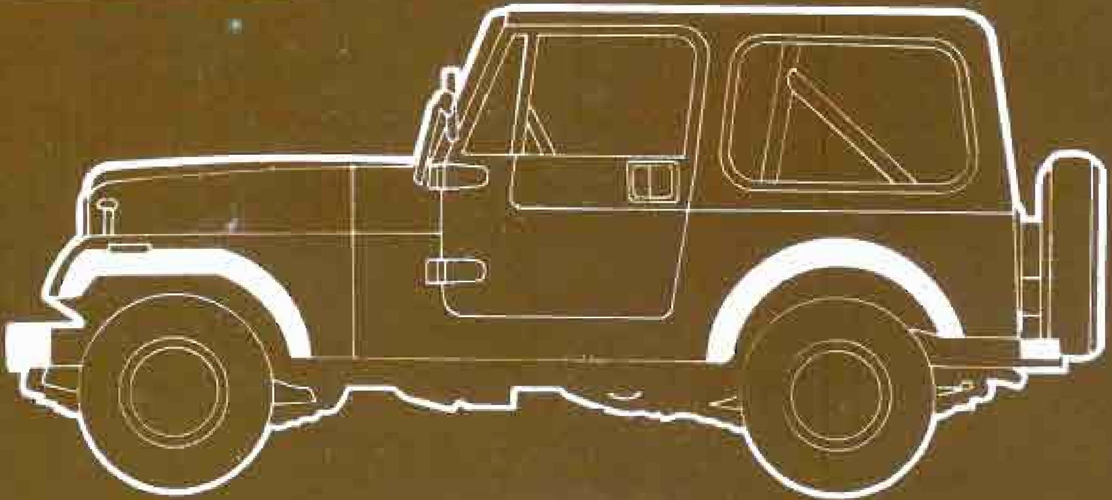
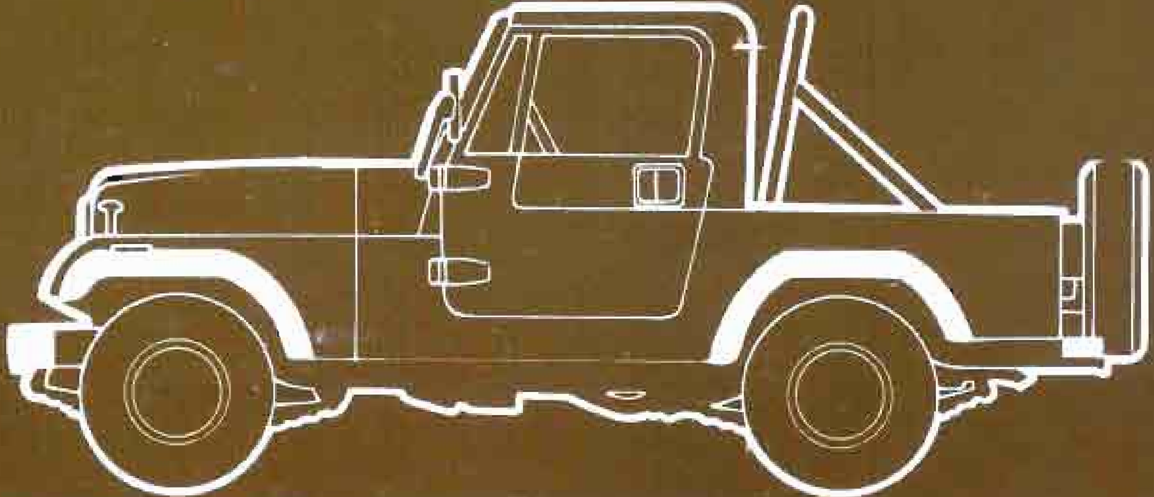
1984 - 1986

M.R.252

8981 320 374 U.S.A./Canada Edition

Includes I.S. Notes
1E - 9E





Jeep®

CJ-7/Scrambler

Jeep®
CJ-7/Scrambler

Workshop manual

M.R.252

MECHANICAL

JANUARY 1984 U.S.A./Canada Edition

8981 320 374

SEE
I.S.
NOTES

CONTENTS

(There is a more detailed contents page at the beginning of every chapter.)

A — GENERAL

B — ENGINES

C — ELECTRICAL

D — CLUTCH

E — GEARBOXES

F — AUTOMATIC TRANSMISSION

G — STEERING AND FRONT AXLE

H — REAR AXLE

J — SUSPENSION

K — BRAKE SYSTEM

L — HEATING AND AIR CONDITIONING

M — ACCESSORIES

A
B
C
D
E
F
G
H
J
K
L
M

Service Information (IS):

Three boxes have been provided near the black tabs (squares) marking the chapter; these enable you to enter IS Note numbers which refer to a particular modification on the page concerned.

SEE
I.S.
NOTES

1E

3E

Special Tools:

Special tools needed for the various operations mentioned in this manual may be found at the beginning of each chapter in which they are used, and also under the appropriate section within the chapter.

Electrical:

Wiring diagrams feature an easy-to-understand format which makes them valuable reference sources when performing electrical service. Each diagram provides information about:

- the location of electrical components on the vehicle
- how each component is wired
- the function of each electrical component
- how to diagnose an electrical malfunction

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

CONTENTS

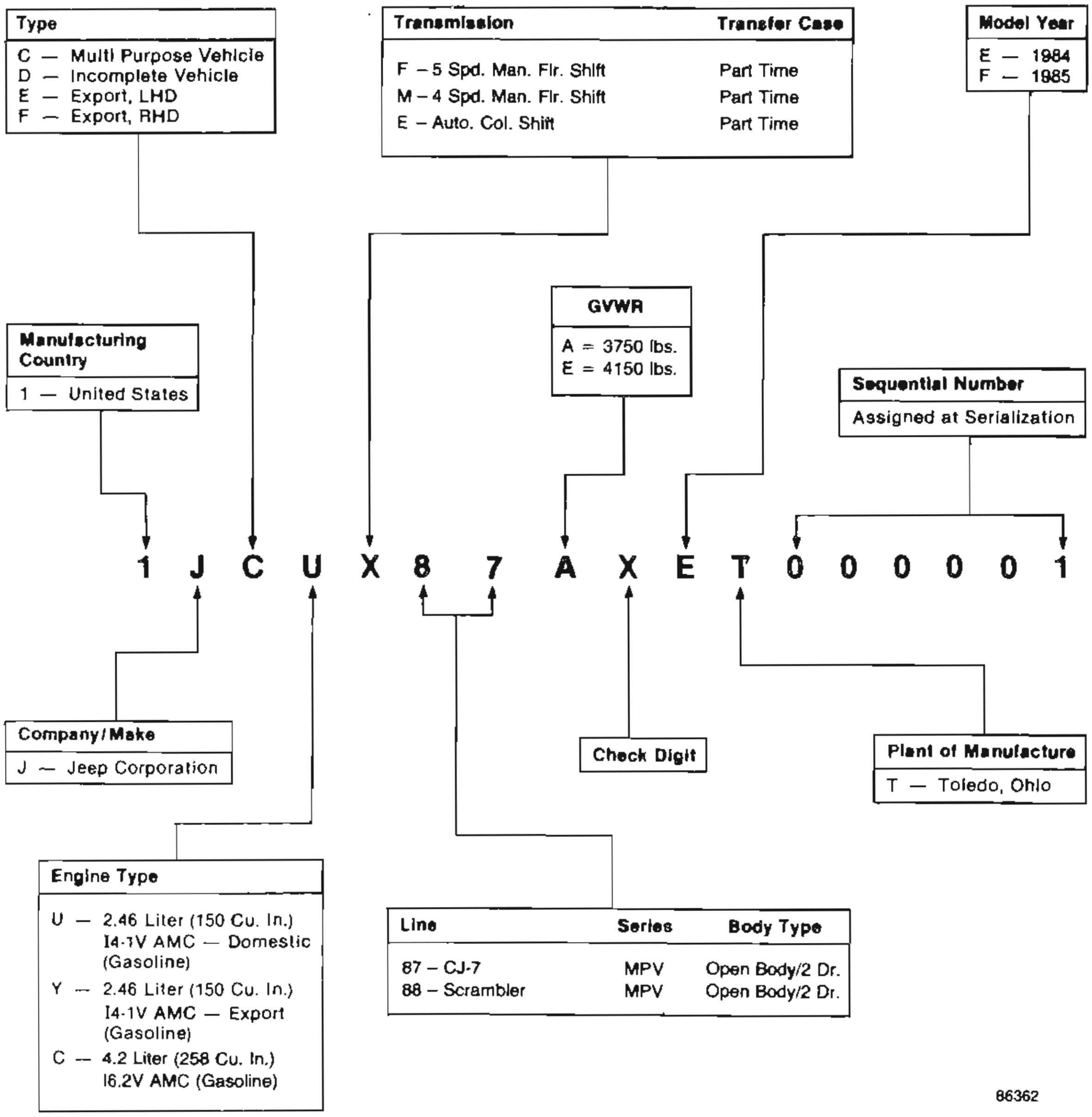
SEE I.S. NOTES

SAFETY NOTE

Warnings and Cautions pertain to critical operations that involve either personal safety or situations in which vehicle damage could result. Use extreme caution for personal safety and adhere to the specified procedures when performing such operations.

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.



1 J C U X 8 7 A X E T 0 0 0 0 0 1

Manufacturing Country	
1	United States

Company/Make	
J	Jeep Corporation

Type	
C	Multi Purpose Vehicle
D	Incomplete Vehicle
E	Export, LHD
F	Export, RHD

Engine Type	
U	2.46 Liter (150 Cu. In.) I4-1V AMC — Domestic (Gasoline)
Y	2.46 Liter (150 Cu. In.) I4-1V AMC — Export (Gasoline)
C	4.2 Liter (258 Cu. In.) I6.2V AMC (Gasoline)

Transmission	Transfer Case
F – 5 Spd. Man. Flr. Shift	Part Time
M – 4 Spd. Man. Flr. Shift	Part Time
E – Auto. Col. Shift	Part Time

Line	Series	Body Type
87 – CJ-7	MPV	Open Body/2 Dr.
88 – Scrambler	MPV	Open Body/2 Dr.

GVWR
A = 3750 lbs.
E = 4150 lbs.

Check Digit

Model Year	
E	1984
F	1985

Plant of Manufacture	
T	Toledo, Ohio

Sequential Number
Assigned at Serialization

86362

SEE I.S. NOTES

GENERAL DIMENSIONS

General Dimensions
Centimeters (Inches)

	CJ-7	Scrambler
Wheelbase	237.2 (93.4)	262.6 (103.4)
Overall Length – Body	389.1 (153.2) 389.1 (153.2)	422.1[1] (166.2) 450.1[2] (177.2)
Overhang – Front – Rear	59.7 (23.5) 92.2 (36.3)	59.7 (23.5) 99.8[1] (39.3) 127.8[2] (50.3)
Overall Width	165.9 (65.3)	165.9 (65.3)
Overall Height – Open Body – Soft Top – Hard Top	180.1 (70.9) 182.6 (71.9) 180.3 (71.0)	179.8 (70.8) 181.6 (71.5) 181.9 (71.6)
Step Height – Front	68.8 (27.1)	69.6 (27.4)
Front Tread	141.7 (55.8)	141.7 (55.8)
Rear Tread	140.0 (55.1)	140.0 (55.1)
Minimum Ground Clearance	19.1 (7.5)	19.1 (7.5)
Minimum Turning Diameter-meters (feet) curb to curb	10.9 (35.8)	11.8 (38.8)
Effective Leg Room Front (Accelerator) Rear (Minimum)	 99.3 (39.1) 88.9 (35.0)	 99.3 (39.1) —
Hip Room – Front – Rear	136.7 (53.8) 91.4 (36.0)	136.7 (53.8) —
Shoulder Room – Front – Rear	136.7 (53.8) 143.0 (56.3)	136.7 (53.8) —
Effective Head Room Front – Soft Top Front – Hard Top Rear – Hard Top	 103.1 (40.6) 101.3 (39.9) 100.6 (39.6)	 103.1 (40.6) 101.3 (39.9) —
Cargo Floor Height	67.8 (26.7)	0.45 (16.0)
Cargo Capacity – cubic meters (feet)	0.45[3] (16.0)	0.86 (30.4)
Cargo Space Length at Floor Width at Wheelhouse/Floor Width of Tailgate Opening	 118.9 (46.8) 91.4 (36.0) 87.6 (34.5)	 156.2 (61.5) 91.4 (36.0) 87.6 (34.5)

1. With roll bar mounted spare tire.
2. With rear mounted swing-away spare tire carrier.
3. With rear seat removed.

NOTE: Length, width and overhang dimensions reflect rear mounted spare tire standard on CJ-7. Height dimensions reflect roll bar as standard, which affects open body heights.

86363

MODEL IDENTIFICATION

Series	Model Number	Wheelbase (Inches)	Gross Vehicle Weight Rating (GVWR)	
			With Standard Suspension	With H.D. Suspension or Hardtop
CJ-7	87	93.4	3750	4150
Scrambler	88	103.4	4150	4150

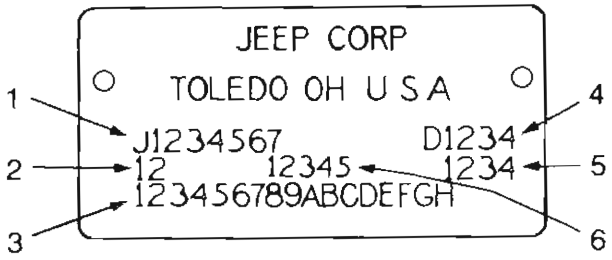
86364

VEHICLE IDENTIFICATION PLATE

A metal identification plate is riveted to the driver side of the dash panel in the engine compartment.

The following information is shown on the plate:

- order number (1)
- paint gun number (2)
- vehicle identification number (VIN) (3)
- vehicle deviation or special sales request and order (SSR & O) (4)
- trim option number (5)
- paint option number (6)



86365

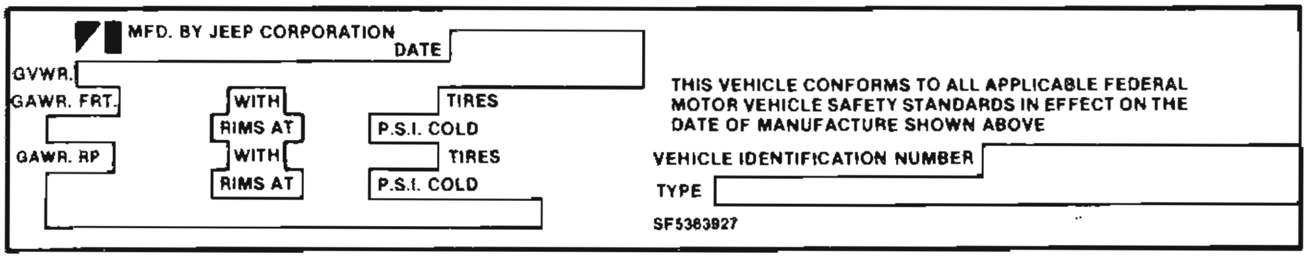
SEE I.S. NOTES

SAFETY CERTIFICATION LABEL

A safety certification label is attached to all vehicles to certify that they conform to Federal Motor Vehicle Safety Certification Standards.

The label is located on the driver side door pillar, and lists:

- the month and year of manufacture
- gross vehicle weight rating (GVWR)
- gross axle weight rating (GAWR)



MFD. BY JEEP CORPORATION
DATE
GVWR.
GAWR. FRT. WITH TIRES
RIMS AT P.S.I. COLD
GAWR. RR WITH TIRES
RIMS AT P.S.I. COLD

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

84069

SEE I.S. NOTES

SPECIAL SALES REQUEST AND ORDER (SSR & O) NUMBER

Certain Jeep vehicles are built for special orders with other than standard parts or equipment. To assist the dealer in ordering correct replacement parts, an SSR & O number is assigned and a permanent record of the deviation is maintained by the factory.

The SSR & O number is embossed on the Vehicle Identification Plate.

The parts ordering procedure for SSR & O parts is detailed in the Jeep Parts Microfiche.

POWERTRAIN – DRIVELINE COMBINATIONS

Model	Engine	Transmission	Axle Ratio (Std./Opt.)	Transfer Case
CJ-7 and Scrambler Models	I4-1V 2.46L (150 C.I.D.)	4-Spd. Man. (T4) 5-Spd. Man. (T5)	3.54/4.10 3.54/4.10	300 300
	I6-2V 4.2L (258 C.I.D.)	4-Spd. Man. (T4) 4-Spd. Man. (T176) 5-Spd. Man. (T5) 3-Spd. Auto. (999)	2.73/3.31 2.73/3.31 2.73/3.31 2.73/3.31	300 300 300 300

86370

FLUIDS – LUBRICANTS – CAPACITIES

Engine	I4-1V 2.46 liter (150 cu. in.) I6-2V 4.2 liter (258 cu. in.)	API "SF" Classification 10W-30, 10W-40, 20W-40 10W-30, 10W-40 5W-30* *Must not be used above 60°F (15.5°C)	 Above ± 32°F (0°C) Above 0°F (-18°C) Below 0°F (-18°C)
Transmission	999 Auto	Use AMC/Jeep/Renault automatic transmission fluid or equivalent Dexron II® fluid.	
	T4-T5	Use only AMC/Jeep/Renault transmission lubricant, part number 89 83 000 000.	
	T-176	Use AMC/Jeep/Renault gear lubricant, or equivalent 75W-90 (API GL-5) lubricant.	
Transfer Case	300	Use only AMC/Jeep/Renault lubricant, part number 89 83 000 000.	
Axle	Front/Rear	Use AMC/Jeep/Renault gear lubricant or equivalent SAE 75W-90, API GL-5 quality gear lubricant. **NOTE: Use SAE 80W-140, API GL-5 quality gear lubricant for trailer towing and in Trac-Lok rear axles.**	
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 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.	

86366

SEE I.S. NOTES

FLUIDS – LUBRICANTS – CAPACITIES (Cont'd)

Capacities (Approximate Refill)	**U.S. Measure**	**Imperial Measure**	**Metric Measure**
Engine Oil:			
2.46 liter I4 (with or without filter change)	4.0 quarts	3.33 quarts	3.78 liters
4.2 liter I6 (with or without filter change)	6.0 quarts	5.0 quarts	5.7 liters
Cooling System: (includes coolant overflow bottle)			
2.46 liter I4	9.0 quarts	7.5 quarts	8.5 liters
4.2 liter I6	10.5 quarts	8.7 quarts	9.9 liters
Transmission:			
T176	3.5 pints	2.9 pints	1.7 liters
T4	3.5 pints	2.9 pints	1.7 liters
T5	4.0 pints	3.3 pints	1.9 liters
999 Auto	8.5 pints	7.1 pints	4.0 liters
Transfer Case:			
Model 300	4.0 pints	3.3 pints	1.9 liters
Axles:			
Front	2.5 pints	2.1 pints	1.2 liters
Rear	4.8 pints	4.0 pints	2.3 liters
Fuel Tank (approx. cap.)			
Standard Tank	14.8 gallons	12.3 gallons	56.0 liters
Optional Tank	20.0 gallons	16.8 gallons	75.5 liters

86367

ADHESIVES – SEALERS – CLEANERS

SEE I.S. NOTES

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.

84107

TOWING PROCEDURES

Safety Precautions

- secure loose or protruding parts of a damaged vehicle
- the end of the vehicle being towed should be lifted a minimum of 100 km (4 in) off the ground; check the opposite end for adequate ground clearance
- always use a safety chain system that is independent of the lifting and towing attachment
- do not allow any of the towing equipment to bear on the fuel tank
- do not go under the vehicle while it is lifted by the towing equipment
- do not allow passengers to ride in a towed vehicle
- always observe all state and local laws regarding such items as warning signals, night illumination, speed, etc.
- do not attempt a towing operation that could jeopardize the operator, any bystanders or other motorists

CAUTION: To prevent driveline damage, shift the transmission and transfer case into the positions outlined in the general towing instructions.

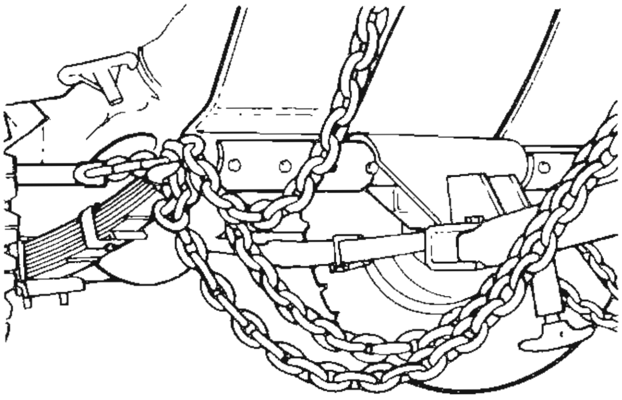
Front Towing – Front End Raised

Attach J-hooks over the axle outboard of the springs.

Tow hooks or chains must not be attached to the bumper or to the constant velocity (CV) joints.

Place a tow bar under the spring shackles.

Attach safety chains around the spring shackles.



86368

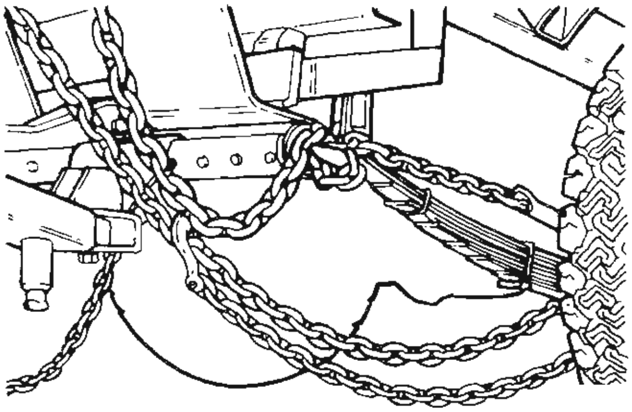
SEE I.S. NOTES

Rear Towing – Rear End Raised

Attach J-hooks around the axle outboard of the springs.

Place a tow bar under the bumper plate.

Attach safety chains to the spring shackles.



EMERGENCY TOWING

If the vehicle is disabled and is to be towed with the front or rear wheels off the ground, the towing speed should be limited to 48 km/h (30 mph) for a distance no greater than 24 km (15 mi).

Towing Vehicles with Manual Transmission and the Model 300 Transfer Case

Ignition Key Available

Shift the transmission and transfer case into the Neutral position and tow the vehicle with either all four wheels on the road or with the front or rear wheels raised.

Turn the front drive hubs to the 4 x 4 or Lock position.

Turn the ignition key to the OFF position to unlock the steering column.

Ignition Key Not Available and Vehicle is Unlocked

Shift the transmission and transfer case into the Neutral position and tow the vehicle with the front wheels raised.

Ignition Key Not Available and Vehicle is Locked

Place a dolly under the rear wheels and tow the vehicle with the front end raised or disconnect the rear propeller shaft at the rear axle yoke (be sure to mark the shaft and yoke for proper alignment at reassembly), secure the shaft to the underside of the vehicle, and tow with the front end raised.

NOTE: When towing the vehicle over 300 km (200 mi), stop every 300 km (200 mi), leave the transfer case in the Neutral position, and shift the transmission into gear. Then start and run the engine for about one minute to circulate oil in the transfer case.

Towing Vehicles with Automatic Transmission and the Model 300 Transfer Case

Ignition Key Available

Turn the ignition key to the OFF position to unlock the steering column and gearshift selector linkage.

Move the gearshift lever to the Park position and the transfer case shift lever to the Neutral position.

Ignition Key Not Available

Place a dolly under the rear wheels and tow the vehicle with the front end raised or disconnect the rear propeller shaft at the rear axle yoke (index mark yoke for correct assembly), secure the shaft to the underside of the vehicle, and tow it with the front wheels raised.

NOTE: When towing the vehicle over 300 km (200 mi), stop every 300 km (200 mi), leave the transfer case in the Neutral position, start the engine, place the automatic transmission in the Drive position and run the engine for about one minute to circulate the oil in the transfer case.

RECREATIONAL TOWING

Jeep vehicles can be towed behind a recreational vehicle such as a motor home, but the following instructions must be observed to avoid damaging driveline components.

Be sure to check and comply with federal, state and local laws or ordinances regarding this type of towing.

SEE I.S. NOTES

Vehicles with Manual Transmission and the Model 300 Transfer Case

Turn the ignition switch to the OFF position to unlock the steering wheel.

Shift the transmission into gear and the transfer case into the Neutral position.

Turn the selective drive hubs to the 4 x 4 or Lock position for axle lubrication.

Vehicles with Automatic Transmission and the Model 300 Transfer Case

Turn the ignition switch to the OFF position to unlock the steering wheel.

Shift the automatic transmission into the Park position.

Shift the transfer case into the Neutral position.

Turn the selective drive hubs to the 4 x 4 or Lock position for axle lubrication.

SEE I.S. NOTES

TRAILER TOWING AND CAMPERS

The Jeep Corporation New Vehicle Warranty includes conditions and limitations for vehicles used in towing trailers or campers. The requirements and recommendations in this manual and other factory literature must be followed in order to maintain this coverage.

In addition to the vehicle maintenance and servicing requirements referred to, the GVW and GAW ratings are of special significance. When a Jeep vehicle is to be used for trailer or camper towing, it is extremely important that the GVW or GAW ratings not be exceeded by the addition of:

- the tongue weight of a trailer
- the weight of any other type of vehicle put in or on the towing vehicle

Remember that additional items placed in or on the trailer or mounted camper will add to the load.

CAUTION: Jeep Corporation will not be responsible for brake performance if the Jeep vehicle and trailer hydraulic brake systems are interconnected in any way. A separate brake system is recommended and actually required in some states for all trailers weighing 454 kg (1,000 lbs) or more.

FLOOR JACK – SAFETY STANDS

The vehicle can be raised with a floor jack and supported with jack stands at the front and rear ends of the frame rails.

Do not attempt to raise the vehicle with a floor jack positioned under the axle tubes or body side sills. Use the frame rail lift points only.

SEE I.S. NOTES

HOIST

The vehicle can be raised on a twin-post, swivelling arm or ramp-type drive hoist.

SEE I.S. NOTES

ENGINE

Change the oil after the first 8 000 km (5,000 mi) and at 12 000 km (7,500 mi) intervals afterward, or as indicated in the Jeep Engine Maintenance Schedule.

Refer to the Fluids – Lubricants – Capacities Chart in this chapter for the recommended lubricant grade and viscosity.

Check the engine oil level at every fuel fill. Add recommended oils only if the oil level is low. Do not overfill.

MANUAL TRANSMISSION

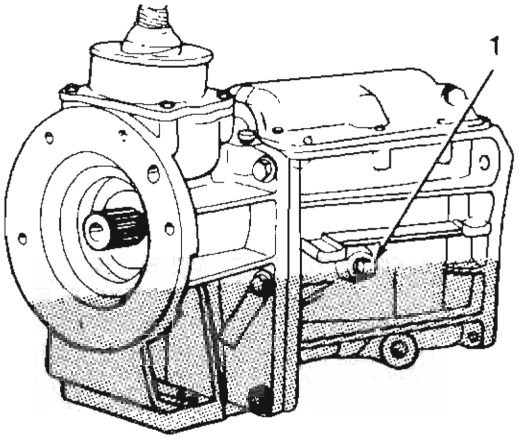
Change the lubricant at the intervals recommended in the Jeep Chassis Maintenance Schedule.

Use recommended lubricants only. Refer to the Fluids – Lubricants – Capacities Chart in this chapter for the recommended lubricant grade and viscosity.

Refilling

Fill the transmission to the bottom edge of the fill plug hole when filling or adding lubricant.

The fill plug (1) is on the passenger side of the manual transmission for all models.



86331

AUTOMATIC TRANSMISSION

Change the fluid and filter at the intervals recommended in the Jeep Chassis Maintenance Schedule.

Use AMC/Jeep/Renault automatic transmission fluid or an equivalent identified as Dexron II® only.

Check the fluid level with the engine running and the transmission in the Park position.

The transmission fluid should be at the normal operating temperature to ensure an accurate level indication.

Refilling

Do not overfill when refilling or adding fluid.

TRANSFER CASE 300

Change the transfer case lubricant at the intervals recommended in the Jeep Chassis Maintenance Schedule.

Use only AMC/Jeep/Renault transmission lubricant part number 8983 000 000.

Refilling

Fill the transfer case to the edge of the fill plug hole.

Do not overfill.

AXLES

Change the front/rear axle lubricant at 48 000 km (30,000 mi) intervals.

Use AMC/Jeep/Renault gear lubricant or an equivalent SAE 75W-90 (A.P.I. GL-5) lubricant.

SEE
I.S.
NOTES

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 5	163 7458
2 4	21 2427	6 4	56 6472	10 4	92 0517	14 4	127 4562	19	168 1714
2 6	23 0129	6,6	58 4174	10 6	93 8219	14 6	129 2264	19 5	172 5970
2 8	24 7831	6 8	60 1876	10 8	95.5921	14 8	130 9966	20	177 0225
3	26 5534	7	61 9579	11	97 3624	15	132 7669	20 5	181 4480
3 2	28 3236	7 2	63 7281	11 2	99 1326	15 2	134 5371	21	185 8736
3 4	30 0938	7 4	65 4983	11 4	100 9028	15 4	136 3073	22	194 7247
3 6	31 8640	7 6	67 2685	11 6	102 6730	15 6	138 0775	23	203.5759
3 8	33 6342	7 8	69 0388	11 8	104 4433	15 8	139 8478	24	212 4270
4	35 4045	8	70 8090	12	106 2135	16	141 6180	25	221 2781

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 8888
5	6 7791	25	33 8954	45	61 0118	65	88 1281	85	115 2446
6	8 1349	26	35 2513	46	62 3676	66	89 4840	86	116 6004
7	9 4907	27	36 6071	47	63 7234	67	90 8398	87	117 9562
8	10 8465	28	37 9629	48	65 0793	68	92 1956	88	119 3120
9	12 2024	29	39 3187	49	66 4351	69	93 5514	89	120 6678
10	13 5582	30	40.6745	50	67 7909	70	94 9073	90	122 0236
11	14 9140	31	42 0304	51	69 1467	71	96 2631	91	123 3794
12	16.2698	32	43 3862	52	70 5025	72	97 6189	92	124 7352
13	17 6256	33	44 7420	53	71 8583	73	98 9747	93	126 0910
14	18 9815	34	46 0978	54	73 2142	74	100 3316	94	127 4468
15	20 3373	35	47 4536	55	74 5700	75	101 6862	95	128 8026
16	21 6931	36	48 8094	56	75.9258	76	103 0422	96	130 1586
17	23 0489	37	50 1653	57	77 2816	77	104 3980	97	131 5144
18	24 4047	38	51 5211	58	78 6374	78	105 7538	98	132 8702
19	25 7605	39	52 8769	59	79 9933	79	107 1196	99	134 2260
20	27 1164	40	54 2327	60	81 3491	80	108 4654	100	135 5820

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

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 9507	24	17 7015	44	32 4527	64	47 2040	84	61 9552
5	3 6878	25	18 4391	45	33 1903	65	47 9415	85	62 6928
6	4 4254	26	19 1766	46	33 9279	66	48 6791	86	63 4303
7	5 1629	27	19 9142	47	34 6654	67	49 4167	87	64 1679
8	5 9005	28	20 6517	48	35 4030	68	50 1542	88	64.9545
9	6.6381	29	21 3893	49	36 1405	69	50 8918	89	65 6430
10	7 3756	30	22 1269	50	36 8781	70	51 6293	90	66 3806
11	8 1132	31	22.8644	51	37 6157	71	52 3669	91	67 1181
12	8 8507	32	23 6020	52	38 3532	72	53 1045	92	67 8557
13	9 5883	33	24 3395	53	39 0908	73	53 8420	93	68 5933
14	10 3259	34	25 0771	54	39 8284	74	54 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	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	256 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	159 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 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	1106 3431

84161

SEE I.S. NOTES

inch to mm

in	mm	in	mm	in	mm	in	mm	in	mm
01	.254	21	5 334	41	10.414	61	15 494	.81	20 574
02	.508	.22	5 588	42	10 668	.62	15 748	.82	20 828
03	762	23	5 842	43	10.922	63	16 002	83	21 082
04	1 016	24	6.096	44	11 176	64	16 256	84	21 336
05	1 270	25	6 350	45	11 430	65	16.510	.85	21.590
06	1 524	26	6 604	46	11 684	66	16 764	86	21.844
07	1 778	27	6 858	47	11 938	67	17.018	87	22.098
08	2 032	28	7 112	48	12 192	68	17 272	88	22 352
09	2 286	29	7 366	49	12 446	69	17 526	.89	22 606
.10	2 540	30	7 620	.50	12 700	70	17 780	.90	22 860
.11	2.794	31	7 874	.51	12 954	71	18 034	91	23 114
.12	3 048	32	8 128	52	13 208	72	18 288	92	23 368
13	3 302	33	8 382	53	13 462	73	18 542	93	23 622
14	3 556	34	8 636	54	13 716	74	18 796	94	23 876
15	3.810	35	8 890	55	13 970	75	19 050	95	24 130
16	4 064	36	9 144	56	14 224	.76	19 304	.96	24 384
17	3 318	37	9 398	57	14 478	77	19 558	97	24 638
18	4 572	38	9 652	58	14 732	78	19 812	98	24 892
19	4 826	39	9 906	59	14 986	79	20 066	99	25 146
20	5 080	.40	10 160	60	15 240	80	20 320	1 00	25 400

fraction to decimal inch to mm

Inches			Inches		
Frac	Dec	mm	Frac	Dec	mm
1/64	015625	.3969	33/64	515675	13 0969
1/32	031250	7938	17/32	531250	13 4938
3/64	046875	1 1906	35/64	546875	13 8906
1/16	062500	1.5875	9/16	562500	14.2875
5/64	078125	1.9844	37/64	578125	14.6844
3/32	093750	2.3812	19/32	.593750	15.0812
7/64	109375	2.7781	39/64	.609375	15 4781
1/8	125000	3.1750	5/8	625000	15.8750
9/64	140625	3.5719	41/64	640625	16 2719
5/32	156250	3 9668	21/32	656250	16 6688
11/64	171875	4.3656	43/64	671875	17 0656
3/16	.187500	4.7625	11/16	687500	17 4625
13/64	203125	5.1594	45/64	703125	17 8594
7/32	218750	5.5562	23/32	718750	18 2562
15/64	234375	5.9531	47/64	.734375	18 6531
1/4	250000	6 3500	3/4	750000	19 0500
17/64	265625	6.7469	49/64	765625	19 4469
9/32	281250	7.1438	25/32	781250	19 8437
19/64	296875	7 5406	51/64	.796875	20 2406
5/16	.312500	7 9375	13/16	.812500	20 6375
21/64	328125	8 3344	53/64	828125	21 0344
11/32	.343750	8 7312	27/32	843750	21.4312
23/64	359375	9 1281	55/64	859375	21 8281
3/8	375000	9 5250	7/8	875000	22.2250
25/64	390625	9 9219	57/64	.890625	22 6219
13/32	406250	10.3188	29/32	.906250	23.0188
27/64	.421875	10.7156	59/64	.921875	23 4156
7/16	.437500	11.1125	15/16	937500	23 8125
29 64	453125	11 5094	61/64	953125	24.2094
15/32	.468750	11.9062	31/32	968750	24 6062
31/64	.484375	12.3031	63/64	.984375	25 0031
1/2	.500000	12.7000	1	1.000000	25 4000

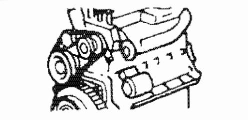
mm to inch

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	1 00	03937

1	03937	21	82677	41	1 61417	61	2.40157	81	3 18897
2	07874	22	86614	42	1 65354	62	2.44094	82	3 22834
3	11811	23	90551	43	1 69291	63	2 48031	83	3 26771
4	15748	24	94488	44	1.73228	64	2 51968	84	3.30708
5	19685	25	98425	45	1 77165	65	2 55905	85	3 34645
6	23622	26	1 02362	46	1 81102	66	2.59842	86	3 38582
7	27559	27	1.06299	47	1.85039	67	2.63779	87	3 42519
8	31496	28	1 10236	48	1.88976	68	2 67716	88	3 46456
9	35433	29	1.14173	49	1 92913	69	2 71653	89	3.50393
10	.39370	30	1.18110	50	1.96850	70	2 75590	90	3.54330
11	.43307	31	1 22047	51	2.00787	71	2 79527	91	3 58267
12	.47244	32	1.25984	52	2.04724	72	2 83464	92	3.62204
13	.51181	33	1 29921	53	2 08661	73	2 87401	93	3 66141
14	.55118	34	1 33858	54	2.12598	74	2 91338	94	3 70078
15	59055	35	1 37795	55	2 16535	75	2.95275	95	3.74015
16	.62992	36	1.41732	56	2.20472	76	2.99212	96	3 77952
17	66929	37	1.45669	57	2.24409	77	3 03149	97	3 81889
18	.70866	38	1.49606	58	2.28346	78	3 07086	98	3 85826
19	74803	39	1 53543	59	2 32283	79	3 11023	99	3.89763
20	78740	40	1.57480	60	2 36220	80	3 14960	100	3 93700

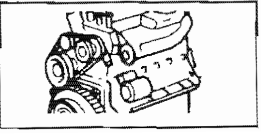
84162

General Jeep CJ-7 I-6 Engine Information and Tune-Up Procedure

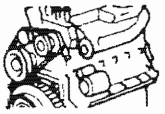


ENGINES

CONTENTS

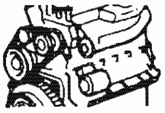


SEE I.S. NOTES

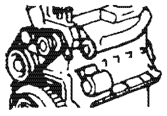


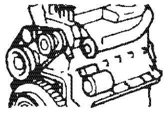
ENGINES

CONTENTS



SEE I.S. NOTES





GENERAL

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.

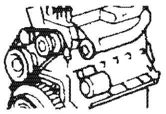
The cylinders in the four-cylinder engine are numbered 1 through 4 from front to rear. The firing order is 1-3-4-2.

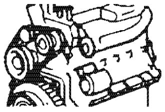
The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within five main bearings and the camshaft rotates within four line-bored bearings.

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.

