) Add antifreeze to raise boiling point.
	(5) Antifreeze deteriorated because of age or contamination.	(5) Replace coolant.
	(6) Leaks due to loose hose clamps, loose nuts, bolts, drain plugs, faulty hoses, or defective radiator.	(6) Pressure test system to locate source of leak(s) then repair as necessary.

NOTE: Immediately after shutdown, the engine enters a condition known as heat soak. This is caused by the cooling system being inoperative while engine temperature is still high. If coolant temperature rises above boiling point, expansion and pressure may push some coolant out of the radiator overflow tube. If this does not occur frequently it is considered normal.



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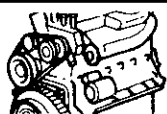
COOLING SYSTEMS



Service Diagnosis (Continued)

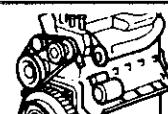
Condition	Possible Cause	Correction
COOLANT LOSS — BOILOVER (Continued)	(7) Faulty head gasket. (8) Cracked head, manifold, or block. (9) Faulty radiator cap.	(7) Replace head gasket. (8) Replace as necessary. (9) Replace cap.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER(S)	(1) Faulty head gasket. (2) Crack in head, manifold or block.	(1) Replace head gasket. (2) Replace as necessary.
COOLANT RECOVERY SYSTEM INOPERATIVE	(1) Collant level low. (2) Leak in system. (3) Pressure cap not tight or seal missing, or leaking (4) Pressure cap defective. (5) Overflow tube clogged or leaking. (6) Recovery bottle vent restricted.	(1) Replenish coolant to FULL mark. (2) Pressure test to isolate leak and repair as necessary. (3) Repair as necessary. (4) Replace cap. (5) Repair as necessary. (6) Remove restriction.
NOISE	(1) Fan contacting shroud. (2) Loose water pump impeller. (3) Glazed fan belt. (4) Loose fan belt. (5) Rough surface on drive pulley. (6) Water pump bearing worn. (7) Belt alignment.	(1) Reposition shroud and inspect engine mounts. (2) Replace pump. (3) Apply silicone or replace belt. (4) Adjust fan belt tension. (5) Replace pulley. (6) Remove belt to isolate. Replace pump. (7) Check pully alignment. Repair as necessary.
NO COOLANT FLOW THROUGH HEATER CORE	(1) Restricted return inlet in water pump. (2) Heater hose collapsed or restricted. (3) Restricted heater core. (4) Restricted outlet in thermostat housing. (5) Intake manifold bypass hole in cylinder head restricted. (6) Faulty heater control valve. (7) Intake manifold coolant passage restricted.	(1) Remove restriction. (2) Remove restriction or replace hose. (3) Remove restriction or replace core. (4) Remove flash or restriction. (5) Remove restriction. (6) Replace valve. (7) Remove restriction or replace intake manifold.

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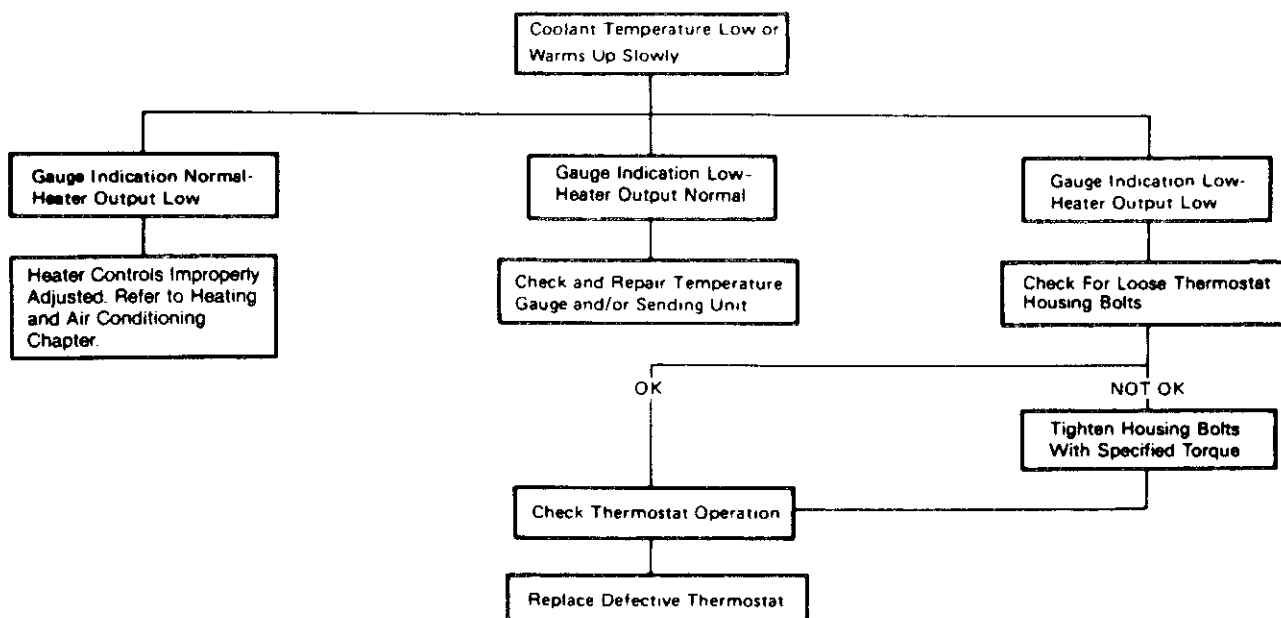


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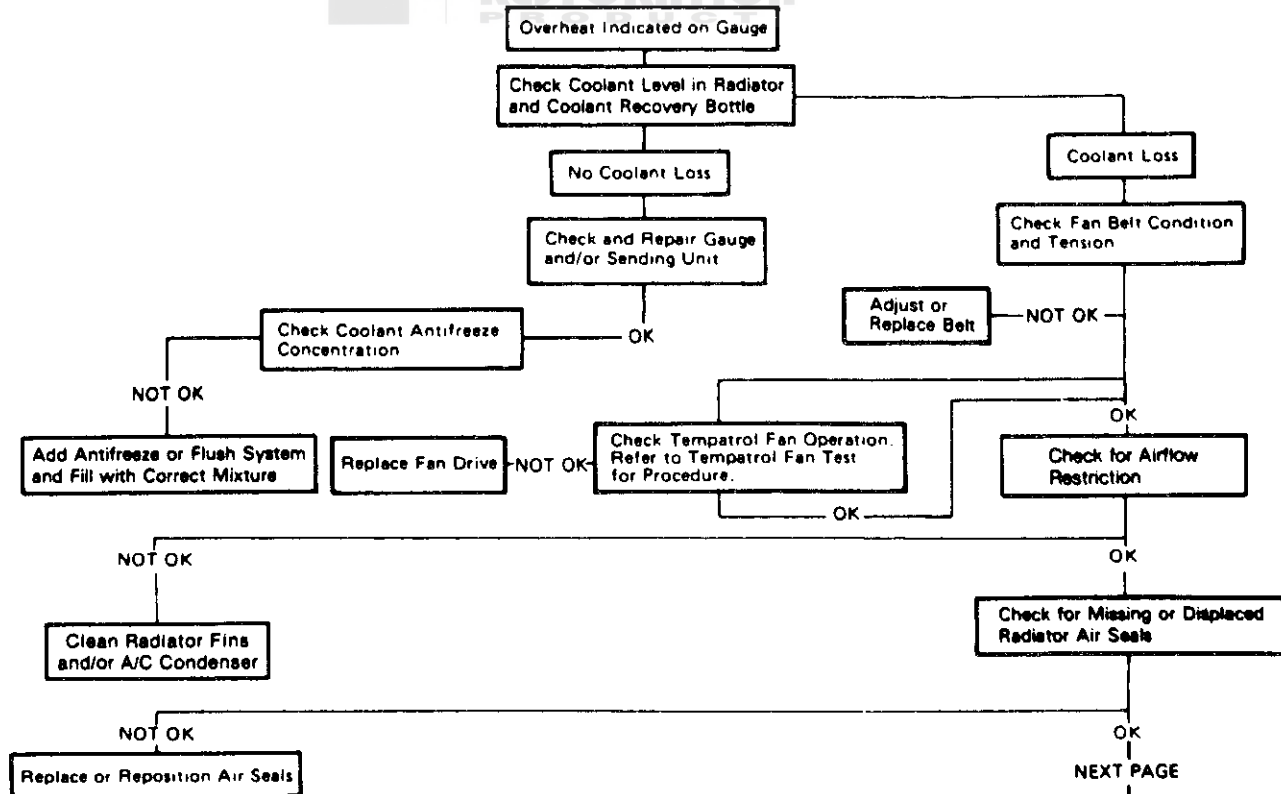
COOLING SYSTEMS



Low Coolant Temperature Diagnosis Guide



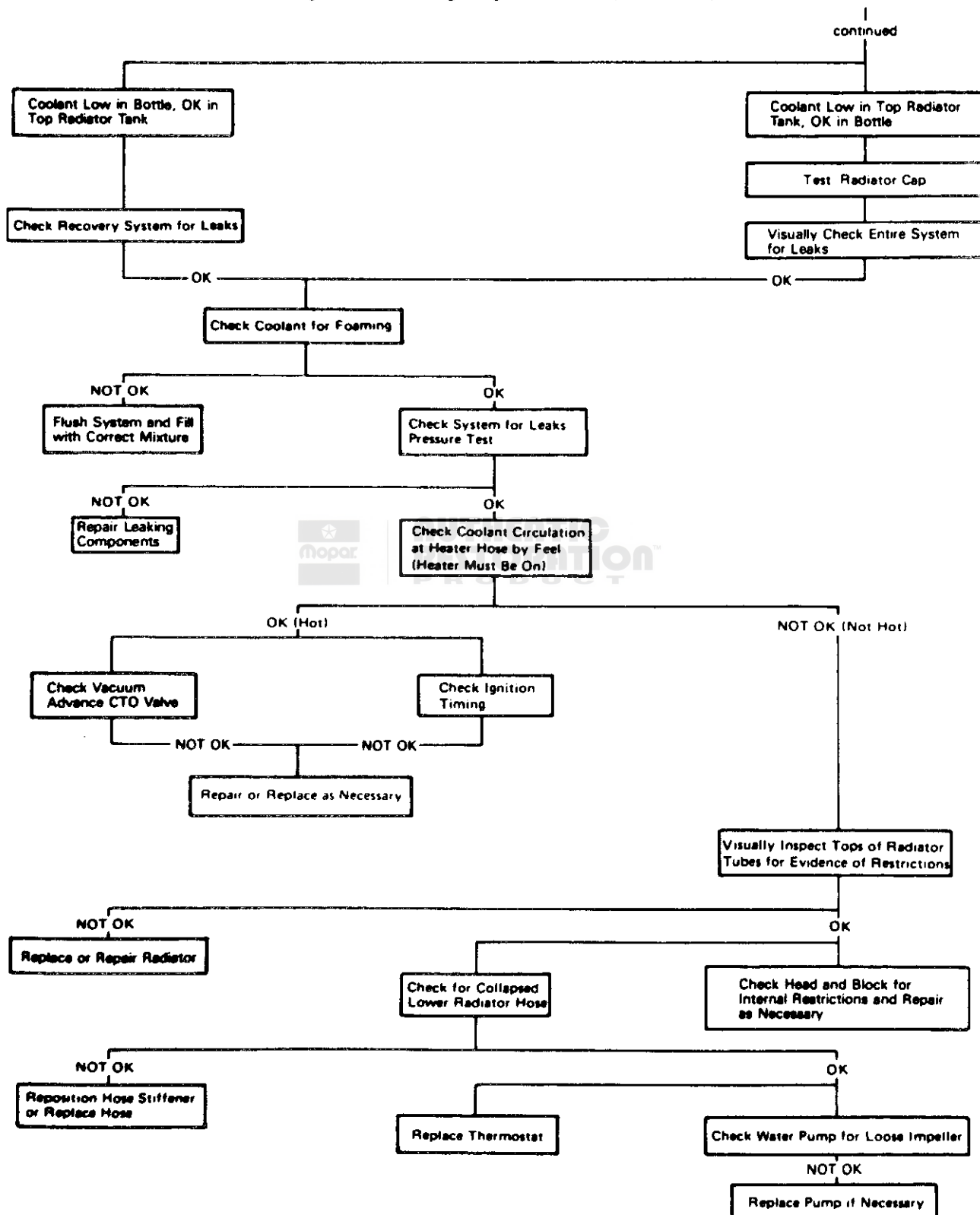
Engine Overheating Diagnosis Guide



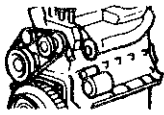
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Engine Overheating Diagnosis Guide (Continued)

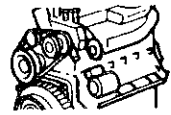


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Cooling System Leakage Tests

NOTE: The engine should be at the normal operating temperature. Inspect the system cold if the cause of coolant loss is not located during warm engine examination.

WARNING: Hot, pressurized coolant can cause injury by scalding.

Carefully remove the radiator pressure cap from the filler neck and check the coolant level.

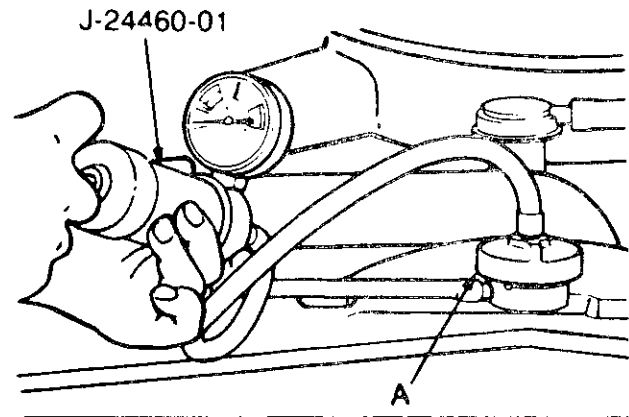
NOTE: Push down on the cap to disengage it from the stop tabs.

Wipe the inside of the filler neck and examine the lower inside sealing seat for nicks, cracks, paint, dirt and solder residue.

Inspect the overflow tube for internal obstructions. Insert a wire through the tube to ensure it is not obstructed.

Inspect the cams on the outside of the filler neck. If the cams are bent, seating of pressure cap valve and tester seal will be affected. Bent cams can be reformed if done carefully.

Attach a pressure tester (J-24460-01) to the filler neck (A). Do not force.



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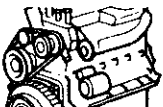
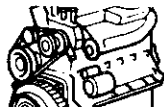
Operate the tester pump to apply 103.4 kPa (15 psi) pressure to the system. If the hoses enlarge excessively or bulge while testing, replace as necessary.

Observe the gauge pointer and determine the condition of the cooling system according to the following criteria.

Holds Steady: If the pointer remains steady for two minutes, there are no serious coolant leaks in the system.

NOTE: 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 no leaks can be detected, inspect for interior leakage or perform the Combustion Leakage Test.

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Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect the radiator, hoses, gasket edges and heater. Seal small leak holes with AMC Sealer Lubricant, or equivalent. Repair the leak holes and reinspect the system with pressure applied.

Drops Quickly: Indicates that a serious leakage is occurring. Examine the system for serious external leakage. If no leaks are visible, inspect for internal leakage.

NOTE: Large radiator leak holes should be repaired by a reputable radiator repair shop.

Internal Leakage Inspection

Remove the oil pan drain plug and drain a small amount of engine oil. Coolant, being heavier, will drain first, or operate the engine to churn the oil, then examine the dipstick for water globules.

Inspect the transmission dipstick for water globules.

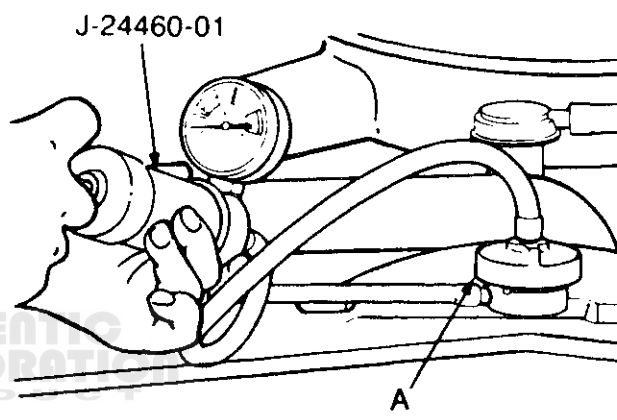
Inspect the transmission fluid cooler for leakage. Refer to Transmission Fluid Cooler Leakage Test.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Operate the engine without the pressure cap on the radiator until the thermostat opens.

Attach a pressure tester (J-24460-01) to the filler neck. If the pressure builds up quickly, a leak exists as result of a faulty cylinder head gasket or crack. Repair as necessary.

WARNING: Do not allow pressure to exceed 103.4 kPa (15 psi). Turn the engine Off. To release the pressure, rock the tester from side to side. When removing the tester, do not turn the tester more than 1/2 turn if the system is under pressure.



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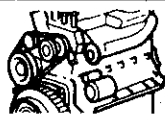
If there is no immediate pressure increase, pump the pressure tester until the indicated pressure is within the system range.

Vibration of the gauge pointer indicates compression or combustion leakage into the cooling system.

CAUTION: Do not disconnect the spark plug wires while the engine is operating.

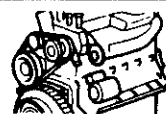
Isolate the compression leak by shorting each spark plug to the cylinder block. The tester gauge pointer should stop or decrease vibration when the spark plug for the leaking cylinder is shorted because of the absence of combustion pressure.

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CAUTION: Do not operate the engine with a spark plug shorted for more than a minute, otherwise the catalytic converter may be damaged.

Combustion Leakage Test (without Pressure Tester)

NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the cooling system, drain the coolant into a clean container for reuse.

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with the system hot and pressurized because serious burns from coolant can occur.

Drain sufficient coolant to allow the thermostat to be removed. Refer to Thermostat Replacement.

Disconnect the water pump drive belt.

Disconnect the radiator upper hose from the thermostat housing.

Remove the housing and thermostat. Install the thermostat housing on the cylinder head.

Add coolant to the radiator to raise the level to within 6.3mm (1/4-in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate boilover.

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.

Start the engine and accelerate rapidly three times, to approximately 3000 RPM while observing the coolant.

If internal engine combustion gases are leaking into the cooling system, bubbles will appear in the coolant. If bubbles do not appear, there is no internal combustion gas leakage.

Transmission Fluid Cooler Leakage Test

Transmission fluid cooler leaks can be detected by the presence of transmission fluid in the coolant.

If fluid appears in the coolant, check the fluid level in the automatic transmission. If the fluid level is low, test the fluid cooler according to the following procedure.

Disconnect the transmission-to-cooler pipes at the radiator.

Plug one cooler fitting.

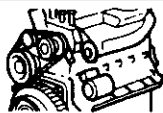
Remove the radiator cap and ensure the radiator is filled with coolant.

Apply shop air pressure 344 - 690 kPa (50 - 100 psi) to the other cooler fitting.

CAUTION: Because of high fluid pressure, conventional soldering must not be used for fluid cooler repair. All repairs must be silver-soldered or brazed.

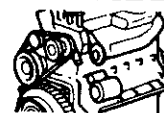
Bubbles in the coolant at the filler neck indicate a leak in the fluid cooler.

If a transmission fluid cooler leak is discovered, remove the radiator for cooler repair. Remove the outlet tank for access to the fluid cooler.



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DRIVE BELT ADJUSTMENTS

General Information

After the need for adjustment has been determined, drive belts are adjusted by pivoting the driven component in its mount to achieve the specified tension.

In some applications, a belt may either drive several components or a single drive belt (serpentine) is used to drive all the components.

It is necessary to loosen and pivot only one component.

Locate the drive belt that is to be tested for the correct tension.

Test the tension with Belt Tension Gauge J-23600. If accessibility is limited (e.g., A/C compressor drive belt) use J-29550. Use Gauge J-23600-B, for serpentine drive belts.

If necessary, adjust the drive belt.

Re-test tension after the adjustment.

Alternator and Fan Adjustment: (Without Air Conditioner) – All Engines

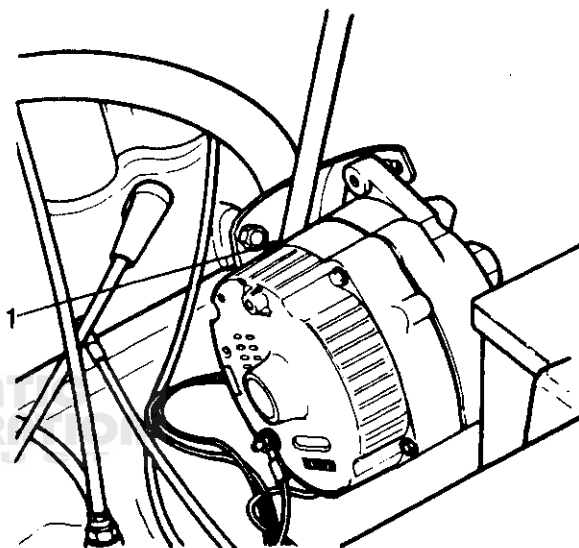
Position Tension Gauge Tool J-23600-B on the upper section of the belt midway between the alternator pulley and the fan pulley.

Test the belt tension according to the manufacturer's instructions.

Adjust the belt tension to the specification if less than 400 N (90 lb-f).

Adjustment procedure (except serpentine):

- loosen the alternator pivot and adjusting bolts
- pry on the alternator front housing only (1).



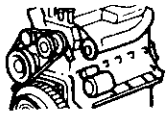
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- tighten the belt with a pry bar
- tighten the adjusting bolt with 27 N·m (20 ft-lbs) torque
- tighten the pivot bolt with 38 N·m (28 ft-lbs) torque
- re-test the tension

Alternator Adjustment: (With Air Conditioner) – Six-Cylinder Engine

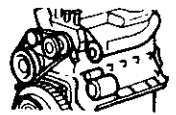
Position Tension Gauge Tool J-23600-B on a section of the belt left of the alternator and below the A/C compressor.

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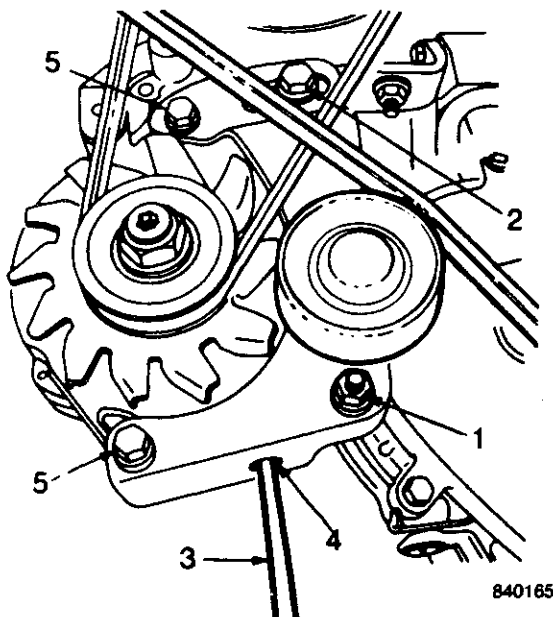
Test the belt tension according to manufacturer's instructions.

Adjust the belt tension to the specification if less than 400 N (90 lb-f).

Adjustment procedure (except serpentine):

- from the underside of the engine compartment, loosen the lower mounting bracket pivot nut (1) and adjusting bolt (2).
- do not loosen the bracket attaching bolts (5).
- insert a pry bar (3) into the hole (4) in the bottom of the bracket and pry to tighten the belt.

NOTE: Some alternator brackets have a 12.7mm (1/2-in) square hole to facilitate adjustments from above the alternator with a 12mm (1/2-in) drive ratchet and extension.



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- tighten the adjusting bolt and nut with 38 N·m (28 ft-lbs) torque
- tighten the pivot bolt and nut with 38 N·m (28 ft-lbs) torque
- re-test the tension

Air Conditioner Compressor Adjustment: – Six-Cylinder Engine

Position Tension Gauge Tool J-23600-B on the upper section of the belt midway between the compressor pulley and the idler pulley.

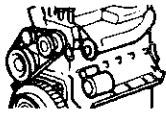
Test the belt tension according to the manufacturer's instructions.

Adjust the belt tension to the specification if less than 400 N (90 lb-f).

Adjustment procedure (except serpentine):

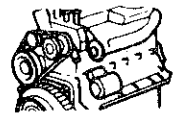
- loosen the clamp bolt and the idler pulley bracket pivot bolt
- insert the drive lug of a 12mm (1/2-in) drive ratchet into the adjustment hole in the idler pulley bracket and pivot the bracket to tighten the belt
- tighten the bolts with 41 N·m (30 ft-lbs) torque
- re-test the tension

NOTE: Because of the higher tension required for serpentine drive belts, a helper may be necessary for belt adjustment.



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Power Steering Pump Adjustment: – All Engines

Position Tension Gauge Tool J-23600-B on the lower section of the belt midway between the power steering pump pulley and the crankshaft pulley.

Test the belt tension according to the manufacturer's instructions.

Adjust the belt tension to the specification if less than 400 N (90 lb-f).

Adjustment procedure (except serpentine):

- loosen the adjusting bolts that attach the power steering pump bracket to the adapter plates

NOTE: The bolt that attaches the pump bracket to the rear adapter plate is located behind the rear adapter plate flange.

- insert the drive lug of a 12mm (1/2-in) drive ratchet into the adjustment hole in the bracket and pivot the bracket to tighten the belt
- tighten the bolts with 38 N·m (28 ft-lbs) torque
- re-test the tension

Serpentine Drive Belt Adjustment

Position Tension Gauge Tool J-23600-B on the longest accessible span of the belt.

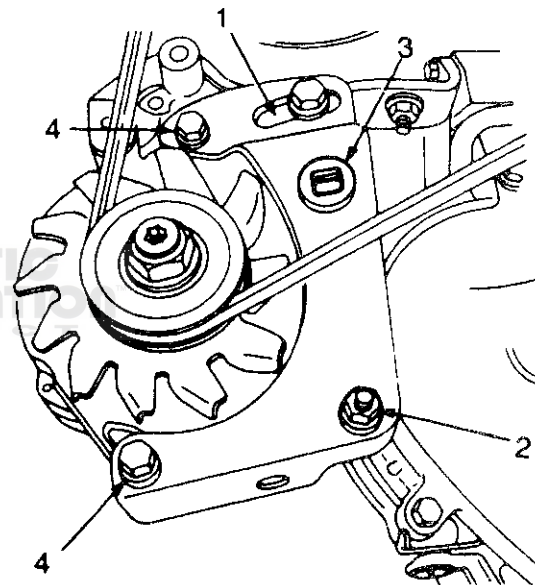
Test the belt tension according to the manufacturer's instructions.

Adjust the belt tension to the specification if less than 623 N (140 lb-f).

Loosen the alternator adjustment bolt (1) and pivot bolt (2) from the underside of the engine compartment.

NOTE: Do not loosen the bracket attaching bolts (4).

Insert the drive lug of a 12mm (1/2-in) drive ratchet into the adjustment hole (3) in the alternator mounting bracket and pivot the bracket to tighten the belt.



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Tighten the adjustment bolt (1) and pivot bolt (2) with 38 N·m (28 ft-lbs) torque.

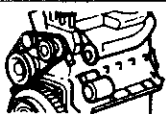
Re-test the tension.

NOTE: Because of the higher tension required for serpentine drive belts, a helper may be necessary for belt adjustment.

SERPENTINE DRIVE BELT DIAGNOSIS

Refer to the diagnosis chart when servicing serpentine drive belts.

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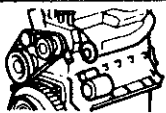
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Serpentine Drive Belt Diagnosis

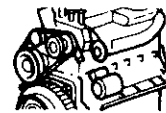
Condition	Possible Cause	Correction
TENSION SHEETING FABRIC FAILURE (WOVEN FABRIC ON OUTSIDE CIRCUM-FERENCE OF BELT HAS CRACKED OR SEPARATED FROM BODY OF BELT)	(1) Grooved or backside idler pulley diameters are less than minimum recommended. (2) Tension sheeting contacting (rubbing) stationary object. (3) Excessive heat causing woven fabric to age. (4) Tension sheeting splice has fractured.	(1) Replace pulley(s) not conforming to specification. (2) Correct rubbing condition. (3) Replace belt. (4) Replace belt.
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	(1) Belt slippage. (2) Bearing noise. (3) Belt misalignment. (4) Belt-to-pulley mismatch. (5) Driven component inducing vibration. (6) System resonant frequency inducing vibration.	(1) Adjust belt. (2) Locate and repair. (3) Align belt/pulley(s). (4) Install correct belt. (5) Locate defective driven component and repair. (6) Vary belt tension within specifications. Replace belt.
RIB CHUNKING (ONE OR MORE RIBS HAS SEPARATED FROM BELT BODY)	(1) Foreign objects imbedded in pulley grooves. (2) Installation damage. (3) Drive loads in excess of design specifications. (4) Insufficient internal belt adhesion.	(1) Remove foreign objects from pulley grooves. (2) Replace belt. (3) Adjust belt tension. (4) Replace belt.
RIB OR BELT WEAR (BELT RIBS CONTACT BOTTOM OF PULLEY GROOVES)	(1) Pulley(s) misaligned. (2) Mismatch of belt and pulley groove widths. (3) Abrasive environment. (4) Rusted pulley(s). (5) Sharp or jagged pulley groove tips. (6) Rubber deteriorated.	(1) Align pulley(s). (2) Replace belt. (3) Replace belt. (4) Clean rust from pulley(s). (5) Replace pulley. (6) Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	(1) Belt has mistracked from pulley groove. (2) Pulley groove tip has worn away rubber-to-tensile member.	(1) Replace belt. (2) Replace belt.

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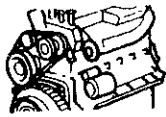
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Serpentine Drive Belt Diagnosis (Continued)

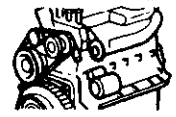
Condition	Possible Cause	Correction
BELT SLIPS	(1) Belt slipping because of insufficient tension. (2) Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction. (3) Driven component bearing failure. (4) Belt glazed and hardened from heat and excessive slippage.	(1) Adjust tension. (2) Replace belt and clean pulleys. (3) Replace faulty component bearing. (4) Replace belt.
"GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY, OR TURNS OVER AND/OR RUNS OFF PULLEYS)	(1) Insufficient belt tension. (2) Pulley(s) not within design tolerance. (3) Foreign object(s) in grooves. (4) Excessive belt speed. (5) Pulley misalignment. (6) Belt-to-pulley profile mismatched. (7) Belt cordline is distorted.	(1) Adjust belt tension. (2) Replace pulley(s). (3) Remove foreign objects from grooves. (4) Avoid excessive engine acceleration. (5) Align pulley(s). (6) Install correct belt. (7) Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE REPLACEMENT BELT IS INSTALLED)	(1) Excessive tension. (2) Tensile members damaged during belt installation. (3) Belt turnover. (4) Severe pulley misalignment. (5) Bracket, pulley, or bearing failure.	(1) Replace belt and adjust tension to specification. (2) Replace belt. (3) Replace belt. (4) Align pulley(s). (5) Replace defective component and belt.
CORD EDGE FAILURE (TENSILE MEMBER EXPOSED AT EDGES OF BELT OR SEPARTED FROM BELT BODY)	(1) Excessive tension. (2) Drive pulley misalignment. (3) Belt contacting stationary object. (4) Pulley irregularities. (5) Improper pulley construction. (6) Insufficient adhesion between tensile member and rubber matrix.	(1) Adjust belt tension. (2) Align pulley. (3) Correct as necessary. (4) Replace pulley. (5) Replace pulley. (6) Replace belt and adjust tension to specifications.

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Serpentine Drive Belt Diagnosis (Continued)

Condition	Possible Cause	Correction
SPORADIC RIB CRACKING (MULTIPLE CRACKS IN BELT RIBS AT RANDOM INTERVALS)	(1) Ribbed pulley(s) diameter less than minimum specification. (2) Backside bend flat pulley(s) diameter less than minimum. (3) Excessive heat condition causing rubber to harden. (4) Excessive belt thickness. (5) Belt overcured. (6) Excessive tension.	(1) Replace pulley(s). (2) Replace pulley(s). (3) Correct heat condition as necessary. (4) Replace belt. (5) Replace belt. (6) Adjust belt tension.

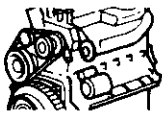
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**AUTHENTIC
RESTORATION**
PRODUCT

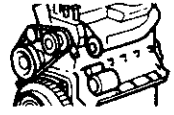
TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Fuel Pump Mounting Bolts (6-Cyl.Eng.)	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Fuel Pipe-to-Fuel Pump Fitting (6-Cyl.Eng.)	25 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Carburetor-to-Intake Manifold Nuts (6-Cyl.Eng.)	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)



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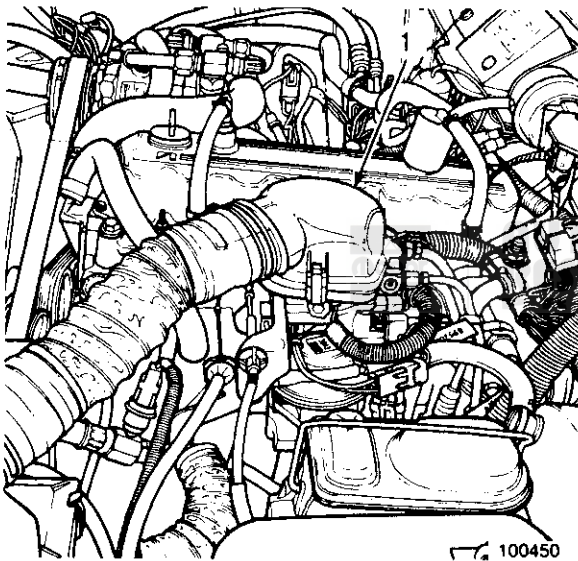
THROTTLE BODY INJECTION FUEL SYSTEMS



THROTTLE BODY INJECTION REMOVAL: – 4-CYL. ENG.

NOTE: General removal and installation procedures are outlined here. For diagnosis and testing procedures, refer to the INJ. R.(G) manual and related I.S. Notes.

Remove the upper bonnet assembly (1).

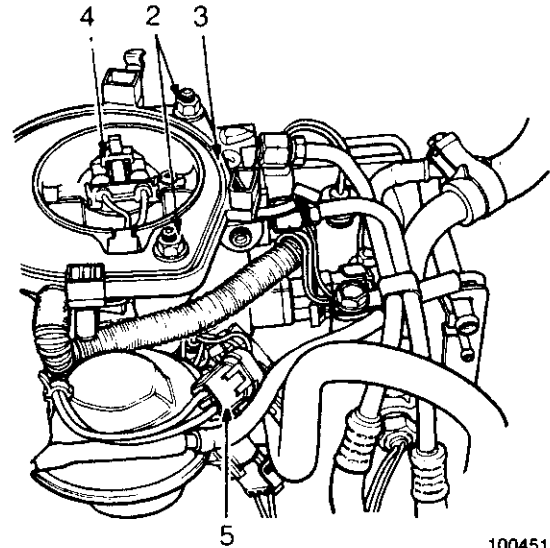


Remove the lower bonnet assembly retaining bolts (2) and lower bonnet assembly (3).

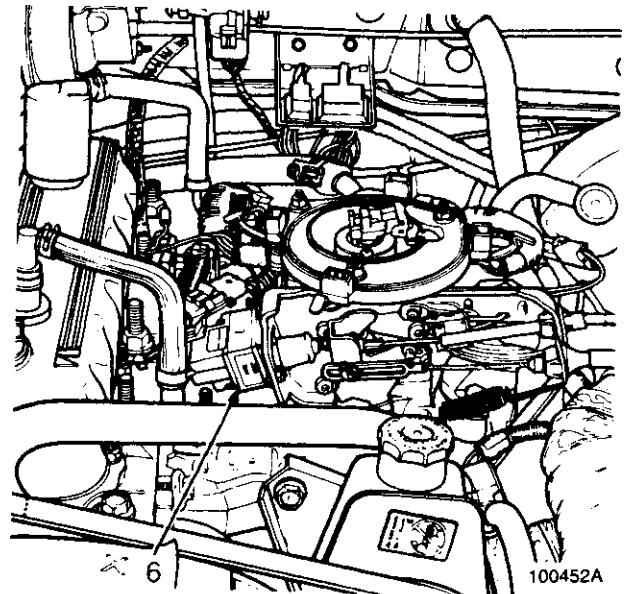
Remove the throttle cable and return spring.

Disconnect the wire harness connector from the injector (4).

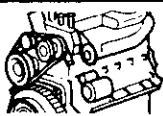
Disconnect the wire harness connector from the wide open throttle (WOT) switch (5).



Disconnect the wire harness connector from the ISC motor (6).

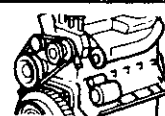


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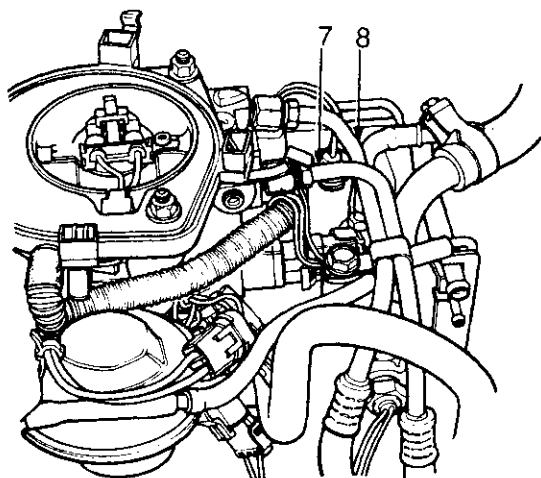


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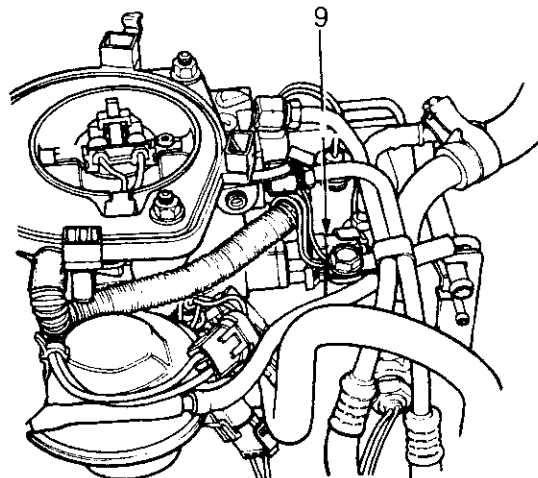
THROTTLE BODY INJECTION FUEL SYSTEMS



Disconnect the fuel supply pipe (7) from the throttle body.

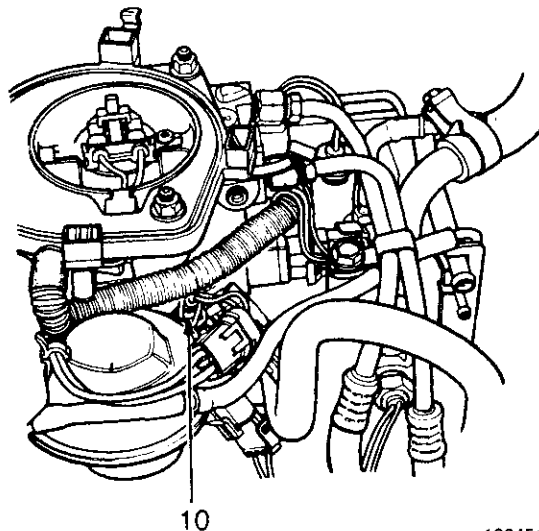


100451B



100451C

Remove the throttle body-to-manifold retaining nuts (10) from the studs.



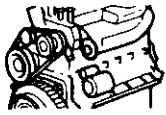
100451D

Disconnect the fuel return pipe (8) from the throttle body.

Disconnect the vacuum hoses from the throttle body assembly. Identify and tag the hoses for installation reference.

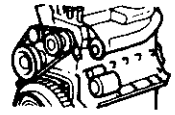
Disconnect throttle position sensor (TPS) (9).

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ENGINES

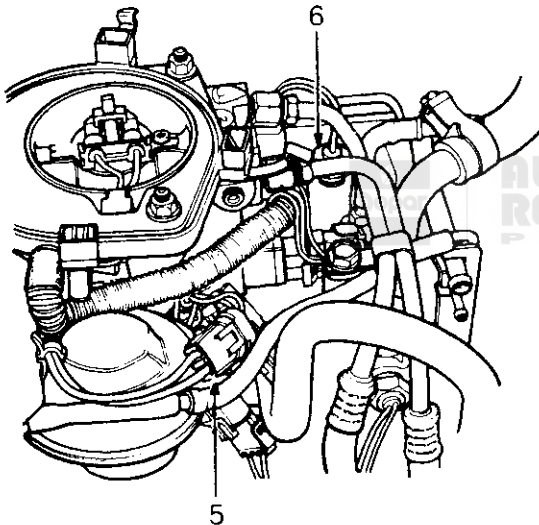
THROTTLE BODY INJECTION FUEL SYSTEMS



Remove the throttle body assembly from the intake manifold.

If the throttle body assembly is being replaced, transfer the following components to the replacement throttle body.

- idle speed control (ISC) motor (6).
- WOT switch and bracket assembly (5).



100451E

THROTTLE BODY INJECTION INSTALLATION – 4-CYL. ENG.

Install the replacement throttle body assembly on the intake manifold. Use a replacement gasket between the components.

Install the throttle body-to-manifold retaining nuts (10) on the studs.

Connect the vacuum hoses.

Connect the fuel return pipe (8) to the throttle body.

Connect the fuel supply pipe (7) to the throttle body.

Connect the wire harness connector to the injector (4).

Connect the wire harness connector to the ISC motor (5).

Connect the throttle position sensor (TPS) (9).

Install the throttle cable and return spring.

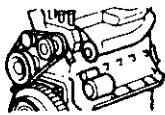
Install the lower bonnet assembly (3) and retaining nuts (2).

Install the upper bonnet assembly.

FUEL BODY ASSEMBLY REMOVAL

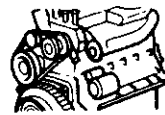
Remove the throttle body assembly from the intake manifold. Refer to the Throttle Body Assembly Removal procedure.

SEE
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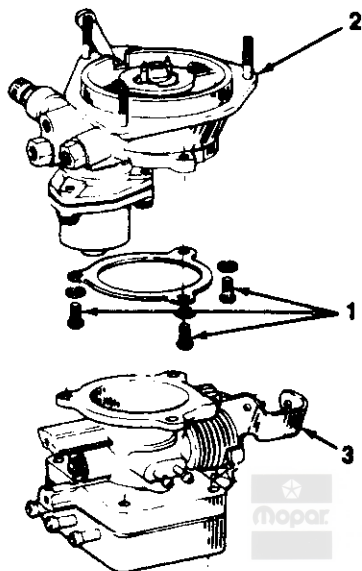
ENGINES

THROTTLE BODY INJECTION FUEL SYSTEMS



Remove the three Torx head screws (1) that retain the fuel body (2) to the throttle body (3).

Remove the original gasket and discard.



83047

FUEL BODY ASSEMBLY INSTALLATION

Install the replacement fuel body (2) on the throttle body (3) using a replacement gasket.

Install the three fuel body-to-throttle body retaining Torx head screws (1) and tighten securely.

Install the throttle body assembly on the intake manifold. Refer to the Throttle Body Assembly Installation procedure.

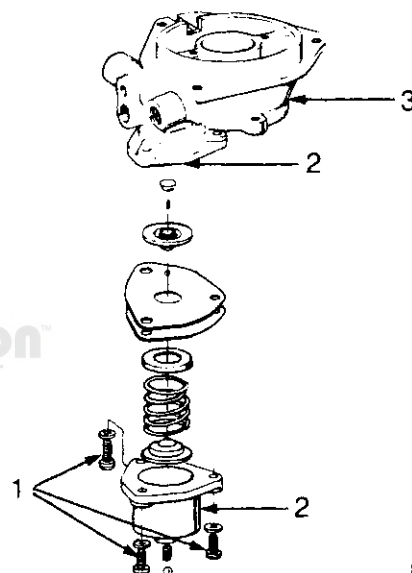
FUEL PRESSURE REGULATOR REMOVAL

Remove the throttle body assembly as outlined previously.

Remove the three retaining screws (1) that secure the pressure regulator (2) to the fuel body (3).

Remove the pressure regulator assembly (2). Be sure to note the location of the components for assembly reference.

Discard the gasket.



83037

FUEL PRESSURE REGULATOR INSTALLATION

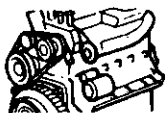
Position the pressure regulator assembly (2) with the replacement gasket.

Install the three retaining screws (1) to secure the pressure regulator (2) to the fuel body (3).

Operate the engine and inspect for leaks.

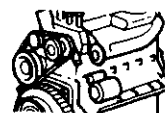
Install the throttle body assembly.

SEE
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ENGINES

THROTTLE BODY INJECTION FUEL SYSTEMS



FUEL INJECTOR REMOVAL

Remove the air inlet bonnet and hose.

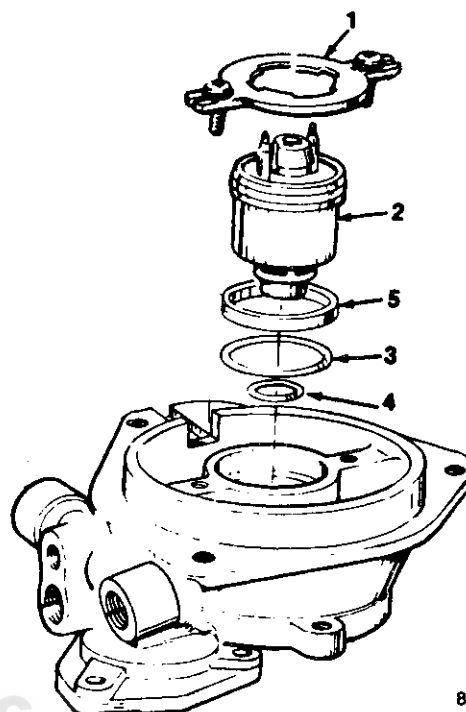
Remove the injector wire connector.

Remove the injector retainer clip screws.

Remove the injector retainer clip (1).

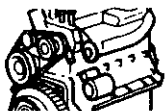
Using a pair of small pliers, gently grasp the center collar of the injector (between electrical terminals) and carefully remove the injector (2) with a lifting-twisting motion.

Discard the upper (3) and lower (4) O-rings. Note that the backup ring (5) fits over the upper O-ring (3).



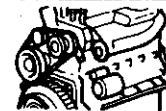
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THROTTLE BODY INJECTION FUEL SYSTEMS



FUEL INJECTOR INSTALLATION

Lubricate with light oil and install a replacement lower O-ring (4) in the housing bore.

Lubricate with light oil and install replacement upper O-ring (3) in the housing bore.

Install the backup ring (5) over the upper O-ring (3).

Position the replacement injector (2) in the fuel body and center the nozzle in the lower housing bore. Seat the replacement injector (2) using a pushing-twisting motion.

Align the wire terminals in the proper orientation.

Install the retainer clip (1) and screws.

Install the injector wire connector.

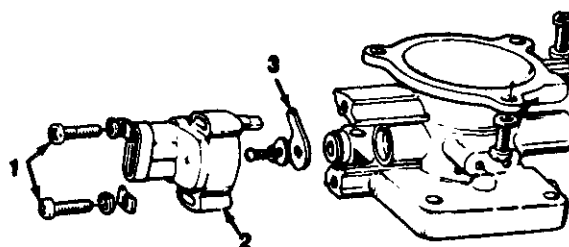
Install the air inlet bonnet and hose.

THROTTLE POSITION SENSOR (TPS) REMOVAL

Disconnect the wire connector from the sensor.

Remove the two Torx head retaining screws (1).

Remove the throttle position sensor (2) from the throttle shaft lever.



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THROTTLE POSITION SENSOR (TPS) INSTALLATION

Position the throttle position sensor (2) over the throttle shaft lever (3).

Install the two Torx head screws (1) to retain the sensor.

Connect the wire connector to the sensor.

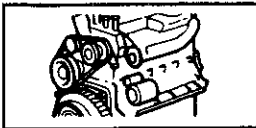
IDLE SPEED CONTROL (ISC) MOTOR REMOVAL

NOTE: The closed throttle (idle) switch is integral with the ISA motor.

Disconnect the throttle return spring.

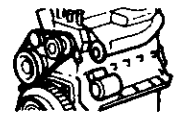
Disconnect wire harness connector from the motor.

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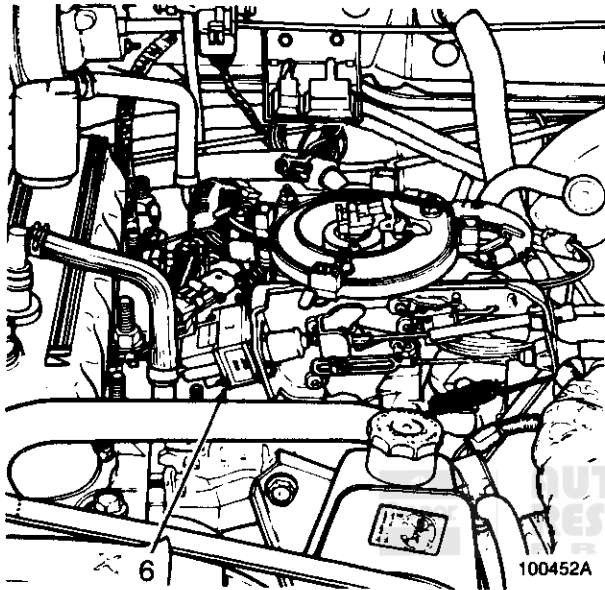
ENGINES

THROTTLE BODY INJECTION FUEL SYSTEMS



Remove the ISA motor-to-bracket retaining nuts.

Remove the ISA motor (6) from the bracket.



IDLE SPEED ACTUATOR (ISA) MOTOR INSTALLATION

Install the ISC motor (6) on the bracket.

Install the motor-to-bracket retaining nuts.

Connect the wire harness connector to the ISC motor.

Connect the throttle return spring.

EGR VALVE REMOVAL

NOTE: The EGR valve is located on the intake manifold below the throttle body.

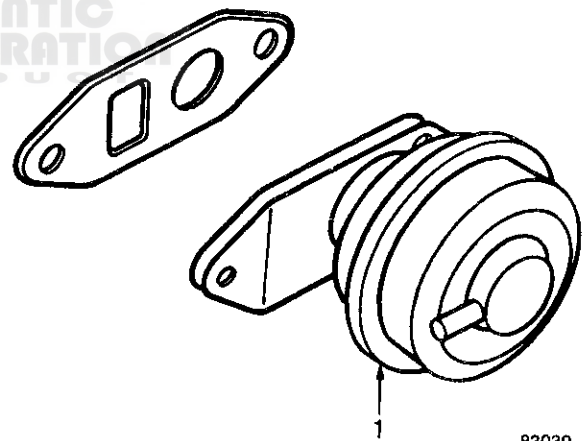
Disconnect the vacuum hose from the EGR valve (1).

Remove the two EGR valve-to-intake manifold retaining bolts.

Remove the EGR valve (1) from the intake manifold.

Discard the original gasket.

Clean the EGR valve (1) and intake manifold mating surfaces.



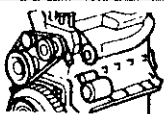
EGR VALVE INSTALLATION

Position the replacement EGR valve (1) on the intake manifold with a replacement gasket.

Install the EGR valve-to-intake manifold bolts.

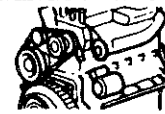
Connect the vacuum hose to the EGR valve (1).

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THROTTLE BODY INJECTION FUEL SYSTEMS

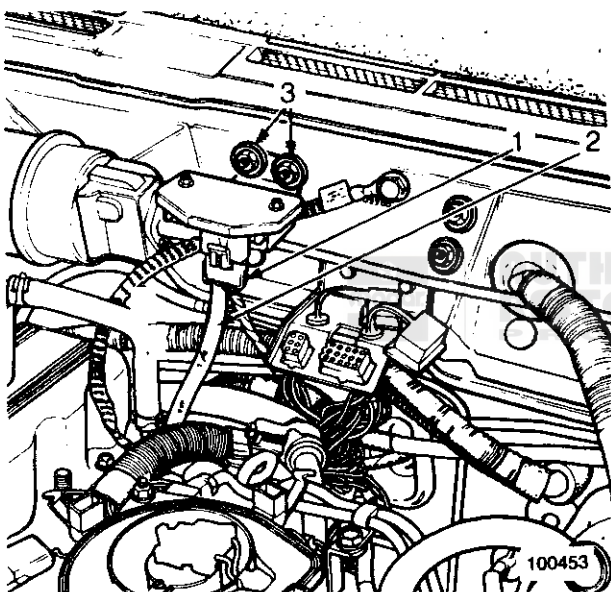


MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR REMOVAL

Disconnect the wire harness connector (1).

Disconnect the vacuum hose (2).

Remove the retaining nuts (3).



Remove the MAP sensor from the dash panel.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSTALLATION

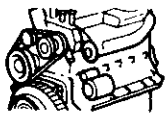
Position the MAP sensor on the dash panel.

Install the MAP sensor-to-dash panel nuts.

Connect the vacuum hose (2).

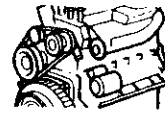
Connect the wire harness connector (1).

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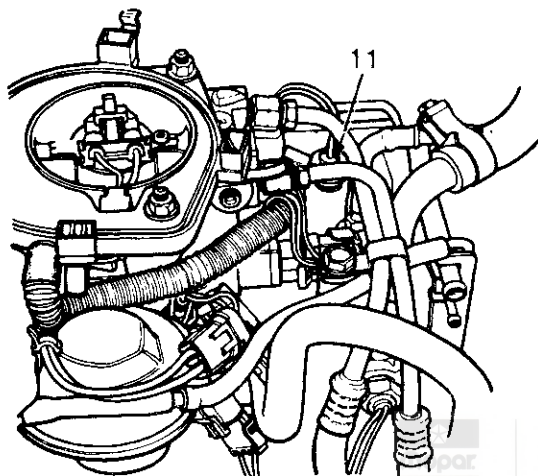
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THROTTLE BODY INJECTION FUEL SYSTEMS



MANIFOLD AIR/FUEL TEMPERATURE (MAT) SENSOR REMOVAL

Disconnect the wire harness connector from the MAT sensor harness .



100451F

Remove the MAT sensor (11) from the intake manifold.

Clean the threads in the manifold.

MANIFOLD AIR/FUEL TEMPERATURE (MAT) SENSOR INSTALLATION

Install the replacement MAT sensor in the intake manifold .

Connect the wire harness connector to the MAT sensor harness .

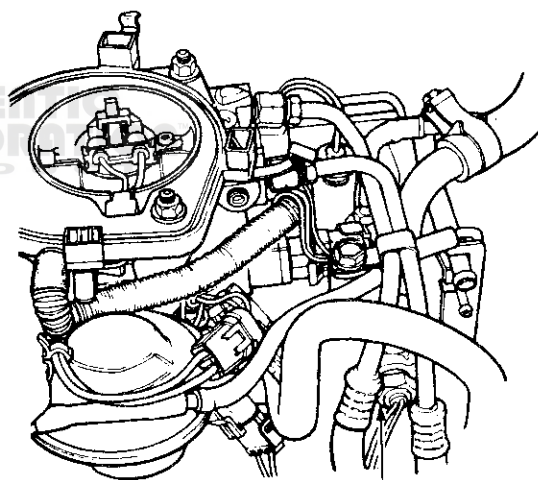
COOLANT TEMPERATURE SENSOR (CTS) REMOVAL

Remove the wire harness connector from the coolant temperature sensor (CTS) (12).

Note: It is located at the rear of the intake manifold.

WARNING: DO NOT remove the CTS with the cooling system HOT and UNDER PRESSURE.

Remove the CTS from the intake manifold and rapidly plug the hole to prevent loss of coolant.



12

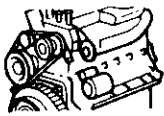
101451G

COOLANT TEMPERATURE SENSOR (CTS) INSTALLATION

Install the replacement CTS (12) in the intake manifold.

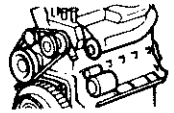
Connect the wire harness connector to the CTS harness connector.

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THROTTLE BODY INJECTION FUEL SYSTEMS



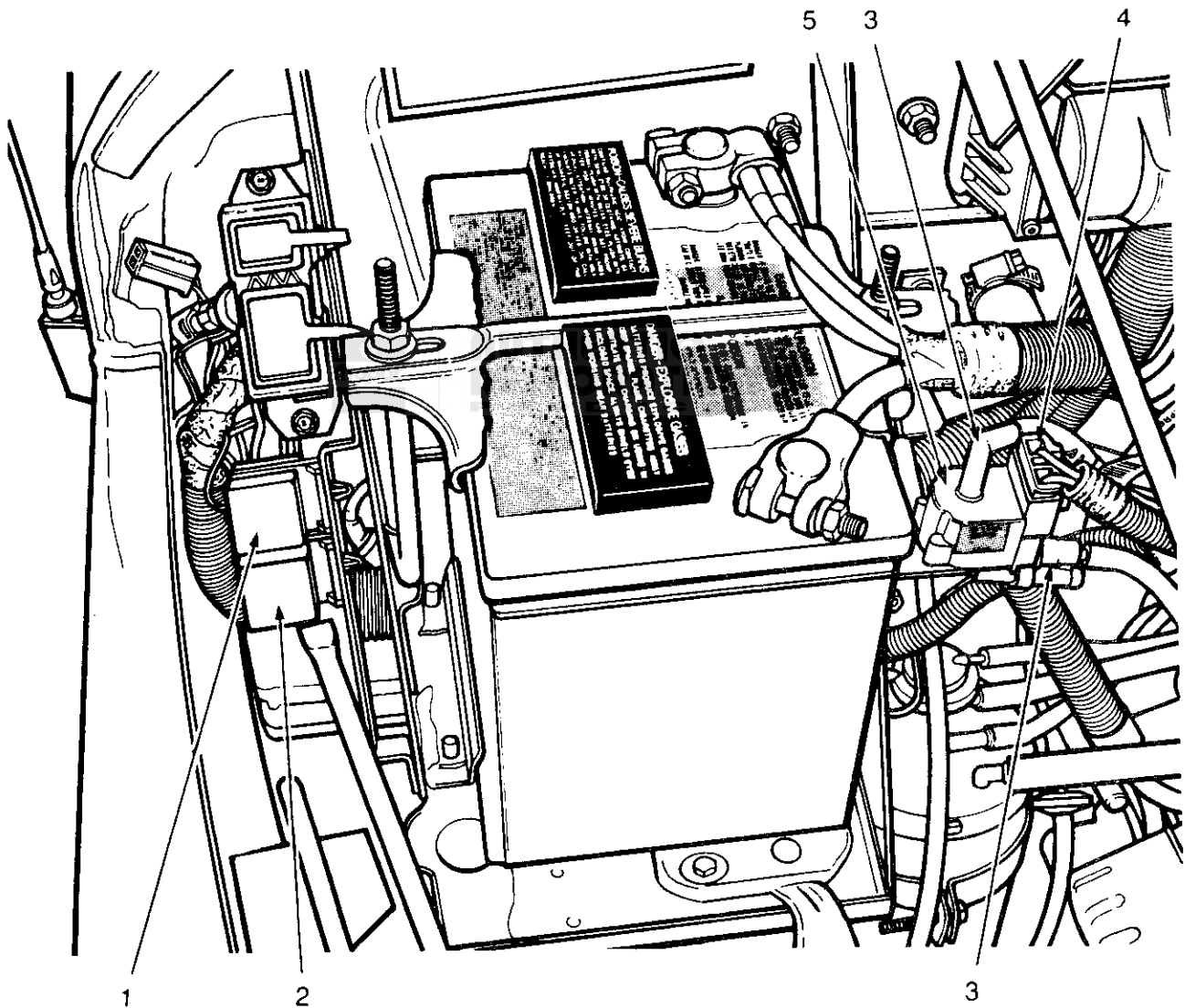
POWER (B+) RELAY/FUEL PUMP RELAY REMOVAL

Remove the power (B+) relay (1) or the fuel pump relay (2) from the relay on the right side battery bracket.

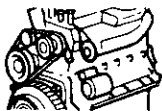
POWER (B+) RELAY/FUEL PUMP RELAY INSTALLATION

Connect the replacement relay to the wire harness connector.

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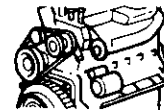


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THROTTLE BODY INJECTION FUEL SYSTEMS



CANISTER PURGE/EGR SOLENOID REMOVAL

Disconnect the vacuum hoses (3) from the solenoid (5).

Disconnect the electrical connection (4) from the solenoid (5).

Remove the solenoid assembly from the relay bracket.

CANISTER PURGE/EGR SOLENOID INSTALLATION

Install the solenoid to the relay bracket.

Connect the electrical connection (4) to the solenoid (5).

Connect the vacuum hoses (3) to the solenoid (5).

WIDE OPEN THROTTLE (WOT) SWITCH REMOVAL

Remove the air inlet bonnet.

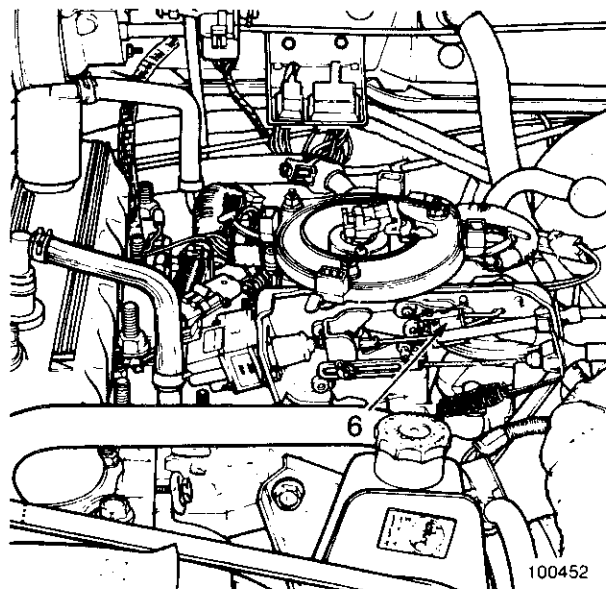
Disconnect the throttle return spring.

Disconnect the throttle cable.

Disconnect the wire harness connector from the WOT switch (6).

Remove the two WOT switch-to-bracket screws.

Remove the WOT switch (6).



WIDE OPEN THROTTLE SWITCH INSTALLATION

Position the replacement WOT switch (6) on the bracket and secure with the two switch-to-bracket screws.

Connect the wire harness connector.

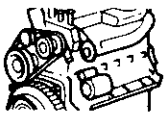
Connect the throttle cable.

Install the air inlet bonnet.

Wide Open Throttle Switch Adjustment

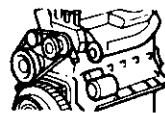
NOTE: Refer to the adjustment procedure outlined in the INJ. R..(G) manual and related I.S. Notes.

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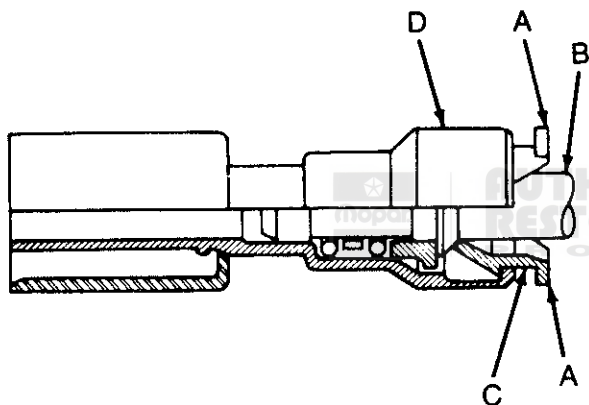
THROTTLE BODY INJECTION FUEL SYSTEMS



QUICK-CONNECT FUEL LINE O-RING REPLACEMENT

Separate the quick-connect fuel line tubes at the left inner fender panel by squeezing the two retaining tabs (A) against the fuel line tube (B).

Pull the tube (B) and retainer (C) from the quick-connect fitting (D).

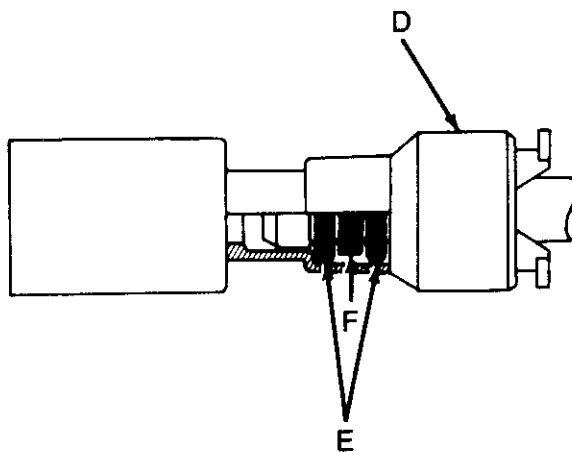


100485B

Replace the O-ring using the Coupling Repair Kit, P/N 8983 502 745, as follows:

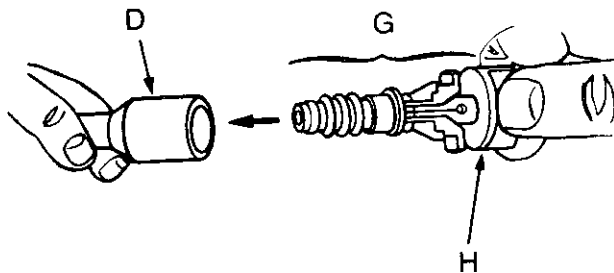
- remove the two O-rings (E) and the spacer (F) from the fitting (D).

NOTE: This can be done by using a paper clip, or piece of wire, bent in an "L" shape.

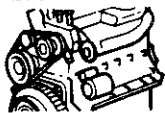


100485A

- remove the retainer from the fuel tube and discard the O-rings, the spacer, and the retainer
- install the retainer assembly (G) by pushing the assembly into the quick-connect fitting (D) until a "click" sound is heard.

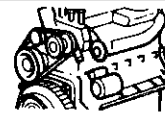


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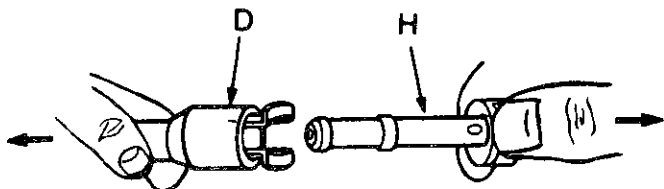
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THROTTLE BODY INJECTION FUEL SYSTEMS



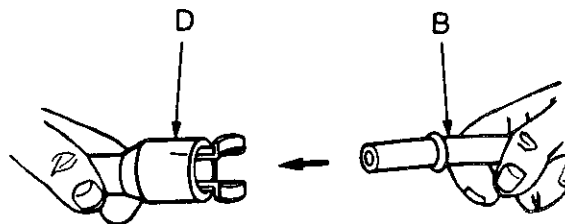
- grasp the disposable plastic plug (H) and remove it from the fitting (D).

NOTE: By removing ONLY the plastic plug (H), the O-rings, spacer, and retainer will remain in the fitting.



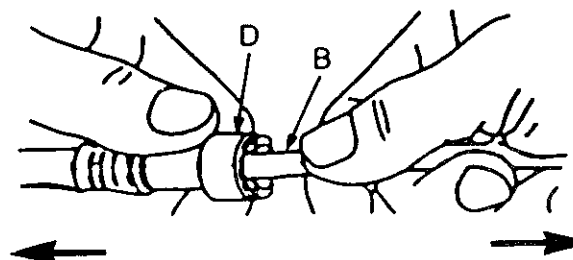
100487

- push the fuel line (B) into the fitting (D) until a "click" sound is heard and the connection is complete.



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- verify that the quick-connect fitting assembly fits securely over the fuel lines by giving the fuel lines a firm tug.



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FUEL FILTER REMOVAL

Raise the vehicle.

Remove protective plate retaining bolts (A) and then, remove protective plate (B).

Remove filter retaining strap bolt (1).

Install clamp MOT. 453.01, or equivalent, to the inlet side of the filter.

Remove hose clamps (2).

Remove filter (3).

Install the inlet and outlet fuel hoses (2) and clamps. Tighten clamps securely.

Install the filter retaining strap and bolt (1).

Install protective plate (B) and retaining bolts (A).

Remove clamp MOT 453.01, or equivalent.

Lower the vehicle.

FUEL TANK REMOVAL

Position jack under shield and remove screws.

Disconnect:

- fuel outlet and return hoses,
- fuel filler hose (A), and ,
- filler vent hose (B).

Partially lower the shield and tank.

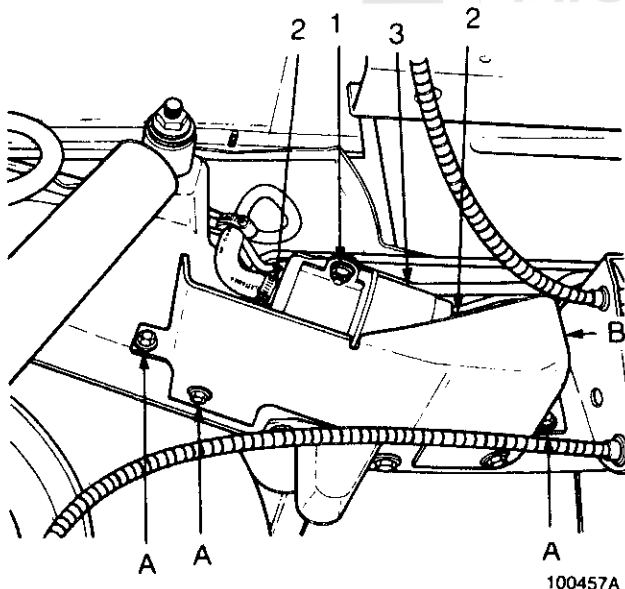
Disconnect tank vapor vent hoses.

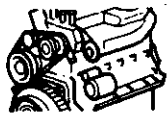
Disconnect fuel gauge sending unit wires.

Lower and remove fuel tank.

FUEL FILTER INSTALLATION

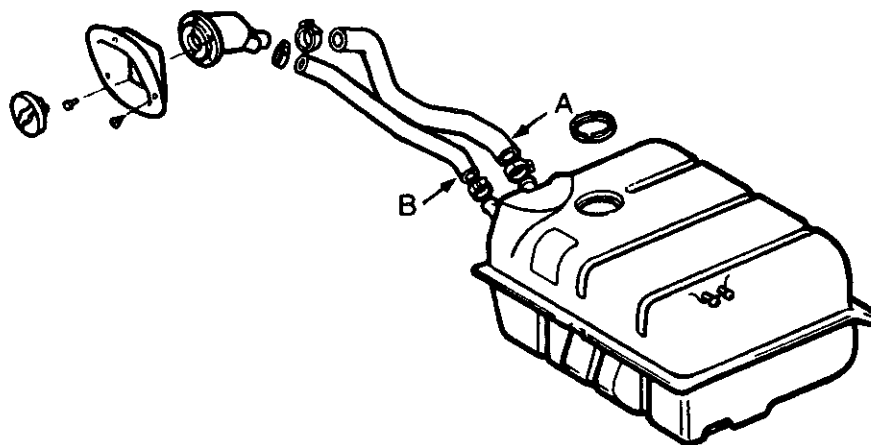
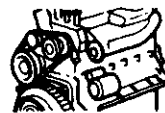
Place the filter (3) into position.





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THROTTLE BODY INJECTION FUEL SYSTEMS



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FUEL TANK INSTALLATION

Position shield and tank on jack.

Partially raise.

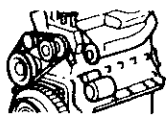
Install:

- fuel outlet hose and return hoses,
- fuel gauge sending unit wires, and,
- tank vapor vent hoses.

Raise shield and tank to installation position.
Install screws and tighten.

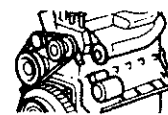
Install fuel filler hose (A) and filler vent hose (B).

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THROTTLE BODY INJECTION FUEL SYSTEMS



SENDING UNIT/FUEL PUMP (TBI MODELS) REMOVAL

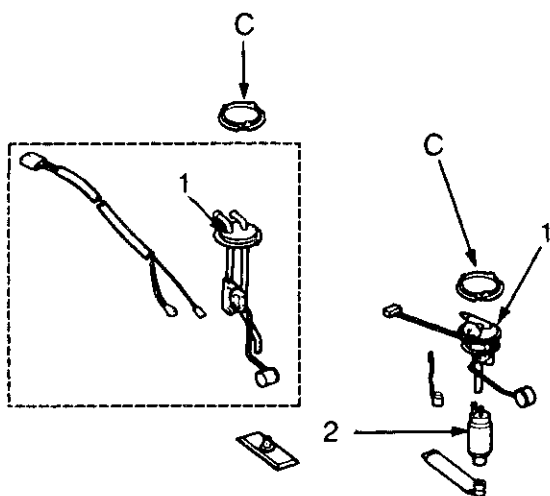
Disconnect the battery cables.

Remove the fuel from the tank.

Position a jack beneath the fuel tank.

Remove the fuel tank as outlined above and lower the tank gradually with the jack.

Turn the fuel gauge sending unit retainer ring (C) with a screwdriver and remove.



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Separate the sending unit (1) and pump (2) (TBI MODELS).

SENDING UNIT/FUEL PUMP (TBI MODELS) INSTALLATION

Connect the fuel pump (2) to the sending unit (1) (TBI MODELS).

Install the sending unit/pump assembly in the tank and secure with the retaining ring (C).

NOTE: Ensure O-ring is properly positioned in its groove.

Connect the hoses.

Install the fuel tank as outlined above.

Connect the battery cables.

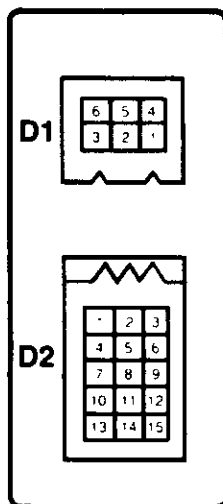
NOTE: The fuel tank is equipped with a pressure/vacuum filler cap.

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DIAGNOSTIC CONNECTOR – THROTTLE BODY INJECTION

DASH PANEL



Connector D2

1. Shift Lamp
2. Power Latch Relay
3. Park/Neutral
4. Power Latched Relay (B +)
5. Air Conditioning Clutch Relay
6. Wide-Open Throttle Switch
7. Ground
8. Air Mixture Temperature
9. M.P.A. (Ignition Output)
10. EGR/Canister Purge Solenoid
11. Idle Speed Control Motor Forward
12. Coolant Temperature Sensor
13. Closed Throttle Switch
14. Idle Speed Control Motor Reverse
15. Not Used

FRONT OF VEHICLE



Connector D1

1. Tach Input
2. Ignition
3. Ground
4. Start Solenoid
5. Battery
6. Fuel Pump

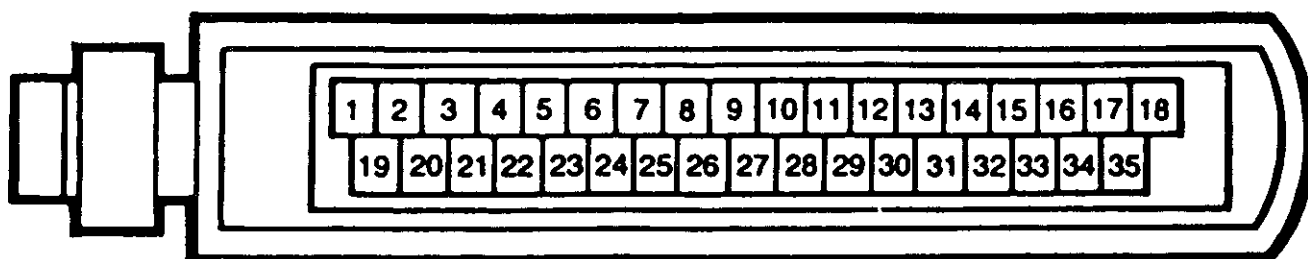
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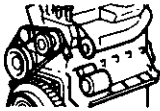
ECU CONNECTOR – THROTTLE BODY INJECTION

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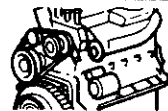
- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Ground 2. Ground 3. Ignition Switch 4. Battery 5. EGR Valve/Canister Purge 6. Fuel Pump Relay 7. System Power Relay (Latch Relay) 8. WOT Switch 9. Not Used 10. System Ground 11. Speed Sensor 12. Park/Neutral Switch (A/T Only) 13. Throttle Position Sensor (TPS) Ground 14. Manifold Air/Fuel Temperature Sensor 15. Coolant Temperature Sensor 16. Manifold Absolute Pressure (Supply Voltage) 17. Manifold Absolute Pressure (Ground) 18. Shift Lamp | <ol style="list-style-type: none"> 19. System Power (B +) 20. Not Used 21. Injector 22. A/C Compressor Clutch 23. ISA Motor Retract (Reverse) 24. ISA Motor Extend (Forward) 25. Closed Throttle (Idle) Switch 26. Not Used 27. Ignition (Output) 28. Speed Sensor 29. Start 30. A/C Select 31. Throttle Position Sensor (TPS) 32. Sensor Ground 33. Manifold Absolute Pressure (Output Voltage) 34. A/C Temperature Control (Request) 35. Oxygen Sensor |
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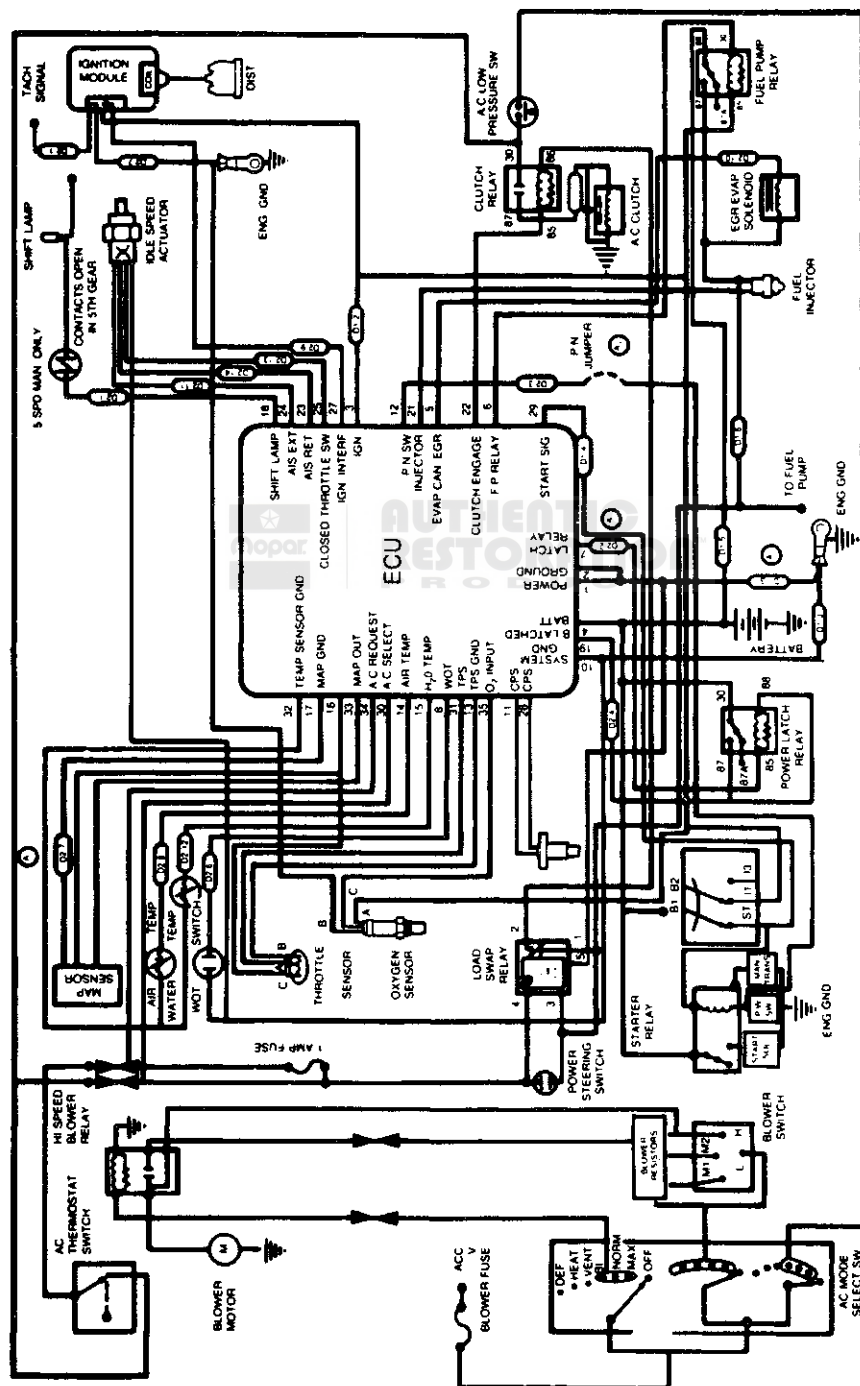
ENGINES

THROTTLE BODY INJECTION FUEL SYSTEMS



1987 TBFi WIRING DIAGRAMS

The electrical circuitry for the 1987 Renix TBFi system is illustrated in the following wiring diagrams.

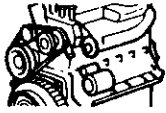


NOTE:

1. ENGINE BLOCK GROUNDS ARE FASTENED AT THE SAME POINT
2. OX - YY INDICATES DIAGNOSTIC JUNCTION.

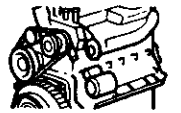
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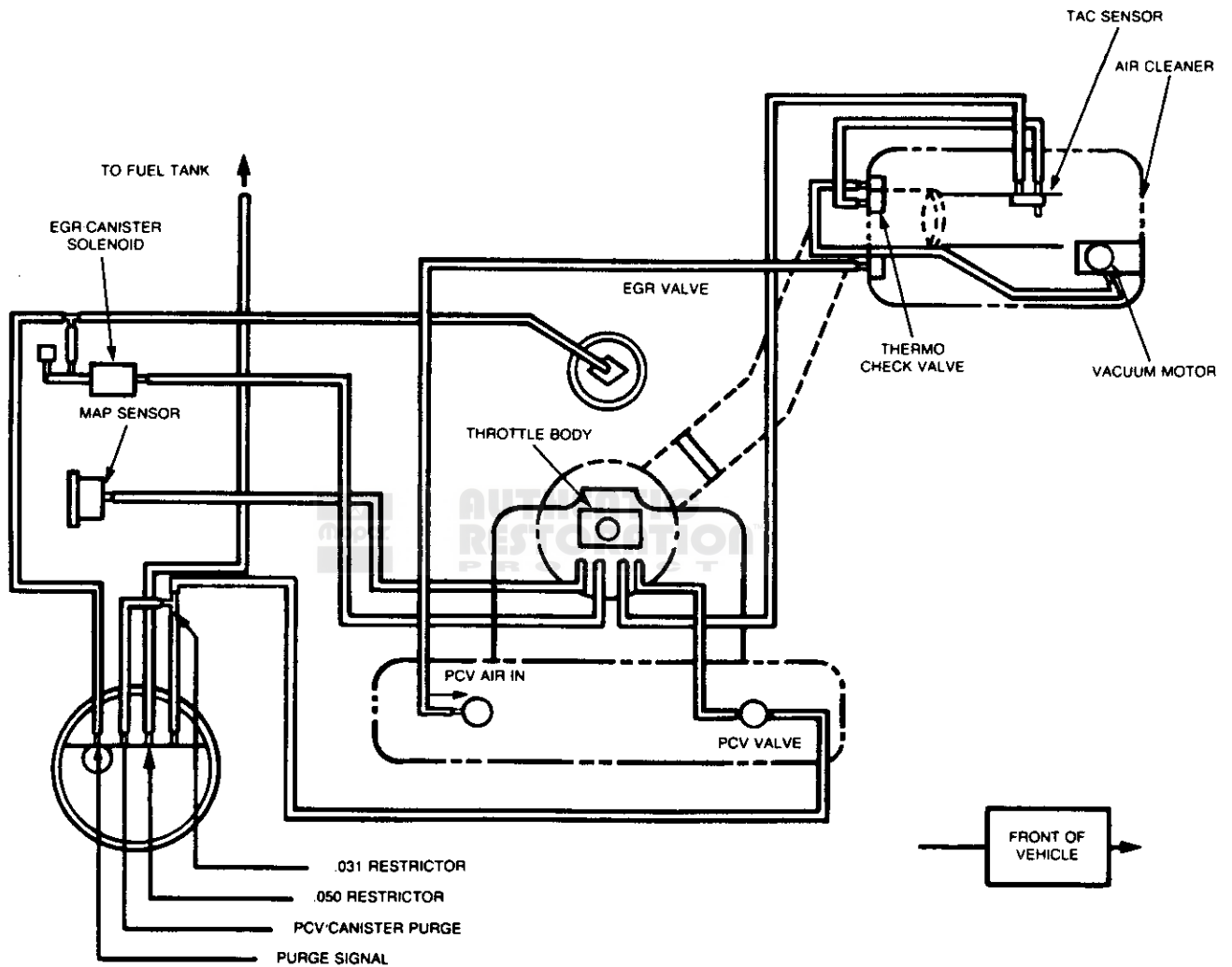
ENGINES

THROTTLE BODY INJECTION FUEL SYSTEMS

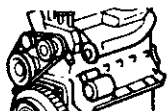


1987 EMISSION CONTROL SYSTEM SCHEMATIC – THROTTLE BODY INJECTION

SEE
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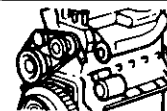


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ENGINES

FUEL SYSTEM – BBD CARBURETOR



GENERAL INFORMATION

The 4.2 liter (258 CID) six-cylinder engine is equipped with a Model BBD two-venturi, feedback type carburetor.

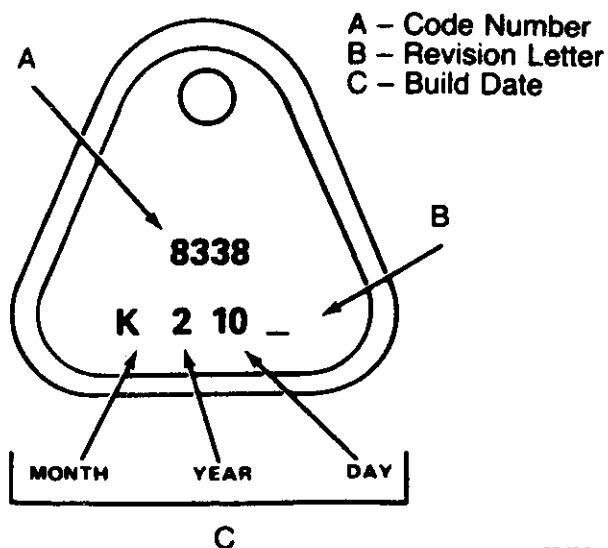
The stepper motor included with this carburetor has two tapered metering pins. Each metering pin is moved in and out of the carburetor air cavity to achieve the proper air/fuel ratio.

CODE NUMBER/BUILD DATE IDENTIFICATION

The carburetor is identified by a code number and a build date stamped on the identification tag.

Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used).

The tag is attached to the carburetor and must remain with it to assure proper identification.



60430

SPECIFICATIONS

Model BBD Carburetor Idle Speed

Displacement and Carburetion	Trans.	Curb Idle Speed – RPM (Auto in Drive, Manual in Neutral)		Sole-Vac Adjustment		
				Vacuum Actuator Energized	Holding Solenoid Energized	
		Set To	OK Range	Set To	OK Range	
258 CID 2V	M	680	± 50	1100	900	± 50
	A	600	± 50	900	800	± 50

90744

Model BBD Carburetor Mixture Adjustment

Displacement and Carburetion	Transmission	Application	Idle Drop
258 CID 2V	Manual	All	50 rpm
	Automatic	All	50 rpm

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	ENGINES FUEL SYSTEM – BBD CARBURETOR	
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Model BBD Carburetor Specifications

SEE I.S. NOTES

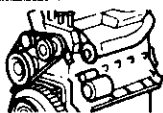
List Number	258 (2V) Application		Float Level		Vacuum Piston Gap		Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Accelerator Pump Dimension		Choke Unloader (Min.)	Fast Idle Speed (RPM)		Bowl Vent Starts To Open	Choke Bi-Metal ID	Choke
	Model	Trans.	Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range			
8383	81	Auto	6.35 mm (0.25 in)	5.56-7.14 mm (0.218-0.282 in)	0.9 mm (0.035 in)	0.5-1.3 mm (0.020-0.050 in)	3.5 mm (0.140 in)	3.18-3.97 mm (0.125-0.155 in)	2.4 mm (0.095 in)	2.0-2.8 mm (0.080-0.110 in)	1	1 1/2	13.1 mm (0.520 in)	12.7-13.6 mm (0.500-0.540 in)	7.1 mm (0.280 in)	1850	1950-1750	2nd Step	ET	TR
8384	81	Man	6.5 mm (0.25 in)	5.56-7.14 mm (0.218-0.282 in)	0.9 mm (0.035 in)	0.5-1.3 mm (0.020-0.050 in)	3.5 mm (0.140 in)	3.18-3.97 mm (0.125-0.155 in)	2.4 mm (0.095 in)	2.0-2.8 mm (0.080-0.110 in)	1	1 1/2	13.1 mm (0.520 in)	12.7-13.6 mm (0.500-0.540 in)	7.1 mm (0.280 in)	1700	1800-1600	2nd Step	ET	TR

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Model BBD Carburetor Calibrations

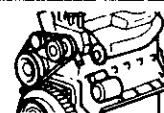
List Number	8383	8384
Throttle Bore Size	36.5mm (1.44 in)	36.5mm (1.44 in)
Main Venturi Valve	27mm (1.0625 in)	27mm (1.0625 in)
Fuel Inlet Diameter	2.6mm (0.101 in)	26mm (0.101 in)
Low Speed Jet (Tube)	0.75mm (0.0295 in)	0.75mm (0.0295 in)
Economizer	1.5mm (0.059 in)	1.5mm (0.059 in)
Idle Air Bleed	1.7mm (0.067 in)	1.7mm (0.067 in)
Mainjet Size	2.35mm (0.092 in)	2.35mm (0.092 in)
Accelerator Pump Jet	0.85mm (0.033 in)	0.85mm (0.033 in)
Main Metering Jet Number	120-392	120-392
Metering Rod Number	75-2384	75-2384

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FUEL SYSTEM – BBD CARBURETOR



CARBURETOR REMOVAL

Remove the air cleaner.

Identify and tag all the hoses attached to the carburetor for aid during installation.

Remove the throttle cable from the throttle lever and disconnect the vacuum hoses, return spring, PCV valve hose, fuel pipe, choke heater wire connector, stepper motor wire connector, bowl cooler deflector (if equipped) and solenoid wire connector.

Remove the carburetor retaining nuts.

Remove the carburetor.

Remove the carburetor gasket from the spacer.

CARBURETOR INSTALLATION

Clean the gasket mating surface on the spacer and install a replacement gasket.

Position the carburetor on the spacer and gasket and install the nuts.

To prevent leakage, distortion or damage to the carburetor body flange, alternately tighten the nuts in a crisscross pattern with 9 N·m (7 ft-lbs) torque.

Complete the tightening sequence by alternately tightening in a crisscross pattern with 19 N·m (14 ft-lbs) torque.

Connect the fuel pipe, throttle cable, choke heater wire connector, PCV valve hose, return spring, stepper motor wire connector, all the vacuum hoses and the solenoid wire connector.

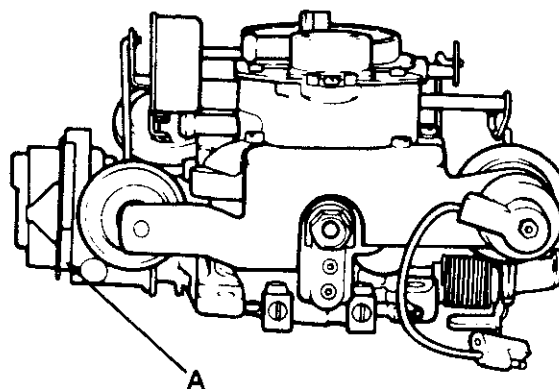
Install the air cleaner.

Adjust the engine idle speed, idle mixture (if necessary) and idle speed control (Sole-Vac) solenoid. Refer to Idle Speed and Mixture Adjustment procedures.

CHOKE MECHANISM DISASSEMBLY

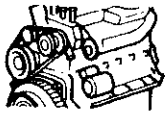
NOTE: The choke mechanism on model BBD carburetors cannot be serviced with the carburetor on the engine. The carburetor must be removed to properly service the choke components.

Note and record the color and position of the choke housing index key (A) for assembly reference. The key color indicates the basic choke setting.



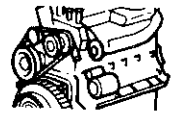
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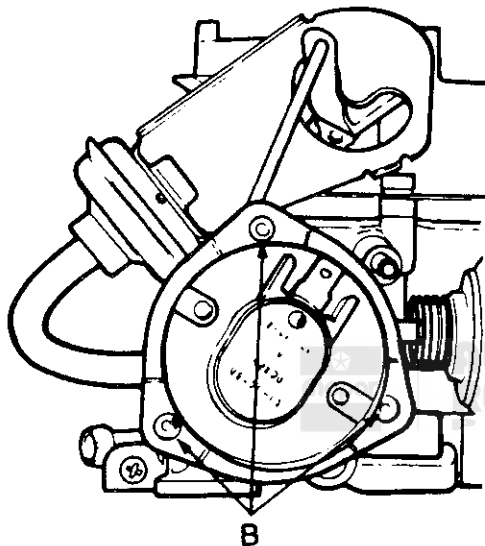
ENGINES

FUEL SYSTEM – BBD CARBURETOR



Grind the heads off the choke cover rivets (B) and remove the retainer, choke cover and coil, gasket and baffle.

Remove the remaining portion of the rivets after removing the cover.



Remove the choke lever screw and the choke lever.

Disconnect the choke rod and remove the choke shaft from the housing.

Clean and polish the choke shaft and the shaft bore in the housing with crocus cloth.

Inspect the choke cover and coil. Replace both components as an assembly if either part is damaged. Replace the cover gasket if damaged and replace the choke lever or baffle if they are damaged.

CHOKE MECHANISM ASSEMBLY

Install the choke shaft in the housing and connect the choke rod to the shaft.

Install the choke lever and lever attaching screw.

Install the choke baffle, gasket, cover and coil, and index key. Ensure that the key notch in the cover is aligned with the index key tang.

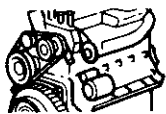
Install the choke cover retainer. Secure the retainer and cover with screws. Do not tighten the screws completely at this time.

Position the choke cover at the following basic setting as indicated by index key color:

- GOLD INDEX KEY – set the choke index at 0
- RED INDEX KEY – set the choke index at one-notch rich
- GREEN INDEX KEY – set the choke index at two-notches rich

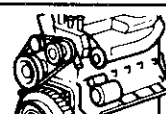
Tighten the choke cover screws.

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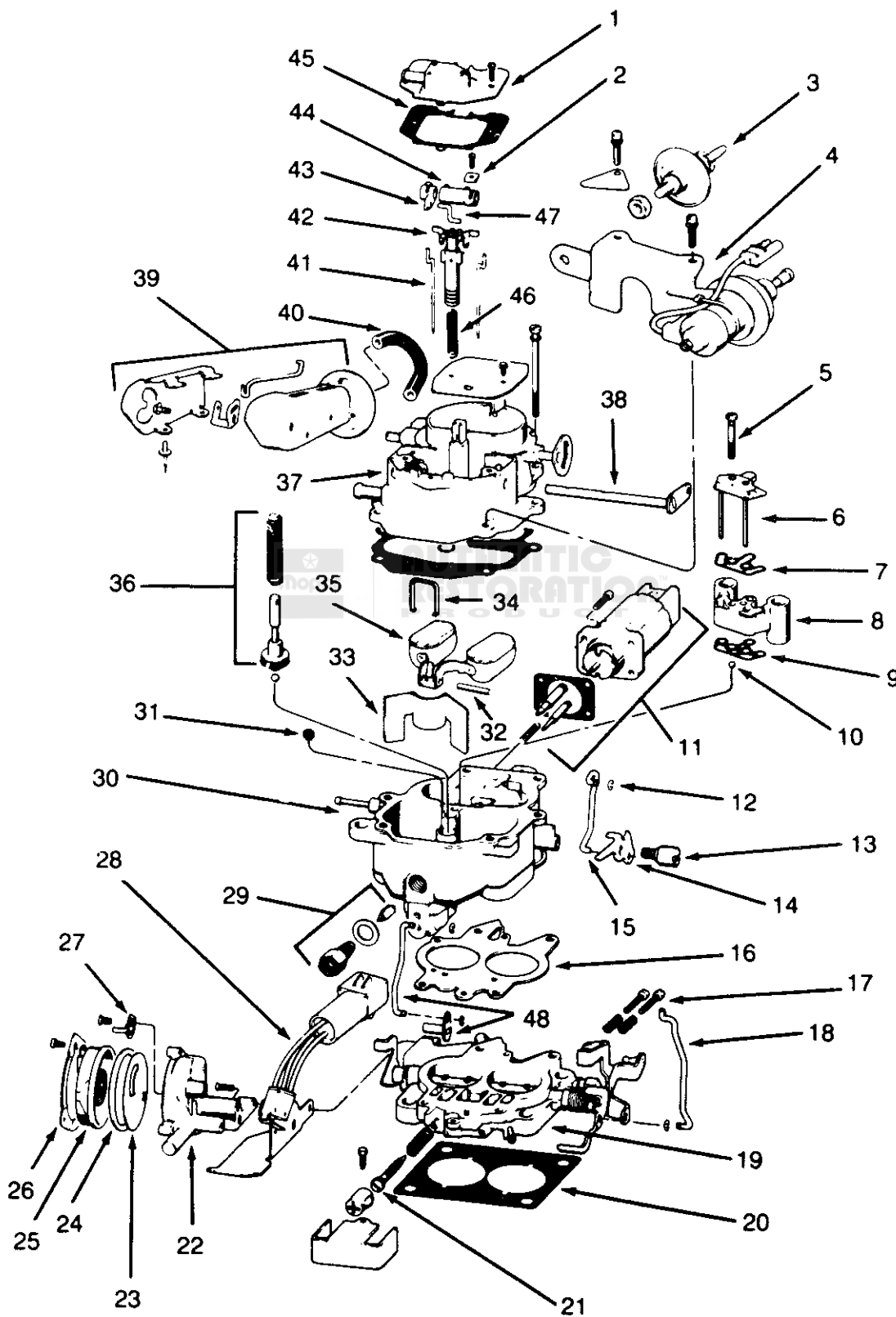


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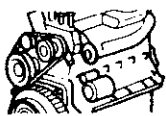
FUEL SYSTEM – BBD CARBURETOR



MODEL BBD CARBURETOR (EXPLODED)

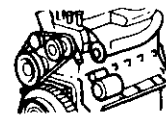


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ENGINES

FUEL SYSTEM – BBD CARBURETOR



Parts Identification

1. Rollover Check Valve and Bowl Vent
2. Lock
3. Dashpot
4. Solenoid and Bracket
5. Cluster Screw
6. Idle Fuel Pickup Tube
7. Gasket
8. Venturi Cluster
9. Gasket
10. Check Ball (Small)
11. Stepper Motor (Actuator)
12. Clip
13. Screw
14. Fast Idle Cam
15. Choke Link
16. Gasket
17. Screw
18. Pump Link
19. Throttle Body
20. Flange Gasket
21. Idle Mixture Screw
22. Choke Housing
23. Baffle
24. Gasket
25. Choke Coil
26. Retainer
27. Lever
28. Wide Open Throttle Switch and Bracket
29. Needle and Seat Assembly
30. Main Body
31. Main Metering Jet
32. Pin
33. Baffle
34. Fulcrum Retainer
35. Float
36. Spring and Accelerator Pump Plunger
37. Air Horn
38. Accelerator Pump Lever
39. Choke Vacuum Diaphragm and Housing
40. Hose
41. Metering Rod
42. Vacuum Piston
43. Pump Arm
44. Rod Lifter
45. Gasket
46. Spring
47. S-Link
48. Choke Rod and Shaft

COMPLETE CARBURETOR OVERHAUL

The following procedures apply to a complete overhaul with the carburetor removed from the engine.

NOTE: A complete disassembly is not necessary for adjustments. In most instances, service adjustments of the individual circuits may be completed without removing the carburetor from the engine.

A complete carburetor overhaul includes:

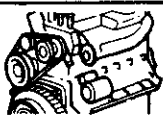
- disassembly,
- thorough cleaning and inspection,
- replacement of all gaskets, and worn or damaged components, and,
- assembly.

It also includes idle speed adjustment, idle mixture adjustment (if necessary) and fast idle speed adjustment after the carburetor is installed.

NOTE: When using an overhaul kit, use all the parts included in the kit.

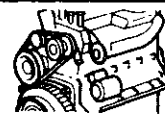
CAUTION: Flooding, hesitation on acceleration, and other performance problems are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing a problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the bowl contents for contamination as the carburetor is disassembled.

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FUEL SYSTEM – BBD CARBURETOR

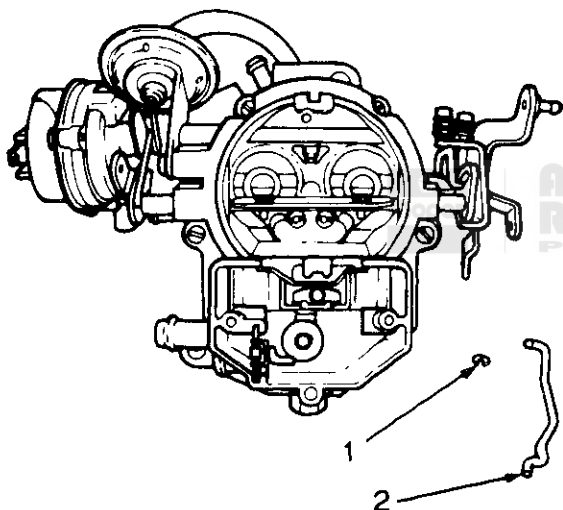


Carburetor Disassembly

Place the carburetor on a repair stand to protect the throttle valves from damage and to provide a stable work surface.

Remove the stepper motor.

Remove the retaining clip (1) from the accelerator pump arm link (2) and remove the link.



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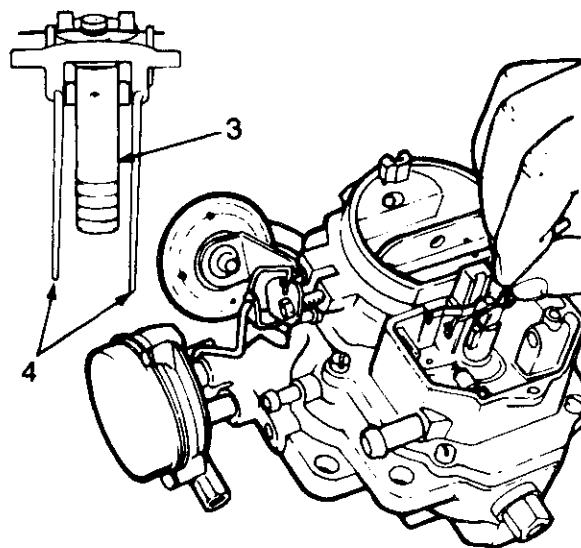
Remove the cover and gasket from the top of the air horn.

Remove the screws and locks from the accelerator pump arm and vacuum piston rod lifter.

Slide the pump lever out of the air horn. Remove the pump arm and rod lifter.

Remove the vacuum piston (3) and metering rods (4) straight up and out of the air horn as an assembly.

Remove the vacuum piston spring.



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If the main body is to be immersed in cleaning solution, perform following steps:

- rotate the bowl vent assembly up and out of the bowl as far as possible to gain access to the rubber valve seal
- carefully remove the valve seal from the lever

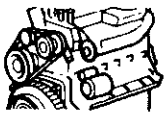
Disconnect the clips and remove the link from the choke housing lever and choke lever.

Remove the screw and lever from the choke shaft.

Remove the vacuum hose between the carburetor main body and the choke vacuum diaphragm.

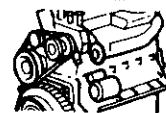
Remove the choke vacuum diaphragm, linkage and bracket assembly. Place the diaphragm aside to be cleaned separately.

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FUEL SYSTEM – BBD CARBURETOR



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Remove the fast idle cam retaining screw.
Remove the fast idle cam, linkage and clip.

Grind the heads off the choke cover rivets.
Remove the choke housing cover, retainers and the remaining portion of the rivets. Remove the gasket and baffle.

Remove the choke housing from the throttle body.

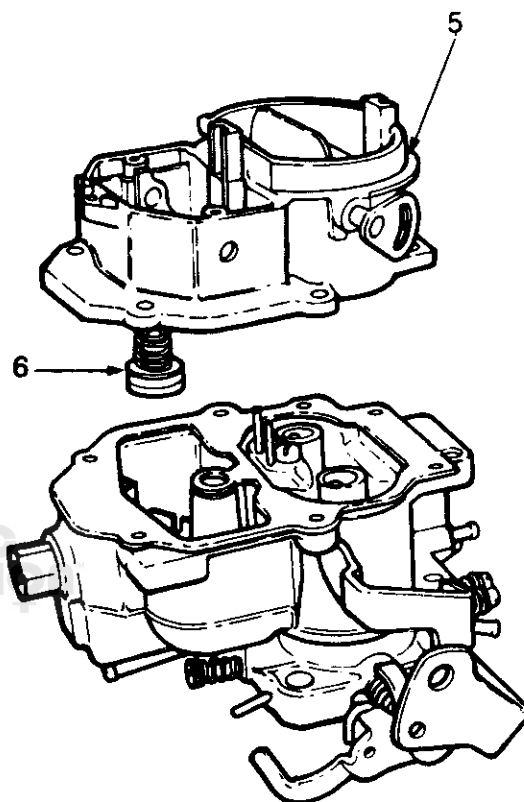
Remove the air horn retaining screws and lift the air horn (5) straight up and away from the main body.

Remove the solenoid. Discard the gasket.

Invert the air horn and compress the accelerator pump drive spring (6).

Remove the S-link from the pump shaft.
Remove the pump assembly.

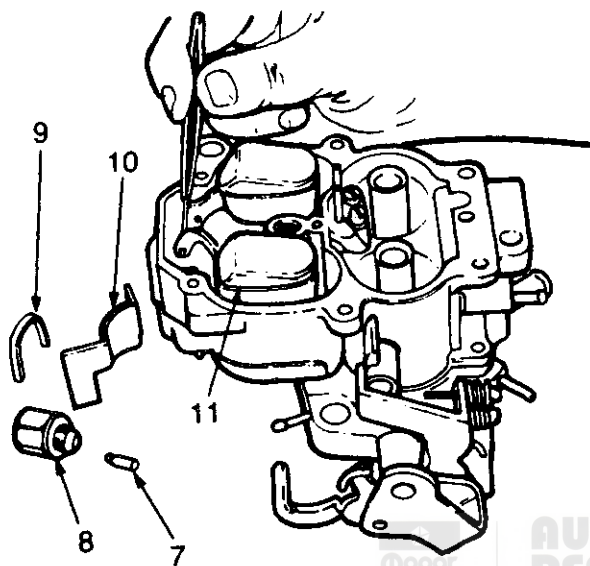
Remove the fuel inlet needle valve (7), seat (8) and gasket from the main body.



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	ENGINES FUEL SYSTEM – BBD CARBURETOR	
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Lift out the float fulcrum pin retainer (9) and baffle (10). Lift out the floats (11) and fulcrum pin.



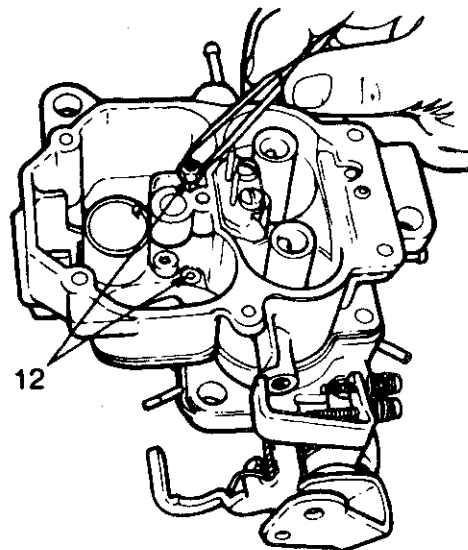
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Remove main metering jets (12).

Remove the venturi cluster screws. Lift the venturi cluster and gaskets away from the main body. Discard the gaskets.

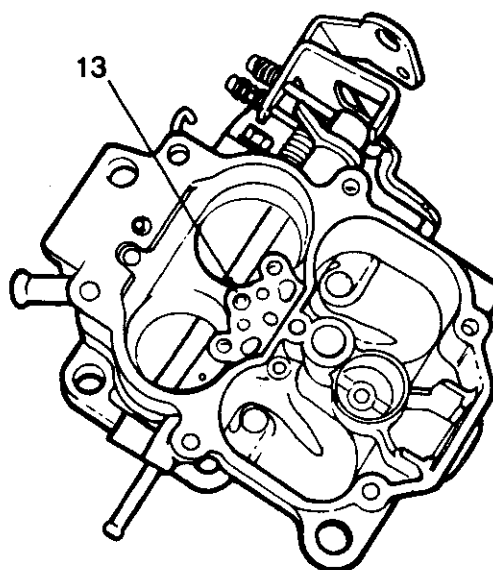
Do not remove the idle orifice tubes or main vent tubes from the cluster.

Clean the tubes with cleaning solvent and dry with compressed air.



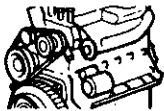
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Invert the carburetor main body and drop out the accelerator pump discharge check valve ball (13).



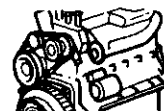
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Remove the screws attaching the throttle body to the main body and separate the bodies. Discard the gasket.

NOTE: If it is necessary to remove the idle mixture adjustment screws because of inability to clean the passages with air pressure or by soaking, remove the dowel pins with a drill and punch.

Count the number of turns required to lightly seat each mixture screw and record this for use during assembly. Remove the screws and springs from the throttle body.

Carburetor Cleaning and Inspection

Dirt, gum, water and carbon contamination in the carburetor or on exterior moving parts is often responsible for unsatisfactory engine performance. Efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection procedures listed below do not involve those parts included in the carburetor overhaul/repair kit.

Install all gaskets and parts included in the repair kit when the carburetor is assembled. Discard the original gaskets and parts.

CAUTION: Do not use a wire brush to clean any component. Do not use a drill bit or wire to clean out openings or passages. This may enlarge the passages and change the calibration of the carburetor.

Wash all the components (except the vacuum break diaphragm, solenoid, bowl vent seal and stepper motor) in clean, commercial carburetor cleaning solvent.

If a commercial solvent is not available, use mineral spirits, lacquer thinner or denatured alcohol.

If a commercial solvent is used, rinse the components in hot water to remove all traces of the cleaning solvent, then blow dry with compressed air.

Wipe the components that cannot be immersed in solvent with a clean, soft, dry cloth. Ensure that all dirt, gum, carbon and other foreign matter are removed from the components.

Force compressed air through all carburetor passages.

Inspect the choke shaft for excessive looseness or binding.

Inspect the choke valve for nicked edges and for ease of operation.

Inspect the throttle shaft for excessive looseness or binding in its bore.

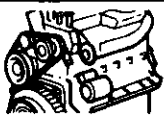
Inspect throttle valve for burrs or nicks that might prevent proper closing.

Inspect the main body, throttle body, air horn, venturi assemblies, choke housing and choke cover for cracks.

Replace the float if the arm needle contact surface is grooved.

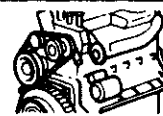
If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool.

Replace the float shaft if worn.



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FUEL SYSTEM – BBD CARBURETOR



Replace all damaged screws and nuts and all distorted or broken springs.

Inspect all gasket mating surfaces for nicks or burrs.

Replace any components that have damaged gasket surfaces.

Carburetor Assembly

NOTE: Ensure that all holes in the replacement gaskets have been properly punched and that no foreign material has adhered to the gaskets.

If removed, install the idle mixture screws and springs in the throttle body.

Turn the screws lightly against the seats.

Turn the screws out the same number of turns counted and recorded during disassembly.

Invert the main body. Place the throttle body on the main body and align. Install the screws and tighten securely.

Install the accelerator pump discharge check valve ball (13) in the discharge passage.

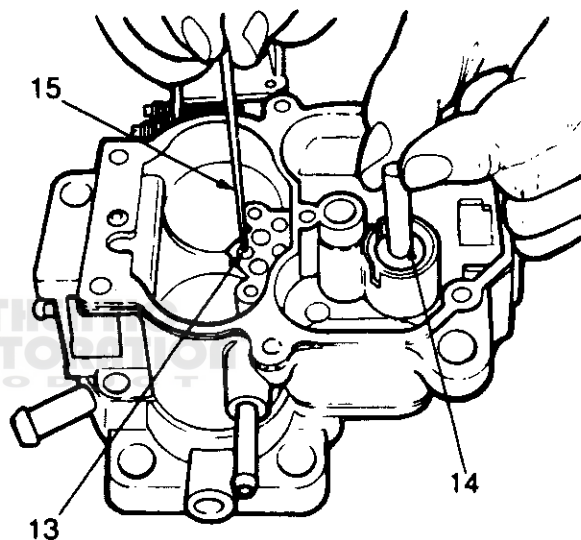
Test the accelerator pump (14) circuit:

- pour clean no-lead fuel into the carburetor bowl 13mm (1/2-in) deep
- insert the pump piston (14) into the pump cylinder and work the piston up and down gently to expel air from the pump passage.

- with a suitable, clean brass rod (15), hold the discharge check valve firmly against its seat.

- raise the piston and press down

- no fuel should be emitted from either the intake or discharge passages



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Clean the passage and valve seat if leakage is evident. If leakage persists, replace the main body.

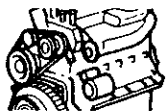
Install replacement gaskets on the venturi cluster. Install the cluster screws and tighten securely.

Install the main metering jets.

Install the floats with the fulcrum pin and pin retainer in the main body.

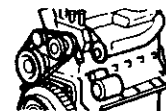
Install the inlet needle, seat and gasket. Tighten securely.

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FUEL SYSTEM – BBD CARBURETOR



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Adjust the float level. Refer to Service Adjustment Procedures.

Install the baffle plate.

Place the accelerator pump drive spring on the pump plunger shaft and insert the shaft into the air horn. Compress the spring and insert the S-link.

Place the vacuum piston spring in the vacuum piston bore.

Position a replacement gasket on the main body and install the air horn.

Tighten the retaining screws alternately to compress the gasket evenly.

Install the solenoid.

Adjust the vacuum piston gap. Refer to Service Adjustment Procedures.

Carefully install the vacuum piston and metering rod assembly into its bore in the air horn.

Ensure that the metering rods are inserted in the main metering jets.

Ensure that the metering rod springs are installed properly.

Rotate the bowl vent assembly up and out of the bowl and install the vent seal, if removed.

Place two of the plastic rod lifter tangs under the piston yoke.

Slide the accelerator pump lever shaft through the rod lifter and pump arm.

Install the locks and adjusting screws, but do not tighten.

Install the fast idle cam and linkage. Tighten the retaining screw securely.

Connect the accelerator pump linkage to the pump lever and throttle lever.

Install the retaining clip.

Adjust the vacuum piston and accelerator pump.

Adjust the bowl vent. Refer to Service Adjustment Procedures.

Install the rollover check valve. Use a replacement gasket.

Install the diaphragm assembly and secure with the attaching screws.

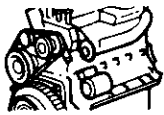
Do not connect the vacuum hose to the vacuum break diaphragm fitting until the initial choke valve clearance has been adjusted. Refer to Service Adjustment Procedures.

Engage the diaphragm link with the slot in the choke lever.

Install the choke lever and screw on the choke shaft.

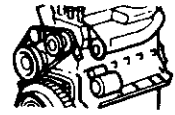
Install the choke housing on the throttle body.

Install the baffle, gasket and cover on the choke housing. Turn the cover 1/4 turn rich (clockwise) and tighten one straight slot-type screw for preliminary adjustment purposes.



ENGINES

FUEL SYSTEM – BBD CARBURETOR



Install the link and retainer between the choke lever and the choke housing lever.

Attach the link and retainer to the fast idle cam and choke lever.

Adjust the initial choke valve clearance. Refer to Service Adjustment Procedures.

Adjust the fast idle cam clearance. Refer to Service Adjustment Procedures.

Adjust the choke unloader clearance. Refer to Service Adjustment Procedures.

Remove the choke cover screw and rotate the cover index to the following basic setting as indicated by index key color:

- **GOLD INDEX KEY** – set the choke index at 0
- **RED INDEX KEY** – set the choke index at one-notch rich
- **GREEN INDEX KEY** – set the choke index at two-notches rich

Install and tighten the choke cover replacement screws.

Install the stepper motor with a replacement gasket.

Install the carburetor. Refer to the installation procedure.

CARBURETOR SERVICE ADJUSTMENTS

Float Level Adjustment

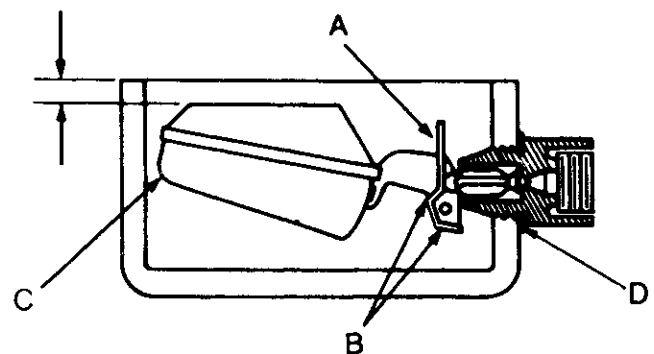
Remove the air horn.

Hold the float gently against the inlet needle to raise the float.

Place a straightedge across the float bowl to measure the float level. Refer to the Specifications chart.

CAUTION: Never bend the float lever while it is resting against the inlet needle. Pressure may damage the synthetic tip and cause an incorrect adjustment.

If adjustment is necessary, release the floats and bend the float lever.

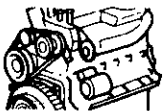


- A - Apply Slight Pressure
- B - Bend to Adjust
- C - Float
- D - Gasket

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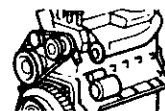
Install the air horn.

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FUEL SYSTEM – BBD CARBURETOR

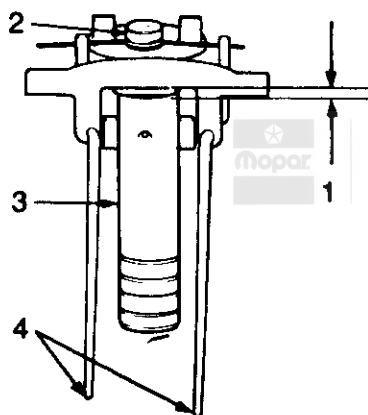


Vacuum Piston Gap Adjustment

The correct vacuum piston gap (1) is a critical adjustment.

- turning the adjusting screw (2) clockwise richens the air/fuel mixture.
- turning the adjusting screw counterclockwise leans the air/fuel mixture

Turn the adjusting screw to adjust the gap. Refer to the Specifications chart.



- 1 - Gap
- 2 - Adjustment Screw
- 3 - Vacuum Piston
- 4 - Metering Rods

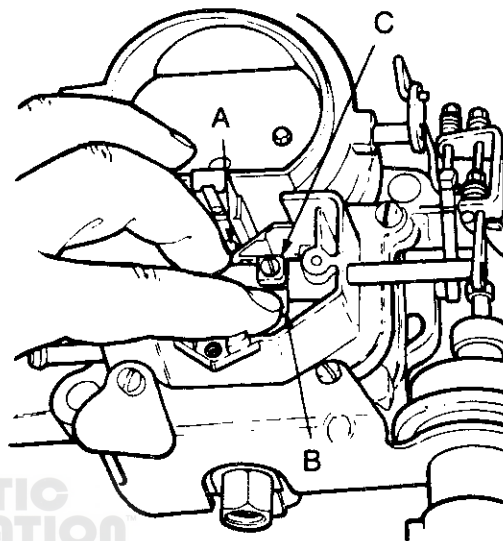
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Vacuum Piston Adjustment

Adjust the vacuum piston gap to the specified dimension.

Turn the curb idle speed adjustment screw counterclockwise until the throttle valves are completely closed. Count and record the number of turns so the screw can be returned to the original position.

Fully depress the vacuum piston (A) while holding moderate pressure on the rod lifter tab (B). While in this position, tighten the rod lifter lock screw (C).



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Release the piston and rod lifter.

Adjust the accelerator pump. Refer to Accelerator Pump Adjustment.

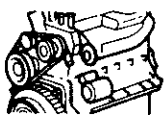
Return the curb idle speed adjustment screw to its original position.

Accelerator Pump Adjustment

Turn the curb idle speed adjustment screw counterclockwise until the throttle valves are completely closed. Count and record the number of turns so that the screw can be returned to the original position.

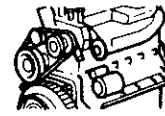
Open the choke valve so that the fast idle cam allows the throttle valves to seat in the bores.

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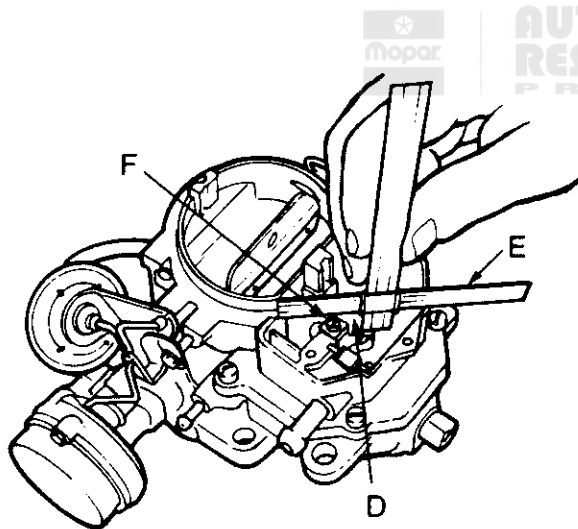


Turn the curb idle speed adjustment screw clockwise until it just barely contacts the stop, then continue two complete turns further.

Measure the distance between the surface of the air horn and the top of the accelerator pump shaft (D) with a T-scale (E). Refer to the Specifications chart for the correct dimension.

Loosen the pump arm adjusting lock screw (F) and rotate the sleeve to adjust the pump travel to the correct dimension. Tighten the lock screw.

Return the curb idle speed adjustment screw to its original position.



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Initial Choke Valve Clearance Adjustment

Grind off the choke housing cover rivets. Remove the remaining portion of the cover rivets.

Turn the cover to 1/4 turn rich position (1). Install and tighten one retaining screw. Use a straight-slot type screw for service.

Open the throttle valve slightly and place the fast idle speed adjustment screw on the high step of the cam.

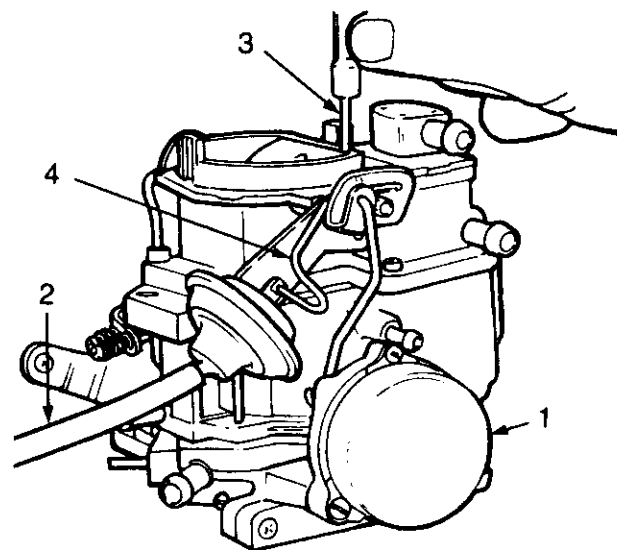
Use Hand Operated Vacuum Pump Tool J-23738-A or any vacuum source that provides vacuum of at least 64 kPa (19 in. Hg) and apply vacuum to force the diaphragm against the stop.

Measure the clearance between the choke valve and the air horn wall with a plug gauge (3). Refer to the Specifications chart for the correct dimension.

Adjust the clearance by bending the vacuum diaphragm connector link (4).

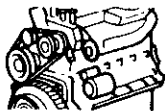
Loosen the choke housing cover retaining straight slot screw and adjust the choke cover index to the specified position.

Install and tighten all the cover retaining screws.



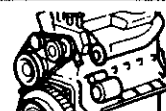
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FUEL SYSTEM – BBD CARBURETOR



Fast Idle Cam Position Adjustment

Grind off the choke housing cover retaining rivets. Remove the remaining portion of the rivets.

Turn the cover to the 1/4 turn rich position (A). Install and tighten one retaining straight-slot type screw.

Open the throttle slightly and place the fast idle speed adjustment screw on the second step of the cam (B).

Measure the distance between the choke valve and the air horn wall with a plug gauge (C).

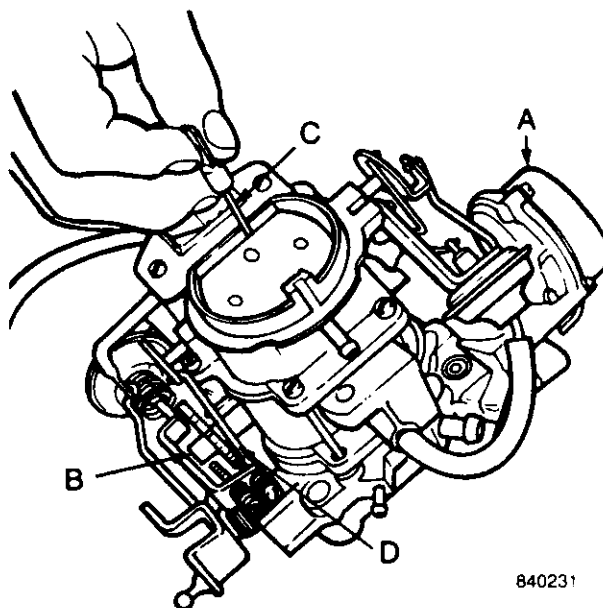
Refer to the Specifications chart for the correct dimension.

Adjust by bending the fast idle cam link (D) down to increase the distance or up to decrease the distance.

Remove the choke housing cover retaining straight slot screw.

Adjust the choke cover index to the specified position.

Install and tighten the choke cover retaining screws.



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Choke Unloader Adjustment

Hold the throttle wide open (1).

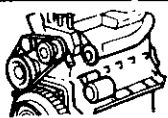
Insert a plug gauge (2) and apply light pressure to close the choke valve (3).

Measure the distance between the choke valve and the air horn wall. Refer to the Specifications chart for the correct dimension.

Adjust by bending choke unloader tang (4).

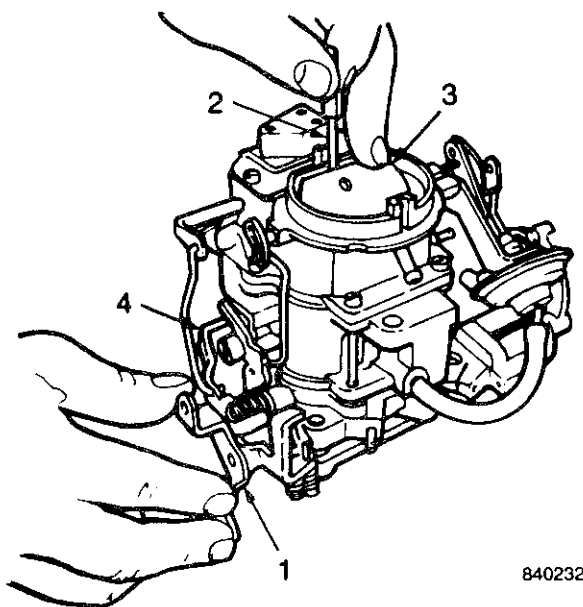
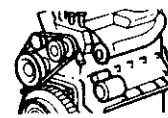
Do not bend the tang so that it binds or interferes with any other component.

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FUEL SYSTEM – BBD CARBURETOR



Fuel Bowl Vent Adjustment

THIS IS NOT A PRECISE ADJUSTMENT.

The fuel bowl vent adjustment is only necessary to ensure that the mechanical fuel bowl vent is open at idle speed and closed at greater throttle openings.

The adjustment can be accomplished with the carburetor either on or off the engine.

Remove the rollover check valve from the air horn to gain access to the metering rod area.

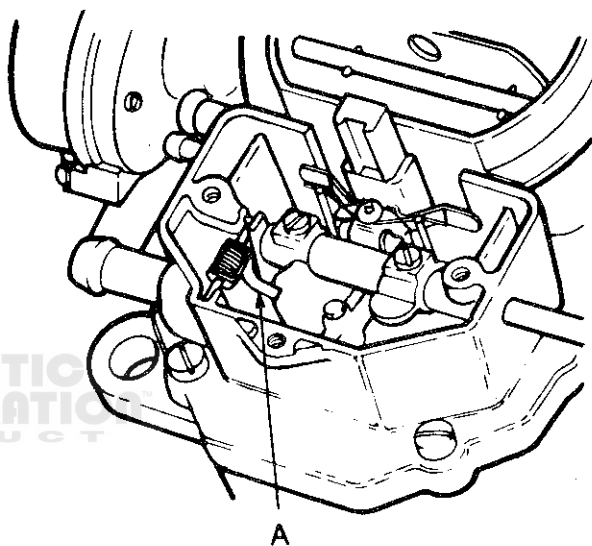
Open the throttle and position the fast idle speed adjustment screw on the high step of the cam.

Observe the fuel bowl vent. It should be closed.

Manually move the cam until the fast idle speed screw drops into the second step of the fast idle cam. The bowl vent should just begin to open.

If the valve is not closed on high, fourth or third steps of the cam, bend the valve tab (A) until it is closed.

If the valve does not just begin to open with the fast idle speed adjustment screw on the second step of the cam, bend the tab until it is just off its seat.



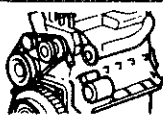
Choke Adjustment (On- or Off-Engine)

NOTE: The choke adjustment is preset during factory assembly and should not normally require readjustment. The choke should be serviced only if absolutely necessary or during major carburetor overhaul.

The automatic choke adjustment is accomplished by removing the housing cover retainers and rotating the cover in the desired direction as indicated by the arrow on the face of the cover.

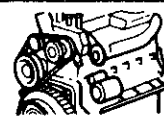
NOTE: Break-away torq-head cover retaining screws are used to discourage indiscriminate choke adjustment.

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FUEL SYSTEM – BBD CARBURETOR



Position the choke cover at the following basic setting as indicated by index key color:

- GOLD INDEX KEY – set the choke index at 0
- RED INDEX KEY – set the choke index at one-notch rich
- GREEN INDEX KEY – set the choke index at two-notches rich

NOTE: The richer the choke setting, the greater length of time that spring tension is exerted against the linkage to hold the choke valve in a closed position. As the electric heater relaxes the spring tension, the fast idle cam weight opens the choke valve.

Fast Idle Speed Adjustment

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.

Adjust the fast idle speed with the engine at normal operating temperature and the EGR valve vacuum hose disconnected and plugged.

Connect a tachometer to the ignition coil negative (TACH) terminal and observe it for the adjustment.

Position the fast idle speed adjustment screw in contact with and against the shoulder of the second step of the fast idle cam.

Refer to the Specifications chart and adjust the engine speed for the correct RPM. Adjust by turning the fast idle speed adjustment screw.

Disconnect the tachometer.

Idle Speed Adjustment

Install the carburetor, fuel pipe, vacuum hoses etc., if removed. Refer to the installation procedure.

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.

Connect a tachometer to the ignition coil negative (TACH) terminal.

Start and allow the engine to attain the normal operating temperature.

The carburetor choke and intake manifold heater must be off. This occurs when the engine coolant heats to approximately 71°C (160°F).

NOTE: When adjusting the idle speed, place a manual transmission in Neutral or an automatic transmission in Drive. Turn all accessories off.

WARNING: Set the parking brake firmly. Do not accelerate the engine.

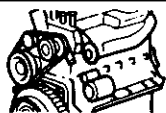
Disconnect the vacuum hose from the Sole-Vac vacuum actuator and plug it.

Disconnect the Sole-Vac holding solenoid wire connector.

Adjust the carburetor curb (slow) idle speed adjustment screw to obtain the specified curb (slow) idle engine RPM, if not at the specified speed. Refer to the Idle Speed chart.

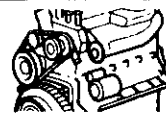
Apply a direct source of vacuum to the vacuum actuator. Use Hand Operated Vacuum Pump Tool J-23738-A, or equivalent.

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FUEL SYSTEM – BBD CARBURETOR



When the Sole-Vac throttle positioner is fully extended, turn the vacuum actuator adjustment screw on the throttle lever until the specified engine RPM is obtained.

Disconnect the vacuum source from the vacuum actuator.

With a jumper wire, apply battery voltage (12V) (or connect the holding solenoid wire connector and turn ON the air conditioner with the compressor clutch wire connector disconnected) to energize the holding solenoid.

Hold the throttle open manually to allow the throttle positioner to fully extend.

NOTE: Without the vacuum actuator, the throttle must be opened manually to allow the Sole-Vac throttle positioner to be fully extended.

If the holding solenoid idle speed is not within specification, adjust the Sole-Vac throttle positioner (hex-head adjustment screw) to obtain the specified engine RPM.

Remove the jumper wire from the Sole-Vac holding solenoid wire connector (if connected).

Connect the Sole-Vac holding solenoid wire connector (if disconnected).

Connect the original vacuum hose to the vacuum actuator.

Remove the tachometer.

If disconnected, connect the A/C compressor clutch wire connector.

Idle Mixture Adjustment

NOTE: It is necessary to remove the carburetor to gain access for removing the dowel pins. Refer to Carburetor Removal for the procedure.

CAUTION: The idle mixture adjustment should only be performed if the adjustment screws were removed during carburetor overhaul for cleaning purposes.

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.

Install the carburetor, fuel pipe, vacuum hoses, etc. Refer to the installation procedure.

Connect a tachometer. Start the engine and warm it to the normal operating temperature.

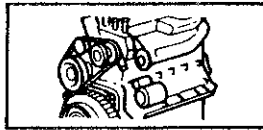
NOTE: Use a tachometer with an expanded scale of 400-800 or 0-1000 RPM. Inspect periodically to ensure the accuracy is within two percent.

Position the gear selector in NEUTRAL for manual transmissions and DRIVE for automatic transmissions. Set the parking brake firmly.

Adjust the idle speed as described in the adjustment procedure. Use the Set-To engine RPM.

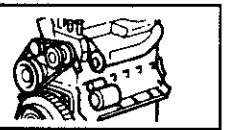
Adjust the mixture screw(s) leaner (clockwise) until a perceptible loss of RPM is noted.

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FUEL SYSTEM – BBD CARBURETOR



Turn the mixture screw(s) richer (counter-clockwise) until the highest RPM indication is obtained. Do not turn the screw(s) any further than the point at which the highest RPM is first obtained. This is referred to as LEAN BEST IDLE.

NOTE: The engine speed will increase above the curb idle speed by an amount that corresponds to approximately the IDLE DROP specification to be obtained in the next step.

As a final adjustment, turn the mixture screws clockwise (leaner) to obtain the specified drop in engine idle RPM.

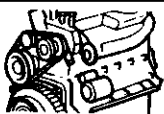
Turn both the idle mixture screws in small, equal amounts until the specified IDLE DROP is achieved. Refer to the Mixture Adjustment chart.

NOTE: If the final engine RPM differs more than ± 30 RPM from the original curb idle RPM, adjust the curb idle speed to the specified RPM and repeat the last two steps listed above.

NOTE: It is necessary to remove the carburetor to gain access for installing the dowel pins. Refer to Carburetor Removal for the procedure.

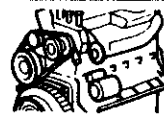
Install the dowel pins after completing the idle mixture adjustment. Use care to prevent disturbing the mixture adjustment screw positions.

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EXHAUST GAS RECIRCULATION SYSTEM



GENERAL INFORMATION

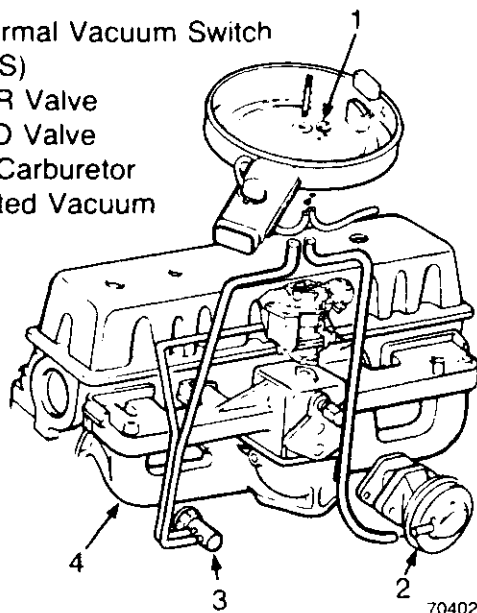
The exhaust gas recirculation (EGR) system consists of a diaphragm-actuated exhaust flow control valve (EGR valve), coolant temperature override (CTO) valve, thermal vacuum switch (TVS), connecting hoses and a forward delay valve.

CAUTION: Do not disconnect the vacuum hose or cause the EGR valve to be inoperative for an extended period of time because preignition could cause piston burning and/or scuffing.

EGR VALVE

The EGR valve is mounted on the side of the intake manifold.

1. Thermal Vacuum Switch (TVS)
2. EGR Valve
3. CTO Valve
4. To Carburetor Ported Vacuum



EGR SYSTEM FUNCTIONAL TESTS

The condition of the exhaust system may affect EGR system operation.

Excessive back-pressure caused by exhaust system restrictions may create driveability problems. Refer to Exhaust Systems for Restricted Exhaust System Diagnosis.

Leaks in the exhaust system may decrease back-pressure enough to prevent proper EGR system operation. This will increase undesirable exhaust emissions.

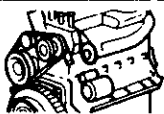
Visually inspect the exhaust system if leaks are suspected.

EGR Valve Opening Test

With the engine at normal operating temperature and at curb idle speed, rapidly open and close the throttle.

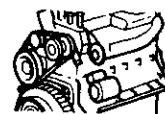
The throttle should be opened sufficiently to allow the engine speed to reach 1500 RPM.

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EXHAUST GAS RECIRCULATION SYSTEM



A distinct movement should be noticed in the EGR valve control diaphragm (1).

- defective EGR valve diaphragm

- defective back-pressure sensor diaphragm.

Inspect the vacuum hoses for air leaks.

EGR Valve Closing Test

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

With the engine at normal operating temperature and at curb idle speed, manually depress the EGR valve diaphragm.

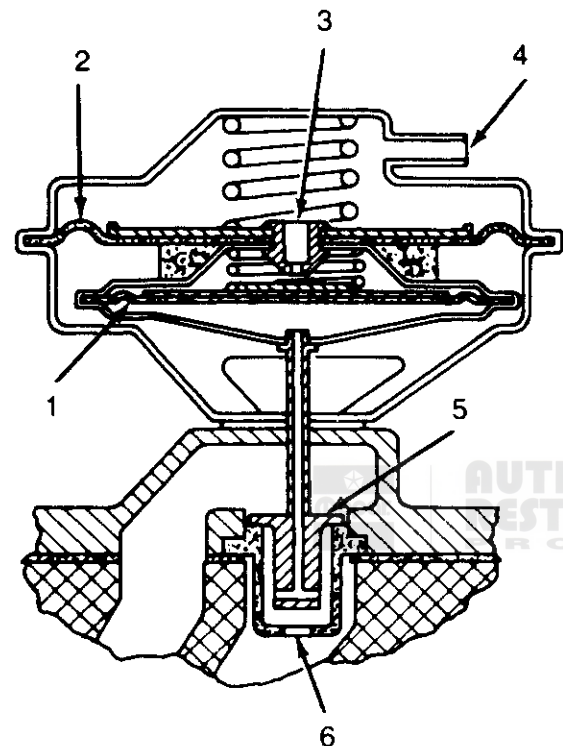
This should cause an immediate drop in engine RPM and indicate that the EGR valve has been properly preventing the flow of exhaust gas to the intake manifold at idle speed.

If there is no change in engine RPM and the engine is idling properly, exhaust gases are not reaching the combustion chamber.

The probable malfunction is a restricted passage between the EGR valve and the intake manifold.

If the engine idles improperly and RPM is not greatly affected by depressing the EGR valve diaphragm, the EGR valve is not preventing the flow of exhaust gases to the intake manifold.

There is either a fault in the vacuum hoses, improper hose connection or the valve is defective.



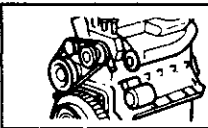
1. Control Diaphragm
2. Power Diaphragm
3. Vent Valve
4. Vacuum Hose Nipple
5. Pintle
6. Control Flow Area

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If the diaphragm does not move, the probable causes are a:

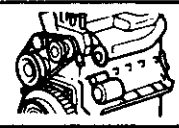
- defective vacuum hose to the EGR valve

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EXHAUST GAS RECIRCULATION SYSTEM



EGR VALVE REMOVAL

Remove the air cleaner assembly.

Identify, tag and disconnect the vacuum hoses.

Remove the EGR valve retaining nuts from the manifold.

Remove the EGR valve, gaskets and restrictor plate or spacer, if equipped.

Discard the gasket and clean the mating surface.

EGR VALVE INSTALLATION

Install the EGR valve and a replacement gasket. If the restrictor plate is used, place it between the two replacement gaskets.

Install the retaining nuts and tighten.

Connect all the vacuum hoses.

Replace the air cleaner assembly.

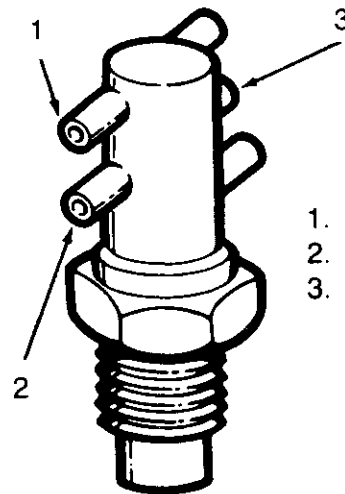
EGR SYSTEM CTO VALVE

The EGR system CTO valve is located in the coolant passage at the left front side of the intake manifold.

The dual-function valve is also used for distributor vacuum advance control.

The outer port (1) connects by a hose to ported vacuum at the carburetor.

The inner port (2) connects by a hose to the EGR thermal vacuum switch (TVS).



- 1. To Ported Vacuum
- 2. To TVS
- 3. To Distributor

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When the coolant temperature is below the calibrated rating of the CTO valve, there is no vacuum applied to the EGR valve.

For six-cylinder engines, the CTO valve starts to open at 46°C (115°F) and at 57°C (135°F) for four-cylinder engines.

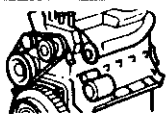
NOTE: The temperature ratings are nominal values and the actual valve opening temperature will vary slightly from unit to unit.

EGR SYSTEM CTO VALVE FUNCTIONAL TEST

NOTE: The engine coolant temperature must be 5.6°C (10°F) below the calibrated opening temperature of the valve.

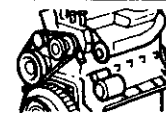
Inspect the vacuum hoses for air leaks and correct the routings/connections.

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EXHAUST GAS RECIRCULATION SYSTEM



Disconnect the hose at the TVS and connect it to a vacuum gauge.

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.

Operate the engine at approximately 1500 RPM. No vacuum should be indicated on the gauge. If vacuum is indicated, replace the CTO valve.

Operate the engine until the coolant temperature exceeds 46°C (115°F) for six-cylinder engines and 57°C (135°F) for four-cylinder engines.

Accelerate the engine at 1500 RPM. Carburetor ported vacuum should be indicated on the vacuum gauge. If not, replace the CTO valve.

EGR SYSTEM CTO VALVE REMOVAL

WARNING: Serious personal injury can result if the cooling system pressure is not released and hot coolant drained before removing the valve from the intake manifold.

NOTE: Do not waste reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

Drain the coolant from the radiator.

Identify, tag and disconnect the vacuum hoses from the valve.

Use an open-end wrench to remove the valve from the intake manifold.

EGR SYSTEM CTO VALVE INSTALLATION

Install the replacement dual-function CTO valve in the intake manifold.

Connect the vacuum hoses.

Fill the cooling system and purge any air from the system.

Test the operation of the valve. Refer to Chapter C – ELECTRICAL for information concerning the distributor vacuum advance CTO valve test.

EGR SYSTEM THERMAL VACUUM SWITCH (TVS)

The thermal vacuum switch (TVS) is located in the air cleaner and functions as an on-off switch controlled by air cleaner intake air temperature.

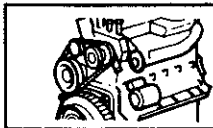
The TVS controls the vacuum between the EGR system CTO valve and the EGR valve.

At air temperatures below 4° - 13°C (40° - 55°F), the TVS prevents vacuum from opening the EGR valve, which prevents EGR operation. This improves cold engine driveability.

NOTE: The temperature ratings are nominal values and the actual switching temperature will vary slightly from unit to unit.

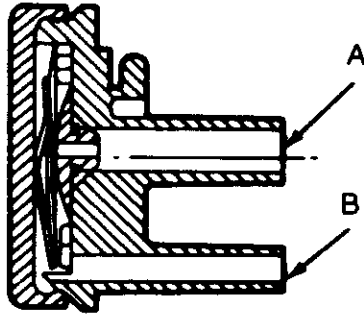
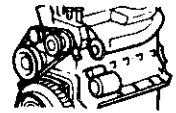
NOTE: A TVS is also used for other engine related systems to control operations that require air cleaner intake air to be at the proper temperature before system operation is activated.

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ENGINES

EXHAUST GAS RECIRCULATION SYSTEM



A - To EGR - CTO Valve
B - To EGR Valve

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EGR SYSTEM THERMO VACUUM SWITCH (TVS) FUNCTIONAL TEST

Cool the air cleaner intake air below the TVS calibrated temperature, 4°C (40°F).

Disconnect the vacuum hoses from the TVS and connect a vacuum pump to the inner port.

Apply vacuum to the TVS. Vacuum should be maintained by TVS check valve. If vacuum is not maintained, replace the TVS.

Start the engine and warm the air cleaner intake air to above 13°C (55°F). Vacuum should not be maintained. If vacuum is maintained by TVS, replace it.

EGR SYSTEM THERMO VACUUM SWITCH REMOVAL

Remove the air cleaner.

Remove the vacuum hoses from the TVS.

Remove the retaining clip(s) attaching the TVS to the air cleaner.

Remove the TVS.

EGR SYSTEM THERMO VACUUM SWITCH INSTALLATION

Install the TVS in the air cleaner.

Install the retaining clip(s).

Install the vacuum hoses.

Install the air cleaner.

EGR SYSTEM FORWARD DELAY VALVE

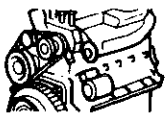
The EGR system forward delay valve is used with certain four-cylinder engines. It is located between the EGR TVS and the EGR valve. Refer to the Vacuum Diagram for the exact location.

Its purpose is to modify the initial vacuum applied to the EGR valve by delaying the full vacuum force.

With a gradual vacuum applied to the EGR valve, a harsh, sudden activation of the EGR system is avoided.

The black side of the valve must always be installed toward the EGR vacuum source.

SEE
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ENGINES

EXHAUST GAS RECIRCULATION SYSTEM



EGR SYSTEM FORWARD DELAY VALVE FUNCTIONAL TEST

Apply a constant vacuum of 34 kPa (10 in. Hg) to the black side of the delay valve.

Connect one end of a 61cm (24-in) section of vacuum to the vacuum gauge and the other end to the colored side of the delay valve.

Observe the time in seconds for the gauge pointer to move from 0 - 27 kPa (0 - 8-in. Hg) vacuum.

The minimum and maximum time for each valve type to reach 27 kPa (8-in. Hg) is listed in the Forward Delay Valve Test chart.

NOTE: When testing a delay valve, care must be exercised to prevent oil or dirt from entering the valve because this will impair its functioning.

Replace the delay valve if the functional test indicated it to be defective. Otherwise, install the delay valve in its original position.

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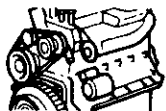


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PRODUCT**

Forward Delay Valve Test

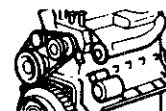
COLOR	PART NUMBER	TIME IN SEC.	
		MIN.	MAX.
BLK/GRAY	323 5261	10	± 2
BLK/BROWN	323 7293	20	± 4
BLK/WHITE	323 1379	63.5	± 13.5
BLK/YELLOW	323 1118	100	± 20
BLK/PURPLE	323 6284	4	± 0.8
BLK/GREEN	323 0422	200	± 40
BLK/ORANGE	323 9134	2	± 0.5

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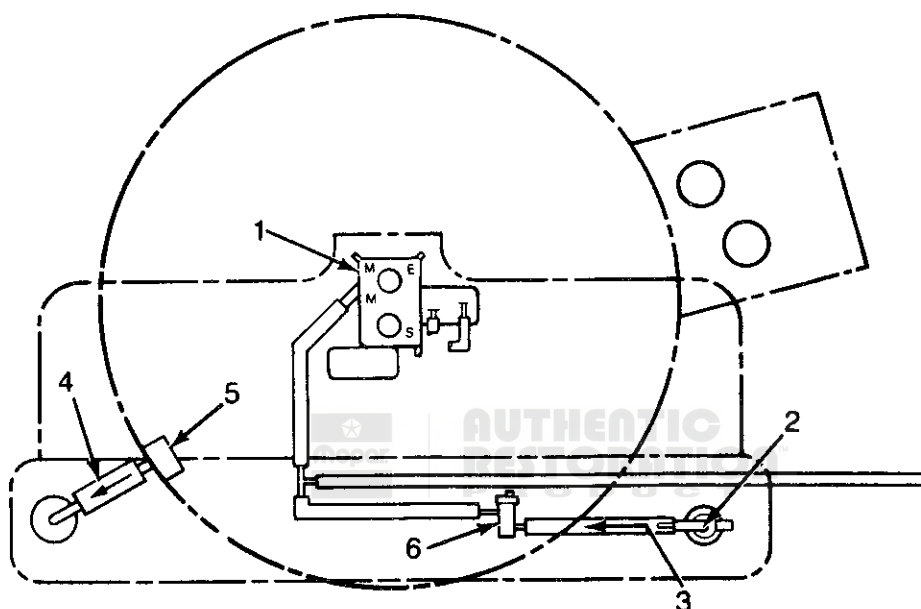
ENGINES

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



GENERAL INFORMATION

The PCV system consists of an air inlet filter, a flow-control (PCV) valve plus associated hoses, and a PCV solenoid. The air inlet filter is located inside the air cleaner housing.



Six-Cylinder Engine

1. Carburetor
2. PCV Valve
3. PCV Air Out
4. PCV Air In
5. PCV Filter
6. PCV Solenoid

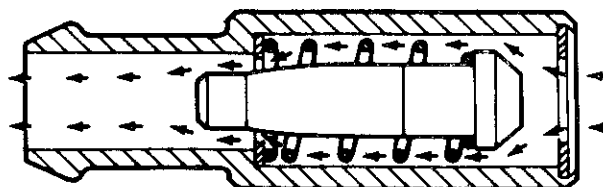
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PCV VALVE FUNCTIONAL TEST

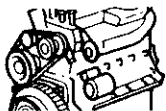
Test the valve at idle speed for the correct flow rate (l/s or cfm).

The engine intake manifold vacuum level must be at least 47.28 kPa (14 in. Hg).

When determining the vacuum level, connect the vacuum gauge to a fitting that is as centrally located as possible on the intake manifold.

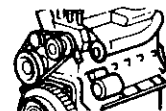


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ENGINES

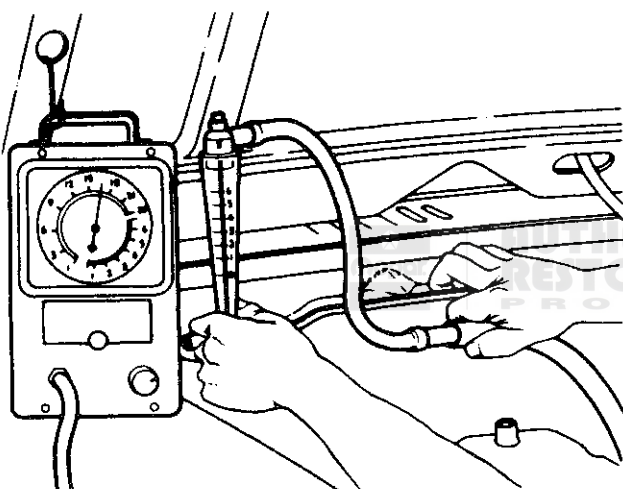
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



Remove the valve from the grommet in the cylinder head cover.

Connect the plastic hose of PCV Valve Tester J-23111, or equivalent, to the valve.

NOTE: Hold the PCV valve in a horizontal position and tap lightly during the test. Hold the tester in a vertical position.



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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.

Start the engine and allow it to idle. Observe the flow rate (l/s or cfm). Refer to PCV Valve Flow Rate chart.

PCV Valve Flow Rate

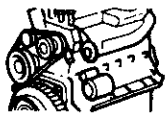
Engine Manifold Vacuum in kPa (Hg.)	Air Flow Liters/Second (CFM)
54 (16) 50.66 (15)	0.0 - 0.094 (0.0 - 0.2)
37 (11) 20.26 (6)	0.424 - 0.943 (0.9 - 2.0)
17 (5) 10.13 (3)	0.708 - 1 - 1.18 (1.5 - 2.5)

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With a low vacuum level, it may be necessary to load the engine while testing the flow rate.

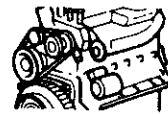
Replace the valve if the airflow rate is either above or below the specification. Ensure the correct PCV valve is used for replacement.

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POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM



PCV AIR INLET FILTER REMOVAL

NOTE: Perform the air inlet filter maintenance at the intervals specified in the Maintenance Schedule.

The polyester, nonwoven felt PCV air filter is located in the filter retainer in the air cleaner housing.

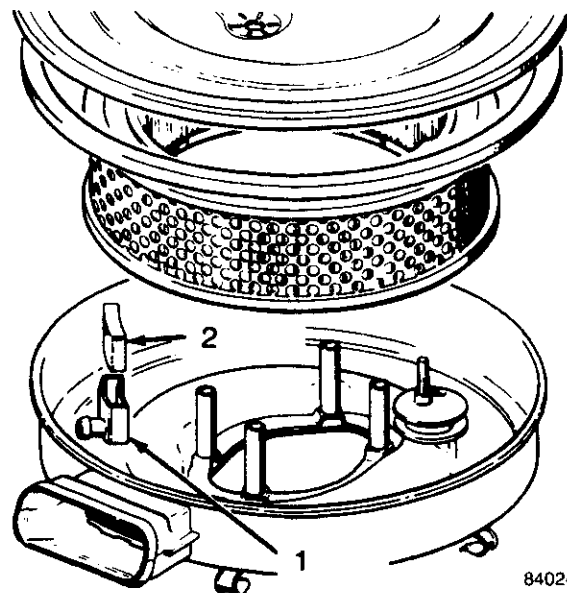
Rotate the retainer (1) and remove the retainer and filter (2) from the air cleaner housing.

PCV AIR INLET FILTER CLEANING AND INSPECTION

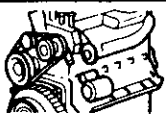
Replace or clean the filter and retainer in kerosene.

PCV AIR INLET FILTER INSTALLATION

Install the filter and retainer in the air cleaner housing.

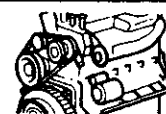


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ENGINES

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC)



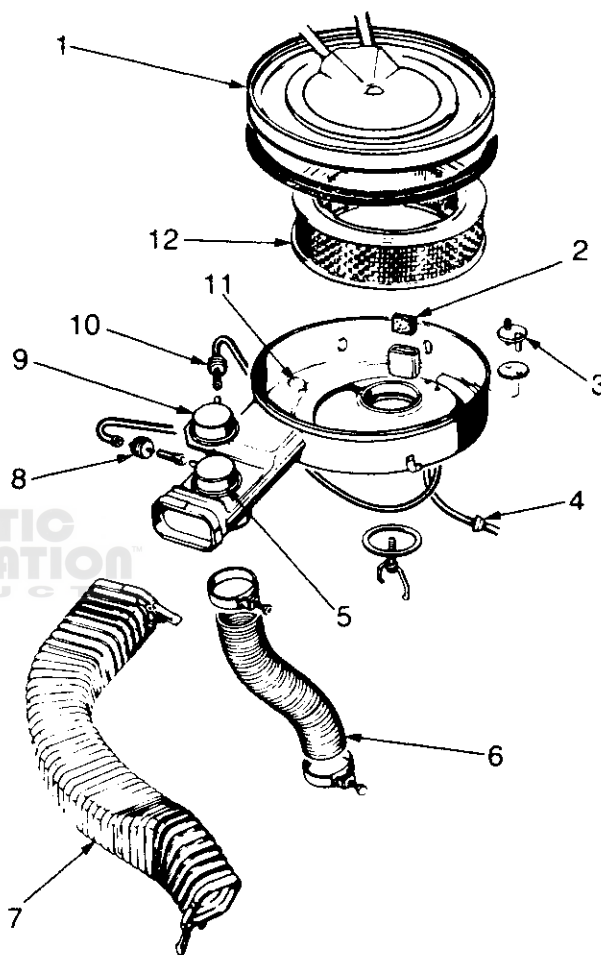
GENERAL INFORMATION

The thermostatically controlled air cleaner (TAC) system provides heated air for the carburetor during engine warm-up.

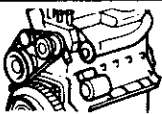
The TAC system is comprised of a heat stove that partially encloses the exhaust manifold, a heated air tube, a special air cleaner assembly equipped with a thermal switch, a reverse delay valve, a check valve and a vacuum motor and air valve assembly.

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NOTES

TAC SYSTEM – SIX-CYLINDER ENGINE

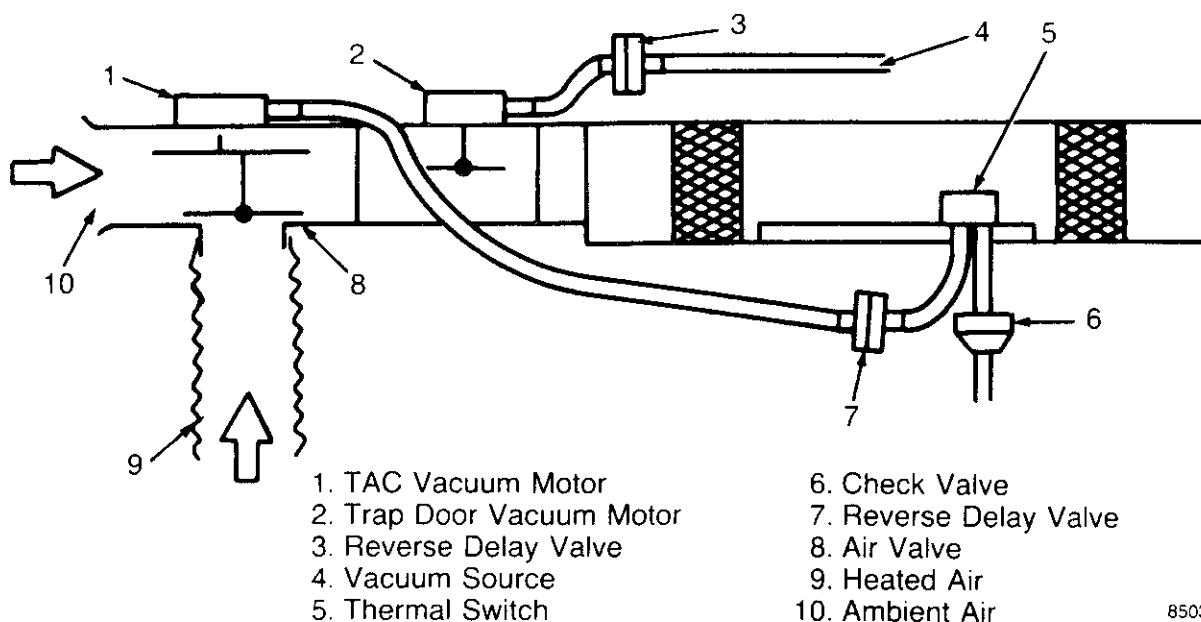
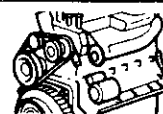


1. Air Cleaner Cover
2. PCV Valve Filter
3. Thermal Switch
4. Check Valve
5. Vacuum Motor
6. Heated Air Tube
7. Ambient Air Duct
8. Reverse Delay Valve
9. Trap Door Assembly
10. Reverse Delay Valve
11. Thermal Vacuum Switch
12. Filter Element



ENGINES

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC)



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AIR VALVE VACUUM MOTOR FUNCTIONAL TEST

With the engine off, detach the ambient air duct at the air cleaner and observe the position of the air valve. It should be fully open to incoming ambient air (heat in the OFF position).

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.

Start the engine and observe the position of the air valve. It should be fully closed to incoming ambient air (heat in the ON position).

Depress the throttle rapidly (1/2 - 3/4-position) and release. The air valve should briefly remain stationary and then move toward the heat OFF position and back to heat ON position.

Loosely attach the ambient air duct to the air cleaner and warm the engine to the normal operating temperature.

Remove the ambient air duct and observe the air valve. It should be either fully open to ambient air or at a mixture position that provides the correct inlet air temperature to the carburetor.

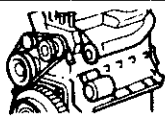
Stop the engine and connect the ambient air duct to the air cleaner.

If the air valve does not function as described in the test, inspect for:

- a mechanical bind in the snorkel
- vacuum hoses being disconnected
- air leaks either at the vacuum motor, thermal switch, reverse delay valve, check valve, intake manifold or vacuum hoses

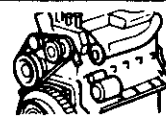
If the air valve manually operates freely and no hose disconnections or air leaks are detected, connect a hose from the intake manifold vacuum source directly to the vacuum motor and the start engine.

SEE
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NOTES



ENGINES

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC)



If the air valve closes, either the thermal switch, reverse delay or check valve is defective and must be replaced. If the air valve does not close, replace the vacuum motor.

AIR VALVE VACUUM MOTOR REMOVAL

CAUTION: The heated air tube is connected to the air cleaner snorkel by a clamp. If the duct is not detached prior to air cleaner removal, the tube and stove may be damaged.

Remove the air cleaner.

Disconnect the vacuum hoses from the air valve motor, thermal switch and trap door motor, if equipped.

Remove the rivet attaching the air valve vacuum motor to the snorkel.

Lift the motor, tilt it to one side to disconnect the motor linkage from the air valve assembly and remove the motor.

AIR VALVE VACUUM MOTOR INSTALLATION

Insert the replacement vacuum motor linkage into the air valve assembly and position it in the snorkel.

Attach the motor to the snorkel with a rivet.

NOTE: Ensure that the rivet does not interfere with the movement of the air valve. Correct as necessary.

Connect the vacuum hoses. Install the air cleaner assembly and test for proper operation of the TAC system.

THERMAL SWITCH FUNCTIONAL TEST

Disconnect the vacuum hoses from the thermal switch.

Connect the vacuum pump and vacuum gauge to the switch.

Apply 47 kPa (14 in. Hg) vacuum to the switch.

With the switch below 5°C (40°F), vacuum should be maintained.

Heat the switch to above 13°C (55°F). The air vent valve should open and decrease the vacuum to zero.

Replace the switch if defective.

NOTE: The temperatures listed above are nominal switching values.

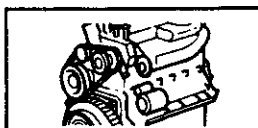
THERMO SWITCH REMOVAL

CAUTION: The heated air tube is attached to the snorkel by a clamp. If the tube is not detached prior to air cleaner removal, the heated air tube and heat stove may be damaged.

Remove the air cleaner housing.

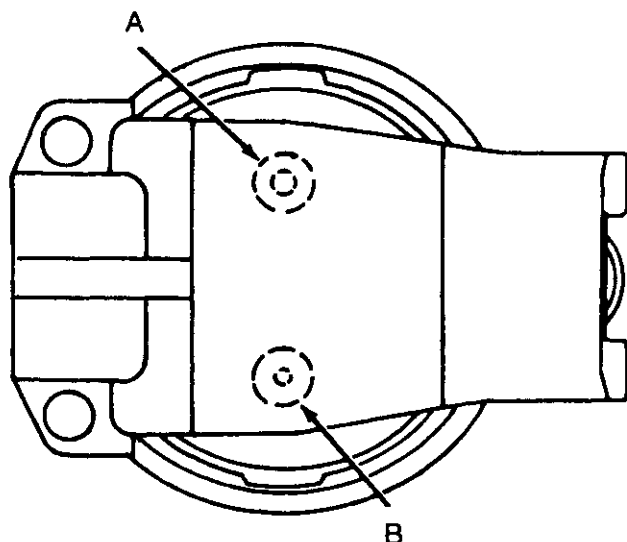
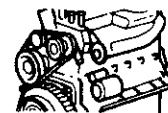
Disconnect the hoses from the switch.

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ENGINES

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC)



- A - To Vacuum Motor
B - To Vacuum Source

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Pry the tabs up on the switch retaining clip. Remove the clip, gasket and switch from the air cleaner housing. Note the position of the switch for installation reference.

THERMAL SWITCH INSTALLATION

Install a replacement switch and gasket assembly in the air cleaner.

Press the retainer clip on the hose nipple connectors.

Connect the vacuum hoses and install the air cleaner housing on the engine.

Test for proper operation of the TAC system.

AIR CLEANER TRAP DOOR

Vehicles equipped with six-cylinder engines have air cleaners with spring-loaded trap doors to close-off the air cleaner/carburetor when the engine is inoperative.

TRAP DOOR FUNCTIONAL TESTS

With the engine off, remove the air cleaner cover and observe the position of the trap door (1). It should be closed.

Remove the vacuum hose from the intake manifold vacuum source and apply an external vacuum of approximately 6.8 - 13.5 kPa (2 - 4 in. Hg). The trap door should open.

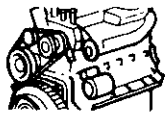
If the door does not open, apply vacuum directly to the vacuum motor (2) on air cleaner intake duct.

If the door does not open, inspect for binding/distortion and adjust as necessary.

Replace the motor if the door swings freely.

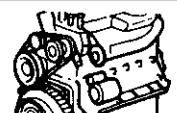
If the door opens during the step above, inspect the vacuum hose for obstruction, cracks and kinks. Correct as necessary and retest.

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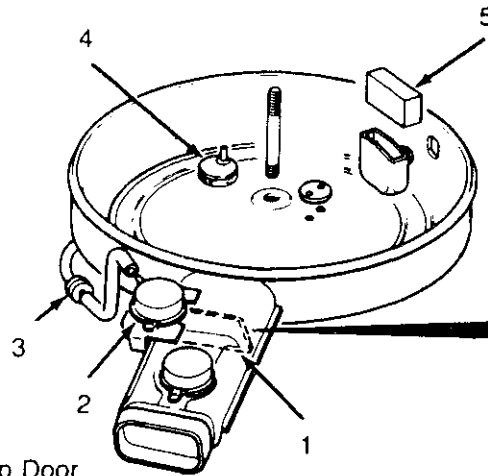


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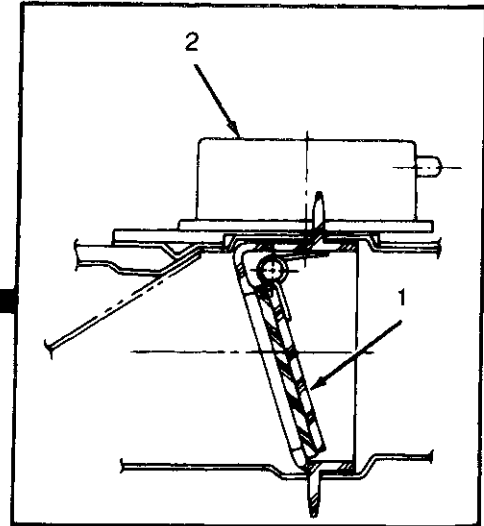
THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC)



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1. Trap Door
2. Trap Door Vacuum Motor
3. Reverse Delay Valve
4. Thermal Vacuum Switch (TVS)
5. PCV Filter



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If the vacuum hose is not defective, remove the reverse delay valve (3), join the vacuum hose with an adapter and retest as described above.

If the door opens, replace the reverse delay valve.

Reverse Delay Valve Functional Test

The reverse delay valve provides approximately 100 seconds delay before allowing the trap door to completely close. Test the valve according to the following procedure.

Remove the vacuum hose from the yellow end of the valve and apply an external vacuum of approximately 6.8 - 13.5 kPa (2 - 4 in. Hg).

With an elapsed time indicator, note the time required for atmospheric pressure to pass through valve and eliminate the vacuum.

Replace the valve if the time required to eliminate the vacuum is less than 4.5 seconds or more than 13.2 seconds.

NOTE: Install a replacement reverse delay valve with the yellow end toward the trap door vacuum motor.

TRAP DOOR VACUUM MOTOR REMOVAL

Disconnect the vacuum hoses, heated and ambient air ducts, and remove the air cleaner housing.

Remove the trap door vacuum motor attaching rivet from the bracket.

Lift the motor away from the bracket. Rotate it to clear the door arm and remove.

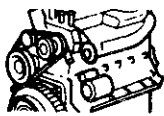
TRAP DOOR VACUUM MOTOR INSTALLATION

Rotate the replacement motor to clear the door arm and lower it into the bracket.

Secure the replacement motor to the bracket with a rivet.

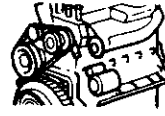
Install the air cleaner, ducts and vacuum hoses.

Test the operation of the trap door.



ENGINES

FUEL FEEDBACK SYSTEMS



COMPUTERIZED EMISSION CONTROL (CEC) FUEL FEEDBACK SYSTEMS

The CEC Feedback System for six-cylinder engines controls undesirable emission to the atmosphere and maintains an ideal air/fuel ratio to provide an optimum balance between emission control and engine performance.

This is accomplished by the use of a micro computer unit (MCU), several MCU input components and several MCU output components.

This system uses the micro computer unit (MCU) to monitor various engine operating conditions.

Based on these conditions, the MCU may, depending on the mode of operation, generate output signals to provide the proper air/fuel mixture, proper ignition timing and engine idle speed.

Each system operates in two modes of operation: closed loop and open loop.

Closed loop operation occurs when the air/fuel ratio is varied according to the oxygen content in the exhaust gas.

During open loop operation, the air/fuel ratio is predetermined by the MCU for several engine operating conditions, such as:

- start-up
- cold engine operation
- wide open throttle (WOT) engine operation

When the engine is started, the MCU determines which mode of operation (closed loop or open loop) is correct.

It can determine this by monitoring the input signals from the various input components.

Air and coolant temperature information, engine RPM information and vacuum levels are all provided to the MCU for this determination.

The MCU operates the system in the open loop mode based on a priority rating for the various predetermined engine operating conditions.

It continues to operate the system and the output components in the open loop mode until such time when the engine operating conditions indicate that the closed loop mode of operation is appropriate.

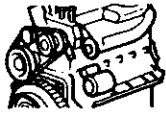
At this time, the MCU shifts the operation to closed loop.

Based upon the oxygen content in the exhaust gas and other inputs, it continues to operate the system in the closed loop mode and constantly varies the air/fuel ratio to maintain an optimum 14.7:1 ratio.

As the engine operating conditions are constantly monitored by the MCU, any change in condition such as the engine being placed in wide open throttle (WOT) operation, is quickly detected by the MCU.

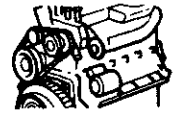
The MCU then places the system back in the appropriate open loop mode of operation.

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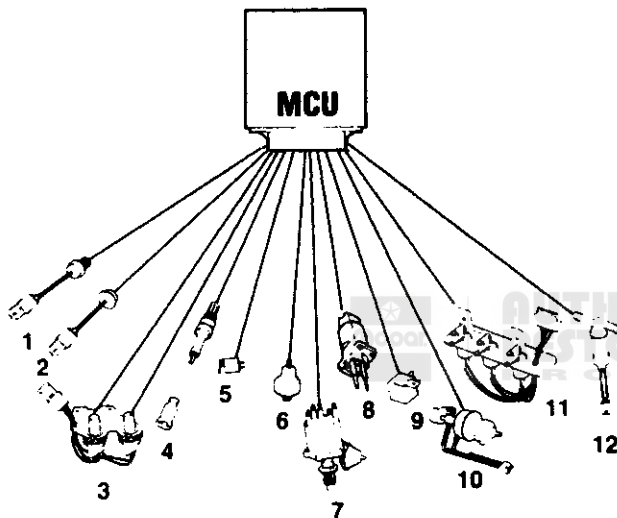


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FUEL FEEDBACK SYSTEMS



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Inputs

1. Coolant Temperature Switch
2. Thermal Electric Switch
3. Four- and Ten-Inch Hg Vacuum Switches
4. Oxygen Sensor
5. Wide Open Throttle (WOT) Switch
6. Knock Sensor
7. Distributor

Outputs

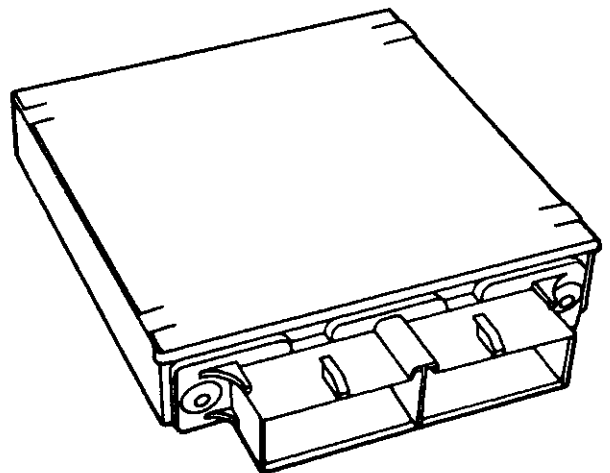
8. Stepper Motor
9. Idle Relay
10. Sole-Vac Throttle Positioner
11. Upstream and Downstream Solenoids
12. PCV Solenoid

Micro Computer Unit (MCU)

The MCU is a microprocessor that monitors various engine operating conditions.

Based upon these conditions, the MCU generates output control signals to provide the correct air/fuel mixture, proper ignition timing and engine idle speed.

The MCU is a permanently sealed module located in the passenger compartment.



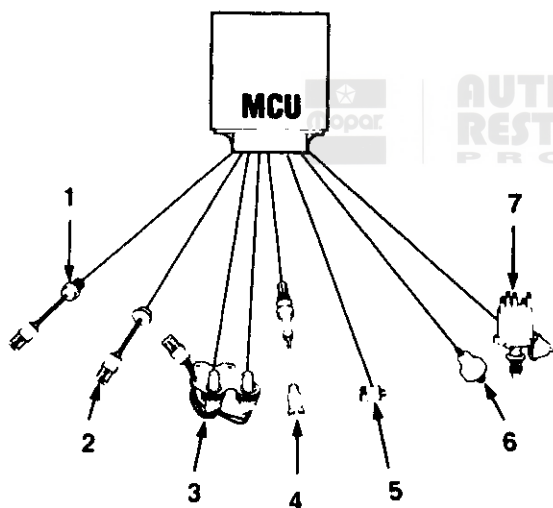
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	ENGINES FUEL FEEDBACK SYSTEMS	
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MCU Inputs

The MCU monitors engine operating conditions by receiving input signals from several components. Refer to the illustration.



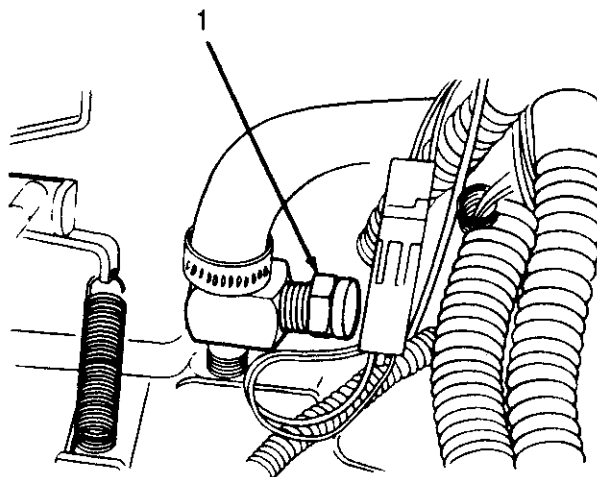
1. Coolant Temperature Switch
2. Thermal Electric Switch
3. Four-and Ten-Inch Hg Vacuum Switches
4. Oxygen Sensor
5. Wide Open Throttle (WOT) Switch
6. Knock Sensor
7. Distributor

Coolant Temperature Switch

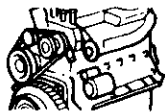
The coolant temperature switch (1) is located at the rear of the intake manifold. It provides the MCU with the temperature of the engine coolant (i.e., whether it is cold or warm).

At a temperature less than 57°C (135°F), the switch is open, indicating a cold engine condition. When the engine coolant is sufficiently warmed, 57°C (135°F) and above, the switch closes.

NOTE: The switching temperatures are nominal values.

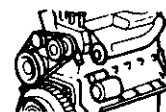


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FUEL FEEDBACK SYSTEMS

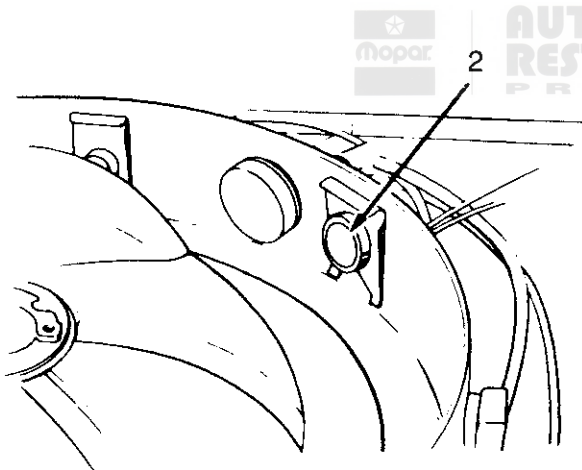


Thermal Electric Switch

The thermal electric switch (2) is located inside the air cleaner.

It detects the incoming air temperature and indicates to the MCU a cold weather engine start-up condition when the air temperature is below 10°C (50°F).

Above 18°C (65°F), it provides an open circuit to indicate a warm engine start-up condition to the MCU.



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Four- and Ten-Inch Hg Vacuum Switches

The 4-inch Hg (A) (ported vacuum) and 10-inch Hg (B) (adaptive vacuum) switches are located together in a bracket attached to the dash panel (center) in the engine compartment.

The 4-inch Hg vacuum switch can be identified by its natural color.

The 10-inch Hg vacuum switch is green in color.

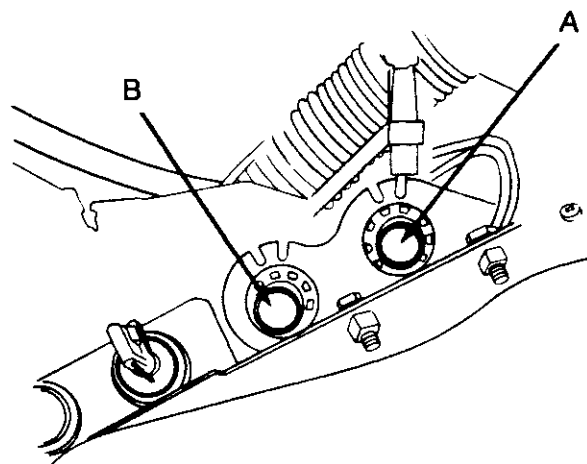
The 4-inch Hg vacuum switch is controlled by ported vacuum. Its electrical contact is normally in the open position when the vacuum level is less than 4-inch Hg. When the vacuum level is 4-inch Hg or greater, the switch closes.

The 4-inch Hg vacuum switch indicates to the MCU when either a closed or deep throttle condition exists.

The 10-inch Hg vacuum switch is controlled by the manifold vacuum. Its electrical contact is normally closed when the vacuum level is less than 10-inch Hg. When the vacuum level is 10-inch Hg or greater, the switch opens.

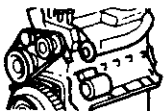
This indicates to the MCU that either a partial throttle or a medium throttle condition exists.

NOTE: The switching values are nominal.



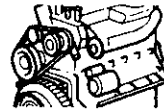
85054

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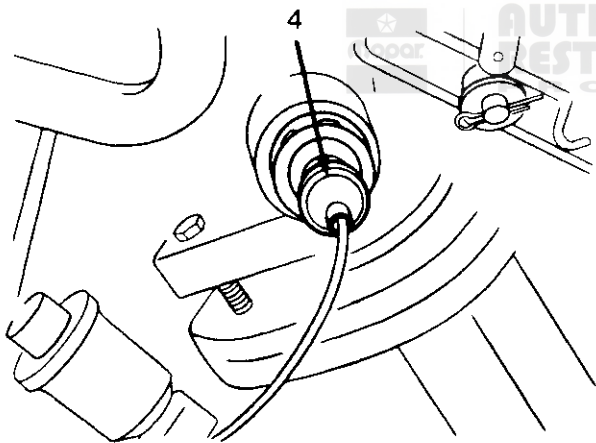
Oxygen Sensor

The oxygen sensor (4) is located in the exhaust manifold.

It reacts to the oxygen content in the exhaust gas and provides a variable voltage to the MCU.

The MCU then adjusts the air/fuel mixture based on the voltage received from the oxygen sensor and other inputs.

A lean air/fuel mixture causes a greater oxygen content in the exhaust gas and a rich air/fuel mixture causes less oxygen content.



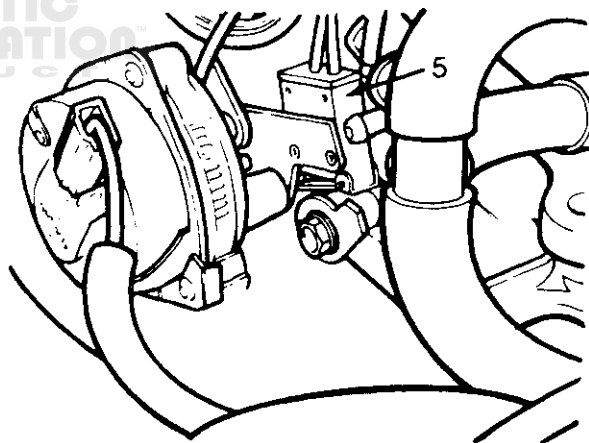
85053

Wide-Open Throttle (WOT) Switch

The wide-open throttle (WOT) switch (5) is attached to the base of the carburetor by a mounting bracket.

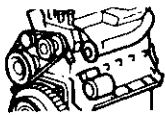
The switch is a mechanically operated electrical switch. It is controlled by the position of the throttle.

When the throttle is placed in the wide-open position, a cam on the throttle shaft actuates the switch at 15° from wide-open throttle position to indicate a wide-open throttle condition to the MCU.



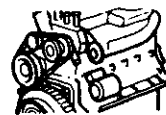
86531

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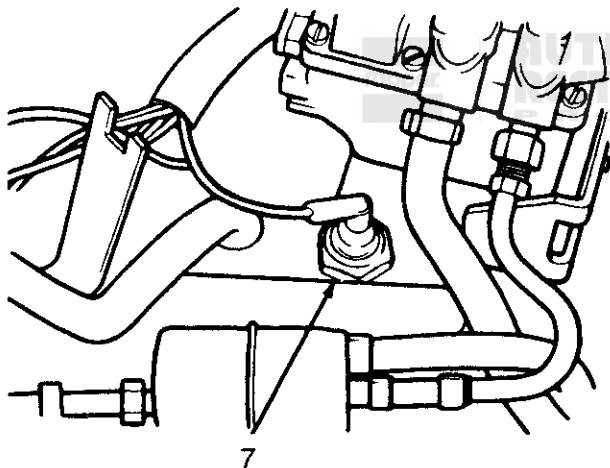
FUEL FEEDBACK SYSTEMS



Knock Sensor

The knock sensor (7) is a tuned piezoelectric crystal transducer that is located in the cylinder head.

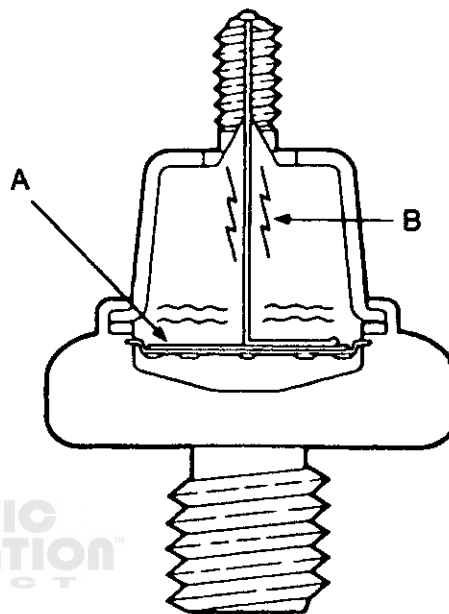
The knock sensor provides the MCU with an electrical voltage that is produced by oscillations that correspond to its center frequency (5,550 Hz).



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Vibrations from engine knock (ping) cause the crystal (A) inside the sensor to oscillate and produce the electrical voltage (B).

Based on the input, the MCU can selectively retard the ignition timing of any single cylinder or a combination of cylinders to eliminate the knock (ping) condition.



85059

Distributor

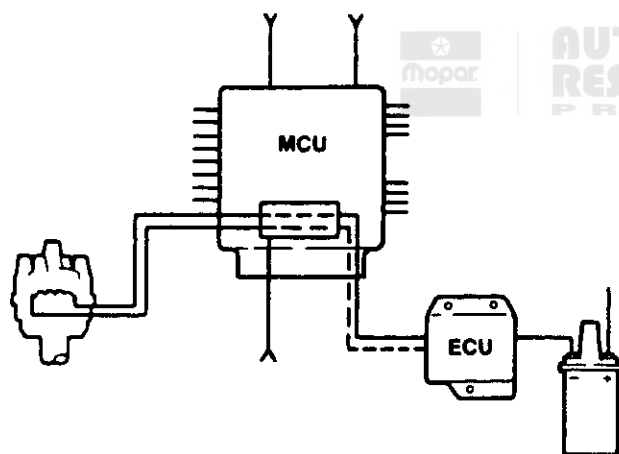
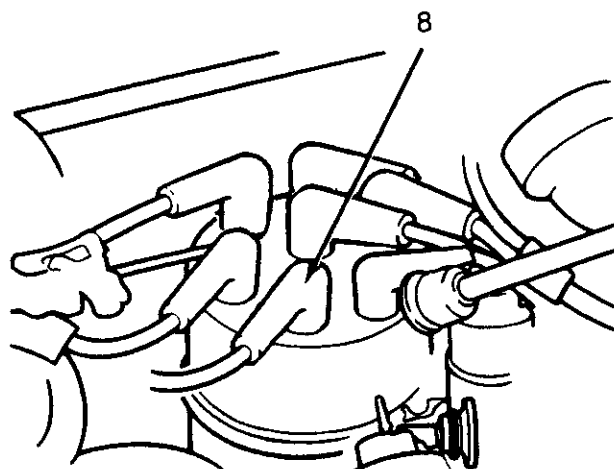
The MCU also changes the ignition timing according to the engine speed (tach) voltage input provided by the distributor (8).

With other ignition systems, the distributor information is routed directly to the ignition system electronic control unit (ECU).

With the CEC Fuel Feedback System, the distributor information must first pass through the MCU.

The MCU then advances or retards the ignition timing as necessary for the engine operating condition that is occurring.

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85060A

Altitude Jumper Wire

The altitude jumper wire is located in the engine compartment taped to the CEC system wire harness.

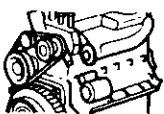
The jumper wire provides the MCU with an indication of whether or not the vehicle is being operated above or below a 6 400-meter (4,000-foot) altitude.

The jumper wire is normally not connected to engine ground. For vehicles operated above 6 400 meters (4,000 feet), the jumper wire must be connected to engine ground.

To connect the altitude jumper wire, remove the tape and extend the wire to the engine ground screw located next to the ignition coil. Remove the screw and attach the eyelet terminal to the engine.

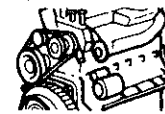
NOTE: Additional engine ground wire connectors are also attached to the engine with the screw.

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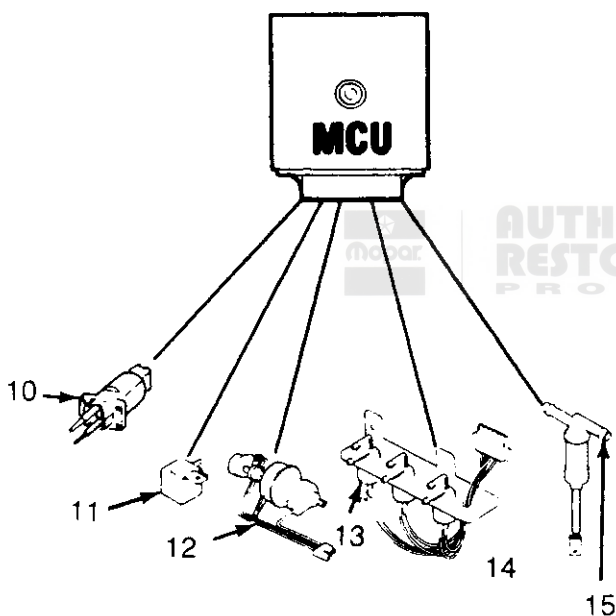
ENGINES

FUEL FEEDBACK SYSTEMS



MCU Outputs

Based on the information received from the various MCU inputs, the MCU generates a number of outputs that provide the correct air/fuel mixture, ignition timing and engine idle speed.



- 10. Mixture Control Solenoid Stepper Motor
- 11. Idle Relay
- 12. Sole-Vac Throttle Positioner
- 13. Idle Solenoid
- 14. Upstream and Downstream Solenoids
- 15. P.C.V. Solenoid

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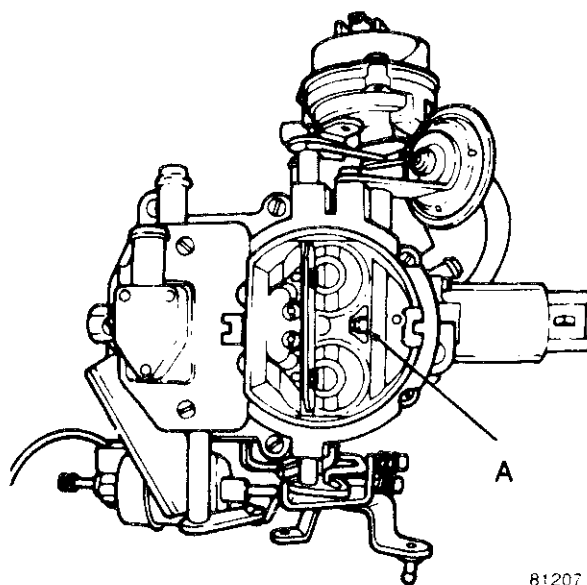
Stepper Motor (Six-Cylinder Engine)

The stepper motor is an integral part of the Model BBD carburetor.

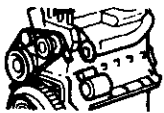
The MCU operates the stepper motor air metering pins (visible from the top of the carburetor air horn) in increments or small steps in reaction to the input from the oxygen (O_2) sensor and the other MCU inputs (i.e., engine operating conditions).

The engine operating conditions never permit the MCU to compute a single metering pin (A) position that constantly provides the optimum air/fuel mixture.

Therefore, closed loop operation is characterized by constant movement of the metering pins because the MCU is forced to make small corrections in an attempt to maintain an optimum air/fuel mixture.

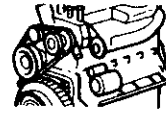


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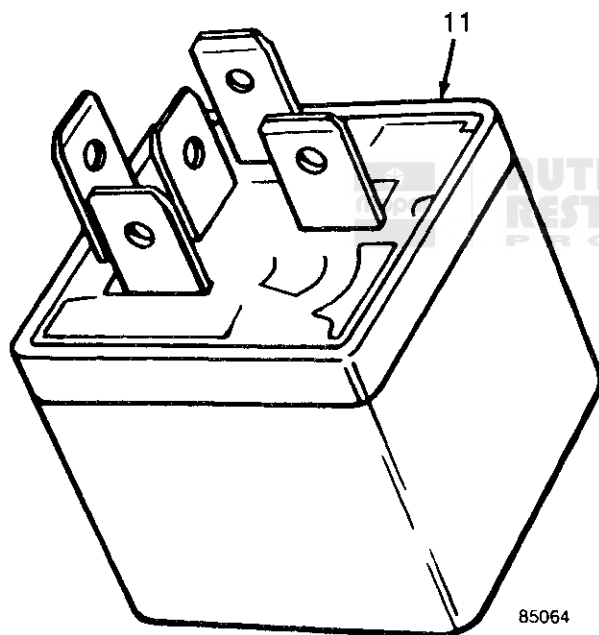


Idle Relay

The idle relay (11) is energized by the MCU.

The MCU controls the vacuum actuator portion of the Sole-Vac throttle positioner by providing a ground for the idle relay.

The relay energizes the idle solenoid, which allows vacuum to operate the Sole-Vac vacuum actuator. This, in turn, opens the throttle and increases engine RPM.



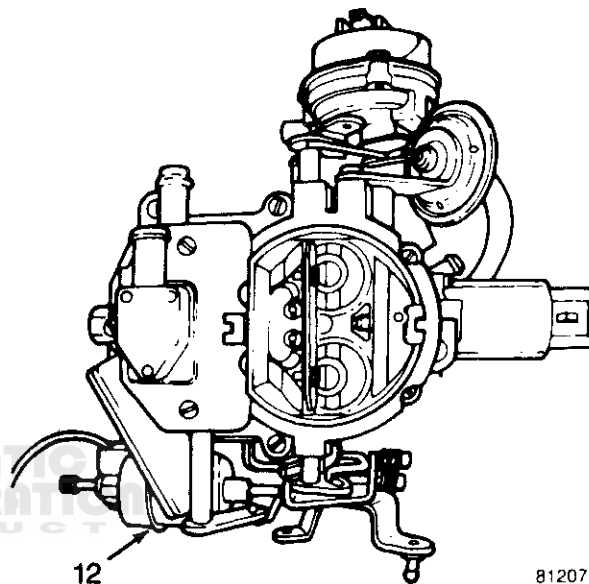
Sole-Vac Throttle Positioner

The Sole-Vac throttle positioner (12) is attached to the carburetor.

The Sole-Vac throttle positioner consists of a holding solenoid and a vacuum actuator.

The holding solenoid provides additional engine idle speed when the air conditioner is in use.

The vacuum actuator is also activated at start-up and during deceleration.



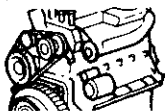
Idle Solenoid

The idle solenoid (13) is located on the same bracket as are the upstream and downstream solenoids (Pulse Air System).

The bracket is located on the cylinder head cover.

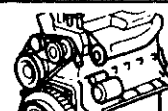
The idle solenoid is energized electrically by the MCU via the idle relay and allows vacuum to operate the Sole-Vac vacuum actuator to increase idle speed.

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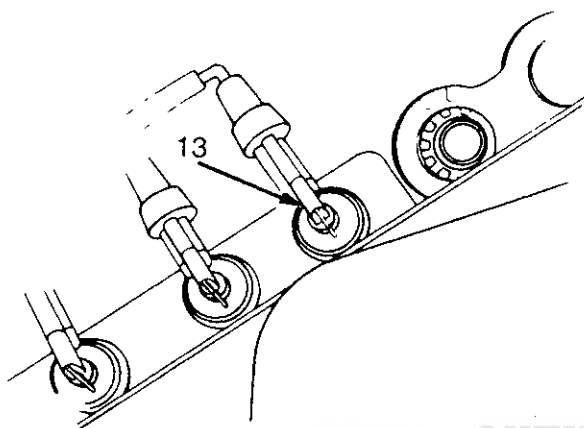
FUEL FEEDBACK SYSTEMS



The idle solenoid is identified by the red connecting wires.

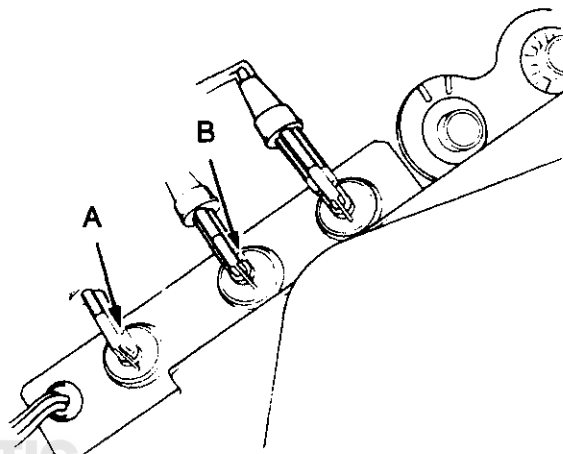
The additional air routed into the system by the solenoids reacts with the exhaust gases to reduce undesirable emissions.

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Upstream and Downstream Solenoids

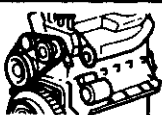
The upstream and downstream solenoids (Pulse Air System) distribute air to the exhaust pipe and catalytic converter.

The upstream (A) and downstream (B) solenoids are located on a bracket attached to the top of the cylinder head cover.

The idle solenoid is also located on the same bracket.

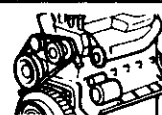
The upstream and downstream solenoids are energized by the MCU. The MCU energizes the upstream solenoid to route air into the exhaust pipe at a location after the oxygen sensor.

When energized by the MCU, the downstream solenoid routes air into the second bed of the dual-bed catalytic converter (TWC-COC).



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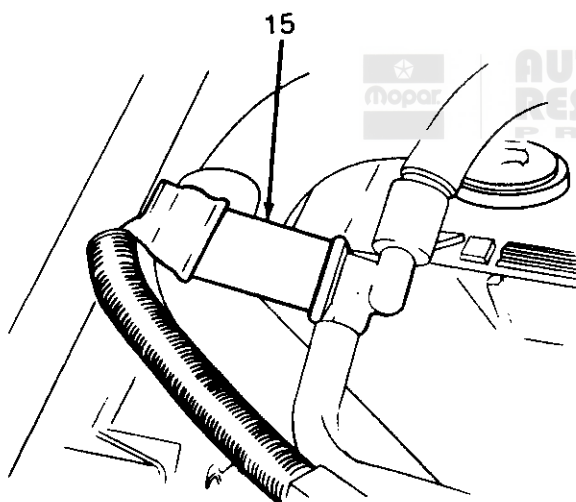


Positive Crankcase Ventilation (PCV) Valve Shut-Off Solenoid

The PCV valve solenoid (15) is installed in-line with the PCV valve hose.

It is energized by the MCU and turns off the crankcase ventilation when the engine is at idle speed.

The system momentarily energizes the PCV valve solenoid when the ignition key is turned off to prevent air entering below the throttle plate. This prevents engine dieseling.



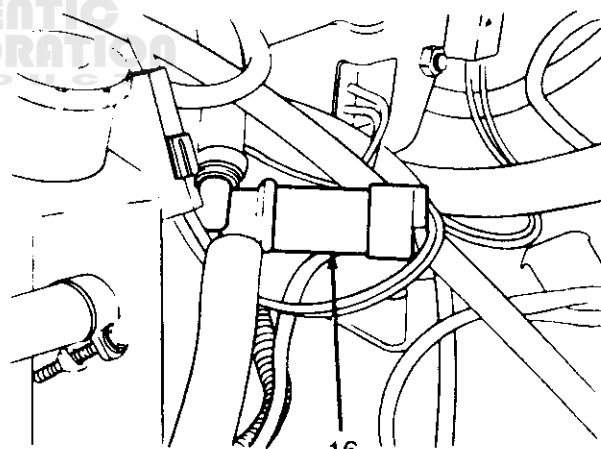
85069

Bowl Vent Solenoid

The bowl vent solenoid (16) is located in-line with the hose between the carburetor bowl vent and the canister.

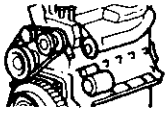
The bowl vent solenoid is closed and allows no vapor to flow when the engine is operating. When the engine is not operating, the solenoid is open and allows vapor to flow to the canister.

The bowl vent solenoid is electrically energized when the ignition key is in the ON position. The solenoid is not controlled by the MCU.



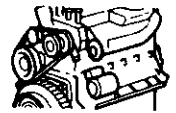
85070

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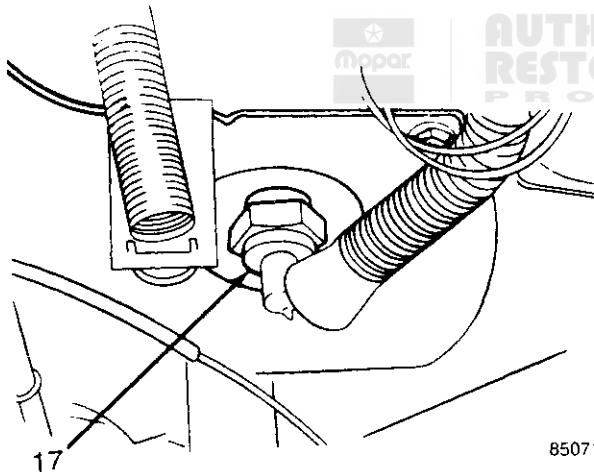


Intake Manifold Heater Switch

The intake manifold heater switch (17) is located in the intake manifold.

It is controlled by the temperature of the engine coolant and indicates a cold engine condition. At temperatures below 71°C (160°F), the manifold heater switch actuates the intake manifold heater, which in turn heats the intake manifold to improve fuel vaporization.

The switch is not controlled by the MCU and does not provide input information to it.



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CEC FUEL FEEDBACK SYSTEM OPERATION

Each CEC Fuel Feedback System has four modes of operation.

- key-on
- start-up

- warm-up
- cruise

KEY-ON MODE OPERATION

In the key-on mode, the system operates as follows:

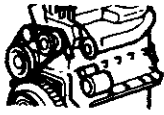
- ignition switch ON
- MCU is energized
- bowl vent solenoid is energized
- Sole-Vac holding solenoid is energized
- idle relay activated; (voltage supplied; no ground)
- PCV valve shut-off solenoid energized by the MCU via the anti-diesel

START-UP MODE

In the start-up mode, the system operates as follows:

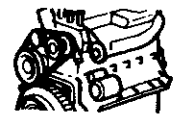
- key to the START position
- starter motor solenoid is energized
- choke relay and intake manifold heater relay (if the intake manifold heater switch is closed) are energized by the oil pressure switch
- intake manifold heater is activated (if the coolant is cold)

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- start signal provided to the MCU
- engine RPM (tach) voltage from the distributor provided to the MCU
- MCU controls the ignition timing

Warm-Up Mode

In the warm-up mode, the system operates as follows:

- system is in open loop operation
- MCU receives certain inputs
- 4-inch Hg vacuum switch is open because the vacuum is less than 4-inch Hg
- 10-inch Hg vacuum switch closed below 10-inch Hg and open at 10-inch Hg vacuum level and above
- coolant temperature switch closed at 57°C (135°F)
- wide-open throttle switch open
- thermal electric switch opens at 18°C (65°F)
- manifold heater switch opens at 71°C (160°F) (the manifold heater is off)
- mixture control (MC) solenoid or stepper motor controlled by the MCU to provide a pre-programmed amount of air for the air/fuel mixture
- upstream and downstream solenoids controlled by the MCU to distribute air to either the exhaust or the catalytic converter

- Sole-Vac holding solenoid is activated if the air conditioner is in operation (six-cylinder engine only); also activated during deceleration

Cruise Mode

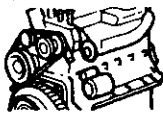
In the cruise mode, the system operates as follows:

- system is in closed loop operation
- MCU produces outputs
- components are controlled as in the warm-up mode
- oxygen (O₂) sensor input accepted by the MCU
- MCU controls the mixture control (MC) solenoid or stepper motor according to the inputs
- MCU may receive input from the knock sensor to advance or retard the ignition timing
- upstream and downstream solenoids route air to the exhaust pipe or catalytic converter
- wide-open throttle switch indicates the throttle position

Diagnostic Tests

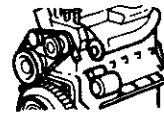
Each CEC Fuel Feedback System incorporates a diagnostic connector to provide a means for a systematic evaluation of each component that could cause an operational malfunction.

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A CEC Fuel Feedback Tester ET-501 is available to aid in the system diagnosis. When a tester is not available, there are several diagnostic tests for each system that are detailed in this section.

To perform a complete system diagnosis, test No. 1 should be performed first. Then the succeeding tests. These series of tests will provide a thorough system diagnosis.

The steps in each test will provide a systematic evaluation of each component that could cause an operational malfunction.

After completing a repair, repeat the test to ensure that the malfunction has been eliminated.

The equipment required to perform the tests is a tachometer, a hand vacuum pump, a digital volt-ohmmeter (DVOM) with a minimum ohms-per-volt input impedance of 10 meg-ohms and jumper wires.

WARNING: When performing system diagnostic tests, the following safety precautions must be followed.

For six-cylinder engines, shape a sheet of clear acrylic plastic at least 6.35mm (0.250-inch) thick and 38cm x 38cm (15 inches x 15 inches). Secure the acrylic sheet on top of the air cleaner with the wing nut after the air cleaner cover has been removed.

Wear eye protection whenever performing the tests.

When the engine is operating, keep your hands and arms clear of the fan, drive pulleys and belts. Do not wear loose clothing. Do not stand in a direct line with the fan blades.

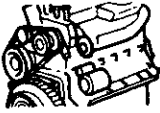
Preliminary Tests

The CEC System should be considered as a possible source of trouble for engine performance, fuel economy and exhaust emission complaints only after normal tests that would apply to a vehicle not equipped with the system have been performed.

Before performing any diagnostic test, other engine associated components and systems that can affect the air/fuel mixture, combustion efficiency or exhaust gas composition should be tested for malfunctions.

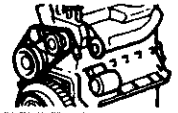
These include:

- basic carburetor adjustments
- mechanical engine operation (i.e., spark plugs, valves and rings)
- ignition system
- gaskets (intake manifold, carburetor or base plate)
- loose vacuum hoses or fittings

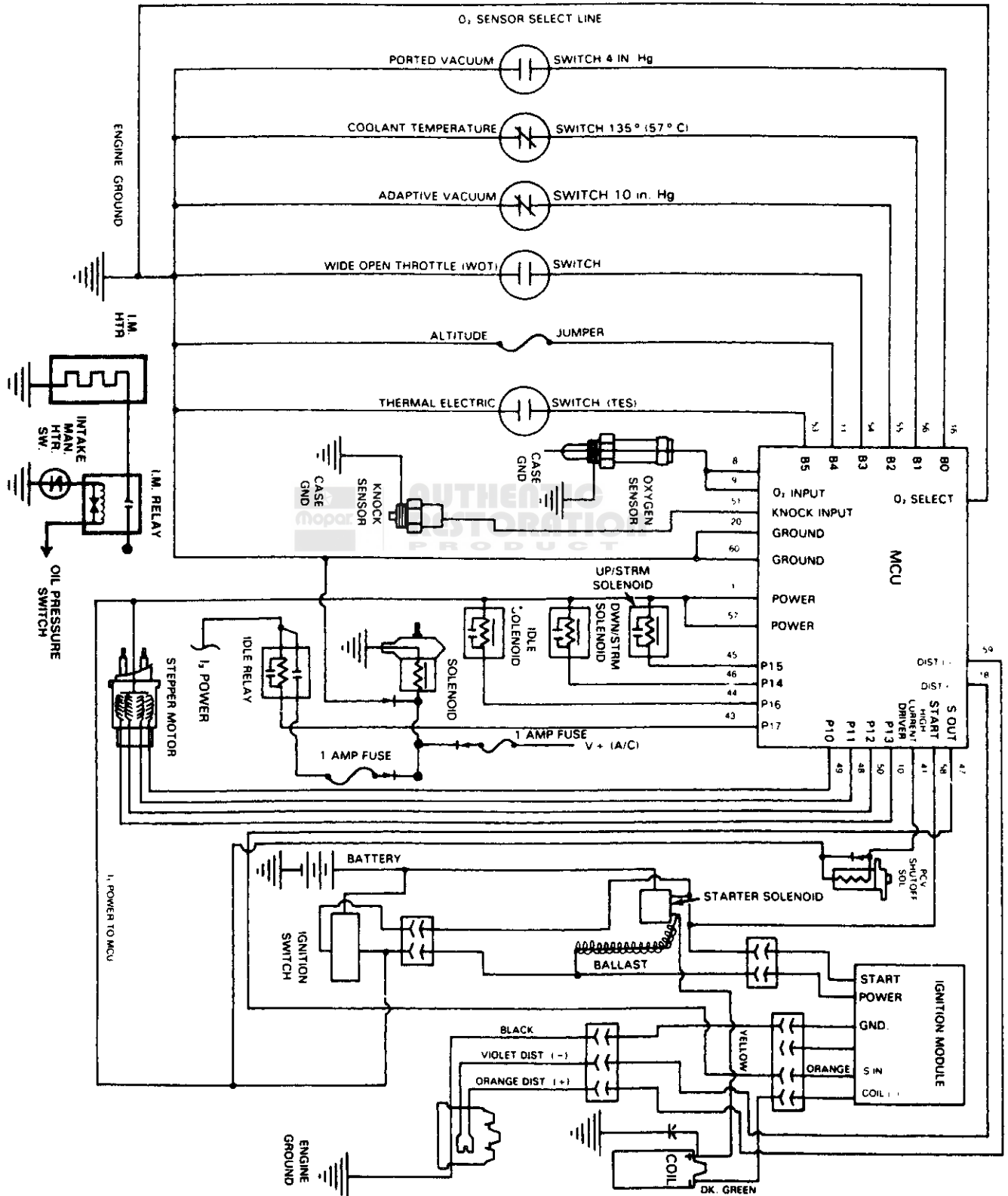


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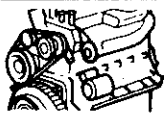


SIX-CYLINDER ENGINE CEC SYSTEM WIRING DIAGRAM



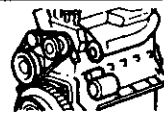
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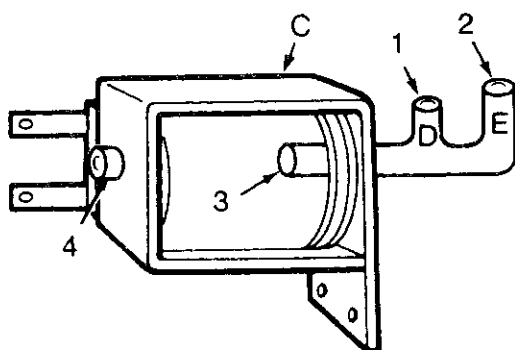


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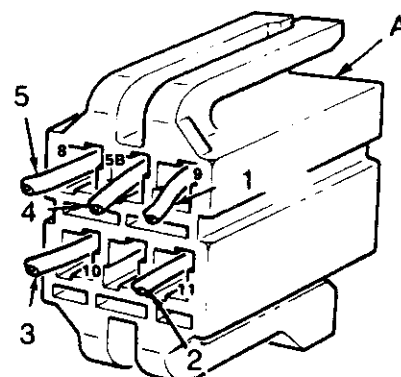


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- C - Vacuum Switch Solenoid
- 1 - Common (D)
- 2 - Normally Closed - NC (E)
- 3 - Springloaded Pin
- 4 - Normally Open - NO (Vent)

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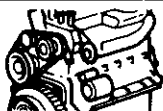


- A - Stepper Motor Connector
- 1 - Orange
- 2 - Tan
- 3 - Violet
- 4 - Red
- 5 - Brown

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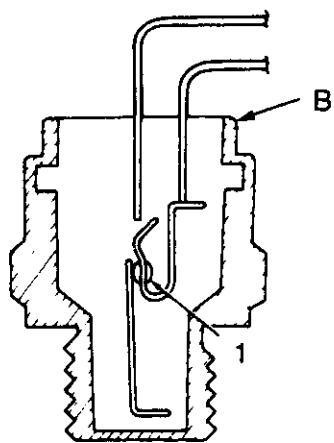
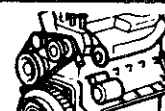


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PRODUCT



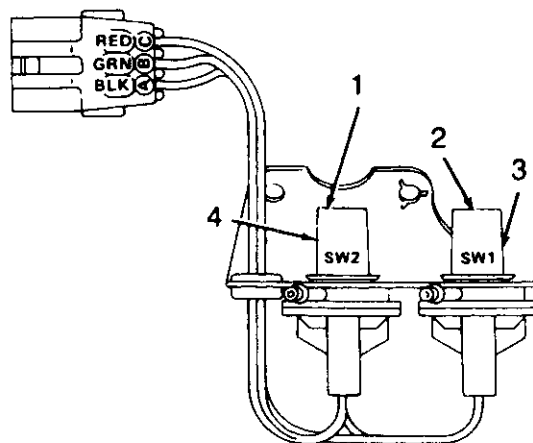
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B - Coolant Temperature Switch
1 - Insulator

81146



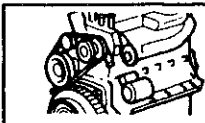
1 - 4-in Hg Vacuum Switch
2 - 10-in Hg Vacuum Switch
3 - Green Color
4 - Natural Color

81147B

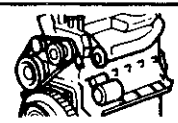


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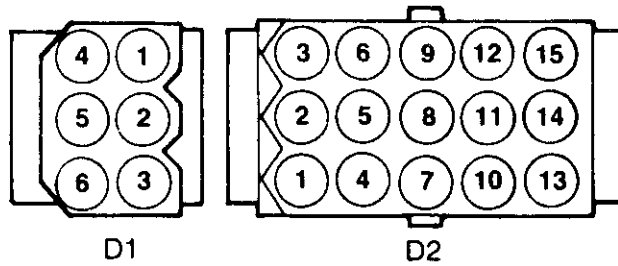
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ENGINES **FUEL FEEDBACK SYSTEMS**



DIAGNOSTIC CONNECTORS



D1

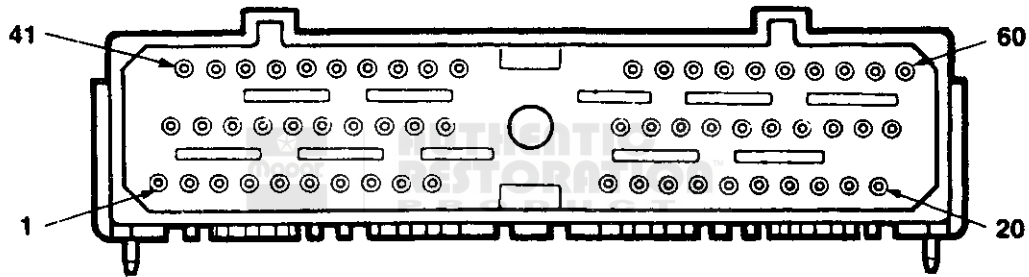
D2

1. TACH
2. ELECTRIC CHOKE
3. GROUND
4. START
5. SOLE-VAC (AFTER RELAY)
6. NOT USED

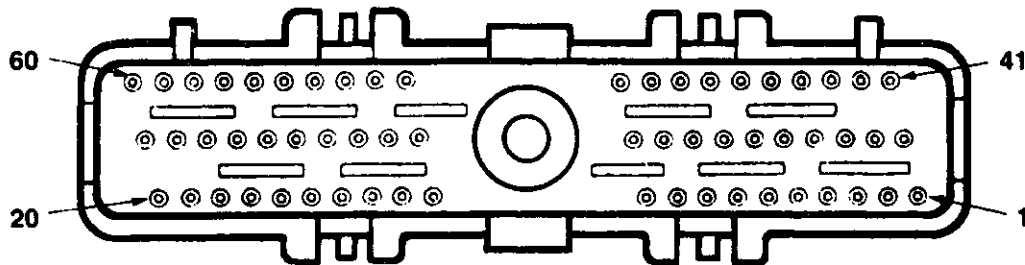
1. PCV SHUTOFF SOLENOID
2. IDLE (SOLE-VAC) SOLENOID
3. ALTITUDE JUMPER WIRE
4. B - (12V) I1
5. DOWNSTREAM SOLENOID
6. WOT SWITCH
7. GROUND
8. UPSTREAM SOLENOID

9. 10 IN. HG VACUUM SWITCH
10. THERMAL ELECTRIC SWITCH (TES)
11. STEPPER MOTOR B0
12. COOLANT TEMP. SWITCH
13. IDLE SPEED RELAY
14. STEPPER MOTOR A0
15. 4 IN. HG VACUUM SWITCH

MCU CONNECTOR



WIRE HARNESS CONNECTOR



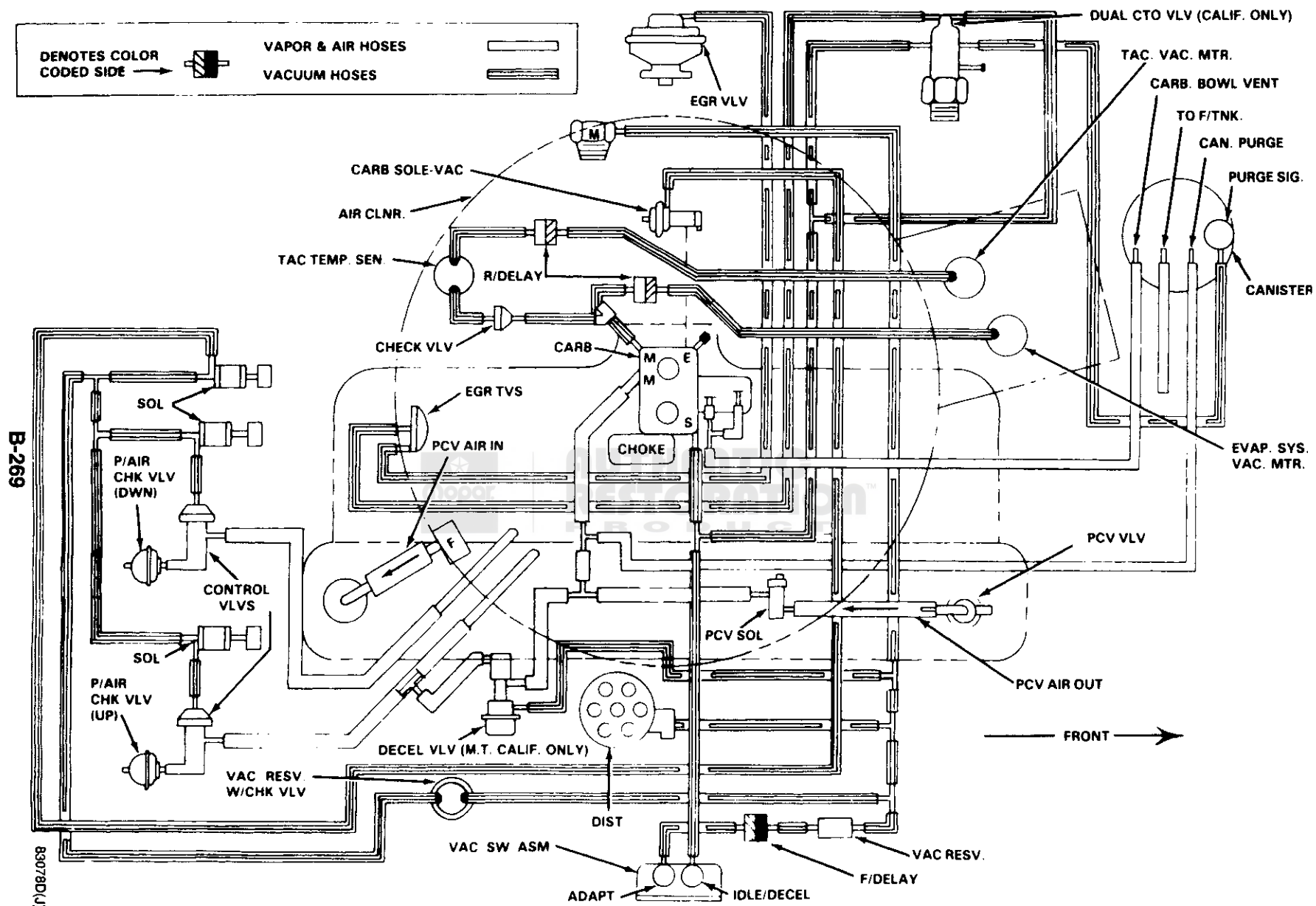
PIN	FUNCTION
1	BATTERY
2	
3	
4	
5	
6	
7	
8	O ₂ INPUT
9	O ₂ INPUT
10	P13
11	B4
12	
13	
14	
15	
16	B0
17	O ₂ SELECT
18	DIST (-)
19	
20	GROUND

PIN	FUNCTION
41	HIGH CURRENT 1
42	
43	P25
44	P24
45	P15
46	P14
47	SPOUT
48	P11
49	P10
50	P12
51	KNOCK INPUT
52	
53	B5
54	B3
55	B2
56	B1
57	BATTERY
58	START
59	DIST (+)
60	GROUND

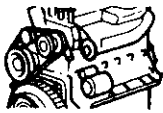
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SIX-CYLINDER ENGINE VACUUM DIAGRAM

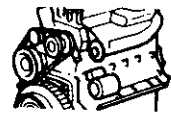


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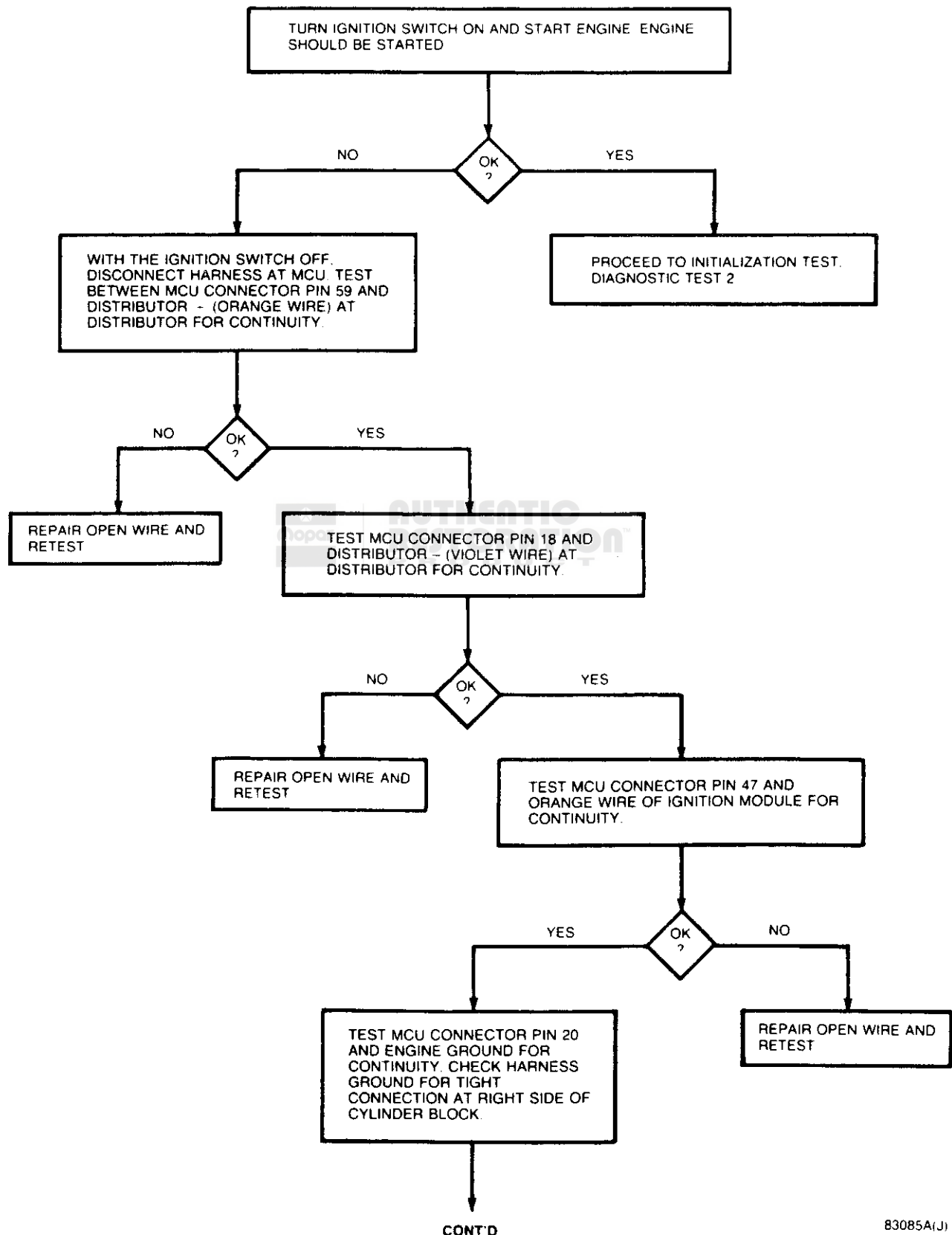
FUEL FEEDBACK SYSTEMS



CEC SYSTEM (SIX-CYLINDER ENGINE)

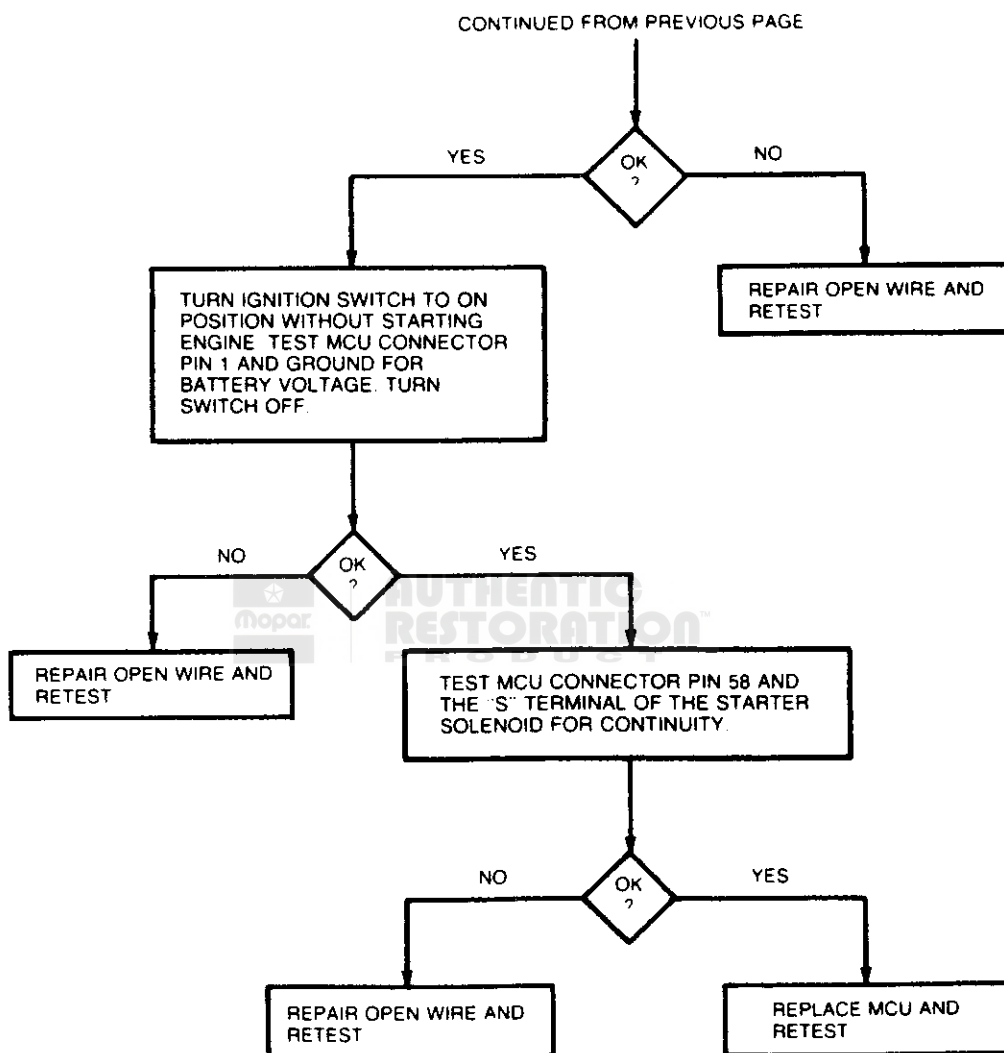
DIAGNOSTIC TEST 1

OPERATIONAL TEST



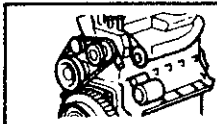
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	ENGINES FUEL FEEDBACK SYSTEMS	
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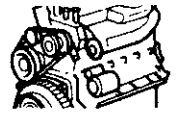
*NOTE: BEFORE REPLACING MCU, IF ENGINE FAILS TO START, CHECK FOR FAILURE OF IGNITION MODULE, COIL, DISTRIBUTOR, ETC. REFER TO IGNITION SYSTEMS – CHAPTER C.

SEE I.S. NOTES



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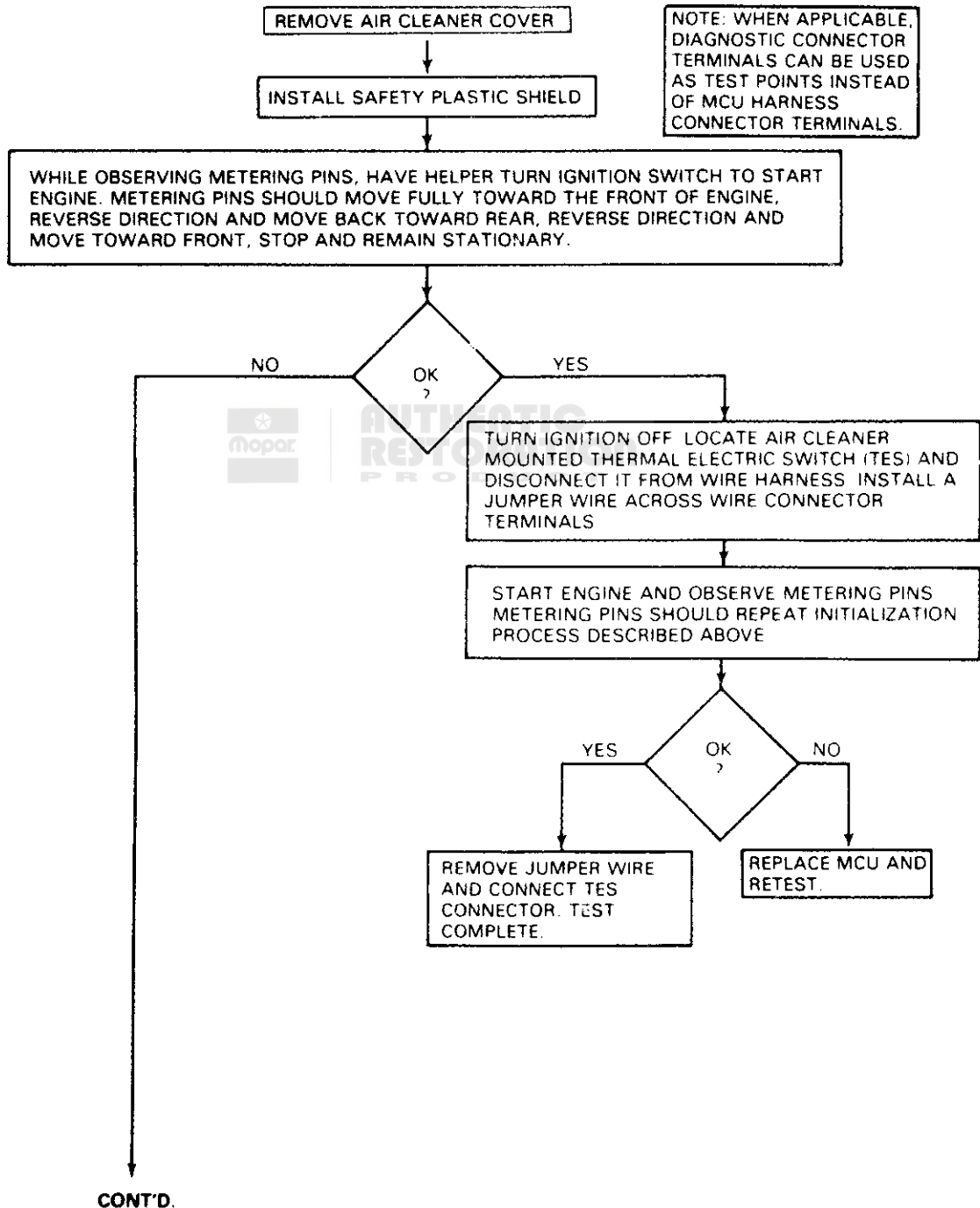
FUEL FEEDBACK SYSTEMS

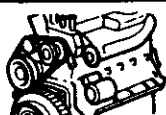


DIAGNOSTIC TEST 2

INITIALIZATION TEST

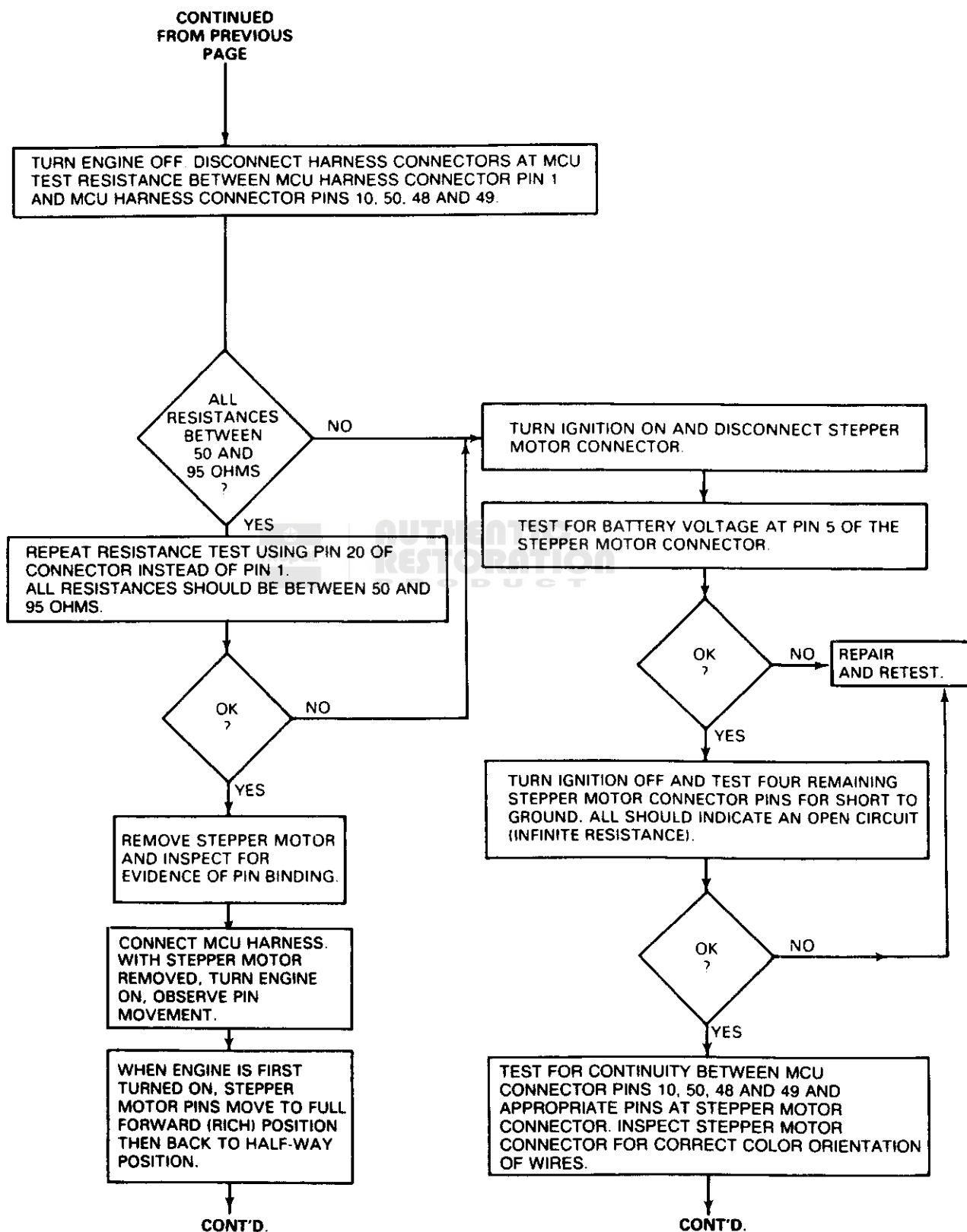
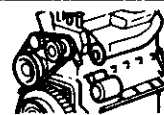
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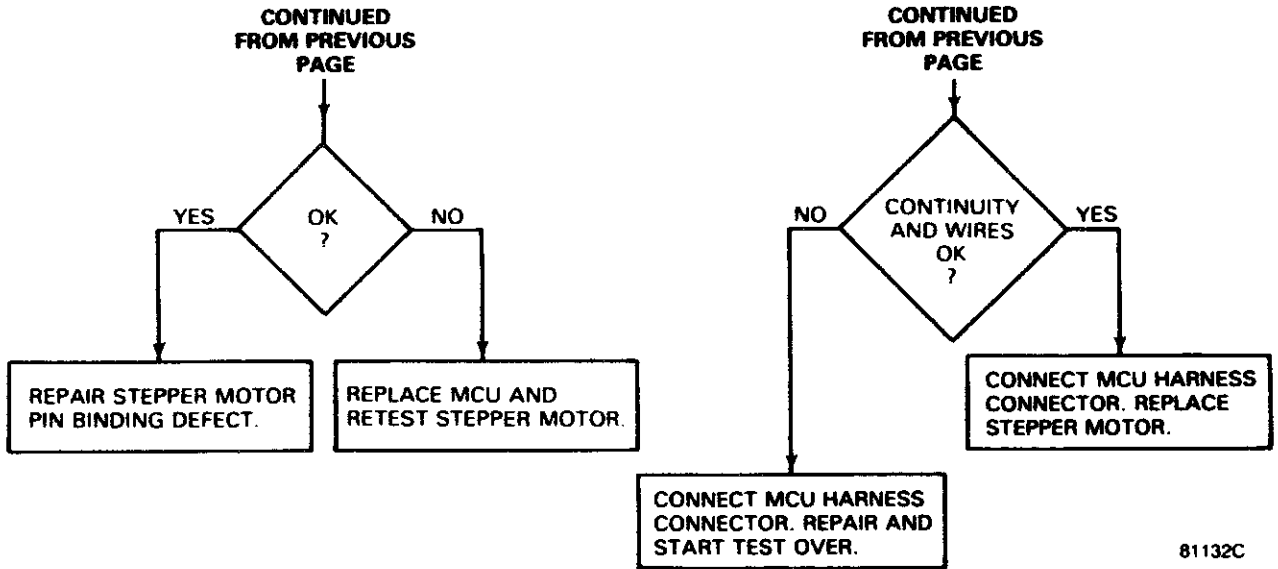


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FUEL FEEDBACK SYSTEMS



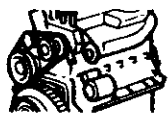
SEE I.S. NOTES



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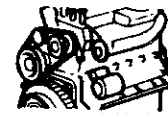


AUTHENTIC
RESTORATION
PRODUCT



ENGINES

FUEL FEEDBACK SYSTEMS

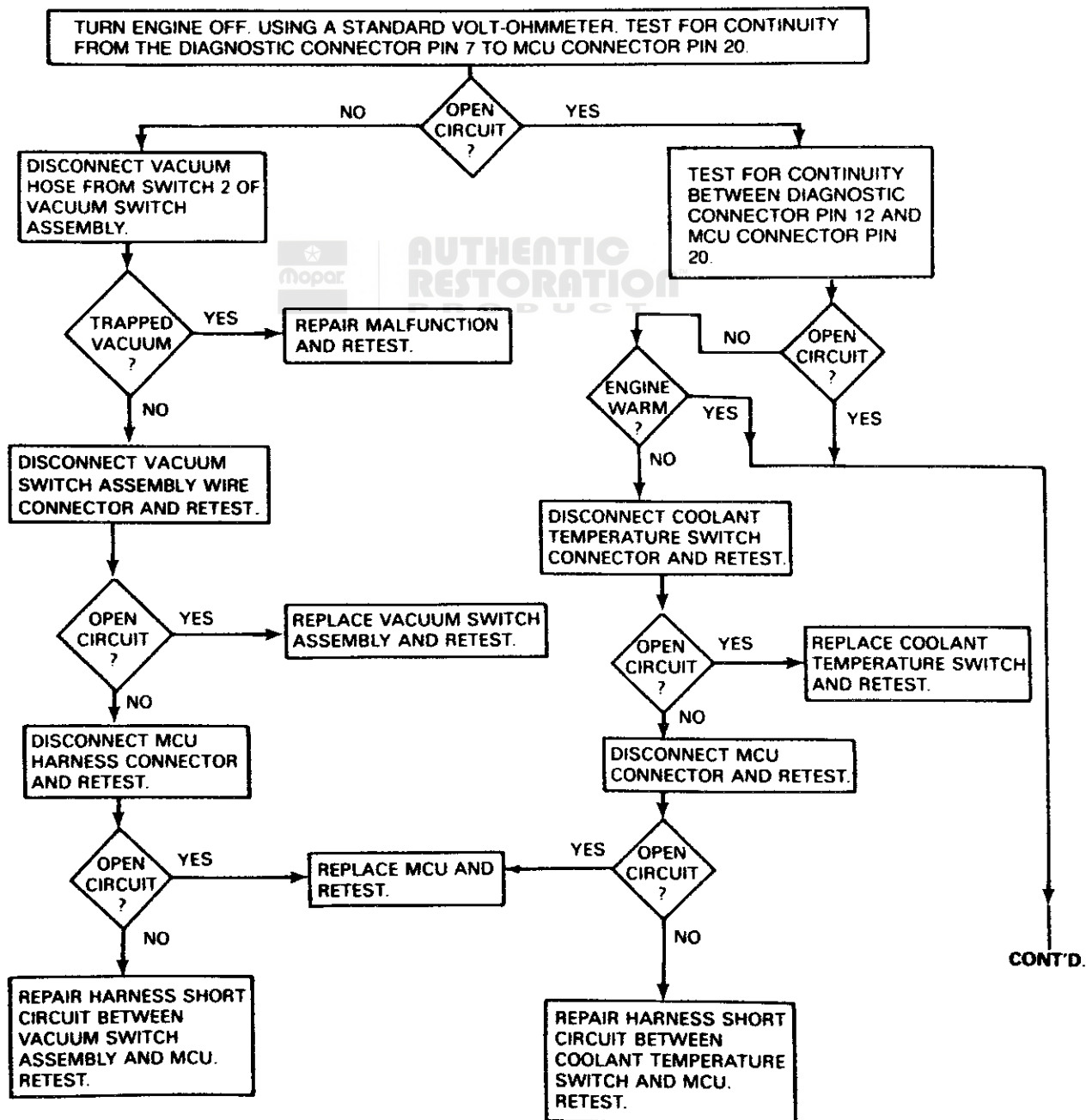


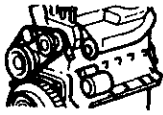
DIAGNOSTIC TEST 3

OPEN LOOP SWITCH TEST

NOTE: ENGINE SHOULD BE AT NORMAL OPERATING TEMPERATURE. ALL CONTINUITY TESTING SHOULD BE DONE WITH MCU DISCONNECTED.

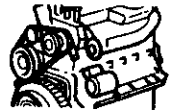
NOTE: CONTINUITY TESTING WITH MCU CONNECTED TO THE SYSTEM SHOULD INDICATE 2 OHMS. WHEN THE MCU IS DISCONNECTED FROM THE SYSTEM, ALL CONTINUITY SHOULD INDICATE LESS THAN 1 OHM. WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU HARNESS CONNECTOR TERMINALS.





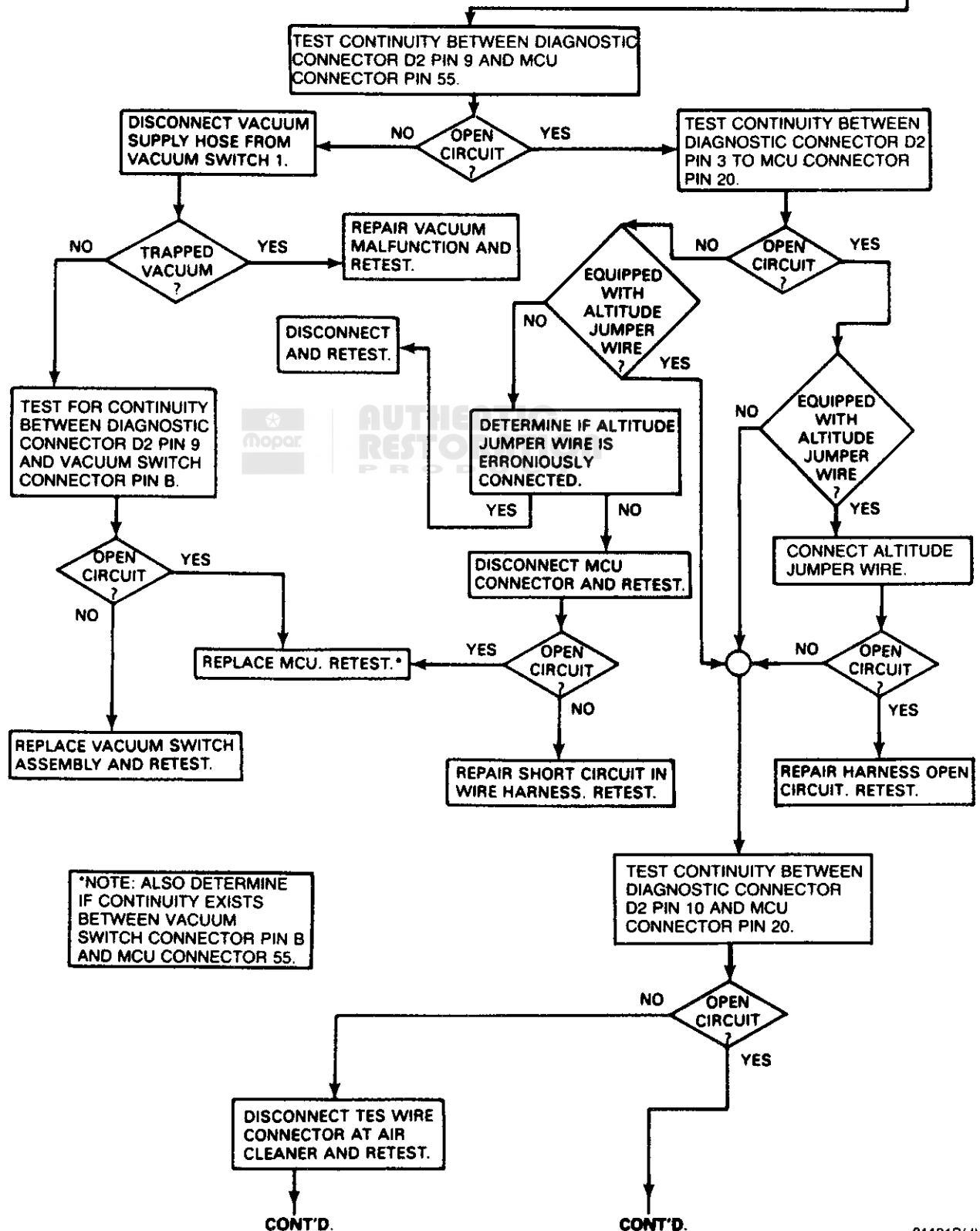
ENGINES

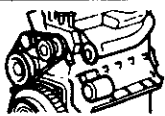
FUEL FEEDBACK SYSTEMS



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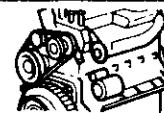
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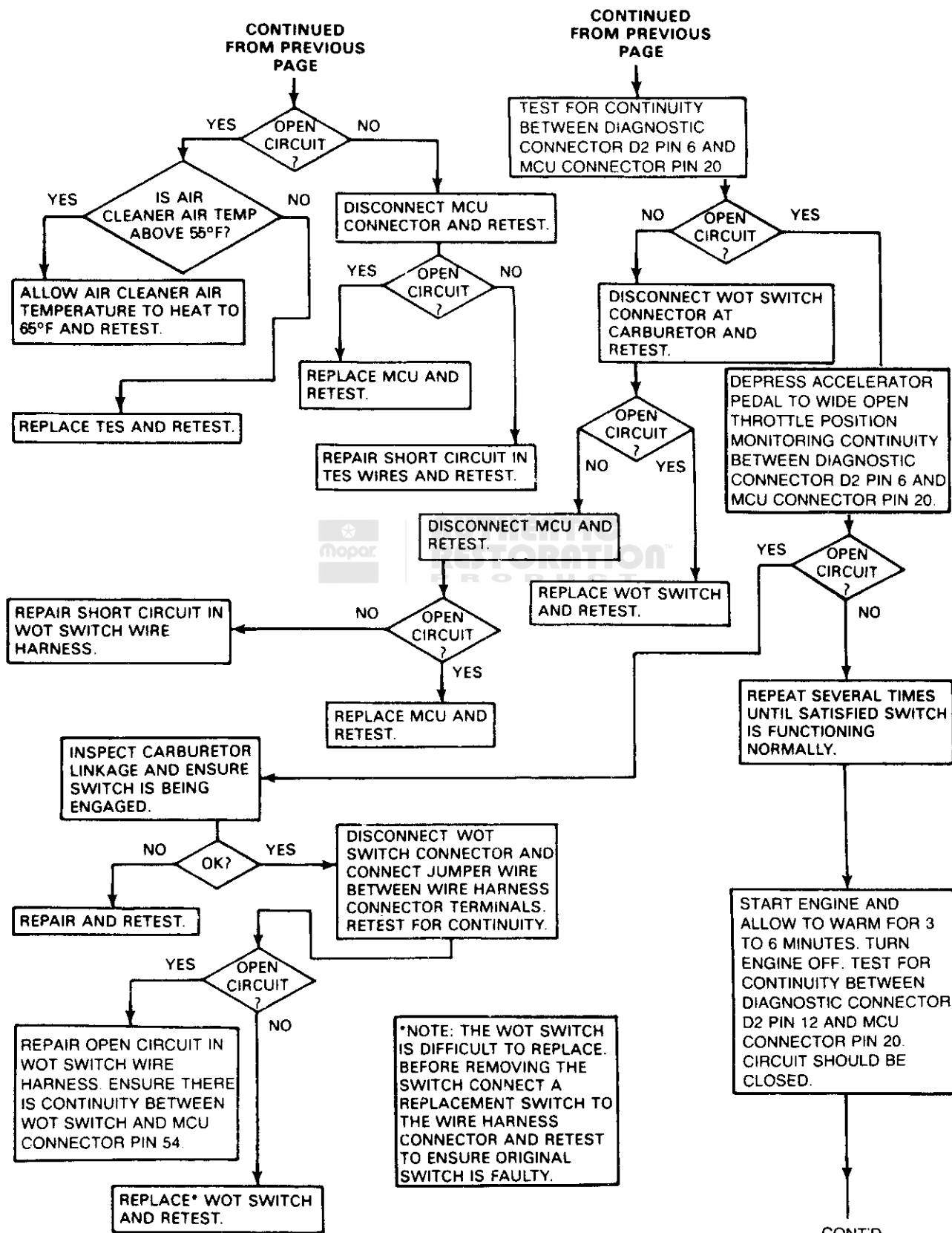


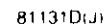
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FUEL FEEDBACK SYSTEMS

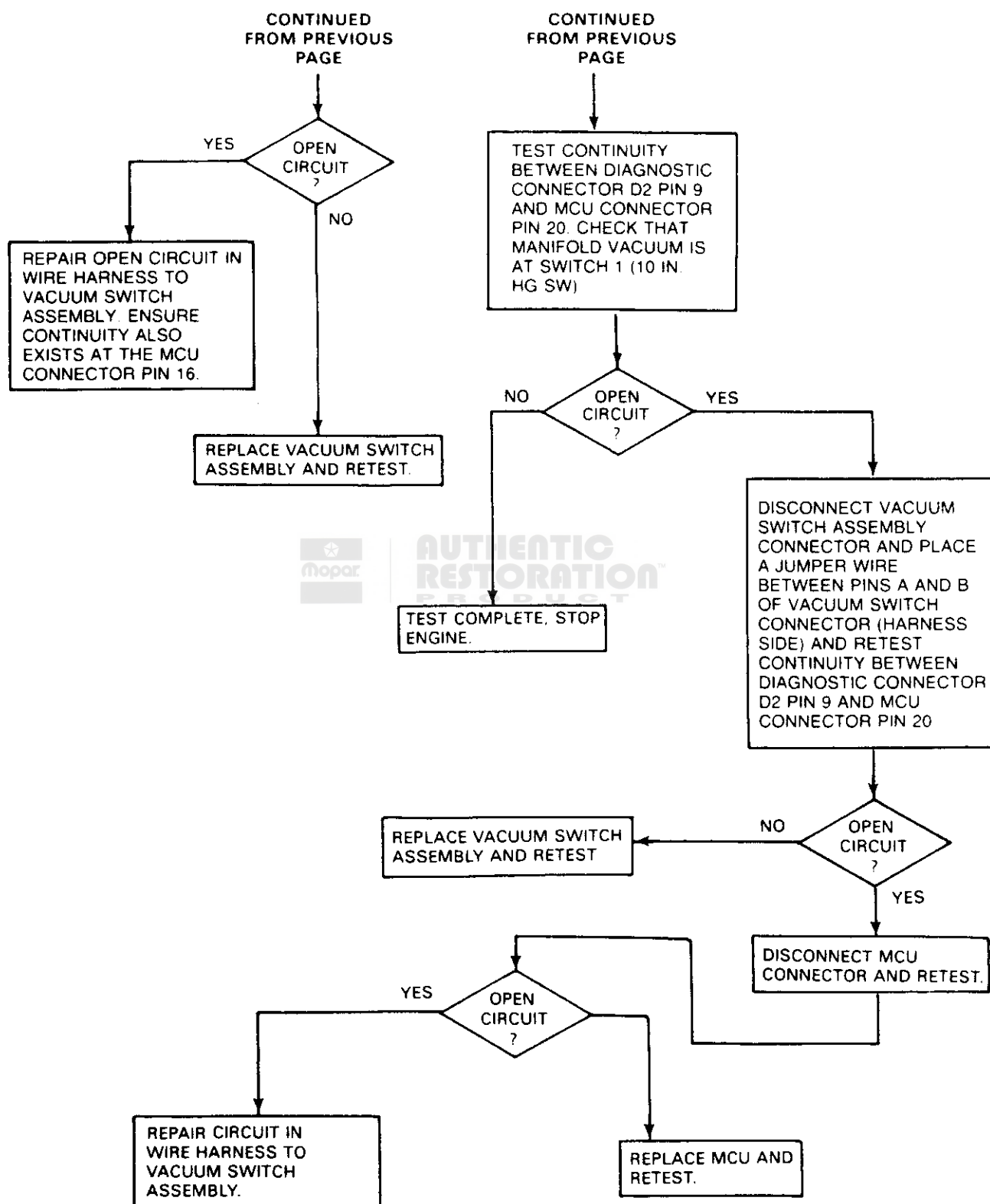


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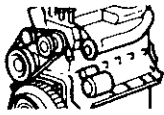




	ENGINES FUEL FEEDBACK SYSTEMS	
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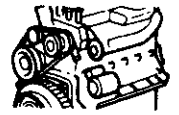


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FUEL FEEDBACK SYSTEMS

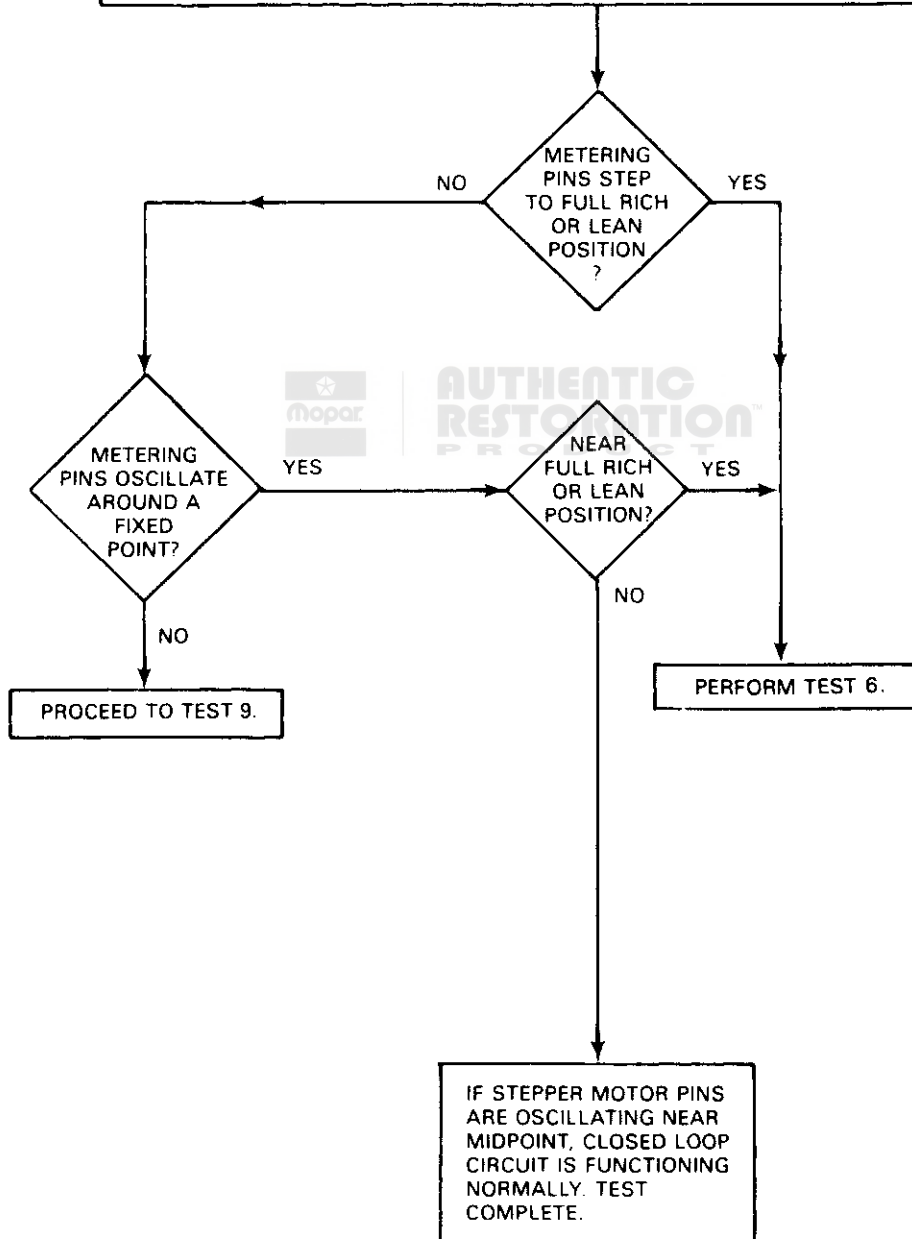


DIAGNOSTIC TEST 4

CLOSED LOOP OPERATIONAL TEST

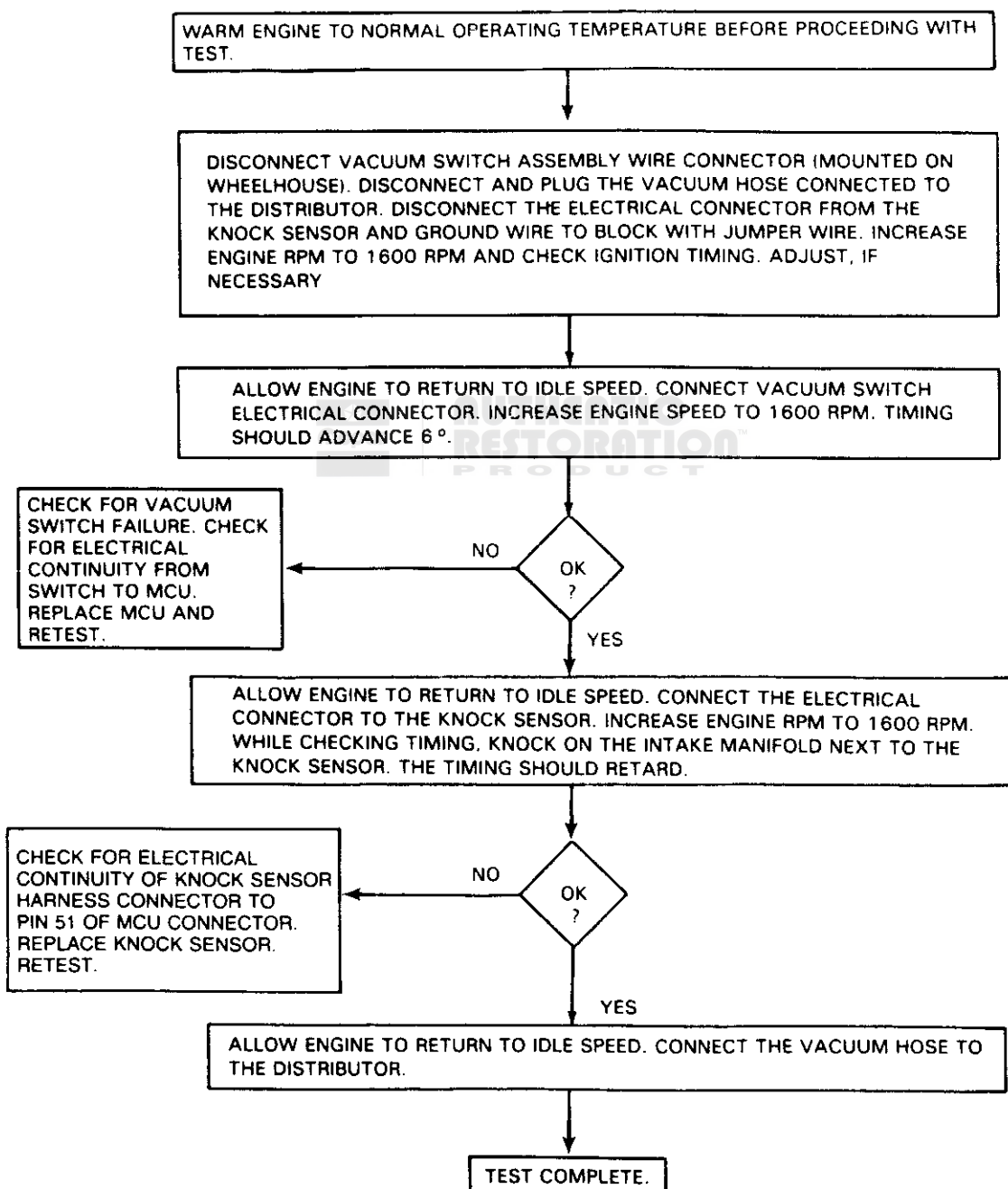
CAUTION: SAFETY SHIELD MUST BE IN PLACE AT TOP OF CARBURETOR AIR CLEANER.

START AND WARM ENGINE UNTIL COOLANT TEMPERATURE HAS STABILIZED. REMOVE AIR COVER AND INCREASE ENGINE SPEED TO 2000 RPM AND MAINTAIN WHILE OBSERVING CARBURETOR STEPPER MOTOR METERING PINS.

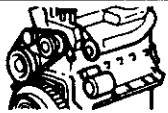


DIAGNOSTIC TEST 5

ELECTRONIC IGNITION RETARD TEST

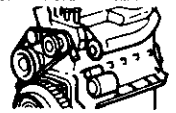


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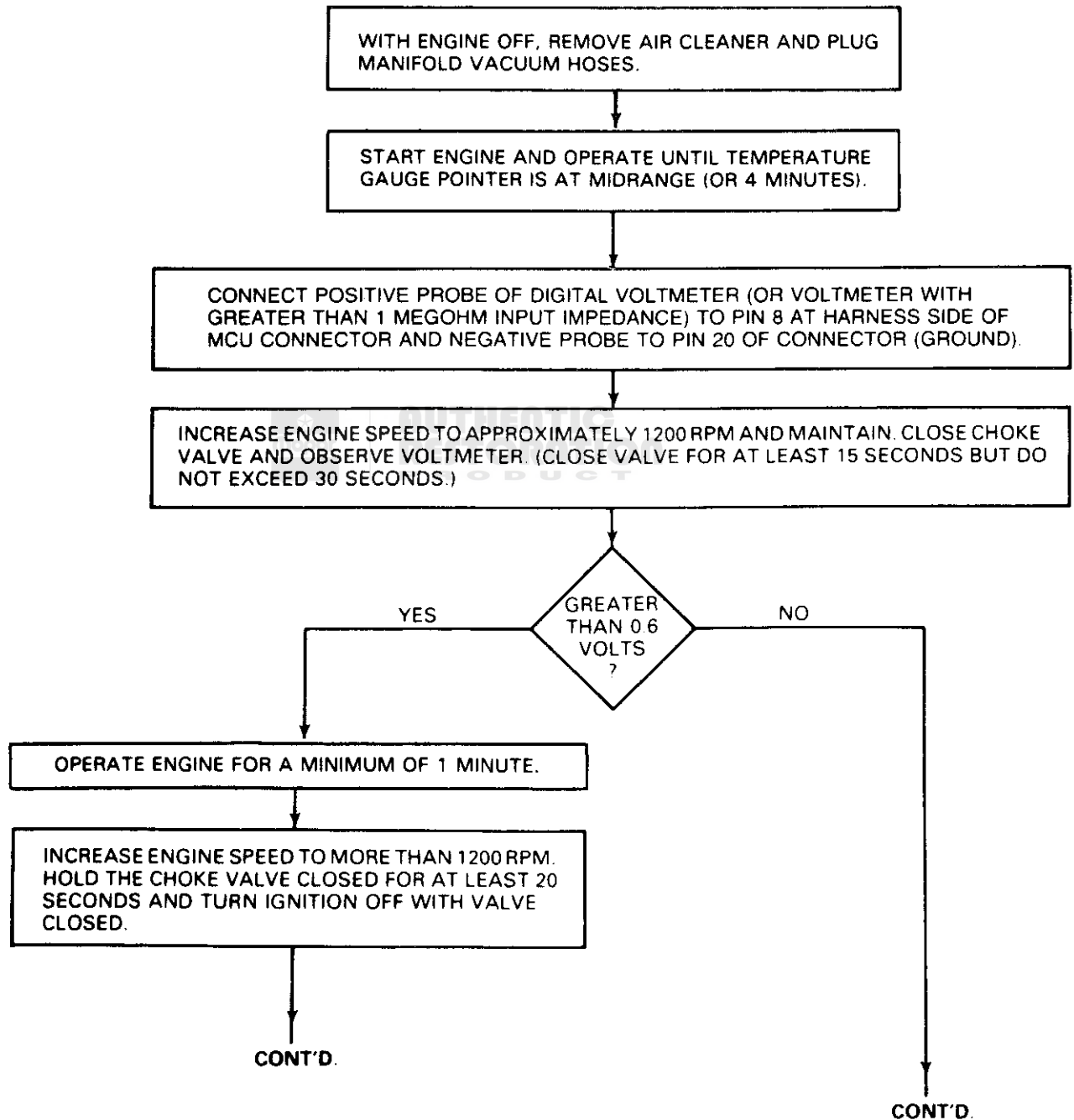
FUEL FEEDBACK SYSTEMS

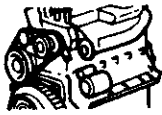


DIAGNOSTIC TEST 6

OXYGEN SENSOR AND CLOSED LOOP TEST

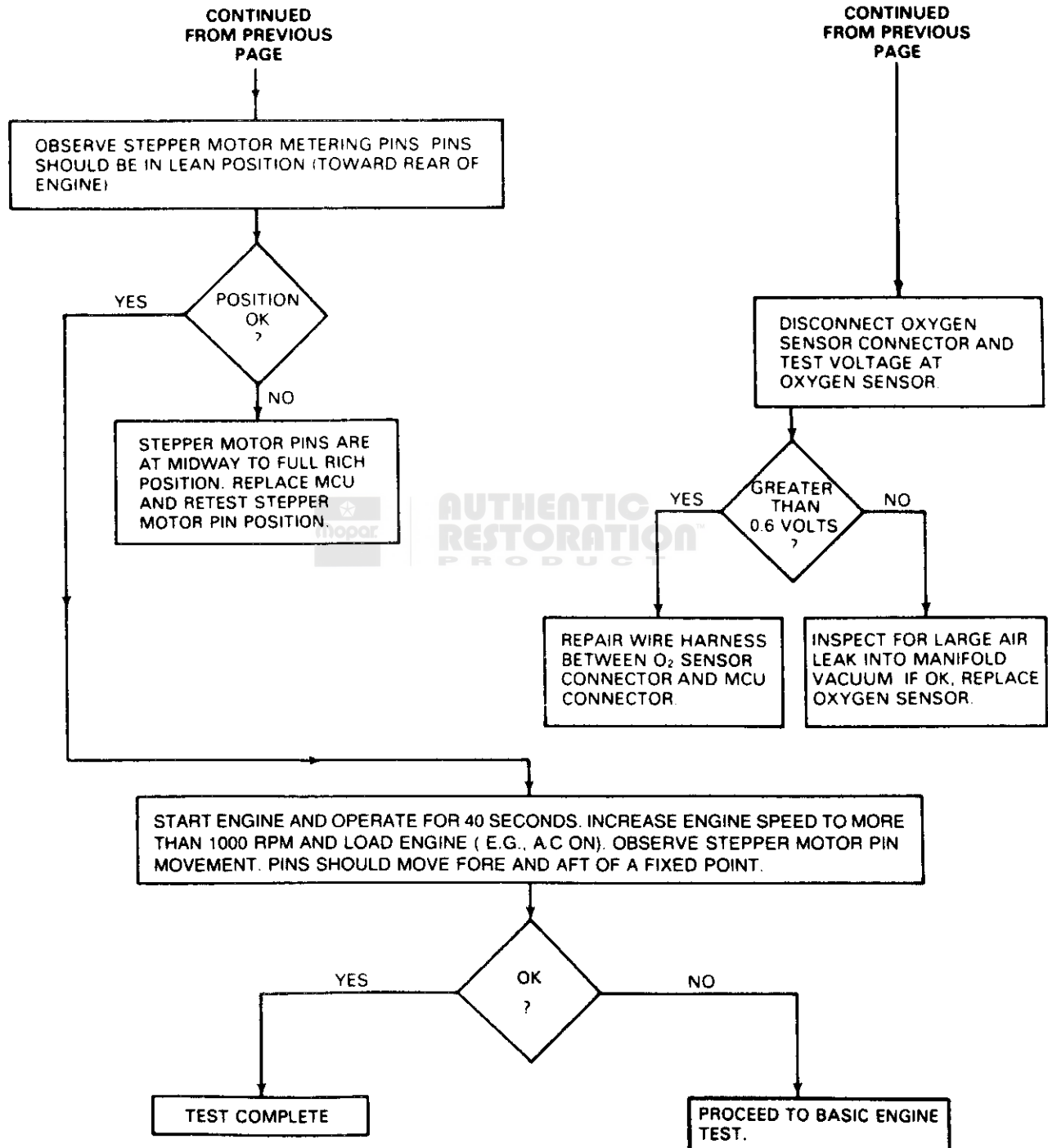
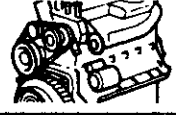
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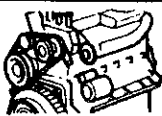


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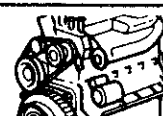


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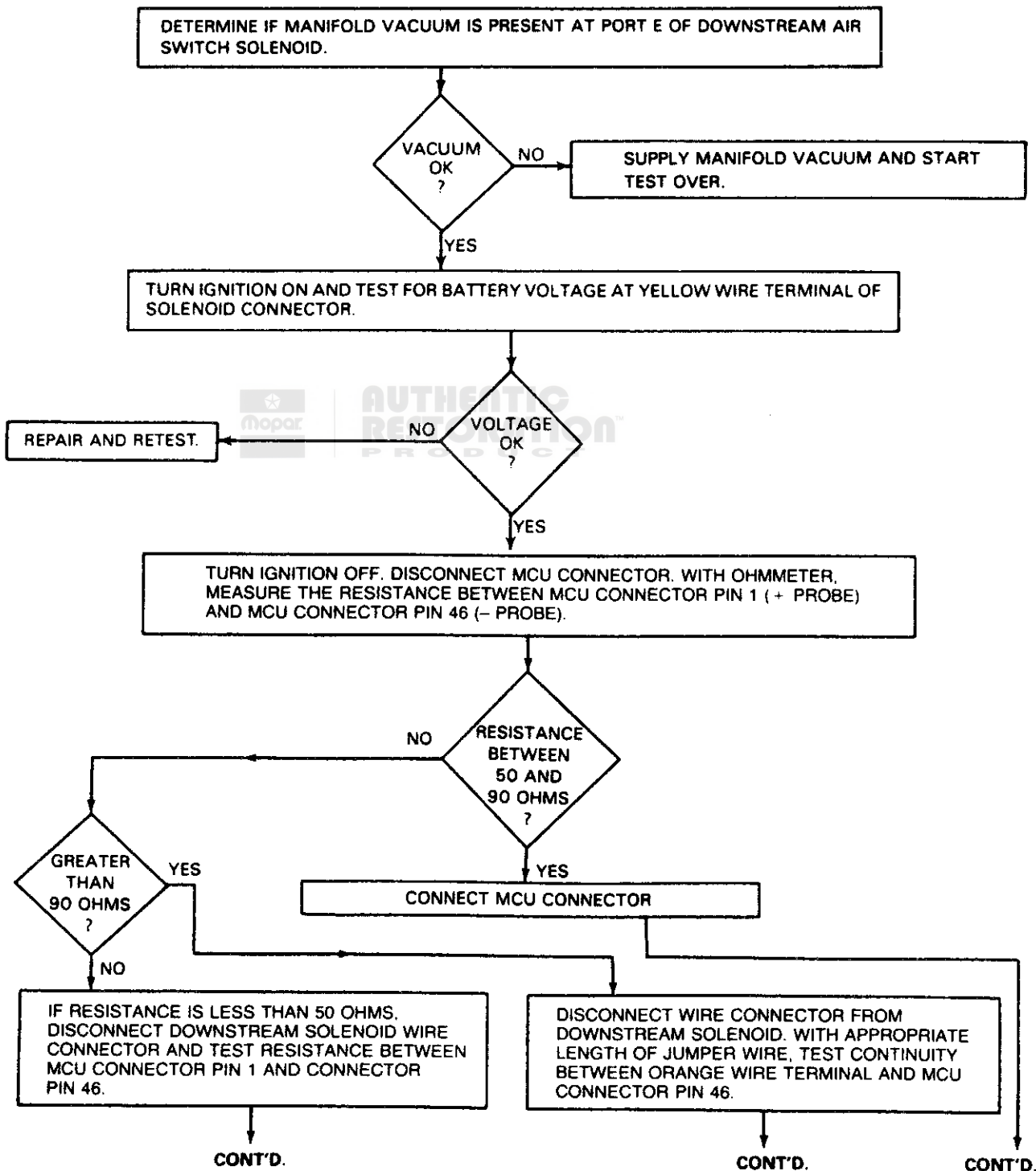


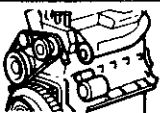
DIAGNOSTIC TEST 7

DOWNSTREAM SOLENOID TEST

NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.

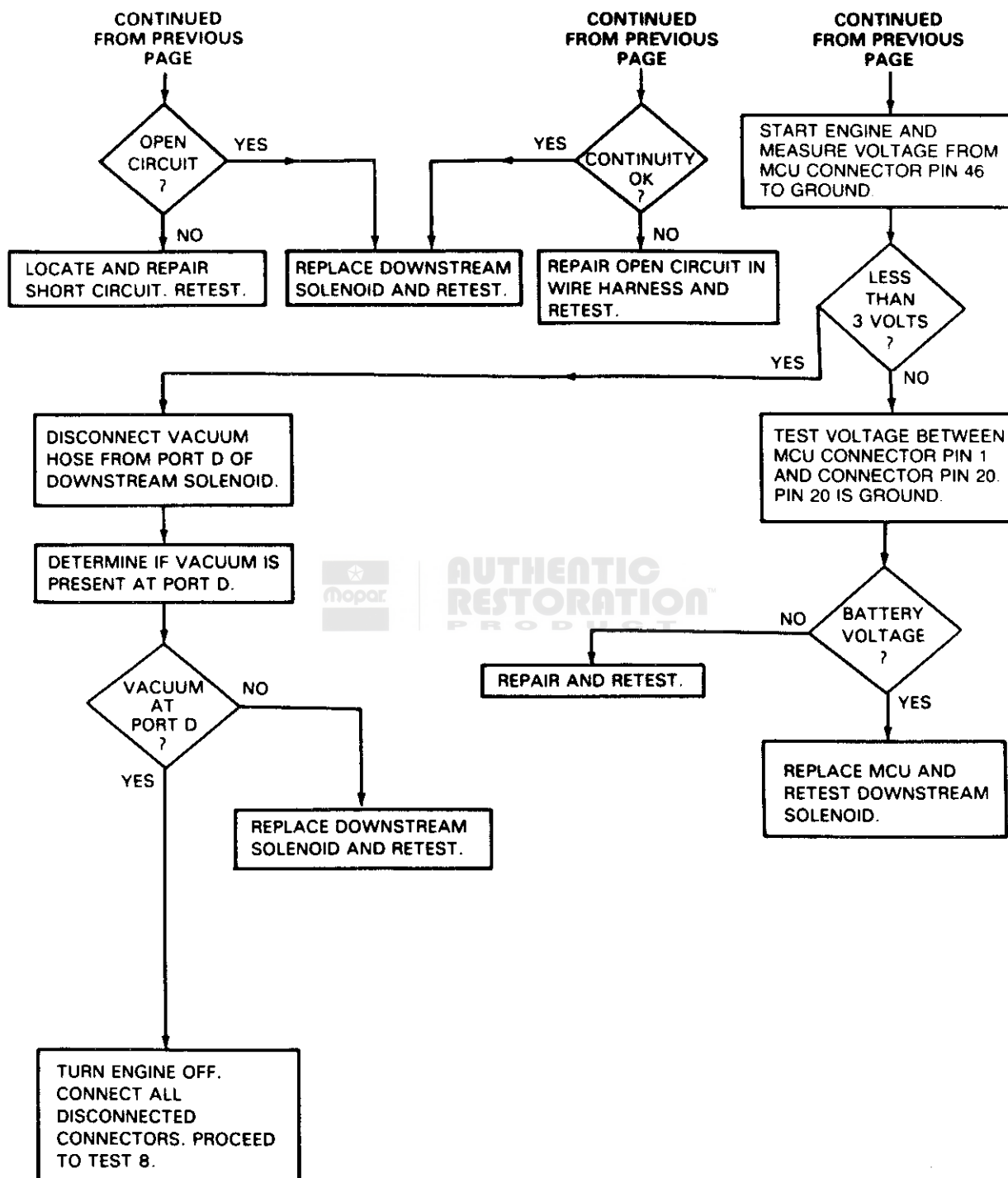
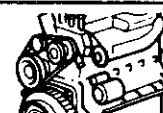
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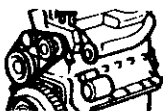




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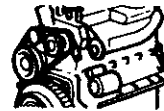
FUEL FEEDBACK SYSTEMS





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FUEL FEEDBACK SYSTEMS

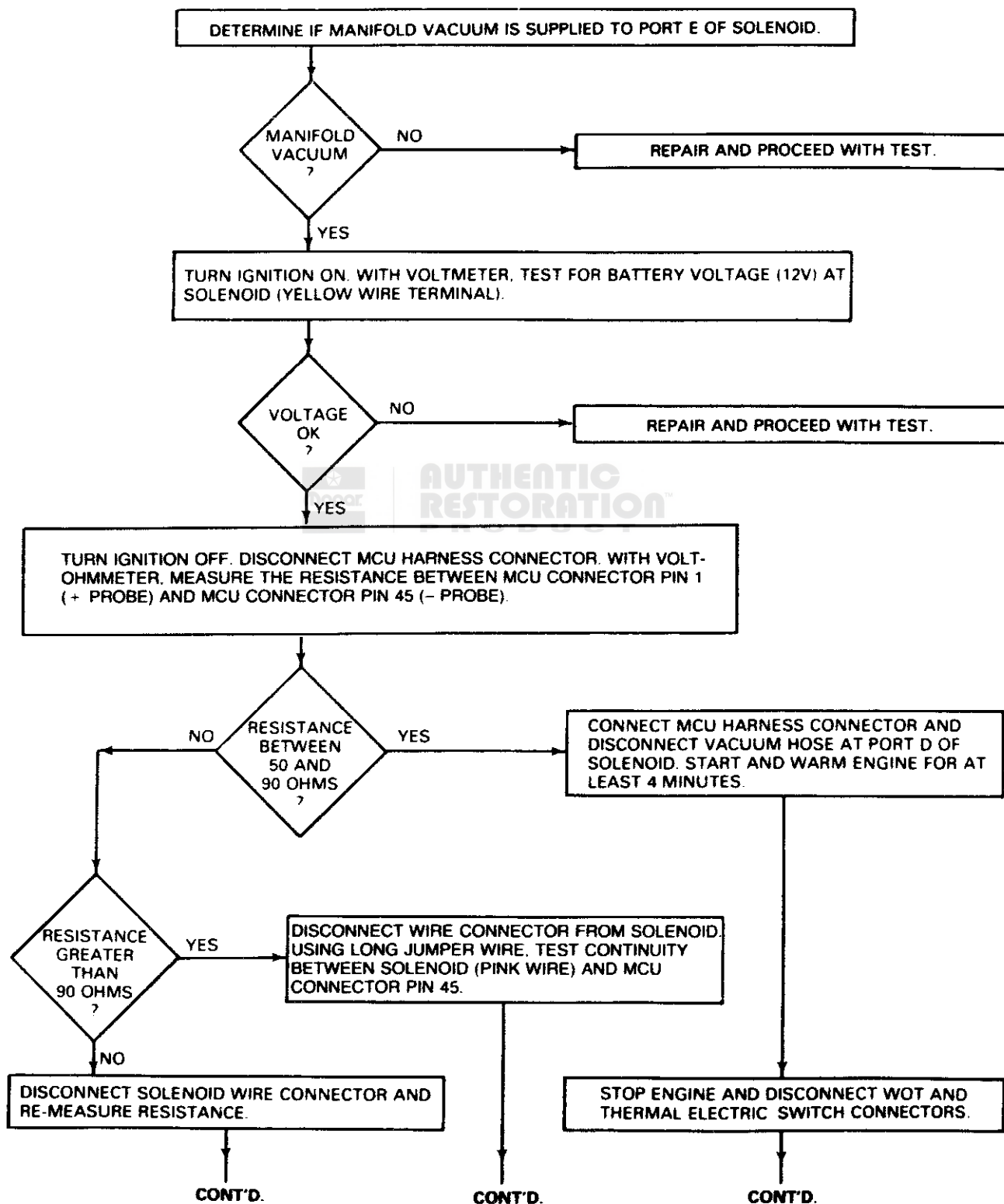


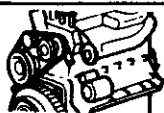
DIAGNOSTIC TEST 8

UPSTREAM SOLENOID TEST

NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.

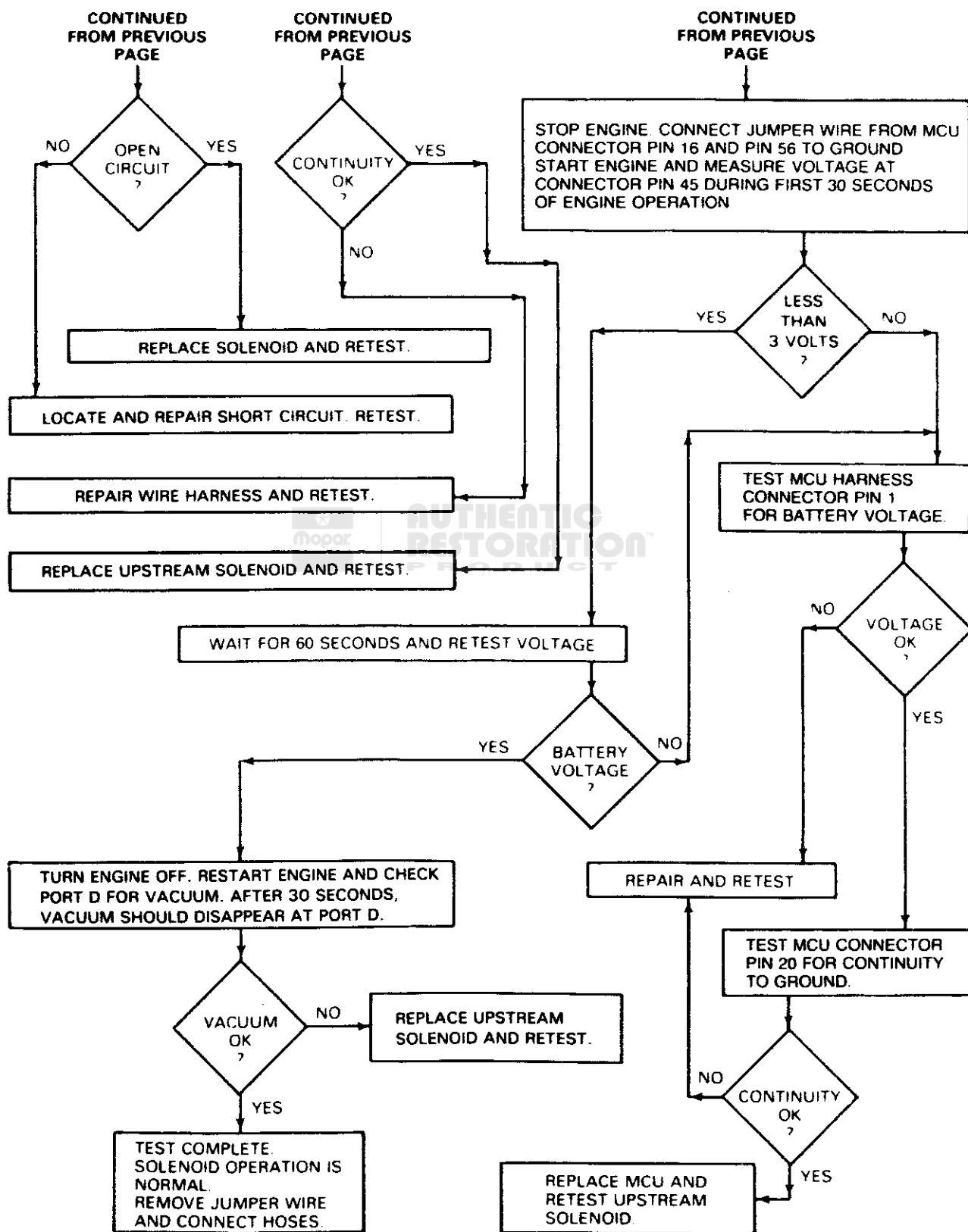
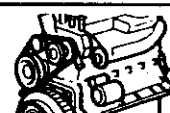
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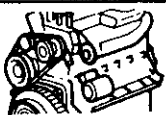


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FUEL FEEDBACK SYSTEMS

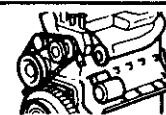


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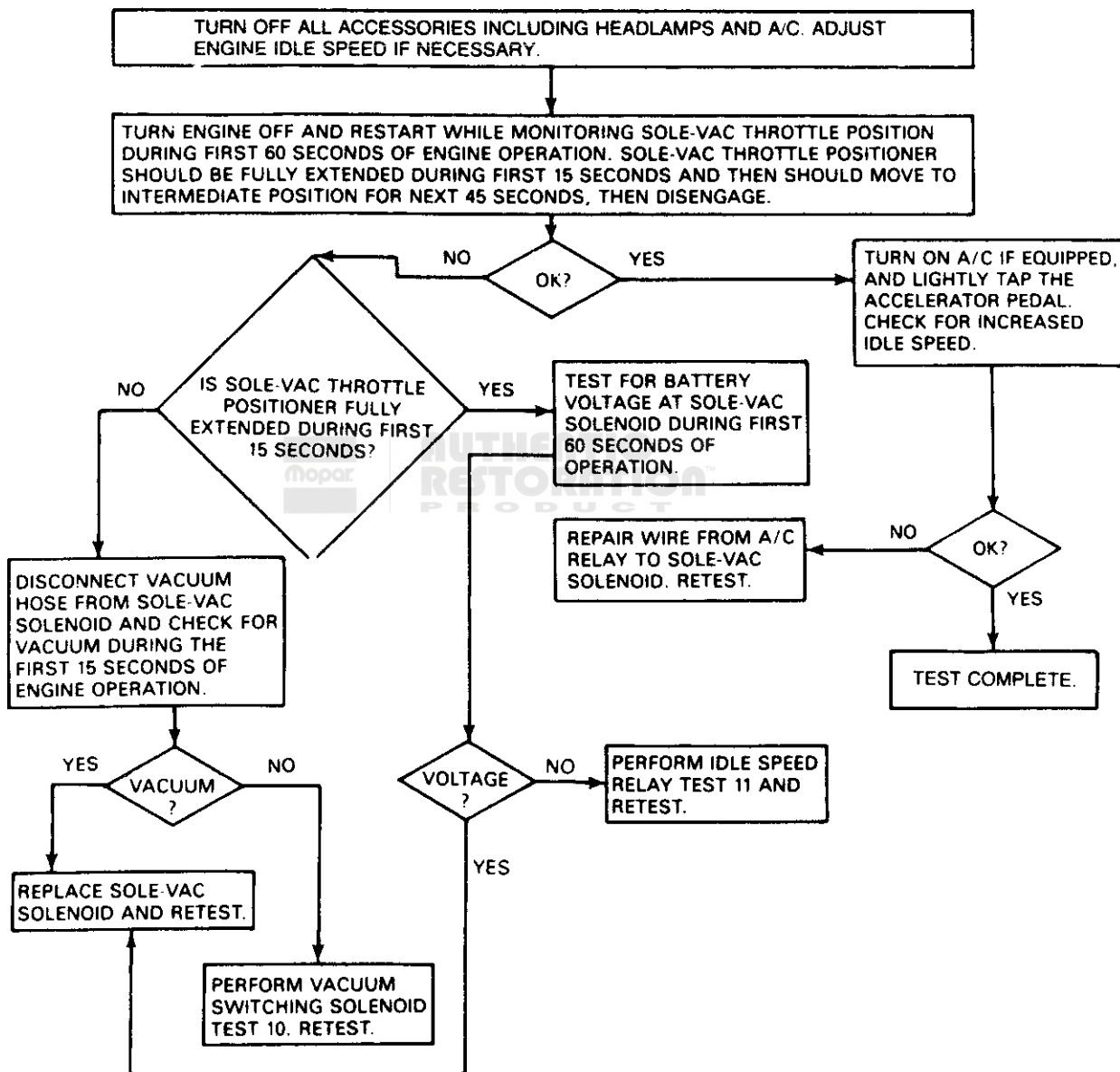


DIAGNOSTIC TEST 9

IDLE SPEED CONTROL SYSTEM TEST

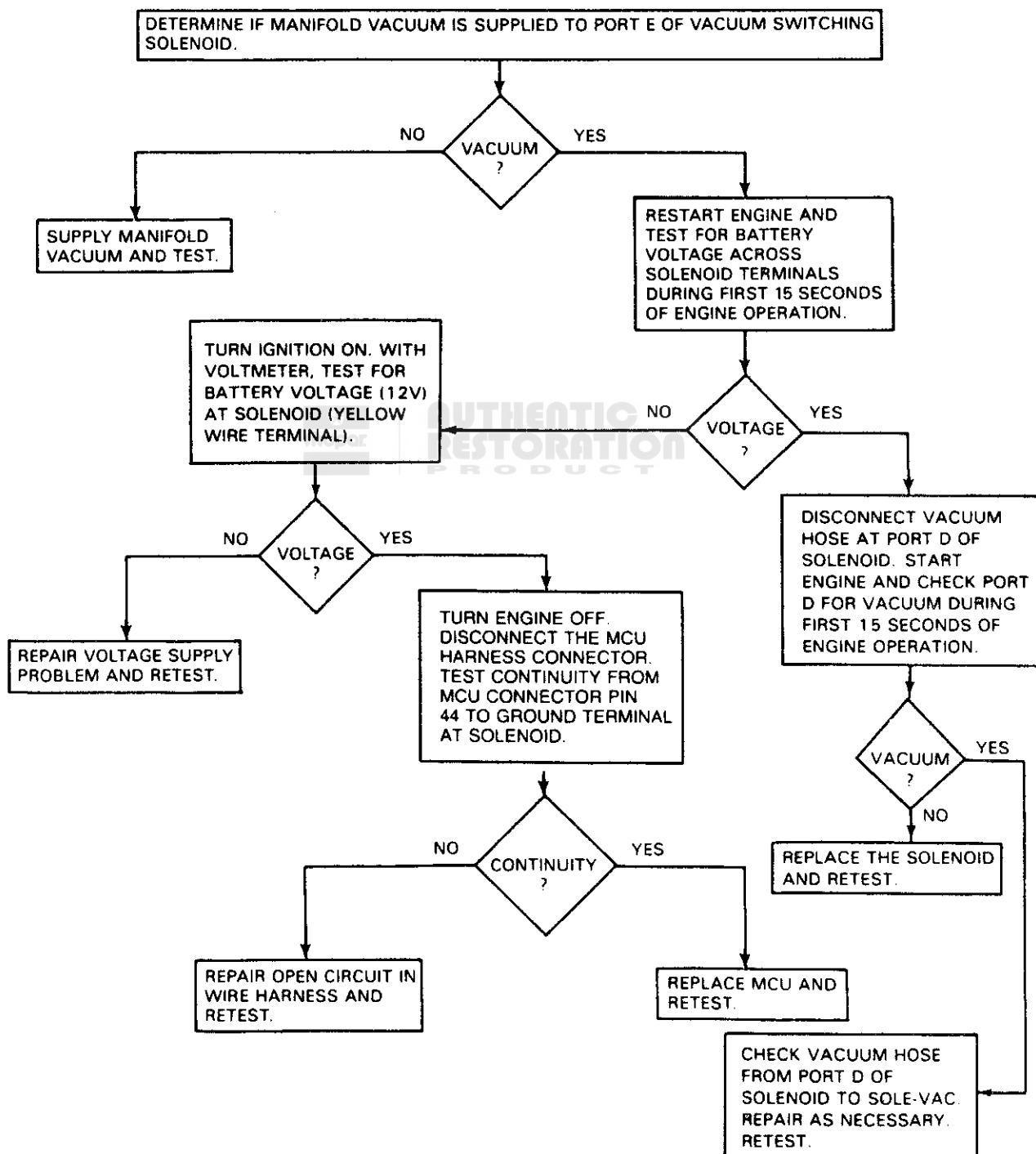
NOTE: TEST MUST BE PERFORMED WITH ENGINE AT NORMAL OPERATING TEMPERATURE AND AFTER PRECEDING CEC SYSTEM DIAGNOSTIC TESTS ARE COMPLETED.

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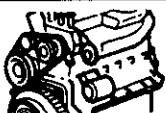


DIAGNOSTIC TEST 10

SOLE-VAC VACUUM SWITCHING SOLENOID TEST

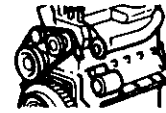


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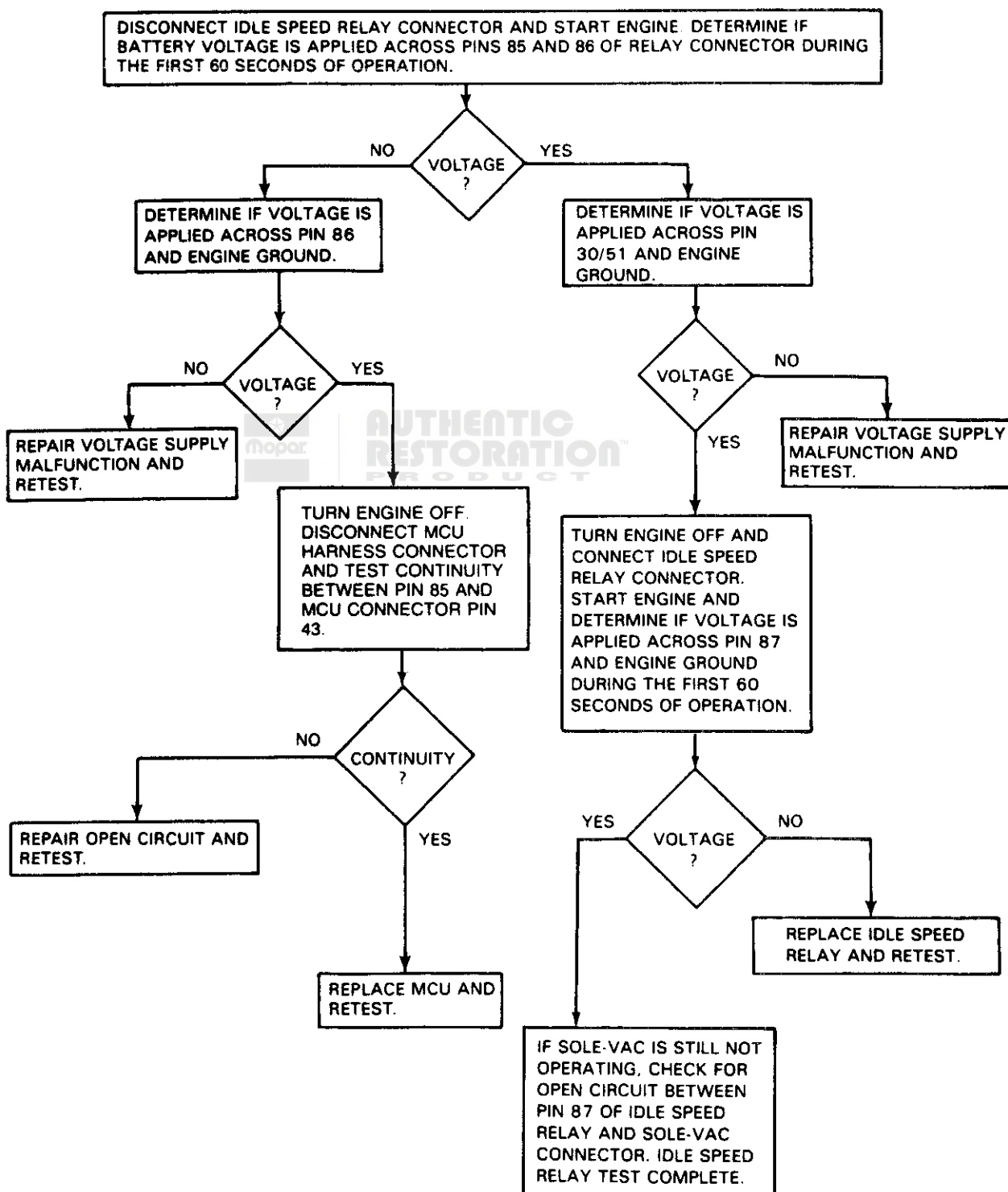
FUEL FEEDBACK SYSTEMS

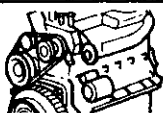


DIAGNOSTIC TEST 11

SOLE-VAC IDLE SPEED RELAY TEST

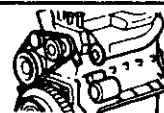
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ENGINES

EXHAUST SYSTEMS



GENERAL INFORMATION

The basic exhaust system for all vehicles consists of an exhaust manifold, front exhaust pipe, catalytic converter, rear exhaust pipe, muffler and tailpipe.

Vehicles with either a four- or six-cylinder engine have a dual bed (TWC and COC) monolithic-type catalytic converter with DOWNSTREAM air injection.

NOTE: Canadian vehicles are not equipped with catalytic converters.

The exhaust system must be properly aligned to prevent stress, leakage and body contact.

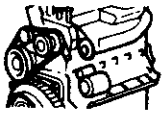
If the system contacts any panel, it may amplify objectionable noises originating from the engine or the body.

When inspecting an exhaust system, critically inspect for cracked or loose joints, stripped screws/bolt threads, corrosion damage, and worn or broken hangers.

Replace all components that are badly corroded or damaged. Do not attempt repair.

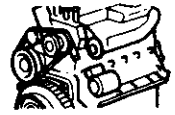
TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Exhaust Manifold Nuts Four-Cylinder Engine	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust and Intake Manifold Screws and Nuts Six-Cylinder Engine	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Oxygen Sensor Four-Cylinder Engine	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)
Six-Cylinder Engine	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)
Exhaust Pipe-to-Manifold Nuts Four-Cylinder Engine	23 N·m (17 ft-lbs)	20-25 N·m (15-19 ft-lbs)
Six-Cylinder Engine	27 N·m (20 ft-lbs)	21-33 N·m (15-25 ft-lbs)



ENGINES

EXHAUST SYSTEMS



RESTRICTED EXHAUST SYSTEM DIAGNOSIS

A partially restricted or blocked exhaust system usually results in loss of power and/or backfire up through the carburetor.

Verify that the condition is not caused by ignition or fuel system problems, then perform a visual inspection of the exhaust system.

If the restriction cannot be located by visual inspection, perform the following procedure.

Attach a vacuum gauge to the intake manifold.

Connect a tachometer to the ignition coil negative (TACH) terminal.

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.

Start the engine and observe the vacuum gauge. The gauge should indicate a vacuum of 53.88 - 70.73 kPa (16 - 21-in. Hg).

Increase the engine speed to 2000 RPM and observe the vacuum gauge.

The vacuum will decrease when the speed is increased rapidly, but should stabilize at 53.88 - 70.73 kPa (16 - 21-in. Hg) and remain constant.

If the vacuum remains below 53.88 kPa (16-in. Hg), the exhaust system is restricted or blocked. Stop the engine and proceed with the next step.

Disconnect the exhaust pipe at the manifold.

Start the engine and increase the speed to 2000 RPM. Observe the vacuum gauge.

If the vacuum stabilizes at 53.88 - 70.73 kPa (16 - 21-in. Hg), the restriction or blockage is either in the exhaust pipe, catalytic converter, muffler or tail pipe.

If the vacuum stabilizes below the 53.88 kPa (16-in. Hg) with the exhaust pipe disconnected, the exhaust manifold is restricted.

Stop the engine, connect the exhaust pipe and remove the muffler.

Start the engine and increase the engine speed to 2000 RPM. Observe the vacuum gauge.

If the vacuum stabilizes below 53.88 kPa (16-in. Hg), the restriction or blockage is in the catalytic converter.

If the vacuum is normal, the muffler or tail pipe is restricted.

NOTE: In the event of a catalytic converter failure, always inspect the muffler and ensure converter debris has not entered the muffler.

Stop the engine.

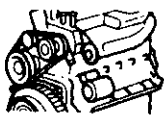
Disconnect the tachometer and vacuum gauge.

Remove the exhaust manifold.

Inspect the ports of the exhaust manifold for casting flash by dropping a length of chain into each port.

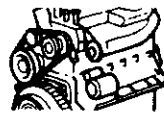
NOTE: Do not use a wire or a light to inspect the ports. The restricted opening may be large enough for a wire or light to pass through but small enough to cause excessive back pressure at high engine RPM.

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EXHAUST SYSTEMS

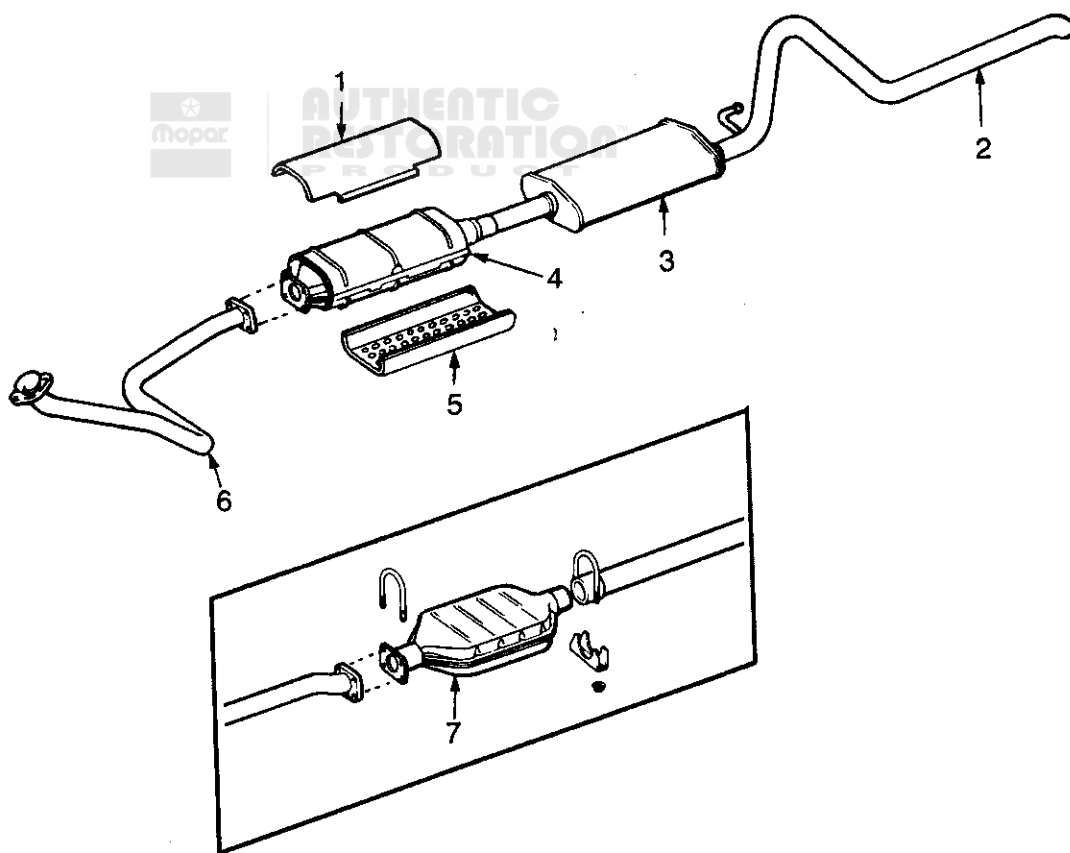


Remove the casting flash. If the flash is at the lower end of the port, it can usually be chipped out. If the flash cannot be removed, replace the manifold.

Install the exhaust manifold.

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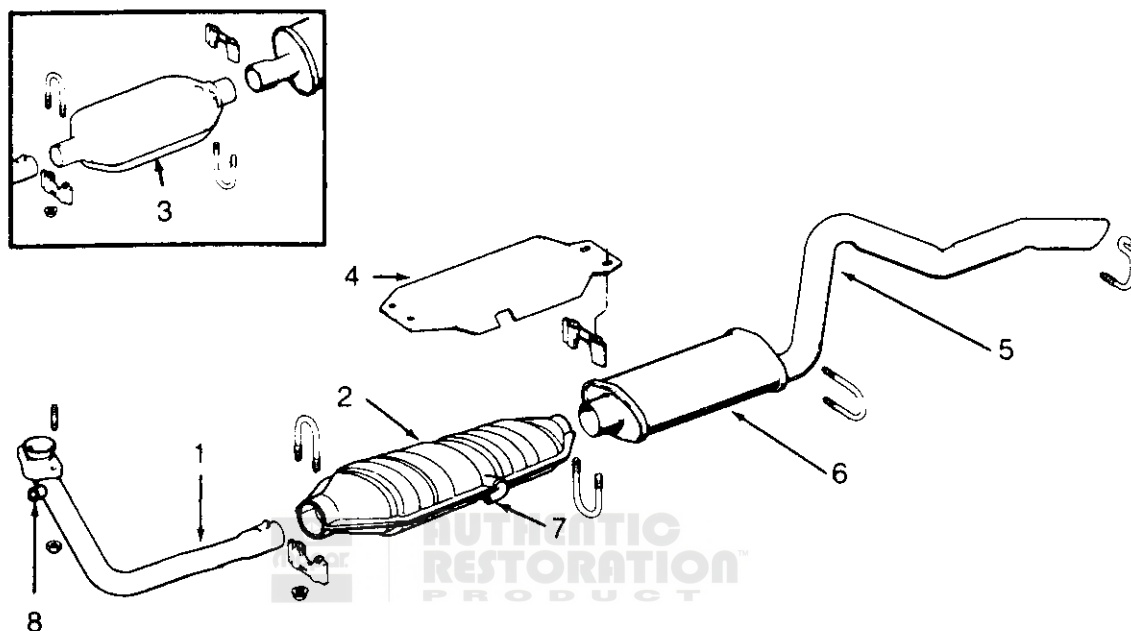
FOUR-CYLINDER ENGINE EXHAUST SYSTEM



- 1 - Upper Heat Shield
- 2 - Tail Pipe
- 3 - Muffler
- 4 - Catalytic Converter

- 5 - Lower Heat Shield
- 6 - Exhaust Pipe
- 7 - Resonator (Canada Only)

SIX-CYLINDER ENGINE EXHAUST SYSTEM



1. Front Exhaust Pipe
2. Catalytic Converter
3. Resonator (Canada Only)
4. Converter Heat Shield
5. Tailpipe
6. Muffler
7. Downstream Air Injection Tube Port
8. Upstream Air Injection Tube Port

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EXHAUST MANIFOLDS

Refer to the Engine Section of this manual.

MUFFLER REMOVAL

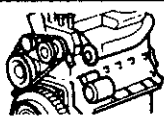
NOTE: All original equipment exhaust systems are manufactured with the rear exhaust pipe

welded to the muffler. Service replacement mufflers and rear exhaust pipes are clamped together.

Remove the front and rear muffler clamps.

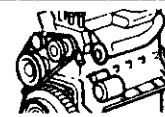
Support the rear of the vehicle by the side rails and allow the axle to hang free.

Remove the tailpipe hanger clamp.



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EXHAUST SYSTEMS



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Insert a chisel tipped tool between the tailpipe and the muffler in several places to loosen the pipe from the muffler.

Disconnect the hanger from the rear of the muffler.

Heat the rear exhaust pipe-to-muffler joint with an oxyacetylene torch until the metal becomes cherry red.

Place a block of wood against the front of the muffler and drive the muffler to the rear to disengage it.

Drive the muffler off the tailpipe.

MUFFLER INSTALLATION

Drive the tailpipe into the replacement muffler. Ensure that the locator on the tailpipe aligns with the muffler slot.

Drive the rear exhaust pipe into the muffler or the muffler into the rear exhaust pipe, as applicable. Ensure the pipe has sufficient clearance from the floor pan.

Install the clamps and hangers.

Start the engine and inspect for exhaust leaks and contact with the body panels.

FRONT EXHAUST PIPE REMOVAL

Disconnect the front exhaust pipe from the exhaust manifold.

Disconnect the rear end of the pipe from the catalytic converter.

FRONT EXHAUST PIPE INSTALLATION

Connect the rear of the replacement pipe to the converter.

Clean the mating surface of the exhaust manifold flange. Connect the pipe to the manifold but do not tighten. Use replacement nuts.

Align the pipe. Tighten the clamp at the converter. Secure the pipe flange to the manifold flange. Tighten the nuts with 27 N·m (20 ft-lbs) torque.

REAR EXHAUST PIPE or TAILPIPE REMOVAL

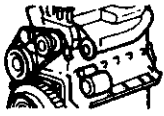
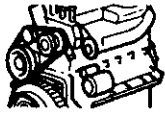
To remove a tailpipe, cut the pipe close to the muffler. Collapse the part remaining in the muffler and remove.

To remove the rear exhaust pipe, cut the pipe close to the converter. Collapse the section remaining in the converter and remove. Twist the pipe to disengage it from the muffler.

REAR EXHAUST PIPE or TAILPIPE INSTALLATION

To install a rear exhaust pipe, disconnect the muffler hanger and lower the front of the muffler. Connect the pipe to the muffler and converter. Install the muffler hanger before tightening the clamps.

To install a tailpipe, support the vehicle by the side sills. Connect the tailpipe to the muffler. Install the clamp and hangers.

	ENGINES PULSE AIR SYSTEM	
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GENERAL INFORMATION

The Pulse Air System (air injection) is used with both four- and six-cylinder engines.

The Pulse Air System utilizes the alternating positive and negative exhaust pressure pulsations instead of an air pump to inject air into the exhaust system and produce exhaust gas oxidation.

The air is routed from the filtered side of the air cleaner through a hose to the air control valve.

When opened by the air switch solenoid, the air control valve allows the air to continue to and through the air injection check valve.

The air enters the exhaust system (upstream or downstream) from the check valve. Air is injected either into the front exhaust pipe (upstream) or into the catalytic converter (downstream) depending upon engine operating conditions.

The CEC System micro computer unit (MCU) controls the switching operation.

Refer to Fuel Feedback System (Diagnosis Tests) for diagnosis of the system.

AIR INJECTION CHECK VALVE

The air injection check valve is a reed valve that is opened and closed by the negative and positive exhaust pressure pulsations.

During the negative exhaust pulse (low pressure) atmospheric pressure opens the check valve and forces air into the exhaust system.

AIR CONTROL VALVE

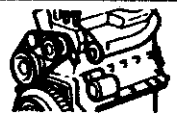
The air control valve controls the supply of filtered air routed to the air injection check valve. The valve is opened and closed by the air switch solenoid.

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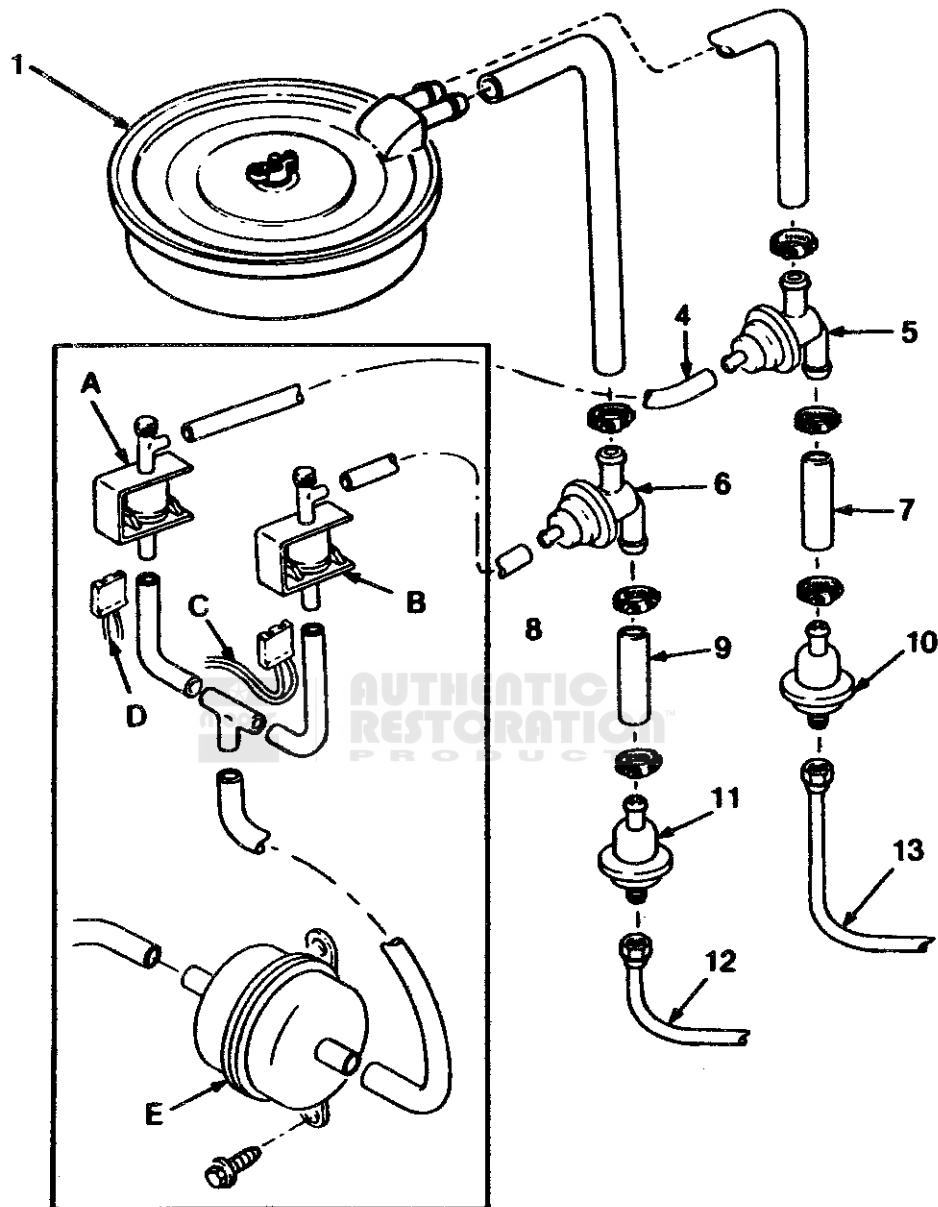


ENGINES

PULSE AIR SYSTEM



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- 1 - Air Cleaner
- 2 - Air Cleaner-To-Downstream Air Control Valve Vacuum Hose
- 3 - Air Cleaner-To-Upstream Air Control Valve Vacuum Hose
- 4 - Upstream Vacuum Hose
- 5 - Upstream Air Control Valve
- 6 - Downstream Air Control Valve
- 7 - Upstream Check Valve Hose
- 8 - Downstream Vacuum Hose
- 9 - Downstream Check Valve Hose

- 10 - Upstream Check Valve
- 11 - Downstream Check Valve
- 12 - Downstream Tube-To-Converter
- 13 - Upstream Tube-To-Exhaust Pipe
- A - Air Switch Solenoid (Upstream)
- B - Air Switch Solenoid (Downstream)
- C - Control Wires from MCU (Downstream)
- D - Control Wires from MCU (Upstream)
- E - Vacuum Storage Reservoir

AIR SWITCH SOLENOID

The air switch solenoid controls the air control valve by switching vacuum on and off. The solenoid is controlled by the micro computer unit (MCU).

VACUUM STORAGE TANK

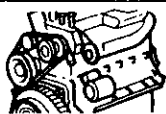
Vacuum is stored in the tank until released by the air switch solenoid.

MICRO COMPUTER UNIT (MCU)

The MCU switches air either UPSTREAM or DOWNSTREAM, depending upon the engine operating conditions by energizing and de-energizing the air switch solenoids.

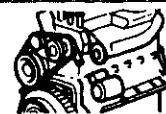
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ENGINES

CATALYTIC CONVERTER SYSTEMS



GENERAL INFORMATION

The stainless steel catalytic converter body is designed to last the life of the vehicle.

Excessive heat can result in bulging or other distortion, but excessive heat will not be the fault of the converter.

A fuel system, air injection system or ignition system malfunction that permits unburned fuel to enter the converter will usually cause overheating.

If a converter is heat-damaged, correct the cause of the damage at the same time the converter is replaced.

Also, inspect all other components of the exhaust system for heat damage.

DUAL BED (TWC and COC) MONOLITHIC-TYPE CONVERTER

The dual bed monolithic-type converter catalyst is not serviceable. If the converter fails to function properly, the complete unit must be replaced.

CONVERTER REMOVAL

Raise and support the vehicle.

Remove the converter-to-exhaust pipe clamp and flange bolts.

Remove the DOWNSTREAM air injection tube.

Remove the converter.

NOTE: It may be necessary to heat the rear exhaust pipe to facilitate converter removal.

CONVERTER INSTALLATION

Install the replacement converter.

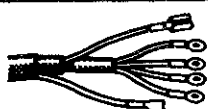
Install the clamp over the converter outlet-rear exhaust pipe junction and tighten the nuts with 61 N·m (45 ft-lbs) torque.

Tighten the manifold flange bolts with 34 N·m (25 ft-lbs) torque.

Install the DOWNSTREAM air injection tube and tighten the clamps with 4 - 5 N·m (3 - 4 ft-lbs) torque.

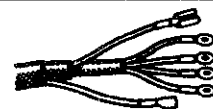
Lower the vehicle.

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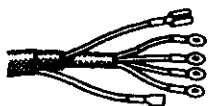
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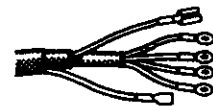
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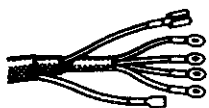
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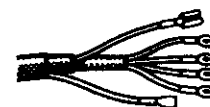
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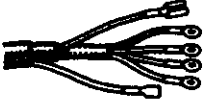
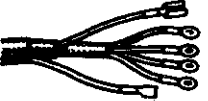
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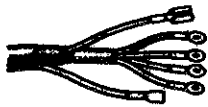
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SPECIAL TOOLS

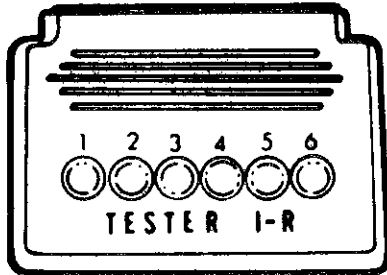
Tool Reference	Description
AM PC-1-R	Cruise Control System Tester
J-8681	Short Tester
J-21008-A	Continuity Test Lamp
J-22124-A	Pressure Gauge and Valve
J-22516	Starter Pole Screw Wrench
J-23600-B	Belt Tension Gauge
J-23738-A	Hand Operated Vacuum Pump
J-24538-A	Universal Gauge Tester
J-24642-E	HEI Ignition Module Tester
J-25300-A	Headlamp Aimer
J-25359-C	Torx Bit and Socket Set
J-26792	HEI Spark Tester
J-28509-A	Distributor Trigger Wheel Puller
J-34029-A	High Impedance Digital Multimeter
KDAL 5028	Stop Ring Sleeve
KDAL 5047	Mounting Base
KDAL 5048	Brush Collar
KDAL 5049	Plug Gauge
KDAL 5487	Stop Ring Support
MS 1700	Electronic Diagnostic Tester Kit - (ENGLISH/US) (ENGLISH/METRIC) (FRENCH/METRIC)
S VAT-40	VOLTS-AMPS Tester (Inc. Portable Stand)

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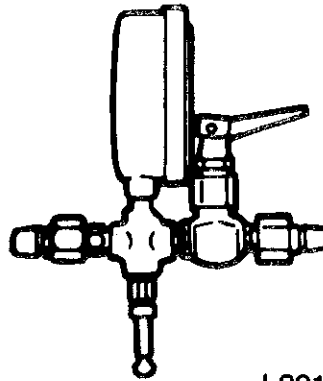
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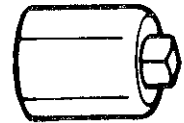
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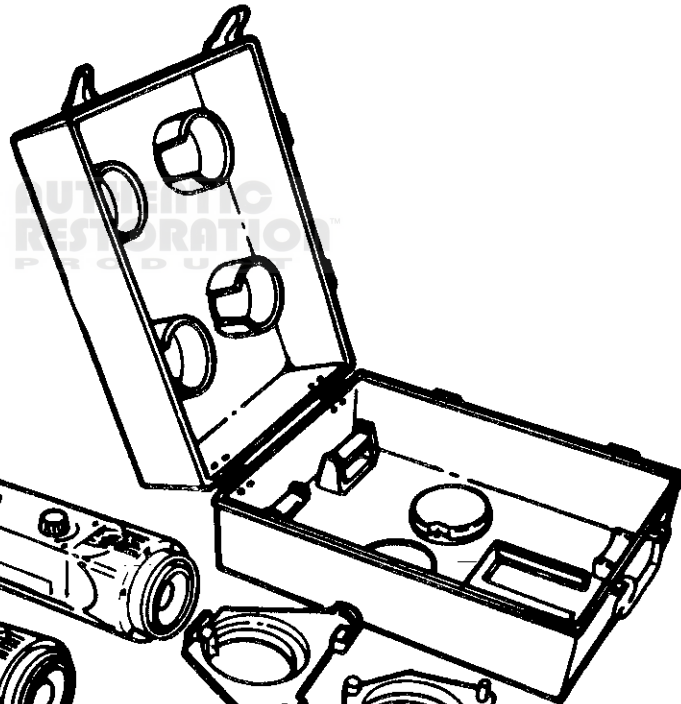
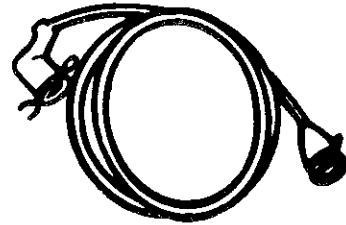
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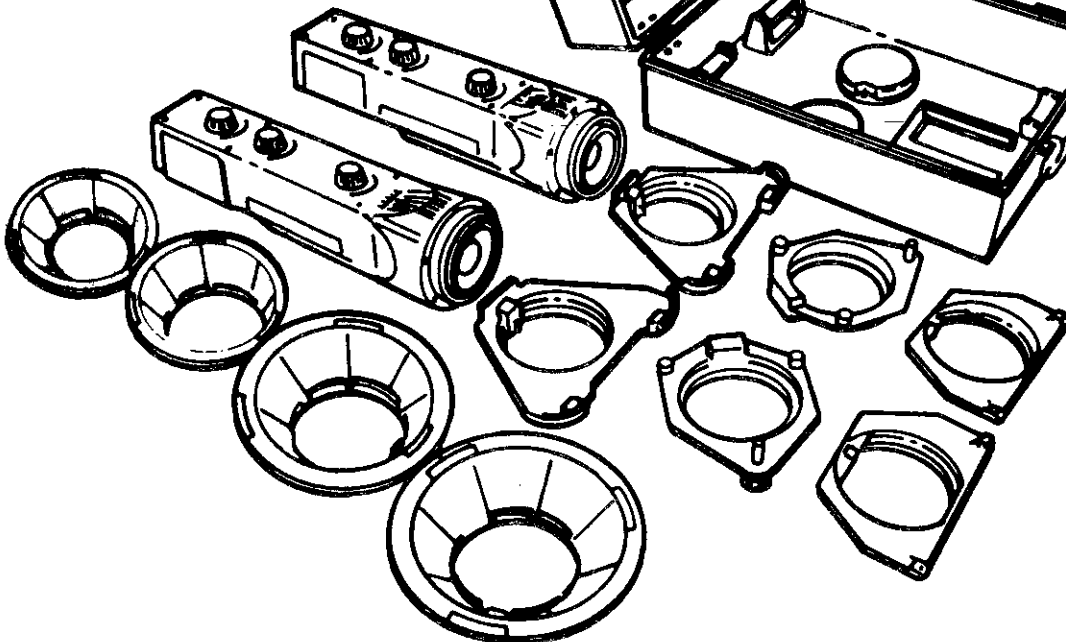
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J-22516



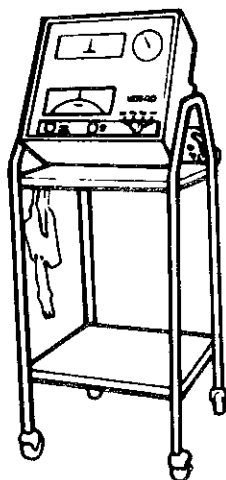
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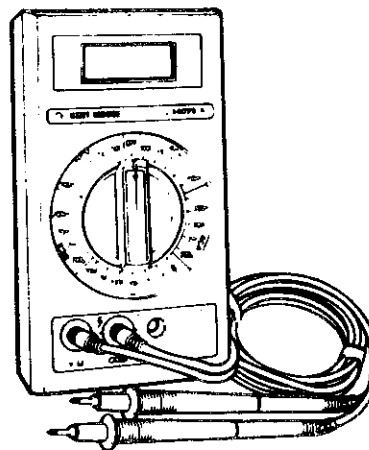
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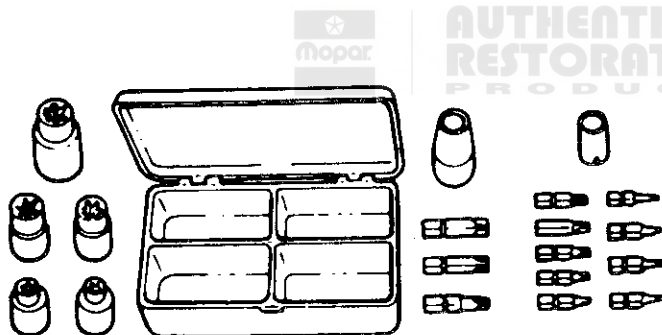
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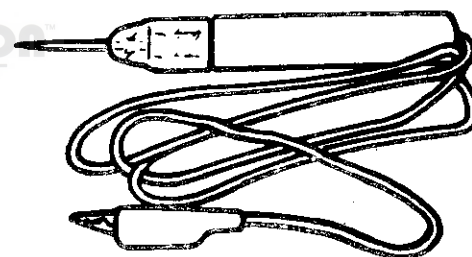
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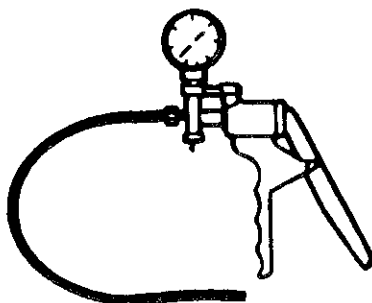
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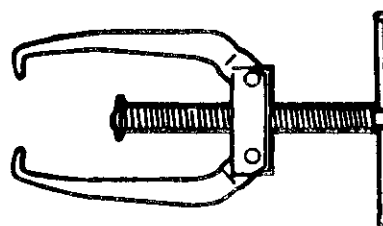
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J-21008-A

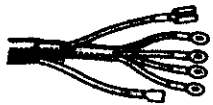


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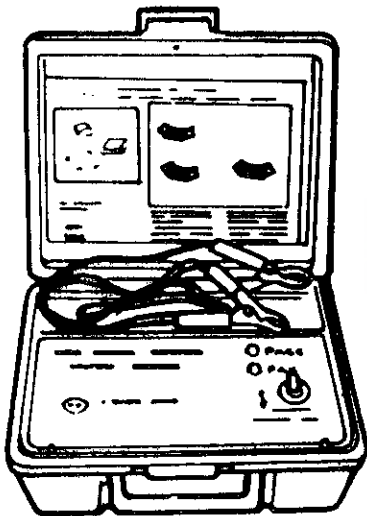


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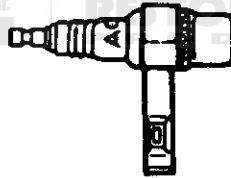
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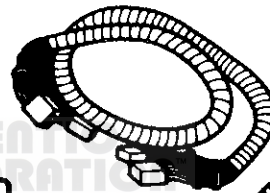
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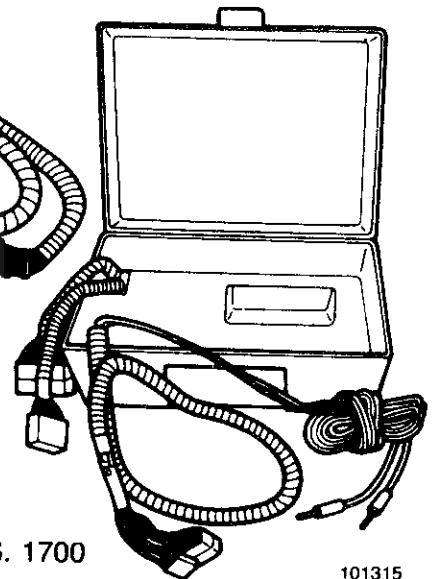
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J-26792 HEI



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	ELECTRICAL BATTERIES	
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GENERAL INFORMATION

The batteries used on 1986 Wrangler/YJ models are lightweight, low-maintenance type batteries. They require inspection of the electrolyte level only at the beginning of each winter season and every 24 000 km (15 000 mi).

In addition to the standard equipment 421 cold crank amps battery, a 452 cold crank amps battery is optionally available for vehicles equipped with heavy-duty equipment. Both batteries are 12-volt, lead composition-acid units.

The vehicle battery tray has a removable spacer that, when removed, will permit the installation of a substitute conventional size group 24 battery in the event a lightweight replacement battery is not available.

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	ELECTRICAL BATTERIES	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Battery Box Screw	16 N·m (145 in-lbs)	11-20 N·m (95-180 in-lbs)
Battery Holddown Screw	8 N·m (75 in-lbs)	6-11 N·m (50-95 in-lbs)
Battery Cable Clamp	8 N·m (75 in-lbs)	7-10 N·m (60-90 in-lbs)

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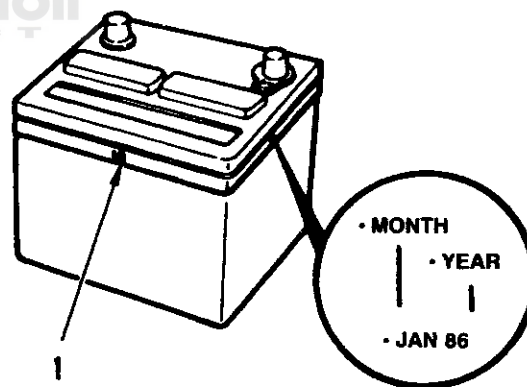
BATTERY SPECIFICATIONS

Engine	Group Size	Rating
150 & 258	55	421 amps 75 min.
Optional	56	452 amps 81 min.

841274

The date code is decoded as follows:

- month: Jan., Feb., etc.
- year: 85-1985, 86-1986



BATTERY CODES

Each battery is date coded at the time of shipment from the manufacturer. This code is stamped into the edge of the plastic case cover. A second code number stamped on the side (1) of the battery case represents manufacturing data and may be ignored.

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	ELECTRICAL BATTERIES	
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BATTERY REMOVAL

Loosen the cable terminal clamps.

Use a puller to remove the cable terminal clamps, if necessary.

Remove the negative cable terminal clamp first.

Loosen the holddowns and remove the battery.

Inspect the cable terminals for corrosion and damage. Remove corrosion using a wire brush or a post and terminal cleaner and sodium bicarbonate/water (baking soda) solution. Replace the cables that have damaged or deformed terminals.

Inspect the battery tray and holddowns for corrosion. Remove the corrosion using a wire brush and sodium bicarbonate/water solution. Paint exposed bare metal. Replace the damaged components.

Clean the outside of the battery case, if the original battery is to be installed. Clean the top cover with a diluted ammonia or sodium bicarbonate/water solution to remove the acid film. Flush the cover with clean water. Ensure that the cleaning solution does not enter the cells.

Remove any corrosion from the terminals with a wire brush or post and terminal cleaner. Inspect the case for cracks or other damage that would result in leakage of electrolyte.

BATTERY INSTALLATION

Refer to the Specifications to determine if the battery has the correct classification and rating for the vehicle.

Use a hydrometer to test the battery electrolyte. Charge the battery if necessary.

Position the battery in the tray. Ensure that the positive (+) and negative (–) terminals (posts) are correctly located. The cables must reach their respective terminals without stretching.

Ensure that the tang at the battery base is positioned in the tray properly before tightening the holddown.

CAUTION: It is imperative that the cables are connected to the battery positive-to-positive and negative-to-negative.

Connect and tighten the positive cable first. Then connect and tighten the negative cable.

NOTE: The tapered battery positive terminal (post) is approximately 1.6mm (1/16-in) larger in diameter than the negative terminal. The opening in the positive cable terminal clamp is correspondingly larger.

Apply a thin coating of petroleum jelly or chassis grease to the cable terminals and the battery posts.

Inspect the negative cable connections on the engine and vehicle body for condition, security and electrical continuity.

BATTERY TESTING

General Information

NOTE: A complete battery test includes cleaning the top of the battery case, cleaning the battery posts and the cable terminals and performing the Hydrometer Test and Heavy Load Test.

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	ELECTRICAL BATTERIES	
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The condition of a battery may be determined from the result of two tests – state of charge (Hydrometer Test) and the ability to supply current (Heavy Load Test).

Perform the hydrometer test first. If the specific gravity is less than 1.225, the battery must be charged before proceeding with further testing. A battery that will not accept a charge is defective and further testing is not necessary.

NOTE: A battery with sulfated plates may require an overnight “slow charge” to determine if the sulfate coating is thin enough to be eliminated by a “charge”.

A battery that has been fully charged but does not pass the heavy load test is defective.

If a battery discharges and no apparent cause can be determined, the battery should be fully charged and allowed to stand on a shelf for three to seven days to determine if the self-discharge is excessive.

NOTE: The Self-Discharge Rate Chart lists the amount of allowable self-discharge for the first ten days of standing after a battery has been fully charged.

A battery is fully charged when all cells are gassing freely and three corrected specific gravity tests, taken at one-hour intervals, indicate no increase in specific gravity.

Apply a thin coating of petroleum jelly or silicone grease to the cable terminals and the battery posts.

Inspect the negative cable connections on the engine and vehicle body for condition, security, and electrical continuity.

Self-Discharging Rate

Temperature	Approximate Allowable Self-Discharge Per Day For First Ten Days
100°F (37.8°C)	0.0024 Specific Gravity
80°F (26.7°C)	0.0009 Specific Gravity
50°F (10°C)	0.0003 Specific Gravity

60338

Hydrometer Test

NOTE: Periodically disassemble the hydrometer and wash the components with soap and water. Inspect the float for possible leaks. If the paper inside has turned brown, the float is defective.

Prior to testing, visually inspect the battery for any damage (cracked case or cover, loose post, etc.) that would cause the battery to be unserviceable. To interpret the hydrometer correctly, hold it with the top surface of the electrolyte in the hydrometer at eye level.

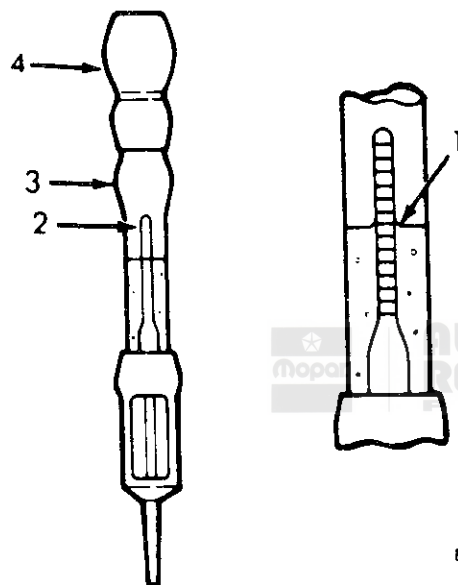
Disregard the curvature of the liquid (1) where the surface rises against the float because of surface cohesion. Remove only enough electrolyte from the battery to keep the float (2) off the bottom of the hydrometer barrel (3) when pressure on the bulb (4) is released.

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	ELECTRICAL BATTERIES	
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Keep the hydrometer in a vertical position while raising the electrolyte into the hydrometer and observing the specific gravity.

CAUTION: Exercise care when inserting the tip of the hydrometer into a cell to avoid damage to the separators. Damaged separators can cause premature battery failure.



84902

Hydrometer floats are generally calibrated to indicate the specific gravity correctly only at one fixed temperature, 26.6°C (80°F). When testing the specific gravity at any other temperature, a correction factor is required.

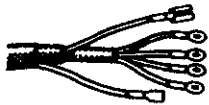
NOTE: The correction factor is approximately a specific gravity value of 0.004, referred to as four points of specific gravity. For each 5.5°C above 26.6°C (10°F above 80°F), add four points. For

each 5.5°C below 26.6°C (10°F below 80°F), subtract four points. Always correct the specific gravity for the temperature variation.

Test the specific gravity of the electrolyte in each battery cell.

Example: A battery is tested at -12.2°C (10°F) and has a specific gravity of 1.240. The actual specific gravity is determined according to the following example:

- number of degrees above or below 26.6°C (80°F) equals 38.8°C (70°F) 26.6 minus -12.2 (80 minus 10)
- 38.8°C divided by 5.5°C (70°F divided by 10°F), each 5.5°C (10°F) difference equals 7
- 7 multiplied by 0.004 (temperature correction factor) equals 0.028
- temperature is below 26.6°C (80°F), therefore, the temperature correction is subtracted
- temperature corrected specific gravity is 1.212 (1.240 minus 0.028)
- a fully charged battery should have a temperature corrected specific gravity of 1.250 - 1.265



ELECTRICAL BATTERIES



If the specific gravity of all cells is above 1.235, but the variation between cells is more than 50 points (0.050), it is an indication that the battery is unserviceable. Remove the battery from the vehicle for additional testing.

If the specific gravity of one or more cells is less than 1.235, recharge the battery at a rate of approximately five amps until three consecutive specific gravity tests, taken at one-hour intervals, are constant.

If the cell specific gravity variation is more than 50 points (0.050) at the end of the charge period, replace the battery.

When the specific gravity of all cells is above 1.235 and variation between cells is less than 50 points (0.050), the battery may be tested under heavy load.

NOTE: The specific gravity is a ratio of the density of the electrolyte and the density of pure water. The electrolyte is composed of sulfuric acid and water. Acid comprises approximately 35 percent by weight or 24 percent by volume.

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State of Charge	Specific Gravity	Charge Rate	Charging Time
Fully Charged	1.265	20	30 min
75% Charged	1.225	20	50 min
50% Charged	1.190	20	70 min
25% Charged	1.155	20	90 min
Discharged	1.120	5	12 hrs

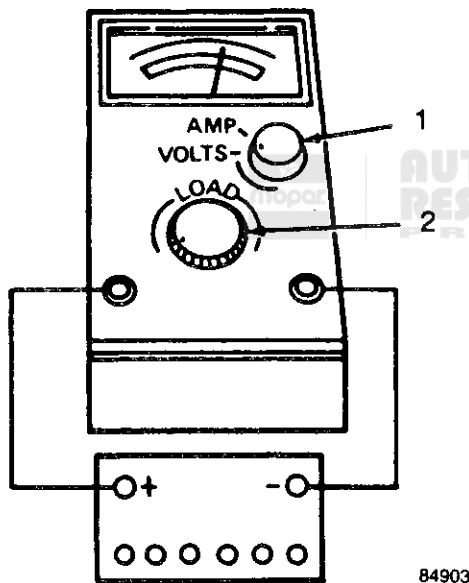
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Heavy Load Test

NOTE: The following instructions refer to **amserv Volts-AMPS Tester, Model S VAT-40**, or equivalent.

Before performing the Heavy Load Test, the battery must be fully charged. Refer to **Slow Charge Section** in this workshop manual.

Turn the selector knob (1) to the AMP position.



Turn the carbon pile rheostat knob (2) of the battery tester to the OFF position.

Connect the battery tester to the battery.

Turn the carbon pile rheostat knob clockwise until the ammeter indicates the correct test amperage:

- 210 amperes for the 55 battery (75 reserve capacity minutes, 421 cold crank amps)
- 225 amperes for the 56 battery (80 reserve capacity minutes, 450 cold crank amps)

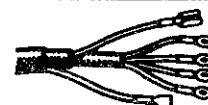
Maintain the load for 15 seconds.

Turn the selector switch to VOLTS and note voltage. If the voltmeter indicates 9.6 volts or higher with the battery temperature at a minimum of 21°C (70°F), the battery is in good condition. If less than 9.6 volts, replace the battery.



ELECTRICAL

CHARGING SYSTEM – DELCO



GENERAL INFORMATION

A Delco charging system is installed on all vehicles. This negative-ground system consists of two primary components: an alternator with an integral regulator and a battery. The non-repairable, non-adjustable regulator is a solid-state device located within the alternator housing.

The standard equipment alternator used with the four- and six-cylinder engines is rated at 56 amps. The optional, heavy-duty electrical system alternators for the four- and six-cylinder engines are rated at 66 and 78 amps. The actual alternator used depends upon the combination of accessories installed in the vehicle.

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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Alternator Adjusting Bolt	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Mounting Strap Bolt	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Alternator Pivot Bolt or Nut	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Pulley Nut	68 N·m (50 ft-lbs)	58-78 N·m (45-55 ft-lbs)

	ELECTRICAL CHARGING SYSTEM – DELCO	
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DELCO CHARGING SYSTEM SPECIFICATIONS

Alternator

Manufacturer Delco

Rating

Standard (4-Cylinder) 56 amp

Optional (4-Cylinder) 66 amp

Optional (4-Cylinder) 78 amp

Standard (6-Cylinder) 56 amp

Optional (6-Cylinder) 66 amp

Optional (6-Cylinder) 78 amp

Field Current 4.0 to 5.0 amps at 27°C (80°F)

Rotation

(Viewing Drive End) Clockwise

Pulley Size 6.18 cm (2.43 in)

V-Belt Tension

New Belt Set to 556-689 N (125-155 lbf)

Used Belt Recheck 400-512 N (90-115 lbf)

Serpentine Belt Tension

New Belt 800-890 N (180-200 lbf)

Used Belt 616-704 N (140-160 lbf)

Regulator

Manufacturer Delco

Model 1116387

Type Solid State

Adjustment None

Output Voltage Specifications

Ambient Temperature °C (°F)	Acceptable Voltage Range
18-10 (0-50)	14.3-15.3
10-38 (50-100)	13.9-14.9
38-66 (100-150)	13.4-14.4
66-93 (150-200)	13.0-14.1

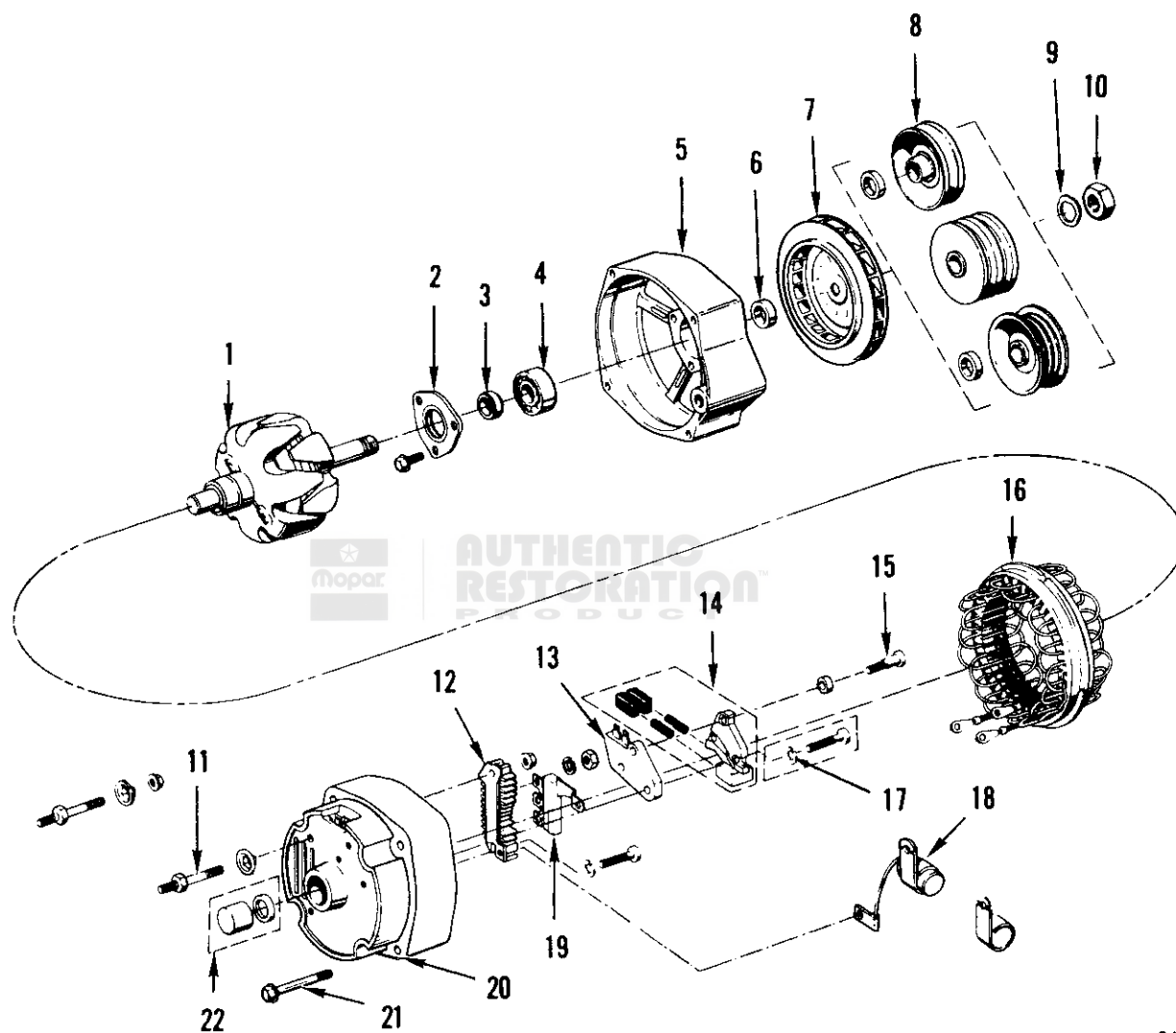
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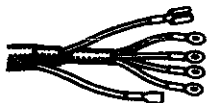
DELCO CHARGING SYSTEM

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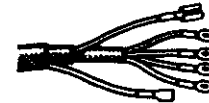
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- | | |
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| <ol style="list-style-type: none"> 1. Rotor 2. Front Bearing Retainer Plate 3. Collar (Inner) 4. Bearing 5. Ft. Housing 6. Collar (Inner) 7. Fan 8. Pulley 9. Lockwasher 10. Pulley Nut 11. Terminal Assembly | <ol style="list-style-type: none"> 12. Bridge Rectifier 13. Regulator 14. Brush Assembly 15. Screw 16. Stator 17. Insulating Washer 18. Capacitor 19. Diode Trio 20. Rear Housing 21. Through-Bolt 22. Bearing and Seal Assembly |
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ELECTRICAL

CHARGING SYSTEM – DELCO



DELCO ALTERNATOR

Other than a regularly scheduled drive belt tension adjustment, the **alternator assembly requires no periodic adjustment or maintenance**. The bearings have sufficient lubricant for the life of the alternator and do not require periodic lubrication.

NOTE: All bolt and screw threads are in metric dimensions.

Voltage Regulator

The voltage regulator unit is attached inside the rear housing of the alternator. The voltage regulator is not adjustable or repairable.

DELCO CHARGING SYSTEM DIAGNOSIS

Servicing Precautions

To avoid damage to the charging system, always observe the following precautions:

- do not attempt to polarize the regulator
- do not short across or ground any of the terminals in the charging system except as specifically instructed
- when the output terminal circuit is open and the No. 1 and No. 2 wire terminals are connected to the alternator never drive the alternator
- ensure that the alternator and battery have the same ground polarity
- when connecting a charger or a booster battery to the battery, connect the positive clamp to the positive battery terminal and the negative clamp to the engine block

- never drive the alternator with the engine when the output terminal circuit is open (i.e., not connected).

Charging System Malfunction Symptoms

Malfunction of the charging system is usually indicated by one or more of the following symptoms:

- faulty voltmeter operation
- an undercharged battery, indicated by slow engine cranking and battery electrolyte having low specific gravity
- an overcharged battery, indicated by excessive water usage

Electrical Test Inspection

Prior to performing any electrical tests, visually inspect all charging system components and wiring for obvious discrepancies.

Visual Inspection

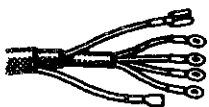
Battery Posts, Engine Block, Starter Motor Solenoid

- inspect for clean and tight cable terminal connections at the battery posts, engine block, and starter motor solenoid

Alternator, Starter Motor Solenoid, Alternator Voltmeter Wiring

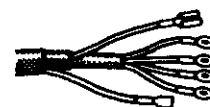
- inspect for corrosion and loose wire terminal connections at the alternator, starter motor solenoid, dash panel connector and the charging system indicator

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ELECTRICAL

CHARGING SYSTEM – DELCO



Fuse Block

- inspect all wires for cracked or broken insulation

Alternator Mounting Bolts/Ground

- inspect to see that the alternator mounting bolts are tight and that the alternator is properly grounded

Battery Fluid

- inspect the electrolyte level in the battery and add water if necessary

Alternator Drive Belt Tension

- inspect and test the alternator drive belt tension

Alternator Noise

Unusual alternator noise may be caused by any one or more of the following conditions:

- loose mounting bolts
- loose or misaligned pulley
- worn or contaminated bearings
- out-of-round or rough slip rings
- defective brushes
- shorted rectifier diode(s) indicated by a high frequency whine

Voltmeter Failure or Abnormal Indication Diagnosis

Test the alternator drive belt tension. Adjust the tension to 400 to 512 N (90 to 115 lbs) force for V-belt and 616 to 704 N (140 to 160 lbs) force for serpentine belt. Replace the belt, if necessary.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put hands near the pulleys, belts, or fan. Do not wear loose clothing.

Start and operate the engine at fast idle. Test the voltage across the battery terminals with a voltmeter. Refer to **Output Voltage Specifications** in the beginning of this section.

If the cluster voltmeter is not operating, refer to the Electrical Troubleshooting Manual (ETM) for circuit information.

Refer to the **Engine Instrumentation Section** in this workshop manual (M.R.) for Cluster Disassembly.

Undercharged Battery

An undercharged battery, indicated by slow engine cranking and battery electrolyte having low specific gravity can be caused by either the accessories being left on for extended periods or improper drive belt tension.

Ensure that the undercharged condition has not been caused by accessories left on for extended periods.

Check the drive belt for proper tension.

If a battery defect is suspected, refer to the **Battery Section**.

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	ELECTRICAL CHARGING SYSTEM – DELCO	
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Battery Discharge Through Alternator

If the alternator is suspected of discharging the battery because of excessive current leakage, perform the following test procedure with a No. 158 bulb and bulb socket with attached jumper wires.

WARNING: Failure to disconnect the battery negative cable before disconnecting the alternator output wire may result in injury.

Disconnect the battery negative cable.

Disconnect the output wire (red) from the alternator output terminal. Prevent this wire from touching any metal.

Connect the test bulb jumper wires in series with the output wire and the alternator output terminal.

Connect the battery negative cable. The bulb should NOT light. If the bulb lights, even dimly, replace the alternator bridge rectifier.

Disconnect the battery negative cable and remove the jumper wires.

Disconnect the wires from No. 1 and No. 2 terminals of the alternator.

Connect the test bulb jumper wires between the No. 1 terminal at the alternator and the battery positive post.

Connect the battery negative cable. The bulb should NOT light. If the bulb lights, even dimly, test the alternator diode trio.

If the diode trio is NOT defective, replace the voltage regulator.

Connect the test bulb jumper wires between the No. 2 terminal at the alternator and the battery positive post. The bulb should NOT light. If the bulb lights, even dimly, replace the voltage regulator.

Overcharged Battery

To determine battery condition, refer to the **Battery Section**.

If an obvious overcharge condition exists, as evidence by excessive spewing of electrolyte, replace the voltage regulator.

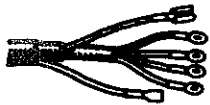
TESTING — ON - VEHICLE

Perform visual inspection as outlined.

With the ignition switch **ON** and all wiring harness leads connected, connect a voltmeter from:

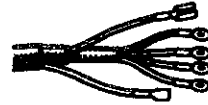
- alternator "BAT" terminal-to-ground (1), 12.5V
- alternator No. 1 terminal-to-ground (2), 2-4V
- alternator No. 2 terminal-to-ground (3), 12.5V

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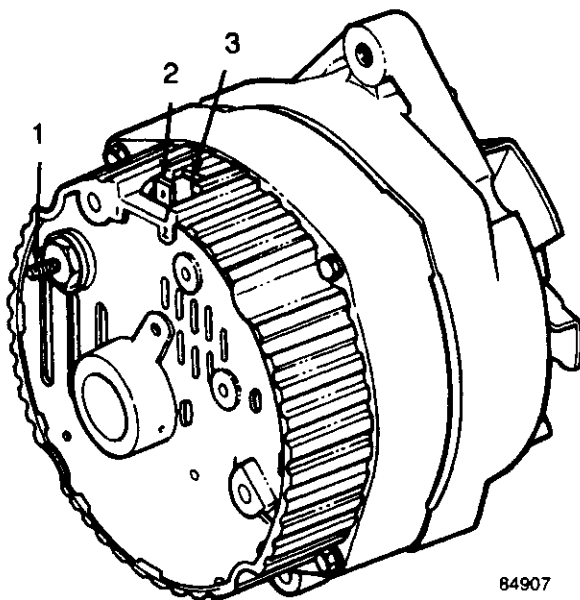


ELECTRICAL

CHARGING SYSTEM – DELCO



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A zero reading indicates an open in the circuit. Refer to the **ETM** for schematic information.

NOTE: Alternators have a built-in feature which avoids overcharge and accessory damage by preventing the alternator from turning **ON** if there is an **OPEN** in the wiring harness connected to the No. 2 regulator terminal.

Test the field windings for grounds or shorts. If defective, replace the rotor.

If the steps check satisfactorily, check the alternator as follows:

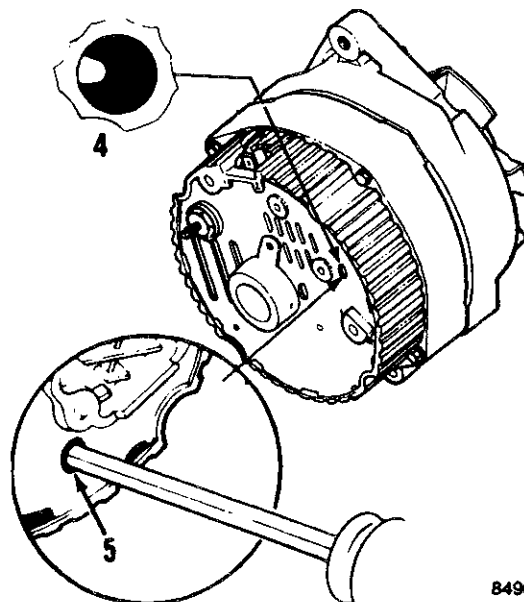
- disconnect the battery negative cable
- connect an ammeter or alternator tester in the circuit at the "BAT" terminal of the alternator
- reconnect the battery negative cable
- turn on the radio, windshield wipers, lights high beam, and blower motor on high speed

- connect a carbon pile across the battery (or use the alternator tester)
- operate the engine about 2 000 RPM
- adjust the carbon pile, as required, to obtain maximum current output
- if ampere output is within 10 amperes of the rated output as stamped on the alternator frame, the alternator is **NOT** defective

Recheck the steps.

If ampere output is **NOT** within 10 percent of the rated output, ground the field winding by inserting a screwdriver into the test hole (5). The tab is within 19mm (3/4-in) of the casting surface.

CAUTION: To avoid damaging the alternator, do not force the screwdriver deeper than 25mm (1-in) into the end frame.



84908

	ELECTRICAL CHARGING SYSTEM – DELCO	
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- operate the engine at moderate speed as required
- adjust the carbon pile as required to obtain maximum current output
- check the field winding, diode trio, rectifier bridge, stator, and test the regulator with an approved tester as covered in the Testing Section

Alternator Tester

Many testers are available to check the alternator. They provide a quick ON-VEHICLE test, and can save time over conventional diagnostic methods. Consult the manufacturer's instructions for usage.

ALTERNATOR REMOVAL

NOTE: All bolt and screw threads are in metric dimensions.

WARNING: Failure to disconnect the battery negative cable before disconnecting the output wire connector (RED) from the alternator may result in injury.

Disconnect the battery negative cable.

Disconnect the two-terminal plug connector and output wire connector (RED) at the back of the alternator.

Remove the mounting and adjusting bolts, washers, and nuts.

Remove the alternator drive belt from the alternator pulley.

Remove the alternator from the mounting bracket.

TESTING – OFF-VEHICLE

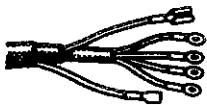
Rotor (Field) Winding-Short Circuit-to-Ground Test

Test Procedure

To perform this test, remove the rotor and front housing assembly from the stator and rear housing assembly. Refer to Alternator Overhaul for the procedure.

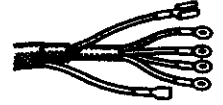
Perform the test with an ohmmeter set for the x1000 ohm scale or with a 110-volt test lamp.

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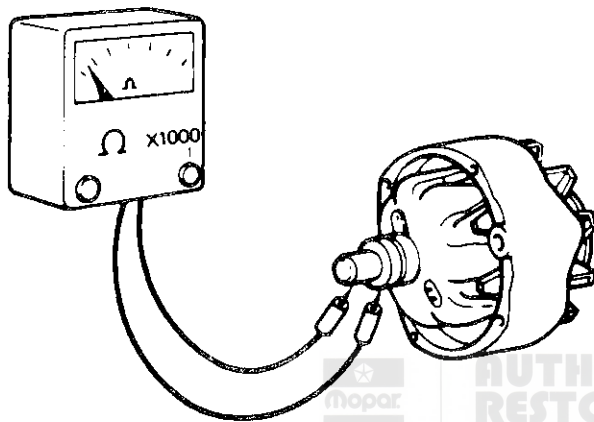


ELECTRICAL

CHARGING SYSTEM – DELCO



Touch one test lead probe to the rotor shaft and touch the other probe to one slip ring. Repeat with the other slip ring. In each test, the ohmmeter should indicate infinite resistance (no pointer movement) or the test lamp should NOT light.



84909

Test Results

If the ohmmeter indicates other than an infinite resistance or the test lamp lights, a short circuit to the rotor shaft (ground) exists. Inspect the soldered connections at the slip rings to ensure they are secure and not shorted to the rotor shaft, or that excess solder is not shorting the rotor winding to the shaft. Replace the rotor, if defective.

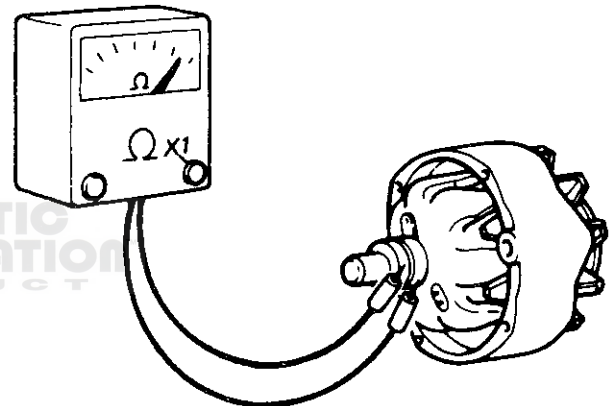
Rotor (Field) Winding-Open Circuit Test

Test Procedure

To perform this test, remove the rotor and front housing assembly from the stator and rear housing assembly. Refer to Alternator Overhaul

for the procedure. Perform the test with an ohmmeter set for the x1 scale or with a 110-volt test lamp.

Touch one test lead probe to one slip ring and the other test lead probe to the other slip ring. The ohmmeter should indicate 2.2 - 3.0 ohms or the test lamp should light.



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Test Results

If the ohmmeter indicates infinite resistance or the test lamp fails to light, the rotor (field) winding has an open circuit.

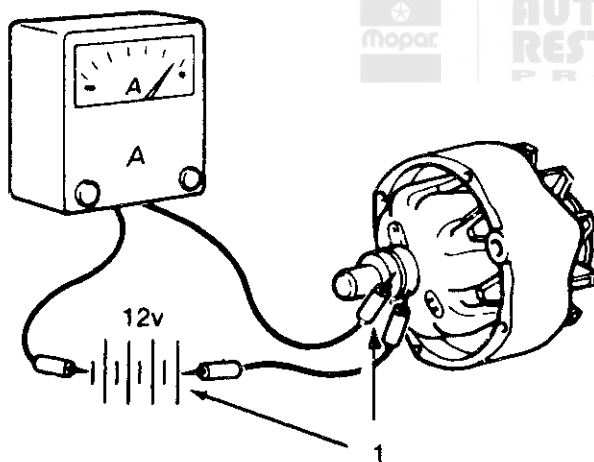
An alternate test method is to determine the field winding resistance by connecting an ohmmeter to the two slip rings. If the resistance is less than 2.2 ohms at 80°C (27°F), the windings are internally shorted. If the resistance is more than 3.0 ohms at 80°C (27°F), the windings have excessive resistance. In both cases replace the rotor.

Rotor (Field) Winding Internal Short Circuit Test

Test Procedure

To perform this test, remove the rotor and front housing from the stator and rear housing assembly. Refer to **Alternator Overhaul Section** for the procedure. This test is performed with a 12-volt battery and an ammeter.

Connect the battery and ammeter in series with the slip rings (1). The field current with 12 volts applied at 27°C (80°F) should be between 4.0 and 5.0 amps. In both cases replace the rotor.



84911

Test Results

Current flow exceeding 5.0 amps indicates internally shorted windings. Replace rotor.

NOTE: The winding resistance and ammeter indication will vary slightly with winding temperature changes.

Stator Windings-Short Circuit to Ground Test

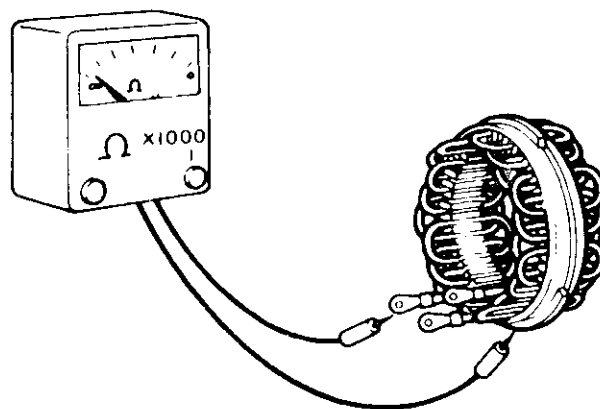
Test Procedure

To perform this test, separate the rear housing and stator from the rotor and front housing assembly.

Disconnect the stator winding terminals from the bridge rectifier (and diode trio) terminal studs. Refer to **Alternator Overhaul Section** for the procedure.

NOTE: The test is performed with an ohmmeter set for the x1000 scale or with a 110-volt test lamp.

Touch one test lead probe to the bare metal surface of the stator core and the other test lead probe to the end of one stator winding. Because all three stator winding terminals are soldered together, it is not necessary to test each winding. The ohmmeter should indicate infinite resistance (no pointer movement) or the test lamp should not light.



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Test Results

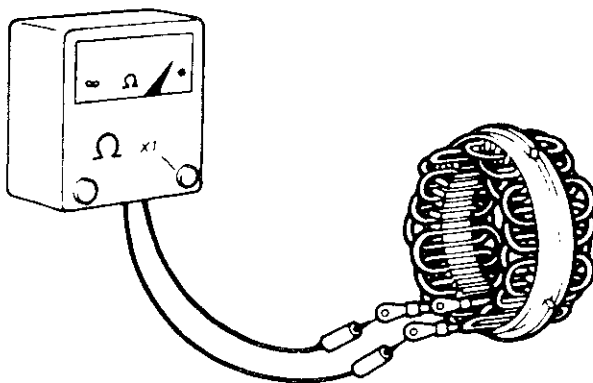
If the ohmmeter indicates other than an infinite resistance or the test lamp lights, the stator windings have a short circuit to the core (ground) and must be replaced.

Stator Windings-Continuity Test

Test Procedure

To perform this test, remove the stator and rear housing assembly from the rotor and front housing assembly. Refer to Alternator Overhaul for the procedure. An ohmmeter set for the x1 scale is used to perform the test.

Touch the ohmmeter test probes to any two stator winding terminals and note the resistance. Test all the stator windings in this manner. Equal indications should be obtained for each pair of windings tested.



84913

Test Results

An infinite resistance (no pointer movement) indicates open windings. Inspect the neutral junction splice for an inadequate solder connection. Resolder the connection even if it appears to be electrically and mechanically good. Retest for winding continuity. If an open circuit still exists, replace the stator windings.

An indication of more than one ohm indicates a possible cold solder joint. Inspect the neutral junction splice and resolder, if necessary.

Stator Windings-Internal Short Circuit Test

Test Procedure

An internal short circuit (e.g., between the adjacent windings) is difficult to locate without laboratory test equipment. If all other alternator test results are normal and the alternator fails to supply the rated output, shorted stator windings are probable.

Diode Trio-Short Circuit Test

The diode trio is tested in two ways:

- when installed in the rear housing, and,
- when removed from the rear housing

CAUTION: Do not use high voltage test device, such as a 110-volt test lamp, to test the diode trio.

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	ELECTRICAL CHARGING SYSTEM – DELCO	
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Test with the Diode Trio Installed

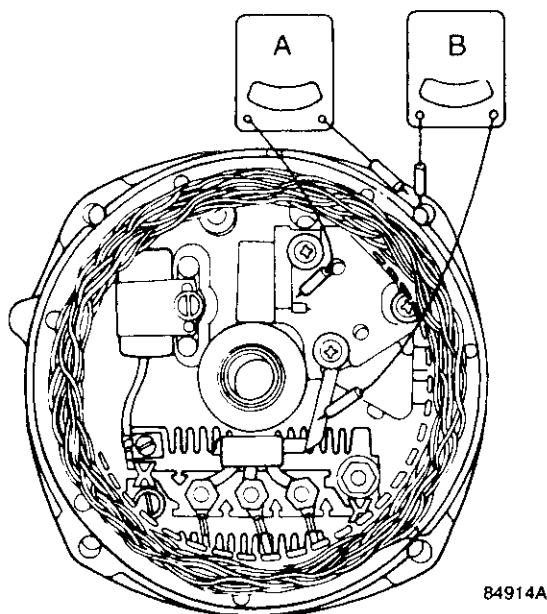
Before removing the diode trio, connect an ohmmeter, with the lowest range scale selected, from the brush holder clip, to rear housing (A) and note the resistance.

With the ohmmeter on its lowest scale, connect between the rear housing and the diode trio (B).

For both meter readings reverse the test probe connections. If both indications are zero, inspect for a shorted brush holder clip caused by absence of the insulating washer/sleeve around the screws or damaged insulation.

Remove the screws to inspect the insulating washers/sleeves (A).

If insulator assemblies are correct and both ohmmeter observations are identical, replace the voltage regulator.



Test with Diode Trio Removed

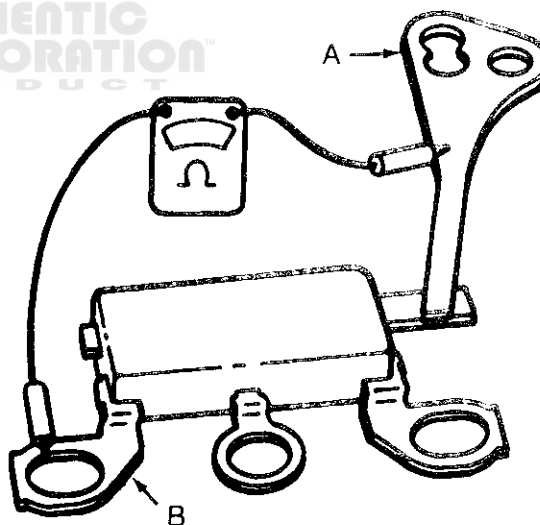
Remove the diode trio from the rear housing assembly.

Use an ohmmeter having 1½ volt cell for the test. Touch one test probe to the brush terminal (A) and the other probe to one of the stator winding terminals (B).

Observe the resistance on the lowest range scale.

Reverse the probes at the same two terminals.

Replace the diode trio if both resistances are identical. The good diode trio will have one high and one low resistance.



Repeat the procedure for each stator winding terminal of the diode trio.

Connect the ohmmeter test probes to any two stator winding terminals. If the resistance is zero, a shorted diode is indicated. Replace the diode trio. Repeat the test for each combination of stator winding terminals.

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Bridge Rectifier Test

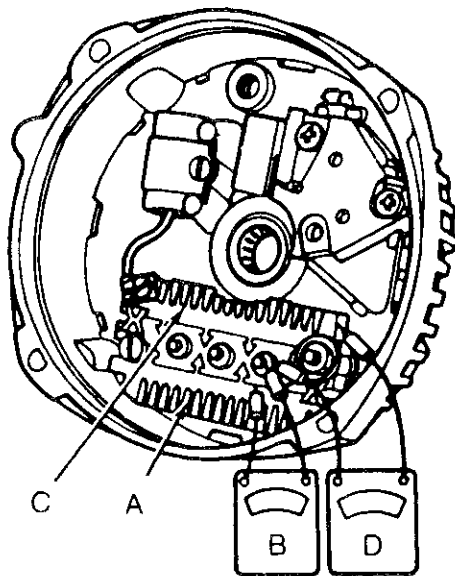
Test Procedure

The bridge rectifier assembly contains six diodes. If one diode is defective, the entire bridge rectifier assembly must be replaced.

CAUTION: Do not use a high voltage test device, such as a 110-volt test lamp, to test the bridge rectifier.

NOTE: Press down firmly on the flat metal area surrounding the thread studs with the ohmmeter test probes.

Firmly touch the ohmmeter test probes to the grounded heat sink (A) and any one of three terminals (B).



Reverse the ohmmeter test probe contacts to the grounded heat sink and the same terminal. Note the resistance.

Repeat the procedure for the remaining two terminals.

In the same manner as described above, test between the insulated heat sink (C) and each of the three terminals (D).

Test Results

Each combination of the terminal and heat sink tested should have one high and one low resistance. Replace the bridge rectifier, if any one pair of resistance indications is the same.

NOTE: Replacement bridge rectifiers may vary in appearance but are completely interchangeable.

ALTERNATOR DISASSEMBLY

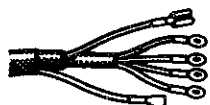
CAUTION: As the rotor and drive end (front) housing assembly is separated from the rear housing assembly the brushes can spring out onto the rotor shaft and come in contact with lubricant. Immediately clean the brushes that contact the shaft to avoid contamination by lubricant, otherwise, they will have to be replaced.

NOTE: All bolt and screw threads are in metric dimensions.

Scribe across the front housing, stator frame and rear housing for assembly reference.

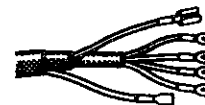
Remove the four through-bolts that connect the rear housing to the front housing.

Separate the front housing and rotor assembly from the rear housing and stator assembly by prying the housings apart with a screwdriver.



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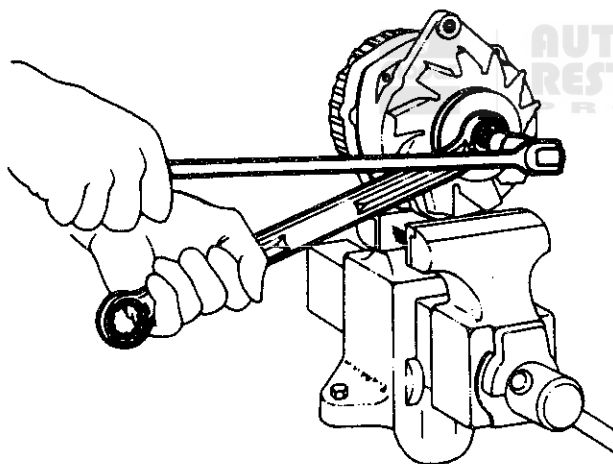
CHARGING SYSTEM – DELCO



NOTE: After disassembly, cover the rear housing bearings with tape to prevent entry of dirt and other foreign material. Also, cover the rotor shaft on the slip ring end with tape. Use pressure-sensitive tape, not friction tape, which would leave a gummy deposit on the shaft. If the brushes are to be reused, clean with a soft, dry cloth.

CAUTION: Avoid excessive tightening of the rotor in the vise to prevent rotor distortion.

Place a rotor in a vise and tighten the vise only enough to permit the removal of the pulley nut.



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An alternate pulley nut removal procedure requires the use of an Allen wrench to prevent the rotor from turning while loosening the nut with a wrench.

Remove the pulley nut, lockwasher, pulley, fan and outer collar.

Separate the front housing from the rotor shaft.

Remove the three stator winding terminal attaching nuts and washers and remove stator winding terminals from the bridge rectifier terminal studs.

Separate the stator from the rear housing.

Remove the diode trio strap terminal attaching screw from the brush holder and remove the diode trio.

Remove the capacitor holddown screw.

Disconnect the capacitor wire terminal from the bridge rectifier. Remove the capacitor.

Remove the bridge rectifier attaching screws and the battery wire terminal (output) stud.

Remove the bridge rectifier.

NOTE: For assembly reference, note the insulator located between the heat sink and the rear housing.

Remove the remaining two brush holder screws. Note the location of all the insulator washer/sleeves to facilitate the correct assembly.

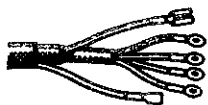
Remove the brush holder and brushes. Carefully note the position of the parts for assembly reference.

Remove the voltage regulator.

Remove the front bearing retainer plate screws, retainer plate and inner collar.

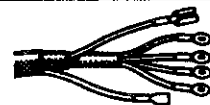
Press out the front bearing and slinger from the front housing with the appropriate tube or collar.

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CHARGING SYSTEM – DELCO



NOTE: If the bearing is in satisfactory condition, it may be reused.

Press out the rear bearing from the rear housing using the tube or collar that fits inside the bearing housing. Press from inside of the housing toward the outside.

NOTE: Replace the rear bearing if its lubricant supply is exhausted. Do not attempt to lubricate and reuse a dry bearing.

ALTERNATOR CLEANING AND INSPECTION

CAUTION: Do not clean the rotor with a degreasing solvent.

Clean the rotor poles by brushing with oleum spirits, or equivalent.

NOTE: Oleum spirits is a heavy, oily, and strongly corrosive solution of sulfur trioxide in anhydrous sulfuric acid.

Inspect the slip rings for contamination and roughness. Clean with solvent. If necessary, clean and finish the slip rings with commutator paper, or 400 grit (or finer) polishing cloth. Do not use metal-oxide paper. Spin the rotor in a lathe or other rotatable support while holding the abrasive against the rings.

NOTE: When using an abrasive, support the rotor while spinning to clean the slip rings evenly. Cleaning the slip rings without support may result in flat spots on slip rings. This will cause brush noise and premature brush wear.

True rough or out-of-round slip rings in a lathe to 0.051 mm (0.002-in) maximum gauge indication. Remove only enough material to make the rings smooth and round. Finish with commutator paper, or 400 grit (or finer) polishing cloth, and blow away all dust.

CAUTION: Do not clean the stator with a degreasing solvent.

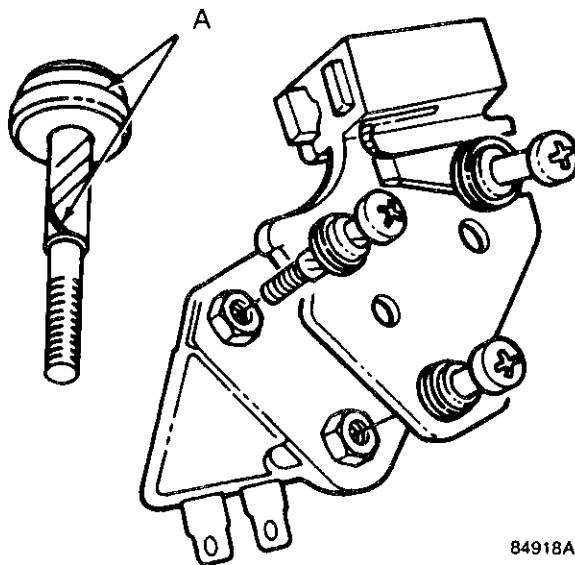
Clean the stator by brushing with oleum spirits, or equivalent.

Inspect the brush springs for damage or corrosion. Replace the springs, if there is any doubt about their condition.

Inspect the brushes for wear or contamination. If the brushes are to be reused, clean them with a soft, dry cloth until it is completely free of lubricant.

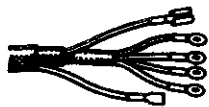
Inspect the condition of the brush holder screw insulating washer/sleeves for broken or cracked insulation (A).

Thoroughly clean the bridge rectifier, diode trio and voltage regulator with a brush and high pressure air.



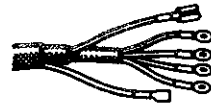
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CHARGING SYSTEM – DELCO



ALTERNATOR ASSEMBLY

CAUTION: Overfilling may cause the bearing to overheat.

Fill the cavity between the retainer plate and front bearing one-quarter full with Delco lubricant No. 1948791, or equivalent.

Assemble the slinger and bearing into the front housing.

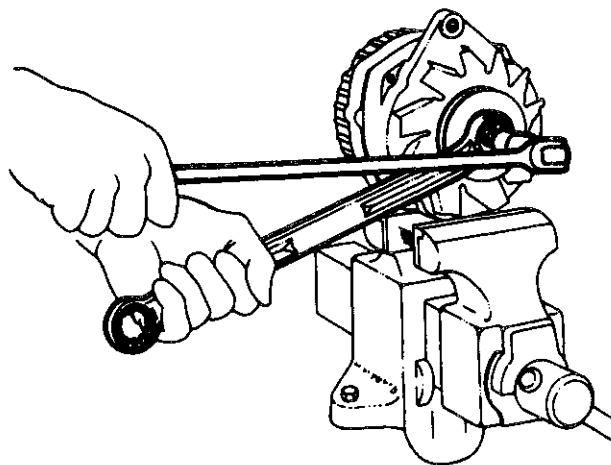
Press the bearing into the housing with the appropriate tube or collar that fits over the outer bearing race.

NOTE: Install a replacement retainer plate if the felt seal in the retainer plate has hardened.

Install the inner collar, retainer plate and screws.

Position the housing, outer collar, fan, pulley and washer on the rotor shaft and install the pulley nut.

Place the rotor in a vise. Tighten the vise only enough to permit tightening of the pulley nut. Tighten the nut with 68 N·m (50 ft·lbs) torque.



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An alternate method of tightening the pulley nut requires the use of an Allen wrench to prevent the rotor from turning while tightening the nut with a torque wrench.

If the rear bearing was removed, support the inside of the rear housing with a hollow cylinder.

CAUTION: Use extreme care to avoid misalignment or placing undue stress on the bearing.

Place a flat plate over the bearing and press the bearing into the housing from the outside until the bearing is flush with the housing.

Install a replacement bearing seal. Lightly lubricate the lip with oil to facilitate installation of the rotor shaft. Press the seal into the housing with the lip away from the bearing.

Install the springs and brushes into the brush holder. The brushes should slide in and out of the brush holder without binding.

NOTE: Should any of the brush holder assembly parts require replacement, it is necessary to replace the entire brush holder assembly. Individual parts are not serviced.

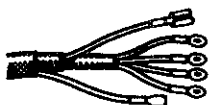
Insert a straight wooden or plastic toothpick (to prevent scratching the brushes) into the hole at the bottom of the holder to retain the brushes.

Install the voltage regulator.

Attach the brush holder to the rear housing. Carefully note the correct locations for insulating the washer/sleeves. Allow the toothpick to protrude through the hole in the rear housing.

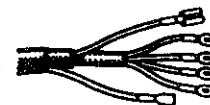
Install the diode trio terminal strap attaching screw and insulating washer.

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CHARGING SYSTEM – DELCO



Tighten the remaining two brush holder screws securely.

Position the bridge rectifier on the rear housing with the insulator inserted between the insulated heat sink and the rear housing.

Install the bridge rectifier attaching screw and battery wire (output) terminal stud.

Connect the capacitor wire terminal to the bridge rectifier and tighten the screw securely.

Install the capacitor holddown screw.

Position the diode trio strap terminals on the bridge rectifier terminal studs.

Install the stator in the rear housing.

Attach the stator winding terminal to the bridge rectifier terminal studs. Secure with washers and nuts.

Before joining the rotor and the front housing assembly with the stator and rear housing assembly, remove the protective tape and ensure that the bearing surface of the shaft is clean.

Join the front housing and rear housing together with the scribe mark aligned.

Install the four through-bolts and tighten securely.

Remove the toothpick from the brush holder assembly. Rotate the rotor.

ALTERNATOR INSTALLATION

Attach the alternator to the mounting bracket with washers and bolts. Tighten bolts finger-tight ONLY.

Install the alternator drive belt.

Tighten the belt to the specified tension. Refer to Drive Belt Adjustment for correct belt tightening procedure.

Tighten the bolt at the bracket sliding adjustment slot with 27 N·m (2 ft-lbs) torque. Tighten the remaining bolts with 38 N·m (28 ft-lbs) torque.

Connect the two-terminal plug connector and output wire connector (red) to the alternator.

Connect the battery negative cable.

DRIVE BELT ADJUSTMENT

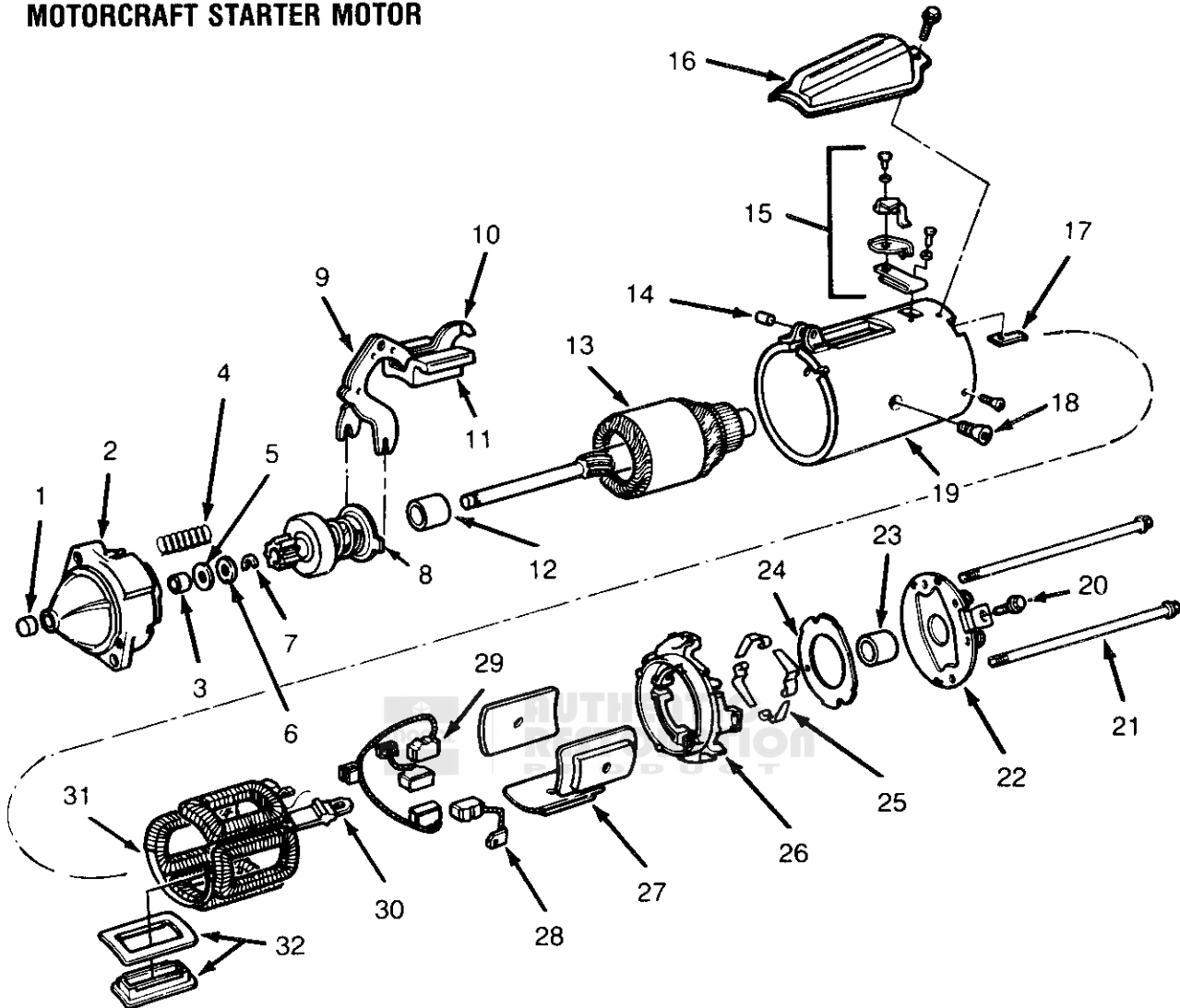
If the belt has been in service for some time, inspect the general condition of the belt before attempting an adjustment. Replace the belt if it is severely cracked or oil-soaked.

Install the belt tension gauge on the longest accessible span of belt, midway between pulleys. Refer to the Belt Tension Specifications Section.

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	ELECTRICAL STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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MOTORCRAFT STARTER MOTOR



Starter Motor – Exploded View

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Seal 2. Drive End Housing 3. Bushing 4. Drive Yoke Return Spring 5. Washer 6. Retainer 7. Snap Ring 8. Pinion Gear Drive Mechanism 9. Drive Yoke 10. Solenoid Contact Point Actuator 11. Movable Pole Shoe 12. Spacer 13. Armature 14. Pivot Pin 15. Solenoid Contact Point Assembly 16. Drive Yoke Cover | <ul style="list-style-type: none"> 17. Hold-In Coil Terminal 18. Field Winding Screw 19. Frame 20. Terminal Screw 21. Through Bolt(s) 22. Brush End Plate 23. Bushing 24. Insulator 25. Spring 26. Brush Holder and Insulator 27. Pole Shoe 28. Ground Brush 29. Insulated Brush 30. Terminal 31. Field Winding 32. Sleeve |
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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



GENERAL INFORMATION

CAUTION: Starter motor solenoids used in previous years (before solid-state ignitions) look similar to the solenoids presently used but are very different internally. Use of the wrong type solenoid can damage the neutral safety switch. Verify the part number stamped on the replacement solenoid before installation.

The Motorcraft starting system, used with six-cylinder engines, consists of a lightweight positive engagement starter motor, a starter motor solenoid, an ignition/start switch, circuits protected by fusible links and the battery. Vehicles equipped with an automatic transmission also have a neutral safety switch. The Motorcraft starter motor has a moveable pole shoe and appropriate linkage to engage the drive mechanism. Inside the drive assembly, an overrunning clutch prevents the starter motor from being driven by the ring gear.

CAUTION: Starter motor solenoids are equipped with both blade terminals and long studs. The blade terminals are attached to the long studs and held in place by retaining nuts. Loosening of the retaining nuts could cause the loss of internal connections and necessitate replacement of the solenoid.

MOTORCRAFT STARTING SYSTEM SPECIFICATIONS

Item	Specifications
Frame diameter	114.3 mm (4.5 in)
Brush Length	12.7 mm (0.5 in)
Wear Limit	6.35 mm (0.25 in)
No Load Test (Free Speed) Volts Amps Min. RPM Max. RPM	 12 67 7380 9356
Contact Point Clearance	2.5-0.5 mm (0.100-0.020 in) 1.5 mm (0.060 in) preferred

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TORQUE SPECIFICATIONS

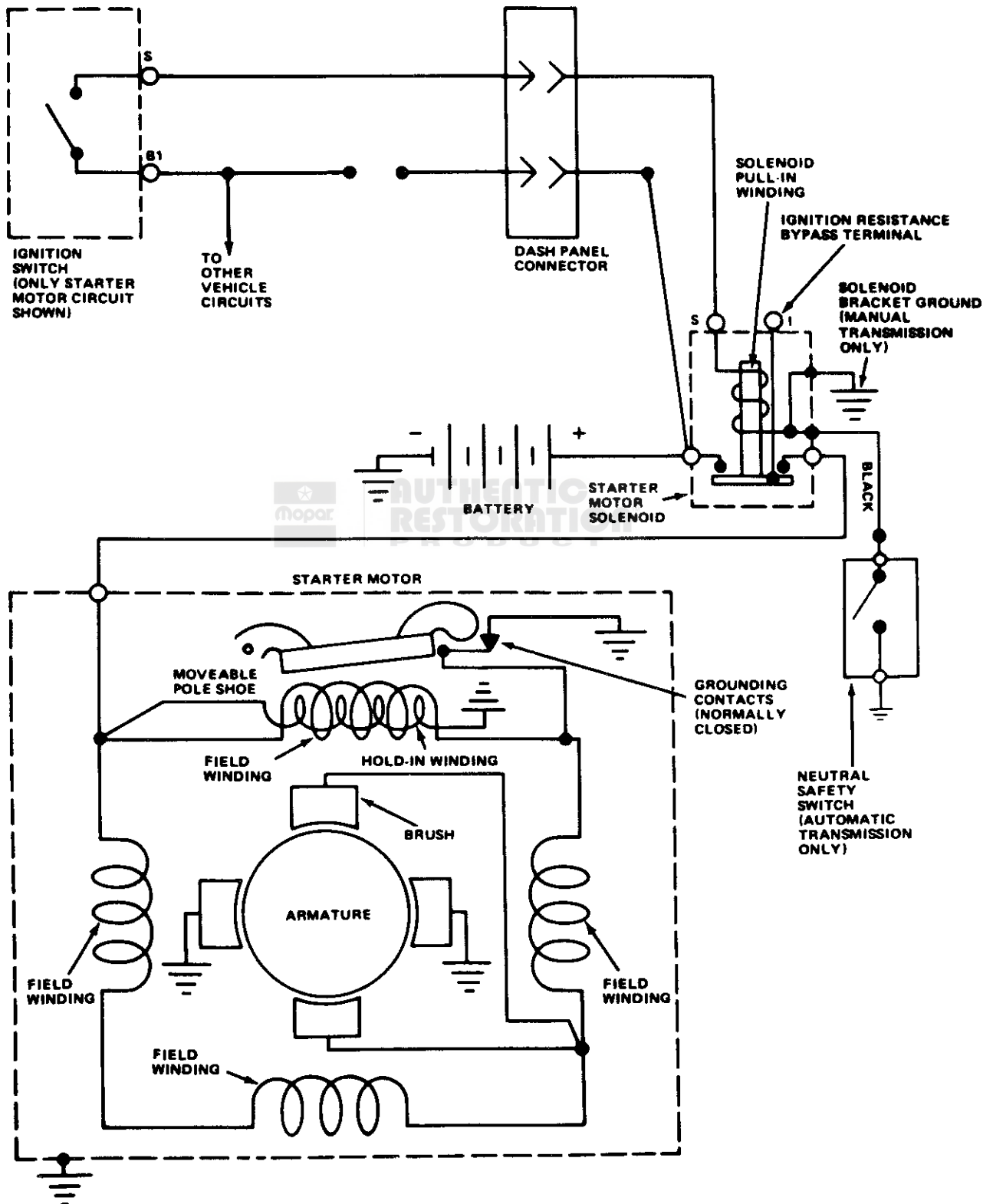
Component	Service Set-To Torque	Service Recheck Torque
Neutral Safety Switch-to-Transmission Case	23 N·m (17 ft-lbs)	19-28 N·m (14-21 ft-lbs)
Starter Motor-to-Flywheel/ Converter Housing	24 N·m (18 ft-lbs)	18-34 N·m (13-25 ft-lbs)
Starter Terminal Screw	6 N·m (55 in-lbs)	4.5 - 9 N·m (40-70 in-lbs)

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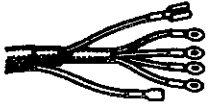
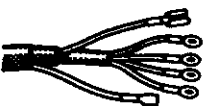
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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)

**SIMPLIFIED STARTER MOTOR CIRCUIT
(REFER TO ETM SCHEMATIC)**



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	ELECTRICAL STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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TROUBLESHOOTING

The Service Diagnosis Chart may be used to isolate the source of the problem the starter motor either:

- rotates the engine too slowly
- will not rotate the engine, or,
- has abnormal drive engagement.



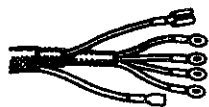
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Fuel System/Ignition System Problems

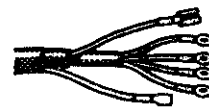
If the starter motor rotating speed is normal and the drive pinion gear engages properly with the ring gear but the engine does not start, a problem exists in either the:

- fuel system, or the,
- ignition system.



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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER MOTOR ROTATES ENGINE SLOWLY	(1) Battery charge low or battery defective. (2) Defective circuit between battery and starter motor. (3) Low load current. (4) High load current.	(1) Charge or replace battery. (2) Clean and tighten, or replace cables. (3) Bench-test starter motor. Inspect for worn brushes and weak brush springs. (4) Bench-test starter motor. Check engine for friction, drag or coolant in cylinders. Check ring gear-to-pinion gear clearance.
STARTER MOTOR WILL NOT ROTATE ENGINE	(1) Battery charge low or battery defective. (2) Faulty solenoid. (3) Damaged drive pinion gear or ring gear. (4) Starter motor engagement weak. (5) Starter motor rotates slowly with high load current. (6) Engine seized.	(1) Charge or replace battery. (2) Check solenoid ground. Repair or replace as necessary. (3) Replace damaged gear(s). (4) Bench-test starter motor. (5) Inspect drive yoke pull-down and point gap. Check for worn end bushings. Check ring gear clearance. (6) Repair engine.
STARTER MOTOR DRIVE WILL NOT ENGAGE (SOLENOID KNOWN TO BE GOOD)	(1) Defective contact point assembly. (2) Inadequate contact point assembly ground. (3) Defective hold-in coil.	(1) Repair or replace contact point assembly. (2) Repair connection at ground screw. (3) Replace field winding assembly.
STARTER MOTOR DRIVE WILL NOT DISENGAGE	(1) Starter motor loose on flywheel housing. (2) Worn drive end bushing. (3) Damaged ring gear teeth. (4) Drive yoke return spring broken or missing.	(1) Tighten mounting bolts. (2) Replace bushing. (3) Replace ring gear or driveplate. (4) Replace spring.
STARTER MOTOR DRIVE DISENGAGES PREMATURELY	(1) Weak drive assembly thrust spring. (2) Hold-in coil defective.	(1) Replace drive mechanism. (2) Replace field winding assembly.
LOW LOAD CURRENT	(1) Worn brushes. (2) Weak brush springs.	(1) Replace brushes. (2) Replace springs.

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	ELECTRICAL STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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ON-VEHICLE TESTING

Starter Motor Will Not Rotate

Verify the battery and cable condition as outlined under **Batteries Section** to assure that the correct voltage is available.

Inspect and tighten the battery and starter motor cable connections at the starter motor solenoid terminals.

Disconnect the wire at the solenoid S-terminal.

WARNING: Place the transmission in NEUTRAL (manual) or PARK (automatic) position and apply the parking brake before conducting the solenoid test.

Connect a jumper wire from the battery positive post to the solenoid S-terminal.

If the starter motor rotates the solenoid is not defective. Inspect the ignition/start switch circuit.

If the starter motor does not rotate, connect another jumper wire from the battery negative terminal to the solenoid mounting bracket (manual transmission) or the ground terminal (automatic transmission). Ensure that a good connection is made.

If the solenoid energizes, it was not properly grounded. Remove any rust or corrosion and attach the solenoid to the inner-fender panel with cadmium-plated screws (manual transmission) or test the operation of the neutral safety switch (automatic transmission).

If the starter motor does not rotate, remove the jumper wires and connect a heavy gauge jumper cable between the battery positive post and the starter motor terminal on the solenoid. If the starter motor rotates, the solenoid is defective and must be replaced. If the starter motor does not rotate, inspect the starter motor.

Solenoid Pull-In Coil Winding Test

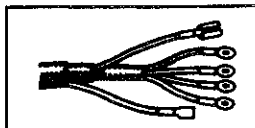
This test will determine if the solenoid pull-in winding is either shorted or open.

Disconnect the S-terminal wire from the solenoid.

Connect the ohmmeter test probes to the S-terminal (1) and mounting bracket (2) (manual transmission) or ground terminal (3) (automatic transmission).

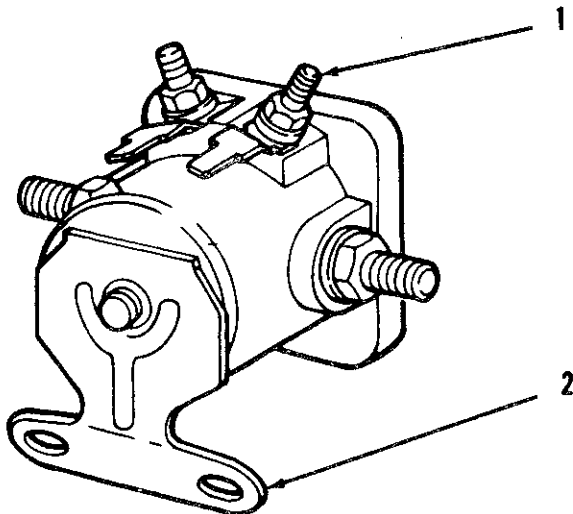
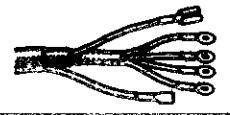
If the solenoid fails the test, replace the solenoid.

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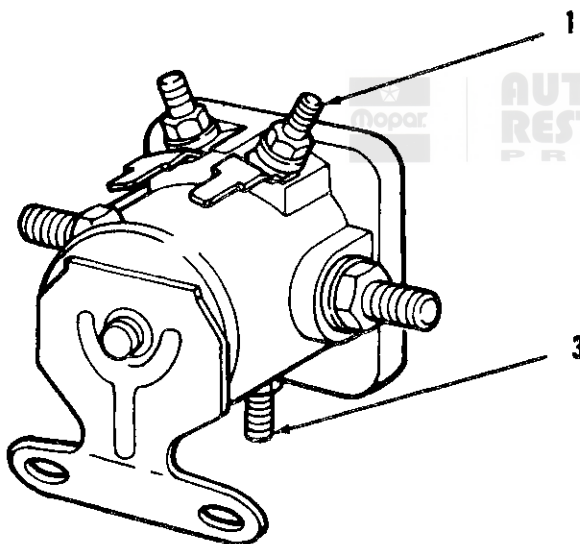


ELECTRICAL

STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



MANUAL TRANSMISSION



AUTOMATIC TRANSMISSION

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Solenoid Ground Test

An inadequate solenoid ground can be determined with an ohmmeter.

Connect one ohmmeter test probe to the battery negative post and the other probe to sheet metal adjacent to the solenoid (manual transmission) or the ground terminal (automatic transmission). Note the resistance.

Move the test probe to the solenoid S-terminal. Note the resistance.

If the resistance increases more than five ohms, the solenoid has an inadequate ground.

Starter Motor Cable and Ground Cable Tests (Voltage Drop Method)

The results of voltage drop tests will determine if there is excessive resistance in the high current circuit. When performing these tests, it is important that the voltmeter test lead probes be in contact with the terminals that the cables are connected to instead of with the cables themselves. For example, when testing between the battery and solenoid, the voltmeter probes must touch the battery post and the solenoid threaded stud.

Before performing the tests, ensure the following items are accomplished:

- disconnect and ground the ignition coil secondary wire
- place the transmission in NEUTRAL (manual) or PARK (automatic) and apply the parking brake
- ensure the battery is fully charged

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	ELECTRICAL STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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Test Procedure

CAUTION: Battery cable voltage drop must not exceed 0.5V MAX. This is measured with the engine cranking and the ignition coil output (secondary wire) shorted to ground.

Follow the steps as outlined in the Starter Motor Voltage Drop Tests (DARS) charts.

Starter Motor-Full Load Current Test

Before performing the full-load current test, ensure the battery is fully charged.

NOTE: The lower the available voltage, the higher the amperage.

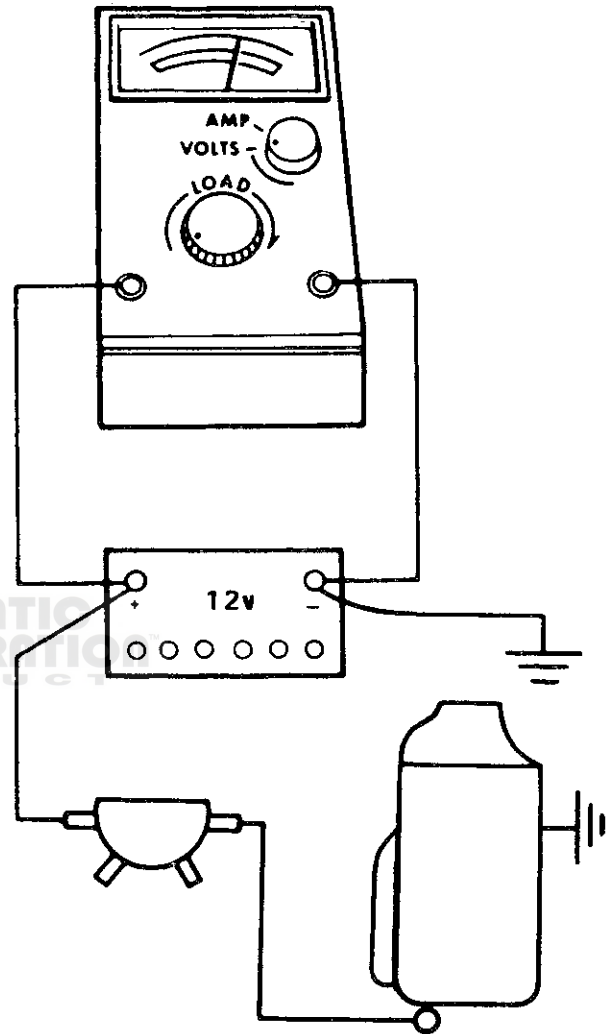
Disconnect and ground the ignition coil secondary wire.

Connect a remote control starter motor switch between the positive battery terminal and the S-terminal on the starter motor solenoid.

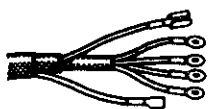
WARNING: Do not operate the starter motor for more than 15 seconds.

NOTE: The tester load control knob must be in the full decrease position (counterclockwise).

Connect the battery-alternator-regulator-starter motor tester as illustrated. Actuate the remote control starter motor switch and observe the voltage indicated on the voltmeter while the starter motor is rotating the engine.

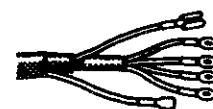


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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



NOTE: Do not consider the initial voltage when the engine first starts rotating. A very hot or very cold engine may cause an excessive voltage drop for the first few revolutions. Note the voltage after the starter motor has obtained its maximum RPM.

Turn the remote control starter switch OFF.

Turn the load control knob toward INCREASE (clockwise) until the indicated voltage is exactly the same as it was when the starter motor was rotating the engine. Switch the meter to the AMP position.

Observe the current on the ammeter scale. This is the current flowing through the starter motor high current circuit under full-load conditions. If the current flow is not within 180-220 amperes for six-cylinder engines at room temperature, approximately 21°C (70°F), remove the starter motor from the engine for bench testing.

Neutral Safety Switch Test

Remove the wire connector from the switch and test the continuity between the center terminal pin and the transmission case. Continuity should exist only when the automatic transmission is in the PARK or NEUTRAL position.

NOTE: Check the linkage adjustment before replacing the switch.

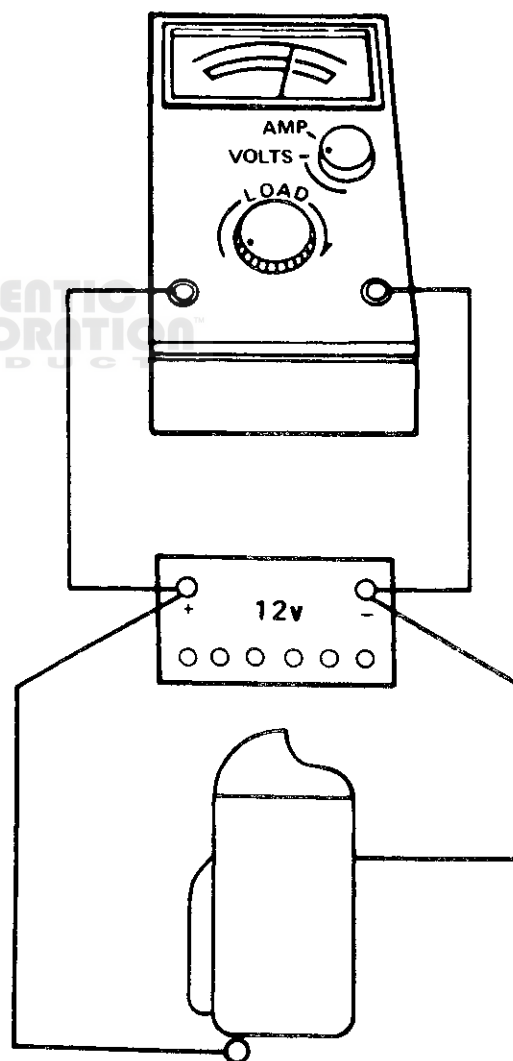
OFF-VEHICLE TESTING

No-Load Current Test

The starter motor no-load current test will indicate faults such as open or shorted windings, worn bushings (rubbing armature) or a bent armature shaft.

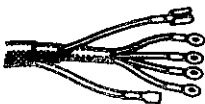
NOTE: The tester load control knob must be in the full DECREASE (extreme counterclockwise) position.

Operate the starter motor with the test equipment connected as illustrated. Note the voltage.



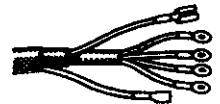
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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Determine the exact starter motor RPM using a mechanical tachometer (not shown).

NOTE: To connect a mechanical tachometer, remove the seal from the end of the drive end housing and clean the grease from the end of the armature shaft.

Disconnect the battery cable from the starter motor.

Turn the load control knob toward INCREASE (clockwise) until the voltage is exactly the same as it was with the battery connected to the starter motor. Switch to the AMP position on the tester.

If the amperage at no-load speed is below the specification, the starter motor has high electrical resistance and should be repaired or replaced.

If the amperage is higher than specification and the starter motor RPM is less than the minimum RPM specification, disassemble, clean, inspect and test the starter motor.

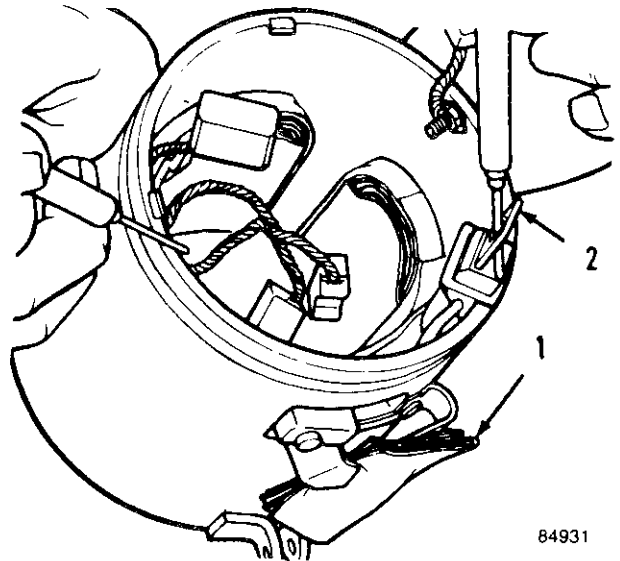
Hold-In Coil Winding-Resistance Test

This test will determine the resistance of the hold-in coil winding.

Insert a piece of paper (1) between the contact points to insulate them.

Use an ohmmeter to measure the resistance between the S-terminal (2) and the starter motor frame.

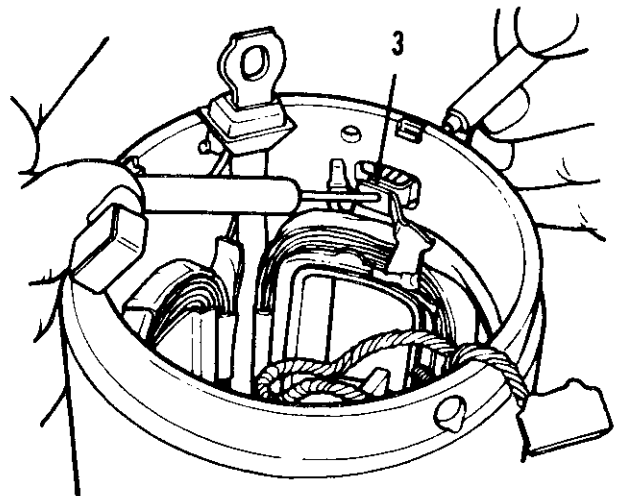
The resistance should be between 2.0 and 3.5 ohms. If the resistance is outside the specification, replace the field winding assembly.



Solenoid Contact-Point Connection Test

This test will determine the quality of the solder joint at the contacts. Use an ohmmeter to test the resistance through solder joint (3).

If the resistance is more than zero ohms, the joint has excessive resistance. Repair by resoldering the joint with a 600 watt soldering iron.



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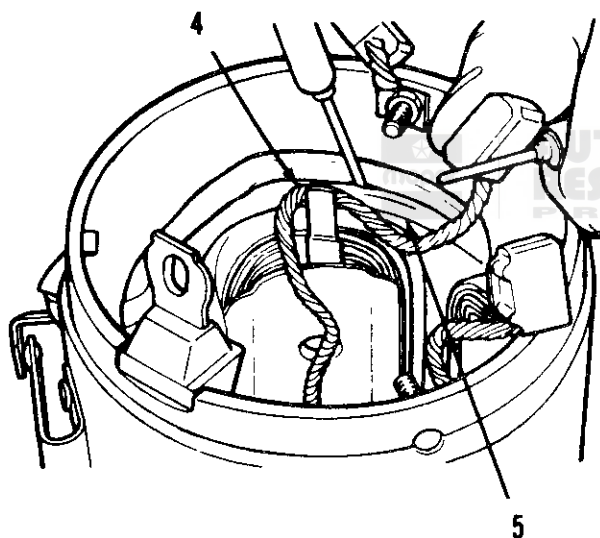
84932

Insulated Brush-Connection Test

This test will determine the quality of the solder joint between the insulated brush braided wire and the field windings. Use an ohmmeter to test the resistance through the solder joint by touching the test probes to the brush (4) and to the copper bus bar (5).

If the resistance is more than zero ohms, the joint has excessive resistance.

Repair by resoldering the joint with a 600 watt soldering iron.



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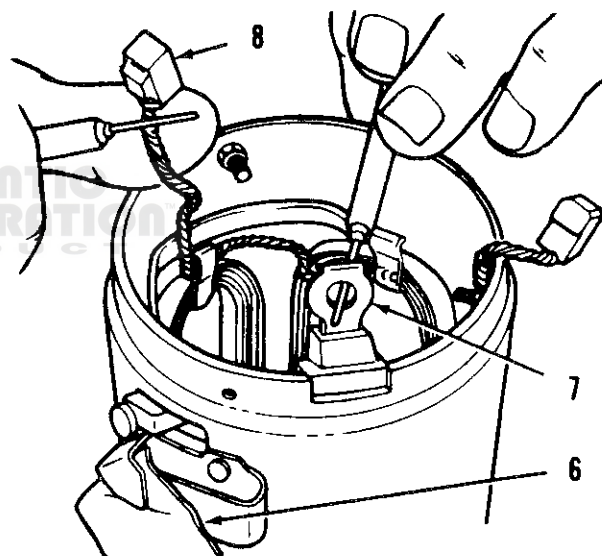
Field Winding-Terminal to Brush Continuity Test

This test will determine the condition of all the field winding solder joints.

Insert a piece of paper between the contact points to insulate them (6).

Touch the ohmmeter test probes to the field winding terminal (7) and to the insulated brush (8).

If the resistance is greater than zero ohms, inspect all the solder joints to determine which have excessive resistance. Repair the faulty joint(s) by resoldering with a 600 watt soldering iron.



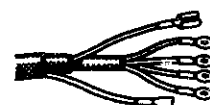
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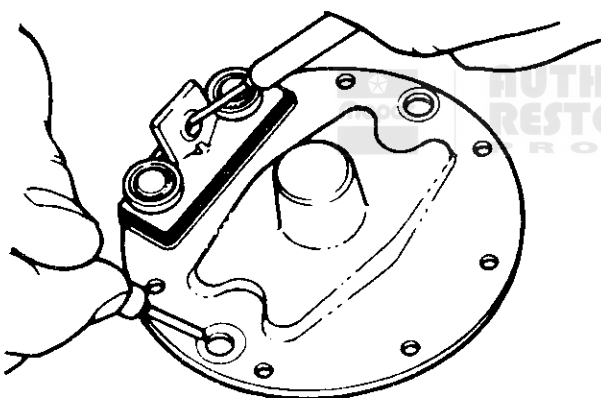
ELECTRICAL

STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Terminal Bracket-Insulation Test

This test will determine if the terminal bracket is properly insulated from the end cap. Use an ohmmeter to test the resistance between the bracket and cap. If the resistance is less than infinite, the insulator is faulty. Repair by replacing the end cap.



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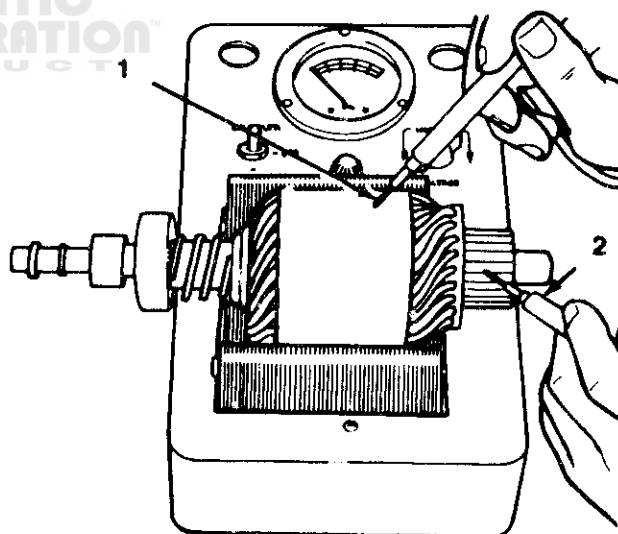
Armature Tests

Test the armature winding for short circuits to the ground, short circuits between the commutator bars and balance whenever the starter motor is overhauled. Follow the test equipment manufacturer's procedure or the following procedure.

Armature-Ground Test

Place the armature in the growler jaws and turn the power switch to the TEST position.

Touch one test probe to the armature core (1), touch the other probe to each commutator bar (2) one at a time and observe the test lamp. The test lamp should not light. If the test lamp lights on any bar, the armature has a short circuit to the ground and must be replaced.



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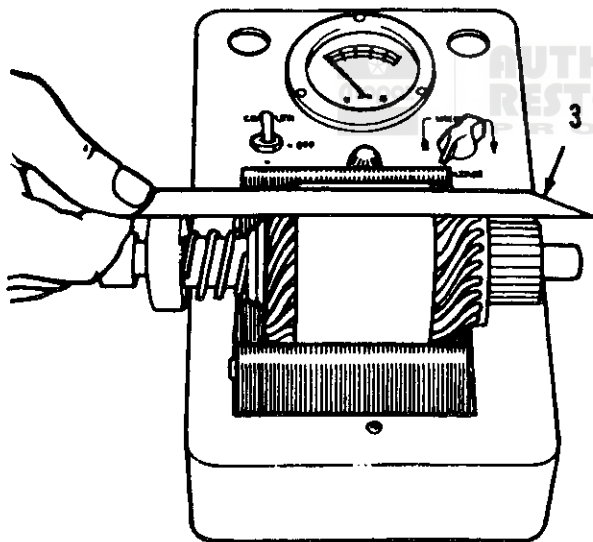
Armature-Short Test

CAUTION: Never operate the growler with the power switch in the growler test position without an armature in the jaws.

Place the armature in the growler jaws and turn the power switch to the GROWLER position.

Hold the steel blade (3) parallel to and touching the armature core. Slowly rotate the armature one or more revolutions in the growler jaws.

If the steel blade vibrates at any area of the core, the winding has a short circuit and the must be replaced.



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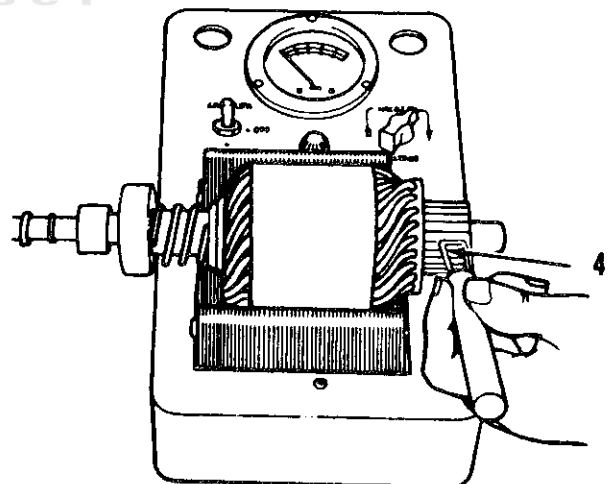
Armature-Balance Test

Place the armature in the growler jaws and turn the power switch to the GROWLER position.

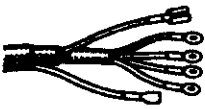
Place the contact fingers of the meter test probe across adjacent commutator bars at side of commutator (4).

Adjust the voltage control until the pointer indicates the highest voltage on the scale.

Test each commutator bar with the adjacent bar until all bars have been tested. Zero voltage indicates a short circuit in a particular pair and the armature must be replaced.

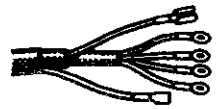


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ELECTRICAL

STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



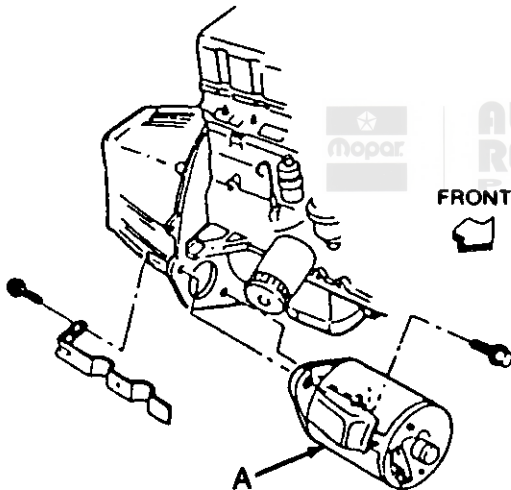
MOTORCRAFT STARTER MOTOR REMOVAL

Disconnect the negative battery cable at the battery.

Disconnect the negative battery cable from the starter motor terminal.

Remove the attaching screws.

Remove the starter motor (A) from the flywheel (drive plate) housing.



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MOTORCRAFT STARTER MOTOR DISASSEMBLY

Remove the drive yoke cover screw and cover.

Remove the through-bolts and remove the brush end plate.

Remove the brush springs. Pull the brushes from the brush holder.

Remove the brush holder from the frame.

Remove the drive end housing and drive yoke return spring.

Remove the pivot pin and drive yoke.

Remove the drive mechanism and armature.

MOTORCRAFT STARTER MOTOR CLEANING AND INSPECTION

Use a brush or air to clean the starter motor frame, field windings, armature, drive mechanism and drive end housing.

Wash all other parts in solvent and dry them thoroughly.

NOTE: Do not wash the overrunning clutch or drive mechanism.

Inspect the armature windings for broken or burned insulation and poor connections.

Test the armature winding for open circuits and short circuits to ground (core).

Clean the commutator with commutator paper. Never use emery cloth to clean the commutator.

If the commutator is worn, out-of-round, 0.125mm (0.005-in) or more, or has insulation protruding from between the bars, turn it down on a lathe.

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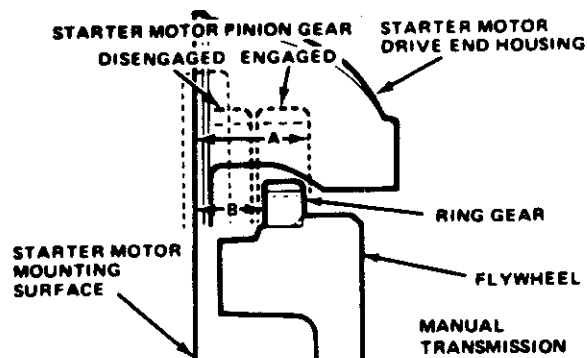
ELECTRICAL

STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)

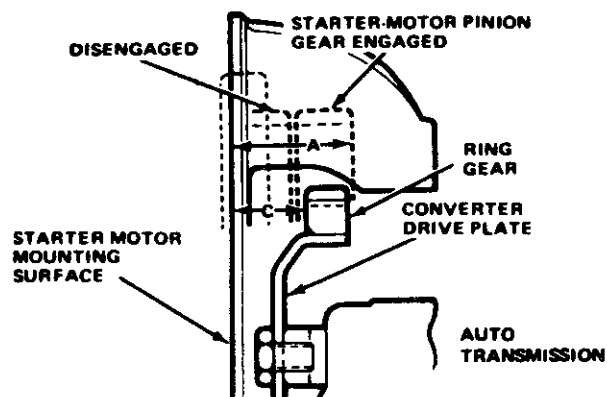
Inspect the armature shaft and bushings for scoring and excessive wear.

Inspect the drive mechanism pinion gear for damage. If the pinion gear has failed repeatedly, perform the following inspection:

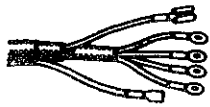
- Inspect for a wobbling ring gear. The maximum allowable runout is 0.76mm (0.030-in). Inspect for broken welds or a broken drive plate (automatic transmission).
- Inspect for foreign objects such as a converter balance weight in the converter housing (automatic transmission).



ENGINE	FLYWHEEL			
	A		B	
6-CYLINDER	30.8 mm to 31.7 mm	1.2060 in. to 1.2465 in.	19.5 mm to 21.2 mm	0.7660 in. to 0.8365 in.

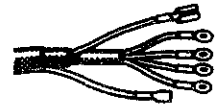


ENGINE	DRIVE PLATE			
	A		B	
6-CYLINDER	30.8 mm to 31.7 mm	1.2060 in. to 1.2465 in.	19.6 mm to 21.1 mm	0.7700 in. to 0.8305 in.



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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



NOTE: Inspect the entire circumference of the ring gear for damage when the teeth of the drive mechanism pinion gear are damaged. A normal wear pattern will be found in three places on a six-cylinder engine. The normal wear pattern extends approximately 5cm (2-in) along the circumference of the ring gear.

Inspect the drive mechanism overrunning clutch by grasping and rotating the pinion gear. The gear should rotate freely in the clockwise direction and lock in the opposite direction.

Inspect for broken brush springs. Replace springs that are discolored from the heat. Replace the brushes if they are worn down to 6.35mm (1/4-in) in length.

Inspect the field windings for burned or broken insulation and for broken or loose connections. Inspect the field brush connections and the wire insulation.

Field Winding Removal

Remove the armature and brush holder before starting this procedure.

Remove the field winding screws using an arbor press and Starter Pole Screw Wrench J-22516. Remove the pole shoes.

CAUTION: Do not cut the solenoid contact point connection joint.

Cut the field winding terminal strap as close as possible to the solenoid contact-point-to-field winding joint.

Cut the hold-in coil winding terminal wire at the terminal strip.

Straighten the tabs of the pull-down coil winding sleeve. Remove the sleeve and flange.

Remove the field winding assembly from the frame.

Field Winding Cleaning and Inspection

Clean and tin the surfaces of the contact tab and the field winding terminal strap that are to be soldered.

Field Winding Installation

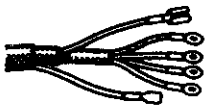
Install the replacement field winding assembly in the frame using the original pole shoes and screws. Apply a drop of Loctite 222, or equivalent, to the screw threads. Tighten the screws using the arbor press and Starter Pole Screw Wrench J-22516.

Install the pull-down coil winding sleeve and flange. Have a helper hold the winding and sleeve assembly against the frame while bending the retaining tabs.

Wrap the hold-in coil winding terminal wire around the terminal strip and solder. Cut off the excess wire.

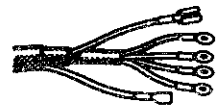
Solder the field winding terminal strap to the contact strap. Use a 600 watt soldering iron and rosin-core solder.

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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Solenoid Contact Point Assembly Removal

Remove the armature and brush holder before starting this procedure.

CAUTION: Do not cut the field winding terminal strap (2).

Cut the upper contact (6) as close as possible to the contact-point-to-field winding joint.

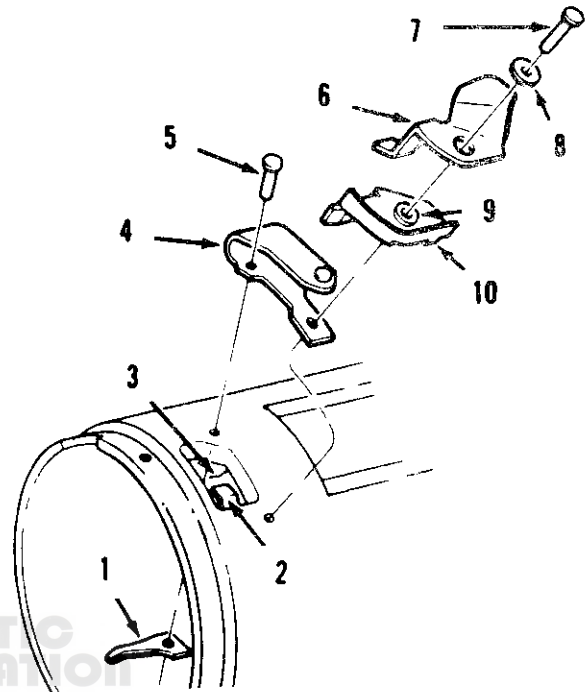
Unsolder the hold-in coil winding terminal wire from the terminal strip.

Remove the field winding screws with an arbor press and J-22516.

Remove the pole shoes.

Cut the rivets inside the frame with a chisel.

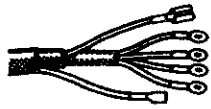
Remove the contact point assembly.



- 1. HOLD-IN COIL TERMINAL
- 2. FIELD WINDING STRAP TERMINAL
- 3. HOLD-IN COIL WIRE
- 4. LOWER CONTACT
- 5. COPPER RIVET
- 6. UPPER CONTACT
- 7. ALUMINUM RIVET
- 8. FIBER WASHER
- 9. SHOULDER
- 10. PLASTIC INSULATOR

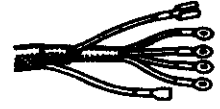
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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Solenoid Contact Point Assembly Installation

Position the replacement lower (movable) contact (4) on the frame.

Position the hold-in coil winding terminal strip inside the frame.

Install a copper rivet (5) through the contact, frame and terminal.

Upset the rivet.

NOTE: Ensure the holes for the second rivet are aligned before upsetting the copper rivet (5).

Install the plastic insulator (10), upper contact (6) and fiber washer (8) to the remaining hole in the frame.

Install an aluminum rivet (7) and upset.

NOTE: Ensure the upper contact (6) is positioned on the shoulder of the plastic insulator (10) before upsetting the rivet.

Install the field winding assembly, pole shoes and screws. Apply a drop of Loctite 222, or equivalent, to each screw.

Solder the hold-in coil winding terminal wire to the terminal strip.

Solder the field winding terminal strap to the upper contact (6). Use 500-600 watt soldering iron and rosin-core solder.

Bushing Replacement

Drive End Bushing Removal

Support the drive end housing and remove the original bushing and seal.

Drive End Bushing Installation

Install a replacement bushing by using the armature and pinion gear as a bushing driver. Do not install the drive end housing seal at this time.

Commutator End Bushing Removal

Carefully remove the original bushing with a chisel.

Commutator End Bushing Installation

Drive a replacement bushing into the end plate until it is seated, using suitable socket or bushing driver.

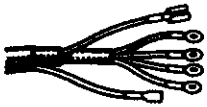
Drive Mechanism Removal

Pry the stop ring off and remove the starter motor drive from the armature shaft.

Drive Mechanism Installation

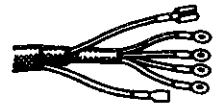
Apply grease to the armature shaft and end bushings. The replacement drive mechanism is prelubricated.

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STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Apply a thin coating of Lubriplate, or an equivalent, on the armature shaft splines.

When installing the drive mechanism, inspect the snap ring for a tight fit on the shaft. Slide the drive assembly over the shaft and install the stop ring and original retainer.

MOTORCRAFT STARTER MOTOR ASSEMBLY

Insert the armature into the motor frame (1).

Install the drive yoke and pivot pin. The drive yoke must engage the lugs on the drive mechanism.

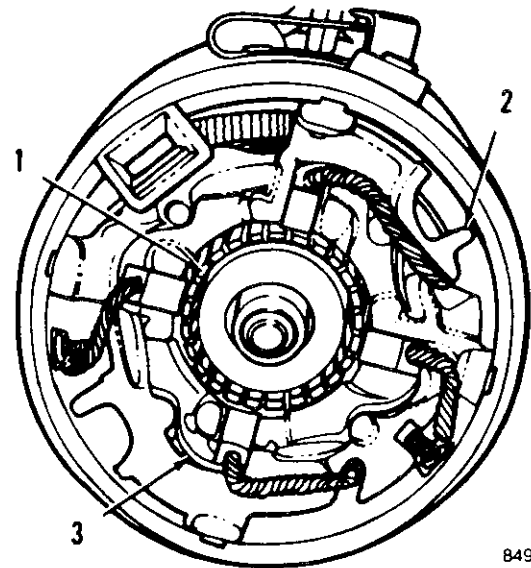
Insert the drive yoke return spring into the recess in the drive housing.

Join the housing to the motor frame.

Install the brush holder (2). Ensure the depression in the holder aligns with the rubber boot on the terminal.

Insert the brushes into the brush holder. Refer to the illustration for correct wire routing.

Install the brush springs (3).



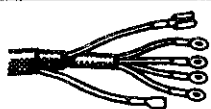
Install the end plate. Align the hole in the terminal with the hole in the terminal bracket.

Install the through-bolts.

Depress the movable pole shoe and adjust the contact point clearance by bending the upper contact, as required. Refer to the specifications.

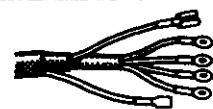
Install the drive yoke cover and clamp.

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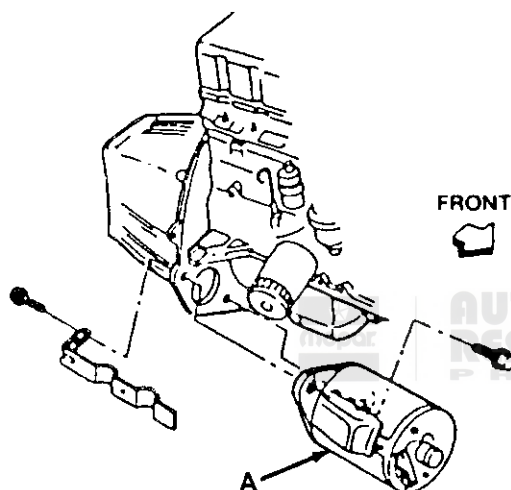
STARTING SYSTEM – MOTORCRAFT (6-Cyl. Engine)



MOTORCRAFT STARTER MOTOR INSTALLATION

NOTE: Ensure that the mounting surfaces are free of burrs and debris.

Position the starter motor (A) on the flywheel housing.



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Install the mounting screws and tighten with 24 N·m (18 ft-lbs) torque.

Attach the negative battery cable to the starter motor terminal and tighten the retaining screw with 6 N·m (55 in-lbs) torque.

NOTE: The initial torque required may exceed this specification, if the end plate has been replaced. The terminal screw cuts threads in the end plate terminal bracket during initial installation.

NEUTRAL SAFETY SWITCH REPLACEMENT

Disconnect the wiring harness connector and remove the switch from the transmission. Allow the fluid to drain into a container.

Move the automatic transmission selector lever to the PARK and NEUTRAL positions. Inspect the location of the switch operating lever fingers in both positions to ensure they are properly centered in the switch opening on the transmission.

Install the replacement switch and seal on the transmission case.

Tighten the switch with 23 N·m (17 ft-lbs) torque.

Test the switch continuity (center terminal to transmission case) in both the PARK and NEUTRAL positions.

Connect the wire harness connector.

Correct the transmission fluid level, as required.

Start the engine in both the PARK and NEUTRAL positions.

Check the operation of the back-up lights.

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	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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SPECIFICATIONS

Component	Dimension	
Carbon Brushes	Minimum Length – 8mm (0.314-in)	
Ring/Pinion Clearance	0.2-0.3mm (0.78-0.118-in)	
Backlash (Meshed Ring and Pinion)	0.3-0.6mm (0.118-0.236-in)	
Commutator Diameter	MAXIMUM	MINIMUM
Out of Round:	2.3mm (1.27-in)	31.2mm (1.23-in)
Commutator	0.03mm (0.001-in)	
Armature (Core)	0.08mm (0.003-in)	
Armature End Play	0.05mm (0.002-in)	

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BOSCH STARTER MOTOR AND SOLENOID TESTING SPECIFICATIONS

ENGINE	STARTER	NO LOAD TEST WITH 11.5 VOLTS		SOLENOID			
	TYPE	AMPS	RPM	SPECIFICATIONS			
		MAX.	MAX.	HOLD-IN WINDING VOLTAGE		PULL-IN WINDING VOLTAGE	
2.5L	DW 1.4	75	2900	MIN.	MAX.	MIN.	MAX.
				.2	2	6	7.3

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BOSCH STARTER MOTOR COLD CRANKING SPECIFICATIONS

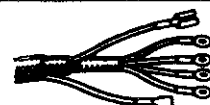
Battery Test Voltage	12.5 Volts
Cold Cranking Voltage (Min.)	9.6 Volts
Cold Cranking Amps	120 Amps

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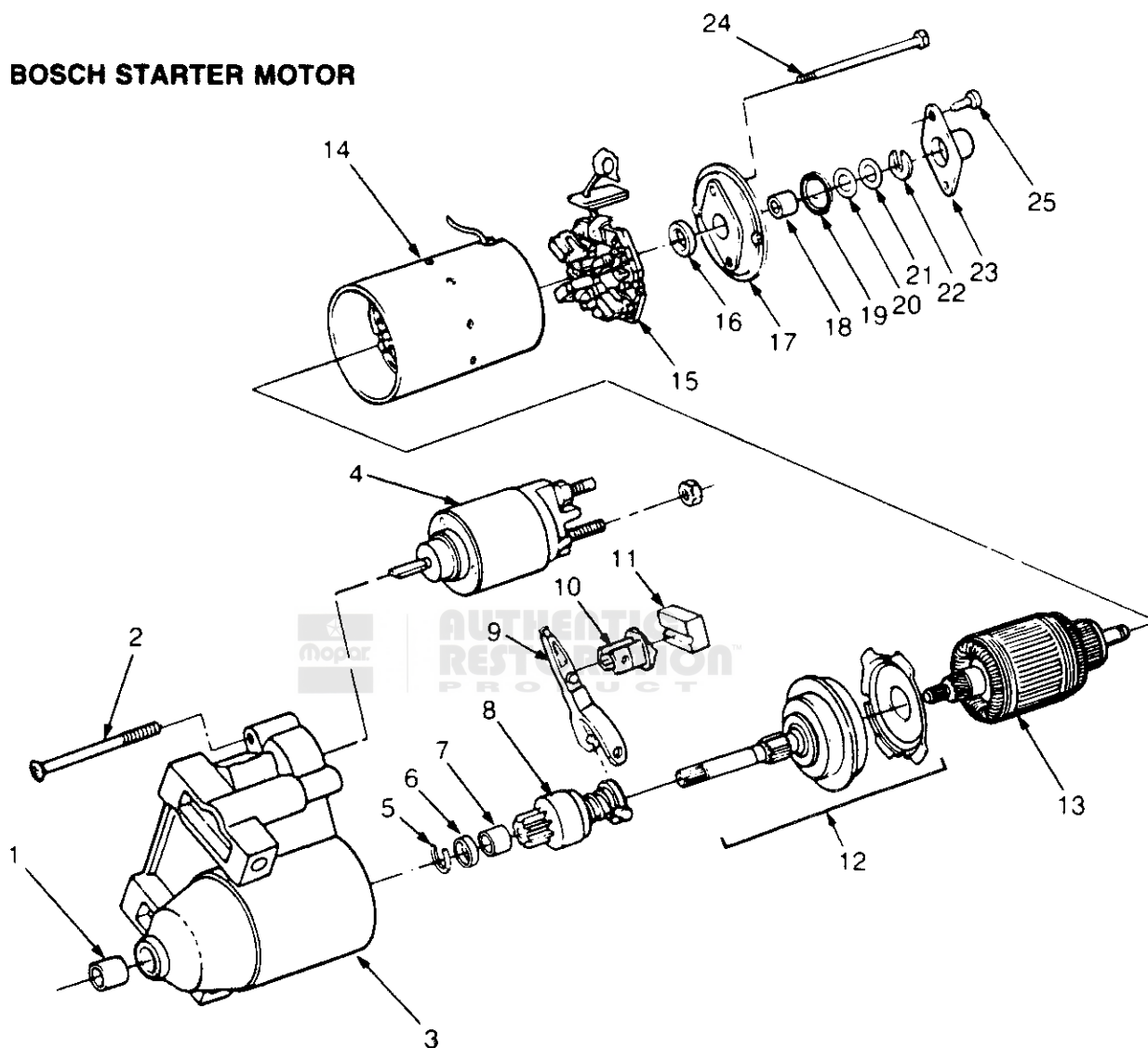


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STARTING SYSTEM – BOSCH (4-Cyl. Engine)



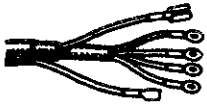
BOSCH STARTER MOTOR



1. Bushing
2. Screw
3. Shield
4. Solenoid Switch
5. Retainer
6. Stop Ring
7. Bushing
8. Overrunning Clutch Drive
9. Fork
10. Bearing Pedestal
11. Sealing Rubber
12. Planetary Gear System
13. Armature

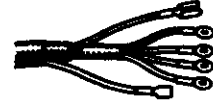
14. Stator Frame
15. Brush Holder
16. Gasket
17. Commutator End Shield
18. Bushing
19. Seal Ring
20. Shim
21. Shim
22. Retaining Washer
23. Closure Cap
24. Hexagon Screw
25. Screw

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ELECTRICAL

STARTING SYSTEM – BOSCH (4-Cyl. Engine)



GENERAL INFORMATION

The Bosch starter motor incorporates several unique features to create an efficient, light-weight unit.

A planetary gear system (intermediate transmission) between the electric motor and pinion shaft makes it possible to reduce the dimensions of the starter, while obtaining a higher rotational speed of the starting motor to produce the same torque at the pinion.

The permanent magnet field consists of six two-component magnets of high remanence and coercive force that are for permanent excitation. They align according to their polarity and are fixed in the stator frame with chips.

The brush holder plate consists of a plastic baseplate with four tubular brush holders.

There are several procedures that must be followed when servicing this starter.

Unlike other starter motors, this unit is highly sensitive to hammering, shocks, and external pressure.

CAUTION: The Bosch starter motor **MUST NOT BE CLAMPED** in a vice by the stator frame. Doing so may damage the magnets. It may be clamped by the mounting flange **ONLY**.

Do not connect the starter motor incorrectly when electrical tests are being performed. The magnets may be damaged and rendered in-serviceable.

Ensure cleanliness when performing repairs.

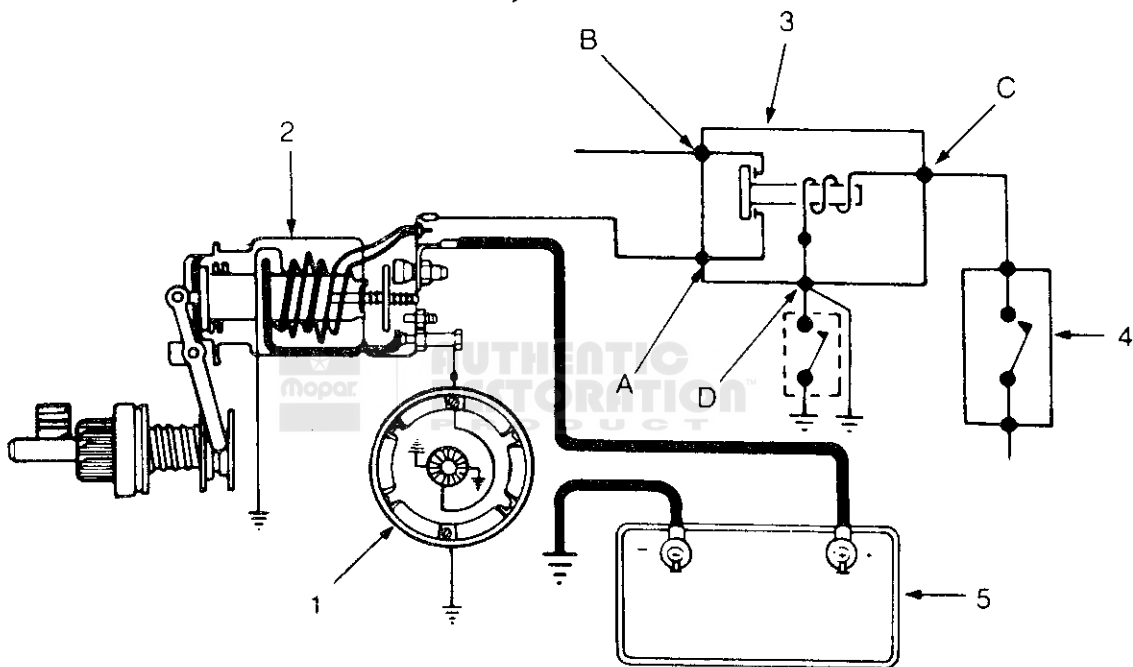
Metal chips are attracted by the magnets and may not be completely removed from the stator frame. Chips in the ring gear can lead to failure of the starter.

The armature, ring gear, overrunning clutch drive, and solenoid may be cleaned with compressed air. **DO NOT** use any liquid cleaning agent. Other components may be washed with cleaning solvents that are commercially available. **DO NOT** breathe the vapors.

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	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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BOSCH STARTER MOTOR SIMPLIFIED CIRCUIT
 (Refer to ETM for Complete Schematic)

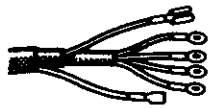


Starting System

1. Starter
2. Solenoid
3. Relay
4. Ignition Switch
5. Battery

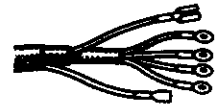
Starter Relay Connections

- A. Solenoid Terminal
- B. Battery Terminal
- C. Ignition Terminal
- D. Ground Terminal



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STARTING SYSTEM – BOSCH (4-Cyl. Engine)



BOSCH STARTER MOTOR SERVICE DIAGNOSTIC INSPECTIONS

Before removing any unit from the starter motor system for repair, perform the following inspections:

Battery Inspection

To determine condition of the battery, perform the testing procedure outlined in the **Battery Section**.

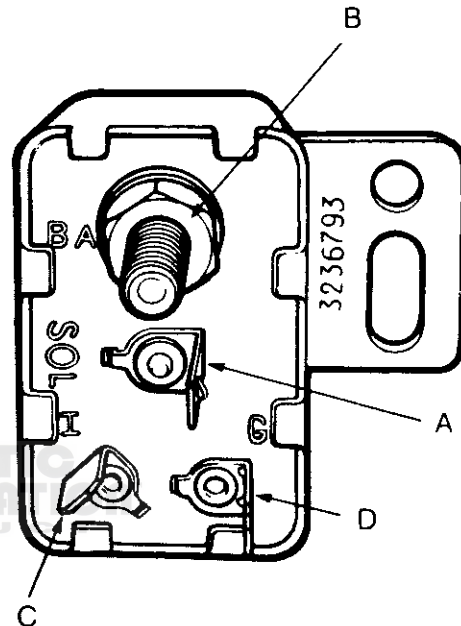
Wiring Inspection

Inspect wiring for damage. Inspect all connections at the starter motor solenoid, relay, neutral safety switch (if equipped), back-up lamp switch connector, ignition/start switch, and battery (including all ground connections). Clean and tighten all connections as required.

Starter Motor Solenoid, Relay and Ignition/ Start Switch

Inspect the solenoid, relay and switch to determine their condition. Also, if equipped with automatic transmission, inspect condition of the neutral safety switch. (Testing information can be found in the following pages).

Starter Relay Connections



Starter Relay Connections

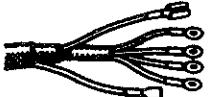
- A. Solenoid Terminal
- B. Battery Terminal
- C. Ignition Terminal
- D. Ground Terminal

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Starter Motor Noise

To correct starter motor noise during starting, refer to the **Starter Motor Noise Diagnosis Chart** to determine the cause.

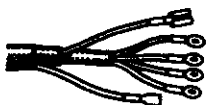
	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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BOSCH STARTER MOTOR NOISE DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
1. VERY HIGH FREQUENCY WHINE BEFORE ENGINE STARTS; ENGINE STARTS OK.	1. Excessive distance between pinion gear and flywheel/drive plate gear.	1. Shim starter motor toward flywheel/drive plate.
2. VERY HIGH FREQUENCY WHINE AFTER ENGINE STARTS WITH IGNITION KEY RELEASED. ENGINE STARTS OK.	2. Insufficient distance between starter motor pinion gear and flywheel/drive plate gear. Flywheel/drive plate runout can cause noise to be intermittent.	2. Shim starter motor away from flywheel/drive plate. Inspect flywheel/drive plate for damage; bent, unusual wear, and excessive runout. Replace flywheel/drive plate as necessary.
3. A LOUD "WHOOOP" AFTER ENGINE STARTS WHILE STARTER MOTOR IS ENGAGED.	3. Most probable cause is defective overrunning clutch. Clutch replacement normally corrects this condition.	3. Replace overrunning clutch or drive assembly.
4. A "RUMBLE," "GROWL," OR "KNOCK" AS STARTER MOTOR COASTS TO STOP AFTER ENGINE STARTS.	4. Most probable cause is bent or unbalanced starter motor armature. Armature replacement normally corrects this condition.	4. Replace starter motor armature.

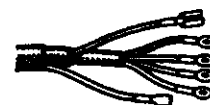
NOTE: A high frequency whine during cranking is normal for this starter motor.

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ELECTRICAL

STARTING SYSTEM – BOSCH (4-Cyl. Engine)

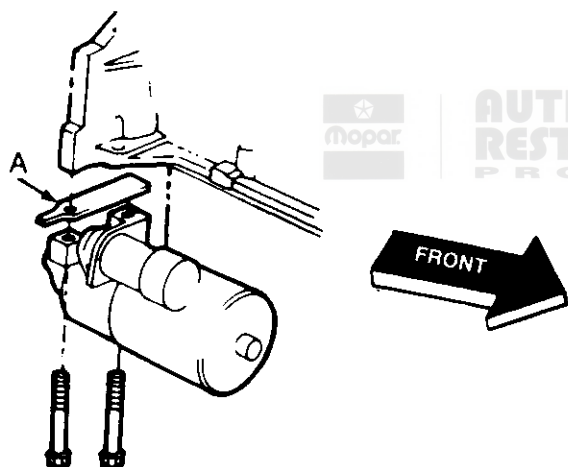


If the complaint is similar to Conditions No. 1 and No. 2, correction can be achieved by proper "shimming" according to the following procedures.

Disconnect the battery cable (to prevent inadvertent starting of engine).

One shim thickness is available - 1.143 mm (0.045-in) (A).

NOTE: If shim is not available fabricate one using a plain washer or other suitable material.



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If the complaint is similar to Condition No. 1, the starter motor must be moved toward the flywheel/driveplate. This can be accomplished by shimming **ONLY** the outboard starter motor mounting pad.

NOTE: This is generally a condition that causes broken flywheel/driveplate ring gear teeth or broken starter motor housings.

If the complaint is similar to Condition No. 2, the starter motor must be moved away from the flywheel/driveplate. This is accomplished by installing pads.

NOTE: More than one pad may be required to accomplish this.

If the battery, wiring, switch, solenoid, relay, and neutral safety switch are in satisfactory condition (and the engine is known to be functioning properly), remove the starter motor and follow procedures in the **Testing Section**.

BOSCH STARTER MOTOR TESTING

A general diagnosis is described at the end of this section. Once a problem has been traced to the starter motor, proceed to **Test Procedure** outlined.

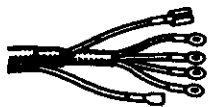
With the starter motor removed from the engine, the pinion gear should be tested for freedom of operation by turning it on the screw shaft. The armature should be tested for freedom of rotation by prying the pinion gear with a screwdriver to engage it with the shaft.

NOTE: Tight bearings, a bent armature or driveshaft, or a bent frame will cause the armature to catch and not rotate freely.

If the shafts do not rotate freely, the motor should be disassembled.

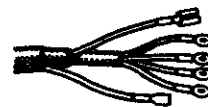
However, if the shafts do rotate freely, the motor should be given a **No-load Test** before disassembly.

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STARTING SYSTEM – BOSCH (4-Cyl. Engine)



No rotation and high current flow conditions indicate one or more of the following:

- connecting terminal or armature windings shorted to ground
- seized bearings (this should have been determined by rotating armature by hand)

No rotation and no current flow conditions indicate one or more of the following:

- open armature windings (inspect commutator for badly burned commutator bars after disassembly)
- broken brush springs, worn brushes, protruding insulation between commutator bars, or other causes could prevent good contact between brushes and commutator

Bosch Starter Motor Relay Test

Disconnect wire connectors from the I-terminal and G-terminal.

Measure the resistance between the terminals with an ohmmeter. Correct resistance is approximately 24 ohms.

Measure the resistance between either terminal and the battery negative post. Resistance should be infinite.

If defective, replace the relay.

If acceptable, connect wire connectors.

Remove the SOL-terminal wire connector and connect a voltmeter between the terminal and the battery negative post.

With the ignition switch in the start position, the voltmeter should indicate battery voltage (12 volts).

If the battery voltage is not present, check the related wiring, bulkhead connector (C-100) and ignition switch adjustment.

WARNING: Check to ensure that the transmission is in PARK (automatic transmission or NEUTRAL (manual transmission) with the parking brake applied before terminal G is jumped.

If the battery voltage is present and the starter relay isn't working, connect connector I (14 DK GRN) and jumper terminal G to ground.

If the starter relay doesn't click, repair the ground circuit. Refer to the Electrical Troubleshooting Manual for detailed information.

Neutral Safety Switch-Continuity Test

Disconnect the wire connector from the switch and test for continuity with an ohmmeter between the center terminal pin and the transmission case. Continuity should exist only when the automatic transmission is in either PARK or NEUTRAL positions.

NOTE: Check linkage adjustment before replacing the switch.

Bosch Starter Motor Relay Removal

Disconnect the battery negative cable.

Identify, tag, and disconnect wires attached to the relay.

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	ELECTRICAL	
	STARTING SYSTEM – BOSCH (4-Cyl. Engine)	

Remove the relay attaching screws and the relay from the dash panel (lower RH side).

Bosch Starter Motor Relay Installation

Install the replacement starter motor relay on the dash panel.

Connect wires to the starter motor relay.

Connect the battery negative cable.

Test relay operation.



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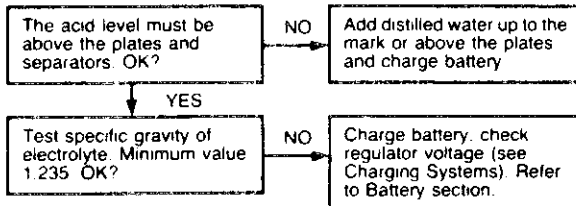
STARTING SYSTEM – BOSCH (4-Cyl. Engine)



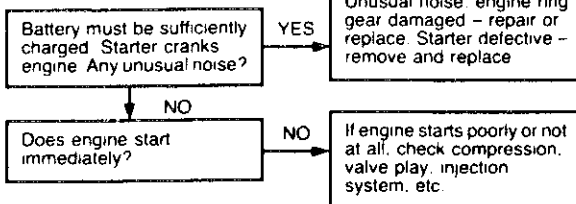
BOSCH STARTING SYSTEM TROUBLESHOOTING

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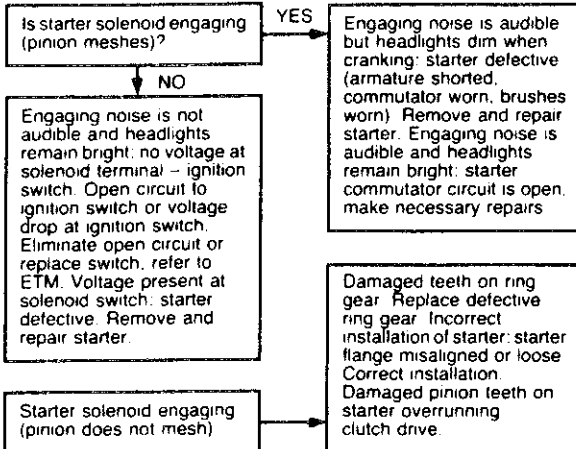
Battery Test



Starter Operation



Starter Does Not Crank Engine

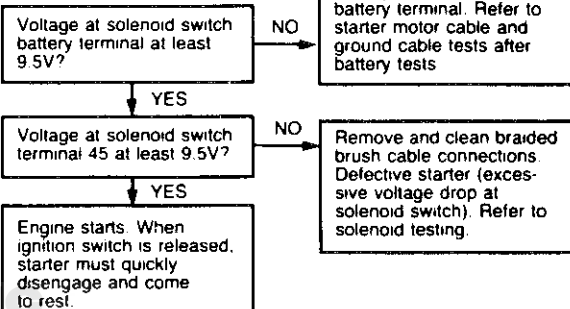


Starter Continues To Spin After Disengagement

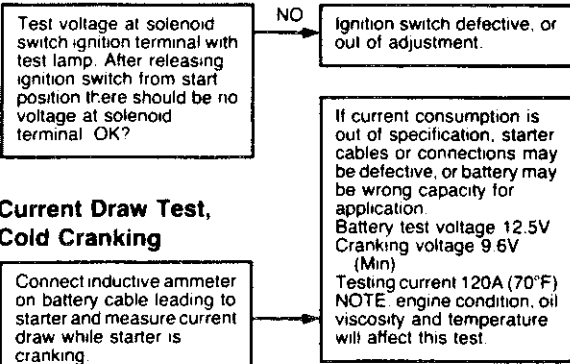
Defective starter (no armature braking effect). Remove and repair overrunning clutch and planetary gear system. Check solenoid switch and fork assembly

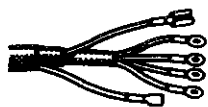
Required Testers:
Hydrometer
Volt Ohmmeter
Test Lamp
Inductive Ammeter

Starter Cranks Too Slowly



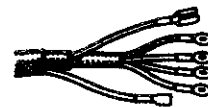
Starter Does Not Disengage





ELECTRICAL

STARTING SYSTEM – BOSCH (4-Cyl. Engine)



Starter Motor Cable and Ground Cable Tests – (Voltage Drop Method)

The cable voltage drop tests will determine if there is excessive resistance in the high current circuit. When performing these tests, it is important that the voltmeter be connected to the terminals that the cables are connected to instead of to the cables themselves. For example, when testing between the battery and solenoid, touch the voltmeter test probes to the battery post and the solenoid threaded stud.

Before performing the tests, assure the following procedures are accomplished:

- ignition control module (ICM) is disconnected
- transmission in NEUTRAL (manual transmission vehicles), or transmission in PARK (automatic transmission vehicles)
- parking brake applied
- battery is fully charged (see Battery Section)

Battery Cable Voltage Drop

Battery cable voltage drop **MUST NOT EXCEED 0.5V MAX.** (This is measured with the engine cranking.)

Solenoid Testing

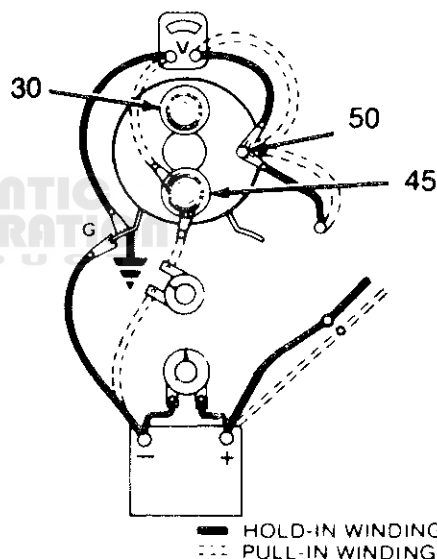
The solenoid can be tested electrically by connecting a battery of the specified voltage, a switch, and a voltmeter to the terminal for the two solenoid windings.

With all wires disconnected from the solenoid, connect the test equipment to solenoid terminal 50 and to the ground to test the hold-in coil winding.

NOTE: Use the carbon pile rheostat across the battery to decrease the battery voltage to the value listed in specifications.

NOTE: A high voltage indicates a high winding resistance. A low voltage indicates a low winding resistance.

Refer to the **Specifications Chart**.



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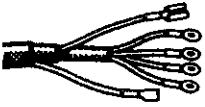
To test the pull-in coil winding, connect the battery across solenoid terminal 50 and solenoid motor terminal 45.

To reduce voltage to the specified value, connect the carbon pile rheostat between the battery and terminal 45.

NOTE: If the voltage is high, the resistance is high. If the voltage is low, the resistance is low.

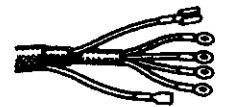
Refer to **Specifications Chart**.

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STARTING SYSTEM – BOSCH (4-Cyl. Engine)

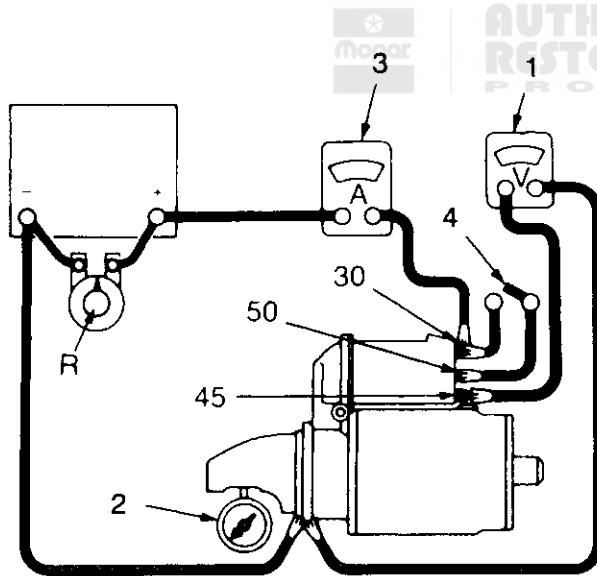


No-Load Test

CAUTION: Overheating, caused by excessive operation, will seriously damage the motor. **Never operate the starter motor for more than a 30-second duration without pausing** to allow it to cool for at least two minutes.

Connect a voltmeter (1) between terminal 45 and the motor frame. Use a mechanical tachometer to measure armature speed (2).

Connect the motor and an ammeter in series with a fully charged battery of the specified voltage (3), and a switch (in the OPEN position) from the solenoid battery (4) terminal 30 to the solenoid terminal 50.



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Close the switch and compare the RPM, current, and voltage with those listed in the specifications.

NOTE: It is not necessary to obtain the exact voltage specified because an accurate interpretation can be made by recognizing that if the voltage is slightly higher the RPM will be proportionately higher with the current remaining the same. However, if the exact voltage is desired, a carbon pile rheostat connected across the battery can be used to reduce the voltage to the specified value.

NOTE: The specified current flow includes the solenoid current flow.

Disconnect test connections **ONLY** with the switch OPEN.

Interpret the test results according to the following criteria:

Normal Conditions – The rated current flow and specified no-load speed indicate normal condition of the starter motor.

Abnormal Conditions – The low no-load speed and high current flow indicate one or more of the following conditions:

- **armature drag** – caused by excessive friction-tight, dirty, or worn bearings, bent armature shaft, or bent frame
- **shorted armature winding** – determined on growler after disassembly
- **grounded armature** – inspect further after disassembly

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	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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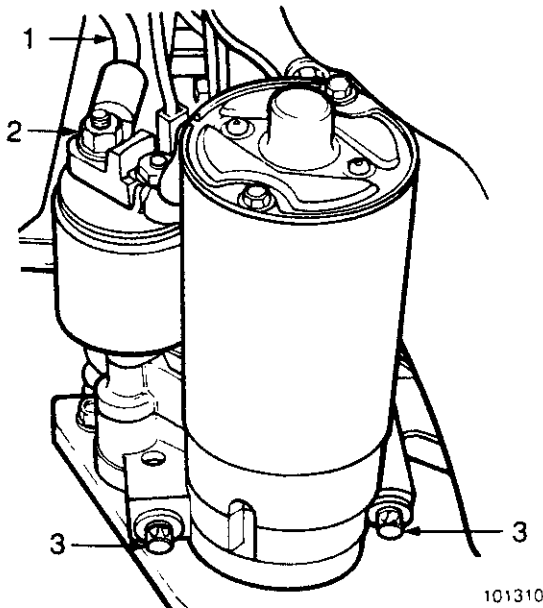
BOSCH STARTER MOTOR REMOVAL

Disconnect the negative battery cable at the battery.

Disconnect the battery cable (1) from the starter motor terminal (2).

Remove the attaching screws (3).

Remove the starter motor (4) at the flywheel (drive plate) housing.

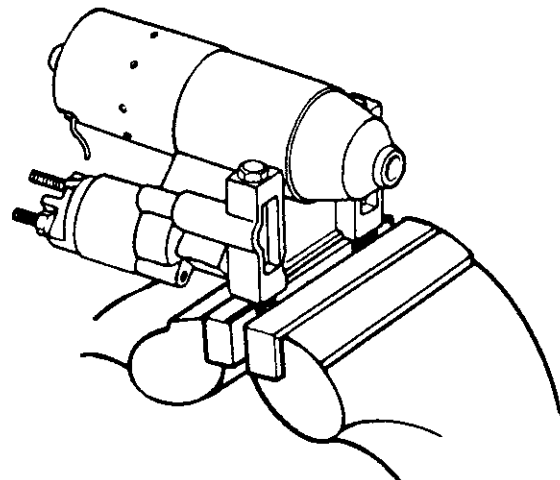


BOSCH STARTER MOTOR DISASSEMBLY

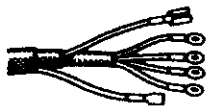
General Information

CAUTION: Do not strike the thin wall stator frame with a hammer or other instrument. Do not clamp the thin wall stator frame in the jaws of a vice. This may result in the permanent magnets being broken or the stator housing becoming deformed.

Mount the stator motor in a vice as shown.

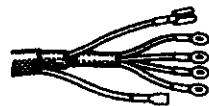


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STARTING SYSTEM – BOSCH (4-Cyl. Engine)

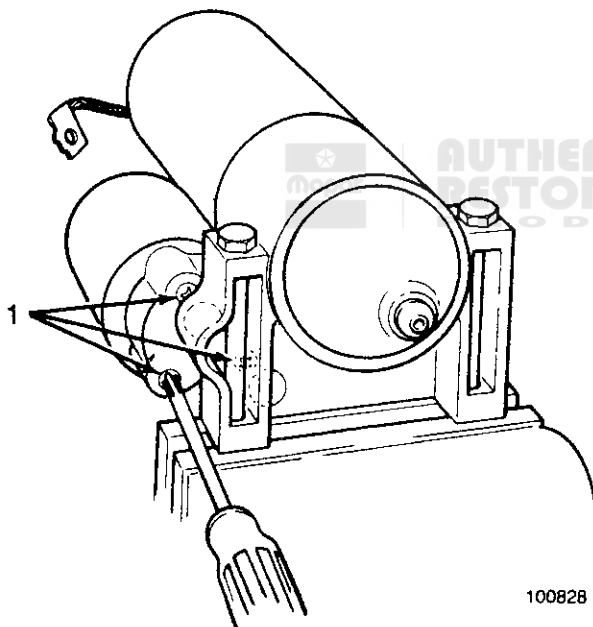


Solenoid Switch Removal

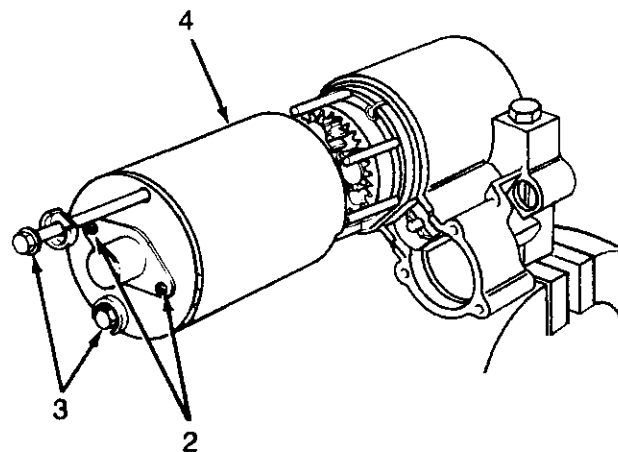
Remove terminal 45 on the solenoid.

Remove the three screws (1) from the solenoid.

Remove the solenoid with the armature and return spring.



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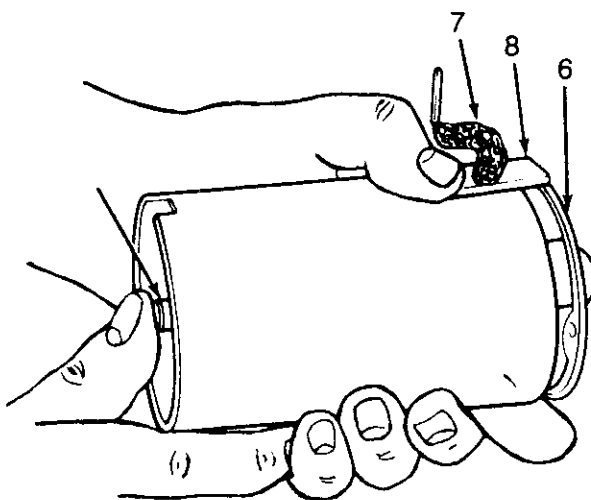


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Armature Removal

Remove the cover plate from the drive end-bearing end ring gear.

Carefully press the armature (5) with the commutator end shield (6) out of the stator by hand. At the same time, push out terminal 45 (7) with the sealing rubber (8).



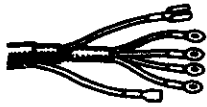
100671

Stator Frame Removal

Loosen the screws on the rear closure cap (2), but do not remove them.

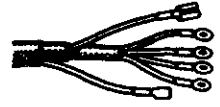
Remove the hexagon screws (3) running through the stator housing.

Remove the stator frame (4) with the cover plate, armature, and commutator end shield.



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STARTING SYSTEM – BOSCH (4-Cyl. Engine)

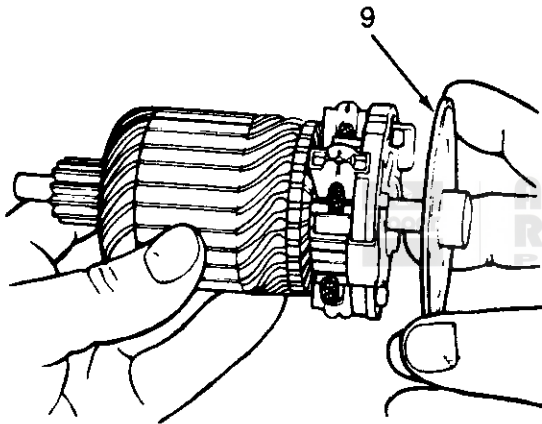


Commutator End Shield Removal

Remove the closure cap from the commutator end shield.

Remove the retaining washer and shims from the armature shaft.

Remove the commutator end shield (9).



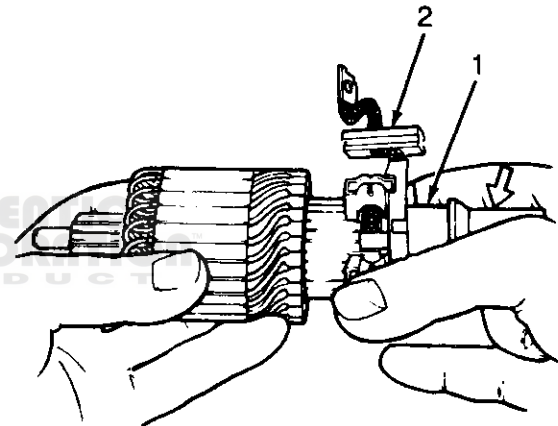
100673

Brush Removal

Slide KDAL 5048 (1) onto the armature shaft.

Slide the brush plate (2) as far as it will go on to KDAL 5048.

Pull KDAL 5048 with the brush plate off the armature shaft.



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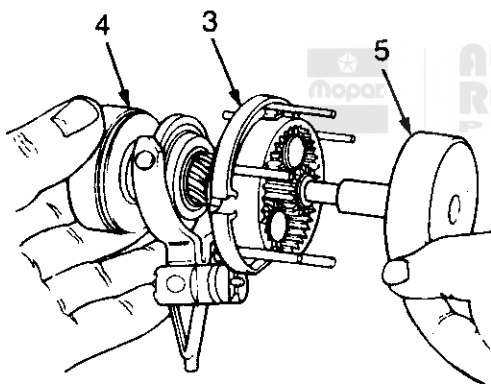
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Overrunning Clutch and Planetary Gear Removal

Remove the sealing rubber.

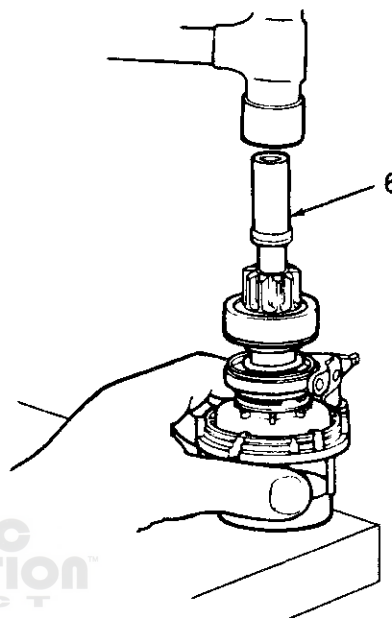
Remove the planetary gear system with the overrunning clutch and fork assembly from the drive end shield.

NOTE: To prevent damage to the planetary gear system (3) when removing it from the overrunning clutch (4) mount both assemblies onto Mounting Base KDAL 5047 (5) and stand it up vertically.



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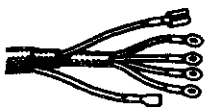
Using KDAL 5028 (6), and a rubber mallet, drive the stop ring down the input shaft.



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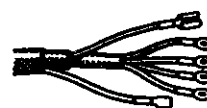
Use a suitable set of pliers to bend the ends of the retainer far enough apart to allow removal without damaging the drive shaft.

If necessary, carefully remove any burr from the armature shaft, otherwise damage to the drive bushing may result.



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STARTING SYSTEM – BOSCH (4-Cyl. Engine)



BOSCH STARTER MOTOR CLEANING AND INSPECTION

The armature, windings, overrunning clutch drive, and relay must be cleaned with compressed air and a dry rag. **Do not use liquid cleaning agents.**

Other parts, such as screws and the armature shaft may be cleaned with cleaning solvent.

Inspect all parts for wear and damage.

Replace any worn parts.

NOTE: If the bushings in the drive end shield or the commutator end shield are worn, they are replaceable.

Inspect the stator frame and permanent magnets for damage. **Do not remove the magnets from the stator frame.**

NOTE: If the stator frame or magnets are damaged, replace the stator frame (magnets are included).

Driveshaft/Ring Gear Assembly Inspection

Loosen the retainer from the planetary gear drive. Remove the ring gear from the drive shaft.

Check the ring gear for cracks and wear.

Check the bushings in the ring gear for excessive play, wear, or for being out of round by moving the drive shaft from side-to-side.

Check the drive shaft bushing in the drive end shield and commutator end shield with plug gauge KDAL 5049.

Inspect the drive shaft in the ring gear for wear or damage. Replace the shaft and ring gear if either is worn.

Overrunning Clutch Drive Inspection

If the fork lever is damaged, disconnect it by spreading the fork on the overrunning clutch drive. Also, if the bearing pedestal is damaged, separate it from the fork lever.

Inspect the bearing bushing in the overrunning clutch for wear.