SEE
I.S.
NOTES





SEE I.S. NOTES

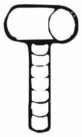
SPECIAL TOOLS

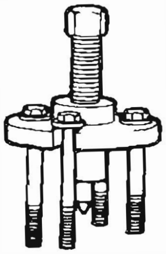
Tool Ref.	Description	Required	Recommended
J-22248	Timing Case Cover Alignment and Seal Installation Tool	■	
J-21882	Oil Pump Inlet Tube Installation Tool	■	
J-22534-01	Valve Spring Removal and Installation Tool	■	
J-22534-04		■	
J-22534-05		■	
J-9256	Timing Case Cover Oil Seal Removal Tool		■
J-22794	Air Hose Adapter		■
J-21884	Hydraulic Valve Tappet Removal and Installation Tool		■
J-8520	Dial Indicator Set		■
J-21791	Vibration Damper Removal Tool		■
J-5959-04	C-Clamp and Rod Extension		■
J-9163	Screw (used with J-22248)		■
J-5601	Piston Ring Compressor		■
J-23600	Belt Tension Gauge		■
J-23600-B	Belt Tension Gauge		■
J-29550	Belt Tension Gauge		■
J-24460-01	Cooling System Pressure Tester and Adapter		■
J-9789-C	Universal Carburetor Gauge Kit		■
J-10174-01	Main Jet Removal and Installation Tool		■
J-23738	Hand Operated Vacuum Pump		■
ET-501-82	Fuel Feedback System Tester	■	
ET-501-84	Fuel Feedback System Tester Adapter	■	
	Tach/Dwell Meter		■


J-9163


J-21882

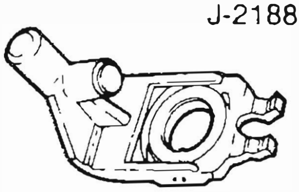

J-9256

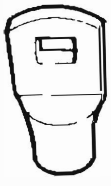

J-22534-5


J-21791

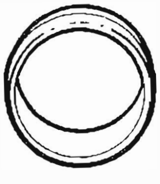

J-22248

SEE I.S. NOTES


J-22534-0

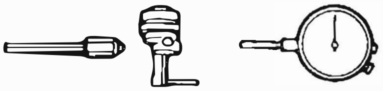

J-22534-4

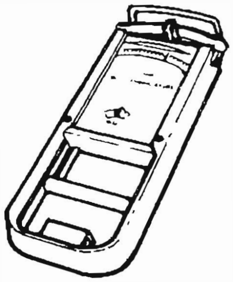

J-21884

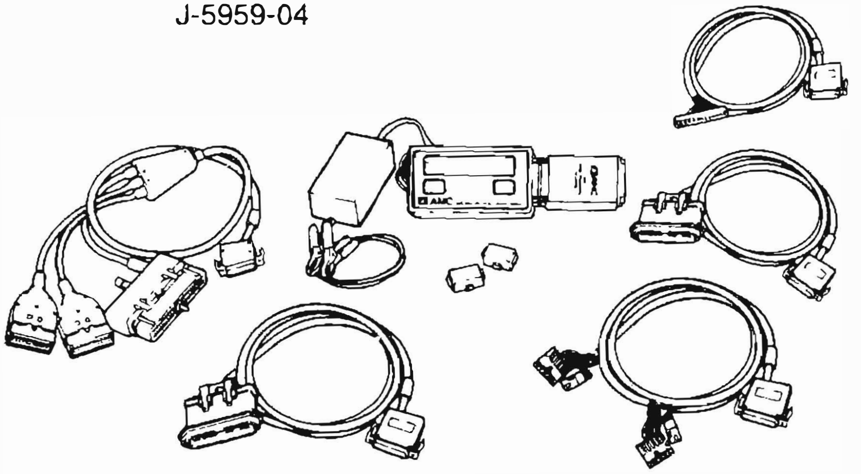

J-5601

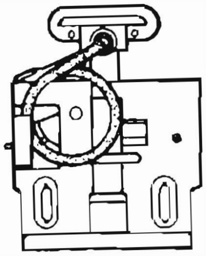

J-22794

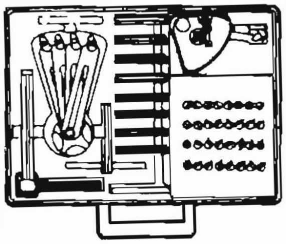

J-5959-04

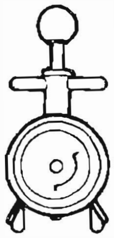

J-8520


J-23600

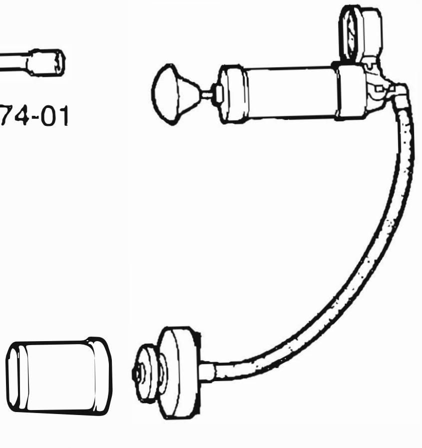

ET-501

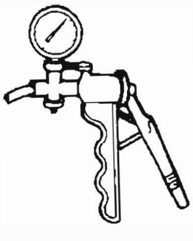

J-29550

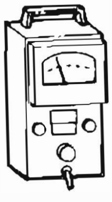

J-9789-C


J-23600-B


J-10174-01


J-24460-01


J-23738


TACH/DWELL METER

86307

EMISSION CONTROL COMPONENTS

SEE I.S. NOTES

Emission Control Components

Engine and Carb	Series	Transmission	Pulse Air Injection	Air Control Valve (Downstream)	Pulse Air Check Valve (Upstream)	Pulse Air Check Valve (Downstream)	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 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
150 CID 1V	87 88	M	●	●	●	●	●	●	●	●	●	●	115° 155°F 46°/68°C	V	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
258 CID 2V	87 88	M	●	●	●	●	●	●	●	●	●	●	115° 155°F 46° 68°C	V	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
		A	●	●	●	●	●	●	●	●	●	●	115° 155°F 46°/68°C	V	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

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

840100(J)

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

840101

DIAGNOSIS PROCEDURES

General

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.

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.

Service Diagnosis – Mechanical

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS	(1) Fuel pump gasket broken or improperly seated.	(1) Replace gasket.
	(2) Cylinder head cover RTV sealant broken or improperly seated.	(2) Replace sealant; inspect cylinder head cover sealant flange and cylinder head sealant surface for distortion and cracks.
	(3) Oil filler cap leaking or missing.	(3) Replace cap.
	(4) Oil filter gasket broken or improperly seated.	(4) Replace oil filter.
	(5) Oil pan side gasket broken, improperly seated or opening in RTV sealant.	(5) Replace gasket or repair opening in sealant; inspect oil pan gasket flange for distortion.
	(6) Oil pan front oil seal broken or improperly seated.	(6) Replace seal; inspect timing case cover and oil pan seal flange for distortion.
	(7) Oil pan rear oil seal broken or improperly seated.	(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) Timing case cover oil seal broken or improperly seated.	(8) Replace seal.
	(9) Excess oil pressure because of restricted PCV valve.	(9) Replace PCV valve.
	(10) Oil pan drain plug loose or has stripped threads.	(10) Repair as necessary and tighten.
	(11) Rear oil gallery plug loose.	(11) Use appropriate sealant on gallery plug and tighten.

B0651A

Service Diagnosis – Mechanical (Continued)

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS (Continued)	(12) Rear camshaft plug loose or improperly seated.	(12) Seat camshaft plug or replace and seal, as necessary.
	(13) Distributor base gasket damaged.	(13) Replace gasket.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high.	(1) Drain oil to specified level.
	(2) Oil with wrong viscosity being used.	(2) Replace with specified oil.
	(3) PCV valve stuck closed.	(3) Replace PCV valve.
	(4) Valve stem oil deflectors (or seals) are damaged, missing, or incorrect type.	(4) Replace valve stem oil deflectors.
	(5) Valve stems or valve guides worn.	(5) Measure stem-to-guide clearance and repair as necessary.
	(6) Poorly fitted or missing valve cover baffles.	(6) Replace valve cover.
	(7) Piston rings broken or missing.	(7) Replace broken or missing rings.
	(8) Scuffed piston.	(8) Replace piston.
	(9) Incorrect piston ring gap.	(9) Measure ring gap, repair as necessary.
	(10) Piston rings sticking or excessively loose in grooves.	(10) Measure ring side clearance, repair as necessary.
	(11) Compression rings installed upside down.	(11) Repair as necessary.
	(12) Cylinder walls worn, scored, or glazed.	(12) Repair as necessary.
	(13) Piston ring gaps not properly staggered.	(13) Repair as necessary.
	(14) Excessive main or connecting rod bearing clearance.	(14) Measure bearing clearance, repair as necessary.
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.

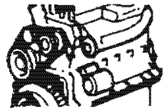
80651B

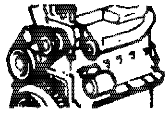
SEE I.S. NOTES

Service Diagnosis – Mechanical (Continued)

Condition	Possible Cause	Correction
NO OIL PRESSURE (Continued)	(2) Oil pressure gauge, warning lamp or sending unit inaccurate.	(2) Refer to Oil Pressure Gauge or Warning Lamp.
	(3) Oil pump malfunction.	(3) Refer to Oil Pump.
	(4) Oil pressure relief valve sticking.	(4) Remove and inspect oil pressure relief valve assembly.
	(5) Oil passages on pressure side of pump obstructed.	(5) Inspect oil passages for obstructions.
	(6) Oil pickup screen or tube obstructed.	(6) Inspect oil pickup for obstructions.
	(7) Loose oil inlet tube.	(7) Tighten or seal inlet tube.
LOW OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Inaccurate gauge, warning lamp or sending unit.	(2) Refer to Oil Pressure Gauge or Warning Lamp.
	(3) Oil excessively thin because of dilution, poor quality, or improper grade.	(3) Drain and refill crankcase with recommended oil.
	(4) Excessive oil temperature.	(4) Correct cause of overheating engine.
	(5) Oil pressure relief spring weak or sticking.	(5) Remove and inspect oil pressure relief valve assembly.
	(6) Oil inlet tube and screen assembly has restriction or air leak.	(6) Remove and inspect oil inlet tube and screen assembly. (Fill inlet tube with lacquer thinner to locate leaks.)
	(7) Excessive oil pump clearance.	(7) Measure clearances; refer to Oil Pump.
	(8) Excessive main, rod, or camshaft bearing clearance.	(8) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper oil viscosity.	(1) Drain and refill crankcase with correct viscosity oil.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Oil Pressure Gauge.

80651C





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.	(1) Inspect for low oil level and low oil pressure.
	(2) Main bearing clearance excessive.	(2) Measure main bearing clearance, repair as necessary.
	(3) Bearing insert missing.	(3) Replace missing insert.
	(4) Crankshaft end play excessive.	(4) Measure end play, repair as necessary.
	(5) Improperly tightened main bearing cap bolts.	(5) Tighten bolts with specified torque.
	(6) Loose flywheel or drive plate.	(6) Tighten flywheel or drive plate attaching bolts.
	(7) Loose or damaged vibration damper.	(7) Repair as necessary.
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply.	(1) Inspect for low oil level and low oil pressure.
	(2) Carbon build-up on piston.	(2) Remove carbon from piston crown.
	(3) Bearing clearance excessive or bearing missing.	(3) Measure clearance, repair as necessary.
	(4) Crankshaft connecting rod journal out-of-round.	(4) Measure journal dimensions, repair or replace as necessary.
	(5) Misaligned connecting rod or cap.	(5) Repair as necessary.
	(6) Connecting rod bolts tightened improperly.	(6) Tighten bolts with specified torque.
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive (scuffed piston).	(1) Measure clearance and examine piston.
	(2) Cylinder walls excessively tapered or out-of-round.	(2) Measure cylinder wall dimensions, rebore cylinder.

SEE
I.S.
NOTES

Service Diagnosis – Mechanical (Continued)

Condition	Possible Cause	Correction
PISTON NOISE (Continued)	(3) Piston ring broken.	(3) Replace all rings on piston.
	(4) Loose or seized piston pin.	(4) Measure piston-to-pin clearance, repair as necessary.
	(5) Connecting rods misaligned.	(5) Measure rod alignment, straighten or replace.
	(6) Piston ring side clearance excessively loose or tight.	(6) Measure ring side clearance, repair as necessary.
	(7) Carbon build-up on piston is excessive.	(7) Remove carbon from piston.
VALVE ACTUATING COMPONENT NOISE	(1) Insufficient oil supply.	(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) Push rods worn or bent.	(2) Replace worn or bent push rods.
	(3) Rocker arms or pivots worn.	(3) Replace worn rocker arms or pivots.
	(4) Foreign objects or chips in hydraulic tappets.	(4) Clean tappets.
	(5) Excessive tappet leak-down.	(5) Replace valve tappet.
	(6) Tappet face worn.	(6) Replace tappet; inspect corresponding cam lobe for wear.
	(7) Broken or cocked valve springs.	(7) Properly seat cocked springs; replace broken springs.
	(8) Stem-to-guide clearance excessive.	(8) Measure stem-to-guide clearance, repair as required.
	(9) Valve bent.	(9) Replace valve.
	(10) Loose rocker arms.	(10) Tighten bolts with specified torque.
	(11) Valve seat runout excessive.	(11) Regrind valve seat/valves.

80651E

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.

80651F

SEE I.S. NOTES

Service Diagnosis – Performance

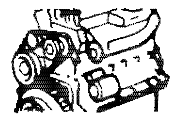
Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY)	(1) Binding linkage, choke valve or choke piston.	(1) Repair as necessary.
	(2) Restricted choke vacuum diaphragm.	(2) Clean passages.
	(3) Improper fuel level.	(3) Adjust float level.
	(4) Dirty, worn or faulty needle valve and seat.	(4) Repair as necessary.
	(5) Float sticking.	(5) Repair as necessary.
	(6) Faulty fuel pump.	(6) Replace fuel pump.
	(7) Incorrect choke cover adjustment.	(7) Adjust choke cover.
	(8) Inadequate choke unloader adjustment.	(8) Adjust choke unloader.
	(9) Faulty ignition coil.	(9) Test and replace as necessary.
	(10) Improper spark plug gap.	(10) Adjust gap.
	(11) Incorrect ignition timing.	(11) Adjust timing.
	(12) Incorrect valve timing.	(12) Check valve timing; repair as necessary.
ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed.	(1) Adjust curb or fast idle speed..
	(2) Incorrect ignition timing.	(2) Adjust timing to specification.
	(3) Improper feedback system operation.	(3) Refer to Feedback System Diagnosis.
	(4) Improper fast idle cam adjustment.	(4) Adjust fast idle cam.
	(5) Faulty EGR valve operation.	(5) Test EGR system and replace as necessary.
	(6) Faulty PCV valve air flow.	(6) Test PCV valve and replace as necessary.

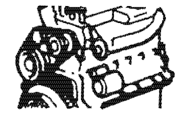
80652A

Service Diagnosis – Performance (Continued)

Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(7) Choke binding.	(7) Locate and eliminate binding condition.
	(8) Faulty TAC vacuum motor or valve.	(8) Repair as necessary.
	(9) Air leak into manifold vacuum.	(9) Inspect manifold vacuum connections and repair as necessary.
	(10) Improper fuel level.	(10) Adjust fuel level.
	(11) Faulty distributor rotor or cap.	(11) Replace rotor or cap.
	(12) Improperly seated valves.	(12) Test cylinder compression, repair as necessary.
	(13) Incorrect ignition wiring.	(13) Inspect wiring and correct as necessary.
	(14) Faulty ignition coil.	(14) Test coil and replace as necessary.
	(15) Restricted air vent or idle passages.	(15) Clean passages.
	(16) Restricted air cleaner.	(16) Clean or replace air cleaner filler element.
	(17) Faulty choke vacuum diaphragm.	(17) Repair as necessary.
FAULTY LOW-SPEED OPERATION	(1) Restricted idle transfer slots.	(1) Clean transfer slots.
	(2) Restricted idle air vents and passages.	(2) Clean air vents and passages.
	(3) Restricted air cleaner.	(3) Clean or replace air cleaner filter element.
	(4) Improper fuel level.	(4) Adjust fuel level.
	(5) Faulty spark plugs.	(5) Clean or replace spark plugs.
	(6) Dirty, corroded, or loose ignition secondary circuit wire connections.	(6) Clean or tighten secondary circuit wire connections.
	(7) Improper feedback system operation.	(7) Refer to Feedback System Diagnosis.
	(8) Faulty ignition coil high voltage wire.	(8) Replace ignition coil high voltage wire.
	(9) Faulty distributor cap.	(9) Replace cap.
FAULTY ACCELERATION	(1) Improper accelerator pump stroke.	(1) Adjust accelerator pump stroke.
	(2) Incorrect ignition timing.	(2) Adjust timing.
	(3) Inoperative pump discharge check ball or needle.	(3) Clean or replace as necessary.

80652B





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.

80652C

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.

80652D

Service Diagnosis – Performance (Continued)

Condition	Possible Cause	Correction
POWER NOT UP TO NORMAL (Continued)	(6) Incorrect valve timing.	(6) Check valve timing and repair as necessary.
	(7) Faulty ignition coil.	(7) Test coil and replace as necessary.
	(8) Faulty ignition wires.	(8) Test wires and replace as necessary.
	(9) Improperly seated valves.	(9) Test cylinder compression and repair as necessary.
	(10) Blown cylinder head gasket.	(10) Replace gasket.
	(11) Leaking piston rings.	(11) Test compression and repair as necessary.
	(12) Worn distributor shaft.	(12) Replace shaft.
	(13) Improper feedback system operation.	(13) Refer to Feedback System Diagnosis.
INTAKE BACKFIRE	(1) Improper ignition timing.	(1) Adjust timing.
	(2) Faulty accelerator pump discharge.	(2) Repair as necessary.
	(3) Defective EGR CTO valve.	(3) Replace EGR CTO valve..
	(4) Defective TAC vacuum motor or valve.	(4) Repair as necessary.
	(5) Lean air/fuel mixture.	(5) Check float level or manifold vacuum for air leak. Remove sediment from bowl.
EXHAUST BACKFIRE	(1) Air leak into manifold vacuum.	(1) Check manifold vacuum and repair as necessary.
	(2) Faulty air injection diverter valve.	(2) Test diverter valve and replace as necessary.
	(3) Exhaust leak.	(3) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Distributor centrifugal or vacuum advance malfunction.	(2) Inspect advance mechanism and repair as necessary.
	(3) Excessive combustion chamber deposits.	(3) Remove with combustion chamber cleaner.
	(4) Air leak into manifold vacuum.	(4) Check manifold vacuum and repair as necessary.
	(5) Excessively high compression.	(5) Test compression and repair as necessary.
	(6) Fuel octane rating excessively low.	(6) Try alternate fuel source.

80652E

Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
PING OR SPARK KNOCK (Continued)	(7) Sharp edges in combustion chamber.	(7) Grind smooth.
	(8) EGR Valve not functioning properly.	(8) Test EGR System and replace as necessary.
SURGING (AT CRUISING TO TOP SPEEDS)	(1) Low carburetor fuel level.	(1) Adjust fuel level.
	(2) Low fuel pump pressure or volume.	(2) Replace fuel pump.
	(3) Metering rod(s) not adjusted properly (BBD Model Carburetor).	(3) Adjust metering rod.
	(4) Improper PCV valve air flow.	(4) Test PCV valve and replace as necessary.
	(5) Air leak into manifold vacuum.	(5) Check manifold vacuum and repair as necessary.
	(6) Incorrect spark advance.	(6) Test and replace as necessary.
	(7) Restricted main jet(s).	(7) Clean main jet(s).
	(8) Undersize main jet(s).	(8) Replace main jet(s).
	(9) Restricted air vents.	(9) Clean air vents.
	(10) Restricted fuel filter.	(10) Replace fuel filter.
	(11) Restricted air cleaner.	(11) Clean or replace air cleaner filter element.
	(12) EGR valve not functioning properly.	(12) Test EGR System and replace as necessary.
	(13) Improper feedback system operation.	(13) Refer to Feedback System Diagnosis.

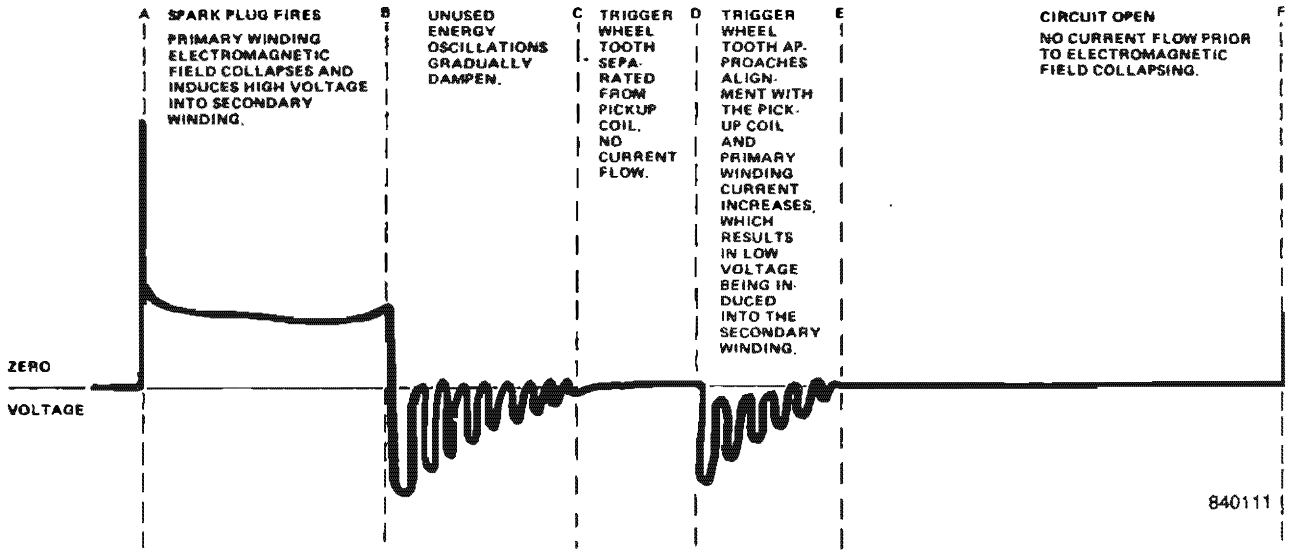
80652F

DIAGNOSIS WITH A SCOPE ANALYZER

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.

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.

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.

SEE I.S. NOTES

SEE
I.S.
NOTES

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.

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.

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.

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.

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.

Exterior Leak

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.

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.

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.

SEE I.S. NOTES

Cylinder Combustion Pressure Leakage Test Diagnosis

Condition	Possible Cause	Correction
AIR ESCAPES THROUGH CARBURETOR	(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.

SEE I.S. NOTES

GENERAL

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.

ENGINE

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

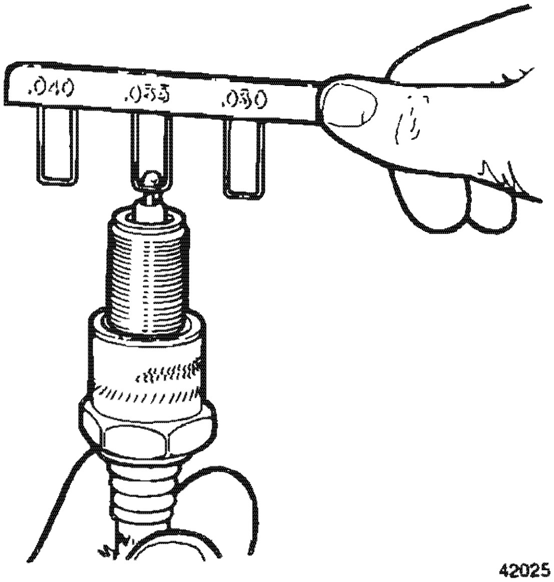
Spark Plugs

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.

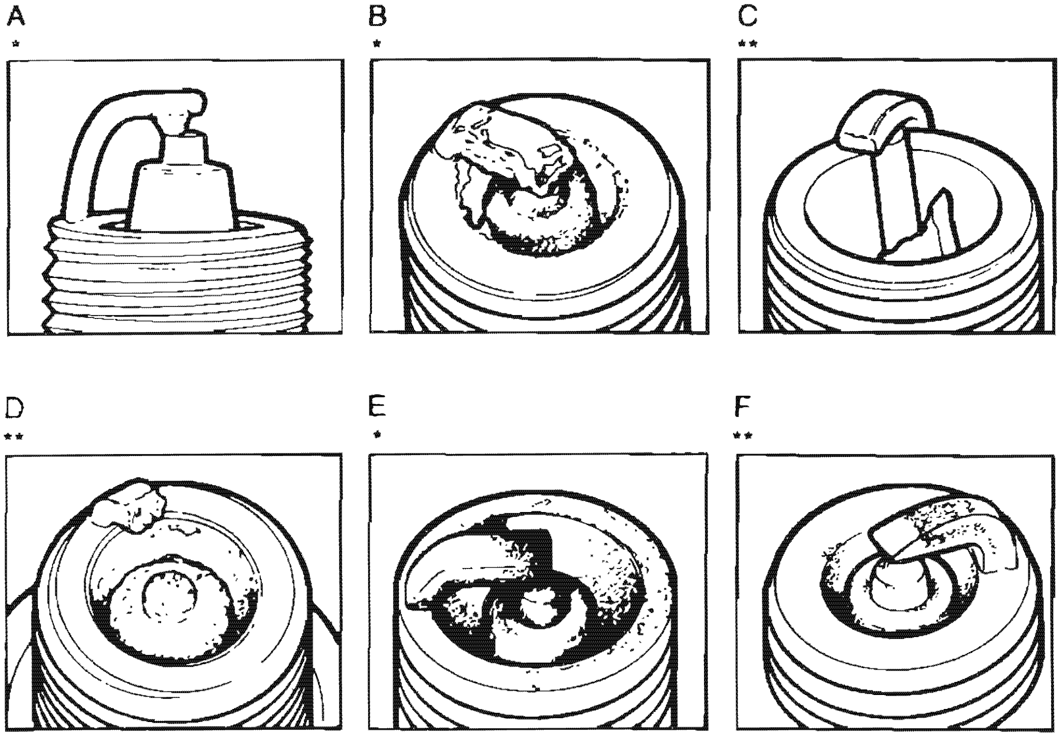


42025

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.



*LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED
**PLUGS WITH THIS CONDITION MUST BE REPLACED

SEE I.S. NOTES

Electrode Gap Bridging (A)

Electrode gap bridging can result from loose deposits in the combustion chamber.

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).

Scavenger Deposits (B)

Fuel scavenger deposits may be white or yellow.

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.

Chipped Electrode Insulator (C)

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap.

Under certain conditions, severe detonation can also separate the insulator from the center electrode.

Preignition Damage (D)

Preignition damage is caused by excessive engine temperature. First the center electrode liquefies, and somewhat later, the ground (side) electrode.

The insulators appear relatively clean of deposits.

Determine if the spark plug has the correct heat range rating, if the ignition timing is over-advanced 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.

Cold Fouling/Carbon Fouling (E)

The deposits that cause cold fouling are basically carbon.

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 Overheating (F)

Overheating is indicated by a white or gray electrode insulator that also appears blistered.

The increase in electrode gap will be considerably in excess of 0.025 mm 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.

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.

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

840113

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.

SEE I.S. NOTES

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.

Ignition Coil

Always test a suspected malfunctioning ignition coil while installed in the automobile. 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).

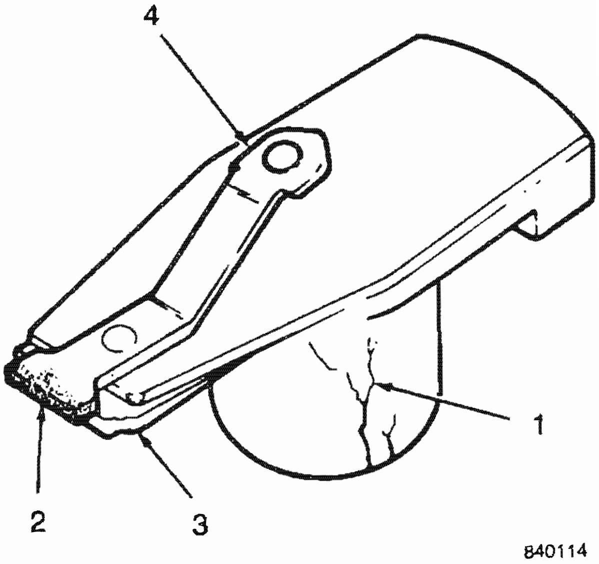
A small quantity of silicone dielectric compound is applied to the rotor tips during manufacture to reduce radio ignition noise and interference.

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/Jeep Silicone Dielectric Compound, or equivalent.

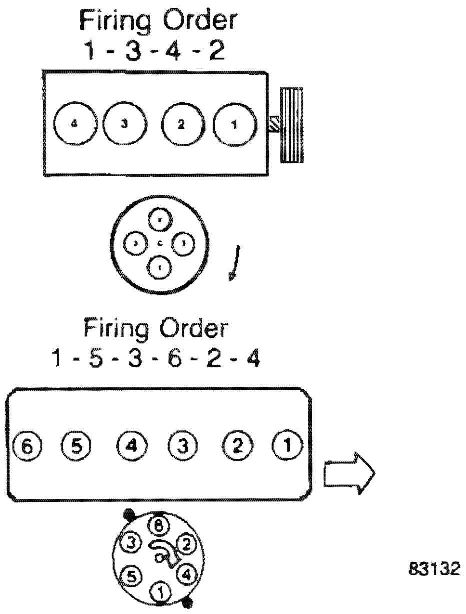


Distributor Cap Inspection

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.

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.

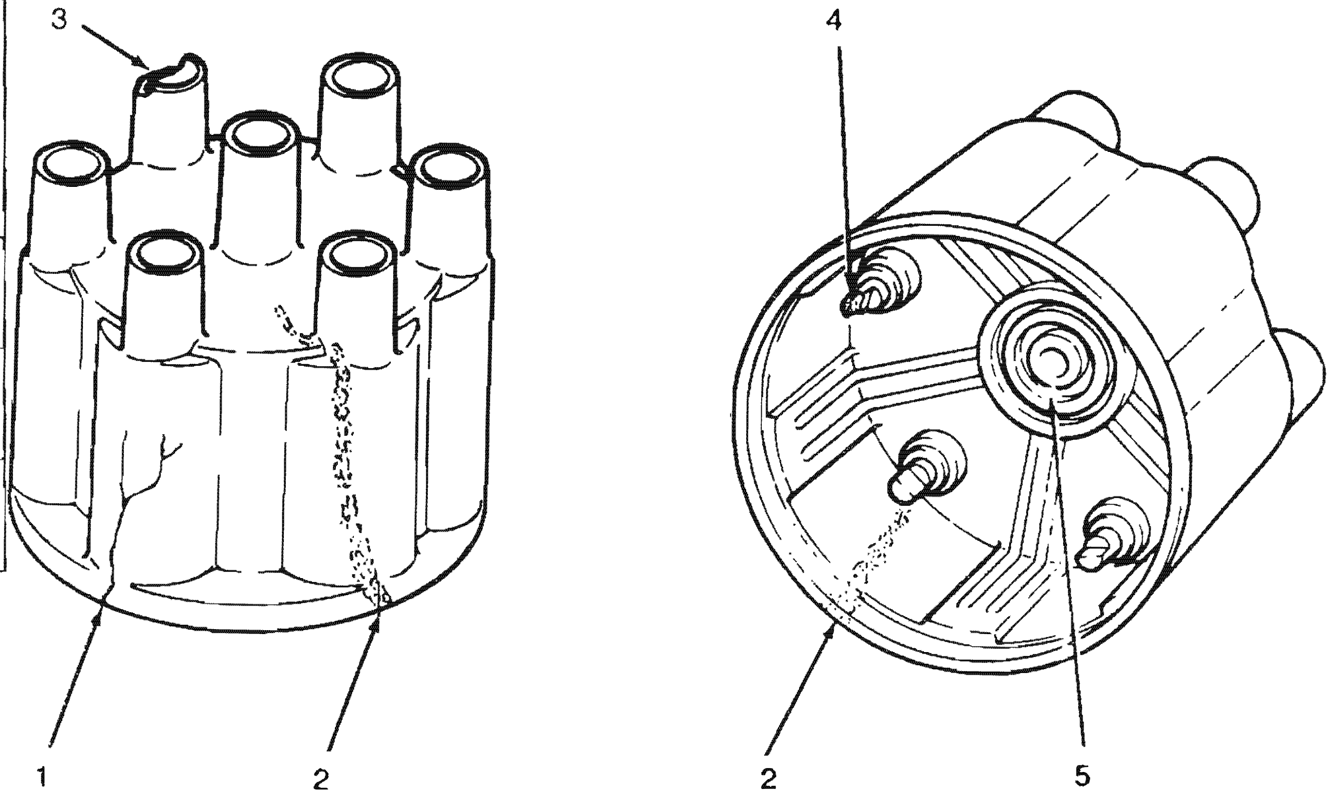


Replace the cap if the terminal ends inside the cap are excessively eroded (4).

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.

SEE
I.S.
NOTES

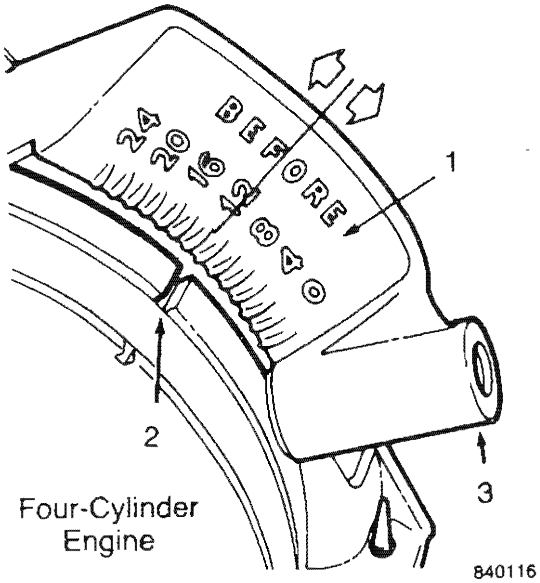


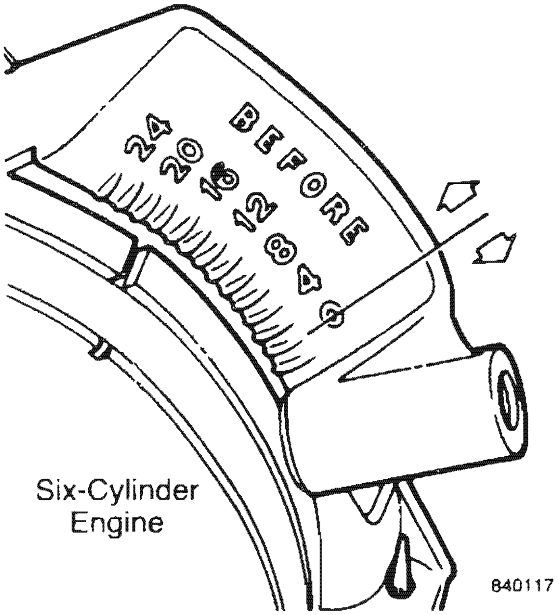
840115

Ignition System Timing

With both four- and six-cylinder engines, a graduated timing degree scale (1) located on the timing case cover 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

With both four- and six-cylinder engines, a magnetic timing probe socket (3) is provided 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.

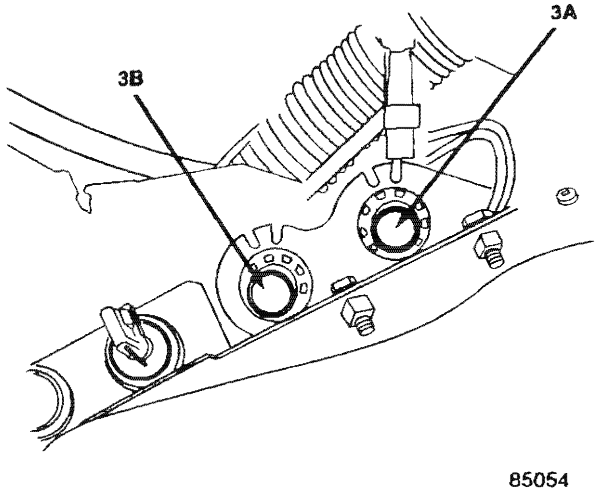
Ignition Timing Procedure – 2.46 Liter (150 CID) Four-Cylinder Engine

SEE I.S. NOTES

Set the parking brake. Shift the transmission to the neutral position.

Start the engine and allow it to attain normal operating temperature.

With the ignition switch Off, disconnect the three-wire connector from the four- and ten-inch Hg vacuum switch assembly (3A and 3B).



Disconnect and plug the vacuum hose connected to the distributor vacuum advance mechanism.

Connect a timing light between the number one 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 to the specified rpm (1600 rpm) 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.

Adjust the timing as necessary to attain 12° BTDC.

Tighten the distributor hold-down clamp.

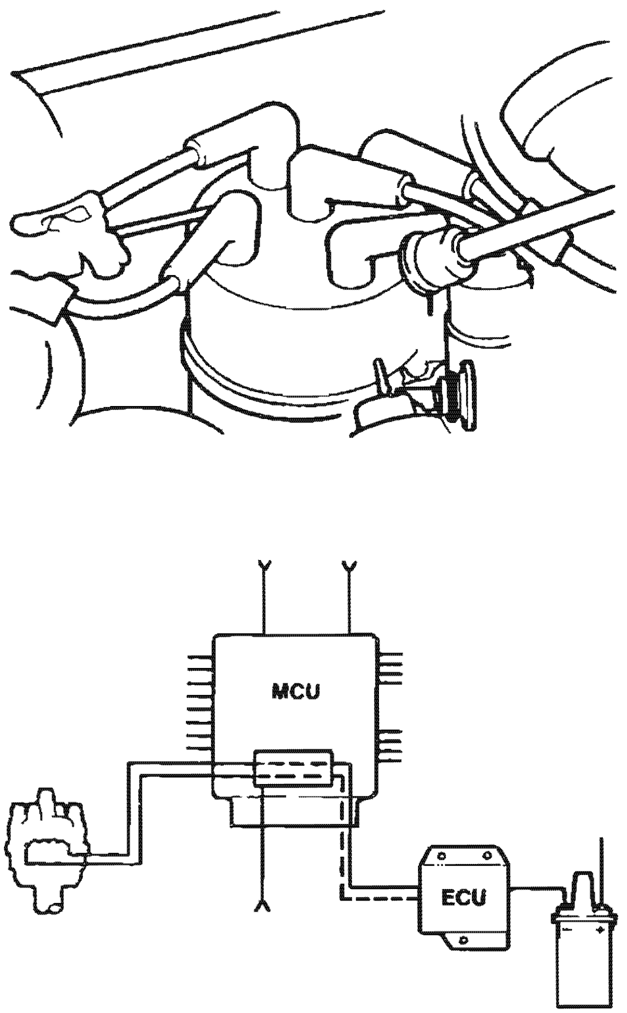
Turn off the engine.