Replace the overrunning clutch if the bearing bushing is worn.

Carbon Brush Inspection

The carbon brushes must have a MINIMUM length of 8mm (0.314-in).

NOTE: To measure the brushes, remove them from the brush holder.



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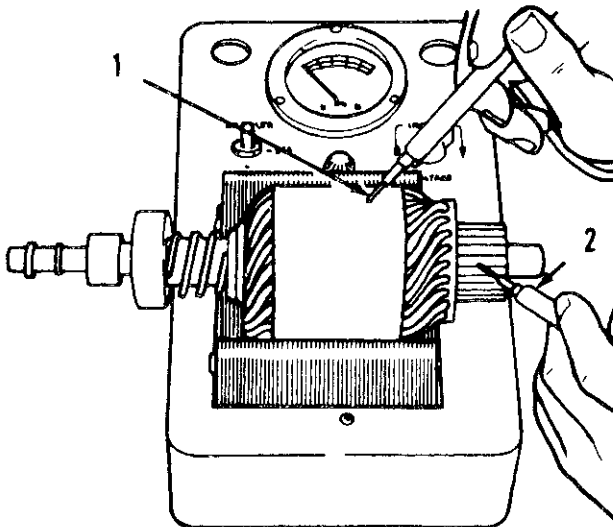
	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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Armature Testing

Armature Ground Test

Place the armature in the growler jaws and turn the power switch to TEST position.

Touch one test probe to the armature core (1). Touch the other probe to each commutator bar (2) one at a time and observe the test lamp. The test lamp should not light. If the test lamp lights on any bar, the armature has a short circuit to ground and must be replaced.



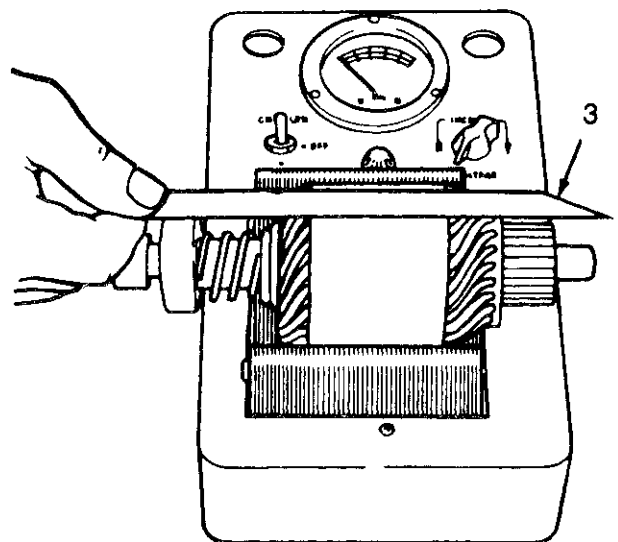
84936

Armature Short Test

CAUTION: Never operate the growler with the power switch in the growler TEST position without an armature in the jaws.

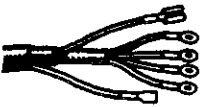
Place the armature in the growler jaws and turn the power switch to GROWLER position.

Hold the steel blade parallel to, and touching, the armature core (3). Slowly rotate the armature one or more revolutions in the growler jaws. If the steel blade vibrates at any area of the core, the windings have a short circuit and the armature must be replaced.



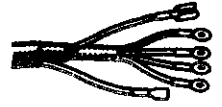
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STARTING SYSTEM – BOSCH (4-Cyl. Engine)



Armature Balance Test

Place the armature in the growler jaws and turn the power switch to GROWLER position.

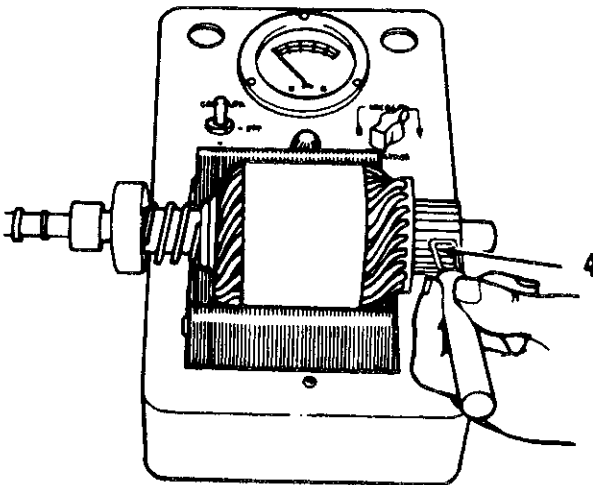
Place the contact fingers of the meter test probe (4) across adjacent commutator bars at the side of the commutator.

Adjust the voltage control until the pointer indicates the highest voltage on scale.

Test each commutator bar with the adjacent bar until all bars have been tested.

NOTE: Zero voltage indicates a short circuit in the particular pair.

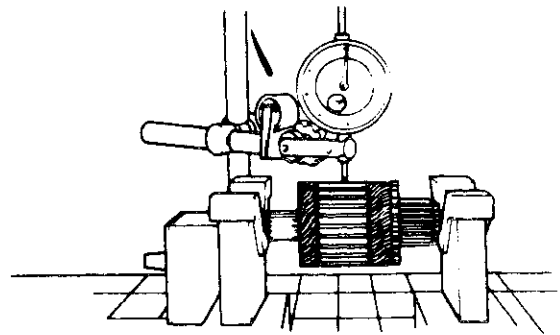
If there is a short circuit indicated, replace the armature.



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Armature Runout Test

Check the runout of the armature as specified in the **Specifications Chart**.



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If the armature is not within the specification, replace the armature.

BOSCH STARTER MOTOR ASSEMBLY

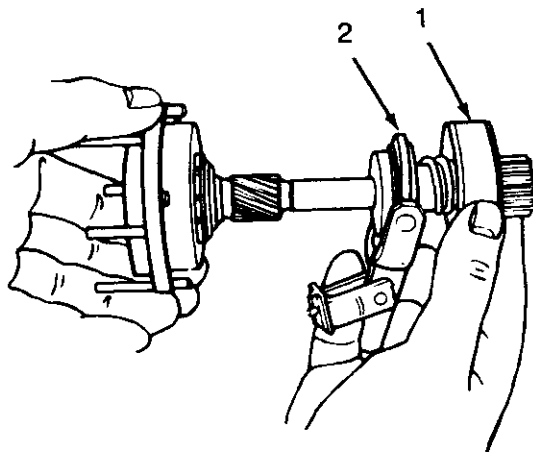
Gear Drive with the Overrunning Clutch Installation

Lightly oil the pinion bearing surface with **20W SAE** oil.

Lightly grease the spiral spline with **Lubriplate** grease.

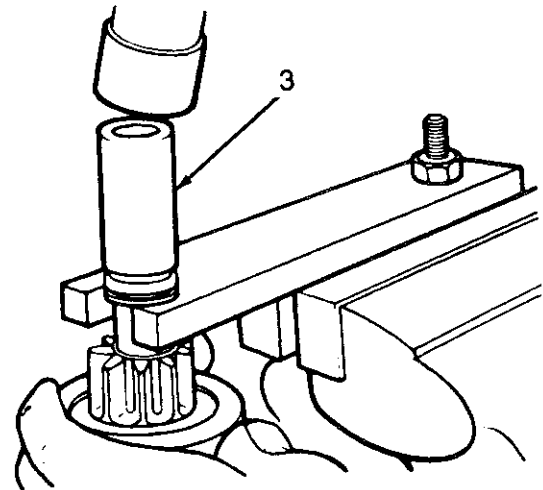
	ELECTRICAL STARTING SYSTEM – BOSCH (4-Cyl. Engine)	
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Slide the overrunning clutch (1) with the fork lever and bearing pedestal (2) on the drive shaft.



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Seat the stop ring using KDAL 5487.

Slide the stop ring onto the armature shaft.

CAUTION: When installing the new retainer, be careful not to scratch the armature shaft.

Open the retainer and insert it into the drive shaft ring groove using pliers.

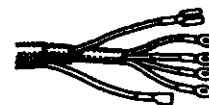
Slide KDAL 5028 (3) onto the armature shaft.

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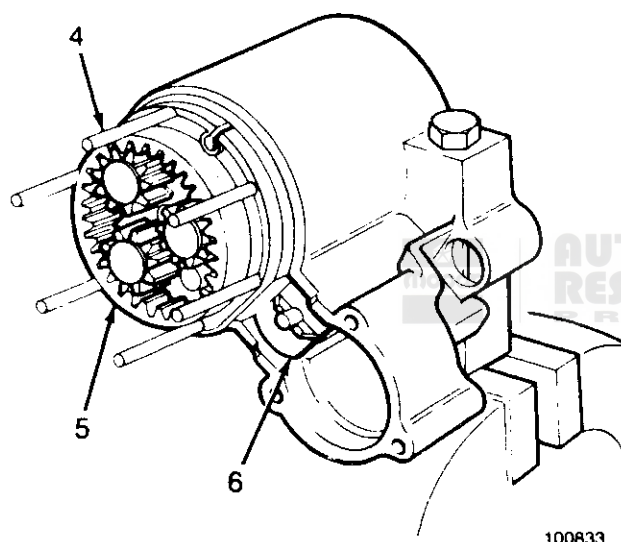
STARTING SYSTEM – BOSCH (4-Cyl. Engine)



Overrunning Clutch and Planetary Gear Installation

Lube the bearing with **20W SAE** oil.

Insert the planetary gear train with the pinion, overrunning clutch, fork lever, and bearing pedestal (4) into the drive end bearing housing.

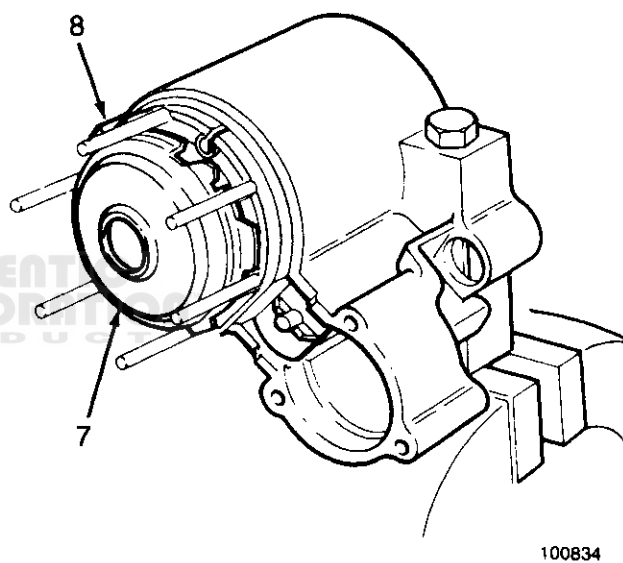


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NOTE: The bevelled part of the ring gear (5) points toward the bearing pedestal/relay.

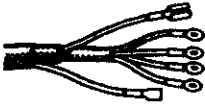
Insert the rubber seal (6).

Position the cover plate (7) on the ring gear so that the recess on the cover plate is seated in the lug (8) on the ring gear.



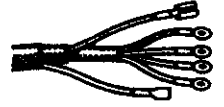
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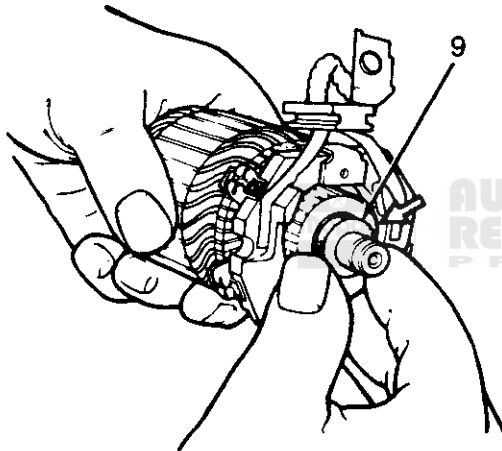
STARTING SYSTEM – BOSCH (4-Cyl. Engine)



Commutator End Shield Installation

Position KDAL 5048 (9) with the brush plate, or the new brush plate with holding ring, on the armature shaft at the commutator end.

Slide the brush plate over the commutator, making sure that the brush holders are properly seated in the anchor point.



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Remove KDAL 5048, or the retaining washer.

Lightly oil the gasket (felt ring) with **20W SAE** oil and slide it on the commutator end of the drive shaft.

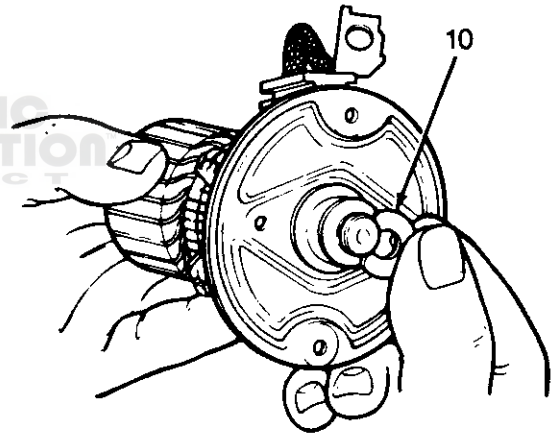
Lightly lubricate the commutator end shield bushing with **Lithium-based** wheel bearing grease.

Slide the commutator end shield onto the armature shaft.

Set the armature end play with one shim (10).

Insert the holding disc and check the end play.

NOTE: The end play should be between 0.05mm (0.002-in) and 0.4mm (0.016-in). Three different shims are available: 1.0mm (0.004-in), 1.2mm (0.047-in), and 1.4mm (0.055-in).



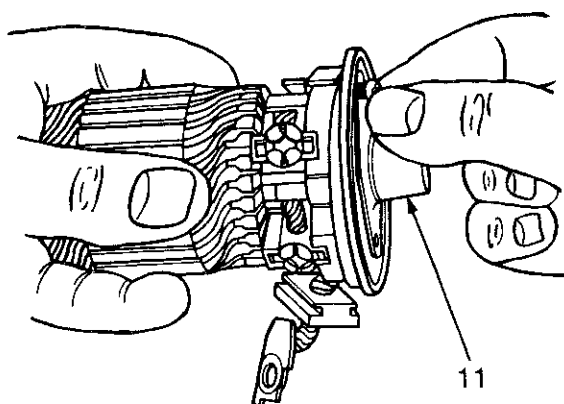
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After setting the armature end play, lubricate the retaining washer with **Lithium-based** wheel bearing grease.

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Mount the seal and closure gap (11).

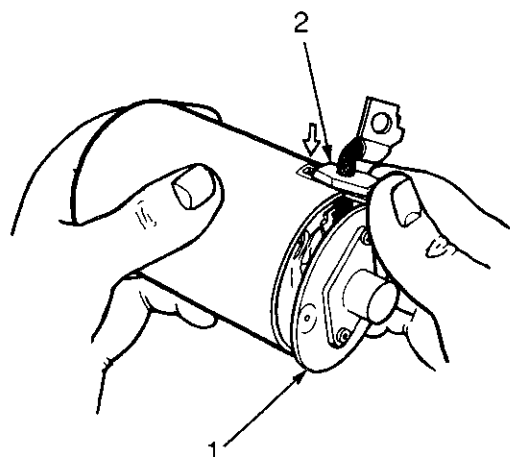
Turn screws into place by hand far enough to hold the closure plate in place.



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Stator Frame Installation

Slide the armature with the brush plate and commutator end shield (1) carefully into the stator frame.



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Fit the rubber seal (2) on terminal 45 (brush plate) into the groove on the stator frame.

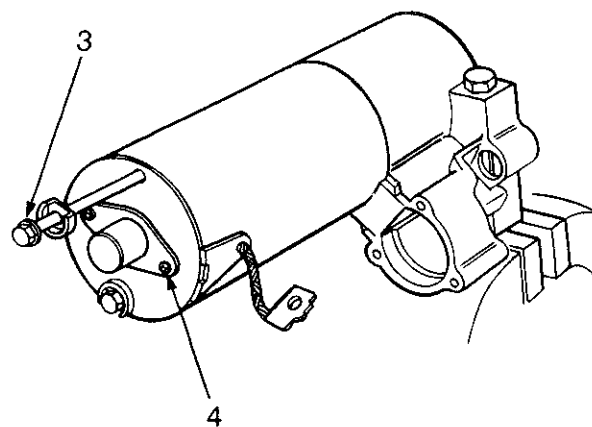
Turn the pinion until the armature latches into the planet gears.

NOTE: Be careful when turning the pinion. Do not use force.

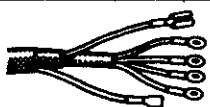
The groove on the stator frame fits onto the sealing rubber of the bearing pedestal.

Turn the commutator end shield until the groove on the commutator end shield points to the sealing rubber.

Install the hexagon head screws (3) and tighten to 2.7-3.5 N·m (2.0-2.6 ft-lbs) torque.

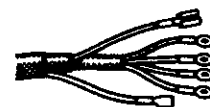


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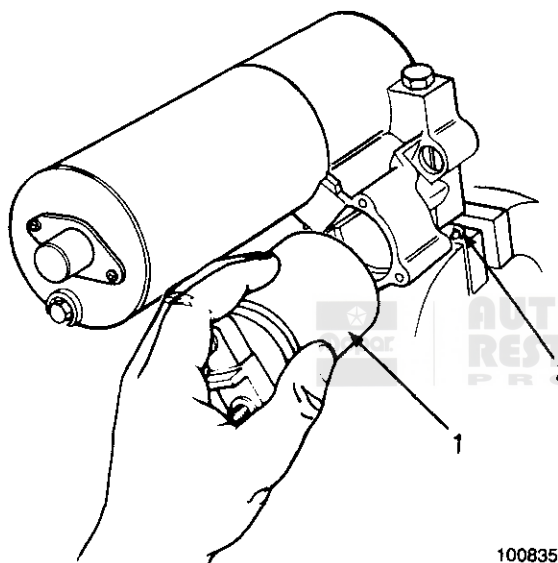
STARTING SYSTEM – BOSCH (4-Cyl. Engine)



Tighten the closure cap screws (4) to 1.4-2.0 N·m (1.0-1.5 ft-lbs) torque.

Solenoid Switch Installation

Hook the solenoid switch armature (1) into the fork lever.



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Insert the solenoid armature return spring.

Install the solenoid switch housing screws (2).

Connect terminal 45 on the solenoid switch.

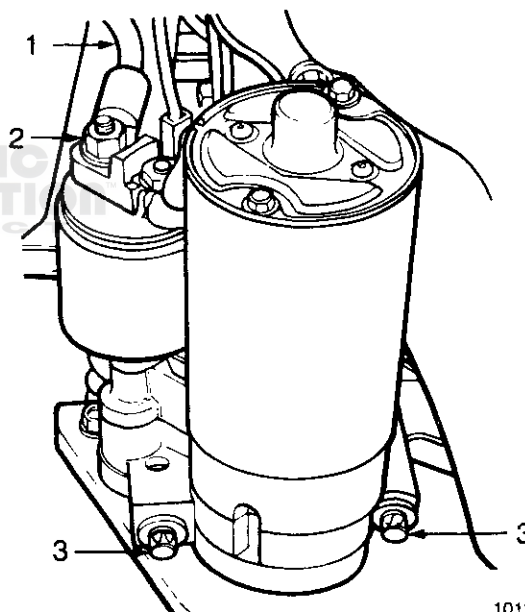
BOSCH STARTER MOTOR INSTALLATION

Align the starter motor (4) at the flywheel (drive plate) housing .

Install the attaching screws (3) and tighten to 18-34 N·m (13-25 ft-lbs).

Connect the battery cable (1) from the starter motor terminal (2).

Connect the negative battery cable at the battery.



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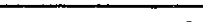
	ELECTRICAL	
	IGNITION SYSTEM – RENIX (4-Cyl. Engine)	

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Distributor Clamp Screw	23 N·m (17 ft-lbs)	20-27 N·m (15-20 ft-lbs)


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	IGNITION SYSTEM – RENIX (4-Cyl. Engine)	

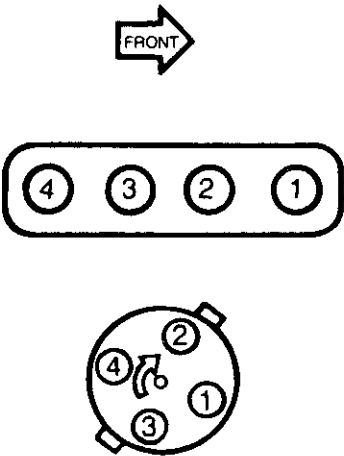
SPARK PLUG SPECIFICATIONS

ENGINE	PLUG TYPE	ELECTRODE GAP	SPARK PLUG TIGHTENING TORQUE
2.5L	RC-12 LYC	0.9 mm (0.035-in)	37 N·m (27 ft-lbs)

SEE I.S. NOTES

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FIRING ORDER



GENERAL INFORMATION

- The ignition system for 2.5L engines consists of:
- solid-state ignition control module (ICM)
 - ignition distributor
 - electronic control unit (ECU)

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	ELECTRICAL IGNITION SYSTEM – RENIX (4-Cyl. Engine)	
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IGNITION SYSTEM COMPONENTS

Ignition Control Module (ICM)

The solid-state ignition control module (ICM) is mounted to the left of the battery on the dash panel.

The ICM consists of a solid-state ignition circuit and an integrated ignition coil that can be removed and serviced separately, if equipped.

Ignition advance/retard is controlled electronically by the Electronic Control Unit (ECU). Electronic signals from the ECU to the ICM determine the amount of ignition timing advance, or retard, needed to meet various engine load requirements.

The ECU provides an input signal to the ICM. The ICM has only two outputs:

- tach signal to the tachometer and diagnostic connector

- high voltage from the coil to the distributor cap

Refer to the 2.5L fuel injection circuit schematic or Electrical Troubleshooting Manual for ECU and ICM connections and circuitry.

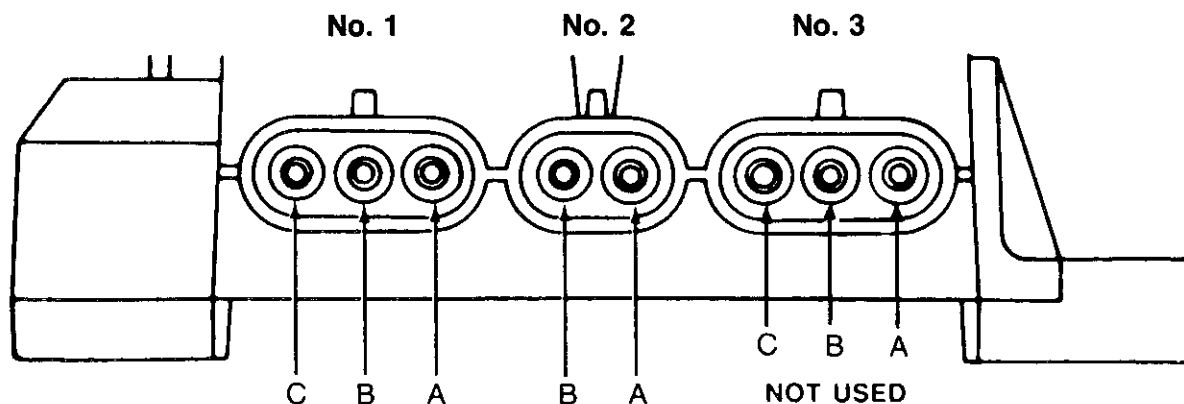
ICM Connections

Electrical feed to the ICM is through terminal A of Connector No. 1 on the module (Fig. 86715B).

NOTE: Electrical feed only occurs with the ignition switch in the START and RUN positions.

Terminal B of Connector No. 1 is grounded at the engine oil dipstick bracket along with the ECU ground wire and oxygen (O₂) sensor ground.

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CONNECTOR NO. 1

A – Ignition (+)
B – Ground (–)
C – Tach Signal Diagnostic
Connector D1 – Pin 1

CONNECTOR NO. 2

A – Not Used
B – ECU Square Wave Input
Ignition Coil Interface

CONNECTOR NO. 3

(Not Used)



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IGNITION SYSTEM – RENIX (4-Cyl. Engine)



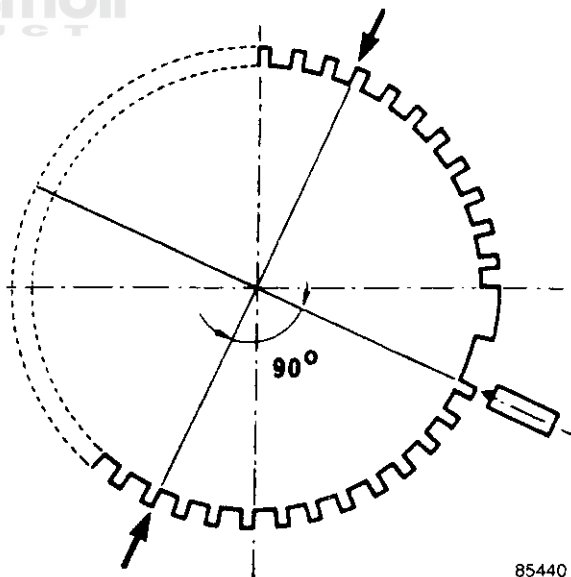
The tachometer output signal wire of the ICM is connected to Pin No. 1 of the D1 diagnostic connector. The wire is routed to the diagnostic connector through a short section of the ECU harness, the engine and instrument panel harness. This type of routing eliminates any potential electrical interference in the various ECU circuitry.

Ignition firing signals from ECU terminal 27 are transmitted through terminal B of Connector No. 2 on the ICM. The ignition signal from the ECU is received by the ICM in the form of a 5-Volt square wave. As the leading edge of the wave contacts the ignition circuitry in the ICM, the ICM charges the coil primary windings.

When coil saturation occurs, the module circuitry opens the primary windings to collapse the magnetic field in the windings. This induces the high voltage in the coil secondary windings which is then transmitted to the spark plugs via the coil wire, distributor cap, and rotor.

Flywheel

There are originally 44 teeth around the flywheel circumference. Two of the teeth are machined off every 180° to define a precise point 90° before TDC and BDC, so only 40 teeth remain.



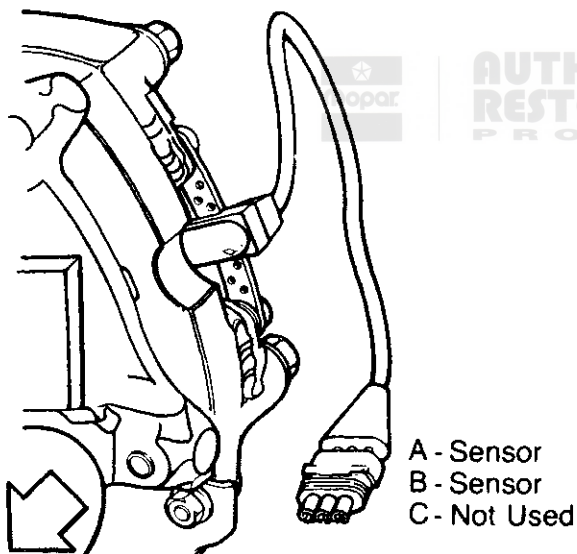
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	ELECTRICAL IGNITION SYSTEM – RENIX (4-Cyl. Engine)	
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TDC Sensor

The TDC sensor senses TDC, BDC, and engine speed. It is **non-adjustable** (preset at the factory in its mounting during engine assembly). The TDC sensor is secured by special shouldered bolts to the flywheel/drive plate housing.



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Component Pin-Outs

Throttle Body Injection (TBI) circuitry component pin-outs can be found in the Electrical Troubleshooting Manual (ETM).

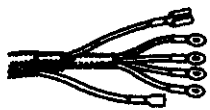
IGNITION SYSTEM DIAGNOSIS

Diagnostic Connector

The diagnostic connector allows the following test to be conveniently made right at the connector:

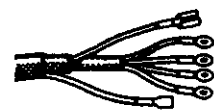
- **Primary Circuit Test** (D1-2) B+ after ignition
- **Engine RPM Test** (tachometer voltage) (D1-1)

NOTE: Use D1-3 for vehicle ground.



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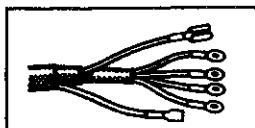
IGNITION SYSTEM – RENIX (4-Cyl. Engine)



IGNITION SYSTEM DIAGNOSIS CHART

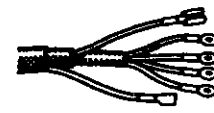
CONDITION	POTENTIAL CAUSE	REPAIR
Weak spark or no spark at plugs (engine will not start).	1. Loose or damaged coil rotor, distributor cap, ignition wires, or spark plugs.	1. Refer to secondary circuit diagnosis. Replace as necessary.
	2. Loose or dirty + or – wire connections at coil terminals.	2. Clean terminals and wire connectors. Be sure wire connectors are properly seated on coil terminals and are not wedged between coil body and terminal.
	3. Loose connectors at ICM or ECU.	3. Verify that wire connectors are firmly plugged into ICM and/or ECU.
	4. Loose or corroded battery ICM or ECU ground wire connections.	4. Clean and retighten ground connections. (NOTE: All three are grounded at the engine oil dipstick bracket.)
	5. Battery weak or discharged.	5. Recharge battery. Replace battery if charging does not restore battery specific gravity to minimum of 1.235 or if battery fails heavy load test.
	6. Low voltage across terminals A and B of the ICM connector 1.	6. Check the voltage between terminals A and B using voltmeter. - With ignition On and starter engaged (engine cranking), voltage should be minimum of 9.5 volts. If the voltage is OK, go to next step. If the voltage is low, check continuity of ICM and ECU ground wires. Repair or replace as necessary.
	7. Malfunction in the ignition coil primary or secondary windings or coil is damaged (cracked or severely dented). (NOTE: Volt ohmmeter must have a minimum of 1 megohm impedance.)	7. Check primary and secondary resistance with ohmmeter. The primary resistance should be 0.4 to 0.8 ohms maximum. Secondary resistance should be 2500 to 4000 ohms maximum. Replace coil if damaged or faulty. Proceed to next step if coil is OK.
	8. Check ECU and ICM with MS 1700 tester.	8. Replace ICM or ECU if either fails the MS 1700 test sequence.

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IGNITION SYSTEM – RENIX (4-Cyl. Engine)



Secondary Circuit Diagnosis

CAUTION: When disconnecting a high voltage wire from a spark plug or from the distributor cap, twist the rubber boot slightly to break it loose. Grasp the boot, **not the wire**, and pull it off with a steady, even force.

Disconnect the ignition coil wire from center tower of the distributor cap. Use insulated pliers to hold a wire terminal approximately 12mm (1/2-in) from the cylinder block, head, or intake manifold.

WARNING: Be very careful when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or the fan. Do not wear loose fitting clothing.

Rotate the engine with the starter motor and observe the wire terminal for an arc.

If an arc occurs, connect the ignition coil wire to the distributor cap by removing a wire from one spark plug.

Use insulated pliers to hold the wire terminal 12mm (1/2-in) from the engine cylinder head or block while rotating the engine with the starter motor. Observe the wire terminal for an arc.

If an arc occurs, inspect the fuel system for problems or the ECU sensors, using the MS 1700 tester, which may indicate incorrect ignition timing.

If no arc occurs, inspect for a defective rotor or distributor cap, or for defective spark plug wires.

Refer to the **INJ. R.. (G). Manual** for additional information.

2.5L DISTRIBUTOR GENERAL INFORMATION

The distributor is mounted on the right-hand side in the center of the cylinder block. It is driven by the camshaft.

The distributor contains no electrical components other than the rotor and the distributor cap.

The sole function of the distributor is to transmit the high voltage (developed in the ICM coil secondary windings) to the spark plugs in the required firing sequence.

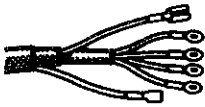
2.5L DISTRIBUTOR REMOVAL

Refer to Chapter B – Engines, under Camshaft Removal.

2.5L DISTRIBUTOR INSTALLATION

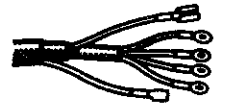
Refer to Chapter B – Engines, under Camshaft Removal.

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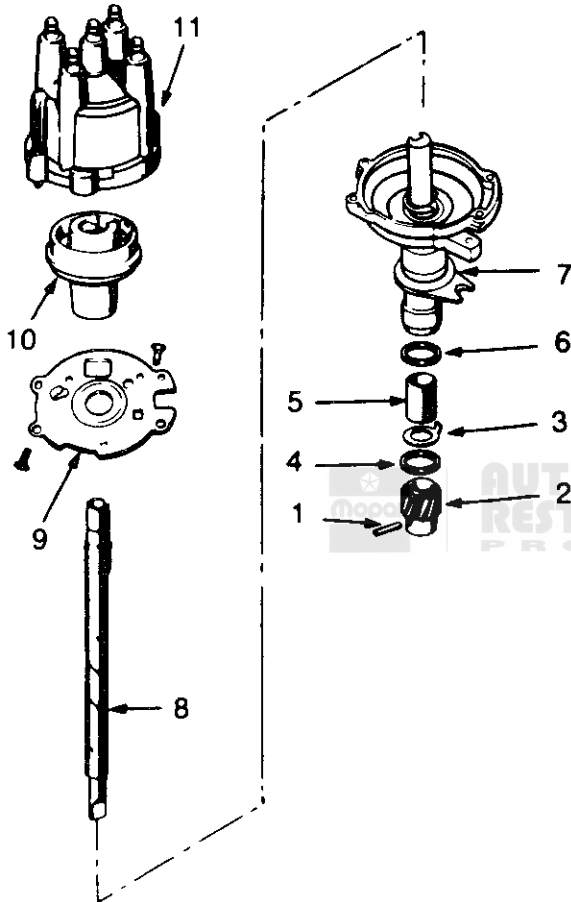
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IGNITION SYSTEM – RENIX (4-Cyl. Engine)



2.5L DISTRIBUTOR COMPONENTS

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| 1. Pin | 7. Housing |
| 2. Gear | 8. Shaft |
| 3. Washer | 9. Plate |
| 4. Shim | 10. Rotor |
| 5. Bushing | 11. Cap, Distributor |
| 6. Gasket | |

Rotor

A unique feature of this system is the silicone applied to the rotor blade during manufacture.

Radio interference is greatly reduced by the presence of a small quantity of silicone dielectric compound on the rotor blade. After a few thousand miles, this compound becomes charred by the high voltage current flowing through the rotor. This condition is normal. Do not scrape the residue from the rotor blade.

When installing a replacement rotor, apply a thin coat (0.03 - 0.12-in) of **AMC Silicone Dielectric Compound**, or equivalent, to the rotor blade.

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	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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TORQUE SPECIFICATIONS

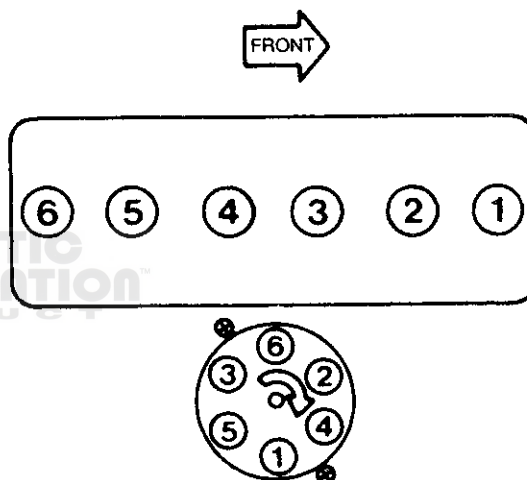
Component	Service Set-To Torque	Service Recheck Torque
Distributor Clamp Screw	23 N·m (17 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Spark Plugs	37 N·m (27 ft-lbs)	30-40 N·m (22-33 ft-lbs)

SSI DISTRIBUTOR AND IGNITION COIL SPECIFICATIONS

Distributor Pickup Coil	
Resistance	400 to 800 ohms @ 24°C (75°F)
Ignition Coil	
Primary Resistance	1.13 to 1.23 ohms @ 24°C (75°F)
	1.5 ohms @ 93°C (200°F)
Secondary Resistance	7700 to 9300 ohms @ 24°C (75°F)
	12,000 ohms @ 93°C (200°F)
Minimum Open Circuit Output at 1000 rpm	24 kv
Spark Plugs	
Required Voltage at 1000 rpm	5 to 16 kv
Maximum Variation Between Cylinders	3 to 5 kv

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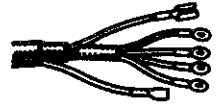
FIRING SEQUENCE



Six-Cylinder Engine

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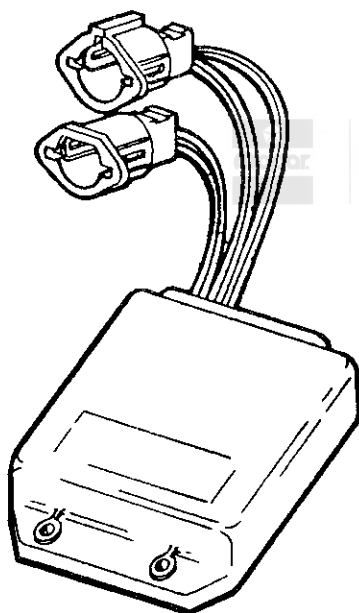


IGNITION SYSTEM COMPONENTS

The MCU is a permanently sealed module located in the passenger compartment. It is not repairable and must be replaced as a unit if service is required.

Electronic Ignition Control Unit

The Electronic Ignition Control Unit is a solid-state module. Its components are permanently sealed. This module is not repairable and must be replaced as a unit if service is required.



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NOTE: When disconnecting the SSI system connectors, pull them apart with a firm, straight pull. Do not attempt to pry them apart with a screwdriver. When connecting them, press together firmly to overcome hydraulic pressure caused by the silicone dielectric compound.

NOTE: If the connector locking tabs weaken or break off, do not replace the associated component. Bind the connectors together with tape or a harness tie strap to assure good electrical connection.

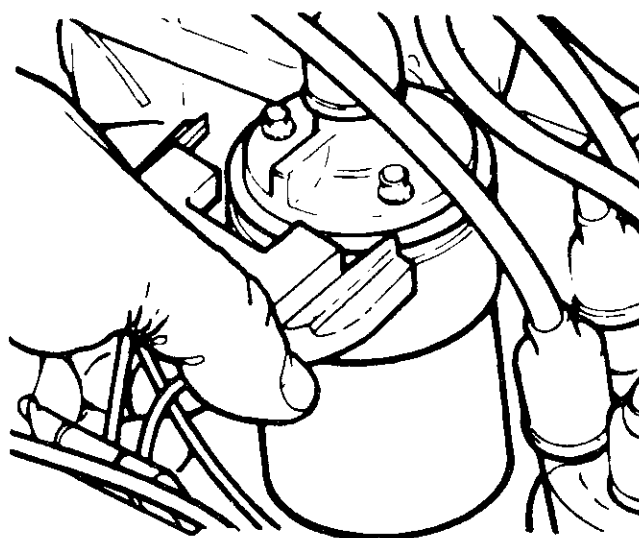
Ignition Coil

The ignition coil does not require special service other than maintaining the terminals and connectors.

When an ignition coil is suspected of malfunctioning, test it on the vehicle. A coil may "break down" after the engine has heated it to a high temperature. It is important that the coil be at operating temperature when tested. Perform the test according to the test equipment manufacturer's instructions.

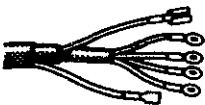
Ignition Coil Connector

The ignition coil terminals and connector are of unique design. The connector is removed from the coil by grasping both sides and pulling away from the coil.



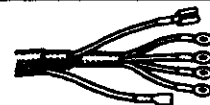
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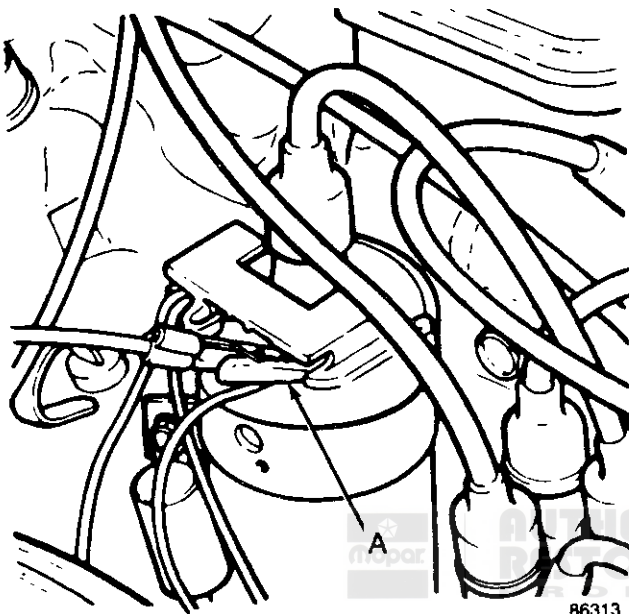


ELECTRICAL

IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



When a tachometer is required for engine testing or tune-up, connect it using an alligator jaw-type connector (A).



Complete failure is always a no-ignition situation. The engine will not start. If a complete failure occurs when the engine is operating, it will not restart.

Intermittent failure is temporary. The engine may not start on the first try, but will eventually start. If an intermittent failure occurs when the engine is operating, it may falter and possibly stop. If it stops, it will restart and will continue to operate intermittently.

Spark knock (pre-ignition) is not actually an ignition system failure. The engine will start and will continue to operate. If not corrected, spark knock can cause extensive internal engine component damage.

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IGNITION SYSTEM DIAGNOSIS

For diagnostic purposes, ignition system problems are considered in three categories:

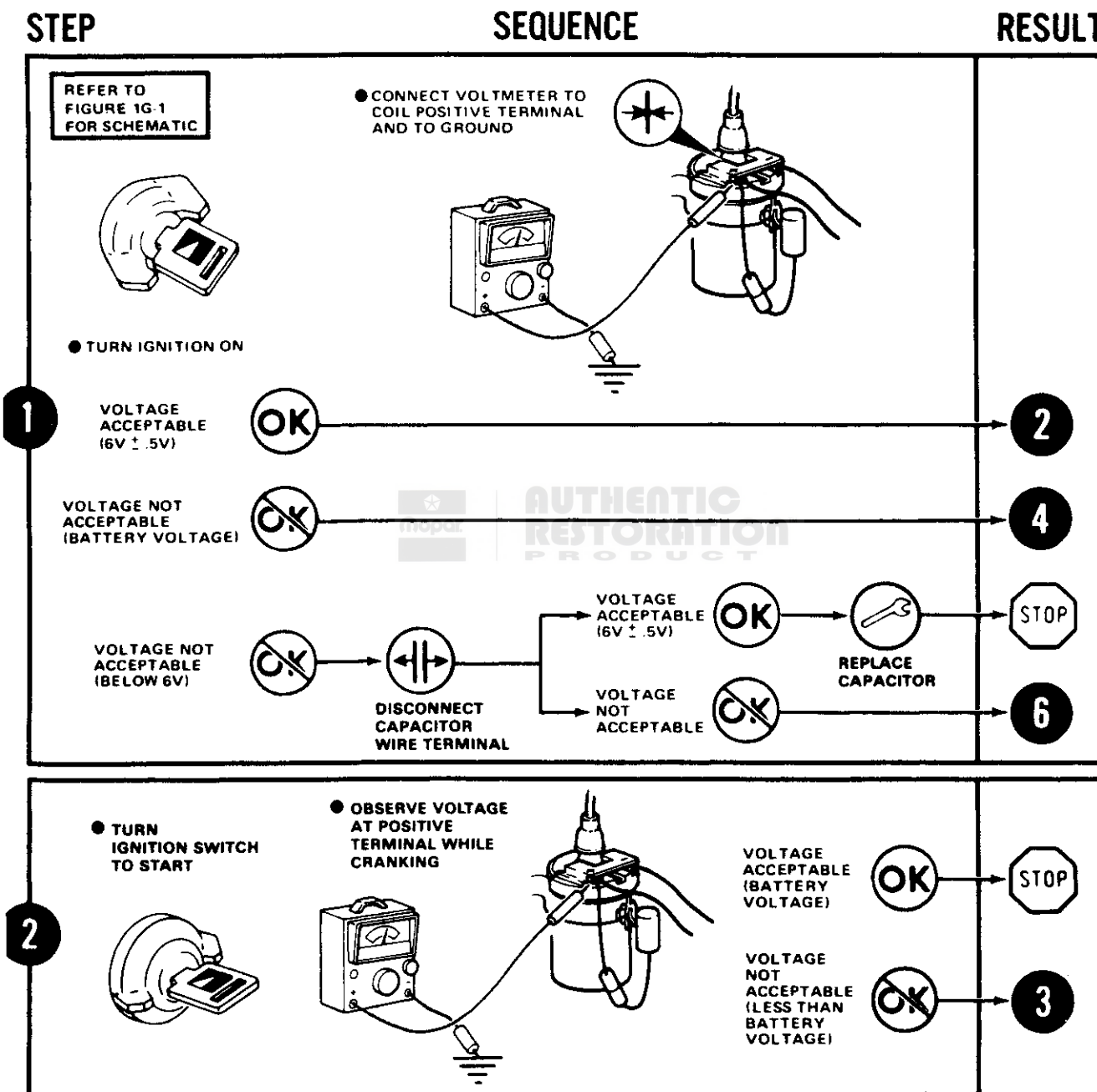
1. Complete failure
2. Intermittent failure
3. Spark knock (pre-ignition)

	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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IGNITION COIL PRIMARY CIRCUIT

FUNCTION: Connects Battery Voltage To Coil and Coil To Ground

Chart 1



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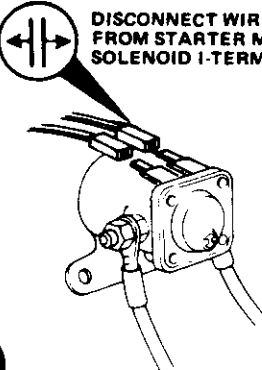
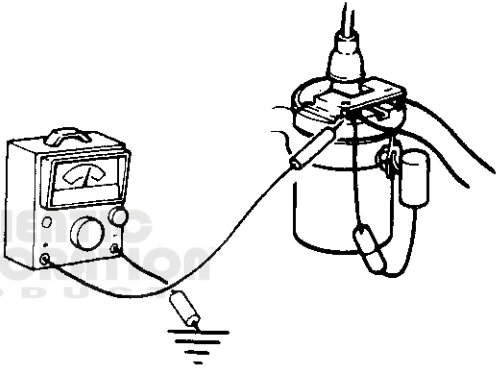
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	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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Chart 1

STEP	SEQUENCE	RESULT
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3	  CHECK FOR SHORT OR OPEN IN WIRE ATTACHED TO STARTER MOTOR SOLENOID I-TERMINAL CHECK STARTER MOTOR SOLENOID AS OUTLINED IN CHAPTER 1F  REPAIR AS REQUIRED	STOP
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4	DISCONNECT WIRE FROM STARTER MOTOR SOLENOID I-TERMINAL  ● IGNITION REMAINS ON ● OBSERVE VOLTAGE AT COIL POSITIVE TERMINAL 	
	VOLTAGE DROPS TO $6V \pm .5V$ OK  REPLACE STARTER MOTOR SOLENOID STOP	
	VOLTAGE REMAINS AT BATTERY VOLTAGE OK CONNECT JUMPER BETWEEN COIL NEGATIVE TERMINAL AND GROUND VOLTAGE DROPS TO $6V \pm .5V$ OK 5 VOLTAGE DOES NOT DROP OK 6	
	TEST RESISTANCE WIRE  6	

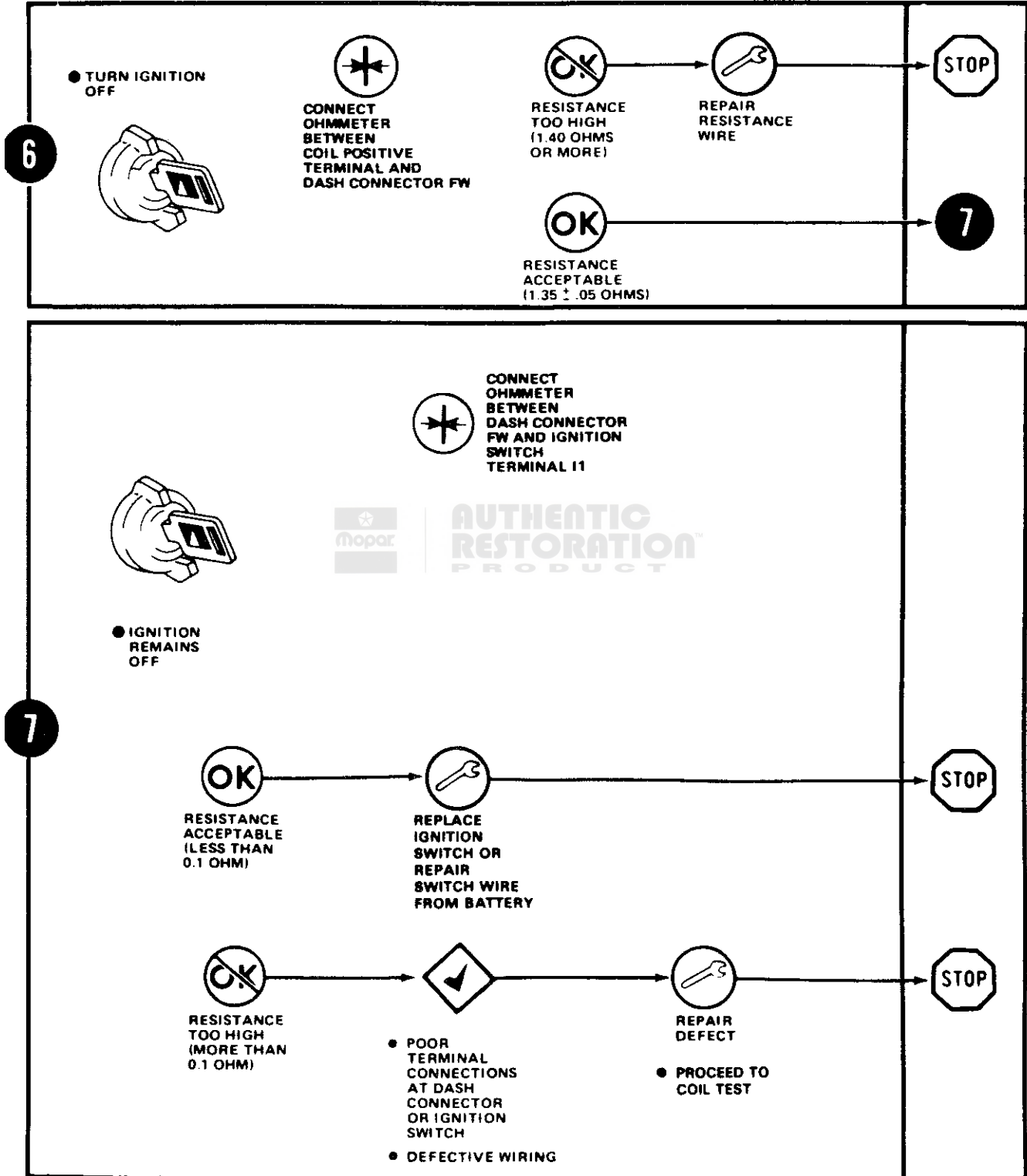
5	CHECK: ● CONTINUITY BETWEEN COIL NEGATIVE TERMINAL AND CONNECTOR OR TERMINAL D4 ● DI CONTINUITY BETWEEN CONNECTOR TERMINAL AND GROUND	
	CONTINUITY OK OK REPLACE CONTROL UNIT  STOP	
	CONTINUITY NOT OK OK LOCATE AND REPAIR OPEN  2	

SEE I.S. NOTES

Chart 1
RESULT

STEP

SEQUENCE

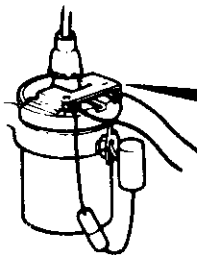
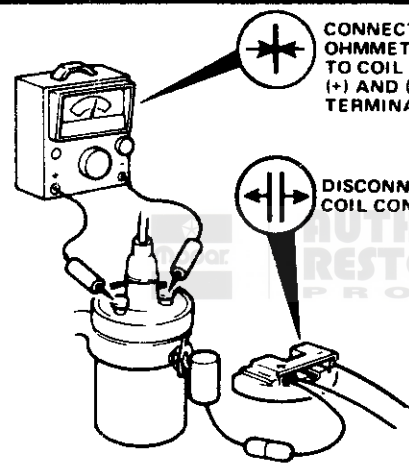
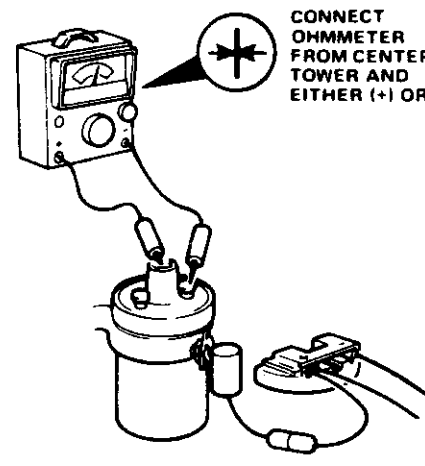


SEE I.S. NOTES

	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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COIL TEST

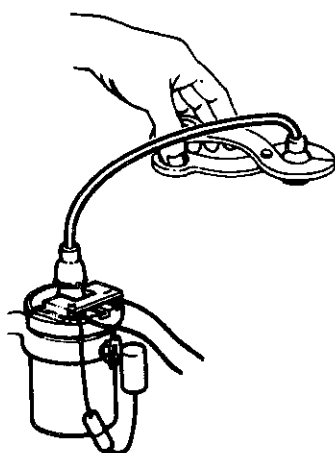
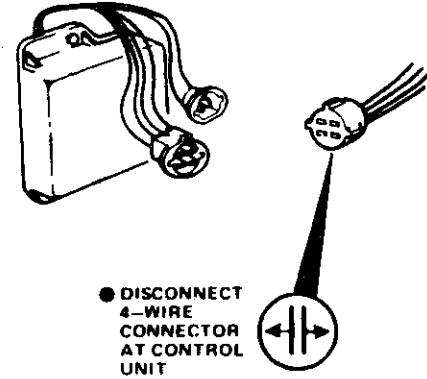
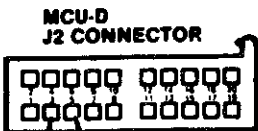
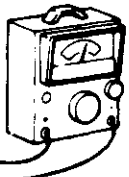
Chart 2

STEP	SEQUENCE	RESULT
1	 INSPECT COIL FOR OIL LEAKS, OTHER EXTERIOR DAMAGE, AND CARBON TRACKS OK → 2 OK (with slash) → REPLACE COIL → STOP	2
2	 CONNECT OHMMETER TO COIL (+) AND (-) TERMINALS DISCONNECT COIL CONNECTOR OK → 3 RESISTANCE ACCEPTABLE (1.13 TO 1.23 OHMS AT 75°F OR 24°C) (1.5 OHMS AT 200°F OR 93°C) OK (with slash) → REPLACE COIL → STOP RESISTANCE NOT WITHIN LIMITS	3
3	 CONNECT OHMMETER FROM CENTER TOWER AND EITHER (+) OR (-) OK → STOP RESISTANCE ACCEPTABLE (7700 - 9300 OHMS @ 75°F OR 24°C) (12,000 OHMS @ 200°F OR 93°C) OK (with slash) → REPLACE COIL → STOP RESISTANCE NOT WITHIN LIMITS	STOP

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SENSOR CHECK AND CONTROL UNIT CHECK

Chart 3

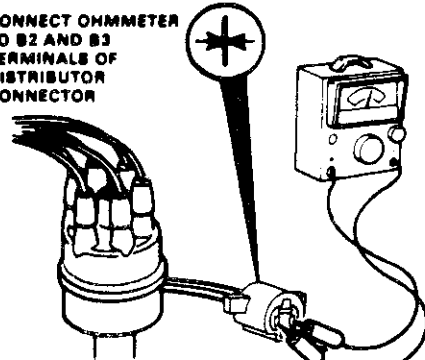
STEP	SEQUENCE	RESULT	
1	 ● TURN IGNITION ON  ● DISCONNECT COIL WIRE FROM CENTER TOWER OF DISTRIBUTOR AND HOLD 1/2 INCH FROM ENGINE WITH INSULATED PLIERS  ● DISCONNECT 4-WIRE CONNECTOR AT CONTROL UNIT	SPARK AT COIL WIRE (NORMAL) → NO SPARK →	2 5
	AUTHENTIC RESTORATION PRODUCT		
2	 MCU-D J2 CONNECTOR  DISCONNECT J2 CONNECTOR FROM MCU AND CONNECT OHMMETER TEST LEADS TO PINS 3 AND 5 OF MCU-D J2 CONNECTOR	OK → OHMMETER INDICATES 400-800 OHMS (NORMAL) ✗ → OHMMETER DOES NOT INDICATE 400-800 OHMS	6 3
3	● DISCONNECT AND RECONNECT 3-WIRE CONNECTOR AT DISTRIBUTOR OK → OHMMETER NOW INDICATES 400-800 OHMS ✗ → OHMMETER REMAINS OUTSIDE 400-800 OHMS →  DISCONNECT 3-WIRE CONNECTOR AT DISTRIBUTOR	DISCONNECT 3-WIRE CONNECTOR AT DISTRIBUTOR →	6 4

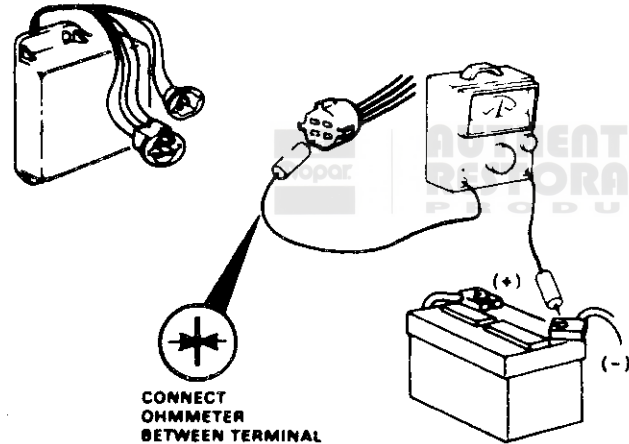
SEE I.S. NOTES

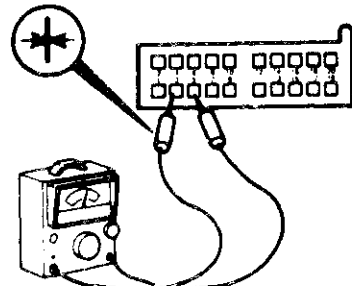
	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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Chart 3

STEP	SEQUENCE	RESULT
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4	CONNECT OHMMETER TO B2 AND B3 TERMINALS OF DISTRIBUTOR CONNECTOR  OK OHMMETER INDICATES 400 - 800 OHMS → ⚙️ REPAIR OR REPLACE HARNESS BETWEEN 3 - WIRE AND 4 - WIRE CONNECTOR → STOP ✗ OHMMETER DOES NOT INDICATE 400 - 800 OHMS → ⚙️ REPLACE PICKUP COIL → STOP	
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5	CONNECT OHMMETER BETWEEN TERMINAL D1 AND BATTERY NEGATIVE TERMINAL  OK OHMMETER INDICATES ZERO (NOT ABOVE 0.002 OHM) → 2 ✗ OHMMETER INDICATES ABOVE 0.002 OHM → ⚙️ LOCATE AND REPAIR SOURCE OF BAD GROUND ● GROUND CABLE RESISTANCE ● DISTRIBUTOR-TO-BLOCK RESISTANCE ● GROUND SCREW IN DISTRIBUTOR TO D1 TERMINAL → STOP	
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6	CONNECT DC VOLTMETER TEST LEADS TO PINS 3 AND 5 OF MCU-D J-2 CONNECTOR  OK VOLTMETER FLUCTUATES, INDICATING PROPER PICKUP COIL AND TRIGGER WHEEL OPERATION → STOP ✗ VOLTMETER DOES NOT FLUCTUATE → ⚙️ LOCATE AND REPAIR FAULT ● DEFECTIVE TRIGGER WHEEL ● DISTRIBUTOR NOT TURNING ● MISSING TRIGGER WHEEL PIN → STOP	
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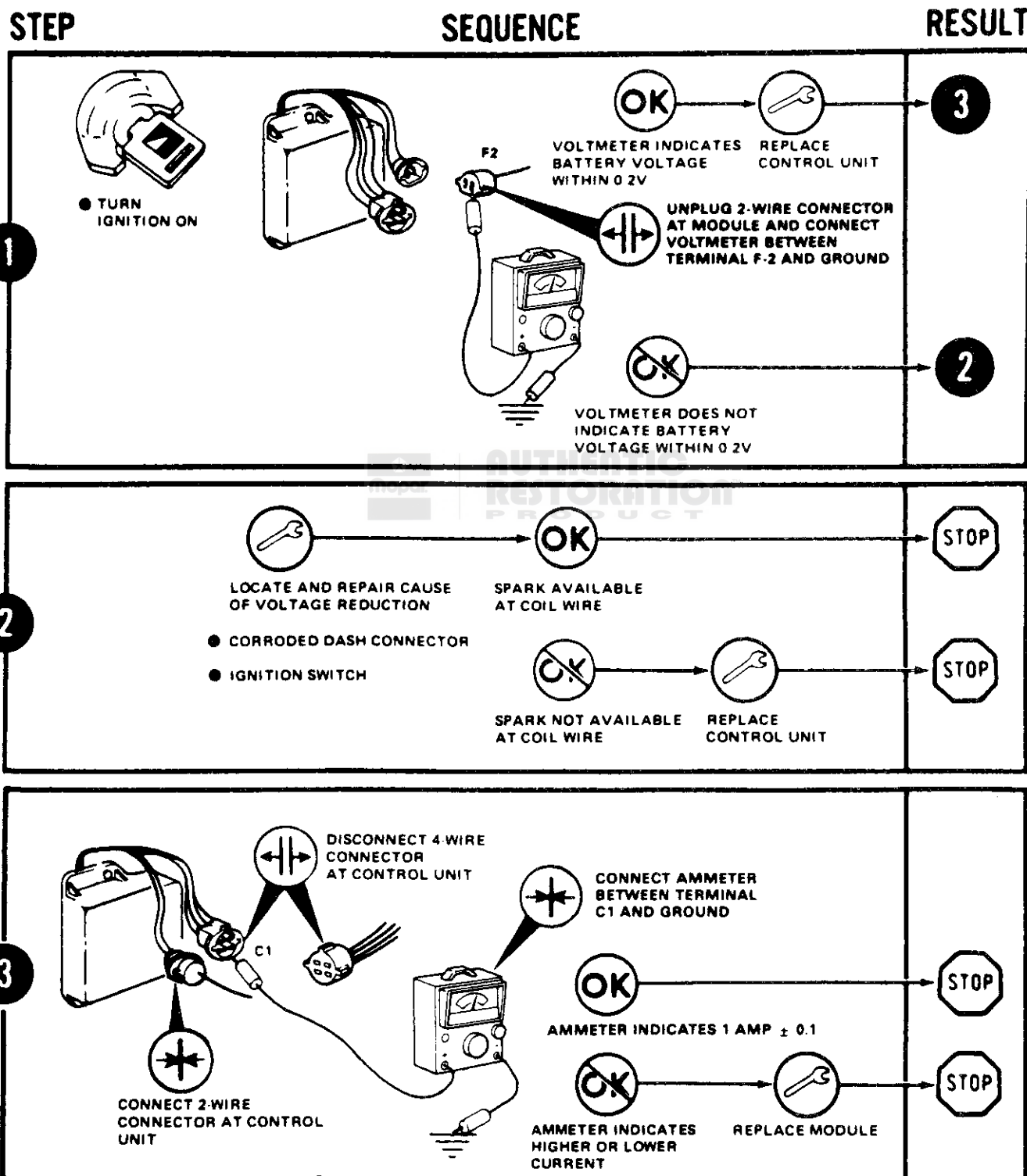
SEE I.S. NOTES

	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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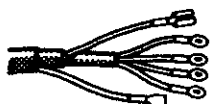
IGNITION FEED TO ELECTRONIC CONTROL UNIT

Chart 4

NOTE DO NOT PERFORM CHART 4 WITHOUT PERFORMING CHART 1



SEE I.S. NOTES



ELECTRICAL

IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Engine Spark Knock (Pre-Ignition) Diagnosis

Spark knock (pre-ignition) can be attributed to several factors. The most common are ambient air conditions, such as air temperature, density and humidity.

High Underhood Air Temperature

Underhood air temperature is increased by the use of air conditioning (especially during long periods of idling), overloading (trailer pulling or operating in too high a gear) and the installation of accessories that restrict airflow.

Air Density

Air density increases as barometric pressure rises or as the air temperature decreases. A denser than normal mixture of air and fuel drawn into a cylinder has the same effect as increasing the engine compression ratio and this increases the possibility of spark knock.

Humidity

Low humidity increases the tendency for engine spark knock. High humidity decreases the tendency for engine spark knock.

Fuel Octane Rating

The six-cylinder engines are designed to operate on unleaded fuel. Fuels having an equivalent research octane rating may vary in their anti-knock characteristics for a given engine. It may be necessary to retard the initial ignition timing (not more than one degree from the specification) or select an alternate source of fuel.

Ignition Timing

Check the ignition timing to ensure it is adjusted to the specification.

NOTE: The white paint mark on the timing degree scale identifies the specified timing degrees before top dead center (BTDC) at 1600 RPM, not top dead center (TDC).

Combustion Chamber Deposits

An excessive buildup of deposits in the combustion chamber may be caused by not using the recommended fuels and lubricants, prolonged engine idling or continuous low speed operation. These deposits can be reduced by the occasional use of AMC/Jeep Carburetor and Combustion Area Cleaner, P/N 8992352, or equivalent, or by operating the engine at higher speeds.

Distributor Ignition Advance Mechanisms

Inspect the centrifugal and vacuum ignition advance mechanisms to ensure they are operating normally.

DISTRIBUTOR ADVANCE TESTS

Centrifugal (Mechanical) Advance Test

Disconnect the vacuum hose from the vacuum advance mechanism and plug.

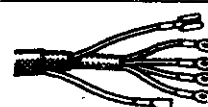
Connect a timing lamp to the No. 1 spark plug and a tachometer to the ignition coil "tach" terminal.

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IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and observe the timing degree scale and index with the timing lamp while the engine is idling.

Slowly increase the engine speed to 2000 rpm. The timing should advance smoothly as engine speed increases. Refer to Chapter B – Engines – General Service and Diagnosis for mechanical advance curve information.

Vacuum Advance Test

NOTE: The engine must be warmed to normal operating temperature.

Connect the vacuum hose to the vacuum advance mechanism.

Observe the timing degree scale and index with the timing lamp while the engine is at idle speed.

Slowly increase the engine speed to 2000 rpm. With vacuum applied, the ignition timing should advance sooner than with the centrifugal advance alone. At 2000 rpm, the vacuum advance should cause total advance to be more than with the centrifugal advance alone. Refer to Chapter B – Engines – General Service and Diagnosis for vacuum advance curve information.

IGNITION COIL TESTS

The ignition coil can be tested on any conventional coil tester or with an ohmmeter. A coil tester is preferable because it can be used to detect faults that are impossible with an ohmmeter.

Primary Winding Resistance Test

Remove the connector from the negative (–) and positive (+) terminals of the ignition coil.

Set the ohmmeter for the low scale and adjust the pointer to zero.

Connect the ohmmeter to the coil negative and positive terminals. The resistance should be 1.13 - 1.23 ohms at 24°C (75°F). If the coil temperature is above 93°C (200°F), 1.50 ohms is acceptable.

Secondary Winding Resistance Test

Remove the high voltage ignition wire from the high voltage terminal of the ignition coil.

NOTE: The ignition switch must be OFF.

Set the ohmmeter for the x1000 scale and adjust the pointer to zero.

Connect the ohmmeter to the brass contact in the high voltage terminal and to either primary winding terminal. The resistance should be 7700 - 9300 ohms at 24°C (75°F). A maximum of 12,000 ohms is acceptable if the coil temperature is 93°C (200°F) or more.

Current Flow Test

Remove the connector from the ignition coil.

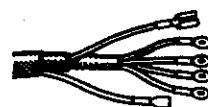
Depress the plastic barb and withdraw the positive (+) wire terminal from the connector. The barb is visible from the coil side of the connector.

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IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Repeat the procedure for the negative (–) wire terminal.

CAUTION: Ensure the ammeter current rating is sufficient for the test.

Connect the ammeter between the positive terminal and the disconnected positive wire.

Connect a jumper wire from the coil negative terminal to a known good ground.

Turn the ignition switch to the **ON** position.

The current flow should be approximately 7 amps and should not exceed 7.6 amps.

- If the current flow is more than 7.6 amps, replace the ignition coil. Leave the ammeter connected to the coil positive (+) terminal. Remove the jumper wire from the negative (–) terminal. Connect the coil green wire to the negative terminal. The current flow should be approximately 4 amps.

- If the current flow is less than 3.5 amps, inspect for poor connections in the 4-wire (control unit) and 3-wire (distributor) connectors or for poor ground at the ground screw inside the distributor.

- If the current flow is greater than 5 amps, the electronic control unit is defective.

WARNING: Use extreme caution when the engine is operating. Do not stand in direct line with the fan. Do not put hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine. Normal current flow with the engine operating is 2.0 - 2.4 amps. If the current flow is not within specifications, the control unit is defective.

Ignition Coil Output Test

Connect an oscilloscope to the ignition coil. Refer to the test equipment manufacturer's instructions.

WARNING: Use extreme caution when the engine is operating. Do not stand in direct line with the fan. Do not put hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and observe the secondary ignition voltage.

CAUTION: Do not remove the wires from the spark plugs for cylinders 1 or 5 of a six-cylinder engine when performing the next test because the pickup coil can be damaged.

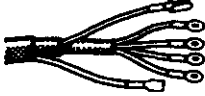
CAUTION: Do not operate the engine with the spark plug disconnected for more than 30 seconds because the catalytic converter can be damaged.

Remove one spark plug wire from the distributor cap. Observe the voltage applied to the disconnected spark plug wire on the oscilloscope. This voltage, referred to as open circuit output voltage, should be 24 kV (24 000 volts) minimum with an engine speed of 1000 rpm.

Intermittent Failure Diagnosis

Intermittent failure may be caused by loose or corroded terminals, defective or missing components, inadequate ground connections, or defective wiring. Refer to the Service Diagnosis Chart.

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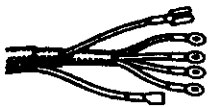
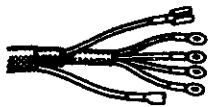
	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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INTERMITTENT FAILURE DIAGNOSIS

Condition	Possible Cause	Correction
ENGINE FAILS TO START (NO SPARK AT PLUGS)	(1) No voltage to ignition system. (2) Electronic Control Unit ground wires inside distributor open, loose or corroded. (3) Primary wiring connectors not fully engaged. (4) Ignition coil open or shorted. (5) Electronic Control Unit defective. (6) Cracked distributor cap. (7) Defective rotor.	(1) Check battery, ignition switch and wiring. Repair as required. (2) Clean, tighten or repair as required. (3) Clean and fully engage connectors. (4) Test coil. Replace if faulty. (5) Replace Electronic Control Unit. (6) Replace cap. (7) Replace rotor.
ENGINE BACKFIRES BUT FAILS TO START	(1) Incorrect ignition timing. (2) Moisture in distributor. (3) Distributor cap faulty. (4) Ignition wires not connected in correct firing order.	(1) Check timing. Adjust as required. (2) Dry cap and rotor. (3) Check cap for loose terminals, cracks and dirt. Clean or replace as required. (4) Connect in correct order.
ENGINE RUNS ONLY WITH KEY IN START POSITION	(1) Open in resistance wire or excessive resistance.	(1) Replace resistance wire and harness assembly.
ENGINE CONTINUES TO RUN WITH KEY OFF	(1) Defective starter motor solenoid. (2) Shorted diode in alternator warning lamp circuit.	(1) Replace solenoid. (2) Replace diode.

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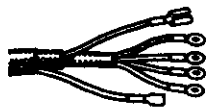
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	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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INTERMITTENT FAILURE DIAGNOSIS (cont'd.)

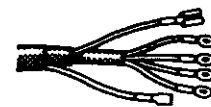
Condition	Possible Cause	Correction
ENGINE DOES NOT OPERATE SMOOTHLY AND OR ENGINE MIS-FIRES AT HIGH SPEED	(1) Spark plugs fouled or faulty. (2) Ignition wires faulty (including electronic retard). (3) Spark advance system(s) faulty. (4) S-terminal shorted to starter S-terminal in solenoid. (5) Trigger wheel pin missing. (6) Ignition wires not connected in correct firing order. (7) Two plug wires of consecutive firing cylinders routed next to each other.	(1) Clean and gap plugs. Replace as required. (2) Check wires. Replace as required. (3) Check operation. Repair as required. (4) Replace solenoid. (5) Install pin. (6) Connect wires correctly. (7) Re-route plug wires away from each other.
EXCESSIVE FUEL CONSUMPTION	(1) Incorrect ignition timing. (2) Spark advance system(s) faulty. (3) MCU (microprocessor) faulty.	(1) Check timing. Adjust as required. (2) Check operation. Repair as required. (3) Test system. Repair as required.
ERRATIC TIMING ADVANCE	(1) Faulty vacuum advance mechanism. (2) Centrifugal advance weights sticking.	(1) Check operation. Replace if required. (2) Remove dirt, corrosion.
TIMING NOT AFFECTED BY VACUUM	(1) Defective vacuum advance mechanism. (2) Vacuum advance mechanism adjusting screws too far counterclockwise. (3) Pickup coil pivot corroded.	(1) Replace vacuum advance mechanism. (2) Turn screw clockwise to bring advance within specifications (Chapter 1A). (3) Clean pivot.
INTERMITTENT OPERATION	(1) Loose or corroded terminals. (2) Defective pickup coil. (3) Defective control unit. (4) Loose ground connector in distributor. (5) Wires to distributor shorted together or to ground. (6) Trigger wheel pin missing.	(1) Tighten terminals, remove corrosion, apply electrical grease. (2) Perform pickup coil test. (3) Perform control unit tests. (4) Clean and tighten ground connection. (5) Check for frayed, pinched, or burned wires. (6) Install new pin.

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IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



4.2L DISTRIBUTOR REMOVAL

Unfasten the distributor cap retaining screws. Remove the distributor cap with the coil and spark plug wires connected and place aside.

Disconnect and plug the distributor vacuum advance hose.

Disconnect the distributor primary wiring connector.

Scribe a mark on the distributor housing in line with the tip of the rotor. Scribe a mark on the distributor housing near the clamp and continue the scribe mark on the engine block in line with the distributor housing mark. Note the position of the rotor and distributor housing in relation to the surrounding engine components as reference points for installing the distributor.

Remove the distributor holddown bolt and clamp.

Withdraw the distributor carefully from the engine.

4.2L DISTRIBUTOR INSTALLATION

Clean the distributor mounting area of the cylinder block.

Install a replacement distributor mounting gasket in the counterbore of the cylinder block.

Position the distributor shaft in the cylinder block. If engine was not rotated while the distributor was removed, perform the following procedure:

Align the rotor tip with the mark scribed on the distributor housing during removal. Turn the

rotor approximately 1/8-turn counterclockwise past the scribe mark.

CAUTION: Ensure that the distributor shaft fully engages the oil pump drive gear shaft. It may be necessary to slightly rotate (bump) the engine while applying downward hand force on the distributor body to fully engage the distributor shaft with the oil pump drive gear shaft.

Slide the distributor shaft down into the engine. Align the scribe mark on the distributor housing with the corresponding scribe mark on the cylinder block.

NOTE: It may be necessary to move the rotor and shaft slightly to start the gear into mesh with the camshaft gear and to engage the oil pump drive tang, but the rotor should align with the scribe mark when the distributor shaft is down in place.

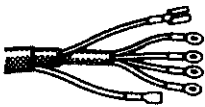
Install the distributor holddown clamp and bolt, but do not tighten the bolt.

If the engine was rotated while the distributor was removed, it will be necessary to establish timing according to the following procedure.

Remove the No. 1 spark plug. Hold a finger over the spark plug hole and rotate the engine until the compression pressure is felt. Slowly continue to rotate the engine until the timing index on the vibration damper pulley aligns with the top dead center (TDC) mark (0 degree) on the timing degree scale. Always rotate the engine in the direction of normal rotation. Do not turn the engine backward to align the timing marks.

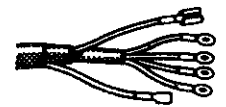
Turn the distributor shaft until the rotor tip points in the direction of the No. 1 terminal in the distributor cap. Turn the rotor 1/8-turn counterclockwise past the position of the No. 1 terminal.

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IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



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Slide the distributor shaft down into the engine and position the distributor vacuum advance mechanism housing in approximately the same location (in relation to the surrounding engine components) as when removed. Align the scribe mark on the distributor housing with the corresponding scribe mark on the cylinder block.

NOTE: It may be necessary to rotate the oil pump shaft with a long flat-blade screwdriver to engage the oil pump drive tang, but the rotor should align with the position of the No. 1 terminal when the distributor shaft is down in place.

Install the distributor holddown clamp and bolt, but do not tighten the bolt.

CAUTION: If the distributor cap is incorrectly positioned on the distributor housing, the cap or rotor may be damaged when the engine is rotated.

Install the distributor cap with the ignition wires on the distributor housing. Ensure the pickup coil wire rubber grommet in the distributor housing aligns with the depression in the distributor cap and that the cap fits on the rim of the distributor housing.

NOTE: Two different diameter screws are used to retain the distributor cap.

Apply AMC/Jeep Silicone Dielectric Compound, or equivalent, to the connector terminal blades and cavities. Connect the distributor primary wiring connector.

CAUTION: Do not puncture the spark plug wires or boots to make a connection. Use the proper adapters.

Connect a timing lamp to the No. 1 spark plug.

NOTE: The timing case cover has a socket adjacent to the timing degree scale for use with a magnetic timing probe. Ignition timing may be checked by inserting the probe through the socket until it rests on the vibration damper.

The probe is calibrated to compensate for the probe socket location, which is 9.5° ATDC. Eccentricity of the damper will properly space the magnetic probe. The timing degrees are indicated on a meter.

WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put hands near the pulleys, belts, or fan. Do not wear loose clothing.

Operate the engine at the specified idle RPM and observe the timing degree scale and index with a timing lamp. Rotate the distributor housing as needed to align the timing index on the vibration damper pulley with the correct mark on the timing degree scale.

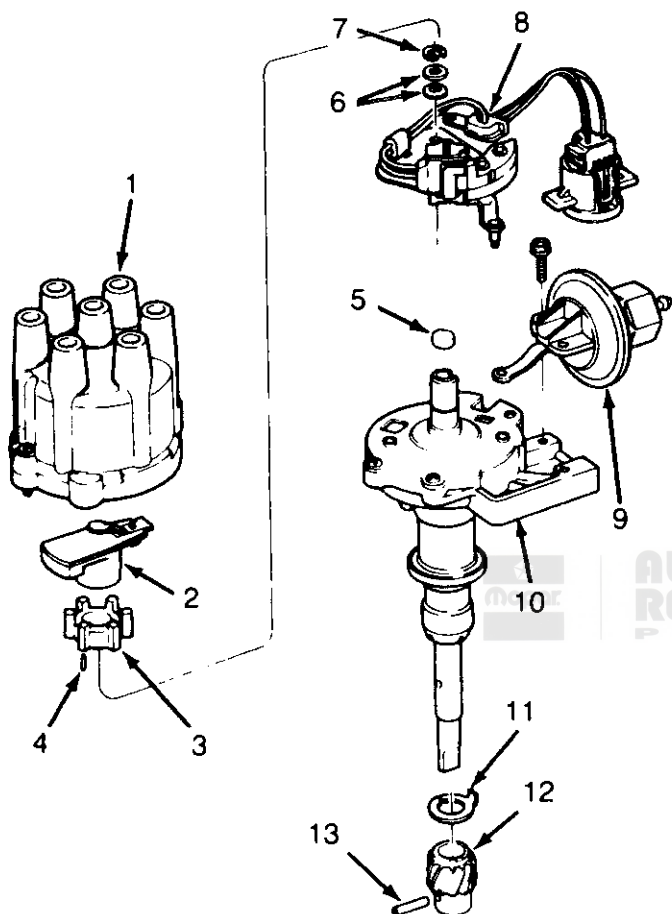
Refer to the Emission Control Information Label or to Chapter B – Engines – General Service and Diagnosis for ignition timing specifications. When the ignition timing is correct, tighten the distributor holddown bolt and recheck the timing to ensure it did not change.

Disconnect the timing lamp and connect the vacuum hose to the distributor vacuum advance mechanism.

4.2L DISTRIBUTOR COMPONENT REPLACEMENT

When replacing the pickup coil assembly (8), trigger wheel (3) or vacuum advance mechanism (9), it is not necessary to remove the distributor from the engine. It is necessary to check ignition timing if the pickup coil assembly or vacuum advance mechanism is replaced.

	ELECTRICAL IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)	
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| <p>1. Distributor Cap</p> <p>2. Distributor Rotor</p> <p>3. Trigger Wheel</p> <p>4. Pin</p> <p>5. Wick</p> <p>6. Washers</p> <p>7. Retainer</p> <p>8. Pickup Coil Assembly</p> | <p>9. Vacuum Advance Mechanism</p> <p>10. Distributor Body</p> <p>11. Washer</p> <p>12. Gear</p> <p>13. Pin</p> |
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Trigger Wheel and/or Pickup Coil Assembly Removal

Place the distributor in a suitable holding device, if removed from the engine.

Remove the cap.

Remove the rotor.

Remove the trigger wheel with Trigger Wheel Puller Tool J-28509, or equivalent. Use a flat washer to prevent the puller from contacting the inner shaft. By prying alternately, two screwdrivers can be used to remove the trigger wheel from the shaft. Remove the pin.

Remove the pickup coil assembly retainer and washers from the pivot pin on the base plate.

Remove the two pickup coil plate screws.

Lift the pickup coil assembly from the distributor housing.

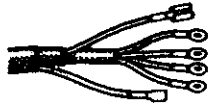
If the vacuum advance mechanism is to be replaced, remove the screws and lift the mechanism out of the distributor housing. Do not remove the vacuum advance mechanism unless replacement is required.

Trigger Wheel and/or Pickup Coil Assembly Installation

If the vacuum advance mechanism was removed, install it on the distributor housing with the attaching screws.

NOTE: If a replacement vacuum advance mechanism is installed, refer to Vacuum Advance Mechanism for the calibration procedure.

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IGNITION SYSTEM – MOTORCRAFT (6-Cyl. Engine)



Position the pickup coil assembly into the distributor housing.

Ensure the pin on the pickup coil assembly fits into the hole in the vacuum advance mechanism link.

Install the washers and retainer onto the pivot pin to secure the pickup coil assembly to the base plate.

Position the wiring harness in the slot in the distributor housing. Install the two pickup coil plate screws and tighten.

Install the trigger wheel on the shaft with hand pressure. The long portion of the teeth must be up. When the trigger wheel and slot in the shaft are properly aligned, use a suitable drift and small hammer to tap the pin into the locating groove in the trigger wheel and shaft.

If the distributor is not installed in the engine, support the shaft while installing the trigger wheel pin.

Install the rotor. Install the distributor cap.

Vacuum Advance Mechanism Removal

Remove the vacuum hose from the vacuum advance mechanism.

Remove the attaching screws and remove the vacuum advance mechanism from the distributor housing. It is necessary to tilt the unit to disengage the link from the pickup coil pin

protruding through the distributor housing. It may be necessary to loosen the base plate screws for necessary clearance.

Vacuum Advance Mechanism Installation

If a replacement vacuum advance mechanism is to be installed, calibrate using the following procedure.

Insert an Allen wrench into the vacuum hose tube of the original vacuum advance mechanism. Count the number of clockwise turns necessary to bottom the adjusting screw.

Turn the adjusting screw of the replacement vacuum advance mechanism clockwise to the bottom. Turn it counterclockwise the same number of turns counted earlier.

Install the vacuum advance mechanism on the distributor housing. Ensure that the link is engaged on the pin of the pickup coil. Install the retaining screws. Tighten the base plate screws, if loosened.

Check the ignition timing and adjust, if required.

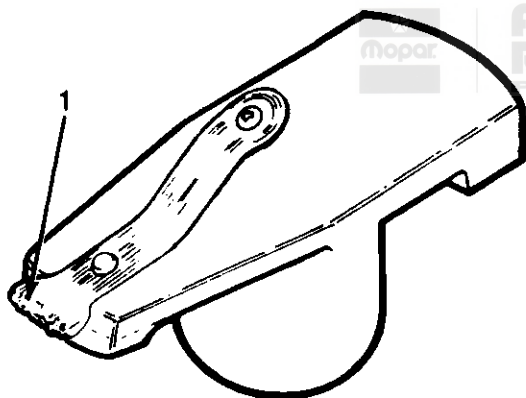
Connect the vacuum hose to the vacuum advance mechanism.

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Rotor

A unique feature of the SSI system is the silicone applied to the rotor blade during manufacture. Radio interference is greatly reduced by the presence of a small quantity of silicone dielectric compound on the rotor blade. After a few thousand miles, this compound becomes charred (1) by the high voltage current flowing through the rotor. This is normal. Do not scrape the residue from the rotor blade.

When installing a replacement rotor, apply a thin coat 0.75 - 3mm (0.03-in - 0.12-in) of AMC/Jeep Silicone Dielectric Compound, or equivalent, to the tip of the rotor blade.



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	ELECTRICAL IGNITION SWITCH	
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GENERAL INFORMATION

The ignition switch is mounted on the steering column and is connected to the key lock assembly by a remote lock rod.

IGNITION SWITCH REMOVAL

Remove the lower instrument panel trim panel.

Place the key lock in the OFF – LOCK position.

Remove the two ignition switch attaching screws.

Disconnect the ignition switch from the remote rod.

Disconnect the black harness connector.

Disconnect the white harness connector.

Remove the ignition switch from the steering column.

IGNITION SWITCH TESTING

To test the ignition switch circuitry and continuity, place the slide bar in the position to be tested and use either an ohmmeter or Continuity Light J-21008, or equivalent.

The ignition switch slide bar positions can be easily identified by first locating the alignment hole which is found in the flat portion of the ignition switch adjacent to the terminals.

Ignition Switch Positions

Starting from the alignment hole end of the ignition switch, the switch positions are:

- ACCESSORY
- OFF – LOCK
- OFF
- ON and START.

Each position has a detent stop except START which is spring loaded to released.

Electrical Resistance

No electrical resistance should be indicated (test lamp ON) between two connected terminals.

Maximum Voltage Drop

The maximum voltage drop between any two connected terminals should not exceed 12.5 millivolts per amp.

For example: if a 10-amp load is drawn through the switch, the maximum voltage drop should be 10×0.0125 or 0.125 volt.

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IGNITION SWITCH

POSITION	CIRCUIT	
START	I-1, B-1 & S G-1, G-2	CONNECTED GROUNDED
ON	I-1 & B-1 A & B-2 I-3 & B-3	CONNECTED CONNECTED CONNECTED
OFF	OPEN	
OFF-LOCK	OPEN	
ACC.	A & B-2	CONNECTED

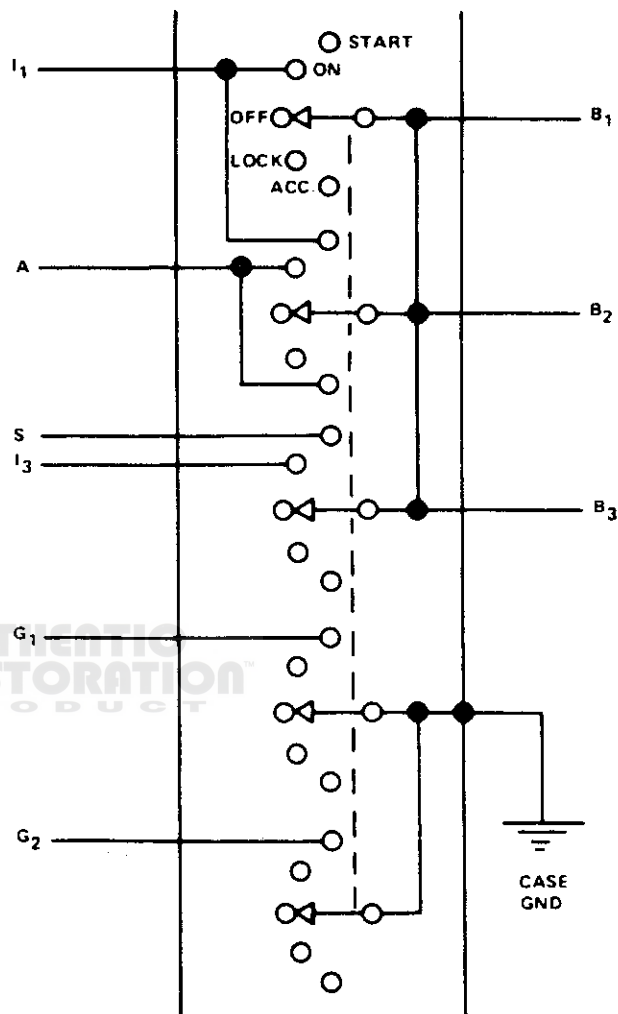
NOTE: B-1, B-2 & B-3 ARE COMMON CONNECTION.

84998

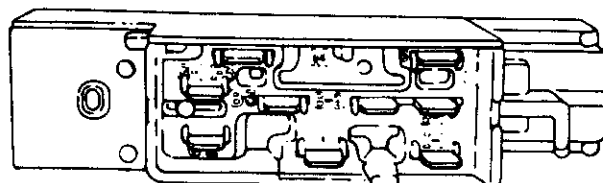


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Ignition Switch Terminals



SEE
I.S.
NOTES



60140A

	ELECTRICAL IGNITION SWITCH	
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IGNITION SWITCH INSTALLATION – STANDARD COLUMN

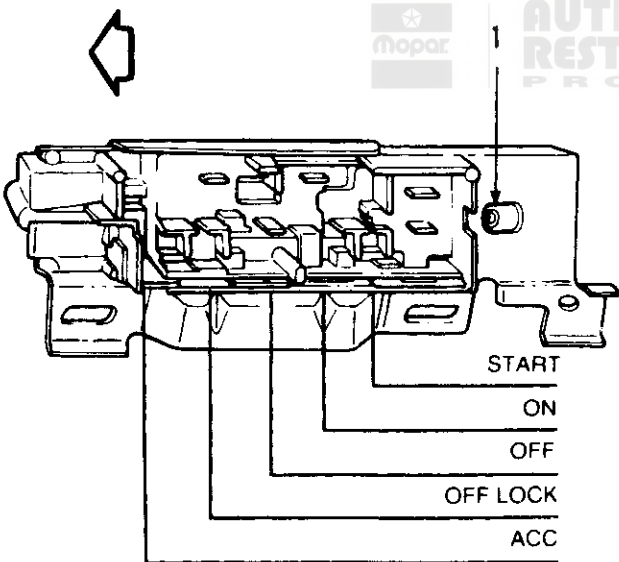
With the actuator rod disconnected, position the ignition switch in place.

Move the slider to the extreme left (ACCESSORY position).

NOTE: The left side of the ignition switch is toward the steering wheel.

Position the actuator rod in the slider hole (1).

Install the switch to the steering column, being careful not to move the slider out of the detent.



84999A

STANDARD COLUMN

Hold the key in the ACCESSORY position and push the switch down the column slightly to remove slack in the actuator rod.

Tighten the attaching screws securely.

Connect the white connector to the ignition switch.

Connect the black connector to the ignition switch.

Install the steering tube cover, if removed.

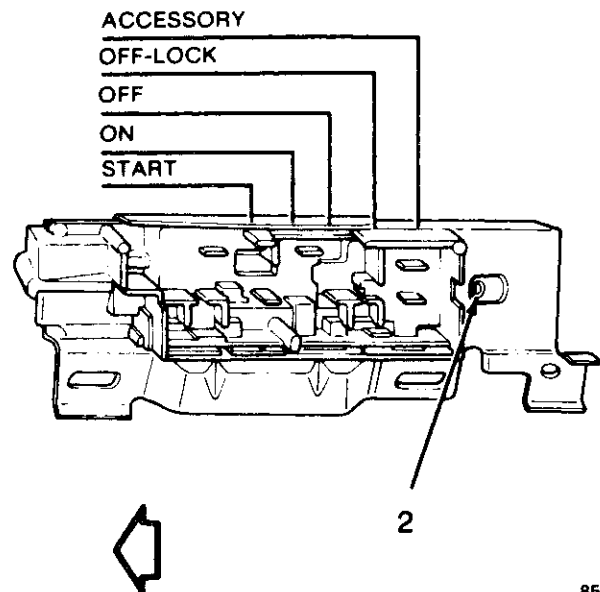
IGNITION SWITCH INSTALLATION – TILT COLUMN

With the actuator rod disconnected, position the switch in place.

Move the slider to the extreme right (ACCESSORY position).

NOTE: The right side of the ignition switch is downward from the steering wheel.

Position the actuator rod (2) in the slider hole.



85000

TILT COLUMN

	ELECTRICAL IGNITION SWITCH	
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Install the ignition switch to the steering column; but, do not tighten the attaching screws.

Lightly push the switch down the column (away from the steering wheel) to remove lash in the actuator rod, while holding the key in the ACCESSORY position.

CAUTION: Be careful not to move the slider out of the detent.

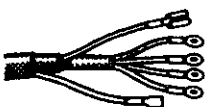
Tighten the attaching screws securely.

Connect the white connector to the ignition switch.

Connect the black connector to the ignition switch.

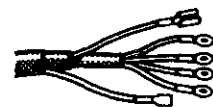


SEE I.S. NOTES



ELECTRICAL

CHASSIS WIRING HARNESS



MAIN HARNESS CONNECTOR

The main wiring harness connector is located at the left upper corner of the dash panel. This connector is made up of the engine and forward lamp harness at the engine compartment and the fuse and instrument panel harness at the passenger compartment side.

The connector can be removed from the dash panel by removing the center bolt from the engine compartment side and the two attaching screws from the driver's side.

CAUTION: Be careful not to bend the male spade terminals when removing or installing the connector. The center of the connector is filled with a non-conductive grease to prevent corrosion of the terminals.

If any wires are replaced on the engine compartment side, the terminal opening must be resealed with a durable waterproof sealer.

CAUTION: Do not use string-type body caulk as a sealer.

FUSIBLE LINKS

General Information

Fusible links are harness wires covered with a special non-flammable insulation. The links protect circuits which are not normally fused due to carrying high amperage loads or because of their location in the chassis.

Fusible links are used to prevent major harness damage in the event a short circuit, short to ground, or overload condition occurs.

Fusible links are located in the engine compartment next to the starter solenoid/relay.

Fusible Link Values

Each fusible link is of a fixed value for the specific load.

Fusible Link Replacement Parts

Replacement fusible links are listed in the Parts Catalog.

Fusible Link Failure Diagnosis

Failure of a fusible link is often caused by a grounded circuit.

Therefore, the cause of the failure must be determined prior to installing a new link.

Fusible Link Removal

Disconnect the battery negative cable.

Follow one end of the link to the terminal end. Follow the remaining end to the wire harness.

Determine which circuit(s) may have caused the failure using the Electrical Troubleshooting Manual (ETM).

Cut the harness wire below the fusible link mold.

Strip the insulation.

SEE
I.S.
NOTES

	ELECTRICAL CHASSIS WIRING HARNESS	
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Fusible Link Installation

Fasten the correct fusible link using a splice clip.

Solder and cover with several layers of heat shrinking tubing.

Apply petroleum jelly to tubing ends.

Connect negative battery cable.

NOTE: The solder joint **MUST** be made with rosin core solder **ONLY**. **DO NOT** use acid or acid core solder. Protect the harness wires from damage when soldering.



SEE I.S. NOTES

	ELECTRICAL EXTERIOR LIGHTING SYSTEM	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Directional Signal Switch Handle	3 N·m (25 in-lbs)	2-3 N·m (15-30 in-lbs)
Hazard Warning Knob		
Mounting Screws	1 N·m (5 in-lbs)	0.5-1 N·m (2-5 in-lbs)
Steering Wheel Nut	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)

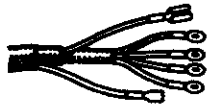
SEE
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EXTERIOR LAMP SPECIFICATIONS

Exterior Lamps	Lamp Type
Back Up Lamps (2)	1156
Front Park/Turn Lamps (2)	2057 NA*
Front Side Marker Lamps (2)	194
Headlights (2)	H 6054
Stop/Tail/Turn Lamps (2)	1157
Underhood Lamp	90

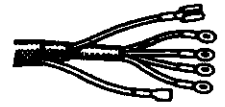
*NA = Natural Amber

101352

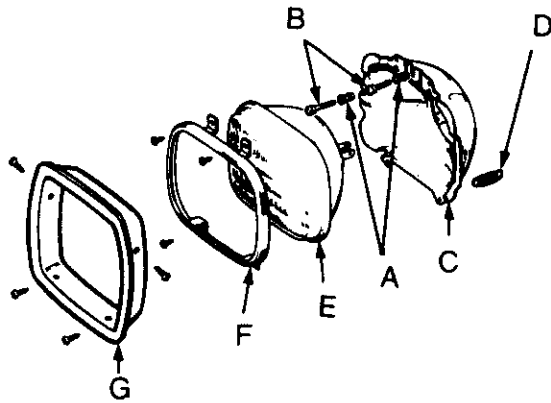


ELECTRICAL

EXTERIOR LIGHTING SYSTEM



HEADLAMP

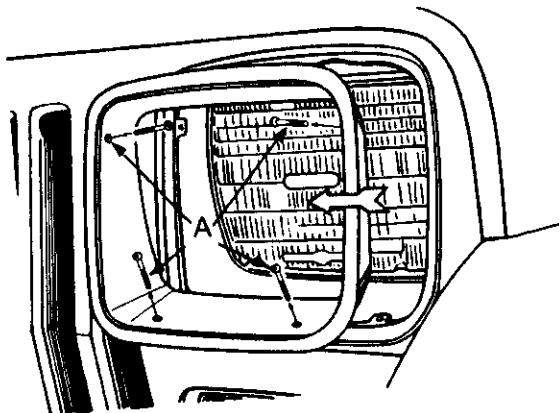


101385

- | | |
|----------------------------|---------------------|
| A. Plastic Adjuster Nut(s) | D. Adjusting Spring |
| B. Adjusting Screw(s) | E. Headlamp |
| C. Headlamp Bucket | F. Retaining Ring |
| | G. Trim Ring |

HEADLAMP REMOVAL

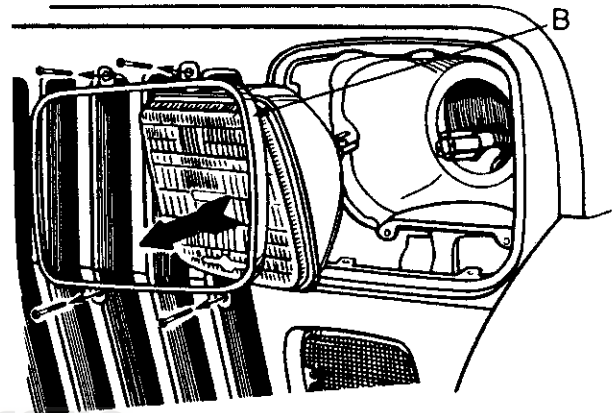
Remove the four trim screws (A).



101353

A. Trim Screw(s)

Remove the four retaining ring screws (B).



101354

B. Retaining Ring Screw(s)

Disconnect the headlamp connector.

Remove the headlamp.

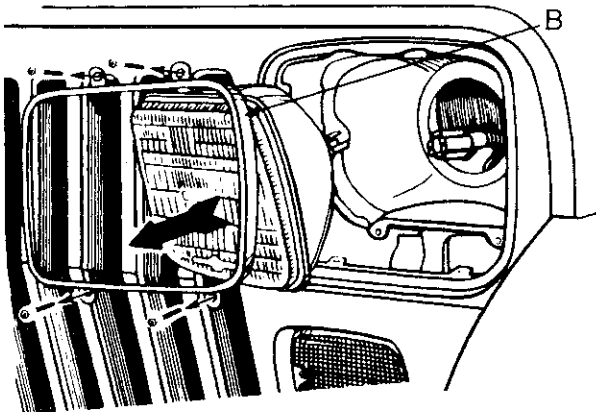
HEADLAMP INSTALLATION

Place the headlamp into the headlamp bucket.

Plug in the headlamp connector.

SEE
I.S.
NOTES

Attach the four retaining ring screws (B).



HEADLAMP AIMING PROCEDURE

Headlamps must be aimed on low beam. They may be aimed either with mechanical aimers, or, by using a screen.

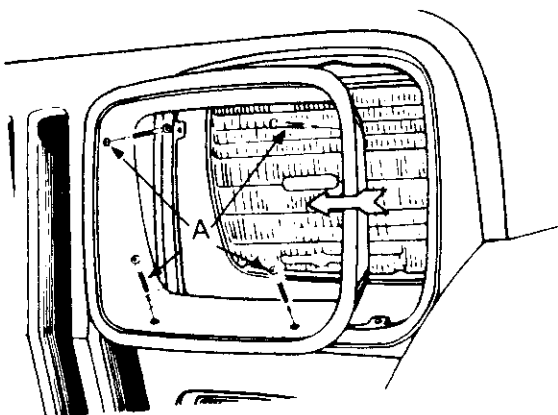
Use Headlamp Aimer J-25300-A following the instructions supplied with the equipment, for proper aiming.

If a screen is to be used, preparation for aiming is as follows:

Locate the vehicle in a darkened area with a level floor and with the screen (wall) having a nonreflecting white surface.

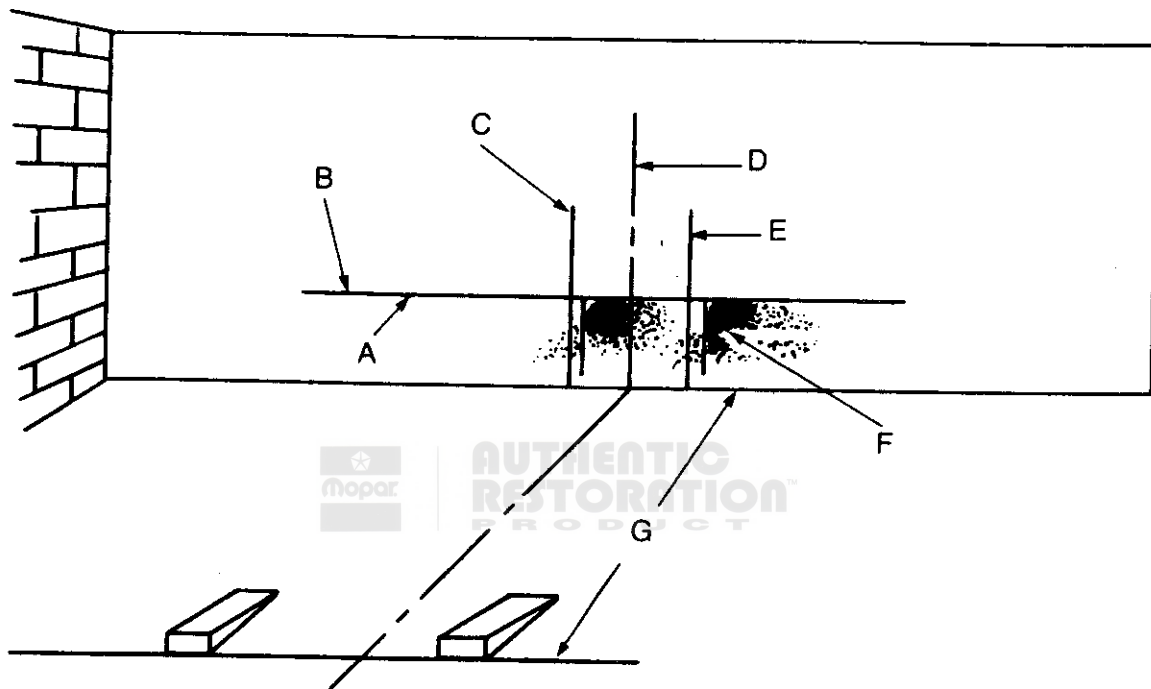
Mark a reference line on the floor 7.5 meters (25 ft) away from, and parallel to, the screen.

Attach the four trim ring screws (A).



101353

HEADLAMP AIMING

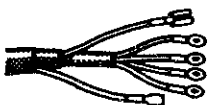


SEE
I.S.
NOTES

- A. Height of Lamp Centers
- B. Horizontal Tape
- C. Vertical Tape (Left Lamp Center)
- D. Vertical Centerline (Car Axis)

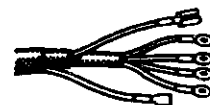
- E. Vertical Tape (Right Lamp Center)
- F. Zone of Greatest Lamp Intensity
- G. 25 Feet of Distance

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ELECTRICAL

EXTERIOR LIGHTING SYSTEM



Position the vehicle perpendicular (at a right angle) to the screen and with the headlamps directly over the reference line 25 feet from the wall.

Locate the middle tape on the screen so it is aligned with the centerline of the vehicle.

Equalize all tire pressures.

Rock the vehicle from side to side to equalize the springs and shock absorbers.

Measure the distance between the vehicle headlamp centers.

Position the marker tapes vertically on the screen to the right and left of the middle tape at half this distance.

Measure the distance from the center of each lamp to the surface on which the vehicle rests.

Position the marker tape horizontally on the screen to cross the vertical tapes at the measured height of each lamp center respectively.

Clean the headlamps.

Turn the headlamps on LOW beam.

NOTE: Cover the lamp not being aimed.

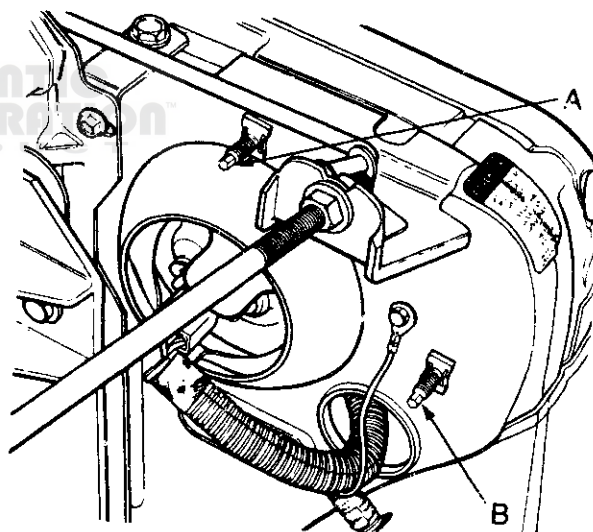
Turn the vertical adjusting screw (A) clockwise until the lamp beam is considerably lower than the horizontal reference line on the screen.

Turn the screw counterclockwise until the top edge of the high intensity area is even with the horizontal line.

Turn the horizontal adjusting screw (B) clockwise until the beam is off the centering tape.

Turn the same screw counterclockwise until the left edge of the high intensity area is 10.2cm (2-in) to the right of the lamp centerline.

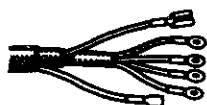
Cover the lamp that has been aimed and aim the other lamp using the same procedure.



101355

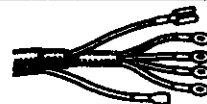
A. Vertical Adjusting Screw
B. Horizontal Adjusting Screw

SEE
I.S.
NOTES



ELECTRICAL

EXTERIOR LIGHTING SYSTEM



PARKING AND DIRECTIONAL LAMP REMOVAL

Remove the lens attaching screws (A).

Turn the Lamp assembly one-quarter turn.

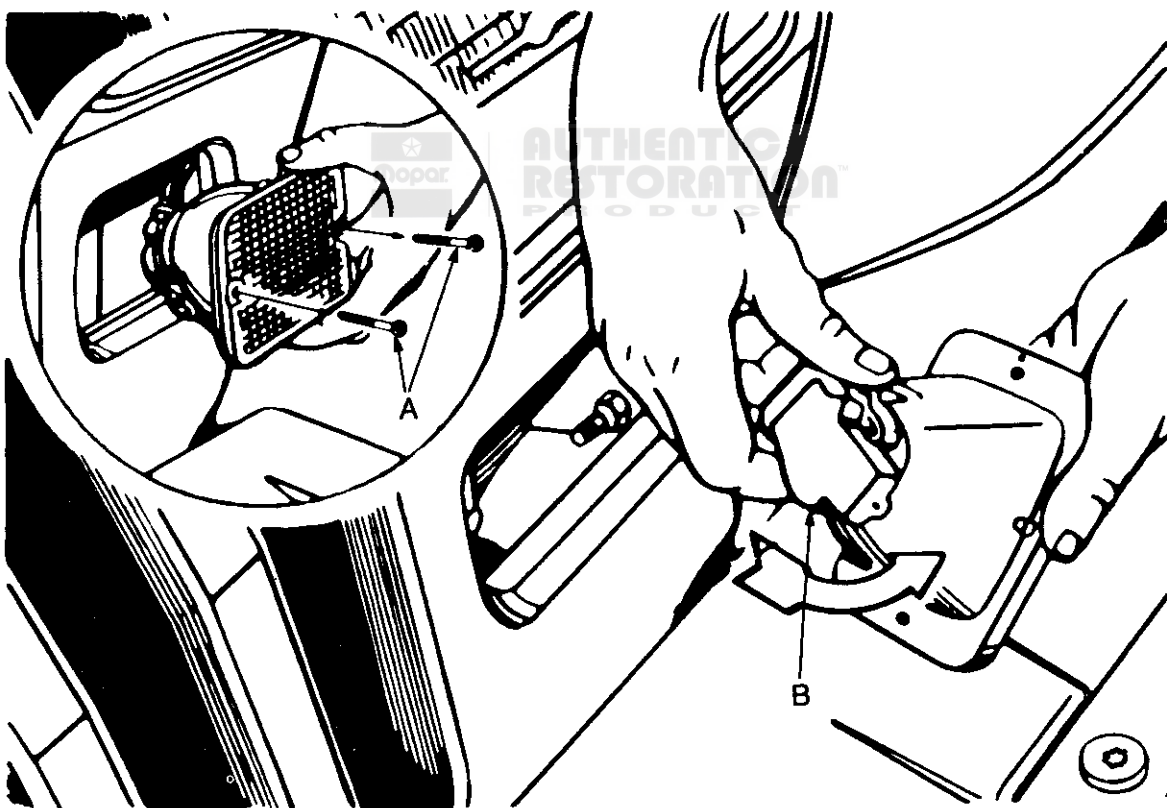
Pull the defective Lamp from the socket.

PARKING AND DIRECTIONAL LAMP INSTALLATION

Place the Lamp in the socket (B).

Turn the Lamp assembly one-quarter turn.

Attach the lens attaching screws (A).



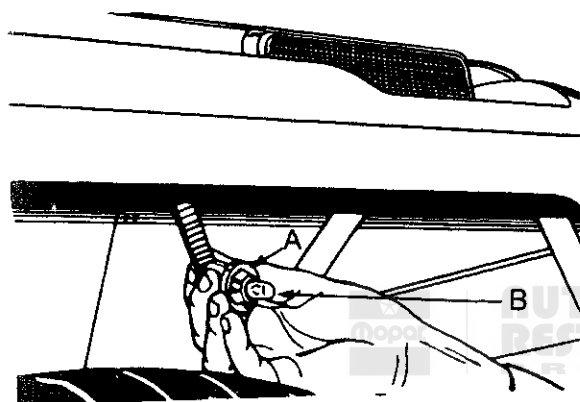
SEE
I.S.
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	ELECTRICAL EXTERIOR LIGHTING SYSTEM	
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FRONT SIDE MARKER LAMP REMOVAL

Reach under the fender and twist the socket (A) one-quarter turn counterclockwise to remove socket from the housing.

Pull the defective lamp (B) from the socket.



101357

FRONT SIDE MARKER LAMP INSTALLATION

Install the Lamp in the socket.

Twist the socket one-quarter turn clockwise.

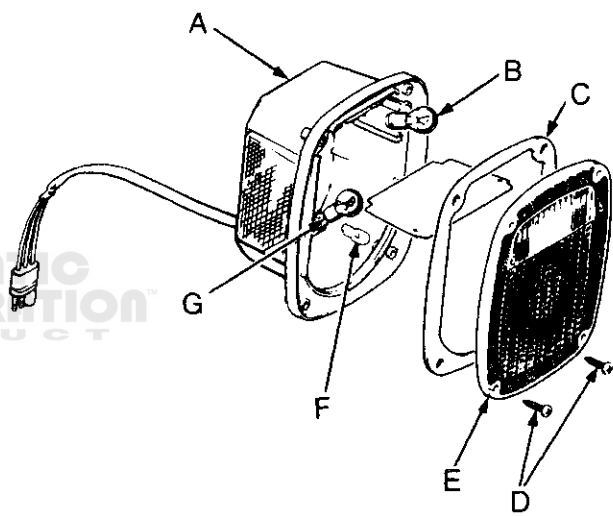
Return assembly to location under the fender.

TAILLAMP REMOVAL

Remove the lens attaching screws (D), taillamp lens (E), and lens gasket (C).

Remove any defective lamps, (B), (F), and/or (G), located in the taillamp housing (A):

- backup lamp (B)
- tail-stop directional lamp (F)
- side marker lamp (G).

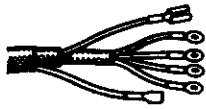


841291

- | | |
|-----------------------|---|
| A. Taillamp Housing | F. Tail-Stop Directional/License Plate Lamp |
| B. Backup Lamp | G. Side Marker Lamp |
| C. Lens Gasket | |
| D. Attaching Screw(s) | |
| E. Taillamp Lens | |

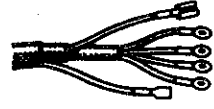
TAILLAMP CLEANING

Clean the lens and reflector before installing replacement taillamp.



ELECTRICAL

EXTERIOR LIGHTING SYSTEM



TAILLAMP INSTALLATION

Install a replacement taillamp in the socket.

Attach the lens gasket (C) and attaching screws (D).

Taillamp Housing Removal

Disconnect the wiring.

Remove the taillamp lens (E).

Remove the attaching screws (D) which hold the taillamp assembly to the body.

Pull the taillamp assembly out and away from the body of the vehicle.

Taillamp Housing Installation

Position the taillamp assembly and align with corresponding screw holes.

Install the attaching screws (D).

Connect the wiring.

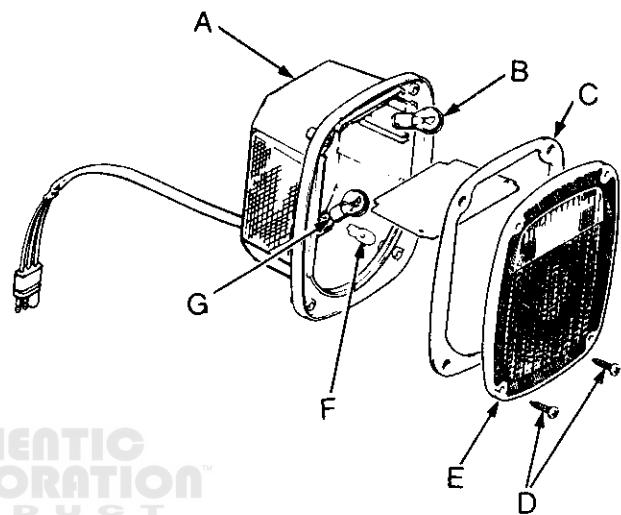
REAR SIDE MARKER LAMP REMOVAL

Remove the attaching screws (D), taillamp lens (E) and lens gasket (C).

Pull the side marker lamp (G) straight out of the socket.

REAR SIDE MARKER LAMP CLEANING

Clean the lens and reflector before installing replacement lamp.



841291

- | | |
|-----------------------|---------------------|
| A. Taillamp Housing | F. Tail-Stop |
| B. Backup Lamp | Directional/ |
| C. Lens Gasket | License Plate |
| D. Attaching Screw(s) | Lamp |
| E. Taillamp Lens | G. Side Marker Lamp |

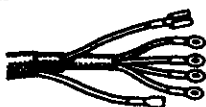
REAR SIDE MARKER LAMP INSTALLATION

Install a replacement lamp. Push the lamp straight into the socket.

Position the lens gasket (C) and taillamp lens (E).

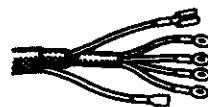
Install the attaching screws (D).

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ELECTRICAL

EXTERIOR LIGHTING SYSTEM



BACKUP LAMP REMOVAL

Remove the taillamp lens (E).

Remove defective lamp.

BACKUP LAMP INSTALLATION

Install replacement lamp in the socket.

LICENSE PLATE LAMP

NOTE: The left taillamp illuminates the license plate.

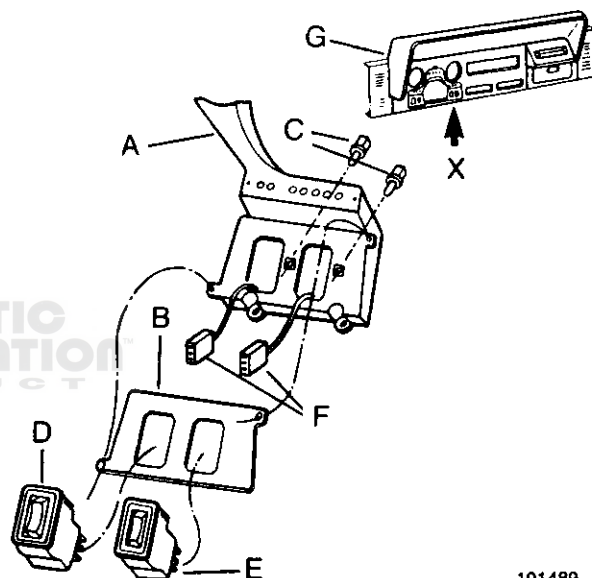


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FOG LAMP GENERAL INFORMATION

The fog lamp switch is located to the right of the steering column.

Fog lamps are turned OFF by the circuit relay when the high beam driving lamps are turned ON.



101489

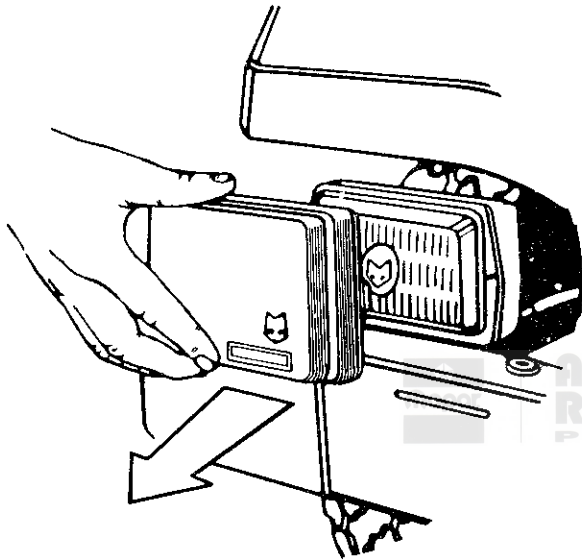
- A. Warning Lamps Housing Assembly and Accessory Switch
- B. Accessory Switch Applique
- C. Lamp and Socket Assembly
- D. Fog Lamp Switch Assembly
- E. Rear Defogger Switch Assembly
- F. Instrument Panel Harness
- G. Instrument Panel Assembly

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	ELECTRICAL EXTERIOR LIGHTING SYSTEM	
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NOTE: The circuit relay is located below the left headlamp.

CAUTION: Remove the protective covers before operating fog lamps. Also, remember to always replace protective covers when fog lamps are not in use.

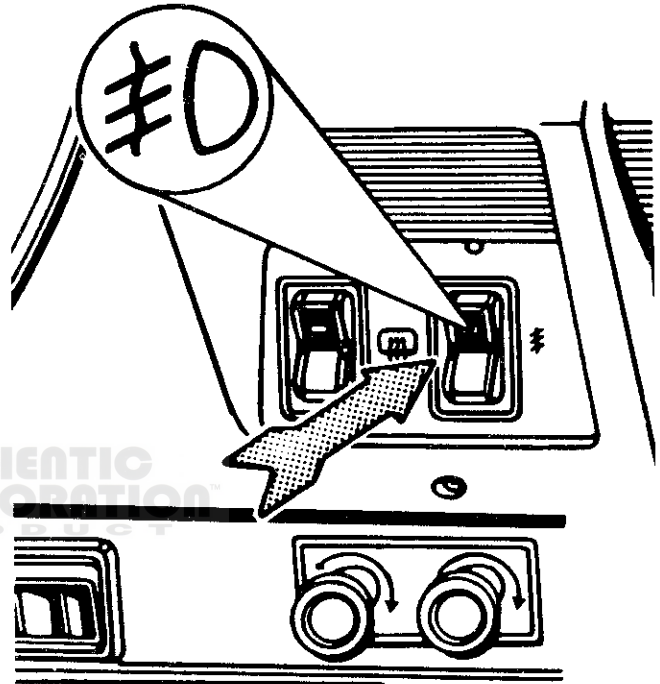


101359A

Fog lamps may be operated **ONLY** when low beam headlamps are ON. If the headlamps are switched to high beam, the low beam lamps and fog lamps will turn OFF. The fog lamps will go back on when the high beams are switched OFF.

The indicator lamp on the fog lamp switch will go:

- OFF when the high beams are ON
- ON when the high beam lamps are switched OFF.

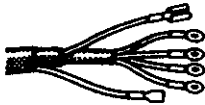


101359B

WARNING: Do not operate fog lamps in the face of oncoming traffic. Fog lamps are intended for use when visibility is limited. The intense brightness of the fog lamps may cause excessive glare to oncoming vehicles.

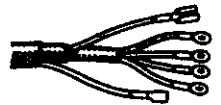
NOTE: Some states **REQUIRE** fog lamps be covered when vehicle is operated on streets and roadways. Be sure to check with state and local authorities concerning operating restrictions.

SEE
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ELECTRICAL

EXTERIOR LIGHTING SYSTEM



FOG LAMP REMOVAL

Refer to the Detachable Components Section in the M.R. 280 workshop manual.

FOG LAMP INSTALLATION

Refer to the Detachable Components Section in the M.R. 280 workshop manual.

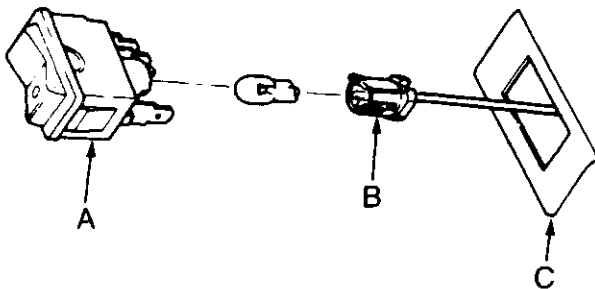
FOG LAMP SWITCH REMOVAL

Remove the instrumentation shroud and indicator bezel as outlined in the Instrument Panel Section.

Unplug the connector from the fog lamp switch (A).

Squeeze the fog lamp switch (A) to release the plastic retaining fingers (B).

Push the fog lamp switch (A) out of the bezel (C).



FOG LAMP SWITCH INSTALLATION

Depress fog lamp switch (A) into the bezel (C) until retaining fingers lock (B) behind the bezel.

Connect the connector onto the fog lamp switch (A).

Install the indicator bezel and instrumentation shroud.

FOG LAMP ELEMENT REMOVAL

Remove the fog lamp stone shield(s) (G).

Remove the screws (E) attaching the bezel (D) to the lamp body (A).

Remove the bezel (D) from the lamp body (A).

Remove the lens and reflector assembly (H) from the lamp body (A).

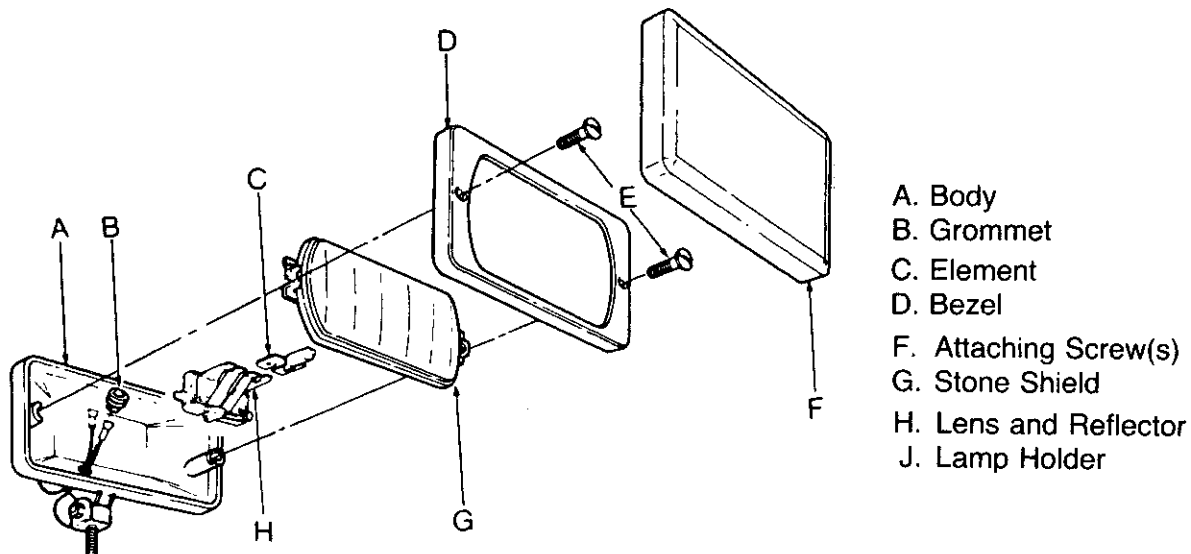
Remove the lamp holder (J) from the lens and reflector assembly (H).

Remove the lamp element (C) from the lamp holder (J).

841264A

	ELECTRICAL EXTERIOR LIGHTING SYSTEM	
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FOG LAMP



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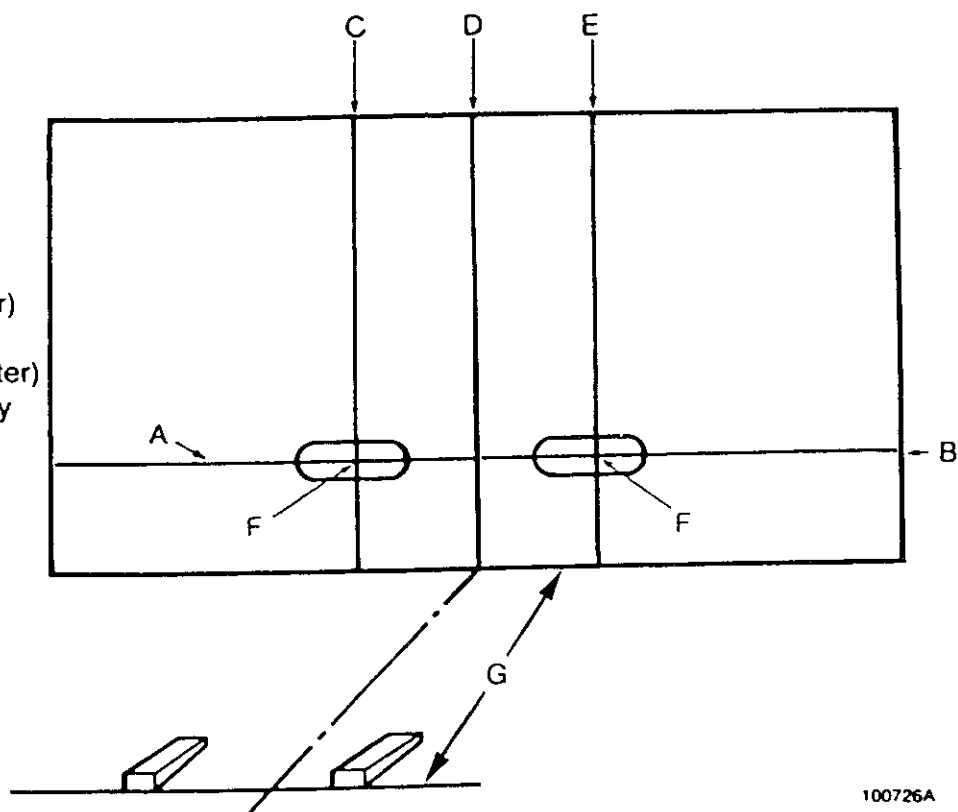


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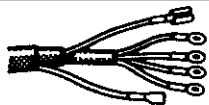
841263A

FOG LAMP AIMING

Height of Lamp Centers
 Horizontal Tape
 Vertical Tape (Left Lamp Center)
 Vertical Centerline (Car Axis)
 Vertical Tape (Right Lamp Center)
 Zone of Greatest Lamp Intensity
 25 Feet of Distance

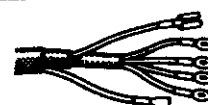


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ELECTRICAL

EXTERIOR LIGHTING SYSTEM



FOG LAMP ELEMENT INSTALLATION

CAUTION: Always handle new elements with a clean cloth. Do not handle quartz elements with your bare hands as body oil residue on the glass will cause the element to fail immediately after ignition.

Install the replacement fog lamp element (C).

Install the lamp holder (J) in the lens and reflector assembly (H).

Position the lens and reflector assembly (H) in the fog lamp body (A) with the top of the lens at the top of the lamp body.

Position the bezel (D) on the fog lamp body (A).

Install the attaching screws (F).

Install the stone shield (G) on the fog lamp.

FOG LAMP AIMING

Position the vehicle on a flat surface, facing and approximately 7.5 meters (25 ft) from the wall.

Remove the lamp stone shields.

Loosen the lamp attaching hardware.

Turn the headlamp and fog lamp switches ON.

Adjust the lamp beams as follows:

- The horizontal distance between the lamp beams on the wall should be the same size as the distance between the lamps on the front bumper.
- The vertical height of the lamp beams on the wall should be 10.2cm (4-in) less than the height of the lamps on the front bumper.

Tighten the lamp attaching hardware.

Install the lamp stone shields.

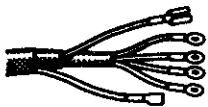
ENGINE COMPARTMENT LAMP

This optional lamp obtains current at the battery terminal of the starter solenoid. A single wire incorporating a fusible link for protection passes current to the lamp assembly.

The lamp assembly has a mercury switch which completes the circuit through the hood assembly when the hood is open. When the hood is closed, the mercury within the lamp assembly opens the circuit and the lamp does not light.

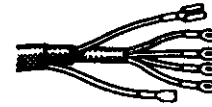
Refer to the Electrical Troubleshooting Manual (ETM) for further circuitry information.

SEE
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ELECTRICAL

INTERIOR LIGHTING SYSTEM



INTERIOR LAMP SPECIFICATIONS

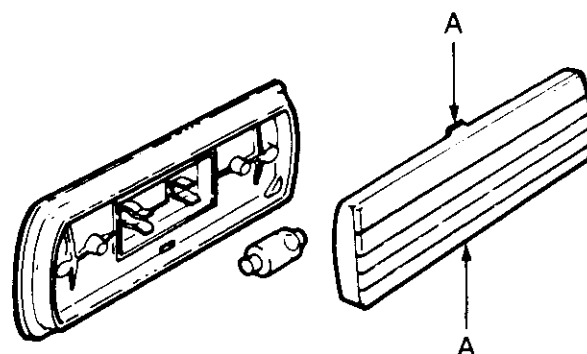
Interior Lamps	Lamp Type
Ash Tray Lamp	1891
Cigarette Lighter Lamp	53
Courtesy Lamps, Under Dash (2)	89
Dome Lamp (hardtop models only)	212
Fog Lamps and Rear Window Defogger	74
Gauge Cluster	161
Glove Box Lamp	194
Heater Control Lamps (2)	194
Indicator	74
PRNDL Lamp	1445-S73
Rocker Switch Indicator Lamp	2182
Speedometer/Tachometer	194

Wrangler/YJ vehicles are equipped with a dome lamp and courtesy lamps.

The dome lamp and courtesy lamps are operated by door pillar switches.

DOME LAMP LENS REMOVAL

The dome lamp lens can be removed by squeezing the sides of the lens (A). This will disengage the retaining tabs.



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A. Dome Lamp Lens

DOME LAMP LENS INSTALLATION

Install the dome lamp lens by squeezing the sides of the lens (A) and sliding it into place.

HEADLAMP SWITCH REMOVAL

Refer to the Instrument Panel Section.

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NOTES

HEADLAMP SWITCH INSTALLATION

Refer to the Instrument Panel Section.

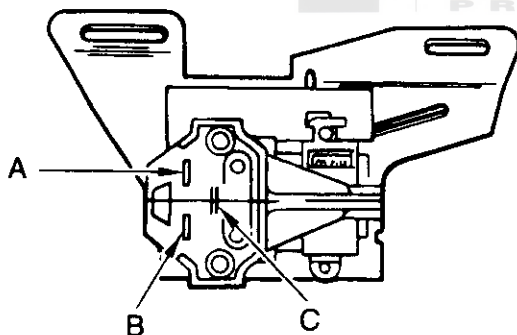
HEADLAMP DIMMER SWITCH REMOVAL

Refer to the Instrument Panel Section.

HEADLAMP DIMMER SWITCH INSTALLATION

Refer to the Instrument Panel Section.

HEADLAMP DIMMER SWITCH CONNECTIONS



84996

A. High Beam
B. Low Beam

C. Headlamp Feed
(from Lamp Switch)

DIRECTIONAL SIGNAL SWITCH DIAGNOSIS

The most frequent causes of failure in the directional signal system are:

- loose connections, and,
- burned out lamps.

A flashing rate, approximately twice the normal rate, usually indicates a lamp has shorted in the circuit.

If a three-lamp flasher is installed in a vehicle having only two lamps per side, the lamps will light but will not flash.

If a two-lamp flasher is used on a vehicle having three lamps (trailer towing), the higher current draw will cause the lamps to flash too fast.

If there is no signal at any front, rear, or indicator lamp, check the fuse.

If the fuse is not defective, substitute a flasher which is known as not defective.

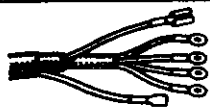
If the replacement flasher does not remedy the problem, check the signal system wiring connections at the fuse and at the steering column connector.

If the brake stoplamps function properly, the rear signal lamps are not defective.

NOTE: The directional signal flasher is attached directly to the fuse panel.

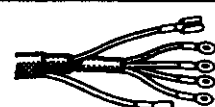
DIRECTIONAL SIGNAL SWITCH REMOVAL

Refer to the Steering Column Section for procedural information.



ELECTRICAL

INTERIOR LIGHTING SYSTEM



DIRECTIONAL SIGNAL SWITCH INSTALLATION

Refer to the Steering Column Section for procedural information.

Four-Way Emergency Flasher -- Hazard Warning

The four-way emergency flasher switch is a part of the directional signal switch.

To operate the system, push in on the switch button.

NOTE: The four-way flasher can only be canceled by pulling out on the flasher switch knob.

Four-Way Emergency Flasher Removal

Refer to the Steering Column Section for the four-way flasher switch removal procedure.

Four-Way Emergency Flasher Installation

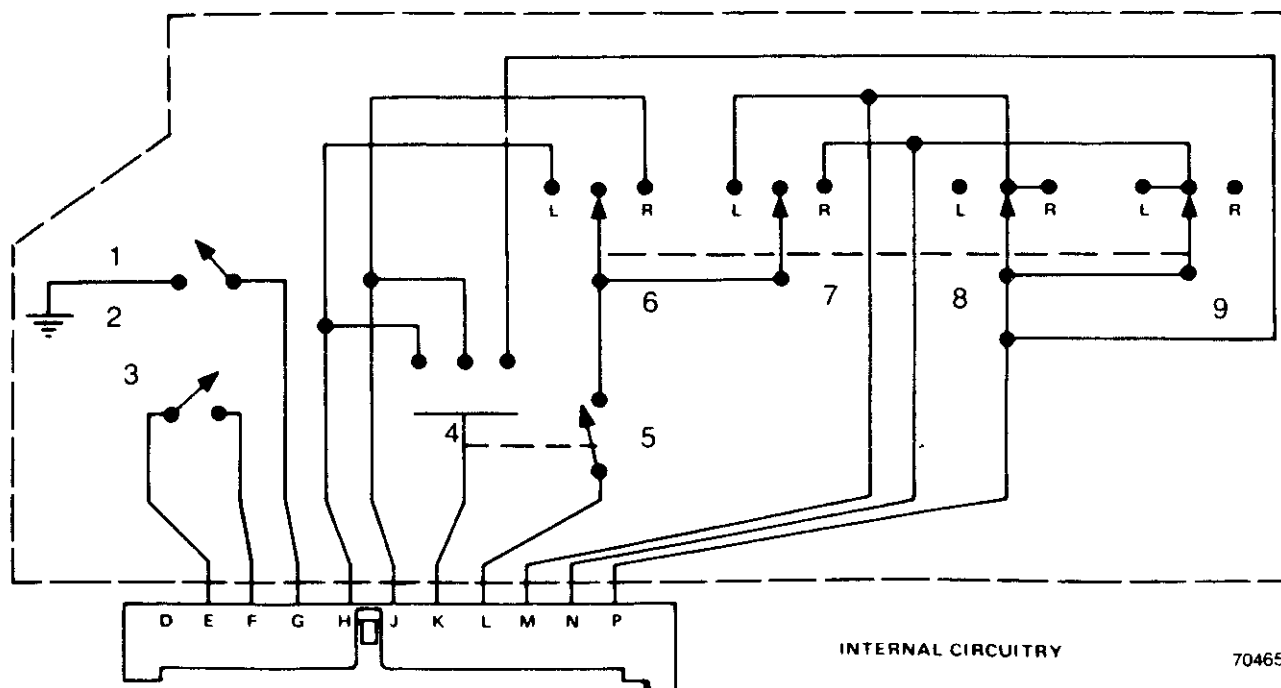
Refer to the Steering Column Section for the four-way flasher switch installation procedure.

Four-Way Emergency Flasher Battery Feed

Refer to the Electrical Troubleshooting Manual (ETM) for diagnosis and repair procedure.

SEE
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NOTES

INTERNAL CIRCUITRY SCHEMATIC



1. Horn Switch
2. Case Gnd.

3. Key Switch
4. Hazard

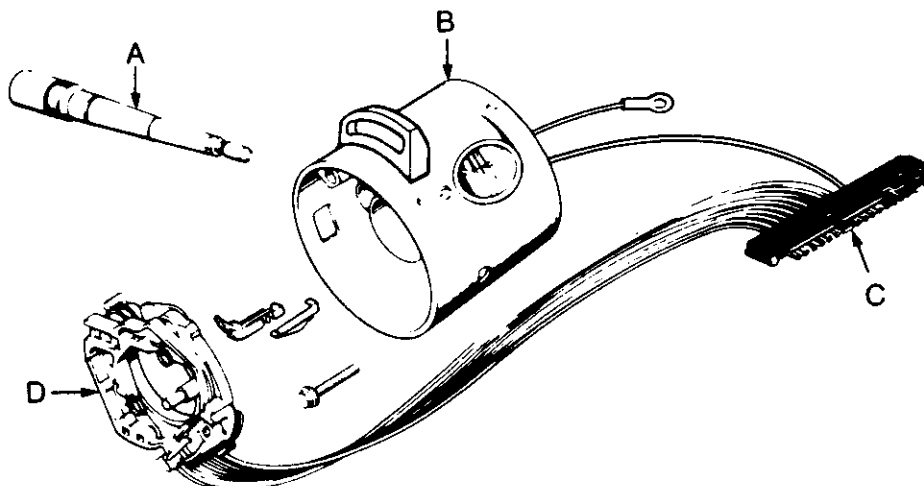
5. T.S. Override
6. Front Turn

7. Rear Turn
8. Left Stop

9. Right Stop

	ELECTRICAL INTERIOR LIGHTING SYSTEM	
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WIRING HARNESS COMPONENTS

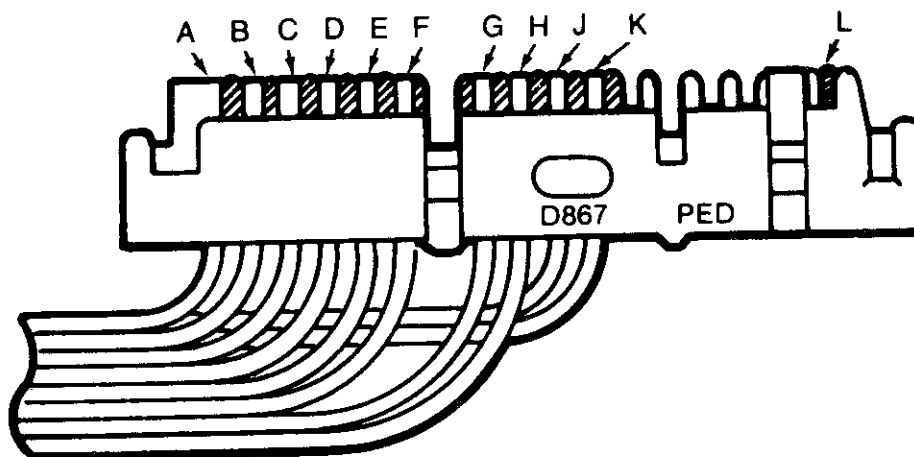


84995C

A. Wiper/Washer Switch and Turn Signal Lever
B. Ignition Switch Housing

C. Turn Hazard Connector
D. Turn Hazard Switch Assembly

Turn Signal/Hazard Warning Connector Diagram



84995D

A. Stop Light Switch – White
B. Right Rear – Dark Green
C. Left Rear – Yellow
D. Flasher – Purple
E. Hazard Warning – Brown
F. Right Front – Dark Blue

G. Left Front – Light Blue
H. Horn – Black
J. Key Alarm – Pink
K. Key Alarm – Black
L. Auto. Trans. Gear Selector Indicator (PRNDL) Lamp – Gray

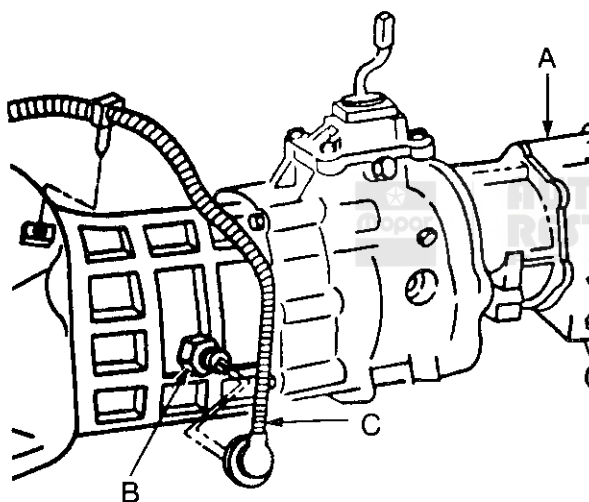
	ELECTRICAL INTERIOR LIGHTING SYSTEM	
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BACKUP LAMP SWITCH – MANUAL TRANSMISSION

The backup lamp switch (A) is threaded into the right rear corner of the transmission cover housing (B).

The backup lamp switch is actuated by the reverse shift rail.

The backup lamp switch is **NOT SERVICE-ABLE OR ADJUSTABLE** and must be replaced as a unit.



101358

- A. Unit Power
- B. Backup Lamp Switch
- C. Harness Assembly

BACKUP LAMP SWITCH – AUTOMATIC TRANSMISSION

A combination backup and neutral safety switch (A) is mounted on the steering column. **THIS SWITCH IS ADJUSTABLE.**

NOTE: If the backup lamp switch is defective, the switch must be replaced.

To adjust the backup lamp switch, place the transmission shift lever in the REVERSE position.

Loosen the two switch attaching screws (B). Do not remove them completely.

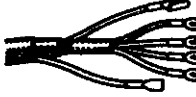
Turn the ignition switch to the ON position.

Rotate the switch one direction or the other until the backup lamps operate.

Tighten the attaching screws.

Check the switch for an engine start in the NEUTRAL and PARK positions.

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	ELECTRICAL INTERIOR LIGHTING SYSTEM	
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The engine **must not start** in the REVERSE, DRIVE, SECOND GEAR or FIRST GEAR position.

As an aid to adjusting the backup lamp switch, install a test lamp to the lamp side of the switch and ground one side of a test lamp. When the test lamp lights, the backup lamps are operating.

SEE
I.S.
NOTES

STOPLAMP SWITCH REMOVAL

Refer to the Steering Column Section for removal procedure.

STOPLAMP SWITCH INSTALLATION

Refer to the Steering Column Section for installation procedure.

STOPLAMP SWITCH ELECTRICAL TEST

Refer to the Electrical Troubleshooting Manual (ETM).



	ELECTRICAL HORN SYSTEM	
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GENERAL INFORMATION

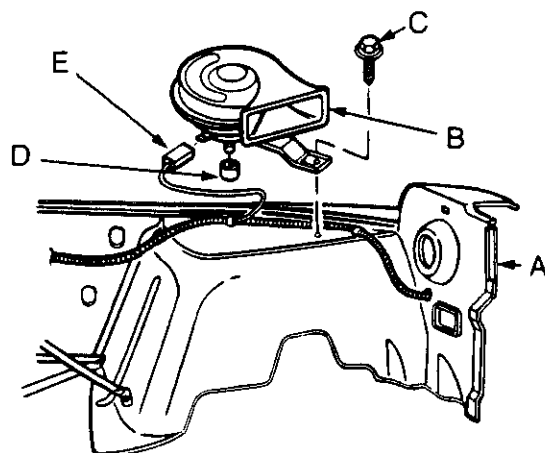
NOTE: A cadmium-plated ground screw is used to attach the horn(s) to the body. DO NOT SUBSTITUTE other types of ground screws as they may become corroded and cause a loss of ground.

The horn circuit includes:

- horn(s)
- horn relay
- battery
- steering column wiring harness
- horn ring, and
- body sheet metal.

Wrangler/YJ horns are located on the inner left wheelhouse.

HORN



101483

- A. Body Assembly
- B. Horn Bracket Assembly
- C. Horn Assembly Screw
- D. Horn Support Bumper
- E. Headlamp Wire Harness

SEE
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NOTES

TORQUE SPECIFICATIONS

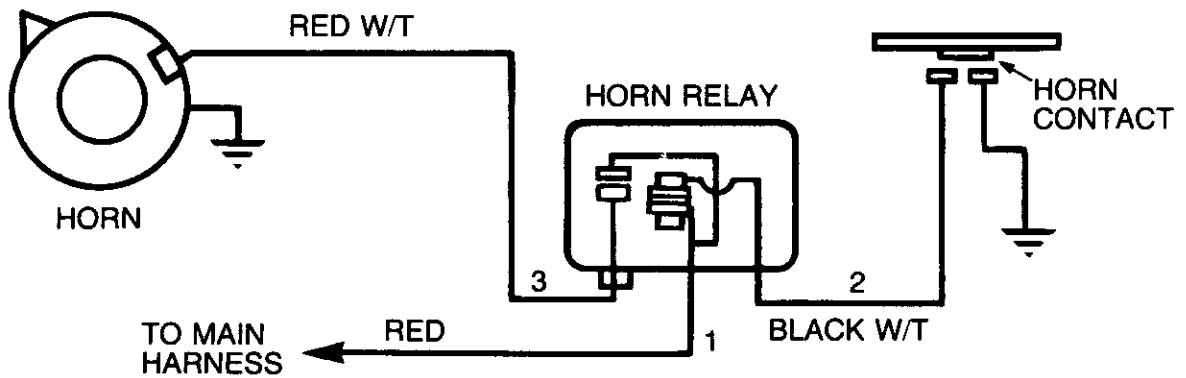
Component	Service Set-To Torque	Service Recheck Torque
Horn Bracket Screw	20 N·m (15 ft-lbs)	11-23 N·m (8-17 ft-lbs)

HORN FAILURE DIAGNOSIS

Refer to the Electrical Troubleshooting Manual (ETM) for diagnosing electrical problems.

	ELECTRICAL HORN SYSTEM	
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SIMPLIFIED HORN CIRCUIT



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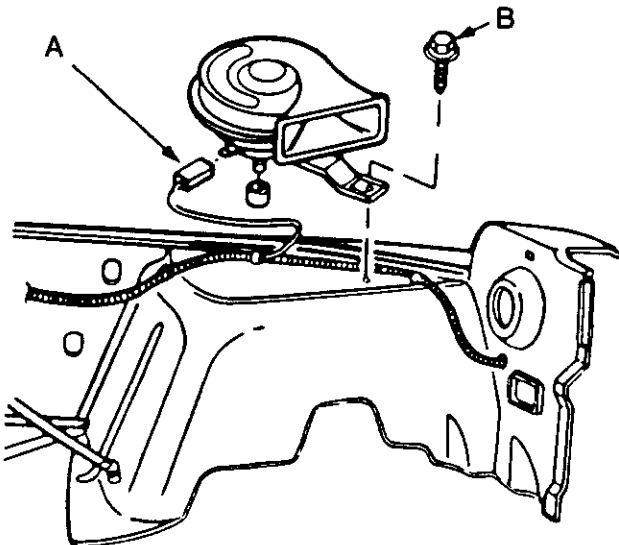
HORN REMOVAL

Remove headlamp wire harness (A).
Remove horn assembly screw (B).

HORN INSTALLATION

Attach the horn assembly screw (B).
Attach the headlamp wire harness (A).

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	ELECTRICAL WINDSHIELD WIPERS	
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GENERAL INFORMATION

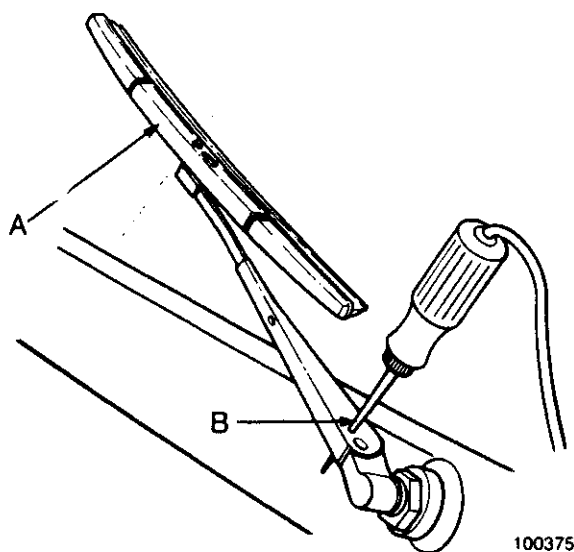
Wrangler/YJ vehicles are equipped with a two-speed electric wiper motor.

The wiper motor is mounted on the lower left corner of the windshield.

WIPER BLADE REMOVAL

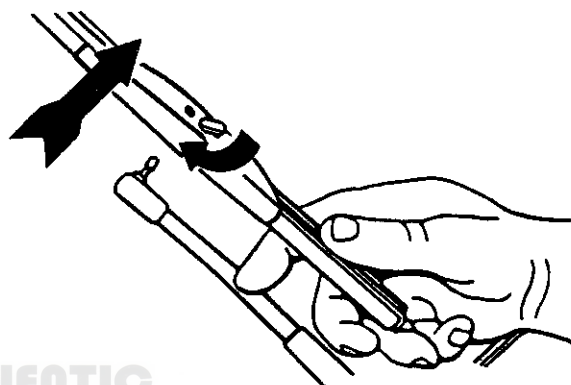
Rotate the wiper blade release (A) clockwise. This will release the wiper blade from the pivot pin.

CAUTION: Take care to insure that the wiper arm does not strike the windshield after the wiper blade has been removed.



WIPER BLADE INSTALLATION

Place the wiper blade assembly on the wiper arm and snap the blade onto the pivot pin.



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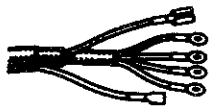
WIPER ARM REMOVAL

Pull the wiper arm forward.

Insert the Continuity Test Lamp J-21008-A or an ice pick-type tool into the hole (B).

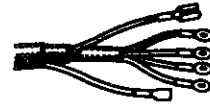
Grasp the wiper arm above the pivot nut.

Pull and remove the wiper arm assembly.



ELECTRICAL

WINDSHIELD WIPERS



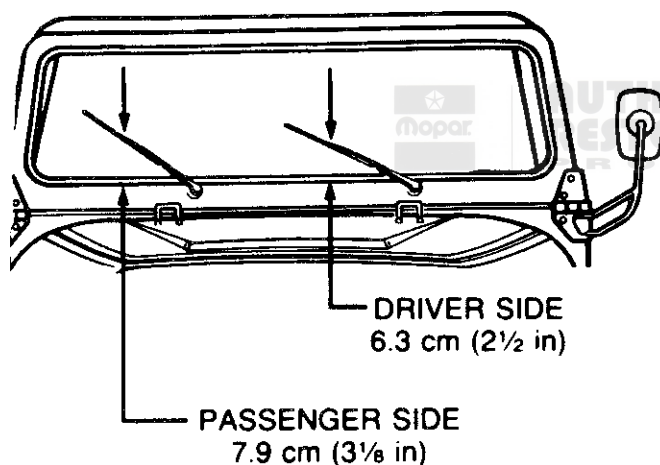
WIPER ARM INSTALLATION

Push the wiper arm over the pivot shaft.

Pull back the wiper arm.

Remove the Continuity Test Lamp J-21008-A, or ice pick-type tool.

CAUTION: Be sure the pivot shaft is in the PARK position and the wiper arm is positioned correctly on the windshield.



841295A

PIVOT SHAFT BODY AND LINKAGE REMOVAL

Remove the left and right wiper arms.

Remove the nuts attaching the pivots to the windshield frame.

Remove the necessary hard or soft top components from the windshield frame.

Remove the left and right windshield holddown knobs and fold the windshield forward.

Remove the left and right access hole covers.

Disconnect the wiper motor drive link from the left wiper pivot.

Remove the pivot shaft body and linkage through the access hole.

PIVOT SHAFT BODY AND LINKAGE INSTALLATION

Install the pivot shaft body and linkage in the windshield frame.

Connect the wiper motor drive link to the left wiper pivot.

Install the left and right access hole covers.

Raise the windshield to the upright position and install the left and right windshield holddown knobs.

Install the nuts attaching the pivots to the windshield frame.

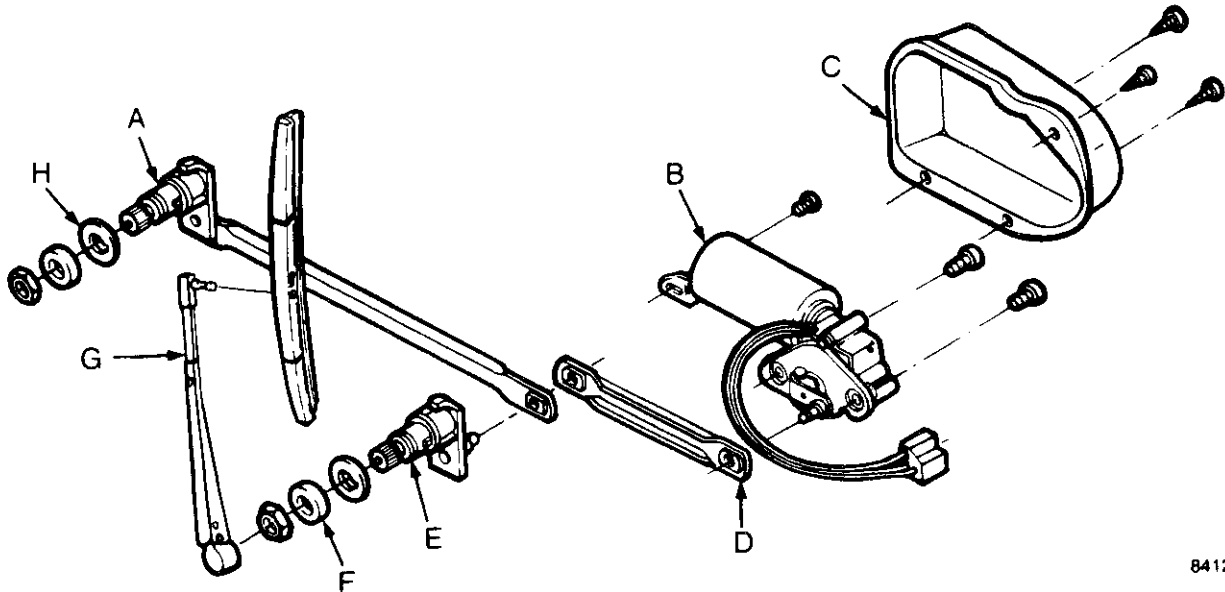
Install the left and right wiper arms.

Install the necessary top components on the windshield frame.

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	ELECTRICAL WINDSHIELD WIPERS	
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Windshield Wiper Systems



841292A

A. Pivot Shaft and Arm
B. Crank and Motor

C. Motor Cover
D. Drive Link

E. Pivot Shaft
F. Escutcheon

G. Wiper Arm
H. Gasket

WIPER MOTOR REMOVAL

NOTE: The wiper motor is protected by a 6.7-amp circuit breaker in the fuse panel.

Remove the necessary hard or soft top components from the windshield frame.

Remove the left and right windshield holddown knobs and fold the windshield forward.

Remove the left access hole cover.

Disconnect the drive link from the left wiper pivot.

Disconnect the wiper motor wire harness from the switch.

Remove the attaching screws and remove the wiper motor.

WIPER MOTOR INSTALLATION

Position the wiper motor on the windshield frame and install the attaching screws.

Connect the wiper motor wire harness to the switch.

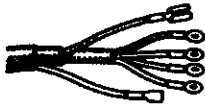
Connect the drive link to the left wiper pivot.

Install the left access hole cover.

Raise the windshield to the upright position and install the left and right windshield holddown knobs.

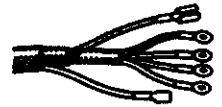
Install the necessary top components on the windshield frame.

SEE
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ELECTRICAL

WINDSHIELD WIPERS



ELECTRIC WASHER PUMP ASSEMBLY

General Information

The electric washer pump assembly is mounted in the water reservoir. The impeller motor case is grounded to the body sheet metal by a black (BLK) ground wire. It is energized by a violet (VIO W/TR) feed wire.

Diagnosis

Refer to the Electrical Troubleshooting Manual (ETM) for diagnostic information.

INTERMITTENT GOVERNOR DIAGNOSTIC TESTING

Remove the intermittent governor wiper module.

Connect the intermittent governor wiper module connectors together.

Test for:

- If the wipers operate in the low and high speed modes, and the washer is working, then the intermittent wiper module is defective.
- If the wipers operate in the low and high speed modes, and the washer is working, then the delay resistance in the wiper switch is defective.

To determine if the delay is defective, rotate the wiper switch in that mode and measure the resistance between **A-D** and **A-G**, (wiper switch disconnected).

If the resistance is not 0-500K OHMS, replace the wiper switch as outlined in the Steering Column Section.

If resistance is correct, replace the module.

NOTE: The intermittent circuit is the same as the nonintermittent circuit when the module is removed.

Refer to the Electrical Troubleshooting Manual (ETM) for further testing. (A "How-to-Troubleshoot" section is located in the front of the ETM.)

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	ELECTRICAL REAR WINDOW DEFOGGER	
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GENERAL INFORMATION

To defog the rear window, press the rocker switch to the ON position. A light on the rocker switch arm will indicate that the defogger is operating.

Defogger operation will normally cease after about ten minutes. Pushing the switch again will give five additional minutes of defogger operation.

To stop defogger operation, push the switch to the OFF position.

Use the defogger only when the engine is operating to prevent excessive battery drain.

CAUTION: Use care when washing the inside of the rear window to prevent damage to the defogger heating elements. Use a soft cloth and a mild washing solution. Wiping motions should be parallel to the heating elements. Also, keep all objects a safe distance from the window to prevent damaging the heating elements.

Refer to the Electrical Troubleshooting Manual (ETM) for rear window defogger additional diagnostic information.

REAR WINDOW DEFOGGER SWITCH REMOVAL

NOTE: Refer to the Instrument Panel Section for information on removing the instrumentation shroud and indicator bezel.

Unplug the connector from the defogger switch.

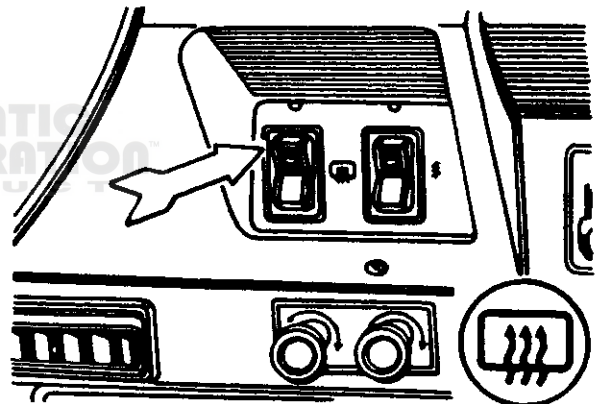
Squeeze the ends of the switch to release the plastic retaining fingers and push outward.

REAR WINDOW DEFOGGER SWITCH INSTALLATION

Depress the rear window defogger switch into the bezel until the retaining fingers lock behind the bezel.

Plug the connector on the switch.

Install the indicator bezel and instrumentation shroud.



101379

REAR WINDOW DEFOGGER GRID TEST

When a grid is inoperable due to an open circuit, the area of glass normally cleared by that grid remains fogged or iced unless, and until, it is cleared by the adjacent grids.

The feed wire is connected to the left (driver) side of the window and the grounding terminal is behind the left taillamp assembly.

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	ELECTRICAL REAR WINDOW DEFOGGER	
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With the engine running at IDLE, push the rear window defogger switch to the ON position and release. The pilot lamp in the rocker switch should light, indicating defogger operation.

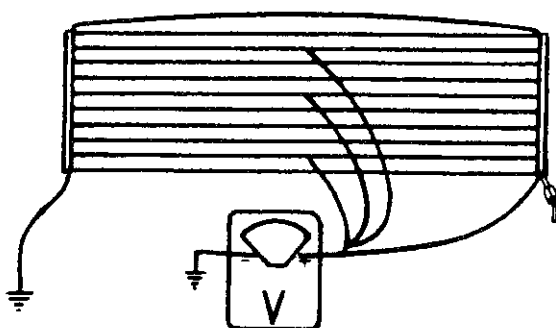
Use a 12-vdc voltmeter and contact the positive lead of the voltmeter to the feed side vertical bus element on the inside surface of the glass and contact the negative lead to the ground side bus element. Voltage on the meter should be 11 to 13 volts. Connect the negative lead of the voltmeter to a good ground; the metal reading should be constant.

Keep the negative lead connected to ground. Use the positive lead and carefully contact each grid at the approximate centerline of the window.

A voltage drop of one-half the full amount, approximately 6 volts, indicates a good grid or closed circuit.

A voltage drop of 12 volts at the centerline indicates a break in the grid between the positive voltmeter lead and the ground.

No voltage drop (0 volts) at the centerline indicates a break in the grid between the centerline and the voltage source or lead.



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The exact location of the break can then be pinpointed by moving the positive voltmeter lead to the left or right along the grid until an abrupt change in the voltage reading is noticed. The break is at that point in the grid.

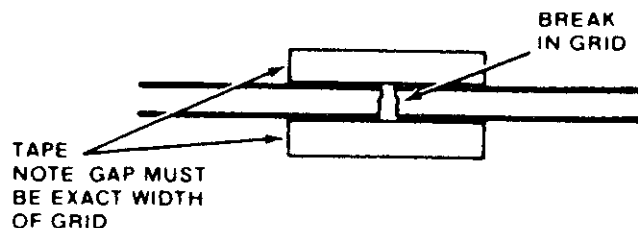
REAR WINDOW DEFOGGER GRID REPAIR

Locate the broken or open grid.

Use the grid repair kit (available as a service part) in accordance with the following procedure:

- Mark the location of the broken or open grid on the exterior surface of the glass using a suitable marking pencil.
- Lightly rub the area to be repaired (inside the rear window) using fine steel wool. Clean the area with alcohol.

Attach two strips of cellophane tape to the inside surface of the rear window (above and below the break in the grid).



A41322

- A. Break in grid B. Tape Location (NOTE: Gap must be exact width of the grid)

	ELECTRICAL REAR WINDOW DEFOGGER	
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Mix the repair coating until it is uniform in consistency, with silver particles mixed throughout the fluid, and apply the coating to the break in the grid with a small brush furnished with the kit. Apply a heavy coat of mixture, extending approximately 6mm (1/4-in) on each side of the break.

Start the engine.

Depress the rear window defogger switch.

Run engine for one minute.

Turn ignition switch OFF.

Apply a second heavy coat of the mixture to the break in the grid. Extend it about 6mm (1/4-in) on either side of the break.

Start the engine.

Depress the rear window defogger switch.

Run the engine until the defogger completes a cycle (pilot light goes off).

Turn the ignition switch OFF.

Remove the tape from the inside of the rear window.

Check the repair grid for continuity.

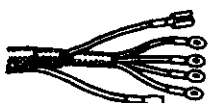
CAUTION: Do not touch or clean the repaired area for 24 hours.

Clean the inside of the rear window, with the exception of the repaired area, with liquid window cleaner.

Clean the pencil markings from the exterior surface of the glass.

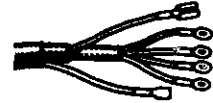
NOTE: Apply a coat of tincture of iodine on approximately 2.5cm (1-in) of either side of the repaired area should the repaired area of the grid appear off-color after performing the repair procedure. Use a fine brush or pipe cleaner. Allow the iodine to dry for about 30 seconds and carefully wipe off the excess with a lint free cloth.

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ELECTRICAL

CRUISE CONTROL



GENERAL INFORMATION

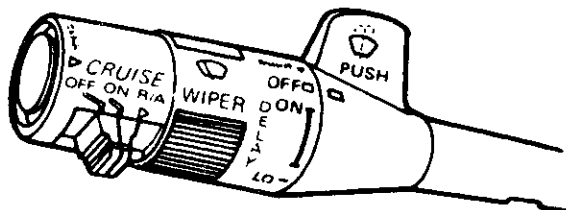
The electronic cruise control functions are built into the turn-signal lever. The cruise control functions are:

- CRUISE
- SET
- ON
- OFF
- COAST
- RESUME SPEED
- ACCELERATE

SEE
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NOTES

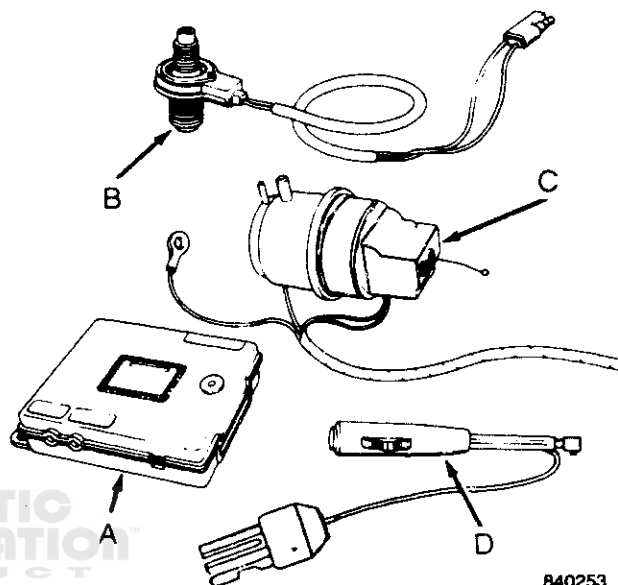
CRUISE CONTROL COMPONENTS

Cruise Control Switch



84968

The cruise control is a closed loop electro-mechanical servo system that consists of the following components:



840253

A. Cruise Control Module

B. Speed Sensor

C. Servo

D. Control Switch

Vacuum Storage Can and Check Valve.

Release Mechanisms, (which consist of a mechanical vacuum vent and brake lamp switch).

	ELECTRICAL CRUISE CONTROL	
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CRUISE CONTROL OPERATION

Cruise control operation is limited to speeds above 48 km/h (30 mph).

WARNING: Do not use the cruise control feature when driving on slippery or congested roads.

CRUISE CONTROL DIAGNOSIS

General Information

Whenever a cruise control malfunction occurs, first verify that the cruise control wire harness is properly connected to the module before starting normal diagnosis and repair procedures.

A poor connection can cause a complete or intermittent malfunction and is also the only nontestable connection in the circuit. This connection is disturbed whenever the AM PC-1-R Cruise Control Tester, P/N 8180 320 315, is used.

For this reason, a loose connection may be misdiagnosed as a module malfunction. Also, whenever a module is replaced, it will be necessary to adjust the replacement module.

Refer to the Module Replacement Section for replacement directions.

To diagnose Cruise Control system malfunctions, refer to the Service Diagnosis Chart and Testing.

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	ELECTRICAL CRUISE CONTROL	
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CRUISE CONTROL DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
A. SYSTEM DOES NOT ENGAGE IN "ON" POSITION	(1) Restricted vacuum hose or no vacuum. (2) Control switch defective. (3) Regulator defective. (4) Speed sensor defective. (5) Brake lamps defective. (6) Brake lamp switch defective. (7) Brake lamp switch wire disconnected. (8) Open circuit between brake lamp switch and brake lamps. (9) Mechanical vacuum release valve position improperly adjusted.	(1) Locate restriction or air leak and repair. (2) Replace switch. (3) Replace regulator. (4) Replace sensor. (5) Replace brake lamp bulbs. (6) Replace switch. (7) Connect wire to switch. (8) Repair open circuit. (9) Adjust vacuum release valve position.
B. RESUME FEATURE INOPERATIVE	(1) Defective servo ground connection. (2) Control switch defective.	(1) Check servo ground wire connection and repair as necessary. (2) Replace switch.
C. ACCELERATE FUNCTION INOPERATIVE	(1) Accelerate circuit in regulator inoperative. (2) Control switch defective.	(1) Replace regulator. (2) Replace switch.
D. SYSTEM RE-ENGAGES WHEN BRAKE PEDAL OR CLUTCH (MANUAL TRANSMISSION) IS RELEASED	(1) Regulator defective. (2) Mechanical vacuum release valve not opening. (3) Kink in mechanical vacuum release valve hose. (4) Brake lamp switch defective.	(1) Replace regulator. (2) Adjust position or replace valve. (3) Reroute hose to remove kink. (4) Adjust or replace switch.
E. THROTTLE DOES NOT RETURN TO IDLE POSITION	(1) Improper linkage adjustment. (2) No slack in lost motion link.	(1) Adjust properly. (2) Adjust servo cable.
F. ROAD SPEED CHANGES MORE THAN 2 MPH (3.2 km/h) WHEN SETTING SPEED	(1) Centering adjustment set wrong.	(1) Adjust centering screw.

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	ELECTRICAL CRUISE CONTROL	
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CRUISE CONTROL DIAGNOSIS (cont'd.)

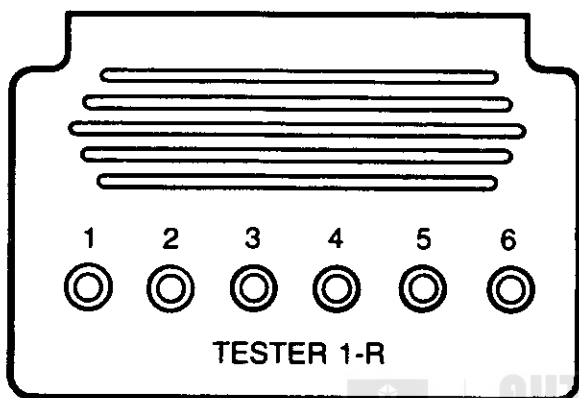
CONDITION	POSSIBLE CAUSE	CORRECTION
G. ENGINE ACCELERATES WHEN STARTED	(1) No slack in bead chain. (2) Vacuum hose connections reversed at servo. (3) Servo defective.	(1) Adjust chain. (2) Check connection and correct. (3) Replace servo.
H. SYSTEM DISENGAGES ON LEVEL ROAD WITHOUT APPLYING BRAKE OR CLUTCH (MANUAL TRANSMISSION)	(1) Loose wire connection. (2) Loose vacuum hose connection. (3) Servo linkage broken. (4) Defective brake lamp switch.	(1) Repair connection. (2) Check vacuum hose connection and repair as necessary. (3) Repair linkage. (4) Replace switch.
I. ERRATIC OPERATION	(1) Reverse polarity. (2) Servo defective. (3) Regulator defective.	(1) Check position of speed sensor wires at connector. (2) Replace servo. (3) Replace regulator.
J. VEHICLE CONTINUES TO ACCELERATE WHEN SET BUTTON IS RELEASED	(1) Servo defective. (2) Regulator defective.	(1) Replace servo. (2) Replace regulator.
K. SYSTEM ENGAGES BUT SLOWLY LOSES SET SPEED	(1) Air leak at vacuum hose connection or in hoses. (2) Air leak at vacuum release valve at brake pedal.	(1) Check hoses and connections. Repair as necessary. (2) Replace vacuum release valve.

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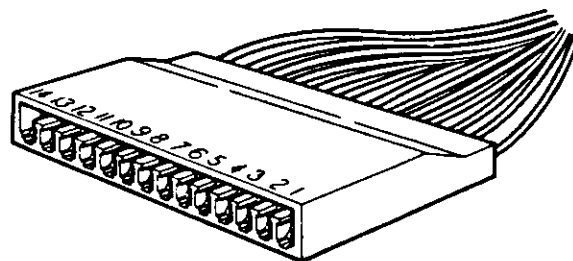
CRUISE CONTROL DIAGNOSTIC TESTING PROCEDURE

NOTE: The AM PC-1-R Cruise Control Tester is
REQUIRED to perform these diagnostic tests.



101151

Disconnect the wire harness connector from the
cruise control module.



84977A

CAUTION: When disconnecting the wire
harness connectors, do not pull on the wires.
PULL ONLY ON THE CONNECTORS.

Disconnect and connect all wire harness
connectors several times to remove terminal
oxidation/corrosion.

Plug the tester connector into the cruise control
module.

	ELECTRICAL CRUISE CONTROL	
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Conduct the following tests:

AM PC-1-R CRUISE CONTROL TESTER DIAGNOSTIC CHART

MINIMUM OPERATION TO TURN ON LAMP	LAMP ON					
	1	2	3	4	5	6
A. CRUISE SWITCH ON • Set Switch Depressed	X					
B. CRUISE SWITCH ON		X				
C. IGNITION SWITCH ON • Depress Brake or Clutch To Turn OFF			X	X		
D. CRUISE SWITCH RESUME/ACCELERATE					X	X

CRUISE CONTROL SERVO CHECKS

E. CRUISE SWITCH RESUME/ACCELERATE • Engine Running					X	X
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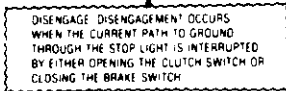
WARNING: Servo will pull throttle wide open. Keep RPM at safe limit by releasing the cruise switch.

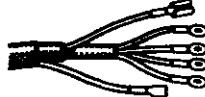
If the tester lamp results are **NOT** as desired, make the following checks and either repair or replace as described.

NOTE: All voltages measured must be at battery potential (voltage). If volt/ohm readings are incorrect, check that circuit for an open or short using the cruise control schematic. The cruise control module ground terminal No. 1 (BLK), grounds through connector C114 to G302 (engine block).

A diagram showing a single cable on the left that branches into five separate conductors on the right. Each conductor ends in a different type of connector: a BNC connector, a D-subminiature connector, a circular connector, a rectangular connector, and a standard two-prong electrical plug.

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	ELECTRICAL CRUISE CONTROL	
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CRUISE CONTROL DIAGNOSTIC TESTING EXPLANATION

LAMP NO. 1 OFF – Set Switch

- Check voltage from HAZ/STOP and inline fuses at terminal 14 (DK GRN), (cruise switch ON) to ground terminal 1 (BLK).

LAMP NO. 2 OFF – Cruise Switch/Speed Sensor

- Check voltage from HAZ/STOP and inline fuses at terminal 5 (BRN), cruise switch ON, to ground 1 (BLK).
- Check resistance between terminals 2 (GRY) and 3 (BLU), 15-50 ohms.

LAMP NO. 3 OFF – Brake Lamp(s) Ground

- With ignition ON, jumper terminals 7 (VIO W/TR) and 13 (LT BLU W/TR); if brake lamps do not turn ON, check gauges fuses and brake switch connections.

LAMP NO. 4 OFF – Throttle Position Feedback Sensor

- Check voltage from gauges fuse (ignition ON) at terminal 7 (VIO W/TR) to ground terminal 1 (BLK).
- Check resistance between terminal 2 (GRY) and 11 (TAN) 240-4K ohms. 280-430 ohms = idle. 4K (4000) ohms - wide open throttle.

LAMP NO. 5 OFF – Resume/Accelerate / Vent Valve

- Check voltage from HAZ/STOP and inline fuses (cruise switch at Resume/Accelerate) at terminal 10 (YEL) to ground terminal 1 (BLK).
- Check resistance between terminals 6 (WHT) and 12 (ORN), 30-50 ohms.
- Terminals 6 (WHT) and 12 (ORN) to ground must have infinite resistance, (OPEN).

LAMP NO. 6 OFF – Resume/Accelerate / Charge Valve

- Check voltage from HAZ/STOP and inline fuses (cruise switch at R/A) at terminal 10 (YEL) to ground terminal 1 (BLK).
- Check resistance between terminals 4 (RED) and 12 (ORN), 30-50 ohms.
- Terminals 4 (RED) and 12 (ORN) to ground must have infinite resistance, (OPEN).

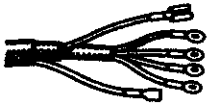
Cruise Control Servo Checks

- Check servo cable for breaks and hook-up.
- Check engine vacuum can and hose connections (small hose).
- Pinch brake vent (large hose) at servo and repeat test.

If servo operates, adjust brake vent hose valve (on brake sled).

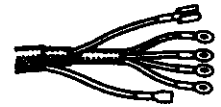
If hose is kinked, check routing. If it is cut, replace with new harness.

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CRUISE CONTROL



Cruise Control Module Adjustments

The cruise control module adjustments are pre-set by the manufacturer. If all other components of the system appear to be functioning normally and the cruise control remains inoperative, perform the following adjustments to determine if the module is functional.

CAUTION: The adjustments are extremely delicate. Insert the screwdriver into the slots **VERY CAREFULLY**. Do not push hard or turn hard against the stops. The arms have a maximum turning angle of 270 degrees (three-quarter turn).

Verify if the cruise control module is defective by using the indicated settings:

Centering Adjustment

Turn the centering adjustment to the 10 o'clock position (A).

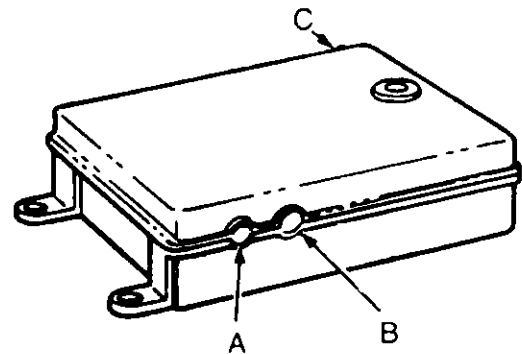
Low Speed Switch Adjustment

Turn the low speed switch adjustment to the 10 o'clock position (B).

Sensitivity Adjustment

Turn the sensitivity adjustment full clockwise (C).

NOTE: The adjustments may not be precisely correct for the vehicle, but are acceptable to determine if the module is functioning. The need for more precise adjustments can be determined by a road test.



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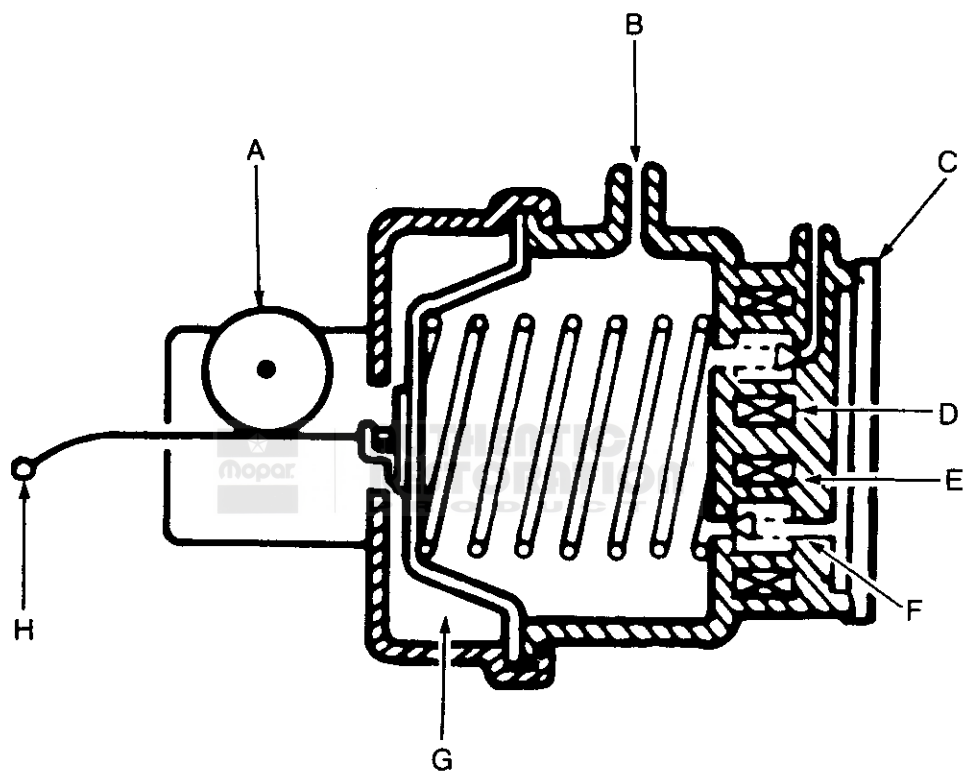
If the adjustments have no effect on the cruise control operation, replace the cruise control module.

NOTE: The cruise control module is the only component of the system that cannot be isolated and tested separately. It must be tested while connected to the other components of the system.

SEE
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CRUISE CONTROL COMPONENT TESTING AND ADJUSTMENTS

Cruise Control Servo



- A. Throttle Position Potentiometer
- B. Brake Pedal Vacuum Vent Valve
- C. Manifold Vacuum Source
- D. Vacuum Charge Valve Solenoid Coil

- E. Vacuum Vent Valve Solenoid Coil
- F. Atmosphere (Vent Valve)
- G. Diaphragm
- H. To Throttle Cable

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ELECTRICAL

CRUISE CONTROL

Control Switch Continuity Test

NOTE: Use a 12-volt test lamp to test the control switch continuity.

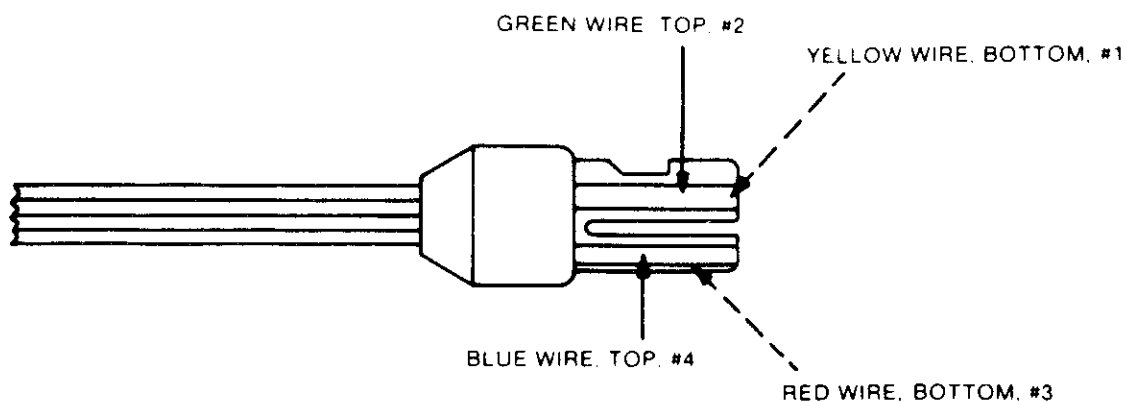
Connect the tester to the wires.

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NOTES

SET/COAST (S/C) SW	POSITION SLIDER	1-2	1-3	1-4	2-3	2-4	3-4
Normal	Off	O	O	O	O	O	O
Normal	On	O	O	O	O	C	O
Normal	R A	C	O	C	O	C	O
Depressed	Off	O	O	O	C	O	O
Depressed	On	O	O	O	C	C	C
Depressed	R A	C	C	C	C	C	C

C — Closed

O — Open



84977

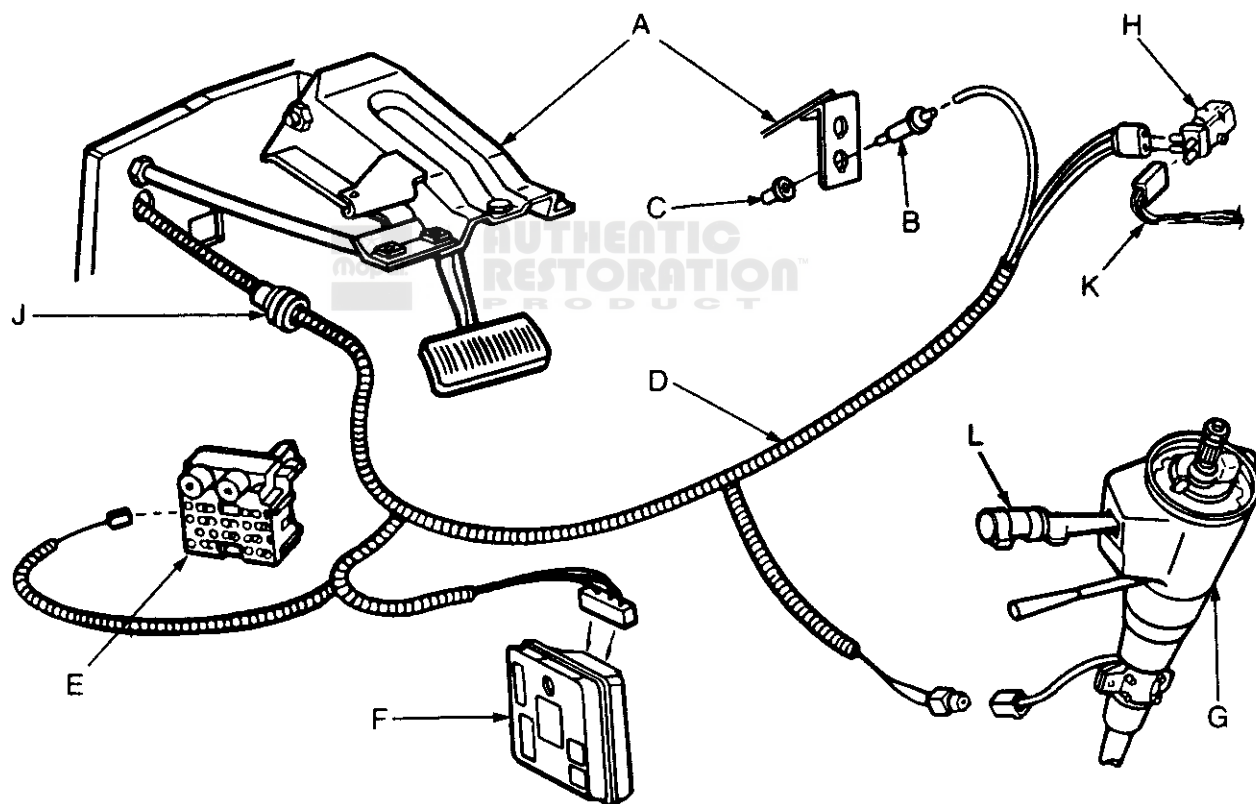
	ELECTRICAL CRUISE CONTROL	
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Vacuum Release Valve Adjustment

Hold the brake pedal in the depressed position.

Push the vacuum valve assembly (B) forward as far as possible.

Release the brake pedal.

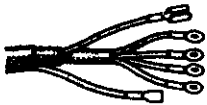


A. Body Sled
B. Vacuum Valve Assembly
C. Tubular Clip
D. Cruise Control Harness

E. Fuse Panel - I/P Harness
F. Cruise Control Module
G. Steering Column and Lever Assembly
H. Cruise Brake Switch

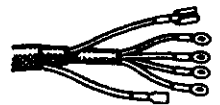
J. Grommet
K. I/P Wire Harness
L. Cruise Switch

101380



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CRUISE CONTROL

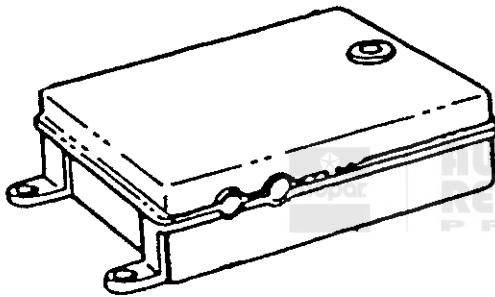


CRUISE CONTROL MODULE REMOVAL

NOTE: The module is mounted below the fuse panel.

Remove the two screws.

Unplug the module.



84970B

CRUISE CONTROL MODULE INSTALLATION

Plug in the module connector.

Mount to the dash panel with two attaching screws.

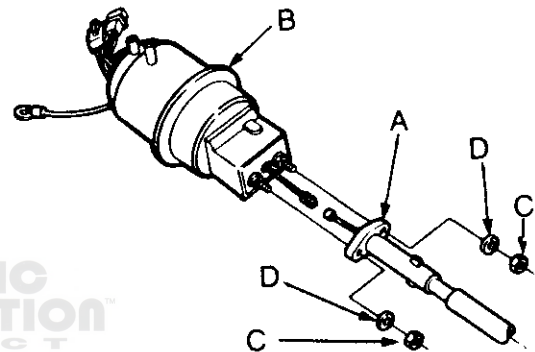
CRUISE CONTROL SERVO REMOVAL

Remove the remaining nuts and cable housing from the servo.

Release the cable clip from the servo cable.

Disconnect the vacuum hoses and connector.

Remove the mounting nut and servo from the bracket.



101382

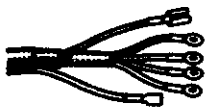
- A. Cruise Assembly – Cruise Command
- B. Servo – Cruise Command
- C. Assembly Nut
- D. Assembly Washer

CRUISE CONTROL SERVO INSTALLATION

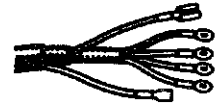
Install the servo and nut on the supporting bracket. Tighten the nut to 7 N·m (60 in-lbs) torque.

Attach the servo cable to the cable clip.

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ELECTRICAL CRUISE CONTROL



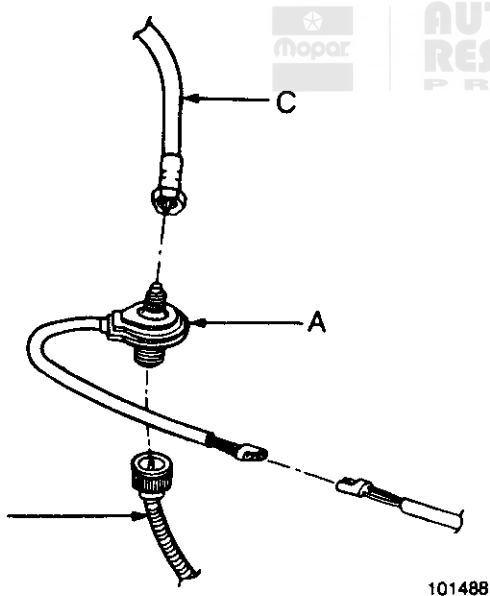
Attach the cable housing to the mounting studs. Make sure that the housing hole is aligned over the servo hole.

SPEED SENSOR REMOVAL

NOTE: The speed sensor is located above the front drive shaft and is in-line with the speedometer cable.

Unscrew the two attaching nuts from the speed sensor.

Disconnect the wire lead from the cruise harness.



- A. Tach Generator Assembly
- B Speedometer Tube Shaft (LWR)
- C. Upper Servo Cable Assembly

101488

SPEED SENSOR INSTALLATION

Plug in the speed sensor.

Screw on the two supporting nuts.

SERVO CABLE REMOVAL

Remove the lock clip and washer from the pin on the bellcrank.

Remove the lost motion link.

Squeeze the tabs that retain the cable housing in the bracket.

Remove the cable from the bracket.

Remove the cable housing from the servo.

Remove the cable clip from the servo cable.

SERVO CABLE INSTALLATION

Attach the cable clip to the servo.

Install the cable housing on the servo.

NOTE: The mounting studs are not equally spaced from the hole in the servo. Ensure the housing is installed correctly.

Attach the cable housing on the bracket. Ensure the tabs are locked in the bracket.

Place the lost motion link on the bellcrank pin.

Install the washer and lock clip.

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CRUISE CONTROL SWITCH REMOVAL

Cruise control switch removal procedures are covered in the Steering Column Section of this workshop manual.

CRUISE CONTROL SWITCH INSTALLATION

Cruise control switch installation procedures are covered in the Steering Column Section of this workshop manual.

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INSTRUMENT PANEL

GENERAL INFORMATION

All electrical troubleshooting is covered in the Electrical Troubleshooting Manual (ETM). (A "how-to-troubleshoot" lesson is provided in the front of the manual.)

INSTRUMENT PANEL SPECIFICATIONS

Oil Pressure Gauge Resistance (Ohms)

0 psi	1 ohm
40 psi	46 ohm
80 psi	90 ohm

Temperature Gauge Resistance (Ohms)

100°F	1600 ohm
220°F	160 ohm
260°F	80 ohm

Fuel Gauge Resistance (Ohms)

Empty	1 ohm
1/2 full	44 ohm
Full	89 ohm

Voltmeter Calibration

VOLTAGE INPUT	POINTER POSITION	TOLERANCE
8V	8V	±0.5V
10V	10V	±0.5V
12V	12V	±0.5V
14V	14V	±0.5V
16V	16V	±0.75V
18V	18V	±0.75V

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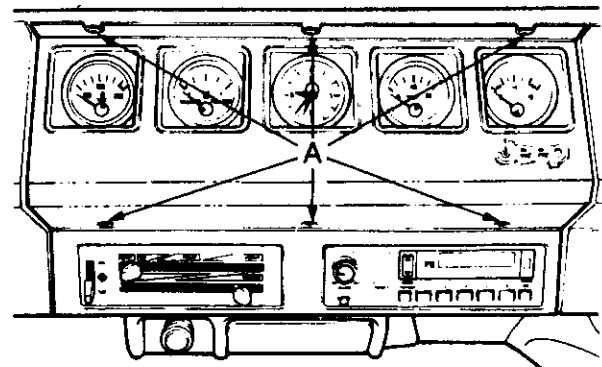
Tachometer Calibration

ENGINE	FREQUENCY	INDICATION
4 CYLINDER	66.7 HZ	2000 RPM + 140
	166.7 HZ	5000 RPM + 140
6 CYLINDER	100 HZ	2000 RPM + 140
	250 HZ	- 5000 RPM + 140

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GAUGE CLUSTER REMOVAL

Remove the six bezel screws (A).



101333

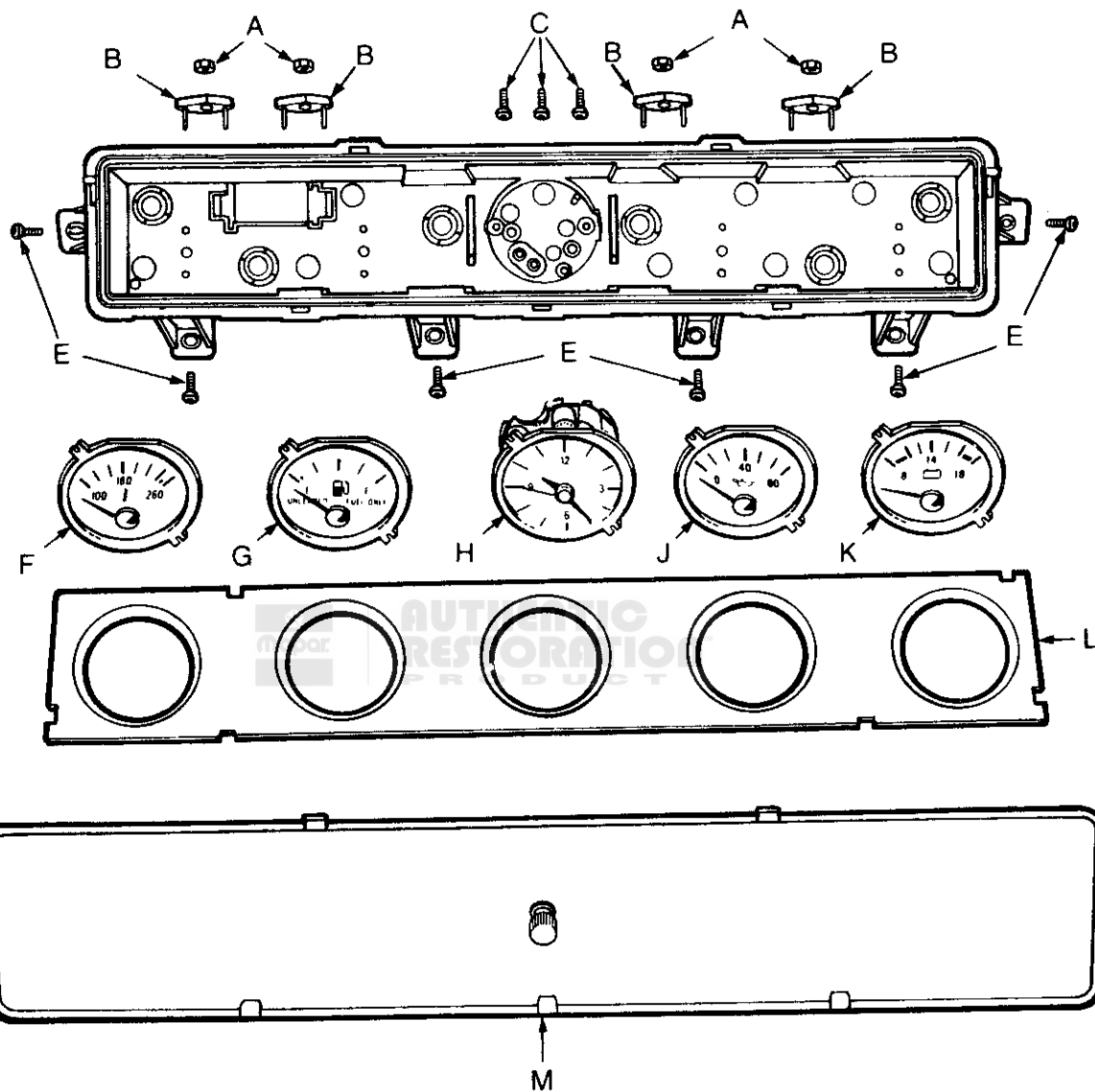
A. Bezel Screws

Remove the six cluster screws (E).

Disconnect the connector from the cluster.

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A. Gauge Nut(s)
 B. Gauge Contact Pins
 C. Clock Screw(s)
 D. Contact Spring(s)
 E. Gauge Housing Mounting Screws
 F. Coolant Temperature Gauge

G. Fuel Gauge
 H. Clock
 J. Oil Pressure
 K. Voltmeter
 L. Metal Shield
 M. Plastic Shield

101334

	ELECTRICAL INSTRUMENT PANEL	
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GAUGE CLUSTER INSTALLATION

Plug in the wire harness connector.

Install the six cluster screws (E).

Install the six bezel screws (A).

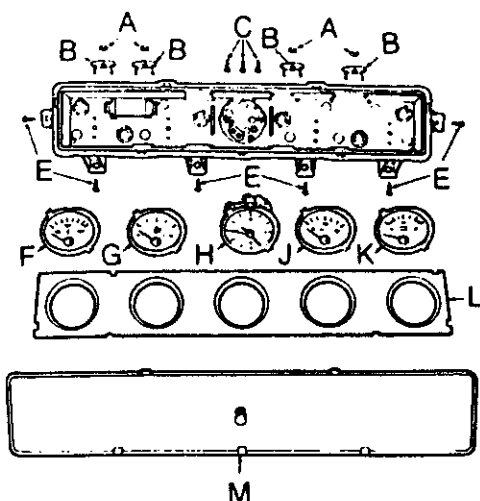
INSTRUMENT PANEL GAUGE REMOVAL

NOTE: This procedure is to be performed with the gauge cluster removed.

Remove the plastic shield (M). Release the seven plastic tabs with a screwdriver.

Remove metal shield (L).

Completely remove gauge nut (A).



- A. Gauge Nut(s)
- B. Gauge Contact Pins
- C. Clock Screw(s)
- D. Contact Spring(s)
- E. Gauge Housing Mounting Screws
- F. Coolant Temperature Gauge
- G. Fuel Gauge
- H. Clock
- J. Oil Pressure
- K. Voltmeter
- L. Metal Shield
- M. Plastic Shield

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INSTRUMENT PANEL GAUGE INSTALLATION

Insert gauge into gauge housing.

Place gauge contact pins (B) over gauge screw. The gauge contact pins (B) will automatically be driven into gauge when gauge nut (A) is tightened.

Install metal shield (L).

Install plastic shield (M).

CLOCK REMOVAL

NOTE: This procedure is to be performed with the gauge cluster removed.

Remove plastic shield (M). Release the seven plastic clips with a screwdriver.

Remove metal shield (L).

Remove clock mounting screws (C).

NOTE: Contact springs (D) may fall out if gauge cluster is not held upright.

Remove clock from gauge housing.

CLOCK INSTALLATION

Make sure contact springs are in position (D).

Place clock (H) into gauge housing (E).

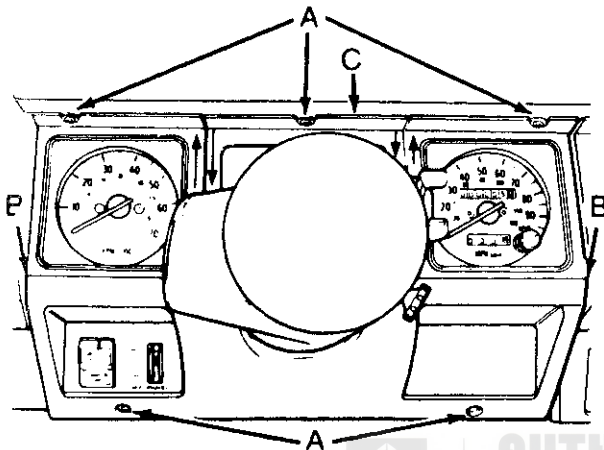
Install the clock mounting screws (C).

Install metal shield (L).

Install plastic shield (M).

INSTRUMENTATION SHROUD REMOVAL

Remove the five shroud screws (A).

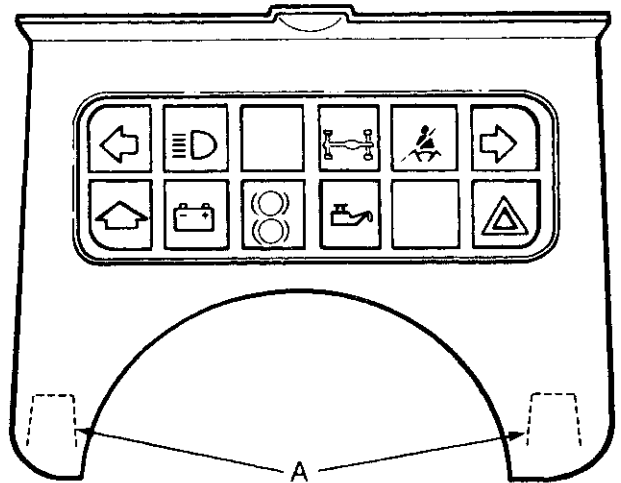


- A. Mounting Screw(s)
- B. Instrumentation Shroud
- C. Indicator Panel

Slide the shroud towards the steering wheel.

Apply upward pressure to the shroud (B) and downward pressure to the indicator panel (C). This will release the holding tabs (A).

Indicator Panel



101337

- A. Holding Tab(s)

INSTRUMENTATION SHROUD INSTALLATION

Place the shroud under the steering column.

Slide the indicator panel tabs into the shroud notches.

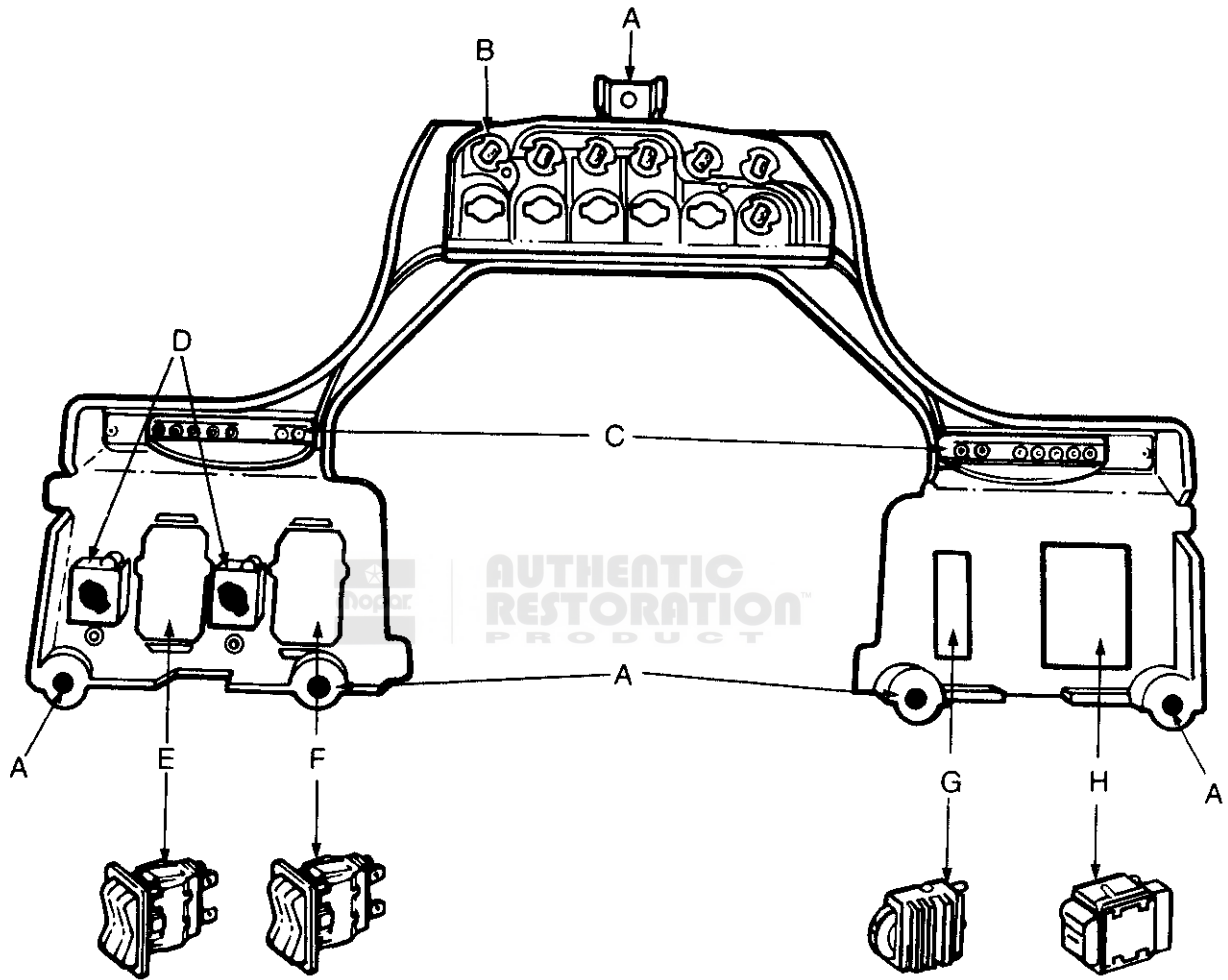
Place the assembled shroud over the indicator lamp foam gasket and tighten the indicator screw.

NOTE: A fragile foam gasket is on the back of the indicator overlay. If the gasket is torn or distorted, replace with a new gasket.

Insert and tighten the remaining four screws (A).

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INSTRUMENT PANEL INDICATOR BEZEL



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- A. Indicator Bezel Mounting Tabs
- B. Indicator Sockets
- C. Indicator Printed Circuit Connector
- D. Indicator Illumination

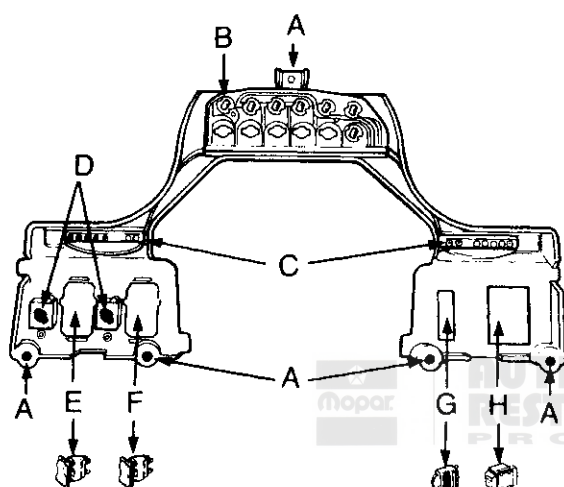
- E. Rear Defogger Switch
- F. Fog Lamp Switch
- G. Illumination Rheostat
- H. Headlamp Switch

101340A

INDICATOR BEZEL REMOVAL

Remove five bezel screws (A).

Disconnect the two indicator connectors (C).



101340A

- A. Indicator Bezel Mounting Tab(s)/Screw(s)
- B. Indicator Socket(s)
- C. Indicator Printer Circuit Connections
- D. Indicator Illumination
- E. Rear Defogger Switch
- F. Fog Lamp Switch
- G. Illumination Rheostat
- H. Headlamp Switch

INDICATOR BEZEL INSTALLATION

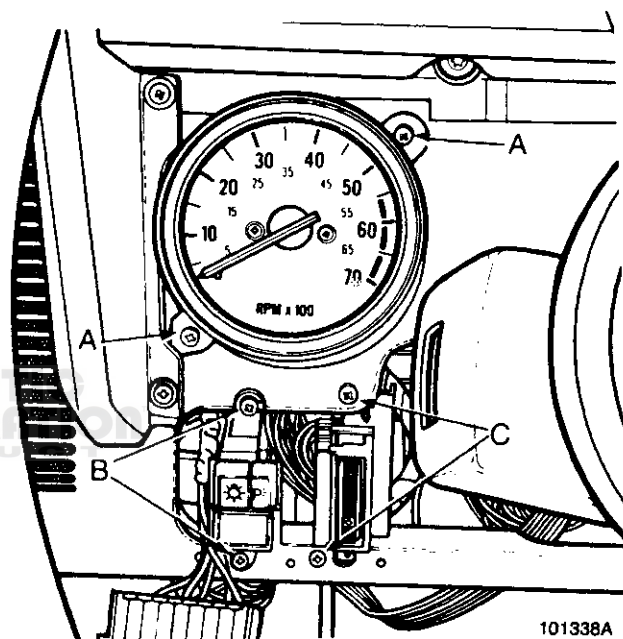
Fasten the five bezel screws (A) into the instrument panel. Be sure the indicator wires are not pinched behind the bezel.

HEADLAMP SWITCH REMOVAL

Disconnect negative battery cable.

Remove two headlamp switch attaching screws (B).

Remove the headlamp switch connector.



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HEADLAMP SWITCH INSTALLATION

Plug in the headlamp switch connector.

Insert the headlamp switch attaching screws (B).

Connect the negative battery cable.

	ELECTRICAL INSTRUMENT PANEL	
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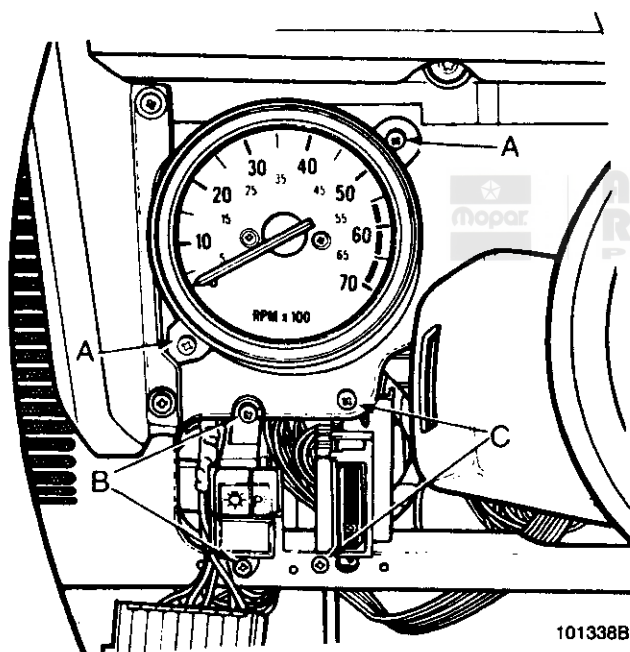
TACHOMETER REMOVAL

NOTE: The tachometer is mounted to the instrument panel with two attaching screws (A).

Remove the attaching screws.

Pull out the meter and disconnect the tachometer lead.

NOTE: The tachometer is a sealed, non-repairable unit.



TACHOMETER INSTALLATION

Plug in the tachometer lead.

Install attaching screws (A).

SPEEDOMETER REMOVAL

NOTE: The speedometer is mounted to the instrument panel with two screws.

Remove the attaching screws.

Pull out the meter and disconnect the speedometer cable.

NOTE: The speedometer is a sealed, non-repairable unit.

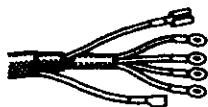
SPEEDOMETER INSTALLATION

Pull speedometer cable through the opening. Connect the cable.

Push the speedometer until mounting tabs touch the instrument panel.

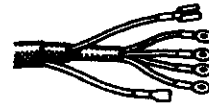
Install the two attaching screws.

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INSTRUMENT PANEL



ILLUMINATION RHEOSTAT REMOVAL

Disconnect negative battery cable.

Remove the two rheostat attaching screws (C).

Disconnect the rheostat connector.

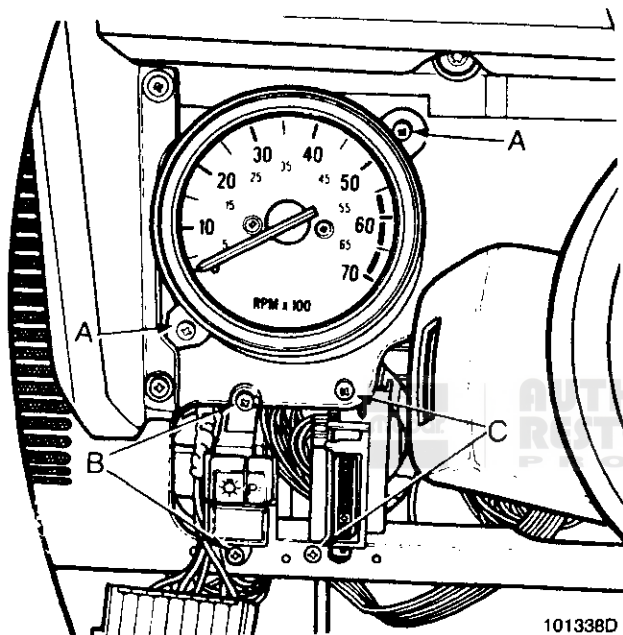
ILLUMINATION RHEOSTAT INSTALLATION

Plug in the rheostat connector.

Install the two rheostat attaching screws (C).

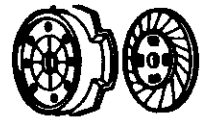
Connect negative battery cable.

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CLUTCH CONTENTS



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	CLUTCH SPECIFICATIONS	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Clutch Cover Bolts (Six-Cylinder)	54 N•m (40 ft-lbs)	47-61 N•m (35-45 ft-lbs)
Clutch Cover Bolts (Four-Cylinder)	31 N•m (23 ft-lbs)	27-35 N•m (20-26 ft-lbs)
Master Cylinder Mounting Stud Nuts	26 N•m (19 ft-lbs)	20-31 N•m (15-23 ft-lbs)
Master Cylinder Hydraulic Line Fitting	15 N•m (11 ft-lbs)	14-16 N•m (10-12 ft-lbs)
Crossmember-To-Frame Rail Bolt	41 N•m (30 ft-lbs)	27-41 N•m (20-30 ft-lbs)
Rear Support-To-Crossmember Bolt	45 N•m (33 ft-lbs)	37-52 N•m (27-38 ft-lbs)
Clutch Housing-To-Engine Bolt (ALL)	38 N•m (28 ft-lbs)	30-41 N•m (22-30 ft-lbs)
Universal Joint Clamp Bolts	19 N•m (170 in-lbs)	16-23 N•m (140-200 in-lbs)

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CLUTCH SPECIFICATIONS

Clutch Driven Plate and Cover Diameter:

Six-cylinder models: 266 mm (10.5-in)

Four-cylinder models: 232 mm (9.28-in)

Clutch Hydraulic Fluid:

JEEP brake fluid or an equivalent J 1703 or

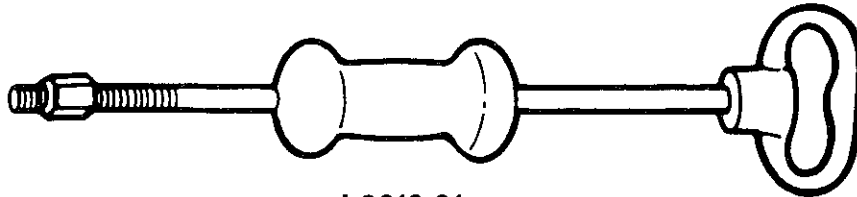
DOT 3 brake fluid

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SPECIAL TOOLS

Tool Ref.	Description
J 2619-01	Slide Hammer
J 5822	Pilot Bushing Removal Tool
J 33169	Clutch Alignment Tool
J 5824-01	Clutch Alignment Tool

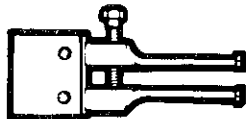
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J 2619-01



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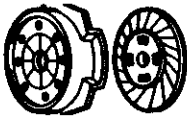
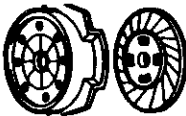
J 5822



J 33169



J 5824-01

	CLUTCH GENERAL INFORMATION	
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CLUTCH COMPONENTS

The clutch assembly consists of a driven plate and diaphragm-type clutch cover actuated by a hydraulic system.

Clutch Cover and Driven Plate

A single, dry-disc driven plate and a diaphragm style clutch cover are used. The cover has a one-piece, circular diaphragm spring with integral release fingers. The driven plate friction material is riveted to the hub which contains four cushion springs.

Driven plate and cover diameter is 266 mm (10.5-in) on six-cylinder models and 232 mm (9.28-in) on four-cylinder models.

Clutch Hydraulic System

Two hydraulic cylinders are used in the system. The throwout bearing, disc and pressure plate are operated by a slave cylinder. The slave cylinder is operated by the master cylinder which is connected to the clutch pedal.

The slave cylinder is mounted inside the clutch housing. The master cylinder is mounted on the engine compartment side of the dash panel. System hydraulic fluid is contained in the master cylinder reservoir. Fluid level is indicated on the side of the reservoir.

Use only Jeep brake fluid, or equivalent marked SAE J-1703 or DOT 3, in the clutch hydraulic system.

Slave Cylinder and Throwout Bearing Assembly

The slave cylinder and throwout bearing are a unique one-piece design. The bearing is permanently attached to the cylinder piston.

The slave cylinder completely encircles the transmission input shaft. In operation, piston movement causes the throwout bearing to move in a linear (straight line) direction. The cylinder is attached to the transmission front case.

SEE
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NOTES



CLUTCH

CLUTCH SERVICE



CLUTCH COVER AND DRIVEN PLATE REMOVAL

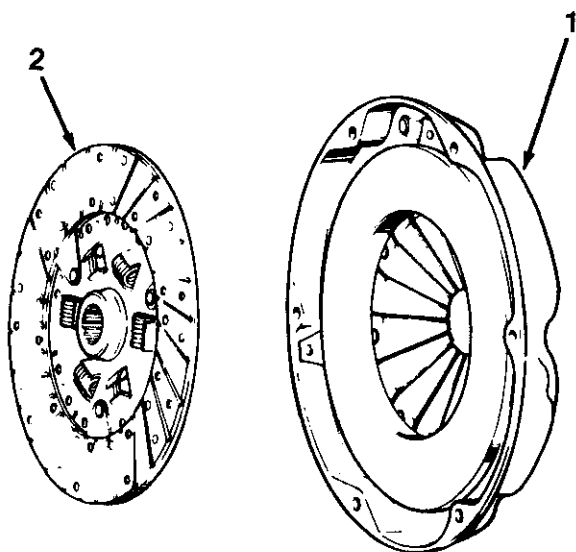
Remove the transmission and transfer case as outlined in Chapter E.

CAUTION: The clutch cover is under considerable spring tension. The cover bolts must be loosened evenly and in rotation to avoid distorting the cover.

Loosen the clutch cover bolts evenly and in rotation to relieve spring tension on the cover. Loosen the bolts a few threads at a time only.

Remove the cover bolts and remove the cover (1) and driven plate (2).

On six-cylinder models, remove the lubricating wick from the pilot bushing bore. Soak the wick in engine oil.



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CLUTCH COVER AND DRIVEN PLATE INSTALLATION

On six-cylinder models, squeeze excess oil from the pilot bushing lubricating wick and insert the wick into the pilot bushing bore.

NOTE: Avoid getting oil from the wick on the flywheel clutch surface.

Insert the clutch plate alignment tool in the driven plate hub. Use tool J 5824-01 on four-cylinder models and tool J 33169 on six-cylinder models.

Insert the alignment tool in the pilot bushing bore and position the driven plate on the flywheel surface.

Position the clutch cover over the driven plate and on the flywheel.

Install the clutch cover attaching bolts finger tight only.

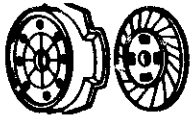
CAUTION: The clutch cover bolts must be tightened correctly to avoid distorting the cover. Tighten the bolts only as outlined to prevent possible cover distortion.

Tighten each cover bolt evenly and in rotation a few threads at a time.

Final tighten the cover bolts. On four-cylinder models, tighten the bolts to 31 N·m (23 ft-lbs) torque. On six-cylinder models, tighten the bolts to 54 N·m (40 ft-lbs) torque.

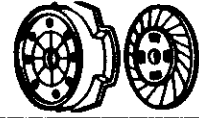
Install the transmission and transfer case as outlined in Chapter E.

SEE
I.S.
NOTES



CLUTCH

CLUTCH SERVICE



PILOT BUSHING REPLACEMENT

Remove the transmission and transfer case as outlined in Chapter E.

Remove the clutch cover and driven plate as outlined in this section.

On six-cylinder models, remove the pilot bushing lubricating wick. Soak the wick in engine oil.

Remove the bushing with puller J 5822 and slide hammer J 2619-01.

CAUTION: The replacement bushing can be damaged if misaligned during installation. Keep the bushing parallel with the crankshaft centerline to avoid damage.

Install the replacement pilot bushing in the crankshaft bore. Use tool J 5824-01 on four-cylinder models or tool J 33169 on six-cylinder models.

On six-cylinder models, squeeze excess oil from the pilot bushing lubricating wick and insert the wick into the pilot bushing bore.

Install the driven plate and clutch cover as outlined in this section.

Install the transmission and transfer case as outlined in Chapter E.

CLUTCH MASTER CYLINDER REMOVAL

Disconnect the hydraulic line from the cylinder.

Cap the hydraulic line and cylinder to prevent dirt entry.

Remove the cotter pin and washer that retain the cylinder push rod on the brake pedal pivot and slide the rod off the pivot.

Remove the nuts attaching the cylinder to the mounting studs on the dash panel.

Remove the cylinder.

CLUTCH MASTER CYLINDER INSTALLATION

Position the cylinder on the dash panel mounting studs.

Install and tighten the cylinder attaching nuts on the studs. Tighten the nuts to 26 N•m (19 ft-lbs) torque.

Connect the hydraulic line to the cylinder. Tighten the line to 15 N•m (11 ft-lbs) torque.

Position the cylinder push rod on the brake pedal pivot and install the retaining washer and a replacement cotter pin.

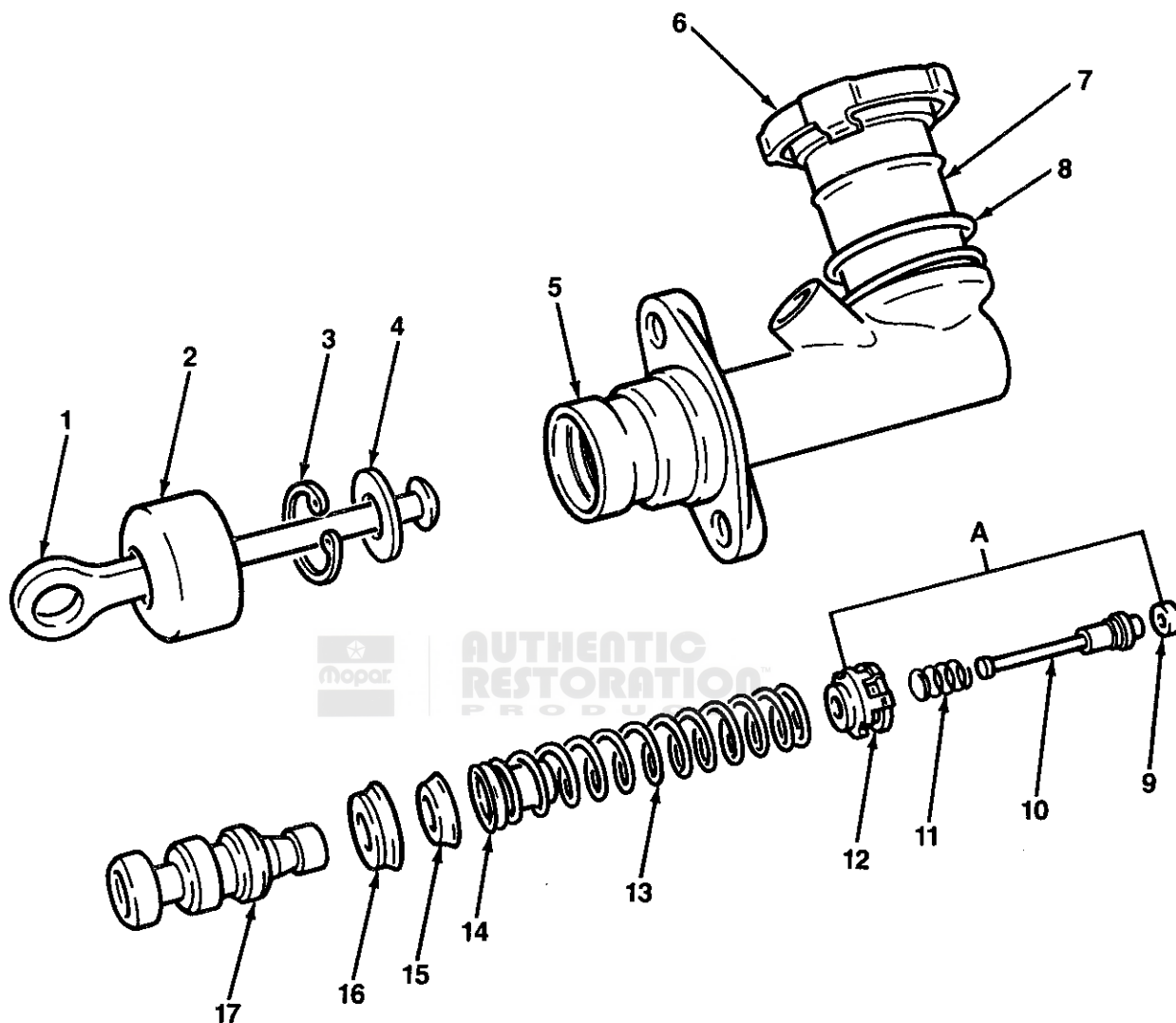
Fill the master cylinder with Jeep brake fluid, or equivalent labeled SAE 1703 or DOT 3, only.

Install the reservoir cap on the cylinder and bleed the hydraulic system. Refer to the bleeding procedure outlined in this section.

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MASTER CYLINDER COMPONENTS

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1. PUSH ROD
2. DUST BOOT
3. SNAP RING
4. WASHER
5. MASTER CYLINDER
6. RESERVOIR CAP
7. RESERVOIR
8. RETAINING CLAMP
9. STEM TIP SEAL

10. VALVE STEM
11. RETAINER SPRING
12. SPRING RETAINER
13. PLUNGER SPRING
14. VALVE STEM RETAINER
15. PLUNGER REAR SEAL
16. PLUNGER FRONT SEAL
17. PLUNGER

CLUTCH MASTER CYLINDER OVERHAUL

Cylinder Disassembly and Cleaning

Remove the reservoir cap (6).

Remove the cylinder dust boot (2).

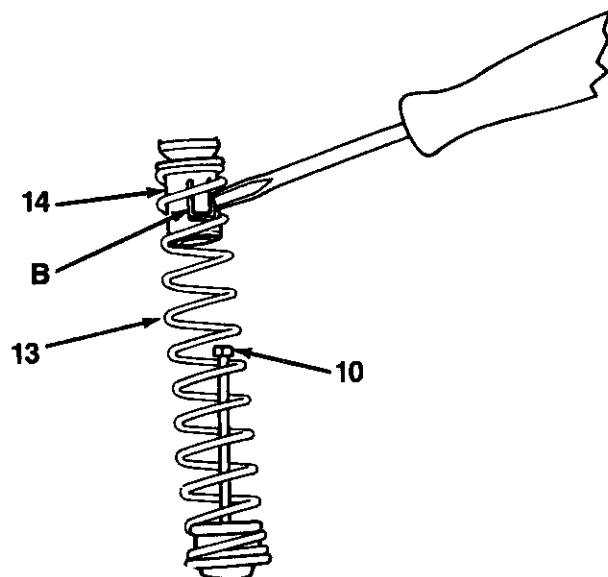
Remove the push rod snap ring (3).

Remove the push rod (1) and washer (4).

Remove the plunger (17), spring (13) and the valve stem assembly (A). Lightly tap the cylinder on a wood block to dislodge the valve stem assembly.

Compress the valve spring (13) slightly. Pry the tab (B) of retainer (14) upward with a small screwdriver to release the valve stem (10).

Remove the retainer (14), spring (13), and valve stem assembly (A) from the plunger (17).



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Remove the seals (15-16) from the plunger (17). Discard the seals.

Remove the spring retainer (12) and spring (11) from the valve stem (10).

Remove the stem tip seal (9) from the valve stem (10). Discard the seal.

Clean all parts thoroughly with fresh brake fluid or brake system cleaner only.

Cylinder Inspection and Assembly

Inspect the cylinder bore for cracks, pitting, corrosion, wear or scoring. Replace the cylinder if the bore exhibits any of these conditions. Inspect the plunger, valve stem retainers, springs, push rod and snap ring. Replace any of these components if worn or damaged.

Lubricate the cylinder bore with clean brake fluid.

Install a replacement seal (9) on the valve stem (10). Be sure the seal shoulder fits in the stem tip undercut.

Install replacement seals (15-16) on the plunger (17). Be sure the seal lips face the valve stem end of the plunger.

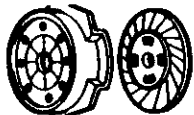
Install the spring (11) and retainer (12) on the valve stem.

Seat the plunger spring (13) on the retainer (12).

Install the plunger retainer (14) in the spring (13) if removed.

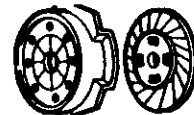
Insert the plunger (17) in the retainer (14).

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CLUTCH

CLUTCH SERVICE



Compress the plunger spring (13) slightly. Align the valve stem (10) with the retainer (14) and seat the stem in the retainer and plunger.

Lock the stem in the retainer by pressing the retainer tab (B) downward.

Lubricate the plunger and valve stem assembly with clean brake fluid.

Install the plunger and valve stem assembly in the cylinder bore.

Install the snap ring and dust boot on the push rod.

Lubricate the ball end of the push rod with the lubricant supplied in the overhaul kit.

Insert the push rod in the plunger. Push the plunger and stem assembly into the cylinder

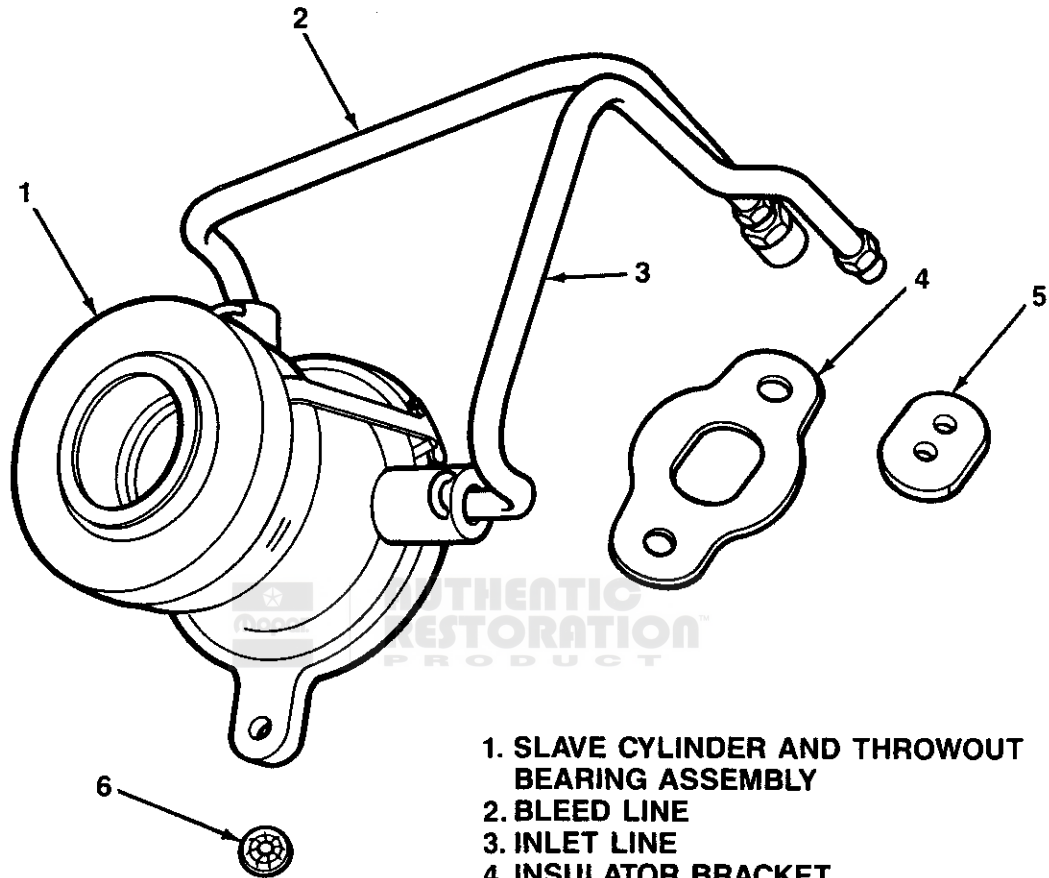
bore. Then seat the washer (4) in the bore and install the push rod snap ring (3).

Install the cylinder dust boot (2). Be sure the boot is firmly seated in the cylinder boot groove.

CLUTCH SLAVE CYLINDER AND THROWOUT BEARING

The integral slave cylinder and throwout bearing assembly (1) is not a serviceable component. The bearing is permanently attached to the cylinder piston and the hydraulic lines are permanently attached to the cylinder. If either the cylinder, bearing or lines become damaged, the entire assembly must be replaced. Removal/installation procedures are as follows.

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1. SLAVE CYLINDER AND THROWOUT BEARING ASSEMBLY
2. BLEED LINE
3. INLET LINE
4. INSULATOR BRACKET
5. INSULATOR
6. RETAINING NUT

SEE
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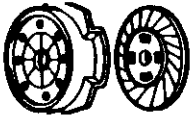
Cylinder and Bearing Removal

Disconnect the master cylinder line (7) from the slave cylinder inlet line (3)

Remove the transmission and transfer case as outlined in Chapter E.

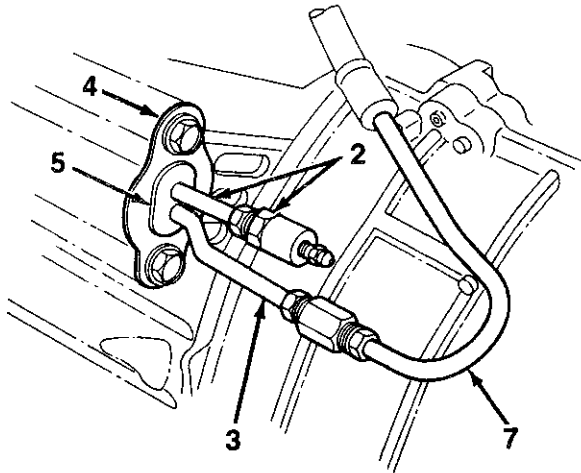
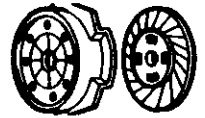
Slide the rubber insulator (5) out of the insulator bracket (4) and off the slave cylinder lines.

Remove the bolts attaching the insulator bracket (4) to the clutch housing and slide the bracket off the cylinder lines (2-3).



CLUTCH

CLUTCH SERVICE

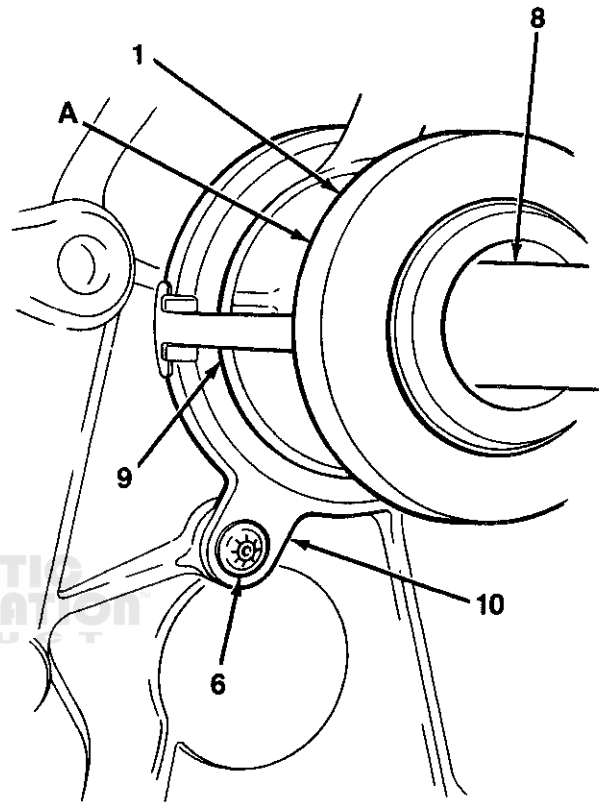


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Remove the cylinder and bearing retaining nut (5). Pry the nut up and off the mounting pin on the transmission front case.

Remove the cylinder and bearing (1) by sliding the assembly off the transmission input shaft (8). If the cylinder and bearing will be reused, take care to avoid bending or kinking the hydraulic lines (2-3) while removing them from the clutch housing.

CAUTION: Do not remove the hydraulic lines from the cylinder and bearing. The lines are not serviceable components and will leak if removal and installation is attempted.

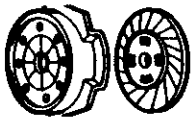


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Cylinder and Bearing Installation

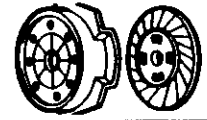
CAUTION: Replacement slave cylinder and bearing assemblies are equipped with nylon retaining straps (A). The straps hold the cylinder piston in place during shipment and installation. Do not remove the straps. They are designed to break away the first time piston movement occurs.

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CLUTCH

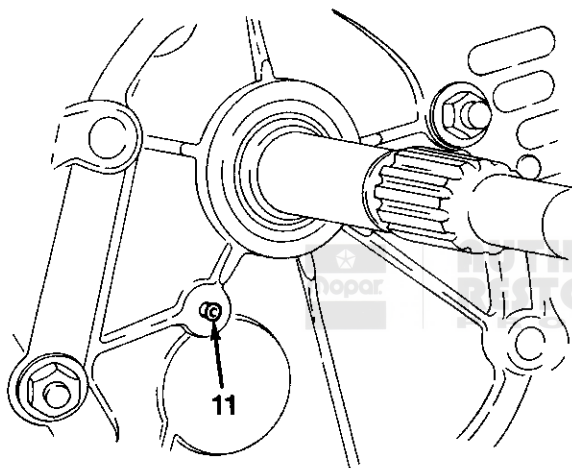
CLUTCH SERVICE



Install the cylinder and bearing assembly on the transmission input shaft (8).

Guide the slave cylinder inlet and bleed lines (2-3) through the opening in the clutch housing.

Position the cylinder mounting boss (10) over the mounting pin (11) and seat the assembly against the transmission front case.



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Secure the cylinder and bearing assembly to the mounting pin (10) with retaining nut (6).

Install the insulator bracket (4) and insulator (5).

Install the transmission and transfer case as outlined in Chapter E.

Connect the master cylinder line (7) to the slave cylinder inlet line (3).

Fill and bleed the clutch hydraulic system as outlined in this section.

CLUTCH HYDRAULIC SYSTEM FLUID

The only fluid recommended for use in the clutch hydraulic system is Jeep brake fluid, or equivalent labeled SAE 1703 or DOT 3. Use recommended fluids only. Never use previously drained fluid or fluid that has been stored in an open container.

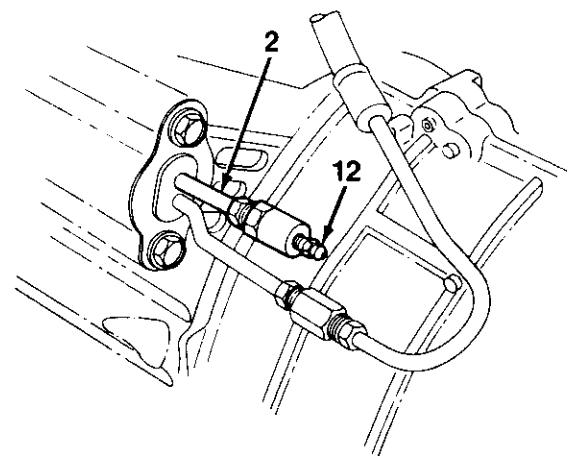
CLUTCH HYDRAULIC SYSTEM BLEEDING

Fill the master cylinder with the specified brake fluid.

Raise the vehicle.

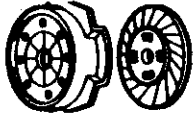
Attach one end of a bleed hose to the bleed screw (12) on the slave cylinder bleed line (2).

Insert the other end of the bleed hose in a glass container partially filled with brake fluid. Be sure the hose end is completely submerged in the brake fluid.



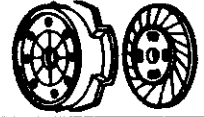
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CLUTCH

CLUTCH SERVICE



Carefully loosen the bleed screw (12). Hold the bleed screw fitting firmly to prevent it from turning while loosening the screw. Do not allow the bleed line (2) to bend or flex when loosening the screw.

Have a helper press and hold the clutch pedal to the floor.

Tighten the bleed screw and have the helper release the clutch pedal.

Check master cylinder fluid level. Add fluid if necessary. Do not allow the cylinder reservoir to run out of fluid during bleeding operations.

Repeat the bleeding process until fluid entering the glass container is free of bubbles.

NOTE: Be sure the bleed hose end remains submerged in brake fluid during bleeding operations.

Lower the vehicle.

Fill the clutch master cylinder to the correct level.

CLUTCH HYDRAULIC SYSTEM FLUID LEVEL

The system fluid is contained in the clutch master cylinder reservoir.

The correct fluid level is indicated on the side of the cylinder reservoir.

Do not overfill the reservoir and use specified fluids only.

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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Crossmember-to-Frame Rail Bolt	41 N•m (30 ft-lbs)	27-41 N•m (20-30 ft-lbs)
Rear Support-to-Crossmember Bolt	45 N•m (33 ft-lbs)	37-52 N•m (27-38 ft-lbs)
Clutch Housing-to-Engine Bolt (ALL)	38 N•m (28 ft-lbs)	30-41 N•m (22-30 ft-lbs)
Transfer Case-to-Transmission Nuts	35 N•m (26 ft-lbs)	30-41 N•m (22-30 ft-lbs)
Universal Joint Clamp Bolts	19 N•m (170 in-lbs)	16-23 N•m (140-200 in-lbs)
Transmission Drain and Fill Plugs	37 N•m (27 ft-lbs)	26-48 N•m (19-35 ft-lbs)
Transfer Case Drain and Fill Plugs	47 N•m (35 ft-lbs)	41-54 N•m (30-40 ft-lbs)



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	GEARBOXES	
	SPECIAL TOOLS	

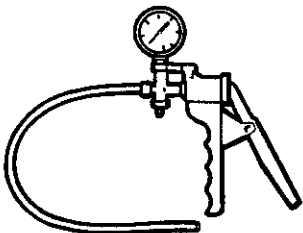
SPECIAL TOOLS

The special tools listed here are for removal/ installation use or general in-vehicle service. Tools required for transmission and transfer

case overhaul operations are detailed in the applicable component service manual.

Tool Ref.	Description
J 5824-01	Clutch Alignment Tool – 4-Cyl.
J 8001	Dial Indicator Set
J 8614-01	Yoke Holder and Remover Tools
J 23738	Vacuum Pump Tool
J 33169	Clutch Alignment Tool – 6-Cyl.
J 33843	Seal Installer

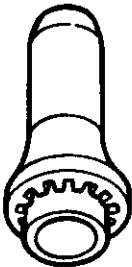
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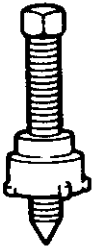
J 23738



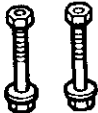
J 8001



J 33843



J 8614-01



J 33169

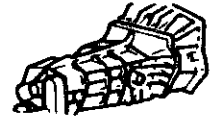


J 5824-01



GEARBOXES

GENERAL INFORMATION



MANUAL TRANSMISSION

Wrangler/YJ vehicles are equipped with either the Model BA 10/5 or the AX-5, five-speed manual transmission depending on engine type.

Model AX-5 is used in four-cylinder models. Model BA 10/5 is used in six-cylinder models. Both transmissions are synchromesh units with fully synchronized gear changing. Fifth gear is an overdrive range in both transmission models. A top mounted shift lever is used for both models.

TRANSFER CASE

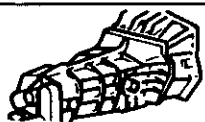
The Model 207 transfer case is used for all engine/transmission applications in Wrangler/YJ models.

The Model 207 is a part-time, four wheel drive unit with three operating ranges plus a Neutral position. A built in low range gear system provides a 2.6:1 reduction ratio for increased low speed torque capability. The three transfer case operating ranges are: Two-wheel high, four-wheel high and four-wheel low. Operating range is selected with a floor mounted shift lever.

Two-wheel high range is for on-road, highway operation. The four-wheel drive ranges are for off-road operation or when the vehicle is driven on paved road surfaces covered by snow, ice, or similar low traction elements.

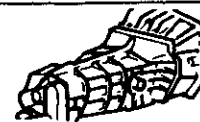
A synchronizer assembly in the transfer case allows the unit to be shifted between while the vehicle is in motion.

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TRANSMISSIONS



GENERAL SERVICE INFORMATION

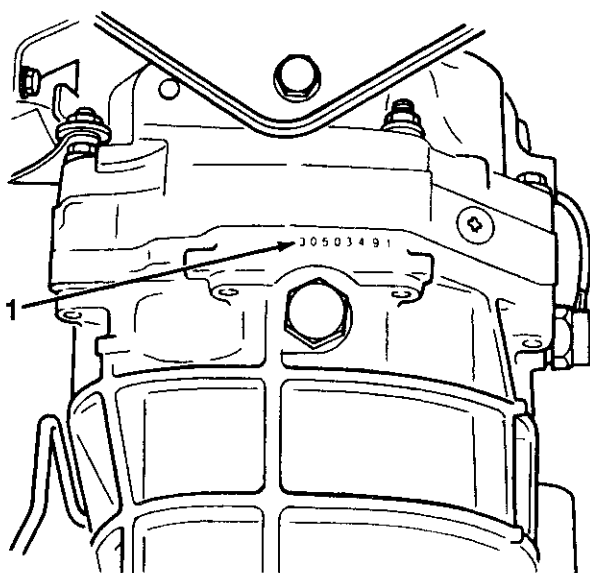
This section covers removal, installation and lubrication procedures for model AX-5 and BA 10/5 manual transmissions.

The procedures, specifications and special tools needed to overhaul the Model 207 transfer case are contained in the B.V. AX-4/5 and B.V. BA 10/5 Component Service Manuals respectively.

Transmission Identification

AX-5 Identification

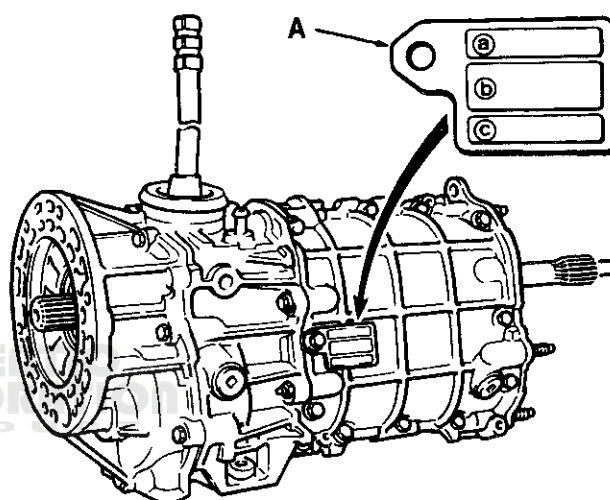
The eight digit AX-5 identification code (1) is stamped on the bottom surface of the transmission case next to the intermediate plate. The first number is year of manufacture (e.g. 5 = 1985, 6 = 1986). The second and third numbers indicate month of manufacture (e.g. 01 = January, 02 = February, etc.). The next series of numbers is the transmission serial number.



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BA 10/5 Identification

The BA 10/5 identification plate (A) is attached to the passenger side of the transmission front case. The Jeep identification/part number is on the top line of the plate. The manufacturers reference number is on the middle line and the transmission serial number is on the lower line.



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Transmission Gear Ratios

Forward speed gear ratios for the AX-5 and BA 10/5 transmissions are as follows:

	AX-5	BA 10/5
First Gear:	3.93:1	4.03:1
Second Gear:	2.33:1	2.38:1
Third Gear:	1.45:1	1.52:1
Fourth Gear:	1.00:1	1.00:1
Fifth Gear:	0.85:1	0.72:1



GEARBOXES

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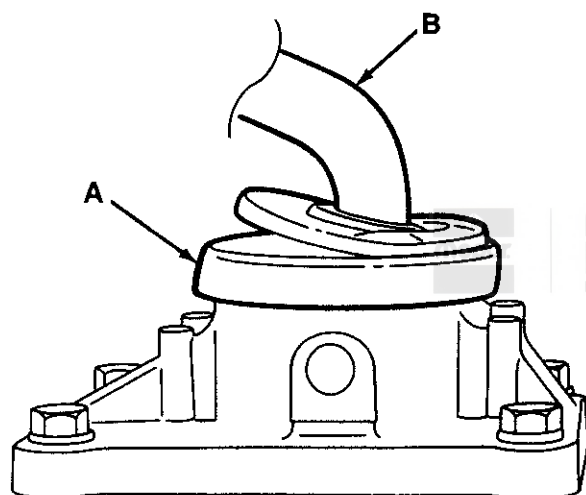


AX-5 TRANSMISSION REMOVAL

Remove the shift knob and locknut from the transmission and transfer case shift levers.

Remove the screws attaching the transmission and transfer case shift lever boots and remove both boots.

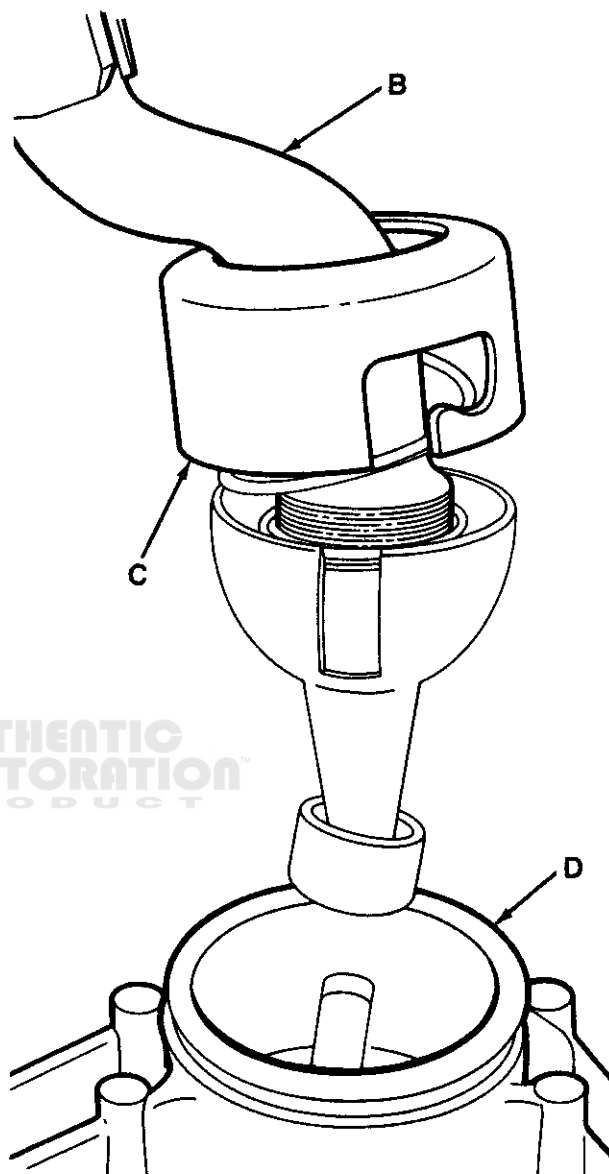
Remove the transmission shift tower dust boot (A).



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Remove the transmission shift lever and stub shaft (B). Press the stub shaft retainer (C) downward. Rotate the retainer counterclockwise to release it from the lugs in the shift tower. Then lift the retainer, stub shaft and shift lever up and out of the shift tower (D).

NOTE: Do not remove the shift lever from the stub shaft.



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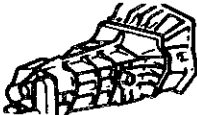
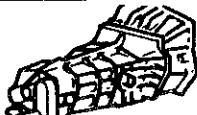
Raise the vehicle and drain the transmission and transfer case lubricant.

Mark the rear propeller shaft for assembly alignment reference and remove the shaft.

Position a safety stand under the transfer case to support the transmission-transfer case assembly.

Remove the rear crossmember.

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Disconnect the speedometer cable.

Disconnect the backup light switch.

Disconnect the transmission and transfer case vent hoses.

Disconnect the transfer case vacuum hoses and range linkage. Tag the vacuum hoses for assembly reference.

Mark the front propeller shaft for alignment reference and remove the shaft.

Disconnect the master cylinder hydraulic line from the slave cylinder inlet line. The slave cylinder line is at the drivers side of the clutch housing.

Position a transmission jack under the transmission-transfer case assembly. Secure the assembly to the jack with safety chains.

Remove the bolts attaching the clutch housing to the engine and remove the transmission-transfer case assembly.

Remove the bolts attaching the transmission to the transfer case and separate the two components.

Remove the slave cylinder and throwout bearing assembly as outlined in Chapter D.

Remove the clutch housing from the transmission.

AX-5 TRANSMISSION INSTALLATION

Install the clutch housing on the transmission.

Install the slave cylinder and throwout bearing assembly.

Insert the shift lever into the transmission tower and shift the transmission into any forward gear. Then remove the shift lever.

Mount the transmission on the transmission jack. Align the splines on the transmission input shaft with the clutch driven plate splines and install the transmission.

Install and tighten the clutch housing-to-engine bolts to 38 N•m (28 ft-lbs) torque.

Connect the clutch slave cylinder inlet line to the master cylinder hydraulic line.

Remove the jack from under the transmission and mount the transfer case on the jack.

Align the transfer case and transmission shafts and install the transfer case. Tighten the transfer case-to-transmission nuts/bolts to 35 N•m (26 ft-lbs) torque.

Remove the transmission jack and position a safety stand under the transfer case to support the assembly.

Connect the transfer case vacuum hoses and linkage.

Connect the transmission and transfer case vent hoses.

Connect the backup light switch switch wires.

Connect the speedometer cable.

Install the rear crossmember. Tighten the crossmember-to-frame bolts to 41 N•m (30 ft-lbs) torque. Tighten the transmission-to-rear support bolts/nuts to 45 N•m (33 ft-lbs) torque.

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	GEARBOXES TRANSMISSIONS	
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Install the shift lever, stub shaft (B) and retainer (C) in the transmission shift tower (D). Seat the retainer in the tower and turn it clockwise to lock it.

NOTE: Be sure the nylon insulator on the end of the stub shaft is fully seated in the shifter block inside the tower. Also be sure the retainer (C) is securely locked into place.

Install the shift tower dust boot (A).

Install the transmission and transfer case shift lever boots, shift knobs and locknuts.

Align and install the front and rear propeller shafts. Tighten the propeller shaft U-joint clamp bolts to 19 N•31m (170 in-lbs) torque.

Fill the transmission and transfer with the specified lubricant.

Lower the vehicle.

BA 10/5 TRANSMISSION REMOVAL

Remove the shift knob and locknut from the transmission and transfer case shift levers.

Remove the screws attaching the transmission and transfer case shift lever boots and remove both boots.

Remove the transmission shift tower dust boot.

Remove the transmission stub shaft retainer plate and remove the stub shaft and shift lever. Do not remove the stub shaft from the lever.

NOTE: On some BA 10/5 transmissions, the shift lever stub shaft may be held in place with a snap ring instead of a retainer plate.

Raise the vehicle and drain the transmission and transfer case lubricant.

Mark the rear propeller shaft for assembly alignment reference and remove the shaft.

Position a safety stand under the transfer case to support the

transmission-transfer case assembly.

Remove the rear crossmember.

Disconnect the speedometer cable.

Disconnect the backup light switch.

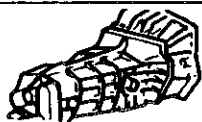
Disconnect the transmission and transfer case vent hoses.

Disconnect the transfer case vacuum hoses and range linkage. Tag the vacuum hoses for assembly reference.

Mark the front propeller shaft for alignment reference and remove the shaft.

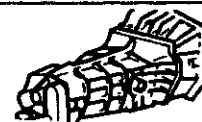
Disconnect the master cylinder hydraulic line from the slave cylinder inlet line. The slave cylinder line is at the drivers side of the clutch housing.

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Position a transmission jack under the transmission-transfer case

assembly. Secure the assembly to the jack with safety chains.

Remove the bolts attaching the clutch housing to the engine and remove the transmission-transfer case assembly.

Remove the bolts attaching the transmission to the transfer case and separate the two components.

Remove the slave cylinder and throwout bearing assembly as outlined in Chapter D.

Remove the clutch housing from the transmission.

BA 10/5 TRANSMISSION INSTALLATION

Install the clutch housing on the transmission.

Install the slave cylinder and throwout bearing assembly.

Insert the shift lever into the transmission tower and shift the transmission into any forward gear. Then remove the shift lever.

Mount the transmission on the transmission jack. Align the splines on the transmission input shaft with the clutch driven plate splines and install the transmission.

Install and tighten the clutch housing-to-engine bolts to 38 N•31m (28 ft-lbs) torque.

N•31m

Connect the clutch slave cylinder inlet line to the master cylinder hydraulic line.

Remove the jack from under the transmission and mount the transfer case on the jack.

Align the transfer case and transmission shafts and install the transfer case. Tighten the transfer case-to-transmission nuts/bolts to 35 N•31m (26 ft-lbs) torque.

Remove the transmission jack and position a safety stand under the transfer case to support the assembly.

Connect the transfer case vacuum hoses and linkage.

Connect the transmission and transfer case vent hoses.

Connect the backup light switch wires.

Connect the speedometer cable.

Install the rear crossmember. Tighten the crossmember-to-frame bolts to 41 N•31m (30 ft-lbs) torque. Tighten the transmission-to-rear support bolts/nuts to 45 N•31m (33 ft-lbs) torque.

Install the shift lever and stub shaft in the transmission shift tower. Secure the stub shaft in the tower with either a retainer plate or snap ring (depending on how the transmission was originally equipped).

Install the shift tower dust boot.

Install the transmission and transfer case shift lever boots, shift knobs and locknuts.

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Align and install the front and rear propeller shafts. Tighten the propeller shaft U-joint clamp bolts to 19 N•31m (170 in-lbs) torque.

Fill the transmission and transfer with the specified lubricant.

Lower the vehicle.

TRANSMISSION LUBRICATION

Lubricant Type

Recommended lubricant for AX-5 and BA 10/5 transmissions is Jeep gear lubricant or an equivalent SAE 75W-90, API Grade GL-5 gear lubricant.



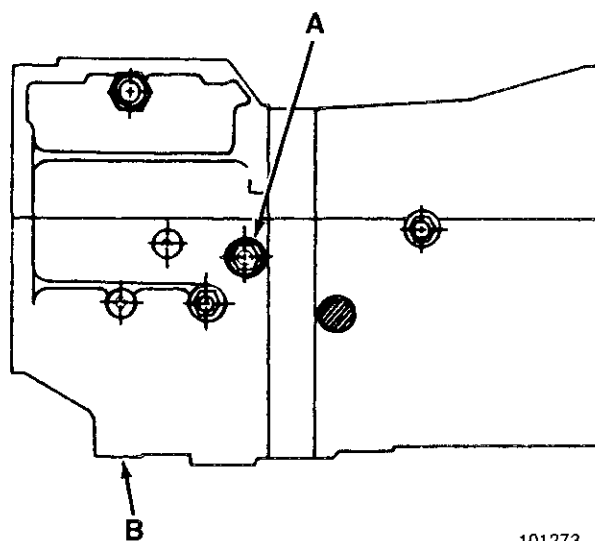
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Lubricant Fill Level

The correct lubricant refill or top-off level for both the AX-5 and BA 10/5 transmissions, is to the bottom edge of the fill plug hole.

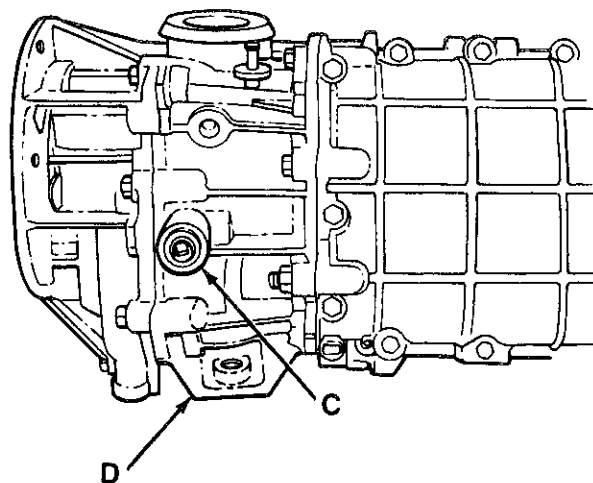
Fill and Drain Plug Locations

The fill plug (A) on AX-5 transmissions is located on the passenger side of the adaptor housing (B). The drain plug is located at the bottom of the case.



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The fill plug (C) on BA 10/5 transmissions is located on the passenger side of the intermediate case (D). The drain plug is located at the back of the rear case.



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	GEARBOXES	
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Lubricant Capacity

Transmission lubricant capacities are:

AX-5: 3.3 liters (7.0 U.S. pints)

BA 10/5: 1.63 liters (3.5 U.S. pints)

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	GEARBOXES TRANSFER CASE	
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GENERAL SERVICE INFORMATION

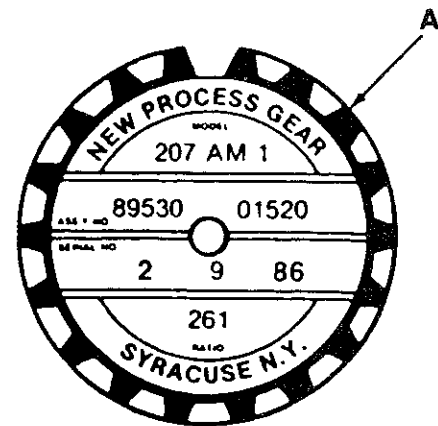
This section covers transfer case removal, installation and lubrication procedures for the Model 207 transfer case.

The procedures, specifications and special tools needed to overhaul the Model 207 transfer case are contained in the T.C. 207 Component Service Manual.

Transfer Case Identification

A circular identification tag is attached to the rear case of each Model 207 transfer case. The tag (A) provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 2-9-86 would represent February 9, 1986.



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Transfer Case Application

The Model 207 transfer case is used for all engine/transmission applications in Wrangler/YJ models.

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	GEARBOXES TRANSFER CASE	
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TRANSFER CASE SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Vehicle speed too great to permit shifting. (2) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty. (3) Transfer case external shift linkage binding. (4) Insufficient or incorrect lubricant. (5) Internal components binding, worn or damaged.	(1) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift. (2) Stop vehicle, shift transmission to neutral, shift transfer case to 2H mode and operate vehicle in 2H on dry paved surfaces. (3) Lubricate, repair or replace linkage, or tighten loose components as necessary. (4) Drain and refill to edge of fill hole with AMC Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. (5) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with AMC Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. Check for leaks and repair if necessary. Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.
NOISY IN — OR JUMPS OUT OF FOUR WHEEL DRIVE LOW RANGE	(1) Transfer case not completely engaged in 4L position. (2) Shift linkage loose or binding. (3) Range fork cracked, inserts worn, or fork is binding on shift rail. (4) Annulus gear or lockplate worn or damaged.	(1) Stop vehicle, shift transfer case in Neutral, then shift back into 4L position. (2) Tighten, lubricate or repair linkage as necessary. (3) Disassemble unit and repair as necessary. (4) Disassemble unit and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(1) Extended operation on dry hard surface (paved) roads in 4H range.	(1) Operate in 2H on hard surface (paved) roads.

SEE I.S. NOTES

TRANSFER CASE REMOVAL

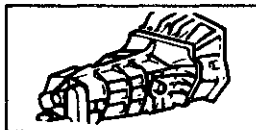
Shift the transfer into four-high range.

Raise the vehicle.

Drain the transfer case lubricant.

Mark the front and rear propeller shafts for alignment reference and remove the shafts.

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GEARBOXES

TRANSFER CASE



Disconnect the transfer case vent and vacuum hoses. Tag the hoses for assembly reference.

Disconnect the transfer case shift linkage rod from the shift lever.

Disconnect the speedometer cable.

Support the transmission with a jack stand.

Remove the rear crossmember.

Position a transmission jack under the transfer case. Raise the jack just enough to support the transfer case.

Remove the transfer case-to-transmission attaching nuts and remove the transfer case.



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TRANSFER CASE INSTALLATION

Mount the transfer case on a transmission jack and raise the transfer case to the level of the transmission.

Align the transfer case and transmission shaft splines and install the transfer case. Tighten the transfer case attaching nuts to 35 N•m (26 ft-lbs) torque.

Connect the speedometer cable and the transfer case shift linkage.

Connect the transfer case vent and vacuum hoses.

Connect the front and rear propeller shafts. Tighten the U-joint clamp bolts to 19 N•m (170 in-lbs) torque.

NOTE: Be sure to align the propeller shaft yokes with the axle yokes according to the reference marks made during removal.

Install the rear crossmember. Tighten the crossmember-to-frame bolts to 41 N•m (30 ft-lbs) torque. Tighten the rear support-to-crossmember bolts to 45 N•m (33 ft-lbs) torque.

Remove the support stands.

Fill the transfer case with Jeep Quadra-Trac lubricant.

Adjust the transfer case shift linkage. Refer to the procedure in this section.

Lower the vehicle.

TRANSFER CASE SHIFT LINKAGE ADJUSTMENT

Remove the transfer case shift lever boot.

Move the shift lever (1) into two-high position.

Insert a 3 mm (1/8-in) spacer between the shift lever and the forward edge of the shift lever gate. Secure the lever and spacer in position.

Raise the vehicle.

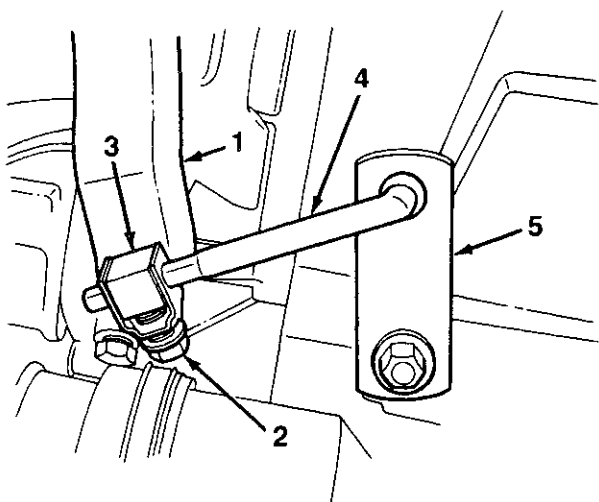
Loosen the lock bolt (2) on adjusting trunnion (3) just enough to allow linkage rod (4) to slide freely in the trunnion.

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TRANSFER CASE



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Move the range lever (5) all the way rearward into two-high position.

Position linkage rod (4) so it is a 'free' fit in the range lever (5). Then tighten the trunnion locknut (2).

Lower the vehicle.

Remove the shift lever spacer and install the shift lever boot.

TRANSFER CASE LUBRICATION

Lubricant Type

Recommended lubricant for the Model 207 transfer case is Jeep automatic transmission fluid or an equivalent Dexron® II automatic transmission fluid.

Lubricant Fill Level

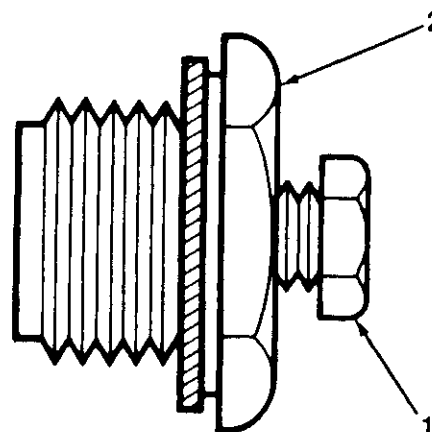
The correct refill or top-off lubricant level for the Model 207 transfer case is to the bottom edge of the fill plug hole.

Two-Piece Fill Plug

The Model 207 transfer is equipped with a two-piece fill plug. Fluid level is checked at the small pipe plug (1).

To check fluid level, remove the small pipe plug (1) from the main plug (2). The correct fluid level is to the bottom edge of the pipe plug hole.

NOTE: If the transfer case is not equipped with a two-piece fill plug, correct fill level is to the bottom edge of the fill plug hole.



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	GEARBOXES TRANSFER CASE	
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Lubricant Capacity

Lubricant capacity of the Model 207 transfer case is: 2.1 liters (4.5 U.S. pints).

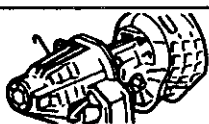
SPEEDOMETER GEAR APPLICATION CHART

AXLE RATIO	TIRE SIZE	DRIVEN GEAR ASSEMBLY	
		Number of Gear Teeth	Gear Color
3.08	P205/75R15	21	GREEN
	P215/75R15	21	GREEN
	P225/75R15	20	BLUE
3.55	P205/75R15	19	RED
	P215/75R15	18	YELLOW
	P225/75R15	18	YELLOW
4.10	P205/75R15	22	BLACK
	P215/75R15	21	GREEN
	P225/75R15	21	GREEN

NOTE: The speedometer drive gear in the model 207 transfer case has 7 teeth.

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AUTOMATIC TRANSMISSION

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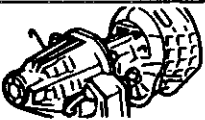
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AUTOMATIC TRANSMISSION

SPECIFICATIONS



TORQUE SPECIFICATIONS

Component	Service Set-To-Torque	Service Recheck Torque
Cooler Line Fitting	18 N•m (160 in-lbs)	14-23 N•m (120-200 in-lbs)
Cooler Line Nut	17 N•m (150 in-lbs)	15-20 N•m (130-180 in-lbs)
Converter Drive Plate-to-Crankshaft Bolts	142 N•m (105 ft-lbs)	129-156 N•m (95-115 ft-lbs)
Converter Drive Plate-to-Torque Converter Bolts	35 N•m (26 ft-lbs)	30-44 N•m (22-30 ft-lbs)
Adapter Housing-to-Transmission Case Bolt	33 N•m (24 ft-lbs)	
Governor Body Bolt	11 N•m (100 in-lbs)	
Front Band Adjusting Screw Locknut	47 N•m (35 ft-lbs)	
Kickdown Lever Shaft Plug	17 N•m (150 in-lbs)	
Rear Band Adjusting Screw Locknut	47 N•m (35 ft-lbs)	
Neutral Safety Switch	33 N•m (24 ft-lbs)	
Oil Filler Tube Bracket Bolt	17 N•m (150 in-lbs)	
Oil Pan Bolt	17 N•m (150 in-lbs)	12-18 N•m (9-13 ft-lbs)
Oil Pump Housing-to-Transmission Case Bolt	20 N•m (175 in-lbs)	
Output Shaft Support Bolt	17 N•m (150 in-lbs)	
Overrunning Clutch Cam Setscrew	4 N•m (40 in-lbs)	
Pressure Test Port Plug	12 N•m (110 in-lbs)	
Reaction Shaft Support-to-Oil Pump Bolt	18 N•m (160 in-lbs)	
Transmission-to-Engine Bolt	38 N•m (28 ft-lbs)	35-41 N•m (26-30 ft-lbs)
Valve Body Screw	4 N•m (35 in-lbs)	
Valve Body-to-Transmission Case Screw	11 N•m (100 in-lbs)	
Rear Crossmember-to-Frame Rail Bolts	41 N•m (30 ft-lbs)	27-41 N•m (20-30 ft-lbs)
Support Cushion-to-Rear Crossmember Bolts	45 N•m (33 ft-lbs)	37-52 N•m (27-38 ft-lbs)
Universal Joint Clamp Bolts	19 N•m (170 in-lbs)	16-23 N•m (140-200 in-lbs)

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AUTOMATIC TRANSMISSION

SPECIFICATIONS



HYDRAULIC PRESSURE TEST SPECIFICATIONS

Lube Pressure	Closed Throttle Full Throttle	34 - 207 kPa (5 - 30 psi) 34 - 207 kPa (5 - 30 psi)
Line Pressure	Closed Throttle 1000 RPM	372 - 414 kPa (54 - 60 psi) 648 kPa (94 psi)
Front Servo Release	Third Gear Only	No more than 21 kPa (3 psi) lower than line pressure.
Rear Servo Apply	1 Range R Range	No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 RPM.
Governor	D Range Closed Throttle	Pressure should respond smoothly to changes in MPH and return to 0 - 7 kPa (0 - 1-1/2 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1-1/2 psi) at standstill will prevent transmission from downshifting.

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STALL SPEED SPECIFICATIONS

Transmission Model	Engine RPM
999	1850-2150

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FLUID CAPACITY AND GEAR RATIOS

Fluid Capacity - Transmission and Torque Converter
Model 999 8 liters (17 pints)
Cooling Method Water-Heat Exchanger in
Radiator Lower Tank
Fluid Pressure and Lubrication -
Model 999 Rotor-Type Pump
Gear Ratios - Model 999
First 2.74:1
Second 1.55:1
Third 1.00:1
Reverse 2.20:1

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	AUTOMATIC TRANSMISSION SPECIFICATIONS	
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TRANSMISSION FLUID

Use JEEP automatic transmission fluid or an equivalent Dexron® II transmission fluid only.



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BAND ADJUSTMENT SPECIFICATIONS

FRONT BAND:

- Tighten screw to 8 N•m (72 in-lbs)
- Back off screw 2 turns

REAR BAND:

- Tighten screw to 8 N•m (72 in-lbs)
- Back off screw 4 turns

NOTE: Tighten screw to 4 N•m (36 in-lbs) if extension J 24063 is used.

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	AUTOMATIC TRANSMISSION SPECIAL TOOLS	
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SPECIAL TOOLS

Tool Ref.	Description
Ele. AB-99	ISA Motor Exerciser Box
J 5853-B	0-250 in-lb. Torque Wrench
J 24027	Pressure Test Set
J 24031	Kickdown Valve Gauge
J 24033	Pump Rotor Alignment Tool
J 24063	Kickdown Band Adjustment Adapter

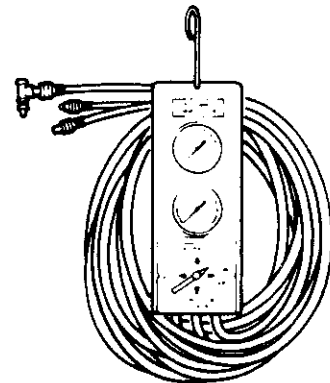
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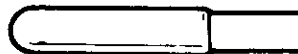
J 5853-B



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J 24027



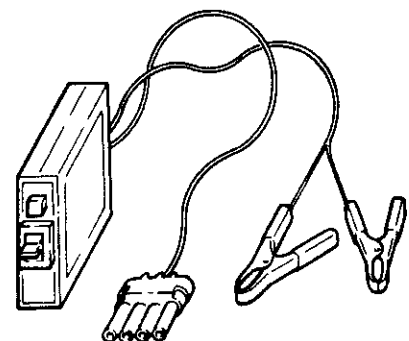
J 24031



J 24033

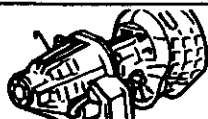


J 24063



Ele. AB-99

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AUTOMATIC TRANSMISSION

GENERAL INFORMATION



GENERAL SERVICE INFORMATION

The Model 999, three speed, automatic transmission is used in Wrangler/YJ models.

This section covers removal, installation, lubrication and in-vehicle service and adjustment procedures for the Model 999 automatic transmission.

The procedures, specifications and special tools needed to overhaul the Model 999 transmission are contained in the T.A. 700/900 Component Service Manual.

TRANSMISSION COMPONENTS

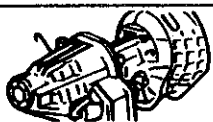
The Model 999 is a three speed, automatic transmission with a compound planetary gear system. A shift lever and linkage is used to select desired drive range. Transmission shift points are controlled by an externally mounted throttle linkage. The transmission case and converter housing are a one-piece aluminum casting. An aluminum adapter housing connects the transmission to the transfer case models.

The Model 999 has two multiple disc clutches (3-4), two bands and actuating servos (7-18), an overrunning clutch (8) and two planetary gear sets (5-6). These components provide one reverse and three forward gear ranges. The planetary gear sets (5-6) are connected by a common sun gear. The sun gear is interconnected to the multiple disc clutches through the driving shell (16) which is splined to the sun gear and front clutch retainer.

The hydraulic system consists of a single oil pump (2), a valve body (15) containing the pressure regulating shift control valves, a governor valve (9), two servos and a three element torque converter.

The transmission fluid is cooled by circulating the fluid through an external cooler built into the radiator lower tank. Transmission fluid is filtered by a Dacron element filter attached to the valve body.

The transmission is vented through a passage drilled into the upper portion of the oil pump housing.

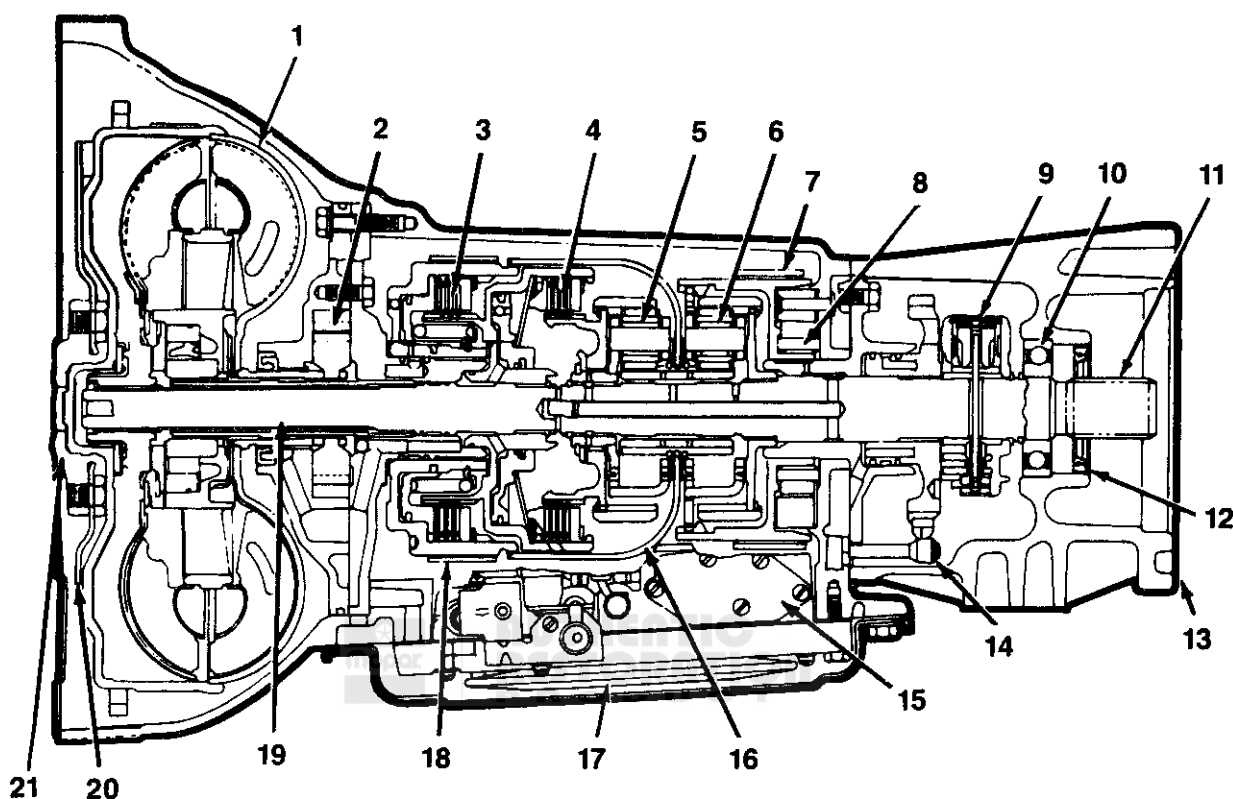


AUTOMATIC TRANSMISSION

GENERAL INFORMATION



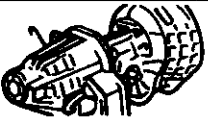
MODEL 999 TRANSMISSION COMPONENTS



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- | | |
|-----------------------------|----------------------------|
| 1. Torque Converter | 12. Seal |
| 2. Oil Pump | 13. Adapter Housing |
| 3. Front Clutch | 14. Parking Lock Assembly |
| 4. Rear Clutch | 15. Valve Body |
| 5. Front Planetary Gear Set | 16. Sun Gear Driving Shell |
| 6. Rear Planetary Gear Set | 17. Oil Filter |
| 7. Rear Band | 18. Front Band |
| 8. Overrunning Clutch | 19. Input Shaft |
| 9. Governor | 20. Drive Plate |
| 10. Bearing | 21. Engine Crankshaft |
| 11. Output Shaft | |

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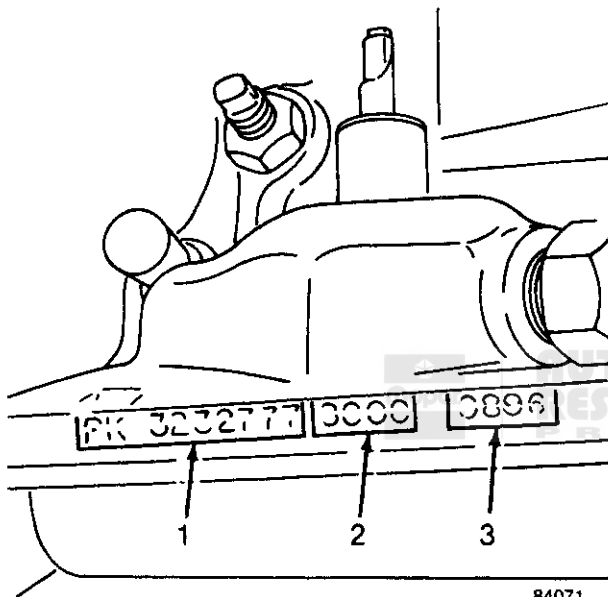
AUTOMATIC TRANSMISSION

GENERAL INFORMATION



TRANSMISSION IDENTIFICATION

A seven-digit part number (1) is stamped on the left side of the case just above the oil pan surface. This number is followed by a four-digit code number (2) which indicates date of manufacture. The final four-digit number group (3) is the transmission serial number.



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TORQUE CONVERTER IDENTIFICATION

The torque converter has an identification decal attached to the converter. The decal indicates converter type and stall ratio. The letters LS indicate a low stall converter. The letters HS indicate a high stall converter.

Torque Converter Service

The torque converter cannot be disassembled for repair. The converter must be replaced as an assembly if diagnosis reveals a malfunction.

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PRELIMINARY DIAGNOSIS

The preliminary diagnosis is the first step in the diagnostic sequence. Two basic procedures are involved. The first procedure is for vehicles that are driveable. The second procedure is for vehicles that will not back up or move forward.

Vehicle Is Driveable

Verify engine operating condition.

Check transmission fluid level and condition.

Adjust the throttle and gearshift linkage before road testing if the complaint was based on delayed, erratic, or harsh shifts.

Perform a stall test if the complaint was based on sluggish, low-speed acceleration or abnormal throttle opening requirements to maintain highway speeds.

Road test the vehicle and analyze the results. Refer to Road Test and Road Test Analysis in this section.

Perform hydraulic and air pressure tests if road test analysis indicates this is necessary.

Vehicle Will Not Back Up or Move Forward

Verify proper engine operation.

Check transmission fluid level and condition.

Check for broken or disconnected throttle linkage.

Check for broken cooler lines and loose or missing pressure test port plugs.

Raise the vehicle, start the engine and shift the transmission into gear.

- If the propeller shafts turn but the wheels do not, the problem is in the differential or axle shafts.
- If the propeller shafts do not turn and the transmission is noisy, stop the engine. Remove the transmission oil pan and check for debris. If debris is not present, remove the transmission and check for a damaged drive plate, drive plate bolts, converter hub, input or output shaft, or oil pump.
- If the propeller shafts do not turn and the transmission is not noisy, perform a hydraulic pressure test to determine if the problem is related to a hydraulic or mechanical component.

FLUID LEVEL AND CONDITION

Check fluid level and condition as follows.

WARNING: Keep hands or loose articles of clothing away from the fan, accessory drive belts or other rotating engine parts. Contact with rotating or hot engine components can result in personal injury.

Drive the vehicle until the transmission fluid is at normal operating temperature of approximately 79.4°C (175°F).

NOTE: Avoid inaccurate fluid level readings. Do not check fluid level until the fluid is at normal operating temperature.

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Shift the transmission into Neutral.

Apply the parking brakes.

Operate the engine at curb idle speed.

Clean the transmission filler cap and tube before removing the dipstick.

Remove the transmission dipstick and check fluid level. Correct fluid level is between the ADD and FULL marks on the dipstick.

Adjust fluid level if necessary.

NOTE: If fluid level was abnormally low, check the transmission for leaks.

Check condition of the fluid. The fluid should be dark red in color and free of dirt or debris.

- If the fluid is discolored or smells burned, but the transmission operates correctly, replace the fluid and filter.
- If the fluid is badly discolored, burned and contains metal or friction material particles and shift problems were experienced, overhaul may be required.

Stop the engine and seat the dipstick in the fill tube after checking fluid level.

NOTE: A low fluid level allows the pump to take in air along with the fluid. Aerated fluid causes low pressures and delayed shifts. If the transmission is overfilled, the fluid will churn into foam causing the same conditions. In either case, air in the fluid will cause overheating, oxidation and varnish buildup. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

Fluid condition must also be checked. When the fluid is dark, smells burnt or is contaminated

with metal or friction material particles, overhaul may be necessary. Examine the fluid on the dipstick closely. After checking fluid level and condition, seat the dipstick fully to seal out water and dirt.

LINKAGE ADJUSTMENT

Correct transmission throttle and gearshift linkage adjustment is important to proper operation. Misadjusted linkage can cause shift problems and premature wear of transmission components.

Throttle Linkage

The throttle (TV) linkage positions a valve that controls shift speed, quality and timing. If adjustment is too short, early shifts and slippage between shifts may occur. If adjustment is too long, shifts may be delayed and part throttle downshifts may be very sensitive.

Gearshift Linkage

The gearshift linkage positions the manual valve in the valve body. Incorrect adjustment will cause creeping in Neutral, premature clutch wear, delayed engagement in any gear, or a no-start condition.

Gearshift Linkage Check

Proper operation of the neutral start switch will provide a quick check of linkage adjustment as follows.



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Turn the ignition key to On position.

Move the gearshift lever into Park.

Turn the ignition key to Start position. If the starter operates, Park position is correct.

Stop the engine.

Move the gearshift lever into Neutral.

Turn the ignition key to Start position. If the starter operates, Neutral position is correct and the linkage is properly adjusted.

NOTE: If the starter fails to operate in Park or Neutral, or if the gearshift lever had to be moved back and forth to start the engine, linkage adjustment is required.

ROAD TEST

Before road testing, be sure the fluid level, throttle and gearshift linkage adjustments have been checked and corrected if necessary.

Observe engine performance during the test (an engine malfunction will effect transmission operation). Operate the transmission in all gearshift positions and check for slippage or shift variations. Note if shifts are harsh or spongy, and record the speeds at which up-and-down shifts occur.

Watch closely for slippage or engine speed flare-up which indicates clutch, band or overrunning clutch problems. If the condition is advanced, the transmission may not shift into one or more drive ranges.

The Clutch and Band Application Chart provides a basis for analyzing road test results. A

slipping clutch or band can be determined by noting transmission operation in all gearshift lever positions and then comparing which elements are applied in each position.

Clutch and Band Application Chart

Drive Elements	Gearshift Lever Position								
	P	R	N	D			2		1
				1	2	3	1	2	
Front Clutch		•				•			
Front Band					•			•	
Rear Clutch				•	•	•	•	•	•
Rear Band		•							•
Over-running Clutch				•			•		•

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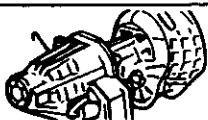
Analyzing Road Test Results

Refer to the Clutch and Band Application Chart. Note what elements are applied in the various gear ranges. The rear clutch is applied in all forward ranges (D, 2, 1). The overrunning clutch is applied in first gear D and 2 range only. The rear band is applied in 1 and R range only.

For example, if slippage occurs in D and 2 range first gear but not in 1 range, the overrunning clutch is slipping. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that both clutches are applied in D third gear only. If slippage occurs in third gear, either the front or rear clutch is slipping. By selecting another gear which does not use one of these

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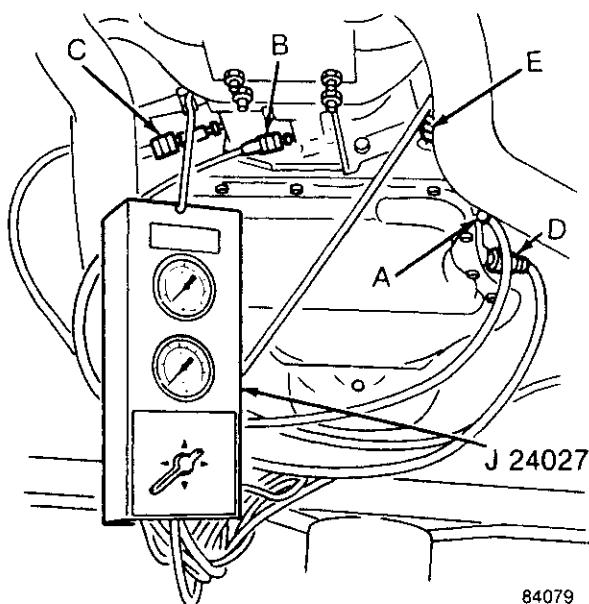


elements, the slipping clutch can be determined. For example, if slippage also occurs in reverse, the front clutch is slipping. If the transmission does not slip in reverse, the rear clutch is slipping.

NOTE: Although road test analysis will identify the slipping element, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Do not disassemble the transmission until hydraulic and air pressure tests have been performed.

HYDRAULIC PRESSURE TEST

The hydraulic pressure test is performed with Test Set J 24027. The set consists of five color-coded pressure hoses, a 2 758 kPa (400 psi) capacity high pressure gauge and a 689 kPa (100 psi) capacity low pressure gauge.



The high pressure gauge is used to record rear servo pressure in R and 1 positions only. The low pressure gauge is used for all other readings.

The test set permits simultaneous connection to all the pressure ports for sequential or independent pressure readings.

Pressure Test Port Location/Connection

The accumulator line pressure port (1) is on the right side of the case between the front and rear servo castings. Connect the blue hose (A) to this port.

The governor pressure port (2) is in the lower center section of the adapter housing. Connect the black hose (B) to this port.

Lubrication pressure is measured by installing a T-fitting in the fluid cooler return line. The line is attached to the fitting (3) on the left rear edge of the case. Connect the white hose (C) to the cooler line.

The front servo release pressure port (4) is on the right side of the case just behind the filler tube opening. Connect the yellow hose (D) to this port.

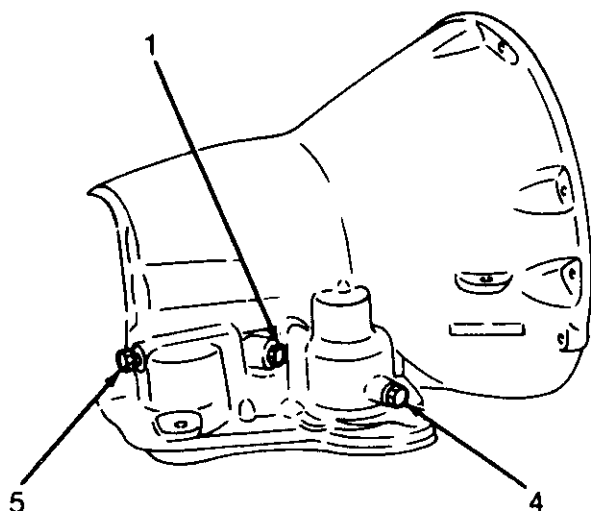
The rear servo apply pressure port (5) is on the right side of the case just above the oil pan. Connect the red hose (E) here.

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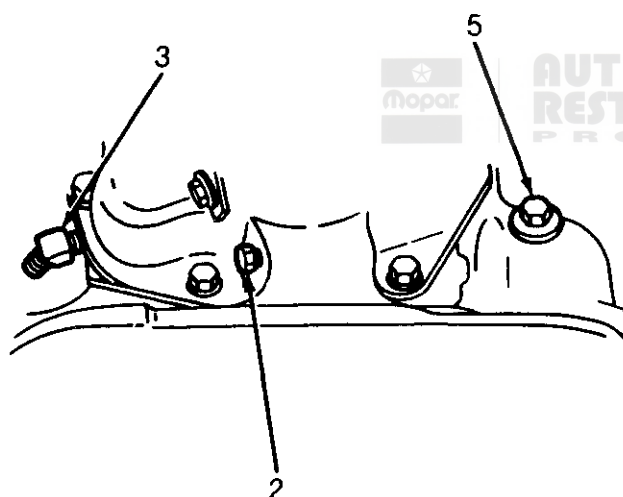


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Hydraulic Pressure Test Procedure

Before testing, check and adjust the fluid level and linkage.

Connect a tachometer to the engine.

Raise the vehicle on a hoist that will allow the wheels to rotate freely.

Connect the test gauge hoses to the appropriate pressure ports.

Test One

Test one checks pump output, pressure regulator valve operation, front/rear clutch and oil filter condition. It measures transmission operating pressure at the accumulator and front servo pressure ports in D range.

Turn the test gauge selector handle to line pressure position.

Start and operate the engine at idle speed.

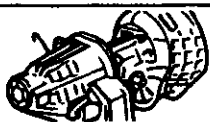
Move the gearshift lever to D range and note line pressure. Pressure should be 372 to 414 kPa (54 to 60 psi).

Increase engine rpm to 1600 and slowly move the valve body throttle lever fully forward, then fully rearward. With the throttle lever in the forward position, pressure should be 372 to 414 kPa (54 to 60 psi) and gradually increase to 648 kPa (94 psi) as the lever is moved rearward.

Turn the test gauge selector to front servo apply position.

Operate the engine at 1000 rpm. Allow the transmission to upshift into third gear and note servo pressure. Pressure should not vary from previous line pressure by more than 21 kPa (3 psi).

Slowly move the throttle linkage to full throttle position and note servo pressure prior to and after transmission downshift. Servo pressure



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should increase then drop to 0 psi after downshift.

Test Two

This test checks pump output, pressure regulation, and front clutch/rear servo condition by comparing operating pressures at the rear servo and accumulator pressure ports in ranges 1 and 2.

Turn the test gauge selector to line pressure position.

Move the gearshift lever to 1 range and operate the engine at 1000 rpm.

Slowly move the valve body throttle lever fully forward then fully rearward. In the forward position, pressure should be 372 to 414 kPa (54 to 60 psi) and gradually increase to 621 to 662 kPa (90 to 96 psi) as the lever is moved rearward.

Turn the test gauge selector handle to the rear servo apply position.

Operate the engine at 1000 rpm.

Slowly move the valve body throttle lever fully forward then fully rearward. Compare servo pressure with line pressure at the accumulator port. Servo pressure should not vary from line pressure by more than 21 kPa (3 psi).

Turn the test gauge selector to line pressure position.

Place the gearshift lever in 2 range and operate the engine at 1000 rpm.

Slowly move the valve body throttle lever fully forward then fully rearward. In the forward position, pressure should be 372 to 414 kPa (54 to 60 psi) and 621 to 662 kPa (90 to 96 psi) as the lever is moved rearward.

Test Three

This test checks pump output, pressure regulation and the front clutch/rear servo condition by measuring and comparing operating pressure at the rear servo pressure port in Reverse.

NOTE: For this test, only the high pressure gauge is used. The gauge hose is connected directly to the rear servo. It is not necessary to move the gauge selector to any specific position.

Operate the engine at curb idle speed.

Move the gearshift lever to Reverse and note the gauge reading. Pressure should be approximately 1 103 kPa (160 psi) at idle.

Slowly increase engine speed to 1600 rpm and note the high pressure gauge reading again. Pressure should increase to approximately 1 862 kPa (270 psi) as engine speed is increased.

Operate the engine at idle speed. Move the gearshift lever from Reverse to Drive and note the high pressure gauge reading. Pressure should drop to 0 psi when the lever is moved to Drive. This test checks for leakage into the rear servo which can cause rear band burnout.

Test Four

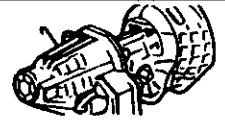
This test checks governor operation. It measures governor pressure response to changes

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in engine speed. It is necessary to check governor operation only when speeds are incorrect or the transmission will not downshift.

Turn the test gauge selector to governor pressure position.

Move the gearshift lever to D range. Operate the engine at idle speed and note pressure. The pressure should be 10 kPa (0 to 1-1/2 psi) maximum. If pressure exceeds this figure, the governor valve or weights are sticking open.

Slowly increase engine speed and observe both the speedometer and test gauge. Governor pressure should increase in proportion to vehicle speed (approximately 1 psi per 1 mph). The pressure rise should be smooth and drop back to 10 kPa (0 to 1-1/2 psi) when the throttle is closed.

Test Five

This test checks lubrication pressure. The test is especially important when the transmission is

noisy, when unexplained rear clutch failure has occurred, or when fluid is forced out the fill tube and the fluid level was known to be correct.

Install the T-fitting in the transmission cooler line.

Connect the white test gauge hose to the T-fitting and turn the test gauge selector to lubrication pressure position.

Start and operate the engine at idle speed. Move the gearshift lever to D range and note pressure.

Lubrication pressure at idle speed should be 35 to 103 kPa (5 to 15 psi).

Increase engine speed to 1000 rpm and slowly move the valve body throttle lever fully forward then fully rearward. With the lever forward, pressure should be 35 to 103 kPa (5 to 15 psi). With the lever rearward, pressure should be 68 to 207 kPa (10 to 30 psi).

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HYDRAULIC PRESSURE TEST DIAGNOSIS

Condition	Indication
Line pressure OK during any one test	Pump and regulator valve OK
Line pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (servo, clutch seals, governor support seal rings)
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area (servo, clutch seals, retainer bore, pump seal rings)
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck pressure regulator valve, worn or defective pump
Governor pressure high at idle Exceeds 10.3 kPa (1-½ psi)	Governor valve sticking open
Governor pressure zero or below specifications at all mph figures	Governor valve sticking in closed position
Lubrication pressure low at all throttle positions	Clogged oil cooler or lines, seal rings leaking, output shaft plugged with debris, worn bushings in pump or clutch retainer

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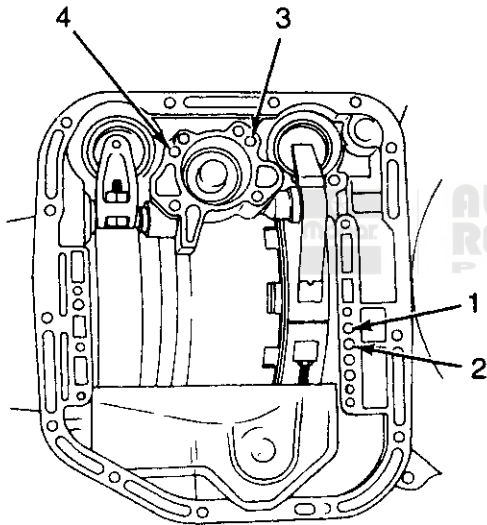
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AIR PRESSURE TEST

Air pressure testing checks clutch, band and servo operation before and after repair. The test involves substituting air pressure for fluid pressure to operate the clutches and bands. The valve body must be removed for this test.

NOTE: Use dry, filtered compressed air only to perform air pressure tests. Pressures of 207 to 689 kPa (30 to 100 psi) are required to perform the tests.



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Rear Clutch Test

Place one or two fingers on the clutch housing and apply air pressure to the rear clutch apply passage (2). Movement of the piston may be felt and a soft thud may be heard as the clutch applies. Check for excessive air leakage while pressure is applied.

Front Servo Test

Apply air pressure to the front servo apply passage (3). The servo rod should extend and apply the front band. Check for excessive air leakage while pressure is applied. Spring tension should release the servo when air pressure is removed.

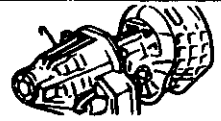
Front Clutch Test

Place one or two fingers on the front clutch retainer and apply air pressure to the front clutch apply passage (1). Movement of the piston can be felt and a soft thud may be heard as the clutch applies. Check for excessive air leakage while pressure is applied.



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Rear Servo Test

Apply air pressure to the rear servo apply passage (4). The servo rod should extend and apply the rear band. While air pressure is applied, check for excessive air leakage. Spring tension should release the servo when air pressure is removed.

GOVERNOR

Governor operational problems are diagnosed using the road test and hydraulic pressure test procedures.

STALL TEST

Stall testing checks the holding ability of the converter stator-clutch and the transmission clutches. Stall testing determines maximum engine rpm obtainable at full throttle with the wheels locked and the transmission in Drive. Refer to the Stall Speed Specifications Chart and diagnosis guides when testing is completed.

WARNING: Never allow anyone to stand in front of the vehicle when performing a stall test. Block the front wheels and have the parking and service brakes fully applied during the test.

Stall Test Procedure

Connect a tachometer to the engine.

Check and adjust transmission fluid level.

Start and operate the engine until the transmission fluid reaches operating temperature.

Block the front wheels.

Fully apply the parking brakes.

Fully apply the service brakes.

Open the throttle completely and record maximum obtainable engine rpm. Engine rpm should be between 1850-2150 rpm.

CAUTION: Release the accelerator immediately if engine speed exceeds 2150 rpm. Engine speed above this figure indicates transmission clutch slippage is occurring. Do not hold the throttle open any longer than five seconds at a time. If more than one stall test is required, operate the engine at 1000 rpm with the transmission in Neutral for at least 20 seconds to cool the transmission fluid, and release.

Shift the transmission into Neutral and operate the engine for 20 seconds to cool transmission fluid.

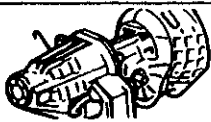
Stop the engine, shift the transmission into Park and release the brakes.

Refer to the stall test diagnosis.

Stall Test Diagnosis

Stall Speed Too High

If engine speed is 2300 rpm or higher, transmission clutch slippage is indicated.



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Stall Speed Too Low

If maximum obtainable engine speed was 1650 rpm or less, the torque converter stator-clutch is not holding. The condition should be confirmed by road testing. A slipping stator clutch will cause poor low speed acceleration. However, highway performance may not be affected.

Stall Speed Normal

If stall speed is normal, road test the vehicle to confirm converter performance. If road testing reveals that low speed acceleration is normal, but an abnormally high throttle opening is required to maintain highway speeds, the converter clutch is seized.

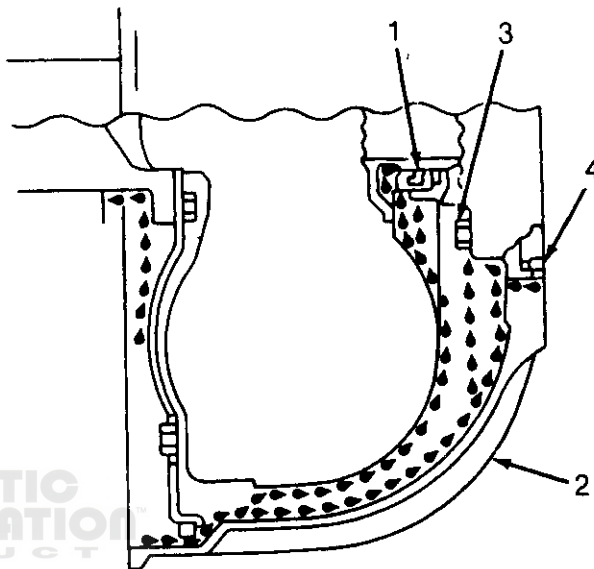
Noise

Fluid flow through the converter during a stall test may generate a whining noise. This is normal. However, loud metallic noises indicate internal damage. Operate the vehicle on a hoist, at light throttle in Drive and Neutral, to verify that this type of noise is actually from the converter.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

Two facts must be established when diagnosing converter housing leaks. First, it must be verified that a leak condition actually exists, and secondly, the real source of the leak must be determined. Suspected converter housing fluid leaks may not be leaks at all. They may be the result of fluid spilled during transmission top-off or refill.

Converter housing area leaks may have several sources. The leak source should be identified before attempting repair. The paths followed by various types of fluid leaks are described below.



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Leak Paths

- Oil Pump Seal (1) — leaks past the seal lip tend to move along the drive hub and onto the rear of the converter housing (2). However, if total seal failure occurs, fluid will be deposited inside the converter housing only, near the outside diameter of the housing.
- Oil Pump Body — leaks past the pump body follow the same path as an oil pump seal leak or fluid may travel down the pump face into the converter housing.
- Oil Pump-to-Case Bolt (3) — leaks past any one of these bolts are deposited on the inside of the converter housing only and not on the converter itself.

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- Oil Pump-to-Case Gasket (4) — leaks past the gasket are deposited inside the converter housing only.
- Front Band Lever Pin Plug — leaks past the plug threads are deposited inside the housing and not on the converter

Leak Diagnosis Procedure

Check fluid level and condition. Adjust fluid level if necessary.

Raise and support the vehicle.

Inspect the transmission. Correct any external leaks from the oil pan gasket, filler tube, governor line, cooler lines and fittings, pressure test port plugs and case-to-adapter housing gasket.

Remove the converter housing inspection plate.

Wipe all fluid from the converter housing area.

Operate the engine at 2000 rpm for 2 minutes and check for leaks.

If a fluid leak pattern is not evident, proceed to the next step.

If a circular type of leak pattern develops, it indicates a damaged torque converter.

If a trickle type of leak develops, it indicates an oil pump leak caused by one or more of the following conditions:

- pump drainback hole obstructed
- pump housing vent obstructed

- pump bushing or converter hub scored, nicked, pitted or burred
- defective oil pump O-ring, gasket or seal
- front band lever pin plug loose or plug threads are stripped

Correct these conditions as follow:

Remove the transmission and converter.

Tighten the front band adjusting screw until the band fully applied. This keeps the front clutch assembly in place when the oil pump is removed and also avoids damaging the clutch discs.

Remove the oil pump and oil seal.

Inspect the pump housing drainback and vent holes for obstructions. Replace the pump if the drainback hole cannot be opened with thin wire. Blow solvent through the vent. Replace the pump housing if the vent cannot be opened.

Inspect condition of the pump housing and converter hub. Replace the housing if the bushing is scored. Polish the converter hub with crocus cloth to avoid damaging a replacement seal.

Install the replacement pump oil seal, O-ring, gasket and oil pump

Loosen the kickdown lever pin plug two turns.

Apply a small quantity of No. 2 Permatex, or equivalent, to the plug threads. Tighten the plug to 17 N•m (150 in-lbs) torque

Adjust the front band.

Install the transmission and converter.

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Install the converter housing inspection plate.

Remove the supports and lower the vehicle.

GENERAL SERVICE DIAGNOSIS

Service Diagnosis Charts

Two service diagnosis charts are provided. The first chart covers in-vehicle diagnosis procedures. The second chart covers out-of vehicle diagnosis procedures.

The Condition columns in each chart describe the most frequently encountered malfunctions.

Each problem condition is cross-referenced to the necessary service procedures.

Code letters in the boxes at the top of each chart identify the service procedures. These letters correspond to procedure descriptions that follow the charts.

Capital letters A through T denote In-Vehicle Procedures. Lower case letters a through j denote Out-Of-Vehicle Procedures.

As an example, assume the problem is Harsh Engagement in R-D-2-1. Locate the description in the Condition column. Then note which procedures are indicated. Procedures B, D, E, G, N, Q are required as shown in the chart. Note the numbers indicating the sequence in which these procedures are to be performed. In this case, the correct order would be D, B, E, G, Q, N.

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DIAGNOSIS CHART — IN-VEHICLE PROCEDURES

CONDITIONS	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Harsh Engagement R, D, 2, 1		2		1 3		4								6			5			
Slow to Engage N, R, D, 2, 1	1		2 3	4		6							5 9				8 7			
No Upshift, Stuck in Low Gear	1	2	3		4 7							5	6 8					9		
No Low Gear Moves in 2nd or 3rd Gear												1	2							
No Kickdown or Normal Downshift	1	2	3		5 4							6	7 8					9		
Delayed Erratic Shifts (Harsh at Times)	1	2	3		4 5							6 7	8 9 10							
Slips in Forward Drive Ranges	1	2	3		4 5								6 7	8 9 10						
Slips in Reverse Only	1		2	3		4							5	6			7			
Will Not Move In Forward Or Reverse	1		2	3									4 5				6			
Reverse OK, Will Not Move Forward In D, 2, 1			1	2										3				4		
No Reverse				1	2		3									4	5			
Moves in Neutral Position (Creeps in "N")				1										2						
Drags or Locks Up					1 2 3		4							5 6 7 8						
Growling, Grating or Scraping Noises	1							2		3		4								
Buzzing Noise	1										2		3				4			
Oil Blows Out Filler Tube	1									2		3 4								
Overheats	1			2 5	4 7					3		6 8								
Will Not Start in N or P Position			1					2						4					3	
Sluggish Acceleration, Excessive Throttle Needed to Maintain Speed	1	3			5														2 4	

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In-Vehicle Procedures

A — Fluid Level and Condition: Fluid should be at the full mark with the engine idling. Fluid should not be milky, full of bubbles or dark and burnt smelling. Use JEEP automatic transmission fluid or an equivalent Dexron® II fluid only.

B — Throttle Linkage: Check for smooth travel. Clean but do not lubricate the linkage pivot points. Adjust as necessary.

C — Gearshift Linkage: Adjust if necessary.

D — Engine Idle Adjustment: Set to specifications.



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E — Hydraulic Pressures: Perform the hydraulic pressure test to determine if operating pressures are within specifications. Repair hydraulic components as necessary. Check and correct throttle and line pressure settings if required.

F — Front Band: Adjust to specifications.

G — Rear Band: Adjust to specifications.

H — Neutral Start Switch: Check the wires and connections. Test the switch. Valve body manual lever must ground the switch in P and N. If not OK, check ground strip at the valve body manual lever. If OK, check the starting circuit.

I — Park Lock: Check condition of the lock rod ball, sprag, reaction plug, governor support and sprag shaft. Replace parts as required.

J — Transmission Oil Cooler: Check cooler and lines for obstructions or leaks. Look for milky colored transmission fluid which indicates coolant in the fluid.

K — Output Shaft Bearing, Bushing or Seal: Remove the extension housing, inspect the parts and replace as necessary.

L — Governor Valve: Clean and inspect the valve components. Check the weights, shaft and valve for burrs, nicks, scores or binding. Check the spring for collapsed or distorted coils and the snap rings for distortion. Check the filter for dirt and debris. Inspect the body for cracks or warpage. Check torque on the governor and output shaft support bolts.

M — Oil Filter: Inspect and replace if clogged.

N — Valve Body: Remove, disassemble and clean thoroughly. Inspect valves and plugs for nicks, scratches, burrs and rounded edges on valve lands. Check the bores for scratches, the springs for collapsed coils, and all mating surfaces for nicks, burrs or warpage. Tighten the valve body screws to exact specifications during assembly.

O — Front Servo and Linkage: Inspect the piston for wear, cracks, and worn or broken seal rings. Check the springs for collapsed for broken coils. Check the servo bore for scratches, nicks or wear. Check the lever, strut and band for damage. Check the lever shaft and O-ring for wear.

P — Rear Servo and Linkage: Refer to the front servo inspection/service procedures.

Q — Accumulator: Clean and inspect for broken seal rings, scratched bores or broken or collapsed springs. Check the piston for cracks or evidence of the piston cocking in the bore.

R — Air Pressure Test: Remove the valve body and use air pressure to apply clutches and bands to check operation.

S — Engine Tune and Performance: Verify proper engine operation. Be sure the compression meets specifications and that the fuel and ignition systems are functioning properly.

T — Stall Test: Perform the stall test to check holding ability of the converter and transmission clutches.

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DIAGNOSIS CHART — OUT-OF-VEHICLE PROCEDURES

CONDITIONS	a	b	c	d	e	f	g	h	i	j
Harsh Engagement R, D, 2, 1				1	2					
Slow to Engage N, R, D, 2, 1		1		2	3					4
No Upshift, Stuck in Low Gear		1		2						
Delayed, Erratic Shifts (Harsh at Times)		1								
Slips in Forward Drive Ranges		1		2	3		4			5
Slips in Reverse Only		1		2			3			
Slips in Low Gear "D" Only But Not in "1" Position								1		
Will Not Move in Forward or Reverse	1	2				3				
Reverse OK, Will Not Move Forward in D, 2, 1					1					
No Reverse				1			2			
Moves in Neutral Position (Creeps in "N")					1					
Drags or Locks Up				1	2	3	4	5		
Growling, Grating or Scraping Noises	1	2		3		4		5	6	
Buzzing Noise		1							2	
Oil Blows Out Filler Tube		1	2							
Overheats	1									
Sluggish Acceleration, Excessive Throttle Needed to Maintain Speed					2				1	

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Out-of-Vehicle Procedures

a — Converter Drive Plate: Check the plate for flatness, cracks, loose attaching bolts, or damaged ring gear teeth.

b — Oil Pump: Clean the pump and check all clearances. Inspect the rotors for scoring and

the seal and bushings for wear. Inspect the pump housing and reaction shaft support mating surfaces for flatness.

c — Transmission Vent: Make sure the vent is open and not obstructed.



AUTOMATIC TRANSMISSION

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d — Front Clutch: Clean and inspect all parts. Examine the retainer and piston for scores and scratches, the discs and plates for wear, the return springs for collapsed coils, and the seal rings for damage. The vent check ball in the retainer must operate freely.

e — Rear Clutch: Refer to the front clutch inspection/service procedures.

f — Planetary Gear Set: Clean and inspect the annulus gear, planet pinion carrier assembly and sun gear. Check for worn thrust washers, damaged gear teeth, and excessive pinion end clearance. Examine the bushings in the sun gear for excessive wear.

g — Rear Band: Inspect the band for wear and for a good bond of lining to band. Inspect the lining for damage and wear. Replace the band if worn or damaged.

h — Overrunning Clutch: Clean and inspect the clutch parts for brinnelled clutch rollers or cam, or for improperly assembled rollers or springs. Check for collapsed springs and bent spring retainer tabs.

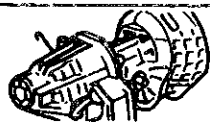
i — Torque Converter: If the converter hub seal surface or drive slots are damaged, or if the converter contains foreign material, burnt-oxidized fluid or debris, replace the converter. Do not attempt to clean or flush the converter.

j — Seal Rings: Inspect the reaction shaft and governor support seal rings for wear, cracks or breakage. Inspect the ring grooves for nicks, burrs or distortion. Inspect the bores in the front clutch retainer and the output shaft support for nicks, grooves, wear, cracks or scratches.

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AUTOMATIC TRANSMISSION

IN-VEHICLE SERVICE AND ADJUSTMENT



GENERAL SERVICE INFORMATION

The Model 999, three speed, automatic transmission is used in Wrangler/YJ models.

This section covers removal, installation, lubrication and in-vehicle service and adjustment procedures for the Model 999 automatic transmission.

The procedures, specifications and special tools needed to overhaul the Model 999 transmission are contained in the T.A. 700/900 Component Service Manual.

GEARSHIFT LINKAGE ADJUSTMENT

Raise the vehicle.

Loosen the shift rod trunnion jamnuts.

Remove the shift rod trunnion-to-bellcrank lock pin and disengage the trunnion and rod at the bellcrank.

Place the gearshift lever in Park.

Move the valve body manual lever rearward into Park detent. Be sure the lever is moved rearward as far as possible. Park detent is the last rearward detent.

Check for positive engagement of the park lock by attempting to rotate the propeller shaft. The shaft will not rotate if the park lock pawl is fully engaged.

Adjust the shift rod trunnion to obtain a free pin fit in the bellcrank arm and tighten the trunnion jamnuts. Prevent the shift rod from turning while tightening the jamnuts.

NOTE: Gearshift linkage lash must be eliminated to obtain proper adjustment. Pull downward on the shift rod and press upward on the outer bellcrank to eliminate lash.

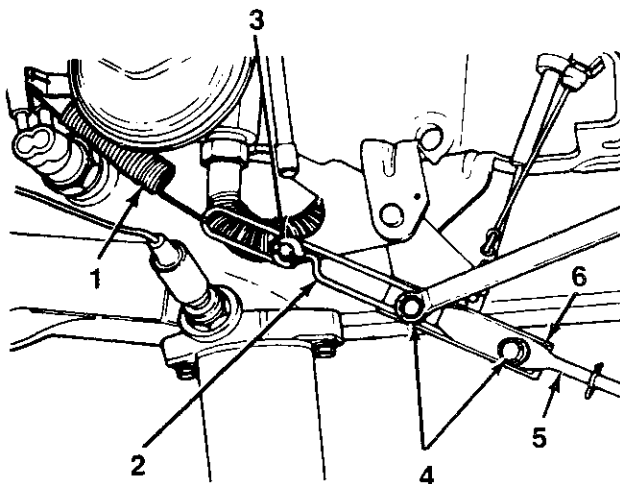
Move the gearshift lever to Park and Neutral and check starter operation. The engine should start only in these positions. If the engine does not start in P or N (or starts in R, D, 2, or 1), adjustment is incorrect or the neutral switch is defective.

Lower the vehicle.

THROTTLE LINKAGE ADJUSTMENT

Disconnect the throttle control rod spring.

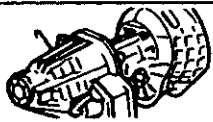
Use the throttle control rod spring (1) to hold the adjusting link (2) forward and against the nylon washer (3).



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Block the choke open and set the carburetor throttle off the fast idle cam.

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AUTOMATIC TRANSMISSION **IN-VEHICLE SERVICE AND ADJUSTMENT**

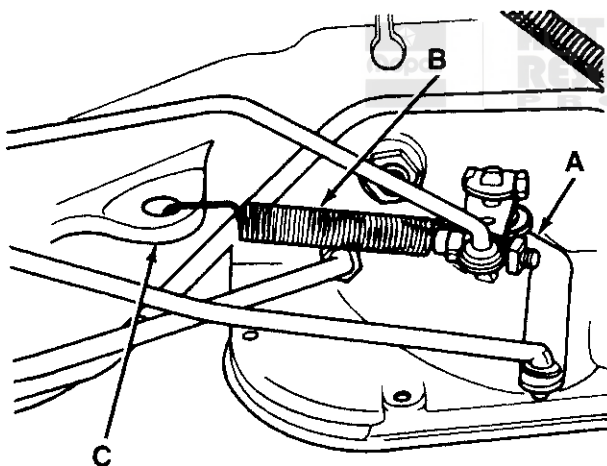


Raise the vehicle.

Loosen the two bolts (4) that attach the adjusting link (2) and control rod (5) to the clamp (6). Do not remove the spring clip that retains the nylon washer.

Hold the transmission throttle lever (A) forward against its stop with a spare spring (B). Hook one end of the spring to the throttle lever and the opposite end to the boss (C) on the side of the converter housing.

NOTE: Throttle linkage adjustment is very sensitive. If a spare spring is not used to hold the throttle lever against its stop, linkage adjustment may be too long or short causing shift problems.



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Push on the end of the adjusting link (2) to eliminate all lash.

Move the connecting clamp (6) rearward until the bolt attaching the control rod (5) to the clamp (6), bottoms against the rear of the slot in the control rod.

Tighten the front bolt (4) that attaches the adjusting link (2) to the clamp (6). Do not tighten the rear bolt at this time.

Pull the throttle control rod (5) rearward until the rear bolt (4) contacts the forward end of the slot in the control rod. Then tighten the rear bolt.

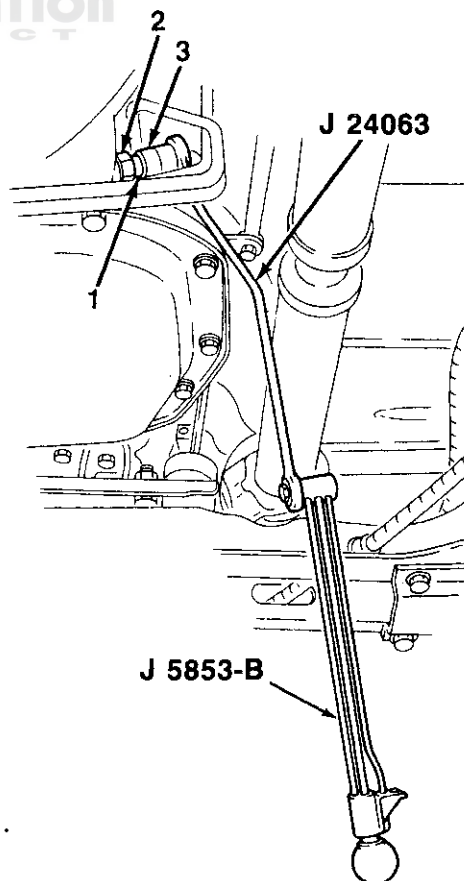
Remove the spare spring (B) from the throttle lever (A).

Lower the vehicle.

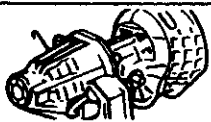
Remove the throttle control spring (1) from the adjusting link and reconnect it to the control rod.

FRONT BAND ADJUSTMENT

NOTE: The front band adjusting screw (1) is located on the left side of the transmission case just above the manual valve and throttle control lever. Band adjustment is as follows:



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IN-VEHICLE SERVICE AND ADJUSTMENT



Raise the vehicle.

Loosen the adjusting screw locknut (2). Back the locknut off five turns.

Check adjusting screw rotation. The screw must turn freely in the case. Lubricate the adjusting screw threads if the screw binds.

Install a 5/16 square drive-socket (3) on the adjusting screw. The socket is needed to adapt torque wrench extension J 24063 to the adjusting screw.

Tighten the adjusting screw to 4 N•m (36 in-lbs) with torque wrench J 5853-B and extension J 24063.

CAUTION: If extension J 24063 is not used, tighten the adjusting screw to 8 N•m (72 in-lbs) torque.

Back off the adjusting screw 2-1/2 turns.

Tighten the adjusting screw locknut to 47 N•m (35 ft-lbs) torque. Do not allow the adjuster screw to rotate when tightening the locknut.

Remove the 5/16 socket from the adjusting screw.

Lower the vehicle.

REAR BAND ADJUSTMENT

NOTE: The transmission oil pan must be removed to gain access to the rear band adjusting screw. Band adjustment is as follows:

Raise the vehicle.

Remove the oil pan and drain the fluid. Note fluid condition while it is draining.

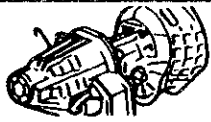
Inspect the filter and oil pan for friction material or metal particles. A light accumulation of this material in the filter or oil pan is normal. However, a heavy accumulation indicates component wear or damage may have occurred.

Clean the old gasket material from the transmission oil pan surface. Replace the oil filter if damaged or clogged.

Adjust the rear band as follows.

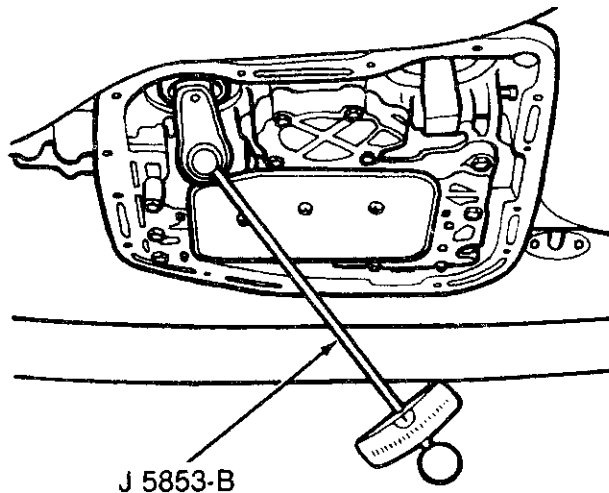
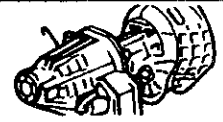
- Remove the adjusting screw locknut.
- Tighten the adjusting screw 8 N•m (72 in-lbs) with torque wrench J 5853-B and a 1/4 hex-head socket wrench.
- Back off the adjusting screw seven turns.
- Install the adjusting screw locknut finger tight. Install a wrench on the adjusting screw to prevent the screw from turning while installing the locknut.
- Hold the adjusting screw in position with the wrench and tighten the locknut to 47 N•m (35 ft-lbs) torque.

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Install the oil pan and replacement pan gasket. Tighten the oil pan bolts to 17 N•m (150 in-lbs) torque.

NOTE: Do not use any sealer on the oil pan gasket.

Lower the vehicle.

Fill the transmission with JEEP automatic transmission fluid or an equivalent Dexron® II fluid.

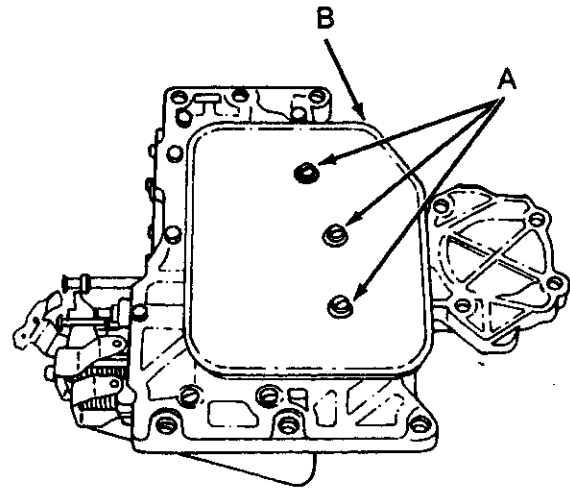
OIL FILTER REPLACEMENT

Raise the vehicle.

Remove the oil pan and drain the fluid. Inspect condition of the fluid while it is draining.

Inspect the oil pan and filter for friction material or metal particles. A light accumulation of this material is normal. However, a heavy accumulation indicates that component damage may have occurred.

Remove the oil filter attaching screws (A) and remove the filter (B).



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Clean the old gasket material from the transmission oil pan surface.

Install the replacement filter. Tighten the filter screws to 4 N•m (35 in-lbs) torque.

Install the oil pan and replacement pan gasket. Tighten the pan bolts to 17 N•m (150 in-lbs) torque.

NOTE: Do not use any sealer on the oil pan gasket.

Lower the vehicle.

Fill the transmission with JEEP automatic transmission fluid or an equivalent Dexron® II fluid.



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VALVE BODY SERVICE AND ADJUSTMENT

Transmission removal is not necessary in order to service the valve body. The valve body can be removed and serviced independently.

Valve body removal, pressure adjustment and installation procedures are outlined in this section. Refer to the T.A 700-900 Component Service Manual for valve body overhaul procedures.

Valve Body Removal

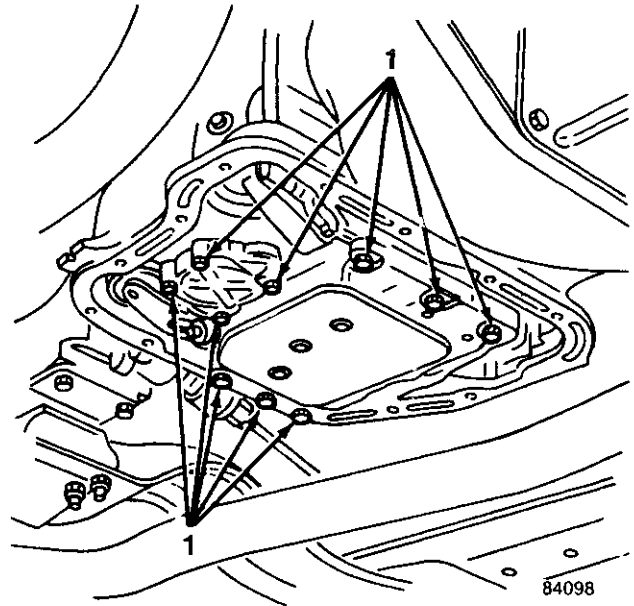
Raise the vehicle.

Remove the oil pan and drain the fluid. Inspect fluid condition while draining.

Loosen the throttle and manual valve control lever clamp bolts. Slide the levers up and off the valve body shafts.

Remove the neutral safety switch.

Remove the valve body attaching screws (1).



Remove the valve body as follows: Lower the valve body about one or two inches. Then pull it forward to disengage the park lock rod and remove the valve body from the transmission.

NOTE: If the park lock rod is difficult to remove, turn the transmission output shaft back and forth (with the propeller shaft) until the rod clears the lock sprag.

Remove the accumulator spring from the valve body.

Remove and discard the oil filter.

Valve Body Installation

Clean the valve body and transmission mating surfaces. Remove any burrs from the case and valve body steel plate surfaces before installation.

Position the accumulator spring on the valve body.

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Insert the park lock rod through the opening in the rear of the case.

Position the knob on the end of the park lock rod against the reaction plug in the sprag. Then exert rearward pressure on the rod to move the rod past the sprag. Rotate the output shaft if necessary.

Align and position the valve body on the case.

Install the valve body attaching screws (1) finger-tight only. Do not final-tighten the screws at this time.

Install the neutral switch.

Place the valve body manual valve in Neutral position.

Move the valve body as necessary to align the neutral finger on the manual lever with the neutral switch plunger.

Tighten the valve body attaching screws (1) alternately and evenly to 11 N•m (100 in-lbs) torque.

Install the oil filter. Tighten the filter screws to 4 N•m (35 in-lbs) torque.

Install the manual and throttle valve control levers on the valve body shafts. Tighten the lever clamp bolts and verify free movement of the shafts. The shafts must not bind at any point.

Install the oil pan and replacement gasket. Tighten the pan bolts to 17 N•m (150 in-lbs) torque.

NOTE: Do not use any sealer on the pan gasket.

Lower the vehicle.

Fill the transmission with JEEP auto matic transmission fluid or an equivalent Dexron® II fluid.

Adjust the gearshift and throttle linkage.

Valve Body Pressure Adjustments

Transmission line and throttle pressure can both be adjusted at the valve body. The two adjustments are interdependent in that each affects shift quality and timing. As a result, the adjustments must be performed accurately and in the correct sequence, which is: line pressure adjustment first - throttle pressure adjustment last.

Line Pressure Adjustment

NOTE: Use a steel machinists ruler for the following measurement to ensure accuracy.

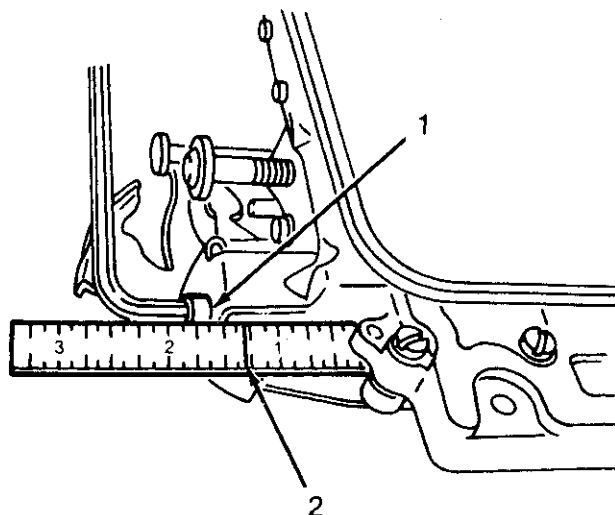
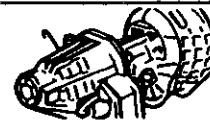
Measure the distance from the valve body to the inner edge of the adjusting screw (1). Distance measured (2) should be 33.4 mm (1-5/16 in).

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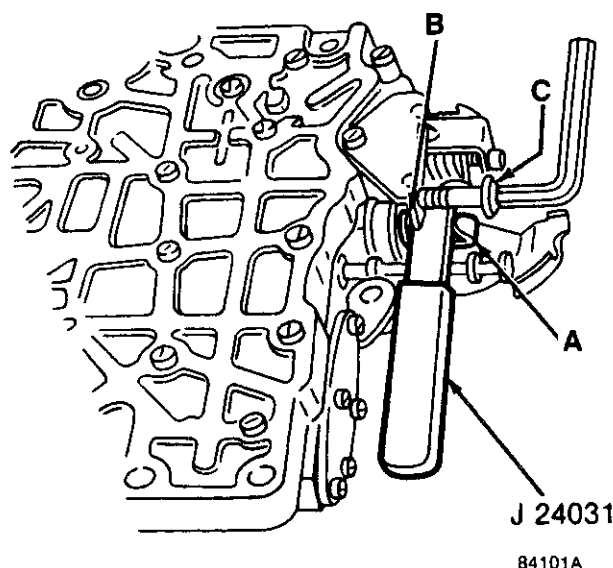
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If adjustment is required, turn the adjusting screw (1) in or out to obtain a 33.4 mm (1-5/16 in) setting.

NOTE: The 33.4 mm (1-5/16 in) dimension is an approximate setting. Manufacturing tolerances may make it necessary to vary from this setting. One complete turn of the adjusting screw changes line pressure approximately 9 kPa (1-2/3 psi). Turn the adjusting screw counterclockwise to increase pressure or clockwise to decrease pressure.

Valve Body Throttle Pressure Adjustment

Insert gauge J 24031 between the throttle lever cam (A) and kickdown valve (B).



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Push the gauge inward to compress the kickdown valve against the spring and bottom the kickdown valve in the valve body. Maintain pressure on the spring and valve.

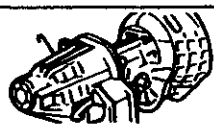
Turn the throttle lever stop screw (C) until the screw head touches the throttle lever tang and the throttle lever cam touches the gauge.

NOTE: Be sure to maintain pressure against the kickdown valve spring and valve during adjustment. If pressure is relaxed, adjustment will be incorrect.

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FRONT — REAR SERVO OVERHAUL

The front and rear servos can both be serviced without removing the transmission. The servos are accessible after the oil pan and valve body have been removed. Servo removal, overhaul and installation procedures are outlined in the T.A. 700-900 Component Service Manual.



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IN-VEHICLE SERVICE AND ADJUSTMENT



GOVERNOR VALVE AND PARK GEAR SERVICE

The transfer case and transmission adapter must be removed for access to the governor valve and park gear. Park gear and governor valve removal, disassembly, cleaning and installation are outlined in this section.

Governor Valve and Park Gear Removal

Raise the vehicle.

Mark the propeller shaft yokes for assembly alignment reference.

Disconnect the front and rear propeller shafts at the transfer case.

Disconnect the speedometer cable at the transfer case.

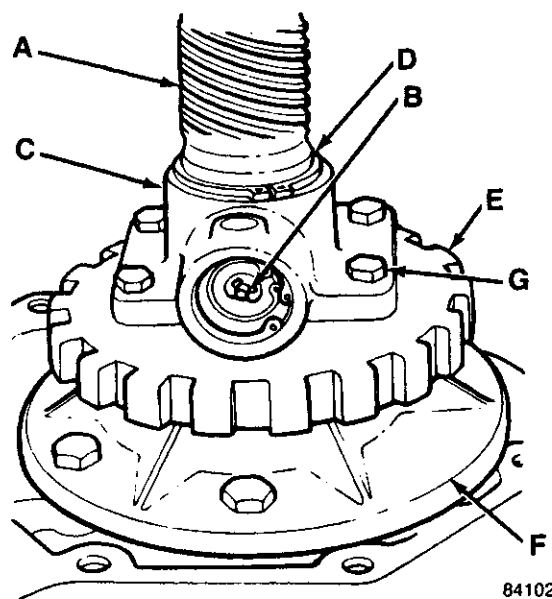
Position a support stand under the transmission converter housing.

Remove the rear crossmember.

Support the transfer case with a transmission jack.

Remove the bolts attaching the transfer case to the transmission adapter housing and remove the transfer case.

Remove the bolts attaching the adapter housing to the transmission and remove the adapter housing.



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Rotate the transmission output shaft (A) until the governor valve faces downward.

Remove an E-clip (B) from one end of the governor valve shaft.

Slide the governor valve shaft out of the governor body (C) and output shaft (A).

Remove the snap ring (D) that holds the governor body and park gear (E) on the output shaft (A).

Remove the bolts (G) that attach the governor body and park gear to the output shaft rear support (F).

NOTE: On some models, the bolts (G) may be secured with lock straps. If so, bend the strap tabs away from the bolt heads before loosening the bolts. Then remove the tabs along with the bolts.

Remove the governor body (D) from the output shaft (A) and park gear (E).

Remove the park gear (E) from the output shaft (A).

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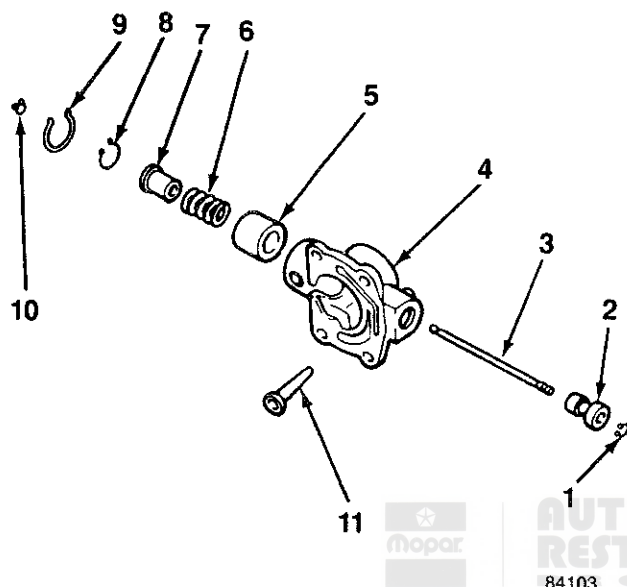
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Governor Valve Disassembly and Cleaning

Remove the large snap ring (9) from the weight end of the governor body (4).



Remove the weight assembly (5-6-7).

Remove the small cap ring (8) that retains the spring (6) and inner weight (7) in the outer weight (5). Remove the spring and filter screen (11).

Thoroughly clean each of the governor parts in solvent. Use compressed air only to dry the parts.

NOTE: Do not use shop towels to dry the governor parts. Small quantities of lint from the towels could cause the valve and weights to stick after installation.

Governor Valve Inspection and Assembly

Trial-fit the valve (2), valve shaft (3) and weights in the governor body. The valve and weights

should slide freely when clean and dry. Small burrs or scratches in the body, or on the valve, shaft or weights may be polished-out with crocus cloth.

Inspect the weight spring (6), E-clips (1) and (10) and snap rings (8) and (9). Replace any component if distorted, collapsed or broken.

Clean the governor filter (11) in solvent and dry it with compressed air. Replace the filter if damaged.

Check torque of the bolts that attach the output shaft rear support (F) to the transmission case (the governor body and park gear are attached to the support). If the bolts are loose, cross leakage and loss of governor pressure can occur.

Inspect the park gear (E). Replace the matic transmission fluid.

Install the spring (6) and inner weight (7) with snap ring (8).

Install the assembled spring and weights in the governor body. Secure the assembly in the body with snap ring (9).

Install the filter screen (9).

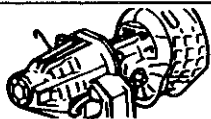
Governor Valve and Park Gear Installation

Install the park gear on the output shaft.

Install the governor body (D) on the output shaft (A) and against the park gear (E).

Align the shaft bore in the governor body with the shaft bore in the output shaft.

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Install the bolts (G) that attach the governor body and park gear to the rear support. Finger-tighten the bolts only.

Install E-clip (10) on the governor valve shaft (3).

Slide the governor valve shaft (3) through the weights (7-8), body (4) and output shaft (A).

Tighten the bolts (G) that attach the governor body and park gear to the rear support to 11 N•m (100 in-lbs) torque.

Install the governor valve (2) on the shaft (3). Secure the valve to the shaft with E-clip (1). Be sure the valve moves freely on the shaft and in the body.

Install the transmission adapter housing. Tighten the housing bolts to 32 N•m (24 ft-lbs) torque.

Install the transfer case and rear crossmember.

Connect the speedometer cable.

Connect the propeller shafts. Align the assembly reference marks and tighten the U-joint clamp bolts to 19 N•m (14 ft-lbs) torque.

Adjust the gearshift and throttle linkage.

Lower the vehicle.

Fill the transmission with JEEP automatic transmission fluid or an equivalent Dexron® II fluid.

PARK LOCK COMPONENT SERVICE

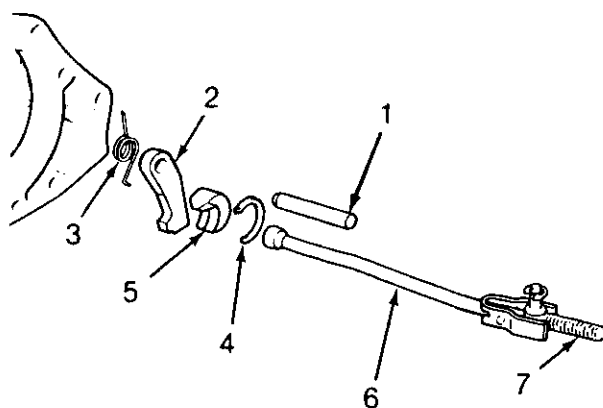
Park Lock Component Removal

Remove the transfer case and transmission adapter housing.

Slide the sprag shaft (1) out of the adapter housing and remove the sprag (2) and spring (3).

Remove the snap ring (4) and slide the sprag plug (5) out of the adapter housing. Remove the plug pin also if so equipped.

Inspect the lock ball on the park lock rod (6). Replace the rod if the ball is worn or damaged. Refer to the valve body removal/installation procedures in this section if the rod must be replaced.



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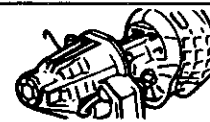
Clean and inspect the park lock components and the park gear. Replace any component that is worn or damaged.

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Park Lock Component Installation

Install the sprag plug (5) and snap ring (4) in the housing. Also install the plug pin if so equipped.

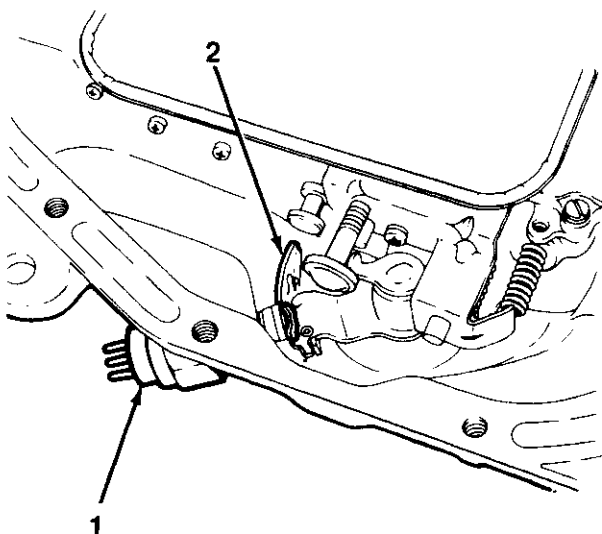
Position the sprag (2) and spring (3) in the housing and install the shaft (1).

NOTE: Be sure the square lug on the sprag faces the park gear and the spring is positioned so it moves the sprag away from the gear.

Install the transmission adapter housing and transfer case.

NEUTRAL SAFETY SWITCH

The switch (1) is actuated by the valve body manual lever (2). The switch has three terminals. The center terminal is the starting circuit. It provides a ground for the starter solenoid circuit through the gearshift lever in Park and Neutral. The outer terminals of the switch are for the backup lamp circuit. Switch removal, testing and installation procedures are as follows:



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Starting Circuit Test

Remove the wiring connector from the switch (1).

Check continuity between the center switch terminal and the transmission case in all gearshift lever positions. Continuity should exist only in Park and Neutral.

If continuity exists in any position other than Park or Neutral, check and adjust the gearshift linkage and repeat the continuity check. Replace the switch if continuity still exists in any position other than Park or Neutral.

Backup Lamp Circuit Test

Remove the wiring connector from the switch (1).

Check continuity between the switch outer terminals. Continuity between the two terminals should exist only in Reverse. Replace the switch if continuity is indicated in any gear other than Reverse.

Check continuity between each terminal and the transmission case in Reverse. Replace the switch if continuity is indicated.

Neutral Safety Switch Replacement

Raise the vehicle.

Disconnect the switch harness.

Position a drain pan under the switch and remove the switch from the center of the case opening if necessary.

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Install the replacement switch and seal in the case. Tighten the switch to 35 N•m (24 ft-lbs) torque.

Verify that switch continuity exists only in Park and Neutral.

Top off the transmission fluid level.

OIL COOLER AND COOLER LINE FLUSHING

Main Oil Cooler

The main transmission oil cooler is located in the radiator lower tank. The cooler and cooler lines must be flushed whenever a transmission malfunction generates sludge and metal or friction material particles.

Auxiliary Oil Cooler

The auxiliary oil cooler augments the transmission cooler in the radiator lower tank. The auxiliary cooler helps prevent fluid overheating during heavy-duty operation. The auxiliary cooler and lines must also be flushed whenever a malfunction generates sludge and metal or friction material particles.

Oil Cooler and Line Flushing Procedure

Remove the auxiliary oil cooler and lines.

Disconnect and remove the main cooler lines.

Dislodge any foreign material in the inlet side of the main cooler with a small screwdriver.

Reverse flush the main and auxiliary coolers and lines with a combination of mineral spirits and short bursts of compressed air. Continue forcing solvent through the coolers until all oil and foreign material are removed.

Remove any remaining mineral spirits from the coolers and lines by flushing them with clean transmission fluid.

Check fluid flow through the main cooler as follow:

- Connect the cooler inlet line to the main (radiator) cooler.
- Connect the cooler outlet line to the main cooler but not to the transmission.
- Place the transmission end of the cooler outlet line in a one quart container.
- Overfill the transmission by one quart.
- Shift the transmission into Neutral.
- Run the engine at curb idle speed for exactly 20 seconds and observe oil flow into the container. If less than one quart flows into the container in 20 seconds, replace the radiator or recondition the cooler.

Connect the main cooler outlet line to the transmission.

Install and connect the auxiliary cooler and lines.

Check and adjust transmission fluid level.

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TRANSMISSION REMOVAL

Disconnect the battery negative cable.

Remove the fan shroud attaching screws.

Disconnect the transmission fill tube upper bracket.

Raise the vehicle.

Remove the converter housing inspection cover, transmission fill tube and the starter motor if necessary.

Mark the front and rear propeller shafts for assembly reference and remove the shafts.

Disconnect the transmission gearshift and throttle linkage.

Disconnect the transfer case vent and vacuum hoses and the neutral safety switch wires.

Mark the converter and drive plate for assembly reference and remove the converter-to-drive plate attaching bolts.

Support the transmission with a jack stand and remove the rear crossmember.

Drain the transfer case lubricant and disconnect the speedometer cable.

Disconnect the transmission main cooler lines at the transmission.

Disconnect the transfer case shift linkage.

Support the transmission-transfer case assembly with a transmission jack.

Remove the support stand previously installed under the transmission and reposition it under the engine rear main.

Remove the bolts attaching the transmission to the engine and remove the transmission-transfer case assembly from the vehicle.

Remove the nuts attaching the transfer case to the transmission adapter housing and remove the transfer case from the transmission.

TRANSMISSION INSTALLATION

Mount the transmission on a transmission jack.

Position the transfer case on the transmission adapter housing and install the transfer case attaching nuts. Tighten the nuts to 35 N·m (26 ft-lbs) torque.

If the torque converter was removed, align the converter hub drive slots with the pump rotor drive lugs using alignment tool J 24033. Then install the converter.

NOTE: Be sure the rotor drive lugs are fully seated in the converter hub drive slots before proceeding.

Raise the transmission-transfer case assembly and align the converter pilot hub with the pilot bore in the engine crankshaft. Move the transmission forward and seat the hub.

Install two of the transmission attaching bolts. Tighten the bolts just enough to draw the converter housing forward and into contact with the engine.

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AUTOMATIC TRANSMISSION

IN-VEHICLE SERVICE AND ADJUSTMENT



Align the converter and drive plate according to the reference marks made during removal. Install and tighten the drive plate-to-converter bolts to 35 N•m (26 ft-lbs) torque.

Install the remaining transmission attaching bolts. Tighten all of the attaching bolts to 38 N•m (28 ft-lbs) torque.

Install the converter housing inspection cover and connect the main cooler lines to the transmission.

Connect the transfer vent and vacuum lines and connect the neutral safety switch wires and the speedometer cable.

Install the transmission fill tube and install the starter motor if removed.

Remove the support stand from under the engine and reposition it under the transmission clutch housing. Then remove the transmission jack from under the transmission-transfer case assembly.

Install the rear crossmember. Tighten the support cushion-to-crossmember bolts to 45 N•m (33 ft-lbs) torque. Tighten the crossmember-to-frame rail bolts to 41 N•m (30 ft-lbs) torque.

Connect the transmission throttle and gearshift linkage.

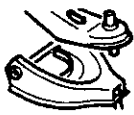
Connect the transfer case shift linkage and refill the transfer case with JEEP automatic transmission fluid, or an equivalent Dexron® II fluid.

Install the front and rear propeller shafts. Align the shafts according to the reference marks made during removal. Tighten the U-joint clamp bolts to 19 N•m (170 in-lbs) torque.

Check and adjust the transmission gearshift and throttle linkage if necessary.

Fill the transmission with specified fluid.

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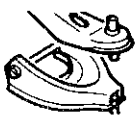


STEERING AND FRONT AXLE



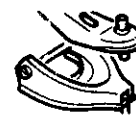
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	STEERING AND FRONT AXLE SPECIFICATIONS	
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FRONT WHEEL ALIGNMENT SPECIFICATIONS

	Set To	OK Range
Toe:		
Right Wheel	0	1/32" IN to 0" OUT
Left Wheel	0	1/32" IN to 0" OUT
Camber	0	- 1/2° to + 1/2°
Caster	8°	7¾° to 8¼°
*Turn Angle:		
(Outside Wheel)	33°	32° to 33°

*Steering stops are non-adjustable.

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MANUAL STEERING GEAR SPECIFICATIONS

Worm Bearing Preload	5 to 8 in-lbs (0.6-1 N·m)
Pitman Shaft Overcenter Preload	
Drag Torque	4 to 10 in-lbs (0.5-1 N·m)
Total Steering Gear Preload	18 in-lbs (2.0 N·m) total (maximum)
Manual Steering Gear Lubricant	Multi-purpose chassis grease
Manual Steering Gear Ratio	24:1
Manual Steering Gear Type	Recirculating Ball

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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POWER STEERING GEAR SPECIFICATIONS

Steering Gear Type Recirculating ball
with hydraulic assist.

Steering Gear Ratio 14:1

Steering Gear Hydraulic Fluid Use Jeep Power
Steering Fluid or Dexron® II

Steering Gear Overhaul Lubricants Lubricate
pitman shaft seals,
bearings races, and track
piston nut ball bearings with
petroleum jelly. Lubricate all
other parts with power steering fluid.

Steering Gear Adjustment:

Worm Bearing Preload 0.5-1 N·m (4 to 10 in-lbs)
drag torque. Refer to
Steering Gear Adjustment.

Pitman Shaft Overcenter Drag Torque:

New Gear (less than 400 miles) 0.5-1 N·m
(4 to 8 in-lbs) in addition
to worm bearing preload
but not to exceed combined
total of 2 N·m (18 in-lbs)

Used Gear (over 400 miles) ... 0.5 N·m (4 to 5 in-lbs)
in addition to worm bearing
preload but not to exceed
combined total of
2 N·m (18 in-lbs)

Caution: Gears must be adjusted exactly as outlined in
Steering Gear Adjustment. Failure to adhere to
the recommended procedures may result in
gear damage or improper steering response.

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PUMP PRESSURE SPECIFICATIONS

4-Cyl. kPa (psi)	6-Cyl. kPa (psi)
9300-10,000 (1350-1450)	7600-8300 (1100-1200)

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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PUMP DRIVE BELT TENSION

Engine	Drive Belt	Belt Tension – Newtons (pounds)	
		Initial (New Belt)	Reset (Used Belt)
6-Cyl.	Serpentine Belt	800-900 (180-200)	623-712 (140-160)
4- and 6-Cyl.	V-Belt	534-712 (120-160)	400-512 (90-115)

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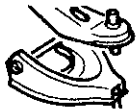
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AXLE RATIO-RING AND PINION TOOTH COMBINATIONS

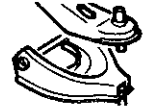
Axle Ratio	Ring/Pinion Gear Tooth Combinations
3.08:1	40/13
3.31:1	43/13
3.55:1	46/13
3.73:1	41/11
4.10:1	37/9

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STEERING AND FRONT AXLE SPECIFICATIONS



AXLE DIFFERENTIAL SPECIFICATIONS

Front Axle Differential Specifications

USA Metric

Differential Bearing Preload	0.15 in	0.38 mm
Differential Side		
Gear-to-Case Clearance	.000-.006 in	0.000-0.15 mm
Ring Gear Backlash	0.005-0.010	0.12-0.25 mm
Pinion Bearing Break-Away		
Preload		
Original Bearings	15-25 in-lbs	2.3 N·m
New Bearings	20-40 in-lbs	2.5 N·m
Pinion Depth		
Standard Setting	2.250	57.1 mm
Lubricant Capacity	2.5 pts.*	1.2 liters
Lubricant Type	SAE75W-90, GL5	

* add 5 ounces (148 ml) to front axle shift housing

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RING AND PINION VARIANCE CHART

O'd Pinion Marking	New Pinion Marking								
	-4	-3	-2	-1	0	+1	+2	+3	+
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

	STEERING AND FRONT AXLE SPECIFICATIONS	
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TIRE PRESSURES

Tire Size	Full Load Pressure
P195/75R15	33 psi (228 kPa) ²
P205/75R15	30 psi (207 kPa) ²
P215/75R15	30 psi (207 kPa) ²
P225/75R15	30 psi (207 kPa) ^{2, 3}
Compact Spare Tire	60 psi (414 kPa)

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WHEEL AND TIRE RUNOUT SPECIFICATIONS

Tire Radial Runout:

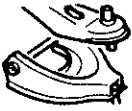
Radial-Ply Tires 2.032 mm (0.080 in)
 Conventional Tires . . . 2.667 mm (0.105 in)
 Tire Lateral Runout 2.510 mm (0.100 in)

Wheel Runout:

Radial 0.889 mm (0.035 in)
 Lateral 1.143 mm (0.045 in)
 Wheel Nuts 102 N·m (75 ft-lbs)

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STEERING AND FRONT AXLE SPECIFICATIONS

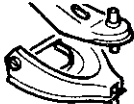


STEERING LINKAGE TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Pitman Arm Nut	251 N·m (185 ft-lbs)	217-285 N·m (160-210 ft-lbs)
Steering Center Link-to-Pitman Arm	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Steering Center Link-to-Steering Knuckle	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Steering Tie Rod-to-Steering Knuckle	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Adjusting Tube Clamp Bolts	19 N·m (14 ft-lbs)	16-22 N·m (12-16 ft-lbs)
Steering Damper-to-Axle Bracket Bolt	75 N·m (55 ft-lbs)	60-90 N·m (44-66 ft-lbs)
Steering Knuckle Ball Joint Nut	137 N·m (100 ft-lbs)	
Steering Center Link Clamp Bolts	49 N·m (36 ft-lbs)	40-58 N·m (30-42 ft-lbs)
Steering Damper-to-Tie Rod Nut	71 N·m (53 ft-lbs)	61-81 N·m (45-60 ft-lbs)

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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STANDARD STEERING COLUMN TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Ignition Switch-to-Column Screws	4 N·m (35 in-lbs)	
Column Mounting Bracket-to-Instrument Panel Bolts	30 N·m (22 ft-lbs)	25-35 N·m (18-26 ft-lbs)
Toe Plate-to-Dash Panel Bolts	14 N·m (10 ft-lbs)	
Intermediate Shaft-to-Steering Shaft Bolt	45 N·m (33 ft-lbs)	35-55 N·m (25-40 ft-lbs)
Steering Wheel Nut	34 N·m (25 ft-lbs)	30-38 N·m (22-28 ft-lbs)
Column Bracket-to-Column Bolts	28 N·m (21 ft-lbs)	20-40 N·m (15-30 ft-lbs)
Lock Cylinder Retaining Screw	4.5 N·m (40 in-lbs)	
Housing-to-Jacket Screws	3.9 N·m (35 in-lbs)	

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TILT STEERING COLUMN TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Column Mounting Bracket-to-Instrument Panel	30 N·m (22 ft-lbs)	25-35 N·m (18-26 ft-lbs)
Toe Plate-to-Dash Panel Screws	14 N·m (10 ft-lbs)	
Intermediate Shaft-to-Steering Shaft Bolt	45 N·m (33 ft-lbs)	35-55 N·m (25-40 ft-lbs)
Lock Cylinder Retaining Screw	2.5 N·m (22 in-lbs)	
Toe Plate Upper/Lower Attaching Screws	8 N·m (6 ft-lbs)	6-10 N·m (4-7 ft-lbs)
Upper Housing-to-Jacket Screws	11 N·m (100 in-lbs)	

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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MANUAL STEERING GEAR TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Steering Gear-to-Frame	101 N·m (75 ft-lbs)	94-108 N·m (70-80 ft-lbs)
Pitman Arm-to-Steering Gear	251 N·m (185 ft-lbs)	217-284 N·m (160-210 ft-lbs)
Front Stabilizer Bar-to-Frame Sill	75 N·m (55 ft-lbs)	65-85 N·m (48-63 ft-lbs)
Front Stabilizer Bar-to-Link	36 N·m (27 ft-lbs)	31-42 N·m (23-31 ft-lbs)
Center Link-to-Pitman Arm	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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POWER STEERING GEAR TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Steering Gear-to-Frame Bolt	101 N·m (75 ft-lbs)	94-108 N·m (70-80 ft-lbs)
Pitman Nut	251 N·m (185 ft-lbs)	217-284 N·m (160-210 ft-lbs)
Stabilizer Bar-to-Frame Bolt	41 N·m (30 ft-lbs)	34-48 N·m (25-35 ft-lbs)
Stabilizer Bar-to-Link Bolt	61 N·m (45 ft-lbs)	48-75 N·m (35-55 ft-lbs)
Centerlink-to-Pitman Arm	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Adjuster Plug Locknut	108 N·m (80 ft-lbs)	102-129 N·m (75-95 ft-lbs)
Return Hose Fitting	28 N·m (21 ft-lbs)	20-36 N·m (15-26 ft-lbs)
Pressure Hose Fitting	28 N·m (21 ft-lbs)	20-36 N·m (15-26 ft-lbs)
Gear Side Cover Bolts	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Gear Rack Piston End Plug	68 N·m (50 ft-lbs)	61-75 N·m (45-55 ft-lbs)
Intermediate Shaft Upper Pinch Bolt	45 N·m (33 ft-lbs)	35-55 N·m (26-40 ft-lbs)
Intermediate Shaft Lower Pinch Bolt	61 N·m (45 ft-lbs)	54-67 N·m (40-50 ft-lbs)

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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POWER STEERING PUMP TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Power Steering Hose-to-Pump	28 N·m (21 ft-lbs)	20-36 N·m (15-26 ft-lbs)
Power Steering Pump-to-Bracket Bolts	38 N·m (28 ft-lbs)	34-37 N·m (25-35 ft-lbs)
Power Steering Pump Bracket-to-Engine Bolts	45 N·m (33 ft-lbs)	38-52 N·m (28-38 ft-lbs)
Pump Mounting Studs-to-Pump	47 N·m (35 ft-lbs)	68-81 N·m (50-60 ft-lbs)
Pump Union-to-Pump	75 N·m (55 ft-lbs)	72-77 N·m (53-57 ft-lbs)
Alternator Adjustment Bolt	24 N·m (18 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Alternator Pivot Bolt	38 N·m (28 ft-lbs)	25-35 N·m (18-26 ft-lbs)
Pump Pivot Stud Nut	28 N·m (21 ft-lbs)	25-35 N·m (18-26 ft-lbs)
Pump Adjustment Bolt	28 N·m (21 ft-lbs)	

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	STEERING AND FRONT AXLE SPECIFICATIONS	
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FRONT AXLE TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Tie Rod-to-Steering Knuckle	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Center Link-to-Steering Knuckle	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Front Shock Lower Bolt	61 N·m (45 ft-lbs)	47-75 N·m (35-55 ft-lbs)
Track Bar-to-Axle Nut	100 N·m (74 ft-lbs)	90-110 N·m (67-81 ft-lbs)
U-Joint Strap Bolts	19 N·m (170 in-lbs)	16-23 N·m (140-200 in-lbs)
Stabilizer Bar Link Bolt	61 N·m (45 ft-lbs)	48-75 N·m (35-55 ft-lbs)
Steering Damper-to-Axle Bracket	75 N·m (55 ft-lbs)	60-90 N·m (44-66 ft-lbs)
Wheel Lug Nuts	102 N·m (75 ft-lbs)	81-122 N·m (60-90 ft-lbs)
Brake Caliper Mounting Pins	40 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Brake Caliper Mounting Bolts	105 N·m (77 ft-lbs)	95-115 N·m (70-85 ft-lbs)
Axle Hub Nut-to-Shaft	237 N·m (175 ft-lbs)	203-271 N·m (150-200 ft-lbs)
Wheel Bearing and Hub Assy-to-Knuckle Bolts	101 N·m (75 ft-lbs)	95-108 N·m (70-80 ft-lbs)
Axle Housing Cover Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Steering Knuckle-to-Ball Joint Nut	136 N·m (100 ft-lbs)	118-153 N·m (87-113 ft-lbs)
Differential Bearing Cap Bolts	54 N·m (40 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Ring Gear-to-Case Bolts	75 N·m (55 ft-lbs)	61-88 N·m (45-65 ft-lbs)
Axle Shift Motor Bolts	11 N·m (101 in-lbs)	9.5-12.2 N·m (94-108 in-lbs)

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	STEERING AND FRONT AXLE	
	SPECIFICATIONS	

PROPELLER SHAFT TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Universal Joint Clamp Bolt	19 N·m (170 in-lbs)	16-22 N·m (140-200 in-lbs)
Slip Yoke Nut	74 N·m (55 ft-lbs)	68-81 N·m (50-60 ft-lbs)

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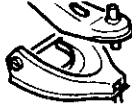
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	STEERING AND FRONT AXLE	
	SPECIAL TOOLS	

SPECIAL TOOLS

Tool Ref.	Description
J 23653-A	Lockplate Compressor
J 23074	Column Support Fixture
J 21232-01	Steering Wheel Puller
J 21854-01	Pivot Pin Remover
J 22635	Roll Pin Punch
J 6632-01	Pitman Arm Puller
J 5822	Two Jaw Internal Bearing Puller
J 2619-01	Slide Hammer or Equivalent
J 5755	Bearing Cup Installer
J 21553	Seal Installer
J 8092	Driver Handle
J 21474-18	Long Nut
J 21474-19	Bolt and Bearing
J 23073	Shift Tube Installer Tool
J 23072	Shift Tube Remover Tool
J 7624	Spanner Wrench
J 4245	Snap Ring Pliers
J 6221	Bearing Remover/Installer
J 21552	Rack Piston Arbor
J 21551	Pitman Shaft Bearing Remover/Installer
J 6217	Valve Connector Seat Installer
J 29810	Adjuster Plug Seal Projector
J 21567	Pressure Gauge Set

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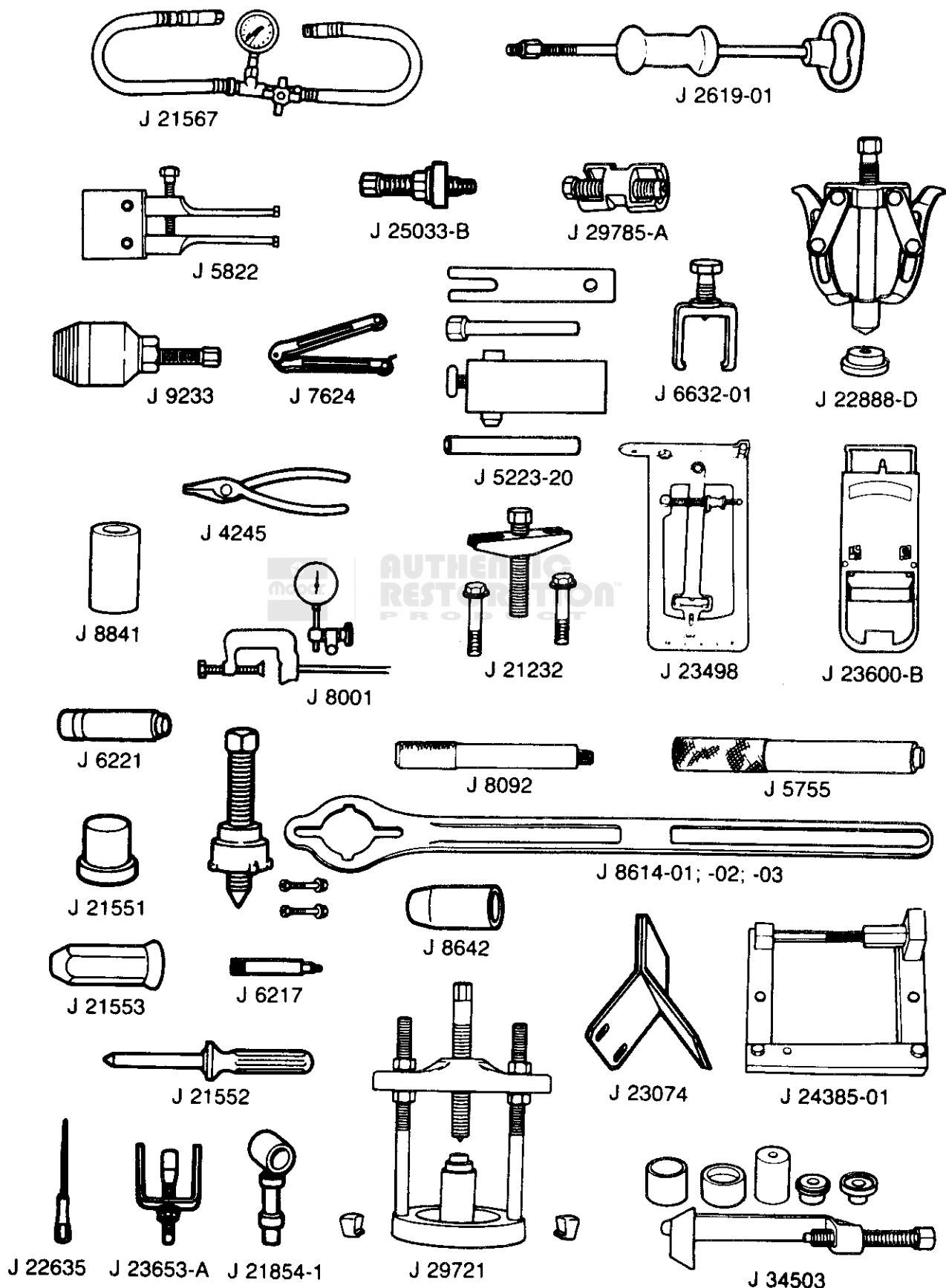
	STEERING AND FRONT AXLE SPECIAL TOOLS	
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Tool Ref.	Description
J 5176-5	Adapter
J 23600-B	Belt Tension Gauge
J 8841	Seal Installer
J 29785-A	Pulley Remover
J 25033-A	Pulley Installer
J 22888-D	Bearing Puller and Button
J 29721	Differential Bearing Remover
J 8614-01	Axle Yoke Holder and Remover
J 9233	Pinion Oil Seal Remover
J 5590	Bearing Cup Installer
J 25104	Pinion Oil Seal Installer
J 5223-4	Pinion Setting Gauge Set
J 22175-A	Differential Bearing Installer
J 8001	Dial Indicator
J 24385-01	Differential Housing Spreader
J 23498-A	Inclinometer
J 34503	Ball Joint Tool Kit
J 34659	Axle Tube Bearing and Seal Remover/Installer

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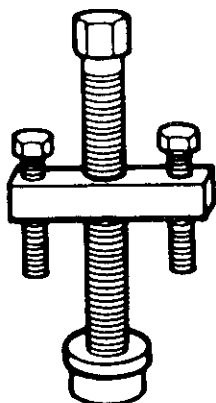
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	STEERING AND FRONT AXLE SPECIAL TOOLS	
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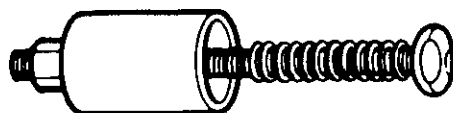


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	STEERING AND FRONT AXLE SPECIAL TOOLS	
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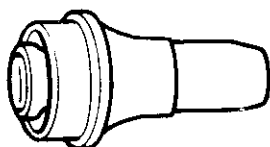
J 23072



J 23073



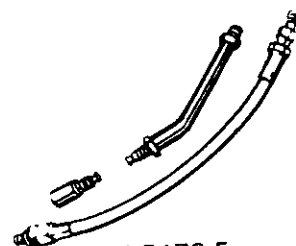
J 22175-A



J 25104



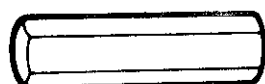
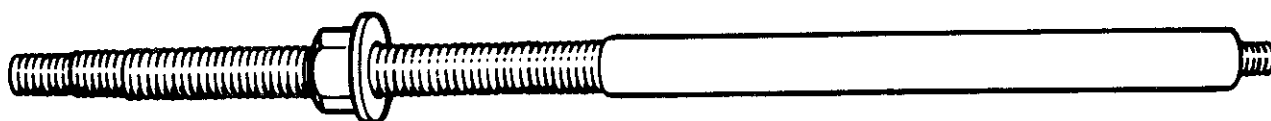
J 5590



J 5176-5



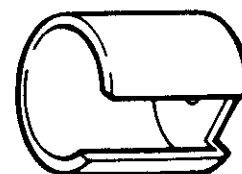
J 34659



J 21474-18



J 21474-19



J 35581-1



J 35581-2

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STEERING AND FRONT AXLE

GENERAL INFORMATION



STEERING AND FRONT AXLE COMPONENTS

Steering Columns

One standard steering column and two tilt steering columns are used. The standard column is used for manual transmission applications. One tilt column is used for manual transmission applications. A second tilt column is used for column shift automatic transmission applications.

Steering Gears

Manual and power steering gears are available. Both gears are recirculating ball design units.

Power Steering Pump

A constant displacement, vane-type pump is used for power steering applications. The pump is belt driven off the engine crankshaft.

Steering Linkage

Parallel linkage rods are used. A pitman arm connects the linkage to the steering gear.

Steering Damper

A steering damper is used on all models. The damper is attached to the center steering link and the spring mounting bracket.

Front Axle

A Model 30 front axle is used in all models. The axle has a vacuum shift mechanism to disengage or engage the right front axle shaft for two or four wheel drive operation.



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STEERING AND FRONT AXLE

FRONT WHEEL ALIGNMENT



ALIGNMENT INFORMATION

Front wheel alignment should be checked on an alignment rack to ensure accurate results.

The front wheel toe setting and caster angle are the only adjustable alignment angles on the front axle. Camber is preset during manufacture and is not adjustable.

CHECKING FRONT WHEEL ALIGNMENT

Check and adjust tire inflation pressures. Note any unusual wear pattern on the tires.

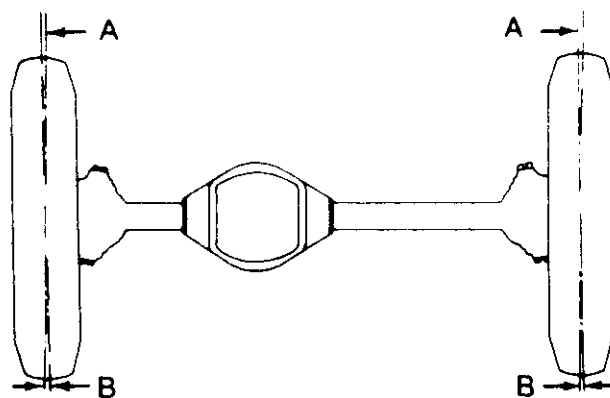
Check the front and rear suspension components for loose or damaged attaching bolts/nuts. Tighten or replace as necessary.

Check the steering knuckle ball studs, steering linkage and front wheel bearings. Repair or replace loose, worn parts if necessary.

Check steering gear adjustment. Correct the overcenter and drag torque adjustments if necessary.

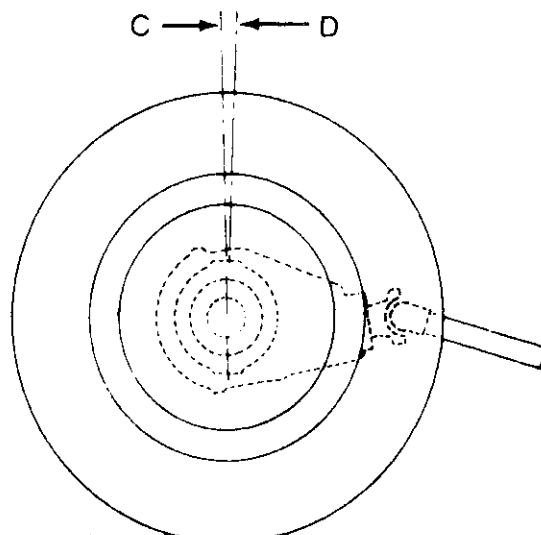
Position the vehicle on the alignment rack.

Check camber angle (A-B). Camber is preset at 0°. Ok range is from minus 1/2 degree to plus 1/2 degree.



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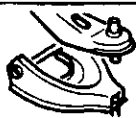
Check caster angle (C-D). Caster is preset at 8°. OK range is 7-3/4° to 8-1/4°.



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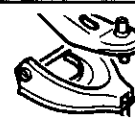
Check toe setting. OK range is from 0.79 mm (1/32 inch) toe-in, to 0.79 mm (1/32 inch) toe-out. Desired toe setting is zero.

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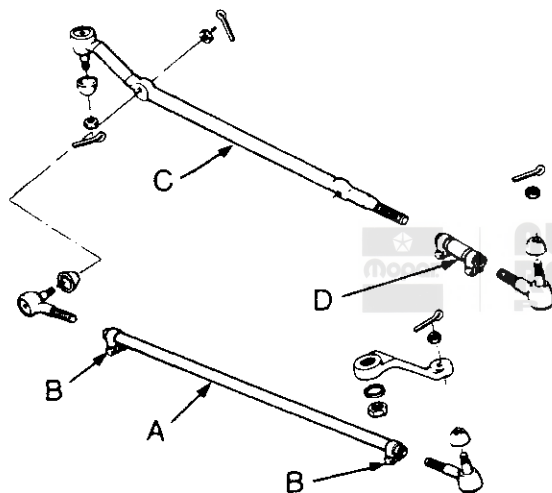
STEERING AND FRONT AXLE

FRONT WHEEL ALIGNMENT



ADJUSTING FRONT WHEEL ALIGNMENT

Front Wheel Toe Setting



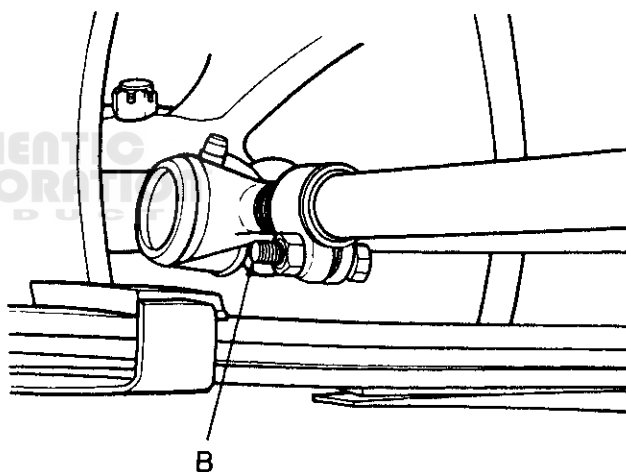
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Center the steering gear as follows:

- Turn the steering wheel to the right until the steering stop is contacted.
- Turn the steering wheel to the left and count the number of turns required to contact the left steering stop.
- Turn the steering wheel back to the right one-half the number of turns and lock the wheel in position.

Set right wheel toe as follows:

- Loosen the clamp bolts (B) at each end of the center link (A).
- Adjust the center link to set right wheel toe at 0°.
- Tighten the center link clamp bolts (B). Position the bolts (B) so the bolt heads face the rear of the vehicle as shown.

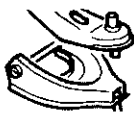


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Set left wheel toe as follows:

- Loosen the clamp bolts on the tie rod adjusting sleeve (D).
- Adjust the tie rod (C) to set left wheel toe at 0°.

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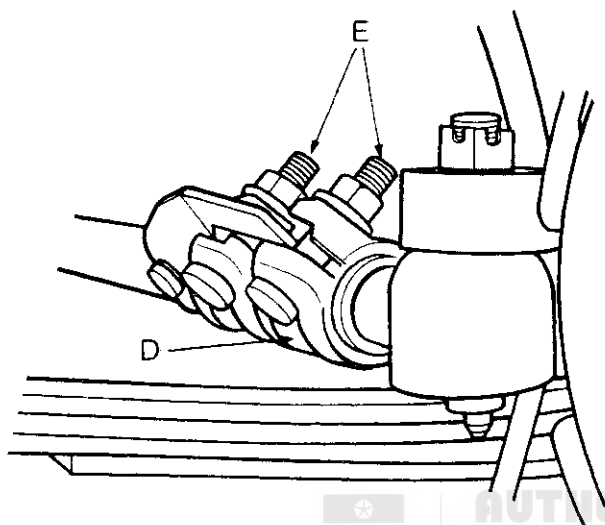


STEERING AND FRONT AXLE

FRONT WHEEL ALIGNMENT



- Tighten the adjusting sleeve clamp bolts. Position the sleeve (D) and clamp bolts (E) as shown. The threaded ends of the bolts should face rearward and be angled upward.

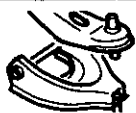


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STEERING AND FRONT AXLE

STEERING LINKAGE

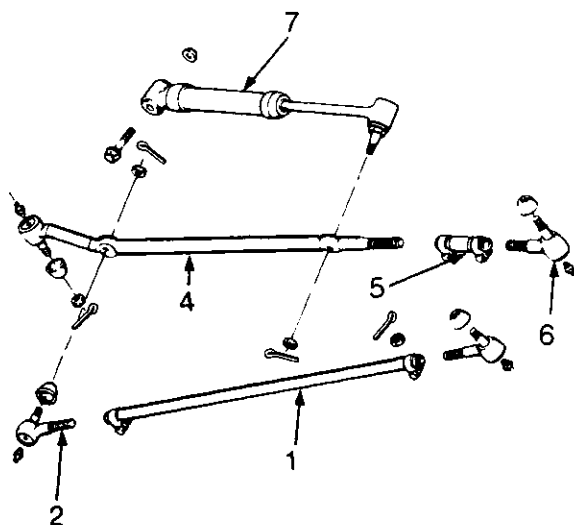


STEERING LINKAGE COMPONENTS

The linkage consists of the following components:

- Center link (1).
- Center link rod ends (2).
- Tie rod (4).
- Tie rod adjusting sleeve (5).
- Tie rod end (6).
- Steering damper (7).

The steering damper, tie rod, pitman arm, center link and rod ends (2) and (6) are serviceable components. The tie rod (4) must be replaced if the fixed rod end is worn or damaged. Replacement procedures are as follows.



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Center Link Replacement

Remove the cotter pins and nuts attaching the link to the pitman arm and center link.

Loosen the rod ends with a puller tool and remove the center link.

NOTE: It is not necessary to remove the center link if only one of the rod ends is to be replaced.

Loosen the rod end clamp bolts and remove the rod ends from the link.

Assemble the replacement center link components and install the link.

Tighten the rod end nuts and install replacement cotter pins.

Adjust front wheel toe setting as outlined in this section.

Tie Rod Replacement

Disconnect the steering damper from the tie rod.

Remove the cotter pins and nuts attaching the tie rod to the steering knuckles and center link.

Loosen the tie rod ends with a puller tool and remove the tie rod.

Remove the adjusting sleeve and rod end from the tie rod.

Assemble the tie rod end components and install the rod.

Install the nuts attaching the tie rod to the steering knuckles and center link.

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	STEERING AND FRONT AXLE STEERING LINKAGE	
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Tighten the attaching nuts and install replacement cotter pins.

Connect the steering damper to the tie rod.

Adjust front wheel toe setting as outlined in this section.

Steering Damper Replacement

Place the front wheels in a straight-ahead position.

Remove the damper attaching bolt, nuts and cotter pins.

Remove the damper.

Extend the damper piston enough to align the damper mounting eye and rod end with the axle bracket and tie rod.

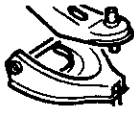
Mount the damper on the bracket and tie rod.

Install the damper attaching bolt, nuts and replacement cotter pins.

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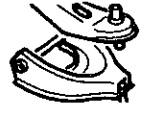


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STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



GENERAL SERVICE INFORMATION

It is not necessary to remove the steering column in order to service the various switches and components inside the column housing.

Column removal is only necessary when the column jacket, shift tube, steering shaft, or lower bearing assembly must be replaced.

Refer to the steering column disassembly procedures for removal and installation of the switches and components mounted inside the column housing.

The ignition and dimmer switches are both mounted on the exterior of the column jacket. Switch replacement and adjustment procedures are outlined in the following procedures.

IGNITION SWITCH REPLACEMENT

Ignition Switch Removal

Disconnect the battery negative cable.

Tape the dimmer switch actuator rod (3) to the column to prevent the rod from disengaging.

Remove the dimmer switch (2).

Disconnect the ignition switch wire harness.

Remove the ignition switch (1). Lift the switch upward until it clears the actuator rod and remove the switch.

Ignition Switch Installation

Insert the actuator rod into the access hole at the bottom of the replacement ignition switch.

Install the switch on the column.

Adjust the ignition switch as follows:

- Turn the ignition lock cylinder to the Off-Unlock position.
- Loosen the switch screws.
- Move the switch downward to eliminate lash and tighten the switch screws to 4 N·m (35 in-lbs) torque.

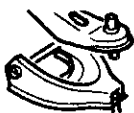
Connect the wire harness to the ignition switch (1).

Engage the actuator rod (3) in the dimmer switch (2) and install the switch on the column jacket.

Remove the tape holding the actuator rod (3) to the column.

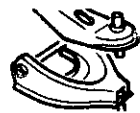
Adjust the dimmer switch (2) as follows:

- Compress the switch slightly and insert a 3/32 inch diameter drill into switch hole (A). The drill will prevent any horizontal movement of the switch.
- Move the switch toward the steering wheel to remove actuator rod lash.



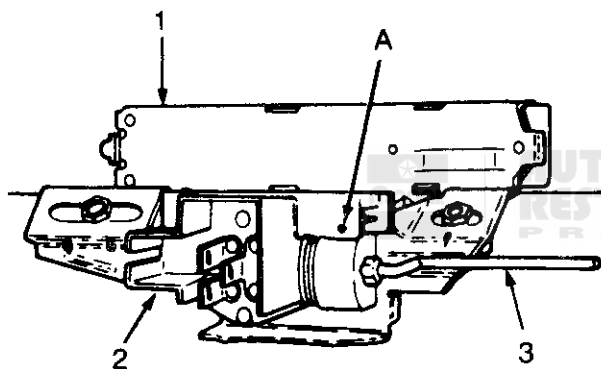
STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



- Tighten the switch attaching screws to 4 N·m (35 in-lbs) torque.
- Connect the battery negative cable.
- Remove the drill and check switch operation. Readjust the switch if necessary.

NOTE: If a tilt column is being serviced, check switch operation in all tilt positions.



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DIMMER SWITCH REPLACEMENT

Dimmer Switch Removal

Disconnect the battery negative cable.

Tape the dimmer switch actuator rod (3) to the column to prevent the rod from disengaging.

Remove the dimmer switch attaching screws and remove the switch (2).

Dimmer Switch Installation

Engage the actuator rod in the switch (2) and mount the switch on the column.

Remove the tape holding the actuator rod to the column.

Adjust the dimmer switch (2) as follows:

- Compress the switch slightly and insert a 3/32 inch diameter drill into switch hole (A). The drill will prevent any horizontal movement of the switch.
- Move the switch toward the steering wheel to remove actuator rod lash.
- Tighten the switch attaching screws to 4 N·m (35 in-lbs) torque.
- Connect the battery negative cable.
- Remove the drill and check switch operation. Readjust the switch if necessary.

NOTE: If a tilt column is being serviced, check switch operation in all tilt positions.

STEERING COLUMN DIAGNOSIS

The diagnosis charts outline procedures for diagnosing malfunctions in the standard and tilt steering columns. A separate diagnosis chart covering the ignition lock system used in both columns is also included.

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SERVICE DIAGNOSIS-ALL COLUMNS

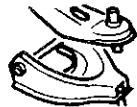
Condition	Possible Cause	Correction
NOISE IN COLUMN	(1) One click when in "off-lock" position and the steering wheel is moved. (2) Flexible coupling bolts not tightened. (3) Lack of grease on bearings or bearing surfaces. (4) Upper or lower shaft bearing worn or damaged. (5) Column not correctly aligned. (6) Flexible coupling pulled apart. (7) Broken flexible coupling lower joint. (8) Steering shaft snap ring not seated. (9) Shroud loose on shift bowl or housing loose on jacket will be noticed with ignition in "off-lock" and when torque is applied to steering wheel.	(1) Normal – lock bolt is seating. (2) Tighten bolts. (3) Lubricate with chassis grease. (4) Replace bearing. (5) Align column. (6) Replace coupling. (7) Repair or replace joint and align column. (8) Replace snap ring. Check for proper seating in groove. (9) Position shroud over lugs on shift bowl. Tighten mounting screws.
HIGH STEERING SHAFT EFFORT	(1) Column misaligned. (2) Damaged, worn upper or lower bearing. (3) Tight steering shaft universal joint. (4) Casting flash on I.D. of shift tube at plastic joint (tilt column only). (5) Upper or lower bearings seized.	(1) Align column. (2) Replace as required. (3) Repair or replace. (4) Replace shift tube. (5) Replace bearings.
LASH IN MOUNTED COLUMN ASSEMBLY	(1) Column mounting bracket bolts loose. (2) Broken weld nuts on column jacket. (3) Column capsule bracket sheared. (4) Column bracket to column jacket mounting bolts loose. (5) Loose lock shoes in housing (tilt column only). (6) Loose pivot pins (tilt column only). (7) Loose lock shoe pin (tilt column only). (8) Loose support screws (tilt column only).	(1) Tighten bolts. (2) Replace column jacket. (3) Replace bracket assembly. (4) Tighten to specified torque. (5) Replace shoes. (6) Replace pivot pins and support. (7) Replace pin and housing. (8) Tighten screws.

	STEERING AND FRONT AXLE		
	STEERING COLUMN SERVICE		

SERVICE DIAGNOSIS-TILT COLUMN

Condition	Possible Cause	Correction
STEERING COLUMN NOT LOCKING IN ANY TILT POSITION	(1) Lock shoe siezed on pivot pin. (2) Lock shoe grooves have burrs or are filled with foreign material. (3) Lock shoe springs weak or broken.	(1) Replace lock shoes and pin. (2) Clean or replace lock shoes. (3) Replace springs.
NOISE WHEN TILTING COLUMN (TILT COLUMN ONLY)	(1) Upper tilt bumpers worn. (2) Tilt spring rubbing in housing.	(1) Replace tilt bumper. (2) Lubricate with chassis grease.
ONE CLICK WHEN IN "OFF-LOCK" POSITION AND STEERING WHEEL IS MOVED	(1) Seating of lock bolt.	(1) None. Click is normal characteristic sound produced by lock bolt as it seats.
HIGH SHIFT EFFORT	(1) Column not correctly aligned. (2) Lower bearing not aligned correctly. (3) Lack of grease on seal or lower bearing areas.	(1) Align column. (2) Assemble correctly. (3) Lubricate with chassis grease.
IMPROPER TRANSMISSION SHIFTING	(1) Sheared shift tube joint. (2) Improper transmission gearshift linkage adjustment. (3) Lower shift lever loose in column shift tube.	(1) Replace shift tube. (2) Adjust linkage. (3) Replace shift tube.
HOUSING LOOSE	(1) Excessive clearance between holes in support or housing and pivot pin diameters. (2) Housing support screws loose.	(1) Replace pivot pins and support. (2) Tighten screws.
STEERING WHEEL LOOSE – EVERY OTHER TILT POSITION	(1) Loose fit between lock shoe and lock shoe pivot pin.	(1) Replace lock shoes and pivot pin.

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	STEERING COLUMN SERVICE	

SERVICE DIAGNOSIS-IGNITION LOCK MECHANISM

Condition	Possible Cause	Correction
WILL NOT LOCK	(1) Lockbolt spring broken or distorted.	(1) Replace lock bolt spring.
HIGH EFFORT REQUIRED TO TURN IGNITION KEY AND LOCK CYLINDER	(1) Ignition lock cylinder malfunction. (2) Ignition switch malfunction. (3) Rack preload spring broken or deformed. (4) Burr on lock sector, lock rack, housing, support or remote rod coupling. (5) Bent sector shaft. (6) Worn, damaged lock rack. (7) Remote rod bent, deformed. (8) Ignition switch mounting bracket bent. (9) Distorted coupling slot in lock rack (tilt column).	(1) Replace lock cylinder. (2) Replace ignition switch. (3) Replace preload spring. (4) Remove burr. (5) Replace shaft. (6) Replace lock rack. (7) Replace rod. (8) Straighten or replace. (9) Replace lock rack.
STICKS IN "START" POSITION	(1) Remote rod deformed. (2) Ignition switch mounting bracket bent.	(1) Straighten or replace. (2) Straighten or replace.
KEY CANNOT BE REMOVED IN "OFF- LOCK"	(1) Ignition switch is not adjusted correctly. (2) Defective lock cylinder.	(1) Adjust switch. (2) Replace lock cylinder.
LOCK CYLINDER CAN BE REMOVED WITH- OUT DEPRESSING RETAINER	(1) Lock cylinder retainer defective. (2) Burr over retainer slot in housing cover or on cylinder retainer.	(1) Replace lock cylinder. (2) Remove burr.
HIGH LOCK CYLINDER EFFORT BETWEEN "OFF" AND "OFF- LOCK"	(1) Distorted lock rack. (2) Burr on tang of shift gate (automatic column). (3) Gearshift linkage not adjusted.	(1) Replace lock rack. (2) Remove burr. (3) Adjust linkage.

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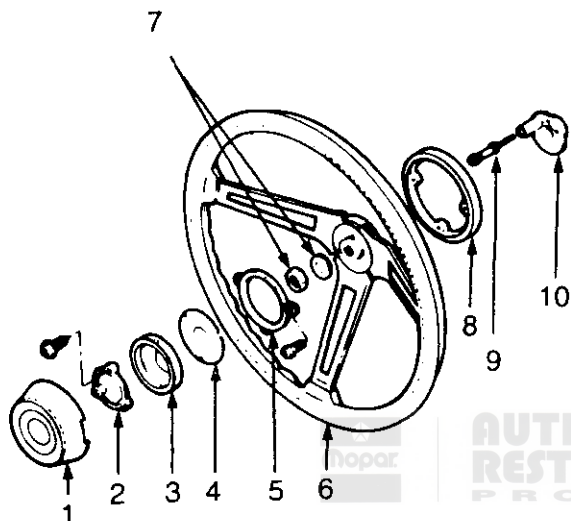
STEERING COLUMN SERVICE



STEERING WHEEL REMOVAL

Disconnect the battery negative cable.

Remove the horn button (1) with a push and turn motion.



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Remove the horn button components (2) through (5).

Remove the steering wheel nut and washer (7).

Paint or scribe alignment marks on the steering shaft and wheel for installation alignment reference.

Remove the steering wheel with puller J 21232.

Remove the steering wheel skirt (8).

Remove the horn grounding pin (9) and holder (10) if they are to be serviced.

STEERING WHEEL INSTALLATION

Install the horn grounding pin holder (10) and pin (9).

Install the steering wheel skirt (8).

Align the steering wheel and shaft and install the wheel on the shaft.

Install the wheel washer and nut (7). Tighten the nut to 34 N·m (25 ft-lbs) torque.

Install horn components (2) through (5).

Install the horn button (1).

Connect the battery negative cable.

Reset the clock.

STEERING COLUMN REMOVAL

CAUTION: Handle the column carefully when removed from the vehicle. A sharp blow on the end of the steering shaft or shift lever, or dropping the column could shear or loosen the plastic fasteners in the energy absorbing components of the column.

Disconnect the battery negative cable.

Set the parking brake.

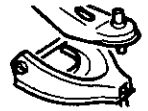
Remove the steering wheel.

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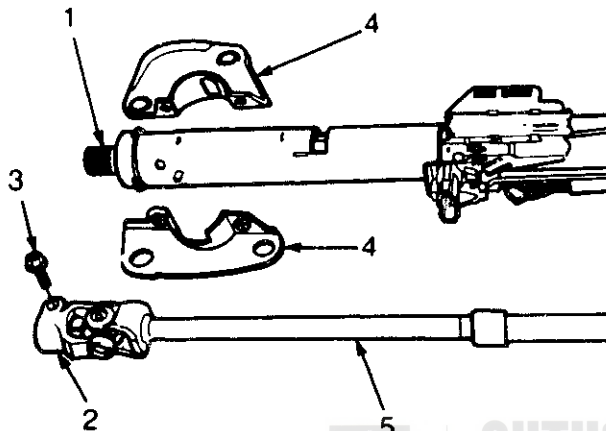


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Paint or scribe alignment marks on the steering shaft (1) and intermediate shaft U-joint (2) for assembly reference.



On models with automatic transmission, disconnect the shift rod from the column shift tube lever.

Remove the pinch bolt (3) from the intermediate shaft U-joint (2).

CAUTION: Do not attempt to separate the steering shaft (1) and intermediate shaft (5) at this time. The energy absorbing connector in the intermediate shaft could be damaged.

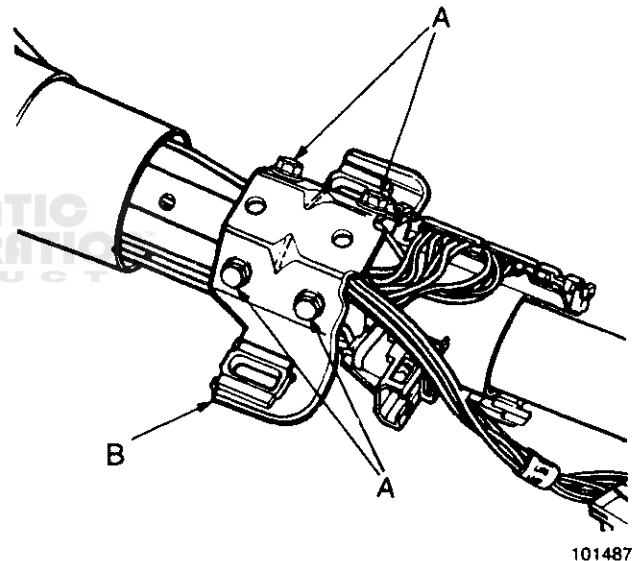
Cover the painted areas of the column.

Remove the speedometer-tachometer trim cover.

Remove the bolts attaching the steering column mounting bracket (B) to the instrument panel.

Remove the bolts (A) attaching the steering column mounting bracket (B) to the column and remove the bracket.

CAUTION: Handle the bracket with care to avoid damaging the mounting bracket breakaway capsules.

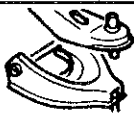


Remove the upper and lower toe plates (4).

Disconnect the wires from the ignition switch, dimmer switch, cruise control, wiper switch and turn signal switch.

Separate the steering shaft (1) from the intermediate shaft (5) and remove the column.

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STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



STEERING COLUMN INSTALLATION AND ALIGNMENT

CAUTION: Be sure to preserve the energy absorbing features of the steering column. Use only the specified screws, bolts and nuts and tighten them to specified torque during reassembly. Incorrect size or length fasteners can prevent the column from compressing under impact. The bolts and nuts that attach the column mounting bracket to the column and instrument panel must be tightened to the correct torque to maintain the breakaway capability of the bracket.

Position the column in the vehicle.

Align the intermediate shaft U-joint (2) and steering shaft (1) and slide the U-joint onto the shaft.

Install and tighten the U-joint pinch bolt (3) to 45 N·m (33 ft-lbs) torque.

Install the mounting bracket (B) on the steering column. Tighten the bracket-to-column bolts to 28 N·m (21 ft-lbs) torque.

Install the upper and lower toe plates (4) on the column. Do not tighten the toe plate bolts at this time.

Position the toe plates on the floorpan and install the toe plate-to-floorpan bolts. Do not tighten the bolts at this time.

Position the column mounting bracket (B) on the instrument panel and install the bracket attaching bolts (A) finger tight.

Pull up on the column and tighten the mounting bracket bolts (A) to 28 N·m (21 ft-lbs) torque.

Tighten all of the toe plate attaching bolts to 14 N·m (10 ft-lbs) torque.

Install the trim cover on the speedometer-tachometer assembly.

Connect all of the column wire harnesses.

Remove the protective tape from painted areas of the column.

Install the steering wheel.

On models with automatic transmission, check and adjust the gearshift linkage if necessary.

Connect the battery negative cable.

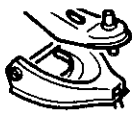
STANDARD STEERING COLUMN DISASSEMBLY

NOTE: Steering column removal is not necessary if only the lockplate, steering shaft snap ring, canceling cam, upper bearing, ignition lock cylinder, housing and shroud, or any of the column switches are to be serviced. Column removal is only necessary if the column jacket, shift tube, or lower bearing must be serviced.

Disconnect the battery negative cable.

Remove the steering wheel.

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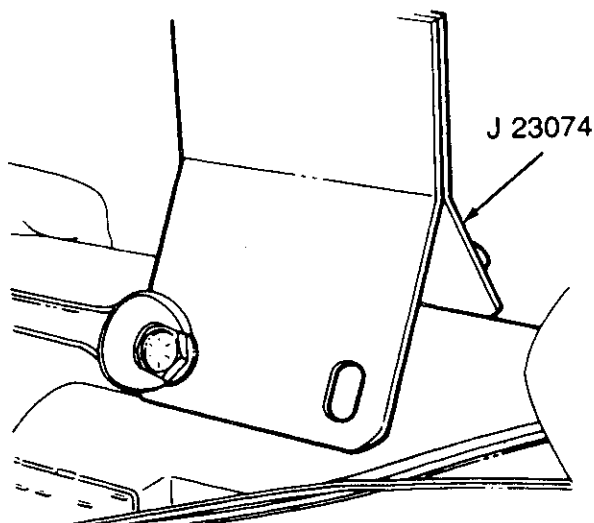


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Remove the column if necessary and attach service bracket J 23074 to the column.

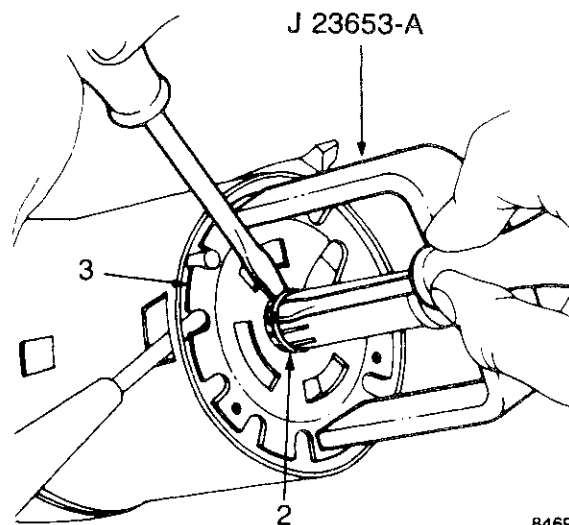


84691A

Remove the lockplate cover (1).

WARNING: In order to remove the steering shaft snap ring (2) in the following step, the lockplate (3) must be compressed. Do not attempt to remove the lockplate without compressor tool J 23653-A as the lockplate is under heavy spring tension.

Compress the lockplate (3) with compressor tool J 23653-A and remove the steering shaft snap ring (2). Discard the snap ring. It is not reusable.



84692

Remove the compressor tool.

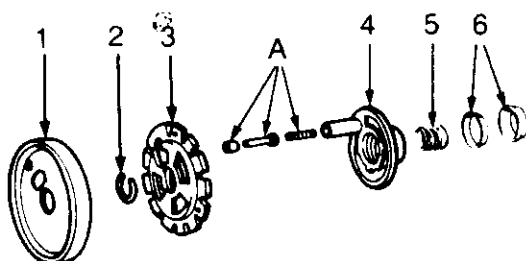
NOTE: When the steering shaft snap ring is removed, the shaft is free in the column. Do not allow the shaft to fall out during disassembly. Secure the shaft to the lower end of the column with tape until the shaft is removed.

Remove the lockplate (3), canceling cam (4), upper bearing preload spring (5) and thrust washer (6) from the shaft. Remove the horn button components (A) from the canceling cam.

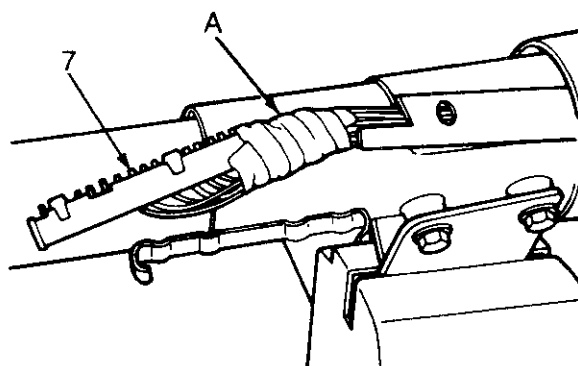


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



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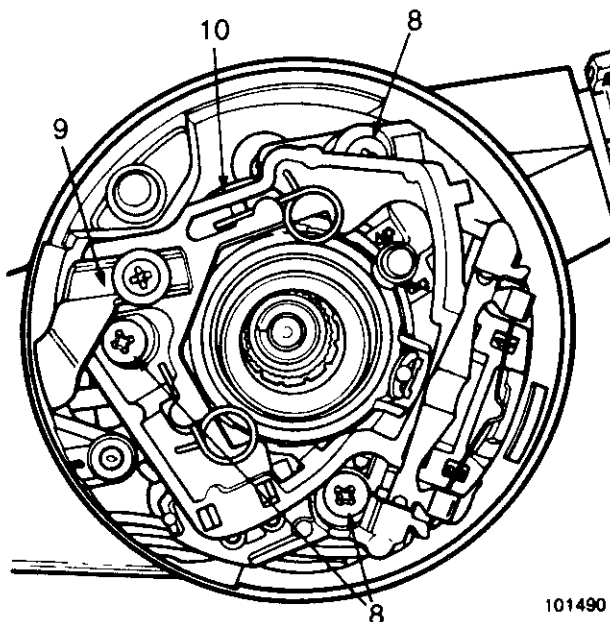


84694

Remove the turn signal switch attaching screws (8) and actuator arm (9).

Remove the turn signal switch (10). Pull the switch and wire harness straight up and out of the housing. Use the fish wire to help guide the harness up and out of the housing.

Remove the wiper switch harness and any additional harnesses from the column.



101490

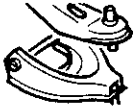
SEE I.S. NOTES

Remove the hazard warning switch knob. Press the knob inward and turn it counterclockwise to remove it.

Remove the turn signal/wiper lever by pulling it straight out of the column.

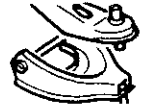
Disconnect the turn signal switch wire harness connector (7) from the bracket at the lower end of the steering column.

Attach a fish wire to the switch harness and tape the harness (A) to prevent snagging during removal.



STEERING AND FRONT AXLE

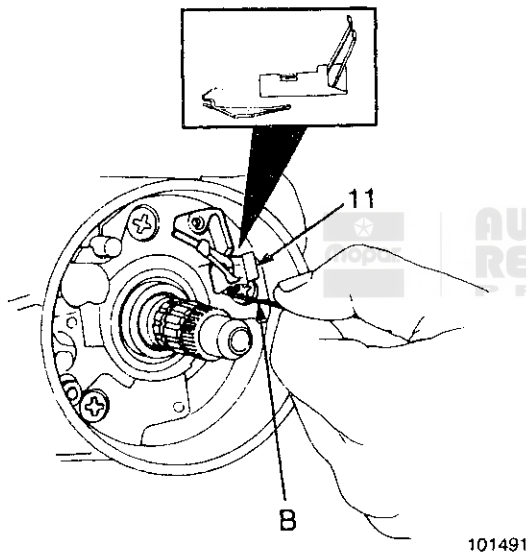
STEERING COLUMN SERVICE



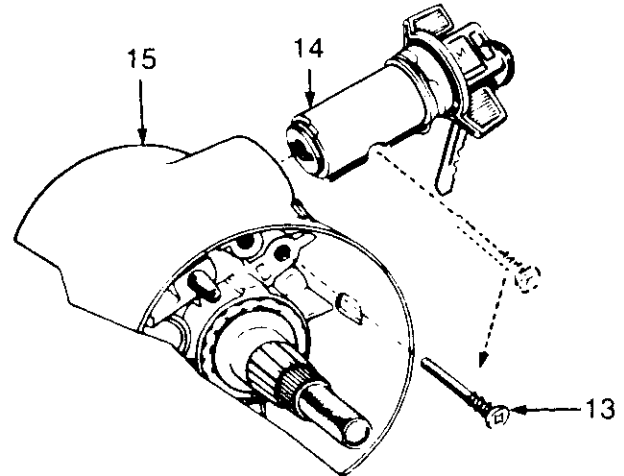
Insert the ignition key in the lock cylinder and turn the key to ON position.

Remove the key warning buzzer switch (11) and retaining clip (12) with needlenose pliers or a paper clip (B) with a right angle bend.

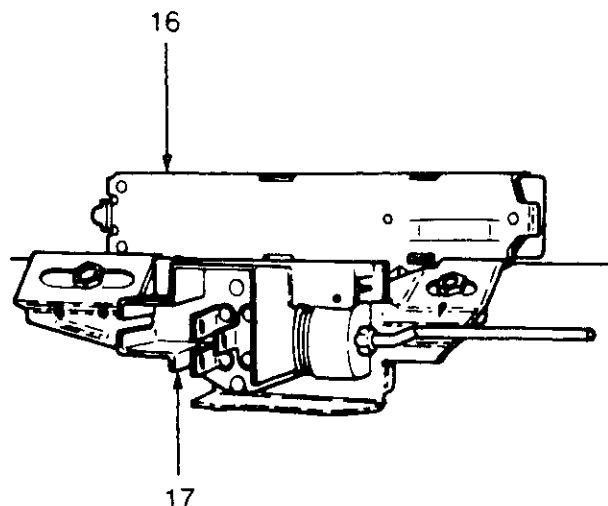
NOTE: Do not attempt to remove the buzzer switch (11) and clip (12) separately. The clip could fall into the column jacket.



Remove the ignition lock cylinder retaining screw (13) and pull the lock cylinder (14) out of the column housing (15).



Remove the ignition switch (16) and dimmer switch (17) from the column jacket.



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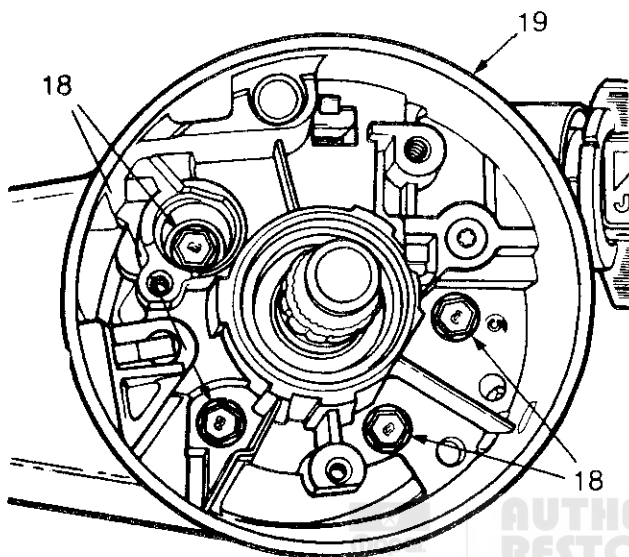


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STEERING COLUMN SERVICE

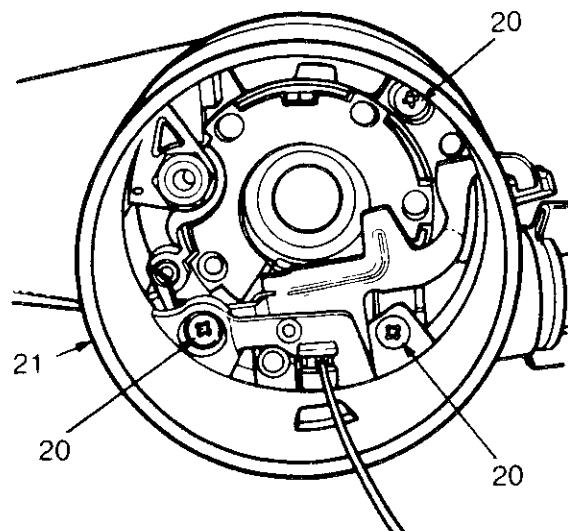


Remove the screws (18) that attach the housing and shroud assembly (19) to the column jacket and remove the housing and shroud assembly.



101497

Turn the housing and shroud assembly (19) over and remove the screws (20) that attach the shroud (21) to the housing (22). Separate the two components.



101493

Disengage the ignition switch actuator rod (29) from the lock rack.

Remove the dimmer switch actuator rod (23) from the housing (22).

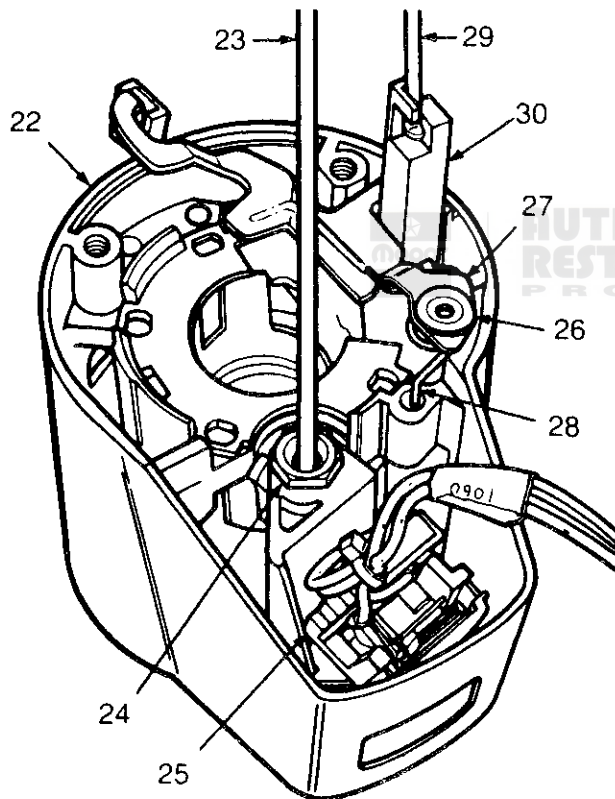
Remove the pivot screw (24) from the housing (22) and remove the wiper switch (25).

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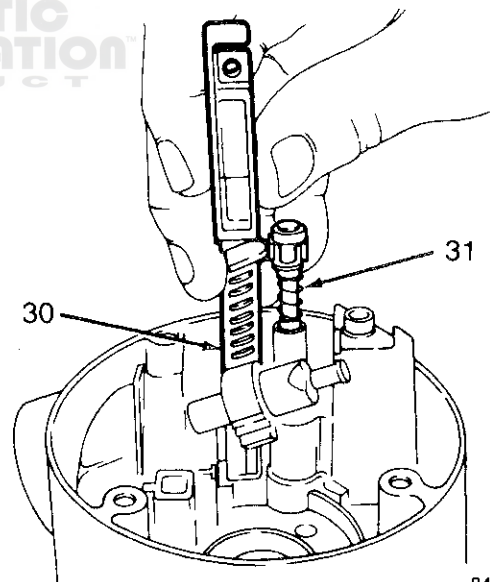
101494

Remove the wave washer (26) from the key release lever pivot.

Remove the key release lever (27) and lever spring (28).

Remove the lock rack (30) and lock bolt (31).

Remove the rack preload spring.



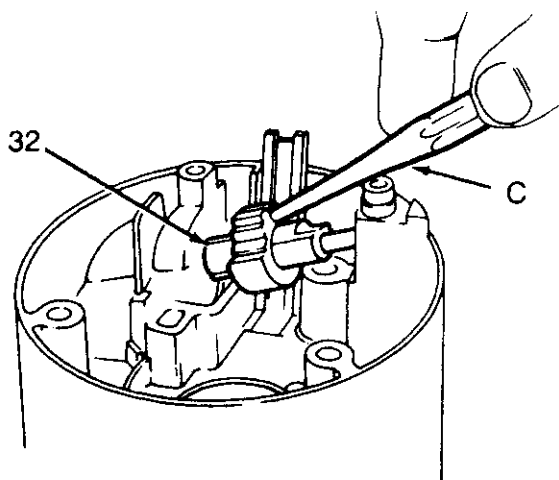
Remove the lock sector (32) through the lock cylinder hole in the housing. Push on the block tooth of the sector with a blunt punch (C) to remove.

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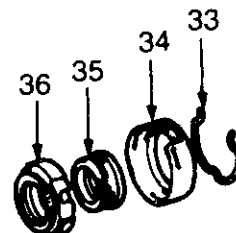


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



84702A



84703A

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NOTE: The following removal procedures can only be performed after the column has been removed from the vehicle.

Remove the steering shaft.

Remove the spring clip (33) from the lower bearing retainer (34) and remove the retainer, bearing (35) and adapter (36) from the column jacket.

STANDARD STEERING COLUMN ASSEMBLY

CAUTION: Be sure to preserve the energy absorbing features of the steering column. Use only the specified screws, bolts and nuts and tighten them to specified torque during reassembly. Incorrect size or length fasteners can prevent the column from compressing under impact. The bolts and nuts that attach the column mounting bracket to the column and instrument panel must be tightened to the correct torque to maintain the breakaway capability of the bracket.

Coat all friction and bearing surfaces with chassis grease before assembly.

Install the lock sector (32) on the sector shaft. Install the sector through the lock cylinder hole in the housing.

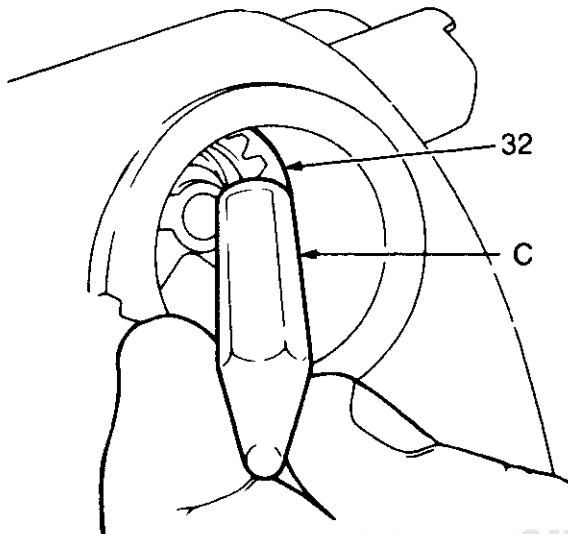


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



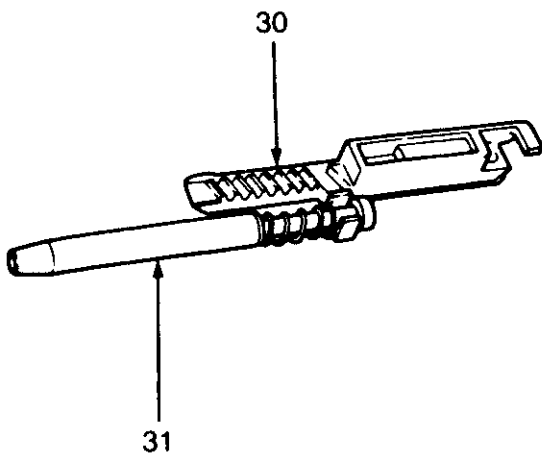
Use the blunt end of a punch (C) to press the sector (32) onto the shaft. Be sure the sector turns freely after installation.



84704A

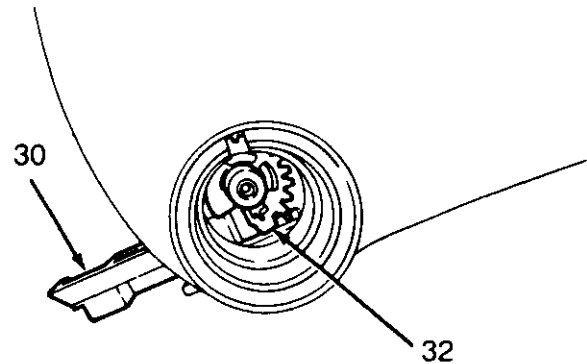
Install the rack preload spring. The bowed side of the spring must bear against the lock rack when the rack is installed.

Assemble the lock bolt (31) and lock rack (30).



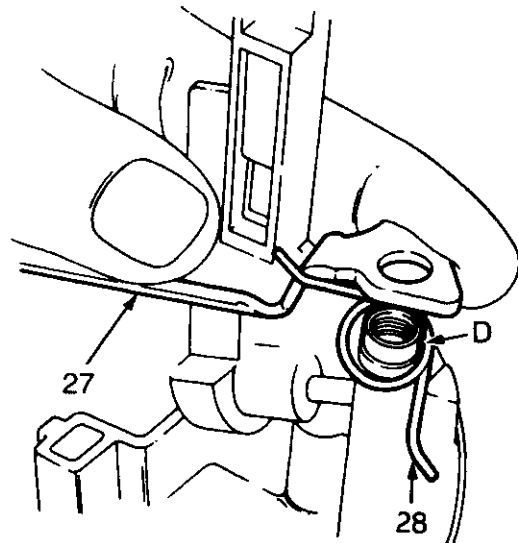
84705A

Install the assembled lock bolt and lock rack in the housing. Mate the block tooth of the lock rack (30) with the block tooth of the sector (32).



84706A

Install the key release lever return spring (28) over the post (D) in the housing.



84707A

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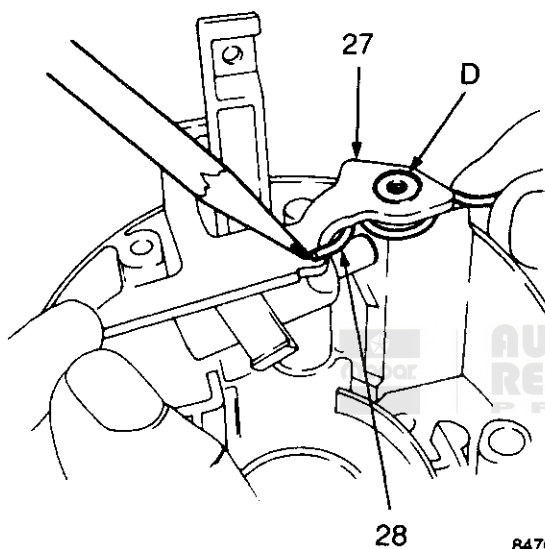
STEERING AND FRONT AXLE

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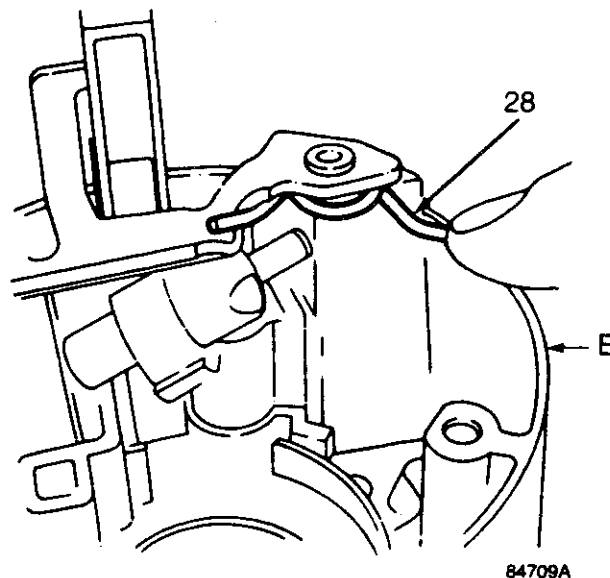
Insert the finger of the key release lever (27) in the lock rack slot and position the lever on the housing post (D).

Position the inner end of the release lever return spring (28) in contact with the release lever (27) as shown.



84708A

Raise the key release lever slightly and install the end of the release lever spring (28) between the lever and housing boss (E).



84709A

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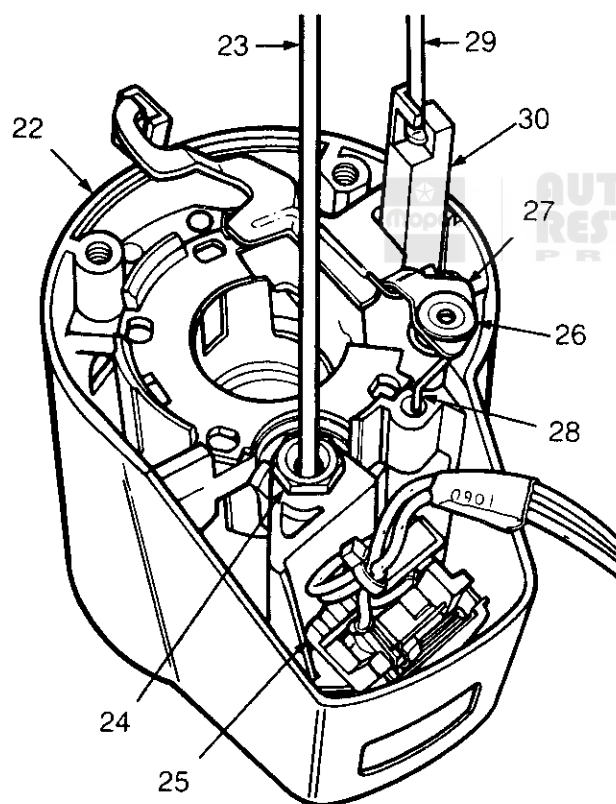
STEERING AND FRONT AXLE

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Install the wiper switch (25) in the housing (22) and install the pivot screw (24).

Coat the wave washer (26) with chassis grease and install the washer on the post and over the release lever (27). Use enough grease to hold the washer in position.



101494

Install the dimmer switch actuating rod (23) through the pivot screw (24).

Engage the short, hooked-end of the ignition switch actuator rod (29) in the lock rack (30).

Align and install the shroud (21) on the housing (22) and install the shroud-to-housing attaching screws (20).

NOTE: Do not displace the wave washer when installing the shroud on the housing.

Tape the dimmer switch actuator rod (23) to the shroud (21) to prevent the rod from disengaging.

Feed the wiper switch harness through the column. Keep the wires flat. Do not allow them to bend or kink.

Install the assembled shroud and housing (19) on the column jacket and tighten the attaching screws (18) to 4 N·m (35 in-lbs) torque.

Retract the lock cylinder actuator before installation as follows: Insert the ignition key into the cylinder (14). Hold the cylinder sleeve from turning and rotate the key clockwise until it stops; This retracts the cylinder actuator.

Install the lock cylinder (14) as follows:

- Align the lock cylinder tab with the housing keyway.
- Push the cylinder into the housing (15) until it bottoms.
- Install and tighten the retaining screw (13) to 5 N·m (40 in-lbs) torque.

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STEERING COLUMN SERVICE

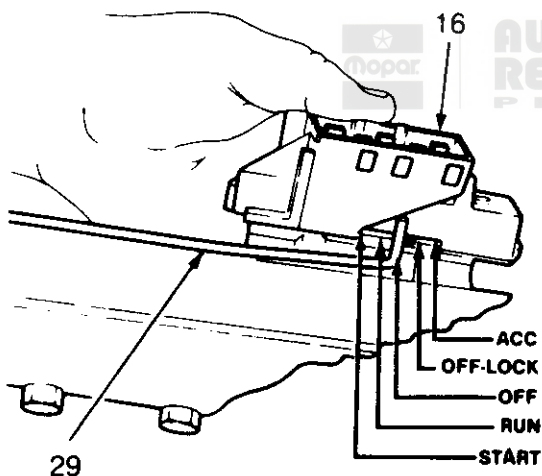


Turn the ignition key to the On position.

Install the key warning buzzer switch (11) and clip (12).

Install the ignition switch (16) as follows:

- Move the switch slider to the Accessory position, then back up two clicks to the OFF-UNLOCK position (3). The actuator rod hole in the slider should be almost at center.
- Insert the actuator rod (29) into the slider hole and install the switch on the column jacket.



Connect the dimmer switch actuator rod (23) to the switch (17) and install the switch and rod on the column jacket.

Install the lower bearing adapter (36), lower bearing (35), retainer (34), and retaining ring (33) on the column jacket.

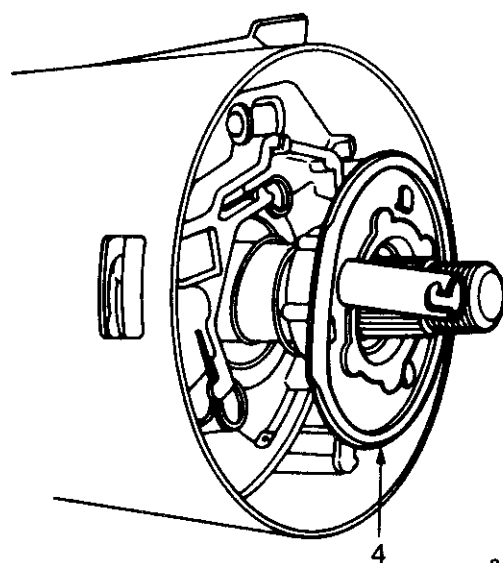
Insert the steering shaft through the lower bearing and guide the shaft upward into the upper bearing in the housing and shroud assembly (19).

Install the turn signal switch (10). Fold the wires against the connector and feed the connector through the housing and shroud.

Align the turn signal switch in the housing and install the switch attaching screws (8). Tighten the screws to 4 N·m (35 in-lbs) torque.

Install the turn signal actuator arm (9). Tighten the attaching screws to 4 N·m (35 in-lbs) torque.

Install the thrust washer (6), upper bearing preload spring (5) and canceling cam (4) on the steering shaft. Position the canceling cam (4) as shown.



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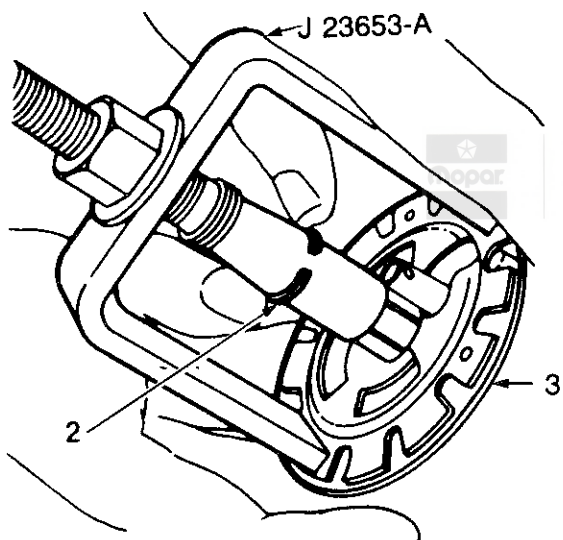


Place the turn signal switch in the neutral position and install the hazard warning switch knob.

Install the horn button components (A) in the canceling cam.

Position the lockplate (3) on the steering shaft.

Install a replacement steering shaft snap ring (2) on the sleeve of compressor tool J 23653-A and mount the tool on the steering shaft.



Compress the lockplate and install the snap ring (2) in the steering shaft groove.

Remove the compressor tool. Be sure the snap ring (2) is fully seated before removing the tool.

Install the lockplate cover (1).

Install the steering column if removed.

Install the steering wheel. Tighten the steering wheel nut to 34 N·m (25 ft-lbs) torque.

Adjust the ignition and dimmer switches as follows:

- Turn the ignition key to the On position.
- Loosen the switch mounting screws.
- Move the ignition switch downward to eliminate lash and tighten the switch screws only enough to hold the switch in position.
- Compress the dimmer switch slightly and insert a 3/32 inch diameter drill into switch hole (A). The drill will prevent any horizontal movement of the switch.
- Move the switch toward the steering wheel to remove actuator rod lash.
- Tighten the switch attaching screws to 4 N·m (35 in-lbs) torque.
- Check operation of both switches. Readjust either switch if necessary.

Install the switch harness protectors (if equipped) and snap the protectors into place on the column.

TILT STEERING COLUMN DISASSEMBLY

NOTE: Steering column removal is not necessary if only the lockplate, steering shaft snap ring, canceling cam, upper bearing, ignition lock cylinder, tilt mechanism, housing or any of the column switches are to be serviced. Column removal is only necessary if the column jacket, shift tube, or lower bearing must be serviced.

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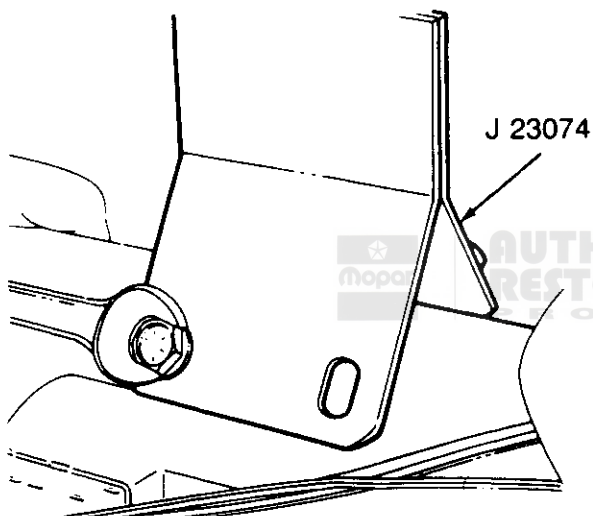


Disconnect the battery negative cable.

Remove the steering wheel.

On column shift models, remove the gearshift lever from the transmission shift control rod.

Remove the column if necessary and attach service bracket J 23074 to the column.

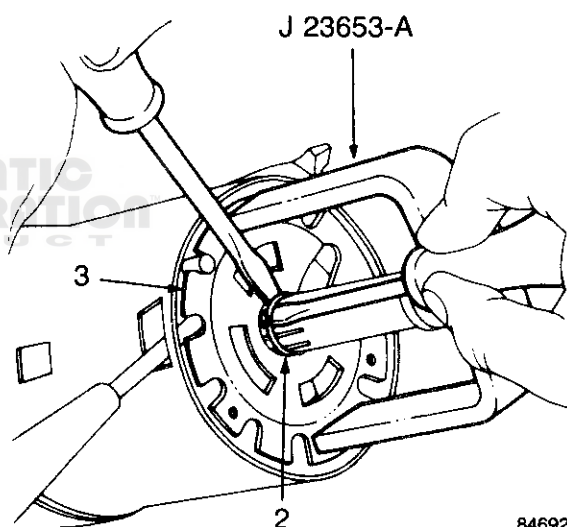


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Remove the lockplate cover (1).

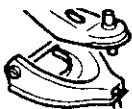
WARNING: In order to remove the steering shaft snap ring (2) in the following step, the lockplate (3) must be compressed. Do not attempt to remove the lockplate without compressor tool J 23653-A as the lockplate is under heavy spring tension.

Compress the lockplate (3) with compressor tool J 23653-A and remove the steering shaft snap ring (2). Discard the snap ring. It is not reusable.



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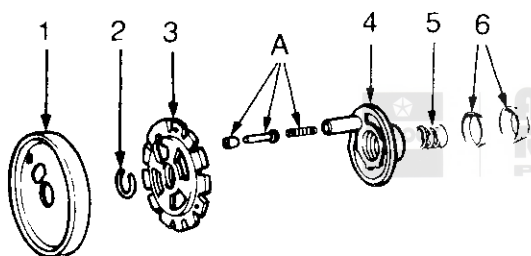
STEERING COLUMN SERVICE



Remove the compressor tool.

NOTE: When the steering shaft snap ring is removed, the shaft is free in the column. Do not allow the shaft to fall out during disassembly. Secure the shaft to the lower end of the column with tape until the shaft is removed.

Remove the lockplate (3), canceling cam (4), upper bearing preload spring (5) and thrust washer (6) from the shaft. Remove the horn button components (A) from the canceling cam.



84693A

Remove the hazard warning switch knob. Press the knob inward and turn it counterclockwise to remove it.

On column shift models, remove the screws attaching the shift indicator cover to the upper housing and remove the cover. Then remove the screw attaching the shift indicator lamp bracket but do not remove the bracket at this time.

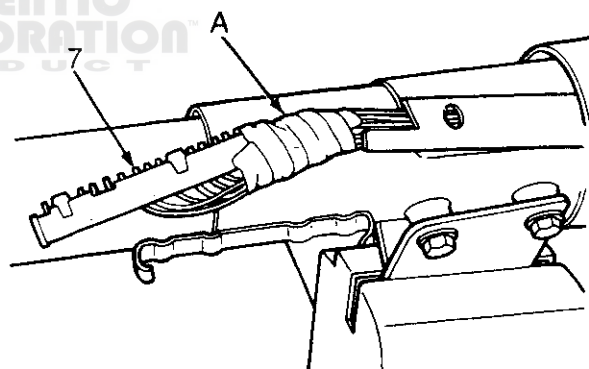
Remove the tilt control lever.

Remove the turn signal/wiper lever by pulling it straight out of the column.

Remove the protective cover(s) from the column harness.

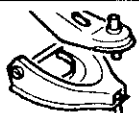
Disconnect the turn signal switch wire harness connector (7) from the the column jacket. Tape the harness (A) to prevent snagging during removal.

Attach a fish wire to the turn signal switch harness and tape the harness (A) to prevent snagging during removal.



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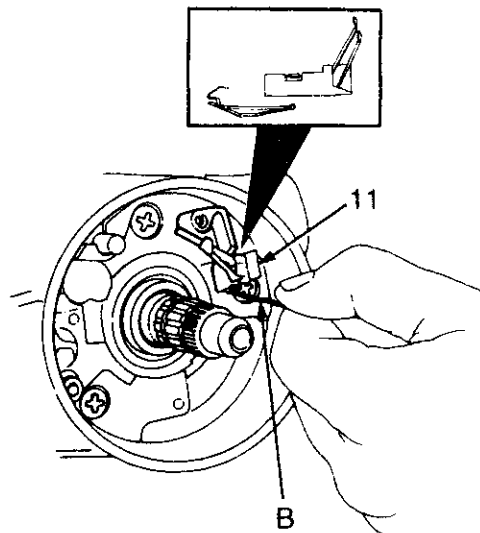
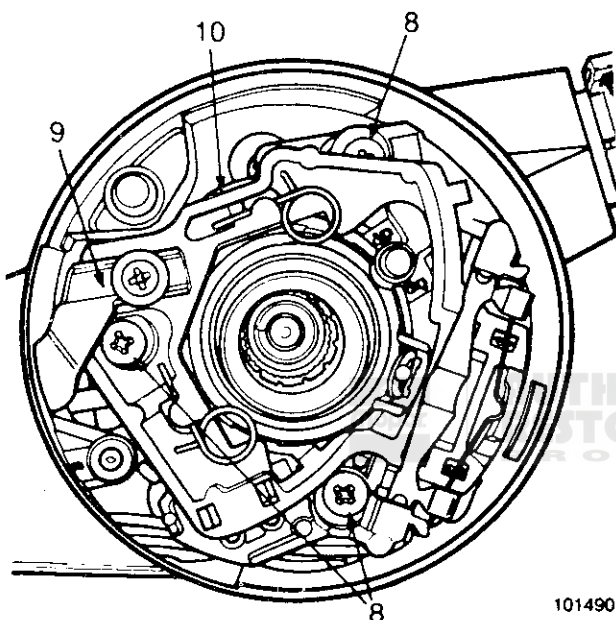
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Remove the turn signal switch attaching screws (8) and actuator arm (9).

Remove the the turn signal switch (10). Pull the switch and wire harness straight up and out of the housing. Use the fish wire to help guide the harness up and out of the housing.

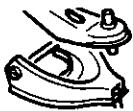


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Insert the ignition key in the lock cylinder and turn the key to ON position.

Remove the key warning buzzer switch and retaining clip (11) with needlenose pliers or a paper clip (B) with a right angle bend.

NOTE: Do not attempt to remove the buzzer switch and clip separately. The clip could fall into the column jacket.

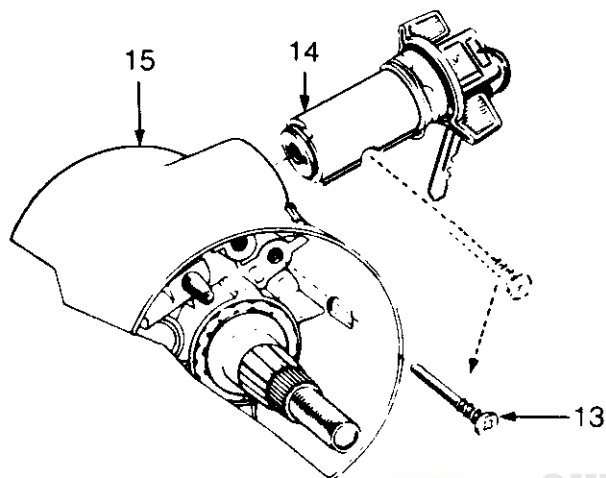


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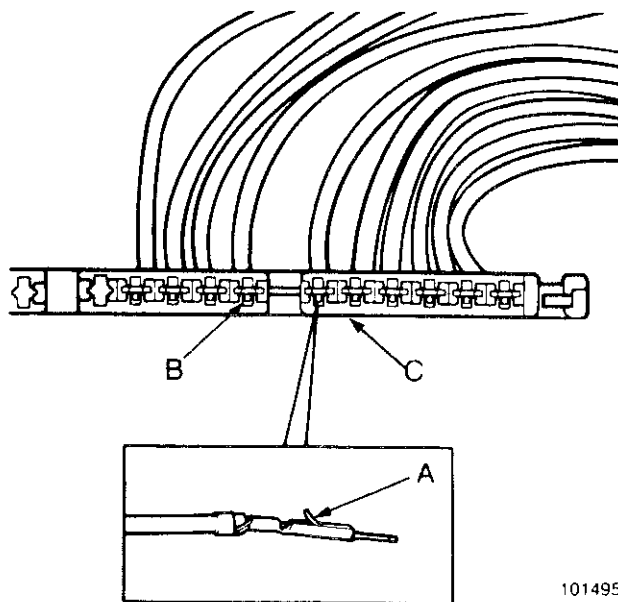


Remove the ignition lock cylinder retaining screw (13) and pull the lock cylinder (14) out of the upper housing (15).



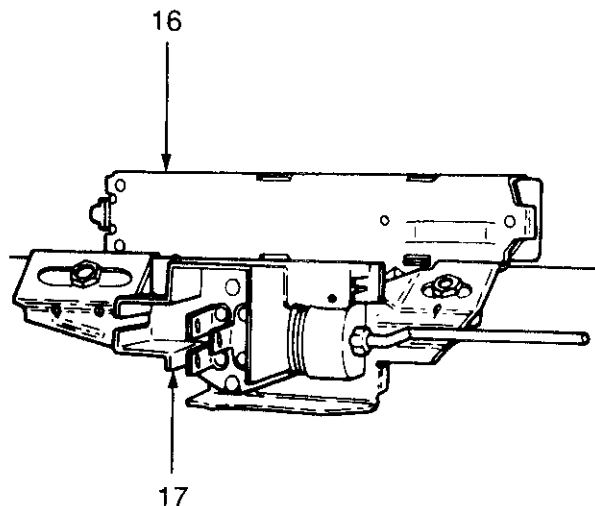
100476B

NOTE: If the wiper switch is being removed with the column out of the vehicle, continue with the disassembly procedure. However, if the column is still in the vehicle, prepare the switch for removal as follows: Loosen the column mounting bracket bolts about 3-4 turns. Mark or tag the switch wires for assembly reference. Compress the wire lock tabs (A) with a drill bit or straight pin and push the wires (B) out of the connector (C) with a drill bit or straight pin.



101495

Remove the ignition switch (16) and dimmer switch (17) from the column jacket.



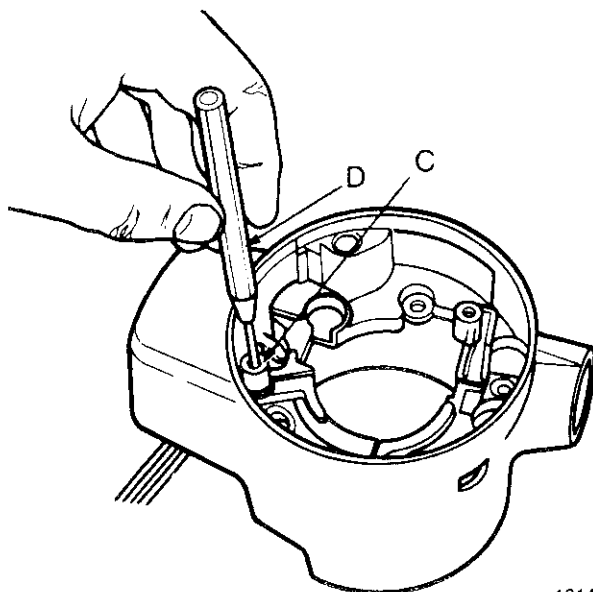
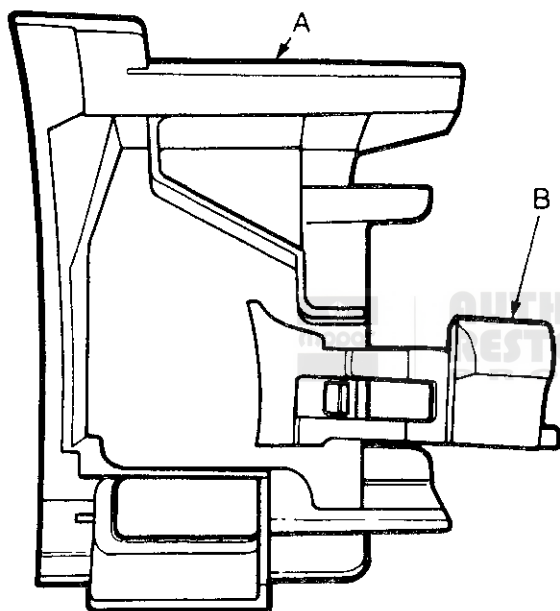
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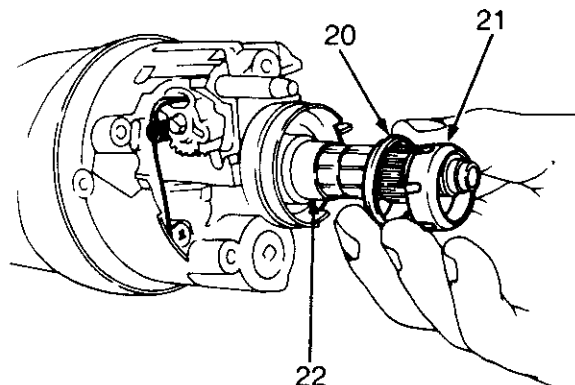
Remove the upper housing attaching screws (18) and remove the housing (19).

If only the wiper switch is to be serviced and the column is still in the vehicle, remove the switch side cover (A) and the dimmer switch rod operating cam (B). Then press out the switch pin (C) with a 1/8-inch diameter punch (D) and remove the wiper switch.



101498

Remove the upper bearing race (20) and bearing seat (21) from the steering shaft (22).

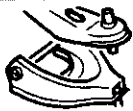


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Reinstall the tilt lever and place the column in the full upward tilt position.

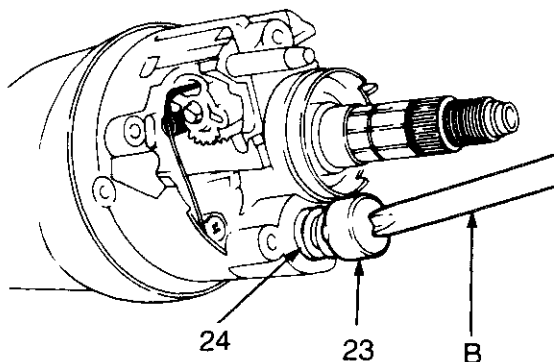
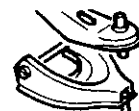
WARNING: The tilt spring guide (23) is under heavy spring tension from the tilt spring (24). Exercise care when removing the guide and spring in the following step.

Remove the tilt spring guide (23) and spring (24) with a Phillips screwdriver (B) as follows: Insert the screwdriver in the guide. Press the guide inward and turn it counterclockwise to release the guide tabs. Then slowly release the guide and spring and remove them from the tilt housing.



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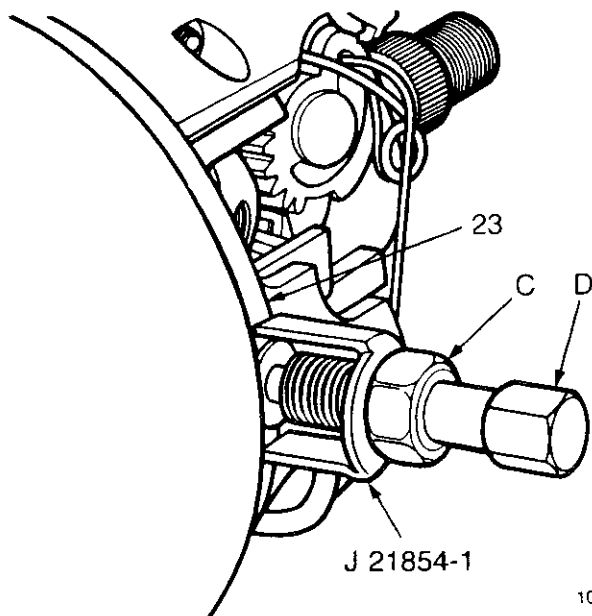
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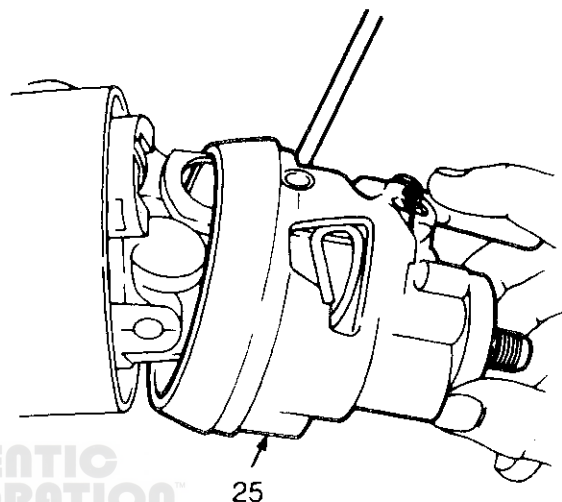
Place the tilt housing in the center (non-tilt) position.

Remove the housing pivot pins with tool J 21854-1. Install a nut (C) on the tool. Thread the tool into one of the pins. Then tighten the tool puller screw (D) and nut (C) as needed to pull the pin from the housing (23). Repeat the procedure to remove the remaining pivot pin.



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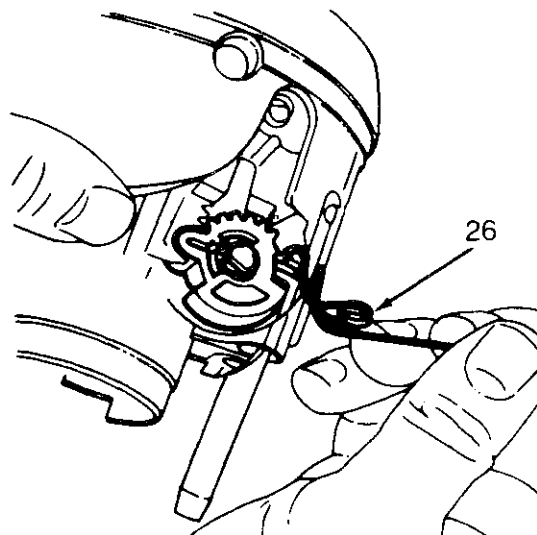
Raise the tilt lever to disengage the lock shoes and remove the tilt housing (25). Pull the housing upward to disengage the shoes and turn the housing clockwise to separate the lock rack from the actuator rod.



84729A

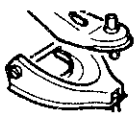
Remove the tilt lever from the tilt housing.

Remove the lock sector spring retaining screw and remove the spring (26). Rotate the spring in a clockwise direction to disengage it.



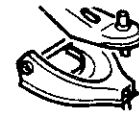
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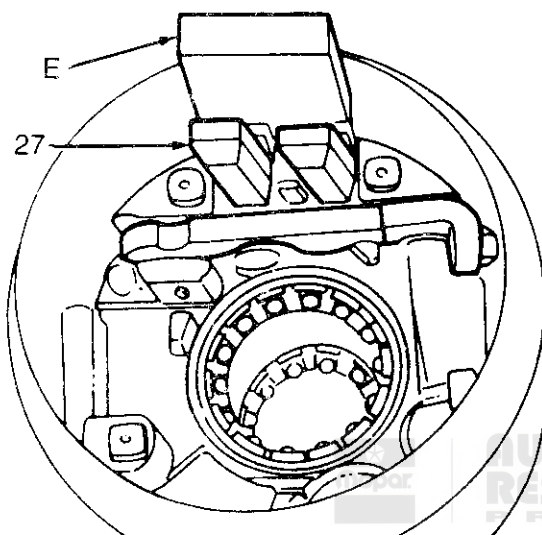
STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



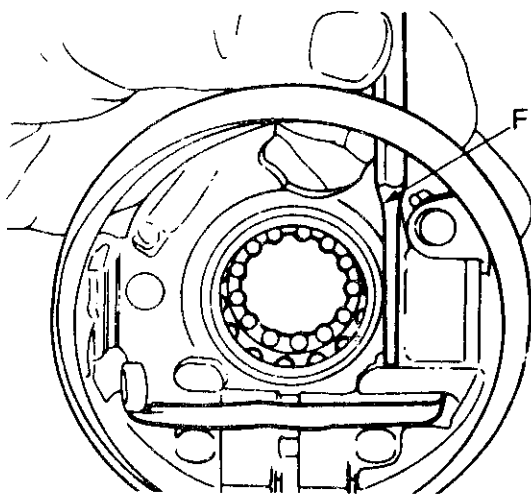
Remove the lock bolt, lock rack and rack preload spring from the tilt housing.

Insert a wedge (E) between the lock shoes (27) and the tilt housing.



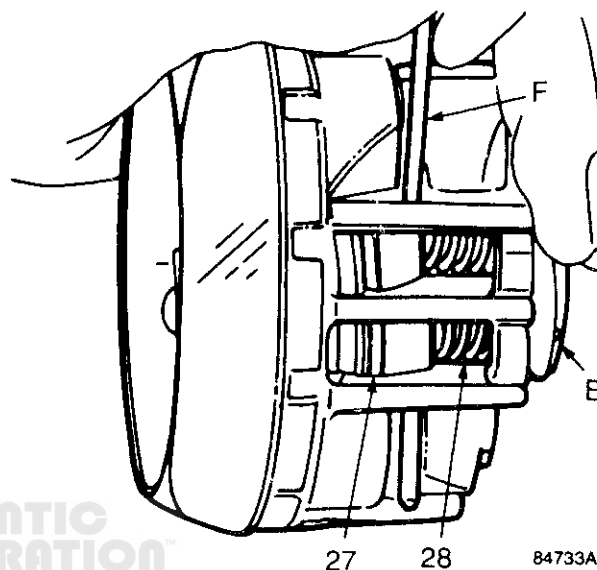
840338A

Remove the tilt lever pin with a pin punch (F) or tool J 22635.



840337A

Remove the lock shoe pin from the support with a pin punch or tool J 22635 and remove the lock shoes (27), springs (28) and wedge (E).

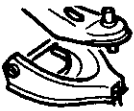


84733A

Remove the upper and lower bearings from the housing only if worn or damaged.

Remove the steering shaft (29) through the upper end of the column.

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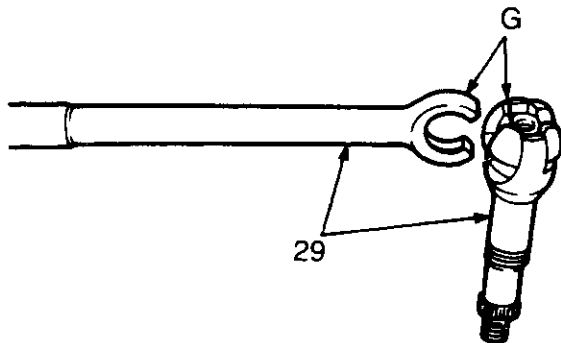


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE

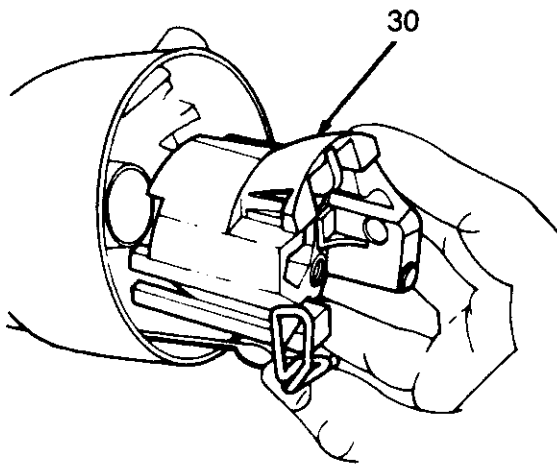


Disassemble the shaft. Fold the shaft 90 degrees and separate the upper and lower halves at the U-joint (G).



84734A

Remove the support attaching screws and remove the support (30).



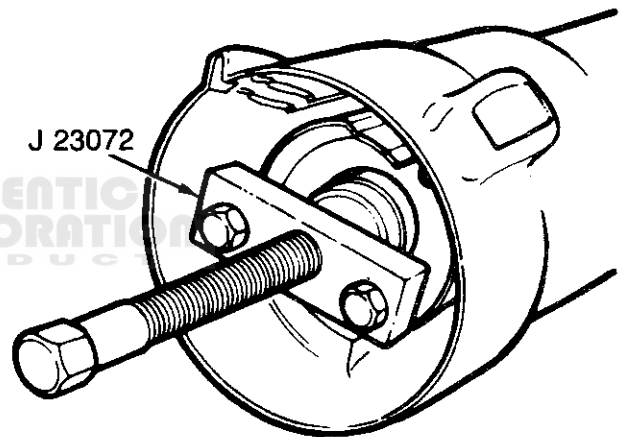
84735A

On column shift models, remove the shift gate screws and remove the shift gate.

Remove the steering shaft bearing assembly from the lower end of the column.

Remove the shift tube retaining ring and thrust washer.

Press the shift tube from the column jacket with tool J 23072.



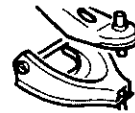
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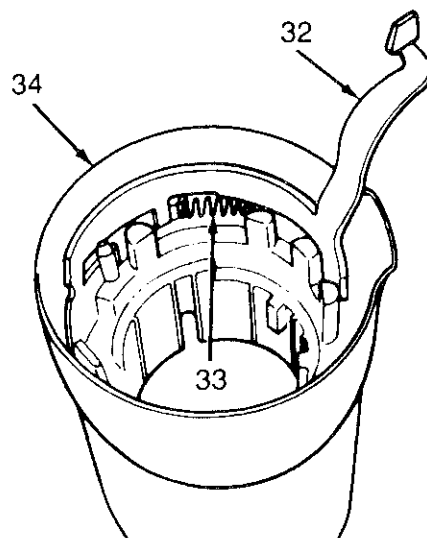
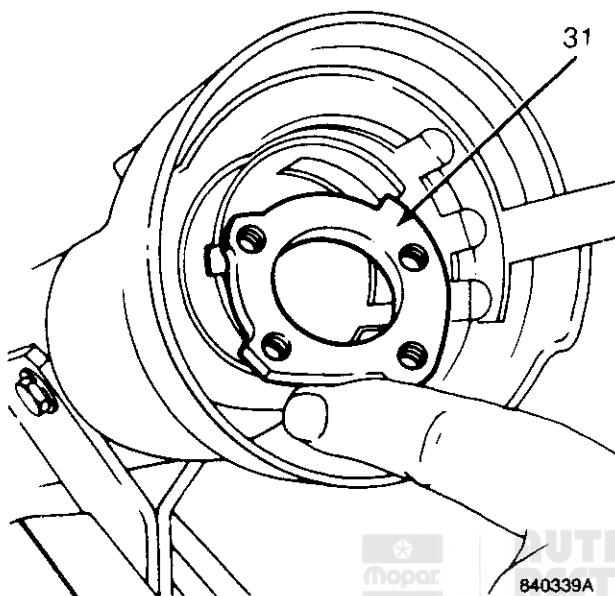


STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Remove the retainer plate (31). Tip the upper end of the plate rearward and turn the plate counterclockwise to remove it.



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TILT STEERING COLUMN ASSEMBLY

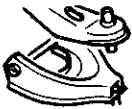
CAUTION: Be sure to preserve the energy absorbing features of the steering column. Use only the specified screws, bolts and nuts and tighten them to specified torque during reassembly. Incorrect size or length fasteners can prevent the column from compressing under impact. The bolts and nuts that attach the column mounting bracket to the column and instrument panel must be tightened to the correct torque to maintain the breakaway capability of the bracket.

Lubricate all of the bearing, friction and thrust surfaces with chassis grease.

SEE
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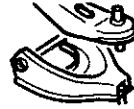
On column shift models, remove the shift tube wave washer and spring and remove the shift bowl from the column jacket.

On floor shift models, remove the key release lever (32) and spring (33) from the housing (34).



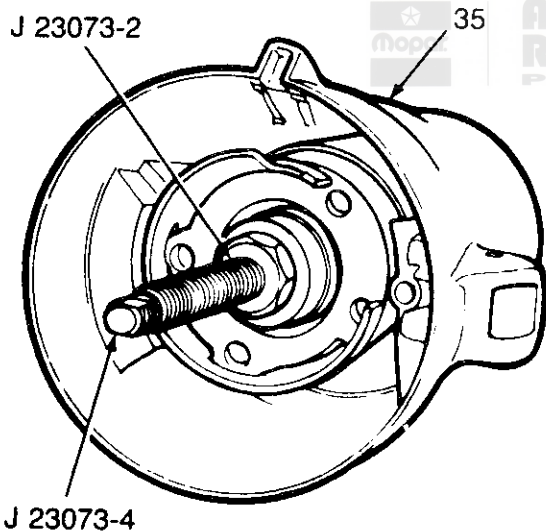
STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



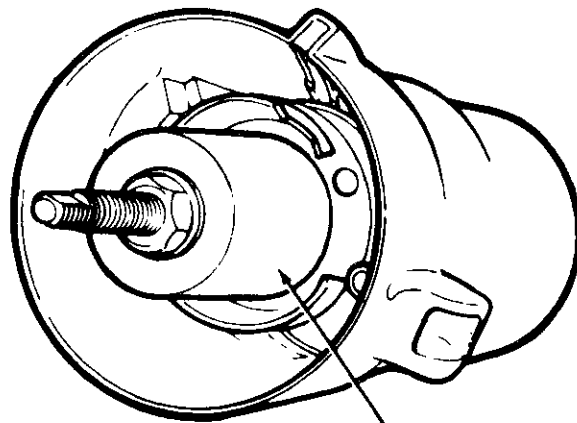
On column shift models, install the following components:

- Install the shift bowl (35) on the column jacket and install the shift tube wave washer and retainer plate in the shift bowl.
- Install the shift tube through the lower end of the column. Align the tube spline with the shift bowl keyway.
- Insert tool J 23073-2 and J 23073-4 in the shift tube. The spring loaded lower foot of the tool must engage the shift tube inner shoulder and the tool guide must be seated in the tube. Tighten the tool tension spring nut to a snug fit.



840784A

- Position the tool receiver J 23073-3 over the puller screw and install the tightening nut on the screw.
- Tighten the tool nut against the receiver to pull the tube into the bowl. Continue tightening the nut until the shift tube is fully seated and remove the tools.



J 23073-3

840785A

- Install the shift tube thrust washer and retainer plate.
- Install the lower bearing assembly in the column jacket.
- Install the shift gate in the support (30).
- Install the support (30) in the shift bowl (35).

On floor shift models, install the following components:

- Install the key release lever (32) and spring (33) in the housing (34).
- Install the housing on the column jacket.
- Install the retainer plate (31). Tip the plate toward the 12 O'clock position. Slide it under the jacket opening and seat it in the column notches.

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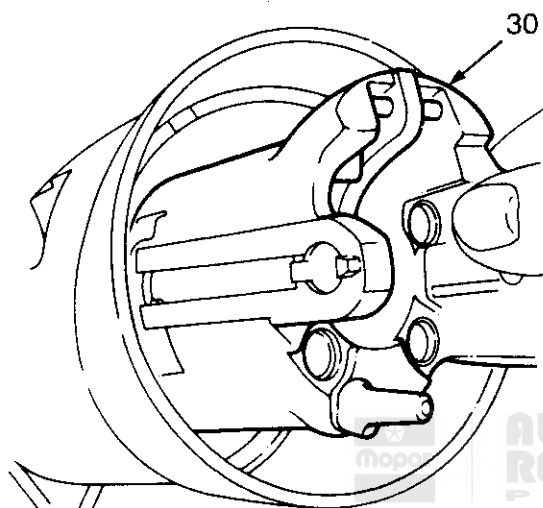
STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Install the support (30). Align the V-notch in the support and column jacket and insert the support in the shift bowl or housing.

Install and tighten the support screws alternately and evenly to 7 N·m (60 in-lbs) torque.



840342A

Engage the ignition switch actuator rod in the support. Guide the rod through the upper end of the bowl or housing and insert it into the slot in the support.

Install dimmer switch rod (39) in the support (30).

Assemble and install the steering shaft (29) in the column.

Install replacement steering shaft bearings in the housing if necessary. Lubricate the bearings with chassis grease before installation.

Install the lock shoes (27), lock shoe springs (28) and the lock shoe pin in the tilt housing (25). Use a 4.5-mm (0.180-in) diameter rod to align the lock shoes and pin during installation.

Place the lock sector on the shaft. Lightly tap the sector onto the shaft until the shaft snap ring groove is exposed. Then install the sector snap ring.

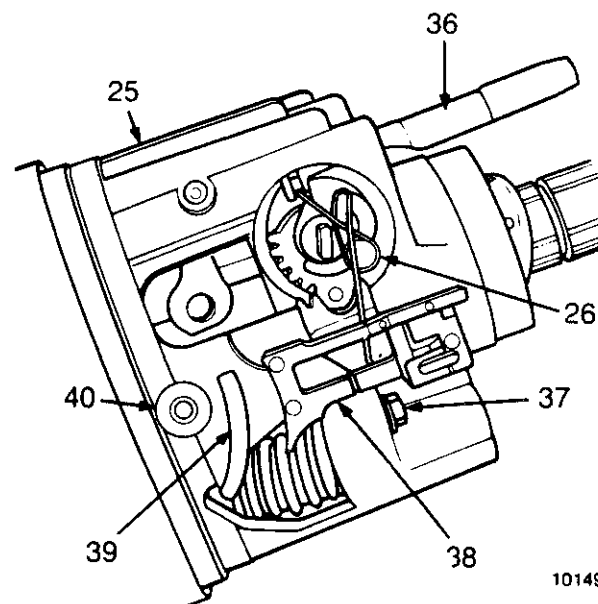
Install the lock bolt (36) in the housing (25). Engage the bolt with the lock sector cam surface.

Install the lock rack, rack preload spring, and replacement shim (if used) in the housing. The square block tooth of the rack must engage the square block tooth of the sector.

Install the lock spring (26) and spring retaining screw (37). Tighten the screw to 4 N·m (35 in-lbs) torque. Be sure the spring is engaged in the lock bolt, housing and attaching screw as shown.

Align and install the assembled tilt housing on the support. Hold the lock shoes in the disengaged position to ease housing installation.

Align the pivot pin holes in the housing (25) and support (30) and insert the pivot pins (40). Press the housing downward when starting the pins to avoid damaging the support. When the pins are started, seat them with a hammer and a punch.



101499



STEERING AND FRONT AXLE

STEERING COLUMN SERVICE

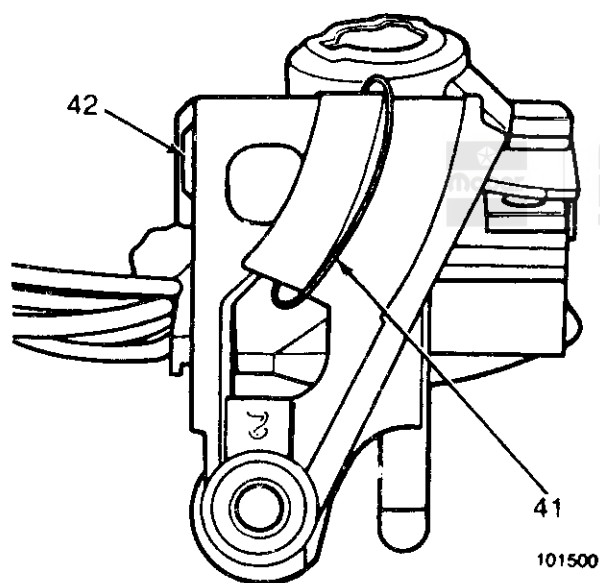


Lubricate the spring contact surface of the tilt spring guide (23) liberally with chassis grease and install the spring (24) in the guide.

Insert the assembled tilt spring (24) and guide (23) in the housing.

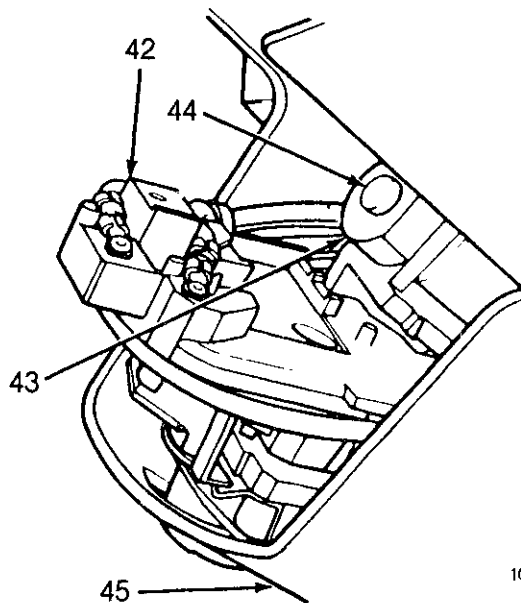
Press the guide downward with a phillips screwdriver. Turn the guide clockwise and seat the guide tabs in the housing.

Install the turn signal actuator arm clip (41) on the wiper switch (42). Be sure the clip is seated.



101500

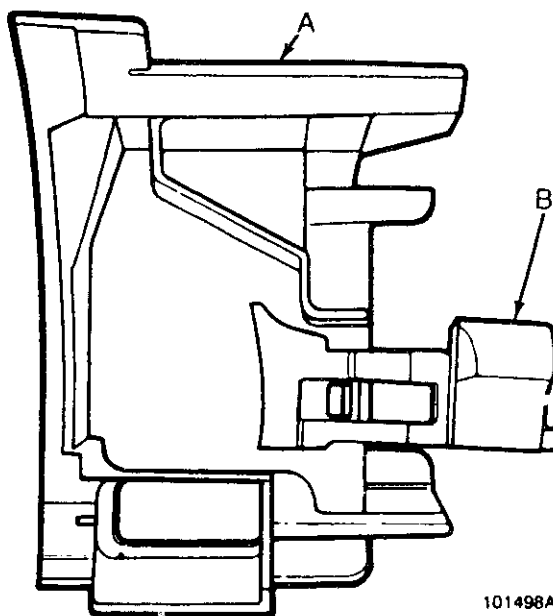
Install the wiper switch (42) and switch pin (44). Install the pin so it protrudes approximately 1/16 inch above the switch pivot (43) as shown.



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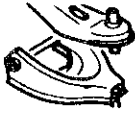
Be sure the dimmer switch rod end (39) is aligned with the cam (38).

Coat the dimmer switch actuator cam (B) with a liberal quantity of chassis grease and position the cam on the cover (A).



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STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Position and hold cover (A) on the housing (25). Then install the cover (45) on the column. Be sure to align the cover (A) and housing (B).

Remove the tilt lever.

Install the cover (45) on the tilt housing. Install and tighten the cover attaching screws to 7 N•m (60 in-lbs) torque.

Install the shift indicator lamp bracket screw.

Install the shift indicator cover and cover screws.

NOTE: If the column is in the vehicle and only the wiper switch is being serviced, disconnect the wires from the replacement switch connector (C) as shown in the disassembly procedure on page G-45. Then use a fish wire to help guide the wires into position. Reinstall the switch connector on the wires afterward.

Insert the wiper switch wires through the cover and housing and down the side of the column. Use a fish wire to help guide the wires into place.

Insert the tilt lever into the housing and place the housing in a full upward tilt position.

Install the lock cylinder (14) as follows:

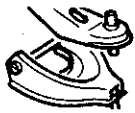
- Align the lock cylinder tab with the housing keyway.
- Push the cylinder into the housing (15) until it bottoms.
- Install and tighten the retaining screw (13) to 5 N•m (40 in-lbs) torque.

Turn the ignition key to the On position.

Install the key warning buzzer switch (11) and clip (12).

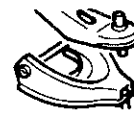
Install the turn signal switch (10). Guide the switch harness and connector through the column and position the switch into the housing. Do not install the switch screws at this time.

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STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Insert the hazard warning knob into the hazard warning switch and press the knob inward. Remove the knob.

Align and install the turn signal switch attaching screws. Tighten the screws to 4 N·m (35 in-lbs) torque. Be sure the switch is properly seated before tightening the screws.

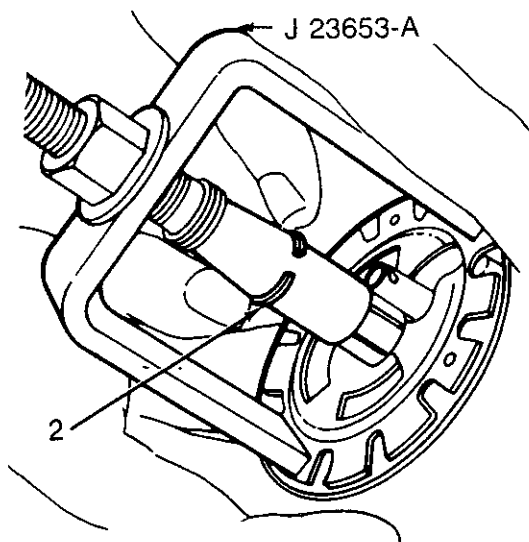
Thread the hazard warning knob into the switch and pull the knob outward.

Install the upper bearing race (20), and seat (21).

Install the upper bearing preload spring, canceling cam and lockplate.

Install a replacement steering shaft snap ring (2) on the sleeve of compressor tool J 23653-A and install the tool onto the steering shaft.

Compress the lockplate and seat the snap ring (2) in the steering shaft groove. Be sure the snap ring is completely seated before removing tool J 23653-A.



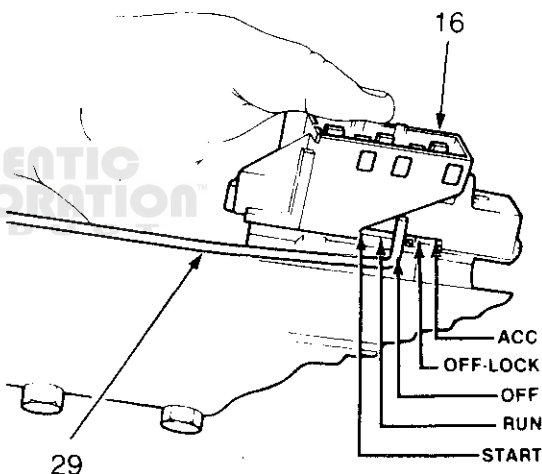
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Install the tilt and turn signal levers.

Install the dimmer switch.

Install the ignition switch (16) as follows:

- Move the switch slider to the Accessory position, then back up two clicks to the Off-Lock position. The actuator rod hole in the slider should be almost at center.
- Insert the actuator rod (29) into the slider hole and install the switch on the column jacket.



84711

Position the switch harness protectors (if equipped) over the harness and snap the protectors into place on the column jacket.

Install the lockplate cover.

Install the steering wheel. Tighten the steering wheel nut to 34 N·m (25 ft-lbs) torque.

Install the horn cover.

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STEERING AND FRONT AXLE

STEERING COLUMN SERVICE



Adjust the ignition and dimmer switches as follows:

- Turn the ignition key to the On position.
- Loosen the switch mounting screws.
- Move the ignition switch downward to eliminate lash and tighten the switch screws only enough to hold the switch in position.
- Compress the dimmer switch slightly and insert a 3/32 inch diameter drill into switch hole (A). The drill will prevent any horizontal movement of the switch.
- Move the switch toward the steering wheel to remove actuator rod lash.
- Tighten the switch attaching screws to 4 N·m (35 in-lbs) torque.
- Check operation of both switches. Readjust either switch if necessary.
- Be sure the engine starts only in Park and Neutral on models with automatic transmission.

Install the switch harness protectors (if equipped) and snap the protectors into place on the column.

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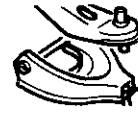


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STEERING AND FRONT AXLE

MANUAL STEERING GEAR

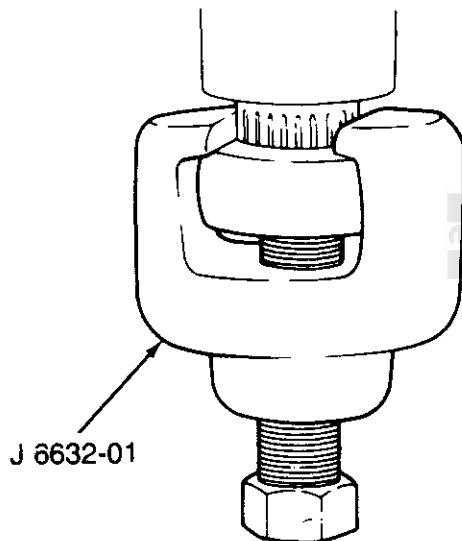


PITMAN SHAFT SEAL REPLACEMENT

Raise and support the vehicle. Turn the front wheels to the straight ahead position.

Remove the front stabilizer bar.

Mark the pitman arm and shaft for assembly reference and remove the pitman arm using puller J 6632-01.



84750A

Disconnect the center link from the pitman arm.

Remove the pitman arm seal with a pointed tool or small screwdriver.

Check condition of the gear lubricant. Replace the lubricant if contaminated. Remove and overhaul the gear if the lubricant is full of metal particles.

Wrap the pitman shaft splines with shimstock to protect the replacement seal during installation.

Lubricate the lip of the replacement seal with chassis grease.

Slide the replacement seal over the shimstock and into the seal seat in the gear housing. Tap the seal into place with a small plastic mallet.

Align and install the pitman arm on the shaft.

Install and tighten the pitman arm nut to specifications.

Stake the pitman nut to the shaft in two places.

CAUTION: The pitman arm nut must be securely staked to the sector shaft for proper retention.

Connect the center link to the pitman arm.

Install the front stabilizer bar.

Remove the supports and lower the vehicle.

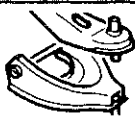
MANUAL STEERING GEAR ADJUSTMENT-IN VEHICLE

Manual steering gear worm bearing preload and overcenter drag torque can be adjusted with the gear in the vehicle.

CAUTION: Adjust steering gear preload and overcenter drag torque in the following sequence only. Failure to do so could result in damage to the gear or improper steering response. Always adjust worm bearing preload first and overcenter drag torque last.

Raise and support the vehicle. Check and correct steering gear mounting bolt torque, if necessary.

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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



Remove the front stabilizer bar.

Mark the pitman arm and steering gear pitman shaft for assembly reference.

Remove the pitman arm nut and remove the pitman arm with tool J 6632-01.

Loosen the pitman shaft adjusting screw locknut and back off the adjusting screw 2 or 3 turns.

Remove the horn button and cover.

Slowly turn the steering wheel in one direction until stopped by the gear. Then turn the steering wheel back 1/2 turn.

CAUTION: Do not turn the steering wheel hard against the stop when the linkage is disconnected. This could damage the steering gear ball return guides.

Measure worm bearing preload as follows:

- Install a socket and inch-pound torque wrench on the steering wheel nut.
- Measure worm bearing preload by rotating the wheel through a 90° arc (1/4 turn). Preload should be 0.6 to 1 N·m (5-8 in-lbs) torque.
- Record worm bearing preload and proceed to the next step.

Center the steering gear. Rotate the steering wheel from stop-to-stop and count the total number of turns. Then turn the steering wheel back 1/2 the total number of turns to center the gear.

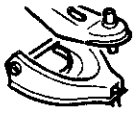
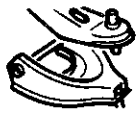
Measure steering gear overcenter drag torque as follows:

- Turn the steering gear off center.
- Install the socket and inch-pound torque wrench on the steering wheel nut.
- Measure the torque required to turn the gear through the center of travel (overcenter drag torque).
- Drag torque should equal worm bearing preload torque plus 0.5-1.0 N·m (4-10 in-lbs) but must not exceed a total of 2 N·m (18 in-lbs) torque.
- For example if worm bearing preload is 0.7 N·m (6 in-lbs) torque, overcenter drag torque should not exceed 1.3 N·m (12 in-lbs) torque. This makes a total of 2 N·m (18 in-lbs) which is the maximum allowable.

If adjustment is necessary, adjust preload first and drag torque last as follows:

- Loosen the worm bearing adjuster locknut.
- Turn the worm bearing preload adjuster clockwise to increase preload or counterclockwise to decrease preload. When desired preload is obtained, tighten the adjuster locknut and recheck preload. Readjust if necessary and proceed to next step.
- Loosen the pitman shaft adjusting screw locknut and loosen or tighten the adjusting screw to obtain desired drag torque. Tighten the adjusting screw locknut and recheck drag torque. Correct adjustment if necessary.

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	STEERING AND FRONT AXLE MANUAL STEERING GEAR	
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Tighten the worm bearing preload adjuster locknut to 68 N·m (50 ft-lbs) and tighten the drag torque adjusting screw locknut to 34 N·m (25 ft-lbs).

Align and connect the pitman arm to the shaft.

Install and tighten the pitman nut to specifications.

Stake the pitman nut to the shaft in two places.

CAUTION: The pitman arm nut must be securely staked to the sector shaft for proper retention.

Install the front stabilizer bar, remove the supports and lower the vehicle.

Install the horn button cover.



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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



MANUAL STEERING GEAR DIAGNOSIS

Condition	Possible Cause	Correction
HARD OR ERRATIC STEERING	(1) Incorrect tire pressure. (2) Insufficient or incorrect lubrication. (3) Suspension or steering linkage parts damaged or misaligned. (4) Improper front wheel alignment. (5) Incorrect steering gear adjustment. (6) Sagging springs.	(1) Inflate tires to recommended pressures. (2) Lubricate as required (refer to Maintenance Section). (3) Repair or replace parts as necessary. (4) Adjust incorrect wheel alignment angles. (5) Adjust steering gear. (6) Replace springs.
PLAY OR LOOSENESS IN STEERING	(1) Steering wheel loose. (2) Steering linkage or attaching parts loose or worn. (3) Pitman arm loose. (4) Steering gear attaching bolts loose. (5) Loose or worn wheel bearings. (6) Steering gear adjustment incorrect or parts badly worn.	(1) Inspect shaft splines and repair as necessary. Tighten attaching nut and stake in place. (2) Tighten, adjust, or replace faulty components. (3) Inspect shaft splines and repair as necessary. Tighten attaching nut and stake in place. (4) Tighten bolts. (5) Adjust or replace bearings. (6) Adjust gear or replace defective parts.
WHEEL SHIMMY OR TRAMP	(1) Improper tire pressure. (2) Wheels, tires, or brake rotors out-of-balance or out-of-round. (3) Inoperative, worn, or loose shock absorbers or mounting parts. (4) Loose or worn steering or suspension parts. (5) Loose or worn wheel bearings. (6) Incorrect steering gear adjustments. (7) Incorrect front wheel alignment.	(1) Inflate tires to recommended pressures. (2) Inspect and replace or balance parts. (3) Repair or replace shocks or mountings. (4) Tighten or replace as necessary. (5) Adjust or replace bearings. (6) Adjust steering gear. (7) Correct front wheel alignment.
TIRE WEAR	(1) Improper tire pressure. (2) Failure to rotate tires. (3) Brakes grabbing.	(1) Inflate tires to recommended pressures. (2) Rotate tires. (3) Adjust or repair brakes.

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STEERING AND FRONT AXLE

MANUAL STEERING GEAR

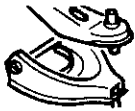


MANUAL STEERING GEAR DIAGNOSIS (cont'd.)

Condition	Possible Cause	Correction
TIRE WEAR (Continued)	(4) Incorrect front wheel alignment. (5) Broken or damaged steering and suspension parts. (6) Wheel runout. (7) Excessive speed on turns.	(4) Align incorrect angles. (5) Repair or replace defective parts. (6) Replace faulty wheel. (7) Make driver aware of condition.
VEHICLE LEADS TO ONE SIDE	(1) Improper tire pressures. (2) Front tires with uneven tread depth, wear pattern, or different cord design (i.e., one bias ply and one belted or radial tire on front wheels). (3) Incorrect front wheel alignment. (4) Brakes dragging. (5) Pulling due to uneven tire size.	(1) Inflate tires to recommended pressures. (2) Install tires of same cord construction and reasonably even tread depth, design, and wear pattern. (3) Align incorrect angles. (4) Adjust or repair brakes. (5) Replace faulty tire.

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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



MANUAL STEERING GEAR REMOVAL

Disconnect the intermediate steering shaft from the gear.

Raise and support the vehicle.

Disconnect the center link from the pitman arm.

Remove the front stabilizer bar.

Remove the pitman arm nut.

Mark the pitman arm and shaft for installation reference and remove the pitman arm with tool J 6632-01.

Remove the steering gear mounting bolts and remove the gear.

MANUAL STEERING GEAR INSTALLATION

Position the steering gear on the frame and install the gear mounting bolts.

Align and install the pitman arm on the pitman shaft.

Install and tighten the pitman nut.

Stake the pitman nut to the shaft in two places.

CAUTION: The pitman nut must be securely staked to the pitman shaft for proper retention.

Connect the center link to the pitman arm.

Install the front stabilizer bar.

Remove the supports and lower the vehicle.

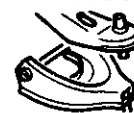
Connect the intermediate steering shaft to the steering gear.

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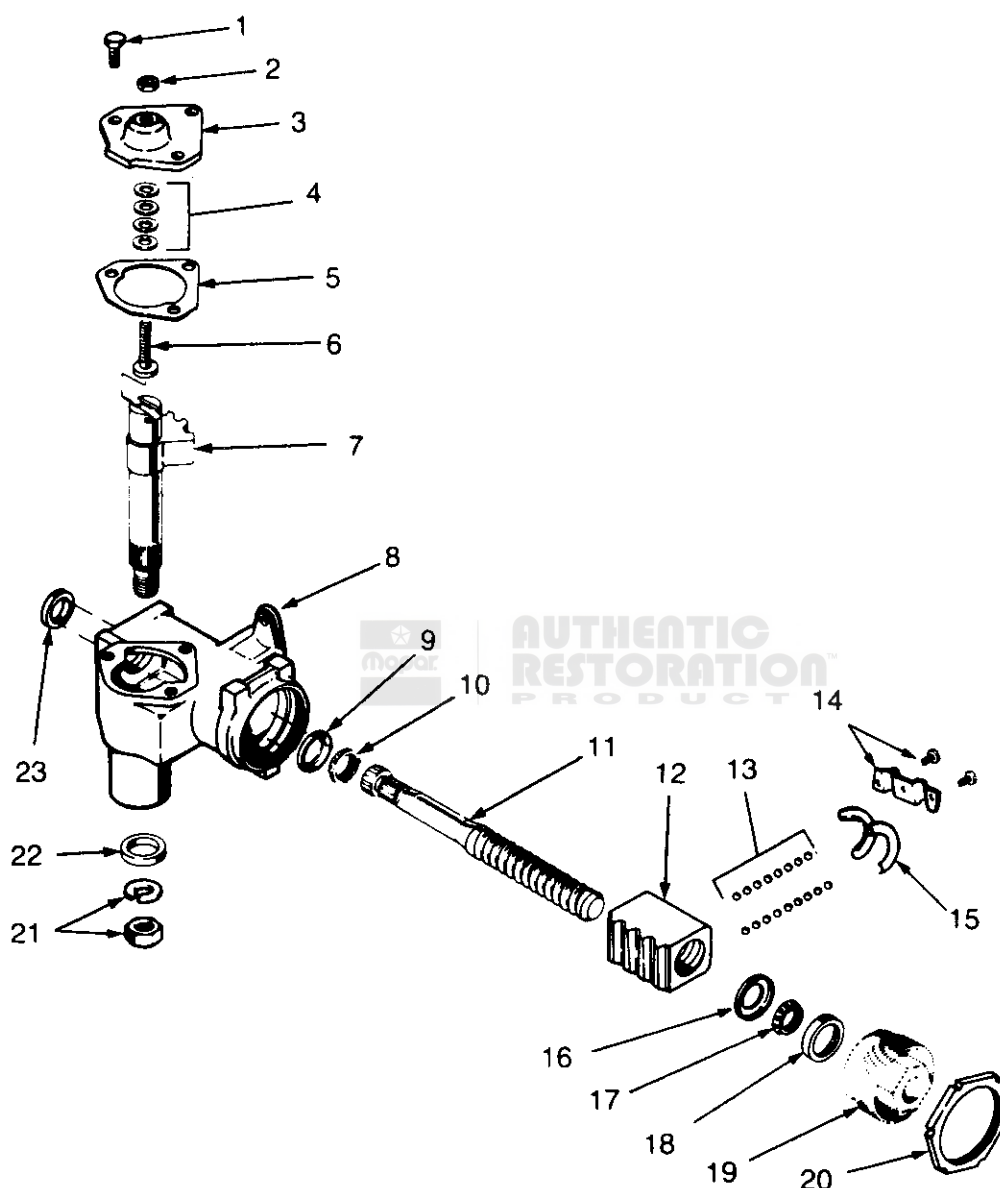


STEERING AND FRONT AXLE

MANUAL STEERING GEAR



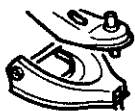
MANUAL STEERING GEAR COMPONENTS



1. Cover Bolt
2. Adjuster Screw Locknut
3. Cover
4. End Play Shims
5. Cover Gasket
6. Adjuster Screw (Pitman Shaft)
7. Pitman Shaft
8. Gear Housing
9. Upper Bearing Race
10. Upper Bearing
11. Wormshaft

12. Ball Nut
13. Ball Bearings (50)
14. Ball Guide Clamp and Screws
15. Ball Guides
16. Lower Bearing Retainer
17. Lower Bearing
18. Lower Bearing Race
19. Worm Bearing Adjuster
20. Adjuster Locknut
21. Pitman Nut and Washer
22. Seal (Pitman Shaft)
23. Seal (Wormshaft)

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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



MANUAL STEERING GEAR DISASSEMBLY

Remove the steering gear from the vehicle.

Remove the flexible coupling.

Mount the steering gear in a vise. Clamp the gear on a mounting boss only.

Center the gear as follows:

- Rotate the wormshaft (10) stop-to-stop and count the total number of turns.
- Turn the wormshaft back 1/2 the total number of turns to center the gear.

Remove the pitman shaft adjuster screw locknut (2).

Remove the cover bolts (1).

Remove the cover (3) and gasket (5).

Slide the adjuster screw (6) and shims (4) out of the pitman shaft (7). Retain the screw and shims for end play measurement during assembly.

Remove the pitman shaft (7).

Remove the worm bearing adjuster locknut (20) and remove the worm bearing adjuster (19).

Remove the wormshaft (11) and ball nut (12) as an assembly.

CAUTION: Do not allow the ball nut to rotate freely and bottom at either end of the wormshaft during service operations. The tangs at the ends of the ball guides (15) could become damaged.

Remove the upper bearing (10) from the wormshaft (11).

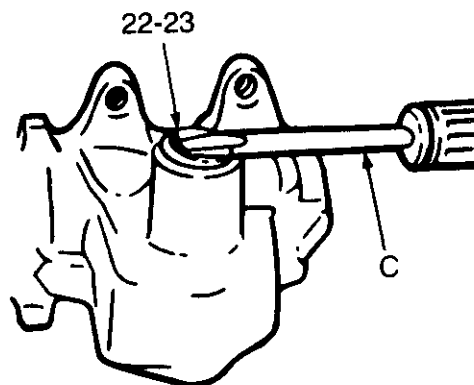
Remove the ball guide clamp attaching screws and remove the clamp (14) and ball guides (15). Separate the guide halves and retain the ball bearings (13) that remained in the guides during removal.

Remove the remaining ball bearings (13) from the ball nut (12). Place a cloth under the ball nut. Then rotate the wormshaft back and forth until the bearings drop out onto the cloth.

NOTE: A total of 50 ball bearings are used (25 in each circuit).

Remove the wormshaft (11) from the ball nut (12).

Remove the seals (22) and (23) from the gear housing (8). Use screwdriver (C) to pry the seals out. Discard the seals.



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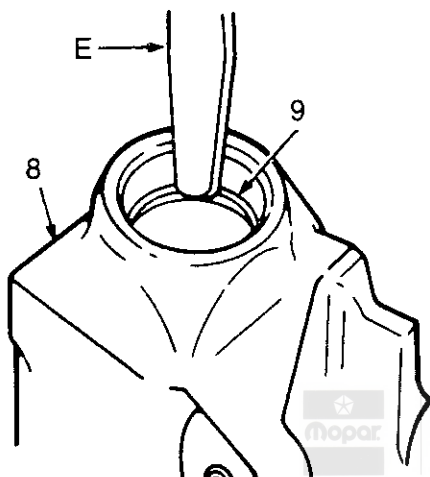
STEERING AND FRONT AXLE

MANUAL STEERING GEAR



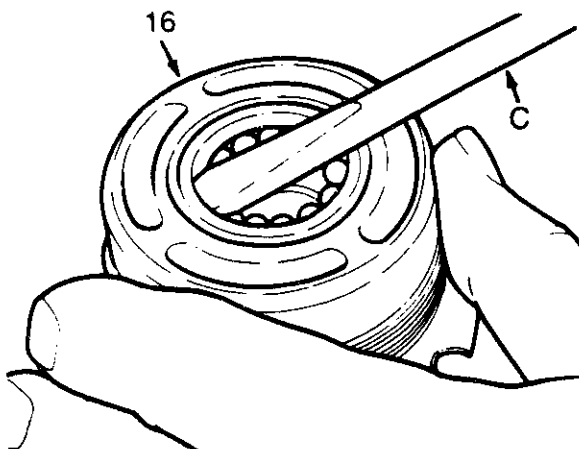
Remove the wormshaft upper bearing (10).

If the wormshaft upper bearing race (9) is to be replaced, remove it from the housing (8) with a hammer and brass punch (E).



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Remove the wormshaft lower bearing retainer (16) from the worm bearing adjuster (19). Use a screwdriver (C) to pry the retainer out of the adjuster.

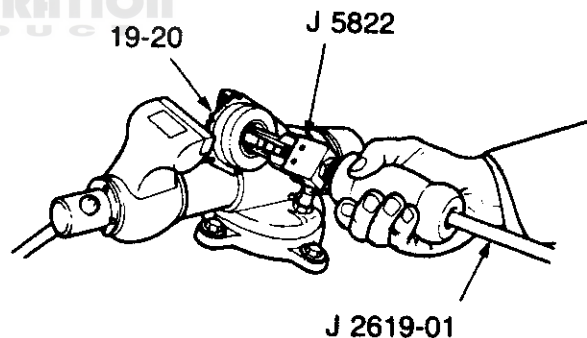


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Remove the wormshaft lower bearing (17) from the bearing race (in the adjuster).

Examine the lower bearing race (18). If the race is worn or damaged, remove it from the adjuster as follows:

- Install the original adjuster locknut (20) on the adjuster (19).
- Position the adjuster in a vise and clamp the vise jaws on the adjuster locknut.
- Remove the race with slide hammer J 2619-01 and puller J 5822.



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- Remove the adjuster from the vise and remove the locknut from the adjuster. Discard the locknut if bent or damaged.

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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



Cleaning and Inspection

Clean the steering gear components with solvent and dry them with shop towels or compressed air.

Inspect the housing for cracks, porosity, damaged threads or gasket surface scoring or distortion.

Inspect the pitman shaft bore contact surface and the sector teeth for wear, pitting, or other damage.

Insert the pitman shaft in the housing bore and check for shaft or housing bore wear. The shaft should be a smooth, bind free fit and not display any visible side play when installed in the bore.

If the shaft appears loose but is not visibly worn, trial fit a replacement shaft in the housing bore. If the replacement shaft is also loose, replace the housing. However, if the replacement shaft fits properly, discard the original pitman shaft.

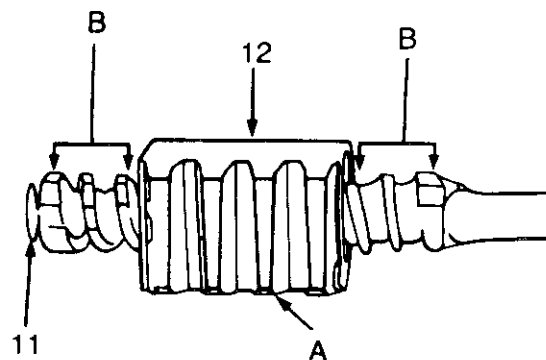
Inspect the wormshaft bearings and races for wear, flat spots, pitting, cracks, or other damage. If either the bearing or race is damaged, both parts must be replaced.

If the upper race is loose in the housing, trial fit a replacement race. If the replacement race is also loose, replace the housing. If the replacement race fits properly, do not replace the housing.

MANUAL STEERING GEAR ASSEMBLY AND ADJUSTMENT

Position the ball nut (12) on its side with the deep part of the sector teeth (A) facing down.

Thread the wormshaft (11) into the ball nut (12) until an equal number of shaft threads (B) are visible at each end of the nut.



84753A

CAUTION: The ball nut teeth are machined to a greater width and depth on one side (A). When assembling the wormshaft and ball nut, position the ball nut so these teeth (A) will face the housing side cover after installation.

Install one bearing (13) in each ball guide hole in the ball nut. Move the wormshaft up and down and side-to-side until the bearings roll down the ball nut threads and under the wormshaft to support it.

Install the ball guides (15) in the ball nut (12).

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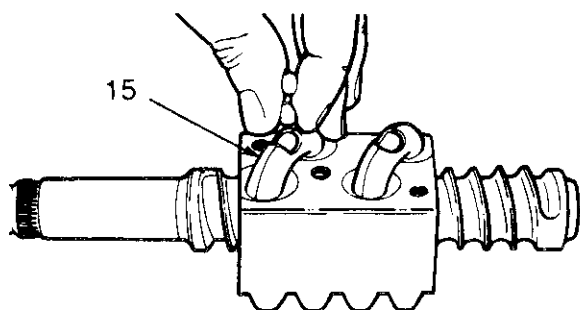


STEERING AND FRONT AXLE

MANUAL STEERING GEAR



Divide the remaining 48 ball bearings (13) into two groups of 24 each. Then install one group into each ball nut circuit through the holes in the ball guides (15).



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NOTE: To ease ball bearing installation, turn the wormshaft back and forth while inserting the bearings.

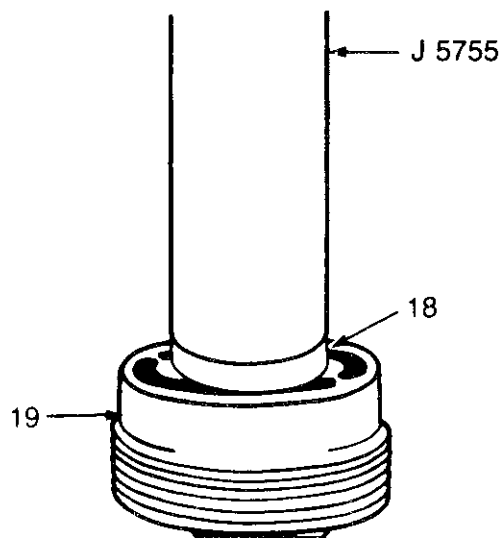
Position the ball guide clamp (14) on the ball nut and install the clamp attaching screws.

Lubricate the wormshaft threads with chassis grease and thread the shaft in and out of the ball nut to circulate the lubricant. Add additional grease as needed to lubricate the ball bearings thoroughly.

CAUTION: Do not allow the wormshaft to bottom in either direction. The tangs on the ball guide ends could become damaged.

Lubricate the wormshaft upper bearing (10) with chassis grease and install the bearing on the wormshaft (11).

Install a replacement lower bearing race (18) in the adjuster (19) with tool J 5755.

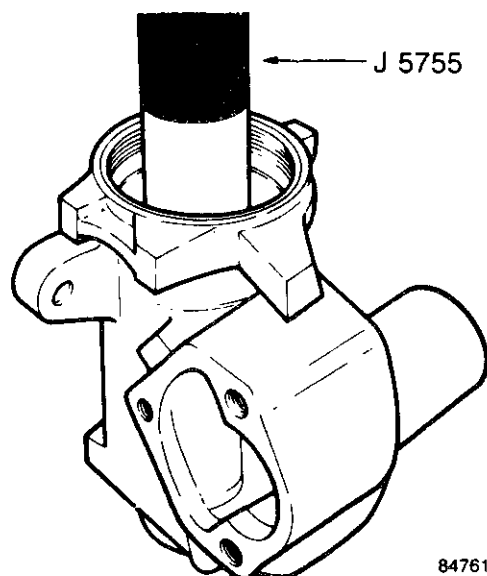


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Lubricate the lower bearing (17) with chassis grease and seat it in the bearing race (18).

Install the lower bearing retainer (16) in the adjuster. Tap the retainer into place with a plastic mallet.

Install a replacement upper bearing cup (9) in the housing (8) with tool J 5755.



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NOTE: Do not install the wormshaft or pitman shaft seals (22-23) at this time.

Mount the gear housing in a vise. Clamp the vise jaws on the housing mounting bosses only.

Install the assembled worm bearing adjuster (19) in the housing. Tighten the adjuster only enough to remove wormshaft end play.

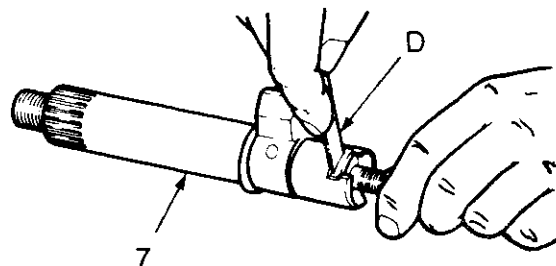
Install the locknut (20) on the worm bearing adjuster but do not tighten the locknut at this time.

Pack the steering gear housing with as much chassis grease as possible.

NOTE: To pack the maximum amount of grease in the housing, move the ball nut back and forth for better access to the housing interior. Rotate the wormshaft in one direction until ball nut travel ceases. Pack the unobstructed housing end full of grease. Then rotate the shaft in the opposite direction and repeat the packing procedure.

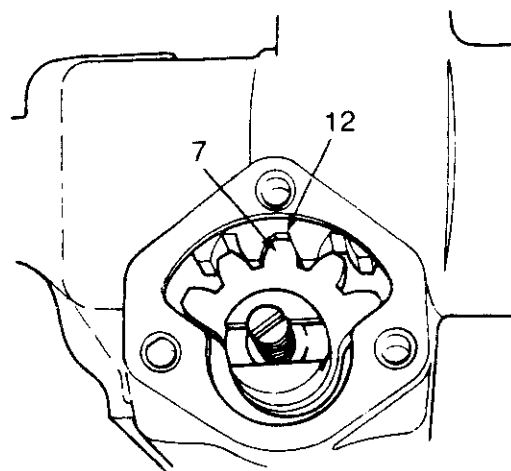
Place the ball nut in a centered position. Rotate the wormshaft from stop-to-stop and count the total number of turns. Turn the wormshaft back 1/2 of the number of turns to center the ball nut.

Measure adjuster screw end play with a feeler gauge (D) inserted between the screw head and the T-slot surface in the pitman shaft (7). End play must not exceed 0.05 mm (0.002 inch). Assemble a shim pack that will provide the required end play.



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Lubricate the pitman shaft (7) with chassis grease and install it in the housing. Engage the center tooth of the shaft in the center groove of the ball nut (12).



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STEERING AND FRONT AXLE

MANUAL STEERING GEAR



Coat the replacement side cover gasket with chassis grease and position the gasket on the housing cover opening.

Install the end play shims (4) on the adjuster screw (6).

Thread the adjuster screw (6) into the cover (3) to a depth of 2-3 threads only.

Slide the adjuster screw (6) into the pitman shaft T-slot. Then turn the screw counterclockwise to thread it into the cover. Stop turning the screw when the cover (3) almost contacts the gasket (5).

Install the cover attaching bolts (1) finger-tight only.

Tighten the adjuster screw (6) until it bottoms. Then back off the screw 1/2 turn.

Tighten the cover bolts (1) to specified torque.

Install the pitman shaft and wormshaft seals (22-23) as follows.

CAUTION: The pitman shaft and wormshaft splines must be covered with a protective wrap during seal installation. If the seals are installed over exposed shaft splines or threads, the seal lips can be damaged.

- Wrap 0.1 mm (0.005 inch) thick shim stock (or a single layer of thin tape) around the pitman and wormshaft splines and threads to serve as a seal protector.

- Lubricate the seals with chassis grease and start them into the housing by hand.

- Seat the seals with a plastic mallet. Be sure each seal is fully seated in the housing.

- Remove the protective material from the shaft splines.

Check gear operation. The wormshaft should rotate freely and not bind in either direction.

Adjust **worm bearing preload** as follows:

CAUTION: Adjust worm bearing preload and overcenter drag torque in the following sequence only. Failure to do so could result in damage to the gear or improper steering response. Always adjust worm bearing preload first and overcenter drag torque last.

- Tighten the worm bearing adjuster (19) until it bottoms, then back off the adjuster 1/4 turn.

- Install a socket and inch-pound torque wrench J 7754-01 on the splined end of the wormshaft (11).

CAUTION: Preload adjustment must be made with the wormshaft turned back no more than 1/2 turn from either the right or left stop.

- Rotate the wormshaft (11) clockwise to the stop. Then back off 1/2 turn.

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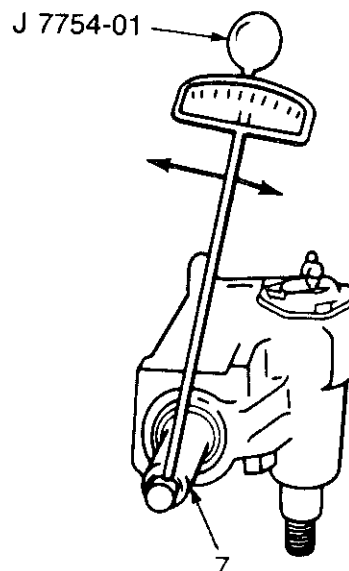
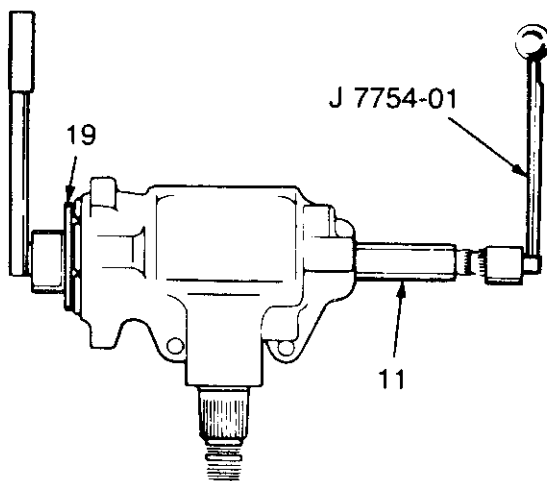


STEERING AND FRONT AXLE

MANUAL STEERING GEAR



- Tighten the worm bearing adjuster (19) until torque required to rotate the wormshaft (11) is between 0.6-0.9 N·m (5-8 in-lbs).



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- Continue tightening the adjuster screw (6) until torque required to rotate the pitman shaft overcenter is increased by an additional 0.5-1 N·m (4-10 in-lbs).

CAUTION: The combined preload and drag torque must not exceed a total of 2 N·m (18 in-lbs). For example if worm bearing preload is 0.7 N·m (6 in-lbs), overcenter drag torque must not exceed 1.3 N·m (12 in-lbs). This makes a total of 2 N·m (18 in-lbs) which is the maximum allowable.

Tighten the worm bearing adjuster locknut (19) to 68 N·m (50 ft-lbs). Do not allow the adjuster to turn while tightening the locknut.

Tighten the pitman shaft drag torque adjusting screw locknut (2) to 34 N·m (25 ft-lbs). Do not allow the adjuster screw to turn while tightening the locknut.

NOTE: If the adjuster or adjuster screw is allowed to turn when the locknut is tightened, the adjustment procedure will have to be redone.

Recheck preload and drag torque and readjust if necessary.

- Tighten the adjuster locknut (20) and recheck wormshaft rotating torque. Readjust if necessary. Record the worm bearing preload torque reading.

Adjust **pitman shaft overcenter drag torque** as follows:

- Center the gear ball nut. Rotate the wormshaft from stop-to-stop and count the total number of turns. Then turn the wormshaft back 1/2 the total number of turns.
- Loosen the pitman shaft adjuster screw locknut (2).
- Install a socket and torque wrench J 7754-01 on the pitman shaft splines (7).
- Turn the pitman shaft (7) back and forth overcenter. Tighten the pitman shaft adjuster screw (6) until torque required to turn the shaft overcenter equals worm bearing preload.

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STEERING AND FRONT AXLE

POWER STEERING GEAR



POWER STEERING SYSTEM LEAK INSPECTION

Raise and support the vehicle.

Clean the exterior surfaces of the gear, pump, hoses, and fittings thoroughly.

Check and correct fluid level in the pump reservoir.

Check for aerated fluid which can cause overflow from the reservoir and be mistaken for a leak.

Check and tighten the hose connections at the gear and the pump if necessary.

Start the engine. Have a helper turn the steering wheel left and right while checking for leak sources. Contact the stops momentarily in each direction. Stop the engine when the leak source is identified.

Steering gear leaks can develop in the following areas.

- hoses and fittings
- adjuster plug O-ring
- stub shaft seals
- steering gear housing core plug
- torsion bar seal (replace valve body assembly if seal leaks)
- side cover locknut and cover gasket
- pitman shaft seals

- end plug gasket

- cracked or porous gear housing

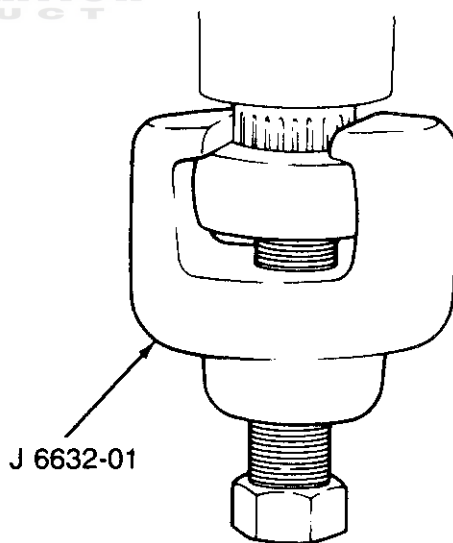
PITMAN SHAFT SEAL REPLACEMENT

Raise and support the vehicle. Place the front wheels in a straight ahead position.

Remove the front stabilizer bar.

Disconnect the center link from the pitman arm.

Mark the pitman arm and shaft for assembly reference and disconnect the arm with puller J 6632-01.

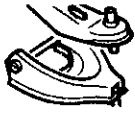


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Position a drain pan under the steering gear pitman shaft.

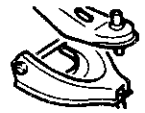
Remove the outer seal retaining ring (1) with snap ring pliers and remove the outer seal backup washer (2).

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STEERING AND FRONT AXLE

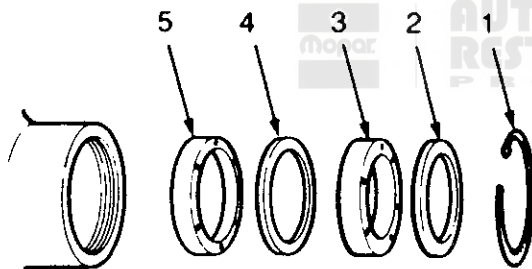
POWER STEERING GEAR



NOTE: In the next step, the outer (3) and inner (5) seals are removed using pump fluid pressure. To avoid excessive fluid loss during removal, do not hold the steering wheel in an extreme turn position for more than one or two seconds at a time.

Start the engine.

Turn and hold the steering wheel in the extreme left-turn position for no more than 2 seconds. Repeat the procedure until the outer and inner seals are pushed out of the housing by fluid pressure.



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Stop the engine and remove the seals (3-5) and backup washers (2-4) from the pitman shaft.

Inspect the seal surfaces on the pitman shaft and in the gear housing. Replace the shaft or housing if the seal surfaces are heavily pitted, scored, or damaged in any way.

Remove minor scratches or corrosion from the pitman shaft and seal areas with crocus cloth.

Lubricate the replacement seals with power steering fluid.

Apply a single layer of thin tape to the pitman shaft splines to avoid damaging the seals.

Install the single-lip inner seal (5) and backup washer (4). Use tool J 21553 to push the seal and backup washer into the housing only far enough to provide clearance for the remaining components. Do not allow the seal to bottom at the end of the counterbore.

Install the double-lip outer seal (3) and backup washer (2) with tool J 21533. Do not force the inner seal against the bottom of the counterbore when installing the outer seal and washer. Leave only enough room for the retaining ring.

Install the retaining ring (1). Be sure the ring is fully seated.

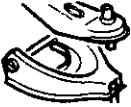
Fill the pump reservoir to the correct level with power steering fluid.

Start the engine and allow it to idle for at least three minutes. Do not turn the steering wheel during this time.

Turn the steering wheel left and right and check for leaks.

Recheck fluid level in the reservoir. Add fluid if required.

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	STEERING AND FRONT AXLE POWER STEERING GEAR	
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HOUSING END PLUG SEAL REPLACEMENT

Rotate the end cover retainer ring until one end of the ring is positioned over the hole in the side of the housing. Unseat the ring from the housing groove with a punch inserted through the hole in the housing.

Position a drain pan under the steering gear end plug.

CAUTION: Do not turn the steering wheel any farther than necessary during the next step. The ball bearings could drop out of the rack piston circuit and fall inside the rack piston chamber.

Turn the steering wheel slowly to the left until the rack piston forces the end plug out of the housing. Then immediately turn the wheel back to center position and stop the engine.

Remove and discard the end plug O-ring seal.

Lubricate the replacement end plug seal with power steering fluid and install the seal on the end plug.

Install the end plug and end plug retaining ring.

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STEERING AND FRONT AXLE

POWER STEERING GEAR



POWER STEERING GEAR DIAGNOSIS

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HISSING NOISE IN STEERING GEAR	(1) There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel or when slowly turning at standstill.	(1) Slight hiss is normal and in no way affects steering. Do not replace valve unless hiss is extremely objectionable. A replacement valve will also exhibit slight noise and is not always a cure. Investigate clearance around flexible coupling rivets. Be sure steering shaft and gear are aligned so flexible coupling rotates in a flat plane and is not distorted as shaft rotates. Any metal-to-metal contacts through flexible coupling will transmit valve hiss into passenger compartment through the steering column.
RATTLE OR CHUCKLE NOISE IN STEERING GEAR	(1) Gear loose on frame. (2) Steering linkage looseness. (3) Pressure hose touching other parts of car. (4) Loose pitman shaft over center adjustment. NOTE: A slight rattle may occur on turns because of increased clearance off the "high point." This is normal and clearance must not be reduced below specified limits to eliminate this slight rattle. (5) Loose pitman arm.	(1) Check gear-to-frame mounting screws. Tighten screws to 88 N·m (65 foot pounds) torque. (2) Check linkage pivot points for wear. Replace if necessary. (3) Adjust hose position. Do not bend tubing by hand. (4) Adjust to specifications. (5) Tighten pitman arm nut to specifications.
SQUAWK NOISE IN STEERING GEAR WHEN TURNING OR RECOVERING FROM A TURN	(1) Damper O-ring on valve spool cut.	(1) Replace damper O-ring.
POOR RETURN OF STEERING WHEEL TO CENTER	(1) Tires not properly inflated. (2) Lack of lubrication in linkage and ball joints. (3) Lower coupling flange rubbing against steering gear adjuster plug. (4) Steering gear to column misalignment.	(1) Inflate to specified pressure. (2) Lube linkage and ball joints. (3) Loosen pinch bolt and assemble properly. (4) Align steering column.

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STEERING AND FRONT AXLE

POWER STEERING GEAR



Service Diagnosis (continued)

Condition	Possible Cause	Correction
POOR RETURN OF STEERING WHEEL TO CENTER (Continued)	(5) Improper front wheel alignment. (6) Steering linkage binding. (7) Ball joints binding. (8) Steering wheel rubbing against housing. (9) Tight or frozen steering shaft bearings. (10) Sticking or plugged valve spool. (11) Steering gear adjustments over specifications. (12) Kink in return hose.	(5) Check and adjust as necessary. With front wheels still on alignment pads of front-end machine, disconnect pitman arm of linkage from pitman shaft of gear. Turn front wheels by hand. If wheels will not turn or turn with considerable effort, determine if linkage or ball joints are binding. (6) Replace pivots. (7) Replace ball joints. (8) Align housing. (9) Replace bearings. (10) Remove and clean or replace valve. (11) Check adjustment with gear out of car. Adjust as required. (12) Replace hose.
CAR LEADS TO ONE SIDE OR THE OTHER (KEEP IN MIND ROAD CONDITION AND WIND. TEST CAR IN BOTH DIRECTIONS ON FLAT ROAD)	(1) Front end misaligned. (2) Unbalanced steering gear valve. NOTE: If this is cause, steering effort will be very light in direction of lead and normal or heavier in opposite direction.	(1) Adjust to specifications. (2) Replace valve.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level. (2) Pump belt slipping. (3) High internal leakage.	(1) Add power steering fluid as required. (2) Tighten or replace belt. (3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level. (2) Loose pump belt. (3) Steering linkage hitting engine oil pan at full turn. (4) Insufficient pump pressure.	(1) Fill as required. (2) Adjust tension to specification. (3) Correct clearance. (4) Check pump pressure. (See pressure test). Replace relief valve if defective.

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STEERING AND FRONT AXLE

POWER STEERING GEAR



Service Diagnosis (continued)

Condition	Possible Cause	Correction
FOAMING MILKY POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow.	(1) Check for leak and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from housing. Check welsh plug and housing for cracks. If plug is loose or housing is cracked, replace housing.
LOW PRESSURE DUE TO STEERING PUMP	(1) Flow control valve stuck or inoperative. (2) Pressure plate not flat against cam ring.	(1) Remove burrs or dirt or replace. Flush system. (2) Correct.
LOW PRESSURE DUE TO STEERING GEAR	(1) Pressure loss in cylinder due to worn piston ring or badly worn housing bore. (2) Leakage at valve rings, valve body-to-worm seal.	(1) Remove gear from car for disassembly and inspection of ring and housing bore. (2) Remove gear from car for disassembly and replace seals.

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	STEERING AND FRONT AXLE POWER STEERING GEAR	
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POWER STEERING GEAR REMOVAL

Place the wheels in a straight-ahead position.

Position a drain pan under the steering gear.

Disconnect the hoses at the gear. Raise and secure the hoses above pump fluid level to prevent excessive oil spillage. Cap the ends of the hoses to prevent any entry of dirt.

Disconnect the intermediate shaft from the steering gear stub shaft.

Raise and support the vehicle.

Mark the pitman arm and shaft for assembly reference.

Disconnect the center link from the pitman arm and remove the front stabilizer bar.

Disconnect the pitman arm with tool J 6632-01.

Remove the steering gear mounting bolts and remove the gear.

POWER STEERING GEAR INSTALLATION

Center the steering gear.

Install the gear in the vehicle.

Align and connect the intermediate shaft to the stub shaft.

Align and connect the pitman arm. Tighten the pitman nut and stake the nut to the pitman shaft in two places.

Install the front stabilizer bar and connect the center link to the pitman arm.

Lower the vehicle.

Connect the hoses to the gear and tighten the fittings.

Fill the pump reservoir and bleed air from the system.

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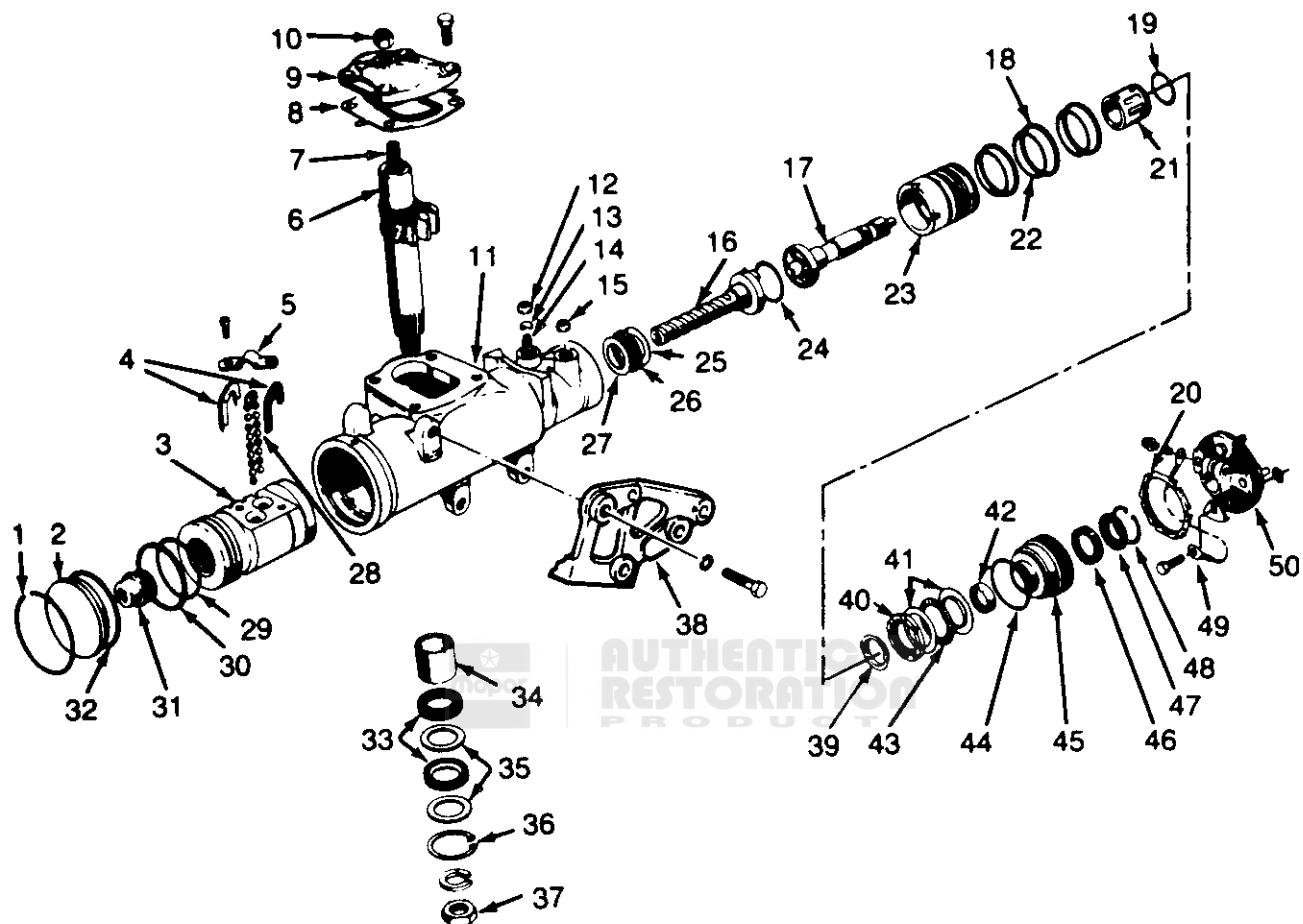


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POWER STEERING GEAR

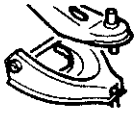


POWER STEERING GEAR COMPONENTS



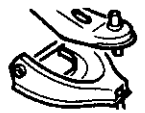
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|-----------------------------|----------------------------|--------------------------|
| 1. Retaining Ring | 18. Teflon Rings (3) | 35. Washers |
| 2. Housing End Plug | 19. Damper O-Ring | 36. Retaining Ring |
| 3. Rack Piston | 20. Adjuster Plug Lock Nut | 37. Pitman Arm Nut |
| 4. Ball Return Guide Halves | 21. Valve Spool | 38. Spacer |
| 5. Clamp | 22. Backup O-Rings (3) | 39. Bearing Retainer |
| 6. Pitman Shaft | 23. Valve Body | 40. Spacer |
| 7. Adjusting Screw | 24. O-Ring | 41. Races |
| 8. Gasket | 25. Race | 42. Bearing |
| 9. Side Cover | 26. Thrust Bearing | 43. Thrust Bearing |
| 10. Lock Nut | 27. Race | 44. O-Ring |
| 11. Housing | 28. Ball Bearings (24) | 45. Adjuster Plug |
| 12. Pressure Port Seat | 29. Backup O-Ring | 46. Oil Seal |
| 13. Poppet Valve | 30. Piston Ring | 47. Washer and Dust Seal |
| 14. Spring | 31. Rack Piston End Plug | 48. Retaining Ring |
| 15. Return Port Seat | 32. O-Ring | 49. Ground Wire |
| 16. Worm Shaft | 33. Oil Seals | 50. Flexible Coupling |
| 17. Stub Shaft | 34. Needle Bearing | |



STEERING AND FRONT AXLE

POWER STEERING GEAR



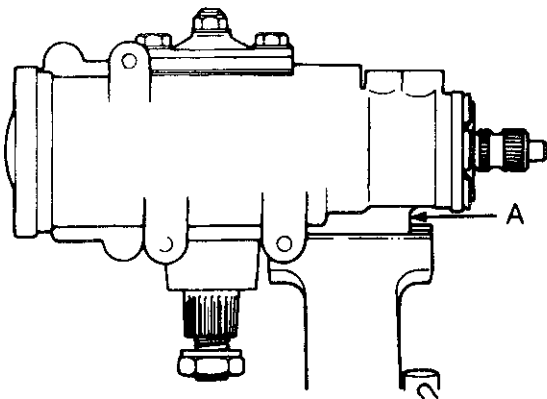
POWER STEERING GEAR DISASSEMBLY

CAUTION: Cleanliness is extremely important when overhauling the power steering gear. Keep the bench, tools, and component parts clean at all times. Thoroughly clean the exterior of the gear with solvent before disassembly and drain as much of the fluid as possible. Use protective vise jaws at all times when mounting subassemblies in a vise. At assembly, lubricate all parts with power steering fluid or petroleum jelly as indicated.

Major Component Removal

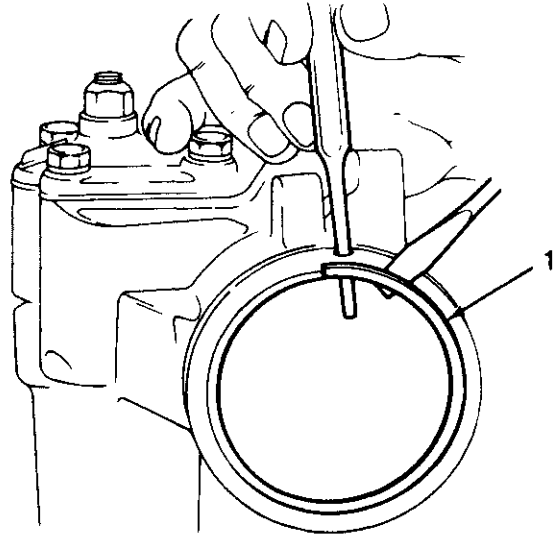
Drain all fluid from the gear.

Mount the gear in a vise with the pitman shaft pointing downward. Clamp the vise jaws on the unmachined housing boss (A) only.



84771A

Rotate the gear housing end plug retaining ring (1) until one end is positioned over the hole in the housing. Unseat and remove the ring (1) with a punch.



84772A

Remove the housing end plug (2). Rotate the stub shaft (17) counterclockwise with 12-point deep socket and ratchet handle until the rack piston (3) pushes the end plug out.

NOTE: Do not rotate the stub shaft any further than necessary or the ball bearings will drop out causing the pitman shaft and rack piston to disengage. If disengagement occurs, remove the side cover and pitman shaft assembly and reengage the teeth.

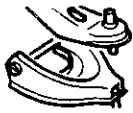
Remove the O-ring seal (32) from the end plug (2). Discard the seal.

Turn the stub shaft clockwise 1/2 turn and strike the rack piston end plug (31) sharply with a plastic mallet to unseat it.

CAUTION: If the rack piston end plug is not unseated, it may break during removal.

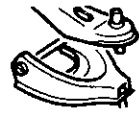
Remove the rack piston end plug (31) with a 13 mm (1/2-in) square drive socket handle.

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STEERING AND FRONT AXLE

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Remove the adjuster screw locknut (10). Hold the adjuster screw (7) with an Allen wrench to prevent the screw from turning. Discard the locknut.

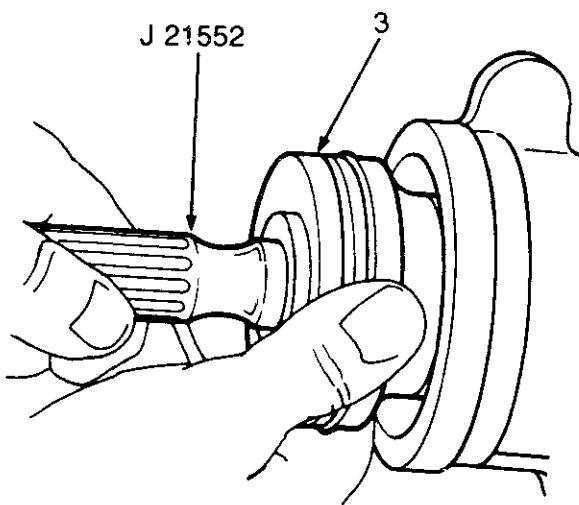
Remove the bolts attaching the side cover (9) to the gear.

Remove the side cover (9) and gasket (8). Rotate the pitman shaft adjuster screw until the cover can be removed from the screw. Discard the cover gasket.

Turn the stub shaft until the pitman shaft teeth are centered in the housing. Tap the end of the pitman shaft (6) with a plastic mallet to remove it from the housing.

NOTE: Do not disassemble the pitman shaft components. They are serviced as an assembly only.

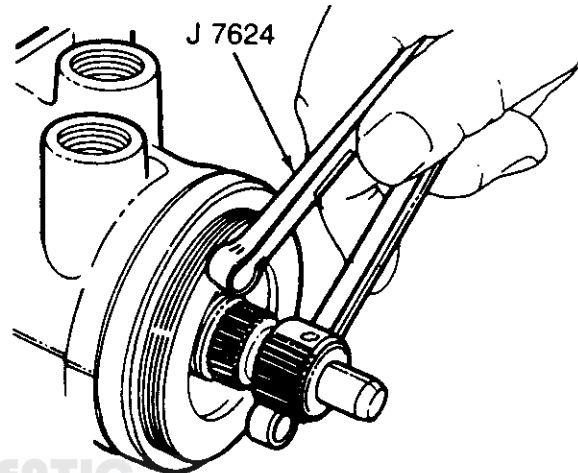
Remove the rack piston (3). Insert arbor tool J 21552 into the rack piston until the tool stops against the end of the wormshaft. Grip the tool firmly. Turn the stub shaft counterclockwise to force the rack piston (3) onto the arbor tool. Then remove the tool and rack piston as a unit.



84774A

Loosen the adjuster plug locknut (20) with a brass drift and remove the locknut.

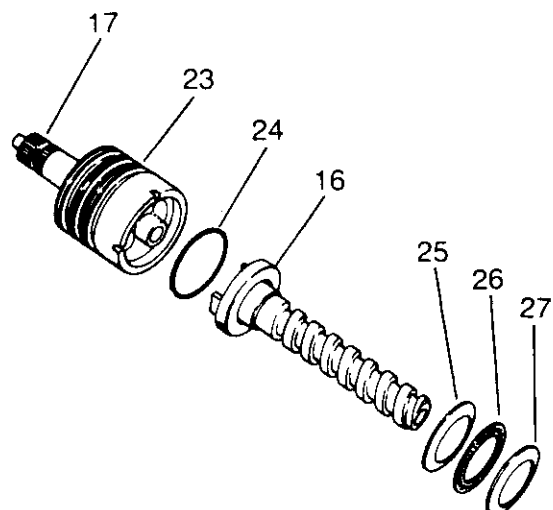
Remove the adjuster plug (45) with tool J 7624.



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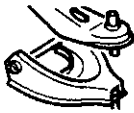
Remove the valve body (23), stub shaft (17), wormshaft (16), bearing (26) and bearing races (25-27) as an assembly.

Remove the wormshaft lower thrust bearing (26) and the conical bearing races (25-27). Note position of the races for assembly reference.



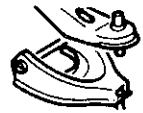
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POWER STEERING GEAR



Major Component Disassembly

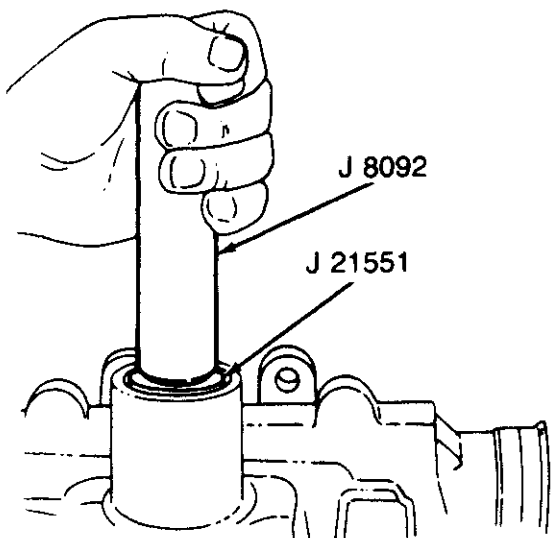
Gear Housing Disassembly

Remove the pitman shaft seal retaining ring (36) with tool J 4245.

Remove the pitman shaft seals (33) and backup washers (35) with a screwdriver.

NOTE: If the inner seal is difficult to remove, drive it out from the upper end of the housing. In extreme cases, it may be necessary to drive out both the needle bearing and inner seal at the same time. Discard the seal and needle bearing if removed in this fashion.

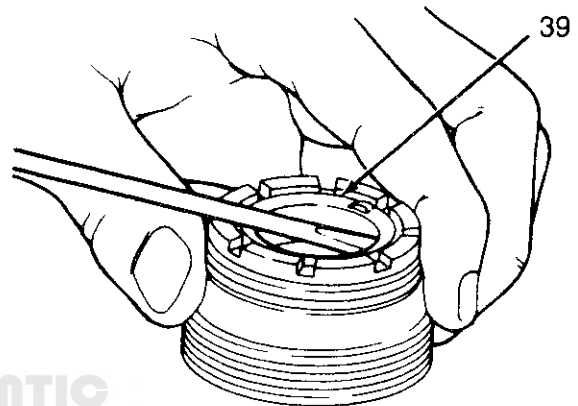
Remove the needle bearing (34) from the housing with tools J 21551 and J 8092.



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Adjuster Plug Disassembly

Remove the bearing retainer (39) with a screwdriver. Discard the retainer.



84783A

Remove the thrust bearing spacer (40), thrust bearing (43) and the bearing races (41).

Remove and discard the adjuster plug O-ring seal (44).

Remove the stub shaft seal retaining ring (48) with tool J 4245.

Remove and discard the stub shaft dust seal (47) and oil seal (46).

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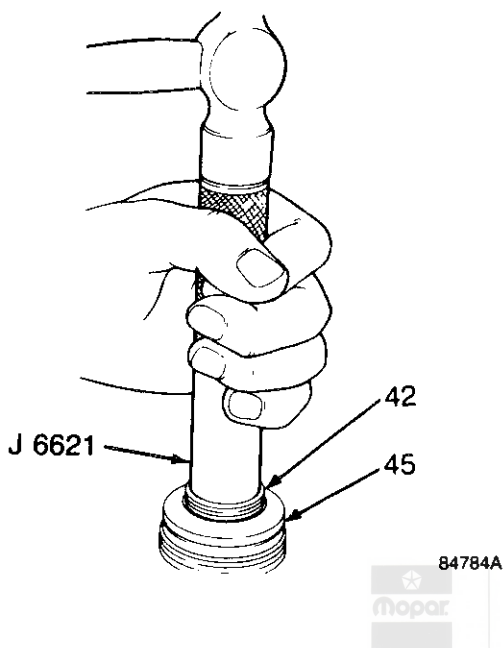


STEERING AND FRONT AXLE

POWER STEERING GEAR



Remove the needle bearing (42) with tool J 6621.



Rack Piston-Wormshaft Disassembly

Remove the return guide clamp (5).

Place the assembly on a cloth and remove the ball return guides.

Remove arbor tool J 21552 and remove the wormshaft (16) and ball bearings (28).

Remove and discard the O-rings (29-30) from the rack piston (3).

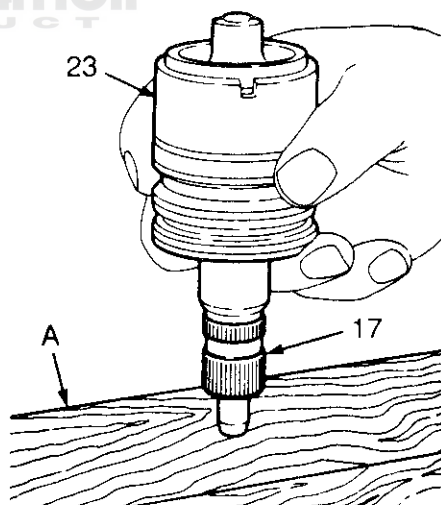
Valve Body-Stub Shaft Disassembly

CAUTION: The complete valve body assembly is a precision manufactured unit with parts selectively fitted to tolerances as close as 0.00082 mm (0.0004 in). The assembly is hydraulically and mechanically balanced during

assembly. If replacement of any valve component other than seals or rings is necessary, the complete valve body assembly must be replaced. To avoid possible damage to the assembly, the valve body should not be disassembled unless absolutely necessary. If the valve spool damper O-ring requires replacement, remove the valve spool only as described in the following procedure.

Remove and discard the stub shaft cap-to-worm-shaft O-ring (24).

Remove the stub shaft (17) and valve spool (21) from the valve body (23). Tap the end of the stub shaft (17) lightly against a wood block (A) until the cap of the stub shaft protrudes from the valve body.



Pull outward on the cap end of the stub shaft until it clears the valve body by approximately 6.35 mm (1/4 in).

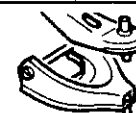
CAUTION: Do not pull the shaft out too far or the spool valve may become cocked in the valve body.

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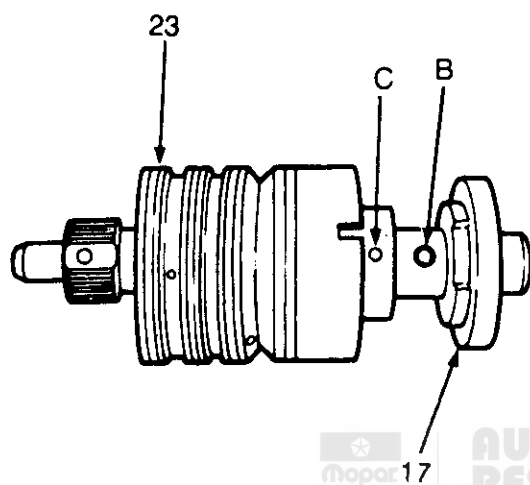


STEERING AND FRONT AXLE

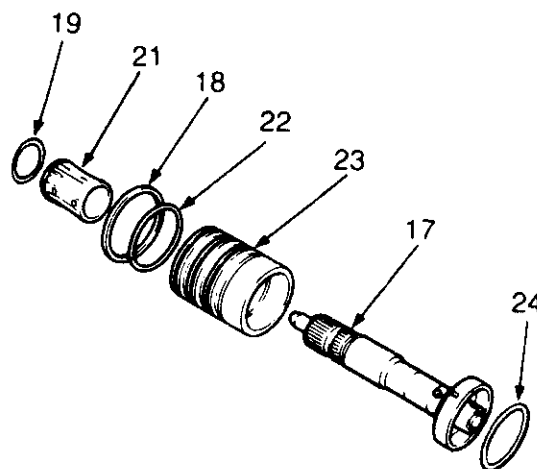
POWER STEERING GEAR



Carefully disengage the stub shaft locating pin (B) from the spool valve locating hole (C) and remove the stub shaft assembly (17).



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Remove the spool valve (21). Carefully push the valve out while rotating it to avoid cocking. If the valve becomes cocked, do not force it out. Carefully realign and remove it.

Remove and discard the damper O-ring (19) from the spool valve (21).

Remove the teflon rings (18) and the backup O-rings (22) located under the teflon rings. Remove the rings by carefully cutting them with a knife or diagonal pliers.

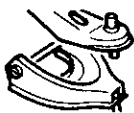
Cleaning and Inspection

Cleaning

Clean the valve body components with solvent and dry them with compressed air only. Do not use shop towels or similar lint producing materials. Place the gear components on paper after cleaning and during assembly operations.

Inspection

Inspect the valve body components. A slight polishing is normal on valve body surfaces as are tiny flat spots on the valve spool locating pin (B). If there are scores, nicks or burrs on any of the finely machined surfaces that cannot be removed with crocus cloth, replace the valve body assembly. Inspect the outside diameter of the spool valve and the inside diameter of the valve body for nicks or wear. Replace the valve body assembly if minor irregularities cannot be removed with crocus cloth.

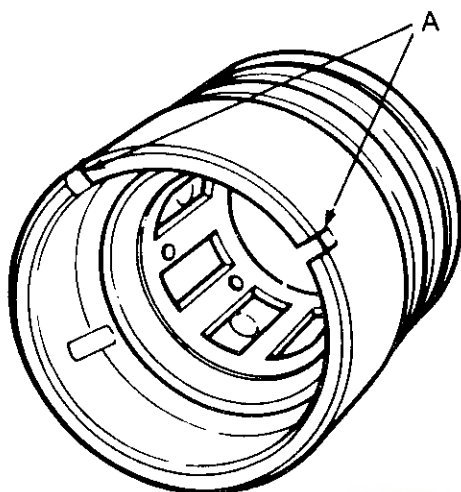


STEERING AND FRONT AXLE

POWER STEERING GEAR



Inspect the notched end of the valve body (23). If the small notches (A) are worn, replace the entire valve body assembly.

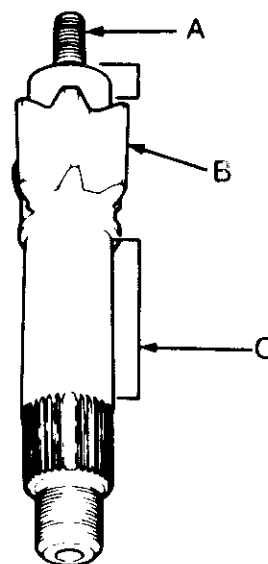


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Inspect the gear housing bore. If badly scored or worn, replace the housing. However, minor scratches usually will not cause any problem during assembly. Inspect the hose connector seats and poppet check valve. Replace them if scored, cracked or worn.

Inspect the adjuster plug components for wear, scoring, nicks, cuts, or distortion. Replace any component exhibiting these conditions.

Inspect the side cover and pitman shaft. Replace the cover if damaged. Replace the shaft if the adjuster screw (A), sector teeth (B) or shaft bearing surfaces (C) are damaged in any way.



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Inspect the wormshaft, rack piston and ball bearings for wear or scoring. If the wormshaft or rack piston must be replaced, they must be replaced as a matched assembly only. Replace the bearings if scored, flat-spotted, or corroded.

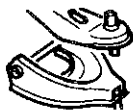
Inspect the ends of the ball return guides, and all the bearings and races. Replace any components that are worn or damaged.

POWER STEERING GEAR ASSEMBLY AND ADJUSTMENT

Gear Housing Assembly

Lubricate the housing bore, bearing, seals and washers with power steering fluid.

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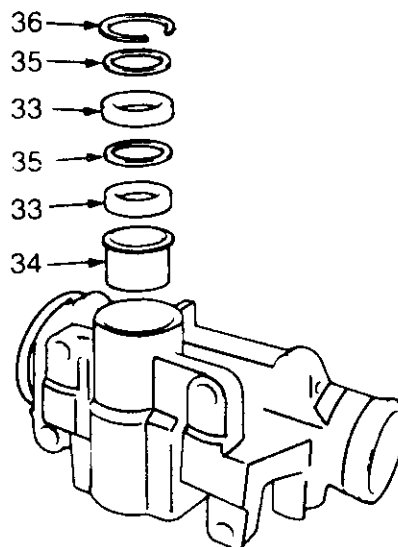
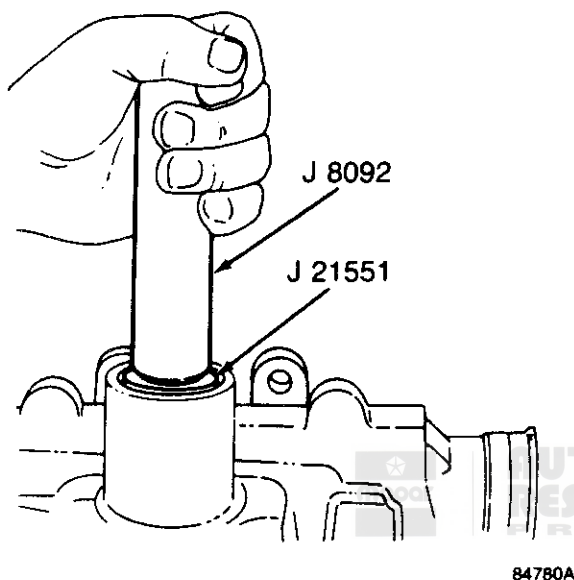


STEERING AND FRONT AXLE

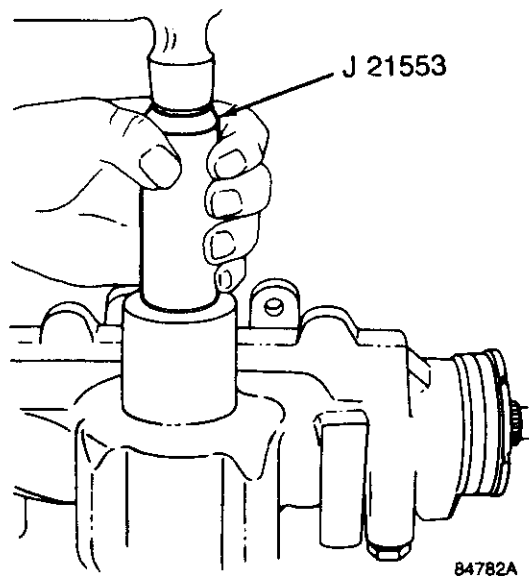
POWER STEERING GEAR



Install the needle bearing (34) in the housing (11) with tools J 21551 and J 8092. Install the bearing in the housing bore until it is approximately 0.76 mm (0.030 in) below the shoulder of the bore.



Install the double lip seal and remaining backup washer with tool J 21553. Install the seal and backup washer into the bore only far enough to allow clearance for the retaining ring.

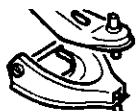


Start the single lip inner seal (33) and a backup washer (35) into the housing bore.

Push the seal and washer into the housing bore with tool J 21553. Install the seal and washer only far enough to provide clearance for the remaining seal, backup washer and retaining ring.

CAUTION: Do not bottom the seal against the end of the housing counterbore.

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STEERING AND FRONT AXLE

POWER STEERING GEAR

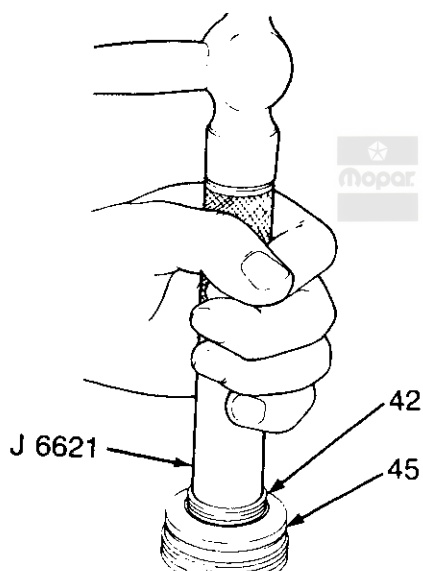


Install the retaining ring (36) with tool J 4245. Be sure the ring is completely seated in the housing groove.

Adjuster Plug Assembly

Place the needle bearing (42) on tool J 6221 with the bearing manufacturer's identification number facing the tool.

Install the bearing (42) in the plug (45) until flush with the bottom surface of the seal bore.

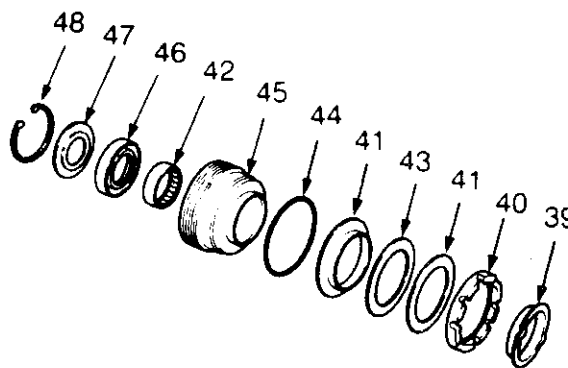


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Lubricate the oil seal (46) and install it deep enough to provide clearance for the dust seal (47) and retaining ring (48).

Lubricate the dust seal (47) with petroleum jelly and install the seal with the seal rubber facing outward.

Install the retaining snap ring. Be sure the ring is properly seated.



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Lubricate the O-ring (44) with petroleum jelly and install it in the adjuster plug groove.

Install the thrust washers (41), thrust bearing (43), spacer (40) and bearing retainer (39) in the adjuster plug.

Press the bearing retainer (39) into the needle bearing bore using a brass drift or wood dowel.

NOTE: The radial location of the notches on the spacer (40) are not important. However, do not damage the notches during installation.

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POWER STEERING GEAR

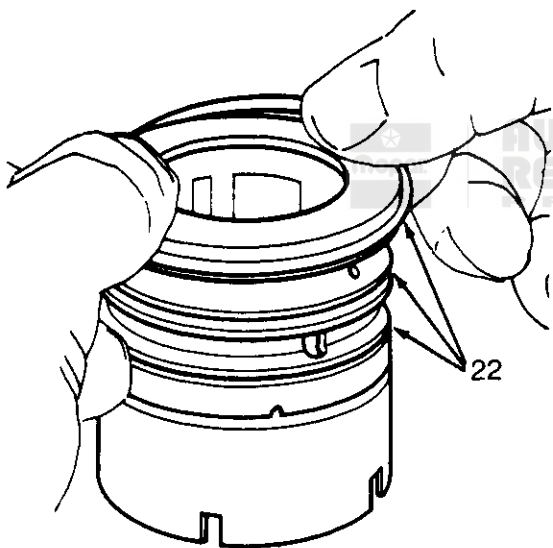


Valve Body Assembly

Lubricate the spool valve with power steering fluid and check fit of the valve in the valve body. If the spool valve does not rotate freely within the valve body, replace the entire valve body assembly.

Lubricate the backup O-rings (22) and teflon rings (18) with power steering fluid.

Install the backup O-rings (22) in the valve body ring grooves.



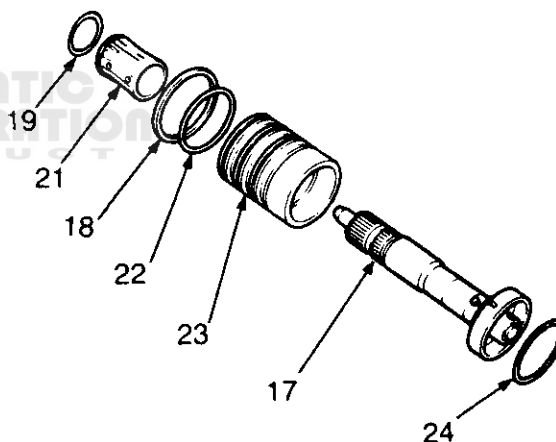
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Install the teflon rings (18) over the backup O-rings. Take care to avoid damaging the teflon rings during installation.

NOTE: The teflon rings may appear slightly loose or distorted after installation. However, the heat generated by the power steering fluid during operation will straighten them.

Lubricate the spool valve damper O-ring (19) with petroleum jelly and install the O-ring in the spool valve groove.

Lubricate the spool valve (21) and valve body (23) with power steering fluid and carefully insert the spool valve into the valve body with a push and turn motion.



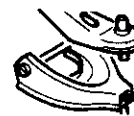
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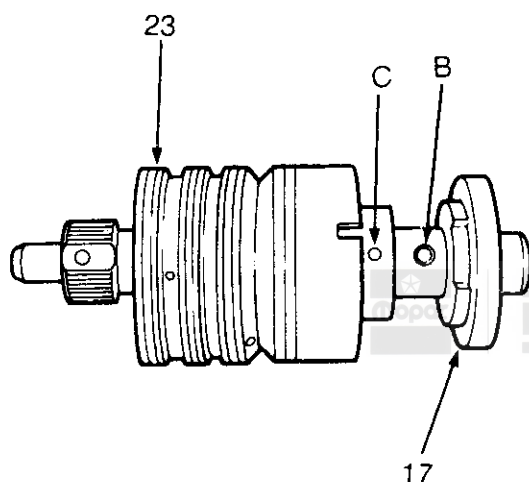
STEERING AND FRONT AXLE

POWER STEERING GEAR



Push the spool valve (21) through the valve body (23) until the spool valve is flush with the notched end of the valve body. Be sure the locating pin hole (C) in the valve spool is visible.

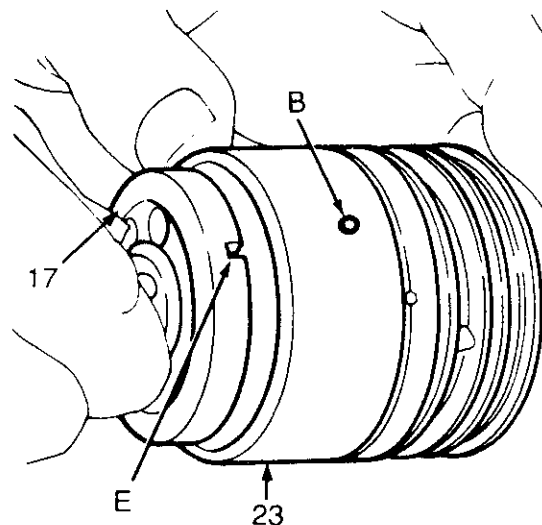
Start the stub shaft (17) into the spool valve. Align the stub shaft locating pin (B) with the spool valve locating hole (C) and seat the shaft in the spool valve.



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Align the notch (E) in the stub shaft cap (17) with locating pin (B) and push the spool valve and stub shaft into the valve body (23).

CAUTION: Make sure the shaft cap notch (E) is mated with the valve body pin before installing the valve body in the gear housing.



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Lubricate the stub shaft cap-to-wormshaft O-ring (24) with power steering fluid and install it in the valve body.

Rack Piston-Wormshaft Assembly

Lubricate the rack piston-wormshaft components with power steering fluid.

Install the backup O-ring (29) in the rack piston groove. Do not allow the O-ring to become twisted during installation.

Install the piston ring (30) over the backup O-ring.

Insert the wormshaft (16) into the rack piston (3).

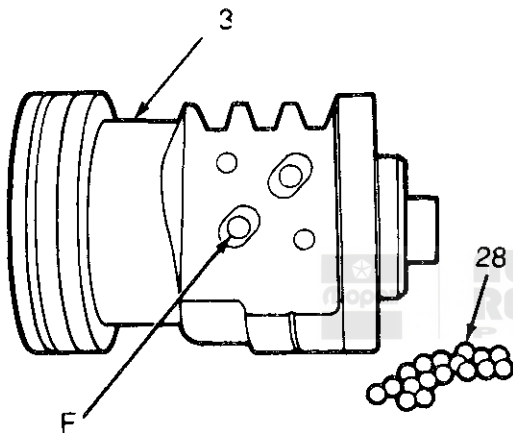
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STEERING AND FRONT AXLE

POWER STEERING GEAR

Install the ball bearings (28) in the rack piston (3) as follows:

- Assemble 9 silver and 9 black ball bearings.
- Alternately install one black ball bearing followed by one silver ball bearing until all 18 bearings have been installed through the return guide hole (F) nearest the rack piston ring.



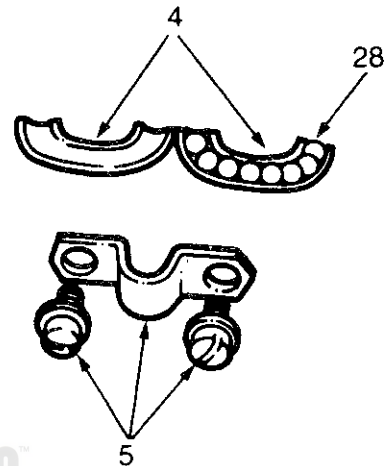
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- After installing each ball bearing, press it downward to provide room for the next ball bearing.

NOTE: To ease bearing installation, rotate the wormshaft while feeding bearings into the rack piston circuit. However, do not let the wormshaft back out of the piston.

- Fill one ball return guide half (4) with petroleum jelly.

- Install the six remaining ball bearings in the guide half (4) filled with petroleum jelly. Be sure to alternate the silver and black bearings in the same sequence used to fill the rack piston.



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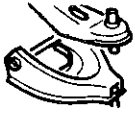
- Install the remaining ball guide half and insert the assembled guides into the guide return holes in the rack piston (3).

CAUTION: Verify that the ball bearings in the guide and rack piston are installed alternately (black bearing followed by silver bearing) before proceeding.

Install the ball return guide clamp and screws (5). Tighten the screws to 14 N·m (10 ft-lbs) torque.

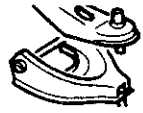
Insert arbor tool J 21552 into the wormshaft and position the assembled rack piston and tool on end. Support the assembly on two wood blocks (G) until ready for installation.

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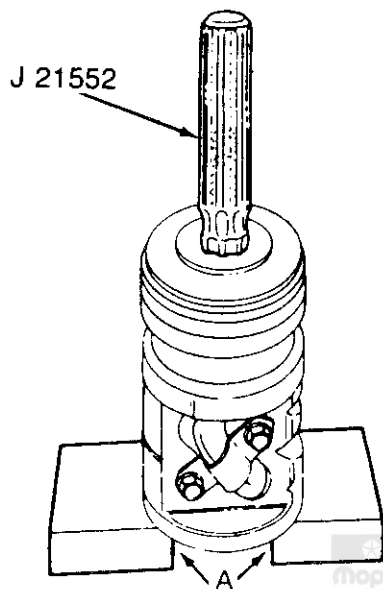


STEERING AND FRONT AXLE

POWER STEERING GEAR



Do not permit the arbor tool to separate from the wormshaft until the rack piston is fully installed on the wormshaft.

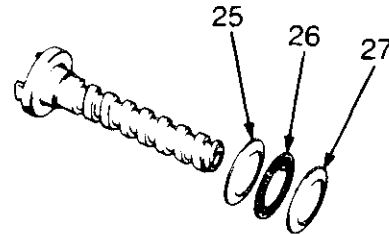


Major Component Installation

Mount the gear housing (11) in a vise with the pitman shaft bore facing downward (3). Clamp the vise jaws on the unmachined housing boss only.

Install the wormshaft lower thrust bearing (26) and bearing races (25-27). Install the first bearing race followed by the thrust bearing and second bearing race.

NOTE: Both of the conical bearing races must be installed so that the top of each cone faces the bottom of the gear housing.



Align the notch in the valve body (23) with the locating pin (H) on the wormshaft and insert the valve body assembly into the gear housing.

Seat the valve body assembly in the housing by pushing it into place with two fingers. Be sure to press only against the valve body.

CAUTION: Do not press against the stub shaft to seat the valve body. This could cause the stub shaft cap to separate from the valve body allowing the spool valve damper O-ring to slip into the valve body fluid grooves. Seat the valve body only by pushing on the outer diameter of the valve body itself using the fingertips.

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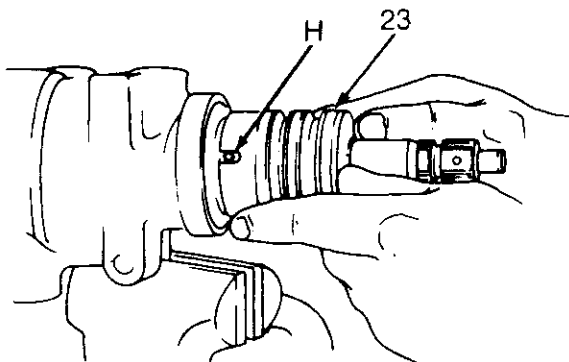


STEERING AND FRONT AXLE

POWER STEERING GEAR



Continue pressing the valve body into the housing until the fluid return hole in the housing is visible. Be sure the teflon rings do not bind in the housing bore during installation.



Tighten the adjuster plug with tool J 7624 until it seats against the valve body. Approximately 27 N·m (20 ft-lbs) torque is required to seat the plug. Remove tools J 29810 and J 7624 after installing the adjuster plug.

Install the assembled rack piston and wormshaft in the housing. Be sure the wormshaft is engaged with the stub shaft and valve body. Do not damage the piston ring during installation.

Turn the stub shaft clockwise to draw the rack piston into the housing. Do not remove arbor tool J 21552 until the valve body piston ring has entered the housing bore.

Turn the stub shaft until the rack piston center groove is aligned with the center of the pitman shaft bearing bore.

Lubricate the side cover gasket (8) and install it on the side cover (9). Be sure the rubber seal in the gasket is seated in the side cover groove.

Install the side cover (9) on the pitman shaft (6). Thread the cover onto the adjuster screw (7) until the cover bottoms against the pitman shaft.

Align the center tooth of the pitman shaft (6) with the center tooth groove in the rack piston (3) and install the pitman shaft in the housing.

Align the side cover and gasket and position them on the housing.

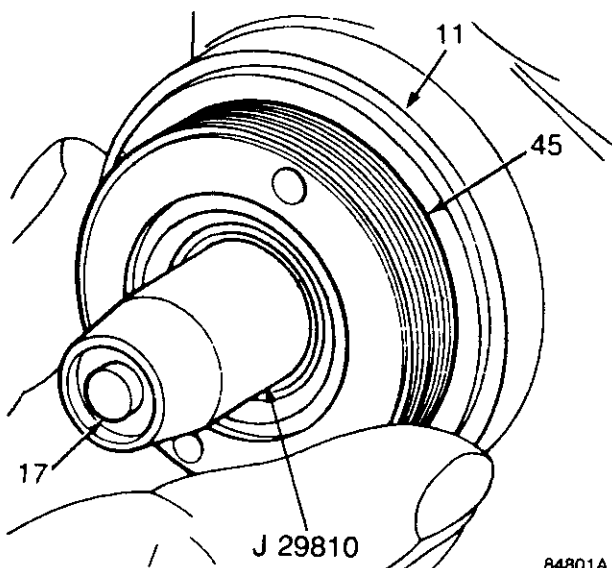
Install the side cover bolts and lockwashers. Tighten the bolts to 61 N·m (45 ft-lbs) torque.

Install the adjuster screw locknut (10) halfway onto the adjuster screw (7). Use an Allen wrench to keep the screw from turning while installing the locknut.

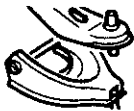
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Install adjuster plug seal protector J 29810 over the end of the stub shaft (17).

Install the adjuster plug (45) over the stub shaft (17) and start it into the housing (11).



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STEERING AND FRONT AXLE

POWER STEERING GEAR



Install the rack piston end plug (31) in the rack piston (3). Tighten the plug to 68 N·m (50 ft-lbs) torque.

Lubricate and install the housing end plug O-ring (32) on the end plug (2).

Install and seat the end plug (2) in the housing. Lightly tap the end plug with a plastic mallet to seat it.

Install the end plug retainer ring (1). Position the ring so the ring end gap is not aligned with the hole inside of the gear housing. Tap lightly on the plug to be sure that the ring is fully seated.

Adjust worm bearing preload and pitman shaft overcenter drag torque as outlined in the following Power Steering Gear Adjustment procedure.

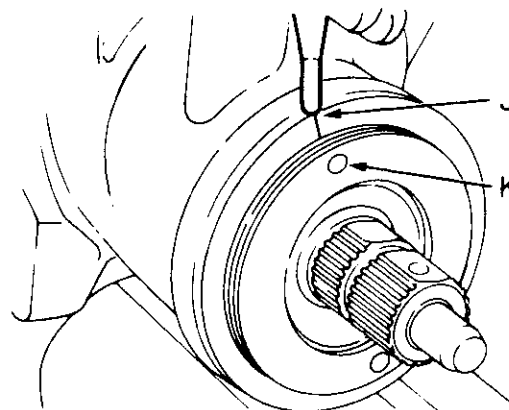
Power Steering Gear Adjustment

CAUTION: The following adjustment procedures must be performed exactly as described and in the sequence outlined. Failure to do so can result in damage to the gear internal components or improper steering response. Always adjust worm bearing preload first and pitman shaft overcenter drag torque last.

Worm Bearing Preload Adjustment

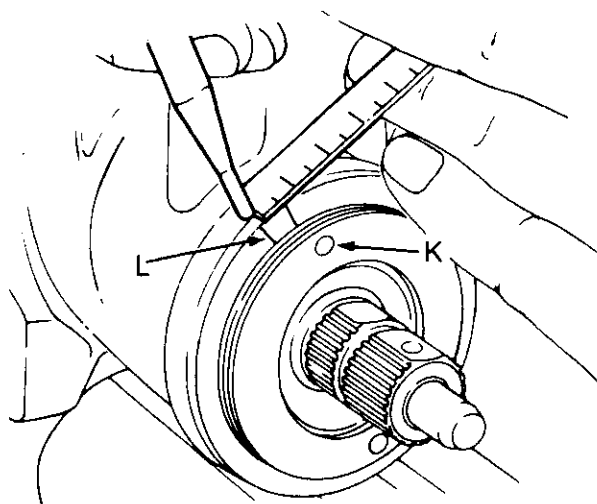
If the adjuster plug was not previously seated in the housing, seat the plug with tool J 7624. Approximately 27 N·m (20 ft-lbs) torque is required.

Place an index mark (J) on the gear housing opposite one of the holes (K) in the adjuster plug (45).



84802A

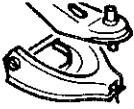
Measure back (counterclockwise) 4.7 to 6.3 mm (3/16 to 1/4 inch) from index mark (J) and make a second index mark (L) on the housing.



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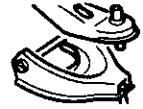
Turn the adjuster plug counterclockwise until the adjuster plug hole (K) is aligned with the second index mark (L).

SEE
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STEERING AND FRONT AXLE

POWER STEERING GEAR



Install and tighten the adjuster plug locknut (20) to 115 N·m (85 ft-lbs) torque. Do not allow the adjuster plug to rotate when tightening the locknut.

Turn the stub shaft clockwise to the stop. Then turn the stub shaft back 1/4 turn.

Install a 12-point deep socket (M) on the stub shaft splines.

Measure torque required to turn the stub shaft with an inch-pound torque wrench having a maximum capacity of 6 N·m (50 in-lbs). Take the reading with the beam of the torque wrench at or near the vertical position (N) while turning the stub shaft at an even rate.

Torque required to turn the stub shaft should be from 0.45 to 1.13 N·m (4 to 10 in-lbs).

If torque is above or below specified, adjust worm bearing preload by loosening or tightening the adjuster plug as needed.

NOTE: If preload is incorrect, the adjuster plug may have turned when the locknut was installed or tightened. Or the gear may be assembled incorrectly, or the wormshaft thrust bearings and races may be worn or damaged. Check and correct as necessary before proceeding.

If turning torque is within specifications, remove the socket and torque wrench.

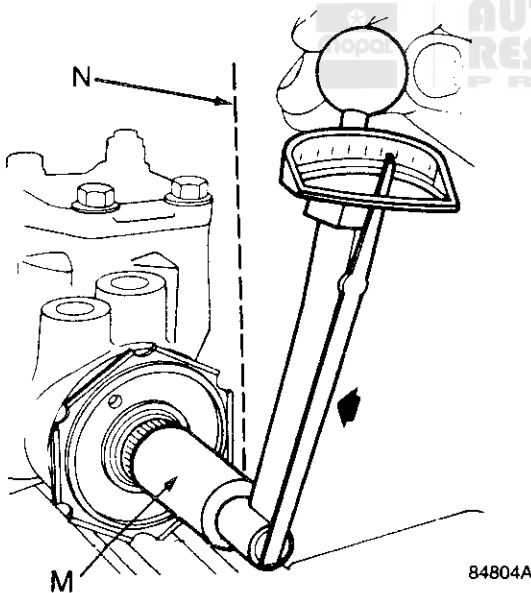
Record the worm bearing preload torque reading and proceed to Pitman Shaft Overcenter Drag Torque.

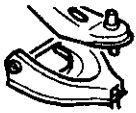
Pitman Shaft Overcenter Drag Torque

Turn the pitman shaft adjuster screw counterclockwise until fully extended; Then turn it back 1/2 turn clockwise.

Center the gear. Rotate the stub shaft from stop-to-stop and count the total number of turns. Then turn the shaft back (from either stop) 1/2 the total number of turns.

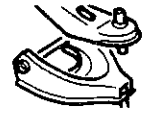
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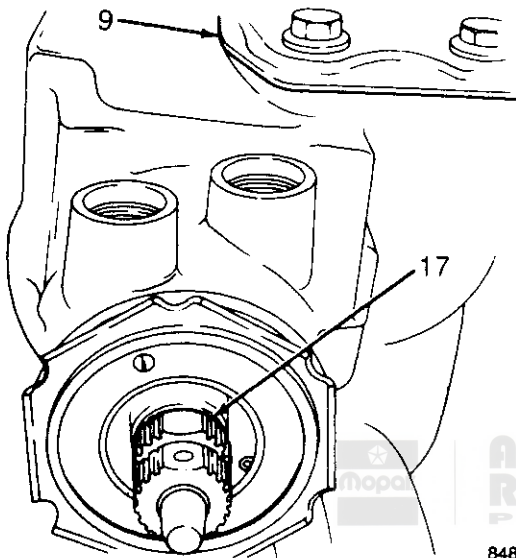


STEERING AND FRONT AXLE

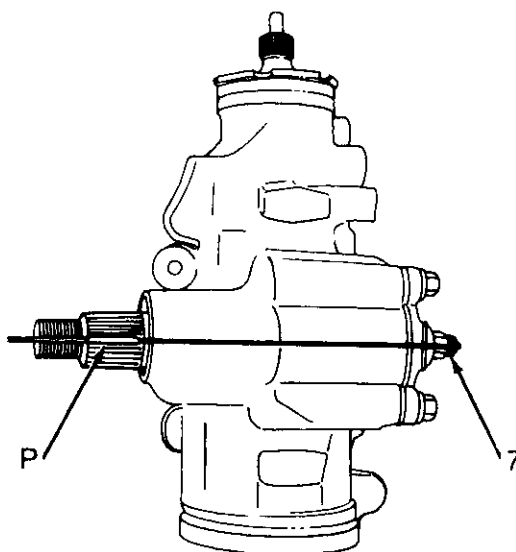
POWER STEERING GEAR



NOTE: When the gear is centered, the flat on the stub shaft (17) should face upward and be parallel with the side cover (9). The master spline (P) on the pitman shaft (6) should be aligned with the adjuster screw (7).



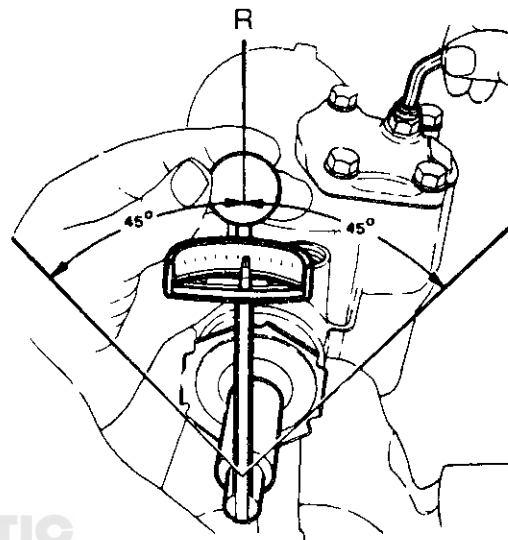
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84806A

Reinstall the 12-point socket and torque wrench on the stub shaft. Place the torque wrench in a vertical position to take the reading.

Rotate the torque wrench 45° left and right of center and record the highest drag torque measured on or near center (R).



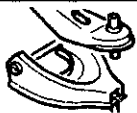
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Overcenter drag torque should be as follows:

- On new steering gears, drag torque should equal worm bearing preload plus an additional 0.45 to 0.90 N·m (4 to 8 in-lbs). However, the combined torque (preload plus drag torque) must not exceed 2 N·m (18 in-lbs) torque.
- On used steering gears (400 or more miles), drag torque should equal worm bearing preload plus an additional 0.5-0.6 N·m (4-5 in-lbs). However, the combined torque (preload plus drag torque) must not exceed 2 N·m (14 in-lbs).

If drag torque must be adjusted, turn the pitman shaft adjusting screw (7) clockwise or counterclockwise until desired drag torque is obtained.

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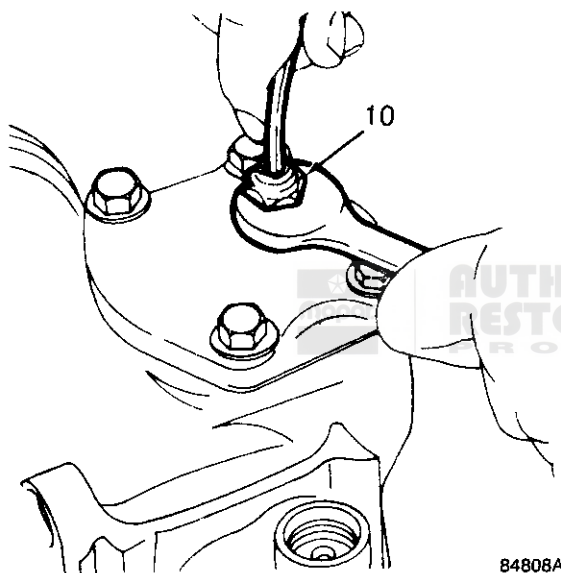


STEERING AND FRONT AXLE

POWER STEERING GEAR



After adjusting drag torque, hold the adjusting screw stationary with an Allen wrench and tighten the locknut (10) to 27 N·m (20 ft-lbs) torque.



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Recheck adjustment after tightening the adjuster screw locknut.

Install the steering gear.

Fill and bleed the power steering system as outlined in the Pump Fluid Level and Initial Operation procedure.

Fluid Level and Initial Operation

Fill the pump reservoir.

Operate the engine until the system fluid reaches normal operating temperature of approximately 170°F (77°C).

Turn the wheels to a full left turn position and stop the engine.

Add power steering fluid to the COLD mark on the dipstick.

Start and operate the engine at curb idle speed.

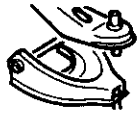
Recheck fluid level. Add fluid, if necessary, to the COLD mark on the dipstick.

Bleed the system by turning the wheels from side-to-side without hitting the stops. Fluid with air in it will have a milky appearance. Continue turning the wheels side-to-side until all air is bled from the system.

Return the wheels to center. Operate the engine for an additional 2-3 minutes and stop the engine.

Road test the vehicle to verify that the steering system functions normally.

Check fluid level. Add fluid as required to raise level to the HOT mark on the dipstick after the system has stabilized at normal operating temperature.



STEERING AND FRONT AXLE

POWER STEERING PUMP



LEAK INSPECTION AND DIAGNOSIS

Raise and support the vehicle and wipe the leakage area dry.

Check for an overfilled reservoir. If overfull, drain fluid from the reservoir with a suction gun.

Check for aerated fluid (full of bubbles and milky in color). Aerated fluid can cause an overflow from the reservoir and be mistaken for a leak.

Check and tighten all hose connections and union fittings at the pump and gear.

Start the engine. Have a helper turn the steering wheel to the left and right several times while locating the exact source of the leak. Contact stops in each direction. Stop the engine when a leak source is determined.

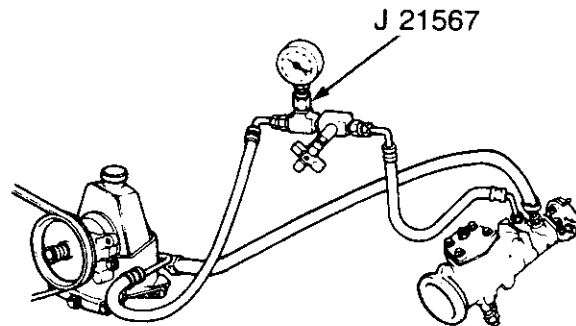
HYDRAULIC PRESSURE TEST

Check and adjust pump belt tension if necessary.

Position a drip pan under the pump and disconnect the power steering pump pressure hose at the pump or steering gear.

Connect the pump and steering gear to test gauge J 21567. Use adapter J 5176-5 to complete hose connection if necessary.

CAUTION: Be sure the gauge pressure hose is connected to the pressure circuit between the pump and gear as shown.



84809A

Open the test gauge valve completely. Turn the valve counterclockwise to open.

Add fluid to the pump reservoir if necessary.

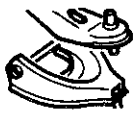
Operate the engine until the system fluid reaches normal operating temperature.

Note initial pressure with the gauge valve open. Pressure should be 552-862 kPa (80-125 psi). If initial pressure is 1 379 kPa (200 psi) or higher, check the hoses for restrictions.

CAUTION: During the following test step, do not hold the gauge valve closed for more than five seconds at a time as pump damage could occur.

Close the test gauge valve, note pressure, then open the valve. Repeat this procedure two more times. Record the highest pressure reading each time the gauge valve is closed. Do not close the valve for more than 3-4 seconds at a time.

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STEERING AND FRONT AXLE

POWER STEERING PUMP



If pressures are within 7 584 to 8 274 kPa (1100-1200 psi) and the three readings do not vary by more than 345 kPa (50 psi), the pump is functioning within specifications.

For example, if pressures are 7 929, 7 998, 8 067 kPa, (1150, 1160, 1170 psi), pressure variance range is within 345 kPa (50 psi) and pump operation is OK.

If pressures recorded are high but do not repeat within 345 kPa (50 psi), the flow control valve (A) is sticking.

Remove and clean the valve (A). Remove any burrs with crocus cloth. If the system contains dirt, flush the system.

NOTE: The power steering system is a closed system. Contamination of fluid in either the pump or gear will be circulated into the other unit. If the system is exceptionally dirty, the pump and gear must be disassembled and cleaned and all hoses removed and flushed.

If pump pressure is OK with the gauge valve open but low with the gauge valve closed, check the steering gear for internal leakage as follows:

Turn the steering wheel to the left and right stops and record highest pressure. Compare the gauge readings with maximum pump output. If pump output cannot be repeated at either side of the gear, the steering gear is leaking internally and must be repaired.

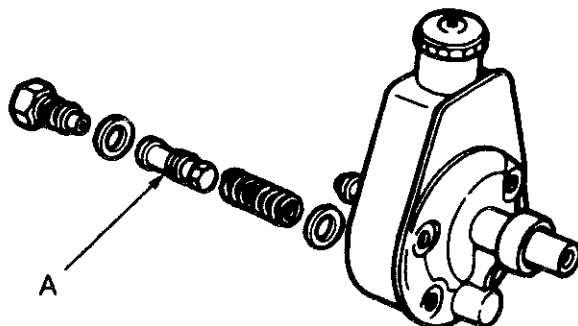
Stop the engine and remove the test gauge.

Connect the pressure hose to the pump (or gear).

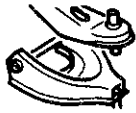
Make the necessary repairs and correct the fluid level.

Remove the drip pan.

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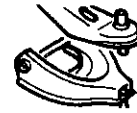


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STEERING AND FRONT AXLE

POWER STEERING PUMP



POWER STEERING PUMP DIAGNOSIS

Condition	Possible Cause	Correction
CHIRP NOISE IN STEERING PUMP	(1) Loose belt	(1) Adjust belt tension to specification
BELT SQUEAL (PARTICULARLY NOTICEABLE AT FULL WHEEL TRAVEL AND STAND STILL PARKING)	(1) Loose belt	(1) Adjust belt tension to specification
GROWL NOISE IN STEERING PUMP	(1) Excessive back pressure in hoses or steering gear caused by restriction	(1) Locate restriction and correct. Replace part if necessary
GROWL NOISE IN STEERING PUMP (PARTICULARLY NOTICEABLE AT STAND STILL PARKING)	(1) Scored pressure plates, thrust plate or rotor (2) Extreme wear of cam ring	(1) Replace parts and flush system (2) Replace parts
GROAN NOISE IN STEERING PUMP	(1) Low oil level (2) Air in the oil. Poor pressure hose connection	(1) Fill reservoir to proper level (2) Tighten connector to specified torque. Bleed system by operating steering from right to left - full turn
RATTLE NOISE IN STEERING PUMP	(1) Vanes not installed properly (2) Vanes sticking in rotor slots	(1) Install properly (2) Free up by removing burrs, varnish, or dirt
SWISH NOISE IN STEERING PUMP	(1) Defective flow control valve.	(1) Replace part
WHINE NOISE IN STEERING PUMP	(1) Pump shaft bearing scored	(1) Replace housing and shaft. Flush system
HARD STEERING OR LACK OF ASSIST	(1) Loose pump belt (2) Low oil level in reservoir NOTE: Low oil level will also result in excessive pump noise (3) Steering gear to column misalignment (4) Lower coupling flange rubbing against steering gear adjuster plug (5) Tires not properly inflated	(1) Adjust belt tension to specification (2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors. (3) Align steering column (4) Loosen pinch bolt and assemble properly (5) Inflate to recommended pressure

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	STEERING AND FRONT AXLE POWER STEERING PUMP	
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POWER STEERING PUMP DIAGNOSIS (cont'd.)

Condition	Possible Cause	Correction
FOAMING MILKY POWER STEERING FLUID, LOW FLUID LEVEL AND POSSIBLE LOW PRESSURE	(6) Sticking flow control valve (7) Insufficient pump pressure output (8) Excessive internal pump leakage (9) Excessive internal gear leakage (1) Air in the fluid, and loss of fluid due to internal pump leakage causing overflow	In order to diagnose conditions such as listed in (6), (7), (8), (9) a pressure test of the entire power steering system is required. (1) Check for leaks and correct. Bleed system. Extremely cold temperatures will cause system aeration should the oil level be low. If oil level is correct and pump still foams, remove pump from vehicle and separate reservoir from body. Check welsh plug and body for cracks. If plug is loose or body is cracked, replace body
LOW PUMP PRESSURE	(1) Flow control valve stuck or inoperative. (2) Pressure plate not flat against cam ring	(1) Remove burrs or dirt or replace. Flush system. (2) Correct
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump. (2) Pump belt slipping (3) High internal leakage	(1) Add power steering fluid as required (2) Tighten or replace belt (3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level (2) Loose pump belt (3) Steering linkage hitting engine oil pan at full turn (4) Insufficient pump pressure (5) Sticking flow control valve	(1) Fill as required (2) Adjust tension to specification (3) Correct clearance (4) Check pump pressure. (See pressure test). Replace flow control valve if defective (5) Inspect for varnish or damage, replace if necessary
EXCESSIVE WHEEL KICKBACK OR LOOSE STEERING	(1) Air in system	(1) Add oil to pump reservoir and bleed by operating steering. Check hose connectors for proper torque and adjust as required

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STEERING AND FRONT AXLE

POWER STEERING PUMP



POWER STEERING PUMP DIAGNOSIS (cont'd.)

Condition	Possible Cause	Correction
LOW PUMP PRESSURE	(1) Extreme wear of cam ring	(1) Replace parts. Flush system.
	(2) Scored pressure plate, thrust plate, or rotor	(2) Replace parts. Flush system
	(3) Vanes not installed properly	(3) Install properly
	(4) Vanes sticking in rotor slots	(4) Freeup by removing burrs, varnish, or dirt
	(5) Cracked or broken thrust or pressure plate	(5) Replace part

84811C



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DRIVE BELT ADJUSTMENT

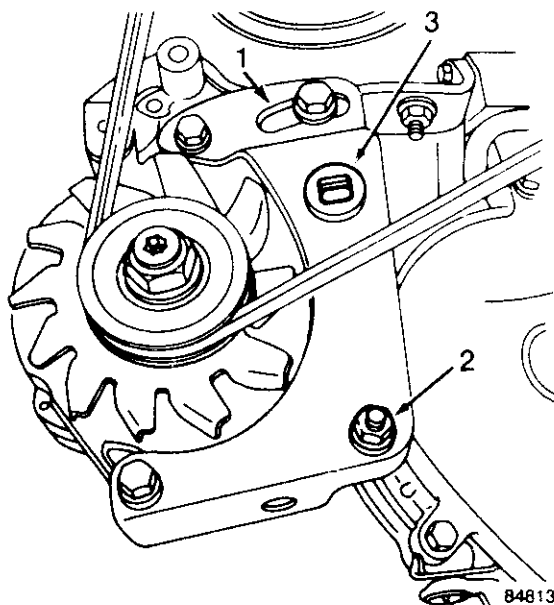
Serpentine Drive Belt

Position the belt tension gauge on the belt and check tension.

If adjustment is necessary, loosen the alternator adjustment (1) and pivot (2) bolts.

Insert the square drive lug of a 1/2-inch drive ratchet into the adjustment slot (3) of the alternator mounting bracket. Pivot the bracket to tighten/loosen the belt as necessary.

Tighten the adjustment (1) and pivot bolts (2) and recheck tension.



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STEERING AND FRONT AXLE

POWER STEERING PUMP



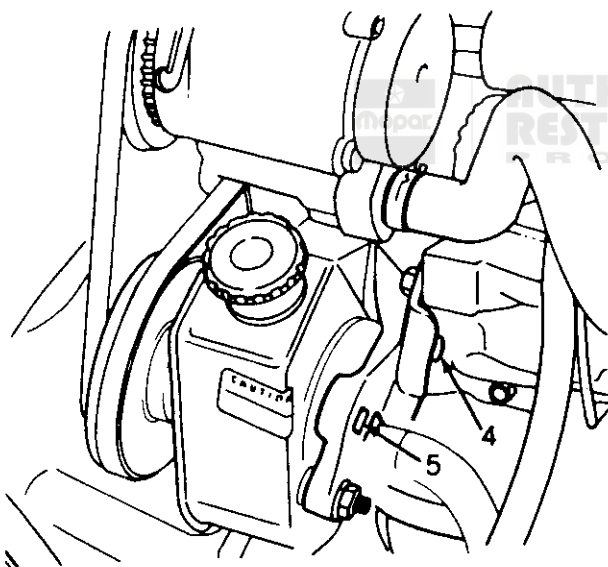
V-Type Drive Belt

Position the belt tension gauge on the longest span of the belt and check tension.

If adjustment is necessary, loosen the power steering pump adjustment and pivot bolts (4).

Insert the square drive lug of a 1/2-inch drive ratchet into the adjustment slot (5) of the pump bracket. Pull the belt taut and tighten the pivot bolts.

Recheck belt tension.



84814

POWER STEERING PUMP REMOVAL

Loosen the pump drive belt and remove it from the pulley.

Remove the air cleaner, if necessary.

Disconnect the pump hoses and cap the hose fittings.

Remove the pump front bracket-to-engine bolts.

Remove the pump-to-rear bracket nuts and remove the pump.

Remove the front bracket from the pump.

POWER STEERING PUMP INSTALLATION

Install the front bracket on the pump.

Position the pump in the rear bracket and install the pump-to-bracket nuts.

Install the pump front bracket-to-engine bolts.

Connect the hoses to the pump.

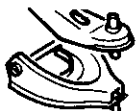
Install and adjust the drive belt.

Fill the pump reservoir.

Bleed the power steering system.

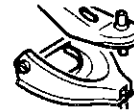
Install the air cleaner, if removed.

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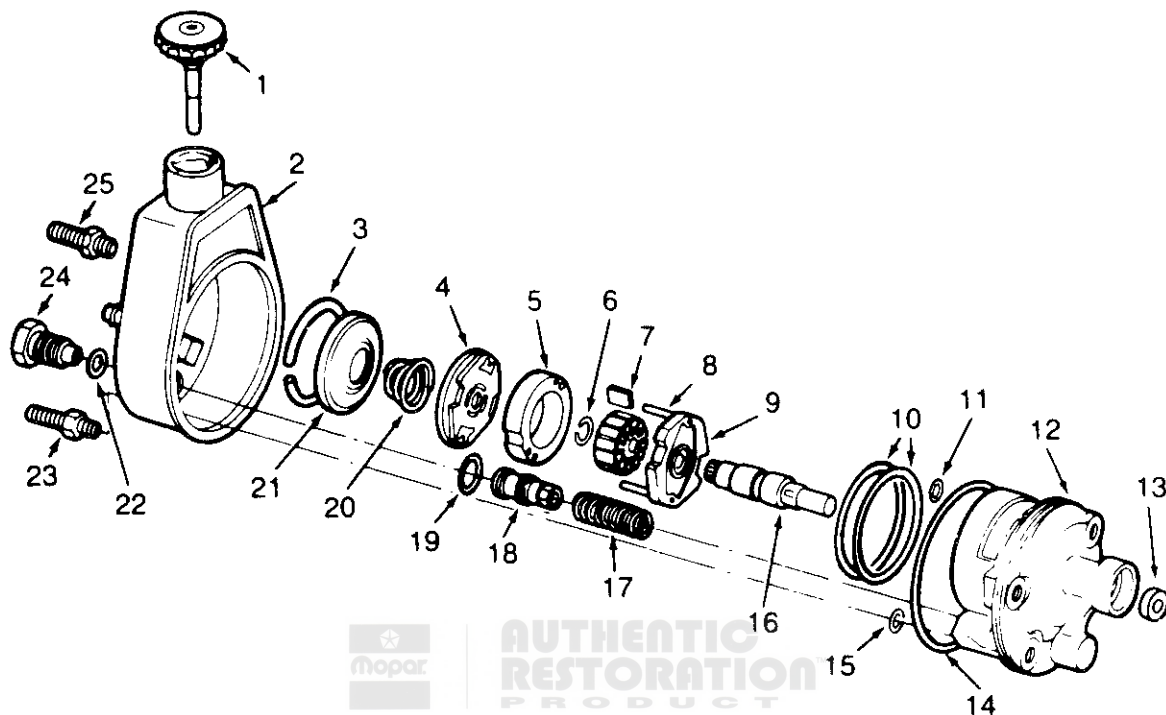


STEERING AND FRONT AXLE

POWER STEERING PUMP



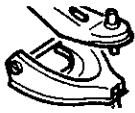
POWER STEERING PUMP COMPONENTS



1. Cap
2. Reservoir
3. End Plate Retaining Ring
4. Pressure Plate
5. Pump Ring
6. Retaining Ring
7. Rotor and Vanes
8. Dowel Pin (2)
9. Thrust Plate
10. Seal
11. Mounting Stud O-Ring
12. Pump Body
13. Pump Shaft Seal

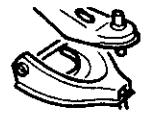
14. Reservoir O-Ring
15. Mounting Stud O-Ring
16. Pump Shaft
17. Valve Spring
18. Flow Control Valve
19. O-Ring
20. Spring
21. End Plate
22. O-Ring
23. Mounting Stud
24. Union Fitting
25. Mounting Stud

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STEERING AND FRONT AXLE

POWER STEERING PUMP

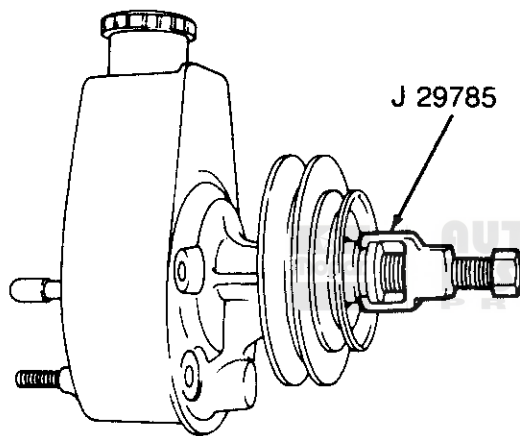


POWER STEERING PUMP DISASSEMBLY

Remove the pump mounting brackets.

Remove the reservoir filler cap and drain the pump reservoir.

Remove the pump pulley with tool J 29785.



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Clamp the pump front hub in a vise with the pump shaft facing downward. Do not over-tighten the vise jaws.

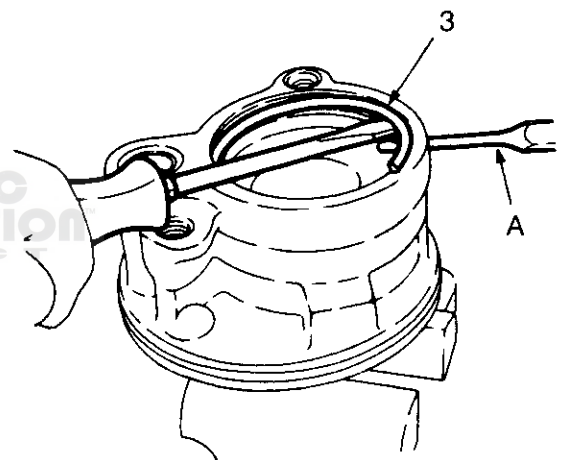
Remove the pump union (24) and mounting studs (23-25). Discard the seals and O-rings.

Remove the reservoir (2) by rocking it lightly back and forth to unseat the O-ring (14).

Remove and discard the reservoir O-ring (14).

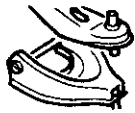
Remove and discard the mounting stud seals (11-15) and the union seal (19) from the housing.

Remove the end plate retaining ring (3) with a screwdriver and small punch. Insert the punch into the small diameter hole in the housing to unseat the ring.



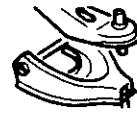
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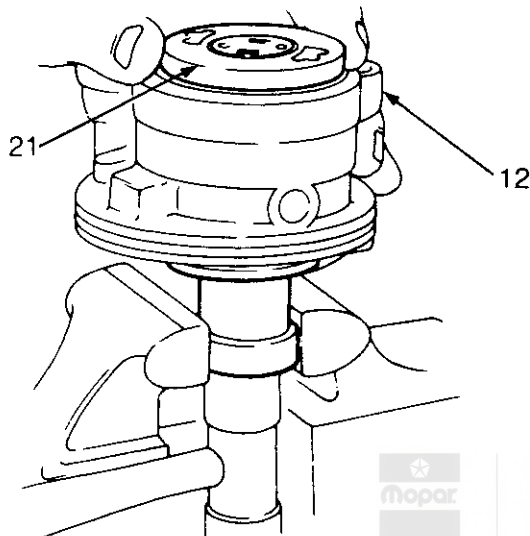
STEERING AND FRONT AXLE

POWER STEERING PUMP



Tap the end of the pump shaft with a mallet until the end plate (21) clears the pump body (12).

Grasp the end plate (21) and lift the pump shaft assembly up and out of the pump body.



84817A

Remove the pump body from the vise.

Remove the flow control valve (18) and valve spring (17) from the pump body.

Remove the end plate (21) and spring (20) from the pump shaft (16).

Remove the snap ring (6) from the pump shaft and remove the pressure plate (4), pump ring (5), rotor and vanes (7) and the thrust plate (9) and dowels (8).

Remove and discard the seals (10) and (13).

Cleaning and Inspection

Clean the pump components with solvent and dry them with compressed air only. Do not use shop towels or rags.

Inspect the flow control valve to be sure it slides freely in the pump body bore. Small burrs on the valve can be removed with crocus cloth. Replace the valve if damaged.

Inspect the pressure plate, rotor, pump ring, thrust plate and pump shaft surfaces for cracks, scoring or any other type of damage. However, a high polish on the rotor pressure plate and thrust plate is normal.

Inspect all the rotor vanes for free movement in the rotor slots.

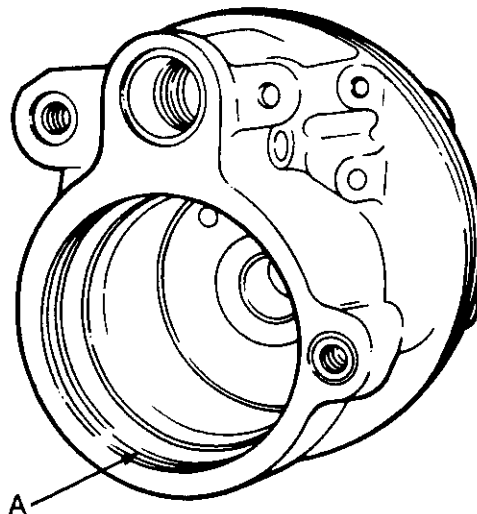
Replace any pump components that are worn or damaged.

POWER STEERING PUMP ASSEMBLY

CAUTION: Do not allow dirt to enter the pump during assembly.

Lubricate the pump components with power steering fluid.

Lubricate the pump body seals (10) with petroleum jelly and install them in the pump body seal grooves (A).



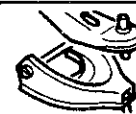
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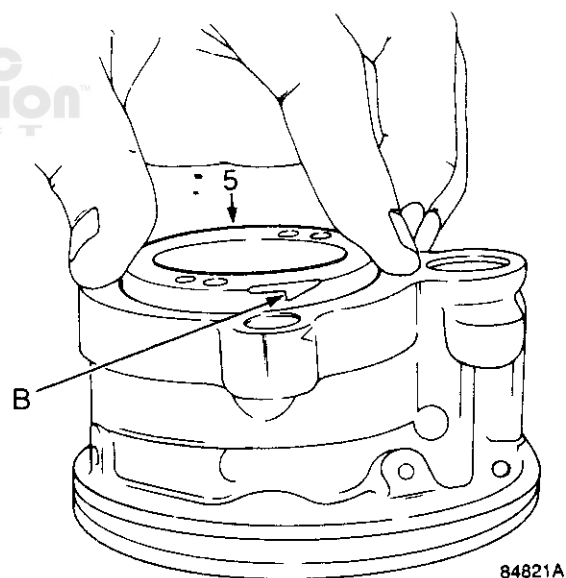
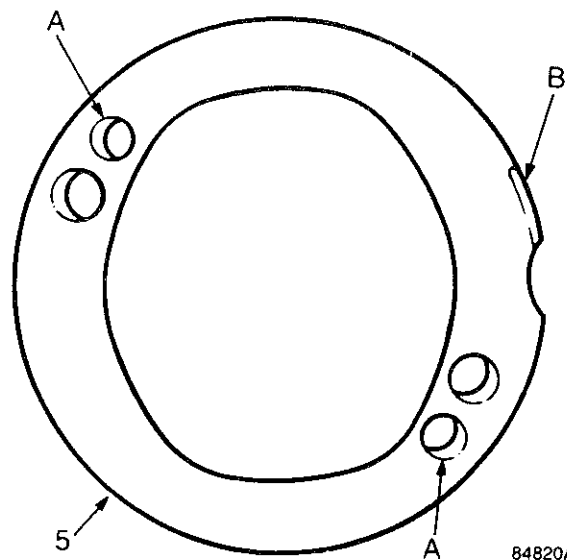
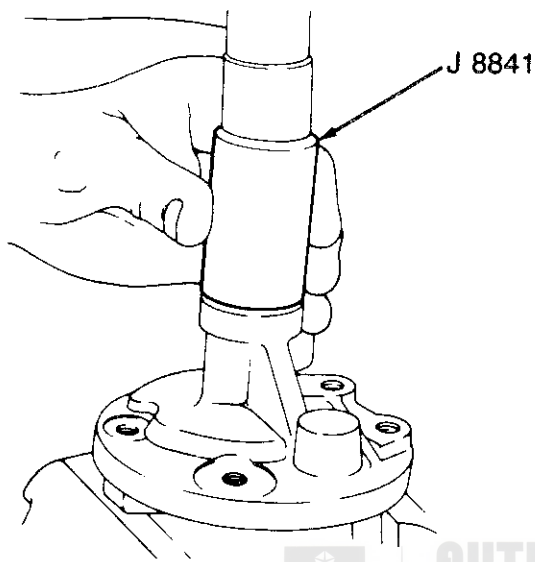


STEERING AND FRONT AXLE

POWER STEERING PUMP



Install the pump shaft seal (13) in the pump body with tool J 8841.



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Install the dowels (8) in the thrust plate (9).

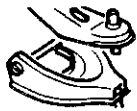
Install the pump shaft (16) in the thrust plate (9).

Install the rotor (7) on the pump shaft (16).

Install a replacement snap ring (6) on the pump shaft (16). Do not overspread the snap ring. Open it only far enough to install it on the shaft.

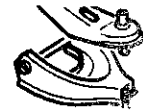
Install the assembled pump shaft, thrust plate and rotor in the pump body (12).

Align and install the pump ring (5) on the thrust plate and dowels. The smaller holes in the pump ring (A) are the dowel holes. Also be sure the rotation arrow (B) on the edge of the ring is facing upward.

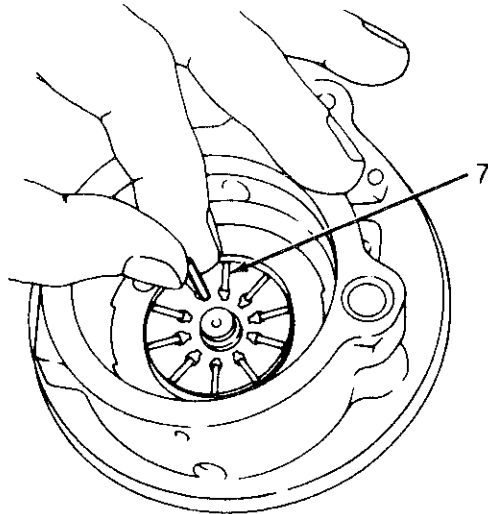


STEERING AND FRONT AXLE

POWER STEERING PUMP



Install the vanes in the rotor (7). The rounded edges of the vanes must face outward.



84822A

Lubricate the outer diameter and the chamfered edge of the pressure plate (4) with petroleum jelly.

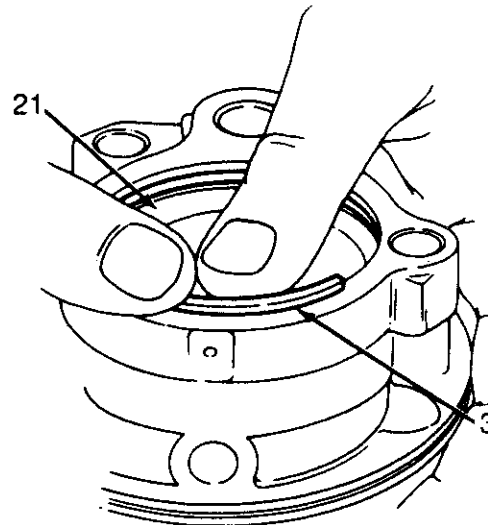
Align and install the pressure plate (4) on the thrust plate dowels. Press the pressure plate downward about 1.5 mm (1/16 inch) to seat it.

Clamp the pump body in a vise with the shaft end facing downward. Do not overtighten the vise or the pump could be damaged.

Install the spring (20) in the center groove of the pressure plate (4).

Lubricate the end plate outer diameter and edges with petroleum jelly and install the end plate (21) on top of the spring (20).

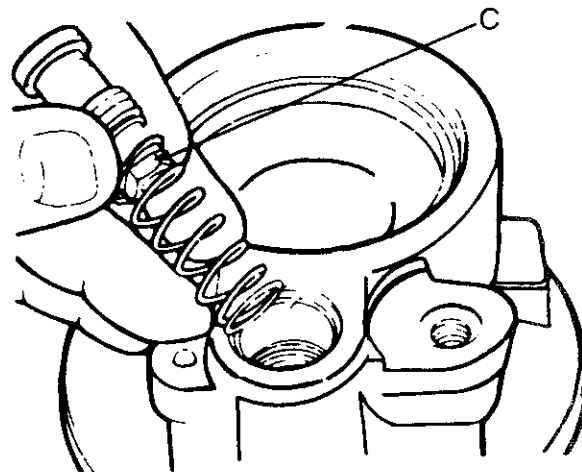
Press the end plate downward and install the end plate retaining ring (3).



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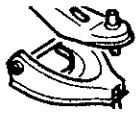
Install the spring (17) on the hex-end of the flow control valve (18).

Install the flow control valve assembly in the pump bore with the hex-end of the valve (C) facing the interior of the bore.



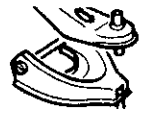
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STEERING AND FRONT AXLE

POWER STEERING PUMP



Lubricate the reservoir O-ring (14) and the mounting stud O-rings (11-15) with petroleum jelly and install them in the pump body.

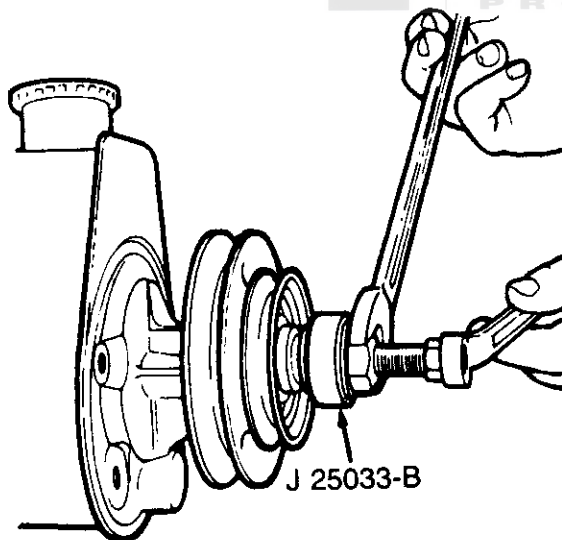
Lubricate the union O-ring (19) with petroleum jelly and install it in the reservoir (2).

Install the reservoir (2) on the pump body (12). Use a plastic tool to guide the reservoir over the O-ring to avoid damaging the O-ring.

Install the mounting studs (23-25) and union fitting (24) and seal (22).

Tighten the union fitting and mounting studs to 47 N·m (35 ft-lbs) torque.

Install the pump pulley with tool J 25033-B.



840401A

Install the pump.

Adjust drive belt tension.

Fill and bleed the system as outlined in Fluid Level and Initial Operation.

Fluid Level and Initial Operation

Fill the pump reservoir.

Operate the engine until the system fluid reaches normal operating temperature of approximately 170°F (77°C).

Turn the wheels to a full left turn position and stop the engine.

Add power steering fluid to the COLD mark on the dipstick.

Start and operate the engine at curb idle speed.

Recheck fluid level. Add fluid, if necessary, to the COLD mark on the dipstick.

Bleed the system by turning the wheels from side-to-side without hitting the stops. Fluid with air in it will have a milky appearance. Continue turning the wheels side-to-side until all air is bled from the system.

Return the wheels to center. Operate the engine for an additional 2-3 minutes and stop the engine.

Road test the vehicle to verify that the steering system functions normally.

Check fluid level. Add fluid as required to raise level to the HOT mark on the dipstick after the system has stabilized at normal operating temperature.

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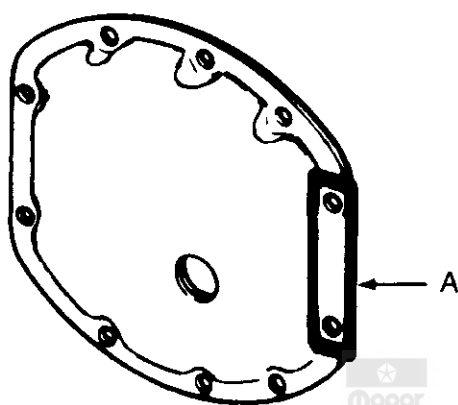
STEERING AND FRONT AXLE

FRONT AXLE



FRONT AXLE IDENTIFICATION

The axle code number is stamped on a tag (A) attached to the differential housing cover.



84831A

The axle build date and the manufacturers build date are stamped on the right-side axle tube near the axle housing.

Refer to the Axle Ratio-Ring and Pinion chart in the Specifications section for axle identification letter decoding.

FRONT AXLE REMOVAL

Raise and support the vehicle.

Remove the front wheels.

Remove the calipers and pads but do not disconnect the brake hoses from the calipers. Tie the calipers to the body or a suspension component. Do not let the brake hose support the weight of the calipers.

Remove the rotors.

Disconnect the vacuum harness (A) from the shift motor and the vent hose from the axle housing.

Mark the front propeller shaft and axle yokes (H) for assembly reference and disconnect the shaft from the axle.

Disconnect the following:

- center link (at right-side of tie rod)
- shock absorbers (B) (at axle)
- steering damper
- track bar (at axle)

Loosen the stabilizer bar links at the stabilizer bar.

Disconnect the stabilizer bar links (C) from the spring tie plates.

Loosen the bolts (D) attaching the front springs to the frame brackets.

Loosen the bolts (E) attaching the front springs to the shackles.

Support the axle (G) with a floor jack and remove the spring U-bolts and tie plates (F).

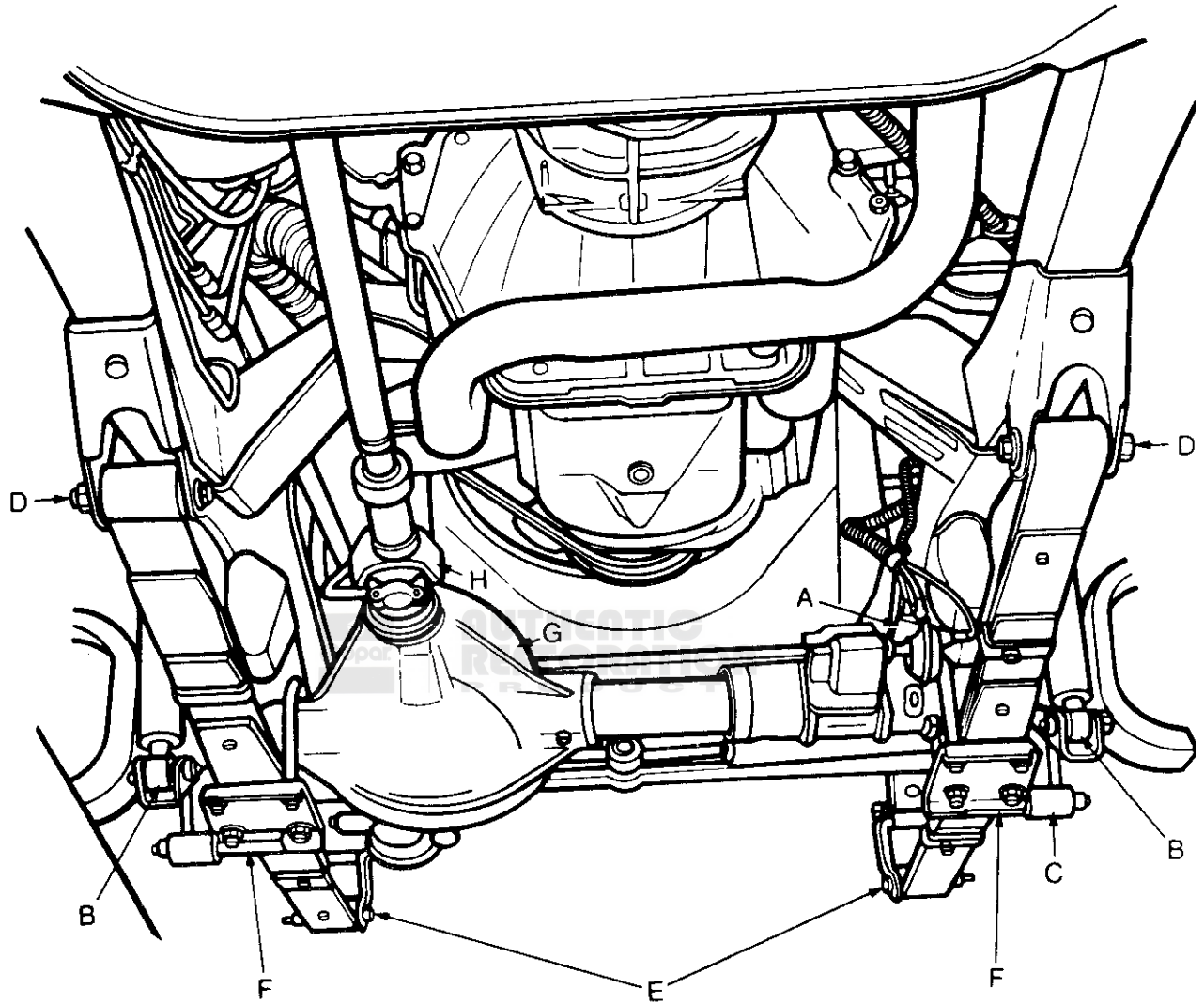
Raise the jack enough to relieve axle weight from the springs.

Remove the front shackle bolts and lower the front springs to the floor.

Remove the axle assembly (G) with the floor jack.

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	STEERING AND FRONT AXLE	
	FRONT AXLE	



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STEERING AND FRONT AXLE

FRONT AXLE



FRONT AXLE INSTALLATION

Position the axle assembly (G) on a floor jack and roll the axle into position.

Raise and align the springs with the shackles and install the shackle bolts and nuts. Do not tighten the bolts at this time.

Lower the jack and position the axle on the front springs. Be sure the spring center bolts are aligned with the axle mounting pads.

Install the U-bolts and tie plates (F). Tighten the U-bolt nuts to 122 N·m (90 ft-lbs) torque.

Connect the following:

- track bar
- steering damper
- shock absorbers
- stabilizer bar links
- center link
- front propeller shaft

Connect the axle vent hose and the axle shift motor vacuum harness (A).

Install the rotors, pads and calipers and the wheels.

Remove the supports and floor jack.

Lower the vehicle.

Tighten the front spring shackle and frame bracket bolts to specified torque.

Check front wheel alignment.

Adjust the turn angle stop screws to obtain required turn angle.

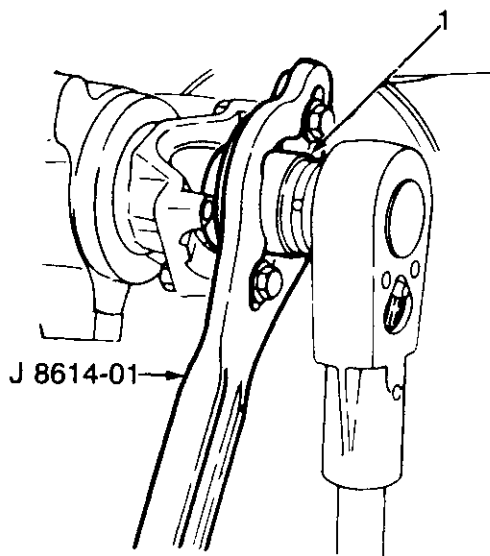
PINION SEAL AND YOKE REPLACEMENT

Yoke and Seal Removal

Raise the vehicle.

Mark the propeller shaft and axle yoke for alignment reference and disconnect the propeller shaft.

Remove the pinion nut and washer with a socket and ratchet (1). Use tool J 8614-01 to hold the yoke while loosening the nut.



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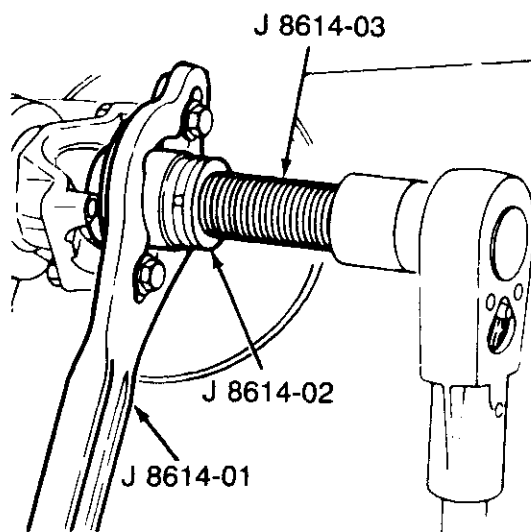


STEERING AND FRONT AXLE

FRONT AXLE



Remove the yoke with tools J 8614-01, -02 and -03.



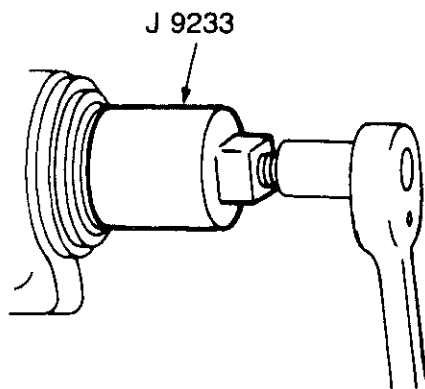
J 8614-03

J 8614-02

J 8614-01

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Remove the pinion seal with tool J 9233 or tool J 7583.

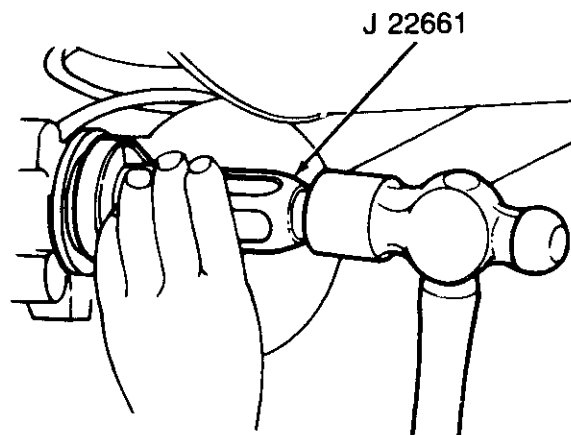


J 9233

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Yoke and Seal Installation

Install the replacement seal with tool J 22661.



J 22661

84830A

Install the yoke.

Install the pinion washer and nut. Tighten the nut to 285 N·m (210 ft-lbs) torque.

Align and connect the propeller shaft and axle yoke. Tighten the U-Joint strap bolts to 19 N·m (170 in-lbs) torque.

Fill the axle with JEEP axle lubricant or an equivalent SAE 75W-90, grade GL 5 gear lubricant.

Lower the vehicle.

84829A



STEERING AND FRONT AXLE

FRONT AXLE



FRONT HUB AND BEARING SERVICE

Hub and Bearing Removal

Raise and support the front of the vehicle.

Remove the wheel, caliper and rotor. Do not disconnect the brake hoses. Tie the calipers to the body or a suspension component. Do not let the hose support the weight of the caliper.

Remove the axle hub nut cotter pin, nut lock and the axle hub nut.

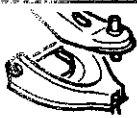
Remove the hub-to-knuckle attaching bolts and remove the hub assembly from the steering knuckle.



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Hub and Bearing Service

The front hub and bearing assembly can be replaced as a complete unit or disassembled for service. However, if the unit is disassembled, be sure to replace both bearings (8 and 12) as a set. The bearings are not reusable after removal.

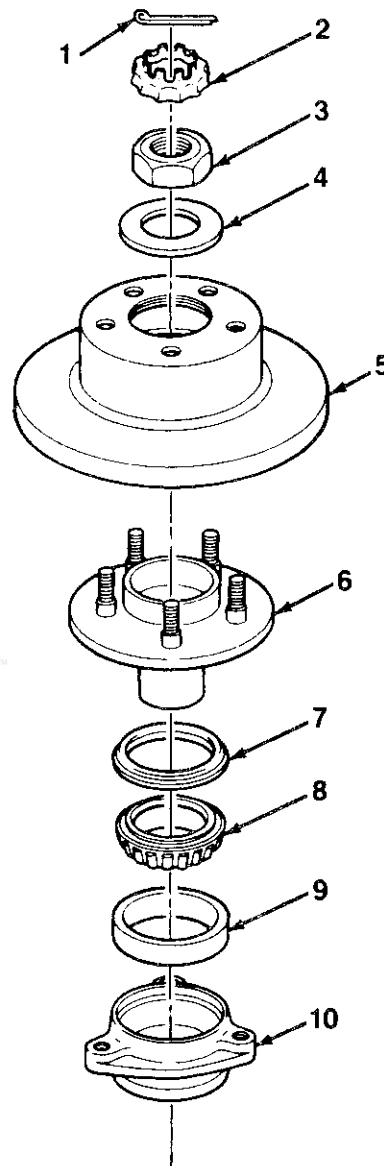
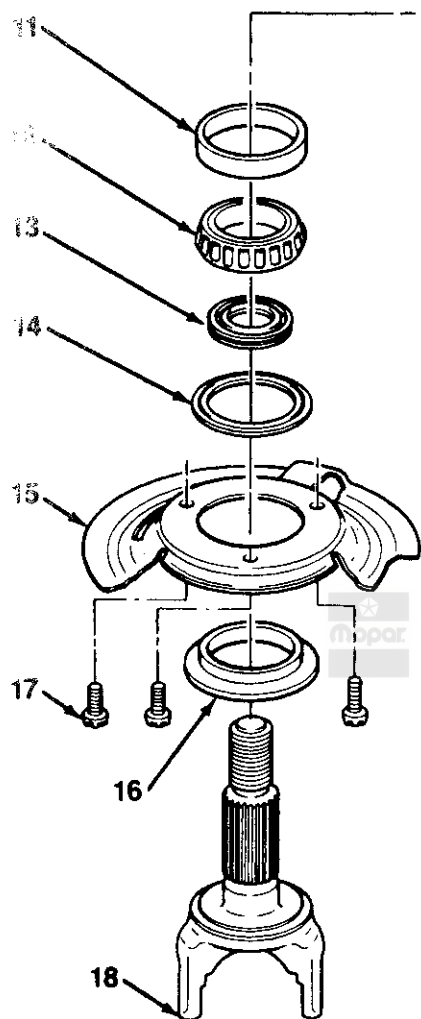


STEERING AND FRONT AXLE

FRONT AXLE



FRONT HUB AND BEARING ASSEMBLY



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1. COTTER PIN
2. NUT RETAINER
3. NUT
4. WASHER
5. BRAKE ROTOR
6. HUB
7. OUTER BEARING SEAL
8. OUTER BEARING
9. OUTER BEARING RACE

10. BEARING CARRIER
11. INNER BEARING RACE
12. INNER BEARING
13. INNER BEARING SEAL
14. CARRIER SEAL
15. ROTOR SHIELD
16. AXLE SHAFT DUST SLINGER
17. BEARING CARRIER BOLTS
18. AXLE SHAFT

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STEERING AND FRONT AXLE

FRONT AXLE



Hub and Bearing Installation

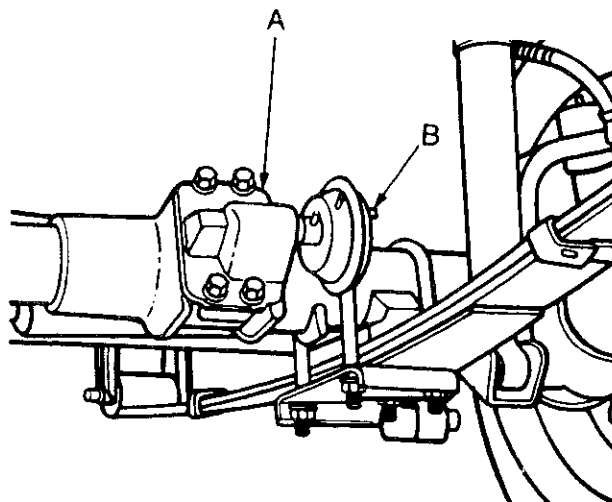
Partially fill the hub cavity of the steering knuckle with chassis lubricant and install the hub assembly.

Tighten the hub bolts to 101 N·m (75 ft-lbs) torque.

Install the hub washer and nut (4) and tighten the hub nut to 237 N·m (175 ft-lbs) torque. Install the nut lock and replacement cotter pins.

Install the rotor, caliper and wheel.

Lower the vehicle.



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FRONT AXLE SHAFT REMOVAL



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Raise the vehicle.

Remove the wheel, caliper and rotor.

Remove the cotter pin, nut lock and axle hub nut.

Remove the hub-to-knuckle attaching bolts.

Remove the hub assembly and splash shield from the steering knuckle.

Remove the left side axle shaft.

Disconnect the vacuum harness from the shift motor.

Remove the shift motor housing (A) and shift motor (B) from the axle.

Remove the right-side axle shaft.

FRONT AXLE SHAFT INSTALLATION

Install the right-side axle shaft. Be sure the shift collar is in position on the intermediate shaft and the axle shaft is fully engaged with the intermediate shaft.

Install the shift motor (B) and housing (A) on the axle. Be sure the shift fork is engaged with the collar.

Partially fill the hub cavity of the steering knuckle with chassis grease and install the hub assembly and splash shield.

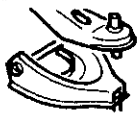
Tighten the hub bolts to 101 N·m (75 ft-lbs) torque.

Install the hub washer and nut. Tighten the hub nut lock and install a replacement cotter pin.

Install the rotor, caliper and wheel.

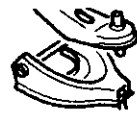
Lower the vehicle.

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STEERING AND FRONT AXLE

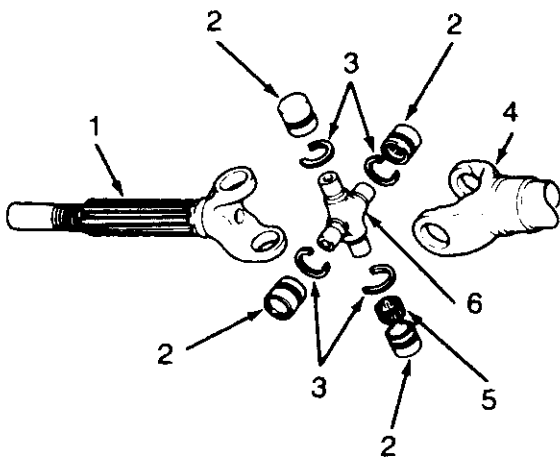
FRONT AXLE



AXLE SHAFT UNIVERSAL JOINT REPLACEMENT

Remove the axle shaft.

Remove the bearing cap snap rings (3).



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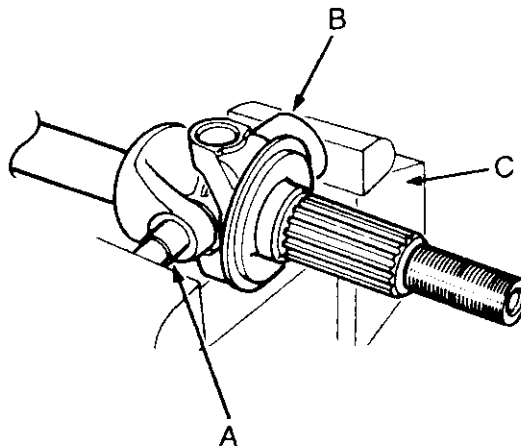
Remove the first bearing cap (2) with a small socket (A), a large socket (B) and a vise (C) as follows:

- Position the shaft and second U-joint assembly in a vise (C).
- Position the small diameter socket (A) on the bearing cap opposite the one to be removed. The small socket will be the press tool. Be sure this socket is smaller than the bearing cap (2).

Position the large socket (B) over the bearing cap to be removed. The large socket will be the receiver. Be sure this socket is larger than the bearing cap.

- Tighten the vise (C) to press the cap out of the yoke.

Repeat the procedure to remove the remaining bearing caps (2) and the spider (6).



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Pack the replacement bearing caps 1/3 full of chassis grease.

Coat the spider bearing surfaces and the bearing cap bores in each yoke with chassis grease.

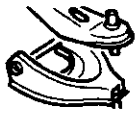
Position the spider (6) in the shaft yokes and install two of the bearing caps. Tap the caps into the yokes just far enough to hold the spider in place.

Install the remaining bearing caps in the yokes.

Seat all of the bearing caps (2) and install the snap rings (3).

Tap the yokes lightly to relieve any pressure on the bearing caps.

Install the axle shaft.



STEERING AND FRONT AXLE

FRONT AXLE



INTERMEDIATE SHAFT REMOVAL

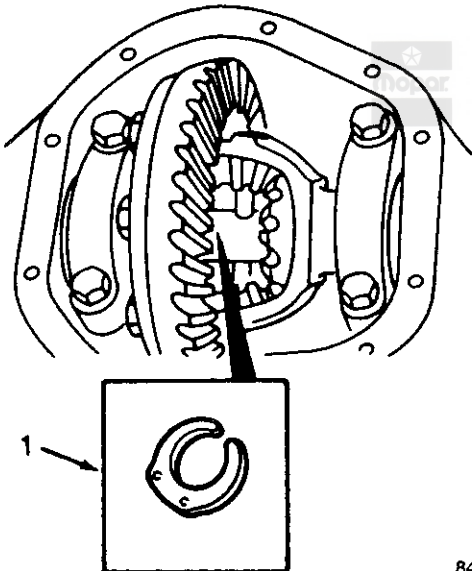
Raise and support the vehicle.

Remove the axle housing cover and drain the lubricant.

Remove the right-side axle shaft, shift collar, shift motor (B) and motor housing (A).

Remove the clip (1) that retains the intermediate shaft in the differential.

Remove the intermediate shaft.



84835

INTERMEDIATE SHAFT INSTALLATION

Install the intermediate shaft. Be sure the shaft is engaged in the differential.

Install the intermediate shaft retaining clip (1).

Install the axle housing cover.

Install the shift collar, outer axle shaft and shift motor housing (A). Do not install the motor (B) at this time.

Fill the axle with 1.2 liters (2.5 pts) of JEEP axle lubricant or an equivalent SAE 75W 90, grade GL 5 lubricant.

Add 148 milliliters (5 ounces) to the shift motor housing (A).

Install the shift motor (B).

Lower the vehicle.

STEERING KNUCKLE SERVICE

Steering Knuckle Removal

Remove the axle shaft.

Remove the caliper anchor plate from the steering knuckle.

Remove the knuckle-to-ball joint cotter pins and retaining nuts.

Tap the knuckle with a brass hammer to unseat it and remove the knuckle.

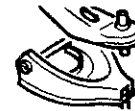
Remove the split ring seat (1) from the knuckle with tool J 23447.

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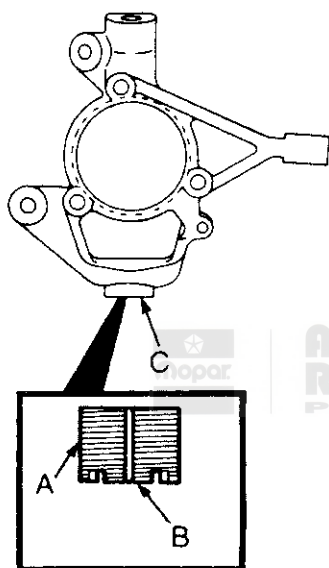
STEERING AND FRONT AXLE

FRONT AXLE



Steering Knuckle Installation

Install the split ring seat (A) to a depth of 5.23 mm (0.206 in) in the bottom ball joint bore of the steering knuckle. Install the seat with tool J 23447. Measure depth from the notched end (B) of the seat to the machined lower surface (C) of the steering knuckle ball joint bore.



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Install the steering knuckle. Position the knuckle over the ball joint studs and install the stud nuts.

Tighten the ball joint stud nuts to 101 N·m (75 ft-lbs) and install replacement cotter pins.

Install the caliper anchor plate. Tighten the anchor plate bolts to 105 N·m (77 ft-lbs).

Install the axle shaft, caliper, hub and wheel and lower the vehicle.

AXLE TUBE BEARING REPLACEMENT

Bearing Removal

Remove the intermediate shaft.

Insert tool J 34659-3 and -4 into the axle tube.

Working through the shift motor housing opening in the axle, connect remover tool J 34659-1 to the tool threaded rod.

Position tool J 34659-1 behind the tube bearing and tighten the tool nut to remove the bearing.

Remove tool J 34659-1 and remove the bearing and tool through the shift motor housing opening in the axle.

Remove the remainder of the remover tools.

Bearing Installation

Position the bearing in the tube. Connect installer tool J 34659-2 to the tool rod through the shift motor housing and drive the bearing into place.

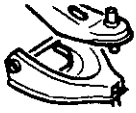
Install the intermediate shaft.

AXLE TUBE SEAL AND GUIDE REPLACEMENT

Remove the intermediate shaft.

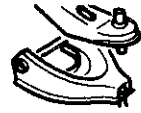
Connect remover tool J 34659-5 to the too threaded rod.

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STEERING AND FRONT AXLE

FRONT AXLE



Insert the tools through the axle tube and drive out the seal and guard. Remove the seal and guard through the shift motor housing opening in the axle.

Working through the shift housing opening in the axle, insert the tool rod into the axle tube. Then position the replacement seal and guide over the tool threaded rod.

Attach installer tool J 34659-2 to the tool rod. Tighten the tool nut to pull the guide and seal into place.

Remove installer tool J 34659-2 from the tool rod. Remove the tool through the axle opening.

Remove the remainder of the installer tools.

Install the intermediate shaft.

BALL JOINT REPLACEMENT

Upper Ball Joint Removal

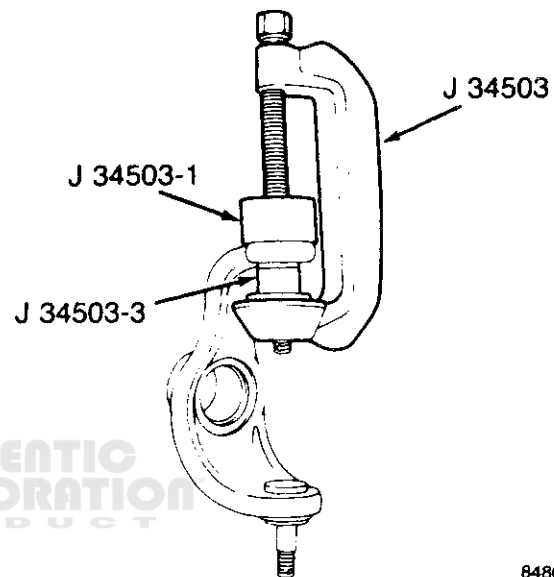
Remove the steering knuckle.

Position receiver tool J 34503-1 on the upper ball joint.

Place adapter tool J 34503-3 in the bottom of the tool C-clamp.

Mount the C-clamp on the receiver tool and ball joint.

Tighten the C-clamp screw to press the ball joint out of the knuckle and into the receiver tool.



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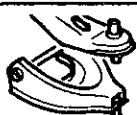
Upper Ball Joint Installation

Start the replacement ball joint in the knuckle.

Place tool J 34503-5 on the replacement ball joint.

Install tool J 34503-12 in the bottom of the tool C-clamp.

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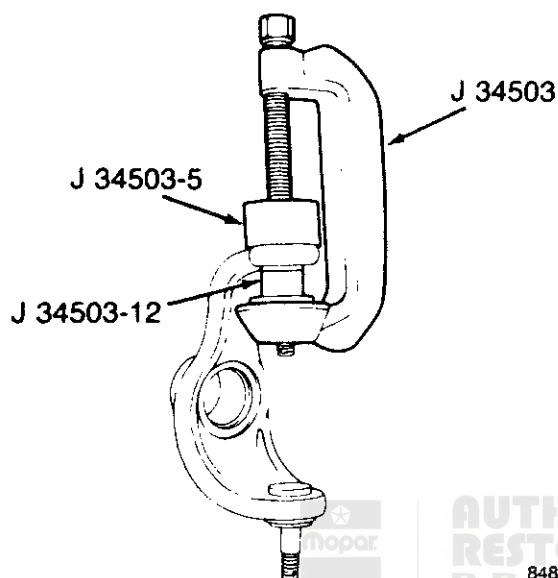


STEERING AND FRONT AXLE

FRONT AXLE



Mount the C-clamp on tool J 34503-5 and the ball joint and tighten the C-clamp screw to press the ball joint into the knuckle.



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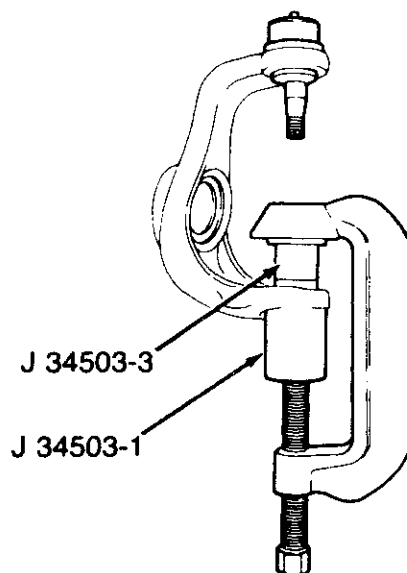
Lower Ball Joint Removal

Position receiver tool J 34503-1 on the C-clamp screw.

Position tool J 34503-3 on the ball joint.

Mount the C-clamp on the tools and ball joint.

Tighten the C-clamp screw to press the ball joint out of the knuckle.



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Lower Ball Joint Installation

Start the replacement ball joint in the knuckle

Place tool J 34503-4 on the C-clamp screw.

Position tool J 34503-12 on the replacement ball joint.

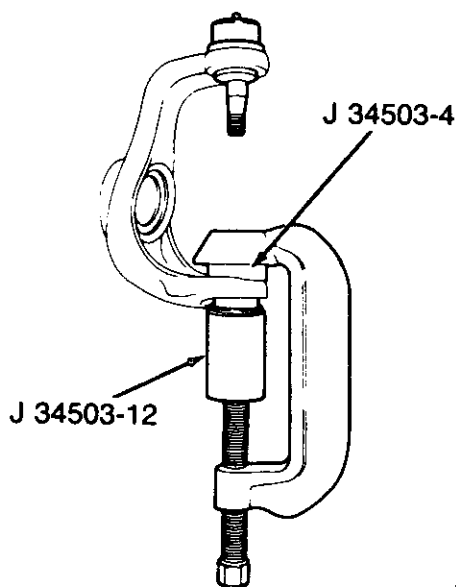
Mount the C-clamp on the tools and ball joint.

Tighten the C-clamp screw to press the ball joint into the knuckle.



STEERING AND FRONT AXLE

FRONT AXLE



84867A

Install the steering knuckle as outlined in Steering Knuckle Installation.

DIFFERENTIAL REMOVAL

Raise and support the vehicle.

Remove the axle housing cover and drain the lubricant.

Mark the propeller shaft and axle yoke for assembly reference and disconnect the propeller shaft.

Remove the wheels, calipers, rotors, hubs, shift motor and housing and the axle shafts.

Remove the intermediate shaft retaining clip and disengage the shaft from the differential.

Mark the differential bearing caps with a center punch for assembly alignment reference.

Loosen the differential bearing cap bolts until only 2 or 3 threads are engaged.

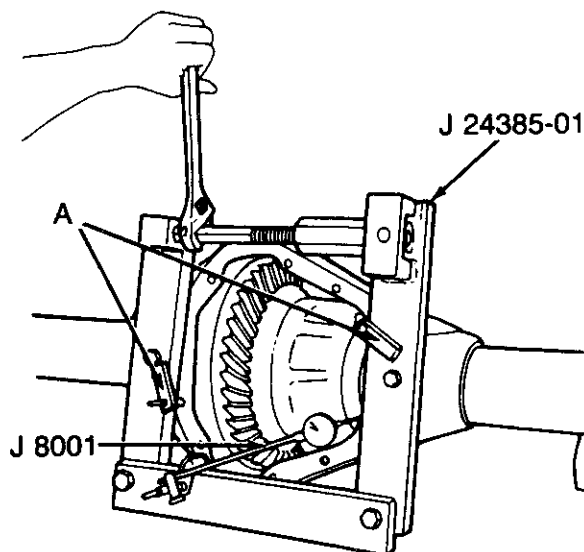
Disconnect the tie rod from the left steering knuckle and disconnect the track bar from the frame rail bracket.

Install spreader tool J 24385-01 on the axle housing. Secure the tool with the holddown clamps (A).

Mount dial indicator J 8001 on the housing. Position the indicator stylus so it contacts one side of the differential opening in the housing.

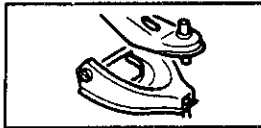
Spread the housing only enough to remove the differential. This should only require about 0.12 mm (0.005 inch). Measure the amount the housing is spread with the dial indicator.

CAUTION: Do not spread the housing any more than 0.25 mm (0.010 inch). Overspreading may distort or damage the housing.



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STEERING AND FRONT AXLE	
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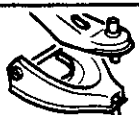
Remove the dial indicator and differential bearing caps. Tag the caps for assembly reference.

Remove the differential assembly. If the differential is still a fairly snug fit, use a pry bar to ease the differential out of the bearing saddles.

Remove the spreader tool and clamps immediately after removing the differential. This is important in avoiding the possibility of the housing taking a set.

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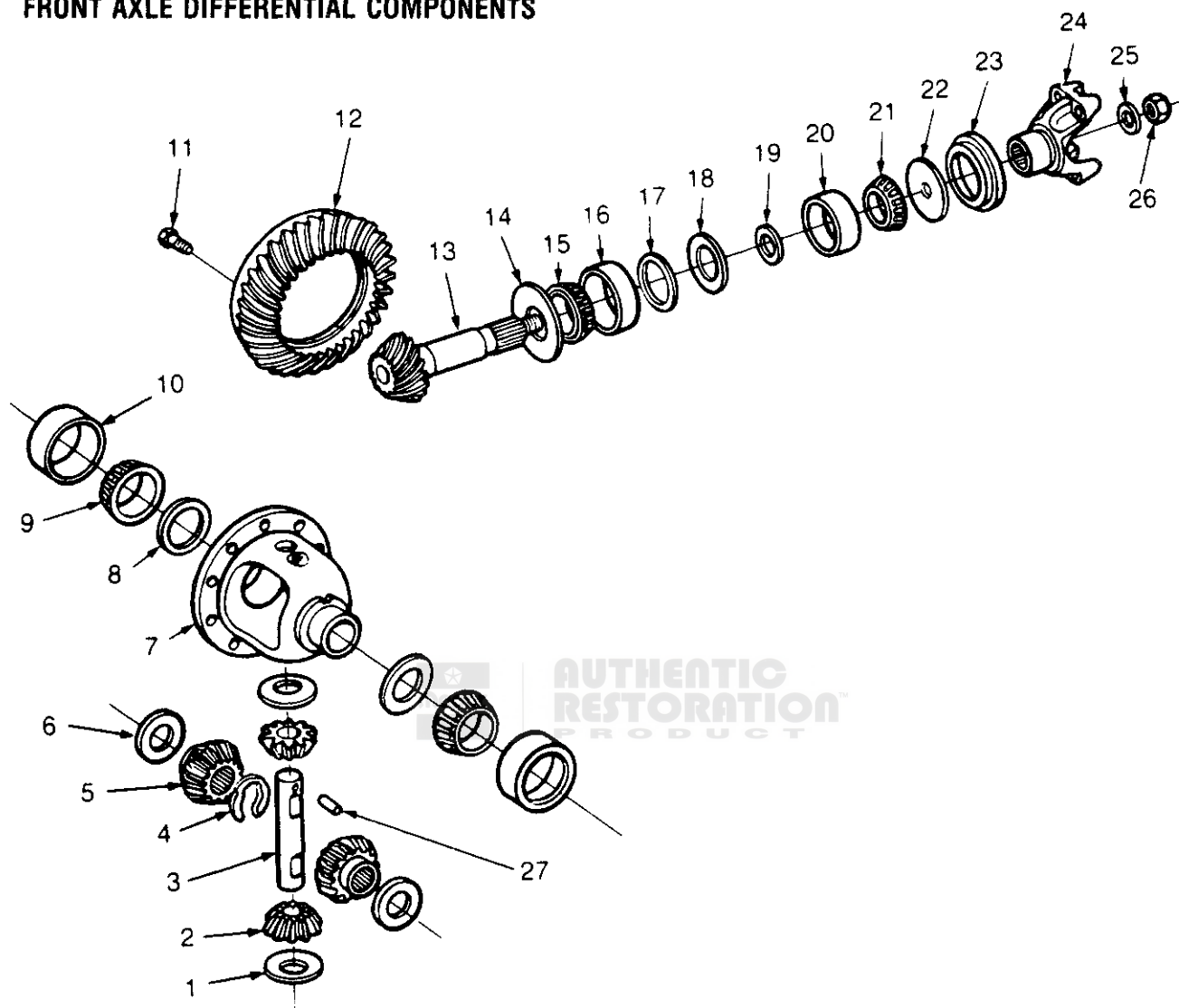


STEERING AND FRONT AXLE

FRONT AXLE



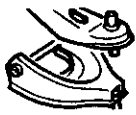
FRONT AXLE DIFFERENTIAL COMPONENTS



1. Pinion Thrust Washer
2. Pinion
3. Pinion Shaft
4. Snap Ring (Int. Shaft)
5. Side Gear
6. Side Gear Thrust Washer
7. Differential Case
8. Bearing Shim
9. Differential Bearing
10. Bearing Cup
11. Ring Gear Bolt (10)
12. Ring Gear
13. Pinion Gear

14. Oil Slinger
15. Pinion Rear Bearing
16. Rear Bearing Cup
17. Pinion Shim
18. Baffle
19. Pinion Shim
20. Front Bearing Cup
21. Pinion Front Bearing
22. Dust Slinger
23. Pinion Seal
24. Pinion Yoke
25. Washer
26. Pinion Nut
27. Pinion Shaft Lockpin

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STEERING AND FRONT AXLE

FRONT AXLE



DIFFERENTIAL DISASSEMBLY

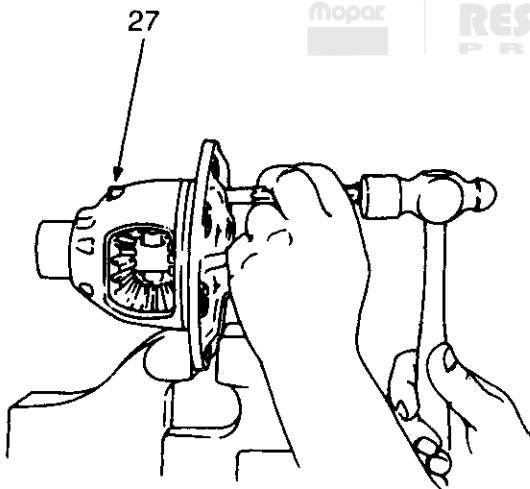
Remove and discard the ring gear attaching bolts (11).

Remove the ring gear (12) from the case (7).

CAUTION: To avoid damaging the case, do not attempt to wedge or chisel the gear off the case.

Mount the differential in a vise equipped with protective jaws.

Remove the pinion shaft lockpin (27) with a pin punch.

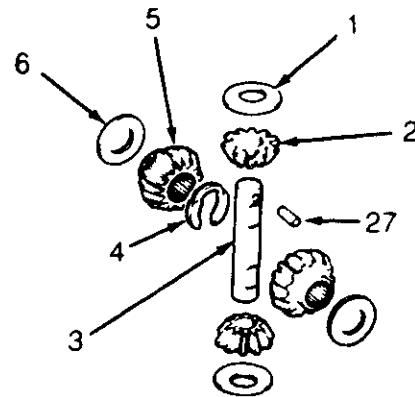


84839A

Remove the pinion shaft (3).

Rotate the pinions (2) until they are aligned with the case opening and remove the pinions and thrust washers (1).

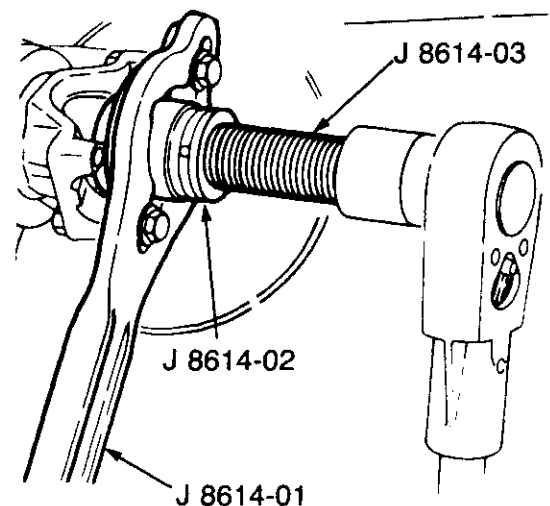
Remove the side gears (5) and thrust washers (6).



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Remove and discard the pinion nut (26). Use tool J 8614-01 to hold the yoke while removing the nut.

Remove the pinion yoke (24) with tools J 8614-01, -02 and -03.



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Remove the pinion gear (13). Tap the end of the gear with a rawhide mallet to release it from the pinion bearings.

Remove and discard the pinion seal (23) and dust cap (22).

Remove the pinion front bearing (21).

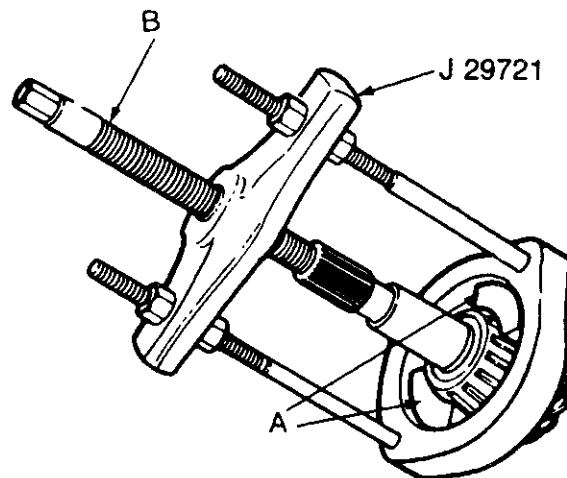
Remove the pinion bearing preload shim (19) and baffle (18).

Remove the pinion front bearing cup (20) from the housing with a brass drift and hammer.

Remove the pinion rear bearing cup (16) and the depth shim (17) from the housing. Use a brass drift and hammer to remove the cup.

Remove the pinion rear bearing (15) from the pinion gear with remover set J 29721 as follows:

- Position the chamfered edges of the adapters (A) under the rear bearing (15).
- Insert the pinion gear and adapters in the base of tool J 29721.
- Position the adapters (A) 180° apart.
- Tighten the remover tool screw (B) to remove the bearing.



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Remove the oil slinger (14) from the pinion gear.

Remove the differential bearings (9) from the case with tool set J 29721. However, use adapters J 29721-9 for the differential bearings. Remove the bearings in the same manner as the pinion rear bearing.

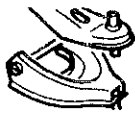
Remove the differential bearing shims (10) after removing the bearings. Tag the shims for reference.

Differential Cleaning and Inspection

Clean all of the parts in solvent. Allow the bearings to air dry. Dry the other differential parts with compressed air.

Inspect the bearings and cups for pitting, galling, flat spots, or cracks. Replace any bearing or cup exhibiting these conditions.

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Inspect the differential case. Replace the case if cracked, or the pinion shaft bore is elongated or enlarged or the machined thrust washer surface areas and counterbores are damaged. Also replace the case if the ring gear mounting surface is distorted or damaged.

Inspect the pinion mate shaft for excessive wear, scoring, or galling. The shaft must be smooth and concentric. Replace the shaft if worn or damaged.

Inspect the pinion gear, ring gear, side gears and pinions. All gear teeth should exhibit a uniform contact pattern. Replace any of the gears if cracked, scored, excessively worn, or chipped.

NOTE: If either the ring gear or pinion gear is damaged, replace both gears as a set only.

Inspect the thrust washers for wear, or damage. Replace the thrust washers in sets if damaged.

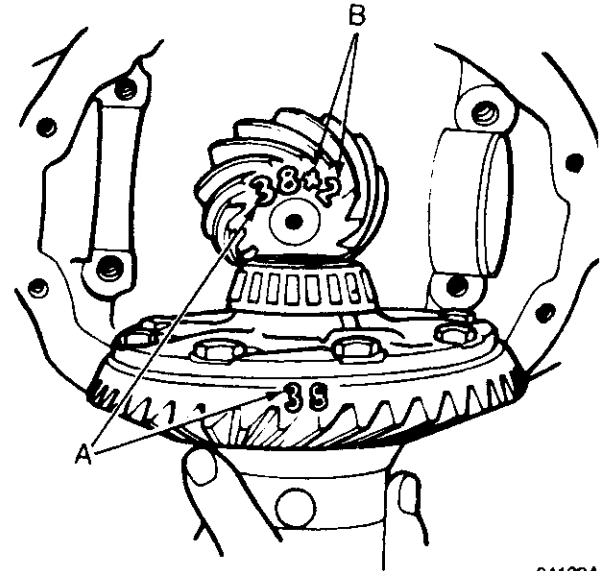
Inspect the pinion mate shaft lockpin. Replace the pin if damaged in any way.

Inspect the bearing shims. Replace the shims if damaged in any way.

Service and Adjustment Information

The ring gear and pinion gear are serviced as a matched set only. They are identified as a matched set by numbers etched on the two gears.

The first two numbers (A) on each gear identify them as a matched set. The second number (B) on the pinion gear is the pinion depth variance. It indicates the amount (in thousandths of an inch) that the set varied from the standard setting of 2.250 inches (57.1 mm). The variance may be a plus or minus figure.



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Pinion gear depth must be measured and adjusted before installing the differential in the axle housing. Depth is controlled by a shim (17) installed under the pinion rear bearing cup (16).

Refer to the Pinion Variance Chart in the Specifications section when adjusting pinion gear depth. The chart helps determine starter shim thickness needed for initial depth measurement.

NOTE: The chart will only help determine starter shim thickness. It will not provide the exact shim thickness needed for final depth adjustment.

DIFFERENTIAL ASSEMBLY AND ADJUSTMENT

Pinion Gear Installation and Depth Adjustment

Verify that the ring and pinion are a matched set before proceeding.

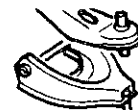
Measure the thickness of the original pinion depth shim (17).

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Note the depth variance (B) marked on the pinion gear.

Determine pinion depth starter shim thickness as follows:

- If the original ring and pinion set is being installed, start with the original depth shim.
- If a replacement gear set is being installed, determine how much must be added to or subtracted from the original shim for best starter shim thickness.
- Refer to the Pinion Variance Chart. Note where the Old and New Pinion Marking columns intersect. The intersecting figure represents the plus or minus amount needed. For example, if the old pinion is +1 and the new pinion is -3, the intersecting figure is +0.004 inch (0.10 mm). Add this amount to the original shim. Or, if the old pinion is -3 and the new pinion is -2, the intersecting figure is -0.001 inch (0.025 mm). Subtract this amount from the original shim.

Clean the bearing cup bores in the axle housing.

Install the starter shim in the rear bearing cup bore of the axle housing.

NOTE: If the shim is chamfered on one side, position the chamfered side so it faces the bottom of the bearing cup bore.

Install the pinion rear bearing cup (16) in the axle housing and on top of the starter shim.

Install the pinion front bearing cup (20) in the axle housing.

Install the oil slinger (14) on the pinion.

Install the rear bearing (15) on the pinion gear with tool J 5590.

Install the pinion gear (13) in the axle housing.

Install the front bearing (21) on the pinion gear. Seat the bearing on the gear and in the cup (20).

Install the pinion yoke (24) and original pinion nut (26) on the pinion gear. Tighten the pinion nut only enough to remove end play.

NOTE: Do not install the pinion seal or preload shims at this time.

Determine **desired** pinion depth as follows:

- Record depth variance marked on the pinion gear.
- If the variance is a plus figure, add the variance to the standard setting of 2.250 inches (57.1 mm). If the variance is a minus figure, subtract it from the standard setting.

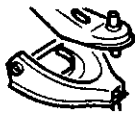
- Record the desired depth figure for final shim selection.

Determine **initial** pinion depth as follows:

Assemble gauge arbor J 5223-4 and discs J 5223-26. Then seat the discs in the axle housing differential bearing saddles.

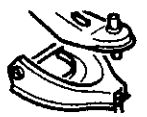
Install the differential bearing caps over the discs and tighten the bearing cap bolts securely.

Remove the standard plunger from gauge block tool J 5223-20 and install front axle plunger J 5223-27.



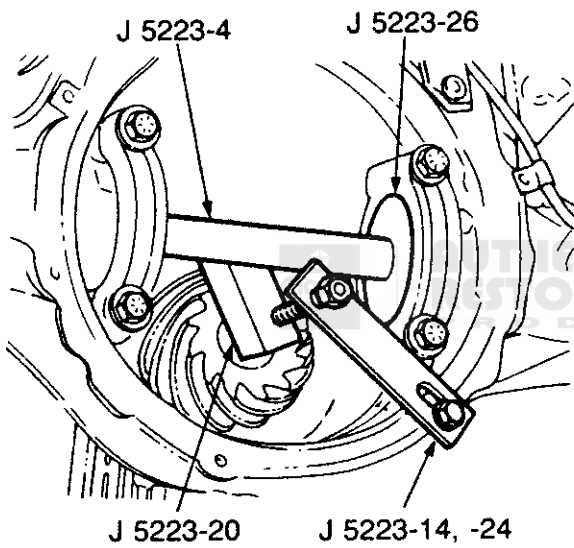
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Place gauge block J 5223-20 on the raised face of the pinion gear. Position the spring loaded plunger under the center of gauge arbor shaft J 5223-4.

NOTE: Do not allow the gauge block anvil to contact the pinion gear teeth.



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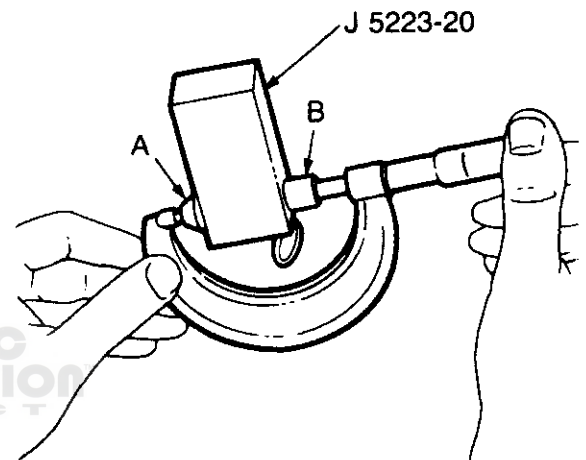
Mount gauge block clamp J 5223-14 and holding screw J 5223-24 on the axle housing. Secure the clamp to the housing with an axle cover bolt. Position the holding screw over the gauge block.

Extend holding screw J 5223-24 until it is firmly seated against the gauge block (to hold the block in position).

Loosen the gauge block thumbscrew and allow the spring loaded plunger to contact gauge arbor J 5223-4.

Tighten the gauge block thumbscrew securely. Then loosen the holding screw and remove the gauge block.

Measure the distance between the anvil (A) and plunger (B) of gauge block J 5223-20 with a micrometer. Record this dimension for final shim selection. It represents initial pinion depth.



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Remove the differential bearing caps and gauge tools from the axle housing.

Remove the pinion nut, yoke, front bearing and pinion gear from the axle housing. Discard the old pinion nut.

Remove the pinion rear bearing cup and the pinion depth starter shim.

Select the correct pinion depth shim (17) as follows:

- Subtract pinion variance from standard setting. This equals desired depth.
- Add starter shim thickness to measured depth. This equals initial depth.



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- Subtract desired depth from initial depth. This equals correct shim thickness.

NOTE: Refer to the following example for an illustration of how the shim thickness computation is performed.

Example – Pinion Depth Variance is Plus (+) 0.004.

Step 1 – Determine desired pinion depth.

Add depth variance (marked on pinion gear) to the standard setting. Result is desired pinion depth.

- standard setting – 57.1 mm (2.250 in)
- pinion depth variance – +0.10 mm (+ 0.004 in)
- desired pinion depth equals – 57.2 mm (2.254 in)

Step 2 – Determine initial pinion depth.

Add measured pinion depth to starter shim thickness. Result is initial pinion depth.

- measured pinion depth – 56.6 mm (2.224 in)
- starter shim thickness – +2.71 mm (+ 0.017 in)
- initial pinion depth equals – 59.2 mm (2.331 in)

Step 3 – Determine correct shim thickness.

Subtract desired depth from initial depth. Result is correct shim thickness.

- total measured pinion depth – 59.2 mm (2.331 in)

- desired pinion depth – 57.2 mm (2.254 in)

- correct shim thickness equals – 1.96 mm (0.077 in)

Install the required pinion depth shim (17) in the rear bearing cup bore.

NOTE: If the shim is chamfered on one side, be sure the chamfered side is facing the bottom of the bearing cup bore.

Install the rear bearing cup (16).

Reinstall the pinion gear (13) in the axle housing.

Pinion Bearing Preload Adjustment

Install the original preload shims (19), pinion front bearing (21), dust cap (22), yoke (24) and washer (25) and the original pinion nut (26) on the pinion gear.

Tighten the pinion nut to 285 N·m (210 ft-lbs) torque.

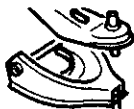
Measure the torque required to rotate the pinion gear with an inch-pound torque wrench. Rotating torque should be as follows:

- With original bearings – 1-2 N·m (10-20 in-lbs)
- With replacement bearings – 2-5 N·m (20-40 in-lbs)

Remove the pinion gear and add or subtract preload shims (19) as needed to obtain required bearing preload torque.

Lubricate the pinion gear, bearings and cups with axle lubricant.

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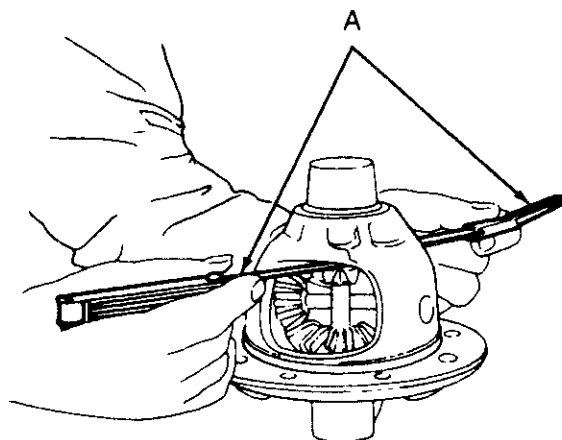
Reinstall the pinion gear and install the baffle (18), pinion bearing (21) and dust cap (22).

NOTE: Discard the original pinion nut. Do not reuse it.

Install a replacement pinion oil seal (23) with tool J 25104.

Install the yoke (24) and nut washer (25).

Install a replacement pinion nut (26). Tighten the nut to 285 N·m (210 ft-lbs) torque.



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Differential Side Gear Clearance Measurement

Install the thrust washers (6) on the side gears (5) and install the gears in the case.

Install the thrust washers (1) on the differential pinions (2) and install the pinions in the case.

Install the pinion shaft pin (3) in the case.

Measure clearance between the case and side gears with two feeler gauges (A). Clearance should be 0.00 - 0.15 mm (0.00 - 0.006 in).

If clearance between the side gears and case exceeds specified maximum, replace the case and side gears.

NOTE: If the case and side gears must be replaced, check side gear clearance in the replacement assembly.

Differential Bearing Preload and Ring Gear Backlash Adjustment

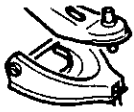
NOTE: Do not install the differential bearing shims (8) at this time.

Install the differential bearings (9) with driver handle J 8092 and installer J 22175-A.

Install the ring gear (12) on the case. Tighten the replacement ring gear bolts (11) to 61-88 N·m (45-65 ft-lbs) torque.

Install the bearing cups (10) on the differential bearings.

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Install the differential in the axle housing.

Install the differential bearing caps and tighten the cap bolts securely but not to full specified torque.

Hold the ring gear in contact with the pinion gear. Then pry the differential bearing cups toward the center of the case with a screwdriver.

Insert various thickness feeler gauges between each bearing cup and the axle housing until ring gear backlash is 0.02 - 0.05 mm (0.001 - 0.002 in).

NOTE: Feeler gauges must be installed at both sides of the differential at the same time to obtain an accurate measurement.

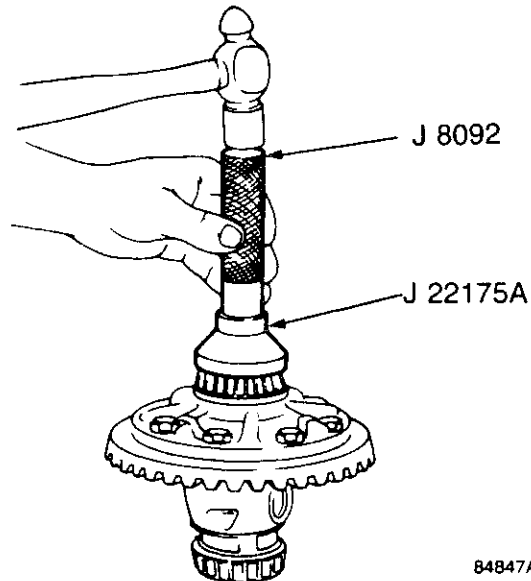
Assemble a bearing shim pack that will provide desired backlash. Insert the shims between the bearing cups and housing and check backlash again. If OK, remove, tag and retain the shims for assembly.

Remove the differential from the housing.

Add an additional 0.38 mm (0.015 in) thickness shim to the differential bearing shim pack on the drive tooth side of the ring gear. The additional shim thickness will provide the necessary preload on the differential bearings.

Remove the differential bearings.

Install the shim packs on the appropriate side of the differential case and reinstall the differential bearings. Use driver handle J 8092 and installer J 22175A to install the bearings.



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Mount spreader tool J 24385-01 and dial indicator J 8001 on the axle housing. Spread the housing no more than 0.25 mm (0.010 in).

CAUTION: Do not overspread the axle housing. It could be damaged or distorted.

Remove the dial indicator when the housing has been spread the specified amount.

Lubricate the differential bearings with axle lubricant and install the bearing cups on the bearings.

Install the differential in the housing. Use a rawhide mallet to seat the differential and bearings. Be sure that the ring and pinion gear teeth mesh completely.

Remove the spreader tool from the housing.

Install the differential bearing caps. Position the caps according to alignment marks made during disassembly.

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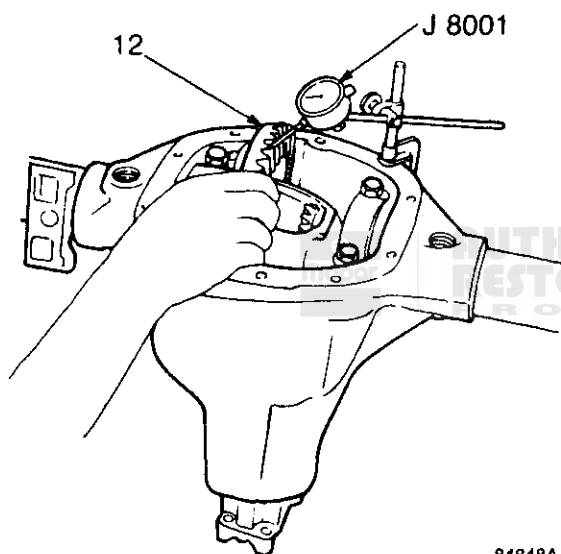
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Apply sealer to the bearing cap bolt threads and install the bolts. Tighten the bolts to 54 N·m (40 ft-lbs) torque.

Attach dial indicator J 8001 to the housing and measure ring gear backlash at two points. Backlash should be 0.12-0.25 mm (0.005-0.010 in). If backlash is incorrect, add or subtract shims from the differential bearing shim packs until correct backlash is obtained.



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NOTE: Moving a 9.12 mm (0.358 in) shim from one side to the other will change backlash by approximately 0.07 mm (0.003 in).

Measure ring gear runout. If the runout exceeds 0.15 mm (0.006 in), the case may be distorted, dirt may be between the case and the gear, or the ring gear bolts are loose. Check and correct as necessary.

DIFFERENTIAL INSTALLATION

Install the intermediate shaft and the shaft retaining clip (4).

Install the axle shafts.

Clean the axle housing and housing cover mating surfaces thoroughly.

Apply a thin bead of JEEP Gasket-In-A-Tube or equivalent silicone sealer to the housing and the cover and install the cover. Tighten the cover bolts to 27 N·m (20 ft-lbs) torque.

Connect the track bar to the bracket and tighten to 47 N·m (35 ft-lbs).

Connect the tie rod to the steering knuckle.

Install the axle shift motor and housing.

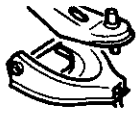
Install the hub and bearing assemblies, rotors and calipers and the wheels.

Align and connect the propeller shaft.

Fill the axle with 1.2 liters (2.5 pts) of SAE 75W-90, grade GL 5 gear lubricant.

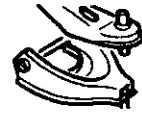
Remove the supports and lower the vehicle.

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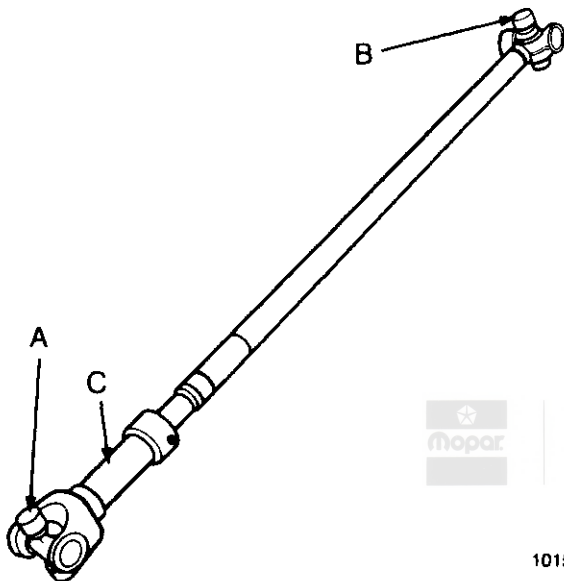
STEERING AND FRONT AXLE

PROPELLER SHAFT



DESCRIPTION

The front propeller shaft has single cardan universal joints (A-B) at each end. A slip yoke (C) connects the shaft to the front axle yoke.



Vibration caused by a propeller shaft may be the result of:

- undercoating on the shaft tube
- missing shaft balance weight
- excessive shaft runout
- worn or damaged propeller shaft yokes or universal joints
- broken seam welds at either end of the shaft
- dents or bends in the shaft

Vibration caused by a yoke may be the result of:

- excessive yoke runout
- loose U-joint clamp bolts or loose pinion nut
- damaged yoke

An incorrect universal joint angle can produce an out-of-phase condition and cause vibration at low or high speed.

PROPELLER SHAFT RUNOUT

Measure propeller shaft runout at the center and both ends of the shaft with a dial indicator.

The dial indicator should be installed perpendicular to the shaft surface and be rigidly mounted for accurate readings.

Remove all dirt and undercoating from the areas where the dial indicator stylus will contact the shaft.

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Propeller Shaft Lubrication

The shaft universal joints and the slip yoke are equipped with zerk-type lubrication fittings. The slip yoke and joints should be lubricated at periodic intervals with chassis grease.

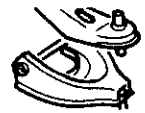
Driveline Vibration

Driveline vibration may be caused by a loose, worn, or damaged propeller shaft, axle yoke, or universal joint. Driveline vibration may also be the result of a loose or damaged engine/transmission mount, engine driven accessory, or damaged wheels/tires.



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PROPELLER SHAFT



Take the front reading 0.13 mm (1/2 inch) from the slip yoke splines.

Take the rear reading 0.13 mm (1/2 inch) from the rear yoke weld joint.

Take the center reading as close to the shaft mid-point as possible.

Runout should not exceed 0.38 mm (0.015 in) at any point.

PROPELLER SHAFT REMOVAL

Mark the propeller shaft, axle and transfer case yokes for alignment reference.

Remove the U-joint clamp bolts.

Remove the propeller shaft assembly.

PROPELLER SHAFT INSTALLATION

Align and install the propeller shaft.

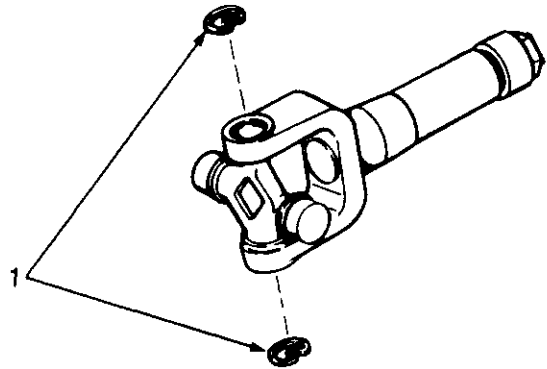
Install replacement U-joint clamps.

Install and tighten the U-joint clamp bolts to 19 N·m (170 in-lbs) torque.

UNIVERSAL JOINT REPLACEMENT

Remove the propeller shaft.

Remove the U-joint bearing cap retainers (1).



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Remove the bearing caps in the same manner outlined for the front axle U-joints. Refer to Front Universal Joint Replacement.

Apply chassis grease to the yoke bores, bearing caps, bearing rollers, and bearing surfaces of the spider.

Position the spider in the yoke and tap the bearing caps into the yoke far enough to hold the spider in position.

Place the shaft yoke in the vise and press the bearing caps into the yoke with a socket.

Install the retaining rings (1) when the bearing caps are completely seated.

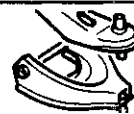
Install the propeller shaft.

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PROPELLER SHAFT



UNIVERSAL JOINT ANGLE

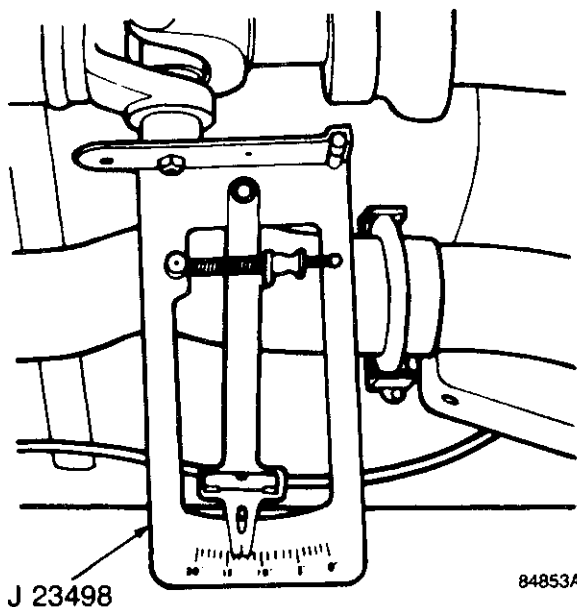
Measuring Universal Joint Angle

Shift the transmission into Neutral.

Raise the vehicle on a twin post or a similar type hoist that will support the vehicle on the axles and allow the wheels to be turned.

NOTE: If a drive-on type hoist is used, place support stands under each tube and lower the hoist until the wheels turn freely.

Turn the propeller shaft until one of the bearing caps in the axle yoke is facing downward. Install inclinometer tool J 23498 on the bearing cap and record the tool reading.



Turn the propeller shaft until one of the bearing caps in the shaft slip yoke is facing downward. Place the inclinometer tool on the bearing cap and record the tool reading.

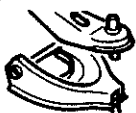
NOTE: The inclinometer frame must face the same direction for both readings.

The difference in readings is the front angle.

Repeat the procedure at the transfer case end of the shaft to obtain the rear angle.

Compare the front and rear angles. The difference between them represents the universal joint angle.

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STEERING AND FRONT AXLE

FRONT AXLE SHIFT MOTOR



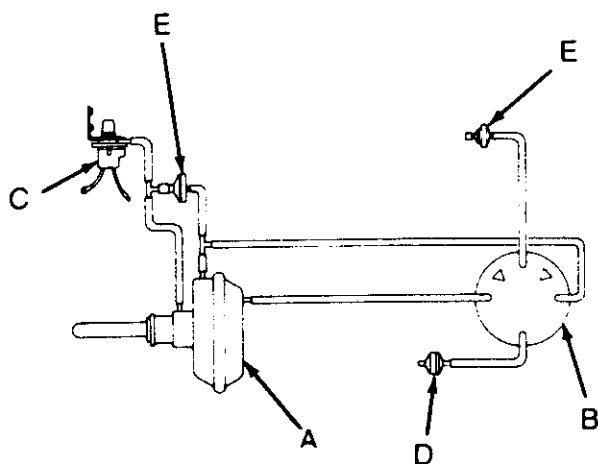
VACUUM CONTROL SYSTEM

The front axle shift motor disconnects the right-front axle shaft for two-wheel drive operation. The shift motor is vacuum operated.

The shift motor is mounted in the motor housing located on the right-front axle tube.

The vacuum control system consists of:

- The axle mounted shift motor (A).
- The control switch (B) on the transfer case.
- The four-wheel drive indicator switch (C).
- An air vent filter (D).
- Two check valves (E).



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VACUUM SYSTEM DIAGNOSIS

Diagnosis procedures for the vacuum system are outlined in diagnosis charts in Chapter D - Gearboxes. Refer to the Transfer Case section in this chapter. However, shift motor function testing is outlined in the following procedure.

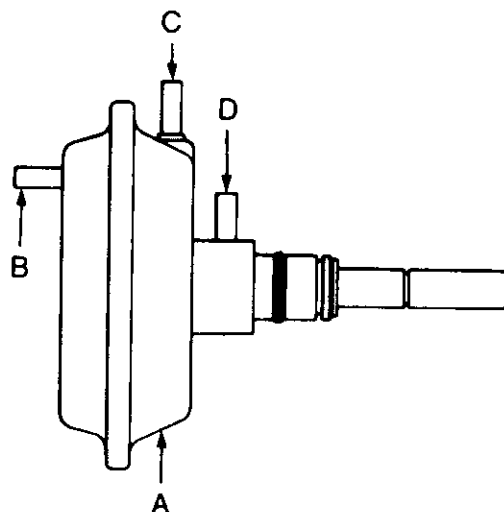
SHIFT MOTOR FUNCTION TEST

Disconnect the vacuum harness from the shift motor (A).

Connect a hand operated vacuum pump to the shift motor front port (B).

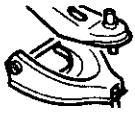
Apply 51 kPa (15 in. Hg.) to the motor through port (B) and rotate the right-front wheel to disengage the axle shaft.

The shift motor should maintain applied vacuum for a minimum of 30 seconds. Replace the motor if it does not hold vacuum for the specified time.



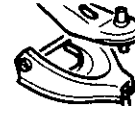
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STEERING AND FRONT AXLE

FRONT AXLE SHIFT MOTOR



Disconnect the vacuum pump from port (B) and connect the pump to port (C).

Block off the shift motor-to-transfer case port (D) with a rubber vacuum cap.

Apply 51 kPa (15 in. Hg.) to the motor through port (C). Replace the motor if it will not hold vacuum for a minimum of 30 seconds.

Maintain vacuum to port (C).

Remove the rubber cap blocking off port (D) and check for vacuum at port (D). If vacuum is present, the motor is OK. If vacuum is not present, proceed to next step.

Maintain vacuum to port (C). Rotate the right front wheel as necessary to be sure the axle has shifted into four-wheel drive.

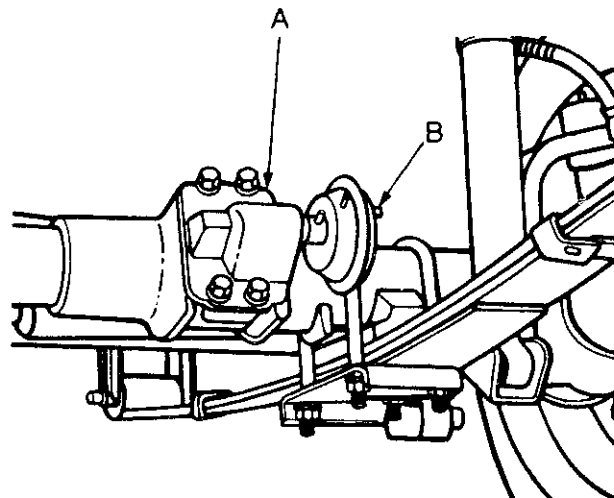
NOTE: The axle must be completely engaged in four-wheel drive mode in order to open port (C) to vacuum.

Check for vacuum at port (D) again. If vacuum is now present at port (D), the shift motor is OK. If vacuum is still not present at port (D), replace the shift motor.

SHIFT MOTOR AND HOUSING REMOVAL

Raise and support the vehicle. Position a drain pan under the shift motor housing (A).

Disconnect the vacuum harness from the motor. Remove the housing attaching bolts and remove the housing (A) and motor (B).

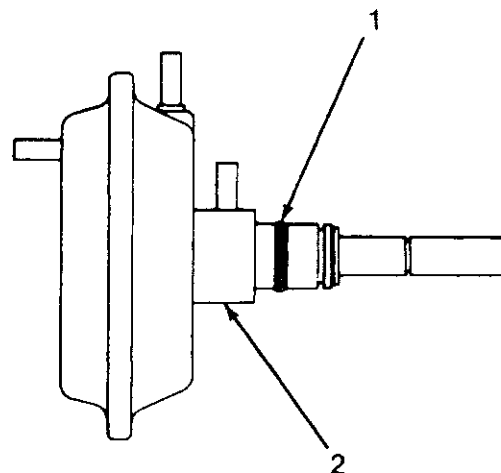


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Mark the shift fork and housing for assembly reference.

Rotate the shift motor and remove the shift fork and motor snap rings.

Remove the shift motor (2) from the housing and remove the O-ring (1) from the motor (2). Discard the O-ring.



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	STEERING AND FRONT AXLE	
	FRONT AXLE SHIFT MOTOR	

SHIFT MOTOR AND HOUSING INSTALLATION

Install a replacement O-ring on the motor shaft.

Install the motor in the housing and slide the shift fork onto the shaft.

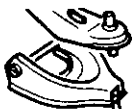
Position the housing and motor on the axle and add 148 ml (5 ounces) of axle lubricant to the shift motor housing.

Engage the shift fork in the shift collar and install the housing attaching bolts.

Connect the vacuum harness to the shift motor.

SEE I.S. NOTES





STEERING AND FRONT AXLE

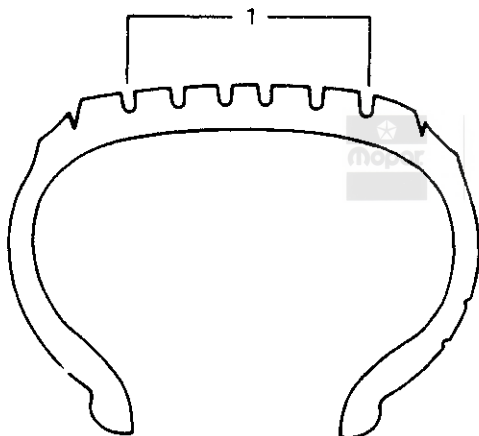
WHEELS AND TIRES



TIRE REPAIR

Punctured tires should be removed from the wheel and permanently repaired from the inside with a combination repair plug and vulcanized patch. When repairing punctures, always follow the manufacturers repair kit instructions.

Only punctures in the tread area (1) are repairable.



84860

Never attempt to repair punctures in the tire shoulders or sidewalls. In addition, do not repair any tire that has sustained the following damage.

- bulges or blisters
- ply separation
- broken or cracked beads
- fabric cracks or cuts

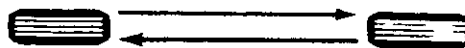
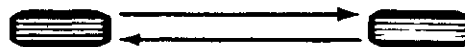
- tires worn to the fabric, or if wear indicators are visible
- punctures larger than 6.35 mm (1/4 in) in diameter

TIRE ROTATION

To equalize tire wear, it is recommended that the tires be rotated every 8 046 km (5,000 mi). The first rotation is by far the most important in setting the stage for long, even tread wear. Earlier and more frequent rotations may be desirable under certain conditions.

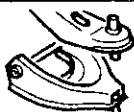
After rotation, adjust inflation pressures to recommended levels.

Radial tires are rotated on the same side front-to-rear and rear-to-front (2).



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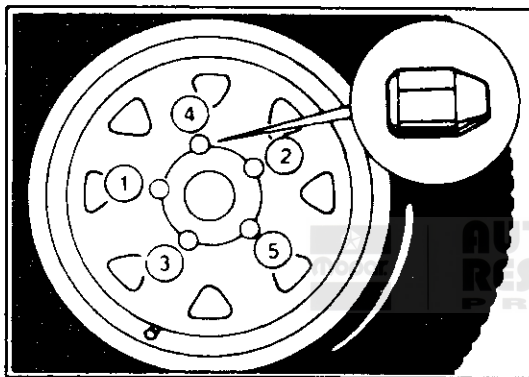
STEERING AND FRONT AXLE

WHEELS AND TIRES



WHEEL LUG NUTS

Tighten the wheel nuts in a criss-cross pattern and in the sequence shown in the illustration. Correct tightening torque for the wheel nuts is 102 N·m (75 ft-lbs).



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NOTES

COMPACT SPARE TIRE

WARNING: The compact spare tire is designed for emergency temporary use only. Do not exceed 80 km/h (50 mph) or travel more than 80 continuous km (50 mi) with the compact spare installed. This is especially important if the vehicle is equipped with a Trac-Lok rear axle.

The compact spare tire is air-inflated with standard inflation equipment. Recommended inflation pressure is 414 kPa (60 psi).

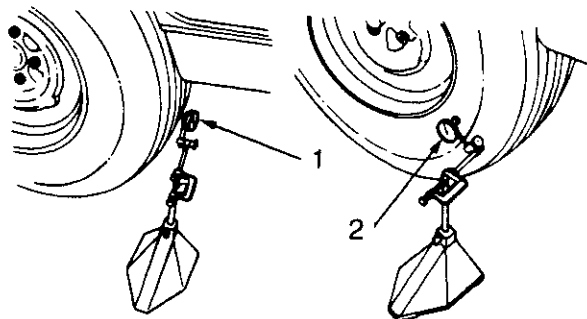
The compact spare tire has a tread life of approximately 4 828 km (3,000 mi) under normal use. Do not attempt to install standard size tires on the special wheel used with the compact spare.

WARNING: To guard against bodily injury, use caution when inflating or adding air to the compact spare. Use a 689 kPa (100 psi) capacity pressure gauge to check pressure and inflate the tire to a maximum of 414 kPa (60 psi) only. When inflating the tire, add air only in very small amounts.

WHEEL AND TIRE RUNOUT

Measure runout with a dial indicator. All measurements should be made on the vehicle with the tires inflated to recommended inflation pressures.

Measure tire radial runout at the center and outside ribs of the tread face (1). Measure lateral runout just above the buffing rib on the sidewall (2).



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Mark the high points of lateral and radial runout for reference.

On conventional tires, radial runout should not exceed 2.66 mm (0.105 in). Lateral runout should not exceed 2.54 mm (0.100 in).



STEERING AND FRONT AXLE

WHEEL AND TIRES

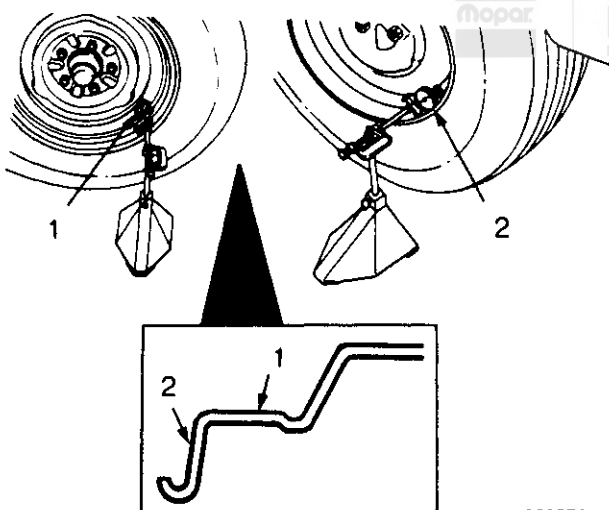


On radial tires, radial runout should not exceed 2.03 mm (0.080 in). Lateral runout should not exceed 2.54 mm (0.100 in).

If the total radial or lateral runout of the tire exceeds specified limits, check wheel runout to determine if the wheel or tire is at fault.

Wheel radial runout is measured at the wheel rim just inside of the wheel cover retaining ribs (1).

Wheel lateral runout is measured at the wheel rim bead flange just inside of the curved lip of the flange (2).



Wheel radial runout should not exceed 0.89 mm (0.035 in). Wheel lateral runout should not exceed 1.14 mm (0.045 in). Mark the high points of radial and lateral runout.

If tire runout (either lateral or radial) exceeds specified limits but wheel runout is within limits, it may be possible to reduce runout to an acceptable level. This is accomplished by changing tire position on the wheel so that the previously marked high points are 180° apart.

FRONT WHEEL SHIMMY

Front wheel shimmy may be caused by one of the following conditions:

- loose front wheel bearings
- worn, out of round or unbalanced front tires
- loose or damaged steering damper
- worn or loose tie rod ends
- worn, loose or damaged steering knuckle ball studs
- incorrect front wheel alignment
- incorrect or uneven tire pressures

Check all of the above items when diagnosing a shimmy condition. Repair or replace components as necessary.

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	REAR AXLE SPECIFICATIONS	
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GENERAL SPECIFICATIONS

Lubricant Capacity	1.2L (2.5 pts)
Lubricant Type	Jeep axle lubricant, or an equivalent SAE 75W-90, API Grade GL5 gear lubricant
Pinion Bearing Preload	2-3 N•m (15-25 in-lbs)
Ring Gear Backlash	0.12—0.23 mm (0.005—0.009 in) 0.20 mm (0.008 in) Preferred
Differential Bearing Preload	0.20 mm (0.008 in)
Differential Case Face Runout	0.05 mm (0.002 in)
Differential Side Gear Clearance	0.00—0.18 mm (0.000—0.007 in)

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RING GEAR SPECIFICATIONS

Axle Ratio	Pinion/Ring Gear Tooth Combinations	Ring Gear Diameter
3.08:1	13/40	19.2 cm (7 ⁵ / ₁₆ inch)
3.31:1	13/43	
3.55:1	13/46	
4.10:1	9/37	

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	REAR AXLE SPECIFICATIONS	
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PINION DEPTH VARIANCE CHART

Old Pinion Marking	New Pinion Marking								
	- 4	- 3	- 2	- 1	0	+ 1	+ 2	+ 3	+ 4
+ 4	+ 0.008	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0
+ 3	+ 0.007	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001
+ 2	+ 0.006	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002
+ 1	+ 0.005	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003
0	+ 0.004	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004
- 1	+ 0.003	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005
- 2	+ 0.002	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006
- 3	+ 0.001	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007
- 4	0	- 0.001	- 0.002	- 0.003	- 0.004	- 0.005	- 0.006	- 0.007	- 0.008

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PROPELLER SHAFT RUNOUT SPECIFICATIONS

Front of shaft 0.25 mm (0.009 in.)
 Center of shaft 0.38 mm (0.015 in.)
 Rear of shaft 0.25 mm (0.009 in.)
 Note: Measure front/rear runout approximately 1.13 cm (1/2 inch) from the weld seam at each end of the shaft tube.

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	REAR AXLE SPECIFICATIONS	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Brake Support Plate Nuts	43 N•m (32 ft-lbs)	34-54 N•m (25-40 ft-lbs)
Differential Bearing Cap Bolts	77 N•m (57 ft-lbs)	70-91 N•m (52-67 ft-lbs)
Ring Gear Bolts	70 N•m (52 ft-lbs)	57-88 N•m (42-65 ft-lbs)
Axle Cover Screws	19 N•m (170 in-lbs)	17-21 N•m (150-190 in-lbs)
Axle Cover Fill Plug	34 N•m (25 ft-lbs)	27-41 N•m (20-30 ft-lbs)
U-Joint Clamp Bolts	19 N•m (170 in-lbs)	16-22 N•m (140-200 in-lbs)
Wheel Nuts	102 N•m (75 ft-lbs)	81-122 N•m (60-90 ft-lbs)
Shock Absorber-to-Axle Nut	60 N•m (44 ft-lbs)	50-70 N•m (37-52 ft-lbs)
Rear Spring U-Bolt Nuts	122 N•m (90 ft-lbs)	108-136 N•m (80-100 ft-lbs)
Rear Spring Front Eye Bolt	142 N•m (105 ft-lbs)	129-156 N•m (95-115 ft-lbs)
Rear Spring Shackle Bolt	129 N•m (95 ft-lbs)	115-142 N•m (85-105 ft-lbs)
Rear Axle Jounce Bumper	27 N•m (20 ft-lbs)	20-34 N•m (15-25 ft-lbs)
Rear Spring Bumper	27 N•m (20 ft-lbs)	20-34 N•m (15-25 ft-lbs)
Track Bar Bolts/Nuts	100 N•m (74 ft-lbs)	90-110 N•m (67-81 ft-lbs)

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	REAR AXLE SPECIAL TOOLS	
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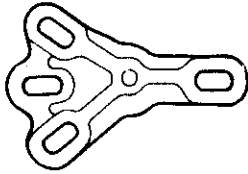
SPECIAL TOOLS

Tool Ref.	Description
J 2619-01	Slide Hammer
J 5853-B	Inch-Pound Torque Wrench
J 8001	Dial Indicator
J 8608, J 8611-01	Bearing Cup Installers
J 8614-01, 02 03	Pinion Yoke Installation and Removal Tools
J 9233	Pinion Oil Seal Remover
J 9431	Inner Axle Oil Seal Installer
J 21579	Axle Shaft Puller
J 22661	Pinion Oil Seal Installer
J 22888	Bearing Puller
J 22912-01	Bearing Remover
J 23498	Pinion Angle Gauge (Inclinometer)
J 23674	Bearing Remover
J 5223-4	Gauge Arbor
J 5223-20	Gauge Block
J 5223-29	Holding Screw
J 5223-24	Bar
J 5223-23	Discs
J 6381-2	Gauge Arbor Discs
J 8646-2	Forcing Screw
J 23781-3	Gear Rotating Tool
J 23781-7	Step Plate
J 21784	Differential Bearing Installer
J 21786	Pinion Rear Bearing Remover
J 21787	Pinion Front Bearing Cup Remover
J 8092	Driver Handle (Threaded)

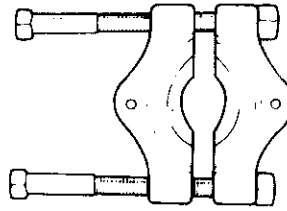
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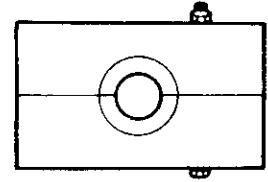
	REAR AXLE SPECIAL TOOLS	
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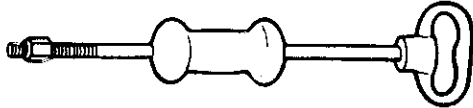
J 21579



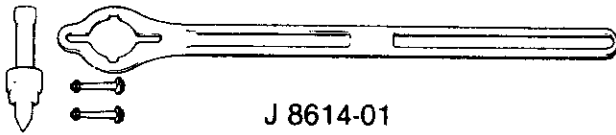
J 22912-01



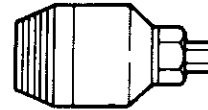
J 23674



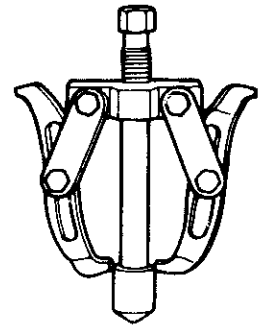
J 2619-01



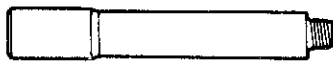
J 8614-01
J 8614-02
J 8614-03



J 9233



J 22888



J 8092



J 8608

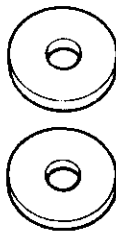


J 8611-01

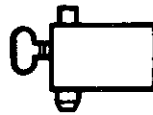
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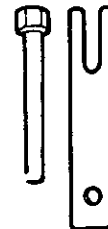
J 5223-4



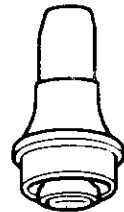
J 6381-2



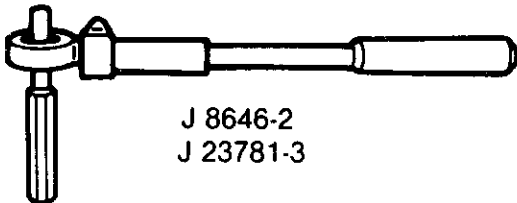
J 5223-20



J 5223-24
J 5223-29



J 22661



J 8646-2
J 23781-3



J 23781-7



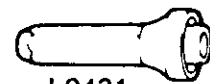
J 21784



J 21786



J 21787



J 9431

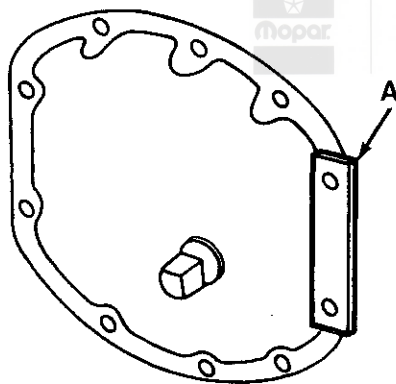
	REAR AXLE	
	GENERAL SERVICE PROCEDURES	

GENERAL

The procedures outlined in this section are all performed with the axle mounted in the vehicle; This includes removal and installation procedures for the standard and Trac-Lok differential.

AXLE IDENTIFICATION

The axle ratio and the ring gear/pinion gear tooth combination is stamped on a tag attached to the differential housing cover (A).



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Drive the vehicle to bring the axle lubricant to normal operating temperature.

Raise the vehicle.

Remove the axle housing fill plug.

Remove the old lubricant from the housing with a suction gun.

Refill the axle with 1.2 liters (2.5 pints) of the specified lubricant.

Install the fill plug.

Lower the vehicle.

AXLE SHAFT

Axle Shaft Removal

Raise the vehicle.

Remove the wheel and brake drum.

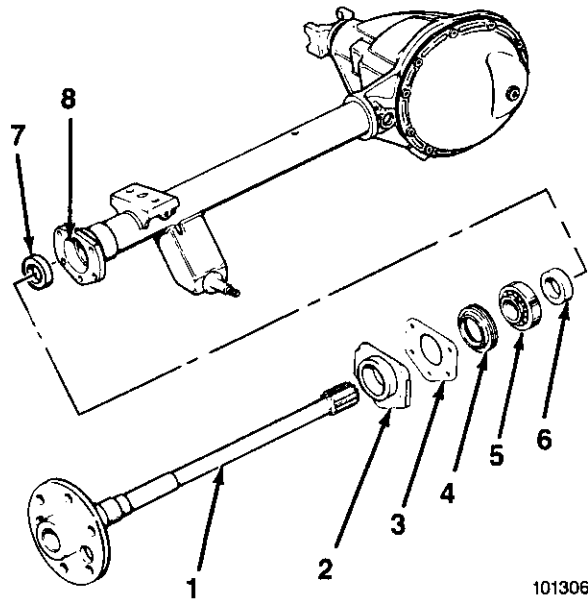
Remove the nuts that attach the guide plate (2), seal retainer (3) and brake support plate to the axle flange.

AXLE LUBRICANT CHANGE

NOTE: The recommended lubricant for standard and Trac-Lok rear axles is JEEP axle lubricant, or an equivalent SAE 75W-90, API Grade GL 5 gear lubricant.

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	REAR AXLE GENERAL SERVICE PROCEDURES	
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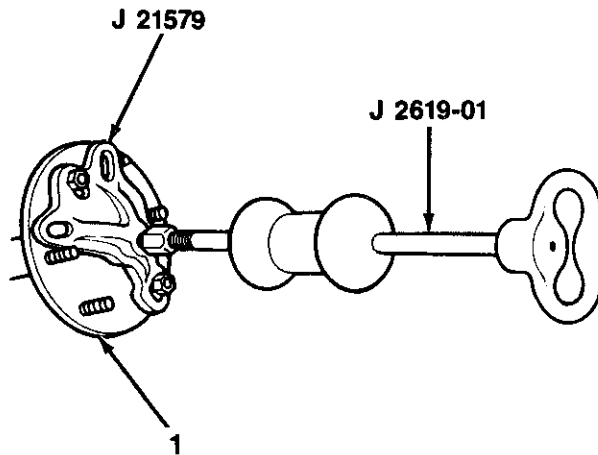


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Remove the axle shaft (1) with slide hammer J 2619-01 and puller J 21579.



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Axle Shaft Installation

Clean the bearing bore in the axle flange (8). Apply a thin coat of bearing lubricant to the bore after cleaning.

Lubricate the axle bearing (5) with JEEP wheel bearing lubricant or an equivalent EP-rated bearing lubricant.

Install the axle shaft.

Position the brake support plate, seal retainer (3) and guide plate (2) on the axle flange studs and install the attaching nuts.

Tighten the guide plate/support plate attaching nuts evenly and in a cross pattern, to 43 N•m (32 ft-lbs) torque.

Install the brake drum and wheel. Tighten the wheel nuts to 102 N•m (75 ft-lbs) torque.

Lower the vehicle.

AXLE SHAFT BEARING AND RETAINER

Bearing and Retainer Replacement

Remove the axle shaft (1).

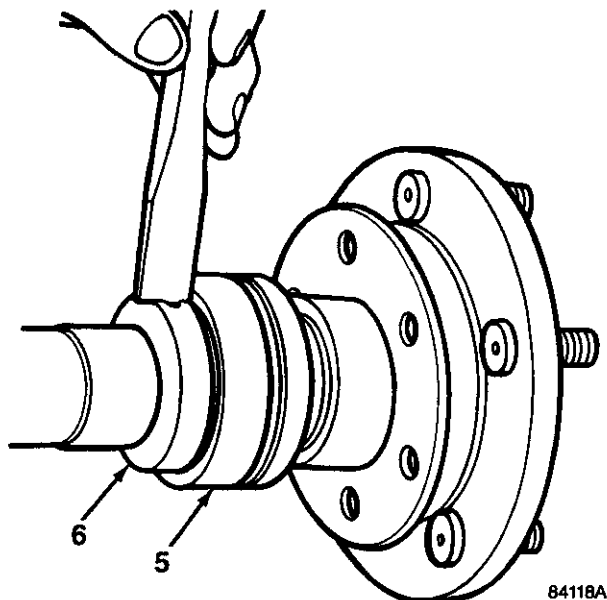
Mount the axle shaft in a vise.

Drill a 6 mm (1/4 in) diameter hole in the bearing retaining ring (6). Drill approximately three quarters of the way through the ring.

Cut the ring (6) with a chisel and remove it from the shaft.

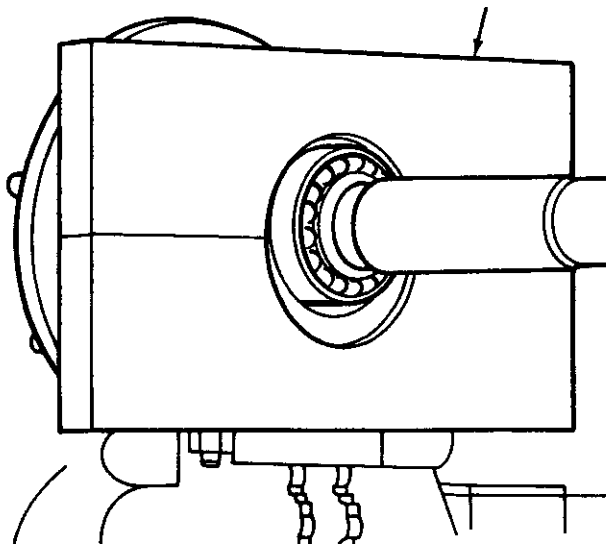
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	REAR AXLE GENERAL SERVICE PROCEDURES	
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Remove the bearing (5) with an arbor press and tool J 22912-01 or J 23674.

J 22912-01/J 23674



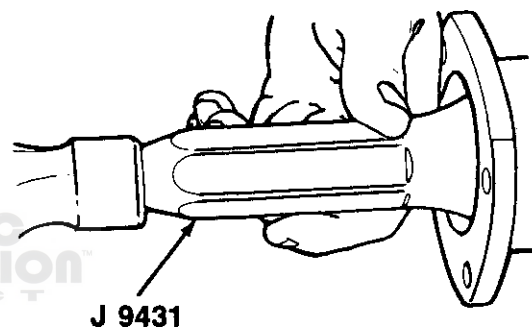
Remove oil seals (4) and (7) if replacement is necessary.

Remove the guide plate (2) if the seal in the plate is to be replaced.

Clean the axle shaft seal and bearing surfaces.

Install the guide plate (2), seal retainer (3) and outer seal (4) on the shaft.

Install the inner seal (7) with tool J 9431.



Lubricate the replacement bearing with JEEP wheel bearing lubricant or an equivalent EP-rated bearing lubricant.

Install the replacement bearing (5) on the shaft with an arbor press and tool J 22912-01 or J 23674.

Install a replacement bearing retaining ring (6) on the shaft.

Apply a thin coating of bearing lubricant to the axle flange bearing bore.

Install the axle shaft.

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	REAR AXLE GENERAL SERVICE PROCEDURES	
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AXLE SHAFT OIL SEALS

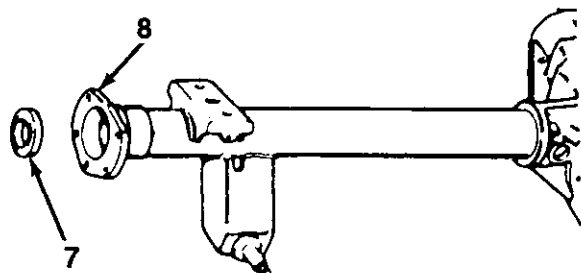
Oil Seal Replacement

NOTE: Three seals are used; The inner seal (7), the outer seal (4) and a third seal in the guide plate (2). The guide plate seal is not removable. If damaged, the seal and guide plate must be replaced as an assembly.

Remove the axle shaft and bearing as outlined in this section.

Remove the outer seal (4) and guide plate (2) from the shaft.

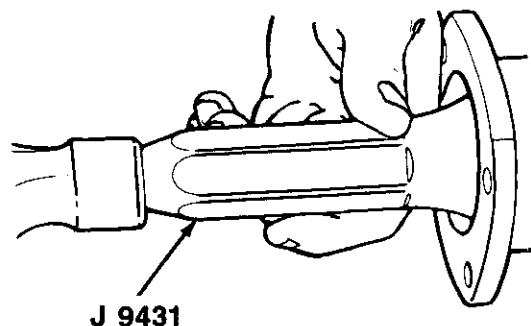
Remove the inner seal (7) from the bore in the axle flange.



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Lubricate the replacement seal lips with wheel bearing lubricant.

Install the replacement inner seal (7) with tool J 9431.



100369

Install the replacement guide plate and seal (2) on the shaft. Then install the original seal retainer (3) and the replacement outer seal (4) on the shaft.

Lubricate the axle bearing (5) with JEEP bearing lubricant or an equivalent EP-rated bearing lubricant.

Install the wheel bearing (5) and a replacement bearing retaining ring (6) on the shaft.

Install the axle shaft.

PINION SEAL

Pinion Seal Replacement

Raise the vehicle.

Remove the rear wheels and brake drums.

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	REAR AXLE GENERAL SERVICE PROCEDURES	
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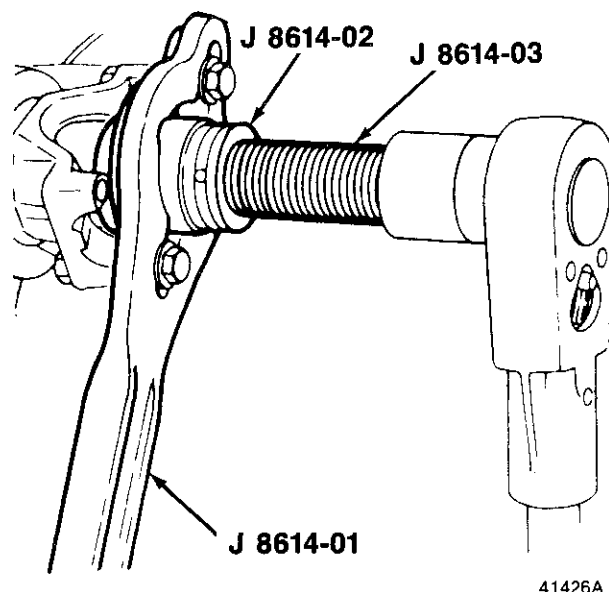
Mark the rear propeller shaft and axle yoke for assembly alignment reference.

Disconnect the rear propeller shaft.

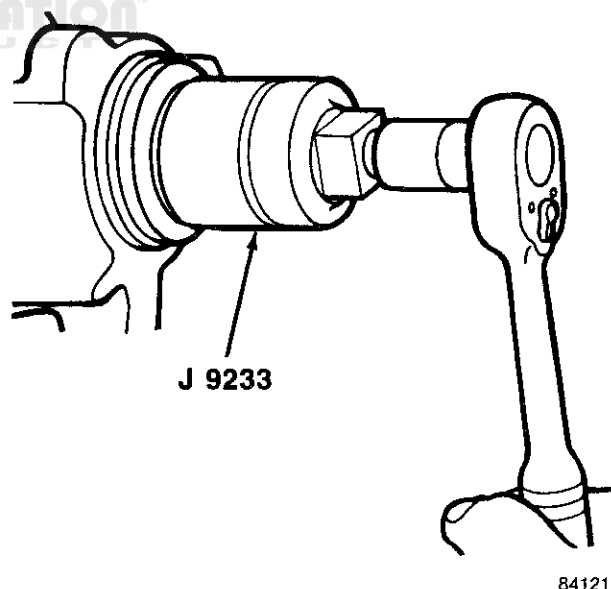
Rotate the pinion gear several revolutions.

Measure the amount of torque (in inch-pounds) required to rotate the pinion gear. Use inch-pound torque wrench J 5853-B to measure the torque. Record the torque reading for assembly reference.

Remove the pinion nut with a socket (A) and yoke holding tool J 8614-01. Discard the pinion nut. It is not reusable.



Remove the pinion seal with tool J 9233.



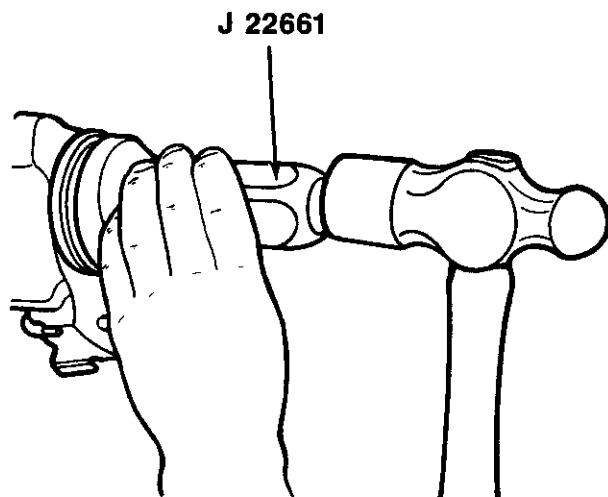
Mark position of the yoke and pinion for assembly alignment reference.

Remove the yoke with holder tool J 8614-01, and remover tools J 8614-02 and -03.

Coat the replacement seal lip with axle lubricant.

Install the replacement seal with tool J 22661.

	REAR AXLE GENERAL SERVICE PROCEDURES	
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84122

Align and install the yoke on the pinion.

Install a replacement pinion nut. **Tighten the nut only enough to remove end play.** Do not tighten the pinion nut any further at this time.

Adjust pinion preload torque as follows:

CAUTION: Exercise care during preload adjustment. Do not overtighten, or loosen and retighten the pinion nut. If required preload torque is exceeded, the collapsible pinion spacer will have to be replaced and pinion preload reset.

- Install the inch-pound torque wrench on the pinion nut.
- Rotate the pinion with the torque wrench. Note the amount of torque needed to rotate the pinion.
- Required pinion preload torque equals the amount recorded during disassembly - plus - an additional 0.56 N·m (5 in-lbs) torque.
- Tighten the pinion nut in very small increments. Check torque after each tightening

operation. Continue tightening the nut in small increments until preload is correct.

Align and connect the propeller shaft. Tighten the U-joint clamp bolts to 19 N·m (170 in-lbs) torque.

Install the rear brake drums and wheels. Tighten the wheel nuts to 102 N·m (75 ft-lbs) torque.

Check and adjust axle lubricant level if necessary.

Lower the vehicle.

DIFFERENTIAL REMOVAL/INSTALLATION

Differential Removal

Raise the vehicle.

Remove the axle housing cover and drain the lubricant.

Mark the axle and propeller shaft yokes for assembly alignment reference and disconnect the propeller shaft.

NOTE: If the pinion gear, bearings or seal are to be serviced, measure and record pinion preload torque as outlined in the Differential Overhaul section or Pinion Seal Replacement procedure.

Remove the wheels and brake drums.

Remove the axle shafts.

Mark the differential bearing caps for assembly reference.

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	REAR AXLE GENERAL SERVICE PROCEDURES	
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Loosen the bearing cap bolts until only two or three bolt threads are engaged.

Install spreader tool J 24385-01 on the axle housing.

Mount dial indicator J 8001 on the housing. Position the indicator stylus so it contacts one side of the differential opening in the housing.

Spread the housing only enough to remove the differential. This should only require about 0.12 mm (0.005 inch). Measure the amount the housing is spread with the dial indicator.

CAUTION: Do not spread the housing any more than 0.38 mm (0.015 inch). Overspreading may distort or damage the housing.

Remove the dial indicator and differential bearing caps. Tag the caps for assembly reference.

Remove the differential assembly. If the differential is still a fairly snug fit, use a pry bar to ease the differential out of the bearing saddles.

Remove the spreader tool and clamps immediately after removing the differential. This is important in avoiding the possibility of the housing taking a set.

Remove the pinion gear, bearings and seal if they are to be serviced.

Differential Installation

Install the pinion gear, bearings and seal if removed. Adjust pinion gear depth if required. Refer to the procedure outlined in the overhaul sections.

Spread the axle housing no more than 0.38 mm (0.015 inch) with tool J 24385-01.

Start the differential bearing cups in the axle housing bearing saddles.

Tap the outer edges of the differential bearing cups with a rawhide mallet to seat them in the axle housing.

Remove the axle housing spreader tool.

Install the differential bearing caps. Tighten the cap bolts to 77 N•m (57 ft-lbs) torque.

Check and adjust ring gear backlash if necessary.

NOTE: If the pinion gear, bearings or seal were serviced, adjust pinion preload as outlined in the Differential Overhaul section or in the Pinion Seal Replacement procedure.

Align and connect the propeller shaft. Tighten the U-joint clamp bolts to 19 N•m (170 in-lbs) torque.

Install the axle housing cover. Tighten the cover bolts to 19 N•m (170 in-lbs) torque.

Fill the axle with 1.2 liters (2.5 pints) of JEEP axle lubricant or an equivalent SAE 75W-90, API Grade GL 5 gear lubricant.

Install the brake drums and wheels. Tighten the wheel nuts to 102 N•m (75 ft-lbs) torque.

Lower the vehicle.

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	REAR AXLE REAR AXLE ASSEMBLY REMOVAL/INSTALLATION	
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REAR AXLE ASSEMBLY REMOVAL

Raise the vehicle.

Position safety stands under the frame rails. Place the stands even with, or slightly ahead of the rear spring front eyes.

Remove the rear wheels.

Mark the rear propeller shaft and axle yokes for assembly reference.

Disconnect the propeller shaft from the axle yoke.

Disconnect the track bar at the axle bracket and the axle vent tube at the axle.

Disconnect the parking brake cables from the equalizer.

Disconnect the shock absorbers from the axle brackets.

Disconnect the brake hose from the fitting on the floorpan. Cap the hose end to prevent dirt entry.

Remove the spring U-bolts and tie plates.

Loosen, but do not remove, the bolts that attach the spring eyes to the frame brackets and rear shackles.

Support the axle with a hydraulic jack.

Raise the axle just enough to relieve axle weight from the springs.

Remove the bolts attaching the springs to the shackles and lower the springs to the floor.

Lower the jack and remove the axle assembly.

REAR AXLE ASSEMBLY INSTALLATION

Support the axle assembly on a hydraulic jack and slide the axle into position under the vehicle.

Raise the springs and install the bolts that attach the springs to the shackles. Do not tighten the bolts at this time.

Align the center bolts on the springs with the bolt locating holes on the axle.

Lower the axle onto the springs and install the spring U-bolts and tie plates.

Tighten the U-bolt nuts to 122 N•m (90 ft-lbs) torque.

Connect the axle vent hose, parking brake cables, and brake hose.

Align and connect the propeller shaft. Tighten the U-joint clamp bolts to 19 N•m (170 in-lbs) torque.

Connect the track bar and shock absorbers.

Check and adjust axle lubricant level if necessary.

Install the wheels.

Bleed the brake system.

Remove supports and lower the vehicle.

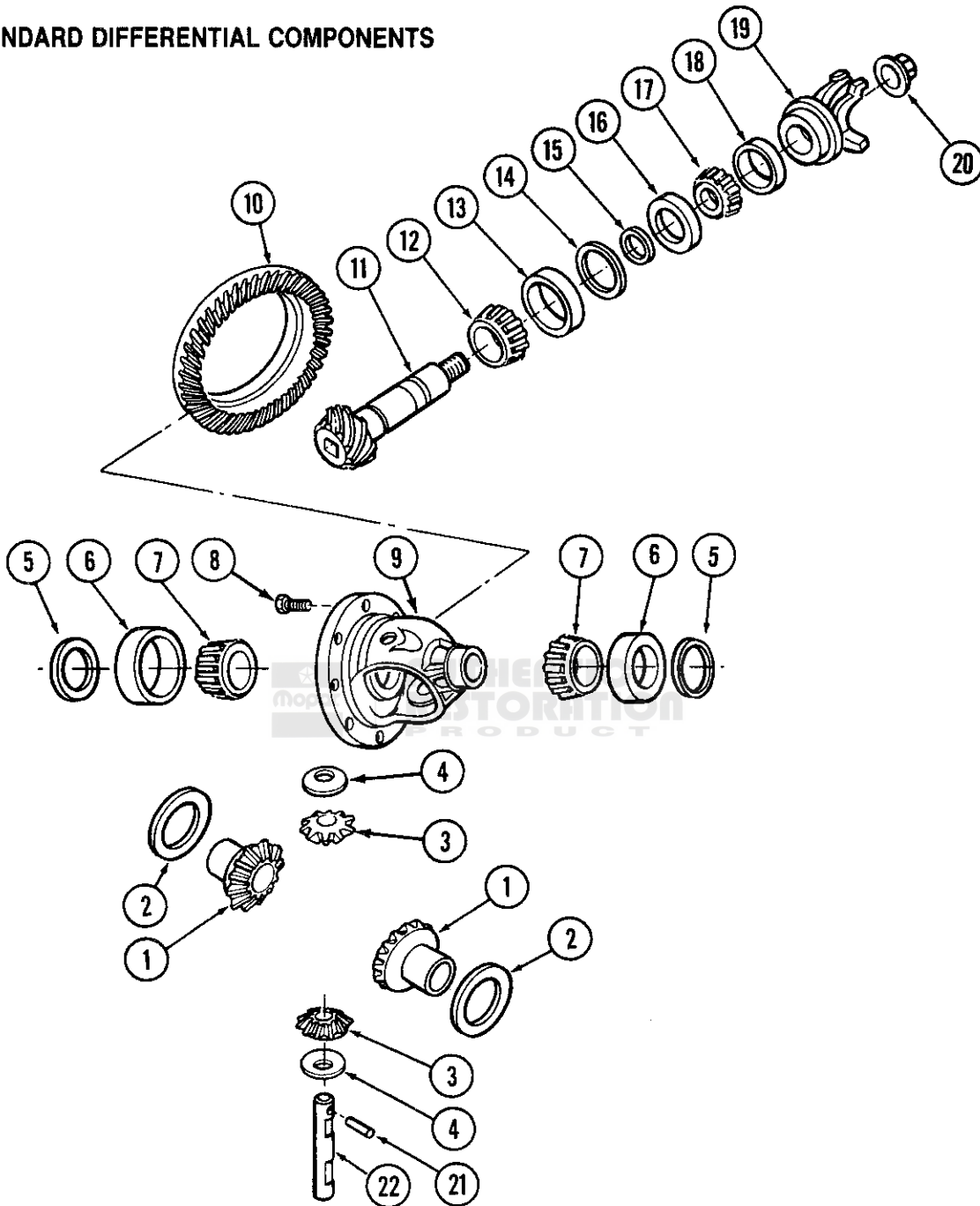
Tighten the rear spring shackle bolts to 129 N•m (95 ft-lbs) torque.

Tighten the rear spring-to-frame bracket bolts to 142 N•m (105 ft-lbs) torque.

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	REAR AXLE STANDARD DIFFERENTIAL OVERHAUL	
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STANDARD DIFFERENTIAL COMPONENTS



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| <ol style="list-style-type: none"> 1. Differential Side Gear 2. Side Gear Thrust Washer 3. Differential Pinion 4. Pinion Thrust Washer 5. Differential Bearing Shim (End Play/Preload) 6. Differential Bearing Cup 7. Differential Bearing 8. Ring Gear Bolt (8 reqd.) 9. Differential Case 10. Ring Gear 11. Pinion Gear | <ol style="list-style-type: none"> 12. Pinion Gear Rear Bearing 13. Rear Bearing Cup 14. Pinion Depth Shim 15. Pinion Bearing Preload Spacer 16. Front Bearing Cup 17. Pinion Gear Front Bearing 18. Pinion Seal 19. Pinion Yoke 20. Yoke Nut 21. Pinion Shaft Lock Pin 22. Differential Pinion Shaft |
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	REAR AXLE STANDARD DIFFERENTIAL OVERHAUL	
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REMOVAL AND DISASSEMBLY PROCEDURES

Pinion Gear and Bearing Removal

Remove the pinion yoke (19) and nut (20).

NOTE: Retain the pinion nut. It will be used for pinion depth adjustment at reassembly.

Tap the end of the pinion gear (11) with a rawhide mallet to release it from the front bearing (17).

Remove the axle housing cover.

Remove the pinion gear (11), pinion bearings (12-17) and preload spacer (15) from the axle housing. Discard the spacer. It is not reusable.

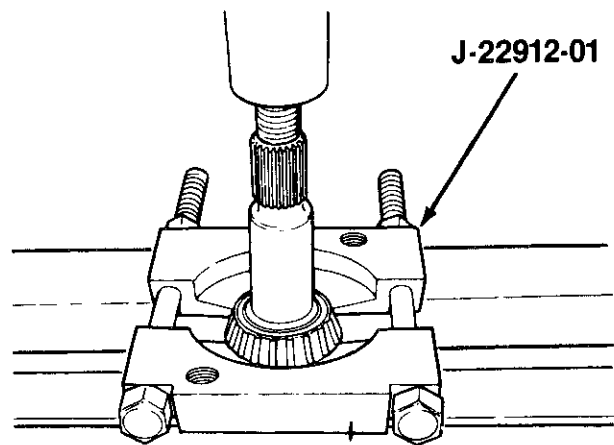
Remove the pinion seal (18) with tool J 9233.

Remove the pinion rear bearing cup (13) with driver handle J 8092 and tool J 21786.

NOTE: The pinion depth shim (14) is located under the rear bearing cup (13). Remove and retain the shim.

Remove the pinion front bearing cup (16) with driver handle J 8092 and tool J 21787.

Remove the rear bearing (12) from the pinion gear with an arbor press and tool J 22912-01.



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Differential Disassembly

Remove the differential bearing cups (5). Tag the cups for assembly reference.

Mount the differential case (9) in a vise.

Remove the ring gear bolts (8). Discard the bolts. They are not reusable.

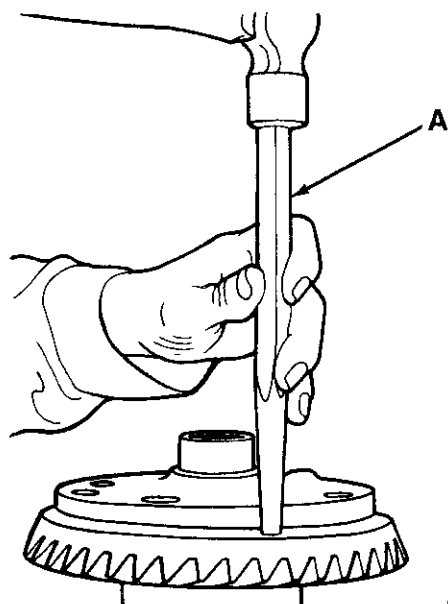
Remove the ring gear (10) from the case with a brass drift (A) and hammer.

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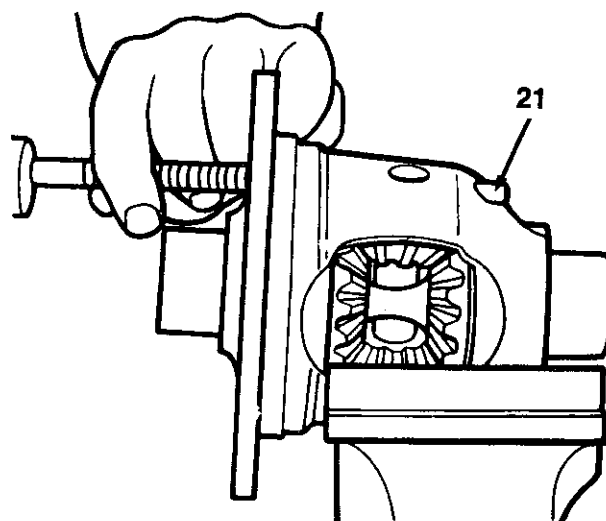
STANDARD DIFFERENTIAL OVERHAUL



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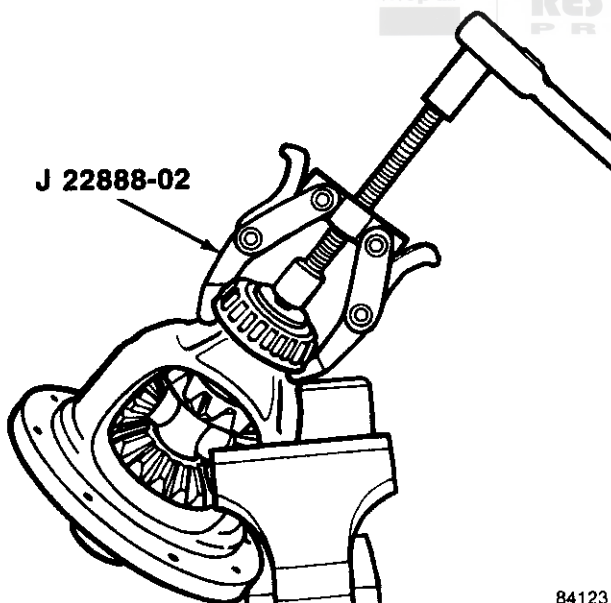
Remove the differential bearings (6) with puller J 22888 or remover J 22912-01 and a press.

Remove the pinion shaft lockpin (21) with a punch.



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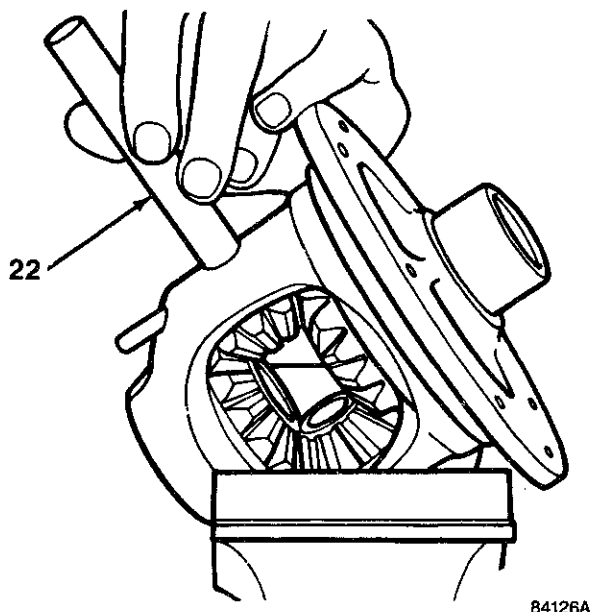
Remove the differential bearing shims (7).

Measure differential side gear clearance with two feeler gauge sets.

- Insert an equal thickness gauge between each side gear (1) and the case (9).
- Continue checking until each feeler gauge is a tight drag fit.
- Side gear clearance should not exceed 0.18 mm (0.007 inch) at either side.
- Discard the side gear thrust washers (2) if side gear clearance exceeds specified tolerance.

Remove the pinion shaft (22).

	REAR AXLE STANDARD DIFFERENTIAL OVERHAUL	
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84126A

Remove the side gears (1), pinions (3) and thrust washers (2) and (4) from the differential case. Roll the pinions around until they can be removed through the case opening. Then remove the side gears and all the thrust washers.

Cleaning and Inspection

Clean all of the differential components in solvent. Use compressed air to dry all parts except the bearings. Dry the bearings with shop towels only.

Examine each component for wear or damage.

Inspect the bearings and bearing cups. Replace bearings and races as a set if either part is galled, worn, cracked, flat spotted or scored.

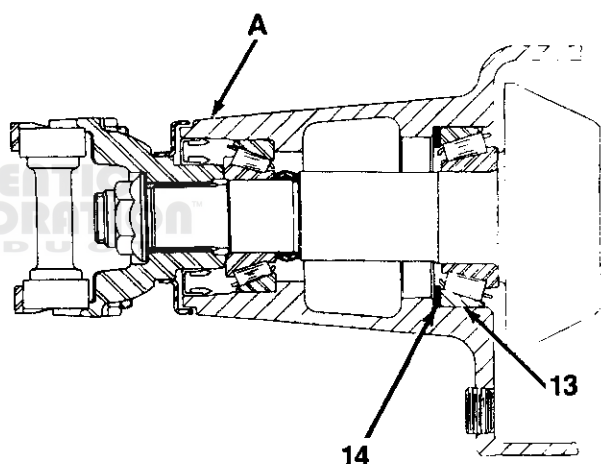
Inspect the differential side and pinion gears. Replace any gear that is worn, cracked, chipped or broken.

Inspect the ring and pinion gears. Replace the gears as a set if either is worn or damaged.

Inspect the differential case. Replace the case if cracked or damaged.

Service and Adjustment Information

Pinion gear depth must be measured and adjusted before installing the differential in the axle housing. Depth is controlled by a shim (14) installed between the pinion rear bearing cup (13) and the axle housing (A).



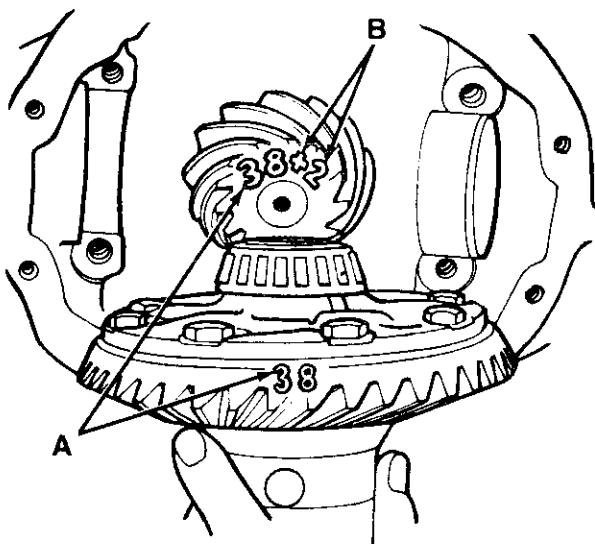
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The ring gear (10) and pinion gear (11) are serviced as a matched set only. They are identified as a matched set by numbers etched on the ring and pinion gears.

The first two numbers (A) on each gear identify them as a matched set. The second number (B) on the pinion gear is the pinion depth variance. It indicates the amount (in thousandths of an inch) that the set varied from the standard setting of 2.095 inches (53.21 mm). The variance may be a plus or minus figure.

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NOTE: The chart will only help determine starter shim thickness. It will not provide the exact shim thickness required for final depth adjustment.

ASSEMBLY AND INSTALLATION PROCEDURES

Pinion Gear Depth Adjustment

Verify that the ring and pinion are a matched set before proceeding.

Measure the thickness of the original pinion depth shim (14).

Note the depth variance (B) marked on the pinion gear.

Determine pinion depth starter shim thickness as follows:

- If the original ring and pinion set is being installed, start with the original depth shim.
- If a replacement gear set is being installed, determine how much must be added to or subtracted from the original shim for best starter shim thickness.
- Refer to the Pinion Variance Chart in the Specifications section. Note where the Old and New Pinion Marking columns intersect. The intersecting figure represents the plus or minus amount needed. For example, if the old pinion is +1 and the new pinion is -3, the intersecting figure is +0.004 inch (0.10 mm). Add this amount to the original shim. Or, if the old pinion is -3 and the new pinion is -2, the intersecting figure is -0.001 inch (0.025 mm). Subtract this amount from the original shim.

Service replacement ring and pinion gear sets are machined to the standard setting only. Pinion depth variance on replacement sets will range from plus to minus 0.004 inches (0.10 mm). Any service replacement set with a variance exceeding these figures, or a set with mismatched identification numbers must not be used. These gear sets should be returned to the parts distribution center.

NOTE: Some factory installed gear sets may have an extra 0.010 or 0.020 inch (0.25 or 0.50 mm) milled off the pinion. These sets have a unique variance number. For example, if the number on the pinion is 23, the number 2 indicates 0.020 inch (0.50 mm) was milled off the pinion and the variance is 0.003 inches (0.076 mm). Similarly, if the variance number is 16, the number 1 indicates 0.010 inch (0.25 mm) was milled off the pinion and variance is 0.006 inch (0.15 mm).

Refer to the Pinion Variance Chart in the Specifications section when adjusting pinion gear depth. The chart helps determine starter shim thickness needed for initial depth measurement.

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Clean the bearing cup bores in the axle housing.

Install the starter shim in the rear bearing cup bore of the axle housing.

NOTE: If the shim is chamfered on one side, position the chamfered side so it faces the bottom of the bearing cup bore.

Install the pinion rear bearing cup (13) in the axle housing and on top of the starter shim. Use tools J 8092 and J 8608 to seat the cup in the bore.

Install the pinion front bearing cup (16) in the axle housing with tools J 8092 and J 8611-01.

Install the rear bearing (12) on the pinion gear (11).

Install the pinion gear (11) in the axle housing.

Install the front bearing (17) on the pinion gear. Seat the bearing on the gear and in the cup (16).

Install the pinion yoke (19) and the original pinion nut (20) on the pinion gear. Tighten the pinion nut only enough to remove end play.

NOTE: Do not install the pinion seal or preload spacer at this time.

Determine **desired** pinion depth as follows:

- Record depth variance marked on the pinion gear.
- If the variance is a plus figure, add the variance to the standard setting of 2.095 inches

(53.21 mm). If the variance is a minus figure, subtract it from the standard setting.

- Record the desired depth figure for final shim selection.

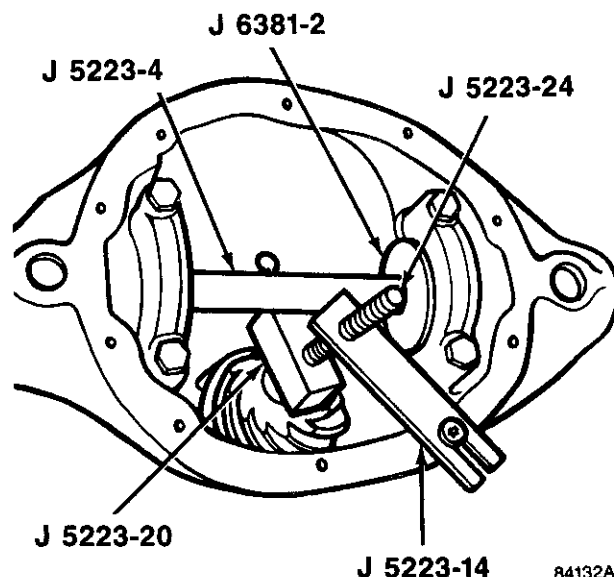
Measure **initial** pinion depth as follows.

Assemble gauge arbor J 5223-4 and discs J 6381-2. Then seat the discs in the axle housing differential bearing saddles.

Install the differential bearing caps over the discs and tighten the bearing cap bolts securely.

Place gauge block J 5223-20 on the raised rear face of the pinion gear. Position the spring loaded plunger in the block under the center of gauge arbor shaft J 5223-4.

NOTE: Do not allow the gauge block anvil to contact the pinion gear teeth.



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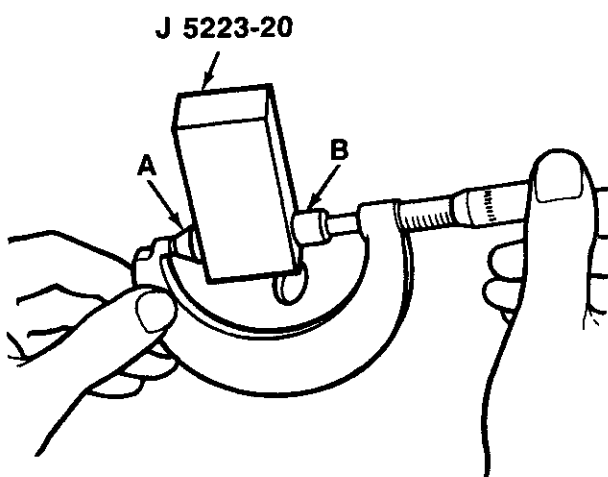
Mount gauge block clamp J 5223-14 and holding screw J 5223-24 on the axle housing. Secure the clamp to the housing with an axle cover bolt. Position the holding screw over the gauge block.

Extend holding screw J 5223-24 until it is firmly seated against the gauge block and holds the block in position.

Loosen the gauge block thumbscrew and allow the spring loaded plunger to contact gauge arbor J 5223-4.

Tighten the gauge block thumbscrew securely. Then loosen the holding screw and remove the gauge block.

Measure the distance between the anvil (A) and plunger (B) of gauge block J 5223-4 with a micrometer. Record this dimension for final shim selection. It represents initial pinion depth.



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Remove the differential bearing caps and gauge tools from the axle housing.

Remove the pinion nut, yoke, front bearing and pinion gear from the axle housing. Discard the old pinion nut.

Remove the pinion rear bearing cup and the pinion depth starter shim.

Select the required pinion depth shim as follows:

- Subtract pinion variance from standard setting. This equals desired depth.
- Add starter shim thickness to existing depth. This equals total depth.
- Subtract desired depth from total depth. This equals required shim thickness.

NOTE: Refer to the Depth Shim Computation Chart for examples of the computation procedure.

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DEPTH SHIM COMPUTATION CHART

Example I

Step 1

Standard pinion
 depth setting 53.21 mm (2.095 in)
 Subtract pinion
 depth variance . . - 0.10 mm (0.004 in)
 Desired pinion depth . 53.11 mm (2.091 in)

Step 2

Initial pinion
 depth 53.34 mm (2.100 in)
 Add starter shim
 thickness + 2.43 mm (0.096 in)
 Total thickness-depth . . 55.77 mm (2.196 in)

Step 3

Total thickness-depth . . 55.77 mm (2.196 in)
 Subtract desired
 pinion depth - 53.11 mm (2.091 in)
 Required shim
 thickness 2.66 mm (0.105 in)

Example II

Step 1

Standard pinion
 depth setting 53.21 mm (2.095 in)
 Add pinion
 depth variance . . + 0.05 mm (0.002 in)
 Desired pinion depth . 53.26 mm (2.097 in)

Step 2

Initial pinion
 depth 53.41 mm (2.103 in)
 Add starter shim
 thickness + 2.39 mm (0.094 in)
 Total thickness-depth . . 55.80 mm (2.197 in)

Step 3

Total thickness-depth . . 55.80 mm (2.197 in)
 Subtract desired
 pinion depth - 53.26 mm (2.097 in)
 Required shim
 thickness 2.54 mm (0.100 in)

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Install the required pinion depth shim (14) in the rear bearing cup bore of the axle housing.

NOTE: If the shim is chamfered on one side, be sure the chamfered side is facing the bottom of the bearing cup bore.

Install the rear bearing cup (13) in the axle housing and on top of the depth shim (14). Use tools J 8092 and J 8608 to install the bearing cup.

Install the pinion gear (11) in the axle housing.

Install a replacement preload spacer (15) on the pinion gear (11).

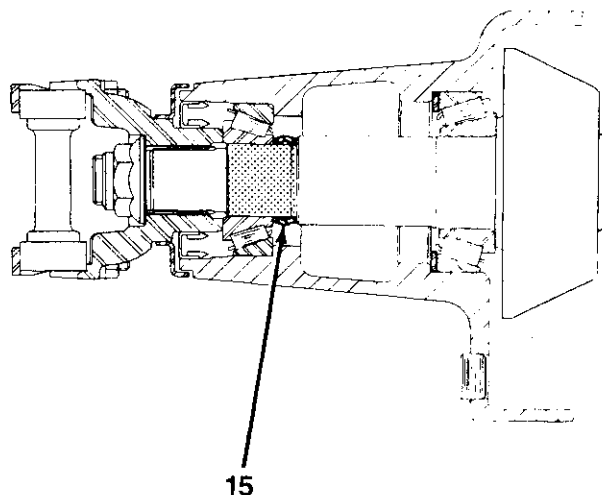
Install the front bearing (12) on the pinion gear (11).

Install a replacement pinion oil seal (18) in the axle housing.

Install the pinion yoke (19) on the pinion gear (11).

Pinion Bearing Preload Adjustment

A collapsible spacer (15) controls preload which is adjusted at the pinion nut (20). The spacer is designed to crush and hold at the set preload. Correct preload is 2-3 N•m (15-25 in-lbs). Preload is measured as the amount of torque required to turn the pinion gear with an inch-pound torque wrench.



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Install a replacement pinion nut (20) on the pinion gear. **Tighten the nut only enough to remove end play. Do not overtighten the nut.**

Place a socket and inch-pound torque wrench J 5853-B on the pinion nut and begin rotating the pinion gear.

Slowly tighten the pinion nut until torque required to rotate the pinion gear is between 2-3 N•m (15-25 in-lbs). Check torque frequently and tighten the nut in very small amounts only.

CAUTION: The preload spacer is designed to permanently crush and hold at whatever preload is set. If specified preload is exceeded, do not attempt correction by loosening and re-tightening the pinion nut. The spacer must be replaced and preload reset.

Remove the inch pound torque wrench and socket.

Proceed to the Differential Case Runout Check.

NOTE: Do not assemble the differential until case runout and bearing end play have been checked and adjusted.

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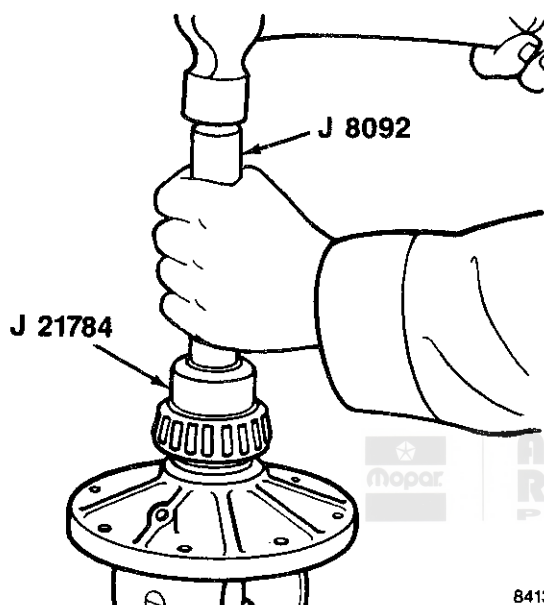
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Differential Case Runout Check

Install the differential bearings (6) on the case, but **do not** install the bearing shims at this time. Use tools J 8092 and J 21784 to install the bearings.



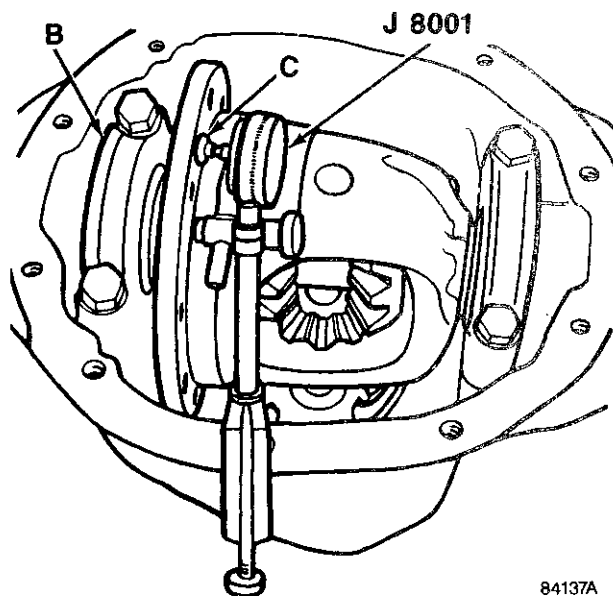
Install the bearing cups (5) on the differential bearings (6).

Mount the differential in the axle housing.

Insert enough spare shims between one of the differential bearings and the axle housing to prevent any differential case side play.

Install the differential bearing caps and cap bolts (B). Tighten the cap bolts securely but not to specified torque.

Mount dial indicator set J 8001 on the axle housing. Position the indicator stylus (C) so it contacts the ring gear mounting face of the differential case.



Pry the differential case to one side and zero the dial indicator.

Rotate the differential case through several revolutions and note the dial indicator reading.

Case runout should not exceed 0.05 mm (0.002 in). Replace the case if runout exceeds this figure.

Leave the dial indicator set in position and proceed to Differential Bearing Zero End Play Adjustment.

Differential Bearing Zero End Play Adjustment

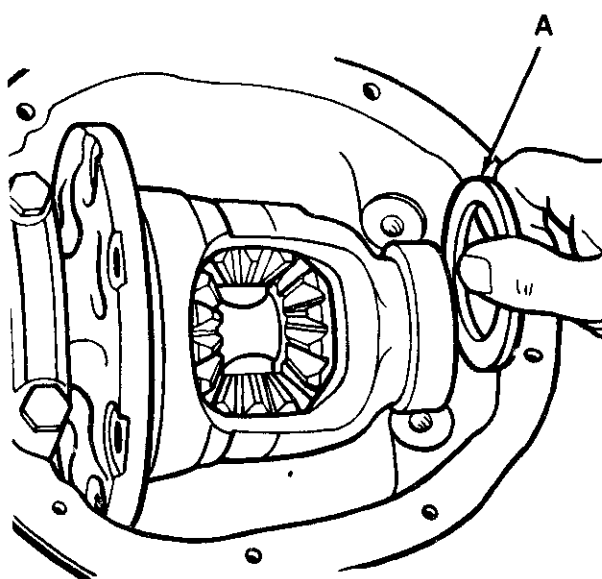
Loosen the differential bearing cap bolts until they are only finger tight.

Remove the spare shims used to hold the differential in position for the runout check.

Install a 3.60 mm (0.142 in) thickness shim (A) between each differential bearing and the axle housing.

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Pry the differential case to one side and zero dial indicator J 8001.

Pry the differential case to the opposite side and record the dial indicator reading. The indicator reading is the additional shim thickness needed for zero end play.

NOTE: For example, if the reading was 0.20 mm (0.008 in), an additional 0.10 mm (0.004 in) shim will be required at each side of the differential.

Assemble the necessary zero end play shims and set them aside for final installation. Tag the shims for reference.

Remove the differential case and dial indicator set and proceed to Differential Case Assembly.

Differential Case Assembly

Assemble the side gears (1) and thrust washers (2) and install them in the case.

NOTE: Be sure to replace the side gear thrust washers if clearance measured at disassembly exceeded 0.18 mm (0.007 in).

Install the differential pinions (3) and thrust washers (4) in the case. Be sure to align the pinions with the shaft bores in the case.

Recheck side gear clearance. If clearance exceeds 0.18 mm (0.007 in), replace the side gears.

Install the differential pinion shaft (22) and the lockpin (21) in the case.

Remove the differential bearings with remover J 22912-01 and a press.

Install the zero end play shims on each side of the case.

Reinstall the differential bearings with tools J 8092 and J 21784.

Position and align the ring gear (10) on the differential case (9).

Install replacement ring gear bolts. Tighten the bolts alternately and evenly to 70 N·m (52 ft-lbs) torque.

Proceed to Ring Gear Backlash Adjustment.

Ring Gear Backlash Adjustment

NOTE: Ring gear backlash establishes the running clearance between the ring and pinion gears. Adjustment involves moving the ring gear toward or away from the pinion. Adjustment is controlled by the differential bearing end play shims.

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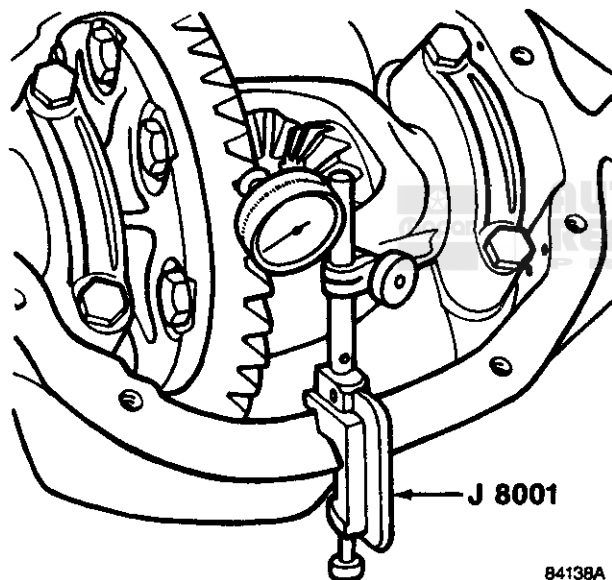
	REAR AXLE STANDARD DIFFERENTIAL OVERHAUL	
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Install the differential assembly in the axle housing.

Install the differential bearing caps. Tighten the bearing cap bolts to 77 N·m (57 ft-lbs) torque.

Remount dial indicator J 8001 on the axle housing.

Position the indicator stylus against the drive side of one of the ring gear teeth. Be sure the stylus is at a right angle to the tooth.



Move the ring gear forward and zero the dial indicator.

Move the ring gear rearward then forward and note the dial indicator reading.

Correct backlash is between 0.13 and 0.23 mm (0.005 and 0.009 in). However, the optimum backlash setting is 0.20 mm (0.008 in).

Record the dial indicator reading and remove indicator set J 8001.

Remove the differential assembly from the axle housing.

Remove the differential bearings and end play shims. Do not intermix the shims. Tag them for reference if necessary.

If backlash is within specified tolerance, proceed to Differential Bearing Preload Adjustment.

If backlash is not within specified tolerance, adjust backlash as follows:

- To **increase** backlash, use a **thinner** shim pack on the ring gear side of the case. To do this, subtract the amount needed from the ring gear shim pack. Then add the same amount to the opposite shim pack.
- To **decrease** backlash, use a **thicker** shim pack on the ring gear side of the case. To do this, add the amount needed to the ring gear shim pack. Then subtract the same amount from the opposite shim pack.

NOTE: The total (or combined) thickness of both shim packs does not change. The amount required for desired backlash is simply transferred from one side to the other as needed.

For example, if measured backlash is 0.28 mm (0.011 in) and the optimum setting of 0.20 mm (0.008 in) is desired, backlash must be decreased by 0.076 mm (0.003 in). To do this, add 0.076 mm (0.003 in) to the ring gear shim pack and subtract the same amount from the opposite shim pack.

Assemble the necessary shim packs and proceed to Differential Bearing Preload Adjustment. Do not install the bearings at this time.

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	REAR AXLE STANDARD DIFFERENTIAL OVERHAUL	
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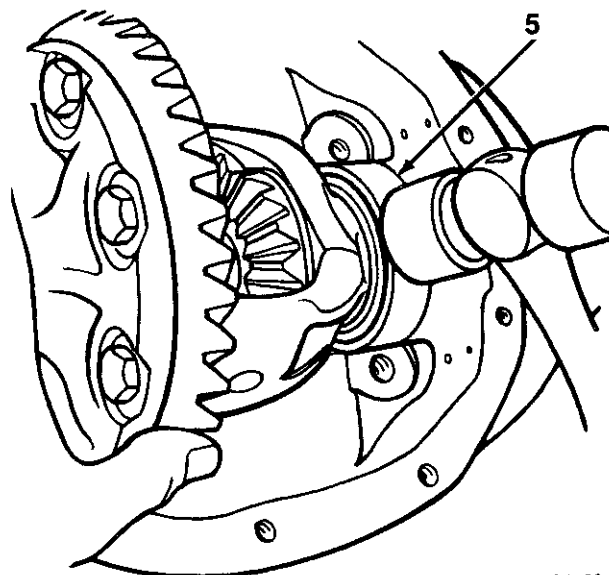
Differential Bearing Preload Adjustment

NOTE: Before installing the differential, the differential bearings must be preloaded to compensate for heat and loads during operation.

Install the differential bearing shim packs on the case.

Add one additional 0.10 mm (0.004 in) shim to each shim pack.

Install the differential bearings with tools J 8092 and J 21784.



84139

Differential Installation

Lightly lubricate the differential bearings, cups, gears and thrust washers with axle lubricant.

Install the bearing cups on the differential bearings.

Install the differential in the axle housing. Tap the outer edges of the differential bearing cups (5) with a rawhide mallet to seat them in the housing.

Install the differential bearing caps. Tighten the cap bolts to 77 N•m (57 ft-lbs) torque.

Recheck ring gear backlash to verify that it has not changed.

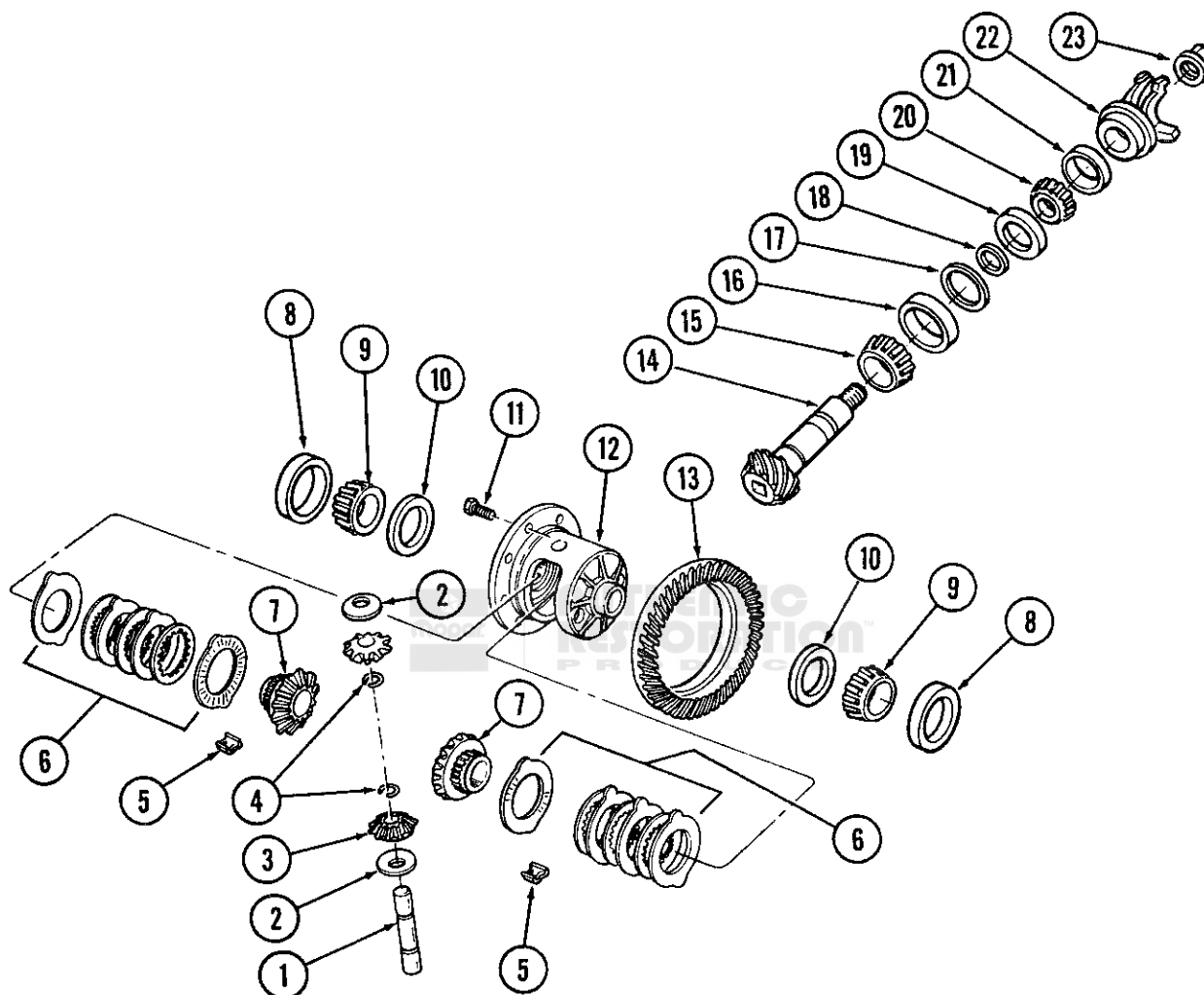
Install the axle housing cover. Tighten the cover bolts to 19 N•m (170 in-lbs) torque.

Refill the axle with 2.1 liters (2.5 pints) of JEEP axle lubricant, or an equivalent SAE 75W-90, API Grade GL 5 gear lubricant.

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	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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TRAC-LOK DIFFERENTIAL COMPONENTS



1. Differential Pinion Shaft
2. Pinion Thrust Washer
3. Differential Pinion
4. Pinion Snap Ring
5. Clutch Pack Retainer Clips (2 per clutch pack)
6. Clutch Pack
7. Differential Side Gear
8. Differential Bearing Cup
9. Differential Bearing
10. Differential Bearing Shim (End Play/Preload)
11. Ring Gear Bolt

12. Differential Case
13. Ring Gear
14. Pinion Gear
15. Pinion Gear Rear Bearing
16. Rear Bearing Cup
17. Pinion Depth Shim
18. Pinion Bearing Preload Spacer
19. Front Bearing Cup
20. Pinion Gear Front Bearing
21. Pinion Seal
22. Pinion Yoke
23. Pinion Nut

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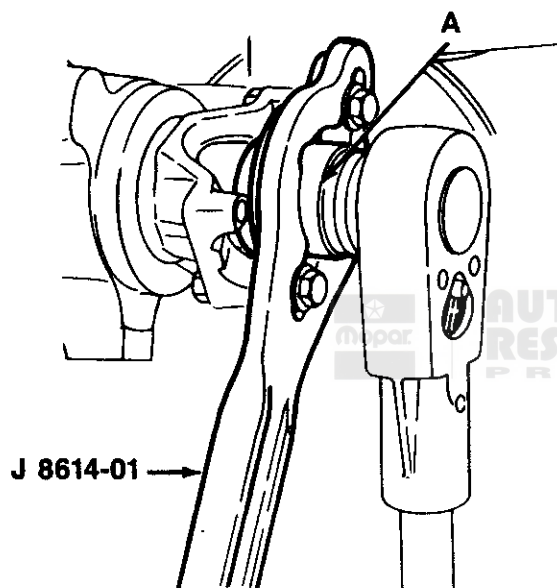
	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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REMOVAL AND DISASSEMBLY PROCEDURES

Pinion Gear and Bearing Removal

Remove the pinion nut (23) and yoke (22) with a socket (A) and holding tool J 8614-01.

NOTE: Retain the pinion nut. It will be used for initial pinion depth measurement at reassembly.

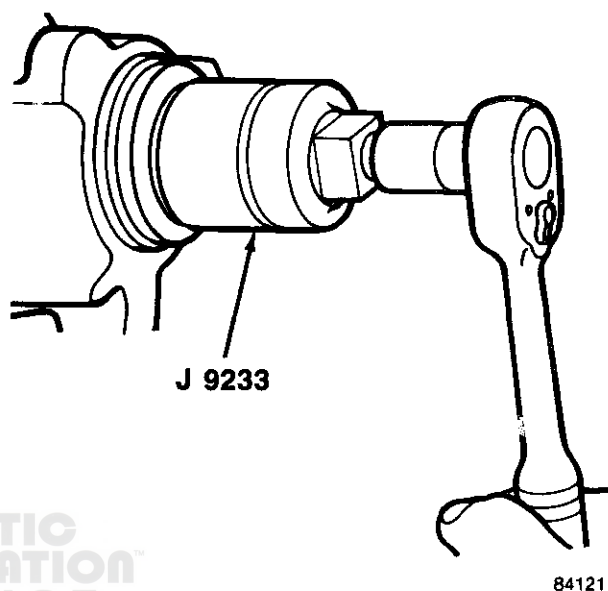


Tap the end of the pinion gear (14) with a raw-hide mallet to release it from the front bearing (20).

Remove the axle housing cover.

Remove the pinion gear (14), pinion bearings (15-20) and preload spacer (19) from the axle housing. Discard the spacer. It is not reusable.

Remove the pinion seal with tool J 9233.



Remove the pinion rear bearing cup (15) with driver handle J 8092 and tool J 21786.

NOTE: The pinion depth shim (17) is located under the rear bearing cup (16). Remove and retain the shim.

Remove the pinion front bearing cup (21) with driver handle J 8092 and tool J 21787.

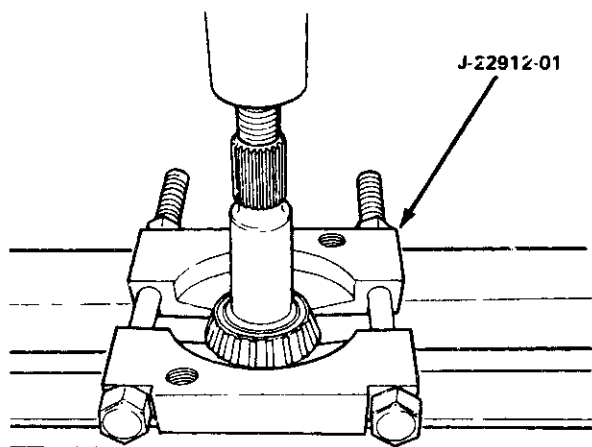
Remove the rear bearing (15) from the pinion gear with an arbor press and tool J 22912-01.

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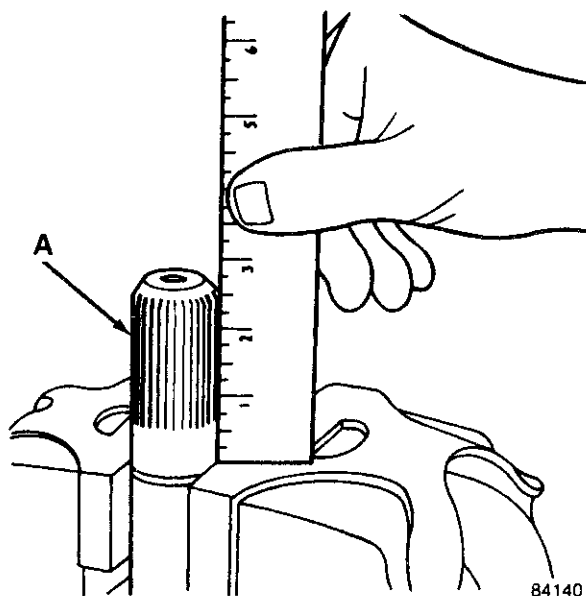
90179

Differential Disassembly

Remove the differential bearing cups (8). Tag the cups for assembly reference.

Install one axle shaft (A) in a vise with the splined end upward. Position the shaft so no more than 7 cm (2-3/4 in) of the shaft end extends above the vise jaws.

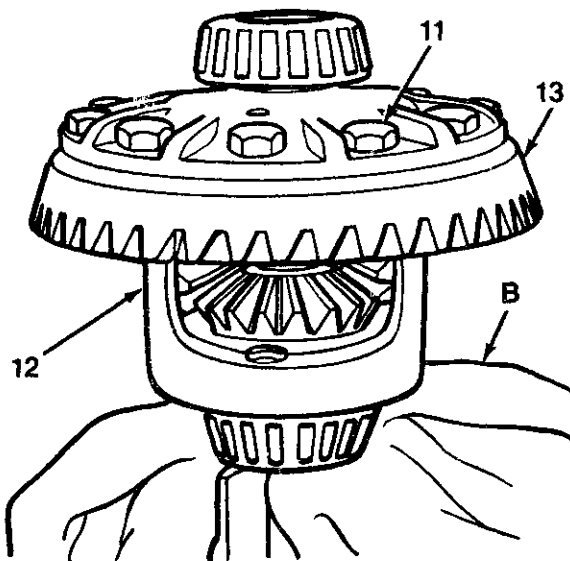
NOTE: If the splined end extends more than 7 cm (2-3/4 in) above the vise jaws, the shaft will prevent installation of the clutch pack remover tools.



84140

Mount the differential case (12) on the axle shaft with the ring gear bolts (11) facing upward.

Place shop towels (B) under the ring gear to avoid damaging the gear during removal.



84141

Remove the ring gear bolts (11). Discard the bolts. They are not reusable.

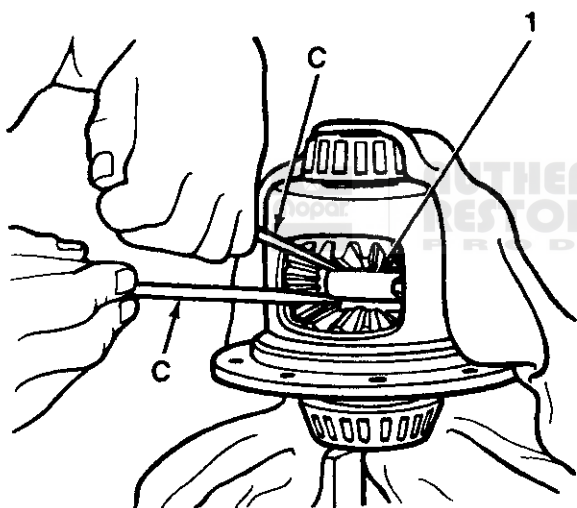
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Remove the differential case from the axle shaft and remove the ring gear with a brass drift and hammer.

Remount the differential case on the axle shaft (A).

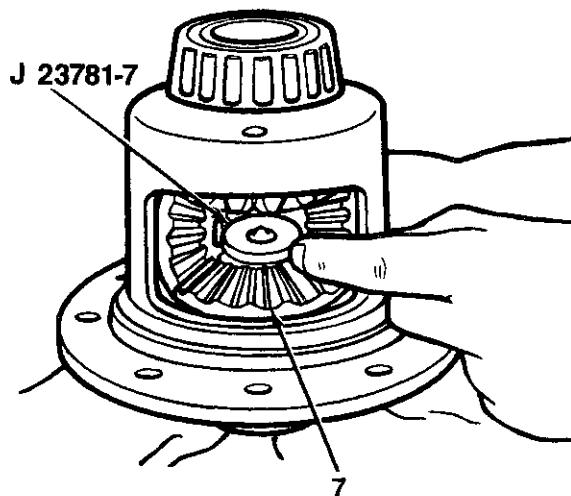
Remove the pinion snap rings from the pinion shaft (1) with two screwdrivers (C). Position the screwdriver blades against the snap ring ends and push the snap rings off the shaft.



84142A

Remove the pinion shaft (1) from the case with a brass drift and hammer.

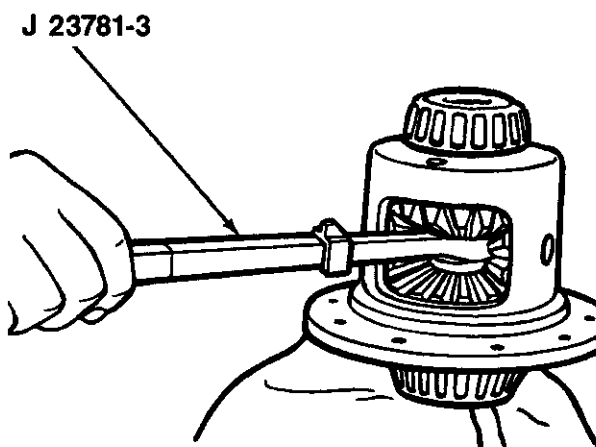
Install step plate tool J 23781-7 in the bottom side gear (7).



84143

Coat the centering hole in the step plate tool with grease.

Position rotating tool J 23781-3 on the step plate tool.



84144A

Coat the threads of forcing screw J 8646-2 with oil.

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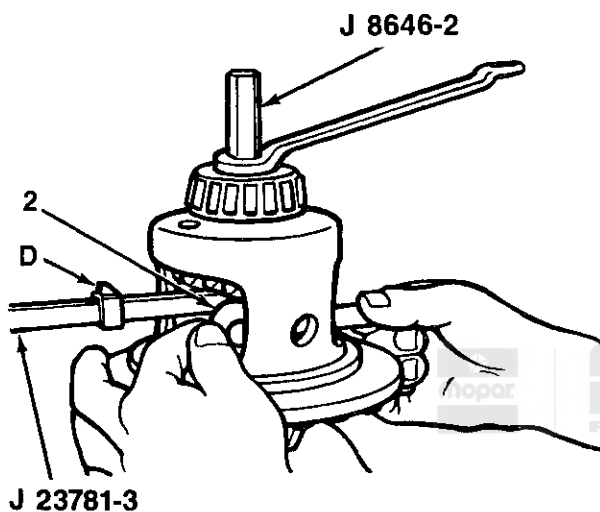
REAR AXLE

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Insert forcing screw J 8646-2 through the case and thread it into the rotating tool J 23781-3. Thread the screw through the tool until it contacts the centering hole in the step plate.

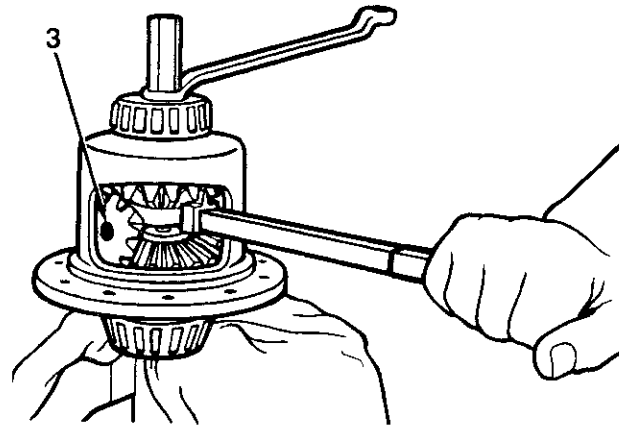
Tighten forcing screw J 8646-2 enough to relieve clutch pack tension from the pinions (3). Then remove the pinion thrust washers (2).



84145A

Tighten the forcing screw until all clutch pack tension is relieved from the pinions (3). Slide the rotating tool pawl (D) into engagement with the side gear teeth.

Rotate the side gears with the rotating tool until the pinions (3) can be removed through the case opening.



84146A

Remove the forcing screw and remove the rotating tool, upper side gear (7) and clutch pack (6).

Remove the differential case from the axle shaft and remove the remaining side gear and clutch pack and the step plate tool.

Remove the retainer clips (5) from the clutch packs. Tag the clutch packs for assembly reference.

Remove the differential bearings (6) with tool J 22912-01 and a press.

Remove the differential bearing shims (10).

Cleaning and Inspection

Clean all of the differential components in solvent. Use compressed air to dry all parts except the bearings. Dry the bearings with shop towels only.

Examine each component for wear or damage.

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	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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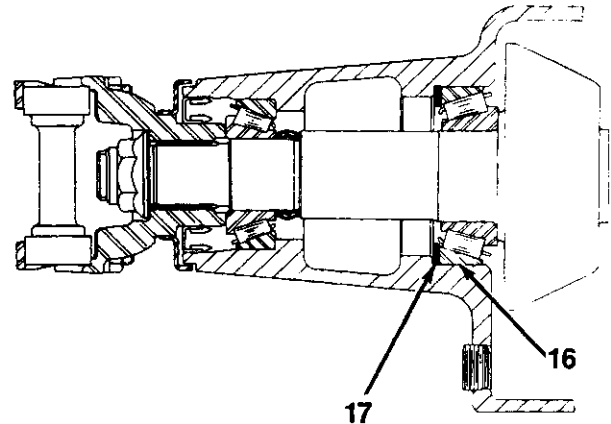
Inspect the clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged.

Inspect the bearings and bearing cups. Replace bearings and races as a set if either part is galled, worn, cracked, flat spotted or scored.

Inspect the differential side and pinion gears. Replace any gear that is worn, cracked, chipped or broken.

Inspect the ring and pinion gears. Replace the gears as a set if either is worn or damaged.

Inspect the differential case and pinion shaft. Replace either part if cracked or damaged.



84128B

The ring gear (13) and pinion gear (14) are serviced as a matched set only. They are identified as a matched set by numbers etched on the ring and pinion gears.

The first two numbers (A) on each gear identify them as a matched set. The second number (B) on the pinion gear is the pinion depth variance. It indicates the amount (in thousandths of an inch) that the set varied from the standard setting of 2.095 inches (53.21 mm). The variance may be a plus or minus figure.

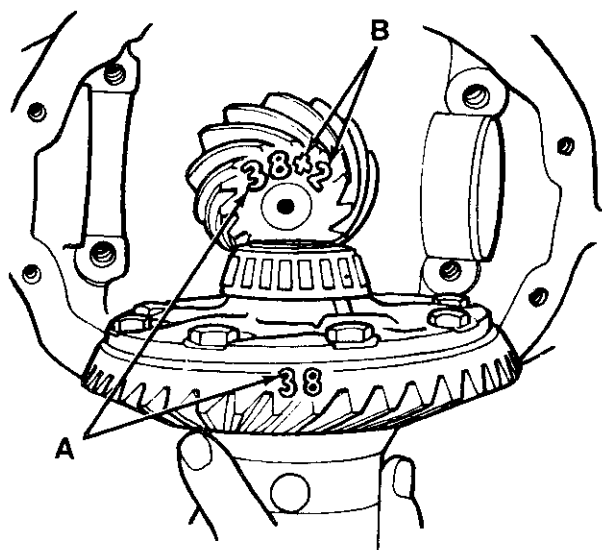
Service and Adjustment Information

The clutch packs are serviced as sets only. If one clutch pack is damaged, both clutch packs must be replaced.

Pinion gear depth must be measured and adjusted before installing the differential in the axle housing. Depth is controlled by a shim (17) installed under the pinion rear bearing cup (16).

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84129

Service replacement ring and pinion gear sets are machined to the standard setting only. Pinion depth variance on replacement sets will range from plus to minus 0.004 inches (0.10 mm). Any service replacement set with a variance exceeding these figures, or a set with mismatched identification numbers must not be used. Such gear sets should be returned to the parts distribution center.

NOTE: Some factory installed gear sets may have an extra 0.010 or 0.020 inch (0.25 or 0.50 mm) milled off the pinion. These sets have a unique variance number. For example, if the number on the pinion is 23, the number 2 indicates 0.020 inch (0.50 mm) was milled off the pinion and the variance is 0.003 inches (0.076 mm). Similarly, if the variance number is 16, the number 1 indicates 0.010 inch (0.25 mm) was milled off the pinion and variance is 0.006 inch (0.15 mm).

Refer to the Pinion Variance Chart in the Specifications section when adjusting pinion gear depth. The chart helps determine starter shim thickness needed for initial depth measurement.

NOTE: The chart will only help determine starter shim thickness. It will not provide the exact shim thickness required for final depth adjustment.

ASSEMBLY AND INSTALLATION PROCEDURES

Pinion Gear Depth Adjustment

Verify that the ring and pinion are a matched set before proceeding.

Measure the thickness of the original pinion depth shim (17).

Note the depth variance (B) marked on the pinion gear.

Determine pinion depth starter shim thickness as follows:

- If the original ring and pinion set is being installed, start with the original depth shim.
- If a replacement gear set is being installed, determine how much must be added to or subtracted from the original shim for best starter shim thickness.
- Refer to the Pinion Variance Chart in the Specifications section. Note where the Old and New Pinion Marking columns intersect. The intersecting figure represents the plus or minus amount needed. For example, if the old pinion is +1 and the new pinion is -3, the intersecting figure is +0.004 inch (0.10 mm). Add this amount to the original shim. Or, if the old pinion is -3 and the new pinion is -2, the intersecting figure is -0.001 inch (0.025 mm).

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mm). Subtract this amount from the original shim.

Clean the bearing cup bores in the axle housing.

Install the starter shim in the rear bearing cup bore of the axle housing.

NOTE: If the shim is chamfered on one side, position the chamfered side so it faces the bottom of the bearing cup bore.

Install the pinion rear bearing cup (16) in the axle housing and on top of the starter shim. Use tools J 8092 and J 8608 to seat the cup in the bore.

Install the pinion front bearing cup (19) in the axle housing with tools J 8092 and J 8611-01.

Install the rear bearing (15) on the pinion gear (14).

Install the pinion gear (11) in the axle housing.

Install the front bearing (20) on the pinion gear. Seat the bearing on the gear and in the cup (19).

Install the pinion yoke (22) and the original pinion nut (23) on the pinion gear. Tighten the pinion nut only enough to remove end play.

NOTE: Do not install the pinion seal or preload spacer at this time.

Determine **desired** pinion depth as follows:

- Record depth variance marked on the pinion gear.
- If the variance is a plus figure, add the variance to the standard setting of 2.095 inches

(53.21 mm). If the variance is a minus figure, subtract it from the standard setting.

- Record the desired depth figure for final shim selection.

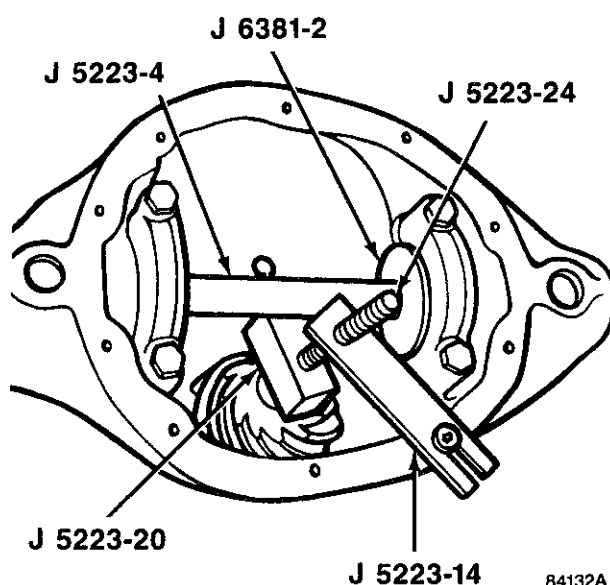
Measure **initial** pinion depth as follows.

Assemble gauge arbor J 5223-4 and discs J 6381-2. Then seat the discs in the axle housing differential bearing saddles.

Install the differential bearing caps over the discs and tighten the bearing cap bolts securely.

Place gauge block J 5223-20 on the raised rear face of the pinion gear. Position the spring loaded plunger in the block under the center of gauge arbor shaft J 5223-4.

NOTE: Do not allow the gauge block anvil to contact the pinion gear teeth.



84132A

	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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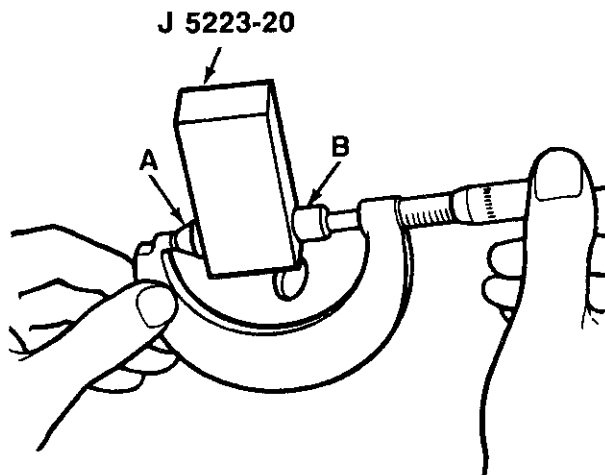
Mount gauge block clamp J 5223-14 and holding screw J 5223-24 on the axle housing. Secure the clamp to the housing with an axle cover bolt. Position the holding screw over the gauge block.

Extend holding screw J 5223-24 until it is firmly seated against the gauge block and holds the block in position.

Loosen the gauge block thumbscrew and allow the spring loaded plunger to contact gauge arbor J 5223-4.

Tighten the gauge block thumbscrew securely. Then loosen the holding screw and remove the gauge block.

Measure the distance between the anvil (A) and plunger (B) of gauge block J 5223-4 with a micrometer. Record this dimension for final shim selection. It represents the initial pinion depth.



84133A

Remove the differential bearing caps and gauge tools from the axle housing.

Remove the pinion nut, yoke, front bearing and pinion gear from the axle housing. Discard the old pinion nut.

Remove the pinion rear bearing cup and the pinion depth starter shim.

Select the required pinion depth shim as follows:

- Subtract pinion variance from standard setting. This equals desired depth.
- Add starter shim thickness to existing depth. This equals total depth.
- Subtract desired depth from total depth. This equals required shim thickness.

NOTE: Refer to the Depth Shim Computation Chart for examples of the computation and selection procedure.

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DEPTH SHIM COMPUTATION CHART

Example I

Step 1

Standard pinion
 depth setting 53.21 mm (2.095 in)
 Subtract pinion
 depth variance . . - 0.10 mm (0.004 in)
 Desired pinion depth . 53.11 mm (2.091 in)

Step 2

Initial pinion
 depth 53.34 mm (2.100 in)
 Add starter shim
 thickness + 2.43 mm (0.096 in)
 Total thickness-depth . . 55.77 mm (2.196 in)

Step 3

Total thickness-depth . . 55.77 mm (2.196 in)
 Subtract desired
 pinion depth - 53.11 mm (2.091 in)
 Required shim
 thickness 2.66 mm (0.105 in)

Example II

Step 1

Standard pinion
 depth setting 53.21 mm (2.095
 Add pinion
 depth variance . . + 0.05 mm (0.002
 Desired pinion depth . 53.26 mm (2.097

Step 2

Initial pinion
 depth 53.41 mm (2.103 in)
 Add starter shim
 thickness + 2.39 mm (0.094 in)
 Total thickness-depth . . 55.80 mm (2.197 in)

Step 3

Total thickness-depth . . 55.80 mm (2.197 in)
 Subtract desired
 pinion depth - 53.26 mm (2.097 in)
 Required shim
 thickness 2.54 mm (0.100 in)

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Install the required pinion depth shim (17) in the rear bearing cup bore of the axle housing.

NOTE: If the shim is chamfered on one side, be sure the chamfered side is facing the bottom of the bearing cup bore.

Install the rear bearing cup (16) in the axle housing and on top of the depth shim (17). Use tools J 8092 and J 8608 to install the bearing cup.

Install the pinion gear (14) in the axle housing.

Install a replacement preload spacer (18) on the pinion gear.

Install the front bearing (20) on the pinion gear.

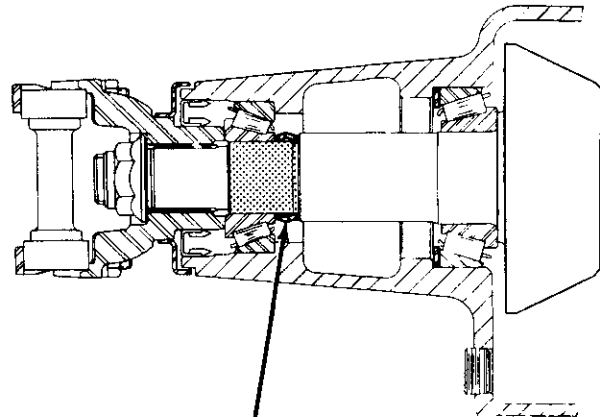
Install a replacement pinion oil seal (21) in the axle housing.

Install the pinion yoke (22) on the pinion gear. Do not install the pinion nut at this time.

Proceed to Pinion Bearing Preload Adjustment.

Pinion Bearing Preload Adjustment

A collapsible spacer (18) controls preload which is adjusted at the pinion nut (23). The spacer is designed to crush and hold at the set preload. Correct preload is 2-3 N·m (15-25 in-lbs). Preload is measured as the amount of torque required to turn the pinion gear with an inch-pound torque wrench.



18

84134B

Install a replacement pinion nut (23) on the pinion gear. **Tighten the nut only enough to remove end play. Do not overtighten the nut.**

Place a socket and inch-pound torque wrench J 5853-B on the pinion nut and begin rotating the pinion gear.

Slowly tighten the pinion nut until torque required to rotate the pinion is between 2-3 N·m (15-25 in-lbs). Check torque frequently and tighten the nut in very small amounts only.

CAUTION: The preload spacer is designed to permanently crush and hold at whatever preload is set. If specified preload is exceeded, do not attempt correction by loosening and re-tightening the pinion nut. The spacer must be replaced and preload reset again.

Remove the inch pound torque wrench and socket.

Proceed to the Differential Case Runout Check.

NOTE: Do not assemble the differential until case runout and bearing end play have been checked and adjusted.

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Differential Case Runout Check

Install the differential bearings (9) on the case, but do not install the bearing shims at this time. Use tools J 8092 and J 21784 to install the bearings.

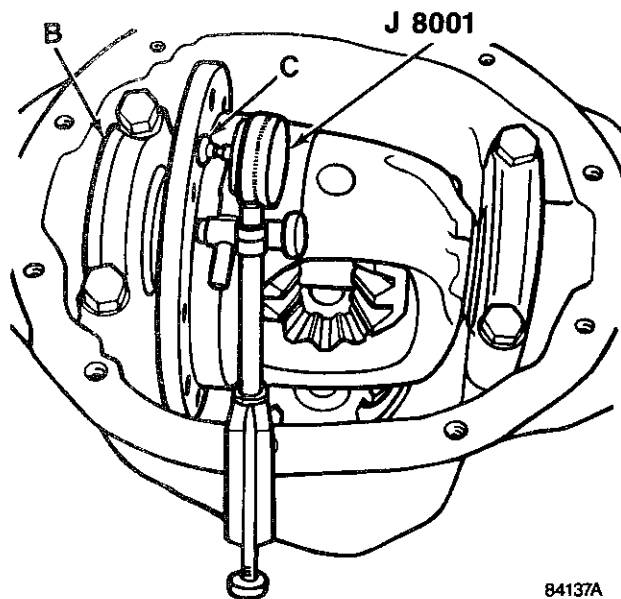
Install the bearing cups (8) on the differential bearings.

Mount the differential in the axle housing.

Insert enough spare shims between one of the differential bearings and the axle housing to prevent any differential case side play.

Install the differential bearing caps and cap bolts (B). Tighten the cap bolts securely but not to specified torque.

Mount dial indicator set J 8001 on the axle housing. Position the indicator stylus (C) so it contacts the ring gear mounting face of the differential case.



Pry the differential case to one side and zero the dial indicator.

Rotate the differential case through several revolutions and note the dial indicator reading.

Case runout should not exceed 0.05 mm (0.002 in). Replace the case if runout exceeds this figure.

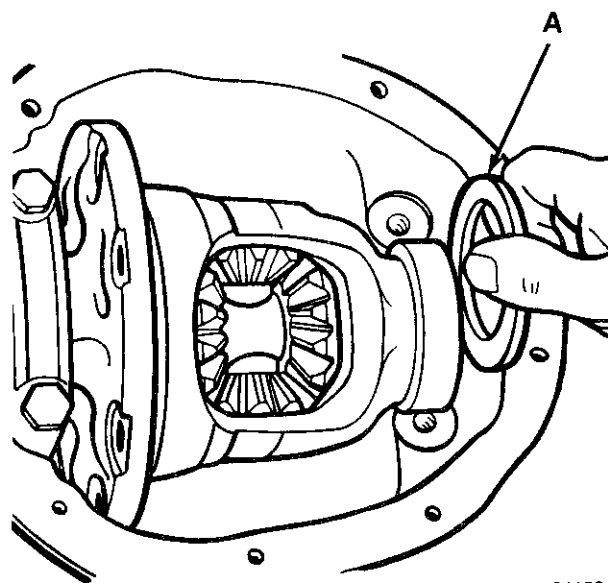
Leave the dial indicator set in position and proceed to Differential Bearing Zero End Play Adjustment.

Differential Bearing Zero End Play Adjustment

Loosen the differential bearing cap bolts until they are only finger tight.

Remove the spare shims used to hold the differential in position for the runout check.

Install a 3.60 mm (0.142 in) thickness shim (A) between each differential bearing and the axle housing.



Pry the differential case to one side and zero dial indicator J 8001.

	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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Pry the differential case to the opposite side and record the dial indicator reading. The indicator reading is the additional shim thickness needed for zero end play.

NOTE: For example, if the reading was 0.20 mm (0.008 in), an additional 0.10 mm (0.004 in) shim will be required at each side of the differential.

Assemble the necessary zero end play shims and set them aside for final installation. Tag the shims for reference.

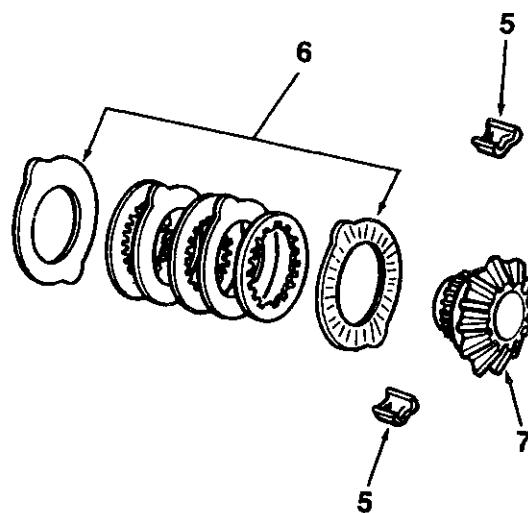
Remove the differential case and dial indicator set and proceed to Differential Case Assembly.

Differential Case Assembly

Lightly lubricate the clutch pack discs with axle lubricant.

Assemble the clutch pack discs (6) as shown and install the retaining clips (5) on the ears of the discs.

Install the assembled clutch packs on the side gears (7).



101331

Mount the differential case on the axle shaft (A).

Install the first clutch pack and side gear in the bottom bore of the case (12).

NOTE: Be sure the retaining clips remain in position and are seated in the case pockets.

Install step plate tool J 8646-2 in the clutch pack just installed.

Install the remaining side gear and clutch pack in the case. Hold the assembly in position and install the rotating tool and forcing screw.

Tighten the forcing screw to compress the clutch packs.

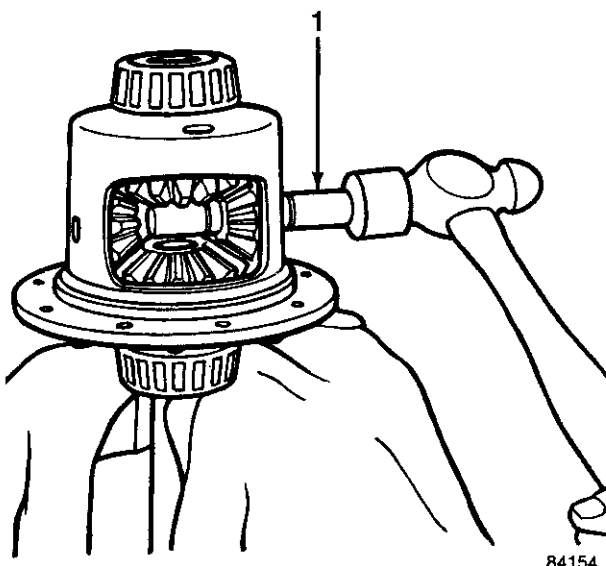
Install the pinions (3). Rotate the side gear with the tool pawl until each pinion is aligned with the pinion shaft bore.

Install the pinion thrust washers (2).

Install the pinion shaft (1).

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Install replacement snap rings (4) on the pinion shaft.

Remove the differential from the axle shaft (A) and remove the shaft from the vise.

Remove the differential bearings with remover J 22912-01 and a press.

Install the zero end play shims on each side of the case.

Reinstall the differential bearings with tools J 8092 and J 21784.

Position and align the ring gear (10) on the differential case (9).

Install replacement ring gear bolts. Tighten the bolts alternately and evenly to 70 N·m (52 ft-lbs) torque.

Proceed to Ring Gear Backlash Adjustment.

Ring Gear Backlash Adjustment

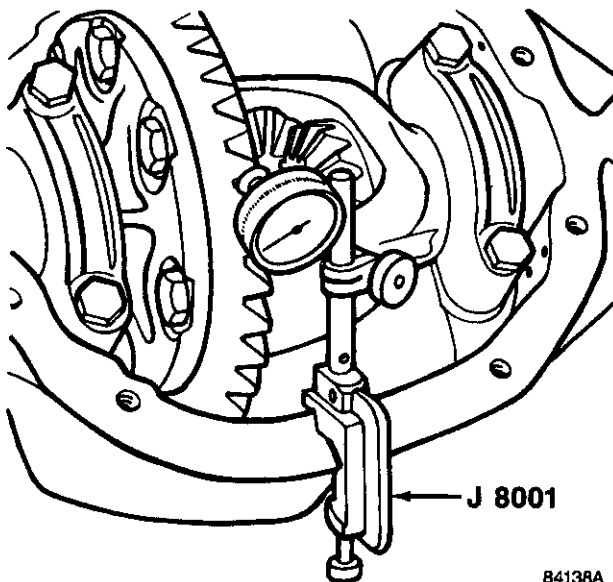
NOTE: Ring gear backlash establishes the running clearance between the ring and pinion gears. Adjustment involves moving the ring gear toward or away from the pinion. Adjustment is controlled by the differential bearing end play shims.

Install the differential assembly in the axle housing.

Install the differential bearing caps. Tighten the bearing cap bolts to 77 N·m (57 ft-lbs) torque.

Remount dial indicator J 8001 on the axle housing.

Position the indicator stylus against the drive side of one of the ring gear teeth. Be sure the stylus is at a right angle to the tooth.



84138A

Move the ring gear forward and zero the dial indicator.

Move the ring gear rearward then forward and note the dial indicator reading.

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Correct backlash is between 0.13 and 0.23 mm (0.005 and 0.009 in). However, the optimum backlash setting is 0.20 mm (0.008 in).

Record the dial indicator reading and remove indicator set J 8001.

Remove the differential assembly from the axle housing.

Remove the differential bearings and end play shims. Do not intermix the shims. Tag them for reference if necessary.

If backlash is within specified tolerance, proceed to Differential Bearing Preload Adjustment.

If backlash is not within specified tolerance, adjust backlash as follows:

- To **increase** backlash, use a **thinner** shim pack on the ring gear side of the case. To do this, subtract the amount needed from the ring gear shim pack. Then add the same amount to the opposite shim pack.
- To **decrease** backlash, use a **thicker** shim pack on the ring gear side of the case. To do this, add the amount needed to the ring gear shim pack. Then subtract the same amount from the opposite shim pack.

NOTE: The total (or combined) thickness of both shim packs does not change. The amount required for desired backlash is simply transferred from one side to the other as needed.

For example, if measured backlash is 0.28 mm (0.011 in) and the optimum setting of 0.20 mm (0.008 in) is desired, backlash must be decreased by 0.076 mm (0.003 in). To do this, add

0.076 mm (0.003 in) to the ring gear shim pack and subtract the same amount from the opposite shim pack.

Assemble the necessary shim packs and proceed to Differential Bearing Preload Adjustment. Do not install the bearings at this time.

Differential Bearing Preload Adjustment

NOTE: Before installing the differential, the differential bearings must be preloaded to compensate for heat and loads during operation.

Install the differential bearing shim packs on the case.

Add one additional 0.10 mm (0.004 in) shim to each shim pack.

Install the differential bearings with tools J 8092 and J 21784.

Differential Installation

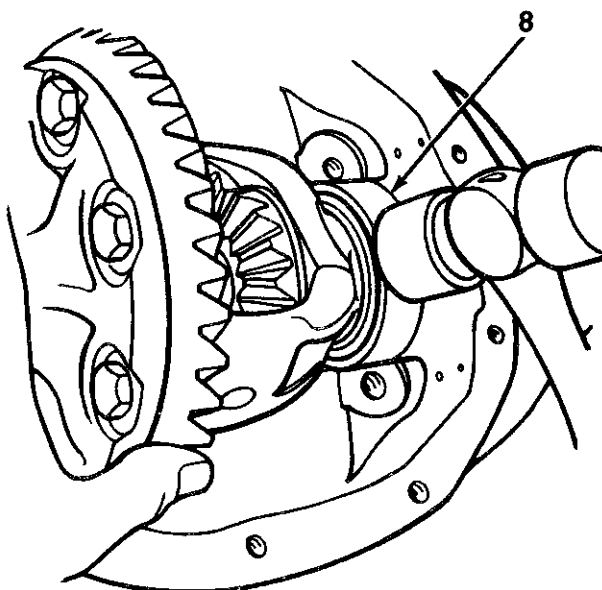
Lightly lubricate the differential bearings, cups, gears and thrust washers with axle lubricant.

Install the bearing cups on the differential bearings.

Install the differential in the axle housing. Tap the outer edges of the differential bearing cups (8) with a rawhide mallet to seat them in the housing.

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	REAR AXLE TRAC-LOK DIFFERENTIAL OVERHAUL	
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84139B

Install the differential bearing caps. Tighten the cap bolts to 77 N•m (57 ft-lbs) torque.

Recheck ring gear backlash to verify that it has not changed.

Install the axle housing cover. Tighten the cover bolts to 19 N•m (170 in-lbs) torque.

Refill the axle with 2.1 liters (2.5 pints) of JEEP axle lubricant, or an equivalent SAE 75W-90, API Grade GL 5 gear lubricant.

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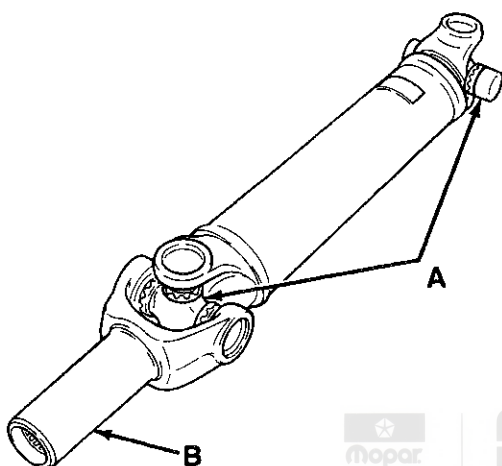


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	REAR AXLE	
	PROPELLER SHAFT	

GENERAL INFORMATION

The rear propeller shaft is a tubular steel unit with welded yokes. Single cardan U-joints (A) are used at the front and rear. A slip yoke (B) is used to connect the shaft to the transfer case.



PROPELLER SHAFT REMOVAL

Raise the vehicle.

Mark the propeller shaft and axle yokes for alignment reference.

Remove the U-joint clamp strap bolts and disconnect the shaft from the axle yoke. Discard the U-joint clamps. They are not reusable.

Slide the slip yoke out of the transfer case and remove the propeller shaft.

PROPELLER SHAFT INSTALLATION

Install the propeller shaft slip yoke on the transfer case output shaft.

Align and install the propeller shaft rear U-joint in the axle yoke.

Secure the rear U-joint to the yoke with replacement clamps.

Tighten the clamp bolts to 19 N·m (170 in-lbs) torque.

Lower the vehicle.

UNIVERSAL JOINT REPLACEMENT

Removal

Remove the propeller shaft.

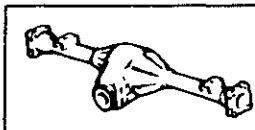
Remove the U-joint bearing cap retainers.

Position the propeller shaft yoke in a vise.

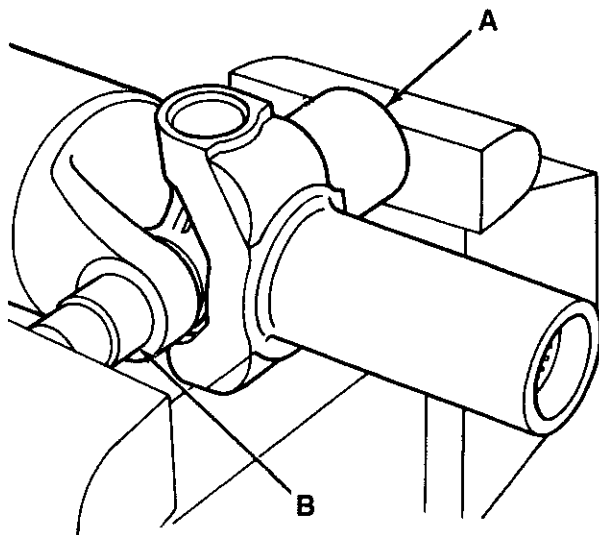
Press the first bearing cap out of the shaft yoke using one large socket (A) as a receiver, one smaller socket (B) as a driver and the vise as a press.

Position the large socket (A) over the bearing cap to be removed. Position the small socket (B) against the opposite bearing cap. Then tighten the vise to press the cap partially out of the yoke.

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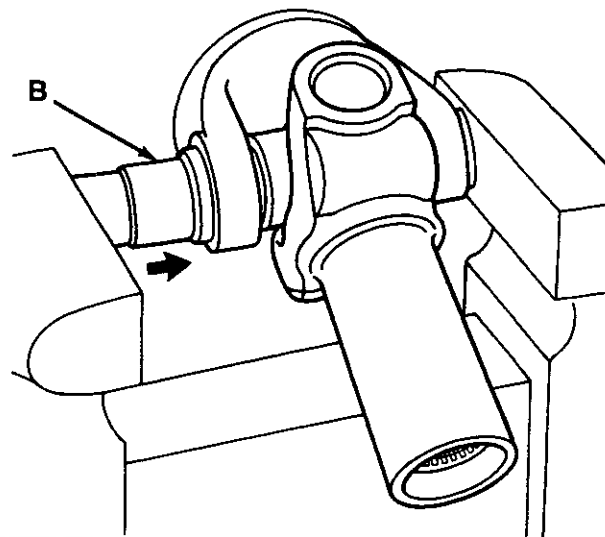


REAR AXLE PROPELLER SHAFT



84157

Seat the bearing caps in the yoke and on the spider using the small socket (B) as a driver and the vise as a press.



84158

Loosen the vise and remove the shaft.

Remove the partially pressed out bearing cap.

Remount the shaft in the vise and repeat the procedure to remove the remaining bearing caps.

Remove the U-joint spider.

Installation

Apply chassis grease to the propeller shaft and yoke bores, bearing caps and roller bearings and the bearing surfaces of the U-joint spider.

Position the spider in the yoke and tap two of the bearing caps far enough into the yoke to hold the spider in position.

Start the remaining bearing caps in the yoke and onto the spider.

Install the bearing cap retainers.

Install the propeller shaft.

PROPELLER SHAFT RUNOUT

Raise the vehicle.

Clean a one inch wide contact area at the rear, center and front of the propeller shaft for the dial indicator stylus.

NOTE: The contact area at the front and rear of the shaft should be approximately 1.25 cm (1/2 inch) from the weld joint on the shaft tube.

Check runout at the rear, center and front of the propeller shaft with dial indicator J 8001.

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REAR AXLE PROPELLER SHAFT



Refer to the Propeller Shaft Runout chart in the Specifications section.

Replace the shaft if runout exceeds specified tolerance at the front, center or rear of the shaft.

UNIVERSAL JOINT ANGLE MEASUREMENT

Shift the transmission and transfer case into Neutral.

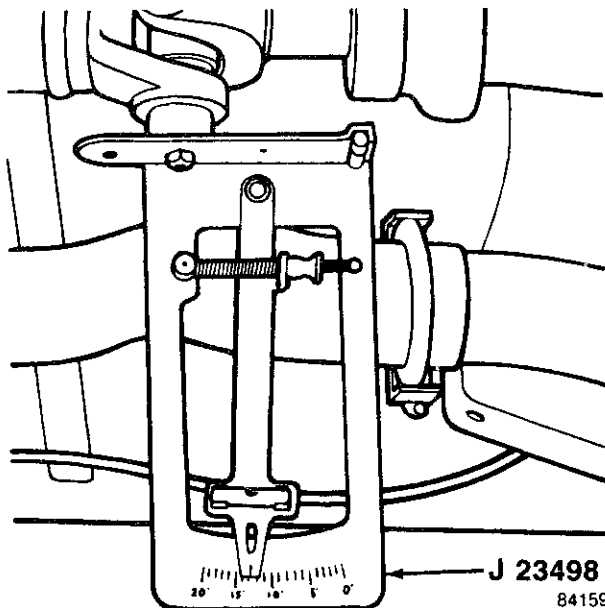
Raise the vehicle on a twin post or similar type-hoist that will support the rear axle and allow the rear wheels to be rotated.

Measure the angles at the axle pinion yoke (A) as follows:

- Rotate the propeller shaft until one of the pinion yoke bearing caps is facing downward.
- Place the magnetic base of inclinometer tool J 23498 on the pinion yoke bearing cap. Record the reading and remove the tool.
- Rotate the propeller shaft until one of the propeller shaft yoke bearing caps is facing downward.
- Place the inclinometer tool on the shaft yoke bearing cap. Record the reading and remove the tool.

NOTE: The inclinometer frame must face the same direction for both readings.

- The difference between the two readings is the rear universal joint angle.



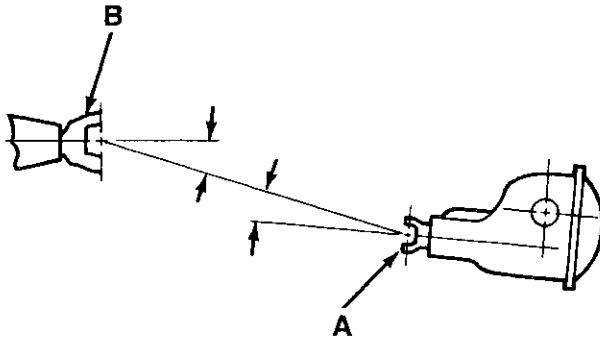
Measure the angles at the front slip yoke (B) as follows:

- Rotate the propeller shaft until one of the slip yoke bearing caps is facing downward.
- Place the inclinometer tool on the bearing cap. Record the reading and remove the tool.
- Rotate the propeller shaft until one of the shaft yoke bearing caps is facing downward.
- Place the inclinometer tool on the shaft yoke bearing cap. Record the reading and remove the tool.
- The difference between the two readings is the front universal joint angle.

Compare the angle measurements taken at the front and rear. The difference between the two readings is the overall universal joint angle.

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	REAR AXLE	
	PROPELLER SHAFT	



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DRIVELINE VIBRATION

Driveline vibration can be caused by damage to the propeller shaft, universal joints or the axle and transfer case yokes.

Propeller Shaft

Inspect the shaft for dents, missing balance weights, cracked weld seams or yokes, undercoating on the shaft tube and excessive runout.

Universal Joints

Inspect the joints for loose clamp bolts, worn bearings, damaged bearing cap retainers, or damaged clamps.

Axle and Transfer Case Yokes

Inspect the yokes for damaged bearing cap bores. Check the pinion yoke for excessive runout or a loose pinion nut. Check the slip yoke splines and seal surface for damage.

NOTE: Driveline vibration may also be the result of loose or damaged engine mounts or engine operated accessories. In addition, loose or damaged crossmembers, support cushions or driveline mounting bolts/nuts can also contribute to vibration.

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SUSPENSION



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	SUSPENSION	
	SPECIFICATIONS	

TORQUE SPECIFICATIONS

Component	Service Set-To-Torque	Service Recheck Torque
Front Shock Upper Steel Nut	13 N•m (9 ft-lbs)	7-19 N•m (5-14 ft-lbs)
Front Shock Lower Eye Bolt	61 N•m (45 ft-lbs)	47-75 N•m (35-55 ft-lbs)
Rear Shock Upper Nut and Lower Bolt	60 N•m (44 ft-lbs)	50-70 N•m (37-51 ft-lbs)
Front/Rear Track Bar Bolts and Nuts	100 N•m (74 ft-lbs)	90-110 N•m (67-81 ft-lbs.)
Stabilizer Bar-To-Link Bolts	61 N•m (45 ft-lbs)	48-75 N•m (35-55 ft-lbs)
Stabilizer Bar Mounting Bracket Bolts	41 N•m (30 ft-lbs)	34-48 N•m (25-35 ft-lbs)
Stabilizer Bar Link-To-Tie Plate Nuts	61 N•m (45 ft-lbs)	48-75 N•m (35-55 ft-lbs)
Front/Rear Spring-To-Shackle Bolt	129 N•m (95 ft-lbs)	115-142 N•m (85-105 ft-lbs)
Front/Rear Spring-To-Frame Bracket Bolt	142 N•m (105 ft-lbs)	129-156 N•m (95-115 ft-lbs)
Jounce Bumper	27 N•m (20 ft-lbs)	20-34 N•m (15-25 ft-lbs)
Rear Spring Bumper	27 N•m (20 ft-lbs)	20-34 N•m (15-25 ft-lbs)
Front/Rear Wheel Nuts	102 N•m (75 ft-lbs)	81-122 N•m (60-90 ft-lbs)

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	SUSPENSION	
	GENERAL INFORMATION	

SUSPENSION COMPONENTS

A leaf spring suspension system with dual action shock absorbers is used on Wrangler/YJ models.

Front Suspension

Two leaf springs and dual action shock absorbers are used in the front suspension. A track bar and stabilizer bar complete the front suspension components.

Rear Suspension

Two leaf springs and dual action shock absorbers are used in the rear suspension. A track bar forms the remainder of the rear suspension components.

Track Bars

The front and rear track bars are attached to brackets on the axle and frame rail. The track

bars maintain lateral positioning of the front and rear axles.

Front Stabilizer Bar

A stabilizer bar is used only at the front suspension on Wrangler/YJ models. Rubber bushings are used at the bar attaching points on the frame rails and front axle.

Shock Absorbers

Dual action, telescopic shock absorbers are used to control front and rear leaf spring action. One shock absorber is used for each spring. Rubber bushings and grommets are used at all shock absorber mounting points.

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	SUSPENSION COMPONENT SERVICE	

FRONT SHOCK ABSORBERS

Front Shock Removal

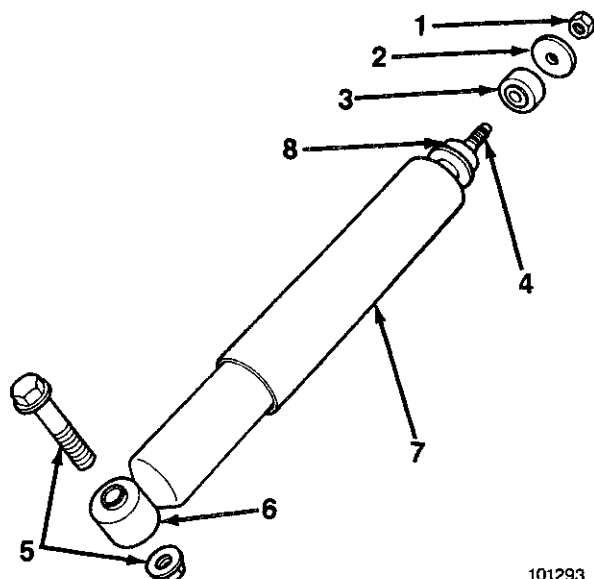
Remove the nut (1), washer (2) and grommet (3) from the shock upper mounting stud (4).

Raise the vehicle.

Remove the bolt and nut (5) that attach the shock lower mounting eye (6) to the spring tie plate bracket.

Remove the shock absorber (7).

Remove the remaining grommet (8) from the mounting stud (4).



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Front Shock Installation

Install grommet (8) on the shock mounting stud (4). Be sure the alignment shoulder on the grommet faces upward.

Position the shock mounting eye (6) in the spring tie plate bracket and install the lower mounting bolt and nut (4) finger tight.

Guide the upper mounting stud (4) into the stud hole in the frame bracket.

Tighten lower mounting bolt and nut (5) to 61 N•m (45 ft-lbs) torque.

Lower the vehicle.

Install grommet (3) on the shock mounting stud (4). Be sure the alignment shoulder on this grommet faces downward (toward the body of the shock).

Align and insert the shoulders of grommets (3) and (8) in the stud hole of the frame bracket.

Install washer (2) and nut (1) on the shock mounting stud (4). Tighten the nut to 11 N•m (8 ft-lbs) torque.

REAR SHOCK ABSORBERS

Rear Shock Removal

Raise vehicle.

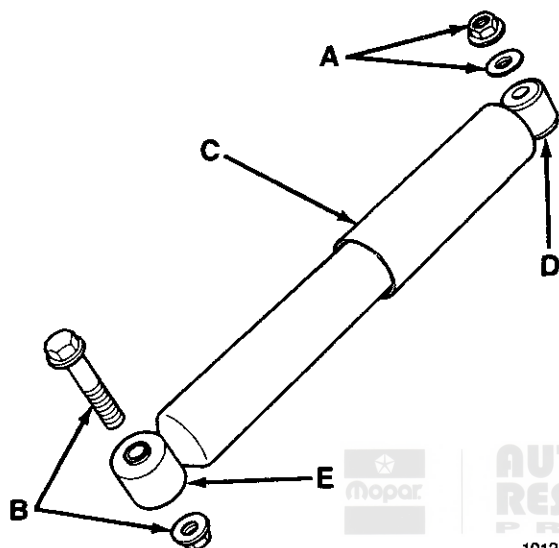
Position a jack under the rear axle. Raise the axle enough to relieve the rear springs of axle weight.

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	SUSPENSION SUSPENSION COMPONENT SERVICE	
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Remove the upper mounting nut and washer (A).

Remove the lower mounting bolt and nut (B) and remove the shock (C).



Rear Shock Installation

Position the shock upper mounting eye (D) on the frame bracket stud.

Position the shock lower mounting eye (E) in the spring tie plate bracket and install the lower bolt and nut (B).

Tighten the upper nut (A) and lower bolt and nut (B) to 60 N•m (44 ft-lbs) torque.

Remove the jack supporting the rear axle and lower the vehicle.

STABILIZER BAR

Removal

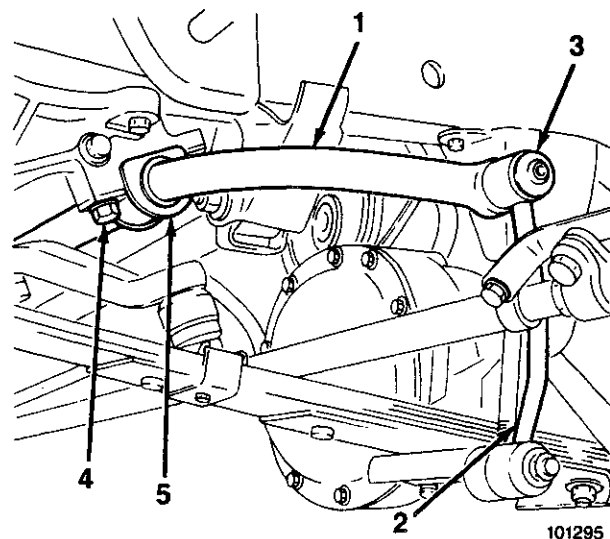
Raise the vehicle.

Remove the bolts and nuts that attach the stabilizer bar (1) to the links (2).

NOTE: Use vise grip pliers to hold the link bolt heads (3) when removing the nuts.

Remove the bolts (4) that attach the stabilizer bar mounting brackets (5) to the frame rail and steering gear bracket.

Remove the stabilizer bar.



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Stabilizer Bar Installation

Inspect the bushings in the stabilizer bar mounting brackets (5). Replace the bushings if cracked, cut, distorted, or worn.

Install the mounting bracket and bushing assemblies on the stabilizer bar.

Position the stabilizer bar in the vehicle.

Align the stabilizer bar mounting brackets and install the attaching bolts (4). Do not tighten the bolts at this time.

Align the stabilizer bar with the links (2) and install the link bolts and nuts.

Tighten the stabilizer bar mounting bracket bolts (4) to 41 N•m (30 ft-lbs) torque.

Tighten the stabilizer bar link bolt nuts to 61 N•m (45 ft-lbs) torque.

TRACK BARS

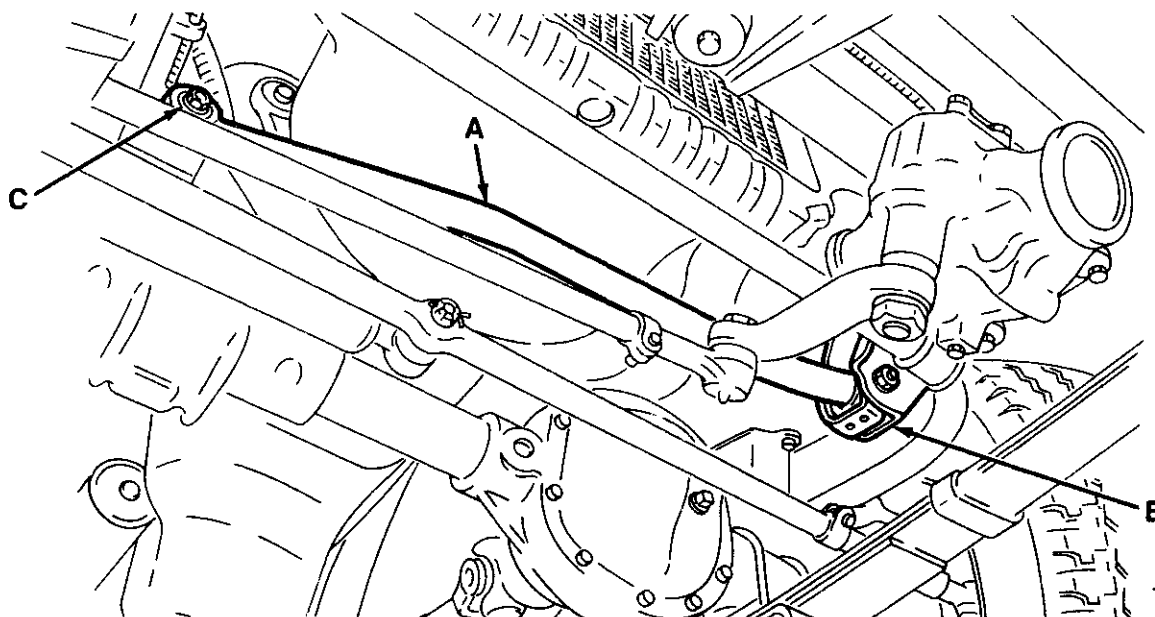
Front Track Bar Removal

Raise the vehicle.

Remove the bolt and nut that attach the track bar (A) to the frame rail bracket (B).

Remove the bolt and nut that attach the track bar to the axle bracket (C).

Remove the track bar.



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Front Track Bar Installation

Position the track bar (A) mounting eyes in the frame rail and axle brackets.

Install and tighten the track bar attaching bolts and nuts to 100 N•m (74 ft-lbs) torque.

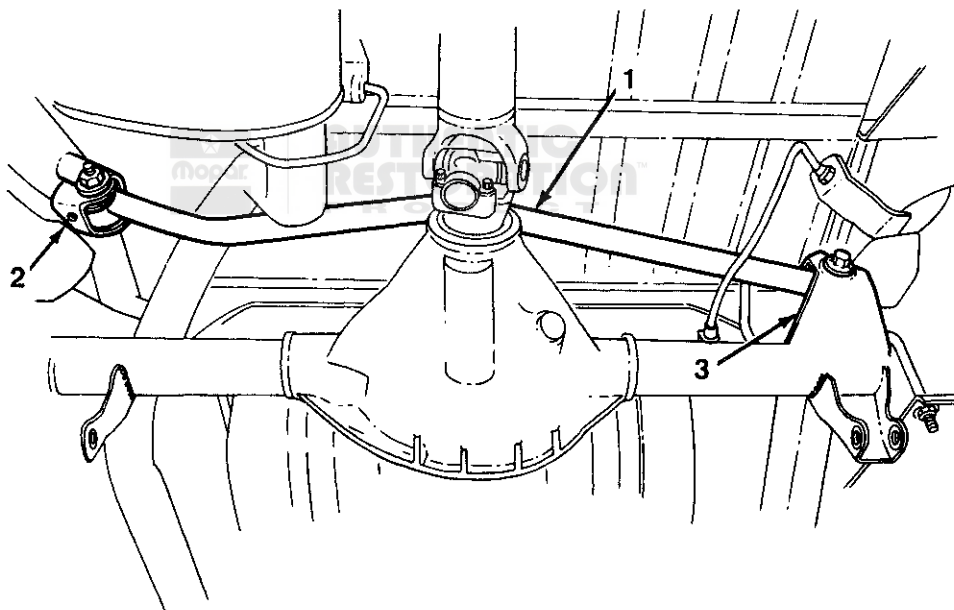
Remove the bolt and nut that attach the track bar (1) to the frame rail bracket (2).

Remove the bolt and nut that attach the track bar to the axle bracket (3).

Remove the track bar.

Rear Track Bar Removal

Raise the vehicle.



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Rear Track Bar Installation

Position the track bar (1) mounting eyes in the frame rail and axle brackets (2 and 3).

Install and tighten the track bar attaching bolts and nuts to 100 N•m (74 ft-lbs) torque.

FRONT SPRINGS

Front Spring Removal

Raise the vehicle.

Remove one or both front wheels as necessary.

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Raise the front axle enough to relieve the springs of axle weight.

Loosen, but do not remove the stabilizer bar link nut (A).

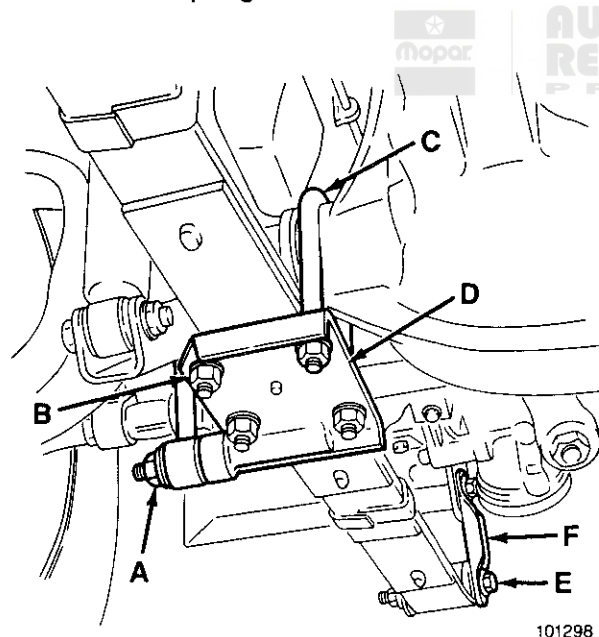
Remove the front spring U-bolt nuts (B) and remove the U-bolts (C).

Move the spring tie plate (D) aside.

Remove the bolt (E) that attaches the spring front eye to the front shackle (F).

Remove the bolt that attaches the spring rear eye to the frame bracket.

Remove the spring.



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Front Spring Installation

Position the spring in the frame bracket and front shackle.

Install, but do not tighten the bolts that attach the spring to the frame bracket and front shackle.

Align the front spring center bolt with the locating hole in the front axle.

Lower the front axle until it is fully supported by the spring.

NOTE: Be sure the spring center bolt is seated in the axle locating hole. Realign the center bolt and locating hole if necessary.

Install the tie plate (D), U-bolts (C) and U-bolt nuts (B).

Tighten the U-bolt nuts to 122 N•m (90 ft-lbs) torque.

Tighten the stabilizer bar link nut (A) to 61 N•m (45 ft-lbs) torque.

Install the wheels. Tighten the wheel nuts to 102 N•m (75 ft-lbs) torque.

Remove all supports and lower the vehicle.

Tighten the front shackle bolt (E) to 129 N•m (95 ft-lbs) torque.

Tighten the spring rear eye-to-frame bracket bolt to 142 N•m (105 ft-lbs) torque.

REAR SPRINGS

Rear Spring Removal

Raise the vehicle.

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Remove one or both rear wheels as necessary.

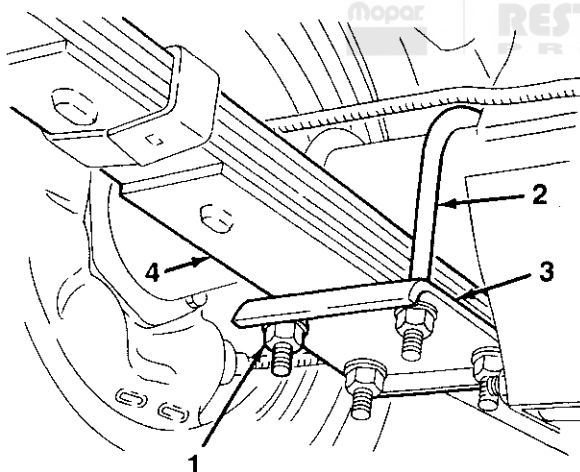
Raise the rear axle enough to relieve the rear springs of axle weight.

Disconnect the rear shock at the axle bracket.

Remove the U-bolt nuts (1) and remove the U-bolts (2) and the spring tie plate (3).

Remove the bolts attaching the rear spring (4) to the shackle and frame bracket.

Remove the spring.



101299

Rear Spring Installation

Position the spring in the shackle and frame bracket.

Install but do not tighten the bolts that attach the spring to the shackle and frame bracket.

Align the rear spring center bolt with the locating hole in the rear axle.

Lower the rear axle until it is fully supported by the spring.

NOTE: Be sure the spring center bolt is seated in the axle locating hole. Realign the center bolt and locating hole if necessary.

Install the tie plate (3), U-bolts (2) and U-bolt nuts (1).

Tighten the U-bolt nuts to 122 N•m (90 ft-lbs) torque.

Connect the shock absorber to the axle bracket. Tighten the shock retaining nut to 60 N•m (44 ft-lbs) torque.

Install the wheels. Tighten the wheel nuts to 102 N•m (75 ft-lbs) torque.

Remove all supports and lower the vehicle.

Tighten the rear spring shackle bolt to 129 N•m (95 ft-lbs) torque.

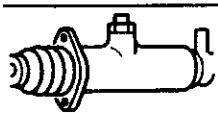
Tighten the rear spring eye-to-frame bracket bolt to 142 N•m (105 ft-lbs) torque.

SPRING BUSHING REPLACEMENT

The front and rear spring eye bushings are serviceable components.

Special tools are not required to remove or install the bushings. Once the spring is removed, the bushings can be replaced using an arbor press and a suitable size socket and length of pipe as bushing drivers.

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BRAKE SYSTEM

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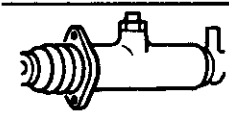
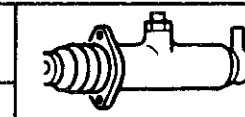
	BRAKE SYSTEM SPECIFICATIONS	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque
Caliper Brake Hose Fitting	31 N·m (23 ft-lbs)
Wheel Cylinder Mounting Bolts	15 N·m (132 in-lbs)
Master Cylinder Brakeline Fittings	20 N·m (180 in-lbs)
Valve Fittings	15 N·m (132 in-lbs)
Caliper Mounting Pins	34-47 N·m (25-35 ft-lbs)
Caliper Anchor Bracket-to-Steering Knuckle Bolts	105 N·m (77 ft-lbs)
Wheel Nuts	102 N·m (75 ft-lbs)
Parking Brake Pedal Assembly-to-Dash Bolt	10 N·m (7 ft-lbs)
Parking Brake Pedal Assembly Stud Nuts	15 N·m (11 ft-lbs)
Master Cylinder Attaching Nuts	13-25 N·m (115-220 in-lbs)
Wheel Cylinder Fitting	15 N·m (132 in-lbs)
Wheel Cylinder Attaching Bolts	10 N·m (90 in-lbs)
Wheel Lug Nuts	102 N·m (75 ft-lbs)

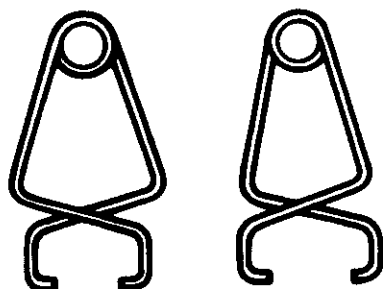
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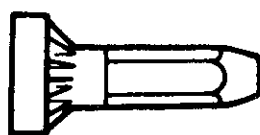
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SPECIAL TOOLS

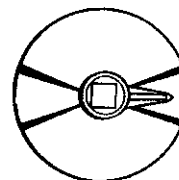
Tool Ref.	Description
J8002	Wheel Cylinder Clamps
J33028	Caliper Piston Dust Boot Installer
J34651-A	Parking Brake Cable Adjustment Gauge
J8057	Brake Spring Tool
J21177	Drum-to-Brakeshoe Clearance Gauge



J8002



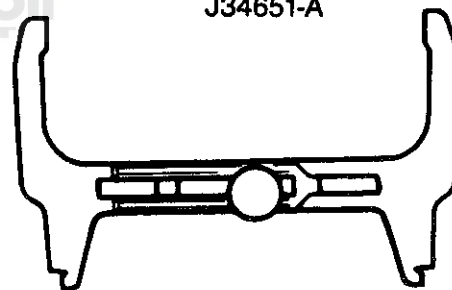
J33028



J34651-A



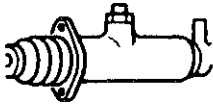
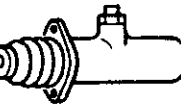
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J21177

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	BRAKE SYSTEM DIAGNOSIS	
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GENERAL DIAGNOSIS INFORMATION

Brake system diagnosis procedures are outlined in the diagnosis guides and charts.

Diagnosis Guides

The procedures in Diagnosis Guides A and B are the beginning diagnostic steps. Use them to determine if a malfunction is related to the mechanical/hydraulic portion of the system, or to the vacuum brake booster portion of the system.

Guide A checks the mechanical/hydraulic portion of the system. Guide B checks the vacuum booster portion of the system. Both guides are used in conjunction with a road test.

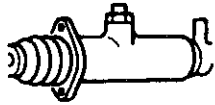
Diagnosis Charts

The diagnosis charts describe specific conditions and the possible causes of the condition. Necessary corrective actions are also described.



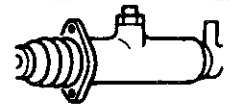
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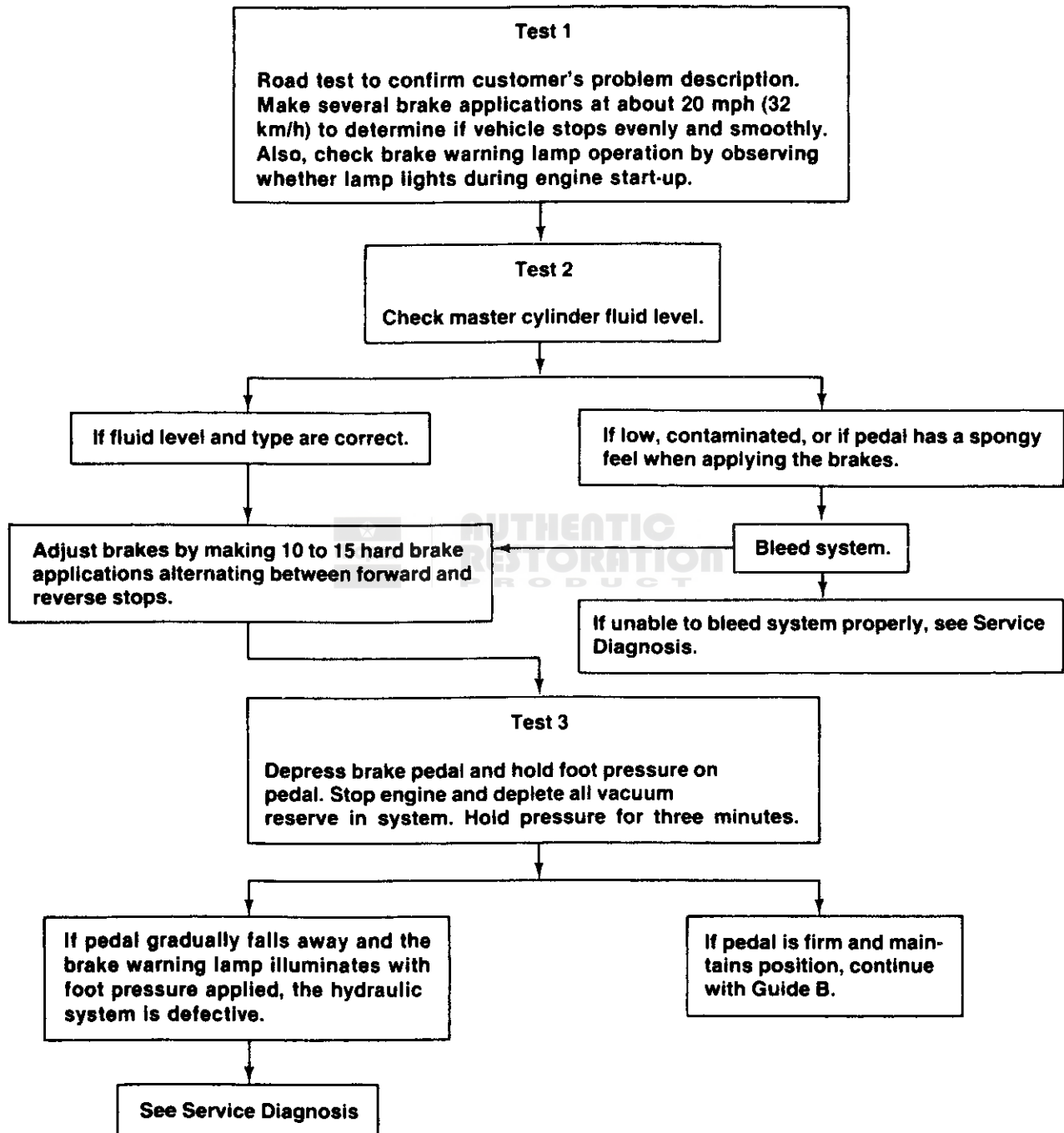


BRAKE SYSTEM

DIAGNOSIS



BRAKE DIAGNOSIS GUIDE A

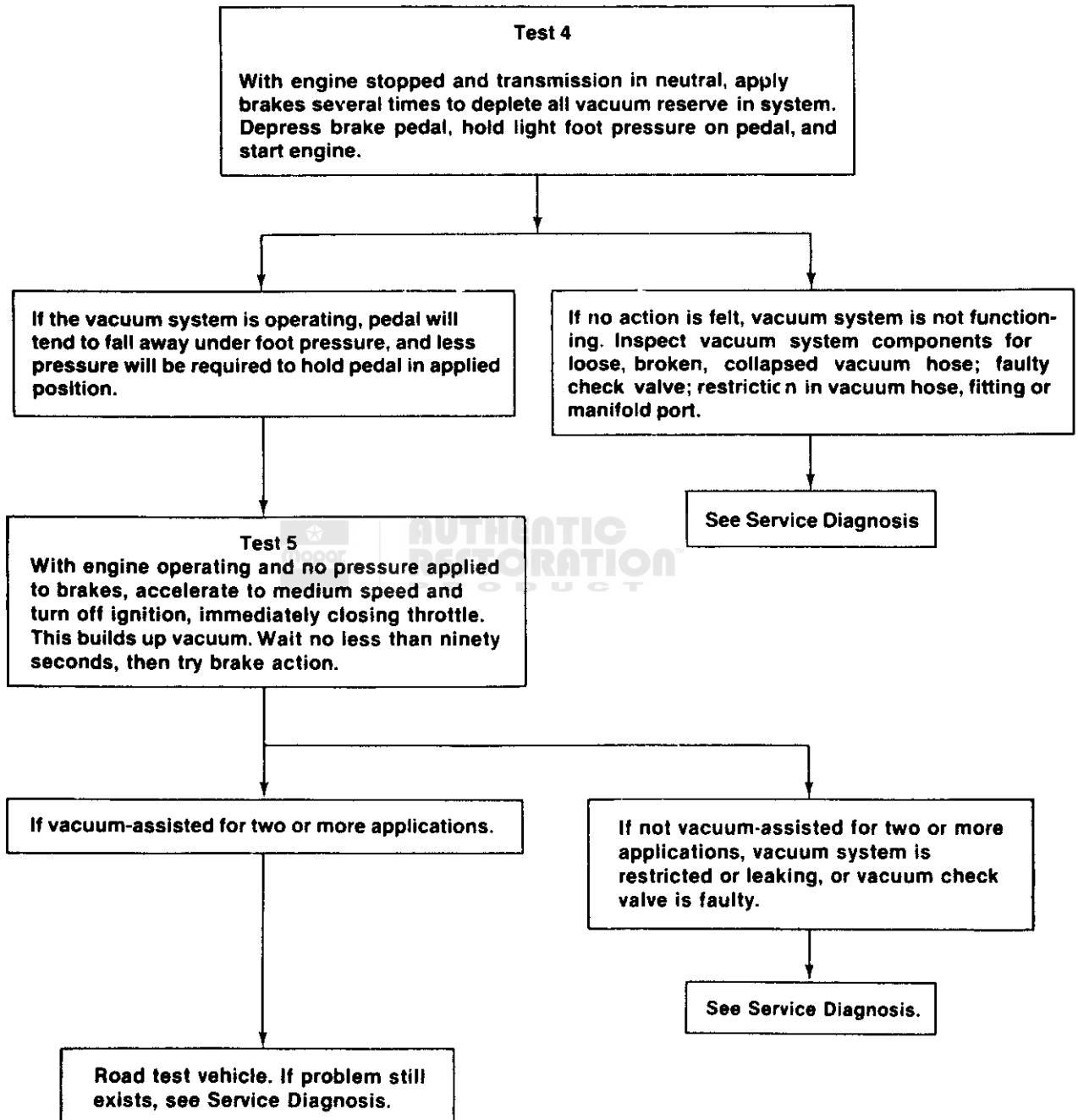


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BRAKE DIAGNOSIS GUIDE B



SEE I.S. NOTES

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A. LOW BRAKE PEDAL — (Excessive pedal travel required for braking action.)

POSSIBLE CAUSES

- (1) Worn pads or brakelining.
- (2) Worn rotors or drums.
- (3) Rear brake adjustment incorrect.
- (4) Caliper pistons not retracting.

CORRECTION

- (1) Inspect and replace pads and lining if beyond minimum thickness specification.
- (2) Replace if worn beyond specifications.
- (3) Make 10 to 15 alternate forward and reverse brake stops to adjust brakes. If brake pedal does not come up, repair or replace rear brake parts as necessary.
- (4) Replace worn rotor or pads. Overhaul caliper if piston is sticking or seal leakage has occurred.

101342A

B. LOW BRAKE PEDAL — (Pedal may go to floor with steady pressure applied.)

POSSIBLE CAUSES

- (1) Low fluid level or fluid leak in hydraulic system.
- (2) Air in hydraulic system.
- (3) Sub-standard brake fluid (fluid boils off at normal brake operating temperatures).
- (4) Master cylinder piston seals worn, or master cylinder bore is scored, worn or corroded.

CORRECTION

- (1) Fill master cylinder. Have helper apply brakes and check calipers, wheel cylinders, differential valve tubes, hoses and fittings for leaks. Repair or replace as necessary.
- (2) Bleed the brakes.
- (3) Flush hydraulic system. Refill with correct fluid.
- (4) Repair or replace master cylinder.

101342B

C. LOW BRAKE PEDAL — (Pedal low on first application — O.K. on subsequent applications.)

POSSIBLE CAUSES

- (1) Low fluid level.
- (2) Disc brake pads sticking on abutment surfaces of anchor plate. Caused by a build-up of dirt, rust, or corrosion on abutment surfaces.

CORRECTION

- (1) Add fluid. Check for leaks.
- (2) Clean abutment surfaces.

101342C

D. FADING BRAKE PEDAL — (Pedal height decreases with steady pressure applied.)

POSSIBLE CAUSES

- (1) Fluid leak in hydraulic system.
- (2) Master cylinder caliper, or wheel cylinder seals worn, or bore is scored, worn or corroded.

CORRECTION

- (1) Fill master cylinder reservoirs. Have helper apply brakes, check calipers, wheel cylinders, differential valve, tubes, hoses, and fittings for fluid leaks. Repair or replace parts as necessary.
- (2) Repair or replace as necessary.

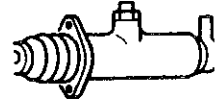
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E. DECREASING BRAKE PEDAL TRAVEL — (Pedal travel required for braking action decreases and may result in hard pedal.)

POSSIBLE CAUSES

- (1) Caliper or wheel cylinder pistons sticking or seized.
- (2) Master cylinder inlet ports blocked (preventing fluid return to reservoirs) or pistons sticking or seized in master cylinder bore.
- (3) Power brake unit malfunction.

CORRECTION

- (1) Repair or replace the calipers, or wheel cylinders.
- (2) Repair or replace the master cylinder.
- (3) Test unit as follows:
 - (a) Shift transmission into neutral and start engine.
 - (b) Increase engine speed to 1500 rpm, close throttle and fully depress brake pedal.
 - (c) Slowly release brake pedal and stop engine.
 - (d) Have helper remove vacuum check valve and hose from booster. Check for rearward movement of brake pedal.
 - (e) If the pedal moves rearward, booster has malfunctioned — replace booster.



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101342E

F. SPONGY BRAKE PEDAL — (Pedal has soft, springy, spongy feel when pressed.)

POSSIBLE CAUSES

- (1) Air in hydraulic system.
- (2) Rear brakeshoes bent or distorted.
- (3) Rear drum brakes not properly adjusted.
- (4) Rear drums worn beyond specification.

CORRECTION

- (1) Bleed brakes.
- (2) Replace brakeshoes.
- (3) Adjust rear brakes.
- (4) Replace drums.

101342F

G. HARD BRAKE PEDAL — (Excessive pedal pressure required to stop vehicle. May be accompanied by brake fade.)

POSSIBLE CAUSES

- (1) Loose or leaking booster vacuum hose.
- (2) Incorrect or poor quality brakelining.
- (3) Bent, broken, distorted brakeshoes.
- (4) Calipers binding or dragging on mounting pins. Rear brakeshoes dragging on support plate.

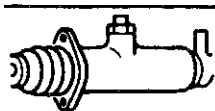
CORRECTION

- (1) Tighten connections or replace leaking hose.
- (2) Replace lining.
- (3) Replace brakeshoes.
- (4) Replace mounting pins and bushings. Clean rust or burrs from rear brake support plate ledges and lubricate ledges with molydisulfide grease.

NOTE: If ledges are deeply grooved or scored, do not attempt to sand or grind them smooth — replace support plate.

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BRAKE SYSTEM

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G. HARD BRAKE PEDAL — (cont'd.)

POSSIBLE CAUSES

- (5) Caliper, wheel cylinder, or master cylinder pistons sticking or seized.
- (6) Booster vacuum check valve malfunction.

CORRECTION

- (5) Repair or replace as necessary.
- (6) Test valve as follows:
 - (a) Start engine, increase engine speed to 1500 rpm, close throttle and immediately stop engine.
 - (b) Wait at least 90 seconds then depress brake pedal.
 - (c) If brakes are not vacuum assisted for 2 or more applications, check valve is faulty.
- (7) Power brake booster has internal bind.
 - (7) Test unit as follows:
 - (a) With engine stopped, apply brakes several times to exhaust all vacuum in system.
 - (b) Shift transmission into neutral, depress brake pedal and start engine.
 - (c) If pedal height decreases with foot pressure and less pressure is required to hold pedal in applied position, booster vacuum system is operating normally. Test booster as outlined in item E, Decreasing Brake Pedal Travel. If booster exhibits a bind condition, replace the unit.
- (8) Master cylinder inlet ports blocked by dirt, scale, rust, or have small burrs (blocked ports prevent fluid return to reservoirs.)
 - (8) Repair or replace master cylinder.
- (9) Brake hoses, tubes, fittings clogged or restricted.
 - (9) Use compressed air to check or unclog parts. Replace any damaged parts.
- (10) Brake fluid contaminated with improper fluids (motor oil, transmission fluid, causing rubber components to swell and stick in bores.)
 - (10) Replace all rubber components, combination valve and hoses. Flush entire brake system with DOT 3 brake fluid or equivalent.
- (11) Low engine vacuum.
 - (11) Adjust or repair engine.

101342G

H. GRABBING BRAKES

POSSIBLE CAUSES

- (1) Brakelining or pads contaminated by grease or brake fluid.
- (2) Parking brake cables incorrectly adjusted or seized.
- (3) Incorrect pads or brakelining or lining loose on brakeshoes.
- (4) Caliper anchor plate bolts loose.

CORRECTION

- (1) Determine and correct cause of contamination and replace brakeshoes in axle sets.
- (2) Adjust cables. Replace seized cables.
- (3) Replace pads or lining in axle sets.
- (4) Tighten bolts.

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H. GRABBING BRAKES — (cont'd.)

POSSIBLE CAUSES	CORRECTION
(5) Rear brakeshoes binding on support plate ledges.	(5) Clean and lubricate ledges. Replace support plate(s) if ledges are deeply grooved. Do not attempt to smooth ledges by grinding. Replace the plates.
(6) Rear brake support plates loose.	(6) Tighten mounting bolts.

101342H

I. DRAGGING BRAKES — (Slow or incomplete release of brakes.)

POSSIBLE CAUSES	CORRECTION
(1) Brake pedal binding at pivot.	(1) Loosen and lubricate. Replace pedal bushings if damaged.
(2) Power brake booster has internal bind.	(2) Inspect for internal bind as outlined in item E, Decreasing Brake Pedal Travel. Replace unit if internal bind exists.
(3) Parking brake cables incorrectly adjusted or seized.	(3) Adjust cables. Replace seized cables.
(4) Rear brakeshoe return springs weak or broken.	(4) Replace return springs. Replace brakeshoe if necessary in axle sets.
(5) Automatic adjusters malfunctioning.	(5) Repair or replace adjuster parts as required.
(6) Caliper, wheel cylinder or master cylinder pistons sticking or seized.	(6) Repair or replace parts as necessary.
(7) Master cylinder compensating ports blocked (fluid does not return to reservoirs).	(7) Use compressed air to clear ports. Do not use wire, pencils, or similar objects to open blocked ports.

101342J

J. VEHICLE PULLS WHEN BRAKES ARE APPLIED

POSSIBLE CAUSES	CORRECTION
(1) Incorrect front tire pressure.	(1) Inflate to recommended cold inflation pressure.
(2) Worn or damaged wheel bearings.	(2) Replace worn or damaged bearings.
(3) Brakelining on one side contaminated.	(3) Determine and correct cause of contamination and replace brakelining in axle sets.
(4) Brakeshoes on one side bent, distorted, or lining loose on shoe.	(4) Replace brakeshoes in axle sets.
(5) Rear brake support plate bent or loose on one side.	(5) Tighten or replace support plate.
(6) Caliper anchor plate loose on one side.	(6) Tighten anchor plate bolts.
(7) Caliper piston sticking or seized.	(7) Repair or replace caliper.
(8) Brakelinings water soaked.	(8) Drive vehicle with brakes lightly applied to dry linings.
(9) Loose suspension component attaching or mounting bolts.	(9) Tighten suspension bolts. Replace worn suspension components.

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	BRAKE SYSTEM DIAGNOSIS	
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K. CHATTER OR SHUDDER WHEN BRAKES ARE APPLIED — (Pedal pulsation and roughness may also occur.)

POSSIBLE CAUSES

- (1) Brakeshoes distorted, bent, contaminated, or worn.
- (2) Caliper anchor plate or support plate loose.
- (3) Excessive runout or thickness variation of disc brake rotors.

CORRECTION

- (1) Replace brakeshoes in axle sets.
- (2) Tighten mounting bolts.
- (3) Refinish or replace rotors.

101342L

L. NOISY BRAKES — (Squealing, clicking, scraping sound when brakes are applied.)

POSSIBLE CAUSES

- (1) Bent, broken, distorted brakeshoes.
- (2) Rust on rotor braking surface.
- (3) Worn brakelining — shoes contacting drum or rotor.
- (4) Broken or loose holdown or return springs.
- (5) Rough or dry drum brake support plate ledges.
- (6) Cracked, grooved, or scored rotor(s) or drum(s).
- (7) Incorrect brakelining and/or shoes (front or rear.)

CORRECTION

- (1) Replace brakeshoes in axle sets.
- (2) Refinish or replace rotor.
- (3) Replace lining in axle sets. Refinish or replace drums or rotors.
- (4) Replace as necessary.
- (5) Lubricate support plate ledges.
- (6) Replace rotor(s) or drum(s). Replace brakeshoes and lining in axle sets if necessary.
- (7) Install specified shoe and lining assemblies.

101342M

M. PULSATING BRAKE PEDAL

POSSIBLE CAUSE

- (1) Out of round drums or excessive lateral runout in disc brake rotor(s).

CORRECTION

- (1) Refinish or replace as necessary.

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BRAKE SYSTEM

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SYSTEM COMPONENTS

Wrangler/YJ models are equipped with power assisted front disc and rear drum brakes. A dual reservoir master cylinder and pressure differential valve are used in the hydraulic system. The parking brakes are actuated by a foot-operated lever assembly. A cable and equalizer mechanism connects the lever to the rear brakes.

Power brake assist is provided by a single diaphragm, vacuum operated brake booster. Pin mounted, slider-type disc brake calipers are used at the front and self adjusting drum brake assemblies are used at the rear.

BRAKE FLUID

Use JEEP brake fluid or an equivalent that meets SAE standard J 1703F and is graded DOT 3 or DOT 4. This is the only type of brake fluid recommended for use in Wrangler/YJ models.

BRAKE FLUID LEVEL

The correct master cylinder fluid level is to within 6 mm (1/4 in) of the reservoir rim. Use the recommended brake fluid only and do not overfill the reservoir.

CAUTION: Avoid contaminating the brake fluid. Always clean off the master cylinder and cover

before checking fluid level or filling the reservoir.

MASTER CYLINDER REMOVAL

Disconnect the brake lines at the master cylinder. Cap the lines to prevent dirt entry.

Remove the nuts that attach the master cylinder to the brake booster mounting studs and remove the cylinder.

MASTER CYLINDER OVERHAUL

Remove the cylinder cover and drain the fluid from the reservoirs.

Inspect the rubber diaphragm in the cover. Replace the diaphragm if cut, torn or damaged in any way.

Press the primary piston (2) inward and remove the snap ring (2).

Remove and discard the primary piston (2).

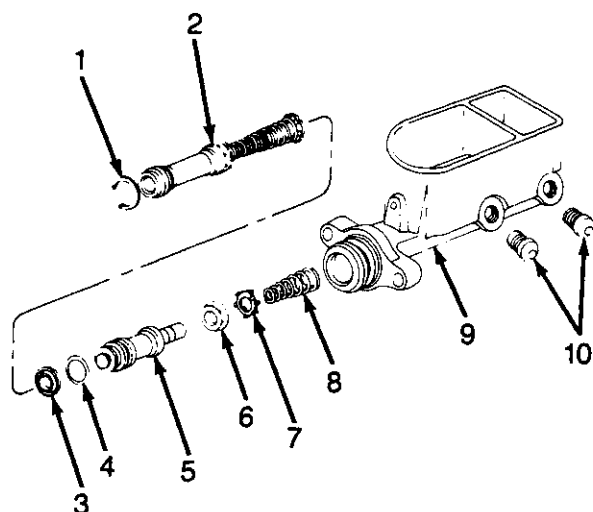
Remove the secondary piston (5) and spring (8). Apply air pressure through the cylinder rear outlet port to push the piston and spring out.

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BRAKE SYSTEM

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Remove and discard seals (3) and (4) from the secondary piston.

Remove the rear seal (6), spring (8) and retainer (7) from the secondary piston. Discard the seal.

Inspect the outlet port tube seats (10). Replace the seats if loose or damaged as follows:

- Enlarge the hole in the seats with a 5 mm (13/64 in) drill bit.
- Place a flat washer on each outlet port and thread a 1/4 - 20 by three quarter inch long screw into each tube seat.
- Tighten the screw until the seat is loose. Then remove the screw and seat.
- Press the replacement tube seats into the outlet ports with a spare tube fitting.

Clean the master cylinder with brake cleaning fluid. Dry the cylinder with compressed air. Be sure to remove any chips generated during tube seat replacement. Replace the cylinder if the bore is scored, corroded or pitted.

Coat the master cylinder bore, pistons and seals with clean brake fluid.

Install replacement seals (3), (4) and (6) on the secondary piston.

CAUTION: Be sure the lip of seal (3) faces forward and the lip of seal (6) faces rearward.

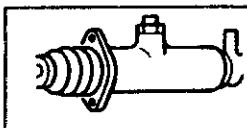
Install the retainer (7) and spring (8) on the secondary piston and install the piston assembly in the cylinder.

Install the replacement primary piston assembly (2) and install the snap ring (1).

Bleed the master cylinder as follows:

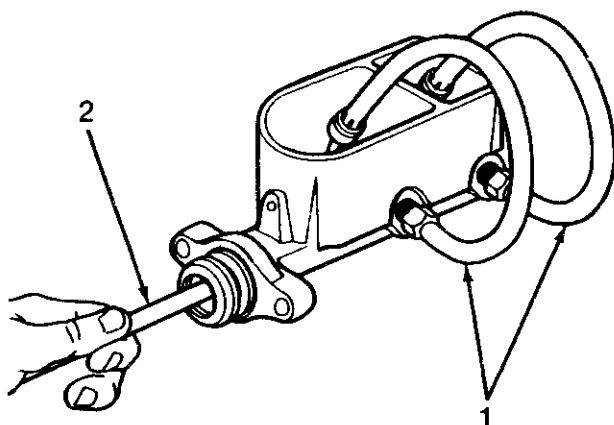
- Mount the cylinder in a vise and fill the reservoirs.
- Fabricate and install two bleed tubes (1) and install them in the outlet ports.
- Slowly compress the pistons with a dowel rod (2). Then allow the pistons to return under normal spring pressure. Continue this operation until air bubbles no longer appear in the brake fluid.

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- Remove the bleed tubes and cap the outlet ports.
- Install the cylinder cover and remove the cylinder from the vise.

MASTER CYLINDER INSTALLATION

Position the master cylinder on the booster mounting studs.

Install and tighten the cylinder attaching nuts.

Connect the brakelines to the master cylinder.

Wipe the cylinder cover clean then remove it.

Fill the cylinder reservoirs to within 6 mm (1/4 in) of the rims and reinstall the cylinder cover.

Check brake operation.

BRAKE BOOSTER REMOVAL

NOTE: The brake booster is serviced as an assembly only. Do not attempt to disassemble the unit for service if a malfunction occurs.

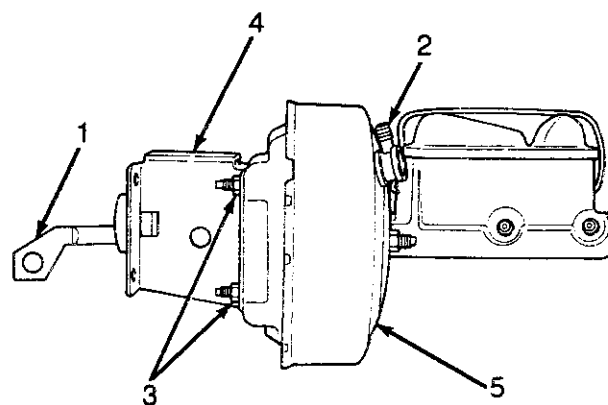
Disconnect the push rod (1) from the brake pedal.

Disconnect the booster vacuum hose from the check valve (2).

Remove the nuts attaching the master cylinder to the booster and move the cylinder away from the booster.

NOTE: It is not necessary to disconnect the brakelines from the master cylinder.

Remove the nuts (3) from the booster mounting studs and remove the booster (5) from the mounting bracket (4).



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BRAKE BOOSTER INSTALLATION

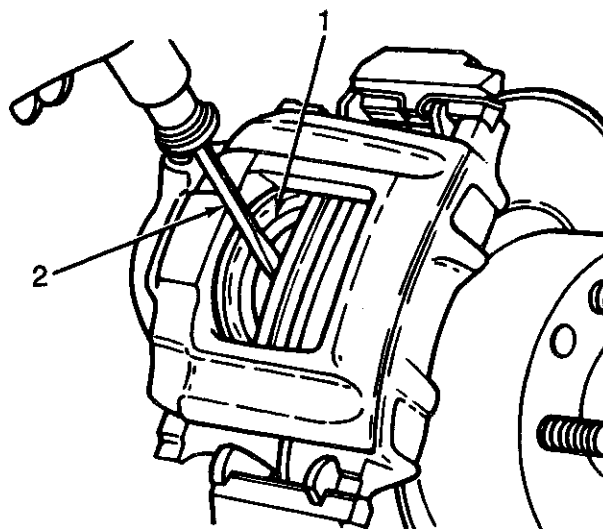
Position the booster (5) on the mounting bracket (4) and install the mounting stud nuts (3).

Connect the vacuum hose to the check valve (2).

Attach the booster push rod (1) to the brake pedal.

Install the master cylinder on the booster.

Check brake operation before moving the vehicle.



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Remove the caliper mounting pins (3).

FRONT BRAKE PAD REPLACEMENT

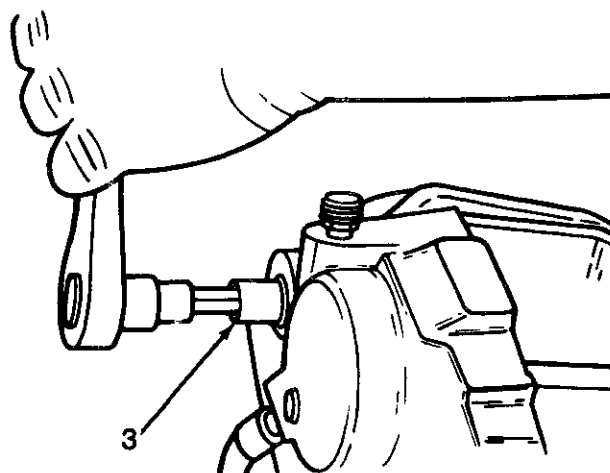
Brake Pad Removal

Remove two-thirds of the fluid from the master cylinder reservoirs. Do not drain the reservoirs completely.

Loosen the wheel nuts.

Raise the vehicle and remove the wheels.

Press the caliper piston (1) back into its bore with a C-clamp or screwdriver (2).

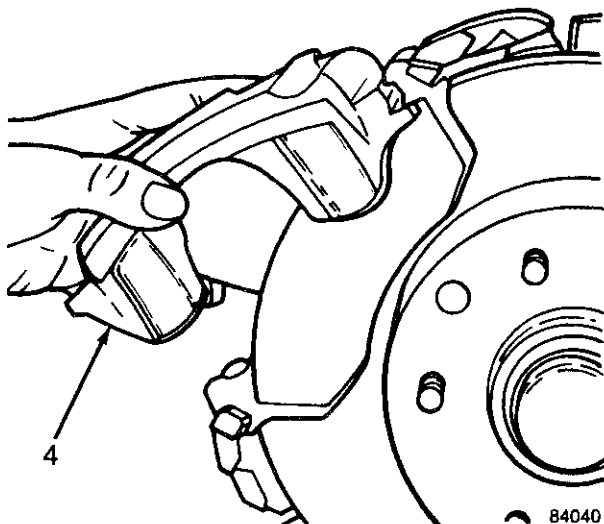


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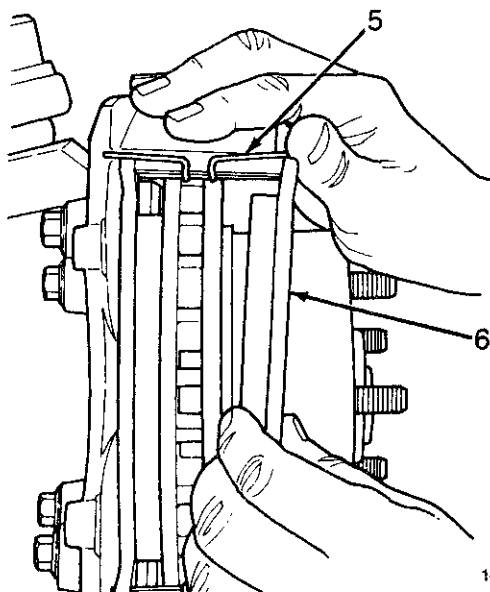
Remove the caliper (4).

CAUTION: Do not allow the brake hose to support the weight of the caliper. Tie the caliper to the body or a suspension component.

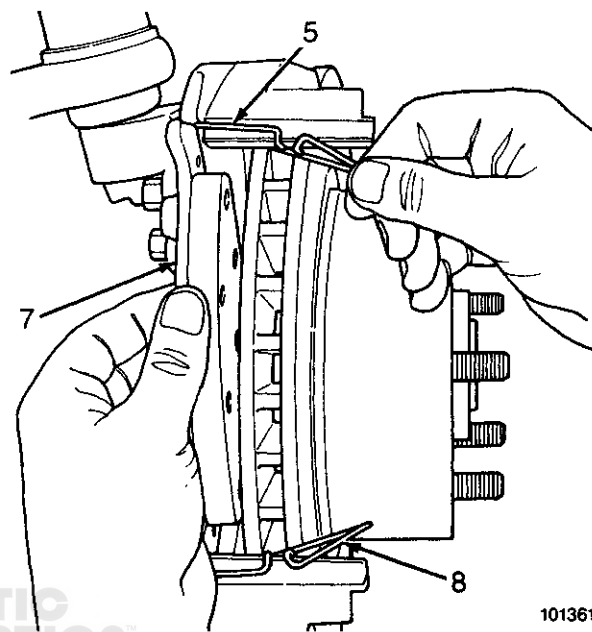
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Push the top anti-rattle spring (5) aside and remove the outboard pad (6).



Remove the inboard pad (7) and the top (5) and bottom (8) anti-rattle springs.



Brake Pad Installation

Inspect the caliper and rotor. Replace or resurface the rotor if necessary. Overhaul the caliper if it shows signs of leakage.

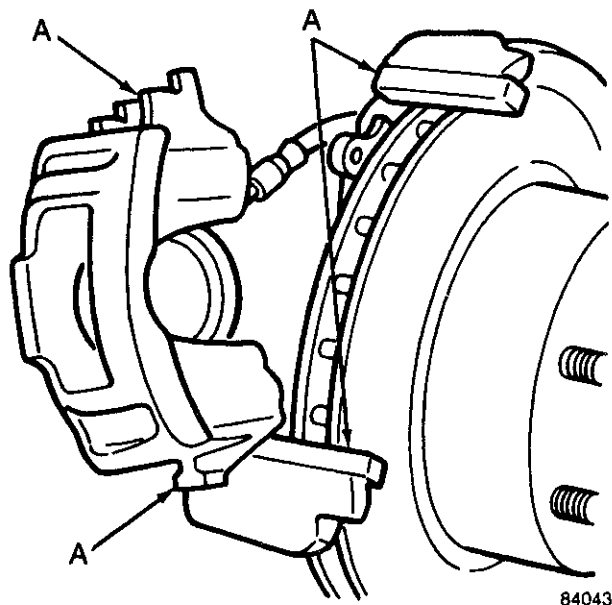
Clean the slide surfaces (A) of the caliper anchor plate with a wire brush. Then lubricate the surfaces with caliper slide surface lubricant.

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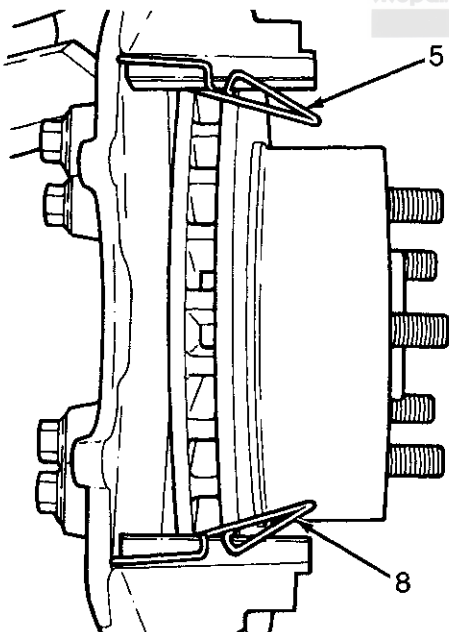
BRAKE SYSTEM

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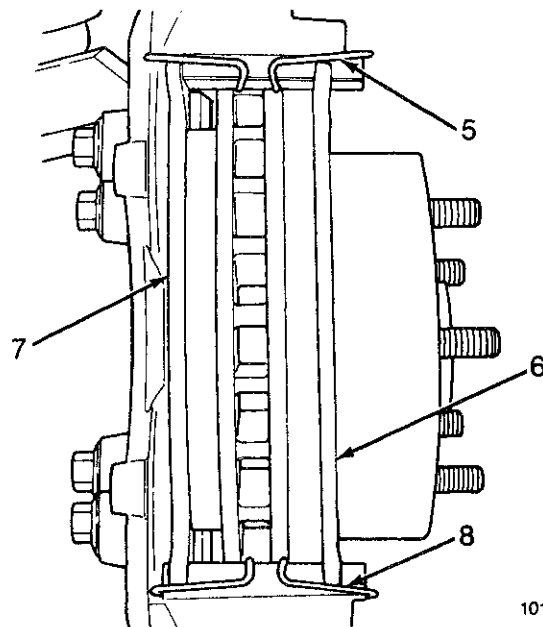
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Install the top (5) and bottom (8) anti-rattle springs.



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Install the inboard brake pad (7) and the outboard brake pad (6).



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Check position of the anti-rattle springs (5) and (8). Be sure they are seated and the spring ends in contact with the pad mounting ears.

CAUTION: Avoid damaging the caliper piston dust boot when installing the caliper. If the boot is cut or torn, the piston will be exposed to dirt and moisture from normal road splash.

Install the caliper on the anchor plate.

Install the caliper mounting pins (3).

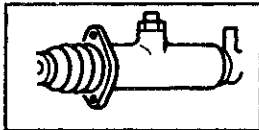
Clean and remove the master cylinder cover.

Fill the master cylinder reservoirs to the specified level.

Pump the brake pedal several times to seat the brake pads. Then top off the master cylinder reservoirs and install the cover.

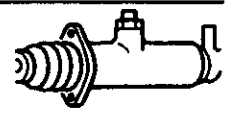
Install the wheels and lower the vehicle.

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Check brake operation before moving the vehicle.

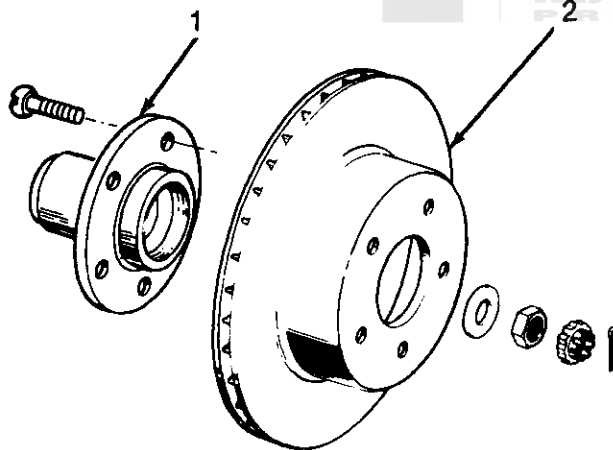
FRONT BRAKE ROTOR REMOVAL

Loosen the wheel nuts and raise the vehicle.

Remove the wheel and front caliper. Do not disconnect the brake hose from the caliper.

CAUTION: Do not allow the brake hose to support the weight of the caliper. Tie the caliper to the body or a suspension component.

Remove the rotor (2) from the hub (1).



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FRONT BRAKE ROTOR INSTALLATION

Clean the mounting surfaces of the hub (1) and rotor (2) and mount the rotor on the hub.

Install the caliper and wheel.

Lower the vehicle and check brake operation.

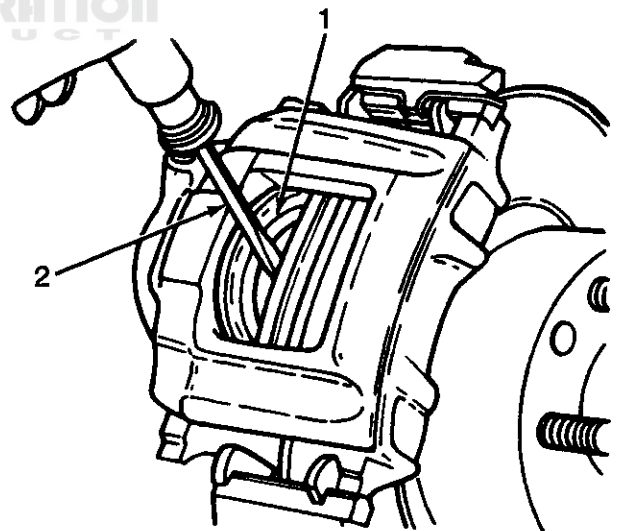
FRONT BRAKE CALIPER REMOVAL

Drain two-thirds of the brake fluid from the master cylinder reservoirs.

Loosen the wheel nuts and raise the vehicle.

Remove the wheels.

Press the caliper piston (1) back into its bore with a C-clamp or screwdriver (2).



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Disconnect the brake hose from the caliper. Discard the seal washer used between the hose and caliper fittings.

Remove the caliper mounting pins (3) and remove the caliper.

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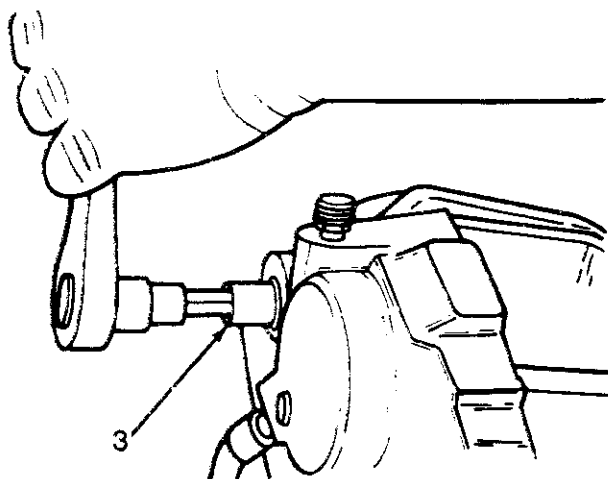


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CAUTION: Do not allow the brake hose to support the weight of the caliper. Tie the caliper to the body or a suspension component.



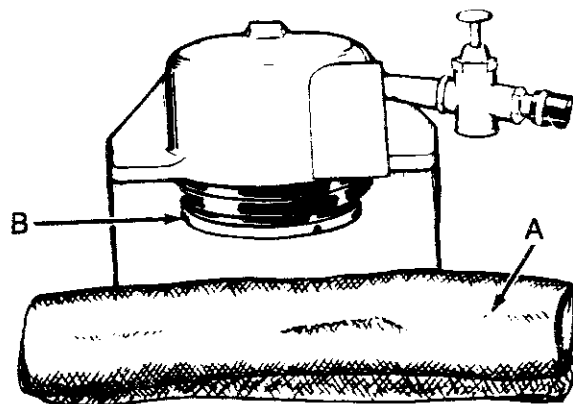
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FRONT BRAKE CALIPER OVERHAUL

Drain the fluid from the caliper and position shop towels (A) under the caliper piston (B).

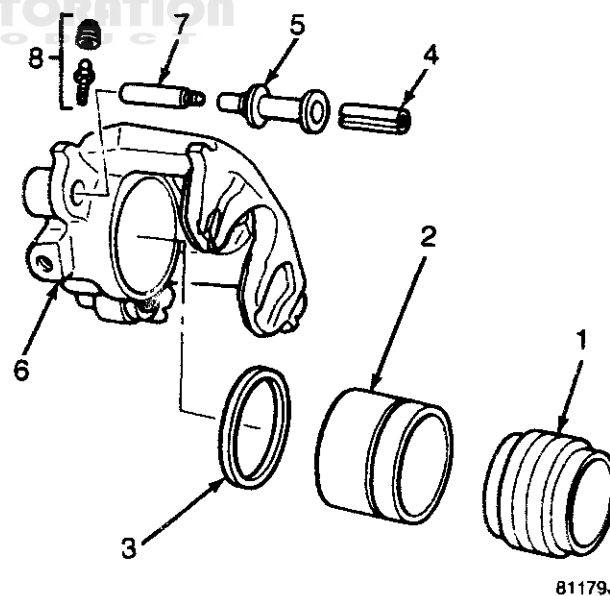
Remove the caliper piston (B) with compressed air. Apply small amounts of compressed air through the fluid inlet port to ease the piston out of the bore.

WARNING: Do not attempt to catch the piston as it comes out of the bore and do not use full line air pressure to remove the piston.



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Remove and discard the piston dust boot (1).



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Remove and discard the caliper piston seal (3).

Remove the inner (5) and outer (4) bushings from the caliper (6).

Clean the caliper components with brake cleaner. Dry the caliper and piston with compressed air.

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Inspect the caliper components. Replace bushings (4) and (5), bleed screw (8) and the mounting pins (7) if corroded or damaged.

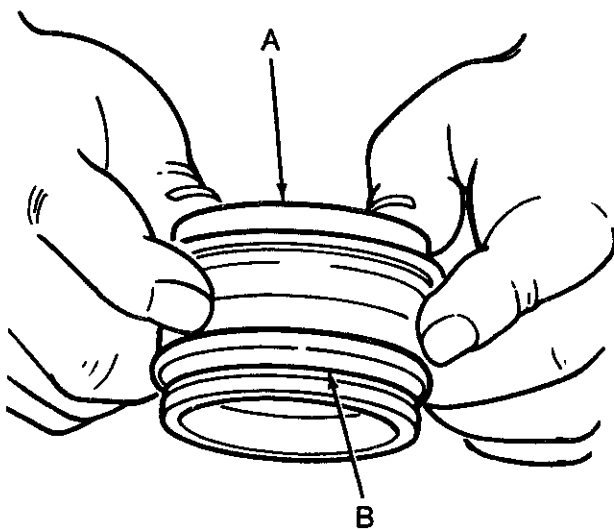
Replace the caliper piston (2) if corroded, scored or damaged in any way. Replace the caliper (6) if the piston bore is corroded, scored or damaged.

Lubricate the caliper piston bore and the caliper piston and seal with clean brake fluid.

Install the seal (3) on the piston (2).

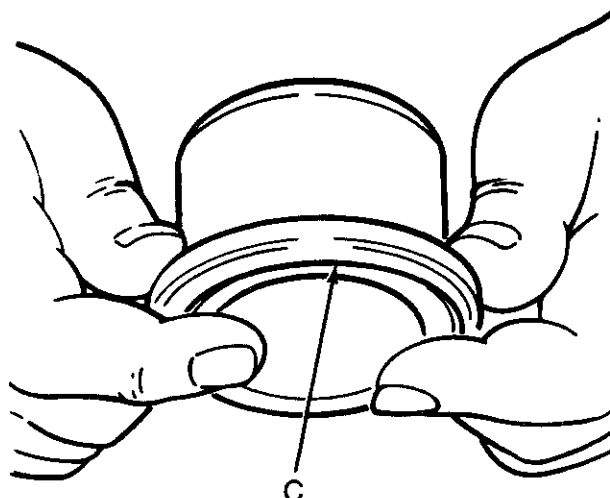
Install the dust boot (1) on the piston (2) as follows:

- Slide the metal retainer portion of the boot (A) over the piston.
- Pull the boot rearward until the boot front lip (B) seats in the piston groove.



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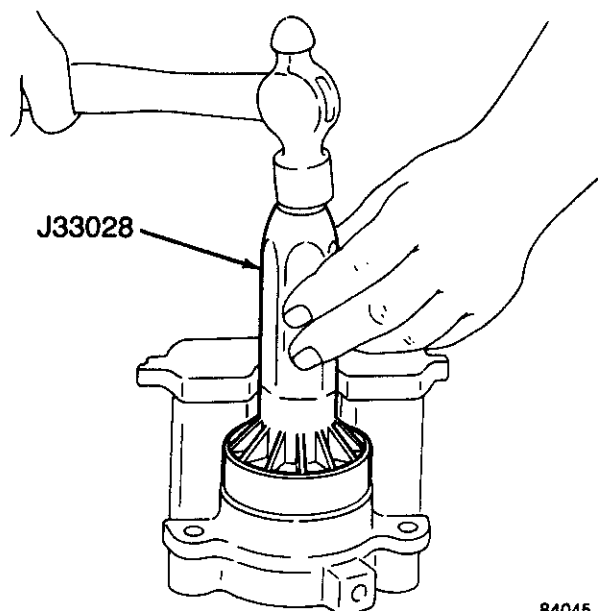
- Push the boot metal retainer (A) forward until the boot folds snap into position (C).



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Install the piston in the caliper bore with a twist and turn motion. Do not unseat the seal during installation.

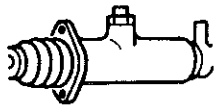
Press the piston to the bottom of the bore and seat the dust boot metal retainer with tool J 33028.



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Install the bleeder screw and cap and the inner and outer bushings.

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BRAKE SYSTEM SERVICE



FRONT BRAKE CALIPER INSTALLATION

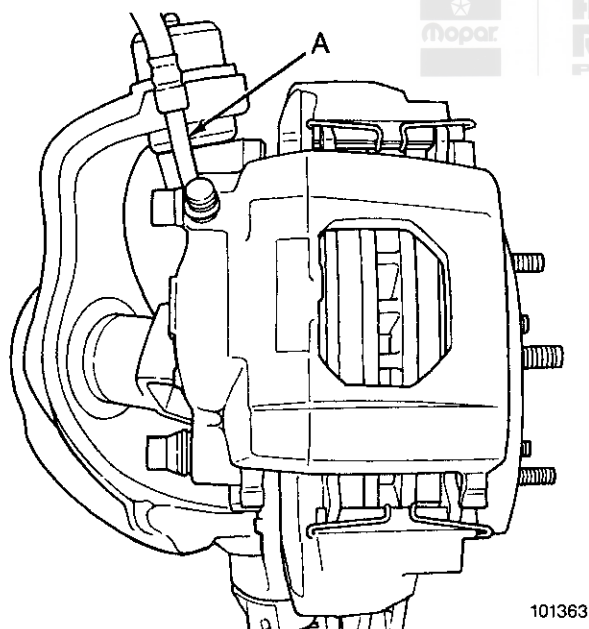
CAUTION: Avoid damaging the caliper piston dust boot when installing the caliper. If the boot is cut or torn, the piston will be exposed to dirt and moisture from normal road splash.

Install the caliper on the anchor plate.

Install and tighten the caliper mounting pins.

Position a replacement seal washer on the brake hose fitting and connect the hose to the caliper.

CAUTION: Position the brake hose (A) so it is clear of any front axle and suspension components.



Bleed the brake system. Refer to the procedure in this section.

Install the wheels and lower the vehicle.

Check brake operation before moving the vehicle.

REAR BRAKESHOE REPLACEMENT

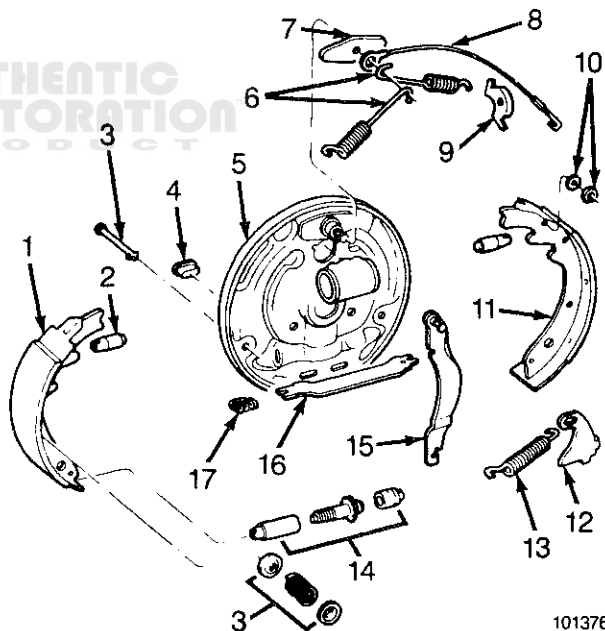
Rear Brakeshoe Removal

Raise the vehicle.

Remove the wheels and brake drums.

Install clamp J 8002 on the wheel cylinders to hold the pistons in place.

Remove the primary and secondary return springs (6) with tool J 8057.



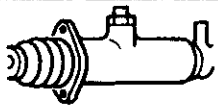
Remove the holddown springs, retainers and pins (3).

Remove the adjuster cable (8), lever (12) and spring (13).

Remove the parking brake strut (16) and spring (17).

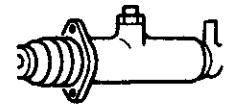
Disconnect the parking brake cable from lever.

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BRAKE SYSTEM

BRAKE SYSTEM SERVICE



Remove the primary (1) and secondary (11) brakeshoes, brakeshoe links (2) and adjuster screw assembly (14).

Remove the guide plate (7) and adjuster spring (8) from the anchor pin.

Remove the cable guide (9) from the secondary brakeshoe.

Remove the parking brake lever U-clip and washer (10) and remove the lever from the secondary brakeshoe. Discard the U-clip.

Rear Brakeshoe Installation

Lubricate the support plate ledges, anchor pins, cable guides, adjuster screw and parking brake lever pivot pin with moly grease.

Install the cable guide (9) and parking brake lever (15) on the secondary brakeshoe (11). Secure the lever with washer and replacement U-clip (10).

Remove the wheel cylinder clamps and install the links (2) in the cylinder.

Install the guide (7) and cable (8) on the anchor pin.

Install the brakeshoes (1) and (11) on the support plate (5). Secure the shoes to the support plate with replacement holddown springs, pins and retainers (3).

Attach the parking brake cable to the lever (15).

Install the strut (16) and spring (17) on the brakeshoes.

Install the adjuster screw (14), spring (13) and lever (12).

Install the primary and secondary return springs (6).

Adjust the rear brakeshoes as outlined in the Rear Brakeshoe Initial Adjustment procedure.

Install the brake drums and wheels and lower the vehicle.

Check brake operation before moving the vehicle.

REAR BRAKESHOE ADJUSTMENT

The rear brakeshoes must be adjusted whenever the shoes have been removed during service operations and before adjusting the parking brakes.

The procedure requires an initial in-shop adjustment followed by final adjustment with the vehicle in motion.

Initial adjustment can be performed with the brake drums on, or off the vehicle.

Final adjustment is performed with the vehicle in motion. It involves a series of alternating reverse and forward brake stops.

Adjustment procedures are as follows:

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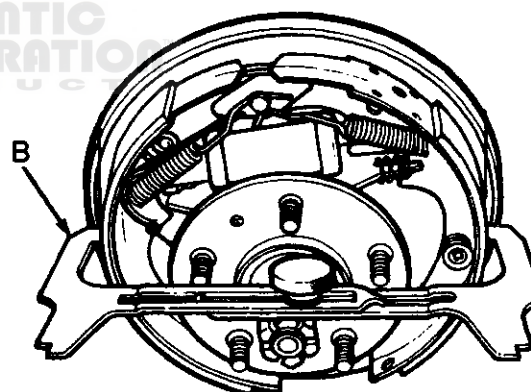
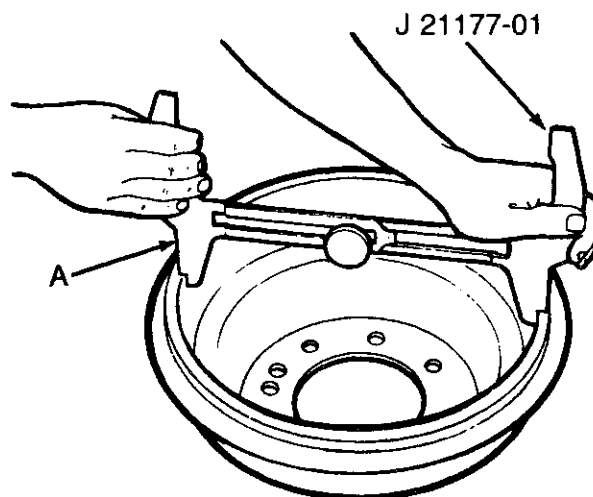


Initial Adjustment - Brake Drums Removed

Position legs (A) of brake gauge J 21177-01 in the brake drum and set the gauge to the drum diameter.

Remove the gauge from the drum and position gauge legs (B) on the brakeshoes. Then adjust the brakeshoes to the gauge legs.

NOTE: With the brake drums removed, the adjuster screw can be turned by hand. Lift the adjuster lever away from the screw and turn the screw in the required direction.



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Install the brake drums. They should be a slight drag fit on the lining.

Install the wheels and lower the vehicle.

Proceed to Final Adjustment.

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Initial Adjustment - Brake Drums Installed

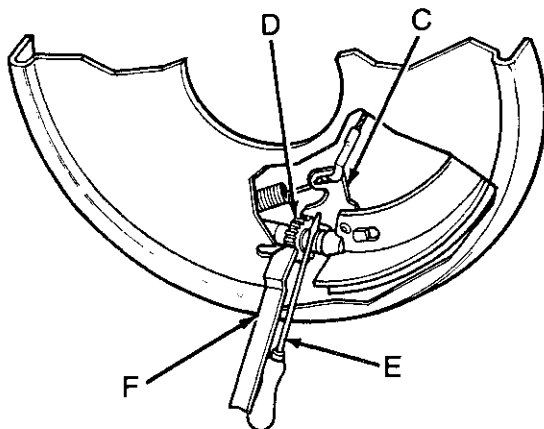
Raise the vehicle.

Remove the access slot covers from the rear of the support plates.

Unseat the adjuster lever (C) from the adjuster screw (D) with a thin blade screwdriver (E) or length of welding rod. Insert the screwdriver (E) through the access slot and hold the lever away from the screw.

Turn the adjuster screw with a brake tool (F) until the wheel cannot be rotated. Then back off the adjuster screw until the wheel rotates freely.

Install the access slot covers and lower the vehicle.



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Proceed to Final Adjustment.

Final Adjustment

Complete rear brakeshoe adjustment by making 10-15 firm brake stops while moving in Reverse gear.

Make one forward stop after each reverse stop to equalize adjustment.

Stop the vehicle completely after each brake application.

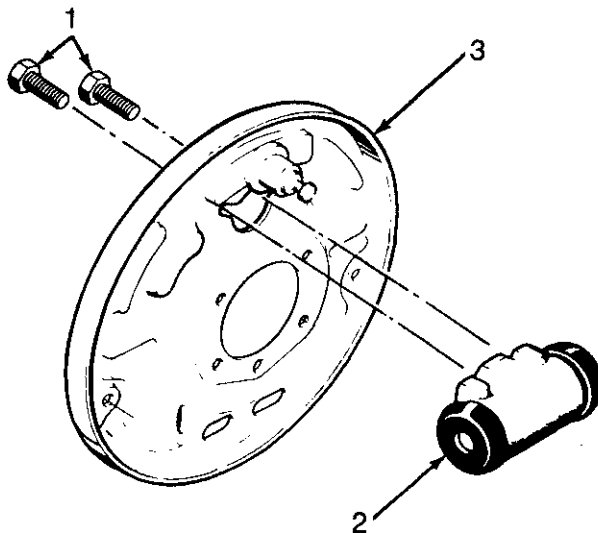
REAR WHEEL CYLINDER REMOVAL

Raise the vehicle and remove the rear wheels.

Remove the rear brakeshoes.

Disconnect the brakeline at the wheel cylinder.

Remove the bolts (1) attaching the wheel cylinder (2) to the support plate (3) and remove the cylinder.



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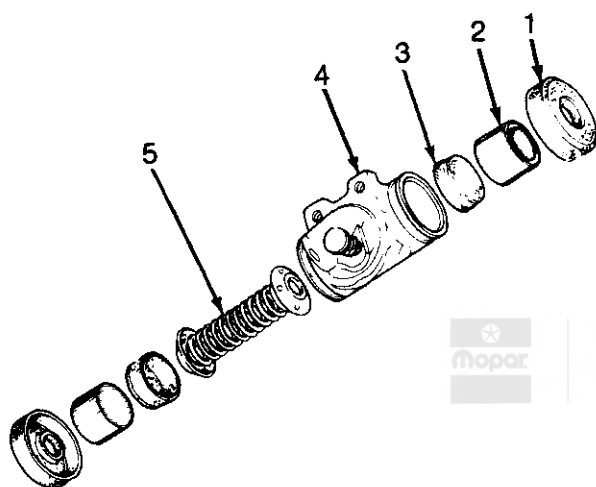
BRAKE SYSTEM SERVICE



REAR WHEEL CYLINDER OVERHAUL

Remove and discard the wheel cylinder dust boots (1).

Remove the pistons (2), piston cups (3) and the spring and expander assembly (5).



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Discard the piston cups.

Clean the cylinder, pistons and spring and expander assembly with brake cleaner.

Inspect the cylinder pistons and the cylinder bore. Replace the cylinder if the bore is corroded, pitted, scored, or damaged in any way. Replace the pistons if scored, scuffed, corroded, pitted or damaged. Also inspect and replace the cylinder bleed screw if damaged.

CAUTION: Do not attempt to recondition the cylinder bore with a hone if the bore is pitted, scored, or coated with heavy accumulations of rust, scale or corrosion. Excessive honing can make the bore oversize or out-of-round.

Coat the cylinder bore, pistons and replacement cups with clean brake fluid.

Install the spring and expander assembly (5) in the cylinder.

Install the replacement cups (3). Seat the cups against the expanders at each end of the spring.

CAUTION: Be sure the lip of each cup faces the spring and expander and the flat side faces the piston.

Install the pistons (2) and the replacement dust boots.

Install the bleed screw if removed.

REAR WHEEL CYLINDER INSTALLATION

Position the cylinder on the support plate and connect the brake line to the cylinder.

Install the wheel cylinder attaching bolts.

Tighten the brake line fitting.

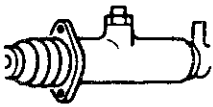
Install the brakeshoes and brake drums.

Bleed the brake system.

Install the wheels and lower the vehicle.

Check brake operation before moving the vehicle.

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PARKING BRAKE ADJUSTMENT

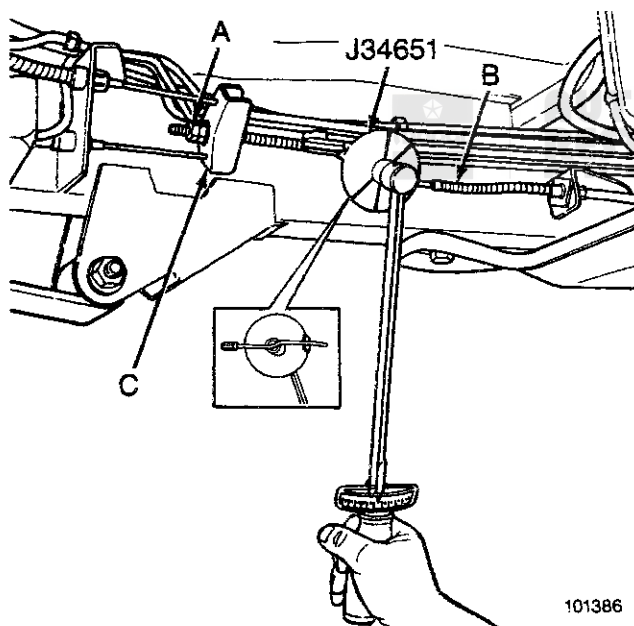
NOTE: Inspect the condition of the cables before adjustment. Replace any that are frayed or damaged.

Perform the rear brakeshoe Final Adjustment procedure outlined in this section.

Fully apply and release the parking brakes five times.

Raise the vehicle.

Loosen cable adjusting nuts (A).



Install adjusting gauge J 34651 on an inch-pound torque wrench.

Place the gauge on the parking brake lever-to-equalizer cable (B).

Apply and hold 6 N•m (50 in-lbs) rotating torque on the cable (A).

Loosen or tighten the cable nuts (A) at the equalizer (C) until the gauge pointer is in the blue band.

Tighten adjusting nuts (A) and remove the gauge.

Fully apply and release the parking brakes five times.

Recheck adjustment. Readjust if necessary and lower the vehicle.

PARKING BRAKE CABLE REPLACEMENT

Rear Cable Removal

Raise the vehicle.

Loosen the cable adjuster nuts (A) at the equalizer (C).

Remove the clamps and cotter pin attaching the rear cable (D) to the equalizer (C) and remove the cable from the equalizer.

Disconnect the rear cable locating spring and disconnect the cable-to-frame retaining clip.

Remove the rear wheel, brake drum and secondary brakeshoe.

Compress the lock tabs that hold the cable in the support plate with a small hose clamp and remove the cable.

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BRAKE SYSTEM

BRAKE SYSTEM SERVICE



Rear Cable Installation

Install the cable in the support plate. Secure the cable by engaging the cable lock tabs in the support plate.

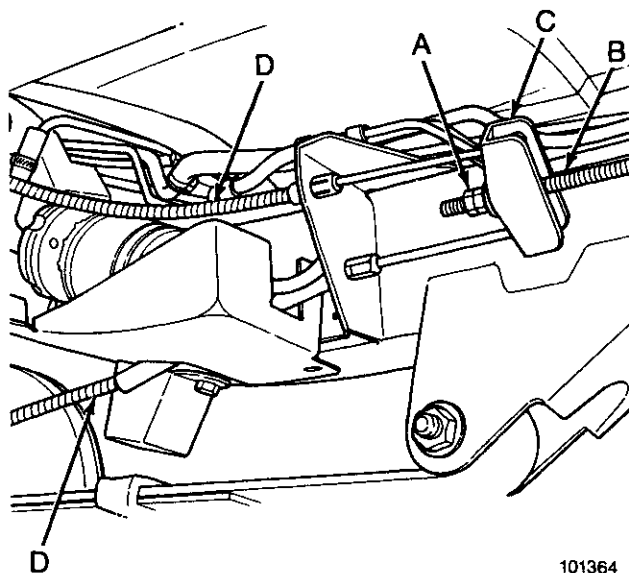
Engage the cable in the parking brake lever and install the secondary brakeshoe, brake drum and rear wheel.

Install the cable-to-frame retaining clip and reattach the locating spring to the cable.

Connect the rear cable to the equalizer.

Adjust the parking brakes. Refer to the Parking Brake Adjustment procedure.

Lower the vehicle.



Front Cable Removal

Raise the vehicle.

Remove adjusting nuts (A) and remove the front cable (B) from the equalizer (C).

Remove the cable-to-frame bracket retaining clip.

Lower the vehicle.

Roll back the front carpet and compress the lock tabs that retain the cable in the parking brake pedal assembly with a hose clamp.

Disconnect the cable from the pedal assembly and remove the cable.

If the cable is to be replaced, remove and retain the grommet from the pedal end of the cable.

Front Cable Installation

Insert the cable through the floorpan.

Install the grommet on the pedal end of the cable and seat the grommet in the floorpan.

Connect the cable to the parking brake pedal assembly. Be sure the cable lock tabs are seated in the pedal assembly.

Raise the vehicle.

Install the cable-to-frame retaining clip.

Insert the cable in the equalizer (C) and install the adjusting nuts (A).

Adjust the parking brakes. Refer to the Parking Brake Adjustment procedure.

Lower the vehicle.

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PARKING BRAKE PEDAL REMOVAL

Loosen the cable adjusting nuts (A) at the equalizer (C).

Disconnect the brake warning light switch wire at the parking brake pedal assembly.

Remove the nuts that attach the pedal assembly mounting studs (1) to the dash panel. The nuts are accessible from the engine compartment.

Remove the bolt (2) that attaches the pedal assembly to the instrument panel.

Compress the front cable lock tabs (3) and disengage the tabs.

Disconnect the front cable (4) from the pivot bracket (5) and remove the pedal assembly (6).

PARKING BRAKE PEDAL INSTALLATION

Connect the front cable (4) to the pedal pivot (5).

Insert the pedal assembly mounting studs (1) into the dash panel stud holes.

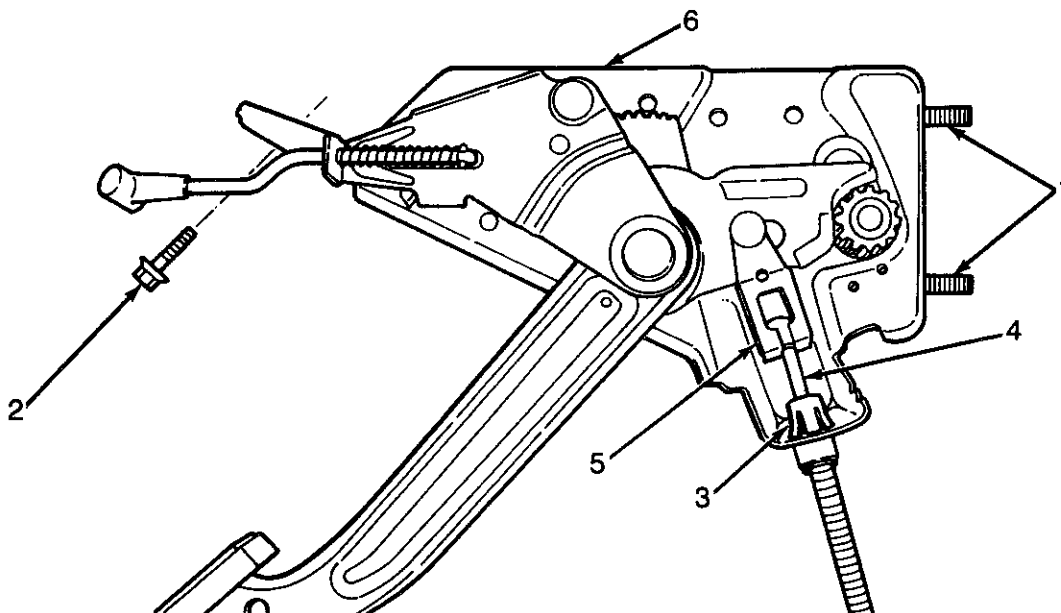
Position the pedal assembly on the kick panel and instrument panel and install attaching bolt (2).

Install the nuts on the pedal mounting studs (1).

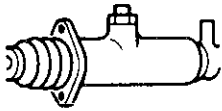
Connect the brake warning light wire.

Adjust the parking brakes. Refer to Parking Brake Adjustment.

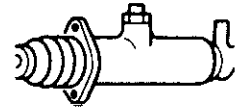
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BRAKE SYSTEM **BRAKE SYSTEM SERVICE**



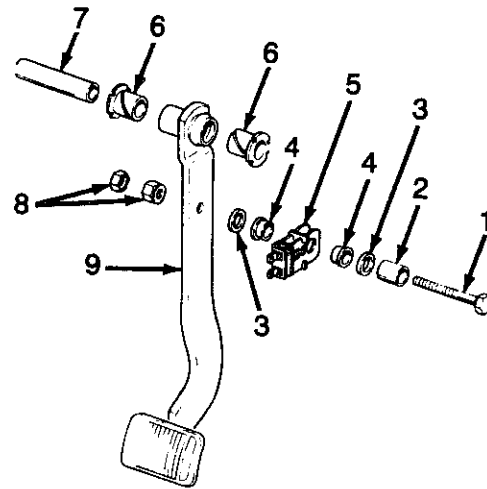
BRAKE PEDAL REMOVAL

Disconnect the brake light switch wires.

Remove the bolt (1) and locknuts (8) that attach the push rod to the pedal (9). Then remove the brake light switch (5) and bushings (2), (3) and (4).

Remove the bolt and nut that attach the brake pedal to the dash bracket and remove the pedal (9).

Remove the spacer (7) and bushings (6) from the pedal.



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BRAKE PEDAL INSTALLATION

Install the bushings (6) in the pedal.

Position the pedal in the dash bracket and install the spacer (7) and pedal attaching bolt and nut.

Assemble the brake light switch (5) and bushings (2), (3) and (4) and install them on the brake pedal.

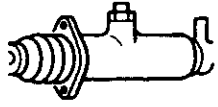
Connect the push rod and brake light switch to the pedal with replacement bolt (1) and nuts (8).

Connect the brake light switch wires.

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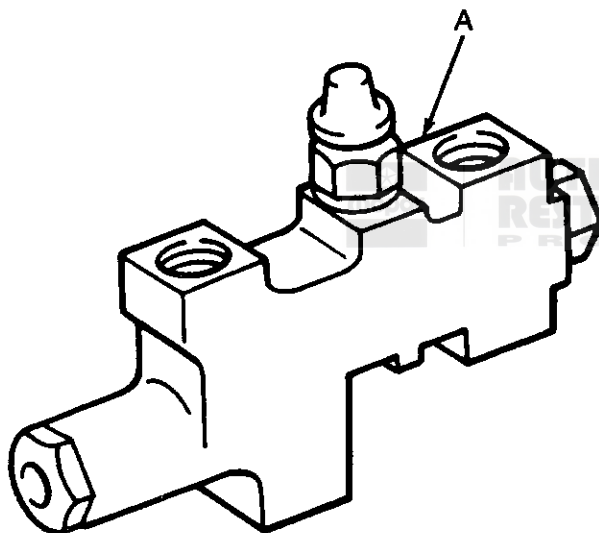
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BRAKE DIFFERENTIAL VALVE

Valve Service

The valve (A) is serviced as an assembly only. It is not a repairable component and must be replaced if a malfunction occurs.

The valve is located on the left fender panel just below the master cylinder.



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Valve Operation

The valve contains a pressure differential piston and a plunger-type electrical switch. The valve is connected to the front and rear brake systems. The switch is connected to the brake warning light.

The pressure differential piston is actuated by a pressure drop in the front or rear brake system.

A pressure differential of 483 to 2 068 kPa (70 to 300 psi) between the front and rear systems will trigger piston operation.

If a fluid pressure drop occurs in the front or rear brake system, pressure from the functioning system moves the piston to the low pressure side. The piston then closes off the low pressure side diverting all fluid pressure to the functioning system. The piston will remain at the low pressure side until the malfunction is corrected.

The electrical switch is actuated by the differential piston. Movement of the piston in either direction will press the switch plunger upward closing the circuit to the brake warning light.

The differential piston will reset automatically after correcting a malfunction. Valve hold-off tools are not required in order to bleed the brakes.

BRAKE BLEEDING

The brake hydraulic system must be bled when diagnosis indicates air has entered the system. Brake bleeding is also required whenever a brakeline has been disconnected or a system hydraulic component has been removed for service.

System contamination requires that the entire system be flushed with clean brake fluid. Continue flushing until only clear, clean brake fluid is bled from the calipers and wheel cylinders.

Use JEEP brake fluid or an equivalent fluid with the SAE J 1703F or DOT 3 or 4 rating.

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BRAKE SYSTEM

BRAKE SYSTEM SERVICE



Brake Bleeding Sequence

Bleed the brake system in the following sequence. Use the sequence for both pressure and manual bleeding procedures.

- Right rear wheel cylinder.
- Left rear wheel cylinder
- Right front caliper.
- Left front caliper.

Pressure Bleeding Procedure

Fill the bleeder tank with the specified brake fluid and close the tank fluid supply valve.

Pressurize the bleeder tank to 103-138 kPa (15-20 psi).

Open the tank fluid supply valve and bleed all air from the tank and supply line.

Close the fluid supply valve and repressurize the tank.

Install the bleeder adapter cover on the master cylinder.

Connect the tank supply line to the fitting on the bleeder adapter cover.

Bleed only one wheel at a time and in the recommended sequence as follows:

- Open the fluid supply valve on the bleeder tank.

- Connect a bleed hose to the wheel cylinder or caliper bleed fitting.

- Insert the end of the bleed hose in a glass container partially filled with brake fluid. Be sure the hose end is completely submerged in the fluid.

- Open the bleed fitting.

- Close the bleed fitting when fluid flowing into the glass container is clear and free of air bubbles.

Repeat the bleeding procedure at the remaining wheels.

Discard the brake fluid remaining in the glass container.

Disconnect the bleeder tank supply line and remove the adapter cover from the master cylinder.

Top off the master cylinder reservoirs to within 6 mm (1/4 inch) of the reservoir rims.

Install the master cylinder cover.

Check brake operation before moving the vehicle.

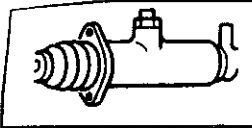
Manual Bleeding Procedure

Fill the master cylinder reservoirs with fresh brake fluid.

Connect a bleed hose to the wheel cylinder or caliper bleed fitting.

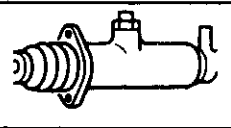
Insert the end of the bleed hose in a glass container partially filled with brake fluid. Be sure

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BRAKE SYSTEM

BRAKE SYSTEM SERVICE



the hose end is completely submerged in the fluid.

Bleed the cylinder or caliper as follows:

- Open the bleed fitting.
- Have a helper press and hold the brake pedal to the floor.
- Tighten the bleed fitting and have the helper release the pedal slowly.
- Continue the bleeding operation until fluid flowing into the glass container is clear and free of air bubbles.

NOTE: Do not allow the master cylinder to run out of fluid during the bleeding process. Check

the cylinder reservoirs frequently and refill as needed.

Repeat the bleeding procedure at the remaining wheels.

Discard the brake fluid remaining in the glass container.

Top off the master cylinder reservoirs to within 6 mm (1/4 inch) of the reservoir rims.

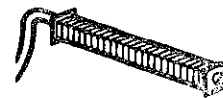
Install the master cylinder cover.

Check brake operation before moving the vehicle.

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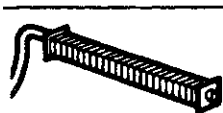


HEATING AND AIR CONDITIONING



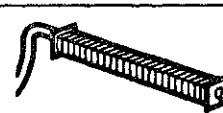
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HEATING AND AIR CONDITIONING

SPECIFICATIONS



TORQUE SPECIFICATIONS

Component	Service Set-To-Torque	Service Recheck Torque
A/C Service Valve	38 N•m (28 ft-lbs) (Wet torque*)	29-45 N•m (21-33 ft-lbs) (Wet torque*)
A/C Compressor-To-Engine Bolt	34 N•m (25 ft-lbs)	24-38 N•m (18-28 ft-lbs)
A/C Compressor Rear Bracket-To-Mounting Bracket Bolts	38 N•m (28 ft-lbs)	27-48 N•m (20-36 ft-lbs)
A/C Compressor-To-Mounting Bracket Nuts/Bolts	38 N•m (28 ft-lbs)	27-48 N•m (20-36 ft-lbs)
A/C Condenser Screws	2 N•m (20 in-lbs)	2-3 N•m (16-25 in-lbs)
A/C Receiver Screws	1 N•m (9 in-lbs)	1-2 N•m (6-12 in-lbs)
A/C Evaporator-To-Receiver Hose Coupling	14 N•m (10 ft-lbs)	11-16 N•m (8-12 ft-lbs)
Magnetic Clutch Nut	37 N•m (27 ft-lbs)	34-39 N•m (25-30 ft-lbs)
Compressor Cylinder Head Bolts	33 N•m (24 ft-lbs)	30-34 N•m (22-25 ft-lbs)
Discharge and Suction Hose Fittings	27 N•m (20 ft-lbs)	24-30 N•m (18-22 ft-lbs)
Heater Hose Clamps	3 N•m (2 ft-lbs)	2-4 N•m (2-3 ft-lbs)
Heater Housing-To-Dash Panel Stud Nuts	6 N•m (55 in-lbs)	5-8 N•m (40-70 in-lbs)
Compressor Oil Fill Plug	10 N•m (7 ft-lbs)	8-12 N•m (6-9 ft-lbs)

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* Wet Torque is with service valve coupling threads and O-rings lubricated with compressor oil.

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	HEATING AND AIR CONDITIONING SPECIAL TOOLS	
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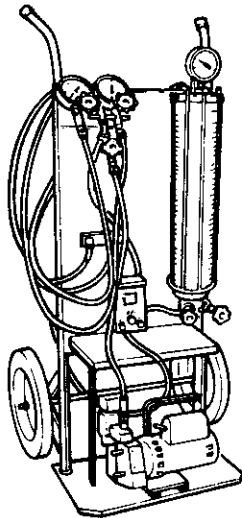
SPECIAL TOOLS

Tool Ref.	Description
J 6084	Halide Torch Leak Detector
J 23500-01	Portable Service Station
J 25359-C	Torx Bit and Socket Wrench Set
J 23575	Pressure Gauge and Manifold
J 5453	Goggles
J 6105	1/4-inch Ratchet
J 6272-02	Multi-Refrigerant Dispenser
J 29642-10	Service Valve Alignment Tool
J 29642-11	Service Valve Removal and Installation Tool
J 29642	Sankyo Air Conditioner Service Kit
J 25498	Adapter
J 25499	Adapter
J 29547	Electronic Leak Detector

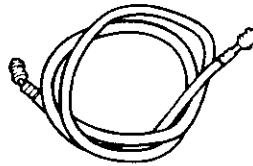
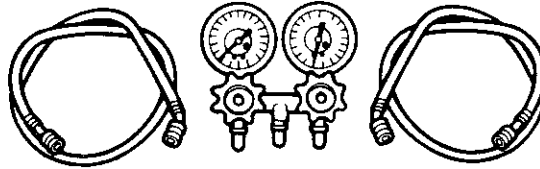
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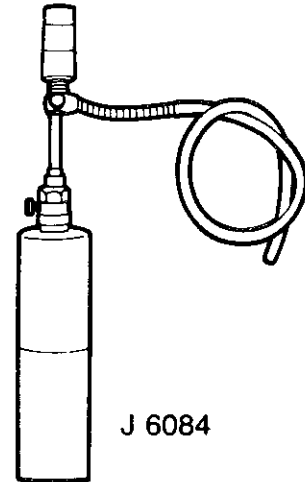
SPECIAL TOOLS



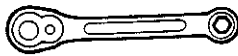
J 23500-01



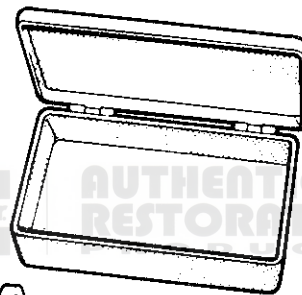
J 23575



J 6084



J 6105



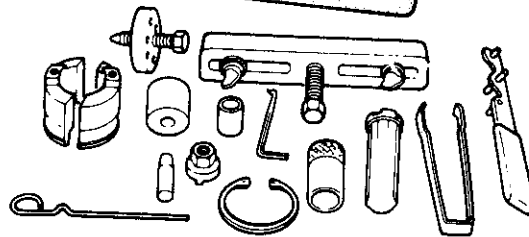

AUTHENTIC RESTORATION



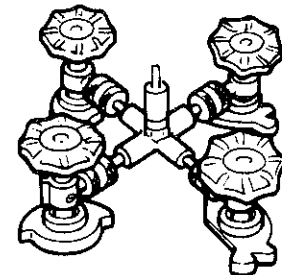
J 5453



J 25498



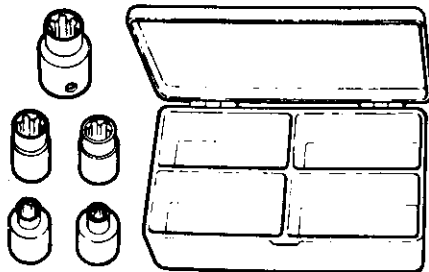
J 29642-A



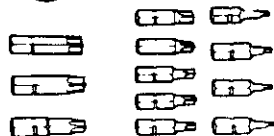
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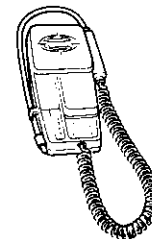
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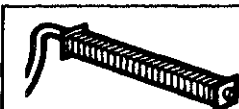


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HEATING AND AIR CONDITIONING

HEATING SYSTEM



GENERAL

A blend-air heating system is used in Wrangler/YJ vehicles. The blend-air system provides a constant flow of engine coolant through the heater core.

The temperature of heated air entering the passenger compartment is controlled by regulating the quantity of air flow through the heater core. This is accomplished by blending a controlled amount of unheated air from outside the vehicle with heated air from the heater core.

HEATER AND DEFROSTER OPERATION

The heater core is connected to the engine cooling system. It operates on the circulation of heated engine coolant through the core and a supply of fresh air drawn in through the intake grille on the cowl. Engine coolant flows through the heater core at all times.

The heater controls are on the heater control panel (1).

The air control lever (2) operates a door in the fresh air intake duct. The door controls the amount of fresh air flow into the heater housing and core. When the lever is in the Off position, the intake door is closed preventing air flow into the housing.

The temperature control lever (3) determines air flow through the heater core. The lever operates the heater housing blend-air door which controls air flow through the core.

The blower motor is operated by the control switch (4). The switch provides three blower speeds for increased air flow in heat or defrost mode.

Heating

Maximum air flow and heater output occurs when the air control lever (2) is in Heat position and the temperature control lever (3) in Warm position. The blend-air door is closed and all intake air is directed through the core in this operating mode.

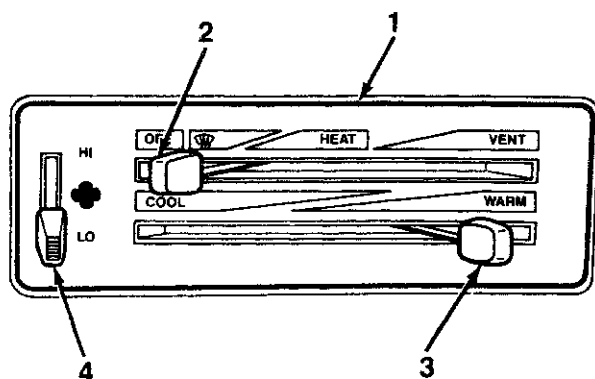
Temperature regulation of the heated air is determined by position of the temperature control lever (3). Moving the control lever from Warm to an in-between position, opens the blend-air door in the heater housing. As the door opens, unheated outside air is drawn into the system and blended with heated air from the core.

Defrosting

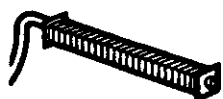
The heater housing contains a defroster door to divert heated air to the defroster duct and windshield outlets. Defrost air flow is controlled by the air control lever (2).

For defroster operation, the air control lever (2) must be moved to the defrost detent. The detent is identified by the defrost symbol on the control panel. In this position, the defroster door in the heater housing diverts all heated air (from the core) to the defroster duct windshield outlets.

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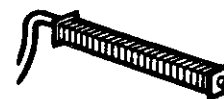


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HEATING AND AIR CONDITIONING

HEATING SYSTEM



NOTE: If the air control lever (2) is moved to any position between the heat and defrost detents, the defroster door does not close completely. In this mode, the door remains partially open causing heated air to be divided equally between the heat and defrost outlets.

A door in the intake duct controls air flow into the duct. The door is operated by a vacuum motor. The motor is controlled by a vacuum switch in the heater control panel. The vent air doors are opened and closed by a cable and linkage operated by the air control lever. Fresh air intake occurs only when the lever is in the Vent position.

FRESH AIR VENTILATION

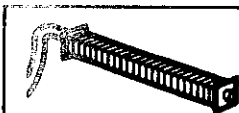
The fresh air ventilating system is operated by the air control lever (2). When the lever is moved to Vent position, outside air from the cowl intake flows into the heater housing. Incoming air is directed into the vehicle interior through vent doors in the housing.

HEATING SYSTEM DIAGNOSIS

Service Diagnosis

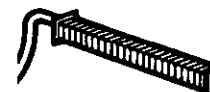
Condition	Possible Cause	Correction
BLOWER MOTOR WILL NOT TURN AT ANY SPEED	(1) Blown fuse (2) Loose connection (3) Defective ground (4) Faulty switch (5) Faulty motor (6) Faulty resistor	(1) Replace fuse (2) Inspect and tighten (3) Clean and tighten (4) Replace switch (5) Replace motor (6) Replace resistor
BLOWER MOTOR TURNS AT ONE SPEED ONLY	(1) Faulty switch (2) Faulty resistor	(1) Replace switch (2) Replace resistor
BLOWER MOTOR TURNS BUT DOES NOT CIRCULATE AIR	(1) Intake blocked (2) Fan not secured to the motor shaft	(1) Clean intake (2) Tighten securely
HEATER WILL NOT HEAT	(1) Coolant does not reach proper temperature (2) Heater core blocked internally (3) Heater core air-bound (4) Blend-air door not in proper position	(1) Check and replace thermostat if necessary (2) Flush or replace core if necessary (3) Purge air from core (4) Adjust cable
HEATER WILL NOT DEFROST	(1) Control cable adjustment incorrect (2) Defroster hose damaged	(1) Adjust control cable (2) Replace defroster hose

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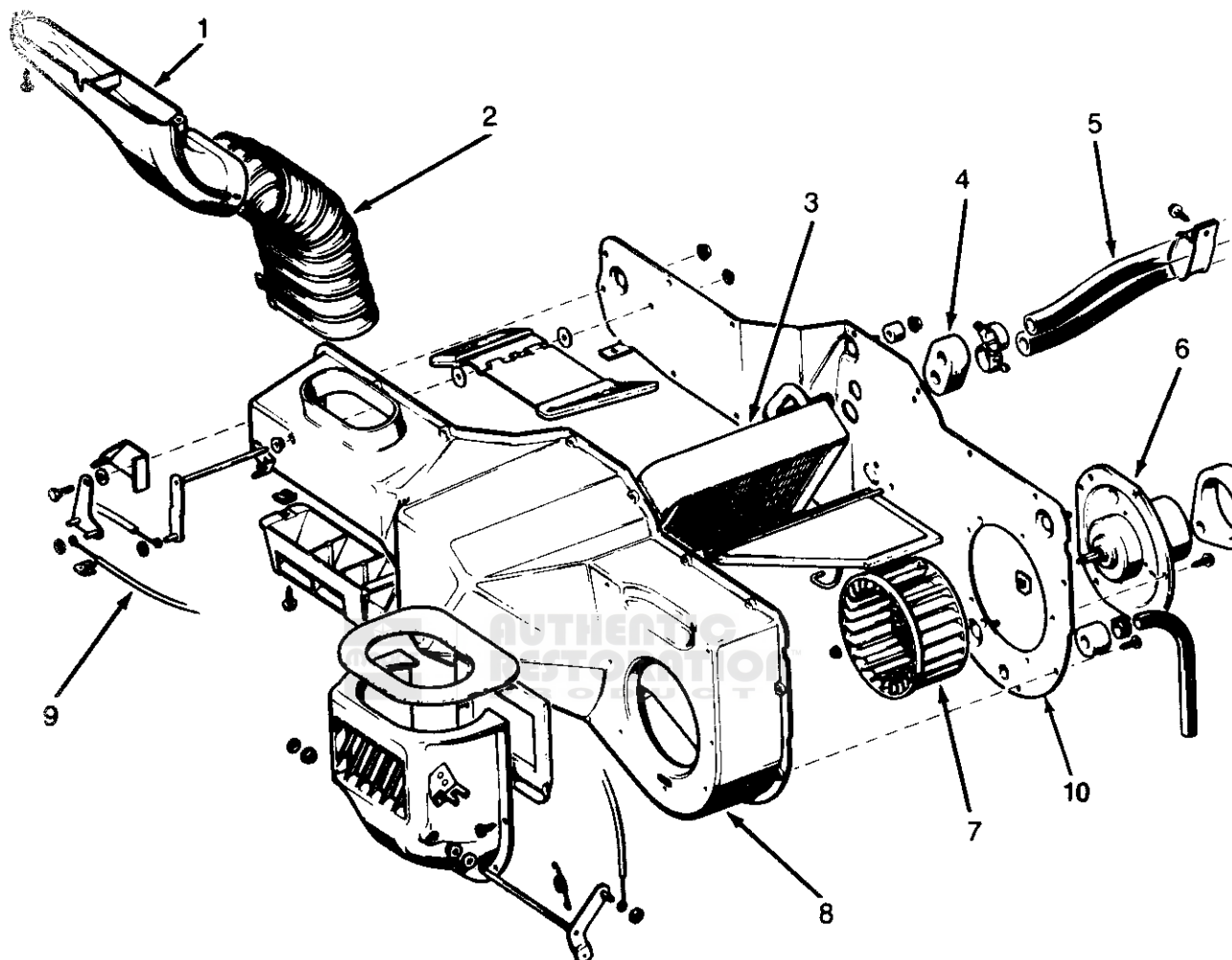


HEATING AND AIR CONDITIONING

HEATING SYSTEM



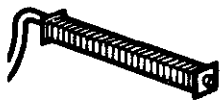
HEATING SYSTEM COMPONENTS



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| 1. Defroster Nozzle | 6. Blower Motor |
| 2. Defroster Duct | 7. Fan |
| 3. Heater Core | 8. Heater Housing |
| 4. Seal | 9. Cable |
| 5. Hose | 10. Heater Housing Cover |

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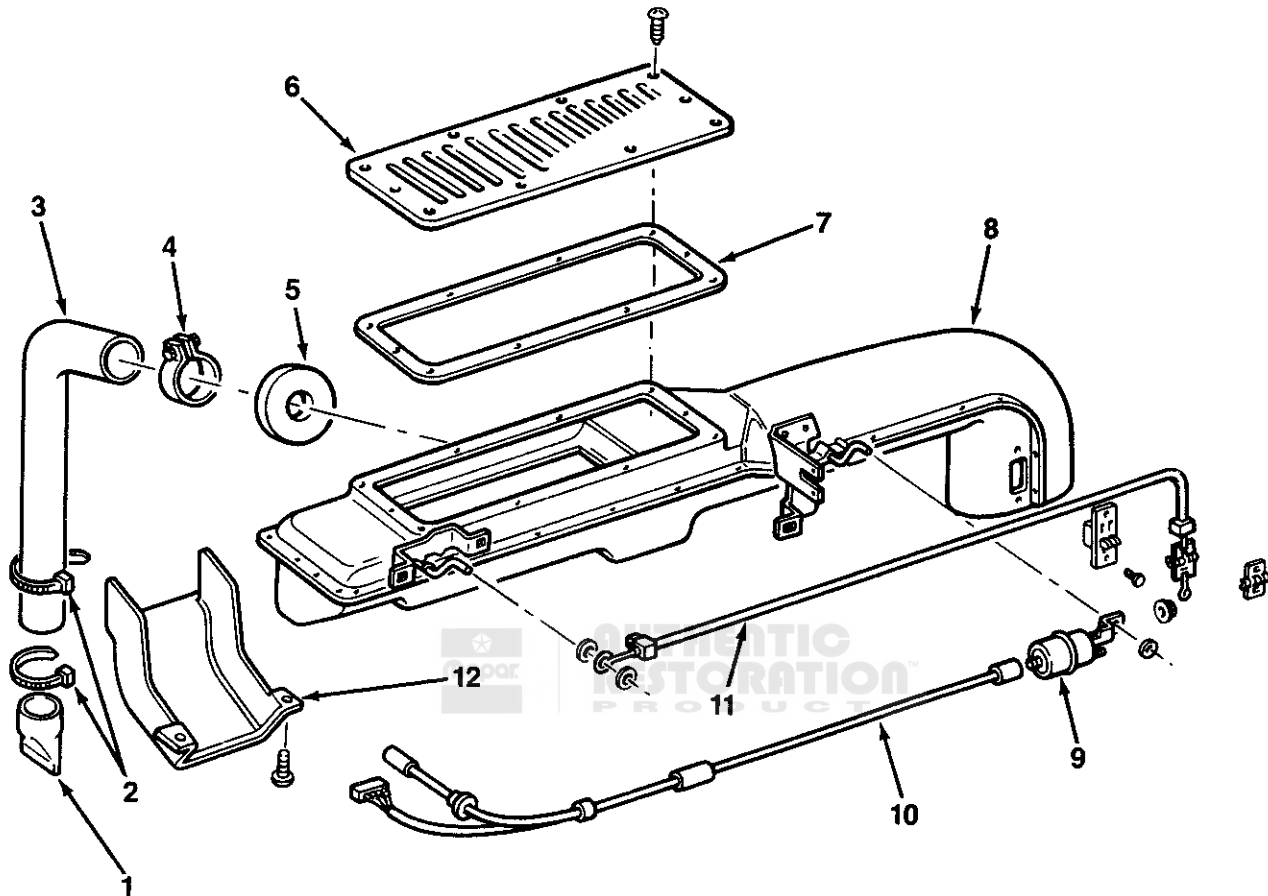


HEATING AND AIR CONDITIONING

HEATING SYSTEM



FRESH AIR INTAKE SYSTEM COMPONENTS



1. Drain Cap
2. Tie Strap
3. Drain Hose
4. Clamp
5. Insulator
6. Air Intake Grille

7. Gasket
8. Fresh Air Intake Duct
9. Air Door Vacuum Motor
10. Vacuum Lines
11. Vent Cable and Brackets
12. Air Duct

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HEATER CONTROL PANEL

REMOVAL

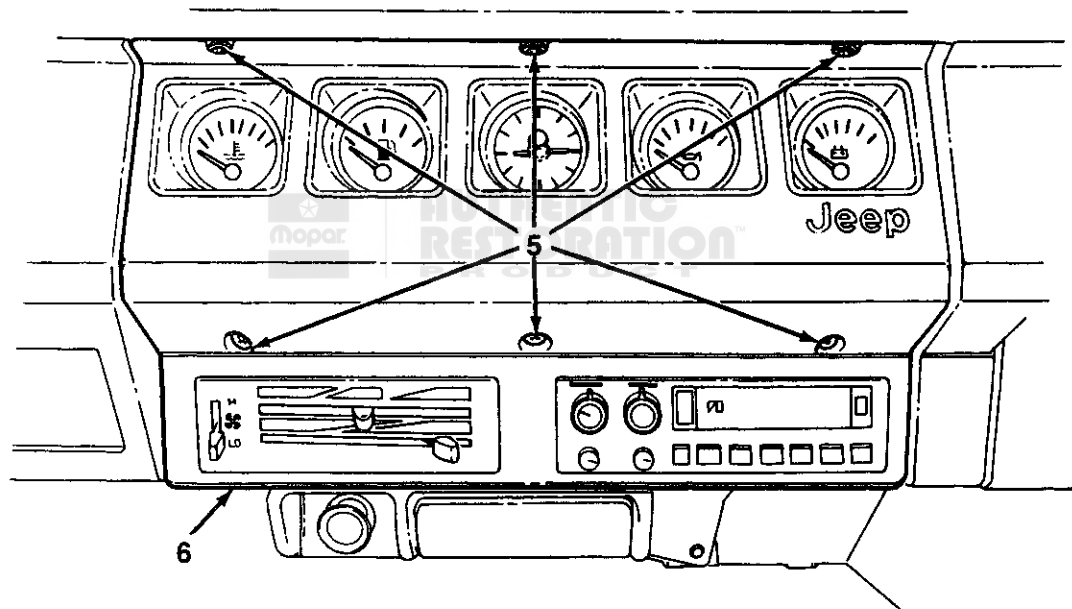
Remove the instrument cluster bezel attaching screws (5).

Remove the instrument cluster bezel (6).

Remove the screws attaching the heater control panel (1) to the instrument panel.

Slide the control panel outward and disconnect the cables, vacuum hoses and electrical wires from the control panel.

Remove the control panel.



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Installation

Connect the electrical wires, vacuum hoses and cables to the control panel.

Position the control panel in the instrument panel.

Install the screws that attach the control panel to the instrument panel.

Install the instrument cluster bezel (6) and the bezel attaching screws (5).

BLOWER MOTOR AND AIR DOOR MOTOR SWITCHES

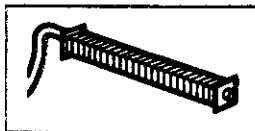
Removal

Remove the heater control panel (1).

Remove the air door motor switch (10).

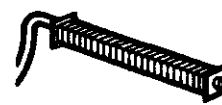
Remove the control knob (7) from the blower switch (8).

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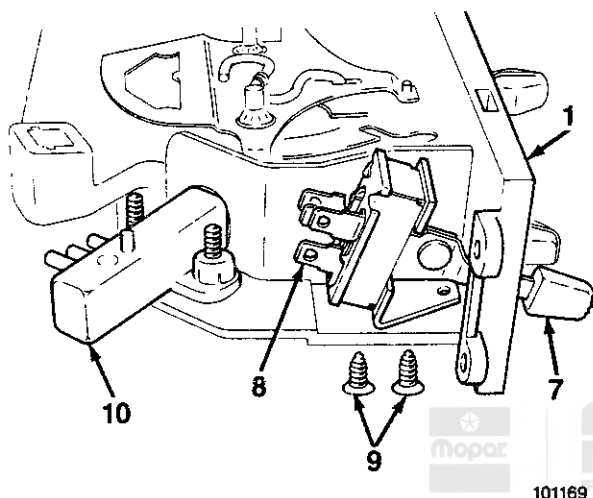
HEATING AND AIR CONDITIONING

HEATING SYSTEM



Remove the screws (9) that attach the switch to the control panel (1).

Remove the switch (8) from the control panel.



Installation

Position the blower switch (8) on the control panel (1) and install the switch attaching screws (9).

Install the air door motor switch (10).

Install the knob (7) on the blower switch (8).

Install the heater control panel (1).

VENT DOOR CONTROL CABLES

Removal

Disconnect the cable from the vent door.

Disconnect the cable from the heater control panel lever.

NOTE: The cables are attached to the control panel levers with plastic tabs. Press the tabs together and lift the cable upward to disengage it from the lever.

Remove the cable.

Installation and Adjustment

NOTE: The clip on the cable wire has two functions. It attaches the cable to the vent door and is also the self adjusting mechanism. Because the left cable operates the right cable, the cables must be installed as outlined to maintain the self adjusting feature and ensure proper vent door operation.

Connect the cables to the heater control panel.

Connect the only the right vent door cable. Do not connect the left door cable at this time.

Open and close the right vent door (one time) using the air control lever on the heater control panel.

Connect the left vent door cable.

Open and close both vent doors with the air control lever. Verify that both vent doors open at the same time.

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HEATER CORE AND HOUSING

Removal

WARNING: Hot engine coolant can cause severe burns. Do not open the radiator draincock when the cooling system is hot and pressurized. Allow the coolant to decrease to room temperature before starting repair operations.

Drain approximately 1.9 liters (2 qts) of coolant from the radiator. Drain the coolant into a clean container.

Disconnect the heater hoses.

Disconnect the vent door cables.

Disconnect the blower motor wire.

Disconnect the defroster duct.

Remove the nuts that attach the heater housing studs to the engine compartment side of the dash panel.

Remove the heater housing assembly by tilting it downward, to disengage it from the defroster duct, and pulling it rearward and out from under the instrument panel.

Remove the heater housing cover from the housing.

Remove the heater core from the housing.

Installation

Install the heater core in the housing and install the cover on the housing.

Position the heater housing on the dash panel. Be sure the housing studs all extend through the dash panel.

Install the seals on the heater core outlet and inlet tubes and over the blower motor housing.

Install the attaching nuts on the housing studs.

CAUTION: Do not over tighten the attaching nuts. The housing could become distorted causing air leaks and improper heater door operation. Tighten the nuts alternately and evenly until two stud threads are visible beyond each nut.

Connect the defroster duct to the housing.

Connect the blower motor wire.

Connect the vent door control cables.

Connect the heater hoses.

Refill and bleed the cooling system.

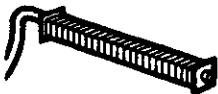
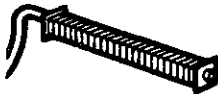
Check system operation.

BLOWER MOTOR

Removal

Remove the heater housing. Refer to Heater Core and Housing Removal.

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	HEATING AND AIR CONDITIONING HEATING SYSTEM	
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Remove the blower motor-to-heater housing attaching screws/nuts.

Remove the blower motor from the housing.

Installation

Position the blower motor in the heater housing.

Install the blower motor-to-heater housing attaching screws/nuts.

Install the heater core and housing. Refer to Heater Core and Housing Installation.

Check blower motor and heater operation.

DEFROSTER NOZZLE AND DUCT

Removal

WARNING: Hot engine coolant can cause severe burns. Do not open the radiator draincock when the cooling system is hot and pressurized. Allow the coolant to decrease to room temperature before starting repair operations.

Drain approximately 1.9 liters (2 qts) of coolant from the radiator. Drain the coolant into a clean container.

Disconnect the heater hoses.

Remove the nuts attaching the heater housing studs to the engine compartment side of the dash panel.

Disconnect the speedometer cable.

Remove the glove box.

Tilt the heater housing back and pull it rearward and out from under the instrument panel.

Disconnect the vent control cables.

Remove the fresh air intake grille from the cowl.

Remove the fresh air intake duct.

Lower the windshield.

Remove the defroster nozzle attaching screws and remove the nozzle and duct.

Installation

Install the defroster nozzle and duct.

Raise and secure the windshield.

Install the fresh air intake duct.

Install the fresh air intake grille on the cowl.

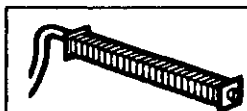
Install the vent cables.

Position the heater housing on the dash panel. Be sure all the housing studs extend through the dash panel.

Install the seals on the blower motor and the heater core inlet and outlet tubes.

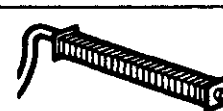
Install the attaching nuts on the housing studs.

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HEATING AND AIR CONDITIONING

HEATING SYSTEM



CAUTION: Do not over tighten the attaching nuts. The housing could become distorted causing air leaks and improper heater door operation. Tighten the nuts alternately and evenly until two stud threads are visible beyond each nut.

Install the glove box.

Connect the speedometer cable.

Connect the heater hoses.

Refill and bleed the cooling system.

FRESH AIR DOOR VACUUM MOTOR

Removal

Remove the glove box and assist handle.

Disconnect the vacuum hose from the motor.

Remove the motor lever retaining clip.

Remove the motor attaching nuts and remove the motor from the fresh air duct.

Installation

Position the motor on the fresh air duct and install the motor attaching nuts.

Align the motor lever with the air door lever and install the lever retaining clip.

Connect the vacuum hose to the motor.

Install the glove box and assist handle.

FRESH AIR INTAKE DUCT

Removal

WARNING: Hot engine coolant can cause severe burns. Do not open the radiator draincock when the cooling system is hot and pressurized. Allow the coolant to decrease to room temperature before starting repair operations.

Drain approximately 1.9 liters (2 qts) of coolant from the radiator. Drain the coolant into a clean container.

Disconnect the heater hoses.

Remove the nuts attaching the heater housing studs to the dash panel from

inside the engine compartment.

Disconnect the speedometer cable.

Remove the glove box and assist handle.

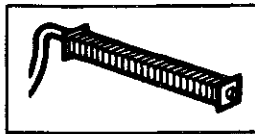
Tilt the heater housing back and pull it rearward and out from under the instrument panel.

Disconnect the vent cables.

Remove the fresh air intake grille from the cowl.

Remove the fresh air intake duct.

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HEATING AND AIR CONDITIONING

HEATING SYSTEM



Installation

Install the fresh air intake duct.

Install the defroster nozzle and duct.

Raise and secure the windshield.

Install the fresh air grille on the cowl.

Install the vent cables.

Position the heater housing on the dash panel.
Be sure all the end through the dash panel.

Install the seals on the blower motor and heater
core inlet and outlet tubes.

Install the attaching nuts on the heater housing
studs.

CAUTION: Do not over tighten the attaching
nuts. The housing could become distorted
causing air leaks and improper heater door op-
eration. Tighten the nuts alternately and evenly
until two stud threads are visible beyond each
nut.

Install the glove box and assist handle.

Connect the speedometer cable.

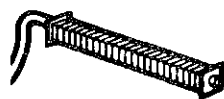
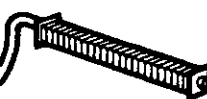
Connect the heater hoses.

Refill and bleed the cooling system.



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	HEATING AND AIR CONDITIONING AIR CONDITIONING SYSTEM	
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GENERAL

The air conditioning system on Wrangler/YJ models is a dual flow unit. Cooling air can be drawn from outside the vehicle or previously cooled air can be recirculated within the interior.

The evaporator, blower fan and motor, thermostat, expansion valve, capillary tube, air outlets and system controls are located in the evaporator housing. The evaporator housing is mounted under the instrument panel. The compressor, condensor, receiver-dryer and refrigerant lines are located in the engine compartment.

A rotary-type compressor with magnetic clutch operated drive pulley is used for Wrangler/YJ models with air conditioning.

The receiver-dryer is a reservoir that supplies pressurized liquid refrigerant to the expansion valve at all times. The receiver-dryer also operates as a dehumidifier by removing moisture from the refrigerant.

The pressurized liquid refrigerant flows into the expansion valve from the receiver-dryer. The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the inlet (suction) side of the compressor.

As refrigerant enters the evaporator, it immediately absorbs heat from the ambient temperature air flowing over the evaporator core. The rapid absorption of heat cools the incoming air which is then distributed into the vehicle interior.

The rapid absorption of heat by the liquid refrigerant, causes the refrigerant to begin boiling almost immediately after entering the evaporator. This process converts the high pressure liquid into a low pressure gas which flows back to the compressor to begin the cooling cycle again.

SYSTEM OPERATION

Refrigerant R-12 is the only refrigerant used in the air conditioning system.

The compressor pressurizes and increases temperature of the refrigerant converting it from a liquid to a high pressure vapor. The vapor is then pumped into the condenser which cools the vapor by transferring heat to the air passing over the condenser fins.

As the refrigerant vapor cools, it condenses back into a liquid that is still pressurized. The pressurized liquid then flows into the receiver-dryer.

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HEATING AND AIR CONDITIONING

AIR CONDITIONING SYSTEM



SERVICE DIAGNOSIS

General Diagnosis Information

The air conditioning system generally operates at peak efficiency at normal highway speeds. However, a slight reduction in cooling efficiency may be experienced in congested city driving conditions; especially when ambient temperatures are high.

Driving at relatively high speeds for extended periods may cause the evaporator coils to frost over. If frosting is severe, a temporary loss of cooling may occur. To correct a frost-over condition, turn the control temperature knob off and operate the blower fan for a few minutes.

When diagnosing a gradual decrease in cooling efficiency, remember to check condition of the condensor and radiator fins. Air flow blockage of either component, caused by dirt, foreign material or insects, will affect the air conditioning and engine cooling systems equally. Also

note if the vehicle is equipped with a protective screen. Some screens can restrict air flow to the radiator and condensor.

During high ambient temperature operation, a slight increase in engine coolant temperature is a normal occurrence when the air conditioner system is operating.

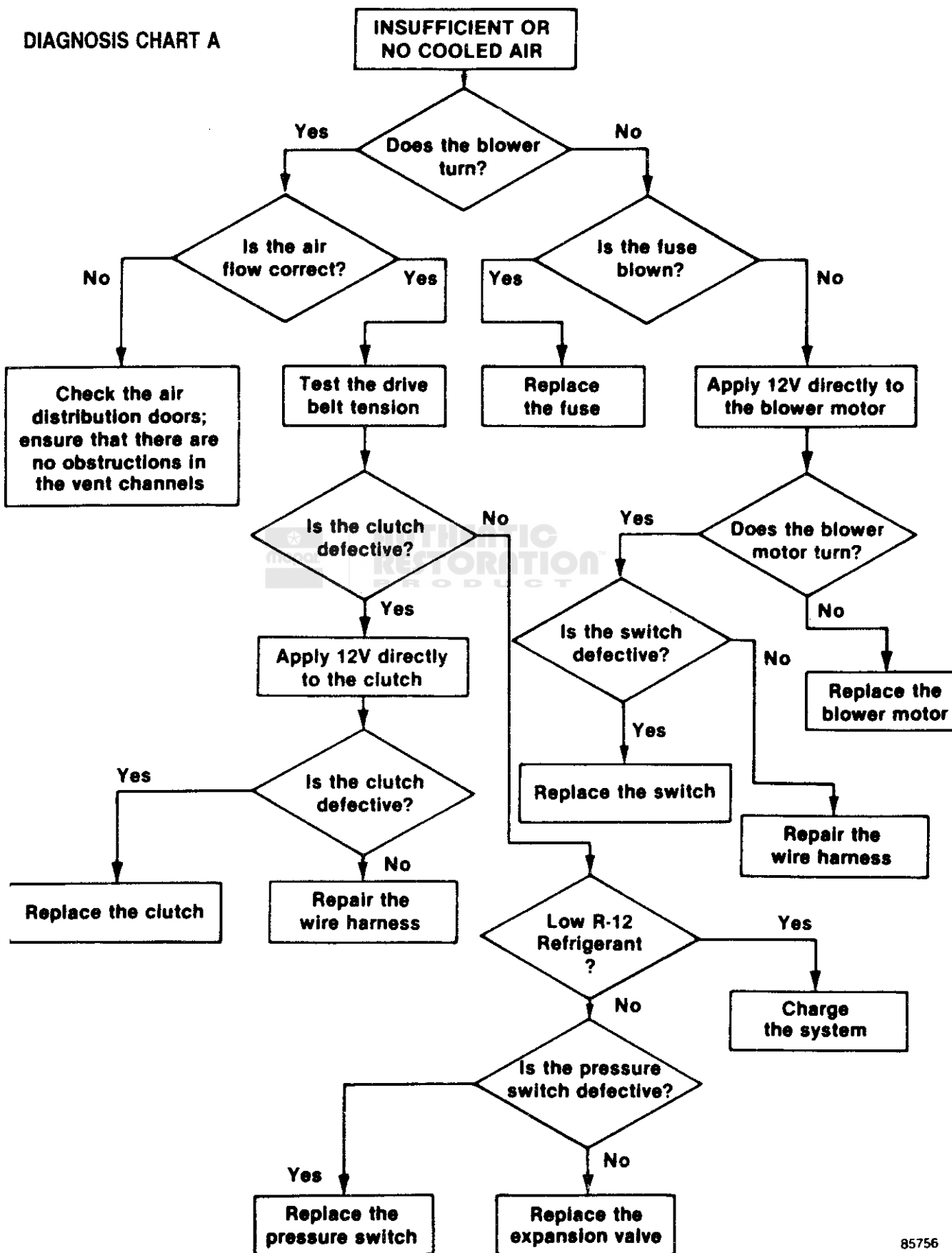
Diagnosis Procedures

Refer to the following charts for basic system diagnosis procedures.

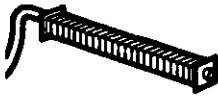
Diagnosis Charts A and B outline general performance diagnosis information. Chart C provides information needed to interpret results of a pressure test using gauge and manifold assembly J 23575 or portable station J 23500-01. Chart D outlines diagnosis information exclusive to the air conditioning compressor.

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DIAGNOSIS CHART A



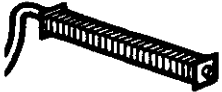
SEE I.S. NOTES

	HEATING AND AIR CONDITIONING AIR CONDITIONING SYSTEM	
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DIAGNOSIS CHART B

Condition	Possible Cause	Correction
COMPRESSOR NOISE	(1) Broken valves. (2) Overcharged. (3) Incorrect oil level. (4) Piston slap. (5) Broken rings. (6) Drive belt pulley bolts are loose.	(1) Replace the valve plate. (2) Discharge, evacuate and install the correct charge. (3) Isolate the compressor and check the oil level. Correct as necessary. (4) Replace the compressor. (5) Replace the compressor. (6) Tighten with the correct torque specification.
EXCESSIVE VIBRATION	(1) Incorrect belt tension. (2) Clutch loose. (3) Overcharged. (4) Pulley is misaligned.	(1) Adjust the belt tension. (2) Tighten the clutch. (3) Discharge, evacuate and install the correct charge. (4) Align the pulley.
CONDENSATION DRIPPING IN THE PASSENGER COMPARTMENT	(1) Drain hose plugged or improperly positioned. (2) Insulation removed or improperly installed.	(1) Clean the drain hose and check for proper installation. (2) Replace the insulation on the expansion valve and hoses.
FROZEN EVAPORATOR COIL	(1) Faulty thermostat. (2) Thermostat capillary tube improperly installed. (3) Thermostat not adjusted properly.	(1) Replace the thermostat. (2) Install the capillary tube correctly. (3) Adjust the thermostat.

SEE I.S. NOTES

	HEATING AND AIR CONDITIONING AIR CONDITIONING SYSTEM	
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DIAGNOSIS CHART C

Condition	Possible Cause	Correction
LOW SIDE LOW – HIGH SIDE LOW	(1) System refrigerant is low. (2) Expansion valve is restricted.	(1) Evacuate, leak test and charge the system. (2) Replace the expansion valve.
LOW SIDE HIGH – HIGH SIDE LOW	(1) Internal leak in the compressor – worn. (2) Cylinder head gasket is leaking. (3) Expansion valve is defective. (4) Drive belt slipping.	(1) Remove the compressor cylinder head and inspect the compressor. Replace the valve plate assembly if necessary. If the compressor pistons, rings or cylinders are excessively worn or scored replace the compressor. (2) Install a replacement cylinder head gasket. (3) Replace the expansion valve. (4) Adjust the belt tension.
LOW SIDE HIGH – HIGH SIDE HIGH	(1) Condenser fins obstructed. (2) Air in the system. (3) Expansion valve is defective. (4) Loose or worn fan belts.	(1) Clean the condenser fins. (2) Evacuate, leak test and charge the system. (3) Replace the expansion valve. (4) Adjust or replace the belts as necessary.
LOW SIDE LOW – HIGH SIDE HIGH	(1) Expansion valve is defective. (2) Restriction in the refrigerant hose. (3) Restriction in the receiver/drier. (4) Restriction in the condenser.	(1) Replace the expansion valve. (2) Check the hose for kinks – replace if necessary. (3) Replace the receiver/drier. (4) Replace the condenser.
LOW SIDE AND HIGH SIDE NORMAL (INADEQUATE COOLING)	(1) Air in the system. (2) Moisture in the system.	(1) Evacuate, leak test and charge the system. (2) Evacuate, leak test and charge the system.

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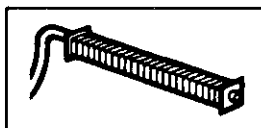
	HEATING AND AIR CONDITIONING AIR CONDITIONING SYSTEM	
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DIAGNOSIS CHART D

Symptom	Problem Diagnosis and Inspection	Cause and Remedy
Lack of Cooling	Smooth Running Compressor Unusually high suction Pressure with unusually low discharge pressure STEP SEQUENCE 1 Remove Valve Plate and Inspect Or Valve Plate Test	Replace or Repair Broken Head or Block Gasket Broken or Deformed Reed Valve Foreign Substance Under Reed Valve or Gasket
	1 Check for low Refrigerant Charge 2 Leak Check Compressor 3 Leak Check and Diagnose System	Replace or Repair Shaft Seal Leak Service Port Cylinder Head Leak Gasket Leak Oil Filler Plug Leak Cracked Cylinder Block Front Housing O Ring Leak
	1 Check Belt Tension	Adjust Air Gap
	Rough Running or Intermittent or Inoperative Intermittent or Inoperative 3 Check Clutch Volts, Amps, Coil Lead Wire 4 Shaft Turning Smoothness Test	Replace or Repair Broken Lead Wire Clutch Coil Defect—Internal System Ground Compressor Failure—Internal

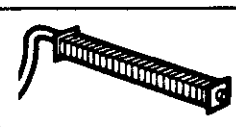
Symptom	Problem Diagnosis and Inspection	Cause and Remedy
Unusual Noise	Clutch engaged 1 Check Compressor Mounting Components 2 Check Engine Components 3 Check for Intermittent or Slipping Clutch 4 Check for Proper Refrigerant Charge 5 Check Clutch Bearing 6 Oil Level 7 Shaft Turning Smoothness Test 8 Remove Valve Plate and Inspect	Adjust Air Gap—Defective Coil Recharge and Recheck Replace Bearing Restore to Proper Level Compressor Failure (Internal) Replace or Repair Broken Discharge Valve Reed or Retainer Broken Suction Valve Reed Broken Gasket
	Clutch disengaged "chattering" 1 Check Air Gap	Replace or Repair Adjust Air Gap Defective Clutch Pulley or Front Plate

SEE I.S. NOTES



HEATING AND AIR CONDITIONING

AIR CONDITIONING SYSTEM



REFRIGERANT SAFETY PRECAUTIONS

The refrigerant used for automotive air conditioner systems is dichlorodifluoromethane, commercially known as Refrigerant-12 or R-12.

R-12 is transparent and colorless in both the liquid and vapor state. Because it has a boiling point of 29.8°C (21.7°F) below zero at atmospheric pressure, it vaporizes rapidly at all ambient temperatures and pressures.

The vapor is heavier than air. It is not flammable nor explosive and is not poisonous unless exposed to an open flame. It is also not corrosive unless combined with water.

Observe the following safety precautions when working with R-12.

- R-12 evaporates almost immediately at normal atmospheric pressures and temperatures. As a result, it can freeze objects on contact.
- For this reason, extreme care must be taken to prevent R-12 from contacting the skin and especially the eyes

WARNING: Always wear safety goggles when servicing the refrigeration part of the air conditioner system. Keep a bottle of sterile mineral oil and a weak solution of boric acid handy when servicing the refrigeration system. If liquid R-12 gets into the eyes, wash them out with a few drops of mineral oil (R-12 is rapidly absorbed by oil). Then wash the eyes again with a weak solution of boric acid. Call a doctor immediately, even if irritation has ceased after first aid treatment.

WARNING: Never heat a container of R-12 above 51.7°C (125°F).

- Before charging or adding R-12 to the system, moderate heat will be required to increase the pressure of R-12 in a container above system pressure. Use warm water in a bucket or pan for this purpose. The water temperature must not exceed 51.7°C (125°F).
- Do not heat the R-12 container with an open flame or any means that would raise refrigerant temperature above the specified maximum.
- Do not weld or steam clean system hoses or components.

CAUTION: Do not add R-12 in liquid form to the system. Liquid refrigerant can damage the compressor.

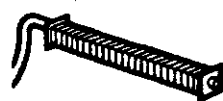
- Add R-12 to the system in vapor form only. Keep refrigerant containers upright when charging the system to ensure this. When recharging the system after service, keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor

WARNING: Large quantities of R-12 vapor in small poorly ventilated areas can displace the air and cause suffocation. Always work in a well-ventilated area and be sure to maintain good ventilation throughout the work area.

- Discharge refrigerant into the service bay exhaust system or outside the building only.

WARNING: Although R-12 vapor is normally not poisonous, it changes into a highly poisonous gas if allowed to contact an open flame.

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- Do not discharge R-12 in any area containing an open flame (e.g. portable heaters, welding equipment).
- Use an electronic-type leak detector to check for system leaks whenever possible. The halide torch leak detector utilizes an open flame for the detection process. R-12 refrigerant becomes a highly poisonous gas when exposed to an open flame. If a halide torch detector must be used, avoid inhaling the resulting fumes.

CAUTION: Generally, R-12 is not corrosive unless combined with water. However, it can discolor chrome and bright metal trim. Keep R-12 refrigerant away from these items.

- R-12 becomes highly corrosive when combined with water and can damage painted

and unpainted metal surfaces. Do not allow R-12 to contact any metal surfaces during service operations.

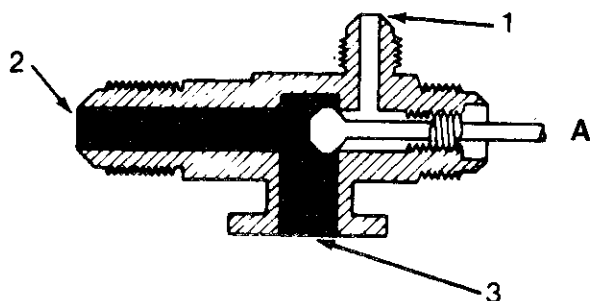
SERVICE VALVES

The discharge (high pressure) and inlet (suction) service valves are used for diagnosis, charging, discharging and evacuating the system. They are also used to isolate the system during component removal/installation.

The service valves are three-position valves. Normal operating position for the valve stem is position (A) which is the back-seated (full-out) position. The stem is turned counterclockwise to place it in this position.

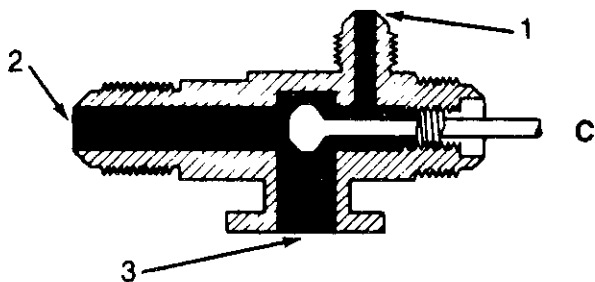
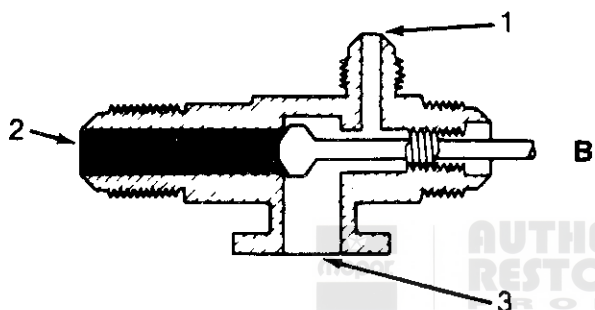
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Valve stem position (B) is the front seated (full-in) position. It is used to isolate the compressor from the system. The stem is turned clockwise to place it in this position.

In position (C), the valve stem is mid-positioned and the gauge port is open. This position is used for pressure testing and for charging, discharging and evacuating the system.



1. To Service Port
2. To Hose
3. To Compressor

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Discharge Service Valve Adapters

On occasion, a service hose may not fit a service valve fitting. The adapters outlined in the following chart are available and can be used to achieve service valve connection.