Connect the distributor vacuum advance hose and the vacuum switch assembly three-wire connector.

Remove the timing light and connect the number one cylinder spark plug wire.

Remove the tachometer.

NOTE: A defective FFB system micro computer unit (MCU) or ignition system electronic control unit (ECU) can alter the ignition timing. Ensure that they are operating normally before attempting any adjustments to the ignition timing.



85060

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.

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 four- and ten-inch 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 number one spark plug wire, if disconnected. Connect the hose to the distributor vacuum advance mechanism. Connect the wire connector to the vacuum switch assembly.

SEE I.S. NOTES

SEE I.S. NOTES

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 Off, 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 four-inch Hg vacuum switch hose (located at the top of the cylinder head cover) and plug the hose opening.

NOTE: The four-inch Hg vacuum switch has black and red wires connected to it.

Disconnect the distributor vacuum advance hose and connect the hose to the four-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.

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° ± 2° at 1600 rpm, the alternate procedure requires 7° ± 2° at idle speed.

Testing the Distributor Advance Mechanisms

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 four- and ten-inch Hg vacuum switch assembly (CEC system).

Disconnect and plug the vacuum hose connected to the distributor vacuum advance mechanism.

Connect a timing light between the number one 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 number one cylinder spark plug wire.

Remove the tachometer.

Vacuum Advance Test

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.

With the ignition switch Off, disconnect the three-wire connector from the four- and ten-inch vacuum switch assembly.

Disconnect and plug the vacuum hose connected to the distributor vacuum advance mechanism.

Connect Vacuum Pump J-23738 to the distributor vacuum advance mechanism.

Connect a timing light between the number one 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.

SEE I.S. NOTES

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.

SEE I.S. NOTES

Remove the timing light and tachometer. Connect the spark plug wire.

Testing the Distributor Advance Mechanisms - Off-Engine

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.

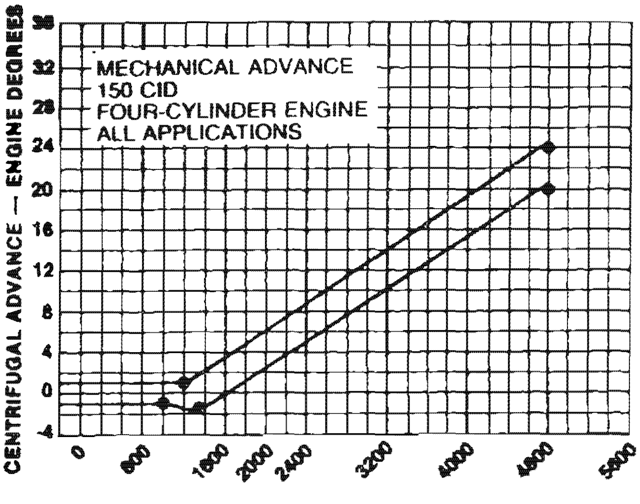
Divide the engine rpm by two to obtain the distributor rpm. Divide the engine degrees advance by two to obtain the distributor degrees advance.

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.

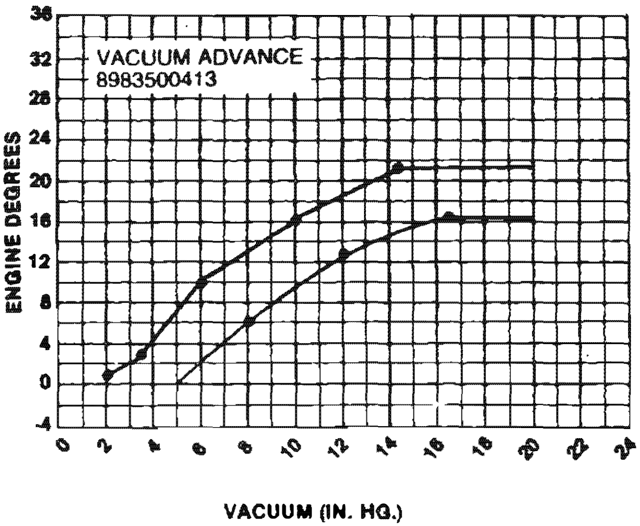
NOTE: The specified kPa (in. Hg) of vacuum is the same, regardless if the test is on-engine or off-engine.

DISTRIBUTOR IGNITION ADVANCE CURVES

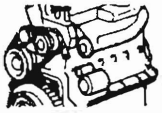
Distributor Curves — Four-Cylinder Engine

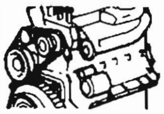


840118



840119





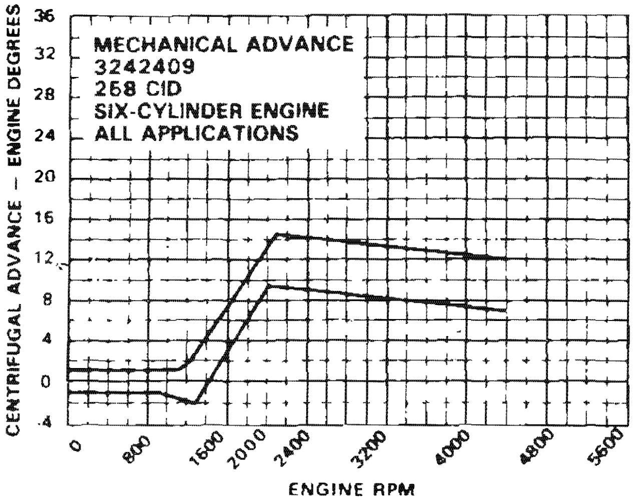
Tune-Up Specifications – On-Vehicle – Four-Cylinder Engine

Engine Displacement Carburetion And Application	Series	Trans.	Initial Timing BTDC at 1600 RPM With Vacuum Advance Hose and 4-in Vacuum Switch Disconnected	Sole-Vac Idle Speed (Manual In Neutral)		Distributor Model Number	Vacuum Advance Mechanism	Centrifugal Degrees Advance At 2000 RPM	Vacuum Advance	Spark Plug Type And Gap
					Curb Idle					
			Set To	Vacuum Actuator Energized	Holding Solenoid Energized					
150 1V 50 State	87 88	M	12° ± 1°	950 ± 50	750 ± 50	3242700	8983500413	2°-6°	Refer To Distributor Curves	Champion RFN14LY (Alternate FN14LY) 0.85mm (0.035-in) Gap 0.84 to 0.97 mm (0.033 to 0.038-in)
150 1V High Alt.	87 88	M	19° ± 1°	950 ± 50	750 ± 50					

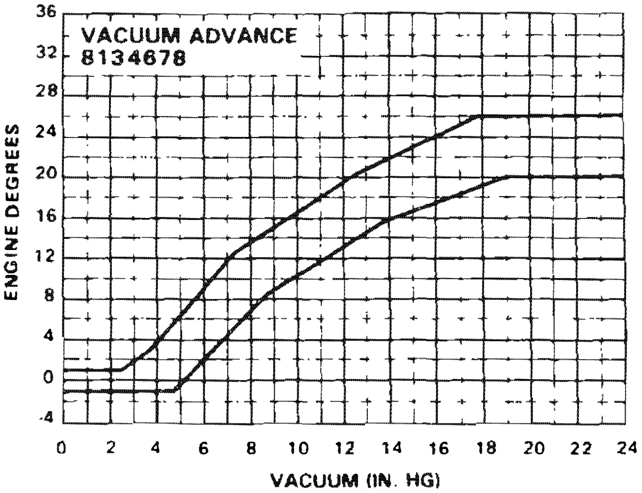
840120(J)

SEE I.S. NOTES

Distributor Curves — Six-Cylinder Engine



83084E



83084F

TUNE-UP SPECIFICATIONS

Tune-Up Specifications – On-Vehicle – Six-Cylinder Engine

Engine Displacement Carburetion And Application	Series	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	87 88	M	9° ± 2°	680	1100	900	3242409	8134678	7.5-12.5	Refer To Distributor Curves	Champion RFN14LY (Alternate FN14LY) 0.85mm (0.035-in) Gap 0.84 to 0.97mm (0.033 to 0 038-in)
		A	9° ± 2°	600	900	800					
258 2V Calif.	87 88	M	9° ± 2°	680	1100	900					
		A	9° ± 2°	600	900	800					
258 2V High Alt.	87 88	M	16 ± 2	700 ± 70	1100	900					
		A	16 ± 2	650 ± 70	900	800					

840121(J)

SEE I.S. NOTES

FUEL SYSTEM

General Inspection

SEE I.S. NOTES

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 requires periodic replacement.

When installing a replacement filter, ensure the fuel return nipple is positioned above the filter.

Carburetor Idle Speed Adjustment Procedures

Idle mixture adjustments are not required as a normal service adjustment.

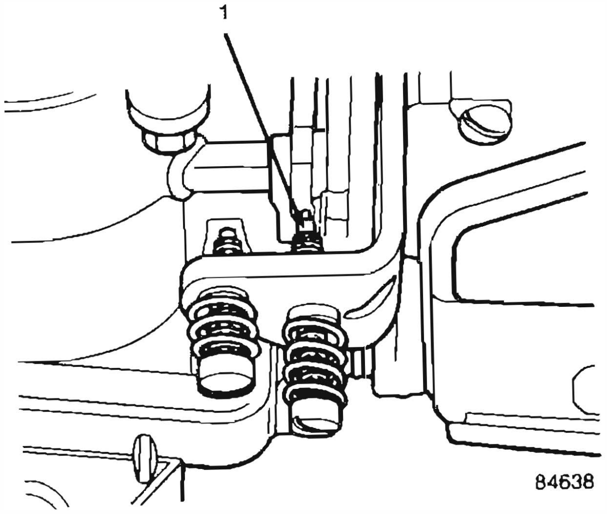
The engine and related systems must be operating properly before performing the idle speed adjustments.

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 – Four-Cylinder Engine

Adjust the fast idle speed with the engine at normal operating temperature and the EGR valve vacuum hose disconnected and plugged.

Connect a calibrated, expanded scale tachometer to the coil negative (TACH) terminal.

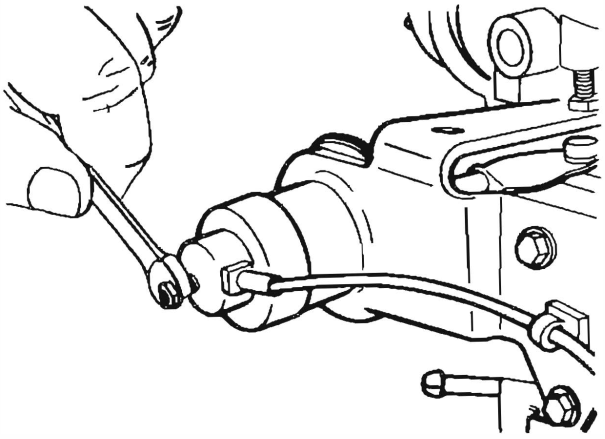


Turn the fast idle adjustment screw (1) in to contact with the fast idle cam until an engine speed of approximately 1500 rpm is achieved.

NOTE: Check the specifications on the Vehicle Emission Control Information label located under the hood.

Sole-Vac Curb Idle Speed Adjustment – Four-Cylinder Engine

Connect a calibrated, expanded scale tachometer to the coil negative (TACH) terminal.



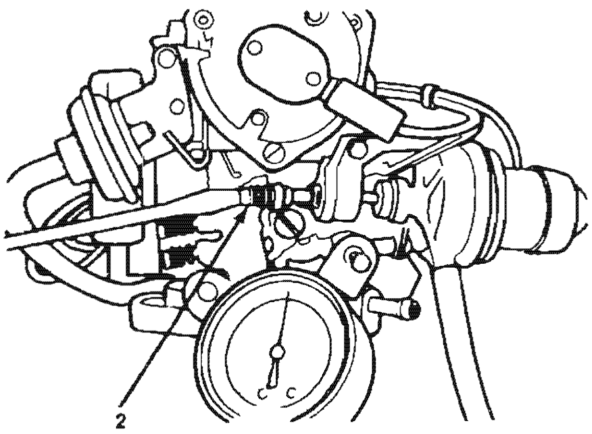
Turn the hex head adjustment screw until an engine speed of approximately 750 (N) rpm is achieved.

NOTE: Check the specifications on the Vehicle Emission Control Information label located under the hood.

SEE I.S. NOTES

Sole-Vac Vacuum Actuator Adjustment – Four-Cylinder Engine

Connect a calibrated, expanded scale tachometer to the coil negative (TACH) terminal.



84639

Using an outside vacuum source, apply 34 to 50 kPa (10 to 15 in. Hg) of vacuum to the Sole-Vac vacuum actuator.

Adjust the vacuum actuator adjustment screw (2) until an engine speed of approximately 1000 rpm is achieved.

NOTE: Check the specifications listed on the Vehicle Emission Control Information label located under the hood.

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.

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.

Disconnect and plug the vacuum hose connected to the Sole-Vac vacuum actuator. Disconnect the holding solenoid wire connector.

Adjust the carburetor curb (slow) idle speed adjustment screw to obtain the specified curb (slow) idle speed rpm, if not within specifications. Refer to the Specifications chart and the Vehicle Emission Control Information label located under the hood.

Apply a direct source of vacuum to the vacuum actuator. Use Vacuum Pump Tool J-23738, or equivalent.

When the 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.

If equipped, turn the air conditioner ON.

With a jumper wire, apply voltage (12V) 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 fully extend.

If the holding solenoid idle speed is not within specification, adjust the Sole-Vac (hex-head adjustment screw) to obtain the specified engine rpm. Refer to the Specifications chart and the Vehicle Emission Control Information label located under the hood.

Remove the jumper wire from the Sole-Vac holding solenoid wire connector.

Connect the Sole-Vac holding solenoid wire connector.

Connect the original hose to the vacuum actuator.

Remove the tachometer.

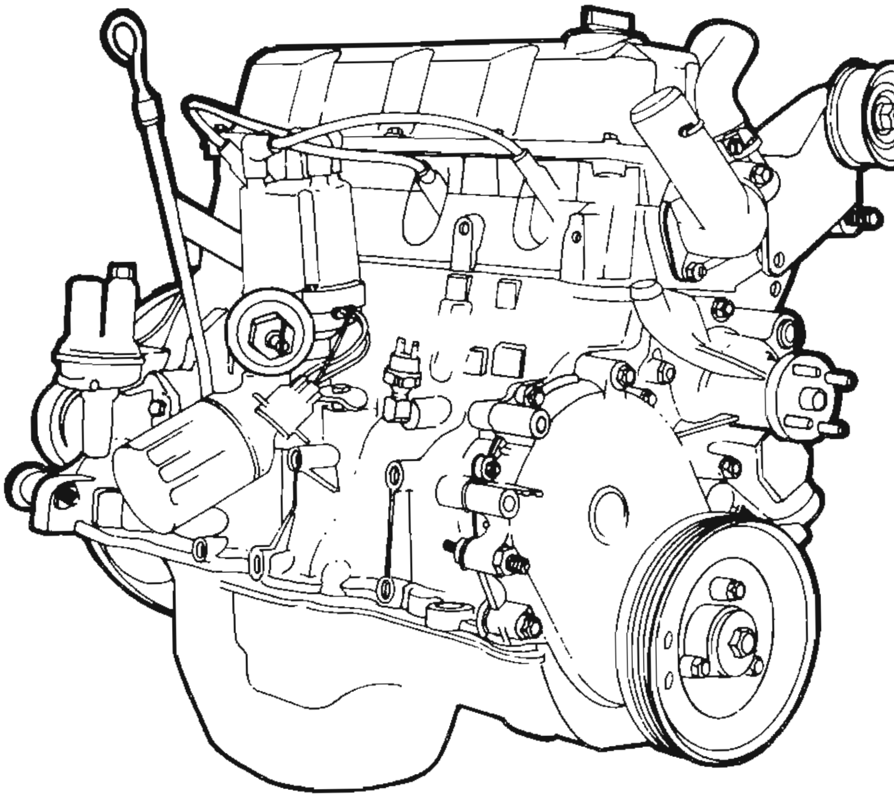
SEE
I.S.
NOTES

Description

Vehicle	Engine	Displacement	Bore mm (in)	Stroke mm (in)	Comp. Ratio	Carburetor	Oil Capacity
87 88	In-line 4-cylinder	2.46L 150 CID	98 (3.876)	80 (3.188)	9.2:1	1-Venturi	4.0 qts. 3.8L 3.3 imp qts. (w/wo filter change)

84164(J)

SEE
I.S.
NOTES



84196

GENERAL

Identification

SEE I.S. NOTES

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 that the engine was built.

The fourth character code letter identifies the cubic inch displacement, carburetor type and compression ratio.

The example code identifies a 2.46 liter (150 CID) engine with a 1V carburetor, 9.2:1 compression ratio and built on September 27, 1982.

Engine Build Date Code Explanation

Example —209 U 27

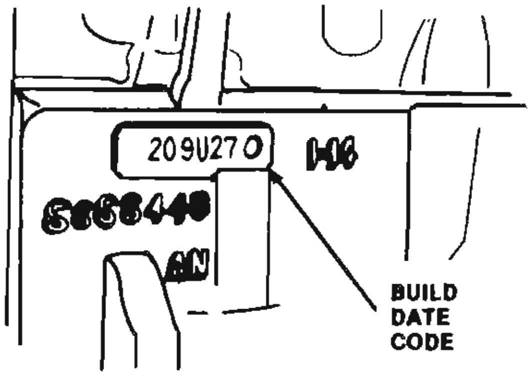
1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
2—1982 3—1983	01-12	U	01-31

Letter Code	CID	Carburetor	Compression Ratio
U	150	1V	9.2:1

60257A

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

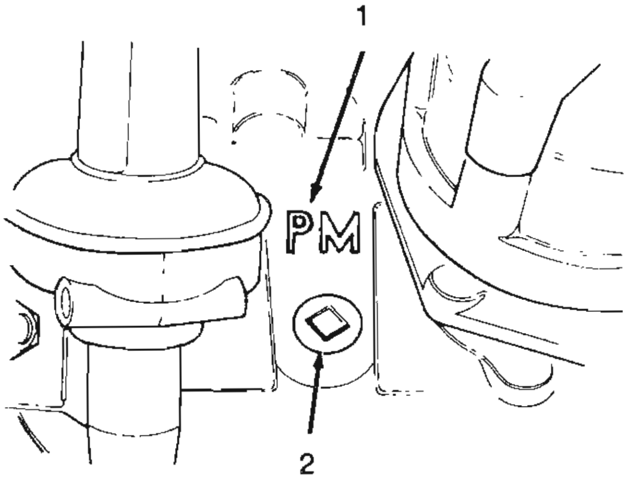


63101

Oversize and Undersize Component Codes

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 fuel pump and distributor.



840122

The letters are decoded as follows.

Oversize or Undersize Components Letter Code

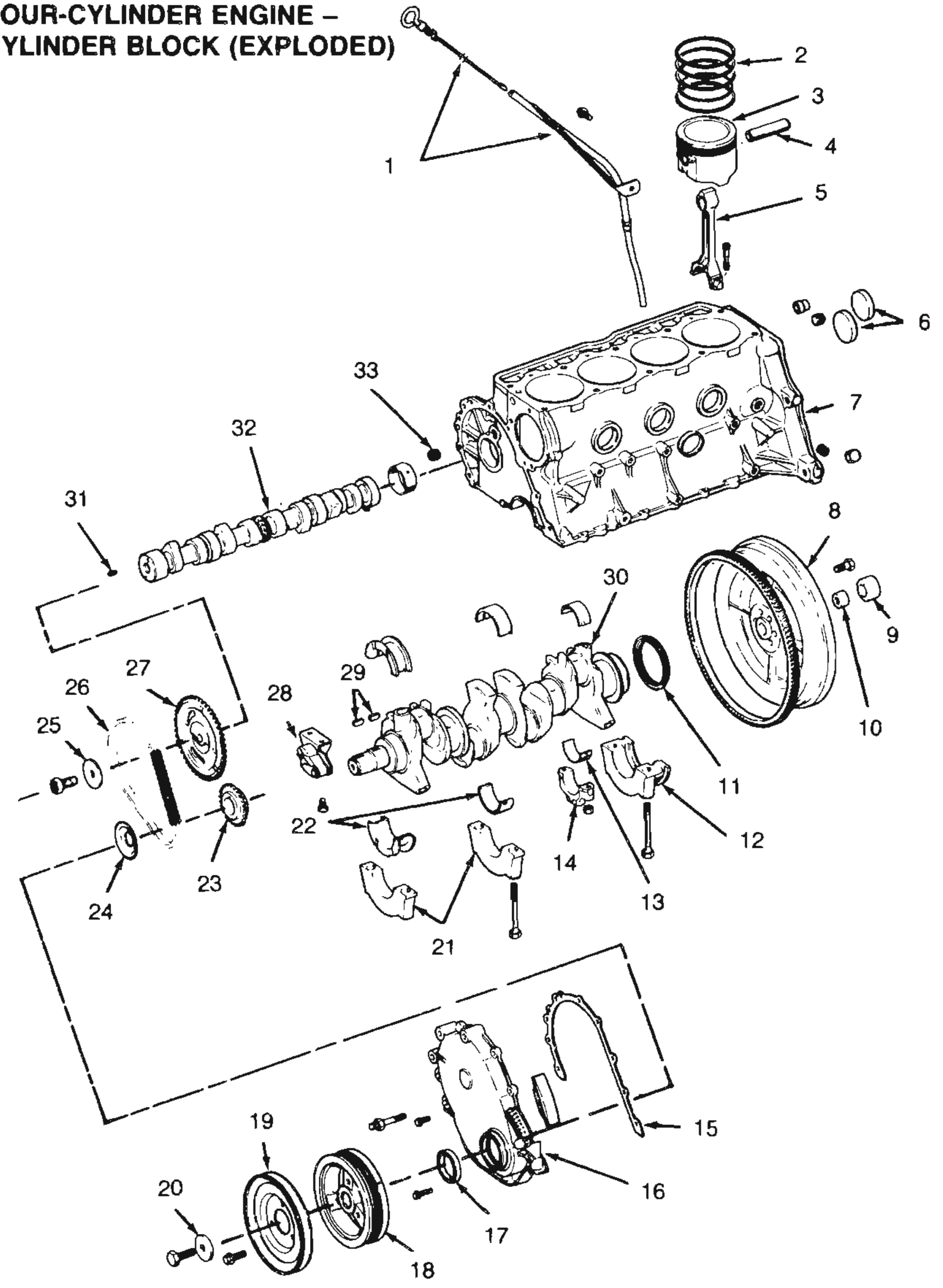
Code Letter	Definition	
B	All cylinder bores	0.254mm (0.010-inch) oversize
M	All crankshaft main bearing journals	0.254mm (0.010-inch) undersize
P	All connecting rod bearing journals	0.254mm (0.010-inch) undersize
C	All camshaft bearing bores	0.254mm (0.010-inch) oversize

Example: The code letters PM indicate that the crankshaft main bearing journals and connecting rod journals are 0.254mm (0.010-inch) undersize.

840123

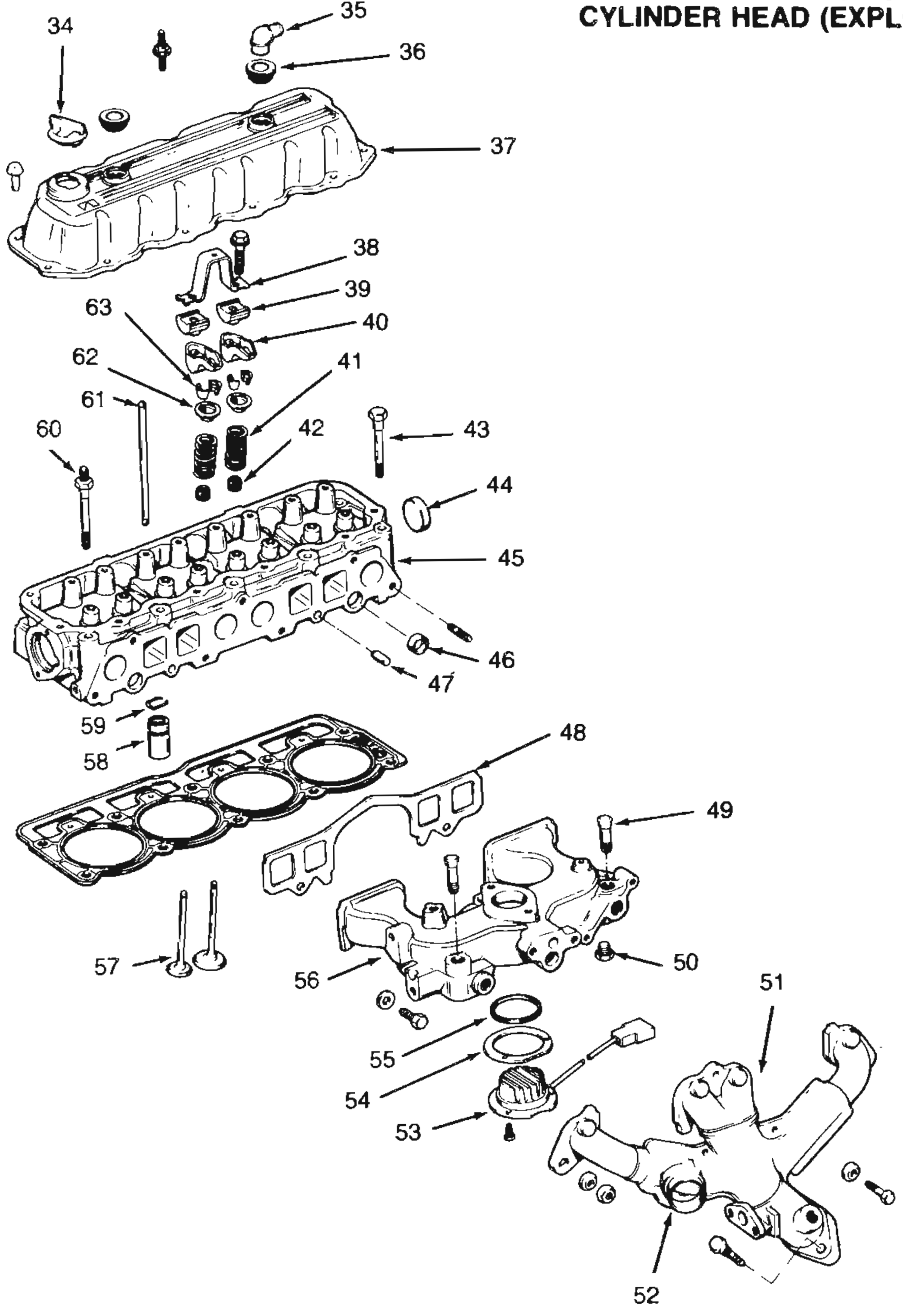
SEE I.S. NOTES

FOUR-CYLINDER ENGINE – CYLINDER BLOCK (EXPLODED)



840124

FOUR-CYLINDER ENGINE – CYLINDER HEAD (EXPLODED)



B40125

SEE I.S. NOTES

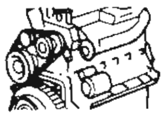
SEE I.S. NOTES

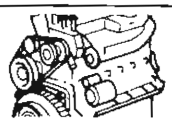
1. Oil Level Gauge (Dipstick) and Tube
2. Ring Set
3. Piston
4. Pin Set
5. Connecting Rod
6. Plugs
7. Cylinder Block
8. Flywheel and Ring Gear (W/Manual Transmission)
9. Pilot Bushing (With Manual Transmission)
10. Bushing Oil Wick (With Manual Transmission
11. Main Bearing Cap Seal Kit (Rear)
12. Main 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
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. Intake Manifold Gasket
49. Hose Fitting
50. Plug
51. Exhaust Manifold
52. Heat Stove
53. Intake Manifold Heater
54. Gasket
55. O-Ring
56. Intake Manifold
57. Valve
58. Tappet
59. Snap Ring
60. Cylinder Head Stud
61. Push Rod
62. Retainer
63. Valve Locks

86346

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-22248	Timing Case Cover Alignment and Seal Installation Tool	■	
J-21882	Oil Pump Inlet Tube Installation Tool	■	
J-22534-01	Valve Spring Removal and Installation Tool	■	
J-22534-4			
J-22534-5			
J-9256	Timing Case Cover Oil Seal Removal Tool		■
J-22794	Air Hose Adapter		■
J-21884	Hydraulic Valve Tappet Removal and Installation Tool		■
J-8520	Dial Indicator Set		■
J-21791	Vibration Damper Removal Tool		■
J-5959-04	C-Clamp and Rod Extension		■
J-9163	Screw (used with J-22248)		■
J-5601	Piston Ring Compressor		■





TORQUE SPECIFICATIONS

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 Adjustment Bolt	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Mounting Bracket-to-Cylinder Block Bolt	38 N·m (28 ft-lbs)	31-41 N·m (23-30 ft-lbs)
Alternator Mounting Bracket-to-Cylinder Head Bolt	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	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-Body Screws	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-to-Block Screws	75 N·m (55 ft-lbs)	65-84 N·m (48-62 ft-lbs)
Clutch Housing Cover Screws	29 N·m (21 ft-lbs)	22-35 N·m (16-26 ft-lbs)
Differential Housing-to-Left Engine Mount Bolt	54 N·m (40 ft-lbs)	47-68 N·m (35-50 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)
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)
Exhaust Manifold Bolts	31 N·m (23 ft-lbs)	24-38 N·m (18-28 ft-lbs)
Exhaust Pipe-to-Manifold Bolts	23 N·m (17 ft-lbs)	20-25 N·m (15-19 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 (50 ft-lbs) Plus 60°	
Front Crossmember-to-Sill Bolts	88 N·m (65 ft-lbs)	75 N·m (55 ft-lbs) min
Front Support Bracket-to-Cylinder Block Bolts	60 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
Front Support Cushion-to-Bracket Bolts	45 N·m (33 ft-lbs)	36-52 N·m (27-38 ft-lbs)
Front Support Cushion-to-Crossmember Bolts	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)
Idler Arm Bracket-to-Sill Bolts	68 N·m (50 ft-lbs)	47-81 N·m (35-60 ft-lbs)
Idler Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idler 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)	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 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)
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)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
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)	37-52 N·m (27-38 ft-lbs)
Rear Support Cushion-to-Bracket Bolts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Rear Support Cushion-to-Crossmember Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 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)
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)
Thermostat Housing Bolt	18 N·m (13 ft-lbs)	13-24 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)

SPECIFICATIONS

FOUR-CYLINDER ENGINE

SEE
I.S.
NOTES

	(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

	(USA)	(METRIC)
Fuel Pump Eccentric Diameter	1 615-1.625	41.02-41.28
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	51.54-51.58
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

	(USA)	(METRIC)
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 (0.0015-0 002 Preferred)	0 03-0.08 (0.044-.05 Preferred)
Side Clearance	0.010-0.019	0.25-0.48
Maximum Twist	0.001 per In.	0.025 per 25.4 mm
Maximum Bend	0.005 per in.	0.0127 per 25.4 mm

Crankshaft

	(USA)	(METRIC)
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. 3-4-5	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

	(USA)	(METRIC)
Deck Height	9.337-9.343	237 15-237.31
Deck Clearance	0.020 (below deck)	0.508 (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	0.9C55-0.9065	23.000-23.025
Cylinder Block Flatness	001/1.0-002/6.0	0.03/25-0.05/152

Cylinder Head

	(USA)	(METRIC)
Combustion Chamber Volume	49.9-52.9 cc	
Valve Arrangement	E-I-I-E-E-I-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	.001/1.0-.002/6 0	0.03/25-0.05/152

84166

SPECIFICATIONS (CONT'D)

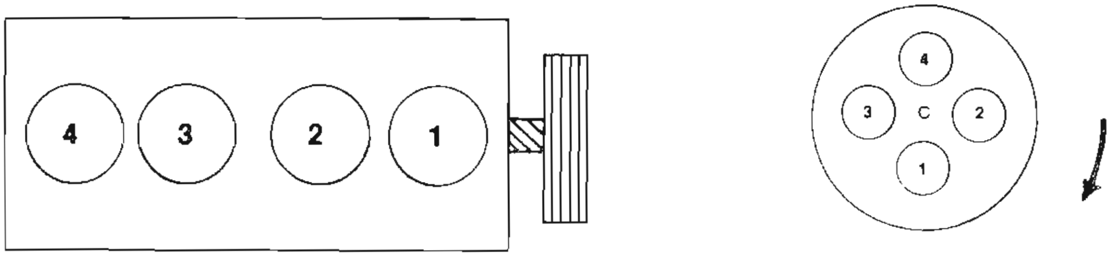
FOUR-CYLINDER ENGINE

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Lubrication System		
Engine Oil Capacity	4 qts. w/wo filter change	3.8 liters w/wo 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)	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	22 952-22 974
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	311- 312	7 89-7 98
Stem-to-Guide Clearance	001 003	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 62	46 22
Spring Tension		
Valve Closed	66-74 lbs at 1 625	294 329 at 41 28
Valve Open	205-220 lbs at 1 200	912-979 at 30 48
Inside Diameter	0.948-0 968	24 08-24 5

Engine Firing Order

1-3-4-2



84168

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.

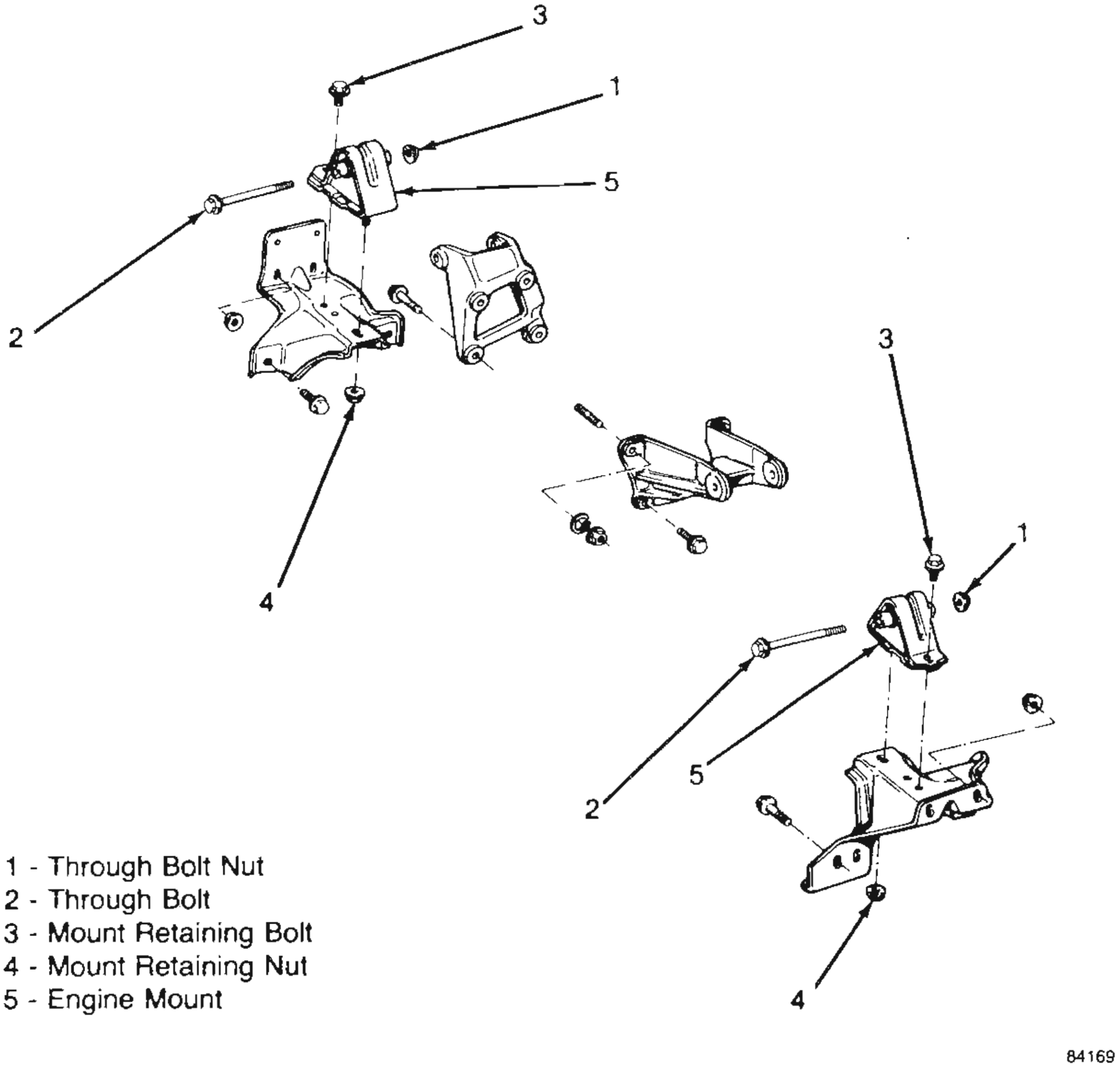
Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this chapter.

ENGINE MOUNTING

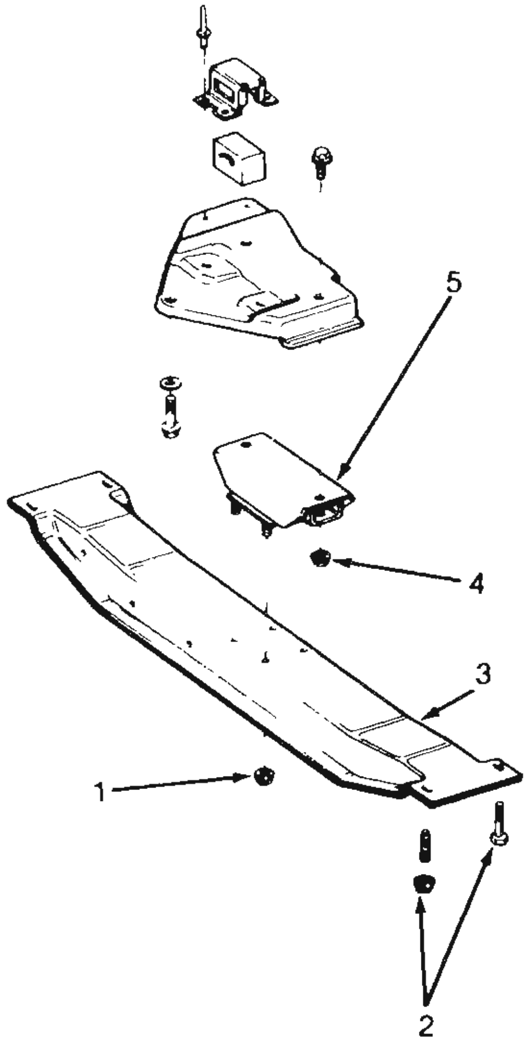
Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine and at the rear between the transmission extension housing and the rear support crossmember.

Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

SEE I.S. NOTES



1 - Through Bolt Nut
2 - Through Bolt
3 - Mount Retaining Bolt
4 - Mount Retaining Nut
5 - Engine Mount

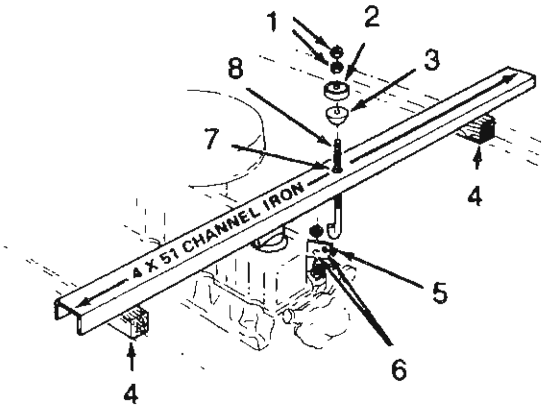


1 - Mount-to-Crossmember Nut
2 - Crossmember Retaining Nuts and Bolts
3 - Crossmember
4 - Mount-to-Support Bracket Nuts
5 - Rear Mount

84170

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
2 - Upper Trunnion Bearing
3 - Pivot or Sleeve
4 - 2×2×6-Inch Hardwood Block
5 - 1¼-Inch Angle Iron
6 - 1/2-Inch Holes
7 - 1-Inch Hole
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 CEC System wire harness connector.

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 air cleaner.

Disconnect the vacuum purge hose at the fuel vapor canister tee.

Disconnect the TAC 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 mixture control (MC) solenoid wire connector.

Disconnect the oxygen (O_2) 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.

SEE I.S. NOTES

SEE I.S. NOTES

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.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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 carburetor mixture control (MC) solenoid wire connector.

Connect the oxygen (O_2) 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.

Remove the plug and connect the fuel pipe to the fuel pump.

Connect the CEC System wire connector at the solenoid.

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. Stop the engine and check the coolant and the fluid levels. Add coolant and fluid as required.

Install the air cleaner and connect the purge hose to the canister.

Install the air cleaner and connect the vacuum hose.

Install and adjust the hood. Connect the underhood lamp, if equipped.

CYLINDER HEAD COVER

Removal

Remove the air cleaner and the PCV valve molded hose.

Disconnect the fuel pipe at the fuel pump. Swivel the fuel pipe to allow removal of the cylinder head cover.

Disconnect the PCV valve from the grommet in the cylinder head cover.

Disconnect the PCV shutoff valve vacuum hose.

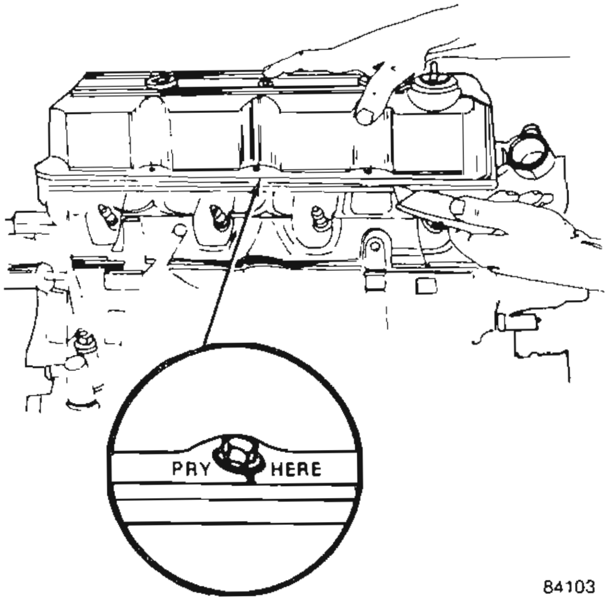
Remove all the necessary vacuum and air hoses to provide clearance for the cylinder head cover.

Remove the cylinder head cover retaining nuts.

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.

Pry the cover up at the pry ramps that are identified by the words PRY HERE.



Inspect the cylinder head cover for cracks.

Installation

Either a standard gasket or a room temperature vulcanizing (RTV) silicone rubber sealant may be used for cylinder head cover installation.

Use AMC/Jeep 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 3-mm (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.

SEE I.S. NOTES

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 with 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.

VALVES AND ACTUATING COMPONENTS

Rocker Arm Assembly

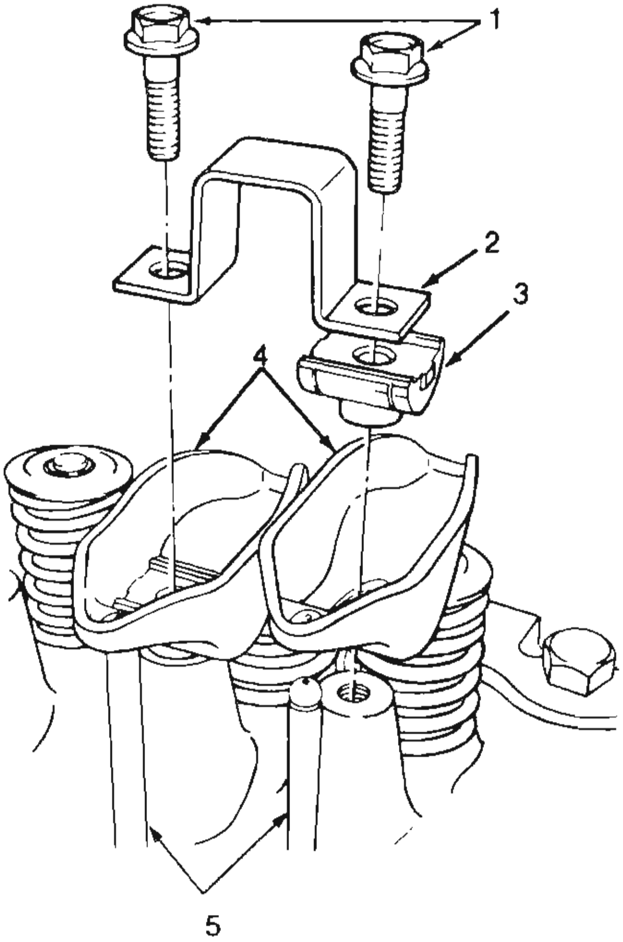
Removal

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.

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.



84174

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.

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.

Hydraulic Valve Tappets

Removal

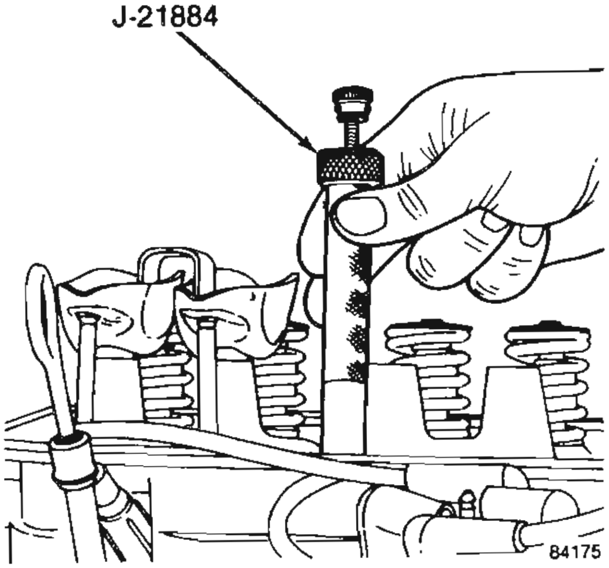
Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

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.

SEE
I.S.
NOTES

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.

SEE I.S. NOTES

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

Valve Spring 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.

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.

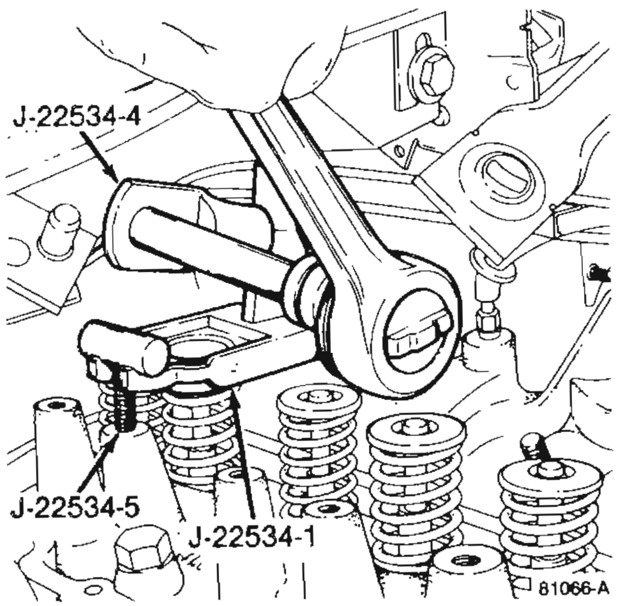
Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.

Install a 14-mm (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.

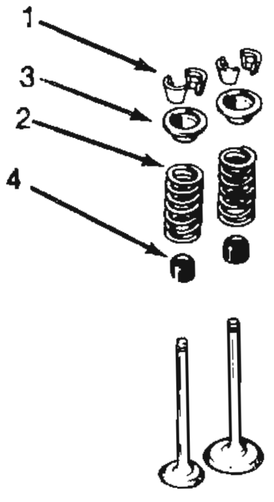
Connect an air hose to the adapter and maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats.

Use Valve Spring Compressor Tool J-22534-01 to compress the spring and remove the locks (1).



Remove the valve spring (2) and retainer (3).

Remove the valve stem oil deflector (4).



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 11-mm (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.

SEE I.S. NOTES

SEE I.S. NOTES

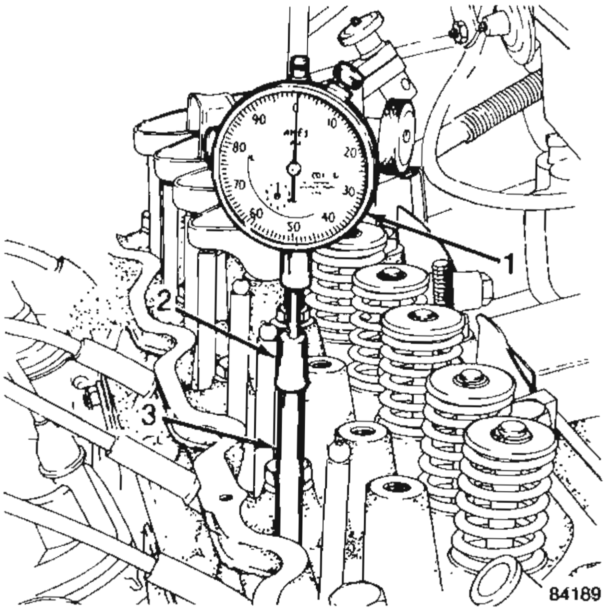
Measuring the Cam Lobe Lift

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.

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.

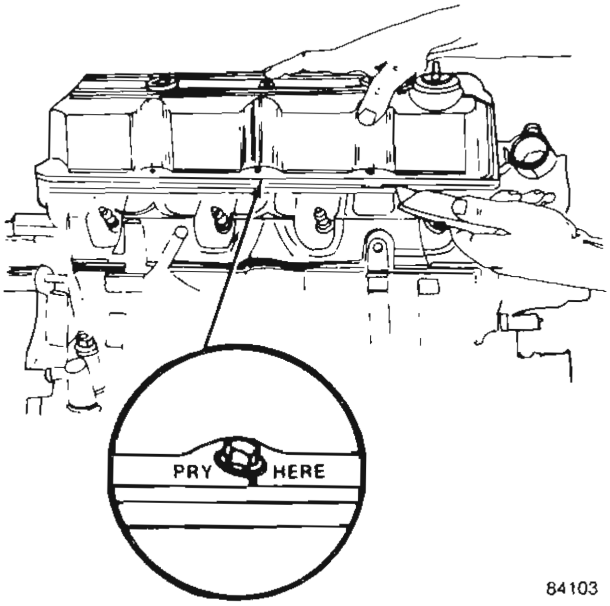
Install the spark plugs and connect the wire connectors.

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 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 0.305-mm (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 13 mm (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

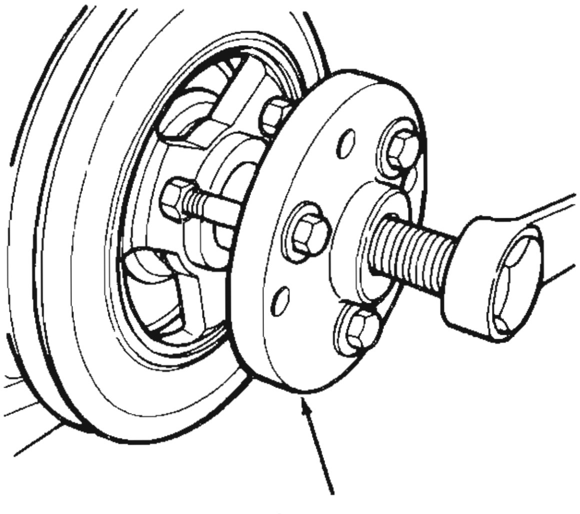
Removal

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.



SEE
I.S.
NOTES

SEE I.S. NOTES

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.

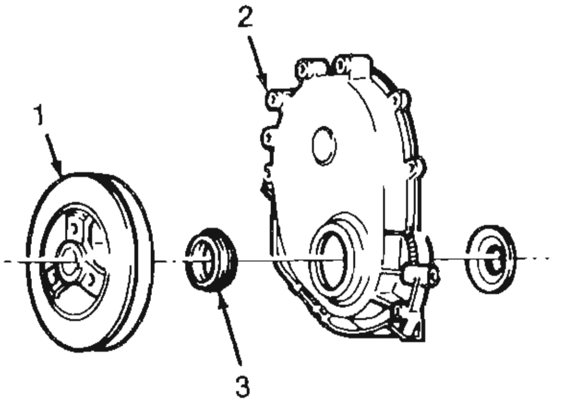
Install the damper pulley and retaining bolts. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

TIMING CASE COVER

Removal

Remove the drive belt(s), engine fan and hub assembly, fan shroud, vibration damper (1), pulley and key.



84180

Remove the alternator bracket assembly.

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 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.

SEE
I.S.
NOTES

Installation

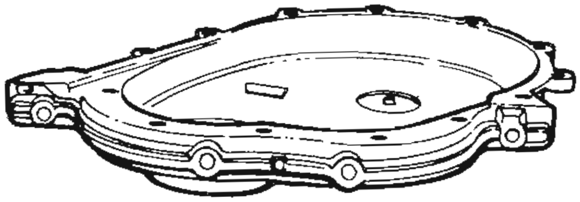
Apply sealing compound (Perfect Seal, or equivalent) to both sides of the replacement timing case cover gasket and position the gasket on the cylinder block.

Cut the end tabs off of the replacement oil pan side gaskets corresponding to those cut off the original gasket.

Cement the end tabs on the oil pan.

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.

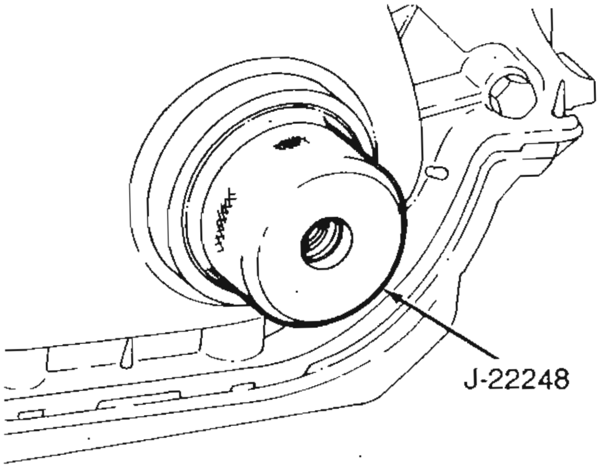
Apply engine oil to the seal-oil pan contact surface.



41894

Position the timing case cover on the cylinder block.

Place Timing Case Cover Alignment and Seal Installation Tool J-22248 in the cover crankshaft opening.



84182

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.

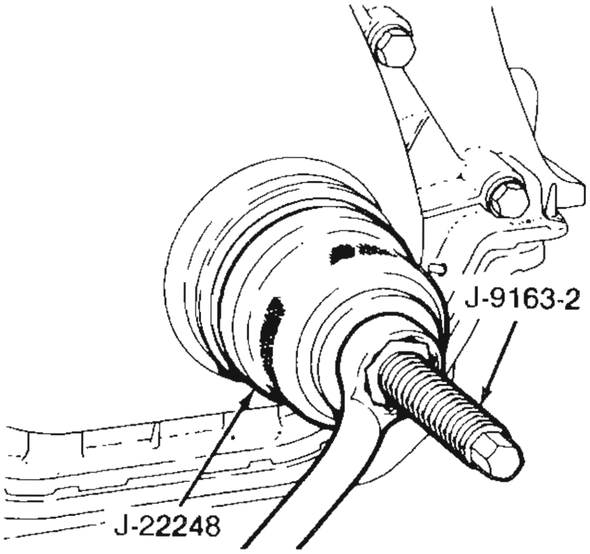
Remove the cover alignment tool and position a replacement oil seal on the tool with the seal lip facing outward.

Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft with engine oil.

Position the tool and seal over the end of the crankshaft and insert Screw Tool J-9163-2 into Seal Installation Tool J-22248.

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 × 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. Tighten the bolts with 27 N·m (20 ft-lbs) torque.

Install the engine fan and hub assembly. Install the fan shroud.

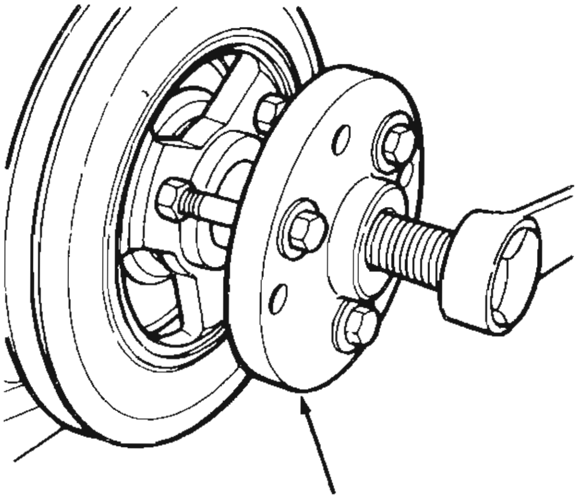
Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Crankshaft (Front) Oil Seal Replacement (Cover Installed)

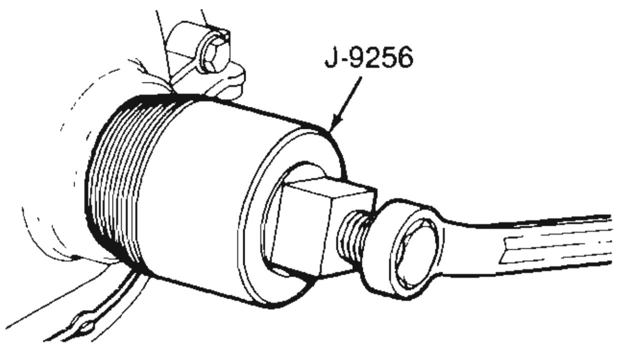
Remove the drive belt(s) and fan shroud.

Remove the vibration damper pulley.

Remove the vibration damper and key.



Remove the crankshaft oil seal with Tool J-9256.



84188

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 the tool and seal over the end of the crankshaft and insert Screw Tool J-9163 into the seal installation tool.

Tighten the nut against the tool until the tool contacts the cover.

Remove the tools.

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 × 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. 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

General

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.

SEE I.S. NOTES

Removal

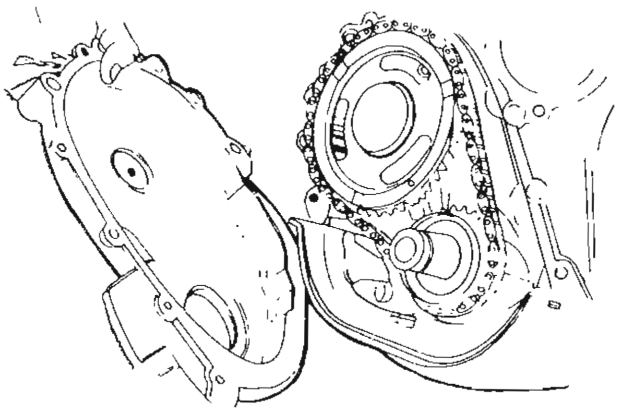
Remove the fan and shroud.

Remove the drive belt(s).

Remove the crankshaft vibration damper and pulley.

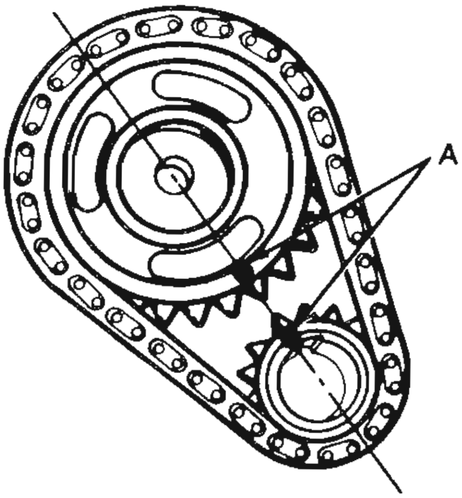
Remove the timing case cover. Refer to the removal procedure.

Remove the crankshaft oil slinger.



84874

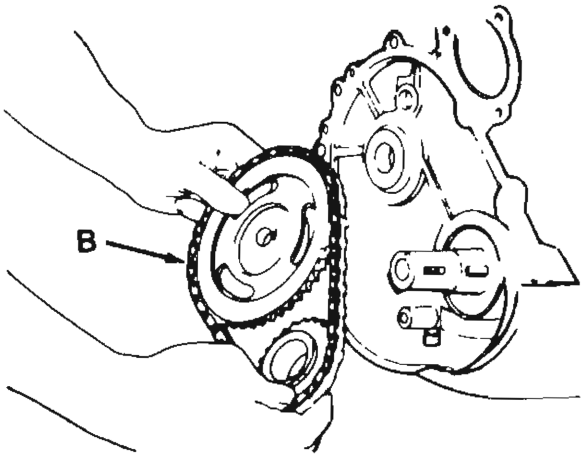
Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).



84184

Remove camshaft sprocket retaining bolt.

Remove the sprockets and chain as an assembly (B).

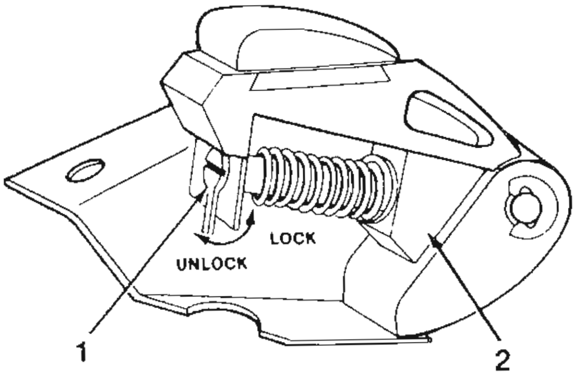


84185

Installation

Turn the tensioner lever (1) to the unlocked (down) position.

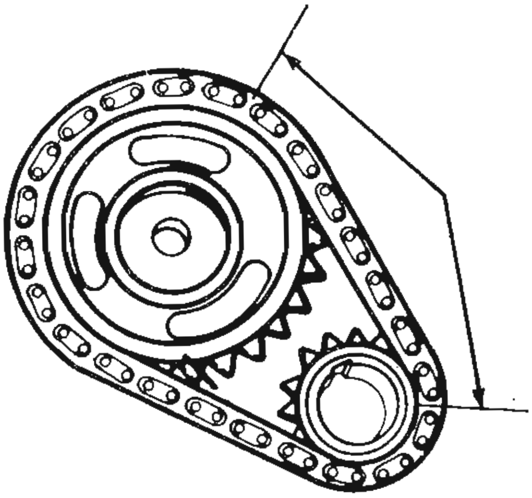
Pull the tensioner block (2) toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the locked (up) position.



84186

Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks (A) aligned.

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.



84187

Tighten the camshaft sprocket bolt with 68 N·m (50 ft-lbs) torque.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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.

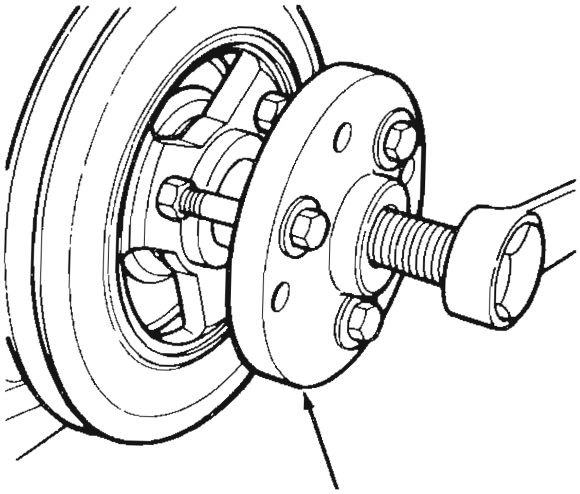
Remove the fan and shroud.

Remove the radiator attaching screws. Disconnect the overflow tube and radiator hoses.

Remove the radiator.

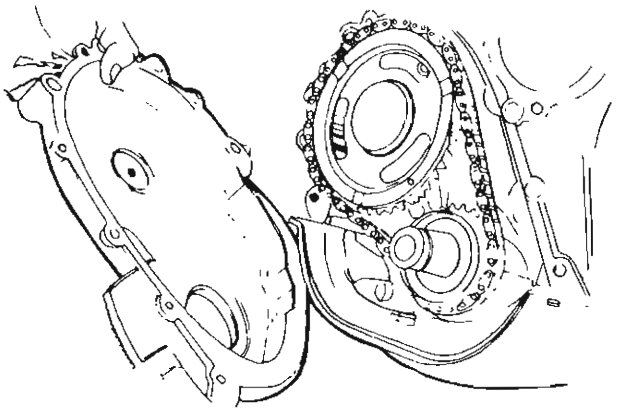
Remove the drive belt(s).

Remove the crankshaft vibration damper and pulley.



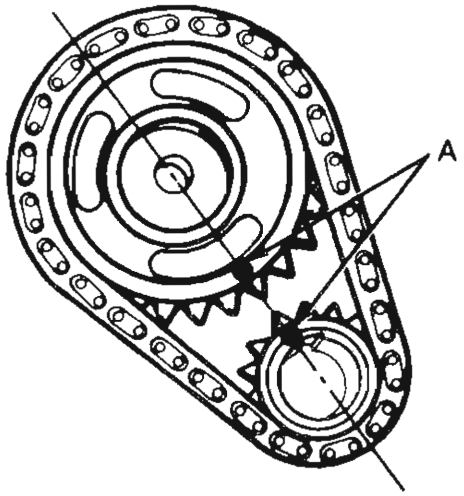
Remove the timing case cover. Refer to the removal procedure.

Remove the crankshaft oil slinger.



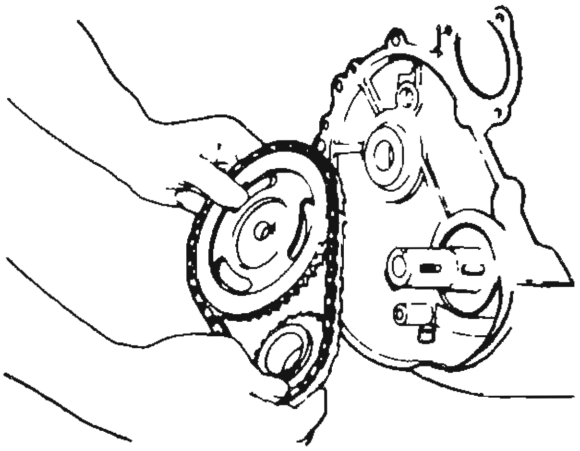
84874

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.



84185

CAUTION: The following procedure 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 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.

SEE I.S. NOTES

CAUTION: Cover the open oil pan area to prevent metal chips from entering the pan.

Drill into the pin center with a 4-mm (5/32-in) drill bit.

Turn a self-tapping screw into the drilled pin hole and carefully pull the pin from the camshaft.

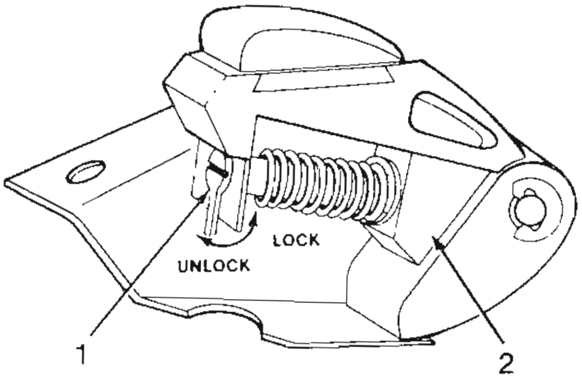
Clean the camshaft pin hole.

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 (1) to the unlocked (down) position.

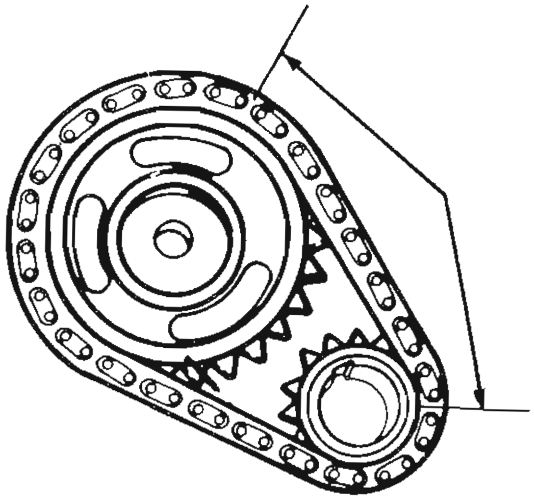
Pull the tensioner block (2) toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the locked (up) position.



84186

Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks (A) aligned.

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.



84187

Tighten the camshaft sprocket bolt with 68 N·m (50 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.

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 × 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 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.

Drain the cooling system.

NOTE: Do not waste reusable coolant. Drain the coolant into a clean container.

Remove the radiator.

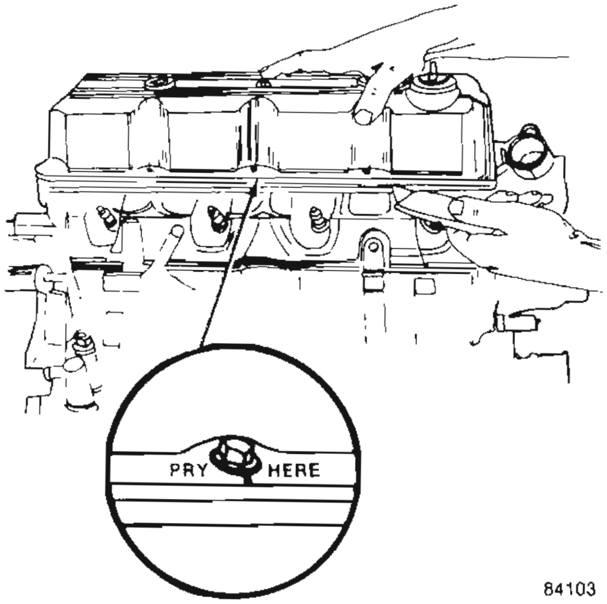
Remove the drive belt(s).

Remove the fuel pump.

Remove the distributor and ignition wires.

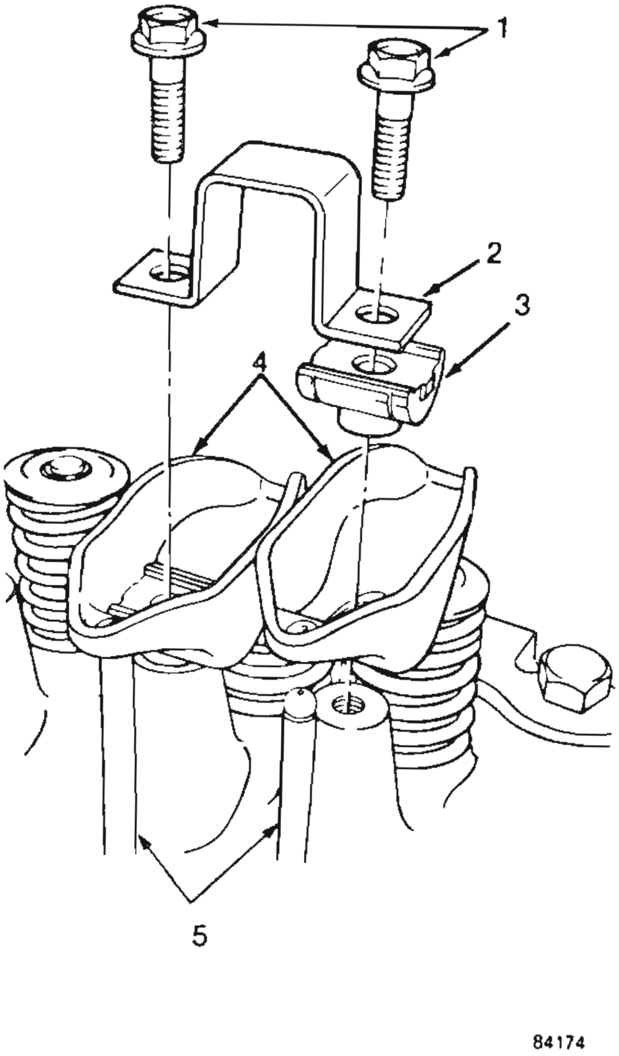
SEE I.S. NOTES

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.



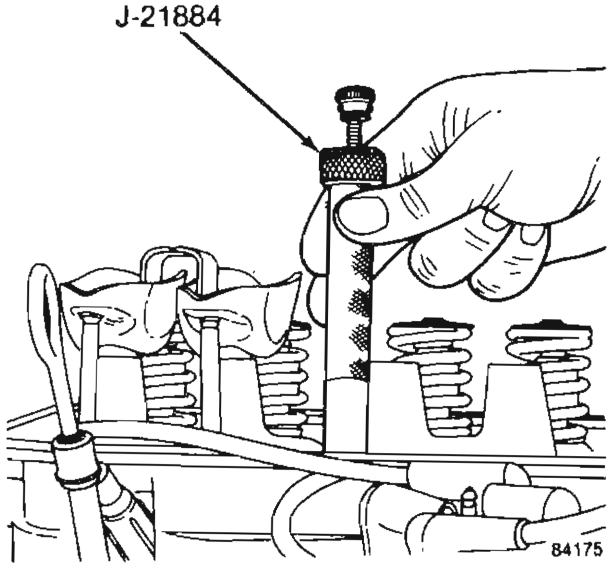
Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4). Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

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.

Remove the hydraulic valve tappets. Refer to the removal procedure.

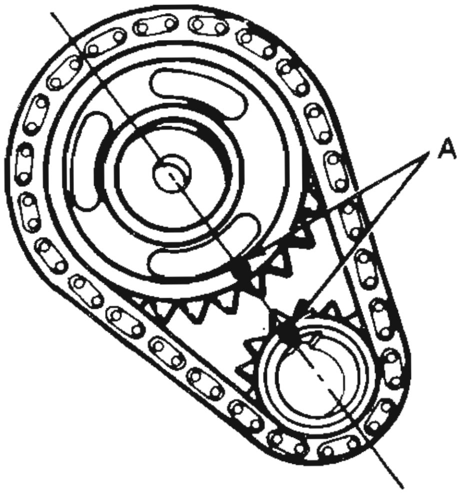


Remove the pulley (if applicable), vibration damper and timing case cover. Refer to Timing Case Cover Removal.

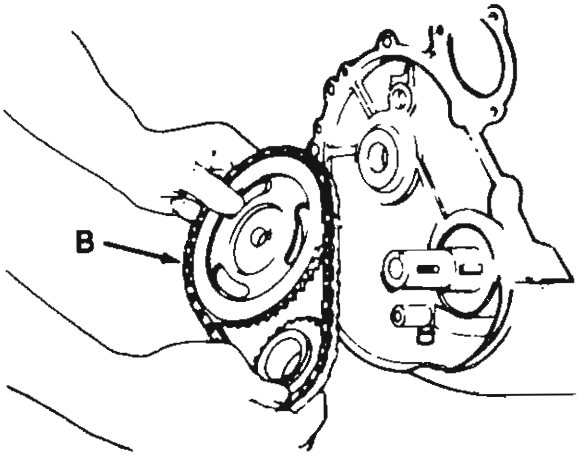
Remove the crankshaft oil slinger.

Remove the camshaft sprocket retaining bolt.

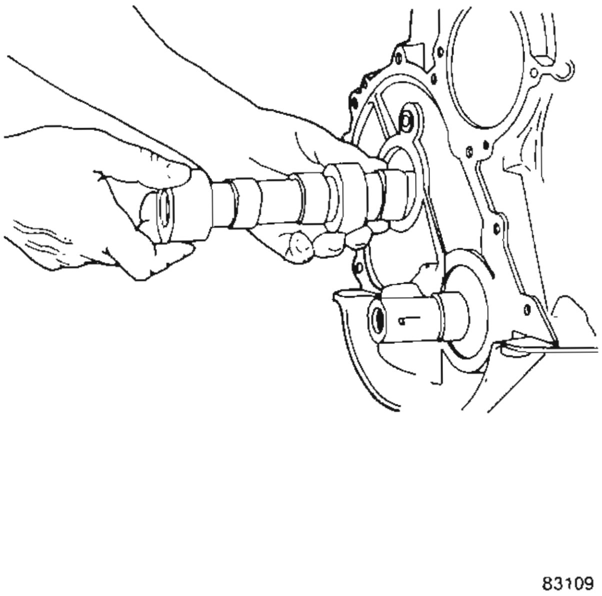
Rotate the crankshaft until the zero degree (0°) timing mark on the crankshaft sprocket is closest to and on the center line with the timing mark on the camshaft sprocket (A).



Remove the timing chain and sprockets as an assembly (B).



Remove the camshaft.