Discharge Service Valve Adapters

MANUFACTURER	PART NUMBER		
	Straight	Right Angle	Flex
Kent Moore	J-25498	J-25499	—
K-D Tools	KD-2409	—	—
Draf Tools	AC 354	—	AC 355

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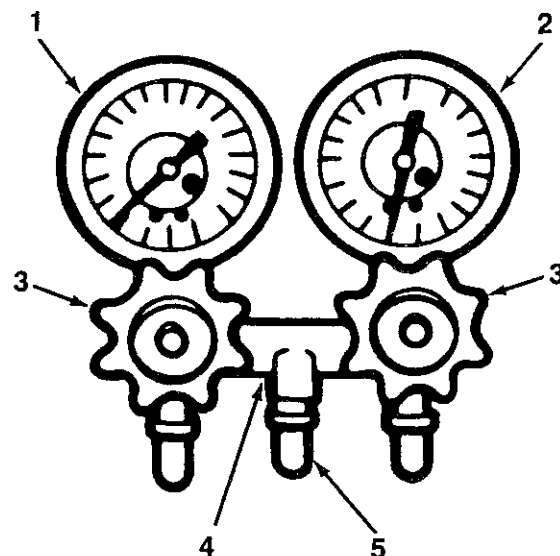


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PRESSURE GAUGE AND MANIFOLD

Pressure gauge and manifold J 23575 is used to test pressures on both the high and low sides of the system. The gauge and manifold can also be used to recharge or add refrigerant to the system in conjunction with refrigerant can holder J 6272-02.



1. Compound Gauge (Suction)
2. High Side Gauge (Discharge)
3. Hand Valves
4. Manifold
5. Center Service Fitting

Connecting The Pressure Gauge and Manifold

Remove and retain the service valve protective caps.

Close both of the hand valves on the gauge and manifold.

Connect the compound gauge hose (1) to the suction (low pressure) service valve.

Connect the high side gauge hose (2) to the discharge (high pressure) service valve.

Turn both of the service valve stems to mid-position (C).

Open both of the manifold hand valves (3) for 3-5 seconds to purge air from the manifold and hoses.

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Verify that both hand valves are fully closed.

The gauge and manifold is now ready for pressure testing. Refer to the System Pressure Test procedure.

SYSTEM PRESSURE TEST

Connect the pressure gauge and manifold to the service valves.

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 pulley, belts or fan. Do not wear loose clothing.

Start the engine.

Set the A/C system at the full cooling setting but not to the MAX setting.

Operate the engine at 1500 rpm for about 10 minutes to stabilize the A/C system.

Insert a thermometer into the discharge air outlet and note air temperature. Temperature should be approximately 7.1°C (45°F).

NOTE: Discharge air temperature will vary depending upon relative humidity. Generally, low humidity results in a slightly lower temperature while high humidity results in slightly higher temperatures. The range variance is usually plus or minus three degrees.

Observe the gauge pressures. High side (discharge) pressure should be approximately two times ambient temperature. Low side (suction) pressure should be approximately 10% of high side pressure.

For example, if shop temperature is 80°F, high side pressure would be about 160 psi. and low side pressure would be about 16 psi.

NOTE: The above pressures are approximations only. Relative humidity, atmospheric pressure and altitude will all affect pressure readings. Depending upon atmospheric conditions, the system may function efficiently with pressures that are lower or higher.

If pressures are abnormally high or low, refer to the Diagnosis Charts.

DISCHARGING THE SYSTEM

The refrigerant must be discharged before replacing any system component except the compressor. The compressor can be isolated with the service valves.

Discharge Procedure

Connect the pressure gauge and manifold to the service valves.

Open both manifold hand valves fully.

CAUTION: Do not allow the refrigerant to discharge rapidly. The oil in the compressor and system will be forced out along with the refrigerant.

Open both of the service valves slightly (from back-seated to mid-position) and allow the refrigerant to discharge slowly.

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EVACUATING THE SYSTEM

The system must be evacuated whenever refrigerant has been discharged or when system refrigerant level has become abnormally low. A vacuum pump is used for the evacuation process.

The system must be evacuated to remove any moisture or air that may have collected in the system. If moisture is not removed from the system, it will combine with R-12 to form a highly corrosive substance.

The vacuum pump decreases system pressure by creating a vacuum within the system. The pressure drop causes the boiling point of moisture in the system to decrease also. The moisture then boils into a vapor which is easily drawn off by the vacuum.

At an ambient temperature of 23.9°C (75°F) and a vacuum of 99 kPa (29.5 in. Hg), water will boil at approximately 12°C (54°F). This will produce complete vaporization of all moisture in the system.

NOTE: At elevations above sea level, it may not be possible to obtain a vacuum of 99 kPa (29.5 in. Hg) on the low side. For each 300 meters (1000 ft) increase in altitude, the vacuum must be corrected by 3.37 kPa (1 in. Hg) to compensate for the change in atmospheric pressure.

For example, at an of altitude of 300 meters (1000 ft), a vacuum of 96 kPa (28.5 in. Hg) will be equivalent to 99 kPa (29.5 in. Hg) at sea level. When this vacuum level is attained, a minimum evacuation time of 30 minutes should be allowed to ensure total moisture removal.

Evacuation With Vacuum Pump J 26695

NOTE: The J 26695 Vacuum Pump and motor must be kept upright at all times to prevent oil spills.

Connect the pressure gauge and manifold to the service valves.

Discharge the system.

Connect the center service hose on the gauge and manifold to the vacuum pump inlet fitting.

Turn both manifold hand valves to the wide open position.

Start the vacuum pump and observe the vacuum gauge reading.

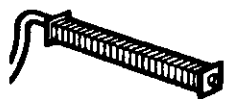
Test the system for leaks as follows:

- Close the manifold hand valves.
- Stop the vacuum pump and observe the vacuum reading.
- If the system is leak-free, vacuum will hold steady at the level indicated when the pump was stopped. If vacuum remains steady for 3-5 minutes, resume and continue evacuation for a minimum of 30 minutes.
- If the system has a leak, vacuum will fall off or rapidly drop to a zero reading. If a leak exists, partially charge the system. Find and repair the leak and resume evacuation.

Continue operating the pump for a minimum of 30 minutes after attaining lowest vacuum indicated on the gauge.

Close the manifold hand valves and stop the vacuum pump.

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Disconnect the center service hose from the vacuum pump. The system is now ready for charging.

Evacuation With Portable Service Station J 23500-01

The J 23500-01 air conditioner service station is a self contained, portable unit equipped with a vacuum pump, metering-charging cylinder, refrigerant supply, pressure and vacuum gauges, service hoses and control valves.

Turn the station vacuum pump control switch Off (the switch is at the front of the station). The pump control switch must be OFF before connecting the station to an electrical power source.

Close all the hand valves.

Connect the red charging hose (1) to the discharge service valve.

Connect the blue charging hose (2) to the inlet (suction) service valve.

Discharge the system. Leave the suction and discharge service valves in the mid-position.

CAUTION: The system must be completely discharged before evacuating. If the system is still charged, refrigerant can enter and damage the vacuum pump.

Connect the vacuum pump hose to the vacuum pump inlet.

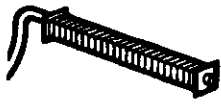
Open the low and high pressure control valves on the charging station.

Start the vacuum pump (3). Open the vacuum control valve and note the vacuum reading.

Test the system for leaks as follows:

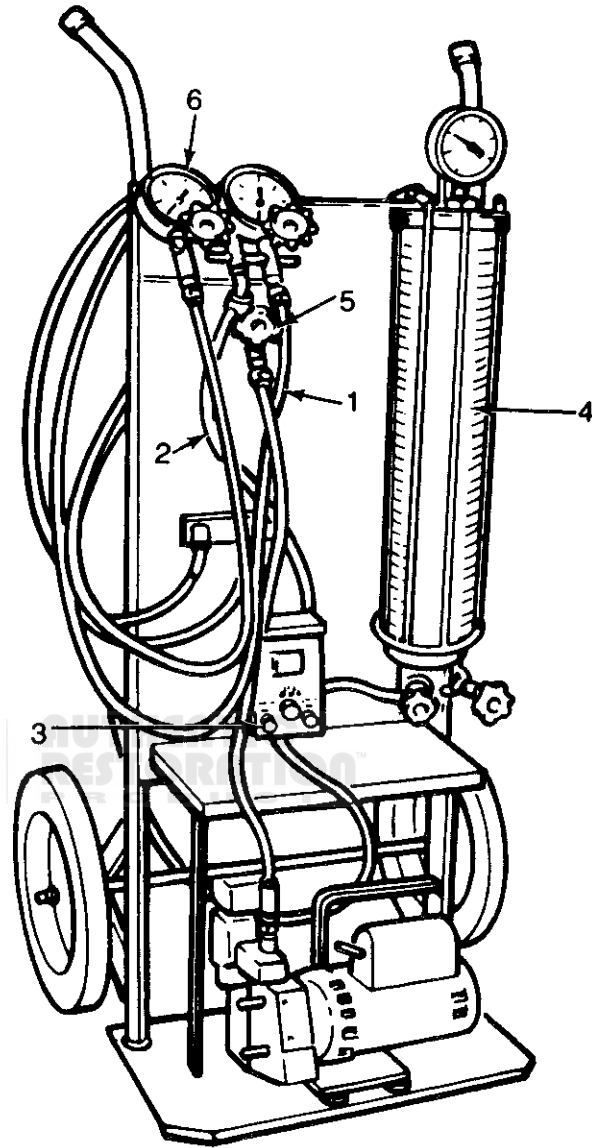
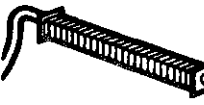
- Close the manifold hand valves.
- Stop the vacuum pump and observe the vacuum reading.
- If the system is leak-free, vacuum will hold steady at the level indicated when the pump was stopped. If vacuum remains steady for 3-5 minutes, resume and continue evacuation for a minimum of 30 minutes.
- If the system has a leak, vacuum will fall off or rapidly drop to a zero reading. If a leak exists, partially charge the system. Find and repair the leak and resume evacuation.
- Continue evacuating the system for a minimum of 30 minutes after attaining the lowest vacuum level.
- Fill the station charging cylinder (4) while the system is evacuating.
- Close the vacuum control valve (5) and stop the vacuum pump.
- Observe low pressure gauge (6) to determine if a system leak exists. If the system is leak-free, the system is now ready for charging.

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LEAK TESTING

External leaks in the system can be located using electronic detector J 29547 or halide torch J 6084.

The electronic leak detector is recommended because it is light, accurate and most important, does not expose the user to toxic gas fumes. The halide torch requires an open flame for leak detection. When R-12 is exposed to an open flame, it turns into Phosgene gas which is poisonous.

Procedures for using the two leak detectors are as follows.

Leak Testing With Electronic Detector J 29547

NOTE: Leak detector J 29547 will locate R-12 leaks as small as one-half ounce per year.

Calibrate the detector as outlined in the manufacturer's instructions.

Remove the flexible detector probe from the case.

Turn the detector control switch On.

Prepare the detector for use.

- Place the flexible probe tip near the leak port on the detector.
- Adjust the BAT thumbwheel a few teeth at a time, until the light illuminates-then goes out when the tip is removed from the leak port.

- Begin leak testing. Move the flexible probe slowly under all suspect connections, joints and seals.

NOTE: Because R-12 refrigerant is heavier than air, leaks are more readily detected on the lower side of components being checked.

The leak indicator light will illuminate when a leak is detected.

NOTE: The indicator light will go out if the probe tip is held near the leak point for an extended period.

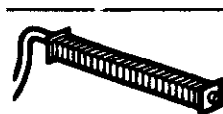
Repair leaks as required.

Evacuate and recharge the system after leaks are corrected.

Leak Testing With Halide Torch J 6084

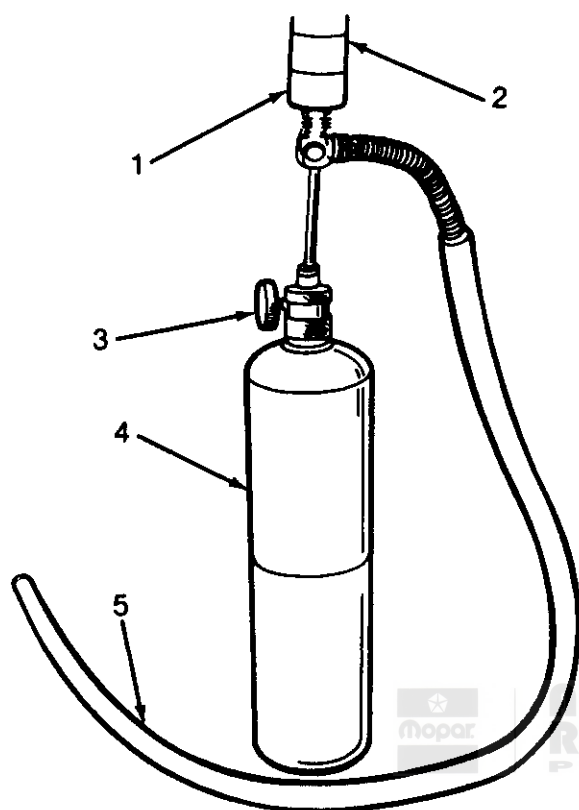
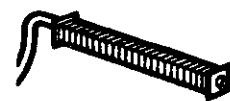
The torch is fueled by propane gas contained in the cylinder (4). The gas heats a copper reactor ring mounted in the stove (2) at the top of the torch. Air entering the search hose (5) is drawn into the stove and into contact with the reactor ring. If R-12 is present in the area being tested, the normally light blue flame will change to green or a purplish-blue color.

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1. Reactor Plate
2. Stove
3. Gas Control Knob
4. Gas Cylinder
5. Search Hose

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Leak Test Procedure

Open the cylinder valve (3) and ignite the torch. Adjust the flame just only high enough to heat the copper reactor ring to a cherry red color.

Lower the flame until it is about 6.4 mm (1/4 in) above or even with the copper reactor ring. A

smaller flame is more sensitive to the presence of R-12.

Move the search hose (5) slowly under all suspected components.

NOTE: Because refrigerant is heavier than air, leaks are more readily detected on the lower side of the areas being tested.

Watch for a change in flame color as the hose is moved under various components. A flame color change indicates a leak.

WARNING: When R-12 refrigerant contacts an open flame, phosgene gas is produced. Never inhale the vapor from the torch because it is poisonous.

Repair any leaks as required.

Evacuate and recharge the system after correcting a leak.

FLUSHING THE SYSTEM

System flushing is accomplished with portable service station J 23500-01.

WARNING: Wear goggles to protect the eyes.

Install the compressor (if removed) and connect the service valves and hoses.

NOTE: The system must be completely discharged before proceeding.

Close all control valves of service station J 23500-01.

Connect the red high pressure hose of the station to the discharge service valve.

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Open the valve on the station refrigerant drum.

Bleed the station charging cylinder with the valve located on the back of the control panel directly above the cylinder.

Stop bleeding the charging cylinder when it contains 0.9 kg (2 lbs) of refrigerant close the bleed valve.

Close the refrigerant drum valve.

Disconnect the receiver-dryer from the condenser.

Place a shop towel on the condenser outlet to absorb the oil that will be flushed from the system.

Midposition the discharge service valve.

Fully open the high pressure valve on the station control panel to allow refrigerant to flow through the condenser.

WARNING: Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated area can displace the air and cause suffocation.

When the charging cylinder is empty, close the valve on the station control panel.

Check and adjust compressor oil level.

A replacement receiver-dryer should be installed and the system evacuated before recharging.

CHARGING THE SYSTEM

Charge Capacity

The recommended system charge is 0.9 kg (2 lbs) of R-12 refrigerant.

NOTE: Replacement of a hose, receiver-dryer, condenser, expansion valve or evaporator core will require that an additional 28 grams (one ounce) of compressor oil be added to the system.

Charging With Multi-Refrigerant Dispenser J 6272-02

The following charging procedure is based on the use of pressure gauge and manifold J 23575 and multi-refrigerant dispenser J 6272-02.

WARNING: Wear goggles to protect the eyes.

Connect pressure gauge and manifold J 23575.

Mid-position the service valves.

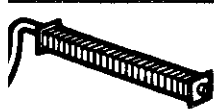
Evacuate the system.

Close both manifold hand valves.

Disconnect the service hose from the vacuum pump and reconnect it to the center fitting of multi-refrigerant dispenser J 6272-02.

Close all of the petcock valves on the dispenser.

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Attach the necessary number of refrigerant cans to the dispenser. Refer to Charge Capacity for the amount of R-12 required to charge the system.

Bleed air from the manifold and dispenser. Loosen the center service hose at the manifold. Open one dispenser petcock and allow refrigerant to purge air from the components. Tighten the service hose and close the petcock after all air is purged.

Open the low pressure (suction) gauge hand valve and one petcock valve. Do not open the discharge (high pressure) gauge hand valve at this time.

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.

Start the engine. Set the air conditioner controls at maximum cooling. Compressor operation will charge the inlet (suction) side of the system.

NOTE: The refrigerant containers may be placed upright in warm water (at a maximum temperature of 51.7°C (125°F) to cut down charging time.

When the first refrigerant can is empty, open another petcock valve to continue charging the system.

Continue adding R-12 until the system is fully charged. The frost line on the refrigerant container will indicate how much refrigerant has entered the system.

NOTE: If an accurate scale is available, weigh the refrigerant cans during the charging procedure to verify the amount of refrigerant added.

When the system is fully charged, close the manifold low pressure gauge hand valve and all the dispenser petcock valves.

Start the engine. Operate the A/C system 5-10 minutes so it will stabilize.

Check system operation.

Charging With Service Station J 23500-01

Fill the station charging cylinder. Refrigerant should be observed rising in the cylinder sight glass.

Slightly open the valve at the top of the cylinder when pressure in the charging cylinder and refrigerant supply tank are equal (this relieves head pressure allowing refrigerant to continue filling the cylinder).

Observe the pressure gauge at the top of the cylinder. Rotate the plastic cover on the cylinder until the pressure heading column corresponds with the gauge pressure in line with the sight glass.

For example, if the pressure gauge at the top of the cylinder indicates 483 kPa (70 psi), locate the column with the pressure heading of 483 (70) and rotate the cover so the 483 (70) column aligns with the sight glass.

When refrigerant reaches the correct level in the sight glass, close the right hand valve at the base of the cylinder and valve on the refrigerant drum.

Close the valve at the top of the charging cylinder.

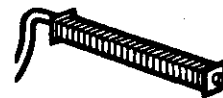
Check for bubbles in the refrigerant using the cylinder sight glass. If bubbles appear in the

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refrigerant, tilt the charging station rearward momentarily.

Connect the heating element cord to the power pack receptacle and turn the heater switch ON.

Allow the refrigerant to warm for about 10 minutes while the vacuum pump is operating.

WARNING: Wear goggles to protect the eyes.

Discharge and evacuate the system.

Close the low pressure valve on the charging station.

Fully open the left hand refrigerant control valve at the base of the cylinder and the high pressure valve on the charging station.

Charge the system.

Close the refrigerant control valve and the high pressure valve on the charging station.

CAUTION: Do not permit the liquid level to drop below zero on the cylinder sight glass.

Close the manifold gauges after completion of the charging operation and check the high and low side pressures.

Check system operation.

CAUTION: Do not check system pressures until the high and low pressure valves on the charging station are closed. The low pressure gauge could be damaged if the valves are open.

Close all the valves on the charging station and close the refrigerant drum valve when all the operations are completed.

Back-seat the service valves by turning them fully counterclockwise. Install the quick seal caps on the valves afterward.

Disconnect the charging hoses from the service valves. A small amount of refrigerant remaining in the hoses will escape.

Discharge any R-12 left in the charging cylinder. The cylinder is not designed to store refrigerant.

A/C CONTROL PANEL

Fan Switch

The fan switch may be serviced by removing the access plate located on the lower evaporator core housing.

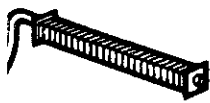
Temperature Control Thermostat

The evaporator housing must be removed and disassembled to service the temperature control thermostat. Refer to the evaporator housing removal/installation procedures.

When installing a replacement temperature control thermostat, insert the capillary tube (1) into the evaporator coil (2) a minimum of 5 cm (2 in).

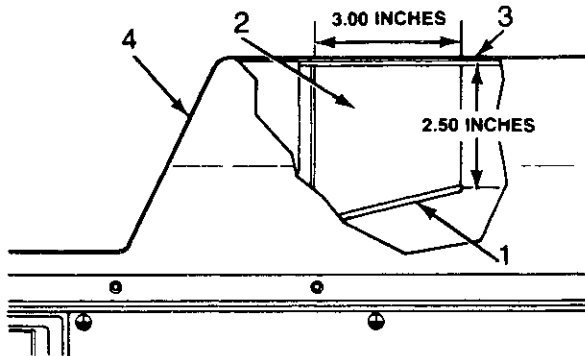
CAUTION: Handle the tube with care to avoid bends or kinks that could cause the thermostat to malfunction.

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- 1 Capillary Tube – Insert into Coil a Minimum of 5.1 cm (2 in)
2. Evaporator Coil
3. Insulation
4. Upper Part of Case

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CONDENSER

Removal

Discharge the system.

NOTE: Discharge the system slowly to prevent loss of compressor oil.

WARNING: Do not loosen the radiator draincock when the cooling system is hot and pressurized. Hot coolant can cause serious burns.

Drain the radiator. Drain the coolant into a clean container.

Remove the fan shroud and radiator.

Disconnect the pressure pipe fitting from the condenser.

Remove the condenser attaching screws and tilt the bottom of the condenser toward the engine.

NOTE: Plug all the condenser openings to prevent entry of dirt or moisture.

Working from under the vehicle, disconnect the receiver-dryer to-evaporator hose fitting from the receiver-dryer.

Remove the condenser and receiver-dryer as an assembly.

Remove the receiver-dryer from the condenser if necessary.

Installation

Attach the receiver-dryer to the condenser.

Place the condenser in position and connect the hose fitting to the receiver-drier.

Install the condenser attaching screws.

Connect the condenser pressure pipe fitting.

Install the radiator and fan shroud.

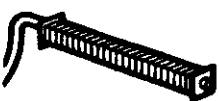
Fill the cooling system.

Evacuate, charge and leak test the air conditioning system.

SIGHT GLASS

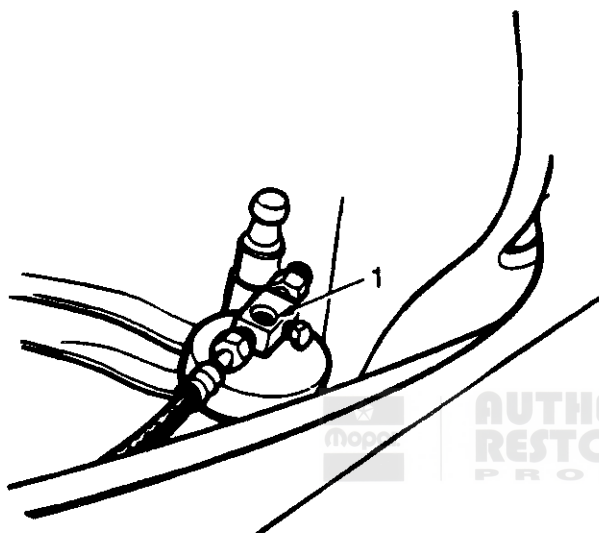
A sight glass (1) is located in the hose attached to the receiver-dryer. The sight glass

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provides a visual check of system refrigerant level.

A continuous stream of bubbles will appear in the sight glass when system charge is low. Bubbles will not appear when the system is fully charged.



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RECEIVER-DRYER

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Removal

Discharge the system.

NOTE: Discharge the system slowly to prevent loss of compressor oil.

Disconnect the evaporator and condenser hose fittings from the receiver-dryer.

Remove the receiver-dryer attaching screws and remove the receiver-dryer.

Installation

Install the receiver-dryer.

Connect the evaporator and condenser hose fittings to the receiver-dryer.

Evacuate, charge and leak test the system.

EVAPORATOR AND HOUSING

Removal

Discharge the system.

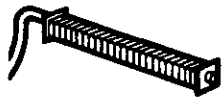
NOTE: Discharge the system slowly to prevent loss of compressor oil.

Disconnect the inlet (suction) hose.

Disconnect the receiver-dryer-to-evaporator hoses.

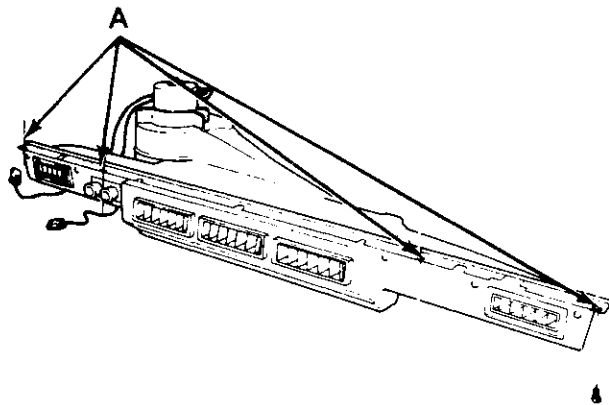
Remove the hose clamps and dash grommet retaining screws.

Remove the evaporator housing-to-instrument panel attaching screws (A) and the housing mounting bracket screw.



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Lower the evaporator housing and pull the hoses and hose grommet through the dash opening.

NOTE: The blower motor, blower motor housing, evaporator core, control switches and expansion valve can all be serviced after removing the evaporator housing.



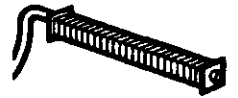
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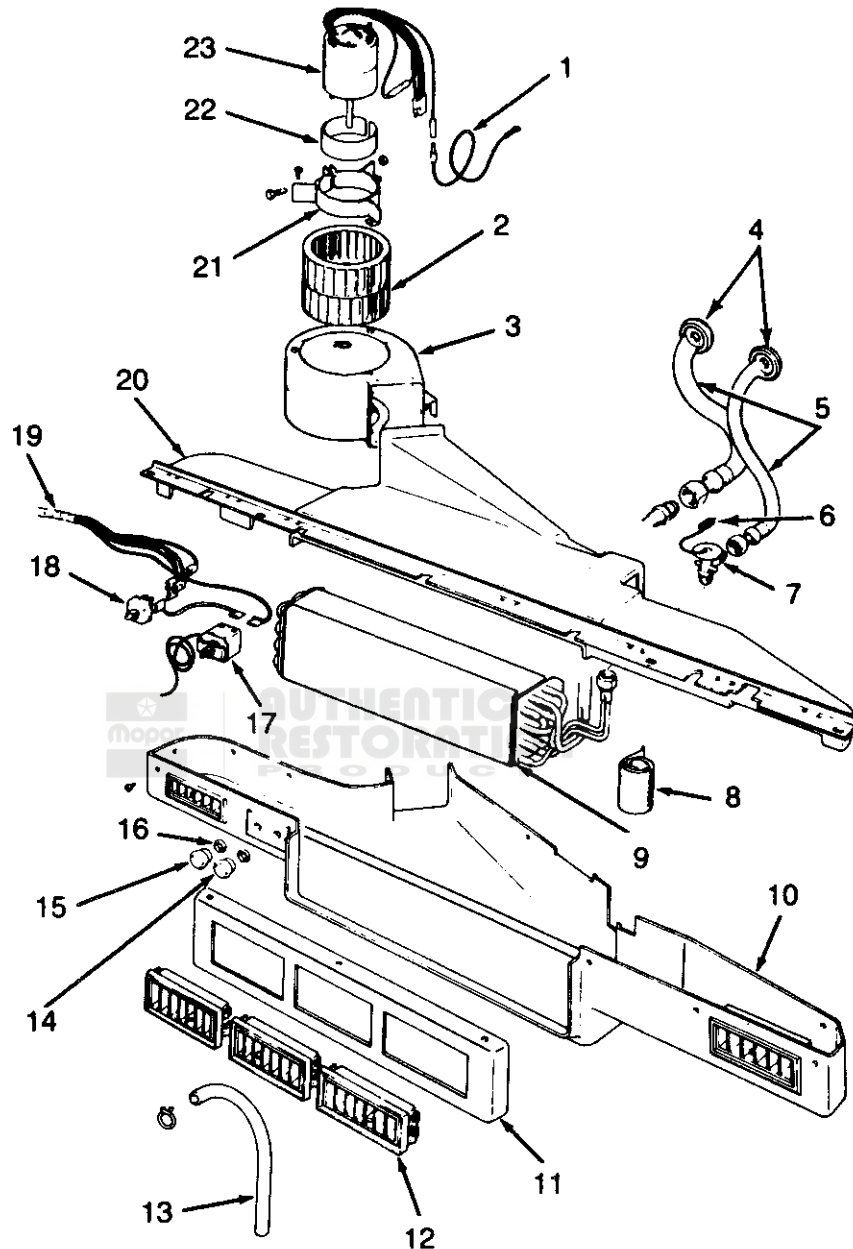


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AIR CONDITIONING SYSTEM

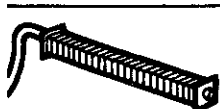


EVAPORATOR HOUSING AND COMPONENTS



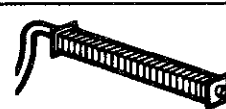
- | | |
|--------------------|------------------------------|
| 1. Feed Wire | 13. Drain Tube |
| 2. Blower Fan | 14. Temperature Control Knob |
| 3. Blower Housing | 15. Fan Control Knob |
| 4. Grommet | 16. Nut |
| 5. Hose | 17. Thermostat |
| 6. Capillary Tube | 18. Fan Control Switch |
| 7. Expansion Valve | 19. Switch Harness |
| 8. Insulation | 20. Upper Housing |
| 9. Evaporator Core | 21. Bracket |
| 10. Lower Housing | 22. Insulation |
| 11. Louver Panel | 23. Blower Motor |
| 12. Louver | |

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Installation

Push the hoses through the grommet openings and install the hose grommet by pushing it toward the engine compartment.

Install the hose grommet attaching screws.

Raise the evaporator housing. Install the evaporator housing-to-instrument panel attaching screws and the evaporator housing mounting bracket screw.

Install the hose clamps.

Connect the receiver-dryer hoses.

Connect the inlet (suction) hose.

Evacuate, charge and leak test the system.

EXPANSION VALVE

Removal

Discharge the system.

NOTE: Discharge the system slowly to prevent loss of compressor oil.

Remove the evaporator housing. Refer to the removal procedure.

Remove the insulation wrapped around the suction hose fitting, expansion valve and evaporator tubing.

Mark the capillary tube location on the evaporator tubing.

Disconnect the inlet and outlet hose fittings, and remove the capillary tube clamp.

Disconnect and remove the expansion valve.

Installation

Clean the evaporator tubing to provide a positive metal-to-metal contact for the replacement expansion valve capillary tube.

Install the replacement expansion valve.

Clamp the capillary tube at the marked location on the evaporator tubing.

Connect the inlet and outlet hose fittings.

NOTE: The capillary tube must be securely clamped and have positive metal-to-metal contact with the evaporator tubing.

Wrap the expansion valve, inlet hose fitting and capillary tube with insulation.

Install the evaporator housing. Refer to the installation procedure.

Evacuate, charge and leak test the system.

BLOWER MOTOR

It is not necessary to discharge the system to service the blower motor. The evaporator housing need only be lowered for access to the blower motor attaching screws.

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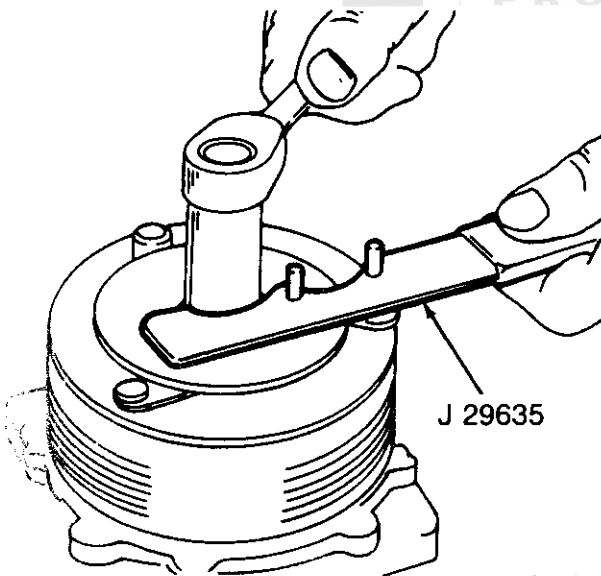
COMPRESSOR CLUTCH

The compressor clutch consists of a stationary electromagnetic coil and a rotating pulley and plate assembly. The pulley and plate are mounted on the compressor shaft.

When the compressor is not operating, the pulley freewheels on the clutch hub bearing. When the coil is energized, the plate is magnetically engaged with the pulley and turns the compressor shaft.

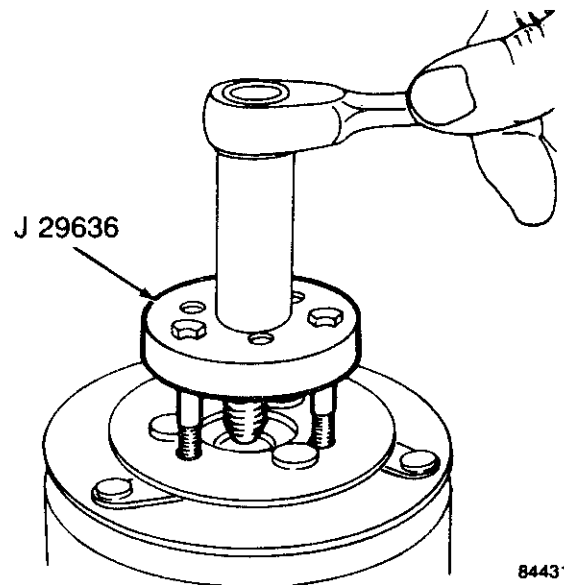
Removal

Insert two pins of Front plate spanner J 29635 into any two bolt holes in the front clutch plate.



Hold the clutch plate stationary and remove the nut.

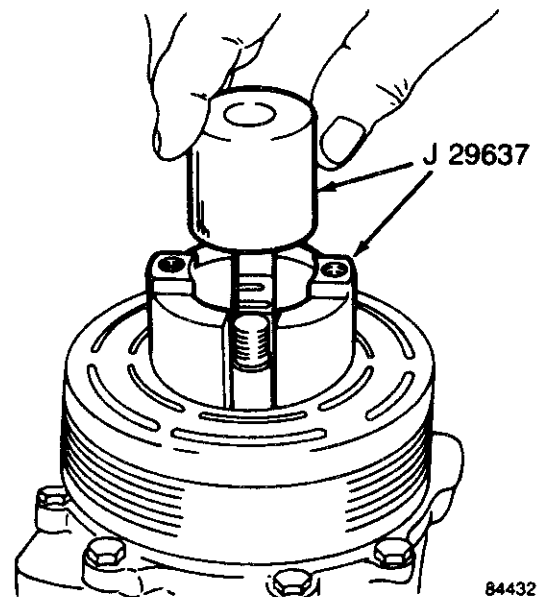
Remove the clutch plate using puller J 29636 and remove the key from the shaft.



Remove the internal bearing snap ring.

Remove the external front snap ring.

Remove the rotor pulley assembly with puller J 29637.



Insert the lip of the puller jaws into the internal bearing snap ring groove.

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Place the rotor puller shaft protector over the exposed compressor shaft.

Align the thumb head bolts with the puller jaws and finger-tighten.

Turn the puller center bolt clockwise to remove the rotor pulley.

Remove the electromagnetic coil wire from the clip on top of the compressor front housing.

Remove the snap ring with snap ring pliers and remove the electromagnetic coil.

Installation

Install the electromagnetic coil. The coil flange protrusion must align with the hole in the front housing. This is necessary to prevent coil movement and correctly position the wire.

CAUTION: Do not clamp the compressor in a vise with the jaw on the compressor body.

Support the compressor using the mounting ears at the rear of the compressor.

Align the and install the rotor assembly squarely on the front housing hub. Use a suitable tool to drive the rotor onto the shaft.

Install the internal bearing snap ring then the external bearing snap ring.

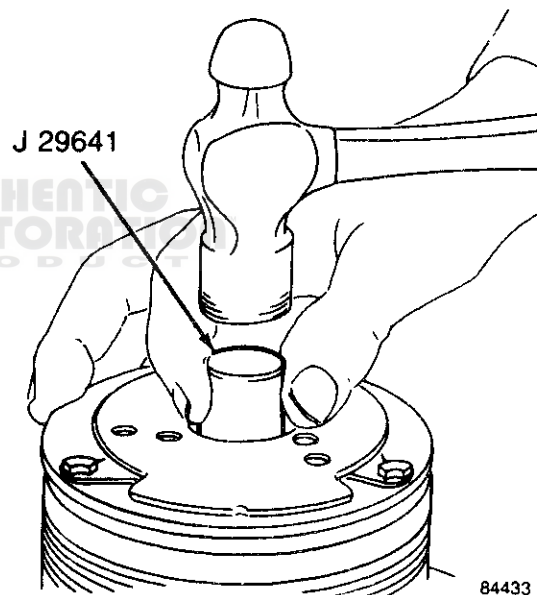
NOTE: The snap rings have a flat edge and a beveled edge on the circumference. Position the snap rings so that the flat edge is toward the compressor and the beveled edge is outward.

Install the front plate assembly and the original clutch shims on the compressor shaft.

Install the compressor shaft key.

Align the front plate keyway with the compressor shaft key. Install the front plate using installer J 29641. Tap the plate onto the shaft until it contacts the clutch shims.

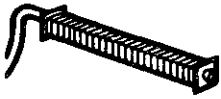
NOTE: When installing the front plate, a distinct change in the sound will be heard when the front plate contacts the shims.



Install and tighten the hex nut to 37 N·m (27 ft-lbs) torque.

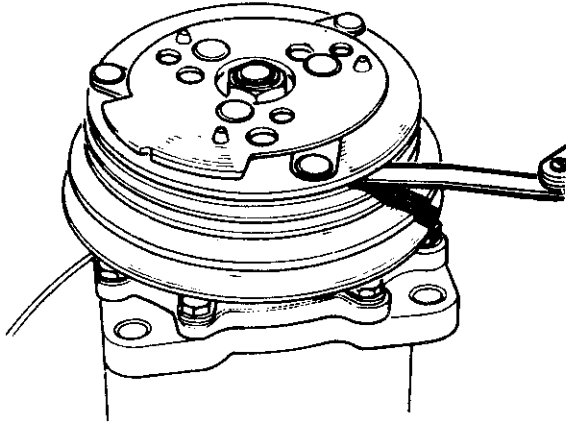
Check the air gap around the perimeter of the clutch plate and pulley with a feeler gauge. Air gap should be 0.41-0.79 mm (0.016-0.031 in) around the entire circumference of the plate and pulley.

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If the air gap varies at any point, lightly pry the plate upward at minimum variations or tap downward at maximum variations.

If the air gap is not or can not be set to specified limits, remove the hex nut and front plate and add or subtract shims as necessary.

NOTE: The air gap is determined by the spacer shims. When assembling existing or replacement clutch components try the original shims first. When installing a replacement clutch on a replacement compressor, use a 1.02-, 0.51- and 0.13-mm (0.040-, 0.020- and 0.005-in) shim.

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COMPRESSOR SERVICE

Service Valve Leak Test

The compressor should be at operating temperature for an accurate test.

Install pressure gauge and manifold J 23575.

Front-seat the suction and discharge service valves by turning them clockwise.

Discharge refrigerant remaining in the compressor by slowly opening the suction service valve.

Open the low pressure gauge hand valve and close the high pressure gauge hand valve.

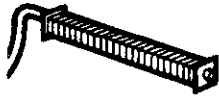
WARNING: Use extreme caution when the engine is operating. Do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear loose clothing.

Start the engine and operate the compressor. Pressure will build up rapidly. Stop the engine and compressor at 1 035-1 380 kPa (150-200 psi).

NOTE: Pressure should hold steady if the discharge service valve is operating properly. A loss of pressure indicates a leaking discharge valve or compressor head gasket.

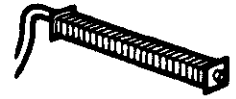
Compressor Isolation

It is not necessary to discharge the system for compressor removal. The compressor can be isolated from the remainder of the system and



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eliminate the need for recharging when performing compressor service.

Connect pressure gauge and manifold J 23575.

Close both gauge hand valves.

Mid-position both service valves.

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.

Start the engine and operate the air conditioning system.

Turn the suction service valve slowly clockwise toward the front seated position.

When pressure drops to zero, stop the engine and compressor and quickly finish front-seating the suction service valve.

Front-seat the discharge service valve.

Loosen the oil level check plug slowly to release any internal pressure in the compressor.

The compressor is now isolated from the remainder of system.

The service valves can be removed from the compressor. Use tightening tool J 29642-11 to loosen or tighten the valve and fittings.

Compressor Removal

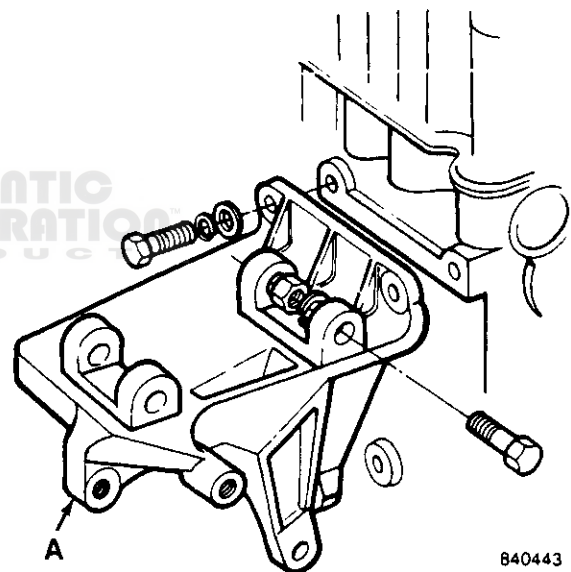
Disconnect the battery negative cable.

Isolate the compressor.

Disconnect the discharge and suction hoses. Cover the hose openings to prevent moisture or dirt entry.

Remove the compressor drive belt by loosening the idler pulley or alternator on engines equipped with serpentine belt.

Remove the compressor attaching bolts and remove the compressor from the mounting bracket (A).



NOTE: If the compressor is being replaced, remove and transfer the magnetic clutch to the new compressor.

Compressor Installation

Check and adjust compressor oil level on the original or replacement compressor.

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If a replacement compressor is being installed, transfer the original magnetic clutch to the new compressor.

Install the compressor on the mounting bracket.

Install the drive belt.

Tighten the drive belt to specified tension.

Connect the discharge and suction hoses.

Connect the battery negative cable.

Evacuate, recharge and test the system for leaks.

Reset the clock.



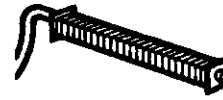
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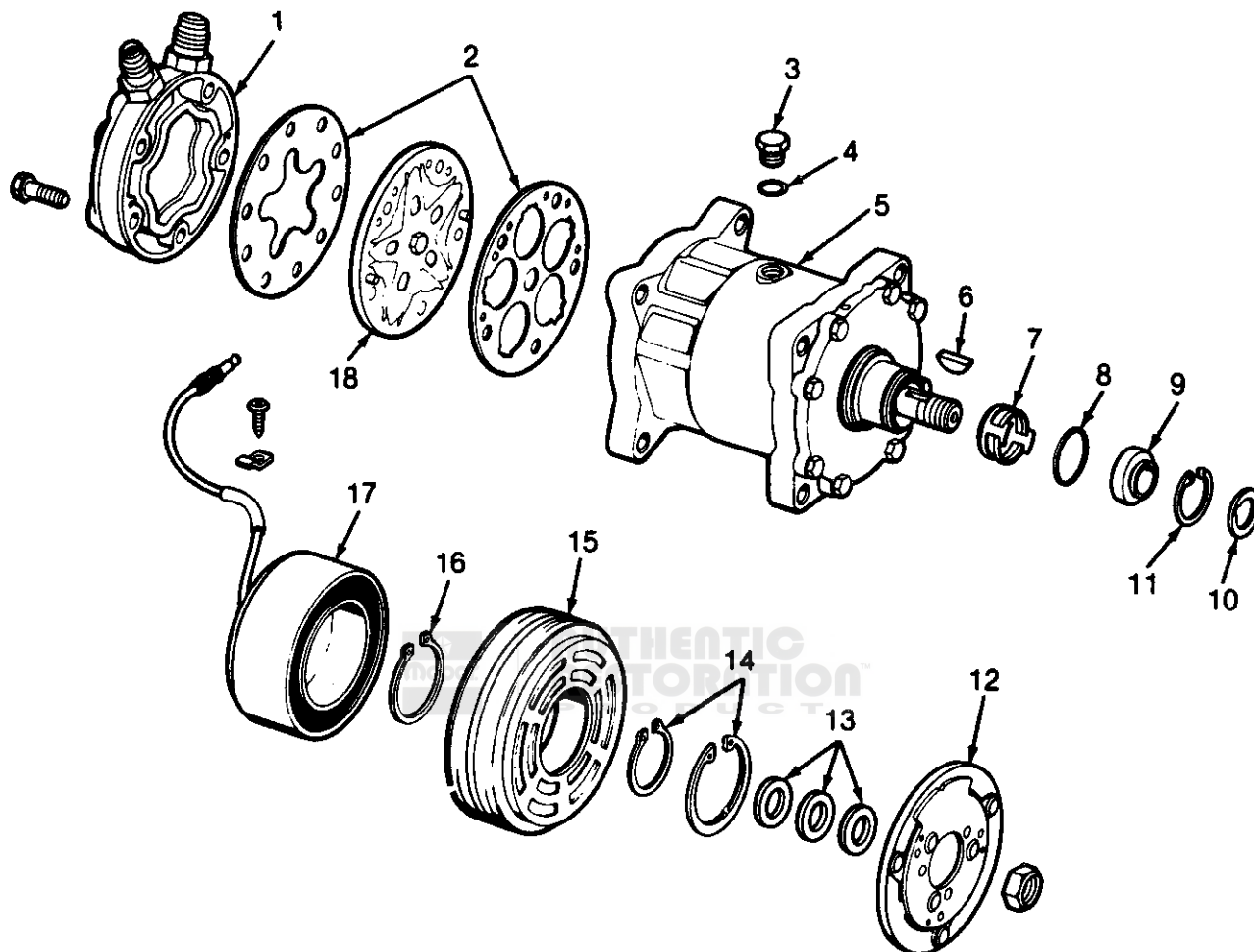


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COMPRESSOR COMPONENTS



1. CYLINDER HEAD
2. GASKETS
3. OIL FILL PLUG
4. O-RING
5. COMPRESSOR HOUSING
6. KEY
7. SHAFT SEAL
8. O-RING
9. SHAFT SEAL SEAT

10. FELT RING
11. SNAP RING
12. FRONT PLATE
13. SHIMS
14. SNAP RING
15. ROTOR PULLEY
16. SNAP RING
17. CLUTCH ASSEMBLY
18. VALVE PLATE

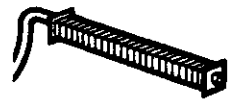
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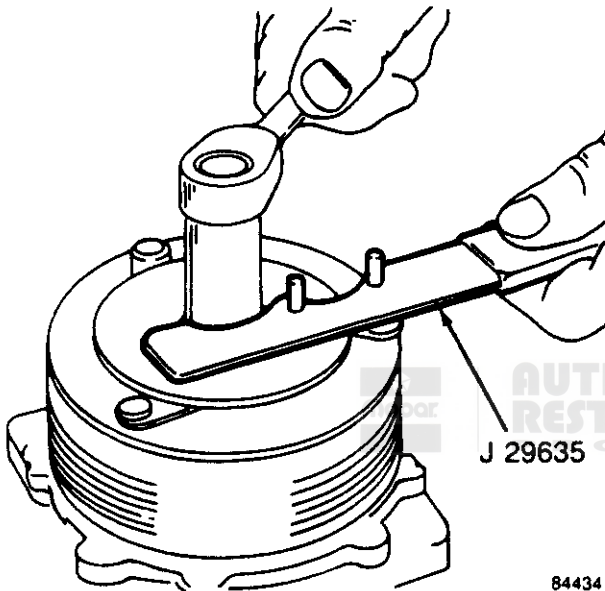
AIR CONDITIONING SYSTEM



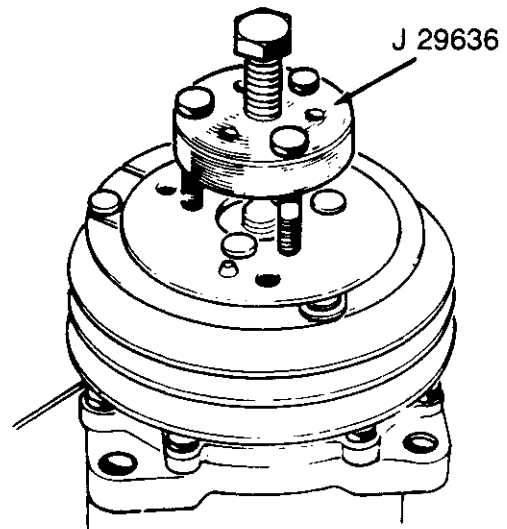
Compressor Front Seal Replacement

Remove the compressor.

Insert two pins of front plate spanner J 29635 into any two bolt holes in the clutch front plate. Hold the clutch plate stationary and remove the pulley nut.



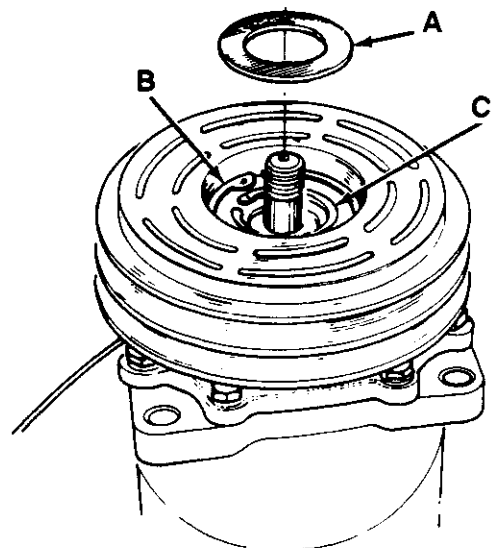
Remove the clutch plate with puller J 29636 and remove the key from the compressor shaft.



Insert snap ring pliers into the two holes in the felt ring metal retainer and remove the ring.

Remove the clutch shims. Use O-ring hook J 9553-01 and a small screwdriver to prevent the shim from binding during removal.

Remove the shaft seal seat retaining snap ring with pliers.



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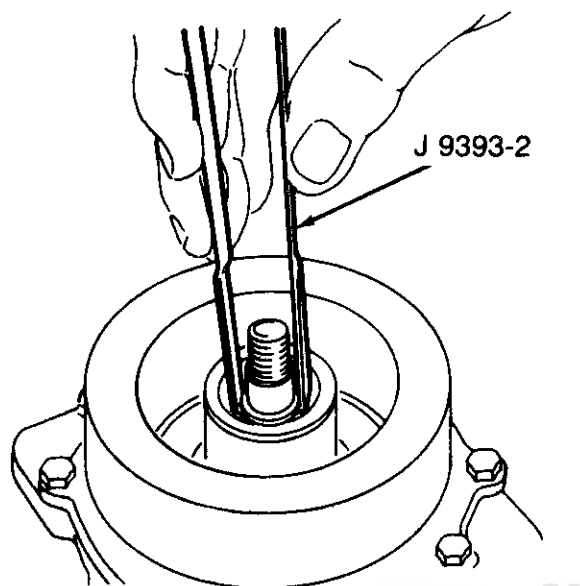


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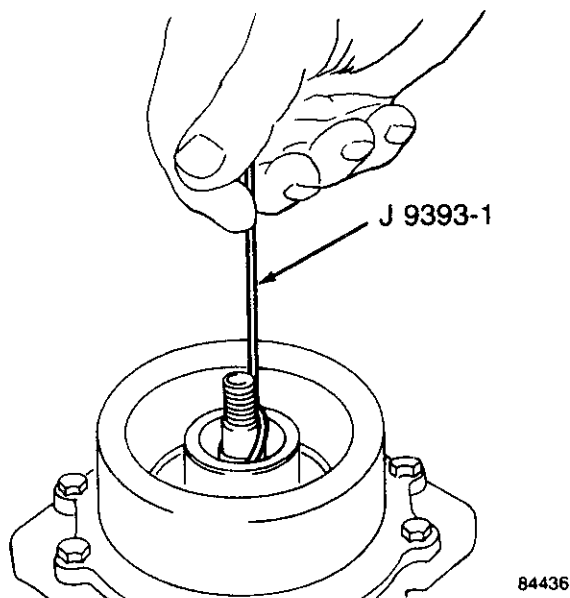


Remove the shaft seal seat using tongs J 9393-2.

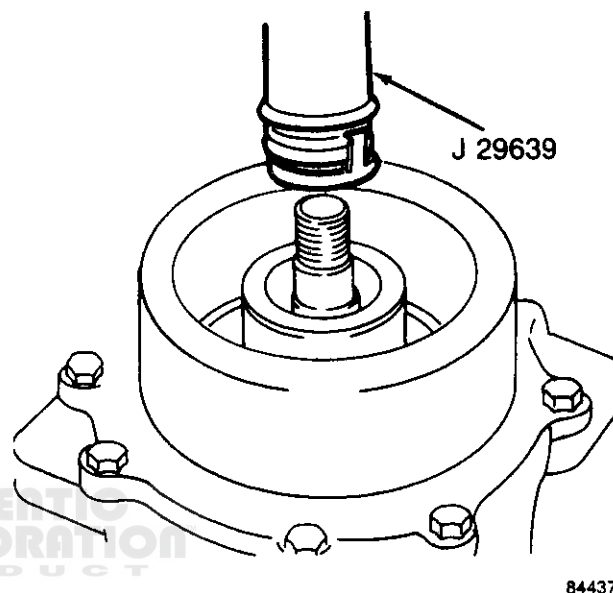


CAUTION: When removing the shaft seal O-ring, do not scratch the O-ring groove with the hook tool.

Remove the shaft seal O-ring with O-ring hook J 9553-01.



Remove the front seal with tool J 29639. Insert the tool into the seal bore. Press the tool down against the seal spring. Then twist the tool until it engages in the slots in the seal cage and lift the seal out.



Clean the seal cavity thoroughly with a lint-free cloth and clean compressor oil. Dirt and foreign material must be removed from the seal bore prior to seal installation.

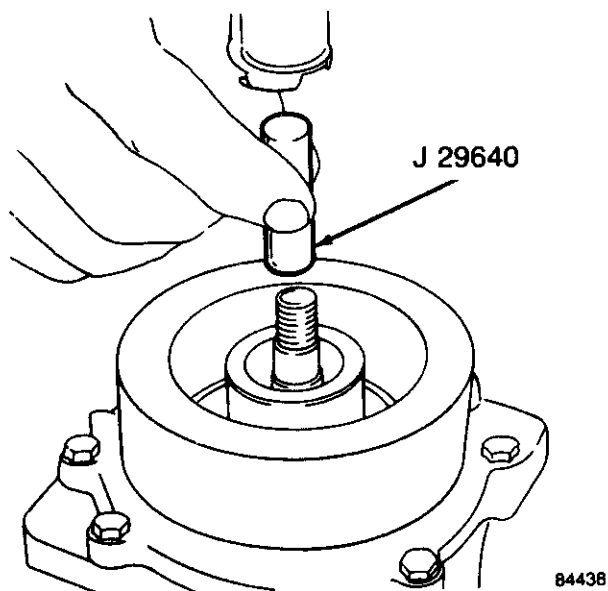
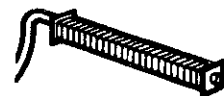
Insert sleeve protector J 29640 over the compressor shaft.

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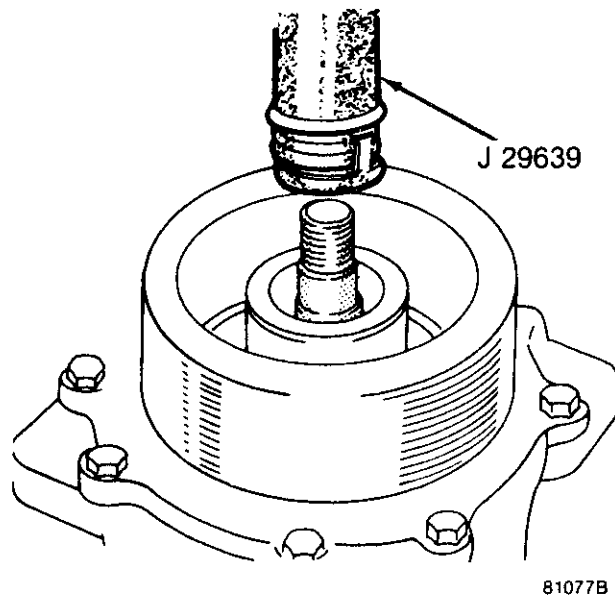
AIR CONDITIONING SYSTEM



CAUTION: Do not touch the lapping surfaces of the replacement seal.

Dip the mating surfaces of the seal lapping surfaces in clean compressor oil.

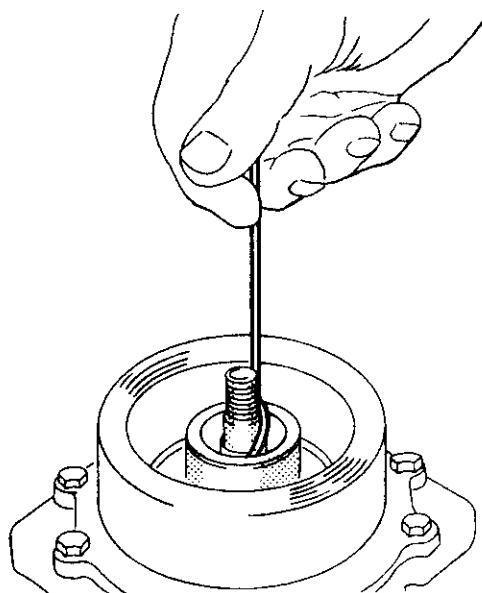
Engage the slots of remover/installer tool J 29639 in the slots in the seal cage. Insert the seal assembly firmly into place in the compressor seal cavity.



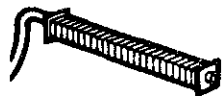
Twist tool J 29639 in the opposite direction to disengage the tool from the seal cage.

CAUTION: When installing the shaft seal O-ring, do not scratch the O-ring groove with the hook tool.

Coat the O-ring with clean compressor oil. Install it carefully in the seal groove with O-ring hook J 9553-01.

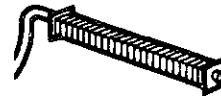


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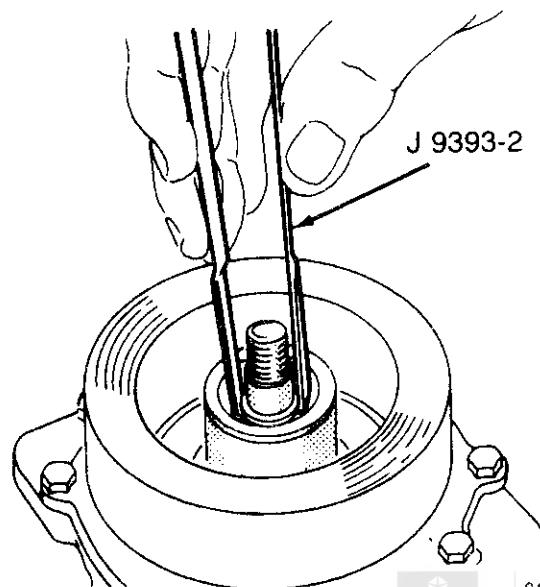


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Coat the seal retainer with clean compressor oil and install it with retainer tongs J 9393-2. Press the retainer lightly against the seal.



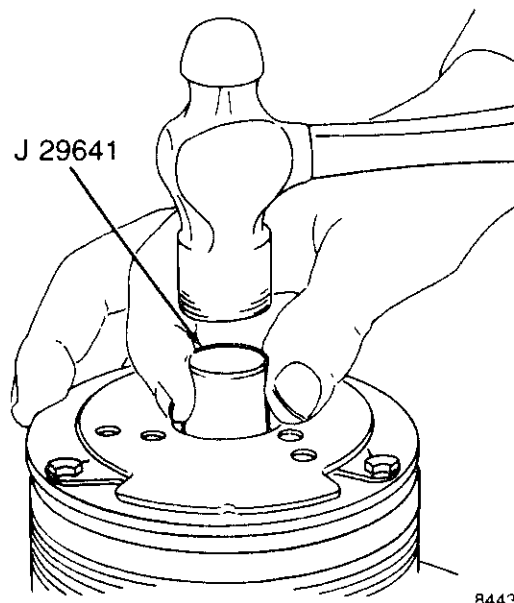
Install the snap ring with the beveled edge out (away from the compressor). Lightly tap the snap ring to seat it in if necessary.

Install the clutch spacer shims.

Tap the replacement felt ring into place and install the compressor shaft key.

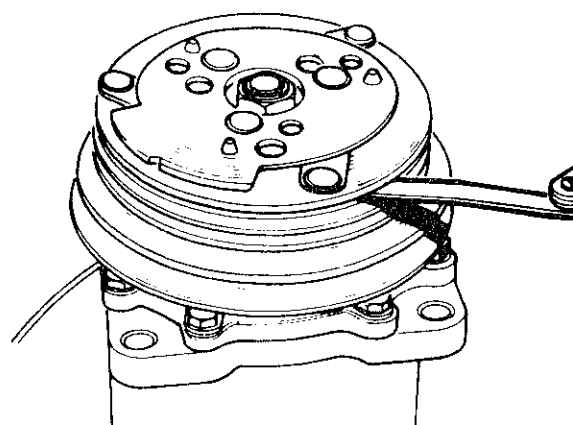
Align the front plate keyway with the compressor shaft key.

Install the front plate. Use clutch face installation tool J 29641 to tap the front plate onto the shaft until it contacts the clutch shims.



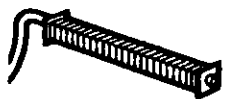
Install and tighten the pulley nut to 34-41 N·m (25-30 ft-lbs) torque.

Check the air gap around the perimeter of the plate with a feeler gauge. The air gap must be between 0.41 and 0.79 mm (0.016 and 0.031 in).



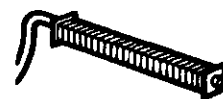
If the air gap is not consistent around the perimeter of the plate, pry up lightly at the areas of

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minimum variation and tap down lightly at the areas of maximum variation.

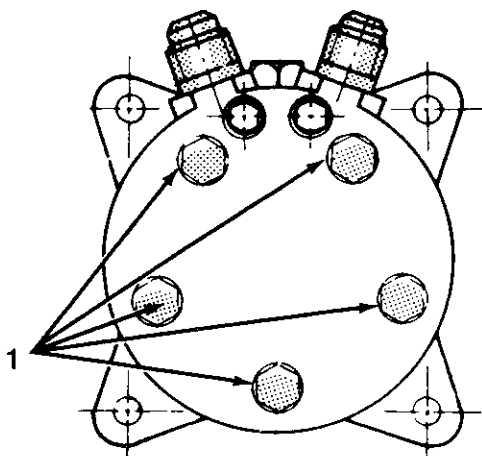
If the air gap is not or cannot be adjusted to 0.41 and 0.79 mm (0.016 and 0.031 in), add or subtract shims as necessary.

NOTE: The air gap is controlled by the shim thickness. When installing a replacement or a previously installed clutch assembly, try the original shims first. When installing a replacement clutch on a replacement compressor (that previously did not have a clutch), use 1.02-, 0.51- and 0.13-mm (0.040-, 0.020- and 0.005-in) shims.

Cylinder Head, Valve Plate and Gasket

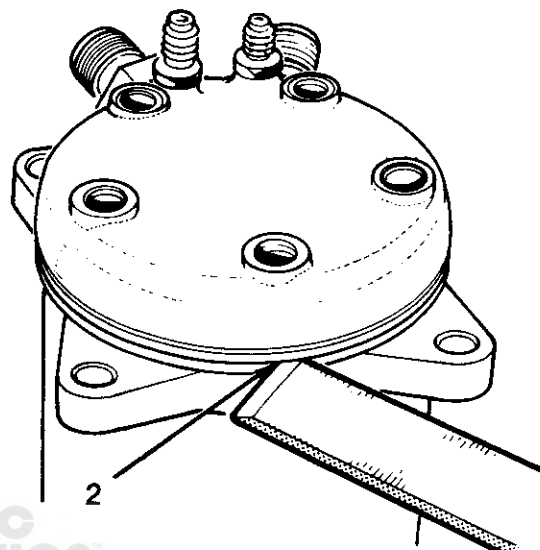
Removal

Remove the cylinder head capscrews (1).



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Remove the head. Use a small hammer and gasket scraper (2) to tap the outer edge of the cylinder head until it separates from the valve plate. Inspect the head and plate for damage.

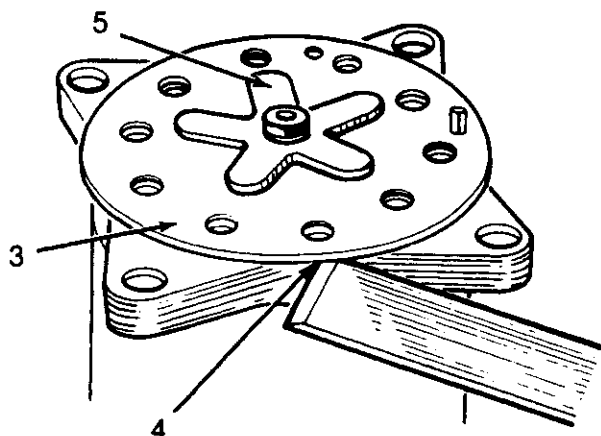


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Remove the valve plate. Position a gasket scraper between the outside edge of the valve plate (3) and cylinder block (4). Lightly tap the valve plate until it loosens.

NOTE: Do not remove the reed valve (5) from the valve plate (3).

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Inspect the reed valve and discharge retainer. Replace either part if damaged.

CAUTION: When cleaning gasket material from the cylinder head or valve plate, be careful not to damage the machined surfaces.

If the valve plate and/or the cylinder head are to be reused, carefully remove the old gasket material with a gasket scraper.

Inspect the cylinder head. Inspect the service ports on the back of the cylinder head. Remove and inspect the valve core. Remove the service port and inspect the O-ring. Replace the head if damaged in any way. Replace the service port O-rings if damaged.

Installation

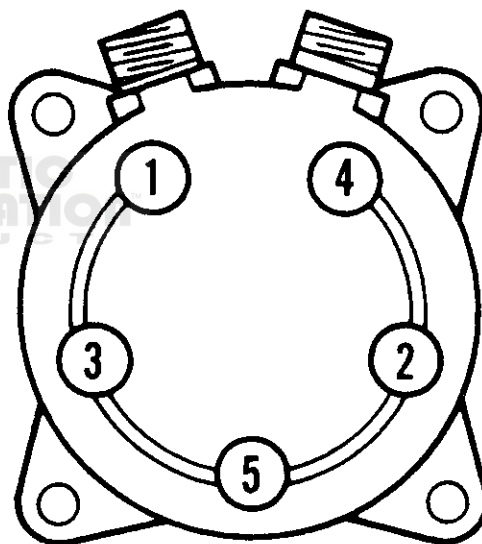
Coat the valve plate gasket with clean compressor oil.

Install the valve plate gasket. Align the gasket with the locating pin holes and the oil orifice in the cylinder block.

Install the cylinder head with the fittings facing upward or aligned with the oil filler plug.

Install the cylinder head capscrews finger-tight.

Tighten the cylinder head capscrews. Follow the tightening sequence outlined in the illustration and tighten the screws to 33 N·m (24 ft-lbs) torque.



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Compressor Oil Level

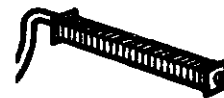
The compressor oil level must be checked and adjusted if the system has been discharged rapidly, or when a component has been replaced. If a replacement compressor is being installed, it must be filled with new compressor oil.

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The normal quantity of oil required for the compressor and entire system is 175 cc (6 oz. ± 0.5 oz.).

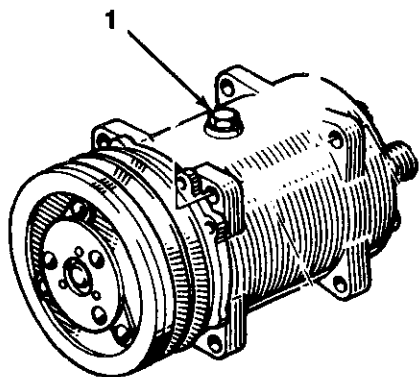
CAUTION: Do not overfill the compressor. Excessive amounts of oil in the system will hinder compressor operation and reduce cooling efficiency.

Two oil level checking procedures are necessary. Use procedure A when the compressor is being replaced and the system was discharged properly (no oil loss). Use procedure B for routine maintenance or when checking oil level after replacing a system component.

NOTE: In cases where rapid loss of refrigerant and oil occurred, the system must be evacuated and purged and the compressor refilled with the necessary amount of oil for the entire system.

Oil Level Check-Procedure A

- Remove the oil filler plug (1) from the original and replacement compressors.

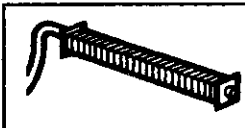


- Drain the oil from the replacement compressor into a clean container.
- Drain the oil from the original compressor into a measuring cup or graduated beaker. Note the amount of oil drained.
- Refill the replacement compressor with the same amount of oil drained from the original compressor plus one additional fluid ounce. For example, if the old compressor contained 3.5 ounces of oil, fill the replacement compressor with a total of 4.5 ounces of oil.

Oil Level Check-Procedure B

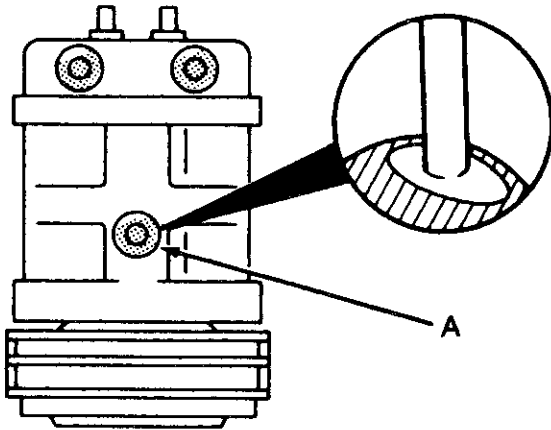
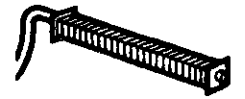
- Start the and operate the engine at idle speed.
- Operate the air conditioning system for 10 minutes to return the maximum amount of oil in the system to the compressor.
- Stop the engine and disconnect the magnetic clutch feed wire.
- Front-seat the discharge and suction service valves.
- Loosen the compressor oil filler plug (1) just enough to release internal pressure. Remove the plug after slowly bleeding off all pressure.
- Look through the oil filler plug hole (A), and rotate the clutch front plate to position the piston connecting rod in the center of the oil filler plug hole.

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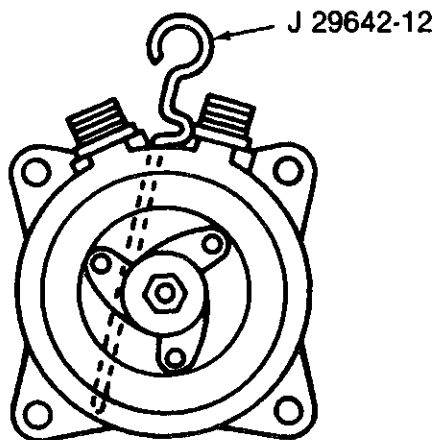
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- Insert dipstick J 29642-12 in the oil filler plug hole. Position the dipstick to the right of the piston connecting rod. Then move the dipstick downward until the dipstick stop contacts the compressor housing.



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- Remove the dipstick and count the number of dipstick increments covered with compressor oil. Correct oil level is between four and six increments.

- Adjust compressor oil level as necessary

CAUTION: Do not overfill the compressor. Excessive amounts of oil in the system will hinder compressor operation and reduce cooling efficiency.

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	ACCESSORIES RADIO REMOVAL/INSTALLATION	
---	---	---

RADIO REMOVAL

- Disconnect the battery.
- Remove the instrument panel bezel attaching screws.
- Remove the radio bezel.
- Remove the radio attaching screws.
- Disconnect the radio antenna cable.
- Disconnect the radio wire harness.
- Remove the radio.

RADIO INSTALLATION

- Install the radio.
- Connect the radio wire harness.
- Connect the radio antenna cable.
- Install the radio attaching screws.
- Install the radio bezel.
- Install the instrument panel bezel attaching screws.
- Connect the battery.

NOTE: The electronically tuned (ETR) radio is self compensating. A radio trimmer adjustment is not required.



**AUTHENTIC
REPAIR**

SEE
I.S.
NOTES

	ACCESSORIES	
	RADIO SPEAKERS	

SPEAKER REMOVAL

Remove the door trim panel.

Peel back the water dam vinyl sheet.

Remove the speaker attaching screws.

Disconnect the speaker wires.

Remove the speaker.

SPEAKER INSTALLATION

Connect the speaker wires.

Mount the speaker in the door frame.

Install the speaker attaching screws.

Reinstall the water dam sheet.

Install the door trim panel.

RADIO SPEAKER TESTING

Radio speakers can be checked for grounds measuring speaker impedance with ohmmeter.

Connect the ohmmeter test leads to the speaker wire leads and note the ohmmeter reading.

Speaker impedance should be equal to the ohm value stamped on the radio chassis.

Replace the speaker if impedance is incorrect.

Refer to the Wrangler/YJ Electrical Troubleshooting Manual for detailed wiring schema and diagnosis information.

SEE
I.S.
NOTES

	ACCESSORIES STANDARD RADIO ANTENNA	
---	--	---

GENERAL INFORMATION

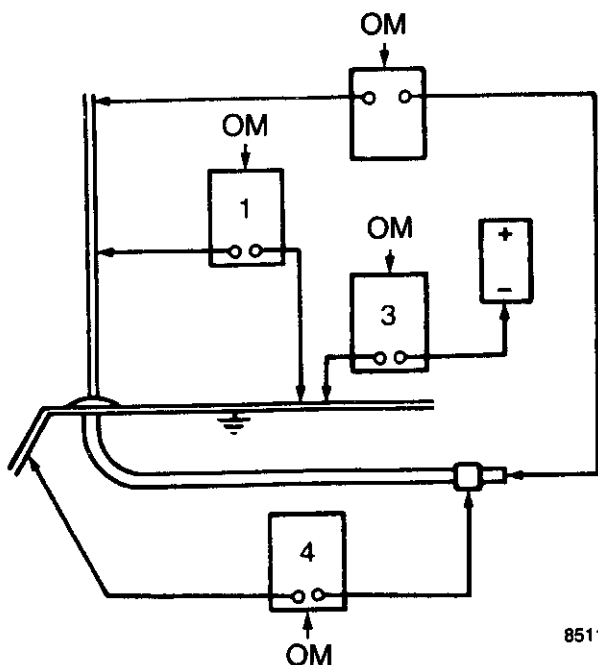
AM and AM/FM radio antennas must have a good ground to eliminate static. The antenna mast is grounded through the radio. The antenna base is grounded to the vehicle body. The wire mesh coaxial shield surrounding the center conductor wire of the antenna lead-in cable is grounded to the radio and the antenna base.

ANTENNA TESTS

Antenna ground continuity is checked with an ohmmeter. The following four tests are required:

- Mast-to-ground test 1
- Tip of mast-to-tip of conductor test 2
- Body ground-to-battery ground test 3
- Body ground-to-coaxial shield test 4

Test lead connections for the ohmmeter (OM) are shown in the following schematic.



Mast-To-Ground Test 1

Test 1 determines if the antenna is making electrical contact with the radio and if the antenna mast is insulated from the base. Procedure is as follows:

- Connect one ohmmeter (OM) lead to the tip of the antenna mast and the other lead to the antenna base.
- With the antenna connected to the radio, there should be continuity (approximately 15 ohms).
- Disconnect the antenna from the radio and check continuity again.
- Continuity should not exist with the antenna disconnected from the radio.

Tip Of Mast-To-Tip Of Conductor Test 2

Test 2 checks the antenna for an open circuit as follows:

- Disconnect the antenna cable from the radio.
- Connect one ohmmeter test lead to the tip of the mast and the other lead to the tip of the antenna cable lead-in (the part inserted into the radio).
- Continuity should not exist (ohmmeter should only register a fraction of an ohm).

SEE I.S. NOTES



ACCESSORIES

STANDARD RADIO ANTENNA



Body Ground-To-Battery Ground Test 3

Test 3 checks condition of the vehicle body ground connection as follows:

- Connect one ohmmeter test lead to the vehicle fender and the other lead to the battery negative post.
- Resistance should be less than one ohm.
- If resistance is more than one ohm, check the braided ground strap connected to the engine and vehicle body for being loose, corroded, or damaged. Repair as necessary.

Body Ground-To-Coaxial Shield Test 4

Test 4 checks condition of the ground between the antenna base and vehicle body as follows:

- Connect one ohmmeter test lead to the fender and the other lead to the crimp on the coaxial shield.
- Resistance should be less than one ohm.
- If resistance is more than one ohm, replace the antenna base attaching screws with new cadmium plated screws.



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NOTES

CAMPAIGN

<u>NUMBER</u>	<u>SECTION</u>	<u>SUBJECT</u>
Asc	ELECTRICAL	87JCRUZ CAMPAIGN (Type "S" Campaign)

I. S. NOTES

<u>NUMBER</u>	<u>SECTION</u>	<u>SUBJECT</u>
1E	ENGINE	Heater Core Hose Chafing
2E	ELECTRICAL	Updated Windshield Wiper Position and Fog Lamp Aiming Specification
3E	BRAKES	Parking Brake Cable Noise
4E	ELECTRICAL	Alternator No-Charge
5E	ENGINE	Idle Speed Variation
6E	ENGINE	New Crankshaft Rear Main Bearing Oil Seal
7E	ENGINE	Altitude Performance Adjustments
8E	ENGINE	No Start Condition When Hot
9E	ENGINE	Engine Compartment Splash Shields
10E	GEARBOXES	Underbody Noise
11E	ENGINE	Idle Speed
12E	GENERAL	Update and Revisions to Workshop Manual



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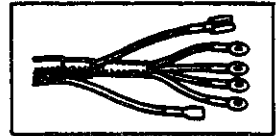
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Asc

FEBRUARY, 1987
ENGLISH EDITION

1987 YJ WITH
CRUISE CONTROL



ELECTRICAL

ATTENTION: Workshop, Parts Department

SUBJECT: 87JCRUZ CAMPAIGN (Type "S" Campaign)

Some 1987 YJ vehicles equipped with cruise control may have a cruise control regulator that could react inconsistently when the cruise control system is in the ON position.

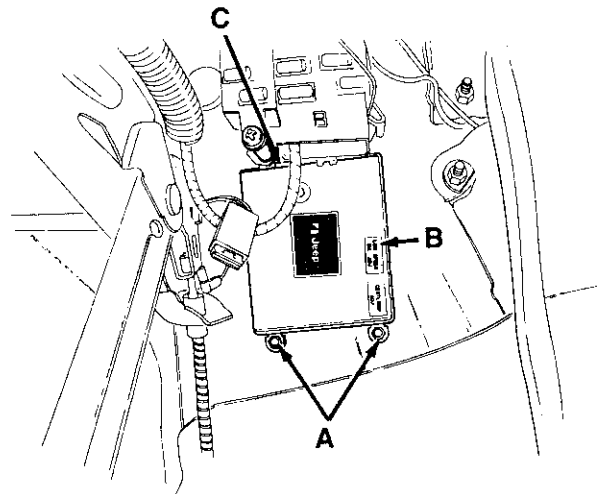
This is a Safety Campaign subject to all campaign procedures involving **safety** related elements.

Vehicles involved in this campaign were built between the following Vehicle Identification Numbers (VIN) 2BXXXXXXXXX530219 and VIN 2BXXXXXXXXX531093.

Service correction involves inspecting vehicles and replacing the regulator if required.

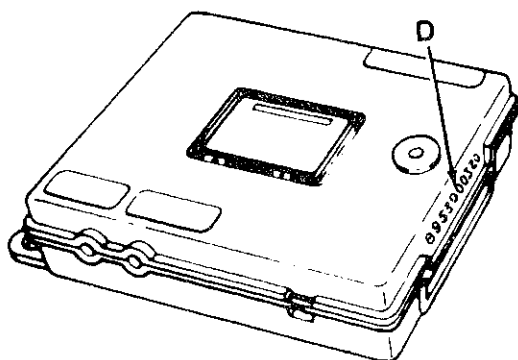
PROCEDURE

1. Check the regulator for a daub of white paint. If there is a white mark, **release** the vehicle. If a white mark is not evident **continue** with the procedure.
2. Remove the mounting screws (A) that holds the regulator (B) in place under the dashboard on the drivers side by the fuse panel.
3. Disconnect the electrical connector (C) from the regulator.



103733

4. Inspect the date code (D) on the connector end of the regulator.



103731

Example of marking with date code underlined:

8953000320
0237B87M

(23rd day of 1987)

If the date code (first three digits of second line) is 020, 041 or any number between 020 and 041, the regulator must be replaced. If the date code is outside of these limits, the regulator does not have to be replaced.

5. Connect the electrical connector and install the regulator using mounting screws previously removed.
6. Place a daub of white paint on the regulator case so that it can be seen in the installed position.

NOTE: The regulator has already been preset during its manufacture.

7. Road test the vehicle to confirm proper operation of the new regulator.
 - a. Move the slide button of the control switch to the ON position. Drive at 45 mph (72 km/h). Press and release the SET/COAST button, then remove foot from the accelerator pedal.

- (1) The controlled speed should stay within 2 mph (3 km/h) of the "Set Speed". This is controlled by the CENTERING ADJ.

- (2) The road speed should not fluctuate more than 2 mph (3 km/h). This is controlled by the SENSITIVITY ADJ.

- b. Slow the vehicle to 15 mph (24 km/h).
- c. Press slide button of control switch to RESUME/ACCEL position and hold it there as you gradually increase speed. When the vehicle suddenly speeds up and the accelerator pedal gives way, glance at the speedometer and release the slide button.
- d. Tap the brake pedal to disengage the system.
- e. The speed at which the system took control is the "Low Speed Setting". If it is NOT between 27 and 33 mph (43 and 53 km/h), it should be corrected. This is controlled by the LOW SPEED SW. ADJ.

8. If necessary adjust the regulator as described in Regulator Adjustment.

REGULATOR ADJUSTMENT

Low Speed Switch (Engagement) Adjustment

On one side of the regulator there are two holes. Insert a small screwdriver in the one marked LOW SPEED SW. ADJ.

1. If the "Low Speed Setting" was too fast, turn the LOW SPEED SW. ADJ. counter-clockwise. If the setting was too slow, turn the LOW SPEED SW. ADJ. clockwise.
2. Repeat the test and adjustment sequence until the "Low Speed Setting" is 27-33 mph (43-53 km/h).

Centering Adjustment

The CENTERING ADJ. is next to the LOW SPEED SW. ADJ.

If controlled speed is more than 2 mph (3 km/h) above or below the "Set Speed", turn the CENTERING ADJ.:

- counterclockwise to decrease
- clockwise to increase

Sensitivity Adjustment

The SENSITIVITY ADJ. is on the opposite side of the regulator from the CENTERING ADJ.

If sensitivity needs to be adjusted turn the SENSITIVITY ADJ.:

- counterclockwise to decrease
- clockwise to increase

NOTE: Changes in the sensitivity setting affect centering, so if sensitivity is changed, check the centering again and adjust as required.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
REGULATOR, Cruise Control	1	8953 000 320

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC	SUPPLIER CODE
CO. REGULATOR, CRUISE CONTROL-INSPECT	0803	0.3	0-779	001
CO. REGULATOR, CRUISE CONTROL-REPLACE (Includes inspect, road test & adjust)	0806	0.6	0-779	002

FILING INSTRUCTIONS

Record this I.S. Note on page C-138 of M.R.279 and file it in the manual.

SAMPLE OWNER NOTICE

CAMPAIGN NO. 8701
VIN 17

American Motors

February 27, 1987

Dear Owner:

This notice is being sent to you in accordance with the requirements of the National Traffic and Motor Vehicle Safety Act.

It has been determined by Jeep Corporation that a defect which relates to motor vehicle safety may exist in certain 1987 Jeep Grand Wagoneer, J-10 Truck, Wagoneer, Cherokee, Comanche and Wrangler models equipped with the cruise control option. A limited number of these vehicles may have been built with a cruise control regulator that reacts inconsistently when the system is in the ON position.

To avoid possible vehicle crash, operate the vehicle with the cruise control switch in the OFF position only.

Please contact your Jeep dealer immediately to have your vehicle inspected and or serviced, if necessary. The dealer's service will usually take no more than one hour and will be performed at no charge to you.

Please present this letter to your dealer when you take your vehicle in for this service. If you no longer own the vehicle identified on the form or you have moved, please complete the pre-addressed, postage paid Change of Information postcard enclosed, and return it so we can update our records accordingly.

If your dealer does not perform this service on your mutually arranged appointment date or within five days thereafter or free of charge, please contact the local Regional Office (listed in the Warranty and Maintenance Guide) or Customer Service, American Motors Canada, Inc. 350 Kennedy Road South, Brampton, Ontario L6V 2H3, Telephone: (416) 451-6780

If you have not received satisfaction from your local Regional Office or Customer Service, you may wish to contact Director, Vehicle Safety and Energy Operations, Road Safety and Motor Vehicle Regulation, Transport Canada, Tower "A", Place de Ville, Ottawa, Ontario K1A 0N5.

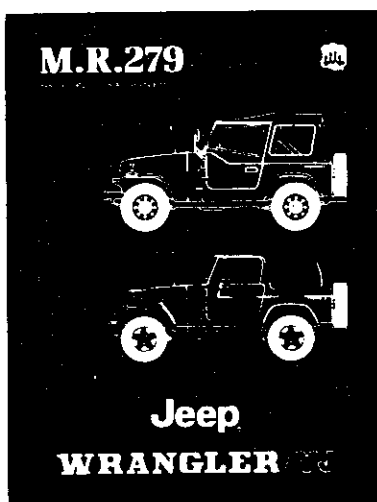
We apologize for this inconvenience, however, we have initiated this action in the interest of your driving safety and continued satisfaction with our products.

WARRANTY ADMINISTRATION
AMERICAN MOTORS (CANADA) INC.

5528N.2/101M

 **RENAULT**

American Motors (Canada) Inc. 350 Kennedy Road South, Brampton, Ontario L6V 2H3



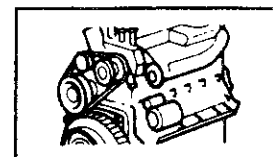
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1E

JULY 1986
ENGLISH EDITION

1987 WRANGLER/YJ WITH
4.2L 6-CYL. ENGINE



ENGINE

Attention: Workshop, Parts Department

HEATER CORE HOSE CHAFING

Some 1987 WRANGLER/YJ vehicles equipped with 4.2L 6-Cyl. engines may have the heater core-to-intake manifold hose chafing on a stud protruding from the dash panel.

NOTE: This problem was corrected on vehicles built after May 28, 1986, and starting with sequence number 9086.

Service correction involves inspecting for this condition and repositioning the hose as follows.

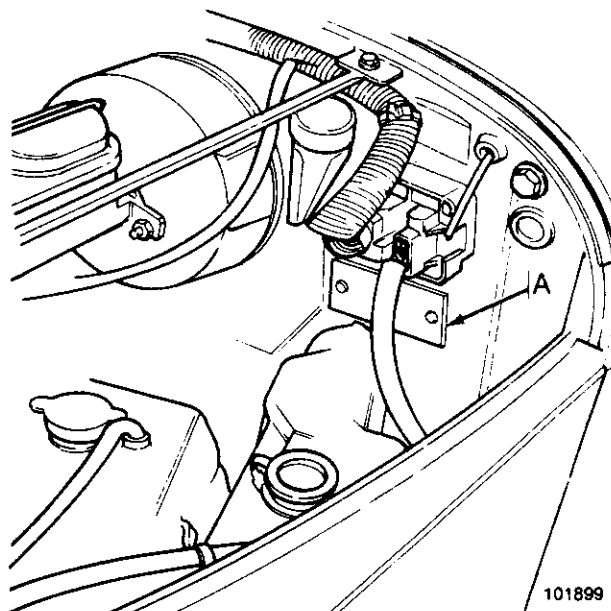
PROCEDURE

Inspection

1. Check for sequence number located on the vehicle identification plate that is mounted under the hood on the driver's side of the dash panel (A).
2. Inspect the heater core-to-intake manifold hose (B) routing at the rear of the engine.

If the heater hose is rubbing against the dash panel stud (C), carefully inspect the heater hose for signs of chafing and/or perforation.

Replace hose, if necessary, before repositioning.



If the heater hose is routed over the cylinder head cover and does not come into contact with the dash panel stud, return the vehicle to owner/stock.

Reposition

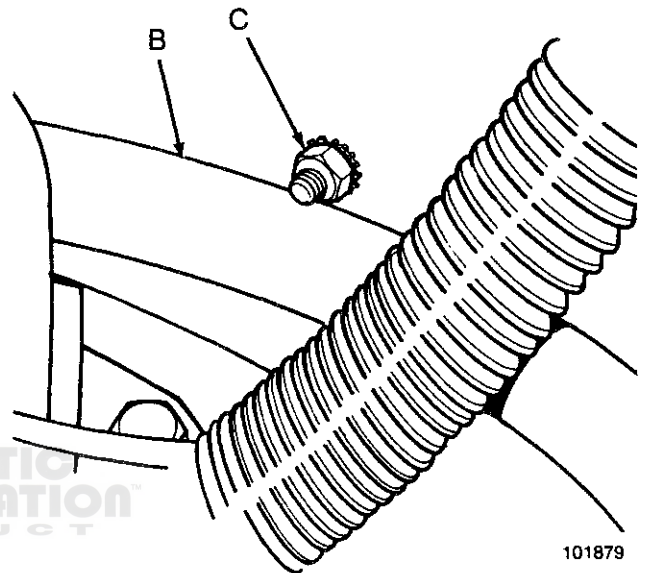
1. Drain approximately 1.9L (2 Qts.) of coolant from the radiator.
2. Remove the clamp and heater hose from the intake manifold fitting.
3. Cut approximately 31.75 mm (1.25 in.) from the end of the hose.
4. Position the heater hose on the intake manifold fitting.
5. Install the heater hose clamp.

NOTE: Inspect to be sure the hose is now routed over the cylinder head cover and away from the dash panel stud.

6. Refill the cooling system.

7. Start the engine.

8. Check for leaks.

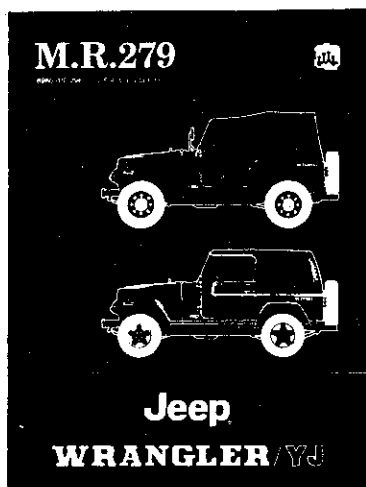


SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. HOSE, HEATER – INSPECTION ONLY	0601	0.1	6-122
CO. HOSE, HEATER – REPOSITION OR REPLACE (Includes Inspection)	0603	0.3	6-122

FILING INSTRUCTIONS

Record this I.S. NOTE on page B-172 and file it in the M.R. 279 Manual.



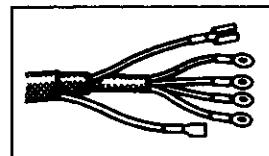
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2E

NOVEMBER 1986
ENGLISH EDITION

1987 WRANGLER/YJ
MODELS



ELECTRICAL

Attention: Workshop, Parts Department

UPDATED WINDSHIELD WIPER POSITION AND FOG LAMP AIMING SPECIFICATIONS

The specifications for windshield wiper positioning and fog lamp aiming on 1987 Wrangler/YJ models have been updated. The new specifications are as follows.

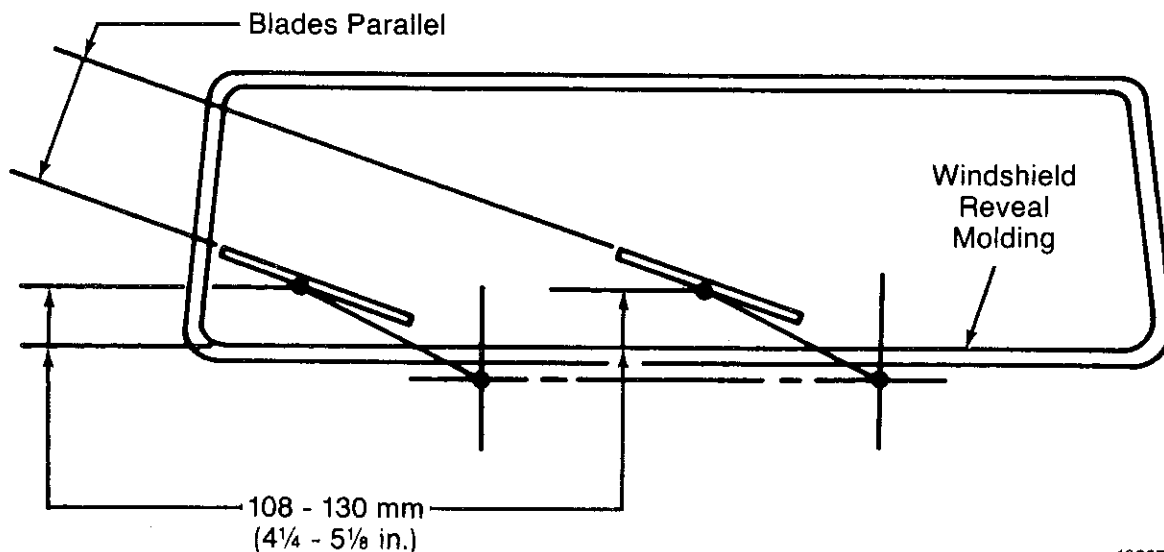
WINDSHIELD WIPER ARM AND BLADE POSITIONING

When installing the wiper arms and blades on a 1987 Wrangler/YJ model, position the arms and blades as shown in the diagram. This location provides optimum coverage and the required park position.

FOG LAMP AIMING

Aim the fog lamps at a wall 25 feet away from the lamps.

The upper edge of each high intensity zone (D) should be $10.16 \text{ cm} \pm 5.08 \text{ cm}$ (4 inches $\pm$ 2 inches) below horizontal reference line (A).



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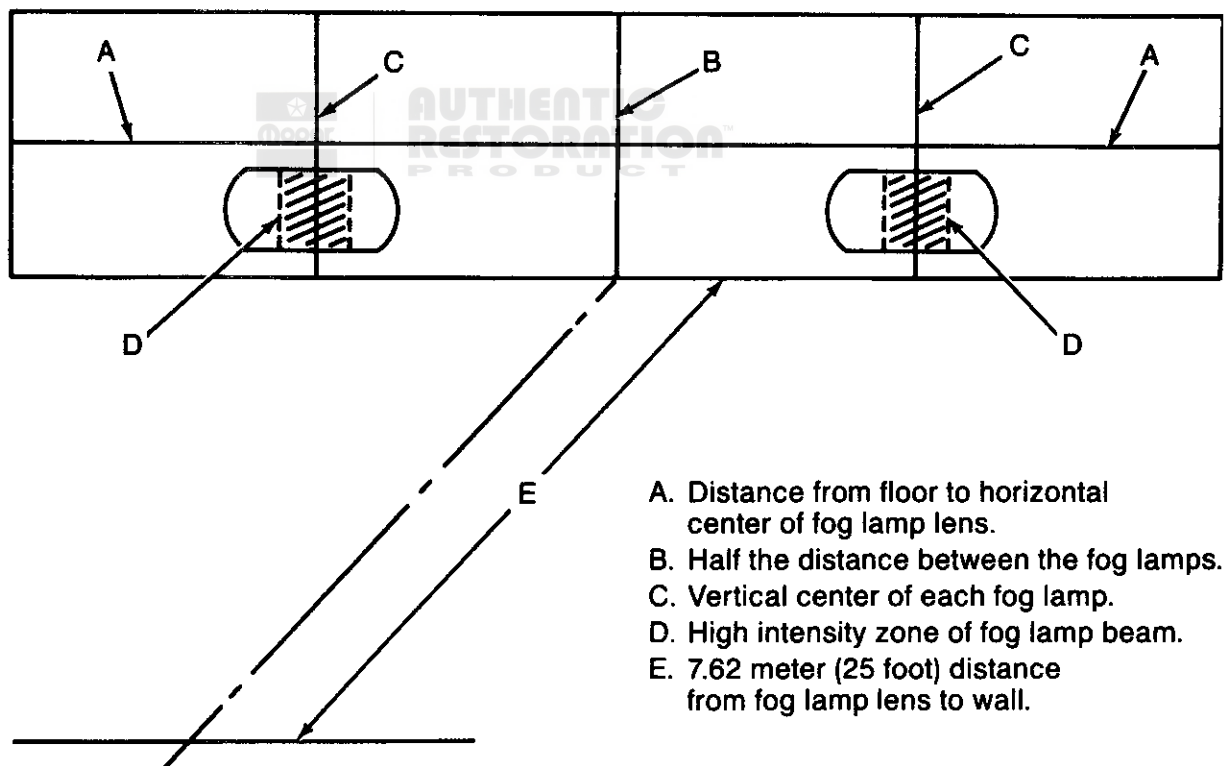
The high intensity zone of each lamp, should be centered on vertical line (C) with a maximum left-right variation of 10.16 cm (4 inches).

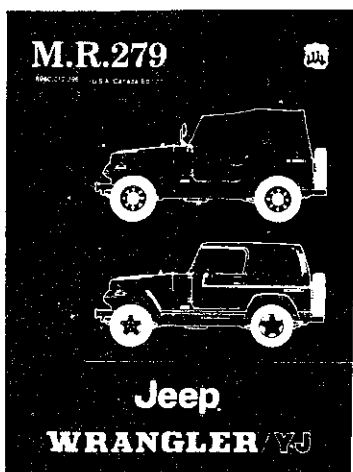
NOTE: Reference line (A) is the distance from the floor to the horizontal center of each lamp lens. Reference lines (C) are the vertical center of each lamp lens.

FILING INSTRUCTIONS

Record the information in this I.S. note on the indicated pages and file it in M.R. 279.

- Record the wiper position specifications on page C-130 and the fog lamp aiming specifications on page C-119.





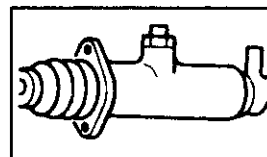
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3E

**DECEMBER 1986
ENGLISH EDITION**

1987 WRANGLER/YJ



BRAKES

Attention: Workshop, Parts Department

PARKING BRAKE CABLE NOISE

Some 1987 WRANGLER/YJ vehicles, built prior to VIN 2BXXXXXXHB520144, may produce a noise in the right rear area when the rear of the vehicle is loaded. This noise may be caused by the parking brake cable rubbing the edge of the right rear wheel rim.

Service correction involves the installation of a parking brake cable locating clip to prevent cable movement.

PROCEDURE

1. Remove the fasteners (D) holding the right rear parking brake cable bracket (C) to the floorpan (Fig. 1).

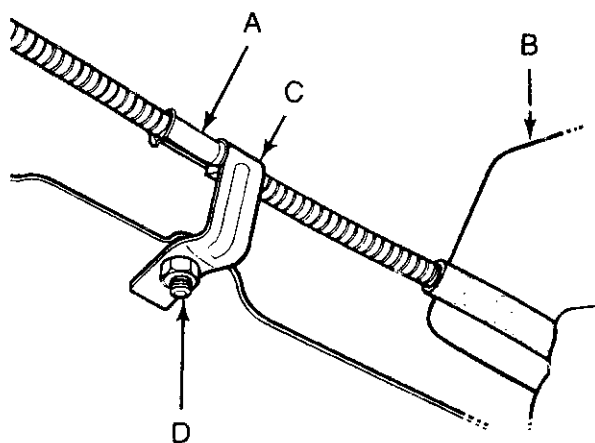


Fig. 1

2. Slide the bracket toward the right rear wheel.
3. Measure 559 mm $\pm$ 3 mm (22.0 in. $\pm$ 0.125 in.) back from the parking brake cable mounting bracket (E) and snap the locating clip (A) over the parking brake cable (Fig. 2).

NOTE: Make sure the parking brake cable is routed below the heat shield (B).

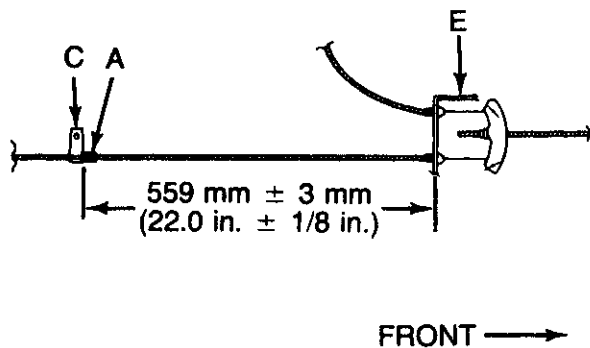


Fig. 2

4. Slide bracket (C) up to the edge of locating clip (A).
5. Using the fasteners removed earlier, attach the bracket to the floorpan at the original location.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
CLIP, Locating	1	8983 100 048



**AUTHENTIC
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SRT/TIC INFORMATION

OPERATION DESCRIPTION	NUMBER	TIME	TIC
CO. CLIP, LOCATING-INSTALL	0302	0.2	3816

FILING INSTRUCTIONS

Record this I.S. NOTE on page K-26 of M.R.279 and file it in the manual.



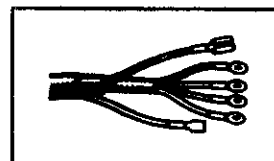
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4E

FEBRUARY, 1987
ENGLISH EDITION

1987 WRANGLER



ELECTRICAL

Attention: Workshop

ALTERNATOR NO-CHARGE

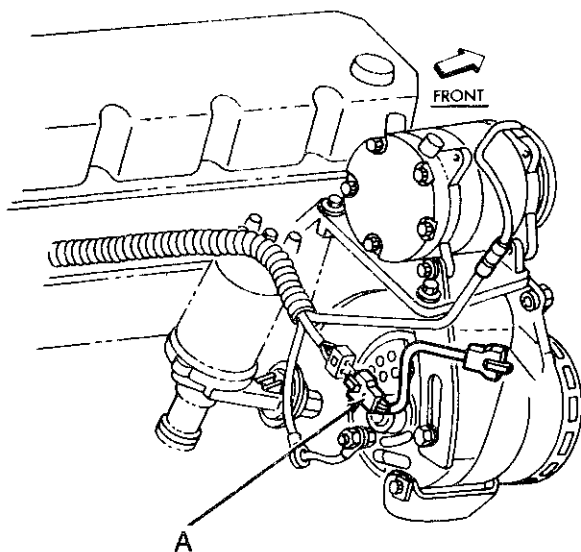
A no-charge condition has been identified on 1987 Wranglers equipped with 4.2L engines that is not caused by an alternator malfunction.

The cause of this no-charge condition may be a bent terminal (brown wire) in the female (gray) connector (A) of the 6-inch alternator jumper harness. When indications of a low battery are noted, e.g., voltmeter below normal or slow cranking, the jumper harness gray connector should be inspected.

Service correction involves inspecting the jumper harness connector and straightening the terminal as follows.

PROCEDURE

1. Disconnect the gray connector (A).



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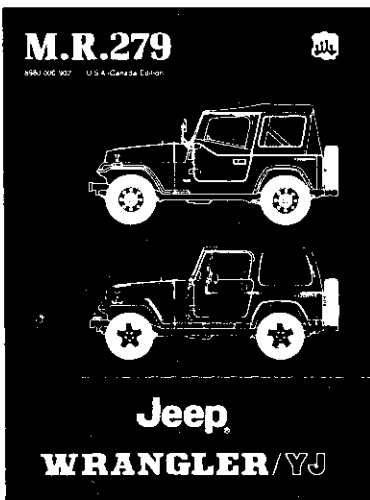
2. Check the terminal of the brown wire to see if it is bent.
3. If the pin(s) are bent use a needle nose pliers and straighten the bent pin(s).
4. If the pin(s) are ok, proceed to diagnosing the charging system as outlined in M.R. 279.
5. Connect the harness together.
6. Test alternator for proper performance. Refer to M.R. 279.

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. CONNECTOR, ALTERNATOR REPAIR (Inc. test on vehicle)	0803	0.3	8-993

FILING INSTRUCTIONS**AUTHENTIC
RESTORATION™**

Record this I.S. Note on page C-16 of M.R. 279 and file it in the manual.



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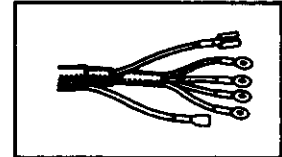
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5E

REVISED EDITION

**APRIL 1987
ENGLISH EDITION**

**1987 WRANGLER
WITH 2.46L
ENGINE**



ENGINE

Attention: Workshop, Parts Department

THIS I.S. NOTE HAS BEEN REVISED AS INDICATED BY THE REVISION BARS:

IDLE SPEED VARIATION

Some 1987 Wrangler vehicles equipped with the 2.46L engine may exhibit a variation in engine idle speed. This condition is generally intermittent and may become more evident with increased temperatures and/or mileage.

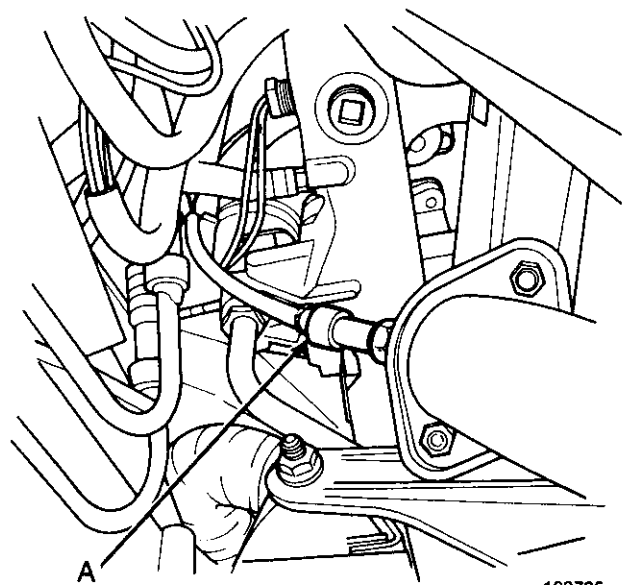
The vehicle should be tested with the MS 1700 Diagnostic Tester. Because the condition is intermittent, the MS 1700 may not be able to detect the fault. If the vehicle passes all the tests and no other problems are found, the oxygen (O₂) sensor may be the cause of this condition.

PROCEDURE

1. Disconnect the O₂ sensor connector (A).
2. Remove the O₂ sensor from the exhaust manifold.
3. Clean the threads in the exhaust manifold.

NOTE: Antiseize sealer is already applied to the threads of replacement O₂ sensors.

4. Install a new O₂ sensor marked with a yellow tag. Tighten the sensor to 27-34 N·m (20-25 ft-lbs) torque.
5. Connect the O₂ sensor connector.



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PARTS INFORMATION

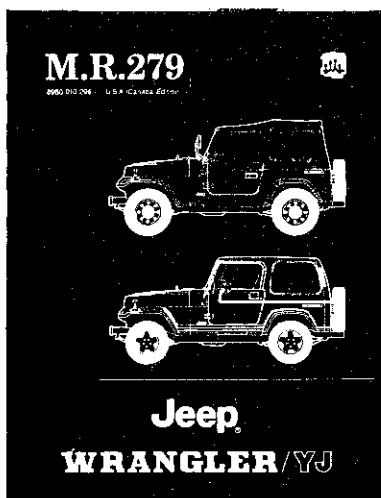
DESCRIPTION	QUANTITY	PART NUMBER
SENSOR, Oxygen	1	8953 002 106

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. SENSOR, OXYGEN-REPLACE	1664	0.3	1-977

**FILING INSTRUCTIONS**

Record this I.S. Note on page B-197 of M.R. 279 and page 83 of INJ. TBI. and file it in the INJ. TBI. component manual.



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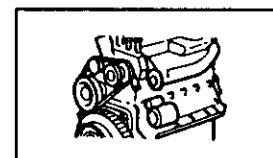
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6E

REVISED EDITION

JUNE 1987
ENGLISH EDITION

WRANGLER/YJ WITH
2.46L ENGINE



ENGINES

Attention: Workshop, Parts Department

THIS I.S. NOTE HAS BEEN REVISED AS INDICATED BY THE REVISION BARS:



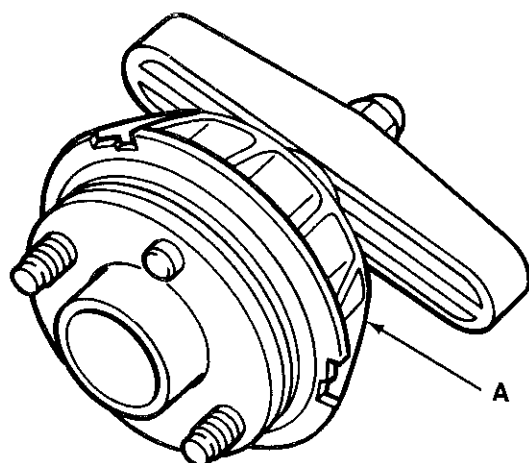
NEW CRANKSHAFT REAR MAIN BEARING OIL SEAL

A new crankshaft rear main bearing oil seal with improved sealing characteristics and a new seal installation tool have been released for the 2.46 Liter four-cylinder engine.

Install the new seal, P/N 8933 004 143, using the new seal installation tool J-36306 (A). The installation tool is a required tool for installing the rear main bearing oil seals correctly. It will be sent to all AMC/Jeep dealers automatically.

This new rear main bearing oil seal is used in production on engines built December 8, 1986 and later.

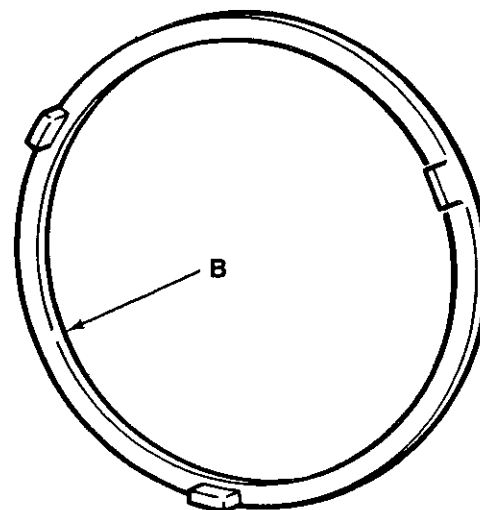
J-36306



103764

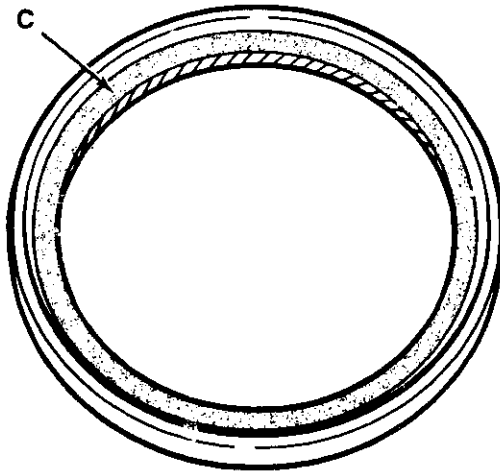
NOTE: The tool comes with a removable shim (B). The shim is used ONLY if the new rear main bearing oil seal (P/N 8933 004 143) is not

available and the old style seal (P/N 324 1669) is used instead. DO NOT use the shim when installing the new seal.



103765

The new seal has a built-in dust shield (C) to prevent dirt from contacting the seal lip.



103766

PROCEDURE

1. Remove the transmission (see Chapter E – Manual Transmission or Chapter F – Automatic Transmission).

2. Remove the flywheel or converter drive plate.

3. Use a thin bladed straight screwdriver to remove the old seal from around the crankshaft flange.

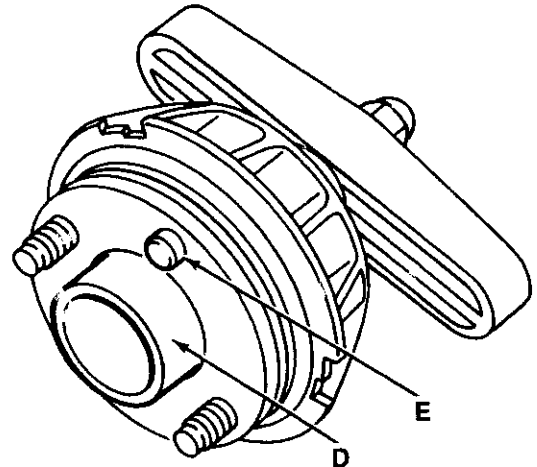
4. Back off the plastic wing nut on tool J-36306 until it contacts the nut.

NOTE: Install the shim (B) ONLY if the old style seal is used.

5. Lightly lubricate the inside and outside edges of the seal.

6. Install the new seal on tool J-36306 with the dust shield facing towards the plastic wing nut.

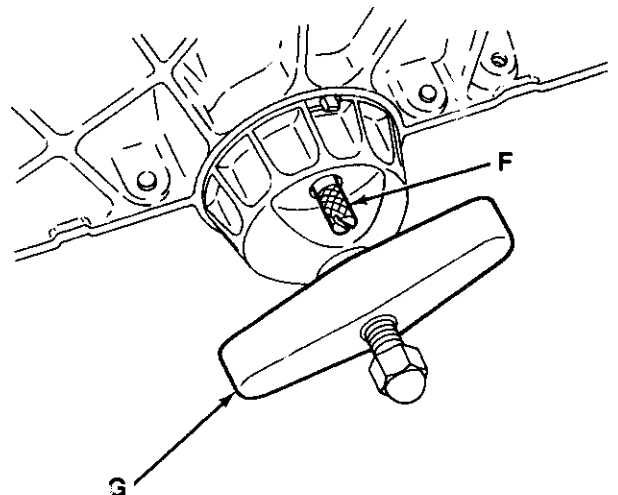
7. The tool pilot (D) fits into the flywheel pilot hole in the back of the crankshaft. The dowel on the tool (E) fits into the small hole in the crankshaft.



103800

8. Thread the two attaching screws (F) into the rear of the crankshaft and tighten them.

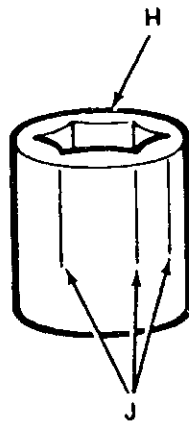
9. Turn the plastic wing nut (G) until it bottoms out. This will seat the seal.



103767

10. Remove the tool from the crankshaft.
11. Ensure that the dust shield is not curled under. If it is, lightly pull the lip out with a small screwdriver.
12. Depending upon the transmission used, pre-tighten the bolt to the applicable torque.
 - a. Tighten the converter drive plate bolts on automatic transmissions to 54 N·m (40 ft-lbs) torque.
 - b. Tighten the flywheel bolts on manual transmissions to 68 N·m (50 ft-lbs) torque.

NOTE: A 3/4 inch hex socket (H) should be permanently marked every 60° (J) on the outer circumference in line with the hex points as illustrated. This procedure will assist in the installation of the bolts.



840138A

13. After all the bolts have been pre-tightened to the specific torque, place the specially marked socket over each bolt.
14. Use a pencil to draw a small mark on the surface of the flywheel or converter drive plate reinforcing ring in line with the 60° mark on the socket.
15. Tighten each bolt until the next 60° mark on the socket is aligned with the pencil mark on the flywheel or drive plate.
16. Install the transmission (see Chapter E — Manual Transmission or Chapter F — Automatic Transmission).

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
SEAL, Rear Main Bearing Oil	1	8933 004 143

SRT/TIC INFORMATION

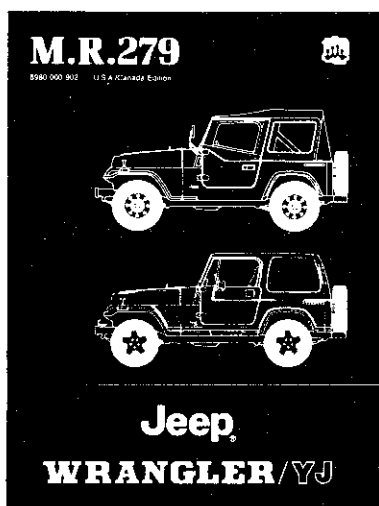
OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC	SUPPLIER CODE
CO. SEAL, REAR MAIN BEARING OIL — REPLACE INC R & R TRANSMISSION and FLYWHEEL / DRIVE PLATE	1817	2.9	1-026	669

FILING INSTRUCTIONS

Record this I.S. Note on pages B-97 and B-98 of M.R. 279 and file it in the manual.



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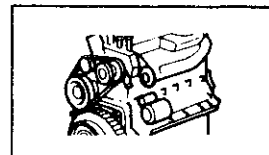
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7E

**SEPTEMBER 1987
ENGLISH EDITION**

**1987 Jeep Wrangler/YJ
Equipped With 2.46L (TBI)
or 4.2L Engines**



ENGINE

Attention: Workshop, Parts Department

ALTITUDE PERFORMANCE ADJUSTMENTS

This I.S. Note outlines adjustments for improved engine performance on 1987 Jeep Wrangler/YJ vehicles, equipped with 2.46L (TBI) or 4.2L engines, being operated at altitudes above or below that which the engine was originally certified.

When necessary, perform the engine adjustments outlined in the adjustment procedure portion of this I.S. Note.



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RESTORATION
PRODUCT**

Any such vehicles so adjusted, must have the Vehicle Emission Control Information Update Label attached next to the original Vehicle Emission Control Information label.

The adjustment procedures and update labels must be made available at no cost to independent repair facilities and to the general public.

Owner Notification

A notification is provided in the current Owner's Manuals to make customers aware of these adjustments.

Vehicle Emission Control Information Label

The Vehicle Emission Control Information Update labels are available from:

MYRIAD SERVICES
8835 General Drive
Plymouth, MI 48170
1-800-AMC-CARS
Operator 43

PROCEDURE

2.46L (TBI) Engine

1987 Jeep Wrangler/YJ vehicles equipped with 2.46L (TBI) engines, have built-in compensating circuits.

The compensating circuits adjust automatically to different altitudes.

NO ADJUSTMENTS ARE NECESSARY when changing the altitude at which the vehicle is being operated.

4.2L Engine

1987 Jeep Wrangler/YJ vehicles equipped with 4.2L engines does not automatically adjust to different altitudes.

These vehicles **REQUIRE ADJUSTMENT** when operating the vehicle at altitudes different from the altitudes for which it was built.

This adjustment procedure is written to coincide with the specifications found on the Vehicle Emission Control Information label.

VEHICLE EMISSION CONTROL INFORMATION	ENGINE/FAMILY DISPLACEMENT	EMISSION CONTROL SYSTEM			ENGINE EMISSION SCHEMATIC
EPA CERTIFICATION		SEQUENCE	SPECIFICATIONS	TRANS	
ALTITUDE APPLICATION			IGNITION TIMING @ RPM	SPEC	
IGNITION TIMING FAST IDLE ADJUSTMENT CURB IDLE ADJUSTMENT BASE IDLE ADJUSTMENT			FAST IDLE RPM CURB IDLE RPM BASE IDLE RPM IDLE CO SPARK PLUG GAP	SPEC SPEC SPEC SPEC SPEC	

103820

Specified positions on the label are called out on sample labels in these instructions. The positions, (1) (2) (3) and (4) list the vehicle specifications that determine the particular adjustment.

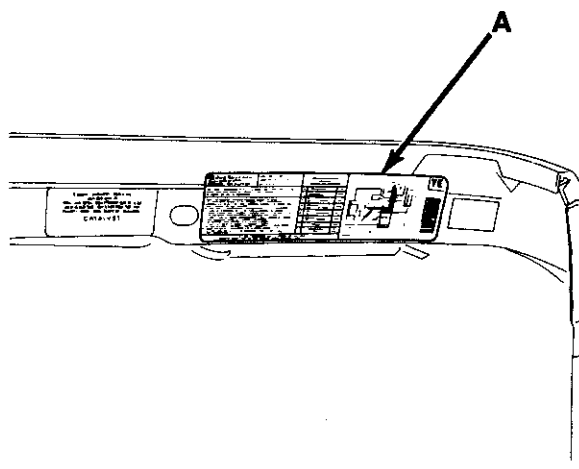
The following information can be identified at these positions on the sample label:

Position	Information
1	Engine Type
2	EPA Certification
3	Altitude Application
4	Transmission Type

Vehicles With 4.2L Engines and Automatic Transmissions Built for Operation BELOW 4,000 Feet Now Being Operated ABOVE 4,000 Feet

1. Open the hood and support with the rod.

2. Check the Vehicle Emission Control Information label (A) located on the underside at the front of the hood.



103821

3. Locate positions (1) (2) (3) and (4).

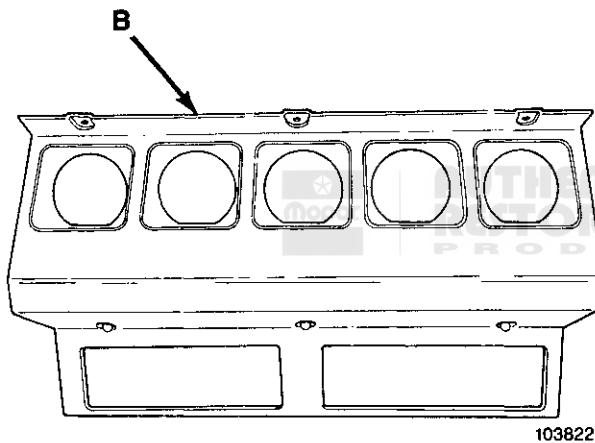
4. Verify that the vehicle is equipped as follows:

1. 4.2L Engine (258 cu. in.)
2. 49-State/California/Canada
3. For Operation BELOW 4,000 Feet
4. Automatic Transmission

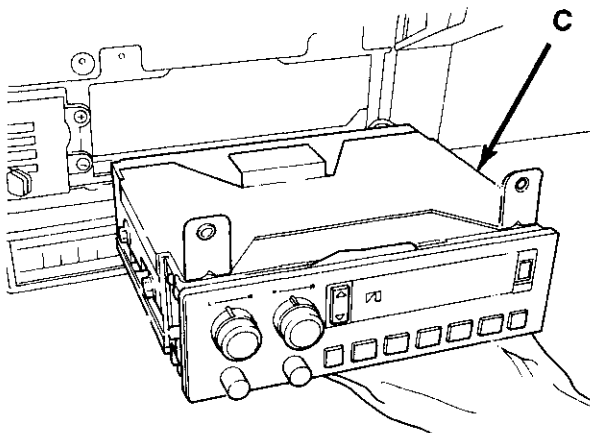
NOTE: If it is not so equipped, proceed to the subsequent section for proper adjustment.

5. Disconnect the battery ground cable.

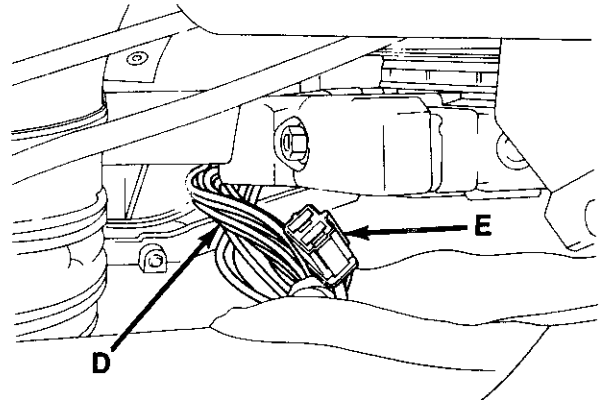
6. Remove the radio bezel (B).



7. Remove the radio (C).



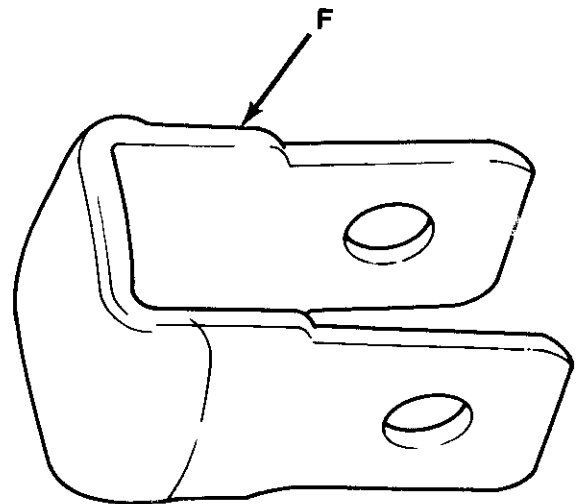
NOTE: This will give access to the MCU harness (D) the two-terminal connector (E).



8. Remove the tape from the two-terminal connector.

NOTE: It is located on the MCU harness.

9. Connect the jumper wire (F), P/N 318 6890, to the two-terminal connector (E).



10. Install the radio.

11. Install the radio bezel.

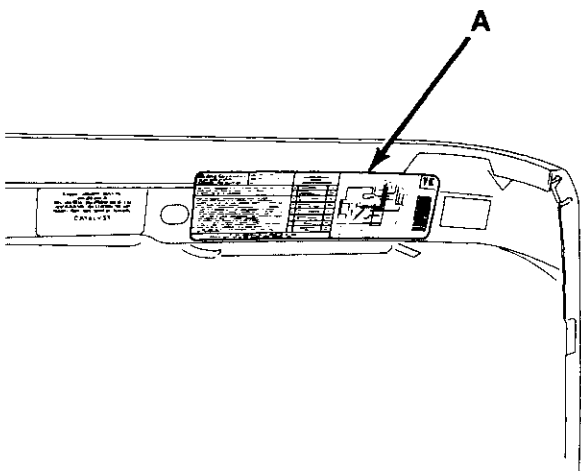
12. Connect the battery ground cable.

13. Set the ignition timing to 16° BTDC.
14. Reset the idle speeds to the settings specified on the original Vehicle Emission Control Information label.
15. Attach the Vehicle Emission Control Information Update label, P/N EF 8980 010 600. Position the Update label next to the original label.
16. Stow the support rod and close the hood.

NOTE: Whenever this vehicle is returned to operation BELOW 4,000 feet, remove the MCU jumper wire, reset the ignition timing to 9° BTDC, reset the idle speed to the original specification, and, remove the Vehicle Emission Control Information Update label.

Vehicles With 4.2L Engines and Automatic Transmissions Built for Operation ABOVE 4,000 Feet Now Being Operated BELOW 4,000 Feet

1. Open the hood and support with the rod.
2. Check the Vehicle Emission Control Information label (A) located on the underside at the front of the hood.

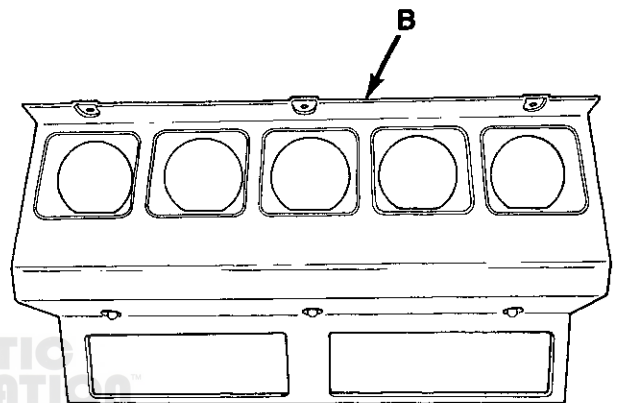


103821

3. Locate positions (1) (2) (3) and (4).
4. Verify that the vehicle is equipped as follows:

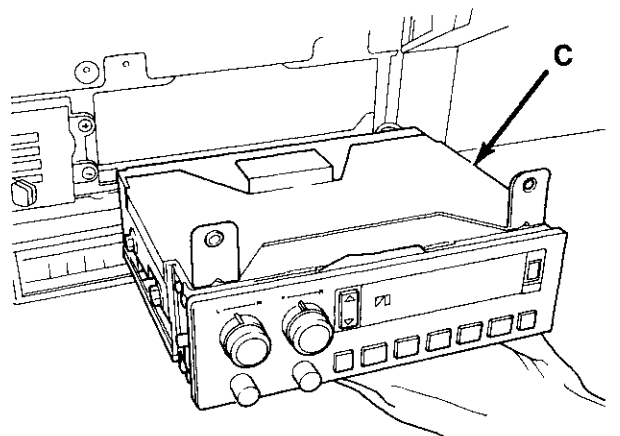
1. 4.2L Engine (258 cu. in.)
2. 49-State/California/Canada
3. For Operation ABOVE 4,000 Feet
4. Automatic Transmission

5. Disconnect the battery ground cable.
6. Remove the radio bezel (B).



103822

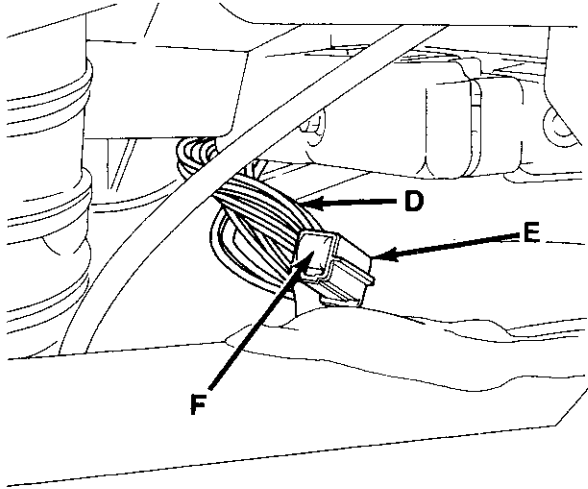
7. Remove the radio (C).



103823

NOTE: This will give access to the MCU harness (D), the two-terminal connector (E), and the jumper wire (F).

8. Remove the jumper wire (F) from the two-terminal connector (E).



103826

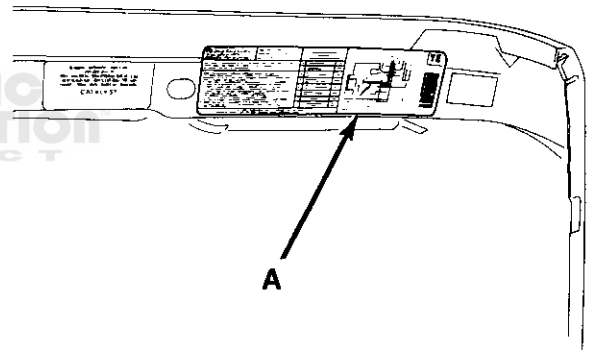
NOTE: DO NOT DISCARD THE JUMPER WIRE. Place the jumper wire in the glove compartment for reinstallation when the vehicle is returned to use at ABOVE 4,000 feet.

9. Tape the two-terminal connector to the MCU harness.
10. Install the radio.
11. Install the radio bezel.
12. Connect the battery ground cable.
13. Set the ignition timing to 9° BTDC.
14. Reset the idle speed to the setting specified on the original Vehicle Emission Control Information label.
15. Attach the Vehicle Emission Control Information Update label, P/N EF 8980 010 601. Position the Update label next to the original label.
16. Stow the support rod and close the hood.

NOTE: Whenever this vehicle is returned to operation ABOVE 4,000 feet, reconnect the MCU jumper wire, reset the ignition timing to 16° BTDC, reset the idle speeds to the original specifications, and, remove the Vehicle Emission Control Information Update label.

Vehicles With 4.2L Engines and Manual Transmissions Built for Operation BELOW 4,000 Feet Now Being Operated Above 4,000 Feet

1. Open the hood and support with the rod.
2. Check the Vehicle Emission Control Information label (A) located on the underside at the front of the hood.



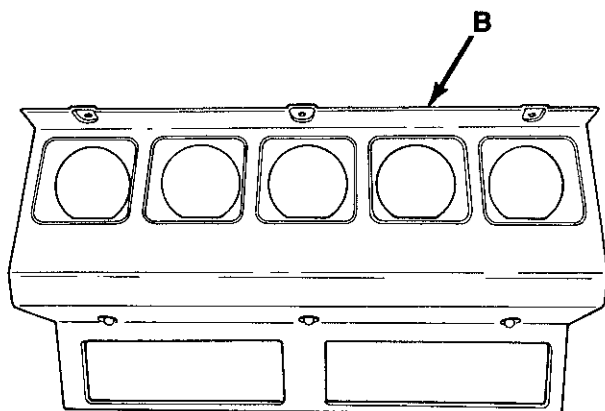
103821

3. Locate positions (1) (2) (3) and (4).
4. Verify that the vehicle is equipped as follows:

- | |
|---|
| <ol style="list-style-type: none">1. 4.2L Engine (258 cu. in.)2. 49-State/California/Canada3. For Operation BELOW 4,000 Feet4. Manual Transmission |
|---|

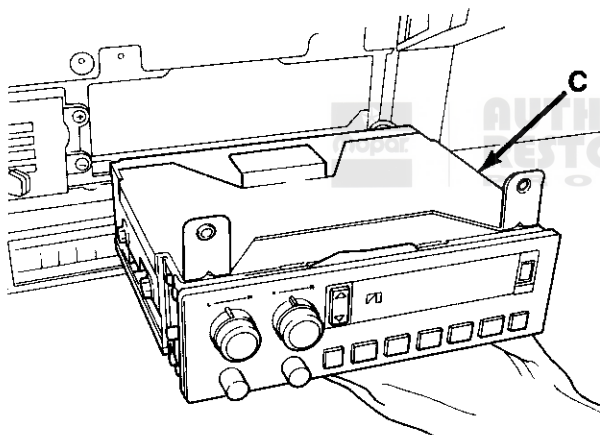
5. Disconnect the battery ground cable.

6. Remove the radio bezel (B).



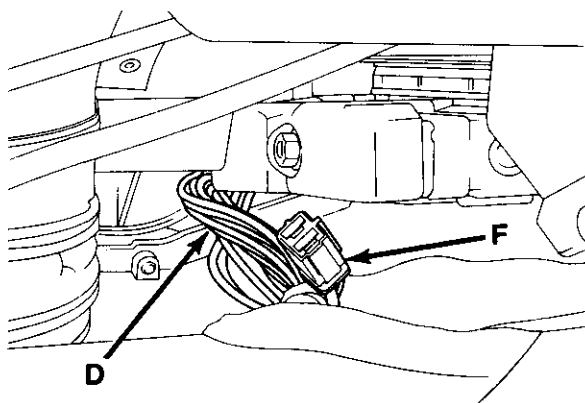
103822

7. Remove the radio (C).



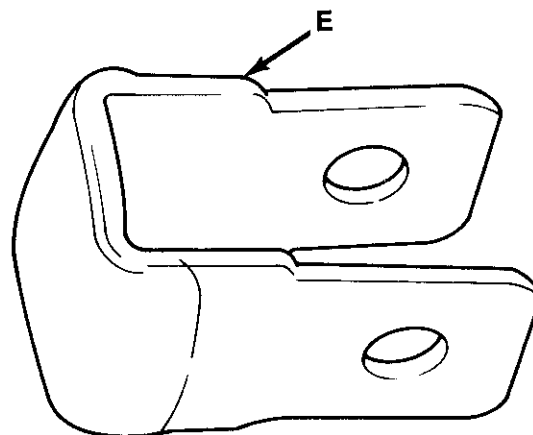
103823

NOTE: This will expose the MCU harness (D) and the two-terminal connector (F).



103824

8. Connect the jumper wire (E), P/N 318 6890, to the two-terminal connector.



103825

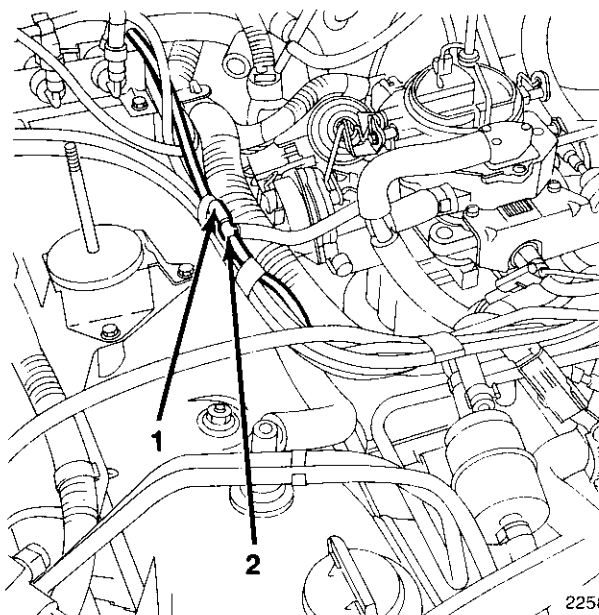
9. Install the radio.

10. Install the radio bezel.

11. Connect the battery ground cable.

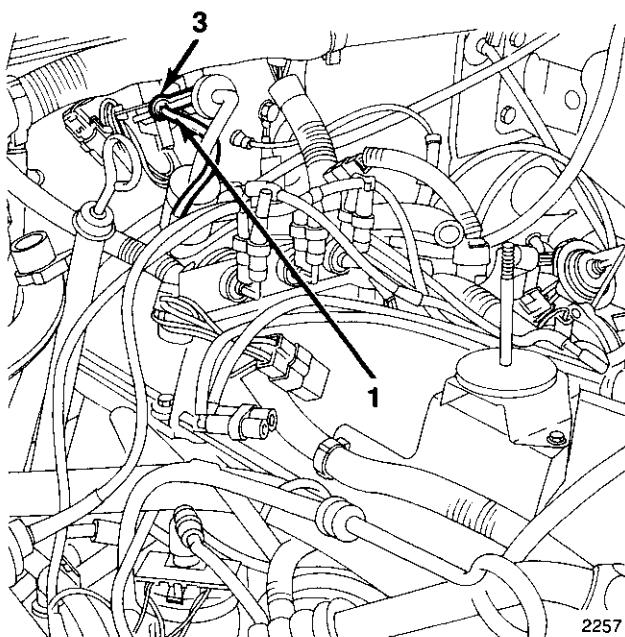
12. Connect the idle decel switch to the carburetor EGR port as follows:

- Remove the vacuum hose (1) from the T-connector (2) and from the idle decel switch (3).



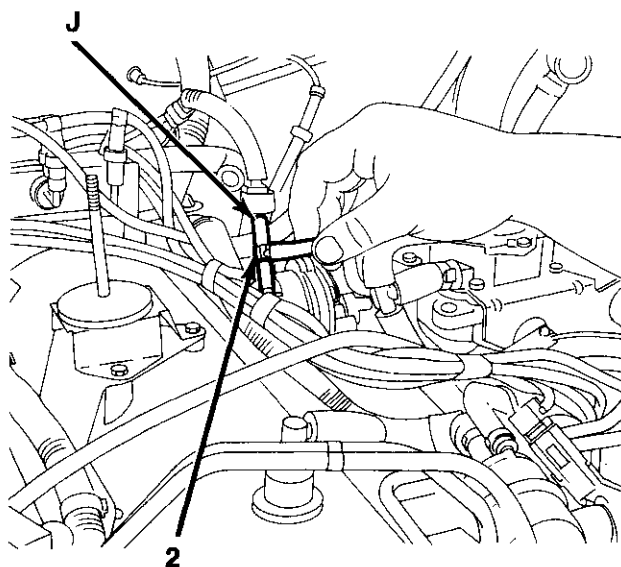
2258

NOTE: The idle decel switch is located on the dash panel behind and to left of the cylinder head cover.

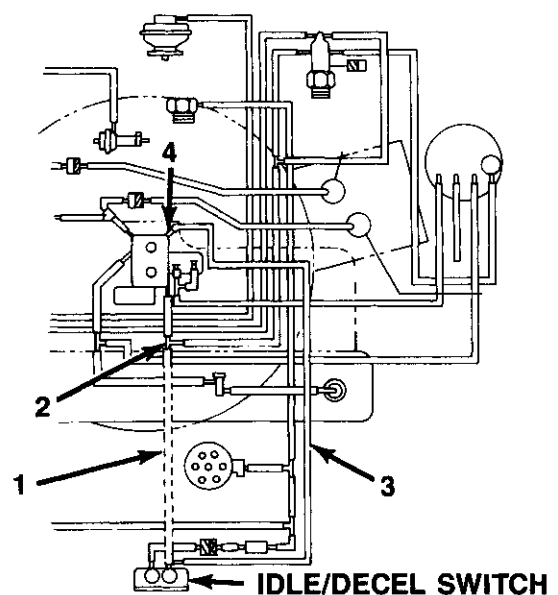


NOTE: DO NOT DISCARD THE VACUUM HOSE. Place the vacuum hose in the glove compartment for reinstallation when the vehicle is returned to use BELOW 4,000 feet.

- Install a vacuum cap (J), P/N 813 2325, over the open end of the T-connector (2).

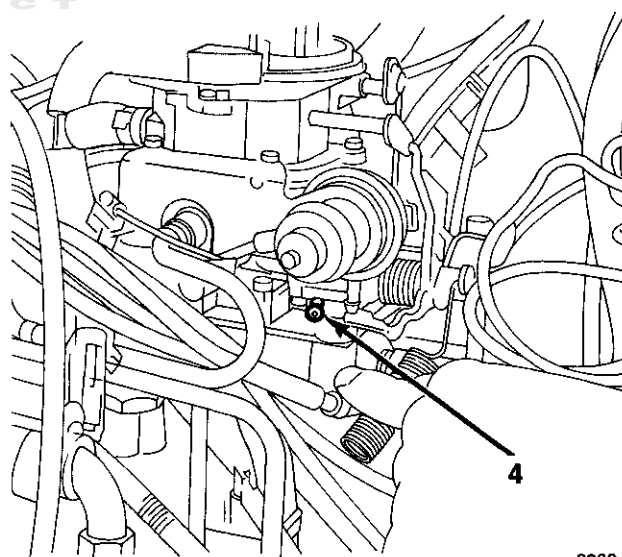


2259



103827

- Connect one end of a 106.8 cm (42 1/8 inch) long vacuum hose (3) to the idle decel switch.
- Connect the other end of the vacuum hose (3) to the carburetor EGR port (4).



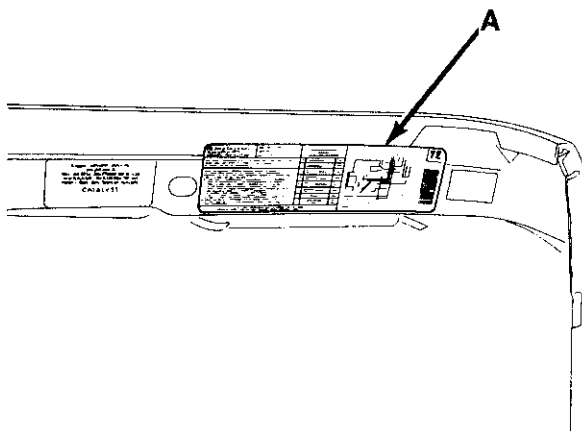
2260

13. Set the ignition timing to 16° BTDC.
14. Reset the idle speeds to the specified settings on the original Vehicle Emission Control Information label.
15. Attach the Vehicle Emission Control Information Update label, P/N EF 8980 010 600. Position the Update label next to the original label.
16. Stow the support rod and close the hood.

NOTE: Whenever this vehicle is returned to operation BELOW 4,000 feet, remove the MCU jumper wire, connect the idle decel switch to the carburetor spark port, reset the ignition timing to 9° BTDC, reset the idle speeds to the original specifications, and, remove the Vehicle Emission Control Information Update label.

Vehicles With 4.2L Engines and Manual Transmissions Built for Operation ABOVE 4,000 Feet Now Being Operated BELOW 4,000 Feet

1. Open the hood and support with the rod.
2. Check the Vehicle Emission Control Information label (A) located on the underside at the front of the hood.

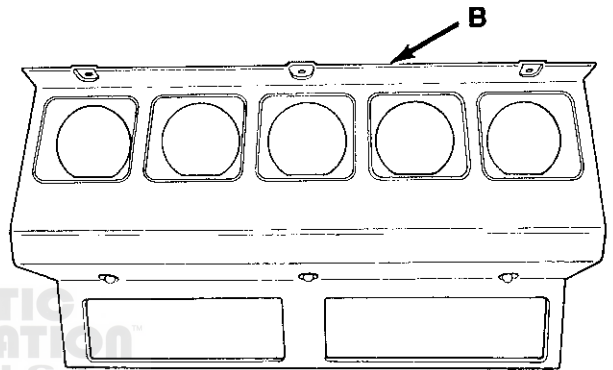


103821

3. Locate positions (1) (2) (3) and (4).
4. Verify that the vehicle is equipped as follows:

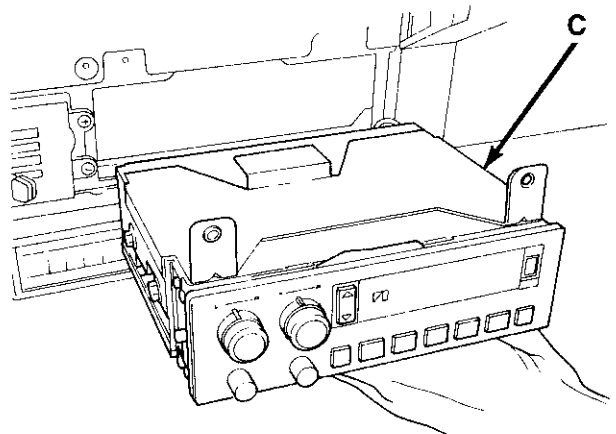
- | |
|--|
| <ol style="list-style-type: none"> 1. 4.2L Engine (258 cu. in.) 2. 50-State/49-State/California or Canada 3. For Operation ABOVE 4,000 Feet 4. Manual Transmission |
|--|

5. Disconnect the battery ground cable.
6. Remove the radio bezel (B).



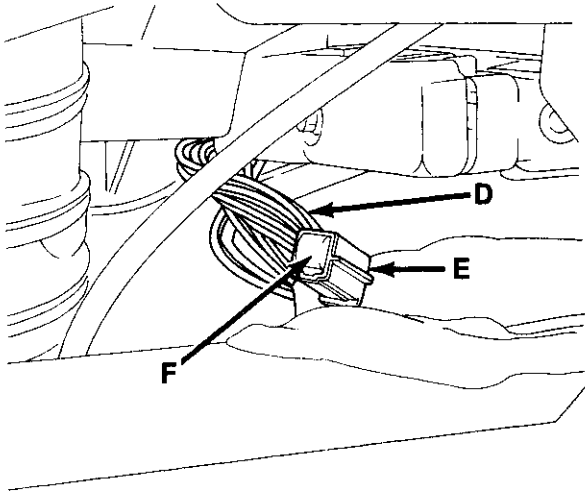
103822

7. Remove the radio (C).



103823

NOTE: This will give access to the MCU harness (D), the two-terminal connector (E), and the jumper wire (F).



103826

8. Remove the jumper wire (F) from the two-terminal connector (E).

NOTE: DO NOT DISCARD THE JUMPER WIRE. Place the jumper wire in the glove compartment for reinstallation when the vehicle is returned to operation ABOVE 4,000 feet.

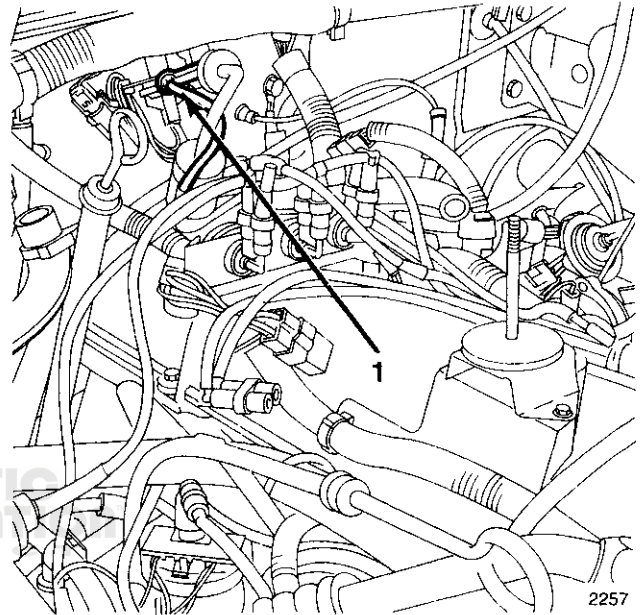
9. Tape the two-terminal connector to the MCU harness.
10. Install the radio.
11. Install the radio bezel.

12. Connect the battery ground cable.

13. Connect the idle decel switch to the carburetor spark port as follows:

- Remove the idle decel switch-to-carburetor EGR port vacuum hose (1).

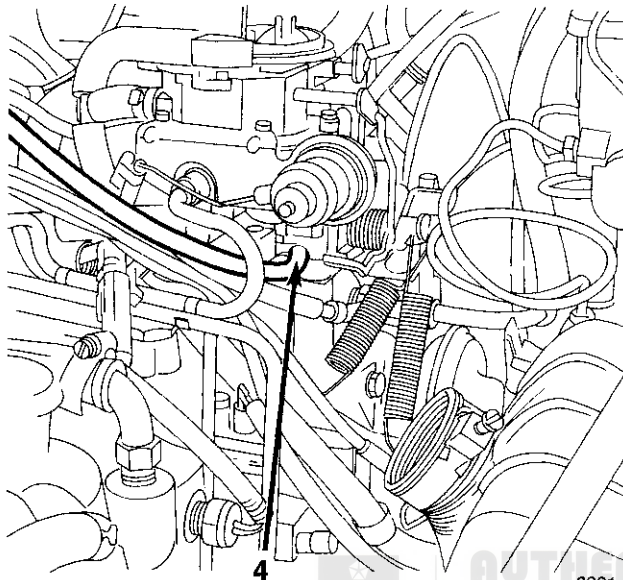
NOTE: The idle decel switch is located behind and to the left of the cylinder head cover.



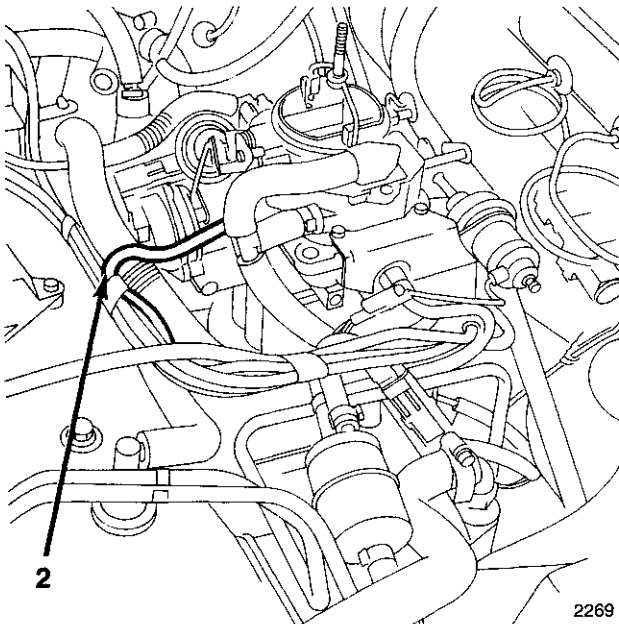
2257

NOTE: DO NOT DISCARD THE VACUUM HOSE. Place the vacuum hose in the glove compartment for reinstallation when the vehicle is returned to operation ABOVE 4,000 feet.

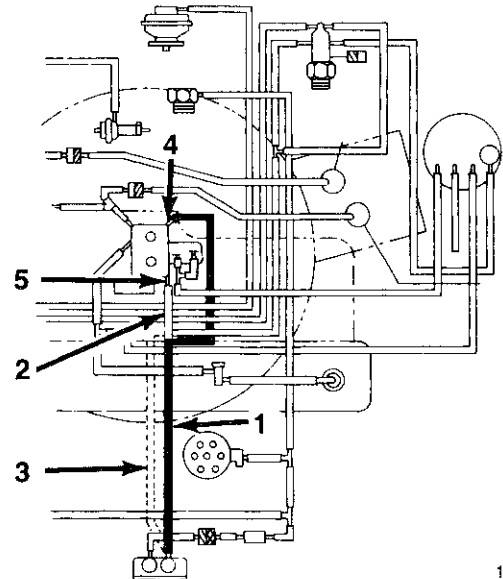
- Plug the carburetor EGR port (4) with a vacuum cap. P/N 813 2325.



- Cut the vacuum hose (2) approximately 127 mm (5 inches) from the carburetor spark port (5), and, install a T-connector, P/N 321 0891, between the two ends of the hose.



- Install a 66.4 cm (26 1/8-inch) long vacuum hose (3) from the idel decel switch to the T-connector just installed in the vacuum hose (2).



103828

14. Set the ignition timing to 9° BTDC.
15. Reset the idle speeds to the settings specified on the original Vehicle Emission Control Information label.
16. Attach the Vehicle Emission Control Information Update label, P/N EF 8980 010 601. Position the Update label next to the original label.
17. Stow the support rod and close the hood.

NOTE: Whenever this vehicle is returned to operation ABOVE 4,000 feet, reconnect the MCU jumper wire, reconnect the idle decel switch to the carburetor EGR port, reset the ignition timing to 16° BTDC, reset the idle speeds to the original specifications, and, remove the Vehicle Emission Control Information Update label.

SAMPLE VEHICLE EMISSION CONTROL INFORMATION UPDATE LABELS:

AMC Jeep Corporation Vehicle Emission Control Information Update Label
This 1987 vehicle was originally sold for principal use <u>below</u> 4000 feet. The engine has been adjusted to maintain emissions performance above 4000 feet (see below). Remove this label and reset the engine to original specifications whenever the vehicle is returned to use below 4000 feet.
Engine application: 4.2L, 5.9L
— ADJUSTMENTS — (1) Advance ignition timing 7° (2) Reset idle speed to specs. on Emission Control Info. Label (3) Install MCU altitude circuit jumper harness on 4.2L models (4) Disconnect idle/decel switch from carb. spark port and reconnect switch to carb. EGR port on 4.2L models with man. trans. REFER TO THE APPROPRIATE I.S. NOTE FOR DETAILED INSTRUCTIONS: M.R. 251 I.S. NOTE 11E; M.R. 253 I.S. NOTE 13E; M.R. 279 I.S. NOTE 7E EF 8980 010 600

103902

AMC Jeep Corporation Vehicle Emission Control Information Update Label
This 1987 vehicle was originally sold for principal use <u>above</u> 4000 feet. The engine has been adjusted to maintain emissions performance below 4000 feet (see below). Remove this label and reset the engine to original specifications whenever the vehicle is returned to use above 4000 feet.
Engine application: 4.2L, 5.9L
— ADJUSTMENTS — (1) Retard ignition timing 7° (2) Reset idle speed to specs. on Emission Control Info. Label (3) Remove MCU altitude circuit jumper harness on 4.2L models (4) Disconnect idle/decel switch from carb. EGR port and reconnect switch to carb. spark port on 4.2L models with man. trans. REFER TO THE APPROPRIATE I.S. NOTE FOR DETAILED INSTRUCTIONS: M.R. 251 I.S. NOTE 11E; M.R. 253 I.S. NOTE 13E; M.R. 279 I.S. NOTE 7E EF 8980 010 601

103903

FILING INSTRUCTIONS

Record this information on Contents Page of Chapter B — Engines in the MR 279 and file it in the binder.



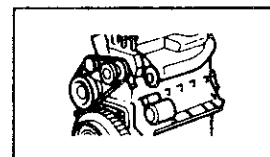
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8E

**AUGUST 1987
 ENGLISH EDITION**

**1987
 WRANGLER/YJ WITH
 4.2L ENGINE**



ENGINES

Attention: Workshop, Parts Department

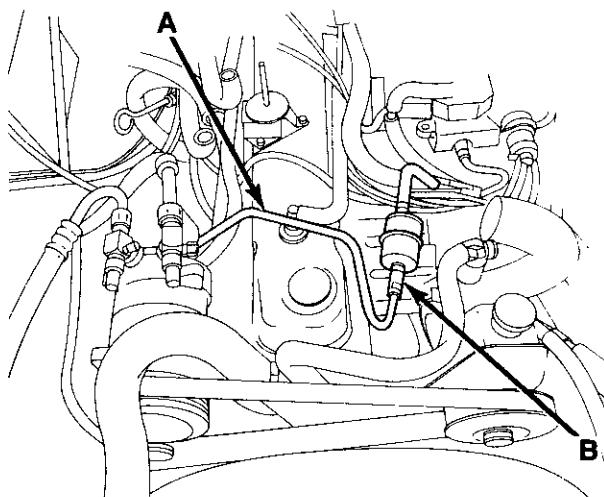
NO START CONDITION WHEN HOT

Some 1987 Wrangler/YJ vehicles equipped with the 4.2L engine may develop a no start condition when operated in high ambient temperatures. This condition may be caused by fuel vaporizing in the fuel lines.

Service correction involves replacing two sections of the fuel line with new fuel lines that are wrapped with convoluted tubing. One section of line runs from the frame to the fuel pump. The other section runs from the fuel pump to the fuel filter.

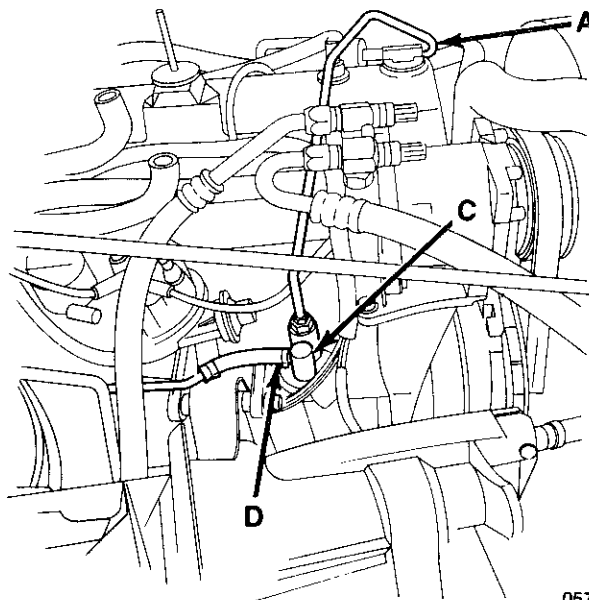
PROCEDURE

1. Remove air cleaner.
2. Disconnect the battery negative cable.
3. Disconnect fuel line (A) at the fuel filter hose (B).



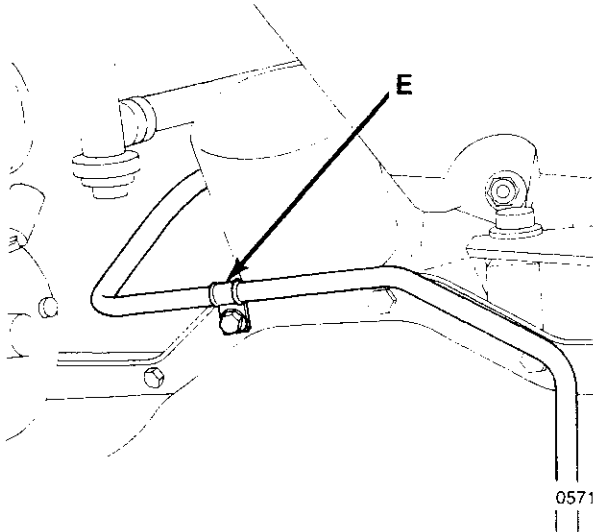
0569

4. Disconnect fuel line (A) from the fuel pump (C) and remove fuel line from vehicle.
5. Disconnect fuel line (D) at the fuel pump.

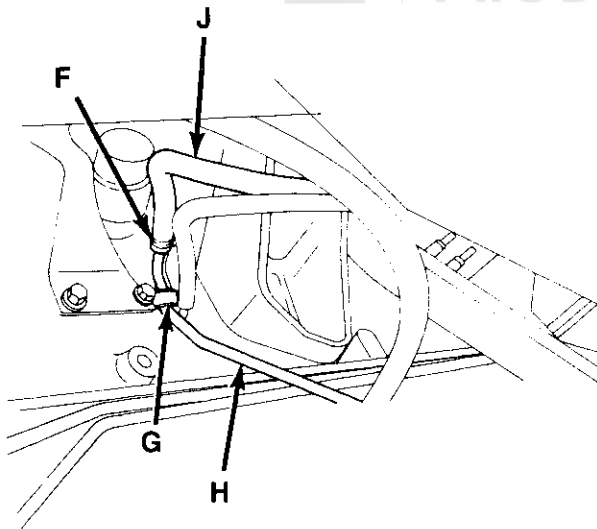


0570

6. Raise the vehicle on a hoist.
7. Remove and discard clip (E) from oil pan. Install oil pan bolt. Torque bolt to 9 N·m (7 ft-lbs).

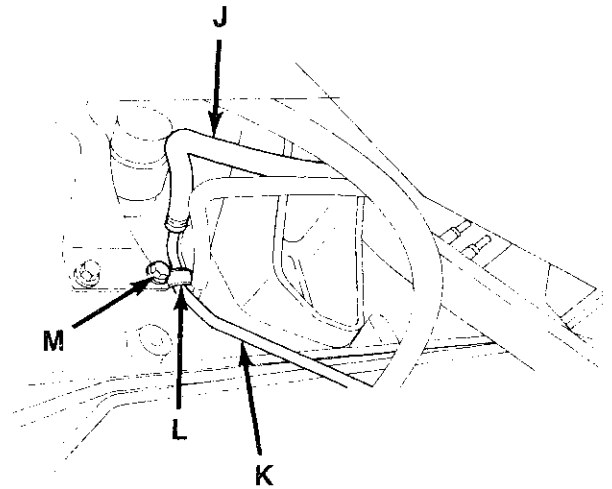


8. On the drivers side of the vehicle, remove hose clamp (F).

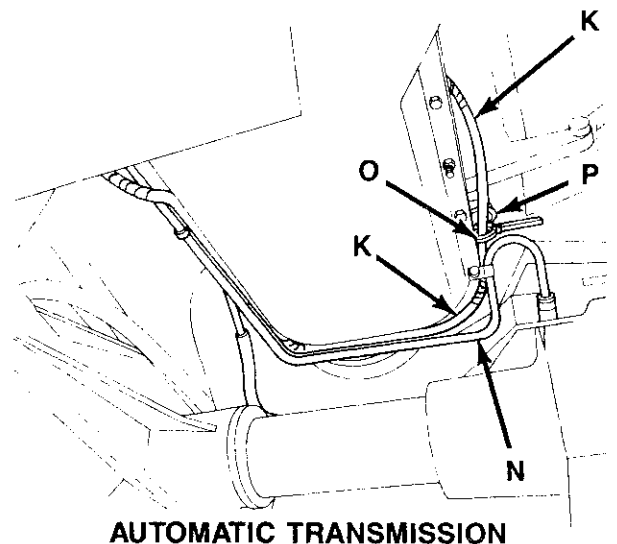


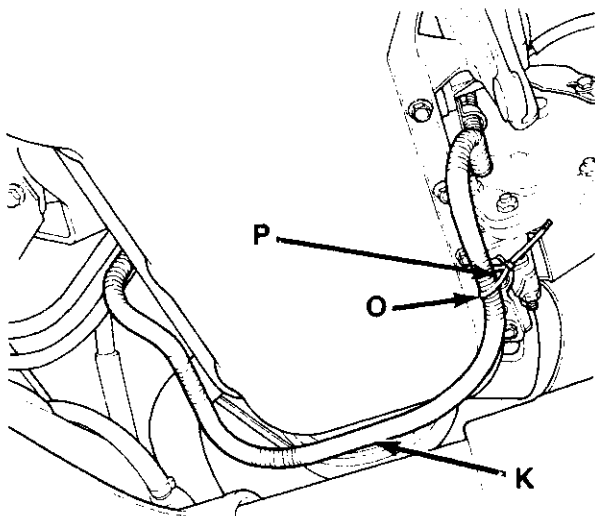
9. Remove clip (G) from the power steering pump bracket.
10. Remove fuel line (H) from fuel hose (J) and remove fuel line from vehicle.
11. Connect the new fuel line, PN 8953 005 138, to the open end of fuel hose (J), and secure with a new hose clamp.

12. Secure the new fuel line (K) to the power steering pump bracket with a new clip (L) PN 4007428. Torque the power steering bracket bolt (M) to 40.5 N·m (30 ft-lbs).



NOTE: The new fuel line (K) is routed around the oil pan. If the vehicle is equipped with an automatic transmission the fuel line goes behind the transmission cooler line (N).

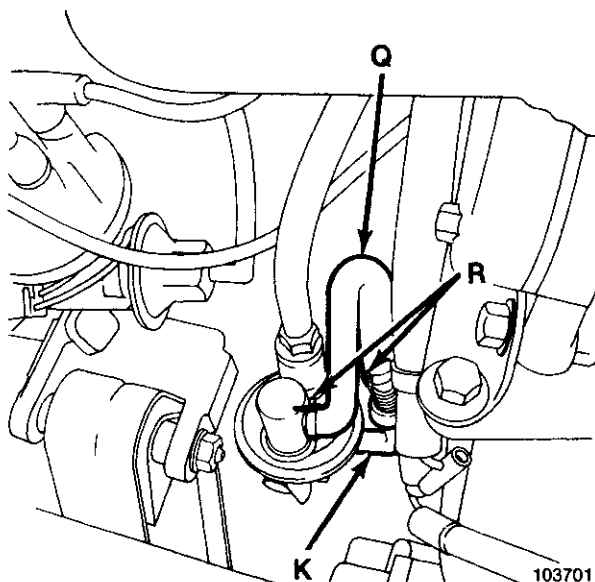




MANUAL TRANSMISSION

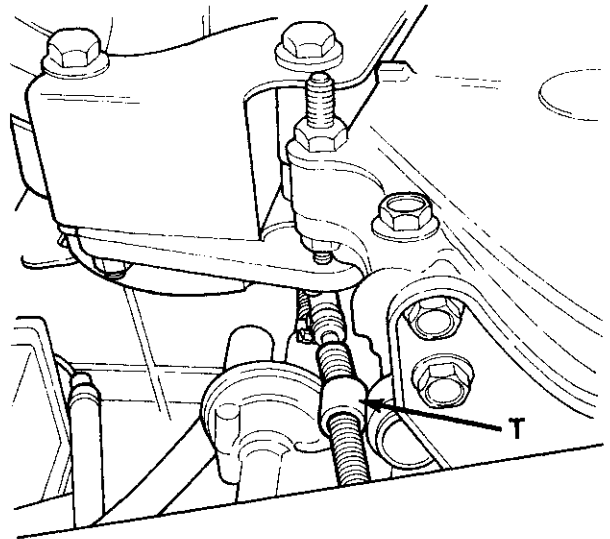
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13. Attach a tie strap (O) to the fuel line and secure it to the machining hole (P) of the block. This will keep the line from dropping until the other end is connected to the fuel pump.
14. Lower the vehicle.
15. Remove the fuel pump.
16. Install new fuel pump PN 3240172. Do not torque the bolts at this time.
17. Attach a 9 inch long section of fuel hose (Q), PN 8125823, to the fuel line (K) and the fuel pump. Use two clamps (R), PN 318 1643, to secure the hose.



103701

18. Remove the front fuel pump attaching bolt.
19. Attach a clip, PN 4007423 (T) to the fuel line and secure the clip to the fuel pump with the bolt previously removed. Torque the fuel pump mounting bolts to 17.5 N.m (13 ft-lbs).



103702

20. Connect the new fuel pump-to-fuel filter line, PN 8953 005 137, to the fuel filter hose. Use a new clamp to secure the line in place.
21. Connect the other end of the fuel pump-to-fuel filter line to the fuel pump.
22. Connect the battery negative cable.
23. Install the air cleaner.
24. Start the vehicle and check for leaks.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
TUBE ASSEMBLY — Fuel Pump to Filter	1	8953 005 137
TUBE ASSEMBLY — Frame to Fuel Pump	1	8953 005 138
FUEL PUMP	1	324 0172

SRT/TIC INFORMATION

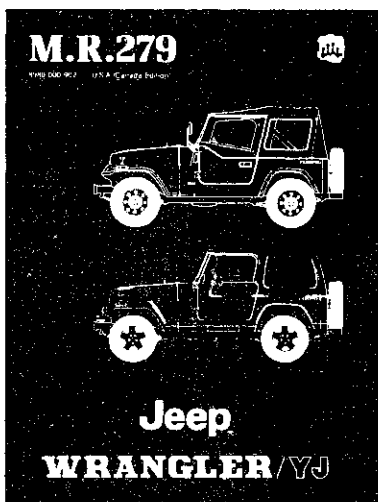
OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. FUEL LINE FRAME TO PUMP, PUMP TO FILTER — REPLACE	0107	0.7	1-951

Filing Instructions

Record this I.S. Note on page B-217 of M.R.279 and file it in the manual.



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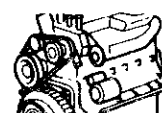
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9E

**AUGUST 1987
ENGLISH EDITION**

**1987 WRANGLER/YJ
MODELS WITH 4.2L
I-6 ENGINE**



ENGINE

Attention: Workshop, Parts Department

ENGINE COMPARTMENT SPLASH SHIELDS

1987 Wrangler/YJ models with 4.2L I-6 engine may collect dirt contamination during off-road driving. Dirt or water may enter the engine compartment and interfere with engine operation. Several modifications have been incorporated in vehicles built after VIN 1JXXXXXX-XXX500974 to reduce water and dirt contamination.

A service kit has been developed to provide shielding in the engine compartment for vehicles built prior to the VIN above. This kit consists of two front splash shields, an air intake deflector, two air cleaner grommets and sealed nuts for the footman loop on the hood. The following procedures outline installation of this shield kit.

PROCEDURES

Front Splash Shields

1. Raise the vehicle with a frame contact hoist.
2. Remove both front wheels and tires.
3. Position a front splash shield to the right front wheelhouse using the brake hose as a locator (A-Fig. 1).

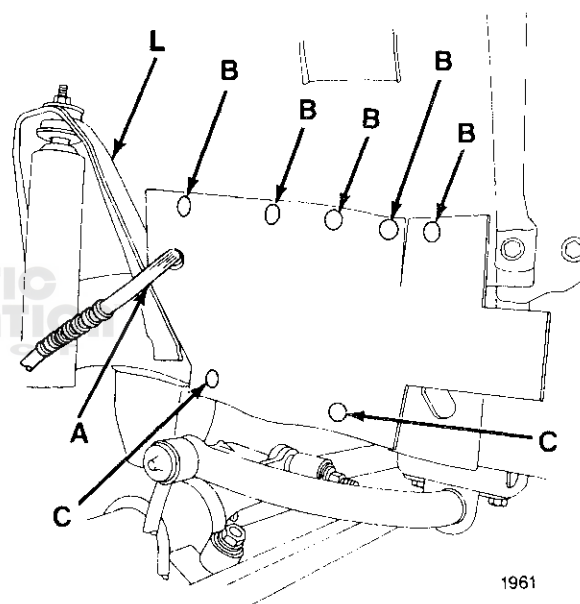


Fig. 1

4. Mark the center of each splash shield hole. There are five holes for the wheelhouse and two holes for the frame (B, C-Fig. 1).
5. Remove splash shield and center punch all hole locations. Using a 7 mm (9/32 in.) drill bit, drill all seven holes for the right splash shield.

Note: Be careful when drilling holes through the wheelhouse into the engine compartment. Keep drill from contacting components inside the engine compartment.

6. Using Ditzler DP40/401, Sikkens Washprimer or Sherwin Williams E2Y36, prime bare metal areas exposed by drilling holes. After applying primer, apply an enamel top coat and allow it to dry.
 7. Position splash shield and install it using panel fasteners (Fig. 1). Push the rear end of shield in behind shock absorber bracket (L-Fig. 1).
 8. Position the other front splash shield to the left wheelhouse using the brake hose as a locator.
 9. Mark the center of the top splash shield holes. Do not mark the two lower holes at the frame (C-Fig. 1). These holes are not used on the driver side shield.
 10. Remove splash shield and center punch the five top hole locations. Using a 7 mm (9/32 in.) drill bit, drill the five holes into the wheelhouse.
- Note:** Be careful when drilling holes through the wheelhouse into the engine compartment. Keep drill from contacting components inside the engine compartment.
11. Using Ditzler DP 40/401, Sikkens Washprimer, or Sherwin Williams E2Y36, prime bare metal areas exposed by drilling holes. After applying primer, apply an enamel top coat and allow to dry.
 12. Position splash shield and install it using panel fasteners. Push rear end of the shield behind the shock absorber bracket.
 13. Install both front wheels and tires.
 14. Lower vehicle.

Air Intake Deflector Installation

1. Remove left headlamp trim ring.
2. Remove headlamp and headlamp bucket.
3. Open hood and remove the two top screws from the ambient air duct attached to the radiator support.
4. Reaching through the headlamp opening, install the ambient air duct deflector, PN 8953 005 120, using two screws and nuts provided in the kit (D, E-Fig. 2). Install screws from the headlamp side to provide clearance for the headlamp bucket.
5. Install headlamp bucket and headlamp.
6. Install headlamp trim ring.

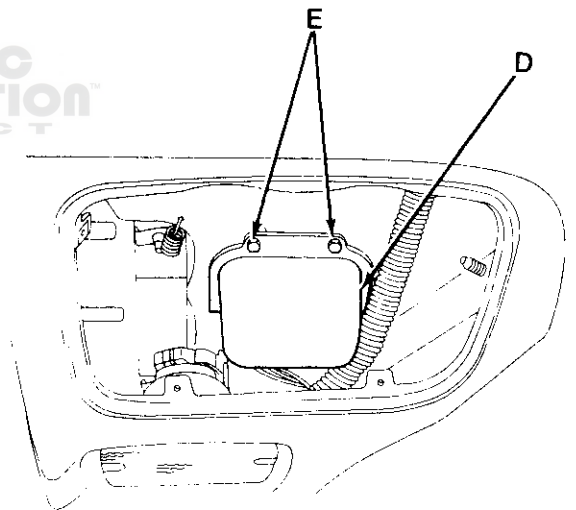


Fig. 2

1850

Footman Loop Nuts and Air Cleaner Grommets

1. Remove air cleaner wing nuts (F-Fig. 3).
2. Install grommet (H-Fig. 3) and flat washer, (J-Fig. 3) on each air cleaner stud.

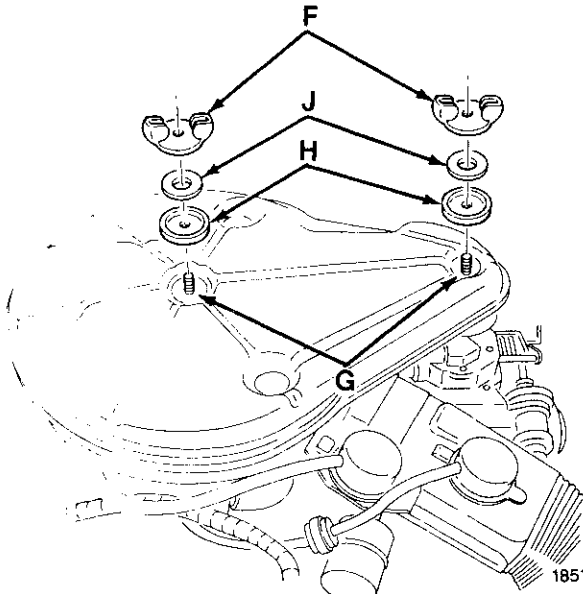


Fig. 3

3. Install air cleaner wing nuts.
4. Using a trim panel removal tool, remove fasteners and lower hood insulation pad, if equipped, from underside of hood.

5. Remove both footman loop nuts (K-Fig. 4) located at the center of the hood.

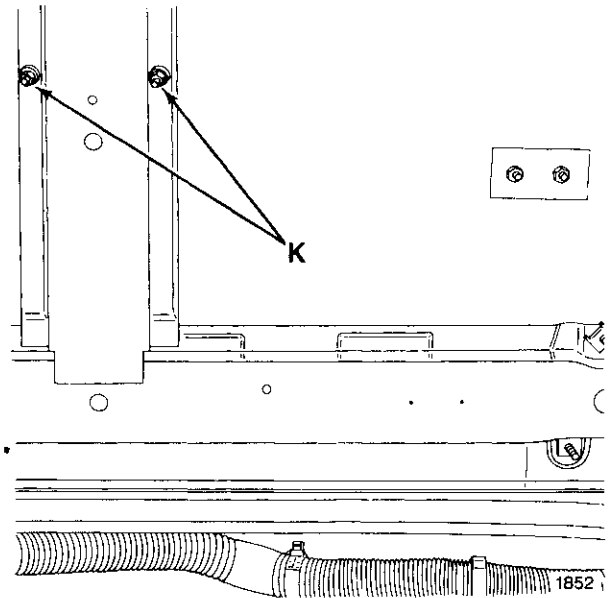


Fig. 4

6. Install new footman nut and sealed washer assemblies, PN 400 0220.

Note: These nuts have sealer on them to close up the holes in the hood for the footman loop.

7. Install hood insulation pad, if equipped.
8. Close hood.

PARTS INFORMATION

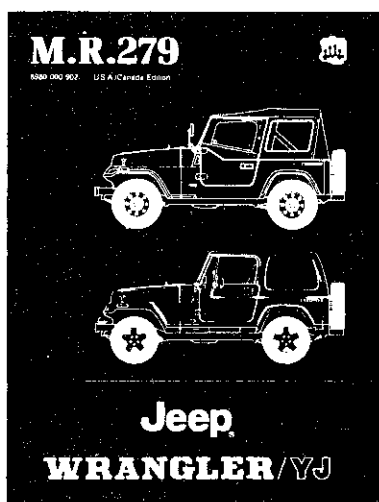
Description	Quantity	Part Number
KIT, Splash Shields	1	8983 100 056
Kit Contents:		
Grommet, Air Cleaner	2	8933 001 941
Washer, Flat	2	400 0847
Splash Shield, Front	2	8955 019 470
Fastener, Panel	12	400 4919
Deflector Assembly, Ambient Air Duct	1	8953 005 120
Screw	2	942 1073
Nut	2	1150 2722
Nut (W/Sealed Washer)	2	400 0220

SRT/TIC INFORMATION

Operation Description	Operation Number	Time	TIC
CO. KIT, SPLASH SHIELDS-INSTALL	0407	0.7	6-430

FILING INSTRUCTIONS

Record this I.S. Note on page B-217 of MR 279 and file it in the manual.



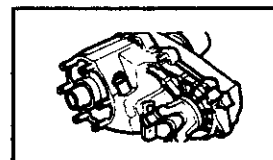
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10E

SEPTEMBER 1987
ENGLISH EDITION

1987 WRANGLER
EQUIPPED WITH 231
TRANSFER CASE



GEARBOXES

Attention: Workshop, Parts Department

UNDERBODY NOISE

Some 1987 Wrangler models equipped with a 231 transfer case may experience an underbody bumping noise while operating the vehicle on rough roads. This condition may be caused by insufficient clearance between the transfer case lower housing and the skid plate/rear crossmember. A new skid plate, PN 8983 100 055, is available to correct this condition.

NOTE: The 231 transfer case entered production with VIN 2BXXXXXXXHB518291.

Service correction involves checking the transfer case-to-skid plate clearance and replacing the skid plate if necessary.

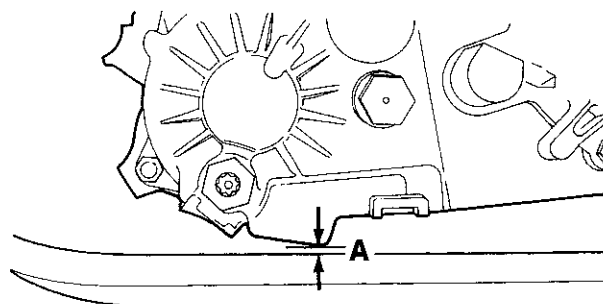
PROCEDURE

Clearance Check

1. Raise and support the vehicle.
2. Measure the clearance (A) between the rear of transfer case and the skid plate as shown. If the clearance is not at least 19 mm (3/4 in.) check the transmission rear mount.

If the transmission rear cushion is in good condition, replace the skid plate as described.

If the rear cushion is damaged replace it and recheck transfer case to skid plate/rear crossmember clearance. If clearance remains



2302

Fig. 1

insufficient, continue with skid plate/rear crossmember replacement.

Skid Plate/Rear Crossmember Replacement

1. Raise and support the vehicle.
2. Place a safety stand under the transmission.
3. Place a second safety stand under the skid plate.

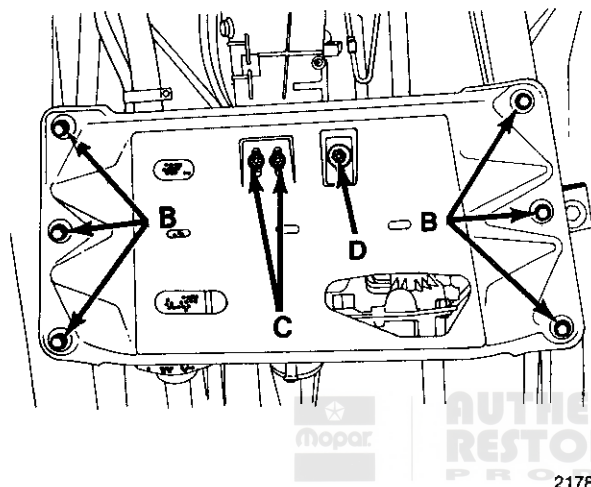


Fig. 2

4. Remove the bolts (B) and the nuts (C) and (D).
5. Remove skid plate/rear crossmember from the vehicle underbody.
6. Install the new skid plate into position.
7. Install bolts (B) and torque to 41 N·m (30 ft-lbs).
8. Install nuts (C) and torque to 45 N·m (33 ft-lbs).
9. Install nut (D) and torque to 41 N·m (30 ft-lbs).
10. Remove the safety stands and lower the vehicle.

PARTS INFORMATION

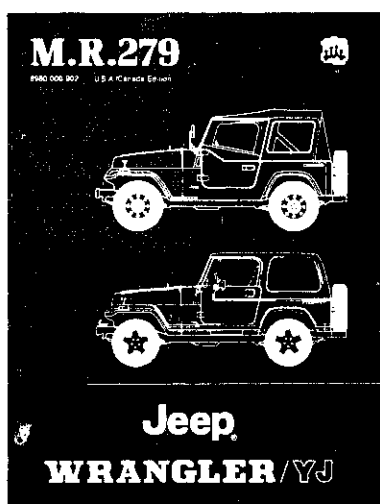
DESCRIPTION	QUANTITY	PART NUMBER
SKID PLATE	1	8983 100 055

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. SKID PLATE — REMOVE AND REPLACE	0408	0.8	4-124

FILING INSTRUCTIONS

Record this I.S. Note on page E-12 of M.R.279 and file it in the manual.



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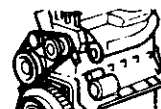
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11E

REVISED EDITION

NOVEMBER 1987
ENGLISH EDITION

1987-88 WRANGLER/YJ
VEHICLES WITH
4.2L ENGINE



ENGINE

Attention: Workshop, Parts Department

THIS I.S. NOTE HAS BEEN REVISED AS INDICATED BY THE REVISION BARS:

IDLE SPEED

The idle speed may be low, or inconsistent on some 1987-88 Wrangler/YJ vehicles equipped with a 4.2L engine. If this condition exists, the following items must be adjusted.

• IGNITION TIMING

• CURB IDLE SPEED

• FAST IDLE SPEED

• SOLE-VAC THROTTLE POSITIONER

Refer to the adjustment procedures listed below.

ADJUSTMENT PROCEDURES

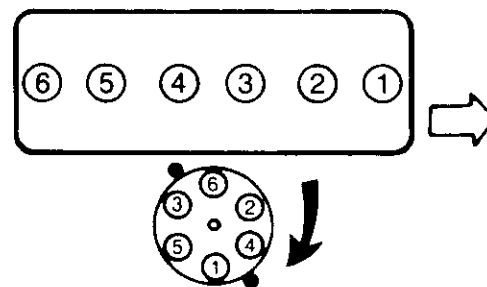
The engine must be at normal operating temperature and all electrical accessory switches in the OFF position.

Ignition Timing

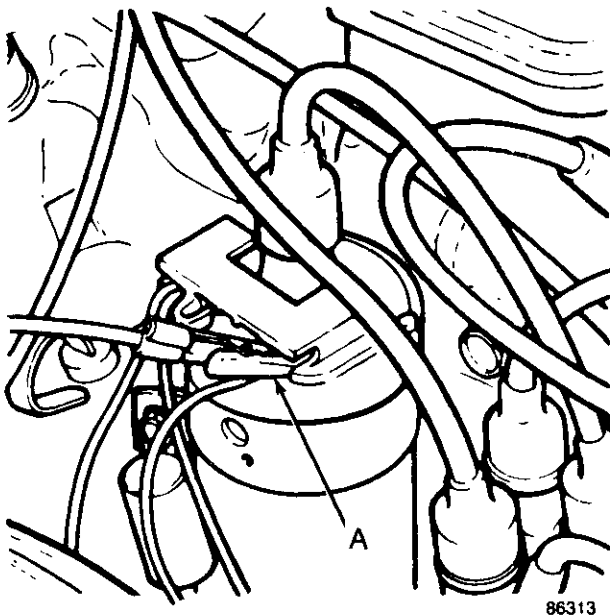
1. Remove the air filter assembly.
2. Set the parking brake. Shift automatic transmissions to PARK and manual transmissions to the NEUTRAL position.
3. With the ignition switch OFF, connect an ignition timing light to the number (1) spark plug and a tachometer to the coil negative terminal (A).

Six-Cylinder Firing Order

Firing Order
1 - 5 - 3 - 6 - 2 - 4

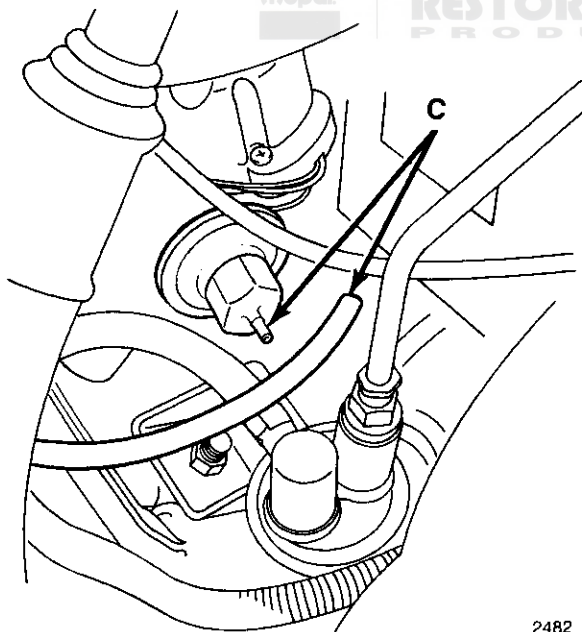


83132B



4. Disconnect the 4-in. and 10-in. Hg vacuum switch assembly wire connector (located adjacent to the vacuum switch assembly).

5. Disconnect and plug the distributor vacuum advance hose (C).



Start the engine.

Increase the engine speed to 1600 rpm and check the ignition timing. If necessary, adjust the timing to the specification listed on the Emission Control Information label.

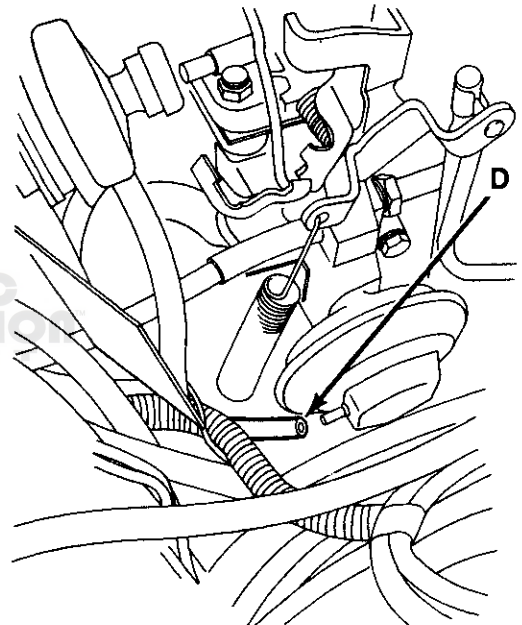
Tighten the distributor hold-down clamp and verify that the ignition timing is correct.

Turn the ignition switch OFF and remove the timing light.

Connect the hose to the distributor vacuum advance mechanism. Connect the wire connector to the vacuum switch assembly.

Fast Idle Speed

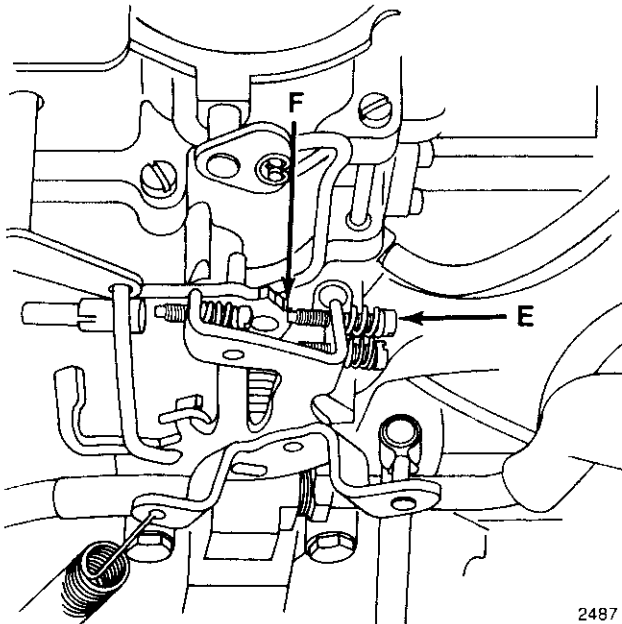
1. Disconnect and plug the EGR valve vacuum hose (D).



2. Place automatic transmissions in the PARK position and manual transmissions in NEUTRAL.

3. Start the engine.

4. Position the fast idle speed adjustment screw (E) in contact with and against the shoulder of the second step (F) of the fast idle cam.



2487

5. Refer to the Vehicle Emission Control Information label located under the hood. Adjust the fast idle speed to the correct rpm. Adjust by turning the fast idle speed adjustment screw (E).

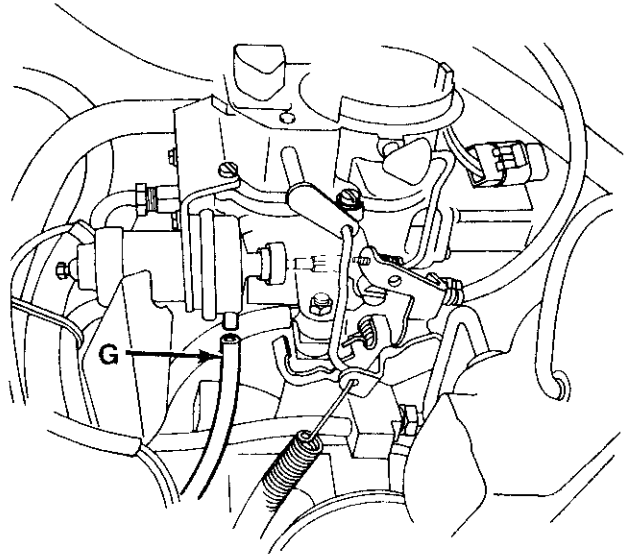
6. Remove the fast idle speed adjustment screw from the fast idle cam and allow the engine to return to curb idle speed.

7. Turn the ignition switch OFF.

8. Remove the plug and connect the vacuum hose to the EGR valve.

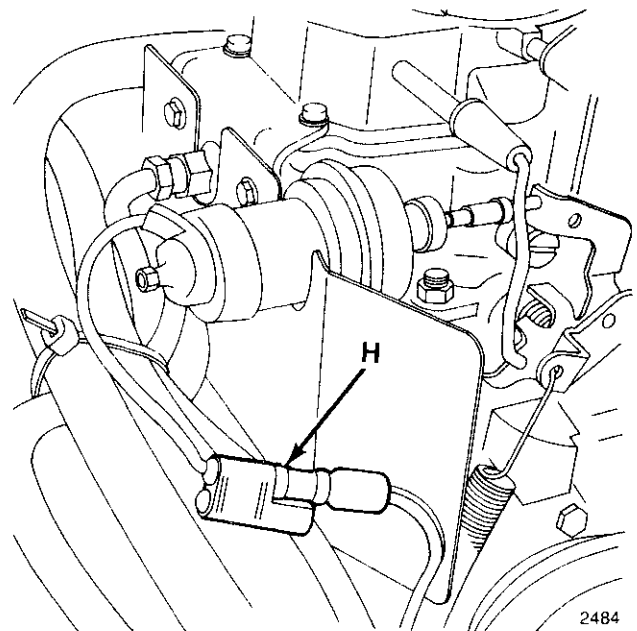
Curb Idle Speed and Sole-Vac Throttle Positioner

1. Disconnect the vacuum hose (G) from the Sole-Vac vacuum actuator and plug it.



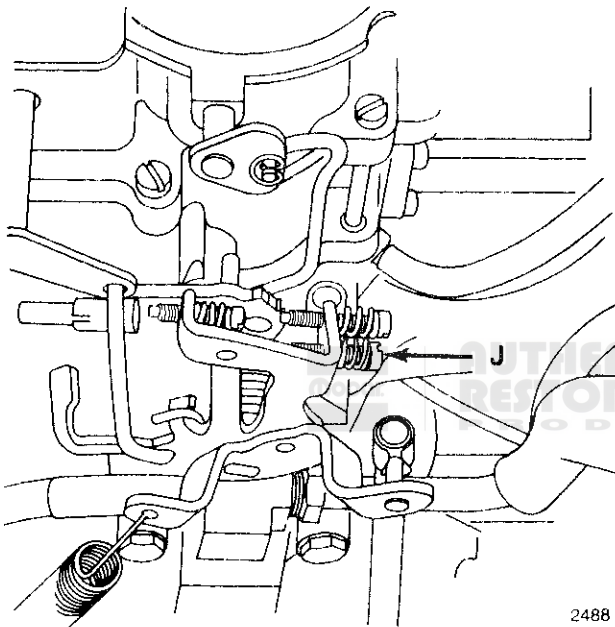
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2. Disconnect the Sole-Vac holding solenoid wire connector (H).

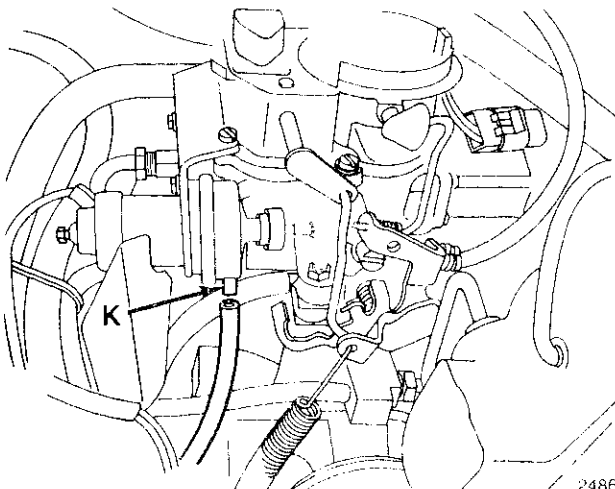


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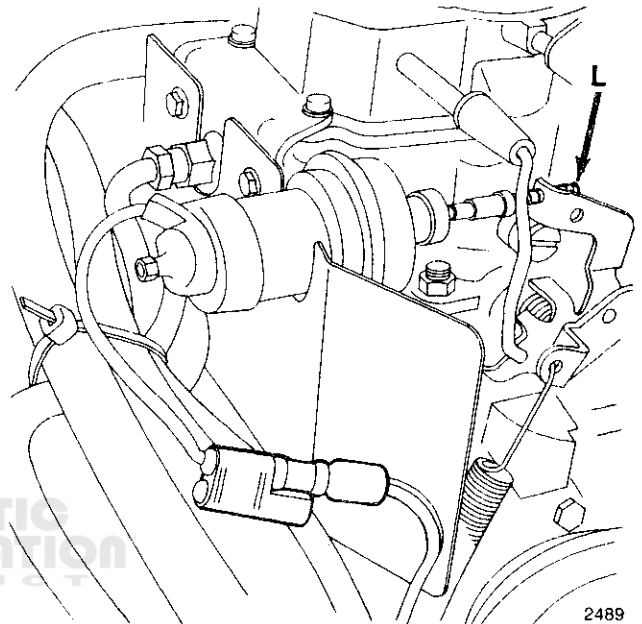
3. Start the engine.
4. Place manual transmissions in NEUTRAL and automatic transmissions in DRIVE. Set the parking brake firmly.
5. Increase the engine speed to above 1200 rpm for 3 to 5 seconds and allow the engine to return to curb idle speed.
6. Adjust the carburetor curb (slow) idle speed adjustment screw (J) to obtain the specified curb (slow) idle speed rpm. Refer to the Vehicle Emission Control Information label.



7. Apply a direct source of 34-51 kPa (10-15 in. Hg) vacuum to the vacuum actuator (K). Use Hand Operated Vacuum Pump Tool J-23738-A, or equivalent.



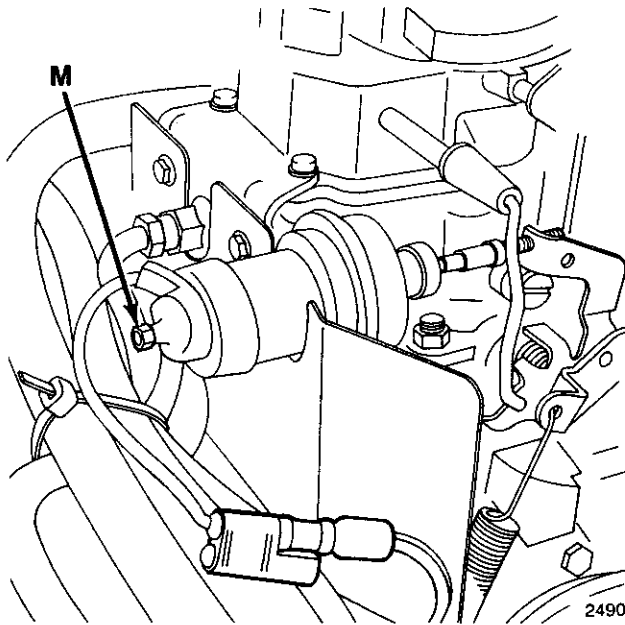
8. Increase the engine speed to above 1200 rpm for 3 to 5 seconds and allow the engine to return to curb idle speed.
9. With the Sole-Vac throttle positioner fully extended, turn the vacuum actuator adjustment screw (L) on the throttle lever until the specified engine rpm is obtained. Refer to the Vehicle Emission Control Information label.



10. Disconnect the vacuum source from the vacuum actuator.
11. With a jumper wire, apply battery voltage (12V) (or connect the holding solenoid wire connector and turn ON the air conditioner with the compressor clutch wire connector disconnected) to energize the holding solenoid.
12. Hold the throttle open manually to allow the throttle positioner to fully extend.

NOTE: Without the vacuum actuator, the throttle must be opened manually to allow the Sol-Vac throttle positioner to be fully extended.

13. Adjust the Sole-Vac throttle positioner (M) to obtain the specified engine rpm. Refer to the Vehicle Emission Control Information label.



14. Turn the ignition switch OFF.
15. Remove the jumper wire from the Sole-Vac holding solenoid wire connector (if connected).
16. Connect the Sole-Vac holding solenoid wire connector.
17. Remove the plug and connect the vacuum hose to the vacuum actuator.
18. Disconnect the tachometer.
19. If disconnected, connect the A/C compressor clutch wire connector.
20. Install the air filter assembly.
21. Road test the vehicle.

SRT/TIC INFORMATION

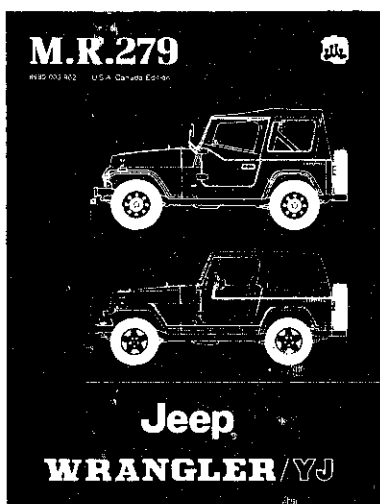


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RESTORATION™**

OPERATION DESCRIPTION	NUMBER	TIME	TIC
■ CO. IDLE SPEED, ENGINE-ADJUST INC. IGNITION TIMING, FAST IDLE, CURB IDLE AND SOLE-VAC THROTTLE POSITIONER ADJUSTMENTS	0106	0.6	1-265

FILING INSTRUCTIONS

Record this I.S. Note on page B-35 of the M.R. 279 manual and file it in the manual.



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12E

NOVEMBER 1987
ENGLISH EDITION

1988 WRANGLER/YJ
MODELS



GENERAL

Attention: Workshop, Parts Department

UPDATE AND REVISIONS TO WORKSHOP MANUAL

This I.S. Note contains service information unique to 1988 WRANGLER/YJ models. Only those items that apply to 1988 Wrangler/YJ models are outlined in this I.S. Note. All other service information in the M.R. 279 remains unchanged. Service information in the M.R. 279 affected by these updates/revisions include:

- General
- Engines
- Electrical
- Gearboxes



**AUTHENTIC
RESTORATION™
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FILING INSTRUCTIONS

File this I.S. Note in the M.R. 279 manual.

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	GENERAL GENERAL INFORMATION	
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MERCON® TRANSMISSION — TRANSFER CASE FLUID

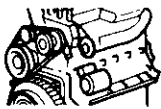
Mercon® automatic transmission fluid is now recommended for use in all Wrangler/YJ automatic transmissions. This same fluid is also recommended for use in transfer case Models 207 and 231.

Mercon® is compatible with Dexron® II and can be used to top off a transmission/transfer case previously filled with a Dexron-type fluid.

The new Mercon® fluid will be the only fluid supplied by your PDC when existing stocks of the current fluid are used up.

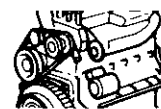


AUTHENTIC
RESTORATION™
PRODUCT



ENGINES

GENERAL INFORMATION



2.5L ENGINE

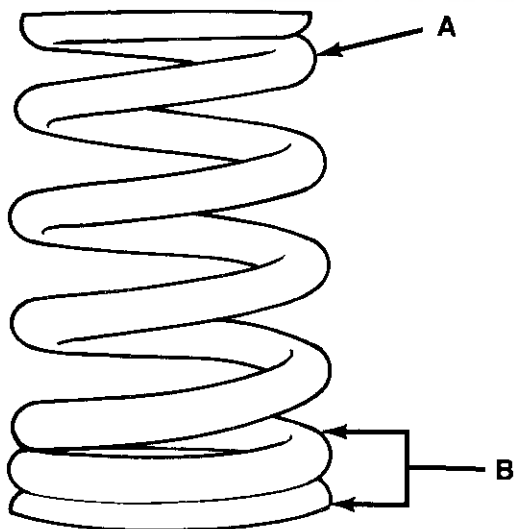
2.5L Crankshaft

A new crankshaft is used in 1988 2.5L engines. The new crankshaft is shorter in length than the previous shaft. A longer crankshaft dampener bolt is required with the new, shorter shaft.

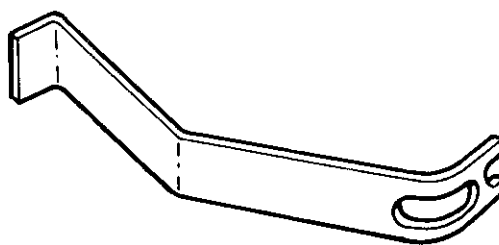
2.5L Valve Springs

1988, 2.5L engines are equipped with new design, valve springs (A). The new springs are slightly tapered top-to-bottom and are identified by the two bottom coils (B) which are flush.

New valve spring retainers and keepers (locks) are also used to accommodate the new design valve springs.



The new valve springs can be removed/installed on the vehicle with service tool J-5892B. Part number for this tool is 8980 002 694. The tool is available from your PDC as part of the special tool program.



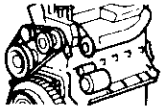
**VALVE SPRING
COMPRESSOR J-5892-B**

2526

4.2L ENGINE

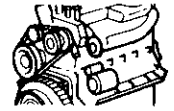
The 4.2L engine is basically unchanged for the 1988 model year. Refer to the M.R. 279 and the Mot. I-6 manuals for necessary specifications and service information.

2516



ENGINES

GENERAL INFORMATION



EMISSION MAINTENANCE TIMER AND INDICATOR LIGHT

1988 Wrangler/YJ 49-State and Canada models are equipped with an emission maintenance timer and indicator light. The timer and light are used to alert the owner when oxygen sensor-PCV valve replacement and other scheduled emission maintenance is required.

The indicator light is located in the instrument cluster. The timer is mounted on the dash panel near the accelerator pedal.

The timer (A) is operated by the ignition system. It activates (flashes) the indicator light when vehicle mileage reaches the scheduled maintenance interval of 133,000 kilometers (82,500 miles).

Emission Maintenance Timer Service

The life cycle of the timer coincides with the emission maintenance interval of 133,000 kilometers (82,500 miles). The timer can not be reset after reaching this mileage interval. The timer can only be replaced or disconnected.

NOTE: The oxygen sensor and timer are inter-dependent. If the timer should fail prematurely, the oxygen sensor must be replaced along with the timer. This is important in preserving the correct sensor replacement interval and ensuring proper engine performance.

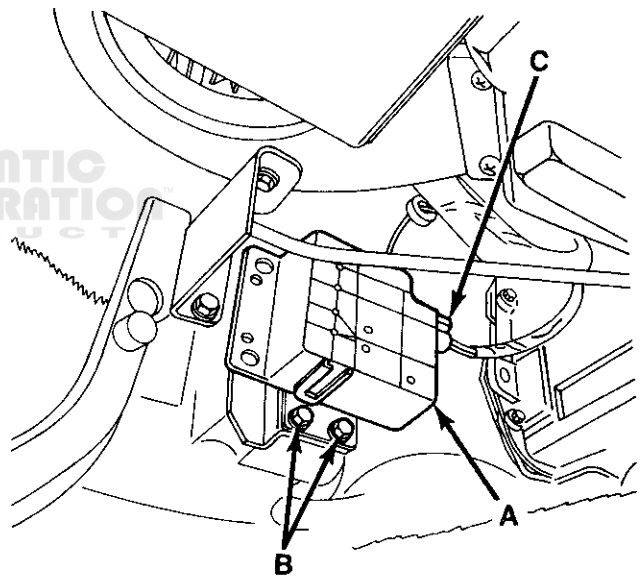
Emission Maintenance Timer Replacement

Remove the screws (B) attaching the timer (A) to the dash bracket.

Disconnect the timer wire harness (C) and remove the timer.

Connect the wire harness to the replacement timer.

Mount the timer on the dash bracket and install the timer attaching screws.



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	ELECTRICAL	
6-CYLINDER STARTER MOTOR		

GENERAL INFORMATION

A Mitsubishi starter motor is used on 1988 Wrangler/YJ six-cylinder engines. This starter motor is a light-weight unit featuring a planetary gear drive and permanent magnets for current induction.

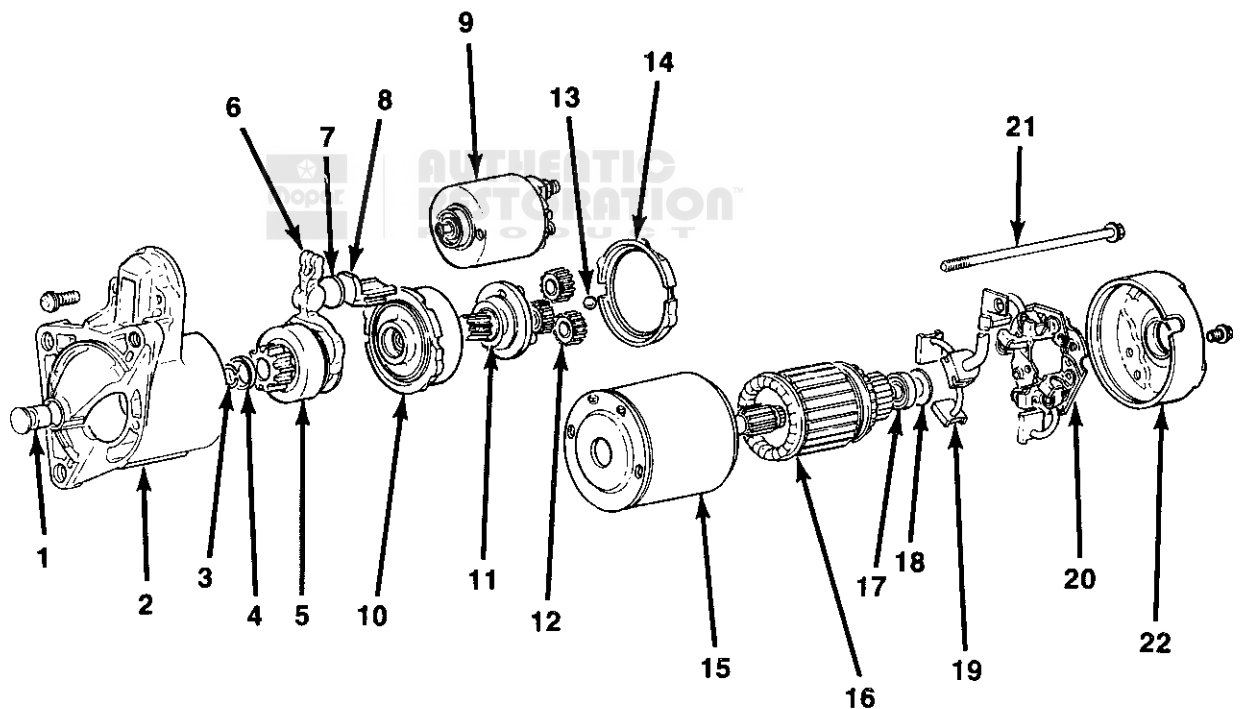
The planetary gear drive is splined to both the armature shaft and overrunning clutch. Starter torque is transmitted to the overrunning clutch

pinion through the planetary gears which provide higher rotational speeds.

The starter magnetic field is produced by six permanent magnets. The magnets are mounted in the armature frame and positioned according to polarity. They are permanently attached to the frame and are not removable.

The starter motor is activated by a solenoid mounted on the overrunning clutch housing.

STARTER MOTOR — 6-CYLINDER ENGINE



- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Bushing 2. Overrunning Clutch Housing 3. Snap Ring 4. Stop Ring 5. Overrunning Clutch 6. Clutch Yoke 7. Yoke Washer 8. Retainer 9. Solenoid 10. Planetary Annulus Gear 11. Planetary Carrier and Pinion Shaft | <ol style="list-style-type: none"> 12. Planetary Gears 13. Armature Shaft Ball 14. Seal Ring 15. Armature Frame and Magnet Assembly 16. Armature 17. Bearing 18. Washer 19. Carbon Brushes 20. Brush Holder 21. Armature Frame Bolts (2) 22. End Cover |
|--|---|

	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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STARTER SERVICE INFORMATION

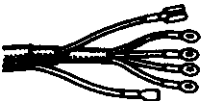
The Mitsubishi starter motor is a serviceable component and can be disassembled for repair.

Replaceable components include the solenoid, overrunning clutch, brushes, brush holder, armature frame and magnets, overrunning clutch housing and the planetary gear drive assembly.

Certain precautions must be observed when servicing the Mitsubishi starter.

- The starter must not be roughly handled. Hammer blows and similar mechanical shocks can damage the unit.
- Never clamp the starter motor armature frame in a vise. Doing so may damage the frame and magnets. Use only the mounting flange on the overrunning clutch housing for clamping purposes.

- Be sure test connections are correct when checking starter performance. A wrong connection will damage the starter magnets seriously enough to require replacement.
- Ensure cleanliness during starter repair. Metal chips are attracted by the starter magnets. Be sure all chips are removed with compressed air and clean shop towels. Chips in the armature frame, planetary gears, or overrunning clutch can cause premature wear.
- The starter armature, armature frame, overrunning clutch, planetary gears, solenoid and rubber parts may be cleaned with dry cloths and compressed air. Do not use liquid cleaning agents on these components. All other starter components may be cleaned with commercially available solvents.

	ELECTRICAL	
	6-CYLINDER STARTER MOTOR	

STARTER MOTOR AND SOLENOID SPECIFICATIONS

Component	Dimension
Carbon Brushes Ring/Pinion Clearance Backlash (Meshed Ring and Pinion) Commutator Diameter Run Out: Commutator Armature Core Armature End Play	Minimum Length 9mm (0.354 in) 2-5 mm (0.078-0.196 in) 0.3-0.7 mm (0.012-0.028 in) Min 28.4mm (1.118 in) max 29.5 mm (1.161 in) 0.03mm (0.001 in) 0.08mm (0.003 in) 0.58mm (0.023 in)

NO LOAD TEST WITH 11.2 VOLTS		SOLENOID SPECIFICATIONS	
AMPS	RPM	HOLD-IN WINDING VOLTAGE	PULL-IN WINDING VOLTAGE
80 MAX.	2500 MIN.	3.5 MIN.	7.8 MAX.

2634

COLD CRANKING SPECIFICATIONS

Battery Test Voltage Cold Cranking Voltage (Min.) Cold Cranking Amps	12.5 Volts 9.6 Volts 130 Amps
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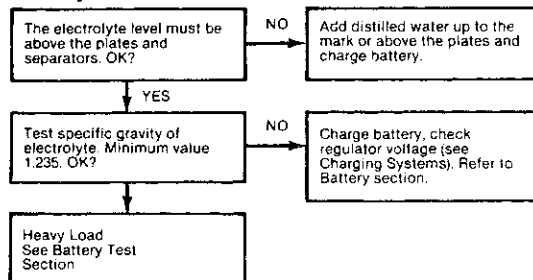
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ELECTRICAL

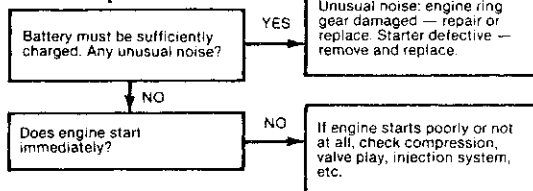
6-CYLINDER STARTER MOTOR

STARTING SYSTEM DIAGNOSIS

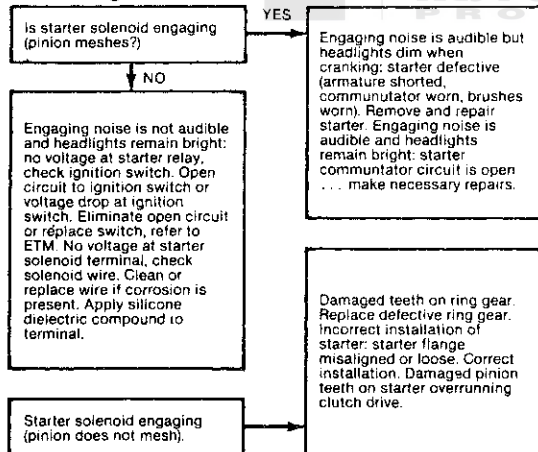
Battery Test



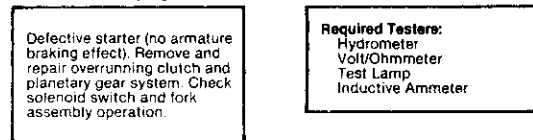
Starter Operation



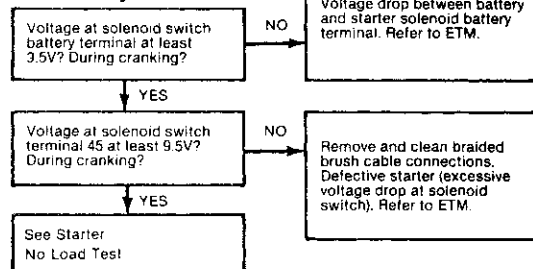
Starter Does Not Crank Engine



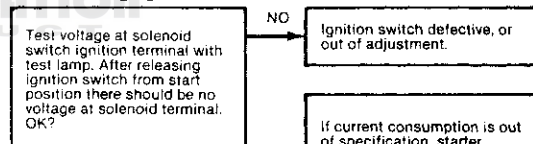
Starter Continues To Spin After Disengagement



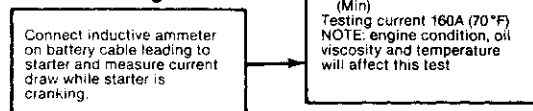
Starter Cranks Too Slowly



Starter Does Not Disengage



Current Draw Test, Cold Cranking

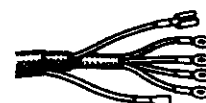


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ELECTRICAL

6-CYLINDER STARTER MOTOR



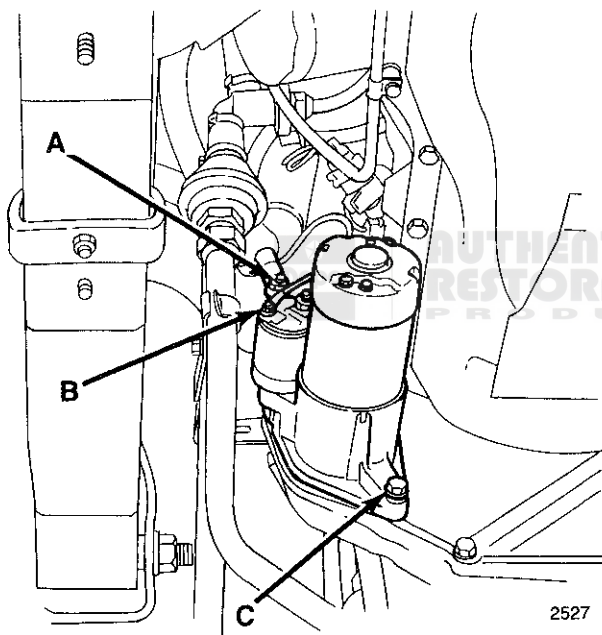
STARTER REMOVAL

Disconnect the battery negative cable.

Raise and support the vehicle.

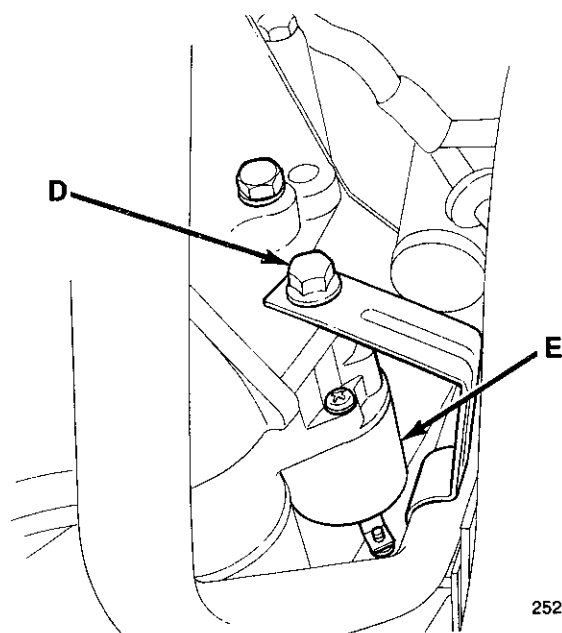
Remove the nuts attaching the starter wires to solenoid terminals (A) and (B). Then remove the wires.

Remove starter mounting bolts (C).



Remove starter mounting bolt (D) at the rear of the housing.

Remove the starter (E).



STARTER INSTALLATION

Position the starter in the housing and install the mounting bolts finger tight. Be sure the bolt at the rear of the housing goes through the pulse air bracket.

Tighten the starter mounting bolts to 45 N·m (33 ft-lbs) torque

Install the starter wires on the solenoid terminals. Tighten the small terminal nut to 6 N·m (55 in-lbs) torque. Tighten the large terminal nut to 9 N·m (80 in-lbs) torque.

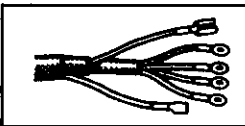
Lower the vehicle.

Connect the battery negative cable.

STARTER TESTING

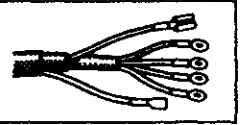
Inspection

Remove the starter and check movement of the armature and overrunning clutch pinion. The



ELECTRICAL

6-CYLINDER STARTER MOTOR



pinion and armature should rotate freely. Engage the pinion and check armature rotation by turning the pinion with a screwdriver.

A damaged bushing or bearing, armature shaft, or armature frame will cause the armature to bind and not rotate freely.

If the armature and pinion rotate freely, perform the No-Load Test before disassembly. If the armature or pinion bind, disassemble and repair the starter as needed.

Starter No-Load Test

CAUTION: Do not operate the starter for more than 5 seconds at a time during the no-load test. The starter can be overheated and damaged if operated for periods longer than this. Allow the starter to cool down for a minimum of two minutes between tests.

Connect a voltmeter (A) between terminal 45 and the starter frame. Connect (ground) the remaining voltmeter terminal to the starter frame or housing.

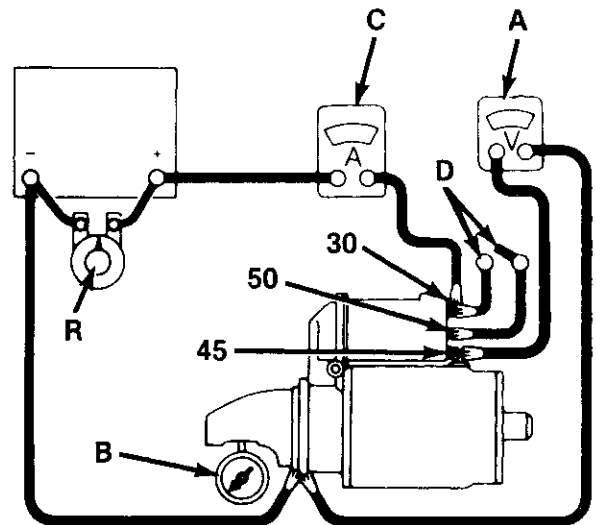
Install a mechanical tachometer (B) on the over-running clutch pinion shaft to measure armature speed.

Connect an ammeter (C) between the battery positive post and terminal 30 of the solenoid.

Verify that the test battery is at specified test voltage. Charge the battery if necessary.

Connect the battery negative terminal to the starter frame or housing.

Connect a test switch (D) between terminals 30 and 50 of the solenoid. The switch should be in the open position.



84945B

Close the test switch (D) and operate the starter for no more than 5 seconds. Record starter rpm, current, and voltage. Then compare the readings with those listed in the test specifications charts.

NOTE: It is not necessary to obtain exact specified test voltage. If voltage is slightly higher, rpm will also be higher proportionately (current will not be affected). However, if test voltage is higher than specified and exact test voltage is desired, use a carbon pile rheostat (R) to reduce voltage. Connect the rheostat across the battery.

Open the test switch and disconnect the test equipment from the starter.

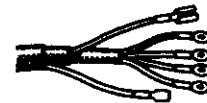
CAUTION: Do not disconnect the test equipment until the switch is open.

Refer to No-Load Test Analysis.



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6-CYLINDER STARTER MOTOR



No-Load Test Analysis

NOTE: The specified current flow also includes solenoid current flow.

Interpret test results as follows:

Starter operation is normal if current flow and rpm are within specified limits.

If rpm is low and current draw high, check for the following conditions:

- Connecting terminal or armature windings shorted to ground
- Armature shaft bent or bearings are seized
- Armature housing damaged

If the starter will not operate and current draw is zero, check for the following conditions:

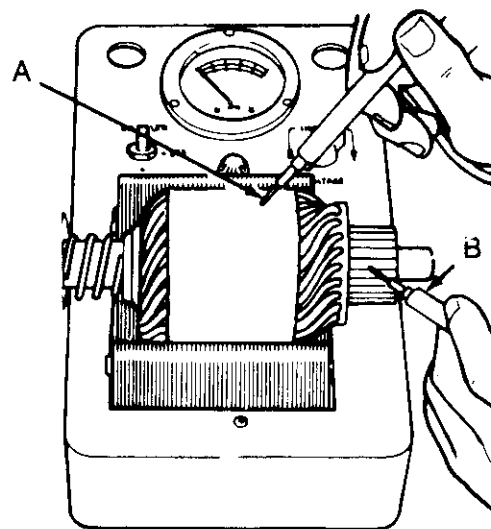
- Grease and dirt on brushes or commutator
- Open armature windings. Inspect commutator for burned spots.
- Worn brushes
- Damaged brush springs or spring holders
- Protruding insulation between commutator bars
- Solenoid terminals damaged
- Brush connecting wire damaged

If tests indicate an armature problem, check the armature on the growler. Refer to the armature testing procedures in this section.

Armature Ground Test

Place the armature in the growler jaws and turn the power switch to TEST position.

Place one test lead (A) on the armature core. Place the other lead (B) on each commutator bar and observe the test lamp. The lamp should not light. If the lamp lights when the test lead contacts one or more of the commutator bars, the armature is grounded and must be replaced.



84936B

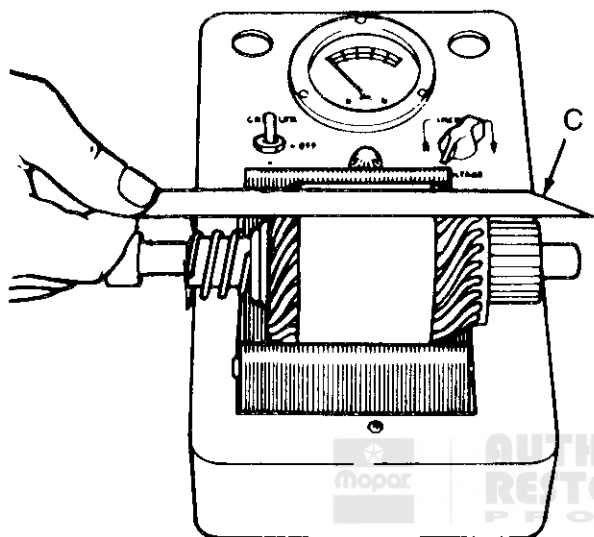
Armature Short Test

CAUTION: To avoid damaging the growler, do not operate the growler unless an armature is mounted in the growler jaws.

Place the armature in the growler jaws and turn the power switch to GROWLER position.

	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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Position the growler steel blade (C) parallel to and touching the armature core. Slowly rotate the armature one or more revolutions in the growler jaws. If the steel blade vibrates at any part of the core, the windings are shorted and the armature must be replaced.



84937B

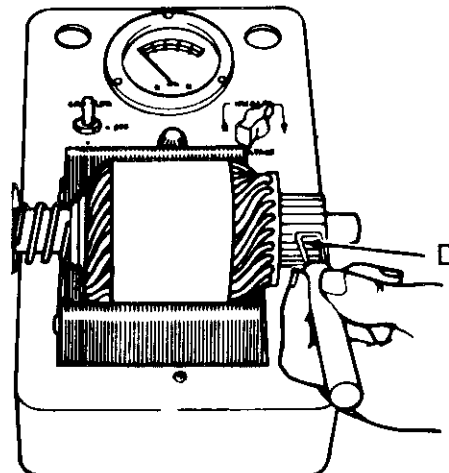
Armature Balance Test

Place the armature in the growler jaws and turn the power switch to GROWLER position.

Place the contact fingers of the meter test lead (D) across adjacent commutator bars.

Adjust the growler voltage control until the pointer indicates highest voltage on scale.

Test each commutator bar with the adjacent bar until all have been tested. Zero voltage at any commutator bar indicates a short circuit in the pair being tested. The armature must be replaced if a short is discovered.

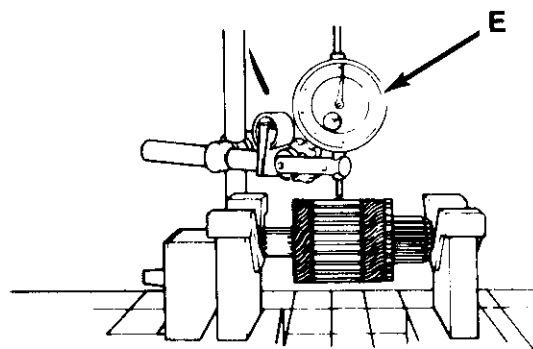


84938B

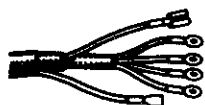
Armature Runout

Check runout of the armature core and commutator with a dial indicator (E). Mount the armature in V-blocks for accurate readings.

Runout at the core should not exceed 0.08mm (0.003 in).

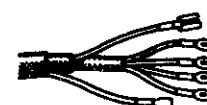


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6-CYLINDER STARTER MOTOR



Runout at the commutator should not exceed 0.03mm (0.001 in).

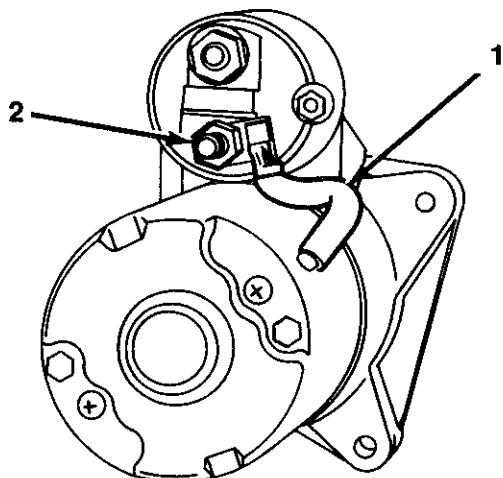
Replace the armature if runout exceeds specified limit at the core or commutator.

STARTER OVERHAUL

Starter Disassembly

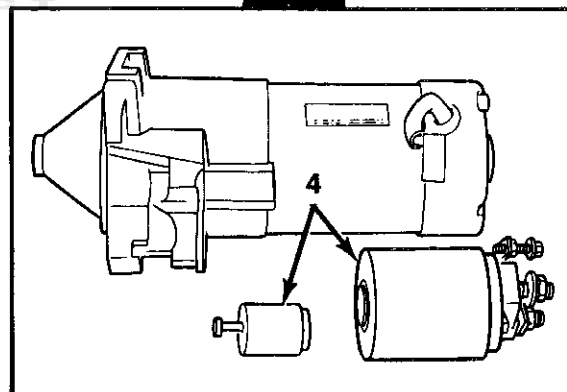
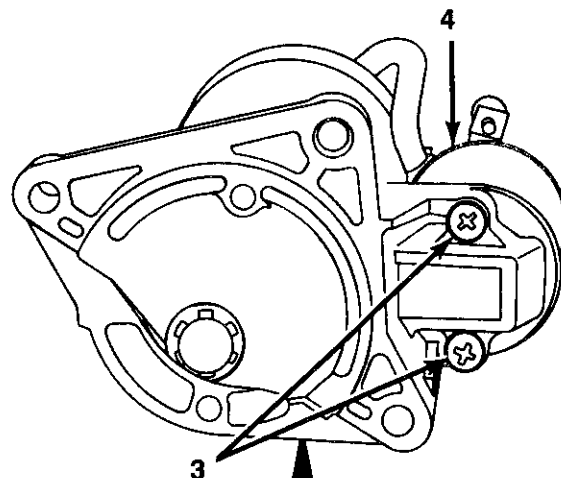
CAUTION: Do not clamp the armature frame in a vise or strike it with a hammer during repair operations. The permanent magnets attached to the frame could be broken and the frame dented or deformed if mishandled. If the starter is to be mounted in a vise during repair, use only the mounting flange on the housing for clamping purposes.

Disconnect the brush wire (1) from the solenoid terminal (2).



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Remove the solenoid screws (3) and remove the solenoid and solenoid plunger (4).



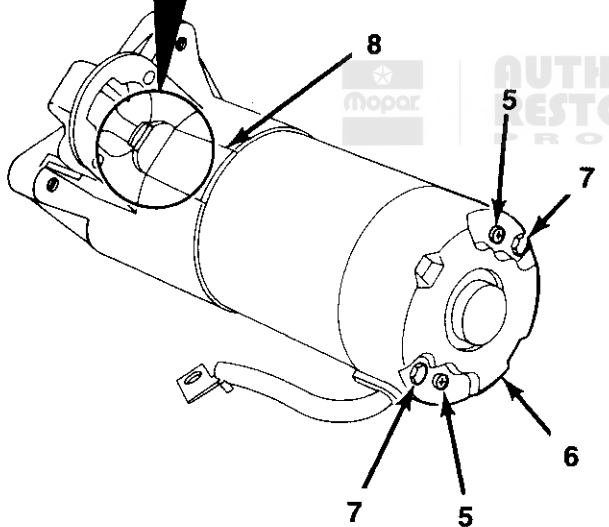
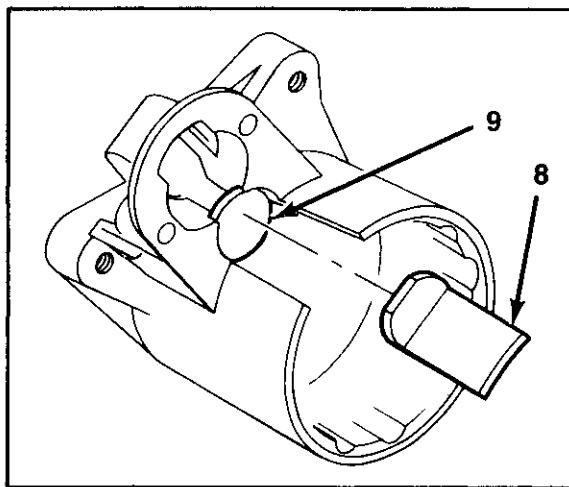
2638

Loosen but do not remove the two screws (5) that attach the commutator shield (6) to the brush holder plate.

Remove the armature frame bolts (7).

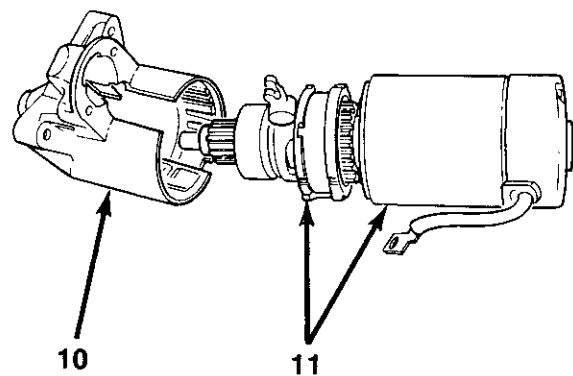
Slide the armature frame away from the over-running clutch housing and remove retainer (8) and washer (9).

	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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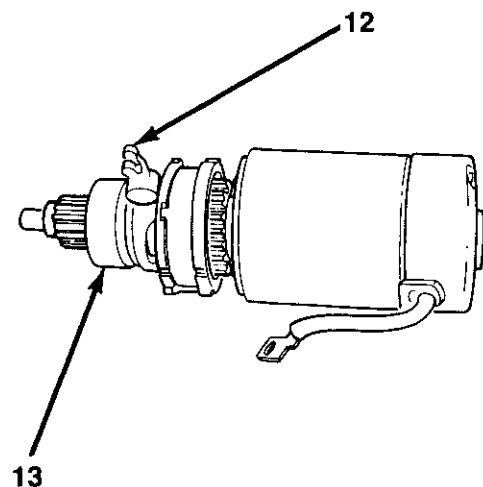


Remove the overrunning clutch housing (10) from the armature frame (11).

Remove and retain the armature shaft ball.

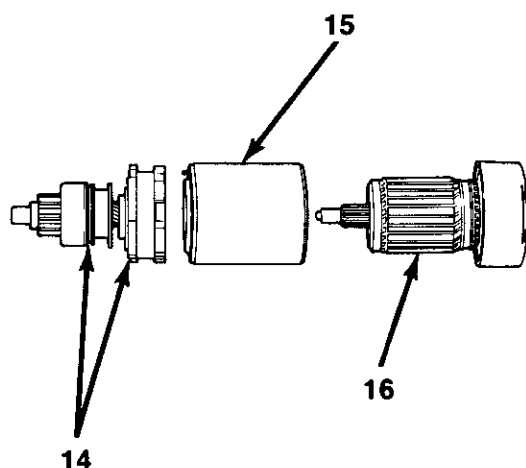


Remove the clutch fork (12) from the overrunning clutch (13).



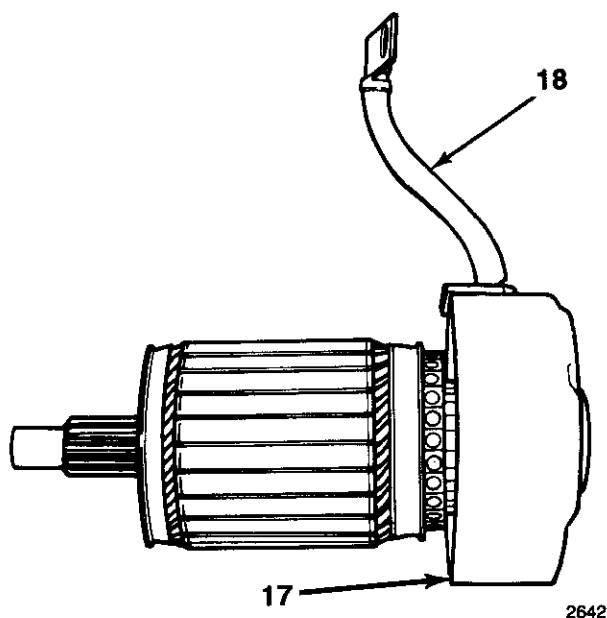
	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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Remove the overrunning clutch (14) and frame (15) from the armature (16).



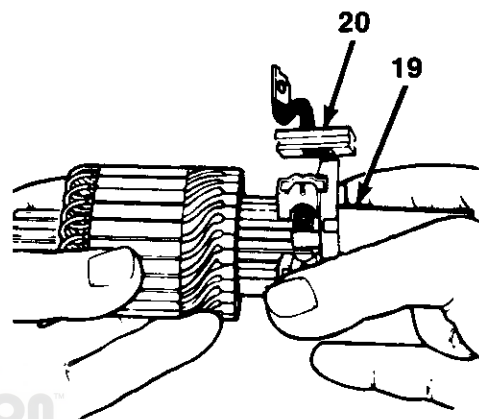
Remove the screws attaching the end cover (17) to the armature. Remove the cover but do not remove the brush holder plate.

Remove the brush feed wire (18) by sliding the wire and wire connector out of the shield (17).



Install a 22mm socket (19) on the armature shaft.

Slide the socket up against the armature commutator. Then slide the brush holder (20) onto the socket (19). Leave the socket in position in the brush holder for inspection and assembly.



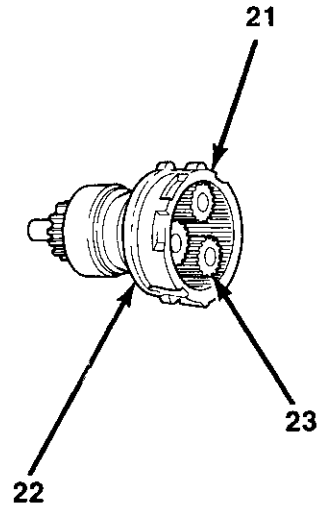
Remove the seal ring (21) from the planetary gear assembly (22).

Remove the planetary gears (23).

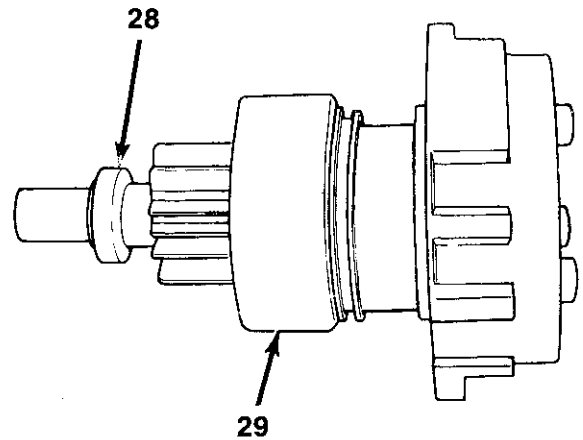
Remove the gear carrier and pinion shaft from the planetary annulus gear.

Place a 17mm socket (24) on the workbench. Then position the planetary gear/overrunning clutch assembly (25) in a vertical position (on end), so the entire assembly rests on the socket.

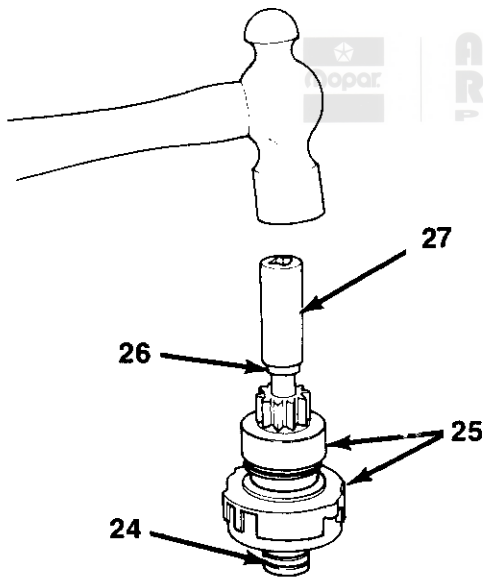
Unseat the stop ring (26) using a 12 point 14mm socket (27). Position the socket on the pinion shaft and against the stop ring (26). Then strike the socket with a hammer to unseat the stop ring and expose the snap ring.



2644



2646



2645

Remove the 14mm socket from the pinion shaft.

Remove the snap ring and stop ring (28) from the pinion shaft.

Remove the overrunning clutch (29) from the pinion shaft.

STARTER CLEANING AND INSPECTION

Cleaning

Clean the armature, armature frame, overrunning clutch, solenoid, and brush holder assembly with clean, dry cloths or compressed air only. Do not use liquid solvents to clean these components. Use mineral spirits or similar solvents to clean the remaining starter components.

Inspection

Inspect the armature frame and magnets. Do not attempt to remove the magnets. They are permanently attached. Replace the frame and magnets as an assembly if either component is damaged.

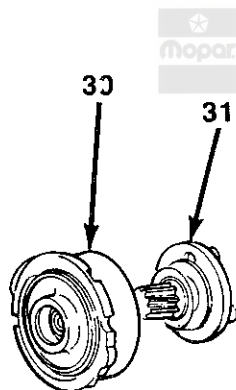
Replace the planetary gear assembly and pinion shaft if worn or damaged.

Inspect the armature shaft bushing and bearing. Replace either part if worn. However, if the bushing or bearing has worn to the point where armature-to-frame contact has occurred, replace the starter motor as an assembly.

Inspect the brushes and brush holder. Replace the brushes if damaged or worn below the minimum length of 9mm (0.354 in.). Replace the brush holder if cracked, bent, or distorted. Do not remove the socket from the brush holder unless the holder must be replaced.

STARTER ASSEMBLY

Install the planetary annulus gear (30) on the gear carrier and pinion shaft (31).

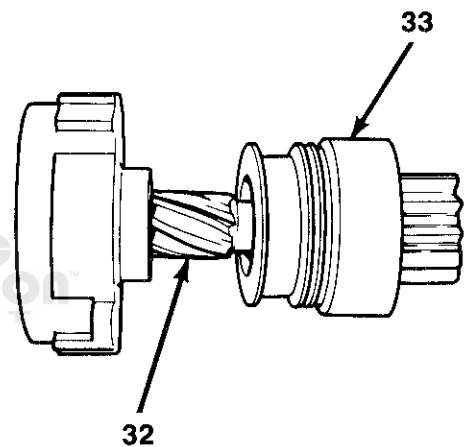


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Lubricate the pinion shaft (32) and the bushing in the overrunning clutch housing with SAE 20W motor oil.

Lubricate the spiral splines in the overrunning clutch bore with Lubriplate.

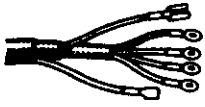
Install the overrunning clutch (33) on the pinion shaft (32).



2648

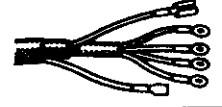
Install the stop ring and snap ring on the pinion shaft as follows:

- Install the stop ring on the pinion shaft. Slide the stop ring past the snap ring groove.
- Expand and install the snap ring on the pinion shaft. position the snap ring in the shaft groove and crimp the snap ring in place.
- Pull the stop ring against the snap ring with a battery cable puller (34).

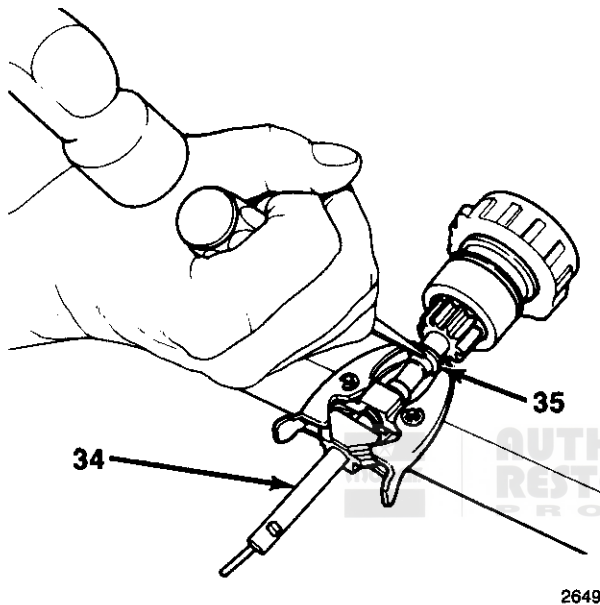


ELECTRICAL

6-CYLINDER STARTER MOTOR



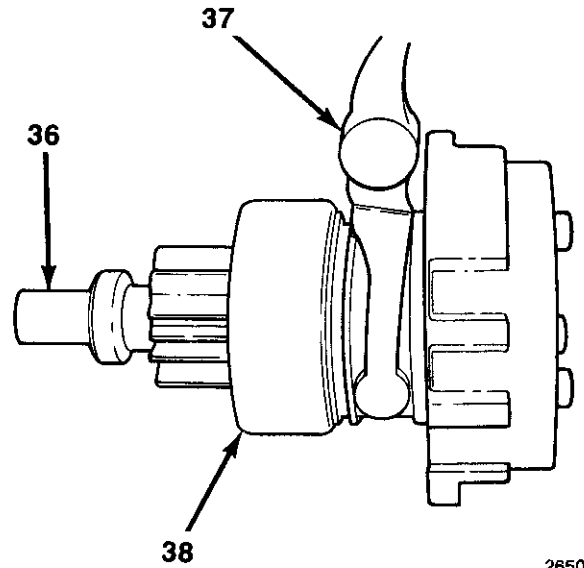
- Check snap ring-to-stop ring alignment. If necessary, tap the snap ring with a screwdriver until aligned in the stop ring.
- Tighten the puller tool to seat the stop ring (35) on-and-over the snap ring.



Inspect the pinion shaft bushing surface (36) after installing the snap and stop rings. Remove small burrs or scratches on this surface with crocus cloth or 400-600 grit sandpaper.

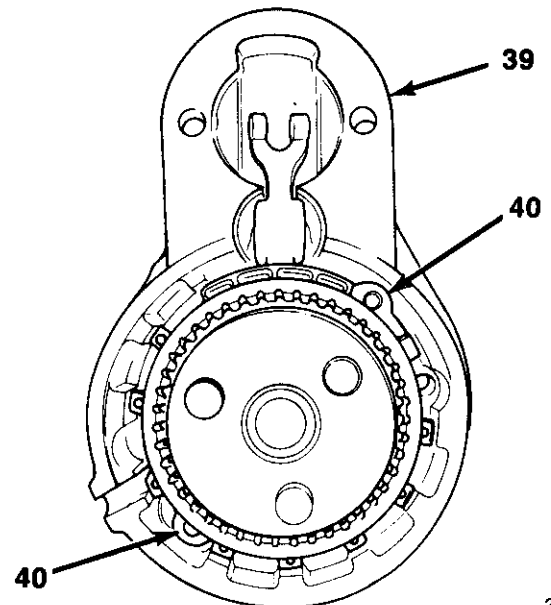
Lightly lubricate the bushing in the overrunning clutch housing with SAE 20W oil.

Install the clutch fork (37) on the overrunning clutch (38).



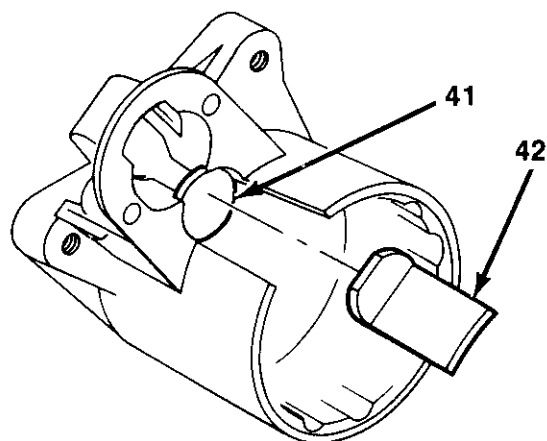
Install the planetary/overrunning clutch assembly in the overrunning clutch housing (39).

Be sure the locating lugs (40) on the planetary annulus are properly aligned and seated in the housing.



	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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Install the fork washer (41) and fork retainer (42).

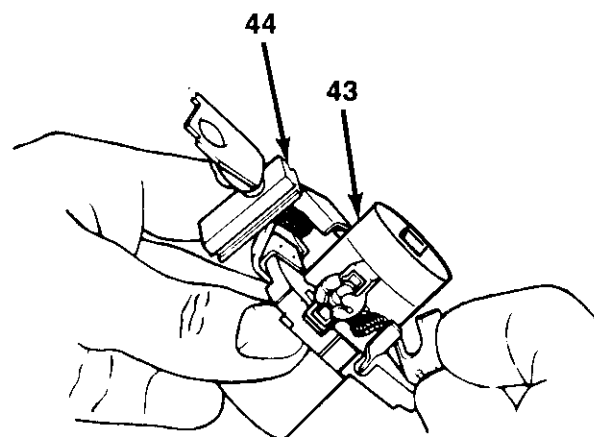


2652

Lubricate the planetary gears with chassis grease and install the three gears on the planetary carrier shafts.

Install the seal ring on the overrunning clutch housing. Position the largest lug on the seal ring at the top.

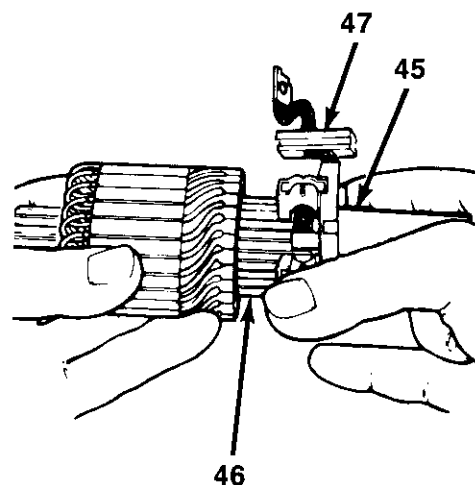
If replacement brushes were installed in the holder, reinsert the socket (43) through the holder (44) to keep the brushes in position.



2653

Position the socket (45) against the armature commutator (46). Then slide the brush holder and brushes (47) onto the commutator and remove the socket.

Verify that the brushes and brush retainers are seated in the holder.



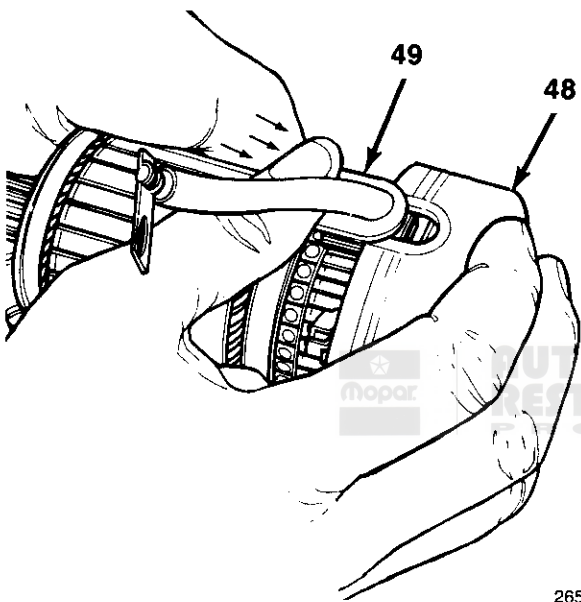
2654

	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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Install the bearing and washer on the armature shaft if not previously installed.

Position the end cover (48) on the brush holder.

Align the brush connector wire and grommet (49) in the end cover and push the cover into place.

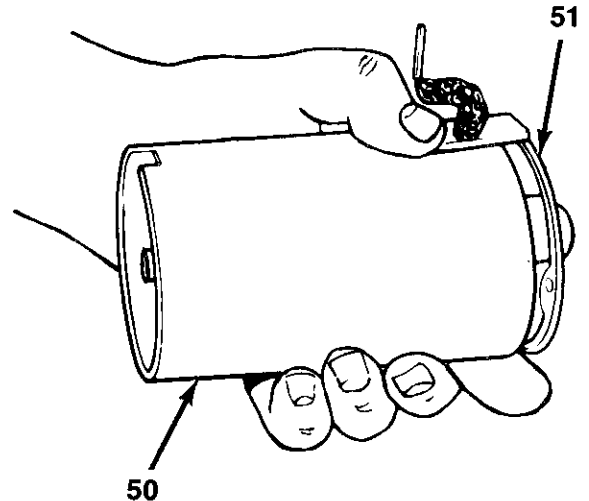


2655

Install but do not tighten the brush holder screws.

Install the armature frame (50) on the assembled armature, brush holder and shield (51). Be sure to align and seat the brush connector wire grommet in the frame during installation.

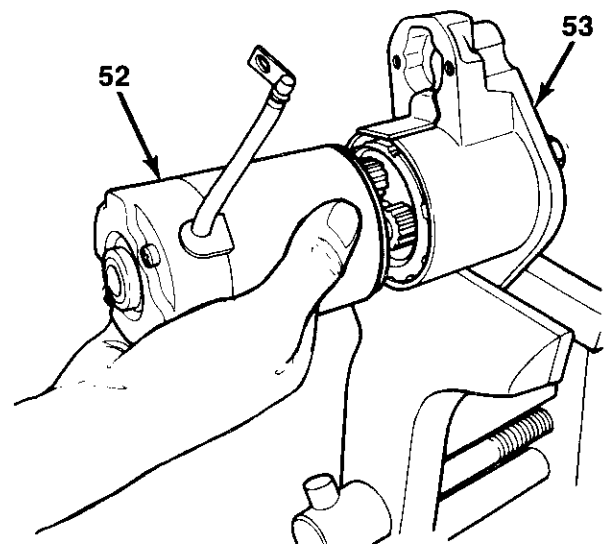
Install the ball in the splined end of the armature shaft. Use chassis grease to hold the ball in place if necessary.



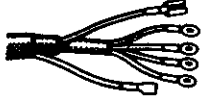
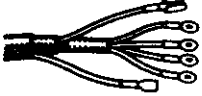
2656

Install the armature and frame (52) on the clutch housing (53). Rotate the armature frame until the alignment tabs on the frame seat in the clutch housing slots.

NOTE: Be sure the armature shaft splines are seated in the planetary gears and the armature shaft is seated in the planetary bushing bore.



2657

	ELECTRICAL 6-CYLINDER STARTER MOTOR	
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Install the bolts that attach the armature frame to the overrunning clutch housing. Tighten the bolts to 3 N·m (28 in-lbs) torque.

Tighten the brush holder attaching screws to 2 N·m (18 in-lbs) torque.

Install the solenoid on the housing as follows:

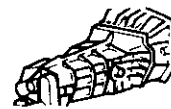
- Engage the solenoid plunger in the clutch fork.
- Install the plunger return spring, spacer washer and the solenoid housing.
- Install and tighten the solenoid attaching screws.
- Attach the brush connecting wire to terminal 45 of the solenoid.





GEARBOXES

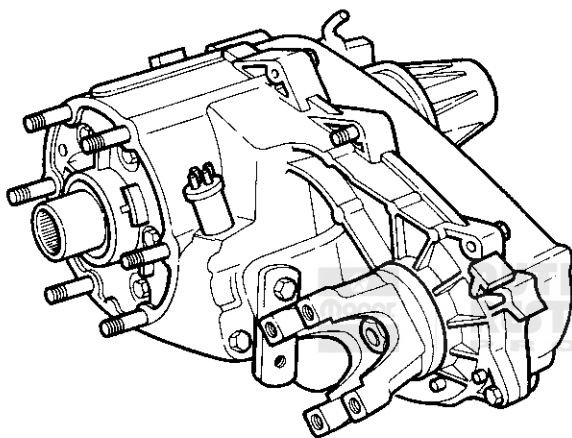
MODEL 231 TRANSFER CASE



GENERAL INFORMATION

Transfer Case Application

The Model 231 transfer case is used in 1987 Wrangler/YJ models built after VIN 2BCCL8119HB518290 and in all 1988 Wrangler/YJ models.



2603

Description

The Model 231 is a part-time transfer case with a built-in low range reduction gear system. It has three operating ranges plus a Neutral position. The low range system provides a gear reduction ratio of 2.72:1 for increased low speed torque capability.

Operating Ranges

The Model 231 is a part-time unit with three operating ranges which are: Two-wheel drive high, four-wheel drive high and four-wheel drive low. The four-wheel drive ranges are undifferentiated. Differential action between the front/rear axles does not occur in the four wheel drive ranges.

Two-Wheel Drive Operation

Two-wheel drive range is for on-road, highway operation or whenever the vehicle is operated on a hard road surface.

Two-wheel drive is provided by a disconnect mechanism in the front axle. A vacuum operated shift motor on the axle disconnects the right-hand axle shaft when 2H range is selected. The axle shift motor is controlled by a vacuum switch that is actuated by the transfer case shift sector and linkage.

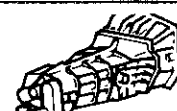
Four-Wheel Drive Operation

Two internal mechanisms provide the four-wheel drive ranges. A vacuum shift motor connects the right-hand axle shaft and a synchronizer assembly engages the transfer case front output shaft. The shift motor is operated by a vacuum switch mounted on the transfer case. The switch is actuated by the transfer case shift linkage.



GEARBOXES

MODEL 231 TRANSFER CASE



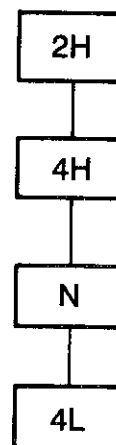
Shift Mechanism

Transfer case operating ranges are selected with a floor mounted shift lever. The lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the the shift lever handle.

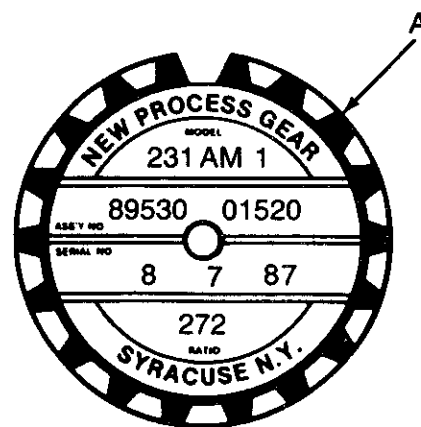
Transfer Case Identification

A circular ID tag (A) is attached to the rear case of each Model 231 transfer case. The ID tag provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 8-7-87 would represent August 7, 1987.



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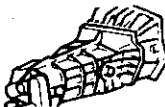


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GENERAL SPECIFICATIONS

Transfer Case Type:	Part-time, dual range with low range reduction. Four-wheel drive range is undifferentiated.
Torque Transfer Mode:	Output shaft and sprocket driven by interconnecting drive chain.
Operating Ranges:	2-high, 4-high, 4-low and Neutral. Low range reduction ratio is 2.72:1.
Case Configuration:	Two-piece aluminum with removable extension and rear retainer housings.
Lubricant Capacity:	1.54 liters (3.25 pints)
Required Lubricant:	MERCON® automatic transmission fluid.
Transfer Case Fill Level:	To bottom edge of fill plug hole.

2591

	GEARBOXES MODEL 231 TRANSFER CASE	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Oil pump screws	1.6 N·m (14 in-lbs)	1.4-1.8 N·m (12-15 in-lbs)
Yoke nut	149 N·m (110 ft-lbs)	122-176 N·m (90-130 ft-lbs)
Vacuum switch	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Range lever nut	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)
Front case-to-rear case bolts	41 N·m (30 ft-lbs)	35-46 N·m (26-34 ft-lbs)
Rear retainer bolts	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Extension housing bolts	41 N·m (30 ft-lbs)	35-46 N·m (26-34 ft-lbs)
Drain/fill plugs	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Detent plug	20 N·m (15 ft-lbs)	16-24 N·m (12-18 ft-lbs)
Front bearing retainer bolts	21 N·m (16 ft-lbs)	16-27 N·m (12-20 ft-lbs)

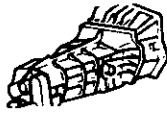
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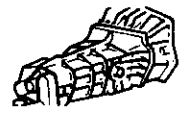
SERVICE DIAGNOSIS

Before attempting to repair a suspected transfer case malfunction, check all other driveline components. The actual cause of a problem may be related to such items as axles, driveshafts, U-joints, wheels/tires and the engine or transmission. If all other driveline components are in good condition and operating properly, refer to the Transfer Case Diagnosis chart for further information.



GEARBOXES

MODEL 231 TRANSFER CASE

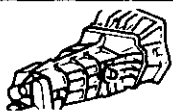


TRANSFER CASE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Vehicle speed too great to permit shifting. (2) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty. (3) Transfer case external shift linkage binding. (4) Insufficient or incorrect lubricant. (5) Internal components binding, worn or damaged.	(1) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift. (2) Stop vehicle, shift transmission to neutral, shift transfer case to 2H mode and operate vehicle in 2H on dry paved surfaces. (3) Lubricate, repair or replace linkage, or tighten loose components as necessary. (4) Drain and refill to edge of fill hole with Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. (5) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with MERCON® automatic transmission fluid. Check for leaks and repair if necessary. Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.
NOISY IN — OR JUMPS OUT OF FOUR WHEEL DRIVE LOW RANGE	(1) Transfer case not completely engaged in 4L position. (2) Shift linkage loose or binding. (3) Range fork damaged, inserts worn, or fork is binding on shift rail. (4) Low range gear worn or damaged.	(1) Stop vehicle, shift transfer case to Neutral, then shift back into 4L position. (2) Tighten, lubricate or repair linkage as necessary. (3) Disassemble unit and repair as necessary. (4) Disassemble and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(1) Extended operation on dry hard surface (paved) roads in 4H range.	(1) Operate in 2H on hard surface (paved) roads.

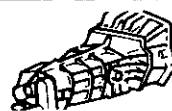


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MODEL 231 TRANSFER CASE



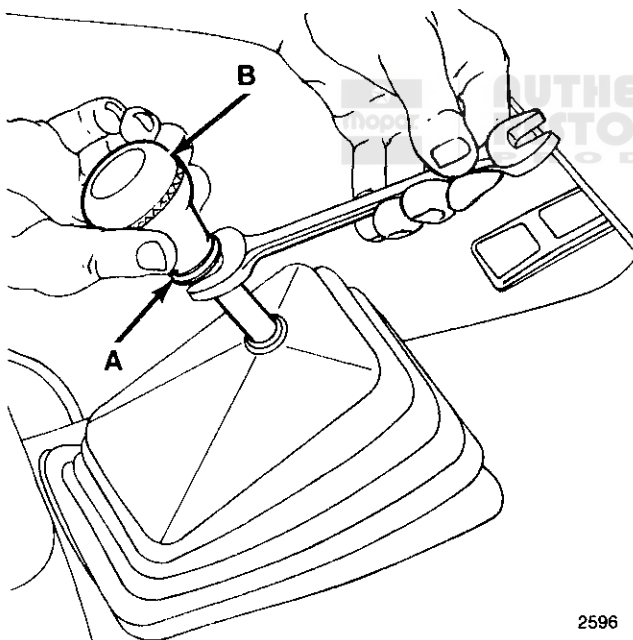
TRANSFER CASE SERVICE

Transfer case removal and installation and in-vehicle service procedures are described in this section.

The special tools, procedures, and specifications needed to overhaul the Model 231 transfer case are outlined in the T.C. 231 Component Service Manual.

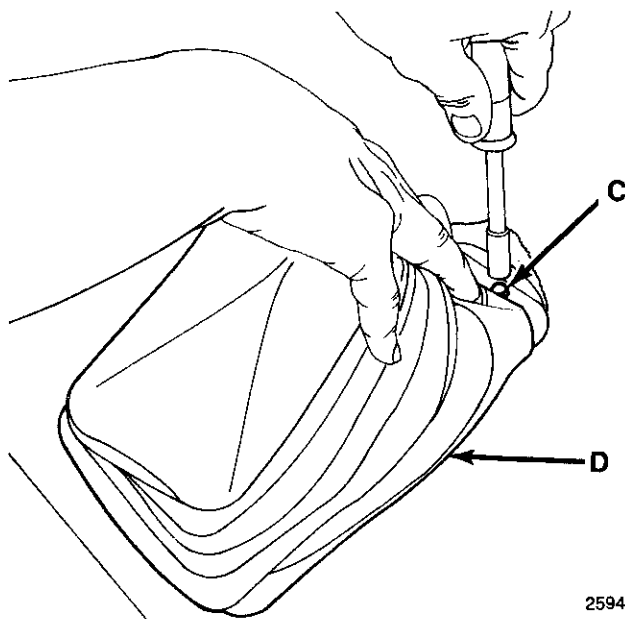
TRANSFER CASE SHIFT LINKAGE ADJUSTMENT

Remove the transfer case shift knob locknut (A) and remove the shift knob (B).



2596

Remove the boot attaching screws (C) and remove the shift boot assembly (D).

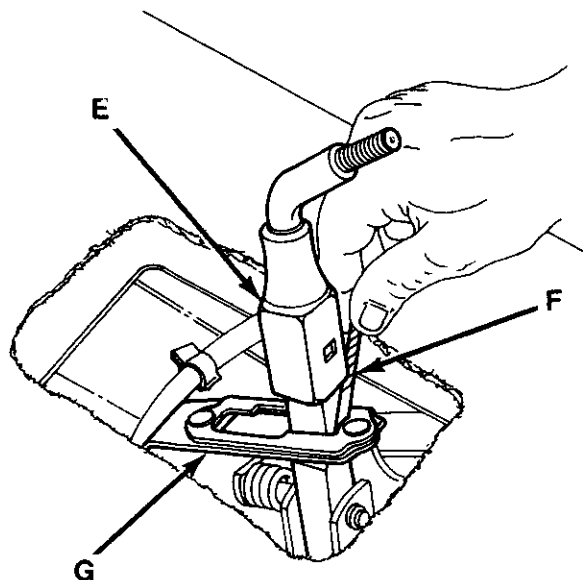


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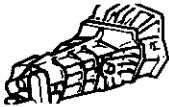
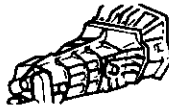
Move the shift lever (E) into 4L position.

Insert a 3mm (1/8 inch) diameter spacer (F) between the shift lever (E) and rear edge of the shift lever gate (G). Use a drill bit, drill rod or similar item as a spacer.

Secure the lever and spacer in position with tape or wire.



2495

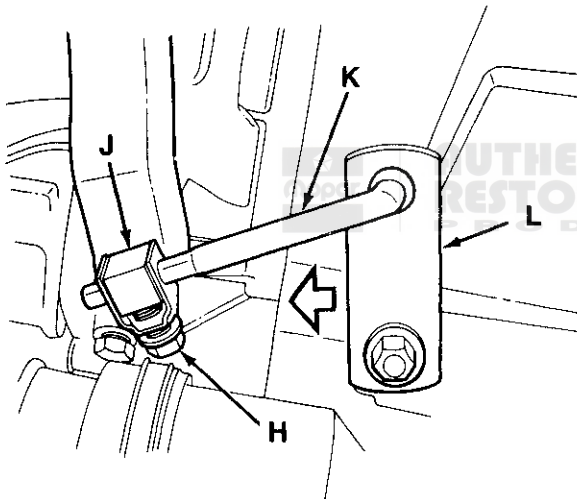
	GEARBOXES	
	MODEL 231 TRANSFER CASE	

Raise the vehicle.

Loosen lock bolt (H) on the adjusting trunnion (J) just enough to allow linkage rod (K) to slide freely in the trunnion.

Verify that the transfer case range lever (L) is all the way forward in the 4L position.

Position linkage rod (K) so it is a free fit in the range lever (L). Then tighten the trunnion lock bolt (H).



2602

Lower the vehicle.

Remove the shift lever spacer and install the shift boot assembly.

Install the shift knob locknut and the shift knob. Tighten the locknut securely.

FRONT YOKE SEAL REPLACEMENT

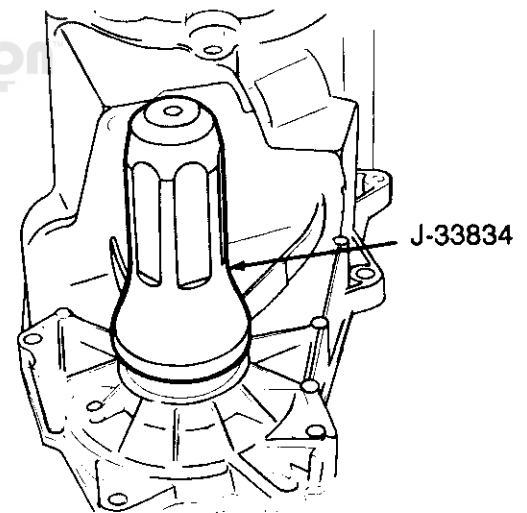
Mark the front propeller shaft yokes for assembly alignment reference.

Remove the front propeller shaft.

Remove the front yoke nut, seal washer and yoke from the transfer case front output shaft. Discard the seal washer and nut.

Remove the yoke seal by prying it out with a screwdriver.

Install the replacement seal with tool J-33834.

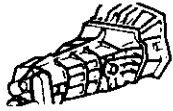


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Polish the seal contact surface of the front yoke with crocus cloth or 400 grit wet or dry sandpaper.

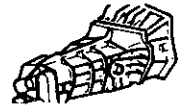
Lubricate the seal lip and yoke seal surface with transmission fluid.

Install the yoke. Secure the yoke with a replacement seal washer and yoke nut.



GEARBOXES

MODEL 231 TRANSFER CASE



Align and install the front propeller shaft.

Top off the transfer case fluid with Mercon® transmission fluid.

EXTENSION HOUSING SEAL AND BUSHING REPLACEMENT

NOTE: It is not necessary to remove the extension housing if only the seal is to be replaced. The seal is readily accessible once the propeller shaft and yoke have been removed.

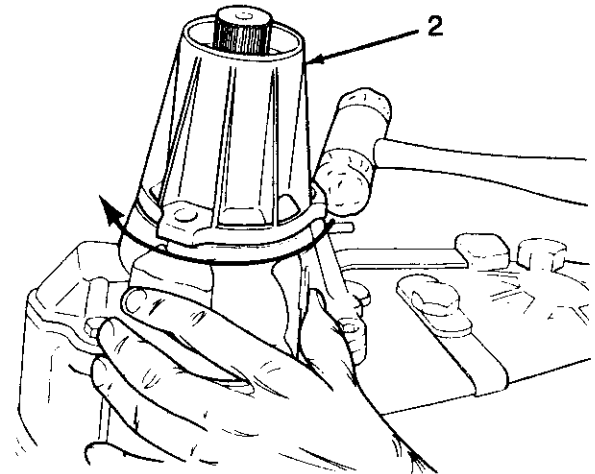
Mark the rear propeller shaft yokes for assembly alignment reference.

Remove the rear propeller shaft.

Remove the extension housing bolts.

Remove the extension housing (2) by tapping it in a clockwise direction.

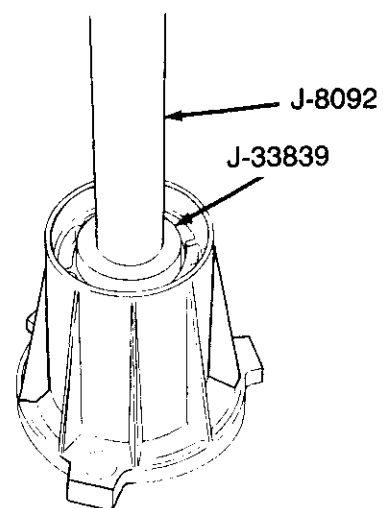
CAUTION: Do not attempt to wedge or pry the housing off the transfer case. The sealing surfaces of both the housing and transfer case could be damaged in the process.



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Remove the housing seal by prying it out with a screwdriver.

Remove the housing bushing with driver handle J-8092 and remover J-33839.

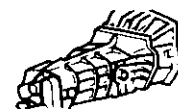


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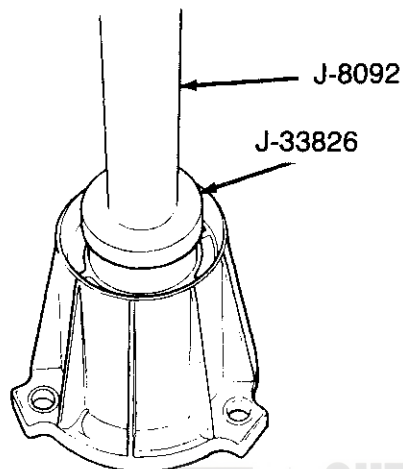


GEARBOXES

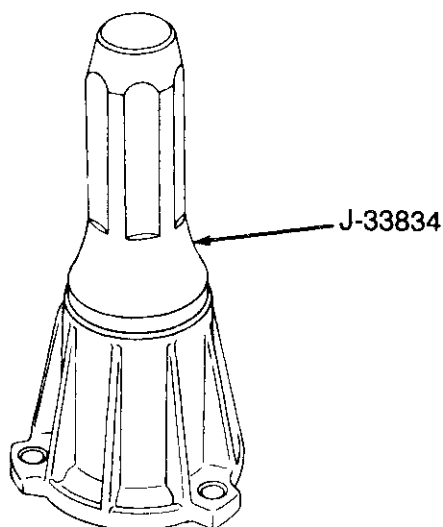
MODEL 231 TRANSFER CASE



Install the replacement bushing with tool J-33826 and driver handle J-8092.



Install the replacement seal with tool J-33843 and driver handle J-8092.



Clean the seal surfaces of the housing and rear case thoroughly. Then apply a 3mm (1/8 inch) wide bead of RTV-type sealer to the extension housing seal surface.

Align and install the housing on the rear case. Tighten the housing bolts to 41 N·m (30 ft-lbs) torque.

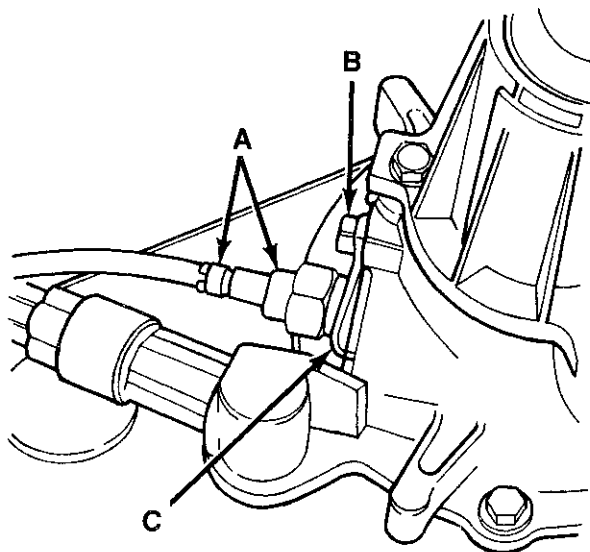
Align and install the propeller shaft.

Top off the transfer case fluid with Mercon® transmission fluid.

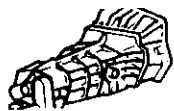
SPEEDOMETER SEAL REPLACEMENT

Disconnect the speedometer cable (A).

Remove the retainer bracket bolt (B) and remove the bracket (C).



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GEARBOXES

MODEL 231 TRANSFER CASE

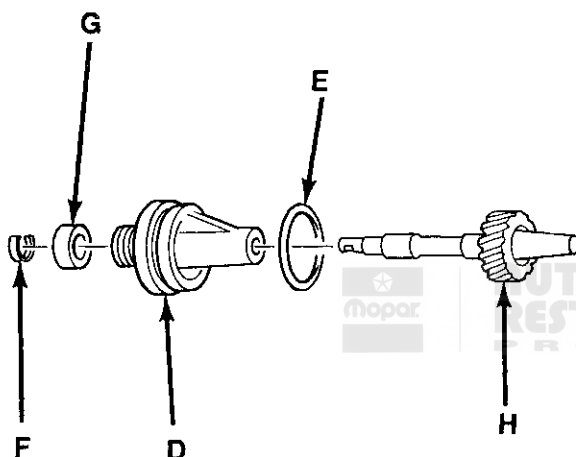


Remove the speedometer adapter (D).

Remove the O-ring (E) from the adapter.

Remove the seal retainer (F) and the oil seal (G) from the adapter.

Inspect the speedometer driven gear (H). Replace the gear if worn or damaged.



2605

Lubricate the replacement O-ring, oil seal and seal retainer with transmission fluid. Then install them in the adapter.

Install the driven gear in the adapter and install the adapter in the transfer case.

Install the adapter retainer bracket. Tighten the bracket bolt securely.

Connect the speedometer cable to the adapter.

TRANSFER CASE FLUID

The fluid recommended for use in the Model 231 transfer case is Mercon® automatic transmission fluid.

TRANSFER CASE REMOVAL

Raise and support the vehicle.

Drain the transfer case fluid.

Mark the front and rear propeller shaft yokes for assembly reference.

Disconnect the rear propeller shaft at the transfer case yoke.

Disconnect the speedometer cable and the vent and vacuum hoses from the transfer case. Mark or tag the hoses for assembly reference.

Support the transfer case with a jack stand.

Remove the rear crossmember/skidplate.

Disconnect the front propeller shaft at the transfer case yoke.

Disconnect the range lever linkage rod from the transfer case shift lever or range lever.

Support the transfer case with a transmission jack.

Remove the transfer case-to-transmission attaching nuts.

	GEARBOXES MODEL 231 TRANSFER CASE	
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Remove the transfer case from the transmission.

Lower the jack and remove the transfer case from under the vehicle.

TRANSFER CASE INSTALLATION

Mount the transfer case on the transmission jack.

Align and install the transfer case on the transmission.

Install the transfer case-to-transmission attaching nuts.

Connect the range lever linkage rod.

Connect the speedometer cable and the vent and vacuum hoses to the transfer case.

Align and connect the front and rear propeller shafts.

Install the crossmember/skidplate.

Remove the transfer case supporting jacks.

Fill the transfer case with Mercon® automatic transmission fluid.

Lower the vehicle.

Verify proper transfer case operation.



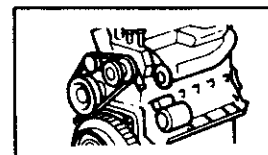
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**AUGUST 1985
ENGLISH EDITION**

**1985 AMC/JEEP/RENAULT
MODELS**



ENGINE

Attention: Workshop, Parts Department

ALTITUDE PERFORMANCE ADJUSTMENTS

This I.S. Note outlines adjustment for optimum engine performance on **1985 AMC/Jeep/Renault models** being operated at high or low altitudes.

When necessary, perform the engine adjustments outlined in the Adjustment Procedures portion of this I.S. Note. In addition, any 1985 model that is so adjusted must have a unique Emission Control Information Update label installed. The part numbers (P/N) for these unique labels are provided in the following Adjustment Procedures.

The adjustment procedures and unique labels must be made available at no cost to independent repair facilities and the general public. A notification is also provided in current owner's manuals to make customers aware of these adjustments. The Emission Control Information Update labels and technical information are available from:

Myriad
8835 General Drive
Plymouth, MI 48170
1-800-AMC-CARS
Operator 43

CONTENTS

1. 1985 Alliance/Encore 1.4L - 1.7L Engines and Fuego/Sportwagon 2.2L Engine
2. 1985 Cherokee/Wagoneer 70 Series 2.8L Gasoline and 2.1L Diesel Engines
3. 1985 Cherokee/Wagoneer 70 Series - CJ/Scrambler 2.46L Engine
4. 1985 Eagle - CJ/Scrambler - Grand Wagoneer/Truck 4.2L Engine
5. 1985 Grand Wagoneer/Truck 5.9L Engine

Filing Instructions

- Record this I.S. Note on the index page of Chapter B, Engines, in the appropriate M.R. service manual.
- File it in the M.R. 171 binder.

1. 1985 ALLIANCE/ENCORE 1.4L - 1.7L ENGINES AND FUEGO/SPORTWAGON 2.2L ENGINE

1985 Alliance/Encore 1.4L - 1.7L engines and Fuego/Sportwagon 2.2L engines do not require adjustment. The electronic control systems on these engines have built-in compensating circuits that make necessary adjustments automatically.

2. 1985 CHEROKEE/WAGONEER 70 SERIES 2.8L GASOLINE AND 2.1L DIESEL ENGINES

For 1985, only the Cherokee/Wagoneer, 70 Series, 49-State/Canada 2.8L gasoline engine requires adjustment as outlined below. The 1985 49-State/Canada and California 2.1L diesel engine and 1985 California 2.8L gasoline engine do not require adjustment. The fuel metering control systems on these engines have built-in compensating devices that make necessary adjustments automatically.

49-State/Canada 2.8L Engine Adjustment

On 49-State/Canada (ONLY) 1985 Cherokee/Wagoneer 70 Series 2.8L models sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label.

1. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
2. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 743, next to the original label.

This adjustment applies to 1985 Cherokee/Wagoneer, 49-State/Canada 2.8L models that were originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 49-State/Canada (ONLY) 1985 Cherokee/Wagoneer 70 Series 2.8L models sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this same label.

1. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.
2. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 744, next to the original label.

This adjustment applies to 1985 Cherokee/Wagoneer, 49-State/Canada 2.8L models that were originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

3. 1985 CHEROKEE/WAGONEER 70 SERIES – CJ/SCRAMBLER 2.46L ENGINE

1985 Jeep California and 49-State/Canada 2.46L engines require adjustment as outlined below.

California – 49-State/Canada 2.46L Engine Adjustment

On 1985 AMC/Jeep California and 49-State/Canada 2.46L models originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label. In addition, a jumper wire must be added to the MCU circuit to activate the altitude compensating circuit in the MCU.

1. Locate the MCU under the instrument panel, just to the right of the steering column.
2. Locate the two-terminal connector on the MCU harness.
3. Connect jumper wire, P/N 318 6890, to the two-terminal connector.
4. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
5. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 743, next to the original label.

This adjustment applies to 1985 Jeep California and 49-State/Canada 2.46L models that were originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission

Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU circuit jumper wire must be removed, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 1985 Jeep California and 49-State/Canada 2.46L models originally sold for operation altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this same label. In addition, the MCU circuit jumper wire must be disconnected.

1. Locate the MCU under the instrument panel to the right of the steering column.
2. Disconnect the jumper wire from the two-terminal connector in the MCU harness and tape the connector securely to the harness. Place the jumper wire in the glove box – do not discard it.
3. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.
4. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 744, next to the original label.

This adjustment applies to 1985 Jeep California and 49-State/Canada 2.46L models that were originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operations at altitudes above 4,000 feet, the MCU circuit jumper wire must be reconnected, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

4. 1985 EAGLE – CJ/SCRAMBLER – GRAND WAGONEER/TRUCK 4.2L ENGINE

For 1985, Eagle/Jeep 49-State/California/Canada 4.2L engines require altitude adjustment. However, the method of adjustment for automatic or manual transmission equipped models are different as outlined in the following procedures.

49-State/California/Canada 4.2L Engine Adjustment – Automatic Transmission

On 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmission, originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing must be advanced 7° and engine idle speed reset. In addition, a jumper wire must be added to the MCU circuit to activate the altitude compensating circuit in the MCU.

1. Move the carpeting away from the passenger front seat toeboard to expose the MCU harness.
2. Untape the two-terminal connector from the MCU harness.
3. Connect jumper wire, P/N 318 6890, to the two-terminal connector and reinstall the carpet.
4. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label in the engine

compartment and reset the engine idle speed to the setting indicated on the same label.

5. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 743, next to the original label.

These adjustments apply to 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmissions originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU circuit jumper wire must be removed, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmission originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing should be retarded 7° and engine idle reset. In addition, the MCU circuit jumper wire must be disconnected and taped to the MCU harness.

1. Move the carpeting away from the passenger front seat toeboard to expose the MCU harness.
2. Disconnect the jumper wire from the two-terminal connector in the MCU harness and tape the connector securely to the harness.
3. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label in the engine compartment and reset engine idle speed to the setting indicated on this same label.
4. Install Vehicle Control Information Update label, P/N EF 8980 000 744, next to the original label.

These adjustments apply to 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmission originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the MCU circuit jumper wire must be reconnected, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

49-State/California/Canada 4.2L Engine Adjustment – Manual Transmission

On 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing must be advanced 7°, engine idle speed reset, and a jumper wire added to the MCU circuit. In addition, the idle/decel switch must be connected to the carburetor EGR port instead of the spark port.

1. Move the carpeting away from the passenger front seat toeboard to expose the MCU harness.
2. Untape the two-terminal connector from the MCU harness.
3. Connect jumper wire, P/N 318 6890, to the two-terminal connector and reinstall the carpet.
4. Connect the idle/decel switch to the carburetor EGR port as follows (Fig. 1).

- a. Disconnect vacuum line 1 from idle/decel switch and from tee connector 2 (Fig. 1). Place this line in the glove box – do not discard it.

- b. Install cap, P/N 813 2325, over the open end of tee connector 2.

- c. Cut and install tee connector, P/N 321 0891, in vacuum line 3 (Fig. 1). Position the connector about 1¼ inches from the EGR-CTO end of the line.

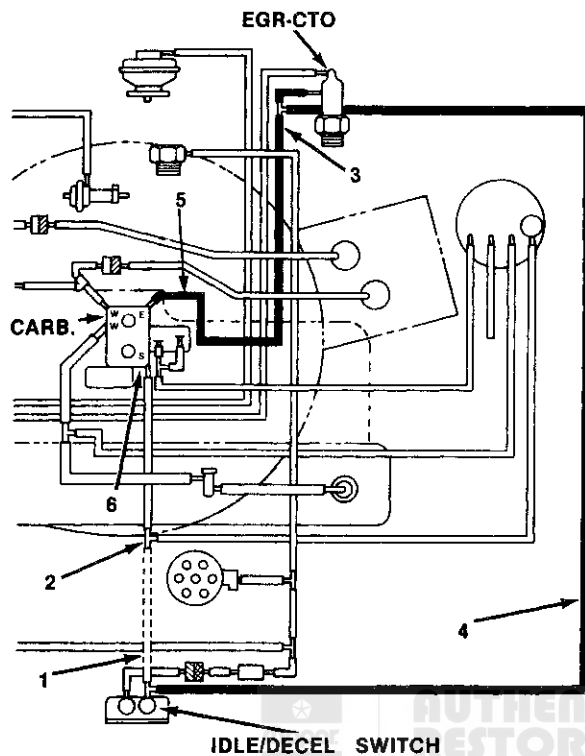
- d. Connect 75-inch long vacuum line 4 to the idle/decel switch and to the tee connector in line 3 (Fig. 1).

5. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label in the engine compartment and reset engine idle speed to the setting indicated on the same label.

6. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 743, next to the original label.

These adjustments apply to 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for use at altitudes below 4,000 feet. Refer to the original Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU jumper wire must be removed, the idle/decel switch reconnected to the carburetor spark port, the ignition timing and idle speed reset to original specifications, and the Vehicle Emission Control Update label removed.



1. IDLE/DECAL SWITCH-TO-SPARK PORT VACUUM LINE (REMOVE AND PLACE IN GLOVEBOX).
2. SPARK PORT VACUUM LINE TEE CONNECTOR (USE CAP 8132325 TO PLUG CONNECTOR AFTER REMOVING LINE 1).
3. EGR PORT-TO-EGR-CTO VACUUM LINE (INSTALL TEE CONNECTOR 3210891 IN THIS LINE ABOUT 1-1/4 INCHES FROM EGR-CTO END OF LINE).
4. 75 INCH LINE, 1/8 INSIDE DIAMETER VACUUM LINE USED TO RECONNECT IDLE/DECAL SWITCH TO EGR PORT 5 (VIA TEE CONNECTOR IN LINE 3).
5. CARBURETOR EGR PORT (E).
6. CARBURETOR SPARK PORT(S).

Fig. 1 Modifying Low Altitude Model for High Altitude Operation

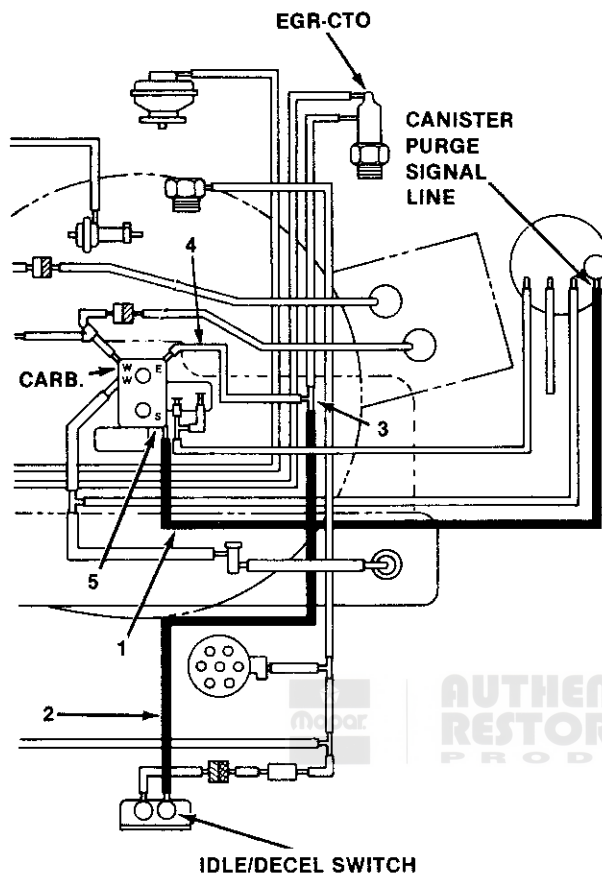
On 1985 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing must be retarded 7°, engine idle speed reset and the MCU jumper wire removed. In addition, the idle/decel switch must be connected to the carburetor spark port instead of the EGR port.

1. Move the carpeting away from the passenger front seat toeboard to expose the MCU harness.
2. Disconnect the jumper wire from the two-terminal connector in the MCU harness and tape the connector securely to the harness. Place the jumper wire in the glove box – do not discard it.

3. Reinstall the carpeting.

4. Connect the idle/decel switch to the carburetor spark port as follows (Fig. 2).

- a. Cut and install tee connector, P/N 321 0891, in vacuum line 1 (Fig. 2). Position the connector about 1 1/4 inches from the spark port end of the line.
- b. Disconnect vacuum line 2 from tee connector 3. Then reconnect line 2 to the tee connector just installed in vacuum line 1 (Fig. 2).
- c. Plug open end of tee connector 3 with cap, P/N 813 2325.



1. SPARK PORT-TO-CANISTER PURGE SIGNAL VACUUM LINE (INSTALL TEE CONNECTOR 3210891 IN THIS LINE ABOUT 1-1/4 INCH FROM SPARK PORT END OF LINE).
2. IDLE/DECEL SWITCH TO-EGR PORT VACUUM LINE (DISCONNECT FROM TEE CONNECTOR 3 AND RECONNECT TO TEE CONNECTOR JUST INSTALLED IN LINE 1).
3. EGR PORT TO-EGR-CTO VACUUM LINE TEE CONNECTOR (PLUG OPEN END WITH CAP 8132325 AFTER DISCONNECTING HOSE 2).
4. CARBURETOR EGR PORT (E).
5. CARBURETOR SPARK PORT(S).

Fig. 2 Modifying High Altitude Model for Low Altitude Operation

5. Retard ignition timing 7° from the setting specified on the original Vehicle Emission Control Information label and reset idle speed to the setting on the same label.
6. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 744, next to the original label.

These adjustments apply to 1985 AMC/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for use at altitudes above 4,000 feet. Refer to the original Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the MCU jumper wire must be reinstalled, the idle/decel switch reconnected to the EGR port, the ignition timing and idle speed reset and the Vehicle Emission Control Information Update label removed.

5. 1985 GRAND WAGONEER/TRUCK 5.9L ENGINE

On 1985 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label.

1. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
2. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 743, next to the original label.

These adjustments apply to 1985 Grand Wagoneer/Truck, 49-State/California 5.9L V-8 models originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 1985 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this same label.

1. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.
2. Install Vehicle Emission Control Information Update label, P/N EF 8980 000 744, next to the original label.

These adjustments apply to 1985 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.



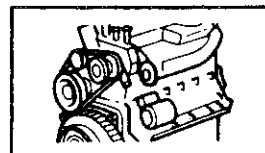
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**AUGUST 1985
ENGLISH EDITION**

ALL 1983-86 VEHICLES



ENGINES

Attention: Workshop, Parts Department

1983-1986 OIL FILTER APPLICATION CHART

The following chart outlines the oil filter connector thread size and oil filter part number for all AMC/Jeep/Renault engines used from 1983-1986.

Oil Filter Application Chart – 1983 Through 1986

YEAR	ENGINE	OIL FILTER CONNECTOR THREAD SIZE	OIL FILTER PART NUMBER
1983	2.46L (150 c.i.)	M18 x 1.5	813 2313
	4.2L (258 c.i.)	13/16" x 16 UNF	324 2397
	5.9L (360 c.i.)	13/16" x 16 UNF	899 3146
	1.4L (C2J/C3J)	3/4" x 16 UNF	8983 501 080
	1.6L Turbo (A7L)	3/4" x 16 UNF	7701 365 661
	1.6L (843)	3/4" x 16 UNF	7701 365 661
1984	2.46L (150 c.i.)	M18 x 1.5	813 2313
	2.8L (173 c.i.)	M18 x 1.5	813 2313
	4.2L (258 c.i.)	13/16" x 16 UNF	324 2397
	5.9L (360 c.i.)	13/16" x 16 UNF	899 3146
	1.4L (C3J)	3/4" x 16"/M20 x 1.50	8983 501 080/8983 501 900*
	1.6L Turbo (A7L)	3/4" x 16 UNF	7701 365 661
	2.2L (J7T)	3/4" x 16 UNF	7701 365 661
1985	2.46L (150 c.i.)	M18 x 1.5	813 2313
	2.8L (173 c.i.)	M18 x 1.5	813 2313
	4.2L (258 c.i.)	13/16" x 16 UNF	324 2397
	5.9L (360 c.i.)	13/16" x 16 UNF	899 3146
	1.4L (C3J)	M20 x 1.50**	8983 501 900**
	1.4L (C2J) (CANADA)	M20 x 1.50	7700 727 480
	1.7L (F3N)	M20 x 1.50	8983 501 900
	2.1L TD (J8S)	M20 x 1.50	7700 730 077
1986	2.46L (150 c.i.)	M18 x 1.5	813 2313
	2.8L (173 c.i.)	M18 x 1.5	813 2313
	4.2L (258 c.i.)	13/16" x 16 UNF	324 2397
	5.9L (360 c.i.)	13/16" x 16 UNF	899 3146
	1.4L (C3J)	M20 x 1.50	8983 501 900
	1.4L (C2J) (CANADA)	M20 x 1.50	7700 727 480
	1.7L (F3N)	M20 x 1.50	8983 501 900
	2.1L TD (J8S)	M20 x 1.50	7700 730 077
	2.2L (J7T)	M20 x 1.50	7700 720 978

*See M.R. 245 I.S. Note 18E for Engine Serial Numbers.

**Any 3/4" x 16 threaded oil filter connector found in a 1985 1.4L engine block must be replaced with a M20 x 1.5 metric threaded connector, P/N 7700 725 923. Then, install the correct metric oil filter.

FILING INFORMATION

File this I.S. Note in the M.R. 171 binder.



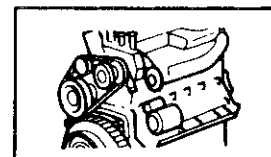
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35E

**OCTOBER 1985
 ENGLISH EDITION**

**1986 AMC/JEEP/RENAULT
 MODELS**



ENGINES

Attention: Workshop, Parts Department

ALTITUDE PERFORMANCE ADJUSTMENTS

This I.S. Note outlines adjustment for optimum engine performance on **1986 AMC/Jeep/Renault models** being operated at high or low altitudes.

When necessary, perform the engine adjustments outlined in this I.S. Note. In addition, any 1986 model that is so adjusted must have a unique Emission Control Information Update label installed. The part numbers for these unique labels are provided in the adjustment procedures outlined in this I.S. Note.

The adjustment procedures and unique labels must be made available at no cost to independent repair facilities and the general public. A notification is also provided in current owner manuals to make the owner aware of these adjustments. The Emission Control Information Update labels and technical information are available from:

Myriad
 8835 General Drive
 Plymouth, MI 48170
 1-800-AMC-CARS
 Operator 43

CONTENTS

1. 1986 Alliance/Encore 1.4L-1.7L Engines and Sportwagon 2.2L Engines
2. 1986 Cherokee/Wagoneer/Comanche 2.8L Engines, 2.46L Engines With Throttle Body Injection and 2.1L Turbo-Diesel Engines
3. 1986 CJ 2.46L Carburetor Equipped Engines
4. 1986 Eagle/CJ/Grand Wagoneer/Truck 4.2L Engines
5. 1986 Grand Wagoneer/Truck 5.9L Engines

FILING INSTRUCTIONS

Record this I.S. Note on the index page of Chapter B, Engines, in the appropriate M.R. manual.

1. 1986 ALLIANCE/ENCORE 1.4L-1.7L ENGINES AND SPORTWAGON 2.2L ENGINES

1986 Alliance/Encore 1.4L - 1.7L engines and Sportwagon 2.2L engines do not require adjustment. The electronic control systems on these engines have built-in compensating circuits that make necessary adjustments automatically.

2. 1986 CHEROKEE/WAGONEER/COMANCHE 2.8L ENGINES, 2.46L ENGINES WITH THROTTLE BODY INJECTION AND 2.1L TURBO-DIESEL ENGINES

For 1986, only the Cherokee/Wagoneer/Comanche, 49-State and Canada 2.8L gasoline engine requires adjustment as outlined below. The 1986 49-State and Canada 2.1L Turbo-Diesel engine, 1986 California 2.8L gasoline engine, and 1986 49-State and California 2.46L engine with throttle body injection do not require adjustment. The fuel metering control systems on these engines have built-in compensating devices that make necessary adjustments automatically. The 2.8L engine adjustments are as follows.

Adjustment – 49-State and Canada 2.8L Engines

On 1986, 49-State and Canada Cherokee/Wagoneer/Comanche 2.8L models sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label.

1. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
2. Install Vehicle Emission Control Information Update label, part number EF 8980 000 818, next to the original label.

This adjustment applies to 1986 Cherokee/Wagoneer/Comanche, 49-State and Canada 2.8L models that were originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 49-State and Canada 1986 Cherokee/Wagoneer/Comanche 2.8L models sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this same label.

1. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.

2. Install Vehicle Emission Control Information Update label, part number EF 8980 000 819, next to the original label.

This adjustment applies to 1986 Cherokee/Wagoneer/Comanche, 49-State and Canada 2.8L models that were originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

3. 1986 CJ 2.46L CARBURETOR EQUIPPED ENGINES

1986, 2.46L carburetor equipped engines in California/49-State/Canada CJ models require adjustment as outlined below.

Adjustment – California/49-State/Canada Carburetor Equipped 2.46L Engines

On 1986 California/49-State/Canada models, with a carburetor equipped 2.46L engine, originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label. In addition, a ground wire must be connected to the MCU circuit to activate the altitude compensating circuit in the MCU.

1. Locate the black with tracer altitude circuit ground wire. The wire is in the MCU harness. It is located near the ignition coil, or at the rear-center of the engine compartment between the dash panel and air cleaner.
2. Remove the tape from the eyelet attached to the end of the ground wire.
3. Connect the ground wire eyelet to a convenient ground location on the engine.
4. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
5. Install Vehicle Emission Control Information Update label, part number EF 8980 000 818, next to the original label.

This adjustment applies to 1986 CJ California/49-State/Canada models, with a carburetor equipped 2.46L engine, originally sold for principal use at altitudes below 4,000 feet. Refer

to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU circuit jumper wire must be removed, the ignition timing and engine idle speed reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 1986, California/49-State/Canada CJ models with a 2.46L carburetor equipped engine, originally sold for use at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing, as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this label. In addition, the MCU circuit ground wire must be disconnected and taped to the MCU harness.

1. Disconnect the black with tracer altitude circuit ground wire from the engine.
2. Cover the connector eyelet with tape and secure the wire to the MCU harness with tape or a tie strap.
3. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.
4. Install Vehicle Emission Control Information Update label, part number EF 8980 000 819, next to the original label.

This adjustment applies to the 1986 California/49-State/Canada CJ models, with a carburetor equipped 2.46L engine, that were originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the MCU circuit jumper wire must be reconnected, the ignition timing and engine idle speed reset to original specifications, and the Vehicle Emission Control Information Update label removed.

4. 1986 EAGLE/CJ/GRAND WAGONEER/TRUCK 4.2L ENGINES

1986 Eagle/Jeep 49-State and California/Canada 4.2L engines require adjustment. However, the adjustment procedures for models with automatic or manual transmission are different. Refer to the following procedures.

Adjustment – 49-State/California/Canada 4.2L Models With Automatic Transmission

1986 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmission, originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing must be advanced 7° and engine idle speed reset. In addition, a jumper wire must be added to the MCU circuit to activate the altitude compensating circuit in the MCU.

1. On Eagle models, move the carpeting away from the passenger side toeboard to expose the MCU harness. Untape the two-terminal connector from the harness. Connect jumper wire, 318 6890, to the two-terminal connector and reinstall the carpet.
2. On Jeep models, locate the black with tracer altitude circuit ground wire. The wire is in the MCU harness located near the ignition coil. Remove the tape covering the eyelet on the ground wire and attach the eyelet to the engine ground screw near the ignition coil.
3. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label in the engine compartment and reset the engine idle speed to the setting indicated on the same label.

4. Install Vehicle Emission Control Information Update label, part number EF 8980 000 818, next to the original label.

These adjustments apply to 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models with automatic transmission, originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU circuit jumper wire must be removed, the ignition timing and engine idle speed reset to original specifications, and the Vehicle Emission Control Information Update label removed.

On 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models, with automatic transmission originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing should be retarded 7° and engine idle reset. In addition, the MCU circuit jumper wire must be disconnected and taped to the MCU harness.

1. On Eagle models, move the carpeting away from the passenger side front toeboard to expose the MCU harness. Disconnect the jumper wire from the two-terminal connector in the MCU harness and tape the connector securely to the harness. Then place the jumper wire in the glove box.
2. On Jeep models, disconnect the black with tracer altitude circuit ground wire from the engine. Cover the ground wire eyelet with tape and secure the wire to the MCU harness with tape or a tie strap.
3. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label in the engine compartment and reset engine idle speed to the setting indicated on this same label.
4. Install Vehicle Control Information Update label, part number EF 8980 000 819, next to the original label.

These adjustments apply to 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models, with automatic transmission, originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the MCU circuit jumper wire must be reconnected, the ignition timing and engine idle speed reset to original specifications, and the Vehicle Emission Control Information Update label removed.

Adjustment – 49-State/California/Canada 4.2L Models With Manual Transmission

On 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission, originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing must be advanced 7°, engine idle speed reset, and a ground wire connected to the MCU circuit. In addition, the idle/decel switch must be connected to the carburetor EGR port instead of the spark port.

1. On Eagle models, move the carpeting away from the passenger side toeboard to expose the MCU harness. Untape the two-terminal connector from the harness. Connect jumper wire, 318 6890, to the two-terminal connector and reinstall the carpet.
2. On Jeep models, locate the black with tracer altitude circuit ground wire. The wire is in the MCU harness located near the ignition coil. Remove the tape covering the eyelet on the ground wire and attach the eyelet to the engine ground screw near the ignition coil.
3. Connect the idle/decel switch to the carburetor EGR port as follows (Fig. 1).
 - a. Disconnect vacuum line 1 from idle/decel switch and from tee connector 2 (Fig. 1). Place this line in the glove box – do not discard it.

- b. Install cap, 813 2325, over the open end of tee connector 2.

- c. Cut and install tee connector, 321 0891, in vacuum line 3 (Fig. 1). Position the connector about 1¼ inches from the EGR-CTO end of the line.

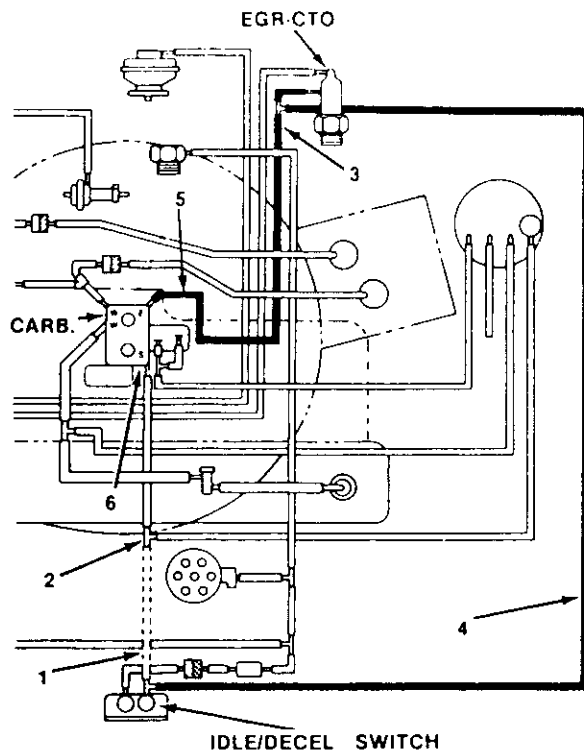
- d. Connect 75-inch long vacuum line 4 to the idle/decel switch and to the tee connector in line 3 (Fig. 1).

4. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label in the engine compartment and reset engine idle speed to the setting indicated on the same label.

5. Install Vehicle Emission Control Information Update label, EF 8980 000 818, next to the original label.

These adjustments apply to 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission, originally sold for use at altitudes below 4,000 feet. Refer to the original Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the MCU ground wire must be removed, the idle/decel switch reconnected to the carburetor spark port, the ignition timing and idle speed reset to original specifications, and the Vehicle Emission Control Update label removed.



1. IDLE/DECEL SWITCH-TO-SPARK PORT VACUUM LINE (REMOVE AND PLACE IN GLOVEBOX).
2. SPARK PORT VACUUM LINE TEE CONNECTOR (USE CAP 8132325 TO PLUG CONNECTOR AFTER REMOVING LINE 1).
3. EGR PORT-TO-EGR-CTO VACUUM LINE (INSTALL TEE CONNECTOR 3210891 IN THIS LINE ABOUT 1-1/4 INCHES FROM EGR-CTO END OF LINE).
4. 75 INCH LINE, 1/8 INSIDE DIAMETER VACUUM LINE USED TO RECONNECT IDLE/DECEL SWITCH TO EGR PORT 5 (VIA TEE CONNECTOR IN LINE 3).
5. CARBURETOR EGR PORT (E).
6. CARBURETOR SPARK PORT(S).

Fig. 1 Modifying Low Altitude Model for High Altitude Operation

On 1986 Eagle/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing must be retarded 7°, engine idle speed reset and the MCU ground wire removed. In addition, the idle/decel switch must be connected to the carburetor spark port instead of the EGR port.

1. On Eagle models, move the carpeting away from the passenger side front toeboard to expose the MCU harness. Disconnect the jumper wire from the two-terminal connector in the MCU harness and tape the connector securely to the harness. Then place the jumper wire in the glove box.
2. On Jeep models, disconnect the black with tracer altitude circuit ground wire from the engine. Cover the ground wire eyelet with tape and secure the wire to the MCU harness with tape or a tie strap.
3. Connect the idle/decel switch to the carburetor spark port as follows (Fig. 2).
 - a. Cut and install tee connector, 321 0891, in vacuum line 1 (Fig. 2). Position the connector about 1¼ inches from the spark port end of the line.
 - b. Disconnect vacuum line line 2 from tee connector 3. Then reconnect line 2 to the tee connector just installed in vacuum line 1 (Fig. 2).
 - c. Plug open end of tee connector 3 with cap 813 2325.
4. Retard ignition timing 7° from the setting specified on the original Vehicle Emission Control Information label and reset idle speed to the setting on the same label.
5. Install Vehicle Emission Control Information Update label, EF 8980 000 819, next to the original label.

These adjustments apply to 1986 AMC/Jeep, 49-State/California/Canada 4.2L models with manual transmission originally sold for use at

altitudes above 4,000 feet. Refer to the original Vehicle Emission Control Information label to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the MCU ground wire must be reinstalled, the idle/decel switch reconnected to the EGR port, the ignition timing and idle speed reset and the Vehicle Emission Control Information Update label removed.

5. 1986 GRAND WAGONEER/TRUCK 5.9L ENGINES

On 1986 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for operation at altitudes below 4,000 feet that are being operated above 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment, should be advanced 7° and engine idle speed reset to the specifications indicated on this same label.

1. Advance ignition timing 7° from the setting indicated on the original Vehicle Emission Control Information label and reset engine idle speed to the setting indicated on the same label.
2. Install Vehicle Emission Control Information Update label, part number EF 8980 000 818, next to the original label.

These adjustments apply to 1986 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L V-8 models originally sold for principal use at altitudes below 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

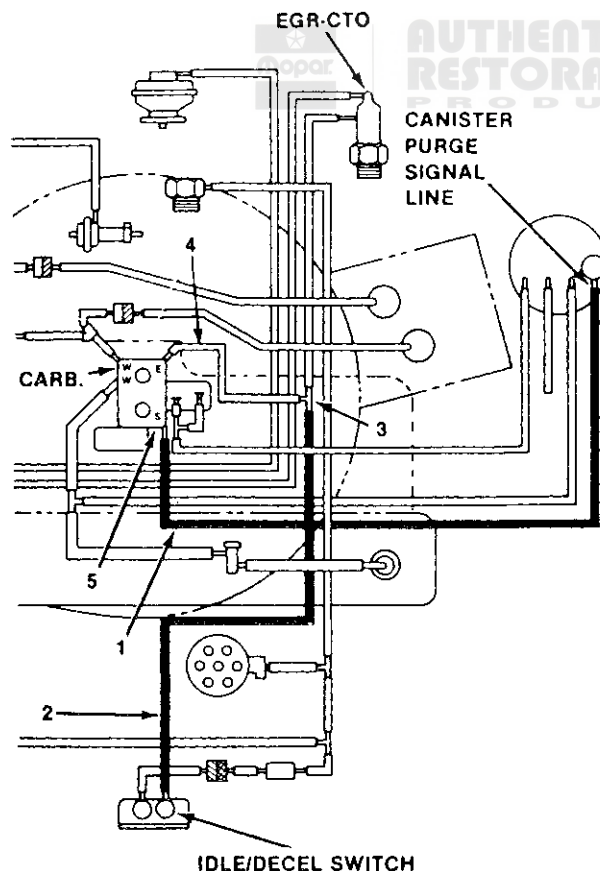
NOTE: Whenever these vehicles are returned to operation at altitudes below 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.

On 1986 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for operation at altitudes above 4,000 feet that are being operated below 4,000 feet, the ignition timing as shown on the original Vehicle Emission Control Information label in the engine compartment should be retarded 7° and engine idle reset to the specification indicated on this same label.

1. Retard ignition timing 7° from the setting indicated on the original Vehicle Emission Control label and reset engine idle speed to the setting indicated on this same label.
2. Install Vehicle Emission Control Information Update label, part number EF 8980 000 819, next to the original label.

These adjustments apply to 1986 Grand Wagoneer/Truck, 49-State/California/Canada 5.9L models originally sold for principal use at altitudes above 4,000 feet. Refer to the Vehicle Emission Control Information label in the engine compartment to identify these vehicles.

NOTE: Whenever these vehicles are returned to operation at altitudes above 4,000 feet, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.



1. SPARK PORT-TO-CANISTER PURGE SIGNAL VACUUM LINE (INSTALL TEE CONNECTOR 3210891 IN THIS LINE ABOUT 1-1/4 INCH FROM SPARK PORT END OF LINE).
2. IDLE/DECEL SWITCH TO-EGR PORT VACUUM LINE (DISCONNECT FROM TEE CONNECTOR 3 AND RECONNECT TO TEE CONNECTOR JUST INSTALLED IN LINE 1).
3. EGR PORT TO-EGR-CTO VACUUM LINE TEE CONNECTOR (PLUG OPEN END WITH CAP 8132325 AFTER DISCONNECTING HOSE 2).
4. CARBURETOR EGR PORT (E).
5. CARBURETOR SPARK PORT(S).

Fig. 2 Modifying High Altitude Model for Low Altitude Operation



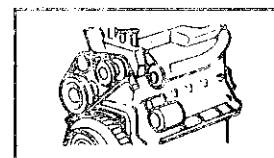
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36E

OCTOBER 1985
ENGLISH EDITION

ALL MODELS



ENGINE

Attention: Workshop, Parts Department

ENGINE COOLANT/OIL LEAK DETECTION

A high intensity black lamp has been approved for use in pinpointing engine coolant and oil leaks.

The following procedures have been developed to detect engine coolant leaks and for other fluid leaks: power steering fluid, automatic and manual transmission fluid and engine oil.

PROCEDURE



AUTHENTIC
RESTORATION
PRODUCTS

Engine Coolant Leak Detection

NOTE: All models (except imports) now have a coolant leak detection additive in the cooling system when the vehicle is delivered from the factory. This additive will appear bright green in color under the black lamp.

1. Add one ounce of coolant additive to the engine cooling system, if necessary.
2. Start and run the engine until it reaches operating temperature.
3. Place the heater controls in the heat mode to circulate coolant through the heater system.
4. Plug the black lamp into an electrical outlet and turn the switch to the ON position. When it is ready to use, it will glow.

5. Aim the black lamp at the components of the cooling system to pinpoint leaks in the radiator, hoses, heater core, water pump and engine assembly components that house the engine coolant. If leaks are present, the additive will be seen under the black lamp as a bright green glow. This additive is water soluble for ease of clean-up for repeat inspections.

PROCEDURE

Oil Leak Detection

NOTE: All models (except imports) have a dye additive added to the engine oil and automatic transmission fluid at the factory. Because of the different additives used, the engine additive may appear light blue or yellow when viewed under the black lamp. The automatic transmission fluid additive will appear a greenish-yellow color under the black lamp.

When checking for an oil leak, verify the color of the additive used by removing the dipstick and observing the oil under the black lamp.

1. Add one ounce of oil leak detection additive to the system that is suspected to be leaking, (engine oil, transmission, etc.), if necessary.
2. Start and run the engine until it reaches operating temperature to allow the additive to circulate throughout the system. Detecting extremely small leaks may require running the engine for a longer period of time.

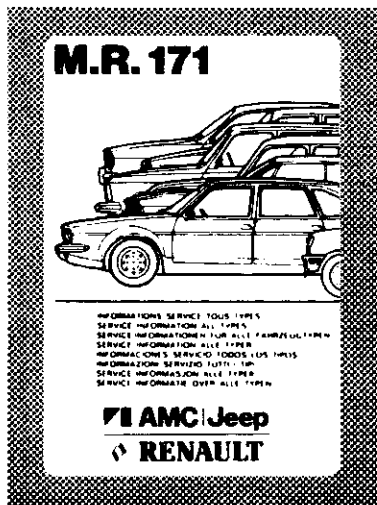
3. Plug the black lamp into an electrical outlet and turn the switch to the ON position. When it is ready to use, it will glow.
4. Raise the vehicle.
5. Aim the black lamp at the areas that are suspected of leaking and look for a bright greenish-yellow glow at the leak origin.

PARTS

DESCRIPTION	QUANTITY	PART NUMBER
LAMP, High Intensity Black (Includes six containers of Fluorescent Oil Additive PN 8980 002 475)	1	8980 002 473
ADDITIVE, Fluorescent Oil	24 (1 oz. containers)	8980 002 524
ADDITIVE, Fluorescent Oil	6 (1 oz. containers)	8980 002 475
ADDITIVE, Fluorescent Coolant	6 (1 oz. containers)	8980 002 476

FILING INSTRUCTIONS

File this I.S.Note in your M.R.171 binder.



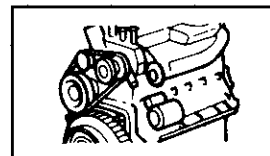
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37E

**NOVEMBER 1985
 ENGLISH EDITION**

**1985 EAGLE/JEEP
 49-STATE AND CANADA
 MODELS**



ENGINES

Attention: Workshop, Parts Department

EMISSION MAINTENANCE REVISION

This I.S. Note is to advise dealers that catalytic convertor replacement is no longer a required emission maintenance item on the following 1985 49-State/Canada Eagle and Jeep models:

1985 49-STATE MODELS

Eagle/Jeep models with:

- 2.46L I-4 engine
- 4.2L I-6 engine
- 2.8L V6 engine
- 5.9L V8 engine

1985 CANADA MODELS

Jeep J-20 Truck models
 with 5.9L V8 engine.

Convertor replacement at 105,000 miles (169,000 km) is indicated in the 1985 Eagle/Jeep Warranty and Maintenance Guides supplied to U.S. and Canada owners. Please advise owners that this is no longer a required item.

NOTE: The convertor replacement indicated in the 1985 Canada Jeep Warranty and Maintenance Guide, applied only to 1985 Jeep J-20 Truck models with V8 engine.

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.



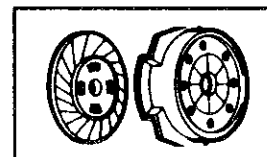
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38E

OCTOBER 1985
ENGLISH EDITION

1983-85 EAGLE/JEEP
MODELS



CLUTCH

Attention: Workshop, Parts Department

CLUTCH HYDRAULIC SYSTEM DIAGNOSIS

On some 1983-85 Eagle/Jeep models with a hydraulic clutch linkage, fluid leakage from one or both clutch cylinders, may be caused by the formation of an abrasive substance in the system fluid. In some cases, material in the master cylinder-to-slave cylinder hose may chemically react with the fluid to produce a mildly abrasive chloride compound.

Include the following information as part of your normal diagnosis and repair procedure when servicing the clutch hydraulic system.

PROCEDURE

1. Inspect the system to determine which clutch hydraulic cylinder is leaking.
 - a. If the slave cylinder is leaking, remove, clean and overhaul the cylinder.
 - b. If the master cylinder is leaking, remove and discard the cylinder.
2. Remove and discard the hose that connects the master cylinder to the slave cylinder.
3. Drain the hydraulic fluid from the cylinder not removed.
4. Install the replacement master cylinder or the repaired slave cylinder.
5. Install a replacement master cylinder-to-slave cylinder connecting hose. Refer to the parts list at the end of this I.S. Note for replacement hose part numbers.
6. Refill and bleed the clutch hydraulic system. Refill the system with AMC/JEEP brake fluid, P/N 8982 200 215, only.
7. Verify proper clutch operation and that all hose connections are tight and leak-free.

PARTS

DESCRIPTION	QUANTITY	PART NUMBER
HOSE, Master Cylinder-To-Slave Cylinder		
70 Series (Gas. Eng.)	1	8953 004 247
70 Series (Diesel Eng.)	1	8953 004 161
CJ 4-Cyl.	1	8953 004 162
CJ 6-Cyl.	1	8953 004 164
Eagle-All	1	8953 004 167

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.



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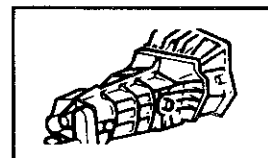
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39E

OCTOBER 1985
ENGLISH EDITION

1982-85 EAGLE/JEEP
MODELS



GEARBOXES

Attention: Workshop, Parts Department

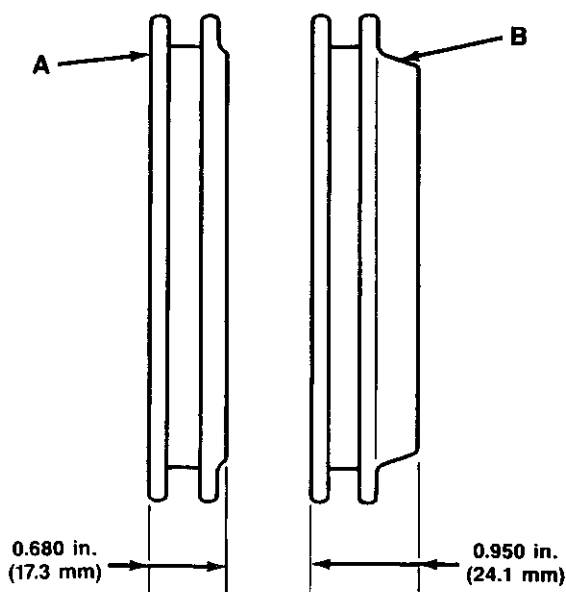
TRANSFER CASE SHIFT SLEEVE USAGE

The shift sleeves used in 1986 Jeep model 228 and Eagle model 128 transfer cases are now available for service use in prior model 129/229 transfer cases.

Use range sleeve (A), P/N 8983 502 611, and mode sleeve (B), P/N 8983 502 516, during overhaul or when replacing the viscous coupling in a 1982-85 Jeep model 229 transfer case.

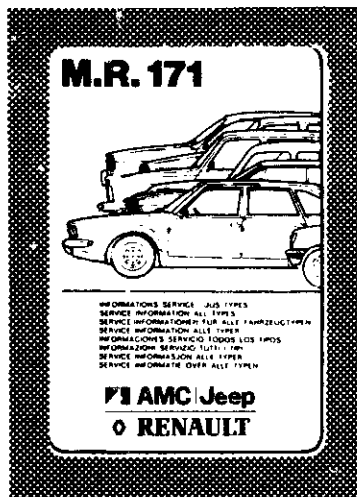
CAUTION: The 1986 mode sleeve is wider and the range sleeve narrower than previous shift sleeves. Do not attempt to interchange the new and previous sleeves. The 1986 sleeves must be installed as a set only.

Use mode sleeve (B), P/N 8983 502 516, during overhaul or when replacing the viscous coupling in a 1982-85 Eagle model 129 transfer case.



FILING INSTRUCTIONS

Record this I.S. Note in the transfer case overhaul section of the appropriate Eagle/Jeep manual and file it in your M.R. 171 binder.



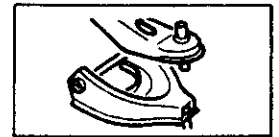
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44E

**FEBRUARY 1986
ENGLISH EDITION**

**1985
JEEP/EAGLE MODELS**



STEERING AND FRONT AXLE

Attention: Workshop, Parts Department

POWER STEERING GEAR SERVICE UPDATE

This I.S. Note is to advise you of a revision to power steering gear housing service on 1985 Eagle/Jeep models.

The current Eagle/Jeep mechanical repair manuals all outline a procedure for repairing fluid leaks from the power steering gear housing ball plug (A). Please be advised that this repair procedure is not effective on 1985 power steering gear housings. The steering gear assembly must be replaced if a ball plug leak has developed.

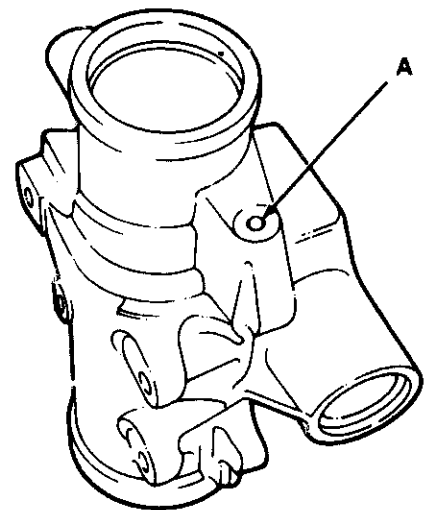
Leakage from the ball plug (A) can be verified using the following test procedure.

Ball Plug Leak Test

1. Clean the ball plug area of the housing.
2. Start and operate the engine at idle speed.
3. Have a helper turn the steering wheel to the full right turn position while you observe the ball plug area.

CAUTION: To avoid damaging the power steering pump or gear, do not hold the wheel against the right steering stop for more than 5 seconds.

4. Replace the steering gear assembly if ball plug leakage occurs.



34779

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.



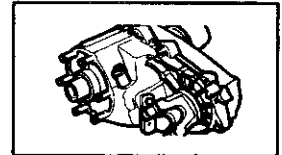
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45E

APRIL 1986
ENGLISH EDITION

1986 EAGLE/JEEP
MODELS WITH 128 OR
228 TRANSFER CASE



TRANSFER CASE

Attention: Workshop, Parts Department

CHECKING 4-WHEEL-DRIVE ENGAGEMENT

If a vehicle equipped with a model 128 or 228 transfer case is suspected of not engaging the front axle when shifted to 4WD, a 4-wheel-drive engagement check should be performed.

PROCEDURE



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PRODUCTS

Drive the vehicle in the 4WD mode a short distance to allow the transfer case to engage.

Leave mode selector in the 4WD position. Turn off engine. If equipped with automatic transmission, place gear selector in park position. If equipped with manual transmission, shift into gear.

With the vehicle on level ground, raise the left-front wheel and attempt to rotate it. If the left-front wheel cannot be rotated, 4-wheel-drive engagement is indicated. If the left-front wheel can be rotated, 4-wheel-drive is not engaged. A shift control check must be performed.

Procedures for checking the vacuum controls and vacuum motors used in the Selec-Trac or Selec-Drive systems can be found in the transfer case section of the appropriate M.R. Workshop Manual.

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.



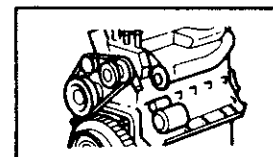
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46E

**MAY 1986
ENGLISH EDITION**

**1981½-1986 AMC/JEEP
WITH 4.2L (258 cu. in.)
ENGINE**



ENGINES

Attention: Workshop, Parts Department

4.2 LITER REVISED CYLINDER HEAD COVER

A new cylinder head cover kit PN 8983 503 343 has been released for service use on 1981½ to 1986 AMC/JEEP vehicles equipped with a 4.2L (258 cu. in.) engine.

1981½-1983 vehicles will require that the cylinder head be drilled and tapped for a 1/4" x 20 threaded insert. Obtain locally a Helicoil, Time-Sert or equivalent threaded insert kit.

NOTE: 1981½ models can be identified by having cylinder head cover retaining screws located at the front and rear of the cylinder head.

The new cylinder head cover comes equipped with a pre-cured RTV seal and is secured to the cylinder head with special shoulder bolts, and unique retaining nuts.

Follow the procedure included in the cylinder head cover kit.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
Kit, Cylinder Head Cover	1	8983 503 343
Contents:		
Cover, Cylinder Head	1	
Bolt, Shoulder	4	
Bolt, Shoulder, Short	1	
Bolt, 7/16	2	
Bolt, Stud-1/2	1	
Bridge	2	
Nut, Retainer	4	
Helicoil 1/4 x 20	3	
Installation Sheet	1	

SRT/TIC INFORMATION

OPERATION DESCRIPTION	NUMBER	TIME	TIC
Co. Kit, Cylinder Head Cover-Install			
1981½-1983 models	0117	1.7 hrs.	1-141
1983-1986 models	0113	1.3 hrs.	1-141

FILING INSTRUCTIONS

Record this I.S. Note in M.R. 251 page B-133, M.R. 252 page B-125, M.R. 253 page B-59 and file it in M.R. 171.



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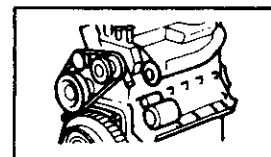
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47E

**JULY 1986
 ENGLISH EDITION**

**1986 JEEP MODELS
 WITH 2.46L ENGINE
 AND AUTOMATIC
 TRANSMISSION**



ENGINES

Attention: Workshop, Parts Department

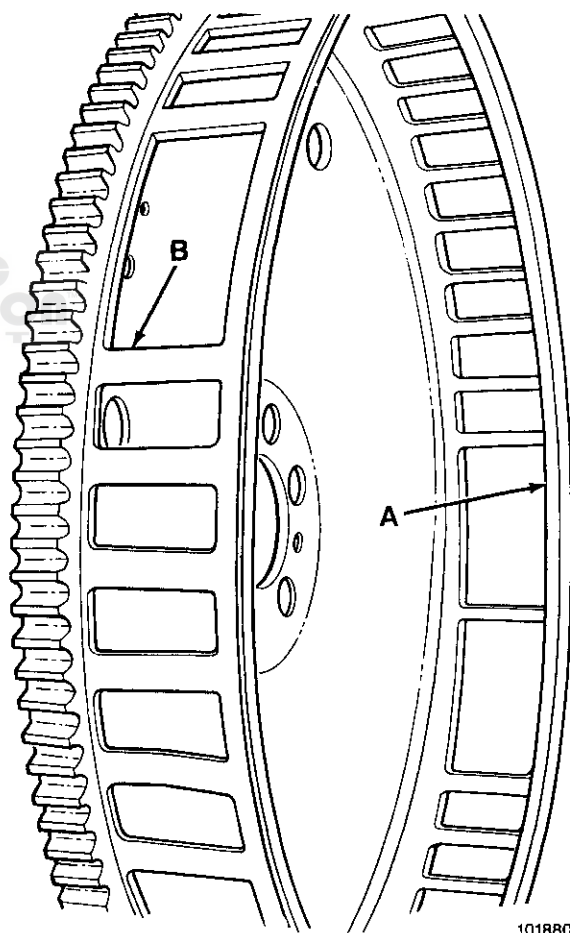
FLEX PLATE TRIGGER WHEEL SERVICE

On Jeep models with a 2.46L engine and automatic transmission, the trigger wheel portion of the flex plate assembly provides the timing signal for the fuel and ignition systems.

If the trigger wheel becomes damaged when removing/installing the engine, transmission, or torque convertor, ignition performance will be affected. The general result is either rough engine operation and backfire, or a no-start condition.

Check for suspected trigger wheel damage as follows:

- Check trigger wheel radial runout on inner surface (A) with a dial indicator. Maximum allowable runout is 0.40 mm (0.016 in). Replace the flex plate assembly if runout exceeds this figure.
- Inspect condition of the timing slot separators (B) in the trigger wheel. Replace the flex plate assembly if the separators are dented, distorted, broken, or bent. Do not attempt to repair the wheel as the results are usually not satisfactory.
- Inspect the starter ring gear for damage. Replace the flex plate assembly if the ring gear is loose or the teeth are damaged.



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FILING INSTRUCTIONS

File this I.S. NOTE in the M.R. 171 binder.



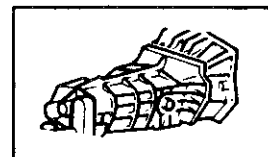
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48E

**AUGUST 1986
ENGLISH EDITION**

**JEEP MODELS WITH AX4-5
or
BA 10/5 MANUAL
TRANSMISSION**



GEARBOXES

Attention: Workshop, Parts Department

NEW SHIFT LEVER INSTALLATION TOOL

A shift lever installation tool is now available for Jeep models with an AX4-5 or BA 10/5 manual transmission.

The new tool simplifies installation and ensures positive seating of the shift lever (A) on the stub lever (B).

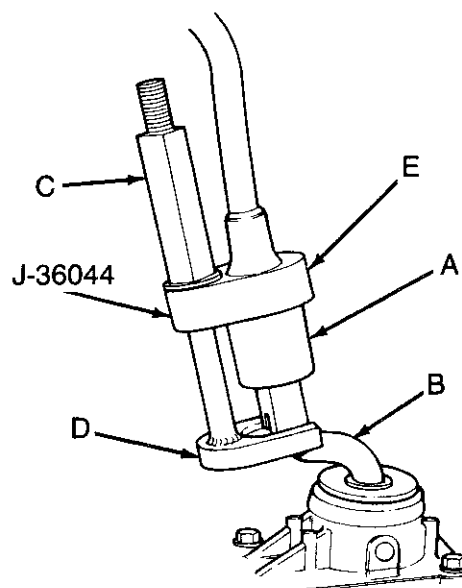


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Use the tool as follows:

1. Apply a generous amount of liquid soap to the inside of the shift lever insulator (A).
2. Position the shift lever on the transmission stub shaft (B).
3. Apply a small amount of grease to the tool threads.
4. Install tool J-36044 as shown. Tool may be installed from the front or rear. Verify that the lower shoe plate (D) is properly secured to the stub shaft.

NOTE: On some shift levers, it may be necessary to reverse the top plate (E) of tool J-36044.



101908

5. Turn the screw until the shift lever is in locked position on the stub shaft. The four dimples on the inside of the shift lever must seat in the groove near the top of the stub shaft. The screw on the tool will become noticeably easier to turn when the dimples seat into the lock groove. Do not install the shift lever too far down on the stub shaft. There should be approximately 6.35 mm (1/4 inch) of stub shaft exposed when the shift lever is properly installed.

6. Remove tool J-36044 and install the outer shift lever boot.

NOTE: In some cases it may be necessary to file (dress) the four edges at the top of the stub shaft to ease installation.

SRT INFORMATION

OPERATION DESCRIPTION	NUMBER	TIME	TIC
CO. LEVER, TRANSMISSION SHIFT – INSTALL Inc. removal if necessary	0204	0.4	3-824

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.





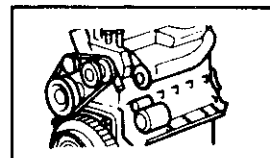
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49E

**AUGUST 1986
ENGLISH EDITION**

**1986-1987 WRANGLER/YJ
CHEROKEE/WAGONEER
COMANCHE VEHICLES
WITH 2.46L AND 4.0L
ENGINES**



ENGINES

Attention: Workshop, Parts Department

DISTRIBUTOR ALIGNMENT FLANGE BREAKAGE

When removing distributors from 1986-1987 Wrangler/YJ/Cherokee/Wagoneer/Comanche vehicles equipped with 2.46L engines and 1987 Cherokee/Wagoneer/Comanche vehicles equipped with 4.0L engines, the timing alignment flange may be found to be broken off from the distributor housing.

It is not necessary to replace the distributor housing for service correction.



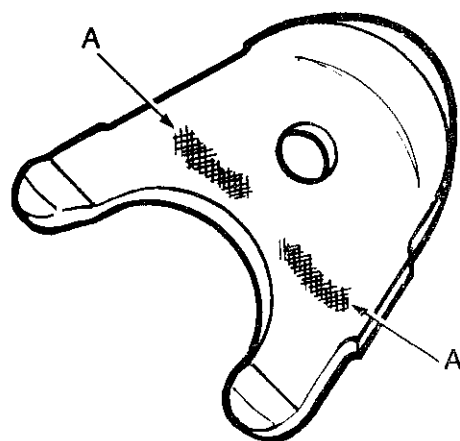
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PROCEDURE

NOTE: Perform this procedure with the distributor removed from the engine.

1. The broken alignment flange can be re-attached to the distributor housing using a two-part epoxy glue, or equivalent.
2. Inspect the distributor holddown clamp. If there is evidence of contact with the alignment flange on the bottom side of the holddown clamp (A), replace the holddown clamp P/N 317 3227.
3. Install a replacement gasket, P/N 318 1288, at the base of the distributor.
4. Install distributor holddown clamp. Tighten the retaining bolt to 11-14 N·m (8-10 ft-lbs).

CAUTION: Distributor holddown bolt torque is critical.



102453

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
CLAMP, Distributor	1	317 3227
GASKET, Distributor	1	318 1288

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC
CO. ALIGNMENT FLANGE, DISTRIBUTOR – REPAIR Inc. R & R Distributor, and Gasket and Holddown Flange	0106	0.6	1-771***

SUPPLIER ***: Ford CODE: 613

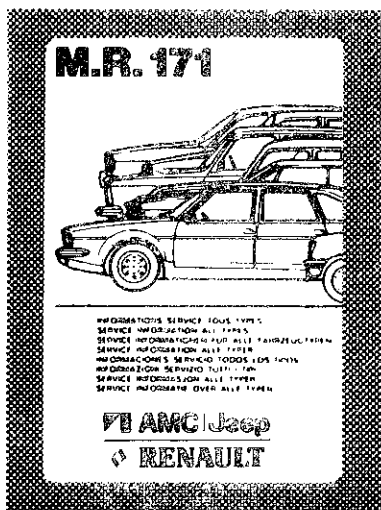


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FILING INSTRUCTIONS

Record this information on the noted pages and file in the MR 171 Component Service Manual:

- MR 279 WRANGLER/YJ REPAIR MANUAL Page B-76
- MR 244 WAGONEER/CHEROKEE REPAIR MANUAL Page B-29
- MR 277 COMANCHE REPAIR MANUAL Page B-29
- INJ. MPI COMPONENT SERVICE MANUAL Page 40



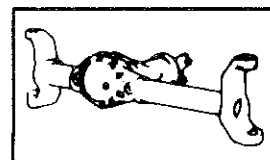
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51E

**SEPTEMBER 1986
ENGLISH EDITION**

**1984-1987 AMC/JEEP
VEHICLES**



STEERING COLUMN

Attention: Workshop, Parts Department

CRUISE CONTROL/TURN SIGNAL/WIPER LEVER SERVICE

An updated procedure for removing and installing the cruise control/turn signal/wiper lever on 1984-1987 AMC/JEEP vehicles has been developed. The procedure also outlines installation of an anti-rattle shim on levers not equipped with a shim.

The updated service procedures apply to the following models:

1984-87 Cherokee/Wagoneer
1987 Wrangler/YJ
1986-87 Comanche

1986-87 Grand Wagoneer
1986-87 J-10, J-20 Truck
1982-87 Eagle

LEVER REMOVAL -- WITH CRUISE CONTROL

1. Disconnect the battery negative cable.
2. On tilt columns, place the steering wheel in the full up position.
3. Place the combination lever (A) in the right turn position.
4. On models with the wiper/washer switch mounted on the lever, turn the wiper/washer switch to the Off position to align lever tab (B) with slot (C) in the column switch.

CAUTION: The column switch will be damaged if the tab and slot are not aligned during removal.

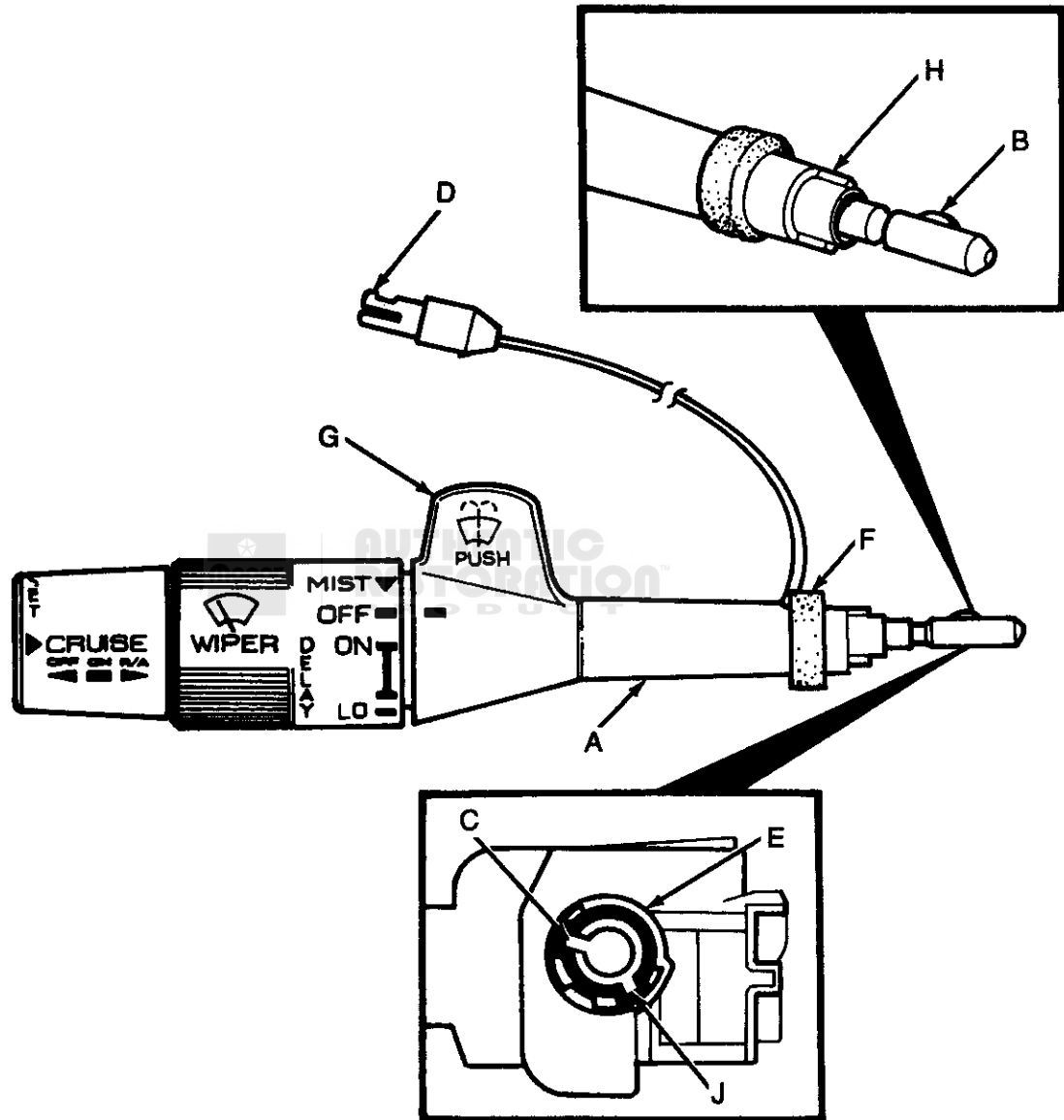
5. Disconnect the cruise control switch harness from the main harness. The harness connection is accessible from under the instrument panel.
6. Attach a fish wire to the cruise control harness as follows:
 - Use mechanics wire and make it long enough to guide the harness out of the column.
 - On Eagle models, tape the fish wire to the harness connectors.
 - On all other models, loop the fish wire through the small hole in harness connector (D).

7. The lever (A) is a snap-fit in the column switch (E). To remove the lever, pull it straight out of the switch.

CAUTION: Do not bend or twist the lever during removal. It must be pulled straight out to avoid damaging the column switch.

8. Guide the switch harness out of the steering column with the fish wire.

9. The lever is serviced as an assembly only. Do not attempt to disassemble it for repair.



102547

LEVER INSTALLATION – WITH CRUISE CONTROL

1. If a replacement lever is being installed, attach the fish wire to the cruise control harness connector(s).
2. Install an anti-rattle shim (F), P/N 8956 002 285, on the lever.
3. Guide the cruise control harness into the column with the fish wire.
4. On Eagle models, install the lever as follows:
Align and start the lever in the column switch. Then push the lever into the switch in one continuous motion until it snaps into place.
5. On all except Eagle models, install the lever as follows:
 - Hold the washer switch thumb lever (G) in the Off position to align lever tab (B) and upper lug (H).
 - Start the lever in the column switch (E). Then push the lever into the switch in one continuous motion until it snaps into place.

CAUTION: Be sure lever tab (B) and the two lugs (H) are aligned with slots (C) and (J) in the column switch. The switch can be broken if misalignment occurs during installation.

6. Remove the fish wire and connect the cruise control harness to the main harness.
7. Connect the battery negative cable.

LEVER REMOVAL – WITHOUT CRUISE CONTROL

1. Turn the wiper switch to the Off position.
2. The lever is a snap-fit in the steering column switch. Remove the lever by pulling it straight out of the column switch.

CAUTION: Do not bend or twist the lever during removal. It must be pulled straight out to avoid damaging the wiper switch.

3. The lever is serviced as an assembly only. Do not attempt to disassemble it for repair.

LEVER INSTALLATION – WITHOUT CRUISE CONTROL

1. Install an anti-rattle shim (F), P/N 8956 002 285, on the lever.
2. Hold the washer switch in the Off position with thumb lever (G). Start the lever in the column. Be sure lever tab (B) is aligned with switch slot (C).
3. Push the lever into the column switch in one continuous motion until the lever snaps into place.

PARTS INFORMATION

Parts Description	Quantity	Part Number
SHIM, Anti-Rattle, Cruise Control/Turn Signal/Wiper Lever	1	8956 002 285

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.



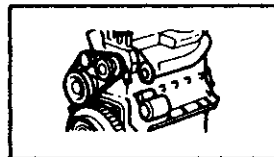
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53E

MARCH 1987
ENGLISH EDITION

1983-87 AMC/JEEP
WITH 4.2L I-6 ENGINE



ENGINES

Attention: Workshop, Parts Department

IMPROVED MANIFOLD CLAMP WASHER FOR 4.2L I-6 ENGINE

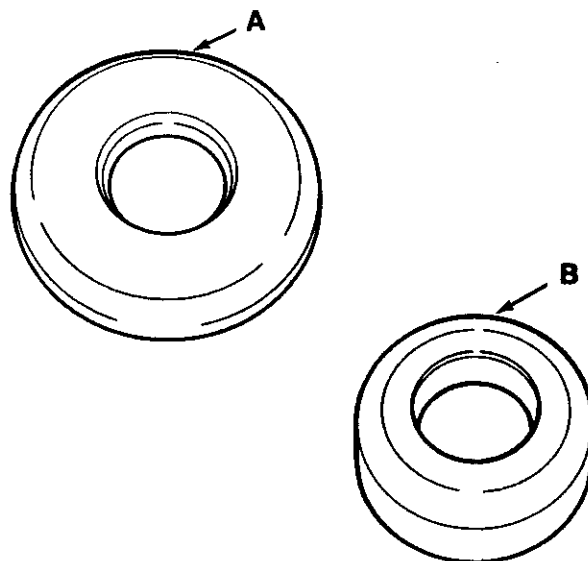
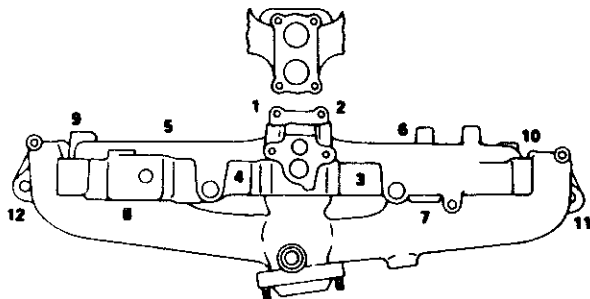
An improved manifold clamp washer, PN 8933 004 255, was phased into 4.2L I-6 engine production on October 16, 1986. The clamp washer is used at manifold retaining bolt positions 3 through 10.

NOTE: The new clamp washer also can be used on all I-6 engines built from 1964 onward.



Do not reuse the old clamp washers when the manifolds or gasket are removed or replaced during service. The new clamp washers must be used.

NOTE: The clamp washers (A) used at positions 3 through 10 secure both the intake and exhaust manifolds. They are different from the smaller chamfered washers (B) that secure only the exhaust manifold at positions 1, 2, 11 and 12. Do not intermix the two washer styles.



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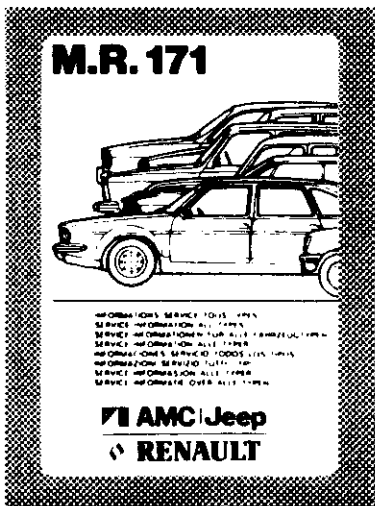
PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
CLAMP WASHER, Manifold	8	8933 004 255

FILING INSTRUCTIONS

Record this I.S. Note in the following workshop manuals and file it in the M.R. 171 binder.

MANUAL	PAGES
• M.R. 251	B-131
• M.R. 253	B-65
• M.R. 279	B-144
• Mot. I-6	60



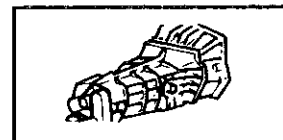
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54E

**MARCH, 1987
ENGLISH EDITION**

**EAGLE/JEEP VEHICLES
WITH MODEL
128-129-228-229
TRANSFER CASE**



GEARBOXES

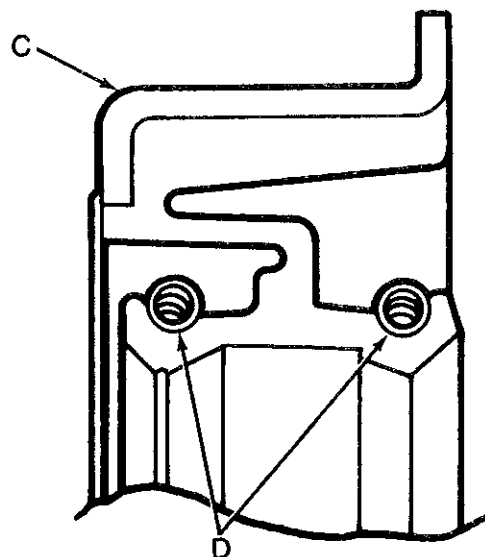
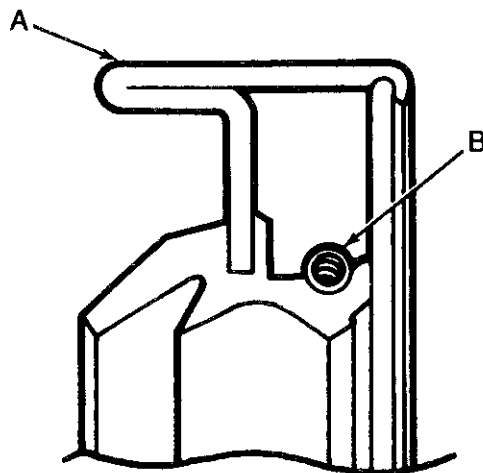
ATTENTION: Workshop, Parts Department

NEW REAR OUTPUT SHAFT SEAL

A new rear output shaft seal PN 8983 502 508, has been released for production and service use on transfer case Models 128, 129, 228 and 229.

The new rear output shaft seal is easily identified. The new rear seal (A) has only one seal spring (B). The previous rear seal (C) has two seal springs (D).

Be sure to install the new rear seal whenever replacement is required. Use tool J-29162 to install and seat the seal properly.



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PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
SEAL, Transfer Case Rear Output Shaft (Model 128-129-228-229)	1	8983 502 508

FILING INSTRUCTIONS

Record this I.S. Note in the following manuals and file it in the M. R. 171 binder.

M. R. 244 page E-62 & E-100 1982 AMC Technical Service Manual page 2D-21
M. R. 251 page E-44 Jeep Supplement No. 1, 1982 Jeep Technical Service Manual page 125
M. R. 253 page E-99
M. R. 277 page E-62



AMC | Jeep
RENAULT

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55E

APRIL 1987
ENGLISH EDITION

1982-87 Eagle
1986-87 Comanche
1984-87 Cherokee-Wagoneer
1987 Wrangler-YJ

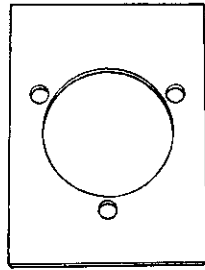


Attention: Workshop, Parts Department

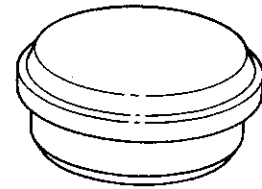
New service procedures have been developed to replace front wheel bearings on the subject vehicles. A new special tool set, PN 8980 002 647 is available to remove the bearing assemblies from the drive hub.

The new tools are designed for use with an arbor or hydraulic press and Kent-Moore bearing remover tool J-22912-01. They must not be used with any impact tools, such as a slide hammer or machinist hammer, to remove or install the bearings (Fig. 1).

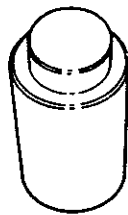
NOTE: Some 1980 and 1981 model Eagles were equipped with ball bearing-type hubs which are not serviceable and must be replaced as an assembly only. The non-serviceable bearings can be readily identified, upon removal, by the absence of the axle-to-bearing spacer (18), (Fig. 2).



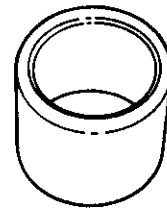
Press Plate 5073



Bearing Race Installer 5077



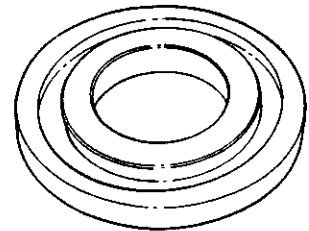
Press Pin 5074



Bearing Installer 5078



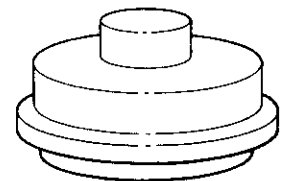
Bearing Race Remover 5075



Seal Installer 5079



Bearing Race Remover 5076



Seal Installer 5080

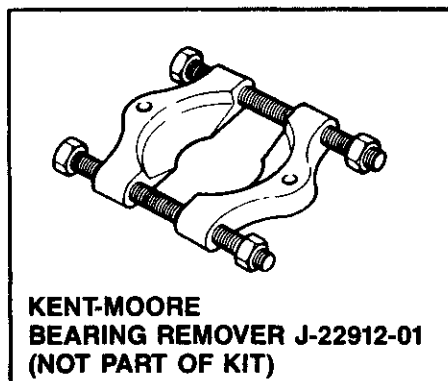
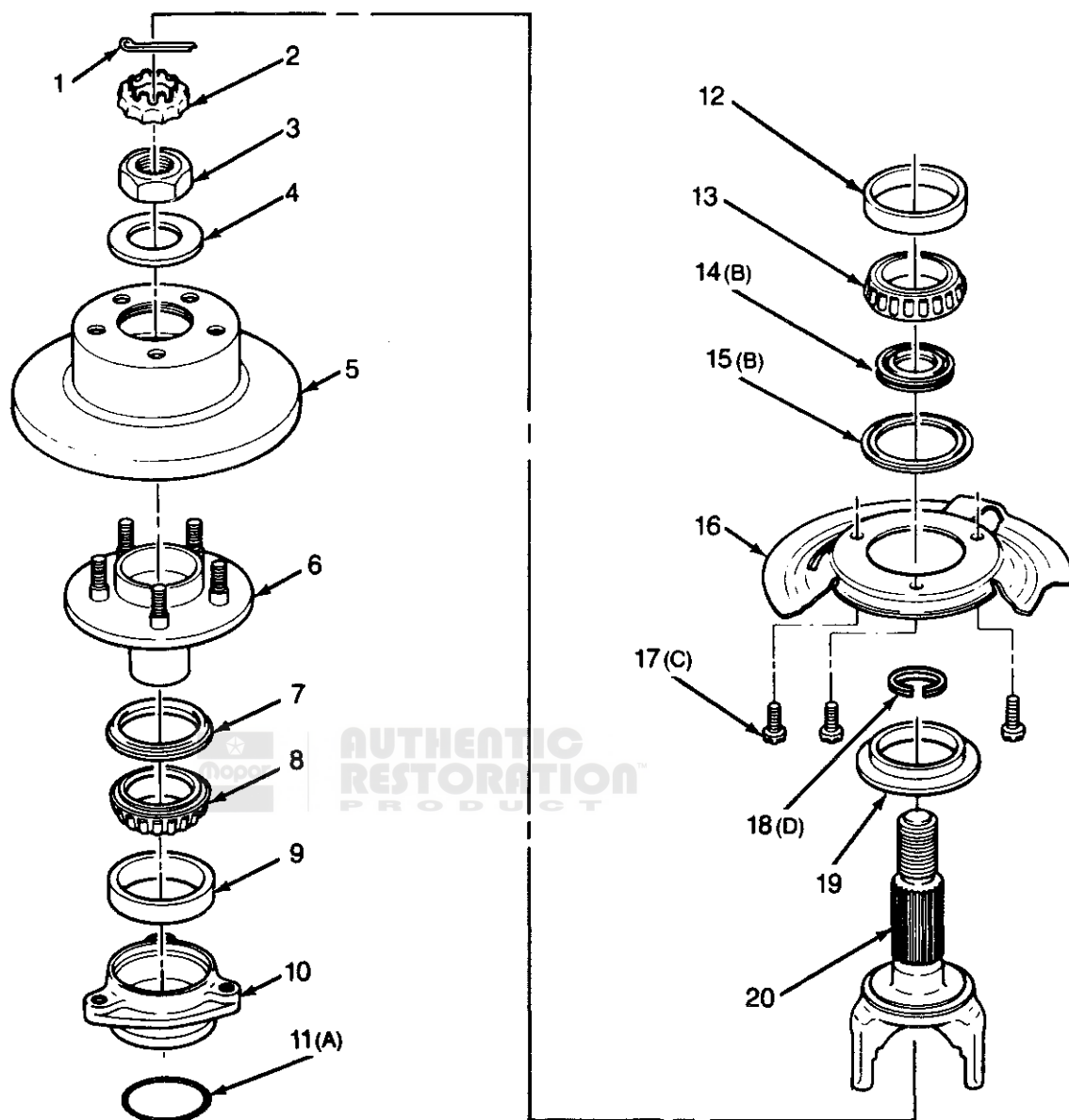


Fig. 1



1. COTTER PIN
2. NUT RETAINER
3. NUT
4. WASHER
5. BRAKE ROTOR
6. HUB
7. OUTER BEARING SEAL
8. OUTER BEARING
9. OUTER BEARING RACE
10. BEARING CARRIER
11. O-RING SEAL (A)
12. INNER BEARING RACE

13. INNER BEARING
14. INNER BEARING SEAL (B)
15. CARRIER SEAL (B)
16. ROTOR SHIELD
17. BEARING CARRIER BOLTS (C)
18. AXLE SHAFT-TO-BEARING SPACER (D)
19. AXLE SHAFT DUST SLINGER
20. AXLE SHAFT

(A) ALL EAGLE MODELS.

(B) ALL EXCEPT EAGLE MODELS.

(C) BOLT SIZE:

ON EAGLE — M12 x 1.75 x 40mm

ON JEEP — M12 x 1.75 x 85mm

(D) LATE MODEL EAGLE ONLY

101530A

Fig. 2

HUB AND BEARING CARRIER REMOVAL — JEEP MODELS

1. Raise the vehicle.
2. Remove the wheel-tire assembly.
3. Remove the disc brake caliper but do not disconnect the brake hose. Secure the caliper to the chassis with wire or string.

CAUTION: Do not allow the brake hose to support caliper weight. Be sure to secure the caliper to the chassis.

4. Remove the brake rotor (5) (Fig. 2).
5. Remove the cotter pin (1), nut retainer (2), axle nut (3), and washer (4) (Fig. 2).
6. Remove the three carrier bolts (17) (Fig. 2).
7. Remove the hub (6), bearing carrier (10) and rotor shield (16) (Fig. 2).

HUB AND BEARING CARRIER REMOVAL — EAGLE MODELS

1. Raise the vehicle.
2. Remove the wheel and tire assembly.
3. Remove the disc brake caliper but do not disconnect the brake hose. Secure the caliper to the chassis with wire or string.

CAUTION: Do not allow the brake hose to support caliper weight. Be sure to secure the caliper to the chassis.

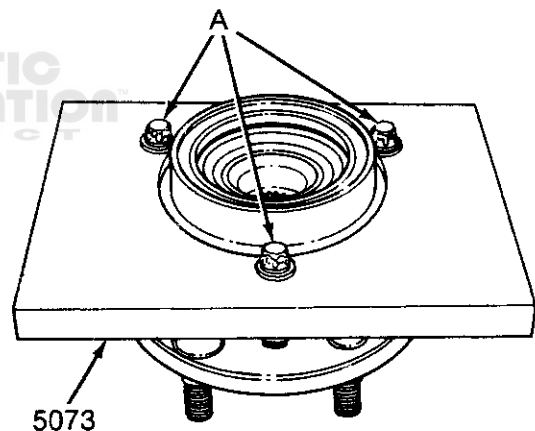
4. Remove the disc brake rotor (5) (Fig. 2).
5. Remove the cotter pin (1), nut retainer (2), axle nut (3), and washer (4) (Fig. 2).
6. Disconnect the steering arm from the steering knuckle.

7. Remove the caliper anchor plate from the steering knuckle.
8. Remove the three carrier bolts (17) (Fig. 2).
9. Remove the hub (6), bearing carrier (10) and rotor shield (16) (Fig. 2).

BEARING REMOVAL

CAUTION: The bearing remover tools are designed for use with an arbor or hydraulic press and Kent-Moore bearing remover J-22912-01. They must not be used with any type of impact tool such as a machinist hammer or slide hammer.

1. Attach press plate 5073 to the rear of the hub and carrier assembly as shown in (Fig. 3). Secure the press plate with the M12 x1.75 x 40 mm bolts (A).



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Fig. 3

2. Position the assembled hub, carrier and press plate in an arbor or hydraulic press.
3. Press the hub out of the carrier (B) with press pin 5074 (Fig. 4).

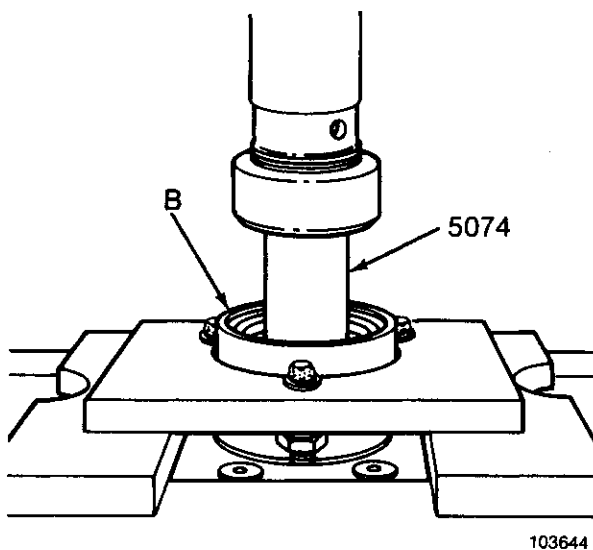


Fig. 4

4. Cut and remove the plastic bearing cage (C) (Fig. 5) from the hub inner bearing. Use diagonal pliers or tin snips to cut the bearing cage. Discard the bearing rollers after removing the cage.

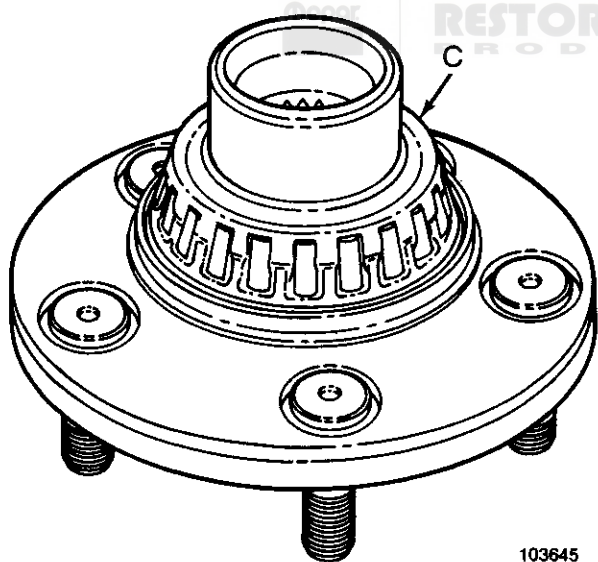


Fig. 5

5. Remove the remaining part of the inner bearing from the hub as follows:

- Install remover tool J-22912-01 on the inner bearing (D) (Fig. 6).

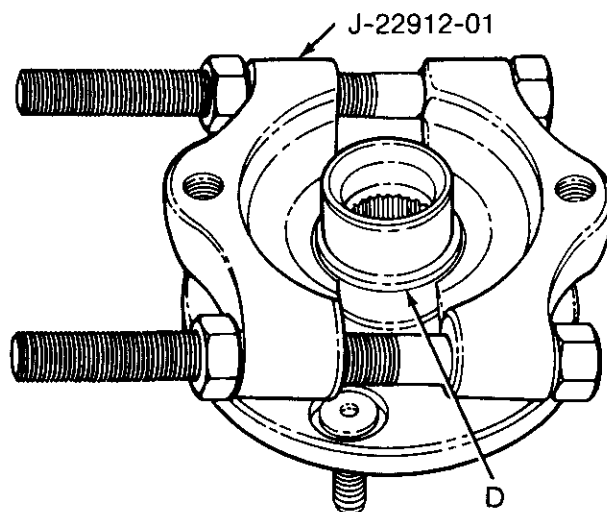


Fig. 6

- Position the remover tool and hub in an arbor or hydraulic press.
- Press the hub (E) out of the inner bearing (F) with press pin 5074 (Fig. 7).

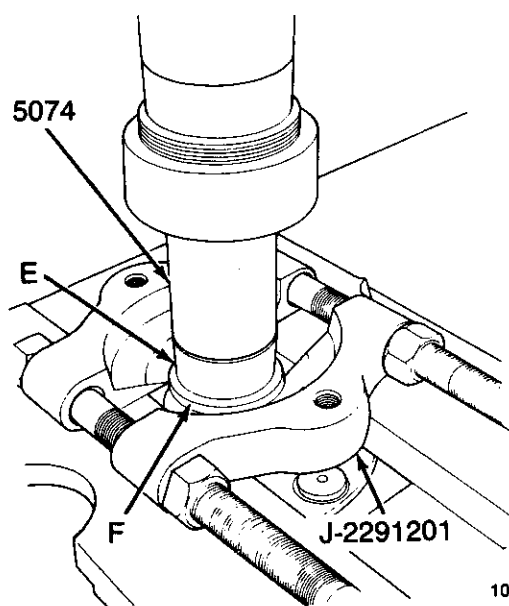


Fig. 7

6. On Eagle models, remove the O-ring seal (11) from the hub (Fig. 2). Discard the seal, it is not reusable.
7. On Jeep models, remove the carrier seal (15) (Fig. 2). Discard the seal, it is not reusable.
8. On Eagle models, remove the inner bearing (12) (Fig. 2).
9. On Jeep models, press the inner bearing seal (G), from the hub using the inner race and bearing installer 5078 (Fig. 8).

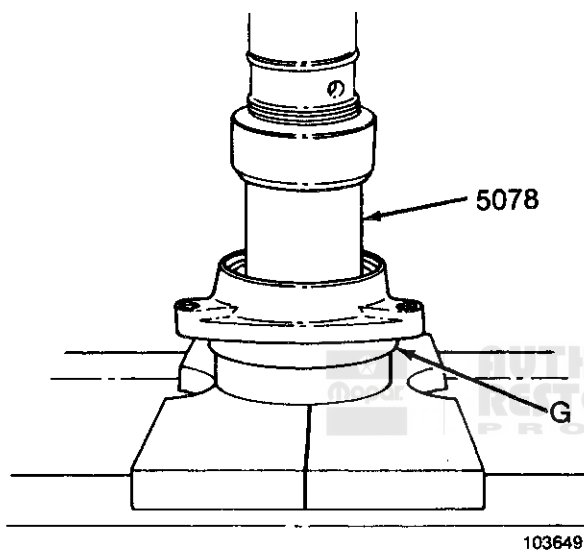


Fig. 8

NOTE: Be sure the word "Jeep" on tool 5078 is facing downward toward the hub.

10. On Eagle models, position bearing race remover tool 5075 between inner and outer bearing races (H) (Fig. 9).
11. On Jeep models, position bearing race remover tool 5076 between inner and outer bearing races (H) (Fig. 9).
12. Position press pin 5074 (Fig. 9) on bearing race remover tool.

13. Place on press and press out inner bearing race, rotate and press out outer bearing race (Fig. 10).

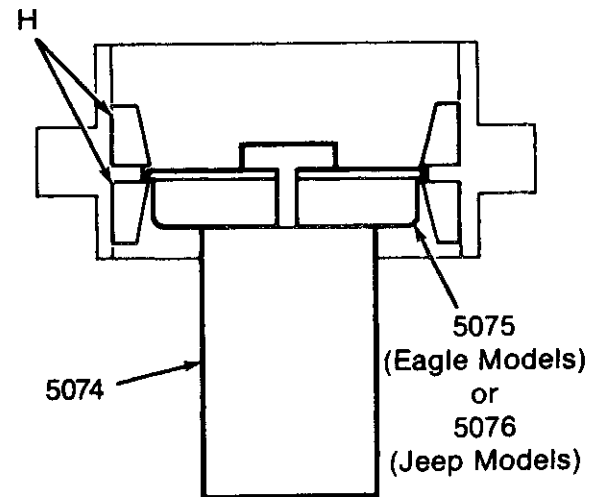


Fig. 9

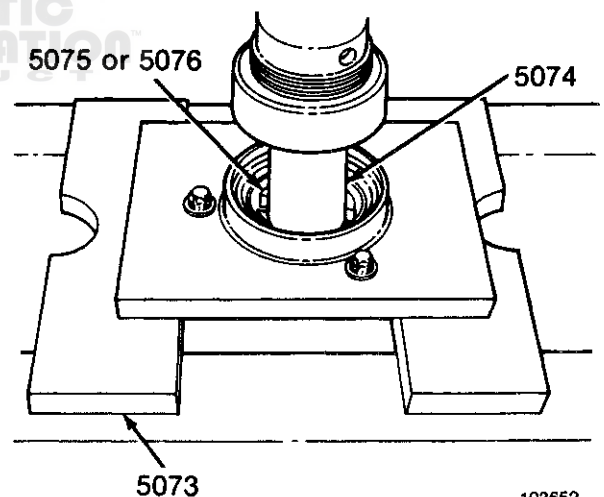


Fig. 10

CAUTION: Never use anything other than prescribed tools to remove bearing races as damage to the internal machined shoulder of the bearing carrier could result.

BEARING INSTALLATION

1. Thoroughly clean hub (6) (Fig. 2) and bearing carrier (10) (Fig. 2) with mineral spirits. Dry using compressed air.
2. Assemble press plate 5073 to bearing carrier (I) (Fig. 11).
3. Position bearing race (J) (Fig. 11) into bearing carrier.

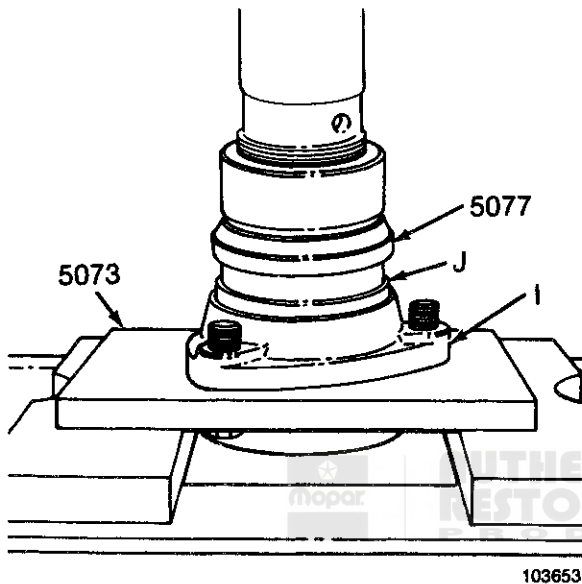


Fig. 11

4. Position bearing installer tool 5077 on outer bearing race.

NOTE: Be sure appropriate end of bearing race installer tool 5077 is facing downward, toward bearing carrier. One end of bearing installer is marked "Eagle" the other end is marked "Jeep".

5. Rotate assembled press plate with bearing carrier and repeat steps 3 and 4 for inner race.

CAUTION: Do not overload press when installing bearing races. Bearing races should be flush with machined shoulder of bearing carrier.

6. Pack outer bearing (K) (Fig. 12) and coat race with AMC/Jeep/Renault All Purpose Lubricant P/N 8993630.

7. Place bearing (K) into bearing carrier (L), (Fig. 12).

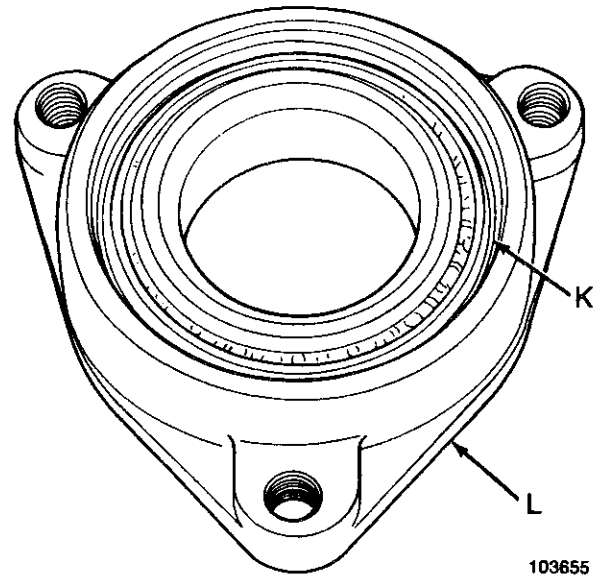


Fig. 12

8. Press outer bearing seal (M) into bearing carrier (N) using seal installer 5079 (Fig. 13).

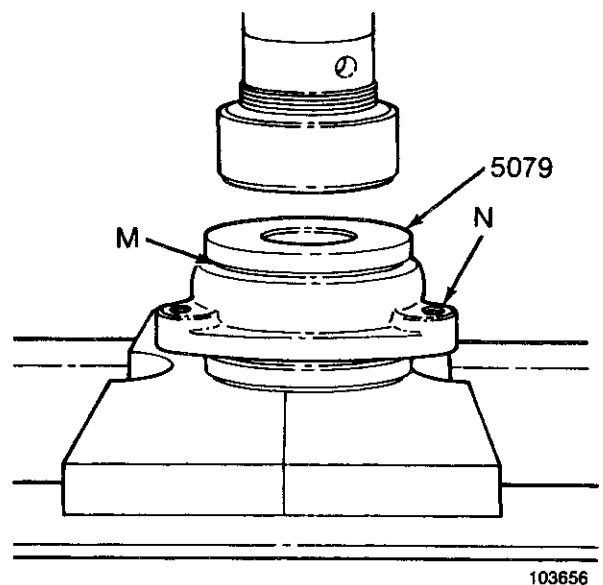
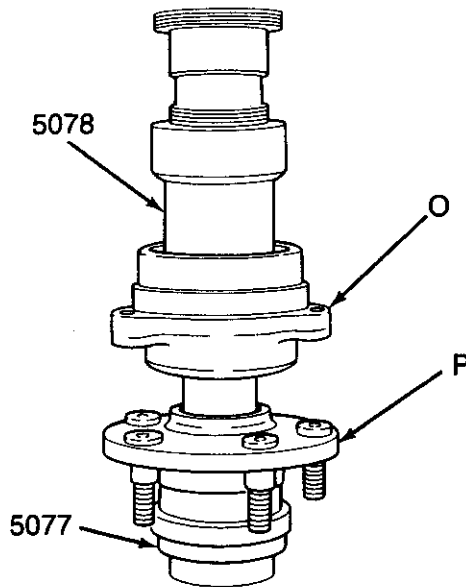


Fig. 13

9. Coat lip of bearing seal with grease.

10. Press bearing carrier (O), (Fig. 14) onto hub (P), (Fig. 13) using bearing installer 5078 and bearing race installer 5077, (Fig. 14).



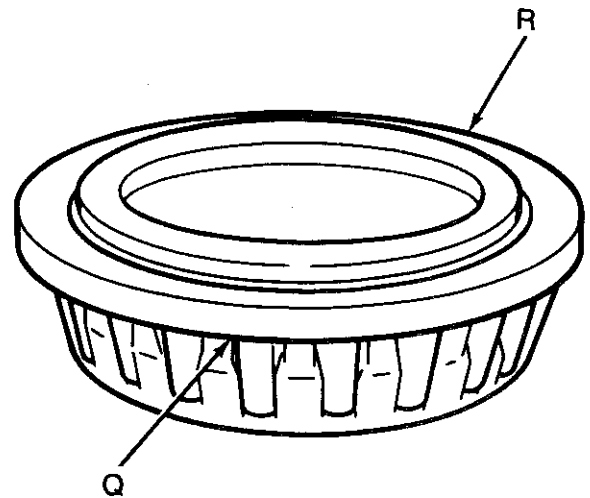
103654

Fig. 14

NOTE: Be sure appropriate end of bearing race installer tool 5077 is facing downward toward hub. One end of the bearing race installer tool is marked "Eagle" the other end is marked "Jeep".

11. Pack inner bearing (Q) (Fig. 15) and coat race with AMC/Jeep/Renault All Purpose Lubricant P/N 8993630.

12. On Jeep models, coat lip of inner bearing seal (R), (Fig. 15) with grease and place on inner bearing.



103657

Fig. 15

13. Place hub (S) (Fig. 16) and bearing carrier (T), (Fig. 16) on bearing race installer 5077 (Fig. 16) on press.

14. Position inner bearing (U), (Fig. 16) in bearing carrier (T), (Fig. 16).

15. On Jeep models, place inner bearing and seal (V), (Fig. 16) on bearing carrier (U), (Fig. 16).

16. Install seal installer tool 5080 (Fig. 16) and press inner bearing (U) (Fig. 16) and seal (V) (Fig. 16) onto hub.

CAUTION: Use extreme care when pressing inner bearing onto hub. Bearing carrier should rotate freely after inner bearing is installed. Do not attempt to eliminate all bearing lash "free-play" when operating the press. Final preload will be achieved by tightening the drive axle nut (3) (Fig. 2).

NOTE: On Jeep models, be sure bearing seal is seated squarely in machined surface of bearing carrier.

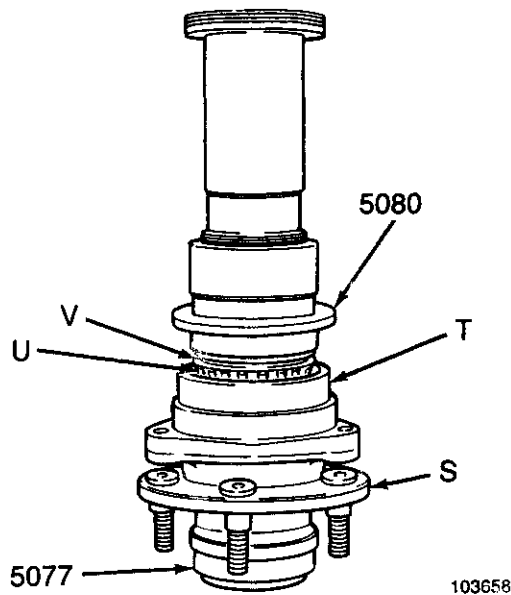


Fig. 16

17. On Jeep models, install carrier seal using tool 5080.

HUB AND BEARING CARRIER INSTALLATION — EAGLE MODELS

1. Thoroughly clean axle shaft (20) (Fig. 2) and apply a thin coating of lithium grease. Install axle shaft-to-bearing spacer (18) (Fig. 2).
2. Install rotor shield (16) to the bearing carrier (10) and hub (6). (Fig. 2). Coat o-ring (11) with grease and install it to the carrier assembly.
3. Apply Locktite, 812 9800, and install the three carrier bolts (17) (Fig. 2) tighten bolts to 102 N·m (75 ft.-lbs.).
4. Install caliper anchor plate to the steering knuckle. Tighten bolts to 136 N·m (100 ft.-lbs.) torque.
5. Connect steering arm to steering knuckle. Tighten bolts to 136 N·m (100 ft.-lbs.) torque.
6. Install disc brake rotor and caliper.

7. Install washer (4), axle nut (3) and tighten to 237 N·m (175 ft.-lbs.) torque (Fig. 2).

8. Install nut retainer (2) and cotter pin (1), (Fig. 2).

NOTE: Do not loosen the nut to fit the retainer. Tighten the nut to the next available slot.

9. Install wheel and tire assembly.

10. Lower vehicle.

HUB AND BEARING CARRIER INSTALLATION — JEEP MODELS

1. Thoroughly clean axle shaft (20) (Fig. 2) and apply a thin coating of lithium grease.
2. Install rotor shield (16), bearing carrier (10) and hub (6), (Fig. 2).
3. Apply Locktite, 812 9800, and install the three carrier bolts (17) (Fig. 2). Tighten bolts to 102 N·m (75 ft.-lbs.) torque (Fig. 2).
4. Install disc brake rotor and caliper.
5. Install washer (4), axle nut (3) and tighten to 237 N·m (175 ft.-lbs.) torque (Fig. 2).
6. Install nut retainer (2) and cotter pin (1), (Fig. 2).
7. Install wheel and tire assembly.
8. Lower vehicle.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
KIT, FRONT WHEEL HUB — BEARING SERVICE	1	8980 002 647
REMOVER, BEARING	1	J-22912-01

NOTE: A plastic sleeve has been provided in kit, 8980 002 647, to retain a copy of this I.S. Note. Insert a copy in the kit sleeve for future reference.

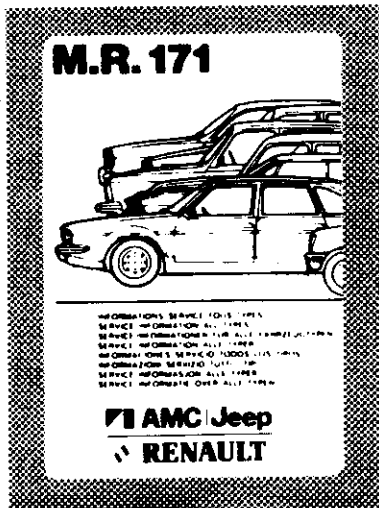
SRT/TIC INFORMATION

OPERATION DESCRIPTION	NUMBER	TIME	TIC	SUPPLIER CODE
CO. BEARING, FRONT WHEEL (JEEP) — REPLACE ONE SIDE ONLY	0310	1.0	3-151	SNR-531 NTN-677
CO. BEARING, FRONT WHEEL (EAGLE) — REPLACE ONE SIDE ONLY	0313	1.3	3-151	KOYO-678 TIMKEN-588

FILING INSTRUCTIONS

File this I.S. Note in the M.R. 171 binder.





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**APRIL 1987
ENGLISH EDITION**

**AMC/JEEP/RENAULT
MODELS**



FRONT AXLE

Attention: Workshop, Parts Department

DRIVE SHAFT BOOTS

This I.S. Note is issued to emphasize the special precautions needed in the care and handling of the front axle drive shaft rubber boots during repair or replacement.

- Care should be taken when removing or replacing the drive shaft rubber boots. These boots are relatively fragile and precautions should be taken to avoid damage.
- Take care not to drop the drive shafts on the boots. Although no apparent damage is observed, internal damage could result in eventual rupture.
- Use care when working around the front axle drive shafts to avoid any contact with the boots. Cover the boots with rags anytime when working in this area.
- When installing new boots do not use any sharp object to remove the protective covering from the boots.
- When replacing the boots thoroughly clean all components with mineral spirits.

NOTE: On Renault models, do not allow any mineral spirits to come in contact with the trunion bearing.

- Inspect all metal parts of the drive shafts for burrs or sharp edges. Dress any burrs or sharp edges and polish with crocus cloth. Be sure to clean the dressed areas with mineral spirits.

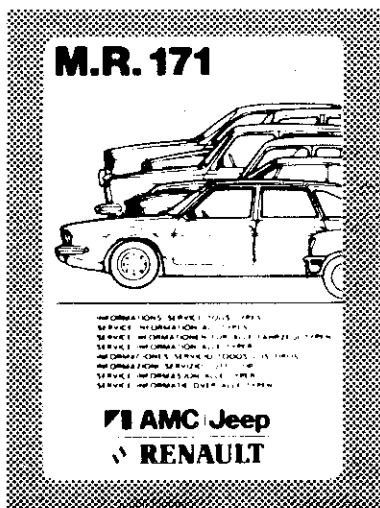
Any burr or sharp edge could result in a boot rupture.

- Always use the prescribed tools when removing or replacing the drive shaft boots (see appropriate M.R.).
- Replacement boots are packaged with new retaining clips. Never use the old retaining clips when replacing the boots.
- Be sure to fill the boot with the specified lubricant to prevent the boot from collapsing.

Bleed any air from the boot bellows before installing retaining clips.

FILING INSTRUCTIONS

File this I.S. Note in your M.R. 171 binder.



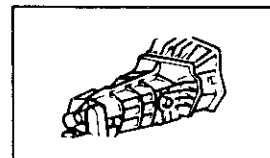
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**NOVEMBER 1987
ENGLISH EDITION**

**EAGLE/JEEP VEHICLES
WITH MODEL 128, 129,
208, 228, 229, 242
TRANSFER CASE**



GEARBOXES

Attention: Workshop, Parts Department

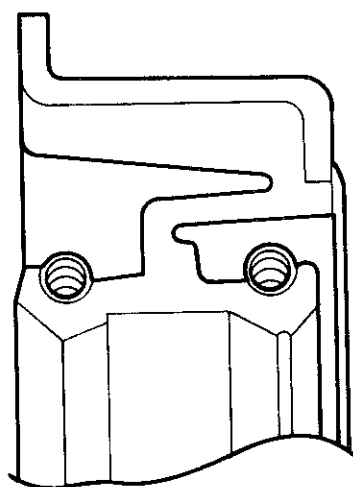
NEW FRONT OUTPUT SHAFT SEAL

A new uni-directional design front output shaft seal, PN 8983 505 290, has been released for service use on transfer case models 128, 129, 208, 228, 229, and 242.

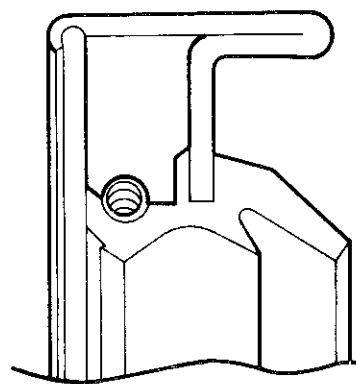
Because the new seal is a uni-directional design, it must be used in the front output application only.

The new seal is similar in appearance to the old seal, but it is blue in color. It will be shipped in a plastic bag stamped "FRONT OUTPUT SHAFT ONLY".

NOTE: For transfer case models 128, 129, 208, 228 and 229, the correct **rear** output shaft seal is PN 8983 502 508. Refer to I.S. Note M.R. 171 54E for further information.



FRONT SEAL



REAR SEAL



FRONT OF TRANSFER CASE

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PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
SEAL, Transfer Case Front Output Shaft (Model 128-129-208-228-229-242)	1	8983 505 290

FILING INSTRUCTIONS

File this I.S. Note in the M. R. 171 binder.





Component Service Manual



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TRANSFER CASE 207

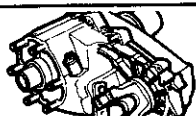
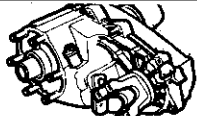
MARCH, 1986

U.S.A./Canada Edition

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All information and specifications in this manual are based on the latest data available at the time of publication. American Motors Corporation and Jeep Corporation reserve the right to discontinue designs or change specifications without notice or incurring obligation.

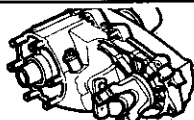
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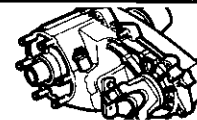


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T.C. 207

GENERAL INFORMATION



DESCRIPTION

The Model 207 is a part-time transfer case with a built-in low range reduction gear system. It has three operating ranges plus a Neutral position. The low range system provides a 2.6:1 gear reduction ratio for increased low speed torque capability.

OPERATING RANGES

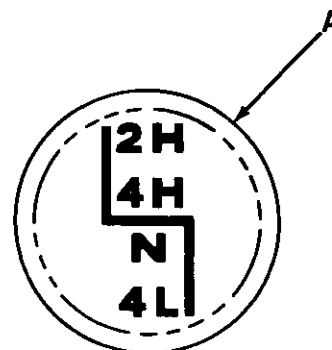
The Model 207 has three operating ranges which are: Two-wheel drive high, four-wheel drive high and four-wheel drive low. The four-wheel drive operating ranges are undifferentiated.

Two-wheel drive range is used for on-road, highway operation. The four-wheel drive ranges are for off-road operation or when the vehicle is driven on paved road surfaces covered by snow, ice or similar low traction elements.

SHIFT MECHANISM

Transfer case operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the gearshift lever knob (A).

A synchronizer assembly in the transfer case allows the unit to be shifted between the two- and four-wheel high ranges while the vehicle is in motion.



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TWO-WHEEL DRIVE OPERATION

Two-wheel drive operation is provided by a disconnect mechanism in the front axle. A vacuum operated shift motor on the axle disconnects the right or left axle shaft when two-wheel drive range is selected. The axle shift motor is controlled by a vacuum switch that is actuated by the transfer case shift sector and linkage.

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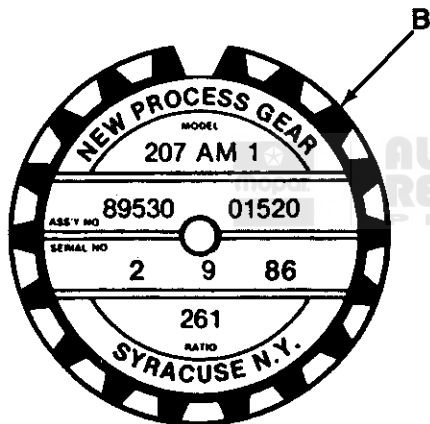
	T.C. 207	
	GENERAL INFORMATION	

IDENTIFICATION

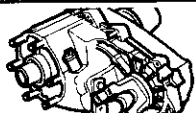
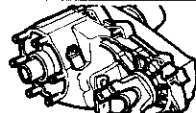
A circular ID tag is attached to the rear case of each Model 207 transfer case. The ID tag (B) provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 2-9-86 would represent February 9, 1986.

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	T.C. 207 SPECIFICATIONS	
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GENERAL SPECIFICATIONS

Transfer Case Type:	Part-time, dual range unit with built-in low range. The two four-wheel drive ranges are undifferentiated.
Torque Transfer Mode:	Drive sprocket and output shaft driven by interconnecting drive chain.
Low Range Gear Reduction:	2.6:1 low range gear ratio.
Operating Ranges:	2-high, 4-high and 4-low. A neutral position is provided for transfer case disengagement.
Case Configuration:	Two-piece aluminum with removable extension and rear retainer housings.
Lubricant Capacity:	2.1 liters (4.5 pints).
Lubricant Type:	AMC/JEEP/RENAULT automatic transmission fluid or equivalent marked DEXRON® II.
Transfer Case Fill Level:	To bottom edge of pipe plug hole.



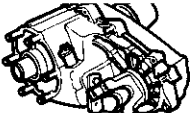
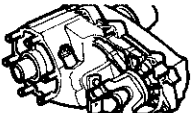
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Bolt, Low Range Lock Plate	34 N•m (25 ft-lbs)	27-41 N•m (20-30 ft-lbs)
Nut, Front Yoke	149 N•m (110 ft-lbs)	122-176 N•m (90-130 ft-lbs)
Vacuum Switch	27 N•m (20 ft-lbs)	20-34 N•m (15-25 ft-lbs)
Nut, Range Lever	24 N•m (18 ft-lbs)	20-27 N•m (15-20 ft-lbs)
Bolt, Front Case-to-Rear Case	30 N•m (22 ft-lbs)	27-34 N•m (20-25 ft-lbs)
Bolt, Rear Retainer	24 N•m (18 ft-lbs)	20-27 N•m (15-20 ft-lbs)
Bolt, Extension Housing	30 N•m (22 ft-lbs)	27-34 N•m (20-25 ft-lbs)
Plug, Drain/Fill	47 N•m (35 ft-lbs)	41-54 N•m (30-40 ft-lbs)
Bolt, Adapter-to-Transfer Case	33 N•m (24 ft-lbs)	26-41 N•m (19-30 ft-lbs)
Nut, Transfer Case-to-Adaptor	35 N•m (26 ft-lbs)	30-41 N•m (22-30 ft-lbs)
U-Joint Clamp Strap Bolts	19 N•m (170 in-lbs)	16-23 N•m (140-200 in-lbs)

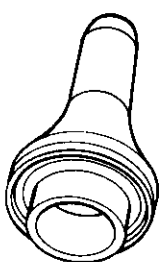
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	T.C. 207 SPECIAL TOOLS	
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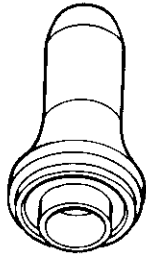
SPECIAL TOOLS

TOOL REF.	DESCRIPTION	REQUIRED	RECOMMENDED
J 2619-01	Slide Hammer		■
J 8092	Driver Handle		■
J 29369-1	Bearing Remover		■
J 33826	Bushing Remover/Bearing Installer	■	
J 33828	Sprocket Bearing Installer	■	
J 33829	Mainshaft Pilot Bearing Installer	■	
J 33830	Input Gear Bearing Installer	■	
J 33831	Input Gear Seal Installer	■	
J 33832	Output Shaft Rear Bearing Installer	■	
J 33833	Output Shaft Front Bearing Installer	■	
J 33834	Output Shaft Seal Installer	■	
J 33835	Pump Housing Seal Installer	■	
J 33839	Extension Housing Bushing Remover	■	
J 33841	Input Gear Bearing Remover	■	
J 33843	Extension Housing Seal Installer	■	

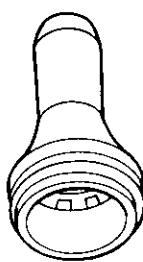
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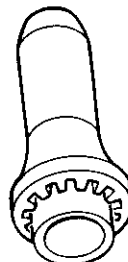
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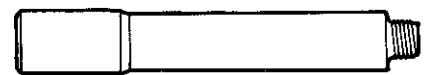
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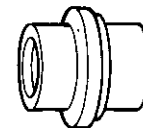
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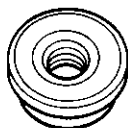
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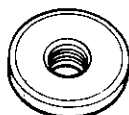
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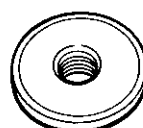
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J 33826



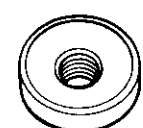
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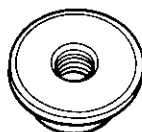
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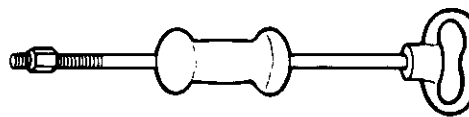
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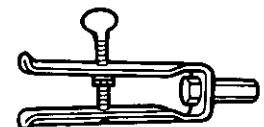
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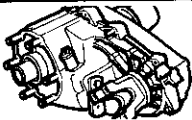
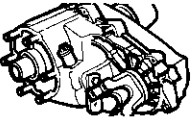
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J 2619-01



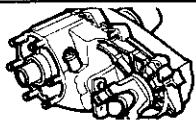
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	T.C. 207 SERVICE DIAGNOSIS	
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SERVICE DIAGNOSIS

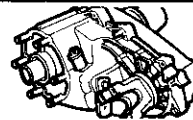
Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Vehicle speed too great to permit shifting.	(1) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift.
	(2) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty.	(2) Stop vehicle, shift transmission to neutral, shift transfer case to 2H mode and operate vehicle in 2H on dry paved surfaces.
	(3) Transfer case external shift linkage binding.	(3) Lubricate, repair or replace linkage, or tighten loose components as necessary.
	(4) Insufficient or incorrect lubricant.	(4) Drain and refill to edge of fill hole with AMC/Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only.
	(5) Internal components binding, worn or damaged.	(5) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with AMC/Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. Check for leaks and repair if necessary. Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.
NOISY IN — OR JUMPS OUT OF FOUR WHEEL DRIVE LOW RANGE	(1) Transfer case not completely engaged in 4L position.	(1) Stop vehicle, shift transfer case to Neutral, then shift back into 4L position.
	(2) Shift linkage loose or binding.	(2) Tighten, lubricate or repair linkage as necessary.
	(3) Range fork cracked, inserts worn, or fork is binding on shift rail.	(3) Disassemble unit and repair as necessary.
	(4) Annulus gear or lockplate worn or damaged.	(4) Disassemble unit and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled.	(1) Drain to correct level.
	(2) Vent closed or restricted.	(2) Clear or replace vent if necessary.
	(3) Output shaft seals damaged or installed incorrectly.	(3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(1) Extended operation on dry hard surface (paved) roads in 4H range.	(1) Operate in 2H on hard surface (paved) roads.

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SHIFT LINKAGE



LINKAGE ADJUSTMENT

Place the shift lever (A) in the 2H position.

Remove the screws attaching the shift lever boot to the floorpan. Slide the boot upward to provide access to the shift gate.

Insert a 3mm (1/8-in.) spacer (B) between the shift lever (A) and the forward edge of the shift lever gate (C). Secure the lever and spacer in position.

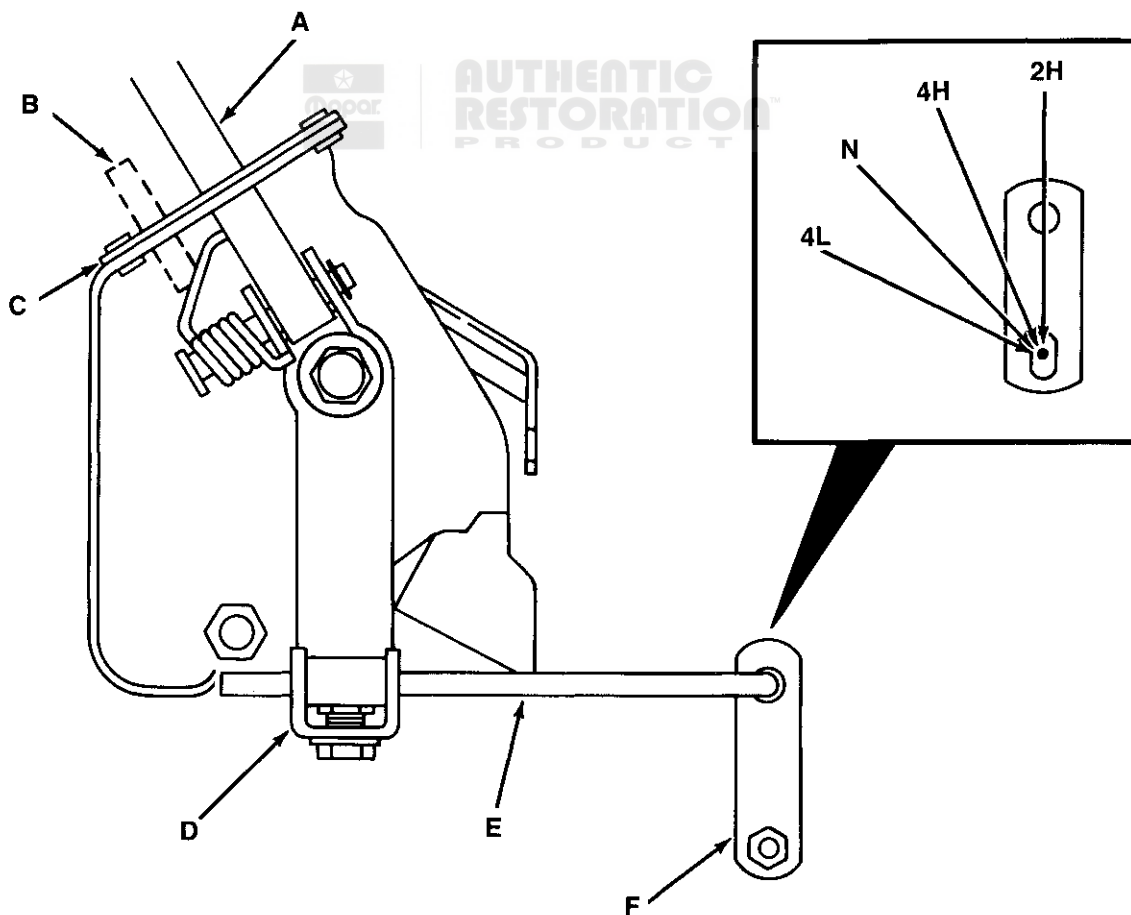
Loosen adjusting link (D) enough to allow linkage rod (E) to slide freely in the link.

Move the transfer case range lever (F) all the way rearward to the 2H position.

Position linkage rod (E) so it is a "free" fit in range lever (F). Then tighten the setscrew in adjusting link (D) securely.

Remove the spacer from the shift gate and install the shift lever boot.

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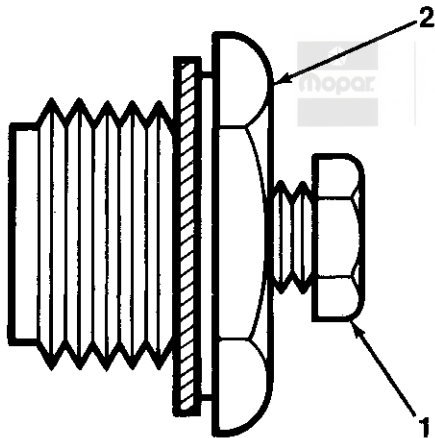


TWO-PIECE FILL PLUG

The Model 207 transfer is equipped with a two-piece fill plug. Fluid level is checked at the small pipe plug (1).

To check the fluid level, remove the small pipe plug (1) from the main plug (2). The correct fluid level is to the bottom edge of the pipe plug hole.

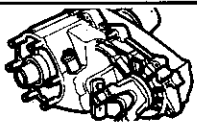
NOTE: If the transfer case is not equipped with a two-piece fill plug, correct fill level is to the bottom edge of the fill plug hole.




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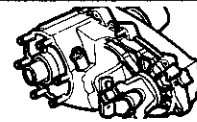
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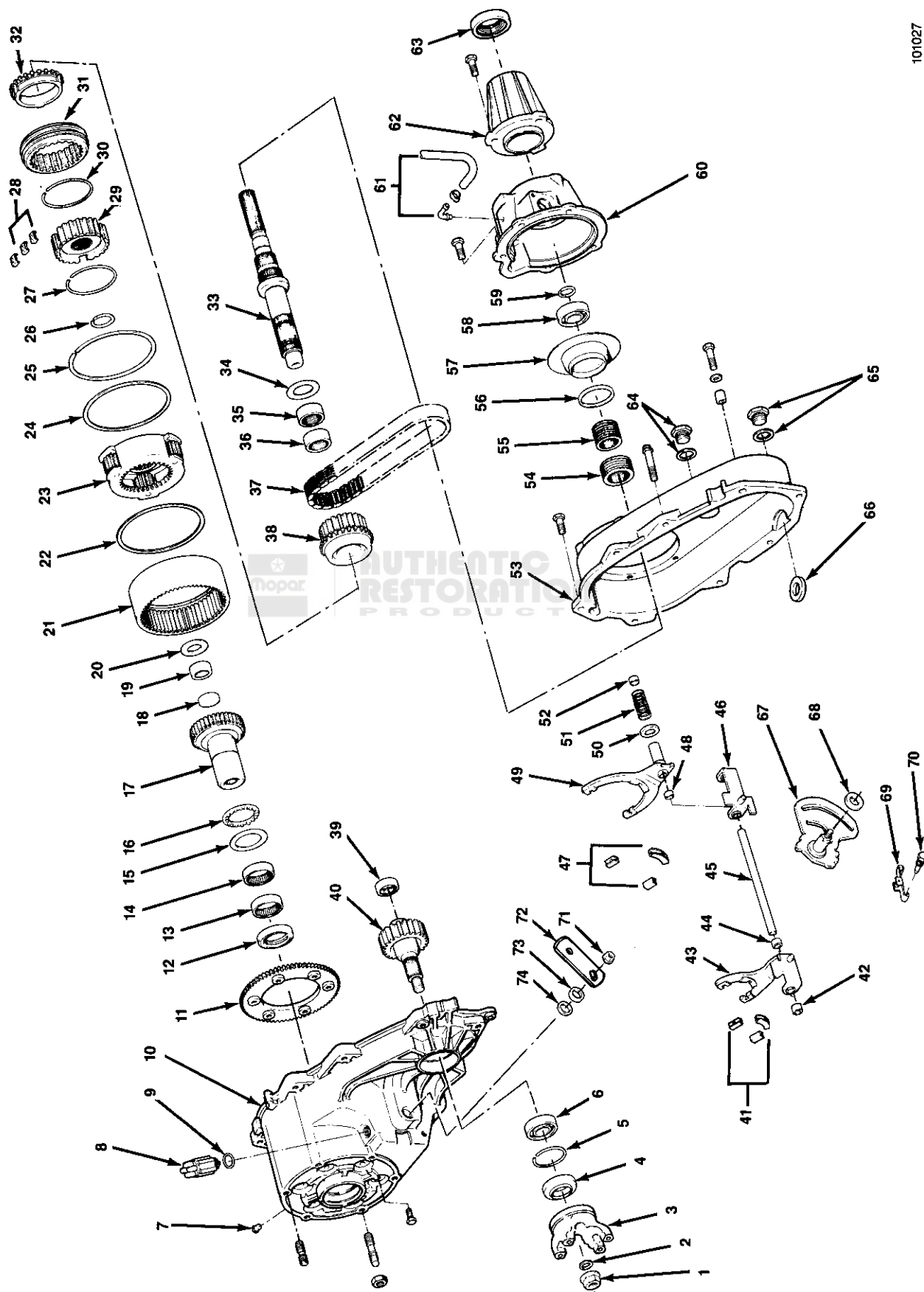
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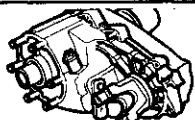
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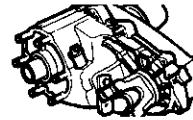
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T.C. 207

OVERHAUL



- | | |
|----------------------------------|--------------------------------|
| 1. Front Yoke Nut | 38. Drive Sprocket |
| 2. Front Yoke Seal | 39. Front Output Shaft Bearing |
| 3. Front Yoke | 40. Front Output Shaft |
| 4. Front Output Shaft Seal | 41. Range Fork Pads |
| 5. Bearing Snap Ring | 42. Range Fork Front Bushing |
| 6. Front Output Shaft Bearing | 43. Range Fork |
| 7. Case Plug | 44. Range Fork Rear Bushing |
| 8. Vacuum Switch | 45. Shift Rail |
| 9. Vacuum Switch Gasket | 46. Shift Rail Bracket |
| 10. Front Case | 47. Mode Fork Pads |
| 11. Low Range Lock Plate | 48. Mode Fork Front Bushing |
| 12. Input Gear Seal | 49. Mode Fork |
| 13. Input Gear Front Bearing | 50. Mode Fork Cup |
| 14. Input Gear Rear Bearing | 51. Mode Fork Spring |
| 15. Thrust Bearing Washer | 52. Mode Fork Rear Bushing |
| 16. Input Gear Thrust Bearing | 53. Rear Case |
| 17. Input Gear | 54. Oil Pump |
| 18. Input Gear Cup Plug | 55. Speedometer Drive Gear |
| 19. Mainshaft Pilot Bearing | 56. Pump Housing Seal |
| 20. Planetary Thrust Washer | 57. Oil Pump Housing |
| 21. Annulus Gear | 58. Mainshaft Rear Bearing |
| 22. Front Thrust Ring | 59. Rear Bearing Snap Ring |
| 23. Planetary Gear | 60. Rear Retainer |
| 24. Rear Thrust Ring | 61. Vent Assembly |
| 25. Planetary Retaining Ring | 62. Extension Housing |
| 26. Snap Ring | 63. Extension Housing Seal |
| 27. Synchronizer Front Spring | 64. Fill Plug |
| 28. Synchronizer Struts (3) | 65. Drain Plug |
| 29. Synchronizer Hub | 66. Magnet |
| 30. Synchronizer Rear Spring | 67. Shift Sector |
| 31. Synchronizer Sleeve | 68. Shift Sector Spacer |
| 32. Synchronizer Stop Ring | 69. Sector Detent Spring |
| 33. Mainshaft | 70. Detent Spring Bolt |
| 34. Thrust Washer | 71. Range Lever Nut |
| 35. Drive Sprocket Rear Bearing | 72. Range Lever |
| 36. Drive Sprocket Front Bearing | 73. O-Ring Retainer |
| 37. Drive Chain | 74. O-Ring |

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TRANSFER CASE DISASSEMBLY

Remove the fill and drain plugs.

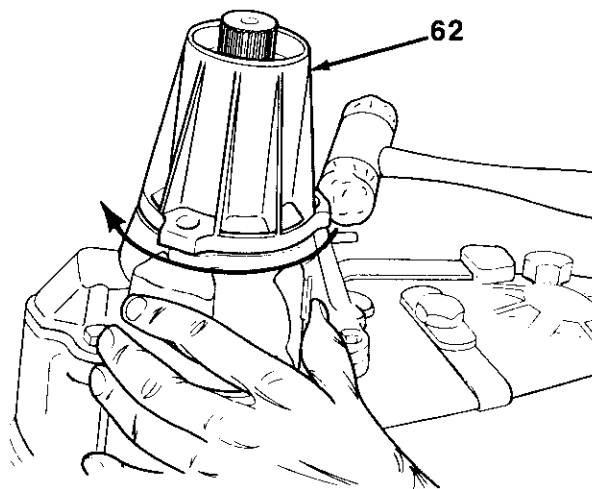
Remove the front yoke (3). Discard the yoke seal (2) and nut (1).

Move the transfer case range lever (72) all the way forward to the four-wheel low position.

Remove the extension housing attaching bolts.

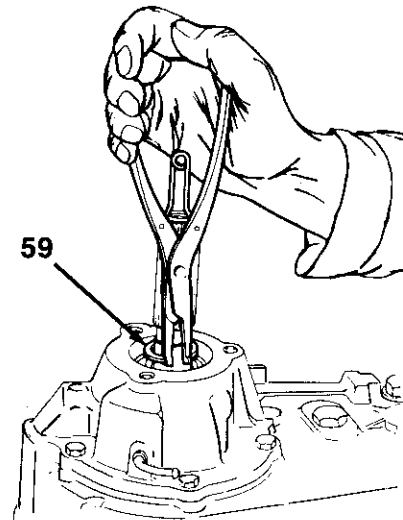
Tap the extension housing (62) in a clockwise direction with a rawhide mallet to break the sealer bead. Then remove the housing.

CAUTION: To avoid damaging the sealing surfaces of the extension housing and rear retainer, do not attempt to pry or wedge the housing off the retainer.



84283

Remove the rear bearing snap ring (59) from the mainshaft. Discard the snap ring.

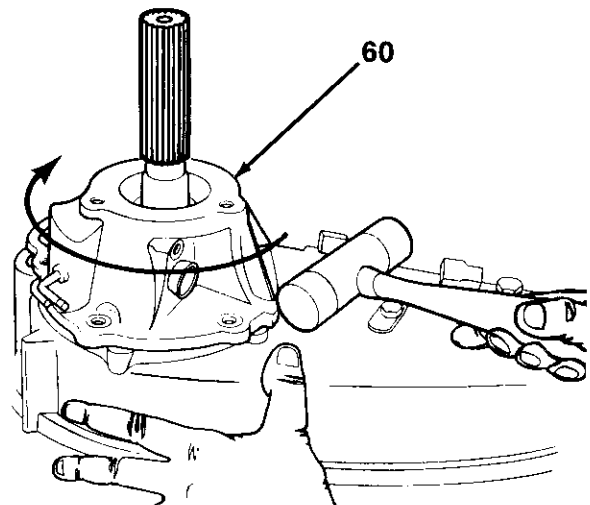


84284

Remove the rear retainer attaching bolts.

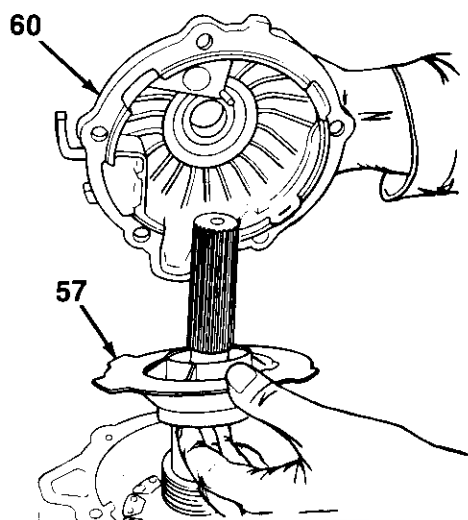
Tap the rear retainer (60) in a clockwise direction with a rawhide mallet to break the sealer bead.

CAUTION: To avoid damaging the sealing surfaces of the rear retainer and rear case, do not attempt to pry or wedge the retainer from the case.



84285

Remove the rear retainer (60) and oil pump housing (57).



84286

Remove the seal (56) from the oil pump housing (57). Discard the seal.

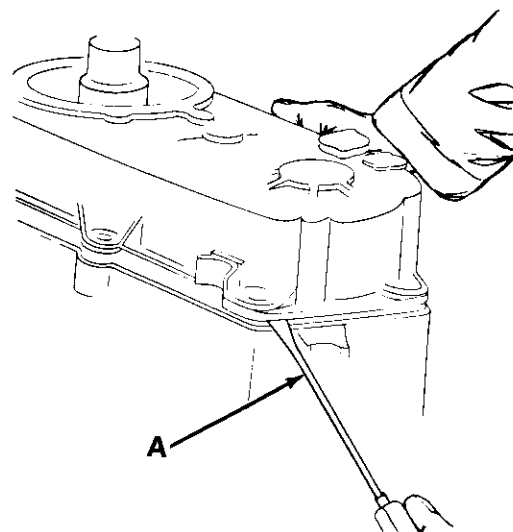
Remove the speedometer drive gear (55) from the mainshaft.

Remove the oil pump (54) from the mainshaft.

Remove the bolts attaching the rear case to the front case.

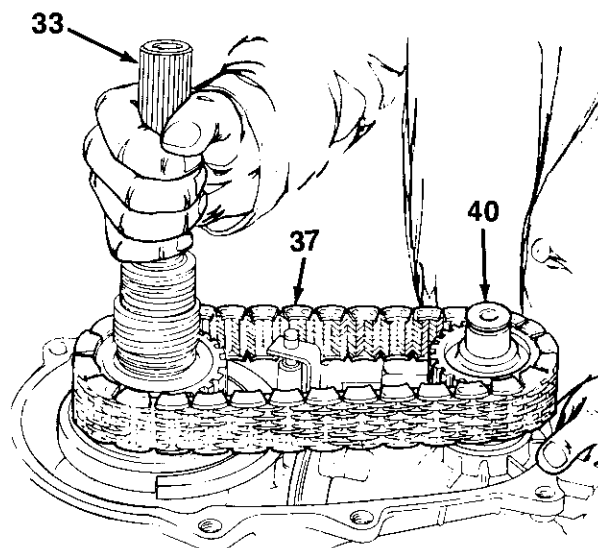
Separate the rear case (53) from the front case (10) using two screwdrivers. Insert the screwdrivers (A) into the slots cast into the case ends. Then gently pry upward to break the sealer bead and separate the case halves.

To avoid damaging the case sealing surfaces, do not separate the case halves at any point other than the slots at the case ends.



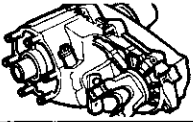
84287

Remove the front output shaft (40) and drive chain (37) as an assembly. It may be necessary to raise the mainshaft (33) slightly before the front output shaft will clear the case.

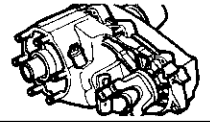


84288

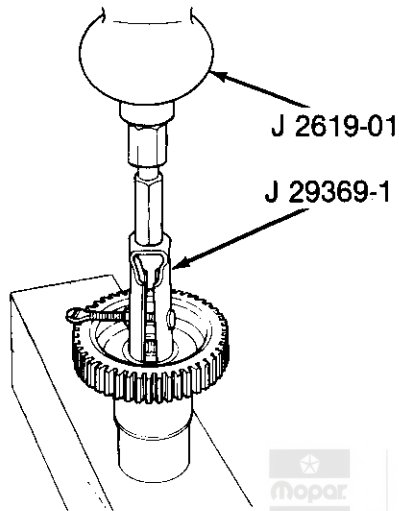
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T.C. 207 **OVERHAUL**



Pull the shift rail (45) upward until it clears the range fork. Then rotate the mode fork (49) outward and remove the fork, shift rail and shift rail bracket as an assembly.

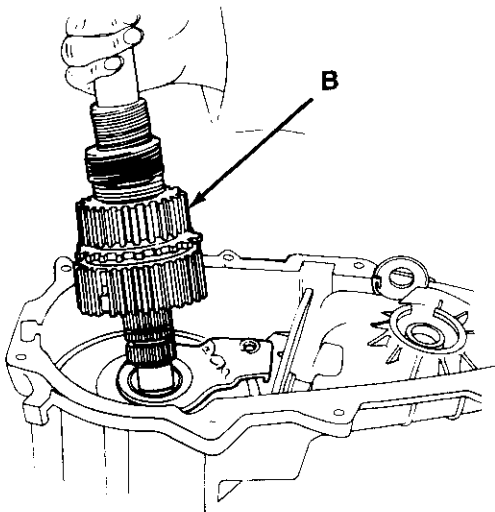


J 2619-01

J 29369-1

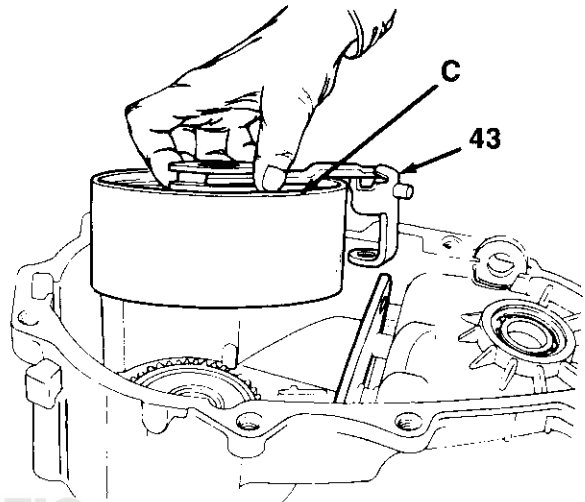
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Lift the mainshaft and geartrain assembly (B) upward and out of the front case.



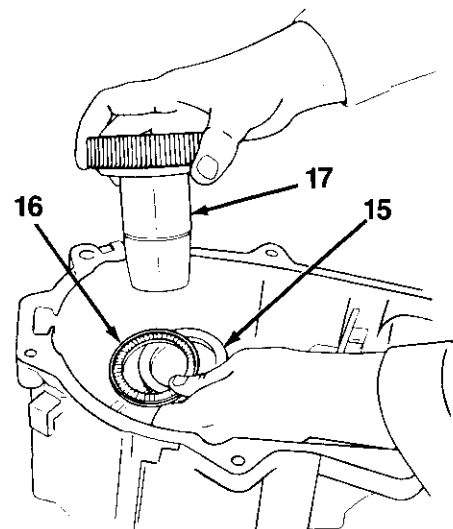
84290

Remove the annulus and planetary gear assembly (C) and the range fork (43) from the front case.



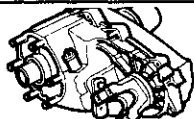
84291

Remove the input gear (17), thrust bearing (16) and thrust bearing washer (15).

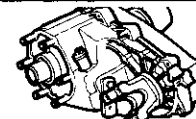


84292

Remove the sector spring detent bolt (70) and the sector detent spring (69).

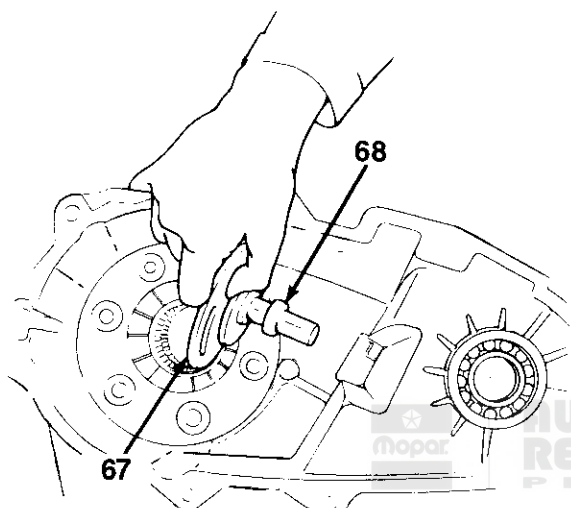


T.C. 207 OVERHAUL



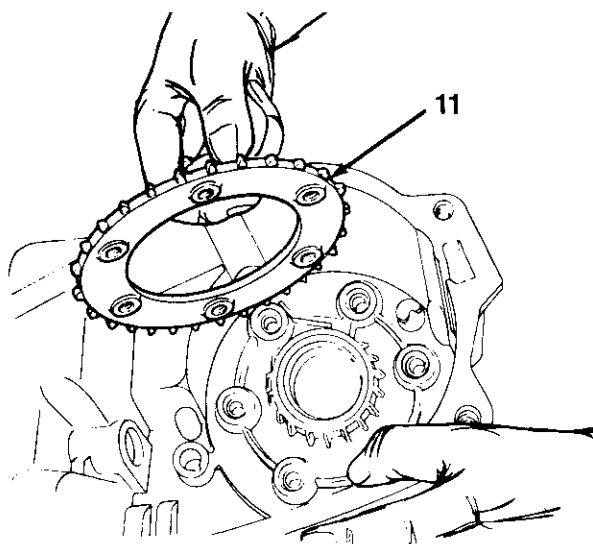
Remove the range lever nut (71) and remove the lever (72), retainer (73) and seal (74).

Remove the shift sector (67) and sector spacer (68) from the front case.



84310

Remove the bolts attaching the low range lock plate to the front case and remove the lockplate (11). Discard the lock plate retaining bolts.



84294

Remove and discard the following oil seals: Input gear oil seal (12); front output shaft oil seal (4); extension housing oil seal (63).

MAINSHAFT DISASSEMBLY

Remove the synchronizer hub snap ring (26).

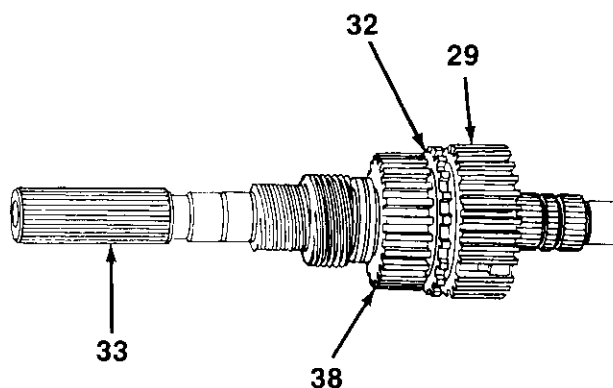
Mark position of the synchronizer sleeve and hub for assembly reference.

Remove the synchronizer sleeve (31), struts (28) and springs (27 and 30) from the hub (29).

Remove the synchronizer hub (29) by tapping it off the mainshaft with a brass mallet.

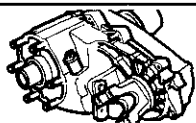
Remove the synchronizer stop ring (32).

Remove the drive sprocket (38) and thrust washer (34).



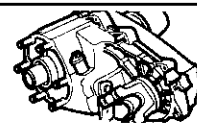
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OVERHAUL



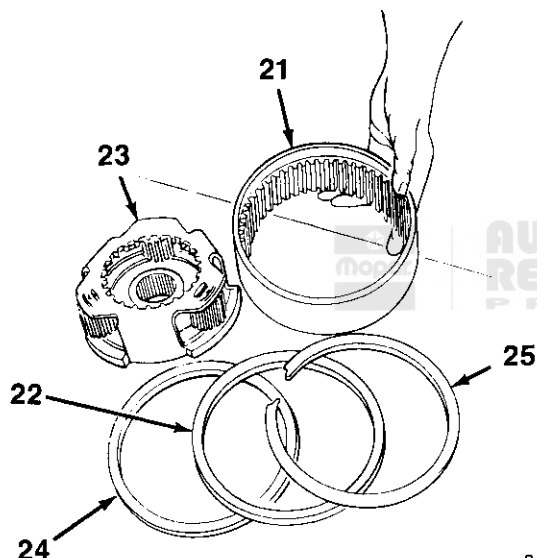
ANNULUS AND PLANETARY GEAR DISASSEMBLY

Remove the planetary snap ring (25).

Remove the rear thrust ring (24) and the planetary gear (23) from the annulus gear (21).

Remove the front thrust ring (22) from the annulus gear.

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CLEANING AND INSPECTION

Wash all components in clean solvent and dry thoroughly with clean shop towels and compressed air. Remove solvent residue from all oil feed passages and channels with compressed air.

Inspect the case halves, extension housing and rear retainer for cracks, porosity, or damaged sealing surfaces.

Inspect the mainshaft, input gear, front output shaft, lock plate and all geartrain components for wear or damage. Check the drive chain for wear stretch, or distortion.

Inspect all of the transfer case bearings and thrust washers for wear, roughness, pitting, or galling.

Inspect the shift sector, shift rail, range and mode fork bushings and pads and both forks. Inspect these components for excessive wear, damage or distortion.

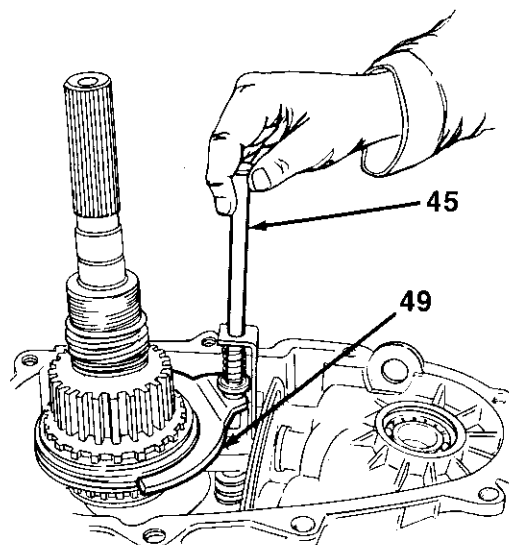
Replace worn or damaged transfer case components as necessary. If any bearings or bushings require replacement, refer to the Bearing Replacement section for procedures.

BEARING REPLACEMENT

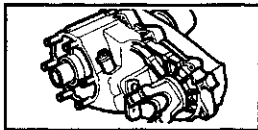
CAUTION: The bearing bores in the input gear, drive sprocket and the two halves of the transfer case, all contain oil feed holes. Be very sure that replacement bearings do not block any of these feed holes after installation. Verify that all oil feed holes are clear before assembling the transfer case.

Mainshaft Pilot Bearing

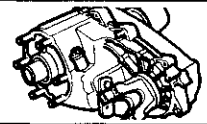
Remove the pilot bearing from the input gear with slide hammer J 2619-01 and tool J 29369-1.



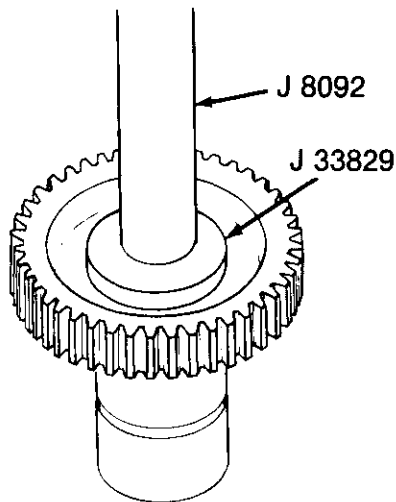
84289



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Install the replacement pilot bearing in the input gear with driver handle J 8092 and tool J 33829.



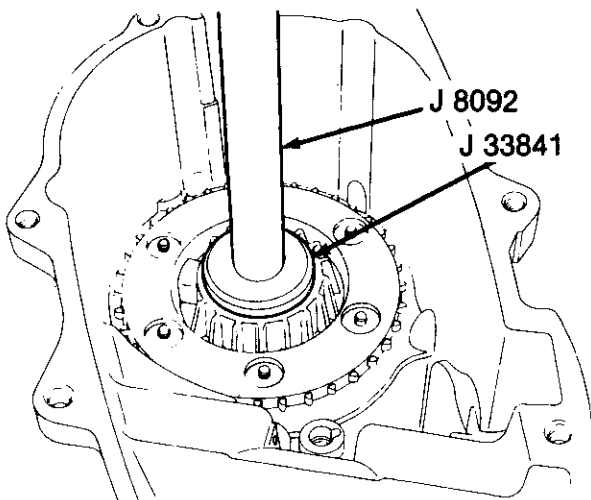
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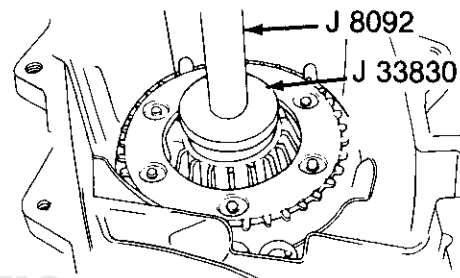
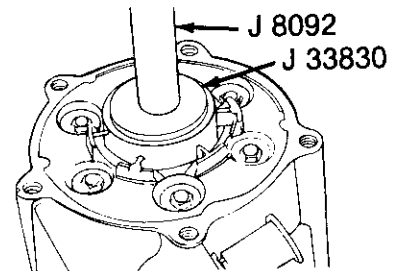
Input Gear Bearings

Remove both bearings from the front case simultaneously with driver handle J 8092 and tool J 33841.



84299

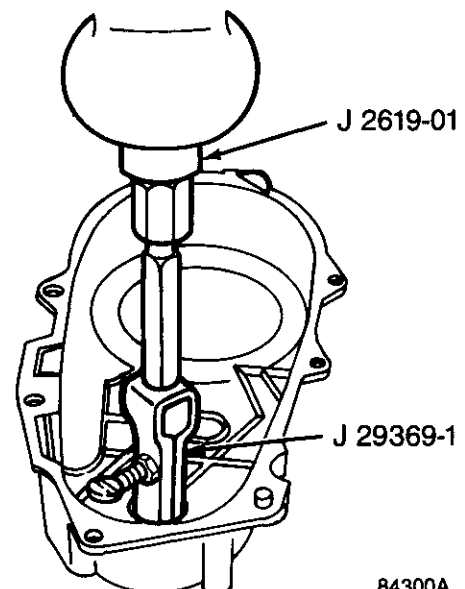
Install the replacement bearings one at a time with driver handle J 8092 and tool J 33830.



84398

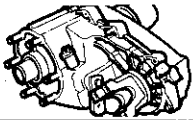
Front Output Shaft Bearings

Remove the rear bearing (39) with slide hammer J 2619-01 and tool J 29369-1.



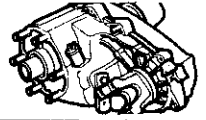
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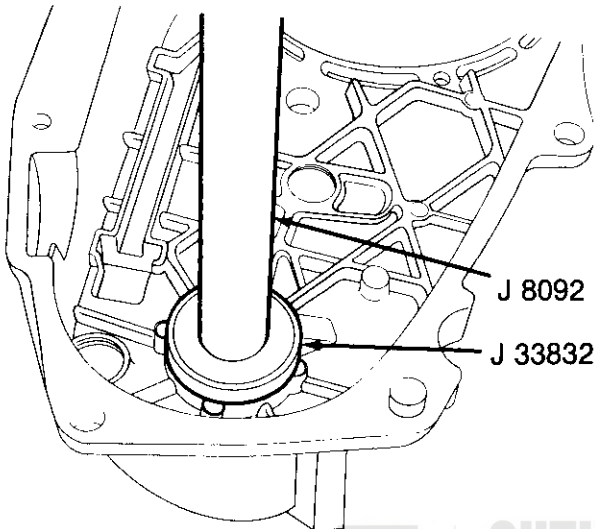


T.C. 207

OVERHAUL

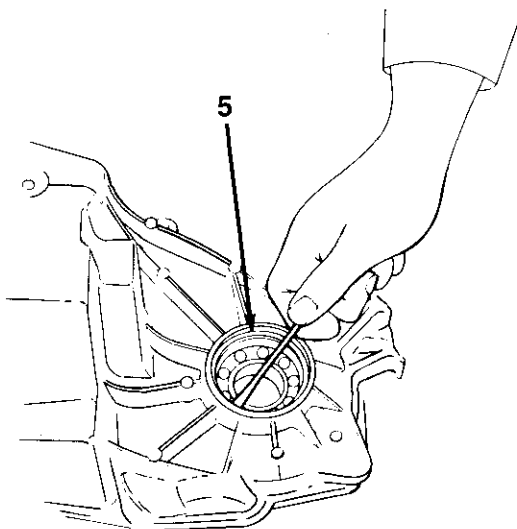


Install the replacement rear bearing with driver handle J 8092 and tool J 33832.



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Remove the snap ring (5) that retains the front bearing (6) using a screwdriver.



84393

Tap the front bearing out of the front case with a rawhide mallet.

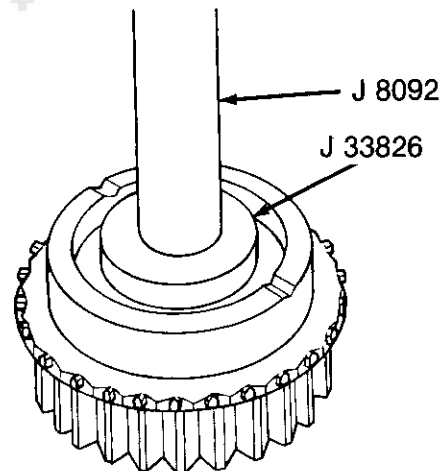
Install the replacement front bearing with driver handle J 8092 and tool J 33833.

NOTE: The front bearing is fully seated when the installer tool contacts the front case.

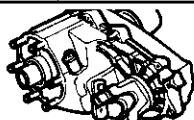
Install the front bearing snap ring (5).

Drive Sprocket Bearings

Remove both sprocket bearings simultaneously with driver handle J 8092 and tool J 33826.

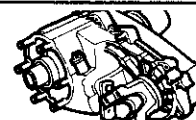


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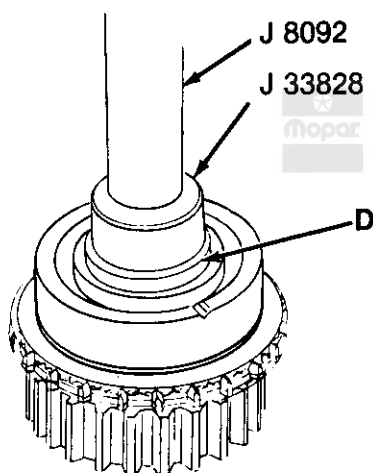
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OVERHAUL



Install the replacement **front** bearing in the sprocket as follows:

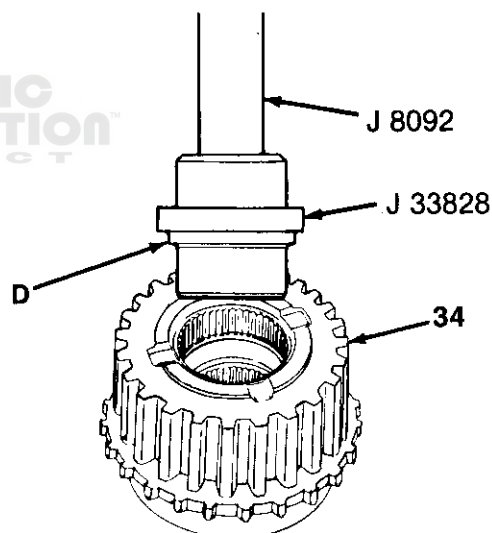
- Mount tool J 33828 on driver handle J 8092. Position the stop flange (D) on tool J 33828 so it faces upward as shown in the illustration.
- Place the front bearing on tool J 33828 and start the bearing in the sprocket.
- Press the bearing inward until it is flush with the front surface of the sprocket.



84396

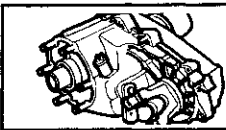
Install the replacement **rear** bearing in the sprocket as follows:

- Reverse tool J 33828 on the driver handle. The stop flange (D) should now face downward as shown in the illustration.
- Place the rear bearing on tool J 33828 and start it in the sprocket.
- Press the bearing inward until it is slightly recessed in the sprocket. The bearing is properly seated when tool J 33828 bottoms against the sprocket.

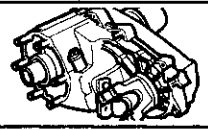


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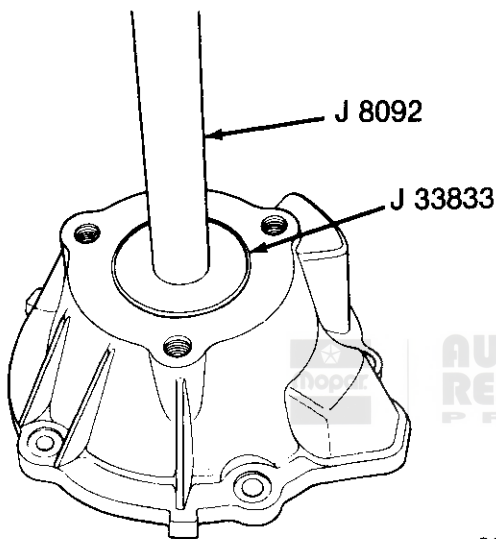
T.C. 207 **OVERHAUL**



Mainshaft Rear Bearing

Tap the bearing (58) out of the rear retainer (60) with a hammer and brass drift.

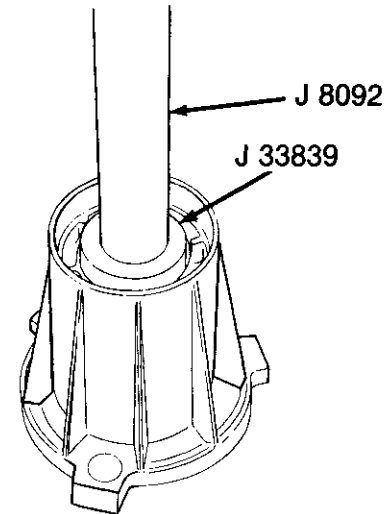
Install the replacement bearing with driver handle J 8092 and tool J 33833.



84321

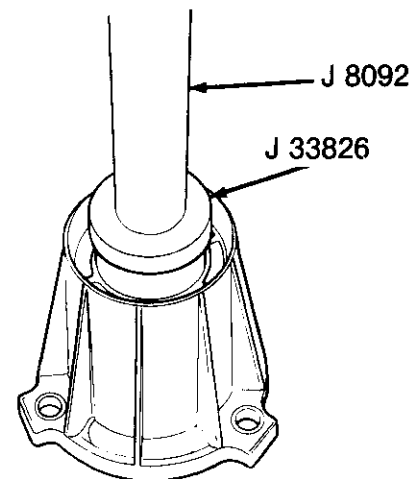
Extension Housing Bushing

Remove the bushing with driver handle J 8092 and tool J 33839.



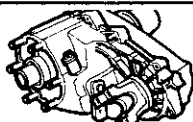
84394

Install the replacement bushing with driver handle J 8092 and tool J 33826. Press the bushing into the housing until the tool bottoms against the housing.



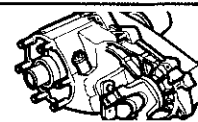
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T.C. 207

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MAINSHAFT ASSEMBLY

Lubricate the mainshaft, sprocket bearings, and synchronizer components with Jeep automatic transmission fluid or equivalent marked Dexron® II.

Install the thrust washer (34) on the mainshaft.

Install the drive sprocket (38) on the mainshaft.

Install the synchronizer stop ring (32) on the mainshaft. The stop ring shoulder should face outward.

Assemble the synchronizer hub, sleeve, struts and springs. Install the sleeve (31) over the hub (29). Insert the struts into the hub slots and install the springs (27 and 30) in the hub to retain the struts.

Install the assembled synchronizer components on the mainshaft. Align the hub and mainshaft splines and tap the hub into place with a rawhide mallet. Be sure the stop ring is properly engaged in the synchronizer hub and sleeve before seating the hub.

Install a replacement snap ring (26) on the mainshaft to retain the synchronizer assembly and drive sprocket.

Install the oil pump (54) and speedometer drive gear (55) on the mainshaft.

ANNULUS AND PLANETARY GEAR ASSEMBLY

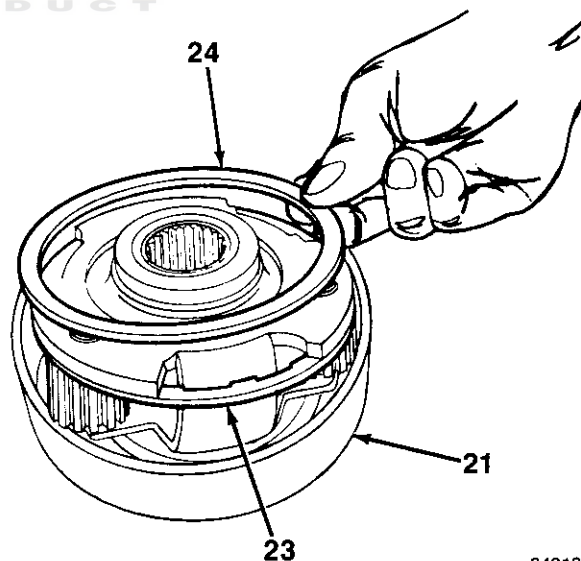
Lubricate the annulus and planetary gears with Jeep automatic transmission fluid or equivalent marked Dexron® II.

Install the front thrust ring (22) in the annulus gear (21).

Install the planetary gear (23) in the annulus gear.

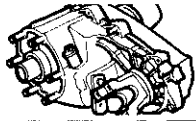
Install the rear thrust ring (24) in the annulus gear.

Install the retaining ring (25). Be sure the retaining ring is fully seated in the annulus gear.



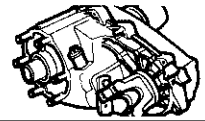
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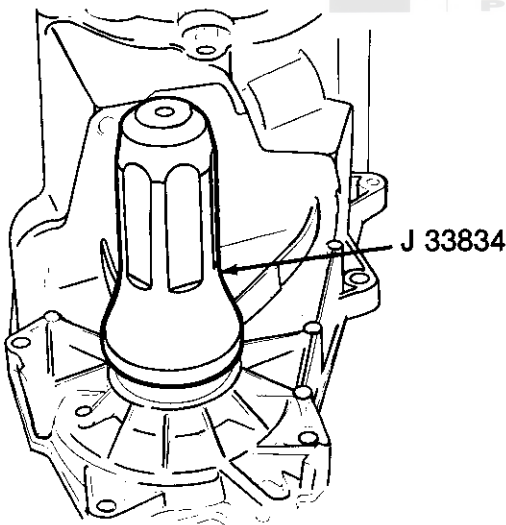
TRANSFER CASE ASSEMBLY

NOTE: Prelubricate all transfer case seals, bearings and bearing surfaces with Jeep automatic transmission fluid, or equivalent marked Dexron® II, during assembly operations.

Apply a bead of Loctite 515 around the low range lockplate bolt holes in the front case and lockplate.

Align the bolt holes in the low range lockplate (11) and front case, and install the lockplate. Install and tighten the lockplate attaching bolts to 34 N·m (25 ft-lbs) torque.

Install a replacement front output shaft oil seal (4) in the front case with tool J 33834.



84401

Install a replacement input gear oil seal (12) in the front case with tool J 33831.

Install sector detent spring (69) and detent bolt (70) in the front case.

Install spacer (68) on shift sector (67) and install the sector in the front case.

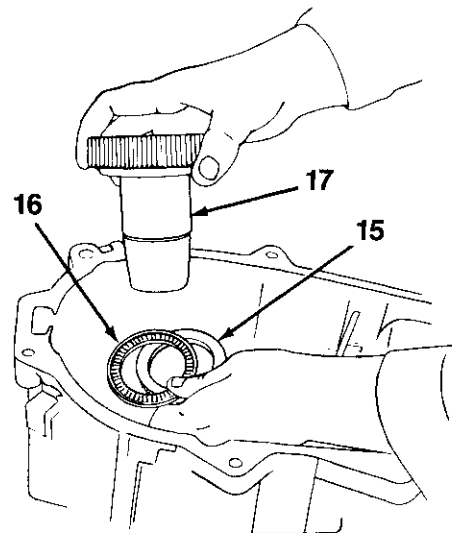
Install the O-ring (74) and retainer (73) on the shift sector and seat them in the case.

Install range lever (72) and range lever nut (71) on the shift sector. Tighten the nut to 24 N·m (18 ft-lbs) torque.

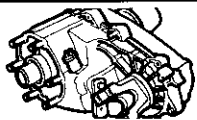
Install cup plug (18) in the input gear (if not installed previously).

Install thrust bearing washer (15) and input gear thrust bearing (16) in the front case.

Insert the input gear (17) through the thrust bearing and washer and into the front case.

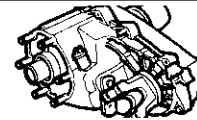


84312



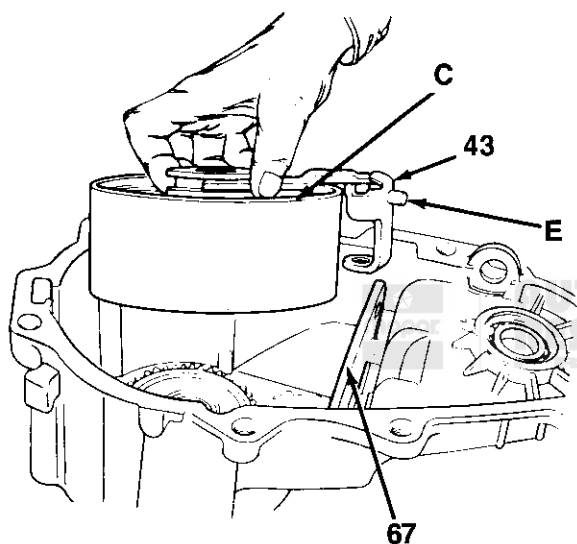
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Install the planetary thrust washer (20) in the input gear.

Install the range fork (43) in the annulus and planetary gear assembly (C). Then install the assembly in the front case. Be sure the input gear is fully engaged in the planetary gear and the annulus gear fully engaged with the low range lockplate.



84315

Align and engage the range fork lug (E) in the shift sector (67).

Install the mainshaft assembly in the front case. Be sure the planetary thrust washer is aligned before attempting to install the mainshaft.

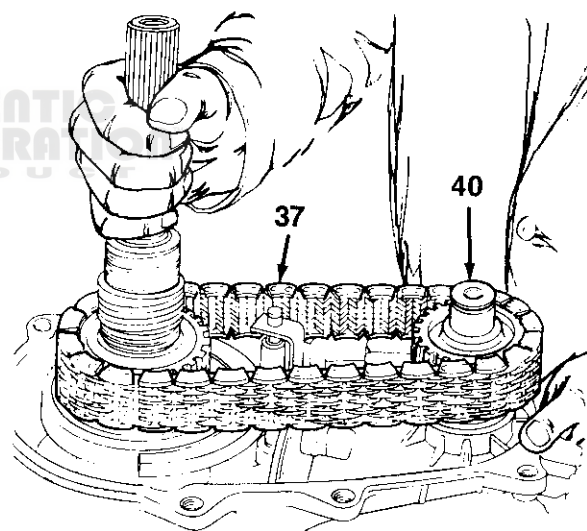
Assemble the mode fork (49), cup (50), spring (51) and shift rail bracket (46).

Position the assembled mode fork (49) in the synchronizer sleeve (31).

Align the mode and range forks and install the shift rail (45). Be sure the shift rail is fully seated in the case and in both forks.

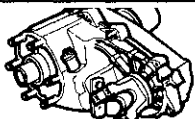
Position the drive chain (37) on the front output shaft (40). Then install the chain on the drive sprocket and the front output shaft in the case.

NOTE: It may be necessary to lift the mainshaft slightly before the front output shaft can be seated in the front case.



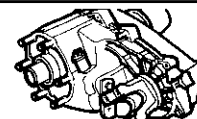
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OVERHAUL

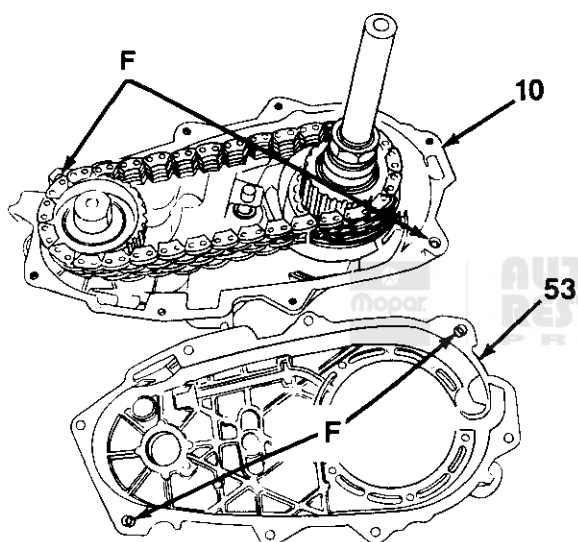


Insert the magnet (66) in the rear case.

Apply a 3mm (1/8-in.) wide bead of Loctite 515, or equivalent, to the sealing surface of the front case.

Align the dowel holes (F) in the two case halves and mount the rear case (53) on the front case (10).

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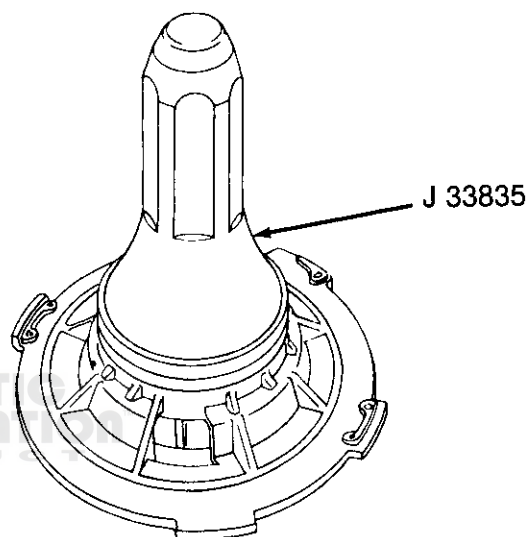


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Insert the locating dowels in the case dowel holes (F) and install the dowel attaching bolts.

Install the remaining front case-to-rear case attaching bolts. Tighten all of the front case-to-rear case bolts to 30 N·m torque.

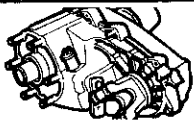
Install a replacement oil seal (56) in the pump housing (57) with tool J 33835.



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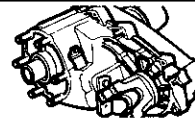
Coat the tabs on the pump housing with petroleum jelly and install the housing in the rear retainer.

Apply a 3mm (1/8-in.) bead of Loctite 515, or equivalent, to the sealing surface of the rear retainer (60). Then align and install the retainer on the rear case. Tighten the retainer bolts to 24 N·m (18 ft-lbs) torque.



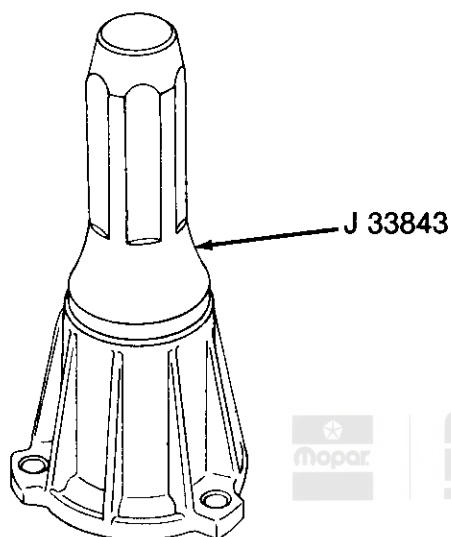
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OVERHAUL



Install a replacement rear bearing snap ring (59) on the mainshaft. Lift the mainshaft slightly and seat the snap ring in its groove.

Install a replacement seal in the extension housing (62) with tool J 33843.



84324

Apply a 3mm (1/8-in.) bead of Loctite 515, or equivalent, to the sealing surface of the extension housing. Then align and install the housing on the rear retainer. Tighten the extension housing bolts to 30 N·m (22 ft-lbs) torque.

Install the front yoke. Install a replacement seal washer and retaining nut on the yoke. Tighten the yoke nut to 149 N·m (110 ft-lbs) torque.

Install and tighten the drain plug (65) plug to 47 N·m (35 ft-lbs) torque.

Install the vacuum switch (8) and replacement switch gasket (9). Tighten the switch to 27 N·m torque.

Fill the transfer case with 2.1 liters (4.5 pints) of Jeep automatic transmission fluid or equivalent marked Dexron® II.

Install and tighten the fill plug (64) to 47 N·m (35 ft-lbs) torque.

NOTE: Adjust the transfer case shift linkage and top off the fluid level after installing the transfer case.

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Component Service Manual



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TRANSFER CASE 231

Application

**Cherokee/Wagoneer
Comanche**

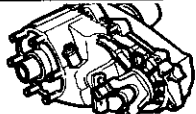
AUGUST, 1986

U.S.A./Canada Edition

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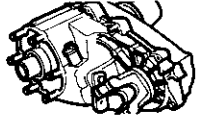
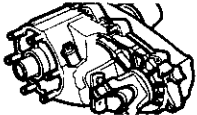
	T.C. 231 TRANSFER CASE	
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	T.C. 231 TRANSFER CASE SPECIAL TOOLS	
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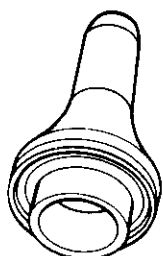
SPECIAL TOOLS

TOOL REF.	DESCRIPTION
J-2619-01	Slide Hammer
J-8092	Driver Handle
J-29369-1	Bearing Remover
J-33826	Bushing Remover/Bearing Installer
J-29170	Sprocket Bearing Tool
J-33829	Mainshaft Pilot Bearing Installer
J-33830	Input Gear Bearing Installer
J-33831	Input Gear Seal Installer
J-29369-2	Bearing Remover
J-33833	Output Shaft Bearing Installer
J-33834	Seal Installer
J-33835	Oil Pump Seal Installer
J-33839	Extension Housing Bushing Remover

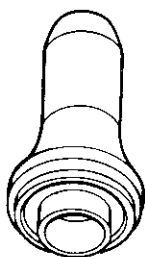
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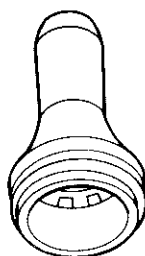
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J-33834



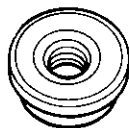
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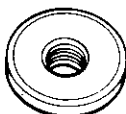
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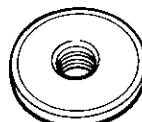
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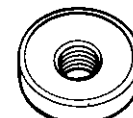
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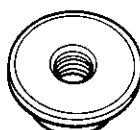
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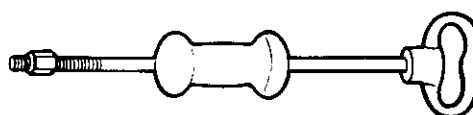
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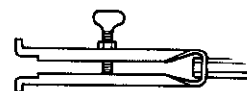
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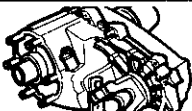
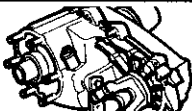
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J-2619-01



J-29369-2

	T.C. 231 TRANSFER CASE SPECIFICATIONS	
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TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Oil pump screws	1.6 N·m (14 in-lbs)	1.4-1.8 N·m (12-15 in-lbs)
Yoke nut	149 N·m (110 ft-lbs)	122-176 N·m (90-130 ft-lbs)
Vacuum switch	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Range lever nut	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)
Front case-to-rear case bolts	41 N·m (30 ft-lbs)	35-46 N·m (26-34 ft-lbs)
Rear retainer bolts	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Extension housing bolts	41 N·m (30 ft-lbs)	35-46 N·m (26-34 ft-lbs)
Drain/fill plugs	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Detent plug	20 N·m (15 ft-lbs)	16-24 N·m (12-18 ft-lbs)
Front bearing retainer bolts	21 N·m (16 ft-lbs)	16-27 N·m (12-20 ft-lbs)

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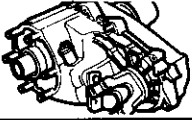
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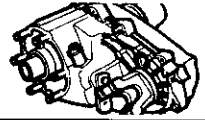
GENERAL SPECIFICATIONS

Transfer Case Type:	Part-time, dual range with low range reduction. Four-wheel drive range is undifferentiated.
Torque Transfer Mode:	Output shaft and sprocket driven by interconnecting drive chain.
Operating Ranges:	2-high, 4-high, 4-low and Neutral. Low range reduction ratio is 2.72:1.
Case Configuration:	Two-piece aluminum with removable extension and rear retainer housings.
Lubricant Capacity: Cherokee/Wagoneer Wrangler/YJ	1.54 liters (3.25 pints) 1.04 liters (2.2 pints)
Required Lubricant:	AMC/JEEP/RENAULT automatic transmission fluid or equivalent marked DEXRON® II.
Transfer Case Fill Level:	To bottom edge of fill plug hole.



T.C. 231 TRANSFER CASE

GENERAL INFORMATION



DESCRIPTION

The Model 231 is a part-time transfer case with a built-in low range reduction gear system. It has three operating ranges plus a Neutral position. The low range system provides a low range reduction ratio for increased low speed torque capability.

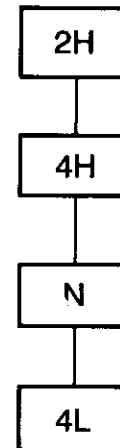
OPERATING RANGES

The Model 231 has three operating ranges which are: two-wheel drive high, four-wheel drive high and four-wheel drive low. The four-wheel drive operating ranges are undifferentiated.

Two-wheel drive range is used for on-road, highway operation. The four-wheel drive ranges are for off-road operation or when the vehicle is driven on paved road surfaces covered by snow, ice or similar low traction elements.

SHIFT MECHANISM

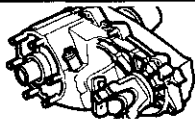
Transfer case operating ranges are selected with a floor mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the shifter bezel cover plate.



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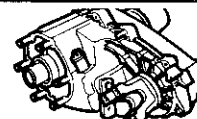
A synchronizer assembly in the transfer case allows the unit to be shifted between the two- and four-wheel high ranges while the vehicle is in motion.

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T.C. 231 TRANSFER CASE

GENERAL INFORMATION



TWO-WHEEL DRIVE OPERATION

Two-wheel drive operation is provided by a disconnect mechanism in the front axle. A vacuum operated shift motor on the axle disconnects the right hand axle shaft when two-wheel drive range is selected. The axle shift motor is controlled by a vacuum switch that is actuated by the transfer case shift sector and linkage.

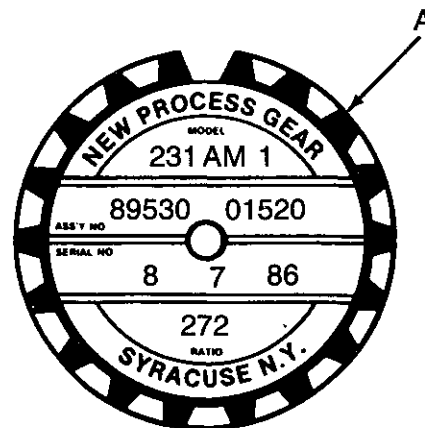
FOUR-WHEEL DRIVE OPERATION

Two internal mechanisms provide four-wheel drive operation. A vacuum shift motor connects the right hand axle shaft and a synchronizer assembly engages the transfer case front output shaft. The shift motor is operated by a vacuum switch mounted on the transfer case. The switch is actuated by the transfer case shift linkage.

IDENTIFICATION

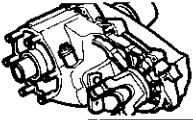
A circular ID tag is attached to the rear case of each Model 231 transfer case. The ID tag (A) provides the transfer case model number, assembly number, serial number and low range ratio.

The transfer case serial number also represents the date of build. For example, a serial number of 8-7-86 would represent August 7, 1986.



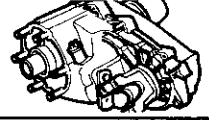
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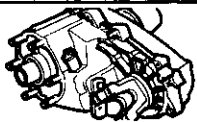
T.C. 231 TRANSFER CASE

SERVICE DIAGNOSIS



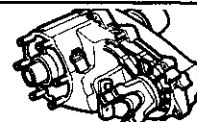
Condition	Possible Cause	Correction
TRANSFER CASE DIFFICULT TO SHIFT OR WILL NOT SHIFT INTO DESIRED RANGE	(1) Vehicle speed too great to permit shifting. (2) If vehicle was operated for extended period in 4H mode on dry paved surface, driveline torque load may cause difficulty. (3) Transfer case external shift linkage binding. (4) Insufficient or incorrect lubricant. (5) Internal components binding, worn or damaged.	(1) Stop vehicle and shift into desired range. Or reduce speed to 3-4 km/h (2-3 mph) before attempting to shift. (2) Stop vehicle, shift transmission to neutral, shift transfer case to 2H mode and operate vehicle in 2H on dry paved surfaces. (3) Lubricate, repair or replace linkage, or tighten loose components as necessary. (4) Drain and refill to edge of fill hole with Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. (5) Disassemble unit and replace worn or damaged components as necessary.
TRANSFER CASE NOISY IN ALL DRIVE MODES	(1) Insufficient or incorrect lubricant.	(1) Drain and refill to edge of fill hole with Jeep Automatic Transmission Fluid or equivalent labeled DEXRON® II only. Check for leaks and repair if necessary. Note: If unit is still noisy after drain and refill, disassembly and inspection may be required to locate source of noise.
NOISY IN — OR JUMPS OUT OF FOUR WHEEL DRIVE LOW RANGE	(1) Transfer case not completely engaged in 4L position. (2) Shift linkage loose or binding. (3) Range fork damaged, inserts worn, or fork is binding on shift rail. (4) Low range gear worn or damaged.	(1) Stop vehicle, shift transfer case to Neutral, then shift back into 4L position. (2) Tighten, lubricate or repair linkage as necessary. (3) Disassemble unit and repair as necessary. (4) Disassemble and repair as necessary.
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	(1) Transfer case overfilled. (2) Vent closed or restricted. (3) Output shaft seals damaged or installed incorrectly.	(1) Drain to correct level. (2) Clear or replace vent if necessary. (3) Replace seals. Be sure seal lip faces interior of case when installed. Also be sure yoke seal surfaces are not scored or nicked. Remove scores and nicks with fine sandpaper or replace yoke(s) if necessary.
ABNORMAL TIRE WEAR	(1) Extended operation on dry hard surface (paved) roads in 4H range.	(1) Operate in 2H on hard surface (paved) roads.

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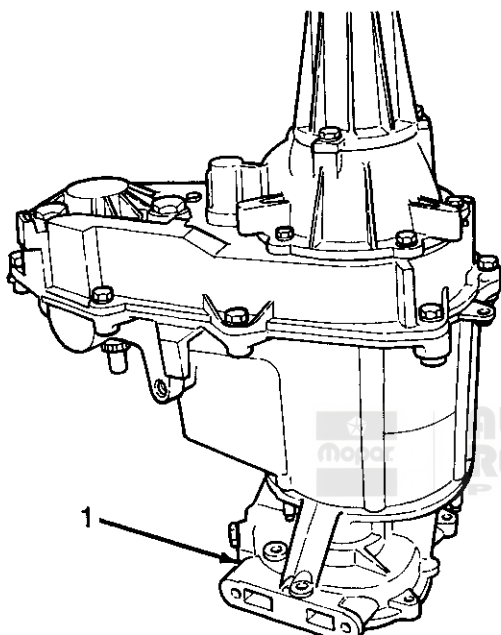
T.C. 231 TRANSFER CASE

OVERHAUL



TRANSFER CASE DISASSEMBLY

NOTE: The rear extension housing (1) from a manual or automatic transmission makes a convenient support stand for the transfer case. The housing can be used for all disassembly/assembly operations.



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Remove the fill and drain plugs.

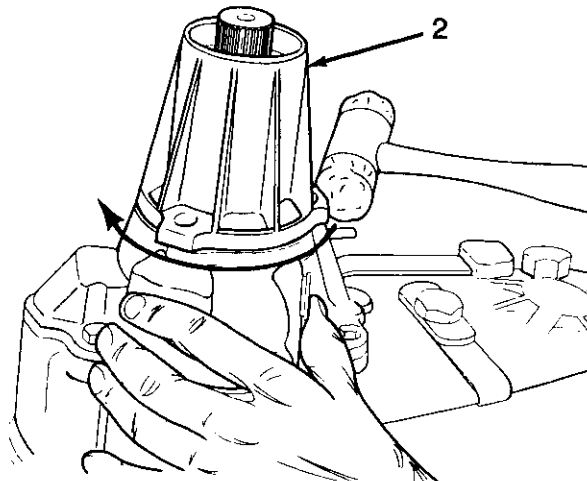
Remove the front yoke. Discard the yoke seal washer and nut. They are not reusable.

Move the transfer case range lever all the way rearward to the four-wheel low position.

Remove the extension housing attaching bolts.

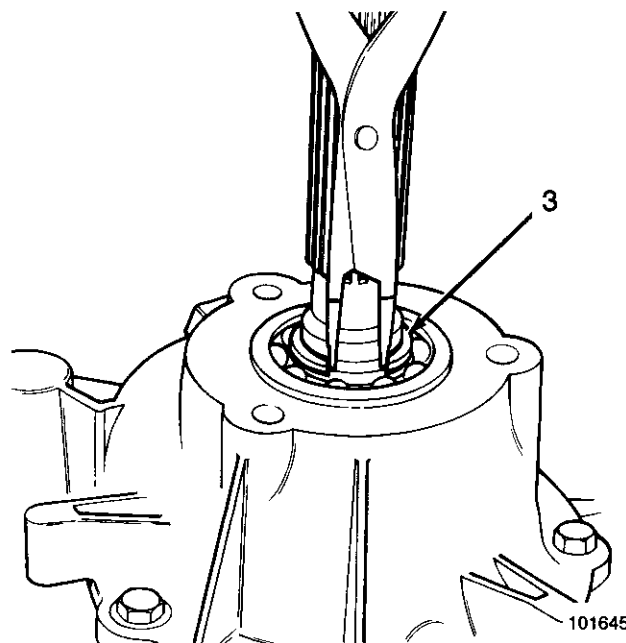
Tap the extension housing (2) in a clockwise direction with a rawhide mallet to break the sealer bead. Then remove the housing.

CAUTION: To avoid damaging the sealing surfaces of the extension housing and rear retainer, do not attempt to pry or wedge the housing off the retainer.



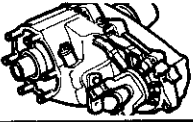
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Remove the rear bearing snap ring (3) from the mainshaft. Discard the snap ring.



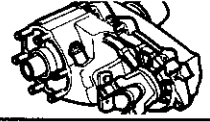
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Remove the rear retainer attaching bolts.



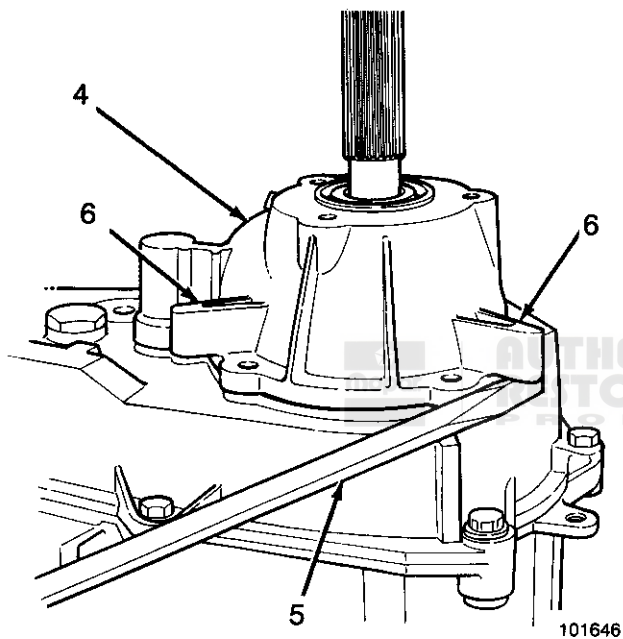
T.C. 231 TRANSFER CASE

OVERHAUL



Remove the rear retainer (4). Position a screwdriver (5) under each of the tabs (6) on the retainer housing. Then carefully pry the retainer upward and off the rear case.

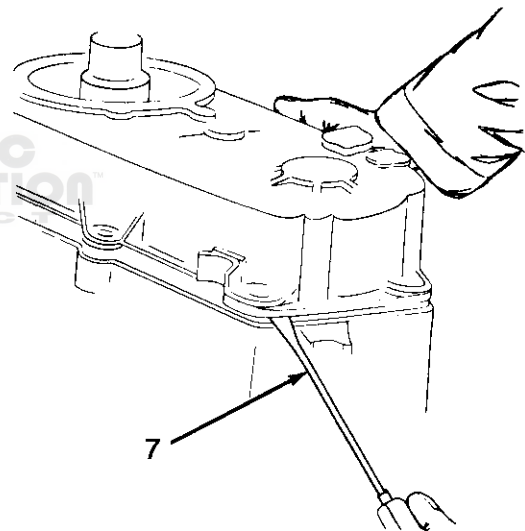
CAUTION: Do not pry against the sealing surfaces of the retainer or rear case. The surfaces could be damaged.



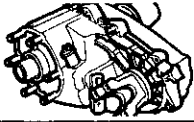
Remove the bolts attaching the rear case to the front case. Retain the bolts and the washers used at the dowel bolt locations.

Separate the rear case from the front case using two screwdrivers (7). Insert the screwdrivers into the slots cast in the case ends. Then gently pry upward to break the sealer bead and separate the case halves.

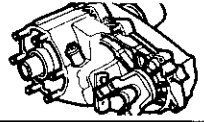
CAUTION: Do not pry against the sealing surfaces of the retainer or rear case. The surfaces could be damaged.



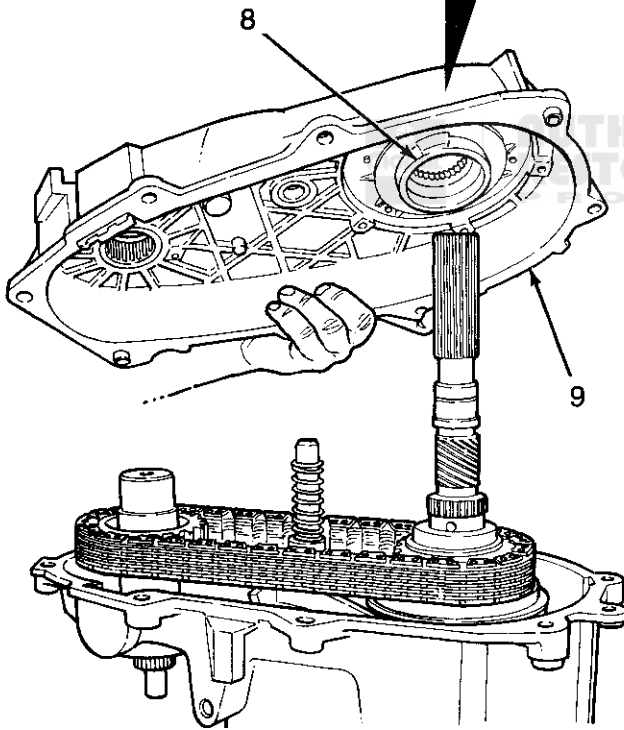
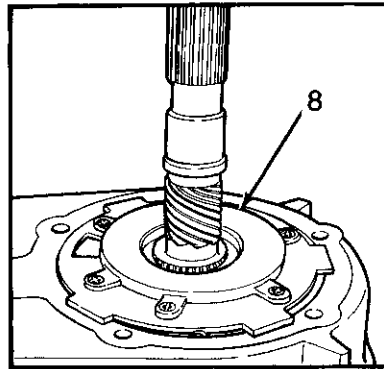
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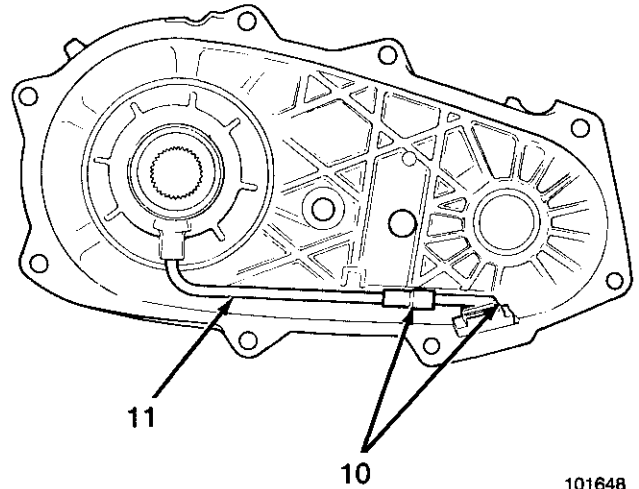


Remove the oil pump (8) and rear case (9) as an assembly.



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Slide the oil pickup screen (10) out of the case pocket. Disconnect the screen from the pickup tube (11).

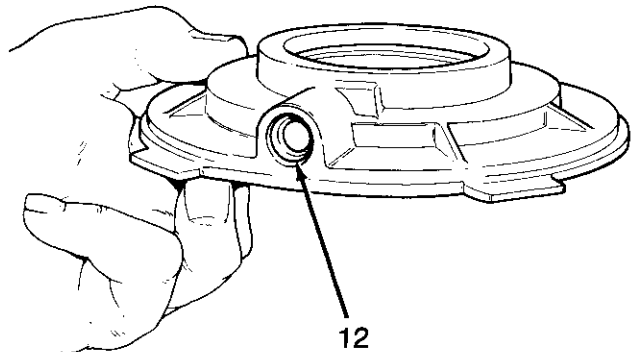


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Remove the pickup tube (11) from the oil pump.

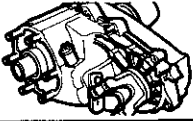
Remove the oil pump from the rear case.

Remove the pickup tube O-ring (12) from the oil pump (10). Discard the O-ring.

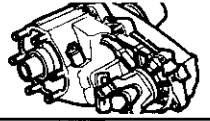


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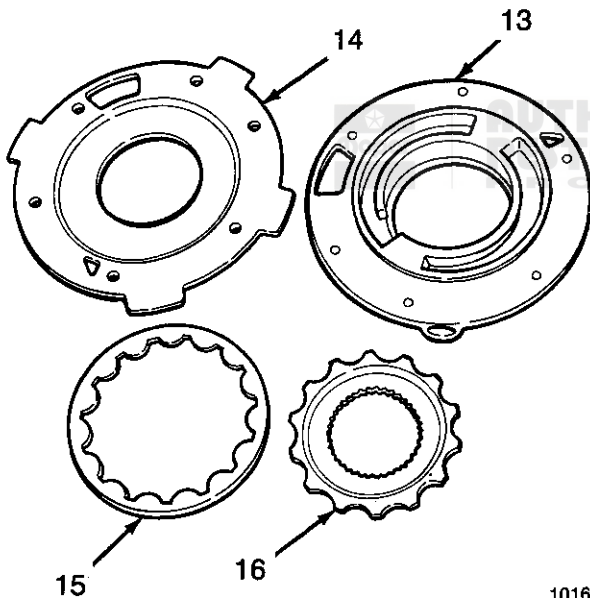


T.C. 231 TRANSFER CASEOVERHAUL

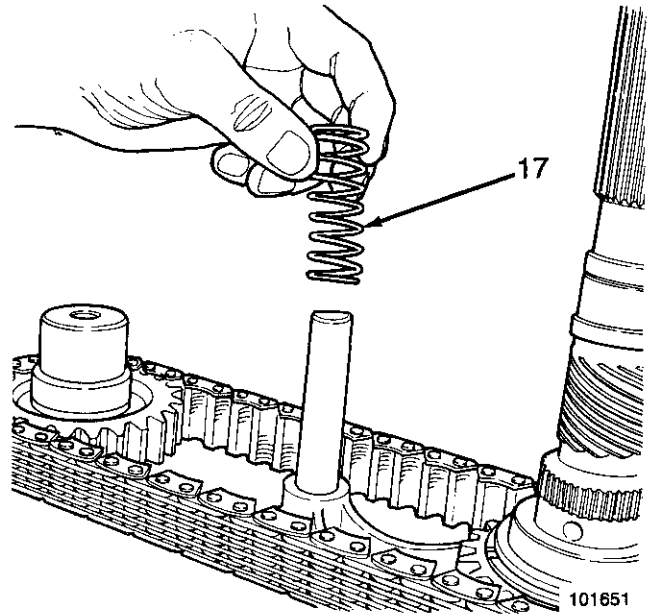


Disassemble the oil pump as follows:

- Mark position of the pump housings for assembly reference.
- Remove the screws that attach the two halves of the pump.
- Remove the feed housing (13) from the gear housing (14).
- Note position of the pump gears (15) and (16) in the gear housing and remove the gears.

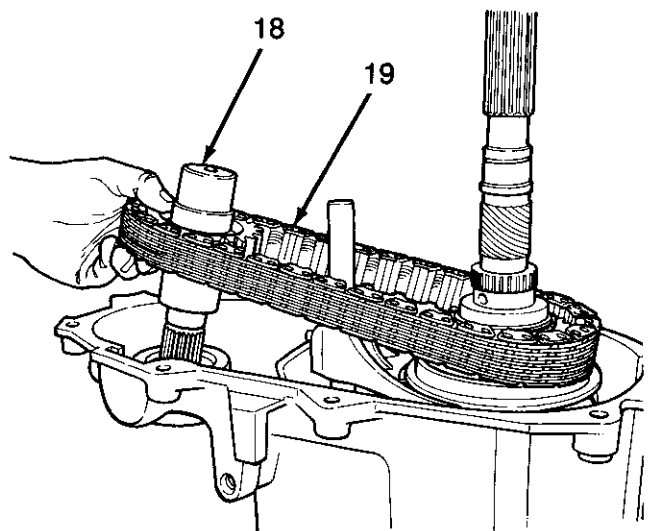


Remove the mode spring (17).

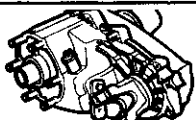


Tap the front output shaft (18) upward with a rawhide mallet to free it from the shaft bearing.

Remove the front output shaft (18) and drive chain (19) as an assembly. Raise the mainshaft slightly to ease chain removal if necessary.

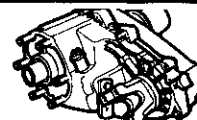


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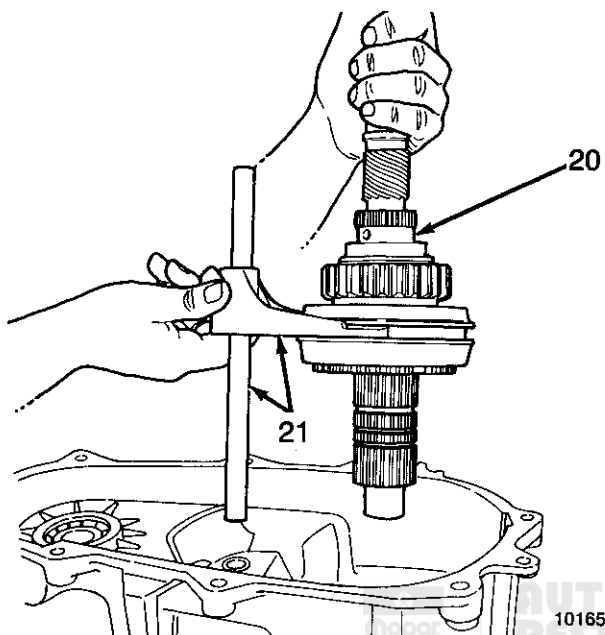


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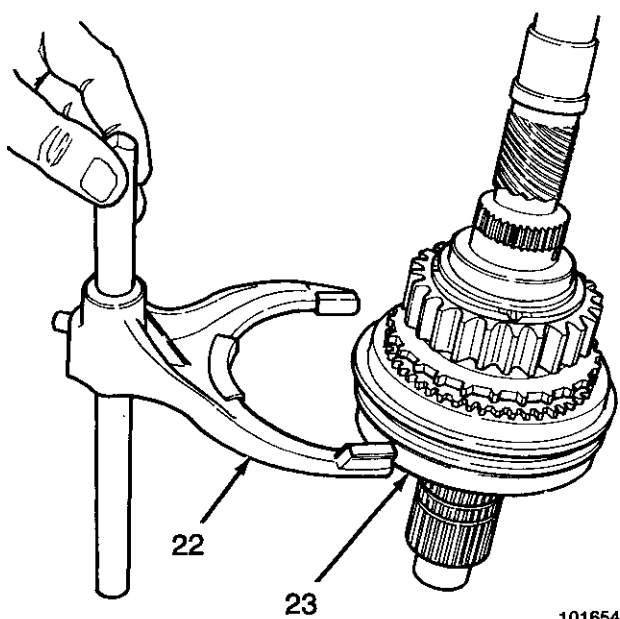


Remove the mainshaft (20) and mode fork and shift rail (21) from the front case as an assembly.

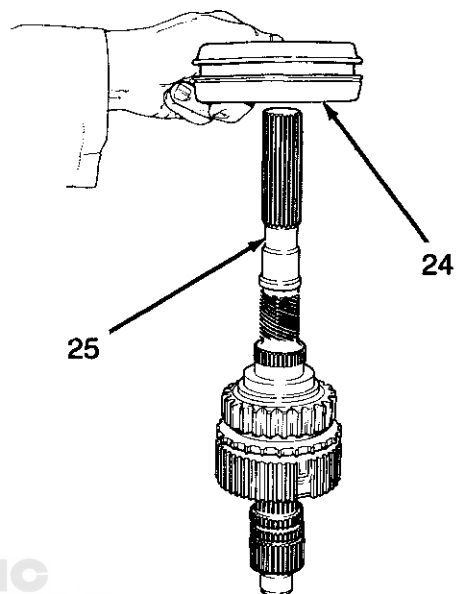


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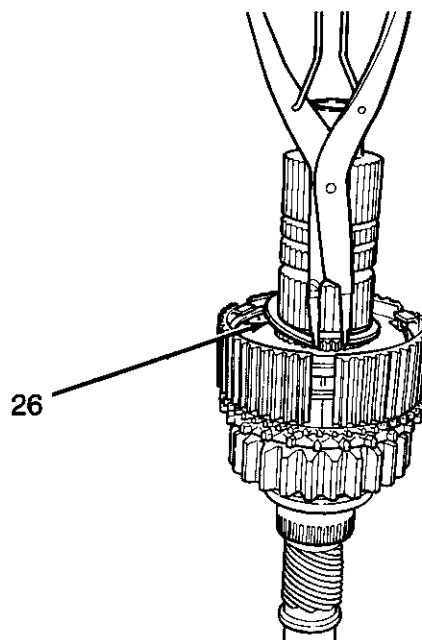
Remove the mode fork and shift rail (22) from the synchronizer sleeve (23). Mark position of the sleeve (23) for assembly reference.

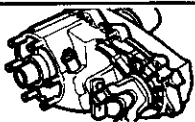


Remove the synchronizer sleeve (24) from the mainshaft (25).



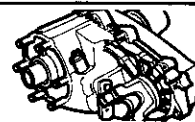
Remove the synchronizer hub snap ring (26). Discard the snap ring.



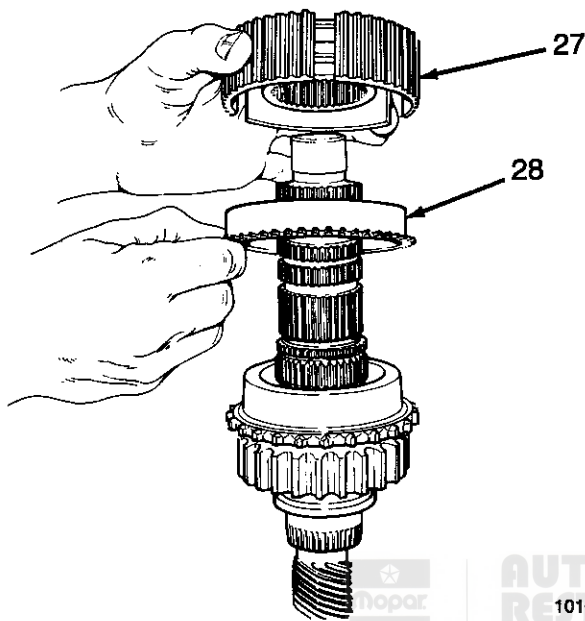


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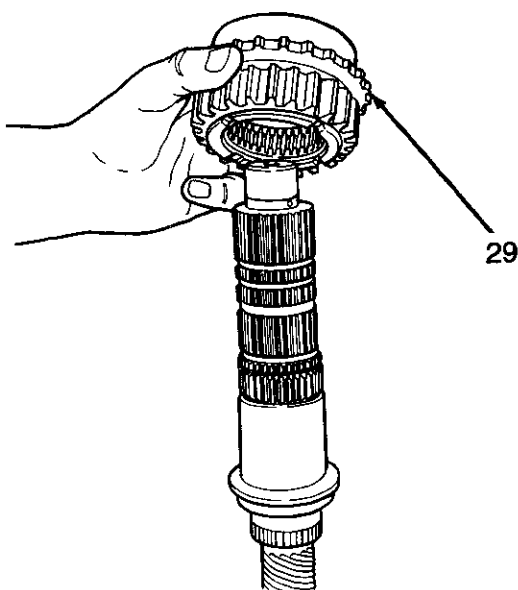
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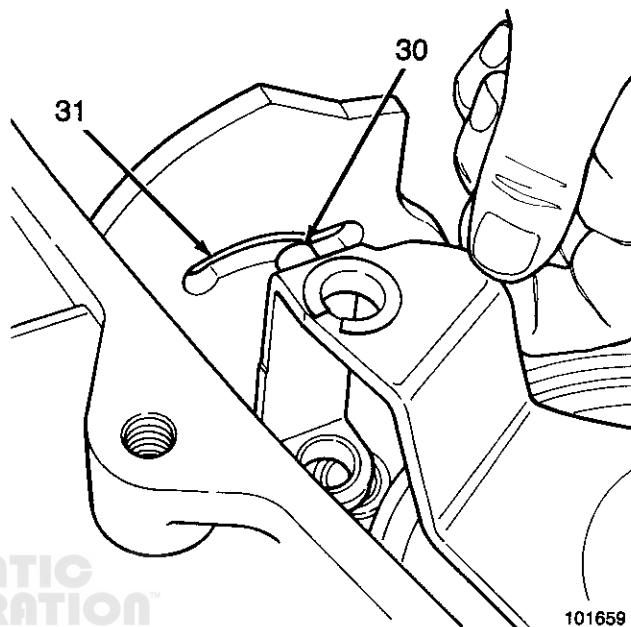
Remove the synchronizer hub (27) and stop ring (28) from the mainshaft.



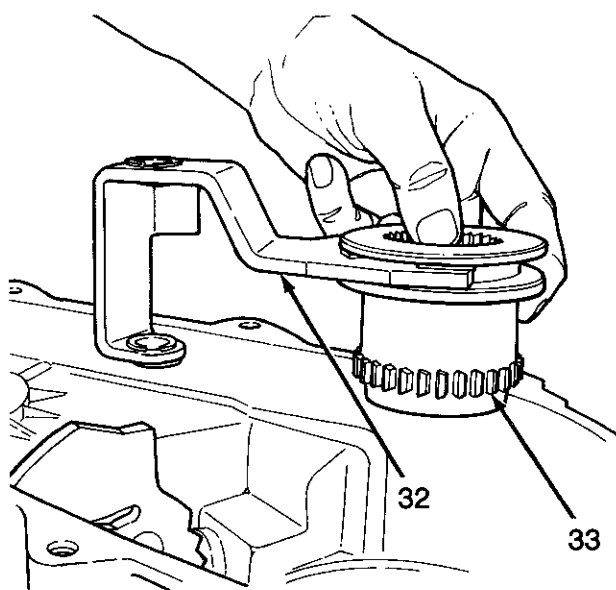
Remove the drive sprocket (29) from the mainshaft.



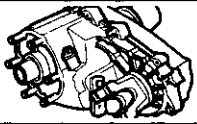
Slide the range fork pin (30) out of the slot in the sector (31).



Remove the range fork (32) and shift hub (33) as an assembly. Note position of the fork and hub for assembly reference.

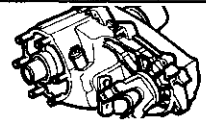


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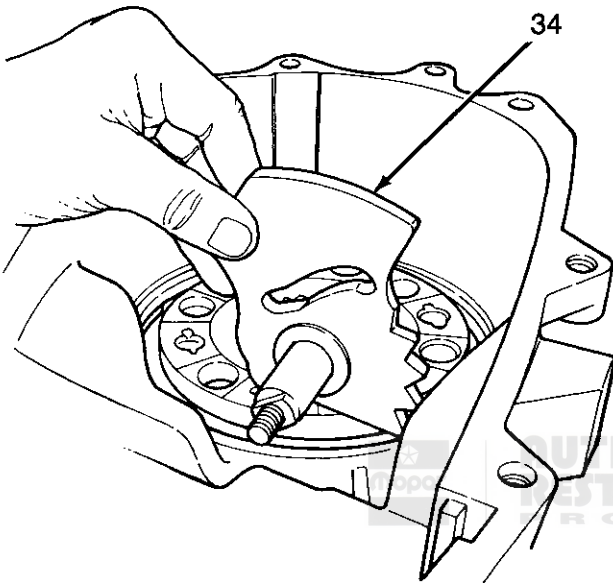
T.C. 231 TRANSFER CASE

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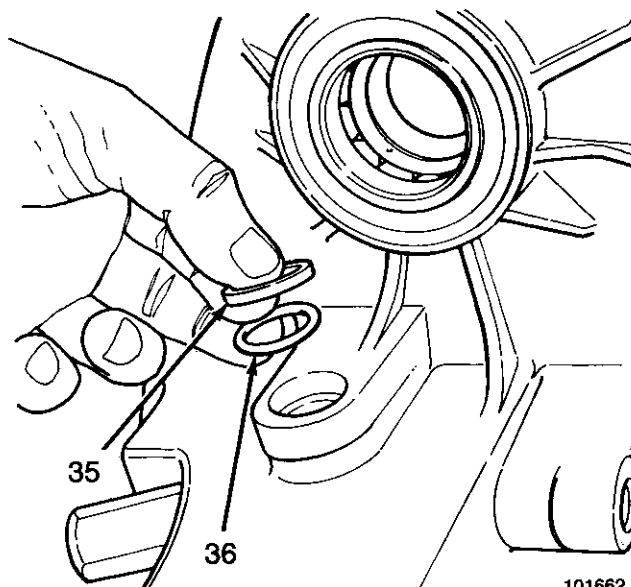
Remove the transfer case range lever from the sector shaft. Retain the lever attaching nut and washer.

Remove the shift sector (34).



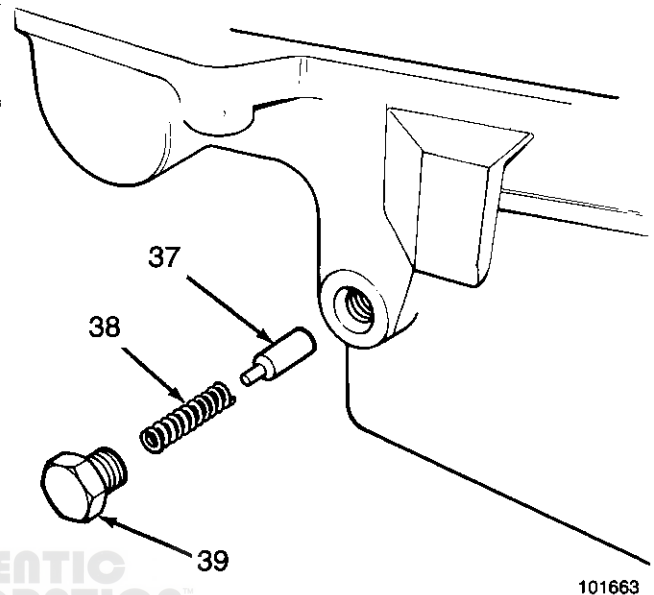
101661

Remove the sector shaft bushing (35) and O-ring (36).



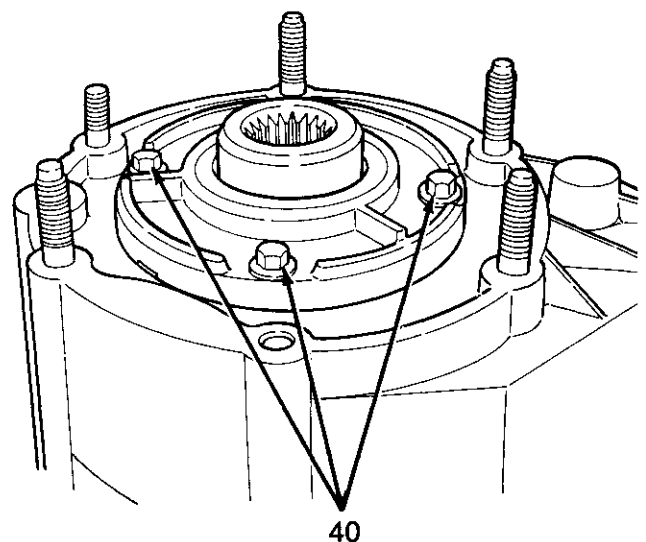
101662

Remove the shift detent pin (37), spring (38) and plug (39).



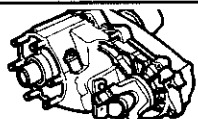
101663

Turn the front case over and remove the front bearing retainer attaching bolts (40).

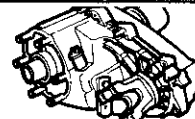


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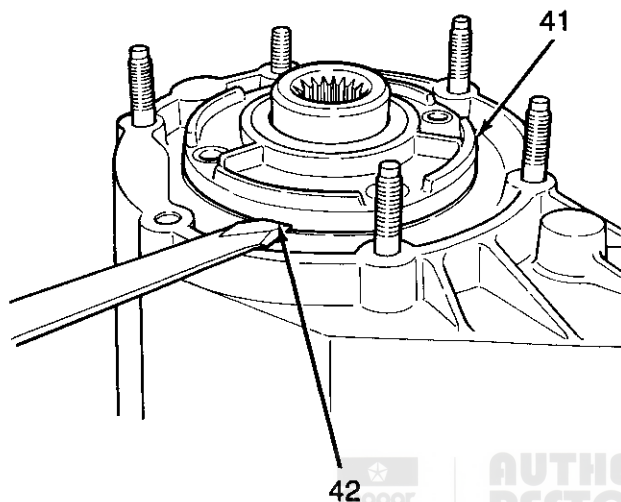
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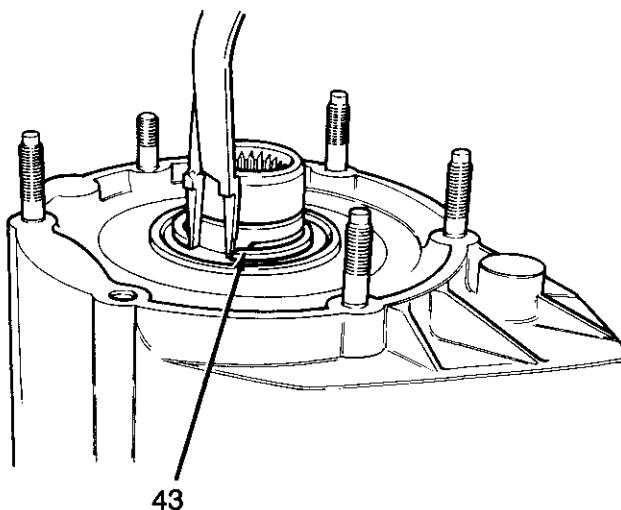


Remove the front bearing retainer (41). Carefully pry the retainer loose with a screwdriver. Position the screwdriver in the slots (42) cast into the retainer.



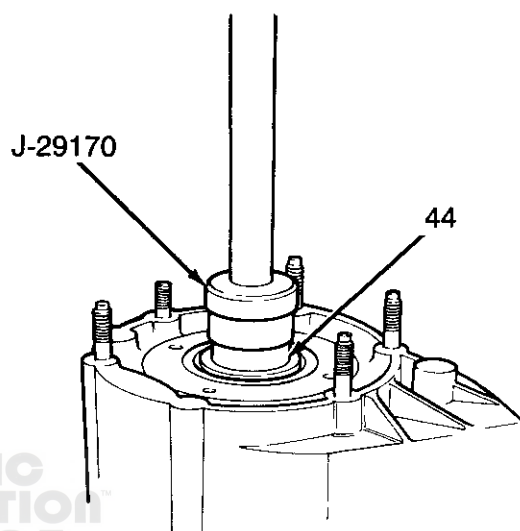
101665

Remove the input gear snap ring (43).



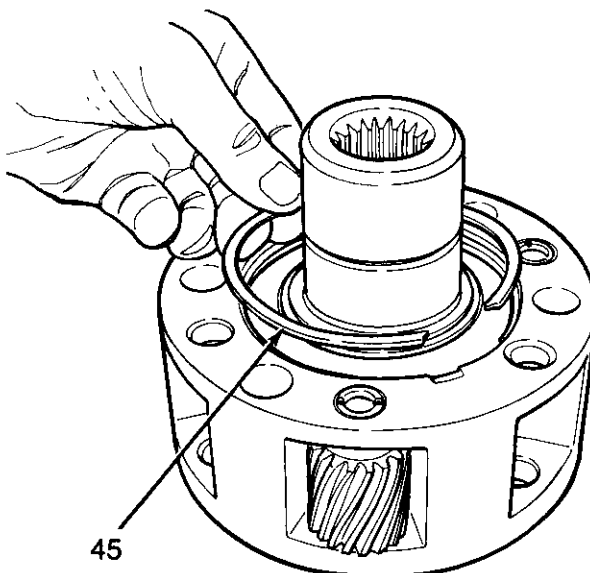
101666

Press the input and low range gear assembly (44) out of the input gear bearing with tool J-29170 and an arbor press.



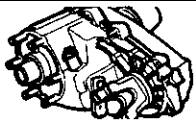
101667

Remove the low range gear snap ring (45).



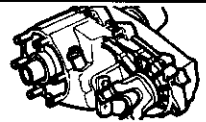
101668

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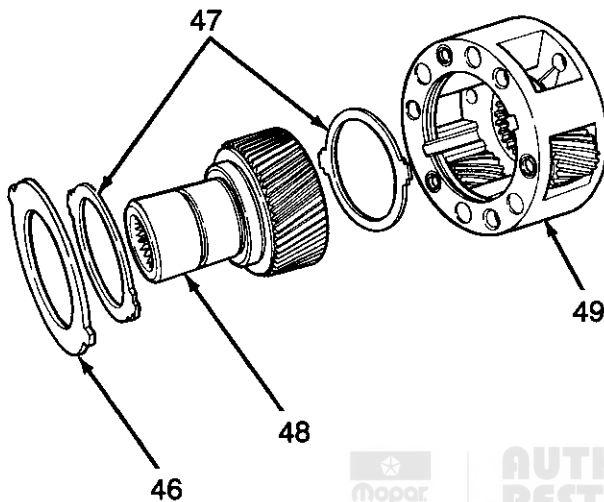


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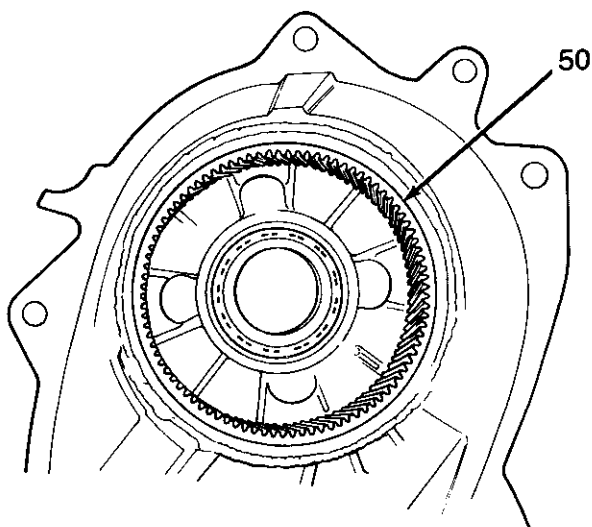


Remove the input gear retainer (46), thrust washers (47) and input gear (48) from the low range gear (49).



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NOTE: The low range annulus gear (50) is not a serviceable component. If the gear is damaged, replace the gear and front case as an assembly.



101670

Remove the oil seals from the rear retainer, rear extension housing, oil pump feed housing and case halves. Discard the seals.

Remove the magnet from the front case.

CLEANING AND INSPECTION

Clean the transfer case components thoroughly with solvent. Remove all traces of sealer from the case and retainer seal surfaces.

Clean the oil pickup screen with solvent and dry it with compressed air. Also use compressed air to remove solvent residue from all oil feed passages and channels.

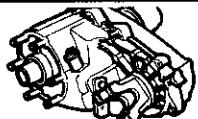
Inspect the case halves, extension housing and retainers for cracks, porosity, or damaged sealing surfaces. Inspect the shafts, gears, chain and shift components for wear or damage.

Inspect all of the transfer case bearings for wear, roughness, pitting, or galling. Replace worn or damaged bearings as outlined in the assembly section.

TRANSFER CASE ASSEMBLY

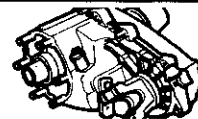
Lubricate the transfer case components with JEEP automatic transmission fluid or an equivalent Dexron® II fluid before installation.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Be sure replacement bearings do not block the feed holes.



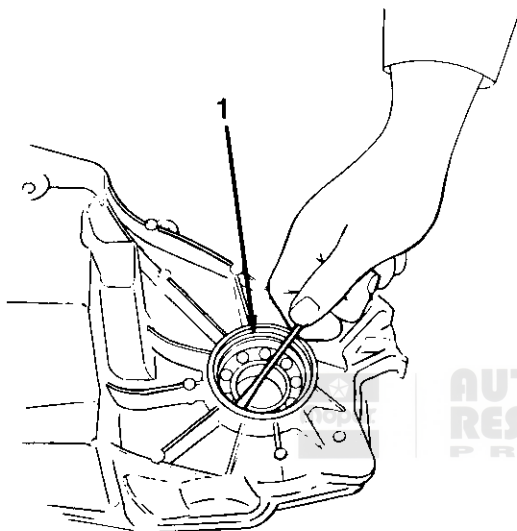
T.C. 231 TRANSFER CASE

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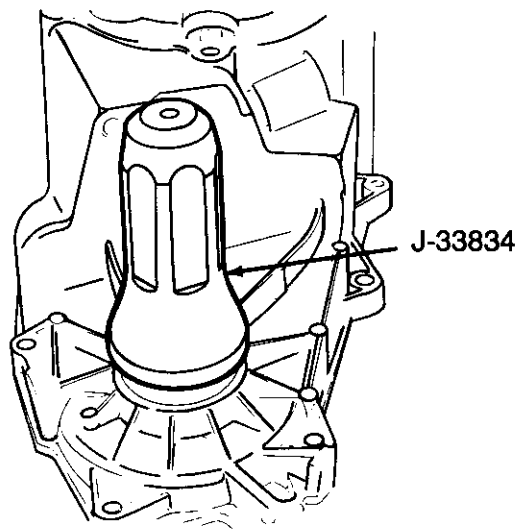
Replace the output shaft front bearing and seal as follows:

- Remove the shaft oil seal from the front case.
- Remove the bearing snap ring (1).



84393

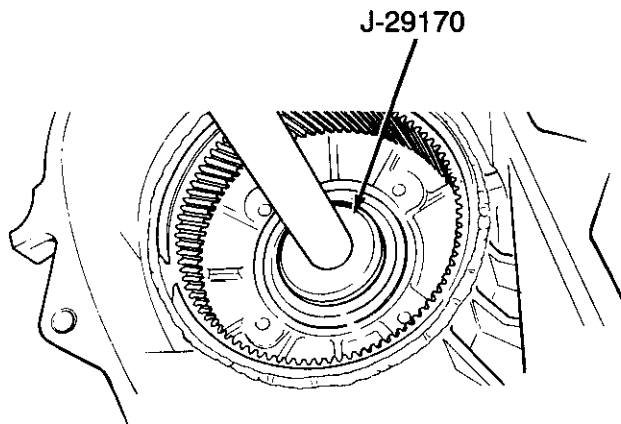
- Tap the original bearing out of the case with a plastic mallet.
- Install the replacement bearing with driver handle J-8092 and tool J-33833. The bearing is fully seated when tool J-33833 contacts the front case.
- Install the bearing snap ring (1).
- Install the replacement shaft seal with tool J-33834.



84401

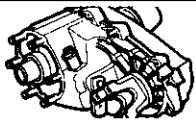
Replace the input gear bearing as follows:

- Press the bearing out of the front case with tool J-29170 and an arbor press.



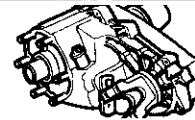
101671

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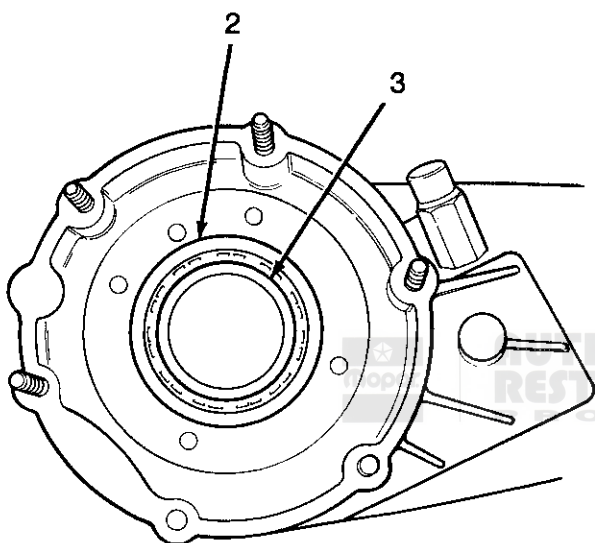
T.C. 231 TRANSFER CASE

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- Install the snap ring (2) on the replacement bearing.
- Install the bearing (3) into the case with tool J-29170 and a wood block. Install the bearing far enough into the case to seat the snap ring (2) against the case.

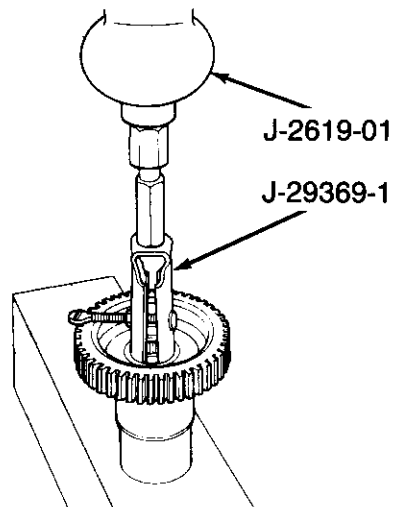
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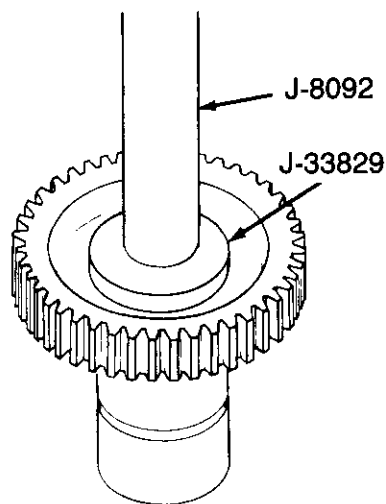
Replace the input gear pilot bearing as follows:

- Remove the pilot bearing with slide hammer J-2619-01 and tool J-29369-1.

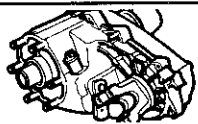


84298

- Install the replacement pilot bearing with driver handle J-8092 and tool J-33829.

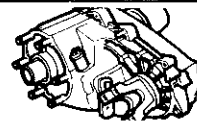


84311

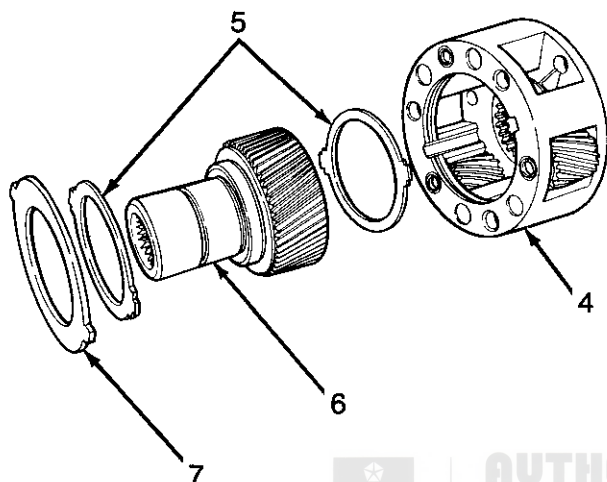


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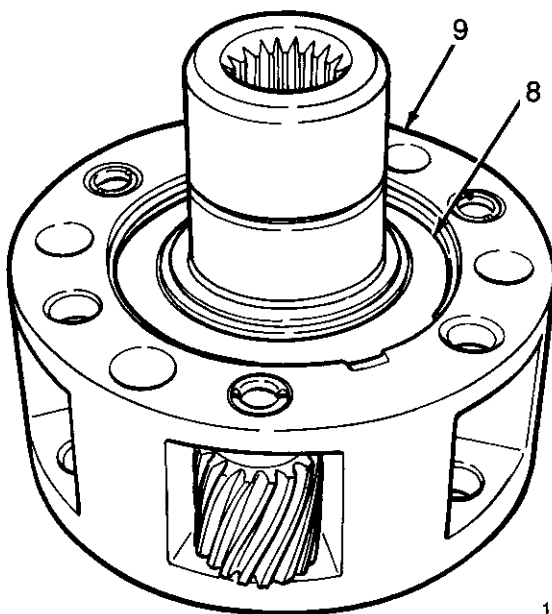


Assemble the low range gear (4), input gear thrust washers (5), input gear (6) and input gear retainer (7).



101673

Install the input gear snap ring (8). Be sure the snap ring is seated in the snap ring groove of the low range gear (9).

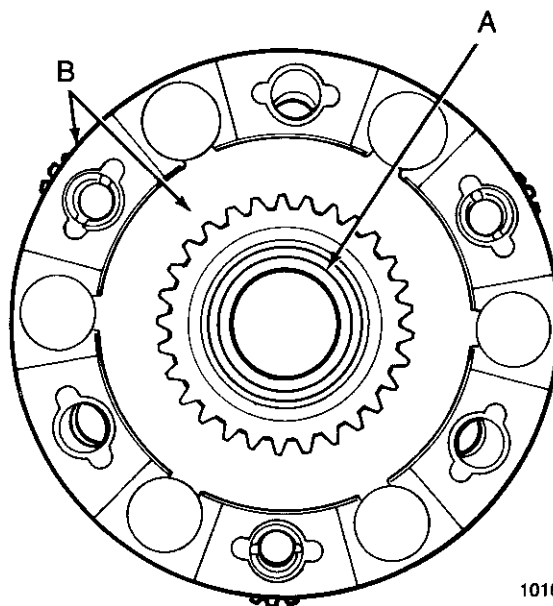


101674

Install the assembled input and low range gears as follows:

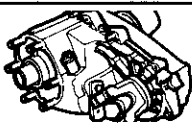
- Lubricate the input gear shaft with automatic transmission fluid.
- Start the input gear shaft into the bearing in the front case.
- Press the input gear shaft into the front bearing with tool J-33829 and an arbor press. Be sure the tool is seated in the input gear before applying any pressure.

CAUTION: Use tool J-33829 only to press the input gear into the front bearing. An incorrect tool could push the input gear pilot bearing (A) too far into the gear bore. Also, do not press against the end surface (B) of the low range gear. The gear case and thrust washers could be damaged.

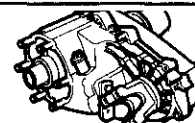


101675

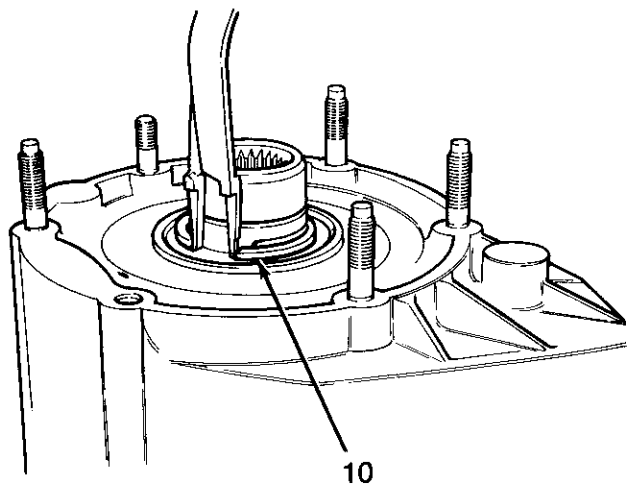
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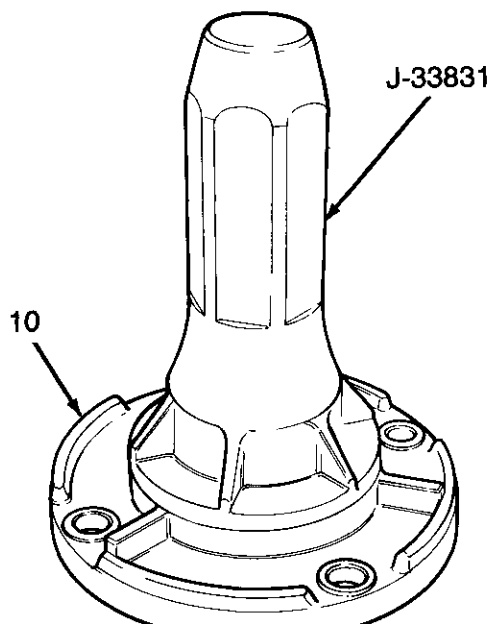


Install a replacement input gear snap ring (10).



101706

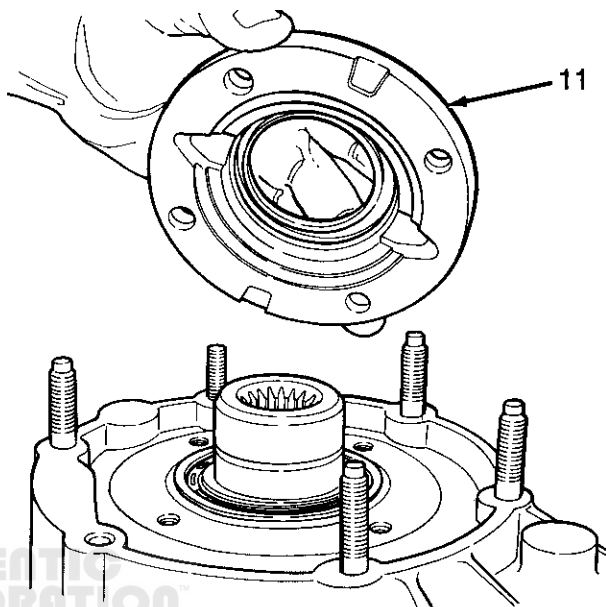
Install a replacement oil seal in the front bearing retainer (10) with tool J-33831.



101705

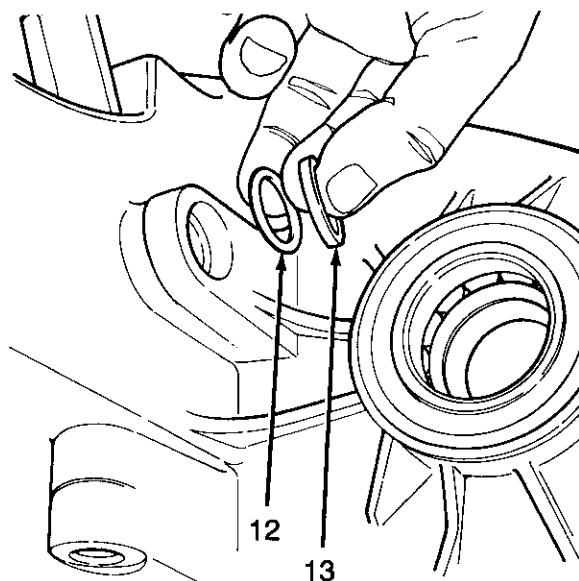
Apply a 3 mm (1/8 inch) wide bead of sealer to the seal surface of the front bearing retainer (11). Use Jeep Gasket-In-A-Tube sealer or an equivalent RTV-type sealer.

Install the front bearing retainer (11) on the front case. Tighten the retainer bolts to specified torque.



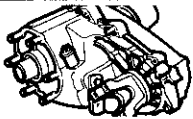
101707

Install a replacement sector shaft O-ring (12) and bushing (13) in the case bore.

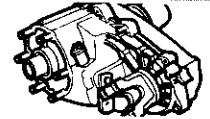


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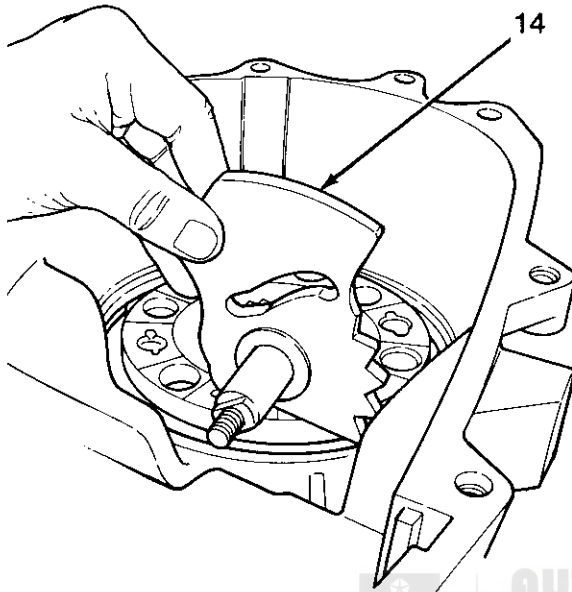
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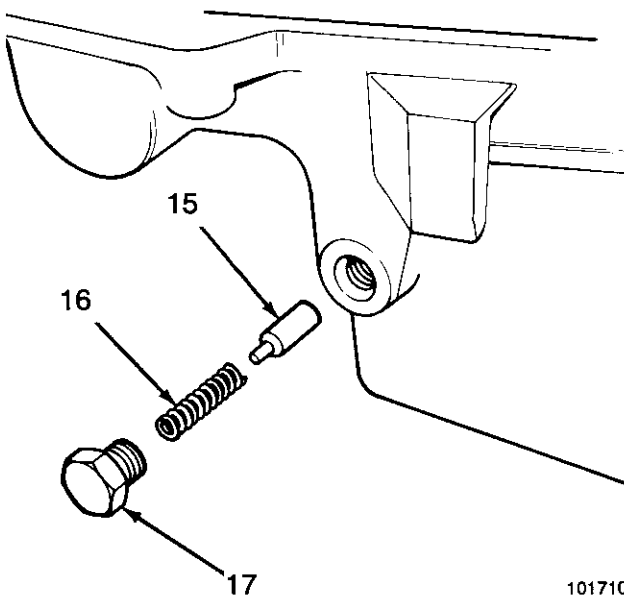
Install the range sector (14) in the case.



101709

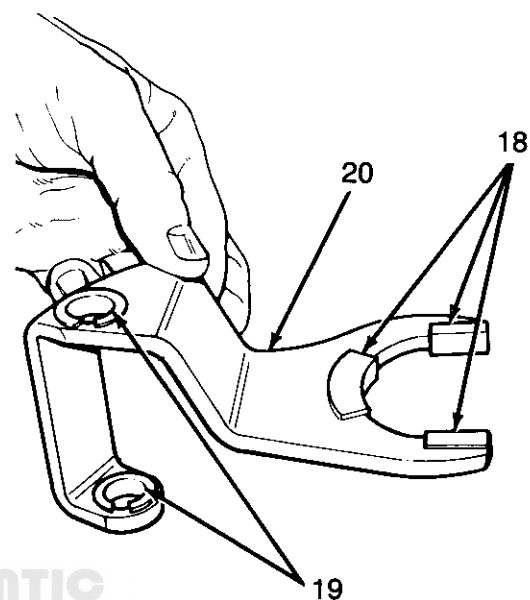
Install the range lever and lever attaching nut on the range sector shaft. Tighten the attaching nut to specified torque.

Install the detent (15), detent spring (16) and detent plug (17) in the case.



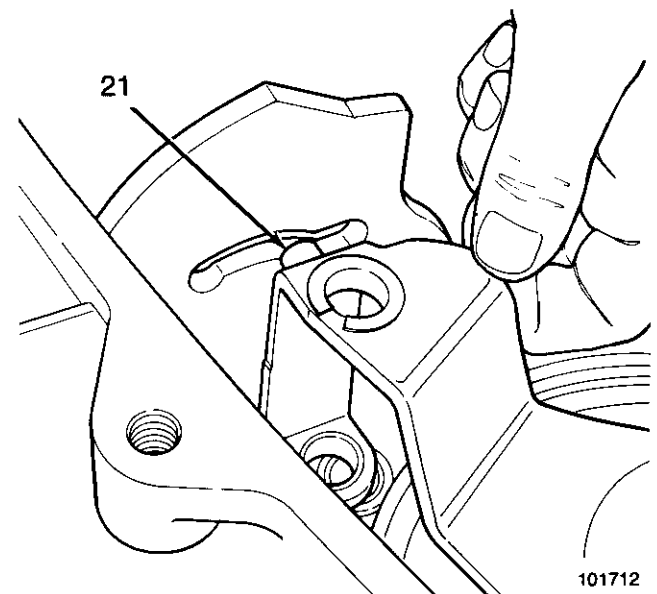
101710

Install replacement pads (18) and shift rail bushings (19) in the range fork (20).



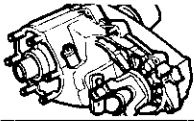
101711

Assemble and install the range fork and shift hub. Be sure the range fork pin (21) is engaged in the sector slot.



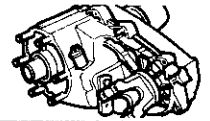
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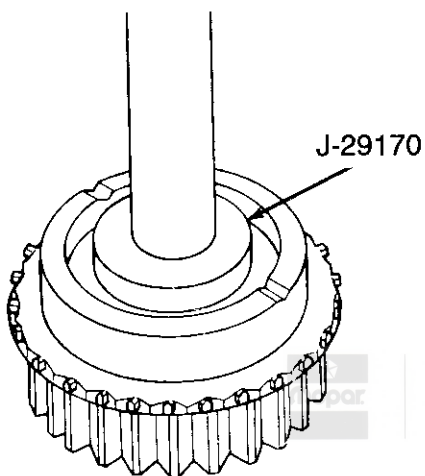
OVERHAUL



Install replacement bearings in the drive sprocket (22) as follows:

- Press both bearings out of the sprocket simultaneously with tool J-29170 and an arbor press.

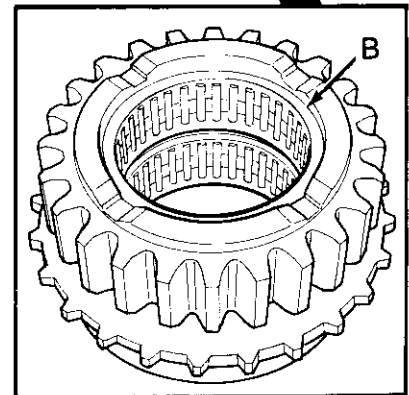
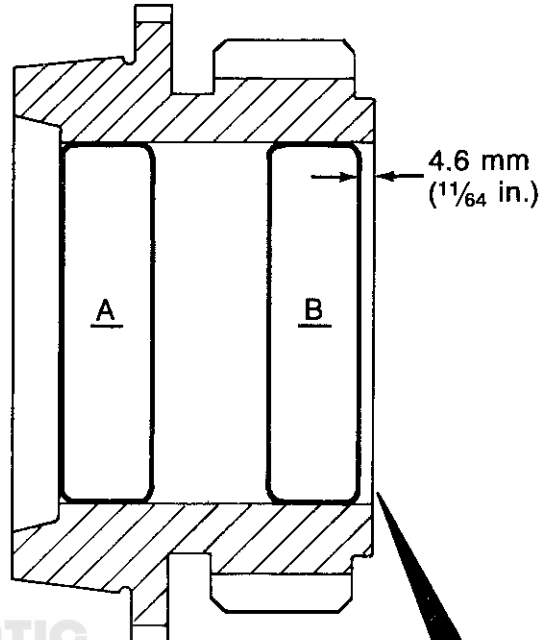
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84395A

- Install the replacement front bearing (A) with an arbor press and tool J-29170. Press the bearing in until flush with the edge of the bore as shown.
- Install the replacement rear bearing (B) with an arbor press and tool J-29170. Press the bearing in until it is 4.6 mm (11/64 inch) below the edge of the bore as shown.

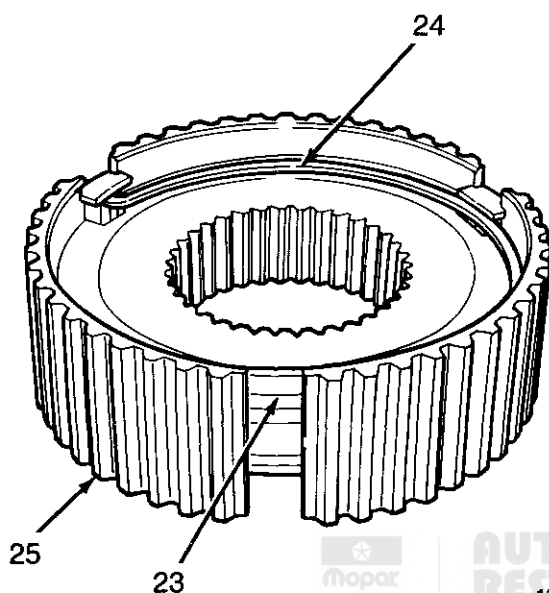
CAUTION: Do not press the bearings any farther into the sprocket than specified. The bearings could block the mainshaft oil feed hole if pressed too deeply into the sprocket.



101713

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Install the struts (23) and spring (24) in the synchronizer hub (25).



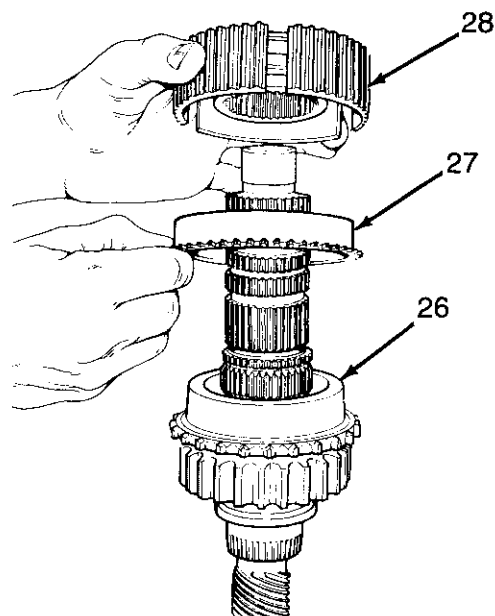
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Lubricate the drive sprocket bearings and install the sprocket (26) on the mainshaft.

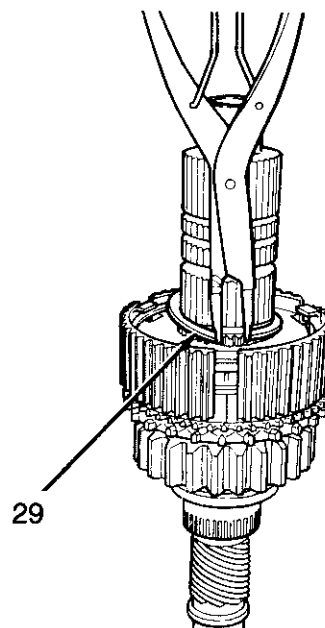
Install the synchronizer stop ring (27) on the mainshaft. Seat the ring on the drive sprocket.

Install the synchronizer hub (28) on the mainshaft. Align and seat the hub struts on the stop ring lugs.



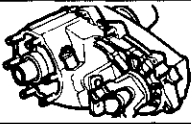
101715

Install a replacement synchronizer hub snap ring (29).

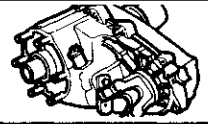


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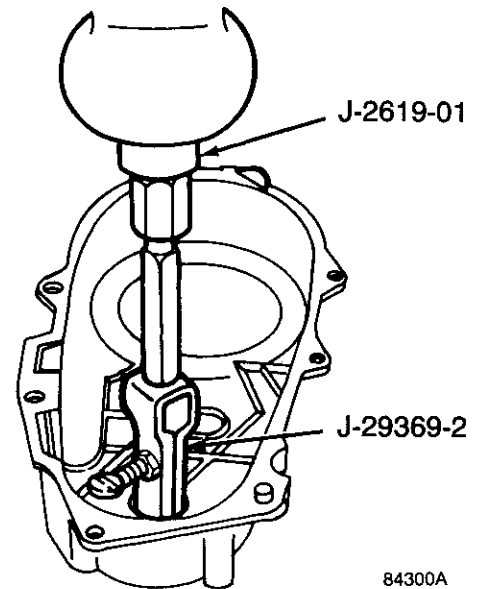


Install the synchronizer sleeve on the synchronizer hub. Be sure the sleeve is installed so the beveled spline ends face the stop ring.

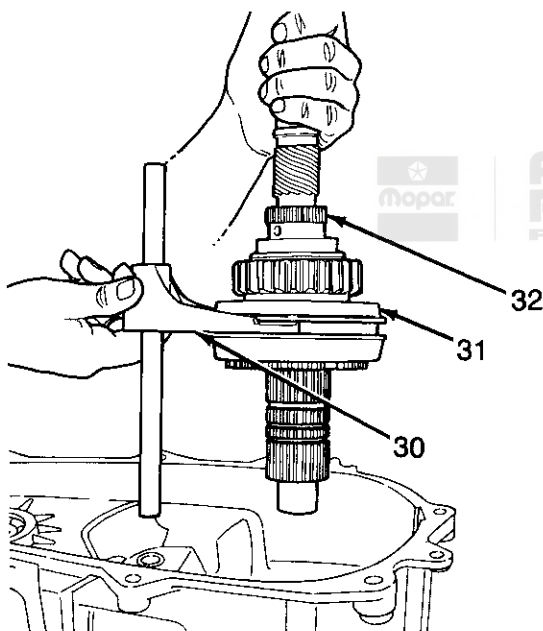
Install replacement pads on the mode fork if necessary.

Engage the mode fork (30) in the synchronizer sleeve (31). Then install the fork and rail and the mainshaft assembly (32) in the case.

NOTE: Be sure the mode fork shift rail is seated in both of the range fork bushings.



- Install the replacement bearing with tool J-33826 and driver handle J-8092. Lubricate the bearing after installation.

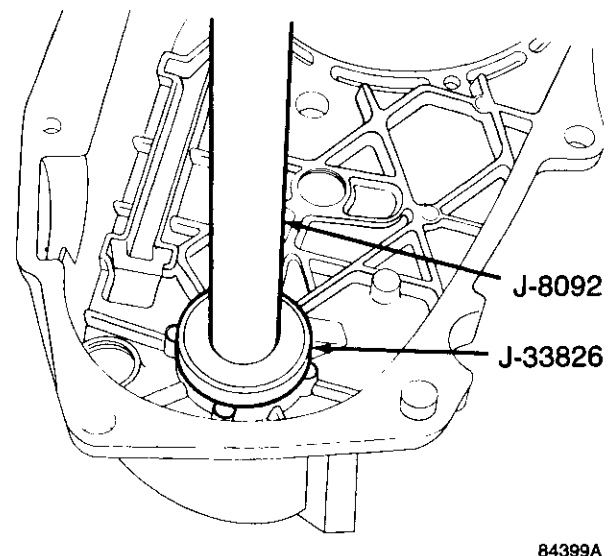


Assemble and install the output shaft and drive chain. Lift the mainshaft slightly to ease chain and shaft installation.

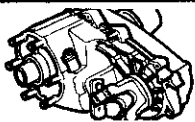
Install the mode spring on the shift rail.

Replace the output shaft rear bearing as follows:

- Remove the bearing with puller J-29369-2 and slide hammer J-2619-01.

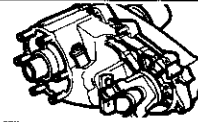


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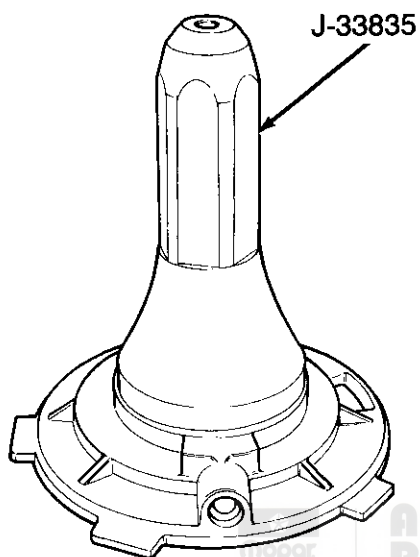


T.C. 231 TRANSFER CASE

OVERHAUL

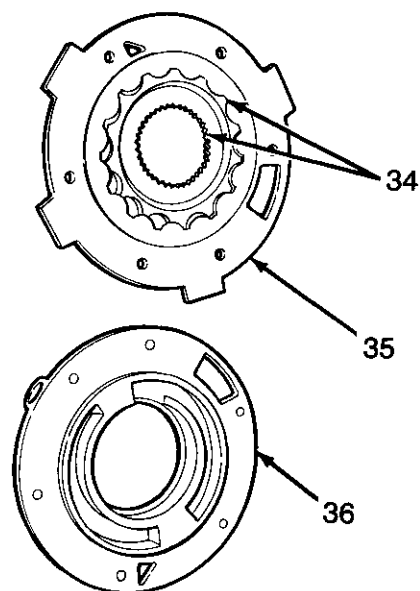


Install a replacement seal in the oil pump feed housing (33) with tool J-33835.

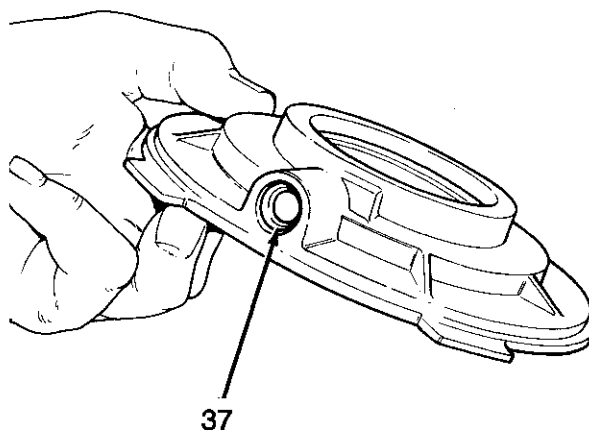


Assemble the oil pump.

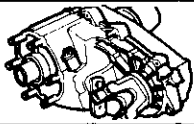
- Lubricate and install the two gears (34) in the gear housing (35).
- Align and install the feed housing (36) on the gear housing.
- Install and tighten the pump screws to specified torque.



Install a replacement pickup tube O-ring (37) in the oil pump.

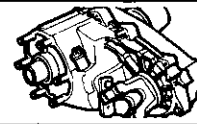


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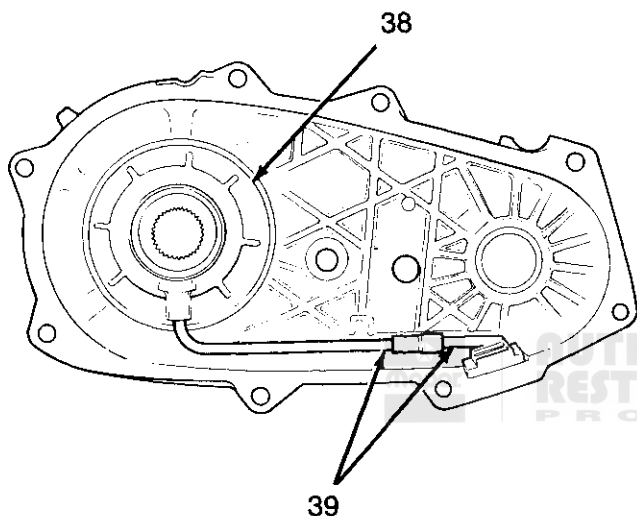
T.C. 231 TRANSFER CASE

OVERHAUL



Insert the oil pickup tube in the oil pump. Then attach the screen and connecting hose to the pickup tube.

Install the assembled oil pump (38), pickup tube and screen (39) in the rear case. Be sure the screen is seated in the case slot as shown.



101721

Install the magnet in the front case.

Apply a 3 mm (1/8 inch) wide bead of sealer to the seal surface of the front case. Use Jeep Gasket-In-A-Tube sealer or an equivalent RTV-type sealer.

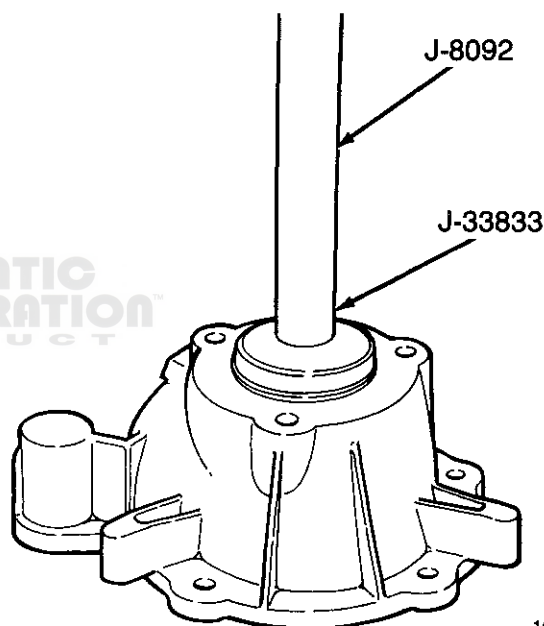
Align and install the rear case on the front case. Be sure the case locating dowels are in place and that the mainshaft splines are engaged in the oil pump inner gear.

Install and tighten the front case-to-rear case attaching bolts to specified torque.

NOTE: Be sure to install a washer under each of the bolts used at the case dowel locations.

Replace the rear bearing as follows:

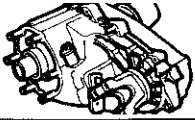
- Tap the original bearing out of the rear retainer with a hammer and brass drift.
- Install the replacement bearing in the retainer with tool J-33833 and driver handle J-8092.



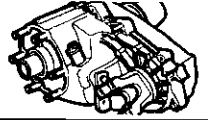
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Apply a 3 mm (1/8 inch) wide bead of sealer to the seal surface of the rear retainer. Use Jeep Gasket-In-A-Tube sealer or an equivalent RTV-type sealer.

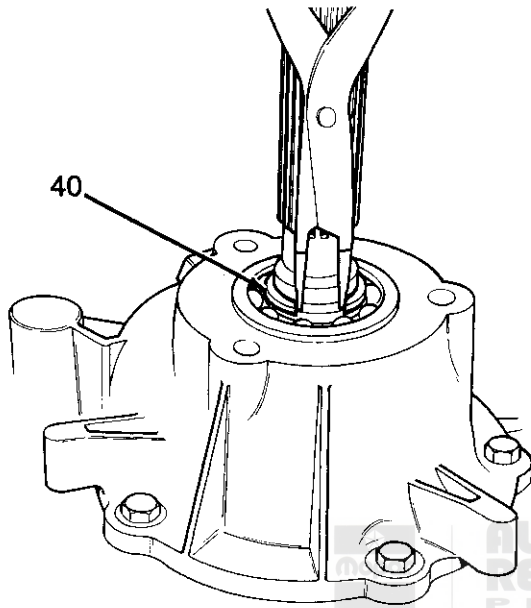
Install the locating dowel in the rear retainer if removed and install the rear retainer on the case. Tighten the retainer bolts to specified torque.



T.C. 231 TRANSFER CASEOVERHAUL

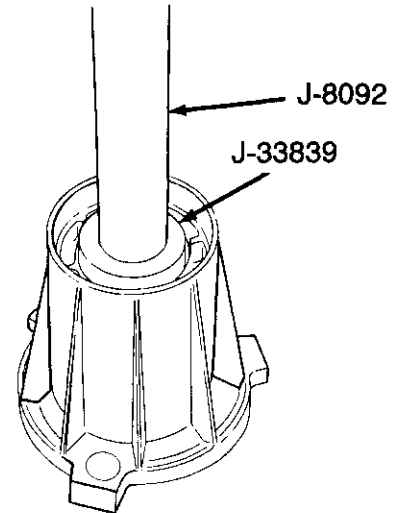


Install a replacement rear retainer snap ring (40). Lift the mainshaft slightly to seat the snap ring in the shaft groove.

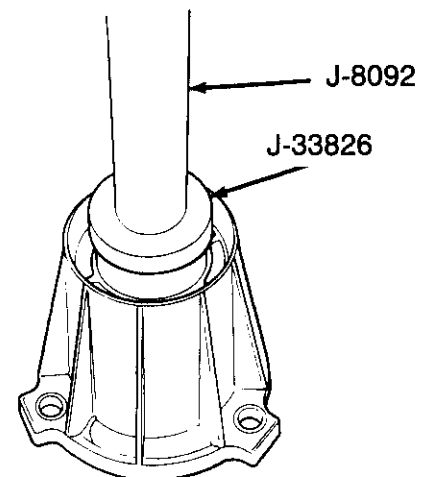


Replace the extension housing bushing as follows:

- Remove the rear extension housing seal if not removed previously.
- Remove the bushing with driver handle J-8092 and tool J-33839.



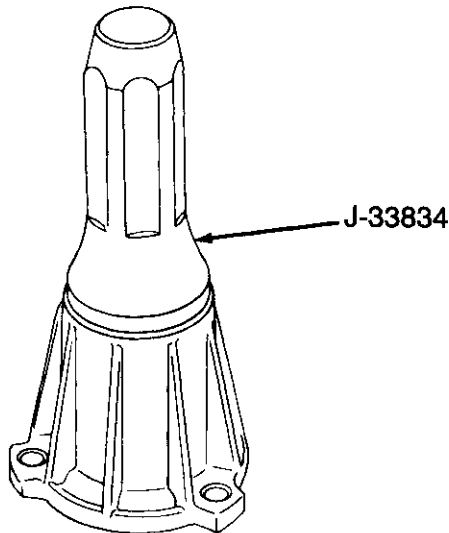
- Install the replacement bushing with driver handle J-8092 and tool J-33826. The bushing is fully seated when the installer tool contacts the housing.



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	T.C. 231 TRANSFER CASE OVERHAUL	
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- Install a replacement seal in the extension housing with tool J-33834.



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NOTES

Apply a 3 mm (1/8 inch) wide bead of sealer to the seal surface of the extension housing. Use Jeep Gasket-In-A-Tube or an equivalent RTV-type sealer.

Install the extension housing on the case. Tighten the housing bolts to specified torque.

Install the front yoke. Secure the yoke with a replacement seal washer and nut. Tighten the nut to specified torque.

Install a replacement gasket on the vacuum switch and install the switch in the case.

Install and tighten the drain plug to specified torque.

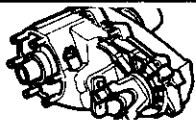
Fill the transfer case with the required amount of Jeep automatic transmission fluid, or an equivalent Dexron® II fluid, after installation.

Install and tighten the fill plug to specified torque.



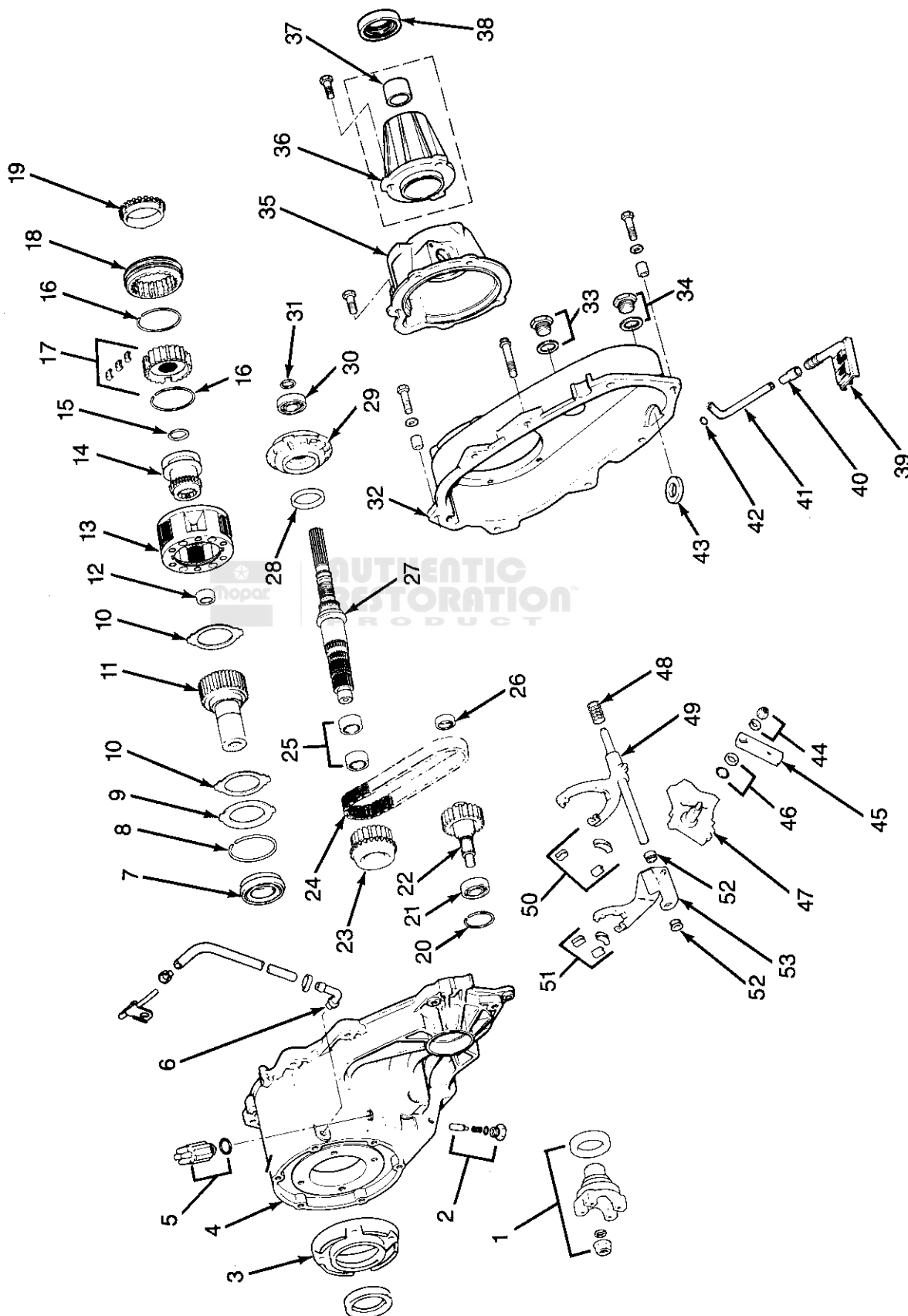
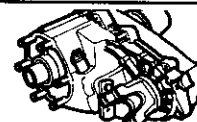
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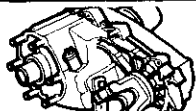
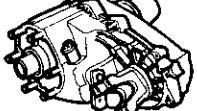


T.C. 231 TRANSFER CASE

TRANSFER CASE COMPONENTS



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NOTES

	T.C. 231 TRANSFER CASE TRANSFER CASE COMPONENTS	
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- | | |
|---|---------------------------------|
| 1 - Front yoke nut, seal washer,
yoke and oil seal | 27 - Mainshaft |
| 2 - Shift detent plug, spring and pin | 28 - Oil seal |
| 3 - Front retainer and seal | 29 - Oil pump assembly |
| 4 - Front case | 30 - Rear bearing |
| 5 - Vacuum switch and seal | 31 - Snap ring |
| 6 - Vent assembly | 32 - Rear case |
| 7 - Input gear bearing and snap ring | 33 - Fill plug and gasket |
| 8 - Low range gear snap ring | 34 - Drain plug and gasket |
| 9 - Input gear retainer | 35 - Rear retainer |
| 10 - Low range gear thrust washers | 36 - Extension housing |
| 11 - Input gear | 37 - Bushing |
| 12 - Input gear pilot bearing | 38 - Oil seal |
| 13 - Low range gear | 39 - Oil pickup screen |
| 14 - Range fork shift hub | 40 - Tube connector |
| 15 - Synchronizer hub snap ring | 41 - Oil pickup tube |
| 16 - Synchronizer hub springs | 42 - Pickup tube O-ring |
| 17 - Synchronizer hub and inserts | 43 - Magnet |
| 18 - Synchronizer sleeve | 44 - Range lever nut and washer |
| 19 - Synchronizer stop ring | 45 - Range lever |
| 20 - Snap ring | 46 - O-ring and seal |
| 21 - Output shaft front bearing | 47 - Sector |
| 22 - Output shaft (front) | 48 - Mode spring |
| 23 - Drive sprocket | 49 - Mode fork |
| 24 - Drive chain | 50 - Mode fork inserts |
| 25 - Drive sprocket bearings | 51 - Range fork inserts |
| 26 - Output shaft rear bearing | 52 - Range fork bushings |
| | 53 - Range fork |



Service Manual

Model 700/900 Series

TRANSMISSION

August 1983

U.S.A./Canada Edition

8981 320 381

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OVERHAUL



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	AUTOMATIC TRANSMISSIONS OVERHAUL	
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GENERAL

The automatic transmissions used in AMC/Jeep vehicles are fully automatic, three speed, hydraulically operated units with a compound planetary gear system. A three element torque converter is used for all applications. A manually operated gear shift linkage is used to select the desired gear range. Transmission shift points are controlled by an externally mounted throttle linkage. The transmission case and converter housing consists of a one-piece aluminum casting. An aluminum adapter housing is used to connect the transmission to the various transfer case models.

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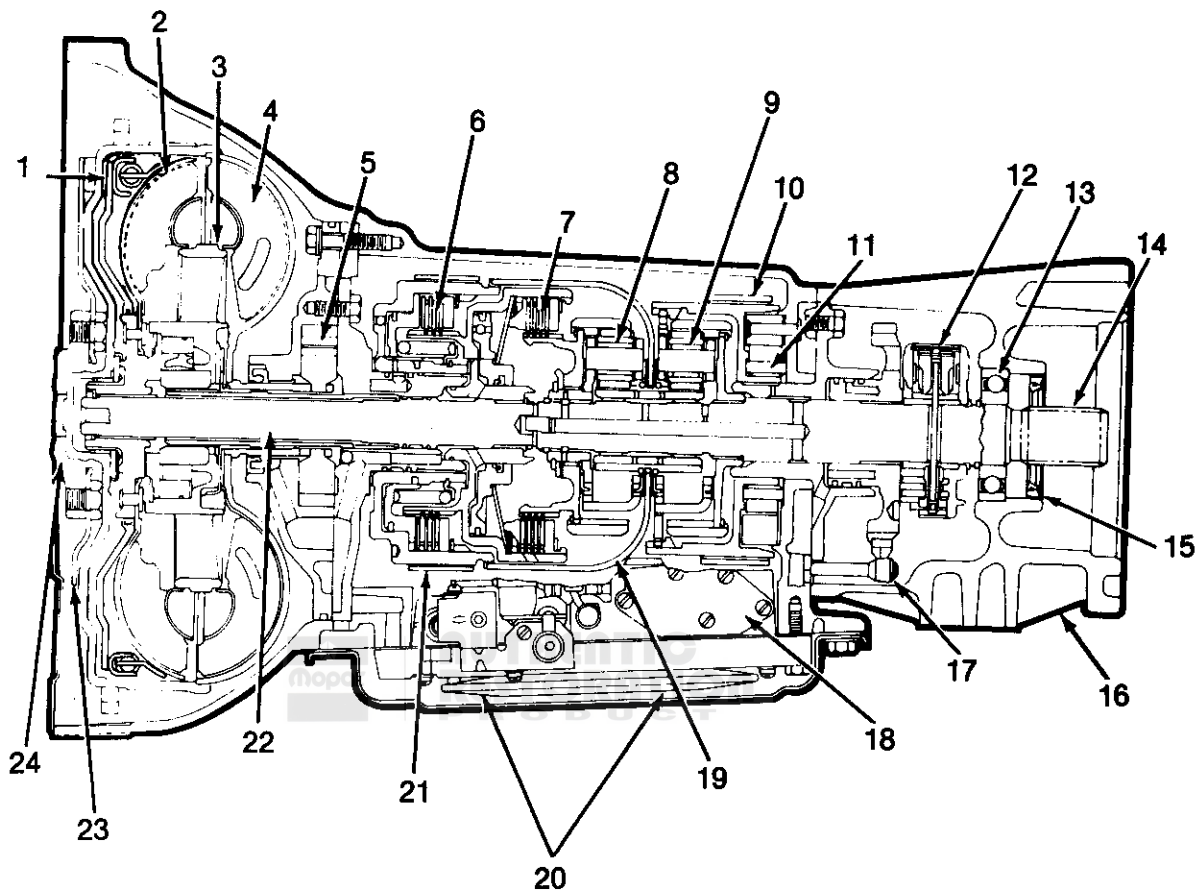


AUTOMATIC TRANSMISSIONS

OVERHAUL



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| 1. Lock-up Clutch | 13. Bearing |
| 2. Turbine | 14. Output Shaft |
| 3. Stator | 15. Seal |
| 4. Impeller | 16. Adapter Housing |
| 5. Oil Pump | 17. Parking Low Assembly |
| 6. Front Clutch | 18. Valve Body |
| 7. Rear Clutch | 19. Sun Gear Driving Shell |
| 8. Front Planetary Gear Set | 20. Oil Filter |
| 9. Rear Planetary Gear Set | 21. Kick Down (Front) Band |
| 10. Low and Reverse (Rear) Band | 22. Input Shaft |
| 11. Overrunning Clutch | 23. Flexible Drive |
| 12. Governor | 24. Engine Crankshaft |



AUTOMATIC TRANSMISSIONS

OVERHAUL



SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-24040-A	Input Shaft Bushing Installer (727)	■	
J-24041-A	Input Shaft Bushing Remover (727)	■	
J-24042	Front Clutch Spring Compressor and Overrunning Clutch Cam Installer (727)	■	
J-24044	Detent Ball Retainer	■	
J-24045	Pump Rotor Alignment Tool (727)	■	
J-24048	Extension Housing Bushing Remover/Installer (727)	■	
J-24049-A	Oil Pump Bushing Remover/Installer	■	
J-24055	Oil Pump Bushing Remover/Installer (727)	■	
J-24063-01	Kickdown Band Adjustment Adapter	■	
J-24064	Front Clutch Bushing Remover/Installer	■	
J-24108-A	Pilot Studs	■	
J-5853-B	Torque Wrench (0-250 in-lbs)		■
J-8001	Dial Indicator Set		■
J-24026	Transmission Holding Fixture		■
J-9617	Front Pump Oil Seal Installer	■	
J-3387-2	Pilot Studs	■	
J-21005-01	Front Pump Oil Seal Installer (727)	■	
J-21232-01	Front Pump Oil Seal Remover	■	
J-22205	Front Pump Oil Seal Remover (Legs)	■	
J-23327	Front Clutch Spring Compressor	■	
J-24031	Kickdown Valve Gauge	■	

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	AUTOMATIC TRANSMISSIONS OVERHAUL	
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SPECIAL TOOLS continued

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Tool Ref.	Description	Required	Recommended
J-24032	Reaction Shaft Bushing Installer	■	
J-24033	Pump Rotor Alignment Tools	■	
J-24036-A	Reaction Shaft Bushing Remover	■	
J-24037-A	Reaction Shaft Bushing Remover (727)	■	
J-24038	Reaction Shaft Bushing Installer (727)	■	
J-24039	Front Clutch Retainer Bushing Remover and Installer (727)	■	

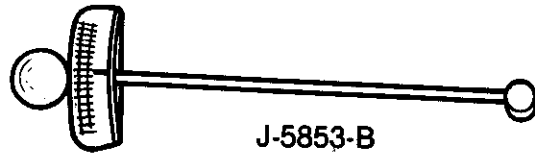


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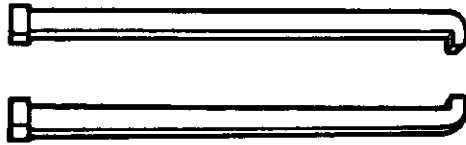
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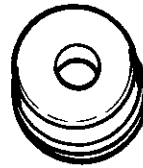
J-24044



J-5853-B



J-22205



J-24039



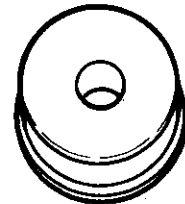
J-24038



J-24031



J-24045



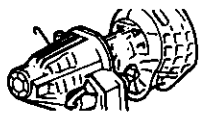
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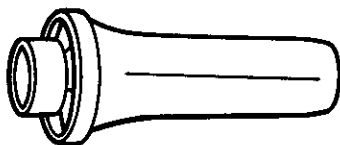


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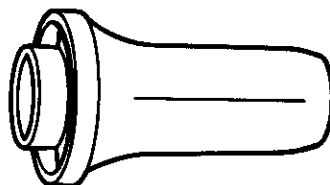
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J-9617



J-21055-01



J-24040-A



J-24064



J-24049-A



J-23327



J-24063-01



J-24036-A



J-24108-A

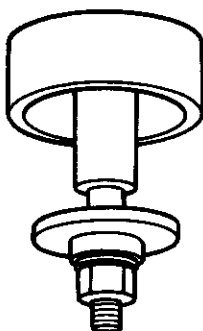
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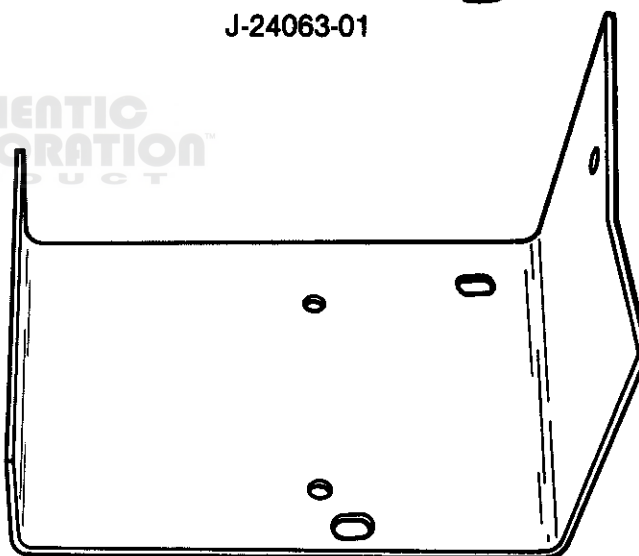
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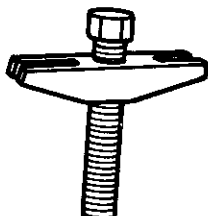
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J-24042



J-24026



J-21232-01



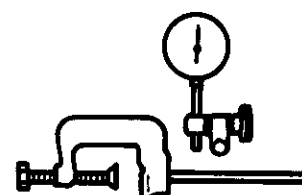
J-24032



J-24048



J-24033

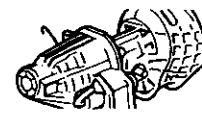


J-8001



AUTOMATIC TRANSMISSIONS

OVERHAUL



SPECIFICATIONS

Transmission Specifications

	MODEL 904 HO - 998	MODEL 999	MODEL 727
Clutch Plate Clearance			
Front Clutch	3 Disc 0.074 to 0.125 in. 4 Disc 0.067 to 0.134 in.	3 Disc 0.074 to 0.125 in. 4 Disc 0.067 to 0.134 in. 5 Disc 0.075 to 0.152 in.	3 Disc 0.070 to 0.129 in. 4 Disc 0.070 to 0.129 in.
Rear Clutch	3 and 4 Disc 0.032 to 0.55 in.	3 and 4 Disc. 0.032 to 0.55 in.	4 Disc. 0.025 to 0.045 in.
Clutch Component Thickness			
Tolerance			
Front Clutch			
Lined Plate	.083 to .088 in.	0.083 to 0.088 in.	0.090 to 0.095 in.
Steel Plate	.066 to .071 in.	0.066 to 0.071 in.	0.066 to 0.071 in.
Pressure Plate	.244 to .218 in	0.244 to 0.218 in.	0.278 to 0.282 in.
Rear Clutch			
Lined Plate	.060 to .065 in.	0.060 to 0.065 in.	0.060 to 0.065 in.
Steel Plate	.066 to .071 in.	0.066 to 0.071 in.	0.066 to 0.071 in.
Flat Pressure Plate	.214 to .218 in.	0.214 to 0.218 in.	0.278 to 0.282 in.
Formed Pressure Plate	.409 to .413 in.	0.409 to 0.413 in.	0.441 to 0.445 in.
Clutches	904 HO	998	999
Number of Front Clutch Plates	4	4	5
Number of Front Clutch Discs	4	4	5
Number of Rear Clutch Plates	3	3	3
Number of Rear Clutch Discs	4	4	4



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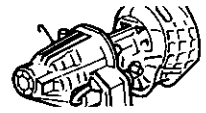
	MODEL 904 HO		MODEL 998		MODEL 999		MODEL 727	
	U.S.	Metric	U.S.	Metric	U.S.	Metric	U.S.	Metric
	Measure	Measure	Measure	Measure	Measure	Measure	Measure	Measure
Torque Converter Diameter	260 mm	(10.2 in.)	10.75 in				10.75 in.	
Oil Capacity — Transmission	15.8 pts.	7.5 ltrs.	17 pts.	7.9 ltrs.	17 pts.	7.9 ltrs.	17 pts.	7.9 ltrs.
and Torque Converter								
Cooling Method — All Models	Water-Heat Exchanger (In Radiator Lower Tank)							
Lubrication - All Models	Rotor Type Pump							
	First	Second	Third	Reverse				
	2.74 to 1	1.55 to 1	1.00 to 1	2.20 to 1				
Pump Clearances								
Outer Rotor to Case Bore	.004 to .008 in.		.004 to .008 in.		.004 to .008 in.			
Outer to Inner Tip	.005 to .010 in.		.006 to .010 in.		.005 to .010 in.			
End Clearance-Rotors	.001 to .003 in.		.001 to .003 in.		.001 to .003 in.		.001 to .002 in.	
Gear Train End Play	.001 to .047 in.		.001 to .047 in.		.001 to .047 in.		.009 to .044 in.	
Output Shaft End Play	.022 to .091 in.		.022 to .091 in.		.016 to .059 in.		.036 to .084 in.	
Snap Rings								
Front and Rear Clutches								
Rear Snap Ring (Selective)	.060 to .062 in.		.060 to .062 in.		.060 to .062 in.		.060 to .062 in.	
	.068 to .070 in.		.068 to .070 in.		.068 to .070 in.		.074 to .076 in.	
	.076 to .078 in.		.076 to .078 in.		.076 to .078 in.		.088 to .090 in.	
Output Shaft (Forward End)	.040 to .044 in.		.040 to .044 in.		.040 to .044 in.		.048 to .052 in.	
	.048 to .052 in.		.048 to .052 in.		.048 to .052 in.		.055 to .059 in.	
	.059 to .065 in.		.059 to .065 in.		.059 to .065 in.		.062 to .066 in.	

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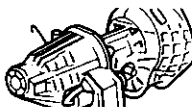
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TORQUE SPECIFICATIONS

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NOTES

Component	Service Set-To Torque	Service Recheck Torque
Adapter Housing-to-Transmission Case Bolt	33 N·m (24 ft-lbs)	—
Governor Body Bolt	11 N·m (100 in-lb)	—
Front Band Adjusting Screw Locknut	47 N·m (35 ft-lbs)	—
Kickdown Lever Shaft Plug	17 N·m (150 in-lb)	—
Rear Band Adjusting Screw Locknut	47 N·m (35 ft-lbs)	—
Neutral Starter Switch	33 N·m (24 ft-lbs)	—
Oil Filler Tube Bracket Bolt	17 N·m (150 in-lb)	—
Oil Pan Bolt	17 N·m (150 in-lb)	12-18 N·m (9-13 ft-lbs)
Oil Pump Housing-to-Transmission Case Bolt	20 N·m (175 in-lb)	—
Output Shaft Support Bolt	17 N·m (150 in-lb)	—
Overrunning Clutch Cam Setscrew	4 N·m (40 in-lb)	—
Pressure Test Port Plug	12 N·m (110 in-lb)	—
Reaction Shaft Support to Oil Pump Bolt	18 N·m (160 in-lb)	—
Valve Body Screw	4 N·m (35 in-lb)	—
Valve Body-to-Transmission Case Screw	11 N·m (100 in-lb)	—

	AUTOMATIC TRANSMISSIONS OVERHAUL	
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Thrust Washer Chart

Thrust Washers	Thrust Washer No. and Transmission Model	
	904 HO - 998 - 999	727
Reaction Shaft Support to Front Clutch Retainer	No. 1 .061 to .063	No.1 Selective .061 to .063 — Natural .084 to .086 — Red .102 to .104 — Yellow
Rear Clutch to Front Clutch Retainer	No. 2 .061 to .063	No. 2 .061 to .063 — Natural
Output Shaft to Input Shaft	No. 3 Selective .052 to .054 — Tin .068 to .070 — Red .083 to .085 — Green	No. 3 .062 to .064
Front Annulus Support to Rear Clutch Retainer	No. 4 .121 to .125	—
Front Annulus Support to Front Planetary Gear	No. 5 .048 to .050	No. 4 .059 to .062
Driving Shell to Front Annulus Gear	—	No. 5 .060 to .062
Front Planetary Gear to Driving Shell	No. 6 .048 to .050	—
Sun Gear and Driving Shell Front Thrust Plate	No. 7 .050 to .052	No. 6 .034 to .036
Sun Gear and Driving Shell Rear Thrust Plate	No. 8 .050 to .052	—
Rear Planetary Gear to Driving Shell	No. 9 .048 to .050	No. 7 .059 to .062
Rear Planetary to Rear Annulus Gear	—	No. 8 .034 to .036
Rear Planetary Gear to Rear Annulus Support	No. 10 .048 to .050	—

SPECIFICATIONS

Band Adjustments

Transmission Model	904 HO	998	999	727
Kickdown (Front) Turns*	2-1/2	3	2	2-1/2
Low-Reverse (Internal) Turns*	**7	4	4	2

* Backed off from 72 inch-pounds.

** Backed off from 41 inch-pounds

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AUTOMATIC TRANSMISSIONS

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TRANSMISSION DISASSEMBLY

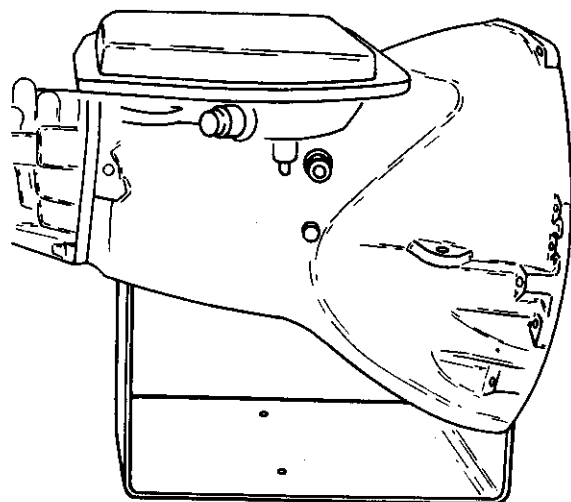
CAUTION: Cleanliness during disassembly and assembly is necessary to avoid a further malfunction after assembly. Before removing any of the transmission subassemblies, plug all openings and thoroughly clean the transmission exterior. Steam cleaning equipment is preferable for this purpose. During disassembly, clean all parts in a suitable solvent and dry each part using compressed air. Do not use cloth or paper towels to dry any parts after cleaning, use compressed air only.

End Play Measurement

NOTE: Measuring end play before disassembly will indicate whether a thrust washer change is required and save time at assembly.

Remove the transfer case from the transmission.

Mount the transmission in Holding Fixture J-24026.

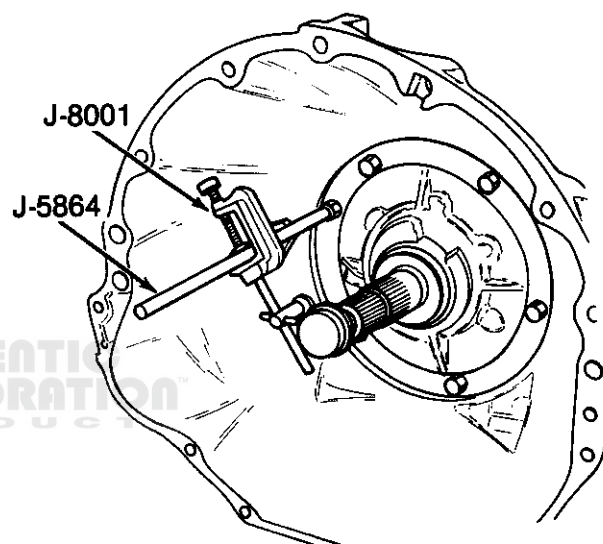


84453

Remove one pump attaching bolt and thread the Dial Indicator Support Rod J-5864 into the bolt hole.

Attach the Dial Indicator J-8001 to the rod.

Position the indicator stylus against the forward end of the input shaft.



84454

Move the input shaft rearward and set the dial indicator at zero.

Pull the input shaft forward to obtain the end play reading.

Record the reading for assembly reference.

Remove the dial indicator and rod.

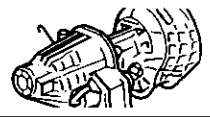
Oil Pan Removal

Remove the oil pan attaching bolts and remove the oil pan and gasket. Be sure that any dirt which remained around the bolts does not fall into the transmission.



AUTOMATIC TRANSMISSIONS

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Valve Body Removal

Loosen the clamp bolts and remove the throttle and gear selector levers from the shafts.

Remove the neutral start switch.

Remove the valve body attaching screws.

Remove the valve body. Lift the valve body from the case and pull the park lock rod forward out of the case at the same time.

NOTE: If necessary, rotate the output shaft to allow the park lock rod to clear the sprag.

Accumulator Piston and Spring Removal

Remove the spring from the piston.

Identify the spring with a tag for assembly reference.

Remove the piston from the case.

Adapter Housing – Rear Bearing and Seal

Remove the housing attaching bolts and remove the housing.

Remove the bearing snap ring and remove the rear bearing from the housing.

Remove the seal from the housing.

Governor – Governor Support

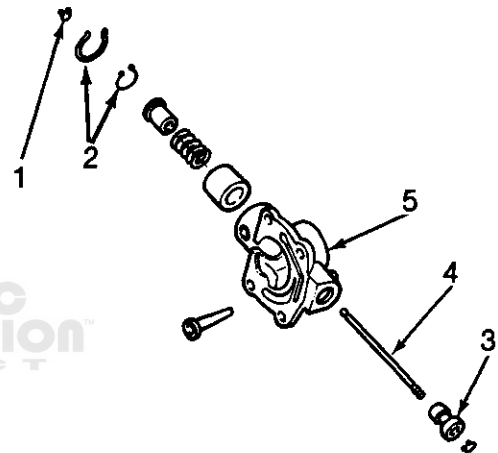
Remove the E-clip (1) from the weight end of the governor valve (2).

Remove the valve (3) and the shaft (4) from the governor body (5).

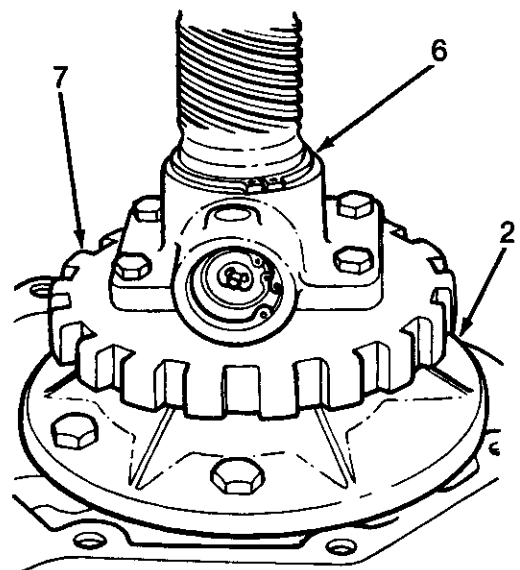
Rotate the output shaft until the governor weight faces downward.

Remove the snap ring located behind the governor body (6).

Remove the governor body and the park gear assembly from the output shaft (7).

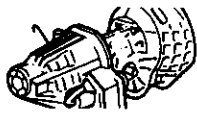


84455



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Oil Pump and Reaction Shaft Support

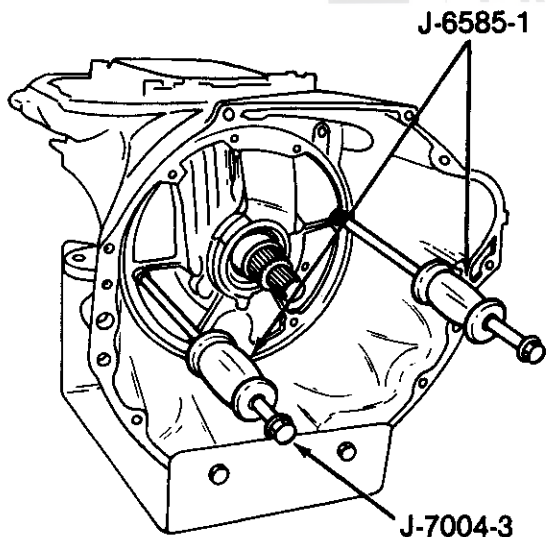
Tighten the front band adjusting screw until the band is tight around the front clutch retainer. This prevents the front clutch assembly from coming out with the pump and damaging the clutch discs.

Remove the oil pump attaching bolts.

Install Slide Hammer Tool J-6568-1 on Slide Hammer Bolts Tool J-7004-3.

Thread the bolts into the holes in the oil pump housing flange.

Bump outward evenly with the slide hammers to remove the pump and reaction shaft support.



84457

Front Band and Front Clutch

Loosen the front band adjusting screw and remove the band strut and band.

Remove the front clutch assembly.

Input Shaft and Rear Clutch

Remove the input shaft and rear clutch assembly by grasping the input shaft and pulling the assembly straight out of the case.

NOTE: Do not lose the thrust washer and thrust plate located between the rear end of the input shaft and the front end of the output shaft.

Output Shaft – Planetary Gears

Carefully remove the driving shell and output shaft assembly.

CAUTION: Be very careful to protect the machined surfaces on the output shaft during removal.

Rear Band and Drum

Pull the drum forward and out of the case.

Loosen the band adjusting screw.

Thread the 6 mm (1/4-inch) bolt into the actuating lever pivot pin.

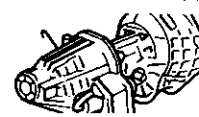
Grip the bolt with pliers and remove pivot pin.

Remove the lever, linkage and band.



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Overrunning Clutch

Carefully remove the clutch hub, rollers and springs, and store the parts where they will not be lost or damaged.

Front Servo Removal

Remove the front servo pressure port plug (1).

Compress the servo piston rod guide until it bottoms in the case bore.

Insert a No. 2 Phillips screwdriver (2) into the pressure port.

Slowly release the rod guide against the screwdriver.

Remove the servo retaining snap ring.

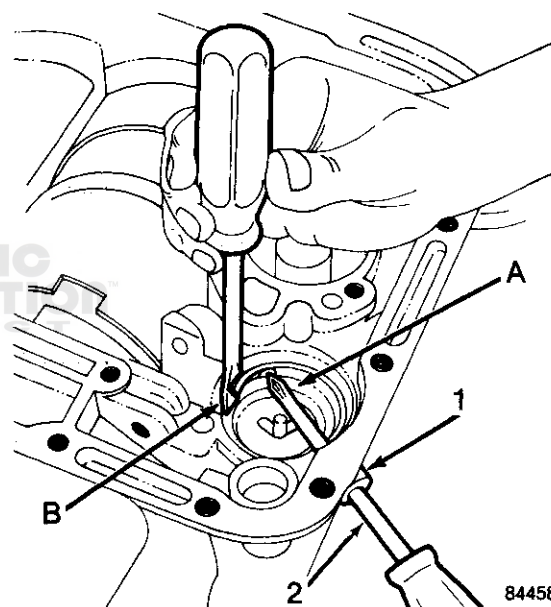
Compress the rod guide and remove the screwdriver.

Slowly release the rod guide and remove the rod guide, springs and piston rod.

CAUTION: Do not grasp the rod with pliers to remove it. If the rod sticks in the case, tap it gently to release it.

Identify the servo spring(s) with tag(s) for assembly reference.

Remove the servo piston.



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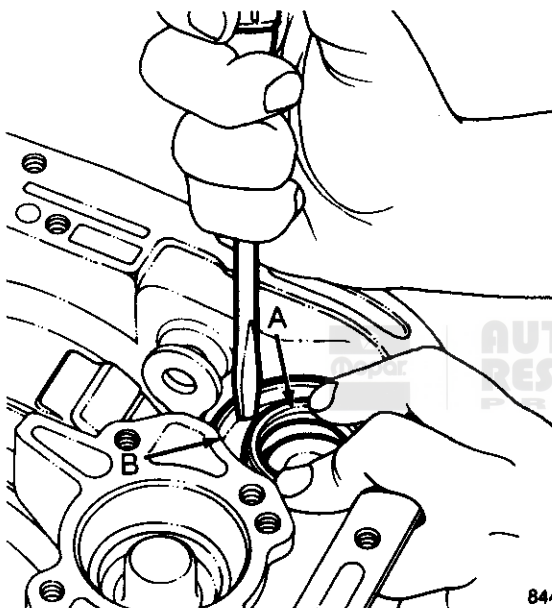


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Rear Servo Removal

Compress piston spring (A) and remove snap ring (B).

Remove the spring retainer, spring, piston and plug assembly. Identify the spring with a tag for assembly reference.



84459

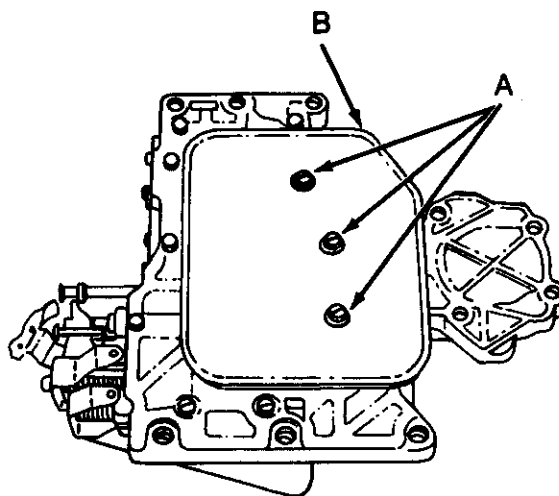
SUBASSEMBLY OVERHAUL

Valve Body With Lock-Up

Disassembly

CAUTION: Do not clamp any part of the valve body or transfer plate in a vise. Any slight distortion of the body or plate will cause sticking valves or excessive leakage or both. When removing and installing valves or plugs, slide them in or out very carefully. Do not use force to remove or install valves.

NOTE: When disassembling the valve body, identify all valve springs with a tag for assembly reference.



84460

Remove the oil filter attaching screws (A) and the oil filter (B).

NOTE: Oil filter screws are longer than transfer plate screws.

Remove the screws attaching the lockup module housing to the valve body.

Slide the lockup module oil tube (1) out of valve body (2) and remove the tube and module (3) as an assembly.

Remove the end plate from the module (4).

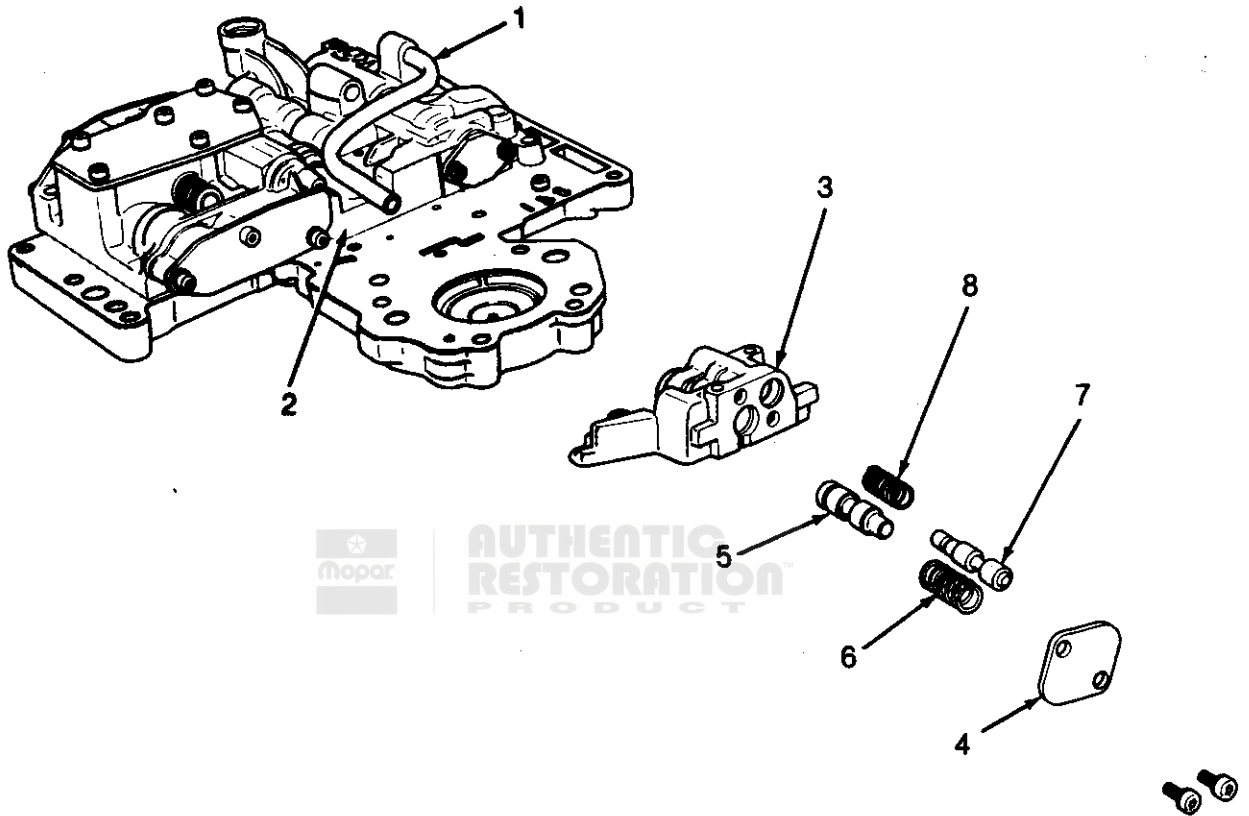
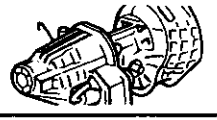
Remove the lockup valve (5) and the spring (6).

Remove the fail-safe valve (7) and the spring (8).



AUTOMATIC TRANSMISSIONS

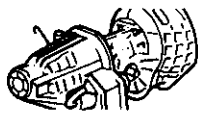
OVERHAUL



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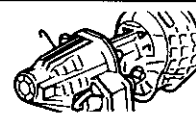
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84461

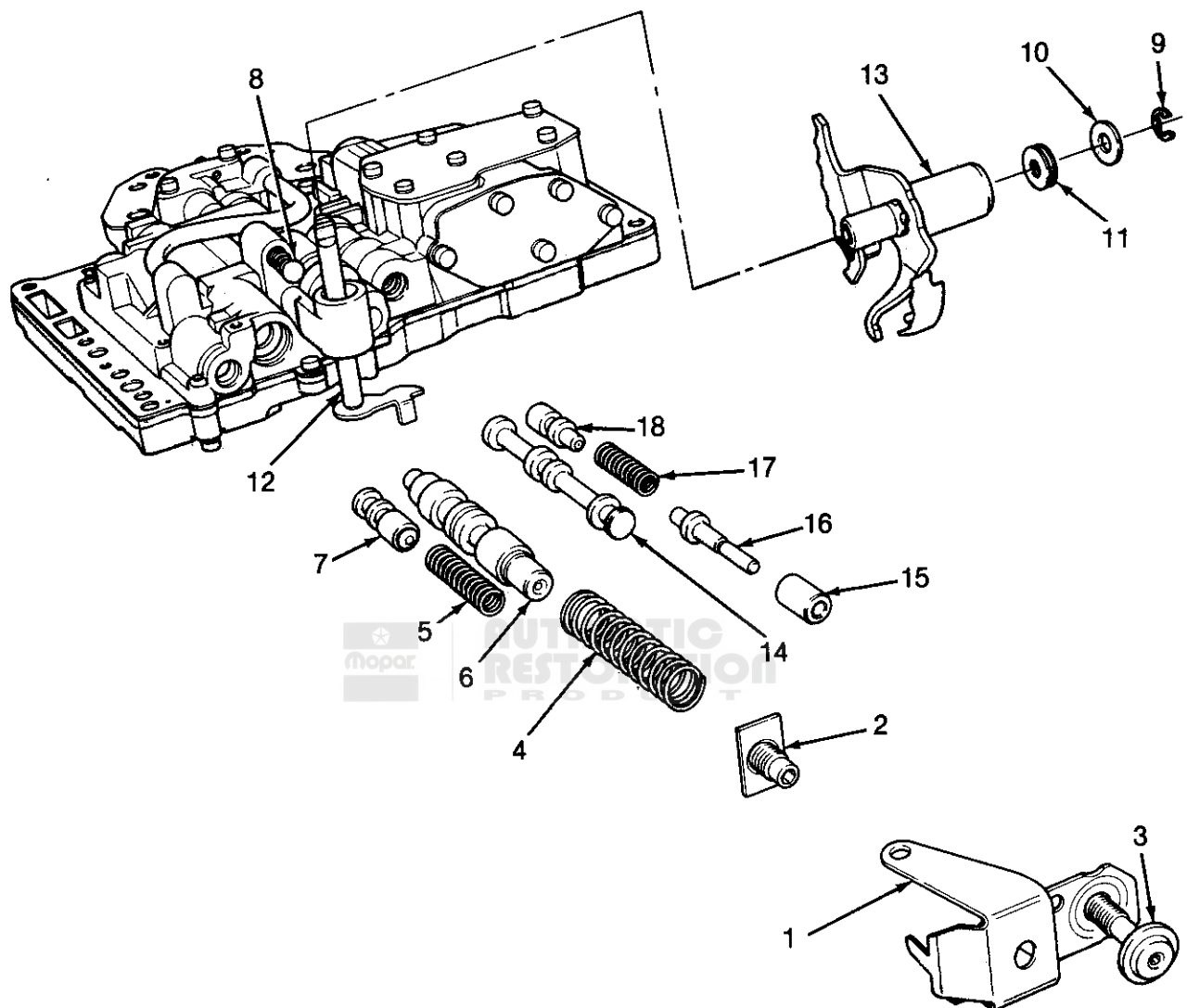


AUTOMATIC TRANSMISSIONS

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84462

NOTE: Tag the springs and valves for reassembly reference.

Remove the upper and lower screws from the spring retainer and adjustment screw bracket (1). Hold the spring retainer firmly against the spring force while removing the last screw.

Remove the spring retainer line (2) and the throttle pressure adjusting screws (3). Do not disturb the screw settings. Remove the line

pressure (4) and torque converter valve regulator springs (5). Tag the springs for assembly reference.

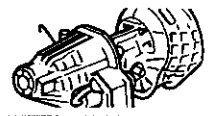
Remove the line pressure regulator (6) and torque converter control valves (7).

Install Detent Ball Retainer Tool J-24044 around detent ball casing (8).



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CAUTION: The detent ball retainer tool is holding the ball under spring pressure. Shield the ball casing area with one hand before removing the retainer tool and detent ball.

Remove E-clip (9), washer (10), and seal (11) from the throttle valve lever shaft (12).

Remove the burrs on the shaft with crocus cloth.

Slide the manual lever assembly (13) off the throttle lever shaft and remove the throttle lever assembly.

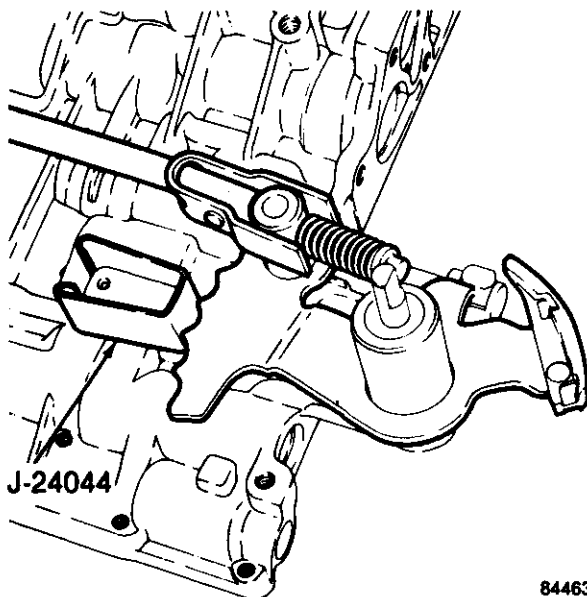
Remove the E-clip and park control rod from the manual lever.

Remove the retainer tool, detent ball, and spring.

Tag the spring for assembly reference.

Remove the manual valve (14).

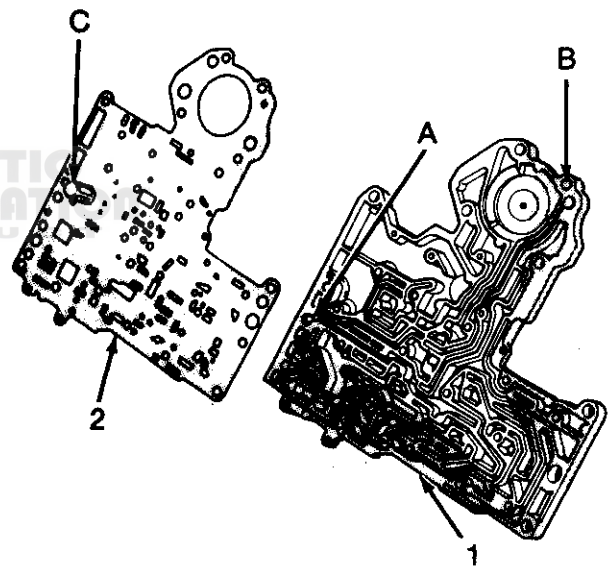
Remove the kickdown detent (15), kickdown valve (16), throttle valve spring (17), and the throttle valve (18). Tag the spring for assembly reference.



Remove the transfer plate assembly retaining screws and remove the transfer plate (1) assembly.

Remove the screws attaching the separator plate (2) to the transfer plate and separate these parts.

Remove the rear clutch check ball (A) from the transfer plate and the rear servo apply check ball (B) on 900 series transmissions and remove the pressure regulator valve screen (C) from the separator plate.



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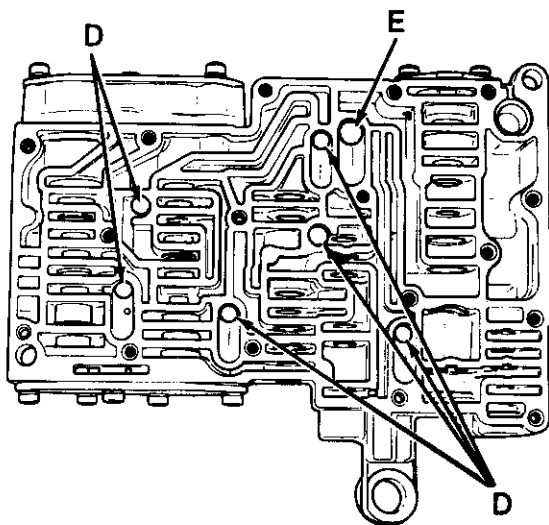
AUTOMATIC TRANSMISSIONS

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Remove the check balls from the valve body.

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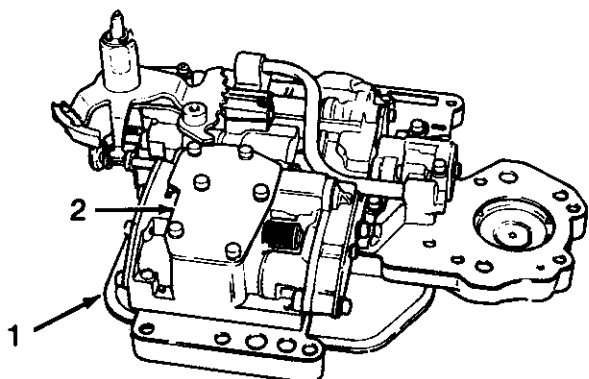
Check Ball Size Chart

A = 11/32 Inch Diameter

B = 1/4 Inch Diameter

84465

Turn the valve body (1) over and remove the shuttle valve cover plate (2).



84466



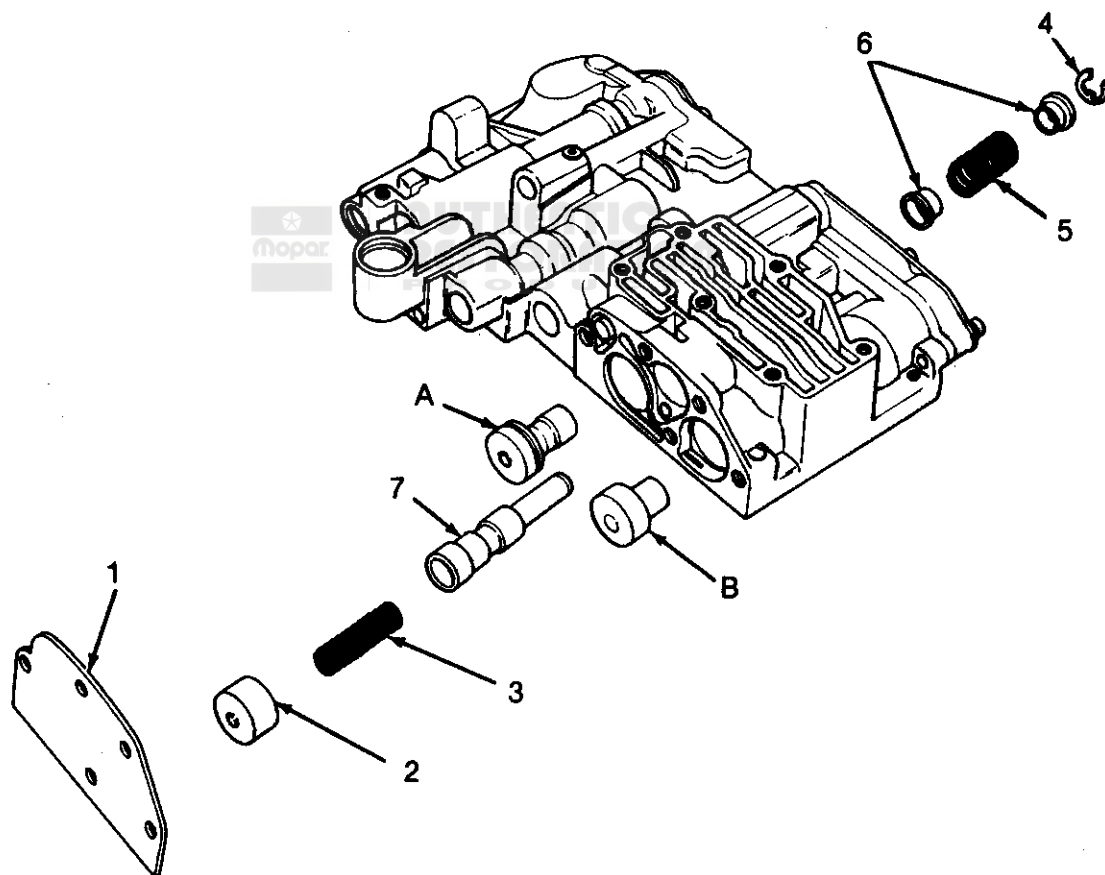
AUTOMATIC TRANSMISSIONS

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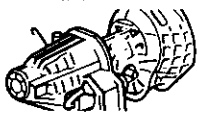
Remove the governor plug end plate (1), shuttle valve throttle plug (2) and spring (3), and the 1-2 (A) and 2-3 (B) shift valve governor plugs.

Remove the shuttle valve E-clip (4), shuttle valve secondary spring (5), spring guides (6), and the shuttle valve (7).

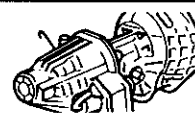


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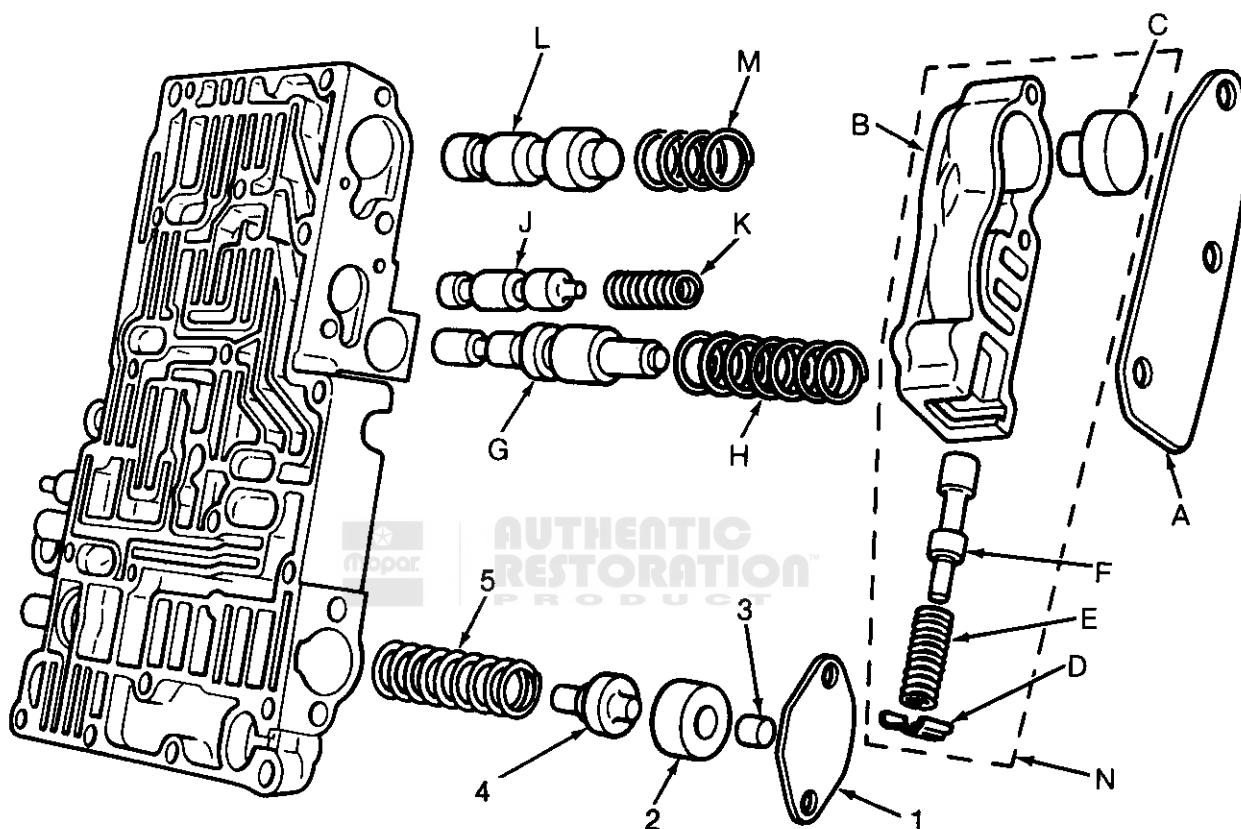
84467



AUTOMATIC TRANSMISSIONSOVERHAUL



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84468

Remove the line pressure regulator valve end plate (1).

Remove the sleeve (2), line pressure regulator valve plug (3), and the throttle pressure regulator valve plug (4), and spring (5).

Remove the downshift valve housing end plate (A).

Remove downshift valve housing (B), remove throttle plug (C) and downshift valve retainer (D), and remove spring (E), and limit valve from the housing (F). Tag spring for assembly reference.

Remove 1-2 shift control valve (G) and spring (H), 1-2 shift valve (J) and spring (K), and 2-3 shift valve (L) and spring (M). Tag all springs for assembly reference.



AUTOMATIC TRANSMISSIONS

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Cleaning and Inspection

Thoroughly wash and air dry all parts.

Do not use any type of caustic cleaning solution. Be sure all passages are clean and free from obstructions.

Clean the regulator filter in solvent and air dry. Replace the filter, if damaged.

Inspect the manual and throttle valve levers and shafts for being bent, worn or excessively loose. If a lever is loose on a shaft, replace the lever and shaft assembly. If a lever or shaft is bent, replace the assembly.

Inspect all mating surfaces for burrs, nicks and scratches. Remove minor irregularities using crocus cloth applying very light pressure.

Use a straightedge and inspect all mating surfaces for warpage or distortion. Very slight warpage or distortion may be corrected by abrading the surface on a sheet of crocus cloth. Position the cloth on a surface plate or flat piece of glass and use very light pressure.

Be sure all metering holes in the separator plate and valve body are open. Use a penlight to inspect the bores in the valve body for corrosion, scores, burrs, scratches, pits, and other irregularities.

Inspect all valve springs for distortion or collapsed coils.

Inspect all valves and plugs for burrs, nicks, and scores. Remove slight irregularities using crocus cloth but do not round off the sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter from lodging between the valve and the body bore.

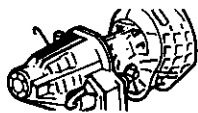
Inspect all valves and plugs for freedom of operation in the valve body bores. When the bores, valves, and plugs are clean and dry, the valves and plugs fall freely in the bores. Make sure the orifice in the 1-2 shift control bore in the valve body is open. Verify this by inserting a .79 mm (1/32-inch) diameter drill through the orifice and into the 1-2 shift control bore.

NOTE: A valve body that functioned properly when the vehicle was new will operate correctly after cleaning, reconditioning, assembly, and adjustment if:

- (a) all mating surfaces are flat.
- (b) bores, plugs, and valves are smooth.
- (c) metering holes are open.
- (d) springs are not damaged.
- (e) valves and plugs slide freely in their bores.

There is no need to replace a valve body unless it is damaged in handling.

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Assembly

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Install the 1-2 and 2-3 shift valves (L) (J) and springs (M) (K), and the 1-2 shift control valve (G) and spring in valve body (H).

Assemble and install the downshift housing assembly in the following sequence:

- (a) Install the limit valve (F) and spring (E).
- (b) Slide the spring retainer into groove.
- (c) Insert the throttle plug (C) into the bore.
- (d) Position the downshift housing end plate (A) on the housing and insert the retaining screws.
- (e) Position the downshift housing assembly (N) against the shift valve springs. Be sure all the springs are in proper alignment. Install and tighten the retaining screws to 4 N·m (35 in-lbs) torque.

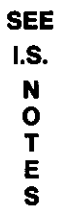
Install the throttle pressure regulator valve spring (5) and plug (4).

Install the line pressure regulator valve sleeve (2) and plug (3).

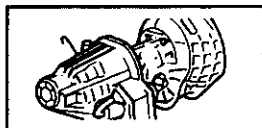
Install the line pressure regulator valve end plate (1).



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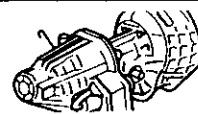


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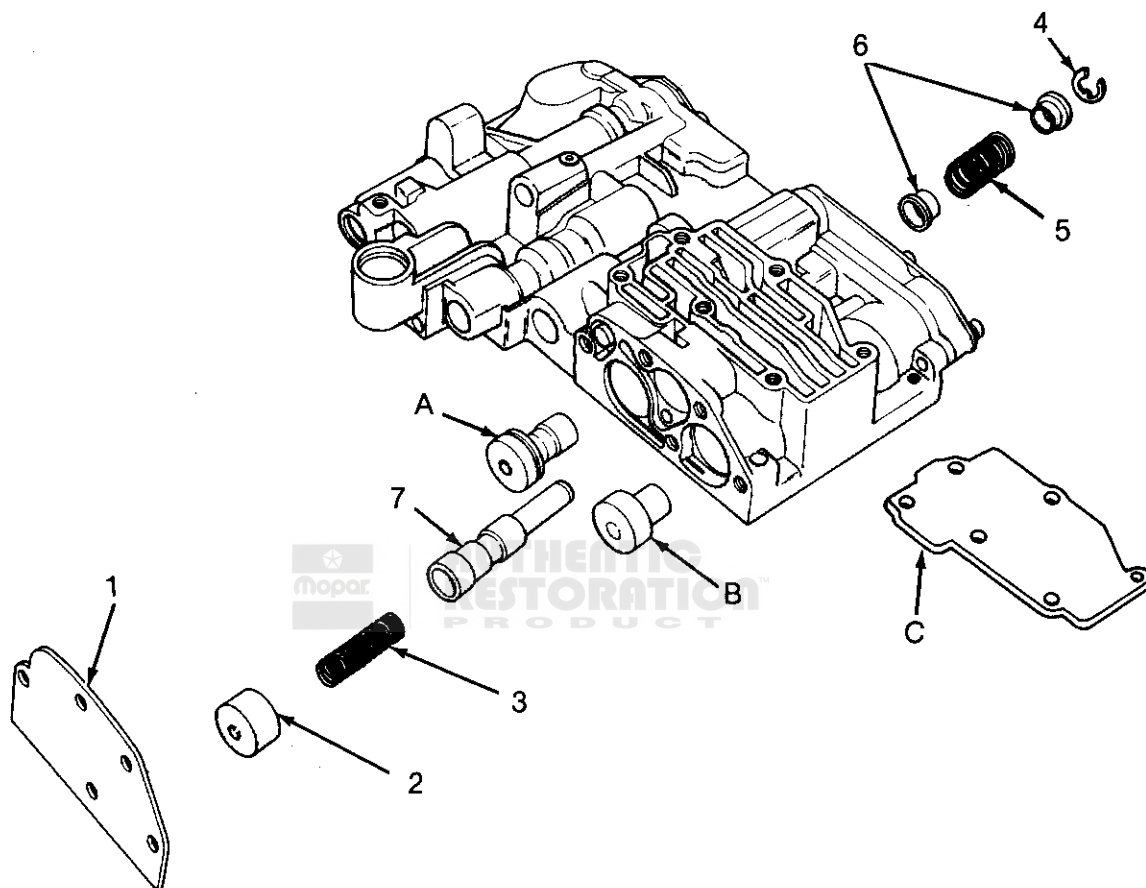


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84470

Install the 1-2 and 2-3 shift valve governor plugs (A) (B).

Install the shuttle valve (7), primary spring (3) and the throttle plug (2).

Install the governor plug end plate (1) and tighten the screws to 4 N·m (35 in-lbs) torque.

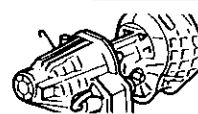
Install the spring guides (6), shuttle valve secondary spring (5), and the E-clip (4).

Install the shuttle valve cover plate (C) and tighten the screws to 4 N·m (35 in-lbs) torque.



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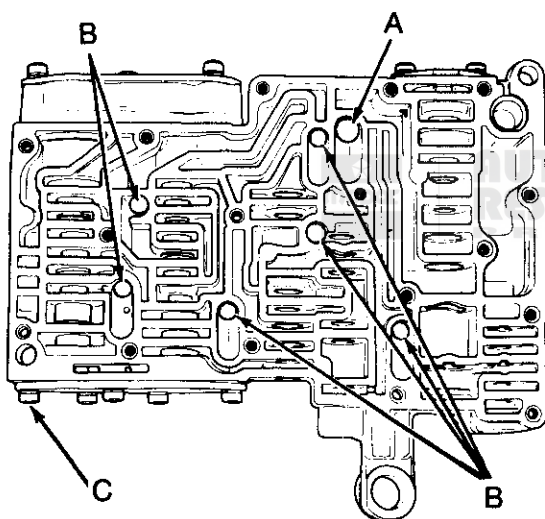


Install the check balls (A) (B) in the valve body (C).

Install the rear clutch check ball (D) in the transfer plate and the rear servo apply check ball (E) on all 900 series transmissions.

Install the pressure regulator valve screen (F) in the separator plate (G).

Position the separator plate on the transfer plate (4).

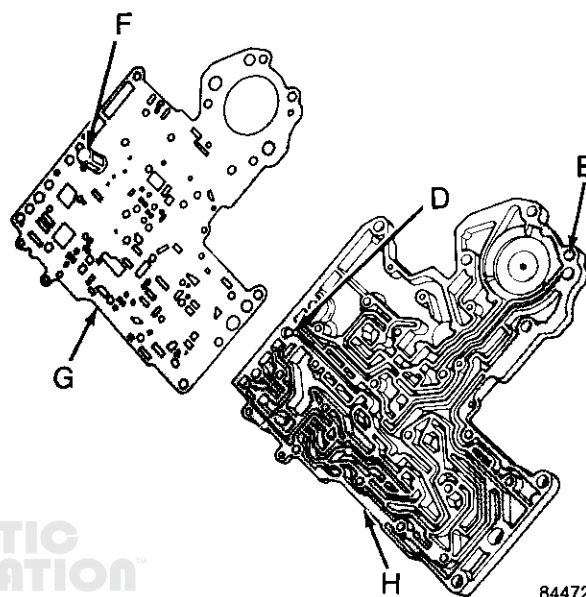


84471

Position the transfer plate assembly on the valve body and install the retaining screws finger-tight.

NOTE: Before tightening the retaining screws be sure the pressure regulator filter screen and 10 mm (3/8-inch) diameter check ball are properly aligned.

Starting at the center and working outward, tighten the transfer plate assembly retaining screws to 4 N·m (35 in-lbs) torque.



84472

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Check Ball Size Chart

A = 11/32 Inch Diameter

B = 1/4 Inch Diameter

84473

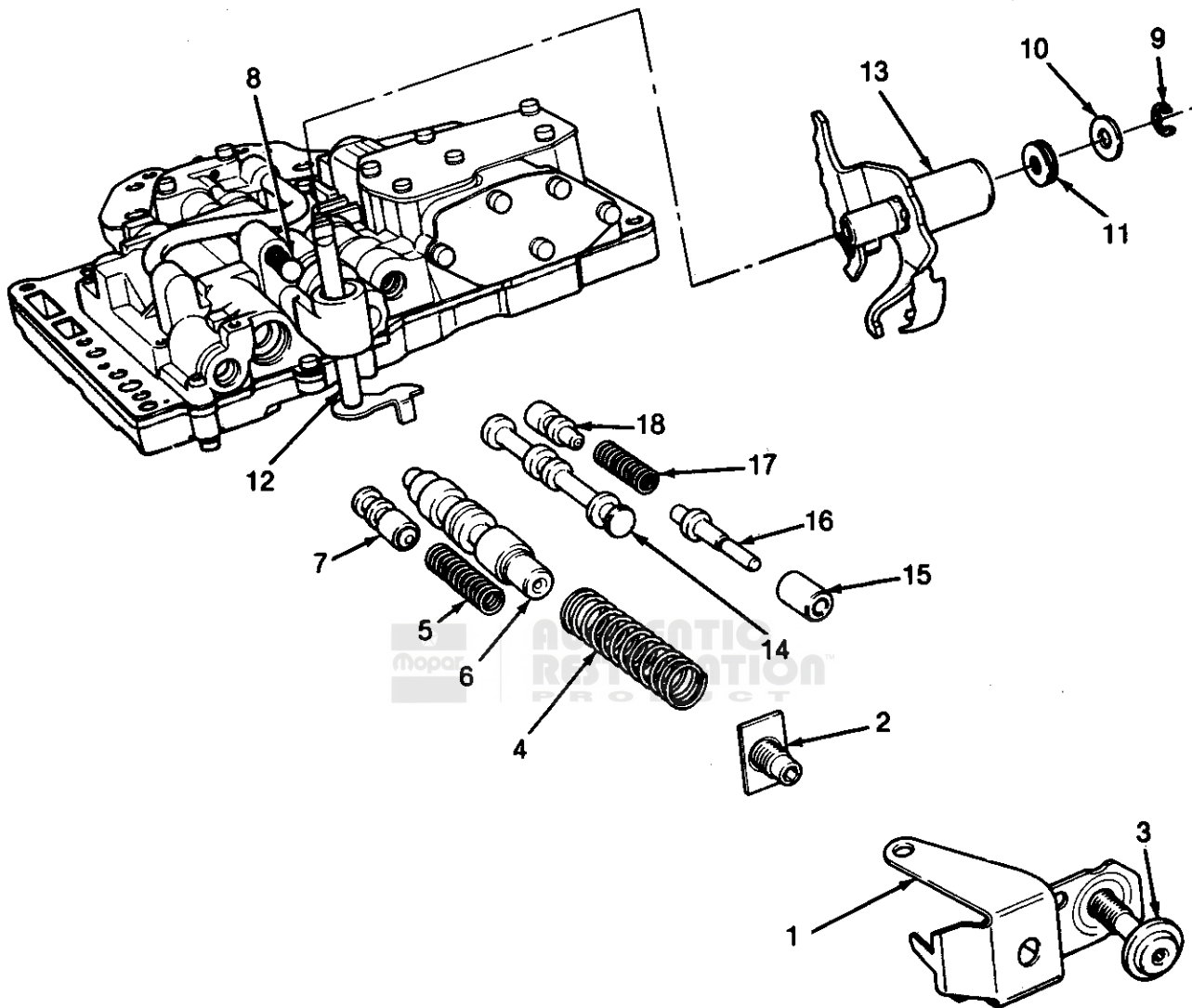


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84474

Install the throttle valve (18), valve spring (17), kickdown valve (16) and the detent (15).

Install the manual valve (14).

Insert the detent ball and spring (8) in the valve body. Install the Retainer Tool J-24044 around the detent ball casing to retain the ball and spring.

Install the throttle lever assembly (12).

Install the manual lever assembly (13) on the throttle lever shaft. Position the manual lever assembly so it engages the manual valve (14) and detent ball.

Install the seal (11), washer (10), and E-clip (9) on the throttle lever shaft.



AUTOMATIC TRANSMISSIONS

OVERHAUL



Remove the detent ball retainer tool.

Install the line pressure and torque converter control valves.

Install the torque converter and line pressure regulator valve springs (4) (5).

Install the line pressure adjusting screw assembly (2) on the spring retainer bracket (1) and position it on the valve body.

Attach the bracket to the side of the valve body and tighten the retaining screws only after starting both the top and bottom bracket screws. Tighten the screws to 4 N·m (35 in-lbs) torque.

NOTE: When installing retainer and bracket, be sure all parts are properly aligned before tightening the screws.

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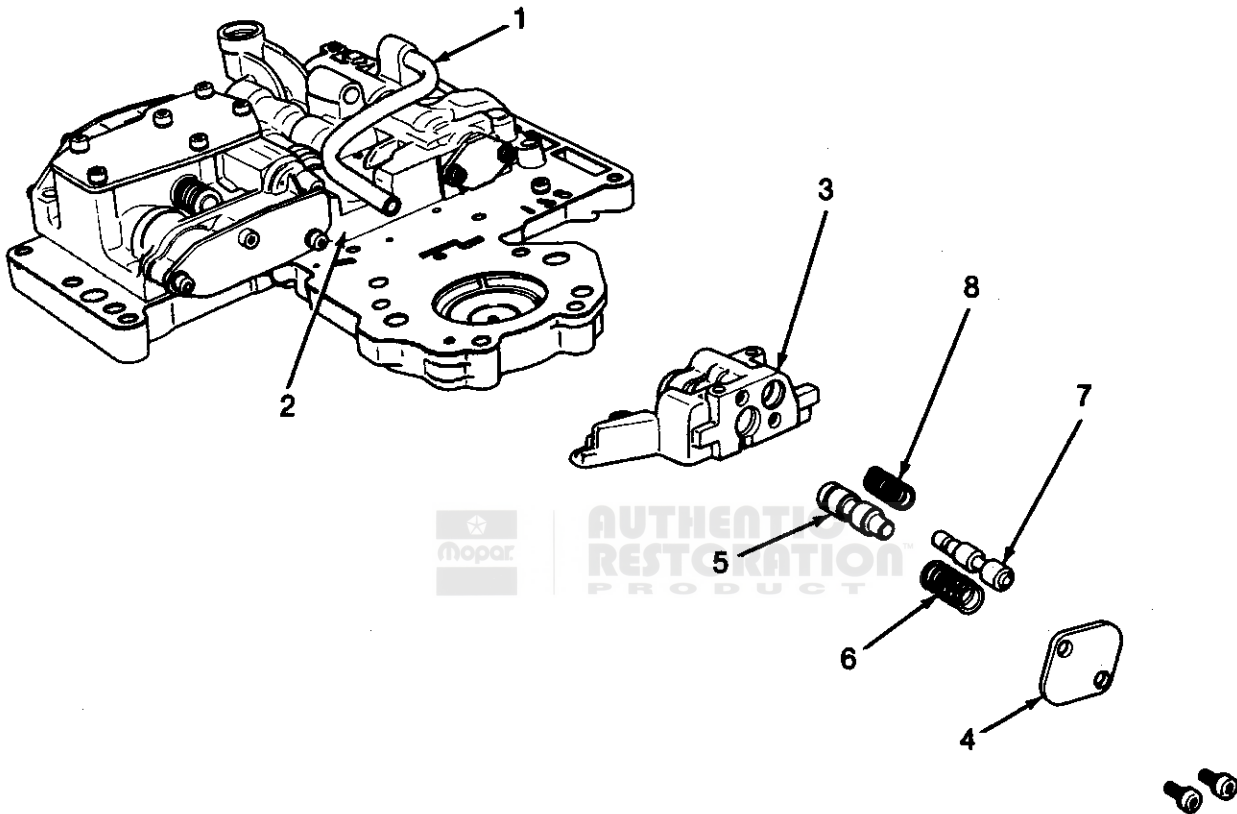


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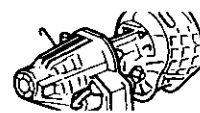


84475



AUTOMATIC TRANSMISSIONS

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Install the fail-safe valve (7) and spring (8) into the housing.

Install the lockup valve (5) and spring (6) into the housing.

Install the end plate and attaching screws (4).

Install lockup module housing (3) and oil tube (1) to the valve body (2).

Install attaching screws.

Install the oil filter.

Measure the throttle and line pressure settings.

NOTE: If pressures were satisfactory before disassembly, do not change the line or throttle pressure adjusting screw settings.

Valve Body Without Lock-Up

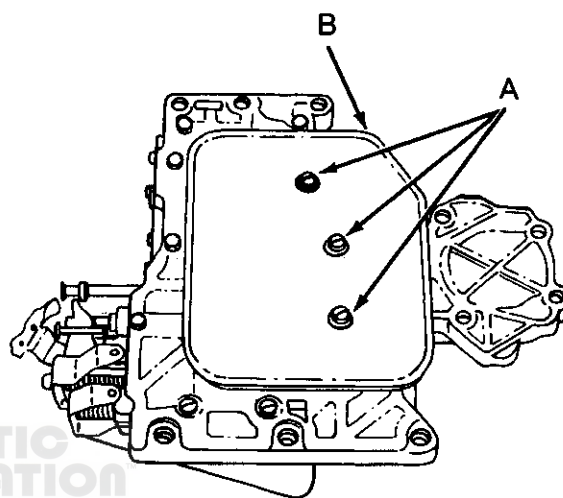
Disassembly

CAUTION: Do not clamp any part of the valve body or transfer plate in a vise. Any slight distortion of the body or plate will cause sticking valves or excessive leakage or both. When removing and installing valves or plugs, slide them in or out very carefully. Do not use force to remove or install valves.

NOTE: When disassembling the valve body, identify all valve springs with a tag for assembly reference.

Remove the oil filter attaching screws (A) and oil filter (B).

NOTE: The oil filter screws are longer than the transfer plate screws.

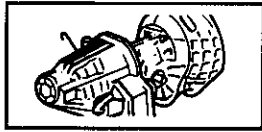


84476

Remove the transfer plate assembly retaining screws and remove the transfer plate assembly (1).

Remove the screws attaching the stiffener and separator plates to the transfer plate and separate these parts.

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AUTOMATIC TRANSMISSIONS

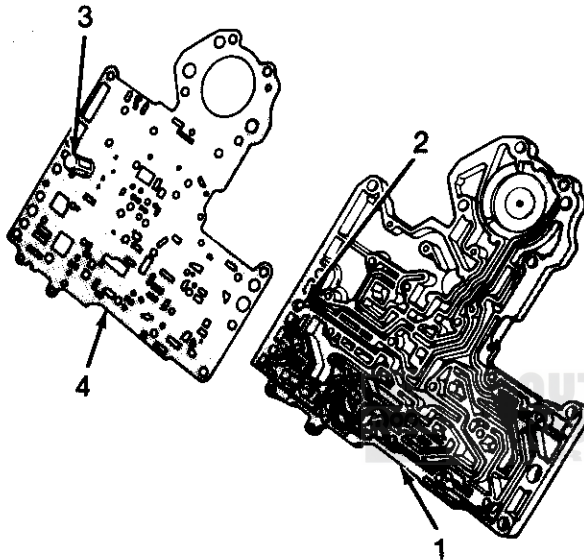
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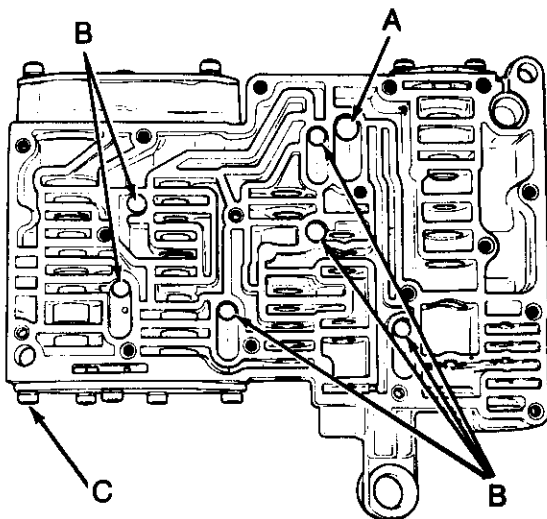
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Remove the rear clutch check ball (2) from the transfer plate and remove the pressure regulator valve screen (3) from the separator plate (4).

Remove check balls (A) and (B) from the valve body.



84477



Check Ball Size Chart

A = 11/32 Inch Diameter

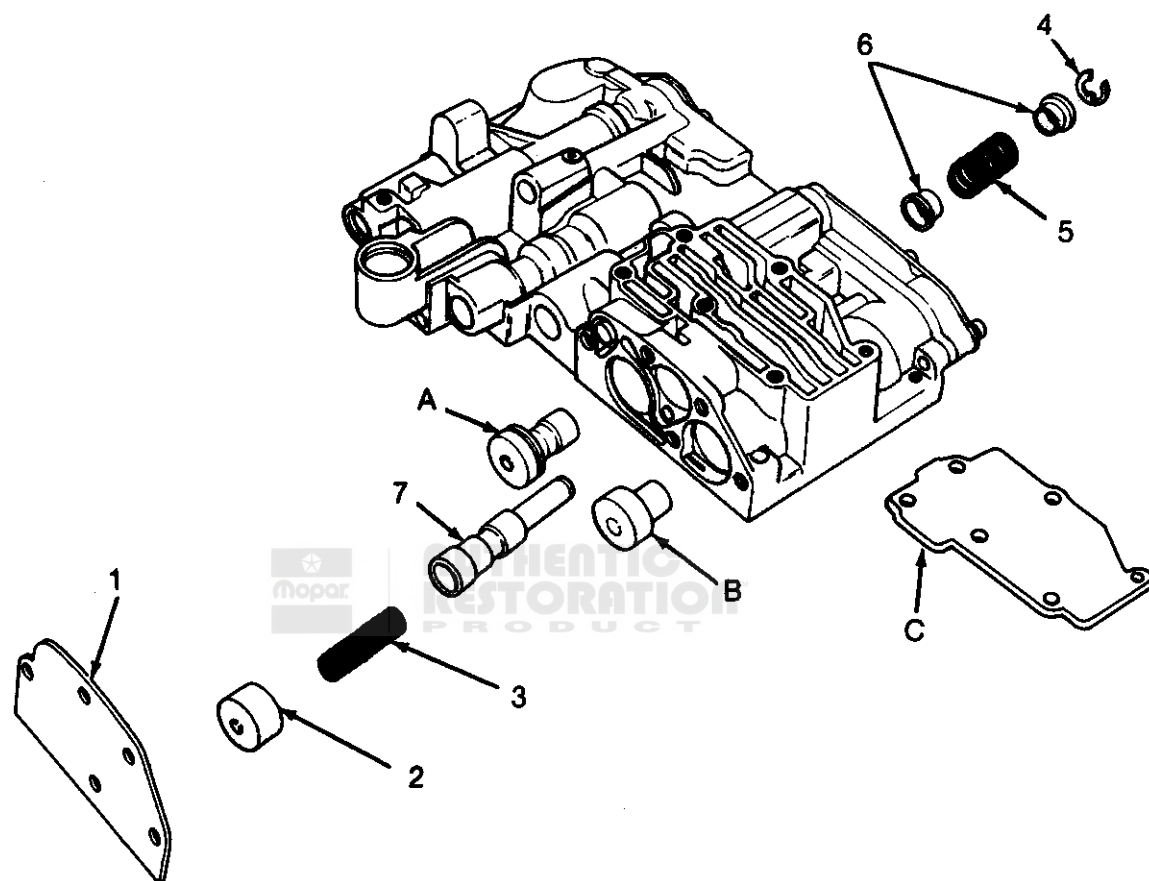
B = 1/4 Inch Diameter

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AUTOMATIC TRANSMISSIONS

OVERHAUL



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84479

Turn the valve body over and remove the shuttle valve cover plate.

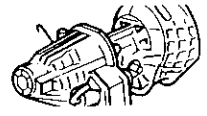
Remove the governor plug end plate (1), shuttle valve throttle plug (2) and spring (3), and 1-2 (A) and 2-3 (B) shift valve governor plugs.

Remove the shuttle valve E-clip (4), shuttle valve secondary spring (5), spring guides (6), and shuttle valve (7).

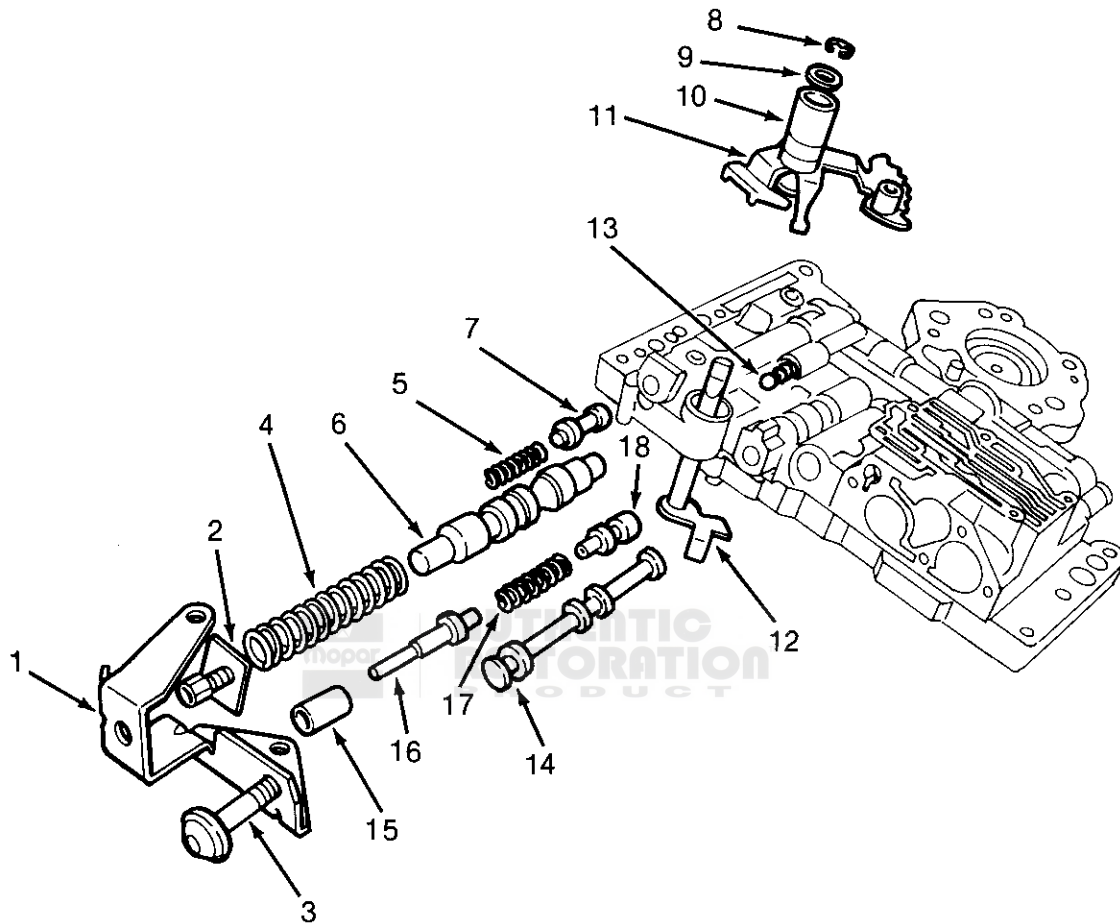


AUTOMATIC TRANSMISSIONS

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84480

Remove the screws attaching the line pressure adjusting screw bracket and retainer (1) to the valve body and remove the bracket, screw, and retainer. Hold the spring retainer firmly against the spring force while removing the last screw.

Release the pressure applied to the spring retainer and remove the spring retainer and line pressure adjusting screw assembly (2) and throttle pressure adjusting screw (3). Do not

disturb the screw settings. Remove the line pressure (4) and torque converter valve regulator springs (5). Tag the springs for assembly reference.

Remove the line pressure regulator (6) and torque converter control (7) valves.



AUTOMATIC TRANSMISSIONS

OVERHAUL



Install the Detent Ball Retainer Tool J-24044 around the detent ball casing.

Remove the E-clip (8), washer (9), and seal (10) from the throttle valve lever shaft.

Remove any burrs on the shaft with crocus cloth.

Slide the manual lever assembly (11) off the throttle lever shaft and remove the throttle lever assembly (12).

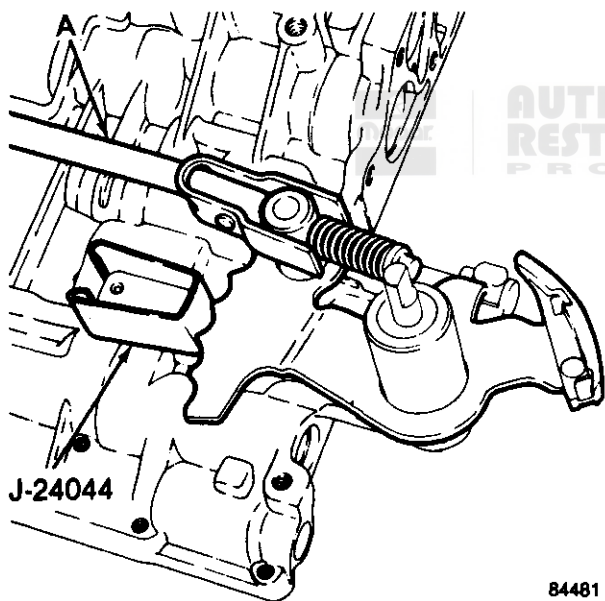
Remove the E-clip and park control rod from the manual lever (A).

CAUTION: The detent ball retainer tool is holding the ball against spring pressure. Shield the ball casing area with one hand before removing the retainer tool and detent ball.

Remove the detent ball retainer tool, detent ball, and spring (13). Tag the spring for assembly reference.

Remove the manual valve (14).

Remove the kickdown detent (15), kickdown valve (16), throttle valve spring (17), and throttle valve (18). Tag the spring for assembly reference.



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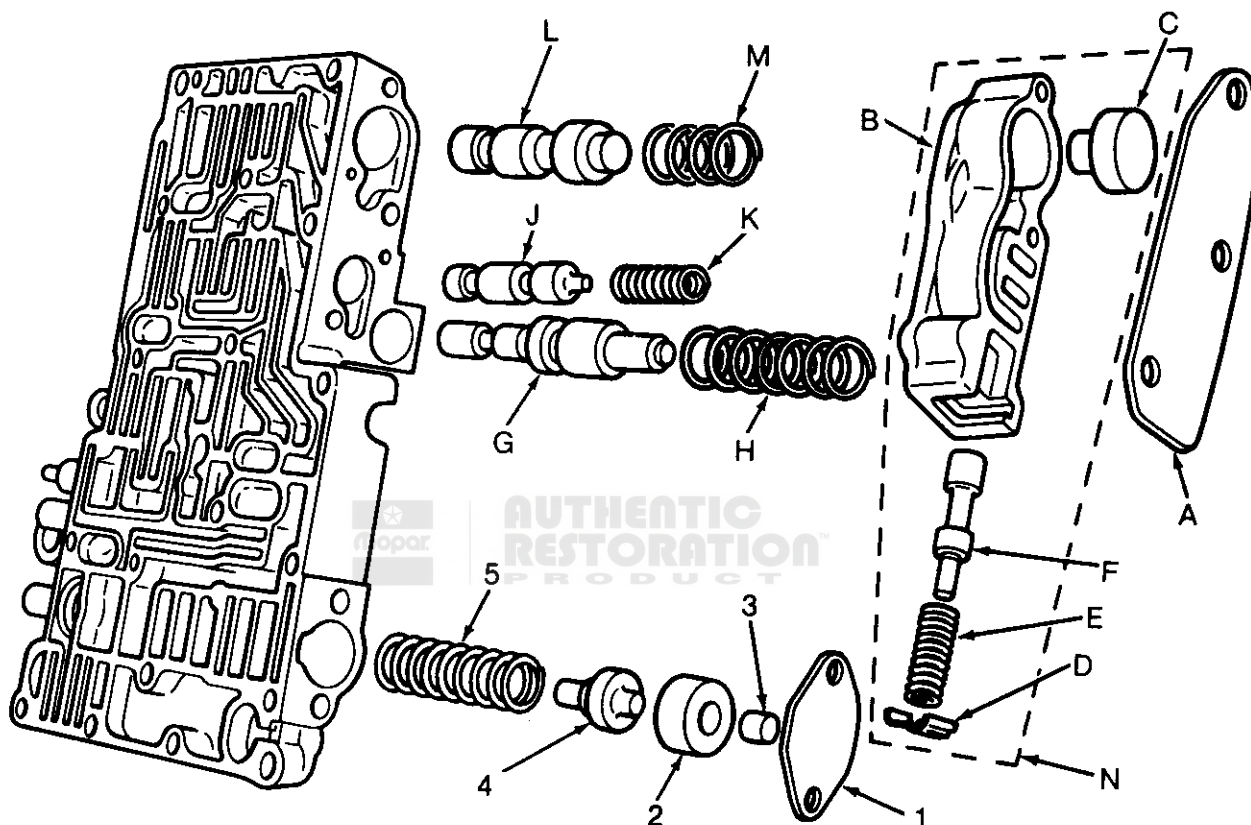


AUTOMATIC TRANSMISSIONS

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84482

Remove the line pressure regulator valve end plate (1).

Remove the sleeve (2), line pressure regulator valve plug (3), and throttle pressure regulator valve plug (4), and spring (5).

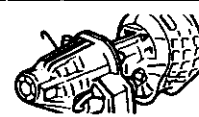
Remove the downshift valve housing end plate (A).

Remove the downshift valve housing (B), throttle plug (C) and downshift valve retainer (D), spring (E) and limit valve (F), from housing.



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Tag the spring for assembly reference.

Remove the 1-2 shift control valve (G) spring (H), 1-2 shift valve (J) spring (K), 2-3 shift valve (L) and spring (M).

Tag all the springs for assembly reference.

Cleaning and Inspection

Thoroughly wash and air dry all parts.

Do not use any type of caustic cleaning solution. Be sure all passages are clean and free from obstructions.

Clean the regulator filter in solvent and air dry. Replace the filter, if damaged.

Inspect the manual and throttle valve levers and shafts for being bent, worn or excessively loose. If a lever is loose on a shaft, replace the lever and shaft assembly. If a lever or shaft is bent, replace the assembly.

Inspect all mating surfaces for burrs, nicks and scratches. Remove minor irregularities using crocus cloth and very light pressure.

Use a straightedge and inspect all mating surfaces for warp or distortion. Very slight warp or distortion may be corrected by abrading the surface on a sheet of crocus cloth. Position the cloth on a surface plate or flat piece of glass and use very light pressure.

Be sure all metering holes in the separator plate and valve body are open. Use a penlight to inspect the bores in the valve body for corrosion, scores, burrs, scratches, pits, and other irregularities.

Inspect all valve springs for distortion or collapsed coils.

Inspect all valves and plugs for burrs, nicks, and scores. Remove slight irregularities using crocus cloth but do not round off the sharp edges. The sharpness of these edges is vitally important because it prevents foreign matter from lodging between the valve and the body bore.

Inspect all valves and plugs for freedom of operation in the valve body bores. When the bores, valves, and plugs are clean and dry, the valves and plugs fall freely in the bores. Make sure the orifice in the 1-2 shift control bore in the valve body is open. Verify this by inserting a .79 mm (1/32-inch) diameter drill through the orifice and into the 1-2 shift control bore.

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NOTE: A valve body that functioned properly when the vehicle was new will operate correctly after cleaning, reconditioning, assembly, and adjustment if:

- (a) all mating surfaces are flat.
- (b) bores, plugs, and valves are smooth.
- (c) metering holes are open.
- (d) springs are not damaged.
- (e) valves and plugs slide freely in their bores.

There is no need to replace a valve body unless it is damaged in handling.

Assembly

Install the 1-2 and 2-3 shift valves (J) (L) and springs (K) (M), and the 1-2 shift control valve (G) and spring (N) into the valve body.

Assemble and install the downshift housing assembly in the following sequence:

- (a) Install the limit valve (F) and spring (E).
- (b) Slide the spring retainer (D) into the groove.
- (c) Insert the throttle plug (C) into the bore.
- (d) Position the downshift housing end plate (A) into the housing (B) and insert the retaining screws.
- (e) Position the downshift housing assembly against the shift valve springs. Be sure all the springs are in proper alignment. Install and tighten the retaining screws to 4 N·m (35 in-lbs) torque.

Install the throttle pressure regulator valve spring (5) and plug (4).

Install the line pressure regulator valve plug (3) and sleeve (2).

Install the line pressure regulator valve end plate (1).

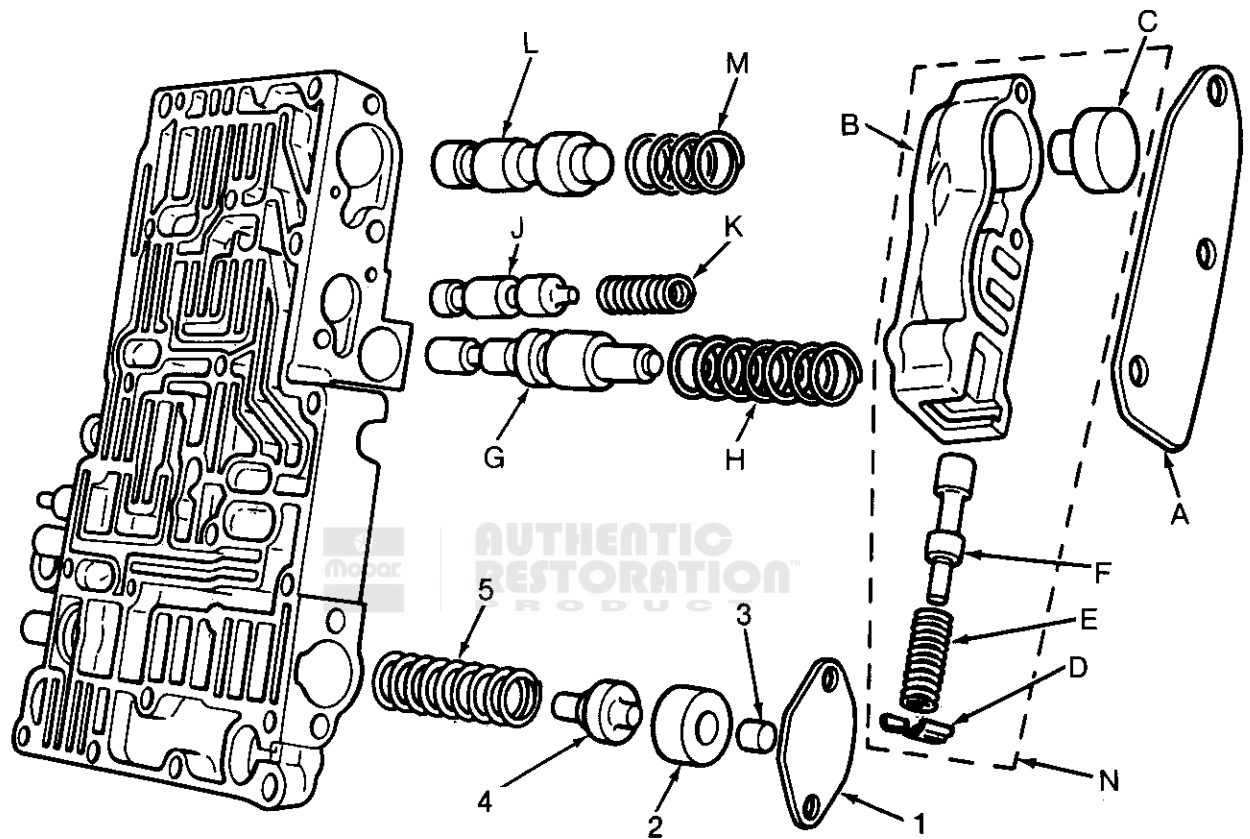
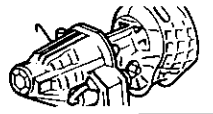


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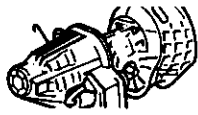
AUTOMATIC TRANSMISSIONS

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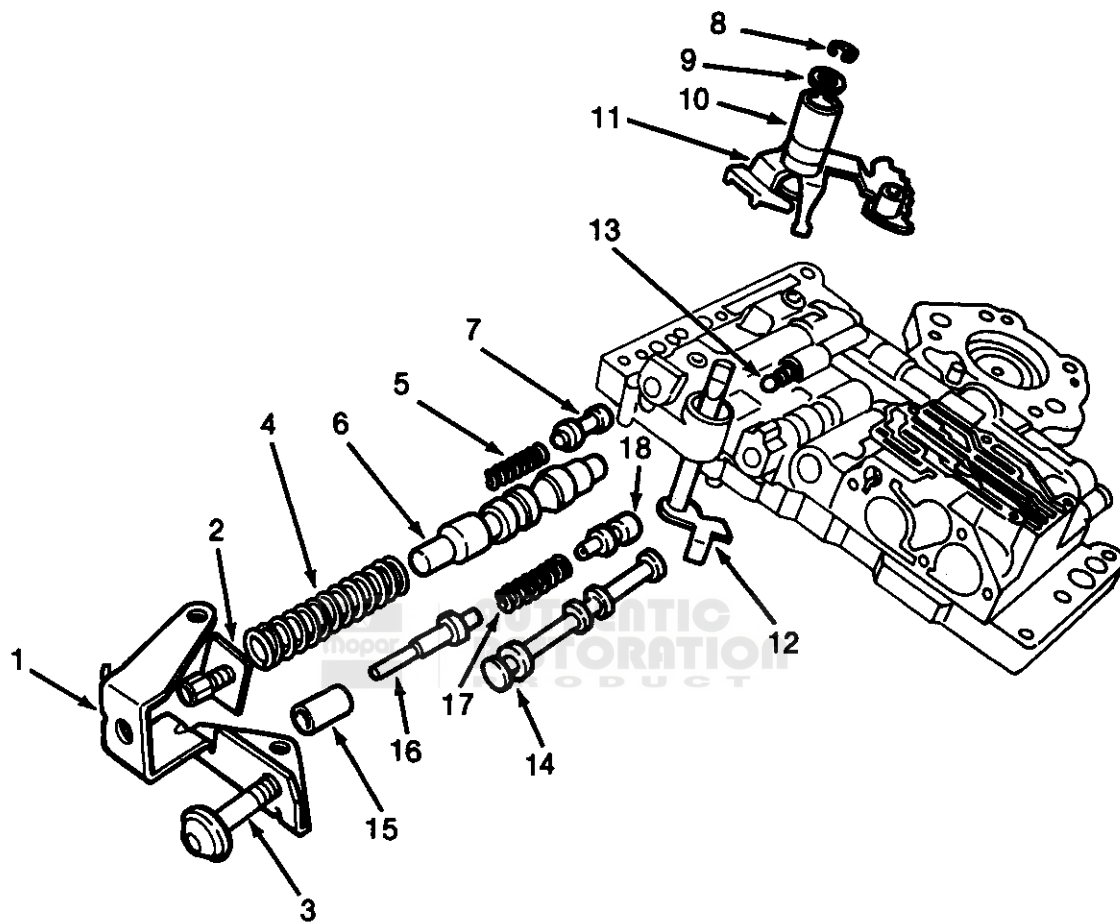


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Install the throttle valve (18), valve spring (17), kickdown valve (16) and detent (15).

Install the manual valve (14).

Insert the detent ball and spring (13) into the valve body. Install Retainer Tool J-24044 around detent ball casing to retain the ball and spring.

Install the throttle lever assembly (12).

Install the manual lever assembly (11) on the throttle lever shaft. Position the manual lever assembly so it engages the manual valve and detent ball.

Install the seal (10), washer (9) and E-clip (8) on the throttle lever shaft.

Remove the detent ball retainer tool.

Install the line pressure regulator valve (6) and spring (4) and install the converter control valve (7) and spring (5).

Install the line pressure regulator valve (3) adjusting screw assembly (2) on the spring retainer bracket (1) and position it on the valve body.

Attach the bracket to the side of the valve body and tighten the retaining screws only after starting both the top and bottom bracket screws. Tighten the screws to 4 N·m (35 in-lbs) torque.

NOTE: When installing spring retainer bracket, be sure all parts are properly aligned before tightening the screws.

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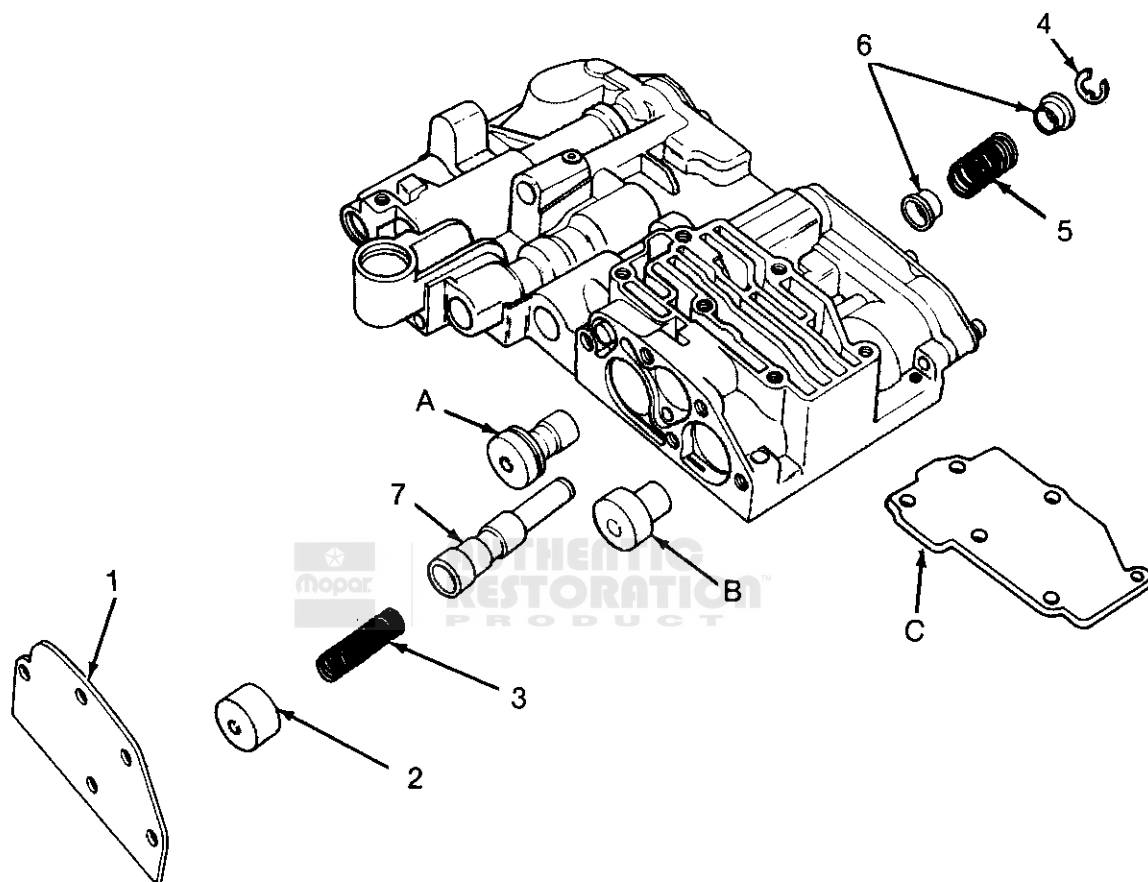


AUTOMATIC TRANSMISSIONS

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84484

Install the 1-2 (A) and 2-3 (B) shift valve governor plugs.

Install the shuttle valve (7), primary spring (3) and the throttle plug (2).

Install the governor plug end plate (1) and tighten the screws to 4 N·m (35 in-lbs) torque.

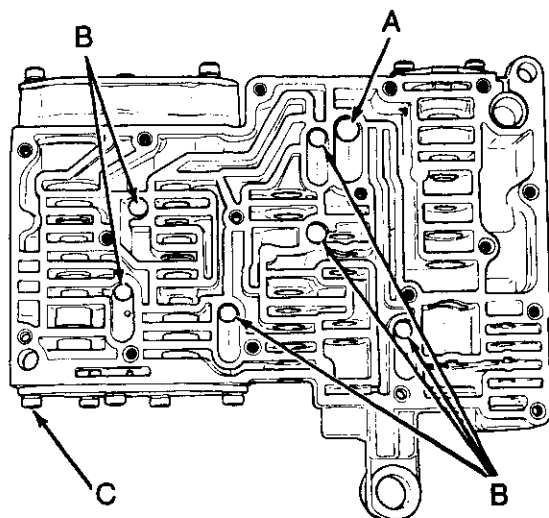
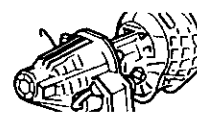
Install the spring guides (6), shuttle valve secondary spring (5) and E-clip (4).

Install the shuttle valve cover plate (C) and tighten the screws to 4 N·m (35 in-lbs) torque.



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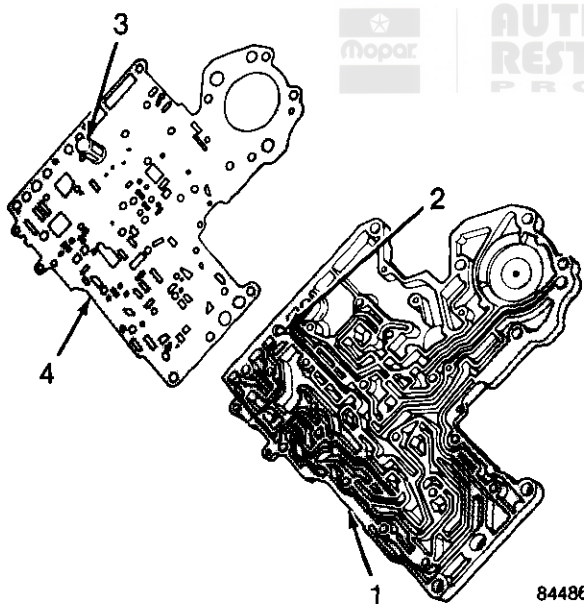
Check Ball Size Chart

A = 11/32 Inch Diameter

B = 1/4 Inch Diameter

84485

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84486

Install the check balls (A) (B) in the valve body.

Install the pressure regulator valve screen (3) in the separator plate (4) and rear clutch check ball (2).

Position the separator plate (4) on the transfer plate (1) and the stiffener plate on the separator plate.

Install the stiffener and separator plate-to-transfer plate retaining screws. Tighten the screws to 4 N·m (35 in-lbs) torque.

Position the transfer plate assembly on the valve body and install the retaining screws finger-tight.

NOTE: Before tightening the retaining screws be sure the pressure regulator filter screen is properly aligned.

Starting at the center and working outward, tighten the transfer plate assembly retaining screws to 4 N·m (35 in-lbs) torque.

Install the E-clip and park control rod on the manual lever assembly.

Install the oil filter.

Check and adjust the throttle and line pressure settings if necessary.

NOTE: If pressures were satisfactory before disassembly, do not change the line or throttle pressure adjusting screw settings.



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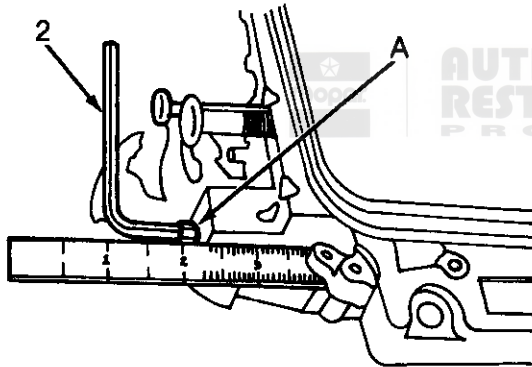


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Valve Body Hydraulic Control Pressure Adjustments

There are two hydraulic control pressure adjustments that can be performed on the valve body, they are: Line pressure and throttle pressure adjustment.

Because line and throttle pressure are interdependent (each affects shift quality and timing), both adjustments must be performed properly and in the correct sequence which is; line pressure adjustment first – throttle pressure adjustment last.



84487

Line Pressure Adjustment

Measure the distance from the valve body to the inner edge of the adjusting screw using the accurate steel scale.

The distance measured should be 33.4 mm (1-5/16 inches).

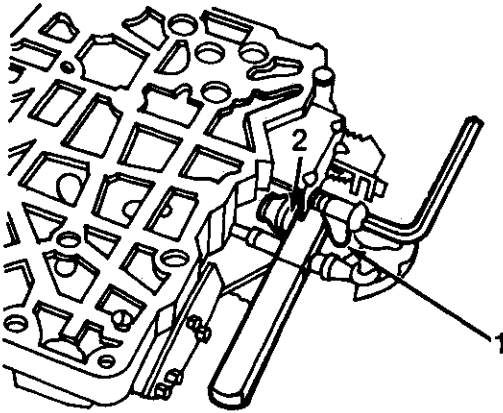
If adjustment is required, turn the adjusting screw (A) in or out to obtain 33.4 mm (1-5/16 inch) setting.

NOTE: The 33.4 mm (1-5/16 inches) setting is an approximate setting. Because of manufacturing tolerances, it may be necessary to vary from this dimension to obtain the desired pressure. One complete turn of the adjusting screw changes line pressure approximately 9kPa (1-2/3 psi). Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.



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Throttle Pressure Adjustment

Insert the Gauge Tool J-24031 between the throttle lever cam (1) and kickdown valve (2).

Push the gauge tool inward to compress the kickdown valve against the spring and to bottom the throttle valve in valve body.

Maintain the pressure against the kickdown valve spring and turn the throttle lever stop screw until the screw head touches the throttle lever tang and the throttle lever cam touches the gauge tool.

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed in the valve body to obtain a correct adjustment.

Accumulator Piston and Spring – Inspection

Inspect the piston for nicks, burrs, scores and wear. Be sure the rings turn freely in the piston grooves. Inspect the case bore for scores or other damage.

Inspect the spring for cracks or distortion. Replace damaged or worn parts.

Adapter Housing Bearing and Seal Replacement

Remove the seal from extension housing using a screwdriver or punch.

Remove the snap rings and remove the bearing from the housing.

Install the replacement bearing in the housing and install the snap rings.

Install the replacement seal in the housing. Seat the seal flush with the edge of the seal bore in the housing.

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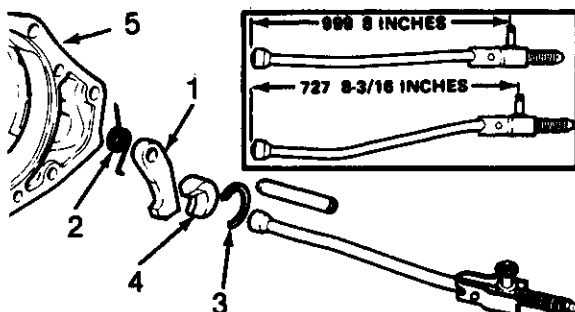


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Park Lock Sprag

Disassembly

Remove the pivot shaft from adapter housing.



Transmission	A	B
727		208 mm (8-3/16)
900	203.6 mm (8 in.)	

84489

Remove the park sprag (1) and the spring (2).

Remove the snap ring (3) and reaction plug and the pin assembly (4) from the housing (5).

Inspection

Inspect the pivot shaft for scores and free movement in the housing and sprag. Inspect the control rod and sprag springs for distortion and loss of tension. Inspect the sprag and gear for cracks and broken edges on the engagement lugs. Inspect the knob at the end of the control rod for excessive wear, nicks, burrs, and free turning.

If necessary, replace the park gear as outlined under Governor and Support – Disassembly and Assembly.

Assembly

Install the reaction plug and pin assembly (4) in housing and install snap ring (3).

Install the sprag (1) and spring (2) in the housing.

NOTE: The square lug on the sprag must face the park gear.

Position the spring so it moves the sprag away from the gear.

Install the pivot pin.

Governor

Disassembly

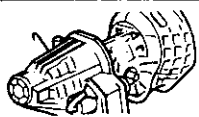
Remove the large snap ring (1) from the weight end of the governor body (A).

Remove the weight assembly (2).

Remove the snap ring (3) from the governor weight assembly.

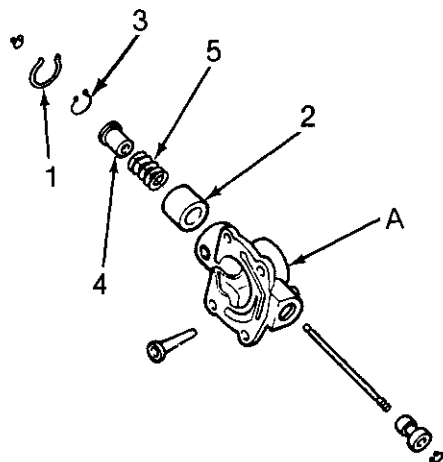
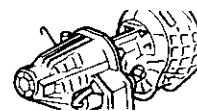
Separate the inner weight (4), spring (5), and outer weight (2).

NOTE: If the park gear or governor body are to be replaced, straighten the lock tabs and remove the four attaching bolts.



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84490

Inspection

Thoroughly clean and dry all governor parts and check for free movement. Do not use a caustic cleaning solution.

The weights and valve should fall freely in their bores when clean and dry. Rough surfaces and burrs may be polished with crocus cloth.

Inspect the governor weight spring for distortion.

Inspect the park gear and governor support for chipped or worn gear teeth and damaged ring grooves.

Clean the filter in solvent and air dry. Replace it if damaged or defective.

Assembly

If the governor body was separated from park gear, assemble the parts and install the attaching bolts finger-tight.

NOTE: The bolts must not be tightened to specified torque until the assembly is installed on the output shaft.

Install governor weights and spring (5) in outer weight (2), and install snap ring (3).

Install weight assembly into body.

Install snap ring (1).

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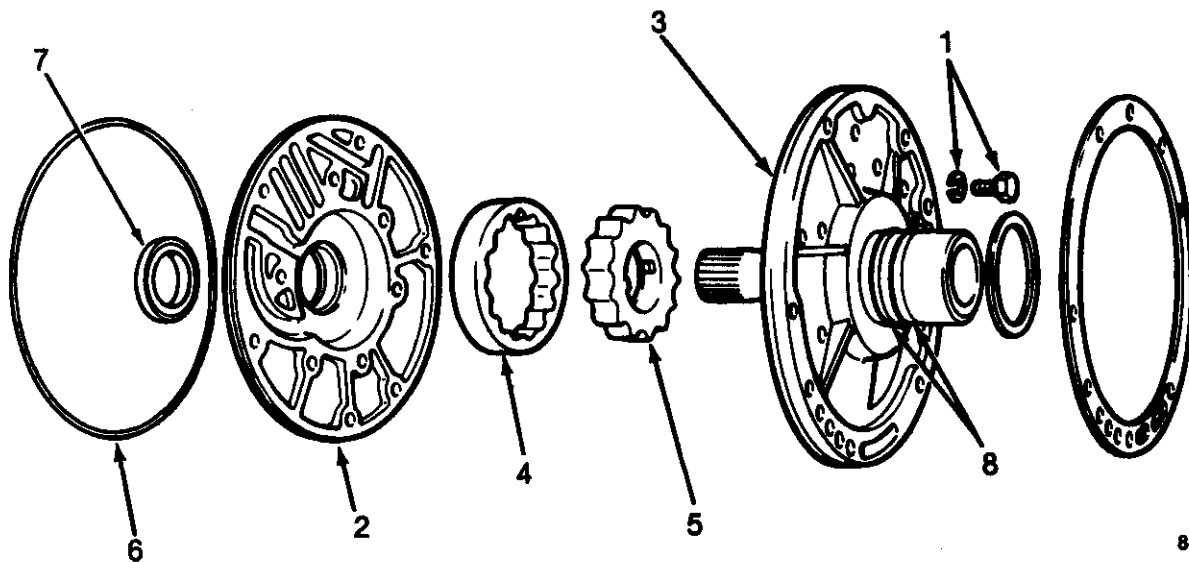


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Oil Pump and Reaction Shaft Support – 900 Series



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Disassembly

Remove the bolts (1) attaching the pump (2) to the support (3) and remove the support.

Mark the pump rotors (4) (5) for assembly reference.

Remove the rotors.

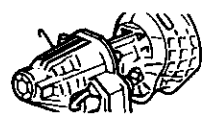
Remove the O-ring (6), seal (7) using a blunt punch.

Remove the front clutch seal rings (8) from the support.



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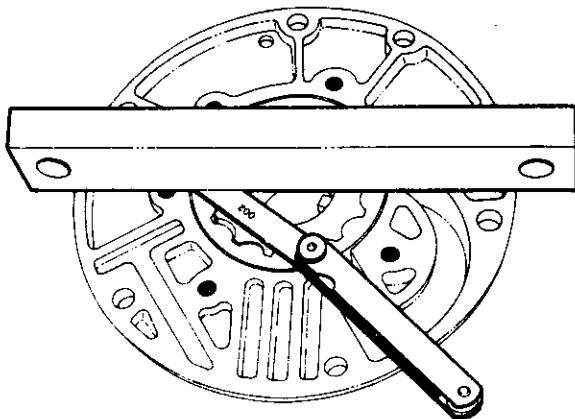
OVERHAUL



Inspection

Inspect the front clutch seal ring grooves for burrs, nicks, or cracked edges. Inspect the front clutch retainer-to-reaction shaft support thrust washer for wear. The washer should be 1.09 to 1.14 mm (0.043 to 0.045 in) thick. Inspect all machined surfaces on the pump housing and support for nicks and burrs. Inspect the pump body and reaction shaft support bushings for wear and scores. Inspect the pump rotors for scores or pits.

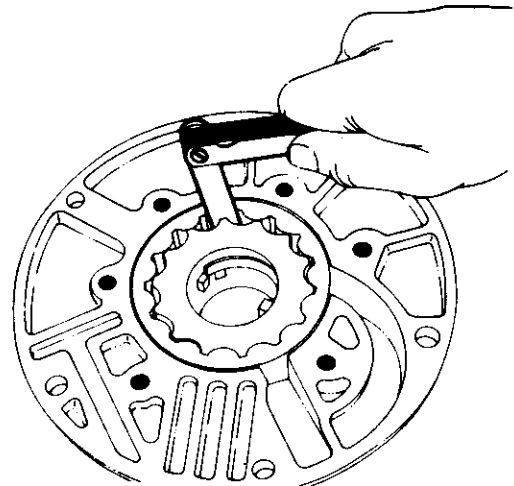
Install the pump rotors in the pump body. Place straightedge across the rotor faces and pump body. Using a feeler gauge, measure the clearance between the straightedge and pump rotors. Clearance limits are 0.02 to 0.07 mm (0.001 to 0.003 in).



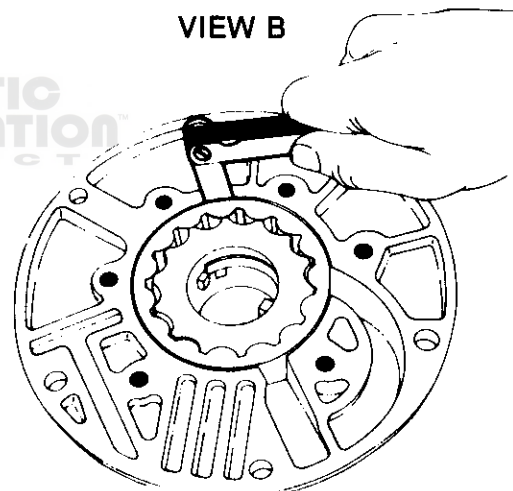
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Position the inner and outer rotors so that the center of one tooth on each rotor is aligned. Measure the clearance between the tips of the teeth. Make four measurements. Rotate the inner rotor approximately 1/4 turn (90°) between measurements. Rotor tip clearance should be 0.13 to 0.25 mm (0.005 to 0.010 in) (View A).

VIEW A



VIEW B



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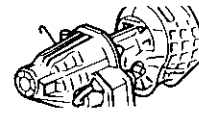
Measure the clearance between the outer surface of the outer rotor and the pump bore. The clearance should be 0.10 to 0.20 mm (0.004 to 0.008 in) (View B).

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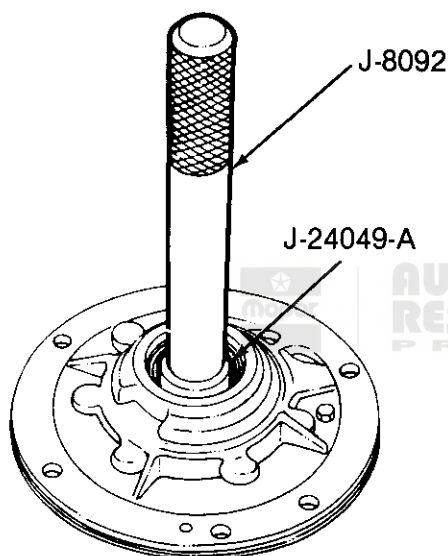


Pump Bushing Replacement

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Position the pump housing, with the reaction shaft support mating surface facing downward, on a flat, level surface.

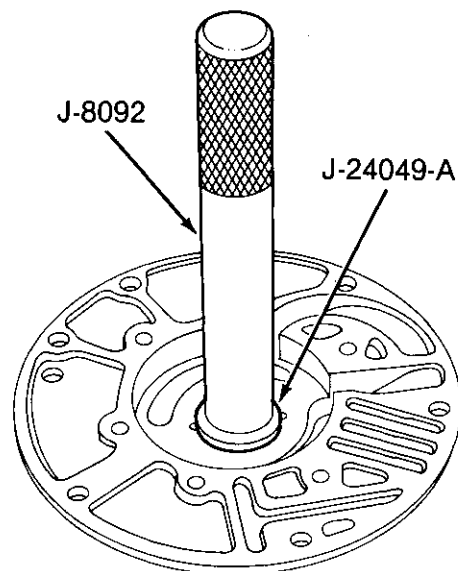
Remove the bushing using Remover and Installer Tool J-24049-A and Driver Handle J-8092.



NOTE: Be careful to keep the tool straight in the bore during removal.

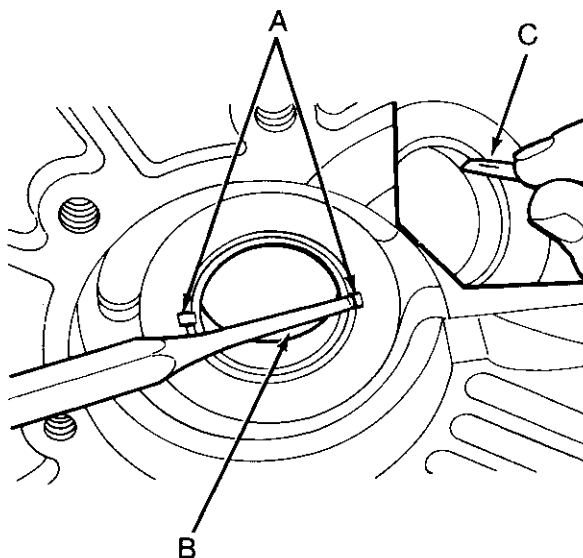
Position replacement bushing on Installer Tool J-24049-A.

Turn the pump housing over and install the bushing straight into the housing until the edge of bushing is flush with the bore.



Stake the bushing in two places (A) (to retain it) using a blunt punch (B).

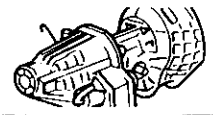
Use a knife, with a narrow blade (C) only, to remove burrs or high points at the stake points. Do not use a file or other tool that will remove more metal than is necessary.





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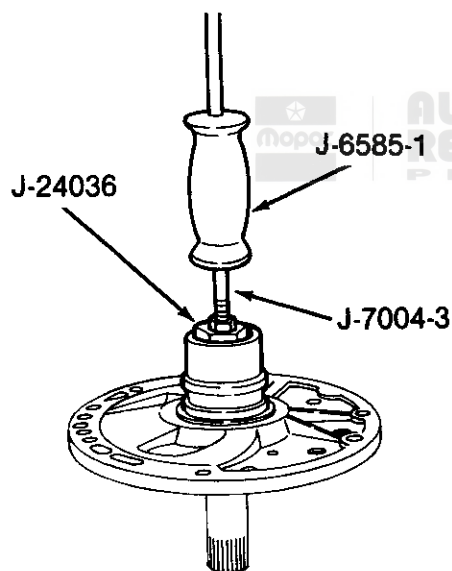


Reaction Shaft Bushing Replacement

NOTE: If the reaction shaft bushing requires replacement, be sure to inspect the support for wear at the input shaft and rear clutch retainer seal ring lands. If the lands are worn or grooved, replace the entire support assembly.

CAUTION: Do not clamp any part of the reaction shaft or support in a vise.

Thread the Bushing Remover Tool J-24036 straight into the bushing as far as possible by hand.



84497

Using a wrench, thread the remover tool into the bushing three or four additional turns to fully engage the threads of the tool in the bushing.

Install the Slide Hammer Tools J-7004-3 and J-6585-1 into remover tool.

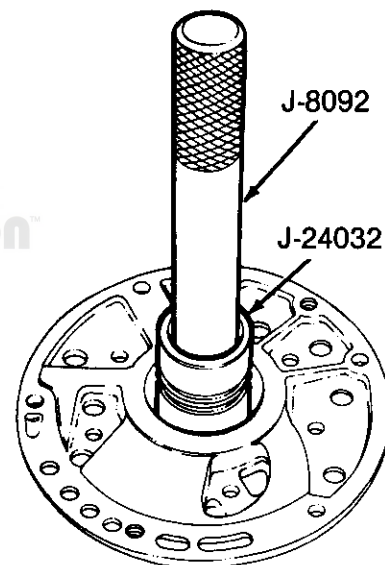
Bump outward with the slide hammers to remove the bushing.

Clean the chips from the reaction shaft support assembly.

Grip the old bushing with pliers and remove it from Tool J-24036.

CAUTION: Be sure to protect the remover tool threads when using the tool.

Thread Bushing Installer Tool J-24032 onto the Driver Handle J-8092.



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Position the replacement bushing on the installer tool and install the bushing straight into the shaft bore until the tool bottoms.

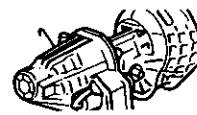
Clean the reaction shaft support thoroughly after bushing installation.

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Assembly

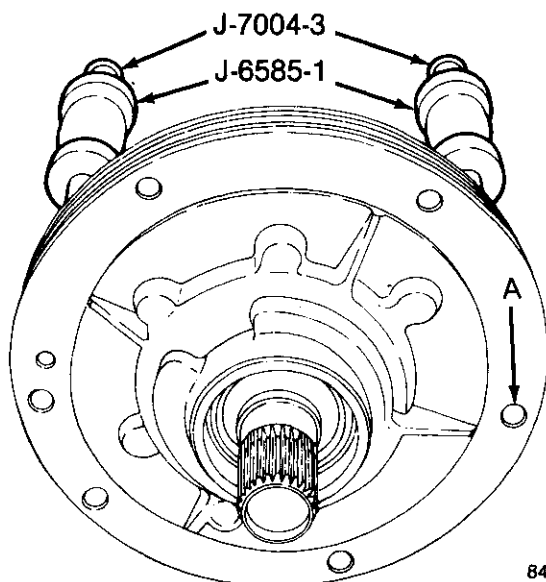
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Position the pump housing on a smooth flat surface and install the pump rotors.

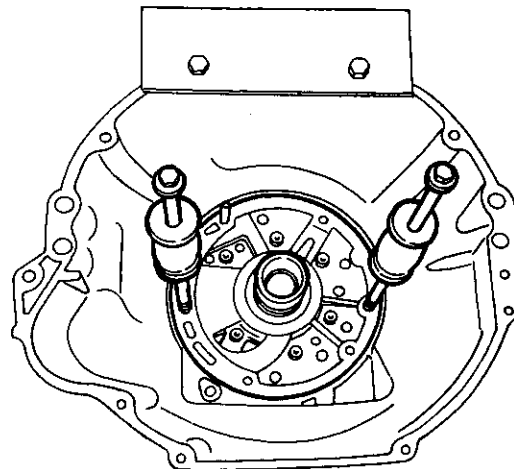
NOTE: New rotors may be installed with either face up. Used rotors must be installed as removed. Refer to reference marks made during disassembly.

Align and install the reaction shaft support on the pump housing and finger-tighten the attaching bolt.

Insert two Slide Hammers J-6585-1 and Bolts J-7004-3, from the back to the front, into the threaded reaction shaft support holes. The bolts should be threaded into the support until the ends of bolts are 1.6 mm (1/16-inch) below front machined surface of pump housing (A).



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Install one Pilot Stud Tool J-3387-2 into the case pump opening.

Install the pump assembly backward into the case opening. Tap the pump gently to seat it in the case.

Tighten the bolts attaching the reaction shaft support to the pump housing to 19 N·m (160 in-lbs) torque.

Remove the pump and reaction shaft support assembly from the case.

Remove the slide hammer tools from the pump.

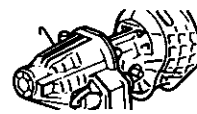
Position the oil seal in the pump housing with the seal lip facing inward.

Install the seal using Installer Tool J-9617. Install the seal into the housing until the tool bottoms.



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Oil Pump and Reaction Shaft Support – Model 727

Disassembly

Remove the pump-to-support attaching bolts (1) and remove the support (2) from pump (3).

Mark the rotors for assembly alignment reference.

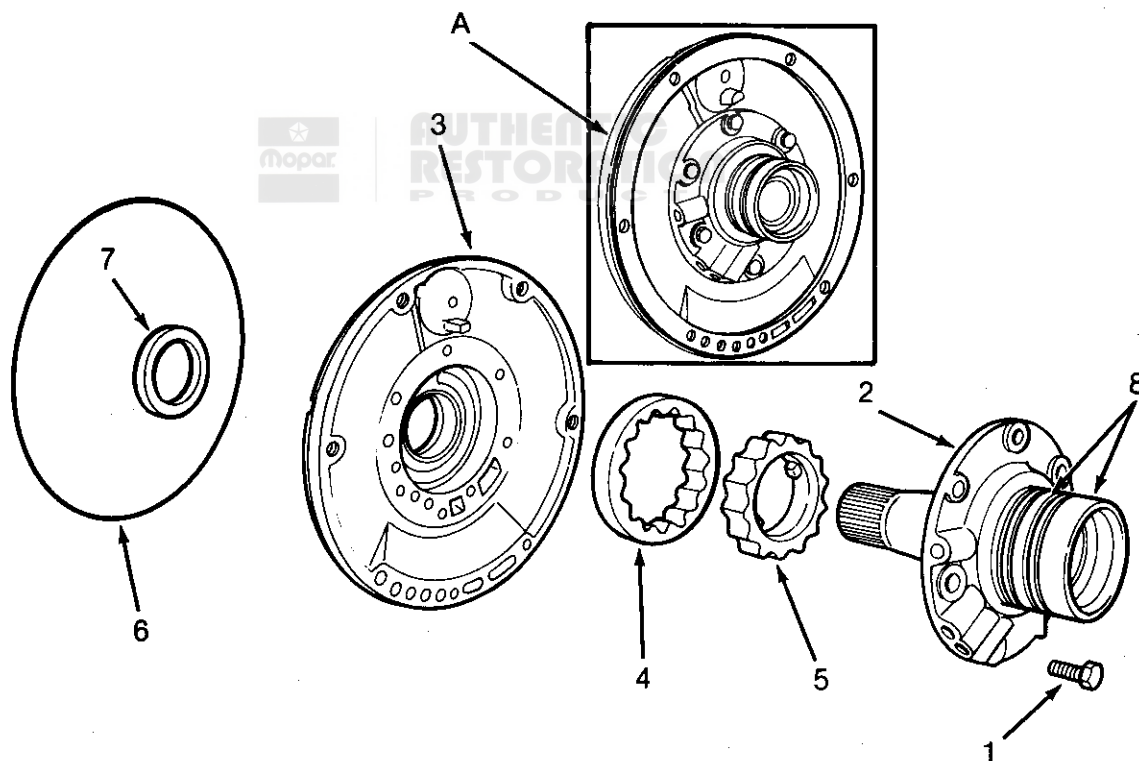
Remove the rotors (4) (5).

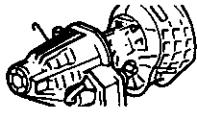
Remove the O-ring seal (6) from the pump body flange (A).

Remove the front oil seal (7) using a blunt punch.

Remove the front clutch seal rings (8) from the support.

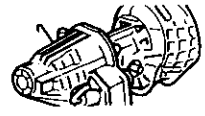
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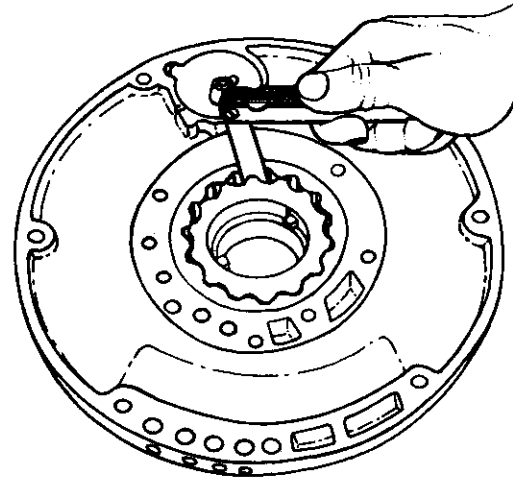
Inspection

Inspect the front clutch seal ring grooves for burrs, nicks, or cracked edges. Inspect all machined surfaces on the pump housing for nicks and burrs. Inspect the pump body and reaction shaft support bushings for wear and scores. Inspect the pump rotors for scores and pits.

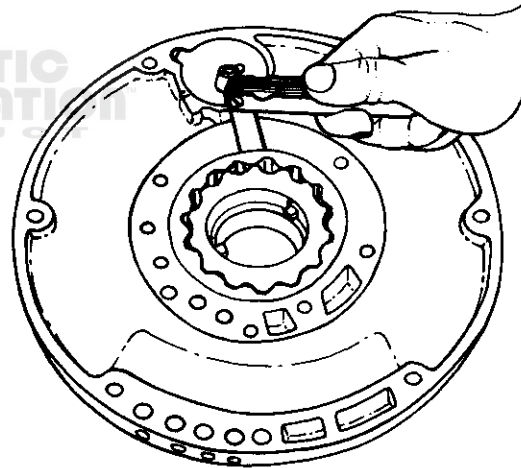
Install the pump rotors in the pump body. Position a straightedge (A) across the rotor faces and pump body and use a feeler gauge (B) to measure the clearance between the straightedge and rotors. Clearance limits are 0.02 to 0.07 mm (0.001 to 0.003 in).

Position the inner and outer rotors so that the center of one tooth on each rotor is aligned and measure the clearance between the tips of the teeth. Make four measurements. Rotate the inner rotor approximately 1/4 turn (90°) between measurements. Rotor tip clearance should be 0.13 to 0.20 mm (0.005 to 0.010 in) (View A).

VIEW A



VIEW B

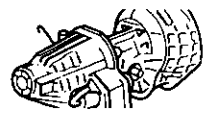


84503

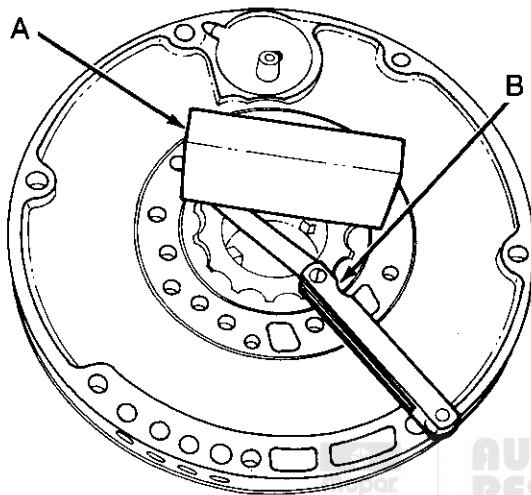


AUTOMATIC TRANSMISSIONS

OVERHAUL



Measure the clearance between the outer surface of the outer rotor and the pump bore. Clearance should be 0.10 to 0.20 mm (0.004 to 0.008 in) (View B).

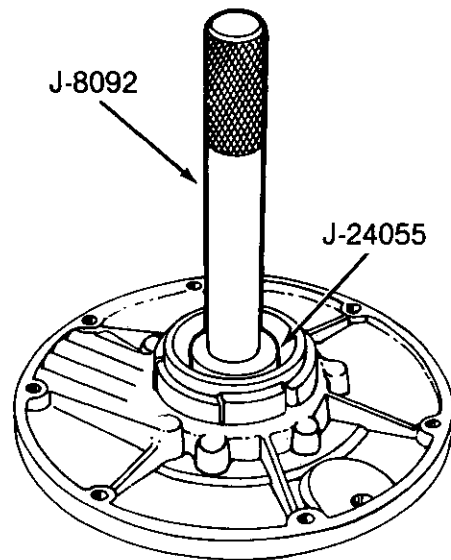


84502

Pump Bushing Replacement

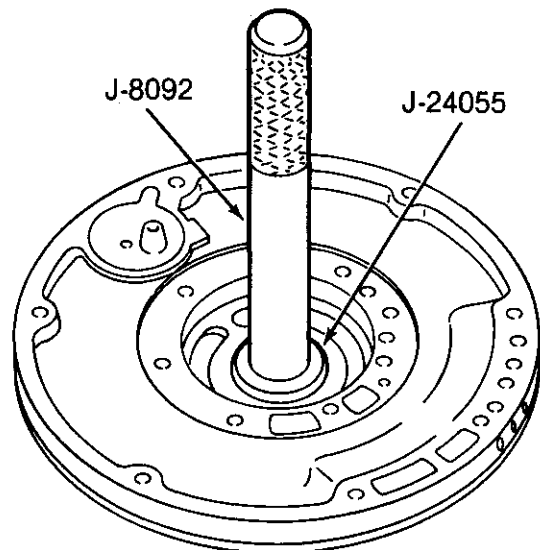
Place the pump housing, with the reaction shaft support mating surface facing downward, on a flat, level surface.

Remove the bushing using Remover/Installer Tool J-24055 and Driver Handle J-8092.



84504

Install the replacement bushing on Remover/Installer Tool J-24055.



84505

Turn the pump housing over and install the bushing straight into the housing until the edge of the bushing is flush with the bore.

SEE
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NOTES



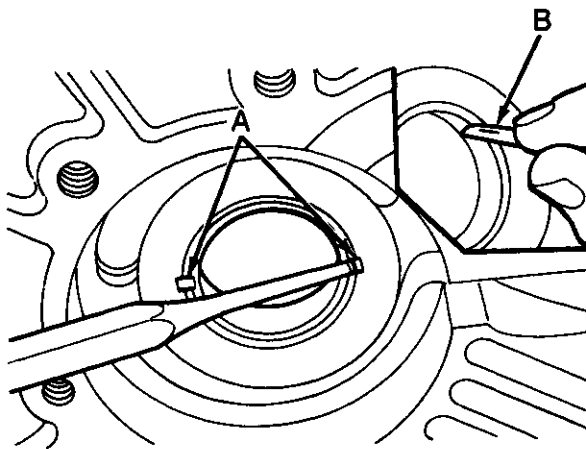
AUTOMATIC TRANSMISSIONS

OVERHAUL



SEE
I.S.
NOTES

Stake the bushing (A) in two places to retain it using a blunt punch (B).



84506

Use a knife, with a narrow blade only, to remove burrs or high spots at the stake points.

NOTE: Do not use a file or similar tool that might remove more metal than is necessary.

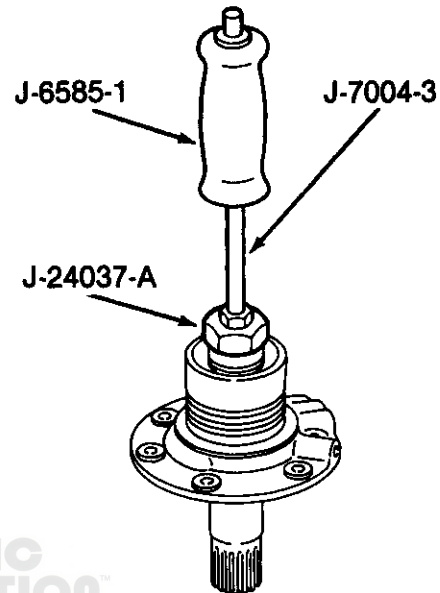
Clean the pump housing thoroughly after bushing installation.

Reaction Shaft Bushing Replacement

NOTE: If the reaction shaft bushing requires replacement, also inspect the shaft and support bore for wear caused by the input shaft seal ring lands. If the bore is worn or grooved, replace the entire support assembly.

CAUTION: Do not clamp any part of the reaction shaft or support in a vise.

Thread Bushing Remover Tool J-24037-A to the bushing as far as possible by hand.



84507

Using a wrench, thread the remover tool into the bushing three to four additional turns to fully engage the threads of the tool into the bushing.

Install Slide Hammer Bolts Tool J-7004-3 and J-6585-1 into the remover tool. Bump outward with the slide hammers to remove bushing.

Thoroughly clean the reaction shaft support assembly after bushing removal.

Grip the old bushing with the pliers and remove it from the Tool J-24037-A.

NOTE: Be sure to protect the threads on the remover tool when using the tool.

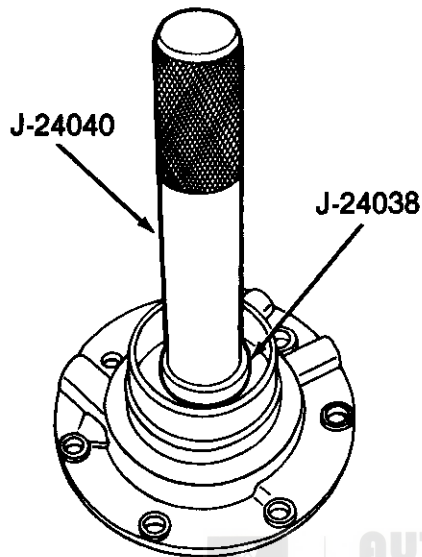


AUTOMATIC TRANSMISSIONS

OVERHAUL



Thread the Bushing Installer Tool J-24038 onto Driver Handle J-8092.



Position the replacement bushing on the installer tool and install the bushing straight into the shaft bore until the tool bottoms.

Assembly

Install the pump rotors in the housing.

Install the reaction shaft support and tighten the attaching bolts to 18 N·m (160 in-lbs) torque.

Install the O-ring seal around the pump housing flange.

Install the oil seal pump housing with the seal lip facing inward.

Install the oil seal on Installer Tool J-21005.

Install the seal straight into the housing until the tool bottoms.

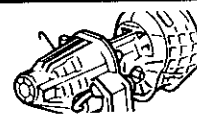
Thoroughly clean the reaction shaft support assembly.

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OVERHAUL



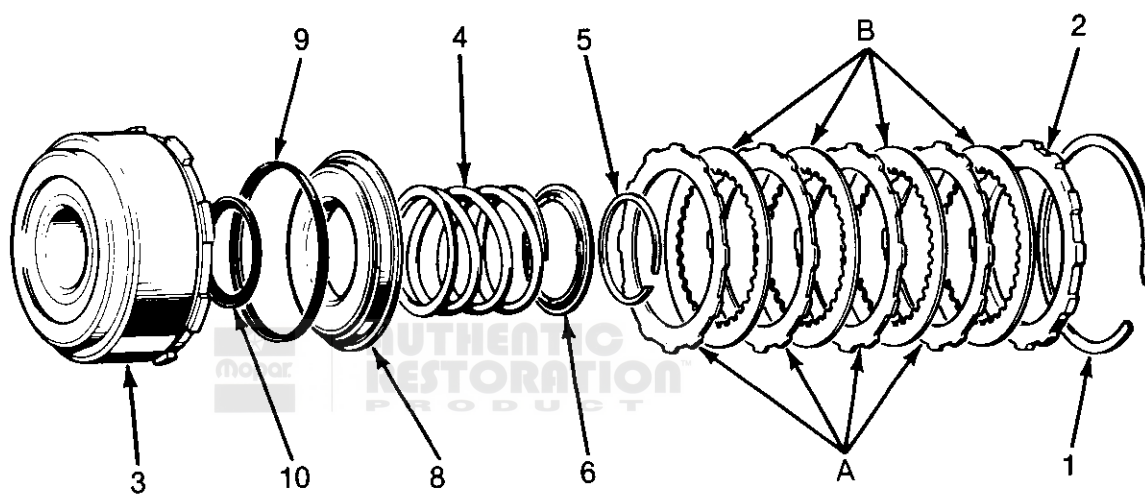
SEE
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Front Clutch – 900 Series

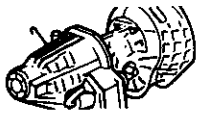
Disassembly

Remove the large waved snap ring (1) which secures the pressure plate (2) in the clutch retainer (3).

Remove the steel plates (A) and the clutch plates (B).

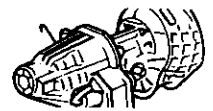


84509

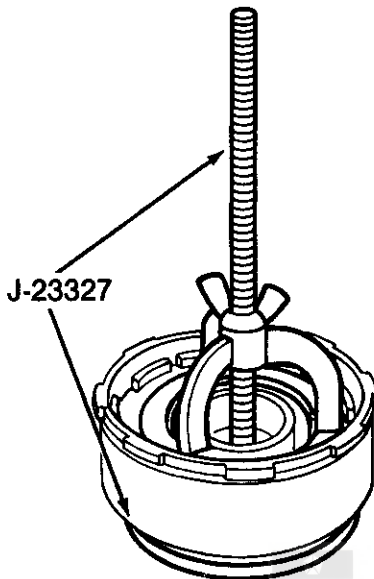


AUTOMATIC TRANSMISSIONS

OVERHAUL



Install the Spring Compressor Tool J-23327 over piston spring retainer.



Compress the piston springs (4) and remove the snap ring (5).

Release the compressor tool slowly until the spring retainer is free of the hub.

NOTE: When releasing the compressor tool, do not allow the spring retainer to stick or bind in the snap ring groove.

Remove the tool, retainer (6) and piston spring.

Turn clutch retainer over and bump on the wood block to dislodge and remove the piston.

Remove the seal rings (9) (10) from the piston and clutch retainer hub.

Inspection

Inspect the friction material on all driving discs. Replace discs that are charred, glazed, heavily pitted, flaking or if the friction material can be scraped off easily.

Inspect the steel plates and pressure plate surfaces for overheating, scoring, warping and for damaged driving lugs. Replace any worn, damaged parts.

Inspect the steel plate lug grooves in the clutch retainer for smooth surfaces. The plates must slide freely in the grooves.

Inspect the band application surface on the clutch retainer for nicks and scores. Light scratches and nicks can be removed with crocus cloth.

Inspect the ball check in the clutch retainer. The ball should move freely in its cage.

Inspect the seal ring surfaces inside the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of the rings. Inspect the clutch retainer bushing for scores and wear and inspect the inner bore surface for wear from the reaction shaft support seal rings and lands.

Inspect the inside of the piston bore for score marks. Remove light scores with crocus cloth. Inspect the seal ring grooves for nicks and burrs. Inspect the piston spring, retainer, and snap ring for distortion.

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AUTOMATIC TRANSMISSIONS

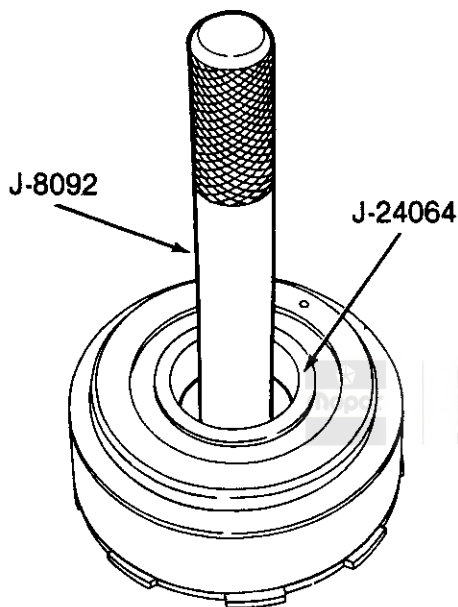
OVERHAUL



Retainer Bushing Replacement

Place the clutch retainer, with the open end facing down, on a clean, smooth surface.

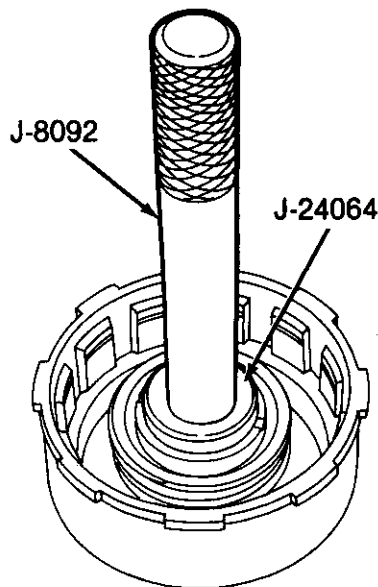
Insert the Bushing Remover/Installer Tool J-24064 in bushing.



Install Driver Handle J-8092 into the remover tool and drive the bushing straight down and out of the retainer bore.

Position the clutch retainer so the open end faces upward.

Install the replacement bushing on the tool and install the bushing straight into the retainer bore until the bushing is flush with the base of the bore chamfer.



Assembly

Lubricate the inner seal with petroleum jelly and install the seal on hub of clutch retainer.

NOTE: Be sure the seal lip is facing into the piston bore and that the seal is properly seated in the retainer groove.

Lubricate the outer seal with petroleum jelly and install it on the clutch piston so the seal lip faces into the piston bore.

Install the piston assembly in the retainer using a twisting motion to seat the piston at the bottom of the bore.

Install the spring on piston hub and spring retainer.

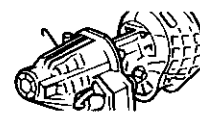
Install the snap ring over the spring.

Install Spring Compressor Tool J-23327 over retainer assembly.



AUTOMATIC TRANSMISSIONS

OVERHAUL



Compress the spring and seat the snap ring in the clutch hub groove.

Remove the compressor tool.

Lubricate the clutch plates and discs with transmission fluid.

Install one steel plate followed by a lined plate until the proper number of plates are installed.

Install the pressure plate and the waved snap ring.

NOTE: Be sure snap ring is completely seated in groove.

Measure the clutch pack clearance using feeler gauge (A).

Insert the gauge between the pressure plate and snap ring. Refer to the Clutch Plate Clearance in the Specifications for tolerances.

If the clutch plate clearance is not within specifications, disassemble the clutch pack and measure the thickness of the line plate, steel plates and pressure plate. The thickness should be as follows:

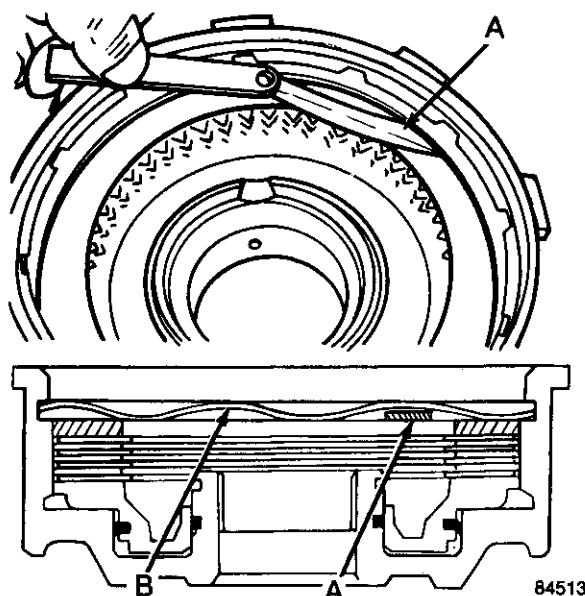
Lined Plate 2.11 to 2.24 mm
(0.083 to 0.088 in)

Steel Plate 1.68 to 1.80 mm
(0.066 to 0.071 in)

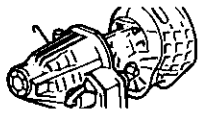
Pressure Plate 5.44 to 5.54 mm
(0.214 to 0.218 in)

Any component not meeting the listed thickness specification must be replaced in order to obtain the correct clutch park clearance.

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84513



AUTOMATIC TRANSMISSIONS

OVERHAUL

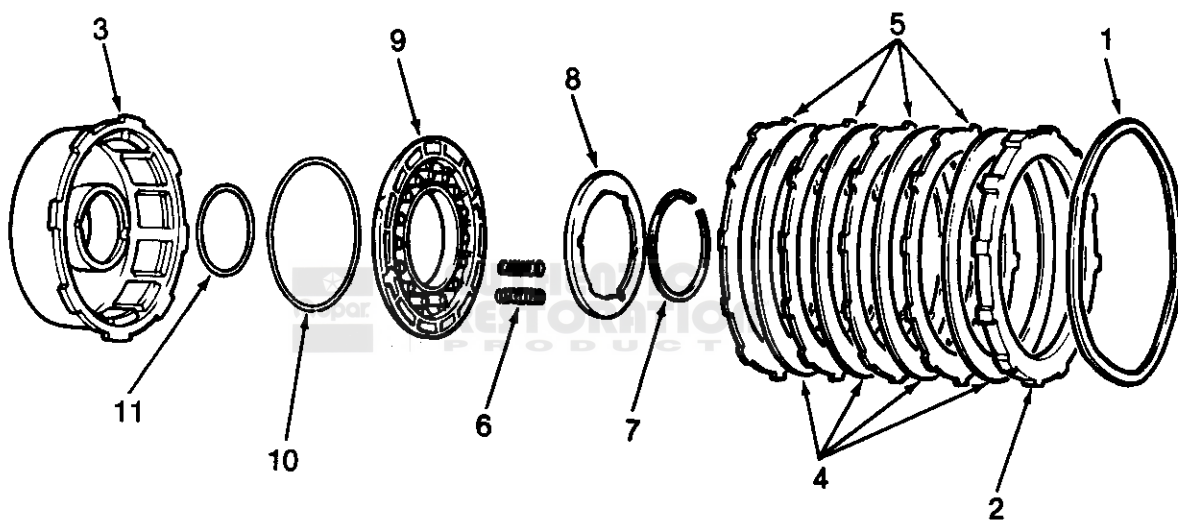


Front Clutch – Model 727

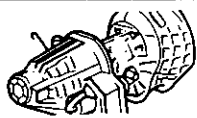
SEE
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NOTES

Disassembly

Remove the large waved snap ring (1) that retains the pressure plate (2) in the clutch piston retainer (3).



84514



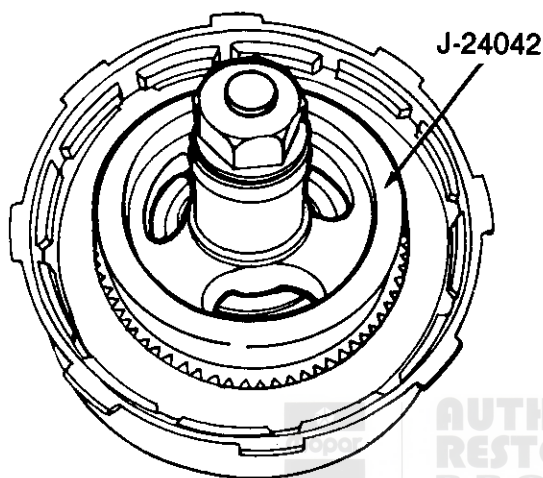
AUTOMATIC TRANSMISSIONS

OVERHAUL



Remove the pressure plate (4) and clutch plates (5).

Install the Compressor Tool J-24042 over the piston spring retainer.



84515

Compress the springs and remove the snap ring (7).

Slowly release the compressor tool until the spring retainer is free of the hub.

NOTE: Do not allow the spring retainer to stick or bind in the snap ring groove.

Remove the compressor tool, retainer (8) and springs (6).

Turn the clutch retainer over and bump on the wooden block to dislodge and remove the piston (9).

Remove the seals from the piston (10) and retainer hub (11).

Inspection

Inspect the friction material on all driving discs. Replace discs that are charred, glazed, heavily pitted, flaking, or if the friction material can be scraped off easily. Inspect internal splines for wear or other damage.

Inspect the steel plates and pressure plate surfaces for overheating, scoring, warping and damaged driving lugs and replace as necessary.

Inspect the steel plate lug grooves in the clutch retainer for smooth surfaces. The plates must slide freely in the grooves.

Inspect the band application surface on the clutch retainer for nicks and scores. Remove light scratches and nicks with crocus cloth.

Inspect the check ball in the clutch retainer. The ball should move freely in its cage.

Inspect the seal ring surface inside the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of the rings. Inspect the clutch retainer bushing for scores and wear from the reaction shaft support sealing rings and lands.

Inspect the inner bore of the piston for score marks. Remove light scores with crocus cloth. Inspect the seal ring grooves for nicks and burrs. Inspect the piston springs, retainer, and snap ring for distortion.

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AUTOMATIC TRANSMISSIONS

OVERHAUL

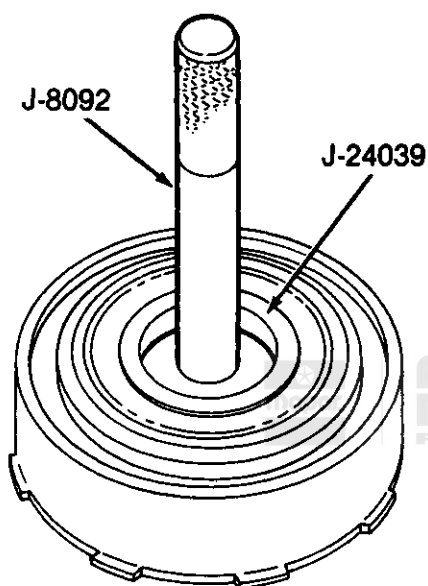


SEE
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Retainer Bushing Replacement – Model 727

Place the clutch retainer, with the open end facing downward, on a clean, smooth surface.

Insert the Bushing Remover/Installer Tool J-24039 in the bushing.

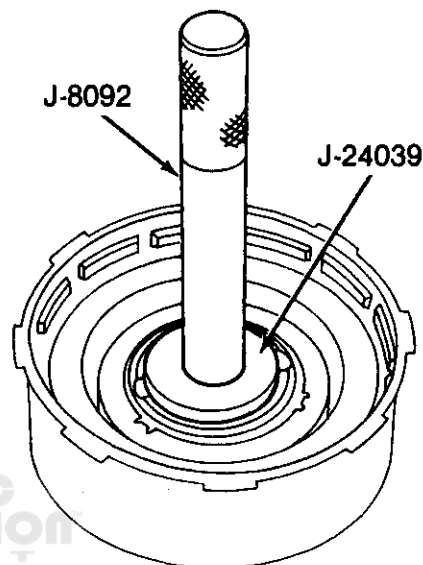


84516

Install the Drive Handle J-8092 in the tool and tap the bushing straight down and out of the bore.

Position the clutch retainer so the open end faces upward.

Install the replacement bushing on the Tool J-24039 and install the bushing straight into the retainer bore until the bushing is flush with the base of the bore chamfer.



84517

Assembly

Lubricate the inner seal with petroleum jelly and install it on hub of clutch retainer.

NOTE: Be sure the seal lip faces into the piston bore and is properly seated in the seal groove.

Lubricate the outer seal with petroleum jelly and install it on the clutch piston with the seal lip facing into piston bore.

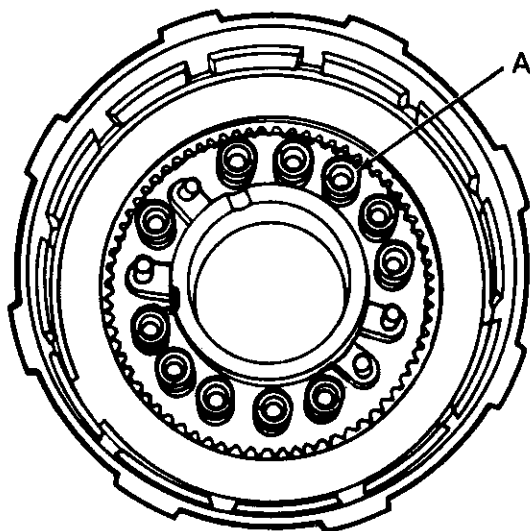
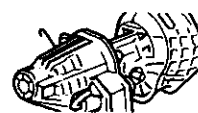
Install the piston assembly in the retainer and carefully seat the piston at the bottom of the retainer bore.

Install the clutch piston springs (A) on the piston.



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OVERHAUL



84518

Install the nine or eleven springs in the clutch (according to original number in clutch).

Install the spring retainer and snap ring over the springs.

Install the Compressor Tool J-24042 over the retainer assembly.

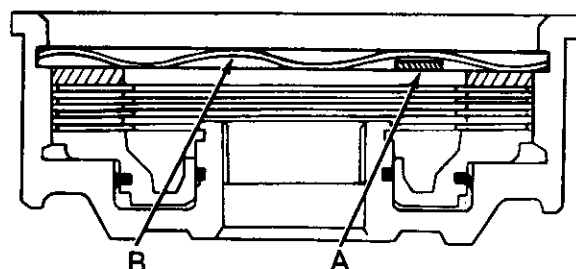
Compress the springs and seat snap ring in the hub groove.

Remove the compressor tool.

Lubricate the clutch plates with transmission fluid.

Install one steel plate followed by one lined plate until the correct number of plates are installed.

Install the pressure plate and waved snap ring. Measure the clutch pack clearance using the feeler gauge.



84519

Refer to the clutch plate clearance in the Specifications section for tolerances.

If the clutch pack clearance is not within specifications, disassemble the clutch pack and measure the thickness of the lined plates, steel plates, and pressure plate. The thickness should be as follows:

Lined Plate 2.29 to 2.41 mm
(0.090 to 0.095 in)

Steel Plate 1.52 to 1.80 mm
(0.060 to 0.071 in)

Pressure Plate 7.06 to 7.16 mm
(0.278 to 0.282 in)

Any component not meeting the listed thickness specification must be replaced in order to obtain the correct clutch pack clearance.

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Rear Clutch – 900 Series

SEE
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NOTES

Disassembly

Remove the large snap ring (1) that retains the pressure plate (2) in the clutch piston retainer (3).

NOTE: This is a selective thickness snap ring and determines clutch pack clearance.

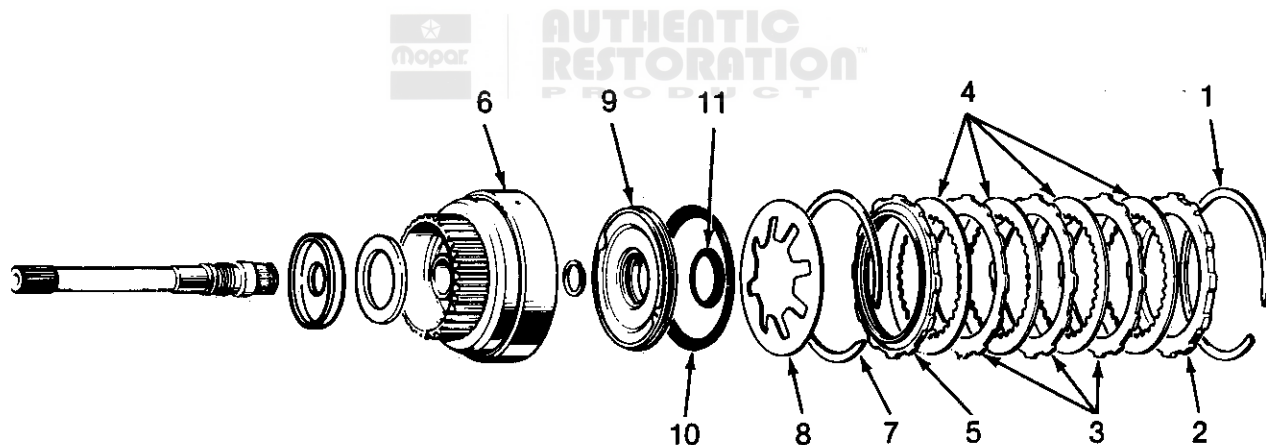
Lift the pressure plate (2), clutch plates (3) (4), and inner pressure plate (5) out of the retainer (6).

Remove the wave spring (7) and the clutch piston spring (8).

Turn the retainer over and bump it on the wooden block to remove the piston (9).

Remove the piston seals (10) (11).

NOTE: If necessary, remove the snap ring and press the input shaft out of the retainer.

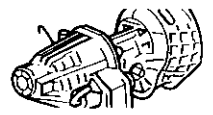


84551



AUTOMATIC TRANSMISSIONS

OVERHAUL



Inspection

Inspect the friction material on the driving discs. Replace discs that are charred, heavily pitted, flaking or if the driving disc inner splines are worn or damaged.

Inspect the steel plates and pressure plate surfaces for overheating, scoring, and for damaged drive lugs. Inspect all discs and plates for flatness and replace if necessary.

Inspect the steel plate lug grooves in the clutch retainer for smooth surfaces. The plates must slide freely in these grooves. Inspect the clutch piston ball check. The ball should move freely in its cage. Inspect the seal ring surfaces in the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing. Inspect the piston spring and wave spring for distortion or breakage.

Inspect the seal ring grooves in the input shaft and piston retainer for nicks, burrs, and wear.

Inspect the rear clutch to front clutch thrust washer. The washer should be 1.09 to 1.14 mm (0.043 to 0.045 in) thick.

Assembly

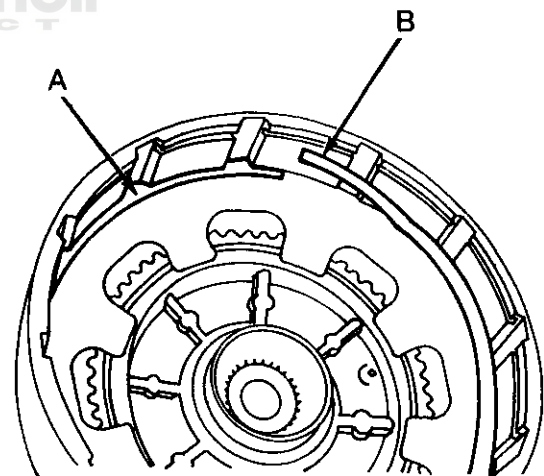
Press the input shaft into the piston retainer (if removed) and install the snap ring.

Lubricate and install the inner and outer seal rings on the clutch piston.

NOTE: Be sure that the lips of the seals face into the retainer bore and that the seals are properly seated in the piston grooves.

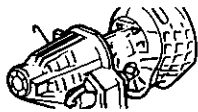
Install the piston assembly into the retainer using a twisting motion to seat the piston at the bottom of the retainer bore. Install the piston spring (A) in the retainer with the spring fingers touching piston and with spring centered in retainer.

Install one end of the wave spring (B) into retainer groove and progressively push or tap the spring into place until completely seated. If necessary, lightly tap the piston spring to keep it centered.



84520

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Install the inner pressure plate. The raised side of plate should rest on the piston spring and the flat surface should face the open end of the retainer.

Lubricate the clutch plates with transmission fluid.

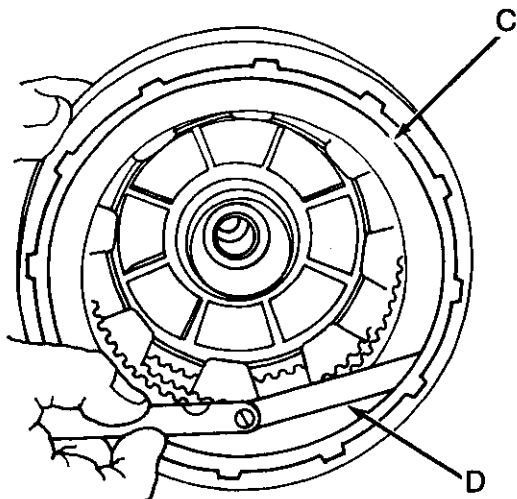
Install a lined plate first and follow with a steel plate and then a lined plate until the correct number of plates are installed.

Install the outer pressure plate and the selective thickness snap ring (C).

Measure the rear clutch pack clearance. Press down firmly on the outer pressure plate and insert the feeler gauge (D) between the pressure plate and selective snap ring.

If necessary, adjust the clearance using one of the following selective thickness outer snap rings. Snap rings are available in 1.52, 1.93 and 2.49 mm (0.060, 0.076 and 0.098 in.) thicknesses. Low limit clearance is desirable.

NOTE: Rear clutch pack clearance is very important in obtaining the proper clutch engagement and shift quality.



84521



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Rear Clutch – Model 727

Disassembly

Remove the large snap ring (1) that retains the pressure plate (2) in the clutch piston retainer (3).

NOTE: This is a selective thickness snap ring and determines clutch pack clearance.

Remove the pressure plate (2), clutch plates (4) (5), and inner pressure plate (6).

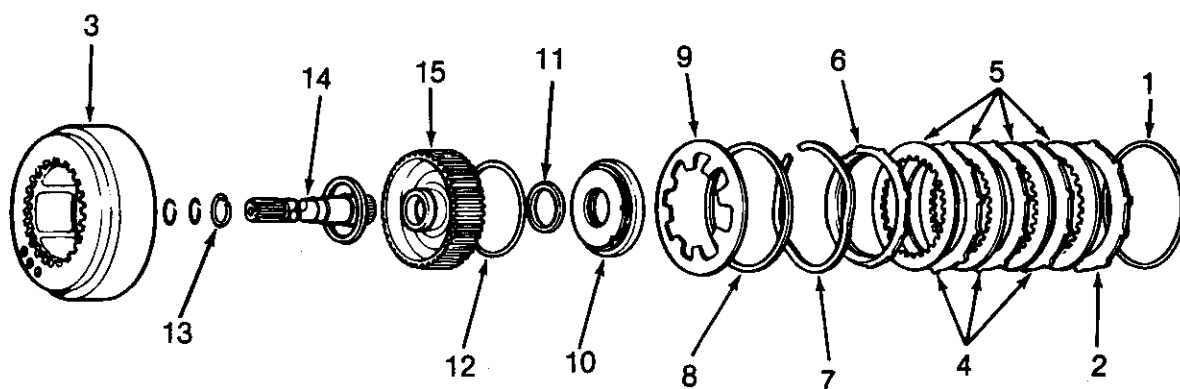
Remove the wave spring (7), spacer ring (8), and clutch piston spring (9).

Turn the retainer over and bump on a wooden block to remove the piston (10).

Remove the piston inner (11) and outer seals (12).

Remove the input shaft snap ring (13) and press the input shaft (14) out of the retainer (15) if necessary.

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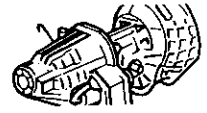


84522



AUTOMATIC TRANSMISSIONS

OVERHAUL



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Inspection

Inspect the friction material on driving discs. Replace all discs that are charred, glazed, heavily pitted, flaking or if the friction material can be scraped off easily. Inspect the driving disc inner splines for wear or other damage.

Inspect the steel plates and pressure plate surfaces for over heating, scoring, and damaged driving lugs. Inspect all discs and plates for distortion. Replace warped or coned discs or plates.

Inspect the steel plate lug grooves in the retainer for smooth surfaces. The plates must slide freely in these grooves. Inspect the clutch piston ball check. The ball should move freely in its cage. Inspect the seal ring surfaces in the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing. Inspect the piston spring, wave spring, and spacer for distortion or breakage.

Inspect the seal ring grooves in the input shaft and piston retainer for nicks, burrs, and wear.

Inspect the rear clutch to front clutch thrust washer. The washer should be 1.55 to 1.60 mm (0.061 to 0.063 in) thick.

Input Shaft Bushing Replacement – Model 727

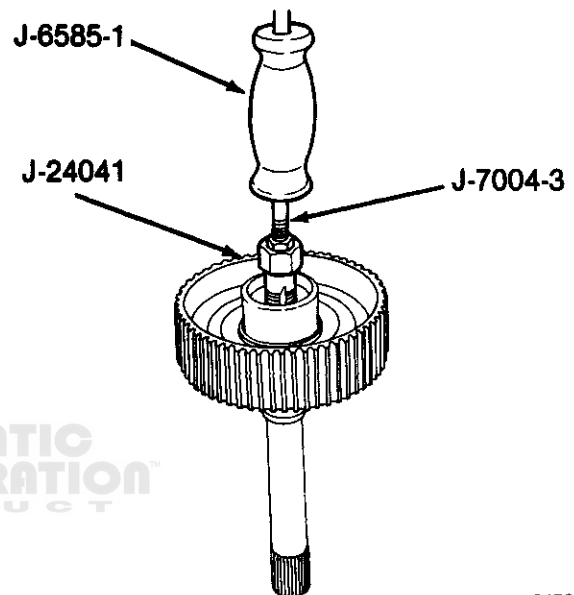
Clamp the input shaft in a vise using brass protective jaws.

CAUTION: Do not clamp the seal ring land or bearing journal.

Thread Bushing Remover Tool J-24041 straight into the bushing as far as possible by hand.

Using a wrench, thread the puller into the bushing three to four additional turns to fully engage the puller threads into the bushing.

Thread Slide Hammer Bolts Tool J-7004-3 into the puller.



Bump outward with the slide hammers to remove the bushing.

Thoroughly clean the input shaft and remove any chips generated by the bushing removal.

Grip the old bushing with pliers and remove it from the tool.

NOTE: Be careful to protect the remover tool threads when using the tool.



AUTOMATIC TRANSMISSIONS

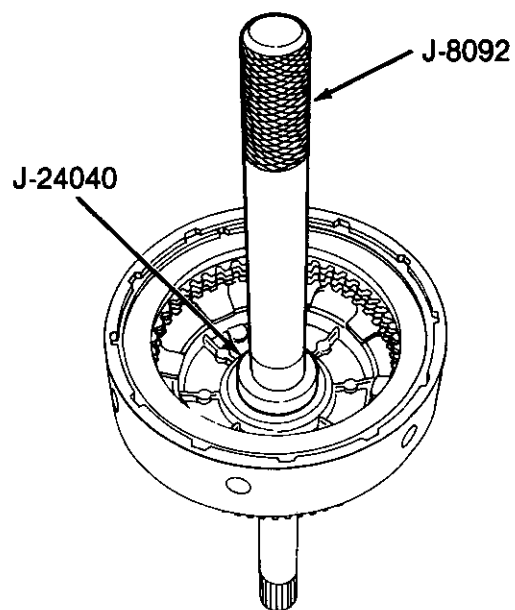
OVERHAUL



Thread Bushing Installer Tool J-24040 onto Driver Handle J-8092.

Position the replacement bushing on the installer tool and install the bushing straight into the shaft until the tool bottoms.

Clean the assembly thoroughly.

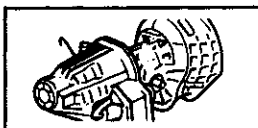


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84524



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PRODUCT

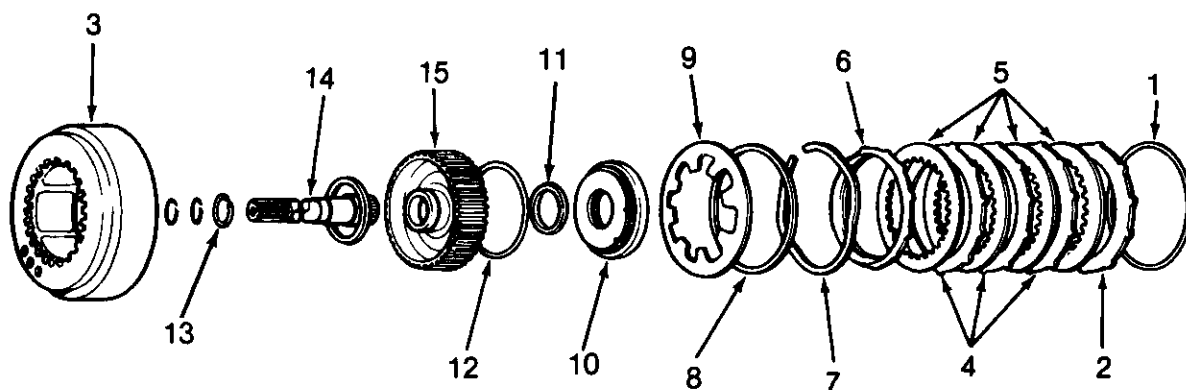


AUTOMATIC TRANSMISSIONS

OVERHAUL



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84522

Assembly

Press the input shaft (14) into the piston retainer (15) and install the snap ring (18), if removed.

Lubricate the inner and outer sealing rings (11) (12) with petroleum jelly and install them on the clutch piston (10).

NOTE: Be sure that the lips of the seals face into the retainer bore and that seals are properly seated in piston grooves.

Install the piston assembly in the clutch retainer (3).

Seat the piston at the bottom of the retainer bore using a twisting motion.

Position the clutch retainer over the piston retainer splines. Support the assembly to maintain the position of the clutch retainer.

Install the piston spring (9) in the clutch retainer with the spring fingers touching the piston.

Install the spacer ring (8). Be sure piston spring and ring are centered in the retainer recess.

Install one end of the wave spring (7) in the retainer groove. Progressively push or tap the spring into the plate until it is completely seated.

NOTE: If necessary, gently tap the piston spring and spacer to keep them centered.

Install the inner pressure plate (6) in the retainer. The raised side of the plate should rest on the piston spring and the flat surface should face outward.

Lubricate the remaining clutch plates (5) with transmission fluid and install them in the retainer. Alternately install the lined plate (5) followed by the steel plate (4) until the correct number of lined and steel plates have been installed.

Install the outer pressure plate (2) and the selective thickness snap ring (1).



AUTOMATIC TRANSMISSIONS

OVERHAUL



Install the outer pressure plate (2) and the selective thickness snap ring (1).

Measure the clutch pack clearance. Press down firmly on the outer pressure plate and insert a feeler gauge between the pressure plate and selective outer snap ring.

If necessary, adjust the clearance using one of the following selective thickness snap rings. Snap rings are available in 1.52, 1.88 and 2.70 (0.060, 0.074, 0.088 and 0.106 in) thicknesses.

NOTE: Rear clutch pack clearance is very important in obtaining proper clutch engagement and shift quality.

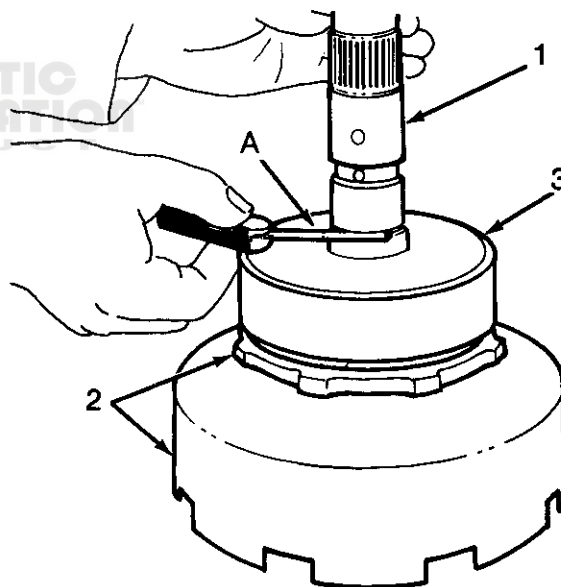
Planetary Gear Assembly – 900 Series

End Play Measurement

Measure the end play of the planetary assembly before removing component parts from the output shaft.

Support the front end of the output shaft (1) on a wooden block and position the assembly (2) in an upright position.

Push the rear annulus gear support (3) downward on the output shaft.



84525

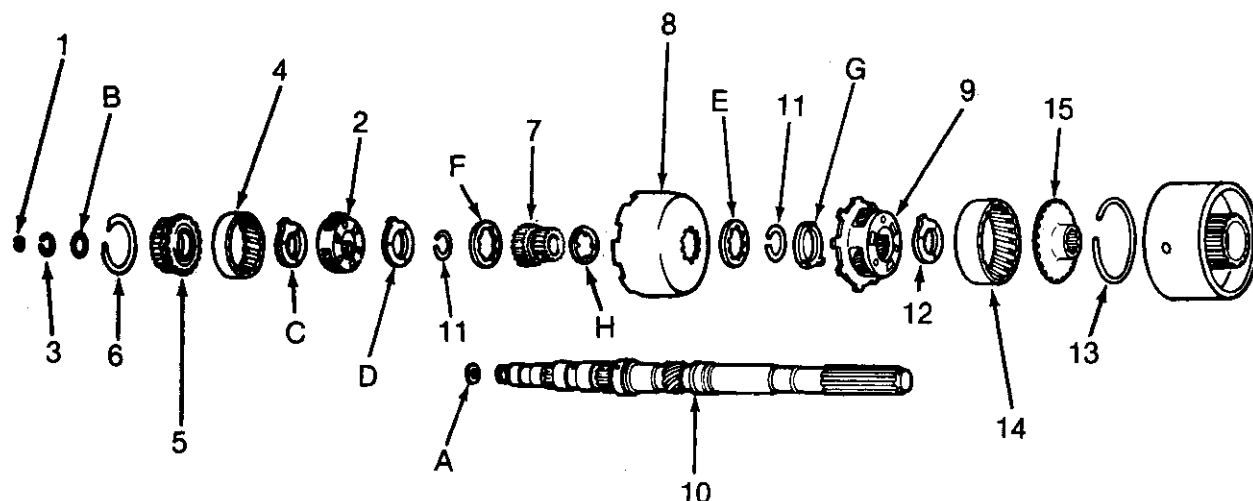
Insert a feeler gauge (A) between the rear annulus support and the shoulder on the output shaft. Clearance should be 0.02 to 1.19 mm (0.001 to 0.047 in). If the clearance is not within specifications, replace the thrust washers, any worn parts, and the selective thickness snap ring at assembly.

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84526

Disassembly

Remove the thrust washer (A) from the forward end of the output shaft (10).

Remove the selective snap ring (1) from the forward end of the output shaft.

Remove the front planetary gear assembly (2).

Remove the snap ring and the thrust washer (8) from the forward hub of the front planetary assembly.

Remove the front annulus gear (4) and the support (5) from the planetary gear assembly. If necessary, remove the large snap ring (6) from the front annulus gear and separate the support from the gear.



AUTOMATIC TRANSMISSIONS

OVERHAUL



Remove the C and D thrust washers from the planetary gear assembly.

Remove the sun gear (7), driving shell (8), and the rear planetary assembly (9) from the output shaft (10).

Separate the sun gear and driving shell from the rear planetary assembly.

Remove the rear snap ring (11) and steel thrust plate (E) from the sun gear.

Remove the remaining snap ring and steel thrust plate (F) from the sun gear.

Remove the thrust washer (G) from the forward side of the rear planetary assembly.

Remove the planetary gear assembly and thrust washer (12).

If necessary, remove the large snap ring (13) from the rear of annulus gear (14) to separate the support (15) from the gear.

Inspection

Inspect the bearing surfaces on the output shaft for nicks, burrs, scores or other damage. Light scratches, nicks or burrs can be removed with crocus cloth. Be sure all oil passages in the shaft are open and clean. Inspect the speedometer drive gear. Remove nicks and burrs with an oilstone.

Inspect the sun gear bushings for wear or scores. Replace the sun gear if the bushings are damaged.

Inspect all the thrust washers and plates. Replace all the thrust washers and plates that are damaged or worn below thickness specifications.

Inspect the gear assemblies for cracks, broken pinions, worn gear teeth, broken pinion shafts or lockpins and damaged thrust faces. Replace as required.

Inspect the annulus gears for cracks and worn teeth.

Replace all distorted snap rings.

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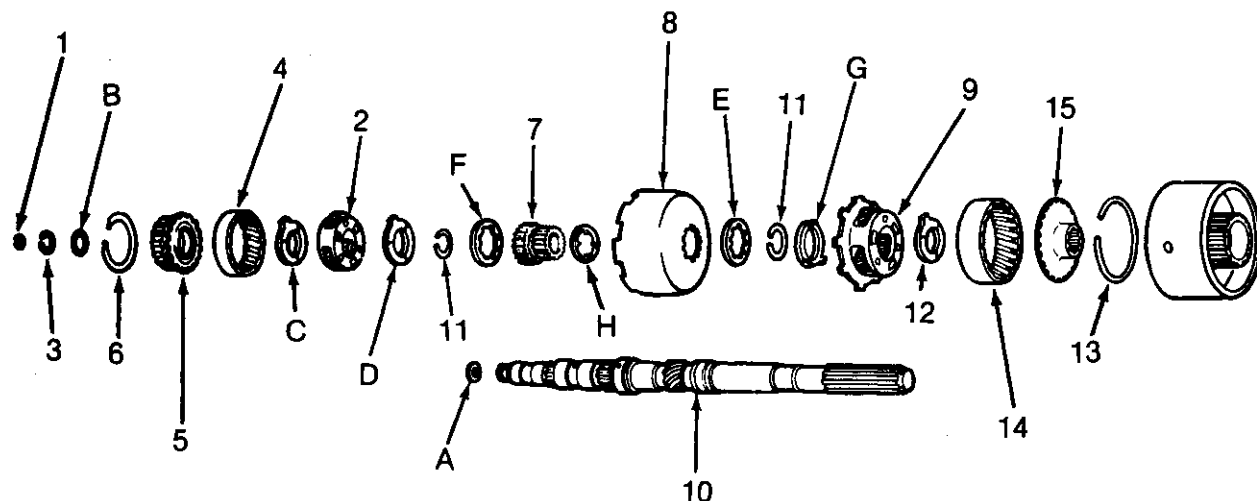


AUTOMATIC TRANSMISSIONS

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84526

Assembly

Install the rear annulus gear support (15) in the annulus gear (14) and install the snap ring (13).

Install the rear annulus gear assembly on the output shaft (10).

Install the thrust washer (12) on the output shaft.

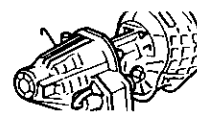
Position the rear planetary gear assembly (9) in the rear annulus gear. Install the thrust washer (G) on the front side of the gear assembly.

Install the steel thrust plate (F) and snap ring (11) on the opposite end of sun gear (7).



AUTOMATIC TRANSMISSIONS

OVERHAUL



Insert the sun gear through the front side of the driving shell (8), and install the steel thrust plate (E) and the snap ring (11) on one end of the sun gear.

Install the driving shell and sun gear onto the output shaft (2), and engage the sun gear teeth with the rear planetary pinions.

Install the front annulus gear support (5) in annulus gear (4) and install the large snap ring (6).

Install thrust washer (C) at the forward end of the front planetary gear assembly (2), and insert assembly into front annulus gear (4).

Position the thrust washer (D) on the rear side of the front planetary gear assembly (2).

Carefully work the front planetary and annulus gear assembly onto the output shaft and mesh the planetary pinions with the sun gear.

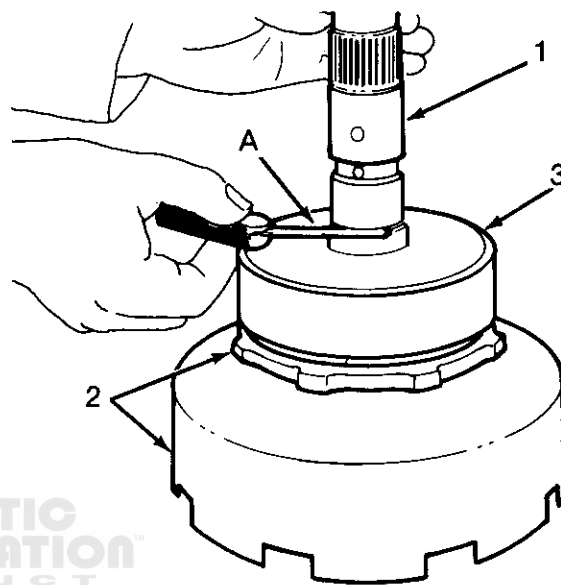
Install the thrust washer (A) on the output shaft.

Install the selective snap ring (1) and measure the assembly end play.

NOTE: If necessary, adjust the clearance by using selective thickness snap rings. Snap rings are available in 1.06, 1.63 and 2.13 mm (0.042, 0.064 and 0.084-inch) thicknesses.

Planetary Gear Assembly – Model 727

End Play Measurement



Measure the planetary assembly end play before removing component parts from the output shaft (1).

Support the front end of output shaft on a wooden block and place the assembly (2) in the upright position.

Push the rear annulus gear support (3) downward on the output shaft.

Insert the feeler gauge (A) between the rear annulus support (3) and shoulder on the output shaft. Clearance should be 0.22 to 1.12 mm (0.009 to 0.044-inch). If the clearance is not within the specifications, replace the thrust washers, any worn parts and the selective thickness snap ring at assembly.

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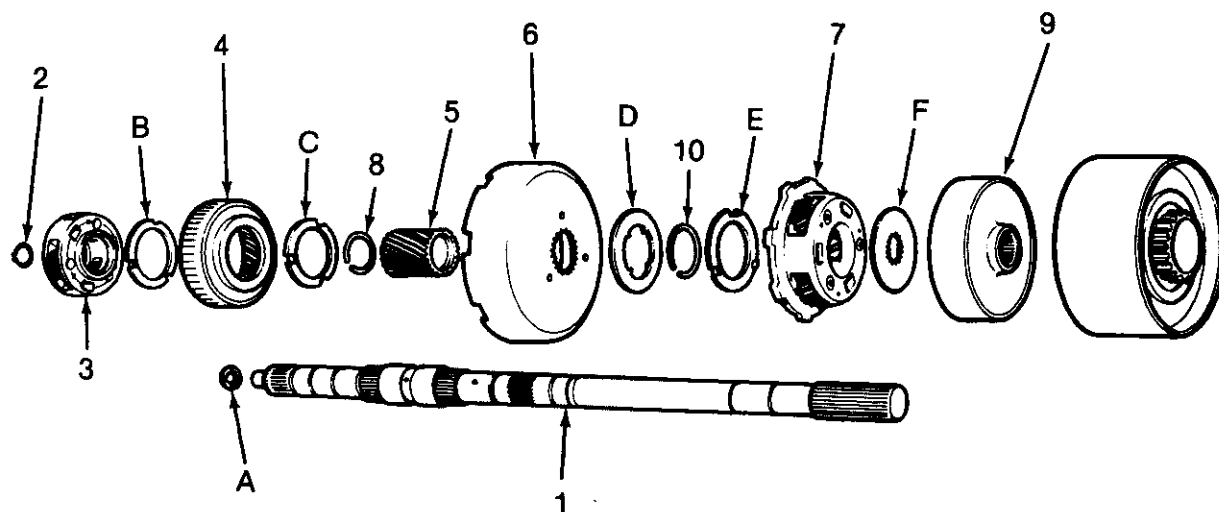


AUTOMATIC TRANSMISSIONS

OVERHAUL



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NOTES



84528

Disassembly

Remove the thrust washer (A) from the forward end of the output shaft (1).

Remove the snap ring (2) and front planetary assembly (3) from the output shaft.

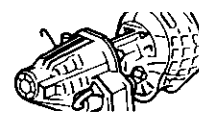
Remove the front annulus gear (4) from the planetary assembly.

Remove the thrust washer (B) from the rear side of planetary gears.



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OVERHAUL



Remove the sun gear (5), driving shell (6) and the rear planetary assembly (7) from the output shaft.

Separate the sun gear and the driving shell from the rear planetary assembly.

Remove thrust washer (C) from the inside of the driving shell.

Remove the rear snap ring (8) and steel thrust plate (D) from the sun gear.

Remove the sun gear from the driving shell.

Remove the remaining snap ring (9) from the sun gear, if necessary.

NOTE: The forward end of the sun gear is longer than the rear.

Remove the thrust washer (E) from the forward side of the rear planetary assembly (6).

Remove the gear assembly and the thrust plate (F) from the rear annulus gear.

Inspection

Inspect the bearing surfaces on the output shaft for nicks, burrs, scores, and other damage. Light scratches, nicks, or burrs can be removed with crocus cloth.

NOTE: Be sure all oil passages in the output shaft are open and clean.

Inspect the speedometer drive gear. Remove nicks and burrs with an oilstone.

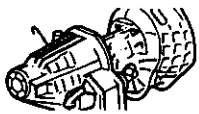
Inspect the sun gear bushings for wear and scores. Replace the sun gear if the bushings are damaged.

Inspect all thrust washers and plates and replace any that are damaged or worn below thickness specifications.

Inspect the gear assemblies for cracks, broken pinions, worn gear teeth, broken pinion shafts or lockpins, or damaged thrust faces. Replace components as necessary.

Inspect the annulus gears for cracks and worn teeth. Replace any distorted snap rings.

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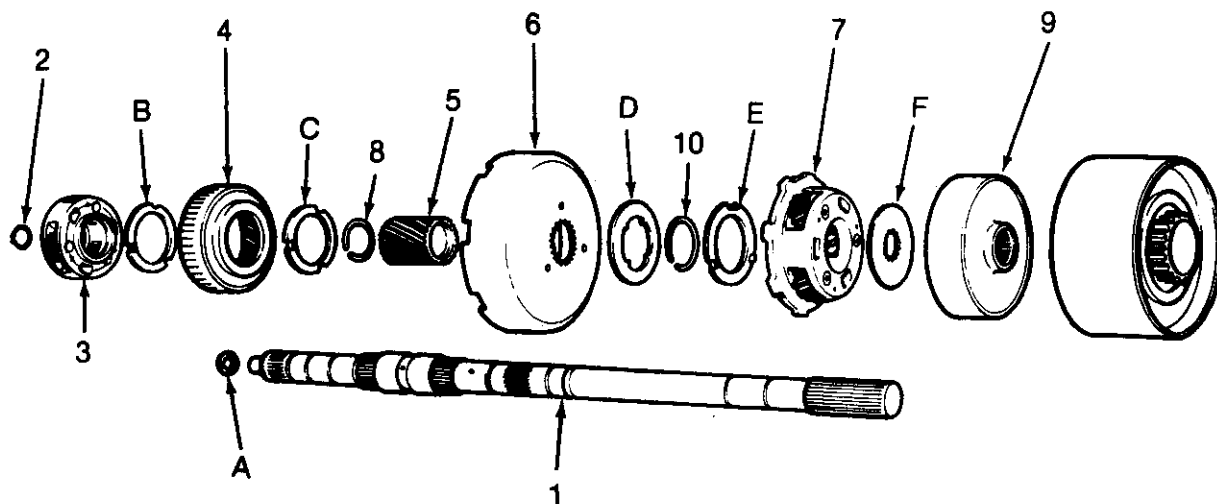


AUTOMATIC TRANSMISSIONS

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Assembly

Install the rear annulus gear (9) on the output shaft (1).

Apply a thin coat of petroleum jelly on the thrust plate (F).

Position the plate (F) on the output shaft (1) and in the rear annulus gear.

NOTE: Be sure the teeth are engaged with the output shaft splines.

Position the rear planetary gear assembly (7) in the rear annulus gear and install the thrust washer (E) on the forward side of the gear assembly.

Insert the sun gear through the forward side of the driving shell (6) and install the steel thrust plate (D) and snap ring (1) on the rear side of the sun gear (5).

Install the snap ring in the forward groove of the sun gear. Install the thrust washer (C) in the driving shell (6) over the sun gear (5).

Install the driving shell and sun gear assembly on the output shaft and engage the sun gear teeth with the rear planetary pinions.



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Position the thrust washer (B) on the rear hub of the front planetary gear (3) and engage the planetary gear with the front annulus gear (4).

Install the front planetary and annulus gear assembly (3) (4) onto the output shaft and mesh the planetary pinions with sun gear.

Install the selective snap ring (2) and measure assembly end play.

NOTE: If necessary, the clearance should be adjusted by using selective thickness snap rings. Snap rings are available in 1.22, 1.40 and 1.57 mm (0.048, 0.055 and 0.062-inch) thicknesses.

Overrunning Clutch

Inspection

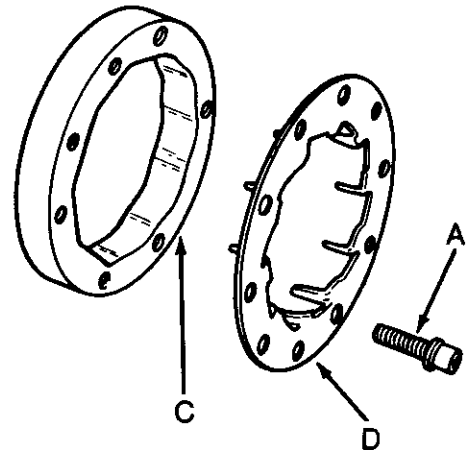
Inspect the clutch rollers for smooth, round surfaces. They must be free of flat spots and chipped teeth.

Inspect the roller contact surfaces in the cam and race for brinelling and inspect the springs for distortion, wear or other damage.

NOTE: On the model 727 transmission only, inspect the cam setscrew for tightness. If loose, tighten the setscrew and restake the case around the screw.

Cam Replacement – 900 Series

If the overrunning clutch cam or spring retainer are damaged, they can be replaced with a service replacement cam, spring retainer and retaining screw.

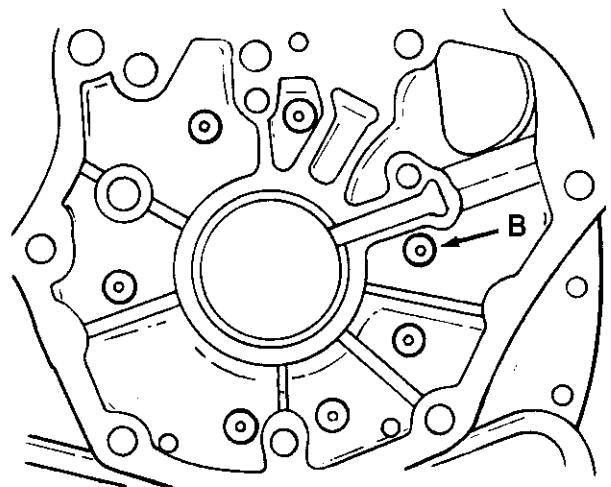


84529

Remove the bolts (A) attaching the output shaft support to the rear of the case.

Remove the support from the rear of the case using a wooden block and hammer.

Centerpunch the rivets (B) exactly in the center of each rivet head.



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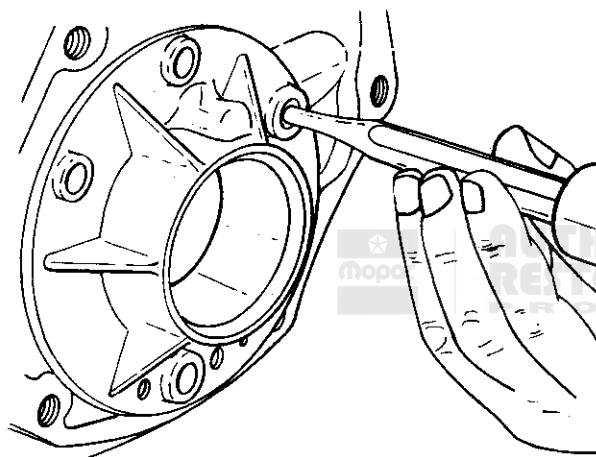
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Drill through each rivet head using a 10 mm (3/8-inch) diameter drill.

CAUTION: Do not drill into the transmission case.

Remove the rivet heads using a small chisel.

Remove the rivets and cam (C) from the case using a blunt punch.



84531

NOTE: Move the punch from one rivet to another in clockwise direction after each punch stroke, to drive the cam out of the case evenly.

Enlarge the rivet holes in the case carefully using a 7 mm (17/64-in) diameter drill.

Remove the chips, burrs, and any foreign material from the case and be sure the cam area is free of burrs and chips.

Install the replacement cam and spring retainer in the case with the bolt holes in the cam and retainer aligned with the holes in the case.

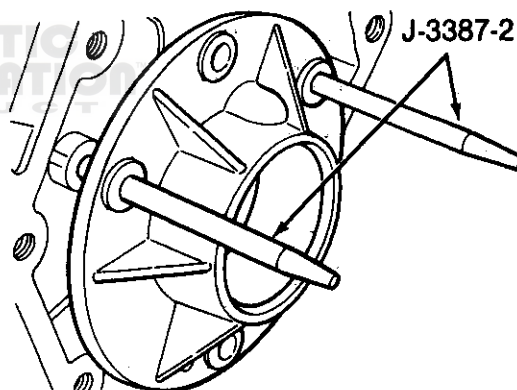
Thread the retaining screws and washers into the cam.

NOTE: Install the washers on the screws so that the inner diameter of the washer contacts the screw head.

Install the cam in the case using brass hammer.

Alternately and evenly tighten the retaining screws to 11 N·m (100 in-lbs) torque.

Thread two Pilot Studs Tool J-3387-2 into the case.



84532

Position an illuminated light bulb next to the case to heat the case.

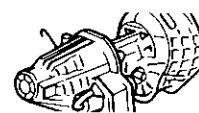
CAUTION: Do not use an open flame to heat the case.

Chill the support with ice (preferably dry ice).



AUTOMATIC TRANSMISSIONS

OVERHAUL



Remove the light, position the support (1) over the pilot studs and install the support in the case using a wooden block and hammer.

Install and tighten the support attaching bolts to 17 N·m (150 in-lbs) torque.

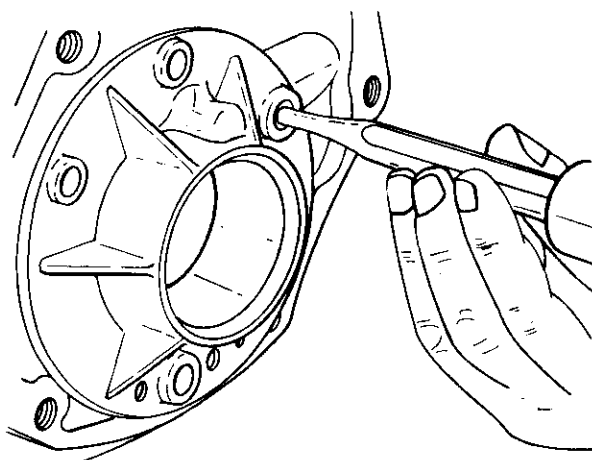
Cam Replacement – Model 727

The overrunning clutch cam and spring retainer should be removed only if replacement is necessary.

Remove the setscrew from the case.

Remove the bolts attaching the output shaft support to the rear of the case.

Insert a punch through the bolt holes and drive the cam (A) out of the case.

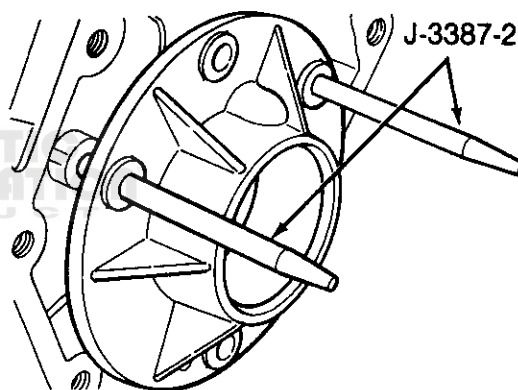


84533

NOTE: Move the punch from one bolt hole to another in a clockwise direction after each punch stroke to drive the cam out of the case evenly.

CAUTION: The output shaft support must be installed in the case before the overrunning clutch cam can be installed. If the support must be replaced, drive it out the rear of the case using a wooden block and hammer.

Thread two Pilot Stud Tools J-3387-2 into the case.



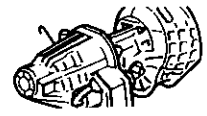
84534

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Install the support in the case using a wooden block and hammer.

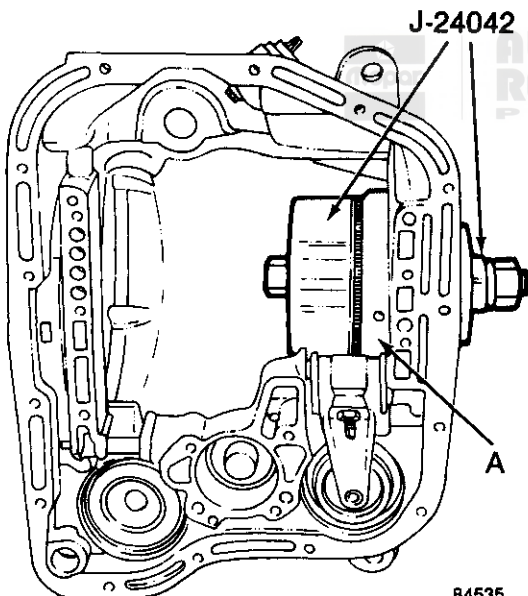
Clean all burrs, chips, and foreign material from the cam (A) area in the case.

Position the spring retainer on the cam. Be sure the retainer lugs snap firmly into the cam notch.

Align the cam serrations with those in the case.

Install the cam evenly into the case as far as possible using a brass hammer.

Install Tool J-24042.



84535

Tighten the tool nut to seat the cam in the case. Be sure the cam is completely seated.

Install the cam retaining setscrew and stake the case around the setscrew.

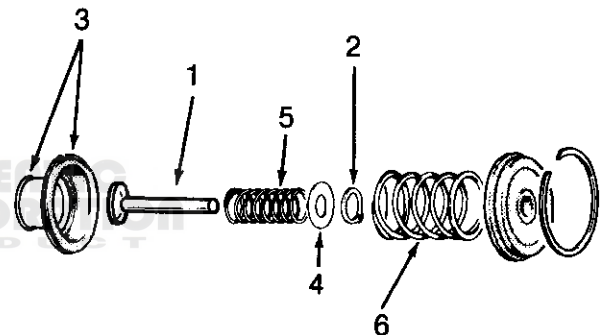
Remove Tool J-24042.

Install and tighten the support retaining bolts to 17 N·m (15 in-lbs) torque.

Stake the case around the cam in twelve places using a blunt chisel.

Front Servo

Two front servo designs are used.



84536

Disassembly

NOTE: The front servo in model 727 transmissions requires further disassembly after removal from the servo bore.

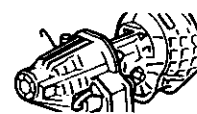
Remove the piston rod (1) retaining snap ring (2) from the servo piston (3).

Remove the washer (4), inner piston rod spring (5), outer spring (6), and piston rod from the servo piston.



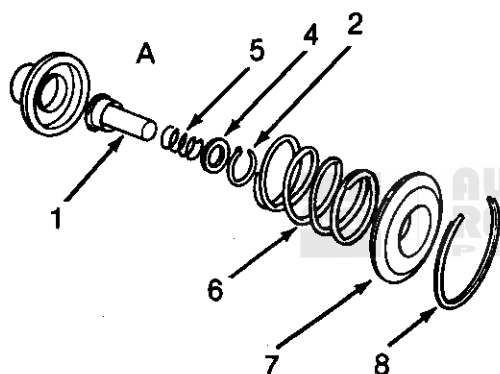
AUTOMATIC TRANSMISSIONS

OVERHAUL



Inspection

Inspect the piston for nicks, burrs, scores, and wear. Be sure the ring grooves are not damaged. Inspect the fit of the guide on the piston rod. Inspect the piston bore in the case for scores or other damage. Inspect the piston spring(s) for distortion. On model 727 transmissions, inspect the bore in the piston and the piston rod O-ring.



84537

Inspect the band lining for a poor bond to the band, burn marks, glazing, uneven wear pattern and flaking.

If the lining is so badly worn that the grooves are not visible at any portion of the band, replace the band. Inspect the band for distortion or cracked ends. Replace as necessary.

Assembly

CAUTION: Do not use force to assemble any of the servo components. If they do not assemble easily, investigate and correct the cause before proceeding with the assembly.

Apply petroleum jelly to the piston rod O-ring (A) and install the piston rod (1) in the servo piston (3) bore.

Install the piston rod spring (5) on the piston rod.

Install the washer (4).

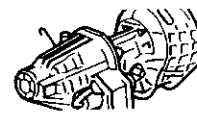
Compress the spring and install the piston rod retaining snap ring (2).

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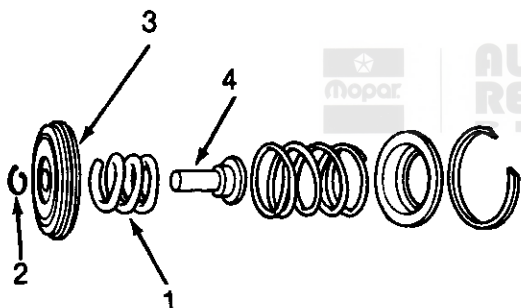
Rear Servo

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Disassembly

Compress the piston plug spring (1) and remove the snap ring (2).

Remove the piston (3), piston plug (4), and plug spring.



84538

Inspection

Inspect the piston and piston plug for nicks, burrs, scores, and wear. The plug must move freely in the piston. Inspect the piston bore in the case for scores or other damage. Inspect the springs for distortion.

Inspect the band lining for poor bonding to the band and for excessive wear. If the lining is so excessively worn that the grooves are not visible at any portion of the band, replace the band. Inspect the band for distortion or cracks and replace as necessary.

Assembly

Lubricate the piston plug (4) and piston (3) with petroleum jelly and insert the piston plug (4) through the plug spring and into the piston.

Compress the piston spring and install the snap ring (2).



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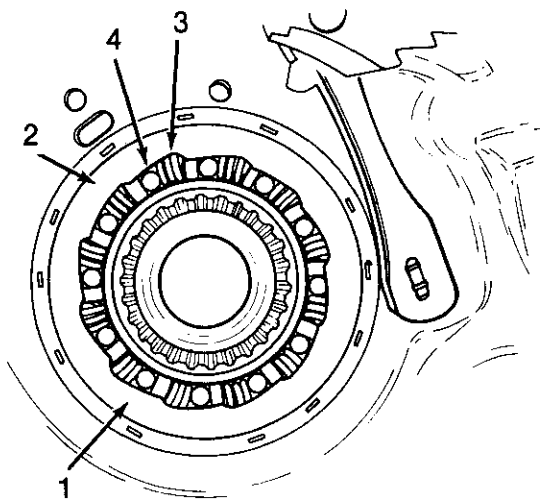
TRANSMISSION ASSEMBLY

NOTE: Use only automatic transmission fluid or petroleum jelly to lubricate the transmission components during assembly.

Overrunning Clutch

Place the transmission case in the upright position and install the clutch cam (1) and spring retainer (2).

Install the clutch spring (3) and rollers (4) so the springs rest against the retainer post and the rollers rest against the spring and with both springs and rollers installed on the counterclockwise side of the spring retainer posts.



84539

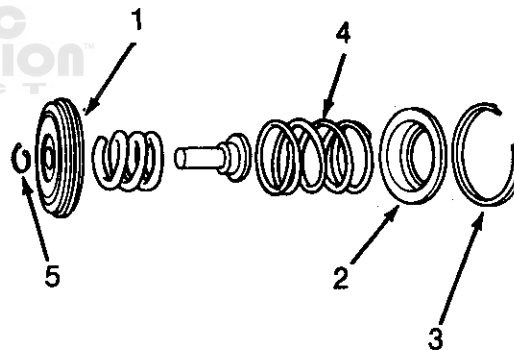
Rear Servo

Servo

Install the servo piston (1) assembly in the case bore with a twisting motion.

Place the spring retainer (2) and snap ring (3) over the piston.

Compress the piston spring (4) by hand and install the snap ring (5).



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Rear Band – Model 727

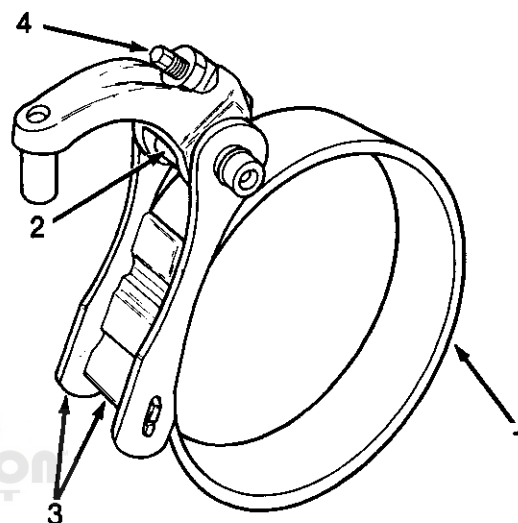
Install the rear band (1) in the case.

Install the short strut (2), and connect the long link and anchor (3) in the band.

Thread the band adjusting screw (4) inward just enough to hold the band strut in place.

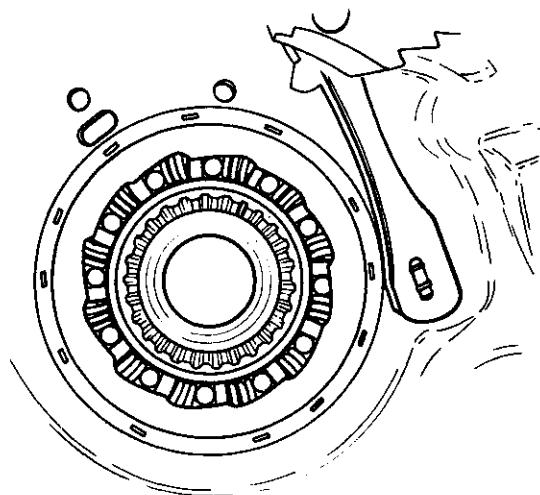
Be sure the long link and anchor assembly are installed as shown to provide clearance for the rear band and drum.

Install the low-reverse drum in the overrunning clutch hub and rear band.

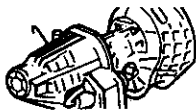


84543

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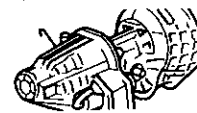


84544



AUTOMATIC TRANSMISSIONS

OVERHAUL



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Front Servo

NOTE: On model 727 transmissions, the servo piston must be subassembled before installation.

Lubricate the O-ring (A) with petroleum jelly and install it on the piston rod (1).

Install the rod in the piston (3).

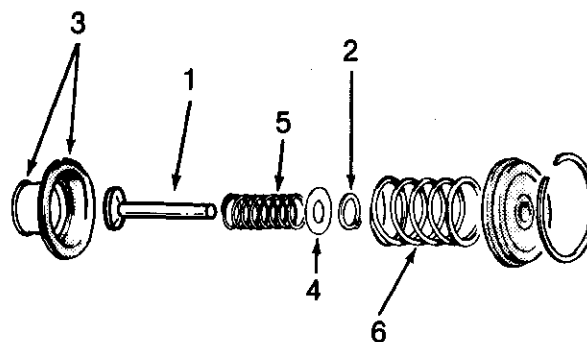
Install the spring (5), flat washer (4) and snap ring (2).

Insert the servo piston assembly into the case bore.

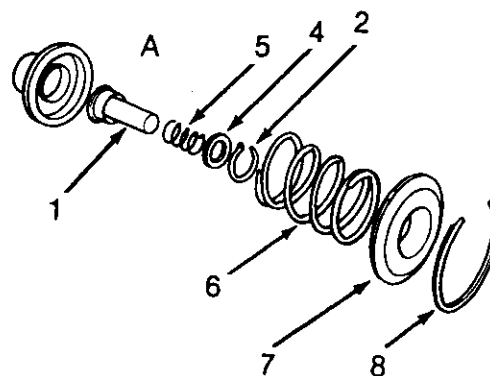
Install the piston rod, spring(s)(6) and guide (7).

Compress the piston spring(s) with a large C-clamp and install the snap ring (8).

Remove the C-clamp.



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84537



AUTOMATIC TRANSMISSIONS

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Planetary Gear Assembly and Output Shaft

CAUTION: Protect all machined surfaces on the output shaft during installation.

Position and support the gear and output shaft assembly in the case and insert the output shaft through the rear support.

Carefully work the gear and shaft assembly rearward and engage the rear planetary carrier lugs in the low reverse drum slots.

Front and Rear Clutch Assemblies

The front and rear clutches, front band, oil pump and reaction shaft support are installed with the transmission in an upright position.

Cut a 9 cm (3½ inch) diameter hole in a workbench. In the end of a small oil drum or a large wooden box strong enough to support the transmission. Cut or file notches at the edge of the hole to accommodate the output shaft.

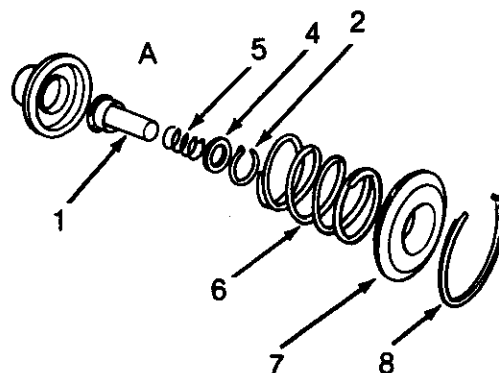
Carefully insert the output shaft into the hole and support the transmission in an upright position on the output shaft support flange.

900 Series

Apply a thin coat of petroleum jelly to the selective thrust washer.

Install the washer on the front end of the output shaft.

If the transmission end play was not within specifications (0.056 to 2.31 mm or 0.022 to 0.091 in) when measured at disassembly, replace the thrust washer with one that will provide proper end play.



83545

Align the front clutch inner splines and place the assembly in position on the rear clutch.

NOTE: Be sure the front clutch plate splines are fully engaged on the rear clutch front hub.

Align the rear clutch inner splines.

Install the clutch assemblies. Grasp the input shaft and lower the assemblies into the case to install them.

Install the clutch assemblies using a twisting motion and engage the rear clutch splines over the splines of the front annulus gear.

NOTE: Be sure the front clutch drive lugs are fully engaged in the driving shell slots.

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Model 727

Apply a thin coat of petroleum jelly to the output shaft thrust washer.

Install the washer on the front of the output shaft.

Align the front clutch inner splines and place the assembly in position on the rear clutch.

NOTE: Be sure the front clutch splines are fully engaged on the rear clutch front hub.

Align the rear clutch inner splines.

Install the clutch assemblies. Grasp the input shaft and lower the clutch assemblies into the case to install them.

Install clutch assemblies using a twisting motion to engage the rear clutch splines over the splines of front annulus gear.

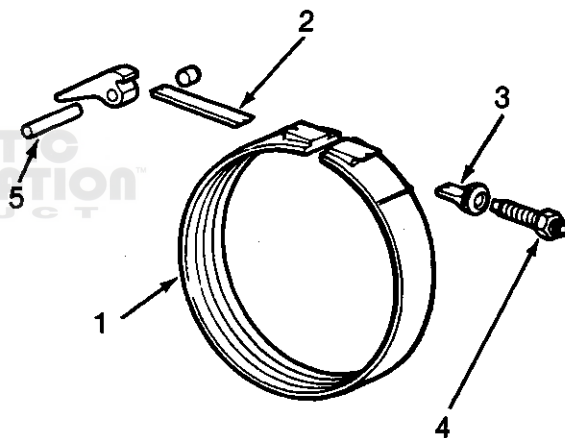
NOTE: Be sure the front clutch drive lugs are fully engaged in the driving shell slots.

Front Band

Slide the band (1) over the front clutch assembly.

Install the band strut (2). Also install the band anchor (3) on model 727.

Tighten the band adjusting screw (4) enough to hold the band and linkage in place (5).

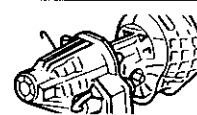


83546



AUTOMATIC TRANSMISSIONS

OVERHAUL



Oil Pump and Reaction Shaft Support

If difficulty was encountered in removing the pump assembly due to an exceptionally tight fit in the case, it may be necessary to heat and expand the case in order to install the pump. If necessary, heat the pump area for a few minutes, using a heat lamp, before installing the pump and support assembly.

900 Series

Install the thrust washer on the reaction shaft support hub.

Thread two Pilot Studs J-3387-2 into the case pump opening.

Install the gasket over the studs.

Install the rubber seal ring in the groove in the outer flange of the pump housing. Be sure the seal is not twisted.

Coat the seal ring with petroleum jelly.

Install the pump assembly in the case. If necessary, tap the pump assembly lightly with a rawhide mallet to install.

Install the four pump attaching bolts finger-tight.

Remove the pilot studs and install the remaining pump attaching bolts finger-tight.

Rotate the input and output shafts to see if any binding exists.

If the shafts rotate freely, tighten all the pump attaching bolts to 20 N·m (175 in-lbs) torque.

Recheck the shafts for a bind-free rotation. If a bind exists, loosen the bolts and tighten the bolts alternately and evenly to 20 N·m (175 in-lbs) torque.

Model 727

If the transmission end play was not within specifications 0.91 to 2.13 mm (0.036 to 0.084 in) when measured at disassembly, replace the thrust washer on the reaction shaft support hub with one that will provide the correct end play.

Thrust Washer Chart — Model 727

Thickness (Inch)	Color
0.061 - 0.063	Natural (Brown)
0.084 - 0.086	Red
0.102 - 0.104	Yellow

SEE
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NOTES

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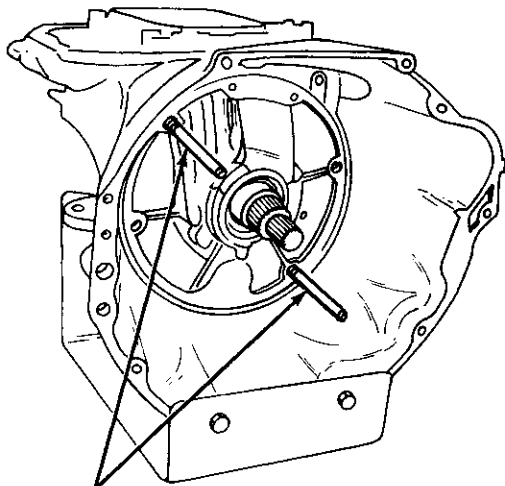


AUTOMATIC TRANSMISSIONS

OVERHAUL



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NOTES



J-3387-2

83547

Thread two Pilot Studs Tool J-3387-2 into the case pump opening.

Install the gasket over the studs.

Install the rubber seal ring in the groove in the outer flange of the pump housing. Be sure the seal is not twisted.

Coat the seal ring with petroleum jelly.

Install the pump assembly in the case. If necessary, tap the pump assembly lightly with a rawhide mallet to install.

Position the deflector, if equipped, over the vent opening and install the four pump attaching bolts finger-tight.

Remove the pilot studs and install the remaining pump attaching bolts finger-tight.

Rotate the input and output shafts to see if any binding exists.

If the shafts rotate freely, tighten all the pump attaching bolts to 20 N·m (175 in-lbs) torque.

Recheck shafts for free rotation. If a bind exists, loosen the bolts and tighten the bolts alternately and evenly to 20 N·m (175 in-lbs) torque.

Governor and Park Gear

Install the gear and governor body assembly on the output shaft.

Align the assembly so the governor valve shaft hole in the governor body is aligned with the hole in the output shaft.

Slide the assembly into place and install the snap ring behind the governor body.

Tighten the governor body-to-gear attaching bolts to 11 N·m (100 in-lbs) torque.

Bend the end of the lock tabs against the shoulders of the bolt heads.

Install the governor valve on the valve shaft.

Insert the assembly into the body and through the governor weights.

Install the valve shaft retaining E-clip.

Output Shaft Bearing and Adapter Housing

Install the bearing in the adapter housing if not installed previously.

Install the seal in the housing.

Install the bearing snap rings.



AUTOMATIC TRANSMISSIONS

OVERHAUL

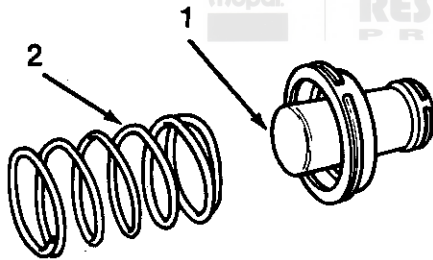


Valve Body and Accumulator Piston

Before installing the valve body, check the operation of the clutches and bands using the air pressure test procedure to confirm proper operation.

Clean all the mating surfaces and remove any burrs from the transmission case or valve body steel plate mating surfaces.

Install the accumulator piston assembly (1) in the case bore and install the piston spring (2) on the piston.



83549

Insert the park lock rod through the opening in the rear of the case.

Position the knob of the lock rod against the reaction plug and sprag.

Move the front end of the rod toward the centerline of the transmission while exerting rearward pressure on the rod to force it past the sprag. Rotate the output shaft, if necessary.

NOTE: Before installing the valve body, be sure the neutral start switch has not yet been installed.

Place the valve body manual lever in the Drive position.

Place the valve body assembly in its approximate position in the case.

Align the valve body in the case and install the attaching screws finger-tight.

Install the neutral start switch.

Shift the valve body manual lever to the Neutral position.

Relocate the valve body if necessary to align the manual lever neutral finger over the neutral start switch plunger ball.

Tighten the valve body attaching screws to 11 N·m (100 in-lbs) torque.

Install the gearshift control lever on the manual lever shaft and tighten the clamp bolt.

Check the lever shaft for binding in the case by moving the lever through all the detent positions.

NOTE: If binding exists, loosen the valve body attaching screws and align the valve body.

Install the flat washer and throttle lever and tighten the throttle lever clamp bolt.

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AUTOMATIC TRANSMISSIONS

OVERHAUL



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Rear Band Adjustment

Loosen the locknut and back the nut off five turns.

Tighten the band adjusting screw to the specified torque.

CAUTION: If Adapter Tool J-24063 is used to adjust the band, tighten the adjusting screw to one half the specified torque only.

Back off the adjusting screw to specifications.

Hold the adjusting screw in position and tighten the locknut to the specified torque.

Install the oil pan and gasket.

Front Band Adjustment

Loosen the locknut and back the nut off five turns.

Be sure the band adjusting screw turns freely in the case. Lubricate the screw, if necessary.

Tighten the band adjusting screw to the specified torque using Torque Wrench J-5853 and an 8 mm (5/16 in) square socket.

CAUTION: If Adapter Tool 2-24063 is used to adjust the band, tighten the adjusting screw to one half the specified torque only.

Back off the adjusting screw to specifications.

Hold the adjusting screw in position and tighten the locknut to the specified torque.



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Component Service Manual



**AUTHENTIC
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B.V. BA 10/5 MANUAL TRANSMISSION

MARCH, 1986

U.S.A./Canada Edition

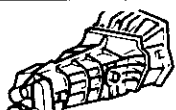
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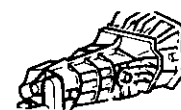


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BA 10/5 MANUAL TRANSMISSION

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DESCRIPTION

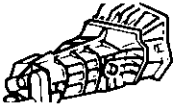
The Model BA 10/5 is a 5-speed, synchromesh manual transmission. Fifth gear is an 0.72:1 ratio overdrive range. All forward gear ranges feature synchronizer controlled engagement.

The transmission geartrain is contained in three case sections. The input shaft (1), cluster gear (14) and the first through fourth gear assemblies are located in the front case (15). The fifth-reverse gear assemblies are located in the intermediate case (16) and rear case (17). The mainshaft (9) is supported by a pilot bearing (2) and by roller bearings in the front and rear case. The shift forks, rails and detent components are in the front case. The gear shift lever is mounted in the intermediate case.



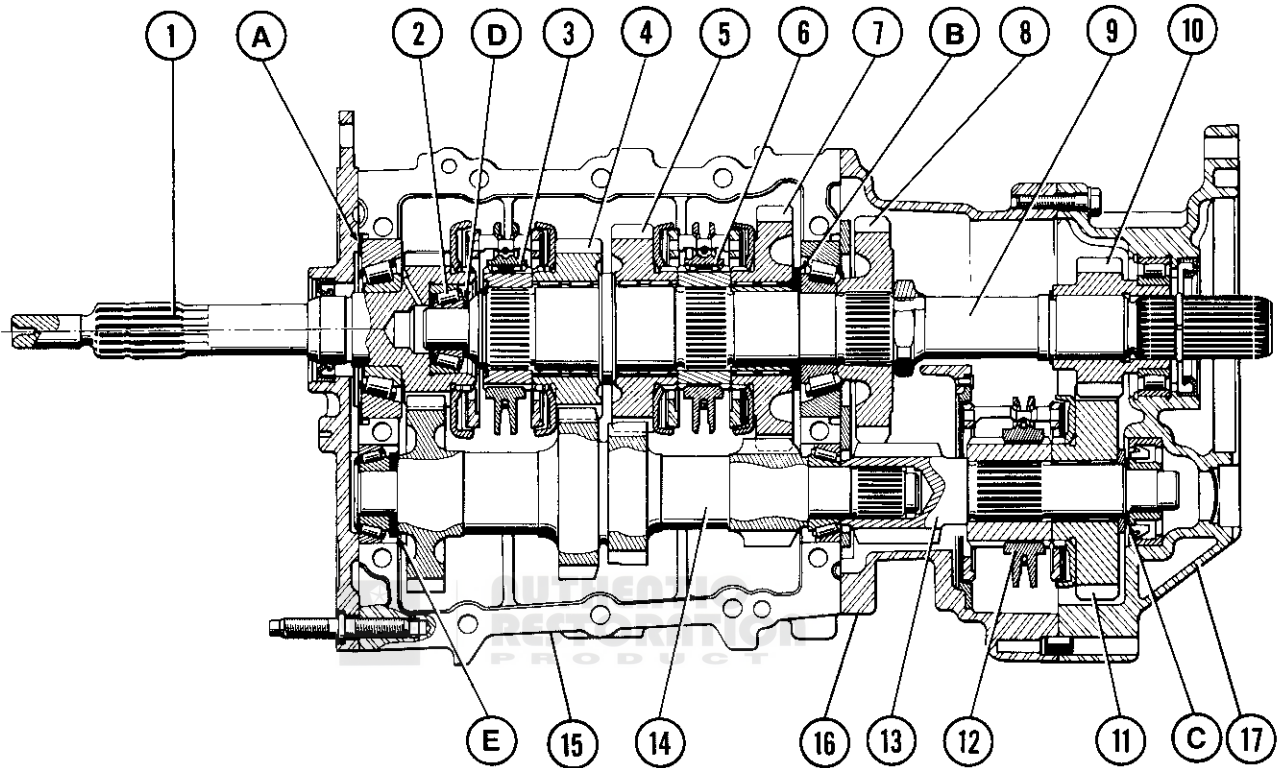
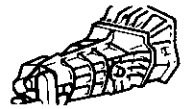
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BA 10/5 MANUAL TRANSMISSION

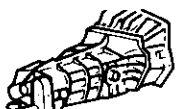
GENERAL INFORMATION



1. INPUT SHAFT
2. PILOT BUSHING
3. 3-4 SYNCHRONIZER
4. THIRD GEAR
5. SECOND GEAR
6. 1-2 SYNCHRONIZER
7. FIRST GEAR
8. REVERSE GEAR
9. MAINSHAFT
10. FIFTH GEAR
11. FIFTH INTERMEDIATE GEAR

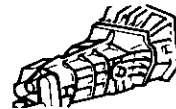
12. FIFTH GEAR SYNCHRONIZER
13. INTERMEDIATE SHAFT
14. CLUSTER GEAR
15. FRONT CASE
16. INTERMEDIATE CASE
17. REAR CASE
- A. FRONT BEARING SHIMS
- B. REAR BEARING SHIMS
- C. INTERMEDIATE SHAFT END PLAY SHIMS
- D. PILOT BEARING SHIMS
- E. CLUSTER FRONT BEARING SHIMS

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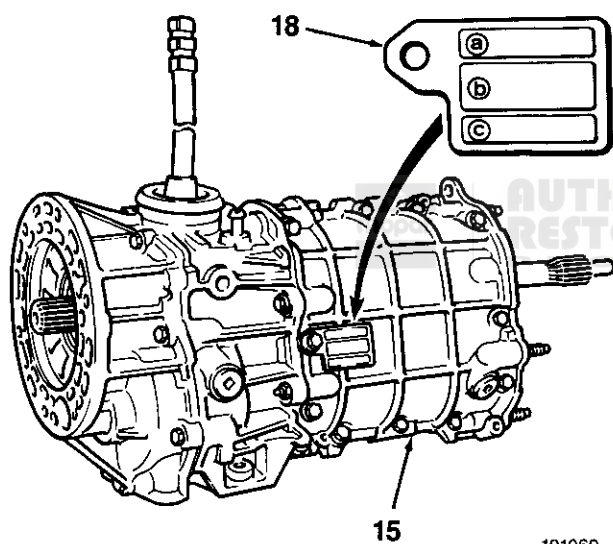
BA 10/5 MANUAL TRANSMISSION

GENERAL INFORMATION

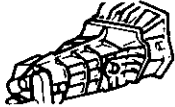
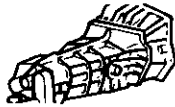


IDENTIFICATION

A transmission I.D. plate (18) is attached to the passenger side of the transmission front case (15). The plate provides the Jeep identification/part number (a), the manufacturer's reference number (b) and the transmission serial number (c). If the plate is removed during service operations, it is important that it be reinstalled. The information on this plate is necessary for accurate parts ordering and service procedures.



SEE
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NOTES

	BA 10/5 MANUAL TRANSMISSION SPECIFICATIONS	
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GENERAL SPECIFICATIONS

Transmission Gear Ratios:

First = 4.03:1
 Second = 2.39:1
 Third = 1.52:1
 Fourth = 1.00:1
 Fifth = 0.72:1
 Reverse = 3.76:1

Lubricant Capacity (dry fill):

1.63 liters (3.5 pints)

Lubricant Type:

SAE 75W-90, API Grade GL-5

Recheck Fill Level:

To bottom edge of fill plug hole

Bearing Preload:

Cluster Gear/Input Shaft

0.10 mm (0.004-in)

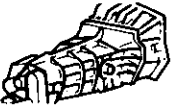
Intermediate Shaft End Play:

0.05 mm (0.002-in)

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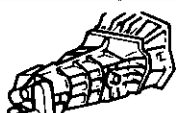
	BA 10/5 MANUAL TRANSMISSION SPECIFICATIONS	
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TORQUE SPECIFICATIONS

COMPONENT	SERVICE SET-TO TORQUE
Front Case Mounting Studs	10 N•m (8 ft-lbs)
Front Case Bolts:	
8 mm (5/16-in.)	15 N•m (11 ft-lbs)
7 mm (1/4-in.)	10 N•m (8 ft-lbs)
Intermediate Case-To-Front	
Case Bolts	18 N•m (13 ft-lbs)
Rear Case-To- Intermediate	
Case Bolts/Nuts	18 N•m (13 ft-lbs)
Rear Bearing Retainer	
Plate Allen Screws	10 N•m (8 ft-lbs)
Rear Bearing Retainer	
Plate Countersunk Screw	8 N•m (6 ft-lbs)
Reverse Gear Nut	65 N•m (48 ft-lbs)
Detent Plugs	13 N•m (10 ft-lbs)
Drain and Fill Plugs	28 N•m (20 ft-lbs)
Backup Light Switch	28 N•m (20 ft-lbs)
Front Case Mounting	
Stud-To-Clutch	
Housing Nuts	35 N•m (26 ft-lbs)

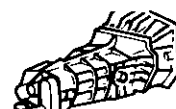
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BA 10/5 MANUAL TRANSMISSION

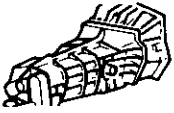
SPECIAL TOOLS



SPECIAL TOOLS

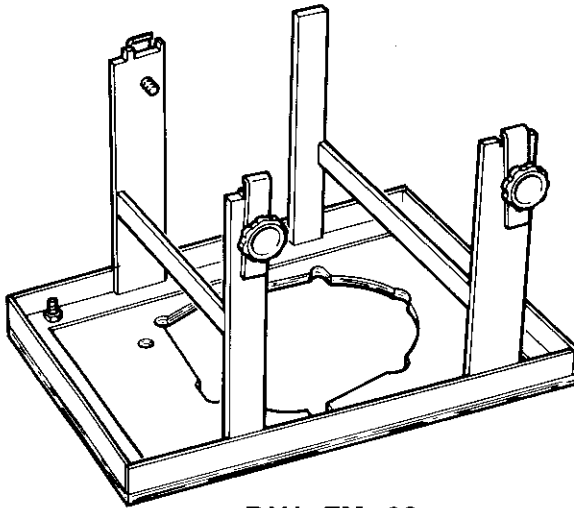
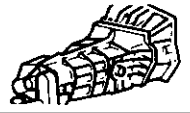
Tool Ref.	Description
B.V.I. FM. 02	Repair Stand
B.V.I. FM. 04	Thrust Pad
B.V.I. FM. 05	Thrust Plate
B.V.I. FM. 06	Fifth-Reverse Shift Rail Support
B.V.I. FM. 07	Press Plate
B.V.I. FM. 08	Bearing Remover — Cluster Gear
B.V.I. FM. 09	Bearing Remover — Input Shaft
B.V.I. FM. 10	Remover — Pilot Bearing Race
B.V.I. FM. 11	Bearing and Race Remover/Installer
B.V.I. FM. 12	Bearing Installer — Cluster Gear
B.V.I. FM. 13	Bearing and Race Installer
B.V.I. FM. 14	Bearing and Race Installer
B.V.I. FM. 15	Bearing Installer — Cluster Gear
B.V.I. FM. 16	Dial Indicator Base
B.V.I. FM. 17	Bearing Race Installer — Input Shaft
B.V.I. FM. 18	Oil Seal Installer
B.V.I. FM. 19	Installer — Fifth Gear
B.V.I. FM. 20	Gauge Block — Int. Shaft End Play
B.V.I. FM. 21	Puller Tool
B.V.I. FM. 22	Open End Wrench (Rev. Gear Nut)
MOT. LM	Dial Indicator
MOT. LM 99	Dial Indicator Extension

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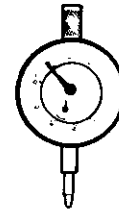


BA 10/5 MANUAL TRANSMISSION

SPECIAL TOOLS



B.V.I. FM. 02



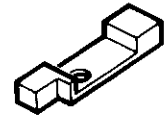
MOT. LM



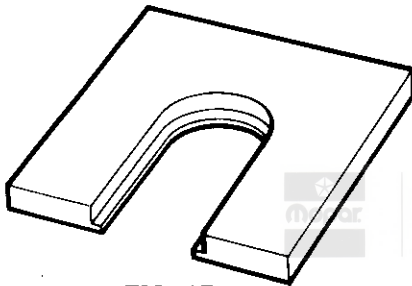
B.V.I. FM. 04



B.V.I. FM. 05



B.V.I. FM. 06



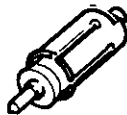
B.V.I. FM. 07



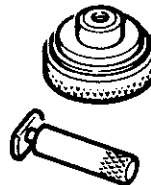
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B.V.I. FM. 09



B.V.I. FM. 10



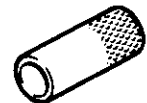
B.V.I. FM. 11



B.V.I. FM. 12



B.V.I. FM. 13



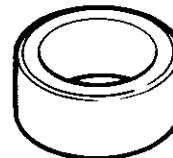
B.V.I. FM. 14



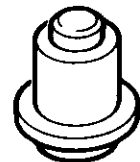
B.V.I. FM. 15



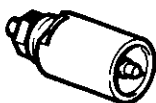
B.V.I. FM. 16



B.V.I. FM. 17



B.V.I. FM. 18



B.V.I. FM. 19

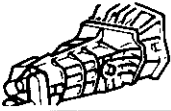


B.V.I. FM. 20



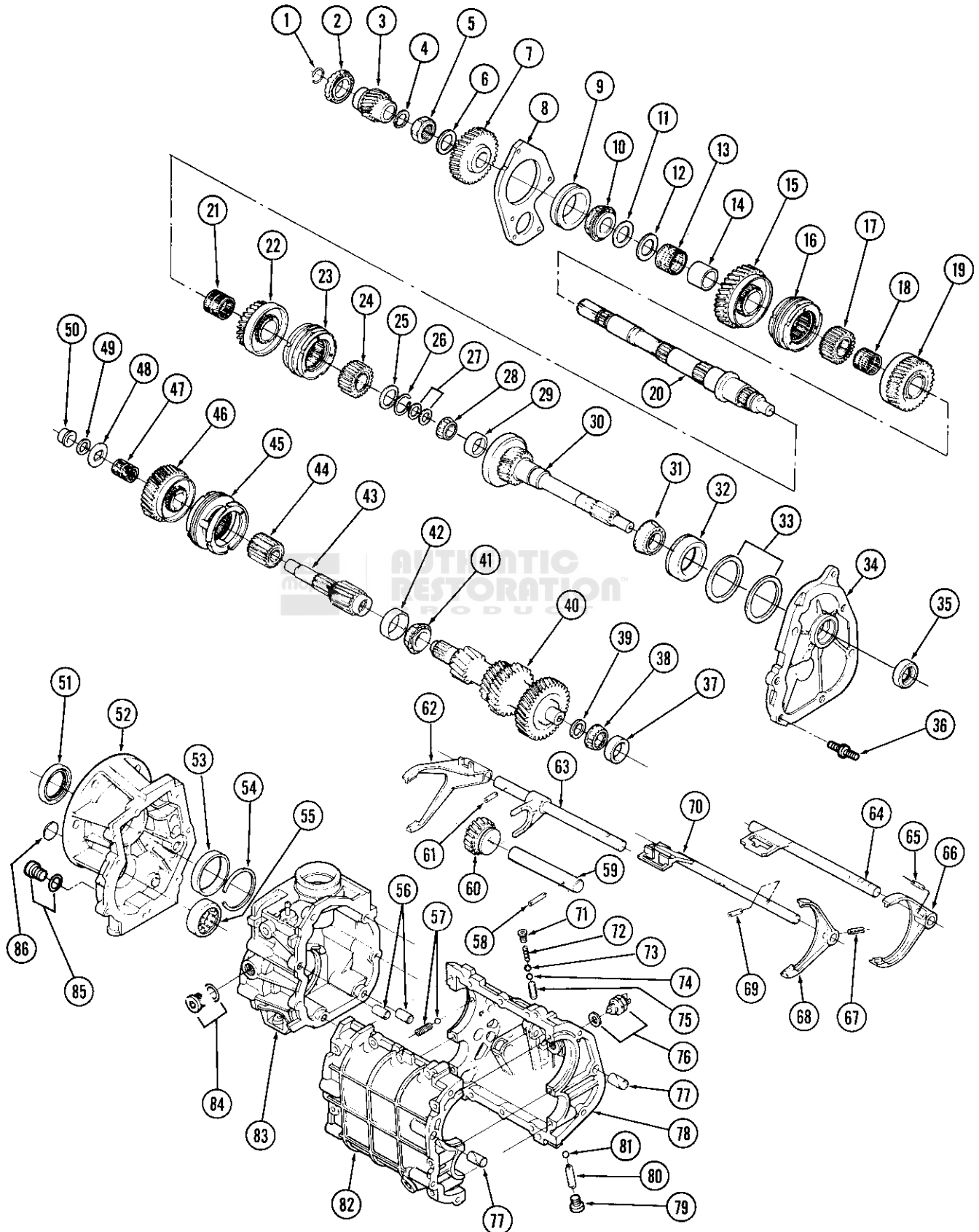
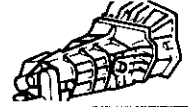
MOT. LM 99

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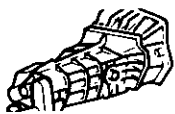


BA 10/5 MANUAL TRANSMISSION

OVERHAUL

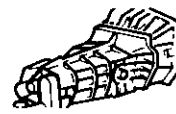


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BA 10/5 MANUAL TRANSMISSION

OVERHAUL



- | | |
|------------------------------------|--|
| 1. FIFTH GEAR LOCK RING | 44. SYNCHRONIZER HUB |
| 2. FIFTH GEAR ROLLER BEARING | 45. FIFTH GEAR SYNCHRONIZER |
| 3. FIFTH GEAR | 46. FIFTH INTERMEDIATE GEAR |
| 4. FIFTH GEAR SNAP RING | 47. FIFTH INTERMEDIATE GEAR BEARING |
| 5. REVERSE GEAR NUT | 48. THRUST WASHER |
| 6. WASHER (NOT USED IN ALL MODELS) | 49. END PLAY SHIM |
| 7. REVERSE GEAR | 50. INTERMEDIATE SHAFT ROLLER BEARING RACE |
| 8. REAR BEARING RETAINER | 51. OIL SEAL |
| 9. REAR BEARING RACE | 52. REAR CASE |
| 10. REAR BEARING | 53. FIFTH GEAR ROLLER BEARING RACE |
| 11. REAR BEARING SHIM | 54. SNAP RING |
| 12. SHIM WASHER | 55. INTERMEDIATE SHAFT ROLLER BEARING |
| 13. FIRST GEAR BEARING | 56. ALIGNMENT DOWELS |
| 14. BEARING SPACER | 57. FIRST-SECOND LOCK SPRING AND BALL |
| 15. FIRST GEAR | 58. ROLL PIN |
| 16. FIRST-SECOND SYNCHRONIZER | 59. IDLER SHAFT |
| 17. SYNCHRONIZER HUB | 60. REVERSE IDLER GEAR |
| 18. SECOND GEAR BEARING | 61. ROLL PIN |
| 19. SECOND GEAR | 62. FIFTH-REVERSE SHIFT FORK |
| 20. MAINSHAFT | 63. FIFTH-REVERSE SHIFT RAIL |
| 21. THIRD GEAR BEARING | 64. FIRST-SECOND SHIFT RAIL |
| 22. THIRD GEAR | 65. ROLL PIN |
| 23. THIRD-FOURTH SYNCHRONIZER | 66. FIRST-SECOND SHIFT FORK |
| 24. SYNCHRONIZER HUB | 67. ROLL PIN |
| 25. SPRING WASHER | 68. THIRD-FOURTH SHIFT FORK |
| 26. LOCK RING | 69. THIRD-FOURTH SHIFT RAIL LOCK PIN |
| 27. PILOT BEARING SHIMS | 70. THIRD-FOURTH SHIFT RAIL |
| 28. PILOT BEARING | 71. DETENT PLUG |
| 29. PILOT BEARING RACE | 72. FIRST-SECOND DETENT SPRING |
| 30. INPUT SHAFT | 73. FIRST-SECOND DETENT BALL |
| 31. FRONT BEARING | 74. INTERLOCK BALL |
| 32. FRONT BEARING RACE | 75. LOCK FINGER |
| 33. FRONT BEARING SHIMS | 76. BACKUP LIGHT SWITCH AND WASHER |
| 34. FRONT BEARING RETAINER | 77. ALIGNMENT DOWELS |
| 35. OIL SEAL | 78. FRONT CASE — LEFT HALF |
| 36. MOUNTING STUDS | 79. DETENT PLUG |
| 37. BEARING RACE | 80. FIFTH-REVERSE DETENT SPRING |
| 38. CLUSTER FRONT BEARING | 81. FIFTH-REVERSE DETENT BALL |
| 39. FRONT BEARING SHIM | 82. FRONT CASE — RIGHT HALF |
| 40. CLUSTER GEAR | 83. INTERMEDIATE CASE |
| 41. CLUSTER REAR BEARING | 84. FILL PLUG AND WASHER |
| 42. BEARING RACE | 85. DRAIN PLUG AND WASHER |
| 43. INTERMEDIATE SHAFT | 86. ACCESS PLUG |



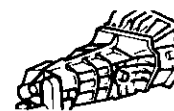
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BA 10/5 MANUAL TRANSMISSION

OVERHAUL



TRANSMISSION DISASSEMBLY

Rear Case Removal and Disassembly

Remove the drain plug (85) and drain all lubricant from the transmission.

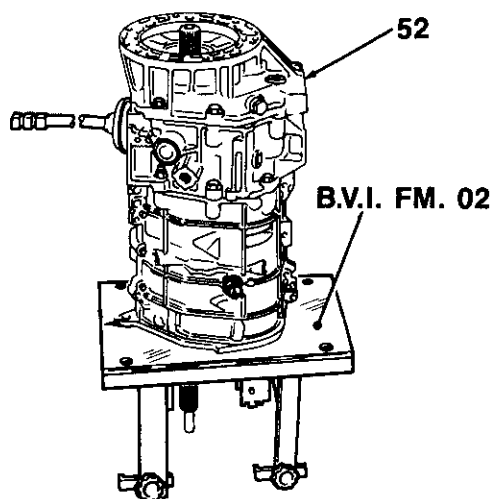
Remove the backup light switch (76).

Shift the transmission into Neutral.

Remove the gearshift lever boot. Then remove the lever retainer and the lever.

NOTE: On some BA 10/5 transmissions, the gearshift lever may be held in place with a snap ring instead of a retainer plate.

Mount the transmission on repair stand B.V.I. FM. 02 with the rear case (52) upward.

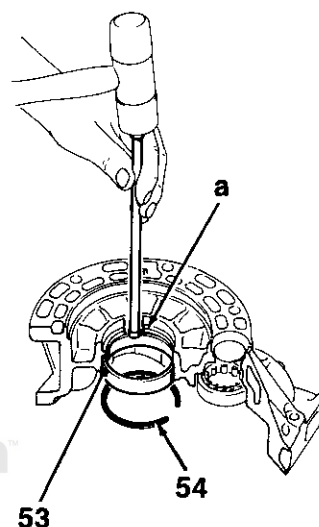


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Remove the rear case attaching bolts and remove the rear case (52).

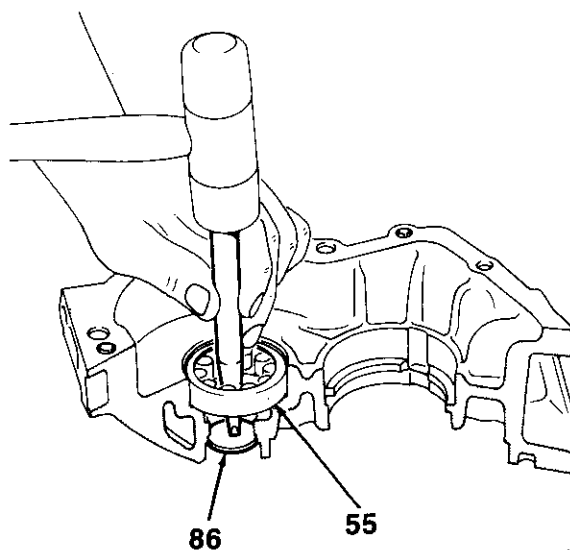
Remove the oil seal (51) from the rear case.

Remove the snap ring (54) and bearing race (53) from the rear case. Use a hammer and brass drift to remove the race. Tap the race out alternately and evenly using the three grooves (a) in the case.



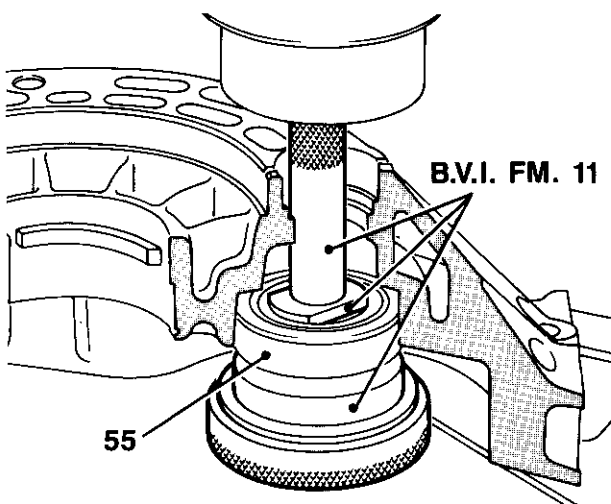
101064

Remove the round metal access plug (86) from the intermediate shaft bearing bore in the rear case.



101065

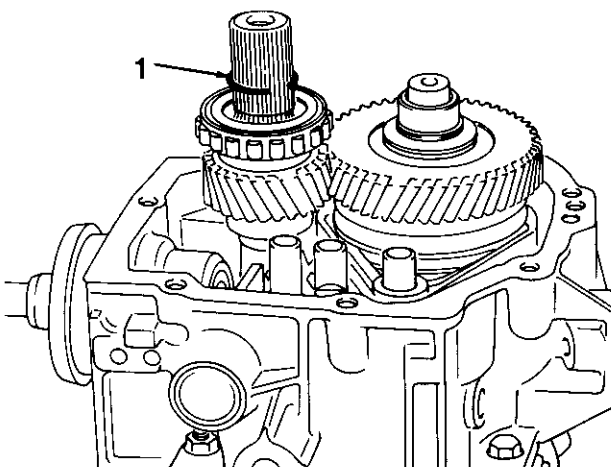
Remove the intermediate shaft roller bearing (55) from the rear case with an arbor press and tool B.V.I. FM. 11.



101066

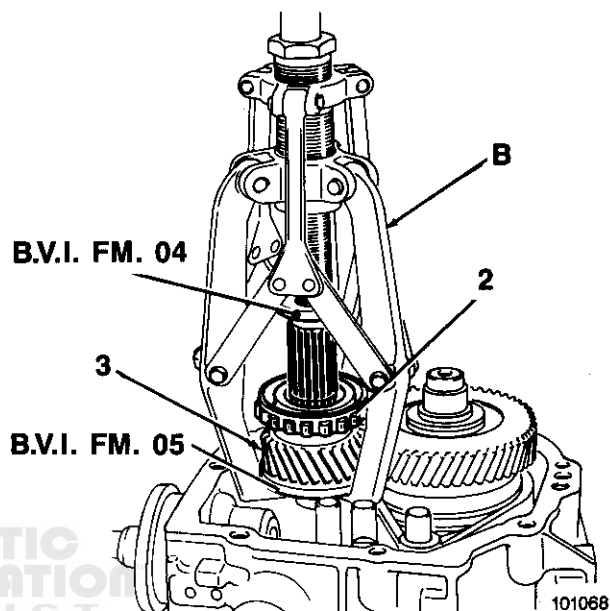
Intermediate Case and Fifth Gear Assembly Removal

Remove the fifth gear lock ring (1) from the mainshaft.



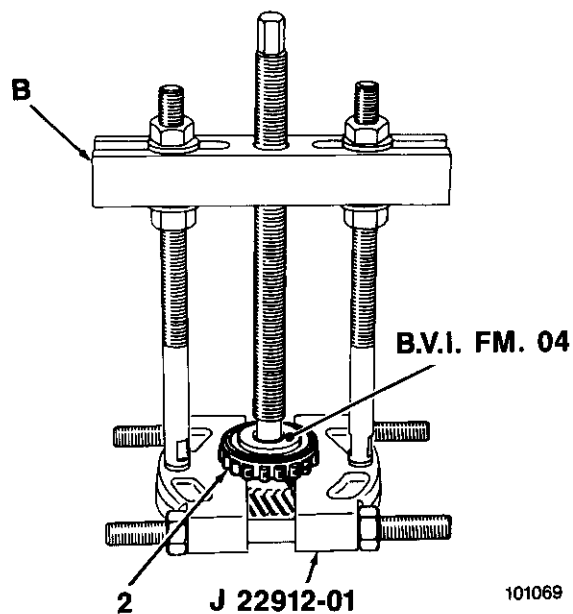
101067

Remove the fifth gear (3) and roller bearing (2) from the mainshaft with tools B.V.I. FM. 04, B.V.I. FM. 05 and a universal-type puller (B).



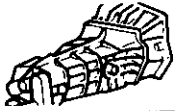
101068

Remove the roller bearing (2) from the fifth gear with tools B.V.I. FM. 04, J 22912-01 or T.Ar. 65 and an arbor press or universal puller (B).

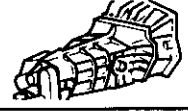


101069

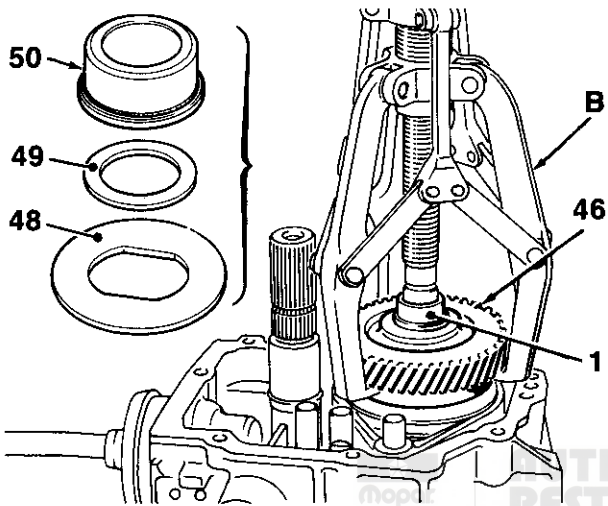
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BA 10/5 MANUAL TRANSMISSION OVERHAUL



Remove the fifth intermediate gear (46), thrust washer (48), end play shim (49) and bearing race (50) from the intermediate shaft (43) with a universal puller (B).

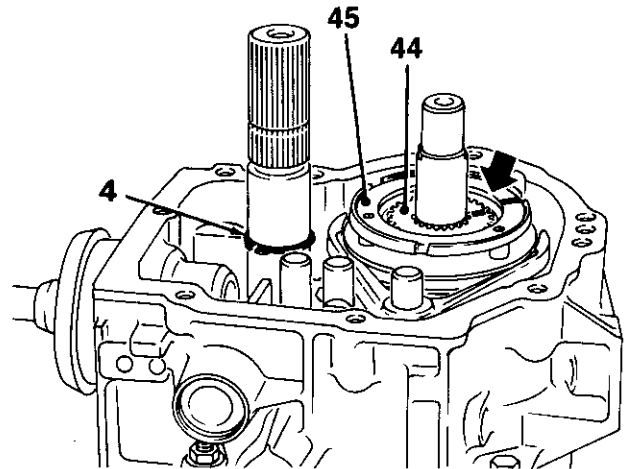


101070

Remove the fifth intermediate gear bearing (47) from the intermediate shaft.

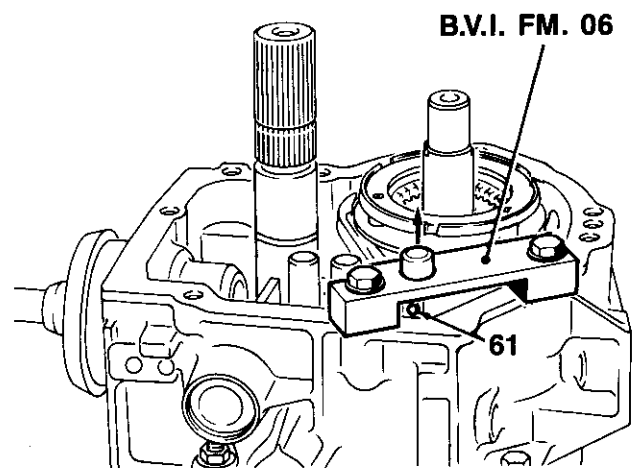
Remove the fifth gear snap ring (4) from the mainshaft.

Mark position of the fifth-reverse synchronizer (45) and hub (44) for assembly alignment reference.

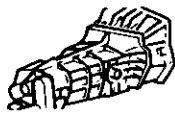


101071

Install support tool B.V.I. FM. 06 on the fifth-reverse shift fork (63) to prevent it from moving. Then remove the shift fork roll pin (61) with a pin punch.

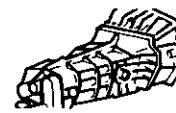


101072

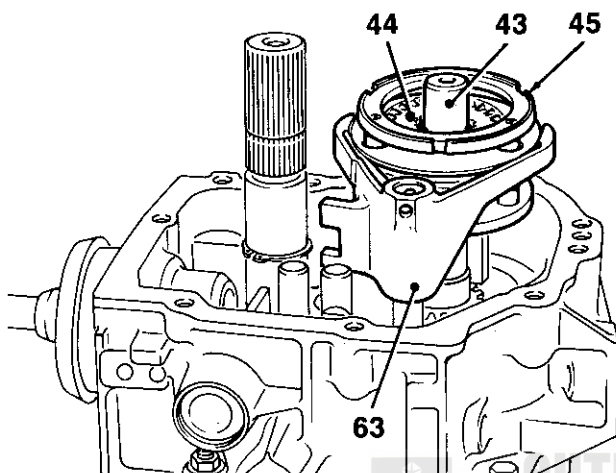


BA 10/5 MANUAL TRANSMISSION

OVERHAUL



Remove the fifth-reverse shift fork (63), synchronizer and hub (44-45) and intermediate shaft (43) as an assembly.



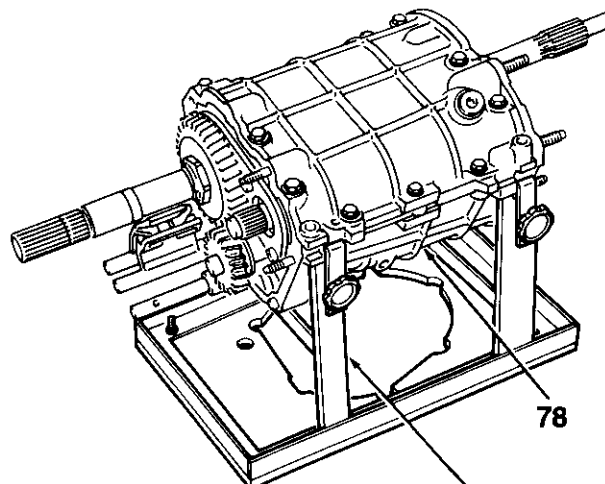
101073

Remove the intermediate case attaching bolts/nuts and remove the case (83).

Front Case Disassembly

Remove the transmission from the repair stand. Turn the stand over and remount the transmission in a horizontal position on the repair stand legs as shown.

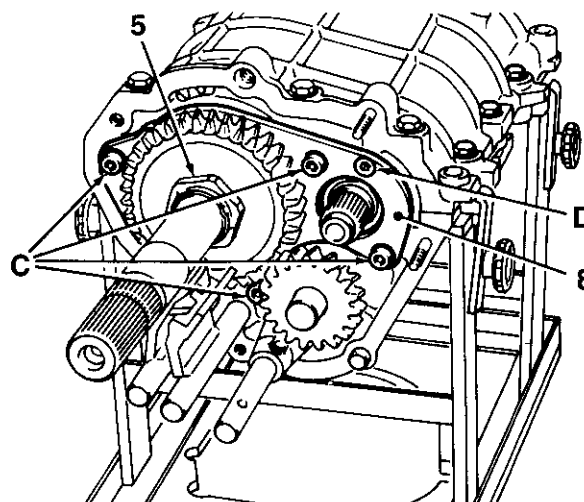
NOTE: Position the left front case half (78) on the repair stand legs.



B.V.I. FM. 02

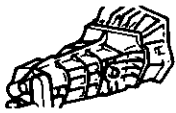
101074

Remove the Allen screws (C) and the small countersunk Torx screw (D) that attach the rear bearing retainer (8) to the case.



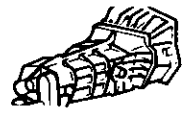
101075

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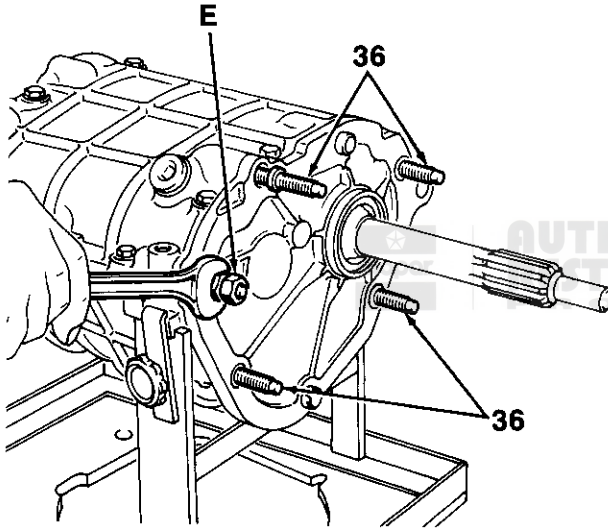


Loosen the reverse gear nut (5) with tool B.V.I. FM. 22 or a suitable size wrench.

NOTE: Use a suitable size 12-point socket or spare yoke to hold the mainshaft while loosening the nut.

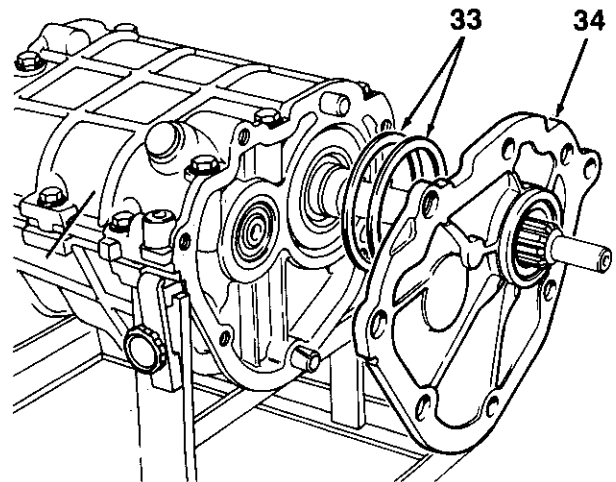
Remove the front mounting studs (36) from the front case with a stud remover or two nuts (E) as shown.

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101076

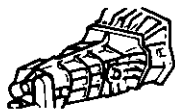
Remove the front bearing retainer (34) and the preload shims (33) from the front case. Tag the shims for assembly reference.



101077

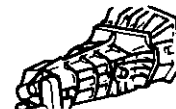
Remove the oil seal (35) from the front bearing retainer (34). Discard the seal.

Remove the bolts attaching the two halves of the front case. Lift the right case half (82) up and off the gear assemblies and left case half.

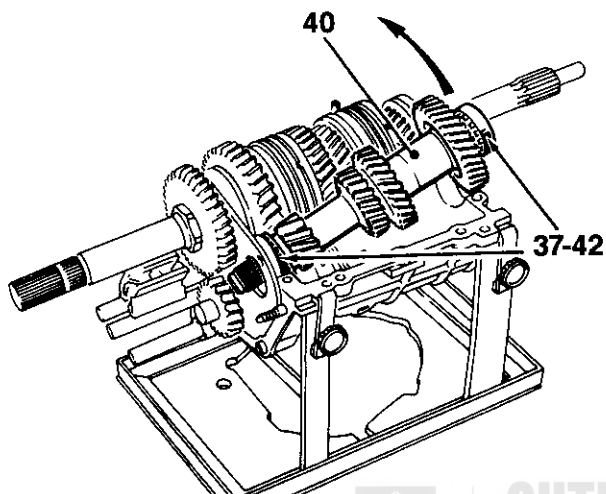


BA 10/5 MANUAL TRANSMISSION

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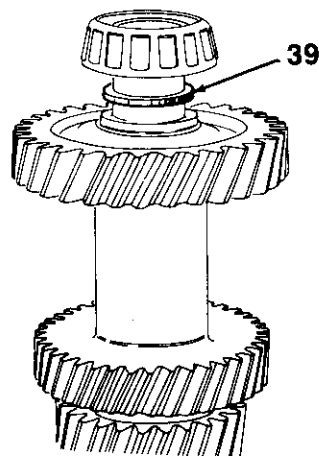
Remove the cluster gear (40) and the cluster gear bearing races (37-42) as an assembly. Tag the races for assembly reference.



**AUTHENTIC
RESTORATION**
PRODUCT

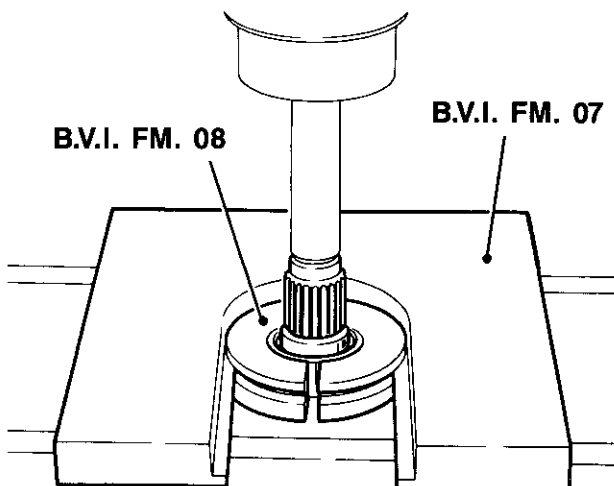
101078

Remove the front bearing preload shim (39) after bearing removal. Tag the shim for assembly reference.



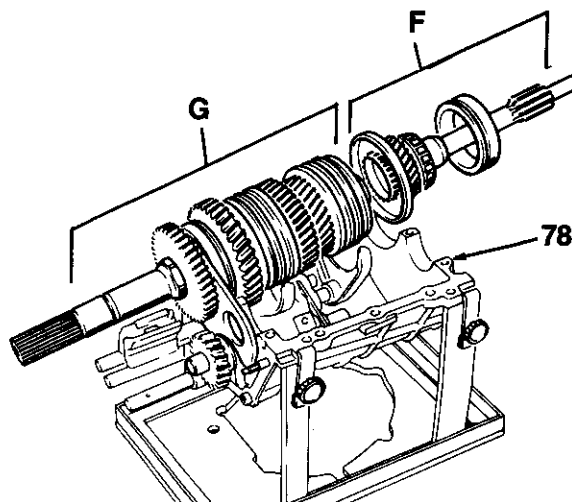
101080

Remove the cluster gear front bearing (38) and rear bearing (41) with an arbor press and remover tools B.V.I. FM. 07 and B.V.I. FM. 08. Tag the bearings for assembly reference.



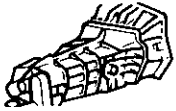
101079

Remove the input shaft (F) and mainshaft (G) assemblies from the case (78).



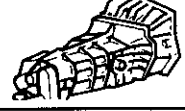
101081

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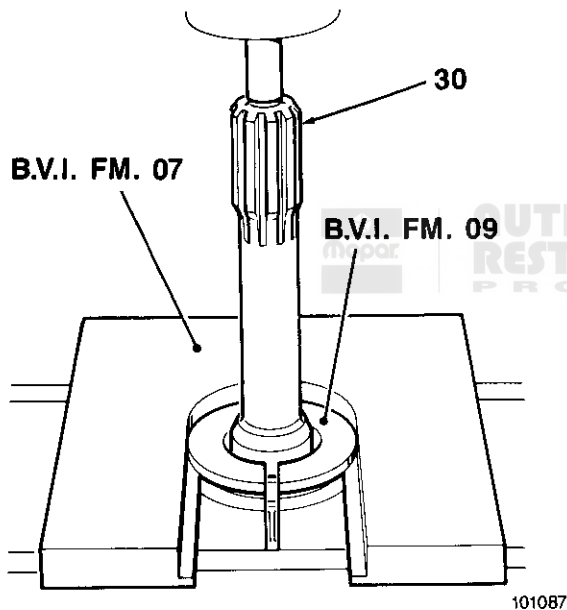
Input Shaft-Mainshaft Disassembly

Separate the input shaft assembly (F) from the mainshaft assembly (G).

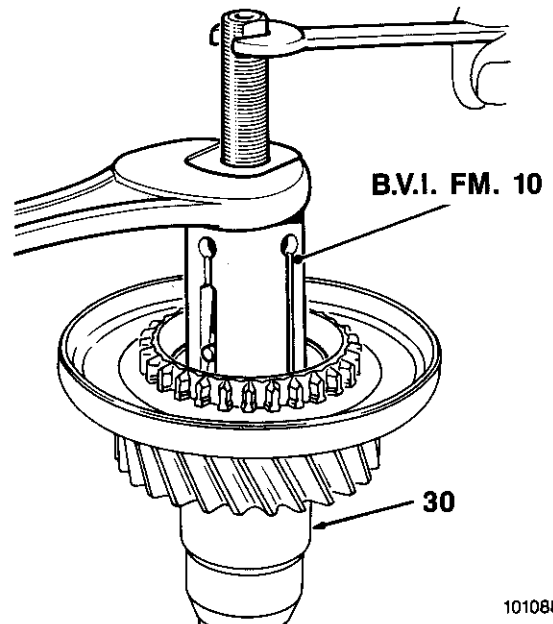
Remove the bearing race (32) from the front bearing (31).

Remove the front bearing from the input shaft (30) with an arbor press and tools B.V.I. FM. 07 and B.V.I. FM. 09.

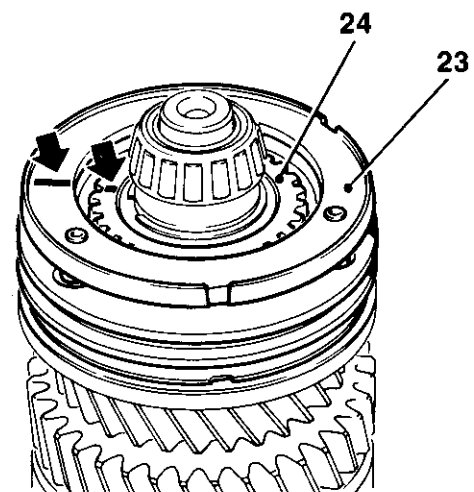
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Remove the pilot bearing race (29) from the input shaft (30) with remover tool B.V.I. FM. 10.

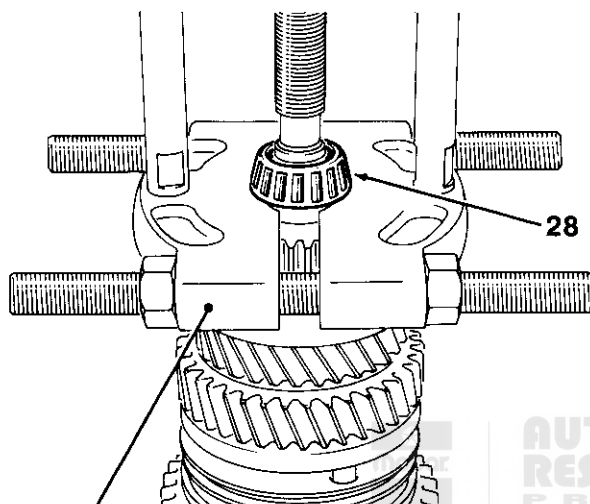


Mark the third-fourth synchronizer and hub for assembly reference. Then remove the synchronizer (24) from the hub (23).



	BA 10/5 MANUAL TRANSMISSION OVERHAUL	
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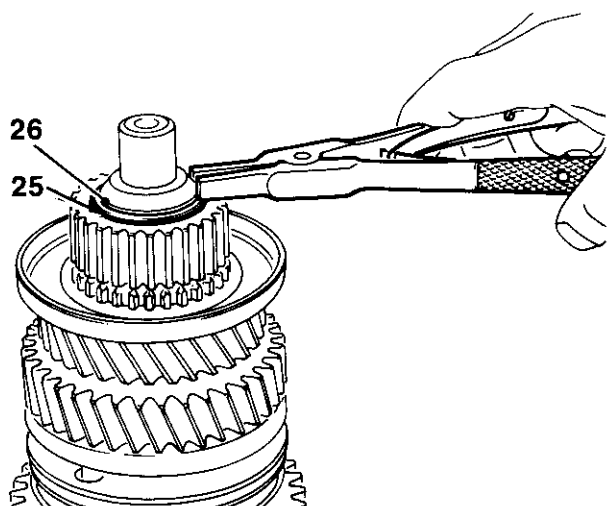
Remove the pilot bearing (28) and the bearing preload shims (27) from the mainshaft. Use an arbor press and puller J 22912-01, T.Ar. 65 or B.V.I. FM. 21 to remove the bearing. Tag the preload shims for assembly reference.



J 22912-01

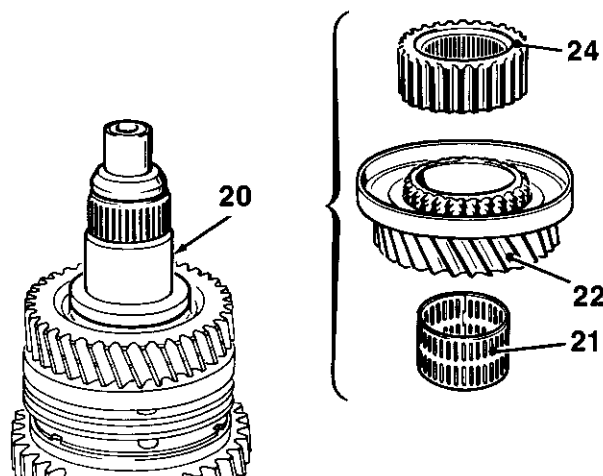
101090

Remove the snap ring (26) and spring washer (25) from the mainshaft.



101091

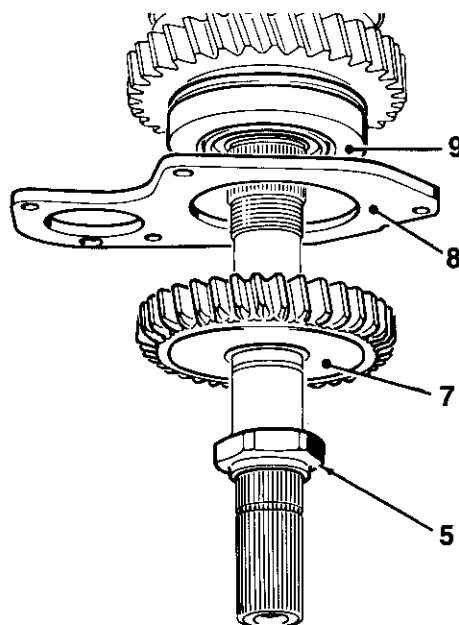
Remove the third-fourth synchronizer hub (24), third gear (22) and third gear needle bearing (21) from the mainshaft (20).



101092

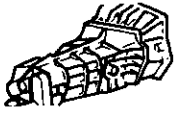
Remove the reverse gear nut (5). Also remove the washer (6) if the transmission is equipped with one.

Remove the reverse gear (7), rear bearing retainer (8) and rear bearing race (9).



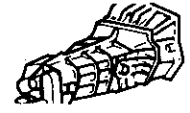
101093

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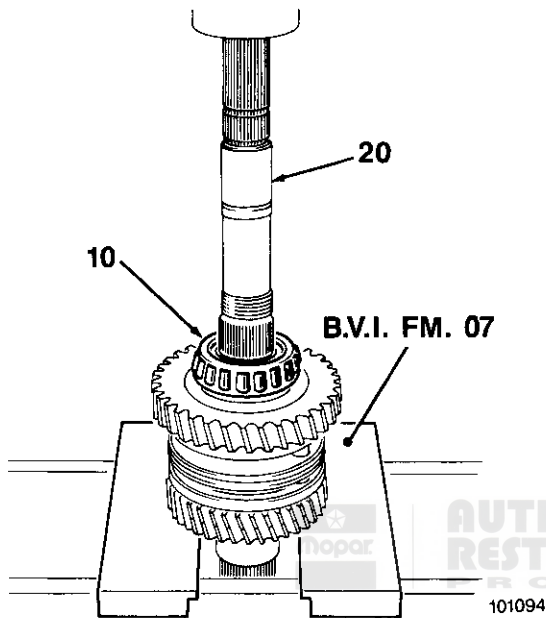


BA 10/5 MANUAL TRANSMISSION

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Press the rear bearing (10) three-quarters of the way off the mainshaft (20) with an arbor press and tool B.V.I. FM. 07. Do not press the bearing completely off the mainshaft at this time.

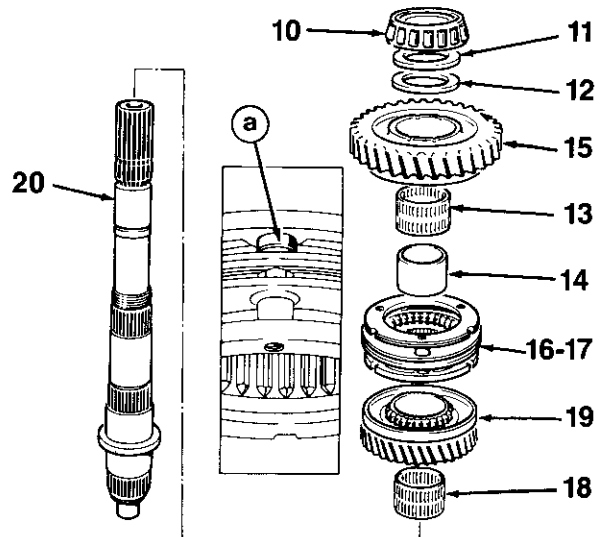


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Mark the first-second synchronizer (16) and hub (17) for assembly reference.

Tap the rear bearing (10) off the mainshaft (20) with a rawhide mallet. Then remove: shim (11); spacer (12); first gear (15); first gear needle bearing (13); bearing spacer (14); first-second synchronizer (16); synchronizer hub (17); second gear (19) and second gear bearing (18).

NOTE: Mark or note position of the synchronizer lugs (a) for assembly reference.



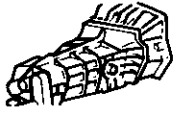
Shift Fork, Rail and Detent Ball Removal

Remove the first-second lock ball and spring (57).

Move the third-fourth shift fork (68) and rail (70) all the way forward into fourth gear position.

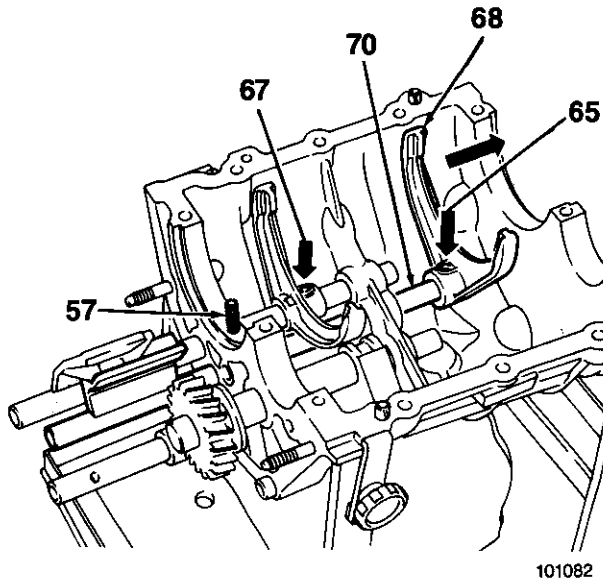
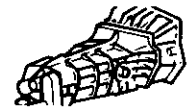
Remove the roll pins (65 and 67) that secure the shift forks to the rails.

Slide the third-fourth shift rail (70) back to Neutral position.

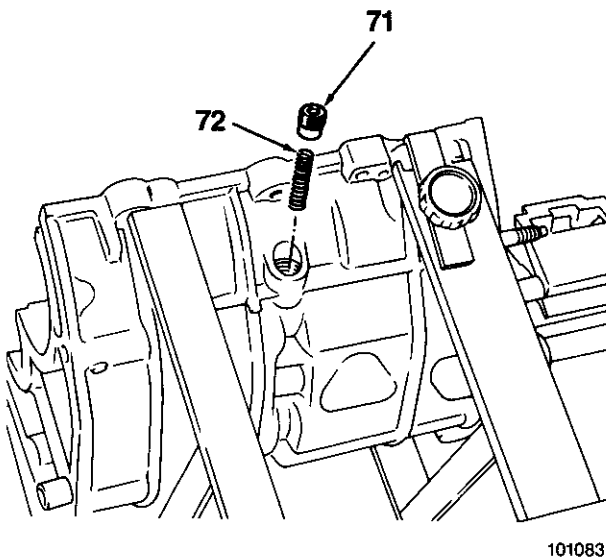


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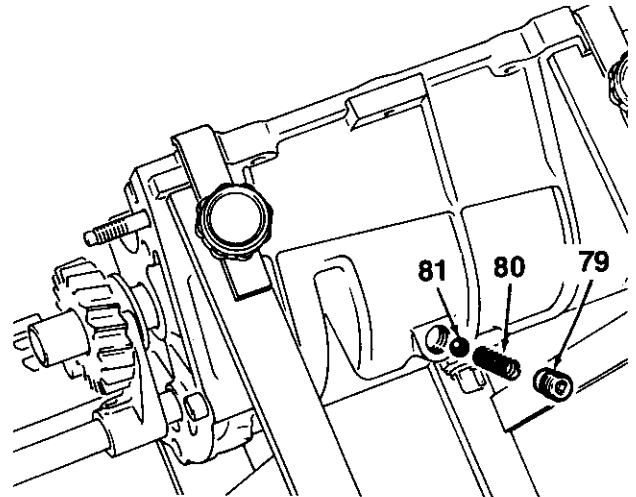
OVERHAUL



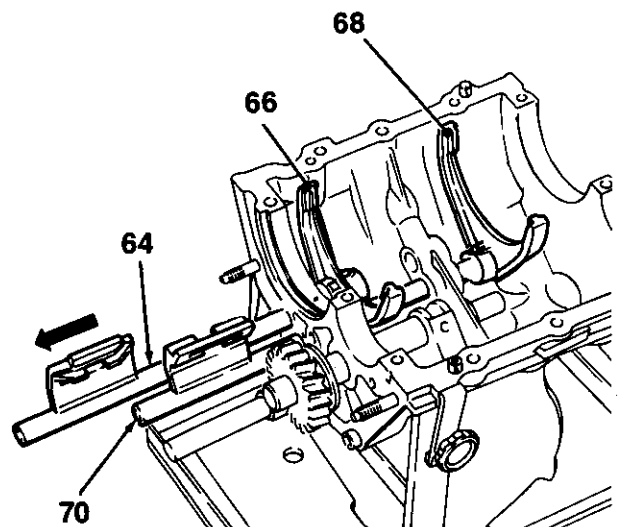
Remove the first-second detent plug (71) and spring (72).



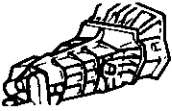
Remove the fifth-reverse detent plug (79), spring (80) and ball (81).



Remove the first-second shift rail and fork (64-66) and the third-fourth shift rail and fork (68-70). Mark or tag the rails and forks for assembly reference.

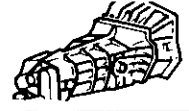


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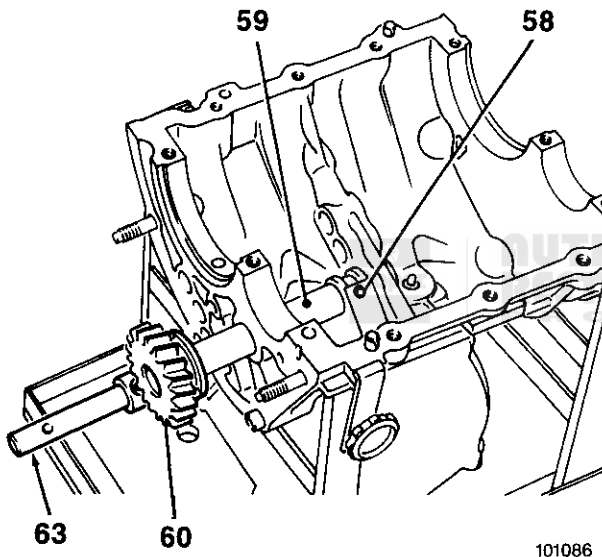


Remove the lock pin (69) from the third-fourth shift rail (70).

Remove the first-second detent ball (73), interlock ball (74), lock finger (75) and fifth-reverse detent ball (81) from the case.

Remove the fifth-reverse shift rail (63) and reverse idler gear (60).

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101086

Remove the idler shaft roll pin (58) and the idler shaft (59).

CLEANING AND INSPECTION

Clean all of the transmission components with solvent. Dry the bearings and races with shop towels. Compressed air may be used to dry the remaining components. Apply compressed air to all feed holes and channels in the gears, shafts and cases to remove cleaning solvent and verify that they are clear.

Inspect the transmission gears and synchronizers for wear or damage. Replace any part

that is worn, chipped, cracked or otherwise damaged.

NOTE: The synchronizers are serviced as assemblies only. Replace any synchronizer that is damaged or worn. Do not attempt to disassemble them.

Check each of the transmission cases for cracks, stripped threads, distortion or damaged bearing or sealing surfaces. Also inspect the shift rail bores in each case for wear or scoring. Repair or replace any case if damaged.

Inspect the shift forks and rails for wear or damage. Replace any rail or fork if worn, distorted, cracked or heavily scored. Replace shift rail detent balls that are chipped, cracked or severely worn and replace any detent springs that are distorted or broken.

Inspect all of the transmission bearings, races and bushings. Replace components that are worn, pitted, chipped or spalled. Carefully inspect the fifth gear roller bearing cage. Replace the roller bearing if the cage is loose, cracked or distorted.

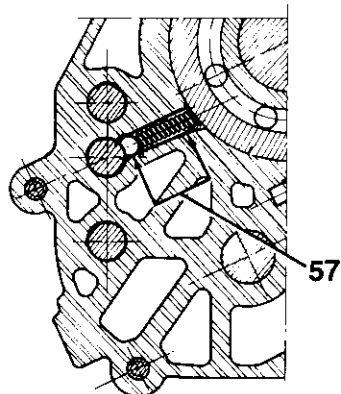
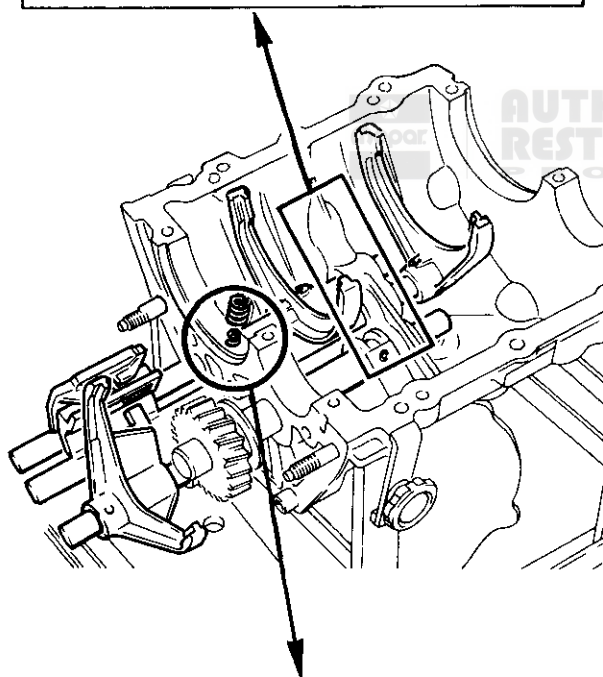
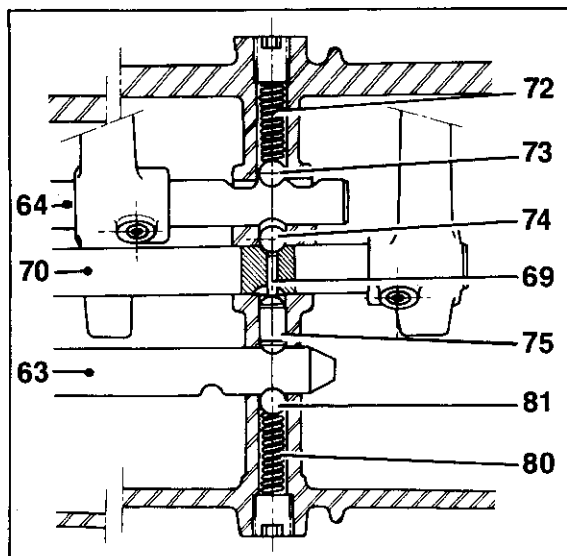
TRANSMISSION ASSEMBLY

NOTE: Lubricate the transmission components with Jeep 75W-90, API Grade GL 5 gear lube during assembly operations.

Shift Fork, Rail and Detent Ball Installation

NOTE: Refer to the Shift Component Location Chart for positioning and identification of the shift forks, rails and detent components. Exercise care during assembly. Improper shift component installation will require transmission disassembly to correct.

SHIFT COMPONENT LOCATION CHART

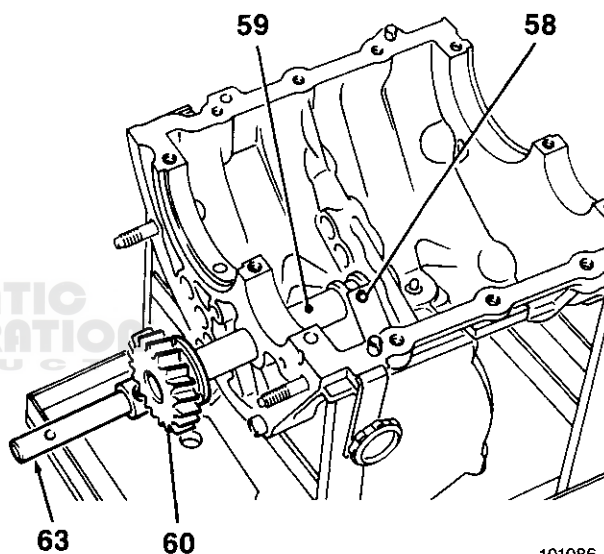


101102

Position the left half of the front case (78) in repair stand B.V.I. FM. 02 as shown.

Install the idler shaft (59). Secure the shaft with a roll pin (58).

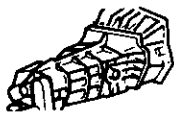
Assemble and install the reverse idler gear (60) and fifth-reverse shift rail (63).



101086

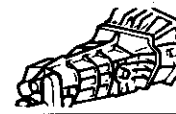
Move the fifth-reverse shift rail (63) to Neutral.

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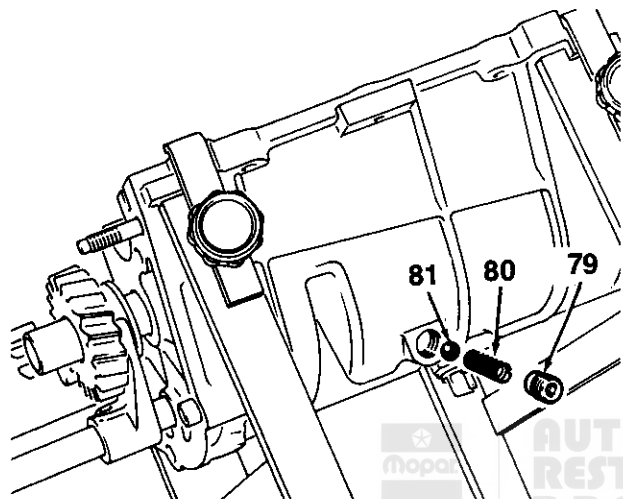


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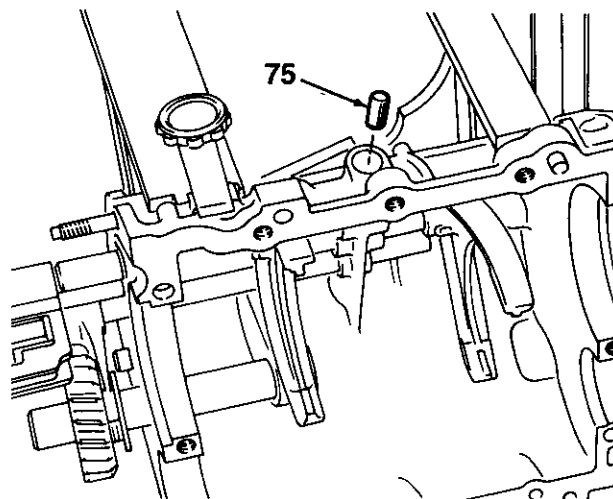


Install the fifth-reverse detent ball (81), spring (80) and plug (79) in the detent bore at the bottom of the case. Coat the plug threads with sealer before installation and tighten it to 13 N·m (10 ft-lbs) torque.



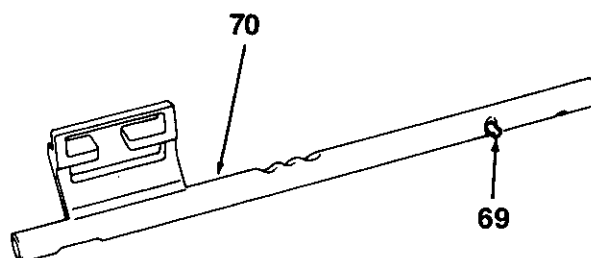
101103

Insert the lock finger (75) into the detent bore at the top of the case. Push the lock finger downward until it seats in the fifth-reverse shift rail detent. Refer to the Shift Component Location Chart.



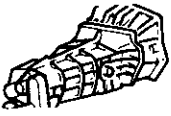
101104

Coat the lockpin (69) with petroleum jelly and install it in the third-fourth shift rail (70).



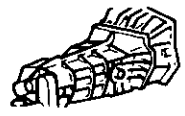
101105

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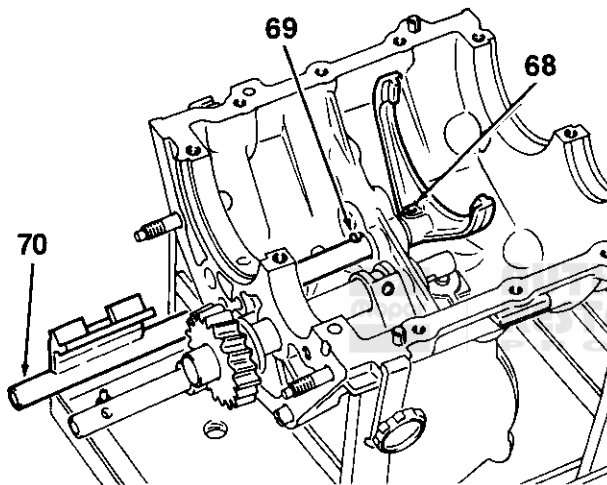
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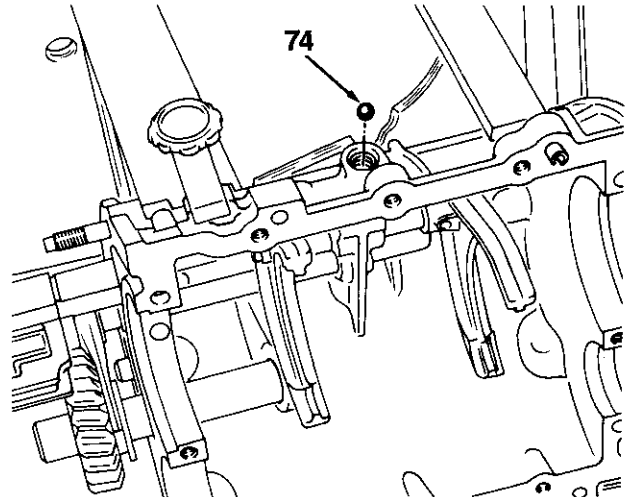
Install the third-fourth shift rail (70) and fork (68) in the case. Move the rail into Neutral. Do not let the lock pin (69) fall out of the shift rail during installation.

NOTE: Be sure the lock finger (75) is seated in the third-fourth shift rail detent and against the lock pin (69). Refer to the Shift Component Location Chart.



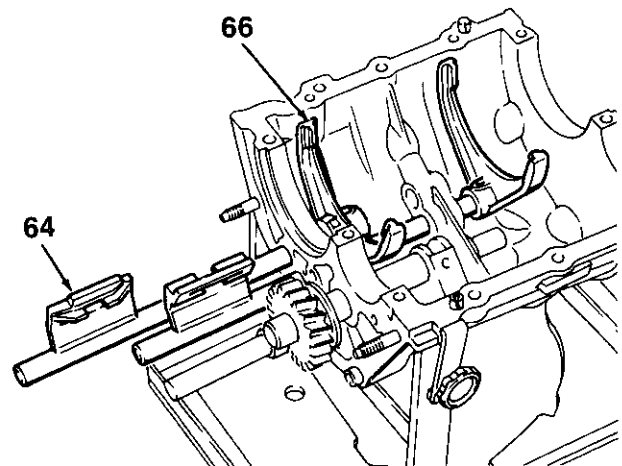
101106

Install the interlock ball (74) in the detent bore at the top of the case. Push the ball downward until it seats in the third-fourth shift rail detent and against the lock pin (69). Refer to the Shift Component Location Chart.



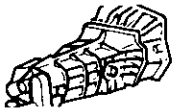
101107

Install the first-second shift rail (64) and shift fork (66) in the case.



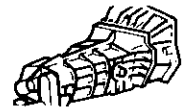
101108

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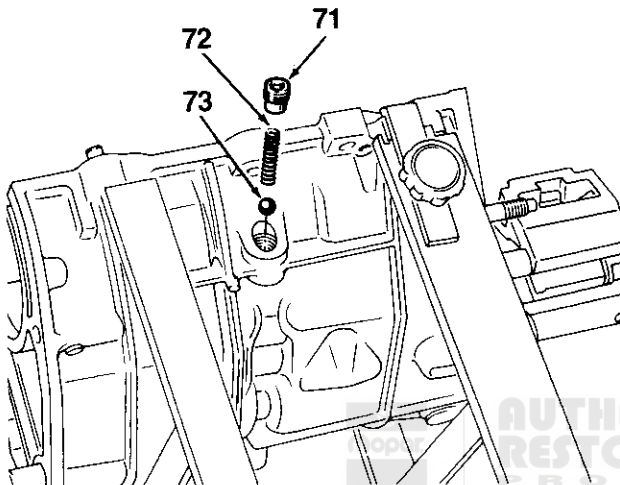


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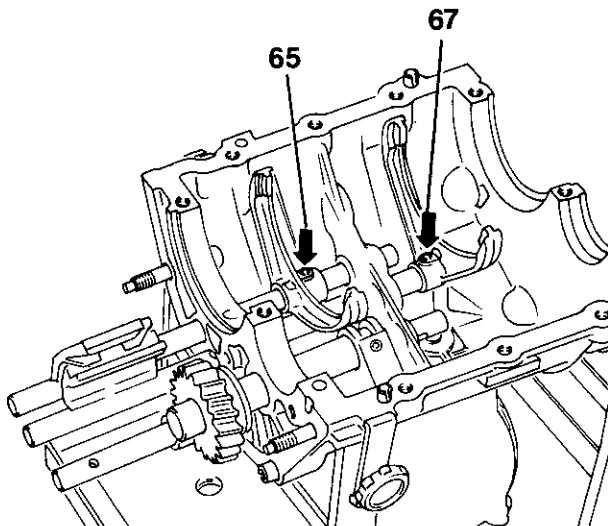


Install the first-second detent ball (73), spring (72) and plug (71) in the detent bore at the top of the case. Coat the plug threads with sealer before installation and tighten it to 13 N·m (10 ft-lbs) torque.



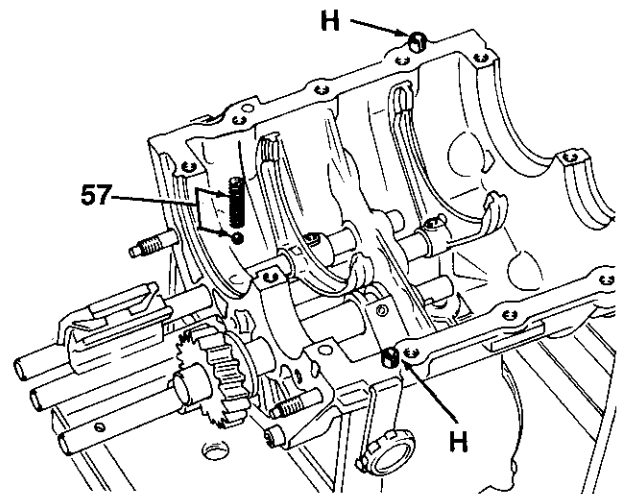
101109

Install the shift fork roll pins (65-67).



101110

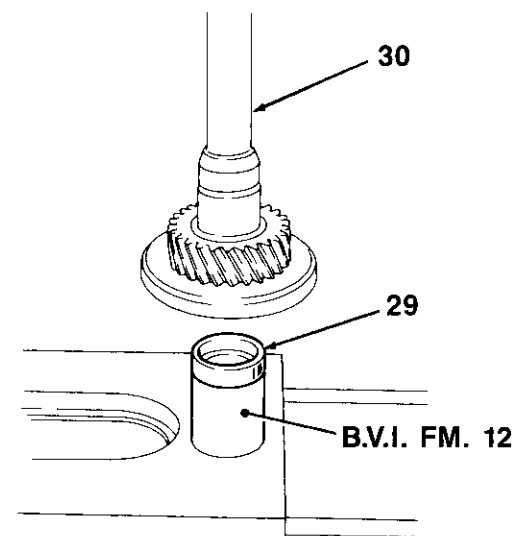
Install the first-second lock ball and spring (57).



101154

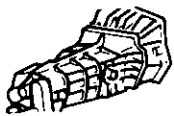
Input Shaft-Mainshaft Assembly

Install the pilot bearing race (29) in the input shaft (30) with an arbor press and tool B.V.I. FM. 12.



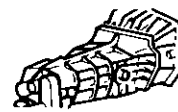
101096

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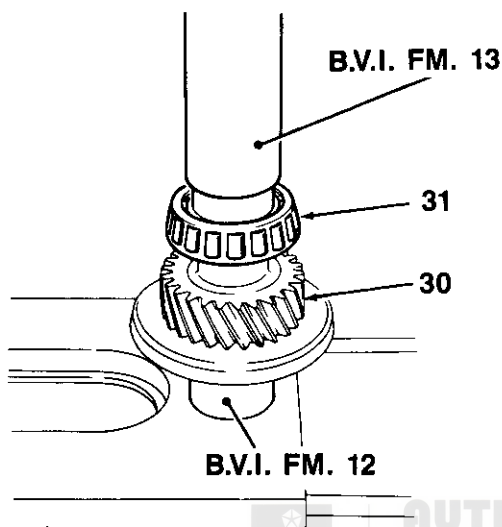


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OVERHAUL



Install the front bearing (31) on the input shaft (30) with an arbor press and tools B.V.I. FM. 12 and B.V.I. FM. 13.

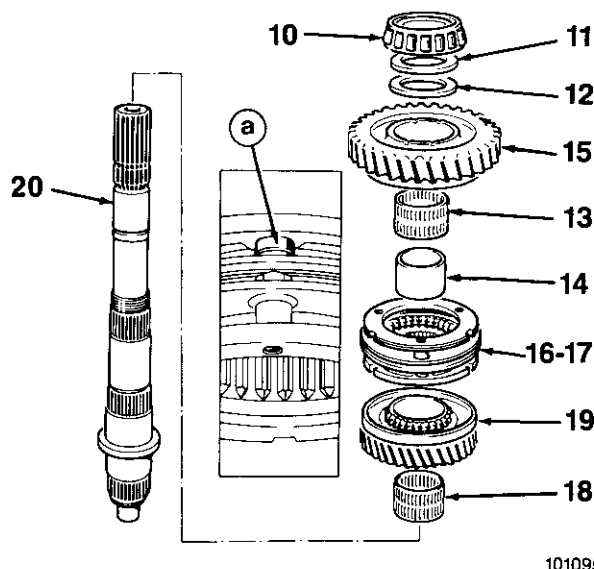


Install first gear bearing (18), bearing spacer (14) and second gear bearing (13) on the mainshaft (20). Be sure the spacer is installed between the two bearings.

Install the second gear (19) on the mainshaft.

Assemble and install the hub (17) and first-second synchronizer (16) on the mainshaft. Install the synchronizer with pins (a) toward the rear of the mainshaft.

Install the first gear (15) and the spacer (12) on the mainshaft.



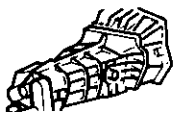
101095

Install the original or a replacement rear bearing preload shim (11) on the mainshaft as follows:

- Use the **original shim** only when all of the original transmission components (except bearings and races) are being reused.
- Use a **replacement shim that is 4.55 mm (0.179-in.) thick** if any transmission case, gear, shaft, synchronizer, or shift fork/rail has been replaced.

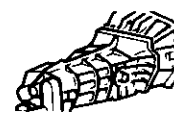
Install the mainshaft rear bearing (10) with an arbor press and tool B.V.I. FM. 13.

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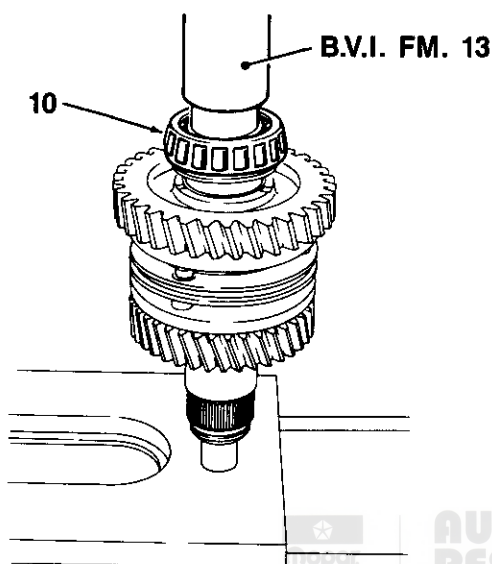


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CAUTION: Do not exceed 3000 kg. (6600 lbs.) force when pressing the bearing onto the mainshaft.

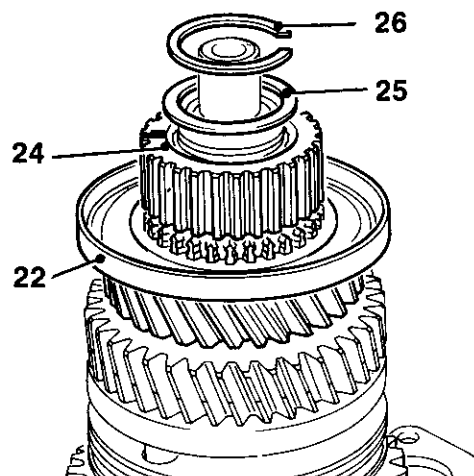


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Install the third gear needle bearing (21) and the third gear (22) on the front of the mainshaft.

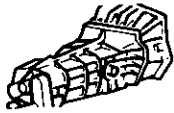
Install the third-fourth synchronizer hub (24) on the mainshaft but do not install the synchronizer at this time.

Position a replacement spring washer (25) and lock ring (26) on the mainshaft.



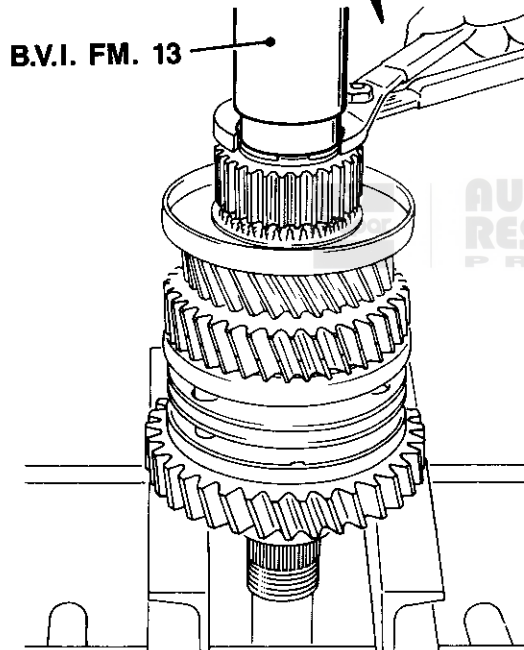
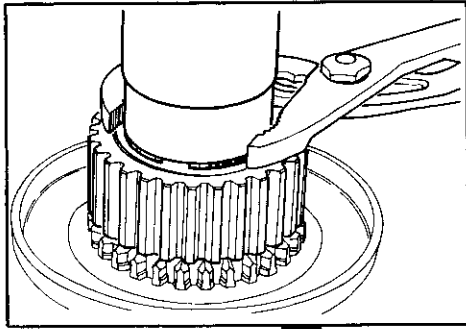
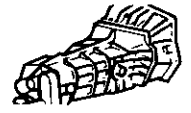
Seat the lock ring (26) as follows:

- Mount the mainshaft in an arbor press.
- Place tool B.V.I. FM. 13 over the end of the mainshaft and against the lock ring (26).
- Apply just enough press pressure to align the lock ring with the groove in the mainshaft.
- Secure the lock ring (26) in the groove by compressing it with pliers.
- Release the press and remove the press tools and mainshaft.



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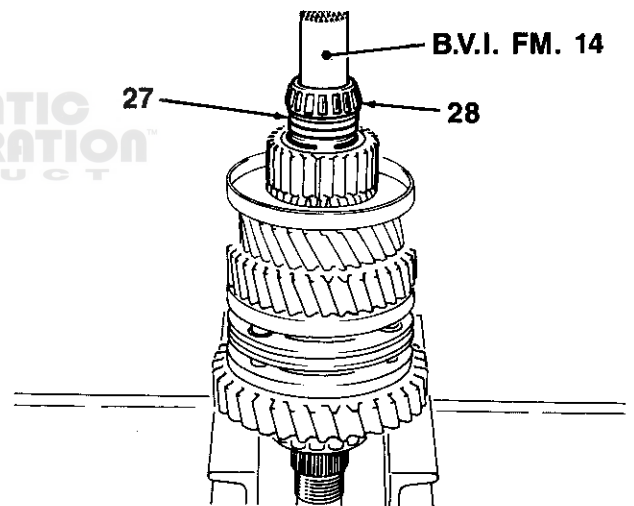


101100

Install original or replacement pilot bearing shims (27) on the mainshaft as follows:

- Use the **original** shims only if the original third gear, synchronizer hub, spring washer and lock ring are being reused.
- Use **replacement** shims with a total thickness of 2.80 mm (0.110-in.) if any of the above components have been replaced.

Install the pilot bearing (28) on the mainshaft with an arbor press and tool B.V.I. FM. 14.

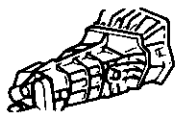


101101

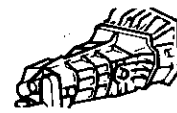
Install the third-fourth synchronizer (23) on the hub (24). Align the two components according to the reference marks made during disassembly.

NOTE: Do not install the rear bearing retainer (8), reverse gear (7) or reverse gear nut (5) on the mainshaft at this time.

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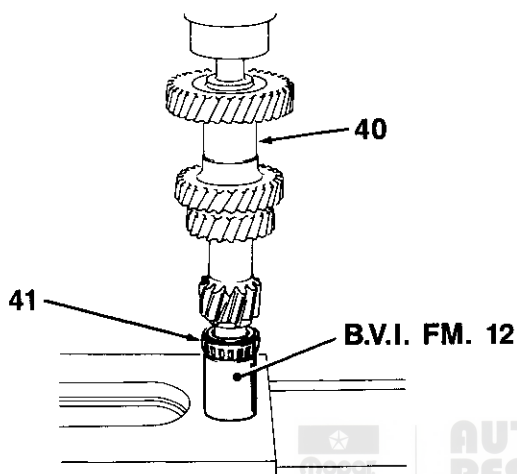


BA 10/5 MANUAL TRANSMISSION OVERHAUL



Cluster Gear Bearing Preload Adjustment

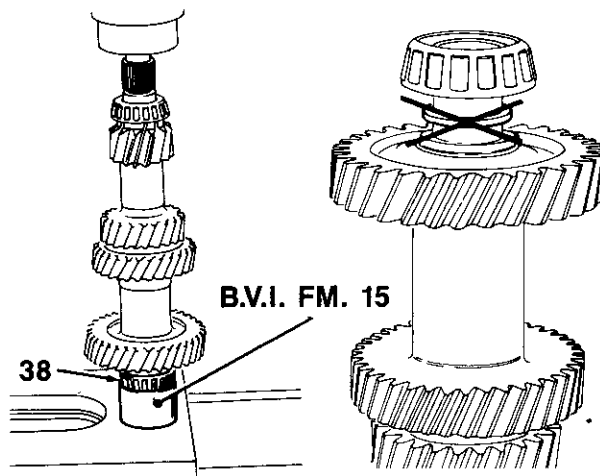
Install the rear bearing (41) on the cluster gear (40) with an arbor press and tool B.V.I. FM. 12.



101111

Install the front bearing (38), **but not the preload shim** on the cluster gear. Use an arbor press and tool B.V.I. FM. 15 to press the bearing all the way onto the shaft.

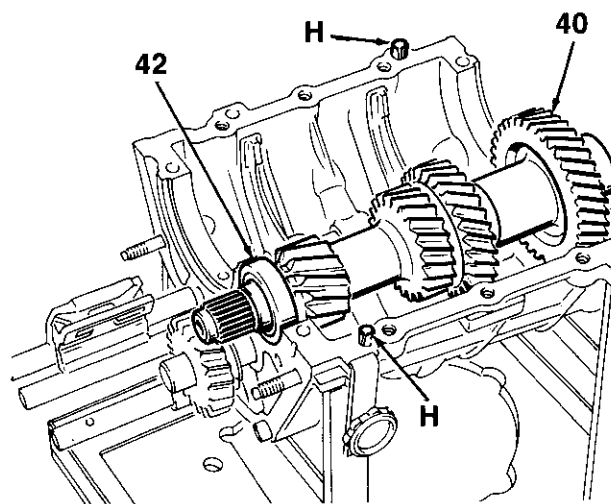
NOTE: Do not install the preload shim (39) between the gear and bearing at this time. The shim thickness required for correct bearing preload will be established later in the adjustment procedure.



101112

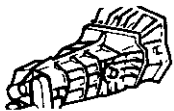
Position the race (42) on the cluster rear bearing (41) and install the cluster gear (40) in the case.

Install the alignment dowels (H) in the left half of the front case if not installed previously.



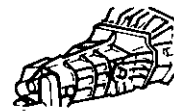
101113

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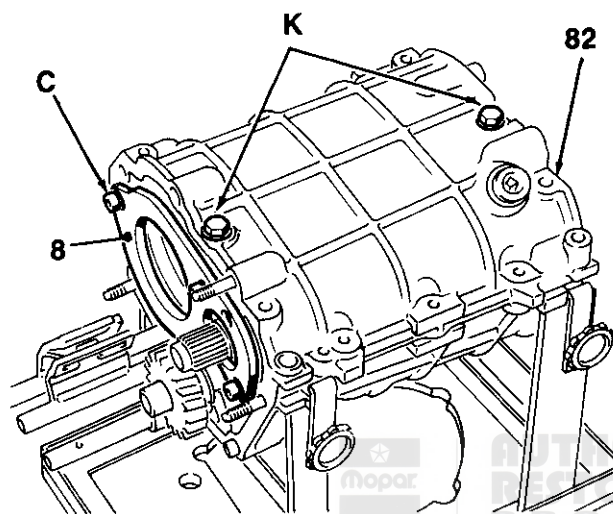
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Install the right half of the front case (82).

Install the two front case center attaching bolts (K) finger tight.

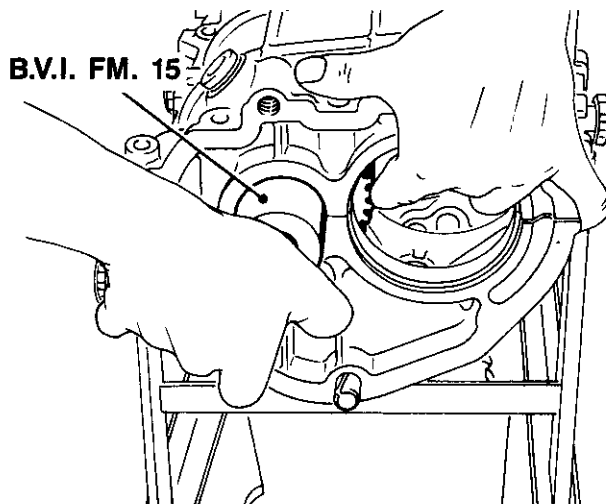


101114

Install the rear bearing retainer (8) and retainer screws (C). Hand tighten the retainer screws.

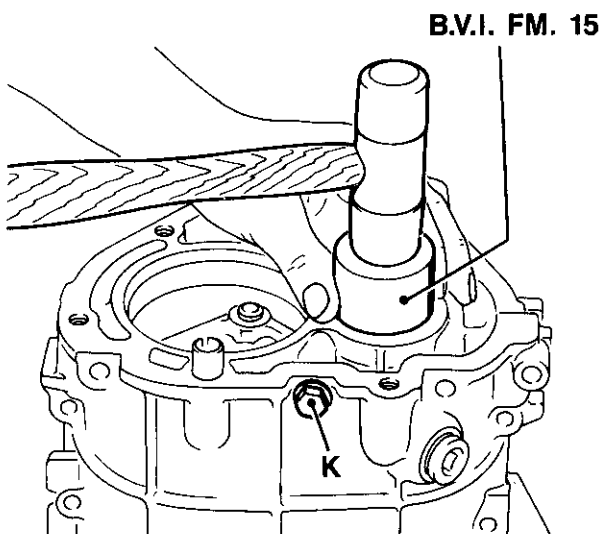
Place the front case in a vertical position in the repair stand. The cluster gear front bearing should be facing upward.

Place tool B.V.I. FM. 15 over the cluster gear front bearing and push the cluster gear rearward. Maintain pressure on the cluster gear and rotate the gear to seat the rear bearing.



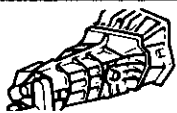
101115

Install the cluster gear front bearing race (37) on the bearing with tool B.V.I. FM. 15. Tap the race into position with a rawhide mallet.



101116

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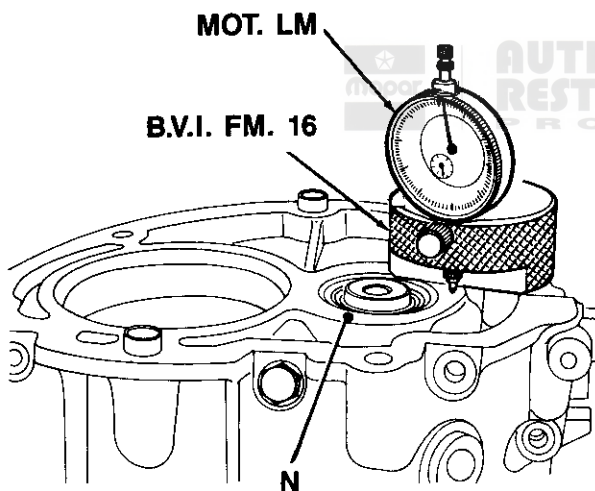


Tighten the case bolts (K) and rear retainer screws (C) to 5 N·m (4 ft-lbs) torque.

Verify that the cluster gear rotates freely. If the gear does not rotate freely, loosen-then-tighten case bolts (K) while rotating the gear.

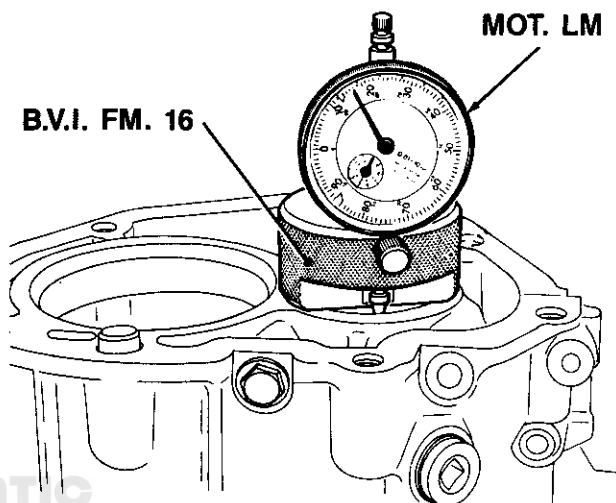
Determine the required cluster gear preload shim thickness with dial indicator MOT. LM and indicator support base B.V.I. FM. 16 as follows:

- Position the indicator stylus on the case surface (N) next to the bearing race. Zero the dial indicator.



101117A

- Move the indicator stylus to the surface of the front bearing race (32). Note the dial indicator reading.

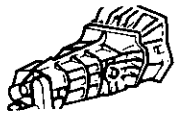


101117B

- Add 0.010 mm (0.004-in) to the indicator reading for required preload shim thickness. For example, if indicator reading was 2.64 mm (0.104-in), required shim thickness would be 2.74 mm (0.108-in).

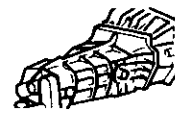
NOTE: The allowable tolerance for the preload shim is plus or minus 0.05 mm (0.002-in).

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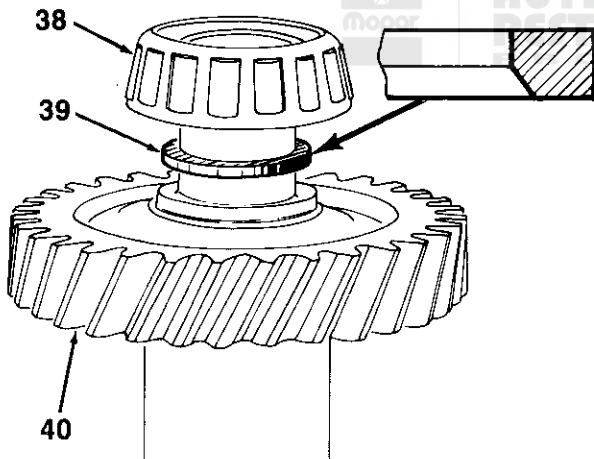
Remove the bolts (K) and screws (C) from the case and rear bearing retainer.

Remove the right side case half (82) and remove the cluster gear (40).

Remove the cluster gear front bearing (38).

Install the required preload shim (39) on the gear and reinstall the front bearing. However, do not reinstall the cluster gear assembly at this time.

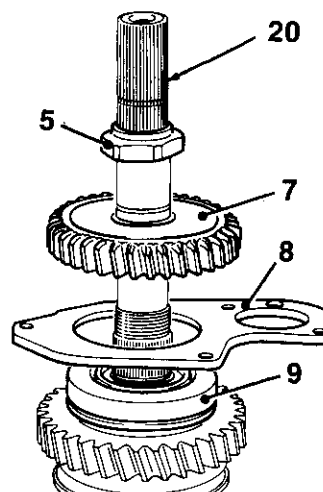
NOTE: The beveled side of the preload shim (39) faces the cluster gear as shown in the illustration.



101118

Install the bearing race (9) on the mainshaft rear bearing. Then install the rear bearing retainer (8), reverse gear (7) and reverse gear nut (5) and washer (6) (if equipped) on the mainshaft (20).

NOTE: The Torx screw hole in the rear bearing retainer (8) is countersunk. Be sure the countersunk side of the retainer is facing out and toward the rear of the case.



101085

Tighten the reverse gear nut (5) to 65 N·m (48 ft-lbs) torque and stake it in place at the two small notches in the mainshaft. Use a suitable size 12-point socket or spare yoke to hold the mainshaft while tightening the nut.

Front Case Assembly

Assemble and install the mainshaft and input shaft in the front case. Be sure the shift forks are fully engaged in the synchronizers.

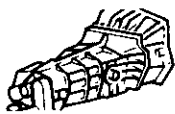
Install the cluster gear assembly in the front case.

Install the alignment dowels (H and 77) in the front case if not installed previously.

Apply Jeep silicone sealer to the mounting surfaces of the front case halves and to the threads of the case and rear bearing retainer attaching bolts.

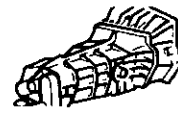
Align and mount the right case half (82) on the left case half (78).

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OVERHAUL



Install the 8 mm (5/16-in) diameter case attaching bolts only. Tighten the bolts to 15 N·m (12 ft-lbs) torque.

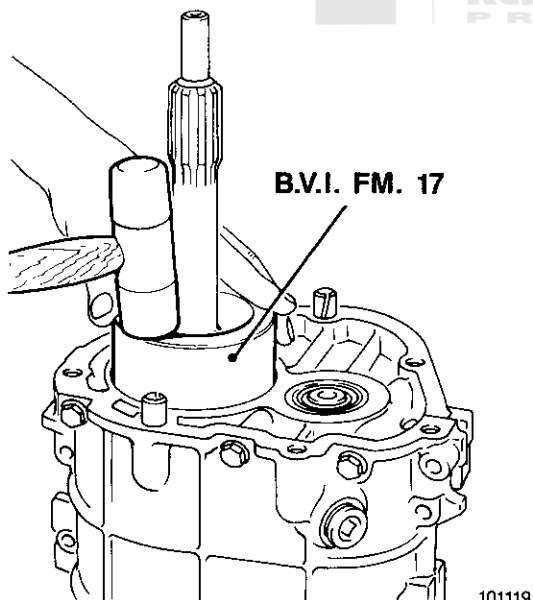
NOTE: Do not install the 7 mm (1/4-in) diameter case attaching bolts at this time.

Install the rear bearing retainer screws (C and D). Install the countersunk screw first; then the Allen screws. Tighten the countersunk screw to 8 N·m (6 ft-lbs) torque and the Allen screws to 10 N·m (8 ft-lbs) torque.

Place the front case in a vertical position in the repair stand with the input shaft facing upward.

Input Shaft Bearing Preload Adjustment

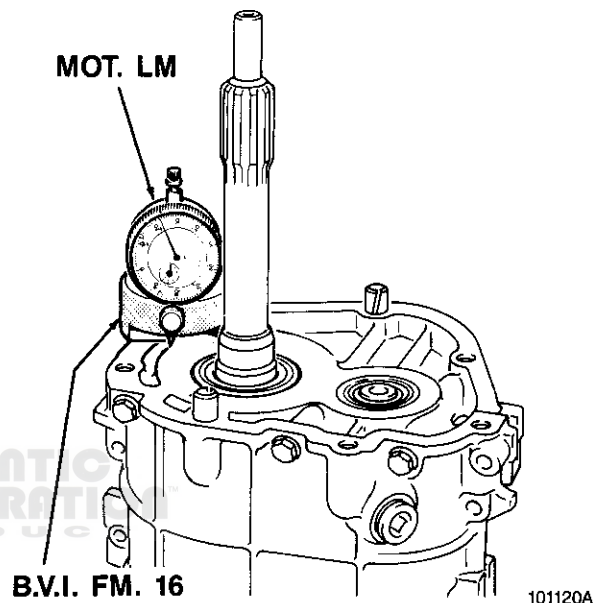
Seat the bearing race (32) on the front bearing (31) with tool B.V.I. FM. 17 and a rawhide mallet.



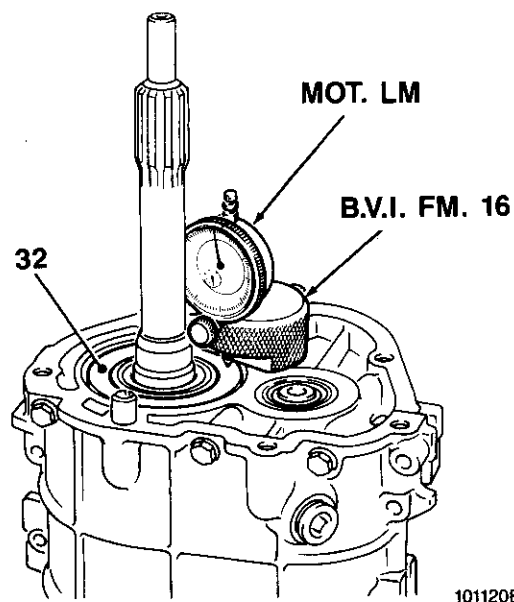
Check runout of the bearing race (32) with dial indicator MOT. LM and indicator support base B.V.I. FM. 16. Position the indicator stylus on the race and zero the indicator. Take four readings 90° apart. If runout exceeds 0.76 mm (0.003-in), reseal the bearing race with tool B.V.I. FM. 17 until runout is less than specified.

Determine the required preload shim thickness as follows:

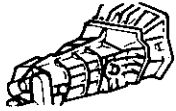
- Position the dial indicator stylus on the case surface (P) next to the bearing race. Zero the dial indicator.



- Move the indicator stylus to the surface of the bearing race (32). Note the indicator reading.

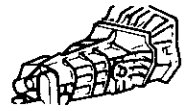


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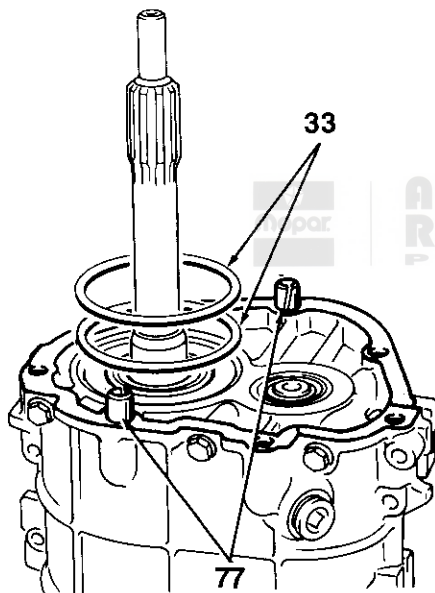
OVERHAUL



- Add 0.10 mm (0.004-in) to the dial indicator reading for required preload shim thickness. For example, if the indicator reading was 2.16 mm (0.085-in), required thickness would be 2.26 mm (0.089-in).

NOTE: The allowable tolerance for the preload shim is plus or minus 0.05 mm (0.002-in).

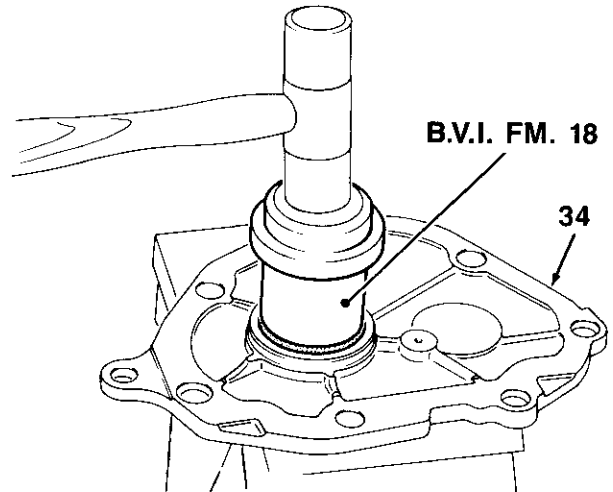
Install the required thickness preload shims (33) on the front bearing race (32). Use petroleum jelly to hold the shims in place.



101121

Install the alignment dowels (77) in the front case.

Install a replacement oil seal (35) in the front bearing retainer (34) with tool B.V.I. FM. 18. Seat the seal fully into the retainer.



101122

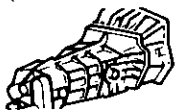
Coat the mounting surface of the front bearing retainer (34) with Jeep silicone sealer.

Align and install the front bearing retainer (34) on the front case.

CAUTION: Be sure the preload shims (33) are not displaced during retainer plate installation.

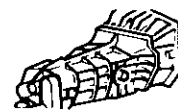
Install and tighten the front mounting studs (36) to 28 N·m (21 ft-lbs) torque. Use two nuts to tighten the studs. Rotate the mainshaft while tightening the studs to help seat the shaft bearings.

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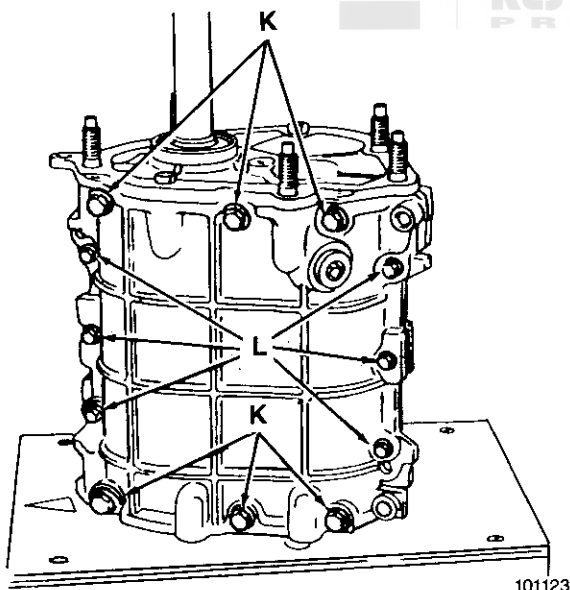
OVERHAUL



Final-seat the front case halves and gear assemblies as follows:

- Loosen but do not remove the 8 mm (5/16-in) diameter case bolts (K) installed previously.
- Lightly tap the front case halves several times with a rawhide mallet to seat them. Rotate the mainshaft while tapping to help seat the bearings and case halves.
- Retighten the 8 mm (5/16-in) diameter case bolts (K) to 15 N·m (11 ft-lbs) torque. Then install and tighten the 7 mm (1/4-in) case bolts (L) to 10 N·m (8 ft-lbs) torque.

NOTE: Be sure all of the front case bolts are coated with silicone sealer before installation.



101123

Intermediate Case and Fifth Gear Installation

Install the alignment dowels (56) in the intermediate case.

Remount the transmission in the repair stand so the shift rail ends are facing upward.

Carefully move the fifth-reverse shift rail into fifth gear position.

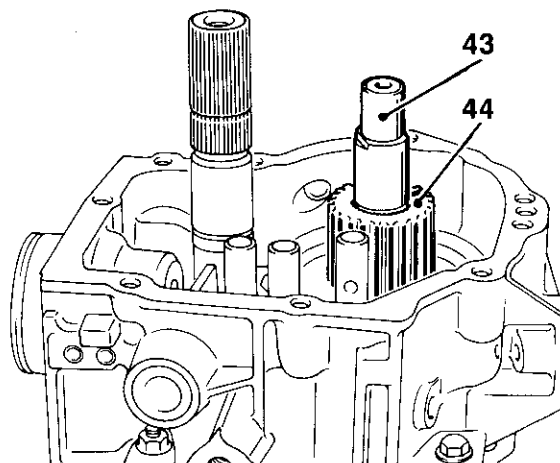
CAUTION: Do not move the fifth-reverse shift rail beyond fifth gear position. The fifth-reverse detent ball will disengage if the rail is moved too far. If the ball disengages, the transmission will have to be completely disassembled in order to reinstall it.

Apply Jeep silicone sealer to the mounting surfaces of the front case and intermediate case.

Align and install the intermediate case (83) on the front case.

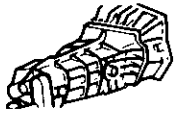
Install and tighten the intermediate case attaching bolts to 18 N·m (13 ft-lbs) torque.

Install the intermediate shaft (43) and fifth-reverse synchronizer hub (44). Be sure the shaft is fully seated on the cluster gear.



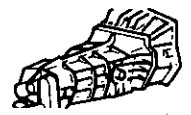
101124

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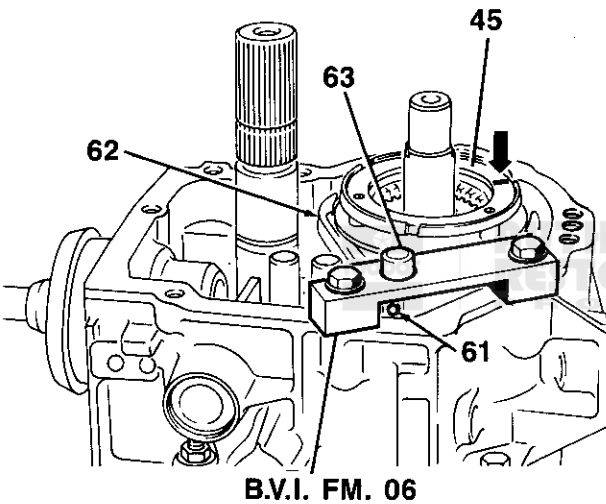
BA 10/5 MANUAL TRANSMISSION

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Assemble the fifth gear shift fork (62) and synchronizer (45).

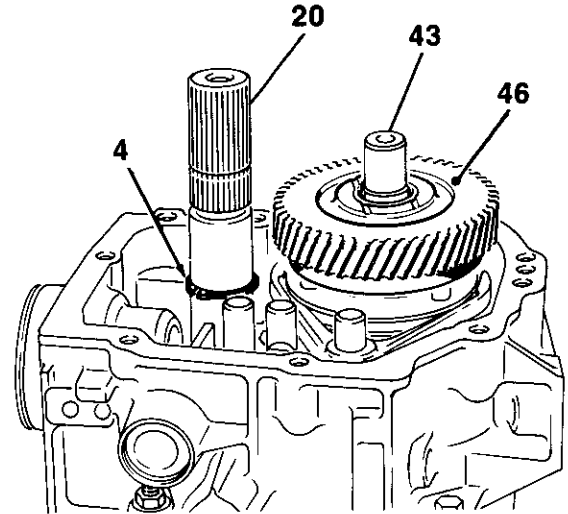
Start the the fifth-reverse fork (62) on the shift rail (63). Then slide the fork and synchronizer downward onto the intermediate shaft and synchronizer hub. Align the synchronizer and hub according to the reference marks made during disassembly.



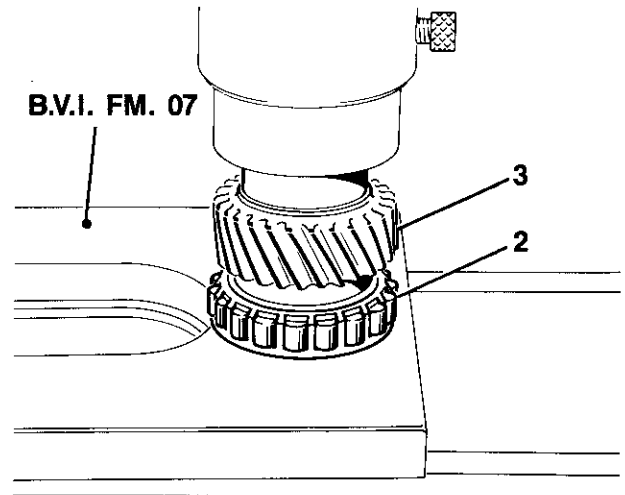
Secure the shift fork (62) to the shift rail (63) with a roll pin (61). Use tool B.V.I. FM. 06 to hold the fork in position while installing the roll pin.

Install the fifth intermediate gear (46) and needle bearing (47) on the intermediate shaft (43). Do not install the thrust washer, preload shim or bearing race at this time.

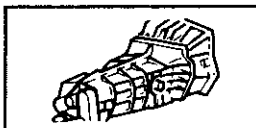
Install the fifth gear snap ring (4) on the mainshaft (20).



Press the roller bearing (2) onto the fifth gear (3).

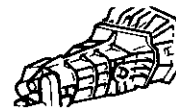


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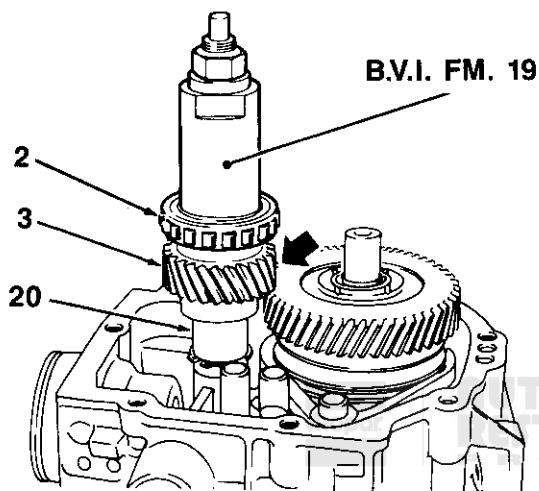
BA 10/5 MANUAL TRANSMISSION

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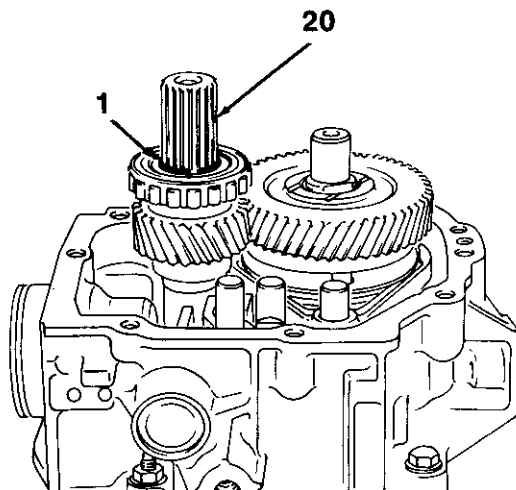
Coat the bore of the fifth gear and the bearing rollers with transmission lubricant.

Install the assembled fifth gear (3) and roller bearing (2) on the mainshaft (20) with tool B.V.I. FM. 19.



101128

Install the fifth gear lock ring (1) on the mainshaft (20). Be sure the lock ring is fully seated in the shaft groove.



101129

Intermediate Shaft End Play Adjustment

NOTE: Do not install the fifth gear bearing race or the intermediate shaft roller bearing in the rear case at this time.

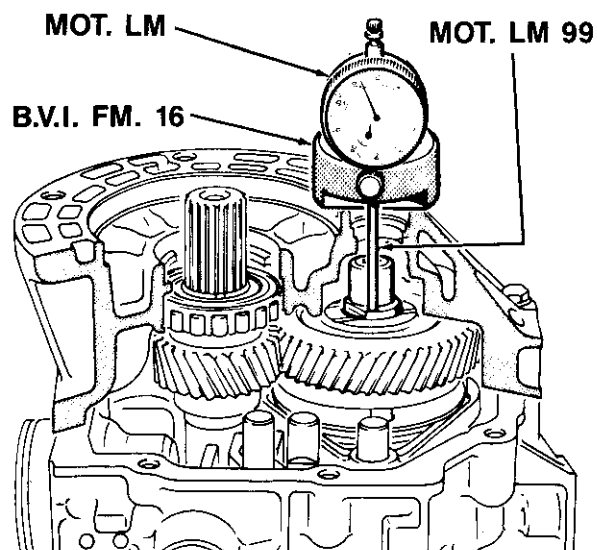
Wipe the rear case and intermediate case mounting surfaces clean.

Mount the rear case (52) on the intermediate case (83). Temporarily secure the rear case with one or two bolts to hold it in place.

Install extension MOT. LM 99 on the stylus of dial indicator MOT. LM. Then install the dial indicator in support base B.V.I. FM. 16.

Position the dial indicator over the access hole in the rear case.

Extend the indicator stylus through the hole until it contacts the ridge on the end of the intermediate shaft as shown.



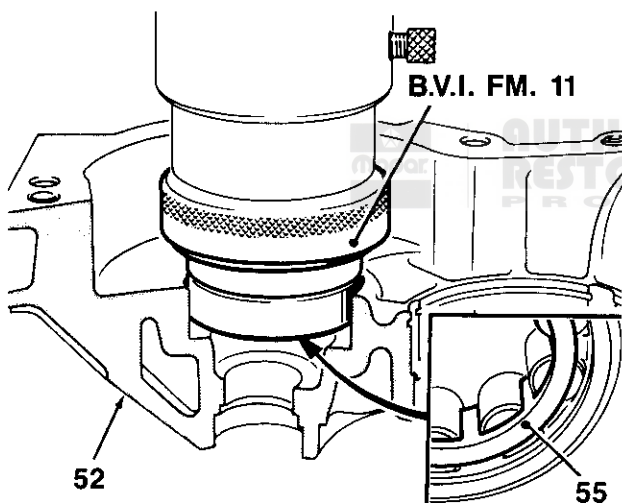
101130

Zero the dial indicator.

Lock the indicator pointer at the zero setting and carefully remove the dial indicator. Set the indicator aside in preparation for the next measurement.

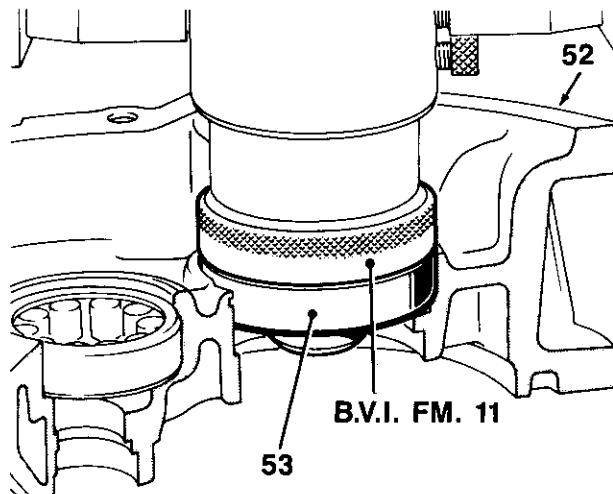
Remove the rear case.

Install the intermediate shaft roller bearing (55) in the rear case (52) with tool B.V.I. FM. 11 and an arbor press.



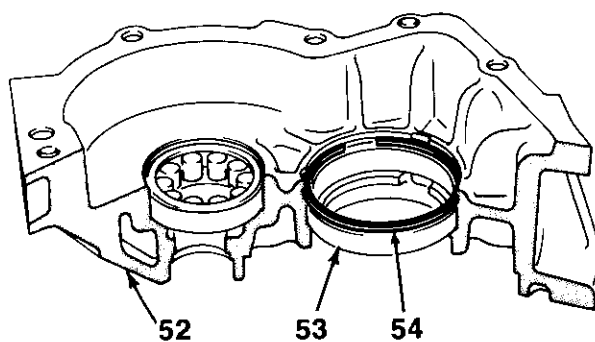
101131

Install the fifth gear bearing race (53) in the rear case (52) with tool B.V.I. FM. 11 and an arbor press.



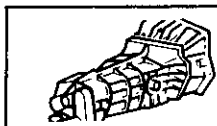
101132

Install the fifth gear bearing race snap ring (54) in the rear case (52).



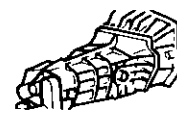
101133

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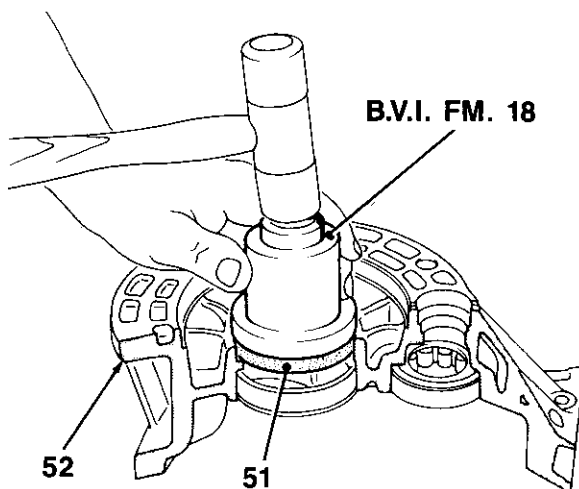


BA 10/5 MANUAL TRANSMISSION

OVERHAUL



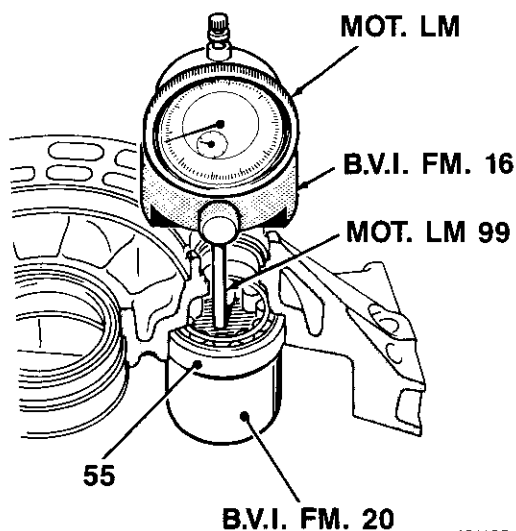
Install the oil seal (51) in the rear case (52) with tool B.V.I. FM. 18.



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Position the intermediate shaft roller bearing (55) on gauge block B.V.I. FM. 20. Be sure the bearing sits squarely upon the gauge block.

Position the dial indicator over the access plug hole in the rear case. Extend the indicator stylus through the hole until it contacts gauge block B.V.I. FM. 20.



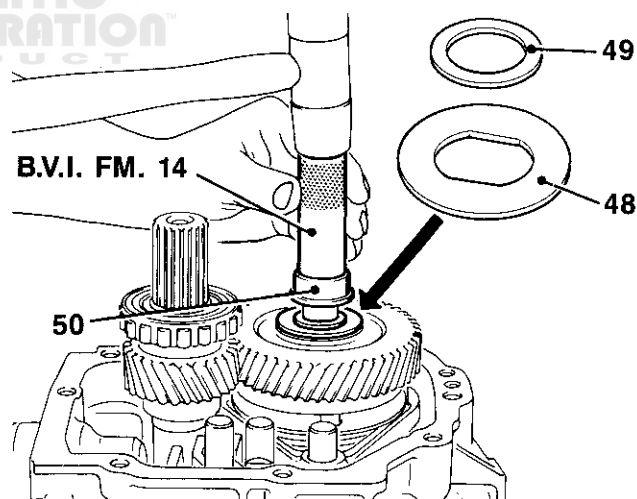
101135

Note the dial indicator reading and remove the indicator and gauge block.

Select the required end play shim as follows:

- Record the dial indicator reading off the gauge block.
- Subtract 0.05 mm (0.002-in) from the gauge block reading for required end play. For example, if the reading was 1.57 mm (0.062-in), correct shim thickness would be 1.52 mm (0.060-in).

Install the thrust washer (48), end play shim (49) and bearing race (50) on the intermediate shaft. Use tool B.V.I. FM. 14 to install the bearing race.



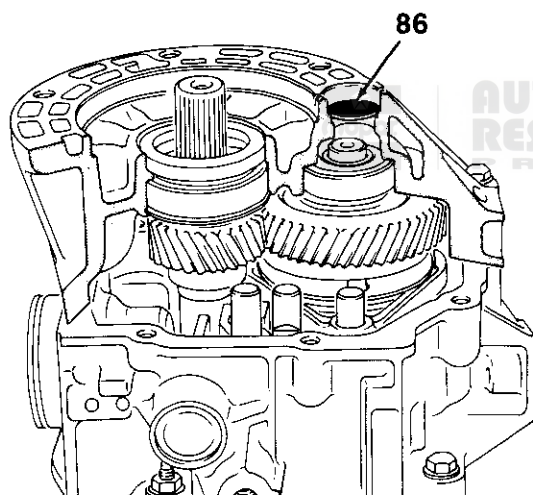
101136

Rear Case Installation

Apply Jeep silicone sealer to the mounting surface of the rear case and install the case (52). Tighten the case bolts to 15 N.m (11 ft-lbs) torque.

Tap the rear case-to-intermediate case dowels into place.

Coat the edges of the intermediate shaft access plug (86) with Jeep silicone sealer and install the plug in the rear case.



101137

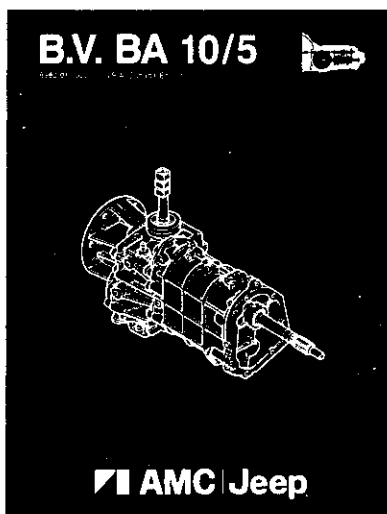
Coat the fill plug, drain plug and backup light switch threads with Jeep silicone sealer.

Install and tighten the switch and plugs to 28 N.m (20 ft-lbs) torque.

Install the gearshift lever and boot.

NOTE: Fill the transmission with Jeep 75W-90, API grade GL 5 gear lube after installing the transmission.

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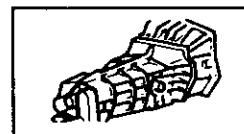
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1E

**FEBRUARY 1987
ENGLISH EDITION**

1986-87 JEEP WRANGLER/YJ



MANUAL TRANSMISSION

Attention: Workshop

COMPONENT SERVICE MANUAL REVISIONS

This I.S. Note contains revisions to the B.V. BA 10/5 Component Service Manual. Refer to the revised information when servicing a BA 10/5 manual transmission.

Backup Light Switch

The tightening torque for the backup light switch has been revised. The new torque is 15-19 N.m (11-14 ft-lbs). Make a note of the new torque on pages 5 and 39 of the manual.

The backup light switch does not require a washer. Make a note of this information on pages 8 and 9 of the manual (the switch is item 76).

Input Shaft Bearing Preload

Input shaft bearing preload and the method of selecting the desired preload shim have been revised. Make a note of the revisions on page 33 of the manual.

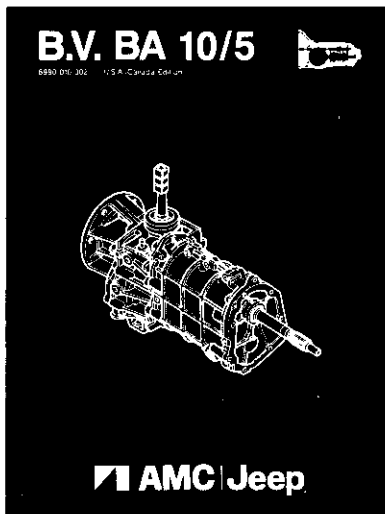
The new input shaft preload is 0.05 mm/0.002 in. (original preload was 0.10 mm/0.004 in.).

The new shim selection method involves: Rounding required shim thickness up or down to the nearest 0.05 mm/0.002 in. increment to arrive at desired thickness. An example of the procedure is as follows:

Required shim thickness	Use this shim
2.21 mm 2.28 mm 2.37 mm	2.20 mm 2.30 mm 2.35 mm

FILING INSTRUCTIONS

Record the above information on the indicated pages and file this I.S. Note in the B.V. BA 10/5 Component Service Manual.



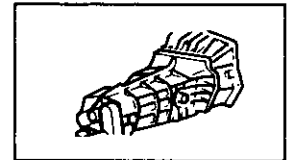
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2E

**OCTOBER 1987
ENGLISH EDITION**

**2WD CHEROKEE AND
COMANCHE VEHICLES
WITH BA-10/5
TRANSMISSION**



MANUAL TRANSMISSION

Attention: Workshop, Parts Department

FIFTH-SPEED GEAR REMOVAL AND INSTALLATION (2WD)

The repair tool set for BA-10/5 manual transmissions does not include a removal tool for the 5th-speed gear and bearing assembly in transmissions manufactured for 2WD applications. Removal tool B.Vi.ML.02 (PN 8980 002 693) is now available for this purpose.

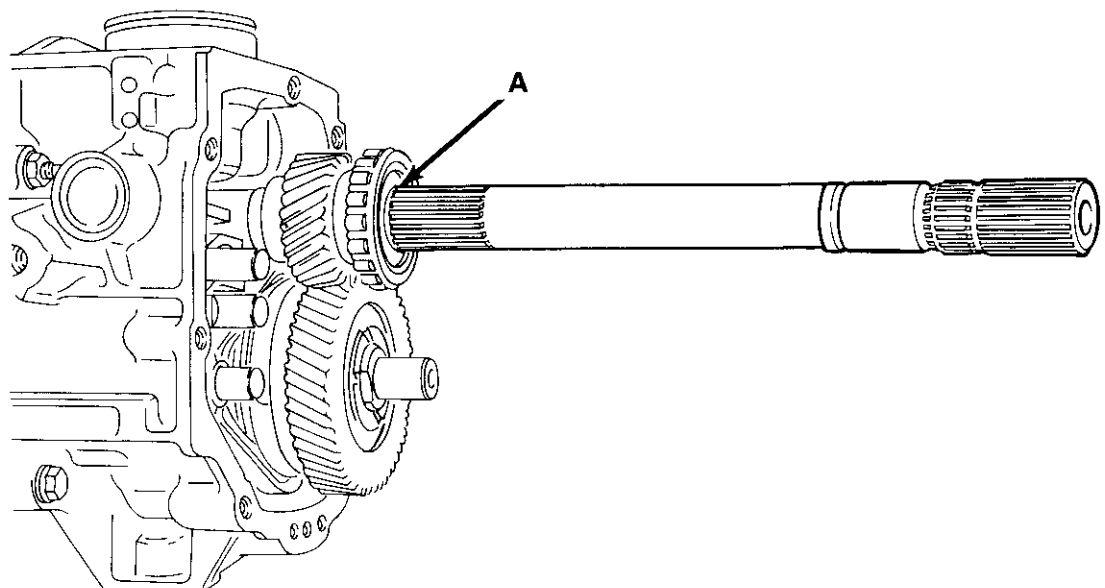
CAUTION: Because of the design of BA-10/5 transmissions for 2WD applications, do not use any other type of puller tool to remove the 5th-speed gear and bearing assembly.

Refer to the following procedure when required to remove and install the 5th-speed gear and bearing assembly (2WD transmissions).

PROCEDURE

Removal

1. Remove the clip ring (A) from the output shaft.

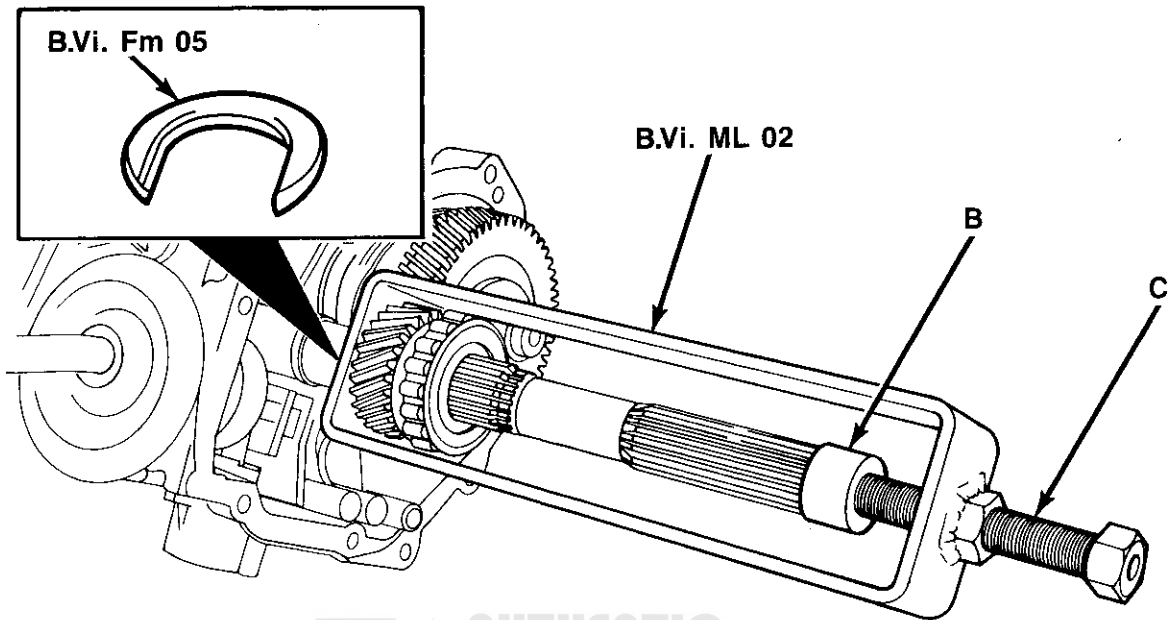


2677

2. Install Removal Tool B.Vi.ML.02 on the output shaft and insert tool B.Vi.FM.05 between the 5th-speed gear face and the inside face of tool B.Vi.ML.02.

NOTE: Tool B.Vi.FM.05 will protect the gear teeth from damage.

3. Ensure the shaft protector cup (B) is properly positioned over the end of the shaft.
4. Turn bolt (C) clockwise while holding the tool body stationary to extract the 5th-speed gear and bearing assembly from the output shaft.

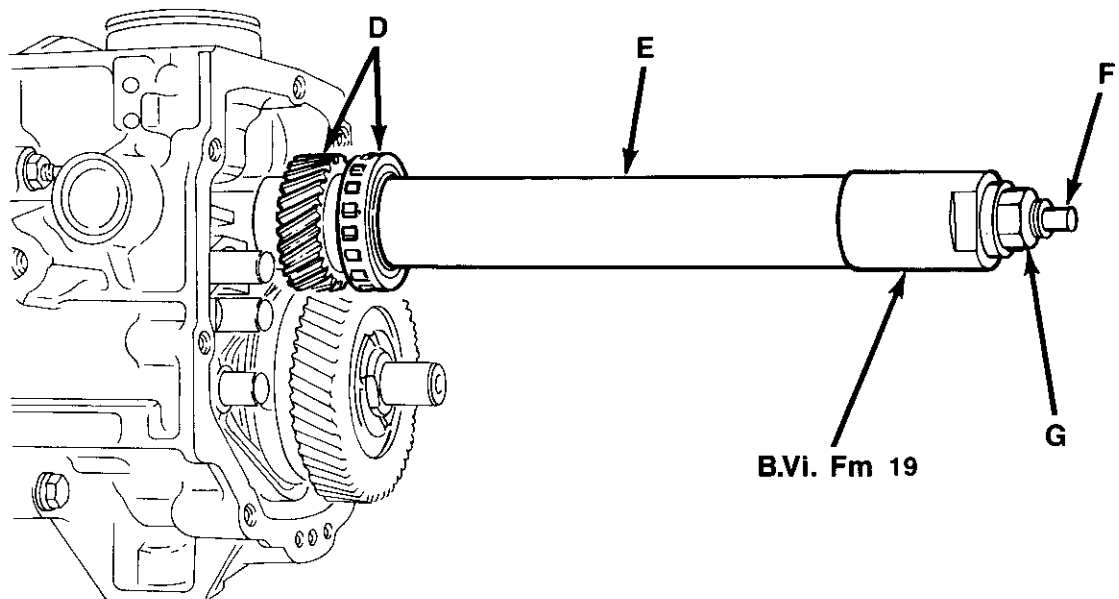


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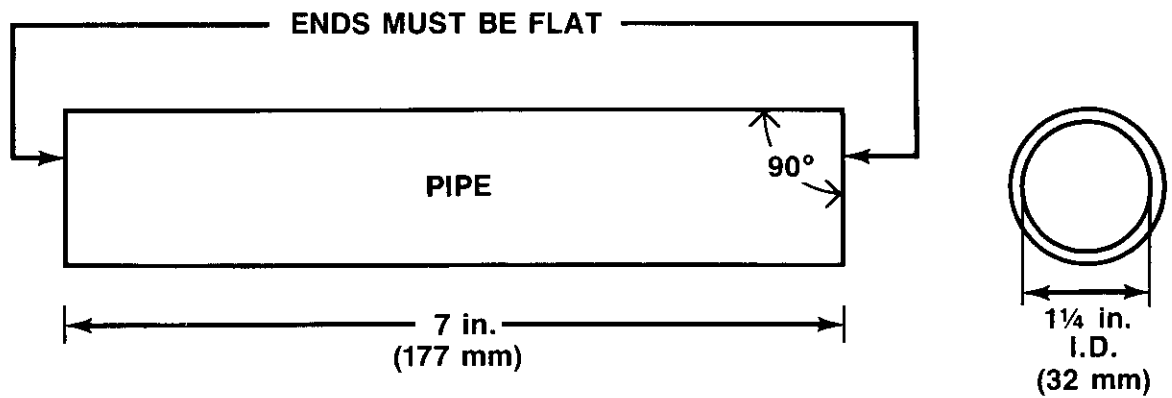
Installation

1. Lubricate the inside bores of the 5th-speed gear and bearing assembly (D) with gear oil (75w-90).

2. Slide the gear and bearing assembly (D) onto the output shaft.
3. Position a spacer tube (E) on the output shaft (refer to the drawing below).



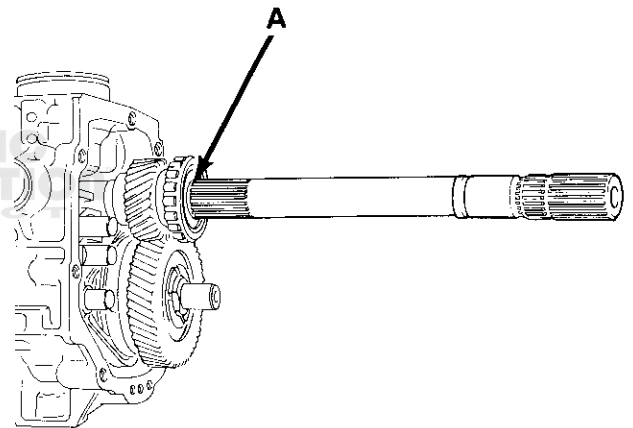
2679



2680

4. Install tool BVi.FM.19 adjacent to the spacer tube (E) on the end of the output shaft.
5. Turn screw (F) clockwise until it seats against the end of the output shaft.
6. Turn nut (G) clockwise to force the 5th-speed gear and bearing assembly into the correct position.
7. Remove tool BVi.FM.19 and the spacer tube (E).

8. Install the clip ring (A).



2677

FILING INSTRUCTIONS

Record this I.S. Note on page 11 of the B.V. BA 10/5 manual and file it in the manual.

NOTES



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Component Service Manual



**AUTHENTIC
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4.0/4.2L SIX-CYLINDER ENGINE

Application

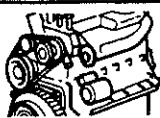
Cherokee/Wagoneer/Comanche
YJ/Wrangler/CJ-7/Scrambler
Grand Wagoneer/Truck/Eagle

REVISED AUGUST, 1986 U.S.A./Canada Edition

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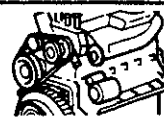
All information and specifications in this manual are based on the latest data available at the time of publication. American Motors Corporation and Jeep Corporation reserve the right to discontinue designs or change specifications without notice or incurring obligation.

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4.0L/4.2L ENGINE OVERHAUL

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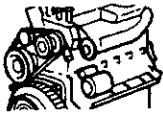
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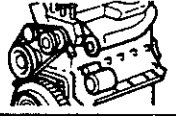
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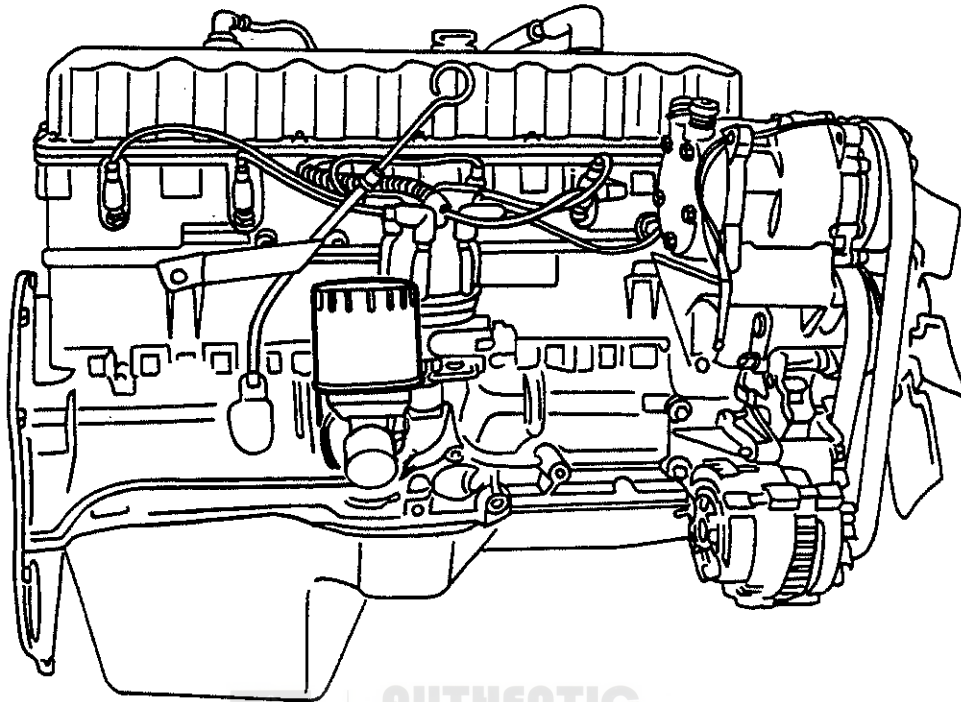
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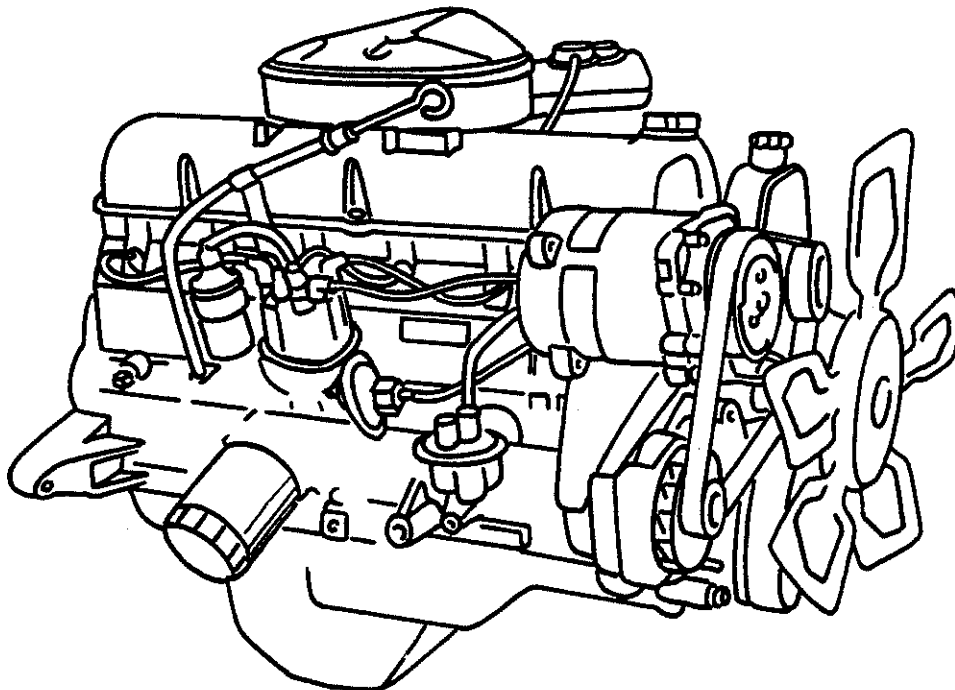
4.0L (243 CID)



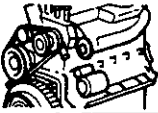
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4.2L (258 CID)

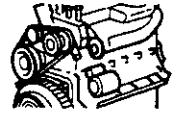


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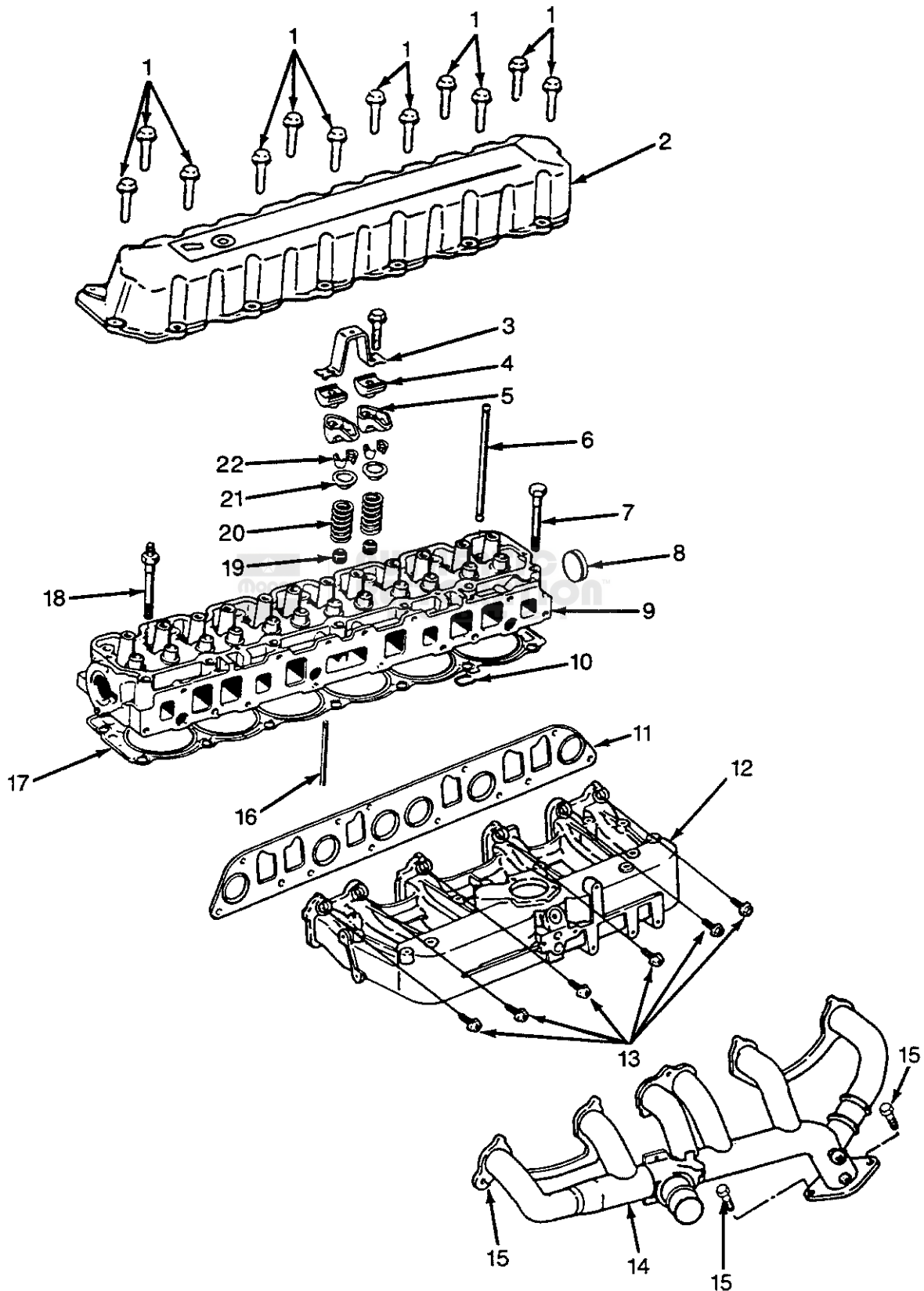
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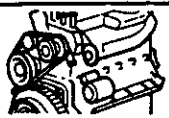
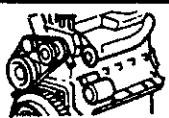
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CYLINDER HEAD ASSEMBLY COMPONENTS – 4.0L

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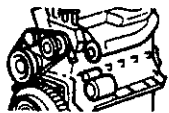
CYLINDER HEAD COMPONENTS - 4.0L

1. Cylinder Head Cover Bolts
2. Cylinder Head Cover
3. Bridge
4. Pivot
5. Rocker Arm
6. Push Rod
7. Cylinder Head Bolt
8. Cylinder Head Core Plug
9. Cylinder Head
10. Snap Ring
11. Intake Manifold Gasket
12. Intake Manifold
13. Intake Manifold Bolts
14. Exhaust Manifold
15. Exhaust Manifold Bolts
16. Hydraulic Valve Tappet
17. Gasket
18. Cylinder Head Stud
19. Oil Deflector
20. Valve Spring
21. Valve Retainer
22. Valve Lock (Keeper)



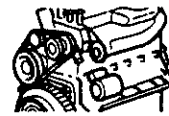
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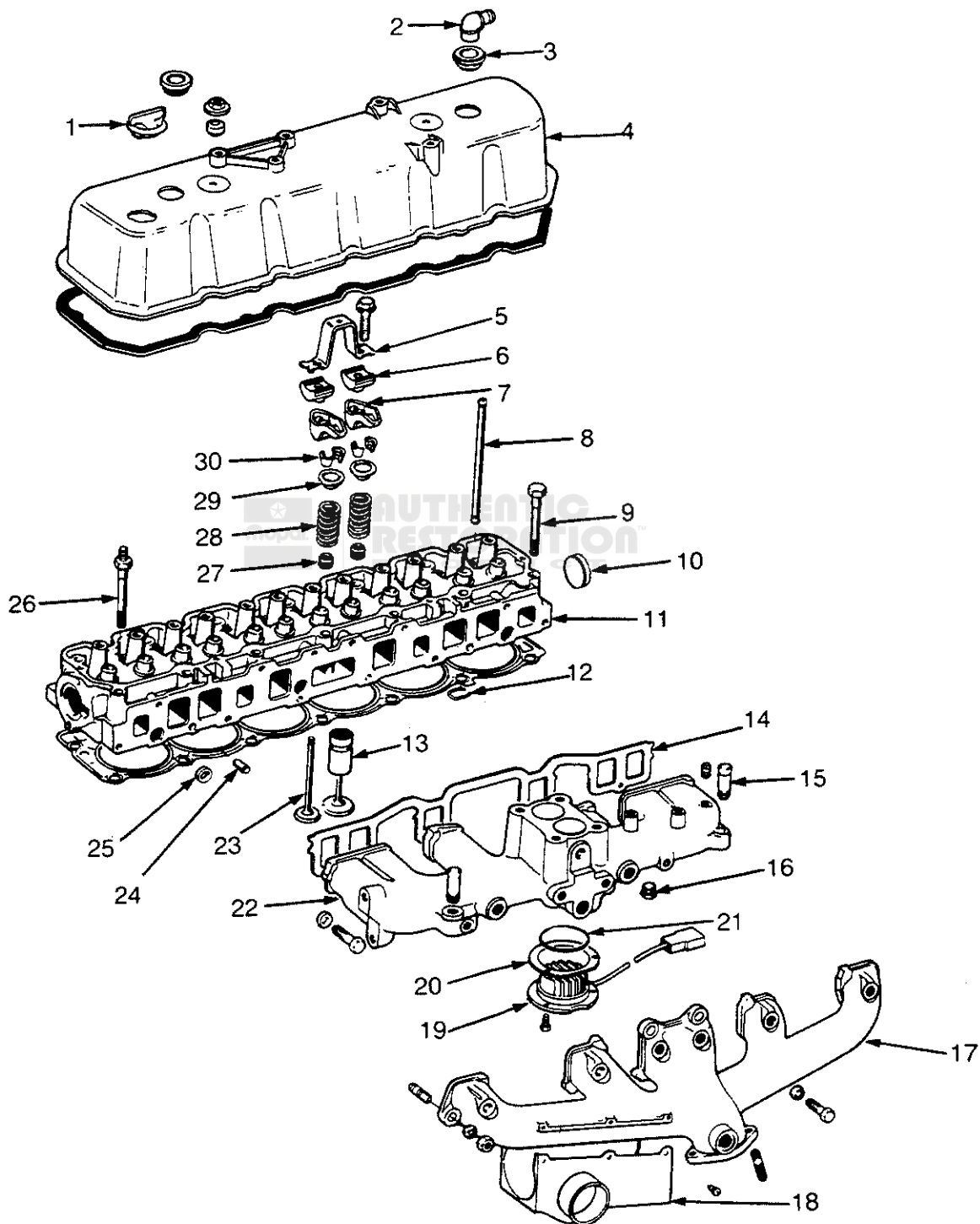
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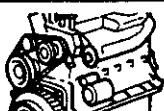
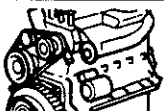
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CYLINDER HEAD ASSEMBLY COMPONENTS – 4.2L

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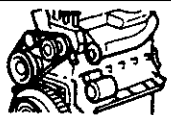
CYLINDER HEAD COMPONENTS – 4.2L

1. Oil Filler Cap
2. Ventilation Valve
3. Grommet
4. Cylinder Head (Rocker) Cover
5. Bridge
6. Pivot
7. Rocker Arm
8. Push Rod
9. Cylinder Head Bolt
10. Cylinder Head Core Plug
11. Cylinder Head
12. Snap Ring
13. Tappet
14. Intake Manifold Gasket
15. Hose Fitting
16. Plug
17. Exhaust Manifold
18. Heat Stove
19. Intake Manifold Heater
20. Gasket
21. O-Ring
22. Intake Manifold
23. Valve
24. Dowel Pin
25. Plug
26. Cylinder Head Stud
27. Oil Deflector
28. Valve Spring
29. Valve Retainer
30. Valve Lock (Keeper)



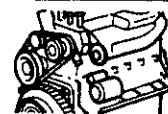
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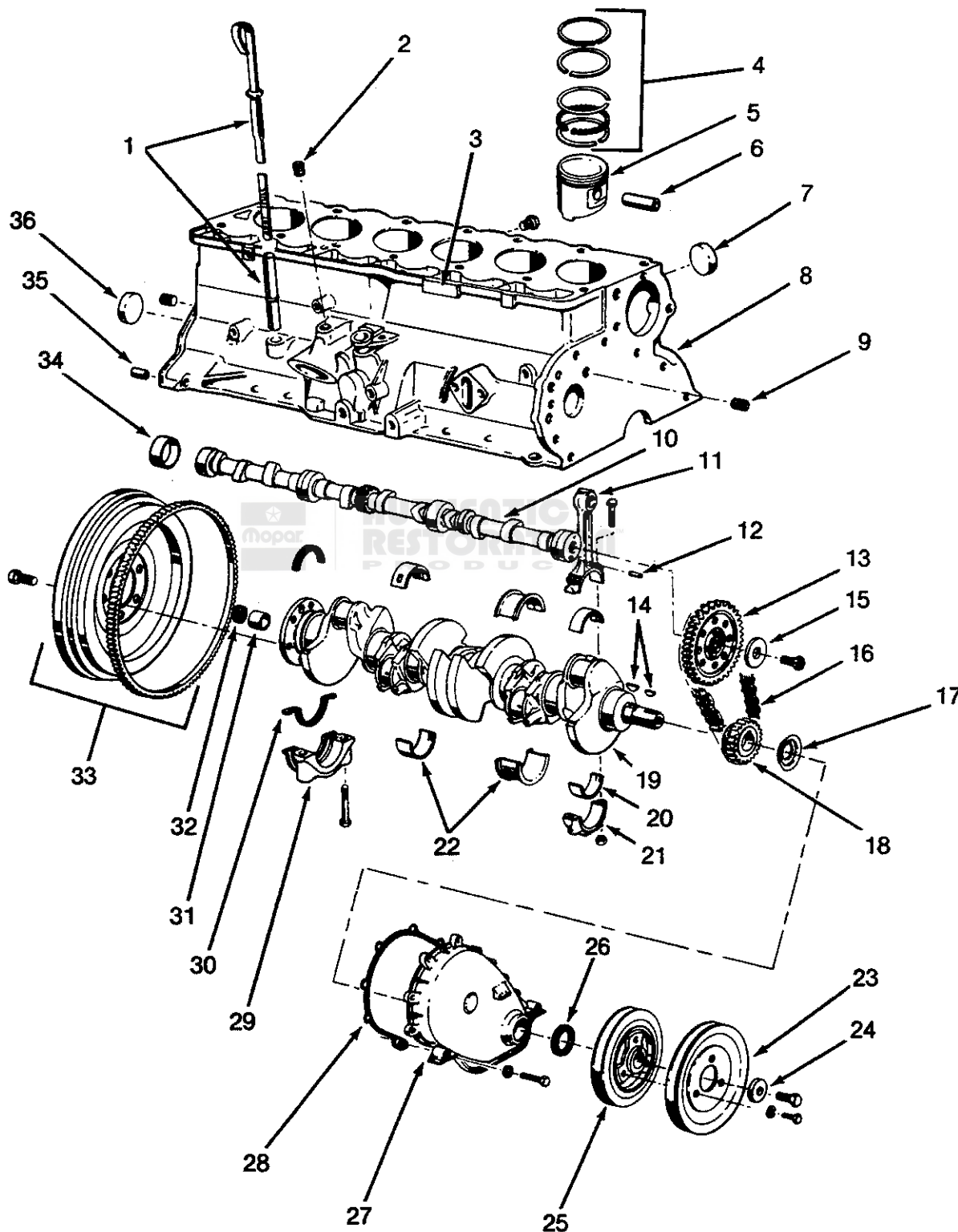
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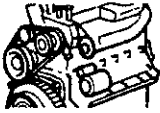
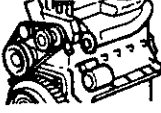
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CYLINDER BLOCK COMPONENTS – 4.0L/4.2L

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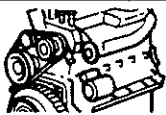
CYLINDER BLOCK COMPONENTS – 4.0L / 4.2L

1. Oil Level Gauge (Dipstick) and Tube
2. Oil Filter By-Pass Plug
3. Build Date Code Location
4. Ring Set
5. Piston
6. Pin Set
7. Plug
8. Cylinder Block
9. Oil Channel Plug
10. Camshaft
11. Connecting Rod
12. Pin
13. Camshaft Sprocket
14. Keys
15. Washer
16. Timing Chain
17. Oil Shedder (Slinger)
18. Crankshaft Sprocket
19. Crankshaft
20. Connecting Rod Bearing
21. Connecting Rod Bearing Cap
22. Main Bearings
23. Vibration Damper Pulley
24. Washer
25. Vibration Damper
26. Seal
27. Timing Case Cover
28. Gasket
29. Main Bearing Cap (Rear)
30. Main Bearing Cap Seal Kit (Rear)
31. Pilot Bushing (with Manual Transmission)
32. Bushing Oil Wick (with Manual Transmission)
33. Flywheel and Ring Gear (with Manual Transmission)
34. Bearing Set
35. Dowel
36. Plug



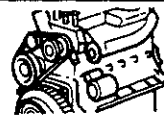
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GENERAL DESCRIPTION

ENGINE IDENTIFICATION INFORMATION



GENERAL INFORMATION

Both the 4.0L (243 CID) and the 4.2L (258 CID) six-cylinder engines are in-line, lightweight, overhead valve engines.

These engines are designed to burn unleaded gasoline.

The cylinders are numbered 1 through 6 from front to rear.

The firing order is

1-5-3-6-2-4



86221

The crankshaft rotation is clockwise, viewed from the front. The crankshaft rotates within seven main bearings. The camshaft rotates within four line bored bearings.

The engine features a quench-type combustion chamber, which creates turbulence and fast burning of the air/fuel mixture for good fuel economy.

ENGINE IDENTIFICATION

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No. 2 and No. 3 cylinders.

The numbers of the code identify the year, month and day that the engine was built.

Letter Code	C.I.D.	Carburetor	Compression Ratio
C	258/4.2L	2V	9.2:1
M	243/4.0L	MPI	9.2:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
6 = 1986 7 = 1987	01 - 12	C M	01 - 31

86159A

Code Letter Explanation

The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

EXAMPLE: **6 10 C 11**

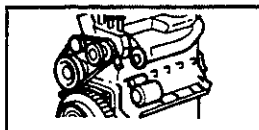
The example code identifies the 258 CID (4.2 liter) engine with a 2 V carburetor and an 9.2:1 compression ratio built on October 11, 1986.

NOTE: Engines built for sale in Georgia and Tennessee have an additional, nonrepeating number, located on the right side of the engine below the build date code.

Example:

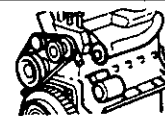
Kenosha-Built

E-1197277 or *W-1207177*



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ENGINE IDENTIFICATION INFORMATION

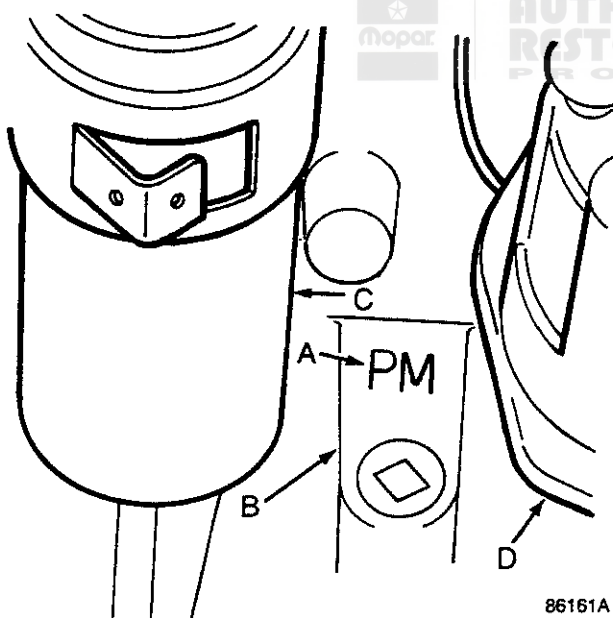


Oversize or Undersize Components

Some engines may be built with oversize or undersize components such as:

- Oversize cylinder bores
- Undersize crankshaft main bearing journals
- Undersize connecting rod journals
- Oversize camshaft bearing bores

These engines are identified by a letter code (A) stamped on a boss (B) between the ignition coil (C) and distributor (D).



86161A

Oversize or Undersize Code Component Letter Explanation

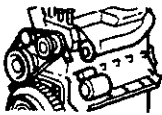
The letters are decoded as follows:

Code Letter	Definition	
B	All cylinder bores	0.010-inch (0.254 mm) oversize
M	All crankshaft main bearing journals	0.010-inch (0.254 mm) undersize
P	All connecting rod bearing journals	0.010-inch (0.254 mm) undersize
C	All camshaft bearing bores	0.010-inch (0.254 mm) oversize

EXAMPLE: The code letters PM mean that the crankshaft main bearing journals and connecting rod journals are 0.010-inch undersize.

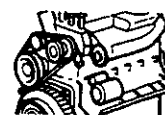
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GENERAL DESCRIPTION

SPECIAL TOOLS

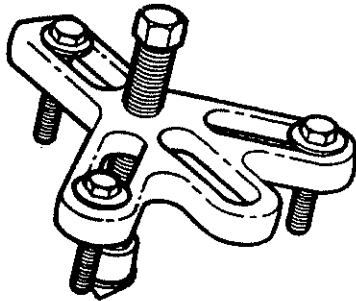


SPECIAL TOOLS

Tool Ref.	Description
J-5268	Hydraulic Valve Tappet Test Oil
J-5601	Piston Ring Compressor
J-5790	Hydraulic Valve Tappet Tester
J-5959-4	C-Clamp and Rod Extension
J-6042-1,4,5	Valve Guide Reamer Set
J-8056	Valve Spring Tester
J-8062	Valve Spring Compressor Tool
J-8520	Dial Indicator Set
J-21872-1,2,3	Piston Pin Remover and Installer
J-21882	Oil Pump Inlet Tube Installer
J-21884	Hydraulic Valve Tappet Removal and Installation Tool
J-22248	Timing Case Cover Alignment Tool and Seal Installer Tool
J-24420-B	Vibration Damper Remover

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	GENERAL DESCRIPTION SPECIAL TOOLS	
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J-24420-B



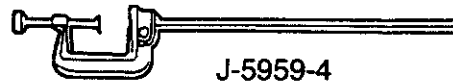
J-22248



J-21882



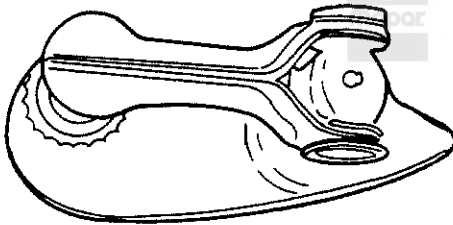
J-21884



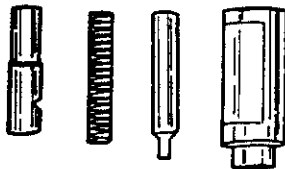
J-5959-4



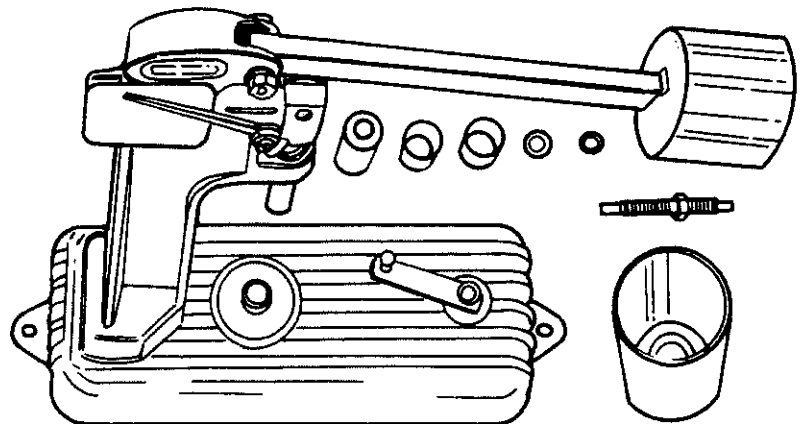
J-8520



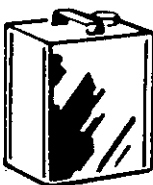
J-8056



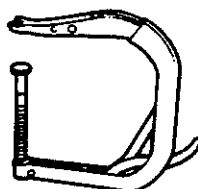
J-21872-1,2,3



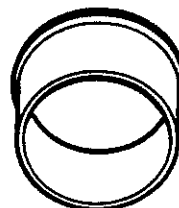
J-5790



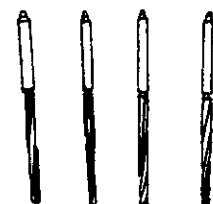
J-5268



J-8062



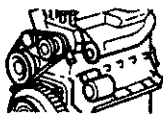
J-5601



J-6042-1,4,5

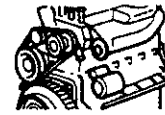
SEE
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GENERAL DESCRIPTION

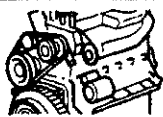
TORQUE SPECIFICATIONS



TORQUE SPECIFICATIONS

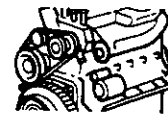
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NOTES

Component	Service Set-To Torque	Service Recheck Torque
Air Injection Tube-to-Manifold	27 N·m (20 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Air Pump-to-Bracket	27 N·m (20 ft-lbs)	20-30 N·m (15-22 ft-lbs)
Air Pump Brackets-to-Engine (A.C. Compressor or Pedestals)	34 N·m (25 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Air Pump Adjusting Strap-to-Pump	27 N·m (20 ft-lbs)	20-30 N·m (15-22 ft-lbs)
Alternator Pivot Bolt or Nut	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Alternator Adjusting Bolt	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Mounting Bracket-to-Engine	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Alternator Pivot Mounting Bolt-to-Head	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Block Heater Nut	2 N·m (20 in-lbs)	2-3 N·m (17-25 in-lbs)
Camshaft Sprocket Screw	68 N·m (50 ft-lbs)	61-75 N·m (45-55 ft-lbs)
Carburetor Hold-Down Nuts	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Coil Bracket-to-Cylinder Head Bolt	19 N·m (14 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Connecting Rod Bolt Nuts	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Cylinder Head Capscrews	115 N·m (85 ft-lbs)	108-122 N·m (80-90 ft-lbs)
Cylinder Head Cover Nuts	3.2 N·m (28 in-lbs)	2.8-3.5 N·m (25-31 in-lbs)
Crankshaft Pulley-to-Damper	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Clutch Housing Spacer-to-Block Screws	16 N·m (12 ft-lbs)	12-20 N·m (9-15 ft-lbs)
Clutch Housing-to-Block Screws (top)	37 N·m (27 ft-lbs)	30-41 N·m (22-30 ft-lbs)
Clutch Housing-to-Block Screws (bottom)	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Differential Housing-to-Left Engine Mounting Bolt	54 N·m (40 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Distributor Clamp Bracket Screw	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Drive Plate-to-Converter Bolt	30 N·m (22 ft-lbs)	27-34 N·m (20-25 ft-lbs)



GENERAL DESCRIPTION

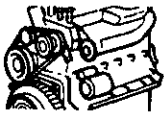
TORQUE SPECIFICATIONS



TORQUE SPECIFICATIONS (Cont'd)

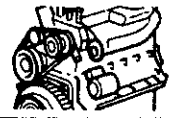
Component	Service Set-To Torque	Service Recheck Torque
EGR Valve Tube Nuts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
EGR Valve	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)
Exhaust Manifold Bolts	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust Pipe-to-Manifold	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Fan and Hub Assembly Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Flywheel or Drive Plate-to-Crankshaft	142 N·m (105 ft-lbs)	129-156 N·m (95-115 ft-lbs)
Front Crossmember-to-Sill	88 N·m (65 ft-lbs)	75 min (55 min)
Front Support Bracket-to-Block	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front Support Bracket-to-Block (Eagle)	47 N·m (35 ft-lbs)	34-54 N·m (40-50 ft-lbs)
Front Support Cushion-to-Bracket	45 N·m (33 ft-lbs)	36-52 N·m (27-38 ft-lbs)
Front Support Cushion-to-Crossmember	50 N·m (37 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Fuel Pump Screws	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Idle Arm Bracket-to-Sill	68 N·m (50 ft-lbs)	47-81 N·m (35-60 ft-lbs)
Idle Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idle Pulley Bearing Shaft-to-Bracket Nut	45 N·m (33 ft-lbs)	38-52 N·m (28-38 ft-lbs)
Intake Manifold Coolant Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Intake Manifold Heater Screws	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Intake Manifold Screws	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Main Bearing Capscrews	108 N·m (80 ft-lbs)	101-115 N·m (75-85 ft-lbs)
Oil Filter Adapter	65 N·m (48 ft-lbs)	57-75 N·m (42-55 ft-lbs)
Oil Pan Drain Plug	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Oil Pan Screws – 1/4 inch – 20	9 N·m (7 ft-lbs)	7-12 N·m (5-9 ft-lbs)
Oil Pan Screws – 5/16 inch – 18	15 N·m (11 ft-lbs)	12-18 N·m (9-13 ft-lbs)
Oil Pump Cover Screws	8 N·m (70 in-lbs)	7-9 N·m (60-80 in-lbs)

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GENERAL DESCRIPTION

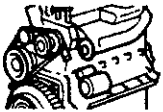
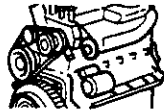
TORQUE SPECIFICATIONS



TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
Oil Pump Attaching Screws (Short)	14 N·m (10 ft-lbs)	11-18 N·m (8-13 ft-lbs)
Oil Pump Attaching Screws (Long)	23 N·m (17 ft-lbs)	16-27 N·m (12-20 ft-lbs)
Oxygen Sensor	48 N·m (35 ft-lbs)	43-52 N·m (32-38 ft-lbs)
Power Steering Pump Adapter Screw	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Power Steering Pump Bracket Screw	58 N·m (43 ft-lbs)	50-64 N·m (37-47 ft-lbs)
Power Steering Pump Mounting Screw	38 N·m (28 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Power Steering Pump Pressure Hose Nut	52 N·m (38 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Power Steering Pump Pulley Nut	79 N·m (58 ft-lbs)	54-88 N·m (40-65 ft-lbs)
Rear Crossmember-to-Side Sill Nut	41 N·m (30 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Rear Support Bracket-to-Transmission	45 N·m (33 ft-lbs)	37-52 N·m (27-38 ft-lbs)
Rear Support Cushion-to-Bracket	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Rear Support Cushion-to-Crossmember	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Rocker Arm Assembly-to-Cylinder Head	26 N·m (19 ft-lbs)	22-35 N·m (16-26 ft-lbs)
Spark Plug	15 N·m (11 ft-lbs)	10-20 N·m (7-15 ft-lbs)
Starter Motor-to-Converter Housing Bolt	24 N·m (18 ft-lbs)	18-34 N·m (13-25 ft-lbs)

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	GENERAL DESCRIPTION	
	TORQUE SPECIFICATIONS	

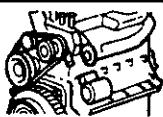
TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
Timing Case Cover-to-Block Screws	7 N·m (5 ft-lbs)	5-11 N·m (4-8 ft-lbs)
Timing Case Cover-to-Block Studs	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Thermostat Housing Bolt	18 N·m (13 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Vibration Damper Bolt (Lubricated)	108 N·m (80 ft-lbs)	95-122 N·m (70-90 ft-lbs)
Water Pump Bolt	18 N·m (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)

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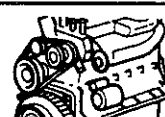


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GENERAL DESCRIPTION

ENGINE SPECIFICATIONS



ENGINE SPECIFICATIONS – 4.0L

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GENERAL	USA Inches*	METRIC Millimeters*
Type	In Line, OHV, Six-cylinder	
Bore	3.88	98.4
Stroke	3.44	87.4
Displacement	243 cubic inches	4.0 liter
Compression Ratio	9.2:1	
Compression Pressure	120-150 psi	827-1034 kPa
Maximum Variation Between Cylinders	30 psi	206 kPa
Firing Order	1-5-3-6-2-4	
Taxable Horsepower	36.13 Bhp	26.85 kW
Fuel	unleaded	

CAMSHAFT

Tappet Clearance	Zero Lash (Hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 (max)	0.03 (max)
Cam Lobe Lift	0.253	6.43
Valve Lift	0.424	10.76
Intake Valve Timing		
Opens	15° BTDC	
Closes	75° ABDC	
Exhaust Valve Timing		
Opens	59° BBDC	
Closes	31° ATDC	
Valve Overlap	46°	
Intake Duration	270°	
Exhaust Duration	270°	

*Unless Otherwise Specified

CONNECTING RODS	USA Inches*	METRIC Millimeters*
Total Weight (less bearings)	657-665 grams	
Total Length (center-to-center)	6.123-6.127	155.52-155.62
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2085-2.2080	56.09-56.08
Bearing Clearance	0.001-0.003 (0.0015-0.002 preferred)	0.03-0.08 (0.044-0.05 preferred)
Side Clearance	0.010-0.019	0.25-0.48
Maximum Twist	0.001 per inch	0.025 per 25.4 mm
Maximum Bend	0.0005 per inch	0.0127 per 25.4 mm

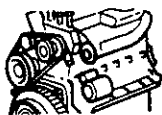
CRANKSHAFT

End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025 (0.002 preferred)	0.03-0.06 (0.051 preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013

CYLINDER BLOCK

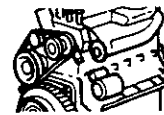
Deck Height	9.429-9.435	239.49-239.64
Deck Clearance	0.0215 (below block)	0.546 (below block)
Cylinder Bore Diameter (standard)	3.8751-3.8775	98.42-98.48
Maximum Taper	0.001	0.025
Maximum Out-of-Round	0.001	0.025
Tappet Bore Diameter	0.9055-0.9065	23.000-23.025
Cylinder Block Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

86218A



GENERAL DESCRIPTION

ENGINE SPECIFICATIONS



ENGINE SPECIFICATIONS – 4.0L (Continued)

CYLINDER HEAD	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	E-I-E-I-E-I-E-I-E	
Valve Guide ID (Integral)	3.12	7.9
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	44.5°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

LUBRICATION SYSTEM

Engine Oil Capacity	5 quarts (Add ½ quart with filter change)	4.7 liters (Add .45 liter with filter change)
Normal Operating Pressure	13 psi at 600 rpm; 37-75 psi (max) at 1600+ rpm	89.6 kPa at 600 rpm; 255.1-517.1 kPa (max) at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)
Gear-to-Body Clearance (Radial)	0.002-0.004 (.002 preferred)	0.051-0.102 (.051 preferred)
Gear End Clearance, Plastigage	0.002-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)

PISTONS

Weight (less pin)	510-514 grams	
Piston Pin Bore		
Centerline-to-Piston Top	1.651-1.655	41.94-42.04
Piston-to-Bore Clearance	0.0009-0.0017 (0.0012-0.0013 preferred)	0.023-0.043 (0.030-0.033 preferred)
Piston Ring Gap Clearance – Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance – Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance No. 1 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
No. 2 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Piston Ring Groove Height Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80
Piston Ring Groove Diameter No. 1 and No. 2	3.476-3.486	88.30-88.55
Oil Control	3.557-3.566	90.35-90.60
Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Piston-to-Pin Connecting Rod	2000 lbf press-fit	8.9kN press-fit

ROCKER ARMS, PUSH RODS AND TAPPETS	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio		1.6:1
Push Rod Length	9.640-9.660	244.856-245.364
Push Rod Diameter	0.312-0.315	7.92-8.00
Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05

VALVES

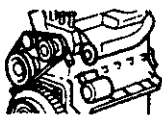
Valve Length (Tip-to-Gauge Dim. Line) (Intake)	4.822-4.837	122.4-122.8
(Exhaust)	4.837-4.852	122.8-123.2
Valve Stem Diameter	3.12	7.9
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.91	48.5
Intake Valve Face Angle		45°
Exhaust Valve Head Diameter	1.50	38
Exhaust Valve Face Angle		45°
Maximum Allowable Removed for Tip Refinishing	0.010	0.25

VALVE SPRINGS

Free Length	1.82 approx.	46.22 approx.
Spring Tension Valve Closed	66-74 lbf at 1.625	293-329 N at 41.2
Valve Open	205-220 lbf at 1.200	911-978 N at 30.4
Inside Diameter	0.948-0.968	24.08-24.59

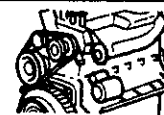
*Unless Otherwise Specified

SEE
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GENERAL DESCRIPTION

ENGINE SPECIFICATIONS



ENGINE SPECIFICATIONS – 4.2L

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GENERAL	USA Inches*	METRIC Millimeters*
Type	In Line, OHV, Six-cylinder	
Bore	3.75	95.25
Stroke	3.895	98.93
Displacement	258 cubic inches	4.2 liter
Compression Ratio	9.2:1	
Compression Pressure	120-150 psi	827-1034 kPa
Maximum Variation Between Cylinders	30 psi	206 kPa
Firing Order	1-5-3-6-2-4	
Taxable Horsepower	33.75 Bhp	25.2 kW
Fuel	unleaded	

CAMSHAFT

Fuel Pump Eccentric Diameter	1.615-1.625	41.02-41.28
Tappet Clearance	Zero Lash (Hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 (max)	0.03 (max)
Cam Lobe Lift	0.253	6.43
Valve Lift	0.405	10.29
Intake Valve Timing		
Opens	9° BTDC	
Closes	73° ABDC	
Exhaust Valve Timing		
Opens	57° BBDC	
Closes	25° ATDC	
Valve Overlap	34°	
Intake Duration	262°	
Exhaust Duration	262°	

*Unless Otherwise Specified

CONNECTING RODS	USA Inches*	METRIC Millimeters*
Total Weight (less bearings)	695-703 grams	
Total Length (center-to-center)	5.873-5.877	149.17-149.28
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2085-2.2080	56.09-56.08
Bearing Clearance	0.001-0.003 (0.0015-0.002 preferred)	0.03-0.08 (0.044-0.05 preferred)
Side Clearance	0.010-0.019	0.25-0.48
Maximum Twist	0.001 per inch	0.025 per 25.4 mm
Maximum Bend	0.0005 per inch	0.0127 per 25.4 mm

CRANKSHAFT

End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025 (0.002 preferred)	0.03-0.06 (0.051 preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013

CYLINDER BLOCK

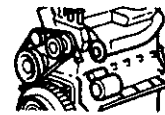
Deck Height	9.487-9.493	240.97-241.12
Deck Clearance	0.0148 (below block)	0.376 (below block)
Cylinder Bore Diameter		
(standard)	3.7501-3.7533	95.253-95.334
Maximum Taper	0.001	0.025
Maximum Out-of-Round	0.001	0.025
Tappet Bore Diameter	0.9055-0.9065	23.000-23.025
Cylinder Block Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

86218B



GENERAL DESCRIPTION

ENGINE SPECIFICATIONS



ENGINE SPECIFICATIONS – 4.2L (Continued)

CYLINDER HEAD	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	E-I-E-I-E-I-E-I-E-I-E	
Valve Guide ID (Integral)	0.3735-0.3745	9.487-9.512
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	30°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.001/1-0.002/6 (0.008 max)	0.03/25-0.05/152 (0.20 max)

LUBRICATION SYSTEM

Engine Oil Capacity	4 quarts (Add 1 quart with filter change)	3.8 liters (Add 0.9 liter with filter change)
Normal Operating Pressure	13 psi at 600 rpm; 37-75 psi (max) at 1600+ rpm	89.6 kPa at 600 rpm; 255.1-517.1 kPa (max) at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)
Gear-to-Body Clearance (Radial)	0.002-0.004 (.002 preferred)	0.051-0.102 (.051 preferred)
Gear End Clearance, Plastigage	0.002-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)

PISTONS

Weight (less pin)	510-514 grams	
Piston Pin Bore	1.651-1.655	41.94-42.04
Centerline-to-Piston Top	0.0009-0.0017	0.023-0.043
Piston-to-Bore Clearance	(0.0012-0.0013 preferred)	(0.030-0.033 preferred)
Piston Ring Gap Clearance – Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance – Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance No. 1 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
No. 2 Compression	0.0017-0.0032 (0.0017 preferred)	0.043-0.081 (0.043 preferred)
Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Piston Ring Groove Height Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80
Piston Ring Groove Diameter No. 1 and No. 2	3.324-3.329	84.43-84.56
Oil Control	3.329-3.339	84.56-84.81
Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645
Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Piston-to-Pin Connecting Rod	2000 lbf press-fit	8.9kN press-fit

ROCKER ARMS, PUSH RODS AND TAPPETS

	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio	1.6:1	
Push Rod Length	9.710-9.730	246.63-247.14
Push Rod Diameter	0.312-0.315	7.92-8.00
Hydraulic Tappet Diameter	0.904-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.03-0.05

VALVES

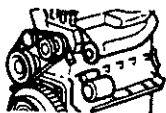
Valve Length (Tip-to-Gauge Dim. Line)	4.7895-4.8045	121.653-122.034
Valve Stem Diameter	0.3715-0.3725	9.436-9.462
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.782-1.792	45.26-45.52
Intake Valve Face Angle	29°	
Exhaust Valve Head Diameter	1.401-1.411	35.59-35.84
Exhaust Valve Face Angle	44°	
Maximum Allowable Removed for Tip Refinishing	0.010	0.25

VALVE SPRINGS

Free Length	1.99 approx.	50.55 approx.
Spring Tension		
Valve Closed	64-72 lbf at 1.786	285-320 N at 45.4
Valve Open	188-202 lbf at 1.411	836-898 N at 35.84
Inside Diameter	0.948-0.968	24.08-24.59

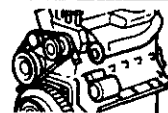
*Unless Otherwise Specified

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CYLINDER HEAD

DISASSEMBLY



INTAKE MANIFOLD REMOVAL

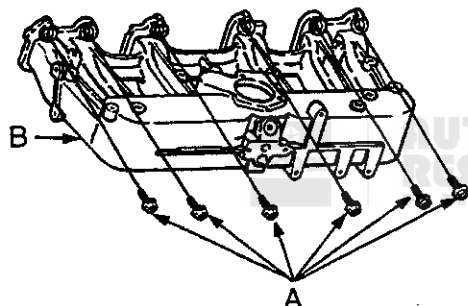
Remove the intake manifold retaining bolts (A).