SEE I.S. NOTES

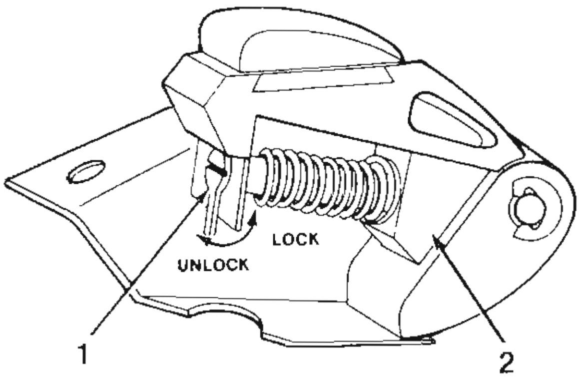
Installation

Lubricate the camshaft with AMC Engine Oil Supplement (EOS), or equivalent.

Install the camshaft carefully to prevent damaging the camshaft bearings.

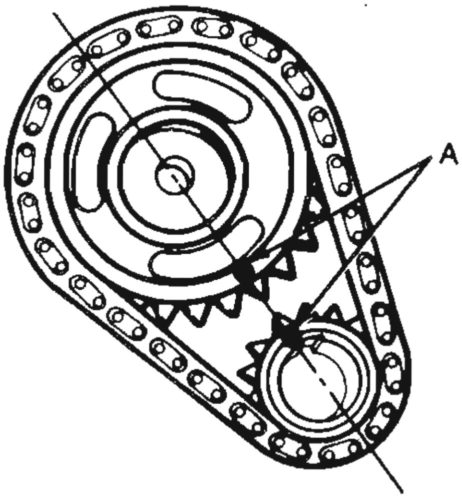
Turn the tensioner lever (1) to the unlocked (down) position.

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.



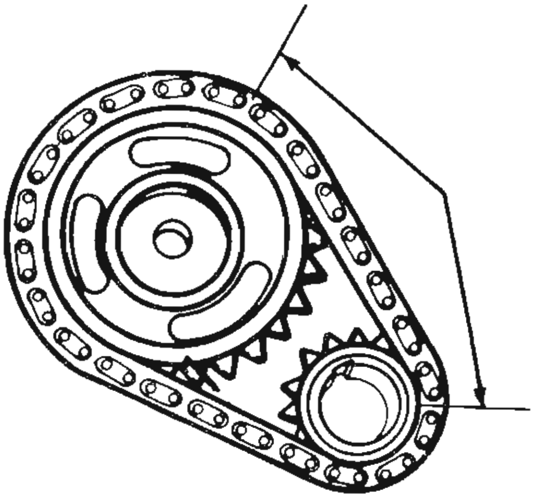
84186

Install the 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.

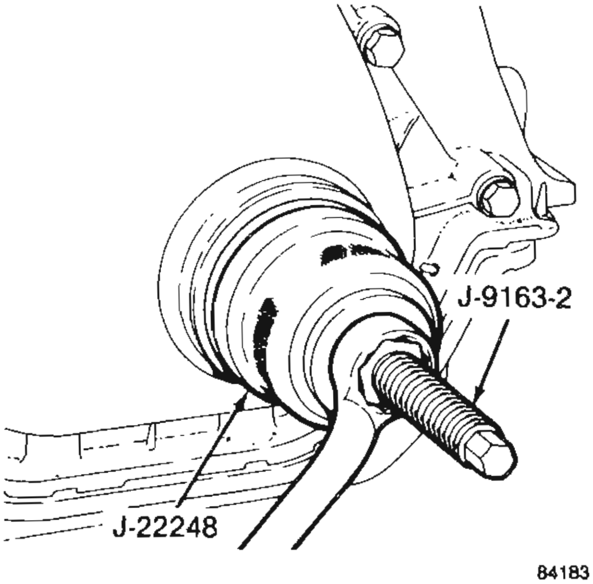


84187

Install the camshaft sprocket retaining bolt and tighten with 68 N·m (50 ft-lbs) torque.

Install the crankshaft oil slinger.

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 × 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.

Install the fan assembly and shroud.

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

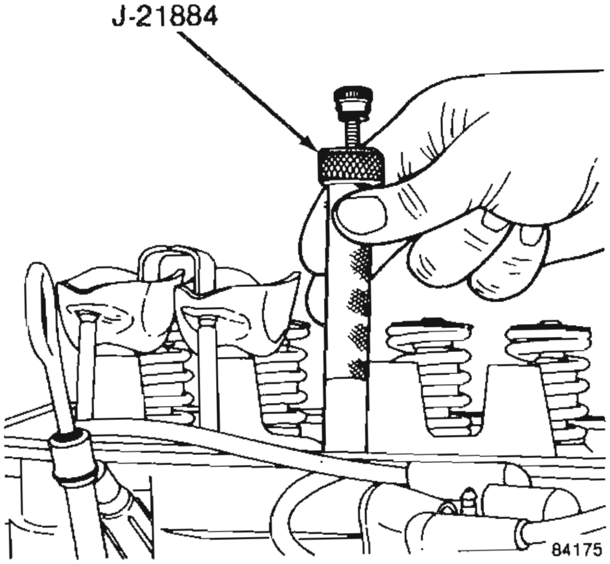
Install the fuel pump.

Rotate the crankshaft until number 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.



SEE I.S. NOTES

SEE I.S. NOTES

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.

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 AND EXHAUST MANIFOLDS

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.

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 choke heater 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 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.

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.

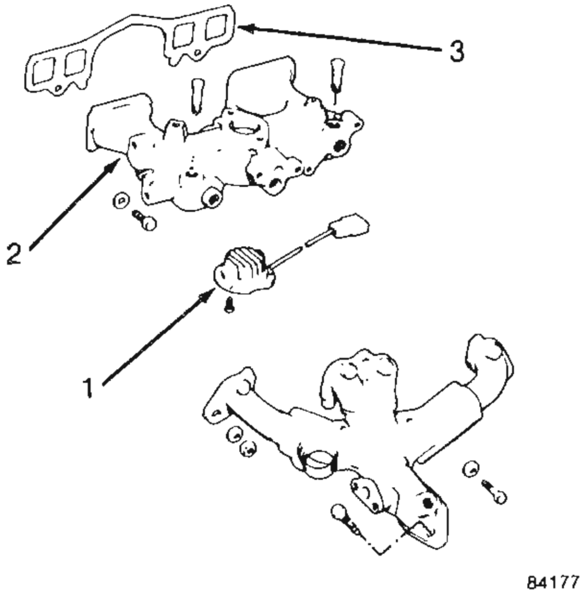
Disconnect the throttle valve linkage, if equipped with an automatic transmission.

Disconnect the EGR valve tube from the intake manifold.

Remove the intake manifold attaching screws, nuts and clamps. Remove the intake manifold (2). Discard the gasket (3).

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.



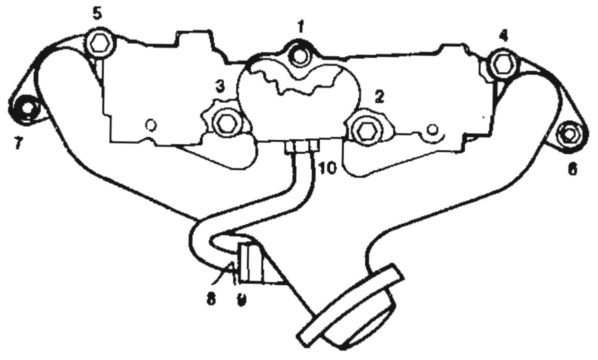
Installation

Position the replacement intake manifold gasket (3) on the cylinder head and install the intake manifold (2).

SEE
I.S.
NOTES

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).



84178

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 9 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 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 (if equipped).

Connect the following wire connectors:

- CEC system coolant temperature sender
- electric intake manifold heater

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.

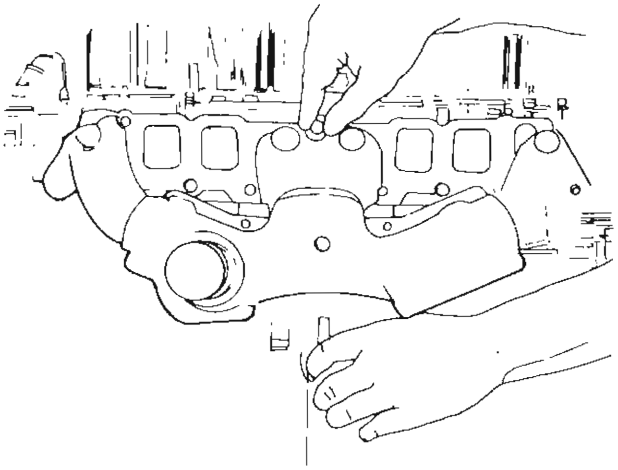
Disconnect the oxygen (O_2) sensor wire connector and remove the sensor from the exhaust pipe.

Remove the nuts from the end studs and remove the exhaust manifold.

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

Installation

Position the exhaust manifold over the end studs on the cylinder head.



83128

Install the nuts on the end studs finger-tight.

Clean the threads in the bore for the oxygen (O_2) sensor.

Apply antiseize compound to the oxygen (O_2) sensor threads.

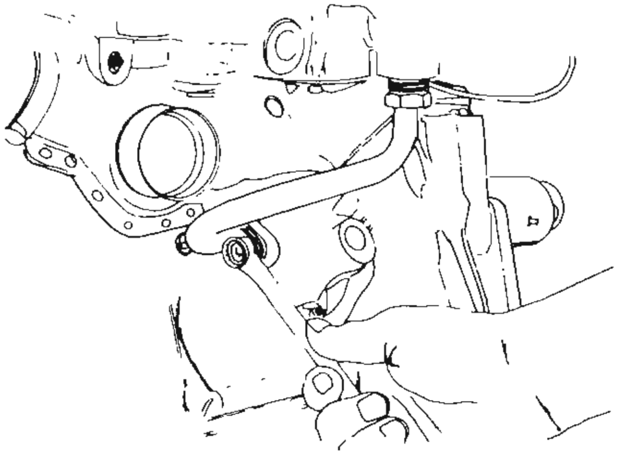
Install the oxygen (O_2) sensor and connect the wire connector. Tighten the sensor with 47 N·m (35 ft-lbs) torque.

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.

SEE I.S. NOTES

Install the EGR valve tube.



83130

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.

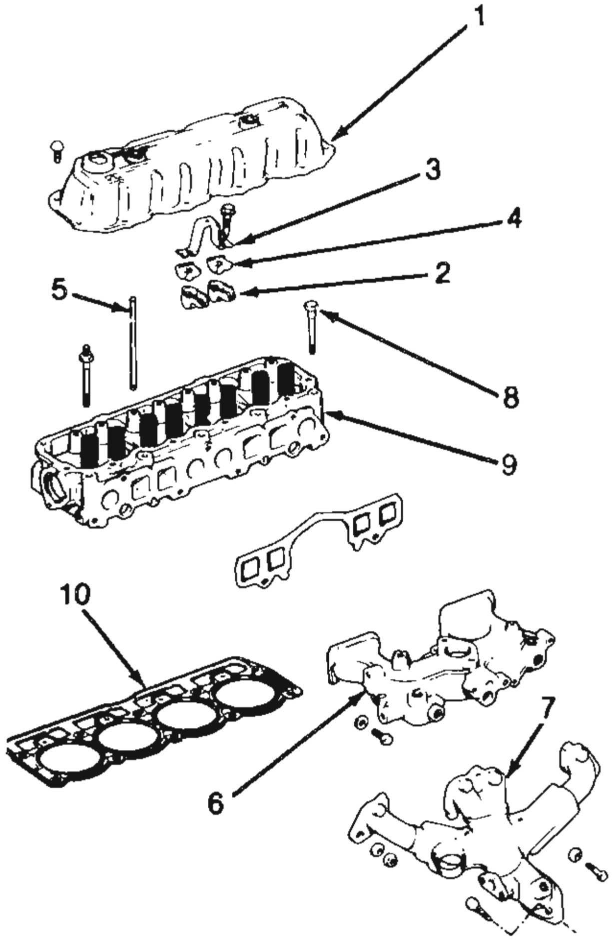
Remove the air cleaner.

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.

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.



84198

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).

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.

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. 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.

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.

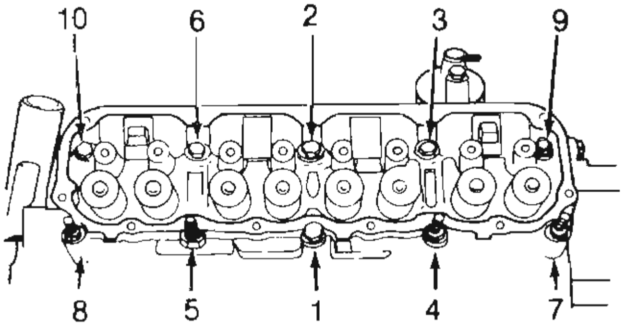
SEE I.S. NOTES

SEE I.S. NOTES

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.



83126

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 number 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 and Exhaust Manifold Installation for the procedures.

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 sending unit and connect the wire connector.

Connect the fuel pipe.

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.

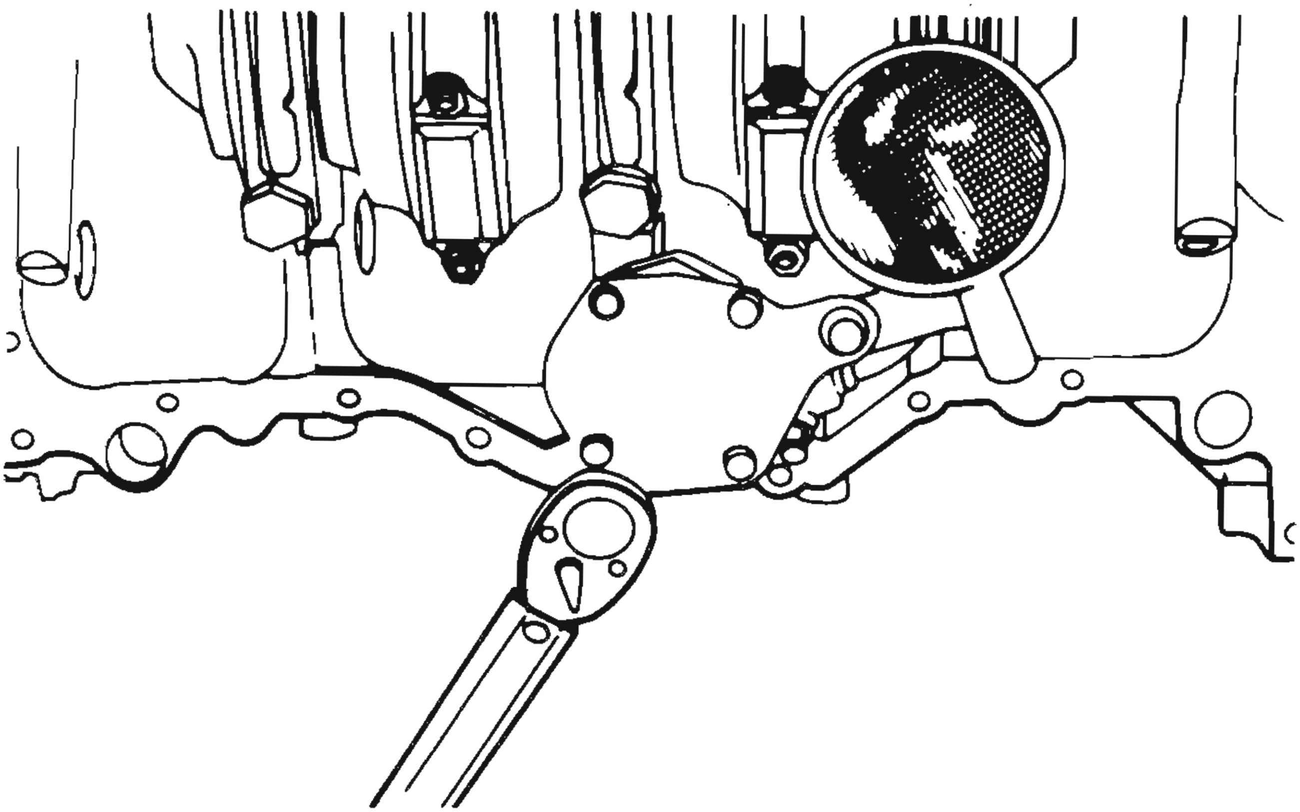
SEE I.S. NOTES

LUBRICATION SYSTEM

SEE
I.S.
NOTES

General

A gear-type oil pump is located at the underside of the cylinder block opposite the No. 3 main bearing.



Oil Pan

Removal

Lock the steering wheel.

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.

Installation

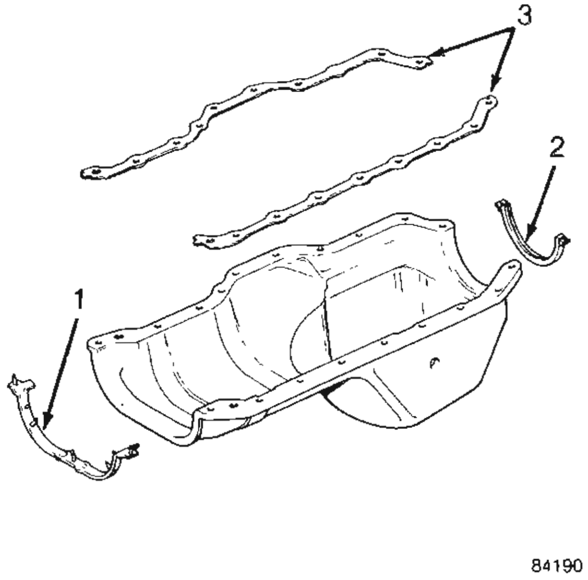
Clean the gasket and seal surfaces. Remove all sludge and grime from the oil pan sump.

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.

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.



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 housing access cover.

SEE
I.S.
NOTES

SEE I.S. NOTES

Raise the vehicle and remove the sill supports. Lower the vehicle.

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.

Fill the oil pan with engine oil to the specified level. Start the engine and inspect for leaks.

Oil Pump

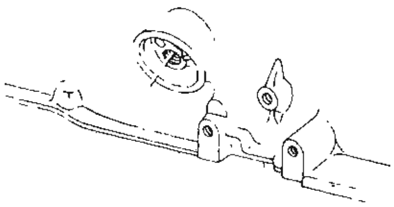
Removal

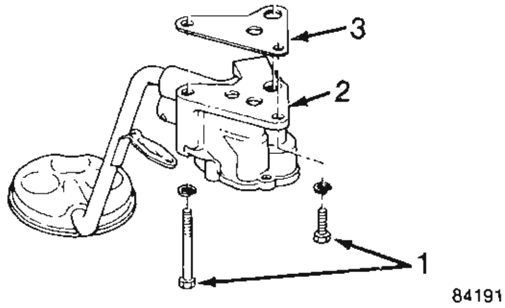
NOTE: Oil pump removal or replacement will not affect the distributor ignition timing because the distributor drive gear remains in mesh with the camshaft gear.

Drain the engine oil.

Remove the oil pan. Refer to Oil Pan Removal.

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.

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 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

Refer to the 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.

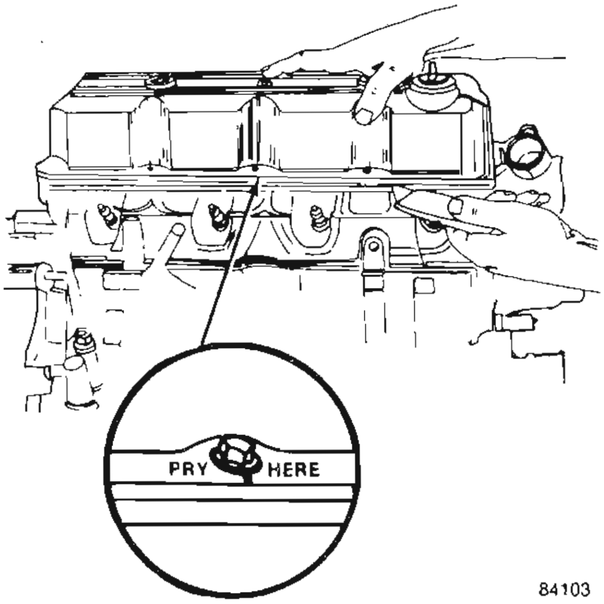
PISTONS AND CONNECTING RODS

Replacement as an Assembly

NOTE: The following procedure is used to service the piston and connecting rod assemblies with the engine installed in the vehicle.

Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.



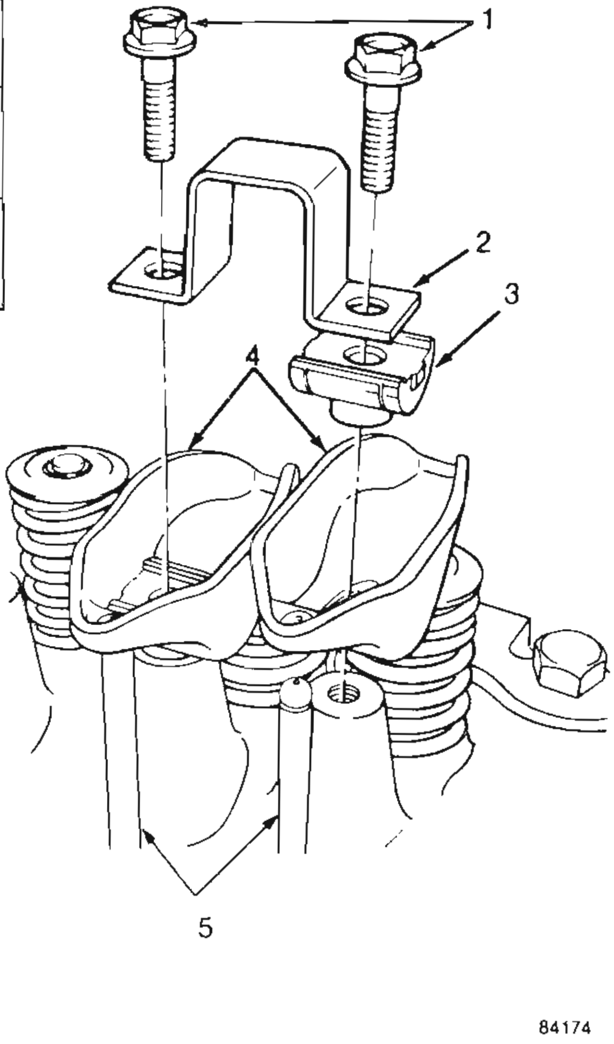
84103

SEE I.S. NOTES

SEE I.S. NOTES

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 bridges.

Remove the push rods (5).



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.

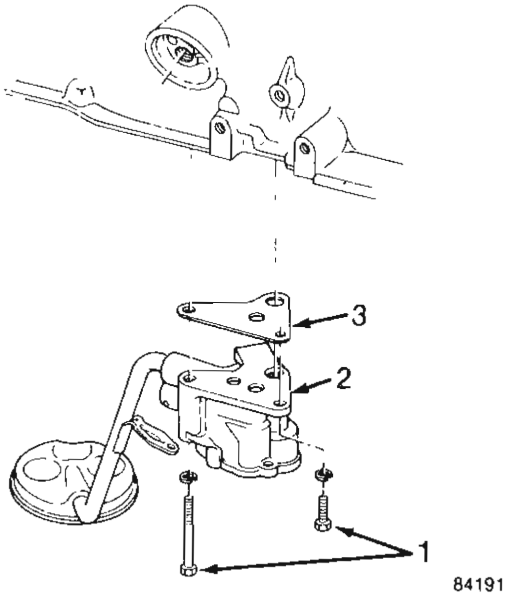
Remove the intake manifold, gasket, exhaust manifold, cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.

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.

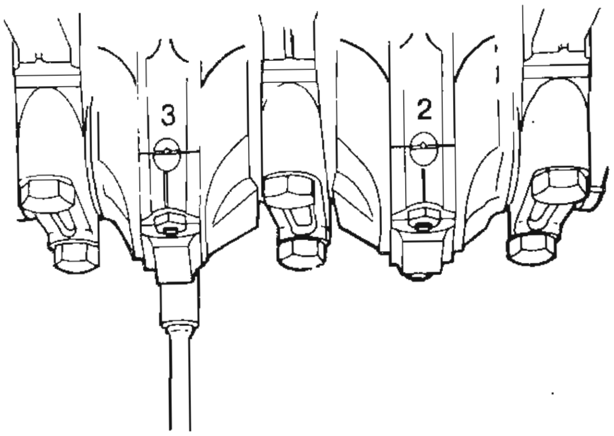
Drain the engine oil.

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.

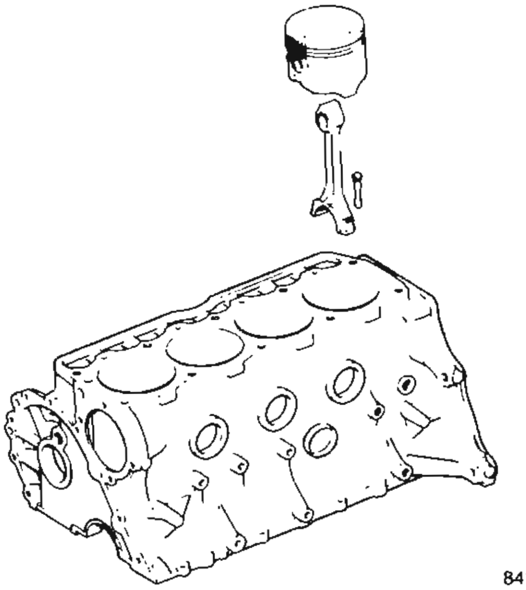


83115

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.

Remove the connecting rod and piston assemblies through the top of the cylinder bores.



84194

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.

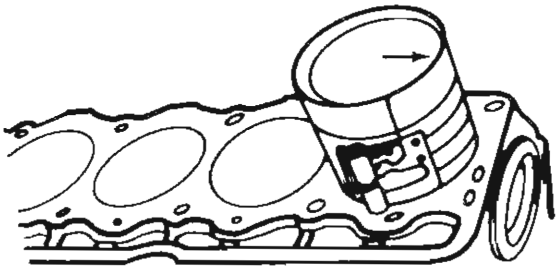
Lubricate the pistons and rings with clean engine oil.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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.



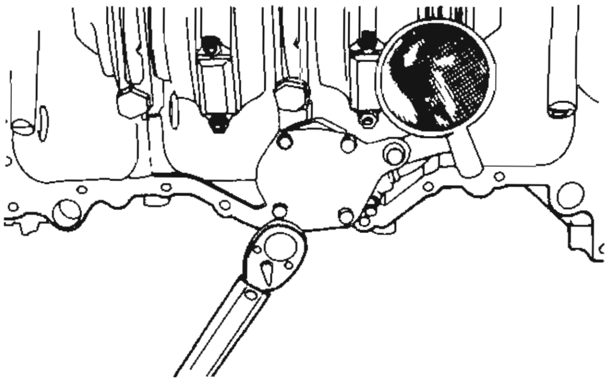
84195

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.

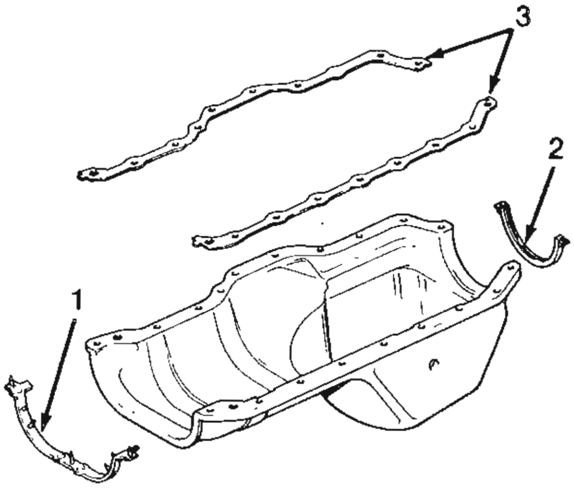
Install the connecting rod bearing caps and inserts at their original locations. Refer to Connecting Rod Bearings Installation for the procedure.

Install the oil pump with a replacement gasket. Refer to Oil Pump Installation for the procedure.



83121

Install the oil pan with replacement gaskets (3) and seals (1 and 2).

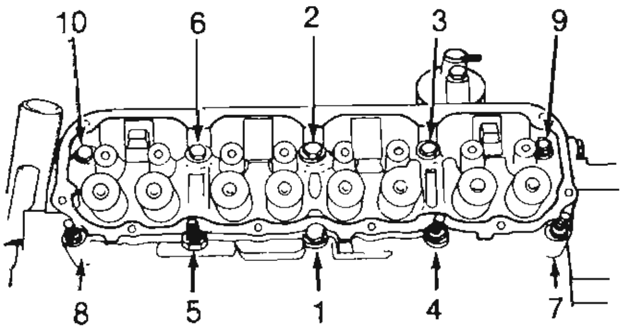


84190

Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

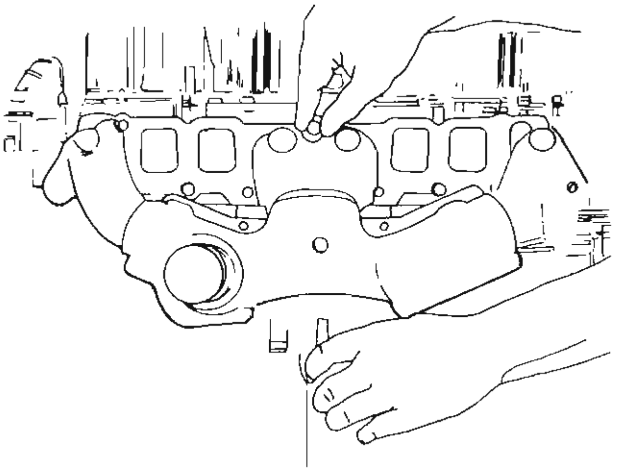
Lower the vehicle.

Install a replacement gasket and the cylinder head. Refer to Cylinder Head Installation for the procedure.

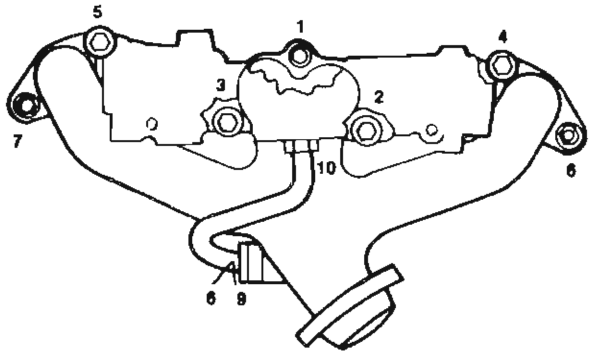


83126

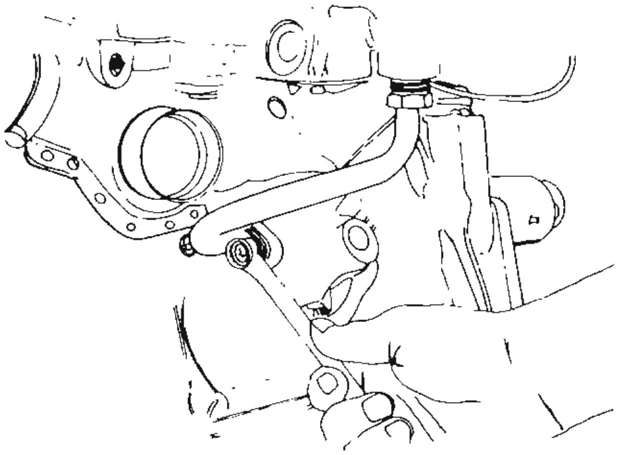
Install the exhaust manifold, a replacement gasket and the intake manifold. Refer to the installation procedures.



83128



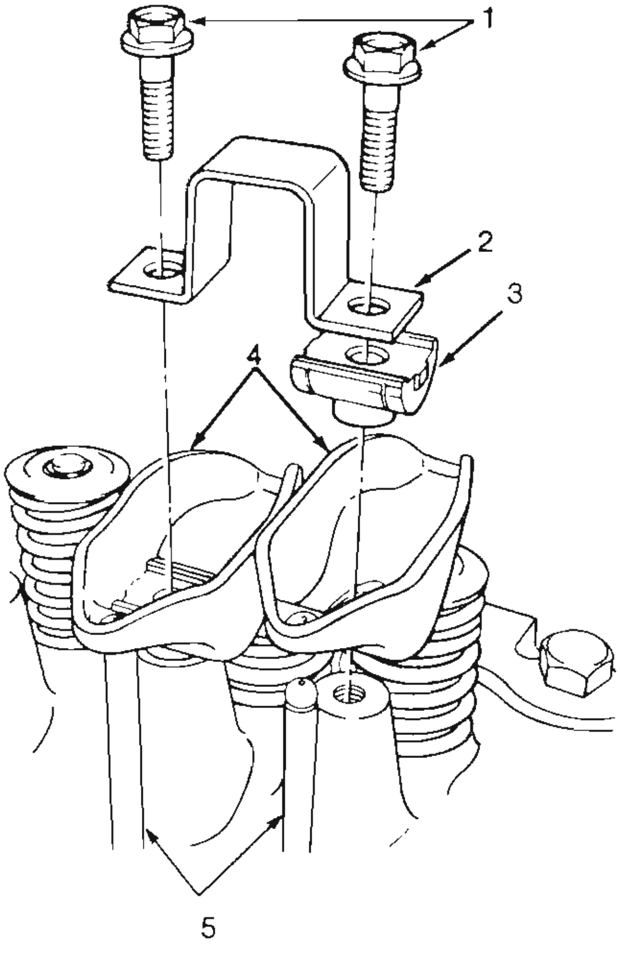
84178



83130

SEE I.S. NOTES

Install the push rods (5), rocker arms (4), bridge (2) and pivot (3) assemblies, and cap screws (1). Alternately tighten the capscrews at each bridge, one turn at a time, to avoid damaging the bridges.



84174

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 Pins

Refer to the MOT. 2.46L manual for the removal, inspection and installation procedures.

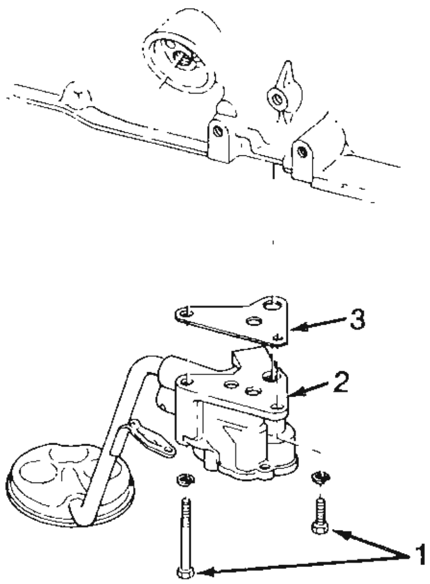
Connecting Rod Bearings

Removal

Drain the engine oil.

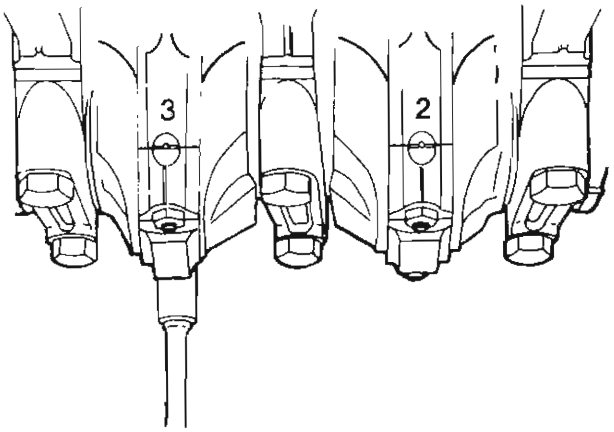
Remove the oil pan, seals and gaskets. Refer to Oil Pan Removal for the procedure.

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.

Inspection

Refer to the MOT. 2.46L manual for the procedure.

Measuring Bearing-to-Journal Clearance with Plastigage

Refer to the MOT. 2.46L manual for the procedure.

Installation

Lubricate the bearing surface of each insert with clean engine oil.

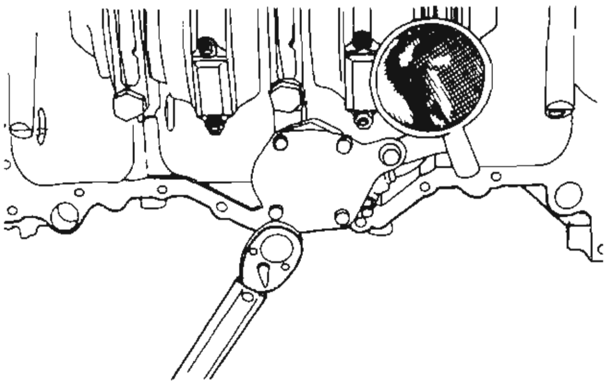
CAUTION: Use care when rotating the crankshaft with the bearing caps removed. Ensure that the connecting rod bolts do not accidentally come into contact with the crankshaft journals and scratch the surface. Bearing failure would result. Short pieces of rubber hose, slipped over the connecting rod bolts, 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.

SEE
I.S.
NOTES

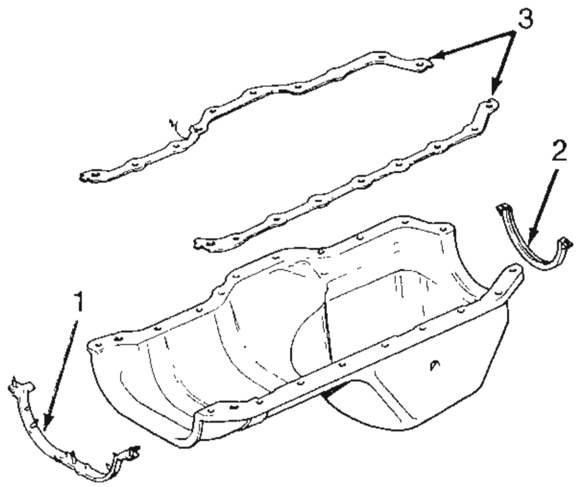
SEE I.S. NOTES

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.

Pistons

Refer to the MOT. 2.46L manual for piston replacement and.servicing procedures.

CRANKSHAFT

Removal and Installation

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible. Removal and installation procedures are described in the MOT. 2.46L manual.

Crankshaft Main Bearings

Removal

Remove the spark plugs.

Disconnect the battery cables.

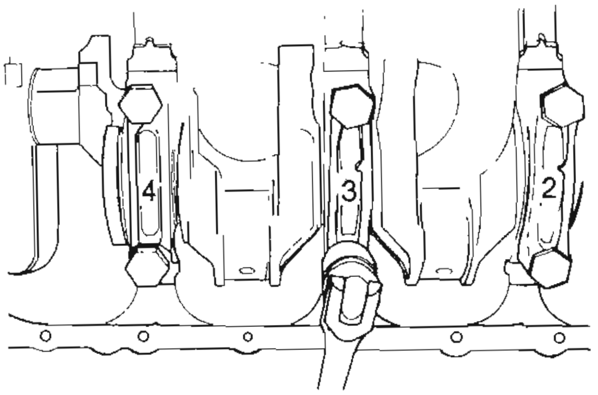
Raise and support the vehicle.

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. A tongue depressor may also be used to remove the bearing insert.

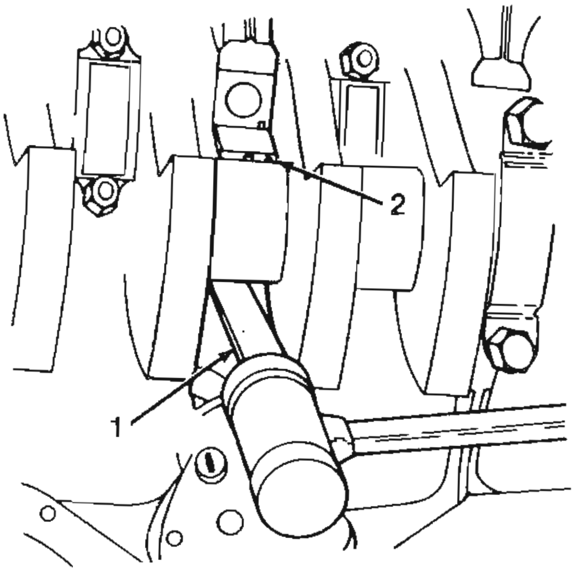
84192

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.

SEE I.S. NOTES

SEE I.S. NOTES

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 25 mm (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.

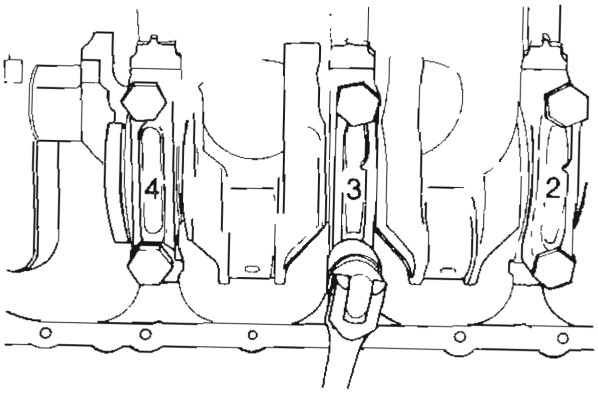
Installation

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.

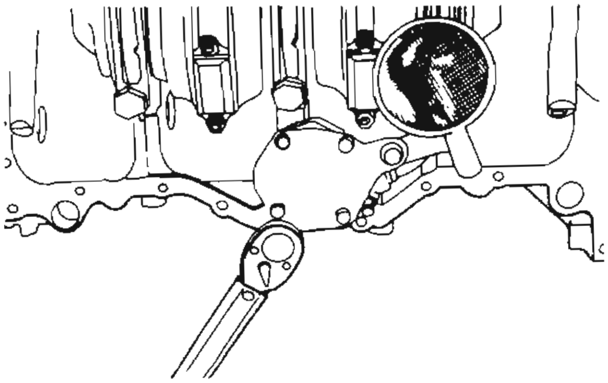


83116

Rotate the crankshaft after tightening each main bearing cap to ensure that the crankshaft rotates freely.

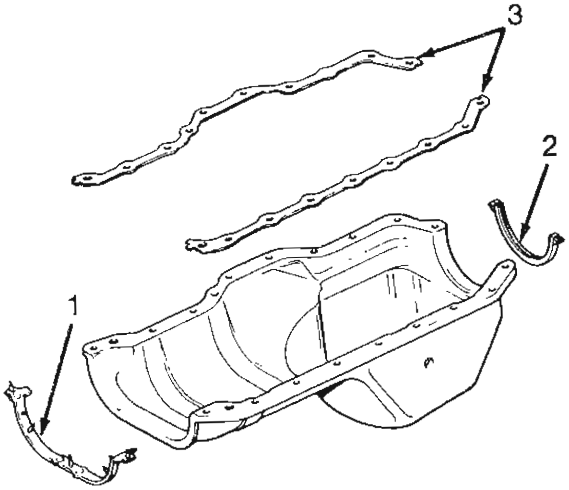
NOTE: When installing a crankshaft kit (crankshaft plus bearing inserts), measure each bearing-to-journal clearance with Plastigage to ensure a proper fit.

Install the oil pump with a replacement gasket. Refer to Oil Pump Installation for the procedure.



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 oil pan with engine oil to the FULL MARK on the dipstick.

Rear Main Bearing Oil Seal

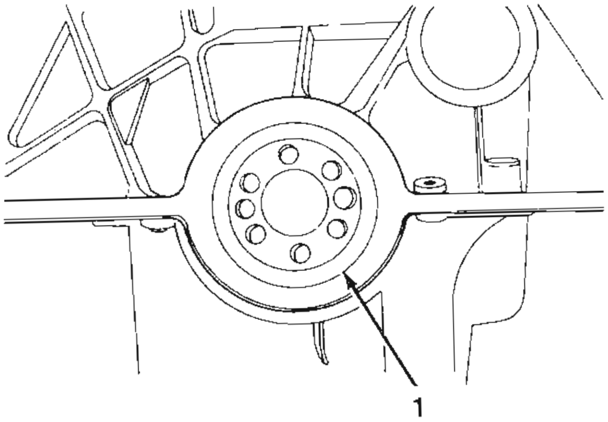
The crankshaft rear main bearing oil seal is a one-piece, single-lip seal that fits tightly between the cylinder block and the crankshaft.

Removal

NOTE: When replacing the rear main oil seal, the transmission must be removed. Refer to the transmission removal procedure.

Remove the flywheel.

Remove the seal (1) from the crankshaft flange by prying around the crankshaft flange.



83131

SEE I.S. NOTES

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 installation procedure.

FLYWHEEL

Removal and Installation

NOTE: Before removing the flywheel, the transmission must be removed. Refer to the transmission removal procedure.

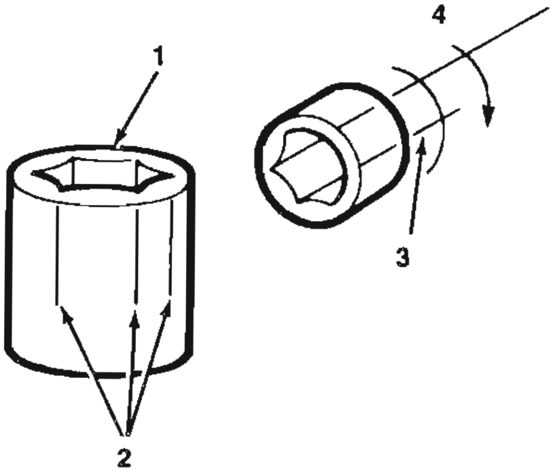
Remove the transmission.

Remove the flywheel.

Install the flywheel with replacement bolts.

Tighten the flywheel bolts with 68 N·m (50 ft-lbs) plus 60° torque.

NOTE: A 19-mm (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.

Use a pencil to draw a small mark (3) on the surface of the flywheel.

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.

Install the transmission. Refer to the 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.

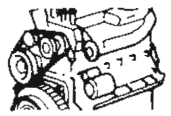
Press the flywheel into the replacement ring gear.

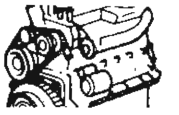
NOTE: The flywheel is balanced as an individual component and also as part of the crankshaft assembly. Do not attempt to duplicate the original flywheel balance holes when installing a service replacement flywheel. Service replacement flywheels are balanced during manufacture and do not require additional balancing.

CYLINDER BLOCK OVERHAUL

Refer to the MOT. 2.46L manual.

SEE
I.S.
NOTES





GENERAL

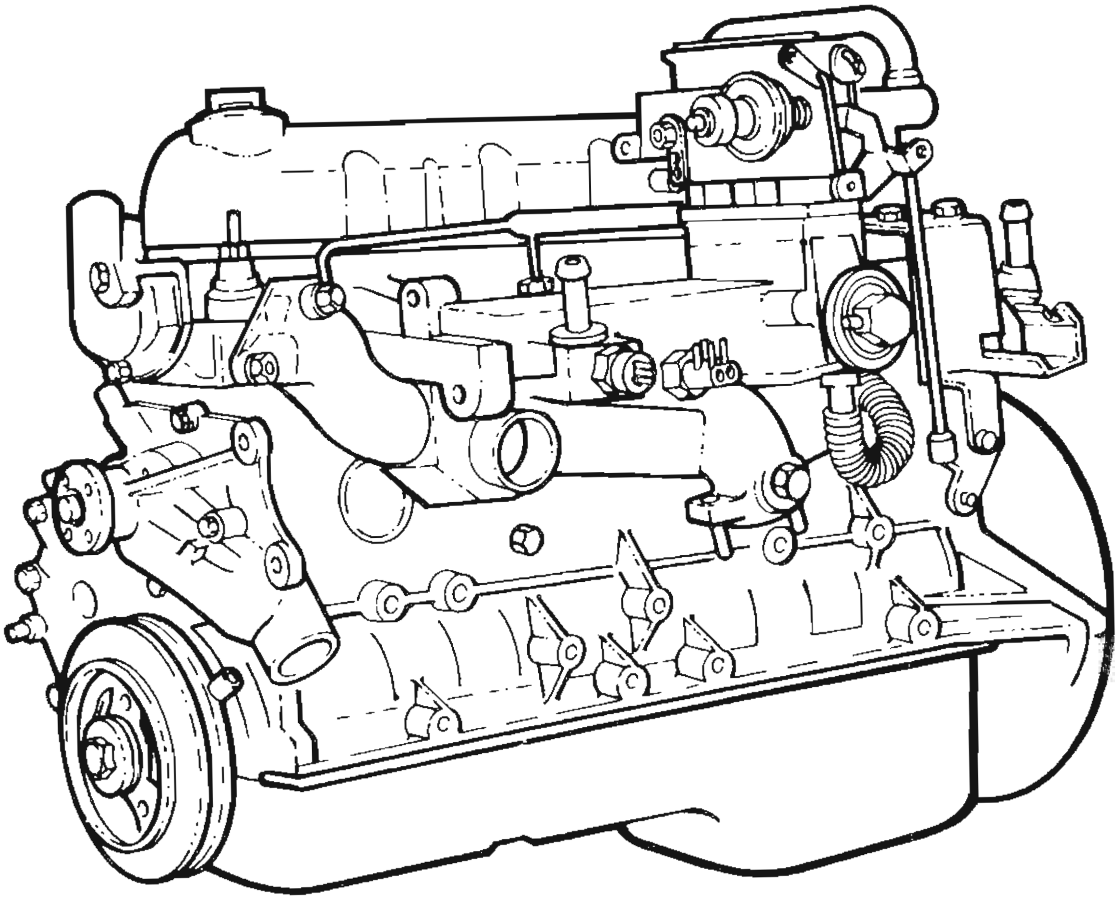
SEE
I.S.
NOTES

Description

Vehicle	Engine	Displacement	Bore mm (in)	Stroke mm (in)	Comp. Ratio	Carburetor	Oil Capacity
87 88	6-cylinder	4.2L 258 CID	95.25 (3.75)	98.93 (3.895)	9.2:1	2-Venturi	4.75L 5.0 qts. 4.1 imp qts. (w/o filter change)

86348(J)

SEE I.S. NOTES



Engine Identification

Build Date Code

SEE I.S. NOTES

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.

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 October 11, 1983.

Engine Build Date Code Explanation

Letter Code	CID	Carburetor	Compression Ratio
C	258	2V	9.2:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
3 – 1983 4 – 1984	01 - 12	C	01 - 31

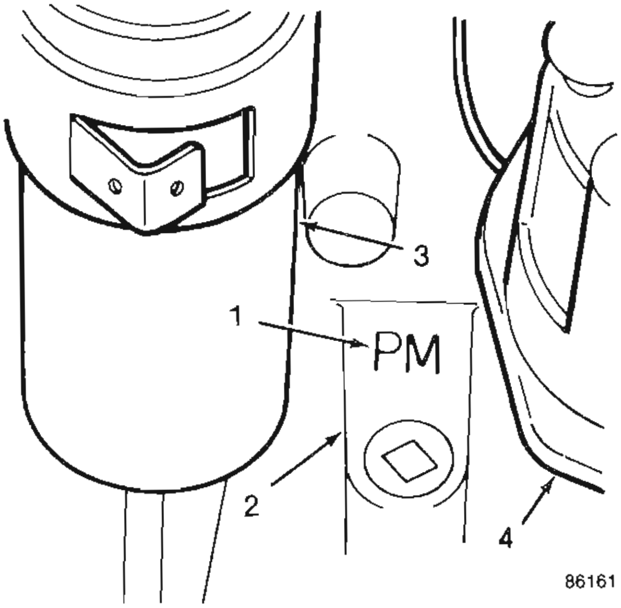
EXAMPLE: 3 10 C 11

60257B

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.

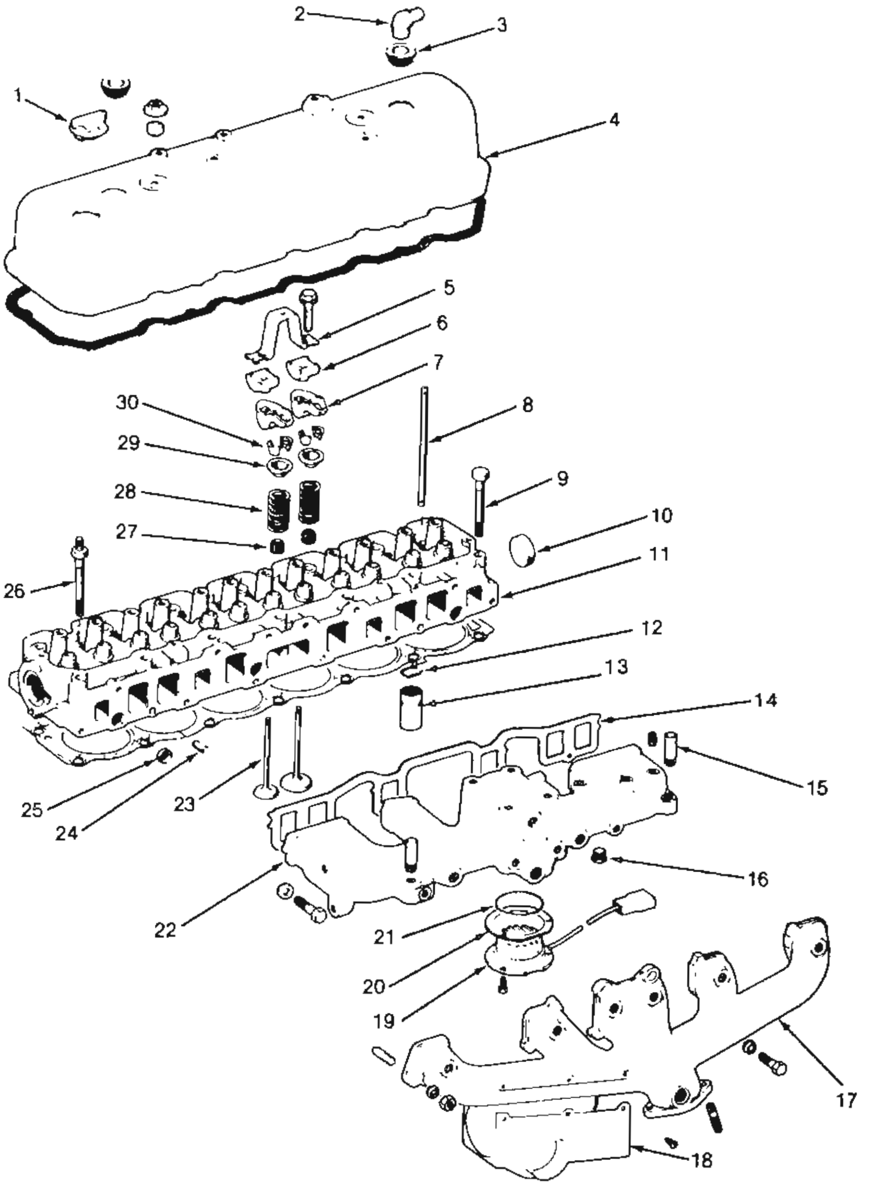
Oversize or Undersize Components Letter Code

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.

60258

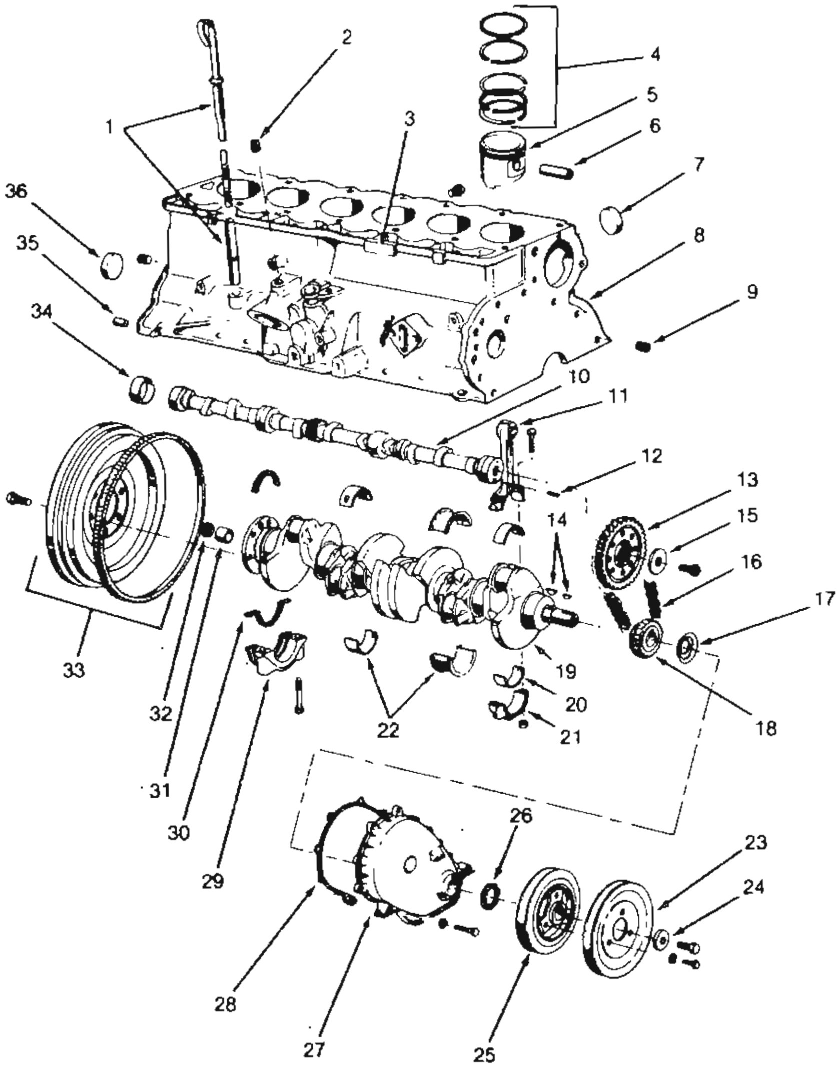
SIX CYLINDER ENGINE ASSEMBLY — CYLINDER HEAD



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 – Retainer
30 – Valve Locks

86157

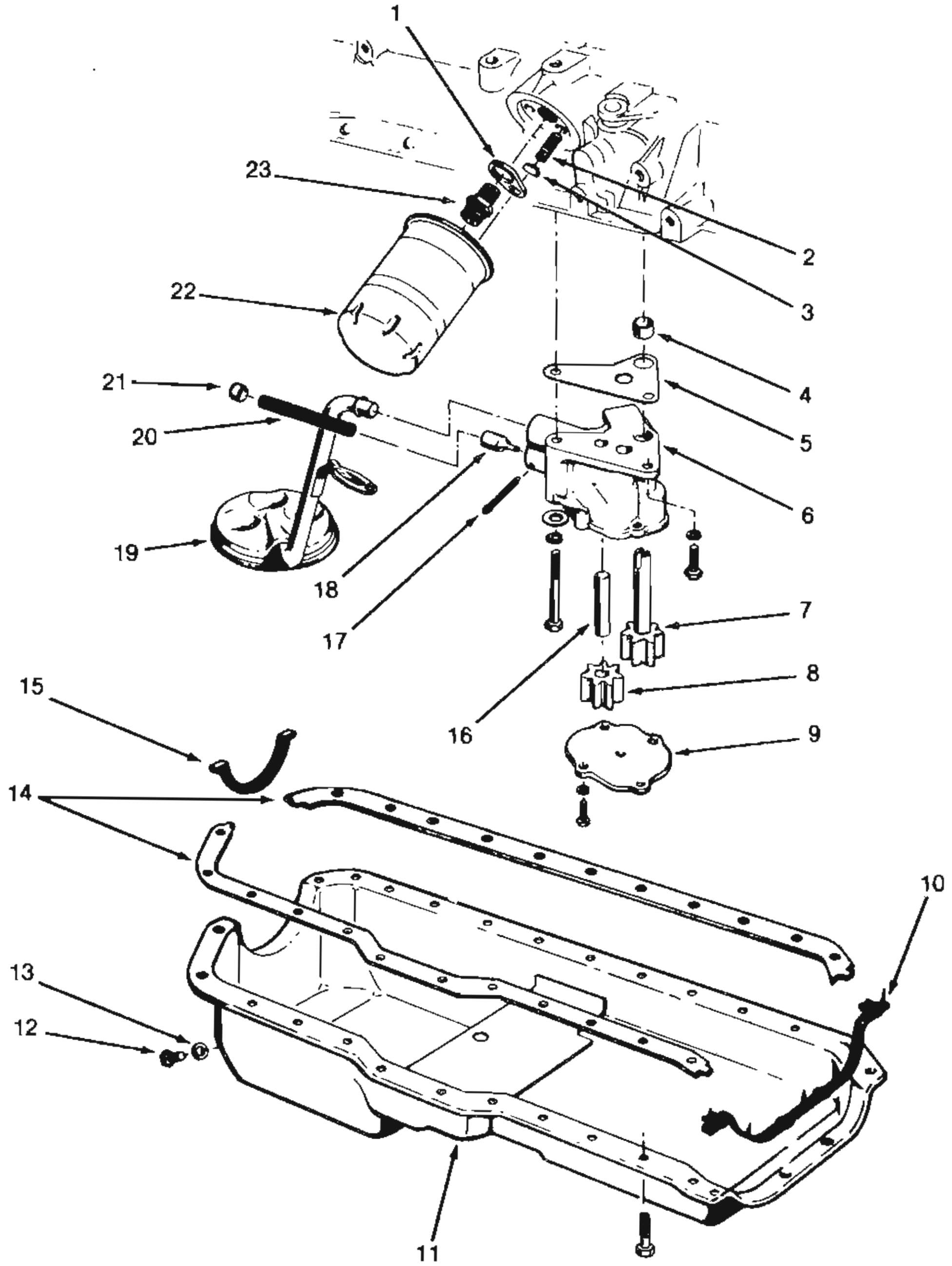
SIX CYLINDER ENGINE ASSEMBLY — CYLINDER BLOCK



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

86158

SIX CYLINDER ENGINE ASSEMBLY — OIL PAN AND PUMP

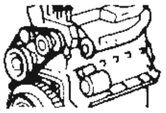


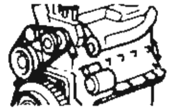
1 – Oil Filter By-Pass Valve Retainer
2 – Oil Filter By-Pass Valve Spring
3 – Oil Filter By-Pass Valve
4 – Dowel Pin
5 – Oil Pump-to-Cylinder Block Gasket
6 – Oil Pump Body
7 – Oil Pump Drive Shaft and Gear
8 – Oil Pump Idler Gear
9 – Oil Pump Cover
10 – Oil Pan Timing Case Cover Seal
11 – Oil Pan
12 – 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

86180

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-22248	Timing Case Cover Alignment and Seal Installation Tool	■	
J-21882	Oil Pump Inlet Tube Installation Tool	■	
J-22534-01	Valve Spring Removal and Installation Tool	■	
J-22534-04		■	
J-22534-05		■	
J-9256	Timing Case Cover Oil Seal Removal Tool		■
J-22794	Air Hose Adapter		■
J-21884	Hydraulic Valve Tappet Removal and Installation Tool		■
J-8520	Dial Indicator Set		■
J-21791	Vibration Damper Removal Tool		■
J-5959-04	C-Clamp and Rod Extension		■
J-9163	Screw (used with J-22248)		■
J-5601	Piston Ring Compressor		■
J-23600	Belt Tension Gauge		■
J-23600-B			■
J-29550			■
J-24460-01	Cooling System Pressure Tester and Adapter		■
J-9789-C	Universal Carburetor Gauge Kit		■
J-10174-01	Main Jet Removal and Installation Tool		■
J-23738	Hand Operated Vacuum Pump		■
ET-501-82	Fuel Feedback System Tester	■	
ET-501-84	Fuel Feedback System Tester Adapter	■	
	Tach/Dwell Meter		■





SEE I.S. NOTES

TORQUE SPECIFICATIONS

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	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 Bolt	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 ft-lbs)
Crankshaft Pulley-to-Damper Bolts	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 (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)
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 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)
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)
Front Crossmember-to-Sill Bolts	88 N·m (65 ft-lbs)	75 N·m (55 ft-lbs) min

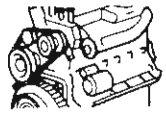
TORQUE SPECIFICATIONS (Cont'd)

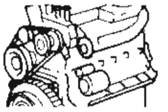
Component	Service Set-To Torque	Service Recheck Torque
Front Support Bracket-to-Block Bolts	60 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Front Support Cushion-to-Bracket Bolts	45 N·m (33 ft-lbs)	36-52 N·m (27-38 ft-lbs)
Front Support Cushion-to-Crossmember Bolts	50 N·m (37 ft-lbs)	41-61 N·m (30-45 ft-lbs)
Fuel Pump Screws	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Idler Arm Bracket-to-Sill Bolts	68 N·m (50 ft-lbs)	47-81 N·m (35-60 ft-lbs)
Idler Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idler 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)

SEE I.S. NOTES

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
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 Crossmember-to-Side Sill Nut	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Rear Support Bracket-to-Transmission Bolts	45 N·m (33 ft-lbs)	37-52 N·m (27-38 ft-lbs)
Rear Support Cushion-to-Bracket Bolts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Rear Support Cushion-to-Crossmember Bolts	24 N·m (18 ft-lbs)	16-34 N·m (12-25 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 (13 ft-lbs)	12-24 N·m (9-18 ft-lbs)





SEE
I.S.
N
O
T
E
S

SPECIFICATIONS

Six-Cylinder Engine Specifications

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
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	8.6 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°	

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Connecting Rods		
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 .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	0.0149 (below block)	0 376 (below block)

86218

Six-Cylinder Engine Specifications (Continued)

SEE I.S. NOTES

	(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
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)
Cylinder Head		
Combustion Chamber Volume	64 45-67.45cc	
Valve Arrangement	EI-IE IE-EI-EI-IE	
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	5 quarts (Add 1 quart wilh filler change)	4.75 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 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

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
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		
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)	4.7895-4.8045	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	836-898N at 35.84
Inside Diameter	0 948-0.968	24.08-24.59

86219

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.

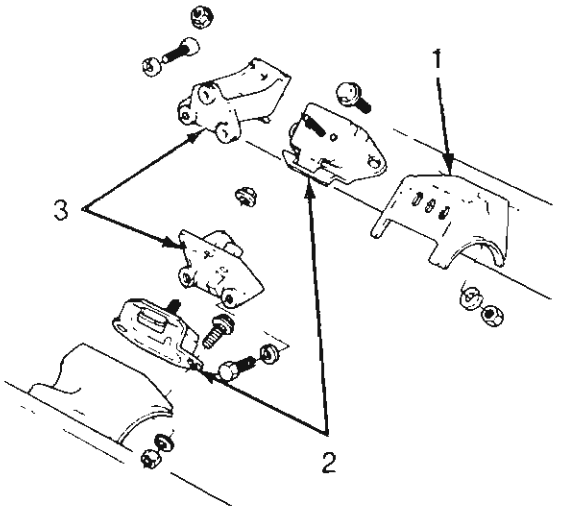
NOTE: For identification, short engine assemblies have the letter S stamped on the same machined surface where the build date code is stamped for complete engine assemblies.

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.

ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine (1 and 2) and at the rear between the transmission adapter housing and the rear support crossmember.



1 - Frame Support
2 - Cushions
3 - Engine Mounting Brackets

Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

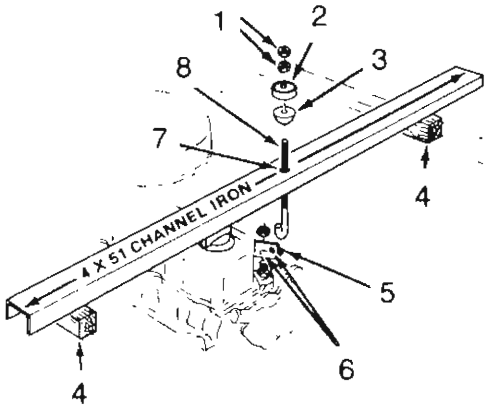
CAUTION: Before raising the engine, remove the screws that attach the fan shroud to the radiator to prevent damage to the shroud by the fan.

SEE
I.S.
NOTES

SEE I.S. NOTES

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
2 - Upper Trunnion Bearing
3 - Pivot or Sleeve
4 - 2×2×6-Inch Hardwood Block
5 - 1¼-Inch Angle Iron
6 - 1/2-Inch Holes
7 - 1-Inch Hole
8 - 9/16-Inch – 12 Trunnion

41883

ENGINE REPLACEMENT

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.

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 (O_2) 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.

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.

SEE
I.S.
NOTES

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 and the clutch release bellcrank inner support screws
- disconnect the springs and remove the clutch release bellcrank
- remove the outer bellcrank-to-throwout lever rod bracket retainer

Remove the engine mount cushion-to-bracket nuts.

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 off the front mount cushions.

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.

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 onto the mount cushions. Ensure the bolt holes are aligned.

Install the 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
- insert the clutch release bellcrank through the bushing in the throwout lever rod bracket and install the retainer
- attach the bellcrank-to-throwout lever rod to the throwout lever and connect the springs
- attach the inner support bracket to the flywheel housing
- connect the clutch pedal to the bellcrank rod

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.

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.

SEE I.S. NOTES

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.

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.

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 the diverter valve and bracket assembly.

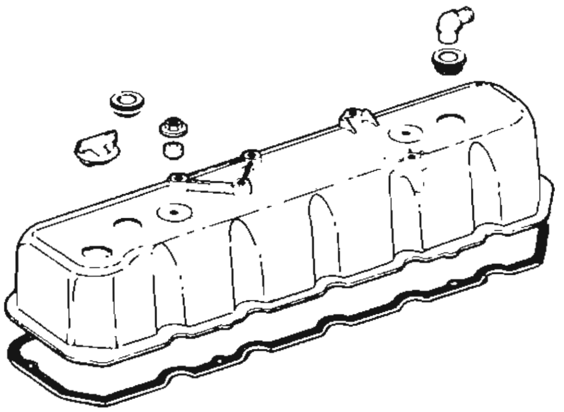
Remove all the necessary vacuum and air hoses to provide clearance for the cylinder head cover removal/installation.

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.



86319

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.

SEE I.S. NOTES

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.

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

840150

Apply a 3-mm (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 the diverter valve and bracket assembly on the cover.

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

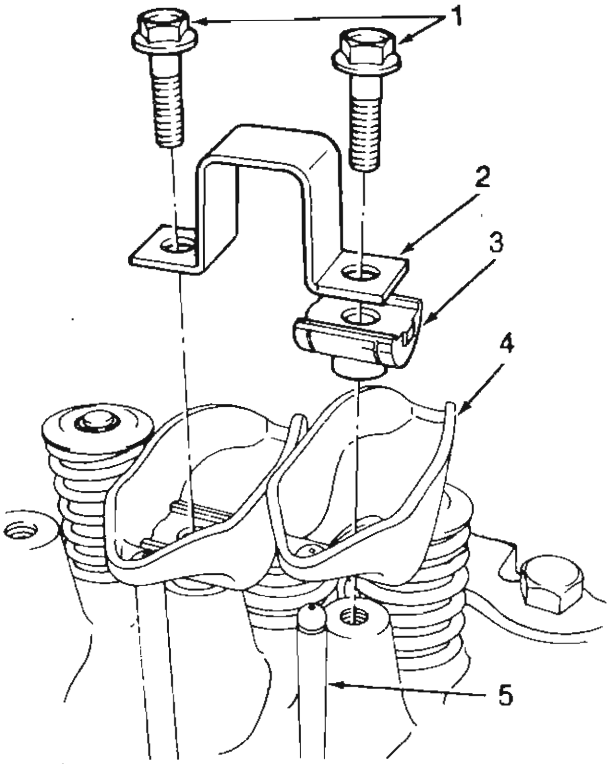
Removal

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.

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.



86162

SEE I.S. NOTES

SEE I.S. NOTES

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.

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.

Hydraulic Valve Tappets

Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

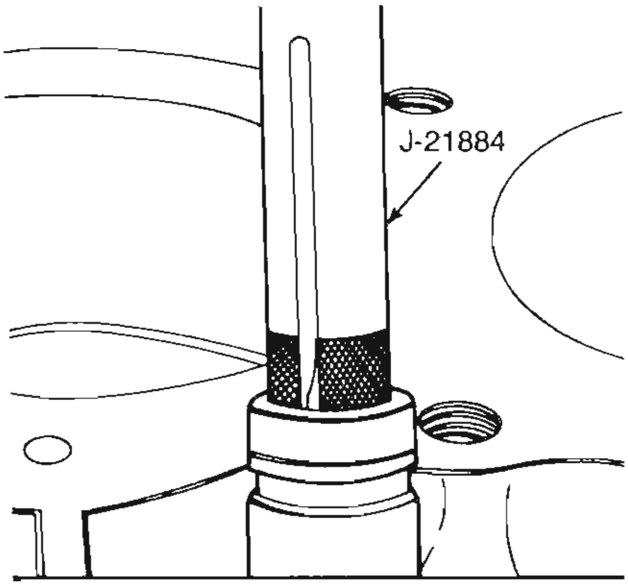
Remove the bridge and pivot assemblies and rocker arms by removing the two capscrews at each bridge. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

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 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 at the original positions.

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 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.

SEE
I.S.
N
O
T
E
S

Valves

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.

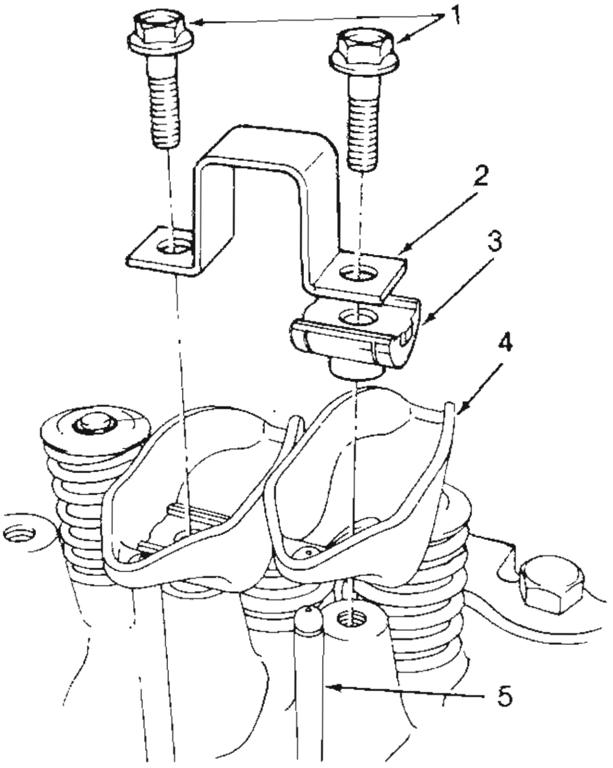
Valve Spring and Oil Deflector Removal

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).



86162

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.

Remove the spark plug adjacent to the cylinder below the valve springs to be removed.

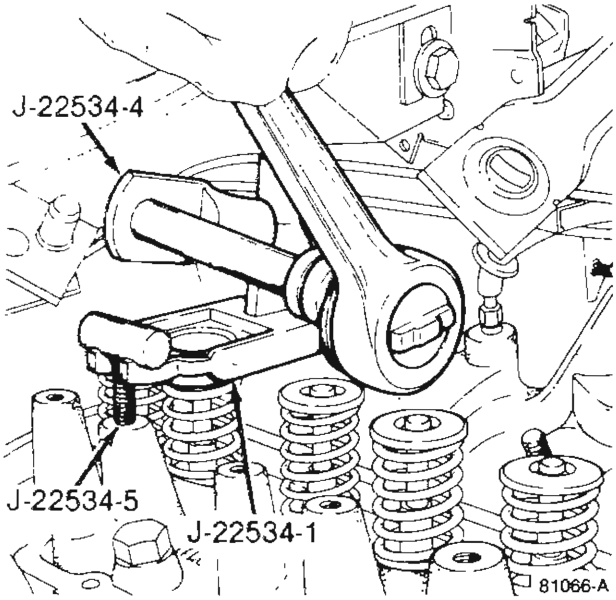
Install a 14-mm (thread size) air adapter (J-22794 or equivalent) in the spark plug hole.

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.

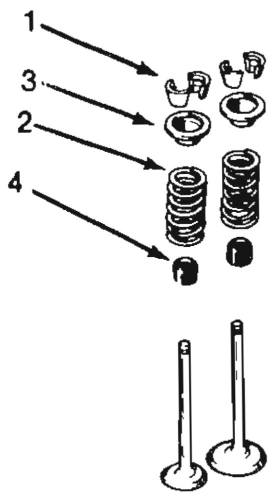
Use Valve Spring Compressor Tool Set J-22534 to compress the spring and remove the locks (1).



81066-A

Remove the valve spring (2) and retainer (3).

Remove the valve stem oil deflector (4).



84197

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 11-mm (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.

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.

Measuring the Cam Lobe Lift

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

Remove the capscrews, bridge and pivot assemblies, and rocker arms.