Remove the intake manifold (B).

Discard the intake manifold gasket (C).

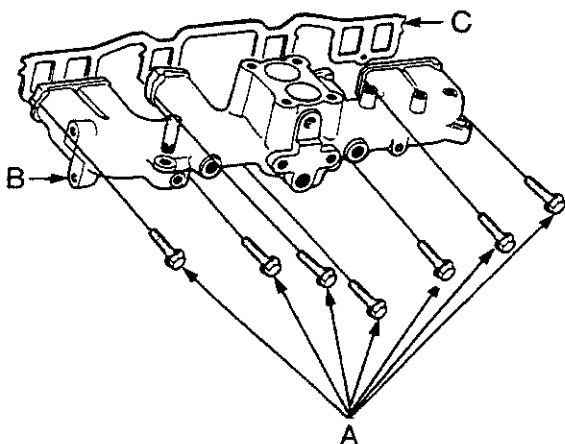
SEE
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4.0L



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4.2L



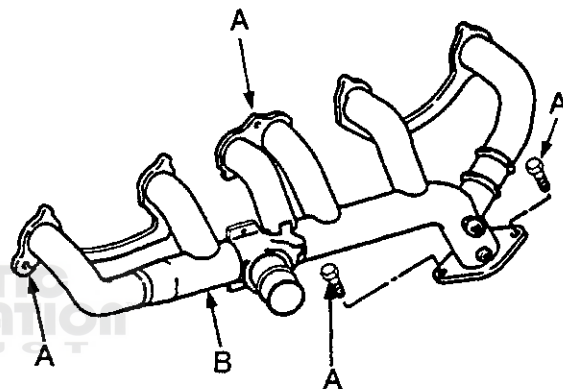
101935B

EXHAUST MANIFOLD REMOVAL

Remove the exhaust manifold retaining bolts (A).

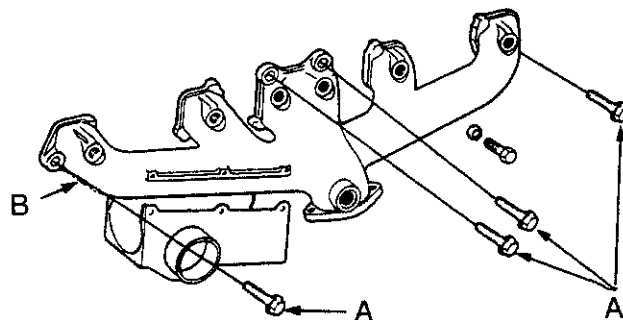
Remove the exhaust manifold (B).

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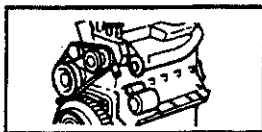


101935D

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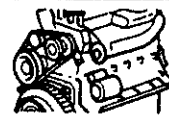


101935C



CYLINDER HEAD

DISASSEMBLY

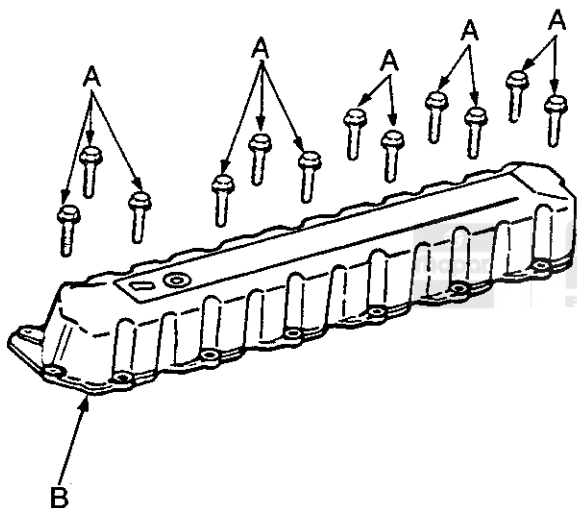


CYLINDER HEAD COVER REMOVAL

Remove the cylinder head cover retaining nuts/bolts (A).

Detach the cover from the cylinder head (B) by breaking the RTV sealant with a putty knife or razor blade.

4.0L



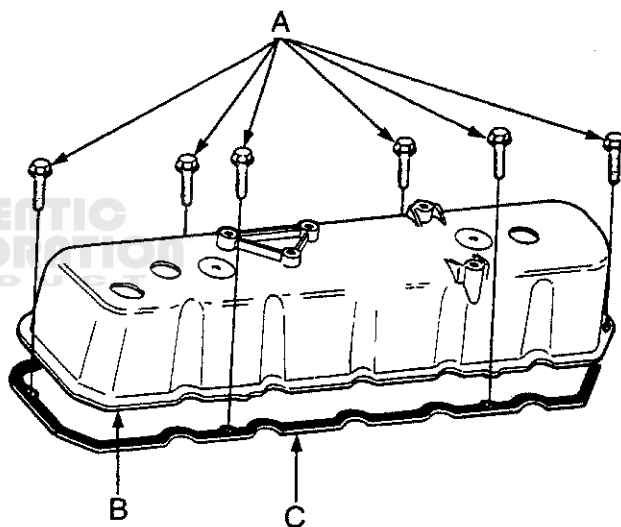
102303A

NOTE: Do not pry the cover upward until the seal has been completely broken.

NOTE: Some 1986 4.2L engines and all 4.0L engines use a new cylinder head cover with a pre-cured RTV sealer. DO NOT use a putty knife, razor blade, or similar tool, to remove the cover.

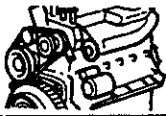
Remove the gasket (C).

4.2L



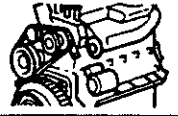
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CYLINDER HEAD

DISASSEMBLY



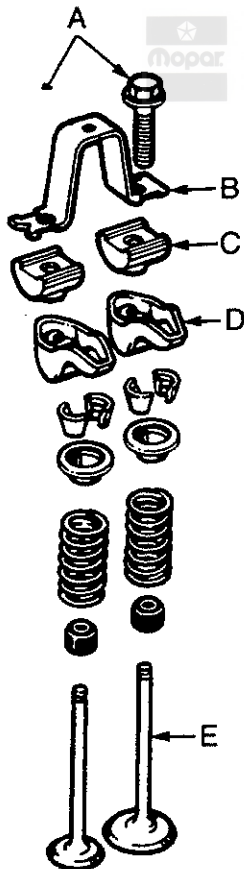
CYLINDER HEAD REMOVAL

Remove the two capscrews (A) at each bridge (B) and pivot (C) assembly. Alternately loosen the capscrews one turn at a time to avoid damaging the bridge.

Remove the bridges, pivots and corresponding pairs of rocker arms (D). Place these components on the bench in the order in which they were removed.

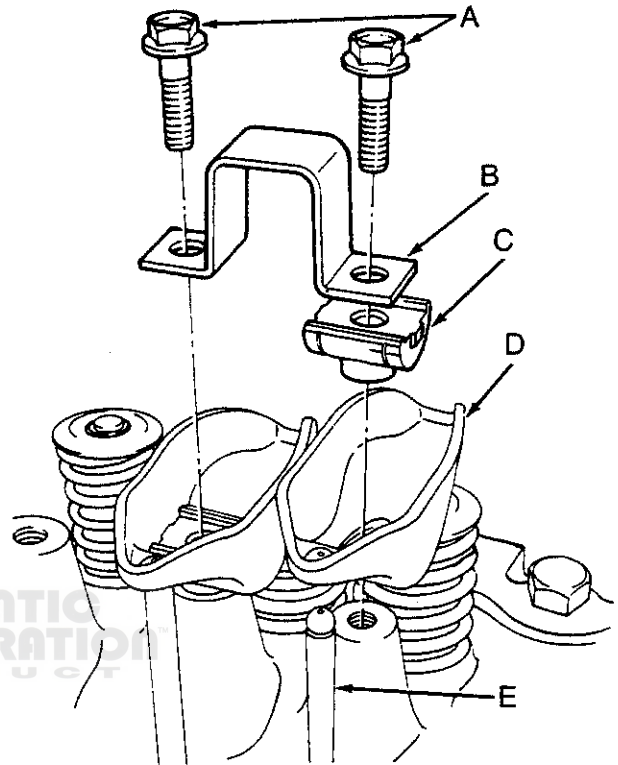
Remove the push rods (E) and place them on the bench in the order in which they were removed.

4.0L



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4.2L



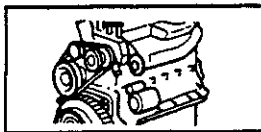
101302B

Remove the spark plugs.

Remove the cylinder head bolts.

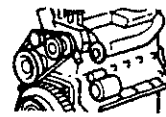
Remove the cylinder head.

Remove the cylinder head gasket.



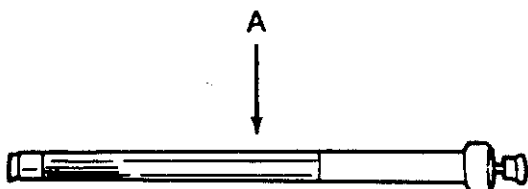
CYLINDER HEAD

DISASSEMBLY



HYDRAULIC VALVE TAPPET REMOVAL

Remove the valve tappets through the push rod openings in the cylinder block. Use Hydraulic Valve Tappet Removal and Installation Tool J-21884, or equivalent (A).



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NOTE: Be sure to keep the valve tappets in the same order in which they are removed to help later when installing them in their original positions.

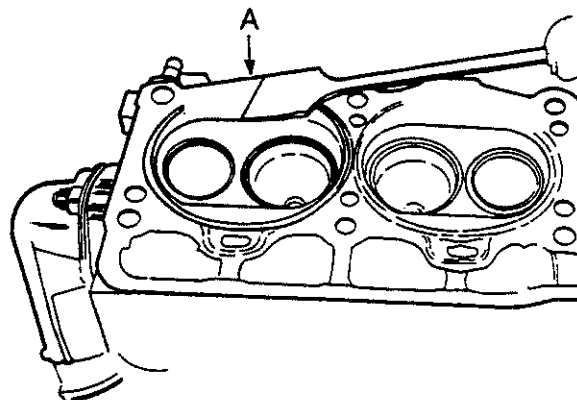
CLEANING AND INSPECTION

Thoroughly clean the machined surfaces of the cylinder head and block.

Remove all gasket material and cement (A).

Remove carbon deposits from the combustion chambers and from the top of the pistons.

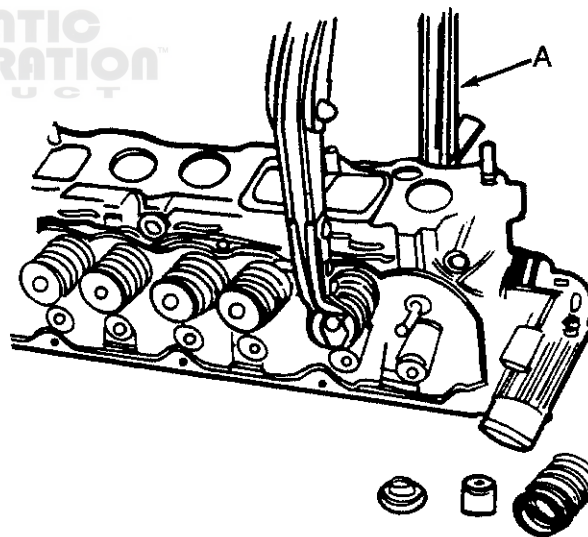
Use a straightedge and a feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to the Specifications.



86163

VALVE REMOVAL

Compress each valve spring. Use the Valve Compressor Tool J-8062 (A), or equivalent.



86164

Remove the valve locks.

Remove the valve retainers.

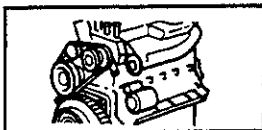
Remove the valve springs.

Remove the valve stem oil deflectors.

Discard the deflectors.

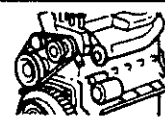
Remove the valves, and place them in a rack in the order in which they are removed.

SEE
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CYLINDER HEAD

DISASSEMBLY



CLEANING AND INSPECTION

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

Clean all grime and gasket cement from the cylinder head machined gasket surface.

Inspect for cracks in the combustion chambers and valve ports.

Inspect for cracks in the gasket surface at each coolant passage.

Inspect the valves for burned, cracked or warped heads.

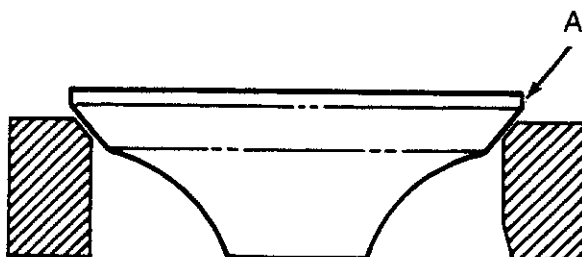
Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

VALVE REFACING

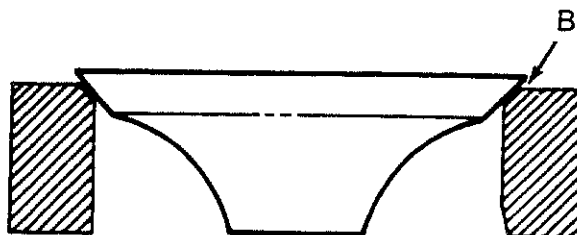
Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

After refacing, a margin of at least 0.787 mm (A) (0.031 in.) must remain.



86165A

If the margin is less than 0.787 mm (B) (0.031 in.), the valve must be replaced.



86165B

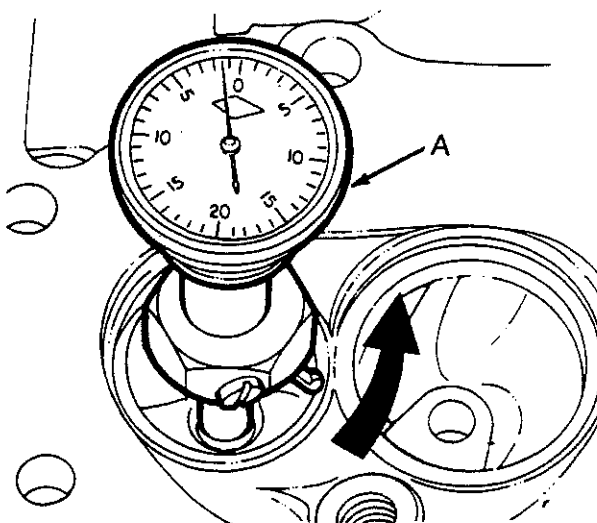
VALVE SEAT REFACING

Install a pilot of the correct size in the valve guide bore and reface the valve seat to the specified angle with a good dressing stone.

Remove only enough metal to provide a smooth finish.

Use tapered stones to obtain the specified seat width when required.

Control seat runout to a maximum of 0.0635 mm (0.0025 in.), using a dial indicator (A).



86166A

	CYLINDER HEAD DISASSEMBLY	
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VALVE STEM OIL DEFLECTOR REPLACEMENT

Nylon valve stem oil deflectors are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guide bores.

Replace the oil deflectors whenever valve service is performed or if the deflectors have deteriorated.

VALVE GUIDE REPLACEMENT

Valve guides are an integral part of the cylinder head. VALVE GUIDES ARE NOT REPLACEABLE.

When the stem-to-guide clearance is excessive, the valve guide bores must be reamed to accommodate the next larger oversize valve stem.

Oversize stem service valves are available in 0.076 mm (0.003 in.), 0.381 mm (0.015 in.), and 0.762 mm (0.030 in.) stem sizes.

Valve Guide Reamer Size – 4.0L

Reamer Tool Number	Size
J-26590-L	0.076 mm (0.003 in.) [Oversize]

Valve Guide Reamer Size – 4.2L

Reamer Tool Number	Size
J-6042-1	0.076 mm (0.003 in.)
J-6042-5	0.381 mm (0.015 in.)
J-6042-4	0.762 mm (0.030 in.)

NOTE: Ream valve guide bores in steps, starting with the 0.0762 mm (0.003 in.) oversize reamer and progress to the size required.

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

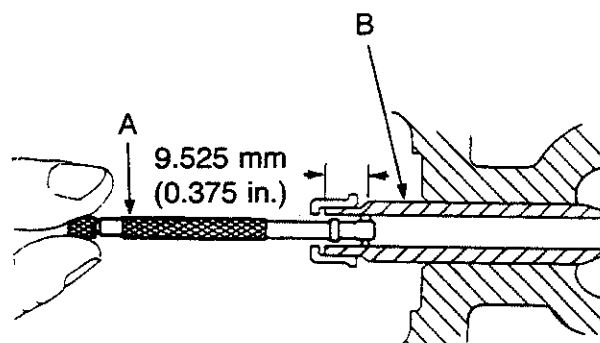
Valve stem-to-guide clearance may be measured by either of the following two methods.

Preferred Method

Remove the valve from the head. Refer to Valve Removal for the procedure.

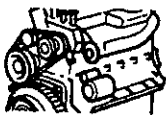
Clean the valve stem guide bore with solvent and a bristle brush.

Insert the telescoping gauge (A) into the bore of the valve stem guide (B) approximately 9.525 mm (.375 in.) from the valve spring side of the head with contacts crosswise to the cylinder head.



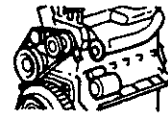
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CYLINDER HEAD

DISASSEMBLY



Remove and measure the telescoping gauge with a micrometer.

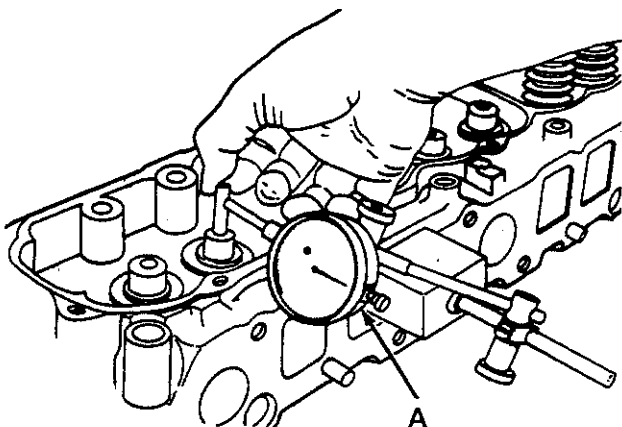
Repeat the measurement with contacts lengthwise to the cylinder head.

Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate the oversize valve stem.

Compare the measured valve guide bore diameter with the diameter listed in the Specifications. If the measurement differs from the specification by more than 0.0762 mm (0.003 in.), ream the guide bore to accommodate the oversize valve stem.

Alternate Method

Use Dial Indicator Tool J-8520 (A), or equivalent, and a C-Clamp and Rod Extension Tool J-5959-4, or equivalent, to measure the lateral movement of the valve stem (stem-to-guide clearance) with the valve installed in its guide and just off the valve seat.

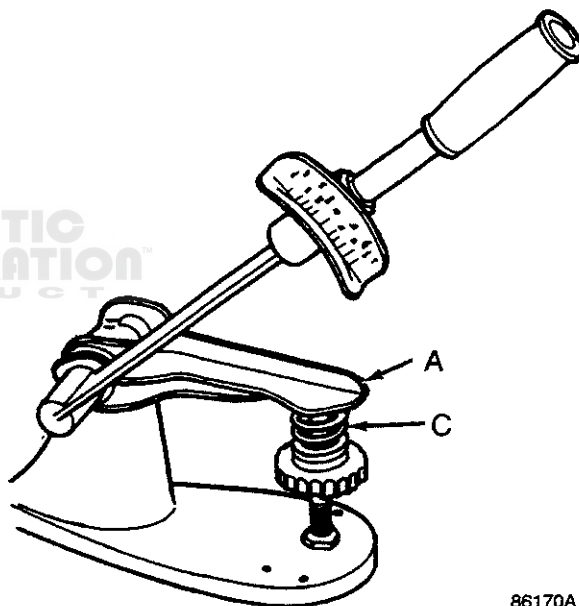


86169A

The correct clearance is 0.0025 – 0.0762 mm (0.001 – 0.003 in.). If the indicated movement exceeds the specification, ream the guide bore to accommodate an oversize valve stem.

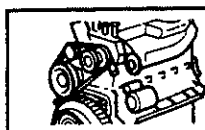
VALVE SPRING TENSION TEST

Use the Valve Spring Tester Tool J-8056, or equivalent and torque wrench (A) to test each valve spring (B) for the specified tension value.

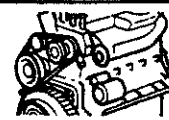


86170A

Replace the valve springs that are not within specifications.



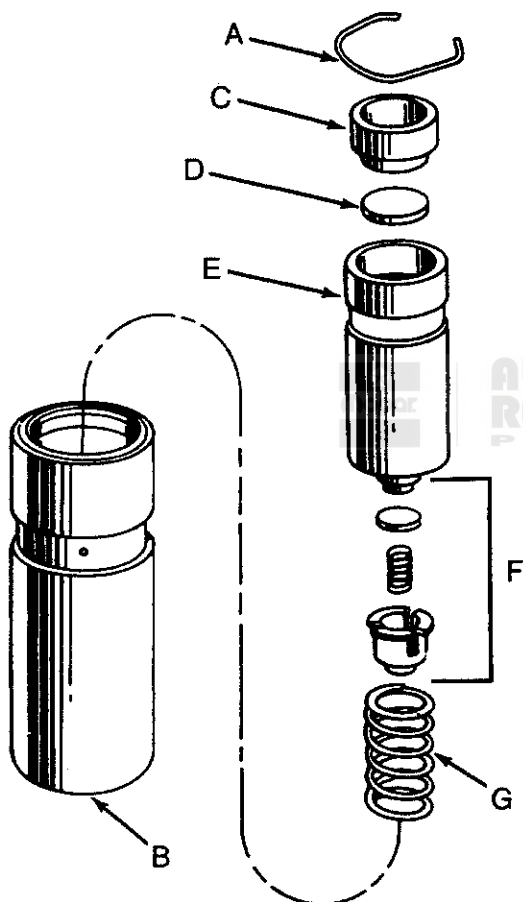
CYLINDER BLOCKDISASSEMBLY



HYDRAULIC VALVE TAPPET DISASSEMBLY

NOTE: Be sure to place the components of each valve tappet in a separate location. This will greatly assist in the installation operation.

Release the snap ring (A).



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Remove the following components from the tappet body (B):

- Plunger cap (C)
- Metering valve (D)
- Plunger (E)
- Check valve assembly (F)
- Plunger return spring (G)

CLEANING AND INSPECTION

Clean the components of each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

Inspect for indications of scuffing on the side and base of each tappet body.

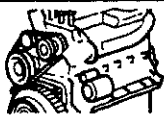
Inspect each tappet base for concave wear with a straightedge positioned across the base.

If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and tappets.

HYDRAULIC VALVE TAPPET ASSEMBLY

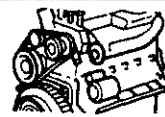
Refer to hydraulic valve tappet assembly in the **CYLINDER BLOCK ASSEMBLY** section, page 55.

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CYLINDER BLOCK

DISASSEMBLY



WATER PUMP REMOVAL

Remove the water pump from the cylinder block.

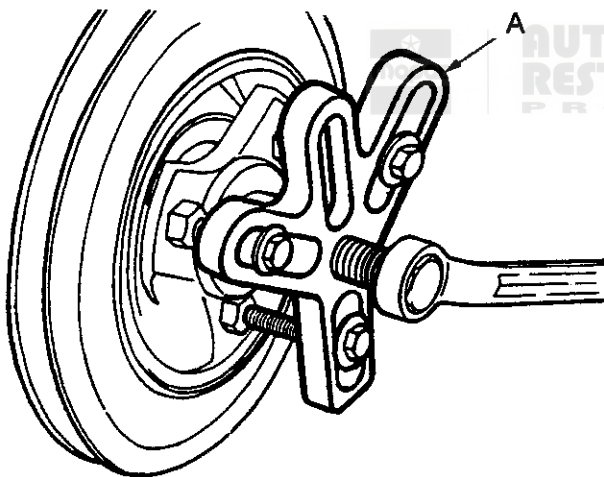
FUEL PUMP

Remove the fuel pump from the cylinder block (4.2L ONLY).

VIBRATION DAMPER REMOVAL

Remove the vibration damper.

Use Vibration Damper Tool J-24420-B (A), or equivalent.

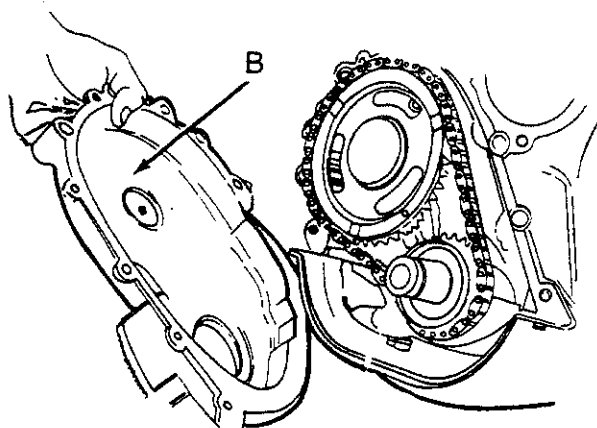


86174A

TIMING CASE COVER REMOVAL

Remove the timing case cover seal using a screwdriver or suitable tool (A).

Remove the timing case cover.



86176A

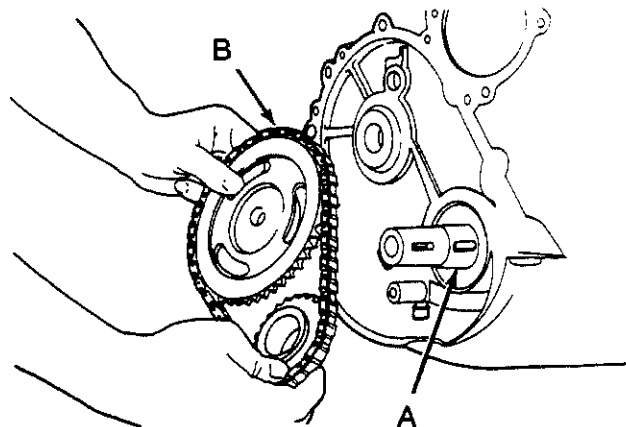
CAMSHAFT REMOVAL

Remove the oil slinger (A) from the crankshaft.

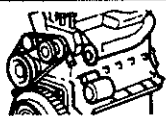
Remove the camshaft retaining bolt.

Remove the sprockets and chain (B) as an assembly.

Remove the camshaft.

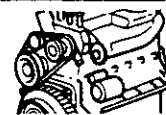


86177A



CYLINDER BLOCK

DISASSEMBLY



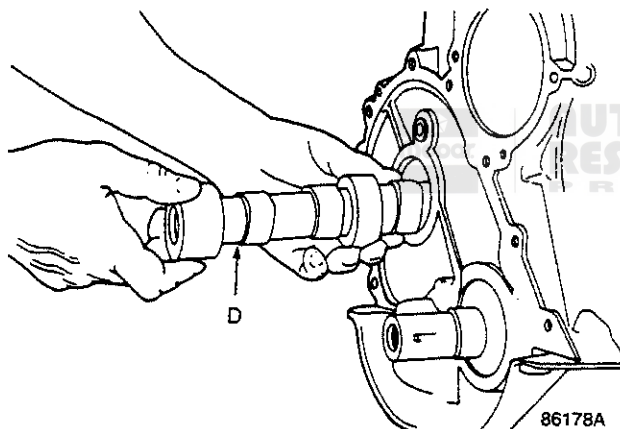
Inspect the cam lobes for wear.

Inspect the bearing journals for uneven wear pattern or finish.

Inspect the bearings for wear.

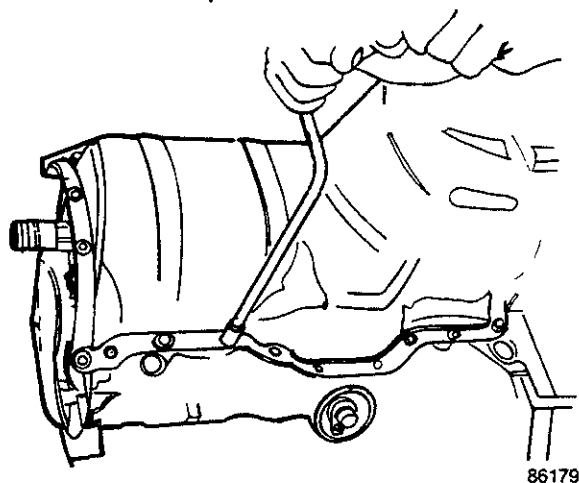
Inspect the distributor drive gear for wear.

NOTE: If the camshaft (D) appears to have been rubbing against the timing case cover, examine the oil pressure relief holes in the rear cam journal to ensure that they are free of debris.



OIL PAN REMOVAL

Remove the oil pan.



Remove the gaskets.

Remove the seals.

Thoroughly clean the pan and engine block gasket surfaces.

OIL PUMP REMOVAL

The positive-displacement, gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft.

Oil is siphoned into the pump through an inlet tube and strainer assembly that is pressed into the pump body.

The pump incorporates a non-adjustable pressure relief valve to limit maximum pressure to 75 psi (517 kPa).

In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

NOTE: Replacement or removal of the oil pump will not affect the distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

Remove the oil pump assembly and gasket from the cylinder block.

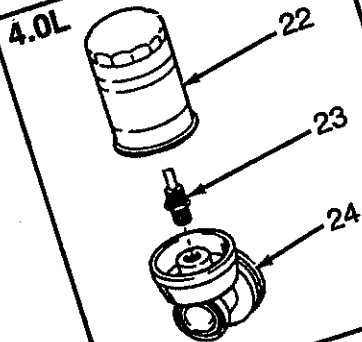
CAUTION: If the oil pump is not to be serviced, do not disturb the position of the oil inlet tube and strainer assembly in the pump body.

If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to ensure an airtight seal.

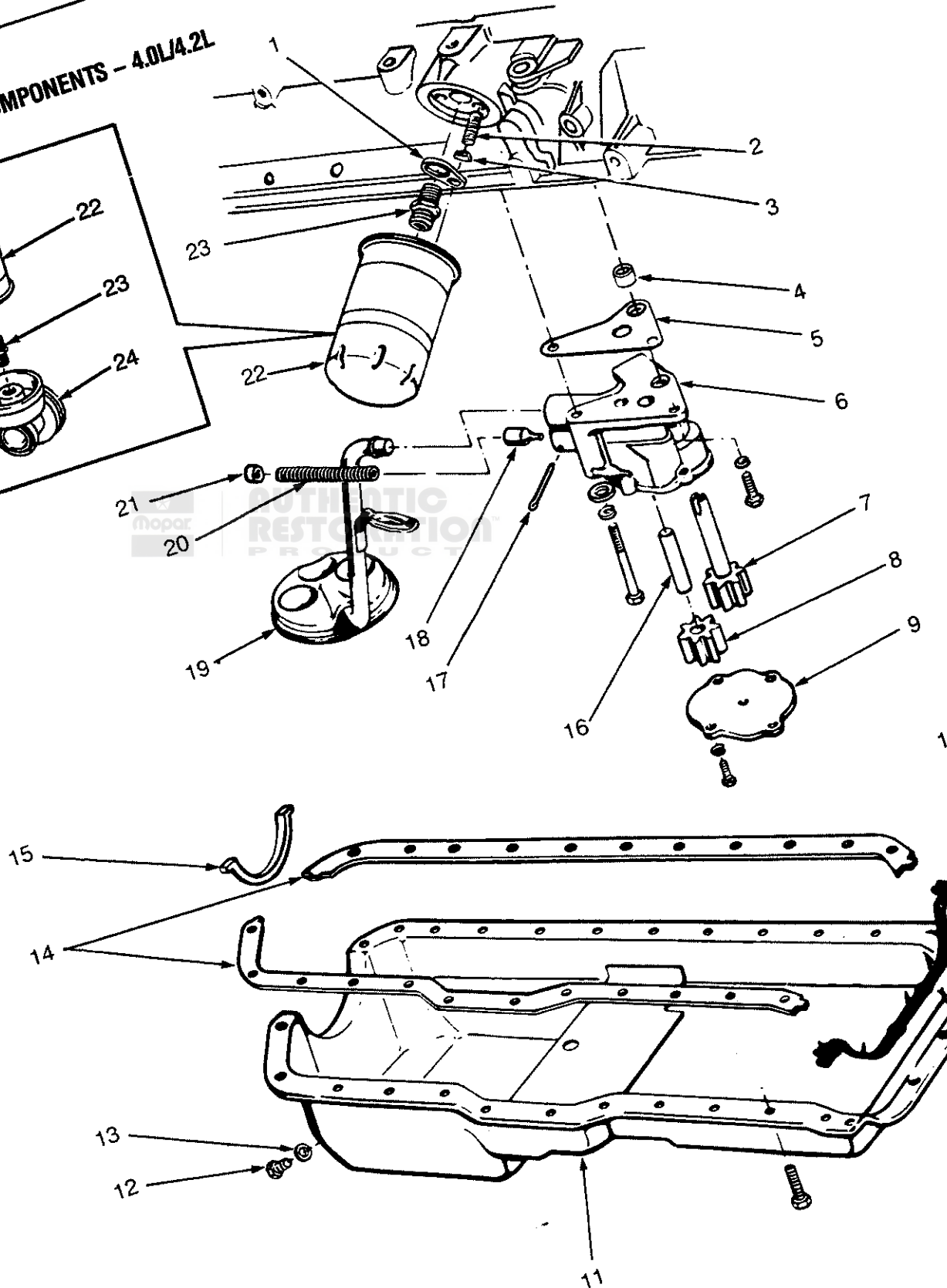
SEE
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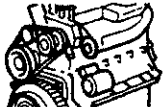
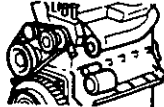
CYLINDER BLOCK DISASSEMBLY

LUBRICATION SYSTEM COMPONENTS - 4.0L/4.2L



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	CYLINDER BLOCK DISASSEMBLY	
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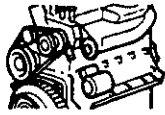
LUBRICATION SYSTEM COMPONENTS – 4.0L/4.2L

1. Oil Filter By-Pass Valve Retainer¹
2. Oil Filter By-Pass Valve Spring¹
3. Oil Filter By-Pass Valve¹
4. Dowel Pin
5. Oil Pump-to-Cylinder-Block Gasket
6. Oil Pump Body
7. Oil Pump Drive Shaft and Gear
8. Oil Pump Idler Gear
9. Oil Pump Cover
10. Oil Pan Timing Case Cover Seal
11. Oil Pan
12. Oil Pan Drain Plug
13. Oil Pan Drain Plug Gasket
14. Oil Pan Gasket Set
15. Oil Pan-to-Bearing Cap Seal
16. Oil Pump Idler Gear Shaft
17. Cotter Pin
18. Release Valve Plunger
19. Oil Pump Strainer and Inlet Tube Assembly
20. Oil Pump Release Valve Spring
21. Valve Spring Release Cap
22. Oil Filter Element
23. Oil Filter By-Pass Connector
24. Oil Filter Adapter

¹ – Not on 1987 engines

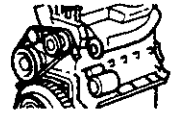
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CYLINDER BLOCK

DISASSEMBLY

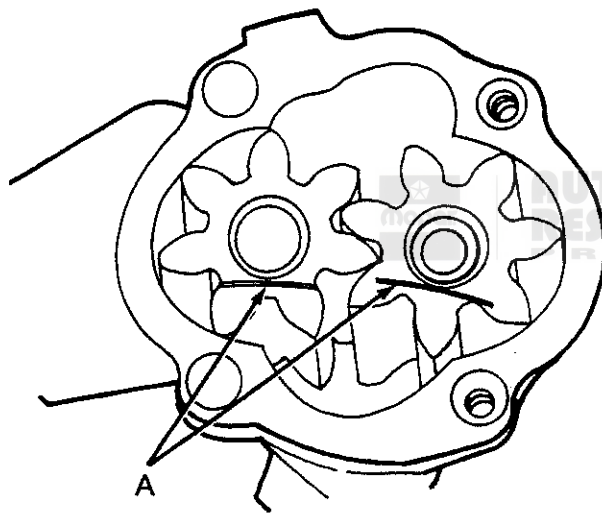


OIL PUMP GEAR END CLEARANCE MEASUREMENT

Remove the cover retaining screws and cover from the pump body.

Preferred Method

Place a strip of Plastigage (A) across the full width of each gear.



86181A

Install the pump cover and tighten the screws to 8 N·m (70 in-lbs) torque.

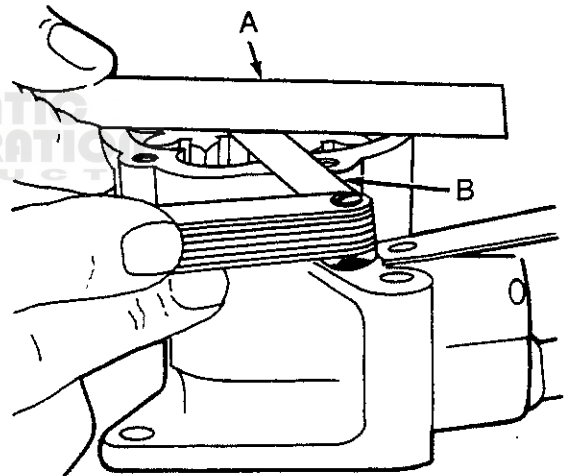
Remove the pump cover and determine the amount of clearance by measuring the width of compressed Plastigage with the scale on the Plastigage envelope.

The correct clearance by this method is 0.051 – 0.152 mm (0.002 – 0.006 in.). The preferred measurement is 0.051 mm (0.002 in.).

Alternate Method

Place a straightedge (A) across the ends of the gears and the pump body.

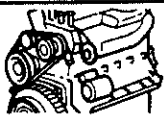
Select a feeler gauge (B) that fits snugly but freely between the straightedge and the pump gears.



86182A

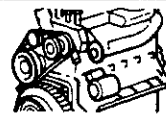
Using this method the correct clearance is 0.051 – 0.152 mm (0.002 – 0.006 in.), with the preferred measurement being 0.051 mm (0.002 in.).

If the gear end clearance is excessive, replace the oil pump assembly.



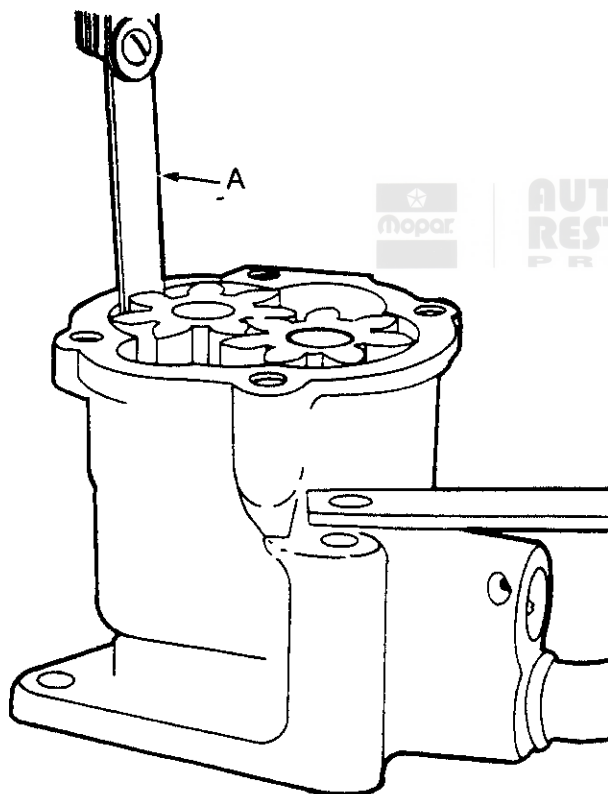
CYLINDER BLOCK

DISASSEMBLY



OIL PUMP GEAR-TO-BODY CLEARANCE MEASUREMENT

Measure the gear-to-body clearance by inserting a feeler gauge (A) between the gear tooth and the pump body inner wall directly opposite the point of the gear mesh.



86183A

NOTE: Select a feeler gauge which fits snugly but freely.

Rotate the gears to measure each tooth-to-body clearance in this manner.

The correct clearance is 0.051 – 0.102 mm (0.002 – 0.004 in.). The preferred clearance is 0.051 mm (0.002 in.).

If the gear-to-body clearance is more than specified, replace the idler gear, the idler shaft and the drive gear assembly.

Remove the cotter pin and slide the spring retainer, spring and oil pressure relief valve plunger out of the pump body.

Inspect for binding condition during disassembly.

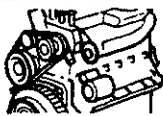
Clean or replace, as necessary.

NOTE: The oil inlet tube and strainer assembly must be moved to allow removal of the relief valve. Install a replacement inlet tube and strainer assembly.

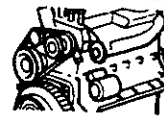
OIL PUMP ASSEMBLY

Refer to **CYLINDER BLOCK ASSEMBLY** section, page 50.

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CYLINDER BLOCK DISASSEMBLY

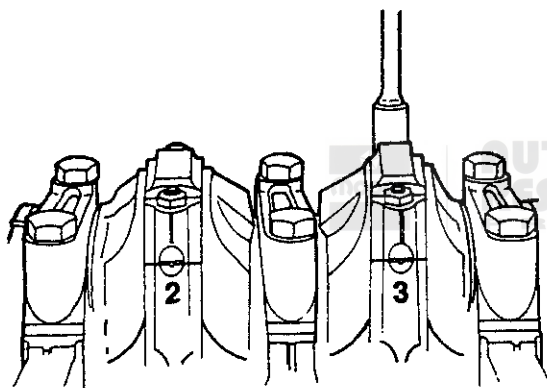


CONNECTING ROD AND PISTON REMOVAL

Remove the connecting rod bearing caps and inserts.

Keep them in the same order in which they were removed to facilitate installation in the original location.

NOTE: The connecting rods and caps are stamped with the corresponding cylinder number.



86185

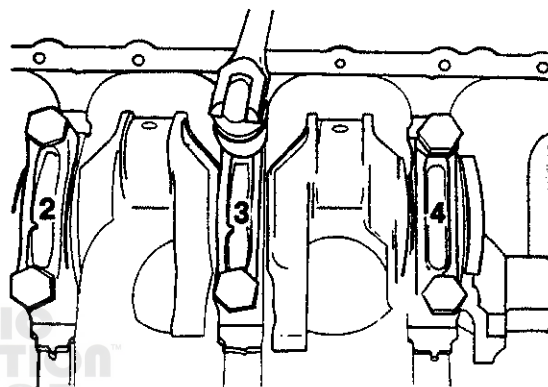
Remove the connecting rod and piston assemblies through the top of the cylinder bores.

NOTE: Be sure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during removal.

CRANKSHAFT REMOVAL

Remove the main bearing caps and bearings.

NOTE: The bearing caps are numbered front to rear.



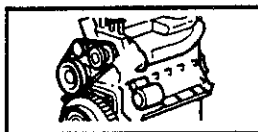
86186

Remove the rear main bearing oil seal.

Remove the crankshaft and upper bearing inserts.

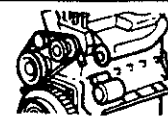
Inspect the crankshaft for scoring.

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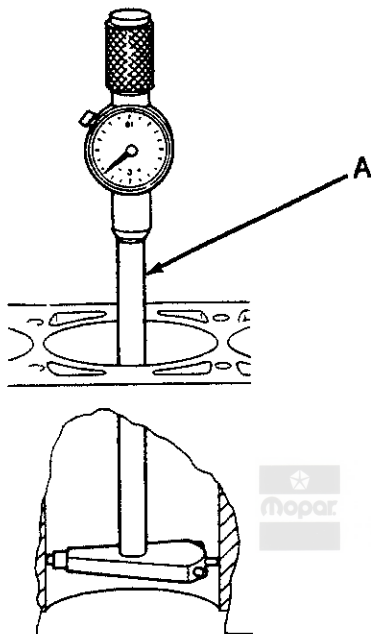
CYLINDER BLOCK

DISASSEMBLY



CYLINDER BORE MEASUREMENT

Use a bore gauge (A) to measure each cylinder bore diameter. If a bore gauge is not available, use an inside micrometer.



Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement at the bottom of the bore.

Determine the taper by subtracting the smaller diameter from the larger diameter.

Rotate the measuring device 120 degrees and repeat the previous steps.

Lastly, rotate the device another 120 degrees and repeat the measurements.

Determine out-of-roundness by comparing the difference between each 120 degree measurement.

If the cylinder bore taper does not exceed 0.025 mm (0.001 in.) and the out-of-roundness does not exceed 0.025 mm (0.001 in.) the cylinder bore can be trued by honing.

If the cylinder bore taper or out-of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston.

NOTE: A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

CYLINDER BORE RESURFACING

CAUTION: Do not use rigid type hones to remove cylinder wall glaze.

Use an expanding type hone to true the cylinder bore and to remove the glaze for faster piston ring seating.

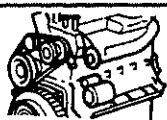
Move the hone down and up (stroke) at sufficient speed to produce a uniform 60 degree angle crosshatch pattern on the cylinder walls. Do not use more than ten strokes per cylinder (one stroke is one down-and-up movement).

Clean the cylinder bores by scrubbing clean with a solution of hot water and detergent.

Immediately apply light engine oil to the cylinder walls. Wipe with a clean, lint-free cloth.

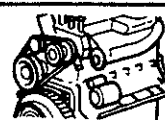
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86187



CYLINDER BLOCK

DISASSEMBLY/ASSEMBLY



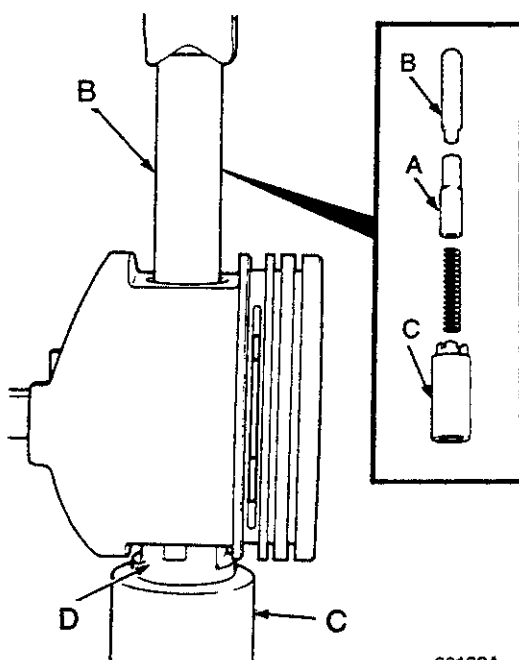
PISTON PIN REMOVAL

Piston pins are press-fitted into the connecting rods and require no locking device.

Position the following components in place on an arbor press:

- Piston Pin Pilot Tool J-21872-2 (A), or equivalent
- Piloted Driver Tool J-21872-3 (B), or equivalent
- Removal Support Tool J-21872-1 (C), or equivalent
- Piston and connecting rod assembly

Apply force to the piloted driver to press the pin completely out of the connecting rod and piston. Note the position of the pin through the gauge window (D) of the Removal Support Tool J-21872-1, or equivalent.



86188A

PISTON PIN INSPECTION

Inspect the piston pin and pin bore in the connecting rod.

NOTE: Never re-use the piston pin after it has been installed in, and removed from, a connecting rod.

With the pin removed from the piston and connecting rod, clean and dry the piston pin bores and the replacement piston pin.

Position the piston so that the pin bore is in the vertical position.

Insert the pin in the bore. At room temperature, the replacement pin should slide completely through the pin bore in the piston by the force of gravity.

Replace the piston if the pin jams in the pin bore.

PISTON PIN INSTALLATION

Insert the Pin Pilot Tool J-21872-2, or equivalent, through the piston and connecting rod pin bores.

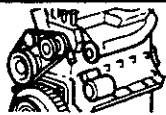
Position the pin pilot, piston and connecting rod on the Support Tool J-21872-1, or equivalent.

Insert the piston pin through the upper piston pin bore and into the connecting rod pin bore.

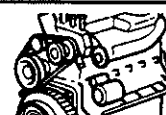
Position the Piloted Driver Tool J-21872-3, or equivalent, inside the piston pin.

Using an arbor press, press the piston pin through the connecting rod and piston bores until the pin pilot indexes with the mark on the support.

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CYLINDER BLOCK ASSEMBLY



NOTE: The piston pin requires an 8.9 kN (2 000 pounds-force) press fit. If little effort is required to install a piston pin in a connecting rod, or if the rod moves laterally on the pin, the connecting rod must be replaced.

Remove the piston and connecting rod assembly from the press. The pin should be centered in the rod ± 0.792 mm (0.0312 in.).

PISTON FITTING – MICROMETER METHOD

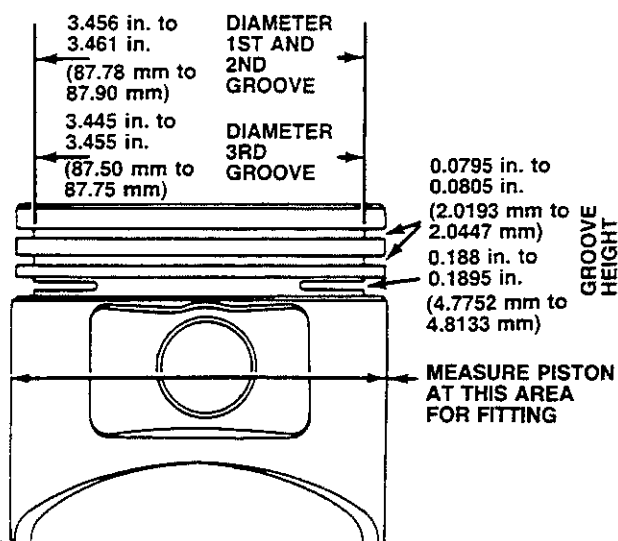
Measure the inside diameter of the cylinder bore at a point 58.725 mm (2.3125 in.) below the top of the bore.

Measure the outside diameter of the piston.

NOTE: Because pistons are cam ground, measure at a right angle to the piston pin at the centerline of the pin.

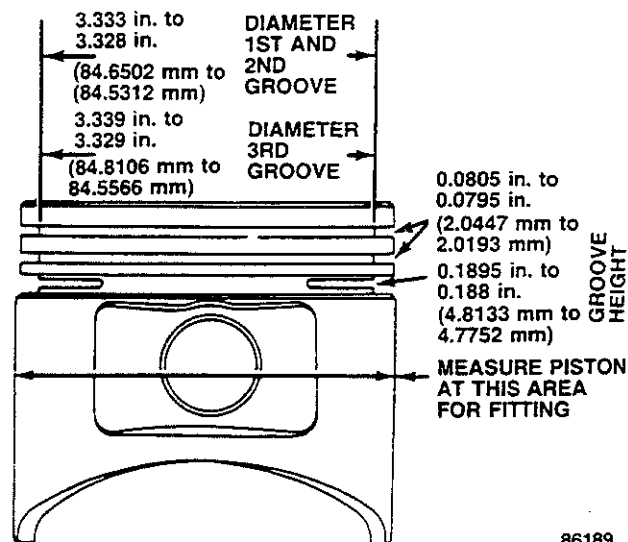
The difference between the cylinder bore diameter and the piston diameter is the piston-to-bore clearance.

4.0L



41909A

4.2L



86189

PISTON FITTING – FEELER GAUGE METHOD

Remove the rings from the piston.

Insert the long 0.025 mm (0.001 in.) feeler gauge into the cylinder bore.

Insert the piston, top first, into the cylinder bore alongside the feeler gauge.

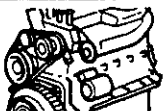
With the entire piston inserted in the cylinder bore, the piston should not bind against the feeler gauge.

Repeat these steps with a long 0.051 mm (0.002 in.) feeler gauge. The piston should bind.

If the piston binds on the 0.025 mm (0.001 in.) feeler gauge, the piston is too large or the cylinder bore is too small.

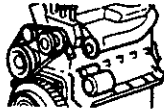
If the piston does not bind on the 0.051 mm (0.002 in.) feeler gauge, the piston is too small for the cylinder bore. The piston may be enlarged by knurling or shot-peening. Replace pistons that are at least 0.102 mm (0.004 in.) undersize.

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CYLINDER BLOCK

ASSEMBLY



PISTON RING FITTING

NOTE: The two compression rings are made of cast iron. The oil control ring is a three-piece steel design.

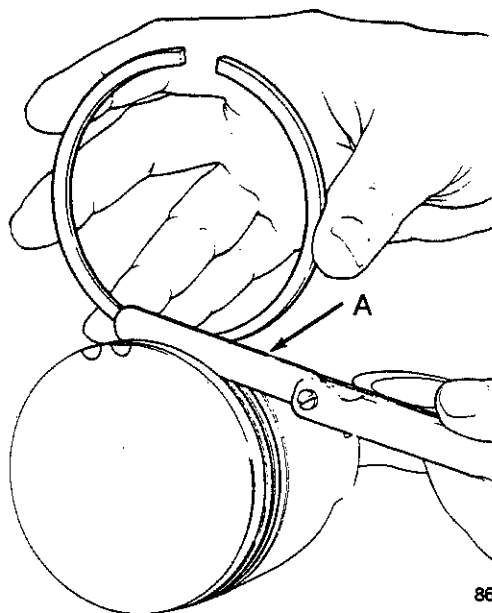
Carefully clean the carbon from all ring grooves.

The oil drain openings in the oil ring grooves and pin boss must be clear.

CAUTION: Do not remove metal from the grooves or lands. This will change the ring-to-groove clearances and will damage the ring-to-land seating.

Measure the ring side clearance with a feeler gauge (A) fitted snugly between the ring land and ring.

Rotate the ring in the groove. It must move freely around the circumference of the groove.



86190A

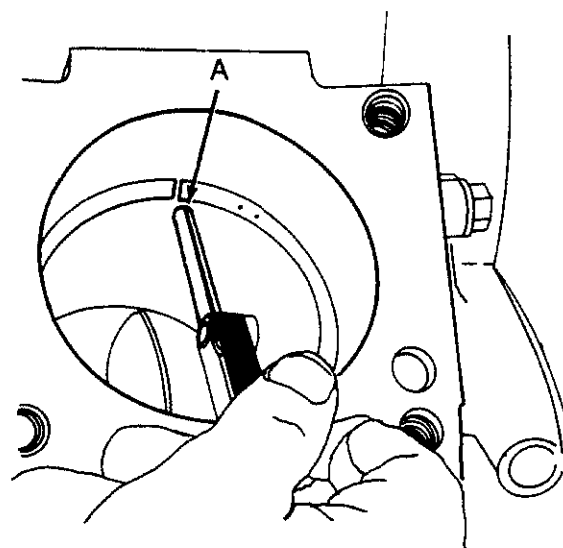
PISTON RING SIDE CLEARANCE MEASUREMENTS

	Millimeters	Inches
No. 1. Compression	0.043-0.081 (0.043 Preferred)	0.0017-0.0032 (0.0017 Preferred)
No. 2. Compression	0.043-0.081 (0.043 Preferred)	0.0017-0.0032 (0.0017 Preferred)
Oil Control	0.03-0.020 (0.08 Preferred)	0.001-0.008 (0.003 Preferred)

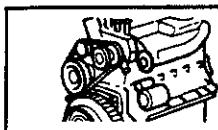
86287A

Place the ring in the cylinder bore and push down with the inverted piston to position near the lower end of the ring travel.

Measure the ring gap with a feeler gauge (A) fitting snugly between the ring ends.

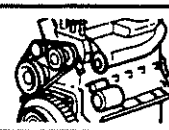


86191A



CYLINDER BLOCK

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PISTON RING INSTALLATION

Refer to the figure for the position of the ring gaps when installing the piston rings.

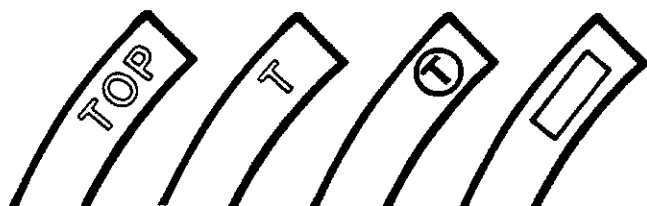
Install the oil control rings according to the instructions in the package. It is not necessary to use a tool to install the upper and lower rails.

Insert the expander ring first, and then the side rails.

Install the lower compression ring using the ring installer to expand the ring around the piston.

NOTE: Be sure that the upper and lower compression rings are installed with the markings that indicate the top side of the ring facing up.

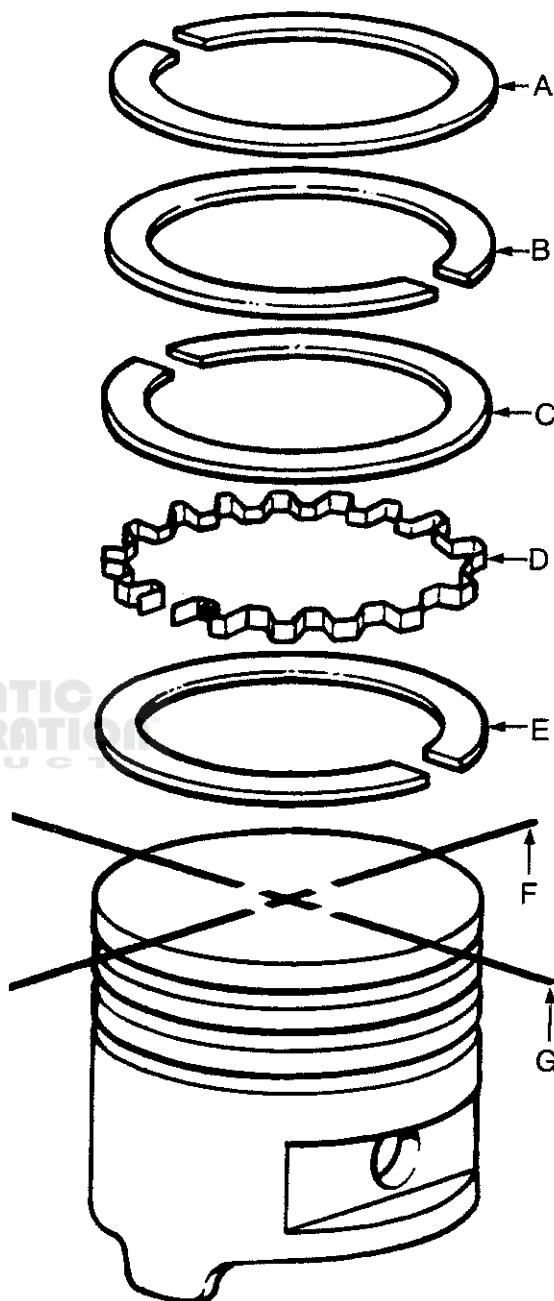
Typical piston ring markings are as follows:



86192A

NOTE: The ring gap position may vary $\pm 20^\circ$ from the position illustrated.

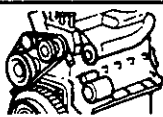
The ring gap position is as follows:

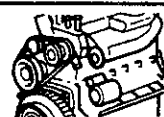


- A. Top Compression Ring
- B. Bottom Compression Ring
- C. Top Oil Control Rail
- D. Oil Rail Expander
- E. Bottom Oil Control Rail
- F. Imaginary Line Through Center of Piston Skirt
- G. Imaginary Line Parallel to Piston Pin

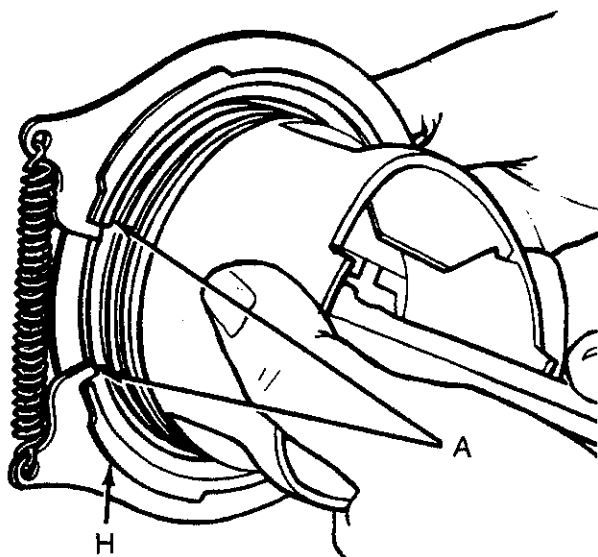
86193A

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Install the upper compression ring (A) using the ring installer to expand the ring around the piston. A ring expander (H) is recommended.



86194A

Install the crankshaft upper bearing inserts to the block assembly.

Install the lower bearing inserts into the main bearing caps.

Install the upper half of the rear main seal into the cylinder block.

Gently lower the crankshaft into the cylinder block.

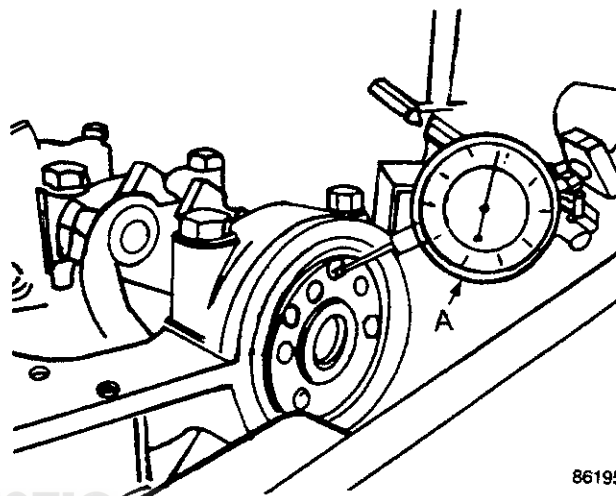
Install the lower half of the rear main oil seal into the rear main bearing cap.

Install the main bearing caps (with the new inserts) in their original positions.

Tighten the bolts to 108 N·m (80 ft-lbs) torque.

NOTE: The bearing caps are numbered front to rear.

The crankshaft end play is controlled at the No. 3 main bearing, which is flanged for this purpose.



86195

Attach a dial indicator (A) to the cylinder block adjacent to the end of the crankshaft to check end play.

Pry the shaft forward.

Position the dial indicator push rod on the face of the crankshaft.

Set the dial pointer at zero.

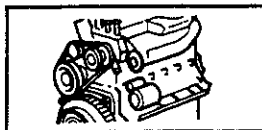
Pry the shaft fore and aft. Note the dial indicator pointer.

End play is the difference between the high and low measurements. The correct crankshaft end play is 0.038 – 0.165 mm (0.0015 – 0.0065 in.). The desired end play is 0.051 – 0.064 mm (0.002 – 0.0025 in.).

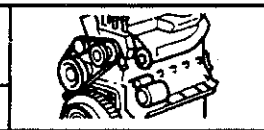
If the end play is not within specifications, inspect the crankshaft thrust faces for wear.

If no wear is apparent, replace the thrust bearing and remeasure the end play.

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If the end play is still not within specifications, replace the crankshaft.

NOTE: When replacing the thrust bearing, pry the crankshaft fore and aft to align the faces of the thrust bearing before the final tightening.

MAIN BEARING DESCRIPTION

The main crankshaft bearings are the steel-backed, micro-babbitt, two-piece precision type.

The main bearing caps, numbered (front to rear) from 1 through 7, have an arrow to indicate the forward position.

The upper main bearing inserts are grooved to provide oil channels. The lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance.

In production, the select fit is obtained by using various-sized, color-coded bearing insert pairs as listed in the **MAIN BEARING FITTING CHART**. The bearing color code appears on the edge of the insert.

NOTE: The size is not stamped on inserts used for engine production.

The main bearing journal size (diameter) is identified in production by a color-coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft, except for the rear main journal, which is on the crankshaft rear flange.

When required, the upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 in.) undersize insert to reduce the clearance by 0.013 mm (0.0005 in.).

Example:

BEARING INSERT PAIRS

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) undersize	0.051 mm (0.002 in.) undersize

86196

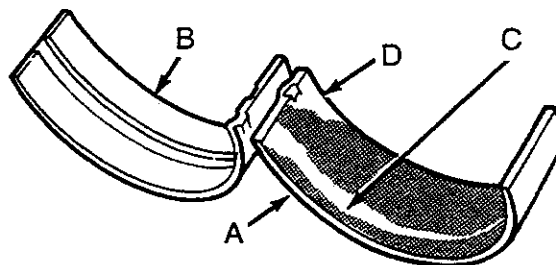
CAUTION: Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 in.) difference in size.

CAUTION: When replacing the inserts, the odd size inserts must be either all on the top (in the cylinder block) or all on the bottom (in the main bearing cap).

MAIN BEARING-TO-JOURNAL CLEARANCE MEASUREMENT

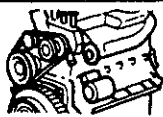
[Using Plastigage With Crankshaft Installed]

A heavier wear pattern is seen on the lower bearing (A) than on the upper bearing (B). A low area in the lower bearing lining is illustrated at (C). No wear is shown at (D).



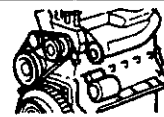
86198A

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CYLINDER BLOCK

ASSEMBLY



Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

NOTE: Do not rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate indication. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

If the specified clearance is indicated, replacement bearing fitting is not necessary. Remove the Plastigage from the crankshaft and bearing insert and proceed to installation.

If the clearance exceeds specifications, install a pair of 0.025 mm (0.001 in.) undersize bearing inserts and remeasure the clearance as described in the previous steps.

The clearance indicated with the 0.025 mm (0.001 in.) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance.

For example, if the clearance was 0.089 mm (0.0035 in.) originally, a pair of 0.025 mm (0.001 in.) undersize inserts would reduce the clearance by 0.025 mm (0.001 in.). The clearance would then be 0.063 mm (0.0025 in.) and within the specification.

A 0.051 mm (0.002 in.) undersize bearing insert and a 0.025 mm (0.001 in.) undersize insert would reduce the original clearance an additional 0.013 mm (0.005 in.) and the clearance would then be 0.051 mm (0.002 in.).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair. For example, do not use a standard size upper insert and a 0.051 mm (0.002 in.) undersize lower insert.

If the clearance exceeds the specifications using a pair of 0.051 mm (0.002 in.) undersize bearing inserts, measure the crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

If the diameter for journals 1 through 5 is less than 63.4517 mm (2.4981 in.), replace the crankshaft or grind down to accept the appropriate undersize bearing inserts.

MAIN BEARING JOURNAL DIAMETER MEASUREMENT

[Using a Micrometer With Crankshaft Removed]

Clean the main bearing journal of oil.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90 degrees apart at each end of the journal.

Compare the measured diameter with the journal diameter specification listed in the Main Bearing Fitting Chart, and select inserts required to obtain the specified bearing-to-journal clearance.

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	CYLINDER BLOCK ASSEMBLY	
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MAIN BEARING FITTING CHART

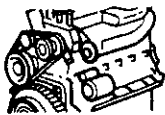
Crankshaft No. 1 Main Bearing Journal Color Code and Diameter	Cylinder Block No. 1 Main Bearing Bore Color Code and Size	Bearing Insert Color Code	
		Upper Insert Size	Lower Insert Size
Yellow – 63.5025-63.4898 mm (2.5001-2.4996 in.) (Standard)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Yellow – Standard Yellow – Standard	Yellow – Standard Black – 0.025 mm Undersize (0.001 in.)
Orange – 63.4898-63.4771 mm (2.4996-2.4991 in.) (0.0005 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Yellow – Standard Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.) Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4771-63.4644 mm (2.4991-2.4986 in.) (0.001 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.) Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	Black – 0.025 mm Undersize (0.001 in.) Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.) Green – 0.051 mm Undersize (0.002 in.)
Green – 63.4644-63.4517 mm (2.4986-2.4981 in.) (0.0015 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2485-63.2358 mm (2.4901-2.4896 in.) (0.010 Undersize)	Yellow – 68.3514-68.3641 mm (2.6910-2.6915 in.)	Red – 0.254 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

NOTE: With Green and Red Coded Crankshaft Journals, Use Yellow Coded Cylinder Block Bores Only.

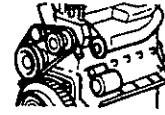
Crankshaft Main Bearing Journals 2-6 Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 63.5025-63.4898 mm (2.5001-2.4996 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 63.4898-63.4771 mm (2.4996-2.4991 in.) (0.0005 Undersize)	Yellow – Standard	Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4771-63.4644 mm (2.4991-2.4986 in.) (0.001 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.)
Green – 63.4644-63.4517 mm (2.4986-2.4981 in.) (0.0015 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2485-63.2358 mm (2.4901-2.4896 in.) (0.010 Undersize)	Red – 0.054 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

Crankshaft Main Bearing Journal 7 Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 63.4873-63.4746 mm (2.4995-2.4990 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 63.4746-63.4619 mm (2.4990-2.4985 in.) (0.0005 Undersize)	Yellow – Standard	Black – 0.025 mm Undersize (0.001 in.)
Black – 63.4619-63.4492 mm (2.4985-2.4980 in.) (0.001 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.)
Green – 63.4492-63.4365 mm (2.4980-2.4975 in.) (0.0015 Undersize)	Black – 0.025 mm Undersize (0.001 in.)	Green – 0.051 mm Undersize (0.002 in.)
Red – 63.2333-63.2206 mm (2.4895-2.4890 in.) (0.010 Undersize)	Red – 0.254 mm Undersize (0.010 in.)	Red – 0.254 mm Undersize (0.010 in.)

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CYLINDER BLOCK ASSEMBLY



REAR MAIN BEARING OIL SEAL INSTALLATION

NOTE: The crankshaft rear main bearing oil seal consists of two half pieces of neoprene with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

Remove the rear main bearing cap.

Wipe the seal surface area of the crankshaft until it is clean.

Apply a thin coat of engine oil.

Coat the lip of the seal with engine oil (A).

Position the upper seal into the cylinder block.

NOTE: The lip of the seal faces toward the front of the engine.

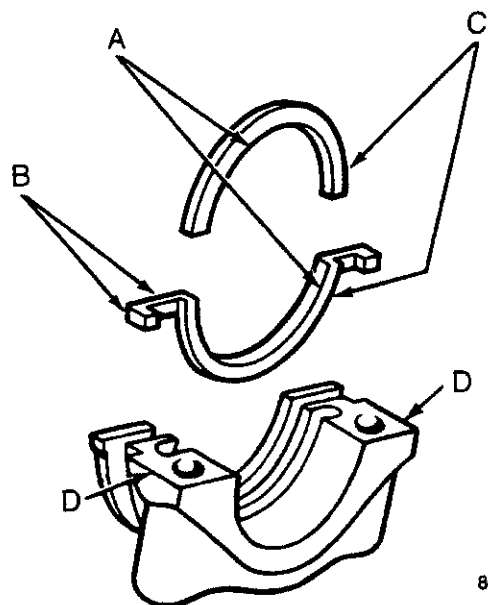
Coat both sides of the lower seal end tabs with RTV sealant (B) (AMC Gasket-in-a-Tube, or equivalent). Do not apply sealant to the lip of the seal.

Coat the outer curved surface of the lower seal with soap (C) and the lip of the seal with engine oil.

Position the lower seal into the bearing cap recess and seat it firmly.

Coat both chamfered edges of the rear main bearing cap with RTV sealant (D).

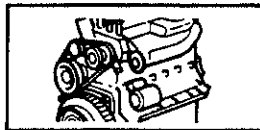
CAUTION: Do not apply sealant to the cylinder block mating surfaces of the rear main bearing cap because the bearing-to-journal clearance would be altered.



86200A

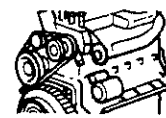
Install the rear main bearing cap.

Tighten all main bearing bolts to 108 N·m (80 ft-lbs) torque.



CYLINDER BLOCK

ASSEMBLY



CONNECTING ROD INSTALLATION

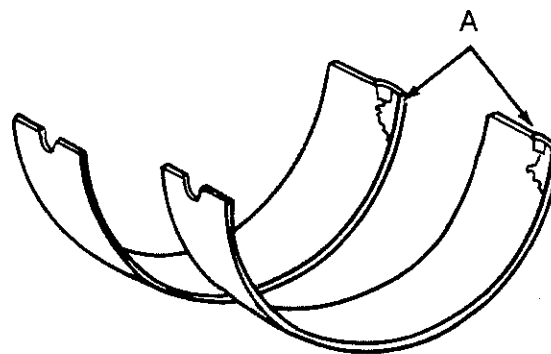
The connecting rods are made of malleable iron and are balanced assemblies with bearing inserts at the crankshaft journal end. The piston pin is 8.9 kN (2 000 pounds-force) press-fitted into the rod.

A squirt hole in the crankshaft end of the connecting rod provides lubrication for the camshaft lobes, distributor drive gear, cylinder walls and piston pins. The squirt hole faces the camshaft when the connecting rod is installed correctly.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment.

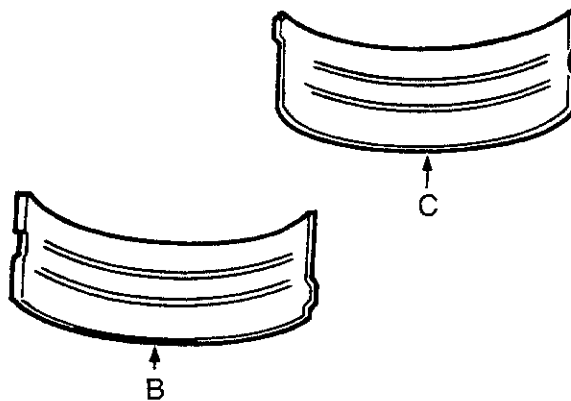
Replace misaligned or bent rods. Refer to Side Clearance Measurement.

Example of abnormal contact areas (A) caused by locking tabs that have not been fully seated or are bent:



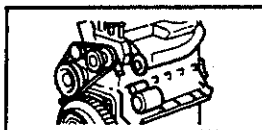
86202A

Example of scoring on the lower (B) and upper (C) bearing surfaces:

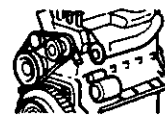


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CYLINDER BLOCK ASSEMBLY



CONNECTING ROD BEARINGS

The connecting rod bearings are two-piece, steel backed, lead-aluminum alloy units.

Each bearing insert is selectively fitted to its respective journal to obtain the specified operating clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the bearing fitting chart. The color code appears on the edge of the bearing insert.

NOTE: The size is not stamped on inserts used for the production of engines.

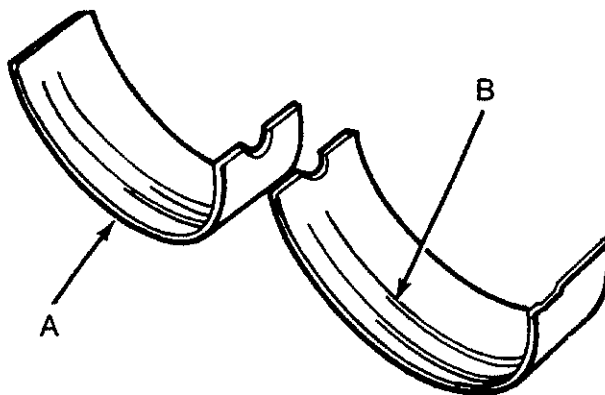
The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the bearing fitting chart.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 in.) undersize insert to reduce clearance 0.013 mm (0.005 in.).

NOTE: Do not intermix bearing caps. Each connecting rod and its bearing cap are stamped with the associated cylinder number on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

CONNECTING ROD BEARING INSPECTION

The wear pattern is always greater on the upper bearing (A). Grooves (B) may be caused by the rod bolts scratching the journal during installation.



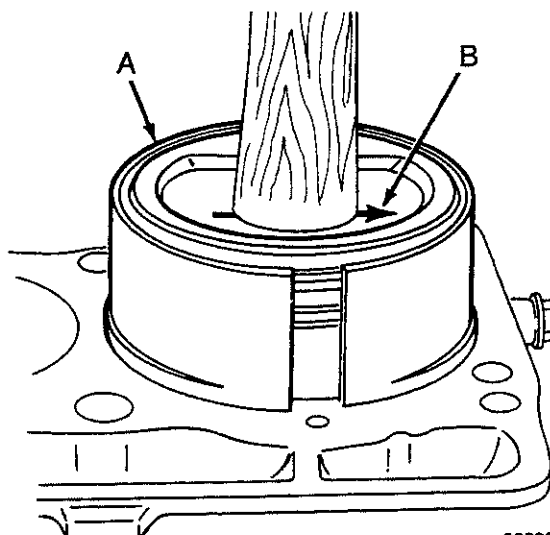
86204

CONNECTING ROD BEARING INSTALLATION

Wipe the journal clean of oil.

Lubricate the upper bearing insert and install in the connecting rod.

Use the Ring Compressor Tool J-5601 (A), or equivalent, to install the rod and piston assemblies.

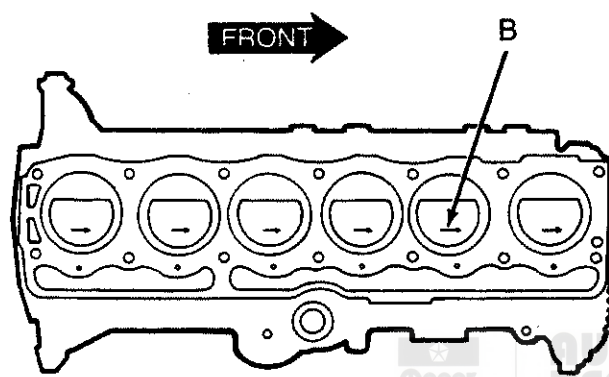


86206A

	CYLINDER BLOCK ASSEMBLY	
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Use short rubber hose sections over the rod bolts during installation.

NOTE: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine (B).



86205A

Install the lower bearing insert in the bearing cap. The lower insert must be dry.

CONNECTING ROD BEARING-TO-JOURNAL CLEARANCE MEASUREMENT [Using Plastigage]

Place a strip of Plastigage across the full width of the lower insert at the center of the bearing cap.

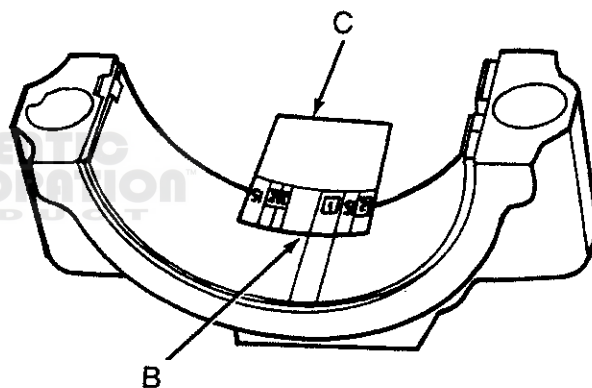
Install the bearing cap and connecting rod on the journal and tighten the nuts to 45 N·m (33 ft-lbs) torque.

NOTE: Do not rotate the crankshaft. The Plastigage will shift, resulting in an inaccurate indication.

NOTE: The Plastigage must not crumble in use. If brittle, obtain fresh stock.

Remove the bearing cap and determine the amount of bearing-to-journal clearance by measuring the width of the compressed Plastigage (B) with the scale (C) on the Plastigage envelope.

The correct clearance is 0.025 – 0.076 mm (0.001 – 0.003 in.).



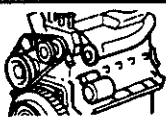
86207A

NOTE: The Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod, or foreign material trapped between the insert and cap or rod.

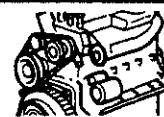
If the correct clearance is indicated, replacement bearing fitting is not necessary.

Remove the Plastigage from the crankshaft journal and bearing insert and proceed with installation.

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CYLINDER BLOCK ASSEMBLY



If bearing-to-journal clearance exceeds the specification, install a pair of 0.025 mm (0.001 in.) undersize bearing inserts and measure the clearance as described in the previous steps.

The clearance measured with a pair of 0.025 mm (0.001 in.) undersize bearing inserts will determine if two 0.025 mm (0.001 in.) undersize inserts or another combination is needed to provide the correct clearance.

For example, if the initial clearance was 0.076 mm (0.003 in.), 0.025 mm (0.001 in.) undersize inserts would reduce the clearance by 0.025 mm (0.001 in.). The clearance would be 0.051 mm (0.002 in.), and within specification. A 0.051 mm (0.002 in.) undersize insert and a 0.025 mm (0.001 in.) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 in.). The clearance would then be 0.038 mm (0.0015 in.).

SIDE CLEARANCE MEASUREMENT

Slide a snug-fitting feeler gauge between the connecting rod and the crankshaft journal flange.

The correct clearance is 0.254 – 0.482 mm (0.010 – 0.019 in.).

Replace the connecting rod if the side clearance is not within specifications.

NOTE: Never use a pair of bearing inserts with more than a 0.025 mm (0.001 in.) difference in size.

Example:

BEARING INSERT PAIRS

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) undersize	0.051 mm (0.002 in.) undersize

86224

When replacing bearing inserts, all the odd size inserts must be on the bottom.

The sizes of the service replacement bearing inserts are stamped on back of the inserts.

Repeat the Plastigage measurement to verify bearing selection prior to final assembly.

Once the proper insert has been selected, install the insert and cap and tighten the screws to 45 N·m (33 ft-lbs) torque.

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CONNECTING ROD BEARING FITTING CHART

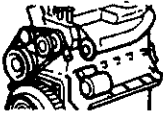
Connecting Rod Bearing Journal Color Code and Diameter (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow – 53.2257 - 53.2079 mm (2.0955 - 2.0948 in.) (Standard)	Yellow – Standard	Yellow – Standard
Orange – 53.2079 - 53.1901 mm (2.0948 - 2.0941 in.) (0.0007 Undersize)	Yellow – Standard	Black – 0.025 mm (0.001 in.) Undersize
Black – 53.1901 - 53.1723 mm (2.0941 - 2.0943 in.) (0.0014 Undersize)	Black – 0.025 mm (0.001 in.) Undersize	Black – 0.025 mm (0.001 in.) Undersize
Red – 53.9717 - 53.9539 mm (2.0855 - 2.0848 in.) (0.010 Undersize)	Red – 0.254 mm (0.010 in.) Undersize	Red – 0.245 mm (0.010 in.) Undersize

86208

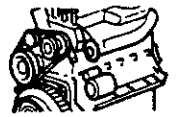


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CYLINDER BLOCK ASSEMBLY



OIL PUMP ASSEMBLY

NOTE: Two relief valve plunger sizes (standard and oversize) are available. When replacing the valve, assure that the correct replacement valve, standard size or 0.254 mm (0.010 in.) oversize plunger diameter, is obtained and installed.

Install the oil pressure relief valve plunger.

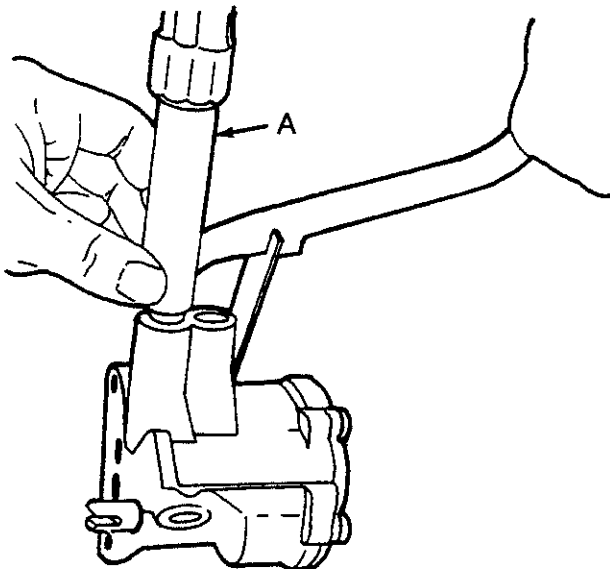
Install the spring.

Install the retainer.

Install the cotter pin.

If the position of the inlet tube in the pump body has been disturbed, install a replacement inlet tube and strainer assembly. Apply a light film of Permatex No. 2 sealant, or equivalent, around the end of the tube.

Use the Oil Pump Inlet Tube Installer Tool J-21882 (A), to drive the tube into the body. Ensure that the support bracket is properly aligned.



86184A

Install the idler gear.

Install the drive gear assembly.

NOTE: To ensure self-priming of the oil pump, fill the pump with petroleum jelly before installing the oil pump cover. Do not use grease.

Apply a bead of Loctite 515, or equivalent, and install the pump cover.

Tighten the cover screws to 8 N·m (70 in-lbs) torque.

NOTE: Inspect the gears to ensure that a binding condition does not exist before installing the oil pump.

OIL PUMP INSTALLATION

Install the oil pump with a new gasket.

Tighten the short bolts to 14 N·m (10 ft-lbs) torque.

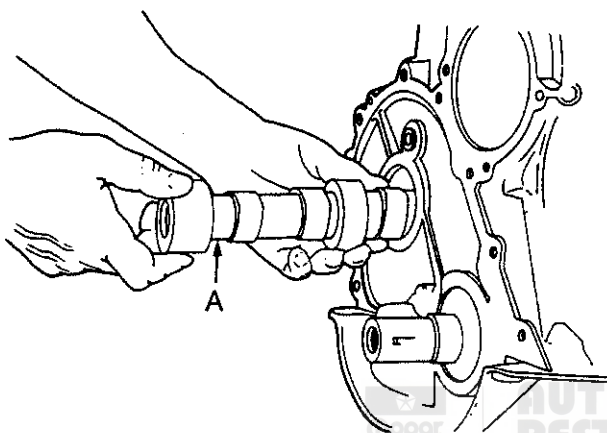
Tighten the long bolts to 23 N·m (17 ft-lbs) torque.

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	CYLINDER BLOCK ASSEMBLY	
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CAMSHAFT BEARING DESCRIPTION

The camshaft (A) rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed.



86209A

The camshaft bearing bores are step-bored (larger at the front bearing than at the rear) to permit easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated.

NOTE: It is not advisable to attempt to replace the camshaft bearings unless special removal and installation tools are available.

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear.

The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face. Camshaft end play is zero during engine operation.

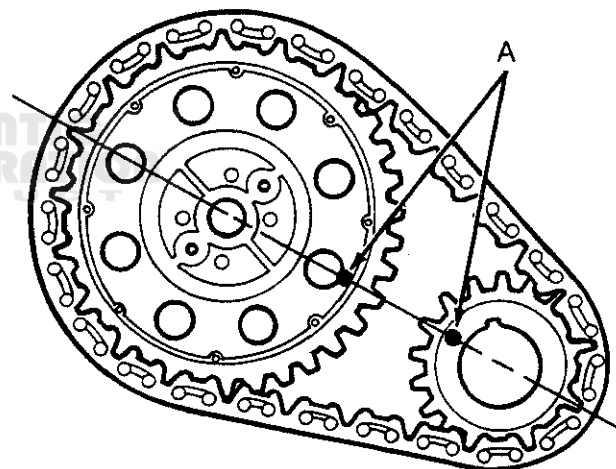
CAMSHAFT INSTALLATION

Lubricate the camshaft with AMC/Jeep Engine Oil Supplement, or equivalent, prior to installing the camshaft.

Install the camshaft sprockets.

Install the timing chain.

NOTE: Be sure the timing marks (A) on the sprockets are properly aligned.

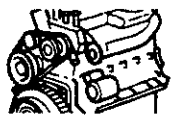


86210A

Install the camshaft sprocket retaining bolt and washer and tighten the bolt to 108 N·m (80 ft-lbs) torque.

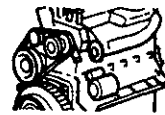
NOTE: To verify the correct installation of the timing chain, turn the crankshaft to locate the camshaft sprocket timing mark at approximately the one o'clock position. This positions the crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the three o'clock position.

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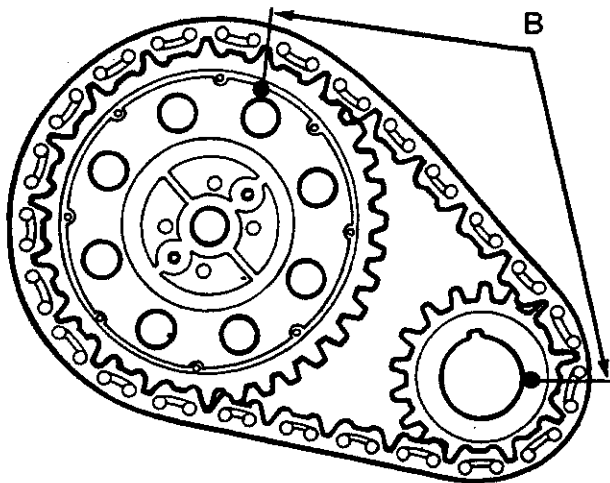
CYLINDER BLOCK

ASSEMBLY



Count the number of chain pins between the timing marks of both sprockets. There must be 15 pins (B).

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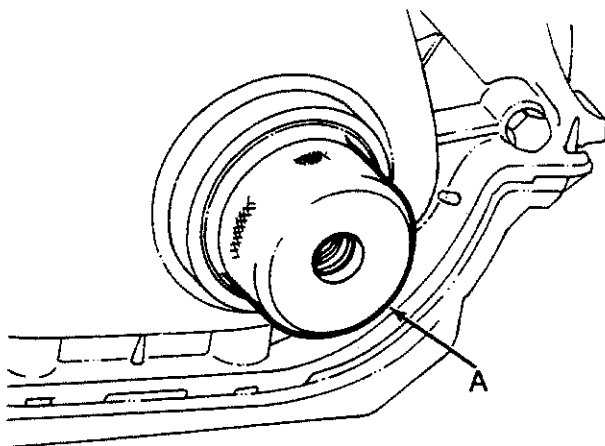


86211A

TIMING CASE COVER INSTALLATION

Install the oil slinger.

Install the timing case cover and gasket. Use Timing Case Cover Alignment and Seal Installer Tool J-22248 (A), or equivalent, for cover alignment.



86212

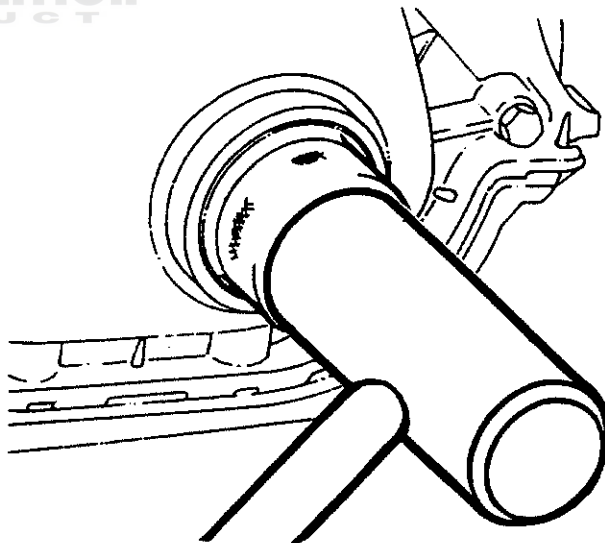
Tighten the cover bolts to 7 N·m (5 ft-lbs) torque, and the oil pan-to-cover bolts to 13 N·m (11 ft-lbs) torque.

Apply Perfect Seal, or equivalent, to the outside diameter of the timing cover seal.

Install the seal into position.

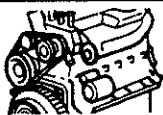
NOTE: The seal can be installed by gently tapping on Timing Case Cover Alignment and Seal Installer Tool J-22248 (A), or equivalent, with a plastic or rubber mallet until the tool comes into contact with the cover.

Apply a light film of engine oil to the seal lip on the inside diameter of the timing cover seal.

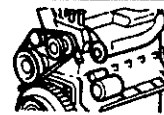


86212A

Remove the tool.



CYLINDER BLOCK ASSEMBLY



OIL PAN INSTALLATION

NOTE: Inspect to be sure that the oil pan and engine block gasket mating surfaces are thoroughly clean and free of debris.

Install the front oil pan seal (A) to the timing case cover.

Install the rear oil pan seal (G) to the rear main bearing cap.

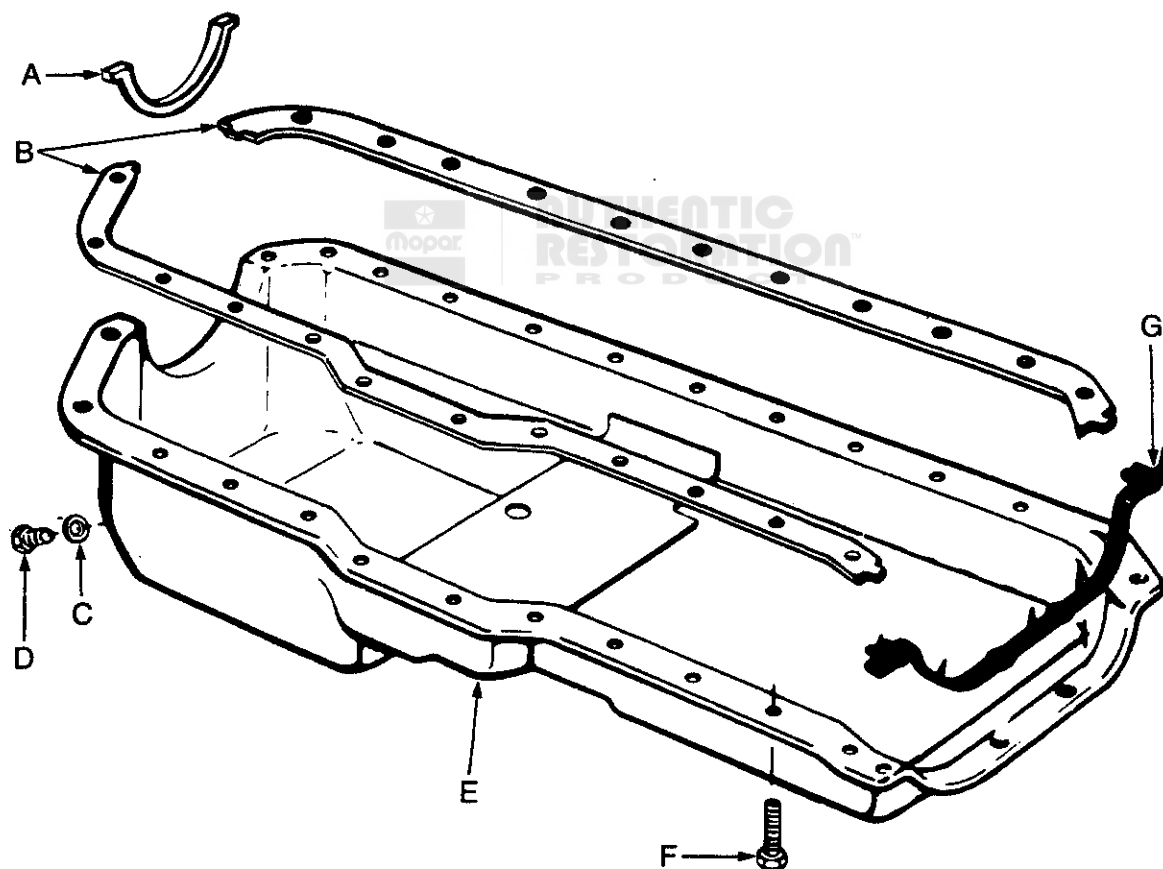
Install the oil pan side gaskets (B) in position on the engine block.

Apply a generous amount of AMC Gasket-in-a-Tube, or equivalent to the side gasket contacting surface of the seal end tabs.

Install the oil pan (E).

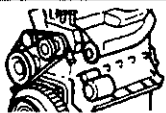
Tighten the oil pan bolts (F) to 9 N·m (7 ft-lbs) torque.

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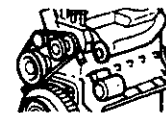


- A. Oil Pan-To-Bearing Cap Seal
- B. Oil Pan Gasket Set
- C. Oil Pan Drain Plug Gasket
- D. Oil Pan Drain Plug

- E. Oil Pan
- F. Bolt(s)
- G. Oil Pan Timing Case Cover Seal



CYLINDER BLOCK ASSEMBLY



WATER PUMP INSTALLATION

Install the water pump and gasket.

Tighten the bolts to 18 N·m (13 ft-lbs) torque.

Install the oil filter to the engine.

FUEL PUMP INSTALLATION

Install the fuel pump and gasket.

Tighten the bolts to 22 N·m (16 ft-lbs) torque.

VIBRATION DAMPER INSTALLATION

Align the key slot on the vibration damper with the crankshaft key and tap the damper onto the crankshaft.

Install the vibration damper retaining bolt and washer.

Tighten the bolt to 108 N·m (80 ft-lbs) torque.

Install the damper pulley and retaining bolts.

Tighten the bolts to 27 N·m (20 ft-lbs) torque.

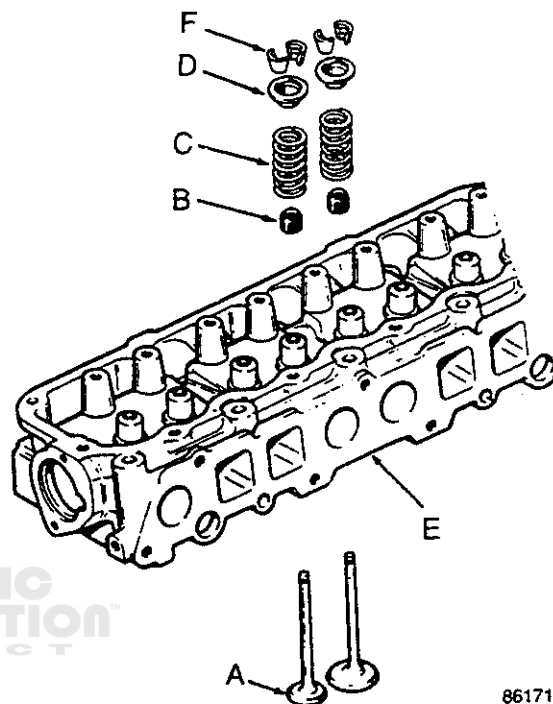
VALVE INSTALLATION

Thoroughly clean the valve stems and the valve guide bores.

Lubricate the stem lightly.

Install the valve (A) in the original valve guide bore from where it was removed.

Install the replacement valve stem oil deflector (B) on the valve stem.



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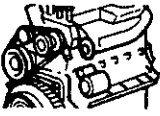
NOTE: If the oversize valve stems are used, oversize oil deflectors are required.

Position the valve spring (C) and retainer (D) on the cylinder head (E) and compress the valve spring with the Valve Spring Compressor Tool J-8062, or equivalent.

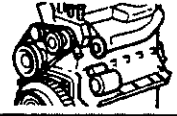
Install the valve locks (6) and release the tool.

Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the cylinder head.

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CYLINDER HEAD ASSEMBLY



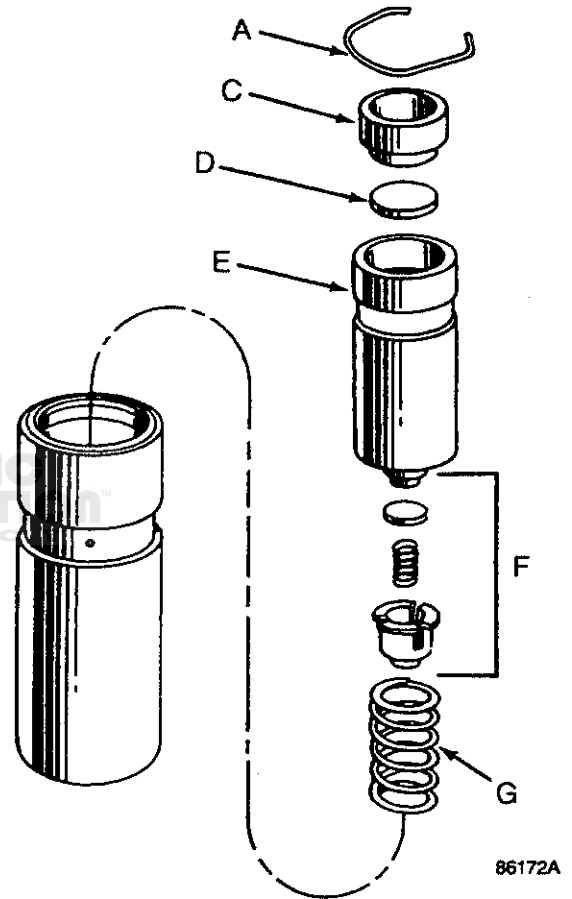
HYDRAULIC VALVE TAPPET ASSEMBLY

Install the following components in the tappet body:

- Plunger return spring (G)
- Check valve assembly (F)
- Plunger (E)
- Metering valve (D)
- Plunger cap (C)

Compress the plunger assembly by exerting force on the plunger cap with the push rod.

Install the snap ring (A).



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HYDRAULIC VALVE TAPPET LEAK-DOWN TEST

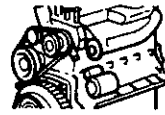
After cleaning, inspection and assembly, test each tappet for the specified leak-down rate tolerance to ensure zero-lash operation.

NOTE: A timing device is required to test the leak-down rate.

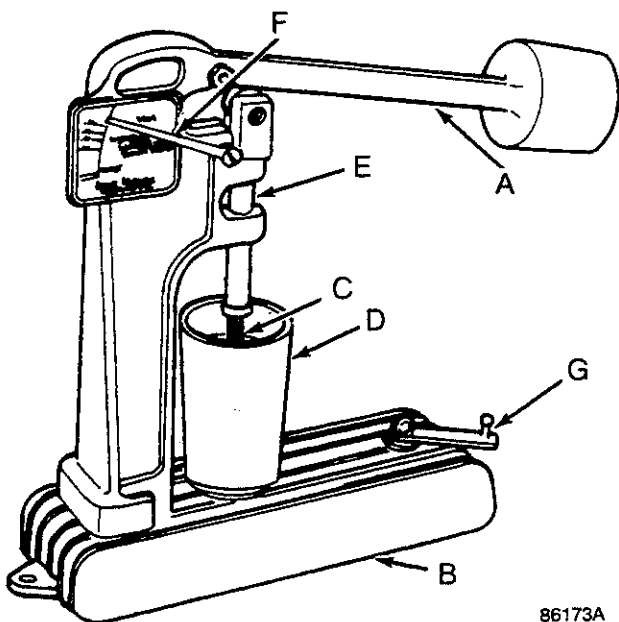


CYLINDER HEAD

ASSEMBLY



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NOTES



Swing the weighted arm (A) of the Hydraulic Valve Tappet Tester Tool J-5790 (B), or equivalent, away from the ram of the tester.

Place a 7.925 - 7.950 mm (0.312 - 0.313 in.) diameter ball bearing on the plunger cap of the tappet.

Lift the ram (C) and position the tappet (with the ball bearing) inside the tester cup (D).

Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. Do not tighten the hex nut on the ram.

Fill the tester cup with Hydraulic Valve Tappet Test Oil J-5268, or equivalent, until the tappet is completely submerged.

Swing the weighted arm onto the push rod (E).

Pump the tappet plunger up and down to remove air.

When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

Adjust the nose of the ram to align the pointer (F) with the SET mark on the scale of the tester and tighten the hex nut.

Slowly swing the weighted arm onto the push rod.

Rotate the cup by turning the handle (G) at the base of the tester clockwise one revolution every two seconds.

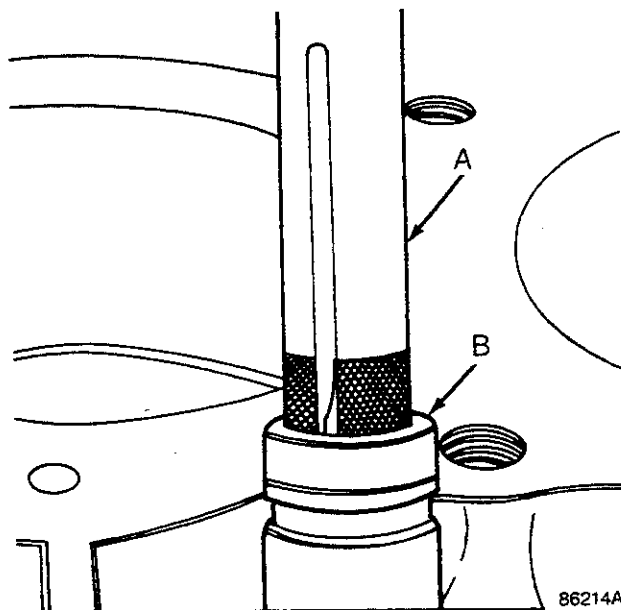
Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark.

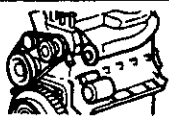
A normally functioning tappet will require 20 - 110 seconds to leak-down. Discard the tappets with leak-down time intervals which are not within this specification.

HYDRAULIC VALVE TAPPET INSTALLATION

Dip each tappet assembly in AMC Engine Oil Supplement, or equivalent.

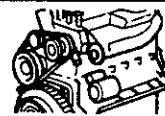
Use Hydraulic Valve Tappet Removal/Installation Tool J-21884 (A), or equivalent, to install each tappet (B) in the original bore.





CYLINDER HEAD

ASSEMBLY



CYLINDER HEAD INSTALLATION

Apply an even coat of Perfect Seal compound, or equivalent, to both sides of the new head gasket.

Install the head gasket with the work "top" up.

Install the cylinder head.

Tighten the cylinder head bolts to 115 N·m (85 ft-lbs) torque following the proper tightening sequence.

NOTE: Coat the threads of the stud bolt in the number 11 sequence position with Loctite 592 sealer, or equivalent, and tighten to 102 N·m (75 ft-lbs) torque.

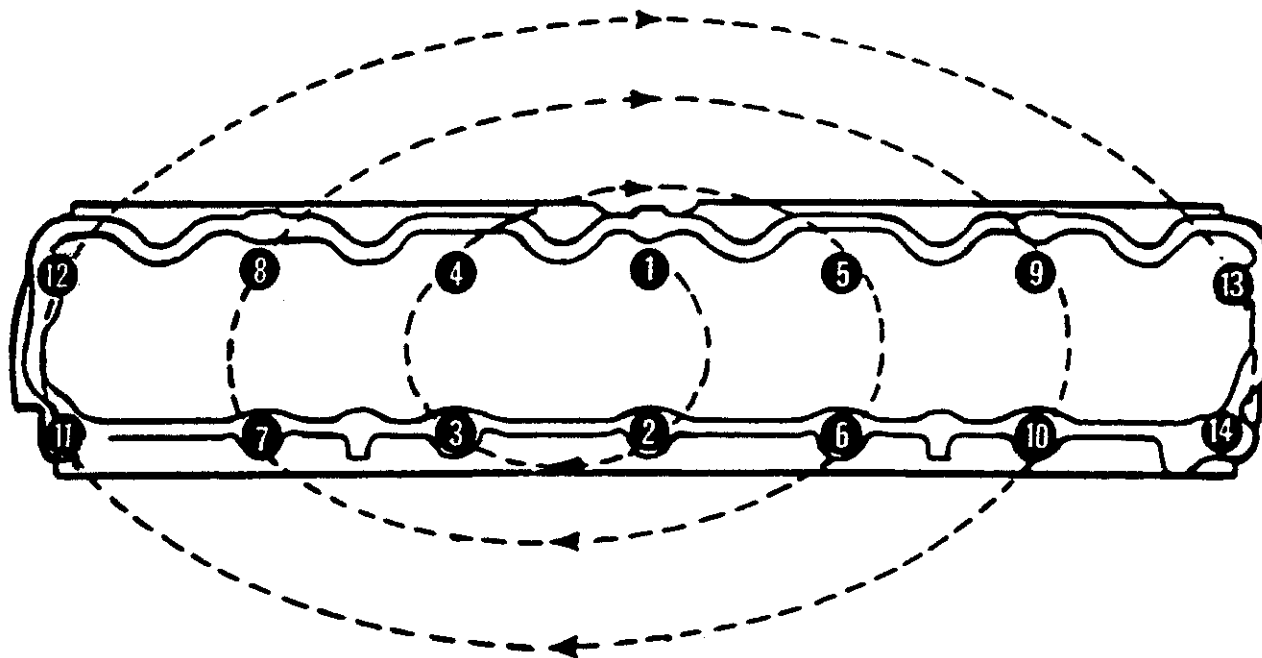
Install the spark plugs.

Tighten to 38 N·m (28 ft-lbs) torque.

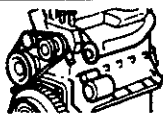
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Cylinder Head Bolt Tightening Sequence

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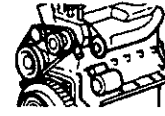


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CYLINDER HEAD

ASSEMBLY



Install the push rods (A) in the original holes.

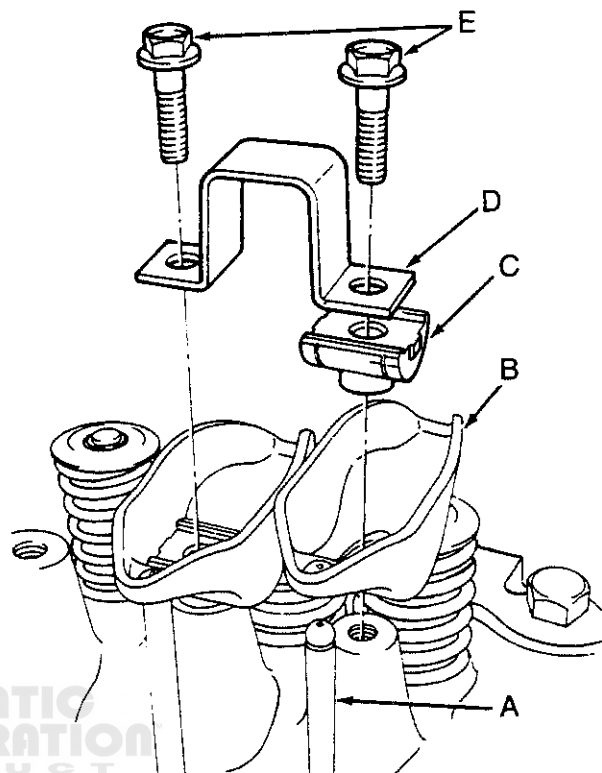
Be sure the bottom end of each push rod is centered in the tappet plunger cap seat.

Install the rocker arms (B), pivots (C) and bridge (D) above each cylinder from where they were originally removed.

Loosely install the capscrews (E) through each bridge.

At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge.

Tighten to 26 N·m (19 ft-lbs) torque.

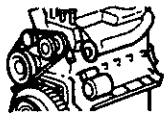


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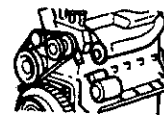


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NOTES



CYLINDER HEAD ASSEMBLY



CYLINDER HEAD COVER INSTALLATION

A room temperature, vulcanizing (RTV) silicone rubber sealant is required for this procedure. Use AMC Gasket-in-a-Tube, or equivalent.

Remove the sealant (or gasket and adhesive) from the sealing surface area of the cylinder head and cover.

Thoroughly clean the sealing surface of the cylinder head and cover.

Apply a 3 mm (.125 in.) bead of RTV sealant along the entire length of the cylinder head sealing surface.

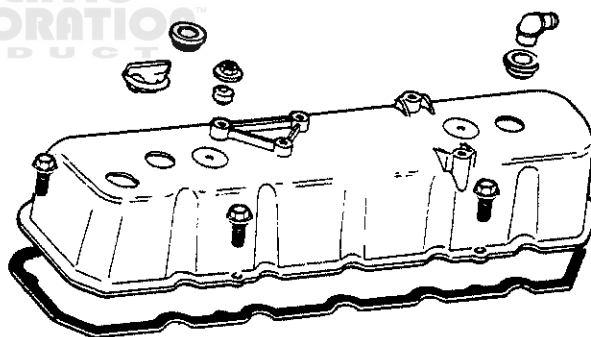
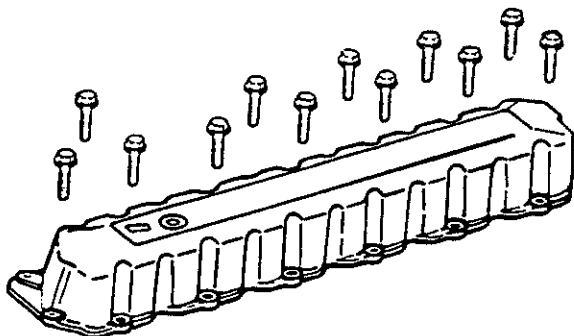
Before the sealant begins to cure, install the cover on the cylinder head. Do not allow the sealant to come into contact with the rocker arms or other valve assembly components.

Install the cylinder head cover retaining nuts and tighten the nuts to 3.2 N·m (28 in-lbs) torque.

NOTE: Some 1986 4.2L and all 4.0L engines utilize a valve cover that has a pre-cured sealer on the cover. Install the valve cover onto the cylinder head and torque retaining bolts to 50 - 70 in-lbs.

4.2L

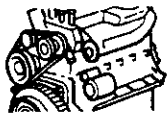
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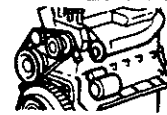
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CYLINDER HEAD

ASSEMBLY



INTAKE MANIFOLD INSTALLATION

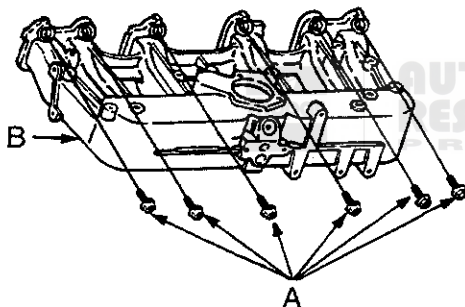
Attach a new intake manifold gasket (C).

Install the intake manifold (B).

Tighten the intake and exhaust manifold bolts in proper sequence to 31 N·m (23 ft-lbs) torque.

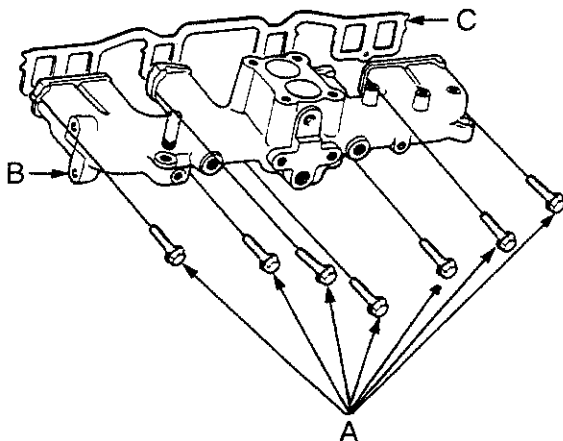
Connect EGR tube.

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4.2L

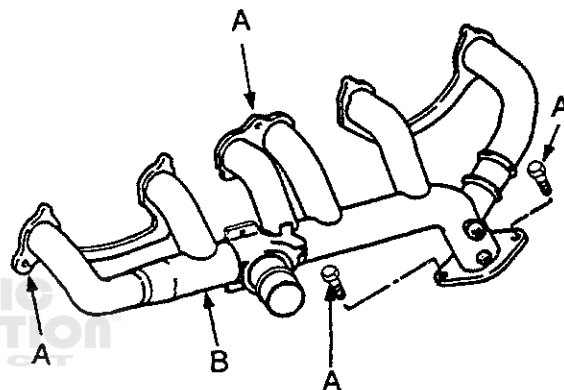


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EXHAUST MANIFOLD INSTALLATION

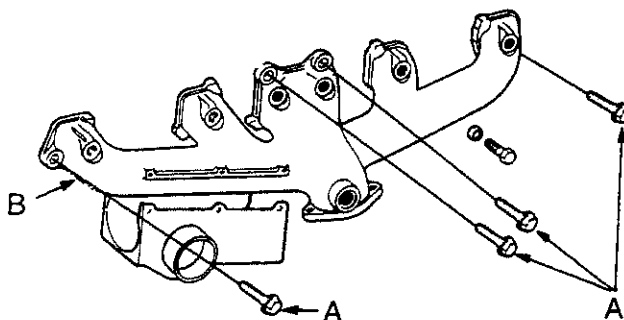
Install the exhaust manifold (A) and finger-tighten the center retaining bolts (B).

4.0L



101935D

4.2L



101935C

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Component Service Manual

THROTTLE BODY FUEL INJECTION (TBI) SYSTEMS

Application

Alliance, Encore, GTA

**Wagoneer/Cherokee
Comanche/Wrangler/YJ**

AUGUST, 1986

U.S.A./Canada Edition

8980 010 380

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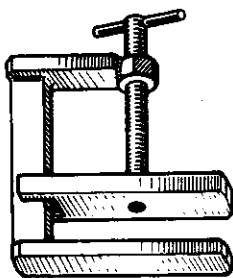
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION

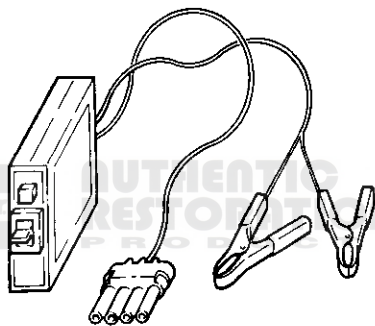


SPECIAL TOOLS

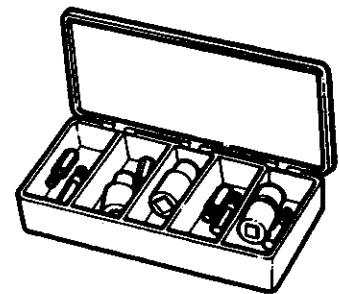
Tool Ref.	Description
Ele. A.B.99	Idle Speed Actuator Exercisor Tool
J-23738-A	Hand Vacuum Pump
J-25359-C	Torx Bit and Socket Set
J-26701-A	Choke Angle Gauge
J-34730-1	Port Fuel Injection Test Kit
MOT. 453.01	Hose Clamp
MS. 1700	Diagnostic Tester



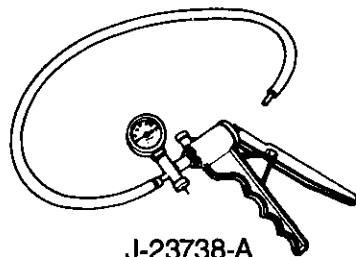
MOT. 453.01



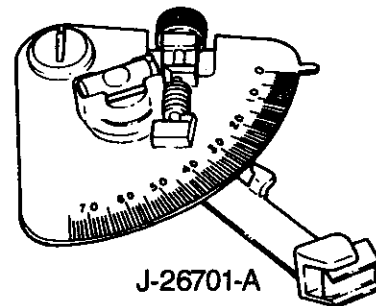
Ele. A.B.99



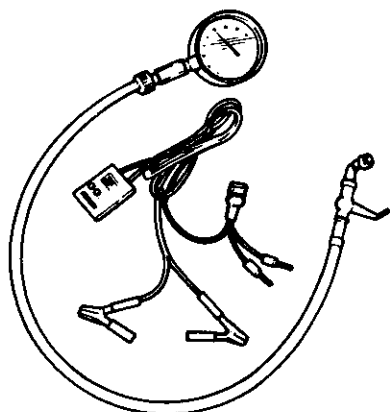
J-25359-C



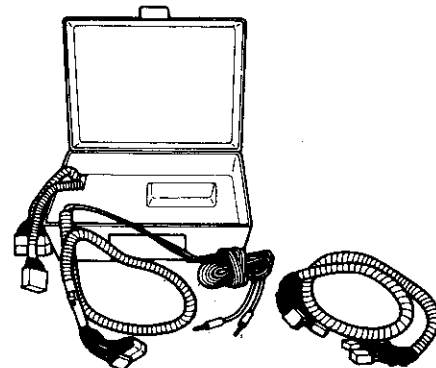
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J-26701-A



J-34730-1



MS. 1700

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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



DESCRIPTION

Throttle Body Fuel Injection (TBI) System is a single-point injection system that injects fuel into the throttle body from above the throttle plate.

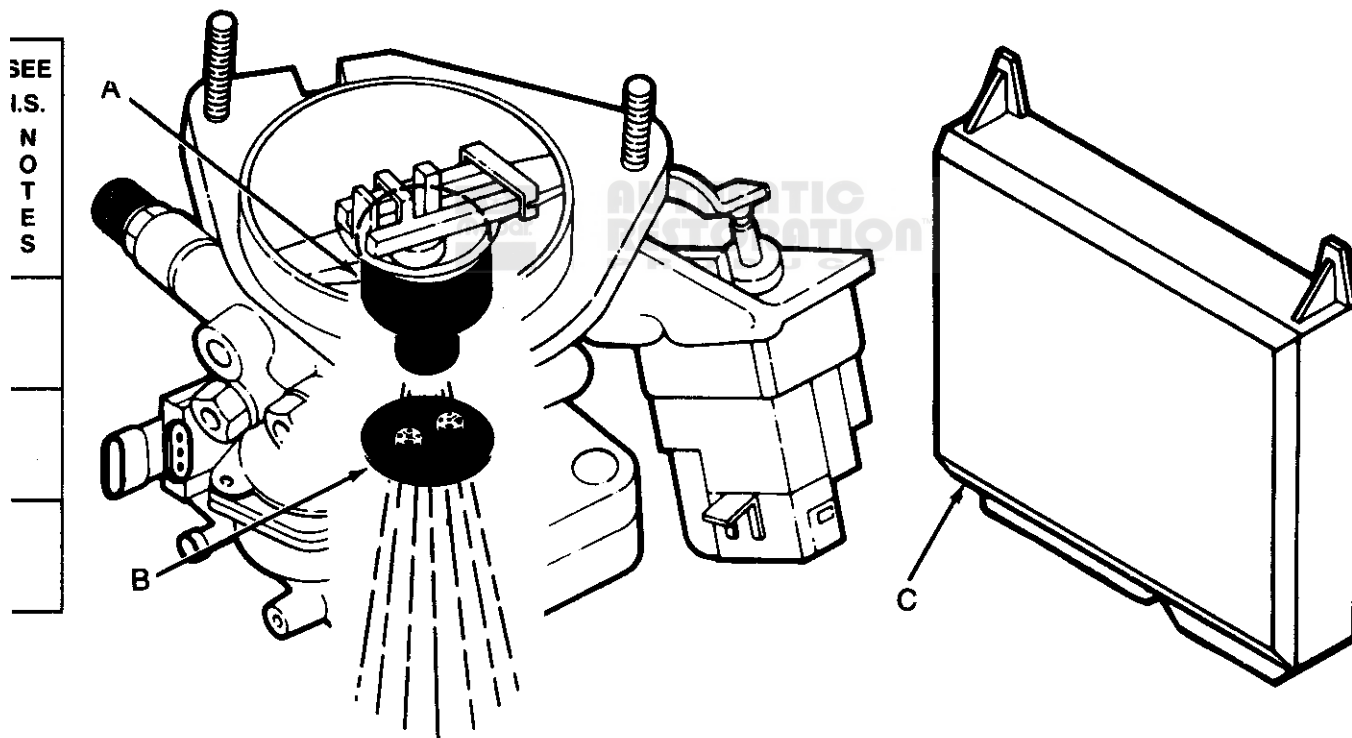
The injector, located within the throttle body, is controlled by the electronic control unit (ECU).

The ECU is a sealed microprocessor that receives inputs from several sensors and other engine associated equipment.

The inputs represent the engine's instantaneous operating conditions.

Based on the inputs, the ECU generates outputs that change the air/fuel mixture ratio and ignition timing as necessary to optimize the performance of the engine.

The ECU also has controlling functions involving fuel delivery, idle speed, emission control, the up-shift indicator lamp (manual transmission) and the A/C compressor clutch.



- A. Injector
- B. Throttle Plate
- C. Electronic Control Unit (ECU)



THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



FUEL DELIVERY SYSTEM

This system is comprised of the following components:

- an electric fuel pump (in tank)
- a fuel filter
- a fuel pressure regulator
- a fuel injector
- a ballast resistor (1983-1986 Renault)

Electric Fuel Pump

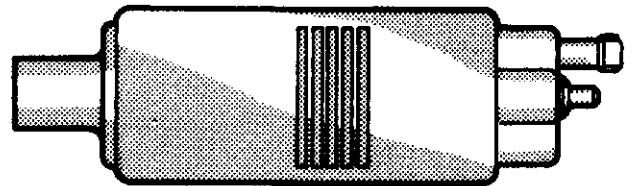


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The purpose of the fuel pump is to deliver and maintain the fuel at standard operating pressure.

The pump is located inside the fuel tank and is attached to the fuel gauge sending unit assembly.

The pump is controlled by the ECU.

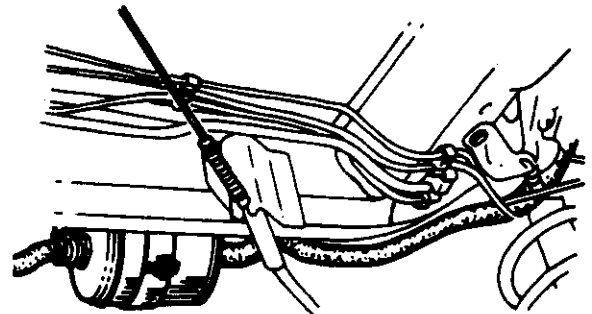


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Fuel Filter

Renault

The fuel system is protected by a replaceable in-line, full-flow fuel filter located under the right rear floor pan.



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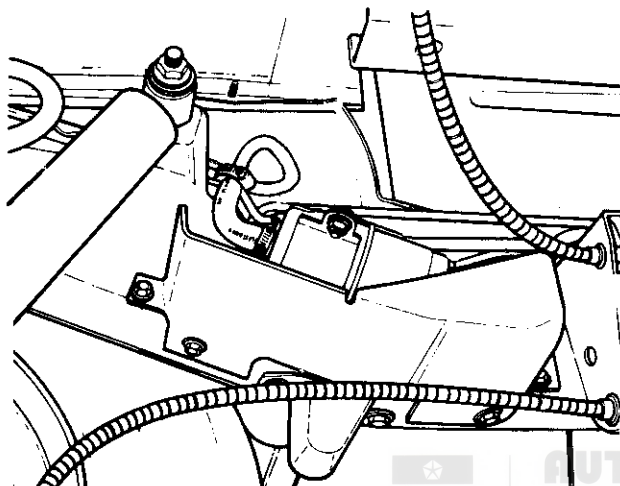
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Jeep

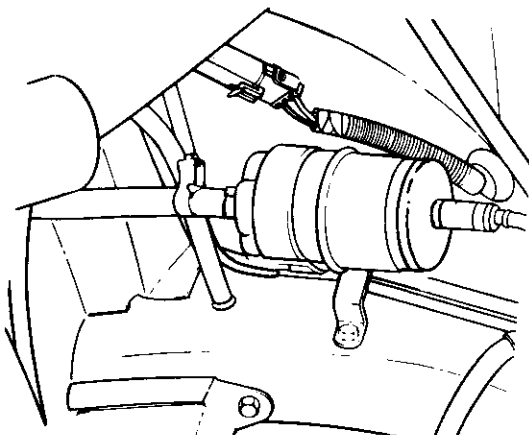
The fuel filter is located on the left inner frame sill toward the rear of the vehicle.



Jeep Wrangler/YJ

100457A

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WAGONEER/CHEROKEE/COMANCHE

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Fuel Pressure Regulator

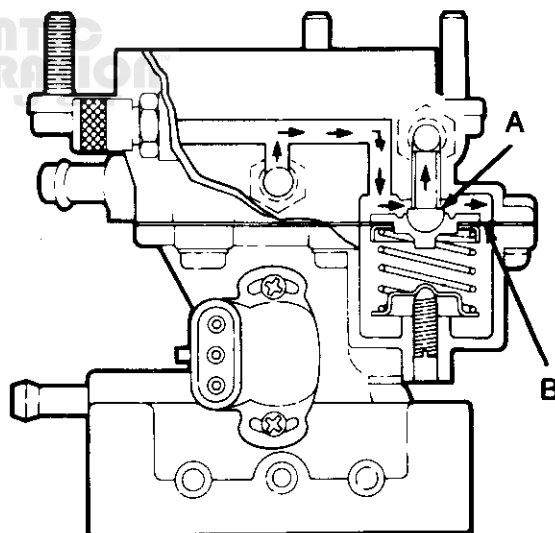
The fuel pressure regulator (overflow type) is integral with the throttle body.

The pressure regulator has a spring chamber that is vented to the same pressure as the tip of the injector.

Because the differential pressure between the injector nozzle and the spring chamber is the same, the volume of fuel injected is dependent only on the length of time the injector is energized.

The fuel pump delivers fuel in excess of the maximum required by the engine and the excess fuel flows back to the fuel tank from the pressure regulator via the fuel return hose.

The fuel pressure regulator is not controlled by the ECU.



A . Relief Valve

B . Diaphragm

87038

Fuel Injector

The injector body (A) contains a solenoid (B) with a plunger (or core piece) that is pulled upward by the solenoid armature, which allows the spring loaded ball valve (C) to move from the valve seat (D).



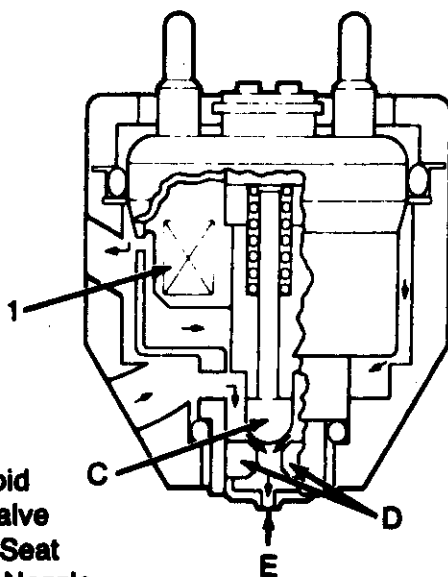
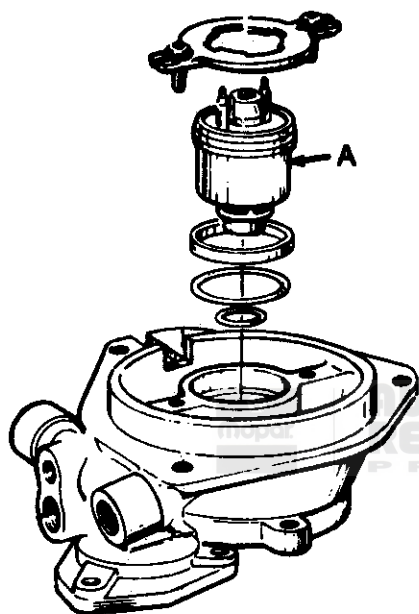
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



This allows fuel to pass through to the atomizer/spray nozzle (E).

During engine operation, the fuel injector is energized by the ECU and functions to meter and direct atomized fuel into the throttle bore from above the throttle plate.



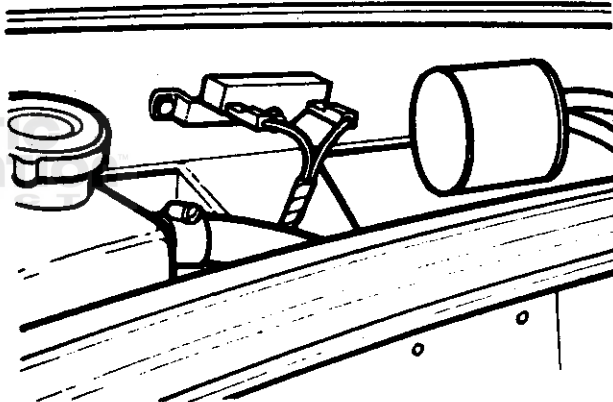
- B. Solenoid
- C. Ball Valve
- D. Valve Seat
- E. Spray Nozzle

BALLAST RESISTOR (1983-1986 Renault)

The ballast resistor is attached to the right side of the plenum chamber.

The purpose of the resistor is to reduce the fuel pump speed after the engine is started-up (ignition switch returned to the ON position).

The resistor is bypassed when the ignition switch is in the START position.



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THROTTLE BODY FUEL INJECTION SYSTEM

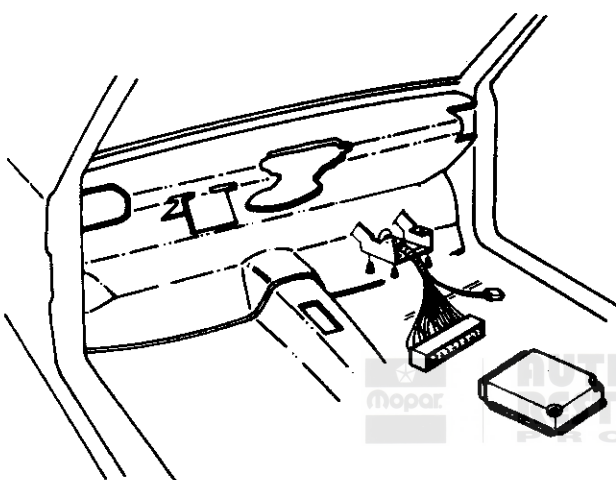
GENERAL INFORMATION



FUEL CONTROL SYSTEM

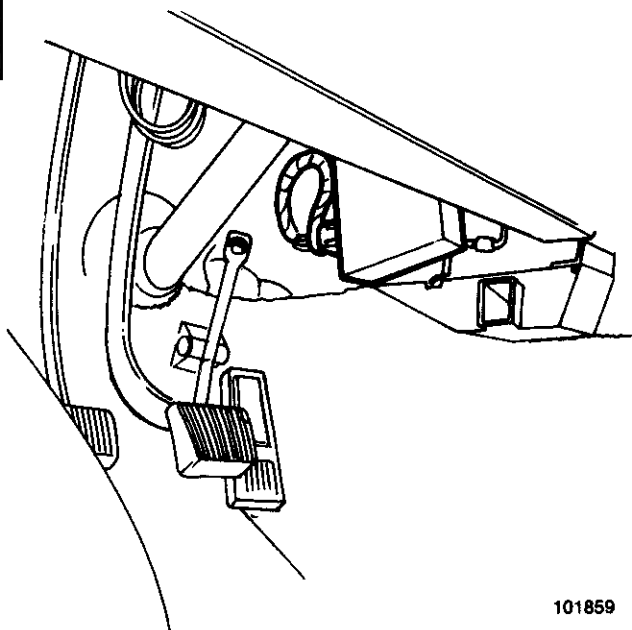
Electronic Control Unit (ECU)

On Renault models the ECU is located below the glove box and adjacent to the fuse panel.



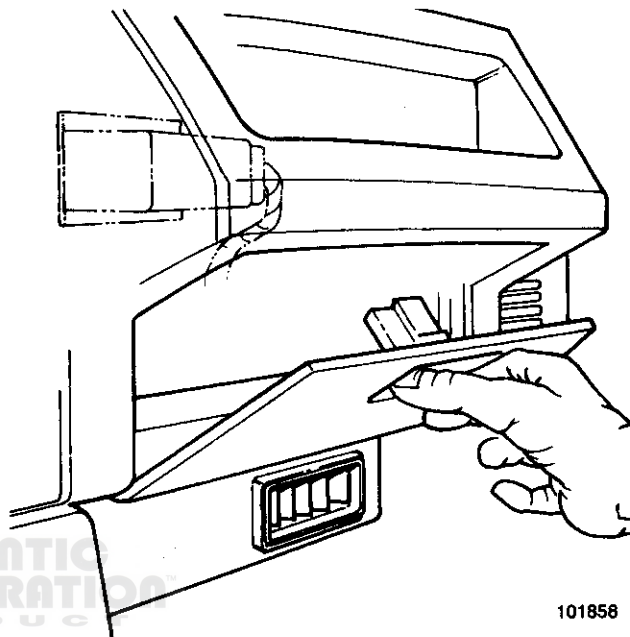
83042A

On Wagoneer/Cherokee/Comanche models the ECU is located to the right of the steering column under the instrument panel.



101859

On Wrangler/YJ models the ECU is located behind the glove box.



101858

The ECU controls the injector injection time and changes the air/fuel mixture ratio according to inputs received from sensors that react to exhaust gas oxygen, manifold air/fuel temperature, coolant temperature, manifold absolute pressure, and also the crankshaft and throttle positions.

ECU Inputs

- manifold absolute pressure (MAP) sensor
- coolant temperature sensor (CTS)
- manifold air/fuel temperature (MAT) sensor
- knock sensor (1.7L/2.0L engines)
- oxygen (O₂) sensor

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I.S.
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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



- battery voltage
- speed sensor
- starter motor relay
- closed throttle (idle) switch
- wide-open-throttle (WOT) switch
- A/C select switch
- A/C temperature control
- transmission gear position indicator (automatic transmission)
- throttle position sensor (TPS) (2.46L/2.0L)
- power steering switch (2.46L)

Manifold Absolute Pressure (MAP) Sensor

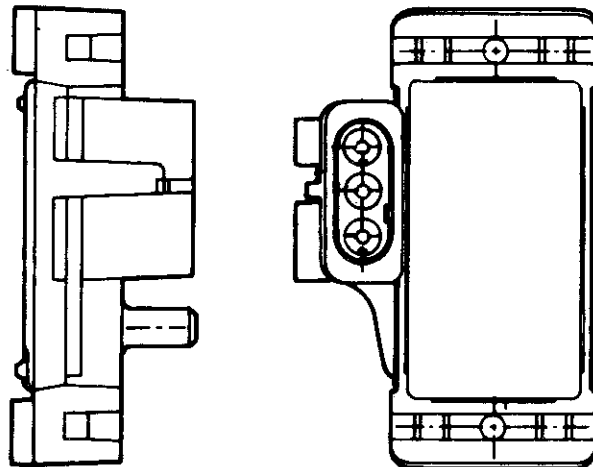
On Renault models the MAP sensor is attached to the plenum chamber near the hood latch.

On Jeep models the sensor is mounted on the dash panel above the engine.

The MAP sensor reacts to absolute pressure in the intake manifold and provides an input voltage to the ECU.

Manifold pressure is used to supply mixture density information and ambient barometric pressure information to the ECU.

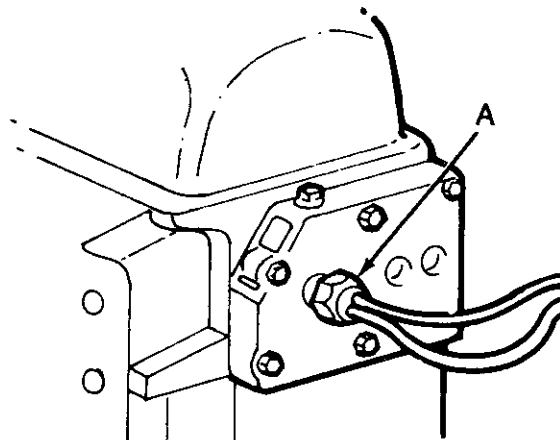
A tube from the throttle body provides the sensor input pressure.



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Coolant Temperature Sensor (CTS) 1983-1985 1.4L

The coolant temperature sensor (A) is installed in the engine coolant jacket. This sensor provides an analog voltage for the ECU. The ECU will enrich the fuel mixture delivered by the injector as long as the engine is cold.



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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



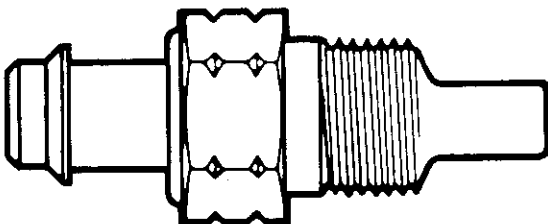
Coolant Temperature Sensor (CTS) 1985 1.7L

The coolant temperature sensor (CTS) is located in the intake manifold coolant jacket.

The CTS provides an engine coolant temperature input to the ECU which will cause the ECU to:

- enrich the air/fuel mixture delivered by the injector when the engine coolant is cold
- compensate for fuel condensation in the intake manifold
- control engine warm-up idle speed
- increase the ignition advance when the coolant is cold
- inhibit the EGR system when the coolant is cold

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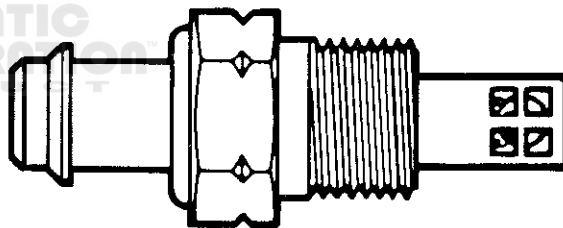
87044

Manifold Air/Fuel Temperature (MAT) Sensor 1985 1.7L

The manifold air/fuel temperature (MAT) sensor is located in the intake manifold.

This sensor reacts to the temperature of the air/fuel mixture in the intake manifold and provides an input to the ECU.

The ECU compensates for air density changes during high temperature operation.



87045

Intake Manifold Temperature (MT) Sensor 1986-1987 1.4L

A new design intake manifold temperature sensor is used with the 1986-1987 Alliance/Encore 1.4L engine TBI system. The sensor (A) does not come into contact with engine coolant. Instead, it measures temperature of the intake manifold outer surface.

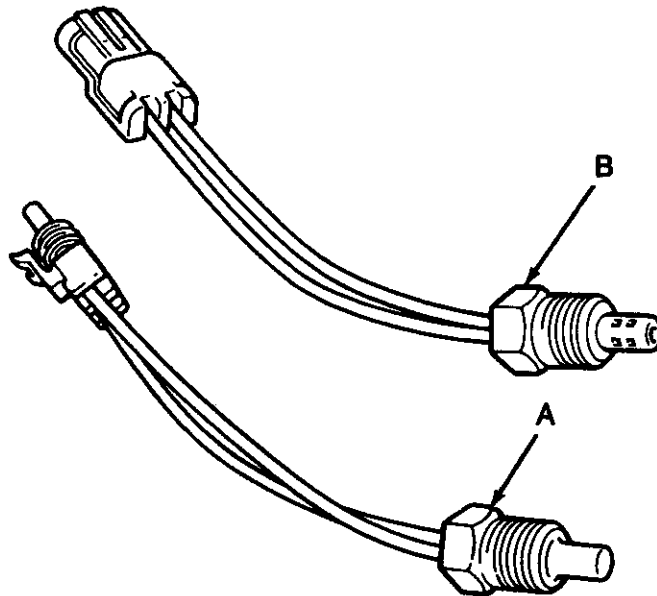


THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



The sensor is located on the intake manifold.



100615

Coolant Temperature Sensor (CTS) and Air/Fuel Temperature (MAT) Sensor

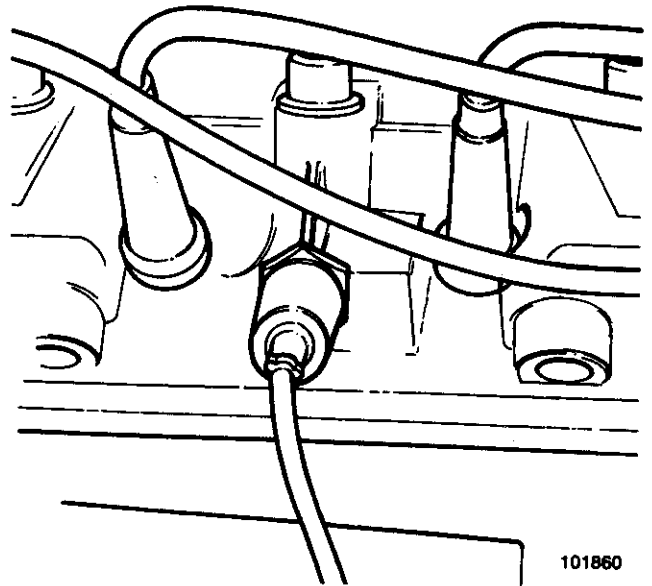
A new CTS (A) and a new MAT sensor (B) are used with 1986-1987 Jeep Wagoneer/Cherokee/Comanche and Alliance/Encore 1.7L TBI systems. The new sensors have an integral wire harness, a smaller diameter boss, and different calibration for use with the 1986-1987 system.

Knock Sensor 1985-1987 1.7L/1987 2.0L

The knock sensor is located in the cylinder head.

This sensor provides an input to the ECU that indicates detonation (knock) during engine operation.

When detonation (knock) occurs, the ECU retards the ignition advance to eliminate the detonation at the applicable cylinder(s).



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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Oxygen (O₂) Sensor 1.4L/1.7L

The oxygen sensor (O₂) is located in the exhaust pipe.

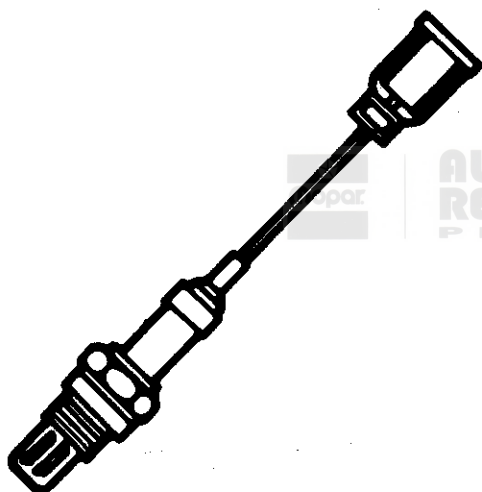
The voltage output from this sensor, which varies with the oxygen content in the exhaust gas, is supplied to the ECU.

The ECU utilizes it as a reference voltage to vary the air/fuel mixture ratio.

Maintaining correct sensor temperature at all times, allows the system to enter closed loop operation sooner, and to remain in closed loop operation during periods of extended idle.

Electrical feed to the oxygen sensor is through the ignition switch.

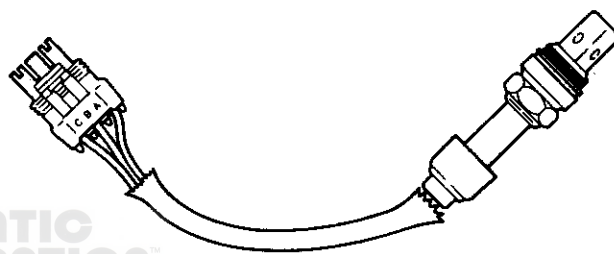
SEE
I.S.
NOTES



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Oxygen Sensor 2.0L/2.46L

A unique oxygen sensor is used on 1986-1987 Renault 2.0L and Jeep Wagoneer/Cherokee/Comanche 2.46L engines. The sensor is equipped with a heating element that keeps the sensor at proper operating temperature during all operating modes.



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Battery Voltage

The battery voltage input to the ECU is used to ensure that the proper voltage is applied to the injector.

The ECU varies the voltage applied to the injector to compensate for battery voltage fluctuations.



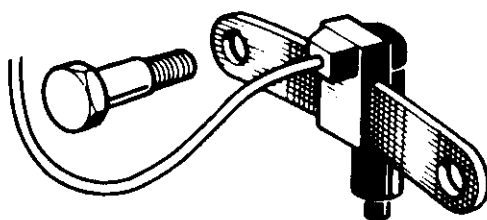
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Speed Sensor

The speed sensor is attached to the flywheel/drive plate housing.



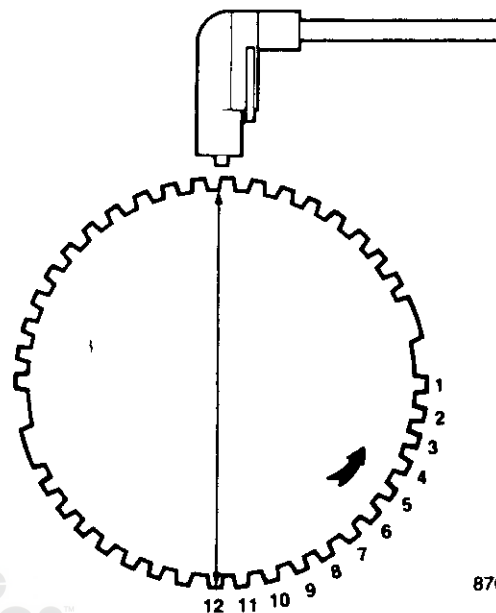
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RESTORATION
PRODUCT

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The sensor detects the flywheel/drive plate teeth as they pass during engine operation and provides engine speed and crankshaft angle information to the ECU.

The flywheel/drive plate has a large trigger tooth and notch located 90 degrees before each top dead center (TDC) position.

There are 12 small teeth between the notch and TDC.



When a small tooth and notch pass the magnet core in the sensor, the concentration and then collapse of the magnetic flux induces a small voltage (spike) into the sensor pick-up coil winding.

These small voltage spikes enable the ECU to count the teeth as they pass the sensor.



THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



When a large trigger tooth and notch pass the magnet core in the sensor, the increased concentration and then collapse of the magnetic flux induces a higher voltage (spike) into the sensor pick-up coil winding.

The ignition timing for the cylinder is either advanced or retarded as necessary by the ECU according to the sensor inputs.

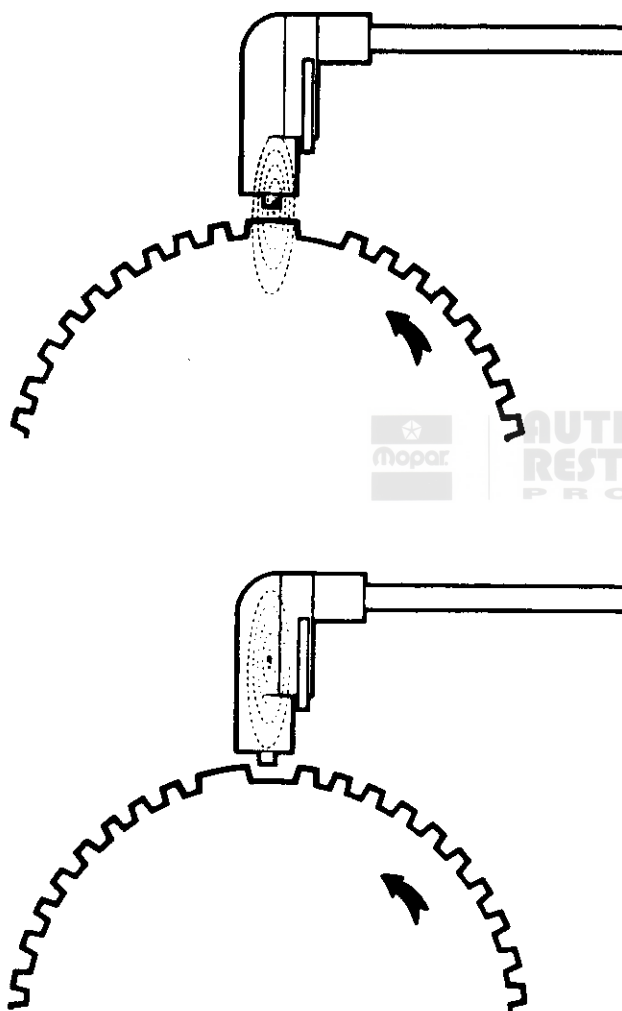
Starter Motor Relay

The starter motor relay provides an input to the ECU that indicates the starter motor is engaged.

Closed Throttle (Idle) Switch

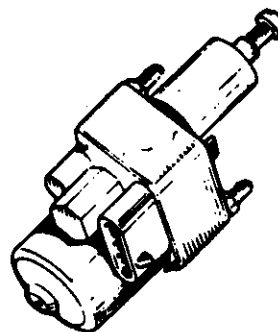
The closed throttle switch is integral with the idle speed actuator (ISA) motor and provides an input to the ECU that will enable it to either increase or decrease the throttle stop angle in response to engine operating conditions.

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The higher voltage (spike) indicates to the ECU that a piston will be at the TDC position 12 teeth later.



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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION

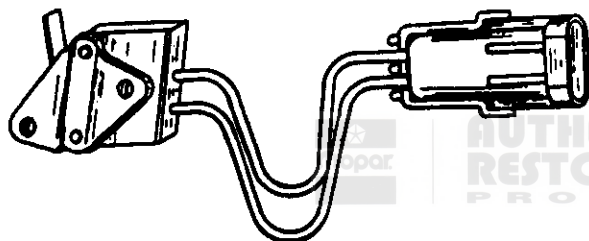


Wide-Open-Throttle (WOT) Switch

The WOT switch is attached to the side of the throttle body.

The switch provides an input to the ECU that indicates a wide-open-throttle condition exists.

The ECU, in turn, enriches the air/fuel mixture.



87051

A/C Controls

The A/C inputs indicate to the ECU that the A/C switch is in the ON position and when the compressor clutch must be engaged to lower the temperature.

The ECU changes the engine idle speed according to the A/C compressor operation.

Transmission Gear Position Indicator (Automatic Transmission)

This device provides an input to the ECU that indicates the automatic transaxle is in a driving mode and not in Park or Neutral. Refer to the T.A. M... for testing and replacement information.

Power Steering Pressure Switch 2.46L Engine

A pressure sensing switch is included in the power steering system used on 1986-1987 Jeep Wagoneer/Cherokee/Comanche with a 2.46L engine. The switch increases the idle speed during periods of high pump load and low engine RPM; such as during parking maneuvers.

Input signals from the pressure switch to the ECU are routed through the A/C request and A/C select input circuits. When pump pressure exceeds $1896 \text{ kPa} \pm 172 \text{ kPa}$ ($275 \pm 25 \text{ PSI}$), the switch contacts close transmitting an input signal to the ECU. The ECU raises engine idle speed immediately after receiving the pressure switch input signal.

Throttle Position Potentiometer 1.4L/1.7L Automatic Transmission

The throttle position potentiometer is a simple potentiometer which provides variable voltage based on throttle position.

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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION

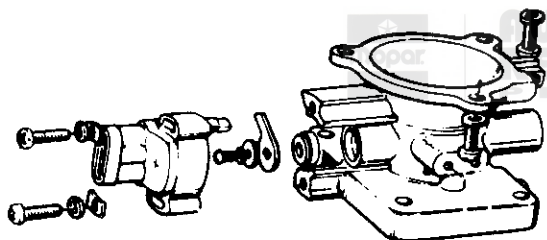


Throttle Position Sensor (TPS) 2.0L/2.46L

At minimum throttle opening (idle speed), a signal input of approximately 1 volt is transmitted to the ECU. As throttle opening increases, signal input voltage increases to a maximum of approximately 5 volts at higher throttle openings.

The throttle position sensor is mounted on the throttle body assembly. The sensor provides the ECU with an input signal of up to 5 volts to indicate throttle position.

SEE
I.S.
NOTES



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ECU Outputs

The following components are controlled by the ECU:

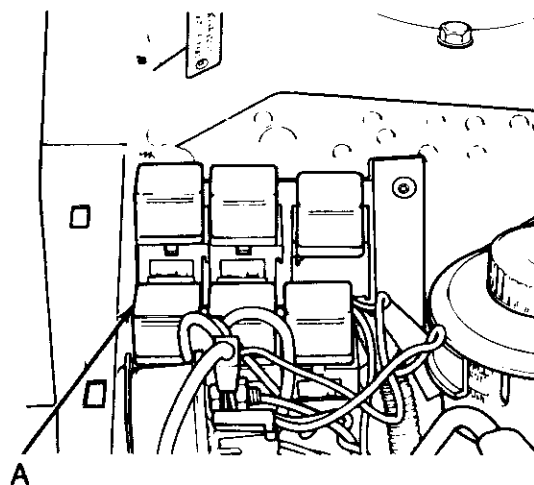
- system power relay
- fuel pump control relay
- A/C compressor clutch relay

- idle speed actuator (ISA) motor
- ignition power module
- ignition control module (ICM) 1983-1985 1.4L
- load swap relay (2.46L)
- fuel injector
- exhaust gas recirculation (EGR) valve/canister purge solenoid
- up-shift indicator lamp (manual transmission)
- cold start relay (1.7L engines)

System Power Relay

The system power relay (A) is located on the right inner fender panel.

Renault



1985-1987 RENAULT

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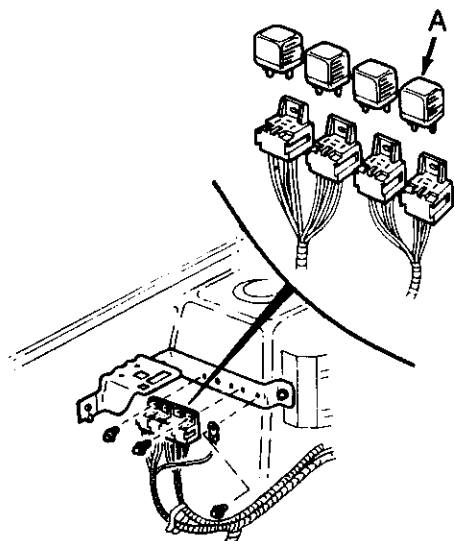


THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Renault

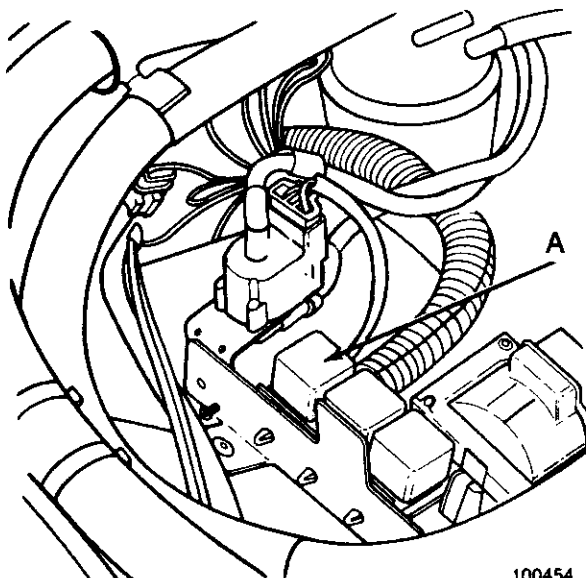


1983-1985 1.4L

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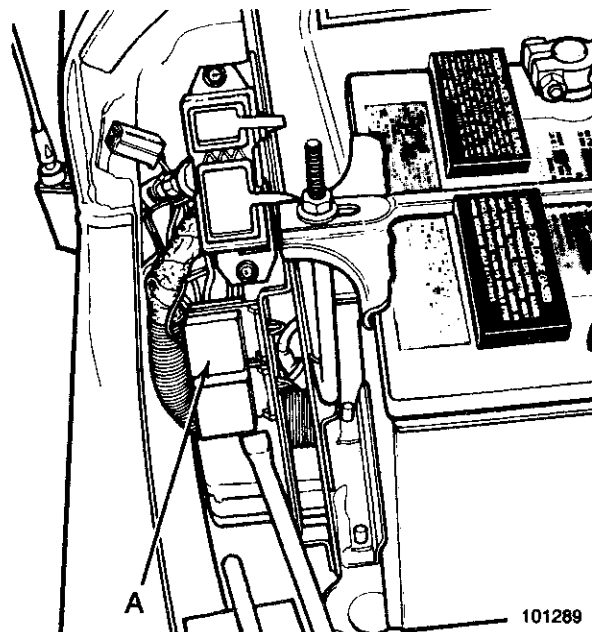


Wagoneer/Cherokee/Comanche



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Jeep



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JEEP WRANGLER/YJ

This relay is initially energized during engine start-up and remains energized until 3 to 5 seconds after the engine is stopped.

This enables the ECU to extend the idle speed actuator (ISA) for the next start-up and then cease operation.

Fuel Pump Control Relay

The fuel pump control relay (B) is located on the front of the right strut tower.

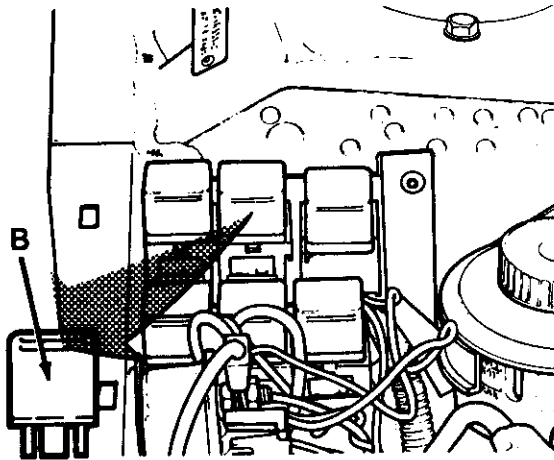


THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Renault



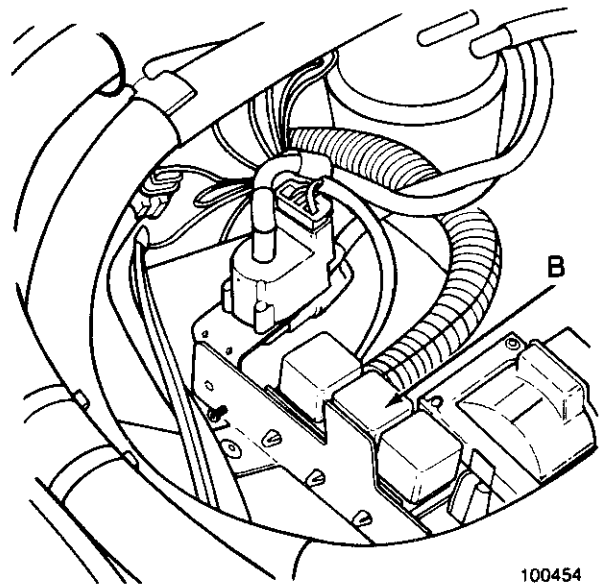
1985-1987 RENAULT

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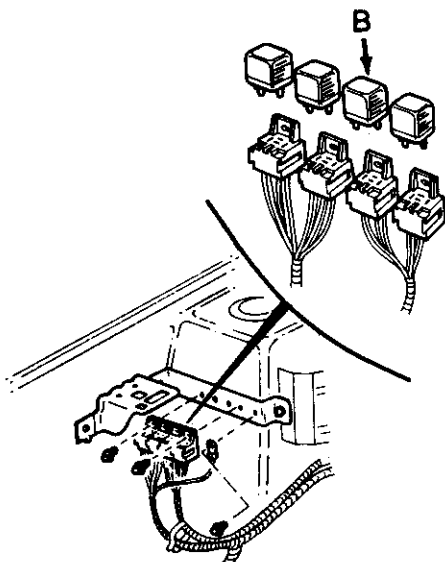
Wagoneer/Cherokee/Comanche



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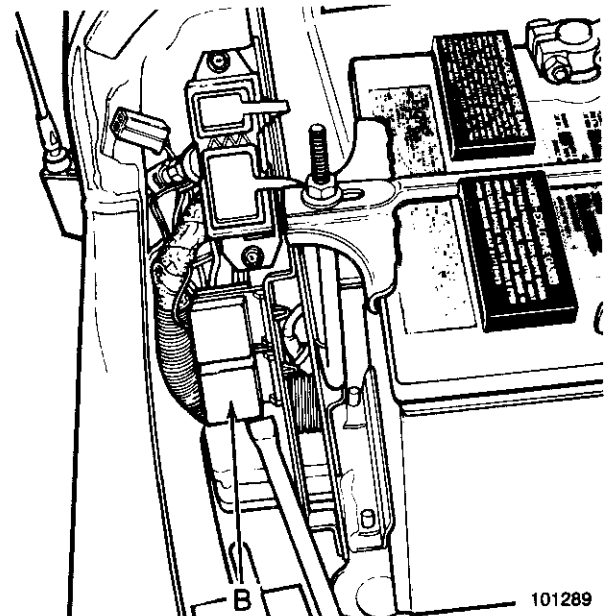
Renault



1983-1985 1.4L

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Jeep Wrangler/YJ



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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



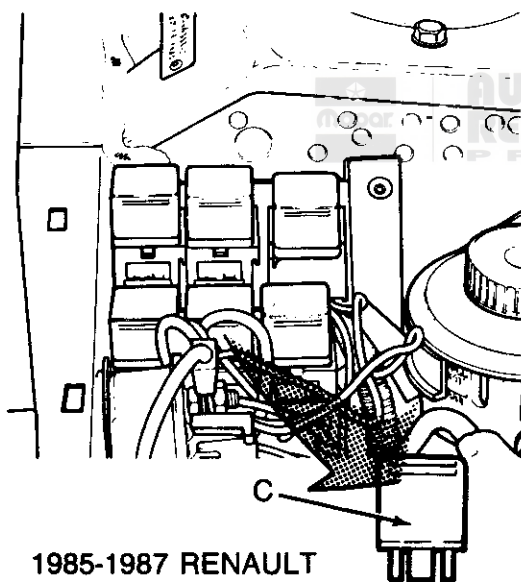
Battery voltage is applied to the relay via the ignition switch and it is energized when a ground is provided by the ECU.

When energized, voltage is applied to the fuel pump.

A/C Compressor Clutch Relay

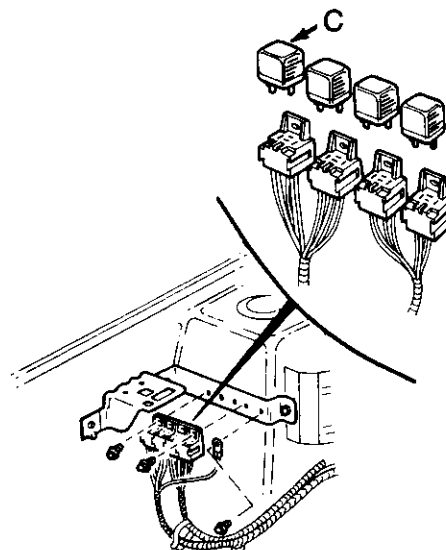
The ECU controls the A/C compressor clutch via the A/C compressor clutch relay (C).

Renault



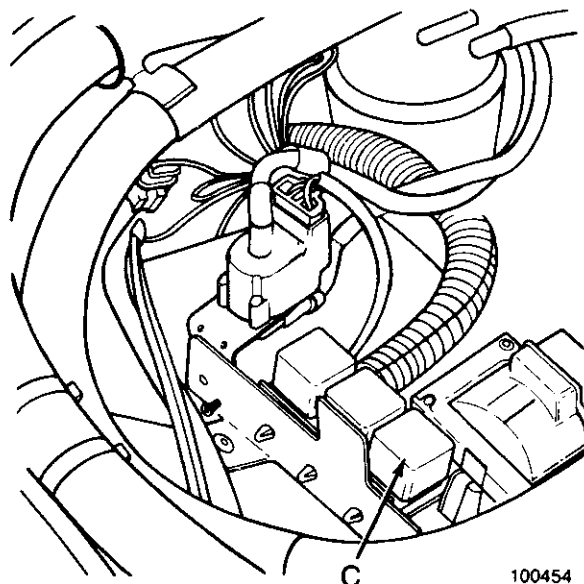
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Renault



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Wagoneer/Cherokee/Comanche



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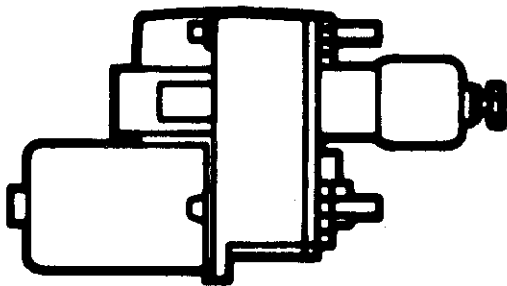
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Idle Speed Actuator (ISA) and Motor

The ISA and motor are located on the throttle body.



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The engine idle speed and engine deceleration throttle stop angle are controlled by the electric motor driven actuator.

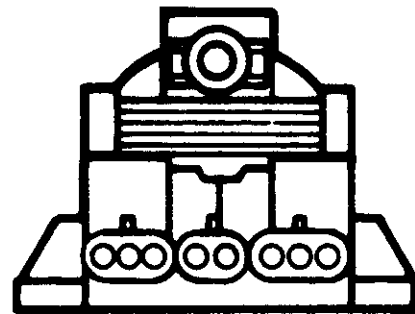
The actuator changes the throttle stop angle by being a moveable idle stop.

The ECU controls the ISA motor by providing the appropriate voltage outputs to produce the idle speed or throttle stop angle required for the particular engine operating condition.

There is no idle speed adjustment.

Ignition Power Module 1985-1987

Based on the inputs, the ECU triggers the ignition coil via the ignition power module.



87058

Ignition Control Module (ICM) 1983-1985 1.4L

This is an electronic system that calculates timing advance based on engine speed and engine vacuum input.

SEE
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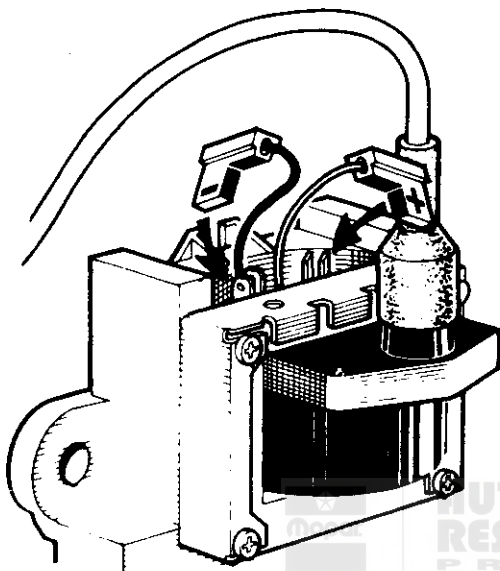
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Ignition Coil

The coil is not an integral part of the ICM and may be serviced separately.



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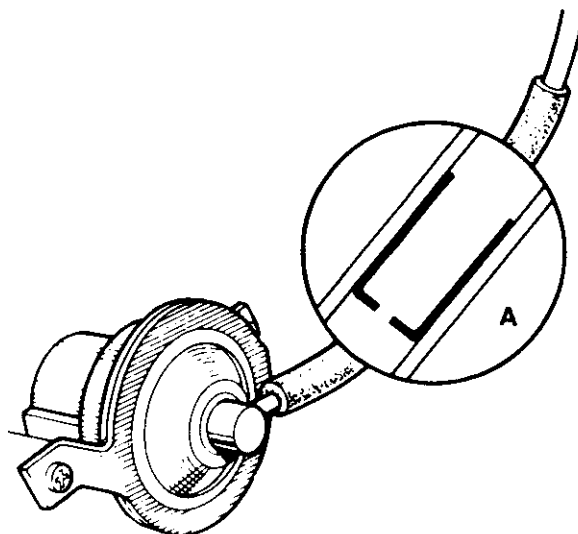
Vacuum Capsule 1983-1985 1.4L

This vacuum capsule is similar externally to a conventional vacuum advance capsule but internally it is different.

Vehicles equipped with a TBFI system have a calibrated orifice (A) in the hose between the capsule and the vacuum line.

NOTE: The orifice is located at the manifold end of the vacuum hose.

Do not remove this capsule because it is connected to the ICM by a very fine wire that will break if separated from the module.



85442

Load Swap Relay 2.46L Engine

A load swap relay is used in 1986 Jeep Wagoneer/Cherokee/Comanche 2.46L models with air conditioning and power steering. The relay works in conjunction with the power steering pressure switch to disengage the A/C compressor clutch.

If the compressor clutch is engaged when the power steering switch contacts close, the input signal from the switch to the ECU also activates the load swap relay. The relay contacts then open cutting off electrical feed to the compressor clutch. The clutch remains disengaged until the pressure switch contacts reopen and engine idle returns to normal.

NOTE: The load swap relay does not reengage the compressor clutch immediately. The relay has a timer that delays energizing the clutch for 0.5 second to ensure smooth engagement.

SEE
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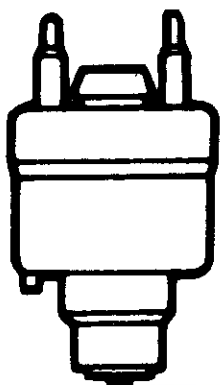
THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



Fuel Injector

The fuel injector is located within the throttle body.



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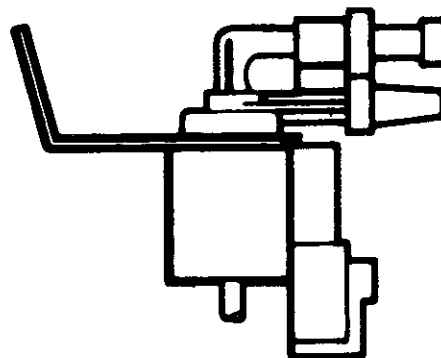
The injector is electronically and exclusively controlled by the ECU.

The injection time duration is based on the engine operating conditions, which are provided to the ECU by the input sensors.

EGR Valve/Canister Purge Solenoid

The vacuum for both the EGR valve and the vapor canister purge function is controlled by this solenoid.

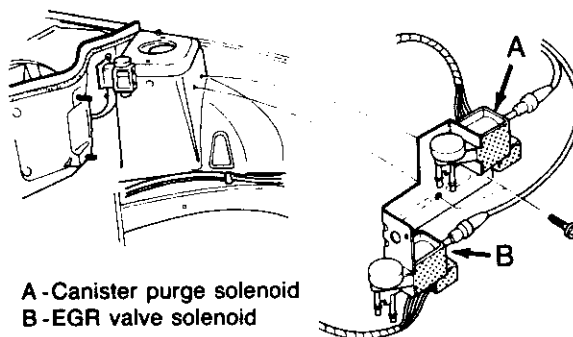
1985-1987



1985-1987

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1983-1985 1.4L



A - Canister purge solenoid
B - EGR valve solenoid

1983-1985 1.4L

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THROTTLE BODY FUEL INJECTION SYSTEM

GENERAL INFORMATION



When the solenoid is energized by the ECU, it prevents vacuum action on the EGR valve and canister.

The solenoid is energized during engine warm-up, closed throttle (idle), wide open throttle and rapid acceleration/deceleration.

NOTE: If the solenoid wire connector is disconnected, the EGR valve and canister purge function will be operational at all times.

Up-Shift Indicator Lamp (Manual Transmission)

For vehicles equipped with a manual transaxle, the ECU controls the up-shift indicator lamp.



87060

The indicator lamp is normally illuminated when the ignition switch is turned ON and it is turned OFF when the engine is started up.

The indicator lamp will be illuminated during engine operation according to engine speed and load.

A switch located on the transmission prevents the lamp from being illuminated when the transmission is shifted to the highest gear.

The ECU will turn the lamp OFF after 3 to 5 seconds if the shift of gears is not performed.

Cold Start Relay 1.7L Engine

This relay enables the system power relay to have maximum voltage when the starter motor is engaged for a cold engine start-up. This relay was not installed on all 1.7L engines.

MODES OF OPERATION

The TBI system has the following modes of operation:

- ignition switch ON
- engine start-up
- engine warm-up
- cruise
- deceleration
- wide open throttle (WOT)
- ignition switch OFF

Ignition Switch ON Mode

When the TBI System is activated by the ignition switch, the following actions occur:

- The system power relay is energized.

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THROTTLE BODY FUEL INJECTION SYSTEM



GENERAL INFORMATION

- The fuel pump is activated by the ECU via the relay.

The fuel pump will operate for approximately one second unless the engine is operating or the starter motor is engaged.

The following engine sensors are activated and begin providing input to the ECU:

- coolant temperature sensor (CTS)
- manifold air/fuel temperature sensor
- manifold absolute pressure (MAP) sensor

The up-shift indicator lamp is illuminated.

Engine Start-Up Mode

The following actions occur when the starter motor is engaged.

The following inputs are received by the ECU:

- coolant temperature sensor (CTS)
- starter motor relay
- speed sensor
- WOT switch

The fuel pump ballast resistor (if equipped) is bypassed.

The fuel pump is activated by the ECU.

Voltage is applied to the injector and the ECU controls the length of injection time.

The ECU determines the proper ignition timing according to the input from the speed sensor.

NOTE: If the WOT switch is engaged, the ECU will deactivate the injector because a possible flooding condition could exist.

Engine Warm-Up Mode

The following inputs are received by the ECU:

- coolant temperature
- manifold air/fuel temperature
- manifold absolute pressure
- engine speed
- throttle position
- gear position (automatic transmission)
- A/C control positions
- engine detonation (knock)

The ECU provides a ground for the injector to precisely control the opening and closing time (pulse width) to deliver fuel to the engine.

The ECU controls engine idle speed and the throttle stop angle.

The ECU controls the ignition timing.

For vehicles equipped with a manual transmission, the up-shift indicator lamp is controlled by the ECU according to engine speed and load.

SEE
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THROTTLE BODY FUEL INJECTION SYSTEM

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Cruise Mode

During cruising speed the following inputs are received by the ECU:

- coolant temperature
- manifold air/fuel temperature
- manifold absolute pressure
- engine speed
- throttle position
- exhaust gas oxygen content
- gear position (automatic transmission)
- A/C control positions
- engine detonation (knock)

The ECU provides a ground for the injector to precisely control the opening and closing time (pulse width) of the nozzle.

The ECU controls engine idle speed and the throttle stop angle.

The ECU controls the ignition timing.

The ECU controls the air/fuel mixture ratio according to the oxygen content in the exhaust gas.

For vehicles equipped with a manual transmission, the up-shift indicator lamp is controlled by the ECU according to engine speed and load.

Deceleration Mode

During deceleration the following inputs are received by the ECU:

- coolant temperature
- manifold air/fuel temperature
- manifold absolute pressure
- engine speed
- throttle position
- exhaust gas oxygen content
- gear position (automatic transmission)
- A/C control positions
- engine detonation (knock)

When the ECU receives the input (deceleration) from the closed throttle (idle) switch, it will provide a ground for the EGR valve/canister purge solenoid.

When grounded, the solenoid interrupts the vacuum to the EGR valve and canister purge function.

The ECU provides a ground for the injector to precisely control the injection time.

During rapid deceleration the ECU may stop all fuel injection for a short period of time.

The ECU controls engine idle speed and the throttle stop angle.

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Wide-Open-Throttle Mode

During wide-open-throttle operation, the following inputs are received by the ECU:

- coolant temperature
- manifold air/fuel temperature
- manifold absolute pressure
- engine speed
- throttle position
- exhaust gas oxygen content
- engine detonation (knock)

When the ECU receives the input from the wide-open-throttle (WOT) switch, it will provide a ground for the EGR valve/canister purge solenoid.

When grounded, the solenoid interrupts the vacuum to the EGR valve and canister purge function.

The exhaust gas oxygen content input is not accepted by the ECU and it will ground the injector to precisely control a predetermined amount of additional fuel.

Ignition Switch OFF Mode

When the ignition switch is turned to the OFF position, the ECU ceases to provide a ground for the injector and all fuel injection stops.

The ECU causes the ISA to fully extend for the next start-up.

The ECU deactivates.

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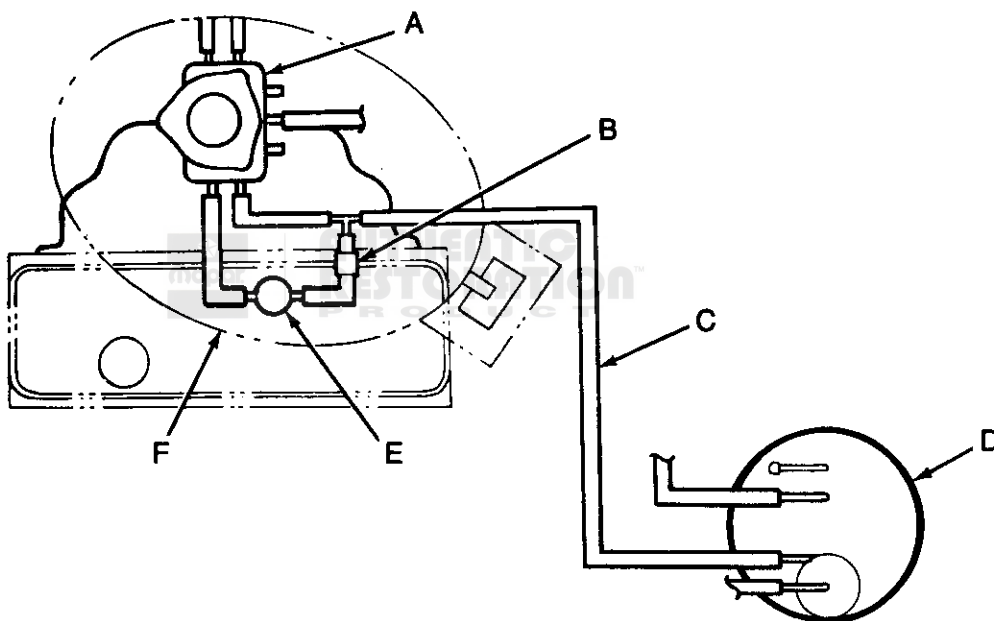
THROTTLE BODY FUEL INJECTION SYSTEM

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POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

- A - Throttle body
- B - Orifice
- C - PCV outlet-to-canister
- D - Canister
- E - PCV outlet
- F - Air filter



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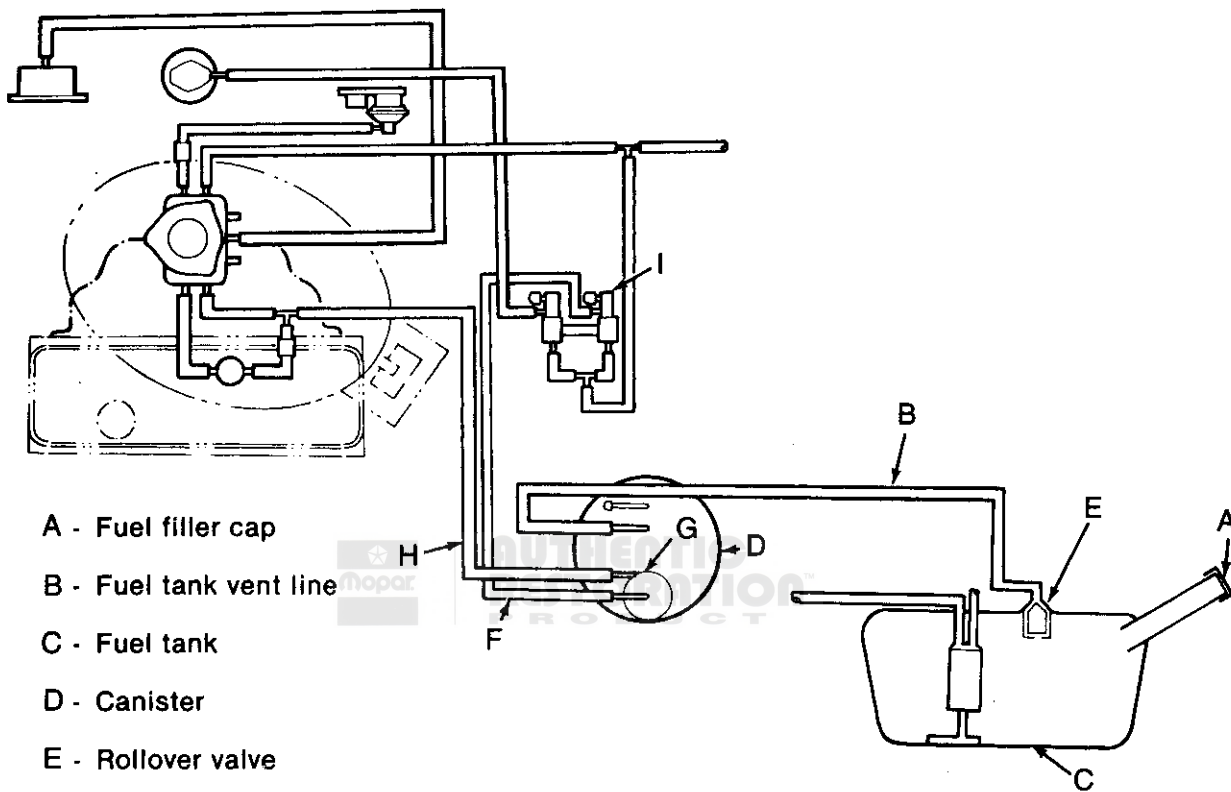


THROTTLE BODY FUEL INJECTION SYSTEM

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FUEL EVAPORATIVE CONTROL SYSTEM



- SEE
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- A - Fuel filler cap
 - B - Fuel tank vent line
 - C - Fuel tank
 - D - Canister
 - E - Rollover valve
 - F - Canister purge
 - G - Purge valve
 - H - Purge line
 - I - Canister purge solenoid

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The system consists of:

- a pressure/vent fuel tank filler cap (A)
- a hose (B) connecting the fuel tank (C) and the canister (D)
- a one way (rollover) valve (E)

The vapor that accumulates in the upper part of the fuel tank is evacuated to the canister via hose (B) when the temperature rises.

With the engine stopped, the vapor is stored in the canister.

With the engine operating, vacuum at hose (F) opens the valve (G) and the vapor is routed to the intake manifold by hose (H).

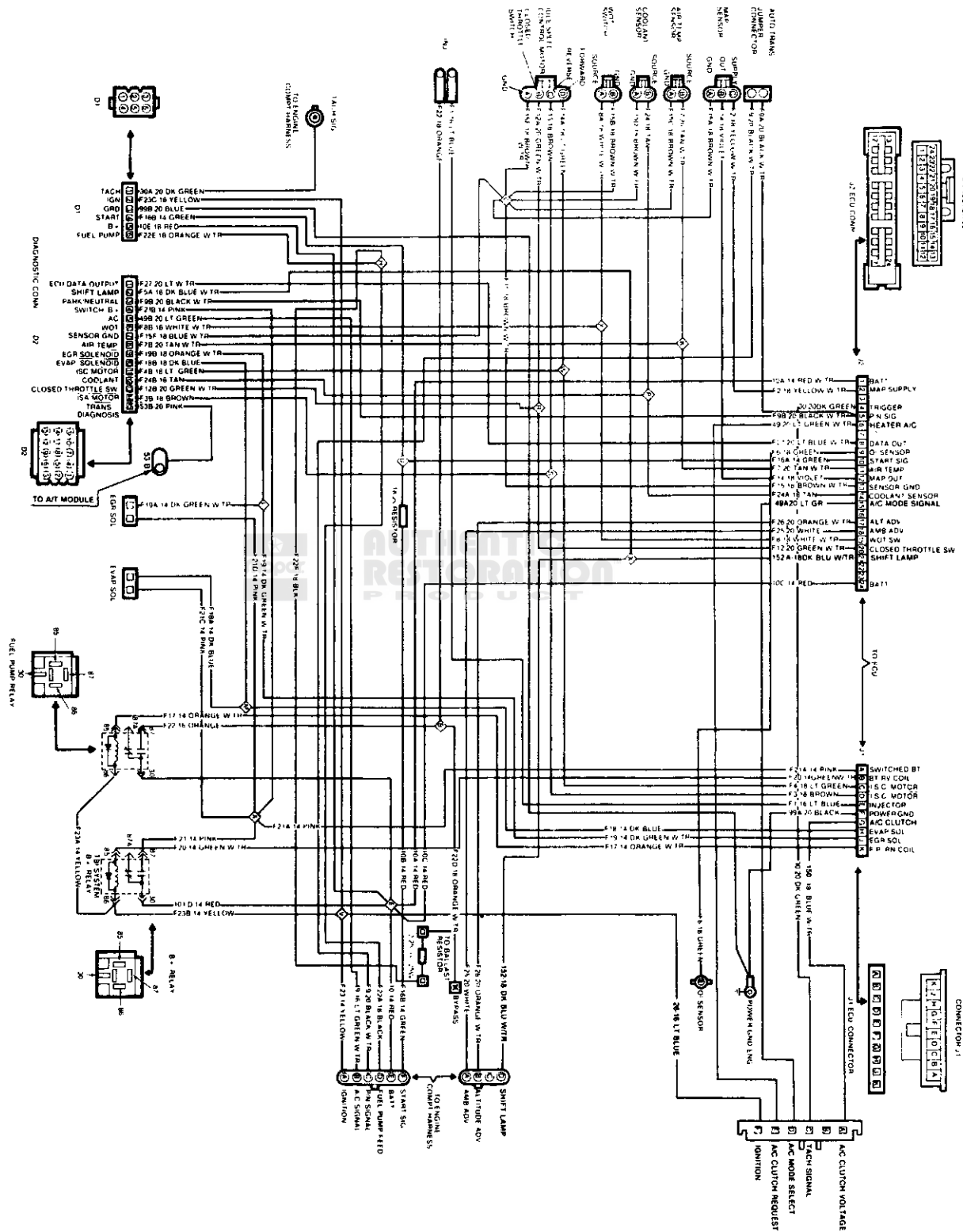


THROTTLE BODY FUEL INJECTION SYSTEM

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TBI SYSTEM WIRING DIAGRAM



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COMPONENT REPLACEMENT

Fuel Injector

Removal

Remove the air cleaner assembly.

Remove the injector wire connector.

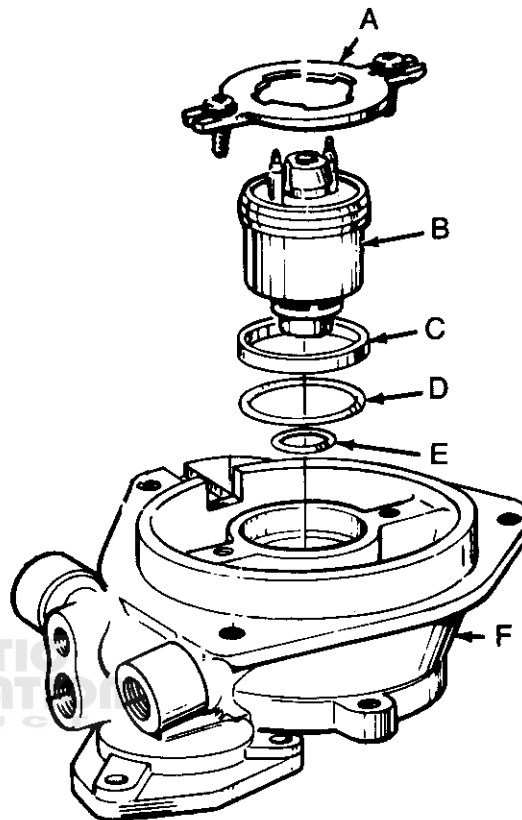
Remove the injector retainer clip screws.

Remove the injector retainer clip (A).

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Using a pair of small pliers, gently grasp the center collar of the injector (between electrical terminals) and carefully remove the injector (B) with a lifting-twisting motion.

Discard the upper (C) and lower (D) O-rings. Note that the backup ring (E) fits over the upper O-ring (C).



- A. Retainer Clip
- B. Injector
- C. Upper O-Ring
- D. Lower O-Ring
- E. Backup Ring
- F. Fuel Body

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Installation

Lubricate with light oil and install a replacement lower O-ring (D) in the housing bore.

Lubricate with light oil and install replacement upper O-ring (C) in the housing bore.

Install the backup ring (E) over the upper O-ring (C).

Position the replacement injector (B) in the fuel body and center the nozzle in the lower housing bore. Seat the injector (B) using a pushing-twisting motion.

Align the wire terminals in the proper orientation.

Install the retainer clip (A) and screws.

Install the injector wire connector.

Install the air cleaner assembly.

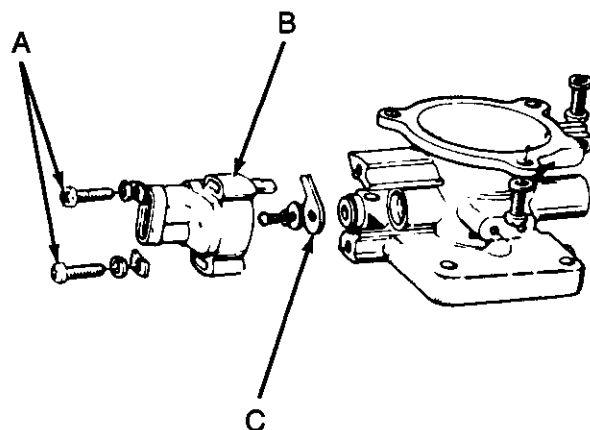
Throttle Position Potentiometer

Removal

Disconnect the wire connector from the sensor.

Remove the 2 Torx head retaining screws (A).

Remove the throttle position sensor (B) from the throttle shaft lever.



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Installation

Position the throttle position sensor (B) over the throttle shaft lever (C).

Install the 2 Torx head screws (A) to retain the sensor.

Connect the wire connector to the sensor.

For adjustment procedure refer to M.R. 245 section F.

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Fuel Pressure Regulator

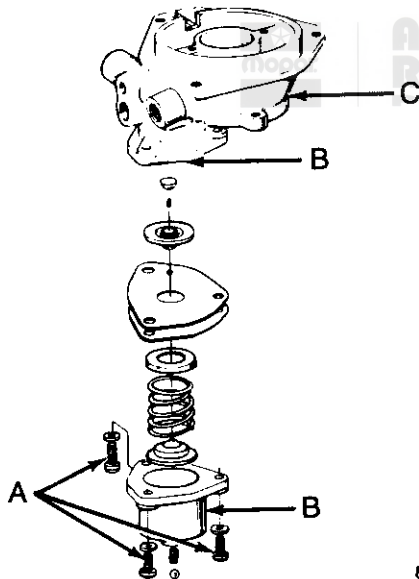
Removal

Remove the throttle body assembly as described in this section.

Remove the 3 retaining screws (A) that secure the pressure regulator (B) to the fuel body (C).

Remove the pressure regulator assembly (B). Note the location of the components for assembly reference.

Discard the gasket.



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Installation

Position the pressure regulator assembly (B) with a replacement gasket.

Install the 3 retaining screws (A) to secure the pressure regulator (B) to the fuel body (C).

Install the throttle body assembly as described in this section.

Operate the engine and inspect for leaks.

Adjust the fuel pressure regulator as outlined in this section.

Idle Speed Actuator Motor

Removal

Remove the air cleaner.

Disconnect the following:

- wide open throttle (WOT) and ISA motor wires
- throttle cable (at WOT/ISA mounting bracket and at throttle body)
- throttle return spring
- cruise control cable (if equipped)

Remove the ISA motor from the mounting bracket as follows:

CAUTION: Do not attempt to remove the ISA motor-to-bracket nuts (B) without using a backup wrench on the stud nuts (A). ISA motor internal components may be dislodged if the studs disengage and the motor cap comes off.

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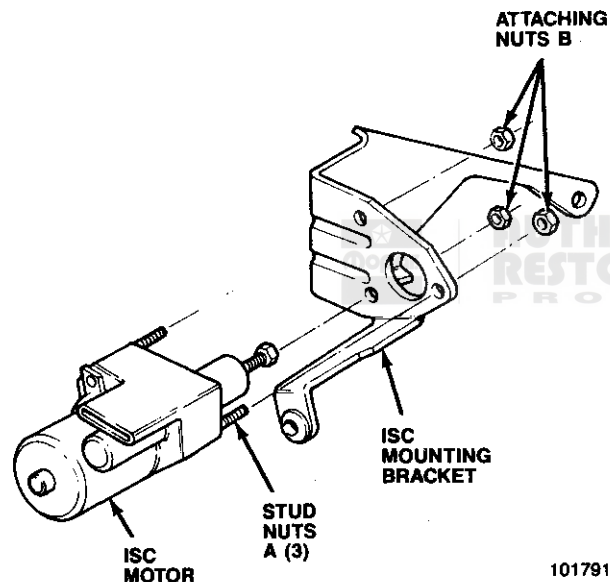
THROTTLE BODY FUEL INJECTION SYSTEM

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NOTE: It may be necessary to thin the backup wrench on a grinder before it will fit between the motor and bracket.

- Place backup 8 mm open end wrench on the ISA motor stud nuts (A) to prevent the studs from turning.
- Remove the ISA motor-to-mounting bracket attaching nuts (B) and remove the motor from the bracket.



Installation

Install the ISA motor on the mounting bracket.

Connect the following:

- cruise control cable (if equipped)
- throttle return spring
- throttle cable (to ISA/WOT mounting bracket and throttle body)
- ISA motor and WOT switch wires

Install the air cleaner.

Extend the ISA motor plunger as follows:

NOTE: The ISA motor plunger must be fully extended before operating the vehicle. If the plunger is not fully extended beforehand, the closed throttle switch may open pre-maturely causing idle speed to drop to approximately 400 RPM.

- Press accelerator downward to 1/4 - 1/2 throttle position and start the engine (this procedure prevents the ISA motor plunger from retracting).
- Stop the engine after 5-10 seconds. When the ignition is turned off, the ISA motor plunger will fully extend.

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Canister Purge and EGR Valve Solenoids

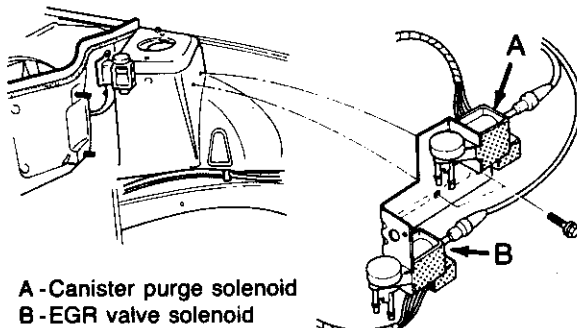
NOTE: The solenoids are located on the left front strut rod tower. Both solenoids are replaced as an assembly.

Removal

Disconnect the vacuum hoses from the canister purge solenoid (A) and the EGR valve solenoid (B).

Disconnect the wire harness connectors from the solenoids.

Remove the solenoids and the mounting bracket.



A - Canister purge solenoid
B - EGR valve solenoid

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Installation

Install the replacement solenoids and the mounting bracket.

Connect the wire harness connectors to the solenoids.

Connect the vacuum hoses to the solenoids.

EGR Valve

NOTE: The EGR valve is located on the intake manifold below the throttle body.

Removal

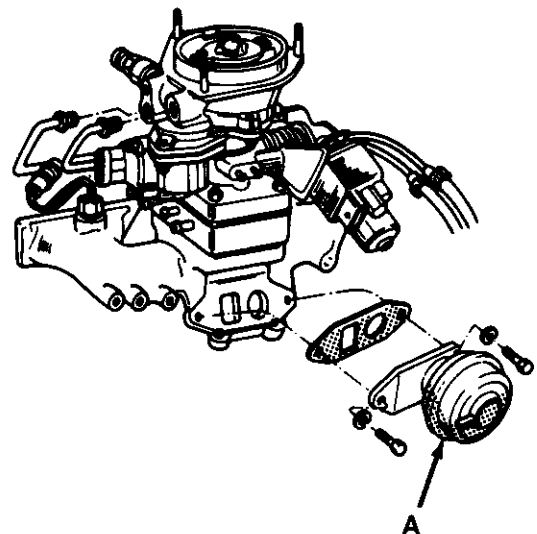
Disconnect the vacuum hose from the EGR valve (A).

Remove the 2 EGR valve-to-intake manifold retaining bolts.

Remove the EGR valve from the intake manifold.

Discard the original gasket.

Clean the EGR valve and intake manifold mating surfaces.



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Installation

Position the replacement EGR valve (A) on the intake manifold with a replacement gasket.

Install the EGR valve-to-intake manifold bolts.

Connect the vacuum hose to the EGR valve.

Manifold Absolute Pressure (MAP) Sensor

NOTE: The MAP sensor is located on the plenum chamber rear panel.

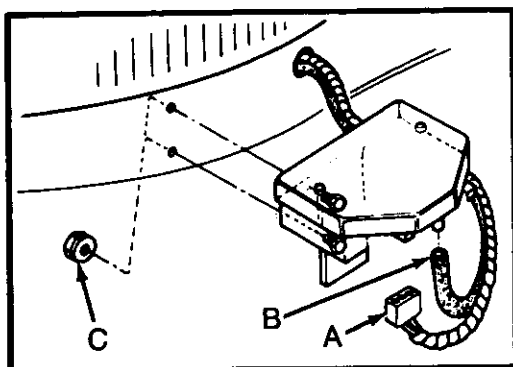
Removal

Disconnect the wire harness connector (A).

Disconnect the vacuum hose (B).

Remove the retaining nuts (C).

Remove the MAP sensor from the plenum chamber panel.



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Installation

Position the MAP sensor on the plenum chamber panel.

Install the MAP sensor-to-plenum chamber panel nuts (C).

Connect the vacuum hose (B).

Connect the wire harness connector (A).

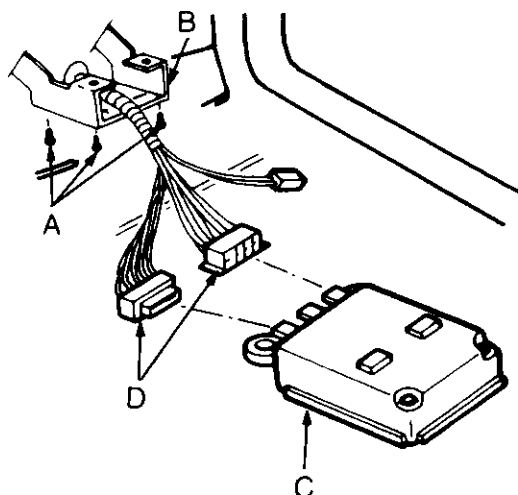
Electronic Control Unit (ECU)

Removal

Remove the retaining screws and bracket that support the ECU below the glove box.

Remove the ECU.

Disconnect the wire harness connectors from the ECU.



- A. Attaching Screws
- B. Bracket
- C. ECU
- D. Wire Connectors

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Installation

Connect the wire harness connectors to the replacement ECU.

Position the replacement ECU in the bracket.

Install the bracket and ECU retaining screws.

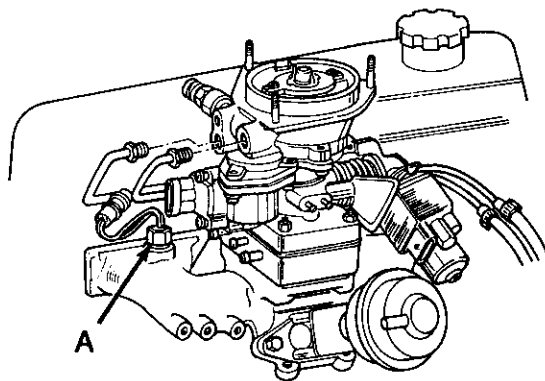
Manifold Air/Fuel Temperature (MAT) Sensor

Removal

Disconnect the wire harness connector from the MAT sensor (A).

Remove the MAT sensor from the intake manifold.

Clean the threads in the manifold.



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Installation

Wrap the replacement MAT sensor threads with Teflon tape.

Install the replacement MAT sensor (A) in the intake manifold.

Connect the wire harness connector to the MAT sensor.

Oxygen (O₂) Sensor

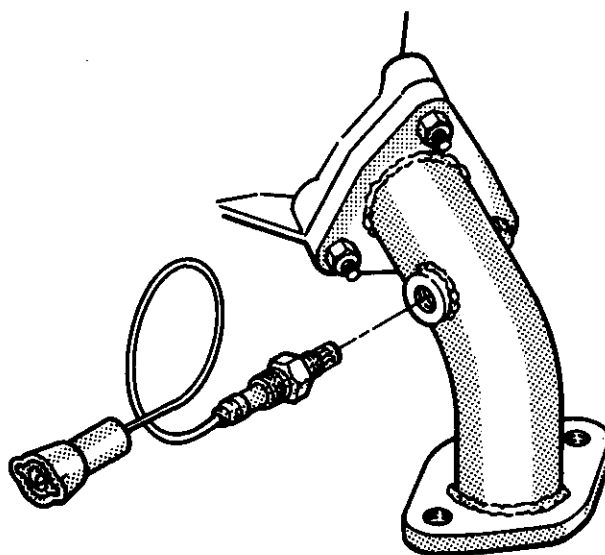
NOTE: The O₂ sensor is located in an exhaust pipe adapter.

Removal

Disconnect the wire harness connector from the O₂ sensor.

Remove the O₂ sensor.

Clean the threads in the adapter.



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Installation

Antiseize sealer is already applied to the threads of replacement O₂ sensors.

Hand start the sensor in the exhaust pipe adapter.

Tighten the sensor to 27-34 N·m (20-25 ft-lbs) torque.

CAUTION: Ensure that the wire terminal ends are properly seated in the connector prior to joining the connectors.

Connect the wire harness connector.

NOTE: Do not push the rubber boot down on the sensor body beyond 13 mm (0.5 in.) above the base. Also, the oxygen sensor pigtail wires cannot be spliced or soldered. If broken, replace the sensor.

Wide Open Throttle (WOT) Switch

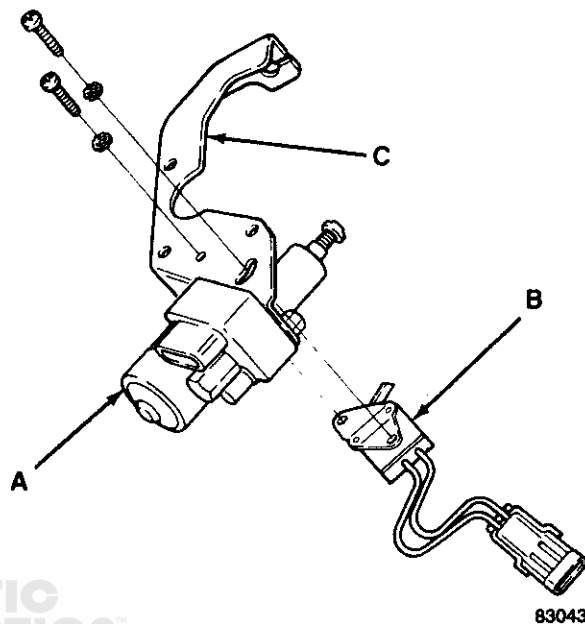
Removal

Remove the air cleaner and disconnect the ISA motor and WOT switch wires.

Disconnect and remove the throttle and cruise control (if equipped) cables from the switch bracket.

Remove the ISA motor (A), WOT switch (B) and switch bracket (C) from the throttle body as an **assembly** only. Do not remove the ISA motor from the bracket.

Remove the WOT switch (B) from the bracket (C).



Installation

Install the replacement WOT switch on the bracket (C). Do not fully tighten the switch screws at this time.

Install the ISA motor, WOT switch and bracket assembly on the throttle body. Connect the ISA motor and WOT switch wires and connect the throttle and cruise control (if equipped) cables.

Refer to Wide Open Throttle (WOT) Switch Adjustment.

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Coolant Temperature Sensor (CTS)

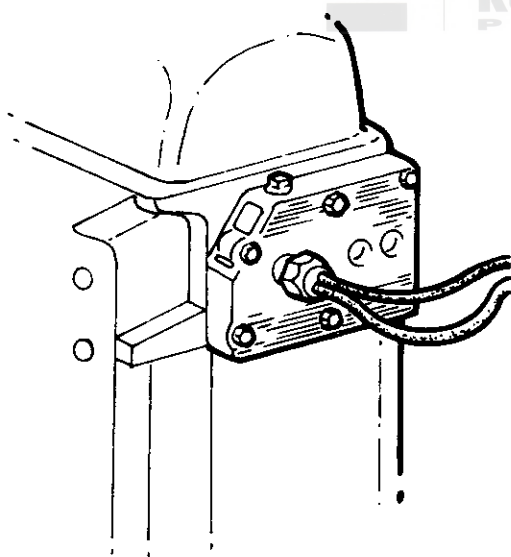
NOTE: The CTS is located at the top of the cylinder head above the flywheel.

Removal

Remove the wire harness connector from the CTS.

WARNING: DO NOT remove the CTS with the cooling system hot and under pressure because serious burns from coolant can occur.

Remove the CTS from the cylinder head and rapidly plug the hole to prevent loss of coolant.



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Installation

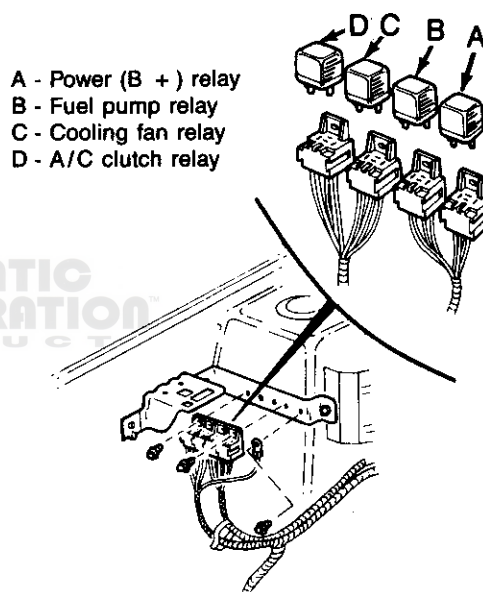
Install the replacement CTS in the cylinder head.

Connect the wire harness connector to the CTS.

Power (B +) Relay and Fuel Pump Relay

Removal

Remove the power (B +) relay (A) or fuel pump relay (B) from the group of four relays on the right strut rod tower.



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Installation

Connect the replacement relay to the wire harness connector.

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Throttle Body Assembly

Removal

Remove the air cleaner assembly.

Disconnect the:

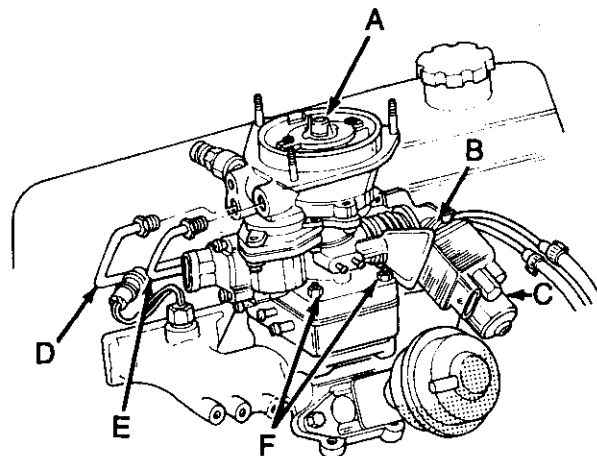
- throttle cable
- return spring
- cruise control cable (if equipped)
- wire harness connector from the injector (A)
- wire harness connector from the WOT switch (B)
- wire harness connector from the ISA motor (C)
- fuel supply pipe (D) from the throttle body
- fuel return pipe (E) from the throttle body

Disconnect the vacuum hoses from the throttle body assembly. Identify and tag the hoses for installation reference.

Remove the throttle body-to-manifold retaining nuts (F) from the studs.

Remove the throttle body assembly from the intake manifold.

If the throttle body assembly is being replaced, transfer the following components to the replacement throttle body: ISA motor WOT switch and bracket assembly.



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Installation

Install the replacement throttle body assembly on the intake manifold. Use a replacement gasket between the components.

Install the throttle body-to-manifold retaining nuts (F) on the studs.

Connect the:

- vacuum hoses
- fuel return pipe (E) to the throttle body
- fuel supply pipe (D) to the throttle body
- wire harness connector to the injector (A)
- wire harness connector to the WOT switch (B)
- wire harness connector to the ISA motor (C)

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- return spring
- cruise control cable (if equipped)
- throttle cable

Install the air cleaner assembly.

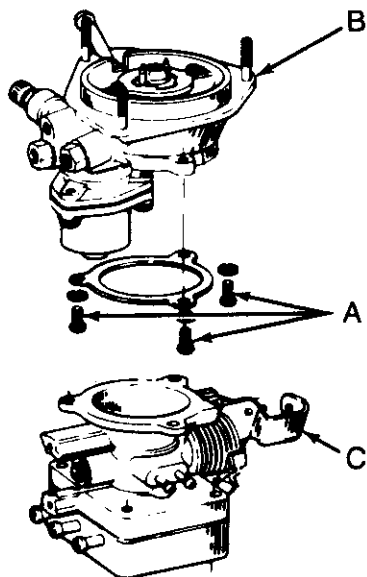
Fuel Body Assembly

Removal

Remove the throttle body assembly as described in this section.

Remove the 3 Torx head screws (A) that retain the fuel body (B) to the throttle body (C).

Remove the original gasket and discard.



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Installation

Install the replacement fuel body (B) on the throttle body (C) using a replacement gasket.

Install the 3 body-to-throttle retaining Torx head screws (A) and tighten securely.

Install the throttle body assembly as described in this section.

Fuel Filter

NOTE: The fuel filter is located on the right rear frame member.

Removal

Raise and support the vehicle.

Place MOT. 453.01 clamps (or equivalent) on the hoses.

Remove the fuel filter bracket attaching bolts.

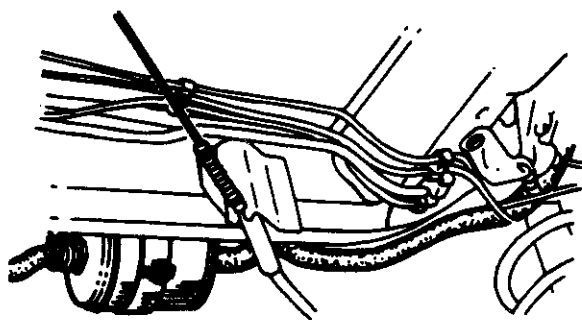
Remove the hose clamps and hoses.

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Installation

NOTE: When installing, ensure that the fuel flow is in the correct direction.

Connect the hoses and tighten the hose clamps.

Remove the MOT. 453.01 clamps.

Lower the vehicle.

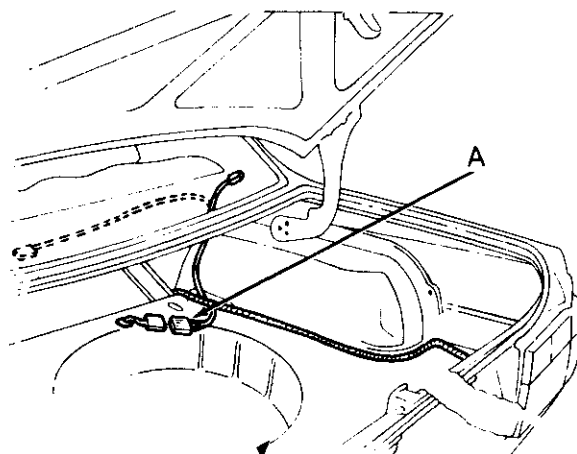
Fuel Tank, Pump/Gauge Sending Unit

Removal

Disconnect the battery cables.

Remove the fuel from the tank.

Disconnect the wire harness connector (A).



A. Wire Harness Connector

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NOTE: 1984-1985 models have connector (A) located underneath the vehicle.

Position a jack beneath the fuel tank.

Separate the fuel filler tube from the fuel tank.

Remove the fuel tank retaining bolts and lower the tank gradually with the jack.

Disconnect the fuel supply, return and vent hoses.

Turn the fuel gauge sending unit retainer ring with a screwdriver and remove.

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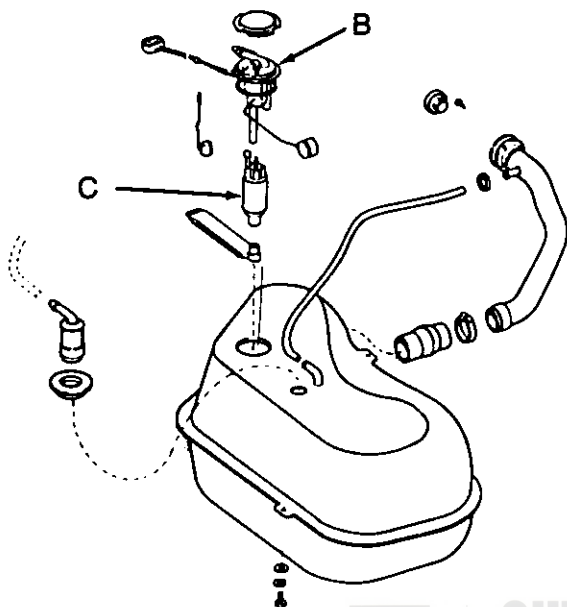


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Separate the sending unit (B) and pump (C).



B. Sending Unit
C. Fuel Pump



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Connect the fuel pump (C) to the sending unit (B).

Install the sending unit/pump assembly in the tank and secure with the retaining ring.

Connect the hoses.

Install the fuel tank with the retaining bolts.

Connect the fuel filler tube to the tank.

Connect the wire harness connector.

Connect the battery cables.

NOTE: The fuel tank is equipped with a pressure/vacuum filler cap.

DIAGNOSTIC PROCEDURES

General Information

The Throttle Body Fuel Injection (TBI) System should be considered as a possible source of trouble for engine performance, fuel economy and exhaust emission complaints only after normal tests and inspections of other engine components have been performed. An integral self-diagnostic system within the ECU detects common malfunctions that are most likely to occur.

The self-diagnostic system will illuminate a test bulb (to be installed by a service technician) if a malfunction exists. When the trouble code terminal (at the diagnostic connector in the engine compartment) is connected to a test bulb the system will flash a trouble code if a malfunction has been detected.

NOTE: If a MS. 1700 Diagnostic Tester is used for diagnosis, the diagnostic procedures listed in this manual are not applicable.

In the following procedures, only complete (non-intermittent) failures are considered. In most instances, intermittent failures can be detected by using diagnostic codes as a guide along with the judgment of the technician to identify the intermittently operating component.



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In a situation where ECU replacement is advised, follow the precautions indicated before installing a replacement ECU to prevent external malfunctions from damaging the replacement unit.

The self-diagnostic feature of the ECU provides support for diagnosing system problems by recording 6 possible failures should they be encountered during normal engine operation.

Additional tests should allow specific tracing of a failure to a single-component source. Multiple disassociated failures must be diagnosed separately.

It is possible that the test procedures can cause false interpretations of certain irregularities and consider them as ECU failures. It is therefore appropriate that all ECU's that are to be returned as failed units be screened by the dealer self-test equipment, MS.1700 Diagnostic Tester, before return to the manufacturer.

In the following procedures, no specialized service equipment is necessary. It is necessary however that the service technician have available a volt-ohmmeter, a 12 volt test lamp (type 1892 or equivalent) and an assortment of jumper wires and probes.

It is expected that the technician will successfully be able to test the system electrically by following the procedures.

Precautions

The following misconnections should be carefully avoided because even momentary contact may cause serious ECU or system damage.

ECU PIN (And Diagnostic Connector Pin)	CONNECTION
J1-E	12V or GND
J2-8 (D2, Pin 1)	12V
J2-18	12V
J2-17	12V
J1-B	12V
J1-C (D2, Pin 11)	12V or GND
J1-D (D2, Pin 14)	12V or GND
J1-K	12V
J1-H (D2, Pin 10)	12V
J1-G (D2, Pin 2)	12V
J1-J (D2, Pin 9)	12V
J2-2	12V or GND
J2-12	12V
J2-13 (D2, Pin 7)	12V
J2-4 (D1, Pin 1)	12V or GND
J2-1 (D1, Pin 5)	GND
J2-24 (D1, Pin 5)	GND
J1-A (D2, Pin 4)	GND
J1-F (D1, Pin 3)	12V
D1, Pin 6	GND

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Before performing any test, ensure that:

- the malfunction is not caused by a component other than the TBI system (e.g., spark plugs, distributor, ignition timing, etc.)
- no air is entering the intake and exhaust system above the catalytic converter
- fuel is actually reaching the injector (test the fuel system pressure)

Never connect or disconnect a component without turning off the ignition switch.

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With the engine stopped and the ignition on, the fuel pump should not be operating.

The fuel pump is controlled by the ECU.

Voltages greater than 12V or AC voltage of any kind should never be applied to any terminal in the system.

In no instance should a service technician attempt to modify or defeat any system function because this could cause system or vehicle damage, or affect vehicle safety.

Disconnect the battery cables before charging the battery.

If the temperature is likely to exceed 80°C (176°F), as in a paint shop bake oven, remove the ECU.



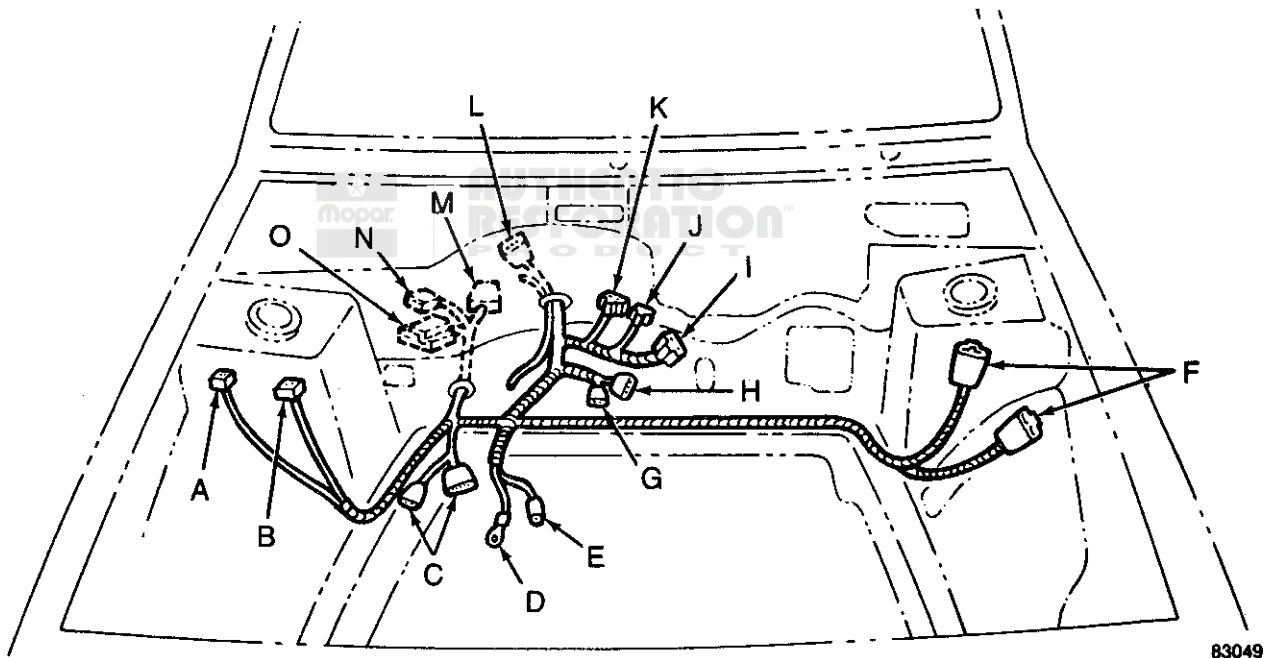
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WIRE HARNESS CONNECTORS

- | | |
|--------------------------------|--------------------------|
| A - Fuel pump relay | I - Injector |
| B - B+ Relay | J - Coolant temp. sensor |
| C - Engine compartment harness | K - Air temp. sensor |
| D - Engine ground | L - MAP sensor |
| E - O ₂ Sensor | M - ECU |
| F - Evaporator & EGR solenoids | N - IP harness |
| G - Wide open throttle switch | O - ECU |
| H - Idle speed control motor | |



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DIAGNOSTIC CONNECTORS

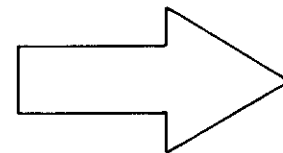
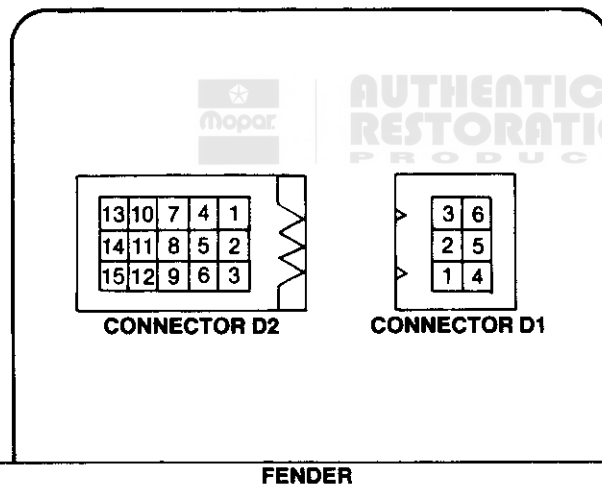
Connector D1

- 1 - Tach (rpm) voltage
- 2 - Ignition
- 3 - Ground
- 4 - Starter motor relay
- 5 - Battery
- 6 - Fuel pump

Connector D2

- 1 - ECU data output
- 2 - Shift Lamp
- 3 - Park/Neutral Switch
- 4 - B+ (power relay)
- 5 - AC on
- 6 - WOT switch
- 7 - Sensor ground
- 8 - Air temp. sensor
- 9 - EGR solenoid
- 10 - Canister purge solenoid
- 11 - ISC motor forward
- 12 - Coolant temp. sensor
- 13 - Closed throttle switch
- 14 - ISC motor reverse
- 15 - Auto trans diagnosis

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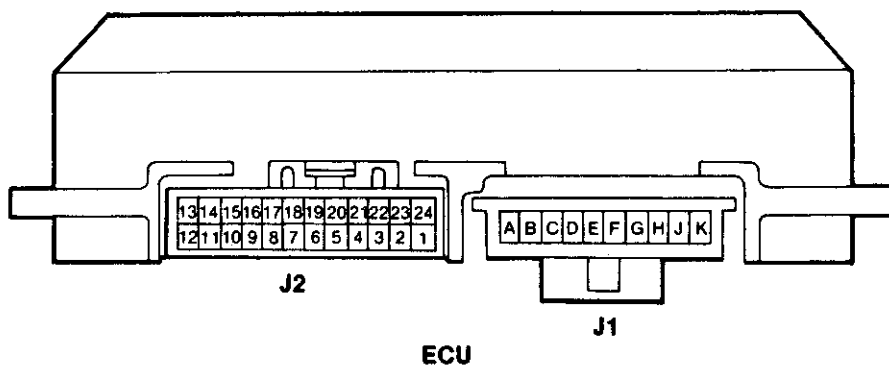


THROTTLE BODY FUEL INJECTION SYSTEM

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ECU CONNECTORS



WIRE HARNESS CONNECTIONS

- J-1**
- A - Switched B +
 - B - B + Relay Coil
 - C - ISA Motor Extend (forward)
 - D - ISA Motor Retract (reverse)
 - E - Injector
 - F - Power Ground
 - G - A/C Clutch
 - H - Evaporator Solenoid
 - J - EGR Solenoid
 - K - Fuel Pump Relay Coil

- J-2**
- 1 - Battery
 - 2 - MAP Supply
 - 3 - Not Used
 - 4 - Trigger (Tach Signal)
 - 5 - Park/Neutral Signal
 - 6 - Heater A/C
 - 7 - Not Used
 - 8 - Data Out
 - 9 - O₂ Sensor
 - 10 - Start Signal
 - 11 - Air Temperature
 - 12 - MAP Out
 - 13 - Sensor Ground
 - 14 - Coolant Temperature Sensor
 - 15 - A/C Mode Signal
 - 16 - Not Used
 - 17 - Altitude Advance
 - 18 - Ambient Advance
 - 19 - WOT Switch
 - 20 - Closed Throttle
 - 21 - Shift Lamp
 - 22 - Not Used
 - 23 - Not Used
 - 24 - Battery

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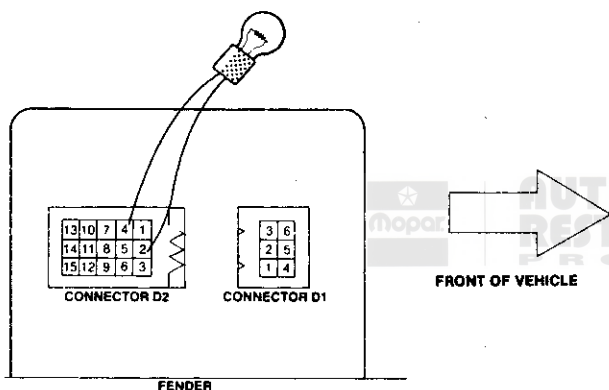
THROTTLE BODY FUEL INJECTION SYSTEM

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Trouble Code Test Lamp (1983 Models Only)

Unsatisfactory fuel economy, erratic idle speed, power surging and excessive engine stalling are typical symptoms that will be reported by the driver when the fuel system has a component failure. If the ECU is functional, service diagnostic codes can be obtained by connecting a No. 158 test bulb (or equivalent) to pins D2-2 and D2-4 of the large diagnostic connector.



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With the test bulb installed, push the WOT switch lever on the throttle body, and with the ISA motor plunger (closed throttle switch) also closed, have a helper turn on the ignition switch while observing the test bulb.

If the ECU is functioning normally, the test bulb should light for a moment, then go out. This will always occur regardless of the failure condition, and provides an indication that the ECU is functional.

After the initial illumination, the ECU will cycle through and flash a single digit code if any system malfunctions have been detected by the ECU during engine operation.

The ECU is capable of storing two different trouble codes in memory. The initial trouble detected will be flashed first and then, followed by a short pause, the second trouble detected will be flashed. There will be a somewhat longer pause between the second code and the repeat cycle of the first code again. This provides distinction between codes 3-6 and 6-3. While both codes indicate the same two failures, the first digit indicates the initial trouble while the last digit indicates the most recent failure.

The trouble codes are as listed below:

- 1 flash – Manifold Air/Fuel Temperature (MAT) Sensor Failure
- 2 flashes – Coolant Temperature Sensor Failure
- 3 flashes – Simultaneous WOT and Closed Throttle Switch Input
- 4 flashes – Simultaneous Closed Throttle Switch and High Air Flow
- 5 flashes – Simultaneous WOT and Low Air Flow
- 6 flashes – Oxygen Sensor (O₂) Failure



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In a situation where further testing indicates no apparent cause for the failure indicated by the ECU self-diagnostic system, an intermittent failure should be suspected. This must be diagnosed the same way as a complete failure, except that marginal components must be more closely examined.

If the trouble code is erased and quickly returns with no other symptoms, the ECU should be suspected. However, in the absence of other negative symptoms, replacement of the ECU is not advisable.

In instances where no symptom problems are detected, the ECU can be suspected. Again, because of the cost involved and the relative reliability of the ECU, the ECU should never be replaced without testing with an MS. 1700.

If the ECU is determined to be defective, it must be replaced. There are no dealer servicable parts in the ECU. No repairs should be attempted.

It is important to note that the trouble memory is erased if the ECU power is interrupted by any one of the following:

- disconnecting the wire harness connector from the ECU
- disconnecting either battery cable terminal
- allowing the engine to remain inoperative in excess of five days

It is equally important to erase the trouble memory when a defective component is replaced. This can be accomplished by any one of the actions listed above.



THROTTLE BODY FUEL INJECTION SYSTEM

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CODE INTERPRETATION AND DIAGNOSIS

The chart below contains a list of troubles, possible causes and suggested corrections.

TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
CODE 1 (unsatisfactory low air temp. engine performance).	Manifold air/fuel temperature (MAT) sensor resistance is not less than 1000 ohms (HOT) or more than 100 kohms (VERY COLD).	Replace the MAT sensor if not within specifications. Refer to the MAT sensor test procedure.
CODE 2 (unsatisfactory warm temp. engine performance-engine lacks power).	Coolant temperature sensor resistance is less than 300 ohms or more than 300 kohms (10 kohms at room temp.).	Replace the coolant temperature sensor. Test the MAT sensor. Refer to the coolant temp. sensor test and MAT sensor test procedures.
CODE 3 (unsatisfactory fuel economy, hard cold engine starting, stalling, and rough idle).	Defective wide open throttle (WOT) switch or closed (idle) throttle switch or both, and/or associated wire harness.	Test WOT switch operation and the associated circuit. Refer to the WOT switch test procedure. Test closed throttle switch operation and the associated circuit. Refer to the closed throttle switch test procedure.
CODE 4 (unsatisfactory engine acceleration, sluggish performance, unsatisfactory fuel economy).	Simultaneous closed throttle switch and manifold absolute pressure (MAP) sensor failure.	Test the closed throttle switch and repair/replace as necessary. Refer to the closed throttle switch test procedure. Test the MAP sensor and associated hoses and wire harness. Repair or replace as necessary. Refer to the MAP sensor test procedure.
CODE 5 (unsatisfactory acceleration, sluggish performance).	Simultaneous WOT switch and manifold absolute pressure (MAP) sensor failure.	Test the WOT switch and repair or replace as necessary. Refer to the WOT switch test procedure. Test the MAP sensor and associated hoses and wire harness. Repair or replace as necessary. Refer to the MAP sensor test procedure.
CODE 6 (unsatisfactory fuel economy, bad driveability, unsatisfactory idle, black smoke from tailpipe).	Inoperative oxygen sensor.	Test oxygen sensor operation and replace if necessary. Test the fuel system for correct pressure. Test the EGR solenoid control. Test the canister purge. Test the secondary ignition circuit. Test the PCV circuit. Refer to the individual component test procedure.

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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
No test bulb flash.	No battery voltage at ECU (J1-A with key on). No ground at ECU (J1-F). Simultaneous WOT and CTS switch contact (Ground at both D2 Pin 6 and D2 Pin 13). No battery voltage at the test bulb (D2 Pin 4). Defective test bulb. Battery voltage low (less than 11.5V).	Repair or replace the wire harness, connectors or relays. Repair or replace the WOT switch, CTS switch, harness or connectors. Repair the harness or connector. Replace the test bulb. Charge or replace the battery, repair the vehicle wire harness. Test ECU with MS 1700 tester.
Fuel pump operates continuously.	Fuel pump relay has short circuit to ground.	Check J1-K for a short circuit to ground with the key off and fuel pump relay disconnected. Repair the wire harness short circuit. Disconnect the ECU from the wire harness. If the pump stops, check the ECU with MS 1700 tester. Disconnect the fuel pump relay and check for a short circuit. Replace the relay. Test the ECU with MS 1700 tester.
Fuel pump will not operate for one second with the ignition switch On.	Open circuit.	Connect a jumper wire across the fuel pump relay. If the pump operates, check for battery voltage at the relay. Check the continuity between the relay and Pin J1-K at the ECU. Repair the wire harness as necessary. Replace the fuel pump relay. Test the ECU with MS 1700 tester Test for continuity between the fuel pump and the relay contacts.



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TRouble CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
Fuel pump will not operate when the starter motor is engaged.	Fuel pump ballast resistor defective. Fuel pump defective. Open circuit.	Check the pump ground circuit. Repair the harness as necessary. Replace the fuel pump ballast resistor. Note: The fuel pump ballast resistor can be bypassed using the pigtail wire connector located below the resistor. Replace the fuel pump. Connect positive battery voltage to the pump contact on the starter motor relay. If the pump operates, repair or replace the starter motor relay. If the pump does not operate, repair the wire harness between the starter motor relay and the pump side of the ballast resistor. Check to determine if the pump operates one second with the ignition switch On. Connect a test bulb between D2 Pin 14 and D2 Pin 11 with the engine operating. Shut the engine off. If the bulb does not light momentarily on shutdown: test the ECU with MS 1700 tester. If the bulb at shutdown: test the wire harness and connector at the ISC motor. Repair as necessary. Test to determine if the motor is jammed in the full retract position. Refer to ISA Motor Diagnostic Test using ISA motor exerciser tool AB.99.
ISC (Idle Speed Control) motor does not extend on engine shutdown (symptom is slow, unsatisfactory quality idle after cold start).	ECU, wire harness, or motor.	

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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
Idle speed erratic, low, or high consistently.	ISC motor inoperative. No ECU output.	Refer to ISA Motor Diagnostic Test using ISA motor exerciser tool AB.99. Connect a test lamp from J1-C to J1-D on the ECU. Remove the ISC motor from the bracket and close the CTS switch manually. With the engine warmed-up and at idle speed, manually open the throttle to a speed well above normal idle speed. The light should flash. Close the throttle so the speed drops well below normal idle speed. The light should flash. Note: Improper handling of the ISC motor outputs can result in system damage. Never connect to ground or the battery. If the light flashes on both over and under idle speed: Check the wiring harness between the ECU and the ISC motor for an open or short circuit. Recheck the ISC motor function. If the light fails to flash on either over or underspeed: Check the ECU with MS 1700 tester.
	Throttle position incorrect.	Check to ensure that the throttle is resting on the switch at normal idle. Connect a voltmeter from D2 pin 13 to D1 Pin 3. Should indicate ground potential at a normal idle speed. Check for air leaks into vacuum. Check the closed throttle switch using the test procedure.
ECU does not turn off after engine shut down (Symptom: battery loses charge with key off.)	MAP sensor voltage supply (ECU Pin J2-2). Voltage should go from 5V to zero within 30 seconds after key is turned off.	Check coolant temperature sensor. Refer to the test procedure. Check the starter motor relay for a short circuit. With the key off, check the relay for battery voltage.



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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
EGR solenoid control is erratic. (Symptoms: unsatisfactory idle quality, bad driveability, inactive oxygen sensor.)	Defective solenoid.	Replace relay. Test the ECU with MS 1700 tester. Check ignition switch and harness for short circuit to battery voltage. Repair or replace as necessary. Check the solenoid valve. Connect the valve (out of harness) to 12V and determine if it opens and closes. Check for 12V to the solenoid valve coil. Replace the valve. Repair the wiring harness. Test the ECU with MS 1700 tester. Follow the procedure above (EGR) for the canister purge valve.
Canister purge is erratic (Symptoms: unsatisfactory idle quality, driveability, complaint, inactive oxygen sensor.)	Defective solenoid.	
Fuel pressure is low at test point on throttle body (14-15 psi at idle). (Symptoms: unsatis- factory driveability, inactive oxygen sensor, hard cold starts.)	Fuel pump malfunction.	Check the pump for proper voltage. (Nominally 7.5V) Check the fuel filter. Replace the filter. Replace the fuel pump ballast resistor. Repair the wiring harness. Check the fuel pressure regulator for proper function. With the engine idling, gently pinch off the rubber fuel return hose to the fuel tank. The pressure should rise greatly when the hose is restricted. Check the fuel pressure out of the pump. With a gauge directly on fuel inlet pipe, (pipe dead headed at gauge), several cycles of key on should produce a pressure well over 20 psi. Warning: This should only be done for a short time, because fuel system is not designed for high pressures. Install a fuel pressure regulator kit. Replace the throttle body. Replace the fuel pump.
Fuel pressure high at test point on throttle body (over 14-15 psi at idle). (Symptoms: unsatis- factory driveability, hard starts, black smoke, inactive oxygen sensor.)	Fuel restriction.	Check the fuel pressure with an oversize temporary fuel return pipe. Pipe should replace the existing return pipe. It should be securely fastened at the throttle body and discharge fuel into an approved closed container.

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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
Engine will not start.	Defective WOT switch.	If the pressure drops, replace the fuel return pipe. Inspect the fuel tank fittings and replace if restricted. If the pressure does not drop, install a fuel pressure regulator kit.
	Low battery voltage.	Refer to the WOT switch test procedure. Replace or charge the battery.
	Fuel supply too low.	Replenish as necessary.
	Low fuel pressure.	Refer to the fuel pressure test. Correct as necessary. Replace the fuel filter.
	Fuel pump inoperative.	Repair or replace as necessary.
	Defective secondary ignition circuit.	Position a spark plug (with ignition wire) on the cylinder block. Engage the starter motor and observe the spark. Repair or replace the ignition module or wiring.
	Primary ignition input to the ECU defective.	Connect a voltmeter between D1 Pin 2 and ground. With key on (engine stopped) voltage should be close to battery voltage. Check the harness and connectors between the ECU and the ignition module. Service the ignition module as necessary.
	No battery voltage applied to the injector (12V from one pin to chasis ground).	Check the B+ relay. Check the wire harness and connectors. Repair or replace as necessary.
	Injector resistance too high (ohmmeter should indicate less than 10 ohms).	Replace the injector.
	ECU is not switching the injector.	Remove the injector wire harness connector. Connect a test lamp across the connector. Engage the starter motor. The lamp should pulse dimly. Check the ECU with MS 1700 tester.
	Leaking injector.	Check to determine if the injector is discharging fuel when the engine is rotated by the starter motor. Install an O-ring kit if it is leaking fuel. Replace the injector if it either discharges no fuel with engine turning or drips fuel with the engine stopped.



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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
Engine starts but will not idle.	No start signal voltage.	Check the start signal (voltmeter from D1 Pin 4 to ground should indicate battery voltage when the starter motor is engaged. Service the starter motor relay or wire harness.
	ISC motor plunger is not extended. Coolant temperature sensor inoperative.	Refer to the ISC motor test procedure. Refer to the coolant temperature sensor test procedure. Perform the self-diagnostic test. Check to ensure that the spark plugs are not fouled or wet. Replace as necessary.
Driveability or fuel economy complaint.	Fuel pump inoperative.	Check the fuel pump.
	Ignition system malfunction.	Check the ignition system. Repair as necessary. Check the start signal after engaging the starter motor. Voltmeter from D1 Pin 4 to D1 Pin 3 should indicate zero volts. Repair wire harness as necessary. Check the MAP sensor. Repair as necessary.
	High fuel pressure.	Test the ECU with MS 1700 tester. Perform the self-diagnostic test. Refer to the trouble codes. Check the fuel pressure. Test the ECU with MS 1700 tester. Replace the ECU if necessary. Check to determine if the oxygen sensor is functioning. Replace if necessary.
	Injector defective. WOT switch malfunction.	Replace the injector. Check the WOT switch. Adjust, repair or replace the switch to ensure that the WOT voltage (D2 Pin 6) is low during an actual wide open throttle condition.

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TROUBLE CODE/CONDITION	POSSIBLE CAUSE	CORRECTION
	Air filter restricted.	Check the air filter. Replace as necessary.
	EGR valve malfunction.	Check the EGR valve and hoses. Repair or replace.
	Canister purge malfunction.	Check the canister purge system. Repair as necessary.

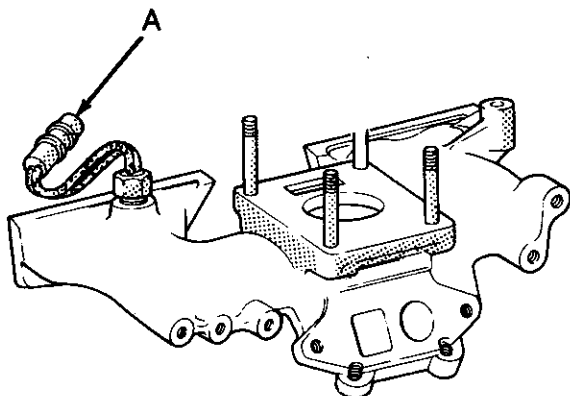
SUMMARY

It should be understood that the ECU is extremely reliable and must be the final component to be replaced if a doubt exists concerning the cause of a fuel injection system failure.

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Manifold Air/Fuel Temperature (MAT) Sensor Test

Disconnect the wire harness connector (A) from the MAT sensor.



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Test the resistance of the sensor with a high input impedance (digital) ohmmeter. The resistance varies from 300 ohms to 300 kohms (10 kohms at room temperature).

Replace the sensor if it is not within the range of resistance specified.

Test the resistance of the wire harness between the ECU harness connector J2-13 and the sensor connector, and J2-11 to the sensor connector.

NOTE: Pins J2-13 and J2-11 are at the ECU wire harness connector.

Repair the harness as necessary if the resistance is greater than 1 ohm.

Coolant Temperature Sensor Test

Disconnect the wire harness connector from the coolant temperature sensor.



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Test the resistance of the sensor with a high input impedance (digital) ohmmeter. The resistance varies from 300 ohms to more than 300 kohms (10 kohms at room temperature).

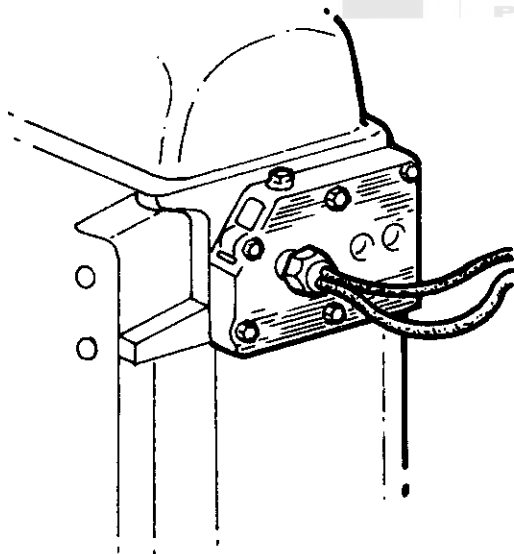
Replace the sensor if not within the range of resistance specified.

Test the resistance of the wire harness between the ECU harness connector J2-14 and the sensor connector, and J2-11 to the sensor connector.

NOTE: Pins J2-14 and J2-11 are at the ECU wire harness connector.

Repair the wire harness if an open circuit wire is indicated.

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Wide Open Throttle (WOT) Switch Test

Disconnect the wire harness connector from the WOT switch.

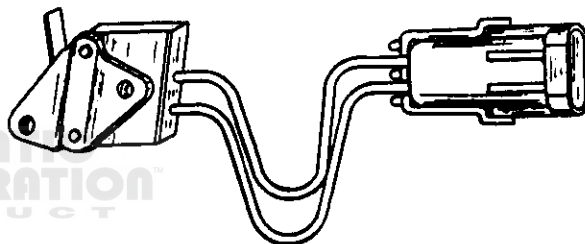
Test the operation of the WOT switch with a high input impedance ohmmeter.

Open and close the switch manually.

The resistances should be infinite when the throttle is closed. A low resistance should be indicated when at the WOT position. Test the switch operation several times.

Replace the WOT switch if defective.

Connect the wire harness connector.



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With the ignition switch ON, test the WOT switch voltage at the diagnostic connector (D2-6 to D2-7/ground). The voltage should be 0 at the WOT position; greater than 2 volts if not at the WOT position.

- If the voltage is always 0, test for a short circuit to ground in the wire harness or switch. Check for an open circuit between J2-19 (ECU) and the switch connector. Repair or replace the wire harness as necessary.
- If the voltage is always greater than 2 volts, test for an open circuit wire or connector between the switch and ground. Repair as necessary.



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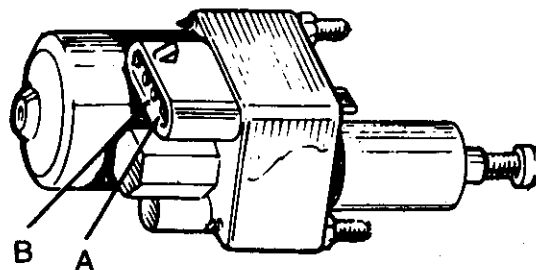
Closed Throttle Switch Test

NOTE: It is important that all testing be done with the ISA motor plunger in the fully extended position, as it would be after a normal engine shut down. If it is necessary to extend the motor plunger to test the switch, an ISA motor failure can be suspected. Refer to the ISA Motor Adjustment if necessary.

With the ignition switch ON, test the switch voltage at the diagnostic connector (D2-13 and D2-7/ground). The voltage should be close to 0 at closed throttle and greater than 2 volts off the closed throttle position.

- If the voltage is always 0, test for a short circuit to ground in the wire harness or switch. Test for an open circuit between J2-20 (ECU connector) and the switch.
- If the voltage is always more than 2 volts, test for an open circuit in the wire harness between the ECU and the switch connector, and between the switch connector and ground. Repair or replace the wire harness as necessary.

NOTE: The closed throttle switch wires are brown w/tr (–) and w/tr (+).



- A. Ground (–)
B. Closed Throttle Switch

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ISA Motor Diagnostic Test

WARNING: After testing the operation of the ISA motor, or if the ISA motor has been replaced, always extend the ISA motor before starting the engine to prevent the ISA motor from jamming.

NOTE: The following test must be performed using Exerciser tool Ele. AB.99.

NOTE: If the ISA motor is to be tested off the vehicle, the ISA motor shaft must be lightly preloaded to avoid having the ISA motor jam during the test. Use light finger pressure to preload the ISA motor shaft and simulate throttle return pressure.

Remove the air cleaner assembly.

Check to ensure that the rubber boot is correctly positioned in its groove on the ISA motor shaft.



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- If not, correct its position and recheck vehicle for proper idle speed operation.
- If correctly positioned, continue diagnosis procedure.

Open the throttle and attempt to extend and retract the ISA motor by pulling and pushing axially (in and out) on the ISA shaft.

CAUTION: If the shaft axial movement is more than 9.525 mm (3/8 in.), do not continue. Replace the ISA motor.

Be sure the ignition switch is in the OFF position.

Connect the exerciser clips to the vehicle battery (red to positive/black to negative).

Disconnect the ISA motor connector.

Connect the ISA motor exerciser 4-pin connector to the ISA motor.

ISA MOTOR DIAGNOSTIC TESTING

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TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
1. Examine the ISA motor shaft tip position.	The ISA motor tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor tip is not in contact with throttle lever and throttle lever is closed.	THEN , ISA motor is fully retracted and jammed. Go to sequence No. 2 to unjam ISA motor.
		IF, desired results were obtained.	THEN , skip test sequence No. 2 and perform test sequence No. 3.
2. Apply parking brake, and start engine. With the engine running, open throttle to approx. 1500 rpm and move exerciser switch in the EXTEND direction several times to unjam the ISA. Turn ignition switch to OFF position.	ISA motor shaft tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor shaft tip is not in contact with the throttle lever and throttle is still closed.	THEN , ISA motor is permanently jammed. Stop procedure and replace ISA motor.
		IF, desired results were obtained.	THEN , ISA motor is unjammed Go to test sequence No. 3.
3. Move the exerciser switch in the EXTEND direction for 5 seconds. Watch ISA motor action.	ISA motor should ratched (click) several times when it has reached fully extended position.	IF, it does not ratchet (click)	THEN , ISA motor is defective. Stop procedure. Replace ISA motor.
		IF, desired results were obtained.	THEN , ISA motor is OK. Perform test sequence No. 4.
4. Move the exerciser switch in the RETRACT direction for 5 seconds. Watch the ISA motor action.	ISA motor should close throttle and stop automatically in 3 seconds. The closed throttle switch light on the exerciser will go out when ISA motor reaches closed throttle position. The tip of the ISA should be in contact with, but no more than 0.50 mm (0.20-in), away from throttle lever (A) when ISA motor has stopped movement (see the illustration). The throttle linkage should also be in contact with the throttle stop screw (B) on the main body of the TBI when ISA motor movement has stopped	IF, ISA motor did not move.	THEN , ISA motor is defective. Stop the procedure. Replace ISA motor.
		IF, ISA motor closed the throttle, but retracted away from throttle lever and was no longer in contact with throttle lever.	THEN , ISA motor is defective. Stop the procedure. Replace the ISA motor.
		IF, ISA motor moved the throttle, but throttle was not in contact with the closed throttle stop screw on the TBI main body when ISA motor movement stopped.	THEN , perform test sequence No. 5.
		IF, desired results were obtained.	THEN , skip test sequence No. 5 and perform test sequence No. 6.



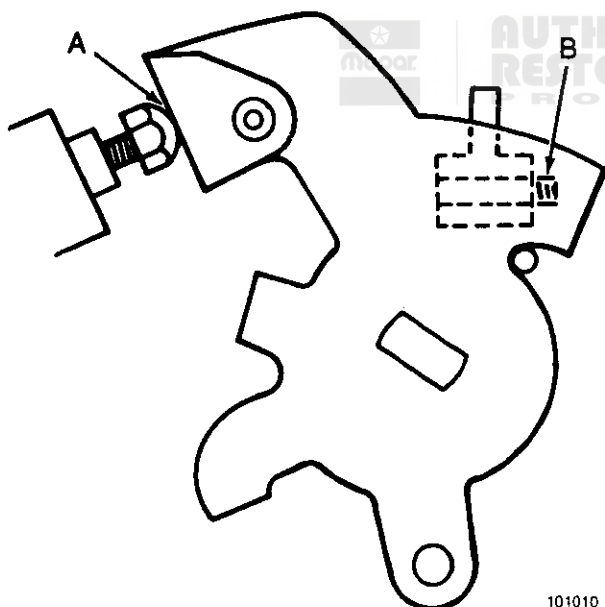
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TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
5. Push throttle in CLOSED direction while pressing exerciser switch in RETRACT direction for 5 seconds.	ISA motor should continue to retract until throttle lever contacts with closed throttle stop screw on TBI main body.	IF, desired results were obtained.	THEN, ISA motor is OK. Check throttle control system for freedom and smoothness of movement. Inspect throttle return springs. Repair as necessary. After repair, perform test sequence No. 6.
		IF, ISA motor did not move.	THEN, ISA motor is defective. Stop the procedure. Replace the ISA motor.
6. Move the ISA motor in the EXTEND and RETRACT direction 2 or 3 times. ALWAYS leave ISA motor EXTENDED.	ISA motor should operate smoothly and ratchet (click) at end of EXTEND travel. It should stop automatically at end of RETRACT travel.	IF, the movement is intermittent, slow, or "gritty sounding".	THEN, replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is OK. Do not replace ISA motor.
		IF, an idle problem still exists.	THEN, further diagnosis is necessary.

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Disconnect the ISA motor exerciser connector from the ISA motor and from the battery.

Connect the original harness connector to the ISA motor.

Install the air cleaner assembly (if it had been removed).

Manifold Absolute Pressure (MAP) Sensor Test

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

Test the MAP sensor output voltage at the MAP sensor connector pin B (as marked on the sensor body) with the ignition switch ON and the engine OFF. Output voltage should be 4 - 5 volts.

NOTE: The voltage should drop to 1.5 - 2.1 volts with a hot neutral idle speed condition.

Test ECU pin J2-12 for the same voltage described above to verify the wire harness condition. Repair as necessary.

Test the MAP sensor supply voltage at the sensor connector pin C with the ignition ON. The voltage should be 5 volts ($\pm 0.5V$).

The voltage should also be at pin J2-2 of the ECU wire harness connector. Repair or replace the wire harness as necessary.

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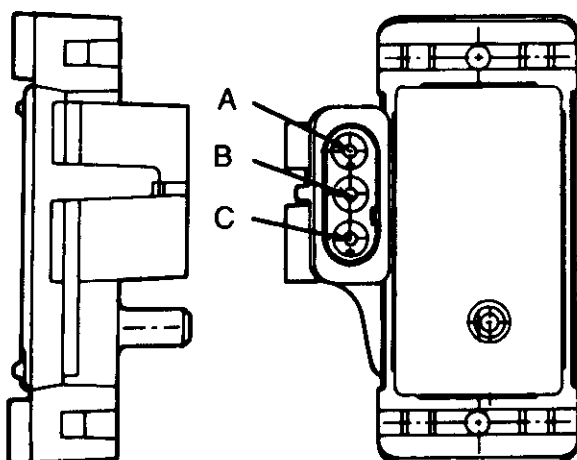
Test the ECU with a MS. 1700 Diagnostic Tester if necessary.

Test the MAP sensor ground circuit at sensor connector pin A and ECU connector pin J2-13. Repair the wire if necessary.

Test the MAP sensor ground circuit at the ECU connector between pin J2-13 and pin J1-F with an ohmmeter.

- If the ohmmeter indicates an open circuit, inspect for a good sensor ground connection on the flywheel housing near the starter motor. If the ground connection is good, replace the ECU.
- If pin J2-13 has a short circuit to 12 volts, correct this condition before replacing the ECU.

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A. Ground
B. Output Voltage
C. 5 Volts

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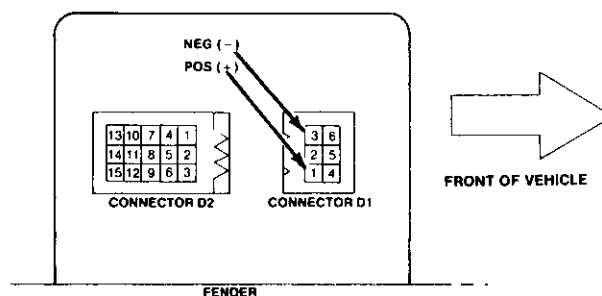
IDLE SPEED ACTUATOR (ISA) MOTOR ADJUSTMENT

Adjustment of the ISA motor plunger is necessary only to establish the initial position of the plunger after the motor has been replaced.

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.

Remove the air filter, start the engine and allow to attain normal operating temperature (upper radiator hose hot). Turn the A/C (if equipped) to the OFF position.

Connect a tachometer to diagnostic terminals D1-1 and D1-3.



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THROTTLE BODY FUEL INJECTION SYSTEM

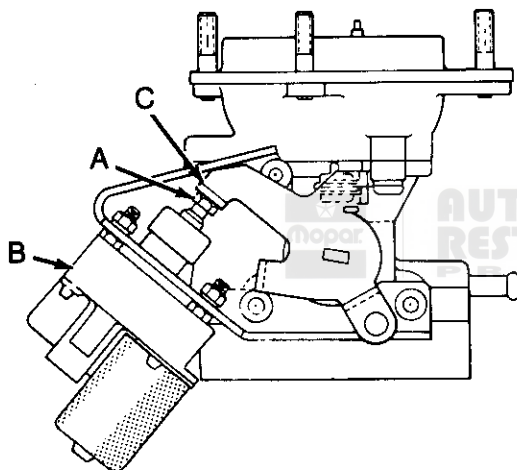
1.4L 1983-1985



Turn the ignition off. The ISA motor plunger should move to the fully extended position.

With the ISA motor plunger fully extended, disconnect the ISA motor wire harness connector and start the engine.

With this condition, the engine idle speed should be 3500 RPM (± 200). If the speed is not correct, turn the hex head screw (A) on the end of the plunger to provide an engine speed of 3500 RPM.



A - Hex-head adjustment screw (also part of the closed throttle switch plunger).
B - Idle speed control (ISC) motor
C - Throttle lever

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Fully retract the ISA motor by holding the closed throttle switch plunger in while the throttle is opened. The closed throttle switch plunger should not be touching the throttle lever when the throttle is returned to the closed position. If contact is noted, check the throttle linkage and/or cable for binding or damage. Correct if necessary.

Connect the ISA wire harness connector.

Turn the ignition off for 10 seconds. The ISA motor should move to the fully extended position.

Start the engine. The engine speed should be approximately 3500 RPM for a short period of time and then decrease to idle speed.

Turn the ignition off. Disconnect the tachometer.

After the final adjustment of the ISA motor, apply a thread penetrating sealant (Loctite 290 or equivalent) to the adjustment screw threads to prevent movement.

NOTE: After the Loctite sealant hardens, application of heat with a soldering gun is required to loosen the adjustment screw threads. Application of Loctite sealant should be done only after the final adjustment is performed. Do not use flame type heat to loosen the adjustment screw, otherwise damage to the ISA motor will result.

Install the air filter.

NOTE: Holding the closed throttle switch plunger in as described above may cause a trouble code to be registered in the ECU memory. This code will be stored as an intermittent trouble. With the ignition off, disconnect the battery negative cable (10 seconds) to clear the trouble code from the ECU memory.

SEE
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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1983-1985



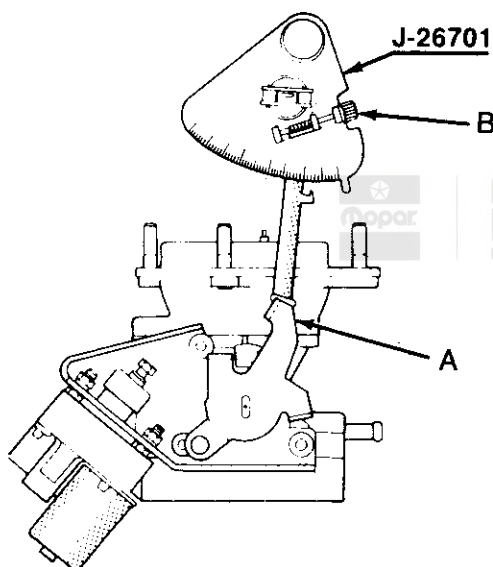
WIDE OPEN THROTTLE (WOT) SWITCH ADJUSTMENT

Adjustment of the WOT switch is necessary only to establish the initial position of the switch after it has been replaced.

Block or tie the throttle linkage in the wide open throttle position.

Attach Angle Measuring Gauge J-26701-A, to the flat surface of the throttle lever (A).

SEE
I.S.
NOTES



Rotate the degree scale of gauge J-26701-A until the 12 degree mark is aligned with the gauge pointer.

Center the gauge bubble between the alignment marks using the bubble adjusting screw (B).

Rotate the gauge degree scale until the zero degree mark is aligned with the gauge pointer.

Close the throttle until the gauge bubble is again centered between the alignment marks. This

positions the throttle plate at 12 degrees before wide open throttle.

Rotate the WOT switch until the switch lever contacts the throttle cam. Stop rotating the switch when the lever starts closing the switch plunger (plunger will make a click sound at this point). Then tighten the switch screws 90 N·m (8.8 in.-lbs) torque.

Verify WOT throttle switch position adjustment. Switch plunger should "click" when the throttle plate is 12 degrees before wide open throttle position.

Remove gauge J-26701 and install the air cleaner.

FUEL PRESSURE REGULATOR ADJUSTMENT

Adjustment of the fuel pressure regulator is necessary to establish the correct pressure after a replacement has been installed.

Remove the air cleaner assembly.

Connect a tachometer to the diagnostic connector terminals D1-1 and D1-3.

NOTE: Some models do not have a pressure test fitting on the throttle body. The fitting, PN 8983 501 572 can be obtained from the Parts Department.

Connect an accurate fuel pressure gauge to the fuel body pressure test fitting (A).

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.



THROTTLE BODY FUEL INJECTION SYSTEM

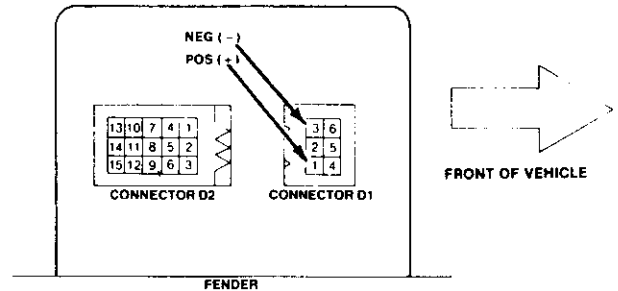
1.4L 1983-1985



Start the engine and accelerate to a speed of approximately 2000 RPM.

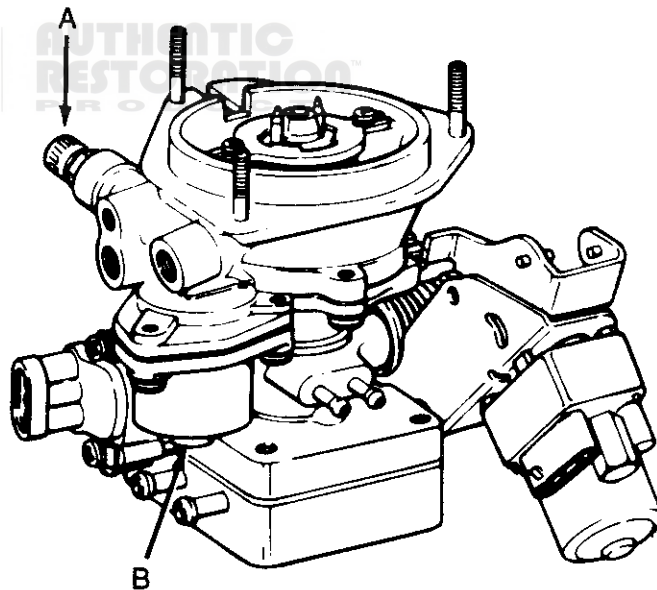
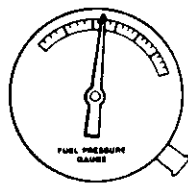
NOTE: Turning the screw inward increases the pressure and turning the screw outward decreases the pressure.

Turn the Torx head adjustment screw (B) on the bottom of the regulator to obtain 1 bar (14.5 psi) of pressure.



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Install a lead seal ball to cover the regulator adjustment screw (B) after adjusting the pressure to specification.

Turn the ignition off.

Disconnect the tachometer.

Disconnect the fuel pressure gauge and install the cap on the test fitting (A).

Install the air cleaner assembly.

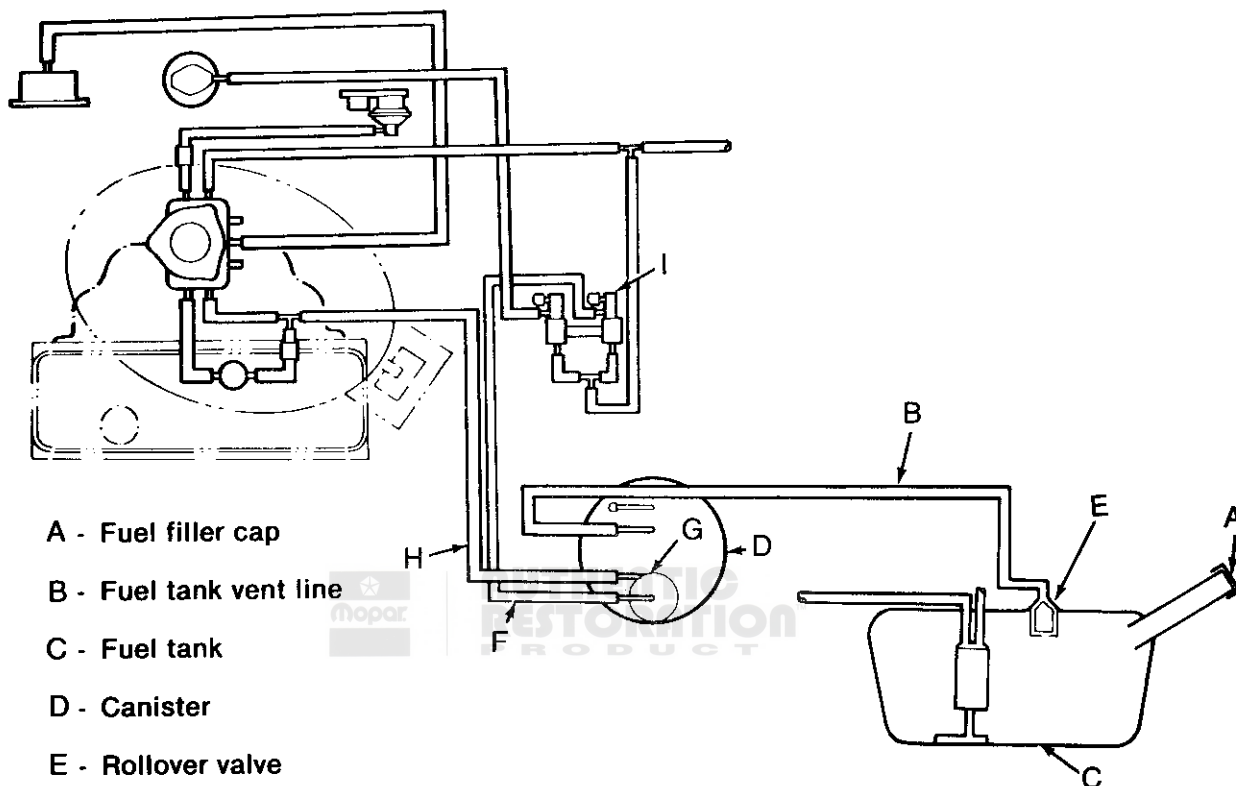


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



VACUUM AND WIRING DIAGRAMS FUEL EVAPORATIVE CONTROL SYSTEM 1.4L



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NOTES

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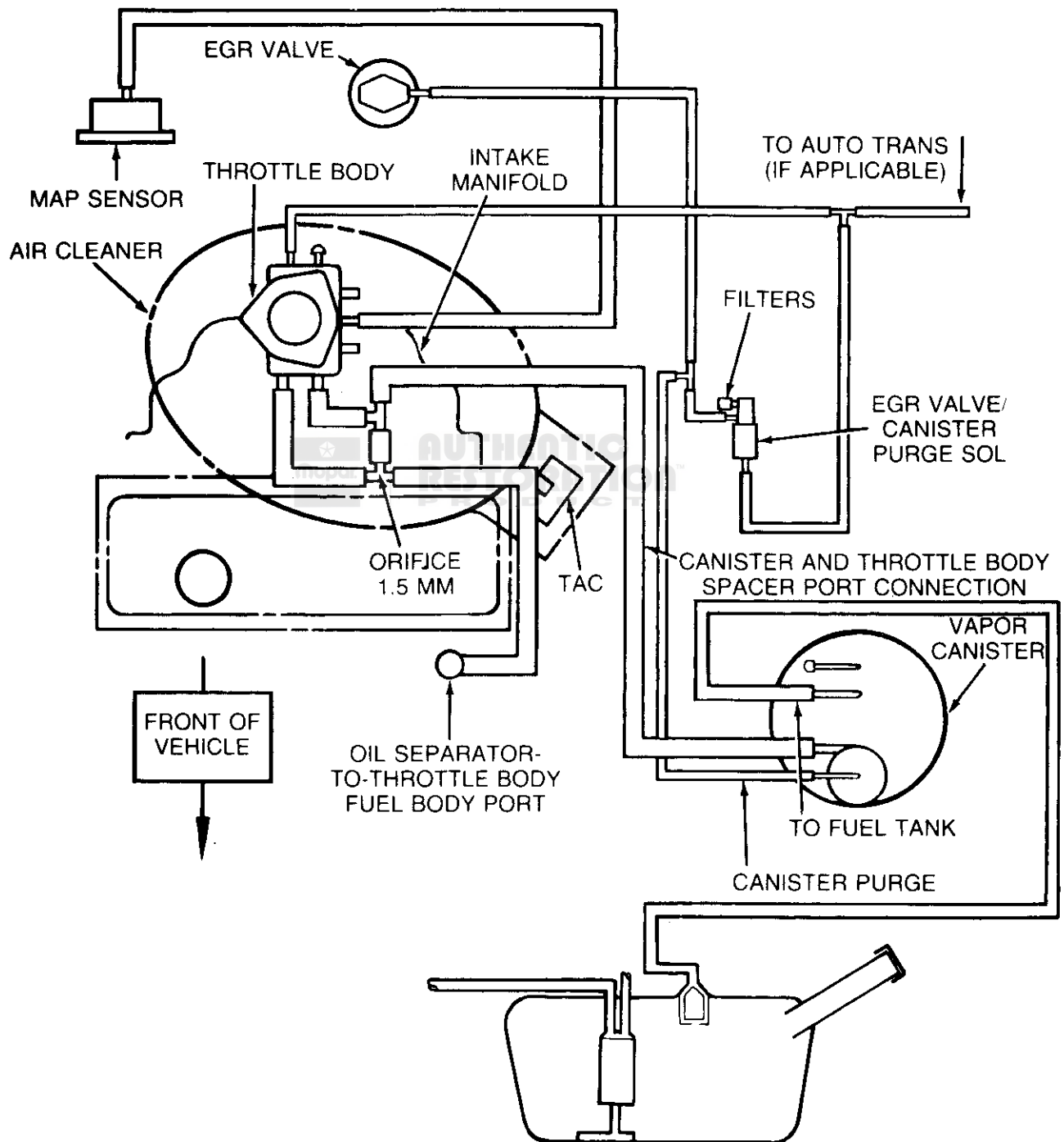


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



FUEL EVAPORATIVE CONTROL SYSTEM 1.7L



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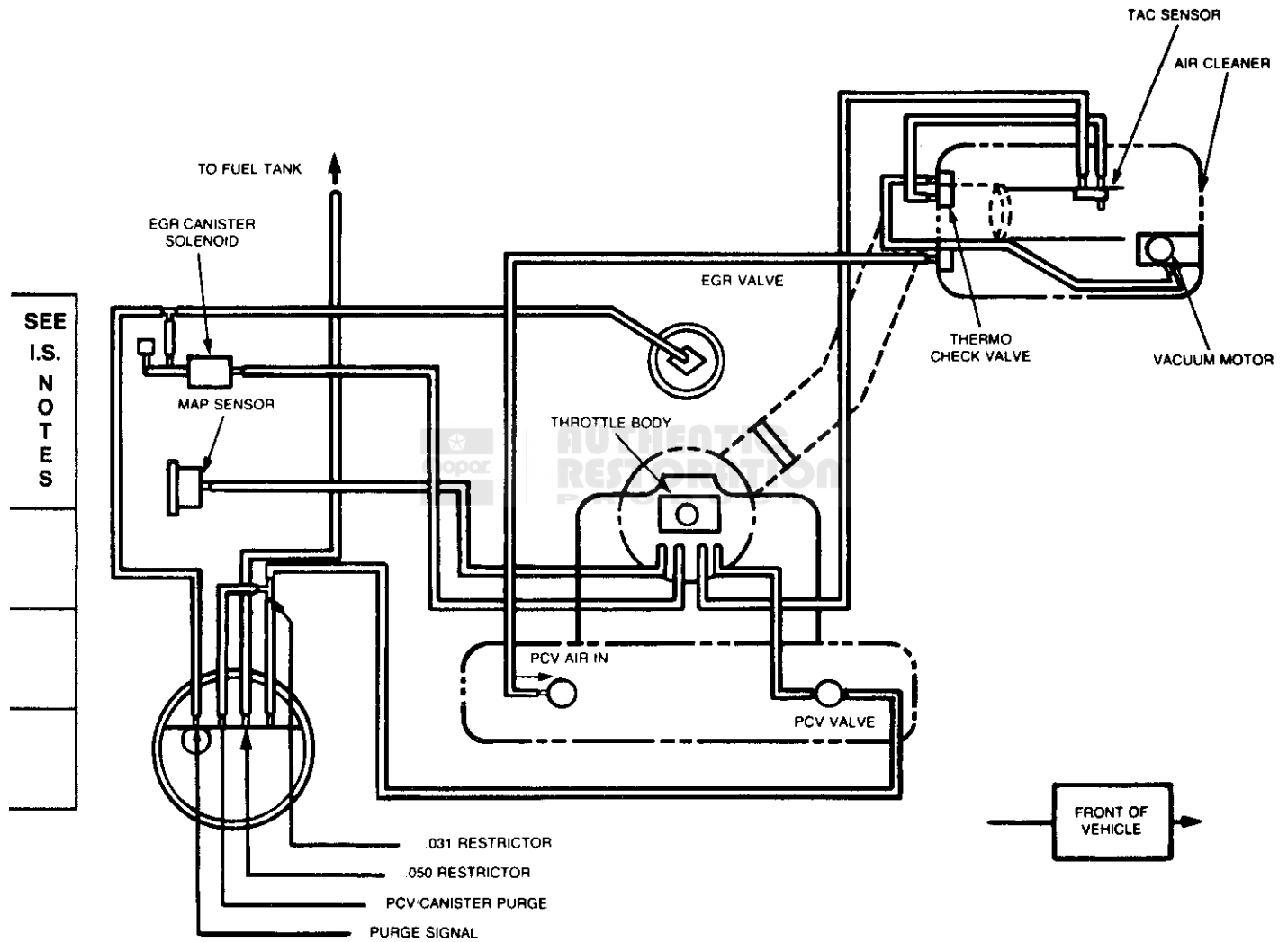


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



FUEL EVAPORATIVE CONTROL SYSTEM 2.46L



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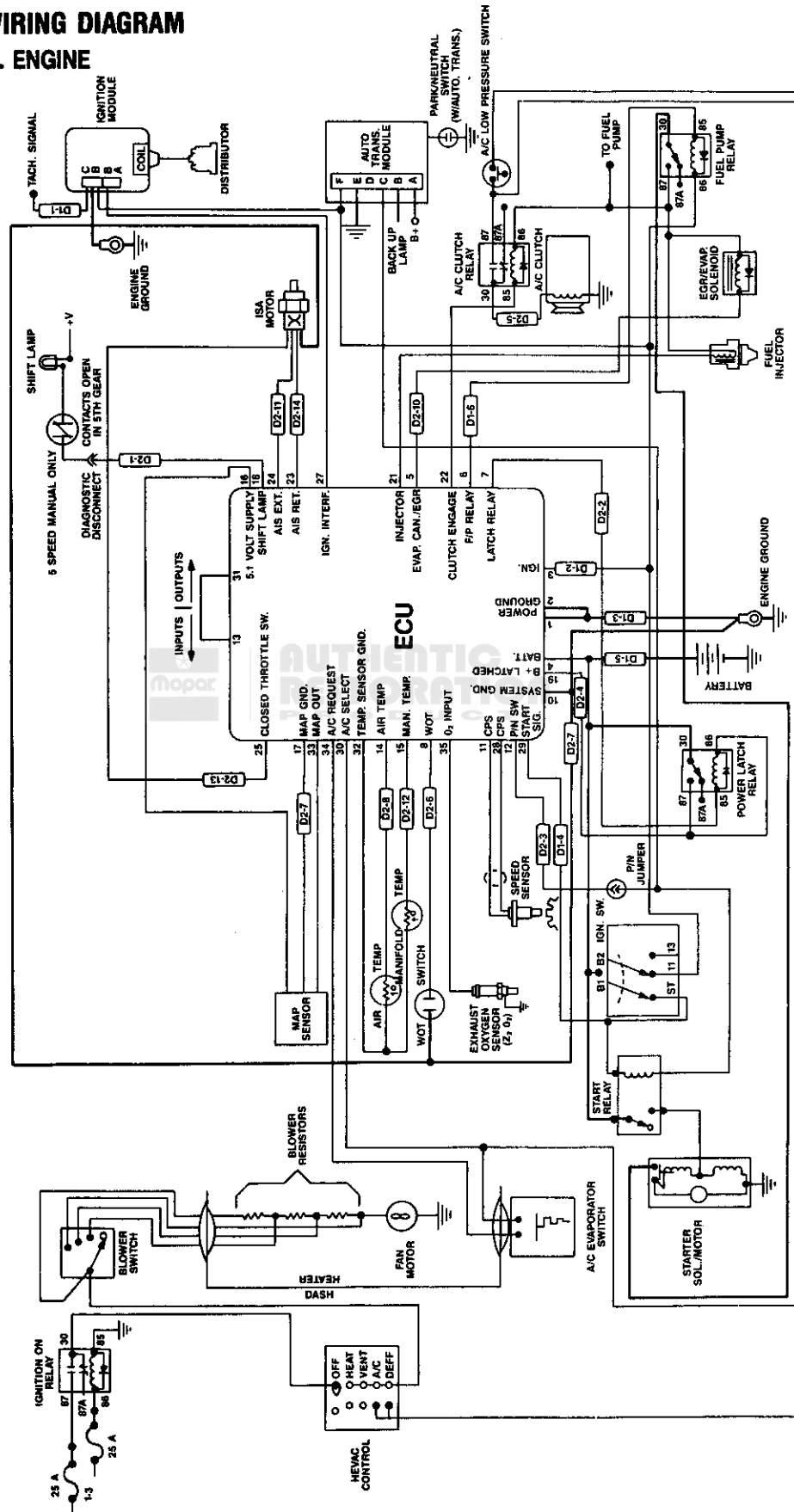
THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



TBI SYSTEM WIRING DIAGRAM

1986 & 1987 1.4L ENGINE



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I.S.
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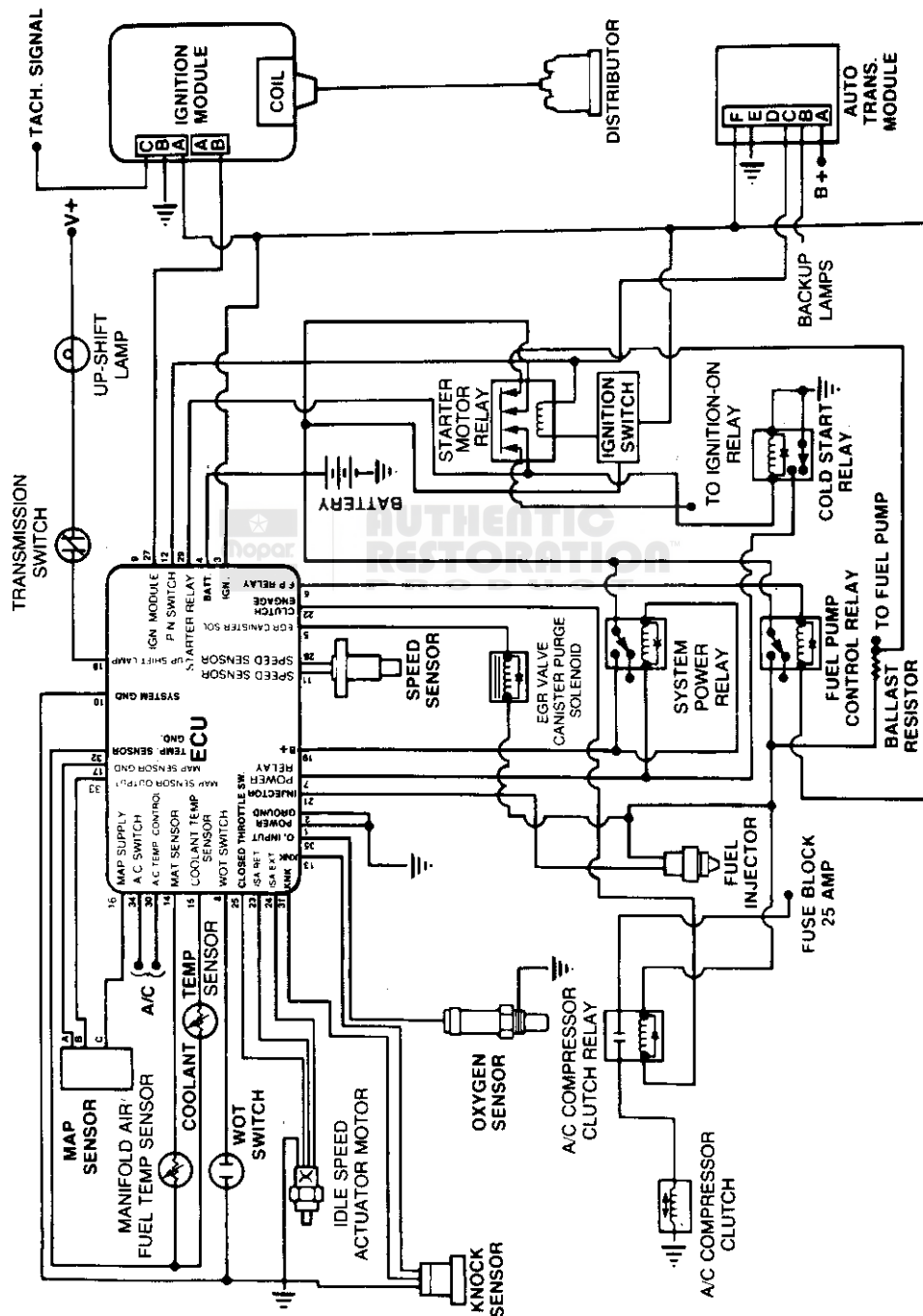
THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



TBFI SYSTEM WIRING DIAGRAM — 1985 1.7L ENGINE

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NOTES



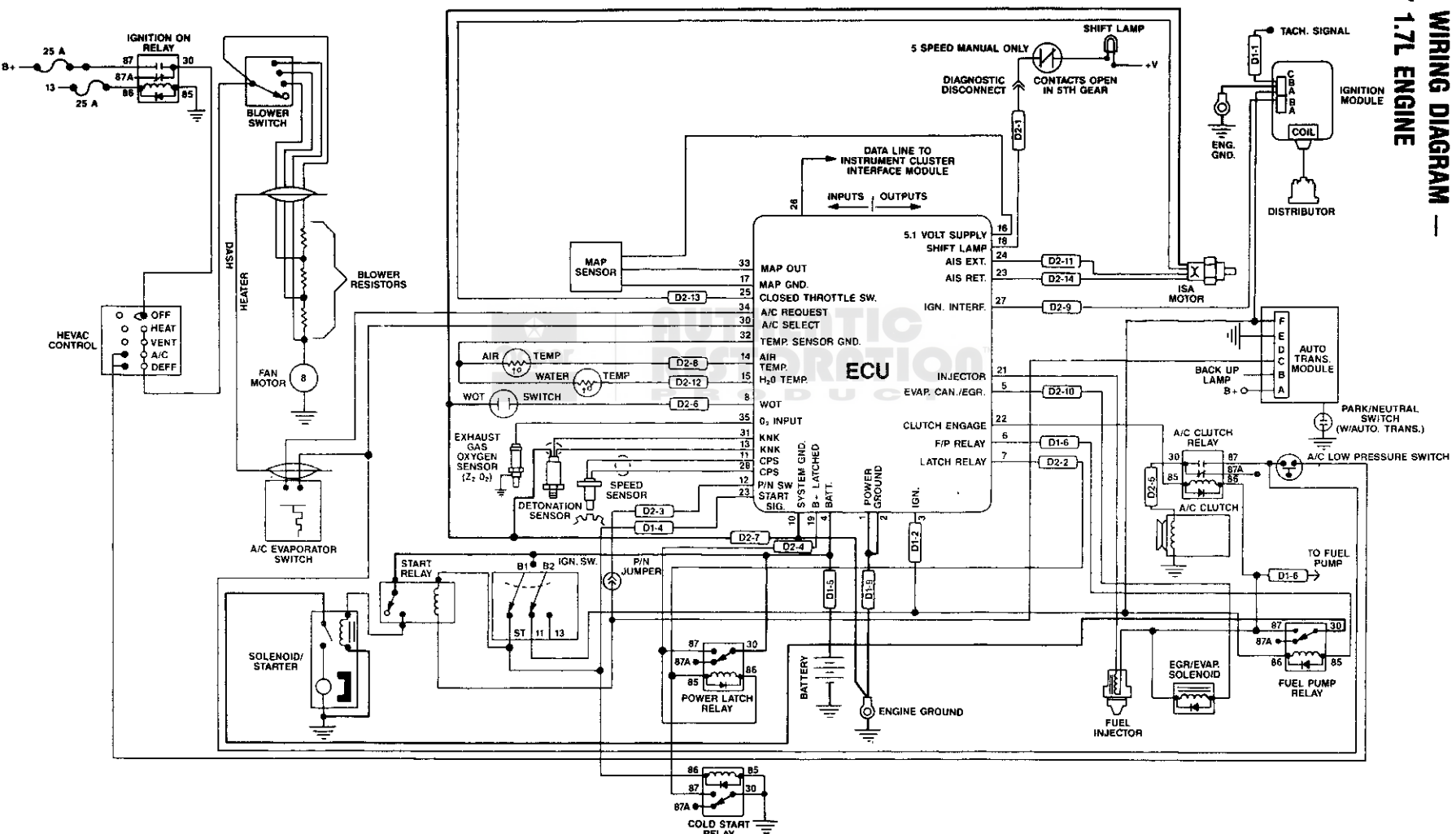


THROTTLE BODY FUEL INJECTION SYSTEM



1.4L 1986-1987/1.7L/2.46L

TBI SYSTEM WIRING DIAGRAM — 1986 & 1987 1.7L ENGINE



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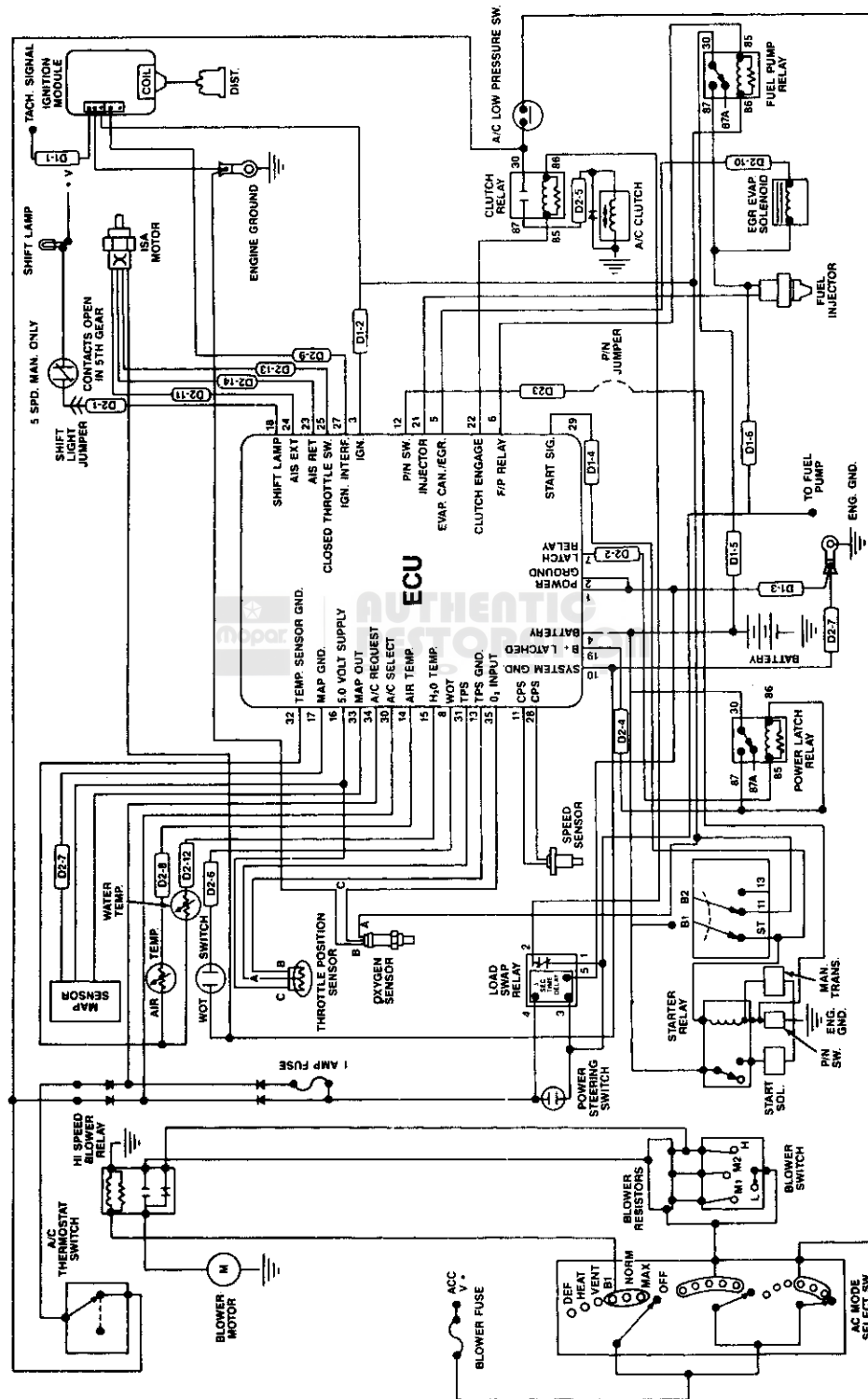
THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



TBI SYSTEM WIRING DIAGRAM — 1986 & 1987 2.46L ENGINE

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



COMPONENT REPLACEMENT

Fuel Injector

Removal

Remove the air cleaner assembly.

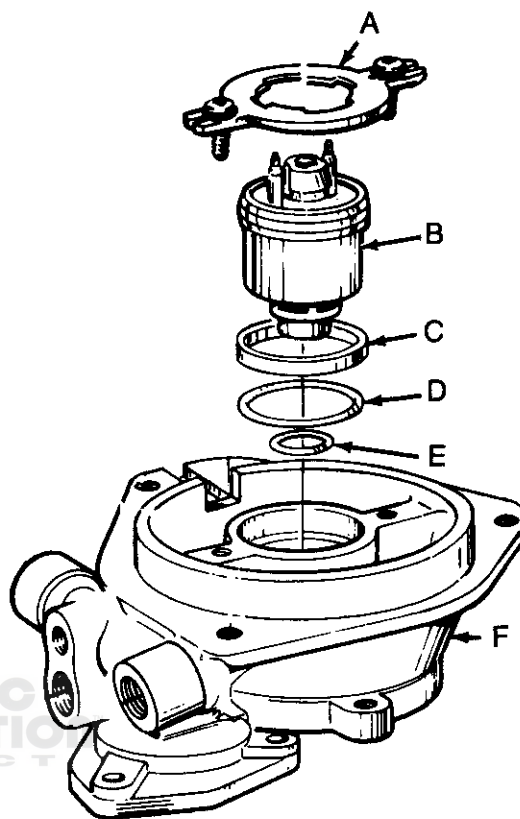
Remove the injector wire connector.

Remove the injector retainer clip screws.

Remove the injector retainer clip (A).

Using a pair of small pliers, gently grasp the center collar of the injector (between the electrical terminals) and carefully remove the injector (B) with a lifting-twisting motion.

Discard the upper (C) and lower (D) O-rings. Note that the backup ring (E) fits over the upper O-ring (C).



- A. Retainer Clip
- B. Injector
- C. Upper O-Ring
- D. Lower O-Ring
- E. Backup Ring
- F. Fuel Body

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

Lubricate with light oil and install a replacement lower O-ring (D) in the housing bore.

Lubricate with light oil and install a replacement upper O-ring (C) in the housing bore.

Install the backup ring (E) over the upper O-ring (C).

Position the replacement injector (B) in the fuel body and center the nozzle in the lower housing bore.

Seat the injector (B) with a pushing-twisting motion.

Align the wire connector terminals in the proper orientation.

Install the retainer clip (A) and screws.

Connect the injector wire connector.

Install the air cleaner assembly.

Fuel Pressure Regulator

Removal

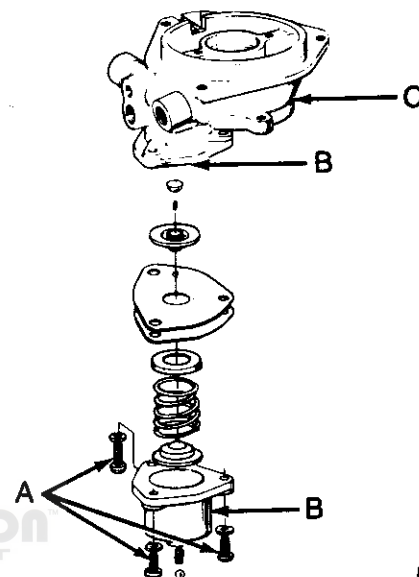
Remove the throttle body assembly as described in this section.

Remove the three retaining screws (A) that secure the pressure regulator (B) to the fuel body (C).

Remove the pressure regulator assembly (B).

Note the location of the components for assembly reference.

Discard the gasket.



83037

Installation

Position the pressure regulator assembly (B) with a replacement gasket.

Install the three retaining screws (A) to secure the pressure regulator (B) to the throttle body (C).

Install the throttle body assembly as described in this section.

Operate the engine and inspect for leaks.

Adjust the fuel pressure regulator as described in this section.

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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Throttle Position Potentiometer 1.4L/1.7L Automatic Transmission

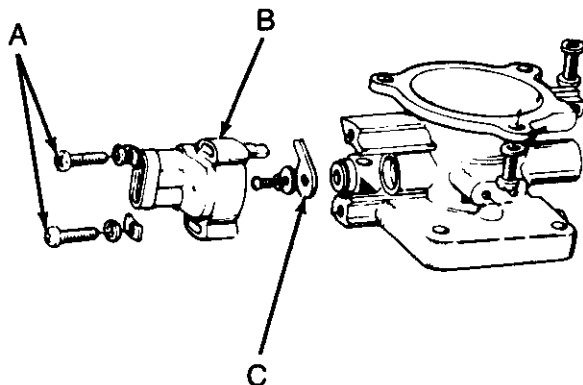
Refer to M.R. 245 section F for replacement procedures. Refer to T.A. M... for adjustment procedures.

Throttle Position Sensor (TPS) 2.46L Engine

Removal

Remove the:

- upper and lower air inlet bonnet
- throttle body assembly as described in this section
- 2 Torx head retaining screws (A)
- throttle position sensor (B) from the throttle shaft lever



83036

Installation

Position the throttle position sensor (B) over the throttle shaft lever (C).

Install the 2 Torx head screws (A) to retain the sensor.

Adjust the TPS switch as described in this manual.

Install the throttle body assembly as described in this section.

Install the upper and lower air inlet bonnet.

Idle Speed Actuator (ISA) Motor (Renault)

Removal

Remove the air cleaner assembly.

Disconnect the following:

- wide open throttle (WOT) and ISA motor wires
- throttle cable (at WOT/ISA mounting bracket and at throttle body)
- throttle return spring
- cruise control cable (if equipped)

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



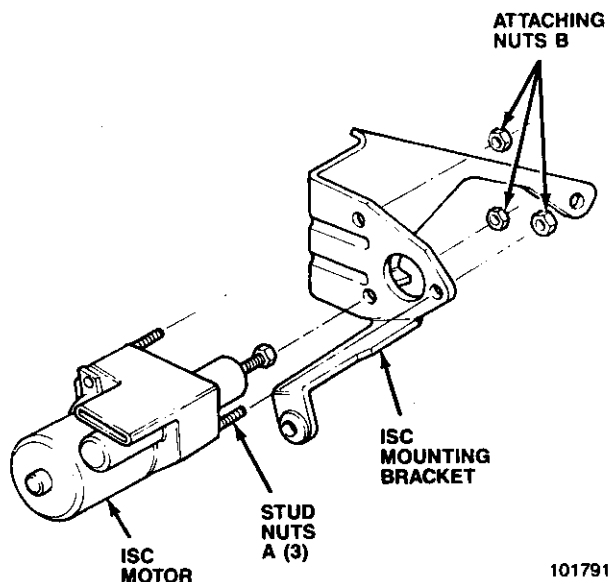
Remove the ISA motor from the mounting bracket as follows:

CAUTION: Do not attempt to remove the ISA motor-to-bracket nuts (B) without using a backup wrench on the stud nuts (A). ISA motor internal components may be dislodged if the studs disengage and the motor cap comes off.

NOTE: It may be necessary to thin the backup wrench on a grinder before it will fit between the motor and bracket.

- Place backup 8 mm open end wrench on the ISA motor stud nuts (A) to prevent the studs from turning.
- Remove the ISA motor-to-bracket attaching nuts (B) and remove the motor (C) from the bracket (D).

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NOTES



Installation

Install the ISA motor (C) on the mounting bracket (D).

Connect the following:

- cruise control cable (if equipped)
- throttle return spring
- throttle cable (to ISA/WOT mounting bracket and throttle body)
- ISA motor and WOT switch wires

Install the air cleaner assembly.

Extend the ISA motor plunger as follows:

- Press accelerator downward to 1/4 - 1/2 throttle position and start the engine (this procedure prevents the ISA motor plunger from retracting).
- Stop the engine after 5-10 seconds. When the ignition is turned off, the ISA motor plunger will fully extend.

NOTE: The ISA motor plunger must be fully extended before operating the vehicle. If the plunger is not fully extended beforehand, the closed throttle switch may open prematurely causing idle speed to drop to approximately 400 RPM.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Idle Speed Actuator (ISA) Motor (Jeep)

Removal

NOTE: The closed throttle (idle) switch is integral with the motor.

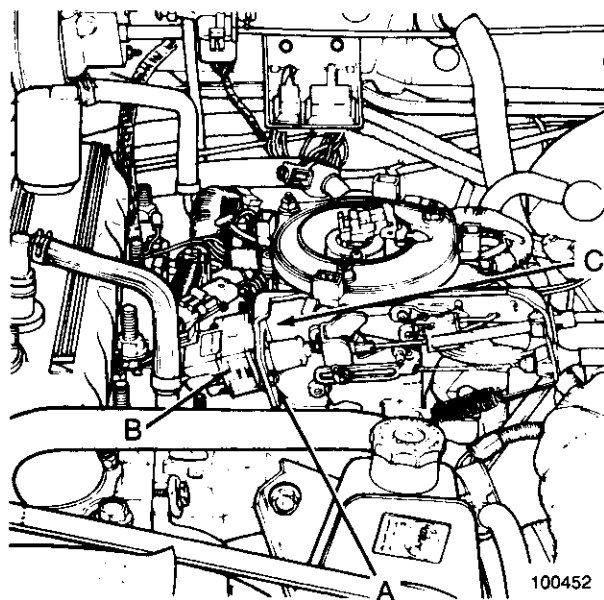
Disconnect the throttle return spring.

Disconnect the wire harness connector from the motor.

CAUTION: Do not attempt to remove the ISA motor-to-bracket nuts (B) without using a backup wrench on the stud nuts (A). ISA motor internal components may be dislodged if the studs disengage and the motor cap comes off.

Remove the motor-to-bracket retaining nuts (A). Use a backup wrench to prevent the studs which hold the ISA motor together from turning.

Remove the motor (B) from the bracket (C).



Installation

Install the ISA motor (B) on the bracket (C) using retaining nuts (A).

Connect the wire harness connector to the ISA motor.

Connect the throttle return spring.

Canister Purge/EGR Solenoid

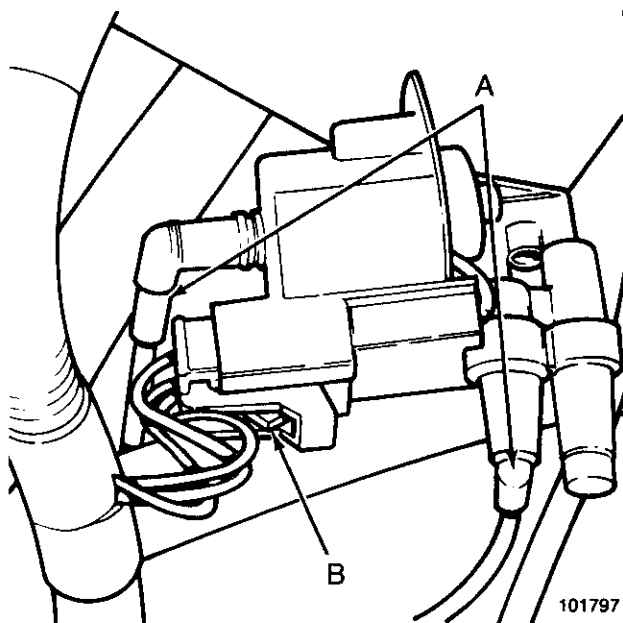
Removal

Disconnect the vacuum hoses (A) from the solenoid.

Disconnect the electrical connection (B) from the solenoid.

Remove the solenoid and bracket as an assembly.

Renault



RENAULT

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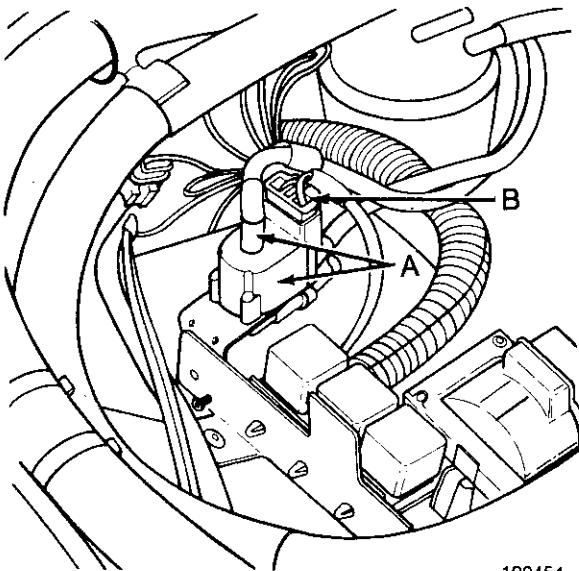


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Wagoneer/Cherokee/Comanche



100454

Connect the electrical connection (B) to the solenoid.

Connect the vacuum hoses (A) to the solenoid.

EGR Valve (Renault)

NOTE: The EGR valve is located on the intake manifold below the throttle body.

Removal

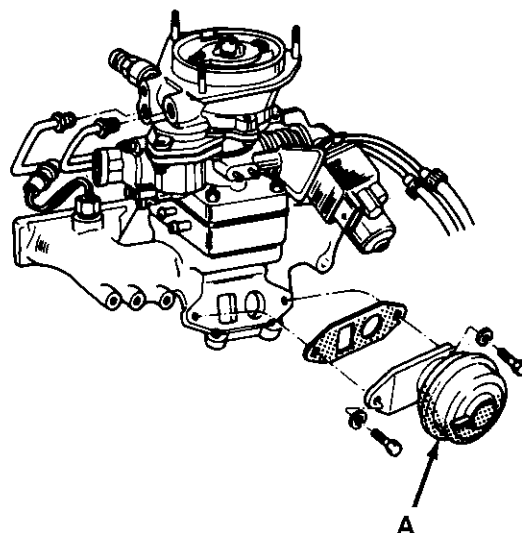
Disconnect the vacuum hose from the EGR valve (A).

Remove the 2 EGR valve-to-intake manifold retaining bolts.

Remove the EGR valve from the intake manifold.

Discard the original gasket.

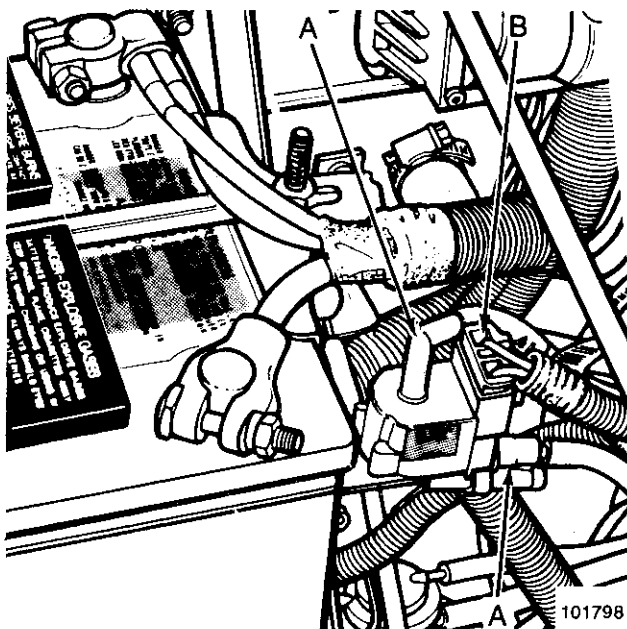
Clean the EGR valve and intake manifold mating surfaces.



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Jeep Wrangler/YJ



101798

Installation

Install the solenoid and bracket assembly.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

Position the replacement EGR valve (A) on the intake manifold with a replacement gasket.

Install the EGR valve-to-intake manifold bolts.

Connect the vacuum hose to the EGR valve.

EGR Valve (Jeep)

Removal

NOTE: The EGR valve is located on the intake manifold below the throttle body.

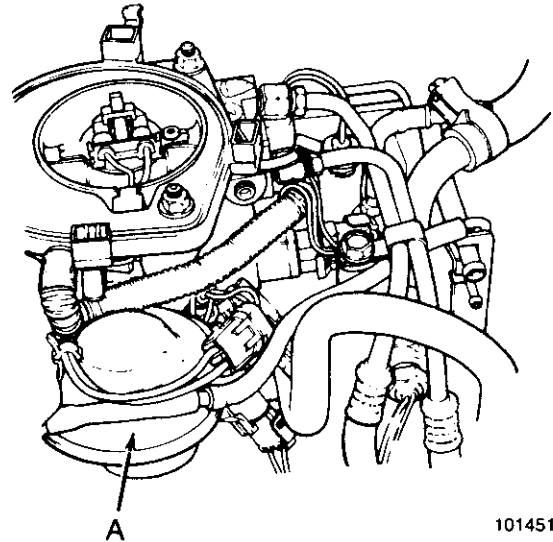
Disconnect the vacuum hose from the EGR valve (A).

Remove the 2 EGR valve-to-intake manifold retaining bolts.

Remove the EGR valve from the intake manifold.

Discard the original gasket.

Clean the EGR valve and intake manifold mating surfaces.



101451G-1

Installation

Position the replacement EGR valve on the intake manifold with a replacement gasket.

Install the EGR valve-to-intake manifold bolts.

Connect the vacuum hose to the EGR valve.

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Manifold Absolute Pressure (MAP) Sensor (Renault)

NOTE: The MAP sensor is located on the plenum chamber rear panel.

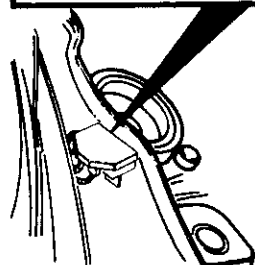
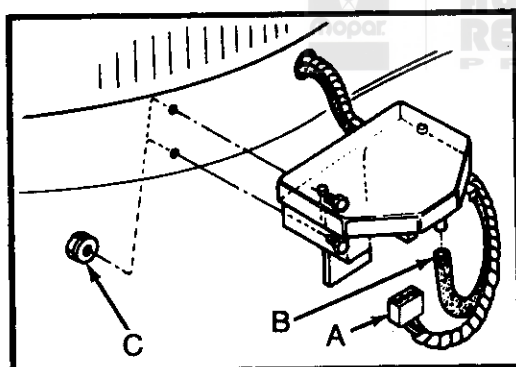
Removal

Disconnect the wire harness connector (A).

Disconnect the vacuum hose (B).

Remove the retaining nuts (C).

Remove the MAP sensor from the plenum chamber panel.



83040A

Installation

Position the MAP sensor on the plenum chamber panel.

Install the MAP sensor-to-plenum chamber panel nuts (C).

Connect the vacuum hose (B).

Connect the wire harness connector (A).

Manifold Absolute Pressure (MAP) Sensor (Jeep)

NOTE: The MAP sensor is located on the dash panel.

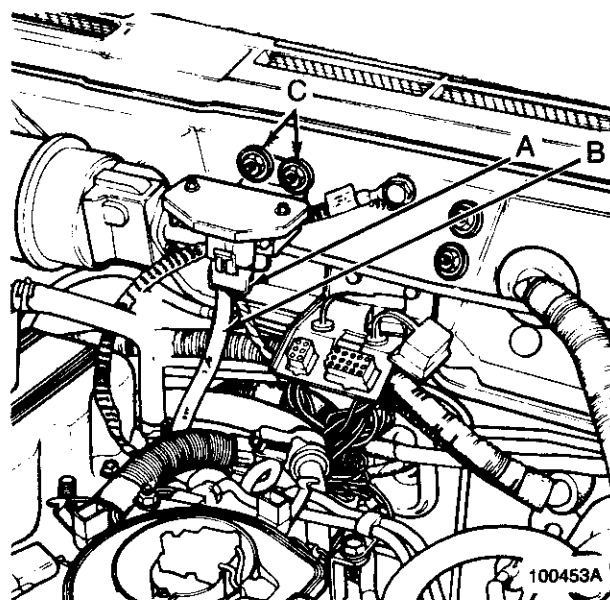
Removal

Disconnect the wire harness connector (A).

Disconnect the vacuum hose (B).

Remove the retaining nuts (C).

Remove the MAP sensor from the dash panel.



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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

Position the MAP sensor on the dash panel.

Install the MAP sensor-to-dash panel nuts (C).

Connect the vacuum hose (B).

Connect the wire harness connector (A).

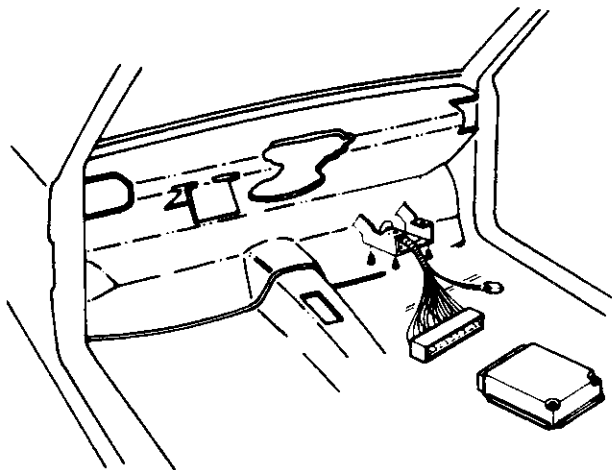
Electronic Control Unit (ECU) (Renault)

Removal

Remove the retaining screws and bracket that support the ECU below the glove box.

Remove the ECU.

Disconnect the wire harness connectors from the ECU.



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Installation

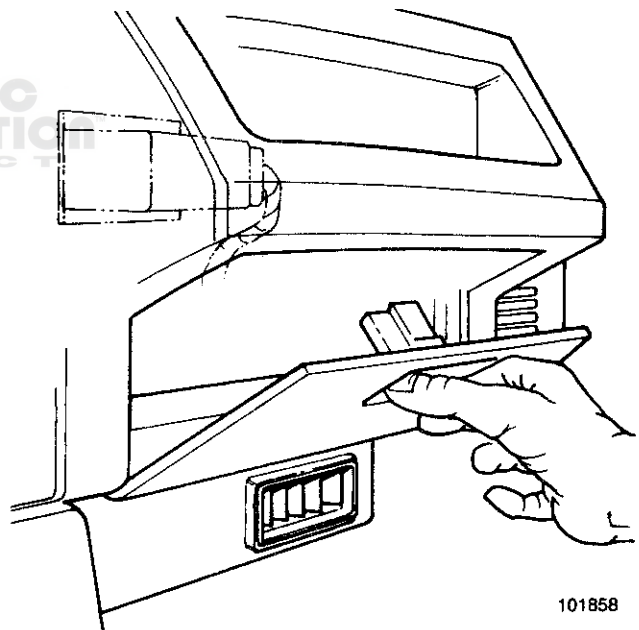
Connect the wire harness connectors to the replacement ECU.

Position the replacement ECU in the bracket.

Install the bracket and ECU retaining screws.

Electronic Control Unit (ECU) (Wrangler/YJ)

NOTE: The ECU is located behind the glove box.



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Removal

Remove the passenger assist handle and the glove box assembly.

Remove the ECU bracket retaining nuts from the engine compartment side of the dash panel.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Disconnect the ECU wire harness from the ECU.

Remove the ECU from the ECU bracket.

Installation

Install the ECU to the ECU bracket.

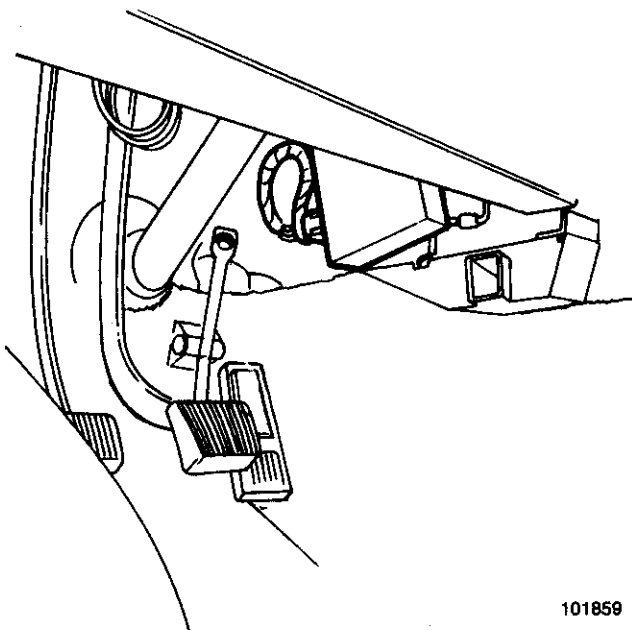
Connect the ECU wire harness to the ECU.

Install the ECU and bracket assembly into position and install retaining nuts on dash panel.

Install the glove box assembly and the passenger assist handle.

Electronic Control Unit (ECU) (Wagoneer/Cherokee/Comanche)

NOTE: The ECU is located under the instrument panel to the right of the steering column.



101859

Removal

Remove the ECU retaining screws.

Lower the ECU from under the instrument panel.

Disconnect the ECU wiring harness connector and remove ECU.

Installation

Connect the ECU to the ECU wire harness connector.

Position the ECU under the instrument panel and install retaining screws into the ECU bracket.

Manifold Air/Fuel Temperature (MAT) Sensor (Renault)

Removal

NOTE: 1986 and later models have a MAT sensor with a pigtail harness and connector.

Disconnect the wire harness connector from the MAT sensor (A).

Remove the MAT sensor from the intake manifold.

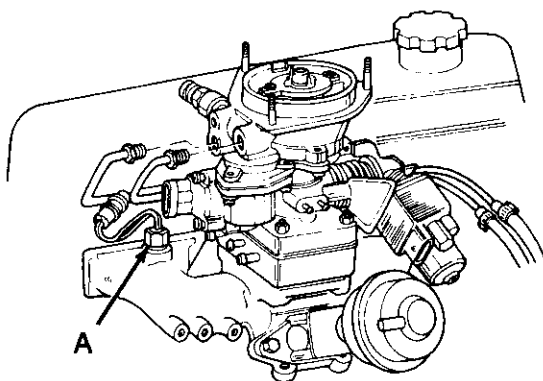
Clean the threads in the manifold.

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



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Installation

Wrap the replacement MAT sensor threads with Teflon tape.

Install the MAT sensor (A) in the intake manifold.

Connect the wire harness connector to the MAT sensor.

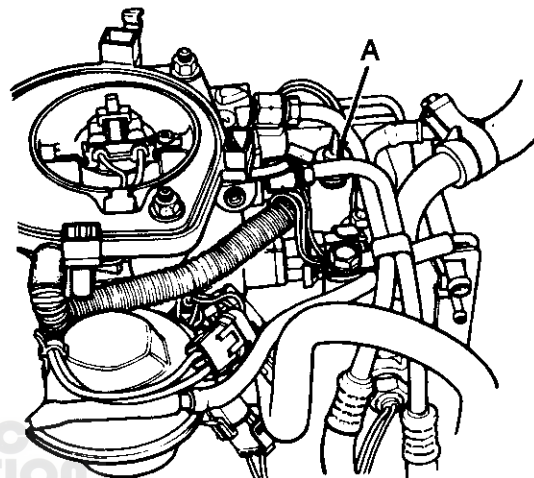
Manifold Air/Fuel Temperature (MAT) Sensor (Jeep)

Removal

Disconnect the wire harness connector from the MAT sensor harness (A).

Remove the MAT sensor from the intake manifold.

Clean the threads in the manifold.



100451F-1

Installation

Install the replacement MAT sensor (A) in the intake manifold.

Connect the wire harness connector to the MAT sensor harness.

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Coolant Temperature Sensor (CTS) (Renault)

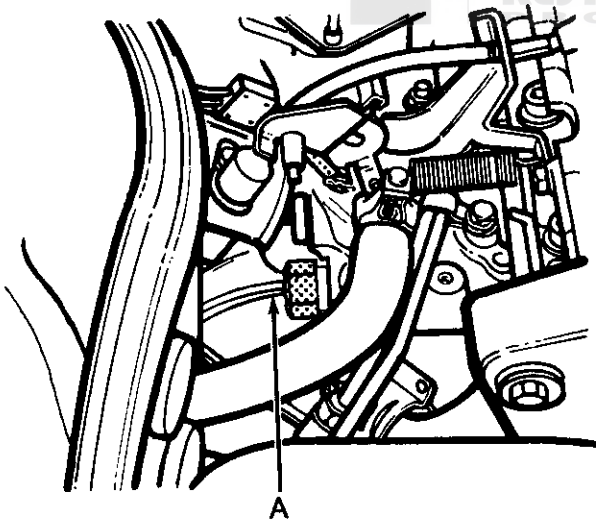
NOTE: The CTS sensor (A) is located at the rear of the intake manifold.

Removal

Remove the wire harness connector from the CTS.

WARNING: Do not remove the CTS with the cooling system hot and pressurized because serious burns from coolant can occur.

Remove the CTS from the intake manifold and rapidly plug the hole to prevent loss of coolant.



RENAULT MODELS

NOTE: 1986 and later models use a CTS with a pigtail harness and a connector.

Installation

Install the replacement CTS in the intake manifold.

Connect the wire harness connector to the CTS.

Coolant Temperature Sensor (CTS) (Jeep)

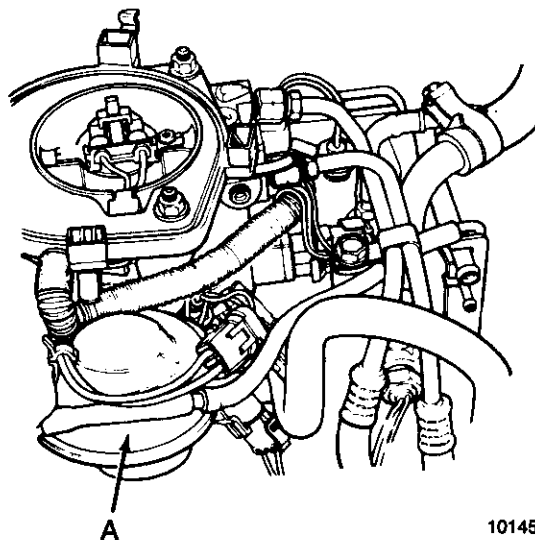
NOTE: The CTS sensor (A) is located at the rear of the intake manifold.

Removal

Remove the wire harness connector from the CTS.

WARNING: Do not remove the CTS with the cooling system hot and under pressure because serious burns from coolant can occur.

Remove the CTS from the intake manifold and rapidly plug the hole to prevent loss of coolant.



101451G-1

SEE
S.
NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

Install the replacement CTS (A) in the intake manifold.

Connect the wire harness connector to the CTS harness connector.

Oxygen (O₂) Sensor

NOTE: On Renault models the O₂ sensor is located in an exhaust pipe adapter.

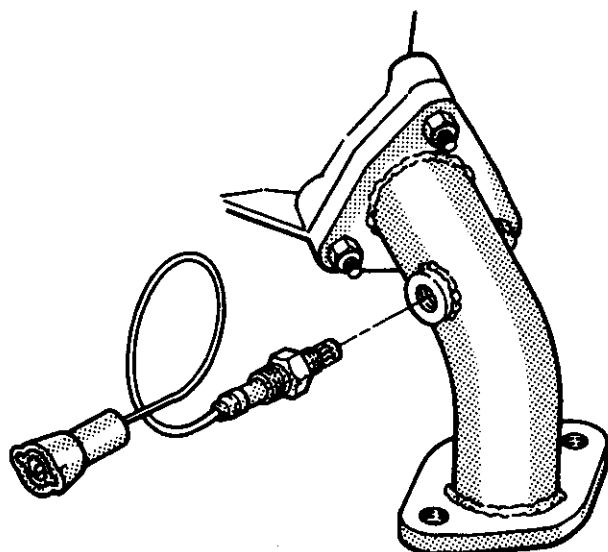
NOTE: On Jeep models the O₂ sensor is located in the exhaust manifold.

Removal

Disconnect the wire harness connector from the O₂ sensor.

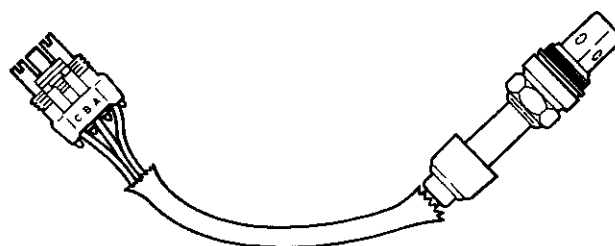
Remove the O₂ sensor.

Clean the threads in the adapter/exhaust manifold.



RENAULT

82047



JEEP

100616

Installation

Antiseize sealer is already applied to the threads of replacement O₂ sensors.

Hand start the sensor in the exhaust pipe adapter/exhaust manifold.

Tighten the sensor to 27-34 N·m (20-25 ft-lbs) torque.

CAUTION: Ensure that the wire terminal ends are properly seated in the connector prior to joining the connectors.

Connect the wire harness connector.

CAUTION: Do not push the rubber boot down on the sensor body beyond 13 mm (0.5 in.) above the base.

The oxygen sensor pigtail wires cannot be spliced or soldered. If broken, replace the sensor.

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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L

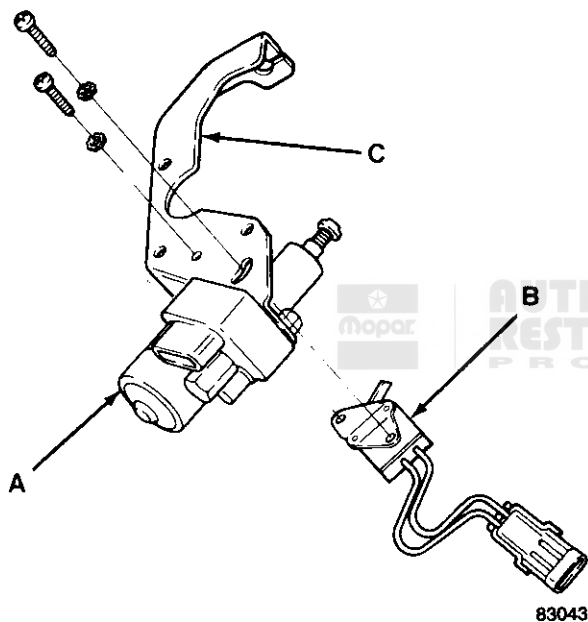


Wide Open Throttle (WOT) Switch (Renault)

Removal

Remove the throttle body assembly as described in this section.

Remove the WOT switch (A) from the bracket (B).



Installation

Install the replacement WOT switch on the bracket (B). Do not fully tighten the switch screws at this time.

Adjust the switch as described in Wide Open Throttle (WOT) Switch Adjustment.

With the switch adjusted, install the throttle body assembly as described in this section.

Wide Open Throttle (WOT) Switch (Jeep)

Removal

Remove the air inlet bonnet.

Disconnect the throttle return spring.

Disconnect the throttle cable.

Disconnect the wire harness connector from the WOT switch.

Remove the 2 screws securing the WOT switch to the bracket.

Remove the WOT switch.

Installation

Install the replacement WOT switch on the bracket. Do not fully tighten the switch screws at this time.

Connect the wire harness connector.

Connect the throttle cable.

Adjust the switch as described in Wide Open Throttle (WOT) Switch Adjustment.

With the switch adjusted, install the air inlet bonnet.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



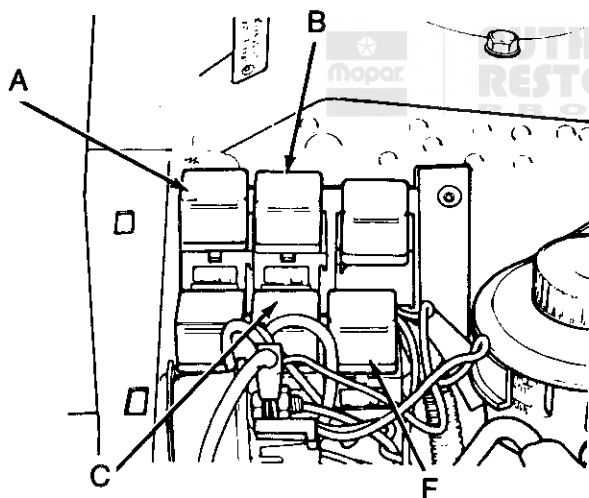
Power (B+) Relay/Fuel Pump Relay/ Compressor Clutch Relay

Removal

Remove the power (B+) relay (A) or the fuel pump relay (B) or the A/C clutch relay (C) from the right inner fender panel.

NOTE: Some models will have a fog lamp relay (F) and some 1.7L engines may have a cold start relay.

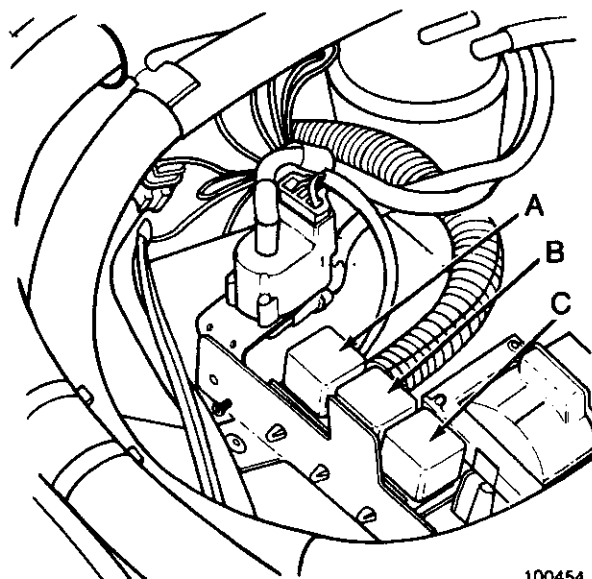
Renault



1985-1987 RENAULT

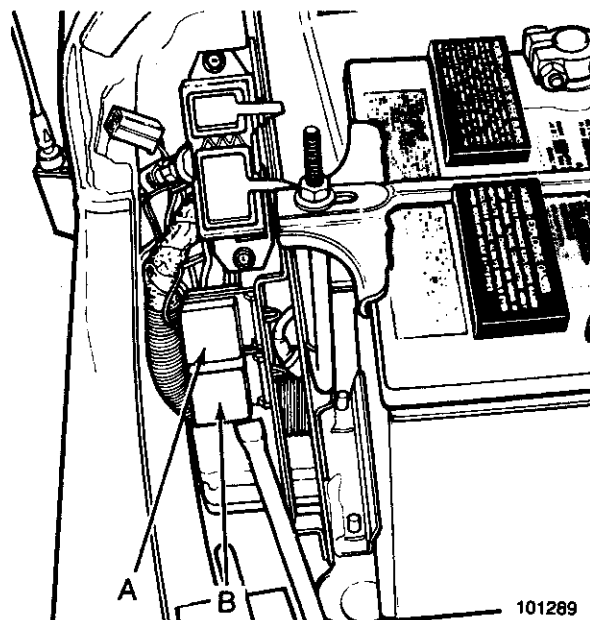
87053

Wagoneer/Cherokee/Comanche



100454

Wrangler/YJ



101289

Jeep Wrangler/YJ



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

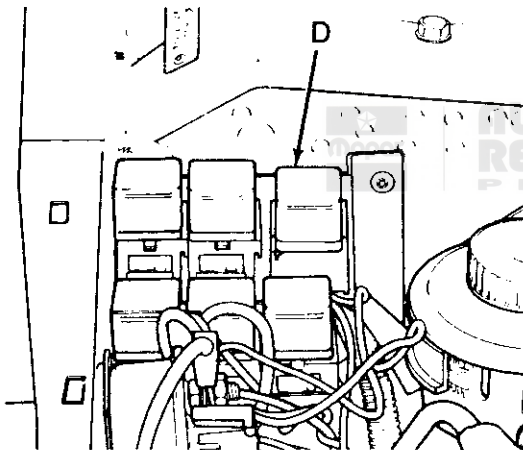
Connect the replacement relay to the wire harness connector.

Cold Start Relay

Removal

Remove the cold start relay (D) from the right fender panel if equipped.

IEEE
S.
NOTES



1985-1987 RENAULT

87053A

Installation

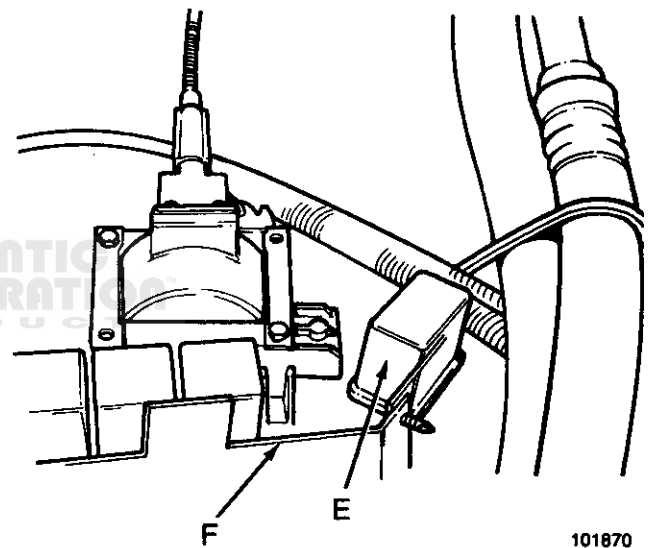
Connect the replacement relay to the wire harness connector.

Load Swap Relay 2.46L

Removal

Remove the screw holding the relay (E) on the bracket (F).

Disconnect the electrical connector.



Installation

Install the electrical connector.

Attach relay to bracket.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Throttle Body Assembly (Renault)

Removal

Remove the air cleaner assembly.

Disconnect the:

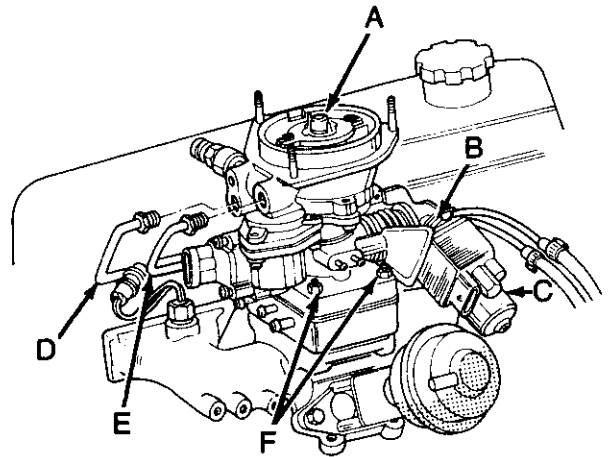
- throttle cable
- return spring
- cruise control cable (if equipped)
- wire harness connector from the injector (A)
- wire harness connector from the WOT switch (B)
- wire harness connector from the ISA motor (C)
- fuel supply pipe (D) from the throttle body
- fuel return pipe (E) from the throttle body

Disconnect the vacuum hoses from the throttle body assembly. Identify and tag the hoses for installation reference.

Remove the throttle body-to-manifold retaining nuts (F) from the studs.

Remove the throttle body assembly from the intake manifold.

If the throttle body assembly is being replaced, transfer the following components to the replacement throttle body: ISA motor WOT switch and bracket assembly.



83046A

Installation

Install the replacement throttle body assembly on the intake manifold. Use a replacement gasket between the components.

Install the throttle body-to-manifold retaining nuts (F) on the studs.

Connect the:

- vacuum hoses
- fuel return pipe (E) to the throttle body
- fuel supply pipe (D) to the throttle body
- wire harness connector to the injector (A)
- wire harness connector to the WOT switch (B)
- wire harness connector to the ISC motor (C)

SEE
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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



- cruise control cable (if equipped)
- return spring
- throttle cable

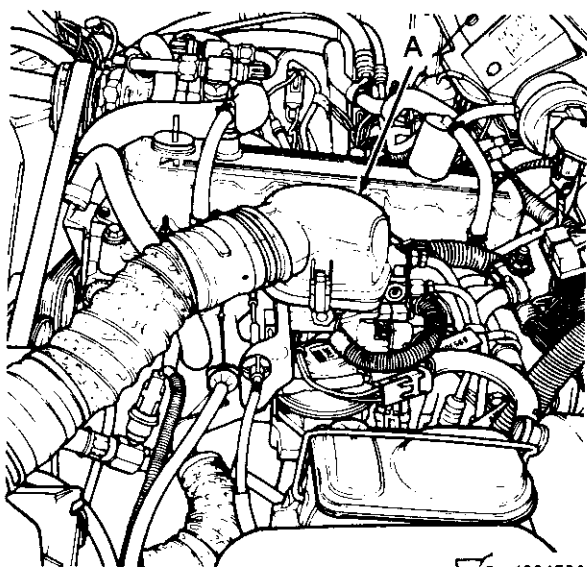
Install the air cleaner assembly.

Throttle Body Assembly (Jeep)

Removal

Remove the upper air inlet bonnet (A).

Remove the lower air inlet bonnet retaining bolts (B) and lower bonnet (C).

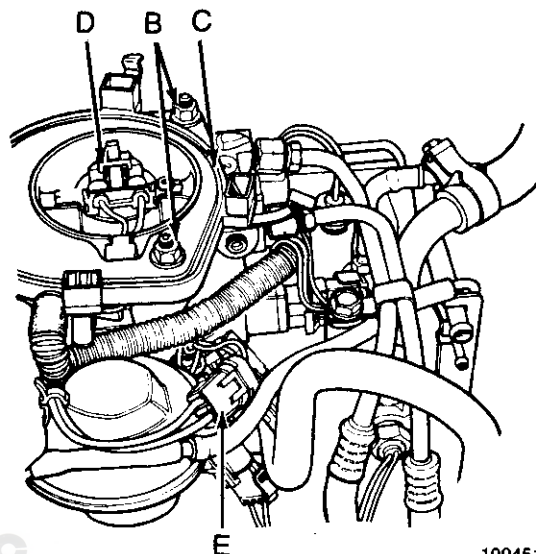


100450A

Remove the throttle cable and return spring.

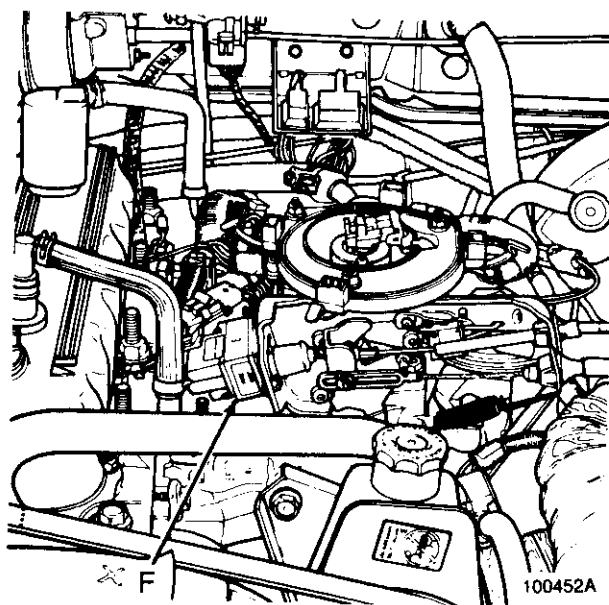
Disconnect the wire harness connector from the injector (D).

Disconnect the wire harness connector from the WOT switch (E).



100451A

Disconnect the wire harness connector from the ISA motor (F).



100452A

SEE
I.S.
NOTES

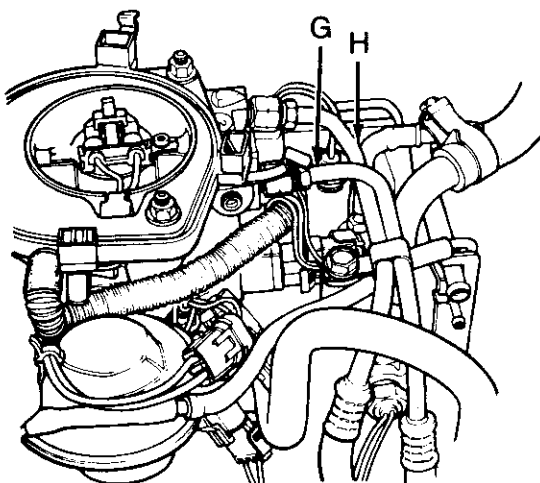


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Disconnect the fuel supply pipe (G) from the throttle body.

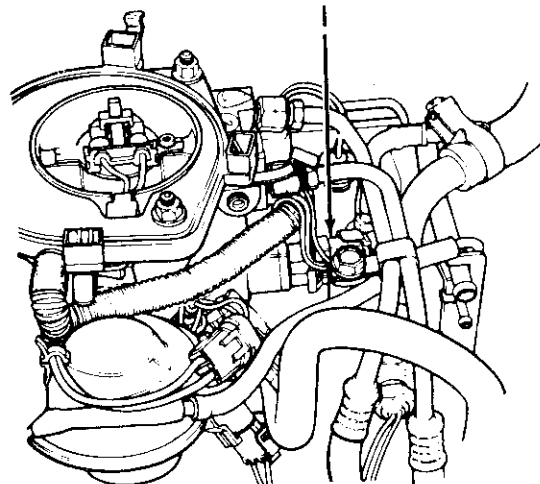


100451B

Disconnect the fuel return pipe (H) from the throttle body.

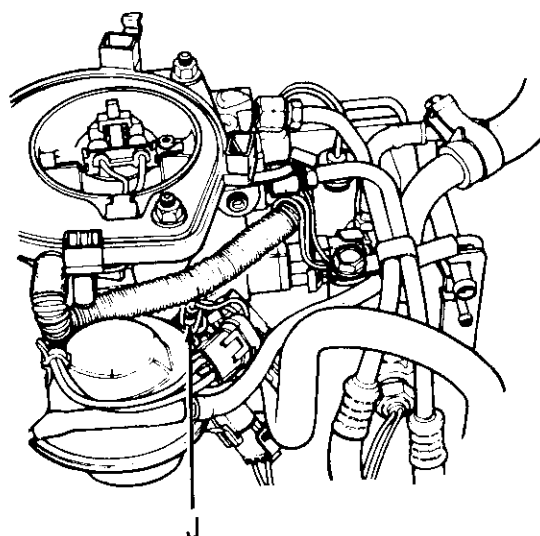
Disconnect the vacuum hoses from the throttle body assembly. Identify and tag the hoses for installation reference.

Disconnect the TPS wire connector (I).



100451C

Remove the throttle body-to-manifold retaining nuts (J) from the studs.



100451D

SEE
I.S.
NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Remove the throttle body assembly from the intake manifold.

If the throttle body assembly is being replaced, transfer the following components to the replacement throttle body: ISA motor/WOT switch bracket assembly.

Installation

Install the replacement throttle body assembly on the intake manifold. Use a replacement gasket between the components.

SEE
I.S.
NOTES

Install the throttle body-to-manifold retaining nuts (J) on the studs.

Connect the vacuum hoses.

Connect the fuel return pipe (H) to the throttle body.

Connect the fuel supply pipe (G) to the throttle body.

Connect the wire harness connector to the WOT switch (E).

Connect the wire harness connector to the ISA motor (F).

Connect the TPS wire connector (I).

Install the throttle cable and return spring.

Install the lower bonnet assembly (C) and retaining nuts (B).

Install the upper bonnet assembly (A).

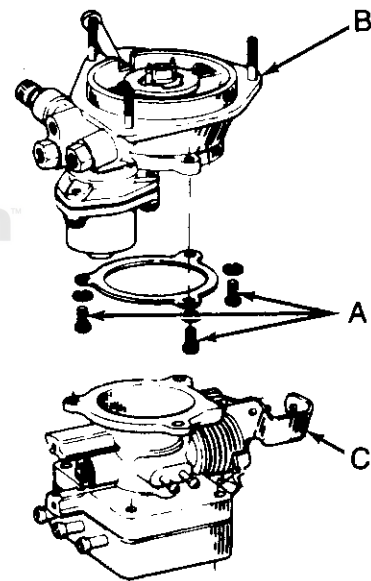
Fuel Body Assembly

Removal

Remove the throttle body assembly as described in this section.

Remove the 3 Torx head screws (A) that retain the fuel body (B) to the throttle body (C).

Remove the original gasket and discard.



83047

Installation

Install the replacement fuel body (B) on the throttle body (C) using a replacement gasket.

Install the 3 body-to-throttle retaining Torx head screws (A) and tighten securely.

Install the throttle body assembly as described in this section.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Fuel Filter (Renault)

NOTE: The fuel filter is located on the right rear frame member.

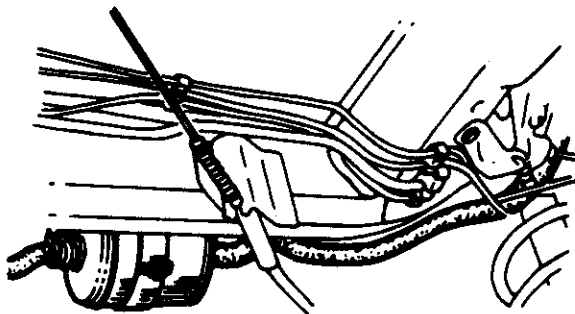
Removal

Raise and support the vehicle.

Place MOT. 453 clamps (or equivalent) on the hoses.

Remove the fuel filter retaining strap bolt and nut.

Remove the hose clamps and hoses.



83915

Installation

NOTE: When installing, ensure that the fuel flow is in the correct direction.

Install the fuel filter retaining strap.

Connect the hoses and tighten the hose clamps.

Remove the MOT. 453 clamps.

Lower the vehicle.

Fuel Filter (Wagoneer/Cherokee/Comanche)

Removal

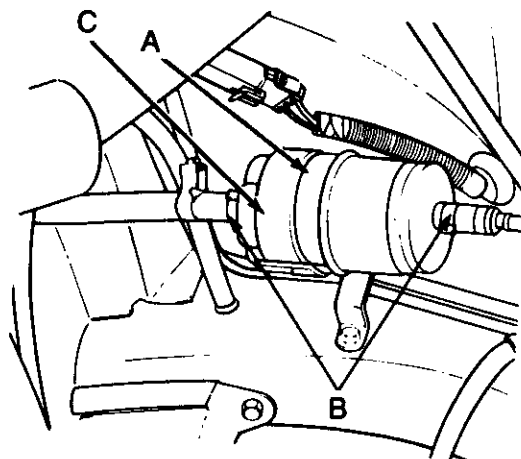
Raise and support the vehicle

Remove filter retaining strap bolt (A).

Install clamp MOT. 453.01, or equivalent, to the inlet side of the filter.

Remove hose clamps (B).

Remove filter (C).



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SEE
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NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Installation

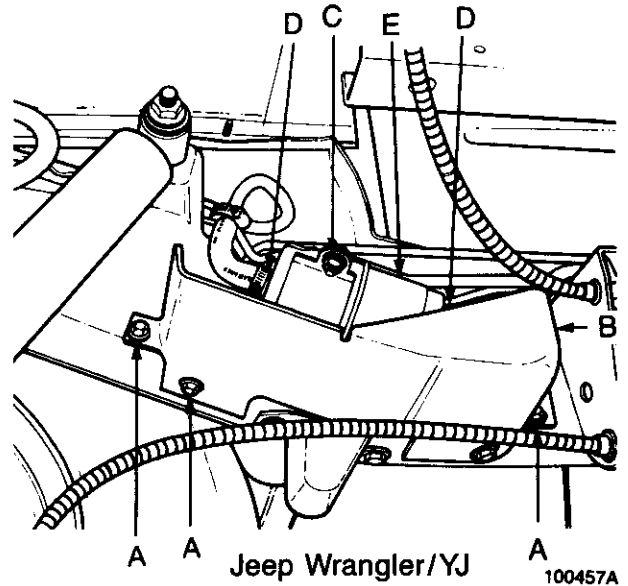
Place the filter (C) in position.

Install the inlet and outlet fuel hoses (B) and clamps. Tighten clamps securely.

Install the filter retaining strap and bolt (A).

Remove clamp MOT. 453.01, or equivalent.

Lower the vehicle.



SEE
I.S.
NOTES

Fuel Filter (Wrangler/YJ)

Removal

Raise and support the vehicle.

Remove protective plate retaining bolts (A).

Remove protective plate (B).

Remove filter retaining strap bolt (C).

Install clamp MOT. 453.01, or equivalent, to the inlet side of the filter.

Remove hose clamps (D).

Remove filter (E).

Installation

Place the filter (E) in position.

Install the inlet and outlet fuel hoses (D) and clamps. Tighten clamps securely.

Install the filter retaining strap and bolt (C).

Install protective plate (B) and retaining bolts (A).

Remove clamp MOT. 453.01, or equivalent.

Lower the vehicle.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



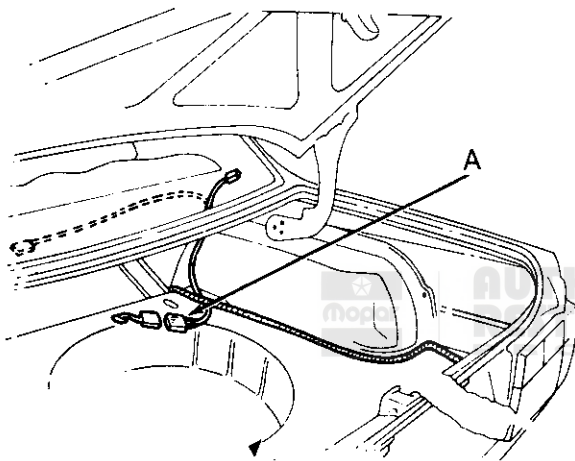
Fuel Tank, Pump/Gauge Sending Unit (Renault)

Removal

Disconnect the battery cables.

Remove the fuel from the tank.

Disconnect the wire harness connector (A).



A. Wire Harness Connector

83048

NOTE: 1984-1985 models have connector (A) located underneath the vehicle.

Position a jack beneath the tank.

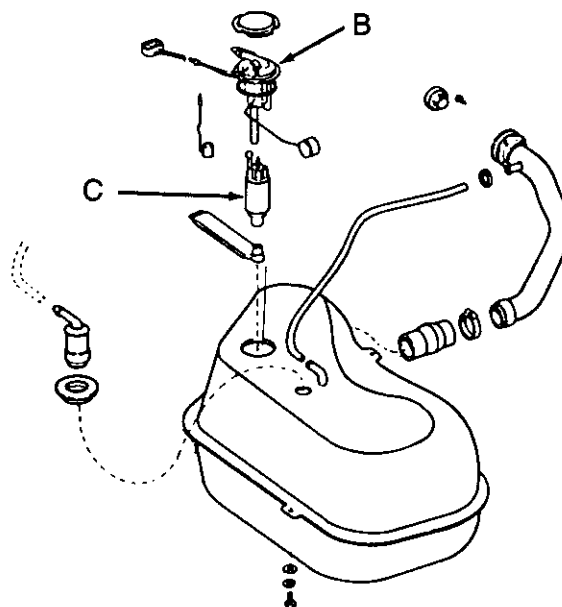
Separate the fuel filler tube from the fuel tank.

Remove the fuel tank retaining bolts and lower the tank gradually with the jack.

Disconnect the fuel supply, return and vent hoses.

Turn the fuel gauge sending unit retainer ring with a screwdriver and remove.

Separate the sending unit (B) and pump (C).



B. Sending Unit
C. Fuel Pump

82079A

Installation

Connect the fuel pump (C) to the sending unit (B).

Install the sending unit/pump assembly in the tank and secure with the retaining ring.

Connect the hoses.

Install the tank with the retaining bolts.

Connect the fuel filler tube to the tank.

Connect the wire harness connector.

Connect the battery cables.

NOTE: The fuel tank is equipped with a pressure/vacuum filler cap.

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Sending Unit/Fuel Pump (Wagoneer/Cherokee/Comanche)

Removal

Disconnect the battery cables.

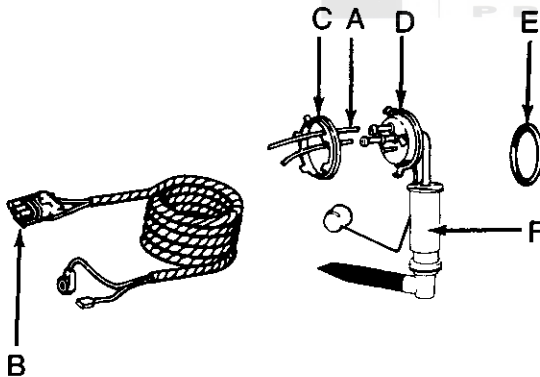
NOTE: The fuel tank fuel level must be less than 1/2 for this procedure. Remove fuel if necessary.

Raise and support the vehicle.

Remove the fuel outlet and return hoses (A), and sending unit wires (B).

Remove the sending unit retaining lock ring (C) and remove the sending unit/fuel pump (D and F) and O-ring seal (E).

SEE
I.S.
NOTES



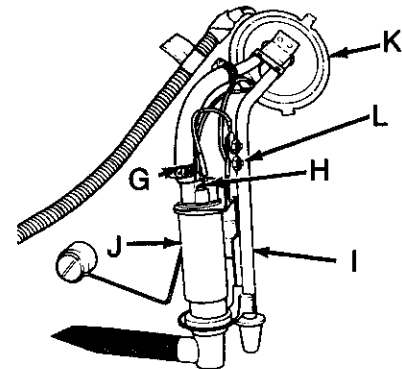
- | | |
|--------------------------------------|------------------|
| A - Return Hoses | D - Sending Unit |
| B - Sending Unit Wires | E - O-Ring Seal |
| C - Sending Unit Retaining Lock Ring | F - Fuel Pump |

84629A

Disconnect the fuel line hose (G) from the fuel pump (H).

Disconnect the wires (I) from the fuel pump (H).

Remove the fuel pump (H) from the sending unit assembly (J) by removing the nut (K).



100447A

Installation

Install the fuel pump (H) to the sending unit assembly (J).

Connect the fuel line hose (G) to the fuel pump (H).

Connect the wires (I) to the fuel pump (H).

Install the O-ring seal (E) and the sending unit/fuel pump (D and F).

Install and tighten the locking ring (C).

Connect the fuel outlet and return hoses (A) and the sending unit wires (B).

Lower the vehicle.

Refill the fuel tank with the fuel previously removed.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Sending Unit/Fuel Pump (Wrangler/YJ)

Removal

Disconnect the battery cables.

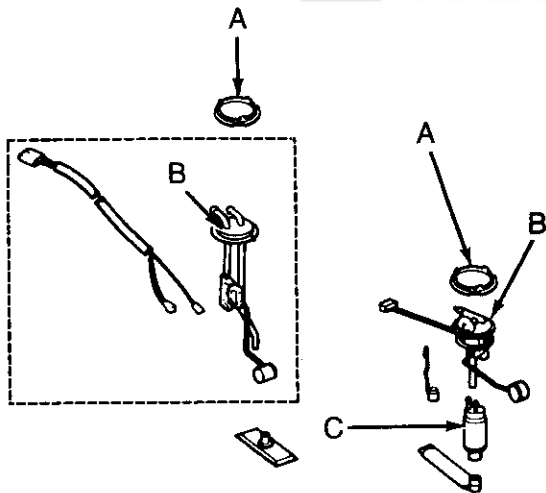
Remove the fuel from the tank.

Position a jack beneath the fuel tank.

Remove the fuel tank as outlined in M.R. 279.

Turn the fuel gauge sending unit retainer ring (A) with a screwdriver and remove.

Remove the sending unit/pump assembly from the tank.



Separate the sending unit (B) and pump (C).

Installation

Connect the fuel pump (C) to the sending unit (B).

Install the sending unit/pump assembly in the tank and secure with the retaining ring (A).

NOTE: Ensure O-ring is properly positioned in its groove.

Connect the hoses.

Install the fuel tank as outlined in M.R. 279.

Refill the fuel tank with the fuel previously removed.

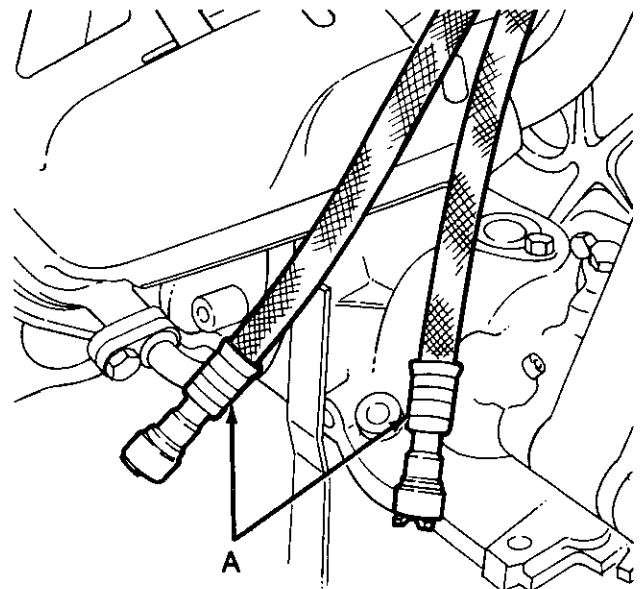
Connect the battery cables.

NOTE: The fuel tank is equipped with a pressure/vacuum filler cap.

Quick-Connect Fuel Lines (1987 Vehicles)

Renault

On Renault models the quick-connect fuel lines (A) are located near the right inner strut tower behind the engine.



SEE
I.S.
NOTES



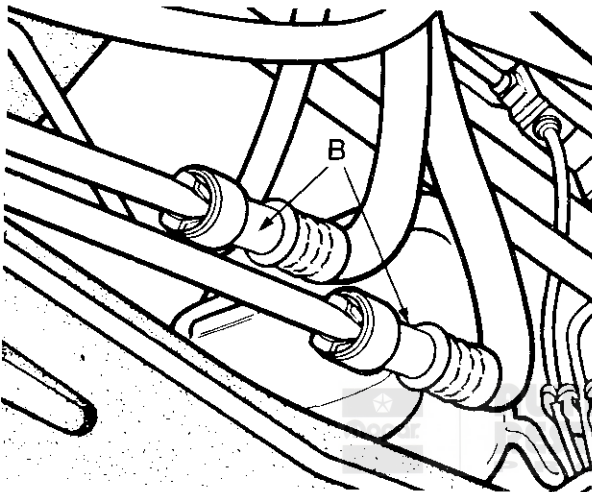
THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



Jeep

On Jeep models the quick-connect fuel lines (B) are located on the left inner frame sill.



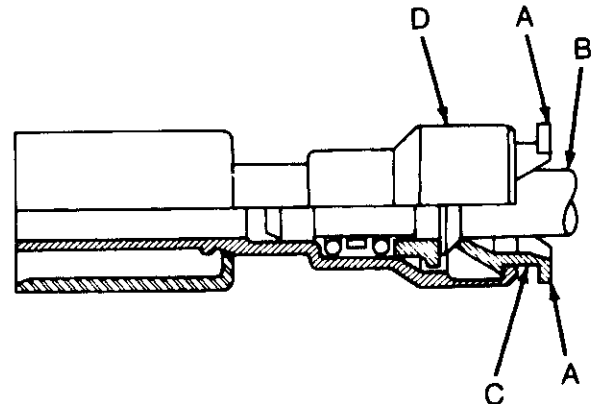
101205

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NOTES

Whenever these fuel lines are disconnected the O-ring seals in the connector should be replaced. Follow the procedure for quick-connect fuel line O-ring replacement.

O-Ring Replacement

Separate the quick-connect fuel line tubes, at the right inner fender behind the engine on Renault, or the left inner fender panel on Jeep, by squeezing the 2 retaining tabs (A) then pull the fuel line tube (B) and retainer (C) from the quick-disconnect fitting (D).

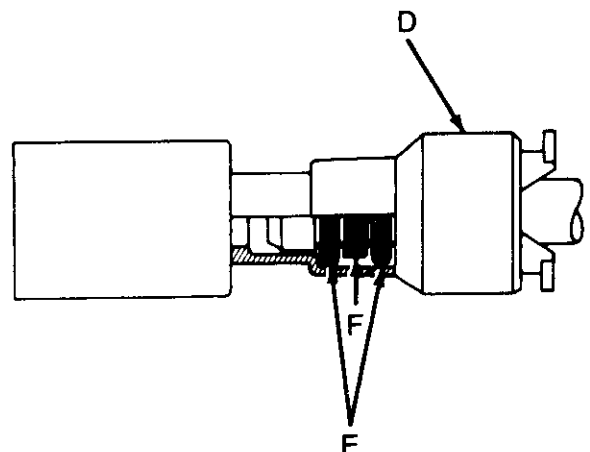


100485B

Replace the O-rings using the Coupling Repair Kit, PN 8983 502 745, as follows:

- remove the 2 O-rings (E) and the spacer (F) from the fitting (D) and discard the O-rings and spacer

NOTE: This can be done by using a paper clip, or piece of wire, bent in an "L" shape.



100485A

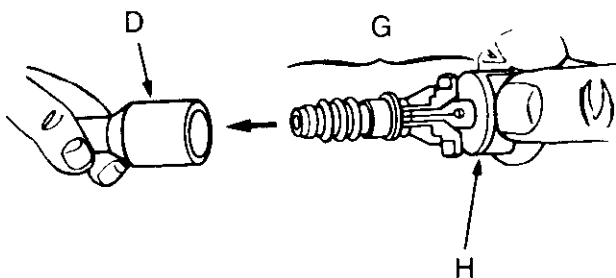


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



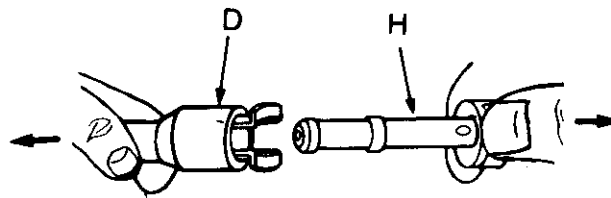
- remove the retainer from the fuel tube and discard
- install a new retainer assembly (G) by pushing the assembly into the quick-connect fitting (D) until a "click" sound is heard



100486

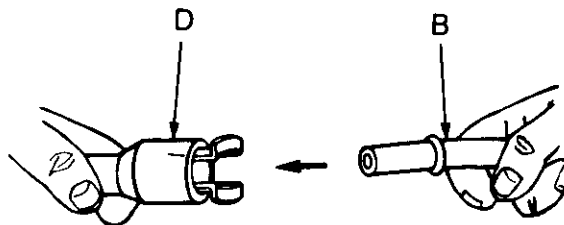
- grasp the disposable plastic plug (H) and remove it from the fitting (D)

NOTE: By removing ONLY the plastic plug (H), the O-rings, spacer, and retainer will remain in the fitting.



100487

- push the fuel line (B) into the fitting (D) until a "click" sound is heard and the connection is complete



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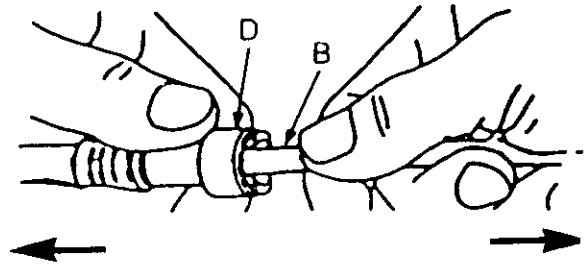


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



- verify that the quick-connect fitting assembly fits securely over the fuel lines by giving the fuel lines a firm tug



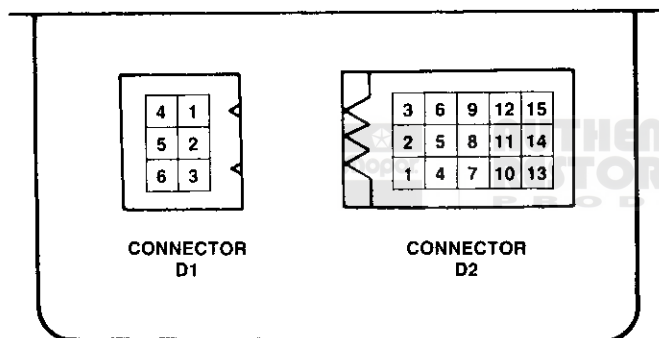
100489

DIAGNOSTIC PROCEDURES

Diagnostic Connectors

JEEP

Dash Panel



(1986-87)

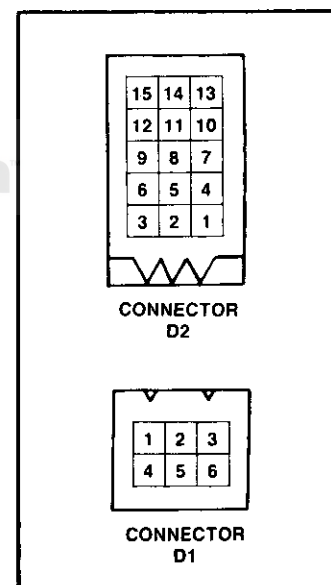
FRONT OF VEHICLE

Connector D2

1. Shift Lamp
2. Power Latch Relay
3. Park/Neutral
4. Power Latch Relay (B +)
5. Air Conditioning Clutch Relay
6. WOT Switch
7. Ground
8. Air/Fuel Temperature
9. M.P.A. (Ignition Output)
10. EGR/Canister Purge Solenoid
11. ISA Motor Forward
12. Coolant Temperature Sensor
13. Closed Throttle Switch
14. ISA Motor Reverse
15. Automatic Transmission Diagnosis

ALLIANCE/ENCORE

Heater Plenum



(1986-87)

FRONT OF VEHICLE

Connector D1

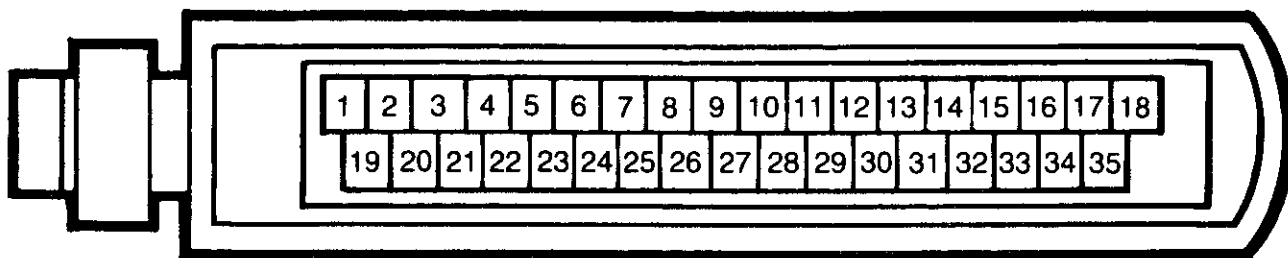
1. Tach Input
2. Ignition
3. Ground
4. Start Solenoid
5. Battery
6. Fuel Pump

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SEE
I.S.
NOTES

ECU Connector 1985-1987 TBI System

The ECU connector used for the 1985-1987 TBI system is similar to the connector used in previous systems. Terminal identification and specific engine application is detailed in the following chart.



**AUTHENTIC
RESTORATION**
PRODUCT

- | | |
|---|-------------------------------------|
| 1. Ground | 18. Shift Lamp (manual trans. only) |
| 2. Ground | 19. System Power (B +) |
| 3. Ignition Switch | 20. Not Used |
| 4. Battery | 21. Injector |
| 5. EGR Valve/Canister Purge | 22. A/C Compressor Clutch |
| 6. Fuel Pump Relay | 23. ISA Motor Retract (reverse) |
| 7. System Power Relay (latch relay) | 24. ISA Motor Extend (forward) |
| 8. WOT Switch | 25. Closed Throttle (idle) Switch |
| 9. Not Used | 26. Not Used |
| 10. System Ground | 27. Ignition Interference |
| 11. Speed Sensor | 28. Speed Sensor |
| 12. Park/Neutral Switch (auto. trans. only) | 29. Start Signal |
| 13. Knock Sensor (1.7L) | 30. A/C Select |
| Throttle Position Sensor Ground (2.46L) | 31. Knock Sensor (1.7L) |
| 14. Manifold Air/Fuel Temperature Sensor | Throttle Position Sensor (2.46L) |
| 15. Coolant Temperature Sensor (1.7L-2.46L) | 32. Temperature Sensor Ground |
| Manifold Temperature Sensor (1.4L) | 33. MAP Sensor Output |
| 16. Manifold Absolute Pressure — Supply Voltage | 34. A/C Request |
| 17. Manifold Absolute Pressure — Ground | 35. O ₂ Sensor Input |



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



COMPONENT DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
FUEL PUMP OPERATES CONTINUOUSLY.	Fuel pump relay has short circuit to ground.	Check Pin 6 for a short circuit to ground with the key off and fuel pump relay disconnected. Repair the wire harness short circuit. Disconnect the ECU from the wire harness. If the pump stops, check the ECU with MS 1700 tester. Disconnect the fuel pump relay and check for a short circuit. Replace the relay. Test the ECU with MS 1700 tester.
FUEL PUMP WILL NOT OPERATE FOR ONE SECOND WITH THE IGNITION SWITCH ON.	Open circuit. Fuel pump ballast resistor defective.	Connect a jumper wire across the fuel pump relay. If the pump operates, check for battery voltage at the relay. Check the continuity between the relay and Pin 6 at the ECU. Repair the wire harness as necessary. Replace the fuel pump relay. Test the ECU with MS 1700 tester. Test for continuity between the fuel pump and the relay contacts. Check the pump ground circuit. Repair the harness as necessary. Replace the fuel pump ballast resistor.

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	THROTTLE BODY FUEL INJECTION SYSTEM	
	1.4L 1986-1987/1.7L/2.46L	

COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
FUEL PUMP WILL NOT OPERATE WHEN THE STARTER MOTOR IS ENGAGED.	Fuel pump defective. Open circuit.	Replace the fuel pump. Connect positive battery voltage to the pump contact on the starter motor relay. If the pump operates, repair or replace the starter motor relay. If the pump does not operate, repair the wire harness between the starter motor relay and the pump side of the ballast resistor. Check to determine if the pump operates one second with the ignition switch on.
ISA (IDLE SPEED ACTUATOR) MOTOR DOES NOT EXTEND ON ENGINE SHUTDOWN. (SYMPTOM: SLOW, UNSATISFACTORY IDLE AFTER COLD START.)	ECU, wire harness, or motor.	Connect a test bulb between D2 Pin 14 and D2 Pin 11 with the engine operating. Shut the engine off. If the bulb does not light momentarily on shutdown: test the ECU with MS 1700 tester. If the bulb lights at shutdown: test the wire harness and connector at the ISA motor. Repair as necessary. Test to determine if the motor is jammed in the full retract position. Refer to ISA Motor Diagnostic Test using ISA motor exerciser tool Ele. AB.99.



THROTTLE BODY FUEL INJECTION SYSTEM

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COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
IDLE SPEED ERRATIC, LOW, OR HIGH CONSISTENTLY.	ISA motor inoperative. NO ECU output.	Refer to the ISA Motor Diagnostic Test using ISA motor exerciser tool Ele. AB.99. Connect a test lamp from Pin 23 to Pin 24 on the ECU. Remove the ISA motor from the bracket and close the CTS switch manually. With the engine warmed-up and at idle speed, manually open the throttle to a speed well above normal idle speed. The lamp should flash. Close the throttle so the speed drops well below normal idle speed. The lamp should flash. NOTE: Improper handling of the ISA motor outputs can result in system damage. Never connect to ground or the battery. If the lamp flashes on both over and under idle speed: Check the wiring harness between the ECU and the ISA motor for an open or short circuit. Recheck the ISA motor function. If the lamp fails to flash on either over or under speed: Check the ECU with MS 1700 tester.
ECU DOES NOT TURN OFF AFTER ENGINE SHUTDOWN. (SYMPTOM: BATTERY LOSES CHARGE WITH KEY OFF.)	Throttle position incorrect. MAP sensor voltage supply (ECU Pin 16). Voltage should go from 5V to zero within 30 seconds after key is turned off.	Check to ensure that the throttle is resting on the switch at normal idle. Connect a voltmeter from D2 Pin 13 to D1 Pin 3. Should indicate ground potential at a normal idle speed. Check for air leaks into vacuum. Check the closed throttle switch using the test procedure. Check coolant temperature sensor. Refer to the test procedure. Check the starter motor relay for a short circuit. With the key off, check the relay for battery voltage.

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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
EGR VALVE/CANISTER PURGE SOLENOID CONTROL IS ERRATIC. (SYMPTOMS: UNSATISFACTORY IDLE, BAD DRIVEABILITY, INACTIVE OXYGEN SENSOR.)	Defective solenoid.	Replace relay. Test the ECU with MS 1700 tester. Check ignition switch and harness for short circuit to battery voltage. Repair or replace as necessary. Check the solenoid valve. Connect the valve (out of harness) to 12V and determine if it opens and closes. Check for 12V to the solenoid valve coil. Replace the valve. Repair the wiring harness. Test the ECU with MS 1700 tester.
FUEL PRESSURE IS LOW AT TEST POINT ON THROTTLE BODY. (SYMPTOMS: UNSATISFACTORY DRIVEABILITY, INACTIVE OXYGEN SENSOR, HARD COLD STARTS.) FUEL PRESSURES ARE: 1.4L, 2.46L = 14.5 psi (1.0 bar) 1.7L = 17.4 psi (1.2 bar)	Fuel pump malfunction.	Check the pump for proper voltage (nominally 7.5V). Check the fuel filter. Replace the filter. Replace the fuel pump ballast resistor. Repair the wiring harness. Check the fuel pressure regulator for proper function. With the engine idling, gently pinch off the rubber fuel return hose to the fuel tank. The pressure should rise greatly when the hose is restricted. Check the fuel pressure out of the pump. With a gauge directly on fuel inlet pipe (pipe dead headed at gauge), several cycles of key on should produce a pressure well over 20 psi. WARNING: This should only be done for a short time because the fuel system is not designed for high pressures. Install a fuel pressure regulator kit. Replace the throttle body. Replace the fuel pump.
FUEL PRESSURE HIGH AT TEST POINT ON THROTTLE BODY. (SYMPTOMS: UNSATISFACTORY DRIVEABILITY, HARD STARTS, BLACK SMOKE, INACTIVE OXYGEN SENSOR.) FUEL PRESSURES ARE: 1.4L, 2.46L = 14.5 psi (1.0 bar) 1.7L = 17.4 psi (1.2 bar)	Fuel restriction.	Check the fuel pressure with an oversize temporary fuel return pipe. Pipe should replace the existing return pipe. It should be securely fastened at the throttle body and discharge fuel into an approved closed container. If the pressure drops, replace the fuel return pipe. Inspect the fuel tank fittings and replace if restricted. If the pressure does not drop, install a fuel pressure regulator kit.



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START.	Defective WOT switch.	Refer to the WOT switch test procedure.
	Low battery voltage.	Replace or charge the battery.
	Fuel supply too low.	Replenish as necessary.
	Low fuel pressure.	Refer to the fuel pressure test. Correct as necessary. Replace the fuel filter.
	Fuel pump inoperative.	Repair or replace as necessary.
	Defective secondary ignition circuit.	Position a spark plug (with ignition wire) on the cylinder block. Engage the starter motor and observe the spark. Repair or replace the ignition power module or wiring.
	Primary ignition input to the ECU defective.	Connect a voltmeter between D1 Pin 2 and ground. With key on (engine stopped) voltage should be close to battery voltage. Check the harness and connectors between the ECU and the ignition power module. Service the ignition power module as necessary.
	No battery voltage applied to the injector (12V from one pin to chassis ground).	Check the B+ relay. Check the wire harness and connectors. Repair or replace as necessary.
	Injector resistance too high (ohmmeter should indicate less than 10 ohms).	Replace the injector.
	ECU is not switching the injector.	Remove the injector wire harness connector. Connect a test lamp across the connector. Engage the starter motor. The lamp should pulse dimly. Check the ECU with MS 1700 tester.
	Leaking injector.	Check to determine if the injector is discharging fuel when the engine is rotated by the starter motor. Install an O-ring kit if it is leaking fuel. Replace the injector if it either discharges no fuel with engine turning or drips fuel with the engine stopped.

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	THROTTLE BODY FUEL INJECTION SYSTEM 1.4L 1986-1987/1.7L/2.46L	
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COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE STARTS BUT WILL NOT IDLE.	No start signal voltage.	Check the start signal. Voltmeter from D1 Pin 4 to ground should indicate battery voltage when the starter motor is engaged. Service the starter motor relay or wire harness.
	ISA motor plunger is not extended.	Refer to the ISA motor test procedure.
	Coolant temperature sensor inoperative.	Refer to the coolant temperature sensor test procedure. Check to ensure that the spark plugs are not fouled or wet. Replace as necessary.
	Fuel pump inoperative. Ignition system malfunction.	Check the fuel pump. Check the ignition system. Repair as necessary. Check the start signal after engaging the starter motor. Voltmeter from D1 Pin 4 to D1 Pin 3 should indicate zero volts. Repair wire harness as necessary. Check the MAP sensor. Repair as necessary. Test the ECU with MS 1700 tester.
DRIVEABILITY OR FUEL ECONOMY COMPLAINT.	High fuel pressure.	Check the fuel pressure. Test the ECU with MS 1700 tester. Replace the ECU if necessary. Check to determine if the oxygen sensor is functioning. Replace if necessary.
	Injector defective.	Replace the injector.
	WOT switch malfunction.	Check the WOT switch. Adjust, repair or replace the switch to ensure that the WOT voltage (D2 Pin 6) is low during an actual wide open throttle condition.

	THROTTLE BODY FUEL INJECTION SYSTEM	
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COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
	Air filter restricted.	Check the air filter. Replace as necessary.
	EGR valve malfunction.	Check the EGR valve and hoses. Repair or replace.
	Canister purge malfunction.	Check the canister purge function. Repair as necessary.

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SUMMARY

It should be understood that the ECU is extremely reliable and must be the final component to be replaced if a doubt exists concerning the cause of a fuel injection system failure.



THROTTLE BODY FUEL INJECTION SYSTEM

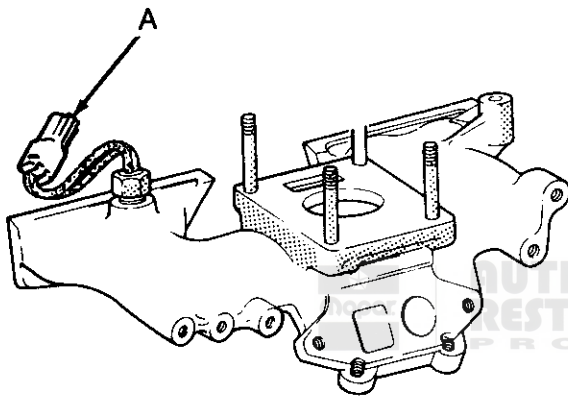
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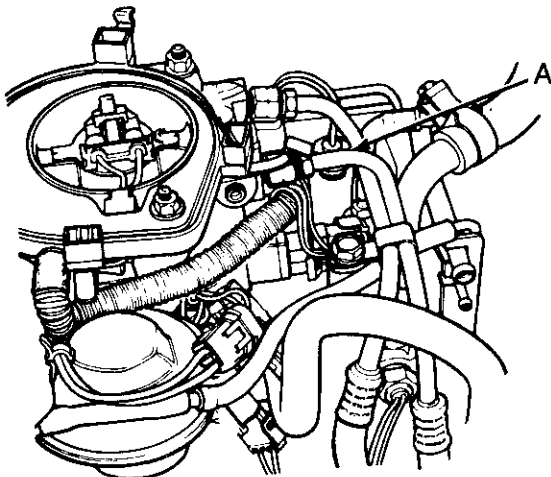
Manifold Air/Fuel Temperature (MAT) Sensor Test

Disconnect the wire harness connector from the MAT (A) sensor.

NOTE: 1986 and later models use a MAT sensor with a pigtail and a wire connector.



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JEEP MODELS

Test the resistance of the sensor with an input impedance (digital) volt-ohmmeter.

The resistance should be less than 1000 ohms with the engine warm.

Refer to the resistance chart.

Manifold Air/Fuel Temperature Sensor

Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between the ECU wire harness connector terminal 32 and the sensor connector terminal, and terminal 14 to the sensor connector terminal.

Repair the wire harness as necessary if the resistance is greater than 1 ohm.



THROTTLE BODY FUEL INJECTION SYSTEM

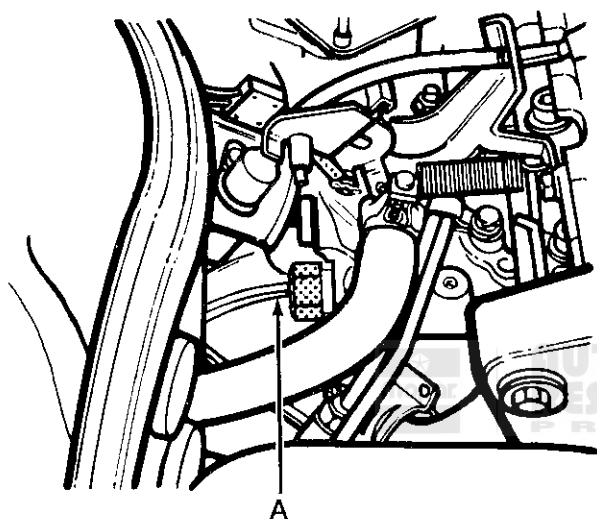
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Coolant Temperature Sensor (CTS) Test

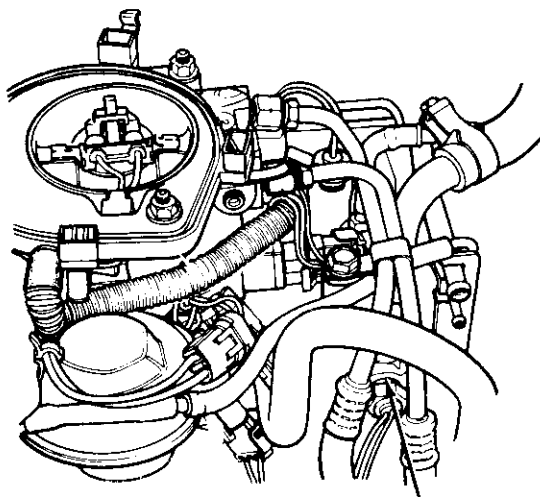
Disconnect the wire harness connector from the CTS (A).

NOTE: 1986 and later models use a CTS with a pigtail and wire connector.



RENAULT MODELS

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Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter.

The resistance should be less than 1000 with the engine warm.

Refer to the resistance chart.

Coolant Temperature Sensor

Temperature-to-Resistance Values (Approximate)

°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between ECU wire harness connector terminal 15 and the sensor connector terminal, and terminal 32 to the sensor connector terminal.

Repair the wire harness if an open circuit is indicated.



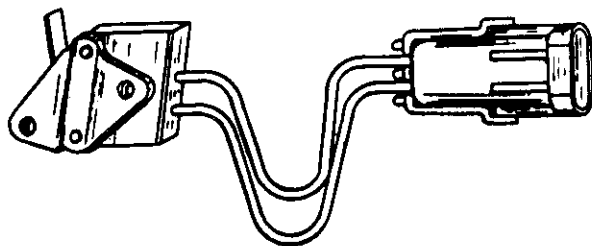
THROTTLE BODY FUEL INJECTION SYSTEM

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Wide Open Throttle (WOT) Switch Test

Disconnect the wire harness connector from the WOT switch.



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Test the on-off operation of the WOT switch with a high input impedance (digital) volt-ohmmeter.

Operate the switch manually.

The resistance should be infinite when the throttle is closed.

A low resistance should be indicated when at the WOT position.

Test the switch operation several times.

Replace the WOT switch if it is defective.

Connect the wire harness connector.

With the ignition switch ON, test the WOT switch voltage at the diagnostic connector (D2-6 to ground/D2-7).

There should be no voltage reading at the WOT position; greater than 2 volts if not at the WOT position.

If no voltage is present in either position, test for a short circuit to ground in the wire harness or switch.

Check for an open circuit between terminal 8 (ECU connector) and the switch connector.

Repair or replace the wire harness as necessary.

If the voltage is always greater than 2 volts, test for an open circuit in the wire or connector between the switch and ground.

Repair as necessary.

Closed Throttle (Idle) Switch Test

NOTE: It is important that all testing be done with the idle speed actuator (ISA) motor plunger in the fully extended position, as it would be after a normal engine shut down. If it is necessary to extend the ISA motor plunger to test the switch, an ISA motor failure can be suspected. Refer to the ISA Motor Adjustment if necessary.

With the ignition switch ON, test the switch voltage at the diagnostic connector (D2-13 and D2-7/ground).

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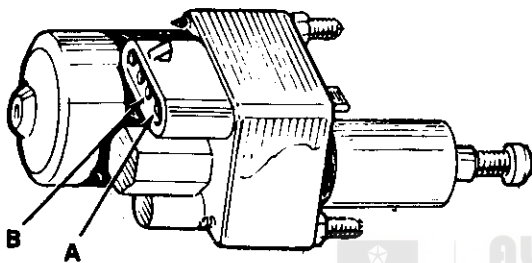
THROTTLE BODY FUEL INJECTION SYSTEM

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The voltage should be close to zero at closed throttle and greater than 2 volts when off the closed throttle position.

If no voltage is present in either position, test for a short circuit to ground in the wire harness or switch.



A - Ground (-)
B - Closed throttle switch

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Test for an open circuit between terminal 25 (ECU connector) and the switch.

If the voltage is always more than 2 volts, test for an open circuit in the wire harness between the ECU and the switch connector, and between the switch connector and ground.

Repair or replace the wire harness as necessary.

ISA Motor Diagnostic Test

WARNING: After testing the operation of the ISA motor, or if the ISA motor has been replaced, always extend the ISA motor before

starting the engine to prevent the ISA motor from jamming.

NOTE: The following test must be performed using Exerciser tool Ele. AB.99.

NOTE: If the ISA motor is to be tested off the vehicle, the ISA motor shaft must be lightly preloaded to avoid having the ISA motor jam during the test. Use light finger pressure to preload the ISA motor shaft and simulate throttle return pressure.

Remove the air cleaner assembly (Renault only).

Check to ensure that the rubber boot is correctly positioned in its groove on the ISA motor shaft.

- if not, correct its position and recheck vehicle for proper idle speed operation
- if correctly positioned, continue diagnosis procedure

Open the throttle and attempt to extend and retract the ISA motor by pulling and pushing axially (in and out) on the ISA shaft.

CAUTION: If the shaft axial movement is more than 9.525 mm (3/8 in.), do not continue. Replace the ISA motor.

Be sure the ignition switch is in the OFF position.

Connect the exerciser clips to the vehicle battery (red to positive/black to negative).

Disconnect the ISA motor connector.

Connect the ISA motor exerciser 4-pin connector to the ISA motor.



THROTTLE BODY FUEL INJECTION SYSTEM

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ISA MOTOR DIAGNOSTIC TESTING

TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
1. Examine the ISA motor shaft tip position.	The ISA motor tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor tip is not in contact with throttle lever and throttle lever is closed.	THEN, ISA motor is fully retracted and jammed. Go to sequence No. 2 to unjam ISA motor.
		IF, desired results were obtained.	THEN, skip test sequence No. 2 and perform test sequence No. 3.
2. Apply parking brake, and start engine. With the engine running, open throttle to approx. 1500 rpm and move exerciser switch in the EXTEND direction several times to unjam the ISA. Turn ignition switch to OFF position.	ISA motor shaft tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor shaft tip is not in contact with the throttle lever and throttle is still closed.	THEN, ISA motor is permanently jammed. Stop procedure and replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is unjammed Go to test sequence No. 3.
3. Move the exerciser switch in the EXTEND direction for 5 seconds. Watch ISA motor action.	ISA motor should ratchet (click) several times when it has reached fully extended position.	IF, it does not ratchet (click)	THEN, ISA motor is defective. Stop procedure. Replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is OK. Perform test sequence No. 4.
4. Move the exerciser switch in the RETRACT direction for 5 seconds. Watch the ISA motor action.	ISA motor should close throttle and stop automatically in 3 seconds. The closed throttle switch light on the exerciser will go out when ISA motor reaches closed throttle position. The tip of the ISA should be in contact with, but no more than 0.50 mm (0.20-in), away from throttle lever (A) when ISA motor has stopped movement (see the illustration). The throttle linkage should also be in contact with the throttle stop screw (B) on the main body of the TBI when ISA motor movement has stopped	IF, ISA motor did not move.	THEN, ISA motor is defective. Stop the procedure. Replace ISA motor.
		IF, ISA motor closed the throttle, but retracted away from throttle lever and was no longer in contact with throttle lever.	THEN, ISA motor is defective. Stop the procedure. Replace the ISA motor.
		IF, ISA motor moved the throttle, but throttle was not in contact with the closed throttle stop screw on the TBI main body when ISA motor movement stopped.	THEN, perform test sequence No. 5.
		IF, desired results were obtained.	THEN, skip test sequence No. 5 and perform test sequence No. 6.

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THROTTLE BODY FUEL INJECTION SYSTEM

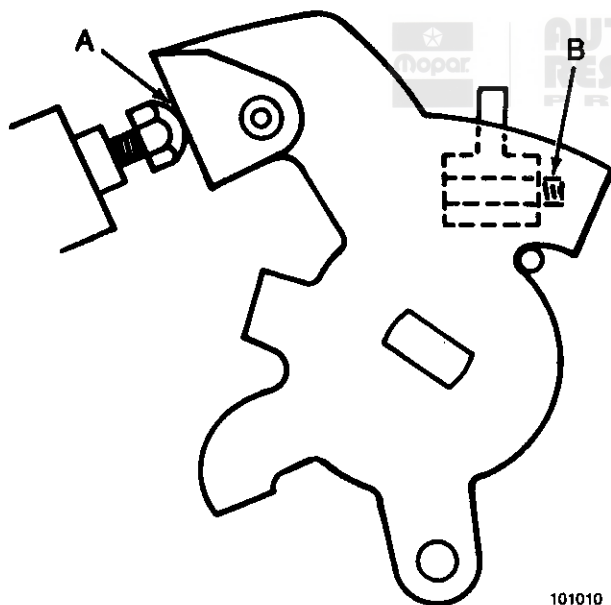
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TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
5. Push throttle in CLOSED direction while pressing exerciser switch in RETRACT direction for 5 seconds.	ISA motor should continue to retract until throttle lever contacts with closed throttle stop screw on TBI main body.	IF, desired results were obtained.	THEN, ISA motor is OK. Check throttle control system for freedom and smoothness of movement. Inspect throttle return springs. Repair as necessary. After repair, perform test sequence No. 6.
		IF, ISA motor did not move.	THEN, ISA motor is defective. Stop the procedure. Replace the ISA motor.
6. Move the ISA motor in the EXTEND and RETRACT direction 2 or 3 times. ALWAYS leave ISA motor EXTENDED.	ISA motor should operate smoothly and ratchet (click) at end of EXTEND travel. It should stop automatically at end of RETRACT travel.	IF, the movement is intermittent, slow, or "gritty sounding".	THEN, replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is OK. Do not replace ISA motor.
		IF, an idle problem still exists.	THEN, further diagnosis is necessary.

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Disconnect the ISA motor exerciser connector from the ISA motor and from the battery.

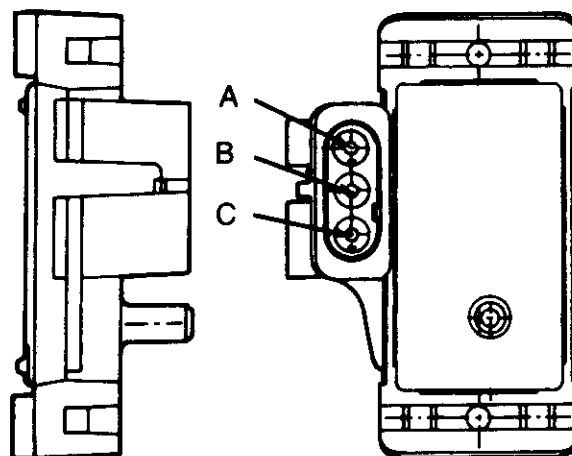
Connect the original harness connector to the ISA motor.

Install the air cleaner assembly (Renault only).

Manifold Absolute Pressure (MAP) Sensor Test

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

Test the MAP sensor output voltage at the MAP sensor connector terminal B (as marked on the sensor body) with the ignition switch ON and the engine OFF.



A. Ground
B. Output Voltage
C. 5 Volts

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THROTTLE BODY FUEL INJECTION SYSTEM

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Output voltage should be 4 - 5 volts.

NOTE: The voltage should drop to 1.5 - 2.1 volts with a hot, neutral idle speed condition.

Test ECU terminal 33 for the same voltage described above to verify the wire harness condition. Repair as necessary.

Test the MAP sensor supply voltage at the sensor connector terminal C with the ignition ON. The voltage should be 5 volts ($\pm 0.5V$).

Five volts ($\pm 0.5V$) should also be at terminal 16 of the ECU wire harness connector. Repair or replace the wire harness as necessary.

Test the ECU with Diagnostic Tester MS. 1700 if necessary.

Test the MAP sensor ground circuit at sensor connector terminal A and ECU connector terminal 17. Repair the wire harness if necessary.

Test the MAP sensor ground circuit at the ECU connector between terminal 17 and terminal 2 with an ohmmeter.

If the ohmmeter indicates an open circuit, inspect for a defective sensor ground connection on the flywheel/drive plate housing near the starter motor.

If the ground connection is good, replace the ECU.

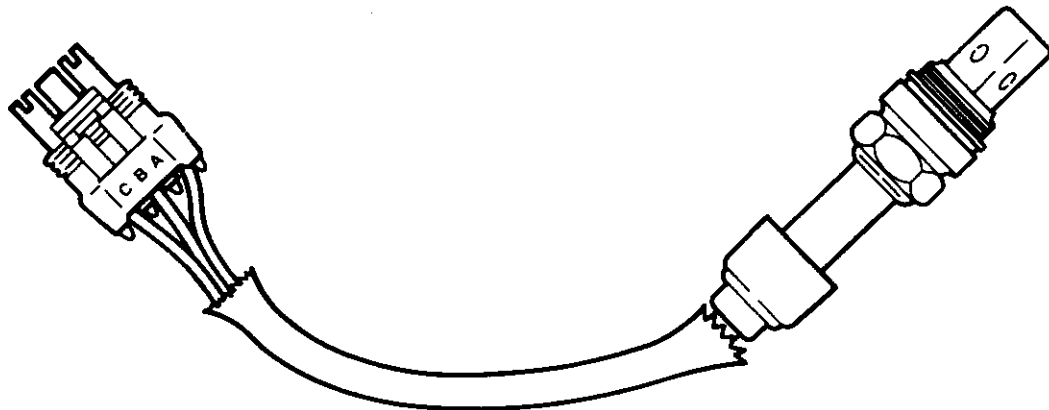
If terminal 17 has a short circuit to 12 volts, correct this condition before replacing the ECU.

2.46L Oxygen Sensor Heating Element Test

The oxygen sensor heating element can be tested with an ohmmeter as follows:

Connect the ohmmeter test leads to connector terminals A and B of the sensor connector (C). Resistance should be between 5 and 7 ohms. Replace the sensor if the ohmmeter displays an infinity reading.

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THROTTLE BODY FUEL INJECTION SYSTEM

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IDLE SPEED ACTUATOR (ISA) MOTOR ADJUSTMENT

Adjustment of the ISA motor plunger is necessary only to establish the initial position of the plunger after the motor has been replaced.

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.

Remove the air filter (Renault), or bonnet (Jeep), and start the engine.

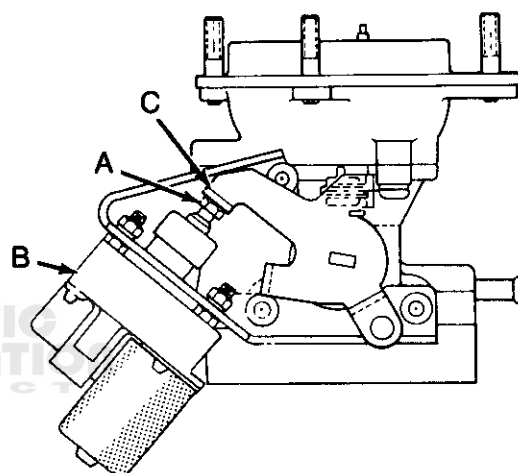
Allow engine to attain normal operating temperature (upper radiator hose hot).

Turn the A/C (if equipped) to the OFF position.

Connect a tachometer to diagnostic terminals D1-1 and D1-3.

With the ISA motor plunger fully extended, disconnect the ISA motor wire harness connector and start the engine.

With this condition, the engine idle speed should be 3500 RPM (± 200). If the speed is not correct, turn the hex head screw (A) on the end of the plunger to provide an engine speed of 3500 RPM.



A - Hex-head adjustment screw (also part of the closed throttle switch plunger).
B - Idle speed control (ISC) motor
C - Throttle lever

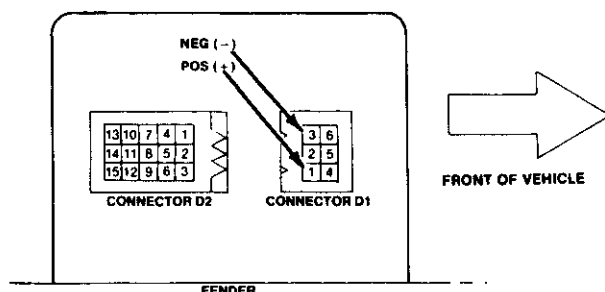
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Fully retract the ISA motor by holding the closed throttle switch plunger in while the throttle is opened. The closed throttle switch plunger should not be touching the throttle lever when the throttle is returned to the closed position. If contact is noted, check the throttle linkage and/or cable for binding or damage. Correct if necessary.

Connect the ISA wire harness connector.

Turn the ignition off for 10 seconds. The ISA motor should move to the fully extended position.

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Turn the ignition off. The ISA motor plunger should move to the fully extended position.



THROTTLE BODY FUEL INJECTION SYSTEM

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Start the engine. The engine speed should be approximately 3500 RPM for a short period of time and then decrease to idle speed.

Turn the ignition off. Disconnect the tachometer.

After the final adjustment of the ISA motor, apply a thread penetrating sealant (Loctite 290 or equivalent) to the adjustment screw threads to prevent movement.

NOTE: After the Loctite sealant hardens, application of heat with a soldering gun is required to loosen the adjustment screw threads. Application of Loctite sealant should be done only after the final adjustment is performed. Do not use flame type heat to loosen the adjustment screw, otherwise damage to the ISA motor will result.

Install the air filter (Renault) or air inlet bonnet (Jeep).

WIDE OPEN THROTTLE (WOT) SWITCH ADJUSTMENT

Adjustment of the WOT switch is necessary only to establish the initial position of the switch after it has been replaced.

Block or tie the throttle linkage in the wide open throttle position.

Attach Angle Measuring Gauge J-26701, to the flat surface of the throttle lever (A).

Rotate the degree scale of gauge J-26701 until the 12 degree mark is aligned with the gauge pointer.

Center the gauge bubble between the alignment marks using the bubble adjusting screw (B).

Rotate the gauge degree scale until the zero degree mark is aligned with the gauge pointer.

Close the throttle until the gauge bubble is again centered between the alignment marks. This positions the throttle plate at 12 degrees before wide open throttle.

Rotate the WOT switch until the switch lever contacts the throttle cam. Stop rotating the switch when the lever starts closing the switch plunger (plunger will make a click sound at this point). Then tighten the switch screws 90 N·m (8.8 in.-lbs) torque

Verify WOT throttle switch position adjustment. Switch plunger should "click" when the throttle plate is 12 degrees before wide open throttle position.

Remove gauge J-26701.

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THROTTLE BODY FUEL INJECTION SYSTEM



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FUEL PRESSURE REGULATOR ADJUSTMENT

Adjustment of the fuel pressure regulator is necessary to establish the correct pressure after a replacement has been installed.

Remove the air cleaner assembly (Renault) or air inlet bonnet (Jeep).

Connect a tachometer to the diagnostic connector terminals D1-1 and D1-3.

NOTE: Some models do not have a pressure test fitting on the throttle body. The fitting, PN 8983 501 572 can be obtained from the Parts Department.

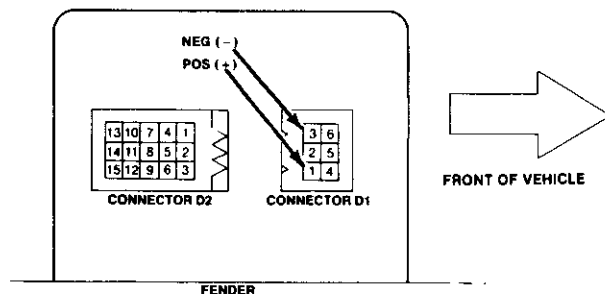
Connect an accurate fuel pressure gauge to the fuel body pressure test fitting (A).

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.

Start the engine and accelerate to a speed of approximately 2000 RPM.

NOTE: Turning the screw inward increases the pressure and turning the screw outward decreases the pressure.

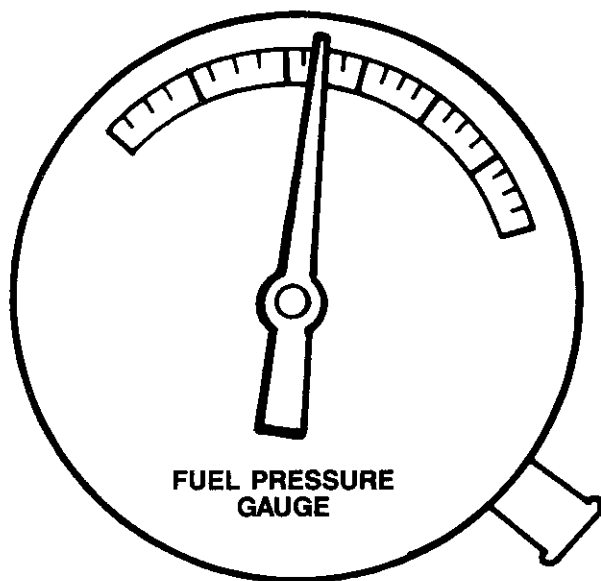
Turn the Torx head adjustment screw (B) on the bottom of the regulator to obtain 14.5 (1 bar) psi of pressure on 1.4L, 2.0L and 2.46L engines; 17.4 psi (1.2 bar) on 1.7L engines.



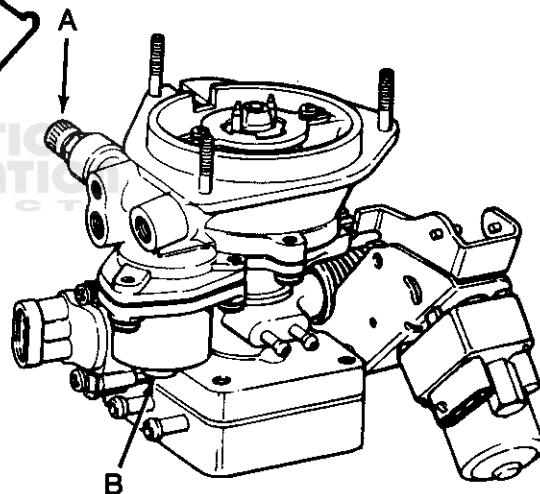
83051

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83053

Install a lead seal ball to cover the regulator adjustment screw (B) after adjusting the pressure to specification.

Turn the ignition off.

Disconnect the tachometer.

Disconnect the fuel pressure gauge and install the cap on the test fitting (A).

Install the air cleaner assembly (Renault) or air inlet bonnet (Jeep).



THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



THROTTLE POSITION POTENTIOMETER ADJUSTMENT 1.4L/1.7L

Refer to M.R. 245 Chapter F.

THROTTLE POSITION SENSOR ADJUSTMENT 2.46L ENGINE

Output Voltage Adjustment

Turn the ignition key to the ON position.

Check sensor input voltage. Connect the negative lead of a voltmeter to sensor terminal B. Then connect the voltmeter positive lead to sensor terminal C.

NOTE: Do not unfasten the sensor wire harness connector. Insert the voltmeter test leads through the back of the wire harness connector to make contact with sensor terminals B and C. On some models, it may also be necessary to remove the throttle body from the intake manifold, to gain access to the sensor wire harness.

Move and hold the throttle plate in the wide open position. Be sure the throttle linkage contacts the stop.

Note the voltmeter reading. Input voltage (at terminals B and C) should be 5.0 volts at wide open throttle.

Return the throttle plate to closed throttle position.

Check sensor output voltage. Disconnect the voltmeter positive lead from sensor terminal C and connect it to terminal A.

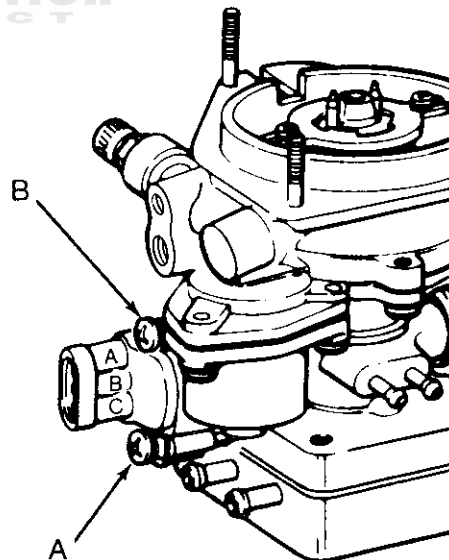
Move and hold the throttle plate in the wide open position. Be sure the throttle linkage contacts the stop.

Note the voltmeter reading. Output voltage should be 4.6 - 4.7 volts. Adjust output voltage as outlined in the next step if necessary.

Adjust output voltage as follows:

Loosen sensor retaining screw (A) and pivot the sensor in the adjustment slot for a coarse adjustment. Loosen sensor retaining screw (B) and pivot the sensor for a fine adjustment.

Remove the voltmeter and return the throttle plate to the closed position. Be sure sensor retaining screws (A) and (B) are tightened securely.

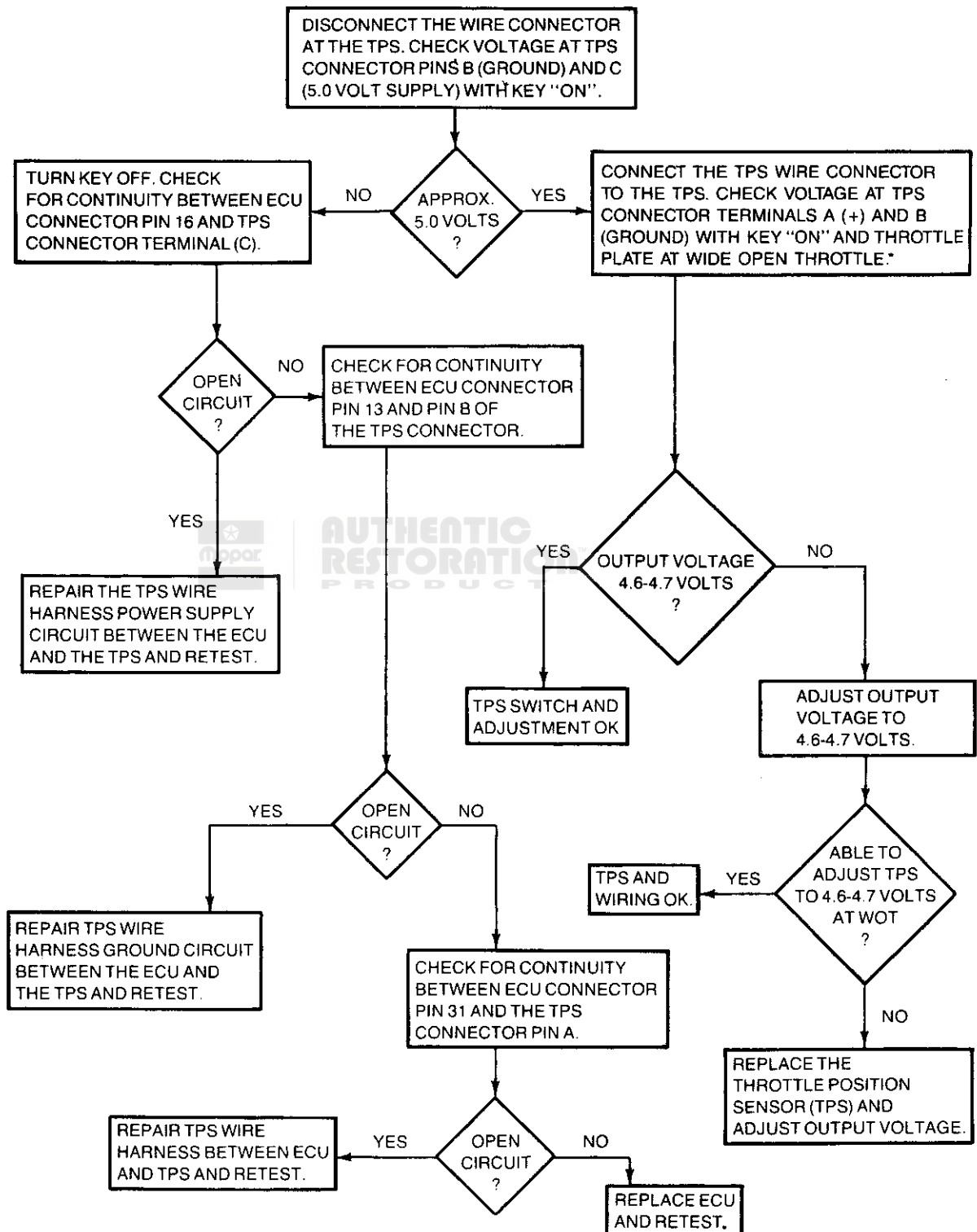


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NOTES



THROTTLE POSITION SENSOR (TPS) TEST — 2.46L ONLY



* DO NOT UNFASTEN THE SENSOR WIRE HARNESS CONNECTOR. INSERT THE VOLTMETER TEST LEADS THROUGH THE BACK OF THE WIRE HARNESS CONNECTOR TO MAKE CONTACT WITH THE SENSOR TERMINALS. ON SOME MODELS, IT MAY ALSO BE NECESSARY TO REMOVE THE THROTTLE BODY FROM THE INTAKE MANIFOLD, TO GAIN ACCESS TO THE SENSOR WIRE

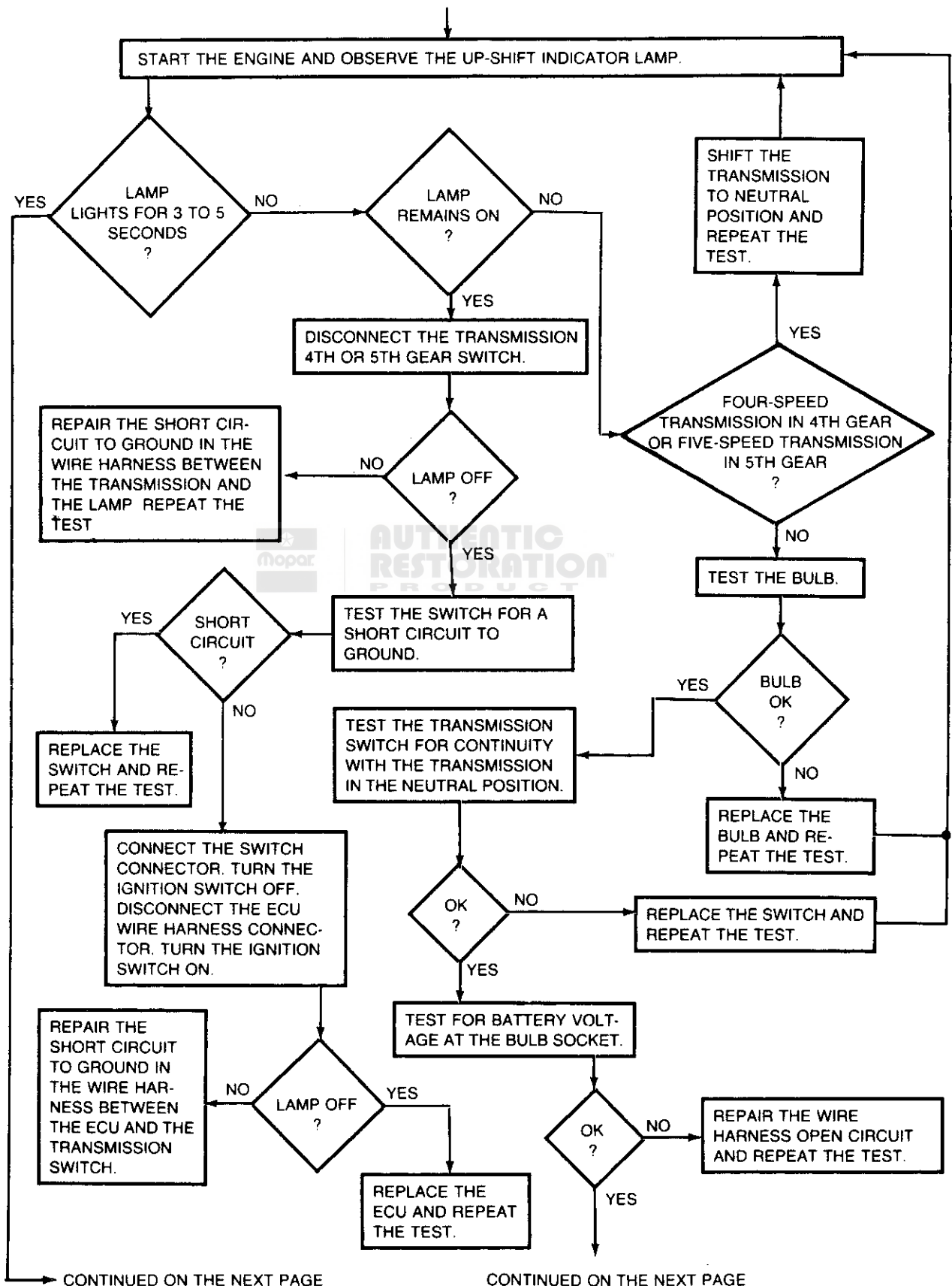


THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



MT UP-SHIFT TEST

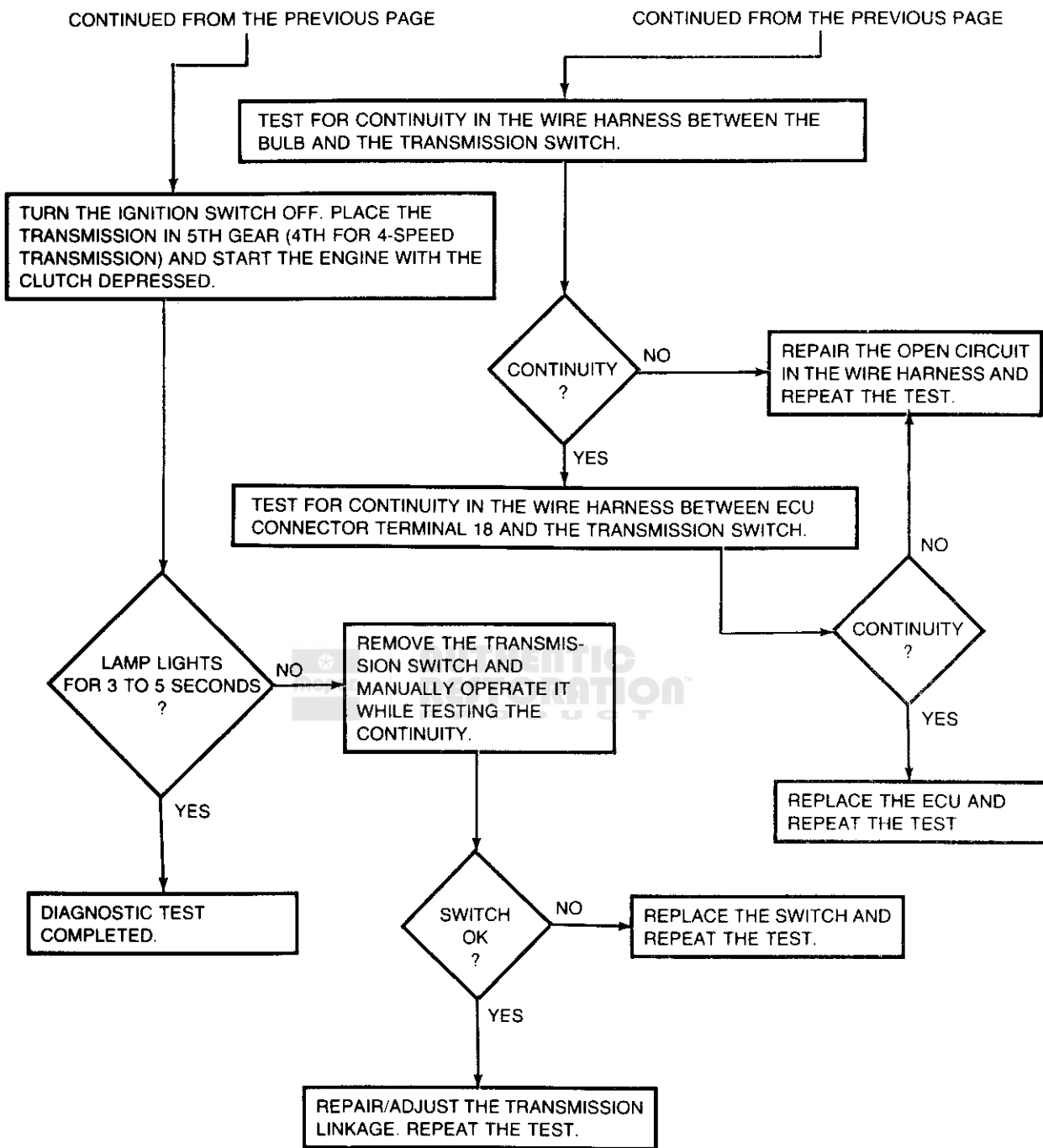


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THROTTLE BODY FUEL INJECTION SYSTEM

1.4L 1986-1987/1.7L/2.46L



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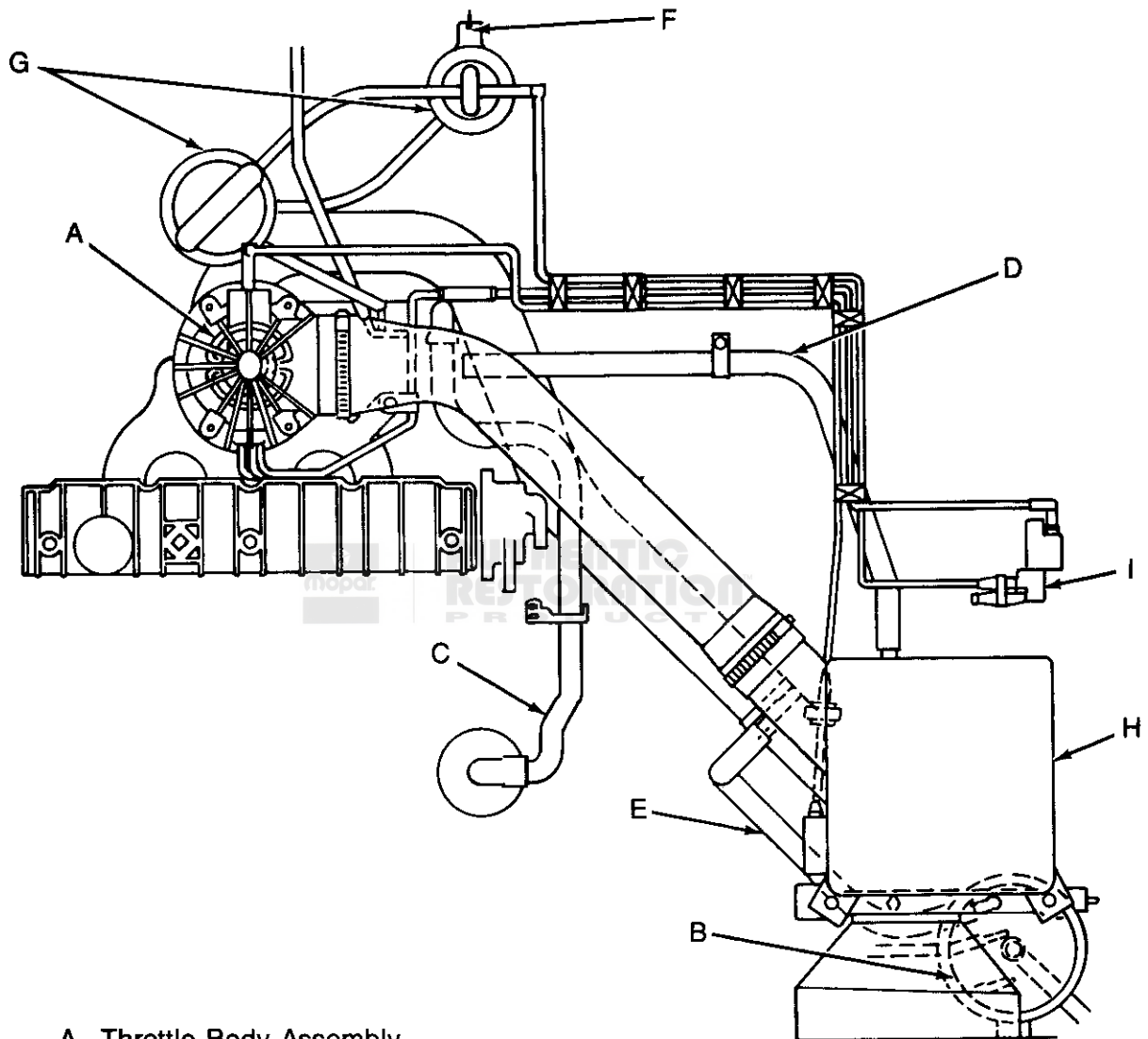
THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



TBI SYSTEM VACUUM DIAGRAM

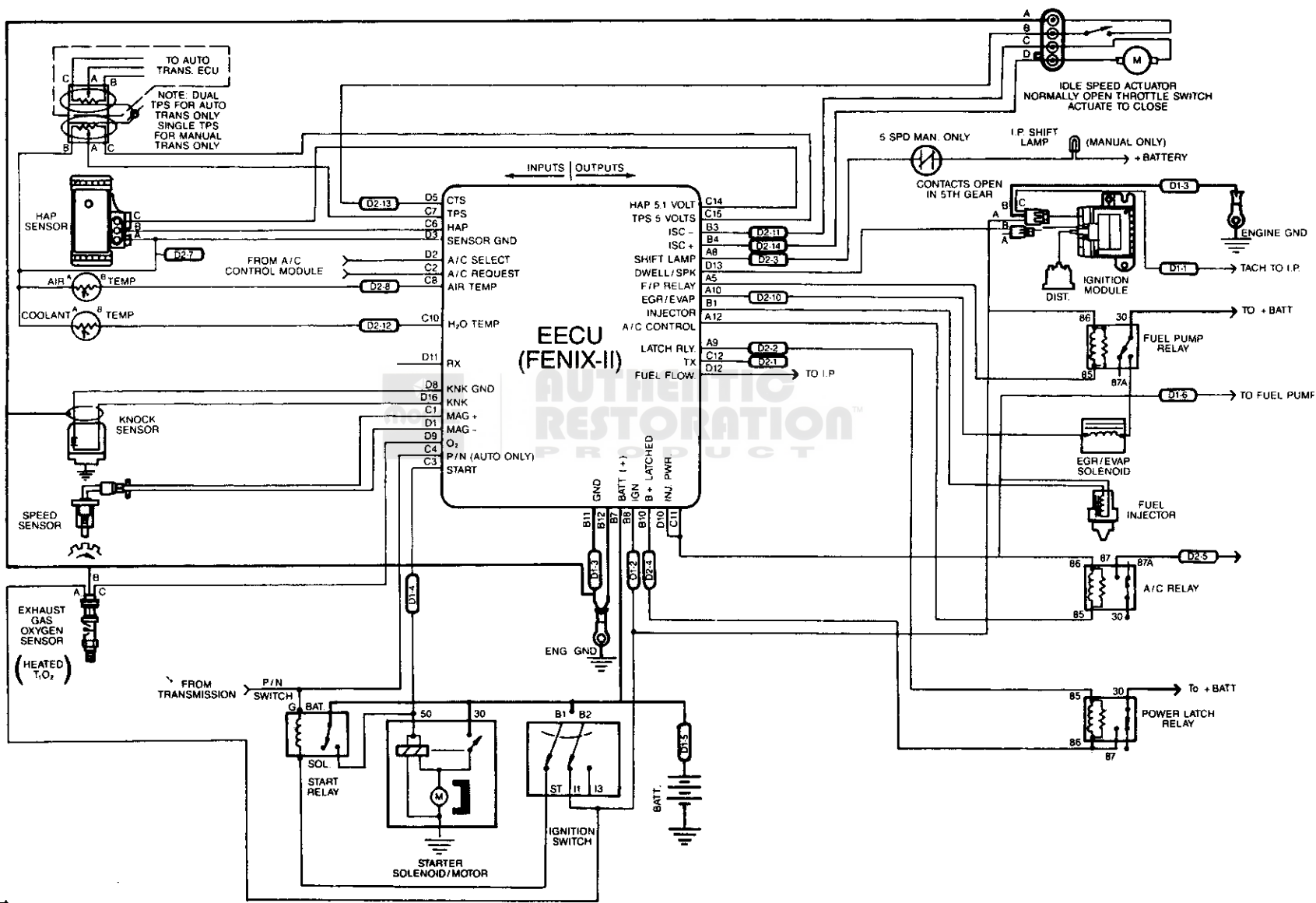
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- A. Throttle Body Assembly
- B. Canister Cap and Hose Assembly
- C. Crankcase Vent Tube
- D. PCV Hose
- E. Canister Purge Hose
- F. Transducer Mounting
- G. EGR Valve and Trans Assembly
- H. Air Cleaner Assembly
- I. Solenoid Vacuum Switch and Bracket

101952

TBI SYSTEM WIRING DIAGRAM



SEE I.S. NOTES



THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



COMPONENT REPLACEMENT

Fuel Injector

Removal

Remove the air inlet bonnet.

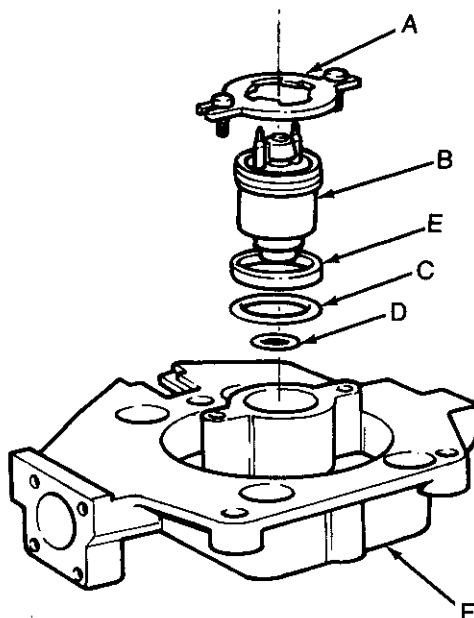
Remove the injector wire connector.

Remove the injector retainer clip screws.

Remove the injector retainer clip (A).

Using a pair of small pliers, gently grasp the center collar of the injector (between the electrical terminals) and carefully remove the injector (B) with a lifting-twisting motion.

Discard the upper (C) and lower (D) O-rings. Note that the backup ring (E) fits over the upper O-ring (C).



A. Retainer Clip
B. Injector
C. Upper O-Ring

D. Lower O-Ring
E. Backup Ring
F. Fuel Body

101799

Installation

Lubricate with light oil and install a replacement lower O-ring (D) in the housing bore.

Lubricate with light oil and install a replacement upper O-ring (C) in the housing bore.

Install the backup ring (E) over the upper O-ring (C).

Position the replacement injector (B) in the fuel body and center the nozzle in the lower housing bore.

Seat the injector (B) with a pushing-twisting motion.

Align the wire connector terminals in the proper orientation.

Install the retainer clip (A) and screws.

Connect the injector wire connector.

Install the air inlet bonnet.

Fuel Pressure Regulator

Removal

Remove the air inlet bonnet.

Remove the 4 retaining screws (A) that secure the pressure regulator (B) to the fuel body (C).

Remove the pressure regulator assembly (B).

Note the location of the components for assembly reference.

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NOTES

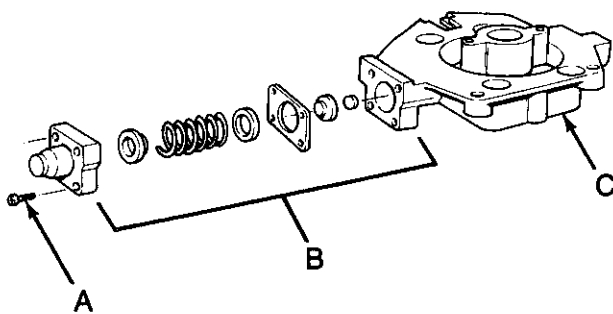


THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Discard the gasket.



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Installation

Position the pressure regulator assembly (B) with a replacement gasket.

Install the 4 retaining screws (A) to secure the pressure regulator (B) to the throttle body (C).

Operate the engine and inspect for leaks.

Adjust the fuel pressure regulator as described in this section.

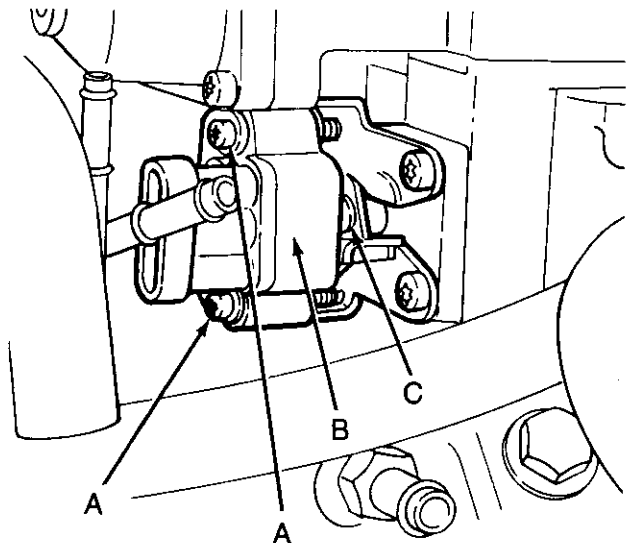
Throttle Position Sensor (TPS)

Removal

Remove the:

- air inlet bonnet
- throttle body assembly as described in this section
- 2 Torx head retaining screws (A)

- throttle position sensor (B) from the throttle shaft lever



101873

Installation

Position the throttle position sensor (B) over the throttle shaft lever (C).

Install the 2 Torx head screws (A) to retain the sensor.

Adjust the TPS switch as described in this section.

Install the throttle body assembly as described in this section.

Install the air inlet bonnet.

Idle Speed Actuator Motor

Removal

Remove the air inlet bonnet.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Disconnect the following:

- ISA motor wires
- throttle return spring

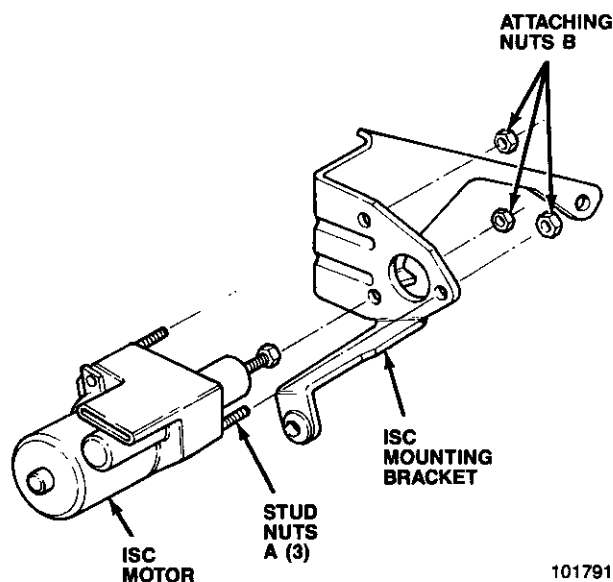
Remove the ISA motor from the mounting bracket as follows:

CAUTION: Do not attempt to remove the ISA motor-to-bracket nuts (B) without using a backup wrench on the stud nuts (A). ISA motor internal components may be dislodged if the studs disengage and the motor cap comes off.

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NOTE: It may be necessary to thin the backup wrench on a grinder before it will fit between the motor and bracket.

- Place backup 8 mm open end wrench on the ISA motor stud nuts (A) to prevent the studs from turning.
- Remove the ISA motor-to-mounting bracket attaching nuts (B) and remove the motor from the bracket.



Installation

Install the ISA motor on the mounting bracket.

Connect the following:

- throttle return spring
- ISA motor switch wires

Install the air inlet bonnet.

Extend the ISA motor plunger as follows:

- Press accelerator downward to 1/4 - 1/2 throttle position and start the engine (this procedure prevents the ISA motor plunger from retracting).
- Stop the engine after 5-10 seconds. When the ignition is turned off, the ISA motor plunger will fully extend.

NOTE: The ISA motor plunger must be fully extended before operating the vehicle. If the plunger is not fully extended beforehand, the closed throttle switch may open prematurely, causing idle speed to drop to approximately 400 RPM.

Canister Purge/EGR Solenoid

Removal

Disconnect the vacuum hoses (A) and (B) from the solenoid.

Disconnect the electrical connection (C) from the solenoid.

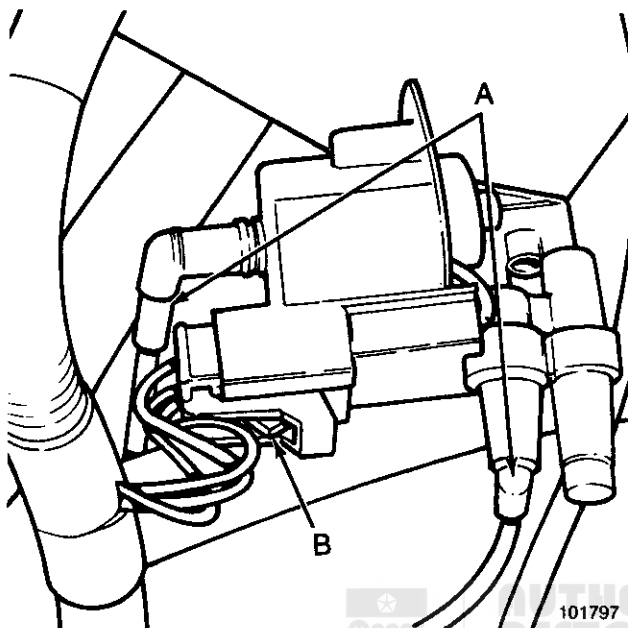


THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Remove the bracket and solenoid as an assembly.



Installation

Install the solenoid and bracket assembly.

Connect the electrical connection (C) to the solenoid.

Connect the vacuum hoses (A) and (B) to the solenoid.

EGR Valve

NOTE: The EGR valve is located on the intake manifold below the throttle body.

Removal

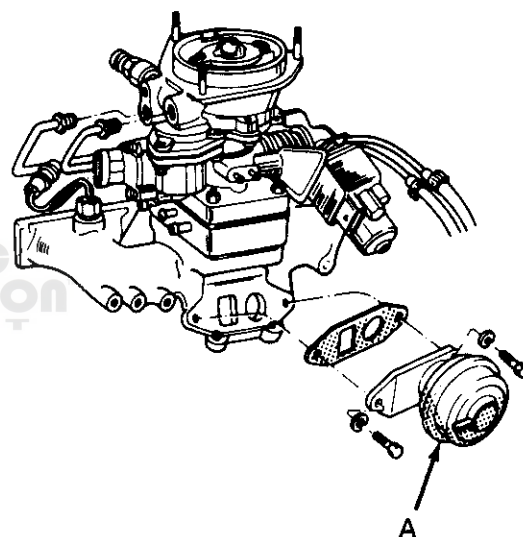
Disconnect the vacuum hose from the EGR valve (A).

Remove the 2 EGR valve-to-intake manifold retaining bolts.

Remove the EGR valve from the intake manifold.

Discard the original gasket.

Clean the EGR valve and intake manifold mating surfaces.



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Installation

Position the replacement EGR valve (A) on the intake manifold with a replacement gasket.

Install the EGR valve-to-intake manifold bolts.

Connect the vacuum hose to the EGR valve.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Manifold Absolute Pressure (MAP) Sensor

NOTE: The MAP sensor is located on the plenum chamber rear panel.

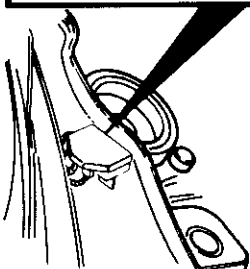
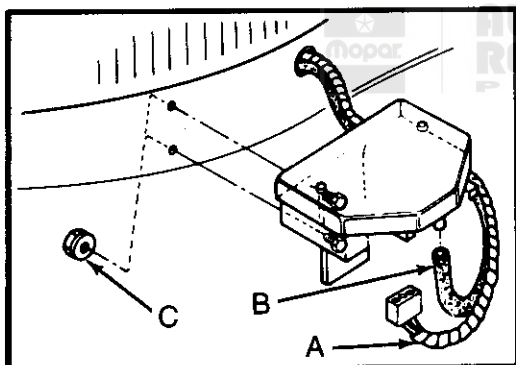
Removal

Disconnect the wire harness connector (A).

Disconnect the vacuum hose (B).

Remove the retaining nuts (C).

Remove the MAP sensor from the plenum chamber panel.



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Installation

Position the MAP sensor on the plenum chamber panel.

Install the MAP sensor-to-plenum chamber panel nuts (C).

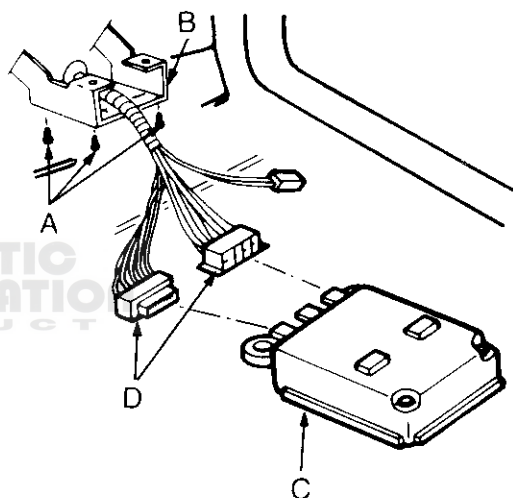
Connect the vacuum hose (B).

Connect the wire harness connector (A).

Electronic Control Unit (ECU)

Removal

Remove the retaining screws and bracket that support the ECU below the glove box.



- A. Attaching Screws
- B. Bracket
- C. ECU
- D. Wire Connectors

83042

Remove the ECU.

Disconnect the wire harness connectors from the ECU.

Installation

Connect the wire harness connectors to the replacement ECU.

Position the replacement ECU in the bracket.

Install the bracket and ECU retaining screws.



THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



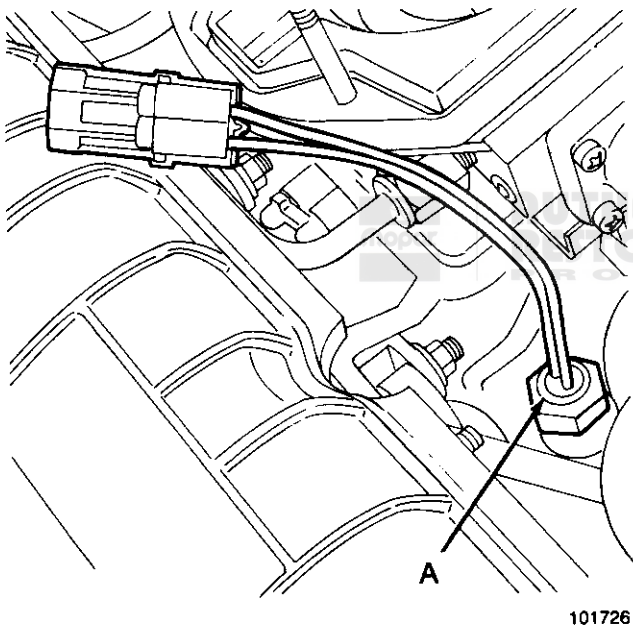
Manifold Air/Fuel Temperature (MAT) Sensor

Removal

Disconnect the wire harness connector from the MAT sensor (A).

Remove the MAT sensor from the intake manifold.

Clean the threads in the manifold.



Installation

Wrap the replacement MAT sensor threads with Teflon tape.

Install the MAT sensor (A) in the intake manifold.

Connect the wire harness connector to the MAT sensor.

Coolant Temperature Sensor (CTS)

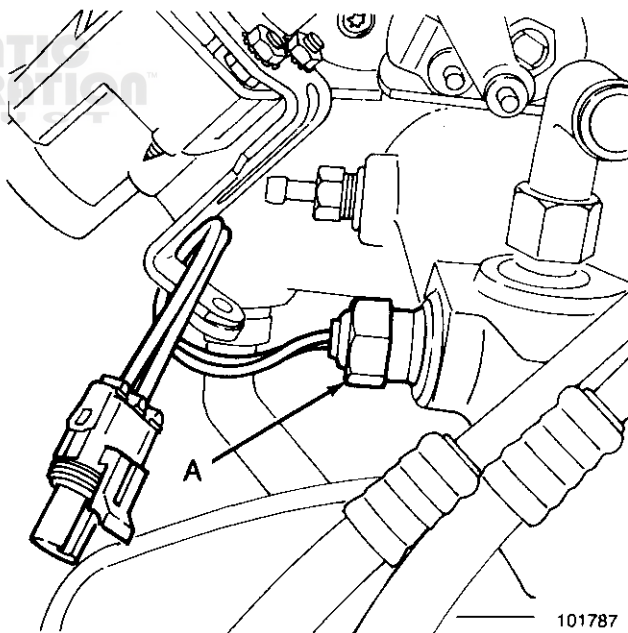
NOTE: The CTS sensor (A) is located at the rear of the intake manifold.

Removal

Remove the wire harness connector from the CTS.

WARNING: Do not remove the CTS with the cooling system hot and pressurized because serious burns from coolant can occur.

Remove the CTS from the intake manifold and rapidly plug the hole to prevent loss of coolant.



Installation

Install the replacement CTS in the intake manifold.

Connect the wire harness connector to the CTS.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Oxygen (O₂) Sensor

Removal

Disconnect the wire harness connector from the O₂ sensor (A).

Remove the O₂ sensor from the exhaust pipe adapter.

Clean the threads in the adapter/exhaust manifold.

CAUTION: Ensure that the wire terminal ends are properly seated in the connector prior to joining the connectors.

Connect the wire harness connector.

CAUTION: Do not push the rubber boot down on the sensor body beyond 13 mm (0.5 in.) above the base.

The oxygen sensor pigtail wires cannot be spliced or soldered. If broken, replace the sensor.

Power (B+) Relay/Fuel Pump Relay/Compressor Clutch Relay

Removal

Remove the power (B+) relay (A) or the fuel pump relay (B) or the A/C clutch relay (C) or the cooling fan relay (D) or the starter relay (E) from the right inner fender panel.

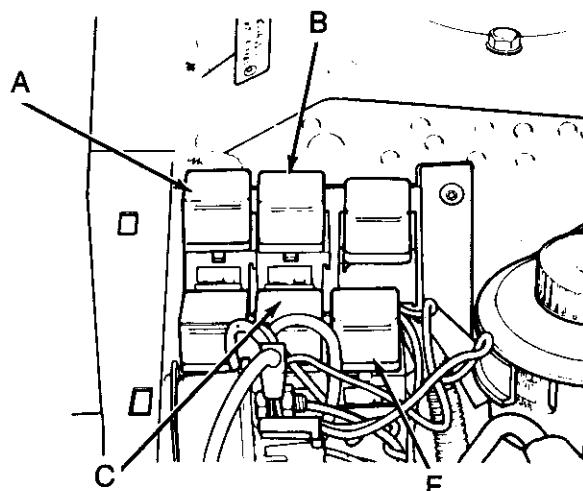
NOTE: Some models will have a fog lamp relay (F).

Installation

Antiseize sealer is already applied to the threads of replacement O₂ sensors.

Hand start the sensor in the exhaust pipe adapter/exhaust manifold.

Tighten the sensor to 27-34 N·m (20-25 ft-lbs) torque.



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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



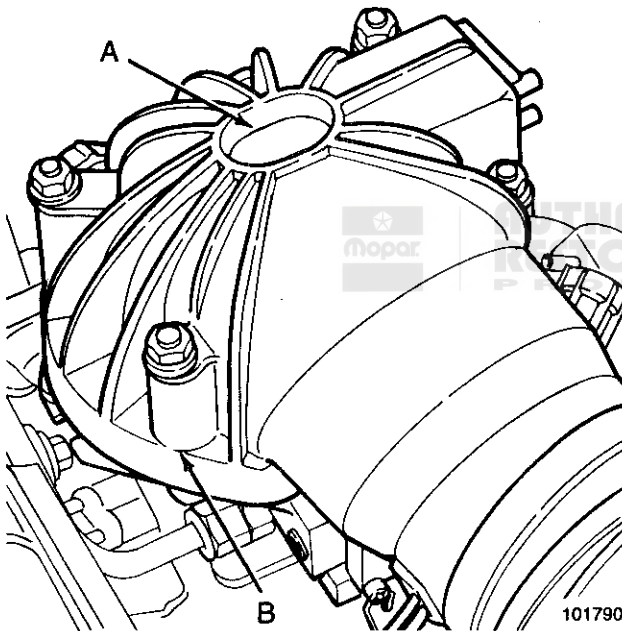
Installation

Connect the replacement relay to the wire harness connector.

Throttle Body Assembly

Removal

Remove the air inlet bonnet (A) and spacer (B).



Disconnect the:

- throttle cable
- throttle return spring
- cruise control cable (if equipped)
- wire harness connector from the injector (A)
- wire harness connector from the TPS (B)

- wire harness connector from the ISA motor (C)

- fuel supply pipe (D) from the throttle body

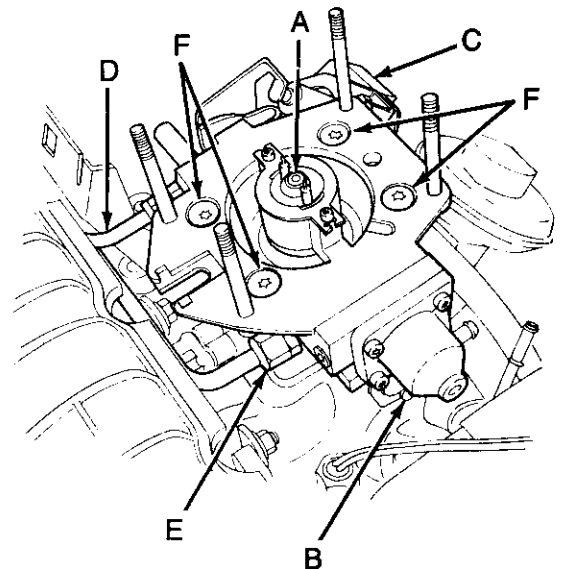
- fuel return pipe (E) from the throttle body

Disconnect the vacuum hoses from the throttle body assembly. Identify and tag the hoses for installation reference.

Remove the throttle body-to-manifold retaining bolts (F).

Remove the throttle body assembly from the intake manifold.

If the throttle body assembly is being replaced, transfer the following components to the replacement throttle body: ISA motor and bracket assembly.



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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Installation

Install the replacement throttle body assembly on the intake manifold. Use a replacement gasket between the components.

Install the throttle body-to-manifold retaining bolts (F).

Connect the:

- vacuum hoses
- fuel return pipe (E) to the throttle body
- fuel supply pipe (D) to the throttle body
- wire harness connector to the injector (A)
- wire harness connector to the TPS (B)
- wire harness connector to the ISA motor (C)
- cruise control cable (if equipped)
- throttle return spring
- throttle cable

Install the air inlet bonnet and spacer.

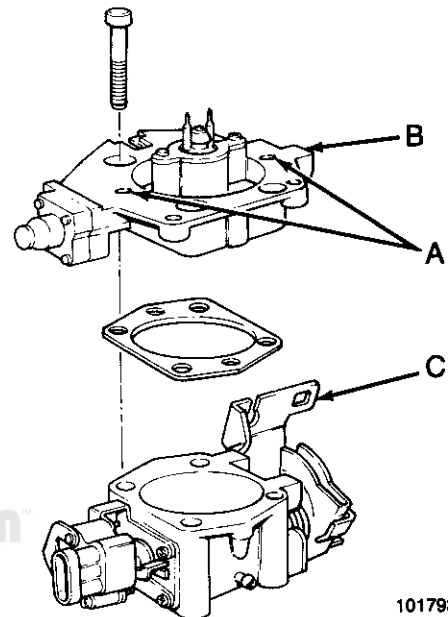
Fuel Body Assembly

Removal

Remove the throttle body assembly as described in this section.

Remove the 2 Torx head screws (A) that retain the fuel body (B) to the throttle body (C).

Remove the original gasket and discard.



Installation

Install the replacement fuel body (B) on the throttle body (C) using a replacement gasket.

Install the 2 Torx head screws (A) and tighten securely.

Install the throttle body assembly as described in this section.



THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Fuel Filter

NOTE: The fuel filter is located on the right rear frame member.

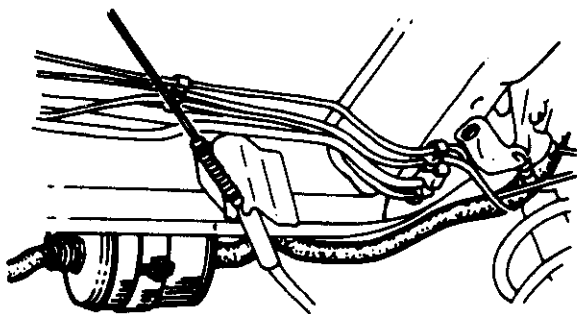
Removal

Raise and support the vehicle.

Place MOT. 453 clamps (or equivalent) on the hoses.

Remove the fuel filter retaining strap bolt and nut.

Remove the hose clamps and hoses.



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Installation

NOTE: When installing, ensure that the fuel flow is in the correct direction.

Install the fuel filter retaining strap.

Connect the hoses and tighten the hose clamps.

Remove the MOT. 453 clamps.

Lower the vehicle.

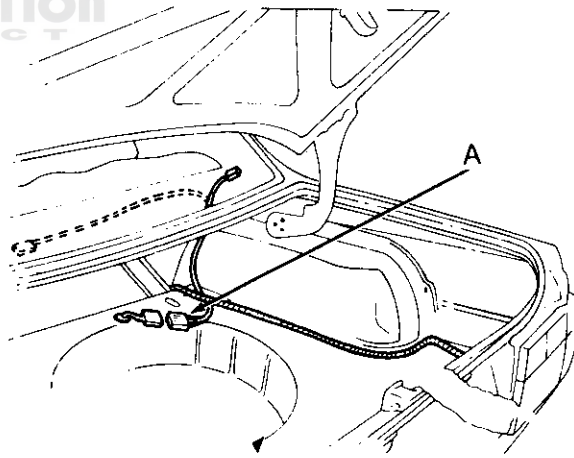
Fuel Tank, Pump/Gauge Sending Unit

Removal

Disconnect the battery cables.

Remove the fuel from the tank.

Disconnect the wire harness connector (A).



A. Wire Harness Connector

83048

Position a jack beneath the tank.

Separate the fuel filler tube from the tank.

Remove the fuel tank retaining bolts and lower the tank gradually with the jack.

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THROTTLE BODY FUEL INJECTION SYSTEM

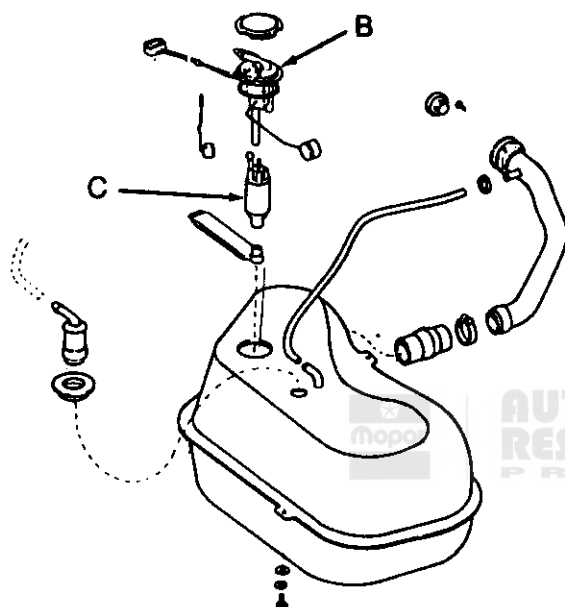
2.0L ENGINE



Disconnect the fuel supply, return and vent hoses.

Turn the fuel gauge sending unit retainer ring with a screwdriver and remove.

Separate the sending unit (B) and pump (C).



B. Sending Unit
C. Fuel Pump

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Installation

Connect the fuel pump (C) to the sending unit (B).

Install the sending unit/pump assembly in the tank and secure with the retaining ring.

Connect the hoses.

Install the tank with the retaining bolts.

Connect the fuel filler tube to the tank.

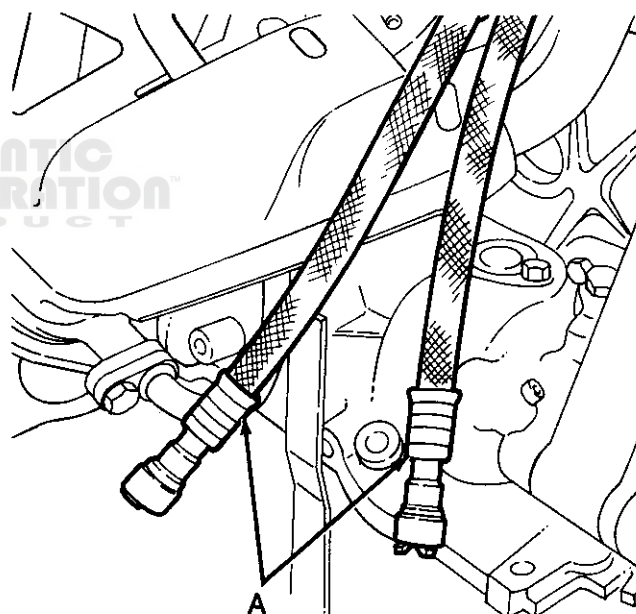
Connect the wire harness connector.

Connect the battery cables.

NOTE: The fuel tank is equipped with a pressure/vacuum filler cap.

Quick-Connect Fuel Lines

The 2.0L engines utilizes quick-connect fuel line couplings for the fuel supply and return lines to the throttle body assembly.



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The quick-connect fuel lines are located near the right strut tower behind the engine. Whenever the quick-connect fuel lines are disconnected, the O-rings in the connector should be replaced. Use the quick-connect fuel line O-ring replacement procedure.

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THROTTLE BODY FUEL INJECTION SYSTEM

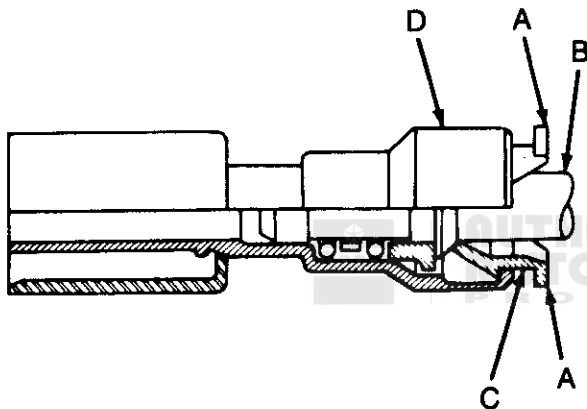
2.0L ENGINE



O-Ring Replacement

Separate the quick-connect fuel line tubes at the right inner fender panel behind the engine by squeezing the 2 retaining tabs (A) against the fuel line tube (B).

Pull the tube (B) and retainer (C) from the quick-disconnect fitting (D).

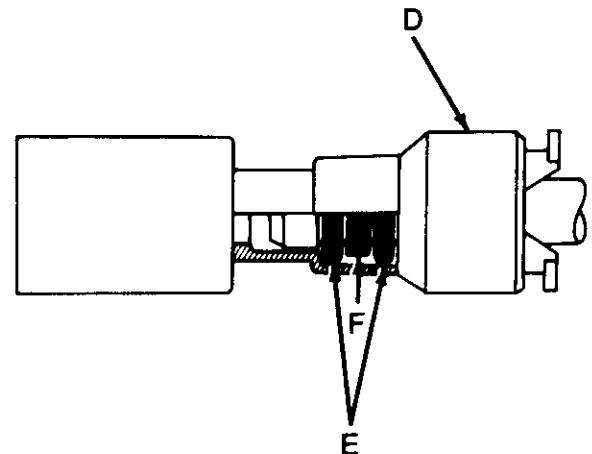


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Replace the O-ring using the Coupling Repair Kit, PN 8983 502 745, as follows:

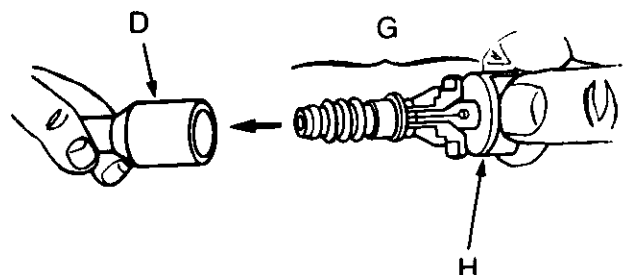
- remove the 2 O-rings (E) and the spacer (F) from the fitting (D)

NOTE: This can be done by using a paper clip, or piece of wire, bent in an "L" shape.



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- remove the retainer from the fuel tube and discard the O-rings, the spacer, and the retainer
- install the retainer assembly (G) by pushing the assembly into the quick-connect fitting (D) until a "click" sound is heard



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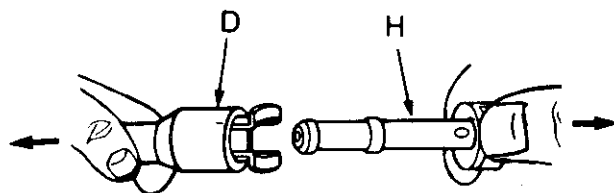
THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



- grasp the disposable plastic plug (H) and remove it from the fitting (D)

NOTE: By removing ONLY the plastic plug (H), the O-rings, spacer, and retainer will remain in the fitting.



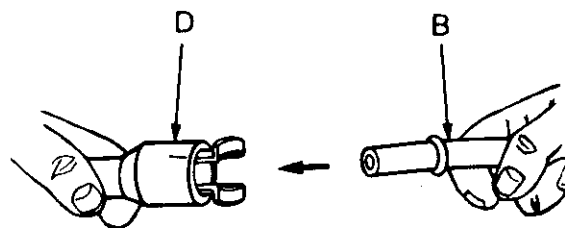
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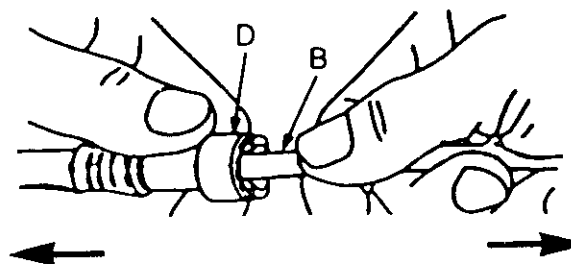
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- push the fuel line (B) into the fitting (D) until a "click" sound is heard and the connection is complete



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- verify that the quick-connect fitting assembly fits securely over the fuel lines by giving the fuel lines a firm tug



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THROTTLE BODY FUEL INJECTION SYSTEM

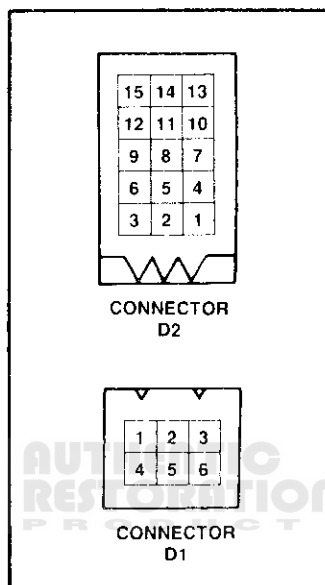


2.0L ENGINE

DIAGNOSTIC PROCEDURES

Diagnostic Connectors 2.0L (1987)

GTA Heater Plenum



FRONT OF
VEHICLE

D1

1. Tach
2. Ignition
3. ECU Ground
4. Start
5. Battery
6. Fuel Pump Relay

D2

1. Data Output
2. Latch Relay
3. Shift Lamp
4. B + Latch
5. A/C Relay
6. Not Used
7. Ignition Ground
8. Air Temperature Sensor
9. Not Used
10. EGR/Evap Solenoid
11. ISA Motor Forward
12. Coolant Temperature Sensor
13. Closed Throttle Switch
14. ISA Motor Reverse
15. Not Used

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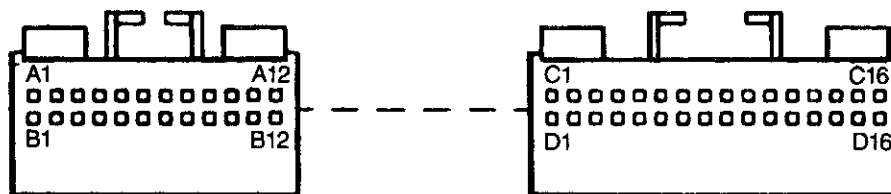


THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



ECU CONNECTOR



A

- 1.
- 2.
- 3.
- 4.
5. Fuel Pump Relay
- 6.
- 7.
8. Upshift Lamp
9. Power Latch Relay
10. EGR/Evap Solenoid
- 11.
12. A/C Clutch Relay

B

1. Injector
- 2.
3. ISA Motor Reverse
4. ISA Motor Forward
- 5.
- 6.
7. Battery
8. Ignition
- 9.
10. Latched B +
11. Power Ground
12. Power Ground

C

1. Speed Sensor (+)
2. A/C Clutch Request
3. Start
4. Neutral Safety Switch
- 5.
6. MAP Sensor Output
7. Throttle Position Sensor
8. Air Temperature Sensor
- 9.
10. Coolant Temperature Sensor
11. Injector Power
12. Data Output to D2-1
- 13.
14. MAP Supply Voltage
15. Throttle Position Sensor Supply Voltage
- 16.

D

1. Speed Sensor (-)
2. A/C Select
3. Sensor Ground
- 4.
5. Closed Throttle Switch
- 6.
- 7.
8. Knock Sensor Ground
9. O₂ Sensor
10. Injector Power
- 11.
12. Fuel Flow Meter
13. Ignition Module
- 14.
- 15.
16. Knock Sensor

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COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
FUEL PUMP WILL NOT OPERATE WHEN THE STARTER MOTOR IS ENGAGED.	Fuel pump defective. Open circuit.	Replace the fuel pump. Connect positive battery voltage to the pump contact on the starter motor relay. If the pump operates, repair or replace the starter motor relay. If the pump does not operate, repair the wire harness between the starter motor relay and the pump side of the ballast resistor. Check to determine if the pump operates one second with the ignition switch on.
ISA (IDLE SPEED ACTUATOR) MOTOR DOES NOT EXTEND ON ENGINE SHUTDOWN. (SYMPTOM: SLOW, UNSATISFACTORY IDLE AFTER COLD START.)	ECU, wire harness, or motor.	Connect a test bulb between D2 Pin 14 and D2 Pin 11 with the engine operating. Shut the engine off. If the bulb does not light momentarily on shutdown: test the ECU with MS 1700 tester. If the bulb lights at shutdown: test the wire harness and connector at the ISA motor. Repair as necessary. Test to determine if the motor is jammed in the full retract position. Refer to ISA Motor Diagnostic Test using ISA motor exerciser tool Ele. AB.99.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
IDLE SPEED ERRATIC, LOW, OR HIGH CONSISTENTLY.	ISA motor inoperative. NO ECU output.	Refer to the ISA Motor Diagnostic Test using ISA motor exerciser tool Ele. AB.99. Connect a test lamp from Pin B-3 to Pin B-4 on the ECU. Remove the ISA motor from the bracket and close the CTS switch manually. With the engine warmed-up and at idle speed, manually open the throttle to a speed well above normal idle speed. The lamp should flash. Close the throttle so the speed drops well below normal idle speed. The lamp should flash. NOTE: Improper handling of the ISA motor outputs can result in system damage. Never connect to ground or the battery. If the lamp flashes on both over and under idle speed: Check the wiring harness between the ECU and the ISA motor for an open or short circuit. Recheck the ISA motor function. If the lamp fails to flash on either over or under speed: Check the ECU with MS 1700 tester.
ECU DOES NOT TURN OFF AFTER ENGINE SHUTDOWN. (SYMPTOM: BATTERY LOSES CHARGE WITH KEY OFF.)	Throttle position incorrect. MAP sensor voltage supply (ECU Pin 16). Voltage should go from 5V to zero within 30 seconds after key is turned off.	Check to ensure that the throttle is resting on the switch at normal idle. Connect a voltmeter from D2 Pin 13 to D1 Pin 3. Should indicate ground potential at a normal idle speed. Check for air leaks into vacuum. Check the closed throttle switch, using the test procedure. Check coolant temperature sensor. Refer to the test procedure. Check the starter motor relay for a short circuit. With the key off, check the relay for battery voltage.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
EGR VALVE/CANISTER PURGE SOLENOID CONTROL IS ERRATIC. (SYMPTOMS: UNSATISFACTORY IDLE, BAD DRIVEABILITY, INACTIVE OXYGEN SENSOR.)	Defective solenoid.	Replace relay. Test the ECU with MS 1700 tester. Check ignition switch and harness for short circuit to battery voltage. Repair or replace as necessary. Check the solenoid valve. Connect the valve (out of harness) to 12V and determine if it opens and closes. Check for 12V to the solenoid valve coil. Replace the valve. Repair the wiring harness. Test the ECU with MS 1700 tester.
FUEL PRESSURE IS LOW AT TEST POINT ON THROTTLE BODY. (SYMPTOMS: UNSATISFACTORY DRIVEABILITY, INACTIVE OXYGEN SENSOR, HARD COLD STARTS.) NOTE: FUEL PRESSURE FOR THE 2.0L ENGINE IS 14.5 PSI (1.0 BAR).	Fuel pump malfunction.	Check the pump for proper voltage (nominally 7.5V). Check the fuel filter. Replace the filter. Replace the fuel pump ballast resistor. Repair the wiring harness. Check the fuel pressure regulator for proper function. With the engine idling, gently pinch off the rubber fuel return hose to the fuel tank. The pressure should rise greatly when the hose is restricted. Check the fuel pressure out of the pump. With a gauge directly on fuel inlet pipe (pipe dead headed at gauge), several cycles of key on should produce a pressure well over 20 psi. WARNING: This should only be done for a short time because the fuel system is not designed for high pressures. Install a fuel pressure regulator kit. Replace the throttle body. Replace the fuel pump.
FUEL PRESSURE HIGH AT TEST POINT ON THROTTLE BODY (SYMPTOMS: UNSATISFACTORY DRIVEABILITY, HARD STARTS, BLACK SMOKE, INACTIVE OXYGEN SENSOR.) NOTE: FUEL PRESSURE FOR THE 2.0L ENGINE IS 14.5 PSI (1.0 BAR).	Fuel restriction.	Check the fuel pressure with an oversize temporary fuel return pipe. Pipe should replace the existing return pipe. It should be securely fastened at the throttle body and discharge fuel into an approved closed container. If the pressure drops, replace the fuel return pipe. Inspect the fuel tank fittings and replace if restricted. If the pressure does not drop, install a fuel pressure regulator kit.

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2.0L ENGINE

COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START.	Defective WOT switch.	Refer to the WOT switch test procedure.
	Low battery voltage.	Replace or charge the battery.
	Fuel supply too low.	Replenish as necessary.
	Low fuel pressure.	Refer to the fuel pressure test. Correct as necessary. Replace the fuel filter.
	Fuel pump inoperative.	Repair or replace as necessary.
	Defective secondary ignition circuit.	Position a spark plug (with ignition wire) on the cylinder block. Engage the starter motor and observe the spark. Repair or replace the ignition power module or wiring.
	Primary ignition input to the ECU defective.	Connect a voltmeter between D1 Pin 2 and ground. With key on (engine stopped) voltage should be close to battery voltage. Check the harness and connectors between the ECU and the ignition power module. Service the ignition power module as necessary.
	No battery voltage applied to the injector (12V from one pin to chassis ground).	Check the B+ relay. Check the wire harness and connectors. Repair or replace as necessary.
	Injector resistance too high (ohmmeter should indicate less than 10 ohms).	Replace the injector.
	ECU is not switching the injector.	Remove the injector wire harness connector. Connect a test lamp across the connector. Engage the starter motor. The lamp should pulse dimly. Check the ECU with MS 1700 tester.
	Leaking injector.	Check to determine if the injector is discharging fuel when the engine is rotated by the starter motor. Install an O-ring kit if it is leaking fuel. Replace the injector if it either discharges no fuel with engine turning or drips fuel with the engine stopped.



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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE STARTS BUT WILL NOT IDLE.	No start signal voltage.	Check the start signal. Voltmeter from D1 Pin 4 to ground should indicate battery voltage when the starter motor is engaged. Service the starter motor relay or wire harness.
	ISA motor plunger is not extended.	Refer to the ISA motor test procedure.
	Coolant temperature sensor inoperative.	Refer to the coolant temperature sensor test procedure. Check to ensure that the spark plugs are not fouled or wet. Replace as necessary.
	Fuel pump inoperative.	Check the fuel pump.
DRIVEABILITY OR FUEL ECONOMY COMPLAINT.	Ignition system malfunction.	Check the ignition system. Repair as necessary. Check the start signal after engaging the starter motor. Voltmeter from D1 Pin 4 to D1 Pin 3 should indicate zero volts. Repair wire harness as necessary. Check the MAP sensor. Repair as necessary. Test the ECU with MS 1700 tester.
	High fuel pressure.	Check the fuel pressure. Test the ECU with MS 1700 tester. Replace the ECU if necessary. Check to determine if the oxygen sensor is functioning. Replace if necessary.
	Injector defective.	Replace the injector.
	TPS switch malfunction.	Check the TPS switch. Adjust, repair or replace the switch to ensure that the TPS voltage is approximately 4.7 volts during an actual wide open throttle condition.

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COMPONENT DIAGNOSIS (Cont'd)

CONDITION	POSSIBLE CAUSE	CORRECTION
	Air filter restricted. EGR valve malfunction. Canister purge malfunction.	Check the air filter. Replace as necessary. Check the EGR valve and hoses. Repair or replace. Check the canister purge function. Repair as necessary.

SUMMARY

It should be understood that the ECU is extremely reliable and must be the final component to be replaced if a doubt exists concerning the cause of a fuel injection system failure.

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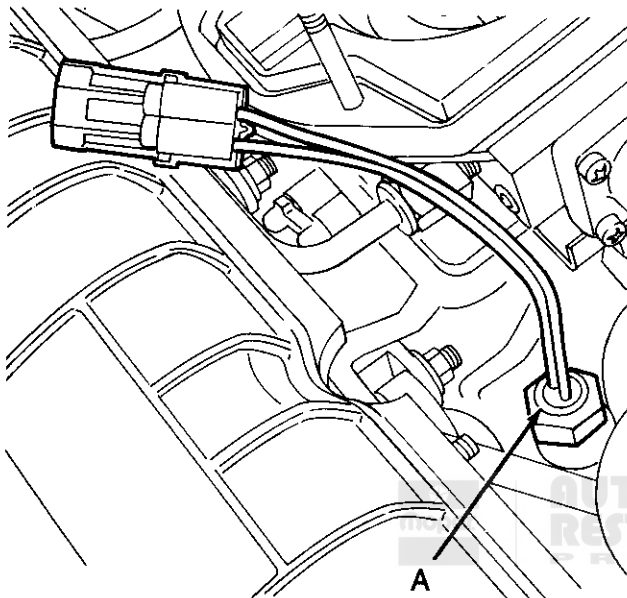
THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Manifold Air/Fuel Temperature (MAT) Sensor Test

Disconnect the wire harness connector from the MAT sensor (A).



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Test the resistance of the sensor with an input impedance (digital) volt-ohmmeter.

The resistance should be less than 1000 ohms with the engine warm.

Refer to the resistance chart.

Manifold Air/Fuel Temperature Sensor

Temperature-to-Resistance Values (Approximate)		
°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between the ECU wire harness connector terminal D-3 and the sensor connector terminal, and terminal C-8 to the sensor connector terminal.

Repair the wire harness as necessary if the resistance is greater than 1 ohm.



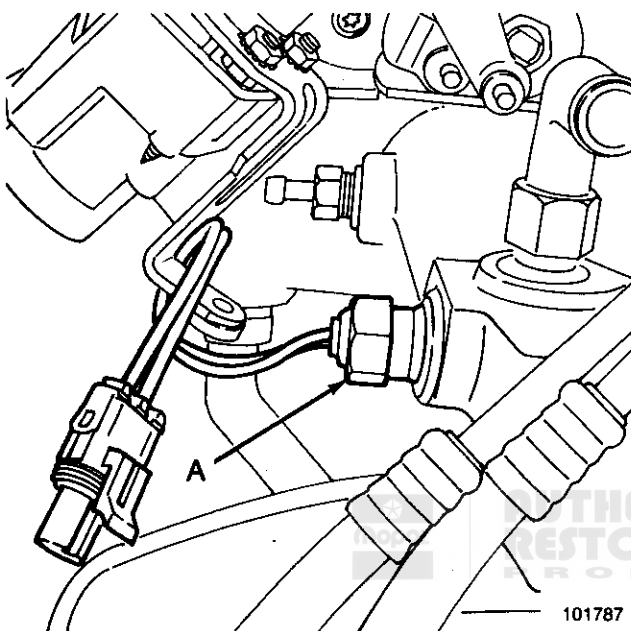
THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Coolant Temperature Sensor (CTS) Test

Disconnect the wire harness connector from the CTS (A).



Test the resistance of the sensor with a high input impedance (digital) volt-ohmmeter.

The resistance should be less than 1000 ohms with the engine warm.