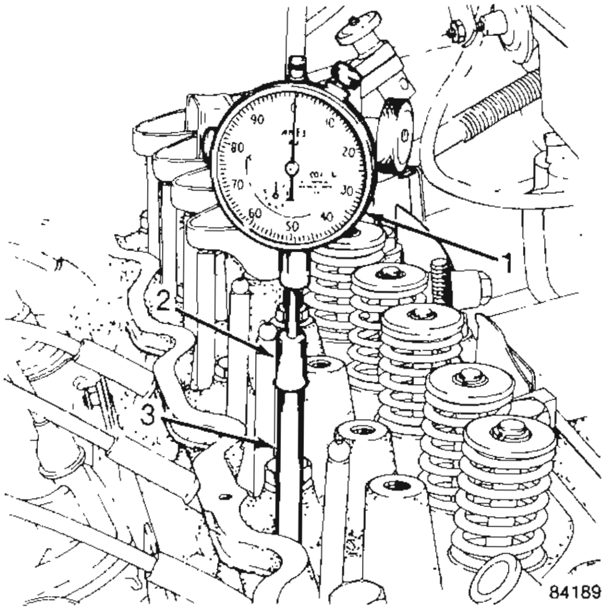
Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

Remove the spark plugs.

SEE I.S. NOTES

SEE I.S. NOTES

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.

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 0.305-mm (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 13 mm (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

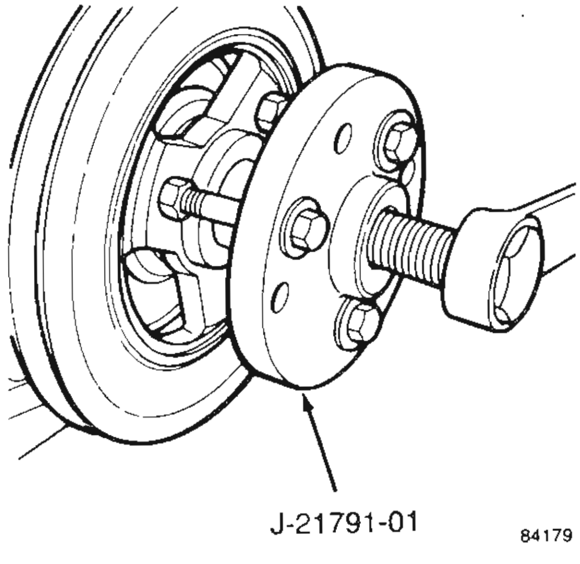
Removal

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.



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 × 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 (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.

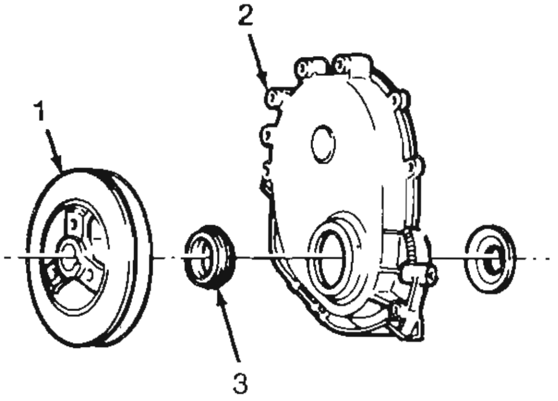
SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

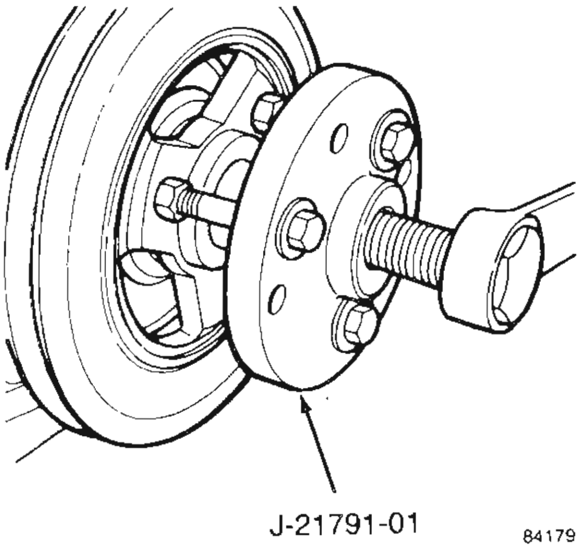
TIMING CASE COVER

Removal

Remove the drive belt(s), engine fan and hub assembly, fan shroud, vibration damper (1), pulley and key. Refer to Vibration Damper Removal.



84180



84179

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 and remove the gasket tabs.

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

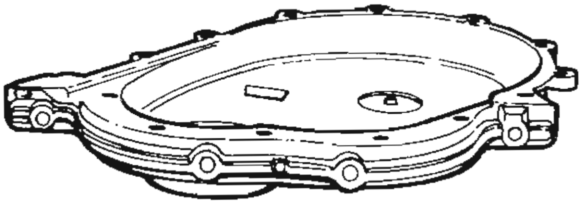
Remove the crankshaft oil seal (3) from the timing case cover.

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.

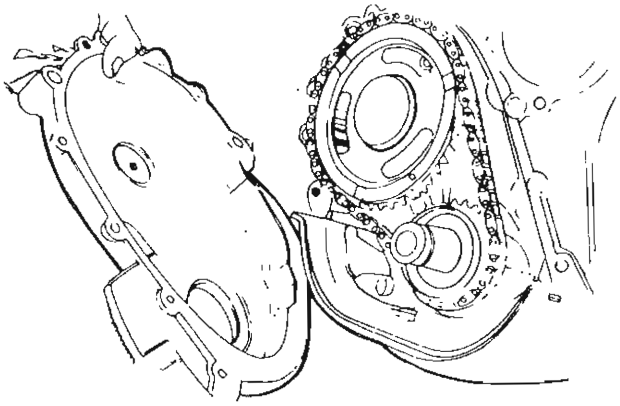
Cut the end tabs off of replacement oil pan side gaskets corresponding to those cut off the original gasket. Cement the end tabs on the oil pan.

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.



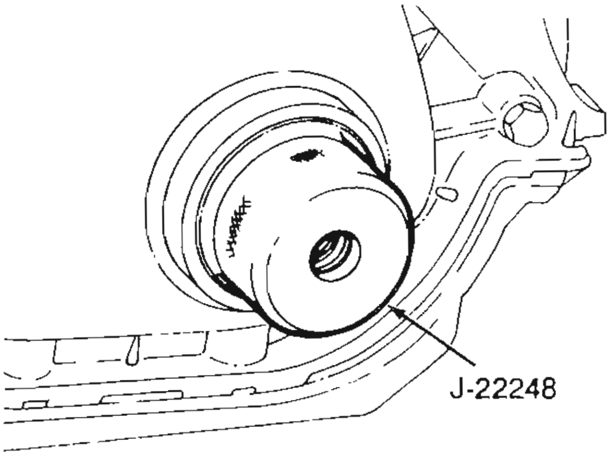
41894

Position the timing case cover on the cylinder block.



84874

Place Timing Case Cover Alignment and Seal Installation Tool J-22248 in the crankshaft opening of the cover.



84182

SEE
I.S.
NOTES

SEE I.S. NOTES

Install the cover-to-cylinder block bolts and the oil pan-to-cover screws.

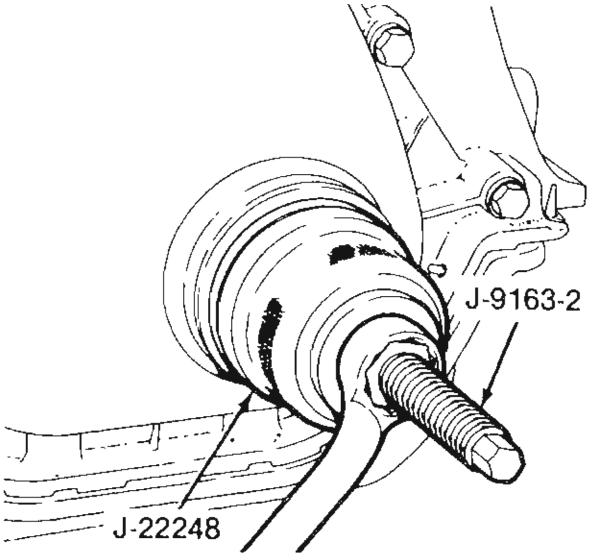
Tighten the cover-to-cylinder block bolts with 7 N·m (5 ft-lbs) torque and the oil pan-to-cover screws with 13 N·m (11 ft-lbs) torque.

Remove the cover alignment tool and position 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 the tool and seal over the end of the crankshaft and insert Screw Tool J-9163-2 into Seal Installation Tool J-22248. Tighten the nut against the tool until the tool contacts the cover.



84183

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.

TIMING CHAIN

Installation of the timing chain with the timing marks on the crankshaft and camshaft sprockets properly aligned ensures correct valve timing.

A worn or stretched timing chain will adversely affect valve timing. If the timing chain deflects more than 12.7 mm (1/2 in) replace it.

The correct timing chain has 48 pins. A chain with more than 48 pins will cause excessive slack.

SEE I.S. NOTES

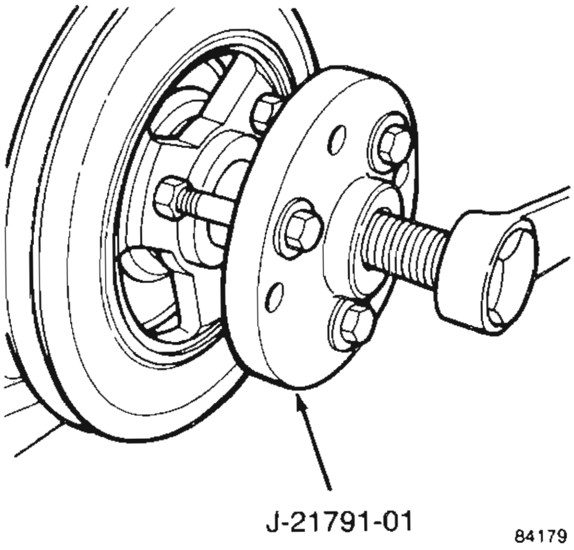
Removal

Remove the drive belt(s).

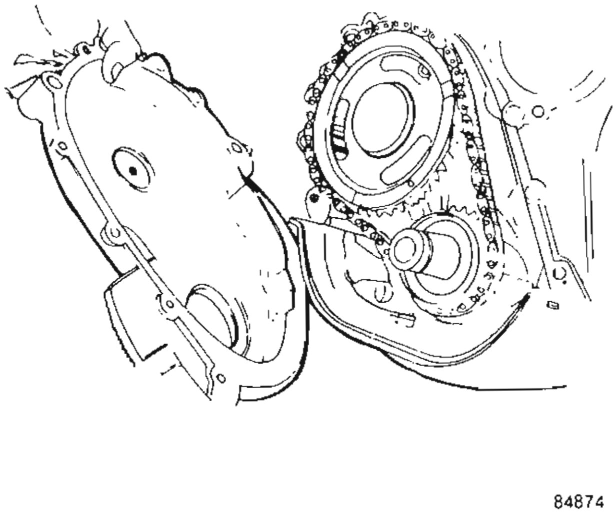
Remove the engine fan and hub (or Tempatrol fan) assembly.

Remove the vibration damper pulley (V-belt drive only).

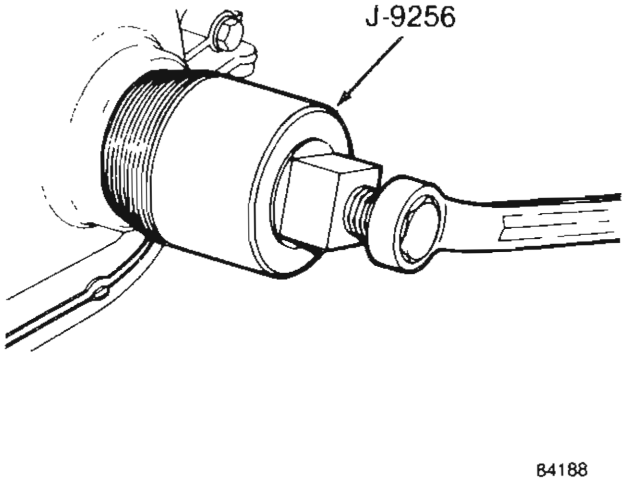
Remove the vibration damper. Refer to the removal procedure.



Remove the timing case cover. Refer to the removal procedure.



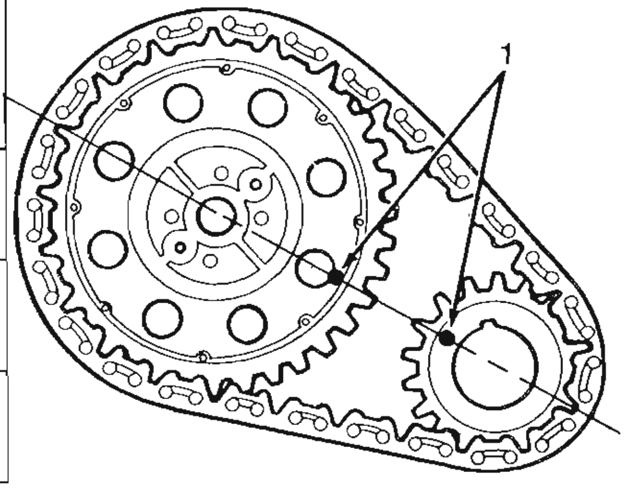
Remove the oil seal from the timing case cover with Tool J-9256.



Remove the camshaft sprocket retaining bolt and washer.

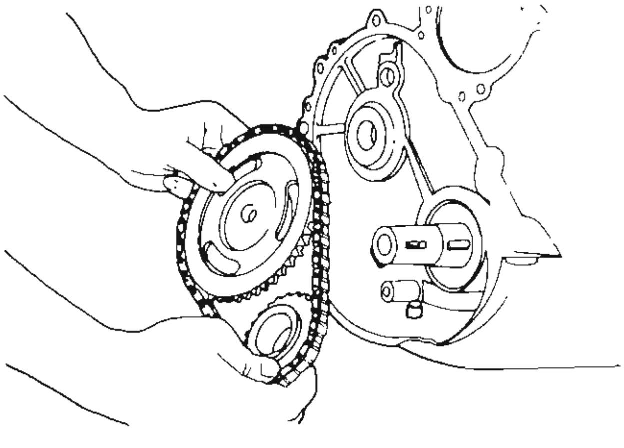
SEE I.S. NOTES

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).



86210

Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly. Disassemble the chain and sprockets.



86177

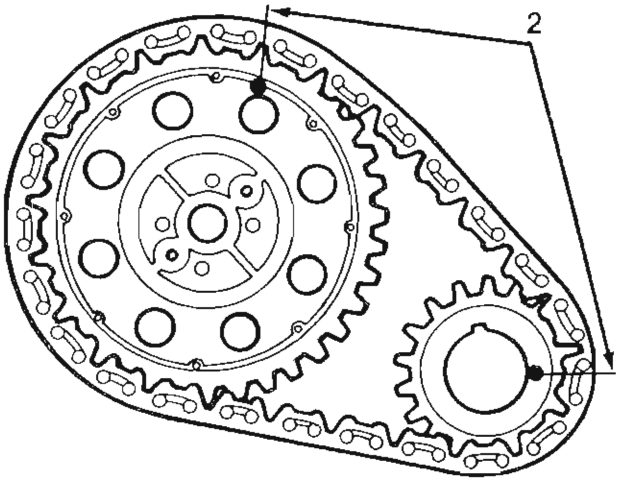
Installation

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks (1) aligned as illustrated.

With the key in the keyway on the crankshaft, install the assembly on the crankshaft and camshaft.

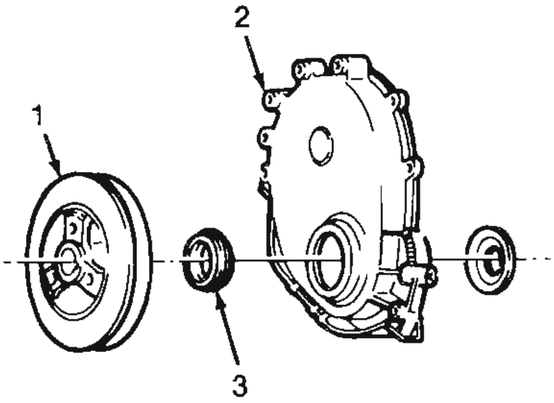
Install the camshaft sprocket retaining bolt and washer and tighten with 68 N·m (50 ft-lbs) torque.

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.



86211

Install the crankshaft oil slinger.



84180

Install the timing case cover (2) and replacement oil seal (3). Refer to Timing Case Cover Installation.

With the key in the keyway on the crankshaft, install the vibration damper (1), washer and bolt. Lubricate and tighten the bolt with 108 N·m (80 ft-lbs) torque.

Install the damper pulley and bolts (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.

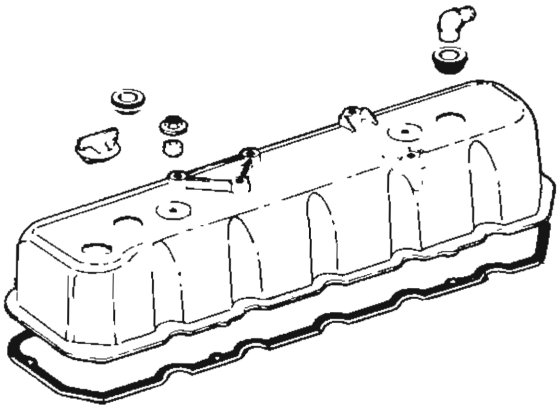
Remove the radiator.

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.

SEE I.S. NOTES

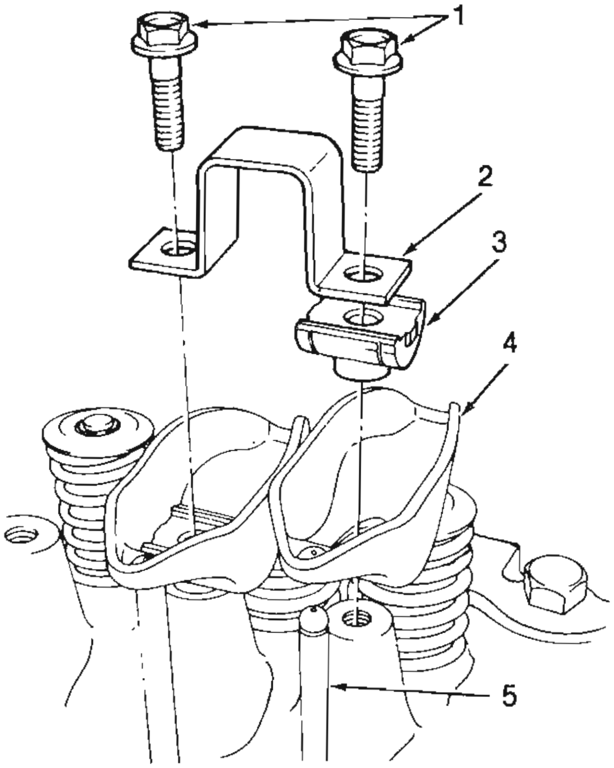
Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.


86319

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.

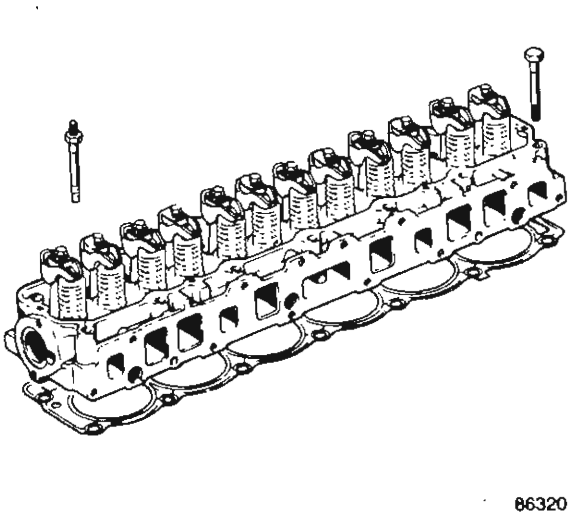
Remove the push rods (5).



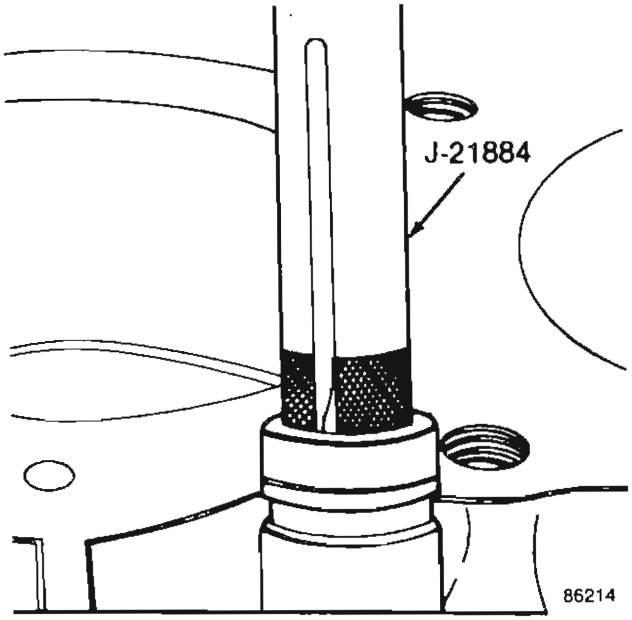
86162

NOTE: Position all components on a work bench in the same order as removed to facilitate installation at the original locations.

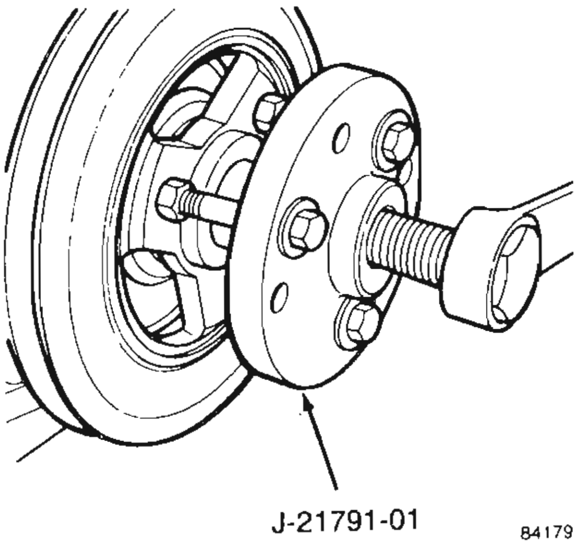
Remove the cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.



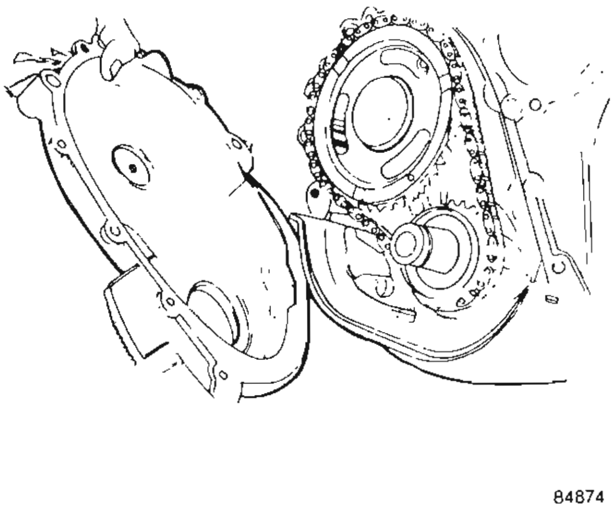
Remove the hydraulic valve tappets.



Remove the vibration damper. Refer to the removal procedure.

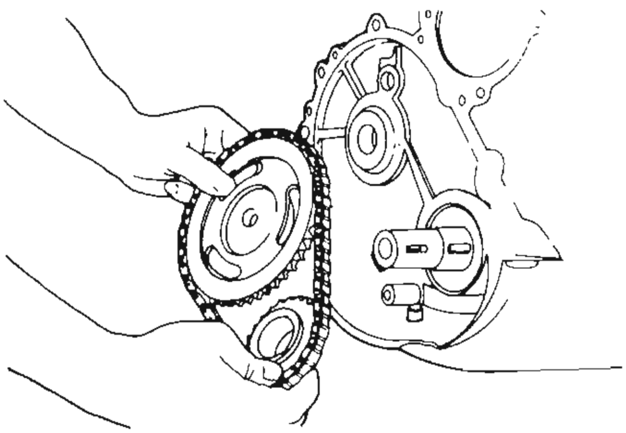


Remove the timing case cover. Refer to Timing Case Cover Removal.



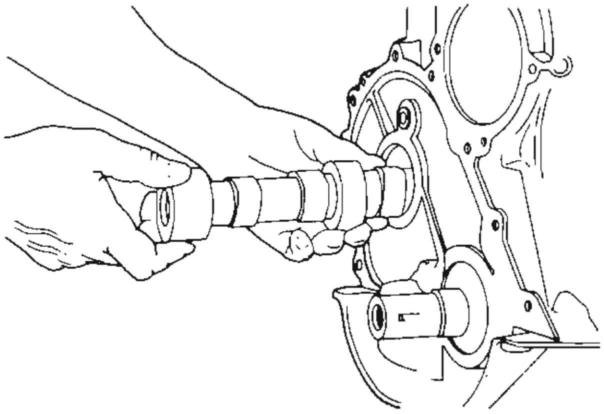
SEE I.S. NOTES

Remove the timing chain and sprockets. Refer to Timing Chain Removal.


86177

Remove the front bumper and/or grille as required.

Remove the camshaft.

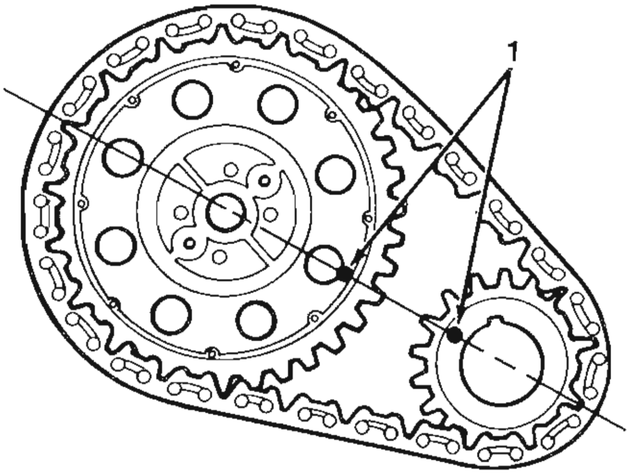

83109

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.



86210

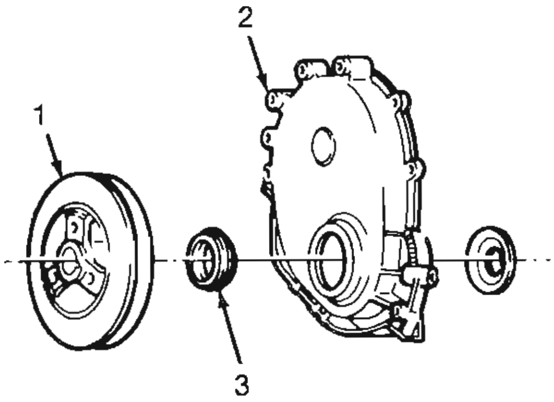
Install the camshaft sprocket retaining bolt and tighten with 68 N·m (50 ft-lbs) torque.

Install the crankshaft oil slinger.

SEE I.S.
NOTES

Install the timing case cover (2) with a replacement oil seal (3). Refer to Timing Case Cover Installation for the procedure.

Install the vibration damper (1).



84180

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.

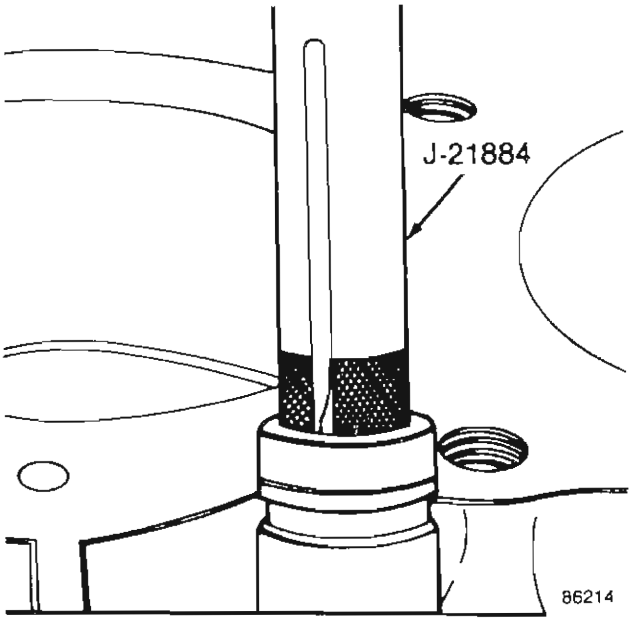
Install the fuel pump.

Rotate the crankshaft until the No. 1 piston is at the TDC position on the compression stroke.

Install the distributor, cap and ignition wires.

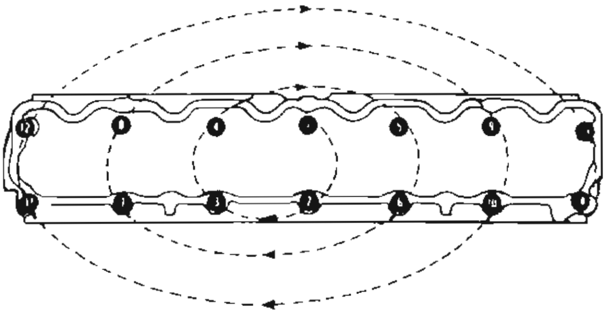
NOTE: Install the distributor so that the rotor is aligned with the No. 1 cylinder spark plug terminal on the cap when the distributor housing is fully seated on the cylinder block.

Install the hydraulic valve tappets.



86214

Install the cylinder head. Refer to Cylinder Head Installation for the procedure.

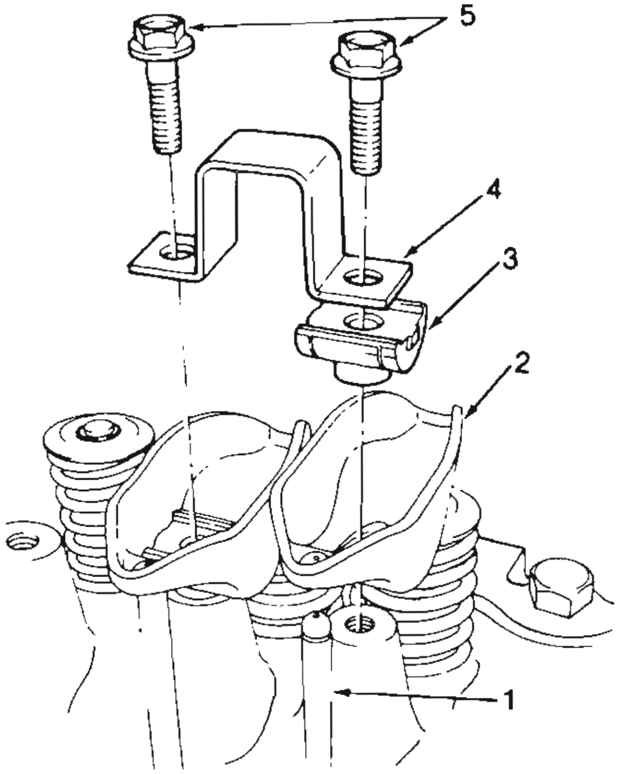


86215

SEE I.S. NOTES

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.



86216

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 grill 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.

Remove the fan and shroud.

Disconnect the radiator overflow tube (or coolant recovery bottle tube), radiator hoses and 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.

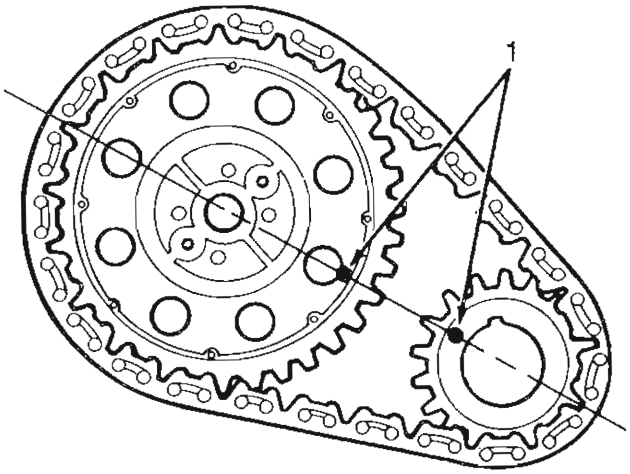
- remove the A/C condenser attaching bolts and move the condenser and receiver/drier assembly up and out of the way

Remove the drive belt(s).

Remove the crankshaft vibration damper and pulley (V-belt drive only). 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 (1).

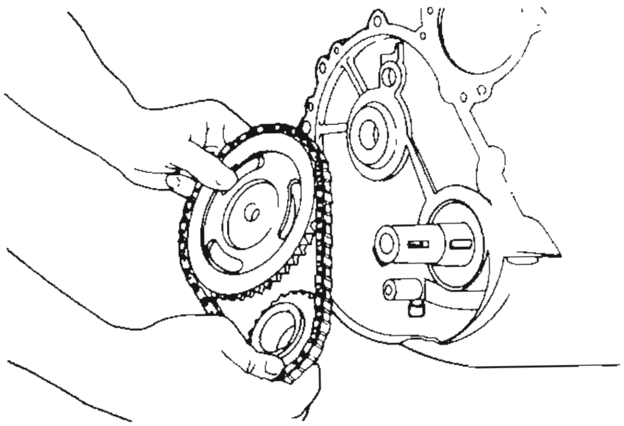


86210

Remove camshaft sprocket retaining bolt.

Remove the crankshaft oil slinger.

Remove the sprockets and chain as an assembly.



86177

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 4-mm (5/32-in) drill bit.

Insert a self-tapping screw into the drilled pin and carefully pull the pin from the camshaft.

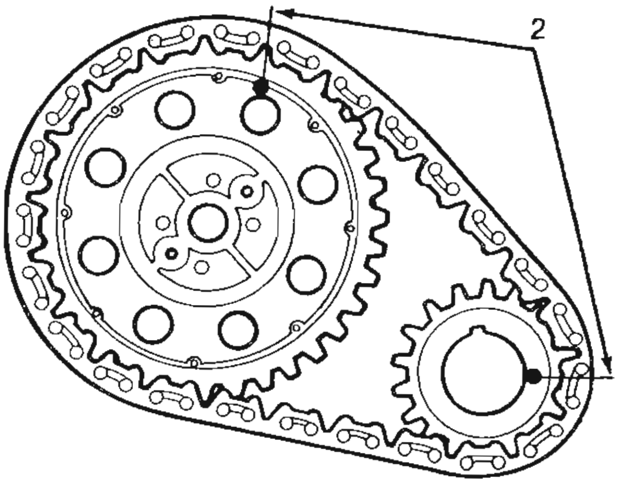
Clean the camshaft pin hole.

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.

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 (2) on both sprockets. There must be 15 pins.



86211

Install the crankshaft oil slinger.

Tighten the camshaft sprocket bolt with 68 N·m (50 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.

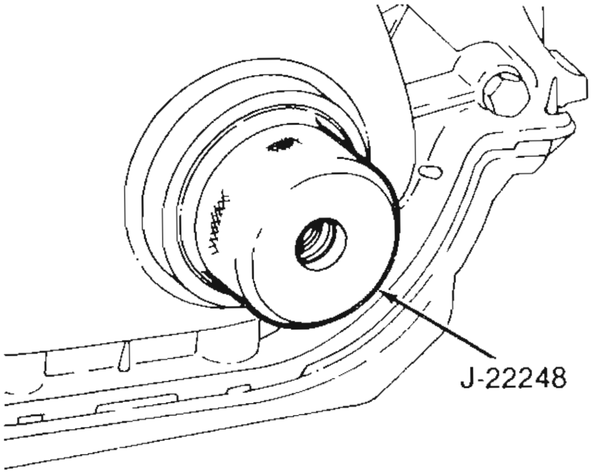
Position replacement oil pan tab gaskets on the oil pan and use RTV sealant to hold them in place.

Coat both sides of the replacement timing case cover gasket with gasket sealer. Apply a 3-mm (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.



84182

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.

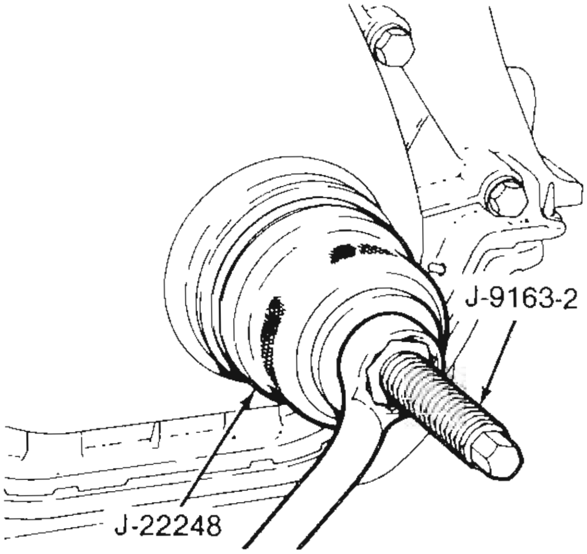
Remove the cover alignment tool and place a replacement oil seal on the tool with the lip facing outward.

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.

Insert Screw Tool J-9163-2 into Seal Installation Tool J-22248.

Turn the nut until the tool contacts the cover.



84183

SEE I.S. NOTES

SEE I.S. NOTES

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, coolant overflow tube (or coolant recovery bottle tube) 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 AND EXHAUST MANIFOLDS

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.

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.

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.

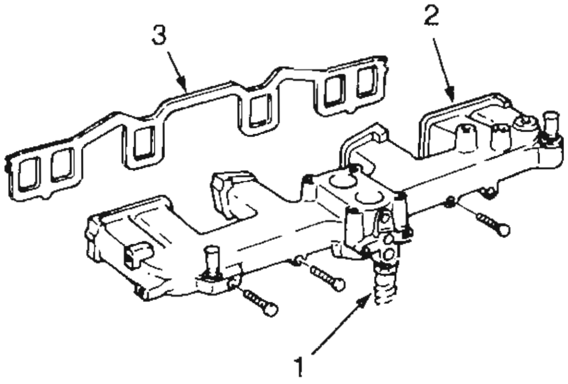
Disconnect the throttle valve linkage, if equipped with an automatic transmission.

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).

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.