Refer to the resistance chart.

Coolant Temperature Sensor

Temperature-to-Resistance Values (Approximate)		
°F	°C	Ohms
212	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

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Replace the sensor if it is not within the range of resistance specified in the chart.

Test the resistance of the wire harness between ECU wire harness connector terminal C-10 and the sensor connector terminal, and terminal D-3 to the sensor connector terminal.

Repair the wire harness if an open circuit is indicated.

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2.0L ENGINE



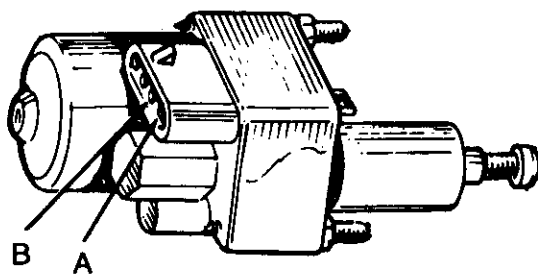
Closed Throttle (Idle) Switch Test

NOTE: It is important that all testing be done with the idle speed actuator (ISA) motor plunger in the fully extended position, as it would be after a normal engine shut down. If it is necessary to extend the ISA motor plunger to test the switch, an ISA motor failure can be suspected. Refer to the ISA Motor Adjustment if necessary.

With the ignition switch ON, test the switch voltage at the diagnostic connector (D2-13 and D2-7/ground).

The voltage should be close to zero at closed throttle and greater than 2 volts when off the closed throttle position.

If no voltage is present in either position, test for a short circuit to ground in the wire harness or switch.



A. Ground (-)

B. Closed Throttle Switch

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Test for an open circuit between terminal 25 (ECU connector) and the switch.

If the voltage is always more than 2 volts, test for an open circuit in the wire harness between the ECU and the switch connector, and between the switch connector and ground.

Repair or replace the wire harness as necessary.

ISA Motor Diagnostic Test

WARNING: After testing the operation of the ISA motor, or if the ISA motor has been replaced, always extend the ISA motor before starting the engine to prevent the ISA motor from jamming.

NOTE: The following test must be performed using Exerciser tool Ele. AB.99.

Remove the air inlet bonnet.

Check to ensure that the rubber boot is correctly positioned in its groove on the ISA motor shaft.

- If not, correct its position and recheck vehicle for proper idle speed operation.
- If correctly positioned, continue diagnosis procedure.

Open the throttle and attempt to extend and retract the ISA motor by pulling and pushing axially (in and out) on the ISA shaft.

CAUTION: If the shaft axial movement is more than 9.525 mm (3/8 in.), do not continue. Replace the ISA motor.

Be sure the ignition switch is in the OFF position.

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THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



Connect the exerciser clips to the vehicle battery (red to positive/black to negative).

Connect the ISA motor exerciser 4-pin connector to the ISA motor.

Disconnect the ISA motor connector.

ISA MOTOR DIAGNOSTIC TESTING

TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
1. Examine the ISA motor shaft tip position.	The ISA motor tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor tip is not in contact with throttle lever and throttle lever is closed.	THEN, ISA motor is fully retracted and jammed. Go to sequence No. 2 to unjam ISA motor.
		IF, desired results were obtained.	THEN, skip test sequence No. 2 and perform test sequence No. 3.
2. Apply parking brake, and start engine. With the engine running, open throttle to approx. 1500 rpm and move exerciser switch in the EXTEND direction several times to unjam the ISA. Turn ignition switch to OFF position.	ISA motor shaft tip should be in contact with the throttle lever. Throttle should be partially open.	IF, the ISA motor shaft tip is not in contact with the throttle lever and throttle is still closed.	THEN, ISA motor is permanently jammed. Stop procedure and replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is unjammed Go to test sequence No. 3.
3. Move the exerciser switch in the EXTEND direction for 5 seconds. Watch ISA motor action.	ISA motor should ratched (click) several times when it has reached fully extended position.	IF, it does not ratchet (click)	THEN, ISA motor is defective. Stop procedure. Replace ISA motor.
		IF, desired results were obtained.	THEN, ISA motor is OK. Perform test sequence No. 4.
4. Move the exerciser switch in the RETRACT direction for 5 seconds. Watch the ISA motor action.	ISA motor should close throttle and stop automatically in 3 seconds. The closed throttle switch light on the exerciser will go out when ISA motor reaches closed throttle position. The tip of the ISA should be in contact with, but no more than 0.50 mm (0.20-in), away from throttle lever (A) when ISA motor has stopped movement (see the illustration). The throttle linkage should also be in contact with the throttle stop screw (B) on the main body of the TBI when ISA motor movement has stopped	IF, ISA motor did not move.	THEN, ISA motor is defective. Stop the procedure. Replace ISA motor.
		IF, ISA motor closed the throttle, but retracted away from throttle lever and was no longer in contact with throttle lever.	THEN, ISA motor is defective. Stop the procedure. Replace the ISA motor.
		IF, ISA motor moved the throttle, but throttle was not in contact with the closed throttle stop screw on the TBI main body when ISA motor movement stopped.	THEN, perform test sequence No. 5.
		IF, desired results were obtained.	THEN, skip test sequence No. 5 and perform test sequence No. 6.



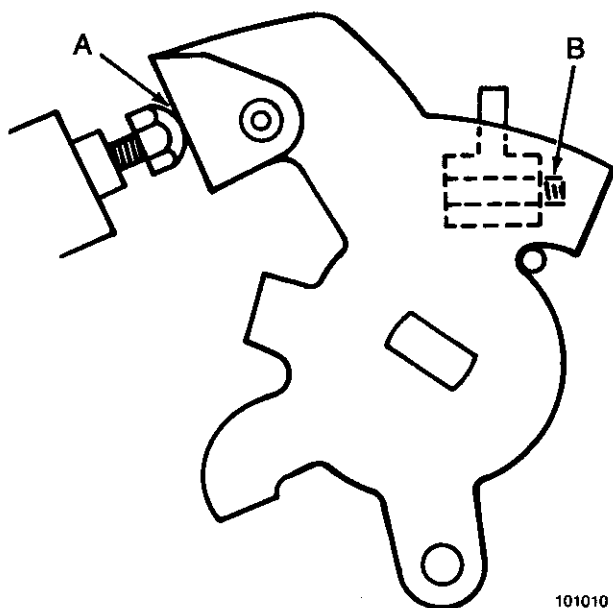
THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



TEST SEQUENCE	DESIRED RESULTS	POSSIBLE ACTUAL RESULTS	DIAGNOSIS CORRECTIVE ACTION
5. Push throttle in CLOSED direction while pressing exerciser switch in RETRACT direction for 5 seconds.	ISA motor should continue to retract until throttle lever contacts with closed throttle stop screw on TBI main body.	IF, desired results were obtained.	THEN , ISA motor is OK. Check throttle control system for freedom and smoothness of movement. Inspect throttle return springs. Repair as necessary. After repair, perform test sequence No. 6.
		IF, ISA motor did not move.	THEN , ISA motor is defective. Stop the procedure. Replace the ISA motor.
6. Move the ISA motor in the EXTEND and RETRACT direction 2 or 3 times. ALWAYS leave ISA motor EXTENDED.	ISA motor should operate smoothly and ratchet (click) at end of EXTEND travel. It should stop automatically at end of RETRACT travel.	IF, the movement is intermittent, slow, or "gritty sounding".	THEN , replace ISA motor.
		IF, desired results were obtained.	THEN , ISA motor is OK. Do not replace ISA motor.
		IF, an idle problem still exists.	THEN , further diagnosis is necessary.

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Disconnect the ISA motor exerciser connector from the ISA motor and from the battery.

Connect the original harness connector to the ISA motor.

Install the air inlet bonnet.

NOTE: If the ISA motor is to be tested off the vehicle, the ISA motor shaft must be lightly preloaded to avoid having the ISA motor jam during the test. Use light finger pressure to preload the ISA motor shaft and simulate throttle return pressure.



THROTTLE BODY FUEL INJECTION SYSTEM

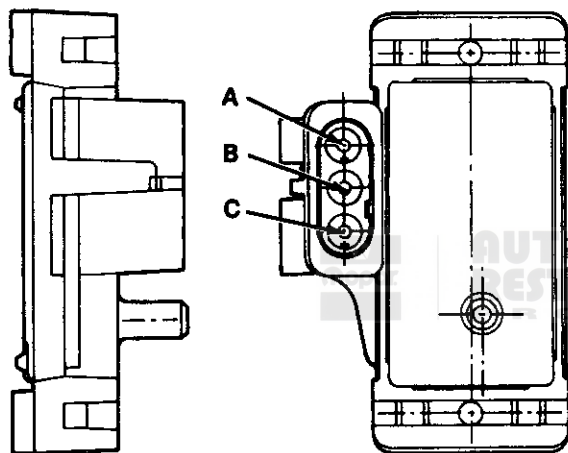
2.0L ENGINE



Manifold Absolute Pressure (MAP) Sensor Test

Inspect the MAP sensor vacuum hose connections at the throttle body and sensor. Repair as necessary.

Test the MAP sensor output voltage at the MAP sensor connector terminal B (as marked on the sensor body) with the ignition switch ON and the engine OFF.



A - Ground
B - Output voltage
C - 5 volts

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Output voltage should be 4 - 5 volts.

NOTE: The voltage should drop to 1.5 - 2.1 volts with a hot, neutral idle speed condition.

Test ECU terminal C-6 for the same voltage described above to verify the wire harness condition. Repair as necessary.

Test the MAP sensor supply voltage at the sensor connector terminal C with the ignition ON. The voltage should be 5 volts ($\pm 0.5V$).

The voltage should also be at terminal C-14 of the ECU wire harness connector. Repair or replace the wire harness as necessary.

Test the ECU with Diagnostic Tester MS. 1700 if necessary.

Test the MAP sensor ground circuit at sensor connector terminal A and ECU connector terminal D-3. Repair the wire harness if necessary.

Test the MAP sensor ground circuit at the ECU connector between terminal D-3 and terminal B-12 with an ohmmeter.

If the ohmmeter indicates an open circuit, inspect for a defective sensor ground connection on the flywheel/drive plate housing near the starter motor.

If the ground connection is good, replace the ECU.

If terminal D-3 has a short circuit to 12 volts, correct this condition before replacing the ECU.

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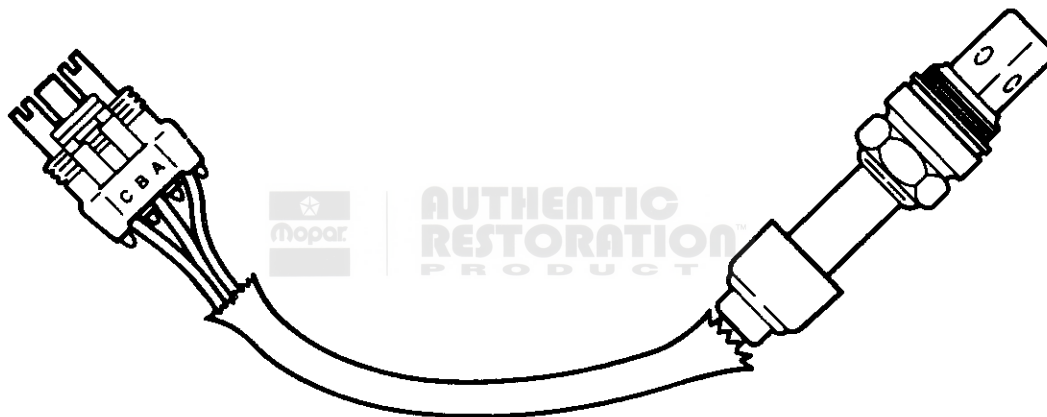
2.0L ENGINE



Oxygen Sensor Heating Element Test

The oxygen sensor heating element can be tested with an ohmmeter as follows:

Connect the ohmmeter test leads to connector terminals A and B of the sensor connector (C). Resistance should be between 5 and 7 ohms. Replace the sensor if the ohmmeter displays an infinity reading.



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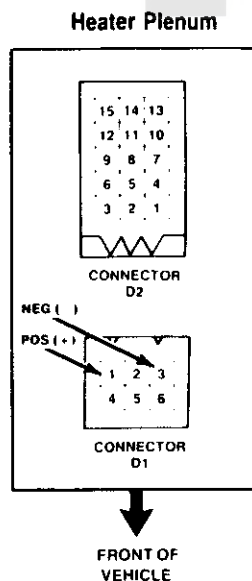
IDLE SPEED ACTUATOR (ISA) MOTOR ADJUSTMENT

Adjustment of the ISA motor plunger is necessary only to establish the initial position of the plunger after the motor has been replaced.

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.

Remove the air inlet bonnet. Start the engine and allow to attain normal operating temperature (upper radiator hose hot). Turn the A/C (if equipped) to the OFF position.

Connect a tachometer to diagnostic terminals D1-1 and D1-3.

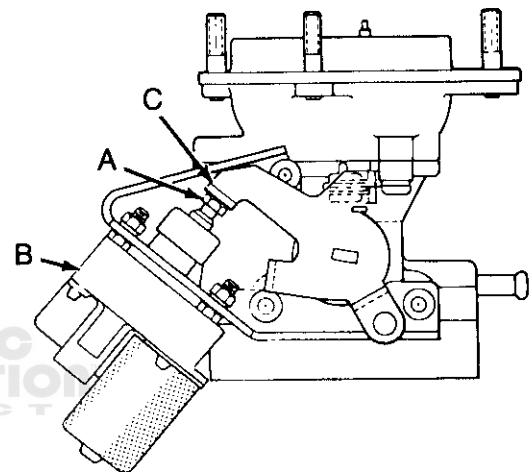


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Turn the ignition off. The ISA motor plunger should move to the fully extended position.

With the ISA motor plunger fully extended, disconnect the ISA motor wire harness connector and start the engine.

With this condition, the engine idle speed should be 3500 RPM (± 200). If the speed is not correct, turn the hex head screw (A) on the end of the plunger to provide an engine speed of 3500 RPM.



A - Hex-head adjustment screw (also part of the closed throttle switch plunger).
B - Idle speed control (ISC) motor
C - Throttle lever

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Fully retract the ISA motor by holding the closed throttle switch plunger in while the throttle is opened. The closed throttle switch plunger should not be touching the throttle lever when the throttle is returned to the closed position. If contact is noted, check the throttle linkage and/or cable for binding or damage. Correct, if necessary.

Connect the ISA wire harness connector.

Turn the ignition off for 10 seconds. The ISA motor should move to the fully extended position.



THROTTLE BODY FUEL INJECTION SYSTEM

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Start the engine. The engine speed should be approximately 3500 RPM for a short period of time and then decrease to idle speed.

Turn the ignition off. Disconnect the tachometer.

After the final adjustment of the ISA motor, apply a thread penetrating sealant (Loctite 290 or equivalent) to the adjustment screw threads to prevent movement.

NOTE: After the Loctite sealant hardens, application of heat with a soldering gun is required to loosen the adjustment screw threads. Application of Loctite sealant should be done only after the final adjustment is performed. Do not use flame-type heat to loosen the adjustment screw, otherwise, damage to the ISA motor will result.

Install the air inlet bonnet.

FUEL PRESSURE REGULATOR ADJUSTMENT

Adjustment of the fuel pressure regulator is necessary to establish the correct pressure after a replacement has been installed.

Remove the air inlet bonnet.

Connect a tachometer to the diagnostic connector terminals D1-1 and D1-3.

NOTE: 2.0L models do not have a pressure test fitting on the throttle body. The fitting, PN 8983 501 572 can be obtained from the Parts Department.

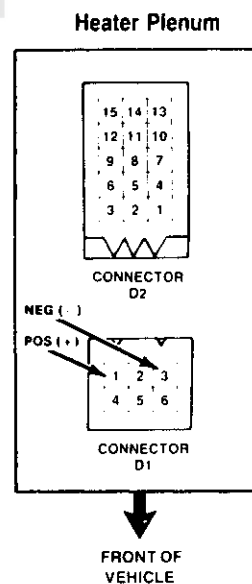
Connect an accurate fuel pressure gauge to the fuel body pressure test fitting (A).

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.

Start the engine and accelerate to a speed of approximately 2000 RPM.

NOTE: Turning the screw inward increases the pressure and turning the screw outward decreases the pressure.

Turn the Torx head adjustment screw (B) on the side of the regulator to obtain 14.5 psi (1 bar) of pressure.

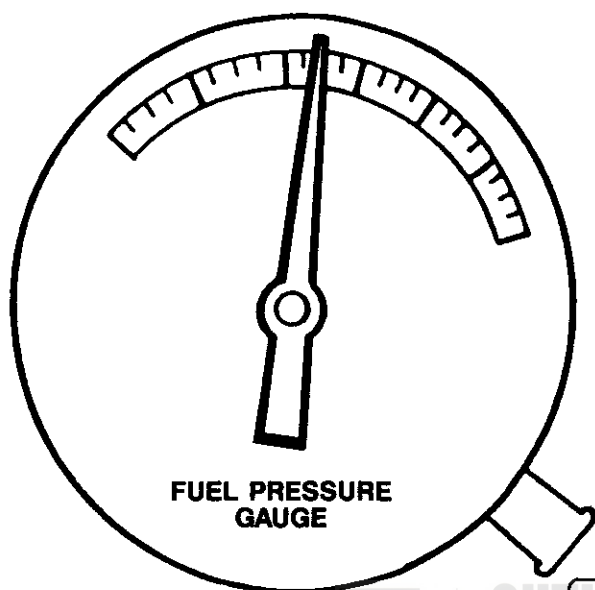


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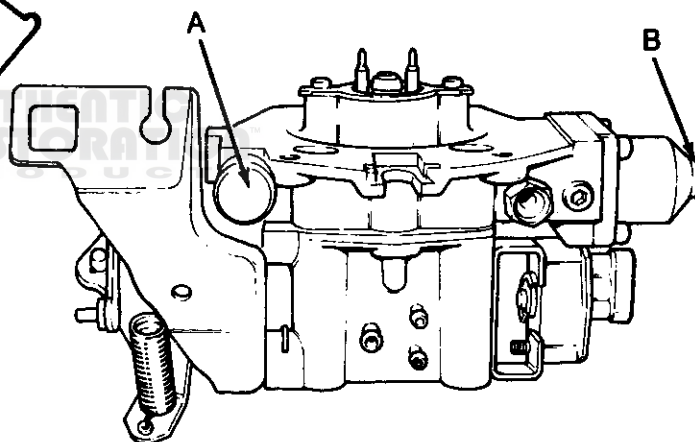


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Install a lead seal ball to cover the regulator adjustment screw (B) after adjusting the pressure to specification.

Turn the ignition off.

Disconnect the tachometer.

Disconnect the fuel pressure gauge and install the cap on the test fitting (A).

Install the air inlet bonnet.



THROTTLE BODY FUEL INJECTION SYSTEM

2.0L ENGINE



THROTTLE POSITION SENSOR

Output Voltage Adjustment

Turn the ignition key to the ON position.

Check sensor input voltage. Connect the negative lead of a voltmeter to sensor terminal B. Then connect the voltmeter positive lead to sensor terminal C.

NOTE: Do not unfasten the sensor wire harness connector. Insert the voltmeter test leads through the back of the wire harness connector to make contact with sensor terminals B and C.

Move and hold the throttle plate in the wide open position. Be sure the throttle linkage contacts the stop.

Note the voltmeter reading. Input voltage (at terminals B and C) should be 5.0 volts at wide open throttle.

Return the throttle plate to closed throttle position.

Check sensor output voltage. Disconnect the voltmeter positive lead from sensor terminal C and connect it to terminal A.

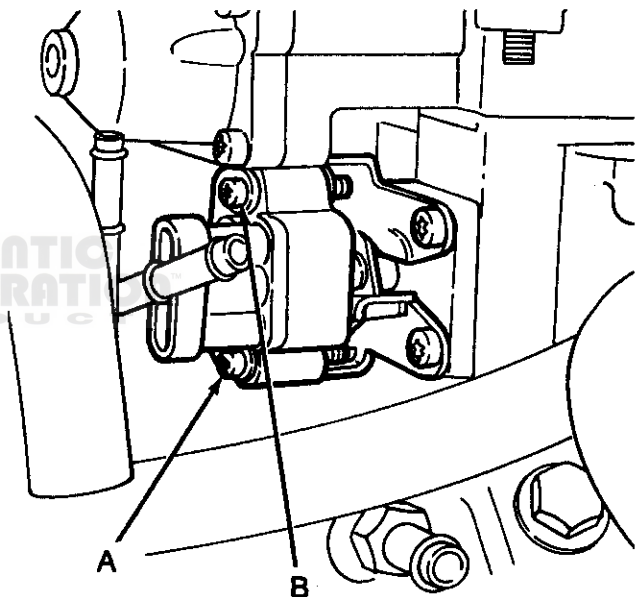
Move and hold the throttle plate in the wide open position. Be sure the throttle linkage contacts the stop.

Note the voltmeter reading. Output voltage should be 4.6 - 4.7 volts. Adjust output voltage as outlined in the next step if necessary.

Adjust output voltage as follows:

Loosen sensor retaining screw (A) and pivot the sensor in the adjustment slot for a coarse adjustment. Loosen sensor retaining screw (B) and pivot the sensor for a fine adjustment.

Remove the voltmeter and return the throttle plate to the closed position. Be sure sensor retaining screws (A) and (B) are tightened securely.



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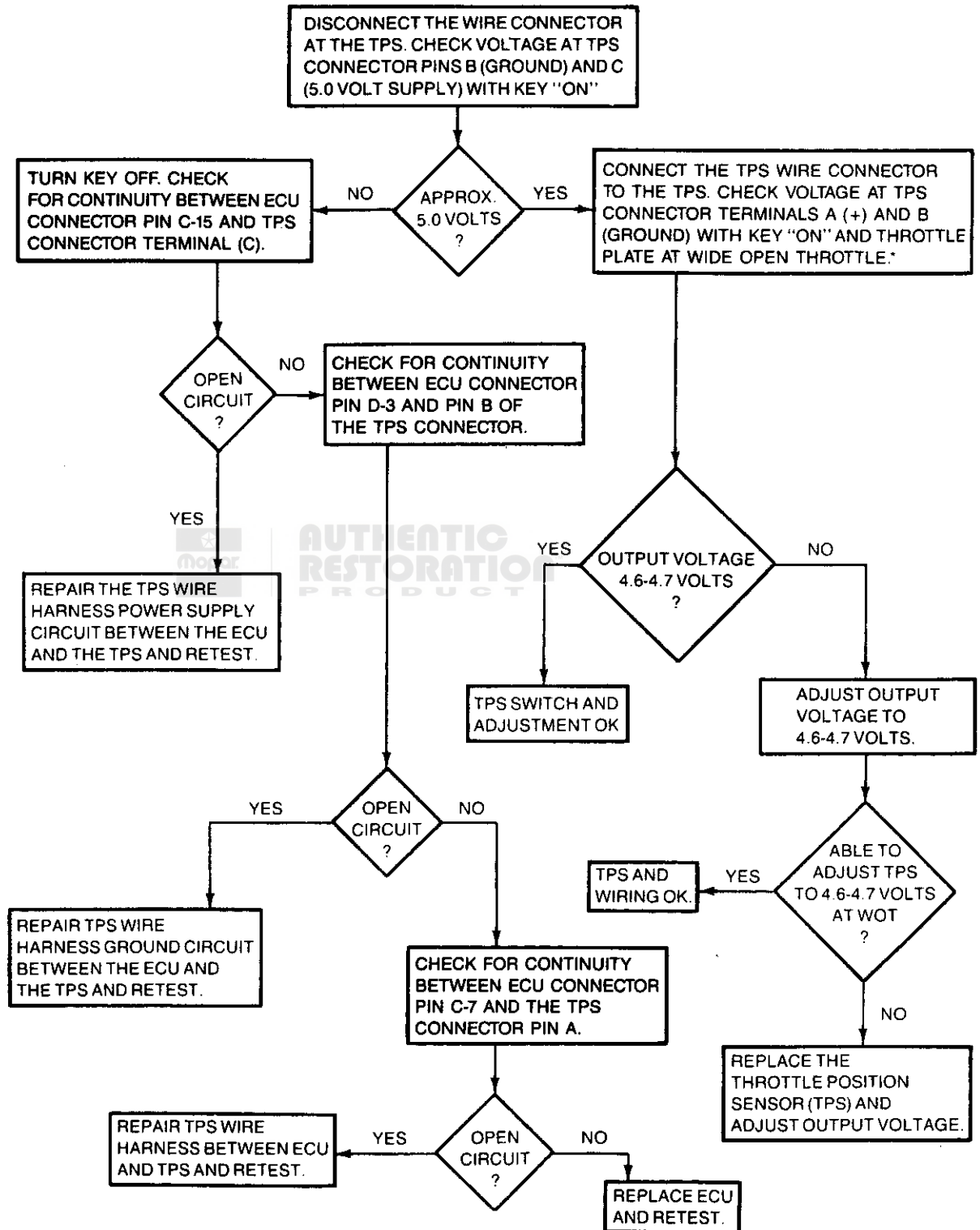


THROTTLE BODY FUEL INJECTION SYSTEM



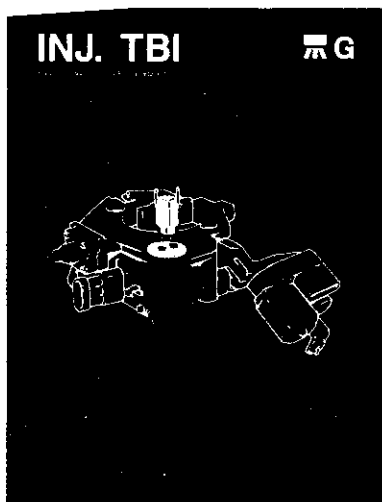
2.0L ENGINE

THROTTLE POSITION SENSOR (TPS) TEST



* DO NOT UNFASTEN THE SENSOR WIRE HARNESS CONNECTOR. INSERT THE VOLTMETER TEST LEADS THROUGH THE BACK OF THE WIRE HARNESS CONNECTOR TO MAKE CONTACT WITH THE SENSOR TERMINALS.

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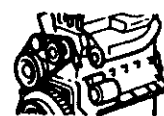
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JUNE, 1987
ENGLISH EDITION

1986 CHEROKEE-WAGONEER-
COMANCHE and
1987 WRANGLER with
2.46L ENGINES and TBI



ENGINE

ATTENTION: Workshop, Parts Department

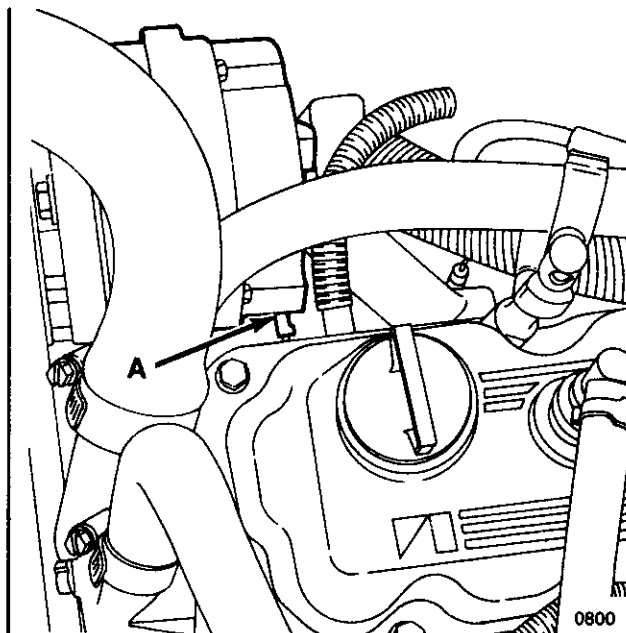
HARD STARTING CONDITION

1986 Cherokee-Wagoneer-Comanche models and 1987 Wrangler models built before VIN 2BXXXXXXX524690 with 2.46L TBI engine may exhibit repeated stalls when starting cold. This condition may be caused by a fuel injector.

Service correction involves diagnosis to verify that the fuel injector is causing the condition and, if necessary, replacing the fuel injector.

DIAGNOSIS PROCEDURE

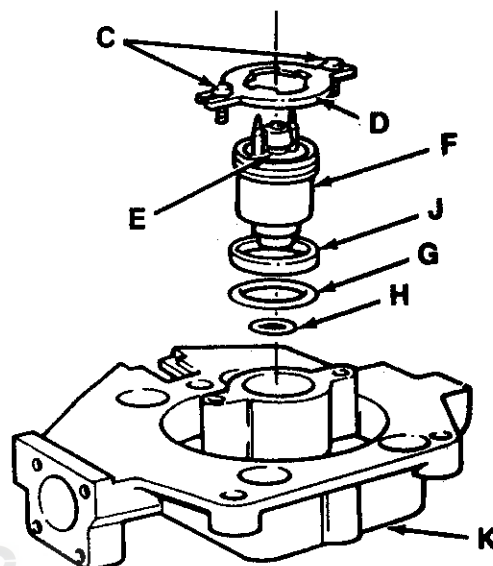
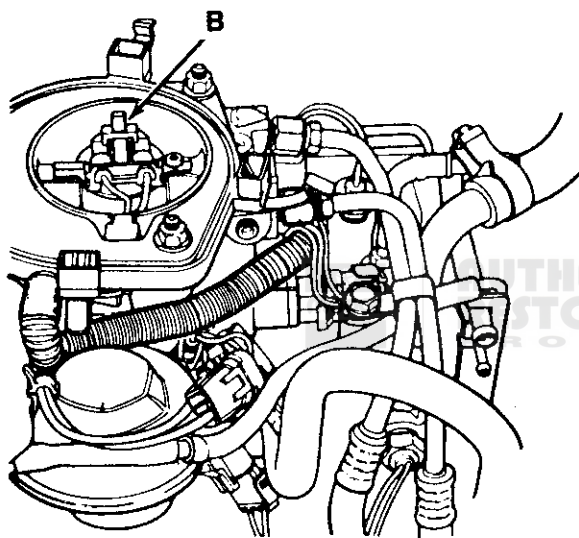
1. The vehicle must be currently exhibiting the condition. That is, vehicle will stall after starting when the engine is cold.
2. Disconnect field wire (A) at the alternator.
3. Start the vehicle. If the vehicle continues to run, fuel injector replacement is required.
4. If the engine continues to stall, perform vehicle test with the M.S. 1700 and continue diagnosis.
5. Turn off the ignition and connect field wire (A) at the alternator.



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NOTES

FUEL INJECTOR REPLACEMENT

1. Remove the air cleaner assembly.
2. Remove wire harness connector (B) from the injector.



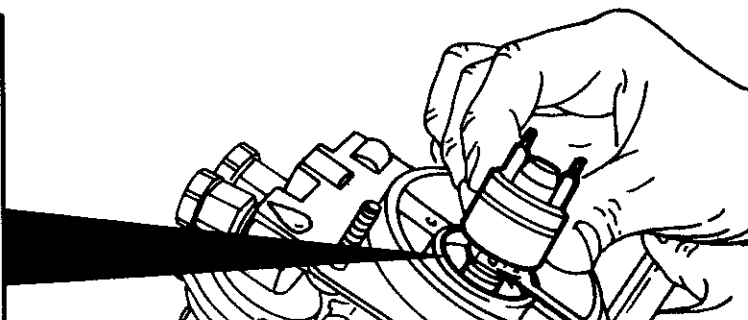
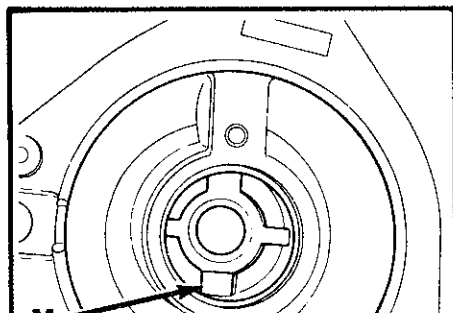
6. Lubricate the replacement upper (G) and lower (H) O-rings with Lithium base grease. Install the O-rings in the housing bore.

NOTE: Make certain that lower O-ring (H) is seated down in its bore.

3. Remove injector retaining clip screws (C).
4. Remove injector retainer (D).
5. Using a pair of small pliers, grasp the center collar (E) of the injector and carefully remove injector (F) with a lifting-twisting motion. Discard upper and lower O-rings (G) and (H). Note that backup ring (J) fits above upper O-ring (G).

7. Install backup ring (J) over upper O-ring (G).
8. Position replacement injector (F) in throttle body (K) and center the nozzle in the lower housing bore.
9. Seat injector (F) with a pushing-twisting motion making certain that the aligning pin (L) engages slot in throttle body (M) so that injector harness connector (B) can be connected to the injector.

SEE
I.S.
NOTES



10. Install retainer clip (D) and screws (C).
11. Connect injector wire harness (B).
12. Check the injector assembly for proper sealing by viewing the injector through

throttle body with the key on. If improper sealing is observed, reinstall the injector. Return to Step 2 and continue the injector replacement procedure.

13. Install the air cleaner assembly.

PARTS INFORMATION

DESCRIPTION	QUANTITY	PART NUMBER
INJECTOR, Fuel	1	8933 004 521

SRT/TIC INFORMATION

OPERATION DESCRIPTION	OPERATION NUMBER	TIME	TIC	SUPPLIER CODE
CO. INJECTOR - REPLACE	0104	0.4	1-861	615

FILING INSTRUCTIONS

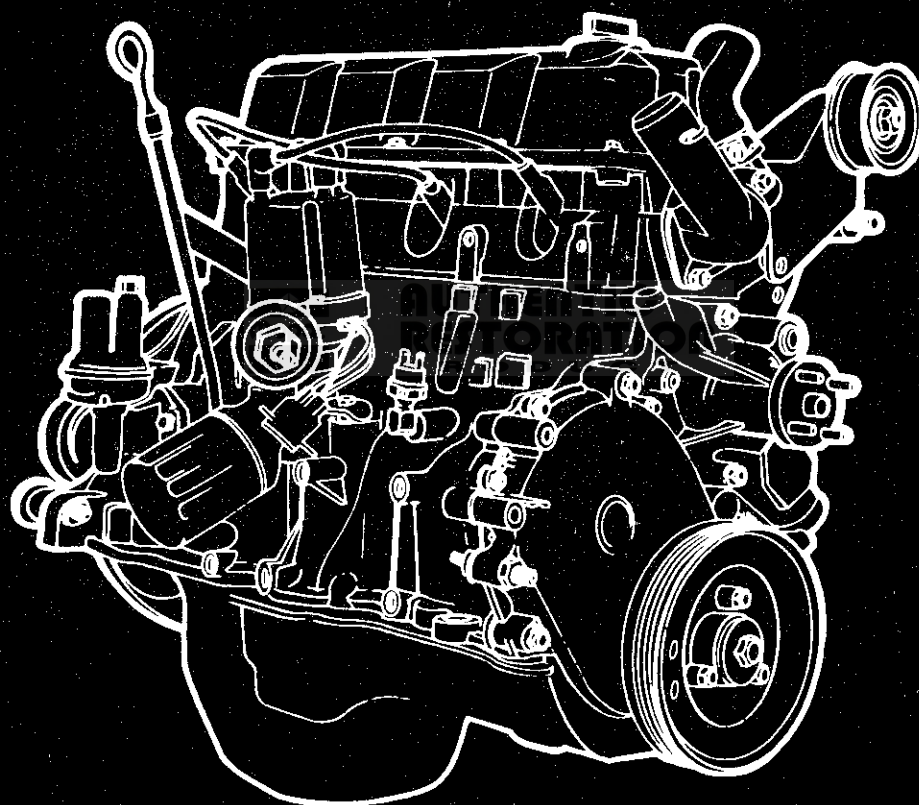


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Record this I.S. Note on pages 71 and 72 in the INJ TBI manual.

MOT. I-4

8980 010 639 U.S.A./Canada Edition



Eagle/Jeep®

Component Service Manual



**AUTHENTIC
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2.5L FOUR CYLINDER ENGINE

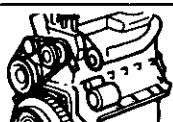
OCTOBER, 1987

U.S.A./Canada Edition

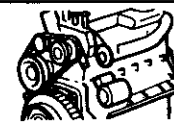
8980 010 639

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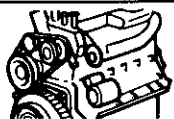


2.5L I-4 ENGINE OVERHAUL

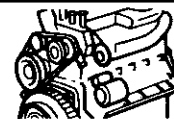


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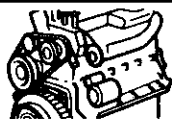
GENERAL INFORMATION

SPECIFICATIONS

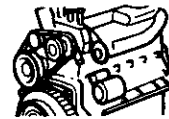
Basic Engine

Engine Type	Engine Displacement	Cyl. Bore Diameter	Stroke Length	Compression Ratio
In-Line OHV 4 Cylinders	2.5L (2465 cc) (150 cu. in.)	98 mm (3.876 in.)	80 mm (3.188 in.)	9.2:1
Premier — 111 BHP @ 4750 rpm — 142 ft-lbs torque @ 2500 rpm Jeep — 121 BHP @ 5250 rpm — 141 ft-lbs torque @ 3250 rpm Wrangler — 117 BHP @ 5250 rpm — 138 ft-lbs torque @ 3500 rpm				
Compression Pressure		1068-1275 kPa		155-185 psi
Max. Variation between Cylinders		206 kPa		30 psi
Use Unleaded Gasoline - ONLY				
Firing Order 1-3-4-2				

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2.5L I-4 ENGINE OVERHAUL

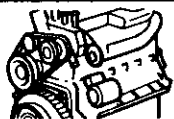


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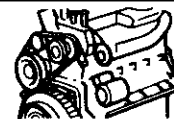
Camshaft

Tappet Clearance	zero lash (hyd.) tappets	
End Play	zero (engine operation)	
Bearing Clearance	0.025-0.076 mm	0.001-0.003 in.
Bearing Journal Diameter		
No. 1	51.54-51.56 mm	2.029-2.030 in.
No. 2	51.28-51.31 mm	2.019-2.020 in.
No. 3	51.03-51.05 mm	2.009-2.010 in.
No. 4	50.78-50.80 mm	1.999-2.000 in.
Base Circle Runout	0.03 mm max.	0.001 in max.
Cam Lobe Lift (Jeep)		
Intake		.265 in.
Exhaust		.265 in.
Cam Lobe Lift (Premier)		
Intake		.240 in.
Exhaust		.250 in.
Valve Lift (Jeep)		
Intake		.424 in.
Exhaust		.424 in.
Valve Lift (Premier)		
Intake		.384 in.
Exhaust		.400 in.
Intake Valve Timing		
Opens (Jeep)	12° BTDC	
Opens (Premier)	9.6° BTDC	
Closes (Jeep)	78° ABDC	
Closes (Premier)	58.5° ABDC	
Exhaust Valve Timing		
Opens (Jeep)	56° BBDC	
Opens (Premier)	54.6° BBDC	
Closes (Jeep)	34° ATDC	
Closes (Premier)	31.4° ATDC	
Valve Overlap		
Jeep	46°	
Premier	41°	
Intake Duration		
Jeep	270°	
Premier	248°	
Exhaust Duration		
Jeep	270°	
Premier	266°	

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2.5L I-4 ENGINE OVERHAUL



GENERAL INFORMATION

Connecting Rods

Total Weight (less bearings)	657-665 grams	23.2-23.5 oz.
Total Length (center-to-center)	155.52-155.62 mm	6.123-6.127 in.
Piston Pin Bore Diameter	23.59-23.62 mm	0.9288-0.9298 in.
Connecting Rod Bore (less bearings)	56.08-56.09 mm	2.2080-2.2085 in.
Bearing Clearance	0.03-0.08 mm	0.001-0.0025 in.
Preferred	0.044-.050 mm	0.0015-0.0020 in.
Side Clearance	0.25-0.48 mm	0.010-0.019 in.
Maximum Twist	0.025 per 25.4 mm	0.001 per in.
Maximum Bend	0.0127 per 25.4 mm	0.005 per in.

Crankshafts

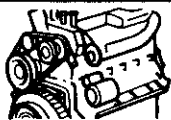
End Play	0.038-0.165 mm	0.0015-0.0065 in.
Main Bearing Journal Diameter	63.489-63.502 mm	2.4996-2.5001 in.
Main Bearing Journal Width		
No. 1	27.58-27.89 mm	1.086-1.098 in.
No. 2	32.28-32.33 mm	1.271-1.273 in.
No. 3-4-5	30.02-30.18 mm	1.182-1.188 in.
Main Bearing Clearance	0.03-0.06 mm	0.001-0.0025 in.
Preferred	0.051 mm	0.002 in.
Connecting Rod Journal Diameter	53.17-53.23 mm	2.0934-2.0955 in.
Connecting Rod Journal Width	27.18-27.33 mm	1.070-1.076 in.
Maximum Out-of-Round (All Journals)	0.013 mm	0.0005 in.
Maximum Taper (All Journals)	0.013 mm	0.0005 in.

Cylinder Block

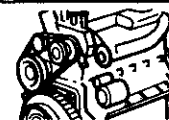
Deck Height	236.73 mm	9.320 in.
Deck Clearance	0.000 mm	0.000 in.
Cylinder Bore Diameter (standard)	98.42-98.48 mm	3.8751-3.8775 in.
Maximum Taper	0.025 mm	0.001 in.
Maximum Out-of-Round	0.025 mm	0.001 in.
Tappet Bore Diameter	23.000-23.025 mm	0.9055-0.9065 in.
Cylinder Block Flatness	.03 per 25 mm	.001 per 1 in.
	.05 per 152 mm	.002 per 6 in.
Main Bearing Bore Dia.	68.35-68.38 mm	2.691-2.692 in.

Cylinder Head

Combustion Chamber Volume	49.9-52.9 cc	3.04-3.23 cu. in.
Valve Arrangement	E-I-I-E-E-I-I-E	
Valve Guide ID (Integral)	7.95-7.97 mm	.313-.314 in.
Valve Stem-to-Guide Clearance	0.02-0.07 mm	.001-.003 in.
Intake Valve Seat Angle	44°30'	
Exhaust Valve Seat Angle	44°30'	
Valve Seat Width	1.02-1.52 mm	.040-.060 in.
Valve Seat Runout	0.064 mm	.0025 in.
Cylinder Head Flatness	.03 per 25 mm	.001 per 1 in.
	.05 per 152 mm	.002 per 6 in.



2.5L I-4 ENGINE OVERHAUL



GENERAL INFORMATION

Pistons

Weight (less pin)	563-567 grams	19.86-20.00 oz.
Piston Pin Bore		
Centerline-to-Piston Top	40.67 mm	1.601 in.
Piston-to-Bore clearance	0.033-0.053 mm	0.0013-0.0021 in.
Piston Ring Gap Clearance —		
Compression (both)	0.25-0.51 mm	0.010-0.020 in.
Piston Ring Gap Clearance —		
Oil Control Steel Rails	0.381-1.397 mm	0.015-0.055 in.
Piston Ring Side Clearance		
No. 1 Compression	0.254-0.0813 mm	0.001-0.0032 in.
No. 2 Compression	0.254-0.0813 mm	0.001-0.0032 in.
Oil Control	0.254-0.241 mm	0.001-0.0095 in.
Piston Ring Groove Height		
Compression (both)	2.019-2.045 mm	0.0795-0.0805 in.
Oil Control	4.78-4.80 mm	0.188-0.1895 in.
Piston Ring Groove Diameter		
No. 1 and No. 2	87.78-87.90 mm	3.456-3.461 in.
Oil Control	87.50-87.75 mm	3.445-3.455 in.
Piston Pin Bore Diameter	23.624-23.655 mm	0.9308-0.9313 in.
Piston Pin Diameter	23.632-23.645 mm	0.9304-0.9309 in.
Piston-to-Pin Clearance	0.008-0.013 mm	0.0003-0.0005 in.
Preferred	Loose 0.013 mm	Loose 0.0005 in.
Piston Pin-to-Connecting Rod	8.9 kN Press-fit	2000 lbs.-f Press-fit

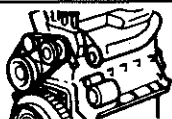
Rocker Arms, Push Rods and Tappets

Rocker Arm Ratio	1.6:1	
Push Rod Length	241.300-241.808 mm	9.500-9.520 in.
Push Rod Diameter	7.92-8.00 mm	0.312-0.315 in.
Hydraulic Tappet Diameter	22.962-22.974 mm	0.904-0.9045 in.
Tappet-to-Bore Clearance	0.03-0.05 mm	0.001-0.0025 in.

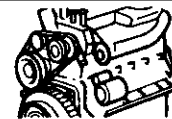
Valves

Valve Length		
(Tip-to-Gauge Dim. Line) Intake	124.435-125.070 mm	4.899-4.924 in.
Exhaust	125.120-125.755 mm	4.927-4.952 in.
Valve Stem Diameter	7.89-7.98 mm	.311-.312 in.
Stem-to-Guide Clearance	0.02-0.05 mm	.001-.003 in.
Intake Valve Head Diameter	48.38-48.6 mm	1.905-1.915 in.
Intake Valve Face Angle	45°	
Exhaust Valve Head Diameter	37.97-38.6 mm	1.495-1.505 in.
Exhaust Valve Face Angle	45°	
Maximum Allowable Removed for		
Tip Refinishing	.25 mm	0.010 in.
Valve Springs Free Length	49.962 mm	1.967 in.
Valve Spring Tension Closed	355-400 N @ 41.656 mm	80-90 lbs @ 1.640 in.
Valve Spring Tension Open	890 N @ 30.886 mm	200 lbs @ 1.216 in.

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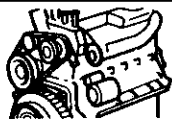
2.5L I-4 ENGINE OVERHAUL



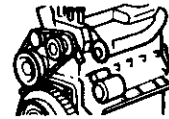
GENERAL INFORMATION

TORQUE SPECIFICATIONS

Component	N·m	Ft-Lbs (In-Lbs)
Block Heater Screw	1.8	(16 in-lbs)
Camshaft Sprocket Bolt	108.5	80 ft-lbs
Connecting Rod Bolt Nuts	45	33 ft-lbs
Cylinder Block Oil Galley Plugs	41	30 ft-lbs
Cylinder Head Bolts ('84-'87)	115	85 ft-lbs
Except #8 Bolt	102	75 ft-lbs
Cylinder Head Bolts ('88)	149	110 ft-lbs
Except #8 Bolt	136	100 ft-lbs
Dipstick Tube Bracket Bolt-to-Cylinder Block	19	14 ft-lbs
Distributor Clamp Bolt	17.6	13 ft-lbs
EGR Valve Tube Nuts	41	30 ft-lbs
EGR Tube to Exhaust Manifold Bolts	19	14 ft-lbs
Exhaust Manifold Bolts	31	23 ft-lbs
Fan and Hub Assembly Bolts	24	18 ft-lbs
Flywheel-to-Crankshaft Bolts	68+60°	50 ft-lbs + 60°
Fuel Pump Boss Plate	22	16 ft-lbs
Intake Manifold Coolant Fittings	27	20 ft-lbs
Intake Manifold Bolts	31	23 ft-lbs
Main Bearing Bolts	108.5	80 ft-lbs
Oil Filter Connector to Block	23	17 ft-lbs
Oil Level Sensor in Oil Pan	33	25 ft-lbs
Oil Pan Drain Plug	34	25 ft-lbs
Oil Pan Bolts — Premier	9.5	7 ft-lbs
Oil Pan Bolts — 1/4 in. — 20 (Jeep)	9.5	7 ft-lbs
Oil Pan Bolts — 5/16 in. — 18 (Jeep)	15	11 ft-lbs
Oil Pump Cover Screws	8	(70 in-lbs)
Oil Pump Inlet Tube Bracket Bolts	27	20 ft-lbs
Oil Pump Mounting Bolts	23	17 ft-lbs
Oxygen Sensor	30	22 ft-lbs
Rocker Arm Assembly Bolt	26	19 ft-lbs
Spark Plug	37	22 ft-lbs
Timing Chain Tensioner Bolts	19	14 ft-lbs
Timing Case Cover-to-Block Bolts	7	5 ft-lbs
Timing Case Cover-to-Block Studs	22	16 ft-lbs
Torque Converter Drive Plate-to-Crankshaft Bolts	54+60°	40 ft-lbs + 60°
Thermostat Housing Bolt	18	13 ft-lbs
Vibration Damper Bolt (Lubricated)	108	80 ft-lbs
Water Pump Bolt	18	13 ft-lbs



2.5L I-4 ENGINE OVERHAUL



GENERAL INFORMATION

LUBRICATION SPECIFICATIONS

Oil Pressure

At Idle Speed (800 rpm)	172-241 kPa	25-35 psi
At 1600 + rpm	255-517 kPa	37-75 psi
Oil Pressure Relief	517 kPa	75 psi

Oil Pump

Gear-to-Body Clearance (Radial)	0.051-0.102 mm	0.002-0.004 in
Preferred	0.051 mm	0.002 in
Gear End Clearance — Plastigauge ...	0.051-0.152 mm	0.002-0.006 in
Preferred	0.051 mm	0.002 in
Gear End Clearance — Feeler Gauge ..	0.1016-0.2032 mm	0.004-0.008 in
Preferred	0.1778 mm	0.007 in

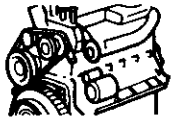
Oil Capacity

With Filler Change — Jeep	3.8 Liters	4 qts.
With Filter Change — Premier	4.7 Liters	5 qts.



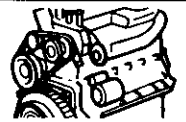
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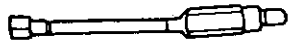


2.5L I-4 ENGINE OVERHAUL

GENERAL INFORMATION

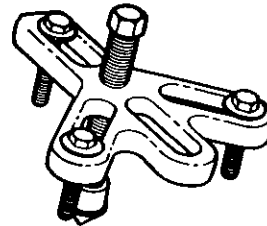


SPECIAL TOOLS



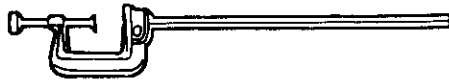
AIR LINE ADAPTOR

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P/N: 8980 002 281



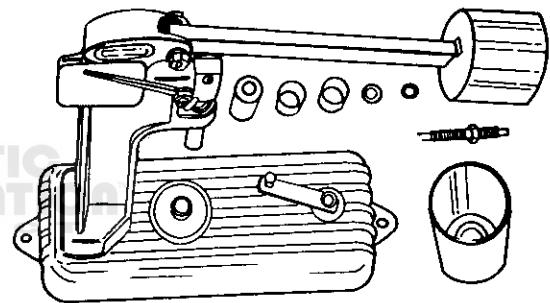
HARMONIC
BALANCER
PULLER

REF: J-24420-B
P/N: 8980 002 513



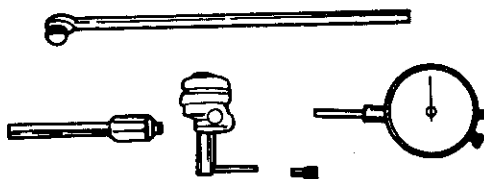
C-CLAMP AND ROD
EXTENSION

REF: J-5959-4
P/N: 8980 002 551



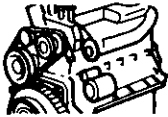
HYDRAULIC VALVE
LIFTER TESTER

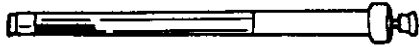
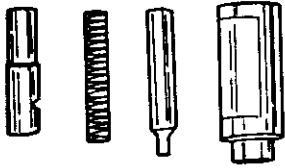
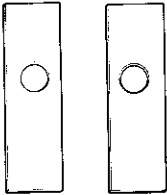
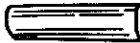
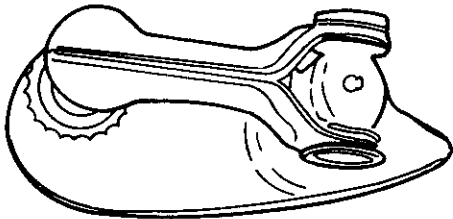
REF: J-5790
P/N: 8980 002 147



DIAL INDICATOR SET

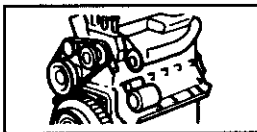
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	2.5L I-4 ENGINE OVERHAUL GENERAL INFORMATION	
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 HYDRAULIC VALVE TAPPET REMOVER & INSTALLER REF: J-21884 P/N: 8980 002 255	 PISTON PIN REMOVER & INSTALLER REF: J-21872 P/N: 8980 002 254
 OIL PAN ALIGNMENT PLATES REF: MOT. ML-04 P/N: 8981 320 993	 TIMING CASE COVER ALIGNMENT TOOL AND SEAL INSTALLER REF: J-22248 P/N: 8980 002 004
 OIL PUMP INLET TUBE INSTALLER REF: J-21882 P/N: 8980 002 003	 VALVE & CLUTCH SPRINT TESTER REF: J-8056 P/N: 8980 002 184

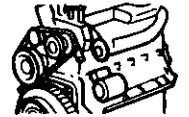
2764

2764



2.5L I-4 ENGINE OVERHAUL

GENERAL INFORMATION



DATE AND COMPONENT CODES

The characters of the code identify the year, month and day that the engine was built.

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No. 3 and No. 4 cylinders.

1ST CHARACTER (YEAR)	2ND & 3RD CHARACTERS (MONTH)	4TH OR 4TH & 5TH CHARACTERS (LETTERS) (ENGINE TYPE)	5TH & 6TH OR 6TH & 7TH CHARACTERS (DAY OF THE MONTH)
2 — 1 9 8 2	0-12 Jan-Dec	H — 2.5L (150 cu in) Throttle Body Injection 9.2:1 Compression Ratio	01 1st Day 02 2nd Day
3 — 1 9 8 3	0-12 Jan-Dec		
4 — 1 9 8 4	0-12 Jan-Dec	U — 2.5L (150 cu in) Carbureted (Domestic) 9.2:1 Compression Ratio	01 1st Day 02 2nd Day
5 — 1 9 8 5	0-12 Jan-Dec		
6 — 1 9 8 6	0-12 Jan-Dec	Y — 2.5L (150 cu in) Carbureted (Export) 8.6:1 Compression Ratio	01 1st Day 02 2nd Day
7 — 1 9 8 7	0-12 Jan-Dec		
8 — 1 9 8 8	0-12 Jan-Dec	HX — 2.5L (150 cu in) Throttle Body 9.2:1 Compression Ratio	01 1st Day 02 2nd Day

2736

	2.5L I-4 ENGINE OVERHAUL GENERAL INFORMATION	
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Engine Build Date Code Explanation

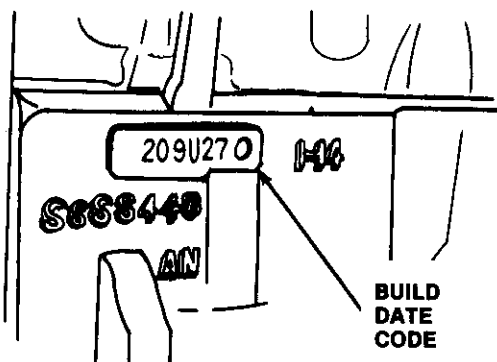
Example - 209 U 27

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character* (Engine Type)	5th and 6th Characters (Day)
2—1982 3—1983	01-12	U	01-31

Letter Code*	CID	Carburetor	Compression Ratio
U	150	1V	9.2:1

NOTE: Vehicles built for sale in Georgia and Tennessee have an additional, nonrepeating number, located on the right side of the engine above the build date code.

Example: Kenosha-Built
E-1197277 or
W-1207177



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PRODUCT

60257

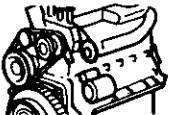
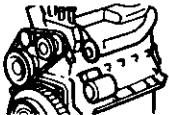
83101

The 4th or 4th and 5th character(s) code letter(s) identify the cubic inch displacement, fuel distribution system - either carbureted or throttle body injection, and compression ratio.

The example code identifies the 150 CID (2.5L liter) engine with 1V carburetor and 9.2:1 compression ratio built on September 27, 1982.

Override and Undersize Component Codes

Some engines may be built with override or undersize components such as: override cylinder bores, undersize crankshaft main bearing journals, undersize connecting rod journals or override camshaft bearing bores. These engines are identified by a letter code stamped on the oil filter boss between the fuel pump and distributor.

	2.5L I-4 ENGINE OVERHAUL GENERAL INFORMATION	
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Oversize or Undersize Components Letter Code

The letters are decoded as follows:

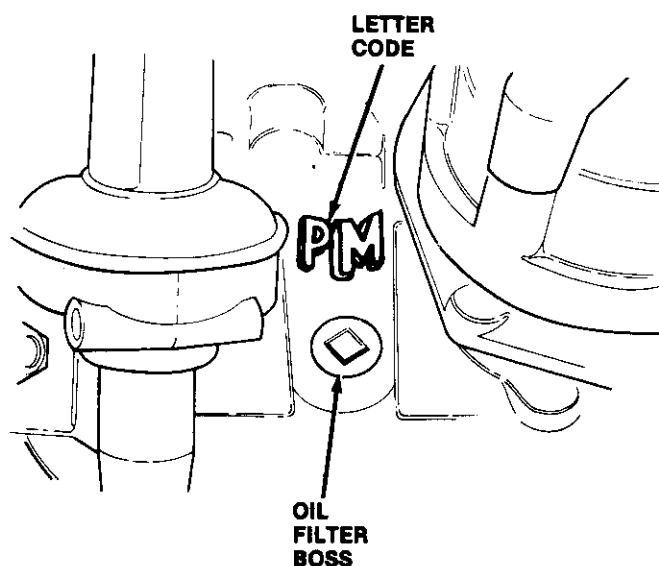
CODE	COMPONENT	UNDERSIZE
P	One or more connecting rod bearing journals	.254 mm (.010 in)
M	All crankshaft main bearing journals	.254 mm (.010 in)
PM	All camshaft main bearing journals and one or more connecting rod journals	.254 mm (.010 in)
B	All cylinder bores	.254 mm (.010 in)
C	All camshaft bearing bores	.254 mm (.010 in)



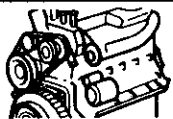
**AUTHENTIC
RESTORATION
PRODUCT**

2737

Example: The code letters PM indicate that all crankshaft main bearing journals and one or more connecting rod journals are 0.254mm (0.010 inch) undersize.

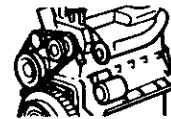


83102



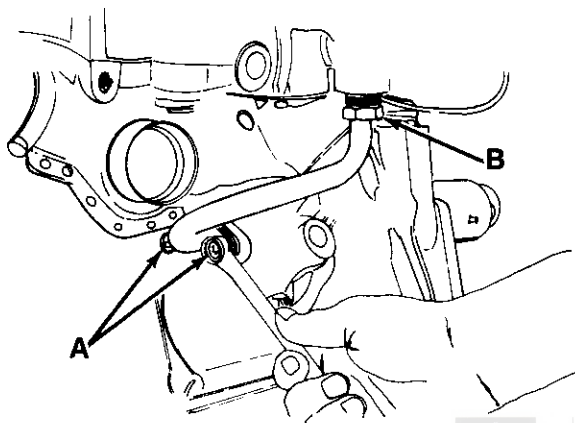
2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



INTAKE AND EXHAUST MANIFOLD REMOVAL

Loosen the EGR tube mounting bolts (A) at the exhaust manifold and line nut (B) at the intake manifold.



83130

Remove the intake and exhaust manifold retaining bolts, nuts and washers.

Remove the intake and exhaust manifolds.

Discard the intake manifold gasket.

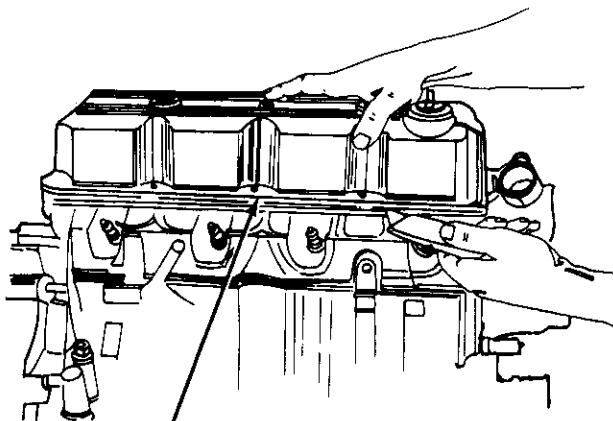
CYLINDER HEAD COVER REMOVAL

1984-1986

Remove the cylinder head cover retaining nuts.

Detach the cover from cylinder head by breaking the RTV sealant with a putty knife or razor blade.

NOTE: To avoid damaging the cover do not pry cover upward until the seal has been completely broken. Provisions for prying are located on the valve cover near bolt holes.



83103

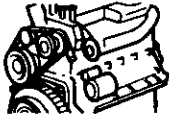
1987-1988

For these years the cylinder head covers have a cured gasket attached to them.

Remove the cover mounting bolts. Lift the cover off.

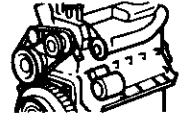
CYLINDER HEAD REMOVAL

Remove the two cap screws at each rocker arm bridge and pivot assembly. Alternately loosen the cap screws one turn at a time to avoid damaging the bridge.

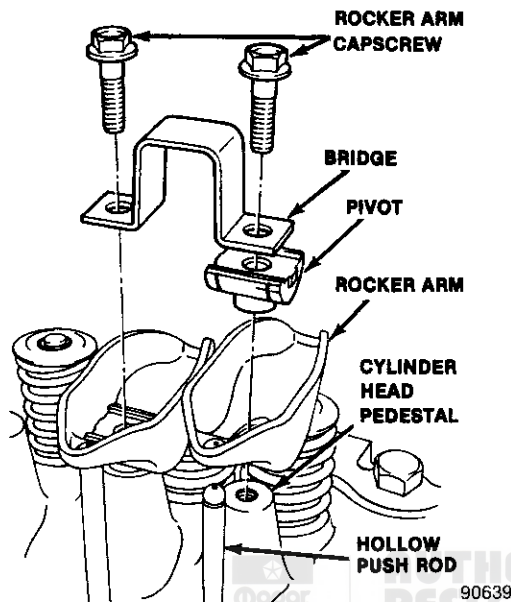


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Remove the bridges, pivots and corresponding pairs of rocker arms and place on bench in the same order as removed.



Remove the push rods and place on bench in the same order as removed. Remove the spark plugs. Remove the cylinder head bolts, cylinder head and gasket.

Remove the tappets through the push rod openings in the cylinder block with Hydraulic Valve Tappet Removal and installation Tool J-21884. Retain the tappets in the same order as removed to facilitate installation in original positions.

CYLINDER HEAD CLEANING AND INSPECTION

Thoroughly clean the machined surfaces of cylinder head and block. Remove all gasket material cement.

Remove carbon deposits from the combustion chambers and top of pistons.

Use a straight edge and feeler gauge to check to flatness of cylinder head and block mating surfaces. Check the flatness across the entire length of the cylinder head. Refer to Specifications for cylinder head flatness specifications.

CYLINDER HEAD DISASSEMBLY

Valve Removal

Use the valve compressor tool J-25534-1 or equivalent and compress each valve spring.

Remove the valve locks, retainers, springs and valve stem oil deflectors. Discard the deflectors/seals.

Use an Arkansas smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

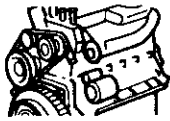
Remove the valves, and place them in a rack in the same order as removed.

Valve Cleaning and Inspection

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

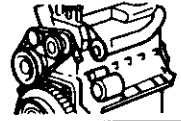
Clean all grime and gasket material from the cylinder head machined gasket surface.

Inspect for cracks in the combustion chambers and valve ports.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



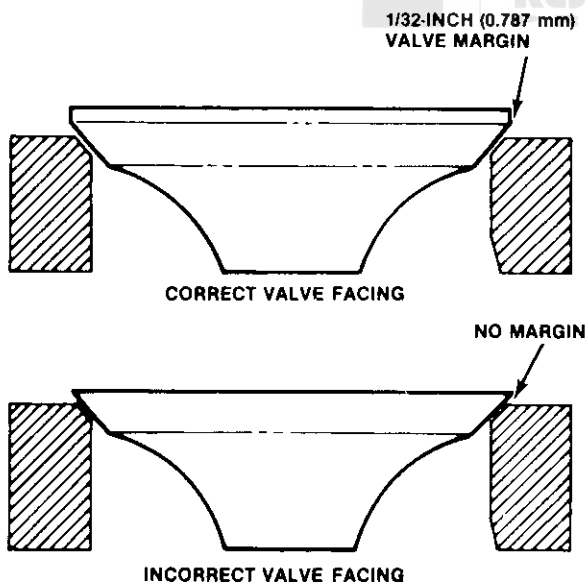
Inspect for cracks in the gasket surface at each coolant passage.

Inspect valves for burned, cracked or warped heads. Inspect for scuffed or bent valve stems. Replace valves displaying any damage.

Valve Refacing

Use a valve refacing machine to reface the intake and exhaust valves to the specified angle. After refacing, at least a 1/32 inch (0.787 mm) margin must remain. If not, replace the valve.

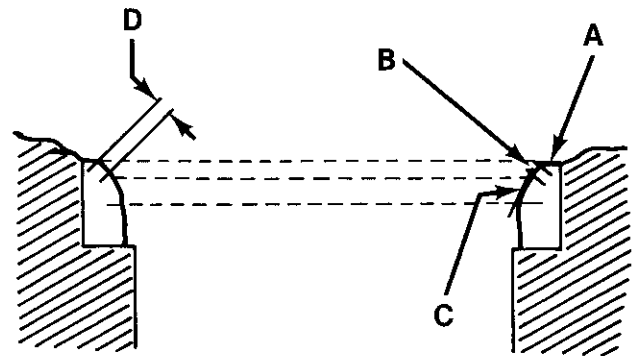
The valve stem tip can be resurfaced and re chamfered when worn. Do not remove more than 0.010 inch (0.25 mm).



60117

Valve Seat Refacing

Install a pilot of the correct size in the valve guide bore and reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.



INTAKE AND EXHAUST SEAT

TOP ANGLE (A) 8°

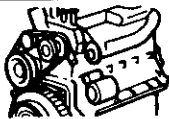
SEAT ANGLE (B) 45°

THROAT ANGLE (C) 60°

SEAT WIDTH = D

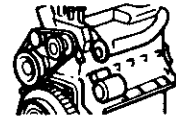
2361

Use tapered stones to obtain the specified seat widths when required.

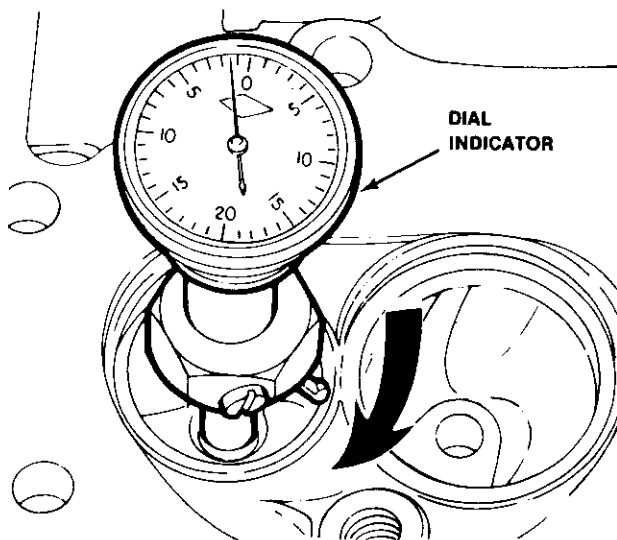


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Control valve seat runout to a maximum of 0.0025 inch (0.0635 mm).



DIAL
INDICATOR



60118
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1984-1985

Valve Stem Oil Deflector Replacement

Nylon valve stem oil deflectors are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guide bores. The same deflector is used for both intake and exhaust valve stems. Replace the oil deflectors whenever valve service is performed or if the deflectors have deteriorated.

1986-1988

Valve Stem Seal Replacement

Valve stem seals are installed over each valve stem and valve guide boss preventing oil from entered the combustion chamber through the valve guides. There are separate seals for both the intake and exhaust valve stems. The seals marked INT are for intake valve stems. The seals marked EXH are for exhaust valve stems. Replace the valve stem seals when service is performed or if the seals have deteriorated.

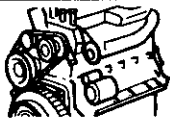
Valve Guides

The valve guides are an integral part of the cylinder head and are not replaceable. When the valve stem guide clearance is excessive, the valve guide bores must be reamed oversize. Service valves are available in 0.003 inch and 0.015 inch increments. Corresponding oversize valve stem seals (or deflectors depending upon model year) are also available and must be used with the oversize valves.

NOTE: If the valve guides are reamed oversize, the valve seats must be reground afterwards to ensure that the valve seat is concentric to the valve guide.

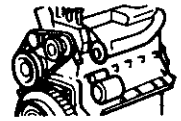
Valve Stem-to-Guide Clearance Measurement

Valve stem-to-guide clearance may be measured by either of the following two methods.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Preferred Method:

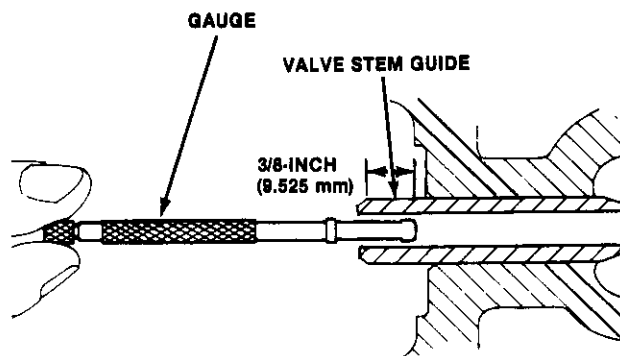
Remove the valve from the head (refer to Valve Removal for procedure) and clean the valve stem guide bore with solvent and bristle brush.

Insert a telescoping gauge into the valve stem guide bore approximately 3/8 inch (9.525 mm) from the valve spring side of the head, with contacts crosswise to the cylinder head. Remove and measure telescoping gauge with a micrometer.

Repeat the measurement with contacts lengthwise to cylinder head.

Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0025 inch (0.0635 mm) ream the guide bore to accommodate an oversize valve stem.

Compare the measured valve guide bore diameter with diameter listed in the Specifications. If the measurement differs from specification by more than 0.003 inch (0.0762 mm), ream the guide bore to accommodate an oversize valve stem.



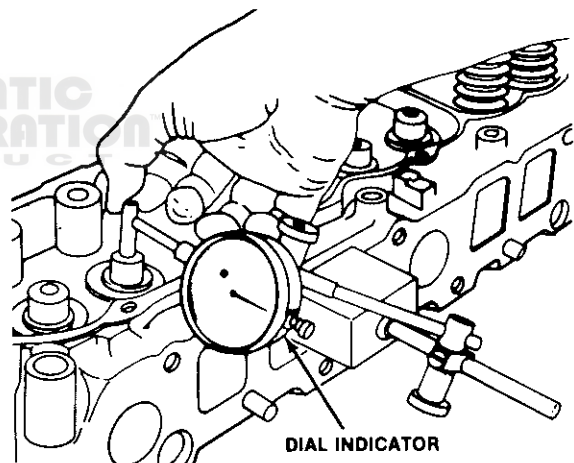
80303A

Alternate Method:

Use a dial indicator to measure the lateral movement of the valve stem (stem-to-guide clearance) with valve installed in its guide and just off the valve seat.

Correct clearance is 0.001-0.003 inch (0.025-0.0762 mm). If indicated movement exceeds the specification ream the valve guide to accommodate an oversize valve stem.

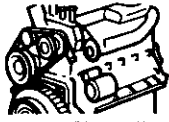
NOTE: Valve seats must be reground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.



83106

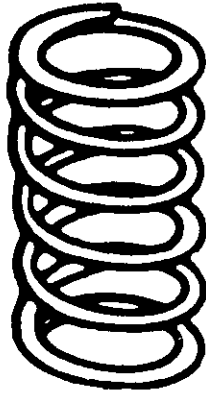
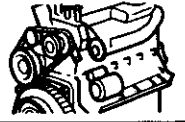
Valve Spring

1984-1987 1/2 engines used a conventional cylindrical valve spring.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY

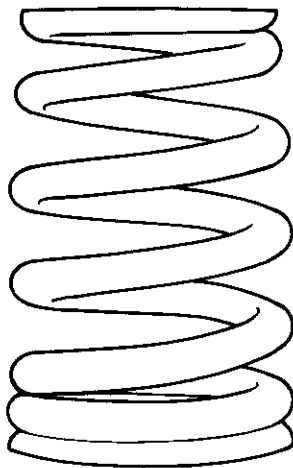


2738

1987 1/2-1988 engines use a conical valve spring.



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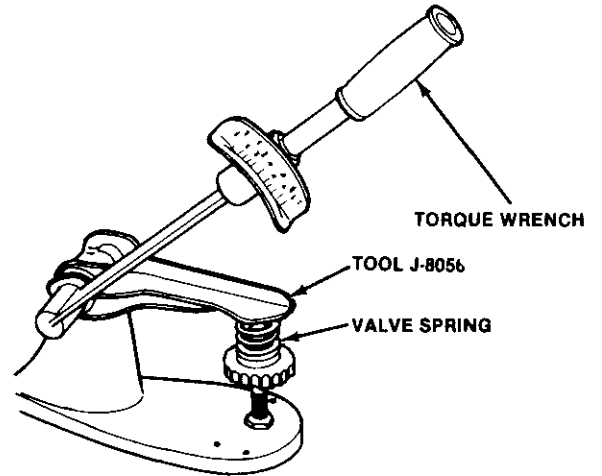


2767

Valve Spring Tension Test

Use the Valve Spring Tester J-22738-02 or J-8056 and torque wrench to test each valve

spring for the specified tension value. Replace valve springs that are not within specification.



41885A

Valve Installation

Thoroughly clean the valve stems and valve guide bores.

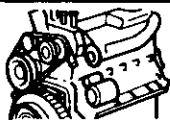
Lightly lubricate the stem and install the valve in original valve guide bore from where it was removed.

Install replacement valve stem oil deflectors (1984-1985) on the valve stem.

Install replacement valve stem oil seals (1986-1988) over the valve stems and onto the valve guide boss.

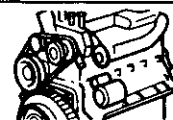
NOTE: If valves with oversize stems are used, oversize oil deflectors or seals are required.

Position the valve spring and retainer on cylinder head and compress the valve spring with the Valve Spring Compressor Tool J-22534-01



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



or equivalent. Install valve locks and release the tool.

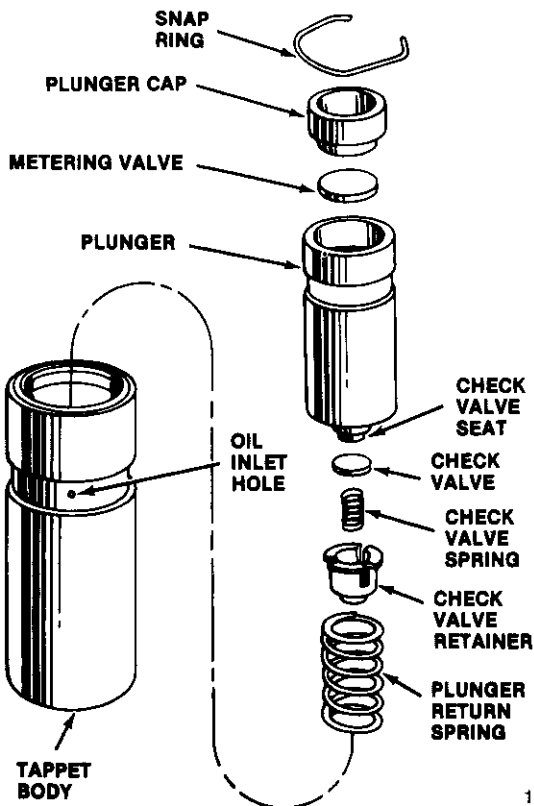
Lightly tap valve spring from side-to-side with rubber hammer to ensure the spring is properly seated at the cylinder head.

HYDRAULIC VALVE TAPPETS

Tappet Disassembly, Cleaning and Inspection

NOTE: Retain components of each tappet separately.

Release snap ring and remove the plunger cap, metering valve, plunger, check valve assembly and plunger return spring from the tappet body.



12811

Clean the components of each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with straightedge positioned across base. If the base is concave, the corresponding lobe on camshaft is also worn. Replace the camshaft and defective tappets.

Tappet Assembly and Leak-down Test

Install the plunger return spring, check valve assembly, plunger, metering valve and the plunger cap in tappet body.

Compress the plunger assembly by exerting force on the plunger cap with the push rod and install snap ring.

After cleaning, inspection and assembly, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation.

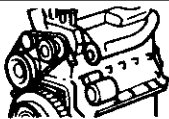
NOTE: A timing device is required to test leak-down rate.

Swing the weighted arm of the Tester J-5790 away from the ram of tester.

Place 7.925 to 7.950 mm (0.312 to 0.313-inch) diameter ball bearing on the plunger cap of the tappet.

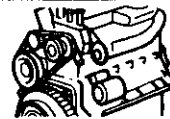
Lift the ram and position tappet (with ball bearing) inside the tester cup.

Lower the ram, then adjust nose of ram until it contacts the ball bearing. Do not tighten the hex nut on the ram.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Fill the tester cup with Hydraulic Valve Tappet Test Oil J-5268 until tappet is completely submerged.

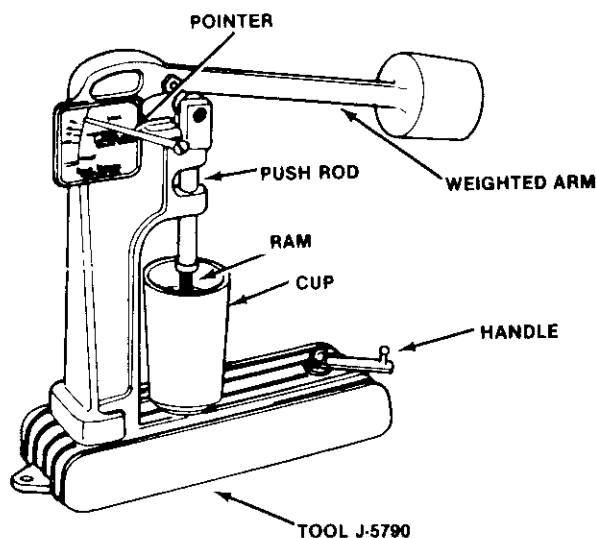
Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to normal position.

Adjust the nose of the ram to align pointer with SET mark on scale of tester and tighten hex nut.

Slowly swing weighted arm onto push rod.

Rotate the cup by turning handle at base of the tester clockwise one revolution every two seconds.

Observe the leak-down time interval from the instant the pointer aligns with the start mark on the scale until pointer aligns with 0.125 mark. Normally functioning tappet will require 20 to 110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.



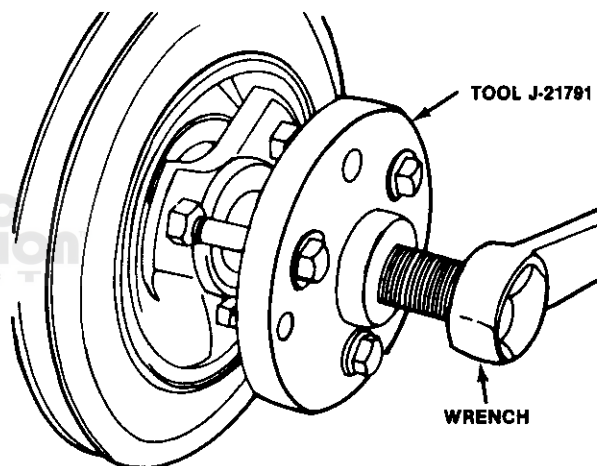
41891A

CYLINDER BLOCK

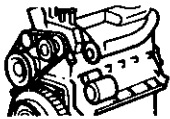
Block Disassembly

Remove the water pump, fuel pump and distributor from the cylinder block.

Remove the vibration damper using tool J-21791.

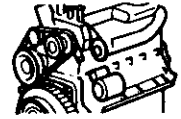


41892A

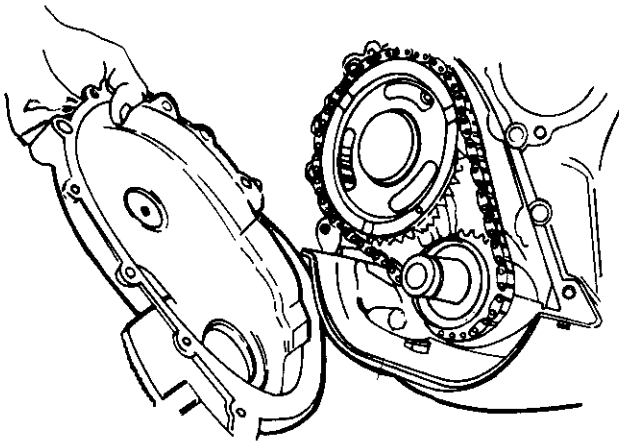


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY

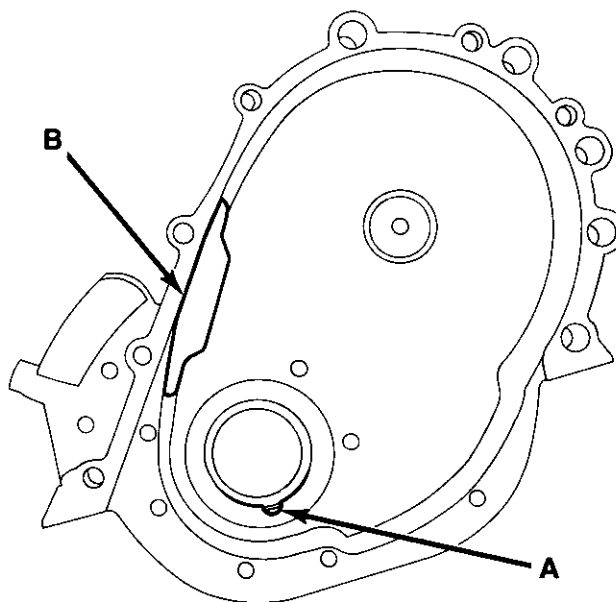


Remove the timing case cover and lay upside down.



83107A

Position a drift punch into the slot (A) in the back of the cover and tap the old seal out.

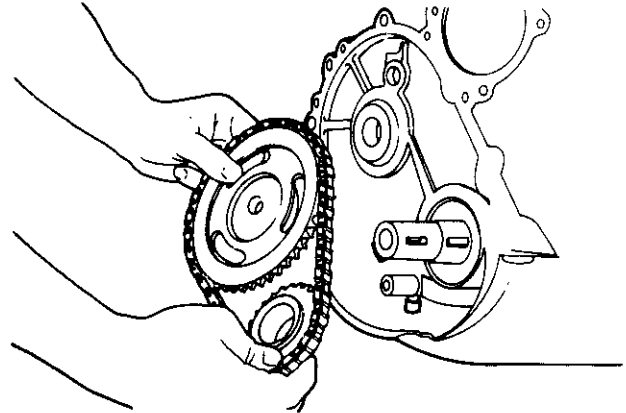


2739

Remove the timing chain bumper (B).

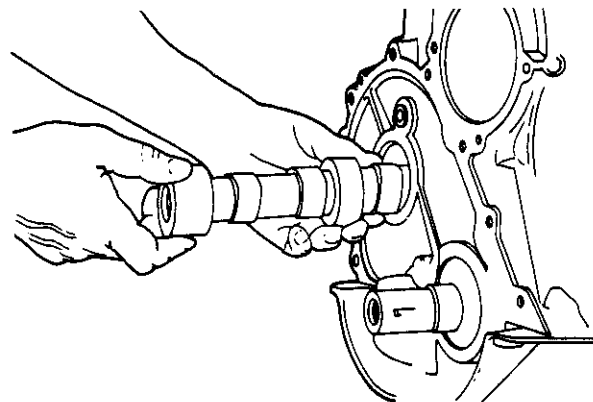
Remove the oil slinger from crankshaft.

Remove the camshaft retaining bolt and remove the sprockets and chain as an assembly.



83108

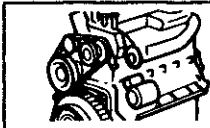
Remove the camshaft.



83109

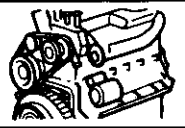
Inspect:

- The cam lobes for wear



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



- Bearing journals for uneven wear pattern or finish
- Bearings for wear
- Distributor drive gear for wear

NOTE: If the camshaft appears to have been rubbing against the timing case cover, examine the oil pressure relief holes in the rear cam journal to assure they are free of debris.

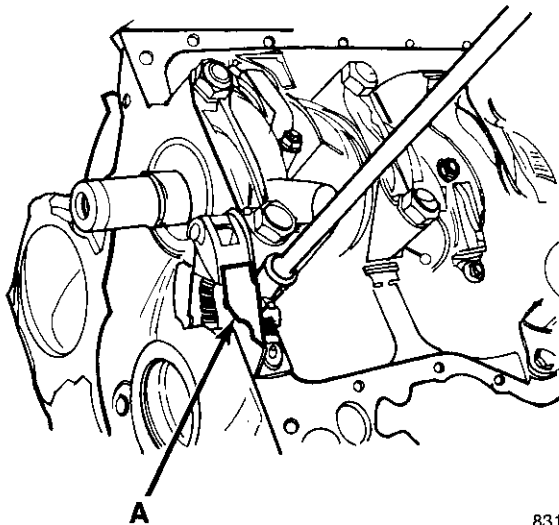
Remove the oil pan, gaskets and seals.

Thoroughly clean the pan and engine block gasket surfaces.

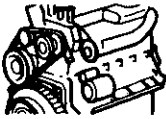
Remove the timing chain tensioner (A).



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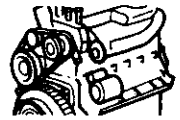


83111A

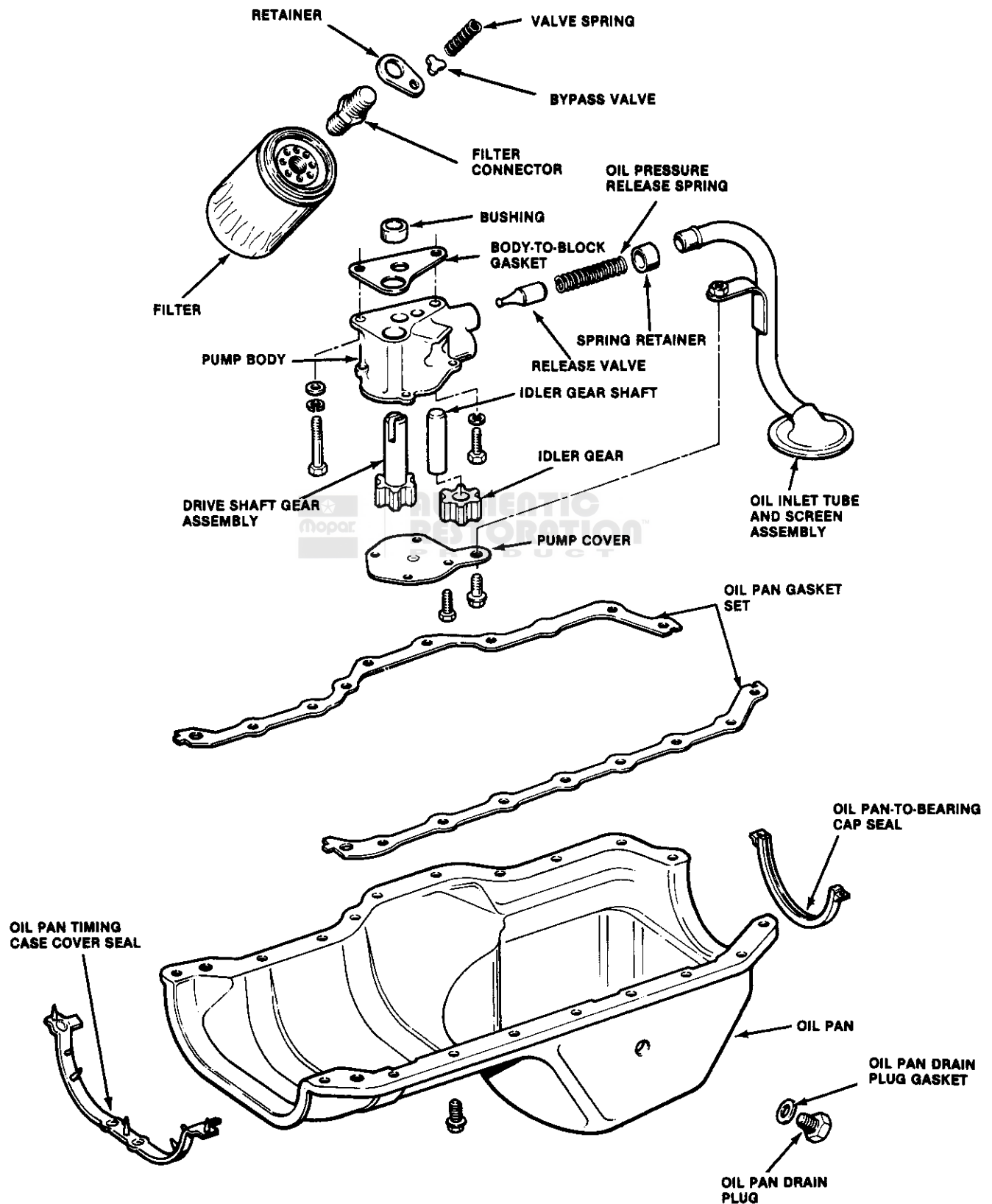


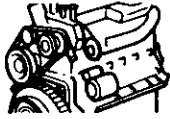
2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



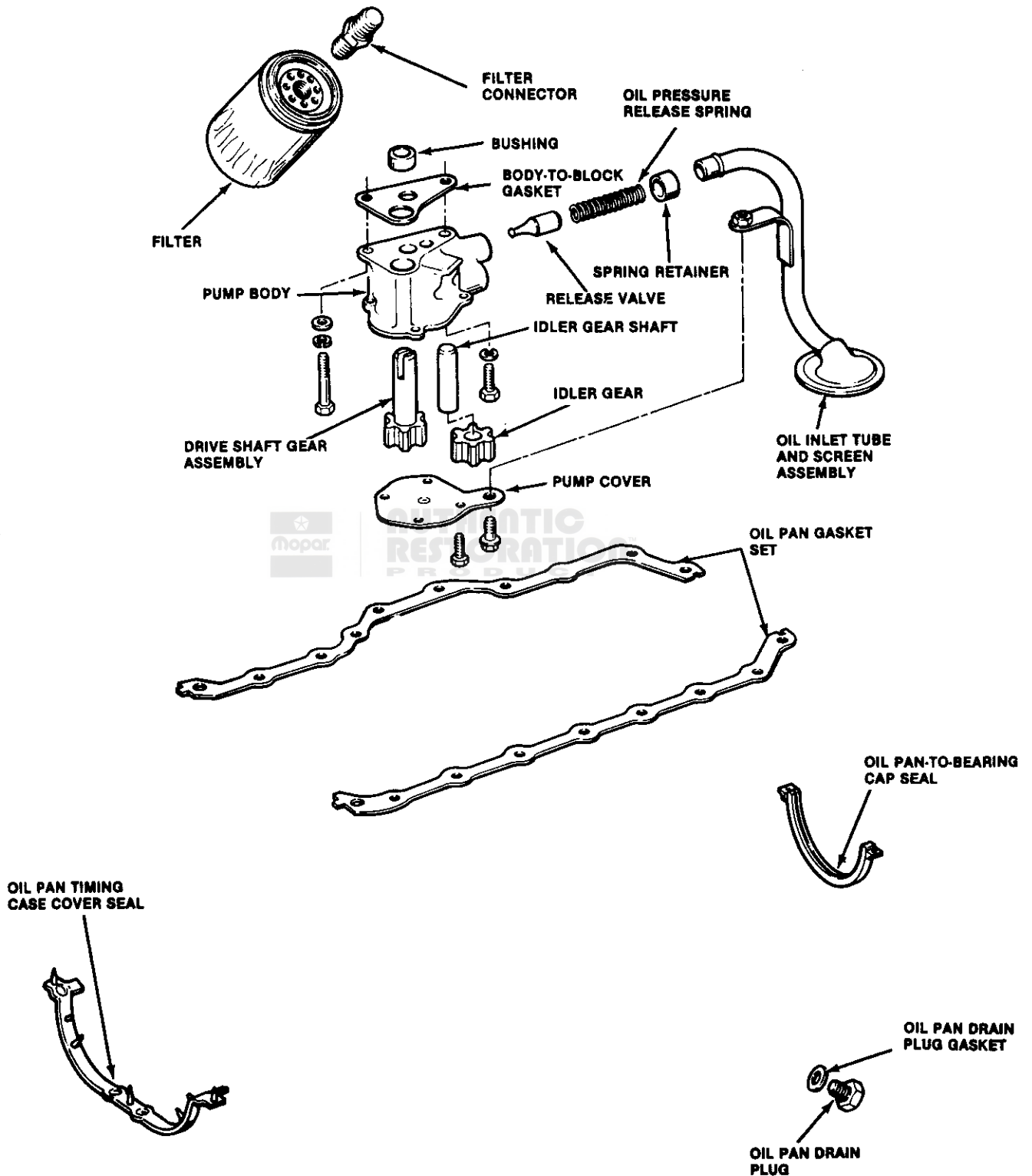
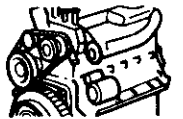
OIL PUMP

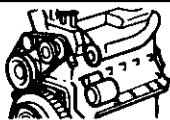




2.5L I-4 ENGINE OVERHAUL

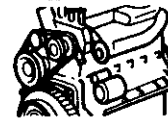
ENGINE DISASSEMBLY





2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Pump Removal and Disassembly

The positive-displacement gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft. Oil is siphoned into the pump through an inlet tube and strainer assembly that is pressed into the pump body. The pump incorporates a nonadjustable pressure relief valve to limit maximum pressure to 75 psi (517 kPa). In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

NOTE: Oil pump removal or replacement will not affect distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

Remove the oil pump assembly and gasket from cylinder block.

CAUTION: If the oil pump is not to be serviced, do not disturb position of oil inlet tube and strainer assembly in pump body. If tube is moved within pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

Gear End Clearance Measurement

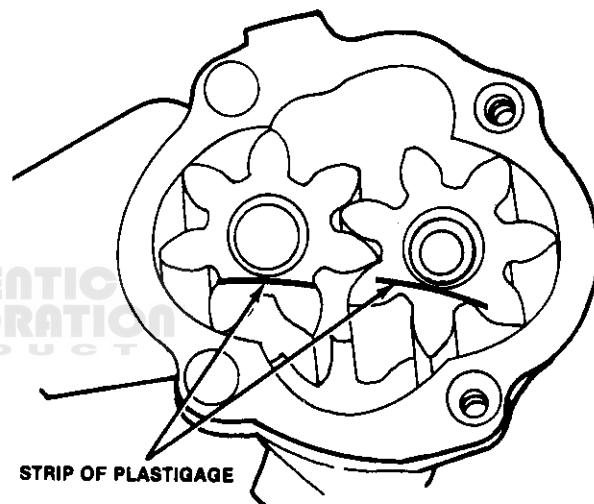
Remove the cover retaining screws and cover from the pump body.

Preferred Method:

Place a strip of Plastigage across the full width of each gear.

Install the pump cover and tighten the screws to 70 in-lbs (8N•m) torque.

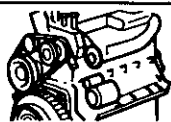
Remove the pump cover and determine the amount of clearance by measuring the width of compressed Plastigage with scale on the Plastigage envelope. Correct clearance by this method is 0.002 to 0.006 (0.002 inch preferred) (0.051 to 0.152 mm (0.051 mm preferred).



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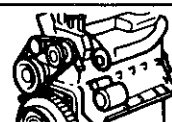
Alternate Method:

Place straightedge across the ends of gears and pump body.

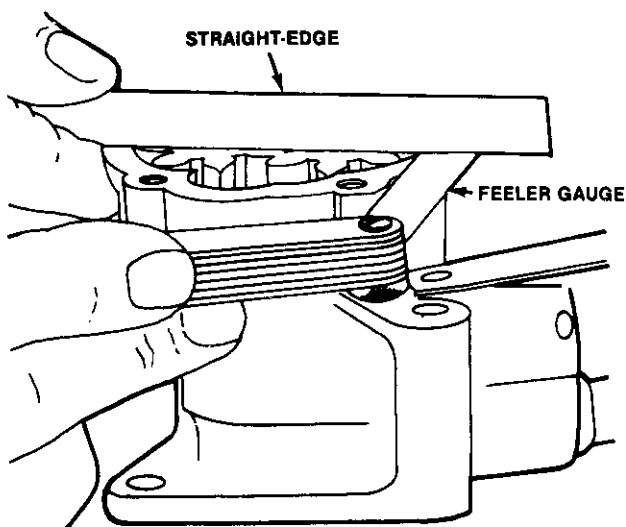


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Select a feeler gauge that fits snugly but freely between the straightedge and pump body.



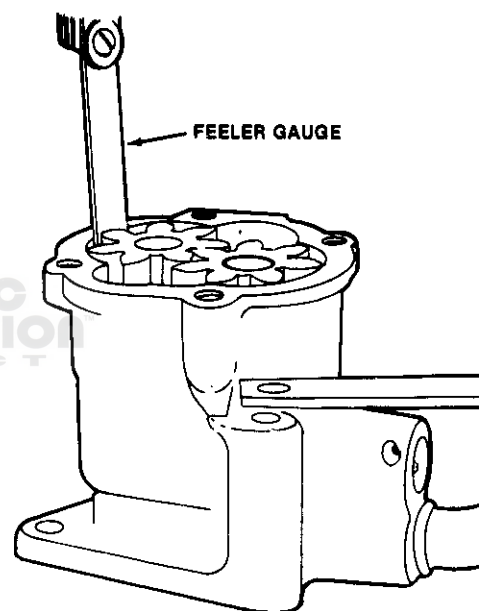
41901A

Correct clearance by this method is 0.002 to 0.006 inch (0.002 preferred) (0.051 to 0.152 mm (0.051 mm preferred).

If gear end clearance is excessive, replace the oil pump assembly.

Gear-to-Body Clearance Measurement

With both gears in place, measure the gear-to-body clearance by inserting feeler gauge between gear tooth and pump body inner wall directly opposite point of gear mesh. Select feeler gauge which fits snugly but freely. Rotate gears to measure each tooth-to-body clearance in this manner. Correct clearance is 0.051 to 0.102 mm (0.051 mm preferred) (0.002 to 0.004 inch-0.002 inch preferred) .

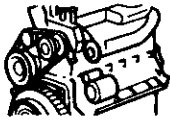


41902A

If the gear-to-body clearance is more than specified, replace idler gear, idler shaft and drive gear assembly.

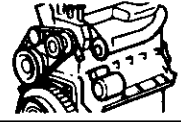
Remove the cotter pin and slide the spring retainer, spring and oil pressure relief valve plunger out of the pump body. Inspect for binding condition during disassembly. Clean or replace as necessary.

NOTE: The oil inlet tube and strainer assembly must be moved to allow removal of the relief valve. Install a replacement inlet tube and strainer assembly.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Pump Assembly

NOTE: Two relief valve plunger sizes (standard and oversize) are available. When replacing the valve, assure correct replacement valve, standard size or 0.010 inch (0.254 mm) oversize plunger diameter, is obtained and installed.

Install the oil pressure relief valve plunger, spring, retainer and cotter pin.

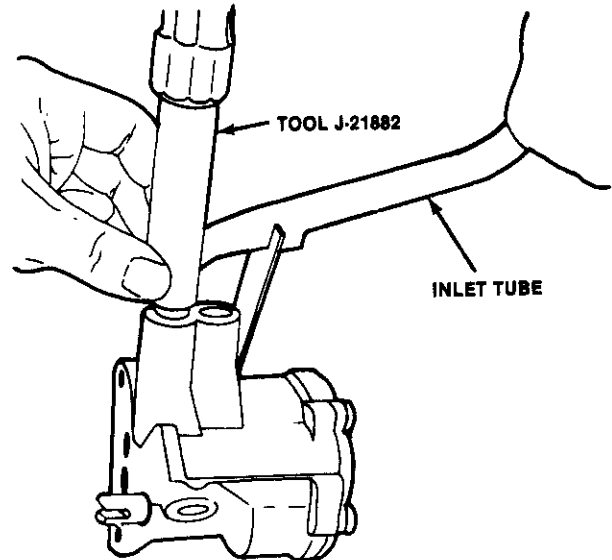
If the position of inlet tube in the pump body has been disturbed, install a replacement inlet tube and strainer assembly. Apply a light film of Permatex No. 2 sealant, or equivalent, around the end of tube. Use Tool J-21882 to drive the tube into body. Assure support bracket is properly aligned.

Install the idler shaft, idler gear and drive gear assembly.

NOTE: To assure self-priming of the oil pump, fill pump with petroleum jelly before installing the oil pump cover. Do not use grease.

Apply a thin bead of Loctite 515 (or equivalent) to the top of the pump housing and install the pump cover screws with 8 N·m (70 in-lbs) torque.

NOTE: Spin the drive gear shaft to assure a binding condition does not exist before installing the oil pump.

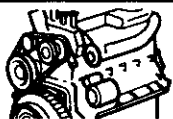


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CRANKSHAFT AND CONNECTING RODS

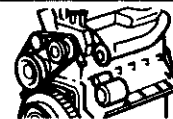
Connecting Rod and Piston Removal

Remove the connecting rod bearing caps and inserts and retain in same order as removed to facilitate installation in original location.

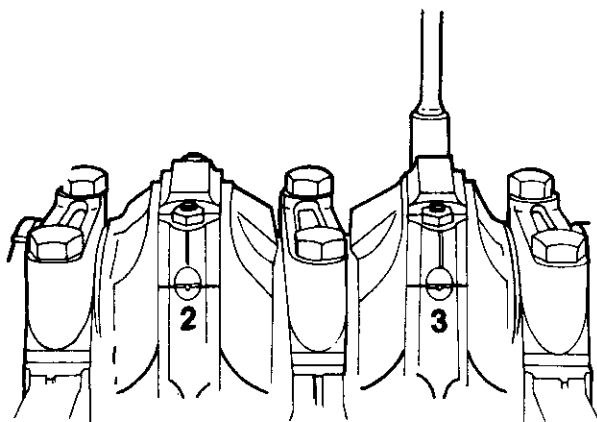


2.5L I-4 ENGINE OVERHAUL

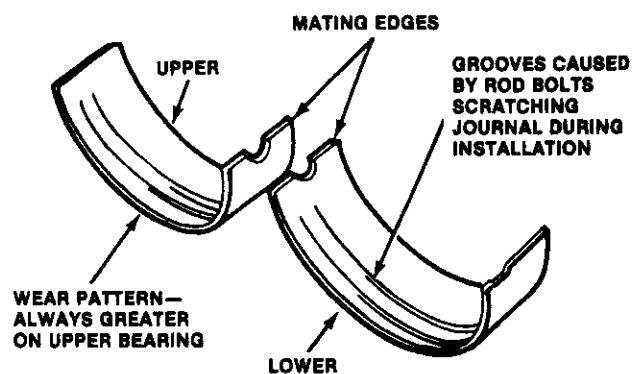
ENGINE DISASSEMBLY



NOTE: Connecting rods and caps are stamped with the corresponding cylinder number.



Inspect the connecting rod journals for signs of scoring, nicks and burrs.



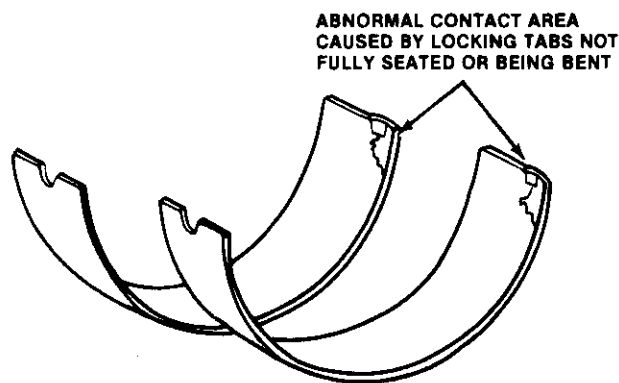
Connecting Rod Bearing Inspection

60757A

Remove the connecting rod and piston assemblies through top of the cylinder bores.

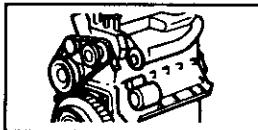
CAUTION: Be sure that the connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during removal.

Inspect the connecting rod bearings for scoring and bent alignment tabs. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.



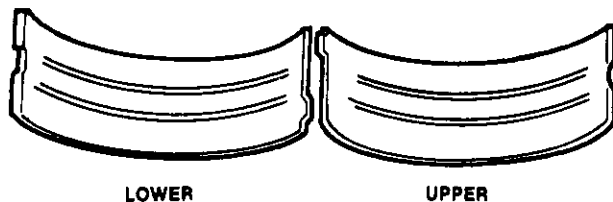
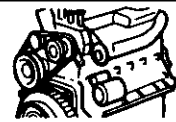
Locking Tab Inspection

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2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY

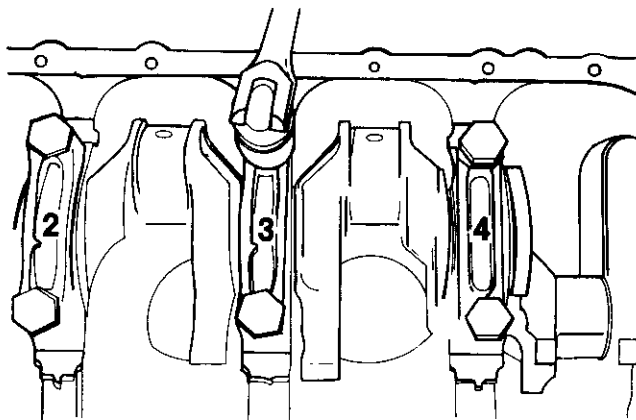


Scoring Caused by Insufficient Lubrication

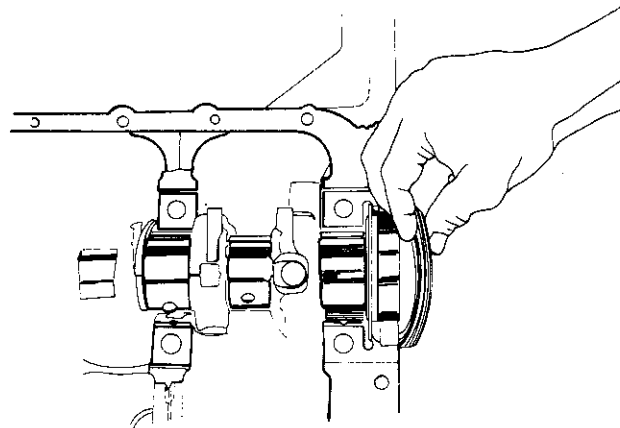
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Crankshaft Removal

Remove the main bearing caps and bearings. The bearing caps are numbered 1 through 5 front to rear.

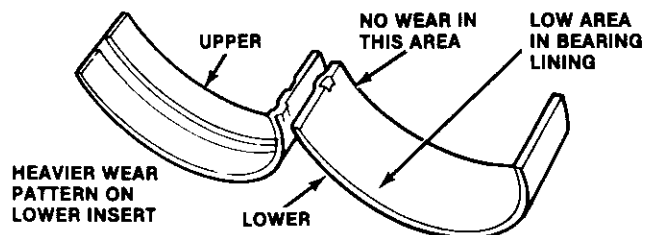


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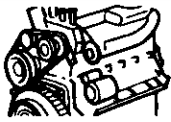
83117

Remove the crankshaft and upper bearing inserts. Inspect the crankshaft for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.



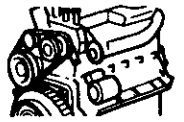
Normal Main Bearing Wear Pattern

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2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



CYLINDER BORE RECONDITIONING

Cylinder Bore Measurement

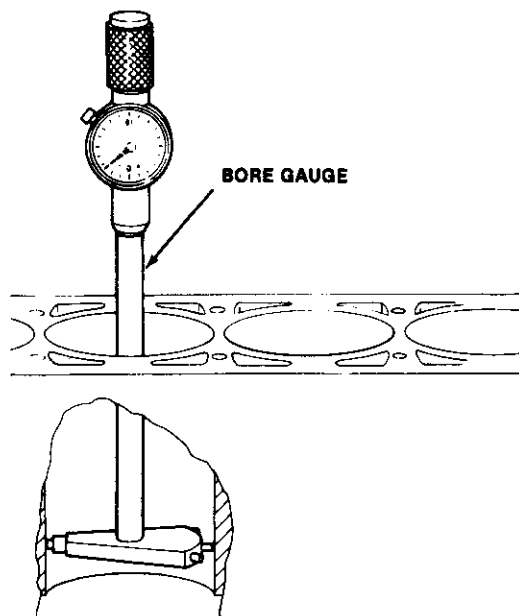
Use a bore gauge to measure each cylinder bore diameter. If a bore gauge is not available, use an inside micrometer.

Measure the cylinder bore diameter crosswise to the cylinder block near the top of bore. Repeat measurement at the bottom of the bore.

Determine taper by subtracting the smaller diameter from the larger diameter.

Rotate measuring device 120° and repeat steps above. Finally, rotate the device another 120° and repeat measurements.

Determine out-of-roundness by comparing difference between each 120° measurement.



80304

If the cylinder bore taper does not exceed 0.025 mm (0.001 inch) and the out-of-roundness does

not exceed 0.025 mm (0.001 inch), the cylinder bore can be trued by honing. If the cylinder bore taper or out-of-round condition exceeds these maximum limits, the cylinder must be bored and then honed to accept an oversize piston.

NOTE: A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

Cylinder Bore Reconditioning

CAUTION: Do not use rigid type hones to remove cylinder wall glaze.

Use an expanding type hone to true the cylinder bore and to remove glaze for faster piston ring seating. Move the hone down and up (stroke) at sufficient speed to produce uniform 60° angle crosshatch pattern on the cylinder walls. Do not use more than ten strokes per cylinder (one stroke is one down-and-up movement).

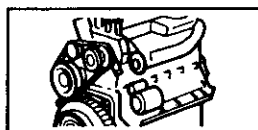
Scrub the cylinder bores clean with a solution of hot water and detergent.

Immediately apply light engine oil to the cylinder walls. Wipe with clean, lint-free cloth.

PISTON PINS

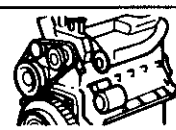
Piston Pin Removal

Piston pins are press-fitted into the connecting rods and DO NOT require a locking device.

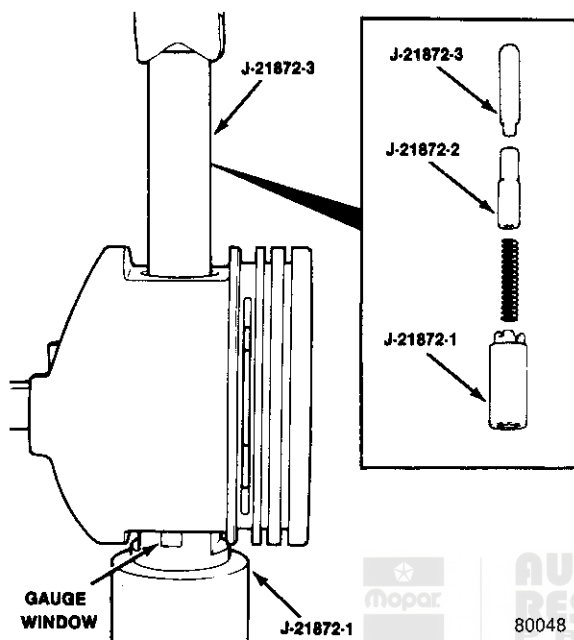


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Position Piston Pin Pilot Tool J-21872-2, Piloted Driver Tool J-21872-3, Removal Support Tool J-21872-1 and piston and connecting rod assembly in place on arbor press.



Apply force to piloted driver to press the pin completely out of the connecting rod and piston. Note position of the pin through the gauge window of removal support tool.

Piston Pin Inspection

Inspect the piston pin and pin bore in the connecting rod for nicks and burrs. Remove as necessary.

NOTE: Never reuse piston pin after it has been installed in and removed from a connecting rod.

With the pin removed from the piston and connecting rod, clean and dry piston pin bores and the replacement piston pin.

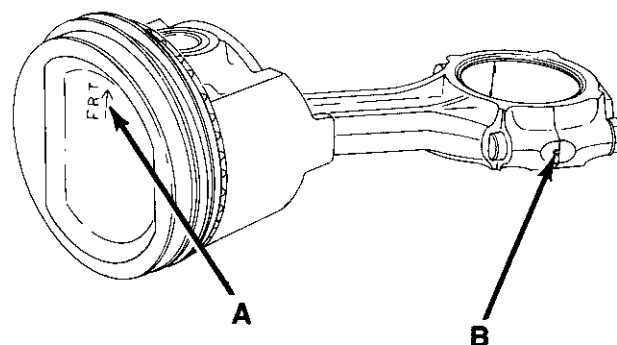
Position the piston so that the pin bore is in vertical position. Insert the pin in bore. At room temperature, the replacement pin should slide completely through the pin bore in piston by force of gravity.

Replace piston if pin jams in the pin bore.

Piston Pin Installation

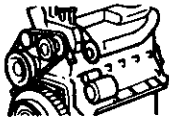
Insert the Pin Pilot J-21872-2 through piston and connecting rod pin bores with the arrow (A) on the piston crown pointing up.

Position the pin pilot, piston and connecting rod on Support J-21872-1 with the squirt hole (B) of the connecting rod to the left-hand side.



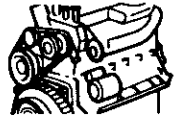
Insert piston pin through the upper piston pin bore and into connecting rod pin bore.

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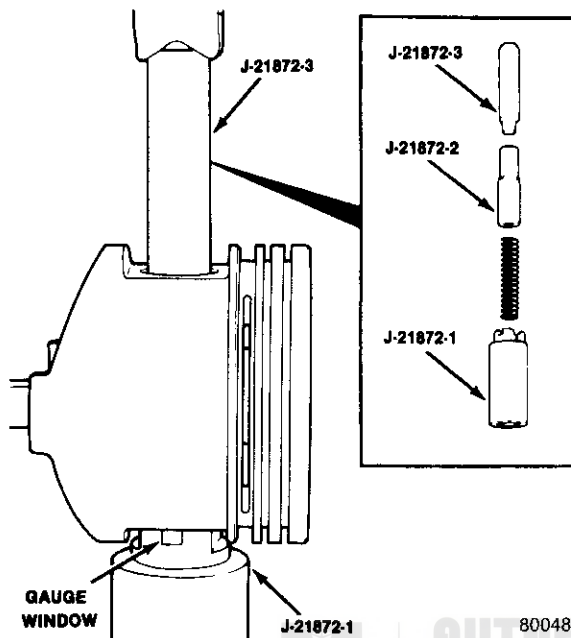


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Position Piloted Driver J-21872-3 inside the piston pin.



Using an arbor press, press the piston pin through the connecting rod and piston bores until pin pilot indexes with mark on support.

NOTE: The piston pin requires a 8900 N (2,000 pounds) press-fit. If little effort is required to install piston pin in a connecting rod, or if the rod moves laterally on the pin, the connecting rod must be replaced.

Remove the piston and connecting rod assembly from the press. Pin should be centered in rod ± 0.792 mm (± 0.0312 inch).

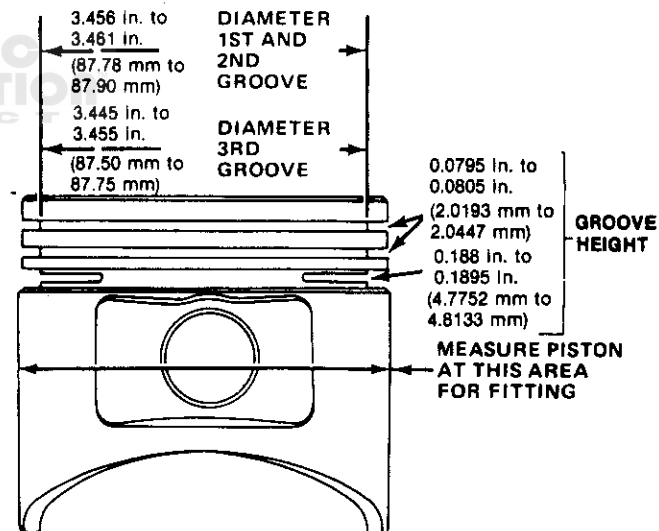
PISTON FITTING METHODS

Piston Fitting - Micrometer Method

Measure the inside diameter of the cylinder bore at a point 58.725 mm (2-5/16 inches) below top of bore.

Measure outside diameter of the piston.

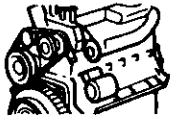
NOTE: Because pistons are cam ground, measure at right angle to piston pin at centerline of pin.



The difference between cylinder bore diameter and piston diameter is piston-to-bore clearance.

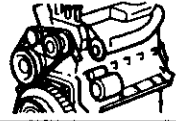
Piston Fitting - Feeler Gauge Method

Remove the rings from the piston.



2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



Insert a long 0.025 mm (0.001 inch) feeler gauge into the cylinder bore.

Insert the piston, top first, into cylinder bore alongside the feeler gauge. With entire piston inserted into cylinder bore, the piston should not bind against feeler gauge.

Repeat steps with a long 0.051 mm (0.002-inch) feeler gauge. The piston should bind.

If the piston binds on 0.025 mm (0.001-inch) feeler gauge, the piston is too large or cylinder bore is too small. If the piston does not bind on 0.051 mm (0.002-inch) feeler gauge, the piston is too small for cylinder bore. Pistons up to 0.102 mm (0.004 inch) undersize may be enlarged by knurling or shot-peening. Replace pistons that are 0.102 mm (0.004-inch) or more undersize.



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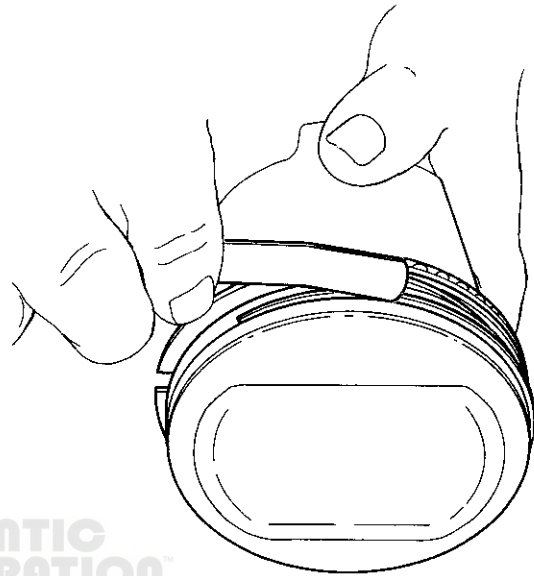
PISTON RINGS

The two compression rings are made of cast iron. The oil control ring is a three-piece steel design.

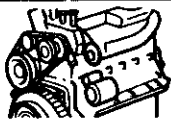
Piston Ring Fitting

Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring grooves 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.

Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring. Rotate the ring in the groove. It must move freely around circumference of the groove.

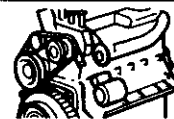


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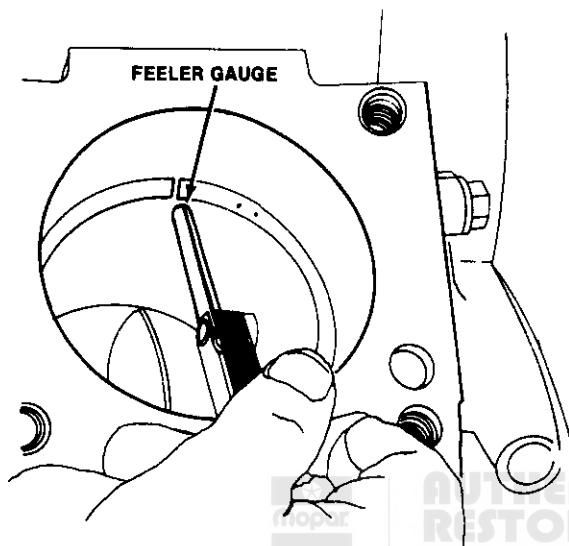


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



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. Refer to Specifications for correct ring end gap.

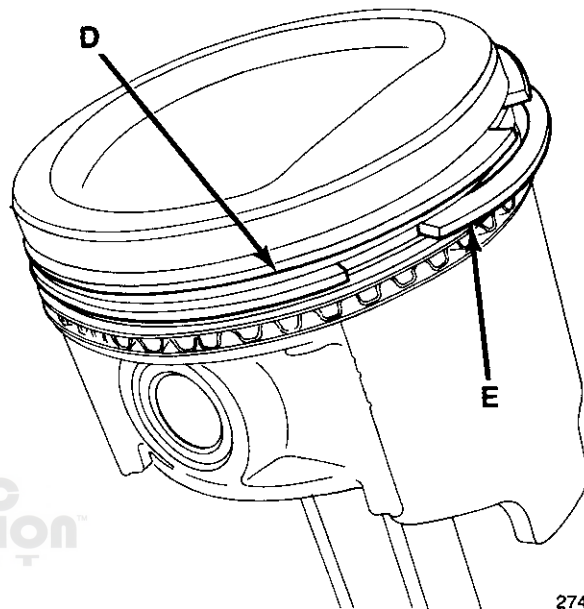


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Refer to Ring Gap Position for position of the ring gaps when installing piston rings.

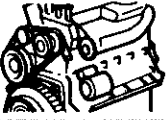
Install the oil control rings according to instructions in the package. It is not necessary to use a tool to install the upper and lower rails. Insert expander ring first, then side rails

The two compression rings are different and cannot be interchanged. The top ring (D) is a moly ring (the scraping edge is gray in color). The second ring (E) is a black cast iron ring (the scraping edge is black in color when new).



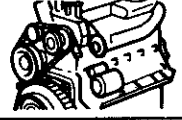
2743

The compression rings can be identified by one or two dots on the top surface of the ring and a chamfer of either the top or bottom inside edge.

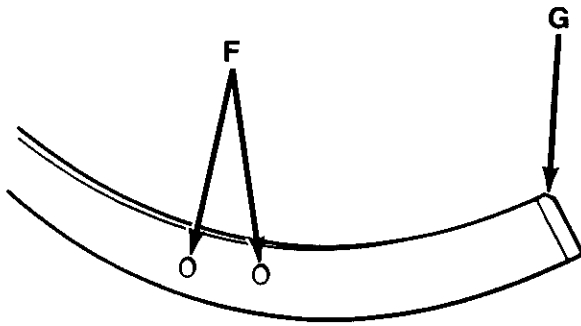


2.5L I-4 ENGINE OVERHAUL

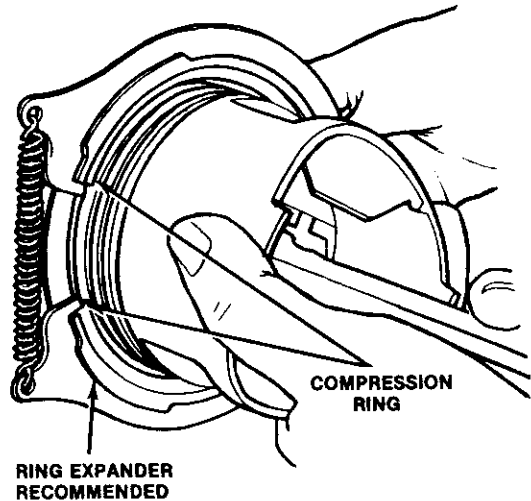
ENGINE DISASSEMBLY



The second compression ring (black cast iron) has two dots (F) on the top surface and a chamfer (G) on the bottom of the inside edge.



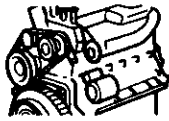
Using a ring installer, install the ring with the dots facing up and the chamfer facing down.



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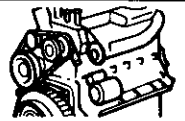


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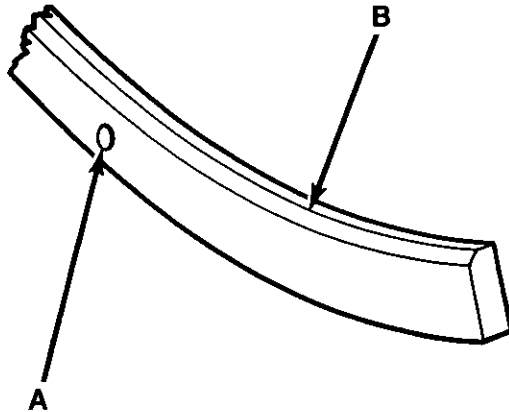


2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY



The top compression ring (the scraping edge is gray in color) has one dot (A) on the top surface and chamfer on the top of the inside edge.

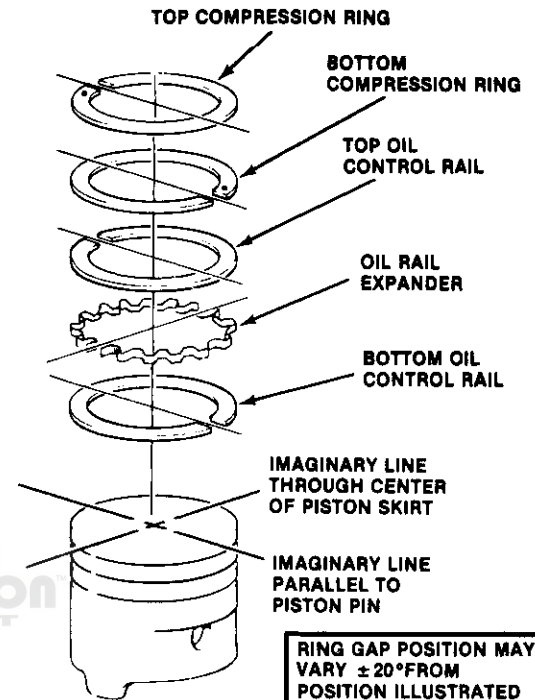


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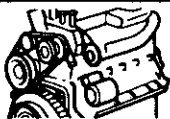
Using a ring installer, install the top ring with the dot and chamfer facing up.

Ring Gap Position

Position the ring end gaps on the piston as shown.

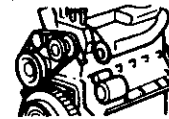


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2.5L I-4 ENGINE OVERHAUL

ENGINE DISASSEMBLY

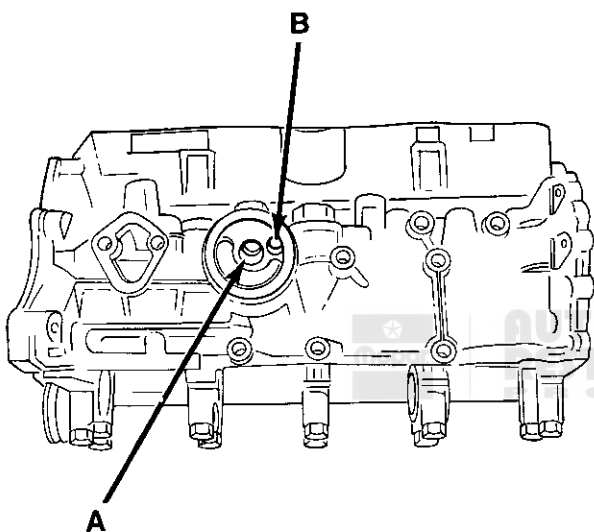


CYLINDER BLOCK

Remove the front and rear oil galley plugs.

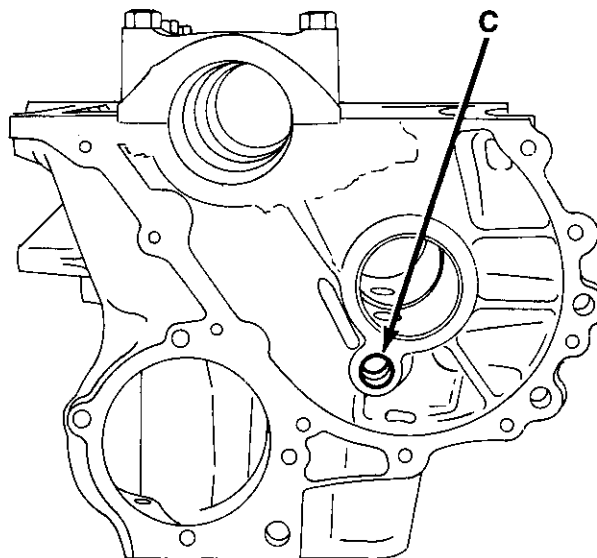
Use compressed air to clean out:

- the galley at the oil filter adaptor hole (A), the filter by pass hole (B).

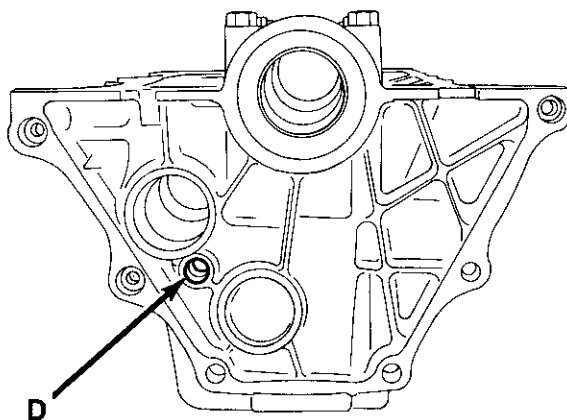


2746

- The front (C) and rear (D) oil galley holes,



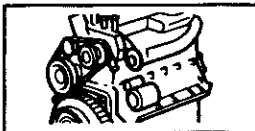
2747



2748

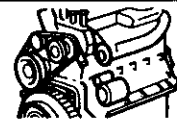
- the feed holes for the crankshaft main bearings.

Apply Loctite PST pipe sealant with Teflon 592 to the threads of the oil galley plugs and tighten them to 41 N·m (30 ft-lbs) torque.



2.5L I-4 ENGINE OVERHAUL

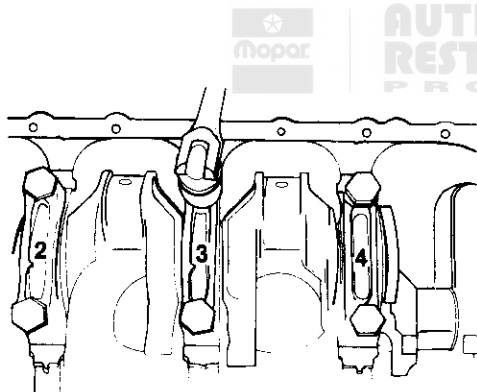
ENGINE ASSEMBLY



MAIN BEARINGS

General

The crankshaft main bearings are steel-backed, micro-babbitt two-piece precision types. The main bearing caps, numbered (front to rear) from 1 through 5 have an arrow to indicate the forward position. The upper main bearing inserts are grooved to provide oil channels while the lower inserts are smooth. Crankshaft end play is controlled by the thrust bearing which is flanged and installed at the number 2 main bearing position.



83116

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance. In production, the select fit is obtained by using various-sized color-coded bearing insert pairs as listed in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert

NOTE: The size is not stamped on bearing inserts used for engine production.

The main bearing journal size (diameter) is identified in production by a color-coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft, except for the rear main journal, which is on the crankshaft rear flange.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce the clearance by 0.013 mm (0.0005 inch).

Example:

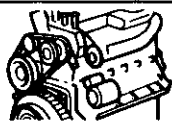
Bearing Insert Pairs

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.001-inch (0.025 mm) undersize	0.002-inch (0.051 mm) undersize

70242

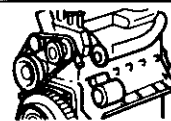
CAUTION: Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 inch) difference in size.

CAUTION: When replacing inserts, the odd size inserts must be either all on the top (in cylinder block) or all on the bottom (in main bearing cap).



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Measuring Main Bearing-to-Journal Clearance with Plastigage

NOTE: When using Plastigage, check only one bearing clearance at a time, with the other main bearing caps torqued to 108 N•m (80 ft-lbs).

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

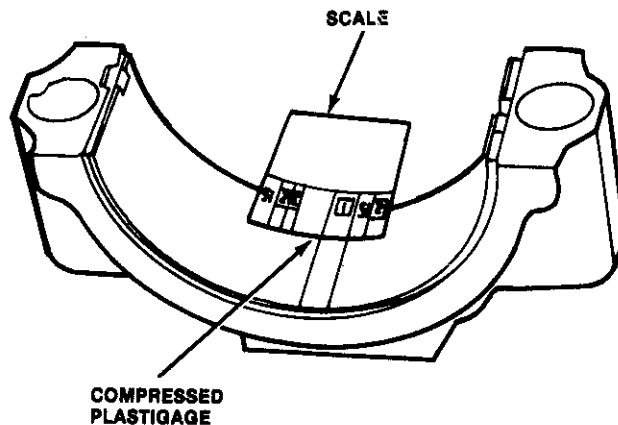
Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten bolts with 108 N•m (80 ft-lbs) torque.

NOTE: Do not rotate crankshaft. This will cause the Plastigage to shift, resulting in inaccurate indication. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

Remove bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope. The correct clearance is .0010 to .0025 inches for all main bearing journals, with 0.002 preferred.



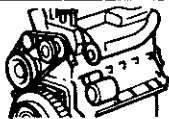
41907A

Plastigage should indicate the same clearance across the entire width of insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replace of the bearing inserts are not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed to installation.

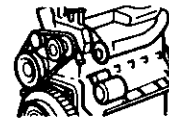
If the clearance exceeds specification, install a pair of 0.001 inch undersize bearing inserts and measure the clearance as described in previous steps.

The clearance indicated with the 0.001 inch undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance. For example, if the clearance was 0.0030 inch originally, a pair of 0.001 inch undersize inserts would reduce the clearance by 0.001 inch. The clearance would then be 0.0020 inch and within the specification. A 0.002 inch undersize bearing insert and a 0.001 inch undersize insert would reduce the original clearance an additional 0.0005 inch and the clearance would then be 0.0015 inch.



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair. For example, do not use a standard size upper insert and a 0.002 inch undersize lower insert.

If the clearance exceeds specification using a pair of 0.002 inch undersize bearing inserts, measure the crankshaft journal diameter with a micrometer (refer to Measuring Main Bearing Journal Diameter with a Micrometer). If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore. If diameter for journals 1 through 5 is less than 2.4981 inches replace crankshaft or grind down to accept appropriate under size bearing inserts.

Once the proper clearances have been obtained remove the crankshaft and proceed to crankshaft installation.

Measuring Main Bearing Journal Diameter with a Micrometer (Crankshaft Removed)

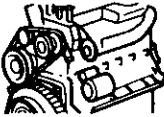
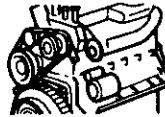
Clean the main bearing journal of oil.

Determine the maximum diameter of journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

Refer to Specification for maximum allowable taper and out of round. Compare measured diameter with the journal diameter specification listed in the Main Bearing Fitting Chart and select inserts required to obtain the specified bearing-to-journal clearance.



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	2.5L I-4 ENGINE OVERHAUL ENGINE ASSEMBLY	
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Main Bearing Fitting Chart

Crankshaft No. 1 Main Bearing Journal Color Codes and Diameter in Inches (mm)	Cylinder Block No. 1 Main Bearing Bore Color Code and Size in Inches (mm)	Bearing Insert Color Code	
		Upper Insert Size	Lower Insert Size
Yellow — 2.5001 to 2.4996 (Standard) (63.5025 to 63.4898 mm)	Yellow — 2.6910 to 2.6915 (68.3514 to 68.3641 mm) Black — 2.6915 to 2.6920 (68.3641 to 68.3768 mm)	Yellow — Standard Yellow — Standard	Yellow — Standard Black — 0.001-inch Undersize (0.025 mm)
Orange — 2.4996 to 2.4991 (0.0005 Undersize) (63.4898 to 63.4771 mm)	Yellow — 2.6910 to 2.6915 (68.3514 to 68.3641 mm) Black — 2.6915 to 2.6920 (68.3641 to 68.3768 mm)	Yellow — Standard Black — 0.001-inch Undersize (0.025 mm)	Black — 0.001-inch Undersize — (0.001 mm) Black — 0.001-inch Undersize (0.025 mm)
Black — 2.4991 to 2.4986 (0.001 Undersize) (63.4771 to 63.4644 mm)	Yellow — 2.6910 to 2.6915 (68.3514 to 68.3641 mm) Black — 2.6915 to 2.6920 (68.3641 to 68.3768 mm)	Black — 0.001-inch Undersize — (0.025 mm) Black — 0.001-inch Undersize (0.025 mm)	Black — 0.001-inch Undersize — (0.025 mm) Green — 0.002-inch Undersize (0.051 mm)
Green — 2.4986 to 2.4981 (0.0015 Undersize) (63.4644 to 63.4517 mm)	Yellow — 2.6910 to 2.6915 (68.3514 to 68.3641 mm)	Black — 0.001-inch Undersize — (0.025 mm)	Green — 0.002-inch Undersize — (0.051 mm)
Red — 2.4901 to 2.4896 (0.010 Undersize) (63.2485 to 63.2358 mm)	Yellow — 2.6910 to 2.6915 (68.3514 to 68.3641 mm)	Red — 0.010-inch Undersize (0.254 mm)	Red — 0.010-inch Undersize — (0.254 mm)

NOTE: With Green and Red Coded Crankshaft Journals, Use Yellow Coded Cylinder Block Bores Only.

Crankshaft Main Bearing Journal 2-3-4-5 Color Code and Diameter in Inches (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow — 2.5001 to 2.4996 (Standard) (63.5025 to 63.4898 mm)	Yellow — Standard	Yellow — Standard
Orange — 2.4996 to 2.4991 (0.0005 Undersize) (63.4898 to 63.4771 mm)	Yellow — Standard	Black — 0.001-inch Undersize (0.025mm)
Black — 2.4991 to 2.4986 (0.001 Undersize) (63.4771 to 63.4644 mm)	Black — 0.001-inch Undersize (0.025 mm)	Black — 0.001-inch Undersize (0.025 mm)
Green — 2.4986 to 2.4981 (0.0015 Undersize) (63.4644 to 63.4517 mm)	Black — 0.001-inch Undersize (0.025 mm)	Green — 0.002-inch Undersize (0.051 mm)
Red — 2.4901 to 2.4896 (0.010 Undersize) (63.2485 to 63.2358 mm)	Red — 0.010-inch Undersize (0.054 mm)	Red — 0.010-inch Undersize (0.254 mm)

2749

CRANKSHAFT INSTALLATION

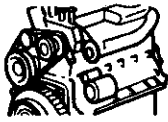
Crankshaft end play is controlled by the thrust bearing which is flanged and installed at the number 2 main bearing position.

Install the grooved main bearings into the cylinder block and the now grooved bearings into the bearing caps.

Lubricate the upper main bearings (grooved bearing on cylinder block) with clean engine oil.

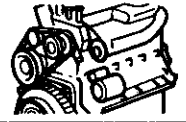
Install the crankshaft.

Lubricate the crankshaft main bearing journals with clean engine oil.

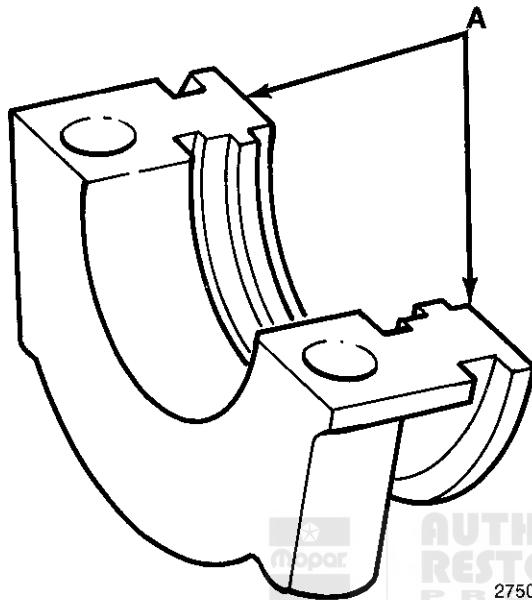


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Apply Loctite 515 or an equivalent in a strip 0.35 inch long, 0.12 inch wide and 0.006 inch thick at positions (A) of the rear (number 5) main bearing cap.



Install main bearing caps 1, 3, 4 and 5 in their original positions with the tab on the top of the cap pointing to the flywheel end of the engine. Torque the bolts to 108 N•m (80 ft-lbs).

NOTE: After installing the thrust bearing cap (number 2) pry the crankshaft forward and backward to align the faces of the upper and lower thrust bearing flanges. Load the crankshaft to the front or rear while tightening the bolts 108 N•m (80 ft-lbs) torque.

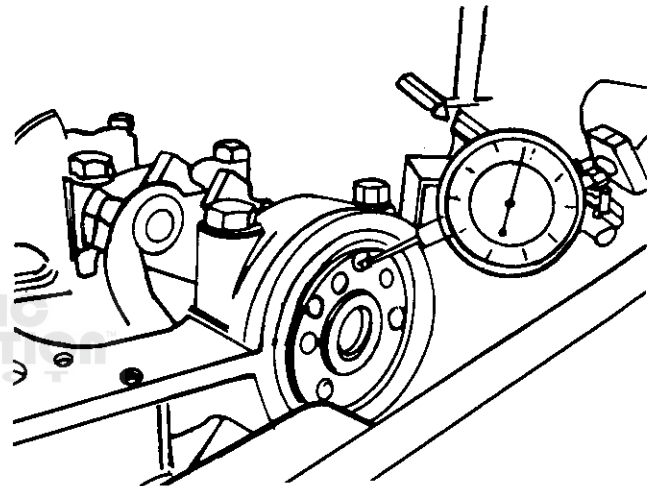
Crankshaft End Play Measurement

Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

Pry the crankshaft forward, position the dial indicator to zero.

Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements. Correct end play is 0.038 to 0.165 mm, 0.051 to 0.064 mm is desired (0.0015 in. to 0.0065 in. 0.002 to 0.0025 is desired).



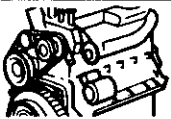
83118

If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

CONNECTING RODS AND ROD BEARINGS

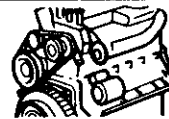
Connecting Rods

The connecting rods are made of malleable iron and are balanced assemblies with bearing inserts at the crankshaft journal end. The piston



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



pin is 8900 N (2,000 pounds) press fitted into the rod.

A squirt hole in the crankshaft end of the connecting rod provides lubrication for the camshaft lobes, distributor drive gear, cylinder walls and piston pins.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

Connecting Rod Bearings



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The connecting rod bearings are two-piece, steel-backed, lead-aluminum alloy units.

Each bearing insert is selectively fitted to its respective journal to obtain the specified operating clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the bearing fitting chart. The color code appears on the edge of the bearing insert.

NOTE: The size is not stamped on inserts used for production of engines.

The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the bearing fitting chart.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.001 inch undersize insert to reduce clearance 0.0005 inch.

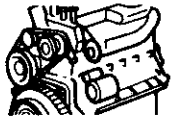
CAUTION: Do not intermix bearing caps. Each connecting rod and its bearing cap are stamped with the associated cylinder number on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

Measuring Connecting Rod Bearing-to-Journal Clearance with Plastigage

Wipe the journal clean of oil.

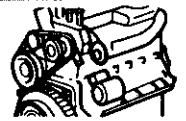
Use short rubber hose sections over rod bolts during installation.

Lubricate the upper bearing insert and install in connecting rod.



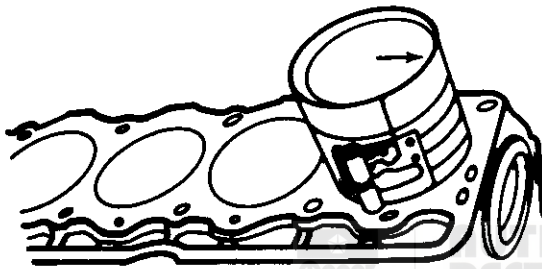
2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Use piston ring compressor to install the rod and piston assemblies with the oil squirt holes in the rods facing the camshaft and the arrow on the piston crown pointing to the front of the engine.

NOTE: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.



83119

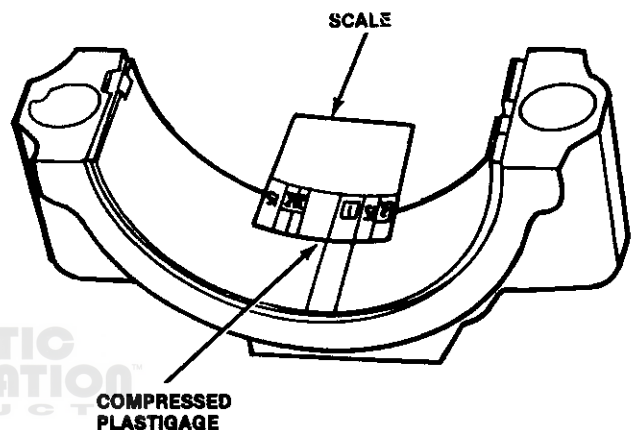
Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap.

Install bearing cap and connecting rod on the journal and tighten nuts with 45 N•m (33 ft-lbs) torque.

NOTE: Do not rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

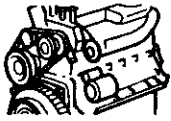
NOTE: Plastigage must not crumble in use. If brittle, obtain fresh stock.

Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage by using the scale on the Plastigage envelope. The correct clearance is 0.0015 to 0.0025 inch.



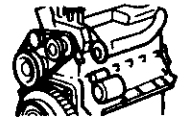
41007A

NOTE: Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod, or



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



foreign material trapped between the insert and cap or rod.

If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

If bearing-to-journal clearance exceeds the specification, install a pair of 0.001 inch undersize bearing inserts and measure the clearance as described in previous steps.

The clearance measured with a pair of 0.001 inch undersize bearing inserts installed will determine if two 0.001 inch undersize inserts or another combination is needed to provide the correct clearance. For example, if the initial clearance was 0.003 inch, 0.001 inch undersize inserts would reduce the clearance by 0.001 inch. The clearance would be 0.002 inch and within specification. A 0.002 inch undersize insert would reduce the initial clearance an additional 0.0005 inch. The clearance would then be 0.0015 inch.

Remember —

- When replacing bearing inserts, all the odd size inserts must be on the bottom.
- The sizes of the service replacement bearing inserts are stamped on the backs of the inserts.
- Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
- Once you have selected the proper insert, install the insert and cap and tighten the screws to 45 N·m (33 ft-lbs) torque.

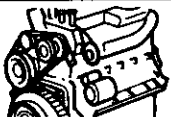
Side Clearance Measurement

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. The correct clearance is 0.254 to .482 mm (0.010 to 0.019 inch). Replace the connecting rod if the side clearance is not within specification.

Connecting Rod Bearing Fitting Chart

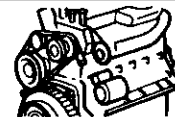
Crankshaft Main Bearing Journal 2-3-4-5 Color Code and Diameter in Inches (Journal Size)	Bearing Insert Color Code	
	Upper Insert Size	Lower Insert Size
Yellow — 2.0955 to 2.0948 (53.2257 - 53.2079 mm) (Standard)	Yellow — Standard	Yellow — Standard
Orange — 2.0948 to 2.0941 (53.2079 - 53.1901 mm) (0.0007 Undersize)	Yellow — Standard	Black — 0.001-Inch (0.025 mm) Undersize
Black — 2.0941 to 2.0943 (53.1901 to 53.1723 mm) (0.0014 Undersize)	Black — 0.001-Inch (0.025 mm) Undersize	Black — 0.001-Inch (0.025 mm) Undersize
Red — 2.0855 to 2.0848 (53.9717 to 53.9539 mm) (0.010 Undersize)	Red — 0.010-Inch (0.254 mm) Undersize	Red — 0.010-Inch (0.245 mm) Undersize

60621



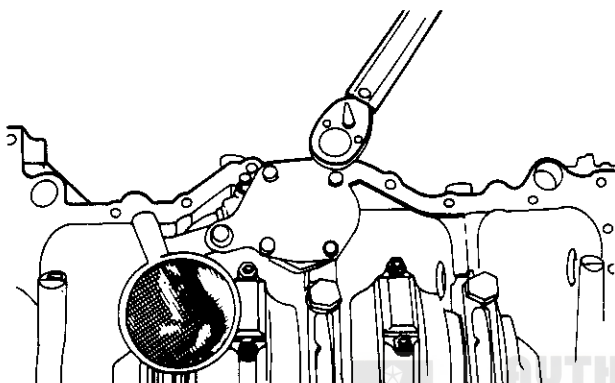
2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



OIL PUMP INSTALLATION

Install the oil pump alignment dowel into the hole in the bottom of the block. Install the oil pump with a new gasket. Tighten the bolts to 23 N•m (17 ft-lbs) torque.



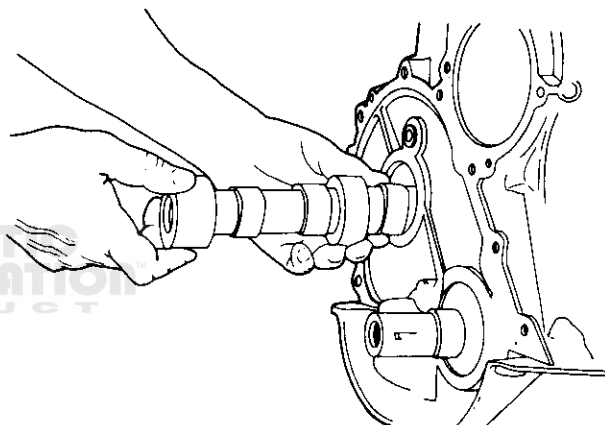
83121

CAMSHAFT BEARINGS

The camshaft rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed. The four camshaft bearing bores and bearing diameters are not the same size. They are stepped down in 0.010 increments from the front bearing (largest) to the rear bearing (smallest). This permits easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated.

NOTE: It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available.

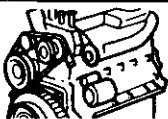
Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear. The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face. Camshaft end play is zero during engine operation.



83109

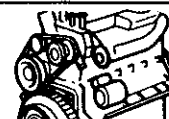
CAMSHAFT AND TIMING CHAIN INSTALLATION

Lubricate the camshaft with Jeep/Eagle Super Oil Conditioner or equivalent then install camshaft.

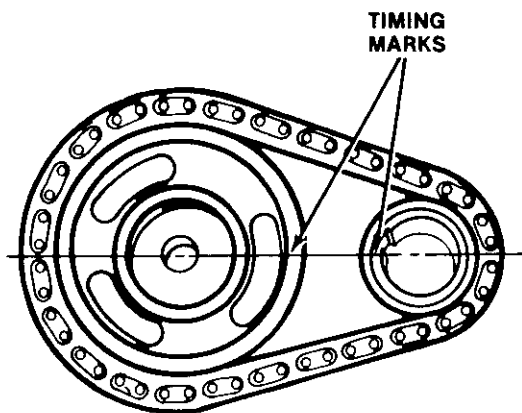


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY

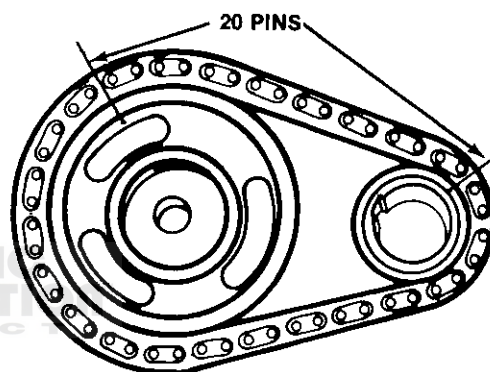


Install the crankshaft, camshaft sprockets, and timing chain. Be sure the timing marks on the sprockets are properly aligned.



41898

NOTE: To verify correct installation of the timing chain, turn crankshaft to locate camshaft sprocket timing mark at approximately the 12 o'clock position. This positions crankshaft sprocket timing mark where the adjacent tooth meshes with the chain at the 4 o'clock position. Count number of chain pins between timing marks of both sprockets. There must be 20 pins.

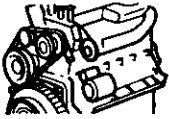


83122

Install the camshaft sprocket retaining bolt and washer and tighten the bolt to 80 ft-lbs (108 Nm) torque.

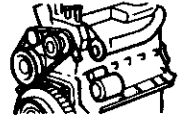
Timing Chain Tensioner Installation

Turn the tensioner lever to the unlock (down) position.

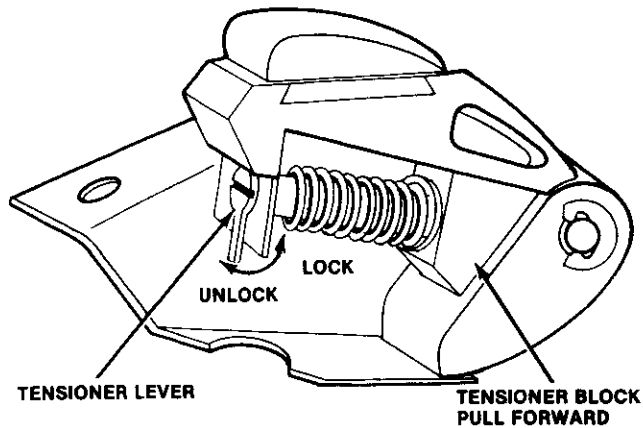


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Pull the tensioner block toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the lock (up) position.



Install the tensioner on the cylinder block and tighten the bolts to 19 N·m (14 ft-lbs) torque. Turn the tensioner lever to the unlock (down) position. Be sure the tensioner is released before installing the timing case cover.

Timing Case Cover Installation

Install the oil slinger.

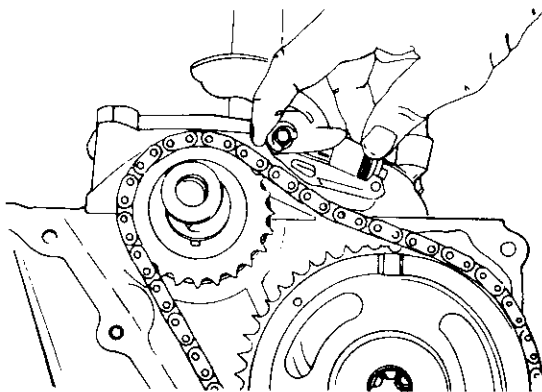
Install the timing chain bumper in to the timing case cover.

Install the timing case cover and gasket, using Tool J-22248 for cover alignment.

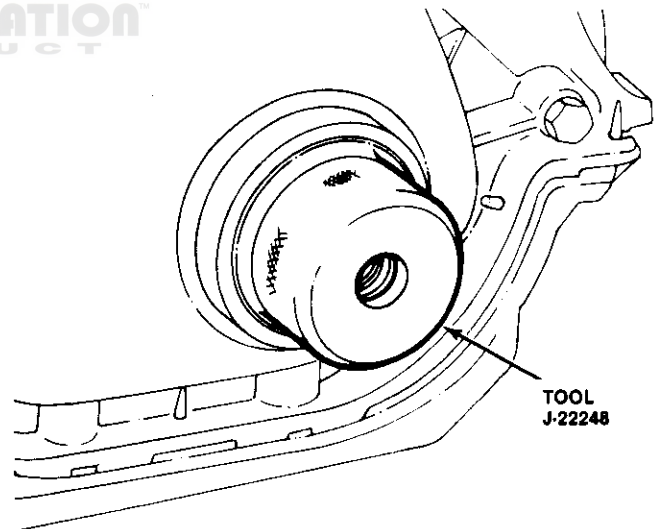


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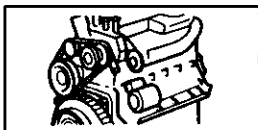
83123



83124

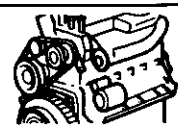


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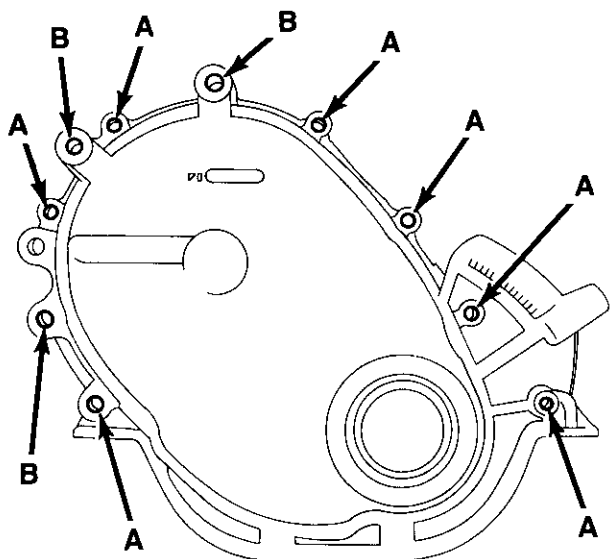


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Tighten the cover bolts (A) to 7 N•m (5 ft-lbs) torque and (B) to 17.5 N•m (16 ft-lbs).



Apply a light film of engine oil to the seal lip and the outside edges of the seal.

Install the seal onto tool J-22248 and tap the seal into place until the tool stops against the cover.

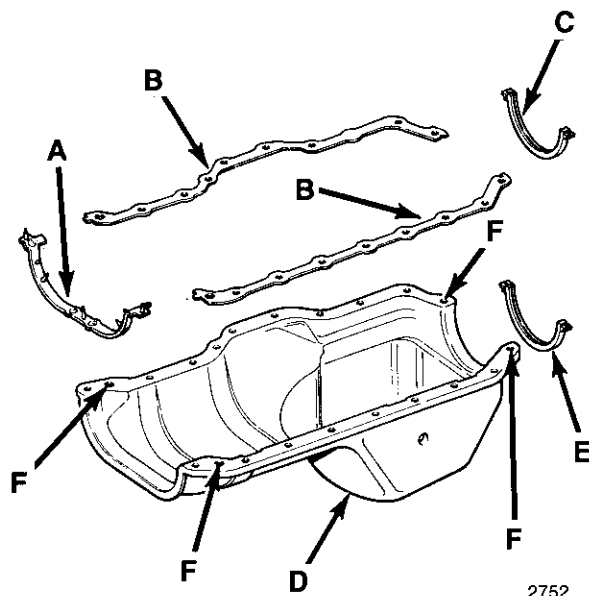
OIL PAN INSTALLATION (Jeep)

Install the front seal (A) to the timing case cover.

Install the side rail gaskets (B).

Install the rear seal (C) into the groove of the rear main bearing cap.

Apply a daub of Jeep/Eagle Gasket-in-a-Tube where the side rail gaskets meet the seals.



Ensure all connecting rod nuts, main bearing cap bolts oil pump mounting bolts and timing chain tensioner bolts are torqued to specifications.

Install the oil pan (D) and rear support strap (E).

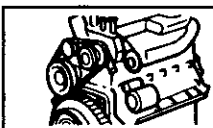
Torque the oil pan bolts at positions (F) to 13.6 N•m (11 ft-lbs).

Torque the remaining oil pan bolts to 9.5 N•m (7 ft-lbs).

OIL PAN INSTALLATION (1988 Eagle - Premier)

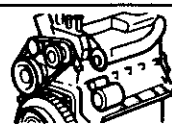
CAUTION: When installing the oil pan for a Premier vehicle the back of the oil pan must be flush with the back of the cylinder block.

Install MOT ML.04 alignment plates to the rear of the cylinder block at the bottom transmission housing mounting bolt holes.

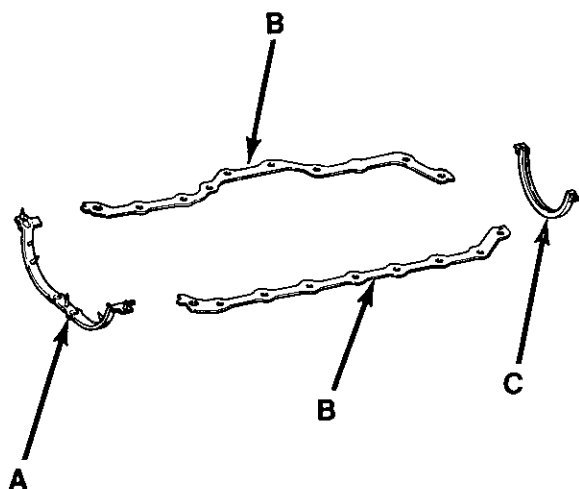


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Install the front oil pan seal (A) to the timing case cover.



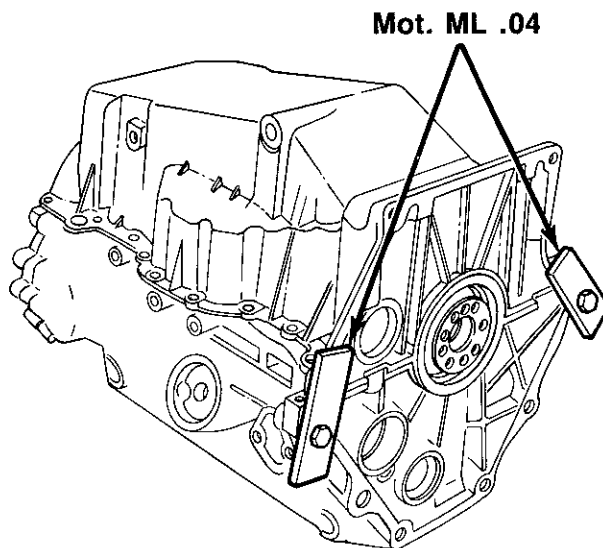
Install the side rail gaskets (B).

Install the rear oil pan seal (C) into the groove of the rear main bearing cap.

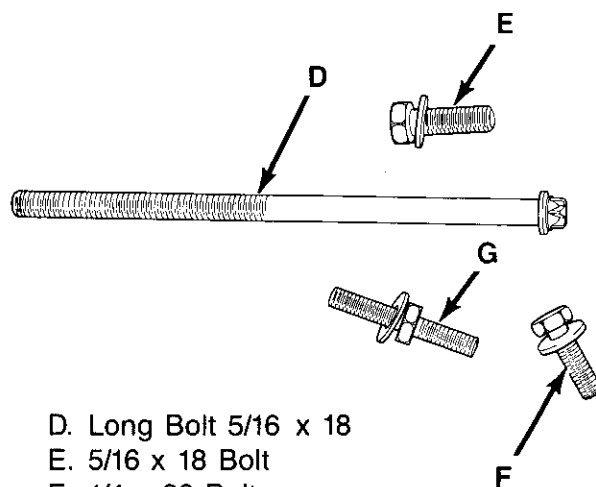
Apply a daub of Jeep/Eagle Gasket-in-a-Tube where the side rail gasket meet the seals.

Ensure all connecting rod nuts, main bearing cap bolts, oil pump mounting bolts and timing chain tensioner bolts are torqued to specifications.

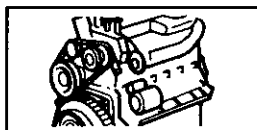
Install the oil pan and pull the pan back against the MOT ML.04 brackets.



Install bolts D, E, F, and G at positions D, E, F, and G as shown.

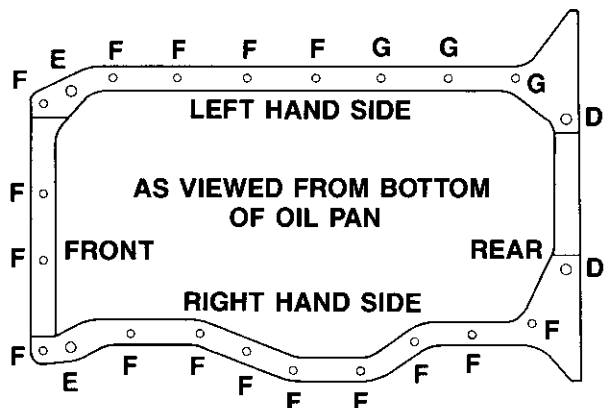
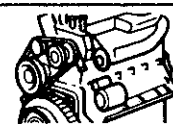


- D. Long Bolt 5/16 x 18
- E. 5/16 x 18 Bolt
- F. 1/4 x 20 Bolt
- G. Stud Bolt 1/4 x 20



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



2756

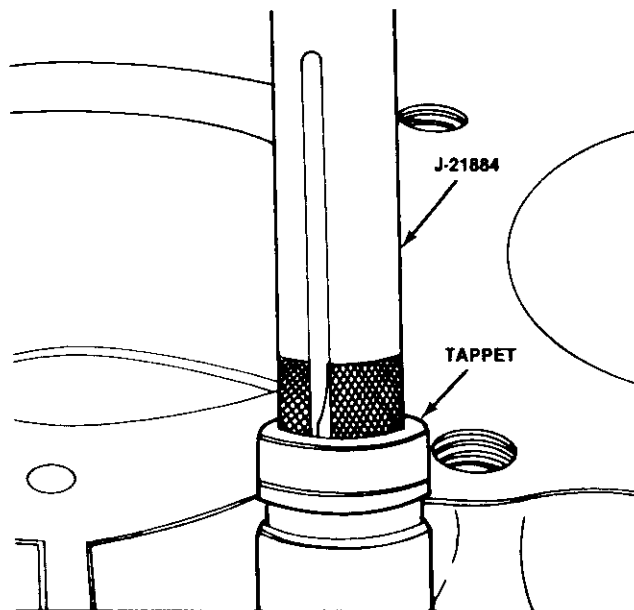
Torque all oil pin mounting bolts to 7 ft-lbs torque.

Remove the MOT ML.04 alignment plates.

Valve Tappet Installation

Dip each tappet assembly in Jeep/Eagle Super Oil Conditioner or equivalent.

Use hydraulic valve tappet removal Tool J-21884 to install each tappet in the original bore.



41890A

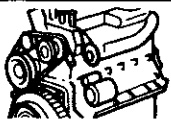
CYLINDER HEAD AND CYLINDER HEAD GASKETS

1984-87 2.5L engines use different cylinder head gasket than 1988 2.5L engines. The two gaskets are N.O.T. interchangeable and require different bolt tightening torques.

1984-1987 Engines

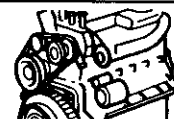
1984 through 1987 2.5L liter engines use a stamped steel cylinder head gasket. Apply an even coat of Jeep/Eagle Gasket Sealing Compound to both sides of the new head gasket and install it with the word 'TOP' facing the cylinder head.

Install the cylinder head and tighten the bolts according to the proper tightening sequence listed below.



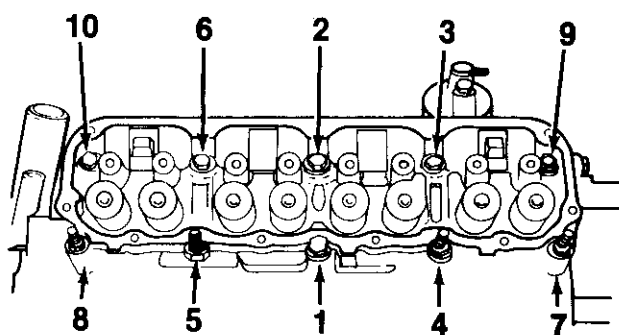
2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



NOTE: Coat the threads of the stud bolt in the number 8 sequence position with Loctite Pipe Sealant with Teflon 592 (or equivalent).

Tighten all bolts in this sequence.



83126

Torque all bolts to 34 N•m (25 ft-lbs).

Torque all bolts to 68 N•m (50 ft-lbs).

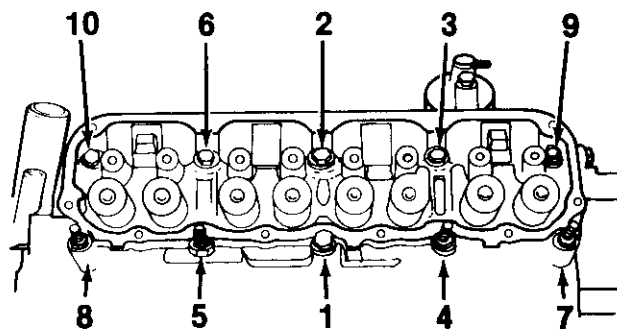
NOTE: During the final tightening bolt 8 is tightened to a lower torque than the other bolts.

In sequence torque bolts 1 through 7 to 115 N•m (85 ft-lbs), bolt 8 to 100 N•m (75 ft-lbs) bolts 9 and 10 to 115 N•m (85 ft-lbs).

1988 Engines

1988 2.5 liter engines use a composition cylinder head gasket that is installed dry, WITHOUT any gasket sealing compound. Install the head gasket with the word "top" facing the cylinder head.

Install the cylinder head and tighten the bolts according to the proper sequence listed below.



83126

NOTE: Coat the threads of the bolt in position number 8 with Loctite Pipe Sealant with Teflon 592 (or equivalent).

Tighten all bolts to 30 N•m (22 ft-lbs) torque.

Tighten all bolts to 61 N•m (45 ft-lbs) torque.

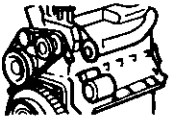
Recheck all bolts to verify they are set at 61 N•m (45 ft-lbs) torque.

NOTE: During the final tightening bolt 8 is tightened to a lower torque than the other bolts.

In sequence, tighten bolts 1 through 7 to 149 N•m (110 ft-lbs), bolt 8 to 135.5 N•m (100 ft-lbs) and bolts 9 and 10 to 149 N•m (110 ft-lbs).

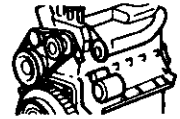
Install the spark plugs.

Tighten to 37 N•m (27 ft-lbs) torque.



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



Coat the balled ends of the push rods and the tops of the valve stems with Jeep/Eagle Super Oil Conditioner or equivalent.

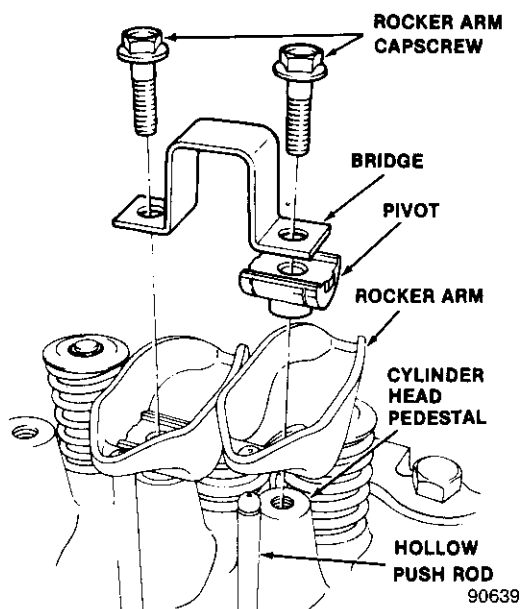
Install the push rods in original positions. Be sure the bottom end of each push rod is centered in the tappet plunger cap seat.

Coat the rocker arm pivots and the pivot contacting area of the rocker arms with Jeep/Eagle Super Oil Conditioner or equivalent.

Install the rocker arms, pivots and bridge above each cylinder from where they were originally removed.

Loosely install the cap screws through each bridge.

At each bridge, tighten the cap screws alternately, one turn at a time, to avoid damaging the bridge. Tighten to 19 ft-lbs (28 N•m) torque.



CYLINDER HEAD COVER INSTALLATION

1984-1986

A room temperature vulcanizing (RTV) silicone rubber sealant is required for this procedure. Use Jeep/Eagle Gasket-in-a-Tube, or equivalent.

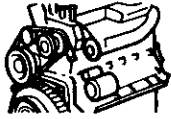
Remove sealant (or gasket and adhesive) from the sealing surface area of cylinder head and cover.

Thoroughly clean the sealing surface of cylinder head and cover.

Apply 3 mm (1/8 inch) bead of RTV sealant along entire length of the cylinder head sealing surface.

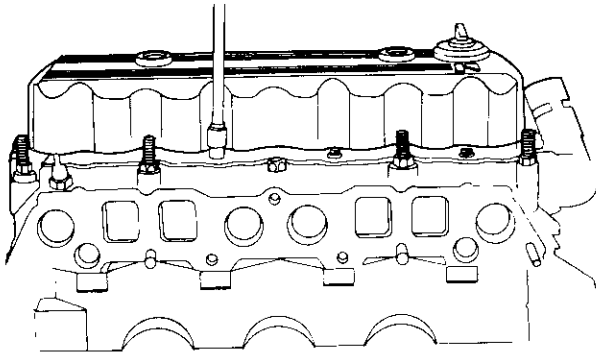
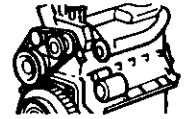
Before sealant begins to cure, install cover on cylinder head. Do not allow sealant to come into contact with rocker arms or other valve assembly components.

Install the cylinder head cover mounting bolts and tighten bolts with 6.2 N•m (55 in-lbs) torque.



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



83127

1987-1988

Install the cover on the cylinder head.

Tighten the mounting bolts to 6.2 N•m (55 in-lbs) torque.

INTAKE AND EXHAUST MANIFOLD ASSEMBLY

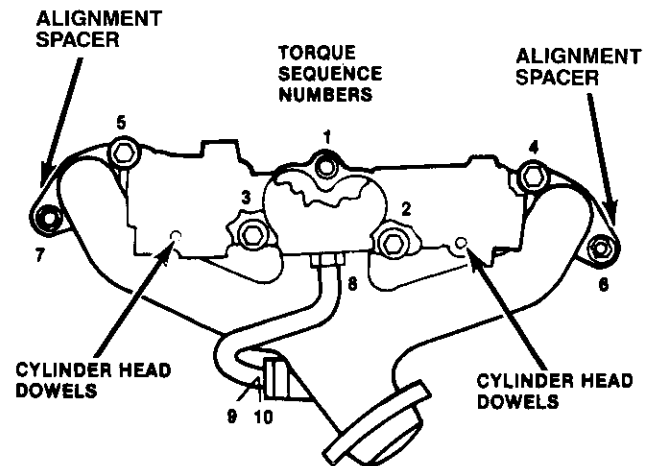
Loosely attach the EGR tube to the intake manifold and exhaust manifold. Do not tighten the fasteners at this time.

Install a new intake manifold gasket over the alignment dowels on the cylinder head.

Install new exhaust manifold spacers over the exhaust manifold mounting studs in the cylinder head.

Install the intake manifold/exhaust manifold/EGR tube assembly.

NOTE: Exhaust manifold must be centrally located over the end studs and spacer.



2757

Tighten bolt #1 to 40.5 N•m (30 ft-lbs) torque.

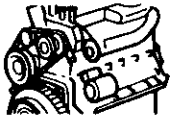
Tighten bolts 2, 3, 4, and 5 to 31 N•m (23 ft-lbs) torque.

Tighten nuts 6, 7, and 8 to 40.5 N•m (30 ft-lbs) torque.

Tighten Bolts 9 and 10 to 19 N•m (14 ft-lbs) torque.

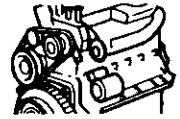
DISTRIBUTOR INSTALLATION

Rotate the engine until the number one cylinder piston is at top dead center (TDC) of the compression stroke.

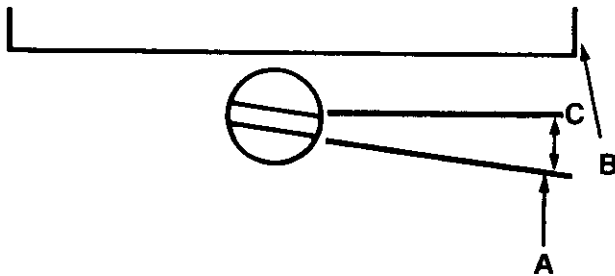


2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



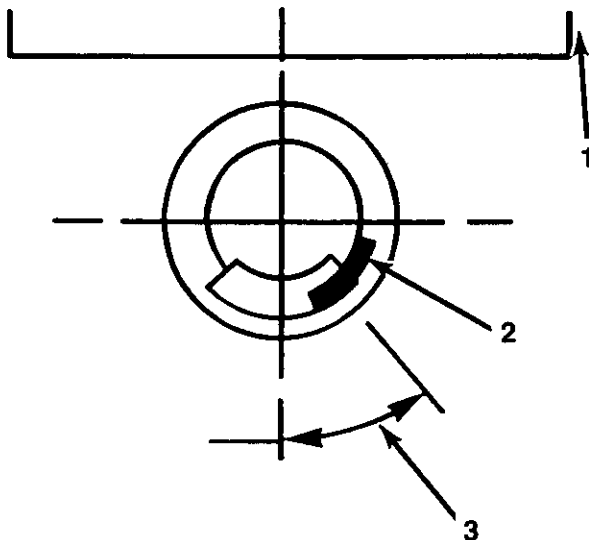
Using a flat blade screwdriver, rotate the oil pump gear so the gear slot (A) on the oil pump shaft is slightly past the 3 o'clock position.



- A. Oil Pump Gear Slot
- B. Right Hand Side of Engine Block
- C. 3 O'Clock Position

100697

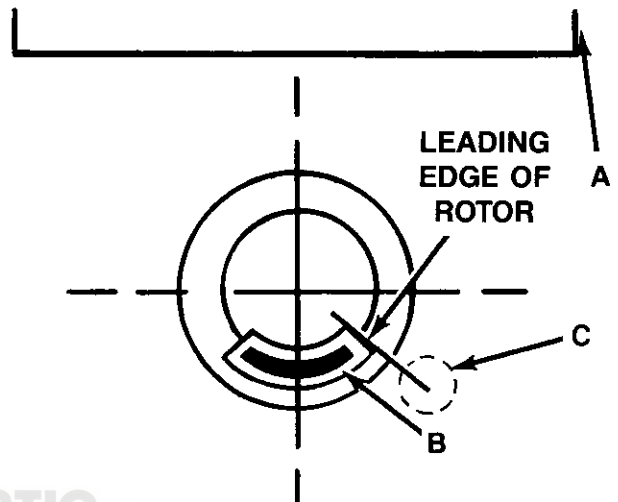
With the distributor cap removed, install the distributor with the rotor positioned at the 5 o'clock position.



- 1. Right Hand Side of Engine Block
- 2. Rotor Pre-Positioned
- 3. 5 O'Clock Position (Approx.)

100698

When the distributor is fully engaged in the proper position, the rotor should be at the 6 o'clock position. With the leading edge of the rotor in line with the tower (C) of distributor cap.



- A. Right Hand Side of Engine Block
- B. Rotor Position When Properly Installed
- C. Distributor Tower

100699

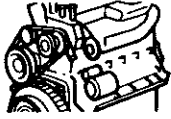
If the distributor is not properly installed or it is removed later, the installation procedure must be repeated.

FINAL ASSEMBLY

Install the water pump and gasket. Tighten bolts to 18 N·m (13 ft-lbs).

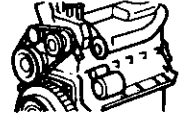
Lubricate the oil filter seal with clean engine oil.

Install the oil filter to engine. Tighten oil filter 3/4 of a turn after oil filter seal contacts the mating surface of the engine.



2.5L I-4 ENGINE OVERHAUL

ENGINE ASSEMBLY



If equipped, install the mechanical fuel pump and gasket. Tighten the bolts to 22 N•m (16 ft-lbs) torque.

Align key slot on the vibration damper with the crankshaft key and tap damper onto the crankshaft.

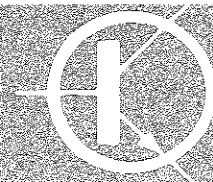
Install the vibration damper retaining bolt and washer. Tighten the bolt to 108 N•m (80 ft-lbs) torque.



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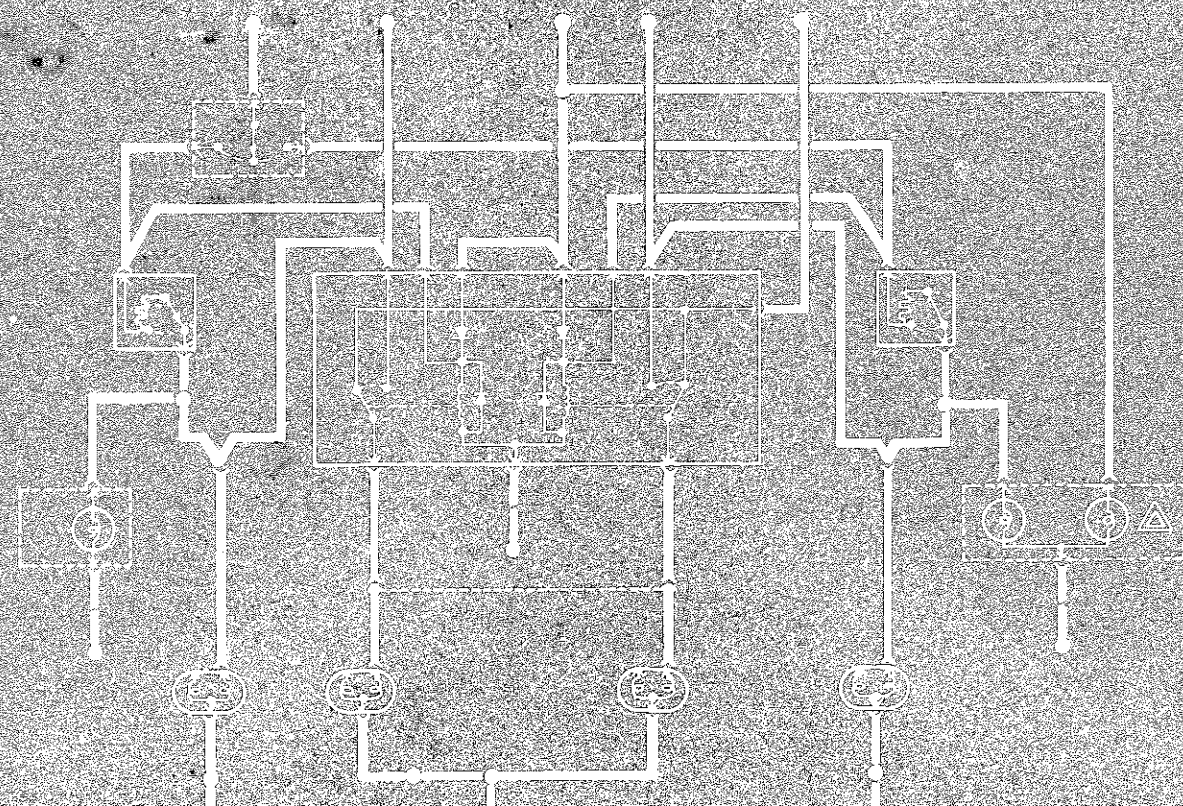
TROUBLESHOOTING



1987

WRANGLER/YJ

USA/Canada Edition 8980-010-325



WRANGLER / YJ

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INTRODUCTION

HOW TO USE THIS MANUAL

The Circuit Index lists the pages for each circuit. A description of how to read wire information, wire color codes and harness codes is shown below. The Component Locations, Connector Locations and Ground Locations are next to the circuit.

All Electrical components, wires, wire splices and grounds associated with each circuit are grouped together. The circuits are arranged so that current flows from positive, at the top of the page, to negative at the bottom of the page. (The conventional theory of current flow is used in this text.) The "hot labels" at the top of a fuse show the ignition switch position and fuse link that supply power to the fuse. All wires, connectors, switches and loads are shown in the flow of current to ground.

Within each circuit, all switches and sensors are shown "at rest," as though the ignition switch was off. Component names are placed near each component. Notes are included that describe how switches and other components work. Transistorized components are labeled "solid state." Some components are part mechanical and part solid state. In these components, both parts are shown to help you understand how the component works. Wiring inside complicated components has been simplified to help you understand the electrical operation of the component.

WIRE COLOR CODES					
CODE	COLOR	CODE	COLOR	CODE	COLOR
BLK	Black	GRY	Gray	VIO	Violet
BLU	Blue	ORN	Orange	WHT	White
BRN	Brown	PNK	Pink	YEL	Yellow
GRN	Green	RED	Red		

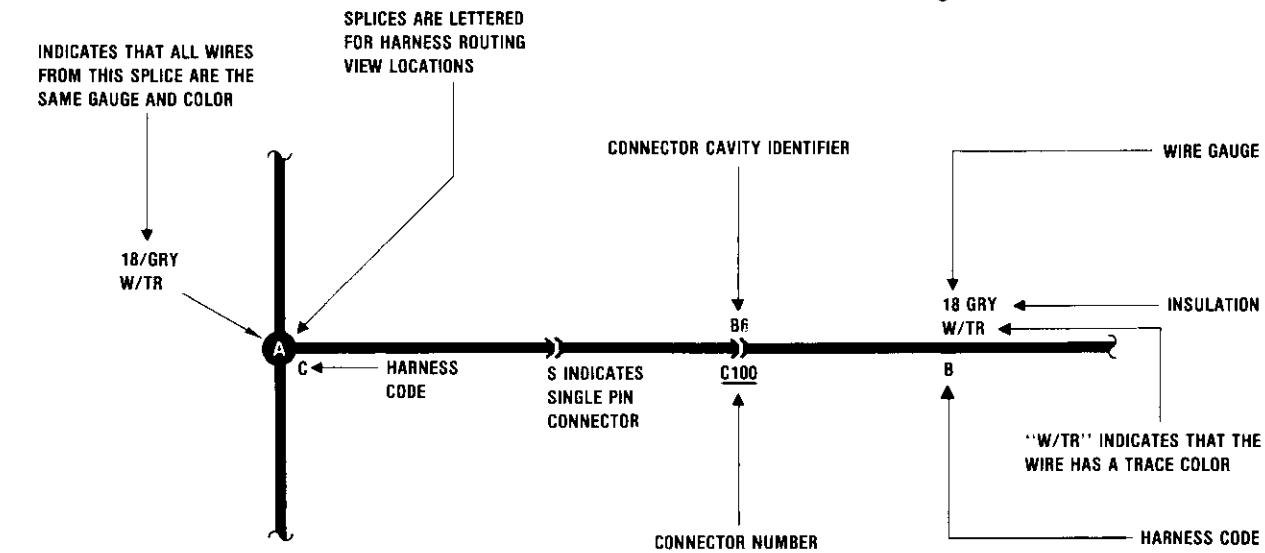
HARNESS CODES			
CODE	HARNESS	CODE	HARNESS
A	Alternator	EC	Engine Control
AC	Air Conditioning	FL	Front Lights
B	Body	H	Heater
BAT	Battery	IP	Instrument Panel
CC	Cruise Control	L	Liftgate
CL	Courtesy Lamps	T	Transmission
E	Engine	TL	Tail Lamps
		R	Roof

Wires that connect to another circuit are shown with an arrow head pointing in the direction of current flow. The name of the component that shares the wiring is provided. You can check shared wiring by checking the operation of the other circuits.

Also in the Manual are Component Connector Views, In Line Connector Views, and Ground Distribution Schematics. These will aid troubleshooting and support the troubleshooting charts provided in this manual.

You can use common connections at the power source, or the ground, to speed your troubleshooting. If the ground schematics or the power distribution shows that an inoperative circuit and a second circuit share a fuse, check the operation of the second circuit. If the second circuit works, you know the fuse is good and that the voltage is available to the inoperative circuit. You can then continue troubleshooting.

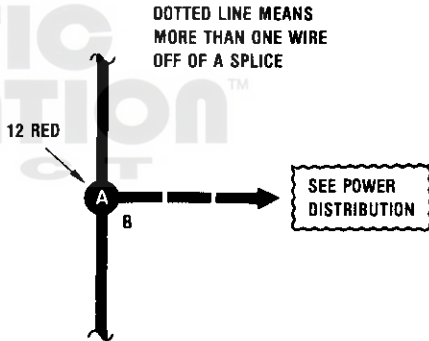
The circuit descriptions in the manual provide additional information about the circuits and troubleshooting hints. The flow of current is often used to describe the circuit operation. By following the schematic of the circuit as you read the circuit description, you can understand how the circuit works.



TROUBLESHOOTING CHARTS

Fault isolating is in the form of troubleshooting charts. For quick and accurate diagnosis, the charts are divided into a numerical sequence. Each numbered chart represents a circuit component or a portion of the circuit wiring. Following the numbered sequence is important because the numbers represent the ease of accessibility of components or wiring. In many cases, specific instructions will follow the numbered component. Follow these instructions carefully, the accuracy of the test results depends on a proper setup.

For example, voltmeter and ohmmeter checks are made from wiring terminals to a clean chassis ground. When making checks, it is important to confirm the ground connection. After connecting the negative lead, continuity can be checked by touching the positive lead to ground.



SIX-STEP TROUBLESHOOTING PROCEDURE

A. GENERAL INFORMATION

The vehicle technician is like a doctor. When you feel ill, you describe your feelings to a doctor. When you do this, you are giving him *symptoms*. The doctor makes a few checks (*pulse, temperature, etc.*), analyzes the results, and concludes what is wrong with you.

The car's electrical system is like your nervous system. When a customer comes in and says, "*The horn doesn't blow,*" he is giving the technician a symptom. The technician must make other checks, analyze the results, and then conclude what the problem is.

A good troubleshooting procedure simplifies finding troubles. The *six-step troubleshooting procedure* saves time and effort and aids in finding the trouble. There are *six* logical steps that should be followed:

STEP 1: VERIFY THE COMPLAINT. Does the problem exist? Check it to see whether or not it does. Note the *symptoms*.

STEP 2: DETERMINE RELATED SYMPTOMS. Most of the circuits in a car are connected to other circuits at one point or another. Related symptoms can be found easily by conducting *operational checks* on these other circuits. Operational checks are made without the use of test equipment.

STEP 3: ANALYZE THE SYMPTOMS. Use *schematics* to isolate the problem area. Determine *what* checks to make, and *where* to make them. Develop a *plan*.

STEP 4: ISOLATE THE TROUBLE. Using the schematic, test equipment, and a logical plan, *find* the trouble.

STEP 5: CORRECT THE TROUBLE. *Repair* the trouble, or *replace* the faulty part.

STEP 6: CHECK FOR PROPER OPERATION. See if the circuit works the way it is supposed to.

B. SPECIFIC DEFINITIONS AND EXAMPLES

STEP 1: VERIFY THE COMPLAINT. If a customer complains of a specific problem, the first thing you should do is find out if the problem really exists. Let's say the customer complains the horn doesn't work. You should then *verify the complaint* by pushing down the horn ring and listen for the *beep*. This action of depressing the horn ring is called an *operational check*. When you perform operational checks you are looking for *symptoms*; both *positive* and *negative*.

Positive Symptoms are symptoms which are *correct*. For example, the radio plays when the radio switch is turned on.

Negative Symptoms are symptoms which are *incorrect*. For example, the horn does not blow when the horn ring is depressed.

If you are in doubt as to how a circuit operates, refer to the schematic and circuit operation. The layout of the schematic simplifies all circuit operations. Circuits can be traced in a matter of seconds.

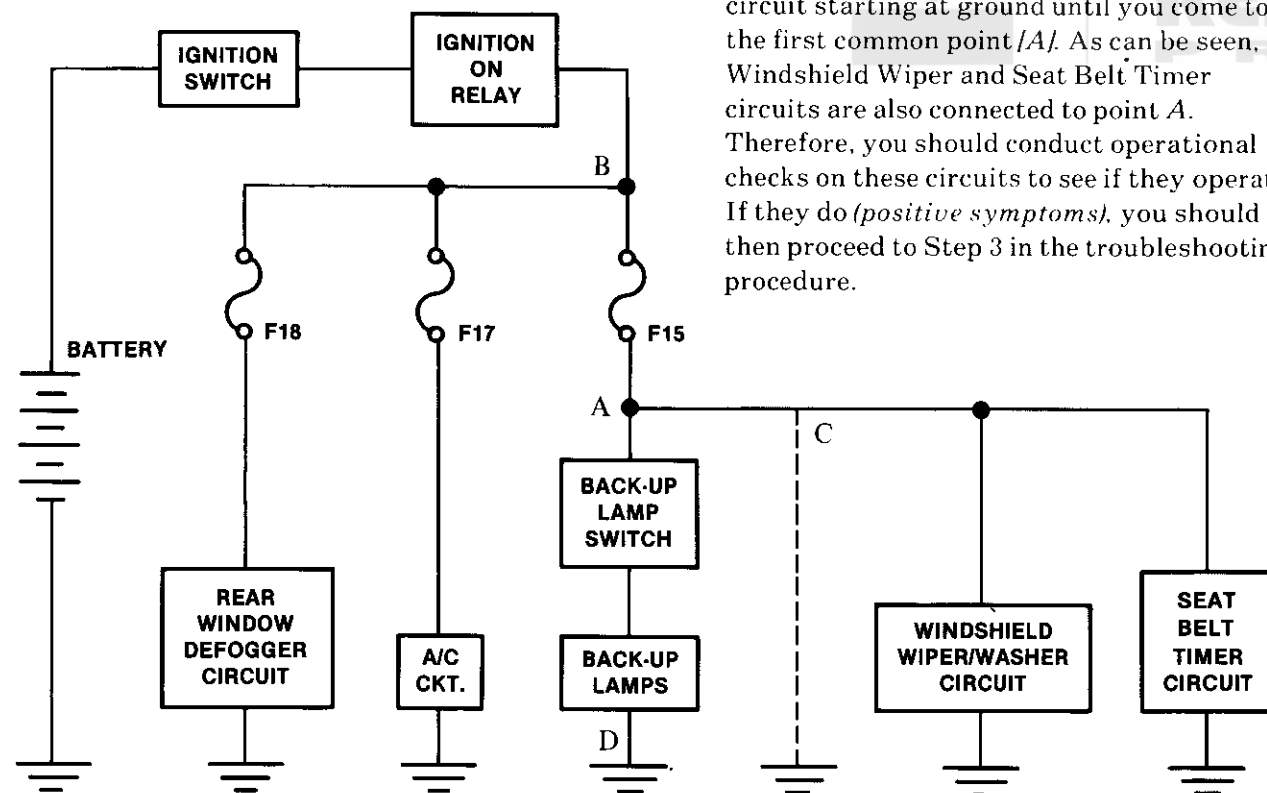


Fig. 1

Sometimes the problem may be intermittent (*momentarily present and not present*). If so, road test vehicle, and if possible, have the customer show you what happens. Try to duplicate the conditions in order to make the trouble appear. You cannot find a problem if everything works normally. When the problem occurs, note the symptoms. Remember! Make sure of both the *positive* and *negative* symptoms. They are both important.

STEP 2: DETERMINE RELATED SYMPTOMS.

Determining related symptoms is a very important step. It will save you much time in the long run. In order to get additional information about where the problem exists, *related symptoms* are found by conducting *operational checks* on circuits which are connected to the problem circuit. Operational checks are made *without* the use of test equipment. Your most important tool will be the *schematic*. For example, refer to Fig 1. If the customer complaint was that the Back Up Lamps didn't work, you would trace the circuit starting at ground until you come to the first common point [A]. As can be seen, the Windshield Wiper and Seat Belt Timer circuits are also connected to point A. Therefore, you should conduct operational checks on these circuits to see if they operate. If they do (*positive symptoms*), you should then proceed to Step 3 in the troubleshooting procedure.

If the circuit did not operate, you would then continue tracing the circuit toward the Battery until you reach the next common point [B]. The A/C and Rear Window Defogger circuits are connected to point B. Therefore, you should check to see if they operate. If they do, you would then proceed to Step 3.

STEP 3: ANALYZE THE SYMPTOMS.

1. Localizing the Trouble:

After conducting operational checks (*Step 2*), the trouble will always lie between a check which resulted in *negative* symptoms, and a check which resulted in a *positive* symptom. Consider the following examples (*refer to Fig 1*):

EXAMPLE 1: If the Back Up Lamps did not operate, but the Windshield Wiper did, the trouble would lie between point A and ground at the Back Up Lamps.

EXAMPLE 2: If the Back Up Lamps, Windshield Wiper, and Seat Belt Timer didn't operate, but the A/C and Rear Window Defogger did, the trouble would lie between point B and ground.

In *Example 1* above, the trouble would be an *open*, since a short would have caused Fuse F15 to open, and the Windshield Wiper and Seat Belt Timer would not operate.

In *Example 2* above, the trouble may be a *short*. Fuse F15 may have opened due to a short in either the Back Up Lamps, Windshield Wiper/Washer, or Seat Belt Timer circuits.

Electrical problems are mainly caused by either *open* or *short* circuits.

2. Open Circuits.

An open circuit is like an open switch. It interrupts the flow of current. An open circuit has an infinite resistance; therefore, no current will flow. Open circuits can be caused by broken wires, parts going bad, loose connections, (like ground screws), and by foreign matter being stuck between contacts.

3. Short Circuit.

A short circuit allows excessive current to flow in a circuit because of the resistance of the circuit going to zero ohms, which usually results in a blown fuse.

4. Intermittent Open Circuits.

This condition can be caused by a piece of dirt becoming momentarily caught between two contacts. In the case of rubber disconnects, excessive rubber could be spilled over into the pins. Other causes could be loose connectors, resulting in poor terminal contact.

5. Intermittent Short Circuits.

This condition can be caused by a frayed wire momentarily touching another wire. A slight bump can cause contact to be made, then broken.

6. Symptoms of Short Circuits [*refer to Fig. 1*]:

A short between points C and D will cause Fuse F15 to blow (*open*). Therefore, the Back Up Lamps, Windshield Wiper/Washer, and Seat Belt Timer circuits will not work.

7. Determine a Plan.

When analyzing symptoms, there are three things to consider:

- What goes wrong most of the time? Some parts receive more use than others and therefore wear out sooner. Other parts are subjected to corrosion such as grounds, while others are just natural trouble spots.
- Check parts which are closest to you. This will save time. Simple tests should be made first.
- How difficult the parts are to get to in order to perform checks on them determines the order in which they are checked. Leave the more difficult places until last. There is no substitute for common sense.

8. Test Equipment.

In developing a strategy to isolate the problem, 3 meters and jumper wires could be used (see following page). Above each meter is a short explanation of their purpose, and how each meter is used.

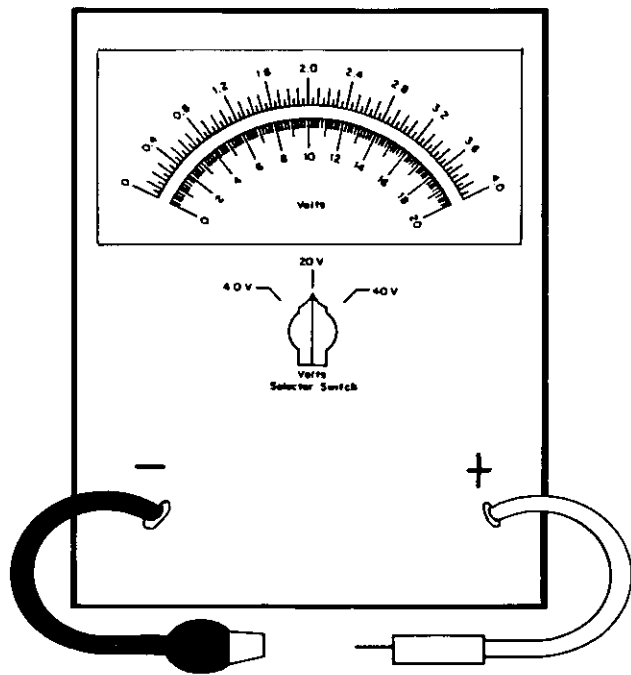
A. **VOLTMETER**—Voltmeters are usually made to measure a wide range of voltages. There are two leads. The *red* lead is *positive* and is connected to the voltage source. The *black* lead is *negative* and is connected to ground. Voltmeters, like test lights, are always connected in *parallel* with the circuit being tested.

B. **AMMETER**—Ammeters are used to measure the amount of current. They are always connected in *series* with the circuit. There are two leads. The *red* lead (*positive*) is connected towards the voltage source. The *black* lead (*negative*) is connected towards ground. Remember, the circuit has to be opened and the ammeter is inserted in *series*.

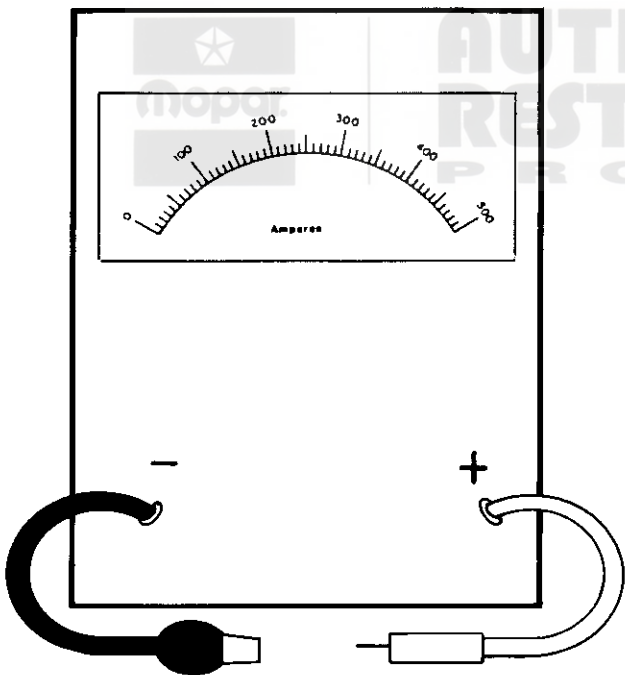
C. **OHMMETER**—Ohmmeters are used to measure resistance. The following procedure is recommended:

- 1) Disconnect the source of voltage from the resistance being tested.
- 2) Bring the test leads together and adjust the *zero adjust* knob until the needle reads *zero*. If unable to adjust to zero, replace the internal battery.
- 3) Connect the leads, one on each side of the resistance. Multiply the *meter reading* by the *multiplier setting* in order to read the resistance.

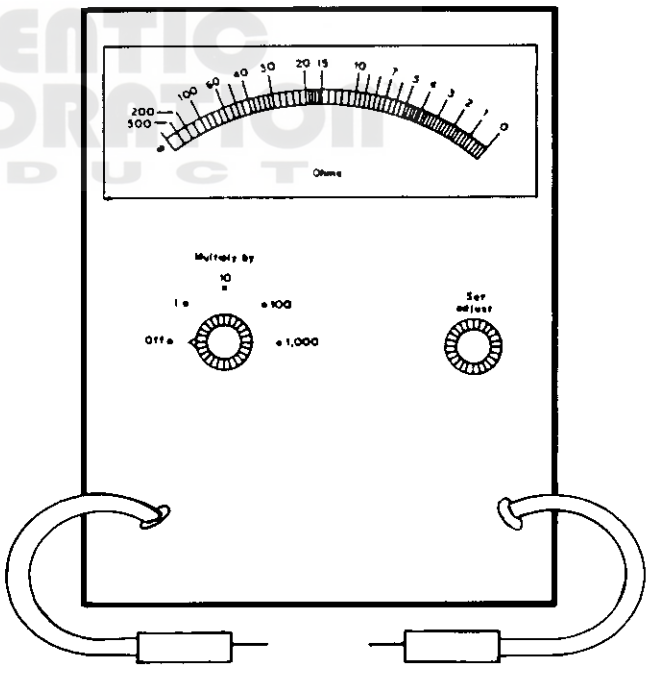
D. **JUMPER WIRES**—Jumper wires are used to bypass a part of a circuit between two points. They can be used to bypass the entire circuit by jumping (*connecting*) from the Battery to the parts. Jumpers can also be used as an extension for the test lights.



Voltmeter



Ammeter

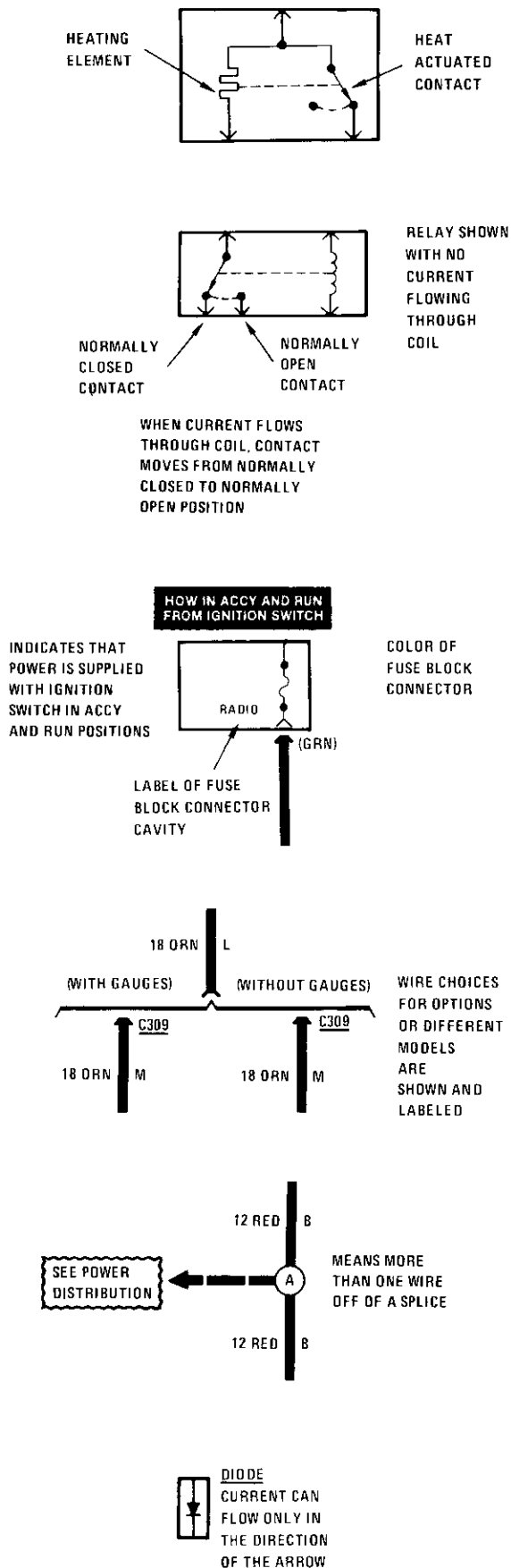
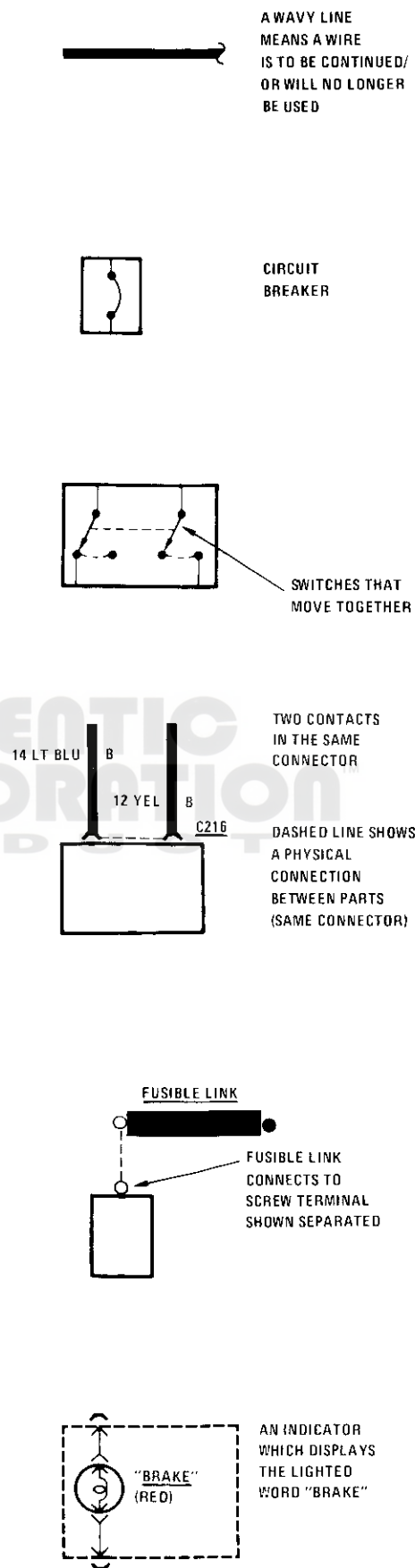
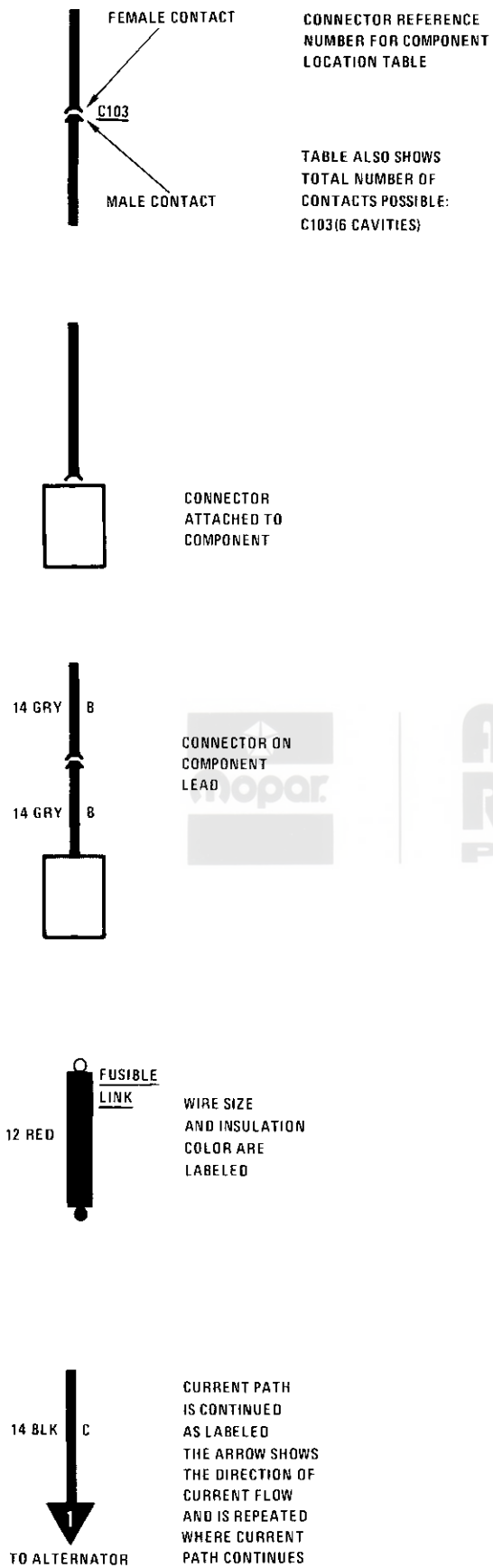
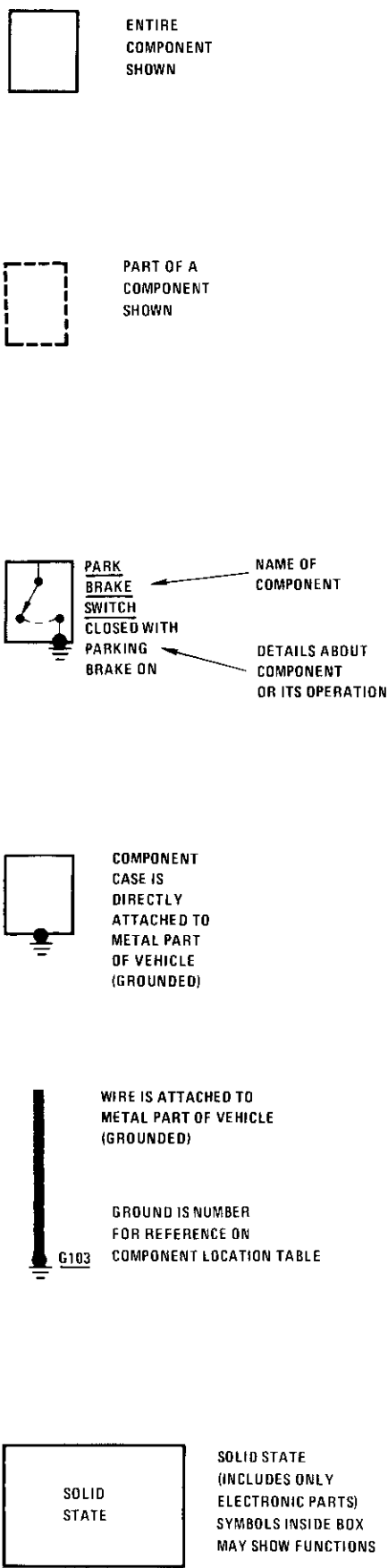


Ohmmeter

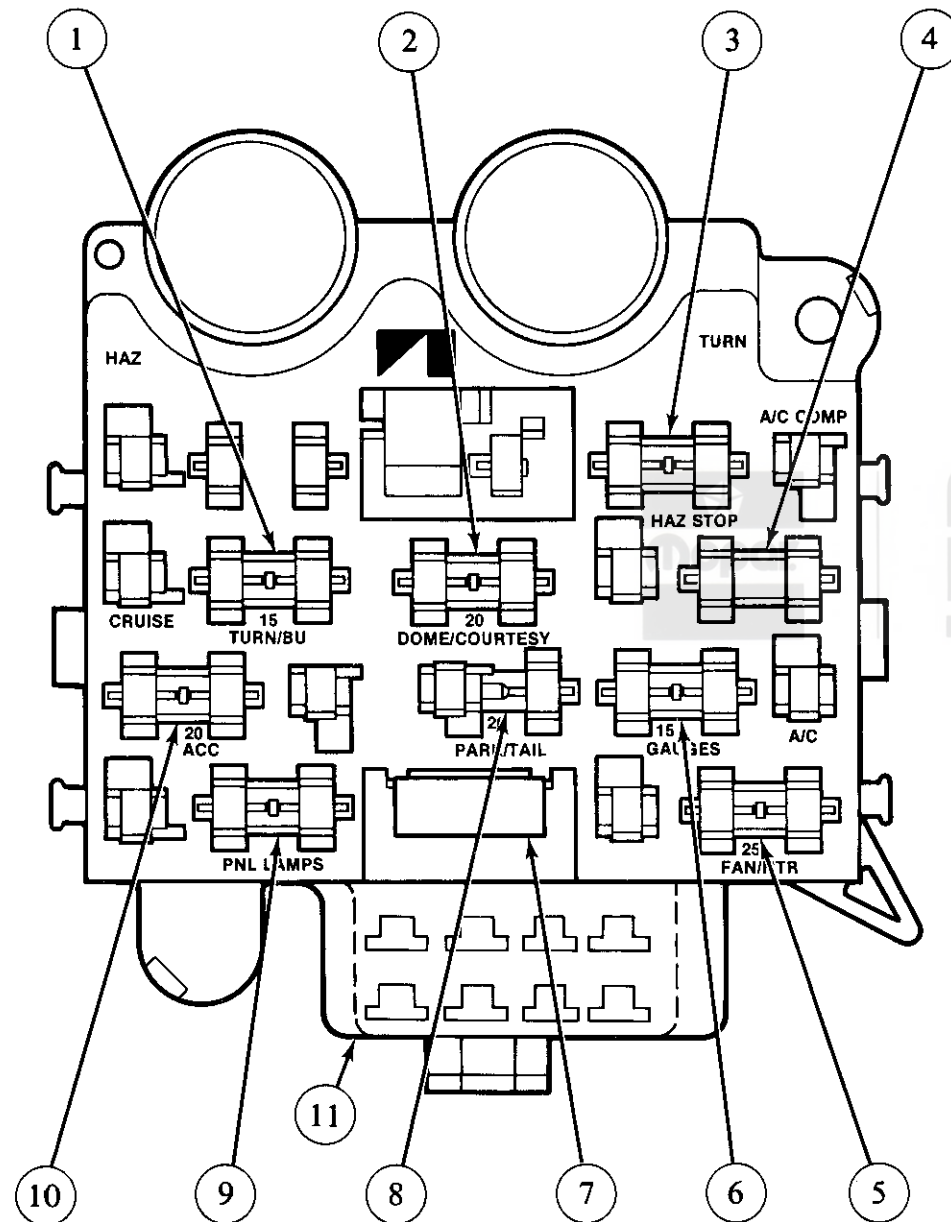
METRIC SIZE	AWG SIZES
.22	24
.35	22
.5	20
.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8
13.0	6
19.0	4
32.0	2

Wire Size Conversion Table

SYMBOLS



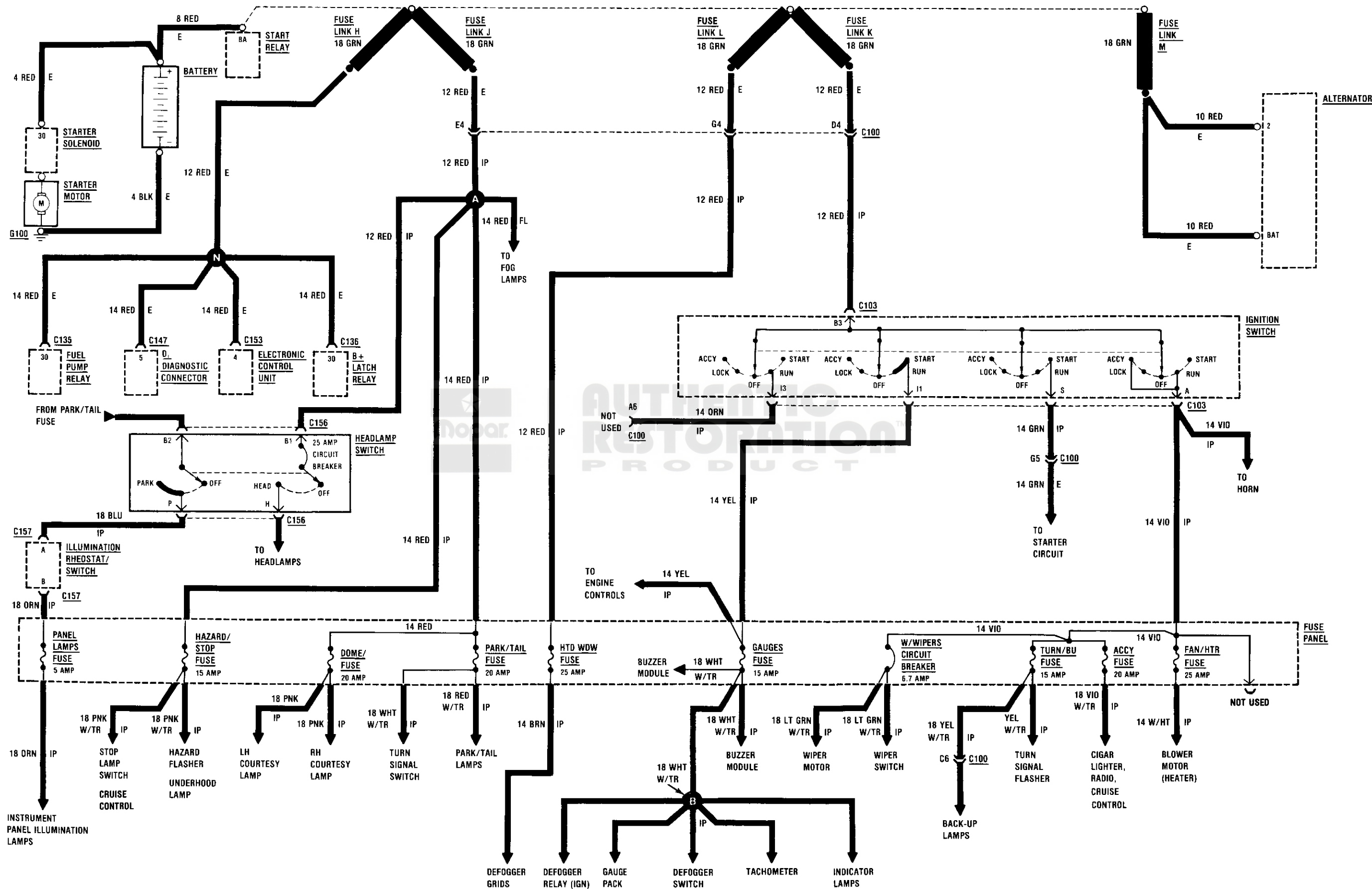
FUSE PANEL



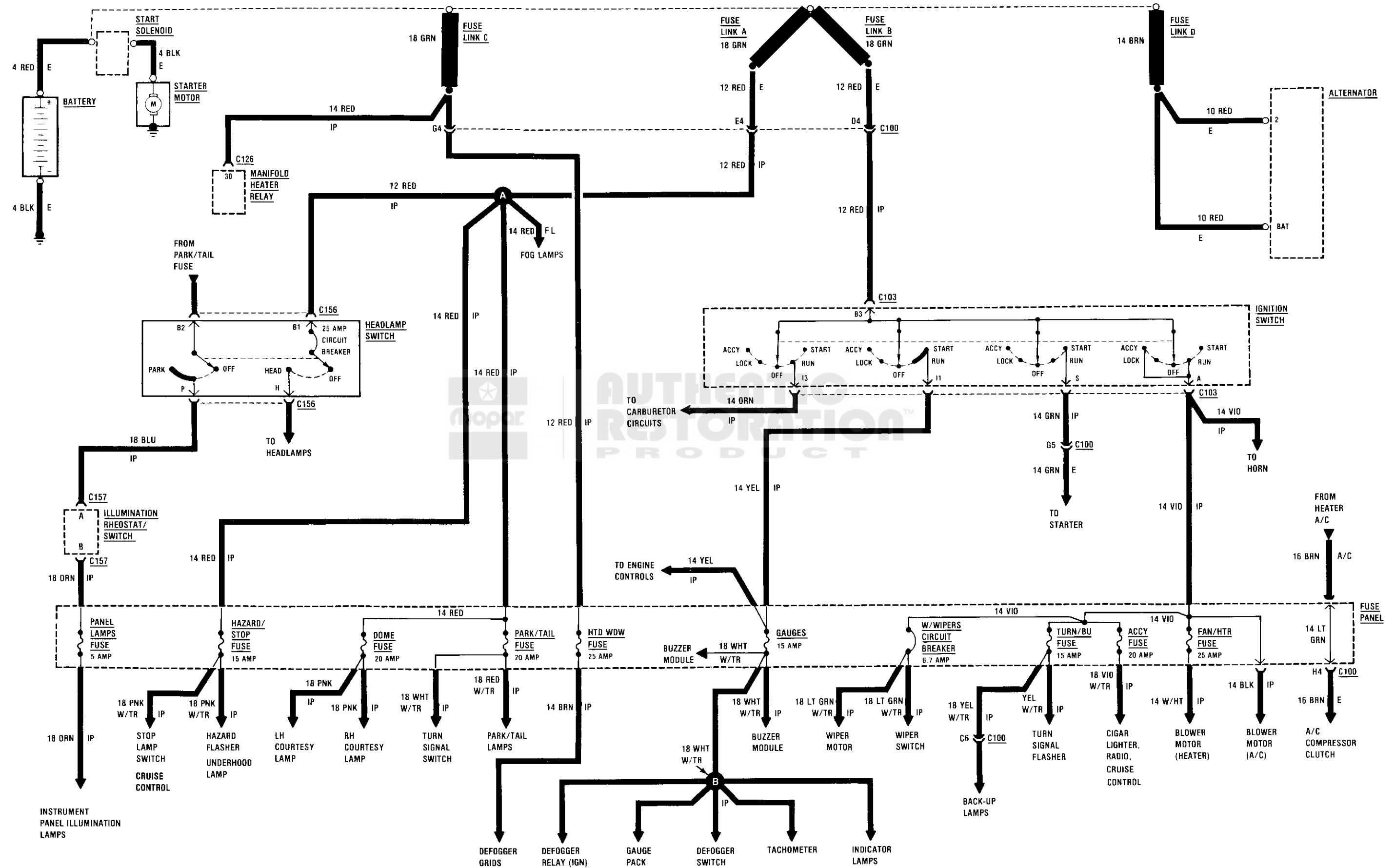
FUSE PANEL DATA

ITEM	IDENTIFIER	COLOR/RATING	CIRCUITS PROTECTED
1	TURN/BLU	Light Blue/15 AMP	Turn Signal Lamps Backup Lamps
2	DOME	Yellow/20 AMP	Courtesy Lamps Cargo Lamp
3	HAZ STOP	Light Blue/15 AMP	Hazard Lamps Stop Lamps
4	HTD WDW	White/25 AMP	Rear Window Defogger Grids
5	FAN/HTR	White/25 AMP	Heater Blower Motor
6	GAUGES TM	Light Blue/15 AMP	Key Buzzer Defogger Relay Gauge Pack Defogger Switch Tachometer Indicator Lamps
7	W/WIPERS	6.7 AMP Circuit Breaker	Windshield Wiper Switch and Motor
8	PARK/TAIL	Yellow/20 AMP	Turn Signal Switch Park Lamps Taillamps
9	PNL LPS	Tan/5 AMP	Instrument Panel Illumination Lamps
10	ACC	Yellow/20 AMP	Cigar Lighter Radio Cruise Control
11	Buzzer Module	_____	_____

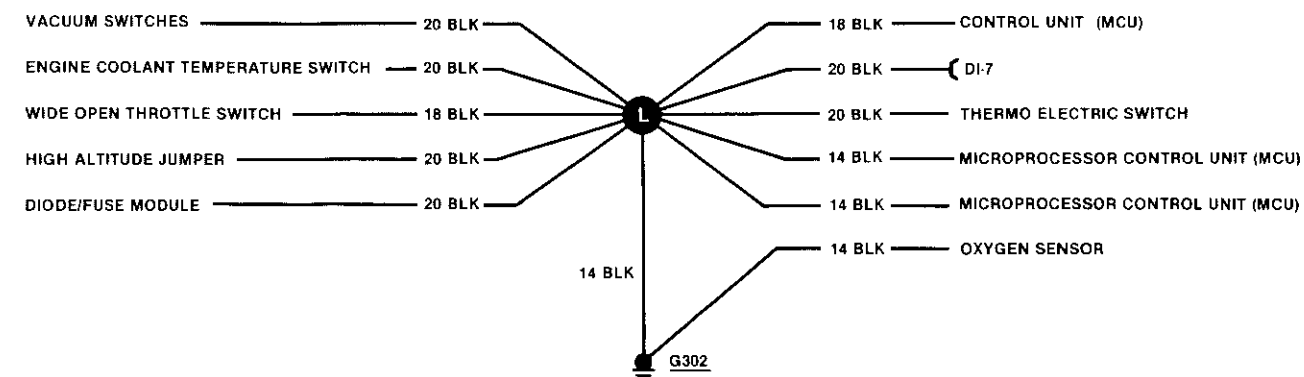
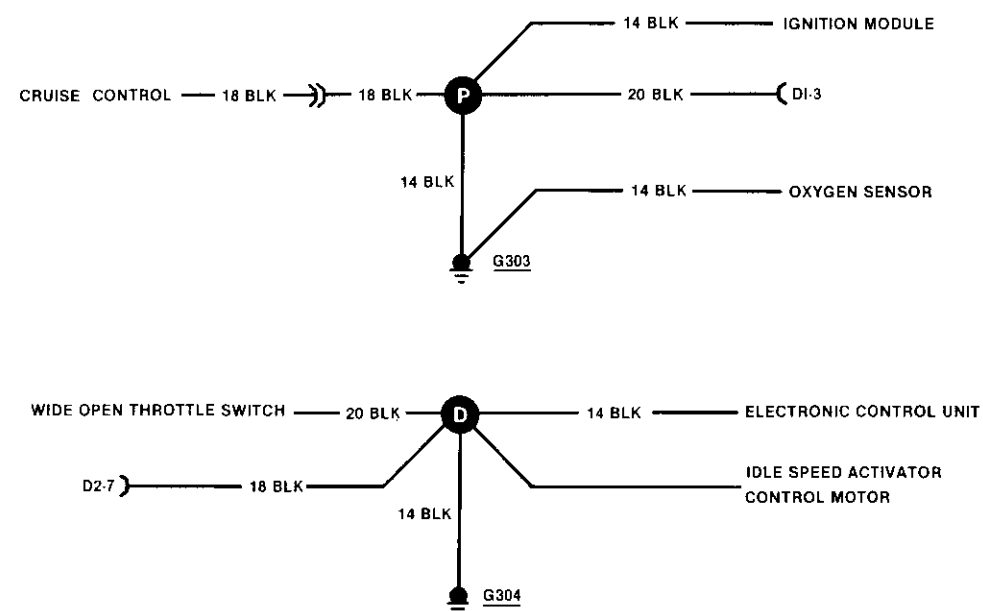
POWER DISTRIBUTION—2.5L ENGINE



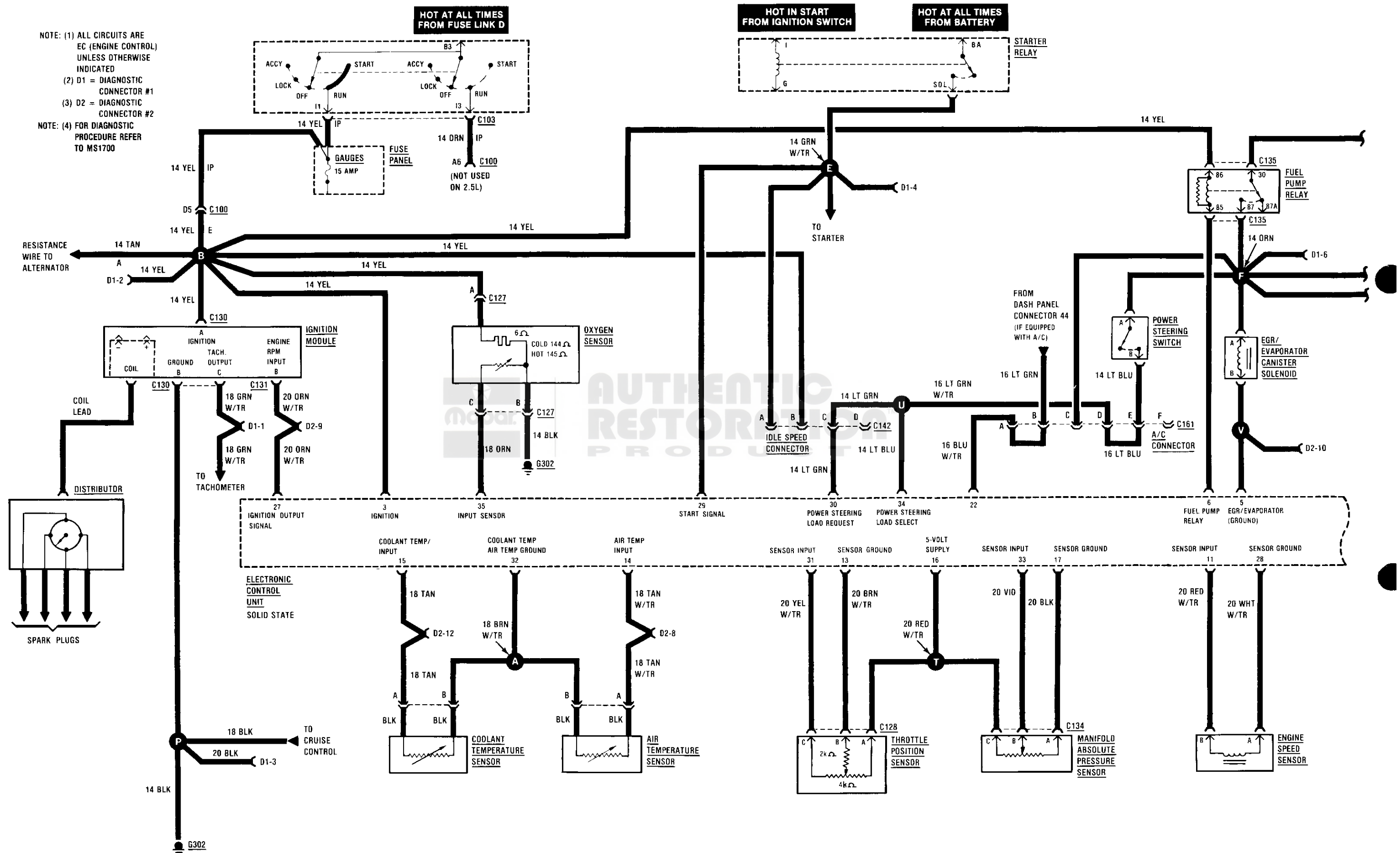
POWER DISTRIBUTION—4.2L

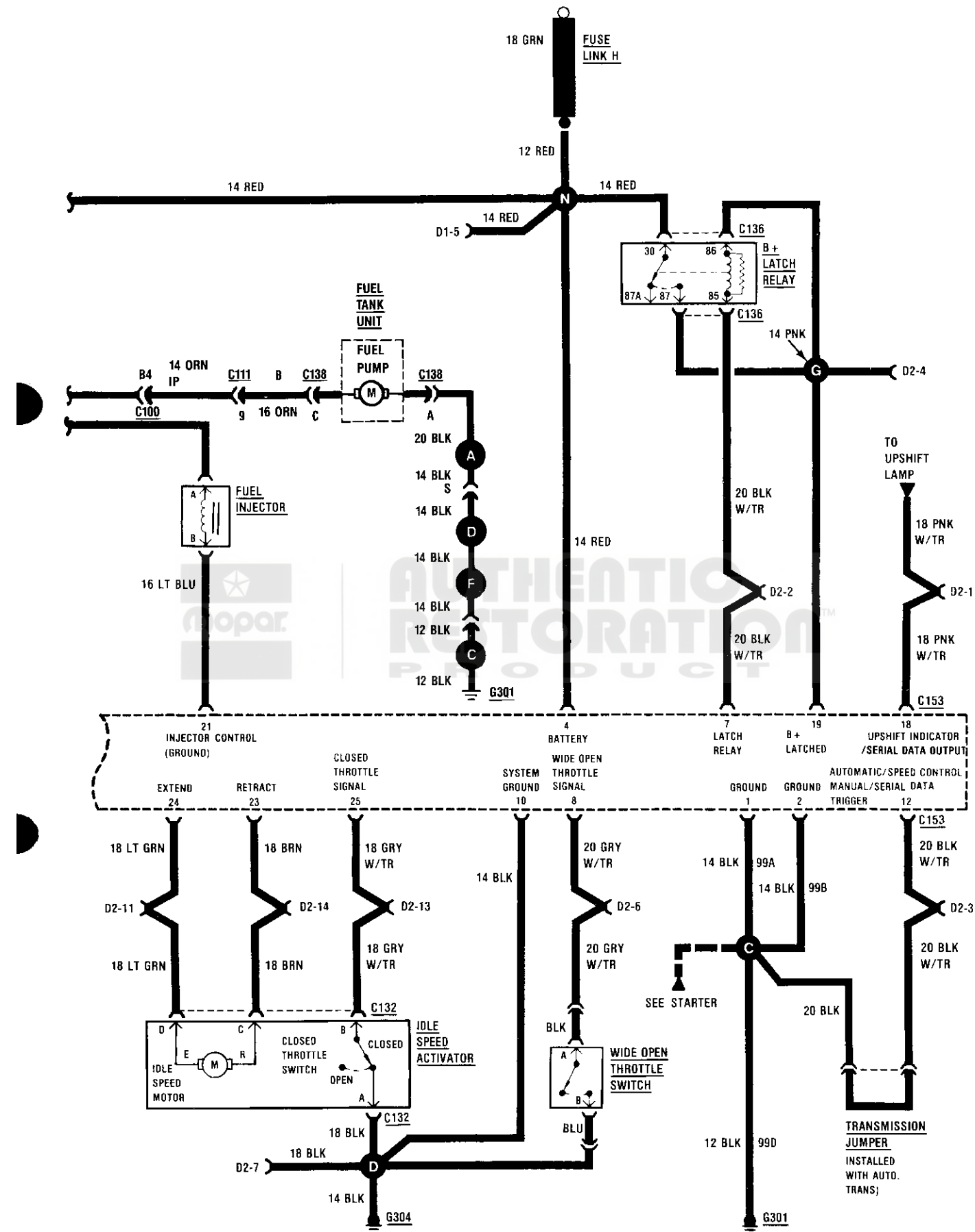


Ground Distribution 9

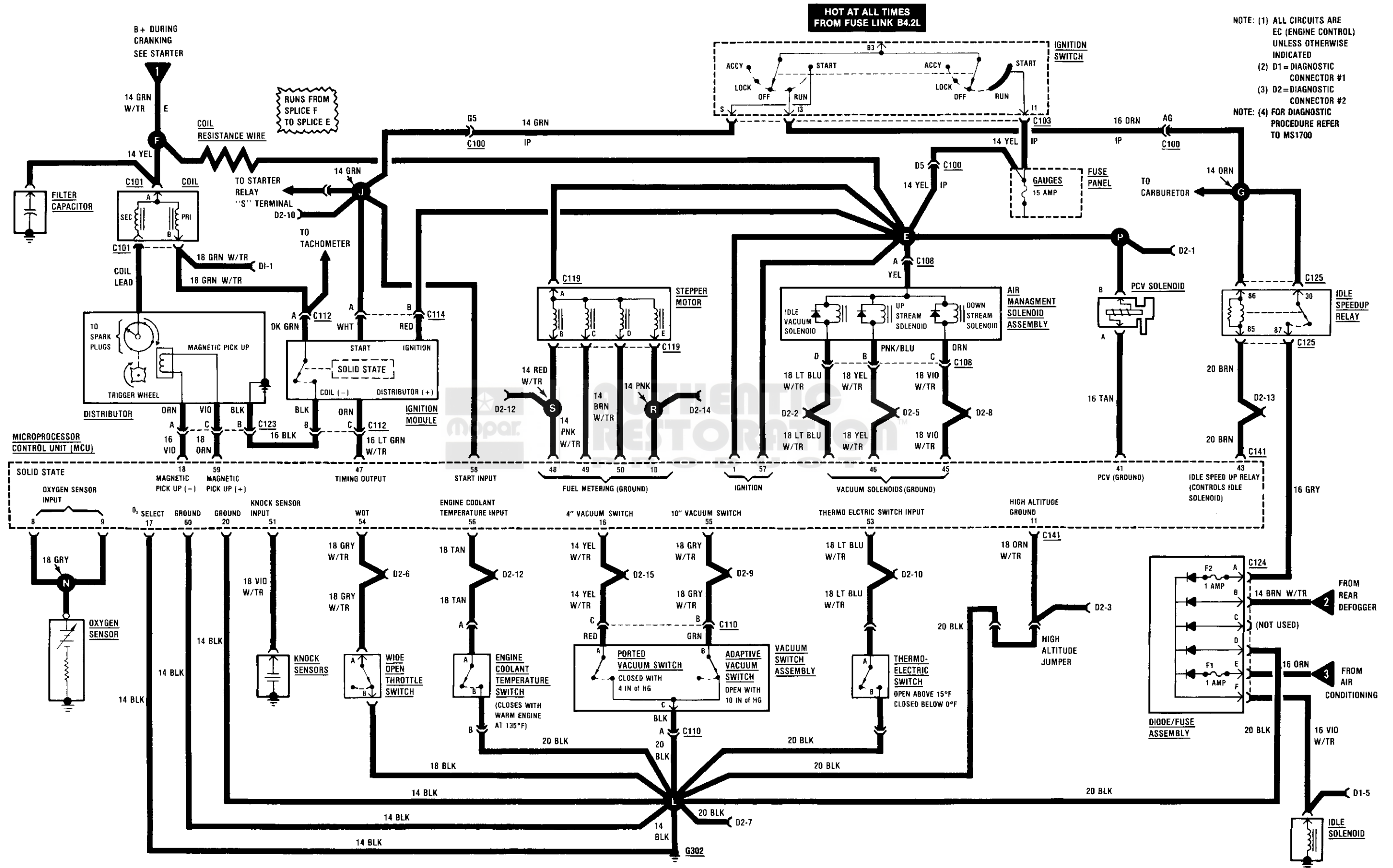


ENGINE CONTROLS—2.5L





ENGINE CONTROLS—4.2L



STARTER

DESCRIPTION

2.5L STARTER MOTOR

The positive battery cable bolts directly to the starter solenoid contact 30. When the ignition switch energizes the starter relay battery power will pass through the relay contacts to terminal 50 of the starter solenoid. Momentary high current through the pull in windings will connect terminal 30 to the starter motor windings. During engine cranking a lower current will travel through the hold in windings, which will allow maximum battery power to the starter motor armature.

There are no field windings in the Bosch starter motor, instead six permanent magnets are used to provide excitation.

Complete starter motor service is outlined in M.R. 279.

The starter relay will not energize until voltage at terminal 1 and ground terminal G (G301) conditions are met.

4.2L STARTER MOTOR

When terminal S of the starter solenoid is energized by the ignition switch. Power from the battery will pass through the heavy contacts in the starter solenoid to the starter motor. Power within the starter motor is divided into the field winding, armature and hold in windings. The bendix clutch is momentarily thrown into the ring gear by a movable pole shoe and one of the field windings, and during cranking is held in by the hold in windings.

Starter motor service information can be found in M.R. 279.

With a manual transmission, the starter solenoid is case grounded, (mounting screws). With an automatic, ground is provided from terminal G through the park/neutral switch when park and neutral positions are selected.

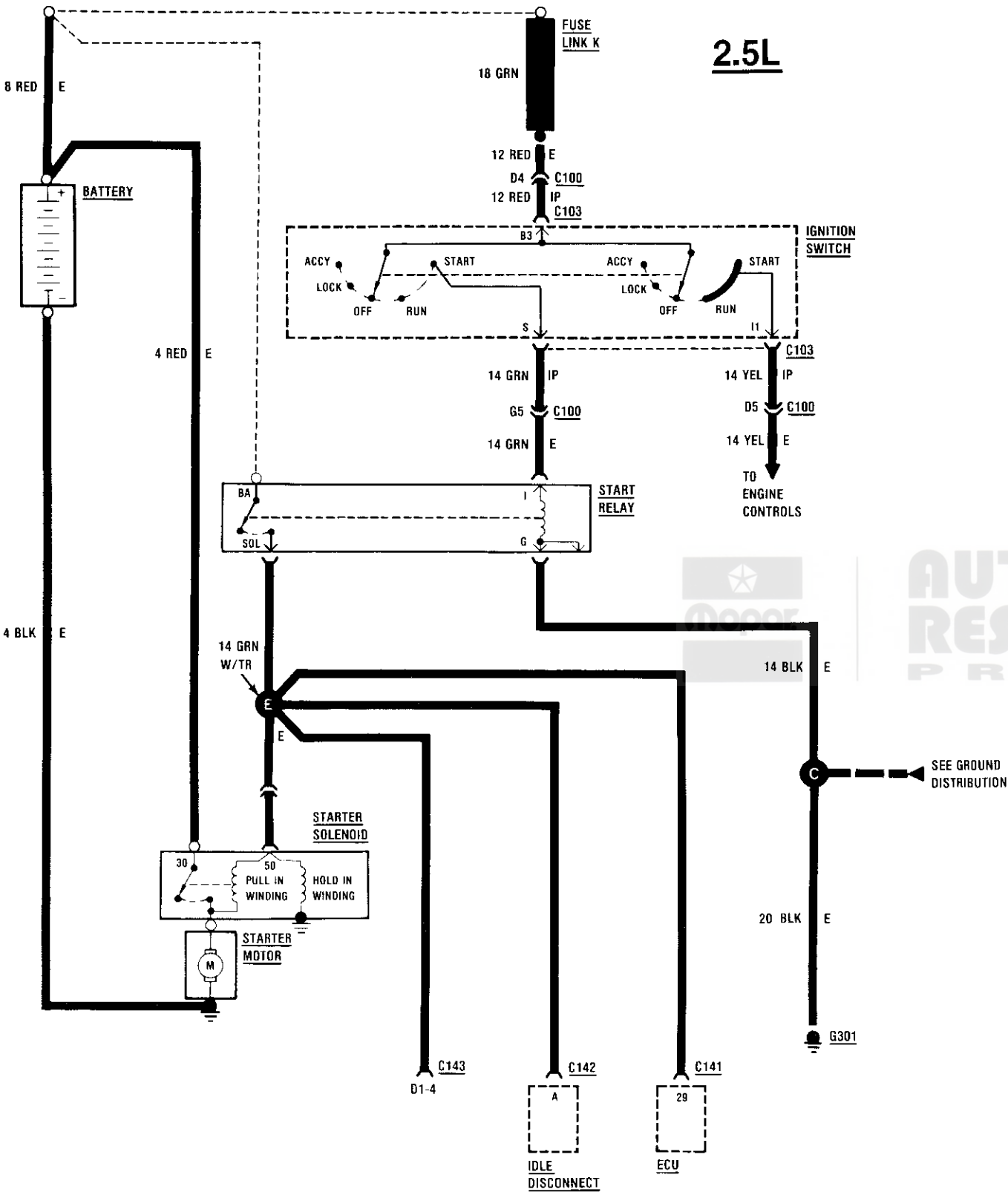
TROUBLESHOOTING

NOTE: The following diagnostic procedures are for a no starter engagement condition. For clicking relay, slow, cranking and other conditions refer to MR279.

Before starting these diagnostic procedures, the battery, starter and interconnecting must be in proper operating condition.

1. START RELAY/SOLENOID COIL: Parking brake fully engaged; manual transmission in neutral; automatic transmission in park; turn ignition switch to START position

TEST	OK	NOT OK
Terminal; I-2.5L, S-4.2L	12 volts	Repair open from ignition switch hand/or adjust ignition switch as outlined in MR 279
Across terminals I and G—2.5L S and G—4.2L (auto trans.) S and Chassis ground—4.2L (man. trans.)	24 ohms ± 3 5 ohms max 5 ohms max	Replace start relay
Terminal G to clean chassis ground	Zero ohms	2.5L—Repair open to ground G301 4.2L (Man.)—Clean starter solenoid ground connection 4.2L (Auto)—Proceed to neutral safety switch tests



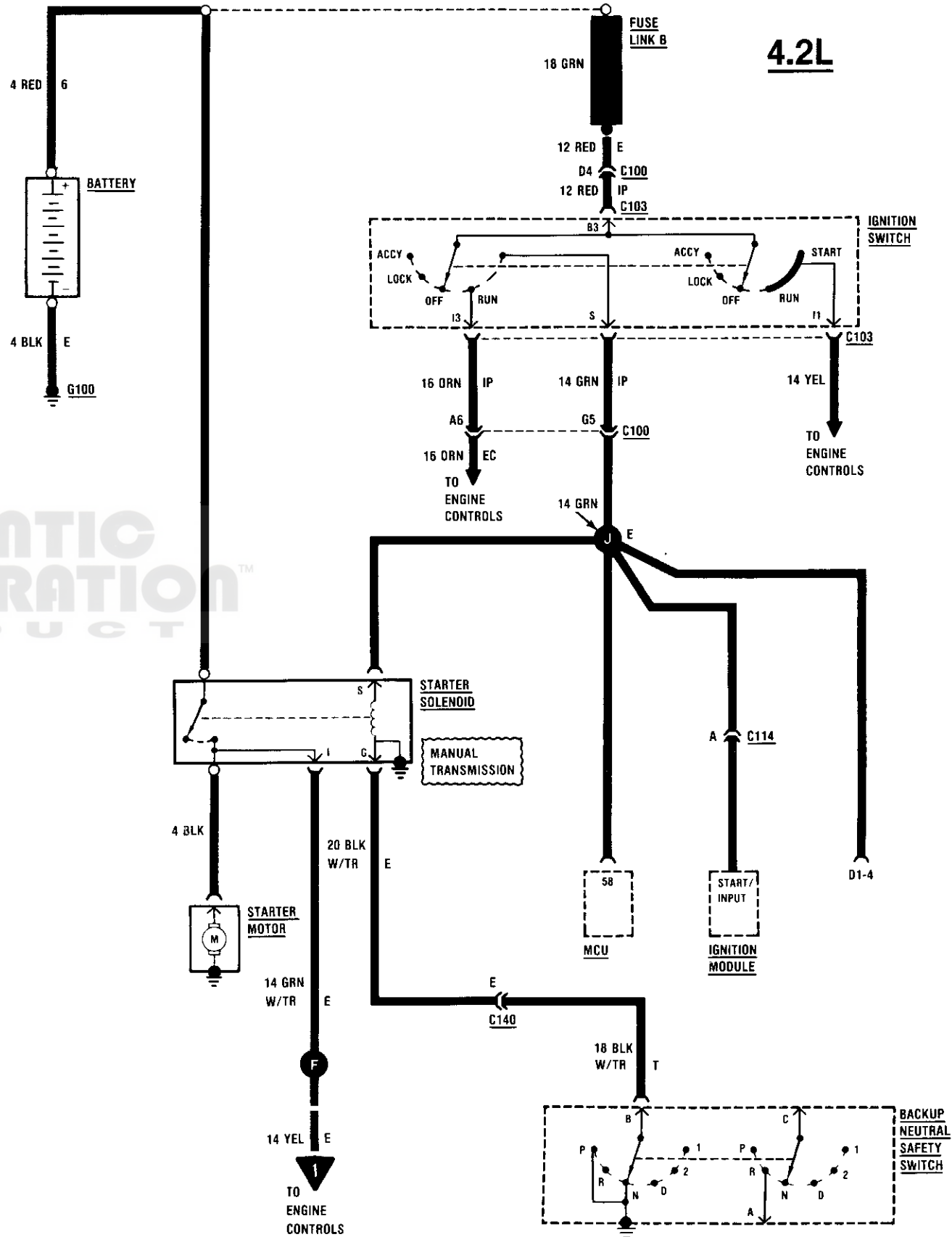
STARTER

2. **START RELAY/SOLENOID STARTER CIRCUIT:** Parking brake fully engaged; manual transmission in neutral; automatic transmission in park; turn ignition switch to START position

TEST	OK	NOT OK
Terminal BA	12 volts	Repair open from battery
Terminal SOL	12 volts	Replace starter relay

3. **NEUTRAL SAFETY SWITCH (AUTO TRANS ONLY):** Parking brake fully engaged; manual transmission in neutral; automatic transmission in park; turn ignition switch to START position

TEST	OK	NOT OK
Terminal D	12 volts	Repair open from start relay
Terminal D to clean chassis ground	Zero ohms	Next step
Check transmission shift linkage adjustment	Properly adjusted	Replace neutral safety switch



CHARGING SYSTEM

DESCRIPTION

The alternator is a belt-driven electrical generator. The output terminal wire on the back of the alternator is connected to the battery side of the starter relay. This point is also the connection for the battery itself and the fusible links that feed the entire vehicle electrical system.

The remaining two wires on the back of the alternator are the voltage sense wire and the field coil battery supply wire. The sense wire originates at the starter relay where it serves as a voltage feedback circuit for the regulator. The field coil circuit begins at the ignition switch.

TROUBLESHOOTING

1. BATTERY/CABLES/DRIVE BELT

TEST	OK	NOT OK
Inspect condition of battery cable terminals	Clean and tight	Repair as required
Battery state of charge Refer to MR279 for specific gravity and load test procedures	Battery passes test	Charge or replace battery as required
Inspect drive belt condition and tension	Drive belt serviceable	Tension or replace belt as required
Inspect connection at starter relay/solenoid	Clean and tight	Repair as required

2. ALTERNATOR CONNECTIONS: Ignition ON; connector separated from alternator

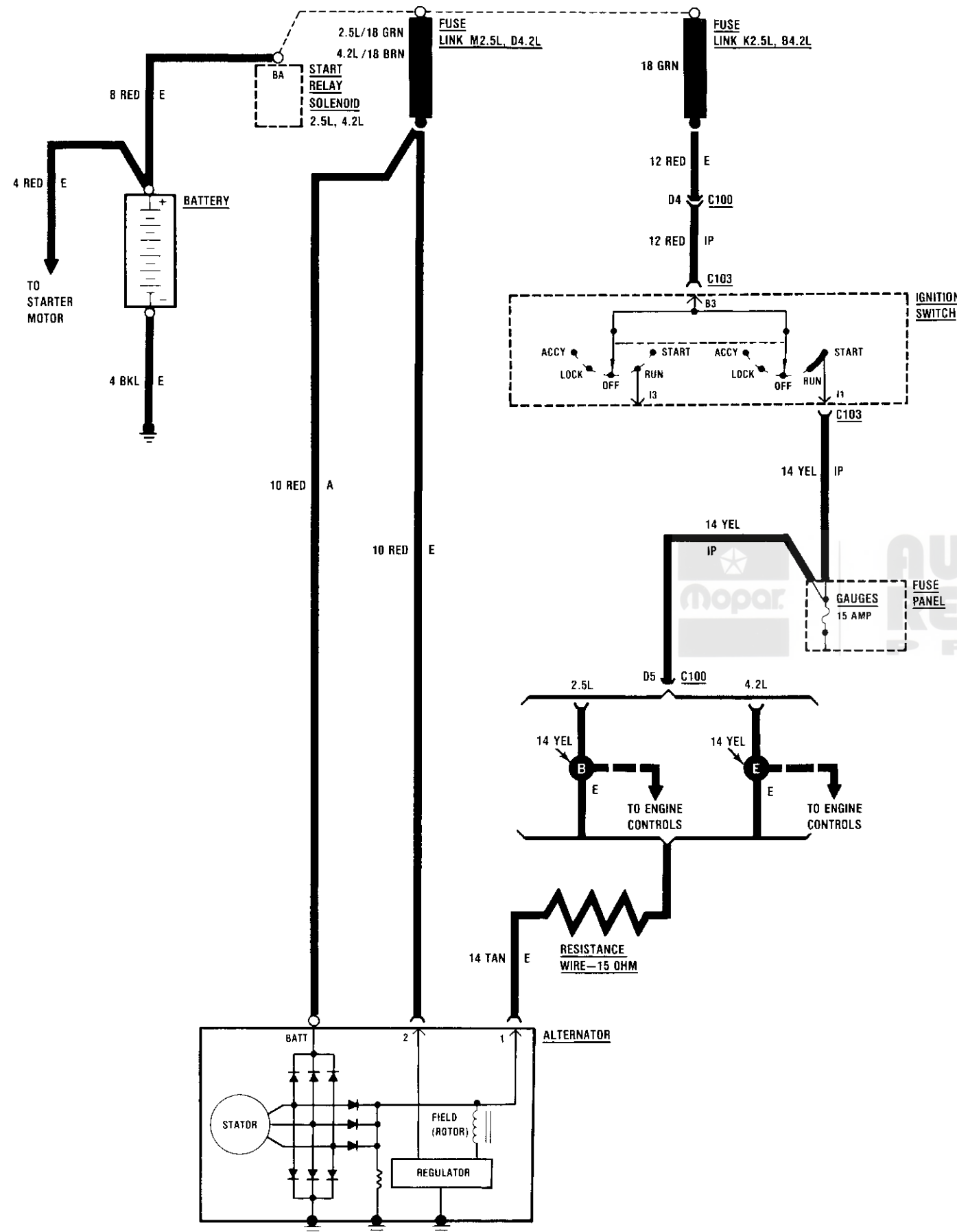
TEST	OK	NOT OK
BATT terminal	12 volts	Repair open from fuse link M/2.5L, D/4.2L
Terminal 2	12 volts	Repair open from fuse link M/2.5L, D/4.2L
Terminal 1	11-12 volts	Repair open from fuse panel
Alternator housing to clean chassis ground	Zero ohms	Clean ground connection-alternator mounting

3. BATTERY DISCHARGE THROUGH ALTERNATOR

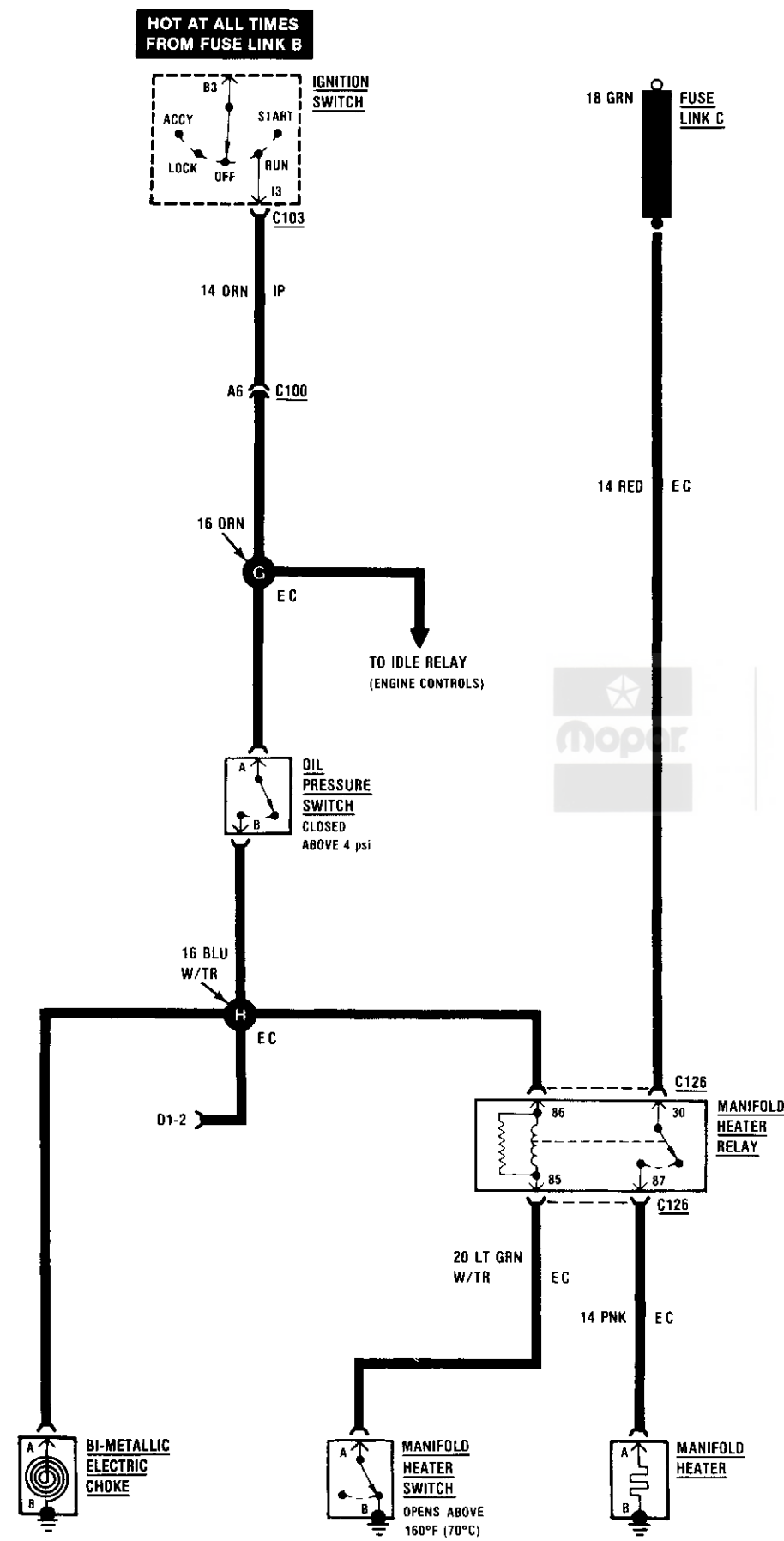
TEST	OK	NOT OK
Refer to MR279 for procedure	No current leakage	Repair as outlined in MR279

4. ALTERNATOR OUTPUT

TEST	OK	NOT OK
Refer to MR279 for procedure	Output as specified	Repair alternator as outlined in MR279



CARBURETOR CIRCUITS



DESCRIPTION

Both the manifold heater and the electric choke are related to cold weather driveability. The manifold heater aids fuel vaporization by warming the incoming cool air. The electric choke is needed to open the choke plate as the engine warms and no longer requires the rich mixtures required for cold start-up and driveability.

The electric choke and the relay coil receive battery voltage from ignition switch terminal I3. The higher current draw manifold heater receives battery voltage from fuse link C which is linked to the heater through the relay contacts.

The oil pressure switch, which is wired in series with the choke heater and relay coil, prevents operation of these circuits unless the engine is running.

While the electric choke operates whenever the engine is running, the manifold heater will operate only until engine coolant temperature reaches 160°F (70°C). At this temperature, the heater switch contacts open the relay coil ground circuit and the relay contacts open.

TROUBLESHOOTING

1. RELAY: Jumper across oil pressure switch; ignition ON

TEST	OK	NOT OK
Terminal 86	12 volts	Repair open from oil pressure switch
Terminal 85	Zero volts	Repair open to manifold heater switch ground
Terminal 30	12 volts	Repair open from fuse link C
Terminal 87	12 volts	Replace relay

2. MANIFOLD HEATER: Jumper across oil pressure switch; ignition ON

TEST	OK	NOT OK
Manifold heater terminal	12 volts	Repair open from relay
Resistance between heater terminal and ground	0.7 ohms	Replace heater

3. CHOKE HEATER: Jumper across oil pressure switch; ignition ON

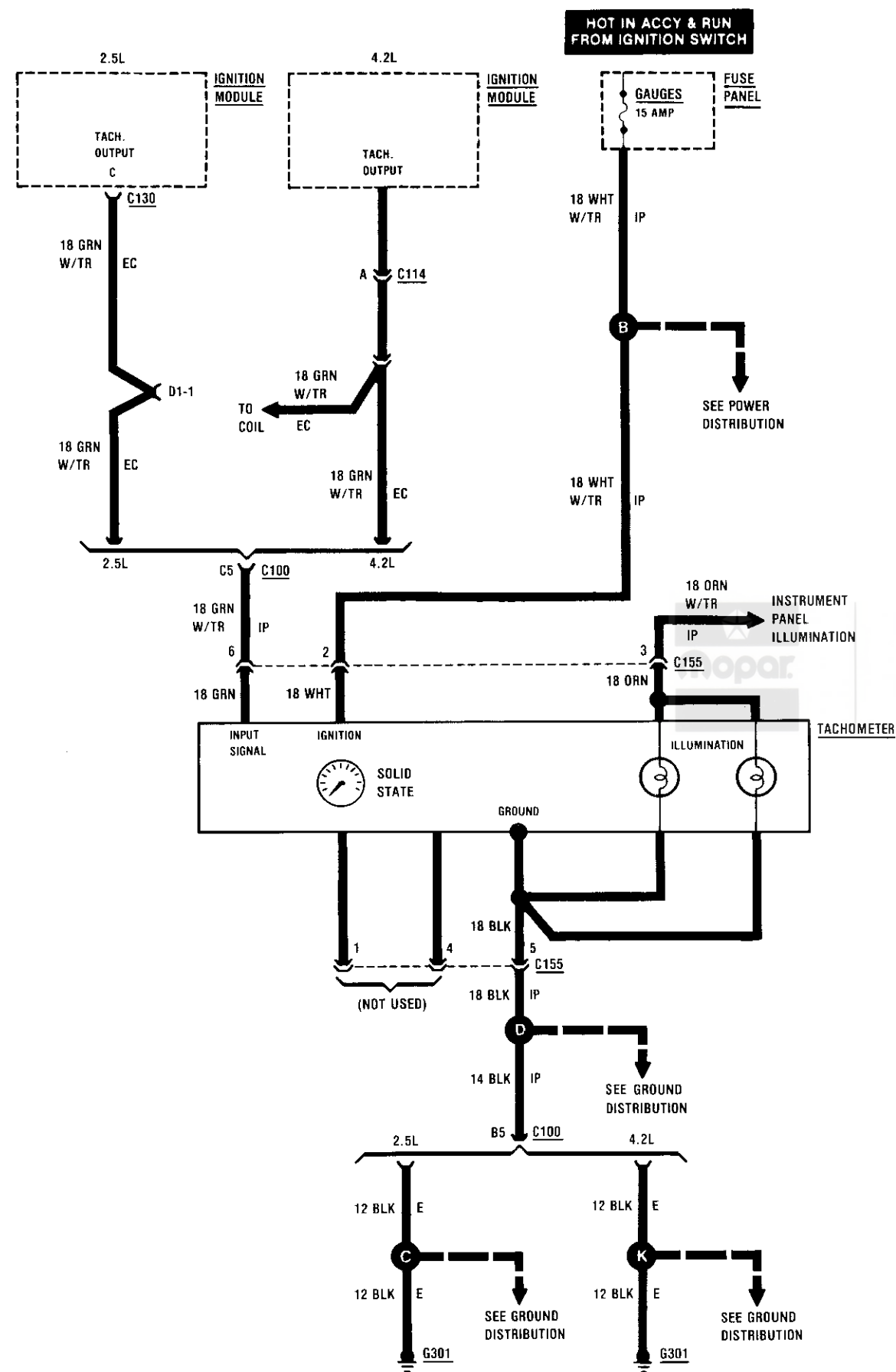
NOTE: Test oil pressure switch first.

TEST	OK	NOT OK
Choke terminal	12 volts	Repair open from oil pressure switch
Resistance between electric choke heater terminal and ground	4 ohms	Replace electric choke heater

4. OIL PRESSURE SWITCH: Ignition ON

TEST	OK	NOT OK
Terminal A	12 volts	Repair open in ignition switch circuit
Terminal B with engine running	12 volts	Replace oil pressure switch

TACHOMETER



DESCRIPTION

The tachometer is a solid state circuit requiring only three connections for operation—battery feed, ground and an engine speed input signal.

The solid state circuits in the tachometer are powered-up through the ignition switch and the 15 amp GAUGES fuse. A second wire connects the necessary circuits to ground.

The third wire connects the tachometer to the ignition module which controls the ignition coil primary circuit. The engine speed input signal is measured by the tachometer solid state circuits and converted to needle movement across the gauge face.

TROUBLESHOOTING —Tachometer

1. FUSE: Ignition ON

TEST	OK	NOT OK
Check operation of gauge pack	Gauge pack operates	Check GAUGES fuse
Battery side of GAUGES fuse	12 volts	Repair open from ignition switch

2. INPUT SIGNAL: Engine running; AC voltmeter connected to ignition module output signal terminal

TEST	OK	NOT OK
Operate engine at speeds indicated in chart below and note voltage readings	Voltage readings as specified	Replace ignition module
Check for input signal at tachometer terminal 6	Voltage signal	Next test

Engine RPM	2.5L Voltage (A/C)	4.2L Voltage (A/C)
1000	8	14
1500	10	16.3
2000	11.5	18.5
2500	12.8	21.5
3000	14.5	22.5
3500	15.5	—
4000	16.5	—

TACHOMETER

3. GROUND: Tachometer connector separated

TEST	OK	NOT OK
Tachometer terminal 5 to a clean chassis ground	Zero ohms	Repair open to ground G301 If zero ohms, replace tachometer

TROUBLESHOOTING —Tachometer Illumination

1. LAMP: Headlamp switch ON

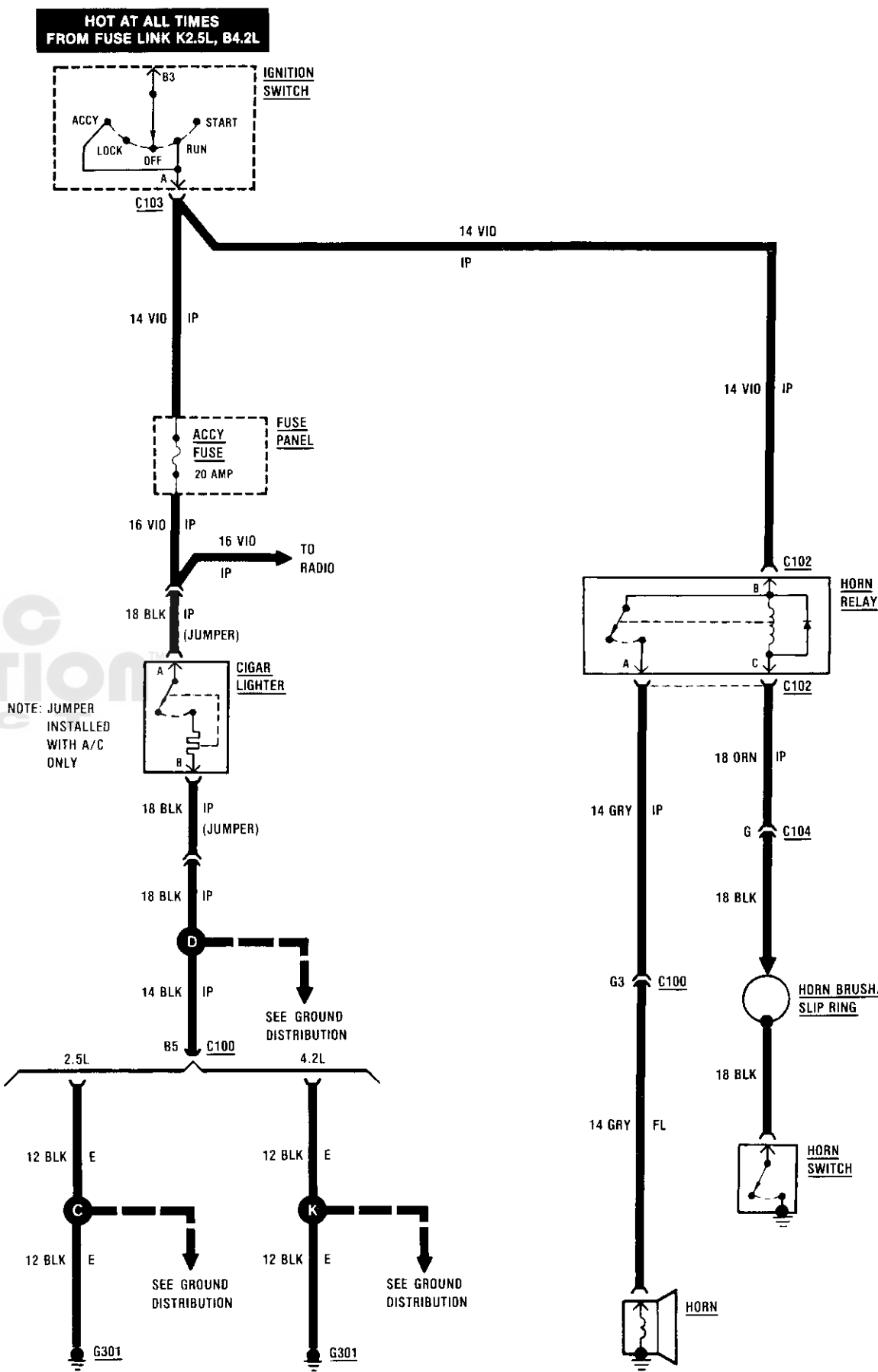
TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of bulb socket	0-12 volts	Repair open from fuse panel
Ground side of bulb socket	Zero ohms	Repair open to ground G301



AUTHENTIC
RESTORATION
PRODUCTS

HORN

CIGAR LIGHTER



CIGAR LIGHTER

DESCRIPTION

The cigar lighter contains a resistance type heating element. When the lighter is pushed in, the element is connected to battery power through the 20 amp accessory fuse and the ignition switch. The ground side of the element is connected to splice D.

If the vehicle is equipped with air conditioning, a short jumper is installed between the cigar lighter and the instrument panel wiring harness connector.

TROUBLESHOOTING

1. ACCESSORY FUSE: Ignition ON

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Battery side of fuse	12 volts	Repair open from ignition switch

2. CIGAR LIGHTER ELEMENT

TEST	OK	NOT OK
Substitute heater element	Lighter works	Replace element

3. CIGAR LIGHTER WIRING: Ignition switch ON

TEST A	OK	NOT OK
Terminal A	12 volts	Repair open from ACC fuse.
Terminal B	0 volts (with cigar lighter pushed in)	Repair open to ground G301

NOTE: If the vehicle is equipped with air conditioning, a jumper is installed between the instrument panel harness and the cigar lighter.

HORN

DESCRIPTION

The horn is supplied battery current through a relay that is closed by a ground switch located in the steering wheel hub.

When the horn switch is closed, the relay coil circuit is completed to ground and the relay contacts close. Battery voltage for the relay coil and contacts is supplied through a common wire from the ignition switch.

A slip ring and brush arrangement in the steering wheel allows the switch circuit to maintain contact while allowing rotation of the steering wheel.

TROUBLESHOOTING

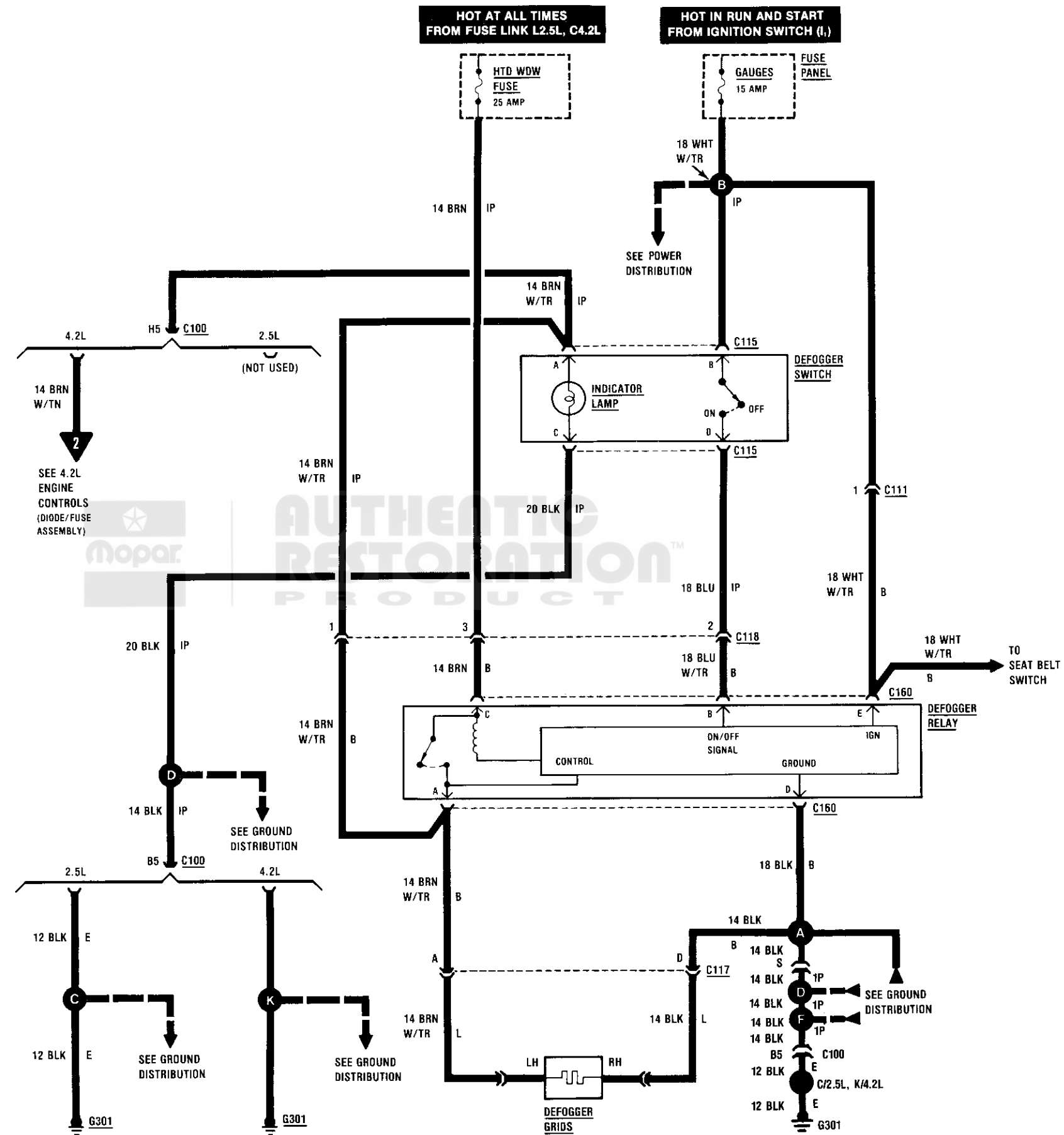
1. HORN: Ignition ON, horn button depressed

TEST	OK	NOT OK
Horn terminal	12 volts, horn sounds	12 volts; replace horn Zero volts; test relay
Horn housing to chassis ground	Zero ohms	Replace horn

2. HORN RELAY: Key ON, horn button depressed

TEST	OK	NOT OK
Terminal B	12 volts	Repair open from ignition switch
Terminal C	Zero volts	Repair open to horn switch
Terminal A	12 volts, horn sounds	12 volts; repair open to horn terminal 0 volts; replace relay

REAR DEFOGGER



REAR DEFOGGER

DESCRIPTION

Using heating elements bonded to the rear window glass, the rear defogger will clear condensation, frost and light snow coverings from the rear window.

The electrical current required to produce the heat in the grid is supplied through a relay and driver operated switch. When the switch is closed, the relay contacts close connecting the grid to battery or charging system power. The power circuit to the grid is protected by a 25 amp fuse located in the fuse panel.

Operation of the relay is prevented unless the ignition switch is in the ON position. The relay is connected to the ignition switch through splice B and the gauge fuse located in the fuse panel. Operation of the system is further limited by a timer contained in the relay. The timer is a small solid state circuit that opens the relay contacts after a specified amount of time. The timer will allow operation of the defogger for ten minutes on the first request. Additional requests will be limited to five minutes.

An indicator lamp incorporated into the switch will alert the driver while the system is operating. The indicator lamp is connected to the output side of the defogger relay allowing it to come on only when the relay contacts are closed.

OPERATIONAL CHECK

- With the engine running press the rear defogger switch.
- The instrument panel indicator lamp should come on and after a brief period of time the rear window should become warm
 - After 10 minutes the system should automatically shut off
 - After the initial warm-up, operation of the rear defogger will be limited to 5 minutes

TROUBLESHOOTING

1. BATTERY, IGNITION & FUSES

TEST	OK	NOT OK
Check HTD/WDW & gauge fuses	Not blown	Replace
Battery side of HTD/WDW fuse	12 volts	Repair open from fuse link L/2.5 L, C/4.2L
Ignition side of GAUGE fuse	12 volts	Repair open from ignition switch NOTE: If open is before splice B seat belt buzzer will also be inoperative.

2.DEFOGGER GRID: Key and defogger switch ON

TEST	OK	NOT OK
RH grid	zero ohms	Repair open to G307
LH grid	10.6 volts	Repair open from relay pin A and check relay

3.DEFOGGER RELAY: Key and defogger switch ON

TEST	OK	NOT OK
Terminal C	10.6 volts	Repair open from HTD/WDW fuse
Terminal B	12 volts	Repair open from gauge fuse—includes defogger switch
Terminal E	12 volts	Repair open from gauge fuse
Terminal D	zero ohms	Repair open to G307
Terminal A	10.6 volts	Replace defogger relay

4.INDICATOR LAMP: Key and defogger switch ON

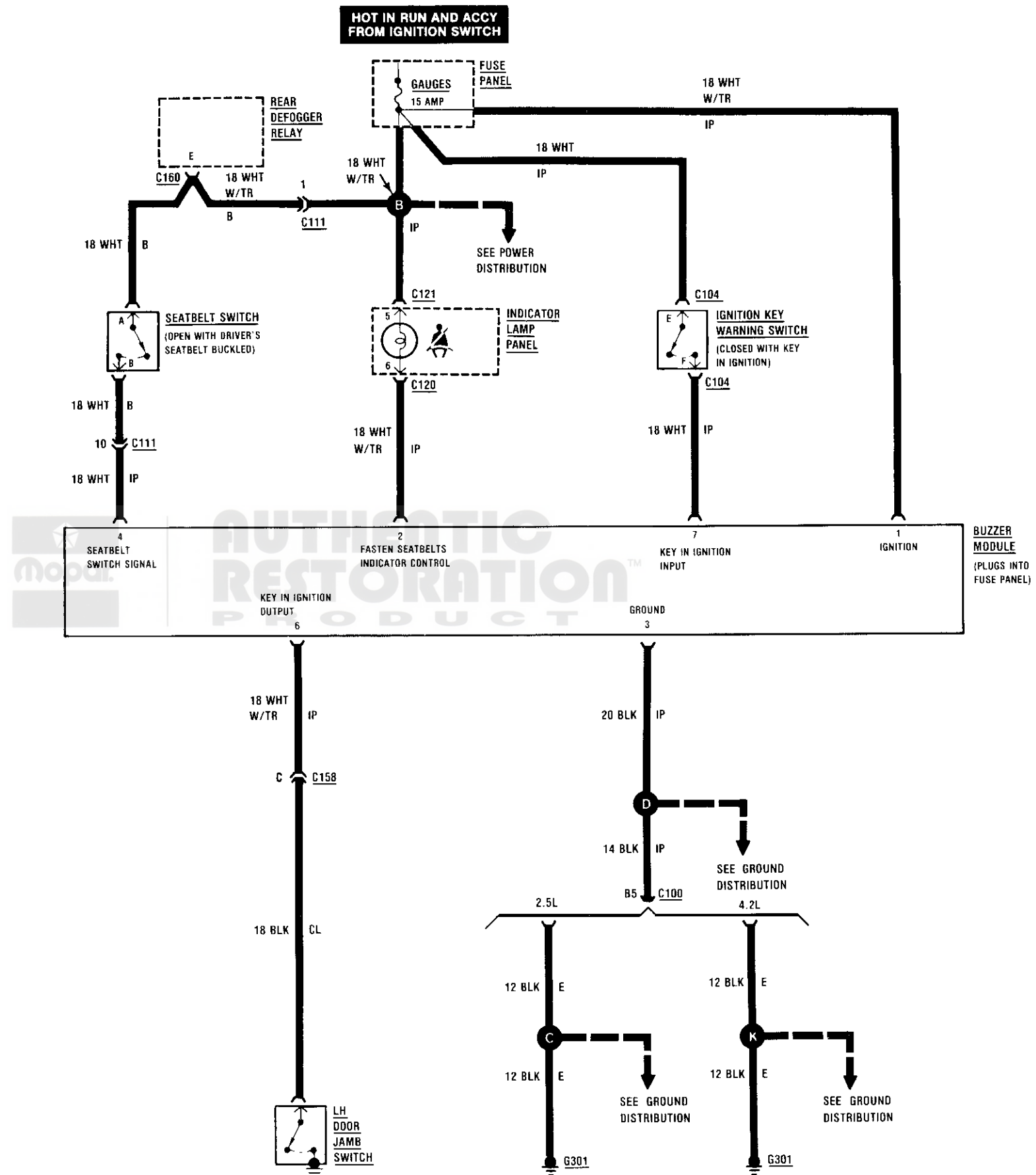
TEST	OK	NOT OK
Terminal A	10.6 volts	Repair open from defogger relay
Terminal C	zero ohms	Repair open to ground G301
Terminal A	zero ohms	Replace indicator lamp/defogger switch

5.IDLE SOLENOID: Key and defogger switch ON

NOTE: 4.2 L Engine only—After the MCU has timed out the idle speedup relay, inputs from the rear defogger or air conditioning systems will hold an increased idle if the accelerator pedal is tapped.

TEST	OK	NOT OK
Terminal B of diode/fuse assembly	10.6 volts	Repair open from terminal A of defogger switch
D1-5	10.6 volts	Replace diode/fuse assembly
Observe	Idle solenoid extends	Replace idle solenoid

SEAT BELT / IGNITION KEY WARNING BUZZER



SEATBELT / IGNITION KEY WARNING BUZZER

DESCRIPTION

The seatbelt warning and ignition key warning are separate circuits with a common connection at the buzzer module. Operation of the buzzer module itself depends on a battery source connected to terminal 1 and a ground circuit connected to terminal 3.

Operation of the buzzer depends upon whether or not various switches are in the open or closed position. The key buzzer portion of the circuit depends on the key switch and the left hand door jamb switch. Both switches must be in the closed position before the buzzer will sound. The seatbelt warning buzzer and indicator lamp portion of the circuit will not operate if the switch in the seatbelt buckle is opened by buckling the driver's seatbelt.

The buzzer module contains solid state components that will complete the buzzer circuit depending upon the input signals it receives from the switches. Voltage at terminal 7 "tells" the module that the key is in the ignition. A ground at the door jamb switch "tells" the module that the door has been opened. If the module "sees" voltage at terminal 7 and a ground through terminal 6 it will sound the buzzer. If the driver's seatbelt is left unbuckled, the module will "see" voltage at terminal 4. A voltage signal at this terminal will cause the module to sound the buzzer. The module will also illuminate the seatbelt indicator lamp by providing a path to ground. Operation of the seatbelt portion of the circuit is limited to a specified amount of time by a timer contained in the buzzer module.

TROUBLESHOOTING

1. BUZZER MODULE: Ignition ON; driver's door open

TEST	OK	NOT OK
Touch door jamb switch wire to a clean chassis ground	Buzzer sounds	Next step
Buzzer module Terminal 1	12 volts	Repair open from gauges fuse
Buzzer module Terminal 3	Zero ohms	Repair open to Ground 301
Buzzer module Terminal 6	Zero ohms	Repair open to door jamb switch

2. SEATBELT BUZZER: Ignition switch ON; seatbelt buckled

TEST	OK	NOT OK
Seatbelt switch Terminal A	12 volts	Repair open from gauges fuse
Seatbelt switch Terminal B	12 volts	Replace seatbelt switch
Buzzer module Terminal 4	12 volts	Replace buzzer module

3. SEATBELT INDICATOR LAMP: Ignition switch ON; seatbelt buckled

TEST	OK	NOT OK
Across bulb terminal	Zero ohms	Replace bulb
Battery side of bulb socket	12 volts	Repair open from gauges fuse
Buzzer module Terminal 2	12 volts	Replace buzzer module If zero volts, repair open from indicator lamp

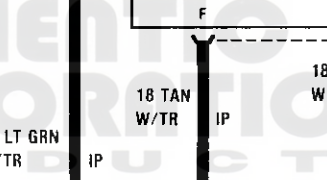
4. IGNITION KEY BUZZER: Key in ignition switch; driver's door open, turn signal switch connector not separated

TEST	OK	NOT OK
Turn signal switch connector Terminal E	12 volts	Repair open from gauges fuse
Turn signal switch connector Terminal F	12 volts	Replace key warning switch
Buzzer module Terminal 7	12 volts	Replace module

16 LT GRN
W/TR



INTERMITTENT



WIPERS / WASHERS

DESCRIPTION

The non-intermittent windshield wiper circuit contains three components—control switch, motor and washer pump. The intermittent circuit contains the same components and a wiper module that provides the delay function. Both circuits receive battery feed from and are protected by a 6.7 amp circuit breaker.

In the non-intermittent wiper circuit, the switch connects the motor directly to battery feed for LO and HI speed operation. In the intermittent circuit, the switch supplies battery feed to the delay module, which then supplies the motor. In the delay position, the module is connected with the variable resistor in the wiper switch. The value of the resistance is used by the solid state module to charge a capacitor, which triggers the amount of delay between wipes.

wiper switch. The value of the voltage signal is used by the solid state module to determine the amount of delay between wipes.

The motor in both circuits is identical with an arrangement of brushes providing the two wiper speeds. The park circuit is also the same. When the wipers are turned off, the park switch maintains current to the motor until the wipers reach the park position on the windshield.

The washer pump receives battery feed either directly from the wiper switch or from the intermittent module. In either case, the electric motor will drive the washer pump.

TROUBLESHOOTING —Windshield Wipers Inoperative

1. CIRCUIT BREAKER: Ignition ON

TEST	OK	NOT OK
Battery side of circuit breaker	12 volts	Repair open from ignition switch
Across circuit breaker terminals	Zero ohms	Replace circuit breaker

2. WIPER MOTOR GROUND

TEST	OK	NOT OK
Wiper motor connector C146 terminal 1 to clean chassis ground	Zero ohms	Repair open to ground G301

3. INTERMITTENT WIPER MODULE: Intermittent wipers only; if equipped with non-intermittent wipers proceed to switch tests; ignition ON

TEST	OK	NOT OK
Remove delay module and plug connectors from module together	Wipers operate in LO and HI speed modes and mist (washer) is working	Proceed to switch test (5). If wipers and mist now operate, replace intermittent module.

4. SWITCH: Ignition ON; wiper switch position as indicated; tests made on switch side of connector C145 A/B (non-intermittent) or C145B (intermittent)

TEST	OK	NOT OK
Connector terminal E —wiper switch in LO and mist/intermittent	12 volts	Replace switch
Connector terminal C —wiper switch in HI	12 volts	Replace switch
Connector terminal F —wiper switch to OFF with voltmeter connected	12 volts until wipers park and then zero volts	Replace switch

5. WIPER SWITCH DELAY RESISTANCE: Wiper switch disconnected; intermittent wiper only

TEST	OK	NOT OK
Across terminals A and D while rotating switch from minimum delay to maximum delay	0–500K ohms	Replace switch
Across terminals A and G while rotating switch from minimum delay to maximum delay	0–500K ohms	Replace switch If OK, replace wiper module.

6. MOTOR: Ignition ON; wiper switch position as indicated; tests made on motor side of connector C146

TEST	OK	NOT OK
Connector terminal 4 —wiper switch in any position	12 volts	Repair open from fuse panel If 12 volts, replace motor
Connector terminal 2 —wiper switch in LO	12 volts	Repair open from wiper switch If 12 volts, replace motor
Connector terminal 3 —wiper switch in HI	12 volts	Repair open from wiper switch If 12 volts, replace motor
Connector terminal 5 —wiper switch to OFF with voltmeter connected	12 volts until wipers park and then zero volts	Repair open from wiper switch If 12 and zero volts, replace motor

WIPERS / WASHERS

TROUBLESHOOTING —Windshield Washer
(Non-Intermittent)

1. PUMP GROUND

TEST	OK	NOT OK
Terminal B at pump to clean chassis ground	Zero ohms	Repair open to ground G305/306

2. PUMP SWITCH CIRCUIT: Ignition ON; wiper switch tab rotated forward

TEST	OK	NOT OK
Terminal A at pump	12 volts	Next step If 12 volts, replace pump
Connector 145A/B terminal B at switch	12 volts	Replace switch If 12 volts, repair open to washer pump

TROUBLESHOOTING —Windshield Washer
(Intermittent)

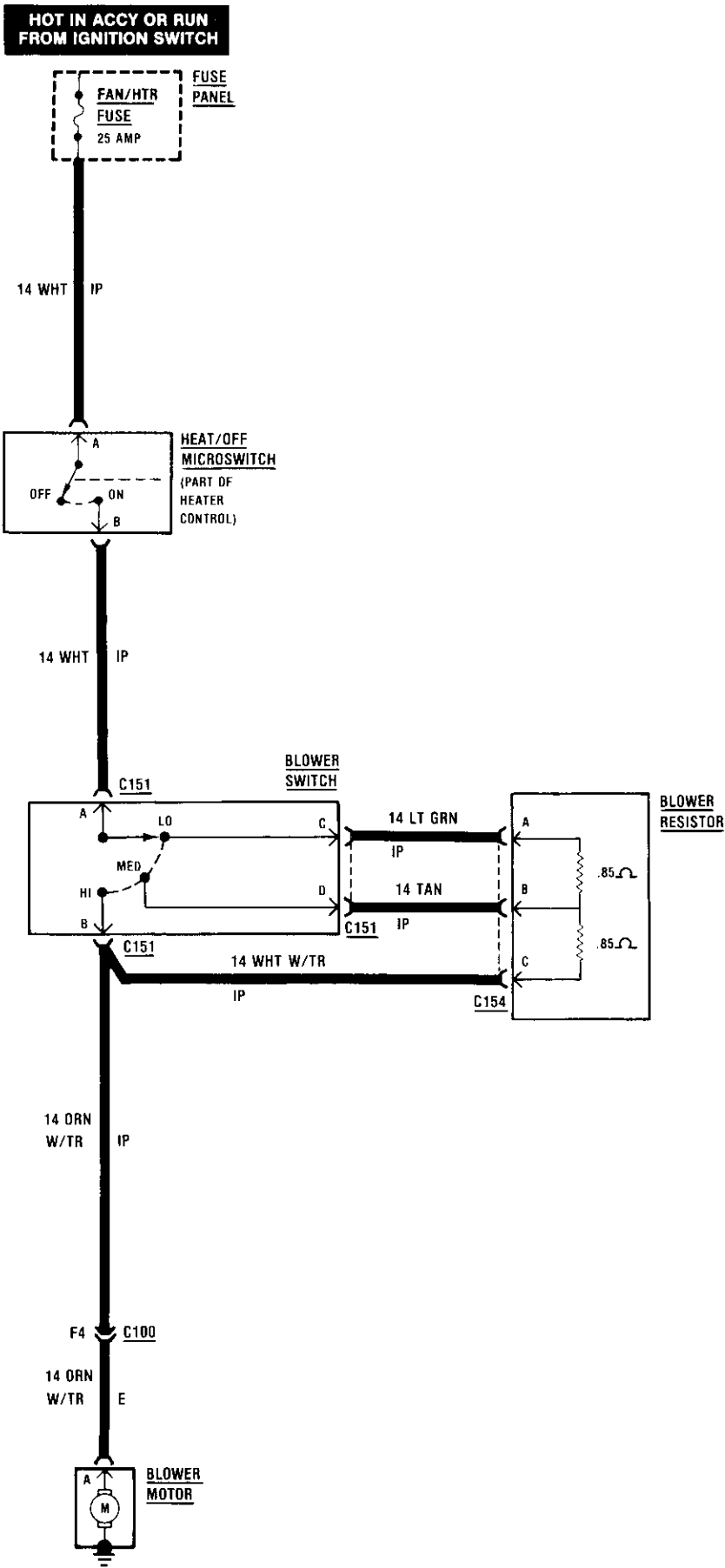
1. PUMP GROUND

TEST	OK	NOT OK
Terminal B at pump to clean chassis ground	Zero ohms	Repair open to ground G305/306

2. PUMP SWITCH CIRCUIT: Ignition ON; washer switch tab rotated forward

TEST	OK	NOT OK
Connector 145B terminal B	12 volts	Replace wiper switch
Connector 145A terminal B	12 volts	Replace module
Terminal A at pump	12 volts	Repair open from terminal B/C145A If 12 volts, replace pump

HEATER



HEATER

DESCRIPTION

The blower motor circuit begins at a 25 amp fuse that receives its battery feed from the ignition switch. From the fuse the circuit extends to a microswitch mounted on the heater control.

The microswitch is opened and closed by a cam attached to the heater control lever. In all heater control lever positions except OFF and VENT, the cam is positioned to close the microswitch and complete the blower motor circuit.

The blower switch allows the driver to select one of three blower speeds—low, medium and high. In the high speed position, the switch connects the motor directly to the battery source. The remaining two slower speeds are accomplished by routing the battery source through a resistor assembly.

The resistor and switch are wired in such a way that only a single wire is needed to operate the blower motor at three different speeds. A separate ground wire is not needed because the blower motor housing serves as the ground connection.

TROUBLESHOOTING

1. BLOWER MOTOR: Selector lever in heat mode; ignition ON; blower switch on HI

TEST	OK	NOT OK
Blower motor terminal	12 volts	Test resistor/switch
Blower motor housing to chassis ground	Zero ohms	Replace blower motor

2. BLOWER RESISTOR: Selector lever in heat mode; ignition ON; blower switch position as indicated

TEST	OK	NOT OK
Terminal A—blower switch in LO	12 volts	Test switch
Terminal B—blower switch in HI	12 volts	Test switch
Terminal C—blower switch in HI	12 volts	Test switch
Across Terminals A and C, connector unplugged	1.7 ohm	Replace resistor
Across Terminals B and C; connector unplugged	.85 ohm	Replace resistor

3. SWITCH: Selector lever in heat mode; ignition switch ON; blower switch position as indicated

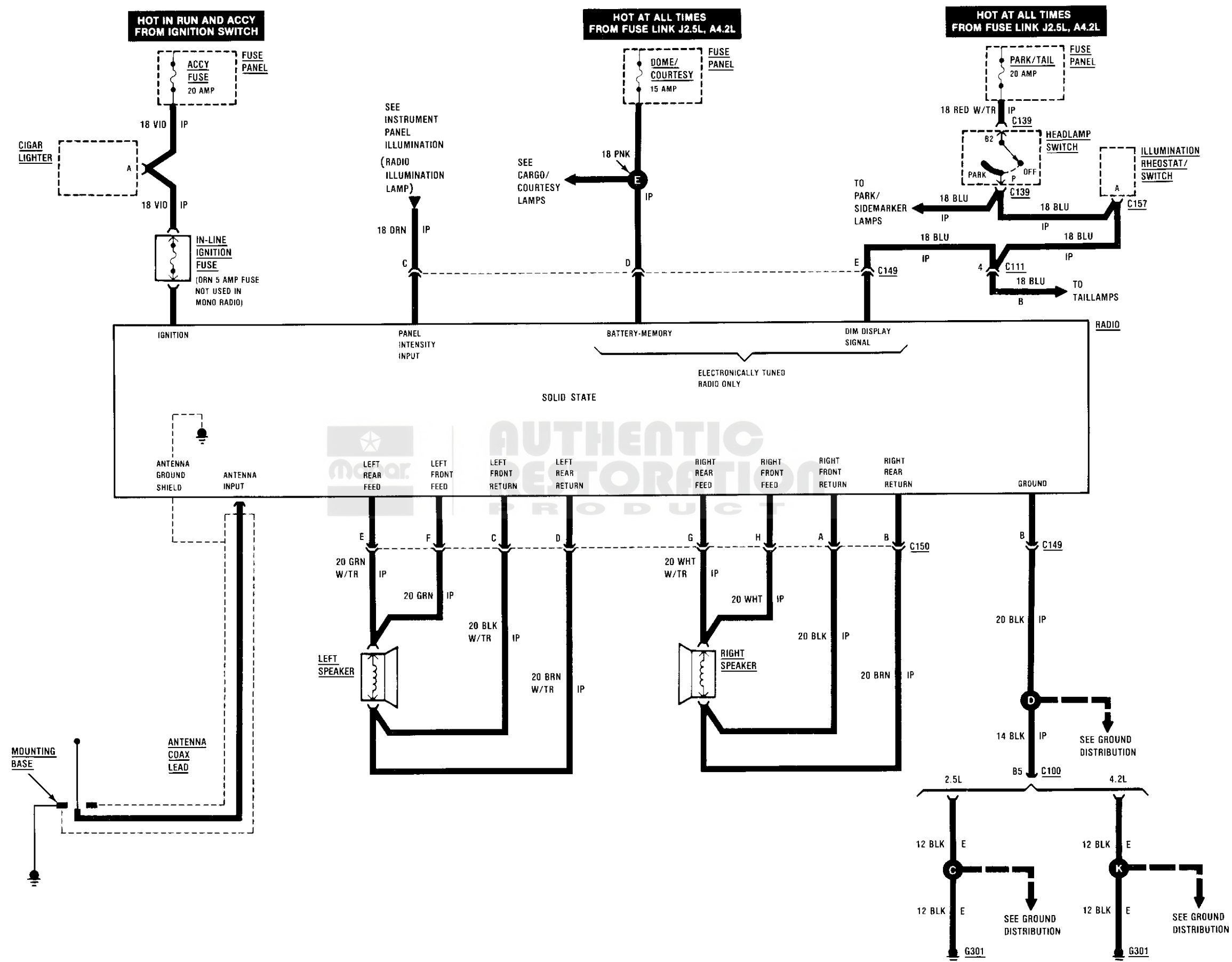
TEST	OK	NOT OK
Terminal A—blower switch in any position	12 volts	Test microswitch
Terminal C—blower switch in LO	12 volts	Replace switch
Terminal D—blower switch in MED	12 volts	Replace switch
Terminal B—blower switch in HI	12 volts	Replace switch

NOTE: If the blower switch passes the above tests but voltage is not present at a resistor terminal, check the interconnecting wiring.

4. MICROSWITCH: Selector lever in heat mode; ignition ON

TEST	OK	NOT OK
Terminal A	12 volts	Repair open from blower fuse
Terminal B	12 volts	Replace microswitch

RADIO



RADIO

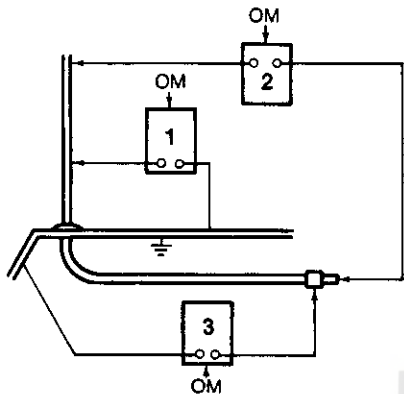
DESCRIPTION

All radios, whether mono or electronically tuned, receive battery feed from the 20 amp ACCY fuse. ETRs have an additional in-line fuse located in the back of the radio chassis. The in-line fuse will blow in the event the battery cables are accidentally reversed, or an internal radio short occurs.

Both types of radios are also connected to the instrument panel illumination circuit. When the headlamp switch is in either the park or headlamp position, the radio illumination lamps will come on.

The electronically tuned radio requires additional connection to the DOME/COURTESY fuse and the headlamp switch. The connection to the fuse is necessary to maintain the radio's memory when the ignition key is turned to the off position. The connection to the headlamp switch provides a dim display voltage signal when the headlamp switch is in either the park lamp or headlamp positions.

NOTE: Never measure resistance when power is on. Discharge all capacitors.



TROUBLESHOOTING —Radio Inoperative

1. ACCESSORY FUSE: Ignition ON

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Battery side of fuse	12 volts	Repair open from ignition switch

2. IN-LINE FUSE: Ignition ON; does not apply to mono radio

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Battery side of fuse	12 volts	Repair open from fuse panel

3. GROUND: Ignition OFF; connector C149 separated

TEST	OK	NOT OK
Connector C149 terminal B to clean chassis ground	Zero ohms	Repair open to ground G301

TROUBLESHOOTING —Noisy Reception

1. ANTENNA—MAST TO GROUND: Lead in cable disconnected for second step only

TEST	OK	NOT OK
Antenna mast to clean chassis ground	Infinite resistance (OPEN)	Replace antenna lead-in cable

2. ANTENNA—MAST TO CENTER CONDUCTOR: Lead-in cable disconnected from radio

TEST	OK	NOT OK
Antenna mast to tip of center conductor	Fraction of an ohm	Replace antenna lead-in cable

3. BODY GROUND TO COAXIAL SHIELD

TEST	OK	NOT OK
Clean chassis ground to crimp on coaxial shield	Zero ohms	Clean antenna base ground and install new cadmium plated attaching screws

TROUBLESHOOTING —Noisy Speaker

TEST	OK	NOT OK
Inspect connections at speaker	Proper connection	Repair as necessary
Across speaker terminals	8 ohms (impedance)	Replace speaker
Substitute known good speaker	Speaker operates	Replace speaker
Connect known good speaker to terminals at radio connector	Speaker operates	Remove radio for repair by authorized outlet If speaker operates, repair wiring from radio connector to speaker

RADIO

TROUBLESHOOTING —Noise That Changes With Engine Speed

1. RADIO INTERFERENCE SUPPRESSION

TEST	OK	NOT OK
Inspect connections at: —Alternator —Ignition coil capacitor (4.2L only) —Coaxial cable ground —Radio ground (G301) —Body to engine braided ground strap Inspect: —Ignition secondary wire routing —Condition of secondary wiring insulation —Distributor rotor	Inspection points OK	Repair connections as required Reroute or replace ignition wires as required Apply silicone grease to rotor tip as outlined in MR279

TROUBLESHOOTING —Memory Does Not Operate (Electronically Tuned)

1. FUSE

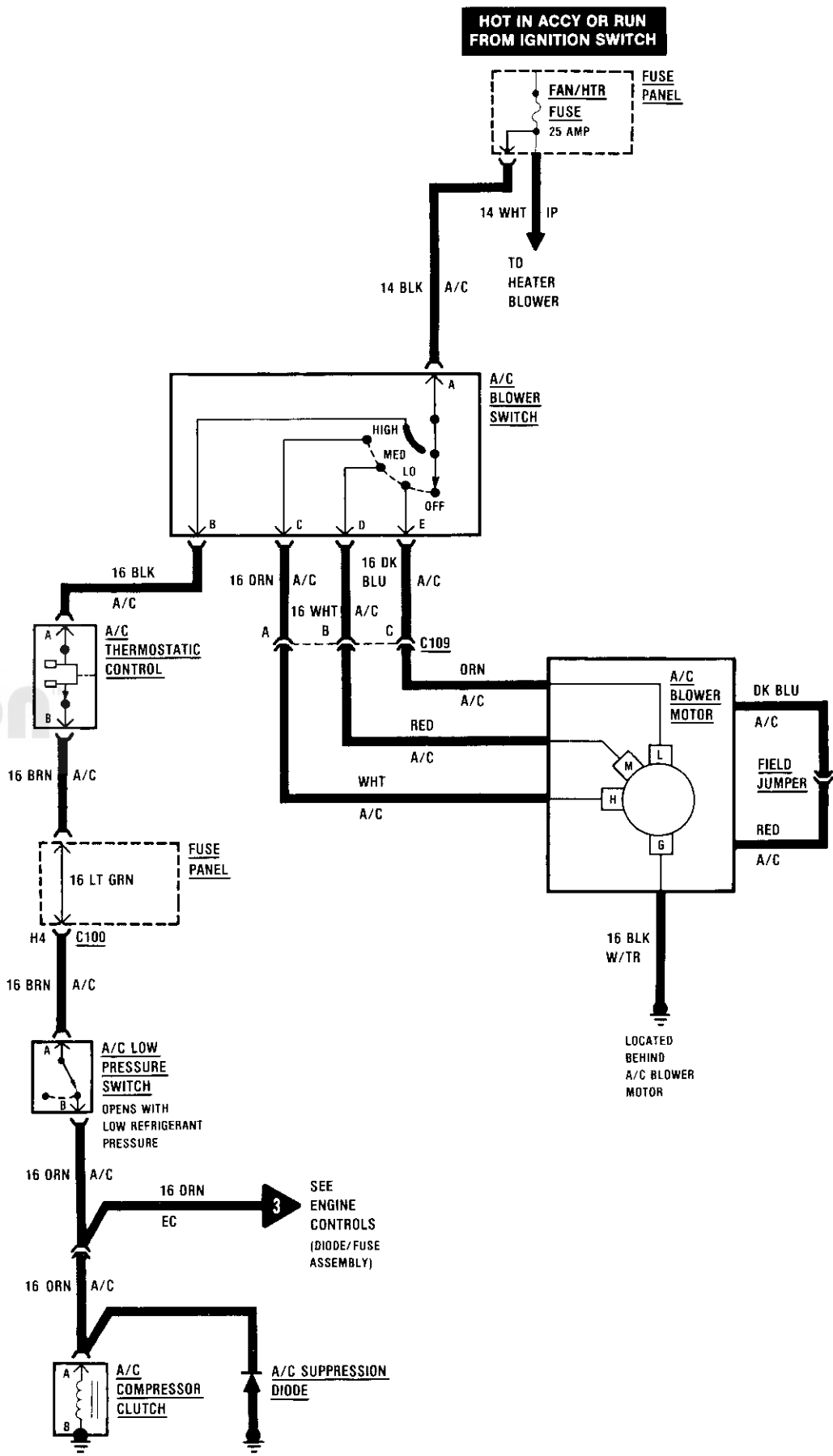
TEST	OK	NOT OK
Inspect DOME/ COURTESY fuse	Not blown	Replace fuse
Battery side of DOME/ COURTESY fuse	12 volts	Repair open from fuse link J/2.5L, A/4.2L
Connector C149 Terminal D	12 volts	Repair open from fuse panel If 12 volts, remove radio for repair by authorized outlet

TROUBLESHOOTING —Digital Display Does Not Dim (Electronically Tuned)

1. BATTERY SUPPLY CIRCUIT: Headlamp switch in park lamp position

TEST	OK	NOT OK
Connector C149 Terminal E	12 volts	Repair open from connector C111, terminal 4 If 12 volts, remove radio for repair by authorized outlet

AIR CONDITIONING



AIR CONDITIONING

DESCRIPTION

The air conditioning circuit consists of three segments—battery feed, blower motor and compressor clutch. The three segments have a common connection point at the blower switch.

The power feed segment of the circuit extends from the 25 amp HTR/FAN fuse to the blower switch. From the blower switch, battery feed is routed to the blower motor and compressor clutch segments of the circuit.

The blower motor segment consists of the three wires from the blower switch to the motor, the motor itself and the motor ground wire. Through the switch, the three wires connect the motor brushes to battery feed. When connected to battery feed, the separate brushes provide the three blower speeds—LO, MED and HIGH.

In all blower switch positions except OFF, the compressor clutch segment of the circuit also receives battery feed. ON and OFF cycling of the compressor and therefore the temperature of the outlet air is regulated by the thermostatic control. A thermal sensor extends from the control to the evaporator housing. When the temperature of the evaporator drops below the set temperature, the thermostatic control opens the clutch circuit. The circuit remains open until evaporator temperature rises above the set temperature.

The compressor clutch segment of the circuit also contains a low pressure switch. If the pressure in the refrigerant system drops due to a leak, the circuit is opened to prevent damage to the compressor.

The last component in the compressor clutch segment of the circuit is the clutch coil. When the coil is connected to battery feed, its windings form an electromagnet that pulls the clutch hub against the clutch pulley.

OPERATIONAL CHECK

Turn the ignition key to the run position, set the thermostat control to maximum cooling and turn the blower switch to the LO position. When the blower motor is switched on, a loud click will be heard as the compressor clutch engages.

Start the engine and set the blower switch on HIGH. After a short period of time, cold air should discharge from the registers.

Rotate the thermostat control from maximum cool to minimum cool and listen for the compressor clutch to disengage. Rotate the thermostat from minimum to maximum several times and listen for engagement and disengagement of the clutch.

3. BLOWER MOTOR: Ignition ON; blower switch position as indicated; tests made on blower motor side of connector C109

TEST	OK	NOT OK
A/C blower housing to chassis ground	Zero ohms	Repair ground connection If zero ohms, replace motor
Connector C109 terminal C—blower switch in LO	12 volts	Repair open from blower switch If 12 volts, replace motor
Connector C109 terminal B—blower switch in MED	12 volts	Repair open from blower switch If 12 volts, replace motor
Connector C109 terminal A—blower switch in HIGH	12 volts	Repair open from blower switch If 12 volts, replace motor

TROUBLESHOOTING —Blower Inoperative

1. FUSE: Ignition ON

TEST	OK	NOT OK
Check operation of heater blower motor	Blower operates	Check FAN/HTR fuse
Battery side of FAN/HTR fuse	12 volts	Repair open from ignition switch
A/C terminal in fuse panel blower switch in any position	12 volts	Repair open from FAN/HTR fuse

2. BLOWER SWITCH: Ignition ON; blower switch position as indicated

TEST	OK	NOT OK
Terminal A—blower switch in any position	12 volts	Repair open from fuse panel
Terminal E—blower switch in LO	12 volts	Replace switch
Terminal D—blower switch in MED	12 volts	Replace switch
Terminal C—blower switch in HIGH	12 volts	Replace switch

TROUBLESHOOTING —Compressor Clutch Inoperative

1. A/C COMPRESSOR CLUTCH

TEST	OK	NOT OK
Jumper wire from battery positive post to clutch coil connector	Clutch engages	Next step with jumper installed
Jumper wire from clutch coil frame to clean chassis ground	Clutch engages	Repair clutch coil ground If clutch does not engage, replace coil

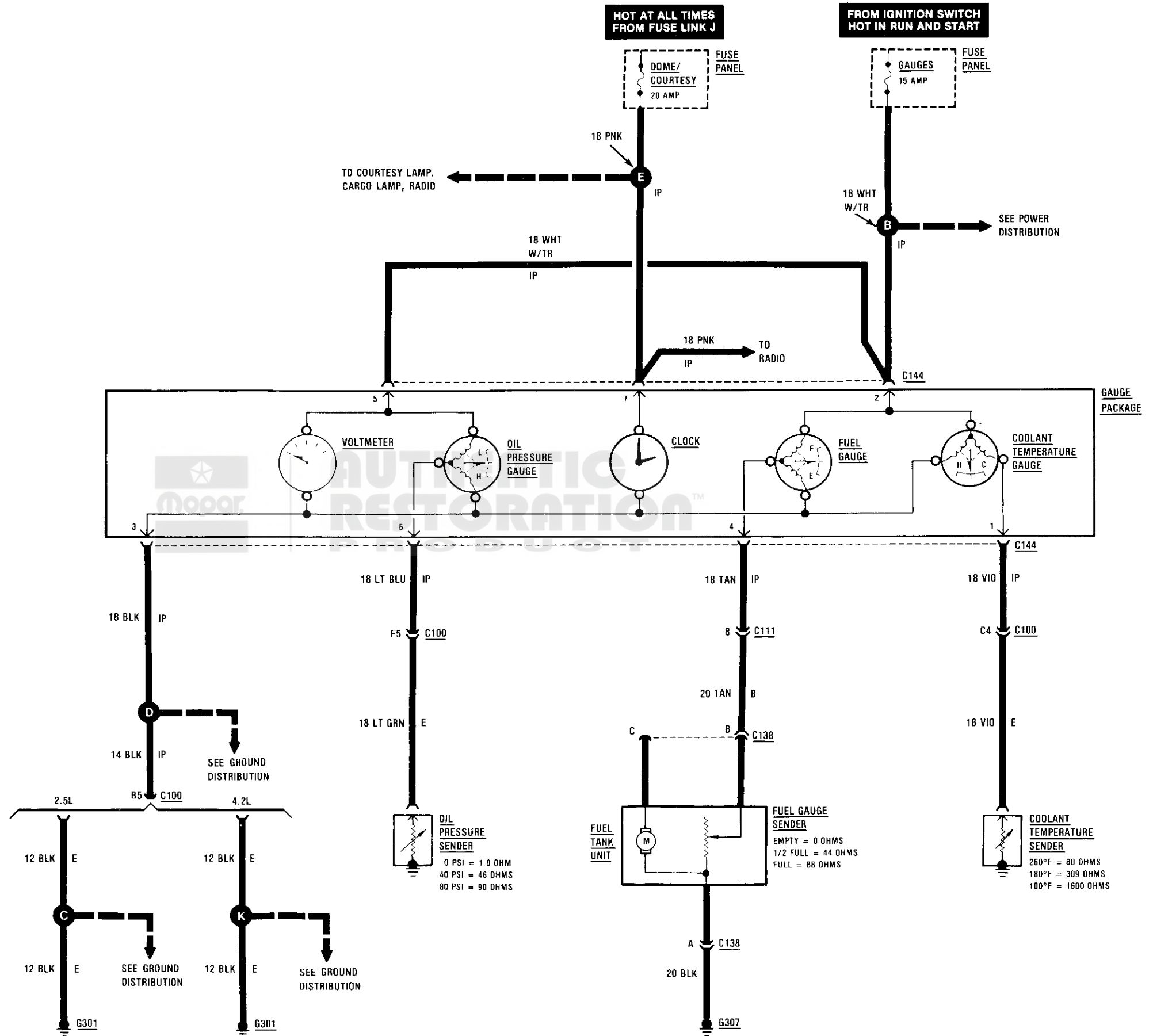
2. LOW PRESSURE SWITCH: Ignition ON; A/C blower switch ON; thermostatic control set to MAX cool

TEST	OK	NOT OK
Connector terminal A	12 volts	Proceed to thermostatic control tests
Jumper wire across connector terminals	Clutch engages	Check system refrigerant charge If system is properly charged, replace low pressure switch

3. THERMOSTATIC CONTROL: Ignition ON; A/C blower switch ON; thermostatic control set to MAX cool

TEST	OK	NOT OK
Terminal A	12 volts	Repair open from blower switch
Terminal B	12 volts	Replace thermostatic control
Low pressure switch terminal A	12 volts	Repair open from thermostatic control

GAUGE PACKAGE



GAUGE PACKAGE

DESCRIPTION

The gauge package contains four gauges and the clock. The gauges have a common battery feed from the GAUGES fuse and ignition switch. The clock is separately powered through the DOME/COURTESY fuse which receives constant battery feed through a fuse link. Although they have separate power sources, the four gauges and clock do share a common ground connection.

The voltmeter indicates electrical system voltage. When the engine is not running, the voltage registered is from the battery. After the engine is started, charging system voltage is indicated. In the gauge package, the voltmeter forms a parallel connection across the battery feed and ground.

The remaining gauges—oil pressure, fuel and coolant temperature—are connected to individual sender units. Variable resistors in the senders will change the amount of current allowed to flow through the gauge coils. As current flow through the coils varies, the position of the indicator needle will also vary.

The four gauges and the clock are connected to battery feed, ground and the sender units through a printed circuit mounted on the back of the gauge housing.

TROUBLESHOOTING —Gauge Package Inoperative

1. GAUGE PACKAGE GROUND

TEST	OK	NOT OK
Terminal 3 to clean chassis ground	Zero ohms	Repair open to ground G301

TROUBLESHOOTING —Clock

1. FUSE

TEST	OK	NOT OK
Inspect dome/courtesy fuse	Not blown	Replace fuse
Battery side of fuse	12 volts	Repair open from fuse link J

2. PRINTED CIRCUIT/CLOCK

TEST	OK	NOT OK
Gauge package terminal 7	12 volts	Repair open from fuse
Printed circuit connection at clock battery terminal	12 volts	Replace printed circuit
Printed circuit connection at clock ground terminal	Zero ohms	Replace printed circuit If zero ohms replace clock

TROUBLESHOOTING —All Gauges Inoperative

1. FUSE: Ignition ON

TEST	OK	NOT OK
Inspect GAUGES fuse	Not blown	Replace fuse
Battery side of GAUGES fuse	12 volts	Repair open from ignition switch

2. GAUGE PACKAGE: Ignition ON

TEST	OK	NOT OK
Gauge package terminals 2 & 5	12 volts	Repair open from fuse panel

NOTE: If the voltmeter and oil pressure gauges are inoperative, an open exists in the jumper wire from gauge package terminal 2 to terminal 5.

TROUBLESHOOTING —One Gauge

NOTE: Does not apply to voltmeter.

1. SENDER UNIT: Ignition ON

TEST	OK	NOT OK
Wiring terminal at sender unit	Coolant temperature—9 volts Oil pressure—7.35 volts Fuel—7.35 volts	Next step
Sender housing to clean chassis ground	Zero ohms	Clean ground connection If zero ohms, replace sender unit

GAUGE PACKAGE

2. PRINTED CIRCUIT: Ignition ON; wiring terminal disconnected at sender unit

NOTE: Includes voltmeter sender unit.

TEST	OK	NOT OK
Printed circuit connections at gauge battery terminal	12 volts	Replace printed circuit
Printed circuit connection at gauge ground terminal	Zero ohms	Replace printed circuit If zero ohms, at voltmeter, replace voltmeter. If zero ohms at other gauges next step
Printed circuit connection at gauge sender unit terminals	12 volts	Replace gauge

4. GAUGE CALIBRATION VALUES

TEST	OK	NOT OK
Using the following charts, the calibration of the gauge can be checked	Indicator needle in correct position	Replace gauge

Oil Pressure Gauge Resistance (Ohms)

0 psi	1 ohm
40 psi	46 ohm
80 psi	87 ohm

Fuel Gauge Resistance (Ohms)

Empty	1 ohm
1/2 full	44 ohm
Full	88 ohm

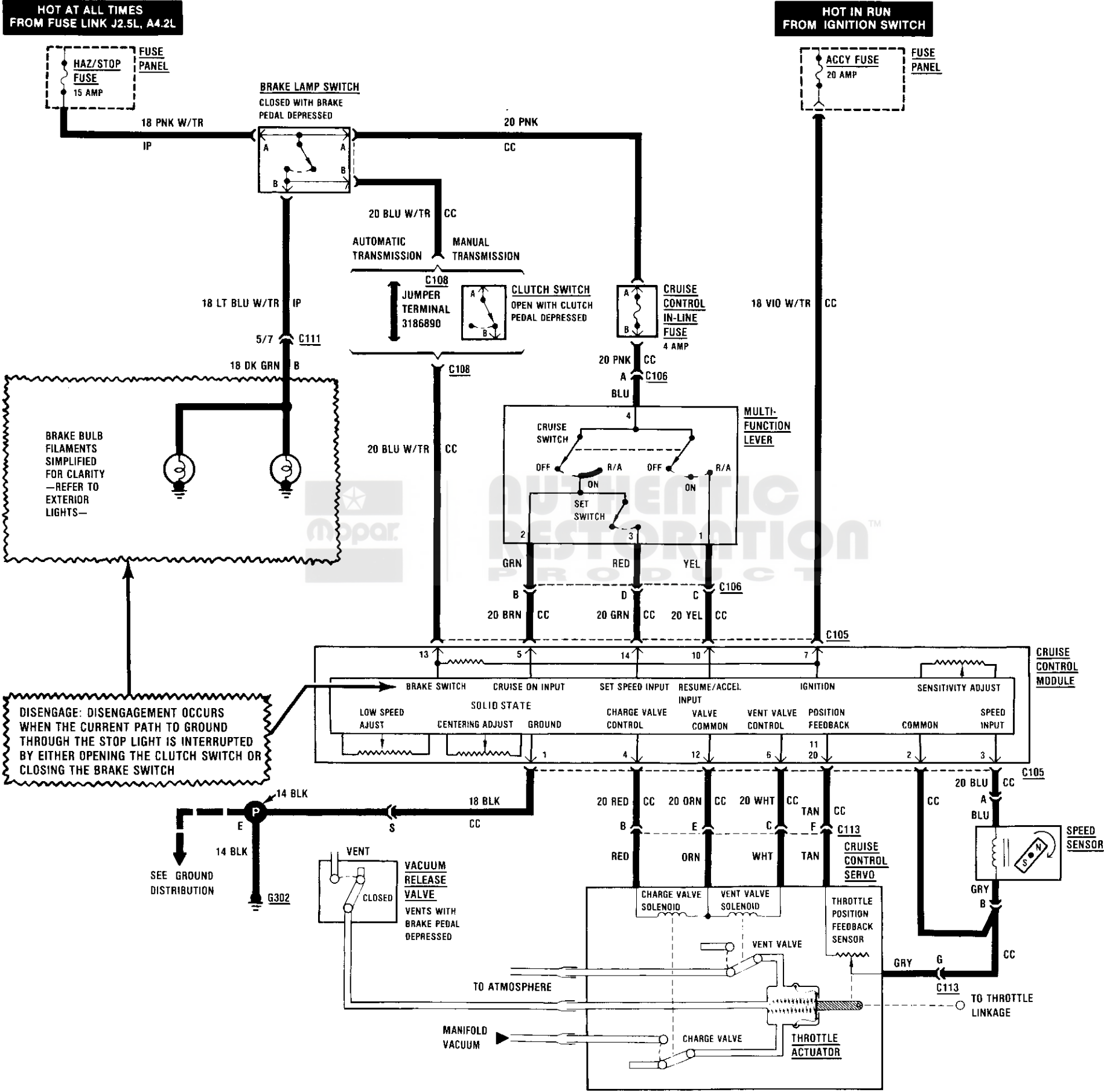
Temperature Gauge Resistance (Ohms)

100 ° F	1365 ohm
220°	93.5 ohm
260°	55.1 ohm

Voltmeter Calibration

VOLTAGE INPUT	POINTER ANGLE FROM VERTICAL	TOLERANCE
8V	− 30.0°	± 0.6V
10V	− 19.1°	
12V	− 6.6°	
14V	+ 6.6°	± 0.5V
16V	+ 19.1°	
18V	+ 30.0°	+ 0.6V

CRUISE CONTROL



CRUISE CONTROL

DESCRIPTION

The cruise control module automatically controls throttle position to maintain a speed set by the operator. The vehicle will keep the set speed unless the driver presses the brake, clutch or accelerator pedal.

The ACCY fuse supplies voltage to the cruise control module with the ignition switch in the RUN position. The HAZ/STOP fuse provides battery feed to the brake switch, cruise control fuse, and the multi-function lever at all times.

When the multi-function lever is in the ON position, voltage is applied to terminal 14 (speed set signal) and terminal 5 (cruise ON input).

The driver opens the set switch when the vehicle is at the set speed. Voltage to the speed set signal stops momentarily. The cruise regulator records the vehicle's speed at the moment there was no voltage at terminal 14 (speed set signal).

The resume/accelerate switch is used after the cruise control module has been interrupted by the current path to ground through the stop lights at terminal 13. This path is broken by the use of the brake or clutch pedals or when the driver wants to accelerate. When the switch is in the R/A position, voltage is applied to the resume/accelerate input (terminal 10). The cruise control module recognizes this voltage as an instruction to accelerate. When the switch is pushed into the R/A position and released immediately, voltage is applied only momentarily to terminal 10. The cruise control module interprets this voltage as an instruction to resume the previously set speed.

The cruise control module controls the servo on the basis of these voltages, the speed signal from the speed sensor and the position feedback input from that servo.

The cruise control module will energize the charge valve in the servo allowing vacuum to retract the bellow when acceleration is needed. During deceleration, the cruise control module will de-energize the vent valve and release the vacuum in the servo.

OPERATIONAL CHECK (ROAD TEST)

The following sequential checks are performed with the cruise switch ON and vehicle speed faster than 35 mph:

1. Press the set button at the end of multi-function lever and vehicle should maintain set speed.
2. Set button held in, foot off accelerator, and vehicle should coast to a slower speed.
3. Release set button and cruise control will engage and hold a slower speed, provided the speed remains above 35 mph.
4. Slide cruise switch to R/A, hold it there and vehicle should accelerate.
5. Release cruise switch back to ON and vehicle will hold the new faster speed, if set speed button has been pressed.
6. Tap brake pedal and vehicle will decelerate.
7. Slide cruise switch momentarily R/A and vehicle will accelerate to former set speed.
If the vehicle has a manual transmission, repeat steps 6 and 7 by depressing the clutch.
8. While cruising, accelerate, then remove foot from accelerator and the vehicle will coast back to set speed.
9. While cruise is engaged, tap set speed button and vehicle speed will increase 1 mph for each time it is tapped.

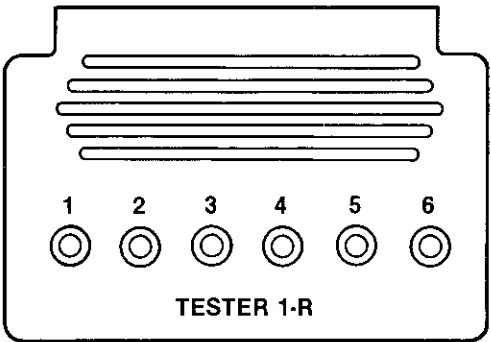
AM PC-1-R CRUISE CONTROL TESTER

The following troubleshooting charts are based on the results obtained from AM PC-1-R Cruise Control Tester.

To install the tester, remove the control module attaching screws, unplug the wiring connector and plug it into the tester. Disconnect and connect all cruise control connectors before testing to remove oxidation that may have formed on the connector terminals.

CAUTION: When separating wiring harness connectors do not pull on the wires. **PULL ONLY ON THE CONNECTORS.**

Proceed through the diagnostic chart and its instructions. Complete the entire test sequence even though a tester lamp may not come on.



If the tester fails the system, refer to the appropriate lamp out TROUBLESHOOTING CHART for component and circuit diagnosis.

CRUISE CONTROL TESTER DIAGNOSTIC CHART

MINIMUM OPERATION TO TURN ON LAMP	LAMP ON					
	1	2	3	4	5	6
A. CRUISE SWITCH ON • Set Switch Depressed	X					
B. CRUISE SWITCH ON		X				
C. IGNITION SWITCH ON • Depress Brake or Clutch To Turn OFF			X	X		
D. CRUISE SWITCH RESUME/ACCELERATE					X	X

CRUISE CONTROL SERVO CHECKS

E. CRUISE SWITCH RESUME/ACCELERATE • Engine Running					X	X
WARNING: Servo will pull throttle wide open. Keep RPM at safe limit by releasing the cruise switch. Parking brake fully engaged; automatic transmission in park; manual transmission in neutral.						

TROUBLESHOOTING — No Lamps On

1. MODULE GROUND: Ignition OFF

TEST	OK	NOT OK
Terminal 1 to chassis ground	Zero ohms	Repair open to Ground G302

TROUBLESHOOTING — Lamp No. 1 Off/Set Switch

1. FUSES: Ignition ON; cruise switch ON; set switch pressed

TEST	OK	NOT OK
Inspect HAZ/STOP fuse	Not blown	Replace fuse
Battery side of HAZ/STOP fuse	12 volts	Repair open from ignition switch
Inspect in-line fuse	Not blown	Replace fuse
Brake switch side of in-line fuse with brake pedal pressed	12 volts	Repair open from brake switch

2. SET SWITCH: Ignition ON; cruise switch ON; set switch pressed

TEST	OK	NOT OK
Connector C106 Terminal A	12 volts	Repair open from in-line fuse
Connector C106 Terminal D	12 volts	Replace cruise switch
Connector C105 Terminal 14	12 volts	Repair open from control switch

CRUISE CONTROL

TROUBLESHOOTING —Lamp No. 2 Off/ Cruise Switch and Speed Sensor

1. CRUISE SWITCH: Ignition ON; cruise switch ON

TEST	OK	NOT OK
Connector C106 Terminal B	12 volts	Replace cruise switch
Connector C105 Terminal 5	12 volts	Repair open from cruise switch
Across connector Terminals 2 and 3	15–50 ohms	Proceed to speed sensor tests
Across speed sensor Terminals A and B	15–50 ohms	Replace speed sensor If correct resistance value, repair open to control module
Terminals A and B with rear wheels spinning	At 30 mph .9v AC voltage should increase .1v AC per each 10 mph	Replace speed sensor

TROUBLESHOOTING —Lamp No. 3 Off/ Brake and Clutch Switch Circuits

1. BRAKE/CLUTCH CIRCUIT: Ignition ON

TEST	OK	NOT OK
Connector C105 Terminal 7	12 volts	Repair open from ACCY fuse
Jumper wire between connector C105 Terminals 7 13	Brake lights ON	Repair open in brake/clutch switch circuits

TROUBLESHOOTING —Lamp No. 4 Off/ Accy Fuse and Throttle Position Feedback Sensor

1. ACCY FUSE/FEEDBACK SENSOR; Ignition ON

TEST	OK	NOT OK
Check ACCY fuse	Not blown	Replace fuse
Battery side of ACCY fuse	12 volts	Repair open from ignition switch
Connector C105 across Terminals 2 and 11 while moving throttle from idle to wide open	240–4K ohms 280–430 ohms at idle 4K (4000) ohms at wide open	Next step
Connector C113 across Terminals G and F while moving throttle from idle to wide open		Replace control servo If resistance values are OK, repair open to control module

TROUBLESHOOTING —Lamp No.’s 5 and 6 Off/Resume and Accelerate

1. VENT VALVE CIRCUIT: Ignition ON; cruise switch in R/A position

TEST	OK	NOT OK
Connector C106 Terminal C	12 volts	Replace cruise switch
Connector C105 Terminal 10	12 volts	Repair open from cruise switch
Across Connector C105 Terminals 6 and 12	30–50 ohms	Proceed to engine running test
Connector C105 Terminal 6 and 12 to clean chassis ground	Infinite resistance (OPEN)	Replace control servo

2. CHARGE VALVE CIRCUIT: Ignition ON; cruise switch in R/A position

TEST	OK	NOT OK
Across Connector C105 terminals 4 and 12	30–50 ohms	Proceed to engine running test
Terminal 4 to clean chassis ground	Infinite resistance (OPEN)	Replace control servo

TROUBLESHOOTING —Engine Running Test

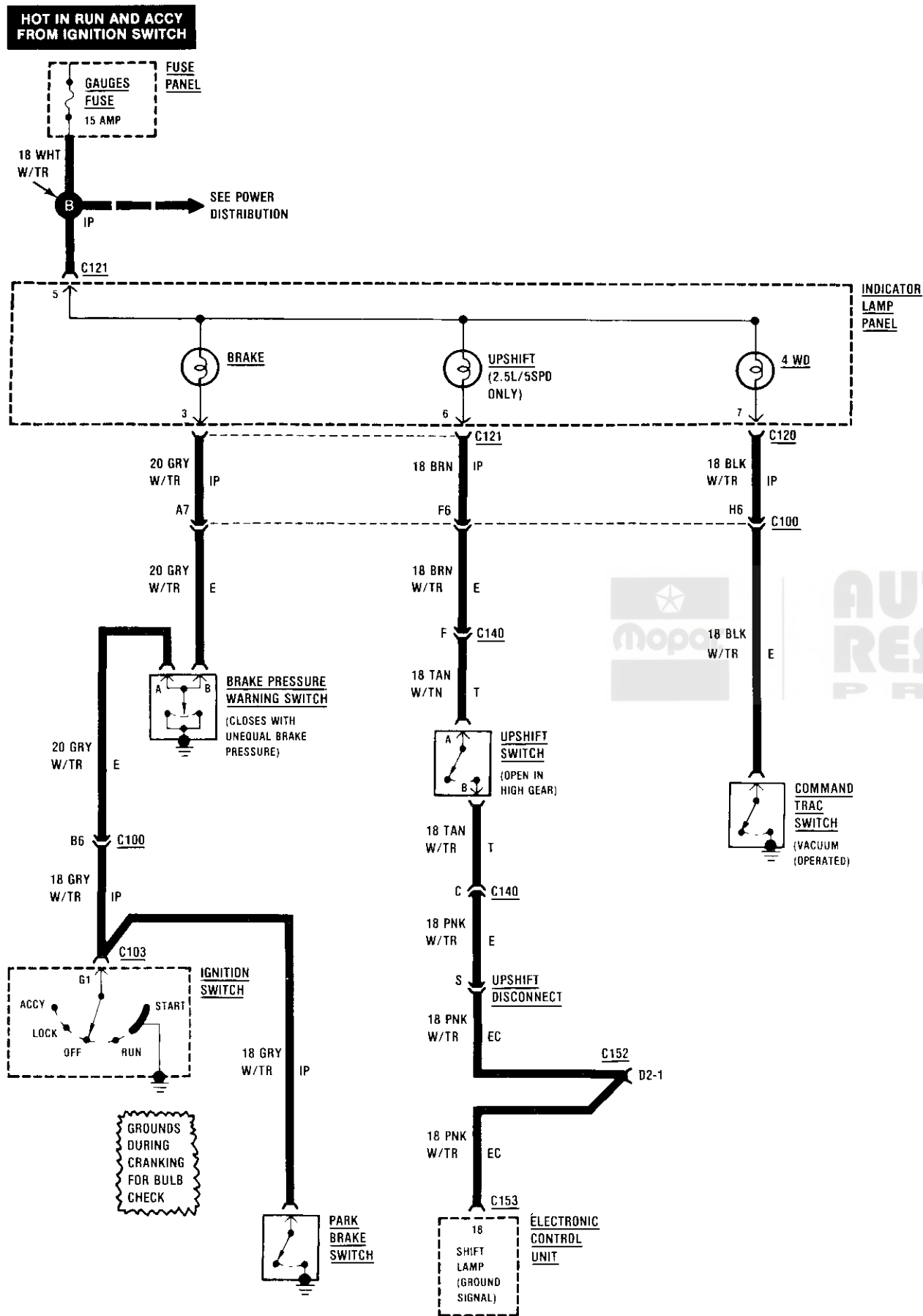
1. HOSE ROUTINGS AND SERVO CABLE

TEST	OK	NOT OK
Inspect the following: - Servo cable for breaks and hook-up. - Engine vacuum can and hose connections (small hose)	Proper connection	Repair as required

2. BRAKE VENT VALVE HOSE AND CONTROL SERVO

TEST	OK	NOT OK
Pinch brake vent hose (large hose) at servo and repeat test	Servo operates	Replace control servo If servo operates, inspect vent hose for kinks, cuts or other damage. Also, check brake vent valve adjustment

INDICATOR LAMPS



DESCRIPTION

The brake, upshift and 4WD lamps are located in the indicator lamp panel above the steering column. The lamps share a common battery feed connection through the ignition switch and GAUGES FUSE. Switches in series with ground circuits complete the indicator lamp circuit.

The 4WD indicator lamp circuit is completed by a vacuum switch located below the battery. When vacuum is applied to the axle mounted shift motor, it is also applied to the indicator lamp switch.

The upshift switch is normally closed to complete the circuit from the lamp to the electronic control module. Since further shifts are no longer possible in fifth gear, the switch is opened to prevent operation of the lamp. With a completed circuit the indicator lamp will be illuminated by the ECU. The numerous inputs received by the ECU enable it to indicate through the lamp the best time to upshift to a higher gear.

The brake indicator is a dual function lamp. It will indicate an unequal pressure condition in the brake hydraulic system and it will also indicate when the parking brake is engaged. Separate switches are used for each indicator lamp function. A switch mounted on the brake pedal assembly will close a ground circuit whenever the parking brakes are applied. A second switch is installed in the brake hydraulic lines near the master cylinder. If the switch is balanced by equal pressure on both ends of the switch valve, the valve remains centered and the lamp remains off. If the valve is shifted by unequal pressure between the front or rear brake hydraulic systems, the lamp circuit is connected to ground. To make sure the brake lamp is functional before the vehicle is driven, it is illuminated through a ground circuit when the ignition switch is turned to the START position.

TROUBLESHOOTING —All Lamps Out

1. FUSE: Ignition ON

TEST	OK	NOT OK
Inspect GAUGES fuse	Not blown	Replace fuse
Battery side of fuse	12 volts	Repair open from ignition switch

2. BATTERY SUPPLY: Ignition ON

TEST	OK	NOT OK
Terminal 5 at connector C121	12 volts	Repair open from fuse panel

TROUBLESHOOTING —One Lamp Out

1. BULB: Ignition ON

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb

INDICATOR LAMPS

2. BULB SOCKET: Ignition ON

TEST	OK	NOT OK
Battery side of bulb socket	12 volts	Replace printed circuit
Terminal 3, 6 or 7, depending upon bulb	12 volts	Replace printed circuit

TROUBLESHOOTING —Command Trac Lamp Out

1. VACUUM SOURCE: Engine running; Command Trac switch in 4WD

TEST	OK	NOT OK
Check for vacuum supply to switch	Vacuum present	Repair as necessary. Refer to M.R. 279

2. COMMAND TRAC SWITCH: Engine running; Command Trac switch in 4WD

TEST	OK	NOT OK
Battery side of switch	12 volts	Repair open from printed circuit
Switch housing to ground	Zero ohms	Clean ground connection If zero ohms, replace switch

TROUBLESHOOTING —Upshift Lamp Out

1. UPSHIFT LAMP SWITCH CIRCUIT: Ignition ON; transmission in 1st gear

TEST	OK	NOT OK
Jumper wire from diagnostic connector terminal D2-1 to a clean chassis ground	Lamp ON	Lamp OFF; proceed to switch test Lamp ON; proceed to ECU test

2. UPSHIFT LAMP SWITCH: Ignition ON; transmission in 1st gear; jumper removed

TEST	OK	NOT OK
Switch Terminal A	12 volts	Repair open from printed circuit
Switch Terminal B	12 volts	Replace switch If 12 volts, repair open to ECU Terminal T8

TROUBLESHOOTING —Brake Lamp Out

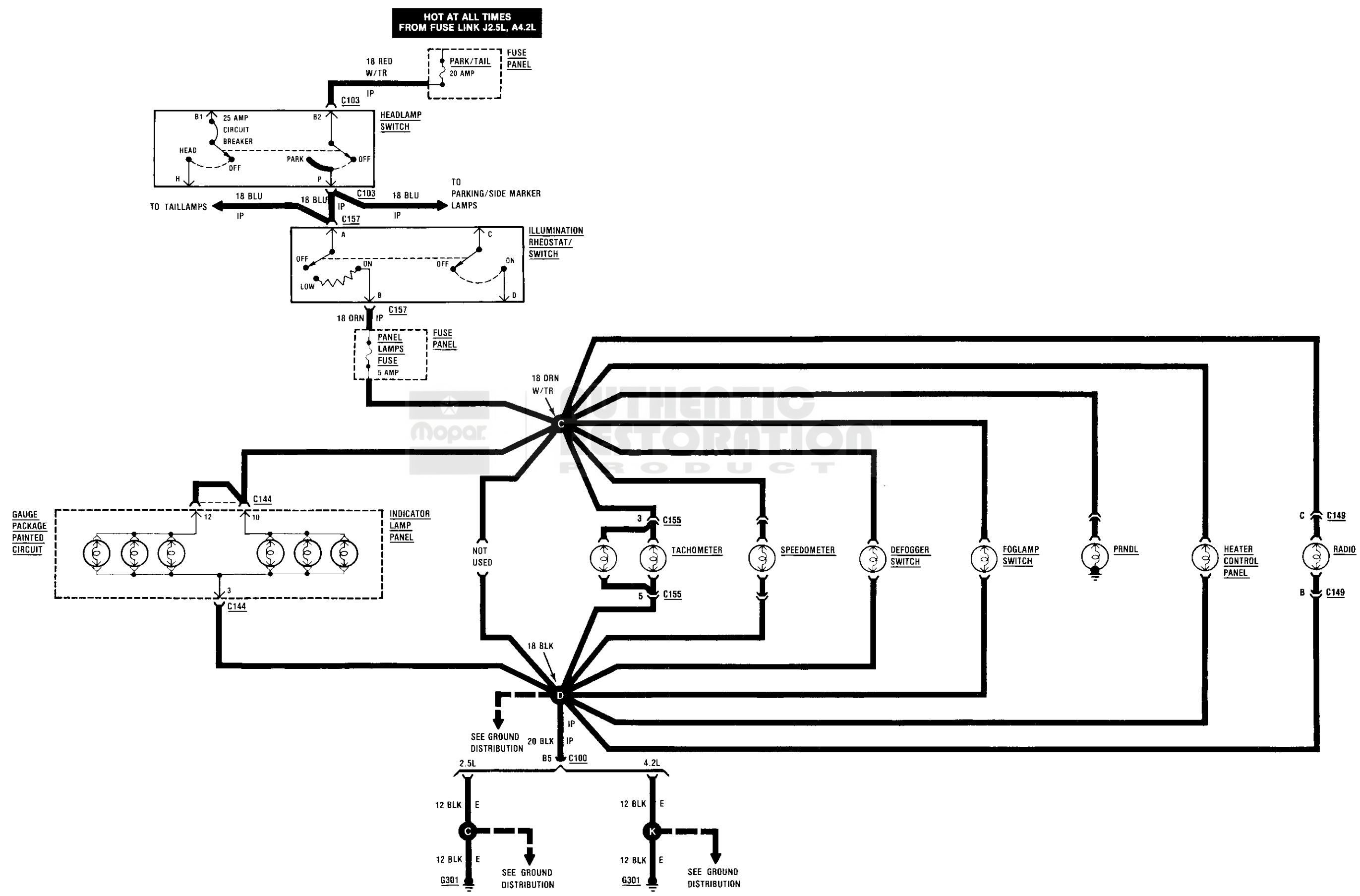
1. PARK BRAKE SWITCH: Ignition ON; parking brake applied

TEST	OK	NOT OK
Ground wire to park brake switch	Lamp ON	Lamp ON; replace switch Lamp OFF; repair open from ignition switch

2. BRAKE PRESSURE WARNING SWITCH: Ignition ON

TEST	OK	NOT OK
Switch Terminal B	12 volts	Repair open from printed circuit
Switch Terminal C	12 volts	Replace switch
Ignition switch Terminal G1	12 volts	Repair open from switch If 12 volts, replace ignition switch

INSTRUMENT PANEL ILLUMINATION LAMPS



INSTRUMENT PANEL ILLUMINATION LAMPS

DESCRIPTION

The instrument panel illumination lamps share two common connections. Splice C connects the lamps to battery feed while splice D connects the lamps to ground. Because they share these common connection points in a parallel circuit, the illumination lamps will all come on at the same time. It also means one or more lamps can be out without affecting the operation of the other lamps.

On the battery side of the circuit, the headlamp switch, illumination rheostat/switch and PANEL LAMPS fuse receive battery feed in series from the PARK/TAIL fuse.

In the park lamp position, the headlamp switch completes the circuit from the PARK/TAIL fuse to the illumination rheostat/switch and PANEL LAMPS fuse.

The illumination rheostat contains a variable resistor that allows the driver to vary illumination intensity from off to full brightness.

TROUBLESHOOTING —All Lamps Out

1. FUSE: Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Battery side of panel lamps fuse	12 volts	Repair open from illumination rheostat/switch

2. ILLUMINATION RHEOSTAT/SWITCH: Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Check operation of taillamps	Taillamps ON	Test headlamp switch
Rheostat/switch Terminal B	12 volts	Replace rheostat/switch

TROUBLESHOOTING —One Lamp Out

1. BULB, BULB SOCKET: Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of bulb socket	12 volts	Repair open to battery side of bulb socket
Ground side of bulb socket	Zero ohms	Repair open to Ground G301

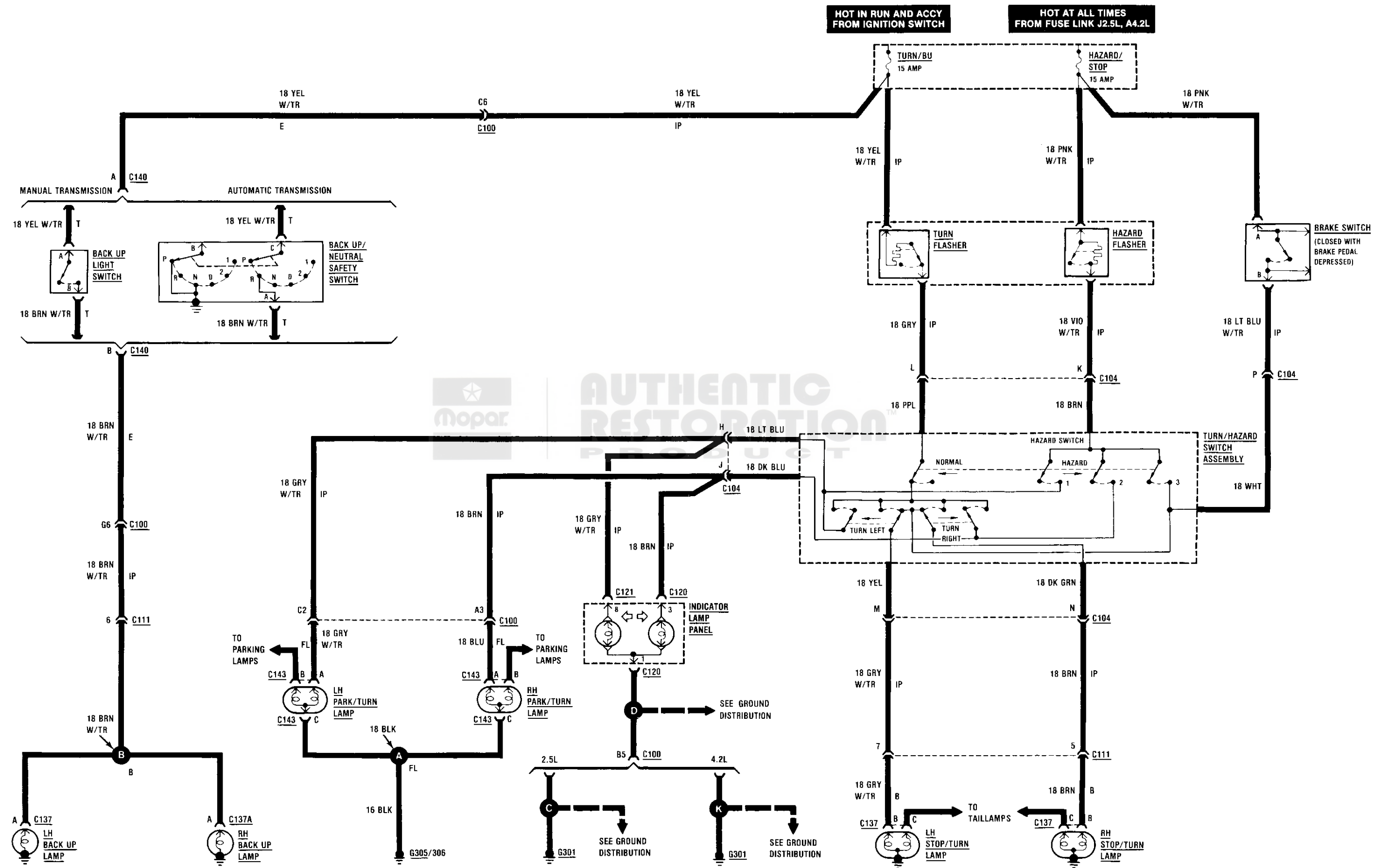
TROUBLESHOOTING —Gauge Package Lamps Out

1. BATTERY FEED, GROUND, PRINTED CIRCUIT: Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Gauge package Terminal 10	12 volts	Repair open from Splice C
Gauge package Terminal 12	12 volts	Repair open in jumper from Terminal 10
Gauge package Terminal 3	Zero ohms	Repair open to Ground G301

NOTE: If the battery feed and ground circuits are OK, replace the gauge package printed circuit.

LAMPS: TURN SIGNAL / STOP / HAZARD / BACKUP



TURN SIGNAL LAMPS

DESCRIPTION

Excluding the backup lamps, all components and lamps in this circuit are connected to the turn signal switch. On the battery side, the flashers and brake switch connect the turn signal switch to the TURN/BU and HAZARD/STOP fuses. The hazard and stop lamps are on a separate fuse and flasher circuit that is hot at all times. The continuous hot feed is necessary because these circuits must be functional without the ignition on.

The turn signal switch, which is mounted in the steering column behind the steering wheel, contains the contacts necessary for connecting various lamp combinations to battery feed. In the neutral position, the stop lamp contacts are aligned and the circuit will be completed whenever the brake switch is closed. In the left or right turn position, the appropriate exterior lamps and instru-

ment panel indicator lamp are connected to the turn signal flasher. While the switch is making the connection to the turn signal, it is also maintaining the circuit to the remaining stop and indicator lamp. In the hazard position, the turn signal lamps are connected to the hazard flasher.

The separate backup lamp circuit has a common connection with the turn signal circuit at the TURN/BU fuse. From the fuse, the battery feed circuit is connected to a transmission mounted switch. On a manual transmission equipped vehicle, the switch is a separate component. On automatic transmission equipped vehicles, the backup lamp switch is incorporated into the neutral safety switch. In either case, the switch is closed only when the transmission is shifted into reverse.

TROUBLESHOOTING — Flasher Circuit

NOTE: Refer to parking and stop lamps for troubleshooting a one lamp out condition.

1. FUSE: Ignition ON

TEST	OK	NOT OK
Check operation of backup lamps	Lamps ON	Check TURN/BU fuse
Battery side of TURN/BU fuse	12 volts	Repair open from ignition switch

2. FLASHER: Ignition ON

TEST	OK	NOT OK
Across flasher terminals	Zero ohms	Replace flasher
Battery side of flasher	12 volts	Repair open from fuse panel
Terminal L of steering column connector	12 volts	Repair open from flasher

3. SWITCH: Steering column connector separated; switch in left or right turn position as required

TEST	OK	NOT OK
Steering column connector terminals L and M for left turn	Zero ohms	Replace switch
Steering column connector terminals L and N for right turn	Zero ohms	Replace switch

TROUBLESHOOTING — Turn Signal Indicator Lamps

1. SWITCH: Ignition ON; turn signal switch in left or right turn position as required

TEST	OK	NOT OK
Steering column connector terminal H for left turn	12 volts (Pulsing)	Replace switch
Steering column connector terminal J for right turn	12 volts (Pulsing)	Replace switch

2. LAMP: Ignition ON: Turn signal switch in right or left turn position as required

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of bulb socket	12 volts (Pulsing)	Repair open from steering column connector
Ground side of bulb socket	Zero ohms	Repair open to ground G301

STOP LAMPS

TROUBLESHOOTING —One Lamp Out

1. BULB: Brake pedal pressed

TEST	OK	NOT OK
Install replacement bulb	Lamp on	Next step
Battery side of bulb socket	12 volts	Repair open from turn signal switch
Ground side of bulb socket	Zero ohms	Repair open in ground wire

TROUBLESHOOTING —Both Lamps Out

1. FUSE

TEST	OK	NOT OK
Check operation of HAZARD/STOP lamps	HAZARD lamps on	Check fuse
Battery side of HAZARD/STOP fuse	12 volts	Repair open from fuse link J/2.5L, A 4.2L

2. BRAKE SWITCH: Brake pedal pressed

TEST	OK	NOT OK
Terminal A	12 volts	Repair open from HAZARD/STOP fuse
Terminal B	12 volts	Replace brake switch

3. TURN SIGNAL SWITCH: Brake pedal pressed

TEST	OK	NOT OK
Turn signal switch connector terminal P	12 volts	Repair open from brake switch
Turn signal switch connector terminals M and N	12 volts	Replace turn signal switch

HAZARD LAMPS

TROUBLESHOOTING —One Lamp Out

NOTE: Refer to park lamps or stop lamps for a one lamp out condition.

1. FUSE

TEST	OK	NOT OK
Check operation of STOP lamps	Lamps on	Check HAZARD/STOP fuse
Battery side of HAZARD/STOP fuse	12 volts	Repair open from fuse link J/2.5L, A/4.2L

2. FLASHER CIRCUIT

TEST	OK	NOT OK
Battery side of flasher	12 volts	Repair open from fuse panel
Across flasher terminals	Zero ohms	Replace flasher
Steering column connector Terminal K	12 volts	Repair open from flasher

3. TURN SIGNAL SWITCH: Hazard switch ON

TEST	OK	NOT OK
Steering column connectors H, J, M and N	12 volts (Pulsating)	Replace turn signal switch

TROUBLESHOOTING —Hazard Indicator Lamps

1. SWITCH: Ignition ON; hazard switch in ON position

TEST	OK	NOT OK
Steering column connector terminal H for left indicator	12 volts (Pulsing)	Replace switch
Steering column connector terminal J for right indicator	12 volts (Pulsing)	Replace switch

HAZARD LAMPS

2. LAMP: Ignition ON; hazard switch in ON position

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of bulb socket	12 volts (Pulsing)	Repair open from steering column connector
Ground side of bulb socket	Zero ohms	Repair open to ground G301

BACKUP LAMPS

1. LAMP: Ignition ON; transmission selector lever in reverse

TEST	OK	NOT OK
Install replacement bulb	Lamp ON	Next step
Battery side of bulb socket	12 volts	Proceed to switch tests
Ground side of bulb socket	Zero ohms	Repair open to ground

2. BACKUP LAMP SWITCH: Ignition ON; transmission selector lever in reverse

TEST	OK	NOT OK
Battery side of switch	12 volts	Repair open from fuse panel
Lamp side of switch	12 volts	Replace switch If 12 volts, repair open to backup lamp



16 WHT

C121

HIGH BEAM

16 LT GRN

IP

16 WHT

IP



DESCRIPTION

Battery feed for this circuit originates at the lighting fuse link located at the starter relay/solenoid. Once inside the passenger compartment, the wire is spliced to feed the PARK/TAIL fuse, headlamp switch and fog lamp relay. Circuit protection is provided by the fuse link, PARK/TAIL fuse and a 25 amp circuit breaker located in the headlamp switch.

From the headlamp switch, the circuits branch into the tail/sidemarkers/park lamp circuits and the headlamp circuit. Before reaching the headlamps, battery feed is routed to the dimmer switch, where it branches into the head/indicator/fog lamp circuits.

The dimmer switch transfers battery feed from the headlamp low beam filament to the high beam filament. It also serves as a fog lamp lock-out circuit. The circuit to the fog lamp switch is completed only when the dimmer switch is in the low beam position.

In the ON position, the fog lamp switch completes the relay coil battery feed circuit. With the coil energized, the relay contacts close connecting the fog lamps to battery feed through splice A and the lighting fuse link.

TAIL / SIDEMARKER / PARK LAMPS

TROUBLESHOOTING —One Lamp Out

1. LAMP: Headlamp switch ON

TEST	OK	NOT OK
Install replacement bulb	Lamp on	Next test
Battery side of bulb socket	12 volts	Repair open to battery side of bulb-socket
Ground side of bulb socket	Zero ohms	Repair open in ground wire

2. FUSE: Battery feed from splice A

TEST	OK	NOT OK
Inspect park/tail fuse	Not blown	Replace fuse
Battery side of park/tail fuse	12 volts	Repair open from fuse link J/2.5L, A/4.2L (splice A)

3. HEADLAMP SWITCH: Headlamp switch ON

TEST	OK	NOT OK
Terminal E	12 volts	Repair open from fuse panel
Terminal A	12 volts	Replace switch

FOG LAMPS

TROUBLESHOOTING —One Lamp Out

1. LAMP

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of lamp connector	12 volts	Repair open to battery side of wiring connector
Ground side of lamp connector to clean chassis ground	Zero ohms	Repair open to G305/306

TROUBLESHOOTING —Both Lamps Out

1. SWITCH/INDICATOR LAMP: Headlamp switch ON; dimmer switch in LO; fog lamp switch ON

TEST	OK	NOT OK
Terminal B	12 volts	Repair open from dimmer switch
Terminal C	12 volts	Replace switch
Terminal A	Zero volts	Zero volts and indicator lamp off—replace switch 12 volts—repair open to ground G305/306

3. RELAY

TEST	OK	NOT OK
Terminal 30	12 volts	Repair open in wire from Splice A (Fuselink J/2.5L, A4.2L)
Terminal 86	12 volts	Repair open from fog lamp switch
Terminal 85	Zero volts	Repair open to G305/306
Terminal 87	12 volts	Replace relay

HEADLAMPS

1. FUSE LINK: Dash panel connector & splice A

TEST	OK	NOT OK
Check operation of stop lamps	Stop lamps on	Repair open from fuse link J/2.5L, A/4.2L

2. HEADLAMP SWITCH: Headlamp switch ON

TEST	OK	NOT OK
Terminal C	12 volts	Repair open from splice A
Terminal D	12 volts	Replace headlamp switch

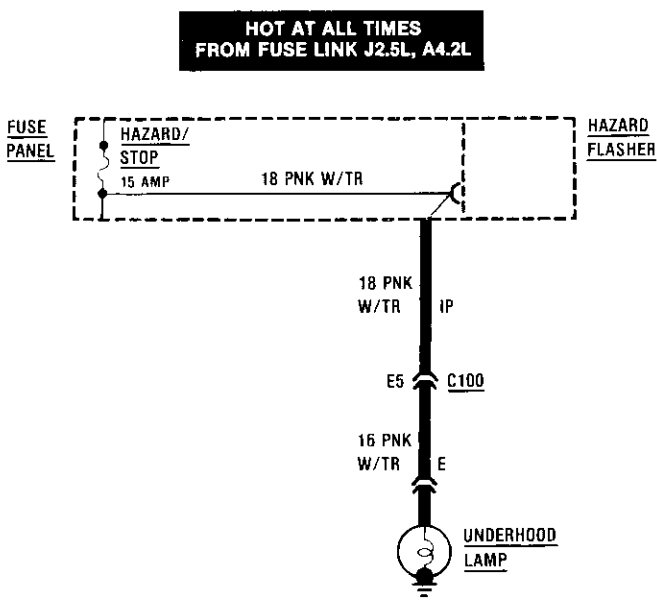
3. DIMMER SWITCH: Headlamp switch ON

TEST	OK	NOT OK
Terminal 2	12 volts	Repair open from headlamp switch
Terminal 1	12 volts (lo beam)	Replace dimmer switch
Terminal 3	12 volts (hi beam)	

4. HEADLAMPS: Headlamp switch ON

TEST	OK	NOT OK
Terminal C	12 volts (lo beam)	Repair open in wiring from dimmer switch
Terminal B	12 volts (hi beam)	
Terminal A	0 volts	Repair open to ground G305

UNDERHOOD LAMP



DESCRIPTION

The underhood lamp circuit begins at the hazard flasher battery terminal and extends into the engine compartment through the dash panel connector. At approximately the center of the dash panel, the wire extends from the wiring harness and joins the lamp connector.

The metallic lamp body serves as the ground connection and contains a mercury switch. When the hood is up, the mercury flows to the back of the lamp housing where it connects the battery supply terminal to the bulb filament.

TROUBLESHOOTING

1. FUSE

TEST	OK	NOT OK
Check operation of hazard lamps	Hazard lamps on	Refer to hazard lamp troubleshooting charts

2. LAMP

TEST	OK	NOT OK
Install replacement bulb	Lamp on	Next step
Underhood lamp housing to clean chassis ground	Zero ohms	Clean ground connection
Jumper from battery positive terminal to underhood lamp terminal	Lamp on	Replace lamp housing

3. BATTERY FEED

TEST	OK	NOT OK
Underhood lamp terminal	12 volts	Repair open from hazard flasher

LAMPS: CARGO / COURTESY

DESCRIPTION

The cargo/courtesy lamps are a switched ground circuit. Power feed from the DOME/COURTESY fuse goes directly to the lamps without passing through an ON/OFF switch. The switches are on the ground side of the circuit. When either door is opened, the door jamb switch closes and completes a path to ground.

The cargo and courtesy lamps can also be turned on at the illumination rheostat/switch.

The switch detent at the end of the maximum brightness setting also completes a path to ground for the cargo and courtesy lamps.

TROUBLESHOOTING —One Lamp Out

1. LAMP

TEST	OK	NOT OK
Across bulb terminals	Zero ohms	Replace bulb
Battery side of bulb socket	12 volts	Repair open from splice E
Ground side of bulb socket	Zero volts	Repair open to door jamb switch

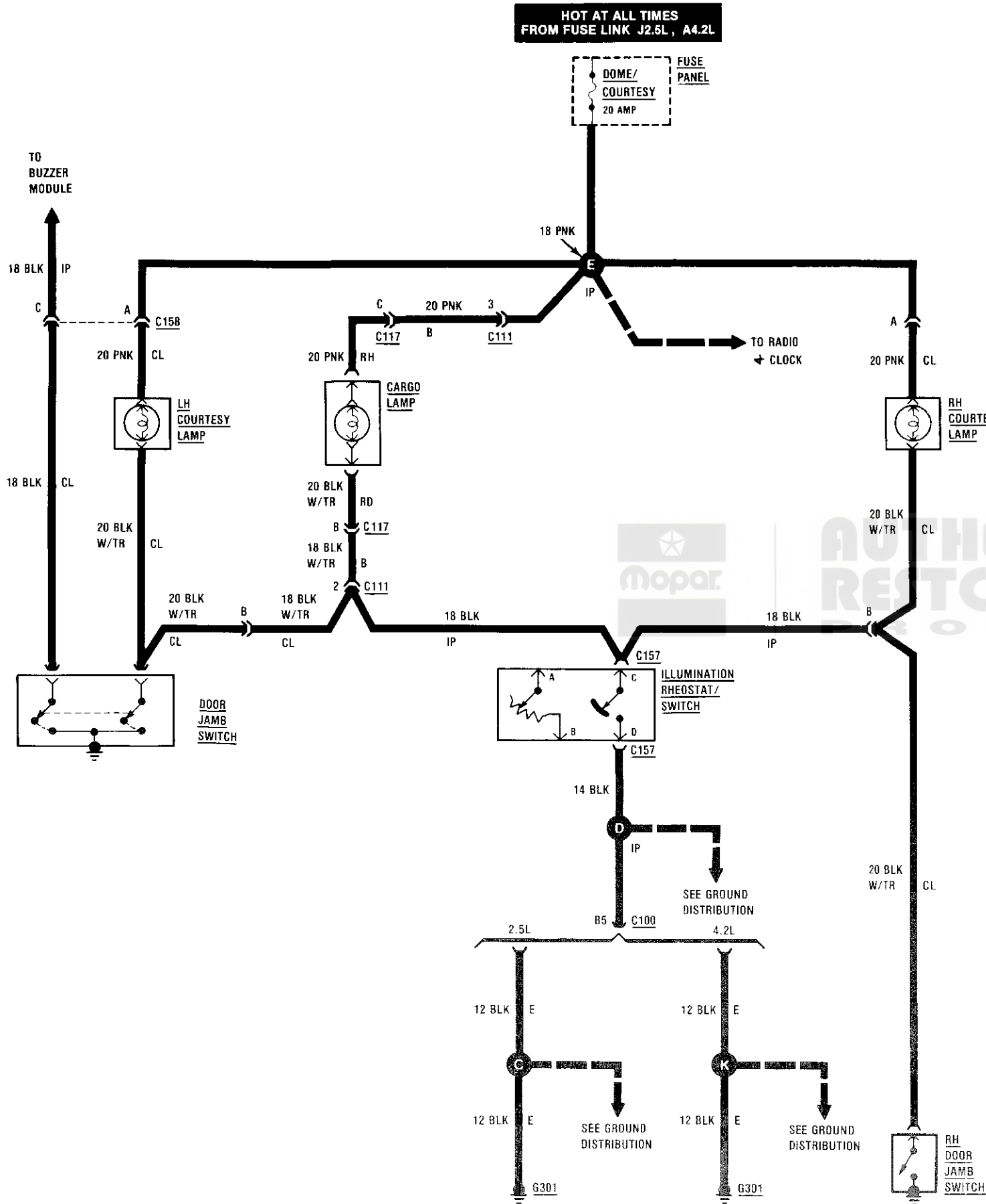
TROUBLESHOOTING —All Lamps Out

1. FUSE

TEST	OK	NOT OK
Inspect DOME/COURTESY fuse	Not blown	Replace fuse
Battery side of DOME/COURTESY fuse	12 volts	Repair open from fuse link J/2.5L, A/4.2L

2. SWITCHES: Illumination rheostat/switch rotated to lamps ON position

TEST	OK	NOT OK
Touch door jamb switch wiring terminal to clean chassis ground	Lamps ON	Next step If lamps come on, clean switch ground or replace switch
Disconnect wiring and measure across illumination rheostat/switch terminals C & D	Zero ohms	Replace switch
Illumination rheostat/switch terminal C	0 volts	Repair open from lamps to ground G301

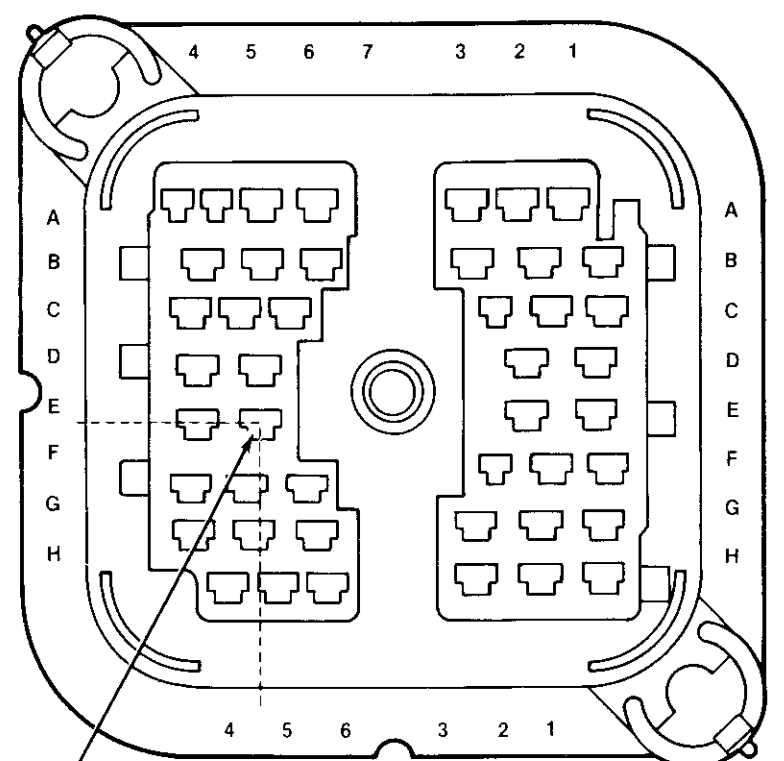
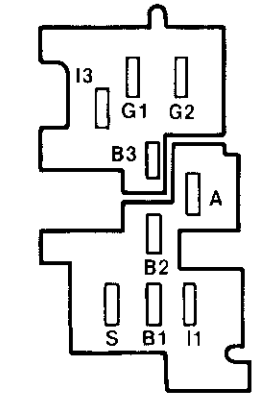
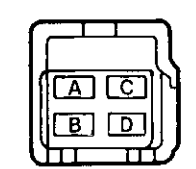
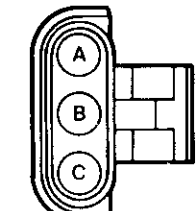
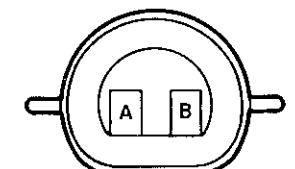
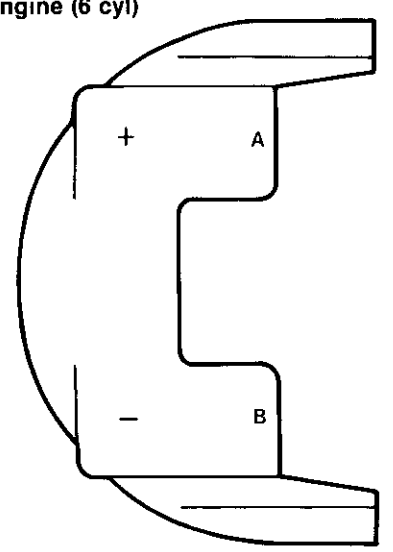
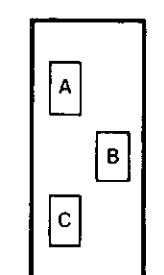
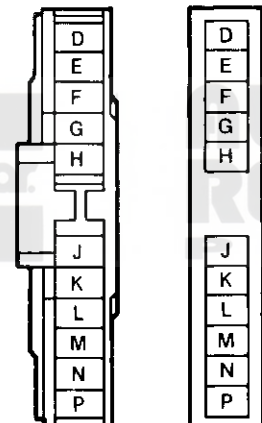
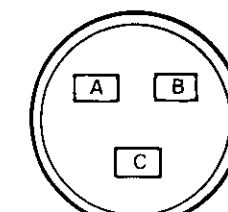
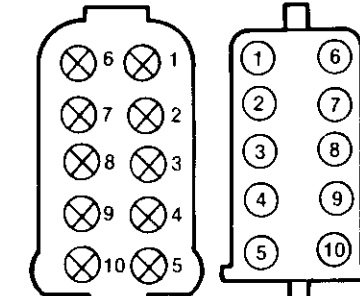
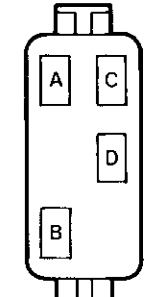
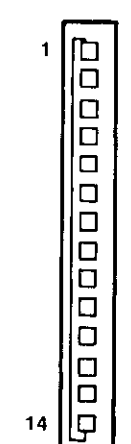
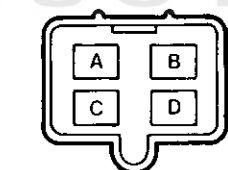
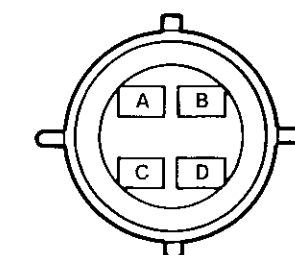
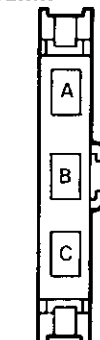
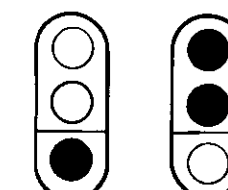
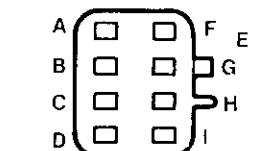
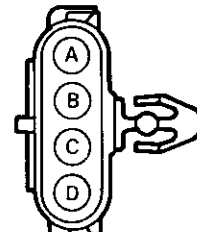


COMPONENT LOCATION LIST

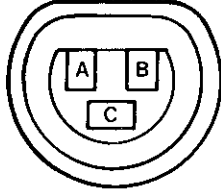
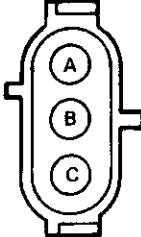
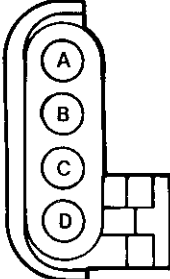
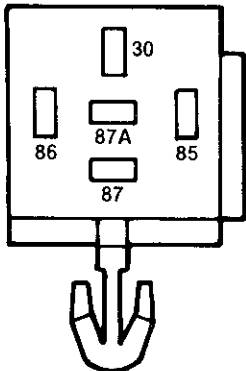
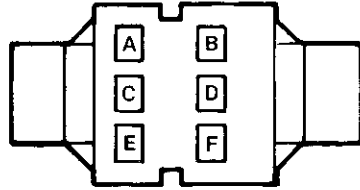
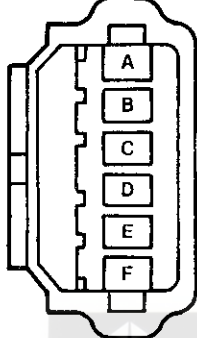
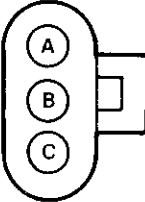
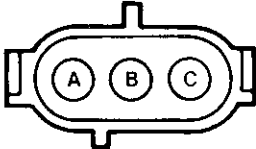
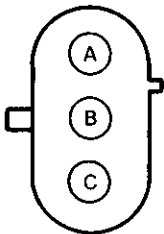
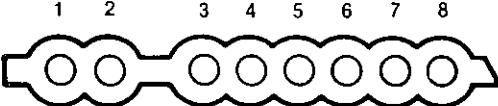
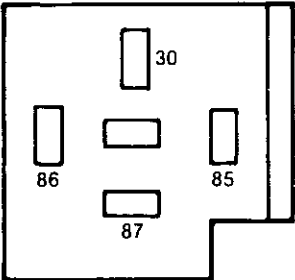
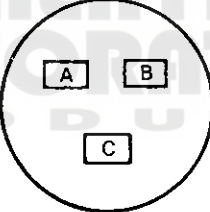
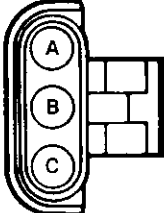
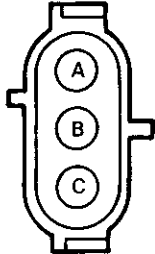
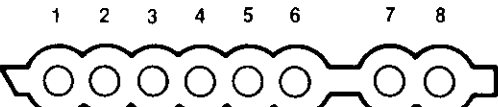
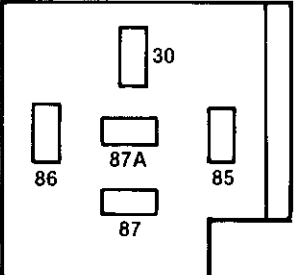
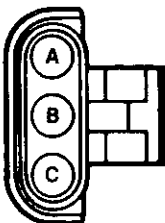
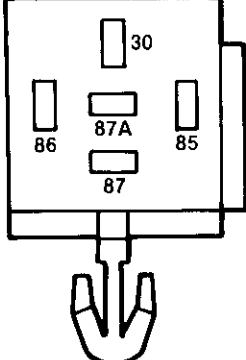
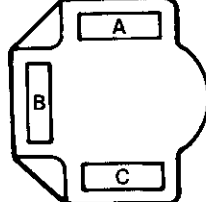
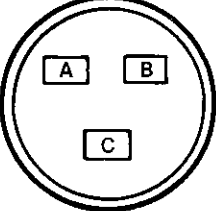
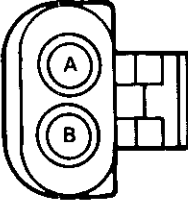
A/C CONTROL SWITCH	Below and to right of steering column
A/C PRESSURE SWITCH	Top of receiver/drier located in right front corner of engine compartment
AIR MANAGEMENT SOLENOID ASSEMBLY	Top of valve cover near dash panel
AIR TEMPERATURE SENSOR	Rear of intake manifold
ALTERNATOR	Right front of engine
AUTOMATIC TRANSMISSION JUMPER	Right rear corner of engine compartment behind diagnostic connectors
B+ LATCH RELAY	Right of battery
BACK-UP LAMP SWITCH	Right side of transmission case (4 spd.) Left side of transmission case (automatic and 5 spd.) NOTE: With automatic transmission, back-up lamp switch and neutral safety switch are in same housing.
BATTERY	Right rear corner of engine compartment
BLOWER RESISTOR	Behind right speaker grille above air vent door on blower housing
BLOWER SWITCH (A/C)	Below and to right of steering column
BLOWER SWITCH (HEATER)	Left side of heater control panel
BRAKE LAMP SWITCH	Above brake pedal
BRAKE PRESSURE SWITCH	Brake line junction block below master cylinder
CIGAR LIGHTER	Below heater control panel (less A/C) Below steering column (with A/C)
COIL	Left of battery on dash panel (4 cyl) Center of cylinder block on right side of engine (6 cyl)
COOLANT TEMPERATURE SENDER	Left rear corner of cylinder head
COOLANT TEMPERATURE SENSOR	Rear of intake manifold
COURTESY LAMPS	Lower edge of IP near doors
CRUISE CONTROL ON SWITCH	Turn signal lever stalk
CRUISE CONTROL CLUTCH SWITCH	Above clutch pedal
CRUISE CONTROL IN-LINE FUSE	Taped to cruise control harness near fuse panel
CRUISE CONTROL MODULE	Below fuse panel
CRUISE CONTROL SERVO	Left fender apron
CRUISE CONTROL SPEED SENSOR	Left lower corner of engine compartment
CRUISE CONTROL VACUUM RELEASE VALVE	Above brake pedal
DIAGNOSTIC CONNECTORS	Right of battery
DIODE/FUSE ASSEMBLY	Right rear corner of engine compartment behind diagnostic connectors
DISTRIBUTOR	Center of cylinder block on right side of engine
EGR/EVAPORATOR CANISTER SOLENOID	Left of battery
ELECTRIC CHOKE HEATER	Right side of carburetor
ELECTRONIC CONTROL UNIT (ECU)	Under instrument panel to left of blower housing
ENGINE SPEED SENSOR	Left side of transmission bellhousing
FOG LAMP RELAY	Behind left headlamp
FOG LAMP SWITCH	Below and to right of steering column
4WD INDICATOR LAMP SWITCH	Right side of front axle in vacuum servo
4WD VACUUM SWITCH	Left of battery on dash panel
FUEL INJECTOR	In throttle body
FUEL PUMP	In fuel tank
FUEL PUMP RELAY	Right side of battery
FUSE PANEL	Left corner under instrument panel
GROUND 301	Dipstick mounting bolt (4 cyl) Behind ignition coil (6 cyl)
GROUND 302	Behind ignition coil
GROUND 303	Dipstick mounting bolt

GROUND 304	Dipstick mounting bolt
GROUND 305	Radiator support to right of right headlamp
GROUND 306	Radiator support to left of left headlamp
GROUND 307	Behind left taillamp assembly
HAZARD LAMP SWITCH	Steering column below lock cylinder
HEADLAMP DIMMER SWITCH	Turn signal lever stalk
HEADLAMP SWITCH	Below and to left of steering column
HEATER BLOWER MOTOR	Below battery
HORN	Left fender apron
HORN RELAY	Above and to left of fuse panel
IDLE SOLENOID	Left side of carburetor
IDLE SPEED CONTROL MOTOR	Front of throttle body on right side
IDLE SPEED-UP RELAY	Right of battery
IGNITION CONTROL MODULE	Left of battery on dash panel
IGNITION KEY WARNING SWITCH	In steering column behind lock cylinder
IGNITION MODULE	Below windshield washer reservoir
IGNITION SWITCH	Steering column behind instrument panel
ILLUMINATION RHEOSTAT/SWITCH	Below and to left of steering column
KNOCK SENSOR	Intake manifold in front of carburetor
MANIFOLD HEATER	Under carburetor
MANIFOLD HEATER RELAY	Right of battery
MANIFOLD HEATER SWITCH	Intake manifold behind carburetor throttle linkage
MAP SENSOR	Behind valve cover on dash panel
MICROPROCESSOR CONTROL UNIT (MCU)	Under instrument panel to left of blower housing
NEUTRAL SAFETY SWITCH	Left side of transmission case NOTE: Neutral safety switch and back-up lamp switch are in same housing.
OIL PRESSURE SENDER	Behind alternator (4 cyl) Right rear corner of cylinder block (6 cyl)
OIL PRESSURE SWITCH	Right side of cylinder block near starter motor
OXYGEN SENSOR	Behind left engine mount (4 cyl) Below EGR valve (6 cyl)
PCV SOLENOID	Between carburetor and valve cover
PARK BRAKE INDICATOR LAMP SWITCH	Rear of park brake pedal assembly
POWER STEERING SWITCH	Right of power steering pump
RADIO IN-LINE FUSE	Back of radio chassis
REAR DEFOGGER RELAY	Behind park brake pedal assembly
REAR DEFOGGER SWITCH	To right of steering column
STARTER MOTOR	Right lower corner of engine
STARTER RELAY/SOLENOID	Below and to left of battery
STEPPER MOTOR	Rear of carburetor
THERMO ELECTRIC SWITCH	Right side of air cleaner housing
THROTTLE POSITION SENSOR	Rear of throttle body near bottom
UP-SHIFT DISCONNECT	Right rear corner of engine compartment behind diagnostic connectors
UP-SHIFT SWITCH	Right side of transmission case
VACUUM SWITCH ASSEMBLY	Behind valve cover on dash panel
WIDE OPEN THROTTLE SWITCH	Front of throttle body on right side (4 cyl) Right side of carburetor near bottom (6 cyl)
WINDSHIELD WASHER MOTOR	Bottom of washer reservoir located in left rear corner of engine compartment
WINDSHIELD WIPER DELAY MODULE	Lower left side of instrument panel
WINDSHIELD WIPER MOTOR	Lower left corner of windshield housing
WINDSHIELD WIPER SWITCH	Turn signal lever stalk

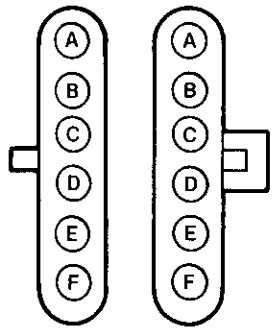
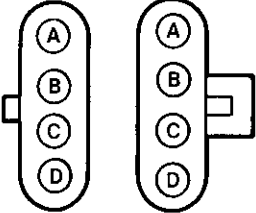
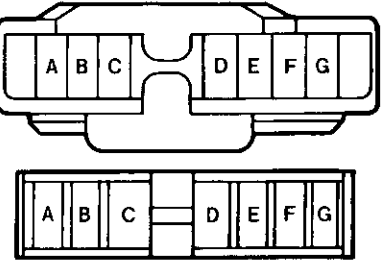
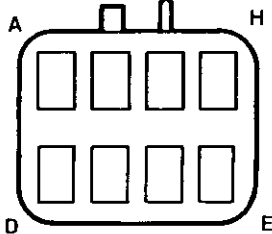
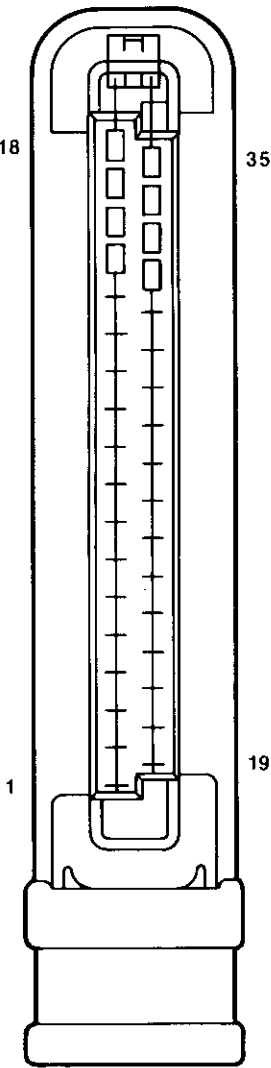
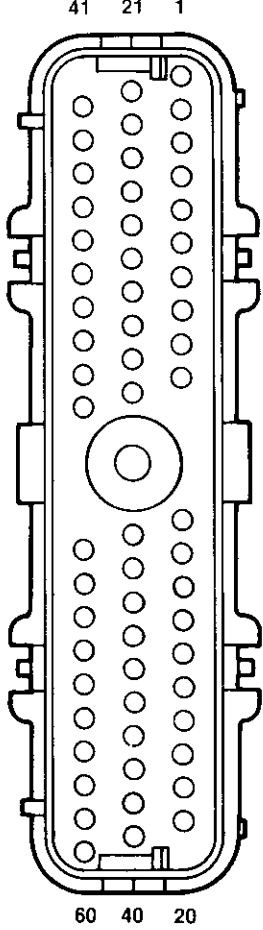
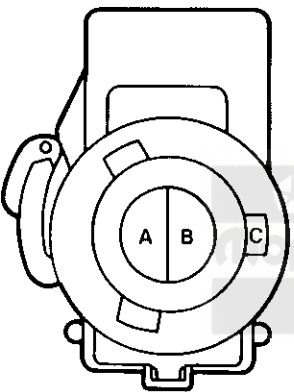
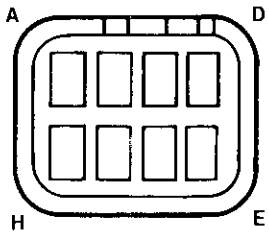
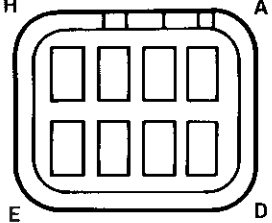
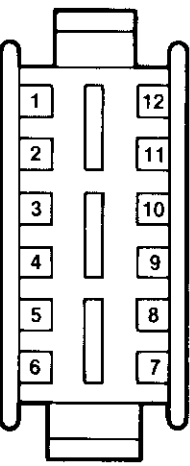
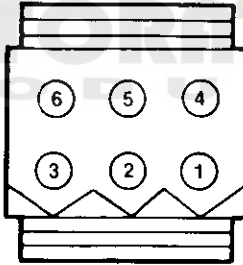
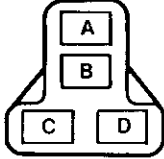
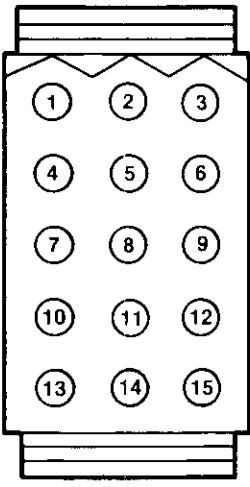
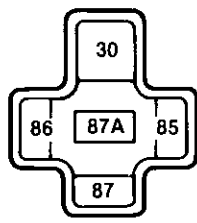
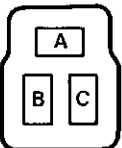
COMPONENT CONNECTOR VIEWS

C100: Dash panel  EXAMPLE E5	C103: Ignition switch Steering column behind instrument panel 	C106: Cruise control multifunction lever Turn signal lever 	C110: Vacuum switches Behind valve cover on dash panel 	C114: Ignition module—4.2L Below windshield washer reservoir 	
C101: Coil Left of battery on dash panel (4 cyl) Center of cylinder block on rt. side of engine (6 cyl) 	C102: Horn relay Above and to left of fuse panel 	C104: Turn signal switch Below ignition switch 	C107: A/C pressure switch Top of receiver/dryer located in right front corner of engine compartment 	C111: Body harness Above parking brake 	C115: Defogger switch To right of steering column 
		C105: Cruise control module Below fuse panel 	C108: Air management solenoid assembly Top of valve cover near dash panel 	C112: Ignition module—4.2L Below windshield washer reservoir 	C116: Foglamps switch Below and to the right of steering column 
			C109: A/C blower motor Plugs on fuse panel 	C113: Cruise control servo Left fender apron 	C117: Roof harness Above left rear tail lamp 

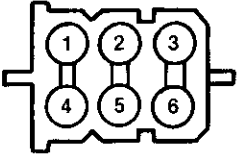
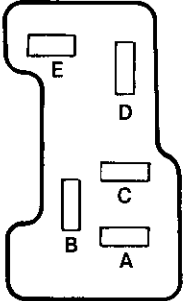
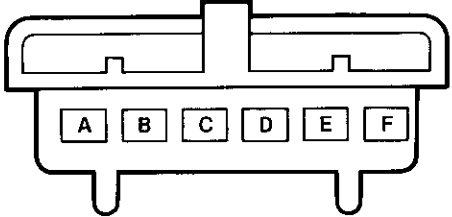
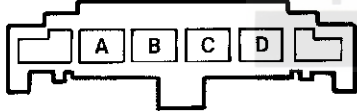
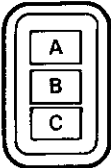
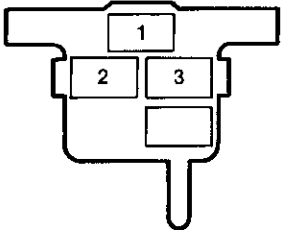
COMPONENT CONNECTOR VIEWS

C118: Body harness Upper LH shroud 	C123: Distributor Center of cylinder block on rt. side of engine 	C127: Oxygen sensor Behind left engine mount (4 cyl) Below EGR valve (6 cyl) 	C132: Idle speed actuator Front of throttle body on right side 	C136: B + latch relay Rt. of battery 
C119: Stepper motor—2.5L Rear of carburetor 	C124: Diode/fuse assembly Rear corner of engine compartment behind diagnostic connectors 	C128: Throttle position sensor Rear of throttle body near bottom 	C133: Speed sensor Left side of transmission bellhousing 	C137: Taillamp Below tail lamp assembly 
C120: Indicator lamps Left side of heater control 	C125: Idle relay Rt. of battery 	C129: Power steering switch Right of power steering pump 	C134: Map sensor Behind valve cover on dash panel 	C138: Fuel sender Lt. of fuel tank 
C121: Indicator lamps Beside rheostat switch 	C126: Manifold heater relay Rt. of battery 	C130: Ignition module—2.5L Below windshield washer reservoir on dash panel 	C135: Fuel pump relay Rt. side of battery 	C139: Headlamp Behind headlamp 
C122: Electric choke switch Lower rt. side of engine block 	C131: Ignition module—2.5L Left of battery on dash panel 			

COMPONENT CONNECTOR VIEWS

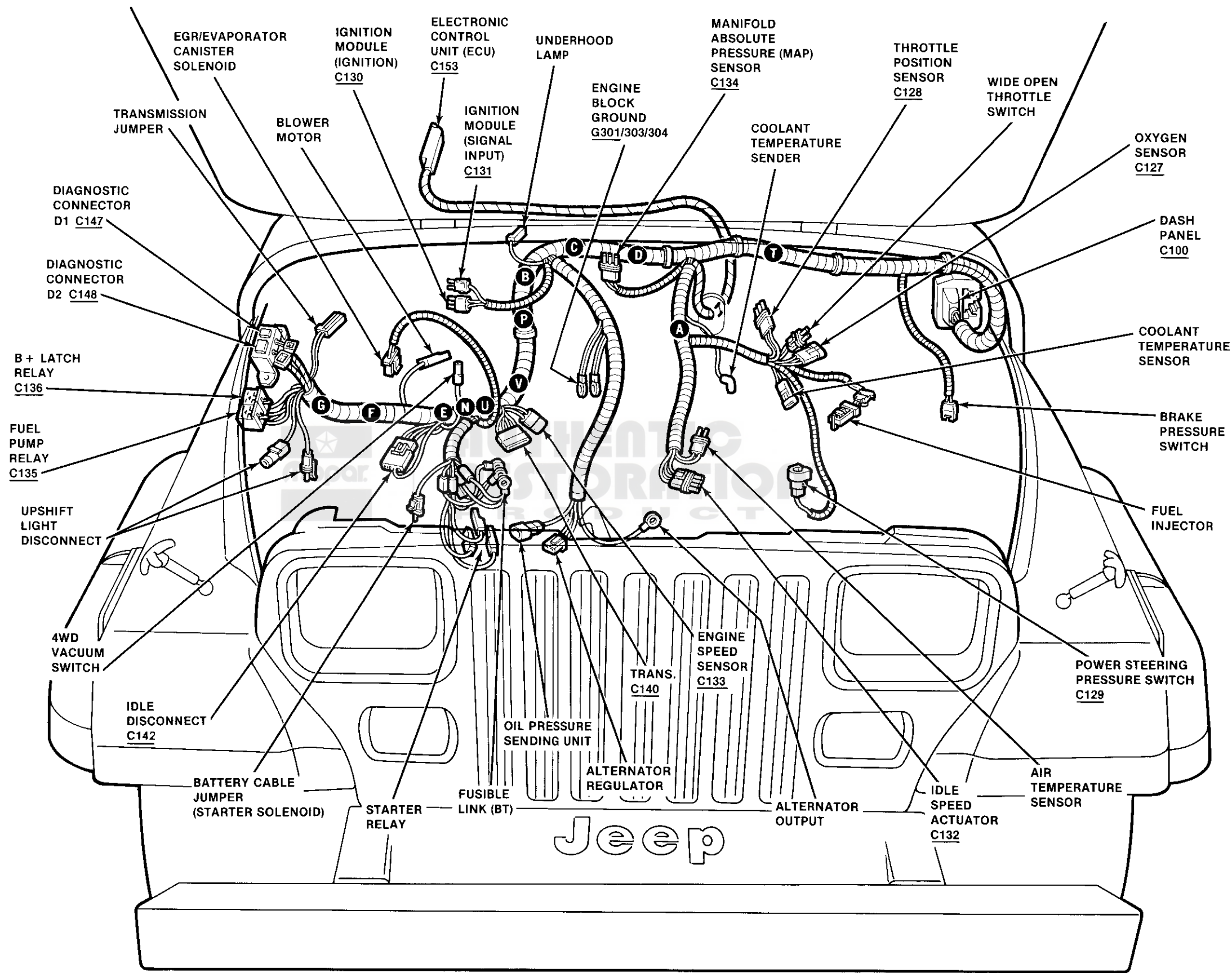
C140: Transmission harness Rt. side of bell housing 	C142: Idle disconnect Beside starter relay 	C145 A/B: Wiper switch Turn signal lever stalk 	C149: Radio Behind radio 	C153: 2.5L Electronic control unit (ECU) Under instrument panel to left of blower housing 
C141: 4.2L Microprocessor control unit (MCU) Under instrument panel to left of blower housing 	C143: Park/turn lamp Below headlamps 	C146: Wiper motor Lower left corner of windshield housing 	C150: Radio Behind radio 	
	C144: Gauge package Behind gauge package 	C147: Diagnostic connector D1 Right of battery 	C151: Blower switch Left of heater controls 	
		C148: Diagnostic connector D2 Right of battery 	C152: Fog lamp relay Behind left headlamp 	C154: Blower resistor Behind right speaker grille above air vent door on blower housing 

COMPONENT CONNECTOR VIEWS

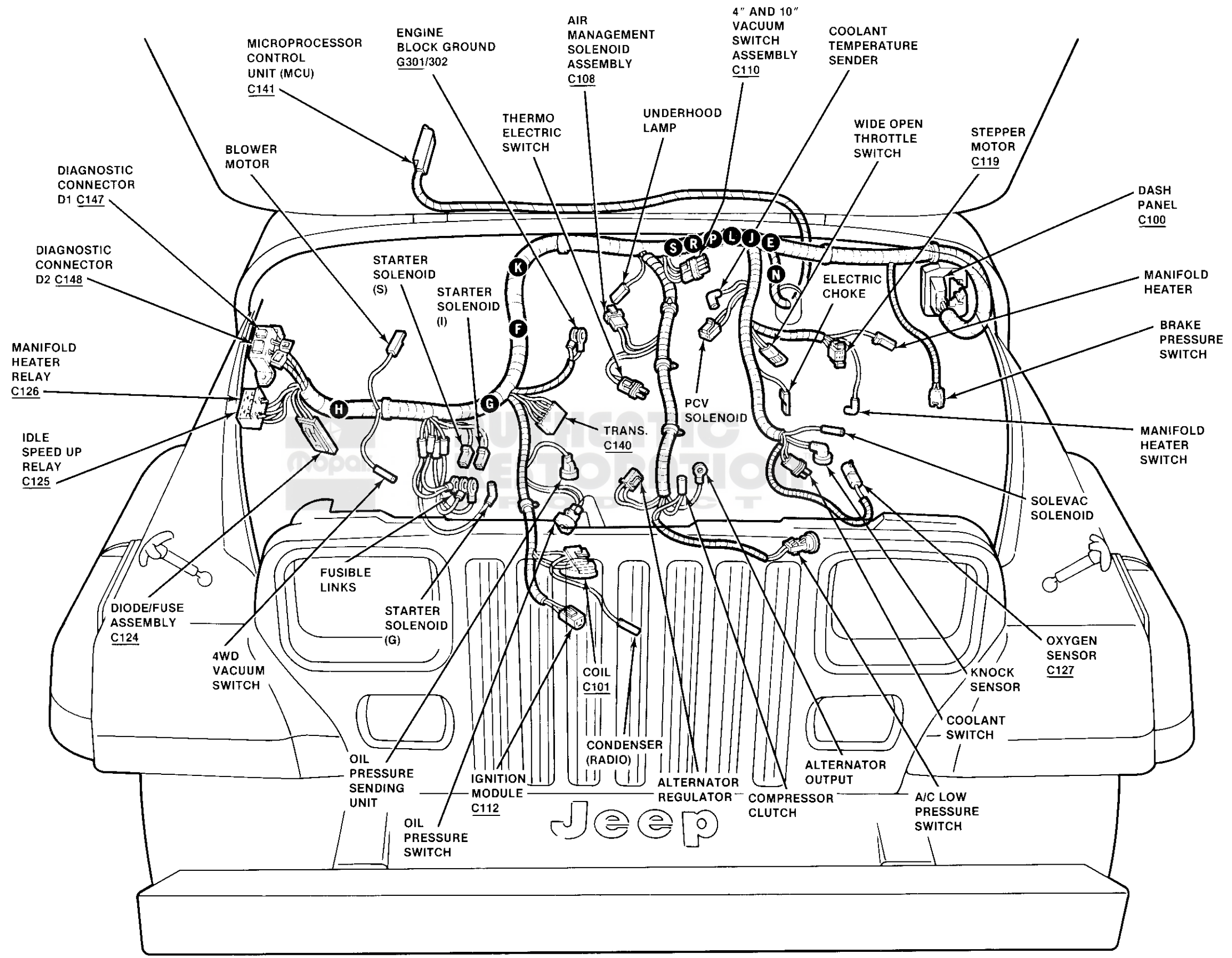
C155: Tachometer Behind tach 	C160: Defogger relay Lower LH shroud 
C156: Headlamp switch Below and to the left of steering column 	
C157: Illumination rheostat Behind rheostat 	
C158: LH courtesy lamp harness Below left speaker 	
C159: Headlamp dimmer switch Turn signal lever stalk 	

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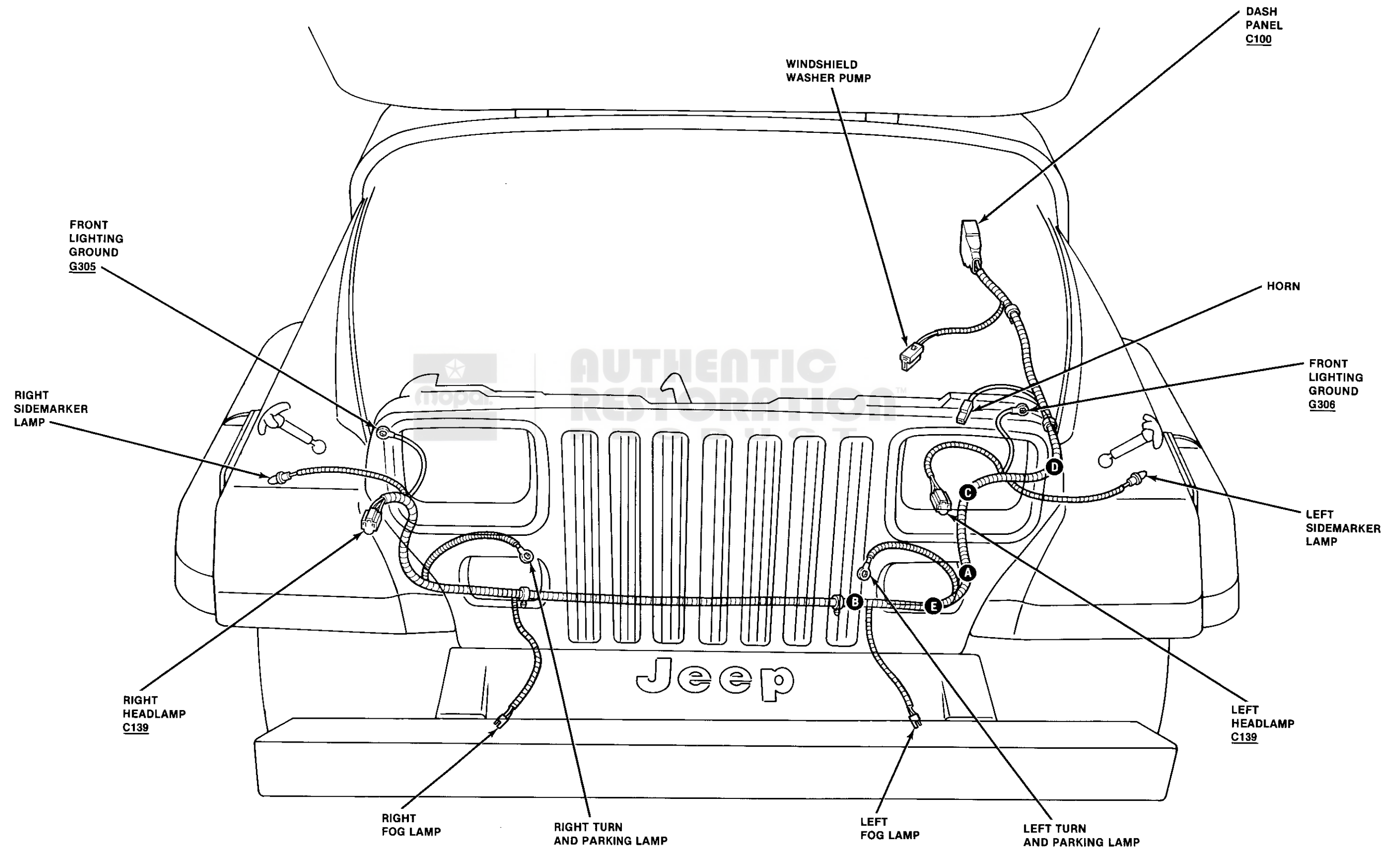
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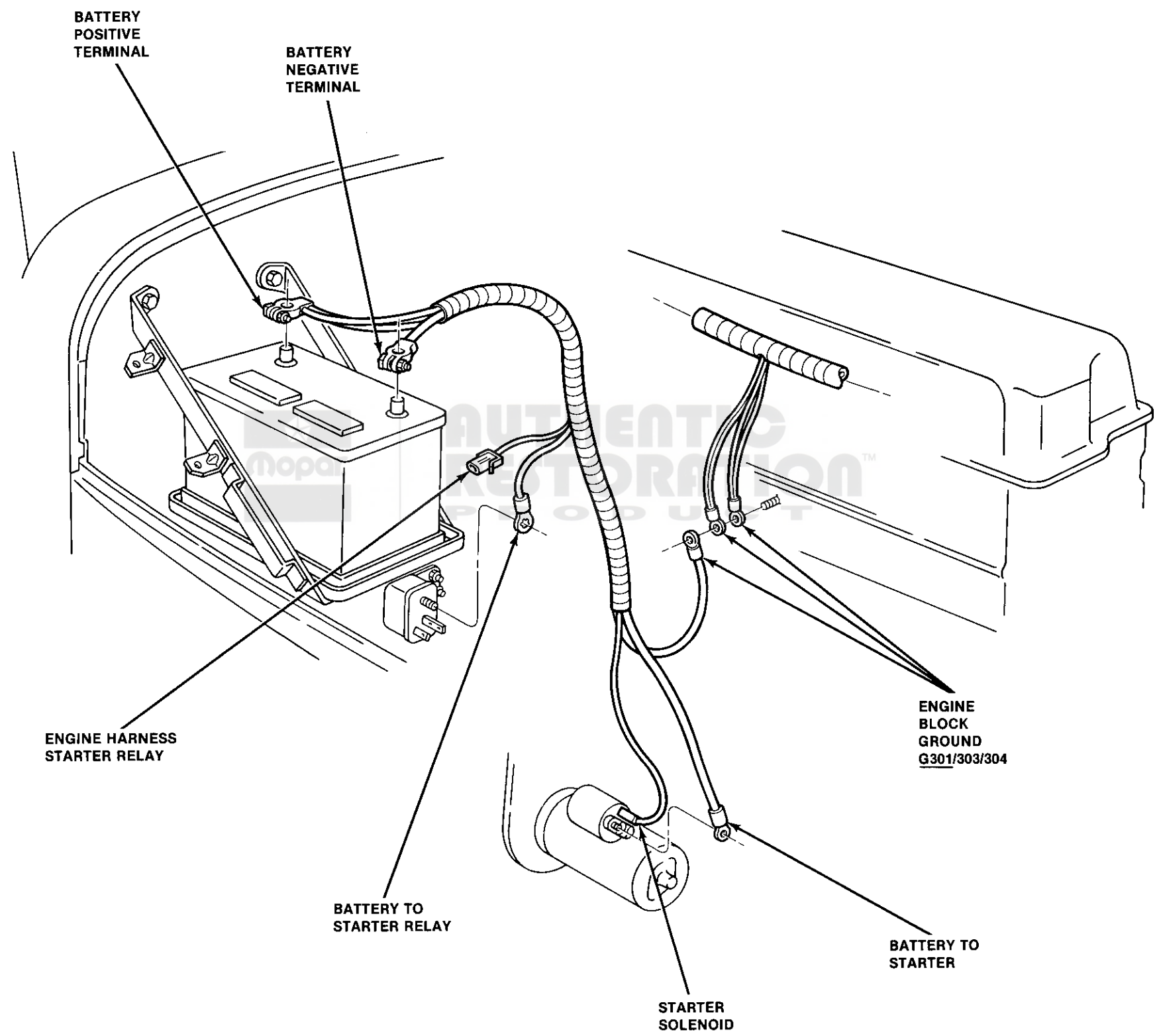
ENGINE /ENGINE CONTROL—4.2L



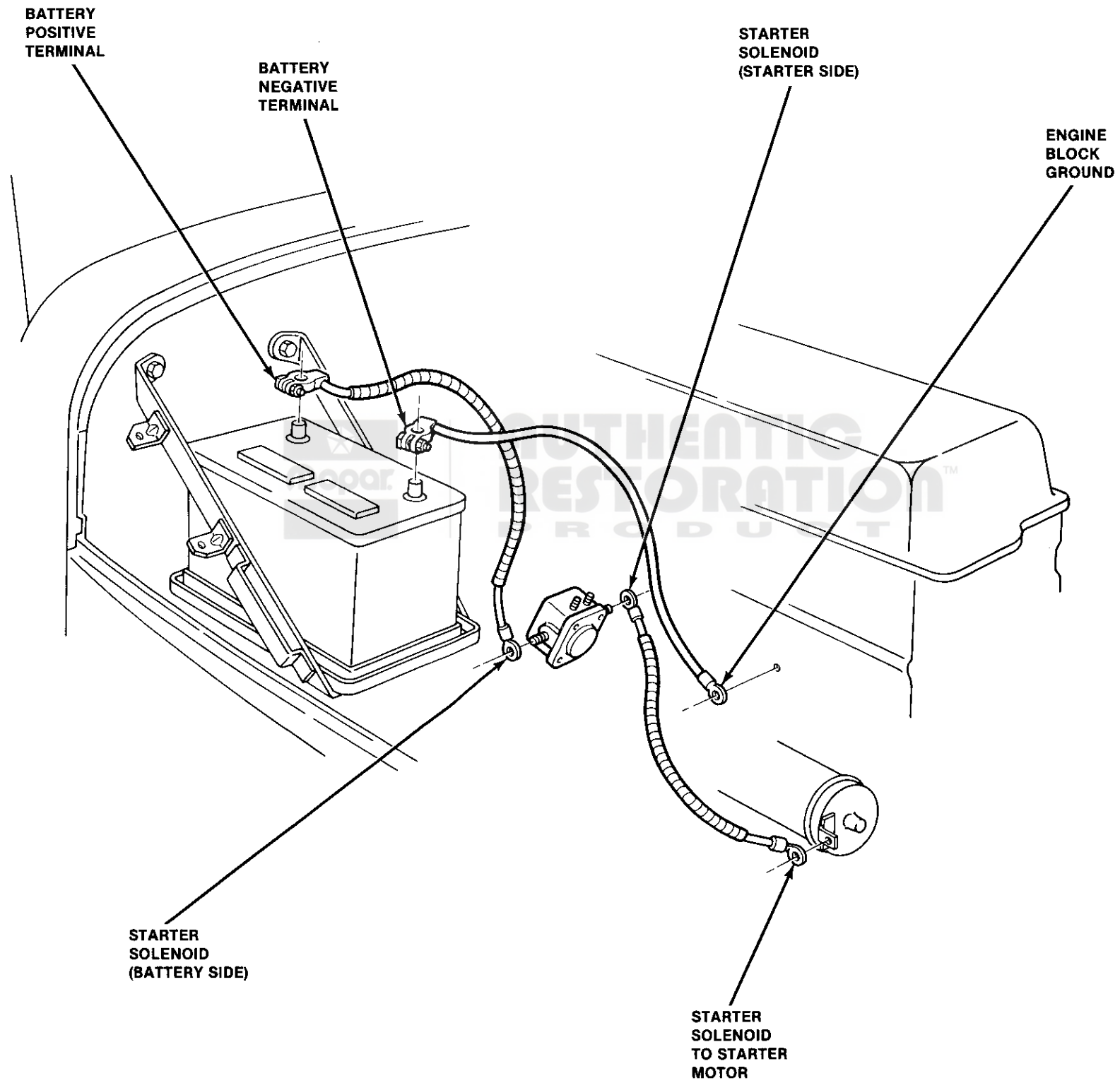
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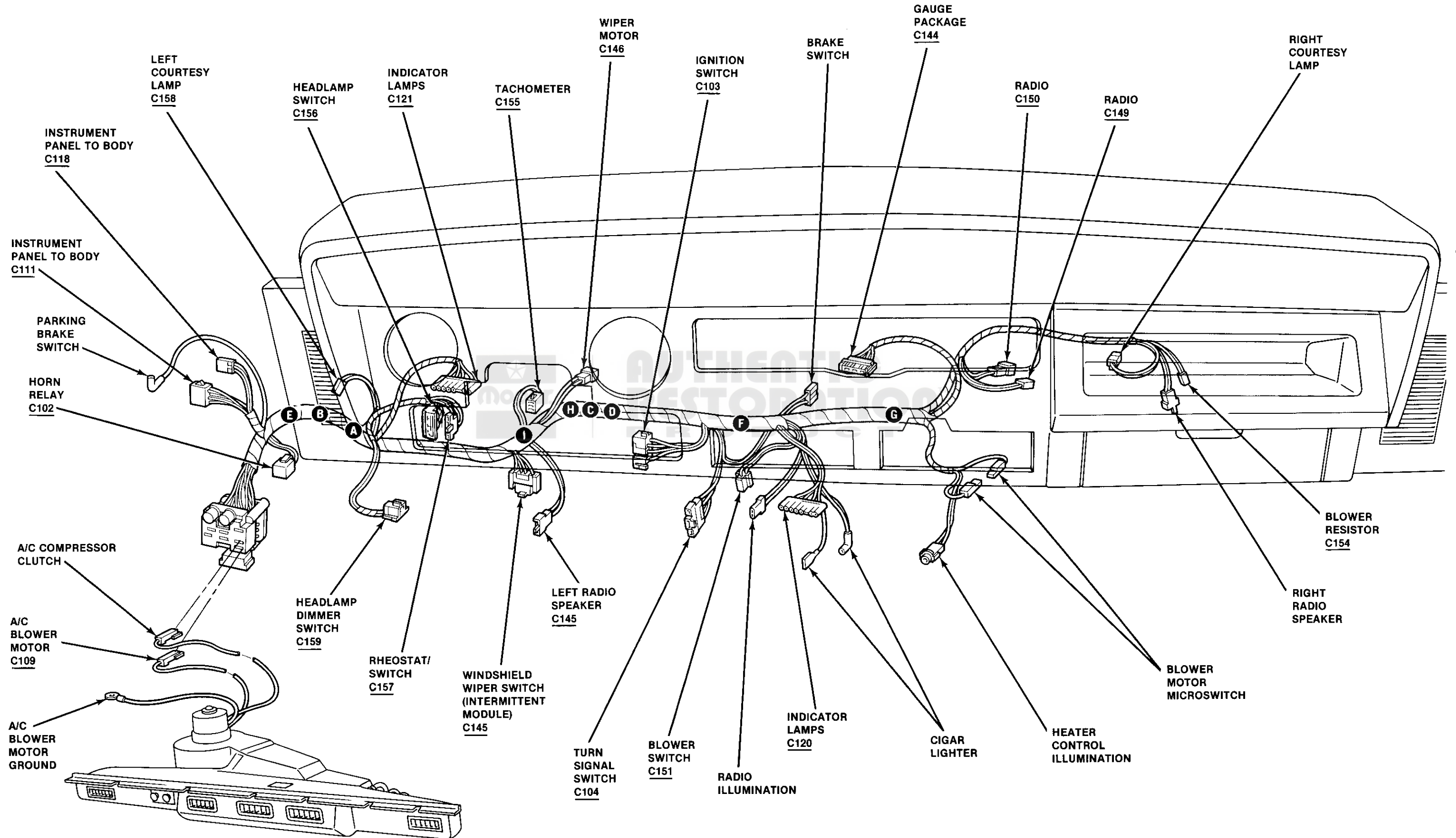
BATTERY/STARTER—2.5L



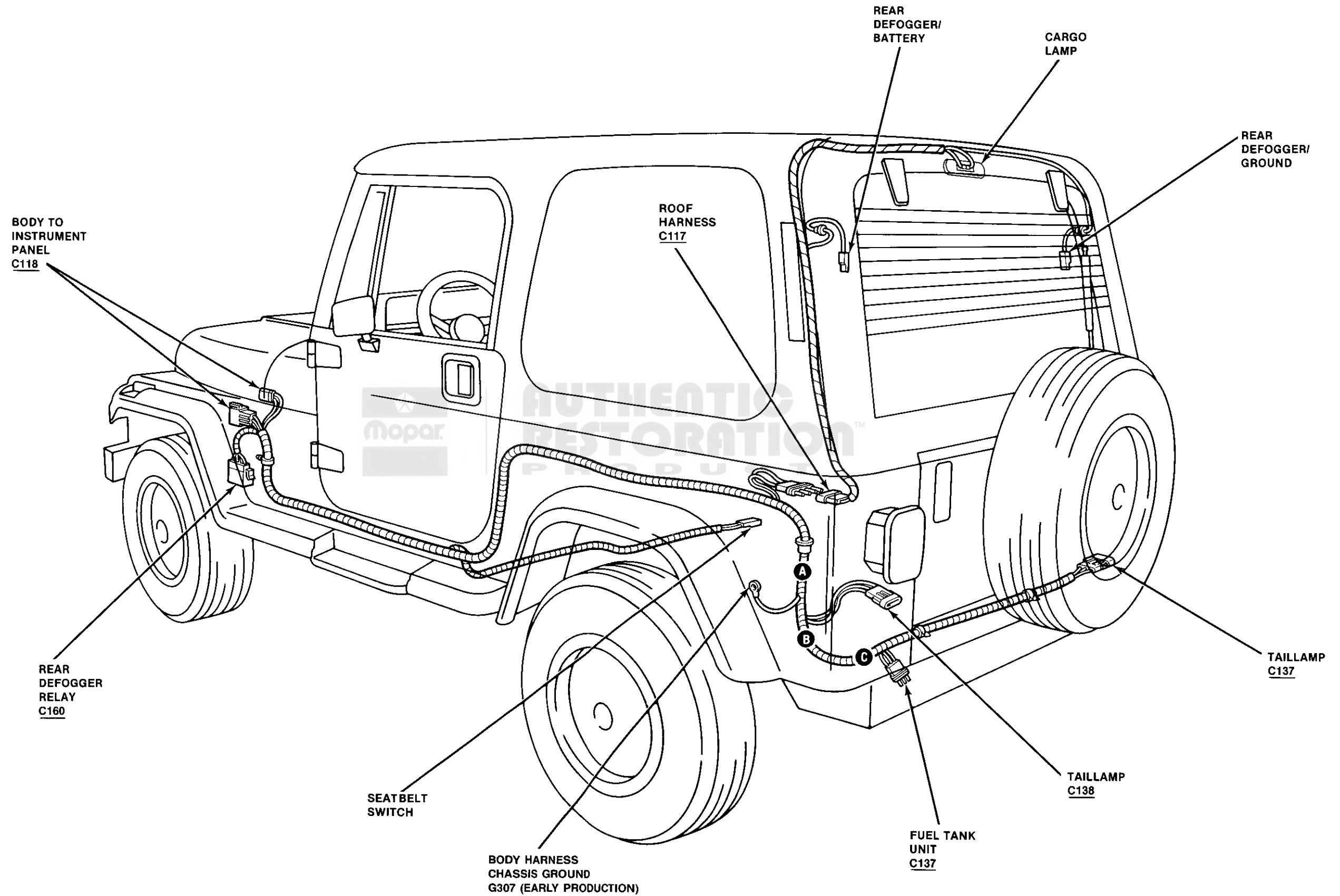
BATTERY/STARTER—4.2L



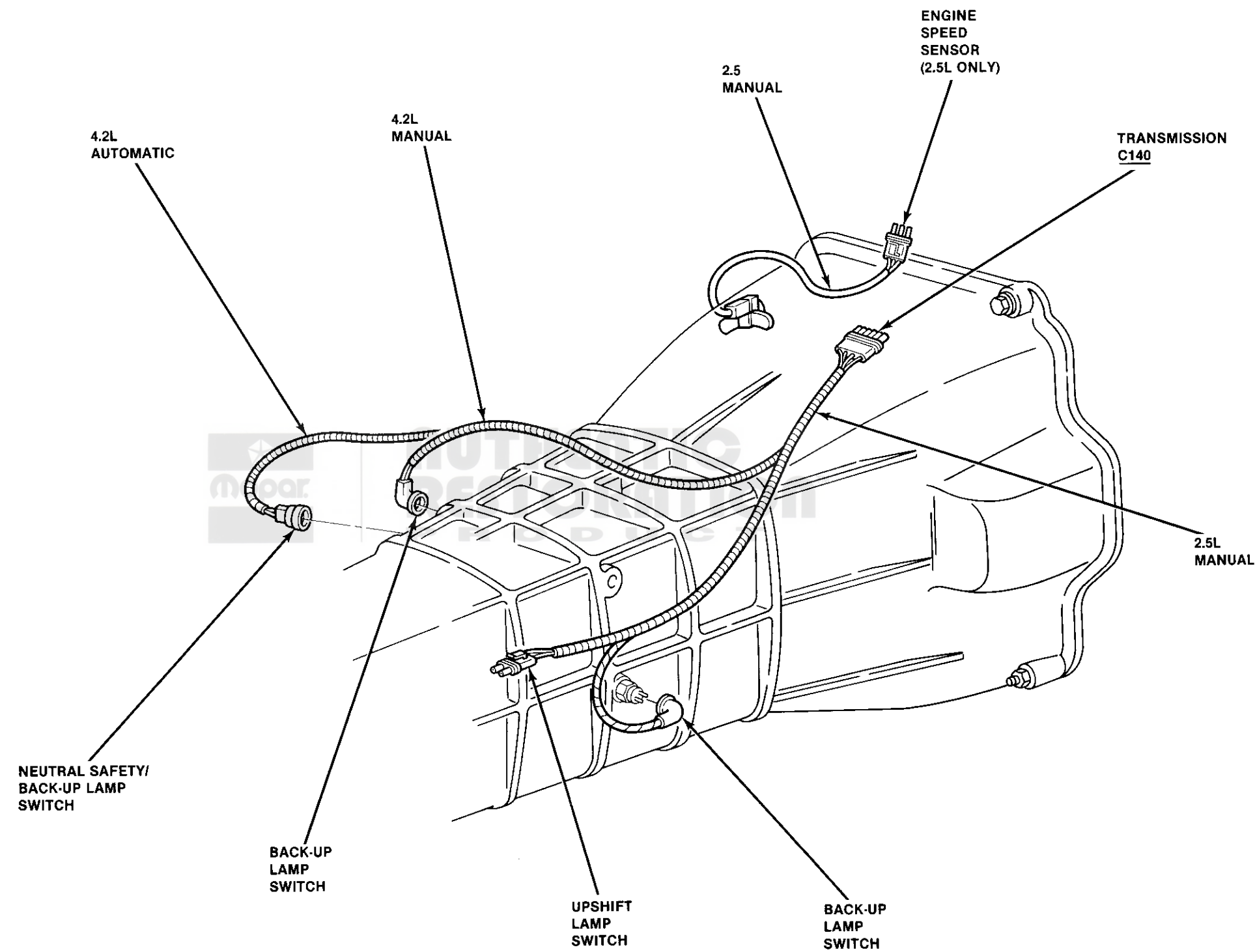
INSTRUMENT PANEL



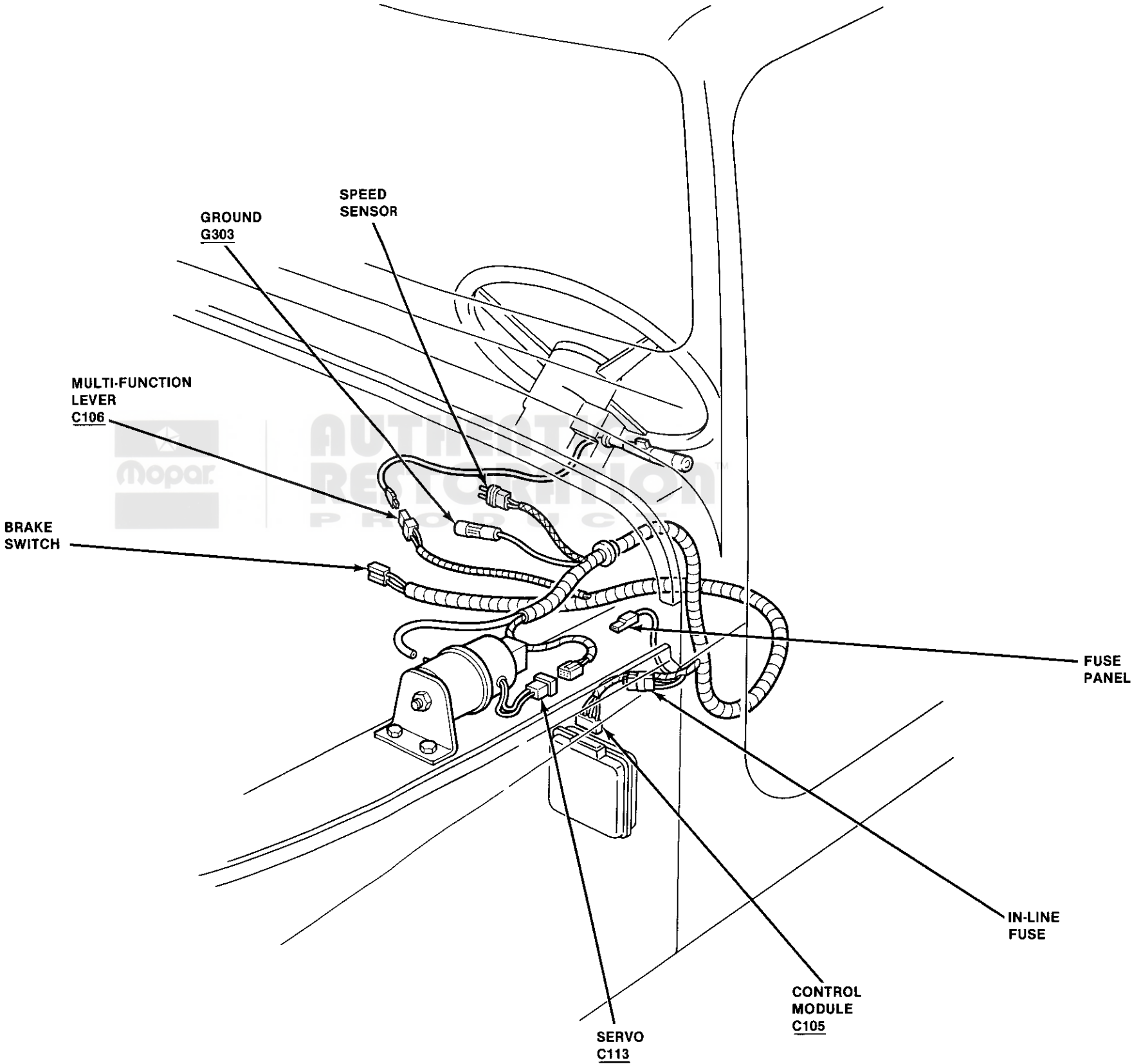
BODY / ROOF



TRANSMISSION



CRUISE CONTROL

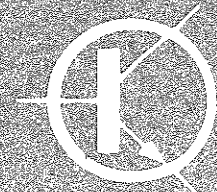




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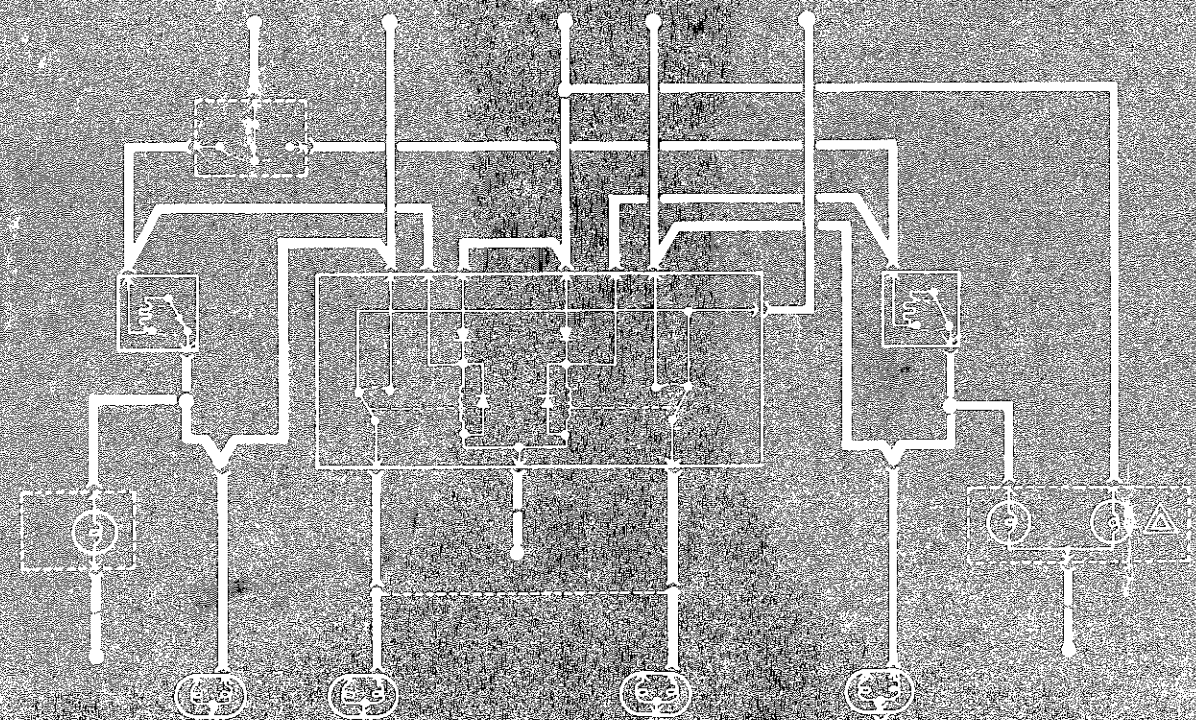
TROUBLESHOOTING



1988

WRANGLER

USA/Canada Edition 8980-010-615



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INTRODUCTION

HOW TO USE THIS MANUAL

The Circuit Index lists the pages for each circuit. A description of how to read wire information, wire color codes and harness codes is shown below. The Component Locations, Connector Locations and Ground Locations are next to the circuit.

All Electrical components, wires, wire splices and grounds associated with each circuit are grouped together. The circuits are arranged so that current flows from positive, at the top of the page, to negative at the bottom of the page. (The conventional theory of current flow is used in this text.) The "hot labels" at the top of a fuse show the ignition switch position and fuse link that supply power to the fuse. All wires, connectors, switches and loads are shown in the flow of current to ground.

Within each circuit, all switches and sensors are shown "at rest," as though the ignition switch was off. Component names are placed near each component. Notes are included that describe how switches and other components work. Transistorized components are labeled "solid state." Some components are part mechanical and part solid state. In these components, both parts are shown to help you understand how the component works. Wiring inside complicated components has been simplified to help you understand the electrical operation of the component.

WIRE COLOR CODES					
CODE	COLOR	CODE	COLOR	CODE	COLOR
BLK	Black	GRY	Gray	VIO	Violet
BLU	Blue	ORN	Orange	WHT	White
BRN	Brown	PNK	Pink	YEL	Yellow
GRN	Green	RED	Red		

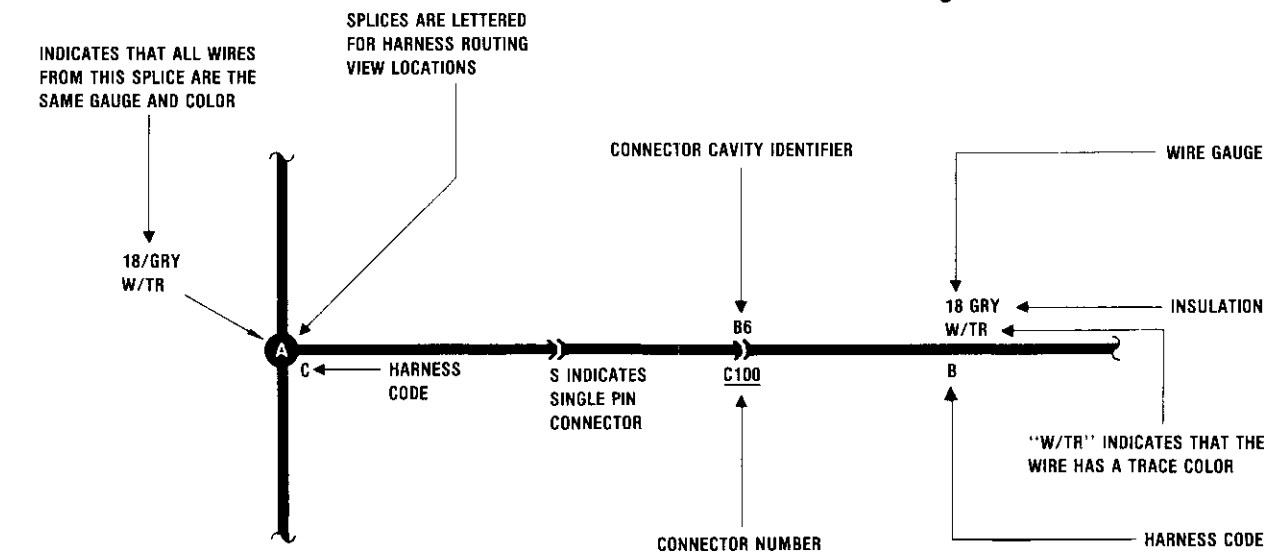
HARNESS CODES			
CODE	HARNESS	CODE	HARNESS
AC	Air Conditioning	H	Heater
B	Body	IP	Instrument Panel
B/S	Battery/Starter	L	Lighter
CC	Cruise Control	R	Roof
CL	Courtesy Lamps	S	Starter Motor
E	Engine/Engine Control	T	Transmission
FL	Front Lights	TL	Tail Lamps

Wires that connect to another circuit are shown with an arrow head pointing in the direction of current flow. The name of the component that shares the wiring is provided. You can check shared wiring by checking the operation of the other circuits.

Also in the Manual are Component Connector Views, In Line Connector Views, and Ground Distribution Schematics. These will aid troubleshooting and support the troubleshooting charts provided in this manual.

You can use common connections at the power source, or the ground, to speed your troubleshooting. If the ground schematics or the power distribution shows that an inoperative circuit and a second circuit share a fuse, check the operation of the second circuit. If the second circuit works, you know the fuse is good and that the voltage is available to the inoperative circuit. You can then continue troubleshooting.

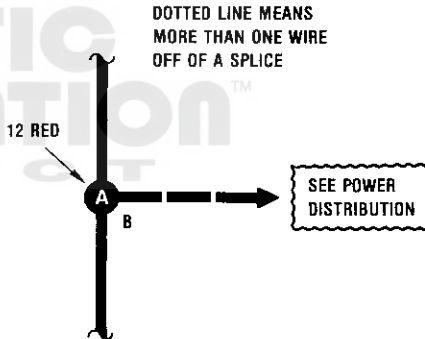
The circuit descriptions in the manual provide additional information about the circuits and troubleshooting hints. The flow of current is often used to describe the circuit operation. By following the schematic of the circuit as you read the circuit description, you can understand how the circuit works.



TROUBLESHOOTING CHARTS

Fault isolating is in the form of troubleshooting charts. For quick and accurate diagnosis, the charts are divided into a numerical sequence. Each numbered chart represents a circuit component or a portion of the circuit wiring. Following the numbered sequence is important because the numbers represent the ease of accessibility of components or wiring. In many cases, specific instructions will follow the numbered component. Follow these instructions carefully, the accuracy of the test results depends on a proper setup.

For example, voltmeter and ohmmeter checks are made from wiring terminals to a clean chassis ground. When making checks, it is important to confirm the ground connection. After connecting the negative lead, continuity can be checked by touching the positive lead to ground.



SIX-STEP TROUBLESHOOTING PROCEDURE

A. GENERAL INFORMATION

The vehicle technician is like a doctor. When you feel ill, you describe your feelings to a doctor. When you do this, you are giving him *symptoms*. The doctor makes a few checks (*pulse, temperature, etc.*), analyzes the results, and concludes what is wrong with you.

The car's electrical system is like your nervous system. When a customer comes in and says, "The horn doesn't blow," he is giving the technician a symptom. The technician must make other checks, analyze the results, and then conclude what the problem is.

A good troubleshooting procedure simplifies finding troubles. The *six-step troubleshooting procedure* saves time and effort and aids in finding the trouble. There are *six* logical steps that should be followed:

STEP 1: VERIFY THE COMPLAINT. Does the problem exist? Check it to see whether or not it does. Note the *symptoms*.

STEP 2: DETERMINE RELATED SYMPTOMS. Most of the circuits in a car are connected to other circuits at one point or another. Related symptoms can be found easily by conducting *operational checks* on these other circuits. Operational checks are made without the use of test equipment.

STEP 3: ANALYZE THE SYMPTOMS. Use *schematics* to isolate the problem area. Determine *what* checks to make, and *where* to make them. Develop a *plan*.

STEP 4: ISOLATE THE TROUBLE. Using the schematic, test equipment, and a logical plan, *find* the trouble.

STEP 5: CORRECT THE TROUBLE. *Repair* the trouble, or *replace* the faulty part.

STEP 6: CHECK FOR PROPER OPERATION. See if the circuit works the way it is supposed to.

B. SPECIFIC DEFINITIONS AND EXAMPLES

STEP 1: VERIFY THE COMPLAINT. If a customer complains of a specific problem, the first thing you should do is find out if the problem really exists. Let's say the customer complains the horn doesn't work. You should then *verify the complaint* by pushing down the horn ring and listen for the *beep*. This action of depressing the horn ring is called an *operational check*. When you perform operational checks you are looking for *symptoms*; both *positive* and *negative*.

Positive Symptoms are symptoms which are *correct*. For example, the radio plays when the radio switch is turned on.

Negative Symptoms are symptoms which are *incorrect*. For example, the horn does not blow when the horn ring is depressed.

If you are in doubt as to how a circuit operates, refer to the schematic and circuit operation. The layout of the schematic simplifies all circuit operations. Circuits can be traced in a matter of seconds.

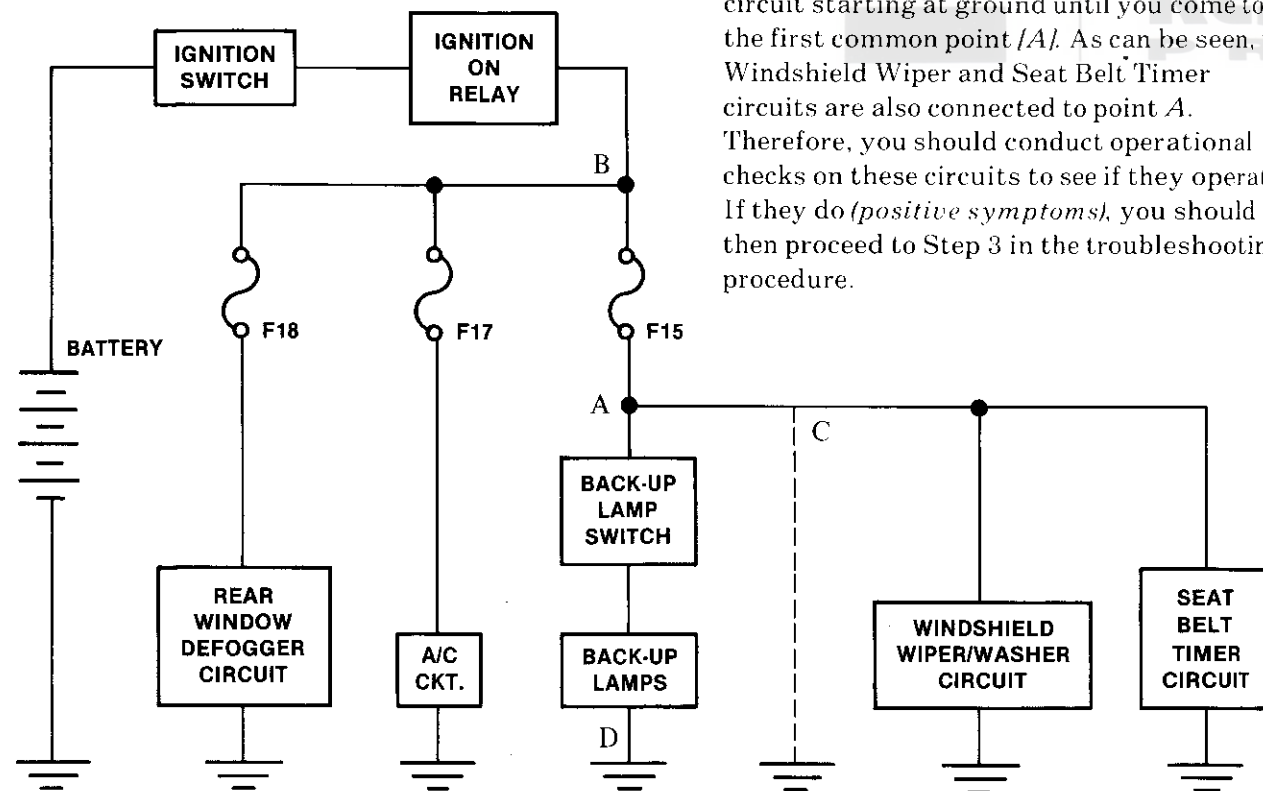


Fig. 1

Sometimes the problem may be intermittent (*momentarily present and not present*). If so, road test vehicle, and if possible, have the customer show you what happens. Try to duplicate the conditions in order to make the trouble appear. You cannot find a problem if everything works normally. When the problem occurs, note the symptoms. Remember! Make sure of both the *positive* and *negative* symptoms. They are both important.

STEP 2: DETERMINE RELATED SYMPTOMS.

Determining related symptoms is a very important step. It will save you much time in the long run. In order to get additional information about where the problem exists, *related symptoms* are found by conducting *operational checks* on circuits which are connected to the problem circuit. Operational checks are made *without* the use of test equipment. Your most important tool will be the *schematic*. For example, refer to Fig 1. If the customer complaint was that the Back Up Lamps didn't work, you would trace the circuit starting at ground until you come to the first common point /A/. As can be seen, the Windshield Wiper and Seat Belt Timer circuits are also connected to point A. Therefore, you should conduct operational checks on these circuits to see if they operate. If they do (*positive symptoms*), you should then proceed to Step 3 in the troubleshooting procedure.

If the circuit did not operate, you would then continue tracing the circuit toward the Battery until you reach the next common point /B/. The A/C and Rear Window Defogger circuits are connected to point B. Therefore, you should check to see if they operate. If they do, you would then proceed to Step 3.

STEP 3: ANALYZE THE SYMPTOMS.

1. Localizing the Trouble:

After conducting operational checks (*Step 2*), the trouble will always lie between a check which resulted in *negative* symptoms, and a check which resulted in a *positive* symptom. Consider the following examples (*refer to Fig 1*):

EXAMPLE 1: If the Back Up Lamps did not operate, but the Windshield Wiper did, the trouble would lie between point A and ground at the Back Up Lamps.

EXAMPLE 2: If the Back Up Lamps, Windshield Wiper, and Seat Belt Timer didn't operate, but the A/C and Rear Window Defogger did, the trouble would lie between point B and ground.

In *Example 1* above, the trouble would be an *open*, since a short would have caused Fuse F15 to open, and the Windshield Wiper and Seat Belt Timer would not operate.

In *Example 2* above, the trouble may be a *short*. Fuse F15 may have opened due to a short in either the Back Up Lamps, Windshield Wiper/Washer, or Seat Belt Timer circuits.

Electrical problems are mainly caused by either *open* or *short* circuits.

2. Open Circuits.

An open circuit is like an open switch. It interrupts the flow of current. An open circuit has an infinite resistance; therefore, no current will flow. Open circuits can be caused by broken wires, parts going bad, loose connections, (like ground screws), and by foreign matter being stuck between contacts.

3. Short Circuit.

A short circuit allows excessive current to flow in a circuit because of the resistance of the circuit going to zero ohms, which usually results in a blown fuse.

4. Intermittent Open Circuits.

This condition can be caused by a piece of dirt becoming momentarily caught between two contacts. In the case of rubber disconnects, excessive rubber could be spilled over into the pins. Other causes could be loose connectors, resulting in poor terminal contact.

5. Intermittent Short Circuits.

This condition can be caused by a frayed wire momentarily touching another wire. A slight bump can cause contact to be made, then broken.

6. Symptoms of Short Circuits [*refer to Fig. 1*]:

A short between points C and D will cause Fuse F15 to blow (*open*). Therefore, the Back Up Lamps, Windshield Wiper/Washer, and Seat Belt Timer circuits will not work.

7. Determine a Plan.

When analyzing symptoms, there are three things to consider:

- What goes wrong most of the time? Some parts receive more use than others and therefore wear out sooner. Other parts are subjected to corrosion such as grounds, while others are just natural trouble spots.
- Check parts which are closest to you. This will save time. Simple tests should be made first.
- How difficult the parts are to get to in order to perform checks on them determines the order in which they are checked. Leave the more difficult places until last. There is no substitute for common sense.

8. Test Equipment.

In developing a strategy to isolate the problem, 3 meters and jumper wires could be used (see following page). Above each meter is a short explanation of their purpose, and how each meter is used.

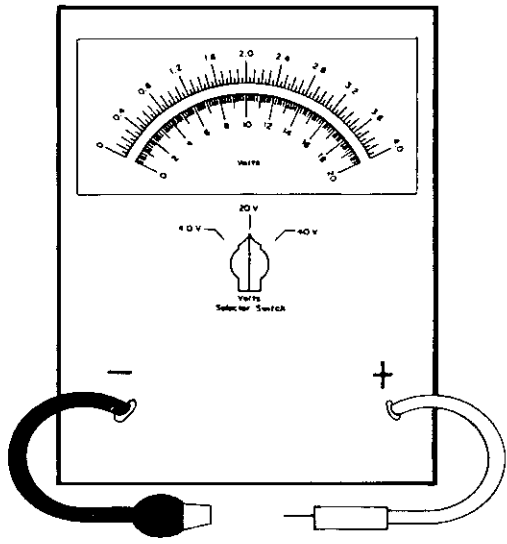
A. **VOLTMETER**—Voltmeters are usually made to measure a wide range of voltages. There are two leads. The *red* lead is *positive* and is connected to the voltage source. The *black* lead is *negative* and is connected to ground. Voltmeters, like test lights, are always connected in *parallel* with the circuit being tested.

B. **AMMETER**—Ammeters are used to measure the amount of current. They are always connected in *series* with the circuit. There are two leads. The *red* lead (*positive*) is connected towards the voltage source. The *black* lead (*negative*) is connected towards ground. Remember, the circuit has to be opened and the ammeter is inserted in *series*.

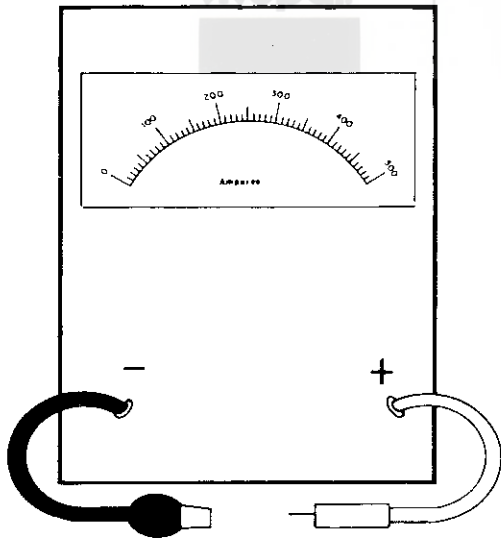
C. **OHMMETER**—Ohmmeters are used to measure resistance. The following procedure is recommended:

- 1) Disconnect the source of voltage from the resistance being tested.
- 2) Bring the test leads together and adjust the *zero adjust* knob until the needle reads *zero*. If unable to adjust to zero, replace the internal battery.
- 3) Connect the leads, one on each side of the resistance. Multiply the *meter reading* by the *multiplier setting* in order to read the resistance.

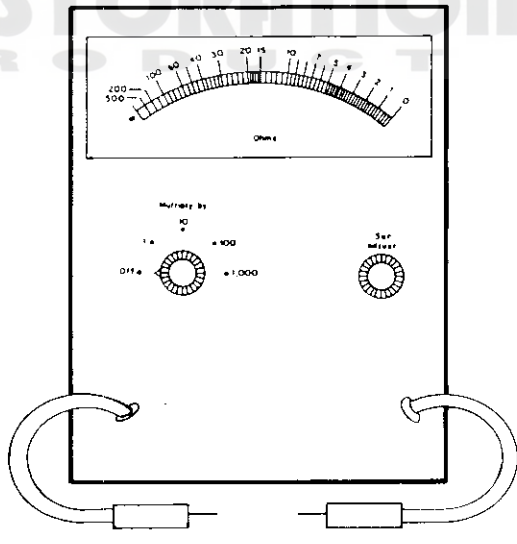
D. **JUMPER WIRES**—Jumper wires are used to bypass a part of a circuit between two points. They can be used to bypass the entire circuit by jumping (*connecting*) from the Battery to the parts. Jumpers can also be used as an extension for the test lights.



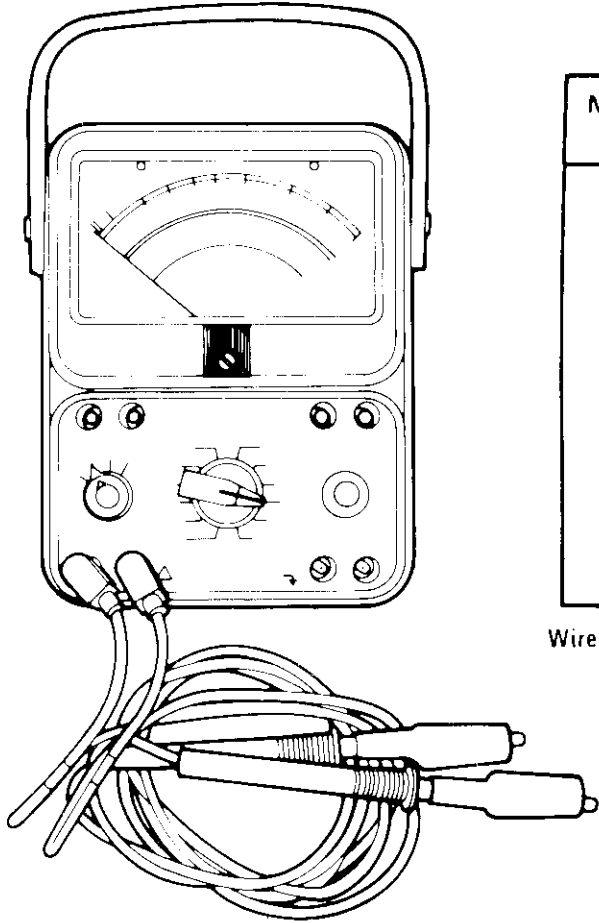
Voltmeter



Ammeter



Ohmmeter

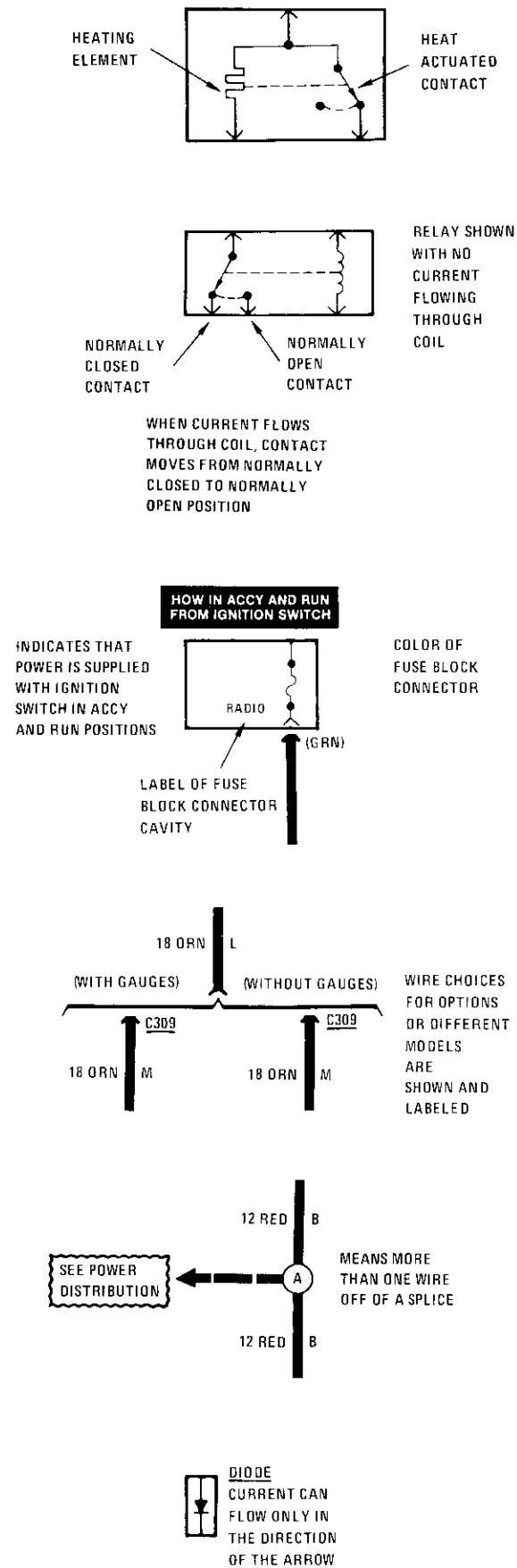
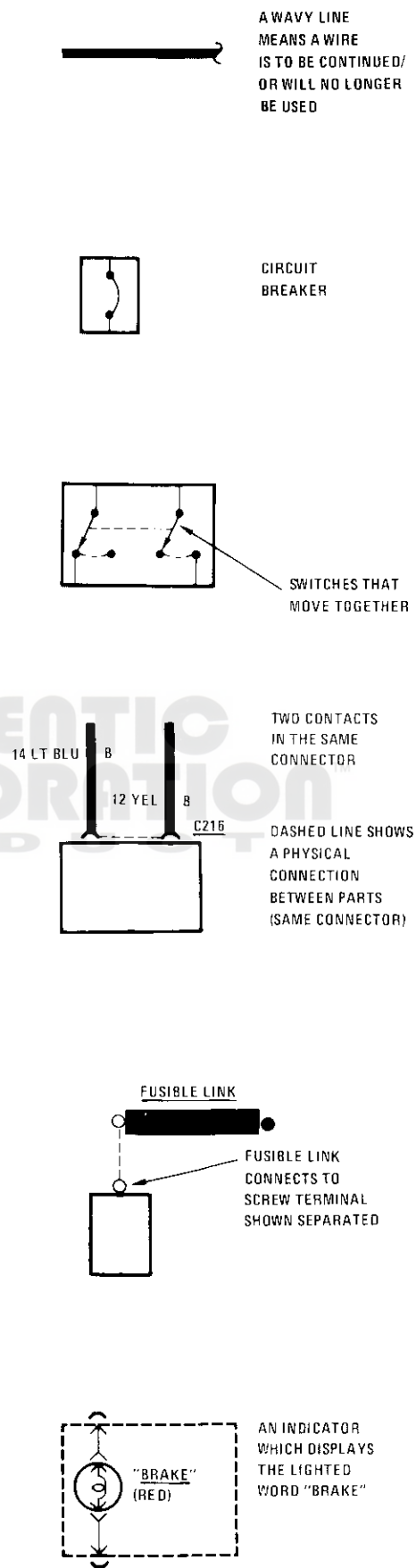
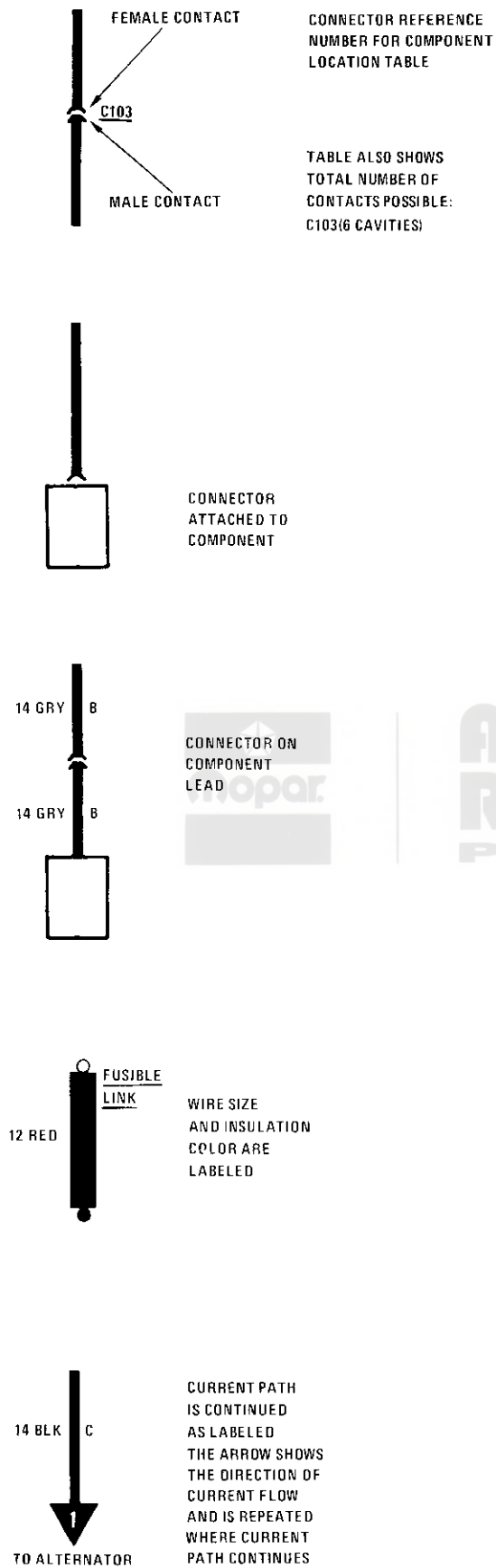
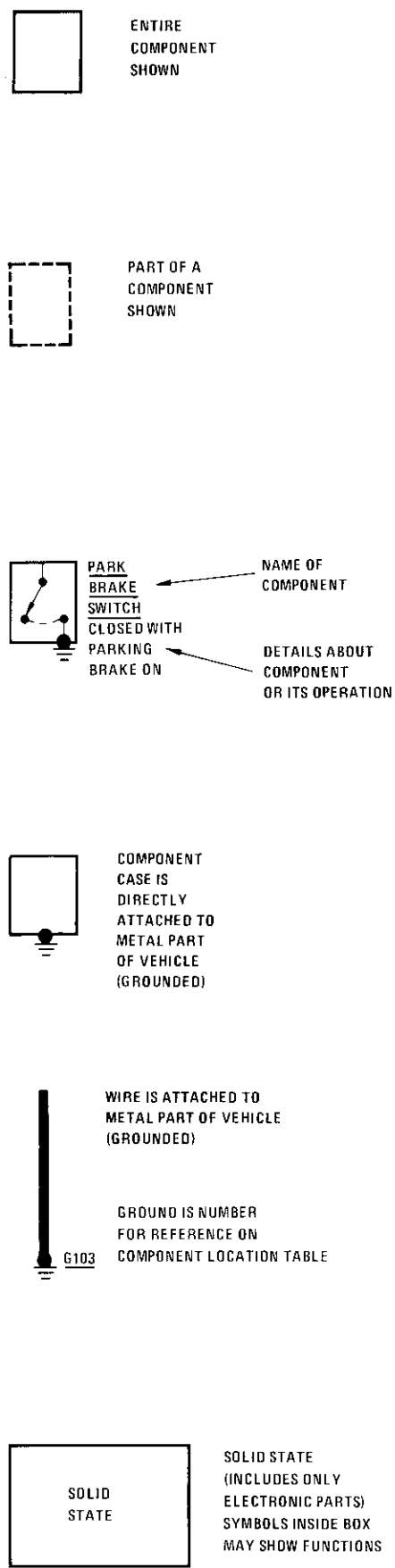


Volt-Ohmmeter
(Multimeter)

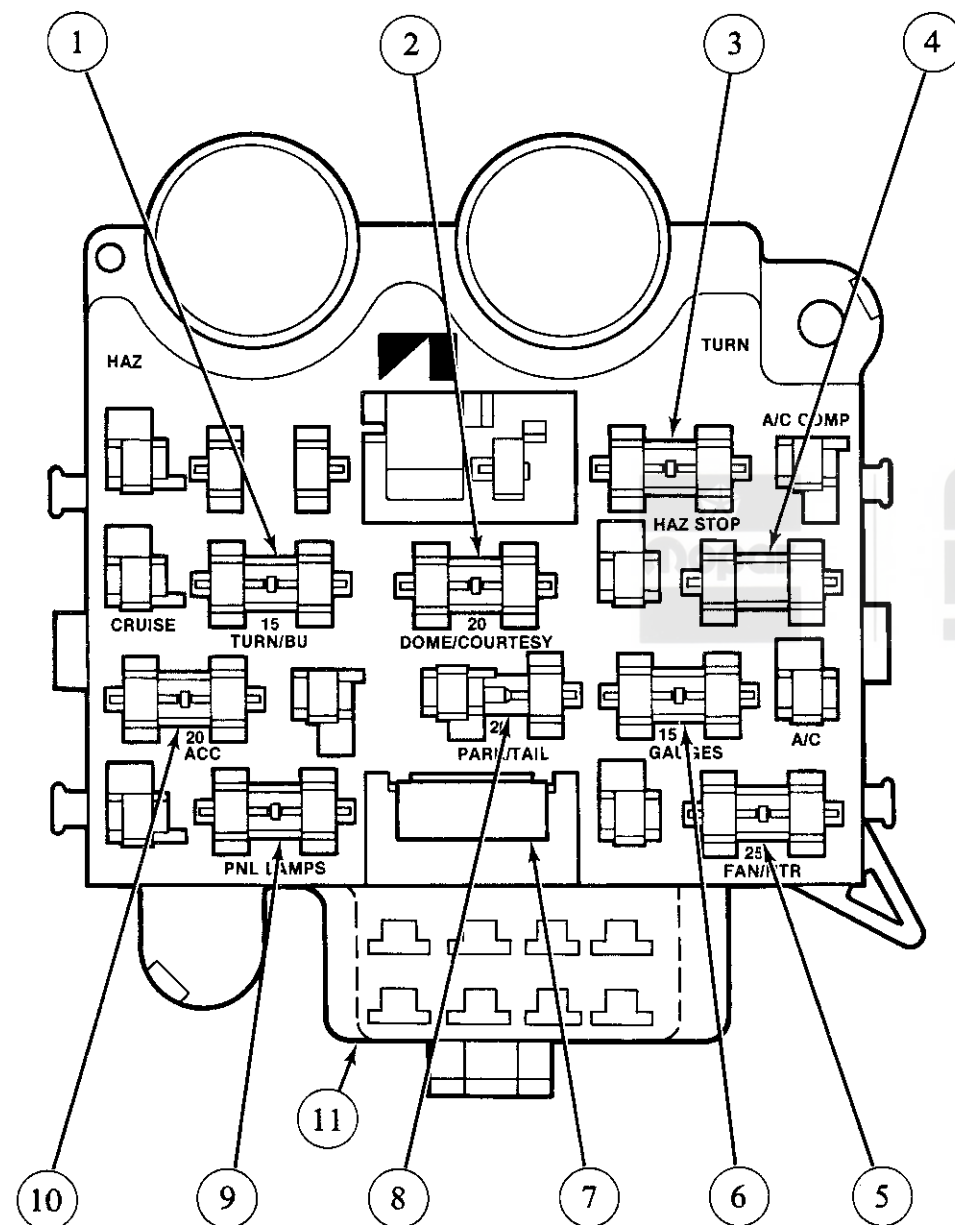
METRIC SIZE	AWG SIZES
22	24
.35	22
5	20
.8	18
1.0	16
2.0	14
3.0	12
5.0	10
8.0	8
13.0	6
19.0	4
32.0	2

Wire Size Conversion Table

SYMBOLS



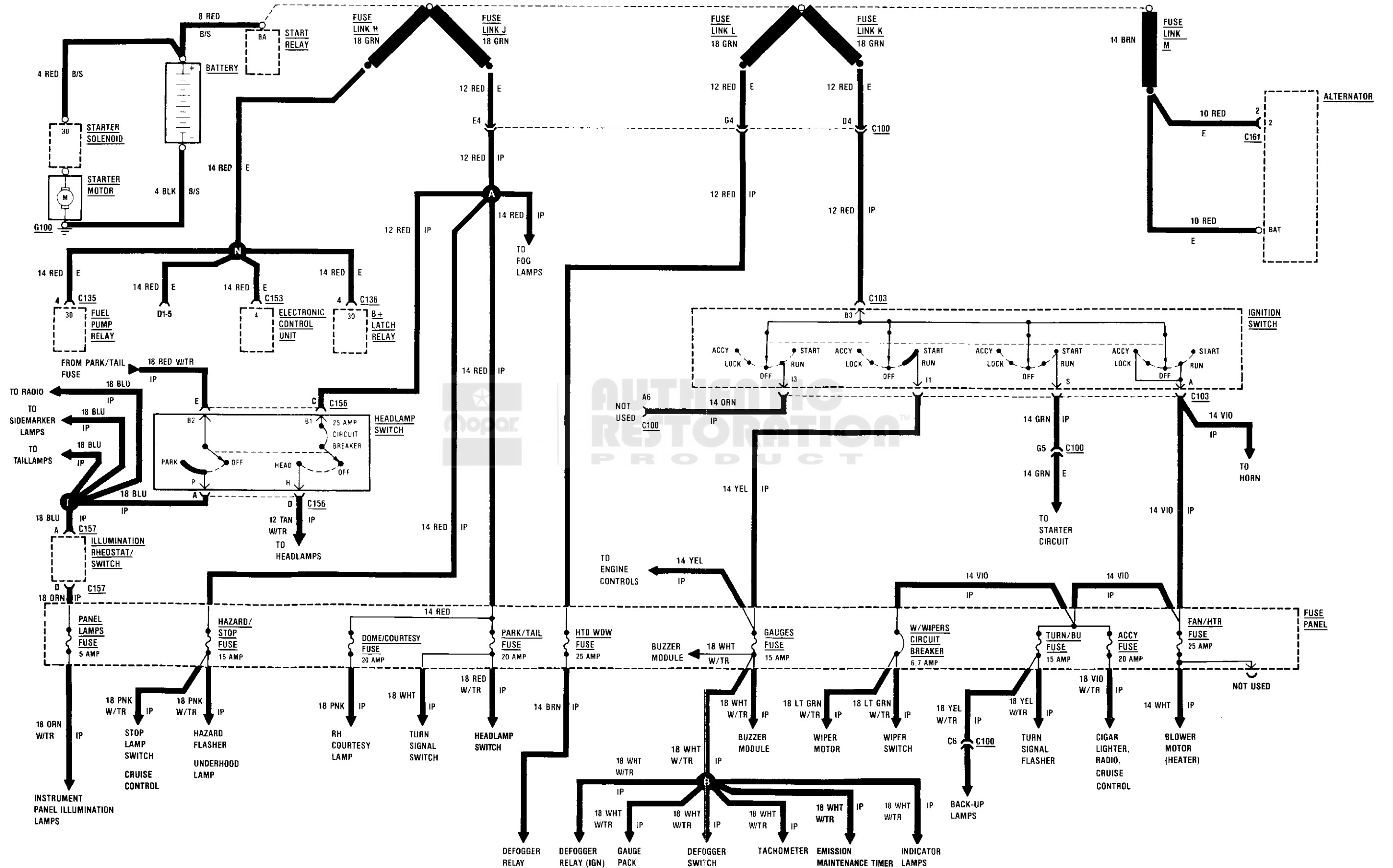
FUSE PANEL



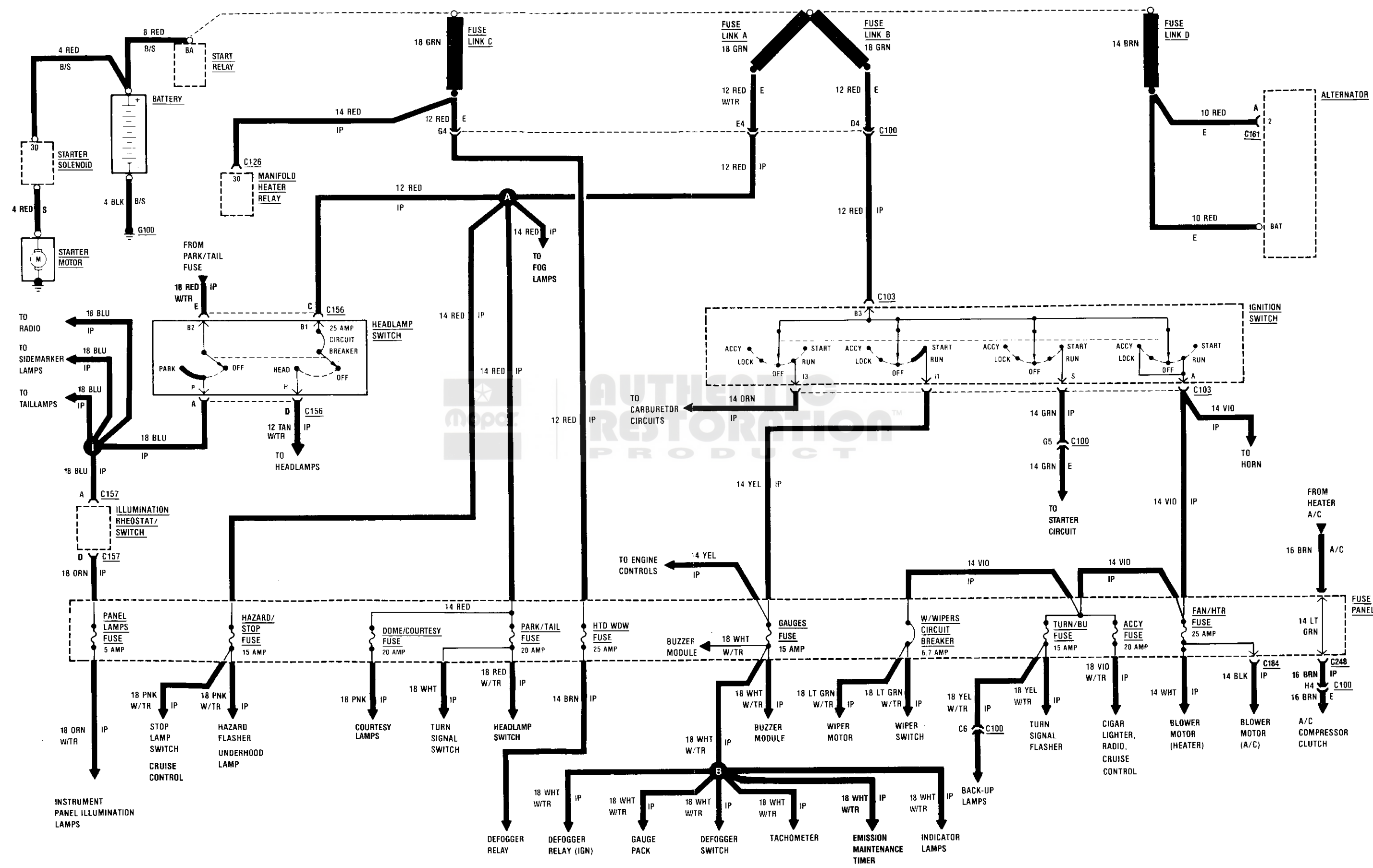
FUSE PANEL DATA

ITEM	IDENTIFIER	COLOR/RATING	CIRCUITS PROTECTED
1	TURN/BLU	Light Blue/15 AMP	Turn Signal Lamps Backup Lamps
2	DOME	Yellow/20 AMP	Courtesy Lamps Cargo Lamp
3	HAZ STOP	Light Blue/15 AMP	Hazard Lamps Stop Lamps
4	HTD WDW	White/25 AMP	Rear Window Defogger Grids
5	FAN/HTR	White/25 AMP	Heater Blower Motor
6	GAUGES TM	Light Blue/15 AMP	Key Buzzer Defogger Relay Gauge Pack Defogger Switch Tachometer Indicator Lamps
7	W/WIPERS	6.7 AMP Circuit Breaker	Windshield Wiper Switch and Motor
8	PARK/TAIL	Yellow/20 AMP	Turn Signal Switch Park Lamps Taillamps
9	PNL LPS	Tan/5 AMP	Instrument Panel Illumination Lamps
10	ACC	Yellow/20 AMP	Cigar Lighter Radio Cruise Control
11	Buzzer Module	_____	_____

POWER DISTRIBUTION—2.5L ENGINE

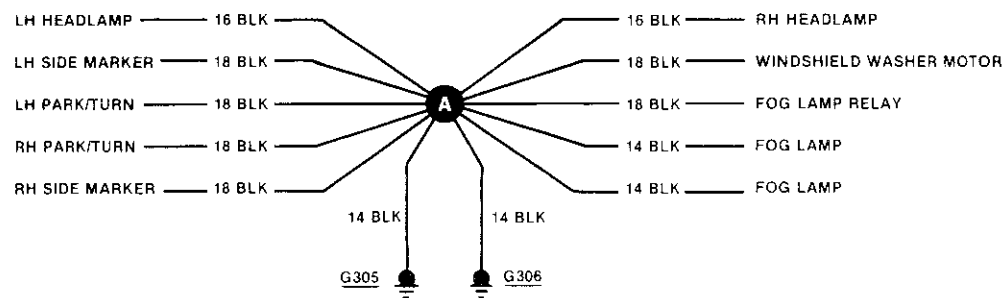


POWER DISTRIBUTION—4.2L

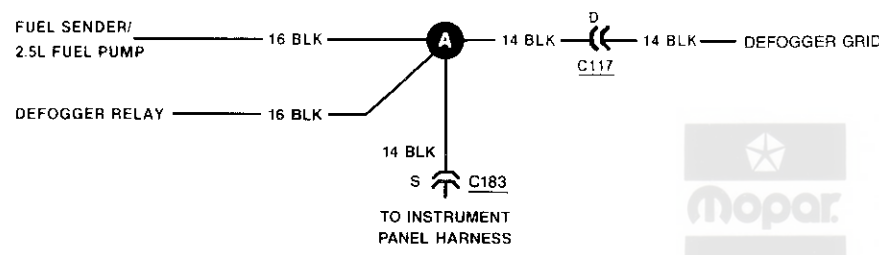


GROUND DISTRIBUTION

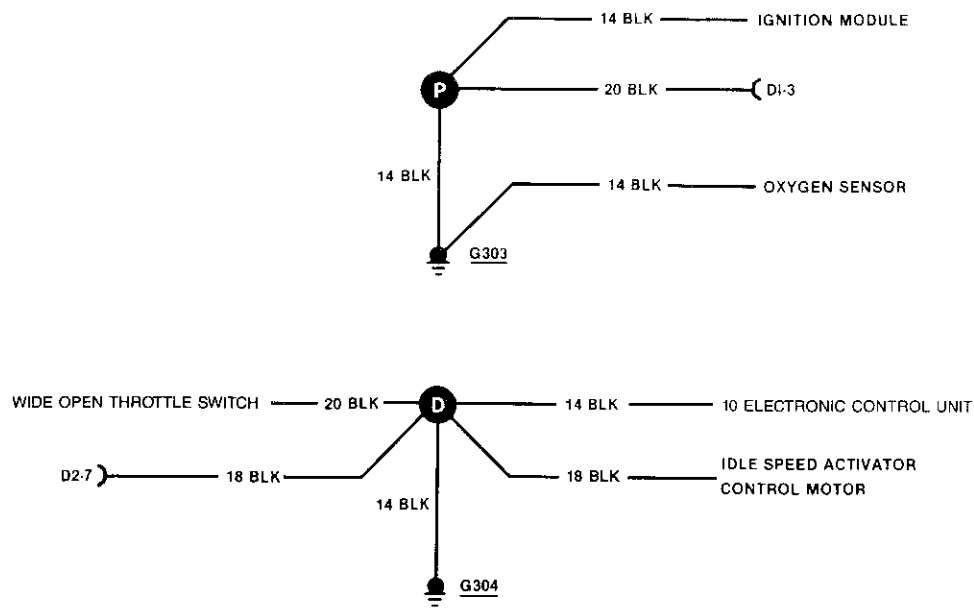
G305/G306
FRONT LIGHTING



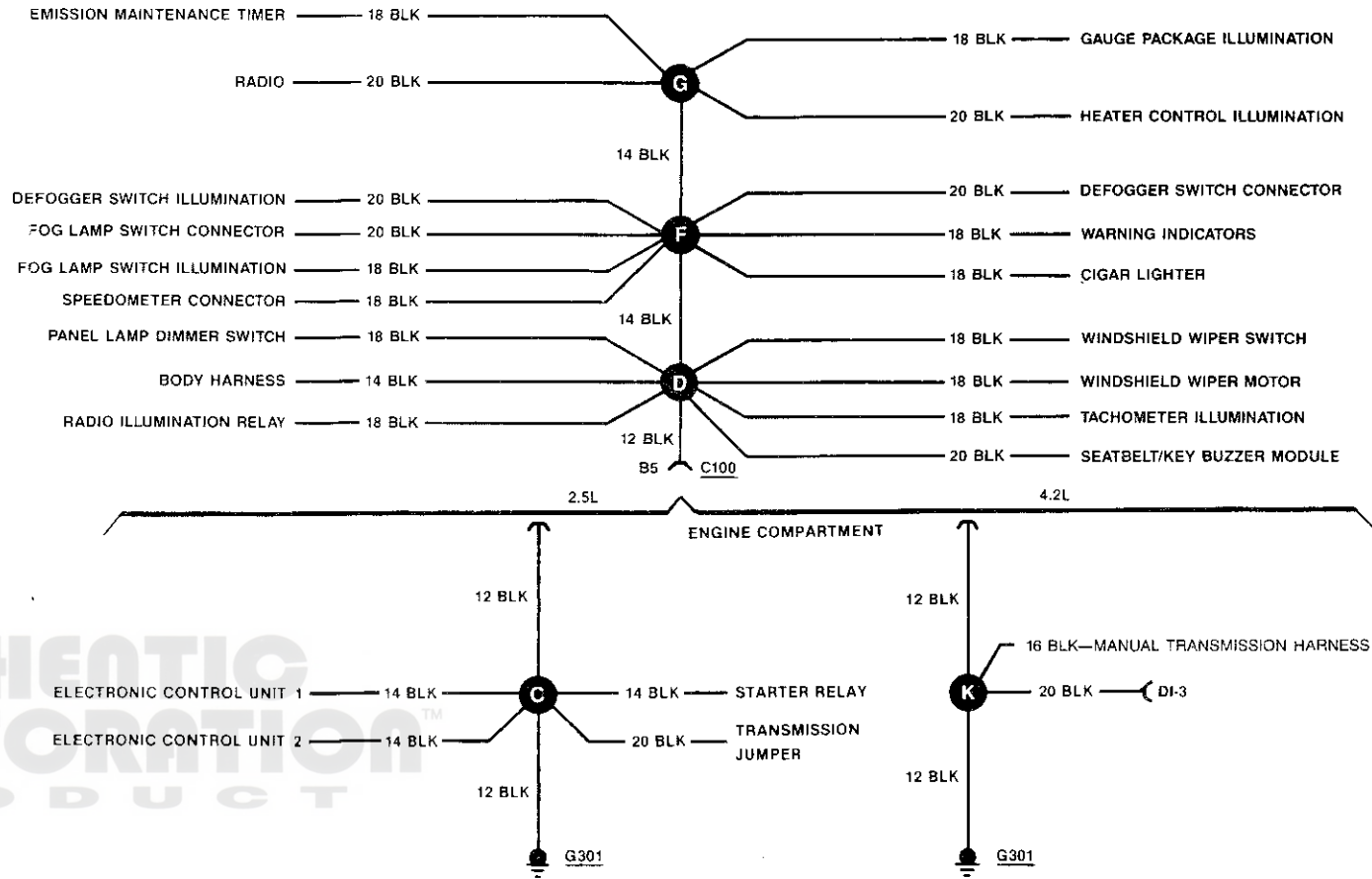
BODY HARNESS GROUND CIRCUIT



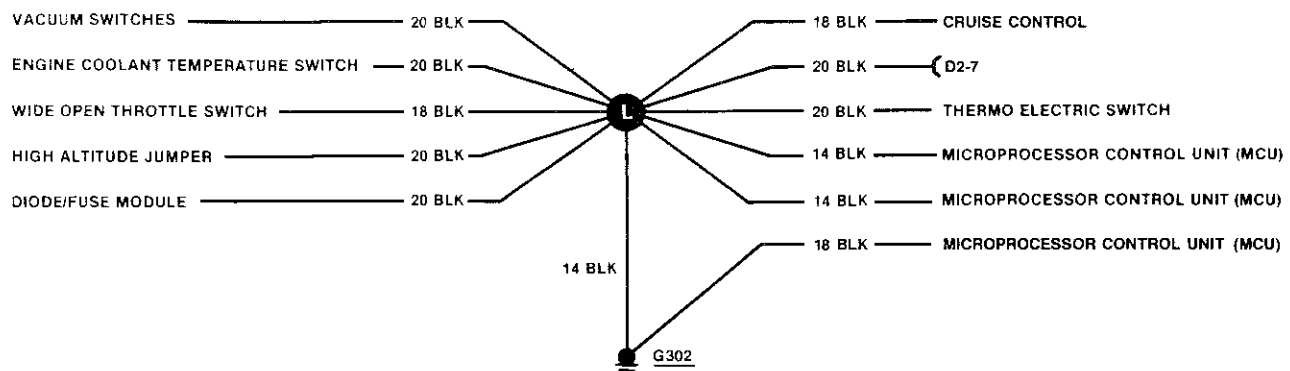
G303/G304
2.5L ENGINE CONTROLS



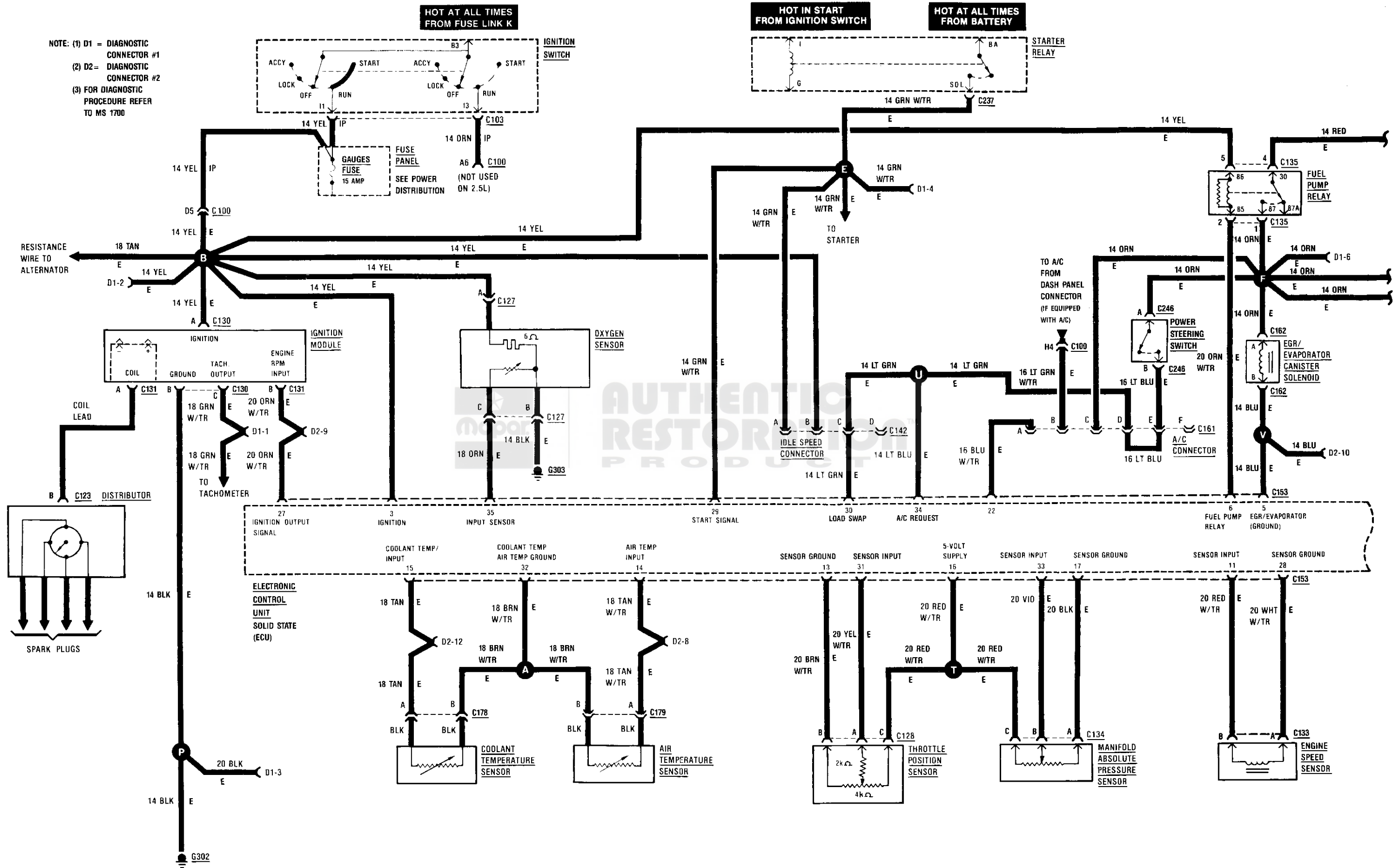
G301
INSTRUMENT PANEL



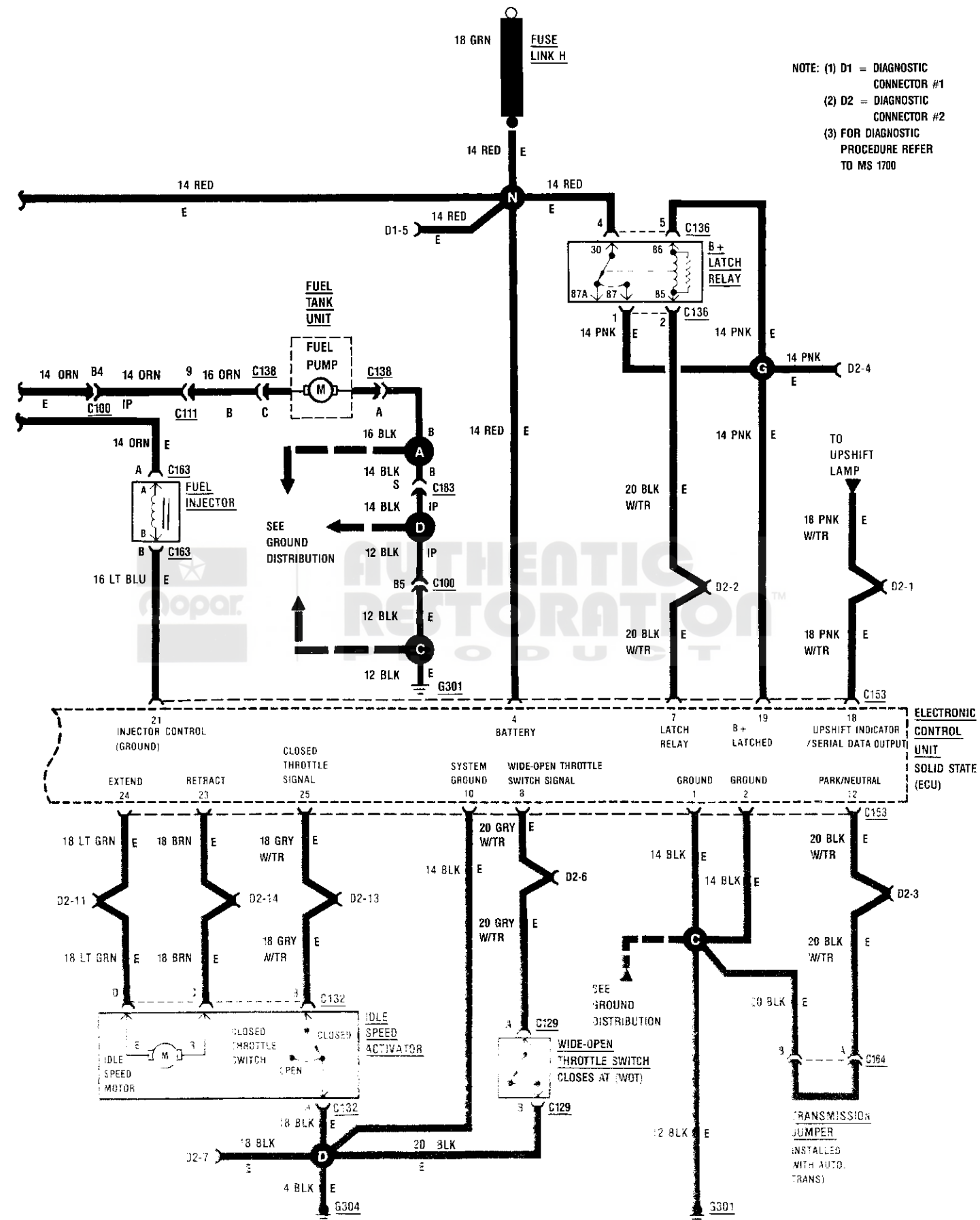
G302
4.2L ENGINE CONTROLS



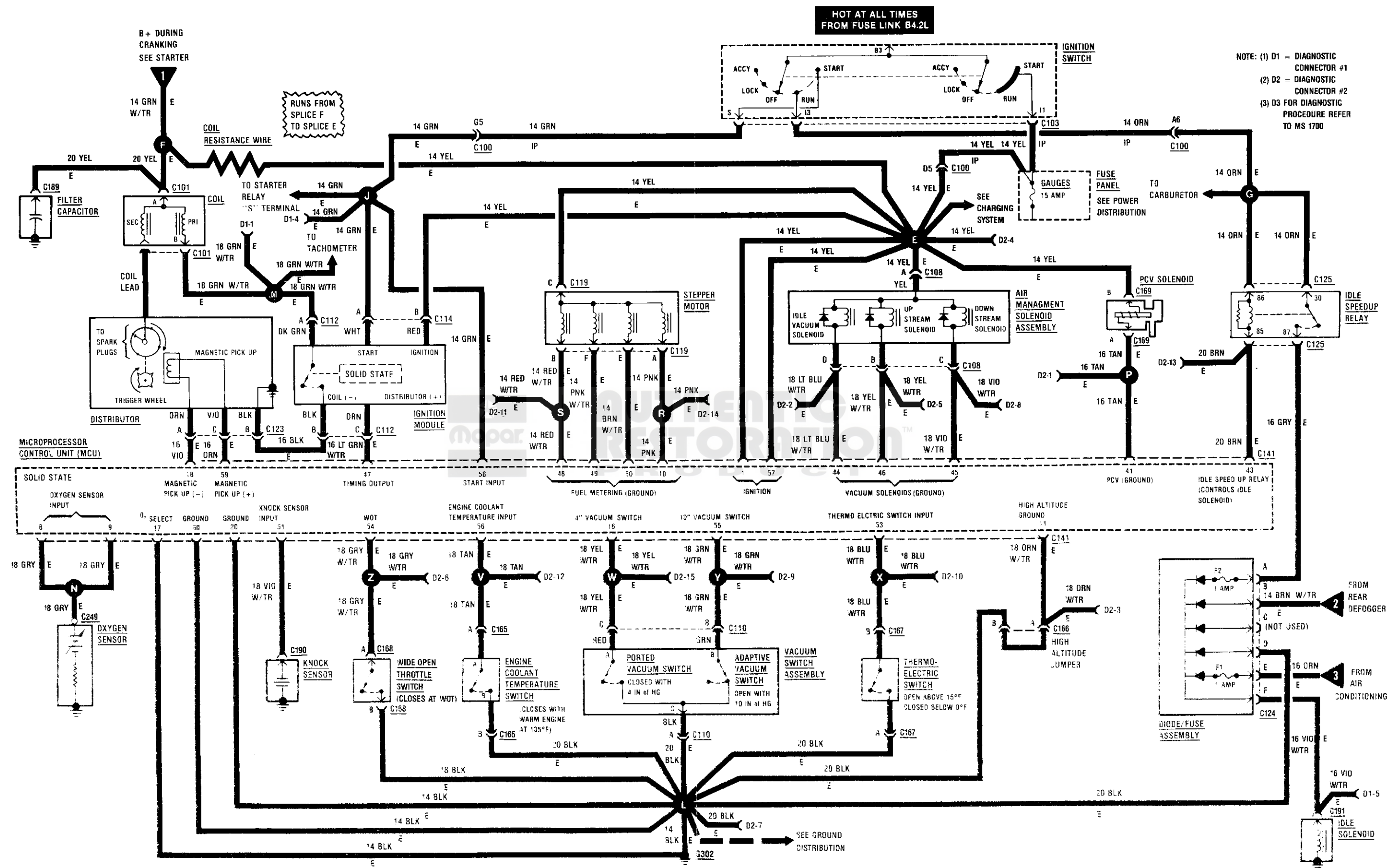
ENGINE CONTROLS—2.5L



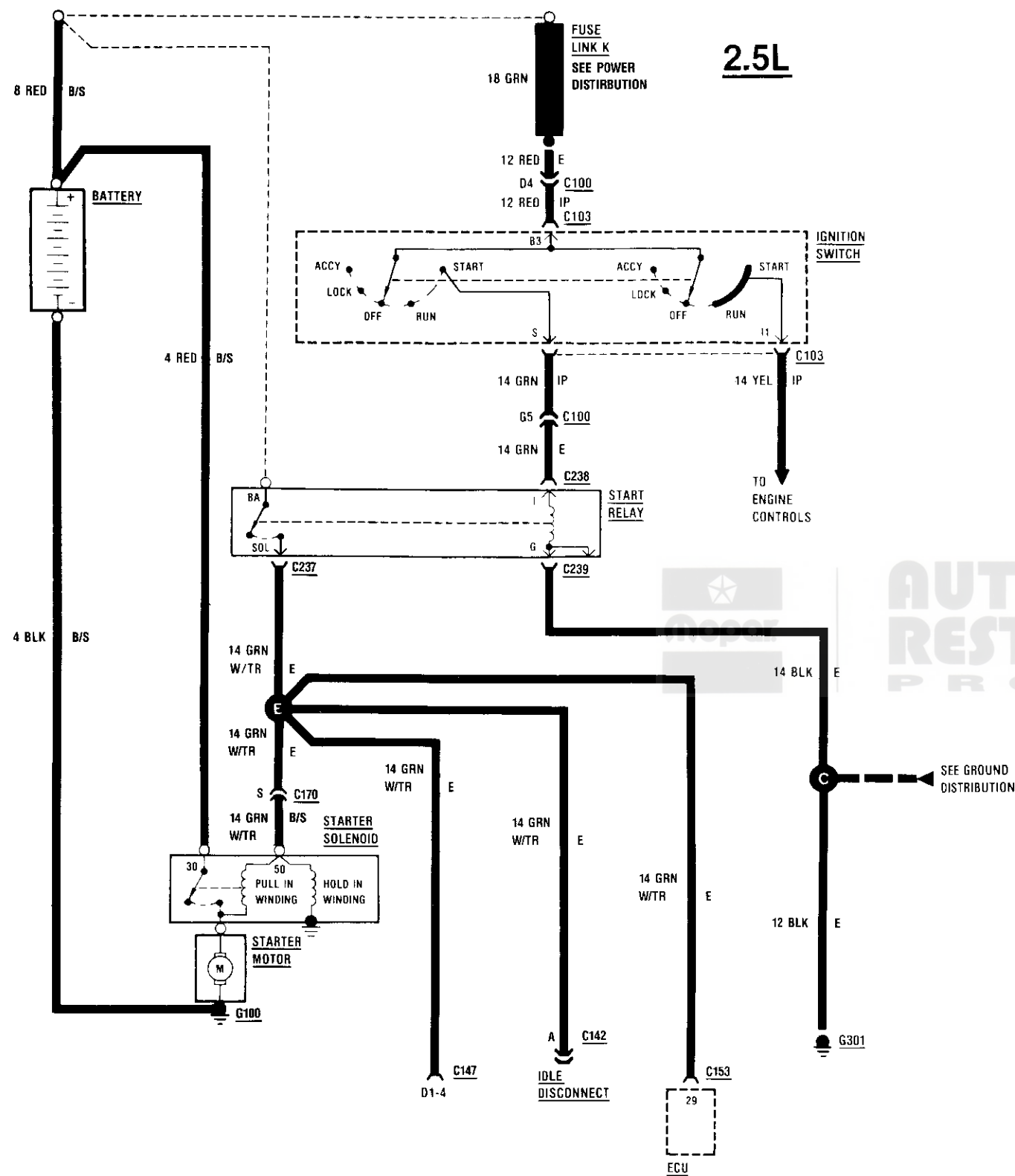
ENGINE CONTROLS — 2.5L (CONT'D)



ENGINE CONTROLS—4.2L



STARTER



DESCRIPTION

2.5L STARTER MOTOR

The positive battery cable bolts directly to the starter solenoid contact 30. When the ignition switch energizes the starter relay battery power will pass through the relay contacts to terminal 50 of the starter solenoid. Momentary high current through the pull in windings will connect terminal 30 to the starter motor windings. During engine cranking a lower current will travel through the hold in windings, which will allow maximum battery power to the starter motor armature.

There are no field windings in the Bosch starter motor, instead six permanent magnets are used to provide excitation.

Complete starter motor service is outlined in M.R. 279.

The starter relay will not energize until voltage at terminal 1 and ground terminal G (G301) conditions are met.

4.2L STARTER MOTOR

Battery voltage is applied to the ignition switch through fuse link B at all times. When the ignition switch is turned to RUN,

battery voltage is applied to the starter relay coil terminal S, through the ignition switch. The starter relay is energized and its contacts pulled closed. Battery voltage is applied to the starter relay contacts at all times. When the starter relay is energized, battery voltage is applied through the contacts to the starter solenoid coils. The starter solenoid coil is energized pulling the heavy contacts closed. Battery voltage is applied to the starter contacts at all times. When the starter solenoid is energized, battery voltage is applied through the heavy contacts to the starter motor. Power within the starter motor is divided into the field winding, armature, and hold windings. The bendix clutch is momentarily thrown into the ring gear by a movable pole shoe and one of the field windings, and during cranking is held in by the hold in windings.

Starter motor service information can be found in M.R. 279.

With a manual transmission, the starter relay is case grounded (mounting screws). With an automatic transmission, the starter relay coil is grounded through the park/neutral switch contacts when the transmission is in park or neutral.

TROUBLESHOOTING

NOTE: The following diagnostic procedures are for a no starter engagement condition. For clicking relay, slow, cranking and other conditions refer to MR279.

Before starting these diagnostic procedures, the battery, starter and interconnecting must be in proper operating condition.

1. **START RELAY/SOLENOID COIL:** Parking brake fully engaged; manual transmission in NEUTRAL; automatic transmission in PARK; ignition switch in START position for voltage test; ignition switch in OFF position for resistance tests

TEST	OK	NOT OK
C238 terminal I-2.5L C240 terminal S-4.2L	Battery voltage	Repair open from ignition switch and/or adjust ignition switch as outlined in MR 279
Across C238 terminal I and C239 terminal G Across C240 terminal S and C243 terminal G-4.2L (auto trans.) C243 terminal S to chassis ground-4.2L (manual trans.)	24 ± 3 ohms 5 ohms max 5 ohms max	Replace start relay
C239 terminal G-2.5L C243 terminal G-4.2L to clean chassis ground	Zero ohms	Repair open between C239 and G301

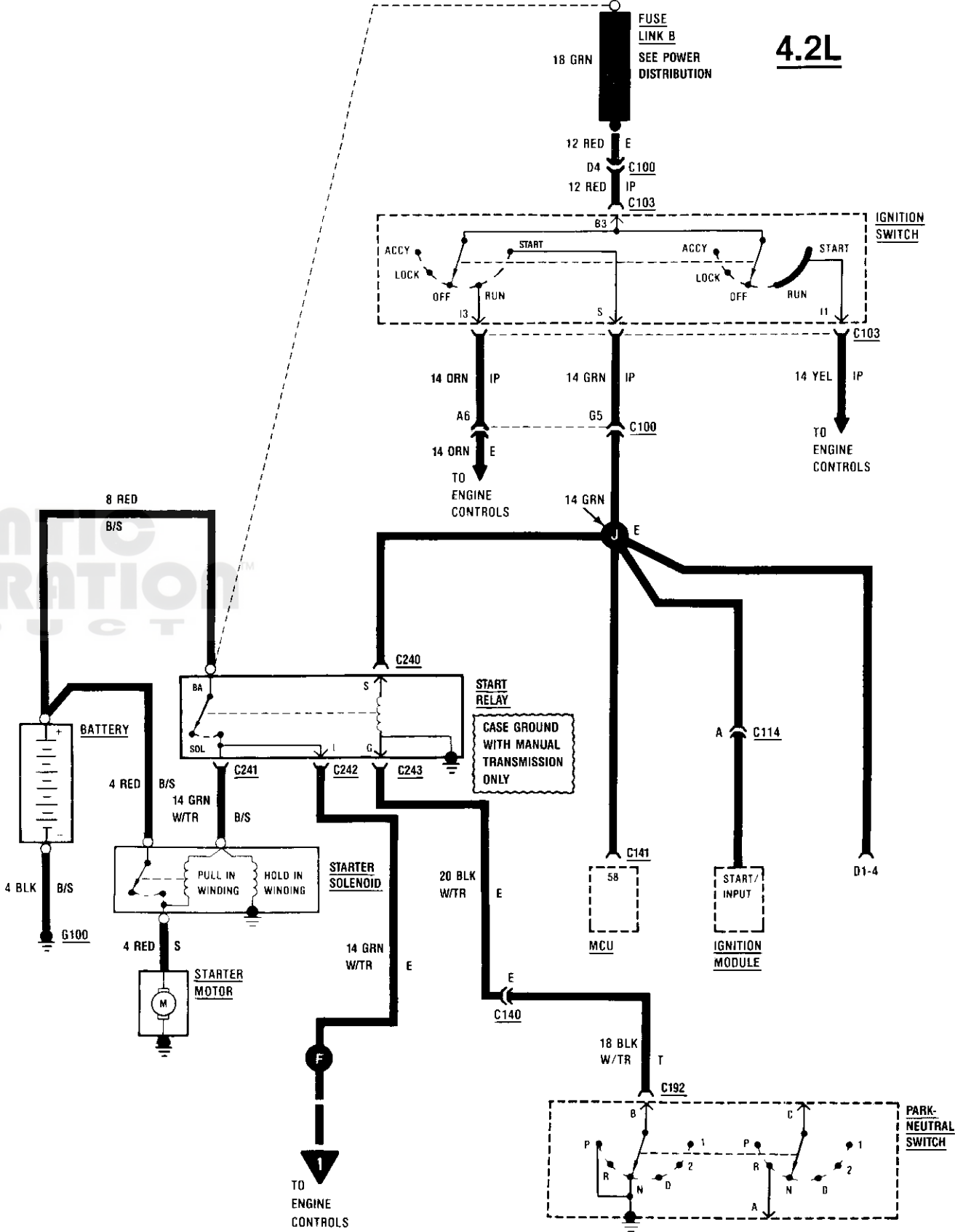
STARTER

2. START RELAY/SOLENOID STARTER CIRCUIT: Parking brake fully engaged; manual transmission in NEUTRAL; automatic transmission in PARK; ignition switch in START position

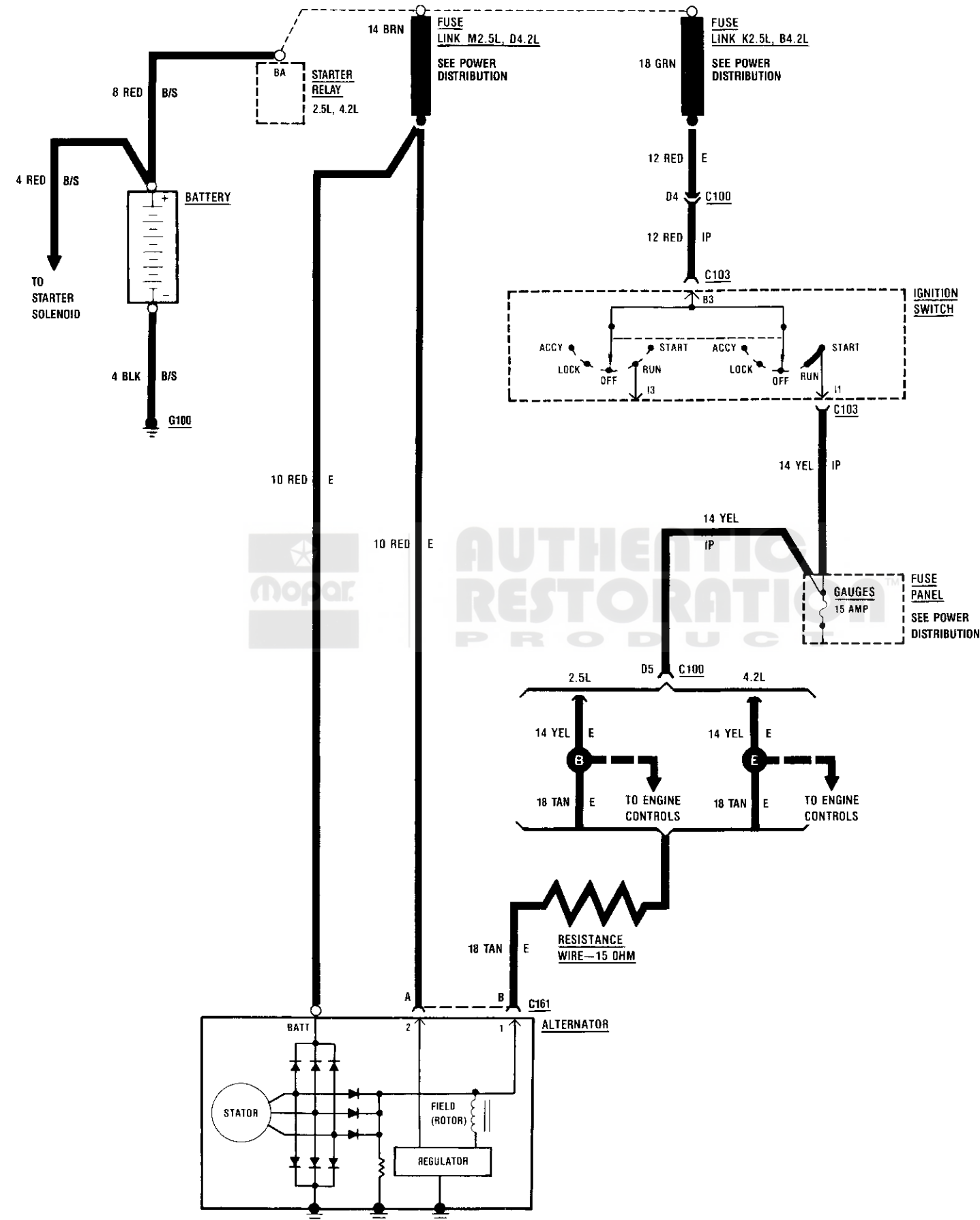
TEST	OK	NOT OK
Terminal BA	Battery voltage	Repair open from battery
C237 terminal SOL-2.5L C241 terminal SOL-4.2L	Battery voltage	Replace start relay

3. PARK/NEUTRAL 4.2L (AUTO TRANS ONLY): Parking brake fully engaged; automatic transmission in PARK or NEUTRAL; turn ignition switch to OFF

TEST	OK	NOT OK
C243 terminal G to C192 terminal B	Zero ohms	Repair open from start relay
Park-neutral switch terminal B to clean chassis ground	Zero ohms	Replace park-neutral switch



CHARGING SYSTEM



DESCRIPTION

The alternator is a belt-driven electrical generator. The output terminal wire on the back of the alternator is connected to the battery side of the starter relay. This point is also the connection for the battery itself and the fusible links that feed the entire vehicle electrical system.

The remaining two wires on the back of the alternator are the voltage sense wire and the field coil battery supply wire. The sense wire originates at the starter relay where it serves as a voltage feedback circuit for the regulator. The field coil circuit begins at the ignition switch.

TROUBLESHOOTING

1. BATTERY/CABLES/DRIVE BELT

TEST	OK	NOT OK
Inspect condition of battery cable terminals	Clean and tight	Repair as required
Battery state of charge Refer to MR279 for specific gravity and load test procedures	Battery passes test	Charge or replace battery as required
Inspect drive belt condition and tension	Drive belt serviceable	Tension or replace belt as required
Inspect connection at starter relay/solenoid	Clean and tight	Repair as required

2. ALTERNATOR CONNECTIONS: All connectors removed from alternator; C103 not removed from ignition switch; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance checks

TEST	OK	NOT OK
BATT terminal	Battery voltage	Repair open from fuse link M-2.5L: fuse link D-4.2L
C161 cavity A	Battery voltage	Repair open from fuse link M-2.5L: fuse link D-4.2L
C103 terminal B3	Battery voltage	Repair open from fuse link K-2.5L: fuse link B-4.2L
C103 terminal I1	Battery voltage	Replace ignition switch
C161 cavity B	8-13 volts	Repair open from ignition switch
Alternator housing to clean chassis ground	Zero ohms	Clean ground connection-alternator mounting

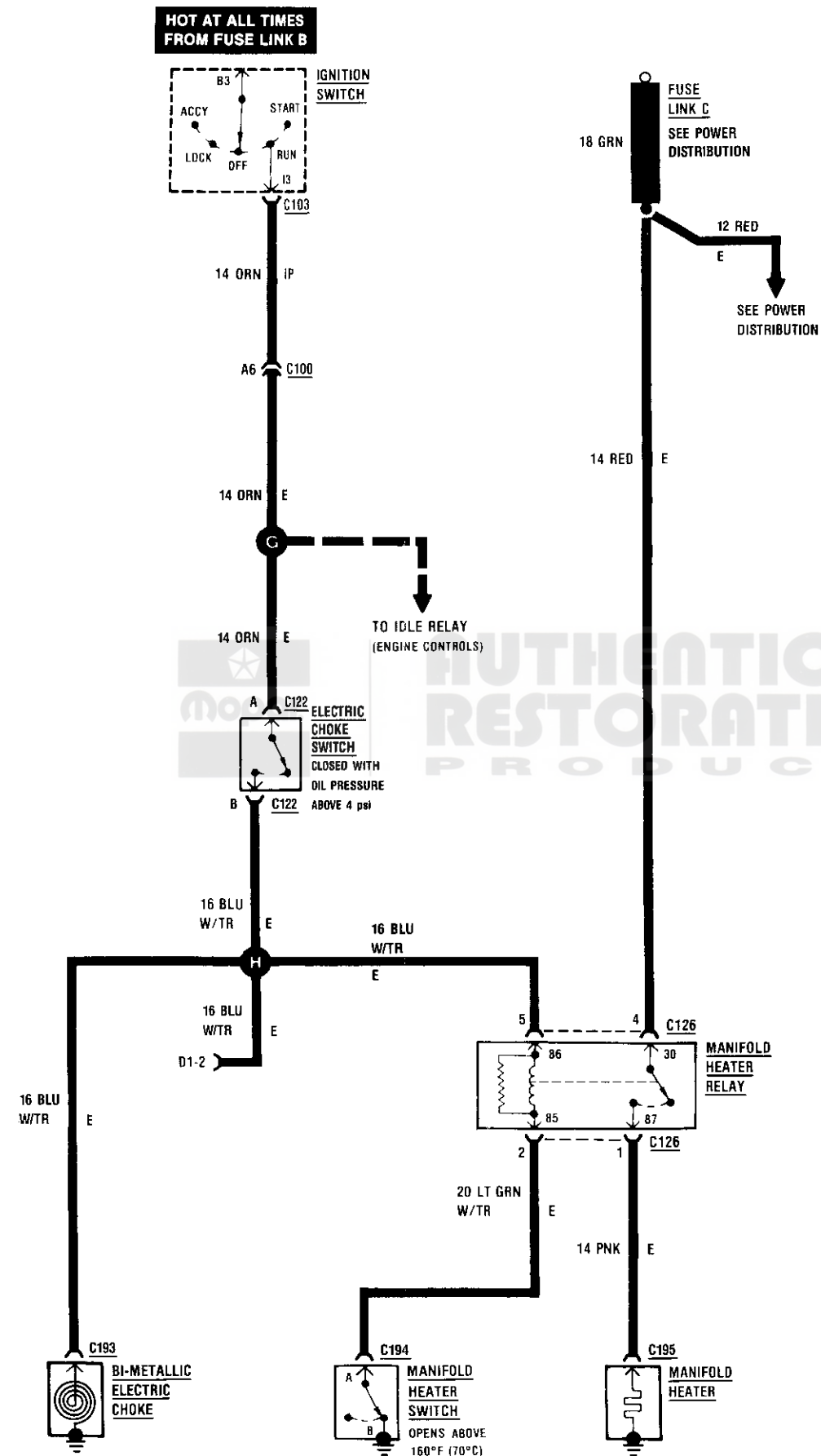
3. BATTERY DISCHARGE THROUGH ALTERNATOR

TEST	OK	NOT OK
Refer to MR279 for procedure	No current leakage	Repair as outlined in MR279

4. ALTERNATOR OUTPUT

TEST	OK	NOT OK
Refer to MR279 for procedure	Output as specified	Repair alternator as outlined in MR279

CARBURETOR CIRCUITS



DESCRIPTION

Both the manifold heater and the electric choke are related to cold weather driveability. The manifold heater aids fuel vaporization by warming the incoming cool air. The electric choke is needed to open the choke plate as the engine warms and no longer requires the rich mixtures required for cold start-up and driveability.

The electric choke and the relay coil receive battery voltage from ignition switch terminal I3. The higher current draw manifold heater receives battery voltage from fuse link C which is linked to the heater through the relay contacts.

The electric choke switch, which is wired in series with the choke heater and manifold heater relay coil, prevents operation of these circuits unless the engine is running.

While the electric choke operates whenever the engine is running, the manifold heater will operate only until engine coolant temperature reaches 160°F (70°C). At this temperature, the heater switch contacts open the relay coil ground circuit and the relay contacts open.

TROUBLESHOOTING

1. **MANIFOLD HEATER RELAY:** Cold engine; connect jumper wire across electric choke switch; separate C126 from manifold heater relay; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
C126 cavity 5	Battery voltage	Repair open from ignition switch
C126 cavity 4	Battery voltage	Repair open from fuse link C
C126 cavity 2 to clean chassis ground	Zero ohms	Repair open between C126 and manifold heater switch or replace manifold heater switch
C126 cavity 1 to C195	Zero ohms	Repair open between C126 and C195

2. **MANIFOLD HEATER RELAY:** Cold engine; leave jumper wire across electric choke switch; reconnect C126 to manifold heater relay; separate C195 from manifold heater; turn ignition switch to RUN

TEST	OK	NOT OK
C195	Battery voltage	Replace manifold heater relay

3. **MANIFOLD HEATER:** Separate C195 from manifold heater; turn ignition switch to OFF

TEST	OK	NOT OK
Measure resistance between heater terminal and a clean chassis ground	0.7 ± 0.2 ohms	Replace manifold heater

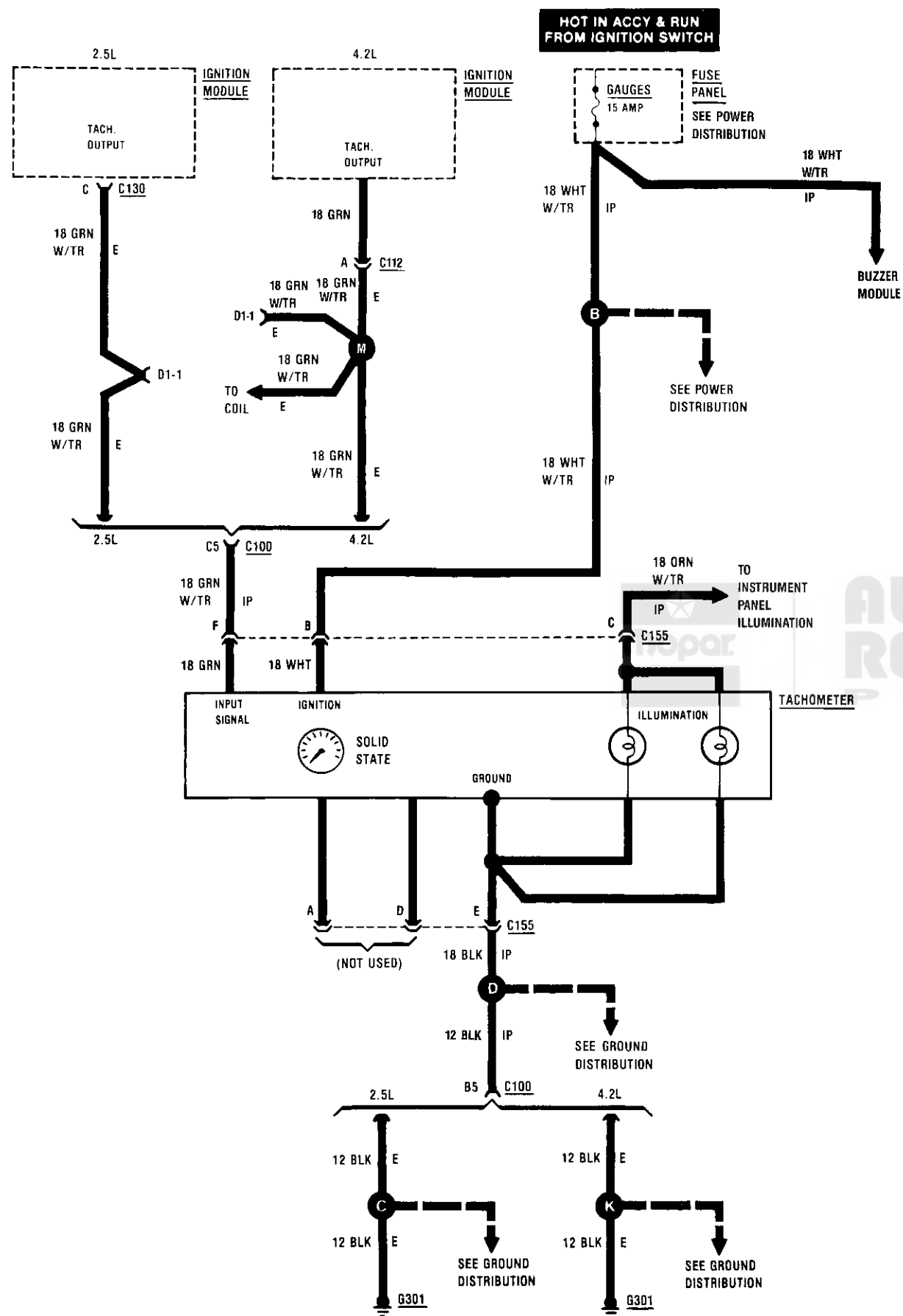
4. **BI-METALLIC ELECTRIC CHOKE:** Separate C193 from bi-metallic electric choke; connect jumper wire across electric choke switch; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
C193	Battery voltage	Repair open from ignition switch
Measure resistance between heater terminal and a clean chassis ground	4 ± 0.5 ohms	Replace bi-metallic electric choke

5. **ELECTRIC CHOKE SWITCH:** Disconnect C122; start engine
NOTE: Be certain engine oil pressure rises above 4 psi

TEST	OK	NOT OK
Measure resistance across electric choke switch terminals	Zero ohms	Replace electric choke switch

TACHOMETER



DESCRIPTION

The tachometer is a solid state circuit requiring only three connections for operation—battery feed, ground and an engine speed input signal.

The solid state circuits in the tachometer are powered-up through the ignition switch and the 15 amp gauges fuse. A second wire connects the necessary circuits to ground.

The third wire connects the tachometer to the ignition module which controls the ignition coil primary circuit. The engine speed input signal is measured by the tachometer solid state circuits and converted to needle movement across the gauge face.

TROUBLESHOOTING —Tachometer

1. GAUGES FUSE: Turn ignition switch to RUN

TEST	OK	NOT OK
Check operation of gauge package	Gauge package operates	Check GAUGES fuse
Measure voltage at battery side of GAUGES fuse	Battery voltage	Repair open from ignition switch

2. IGNITION MODULE TACHOMETER OUTPUT SIGNAL: Connect AC voltmeter to C130 terminal C-2.5L, C112 terminal A-4.2L; start engine

TEST	OK	NOT OK
Operate engine at variable speeds and note voltage readings	AC voltage varies with engine speed	Replace ignition module

3. TACHOMETER INPUT SIGNAL: Connect AC voltmeter to C155 terminal F; start engine

TEST	OK	NOT OK
Operate engine at variable speeds and note voltage readings	AC voltage varies with engine speed	Repair open between ignition module and tachometer

TACHOMETER

4. **GROUND:** Tachometer connector separated; turn ignition switch to OFF

TEST	OK	NOT OK
Measure resistance from C155 terminal E to a clean chassis ground	Zero ohms	Repair open to ground G301

TROUBLESHOOTING —Tachometer Illumination

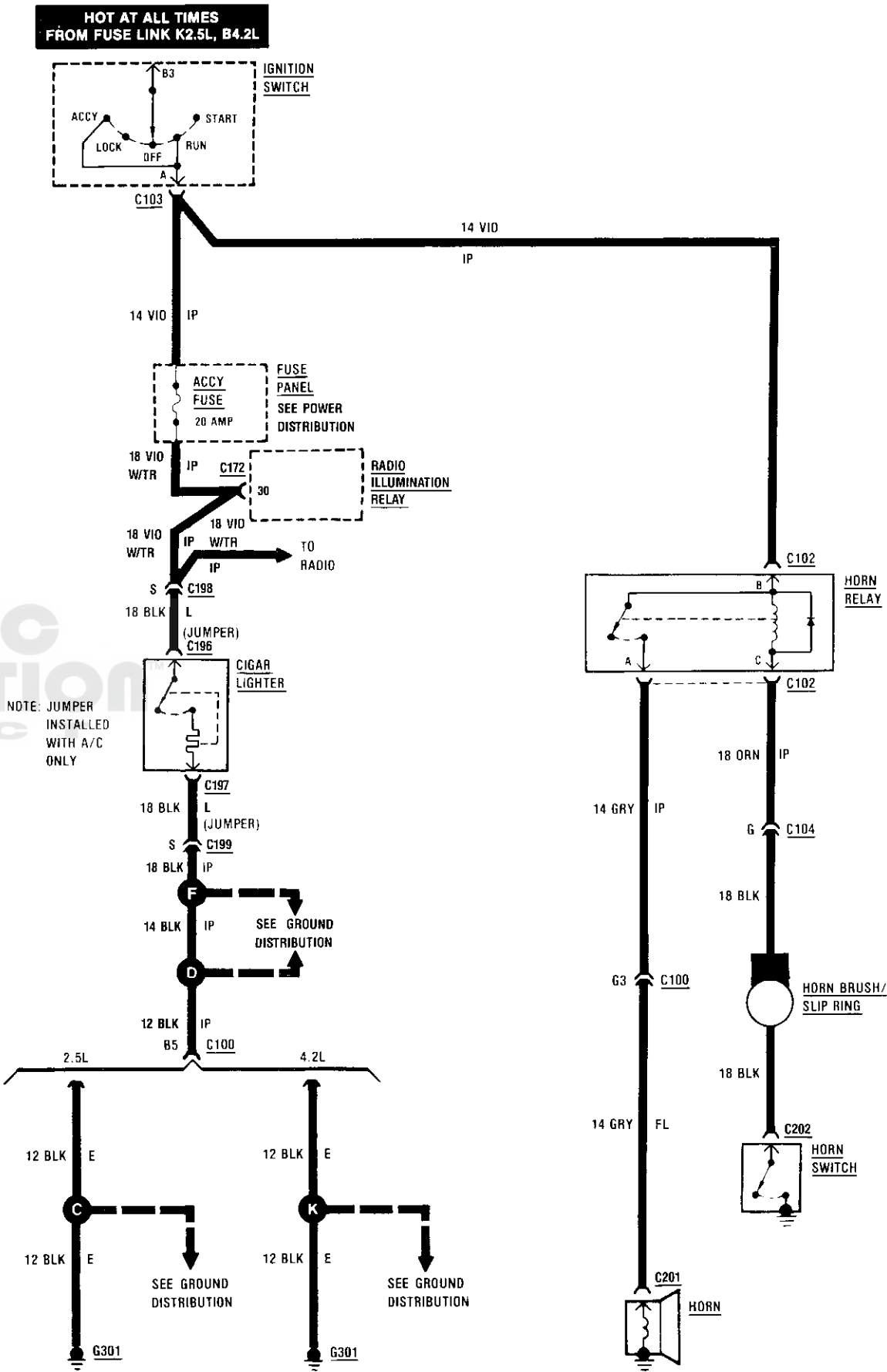
1. **LAMPS:** Headlamp switch OFF

TEST	OK	NOT OK
Measure resistance from C155 terminal C to C155 terminal E	Zero ohms (except filament resistance)	Replace bulb
Measure resistance from C155 terminal E to a clean chassis ground	Zero ohms	Repair open between C155 and G301

2. **LAMPS:** Turn headlamp switch to ON

TEST	OK	NOT OK
Measure voltage at C155 terminal C	Battery voltage	Repair open from headlamp switch

CIGAR LIGHTER



CIGAR LIGHTER

DESCRIPTION

The cigar lighter contains a resistance type heating element. When the lighter is pushed in, the element is connected to battery power through the 20 amp accessory fuse and the ignition switch. The ground side of the element is connected to splice F.

If the vehicle is equipped with air conditioning, a short jumper is installed between the cigar lighter and the instrument panel wiring harness connector.

TROUBLESHOOTING

1. ACCESSORY FUSE: Turn ignition switch to RUN

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Battery side of fuse	Battery voltage	Repair open from ignition switch

2. CIGAR LIGHTER ELEMENT

TEST	OK	NOT OK
Substitute heater element	Lighter works	Next test

3. CIGAR LIGHTER WIRING: Turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C198	Battery voltage	Repair open from ignition switch
Measure resistance from C199 to a clean chassis ground	Zero ohms	Repair open between C199 and G301

NOTE: If the vehicle is equipped with air conditioning, a jumper is installed between the instrument panel harness and the cigar lighter.

HORN

DESCRIPTION

The horn is supplied battery current through a relay that is closed by a ground switch located in the steering wheel hub.

When the horn switch is closed, the relay coil circuit is completed to ground and the relay contacts close. Battery voltage for the relay coil and contacts is supplied through a common wire from the ignition switch.

A slip ring and brush arrangement in the steering wheel allows the switch circuit to maintain contact while allowing rotation of the steering wheel.

TROUBLESHOOTING

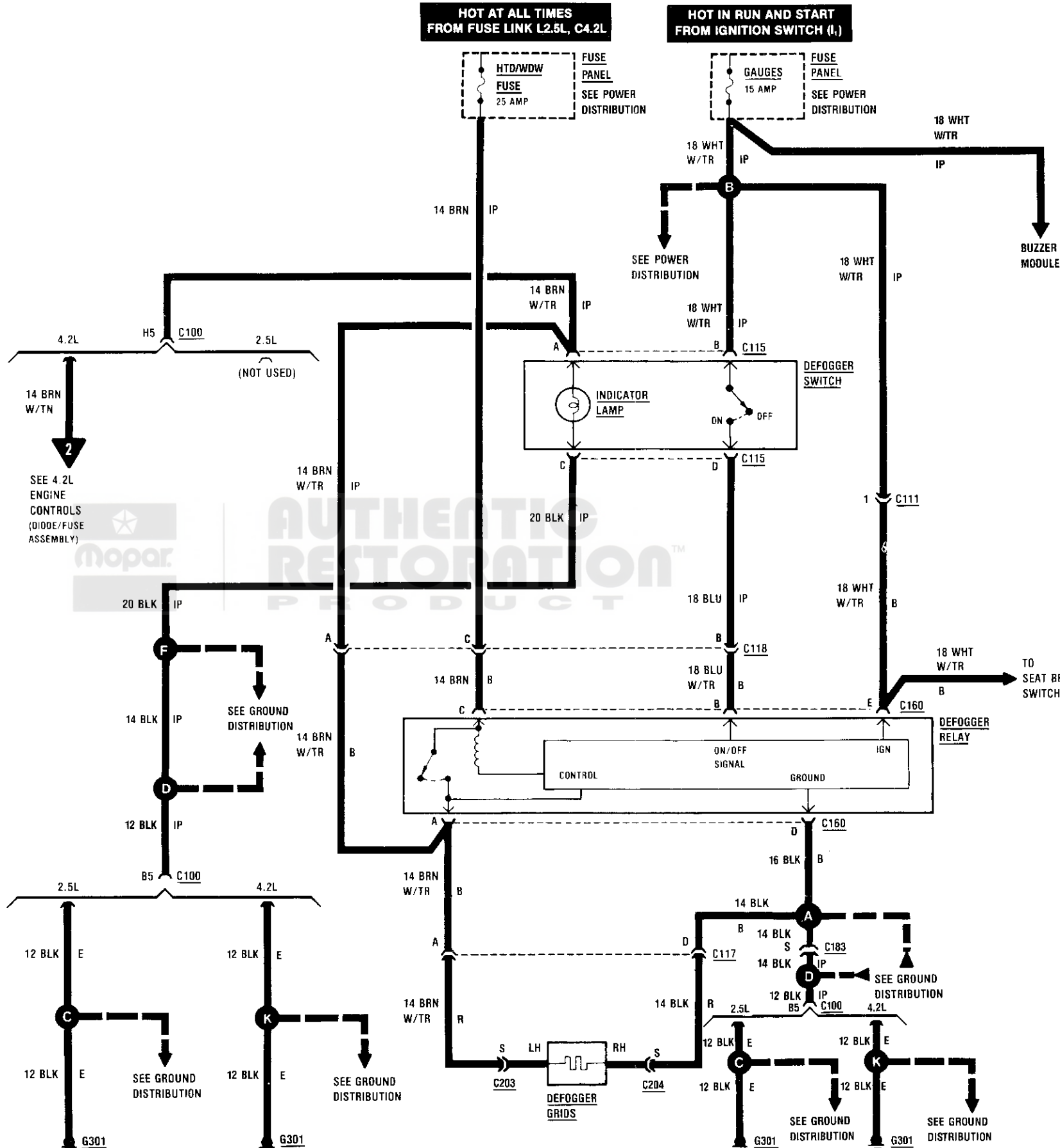
1. HORN: Horn switch is depressed; ignition in RUN for voltage test only

TEST	OK	NOT OK
C201 Horn terminal	Battery voltage, horn sounds	Battery voltage; replace horn Zero volts; test relay
Horn housing to chassis ground	Zero ohms	Replace horn

2. HORN RELAY: Key ON, horn button depressed

TEST	OK	NOT OK
C102 terminal B	Battery voltage	Repair open from ignition switch
C102 terminal C	Zero volts	Repair open to horn switch
C102 terminal A	Battery voltage, horn sounds	Battery voltage; repair open to horn terminal 0 volts; replace relay

REAR DEFOGGER



REAR DEFOGGER

DESCRIPTION

Using heating elements bonded to the rear window glass, the rear defogger will clear condensation, frost and light snow coverings from the rear window.

The electrical current required to produce the heat in the grid is supplied through a relay and driver operated switch. When the switch is closed, the relay contacts close connecting the grid to battery power. The power circuit to the grid is protected by a 25 amp fuse located in the fuse panel.

Operation of the relay is prevented unless the ignition switch is in the ON position. The relay is connected to the ignition switch through splice B and the gauge fuse located in the fuse panel. Operation of the system is further limited by a timer contained in the relay. The timer is a small solid state circuit that opens the relay contacts after a specified amount of time. The timer will allow operation of the defogger for ten minutes on the first request. Additional requests will be limited to five minutes.

An indicator lamp incorporated into the switch will alert the driver while the system is operating. The indicator lamp is connected to the output side of the defogger relay allowing it to come on only when the relay contacts are closed.

OPERATIONAL CHECK

- With the engine running press the rear defogger switch.
- The instrument panel indicator lamp should come on and after a brief period of time the rear window should become warm
 - After 10 minutes the system should automatically shut off
 - After the initial warm-up, operation of the rear defogger will be limited to 5 minutes

TROUBLESHOOTING

1. BATTERY, IGNITION & FUSES

TEST	OK	NOT OK
Check HTD/WDW & GAUGE fuses	Not blown	Replace fuses
Battery side of HTD/WDW fuse	Battery voltage	Repair open from fuse link L/2.5L, C/4.2L
Ignition side of GAUGE fuse	Battery voltage	Repair open from ignition switch NOTE: If open is before splice B seat belt buzzer will also be inoperative.

2. DEFOGGER SWITCH: C115 separated from defogger switch; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C115 terminal B	Battery voltage	Repair open from GAUGES fuse
Measure resistance between C115 terminal D and C118 terminal B	Zero ohms	Repair open between C115 and C118
Turn defogger switch to ON. Measure resistance across switch terminals B and D	Zero ohms	Replace defogger switch

3. DEFOGGER RELAY: C160 separated from defogger relay; turn defogger switch to ON; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C160 terminal C	Battery voltage	Repair open from HTD/WDW fuse
Measure voltage at C160 terminal B	Battery voltage	Repair open from defogger switch
Measure voltage at C160 terminal E	Battery voltage	Repair open from GAUGES fuse
Measure resistance between C160 terminal A and C203	Zero ohms	Repair open between C160 and C203
Measure resistance between C160 terminal D and a clean chassis ground	Zero ohms	Repair open between C160 and G301
Reconnect C160 and measure voltage at terminal A	Battery voltage	Replace defogger relay

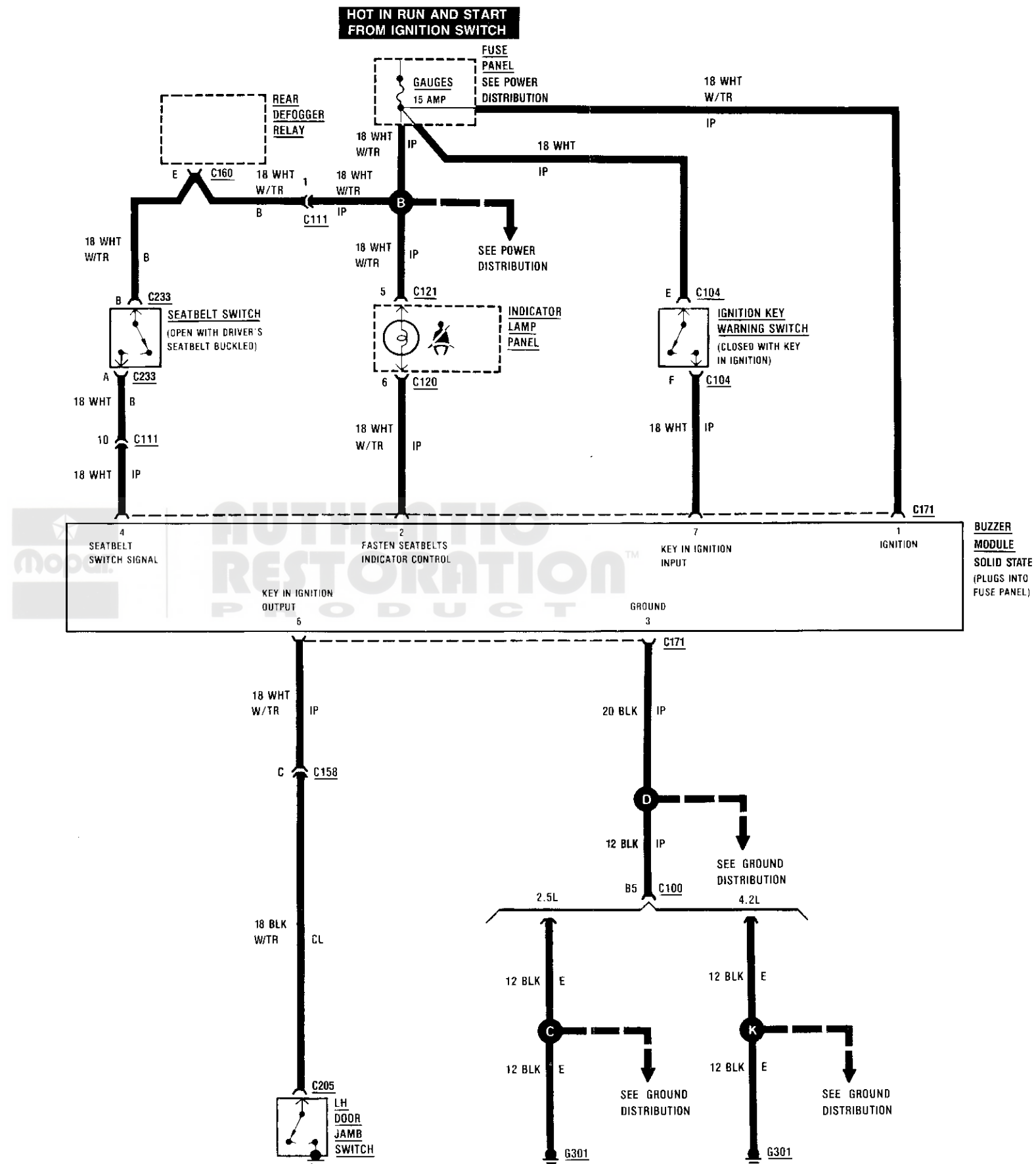
4. INDICATOR LAMP: Turn defogger switch to ON; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure voltage at C115 terminal A	Battery voltage	Repair open from defogger relay
Measure resistance from C115 terminal C to a clean chassis ground	Zero ohms	Repair open between C115 and G301

5. DEFOGGER GRID: Turn defogger switch to ON; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C203	Battery voltage	Repair open from defogger relay
Measure resistance from C204 to a clean chassis ground	Zero ohms	Repair open between C204 and G301

SEAT BELT / IGNITION KEY WARNING BUZZER



SEATBELT / IGNITION KEY WARNING BUZZER

DESCRIPTION

The seatbelt warning and ignition key warning are separate circuits with a common connection at the buzzer module. Operation of the buzzer module itself depends on a battery source connected to terminal 1 and a ground circuit connected to terminal 3.

Operation of the buzzer depends upon whether or not various switches are in the open or closed position. The key buzzer portion of the circuit depends on the key switch and the left hand door jamb switch. Both switches must be in the closed position before the buzzer will sound. The seatbelt warning buzzer and indicator lamp portion of the circuit will not operate if the switch in the seatbelt buckle is opened by buckling the driver's seatbelt.

The buzzer module contains solid state components that will complete the buzzer circuit depending upon the input signals it receives from the switches. Voltage at terminal 7 "tells" the module that the key is in the ignition. A ground at the door jamb switch "tells" the module that the door has been opened. If the module "sees" voltage at terminal 7 and a ground through terminal 6 it will sound the buzzer. If the driver's seatbelt is left unbuckled, the module will "see" voltage at terminal 4. A voltage signal at this terminal will cause the module to sound the buzzer. The module will also illuminate the seatbelt indicator lamp by providing a path to ground. Operation of the seatbelt portion of the circuit is limited to a specified amount of time by a timer contained in the buzzer module.

TROUBLESHOOTING

1. BUZZER MODULE: C171 separated from buzzer module; open driver's door; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C171 terminal 1	Battery voltage	Repair open from GAUGES fuse
Measure resistance between C171 terminal 3 and a clean chassis ground	Zero ohms	Repair open between C171 and G301
Measure resistance between C171 terminal 6 and a clean chassis ground	Zero ohms	Repair open between C171 and C205 or replace LH door jamb switch
Reconnect C171	Buzzer sounds	Replace buzzer module

2. SEATBELT BUZZER: Turn ignition switch to RUN

TEST	OK	NOT OK
Measure voltage at C233 terminal B	Battery voltage	Repair open from GAUGES fuse
Measure voltage at C233 terminal A	Battery voltage	Replace seatbelt switch
Measure voltage at C171 terminal 4	Battery voltage - See Test 1 for buzzer module diagnosis	Repair open from seatbelt switch

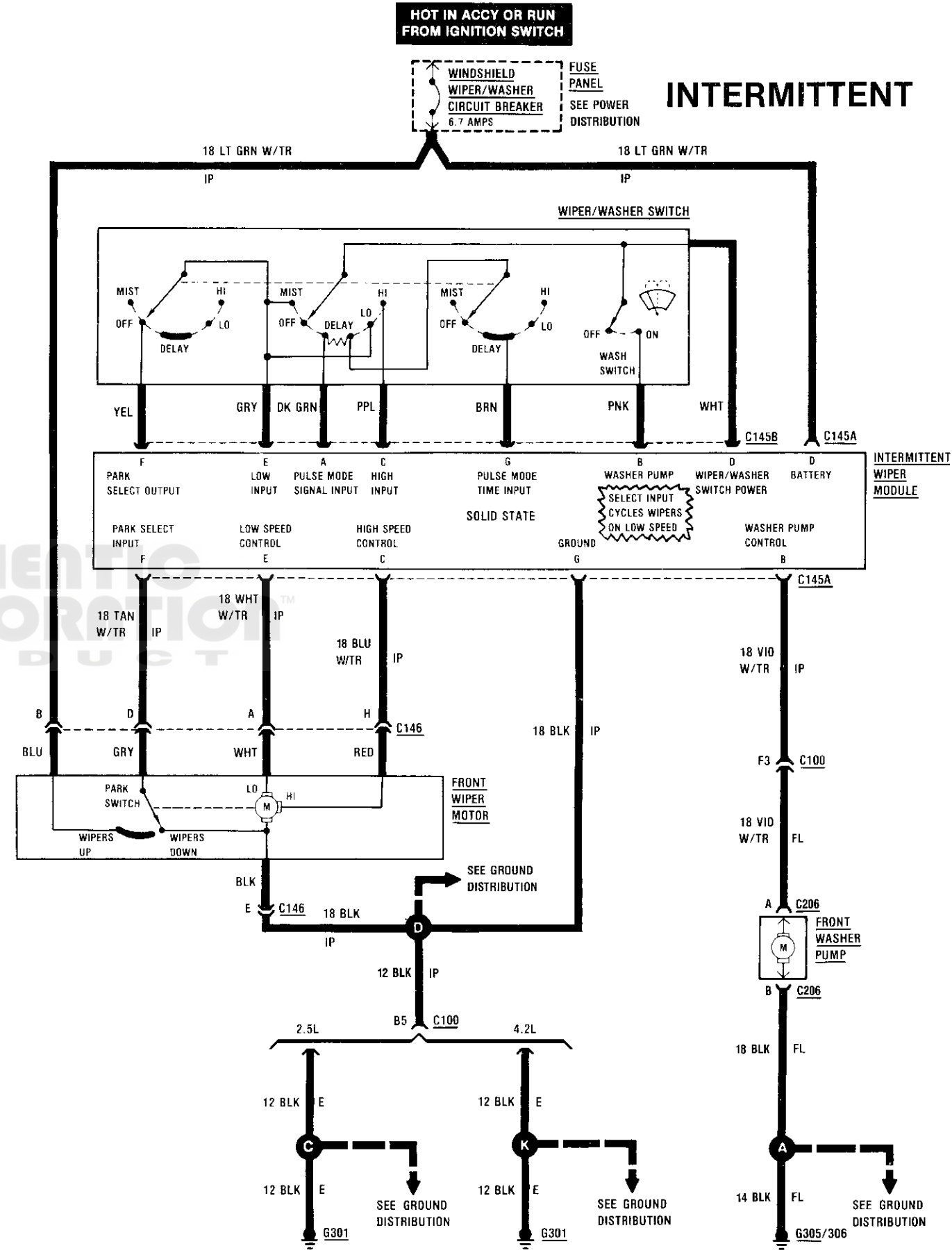
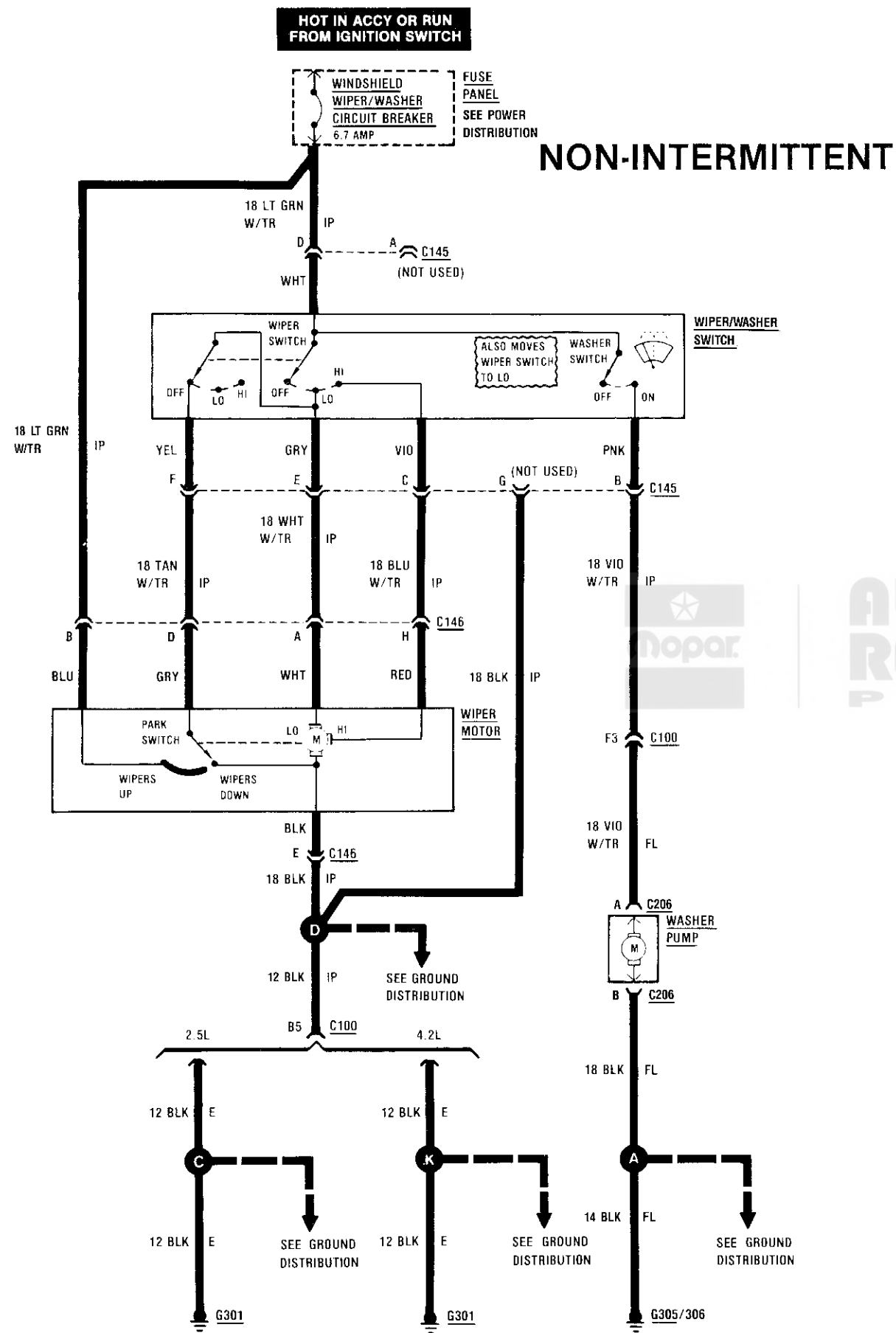
3. SEATBELT INDICATOR LAMP: Turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure voltage at C121 terminal 5	Battery voltage	Repair open from GAUGES fuse
Measure resistance between C120 terminal 6 and C171 terminal 2	Zero ohms - See Test 1 for buzzer module diagnosis	Repair open between C120 and C171

4. IGNITION KEY BUZZER: Place key in ignition; open driver's door

TEST	OK	NOT OK
Measure voltage at C104 terminal E	Battery voltage	Repair open from GAUGES fuse
Measure voltage at C104 terminal F	Battery voltage	Replace ignition key warning switch
Measure voltage at C171 terminal 7	Battery voltage - See Test 1 for buzzer module diagnosis	Repair open between C104 and C171

WIPER / WASHER



WIPERS / WASHERS

DESCRIPTION

The non-intermittent windshield wiper circuit contains three components—control switch, motor and washer pump. The intermittent circuit contains the same components and a wiper module that provides the delay function. Both circuits receive battery feed from and are protected by a 6.7 amp circuit breaker.

In the non-intermittent wiper circuit, the switch connects the motor directly to battery feed for LO and HI speed operation. In the intermittent circuit, the switch supplies battery feed to the delay module, which then supplies the motor. In the delay position, the module is connected with the variable resistor in the wiper switch. The value of the resistance is used by the solid state module to charge a capacitor, which triggers the amount of delay between wipes.

The motor in both circuits is identical with an arrangement of brushes providing the two wiper speeds. The park circuit is also the same. When the wipers are turned off, the park switch maintains current to the motor until the wipers reach the park position on the windshield.

The washer pump receives battery feed either directly from the wiper switch or from the intermittent module. In either case, the electric motor will drive the washer pump.

TROUBLESHOOTING—Windshield Wipers Inoperative

1. CIRCUIT BREAKER: Turn ignition switch to RUN

TEST	OK	NOT OK
Measure voltage at battery side of circuit breaker	Battery voltage	Repair open from ignition switch
Measure voltage at wiper side of circuit breaker	Battery voltage	Replace circuit breaker

2. WIPER MOTOR GROUND

TEST	OK	NOT OK
Measure resistance between C146 terminal E and clean chassis ground	Zero ohms	Repair open between C146 and G301

3. INTERMITTENT WIPER MODULE: Intermittent wipers only; if equipped with non-intermittent wipers proceed to switch tests; turn ignition switch to RUN

TEST	OK	NOT OK
Remove intermittent wiper module and plug C145A and C145B together	Wipers operate in LO and HI speed modes and mist (washer) is working	Proceed to switch test (5). If wipers and mist now operate, replace intermittent module.

4. SWITCH: Turn ignition switch to RUN; wiper switch position as indicated; tests made on switch side of connector C145 (non-intermittent) or C145B (intermittent)

TEST	OK	NOT OK
C145B terminal E —wiper switch in LO and mist/intermittent	Battery voltage	Replace switch
C145B terminal C —wiper switch in HI	Battery voltage	Replace switch
C145B terminal F —wiper switch to OFF with voltmeter connected	Battery voltage until wipers park and then zero volts	Replace switch

5. WIPER SWITCH DELAY RESISTANCE: Wiper switch disconnected; intermittent wiper only; turn ignition switch to OFF

TEST	OK	NOT OK
Across C145B terminals A and D while rotating switch from minimum delay to maximum delay	Ranges from 0-500K ohms	Replace switch
Across C145B terminals A and G while rotating switch from minimum delay to maximum delay	Ranges from 0-500K ohms	Replace switch If OK, replace wiper module.

6. MOTOR: Turn ignition switch to RUN; wiper switch position as indicated; tests made on motor side of connector C146

TEST	OK	NOT OK
C146 terminal B —wiper switch in any position	Battery voltage	Repair open from fuse panel If battery voltage, replace motor
C146 terminal A —wiper switch in LO	Battery voltage	Repair open from wiper switch If battery voltage, replace motor
C146 terminal H —wiper switch in HI	Battery voltage	Repair open from wiper switch If battery voltage, replace motor
C146 terminal D —wiper switch to OFF with voltmeter connected	Battery voltage until wipers park and then zero volts	Repair open from wiper switch If battery voltage and zero volts, replace motor

WIPERS / WASHERS

TROUBLESHOOTING —Windshield Washer
(Non-Intermittent)

1. PUMP GROUND

TEST	OK	NOT OK
Measure resistance from C206 terminal B to a clean chassis ground	Zero ohms	Repair open between C206 and G305/306

2. PUMP SWITCH CIRCUIT: Turn ignition switch to RUN; press washer switch

TEST	OK	NOT OK
Measure voltage at C145 terminal B	Battery voltage	Replace wiper/washer switch
Measure voltage at C206 terminal A	Battery voltage	Repair open between C145 and C206 If battery voltage, replace pump

TROUBLESHOOTING —Windshield Washer
(Intermittent)

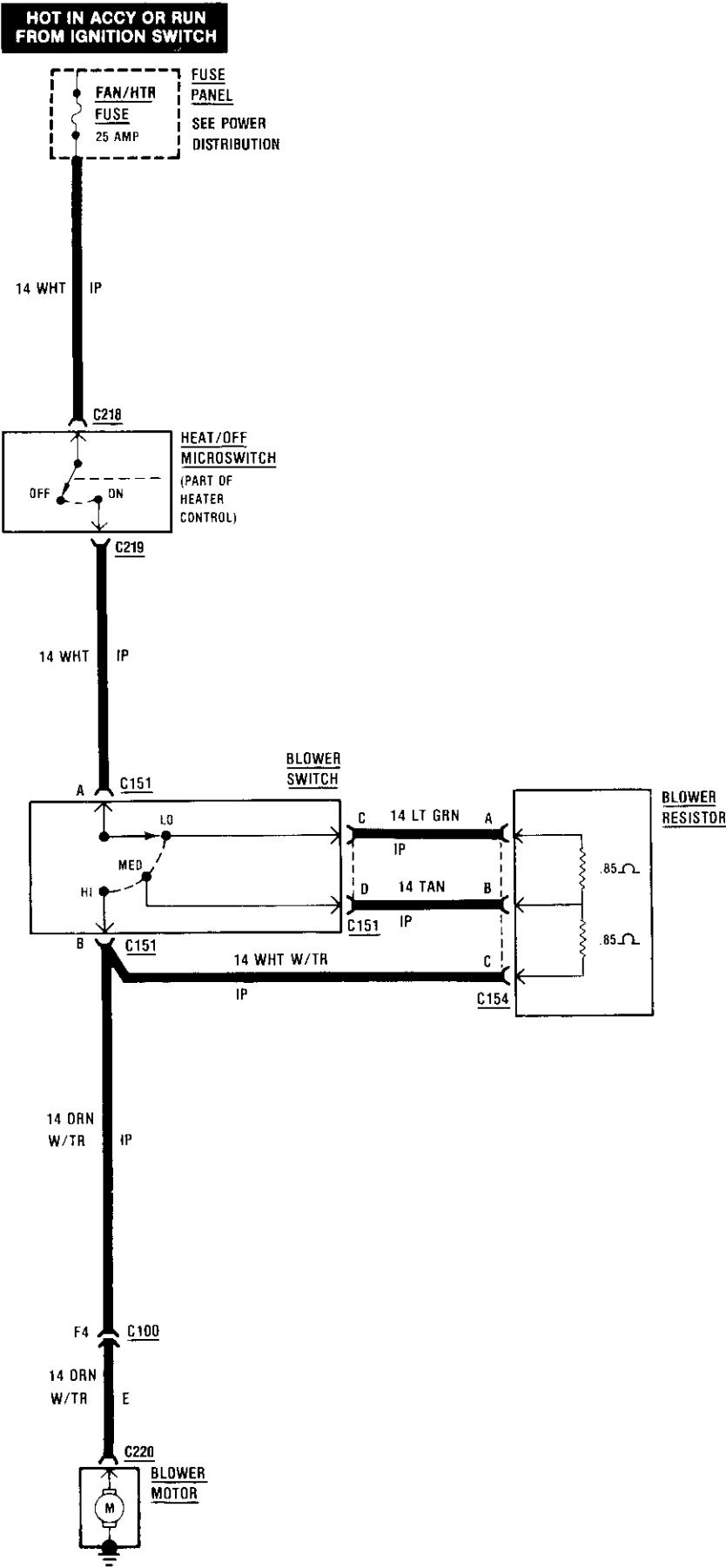
1. PUMP GROUND

TEST	OK	NOT OK
Measure resistance from C206 terminal B to a clean chassis ground	Zero ohms	Repair open between C206 and G305/306

2. PUMP SWITCH CIRCUIT: Turn ignition switch to RUN; washer switch tab rotated forward

TEST	OK	NOT OK
Measure voltage at C145B terminal B	Battery voltage	Replace wiper switch
Measure voltage at C145A terminal B	Battery voltage	Replace intermittent wiper module
Measure voltage at C206 terminal A	Battery voltage	Repair open from C145A terminal B If battery voltage, replace pump

HEATER



HEATER

DESCRIPTION

The blower motor circuit begins at a 25 amp fuse that receives its battery feed from the ignition switch. From the fuse the circuit extends to a microswitch mounted on the heater control.

The microswitch is opened and closed by a cam attached to the heater control lever. In all heater control lever positions except OFF and VENT, the cam is positioned to close the microswitch and complete the blower motor circuit.

The blower switch allows the driver to select one of three blower speeds—low, medium and high. In the high speed position, the switch connects the motor directly to the battery source. The remaining two slower speeds are accomplished by routing the battery source through a resistor assembly.

The resistor and switch are wired in such a way that only a single wire is needed to operate the blower motor at three different speeds. A separate ground wire is not needed because the blower motor housing serves as the ground connection.

TROUBLESHOOTING

1. HEAT/OFF MICROSWITCH: Place selector lever in heat mode; turn ignition switch to RUN

TEST	OK	NOT OK
Measure voltage at C218	Battery voltage	Repair open from FAN/HTR fuse
Measure voltage at C219	Battery voltage	Replace heat/off microswitch

2. BLOWER SWITCH: Turn ignition switch to RUN; place selector lever in heat mode

TEST	OK	NOT OK
Measure voltage at C151 terminal A	Battery voltage	Repair open from C219 to C151
Measure voltage at C151 terminal B - blower switch in HI	Battery voltage	Replace blower switch
Measure voltage at C151 terminal C - blower switch in LO	Battery voltage	Replace blower switch
Measure voltage at C151 terminal D - blower switch in MED	Battery voltage	Replace blower switch

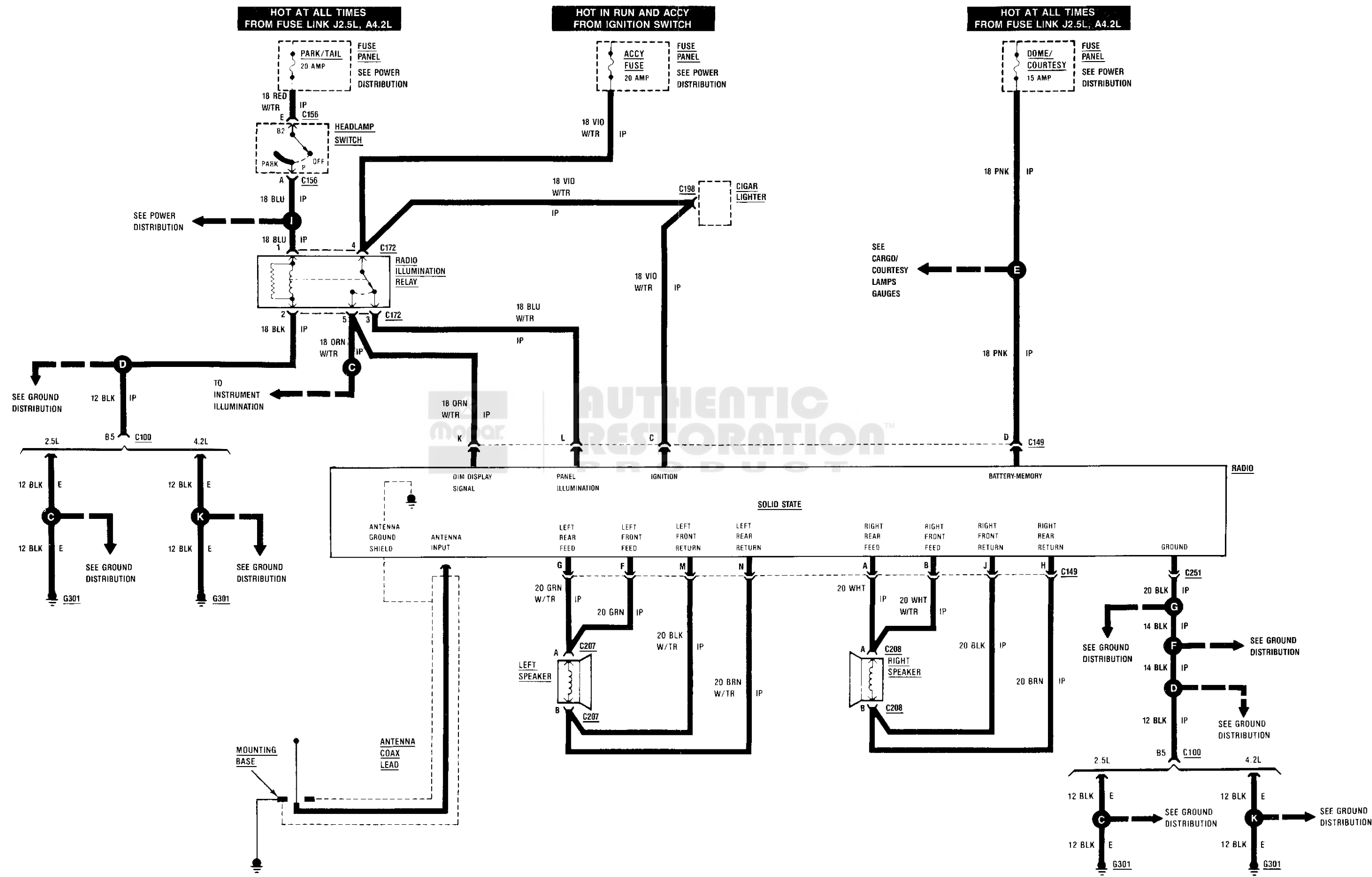
3. BLOWER RESISTOR: Turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C154 terminal A - Blower switch in LO	Battery voltage	Repair open between C151 and C154
Measure voltage at C154 terminal B - blower switch in MED	Battery voltage	Repair open between C151 and C154
Measure voltage at C154 terminal C - blower switch in HI	Battery voltage	Repair open between C151 and C154
Measure resistance between C154 terminal A and terminal B	.85 ohms	Replace blower resistor
Measure resistance between C154 terminal B and terminal C	.85 ohms	Replace blower resistor
Measure resistance between C154 terminal A and terminal C	1.7 ohms	Replace blower resistor

4. BLOWER MOTOR: Turn blower motor switch to HI; place selector lever in heat mode; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C220	Battery voltage	Repair open from blower switch
Measure resistance from blower motor case to a clean chassis ground	Zero ohms	Replace blower motor If zero ohms, replace blower motor

RADIO



RADIO

DESCRIPTION

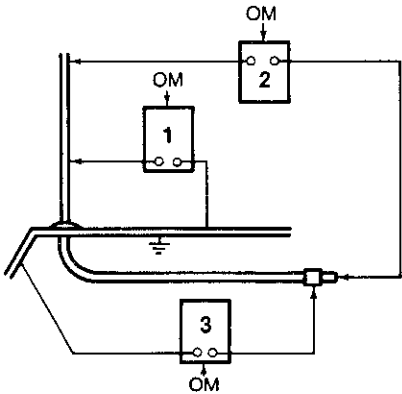
All radios, whether mono or electronically tuned, receive battery feed from the 20 amp ACCY fuse. ETRs have an additional in-line fuse in the back of the radio chassis. The in-line fuse will blow in the event the battery cables are accidentally reversed, or an internal radio short occurs.

Both types of radios are also connected to the radio illumination relay. When the ignition switch is placed in RUN or ACCY and the radio illumination relay remains de-energized, the radio receives battery voltage through the relay

from the 20 amp ACCY fuse for radio panel illumination. The radio illumination relay is energized when the headlamp switch is placed in the park or headlight position. Battery voltage from the 20 amp ACCY fuse is switched to the dim display input of the radio through the relay contacts. The radio panel illumination is dimmed for night driving.

The electronically tuned radio requires an additional connection to the dome/courtesy fuse in order to retain the radio's memory when the ignition switch is turned to OFF.

NOTE: Never measure resistance when power is on. Discharge all capacitors.



TROUBLESHOOTING —Radio Inoperative

1. ACCESSORY FUSE: Turn ignition switch to RUN

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Measure voltage at battery side of fuse	Battery voltage	Repair open from ignition switch

2. IN-LINE FUSE: Turn ignition switch to RUN; does not apply to mono radio

TEST	OK	NOT OK
Inspect fuse	Not blown	Replace fuse
Measure voltage at battery side of fuse	Battery voltage	Repair open from fuse panel

3. GROUND: Turn ignition switch to OFF; connector C149 separated from radio

TEST	OK	NOT OK
Measure resistance from C251 to a clean chassis ground	Zero ohms	Repair open between C149 and G301

TROUBLESHOOTING —Noisy Reception

1. ANTENNA—MAST TO GROUND: Lead in cable disconnected for second step only

TEST	OK	NOT OK
Measure resistance from antenna mast to clean chassis ground	Infinite resistance (OPEN)	Replace antenna lead-in cable

2. ANTENNA—MAST TO CENTER CONDUCTOR: Lead-in cable disconnected from radio

TEST	OK	NOT OK
Measure resistance from antenna mast to tip of center conductor	Fraction of an ohm	Replace antenna lead-in cable

3. BODY GROUND TO COAXIAL SHIELD

TEST	OK	NOT OK
Measure resistance from clean chassis ground to crimp on coaxial shield	Zero ohms	Clean antenna base ground and install new cadmium plated attaching screws

TROUBLESHOOTING —Noisy Speaker

TEST	OK	NOT OK
Inspect connections at speaker	Proper connections	Repair as necessary
Across speaker terminals A & B	8 ohms (impedance)	Replace speaker
Substitute known good speaker	Speaker operates	Replace speaker
Connect known good speaker to terminals at radio connector	Speaker operates	Remove radio for reepair by authorized outlet If speaker operates, repair wiring from radio connector to speaker

RADIO

TROUBLESHOOTING —Noise That Changes With Engine Speed

1. RADIO INTERFERENCE SUPPRESSION

TEST	OK	NOT OK
Inspect connections at: —Alternator —Ignition coil capacitor (4.2L only) —Coaxial cable ground —Radio ground (G301) —Body to engine braided ground strap Inspect: —Ignition secondary wire routing —Condition of secondary wiring insulation —Distributor rotor	Inspection points OK	Repair connections as required Reroute or replace ignition wires as required Apply silicone grease to rotor tip as outlined in MR279

TROUBLESHOOTING —Memory Does Not Operate (Electronically Tuned)

1. FUSE

TEST	OK	NOT OK
Inspect DOME/COURTESY fuse	Not blown	Replace fuse
Measure voltage at battery side of DOME/COURTESY fuse	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L
Measure voltage at C149 terminal D	Battery voltage	Repair open from fuse panel If battery voltage, remove radio for repair by authorized outlet

TROUBLESHOOTING—Radio Illumination (Park and Headlights operating normally)

1. RADIO ILLUMINATION LAMPS: Headlamp switch OFF

TEST	OK	NOT OK
Measure voltage at C172 terminal 4	Battery voltage	Repair open from ACCY fuse
Measure voltage at C172 terminal 3	Battery voltage	Replace radio illumination relay
Measure voltage at C149 terminal L	Battery voltage	Repair open from radio illumination relay If battery voltage, remove radio for repair by authorized outlet

2. RADIO ILLUMINATION DIMMING CIRCUIT: Turn headlamp switch to PARK for voltage tests; turn headlamp switch to OFF for resistance tests

TEST	OK	NOT OK
Measure voltage at C172 terminal 1	Battery voltage	Repair open from headlamp switch
Separate C172 from radio illumination relay. Measure resistance from C172 terminal 2 to a clean chassis ground	Zero ohms	Repair open between C172 and G301
Measure voltage at C172 terminal 4	Battery voltage	Repair open from ACCY fuse
Reconnect C172. Measure voltage at C172 terminal 5	Battery voltage	Replace radio illumination relay
Measure voltage at C149 terminal K	Battery voltage	Repair open from radio illumination relay If battery voltage, remove radio for repair by authorized outlet

AIR CONDITIONING

DESCRIPTION

The air conditioning circuit consists of three segments—battery feed, blower motor and compressor clutch. The three segments have a common connection point at the blower switch.

The power feed segment of the circuit extends from the 25 amp HTR/FAN fuse to the blower switch. From the blower switch, battery feed is routed to the blower motor and compressor clutch segments of the circuit.

The blower motor segment consists of the three wires from the blower switch to the motor, the motor itself and the motor ground wire. Through the switch, the three wires connect the motor brushes to battery feed. When connected to battery feed, the separate brushes provide the three blower speeds—LO, MED and HIGH.

In all blower switch positions except OFF, the compressor clutch segment of the circuit also receives battery feed. ON and OFF cycling of the compressor and therefore the temperature of the outlet air is regulated by the thermostatic control. A thermal sensor extends from the control to the evaporator housing. When the temperature of the evaporator drops below the set temperature, the thermostatic control opens the clutch circuit. The circuit remains open until evaporator temperature rises above the set temperature.

The compressor clutch segment of the circuit also contains a low pressure switch. If the pressure in the refrigerant system drops due to a leak, the circuit is opened to prevent damage to the compressor.

The last component in the compressor clutch segment of the circuit is the clutch coil. When the coil is connected to battery feed, its windings form an electromagnet that pulls the clutch hub against the clutch pulley.

OPERATIONAL CHECK

Turn the ignition key to the run position, set the thermostat control to maximum cooling and turn the blower switch to the LO position. When the blower motor is switched on, a loud click will be heard as the compressor clutch engages.

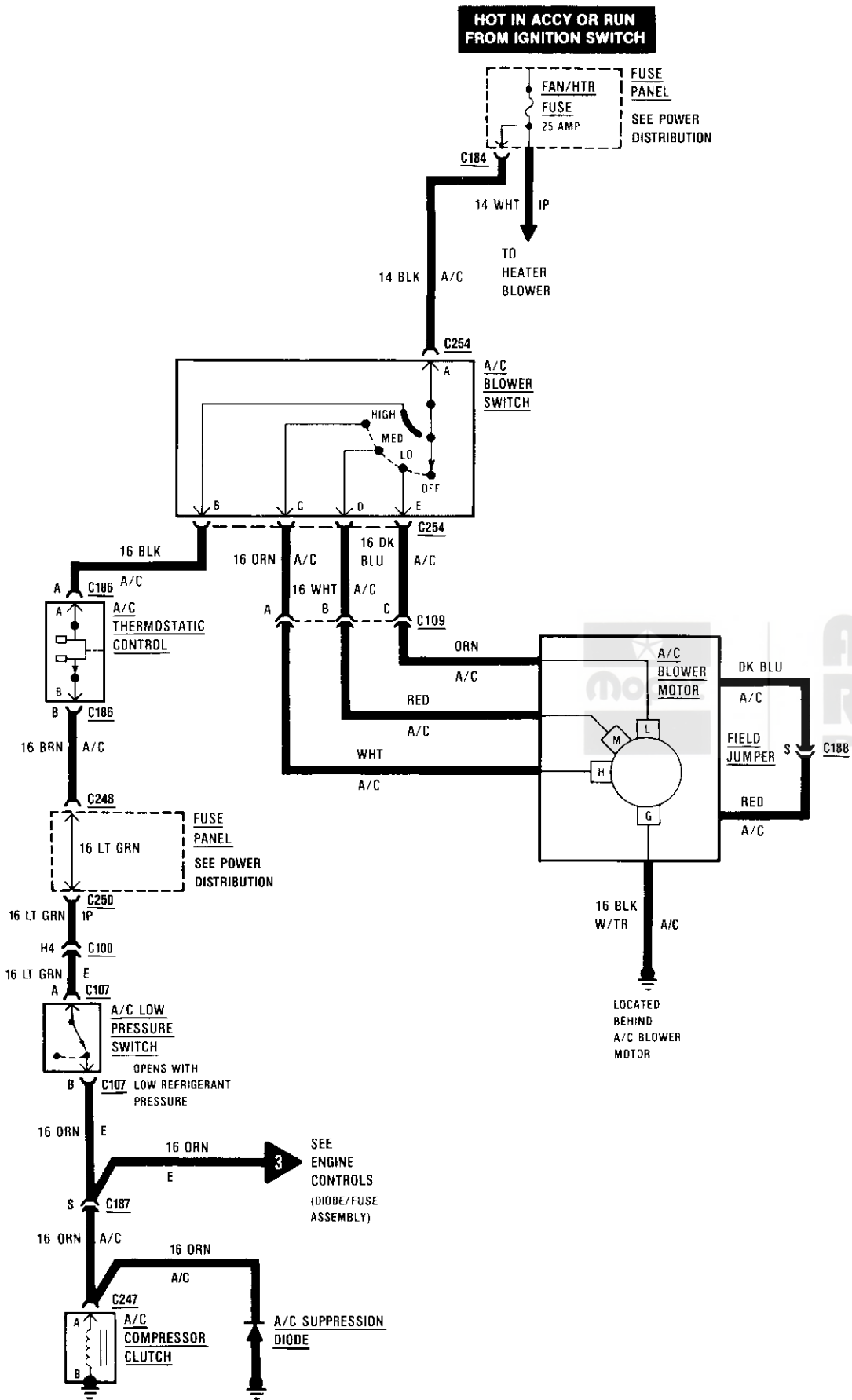
Start the engine and set the blower switch on HIGH. After a short period of time, cold air should discharge from the registers.

Rotate the thermostat control from maximum cool to minimum cool and listen for the compressor clutch to disengage. Rotate the thermostat from minimum to maximum several times and listen for engagement and disengagement of the clutch.

TROUBLESHOOTING —Blower Inoperative

1. FUSE: Ignition in RUN

TEST	OK	NOT OK
Check operation of heater blower motor	Blower operates	Check FAN/HTR fuse
Measure voltage at battery side of FAN/HTR fuse	Battery voltage	Repair open from ignition switch
Measure voltage at C254 terminal A	Battery voltage	Repair open from FAN/HTR fuse



2. BLOWER SWITCH: Ignition in RUN; blower switch position as indicated

TEST	OK	NOT OK
Measure voltage at C254 terminal A—blower switch in any position	Battery voltage	Repair open from fuse panel
Measure voltage at C254 terminal E—blower switch in LO	Battery voltage	Replace switch
Measure voltage at C254 terminal D—blower switch in MED	Battery voltage	Replace switch
Measure voltage at C254 terminal C—blower switch in HIGH	Battery voltage	Replace switch

3. BLOWER MOTOR: Blower switch position as indicated; turn ignition switch to RUN for voltage tests; turn ignition switch to OFF for resistance tests

TEST	OK	NOT OK
Measure resistance from A/C blower housing to a chassis ground	Zero ohms	Repair ground connection If zero ohms, replace motor
Measure voltage at C109 terminal C—blower switch in LO	Battery voltage	Repair open from blower switch If battery voltage, replace motor
Measure voltage at C109 terminal B—blower switch in MED	Battery voltage	Repair open from blower switch If battery voltage, replace motor
Measure voltage at C109 terminal A—blower switch in HIGH	Battery voltage	Repair open from blower switch If battery voltage, replace motor

TROUBLESHOOTING—Compressor Clutch Inoperative

1. A/C COMPRESSOR CLUTCH

TEST	OK	NOT OK
Jumper wire from battery positive post to C247 terminal A	Clutch engages	Next step with jumper installed
Jumper wire from clutch coil frame to clean chassis ground	Clutch engages	Repair clutch coil ground If clutch does not engage, replace coil

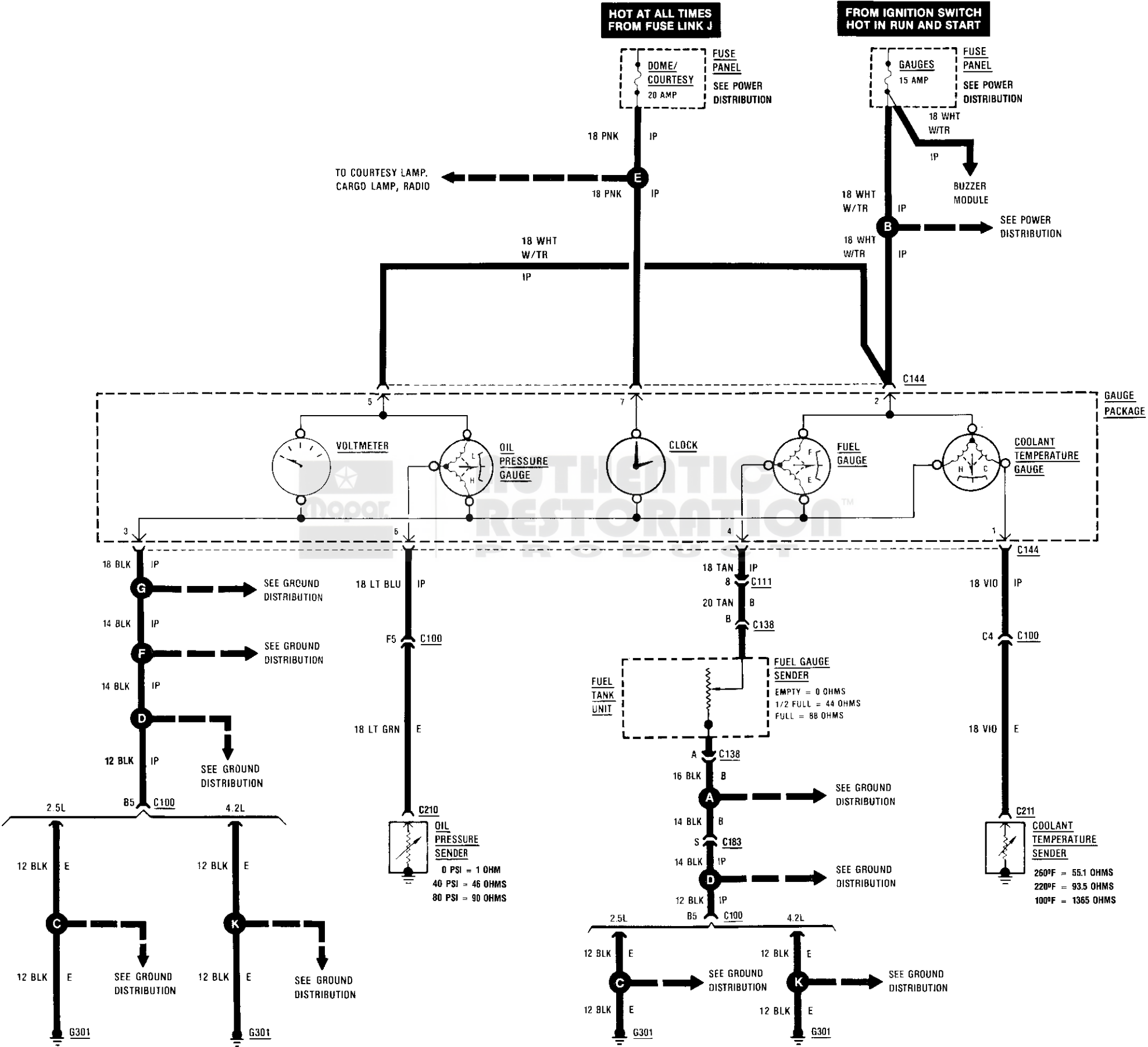
2. LOW PRESSURE SWITCH: Turn ignition switch to RUN; A/C blower switch ON; thermostatic control set to MAX cool

TEST	OK	NOT OK
Measure voltage at C107 terminal A	Battery voltage	Proceed to thermostatic control tests
Jumper wire across C107 terminals A & B	Clutch engages	Check system refrigerant charge If system is properly charged, replace A/C low pressure switch

3. THERMOSTATIC CONTROL: Turn ignition switch to RUN; A/C blower switch ON; thermostatic control set to MAX cool

TEST	OK	NOT OK
Measure voltage at C186 terminal A	Battery voltage	Repair open from blower switch
Measure voltage at C186 terminal B	Battery voltage	Replace thermostatic control
Measure voltage at C107 terminal A	Battery voltage	Repair open from thermostatic control

GAUGE PACKAGE



GAUGE PACKAGE

DESCRIPTION

The gauge package contains four gauges and the clock. The gauges have a common battery feed from the gauges fuse and ignition switch. The clock is separately powered through the dome/courtesy fuse which receives constant battery feed through a fuse link. Although they have separate power sources, the four gauges and clock do share a common ground connection.

The voltmeter indicates electrical system voltage. When the engine is not running, the voltage registered is from the battery. After the engine is started, charging system voltage is indicated. In the gauge package, the voltmeter forms a parallel connection across the battery feed and ground.

The remaining gauges—oil pressure, fuel and coolant temperature—are connected to individual sender units. Variable resistors in the senders will change the amount of current allowed to flow through the gauge coils. As current flow through the coils varies, the position of the indicator needle will also vary.

The four gauges and the clock are connected to battery feed, ground and the sender units through a printed circuit mounted on the back of the gauge housing.

TROUBLESHOOTING —Gauge Package Inoperative

1. GAUGE PACKAGE GROUND: Separate C144 from gauge package

TEST	OK	NOT OK
Measure resistance from C144 terminal 3 to a clean chassis ground	Zero ohms	Repair open between C144 and G301

TROUBLESHOOTING —Clock

1. FUSE

TEST	OK	NOT OK
Inspect DOME/COURTESY fuse	Not blown	Replace fuse
Measure voltage at battery side of fuse	Battery voltage	Repair open from fuse link J

2. PRINTED CIRCUIT/CLOCK: Separate C144 from gauge package

TEST	OK	NOT OK
Measure voltage at C144 terminal 7	Battery voltage	Repair open from fuse panel
Measure resistance from gauge package terminal 7 to clock battery terminal	Zero ohms	Replace/repair printed circuit
Measure resistance from clock ground terminal to gauge package terminal 3	Zero ohms	Replace/repair printed circuit If zero ohms replace clock

TROUBLESHOOTING —All Gauges Inoperative

1. FUSE: Turn ignition switch to RUN

TEST	OK	NOT OK
Inspect gauges fuse	Not blown	Replace fuse
Measure voltage at battery side gauges fuse	Battery voltage	Repair open from ignition switch

2. GAUGE PACKAGE: Turn ignition switch to RUN

TEST	OK	NOT OK
Measure voltage at C144 terminals 2 & 5	Battery voltage	Repair open from fuse panel

NOTE: If the voltmeter and oil pressure gauges are inoperative, an open exists in the jumper wire from gauge package terminal 2 to terminal 5.

GAUGE PACKAGE

TROUBLESHOOTING —One Gauge

NOTE: Does not apply to voltmeter.

1. COOLANT TEMPERATURE SENDER: Turn ignition switch to RUN; separate C211 from coolant temperature sender

TEST	OK	NOT OK
Measure voltage at C211	9 volts	Repair open from gauge package or printed circuit If 9 volts, replace sender

2. OIL PRESSURE SENDER: Turn ignition switch to RUN; separate C210 from oil pressure sender

TEST	OK	NOT OK
Measure voltage at C210	Approximately 7.5 volts	Repair open from gauge package or printed circuit If 7.5 volts, replace sender

3. FUEL GAUGE SENDER: Turn ignition switch to RUN; separate C138 from fuel gauge sender

TEST	OK	NOT OK
Measure voltage at C138 terminal B	Approximately 7.5 volts	Repair open from gauge package or printed circuit
Measure resistance from C138 terminal A to a clean chassis ground	Zero ohms	Repair open from C138 to G301 If zero ohms, replace sender

2. PRINTED CIRCUIT: Turn ignition switch to RUN; separate C144 from gauge package

NOTE: Includes voltmeter sender unit

TEST	OK	NOT OK
Measure resistance from gauge package terminal 2 (fuel and coolant temp gauge) or from terminal 5 (voltmeter and oil pressure gauge) to gauge battery terminal	Zero ohms	Replace/repair printed circuit
Measure resistance from gauge package terminal 3 to gauge ground terminal	Zero ohms	Replace/repair printed circuit If zero ohms, replace gauge

4. GAUGE CALIBRATION VALUES

TEST	OK	NOT OK
Using the following charts, the calibration of the gauge can be checked	Indicator needle in correct position	Replace gauge

Oil Pressure Gauge Resistance (Ohms)

0 psi	1 ohm
40 psi	46 ohm
80 psi	90 ohms

Fuel Gauge Resistance (Ohms)

Empty	0 ohms
1/2 full	44 ohm
Full	88 ohm

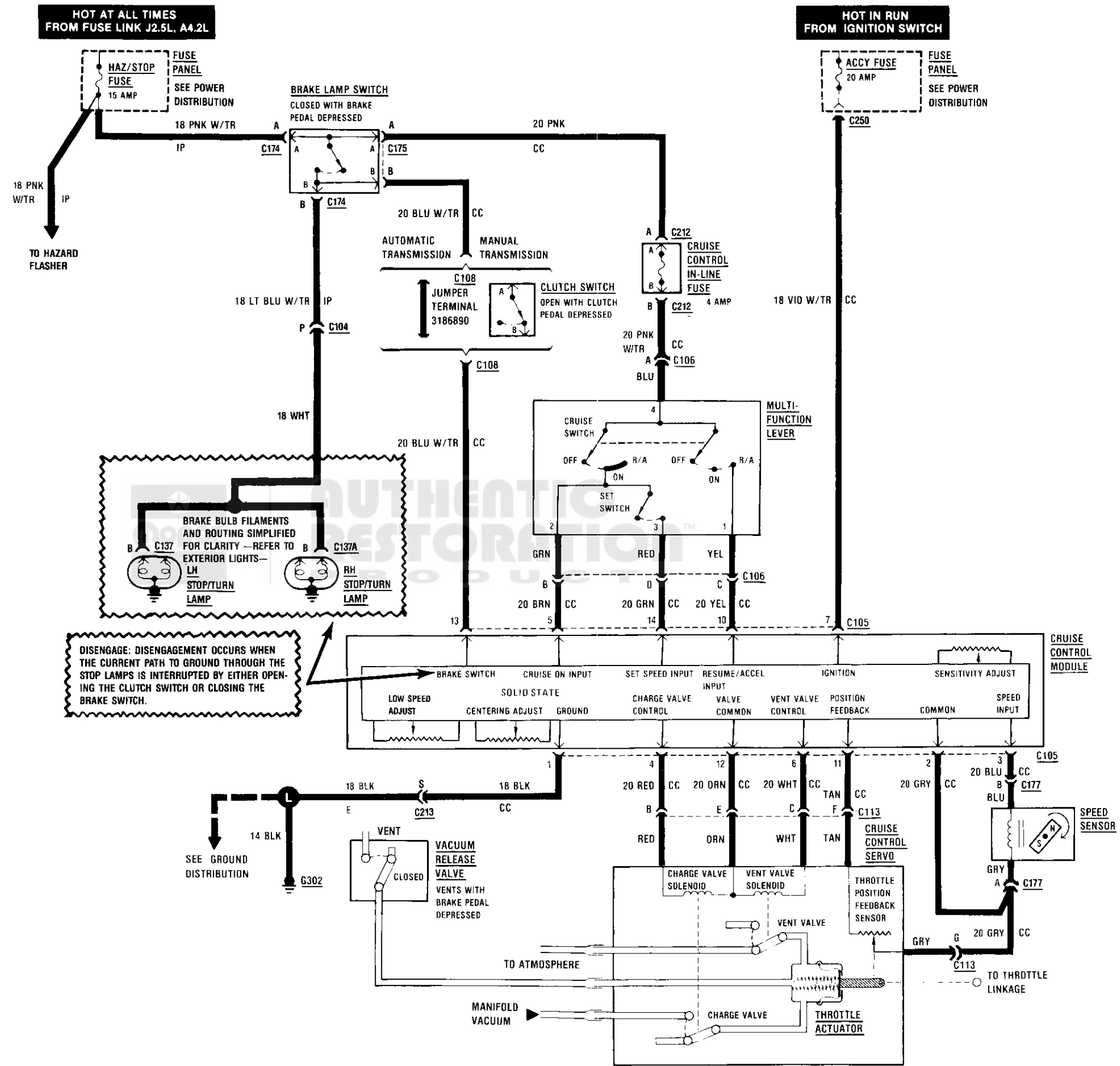
Temperature Gauge Resistance (Ohms)

100 ° F	1365 ohm
220°	93.5 ohm
260°	55.1 ohm

Voltmeter Calibration

VOLTAGE INPUT	POINTER ANGLE FROM VERTICAL	TOLERANCE
8V	− 30.0°	± 0.6V
10V	− 19.1°	
12V	− 6.6°	
14V	+ 6.6°	± 0.5V
16V	+ 19.1°	
18V	+ 30.0°	+ 0.6V

CRUISE CONTROL



CRUISE CONTROL

DESCRIPTION

The cruise control module automatically controls throttle position to maintain a speed set by the operator. The vehicle will keep the set speed unless the driver presses the brake, clutch or accelerator pedal.

The accy fuse supplies voltage to the cruise control module with the ignition switch in the RUN position. The haz/stop fuse provides battery feed to the brake switch, cruise control fuse, and the multi-function lever at all times.

When the multi-function lever is in the ON position, voltage is applied to terminal 14 (speed set signal) and terminal 5 (cruise ON input) of the cruise control module.

The driver opens the set switch when the vehicle is at the set speed. Voltage to the speed set signal stops momentarily. The cruise regulator records the vehicle's speed at the moment there was no voltage at terminal 14 (speed set signal).

The resume/accelerate switch is used after the cruise control module has been interrupted by the current path to ground through the stop lights at terminal 13. This path is broken by the use of the brake or clutch pedals or when the driver wants to accelerate. When the cruise switch is in the R/A position, voltage is applied to the resume/accelerate input (terminal 10). The cruise control module recognizes this voltage as an instruction to accelerate. When the switch is pushed into the R/A position and released immediately, voltage is applied only momentarily to terminal 10. The cruise control module interprets this voltage as an instruction to resume the previously set speed.

The cruise control module controls the servo on the basis of these voltages, the speed signal from the speed sensor and the position feedback input from that servo.

The cruise control module will energize the charge valve in the servo allowing vacuum to retract the bellow when acceleration is needed. During deceleration, the cruise control module will de-energize the vent valve and release the vacuum in the servo.

OPERATIONAL CHECK (ROAD TEST)

The following sequential checks are performed with the cruise switch ON and vehicle speed faster than 35 mph:

1. Press the set button at the end of multi-function lever and vehicle should maintain set speed.
2. Set button held in, foot off accelerator, and vehicle should coast to a slower speed.
3. Release set button and cruise control will engage and hold a slower speed, provided the speed remains above 35 mph.
4. Slide cruise switch to R/A, hold it there and vehicle should accelerate.
5. Release cruise switch back to ON and vehicle will hold the new faster speed, if set speed button has been pressed.
6. Tap brake pedal and vehicle will decelerate.
7. Slide cruise switch momentarily to R/A and vehicle will accelerate to former set speed.
If the vehicle has a manual transmission, repeat steps 6 and 7 by depressing the clutch.
8. While cruising, accelerate, then remove foot from accelerator and the vehicle will coast back to set speed.
9. While cruise is engaged, tap set speed button and vehicle speed will increase 1 mph for each time it is tapped.

CRUISE CONTROL TESTER DIAGNOSTIC CHART

MINIMUM OPERATION TO TURN ON LAMP	LAMP ON					
	1	2	3	4	5	6
A. CRUISE SWITCH ON • Set Switch Depressed	X					
B. CRUISE SWITCH ON		X				
C. IGNITION SWITCH ON • Depress Brake or Clutch To Turn OFF			X	X		
D. CRUISE SWITCH RESUME/ACCELERATE					X	X

CRUISE CONTROL SERVO CHECKS

E. CRUISE SWITCH RESUME/ACCELERATE • Engine Running					X	X
WARNING: Servo will pull throttle wide open. Keep RPM at safe limit by releasing the cruise switch.						Parking brake fully engaged; automatic transmission in park; manual transmission in neutral.

TROUBLESHOOTING —No Lamps On

1. MODULE GROUND: Ignition OFF

TEST	OK	NOT OK
Measure resistance from C105 terminal 1 to chassis ground	Zero ohms	Repair open between C105 and G302

TROUBLESHOOTING —Lamp No. 1 Off/Set Switch

1. FUSES: Ignition in RUN; cruise switch ON; set switch pressed

TEST	OK	NOT OK
Inspect HAZ/STOP fuse	Not blown	Replace fuse
Battery side of HAZ/STOP fuse	Battery voltage	Repair open from ignition switch
Inspect in-line fuse	Not blown	Replace fuse
Measure voltage at C212 terminal A	Battery voltage	Repair open between HAZ/STOP fuse and cruise control module

2. SET SWITCH: Ignition in RUN; cruise switch ON; set switch pressed

TEST	OK	NOT OK
Measure voltage at C106 terminal A	Battery voltage	Repair open from in-line fuse
Measure voltage at C106 terminal D	Battery voltage	Replace cruise switch
Measure voltage at C105 terminal 14	Battery voltage	Repair open from set switch

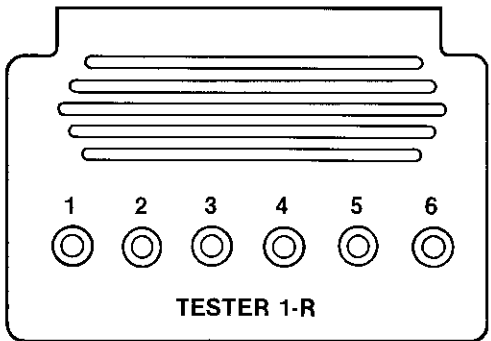
AM PC-1-R CRUISE CONTROL TESTER

The following troubleshooting charts are based on the results obtained from AM PC-1-R Cruise Control Tester.

To install the tester, remove the control module attaching screws, unplug the wiring connector and plug it into the tester. Disconnect and connect all cruise control connectors before testing to remove oxidation that may have formed on the connector terminals.

CAUTION: When separating wiring harness connectors do not pull on the wires. **PULL ONLY ON THE CONNECTORS.**

Proceed through the diagnostic chart and its instructions. Complete the entire test sequence even though a tester lamp may not come on.



If the tester fails the system, refer to the appropriate lamp out TROUBLESHOOTING CHART for component and circuit diagnosis.

CRUISE CONTROL

TROUBLESHOOTING —Lamp No. 2 Off/ Cruise Switch and Speed Sensor

1. CRUISE SWITCH AND SPEED SENSOR: Ignition in RUN for voltage tests; ignition in OFF for resistance tests; cruise switch ON

TEST	OK	NOT OK
Measure voltage at C106 terminal B	Battery voltage	Replace cruise switch
Measure voltage at C105 terminal 5	Battery voltage	Repair open from cruise switch
Measure resistance from C105 terminal 2 to C177 terminal A	Zero ohms	Repair open between C105 and C177
Measure resistance from C105 terminal 3 to C177 terminal B	Zero ohms	Repair open between C105 and C177
Measure AC voltage from C177 terminals B to A with rear wheels spinning	AC voltage varies with changing wheel speed	Replace speed sensor

TROUBLESHOOTING —Lamp No. 3 Off/ Brake and Clutch Switch Circuits

1. BRAKE/CLUTCH CIRCUIT: Ignition in RUN

TEST	OK	NOT OK
Measure voltage at C105 terminal 7	Battery voltage	Repair open from ACCY fuse
Connect a jumper wire between C105 terminals 7 and 13	Brake lights ON	Repair open in brake/clutch switch circuits

TROUBLESHOOTING —Lamp No. 4 Off/ Accy Fuse and Throttle Position Feedback Sensor

1. ACCY FUSE/FEEDBACK SENSOR: Ignition in RUN; C105 separated from cruise control module

TEST	OK	NOT OK
Check ACCY fuse	Not blown	Replace fuse
Measure voltage at battery side of ACCY fuse	Battery voltage	Repair open from ignition switch
Measure resistance between C105 terminals 2 and 11 while moving throttle from idle to wide open	Ranges from approximately 250-4000 ohms	Check for opens in wiring between C113 and C105 If no opens, replace cruise control servo

TROUBLESHOOTING —Lamp No.'s 5 and 6 Off/Resume and Accelerate

1. VENT VALVE CIRCUIT: Ignition in RUN; cruise switch in R/A position; C113 separated from cruise control servo

TEST	OK	NOT OK
Measure voltage at C106 terminal C	Battery voltage	Replace cruise switch
Measure voltage at C105 terminal 10	Battery voltage	Repair open from cruise switch
Measure resistance across servo terminals C & E	30-50 ohms	Replace cruise control servo

2. CHARGE VALVE

TEST	OK	NOT OK
Measure resistance across servo terminals B and E	30-50 ohms	Replace cruise control servo

TROUBLESHOOTING —Engine Running Test

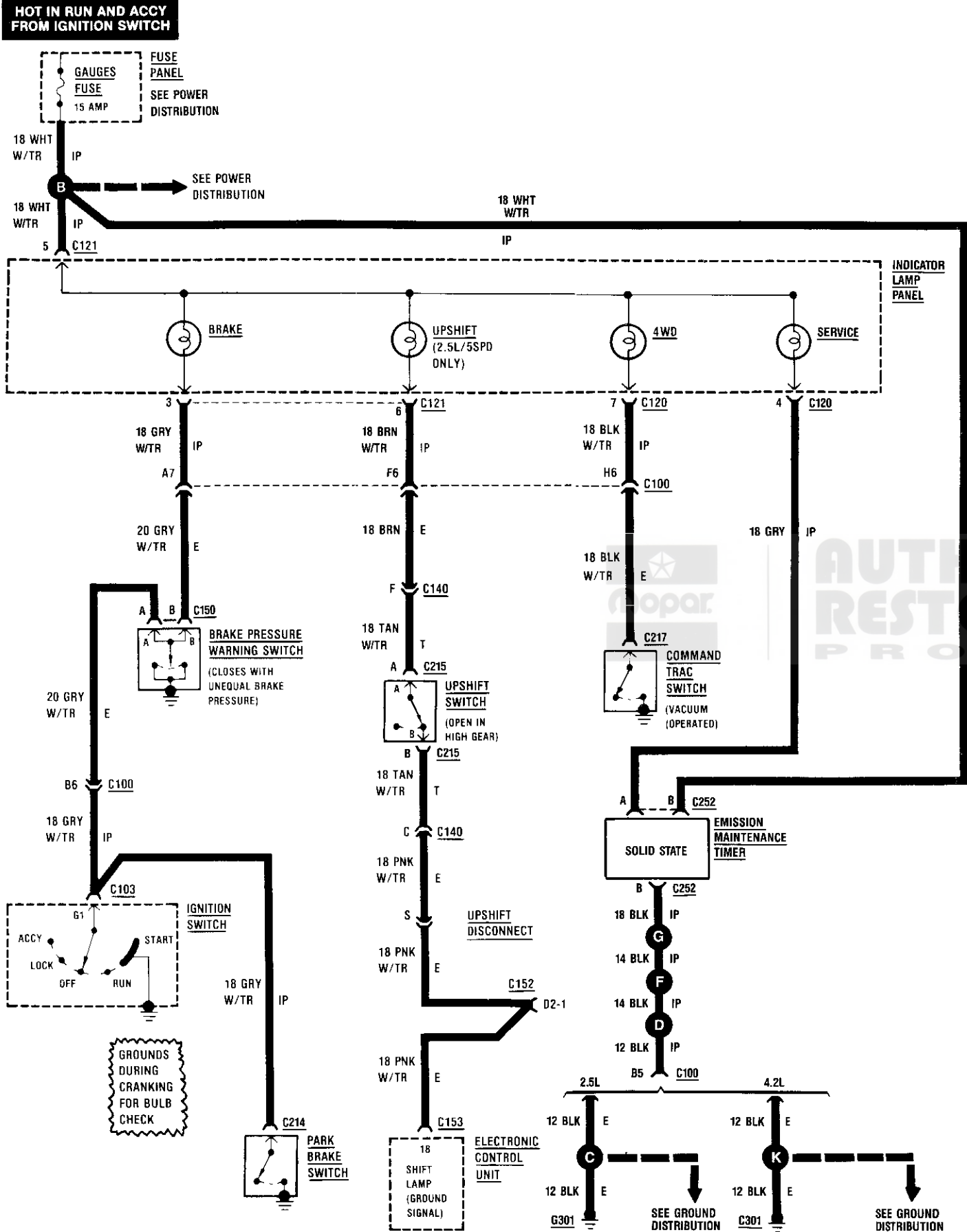
1. HOSE ROUTINGS AND SERVO CABLE

TEST	OK	NOT OK
Inspect the following: - Servo cable for breaks and hook-up. - Engine vacuum can and hose connections (small hose)	Proper connections	Repair as required

2. BRAKE VENT VALVE HOSE AND CONTROL SERVO

TEST	OK	NOT OK
Pinch brake vent hose (large hose) at servo and repeat test	Servo operates	Replace control servo If servo operates, inspect vent hose for kinks, cuts or other damage. Also, check brake vent valve adjustment

INDICATOR LAMPS



DESCRIPTION

The brake, upshift and 4WD lamps are located in the indicator lamp panel above the steering column. The lamps share a common battery feed connection through the ignition switch and gauges fuse. Switches in series with ground circuits complete the indicator lamp circuit.

The 4WD indicator lamp circuit is completed by the Command Trac switch located below the battery. When vacuum is applied to the axle mounted shift motor, it is also applied to the Command Trac switch.

The upshift switch is normally closed to complete the circuit from the lamp to the electronic control module. Since further shifts are no longer possible in fifth gear, the switch is opened to prevent operation of the lamp. With a completed circuit the indicator lamp will be illuminated by the ECU. The numerous inputs received by the ECU enable it to indicate through the lamp the best time to upshift to a higher gear. The upshift lamp is turned off after a time delay if the indicated shift is not performed.

The brake indicator is a dual function lamp. It will indicate an unequal pressure condition in the brake hydraulic system and it will also indicate when the parking brake is engaged. Separate switches are used for each indicator lamp function. A switch mounted on the brake pedal assembly will close a ground circuit whenever the parking brakes are applied. A second switch is installed in the brake hydraulic lines near the master cylinder. If the switch is balanced by equal pressure on both ends of the switch valve, the valve remains centered and the lamp remains off. If the valve is shifted by unequal pressure between the front or rear brake hydraulic systems, the lamp circuit is connected to ground. To make sure the brake lamp is functional before the vehicle is driven, it is illuminated through a ground circuit when the ignition switch is turned to the START position.

The emission maintenance timer is a solid state switching device that is used to inform the driver when the emission system requires service. After approximately 2700 engine operating hours, the solid state switch closes and provides a ground for the SERVICE lamp in the indicator lamp panel.

TROUBLESHOOTING —All Lamps Out

1. FUSE: Turn ignition switch to RUN

TEST	OK	NOT OK
Inspect GAUGES fuse	Not blown	Replace fuse
Measure voltage at battery side of fuse	Battery voltage	Repair open from ignition switch
Measure voltage at C121 terminal 5	Battery voltage	Repair open from fuse panel

TROUBLESHOOTING —One Lamp Out

1. BULB

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb

INDICATOR LAMPS

2. BULB SOCKET: Ignition in RUN

TEST	OK	NOT OK
Measure voltage at battery side of bulb socket	Battery voltage	Repair open from fuse panel
Measure voltage at ground side of bulb	Battery voltage	Replace/repair printed circuit

TROUBLESHOOTING—4WD Lamp Out

1. VACUUM SOURCE: Engine running; Command Trac switch in 4WD

TEST	OK	NOT OK
Check for vacuum supply to switch	Vacuum present	Repair as necessary. Refer to M.R. 279

2. COMMAND TRAC SWITCH: Engine running; Command Trac switch in 4WD; C217 separated from Command Trac switch

TEST	OK	NOT OK
Measure voltage at C217	Battery voltage	Repair open from printed circuit
Measure resistance from switch housing to ground	Zero ohms	Clean ground connection If zero ohms, replace switch

TROUBLESHOOTING —Upshift Lamp Out

1. UPSHIFT LAMP SWITCH CIRCUIT: Ignition in RUN

TEST	OK	NOT OK
Connect a jumper wire from diagnostic connector C152 terminal D2-1 to a clean chassis ground	Lamp ON	Lamp OFF; proceed to upshift lamp switch test Lamp ON; test ECU

2. UPSHIFT LAMP SWITCH: Ignition in RUN; transmission in 1st gear; jumper removed

TEST	OK	NOT OK
Measure voltage at C215 terminal A	Battery voltage	Repair open from printed circuit
Measure voltage at C215 terminal B	Battery voltage	Replace switch If battery voltage, repair open to ECU Terminal 18

TROUBLESHOOTING —Brake Lamp Out

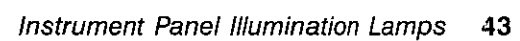
1. PARK BRAKE SWITCH: Ignition in RUN; parking brake applied; C214 separated from switch

TEST	OK	NOT OK
Connect a jumper between C214 and ground	Lamp ON	Lamp ON; replace switch Lamp OFF; repair open from ignition switch

2. BRAKE PRESSURE WARNING SWITCH: Ignition in RUN

TEST	OK	NOT OK
Measure voltage at C150 terminal B	Battery voltage	Repair open from printed circuit
Measure voltage at C150 terminal A	Battery voltage	Replace switch
Measure voltage at C103 terminal G1	Battery voltage	Repair open from brake pressure warning switch If battery voltage, replace ignition switch

**HOT AT ALL TIMES
FROM FUSE LINK J2.5L, A4.2L**



INSTRUMENT PANEL ILLUMINATION LAMPS

DESCRIPTION

The instrument panel illumination lamps share two common connections. Splice C connects the lamps to battery feed while splice D connects the lamps to ground. Because they share these common connection points in a parallel circuit, the illumination lamps will all come on at the same time. It also means one or more lamps can be out without affecting the operation of the other lamps.

On the battery side of the circuit, the headlamp switch, illumination rheostat/switch and panel lamps fuse receive bat-

tery feed in series from the park/tail fuse. In the park lamp position, the headlamp switch completes the circuit from the park/tail fuse to the illumination rheostat/switch and panel lamps fuse.

The illumination rheostat contains a variable resistor that allows the driver to vary illumination intensity from off to full brightness.

TROUBLESHOOTING —One Lamp Out

1. **BULB, BULB SOCKET:** Headlamp switch in HEAD for voltage tests; headlamp switch OFF for resistance tests; illumination rheostat/switch ON; C144 separated from indicator lamp panel

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure voltage at battery side of bulb terminal	Battery voltage	Replace printed circuit
Measure resistance from ground side of bulb terminal to indicator lamp panel terminal 3	Zero ohms	Replace printed circuit

TROUBLESHOOTING —Gauge Package Lamps Out

1. **BATTERY FEED, GROUND:** Headlamp switch in HEAD for voltage tests; headlamp switch OFF for resistance tests; illumination rheostat/switch ON

TEST	OK	NOT OK
Measure voltage at C144 terminal 10	Battery voltage	Repair open from fuse panel
Measure voltage at C144 terminal 12	Battery voltage	Repair open from fuse panel
Measure resistance from C144 terminal 3 to a clean chassis ground	Zero ohms	Repair open between C144 and G301

NOTE: If the battery feed and ground circuits are OK, replace the gauge package printed circuit.

TROUBLESHOOTING —All Lamps Out

1. **FUSE:** Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Inspect fuses	Not blown	Replace fuse
Measure voltage at battery side of panel lamps fuse	Battery voltage	Repair open from illumination rheostat/switch

2. **ILLUMINATION RHEOSTAT/SWITCH:** Headlamp switch ON; illumination rheostat/switch ON

TEST	OK	NOT OK
Check operation of taillamps	Taillamps ON	Test headlamp switch
Measure voltage at C157 terminal D	Battery voltage	Replace rheostat/switch

Lamps: Turn Signal/Stop/Hazard/Backup 45



TURN SIGNAL LAMPS

DESCRIPTION

Excluding the backup lamps, all components and lamps in this circuit are connected to the turn signal switch. On the battery side, the flashers and brake switch connect the turn signal switch to the turn/bu and hazard/stop fuses. The hazard and stop lamps are on a separate fuse and flasher circuit that is hot at all times. The continuous hot feed is necessary because these circuits must be functional without the ignition on.

The turn/hazard switch, which is mounted in the steering column behind the steering wheel, contains the contacts necessary for connecting various lamp combinations to battery feed. In the neutral position, the stop lamp contacts are aligned and the circuit will be completed whenever the brake switch is closed. In the left or right turn position, the appropriate exterior lamps and instrument panel indicator lamp

are connected to the turn signal flasher. While the switch is making the connection to the turn signal, it is also maintaining the circuit to the remaining stop and indicator lamp. In the hazard position, the turn signal lamps are connected to the hazard flasher.

The separate backup lamp circuit has a common connection with the turn signal circuit at the turn bu fuse. From the fuse, the battery feed circuit is connected to a transmission mounted switch. On a manual transmission equipped vehicle, the switch is a separate component. On automatic transmission equipped vehicles, the backup lamp switch is incorporated into the neutral safety switch. In either case, the switch is closed only when the transmission is shifted into reverse.

3. SWITCH: C104 separated from turn-hazard switch assembly; switch in left or right turn position as required

TEST	OK	NOT OK
Measure resistance between C104 terminals L and M for left turn	Zero ohms	Replace switch
Measure resistance between C104 terminals L and N for right turn	Zero ohms	Replace switch
Measure resistance between C104 terminals L and H for left turn	Zero ohms	Replace switch
Measure resistance between C104 terminals L and K for right turn	Zero ohms	Replace switch

TROUBLESHOOTING —Flasher Circuit

NOTE: Refer to parking and stop lamps for troubleshooting a one lamp out condition.

1. FUSE: Ignition in RUN

TEST	OK	NOT OK
Check operation of backup lamps	Lamps ON	Check TURN/BU fuse
Measure voltage at battery side of TURN/BU fuse	Battery voltage	Repair open from ignition switch

2. FLASHER: Ignition in RUN for voltage tests; ignition in OFF for resistance tests

TEST	OK	NOT OK
Measure resistance across C227 terminals A and B	Zero ohms (except element resistance)	Replace flasher
Measure voltage at C227 terminal A	Battery voltage	Repair open from fuse panel
Measure voltage at C104 terminal L	Battery voltage	Repair open from flasher

TROUBLESHOOTING —Turn Signal Indicator Lamps

1. TURN SIGNAL INDICATOR CIRCUIT: Ignition switch in RUN for voltage tests; ignition switch in OFF for resistance tests; switch in right or left turn position as required

TEST	OK	NOT OK
Measure voltage at C121 terminal 8 for left turn	Pulsing battery voltage	Repair open from turn-hazard switch
Measure voltage at C120 terminal 3 for right turn	Pulsing battery voltage	Repair open from turn-hazard switch
Measure resistance between C120 terminal 1 and a clean chassis ground	Zero ohms	Repair open between C120 and G301

STOP LAMPS

TROUBLESHOOTING —One Lamp Out

1. BULB: Brake pedal pressed

TEST	OK	NOT OK
Measure voltage at battery side of bulb socket	Battery voltage	Repair open from turn signal switch
Measure voltage at ground side of bulb socket	Zero volts	Clean ground connection If zero volts, replace bulb

TROUBLESHOOTING —Both Lamps Out

1. FUSE

TEST	OK	NOT OK
Check operation of hazard/stop lamps	Hazard lamps on	Check fuse
Measure voltage at battery side of hazard/stop fuse	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L

2. BRAKE SWITCH: Brake pedal pressed

TEST	OK	NOT OK
Measure voltage at C171 terminal A	Battery voltage	Repair open from HAZARD/STOP fuse
Measure voltage at C171 terminal B	Battery voltage	Replace brake switch

3. TURN SIGNAL SWITCH

TEST	OK	NOT OK
Measure resistance from C104 terminal P to terminals M and N	Zero ohms	Replace turn-hazard switch

HAZARD LAMPS

TROUBLESHOOTING —One Lamp Out

NOTE: Refer to park lamps or stop lamps for a one lamp out condition.

1. FUSE

TEST	OK	NOT OK
Check operation of stop lamps	Lamps on	Check HAZARD/STOP fuse
Measure voltage at battery side of hazard/stop fuse	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L

2. FLASHER CIRCUIT: Flasher removed

TEST	OK	NOT OK
Measure voltage at C228 terminal A	Battery voltage	Repair open from fuse panel
Measure resistance across flasher terminals	Zero ohms (except element resistance)	Replace flasher

3. TURN-HAZARD SWITCH ASSEMBLY: Hazard switch ON; C104 separated from turn-hazard switch

TEST	OK	NOT OK
Measure voltage at C104 terminal K	Battery voltage	Repair open from fuse panel
Measure resistance from turn-hazard switch terminal K to switch terminals H, J, M, and N	Zero ohms	Replace turn-hazard switch

BACKUP LAMPS

TROUBLESHOOTING — One Lamp Out

- LAMP:** Transmission in REVERSE; C137 or C137A separated from back up light; ignition switch in RUN

TEST	OK	NOT OK
Measure voltage at C137/C137A	Battery voltage	Repair open from splice B
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure resistance from socket to a clean chassis ground	Zero ohms	Clean or replace socket

TROUBLESHOOTING — All Lamps Out

- BACK UP LIGHT SWITCH (Manual Transmission):** Ignition switch in RUN; transmission in REVERSE

TEST	OK	NOT OK
Measure voltage at C225 terminal A	Battery voltage	Repair open from fuse panel
Measure voltage at C225 terminal B	Battery voltage	Replace back up light switch

- BACK UP/NEUTRAL SAFETY SWITCH (Automatic Transmission):** Ignition switch in RUN; transmission in REVERSE

TEST	OK	NOT OK
Measure voltage at C226 terminal A	Battery voltage	Repair open from fuse panel
Measure voltage at C226 terminal B	Battery voltage	Replace back up/neutral safety switch

Lamps: Head/Tail/Sidemarker/Fog/Park 49



DESCRIPTION

Battery feed for this circuit originates at the lighting fuse link located at the starter relay/solenoid. Once inside the passenger compartment, the wire is spliced to feed the PARK/TAIL fuse, headlamp switch and fog lamp relay. Circuit protection is provided by the fuse link, PARK/TAIL fuse and a 25 amp circuit breaker located in the headlamp switch.

From the headlamp switch, the circuits branch into the tail/sidemarkers/park lamp circuits and the headlamp circuit. Before reaching the headlamps, battery feed is routed to the dimmer switch, where it branches into the head/indicator/fog lamp circuits.

The dimmer switch transfers battery feed from the headlamp low beam filament to the high beam filament. It also serves as a fog lamp lock-out circuit. The circuit to the fog lamp switch is completed only when the dimmer switch is in the low beam position.

In the ON position, the fog lamp switch completes the relay coil battery feed circuit. With the coil energized, the relay contacts close connecting the fog lamps to battery feed through splice A and the lighting fuse link.

TAIL / SIDEMARKER / PARK LAMPS

TROUBLESHOOTING—One Lamp Out

1. LAMP: Headlamp switch in HEAD; lamp connector separated

TEST	OK	NOT OK
Measure voltage at battery side of lamp connector	Battery voltage	Repair open from splice B
Measure resistance from socket to a clean chassis ground	Zero ohms	Repair open between socket and G305

2. FUSE: Battery feed from splice A

TEST	OK	NOT OK
Inspect PARK/TAIL fuse	Not blown	Replace fuse
Measure voltage at battery side of fuse	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L

3. HEADLAMP SWITCH: Headlamp switch in HEAD

TEST	OK	NOT OK
Measure voltage at C156 terminal E	Battery voltage	Repair open from fuse panel
Measure voltage at C156 terminal A	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L If battery voltage, replace switch

FOG LAMPS

TROUBLESHOOTING—One Lamp Out

1. LAMP: Headlamp switch in HEAD; dimmer switch in LO; fog lamp switch ON; lamp connector separated

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure voltage at battery side of lamp connector	Battery voltage	Repair open to battery side of wiring connector
Measure resistance from ground side of lamp connector to clean chassis ground	Zero ohms	Repair open to G305/306

TROUBLESHOOTING—Both Lamps Out

1. SWITCH/INDICATOR LAMP: Headlamp switch in HEAD; dimmer switch in LO; fog lamp switch ON (Headlamps operating)

TEST	OK	NOT OK
Measure voltage at C116 terminal B	Battery voltage	Repair open from dimmer switch
Measure voltage at C116 terminal C	Battery voltage	Replace switch
Measure voltage at C116 terminal A	Zero volts	Zero volts and indicator lamp off—replace switch Battery voltage—repair open to ground G305/306

3. RELAY

TEST	OK	NOT OK
Measure voltage at C152 terminal 30	Battery voltage	Repair open in wire from Splice A (Fuselink J/2.5L, A/4.2L)
Measure voltage at C152 terminal 86	Battery voltage	Repair open from fog lamp switch
Measure voltage at C152 terminal 85	Zero volts	Repair open to G305/306
Measure voltage at C152 terminal 87	Battery voltage	Replace relay

HEADLAMPS

1. HEADLAMP SWITCH: Headlamp switch in HEAD

TEST	OK	NOT OK
Measure voltage at C156 terminal C	Battery voltage	Repair open from fuse link J-2.5L/A-4.2L
Measure voltage at C156 terminal D	Battery voltage	Replace headlamp switch

2. DIMMER SWITCH: Headlamp switch in HEAD; dimmer switch in HI or LO as required

OK	NOT OK TEST	
Measure voltage at C159 terminal 1	Battery voltage	Repair open from headlamp switch
Measure voltage at C159 terminal 3 - dimmer switch in LO	Battery voltage	Replace dimmer switch
Measure voltage at C159 terminal 2 - dimmer switch in HI	Battery voltage	Replace dimmer switch

3. HEADLAMPS: Headlamp switch in HEAD; dimmer switch in HI or LO as required; C139/C139A separated from headlamps

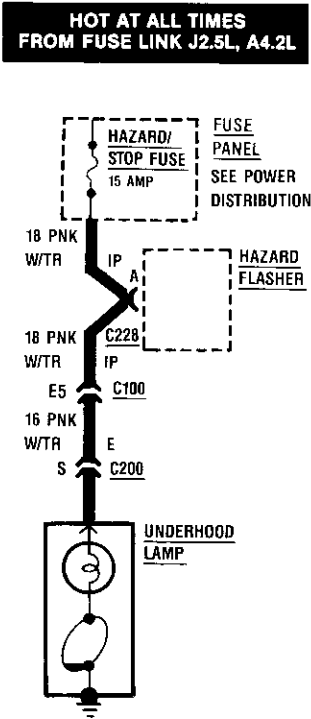
TEST	OK	NOT OK
Measure voltage at C139/C139A terminal B - dimmer switch in LO	Battery voltage	Repair open from dimmer switch
Measure voltage at C139/C139A terminal C - dimmer switch in HI	Battery voltage	Repair open from dimmer switch
Measure resistance from C139/C139A terminal A to a clean chassis ground	Zero ohms	Repair open between C139/C139A and G305

UNDERHOOD LAMP

DESCRIPTION

The underhood lamp circuit begins at the hazard flasher battery terminal and extends into the engine compartment through the dash panel connector. At approximately the center of the dash panel, the wire extends from the wiring harness and joins the lamp connector.

The metallic lamp body serves as the ground connection and contains a mercury switch. When the hood is up, the mercury flows to the back of the lamp housing where it connects the battery supply terminal to the bulb filament.



TROUBLESHOOTING

1. FUSE

TEST	OK	NOT OK
Check operation of hazard lamps	Hazard lamps on	Check HAZARD/STOP fuse

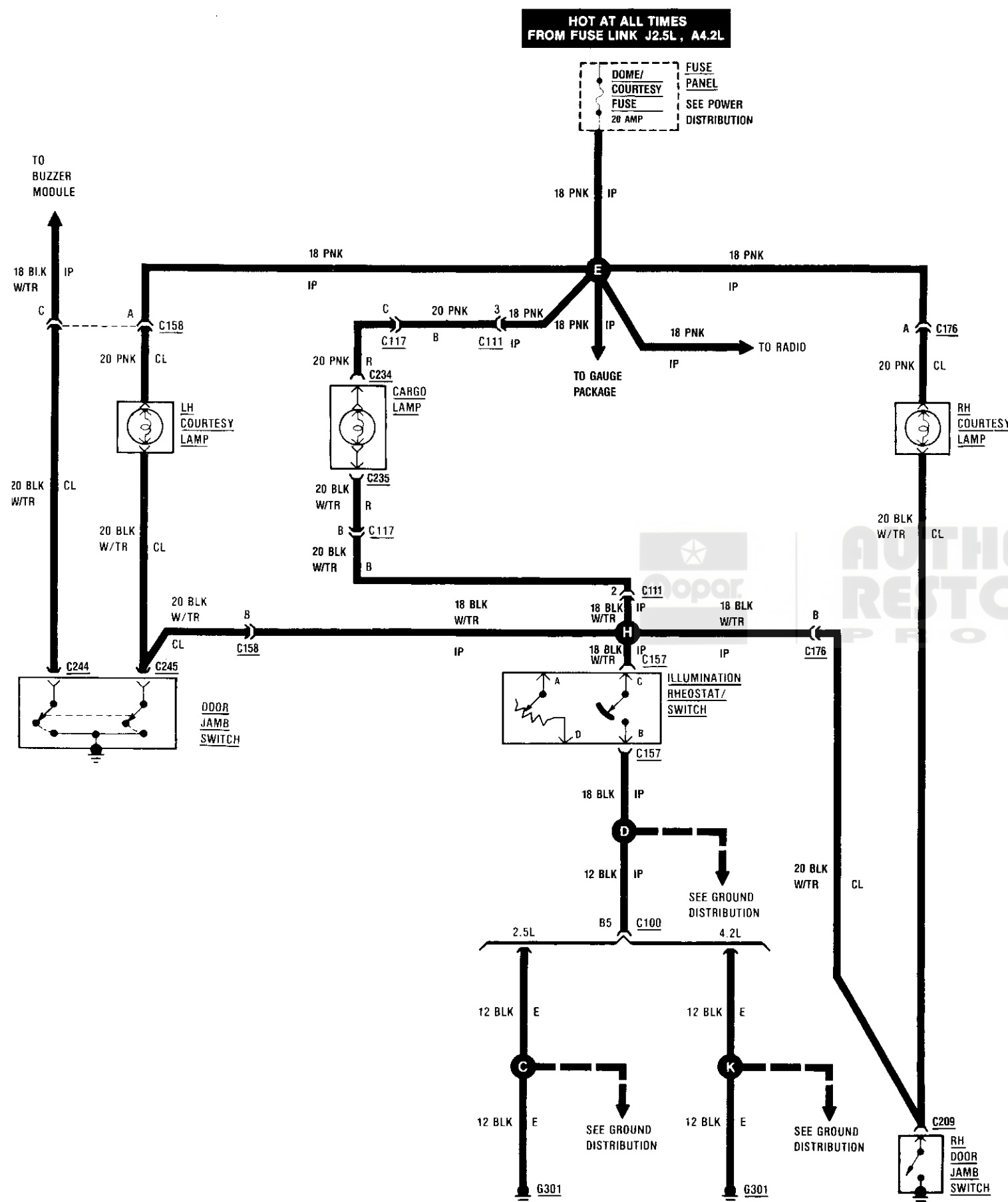
2. LAMP

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb If bulb is good, replace underhood lamp housing

3. BATTERY FEED

TEST	OK	NOT OK
Measure voltage at C200	Battery voltage	Repair open from hazard flasher

LAMPS: CARGO / COURTESY



DESCRIPTION

The cargo/courtesy lamps are a switched ground circuit. Power feed from the dome/courtesy fuse goes directly to the lamps without passing through an ON/OFF switch. The switches are on the ground side of the circuit. When either door is opened, the door jamb switch closes and completes a path to ground.

The cargo and courtesy lamps can also be turned on at the illumination rheostat/switch.

The switch detent at the end of the maximum brightness setting also completes a path to ground for the cargo and courtesy lamps.

TROUBLESHOOTING —One Lamp Out

1. LAMP: Lamp connector separated (C158, C234, or C176)

TEST	OK	NOT OK
Measure resistance across bulb terminals	Zero ohms (except filament resistance)	Replace bulb
Measure voltage at battery side of lamp connector	Battery voltage	Repair open from splice E
Measure resistance from ground side of bulb terminal to a clean chassis ground	Zero ohms	Repair open from bulb socket to C209 If no opens present, replace door jamb switch

TROUBLESHOOTING — All Lamps Out

1. FUSE

TEST	OK	NOT OK
Inspect DOME/COURTESY fuse	Not blown	Replace fuse
Measure voltage at battery side of DOME/COURTESY fuse	Battery voltage	Repair open from fuse link J/2.5L, A/4.2L

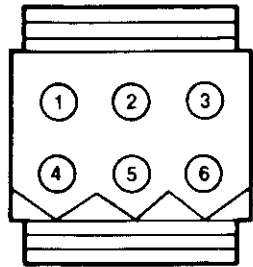
2. ILLUMINATION RHEOSTAT/SWITCH: Switch rotated to ON position; C157 separated from switch

TEST	OK	NOT OK
Measure resistance from illumination rheostat/switch terminals C to B	Zero ohms	Replace illumination rheostat/switch
Measure resistance from C157 terminal B to a clean chassis ground	Zero ohms	Repair open from C157 to G301

COMPONENT LOCATION LIST

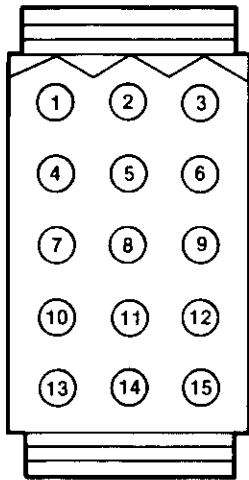
A/C CONTROL SWITCH	Below and to right of steering column	GROUND 304	Dipstick mounting bolt
A/C PRESSURE SWITCH	Top of receiver/drier located in right front corner of engine compartment	GROUND 305	Radiator support to right of right headlamp
AIR MANAGEMENT SOLENOID ASSEMBLY	Top of valve cover near dash panel	GROUND 306	Radiator support to left of left headlamp
AIR TEMPERATURE SENSOR	Rear of intake manifold	HAZARD LAMP SWITCH	Steering column below lock cylinder
ALTERNATOR	Right front of engine	HEADLAMP DIMMER SWITCH	Turn signal lever stalk
AUTOMATIC TRANSMISSION JUMPER	Right rear corner of engine compartment behind diagnostic connectors	HEADLAMP SWITCH	Below and to left of steering column
B + LATCH RELAY	Right of battery	HEATER BLOWER MOTOR	Below battery
BACK-UP LAMP SWITCH	Right side of transmission case (4 spd.) Left side of transmission case (automatic and 5 spd.) NOTE: With automatic transmission, back-up lamp switch and neutral safety switch are in same housing.	HORN	Left fender apron
BATTERY	Right rear corner of engine compartment	HORN RELAY	Above and to left of fuse panel
BLOWER RESISTOR	Behind right speaker grille above air vent door on blower housing	IDLE SOLENOID	Left side of carburetor
BLOWER SWITCH (A/C)	Below and to right of steering column	IDLE SPEED CONTROL MOTOR	Front of throttle body on right side
BLOWER SWITCH (HEATER)	Left side of heater control panel	IDLE SPEED-UP RELAY	Right of battery
BRAKE LAMP SWITCH	Above brake pedal	IGNITION CONTROL MODULE	Left of battery on dash panel
BRAKE PRESSURE SWITCH	Brake line junction block below master cylinder	IGNITION KEY WARNING SWITCH	In steering column behind lock cylinder
CIGAR LIGHTER	Below heater control panel (less A/C) Below steering column (with A/C)	IGNITION MODULE	Below windshield washer reservoir
COIL	Left of battery on dash panel (4 cyl) Center of cylinder block on right side of engine (6 cyl)	IGNITION SWITCH	Steering column behind instrument panel
COOLANT TEMPERATURE SENDER	Left rear corner of cylinder head	ILLUMINATION RHEOSTAT/SWITCH	Below and to left of steering column
COOLANT TEMPERATURE SENSOR	Rear of intake manifold	KNOCK SENSOR	Intake manifold in front of carburetor
COURTESY LAMPS	Lower edge of IP near doors	MANIFOLD HEATER	Under carburetor
CRUISE CONTROL ON SWITCH	Turn signal lever stalk	MANIFOLD HEATER RELAY	Right of battery
CRUISE CONTROL CLUTCH SWITCH	Above clutch pedal	MANIFOLD HEATER SWITCH	Intake manifold behind carburetor throttle linkage
CRUISE CONTROL IN-LINE FUSE	Taped to cruise control harness near fuse panel	MAP SENSOR	Behind valve cover on dash panel
CRUISE CONTROL MODULE	Below fuse panel	MICROPROCESSOR CONTROL UNIT (MCU)	Under instrument panel to left of blower housing
CRUISE CONTROL SERVO	Left fender apron	NEUTRAL SAFETY SWITCH	Left side of transmission case NOTE: Neutral safety switch and back-up lamp switch are in same housing.
CRUISE CONTROL SPEED SENSOR	Left lower corner of engine compartment	OIL PRESSURE SENDER	Behind alternator (4 cyl) Right rear corner of cylinder block (6 cyl)
CRUISE CONTROL VACUUM RELEASE VALVE	Above brake pedal	OIL PRESSURE SWITCH	Right side of cylinder block near starter motor
DIAGNOSTIC CONNECTORS	Right of battery	OXYGEN SENSOR	Behind left engine mount (4 cyl) Below EGR valve (6 cyl)
DIODE/FUSE ASSEMBLY	Right rear corner of engine compartment behind diagnostic connectors	PCV SOLENOID	Between carburetor and valve cover
DISTRIBUTOR	Center of cylinder block on right side of engine	PARK BRAKE INDICATOR LAMP SWITCH	Rear of park brake pedal assembly
EGR/EVAPORATOR CANISTER SOLENOID	Left of battery	POWER STEERING SWITCH	Right of power steering pump
ELECTRIC CHOKE HEATER	Right side of carburetor	RADIO ILLUMINATION RELAY	Below instrument panel left of steering column
ELECTRONIC CONTROL UNIT (ECU)	Under instrument panel to left of blower housing	RADIO IN-LINE FUSE	Back of radio chassis
EMISSION MAINTENANCE TIMER	Under instrument panel left of radio	REAR DEFOGGER RELAY	Behind park brake pedal assembly
ENGINE SPEED SENSOR	Left side of transmission bellhousing	REAR DEFOGGER SWITCH	To right of steering column
FOG LAMP RELAY	Behind left headlamp	STARTER MOTOR	Right lower corner of engine
FOG LAMP SWITCH	Below and to right of steering column	STARTER RELAY/SOLENOID	Below and to left of battery
4WD INDICATOR LAMP SWITCH	Right side of front axle in vacuum servo	STEPPER MOTOR	Rear of carburetor
4WD VACUUM SWITCH	Left of battery on dash panel	THERMO ELECTRIC SWITCH	Right side of air cleaner housing
FUEL INJECTOR	In throttle body	THROTTLE POSITION SENSOR	Rear of throttle body near bottom
FUEL PUMP	In fuel tank	UP-SHIFT DISCONNECT	Right rear corner of engine compartment behind diagnostic connectors
FUEL PUMP RELAY	Right side of battery	UP-SHIFT SWITCH	Right side of transmission case
FUSE PANEL	Left corner under instrument panel	VACUUM SWITCH ASSEMBLY	Behind valve cover on dash panel
GROUND 301	Dipstick mounting bolt (4 cyl) Behind ignition coil (6 cyl)	WIDE OPEN THROTTLE SWITCH	Front of throttle body on right side (4 cyl) Right side of carburetor near bottom (6 cyl)
GROUND 302	Behind ignition coil	WINDSHIELD WASHER MOTOR	Bottom of washer reservoir located in left rear corner of engine compartment
GROUND 303	Dipstick mounting bolt	WINDSHIELD WIPER DELAY MODULE	Lower left side of instrument panel
		WINDSHIELD WIPER MOTOR	Lower left corner of windshield housing
		WINDSHIELD WIPER SWITCH	Turn signal lever stalk

DIAGNOSTIC CONNECTORS—2.5L



D1

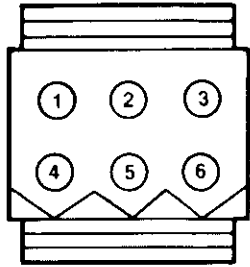
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2	Ignition
3	Ground
4	Start Signal
5	Battery
6	Fuel Pump Relay



D2

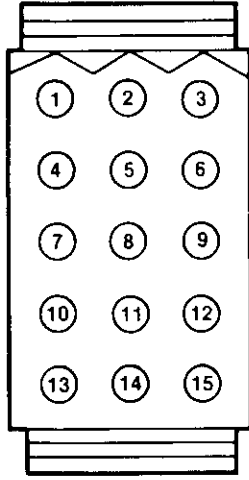
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2	Latch Relay
3	P/N Switch
4	B+ Latch
5	Not Used
6	WOT Switch
7	Not Used
8	Air Temperature Sensor
9	Ignition Interface
10	EVAP/EGR
11	ISC Extend
12	Coolant Temperature Sensor
13	Closed Throttle Switch
14	ISC Retract
15	Not Used

DIAGNOSTIC CONNECTORS—4.2L



D1

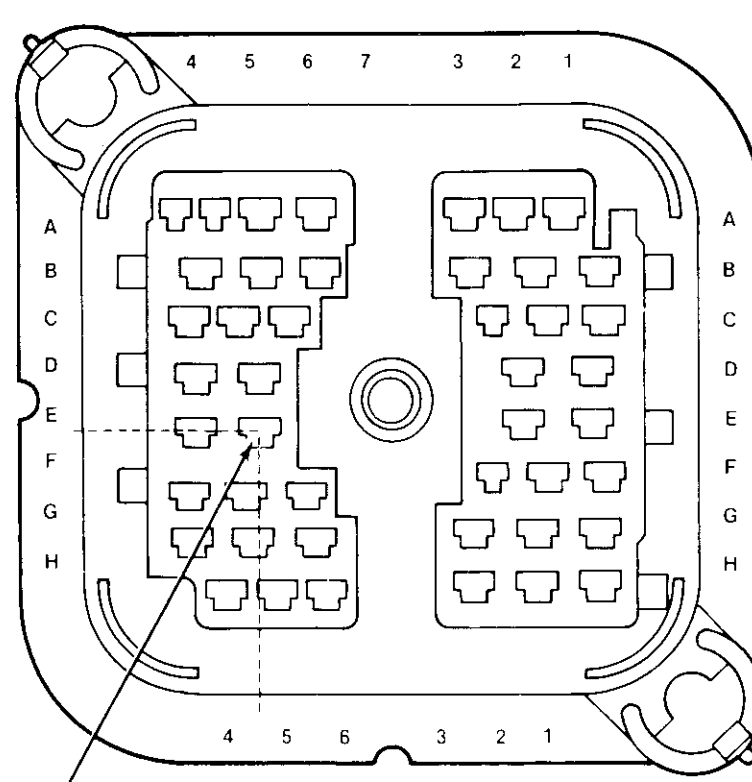
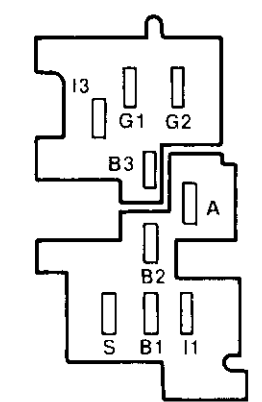
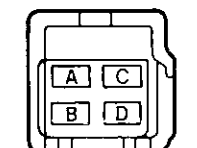
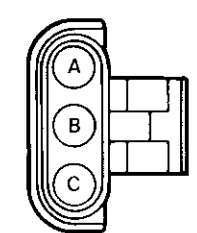
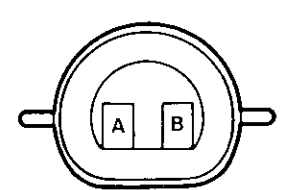
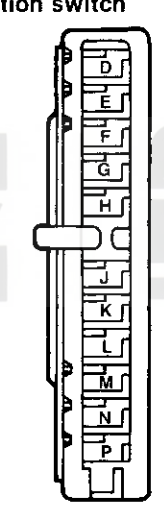
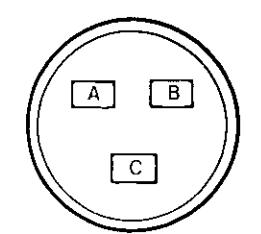
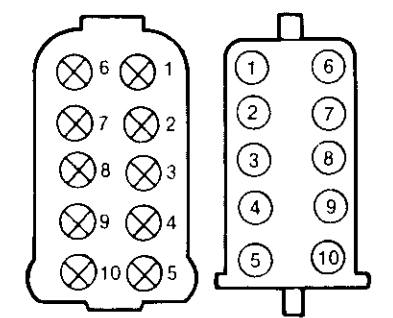
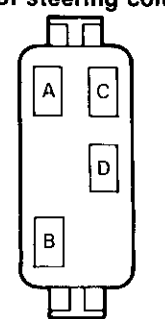
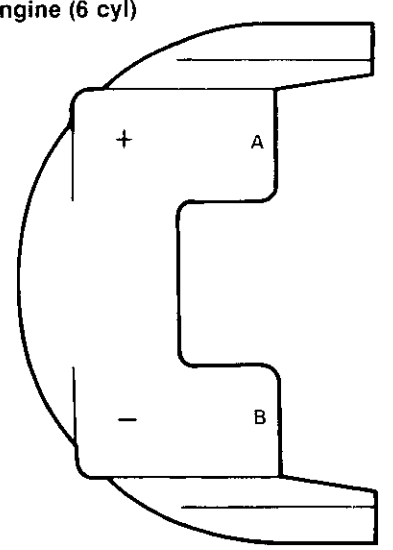
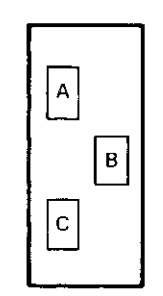
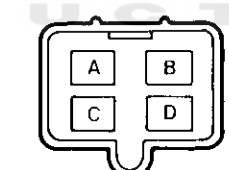
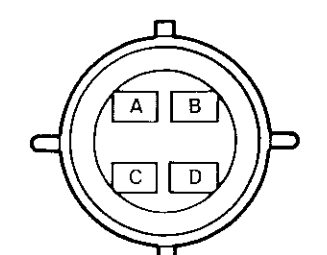
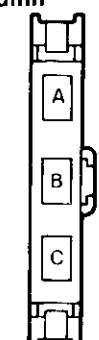
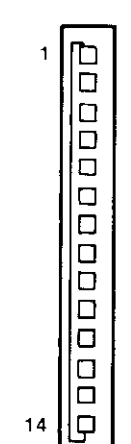
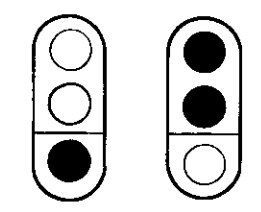
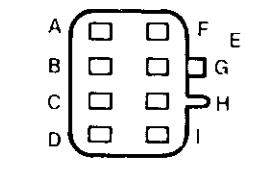
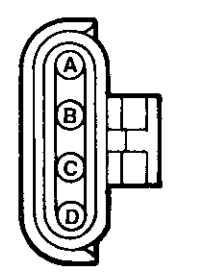
Terminal	Function
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2	Elec. Choke Switch
3	Ground
4	Start Signal
5	Idle Solenoid
6	Not Used



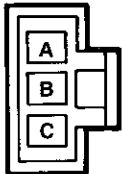
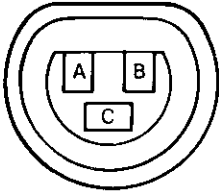
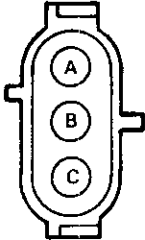
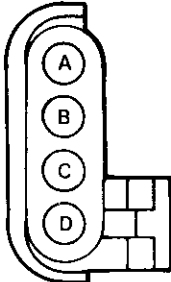
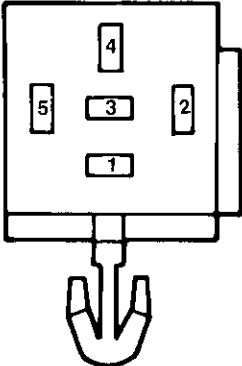
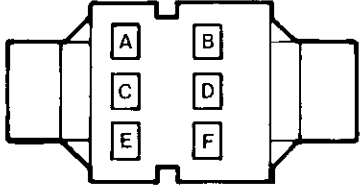
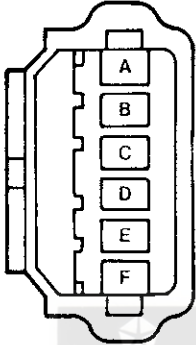
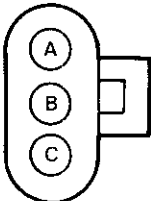
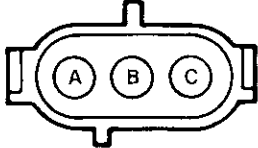
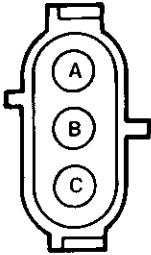
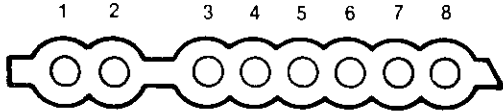
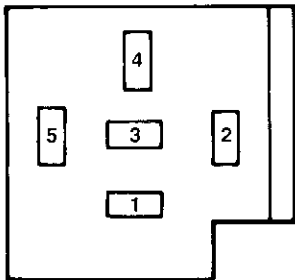
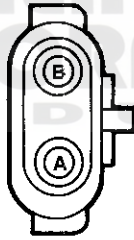
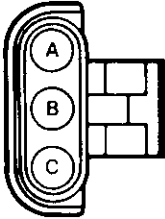
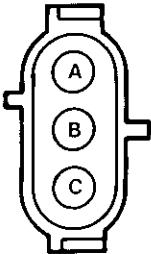
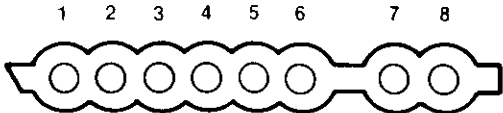
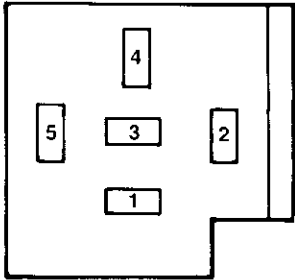
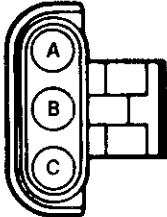
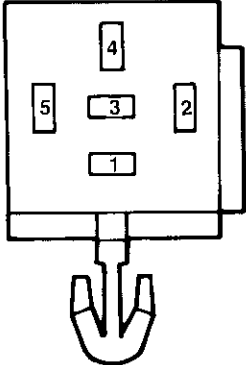
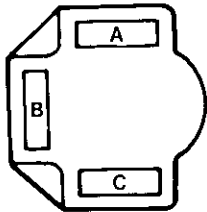
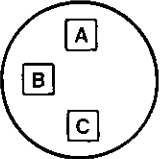
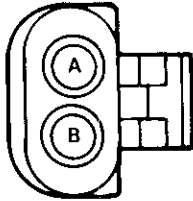
D2

Terminal	Function
1	PCV Switch
2	Idle Vacuum Solenoid
3	O ₂ Sensor
4	Ignition
5	Down Stream Solenoid
6	WOT Switch
7	Ground
8	Up Stream Solenoid
9	Vacuum Switch
10	Thermo-Electric Switch
11	Stepper Motor
12	Coolant Temperature Switch
13	Idle Relay
14	Stepper Motor
15	Vacuum Switch

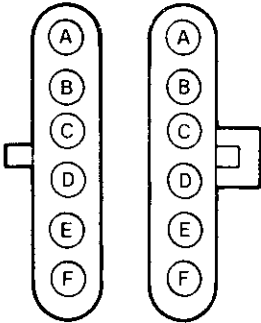
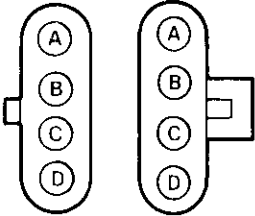
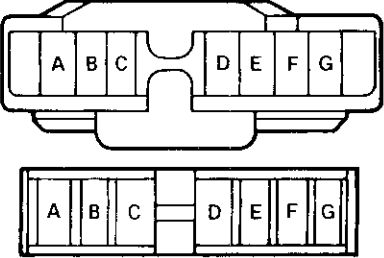
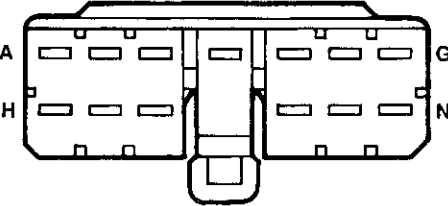
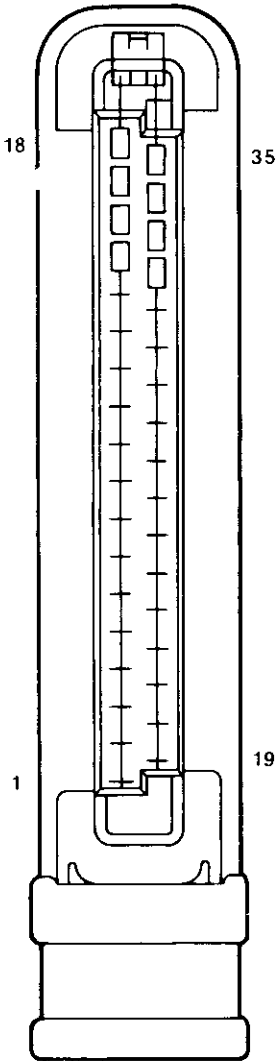
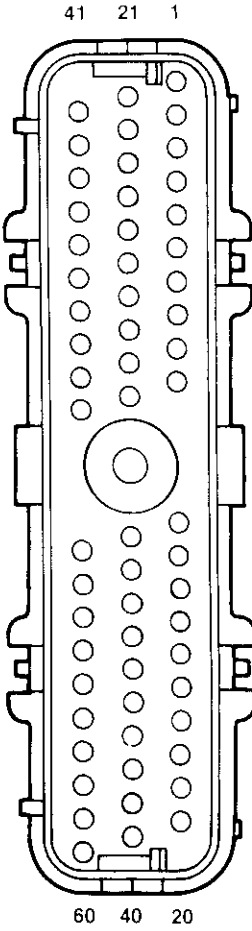
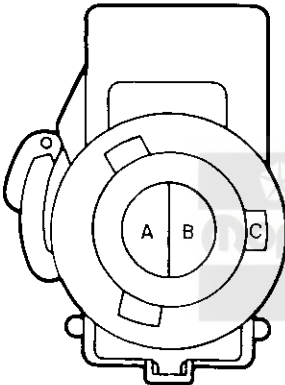
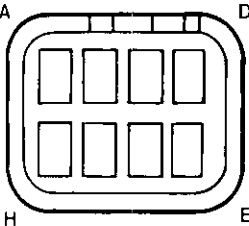
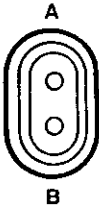
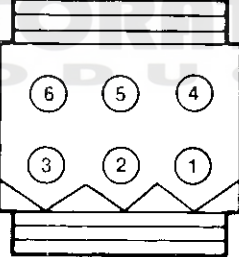
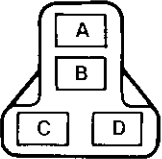
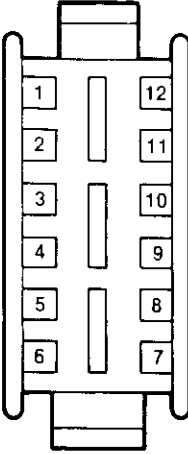
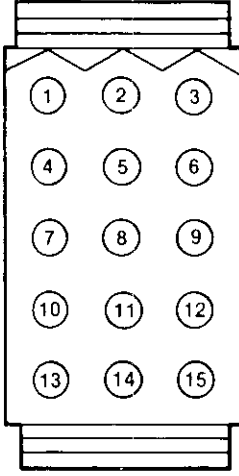
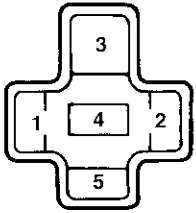
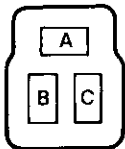
COMPONENT CONNECTOR VIEWS

C100: Dash panel 	C103: Ignition switch Steering column behind instrument panel 	C106: Cruise control multifunction lever Turn signal lever 	C110: Vacuum switches Behind valve cover on dash panel 	C114: Ignition module—4.2L Below windshield washer reservoir 
	C104: Turn signal switch Below ignition switch 	C107: A/C pressure switch Top of receiver/dryer located in right front corner of engine compartment 	C111: Body harness Above parking brake 	C115: Defogger switch To right of steering column 
C101: Coil Left of battery on dash panel (4 cyl) Center of cylinder block on rt. side of engine (6 cyl) 	C102: Horn relay Above and to left of fuse panel 	C108: Air management solenoid assembly Top of valve cover near dash panel 	C112: Ignition module—4.2L Below windshield washer reservoir 	C116: Foglamps switch Below and to the right of steering column 
	C105: Cruise control module Below fuse panel 	C109: A/C blower motor Plugs on fuse panel 	C113: Cruise control servo Left fender apron 	C117: Roof harness Above left rear tail lamp 

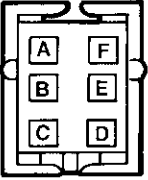
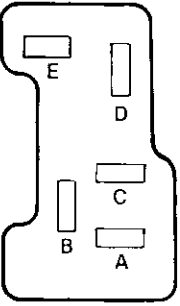
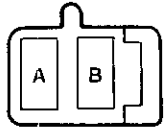
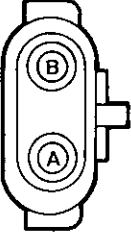
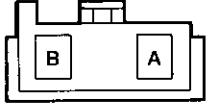
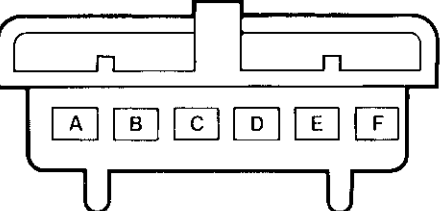
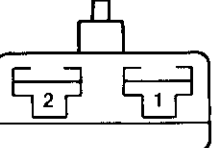
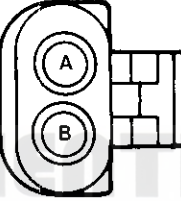
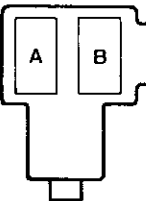
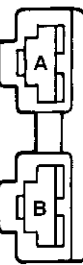
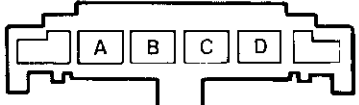
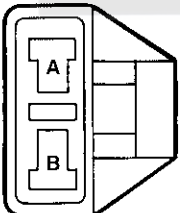
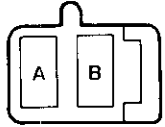
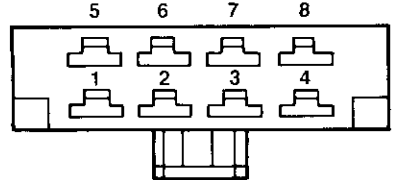
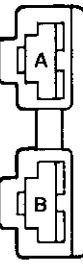
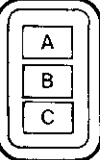
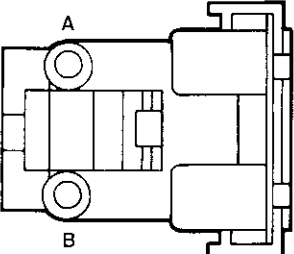
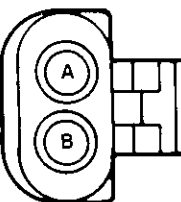
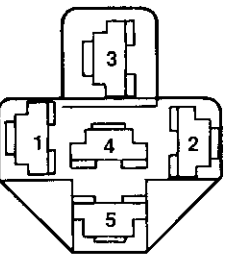
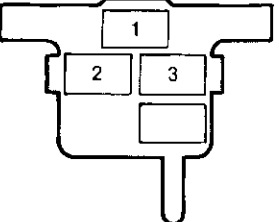
COMPONENT CONNECTOR VIEWS

C118: Body harness Upper LH shroud 	C123: Distributor Center of cylinder block on rt. side of engine 	C127: Oxygen sensor Behind left engine mount (4 cyl) Below EGR valve (6 cyl) 	C132: Idle speed actuator Front of throttle body on right side 	C136: B + latch relay Rt. of battery 
C119: Stepper motor—2.5L Rear of carburetor 	C124: Diode/fuse assembly Rear corner of engine compartment behind diagnostic connectors 	C128: Throttle position sensor Rear of throttle body near bottom 	C133: Speed sensor Left side of transmission bellhousing 	C137: Taillamp Below tail lamp assembly 
C120: Indicator lamps Left side of heater control 	C125: Idle relay Rt. of battery 	C129: Wide-open throttle switch Left of throttle body 	C134: Map sensor Behind valve cover on dash panel 	C138: Fuel sender Lt. of fuel tank 
C121: Indicator lamps Beside rheostat switch 	C126: Manifold heater relay Rt. of battery 	C130: Ignition module—2.5L Below windshield washer reservoir on dash panel 	C135: Fuel pump relay Rt. side of battery 	C139: Headlamp Behind headlamp 
C122: Electric choke switch Lower rt. side of engine block 	C131: Ignition module—2.5L Left of battery on dash panel 			

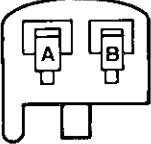
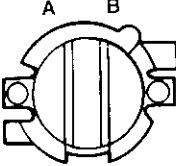
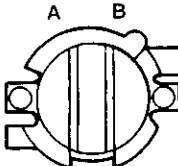
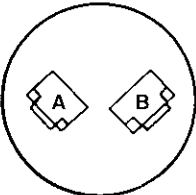
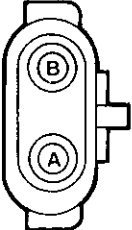
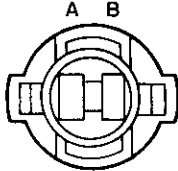
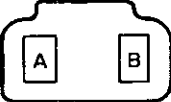
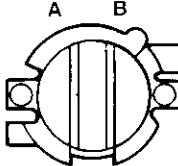
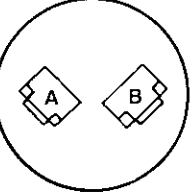
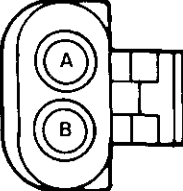
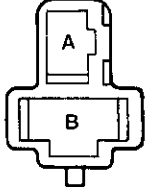
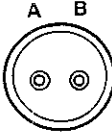
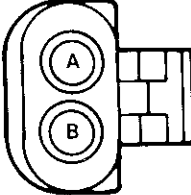
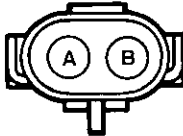
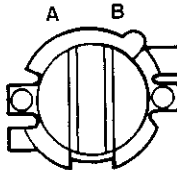
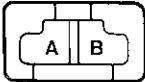
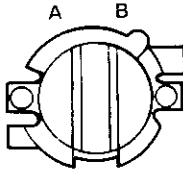
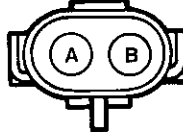
COMPONENT CONNECTOR VIEWS

C140: Transmission harness Rt. side of bell housing 	C142: Idle disconnect Beside starter relay 	C145 A/B: Wiper switch Turn signal lever stalk 	C149: Radio Behind radio 	C153: 2.5L Electronic control unit (ECU) Under instrument panel to left of blower housing 
C141: 4.2L Microprocessor control unit (MCU) Under instrument panel to left of blower housing 	C143: Park/turn lamp Below headlamps 	C146: Wiper motor Lower left corner of windshield housing 	C150: Brake pressure switch At master cylinder 	
		C147: Diagnostic connector D1 Right of battery 	C151: Blower switch Left of heater controls 	
	C144: Gauge package Behind gauge package 	C148: Diagnostic connector D2 Right of battery 	C152: Fog lamp relay Behind left headlamp 	C154: Blower resistor Behind right speaker grille above air vent door on blower housing 

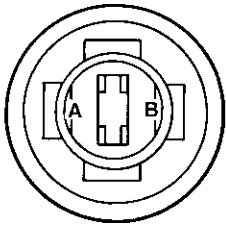
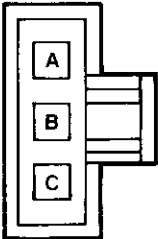
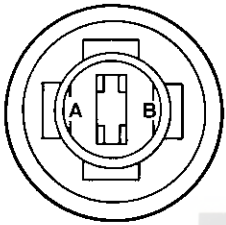
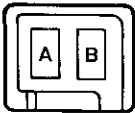
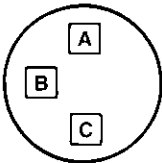
COMPONENT CONNECTOR VIEWS

C155: Tachometer Behind tach 	C160: Defogger relay Lower LH shroud 	C164: Transmission jumper Near transmission (automatic) 	C168: Wide open throttle switch On throttle body 	C173: Speedometer Behind speedometer 
C156: Headlamp switch Below and to the left of steering column 	C161: alternator RH front of engine 	C165: Engine coolant temperature sensor - 2.5L LH rear of engine 	C169: PCV solenoid On front of engine 	C174: Brake switch On brake pedal lever 
C157: Illumination rheostat Behind rheostat 	C162: EGR evaporator canister solenoid Lower front of LH shock tower 	C166: High altitude jumper Near microprocessor control unit (MCU) 	C171: Buzzer module Bottom of fuse block 	C175: Brake switch On brake pedal lever 
C158: LH courtesy lamp harness Below left speaker 	C163: Fuel injector Upper rear of engine 	C167: Thermo-Electric switch On air cleaner housing 	C172: Radio illumination relay Behind instrument panel 	C176: RH courtesy lamp harness Behind courtesy lamp 
C159: Headlamp dimmer switch Turn signal lever stalk 				

COMPONENT CONNECTOR VIEWS

C177: Speed sensor Above accelerator pedal 	C181: Fog lamp switch lamp At fog lamp switch 	C208: Right speaker Bottom of speaker 	C222: Tachometer illumination Behind tachometer 	C227: Turn flasher Above fuse block 
C178: Engine coolant temperature switch - 4.2L LH rear of engine 	C182: Heater control panel lamp Behind heater control panel 	C212: Cruise control inline fuse Near multi-function lever 	C224: Radio lamp Behind radio face 	C228: Hazard flasher Above fuse block 
C179: Air temperature sensor Top of intake manifold 	C206: Windshield washer pump On washer fluid reservoir 	C215: Upshift switch On transmission (manual) 	C225: Back up lamp switch On transmission (manual) 	C229: LH fog lamp Below fog lamp 
C180: Defogger switch lamp At defogger switch 	C207: Left speaker Bottom of speaker 	C221: Tachometer illumination Behind tachometer 	C226: Back up/neutral safety switch On transmission (automatic) 	C230: RH fog lamp Below fog lamp 

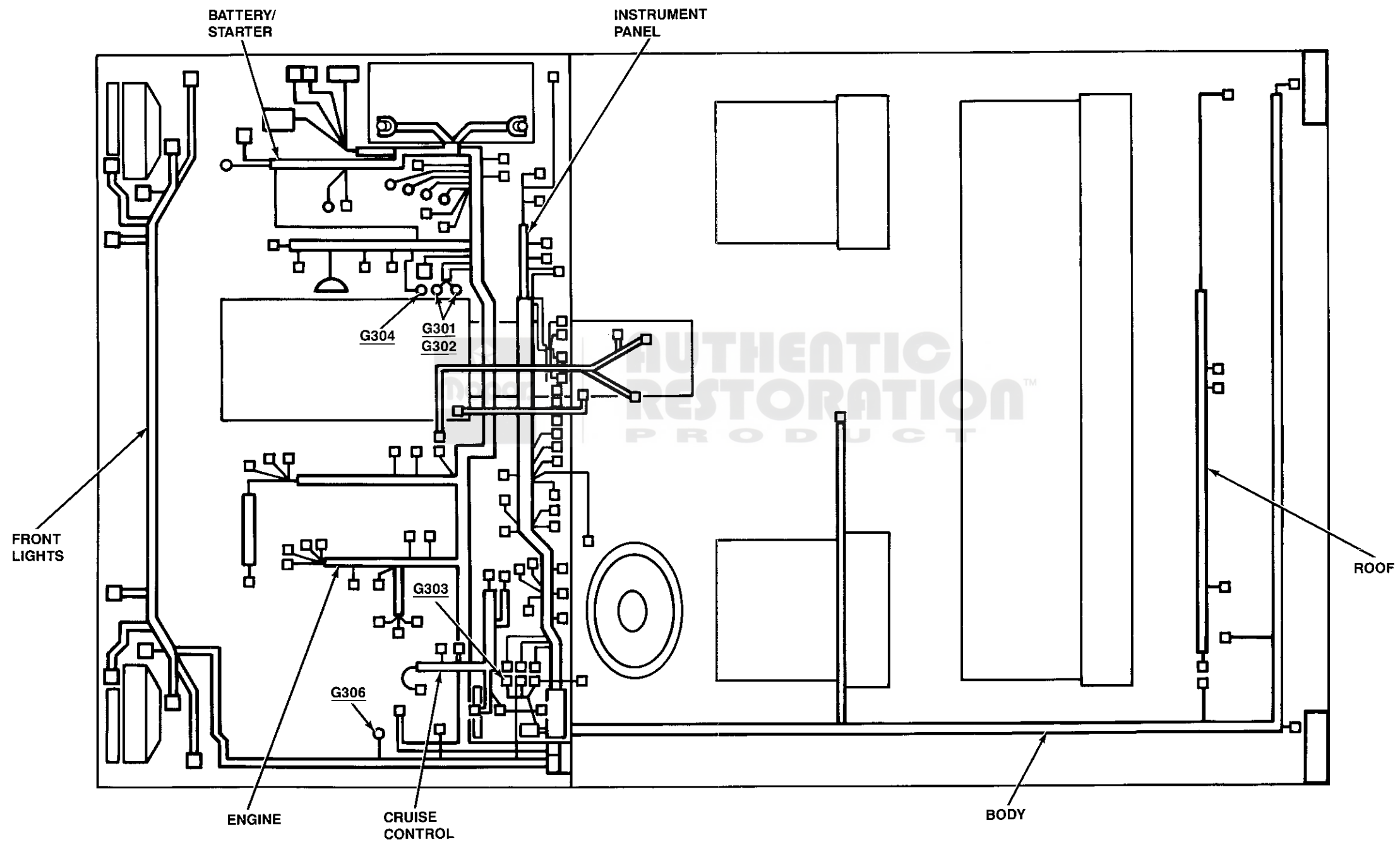
COMPONENT CONNECTOR VIEWS

C231: LH sidemarker lamp Behind sidemarker lamp 	C252: Emission maintenance timer Below radio 
C232: RH sidemarker lamp Behind sidemarker lamp 	 
C233: Seat belt switch In driver's seat belt buckle 	
C246: Power steering switch Left of power steering pump 	

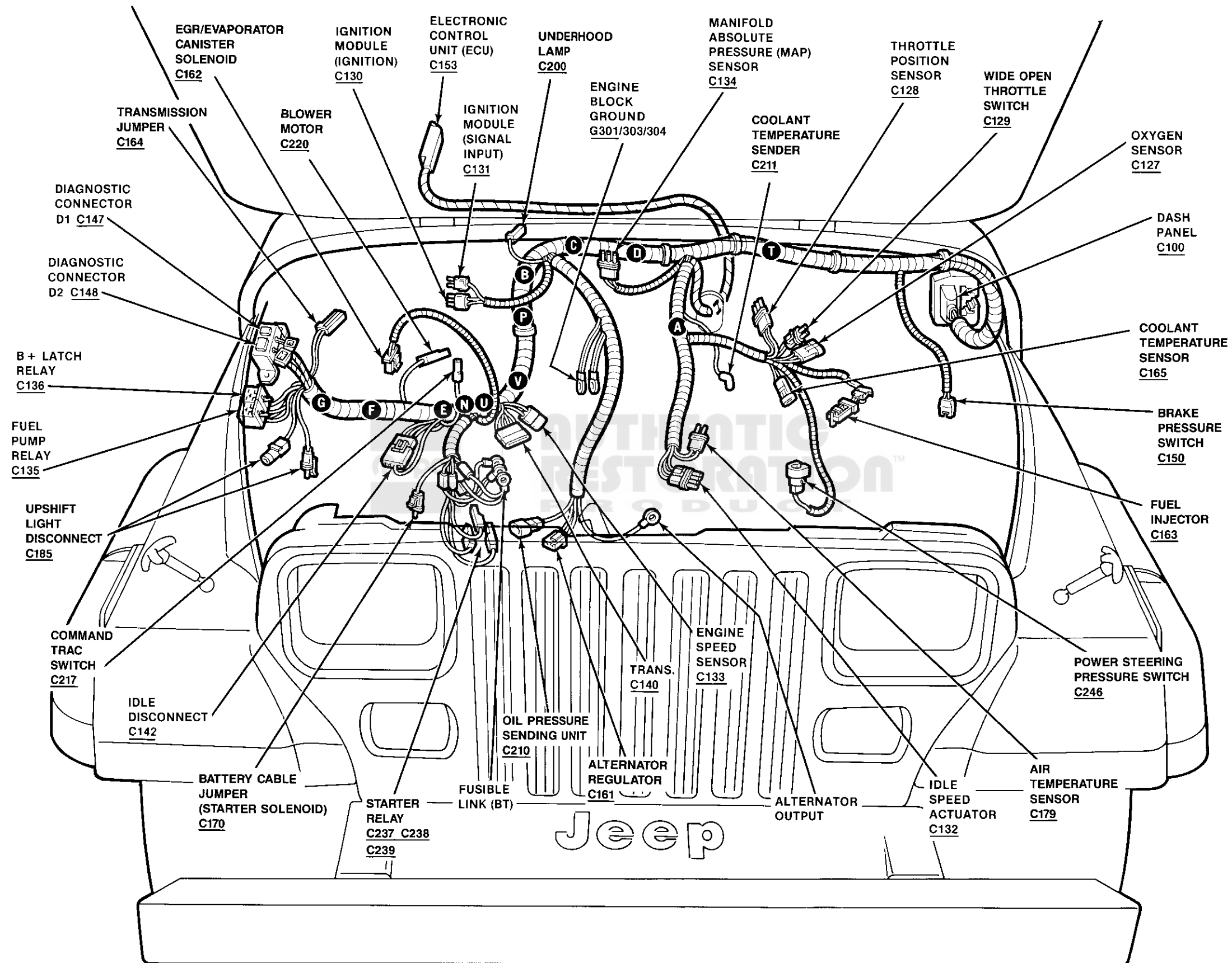
SINGLE PIN CONNECTORS

<u>C170</u> - Near starter solenoid	⊙	<u>C198</u> - Near radio	●	<u>C220</u> - At blower motor	●
<u>C183</u> - Near defogger relay	■	<u>C199</u> - Near cigar lighter	●	<u>C223</u> - At PRNDL illumination	●
<u>C184</u> - At fuse panel	■	<u>C200</u> - Near underhood lamp	■	<u>C234</u> , <u>C235</u> - At cargo lamp	■
<u>C185</u> - Upshift light disconnect	⊙	<u>C201</u> - At horn	■	<u>C236</u> - At wiper motor	■
<u>C186</u> - At thermostatic control	●	<u>C202</u> - At horn switch	●	<u>C237</u> , <u>C238</u> , <u>C239</u> , <u>C240</u> , <u>C241</u> , <u>C242</u> , <u>C243</u> - At starter relay	■
<u>C187</u> - Near low pressure switch	■	<u>C203</u> , <u>C204</u> - At defogger grid	■	<u>C244</u> , <u>C245</u> - At door jamb switch	■
<u>C188</u> - Near blower motor	●	<u>C205</u> - At LH door jamb switch	■	<u>C247</u> - At A/C compressor clutch	●
<u>C189</u> - At filter capacitor	●	<u>C209</u> - At RH door jamb switch	■	<u>C248</u> - At fuse panel	■
<u>C190</u> - At knock sensor	⊙	<u>C210</u> - At oil pressure sender	●	<u>C249</u> - At oxygen sensor (4.2L)	⊙
<u>C191</u> - At idle solenoid	■	<u>C211</u> - At coolant temperature sender	●	<u>C250</u> - At fuse panel	■
<u>C192</u> - At park neutral switch	●	<u>C213</u> - Near cruise control module	⊙	<u>C251</u> - At radio connector	■
<u>C193</u> - At electric choke	■	<u>C214</u> - At park brake switch	●		
<u>C194</u> - At manifold heater switch	●	<u>C216</u> - Near ECU	⊙		
<u>C195</u> - At manifold heater	■	<u>C217</u> - At command trac switch	●		
<u>C196</u> , <u>C197</u> - At cigar lighter	■	<u>C218</u> , <u>C219</u> - At heat/off microswitch	■		

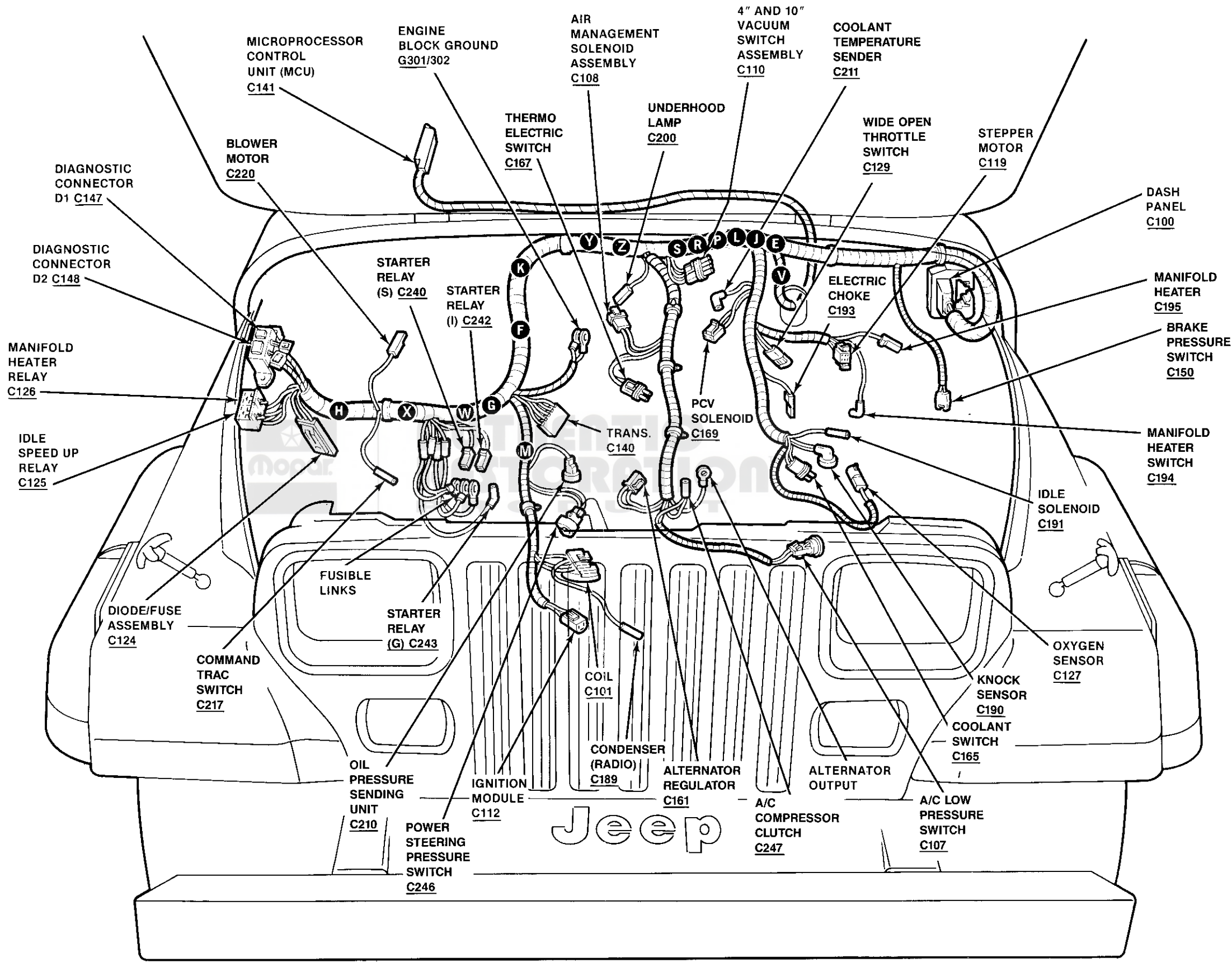
HARNESS ROUTING VIEWS



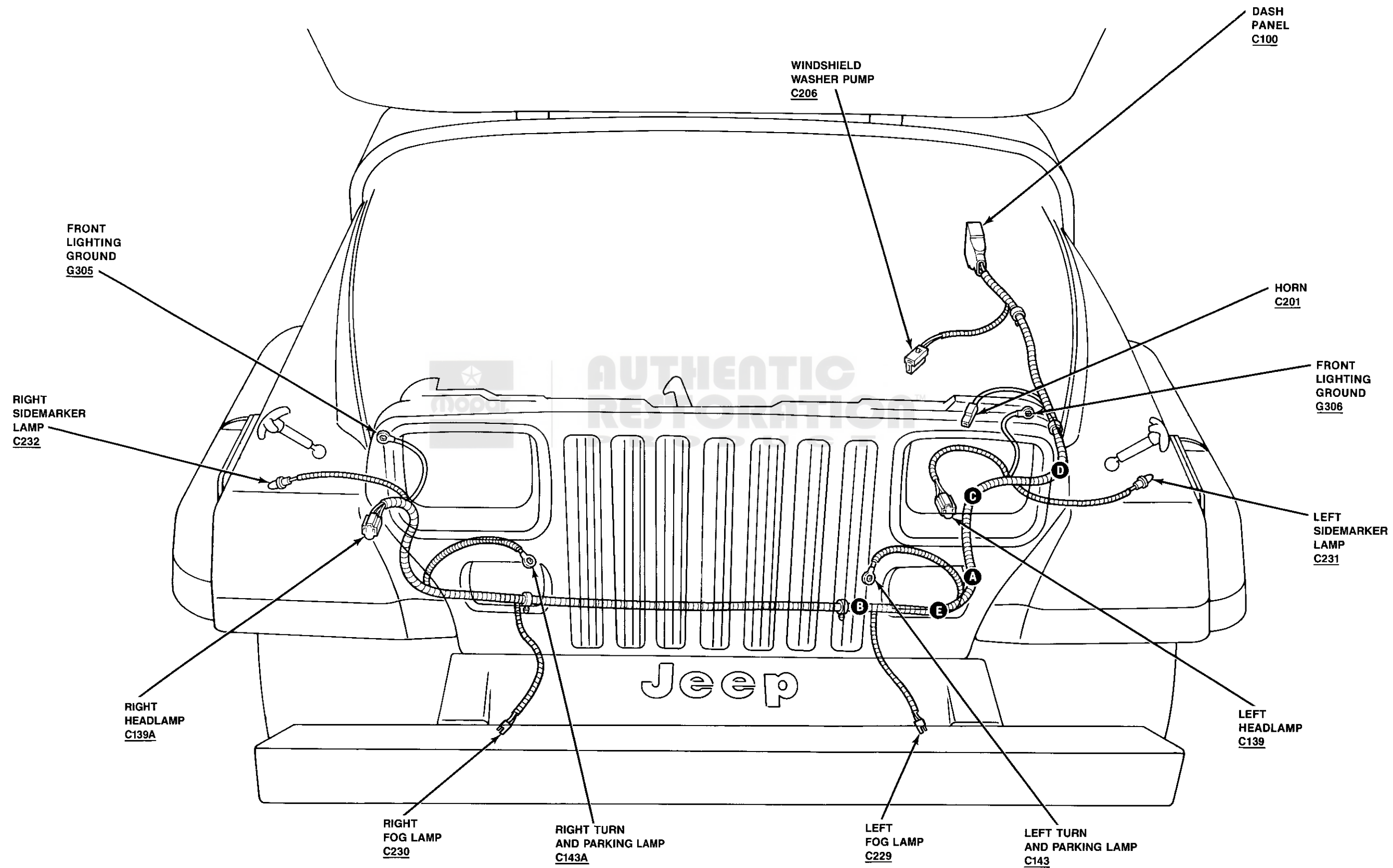
ENGINE/ENGINE CONTROL—2.5L



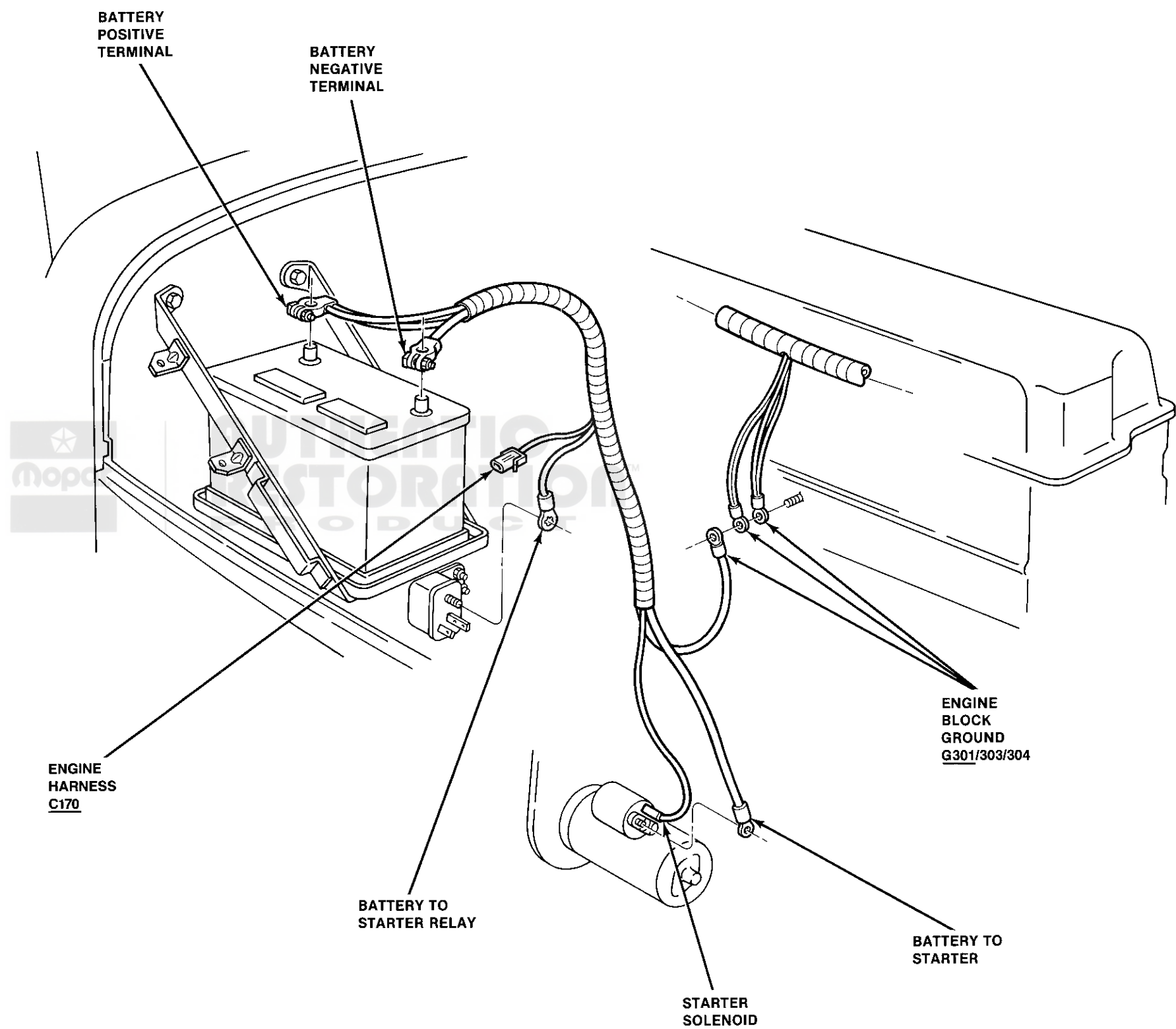
ENGINE/ENGINE CONTROL—4.2L



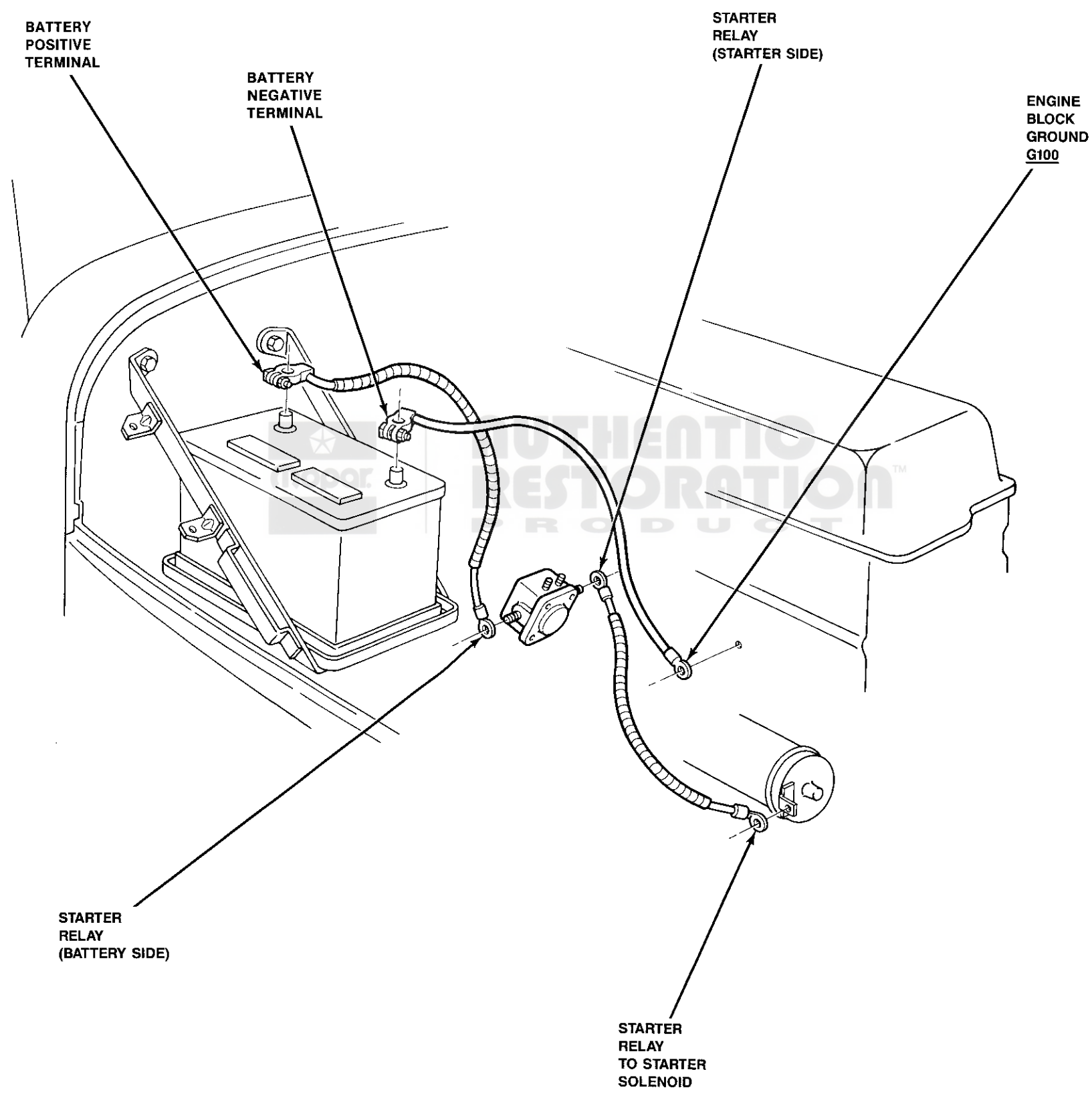
FRONT LIGHTING



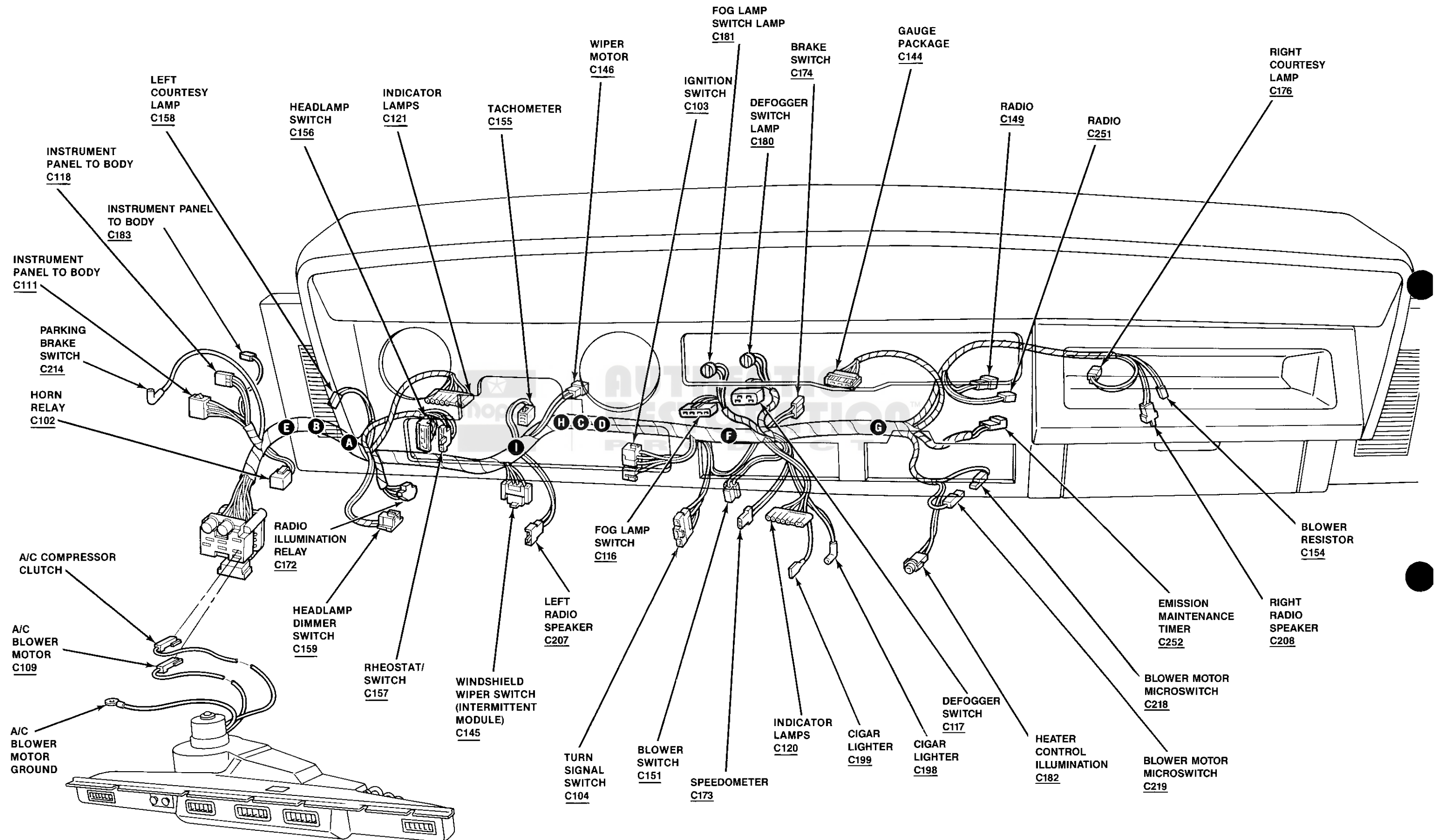
BATTERY/STARTER—2.5L



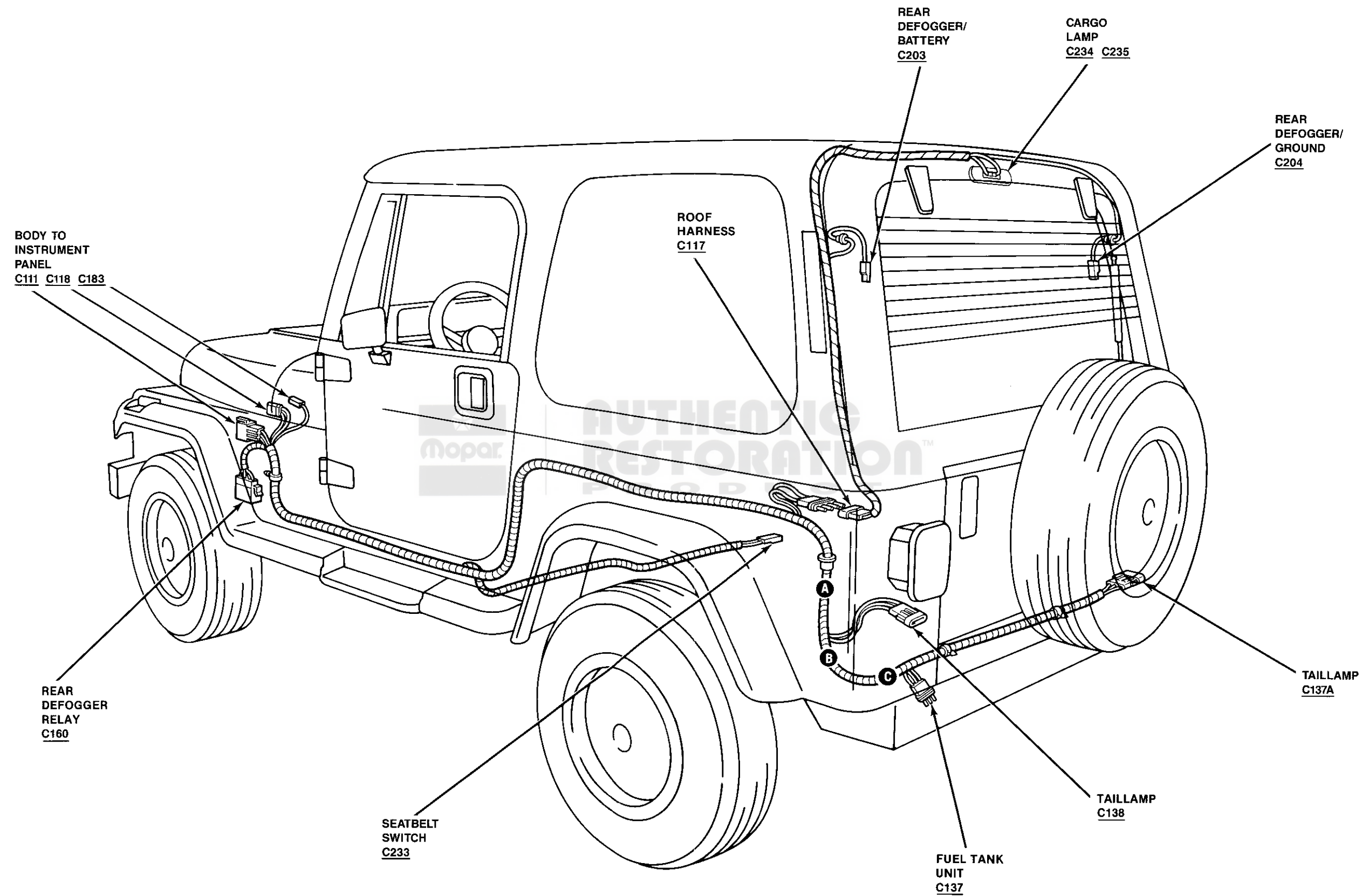
BATTERY/STARTER—4.2L



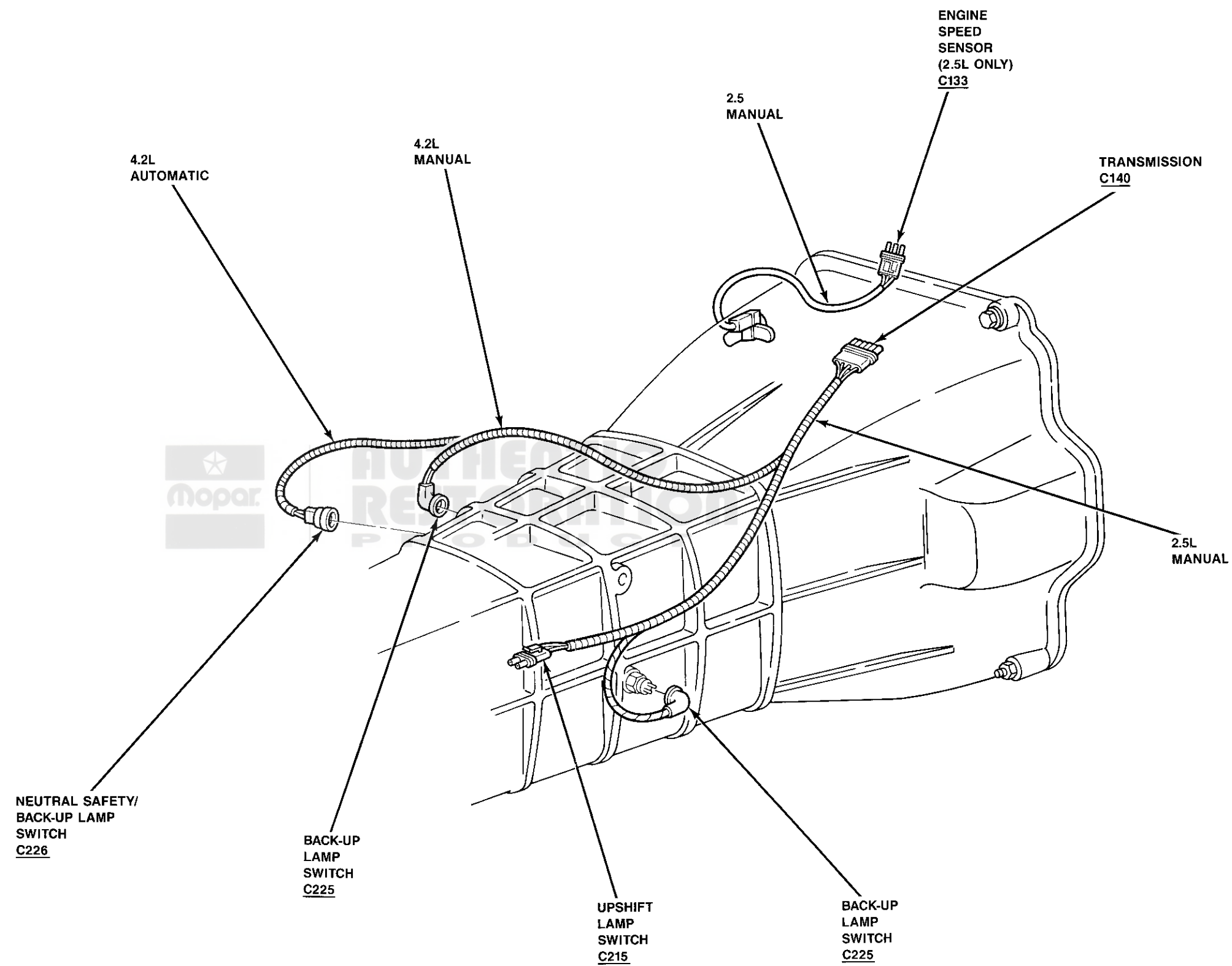
INSTRUMENT PANEL



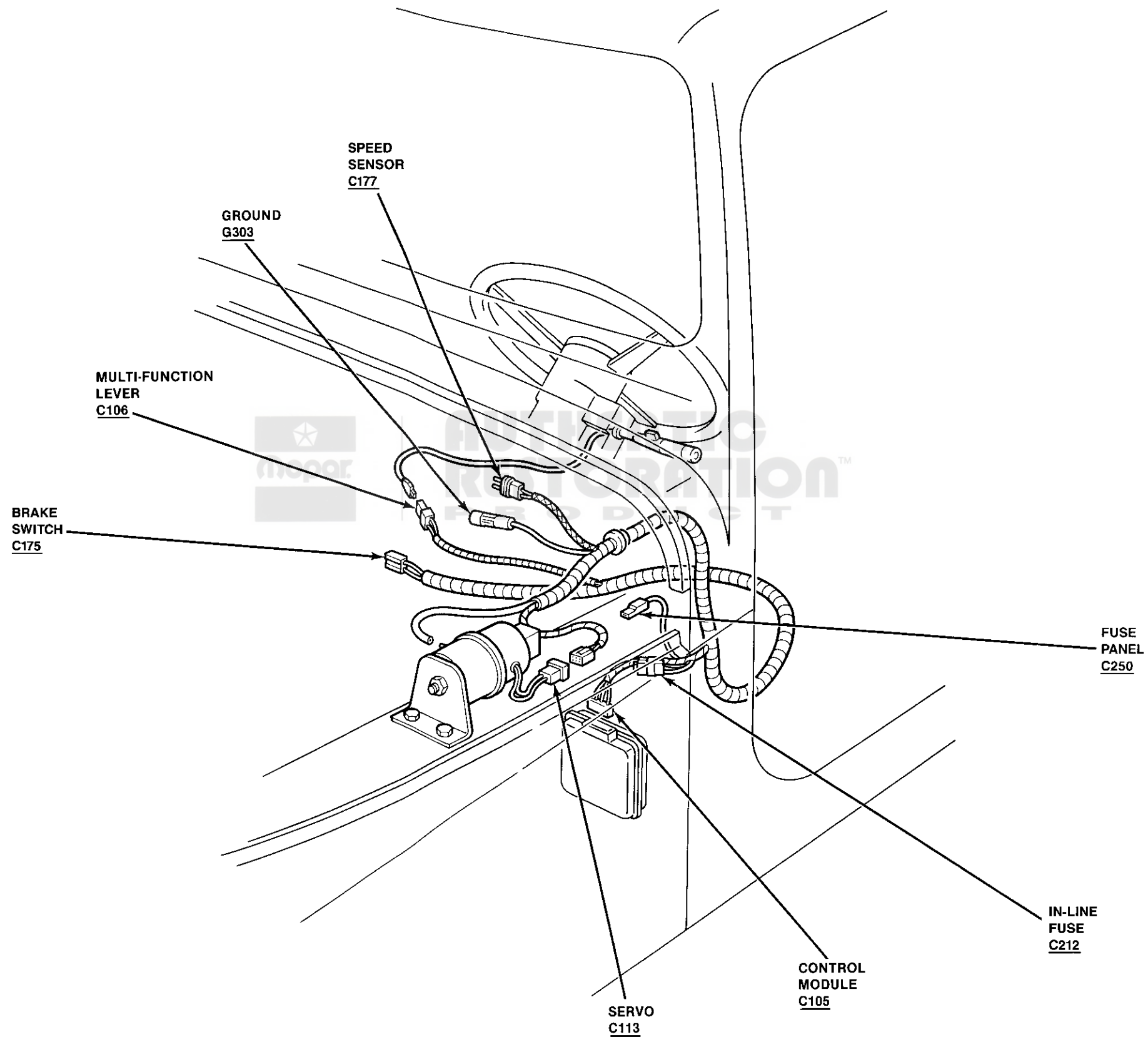
BODY / ROOF



TRANSMISSION



CRUISE CONTROL



CIRCUIT INDEX	
CIRCUIT	ZONE
Air Conditioning	H-12
A/C Compressor Controls	H-12
Blower Controls	H-10
Charging System	H-5
Cigar Lighter	J-3
Coolant Temperature Gauge	K-9
Cruise Control	K-11
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Engine Controls 4.2L	H-2
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—Fog	M-10
—Hazard	P-3
—Headlights	M-10
—Park	P-3
—Sidemarkers	M-10
—Stop	P-3
—Turn	P-3
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Horn	J-4
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—Brake	M-4
—Upshift	M-5
—4 Wheel Drive	M-5
Instrument Cluster	K-9
Instrument Panel	
Illumination Lamps	M-7
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—Underhood Lamp	P-6
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Power Distribution 4.2L	D-4
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Starter 4.2L	D-2
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Warnings:	
—Ignition Key	J-6
—Seatbelt	J-6
Wiper/Washer:	
—Intermittent	M-3
—Non-Intermittent	M-1

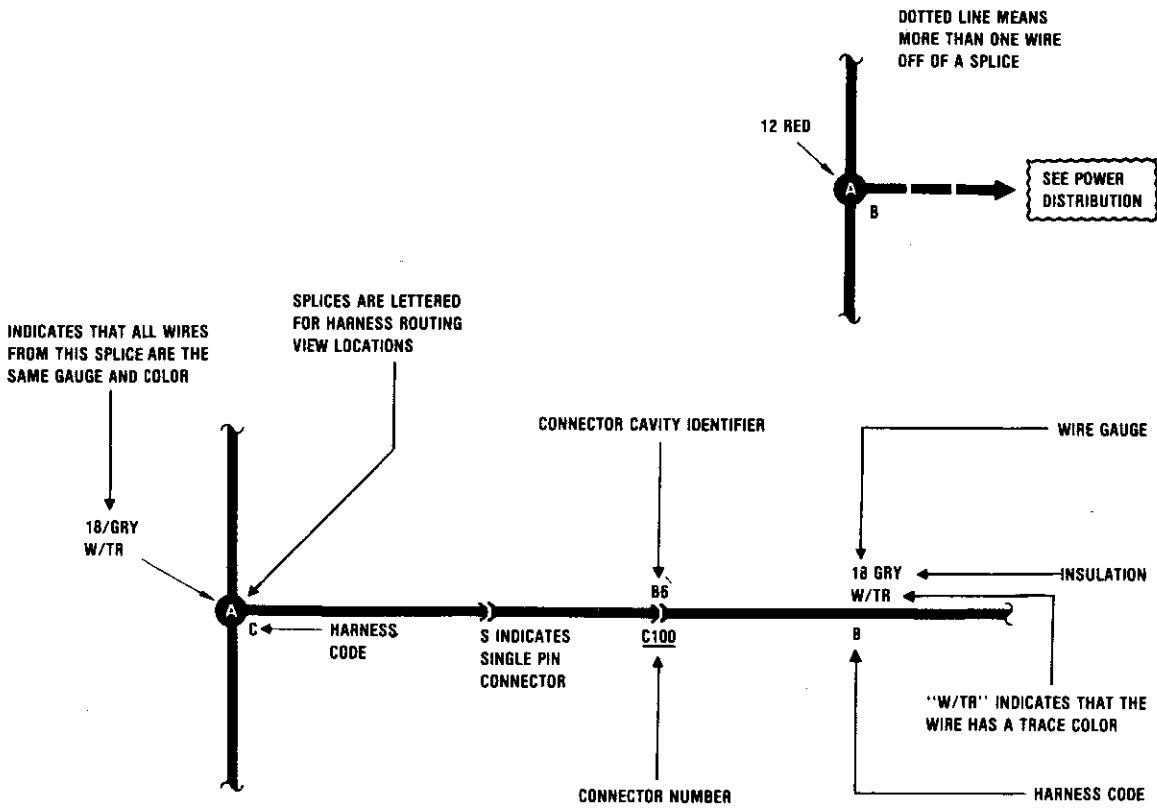
COMPONENT ZONE LOCATIONS					
NAME		DIAGRAM ZONE	NAME		DIAGRAM ZONE
A/C Blower Motor		H-12	Fog Lamp Relay		O-9
A/C Blower Switch		H-11	Fog Lamp Switch		N-10
A/C Compressor Clutch		I-11	Fuel Gauge Sender		L-9
A/C Low Pressure Switch		I-11	Fuel Injector 2.5L		E-10
A/C Suppression Diode		I-11	Fuel Pump Relay 2.5L		B-3,D-10
A/C Thermostatic Control		H-11	Fuel Tank Unit		E-11
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Alternator 2.5L		A-6,I-5	Fuse Link C		D-4,G-6
Alternator 4.2L		D-6,I-5	Fuse Link D		D-5,G-5
Antenna Coax Lead		I-7	Fuse Link H		A-4,D-11
Backup Light Switch		P-1	Fuse Link J		A-4,M-10
Backup Neutral Safety Switch 4.2L		F-2,P-1	Fuse Link K		A-2,A-5,G-5
Battery 2.5L		A-1,A-3,G-4	Fuse Link L		A-4
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Blower Motor		I-10	Fuse Panel 2.5L		C-5
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Blower Switch		H-10	Gauge Package		K-9
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Buzzer Module		K-7	Heat/Off Microswitch		H-10
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Clutch Switch		J-11	Horn Relay		K-4
Coil 4.2L		G-1	Horn Switch		L-4
Command Trac Switch		N-5	Idle Disconnect		C-2
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Coolant Temperature Sensor		F-8	Idle Speed Activator 2.5L		F-10
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Cruise Control Module		K-11	Ignition Key Warning Switch		J-7
Defogger Grid		L-2	Ignition Module 2.5L		E-8,J-4
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Defogger Switch		K-2	Ignition Switch 2.5L		A-2,B-5,D-8,G-5, G-6,J-3,O-5
Door Jamb Switch		Q-4	Ignition Switch 4.2L		D-2,E-5,G-3,J-3,O-5
EGR/Evaporator Canister Solenoid		E-10	Illuminated Rheostat/Switch 2.5L		B-3,G-9,M-7,N-12, Q-5
Electric Choke Heater		I-6	Illuminated Rheostat/Switch 4.2L		E-3,G-9,M-7,N-12, Q-5
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Distributor 4.2L		H-1			
Filter Capacitor 4.2L		G-1			

NAME	DIAGRAM ZONE
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Manifold Heat Relay	D-3,I-6
Manifold Heat Switch	I-6
Microprocessor Control Unit 4.2L	F-2,H-1
Multi-Function Lever	K-11
Oil Pressure Sender	L-8
Oil Pressure Switch	H-6
Oxygen Sensor 2.5L	E-8
Oxygen Sensor 4.2L	I-1
Parking Brake Switch	O-5
Positive Crankcase Ventilation	
Solenoid 4.2L	H-3
Power Steering Switch 2.5L	E-10
Radio	H-8
RH Door Jamb Switch	R-5
RH Speaker	I-8
Seatbelt Switch	J-6
Speed Sensor	L-12
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Starter Solenoid 2.5L	A-3,B-1
Starter Solenoid 4.2L	E-1,D-3
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Tachometer	K-5
Thermo-Electric Switch 4.2L	I-3
Throttle Position Sensor 2.5L	F-9
Turn/Hazard Switch	
Assembly	Q-3
Upshift Switch	N-5
Vacuum Switch	
Assembly 4.2L	I-2
Washer Pump	O-2,O-3
Wide Open Throttle	
Switch 2.5L	F-11
Wide Open Throttle	
Switch 4.2L	I-2
Windshield Wiper/Washer	
Circuit Breaker	M-1,M-3
Wiper Motor	N-1,N-3
Wiper Switch	M-1,M-3

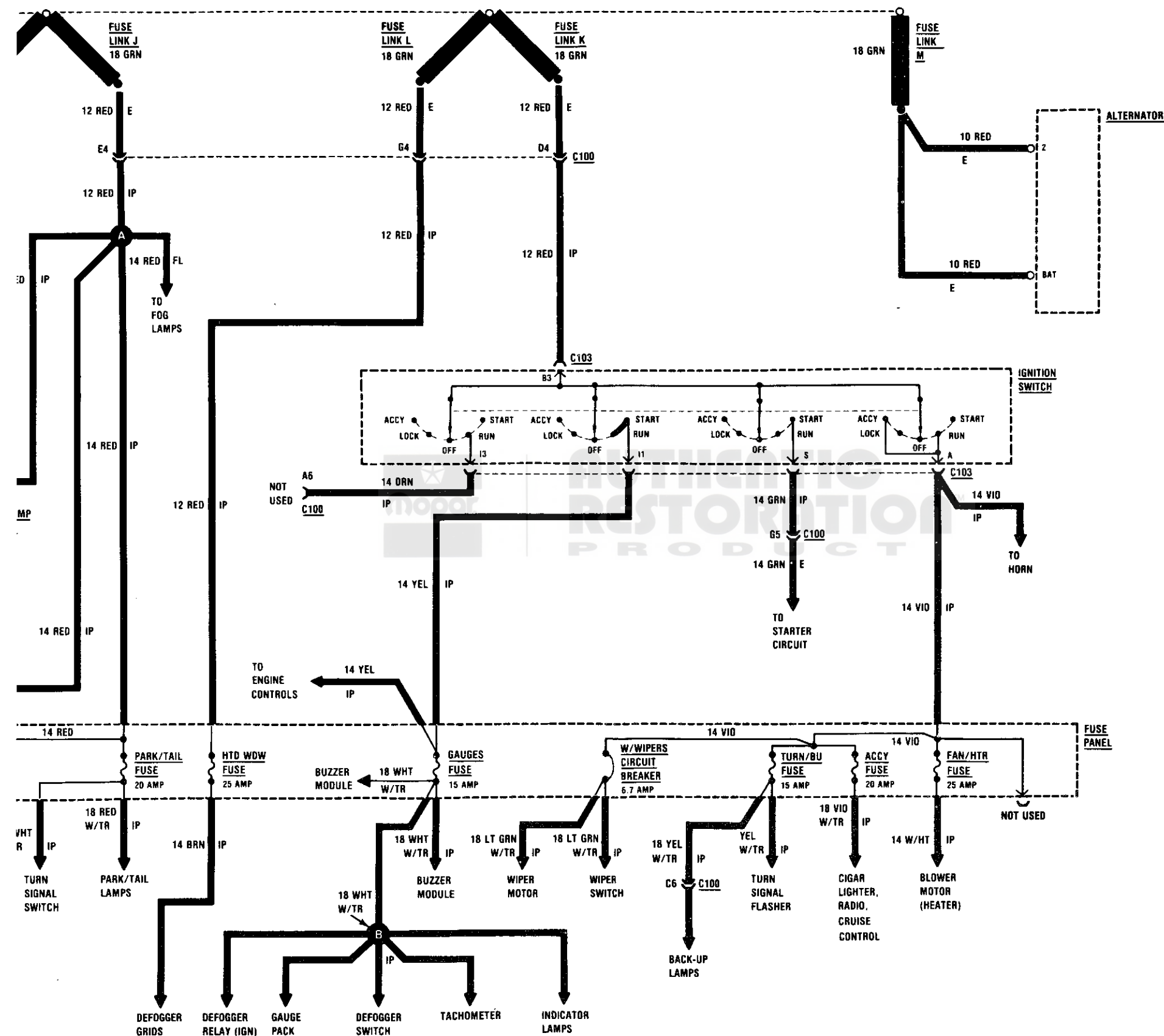
WIRE COLOR CODES					
CODE	COLOR	CODE	COLOR	CODE	COLOR
BLK	Black	GRY	Gray	VIO	Violet
BLU	Blue	ORN	Orange	WHT	White
BRN	Brown	PNK	Pink	YEL	Yellow
GRN	Green	RED	Red		

HARNESS CODES			
CODE	HARNESS	CODE	HARNESS
A	Alternator	EC	Engine Control
AC	Air Conditioning	FL	Front Lights
B	Body	H	Heater
BAT	Battery	IP	Instrument Panel
CC	Cruise Control	L	Liftgate
CL	Courtesy Lamps	T	Transmission
E	Engine	TL	Tail Lamps
		R	Roof

Authentic
RESTORATION
PRODUCT



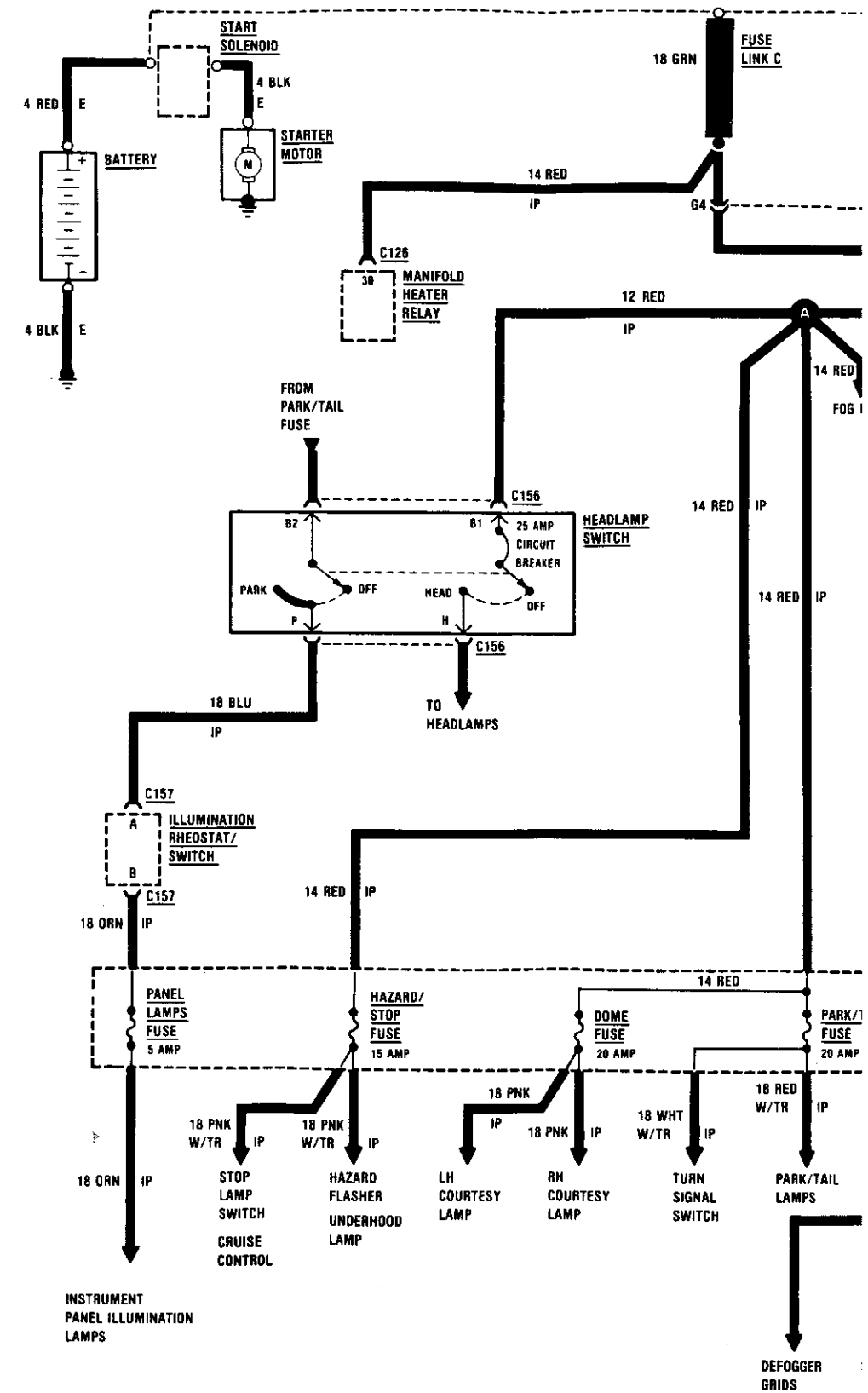
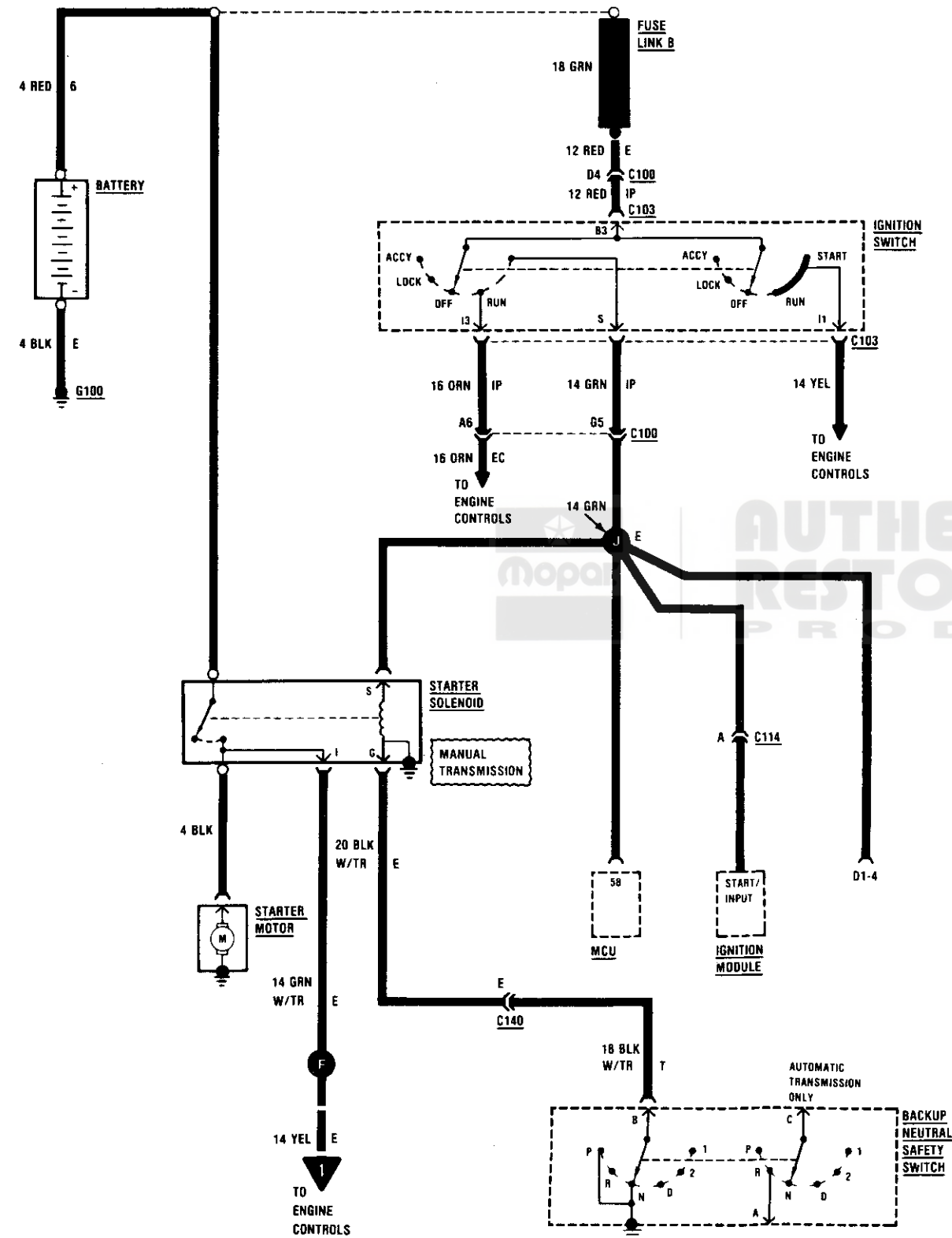
POWER DISTRIBUTION—2.5L ENGINE



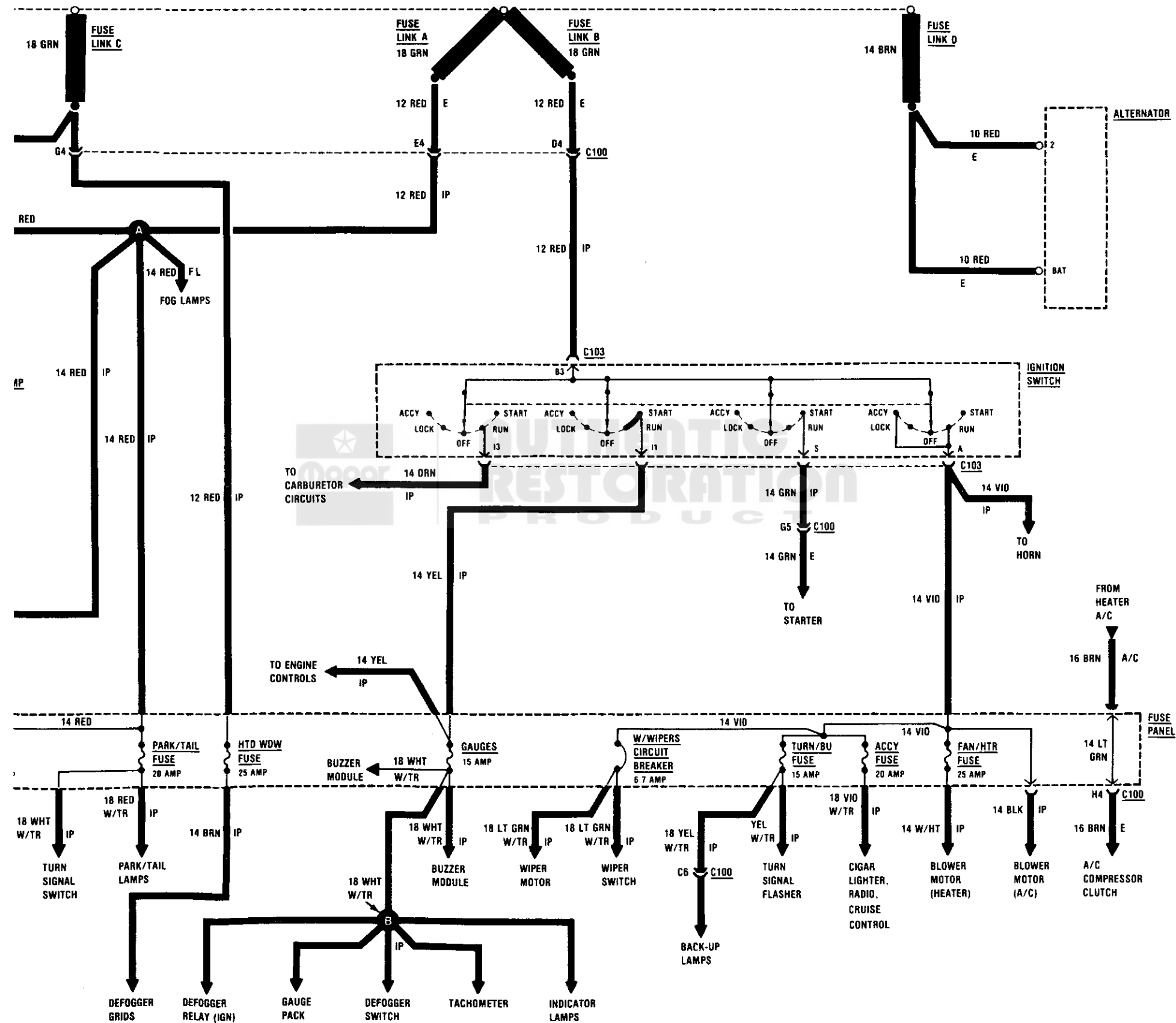
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WRANGLER/YJ
Part Number—8980 010 391
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STARTER—4.2L

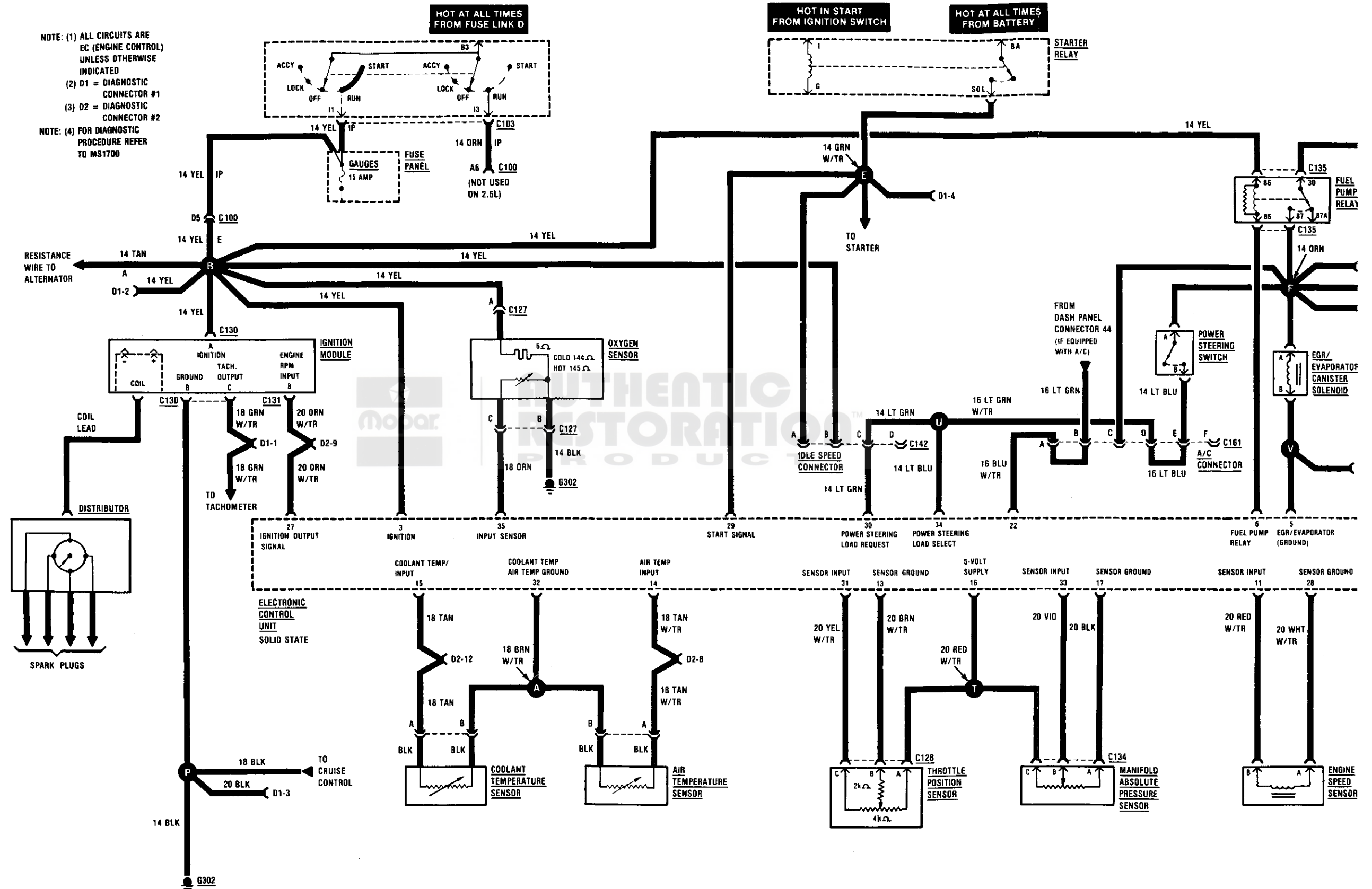
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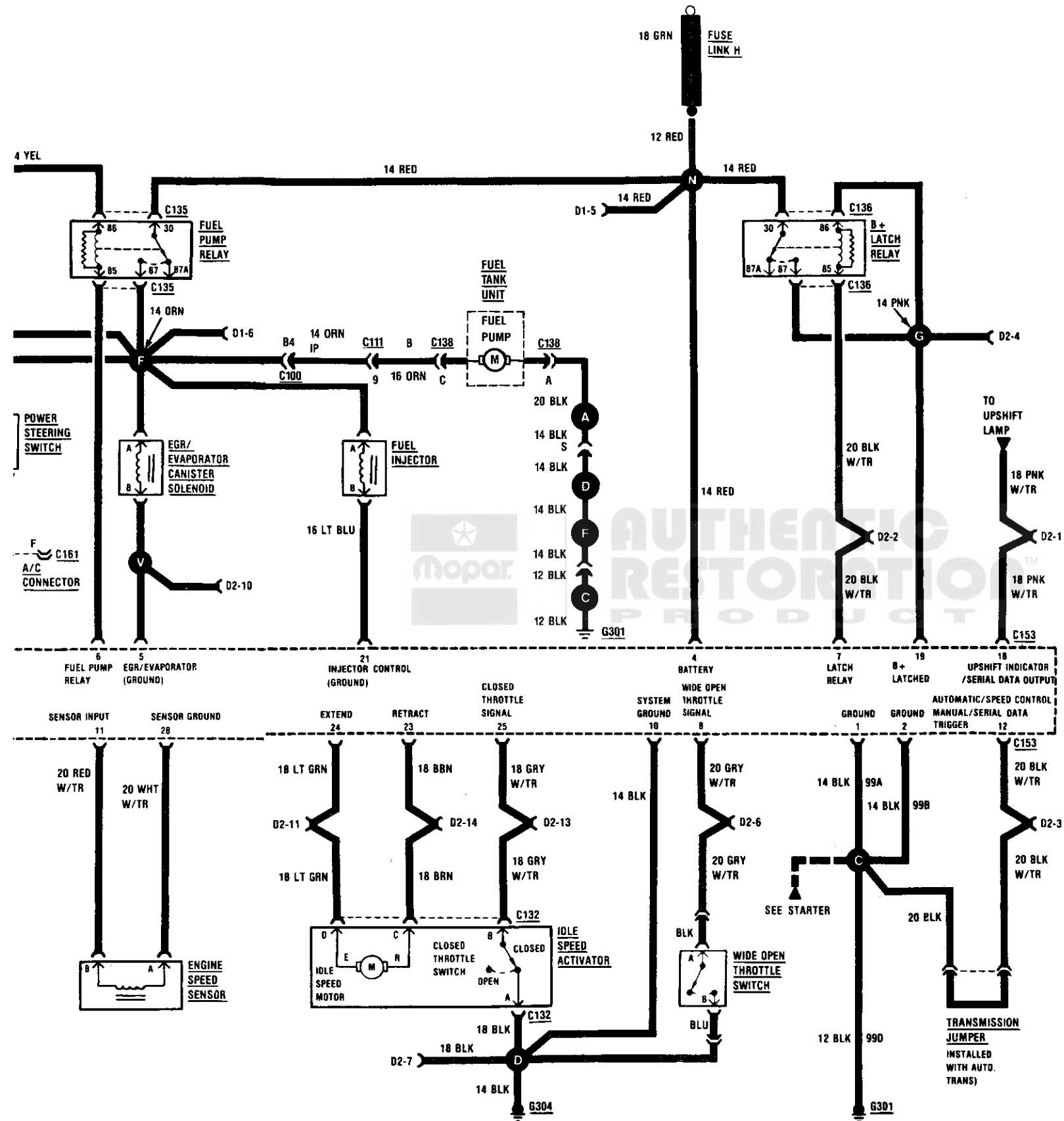


POWER DISTRIBUTION—4.2L



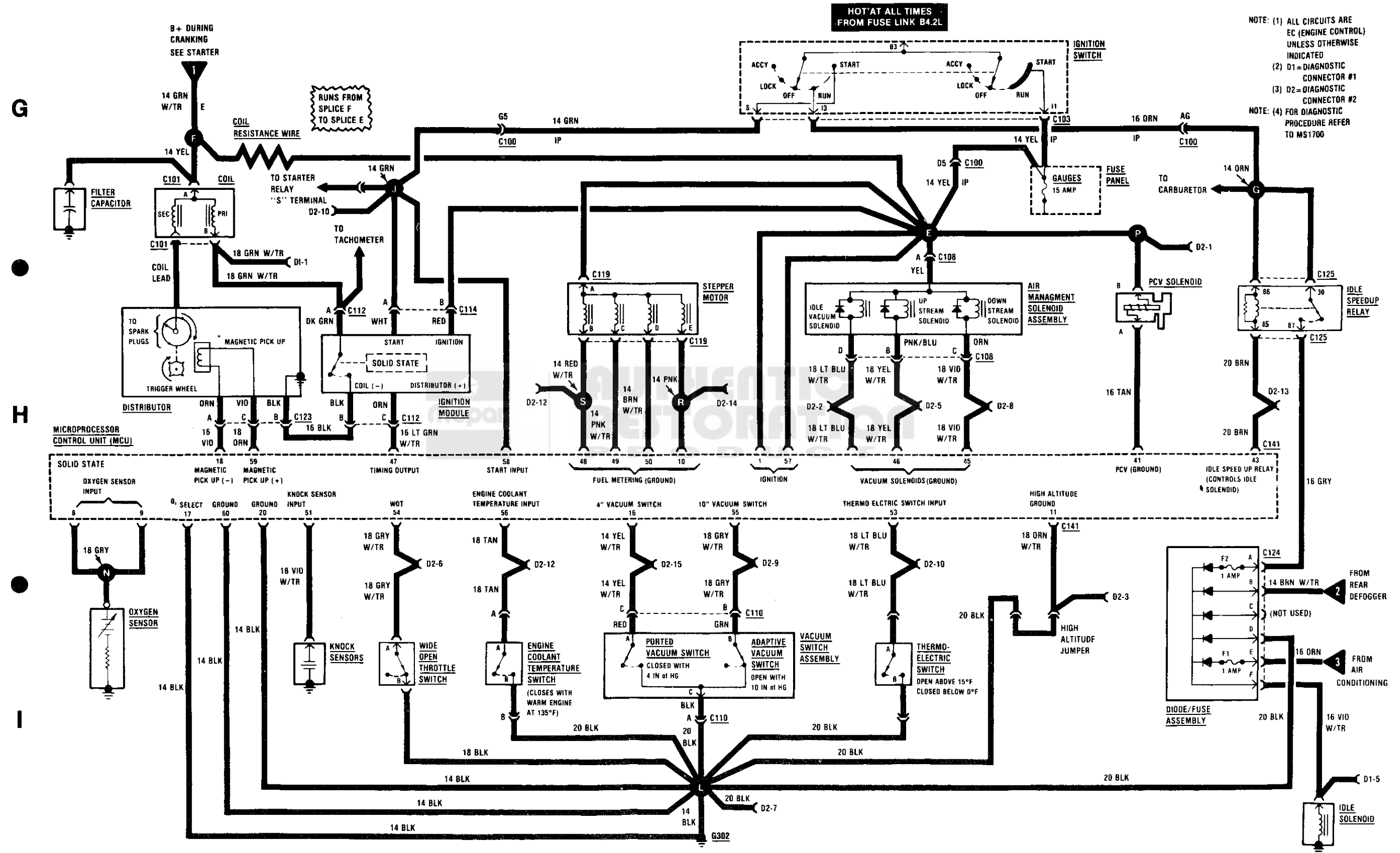
ENGINE CONTROLS—2.5L



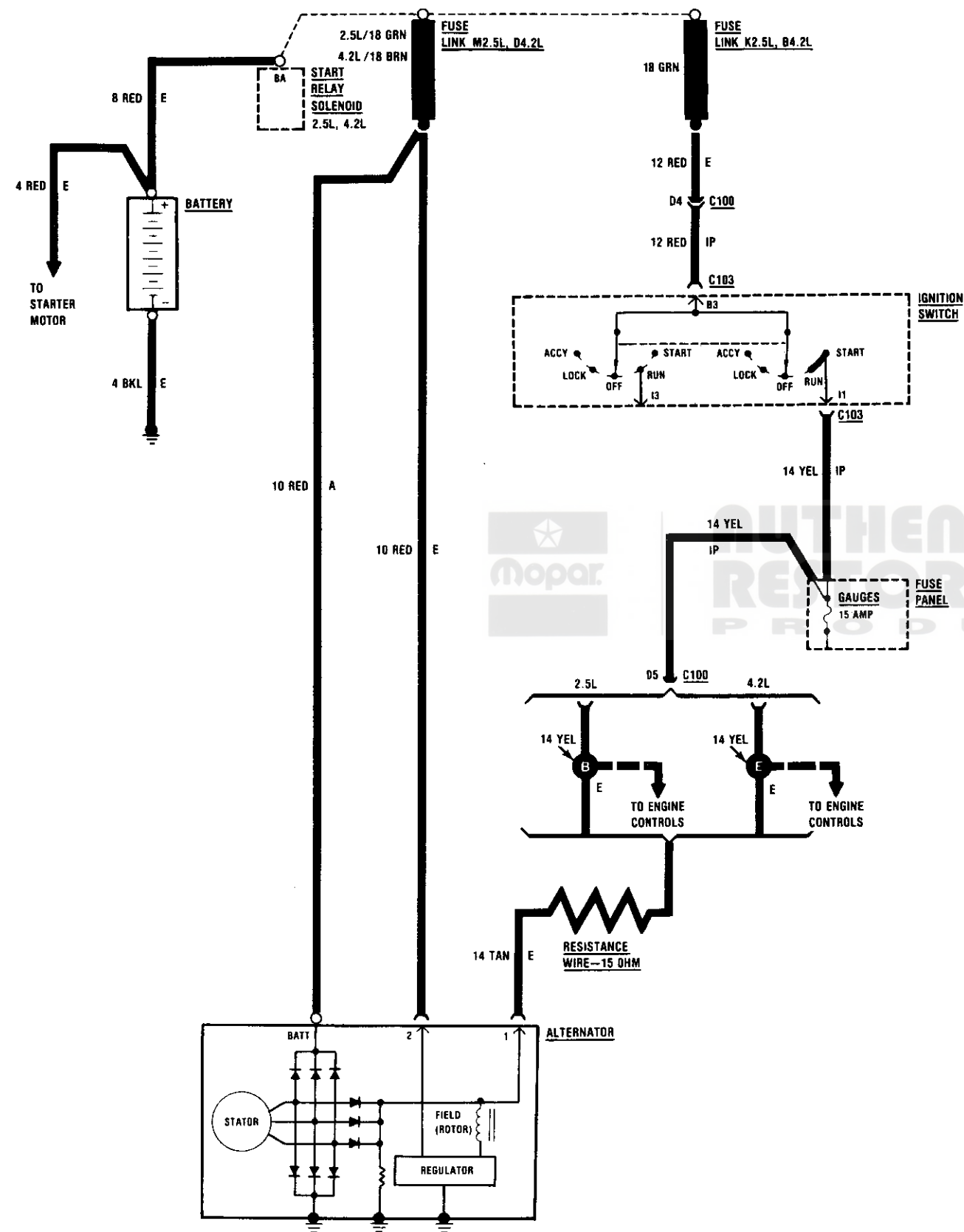


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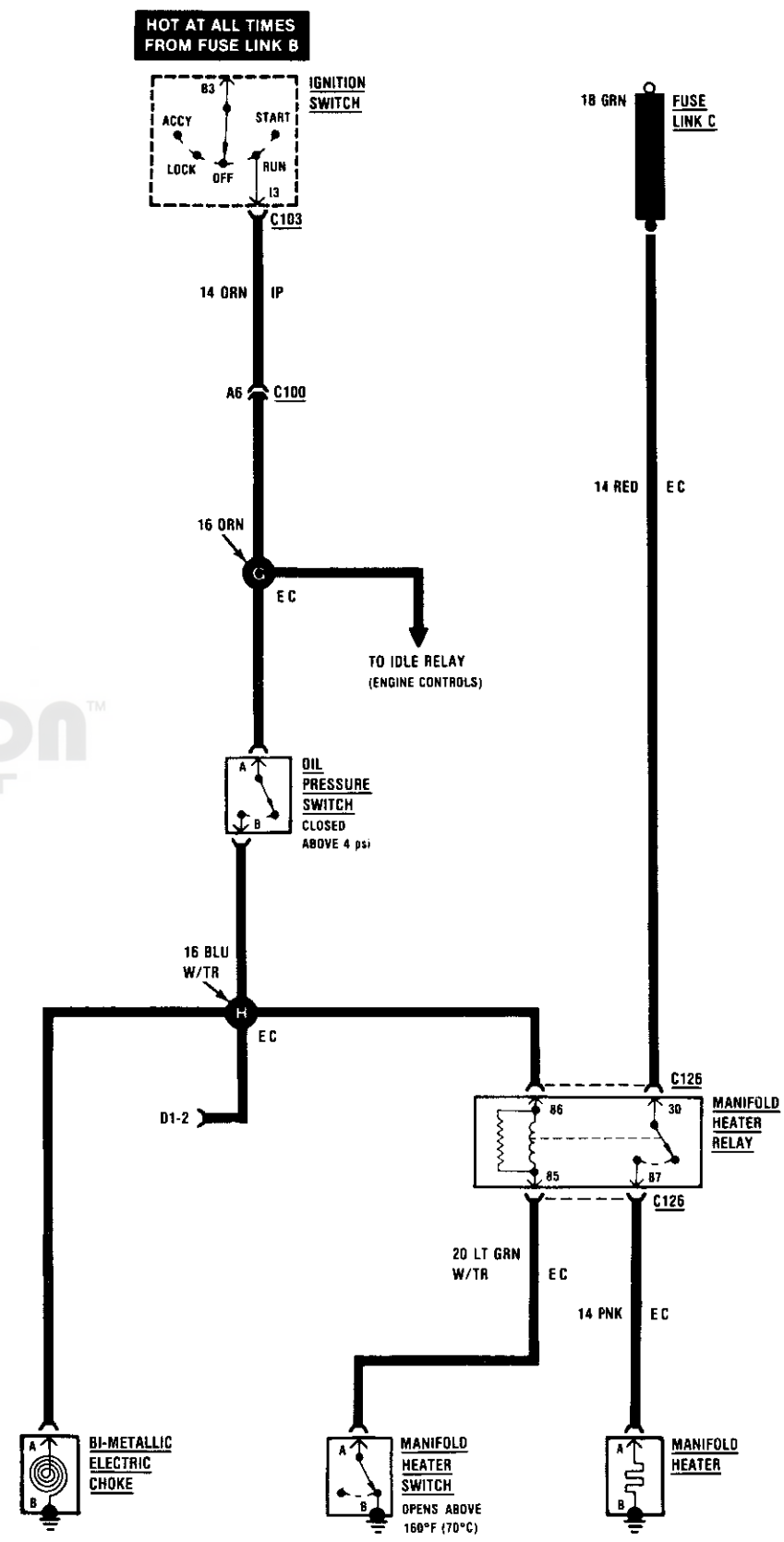
ENGINE CONTROLS—4.2L



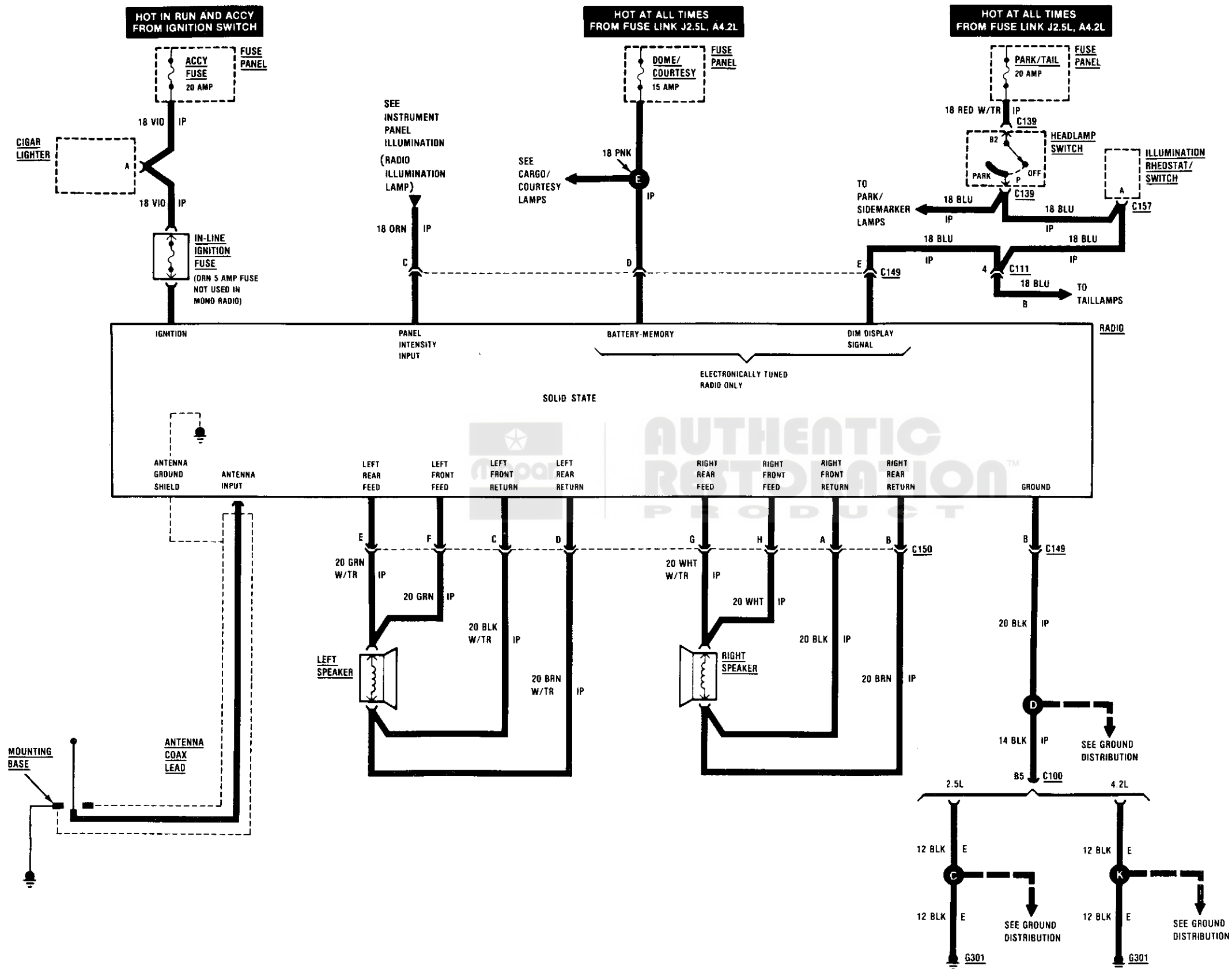
CHARGING SYSTEM



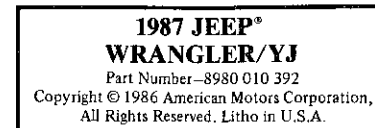
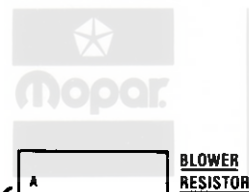
CARBURETOR CIRCUITS



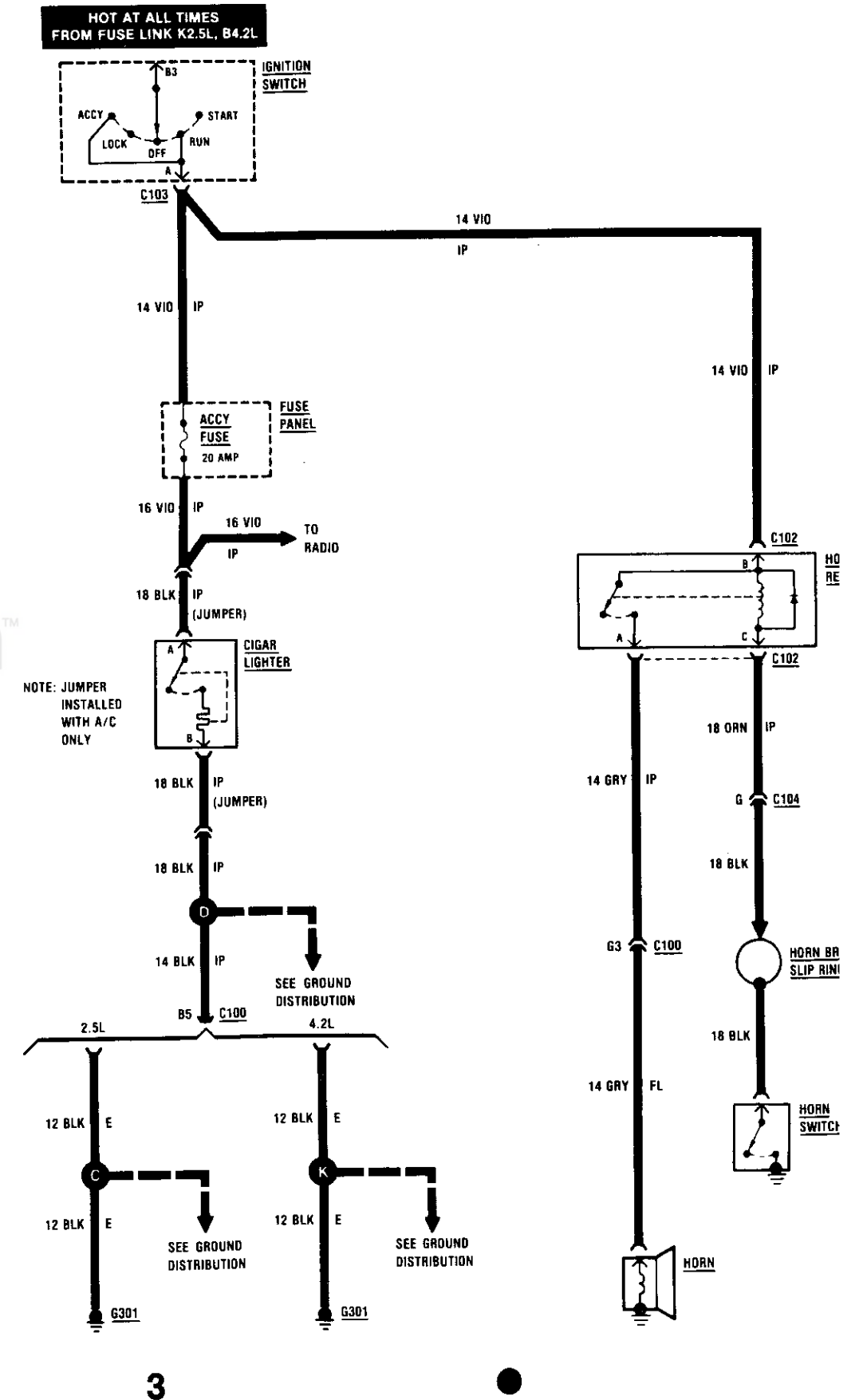
RADIO



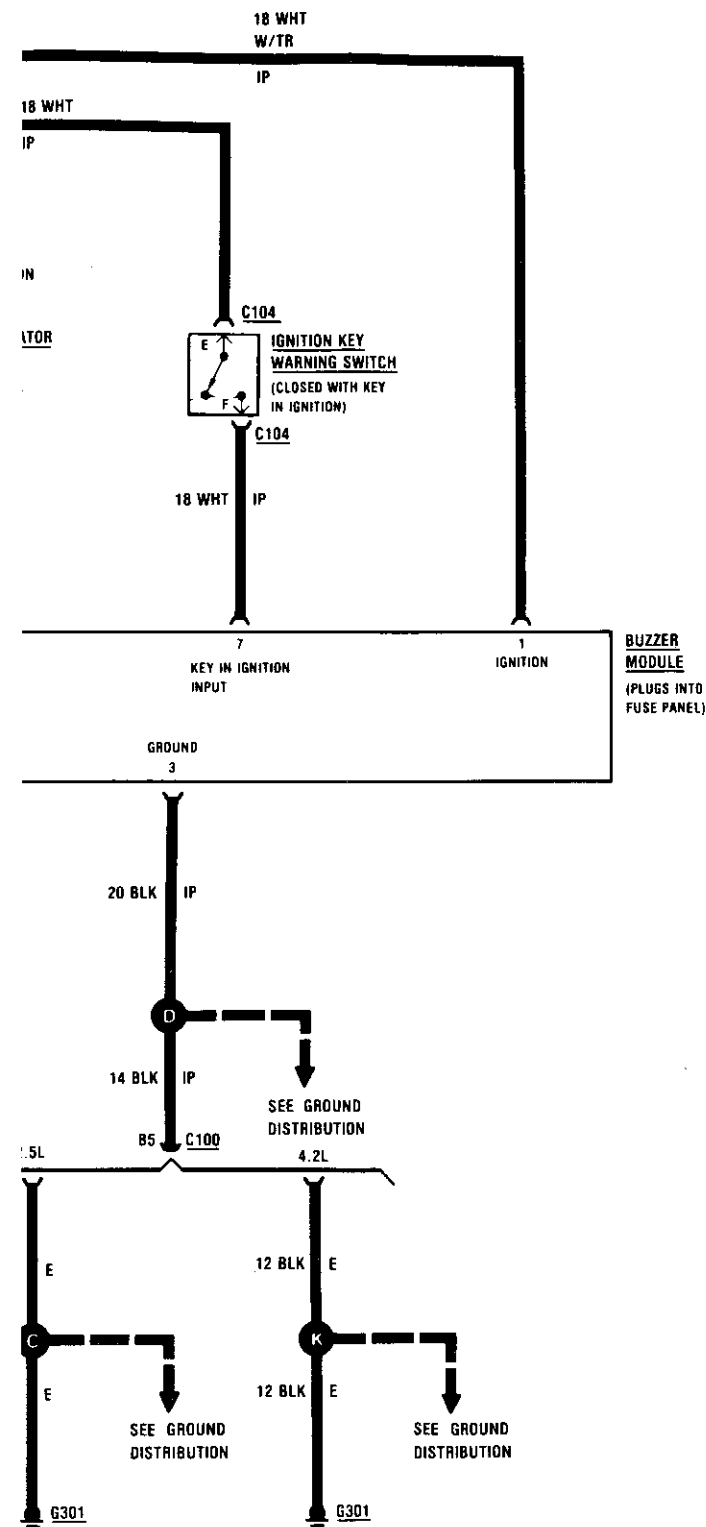
✓



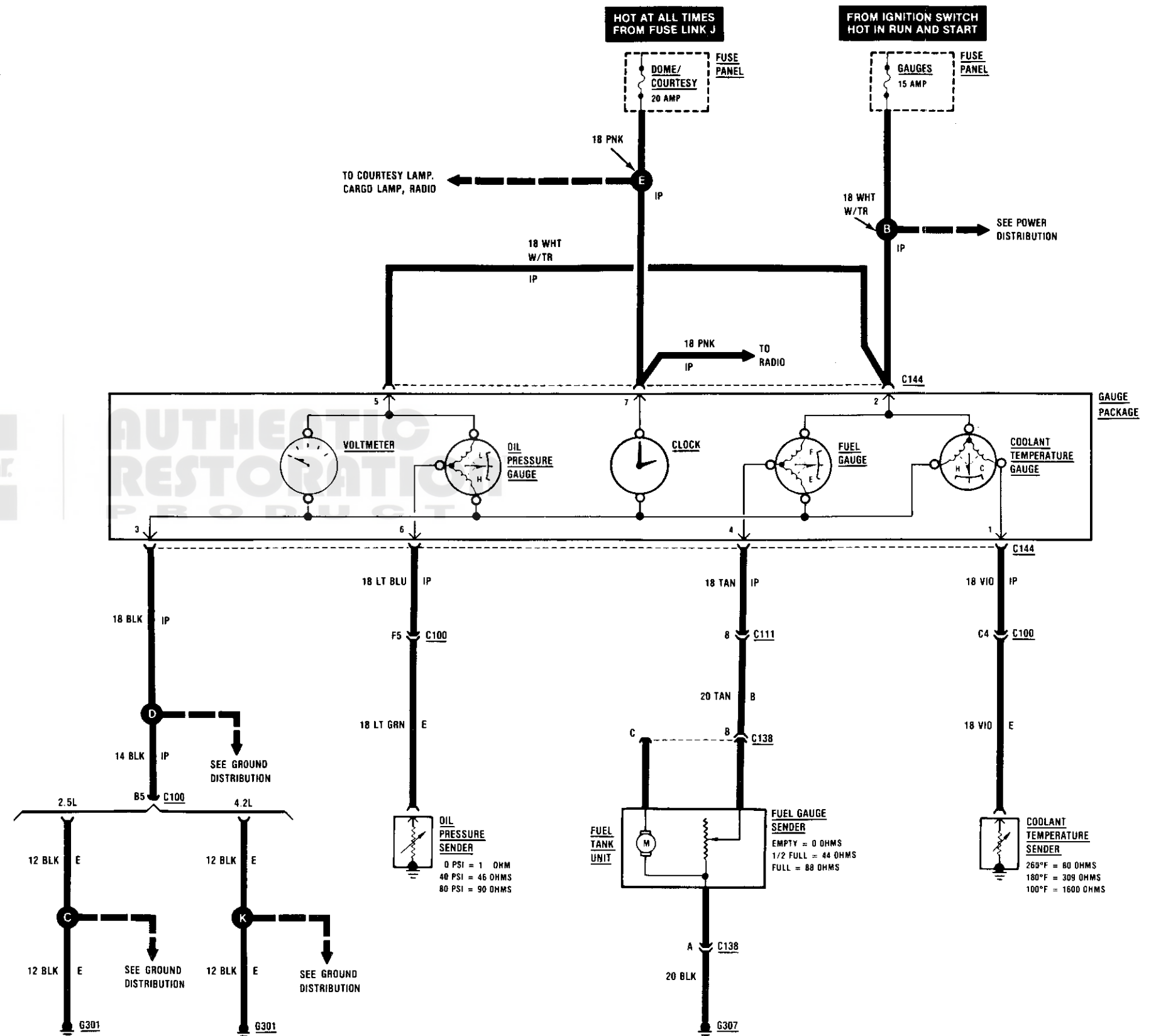
HORN



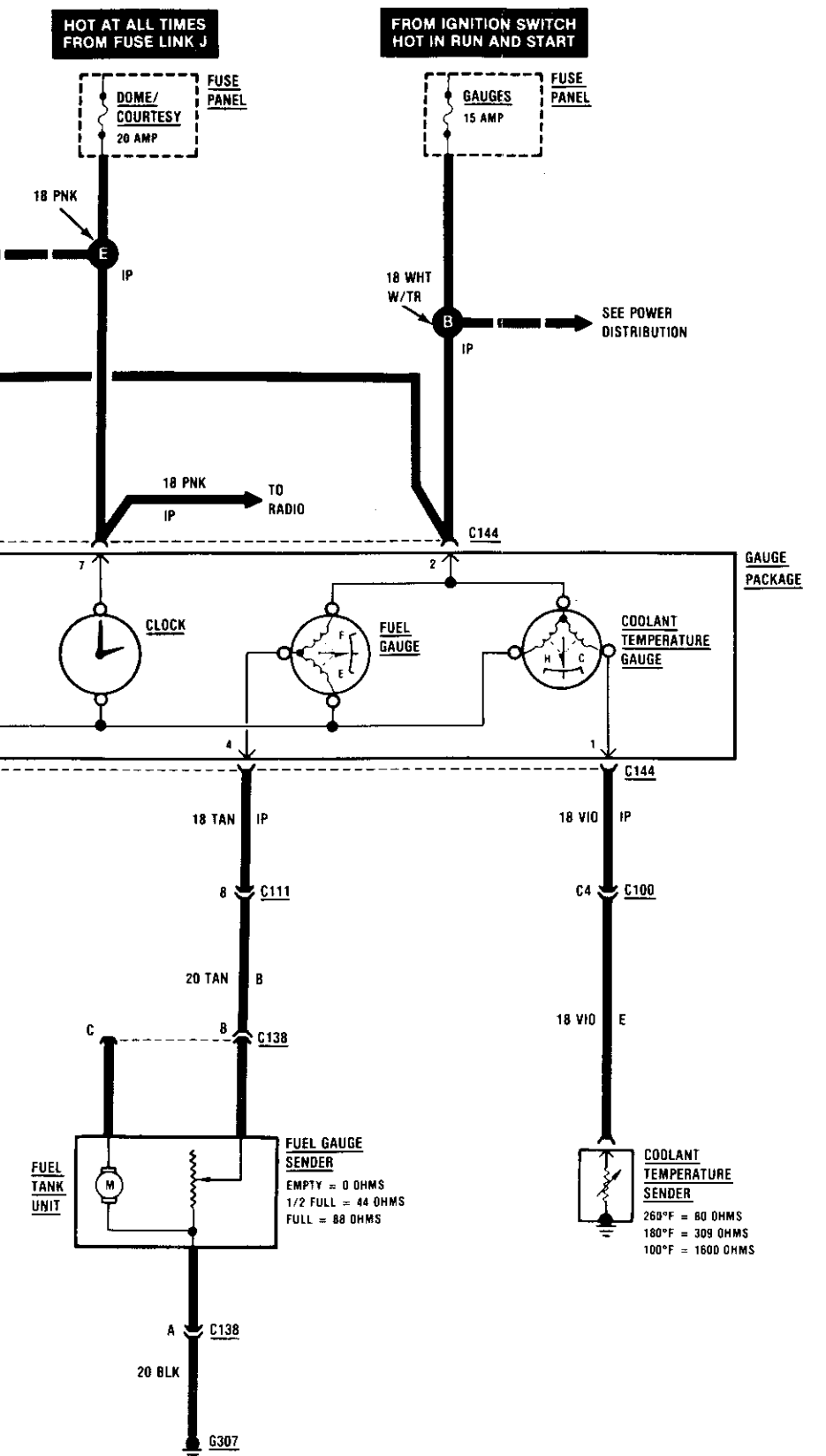
N KEY WARNING BUZZER



GAUGE PACKAGE

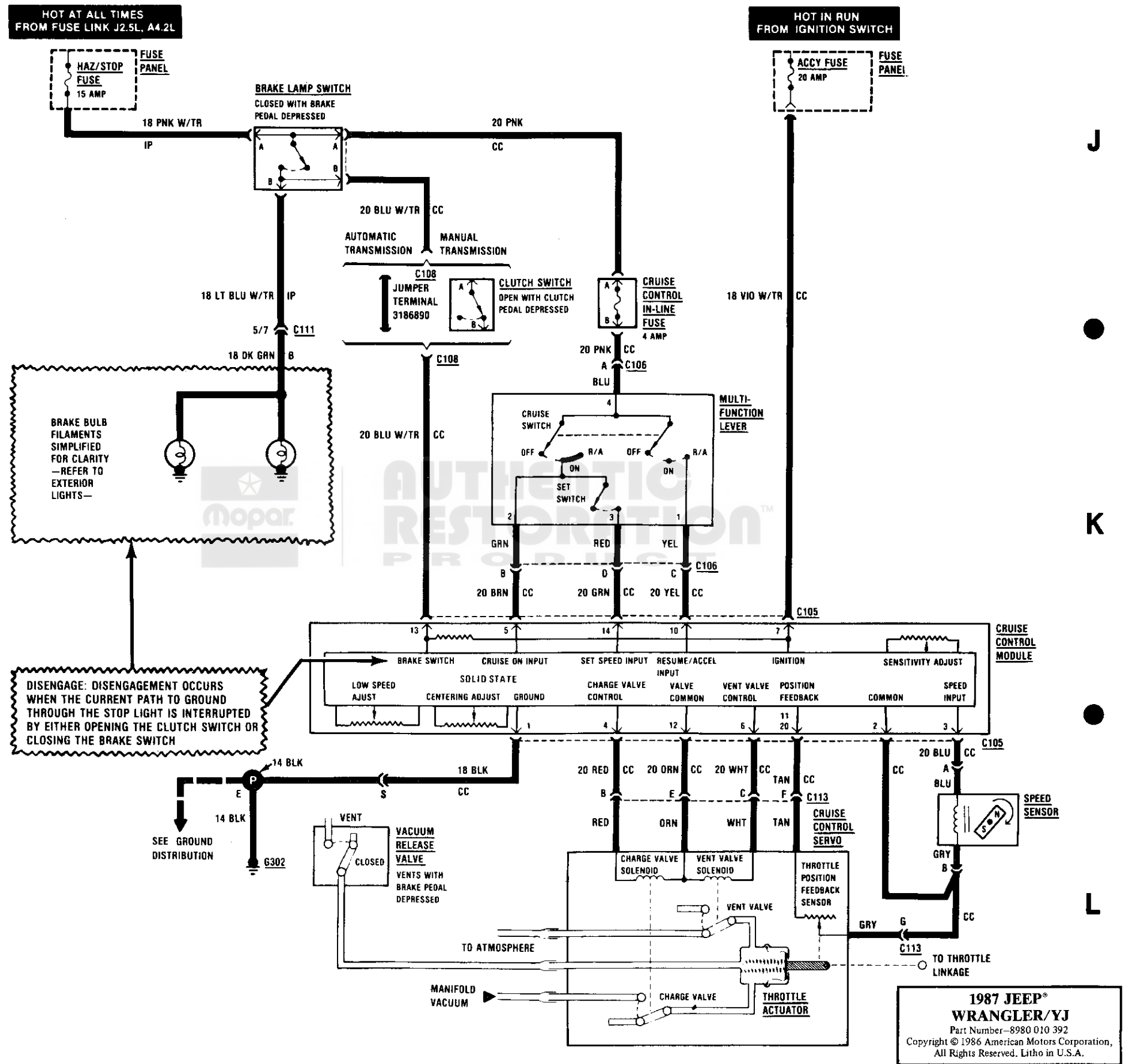


GAUGE PACKAGE



CRUISE CONTROL

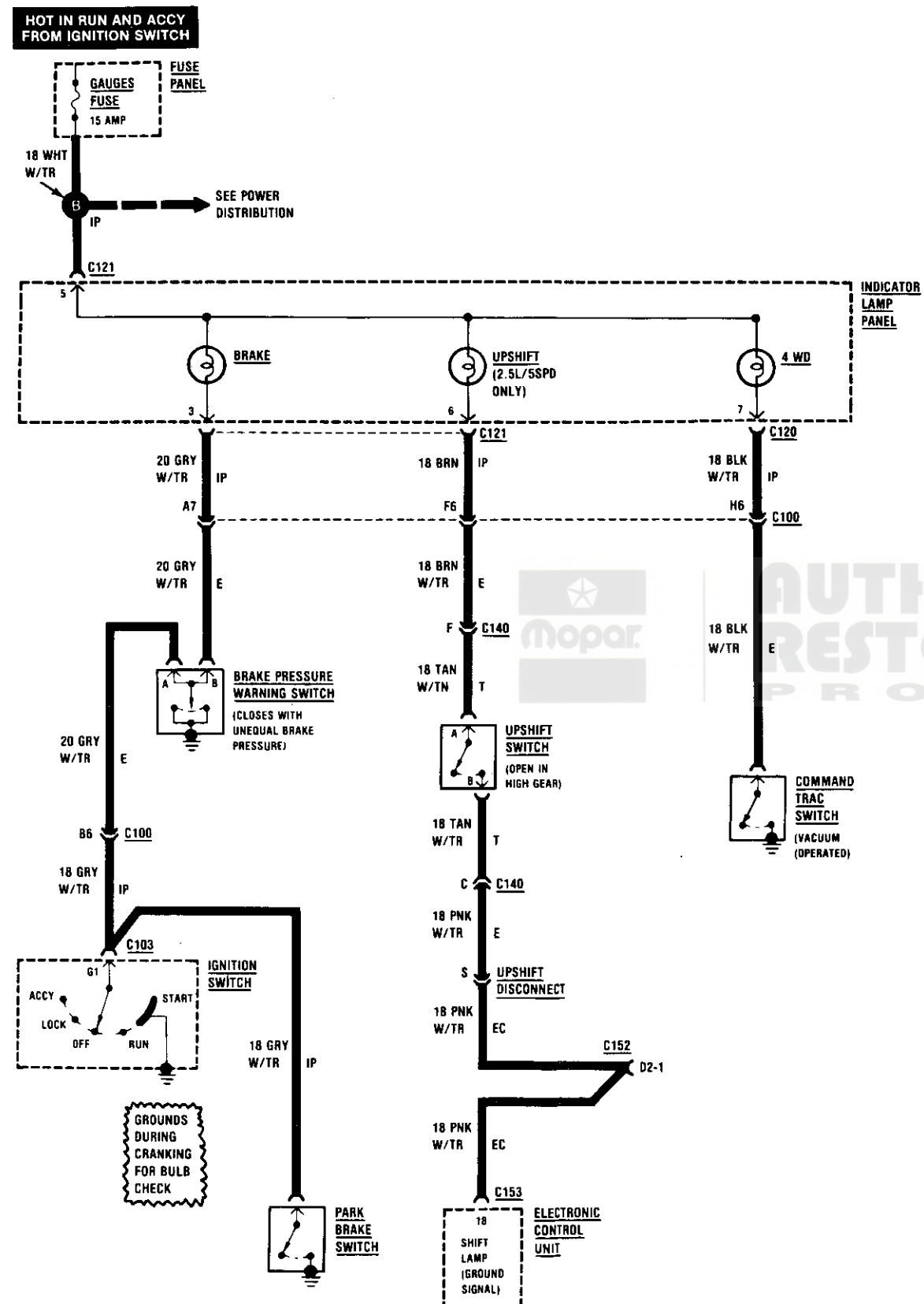
UGE
CKAGE



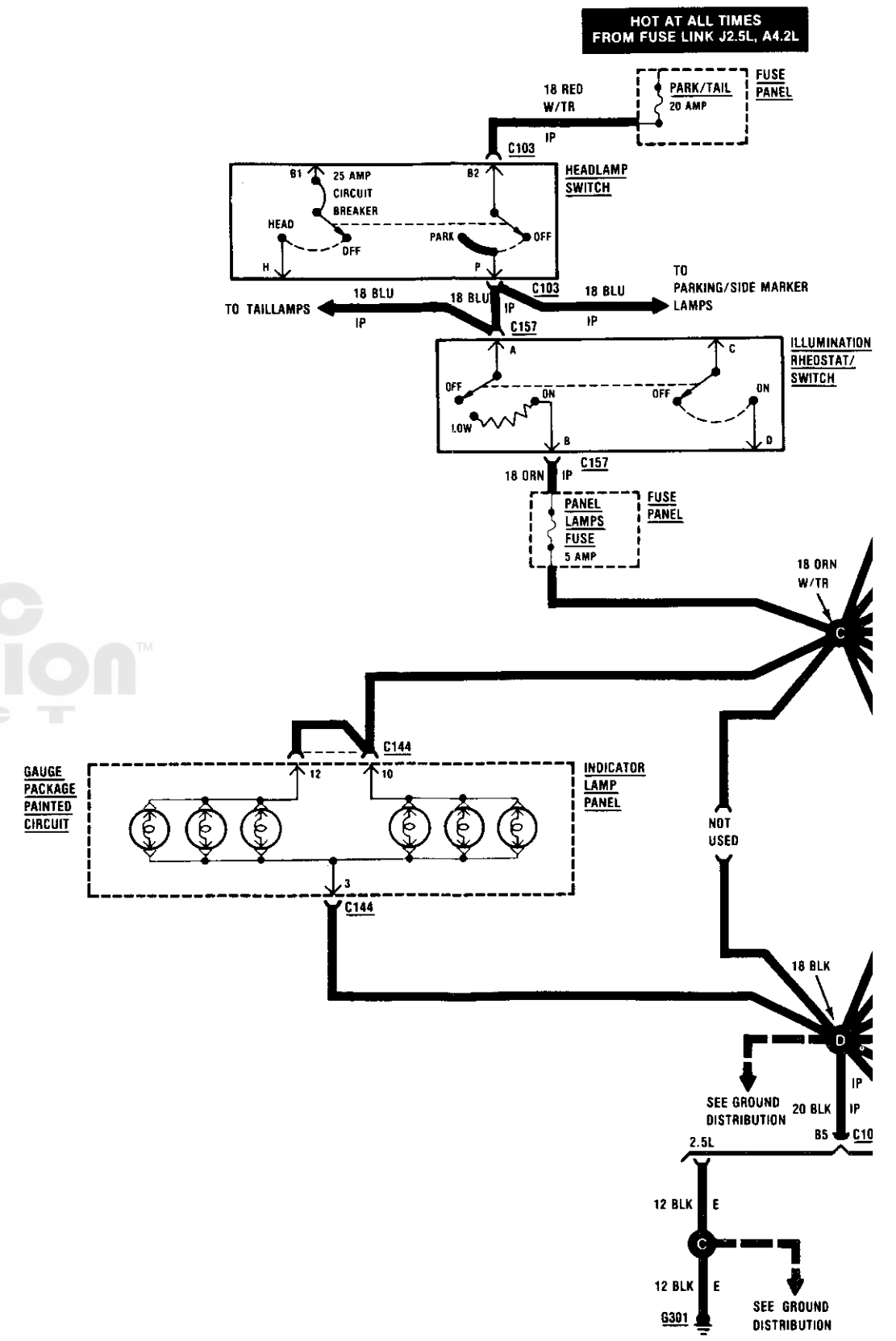
16 LT GRN
W/TR



INDICATOR LAMPS

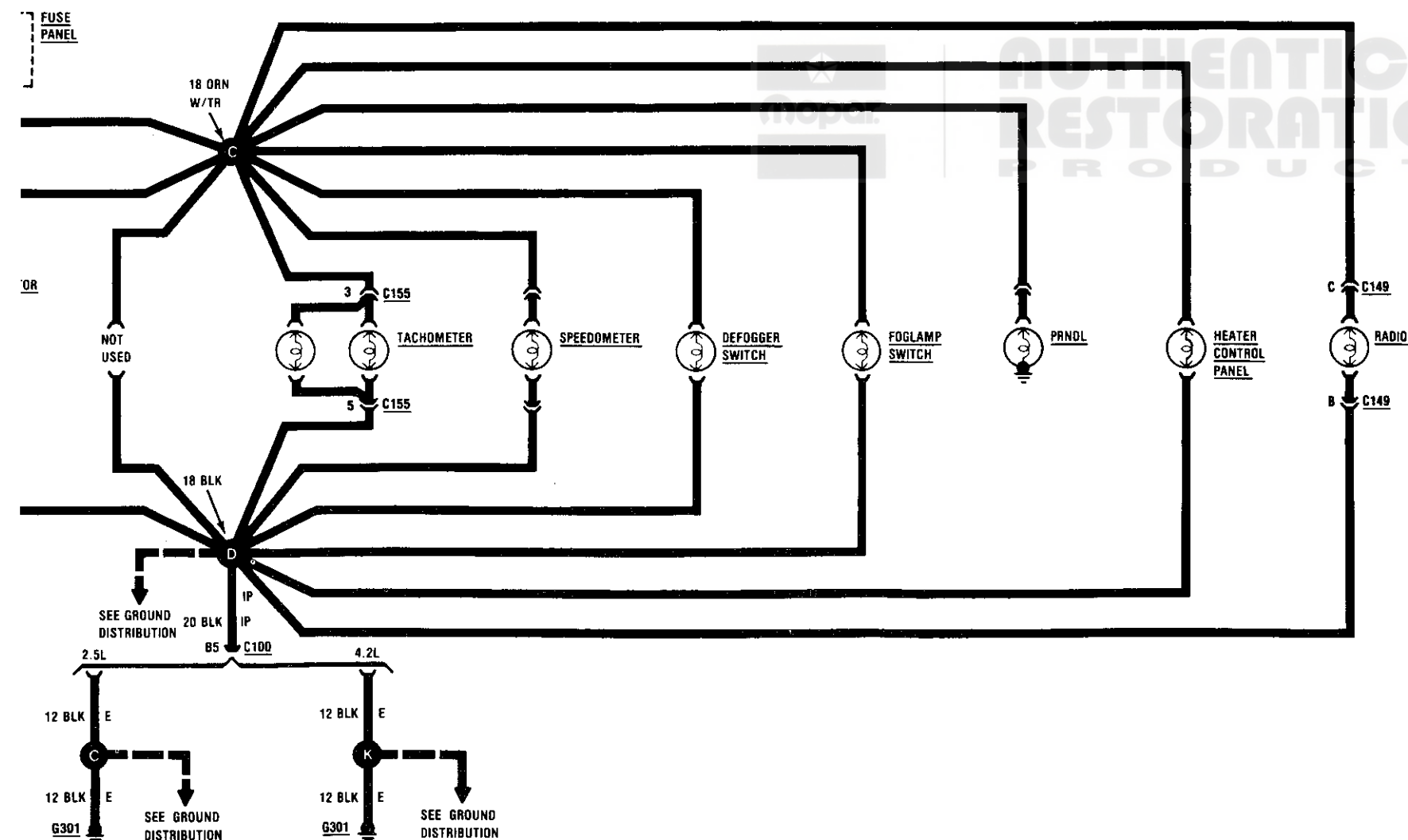
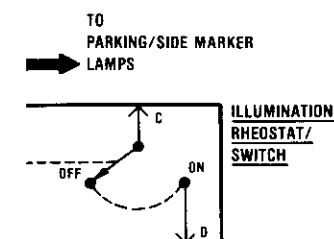


INSTRUMENT P

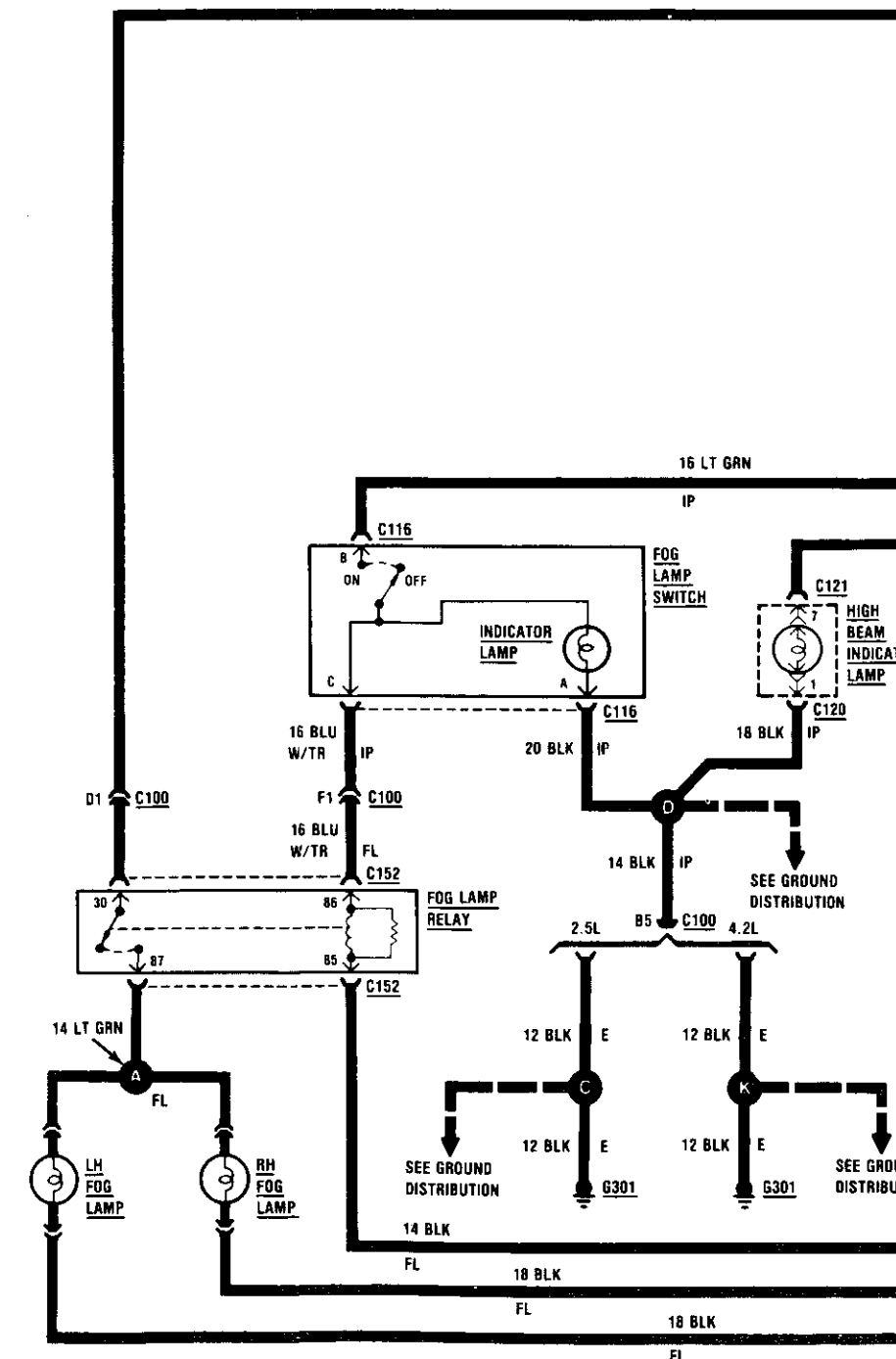


INSTRUMENT PANEL ILLUMINATION LAMPS

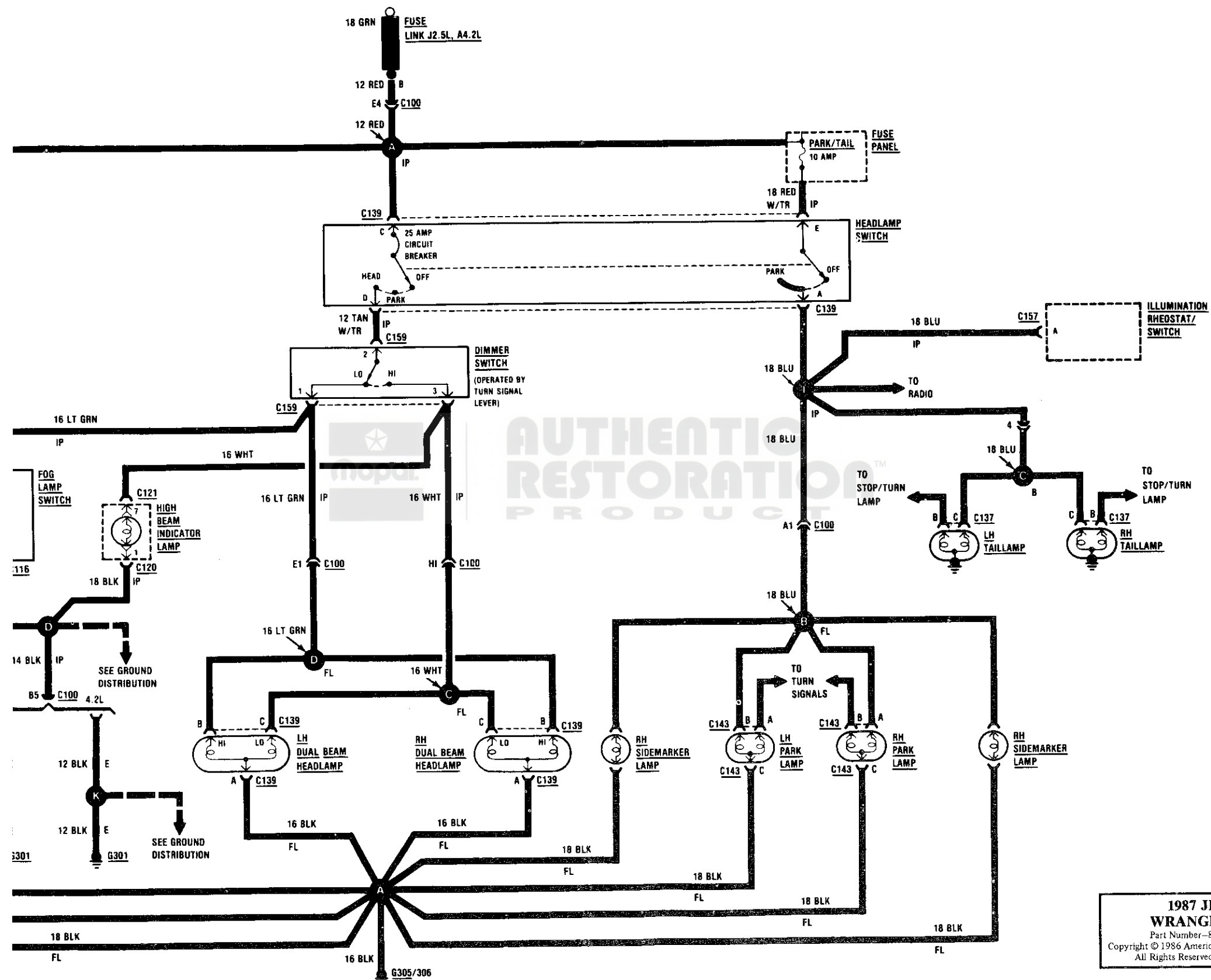
HOT AT ALL TIMES
FUSE LINK J2.5L, A4.2L



LAMPS: H

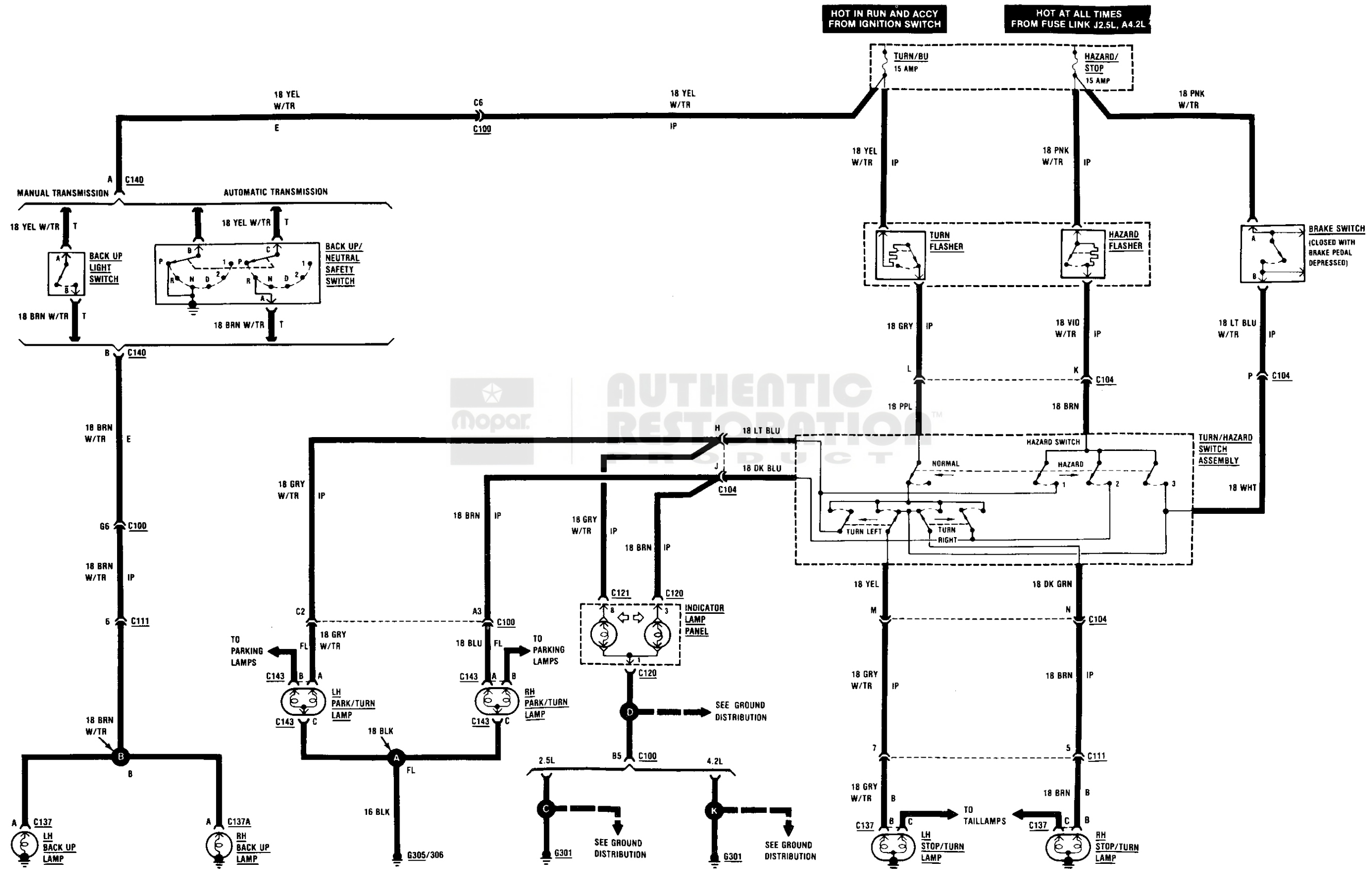


LAMPS: HEAD/TAIL/SIDEMARKER/FOG/PARK

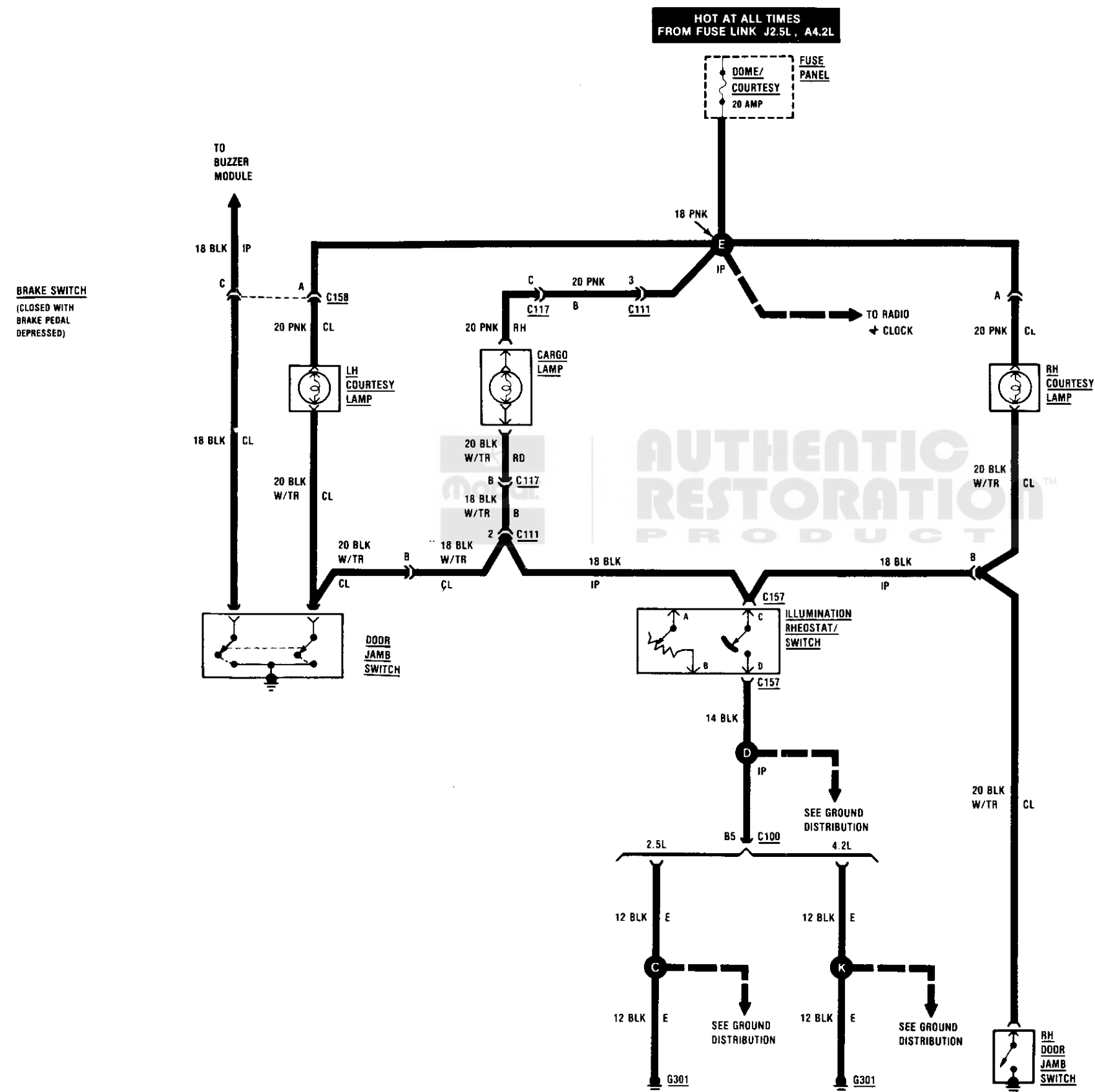


1987 JEEP®
WRANGLER/YJ
Part Number—8980 010 393
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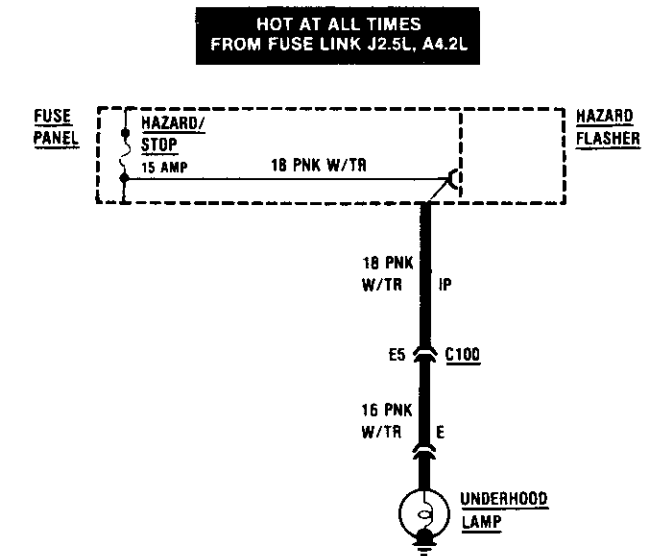
LAMPS: TURN SIGNAL / STOP / HAZARD / BACKUP



LAMPS: CARGO / COURTESY



UNDERHOOD LAMP



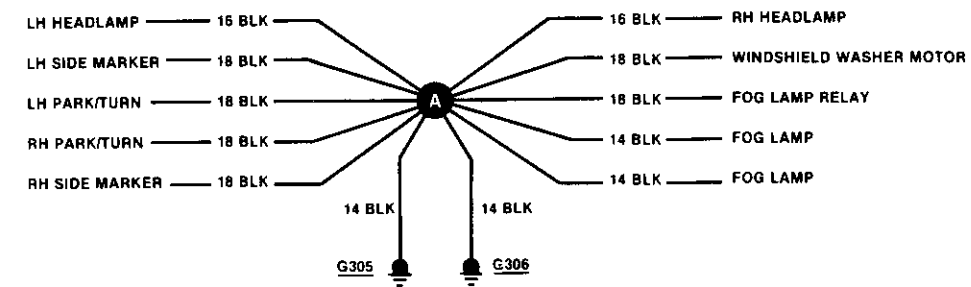
P

Q

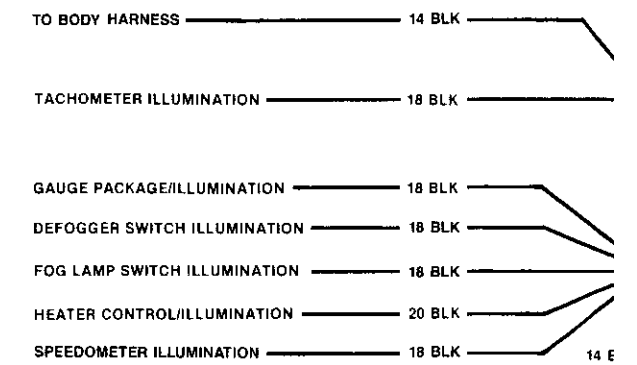
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GROUND DISTRIBUTION

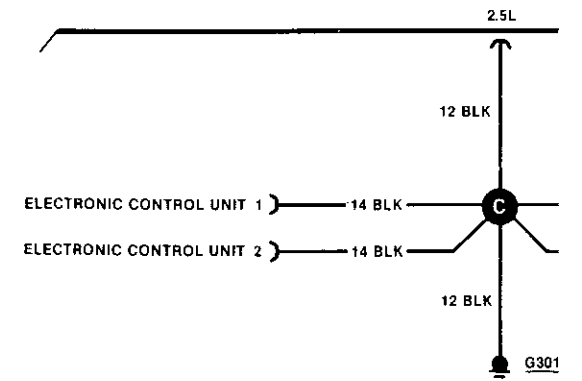
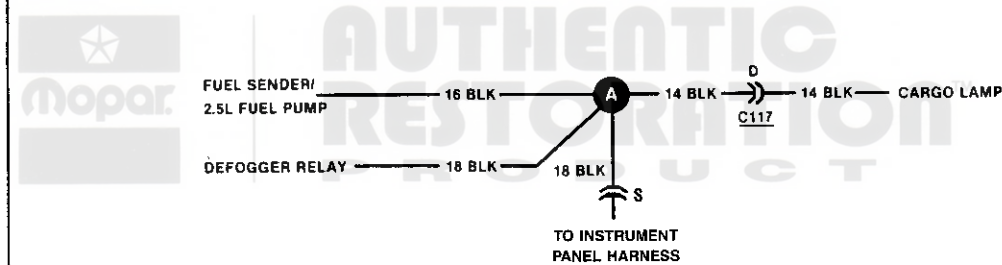
G305/G306 FRONT LIGHTING



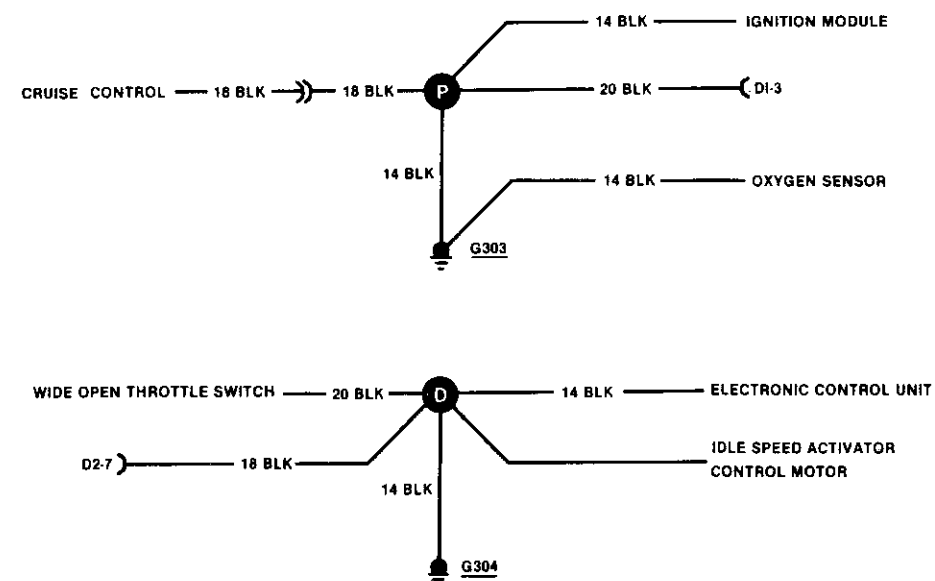
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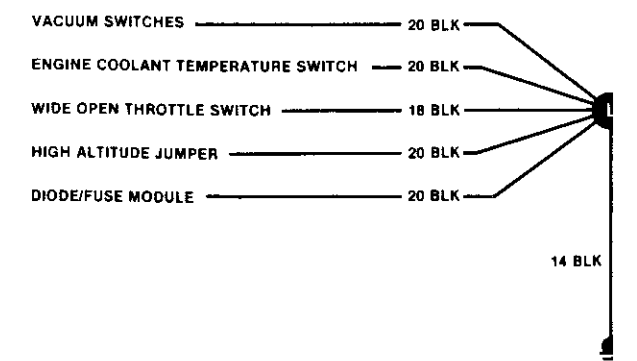
G307 BODY



G303/G304 2.5L ENGINE CONTROLS



G3 4.2L ENGINE



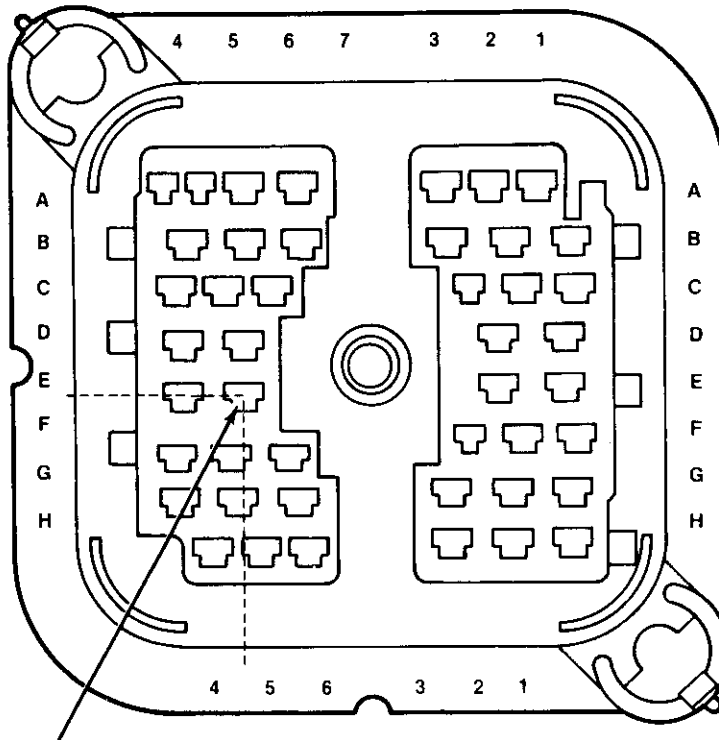
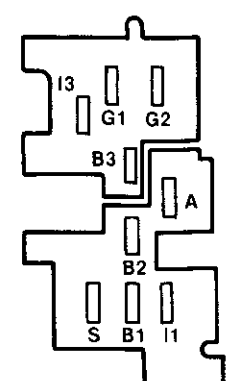
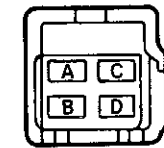
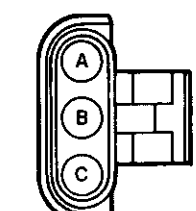
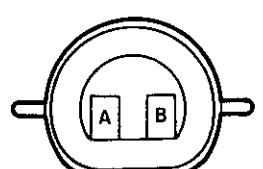
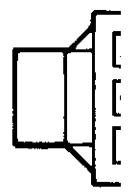
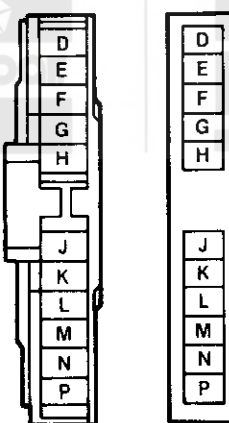
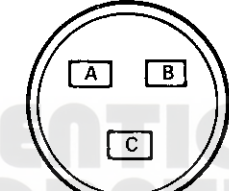
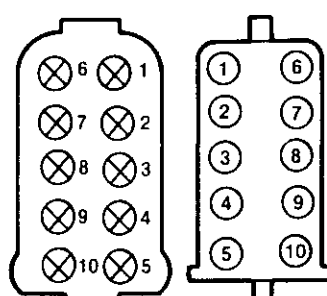
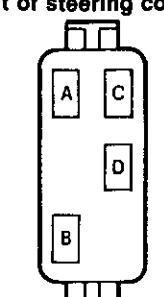
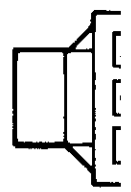
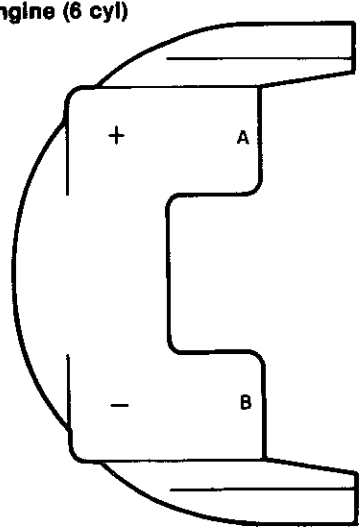
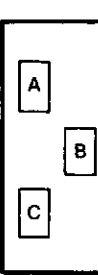
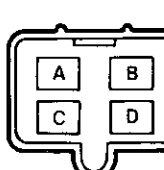
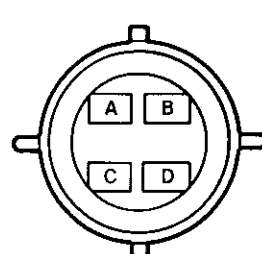
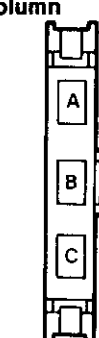
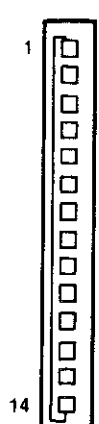
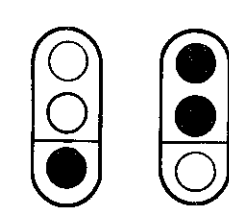
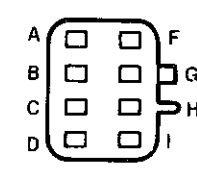
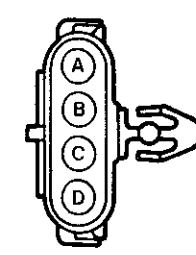
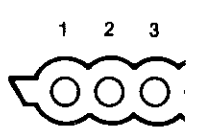
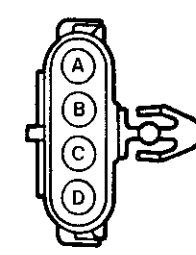
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Wiring diagram for the L terminal of the 1000 Series:

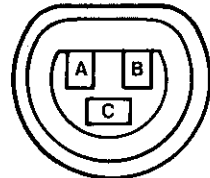
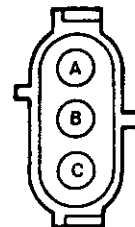
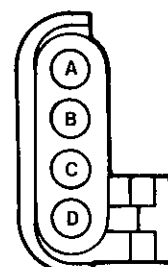
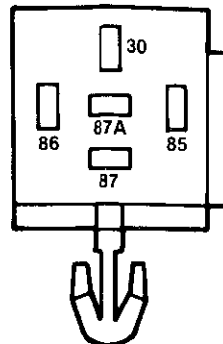
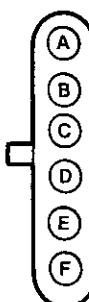
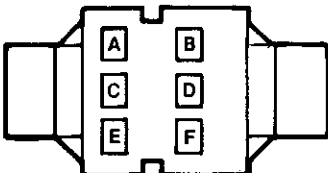
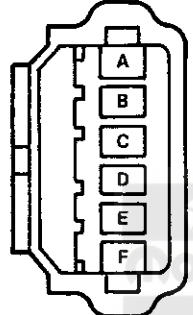
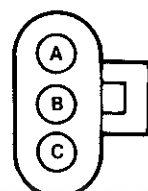
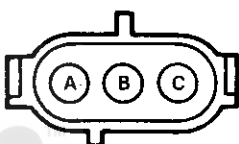
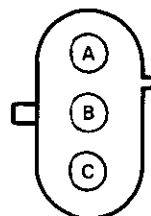
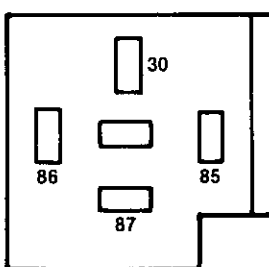
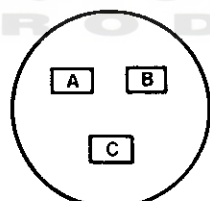
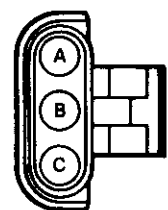
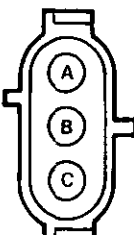
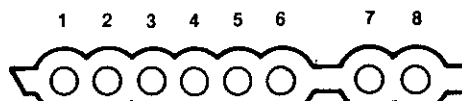
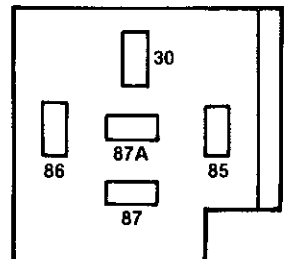
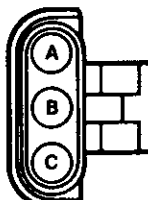
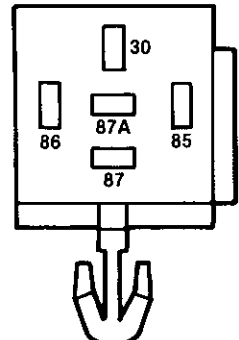
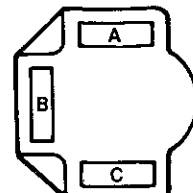
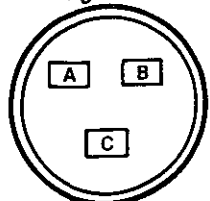
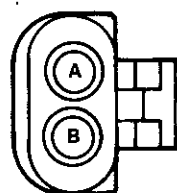
- 20 BLK
- FITCH 20 BLK
- 18 BLK
- 20 BLK
- 20 BLK
- 18 BLK CONTROL UNIT (MCU)
- 20 BLK DI-7
- 20 BLK THERMO ELECTRIC SWITCH
- 14 BLK MICROPROCESSOR CONTROL UNIT (MCU)
- 14 BLK MICROPROCESSOR CONTROL UNIT (MCU)
- 14 BLK OXYGEN SENSOR
- 14 BLK (connected to G302)

SIDE 2 OF 3

COMPONENT CONNECTOR VIEWS

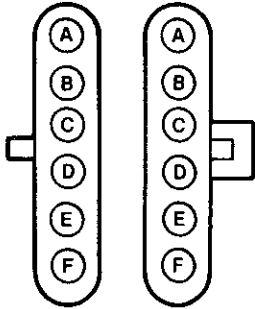
C100: Dash panel  EXAMPLE E5	C103: Ignition switch Steering column behind instrument panel 	C106: Cruise control multifunction lever Turn signal lever 	C110: Vacuum switches Behind valve cover on dash panel 	C114: Ignition module—4.2L Below windshield washer reservoir 	C118: Body harness Upper LH shroud 
	C104: Turn signal switch Below ignition switch 	C107: A/C pressure switch Top of receiver/dryer located in right front corner of engine compartment 	C111: Body harness Above parking brake 	C115: Defogger switch To right of steering column 	C119: Stepper motor Rear of carburetor 
C101: Coil Left of battery on dash panel (4 cyl) Center of cylinder block on rt. side of engine (6 cyl) 	C102: Horn relay Above and to left of fuse panel 	C108: Air management solenoid assembly Top of valve cover near dash panel 	C112: Ignition module—4.2L Below windshield washer reservoir 	C116: Foglamps switch Below and to the right of steering column 	C120: Indicator lamp Left side of heater 
	C105: Cruise control module Below fuse panel 	C109: A/C blower motor Plugs on fuse panel 	C113: Cruise control servo Left fender apron 	C117: Roof harness Above left rear tail lamp 	C121: Indicator lamp Beside rheostat switch 
				C122: Electric chime Lower rt. side of engine 	

COMPONENT CONNECTOR VIEWS

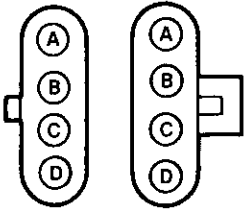
2.2L reservoir	C118: Body harness Upper LH shroud		C123: Distributor Center of cylinder block on rt. side of engine		C127: Oxygen sensor Behind left engine mount (4 cyl) Below EGR valve (6 cyl)		C132: Idle speed actuator Front of throttle body on right side		C136: B + latch relay Rt. of battery		C140: Transmission h Rt. side of bell housi	
	C119: Stepper motor—2.5L Rear of carburetor		C124: Diode/fuse assembly Rear corner of engine compartment behind diagnostic connectors		C128: Throttle position sensor Rear of throttle body near bottom		C133: Speed sensor Left side of transmission bellhousing		C137: Taillamp Below tail lamp assembly		C141: 4.2L Microproce Under instrument pan housing	
	C120: Indicator lamps Left side of heater control		C125: Idle relay Rt. of battery		C129: Power steering switch Right of power steering pump		C134: Map sensor Behind valve cover on dash panel		C138: Fuel sender Lt. of fuel tank			
	C121: Indicator lamps Beside rheostat switch		C126: Manifold heater relay Rt. of battery		C130: Ignition module—2.5L Below windshield washer reservoir on dash panel		C135: Fuel pump relay Rt. side of battery		C139: Headlamp Behind headlamp			
	C122: Electric choke switch Lower rt. side of engine block			C131: Ignition module—2.5L Left of battery on dash panel								

COMPONENT CONNECTOR VIEWS

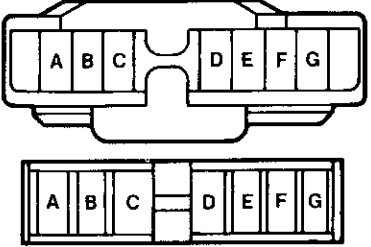
C140: Transmission harness
Rt. side of bell housing



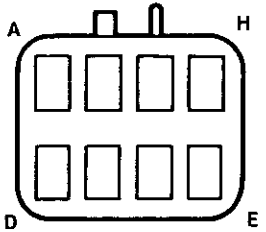
C142: Idle disconnect
Beside starter relay



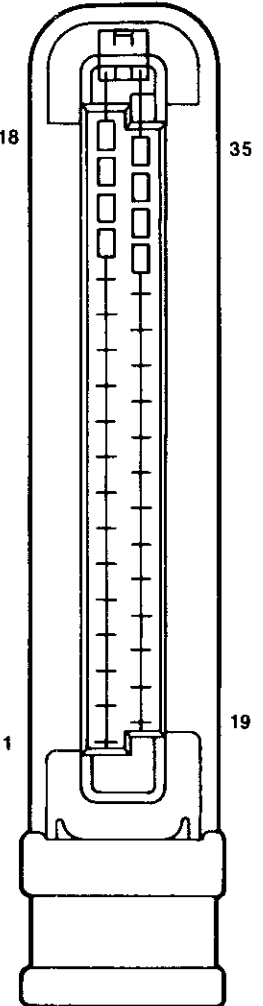
C145 A/B: Wiper switch
Turn signal lever stalk



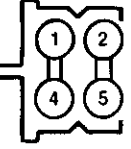
C149: Radio
Behind radio



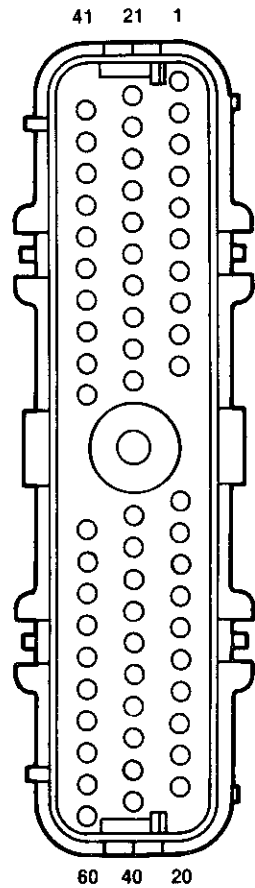
C153: 2.5L Electronic control unit (ECU)
Under instrument panel left of blower housing



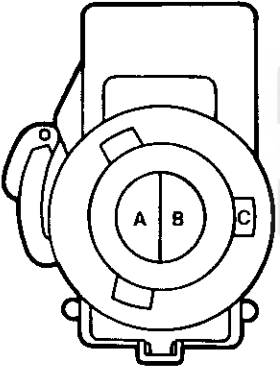
C155: Tachometer
Behind tach



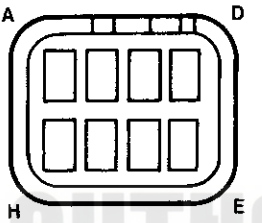
C141: 4.2L Microprocessor control unit (MCU)
Under instrument panel left of blower housing



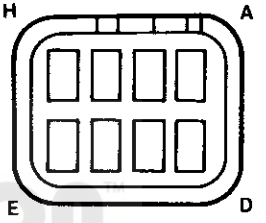
C143: Park/turn lamp
Below headlamps



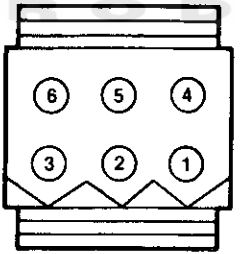
C146: Wiper motor
Lower left corner of windshield housing



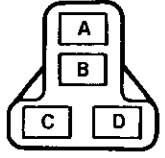
C150: Radio
Behind radio



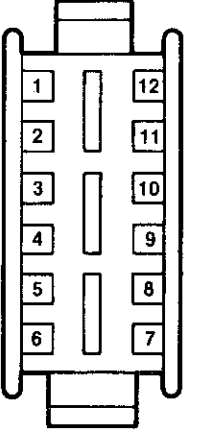
C147: Diagnostic connector D1
Right of battery



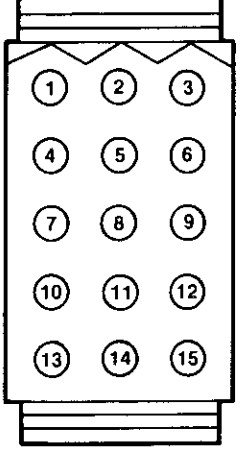
C151: Blower switch
Left of heater controls



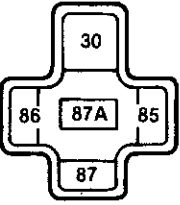
C144: Gauge package
Behind gauge package



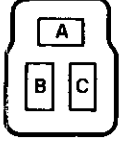
C148: Diagnostic connector D2
Right of battery



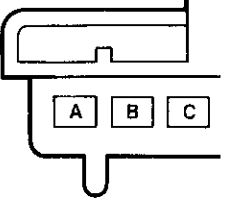
C152: Fog lamp relay
Behind left headlamp



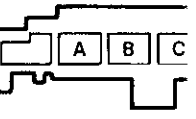
C154: Blower resistor
Behind right speaker grille above air vent door on blower housing



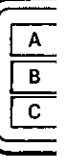
C156: Headlamp switch
Below and to the left of s



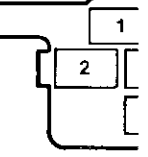
C157: Illumination rheostat
Behind rheostat

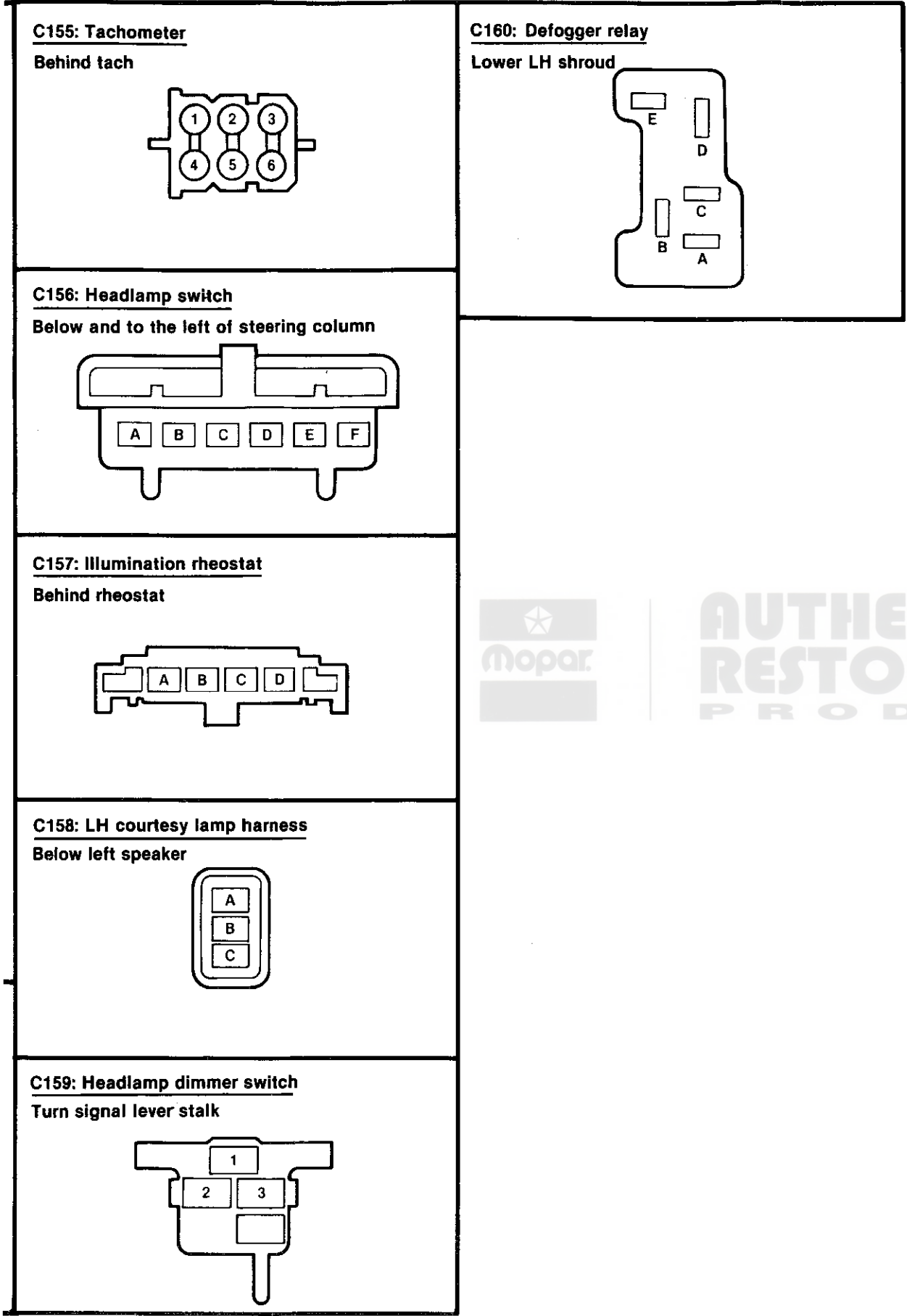


C158: LH courtesy lamp t
Below left speaker



C159: Headlamp dimmer s
Turn signal lever stalk

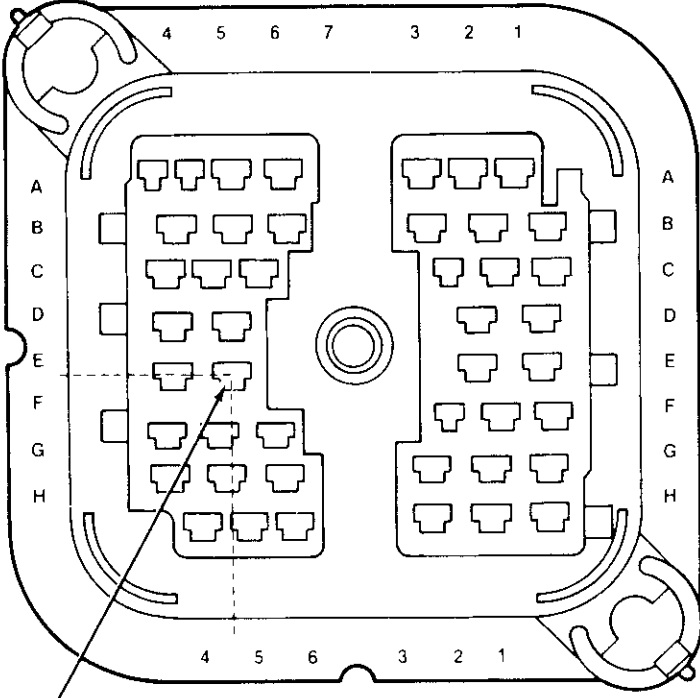
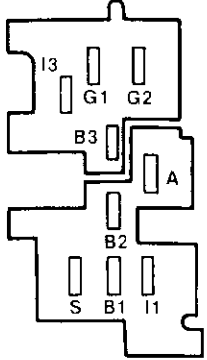
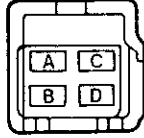
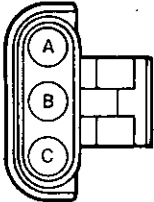
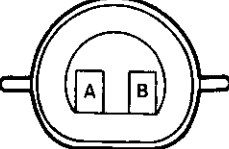
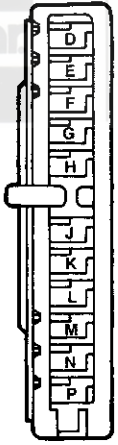
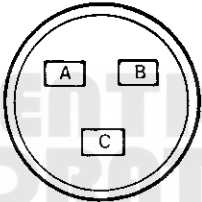
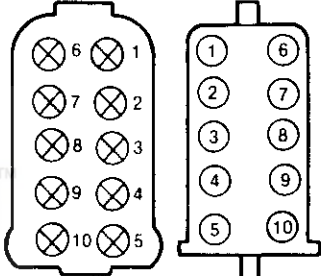
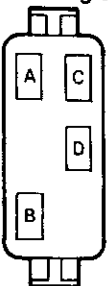
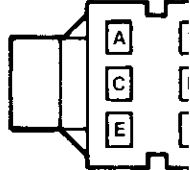
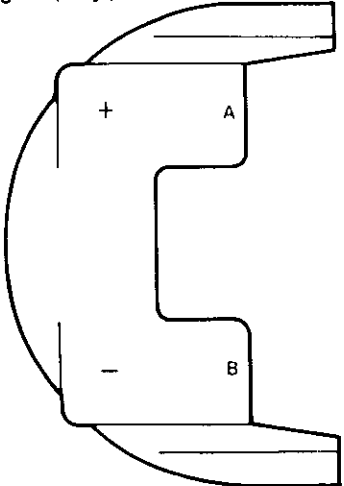
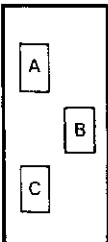
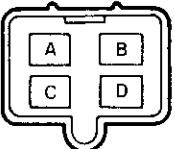
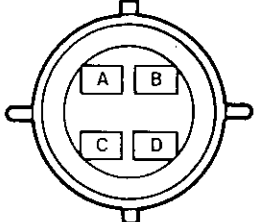
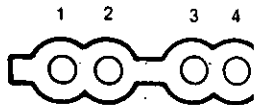
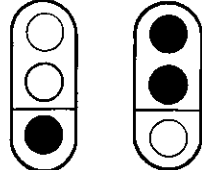
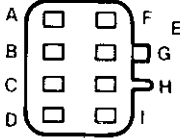
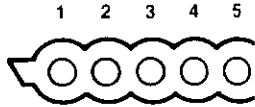
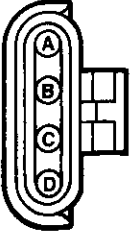
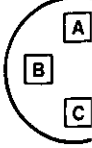




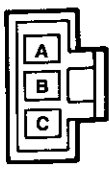
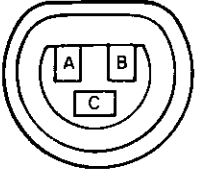
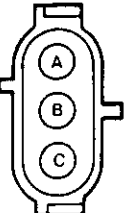
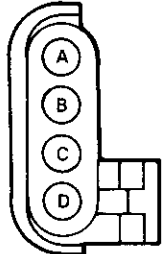
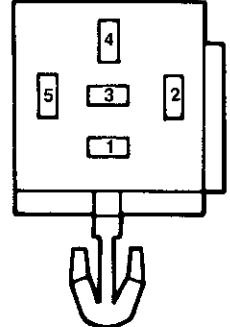
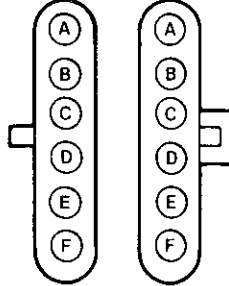
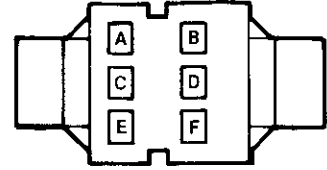
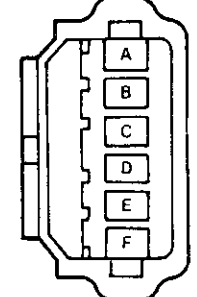
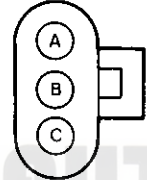
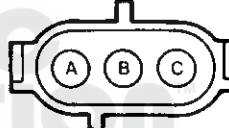
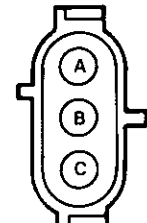
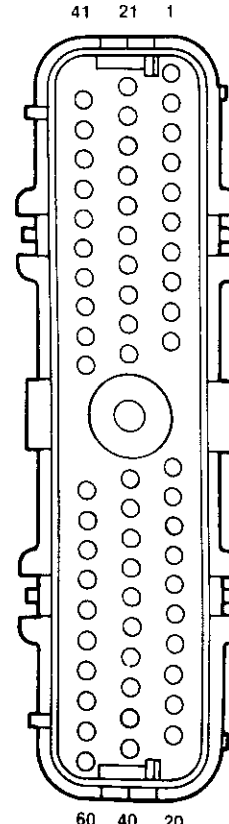
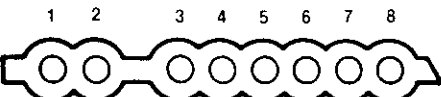
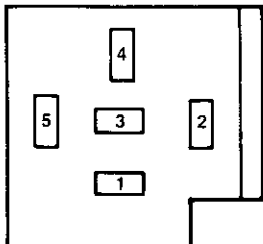
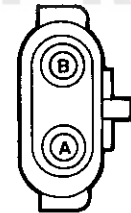
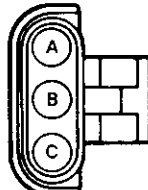
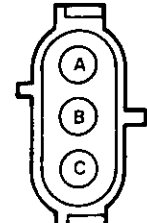
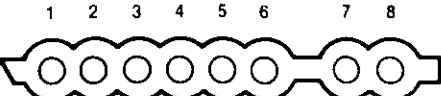
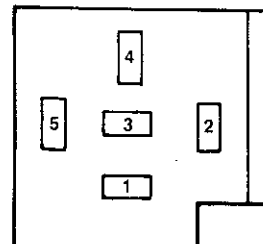
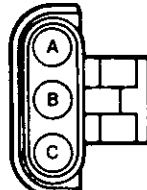
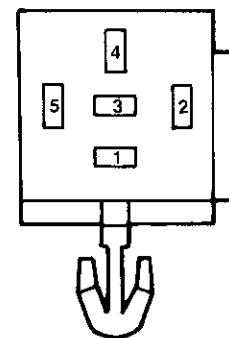
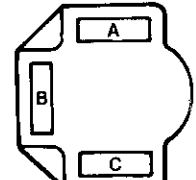
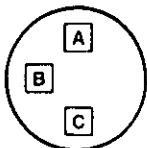
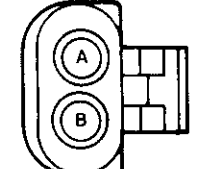
**AUTHENTIC
RESTORATIONTM**
PRODUCT

**1987 JEEP®
WRANGLER/YJ**
Part Number—8980 010 394
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COMPONENT CONNECTOR VIEWS

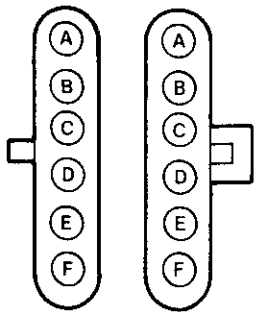
C100: Dash panel  EXAMPLE E5	C103: Ignition switch Steering column behind instrument panel 	C106: Cruise control multifunction lever Turn signal lever 	C110: Vacuum switches Behind valve cover on dash panel 	C114: Ignition module—4.2L Below windshield washer reservoir 	C118: Body harness Upper LH shroud 
	C104: Turn signal switch Below ignition switch 	C107: A/C pressure switch Top of receiver/dryer located in right front corner of engine compartment 	C111: Body harness Above parking brake 	C115: Defogger switch To right of steering column 	C119: Stepper motor—2 Rear of carburetor 
C101: Coil Left of battery on dash panel (4 cyl) Center of cylinder block on rt. side of engine (6 cyl) 	C102: Horn relay Above and to left of fuse panel 	C108: Air management solenoid assembly Top of valve cover near dash panel 	C112: Ignition module—4.2L Below windshield washer reservoir 	C116: Foglamps switch Below and to the right of steering column 	C120: Indicator lamps Left side of heater control 
		C105: Cruise control module Below fuse panel 	C109: A/C blower motor Plugs on fuse panel 	C113: Cruise control servo Left fender apron 	C121: Indicator lamps Beside rheostat switch 
			C117: Roof harness Above left rear tail lamp 	C122: Electric choke sw Lower rt. side of engine 	

COMPONENT CONNECTOR VIEWS

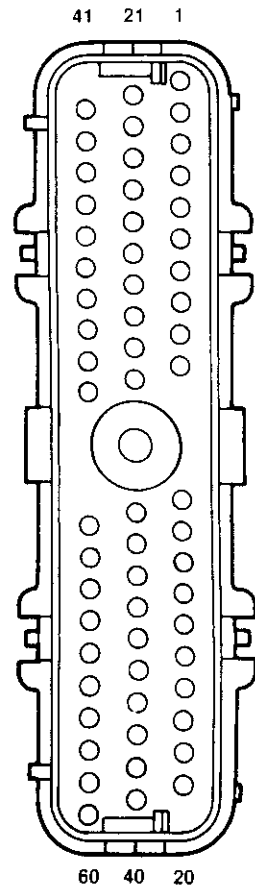
C118: Body harness Upper LH shroud 	C123: Distributor Center of cylinder block on rt. side of engine 	C127: Oxygen sensor Behind left engine mount (4 cyl) Below EGR valve (6 cyl) 	C132: Idle speed actuator Front of throttle body on right side 	C136: B + latch relay Rt. of battery 	C140: Transmission harness Rt. side of bell housing 
C119: Stepper motor—2.5L Rear of carburetor 	C124: Diode/fuse assembly Rear corner of engine compartment behind diagnostic connectors 	C128: Throttle position sensor Rear of throttle body near bottom 	C133: Speed sensor Left side of transmission bellhousing 	C137: Taillamp Below tail lamp assembly 	C141: 4.2L Microprocessor control Under instrument panel to left of housing 
C120: Indicator lamps Left side of heater control 	C125: Idle relay Rt. of battery 	C129: Wide-open throttle switch Left of throttle body 	C134: Map sensor Behind valve cover on dash panel 	C138: Fuel sender Lt. of fuel tank 	
C121: Indicator lamps Beside rheostat switch 	C126: Manifold heater relay Rt. of battery 	C130: Ignition module—2.5L Below windshield washer reservoir on dash panel 	C135: Fuel pump relay Rt. side of battery 	C139: Headlamp Behind headlamp 	
C122: Electric choke switch Lower rt. side of engine block 		C131: Ignition module—2.5L Left of battery on dash panel 			

COMPONENT CONNECTOR VIEWS

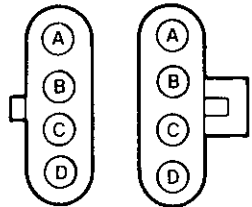
C141: Transmission harness
Side of bell housing



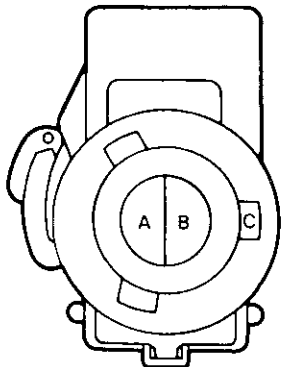
C142: 4.2L Microprocessor control unit (MCU)
Under instrument panel to left of blower housing



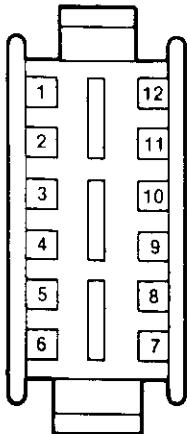
C142: Idle disconnect
Beside starter relay



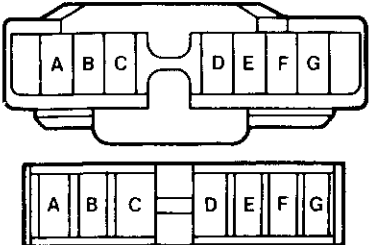
C143: Park/turn lamp
Below headlamps



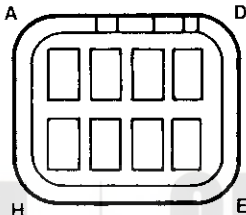
C144: Gauge package
Behind gauge package



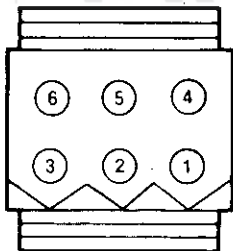
C145 A/B: Wiper switch
Turn signal lever stalk



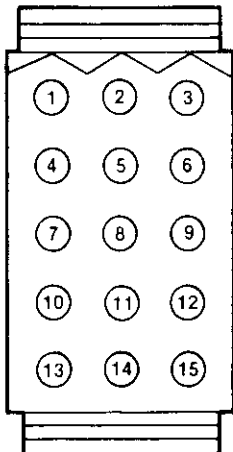
C146: Wiper motor
Lower left corner of windshield housing



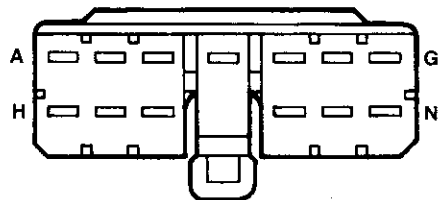
C147: Diagnostic connector D1
Right of battery



C148: Diagnostic connector D2
Right of battery



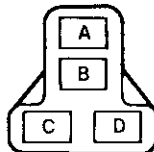
C149: Radio
Behind radio



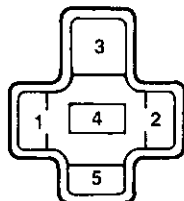
C150: Brake pressure switch
At master cylinder



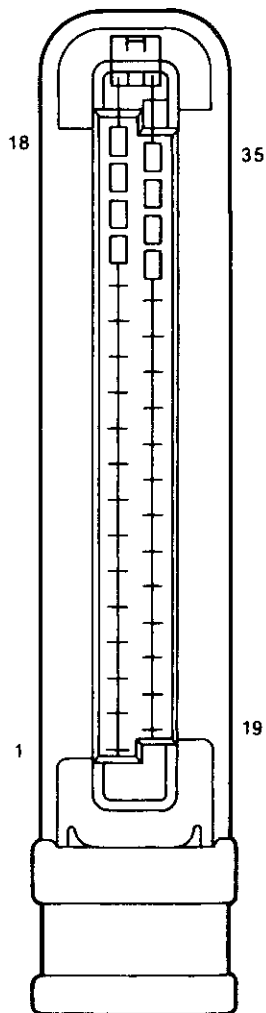
C151: Blower switch
Left of heater controls



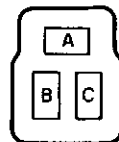
C152: Fog lamp relay
Behind left headlamp



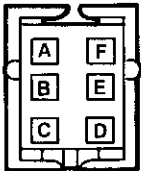
C153: 2.5L Electronic control unit (ECU)
Under instrument panel to left of blower housing



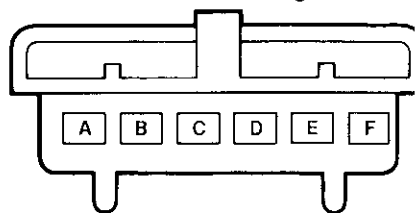
C154: Blower resistor
Behind right speaker grille above air vent door on blower housing



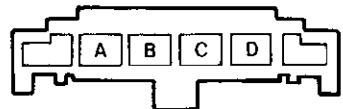
C155: Tachometer
Behind tach



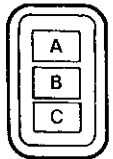
C156: Headlamp switch
Below and to the left of steering column



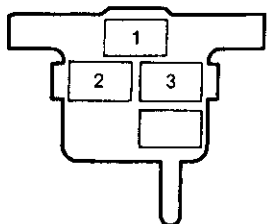
C157: Illumination rheostat
Behind rheostat



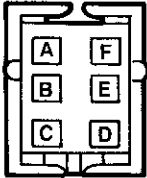
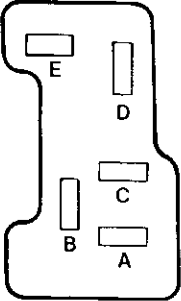
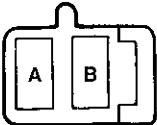
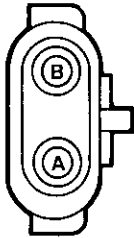
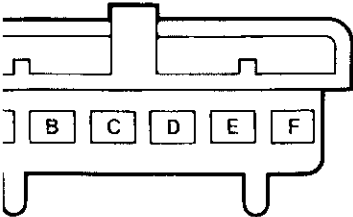
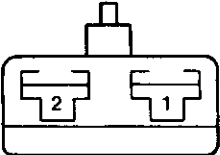
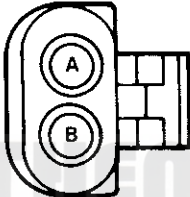
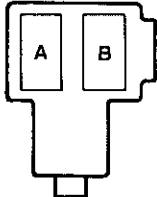
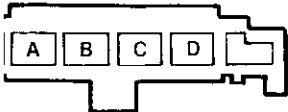
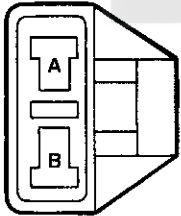
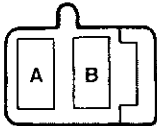
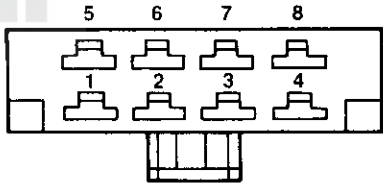
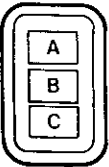
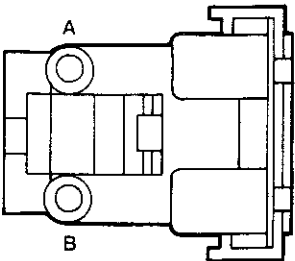
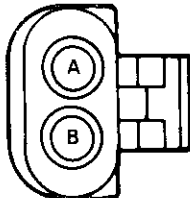
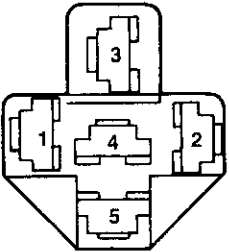
C158: LH courtesy lamp harness
Below left speaker



C159: Headlamp dimmer switch
Turn signal lever stalk

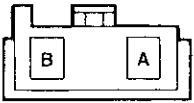
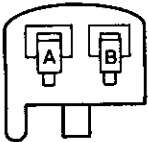
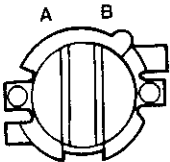
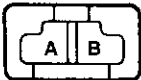
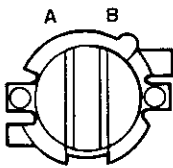
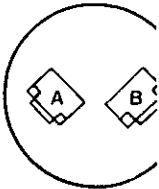
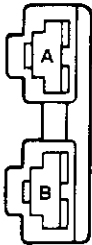
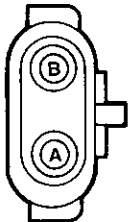
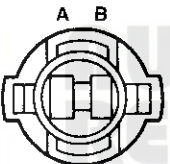
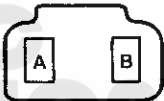
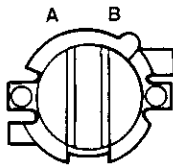
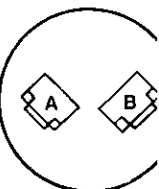
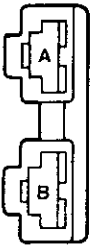
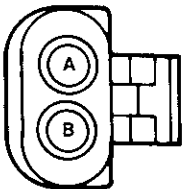
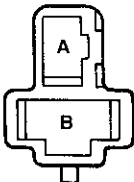
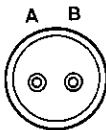
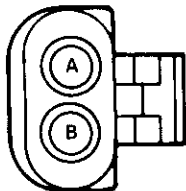
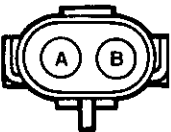
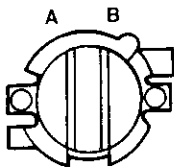
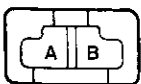
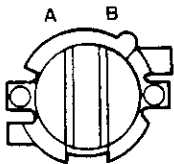
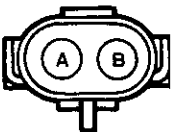


COMPONENT CONNECTOR VIEWS

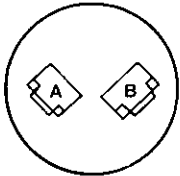
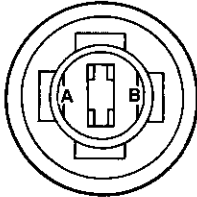
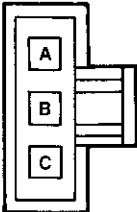
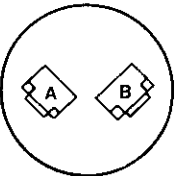
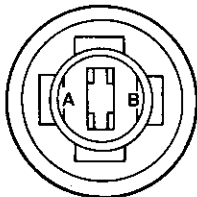
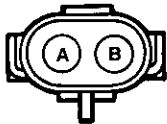
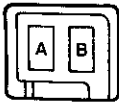
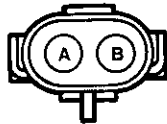
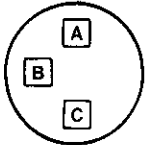
<u>meter</u> 	<u>C160: Defogger relay</u> Lower LH shroud 	<u>C164: Transmission jumper</u> Near transmission (automatic) 	<u>C168: Wide open throttle switch</u> On throttle body 
<u>ump switch</u> the left of steering column 	<u>C161: alternator</u> RH front of engine 	<u>C165: Engine coolant temperature sensor - 2.5L</u> LH rear of engine 	<u>C169: PCV solenoid</u> On front of engine 
<u>ation rheostat</u> tat 	<u>C162: EGR evaporator canister solenoid</u> Lower front of LH shock tower 	<u>C166: High altitude jumper</u> Near microprocessor control unit (MCU) 	<u>C171: Buzzer module</u> Bottom of fuse block 
<u>urtesy lamp harness</u> eaker 	<u>C163: Fuel injector</u> Upper rear of engine 	<u>C167: Thermo-Electric switch</u> On air cleaner housing 	<u>C172: Radio illumination relay</u> Behind instrument panel 

1988 JEEP®
WRANGLER/YJ
Part Number—8980 010 721
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COMPONENT CONNECTOR VIEWS

C173: Speedometer Behind speedometer 	C177: Speed sensor Above accelerator pedal 	C181: Fog lamp switch lamp At fog lamp switch 	C208: Right speaker Bottom of speaker 	C222: Tachometer illumination Behind tachometer 	C227: Turn flasher Above fuse block 
C174: Brake switch On brake pedal lever 	C178: Engine coolant temperature switch - 4.2L LH rear of engine 	C182: Heater control panel lamp Behind heater control panel 	C212: Cruise control inline fuse Near multi-function lever 	C224: Radio lamp Behind radio face 	C228: Hazard flasher Above fuse block 
C175: Brake switch On brake pedal lever 	C179: Air temperature sensor Top of intake manifold 	C206: Windshield washer pump On washer fluid reservoir 	C215: Upshift switch On transmission (manual) 	C225: Back up lamp switch On transmission (manual) 	C229: LH fog lamp Below fog lamp 
C176: RH courtesy lamp harness Behind courtesy lamp 	C180: Defogger switch lamp At defogger switch 	C207: Left speaker Bottom of speaker 	C221: Tachometer illumination Behind tachometer 	C226: Back up/neutral safety switch On transmission (automatic) 	C230: RH fog lamp Below fog lamp 

SINGLE PIN CONN

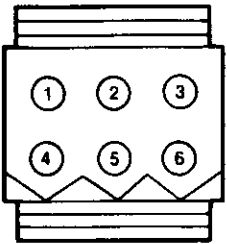
C227: Turn flasher Above fuse block 	C231: LH sidemarker lamp Behind sidemarker lamp 	C252: Emission maintenance timer Below radio 
C228: Hazard flasher Above fuse block 	C232: RH sidemarker lamp Behind sidemarker lamp 	
C229: LH fog lamp Below fog lamp 	C233: Seat belt switch In driver's seat belt buckle 	
C230: RH fog lamp Below fog lamp 	C246: Power steering switch Left of power steering pump 	

C170 - Near starter solenoid	⊙	C198 - Near radio
C183 - Near defogger relay	■	C199 - Near cigar lighter
C184 - At fuse panel	■	C200 - Near underhood lamp
C185 - Upshift light disconnect	⊙	C201 - At horn
C186 - At thermostatic control	●	C202 - At horn switch
C187 - Near low pressure switch	■	C203, C204 - At defogger grid
C188 - Near blower motor	●	C205 - At LH door jamb switch
C189 - At filter capacitor	●	C209 - At RH door jamb switch
C190 - At knock sensor	⊙	C210 - At oil pressure sender
C191 - At idle solenoid	■	C211 - At coolant temperature sender
C192 - At park neutral switch	●	C213 - Near cruise control module
C193 - At electric choke	■	C214 - At park brake switch
C194 - At manifold heater switch	●	C216 - Near ECU
C195 - At manifold heater	■	C217 - At command trac switch
C196, C197 - At cigar lighter	■	C218, C219 - At heat/off microswitch

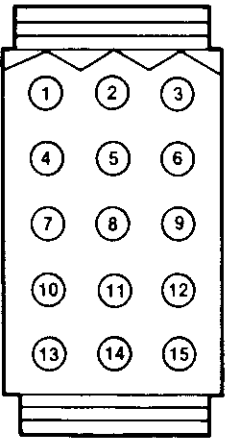
36 PIN CONNECTORS

radio	●	C220 - At blower motor	●
cigar lighter	●	C223 - At PRNDL illumination	●
underhood lamp	■	C234, C235 - At cargo lamp	■
horn	■	C236 - At wiper motor	■
horn switch	●	C237, C238, C239, C240, C241, C242, C243 - At starter relay	■
- At defogger grid	■	C244, C245 - At door jamb switch	■
Left door jamb switch	■	C247 - At A/C compressor clutch	●
Right door jamb switch	■	C248 - At fuse panel	■
Oil pressure sender	●	C249 - At oxygen sensor (4.2L)	⊙
Coolant temperature sender	●	C250 - At fuse panel	■
Cruise control module	⊙	C251 - At radio connector	■
park brake switch	●		
ECU	⊙		
Command Trac switch	●		
- At heat/off microswitch	■		

DIAGNOSTIC CONNECTORS—2.5L

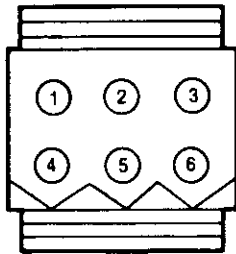


Terminal	Function
1	Tach. Signal
2	Ignition
3	Ground
4	Start Signal
5	Battery
6	Fuel Pump Relay



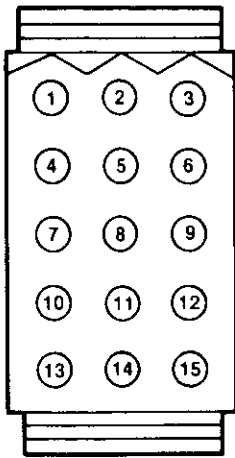
Terminal	Function
1	Shift Lamp
2	Latch Relay
3	P/N Switch
4	B+ Latch
5	Not Used
6	WOT Switch
7	Not Used
8	Air Temperature Sensor
9	Ignition Interface
10	EVAP/EGR
11	ISC Extend
12	Coolant Temperature Sensor
13	Closed Throttle Switch
14	ISC Retract
15	Not Used

DIAGNOSTIC CONNECTORS—4.2L



D1

Terminal	Function
1	Tach. Signal
2	Elec. Choke Switch
3	Ground
4	Start Signal
5	Idle Solenoid
6	Not Used



D2

Terminal	Function
1	PCV Switch
2	Idle Vacuum Solenoid
3	O ₂ Sensor
4	Ignition
5	Down Stream Solenoid
6	WOT Switch
7	Ground
8	Up Stream Solenoid
9	Vacuum Switch
10	Thermo-Electric Switch
11	Stepper Motor
12	Coolant Temperature Switch
13	Idle Relay
14	Stepper Motor
15	Vacuum Switch

CIRCUIT INDEX

CIRCUIT	ZONE
Air Conditioning	H-12
A/C Compressor Controls	H-12
Blower Controls	H-10
Charging System	H-5
Cigar Lighter	J-3
Coolant Temperature Gauge	K-9
Cruise Control	K-11
Engine Controls 2.5L	E-9
Engine Controls 4.2L	H-2
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—Backup	P-1
—Fog	M-10
—Hazard	P-3
—Headlights	M-10
—Park	P-3
—Sidemarkers	M-10
—Stop	P-3
—Turn	P-3
Fuel Gauge	K-9
Gauge Package	K-9
Heater	H-10
Horn	J-4
Indicators Lamps:	
—Brake	M-4
—Upshift	M-5
—4 Wheel Drive	M-5
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—Ignition Key	J-6
—Seatbelt	J-6
Wiper/Washer:	
—Intermittent	M-3
—Non-Intermittent	M-1

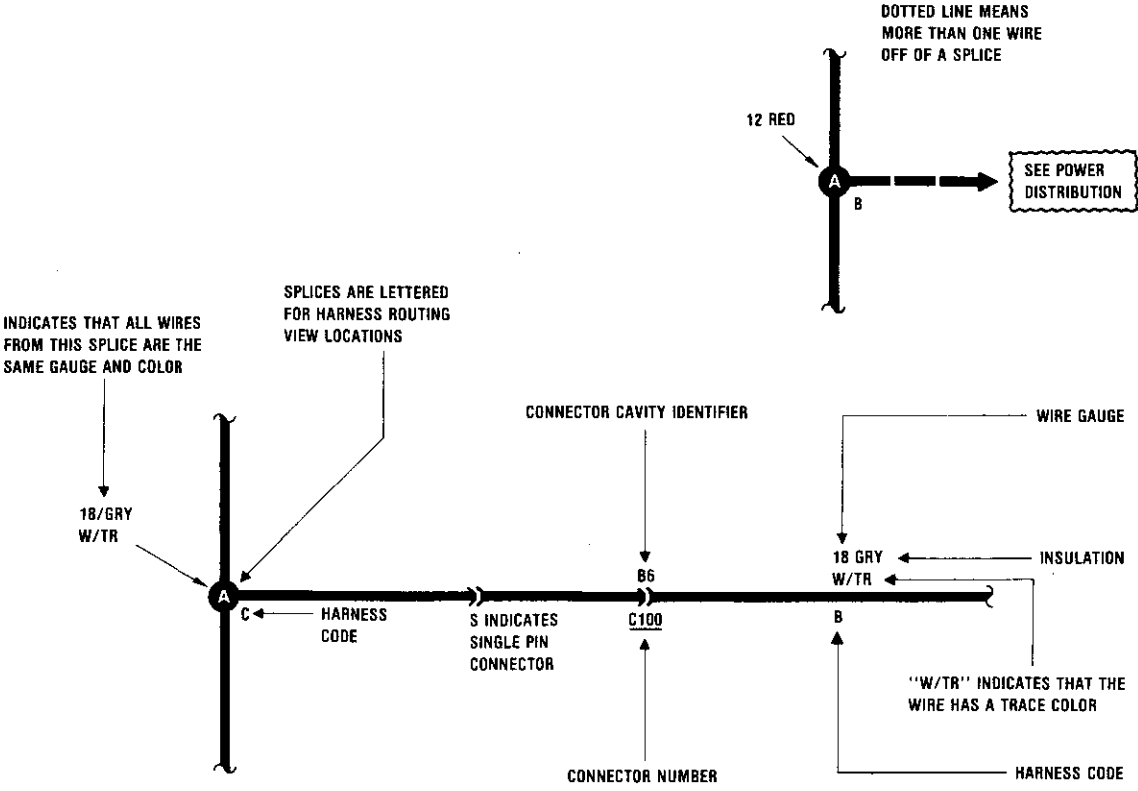
COMPONENT ZONE LOCATIONS

NAME	DIAGRAM ZONE	NAME	DIAGRAM ZONE	NAME
A/C Blower Motor	H-12	Fog Lamp Relay	O-9	Manifold Heater
A/C Blower Switch	H-11	Fog Lamp Switch	N-10	Manifold Heat Relay
A/C Compressor Clutch	I-11	Fuel Gauge Sender	L-9	Manifold Heat Switch
A/C Low Pressure Switch	I-11	Fuel Injector 2.5L	E-10	Microprocessor Control
A/C Suppression Diode	I-11	Fuel Pump Relay 2.5L	B-3,D-10	Multi-Function Lever
A/C Thermostatic Control	H-11	Fuel Tank Unit	D-10	Oil Pressure Sender
Air Management Solenoid Assembly	H-3	Fuse Link A	D-4,M-10	Oil Pressure Switch
Air Temperature Sensor	F-8	Fuse Link B	D-2,D-4,G-5	Oxygen Sensor 2.5L
Alternator 2.5L	A-6,I-5	Fuse Link C	D-4,G-6	Oxygen Sensor 4.2L
Alternator 4.2L	D-6,I-5	Fuse Link D	D-5,G-5	Park Neutral Switch 4.2L
Antenna Coax Lead	I-7	Fuse Link H	A-4,D-11	Parking Brake Switch
Backup Light Switch	P-1	Fuse Link J	A-4,M-10	Positive Crankcase Vent
Battery 2.5L	A-1,A-3,G-4	Fuse Link K	A-2,A-5,G-5	Solenoid 4.2L
Battery 4.2L	E-1,D-3,G-4	Fuse Link L	A-4	Power Steering Switch
Blower Motor	I-10	Fuse Link M	A-5,G-5	Radio
Blower Resistor	H-10	Fuse Panel 2.5L	C-5	Radio Illumination Relay
Blower Switch	H-10	Fuse Panel 4.5L	F-5	RH Door Jamb Switch
Brake Lamp Switch	J-11,P-3	Gauge Package	K-9	RH Speaker
Brake Pressure Warning Switch	N-4	Headlamp Switch 2.5L	B-3,G-7,M-6,M-11	Seatbelt Switch
Buzzer Module	K-7	Headlamp Switch 4.2L	E-3,G-7,M-6,M-11	Speed Sensor
B (+) Relay 2.5L	B-4,D-11	Heat/Off Microswitch	H-10	Starter Motor 2.5L
Cigar Lighter	G-7,K-3	High Beam Indicator	N-10	Starter Motor 4.2L
Clutch Switch	J-11	Horn	L-4	Starter Relay 2.5L
Coil 4.2L	G-1	Horn Relay	K-4	Starter Solenoid 2.5L
Command Trac Switch	N-5	Horn Switch	L-4	Starter Solenoid 4.2L
Coolant Temperature Sender	L-9	Idle Disconnect	C-2	Stepper Motor 4.2L
Coolant Temperature Sensor	F-8	Idle Solenoid 4.2L	I-4	Tachometer
Cruise Control In-Line Fuse	J-11	Idle Speed Activator 2.5L	F-10	Thermo-Electric Switch
Cruise Control Module	K-11	Idle Speedup Relay 4.2L	H-3	Throttle Position Sensor
Defogger Grid	L-2	Ignition Key Warning Switch	J-7	Turn/Hazard Switch
Defogger Relay	K-2,J-6	Ignition Module 2.5L	E-8,J-4	Assembly
Defogger Switch	K-2	Ignition Module 4.2L	F-2,H-2,J-5	Upshift Switch
Door Jamb Switch	Q-4	Ignition Switch 2.5L	A-2,B-5,D-8,G-5, G-6,J-3,O-5	Vacuum Switch
EGR/Evaporator Canister Solenoid	E-10	Ignition Switch 4.2L	D-2,E-5,G-3,J-3,O-5	Assembly 4.2L
Electric Choke Switch	H-6	Illuminated Rheostat/Switch 2.5L	B-3,G-9,M-7,N-12, Q-5	Washer Pump
Electronic Control Unit 2.5L	C-2,B-3,E-8	Illuminated Rheostat/Switch 4.2L	E-3,G-9,M-7,N-12, Q-5	Wide Open Throttle
Engine Coolant Temperature Switch 4.2L	I-2	Indicator Lamp Panel	J-6,M-5,N-6	Switch 2.5L
Engine Speed Sensor 2.5L	F-10	Intermittent Wiper Module	N-3	Wide Open Throttle
Diagnostic Connector D1	B-3	Knock Sensor 4.2L	I-1	Switch 4.2L
Dimmer Switch	N-10	LH Door Jamb Switch	L-6	Windshield Wiper/Washer
Diode/Fuse Assembly 4.2L	I-3	LH Speaker	I-8	Circuit Breaker
Distributor 2.5L	E-7	Manifold Absolute Pressure Sensor 2.5L	F-9	Wiper Motor
Distributor 4.2L	H-1			Wiper Switch
Filter Capacitor 4.2L	G-1			

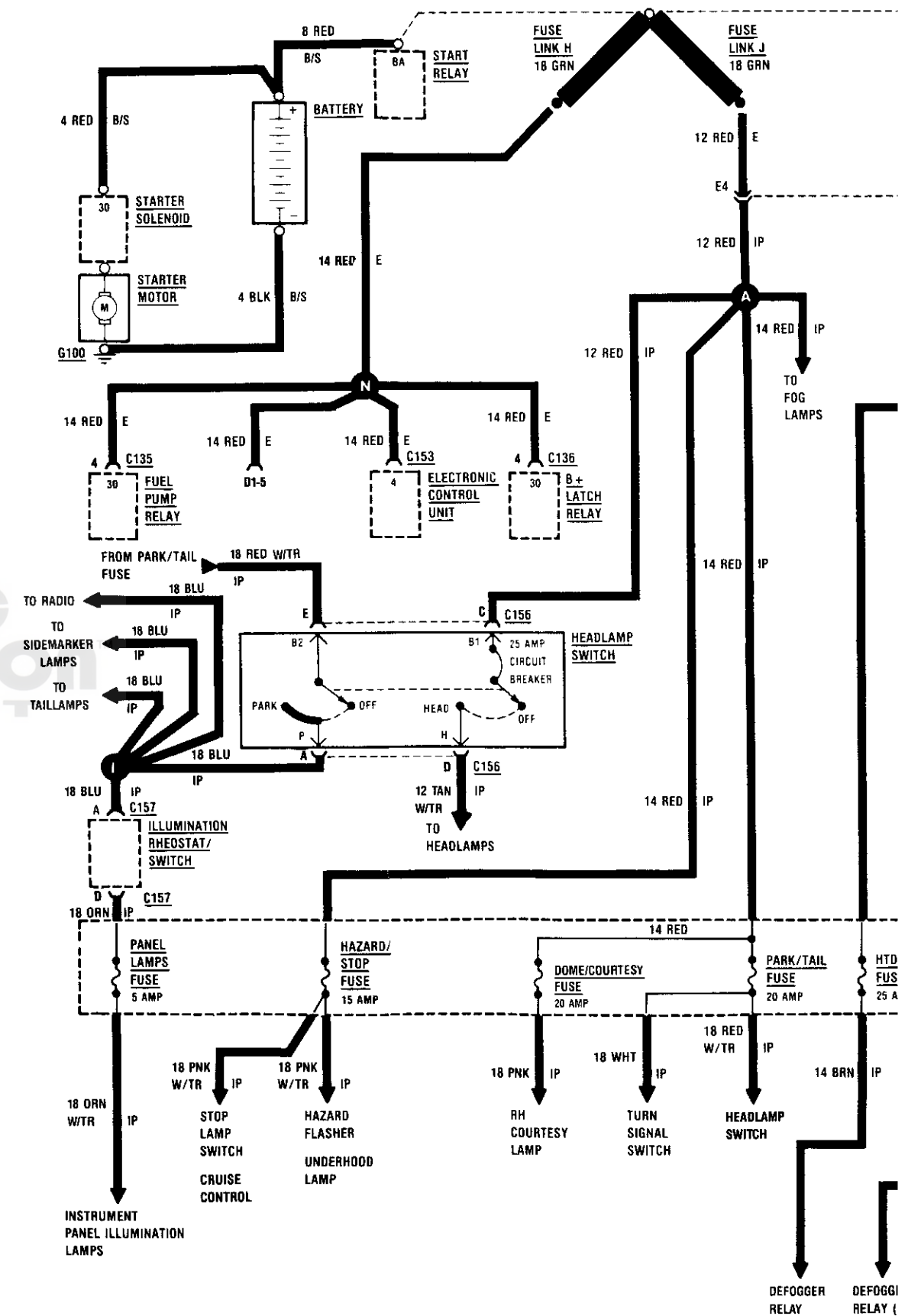
NAME	DIAGRAM ZONE
Manifold Heater	I-6
Manifold Heat Relay	D-3,I-6
Manifold Heat Switch	I-6
Microprocessor Control Unit 4.2L	F-2,H-1
Multi-Function Lever	K-11
Oil Pressure Sender	L-8
Oil Pressure Switch	H-6
Oxygen Sensor 2.5L	E-8
Oxygen Sensor 4.2L	I-1
Park Neutral Switch 4.2L	F-2,P-1
Parking Brake Switch	O-5
Positive Crankcase Ventilation	
Solenoid 4.2L	H-3
Power Steering Switch 2.5L	E-10
Radio	H-8
Radio Illumination Relay	G-7
RH Door Jamb Switch	R-5
RH Speaker	I-8
Seatbelt Switch	J-6
Speed Sensor	L-12
Starter Motor 2.5L	A-3,C-1
Starter Motor 4.2L	F-1,D-3
Starter Relay 2.5L	A-3,B-1,D-9,G-4
Starter Solenoid 2.5L	A-3,B-1
Starter Solenoid 4.2L	E-1,D-3
Stepper Motor 4.2L	H-2
Tachometer	K-5
Thermo-Electric Switch 4.2L	I-3
Throttle Position Sensor 2.5L	F-9
Turn/Hazard Switch	
Assembly	Q-3
Upshift Switch	N-5
Vacuum Switch	
Assembly 4.2L	I-2
Washer Pump	O-2,O-3
Wide Open Throttle	
Switch 2.5L	F-11
Wide Open Throttle	
Switch 4.2L	I-2
Windshield Wiper/Washer	
Circuit Breaker	M-1,M-3
Wiper Motor	N-1,N-3
Wiper Switch	M-1,M-3

WIRE COLOR CODES					
CODE	COLOR	CODE	COLOR	CODE	COLOR
BLK	Black	GRY	Gray	VIO	Violet
BLU	Blue	ORN	Orange	WHT	White
BRN	Brown	PNK	Pink	YEL	Yellow
GRN	Green	RED	Red		

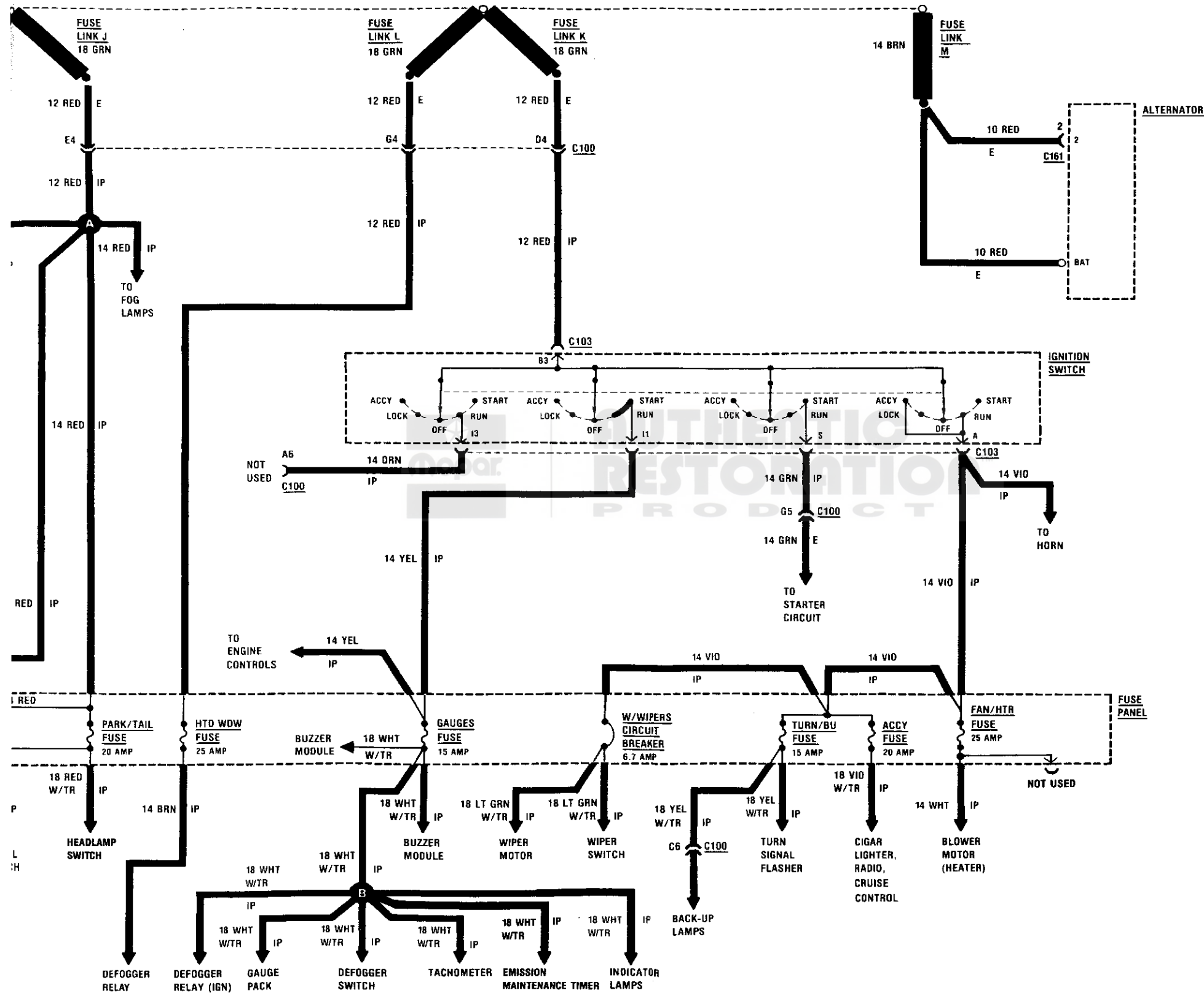
HARNESS CODES			
CODE	HARNESS	CODE	HARNESS
AC	Air Conditioning	H	Heater
B	Body	IP	Instrument Panel
B/S	Battery/Starter	L	Lighter
CC	Cruise Control	R	Roof
CL	Courtesy Lamps	S	Starter Motor
E	Engine/Engine Control	T	Transmission
FL	Front Lights	TL	Tail Lamps



U V W X Y Z



POWER DISTRIBUTION—2.5L ENGINE



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WRANGLER/YJ
Part Number—8980 010 718
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A

B

C

**HOT AT ALL TIMES
FROM FUSE LINK L2.5L, C4.2L**



K

L

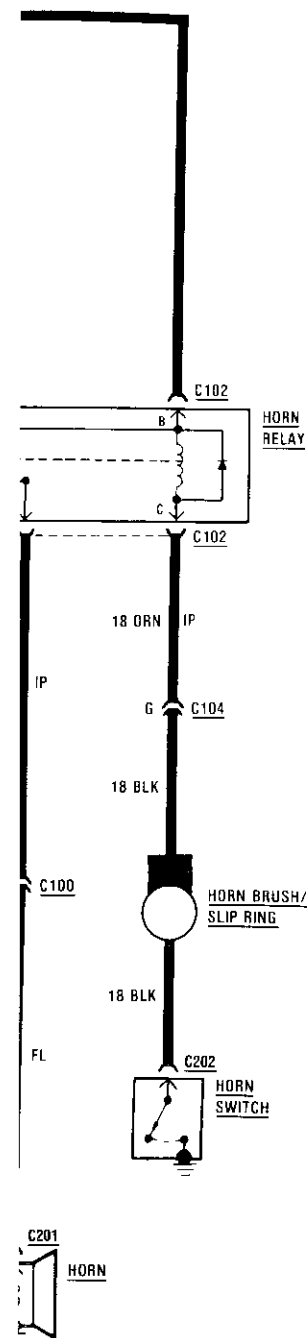
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2

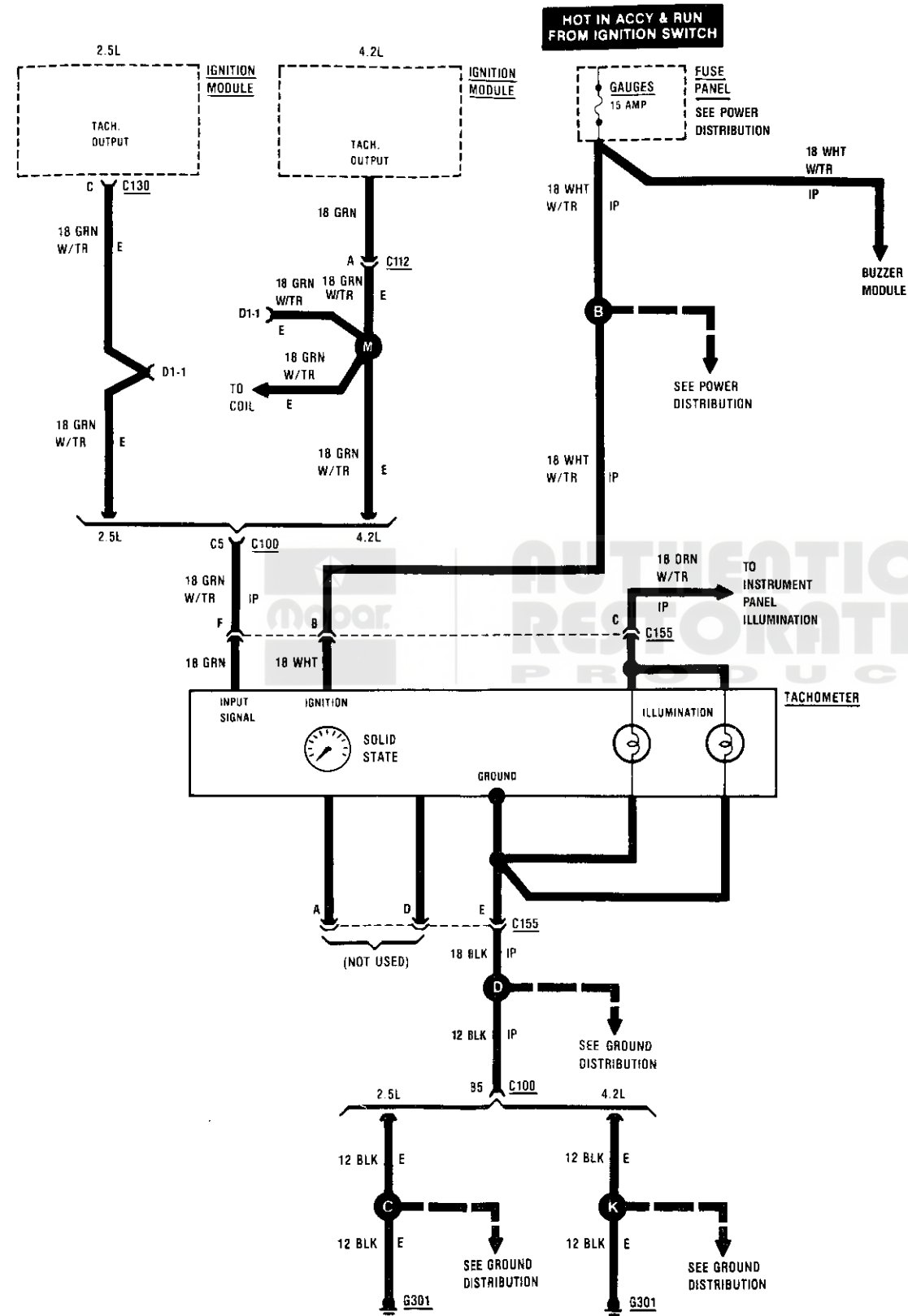
**HOT AT ALL TIMES
FROM FUSE LINK K2.5L, B4.2L**

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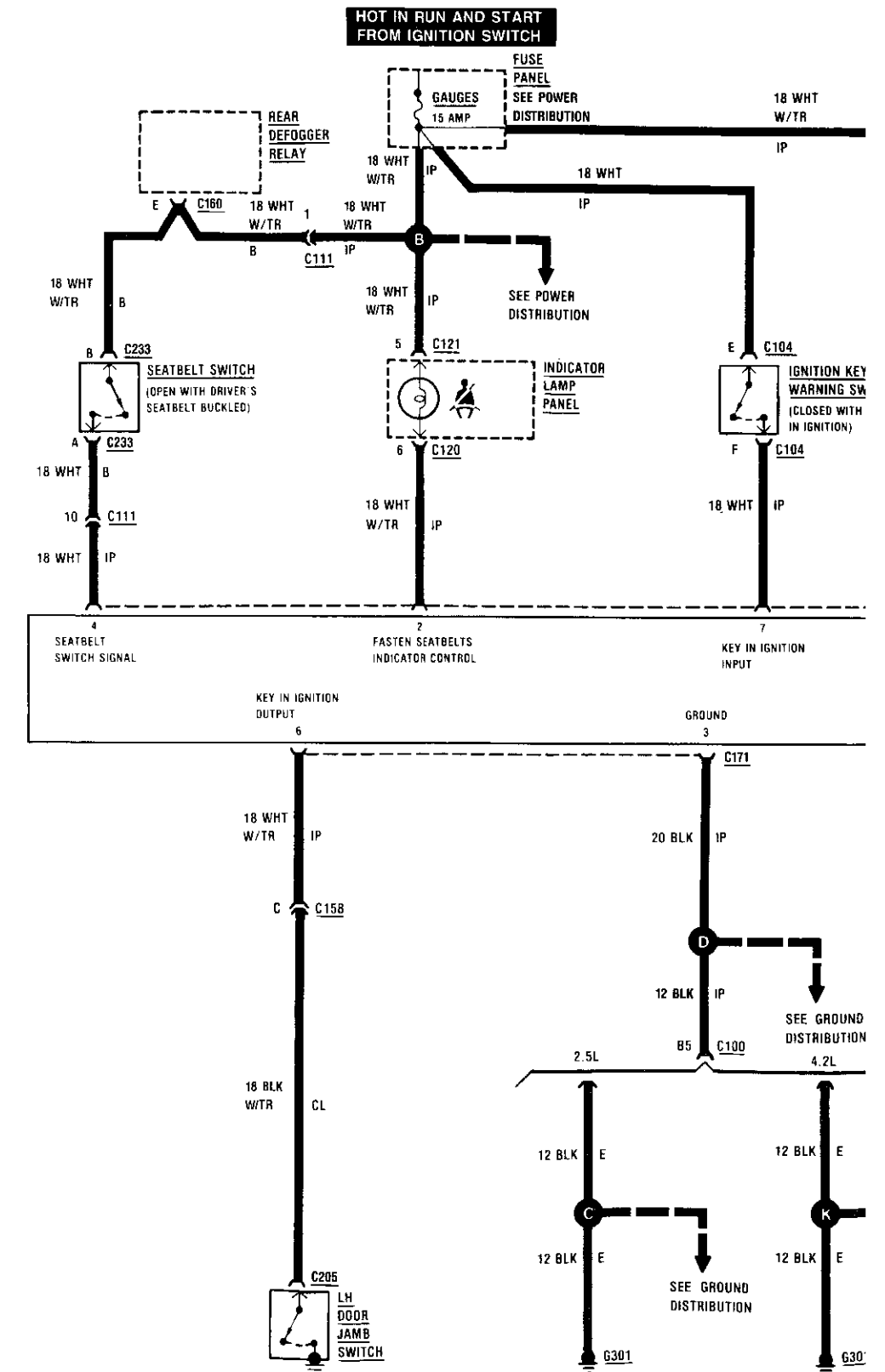
HORN



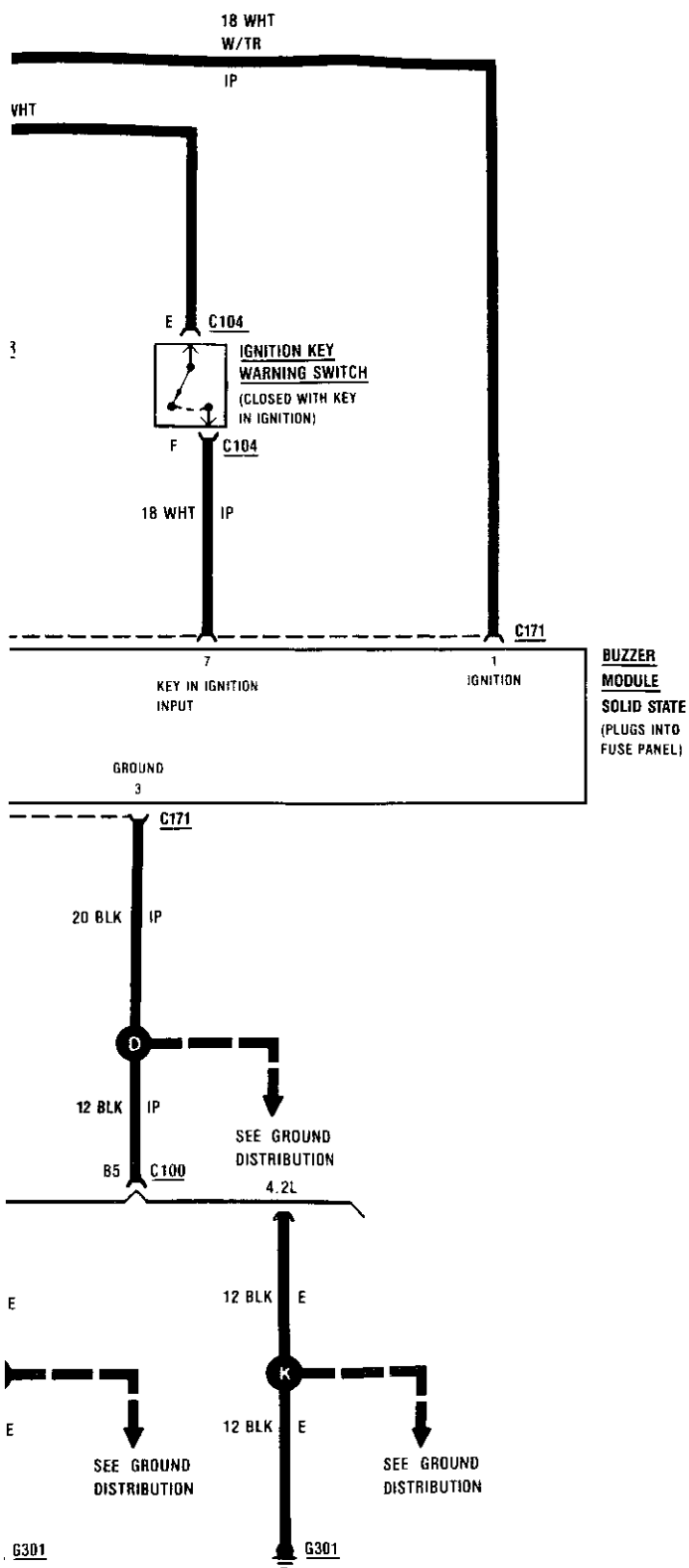
TACHOMETER



SEAT BELT / IGNITION KEY WARNIN

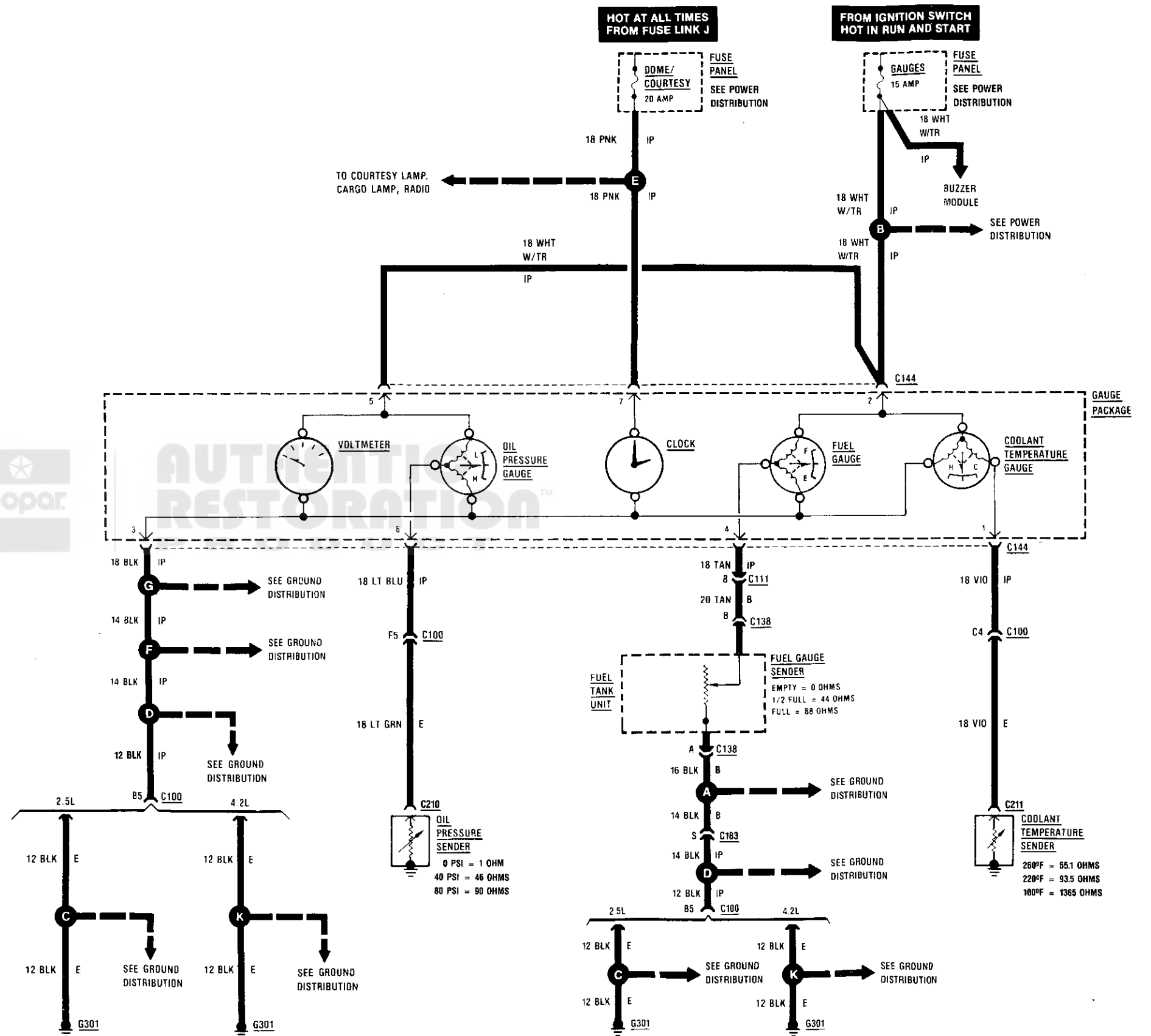


KEY WARNING BUZZER



7

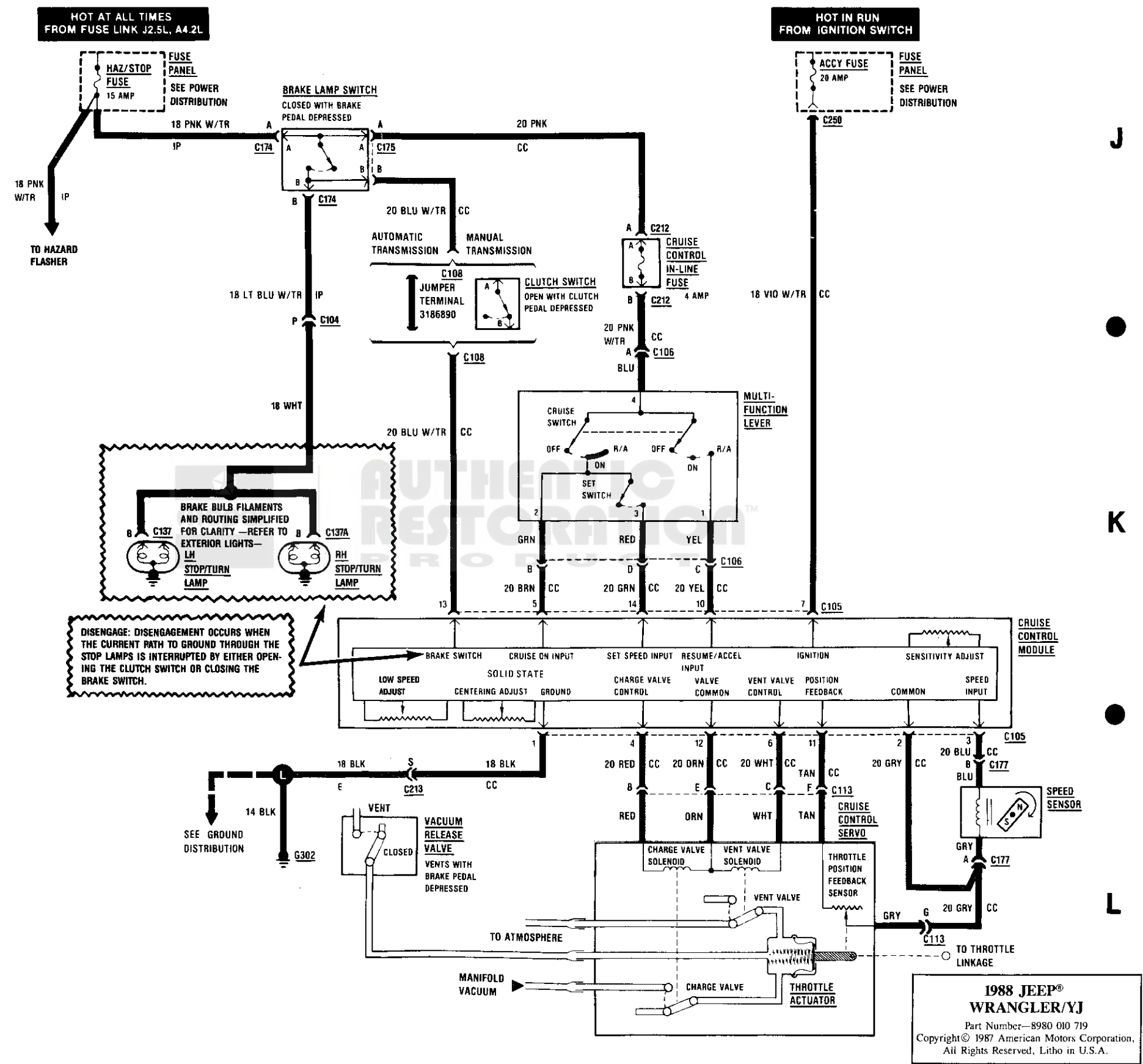
GAUGE PACKAGE



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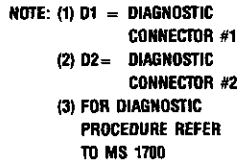
CRUISE CONTROL

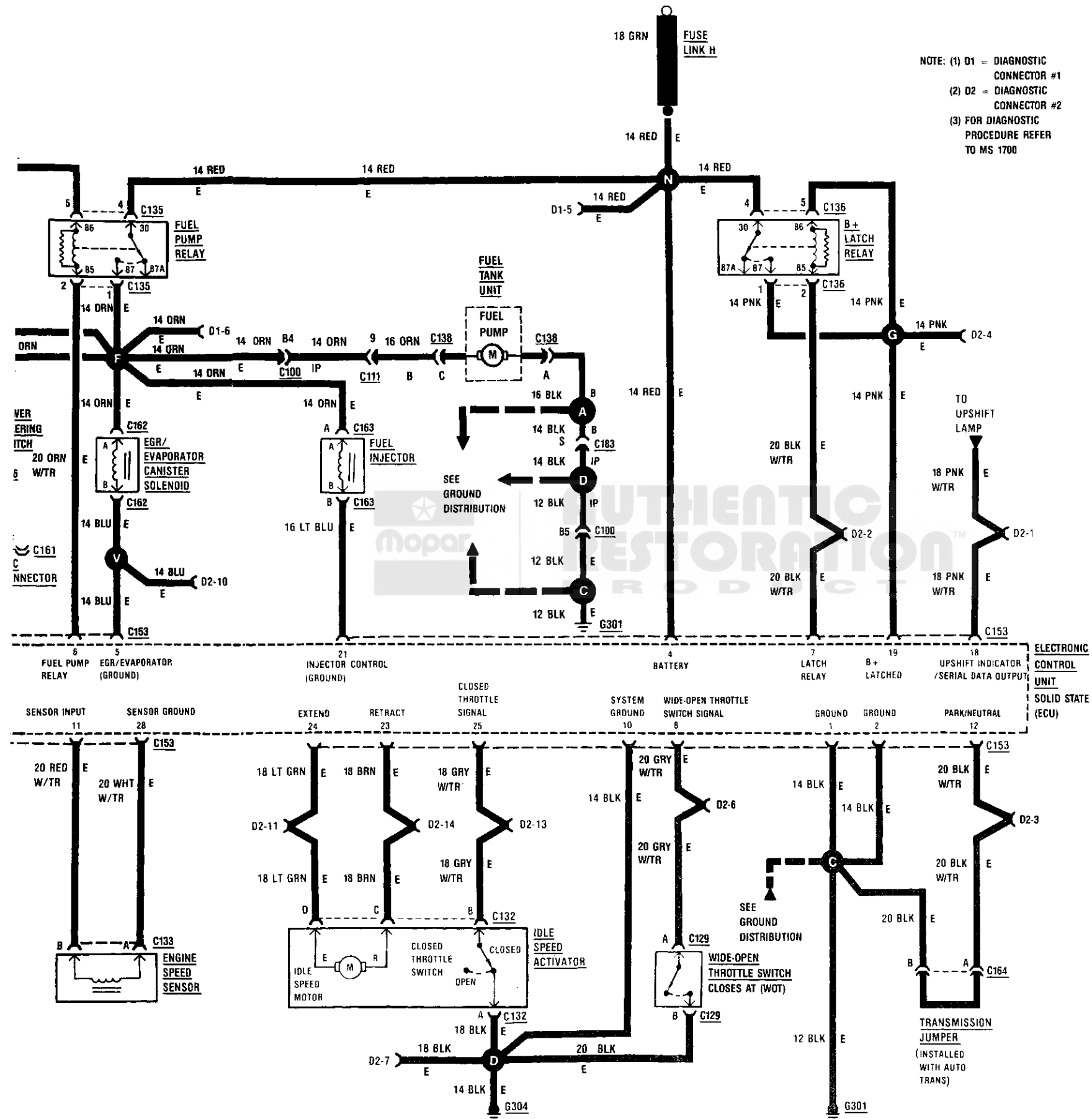


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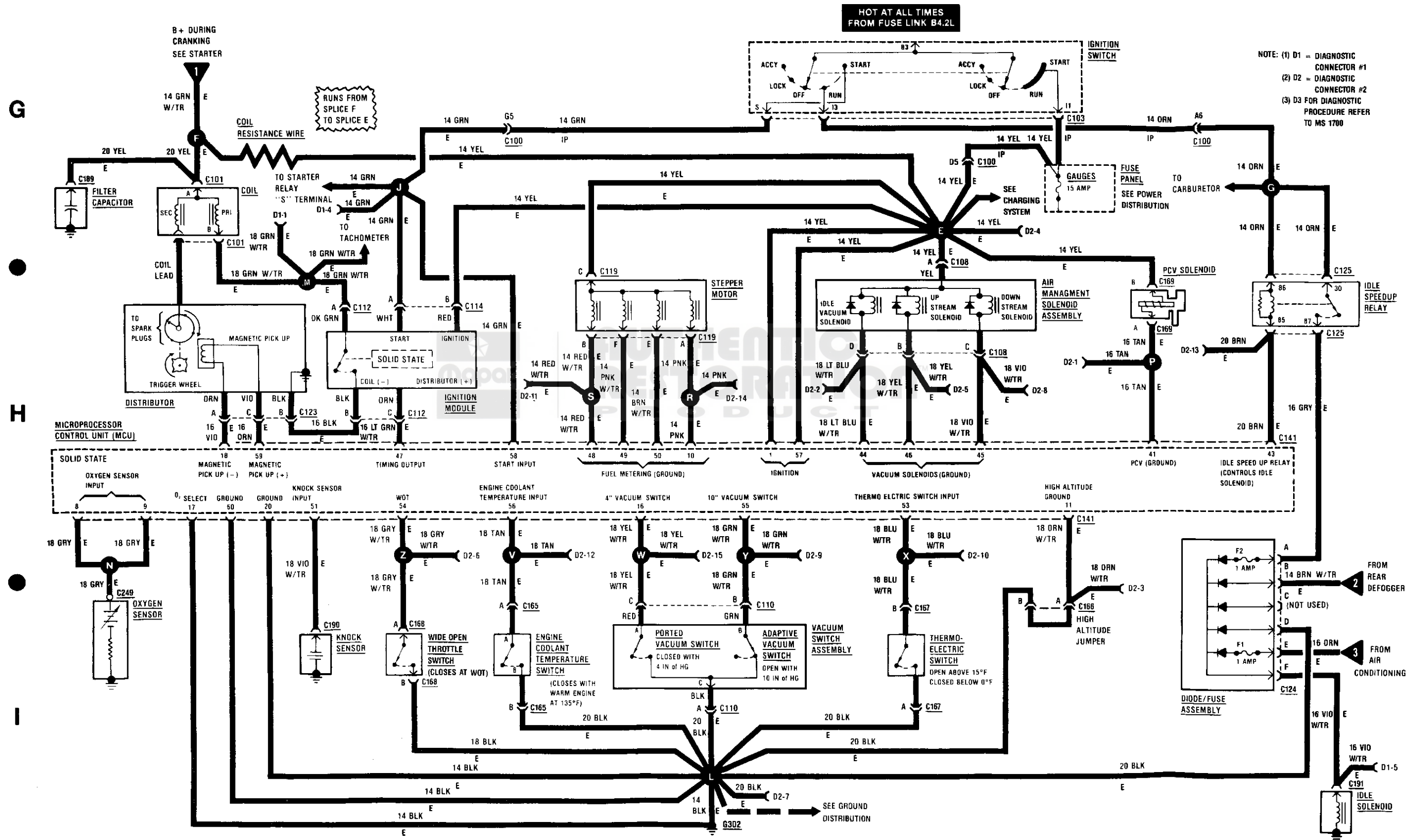


ENGINE CONTROLS—2.5L

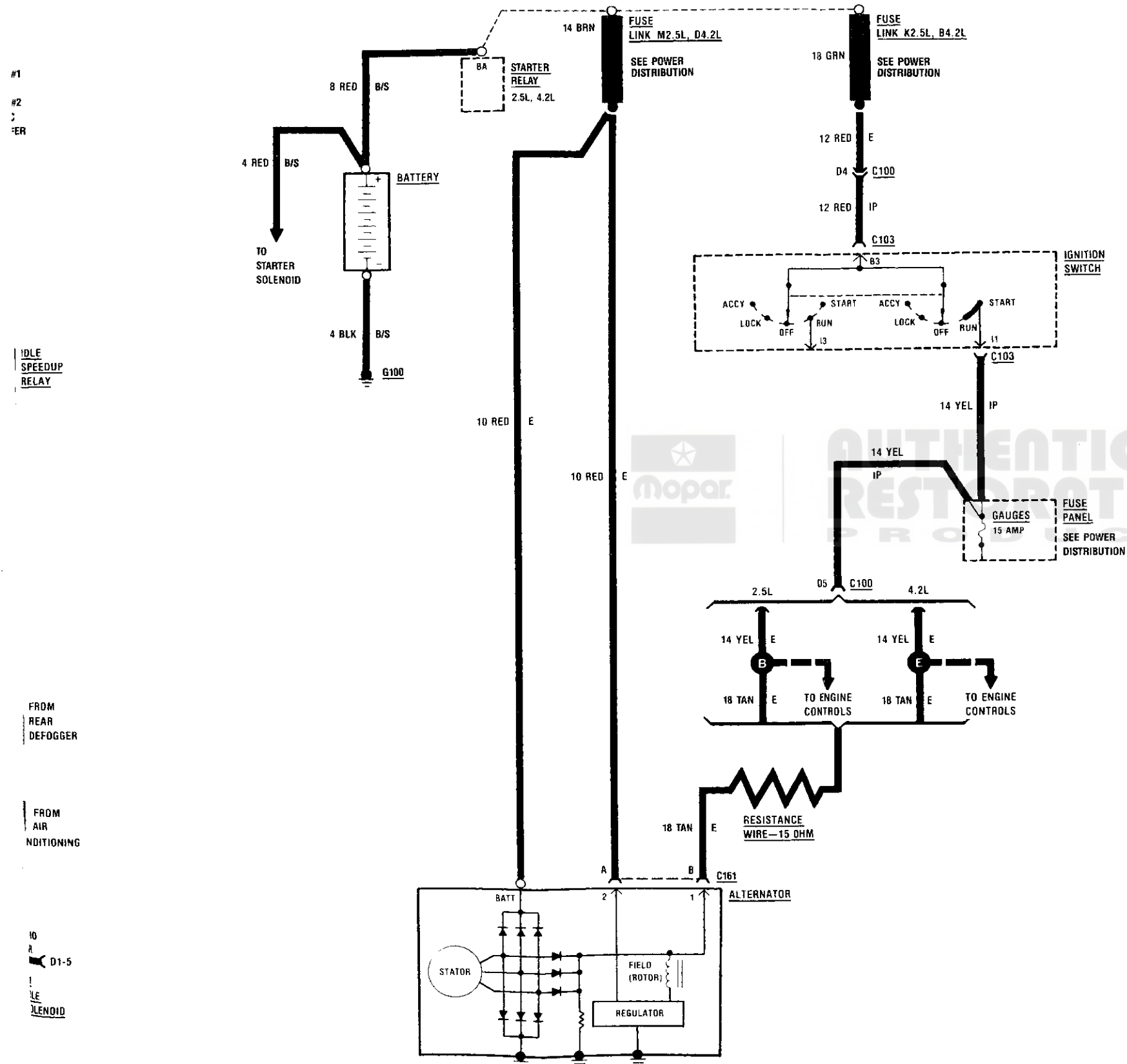




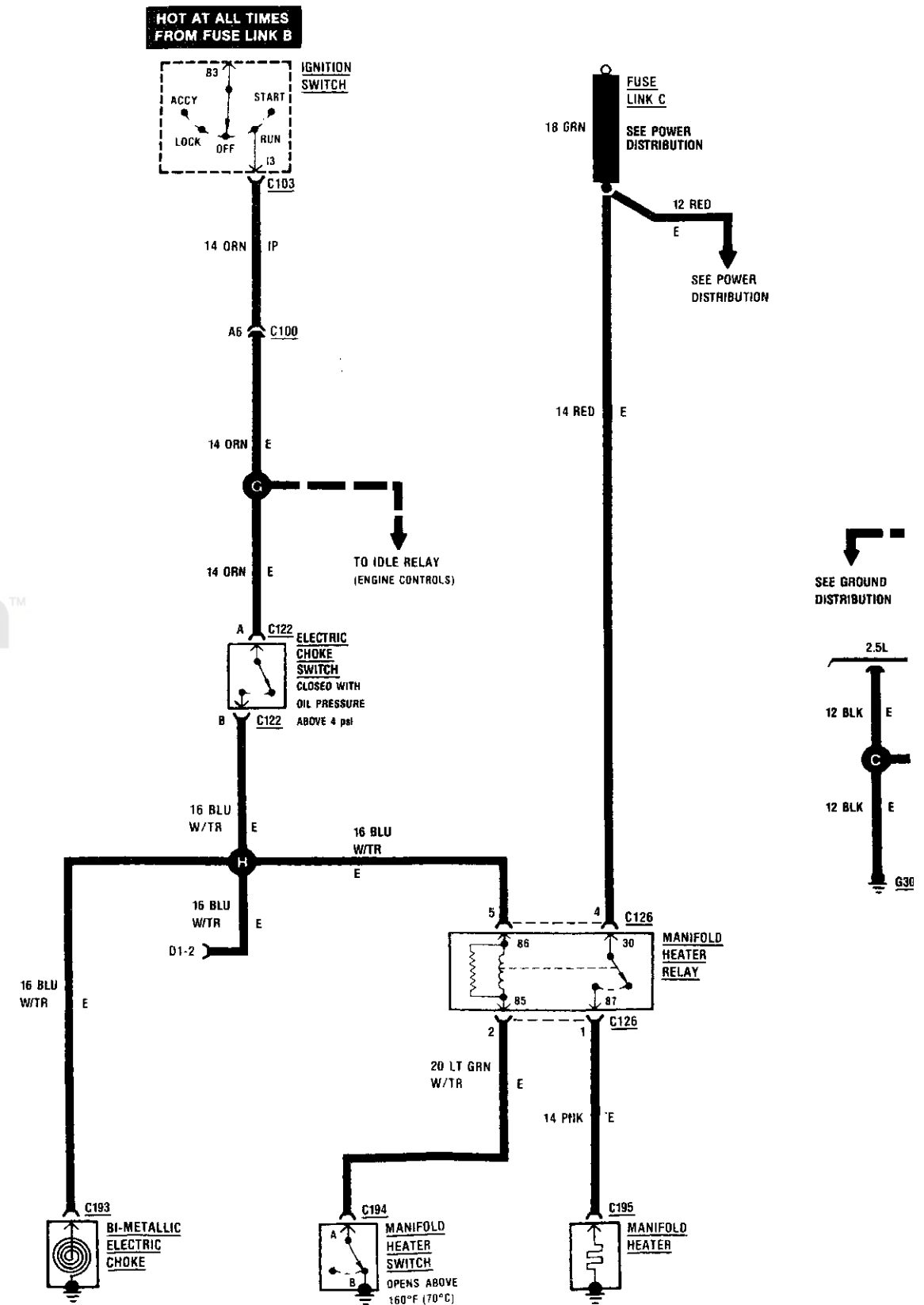
ENGINE CONTROLS—4.2L



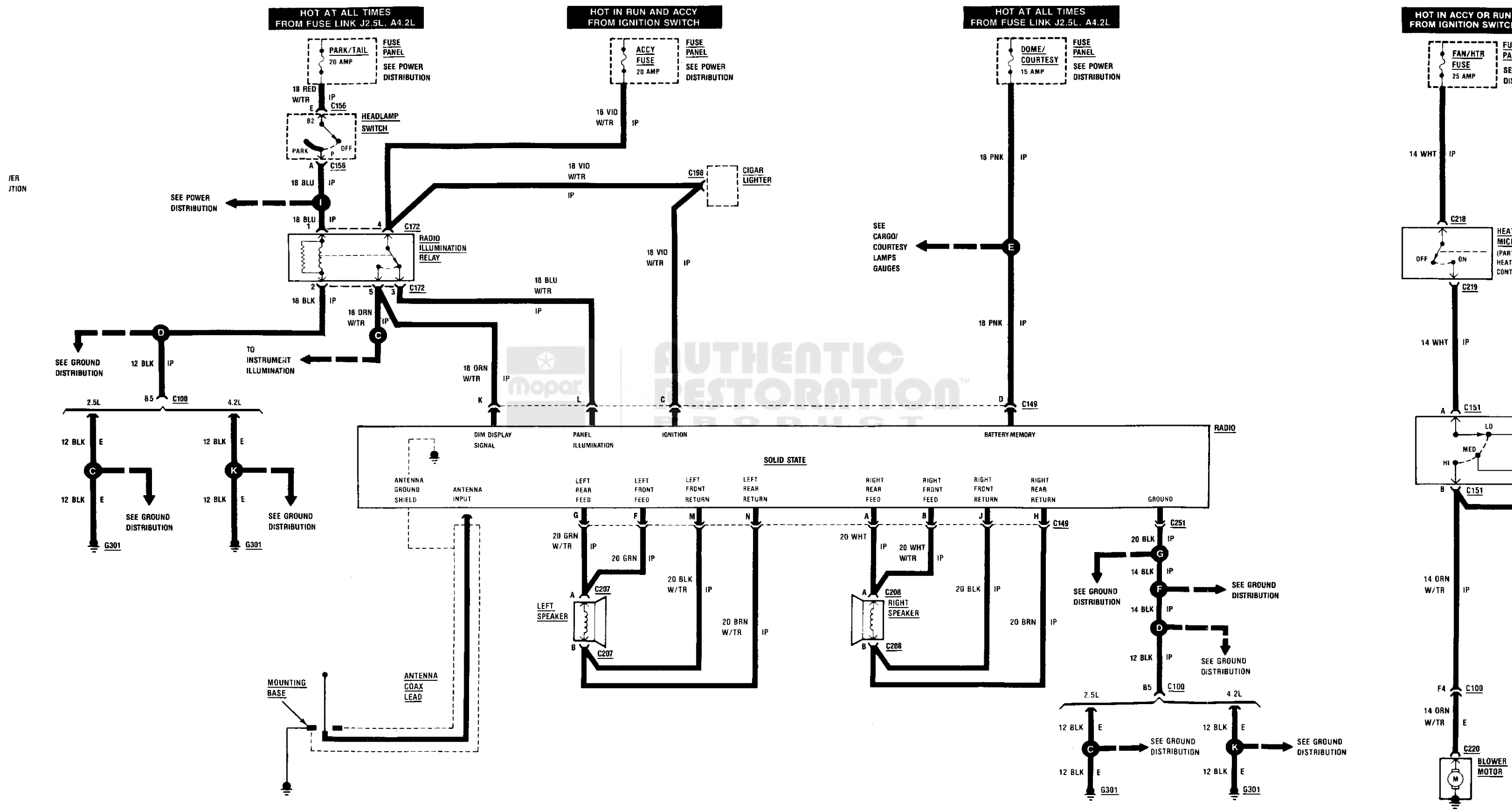
CHARGING SYSTEM



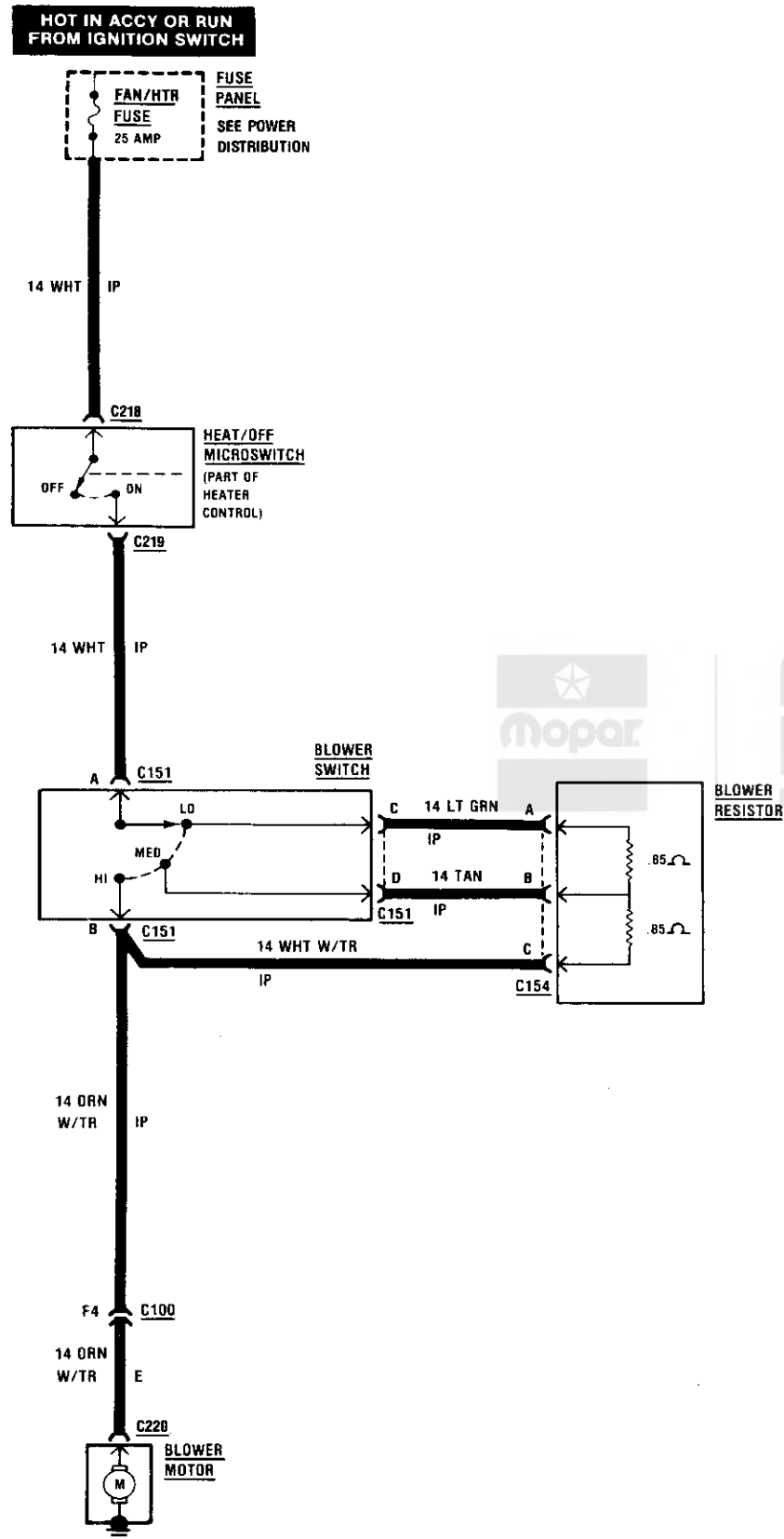
CARBURETOR CIRCUITS



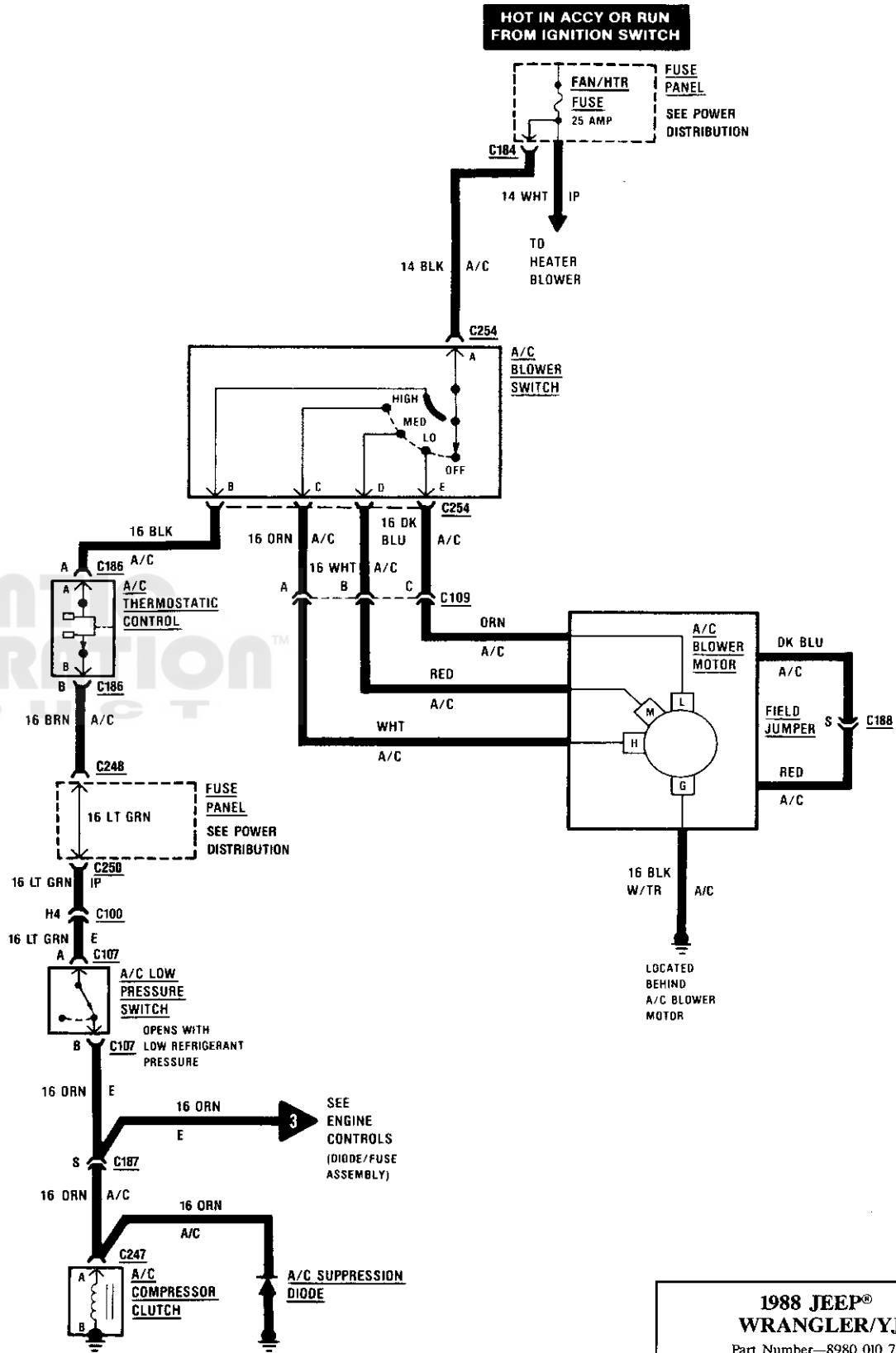
RADIO



HEATER



AIR CONDITIONING



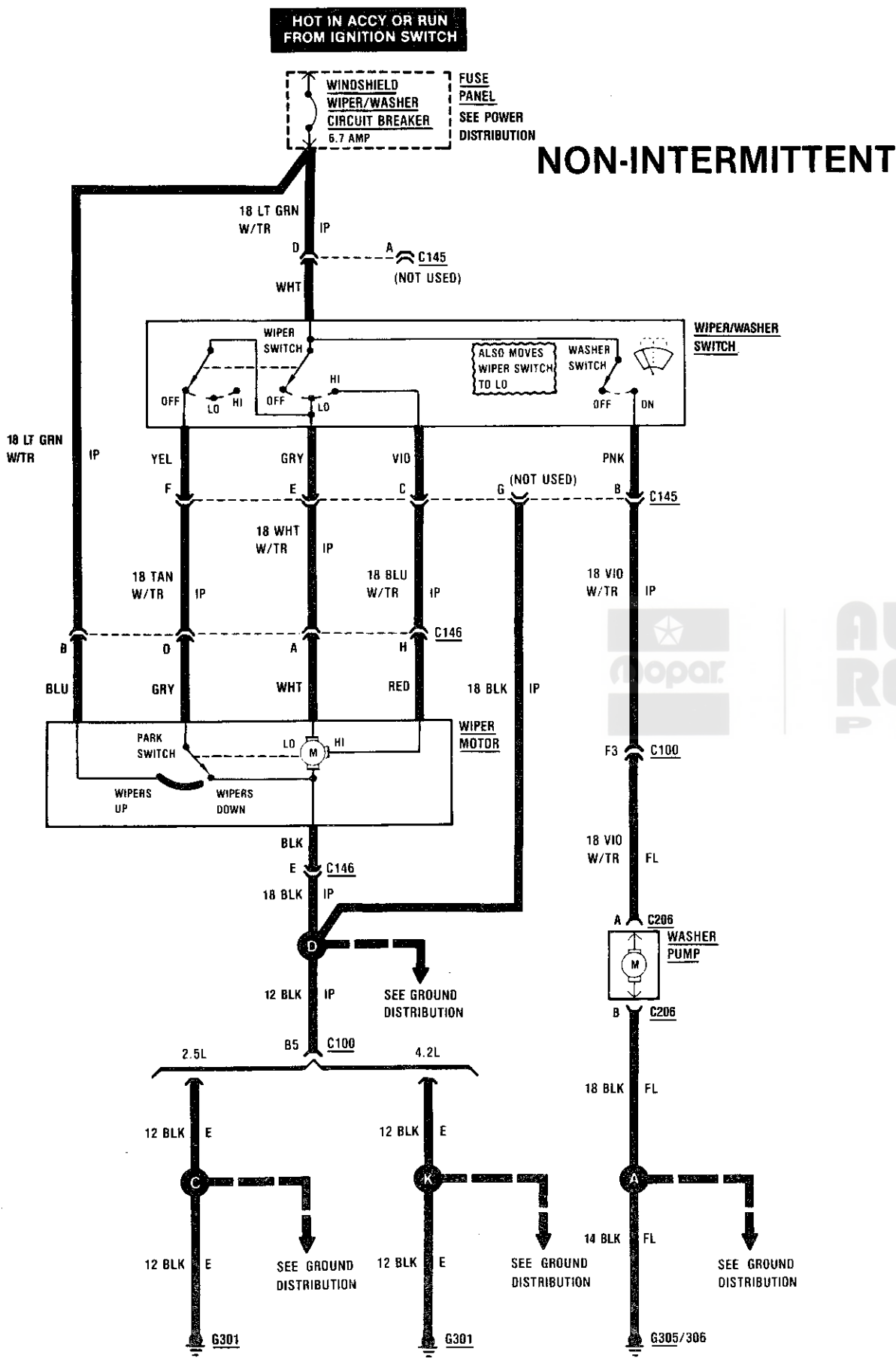
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WRANGLER/YJ
Part Number—8980 010 719
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WIPER / WASHER

M

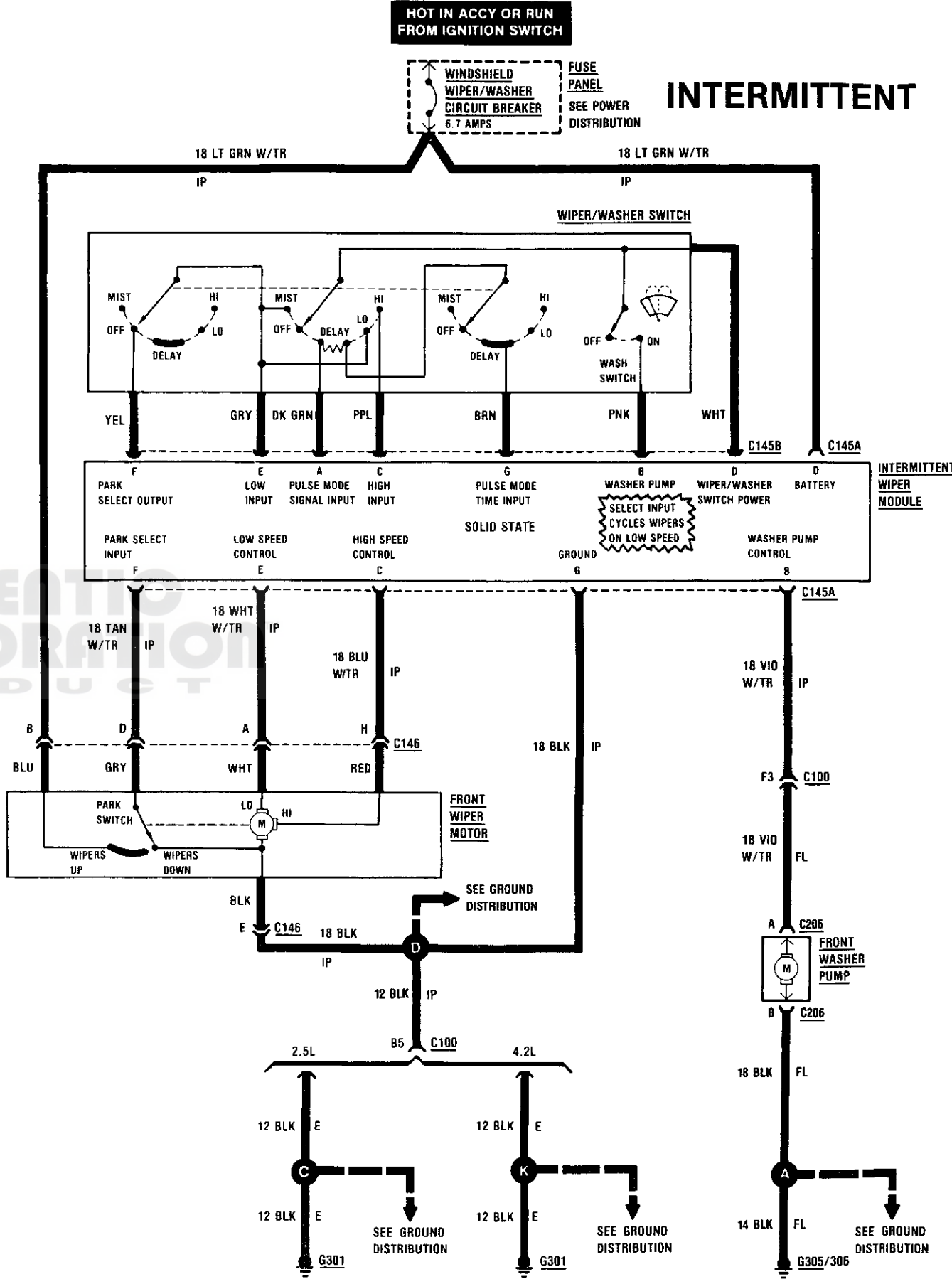
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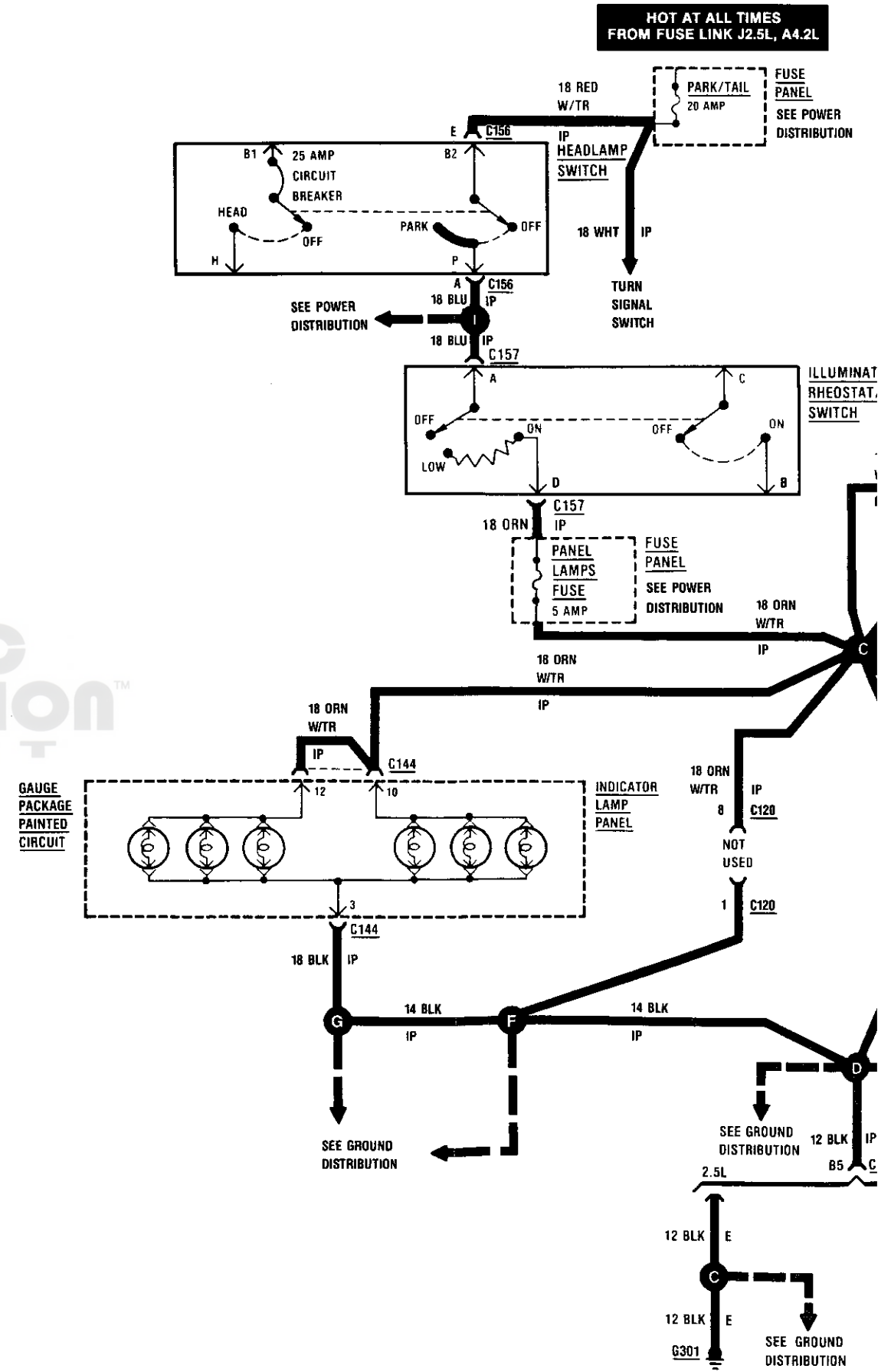


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RESTORATION
PRODUCT

2



INSTRUMENT



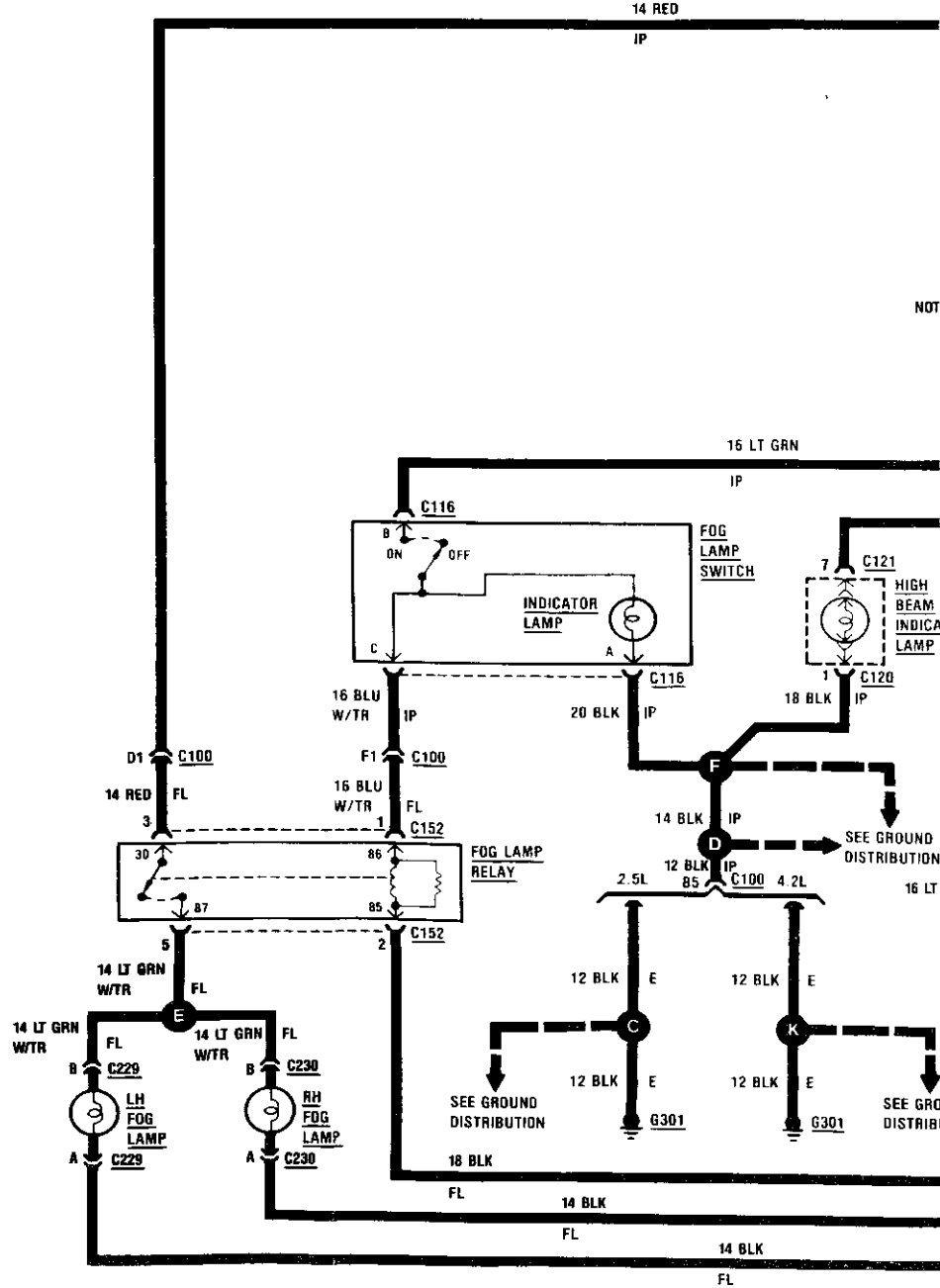
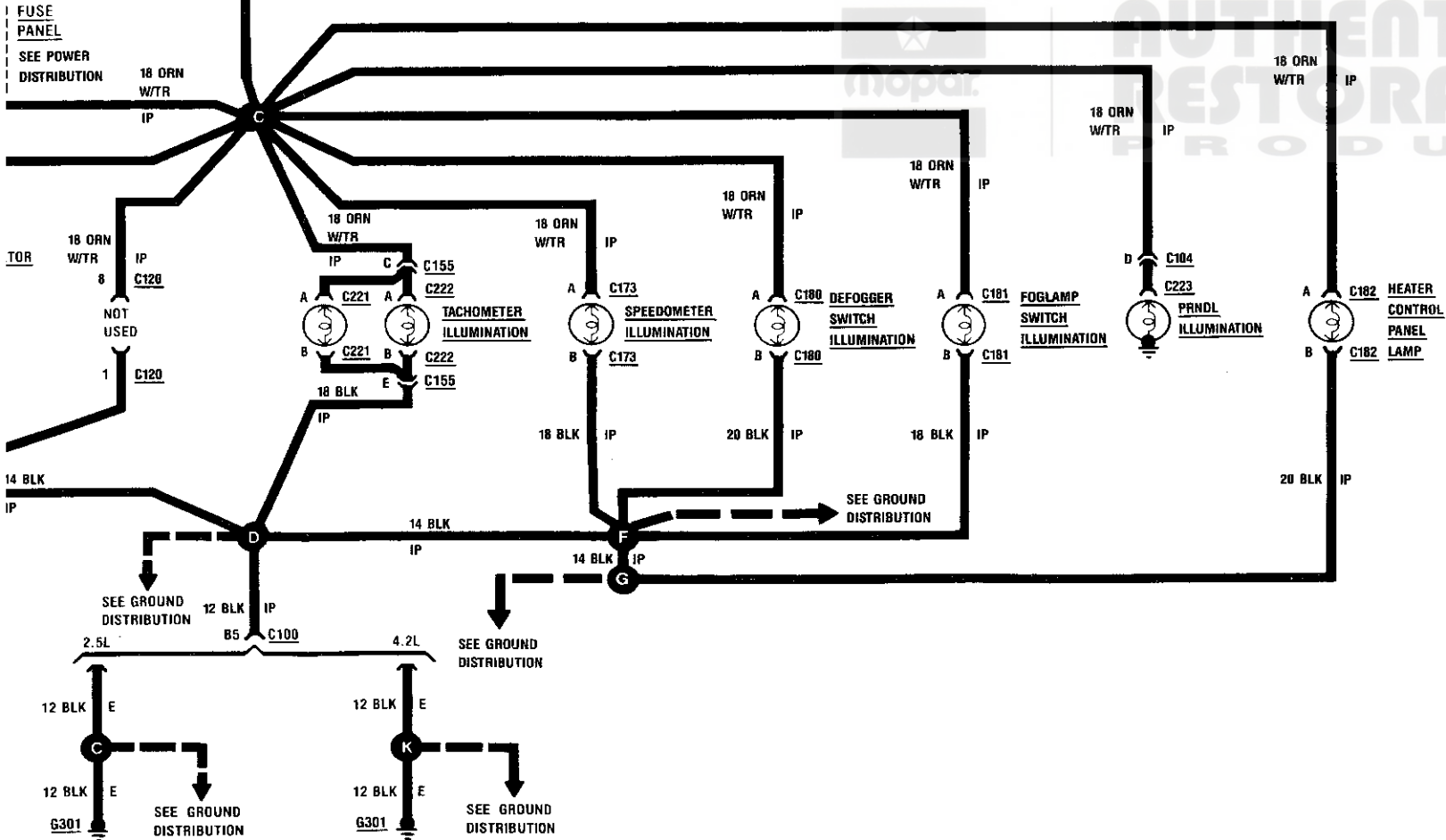
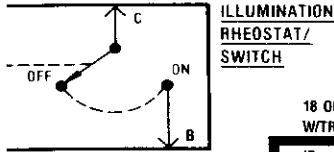
INSTRUMENT PANEL ILLUMINATION LAMPS

LAMPS: F

HOT AT ALL TIMES
M FUSE LINK J2.5L, A4.2L



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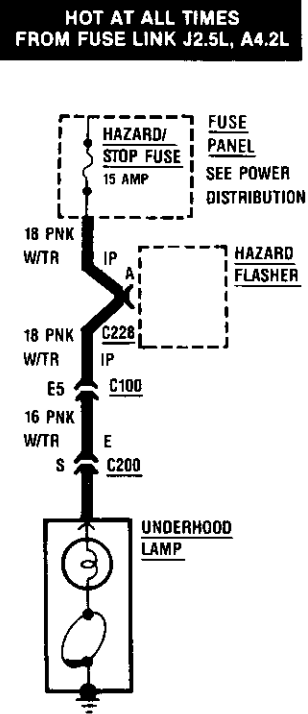
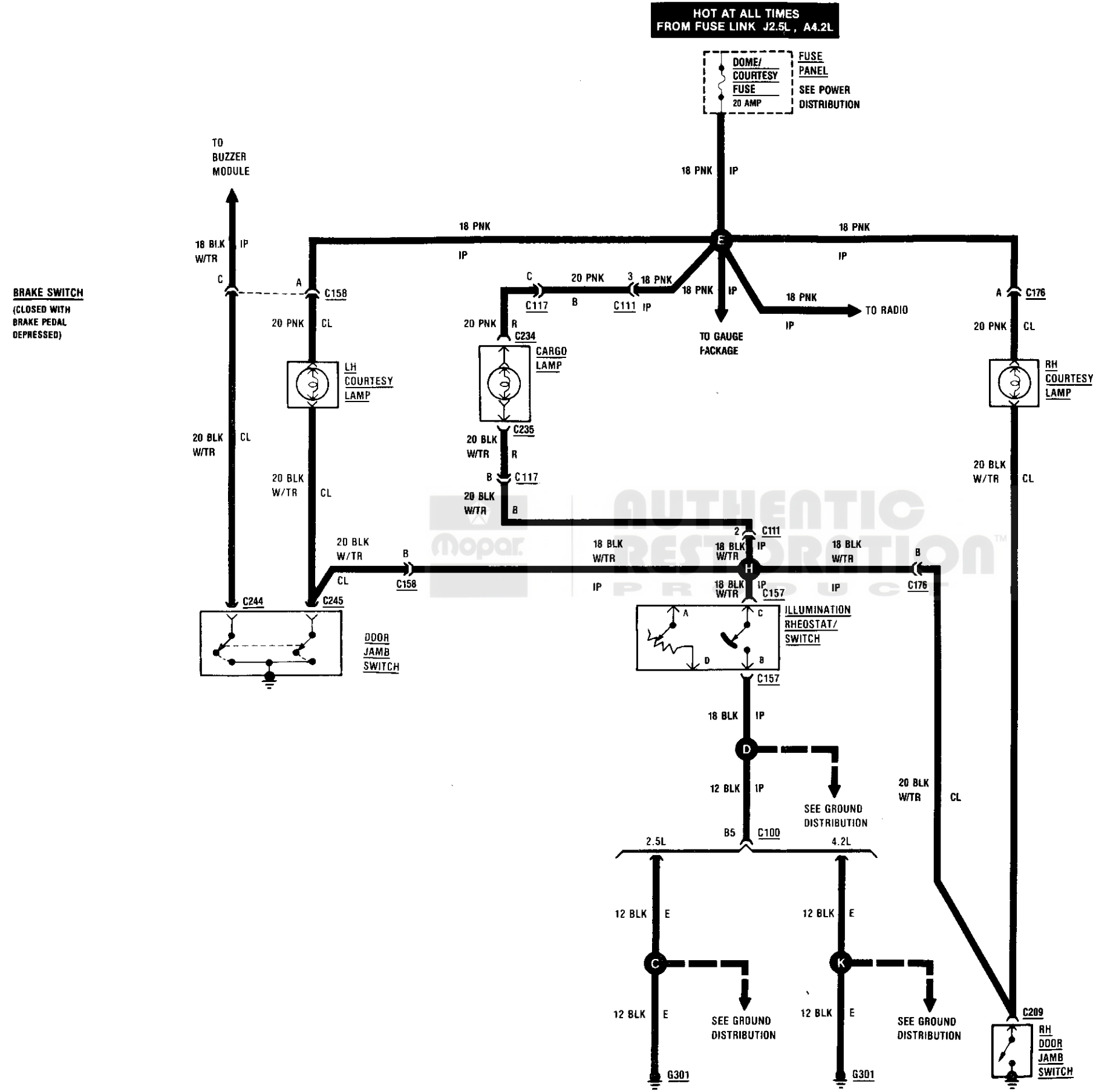
12 SIDE 1 OF 3

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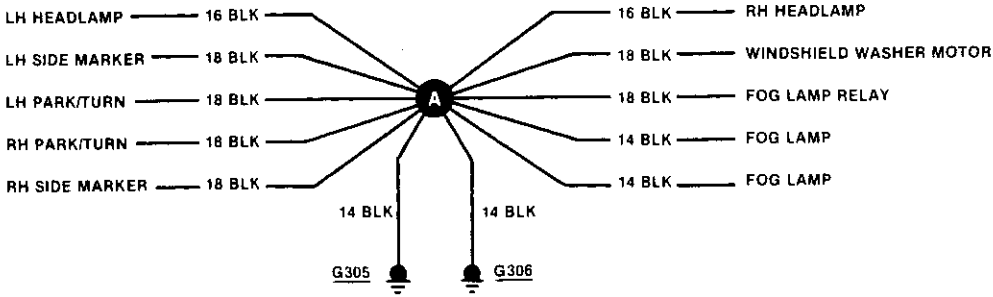
LAMPS: CARGO / COURTESY

UNDERHOOD LAMP

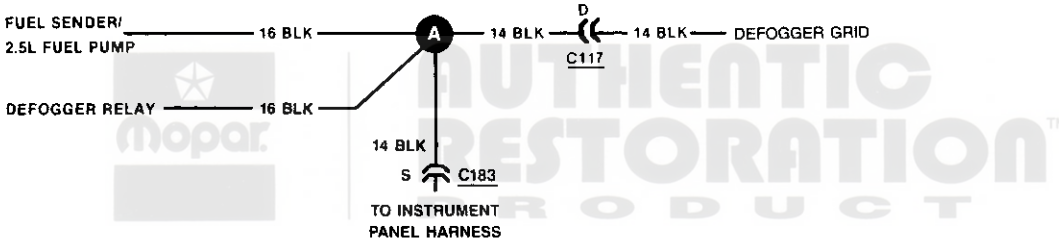


GROUND DISTRIBUTION

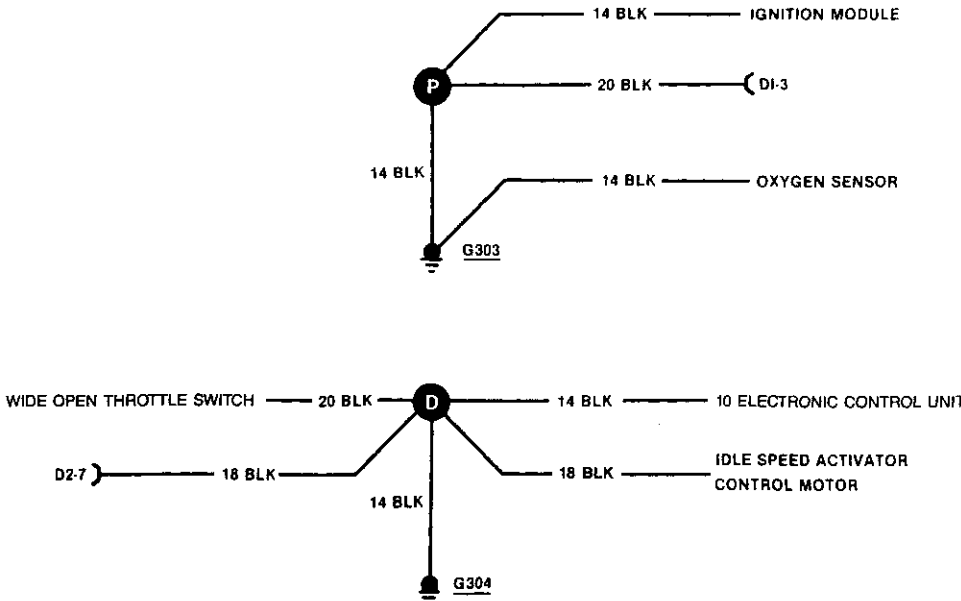
G305/G306
FRONT LIGHTING



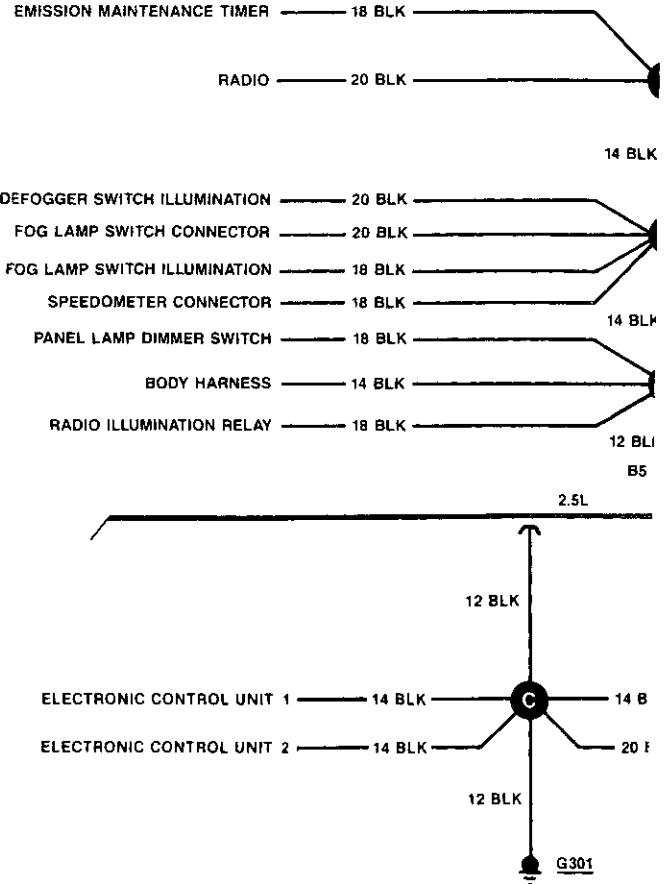
BODY HARNESS GROUND CIRCUIT



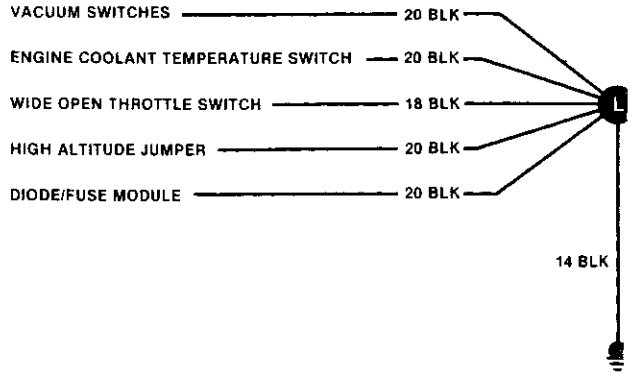
G303/G304
2.5L ENGINE CONTROLS



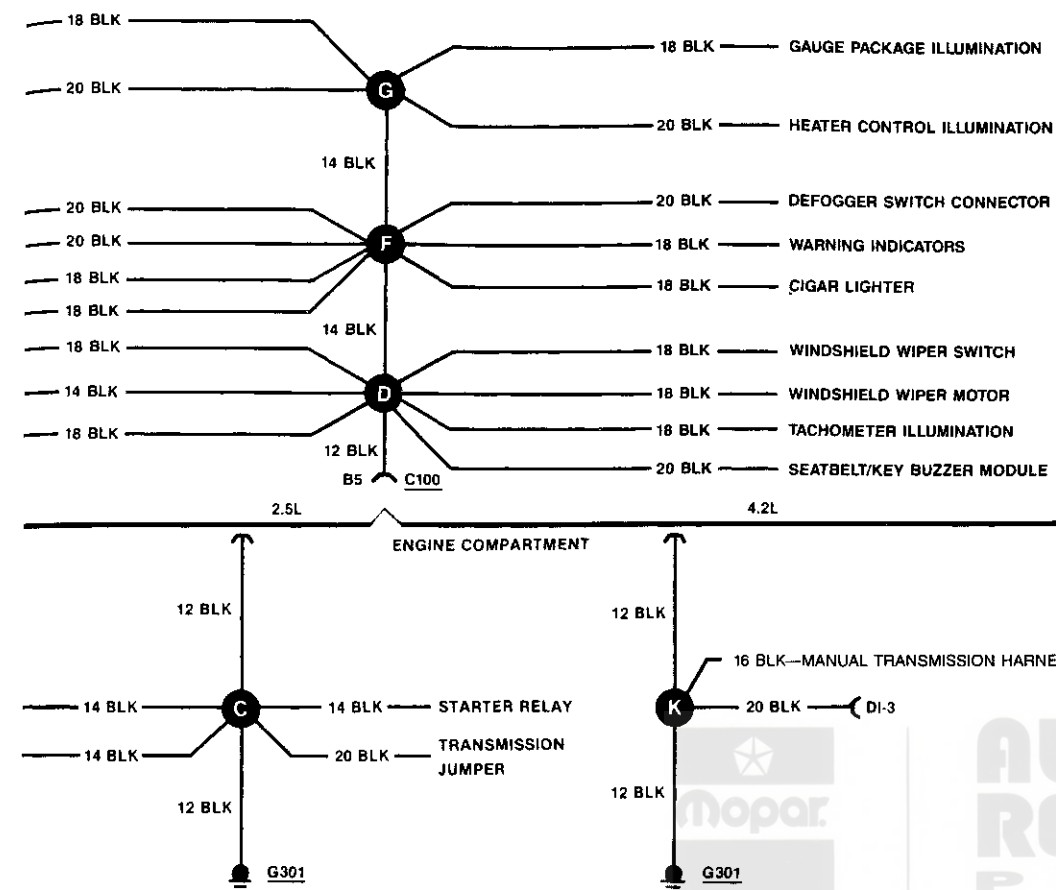
G301
INSTRUMENT



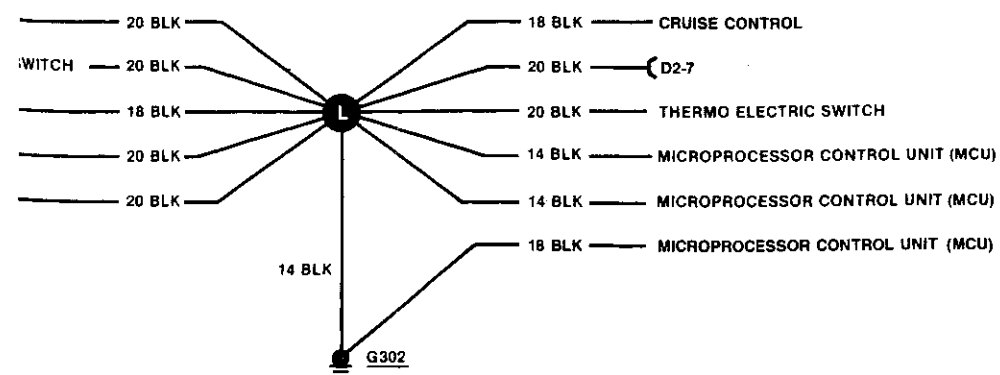
G301
4.2L ENGINE



G301 INSTRUMENT PANEL



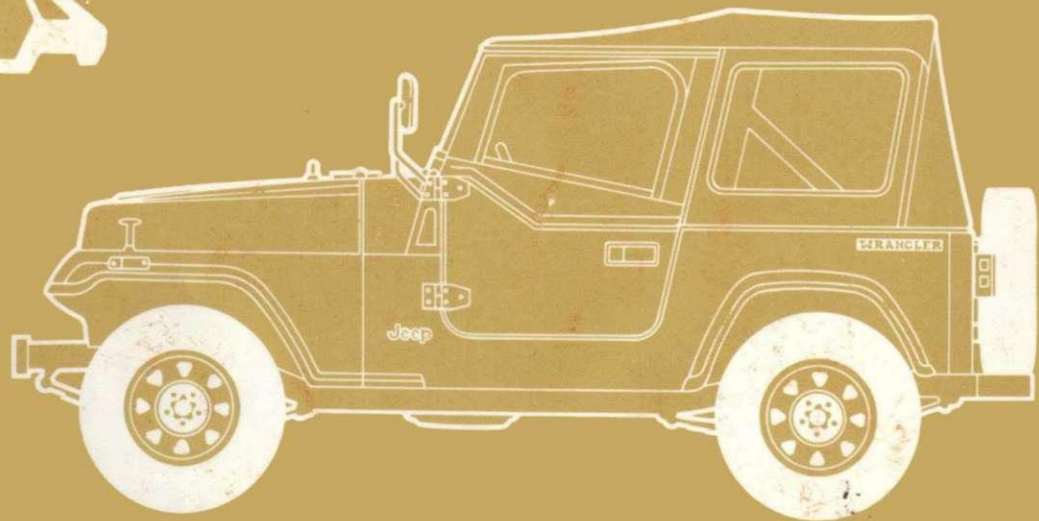
G302 4.2L ENGINE CONTROLS



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M.R.280 _1987-1988

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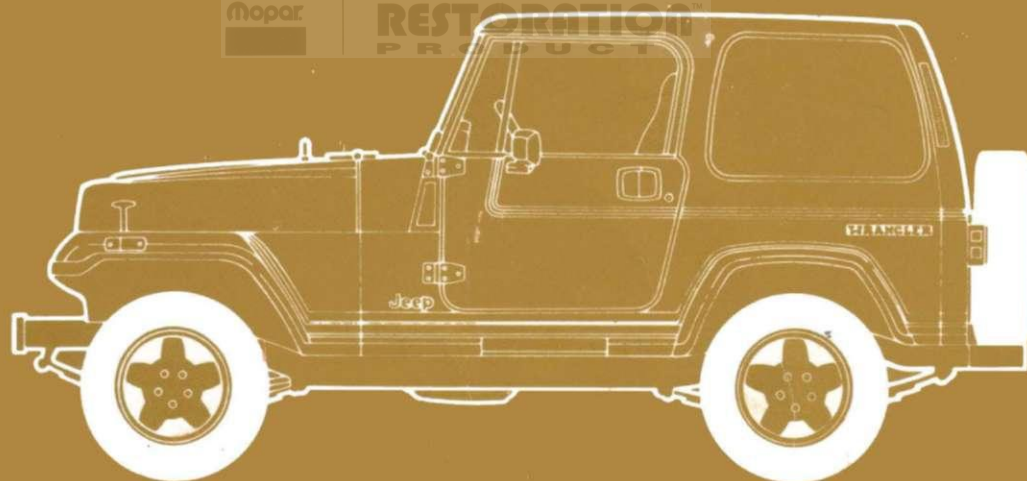
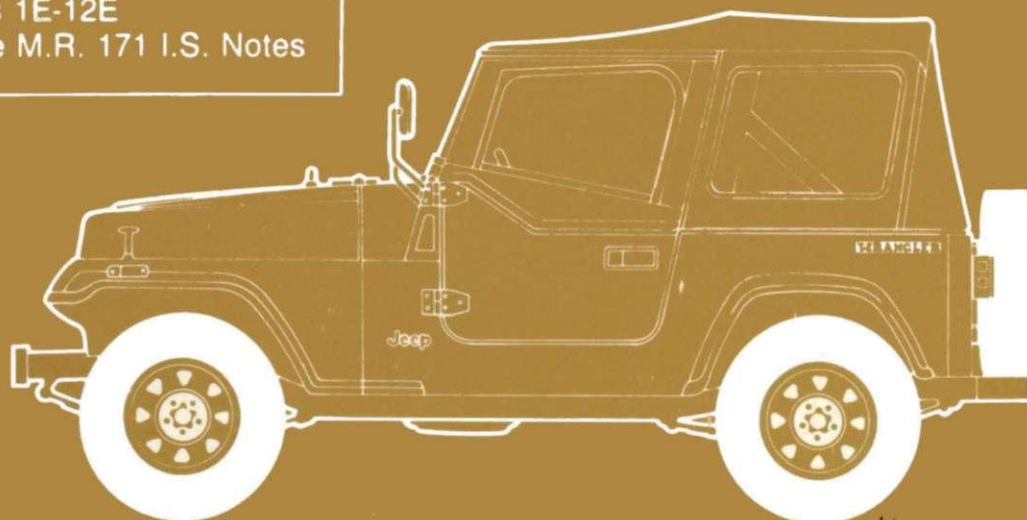
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Includes Campaign Asc
Plus I.S. Notes 1E-12E
Plus applicable M.R. 171 I.S. Notes



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