840149

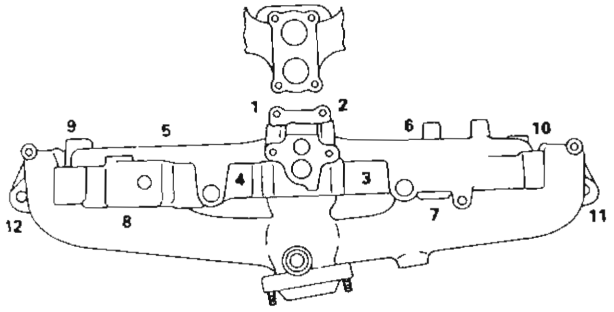
SEE I.S. NOTES

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).



86217

Install the vacuum hoses.

Install the carburetor studs, replacement gaskets and spacer.

Install the carburetor and connect the linkage and hoses.

Tighten the caburetor 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

Connect the EGR valve tube (1) 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 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

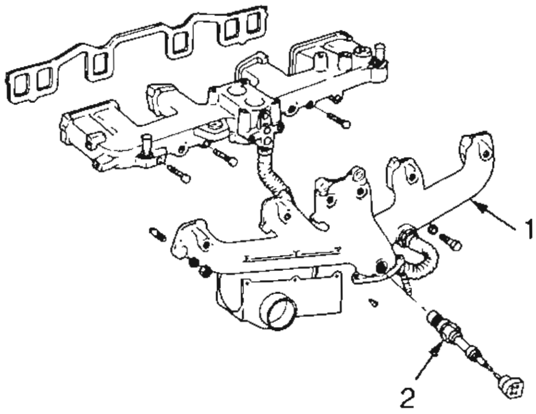
Removal

Remove the intake manifold. Refer to Intake Manifold Removal for the procedure.

Disconnect the exhaust pipe from the exhaust manifold (1).

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.



86318

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

Installation

Postion 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 (O_2) sensor.

Apply antiseize compound to the oxygen (O_2) 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.

SEE
I.S.
NOTES

Install the intake manifold. Refer to Intake Manifold Installation for the procedure.

Install the EGR valve tube.

SEE I.S. NOTES

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.

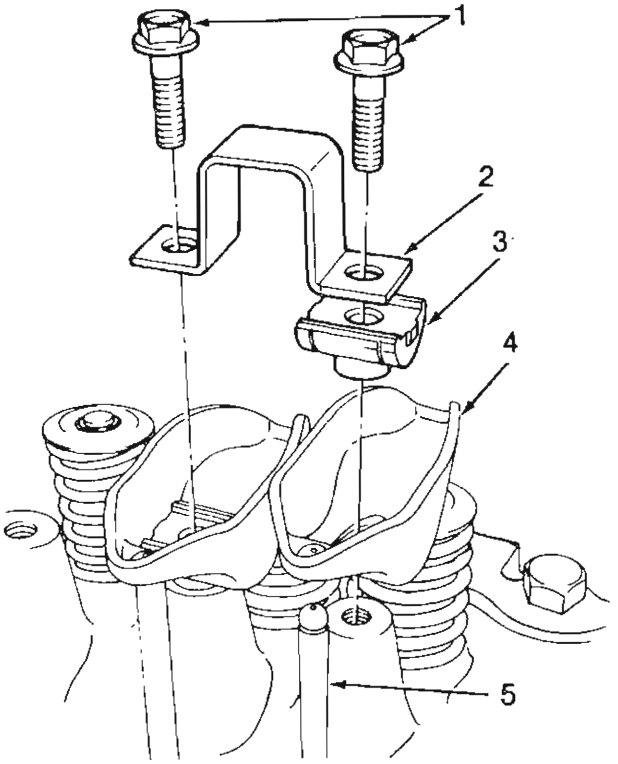
Remove the air cleaner.

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).



86162

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.

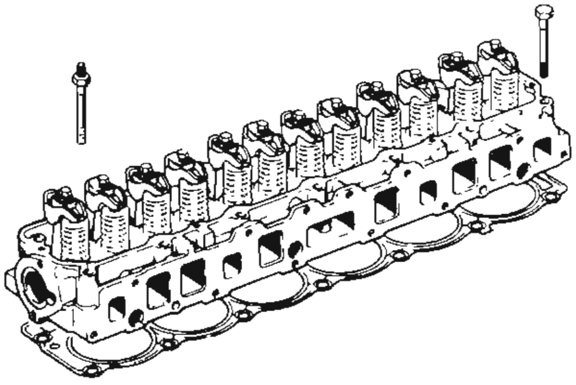
- remove the bolts from the A/C compressor mounting bracket and set the compressor aside

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.



86320

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.

SEE I.S. NOTES

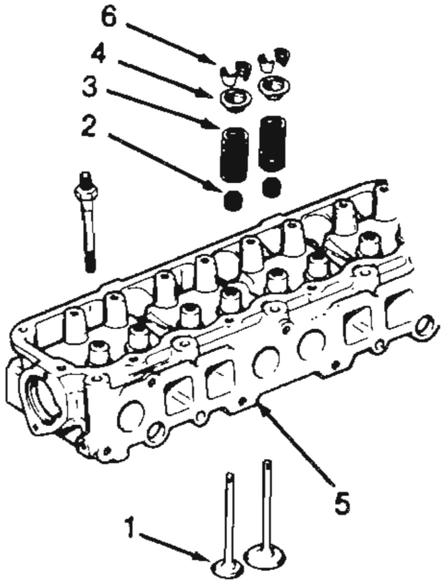
Installation

If the cylinder head is to be replaced and the original valves used, measure the valve stem diameter.

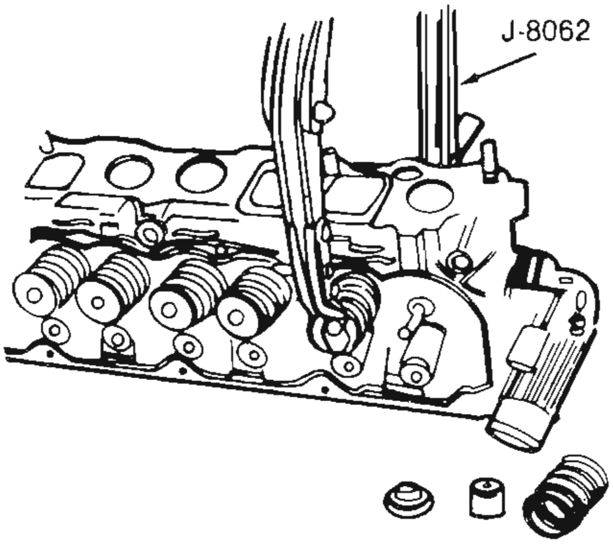
Only standard size valves can be used with a service replacement cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems.

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.



86171



86164

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.

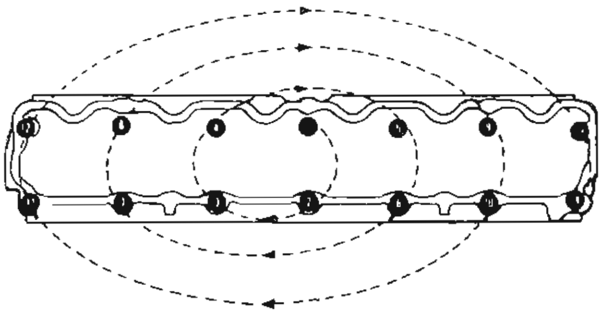
This permits trapped air to escape from the cylinder block and head. Refer to the air vent procedure described in the Cooling Systems section when refilling the system.

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.



86215

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.

SEE
I.S.
NOTES

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.

Remove the flywheel/torque converter housing access cover.

Remove the oil pan screws.

Remove the oil pan by sliding it to the rear.

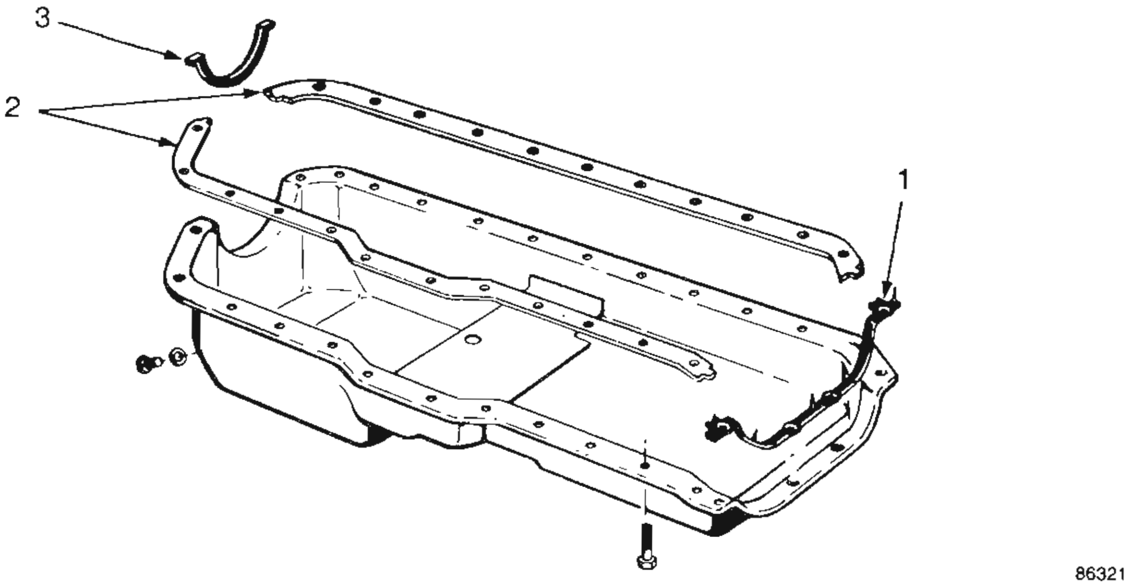
Installation

Clean the gasket and seal surfaces. Remove all sludge and grime from the oil pan sump.

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.

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 the inside curved surface of the replacement oil pan rear seal (3) with soap. Apply a generous amount of RTV sealant to the gasket contacting surface of the seal end tabs.



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.

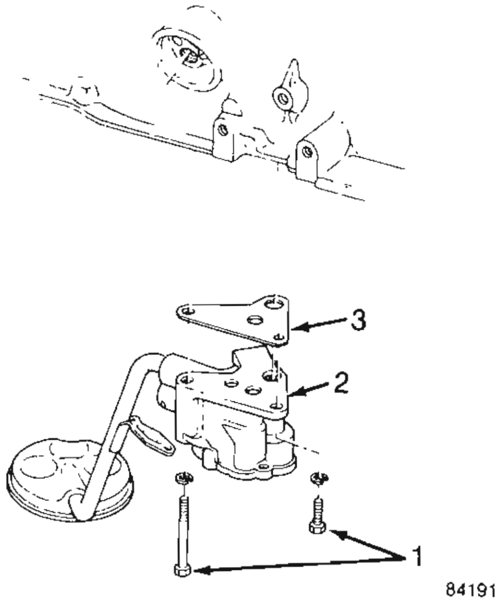
Raise the vehicle and remove the sill supports and jack. Lower the vehicle.

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.

Oil Pump

A gear-type oil pump is mounted at the underside of the cylinder block opposite the No. 4 main bearing.



Removal

NOTE: Oil pump removal or replacemnt 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.

SEE I.S. NOTES

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.

Oil Pump Overhaul

Refer to the MOT. 4.2L 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.

PISTONS AND CONNECTING RODS

Replacement As An Assembly

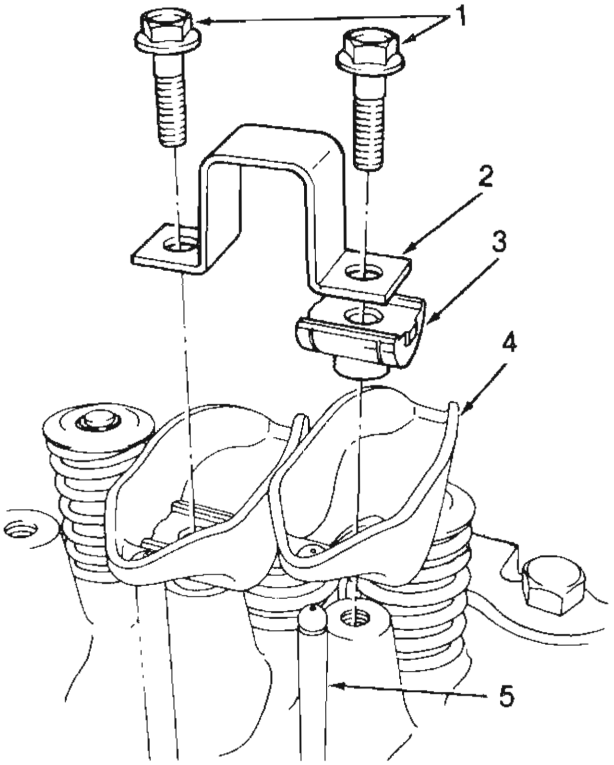
NOTE: The following procedure is for servicing the piston and connecting rod assemblies with the engine installed.

Removal

Remove the cylinder head cover. Refer to Cylinder Head Cover Removal for the procedure.

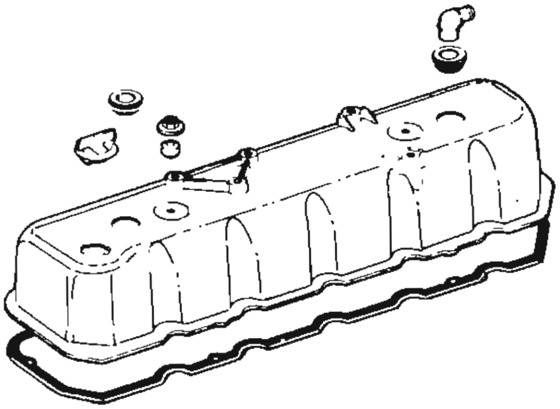
Remove the capscrews (1), bridge (2) and pivot (3) assemblies and rocker arms (4). Alternately loosen the capscrews, one turn at a time, to avoid damaging the bridge.

Remove the push rods (5).



86162

Remove the cylinder head and gasket. Refer to Cylinder Head Removal for the procedure.



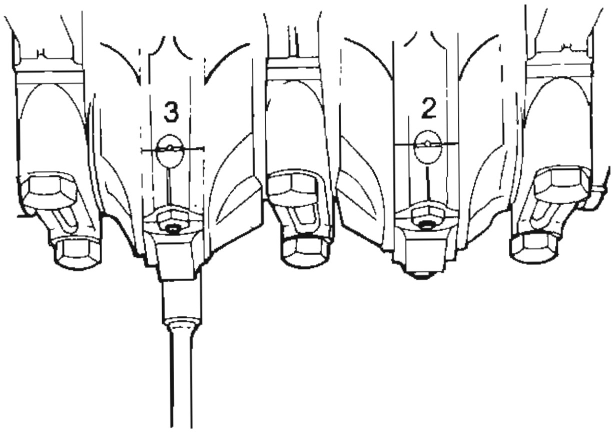
86319

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.

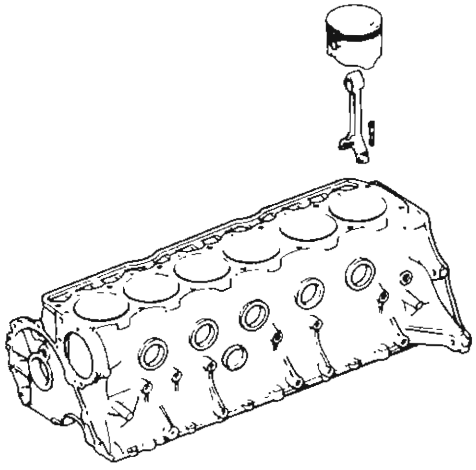


83115

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.

Remove the connecting rod and piston assemblies through the top of the cylinder bores.



86322

Installation

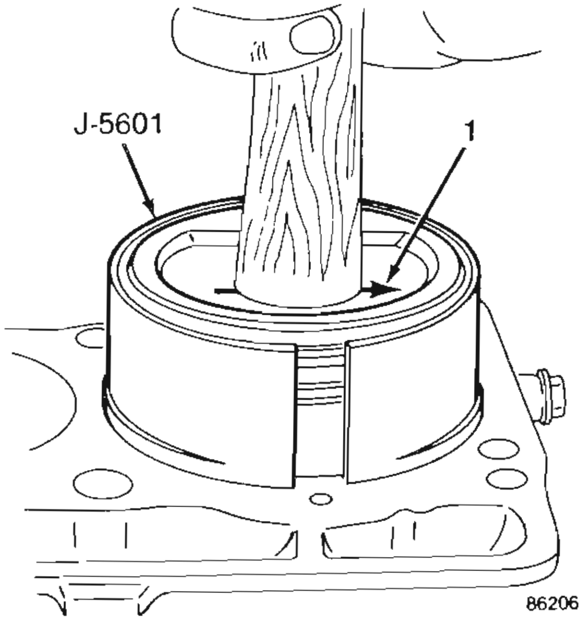
Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean, lint-free cloth.

Install replacement piston rings on the pistons, if necessary. Refer to the MOT. 4.2L manual for the procedure.

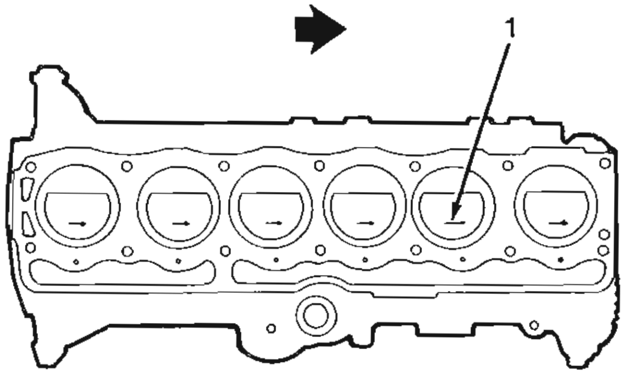
Lubricate the pistons and rings with clean engine oil.

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.

Use a piston ring compressor (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.



86206



86205

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.

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

Refer to the MOT. 4.2L manual for the removal and installation procedure.

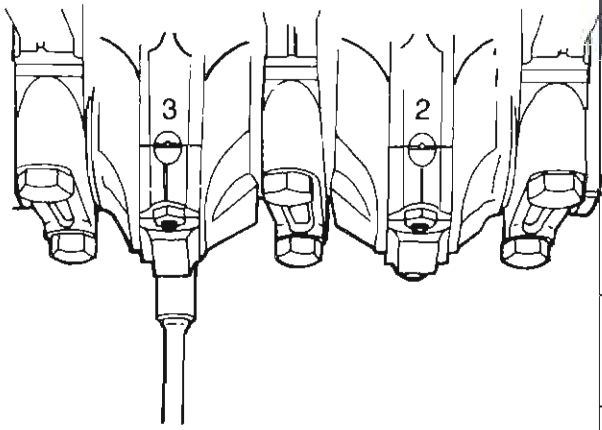
Connecting Rod Bearings

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.



86185

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.

Inspection

Refer to the MOT. 4.2L manual for the procedure.

SEE I.S. NOTES

Measuring Bearing-to-Journal Clearance with Plastigage

Refer to the MOT. 4.2L manual for the procedure.

SEE I.S. NOTES

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 FULL MARK on the dipstick.

Pistons

For piston replacement and servicing procedures, refer to the MOT. 4.2L manual.

CRANKSHAFT

Removal and Installation

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible. 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.

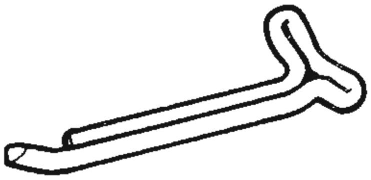
Remove the main bearing cap and lower insert.

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.

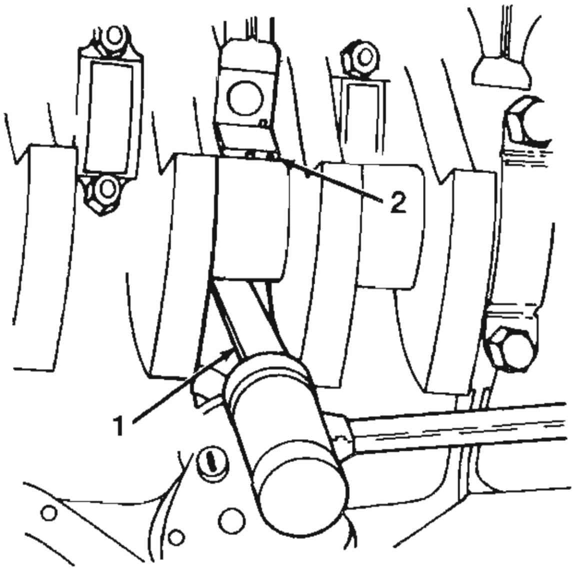
Bend the cotter pin as illustrated to fabricate the tool. A tongue depressor may also be used to remove the bearing insert.

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.



84192

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 25 mm (1 in) it can be removed by applying pressure under the tab.



84193

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.

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.

Install the oil pan with replacement gaskets and seals. Tighten the drain plug securely. Refer to Oil Pan Installation for the procedure.

SEE I.S. NOTES

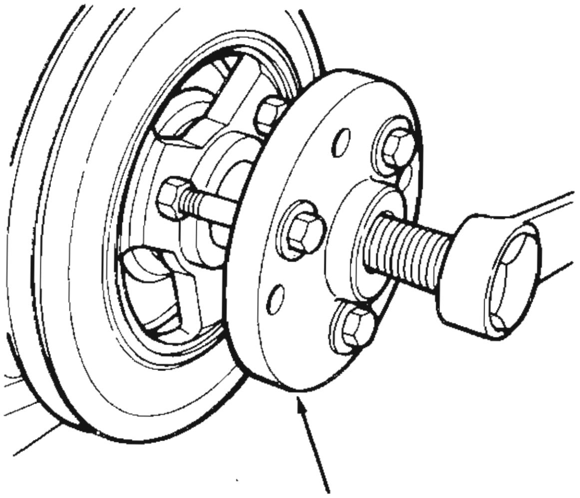
Fill the oil pan with engine oil to the FULL MARK on the dipstick.

Crankshaft Front Oil Seal Replacement (Cover Not Removed)

Remove the drive belts and fan shroud.

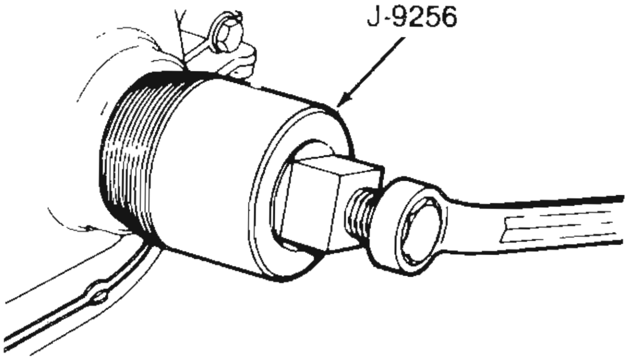
Remove the vibration damper pulley, if equipped (V-belt drive only).

Remove the vibration damper and key with Tool J-21791. Refer to the removal procedure.



84179

Remove the oil seal with Tool J-9256.



84188

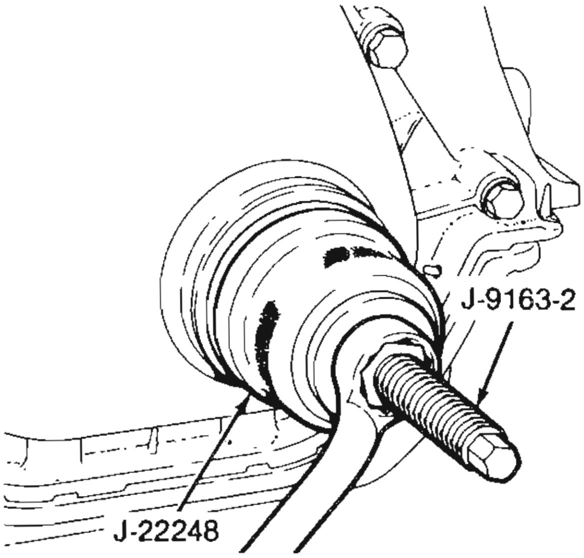
Postion the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool J-22248 with the seal lip facing outward.

Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal.

Lightly coat the crankshaft with engine oil.

Position the tool and seal over the end of the crankshaft and insert Screw Tool J-9163-2 into the seal installation tool.

Tighten the nut against the tool until the tool contacts the cover.



84183

Remove the tools.

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 × 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 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.

SEE
I.S.
NOTES

Rear Main Bearing Oil Seal

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.

Removal

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. 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.

SEE I.S. NOTES

Discard the upper half of the seal.

Clean the rear main bearing cap thoroughly. Remove all the sealant.

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.

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.

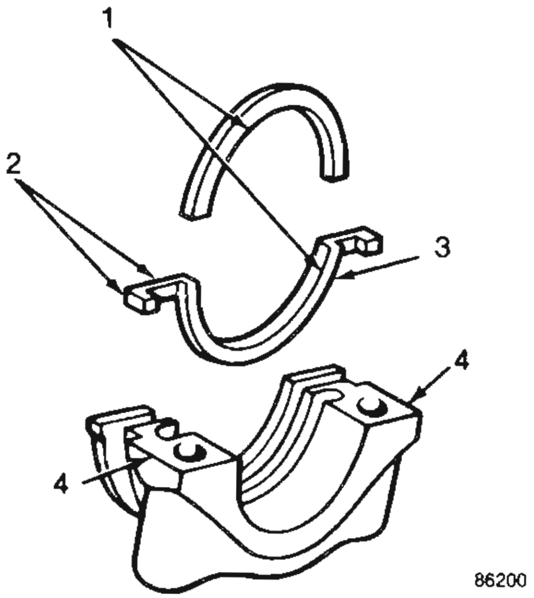
Coat both sides of the replacement lower seal end tabs (2) with RTV sealant (AMC Gasket-in-a-Tube, or equivalent). Do not apply sealant to the lip of the seal.

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 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

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.

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 the procedures.

SEE
I.S.
NOTES

SPECIAL TOOLS

SEE I.S. NOTES

Tool Ref.	Description	Required	Recommended
J-23600	Belt Tension Gauge		■
J-23600-B	Belt Tension Gauge		■
J-29550	Belt Tension Gauge		■
J-24460-01	Cooling System Pressure Tester and Adapter		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Alternator Adjustment Bolt		
Four-Cylinder Engine	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Six-Cylinder Engine	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Alternator Pivot Bolt/Nut		
Four-Cylinder Engine	38 N·m (28 ft-lbs)	27-47 N·m (20-35 ft-lbs)
Six-Cylinder Engine	38 N·m (28 ft-lbs)	34-41 N·m (25-30 ft-lbs)
Pulley-to-Vibration Damper Bolts		
Four-Cylinder Engine	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Six-Cylinder Engine	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Cylinder Block Heater		
T-Type	2 N·m (20 in-lbs)	2-3 N·m (17-25 in-lbs)
Compression Type	14 N·m (10 ft-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)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
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)

SPECIFICATIONS

Cooling System Specifications

	Four- and Six-Cylinder Engine (w/V-Belt)	Four- and 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	

840167(J)

SEE I.S. NOTES

Cooling System Capacities

Engine CID		Capacity (Quarts)		Capacity (Liters)	
4-cyl. 150	6-cyl. 258	Std	w/AC or HD	Std	w/AC or HD
●	●	11	14	10.4	13.2

840168

Cooling System Components

Engine		Package			Fan			Coolant Recovery	Shroud
150	258	Std	HD	A/C	Tempatrol	No. of Blades	Spacer		
•		•				4	•		
•			•		•	7		•	•
	•	•				5	•		
	•		•		•	5		•	•
	•			•	•	5		•	•

NOTE: **Consult parts catalog for correct listing of spacer and radiator application. Correct spacer is determined by length. Radiator is identified by part number on upper tank.**

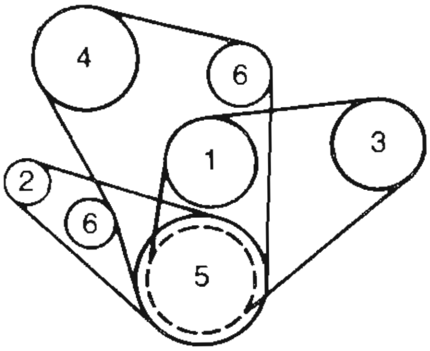
NOTE: **All radiators have two rows of core tubes.** 840169(J)

Engine Drive Belt Tension

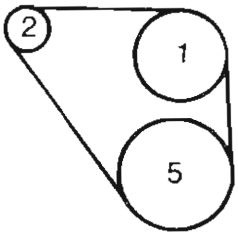
	Initial Newtons New Belt	Initial Pounds-Force New Belt	Reset Newtons Used Belt	Reset Pounds-Force Used Belt
V-TYPE BELT				
Air Conditioner – All Engines	556-689	125-155	400-512	90-115
Alternator and Fan – All Engines	556-689	125-155	400-512	90-115
Power Steering – All Engines	556-689	125-155	400-512	90-115
SERPENTINE DRIVE BELT – All Engines	800-890	180-200	623-712	140-160

840170

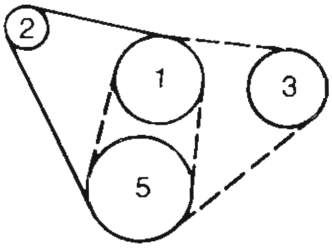
ENGINE DRIVE BELT ARRANGEMENTS



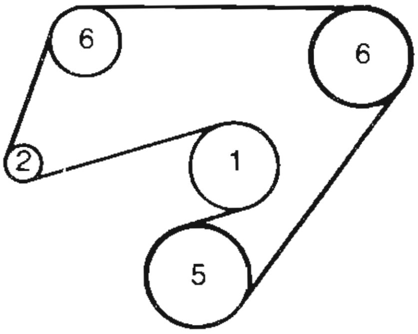
SIX-CYLINDER ENGINE WITH ALTERNATOR, POWER STEERING PUMP, AND A/C COMPRESSOR



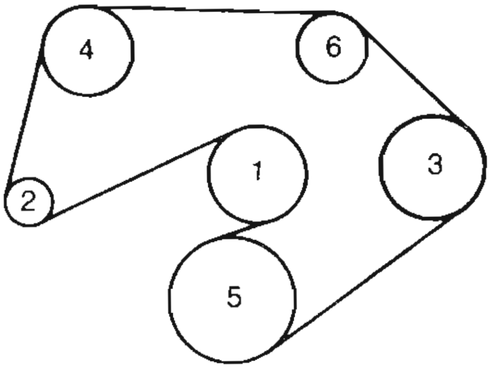
FOUR- AND SIX-CYLINDER ENGINE WITH ALTERNATOR



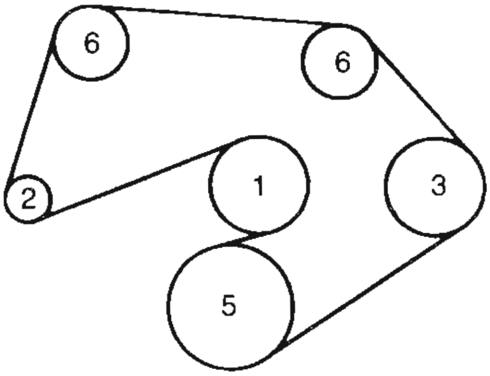
FOUR- AND SIX-CYLINDER ENGINE WITH ALTERNATOR AND POWER STEERING PUMP



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 ONLY)



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

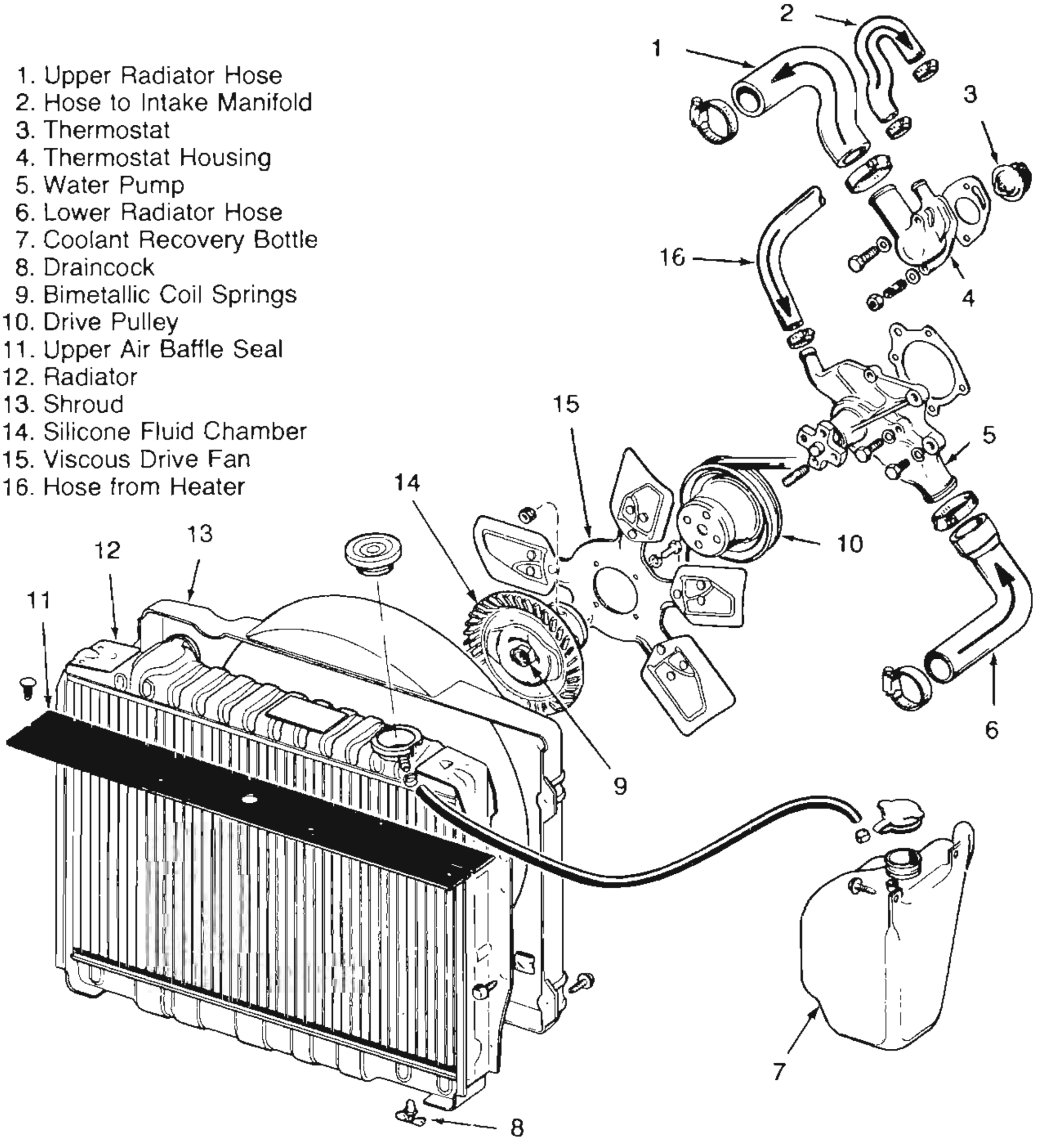
LEGEND
FRONT BELT ———
REAR BELT — — —

840171(J)

SEE I.S. NOTES

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



840155

COOLANT

Maintain the coolant at the specified level with a mixture of ethylene glycol-based antifreeze (containing ALUGARD 340-2™) and low mineral content water.

CAUTION: The antifreeze mixture should always be maintained to satisfy local climatic requirements, or 50 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 50 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 - 51 mm (1½ - 2 in) below the radiator filler neck sealing surface.

When the engine is at normal operating temperature, it should be 13 - 25 mm (1/2 - 1 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.

Draining Coolant

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

SEE
I.S.
N
O
T
E
S

need not be removed from the bottle unless the system is being refilled with a fresh mixture.

SEE I.S. NOTES

WARNING: Do not remove the cylinder block drain plugs or loosen the radiator draincock with system hot and pressurized 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.

Replacing Coolant

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 50 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.

Purging Air 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.

Coolant Freezing Point Test

Check the coolant freezing point, or freeze protection, with an antifreeze hydrometer to determine the protection level.

Removing Coolant from the 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 Replacement

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.

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 Replacement

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.

Removal

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.

SEE
I.S.
NOTES

SEE I.S. NOTES

Disconnect the radiator and heater hoses from the pump.

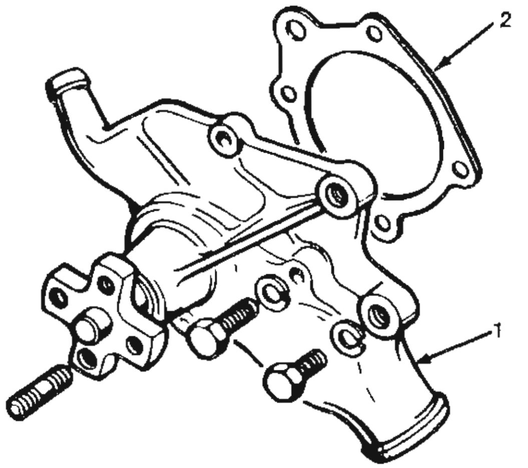
Remove the drive belt(s).

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).



84616

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 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 (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.

Water Pump Tests

Loose Impeller

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.

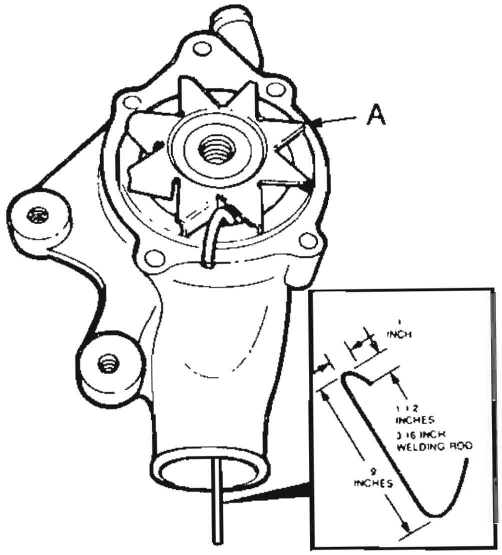
Loosen the fan belt.

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.



50470

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.

Inspecting For Inlet Restrictions

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.

SEE I.S. NOTES

WARNING: Do not loosen the radiator draincock 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 draincock 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 30 cm (12 in) length of 16 mm (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 9.5 mm (3/8 in) inside diameter (ID).

Fill a clean container with ½ 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.

HOSES

Rubber hoses route coolant to and from the radiator, intake manifold and heater core.

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

An arrow or the words TO RAD is stamped on the thermostat to indicate the proper installed position. An engine should not be operated without a thermostat, except for servicing or testing.

Replacement

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.

Clean the gasket mating surfaces.

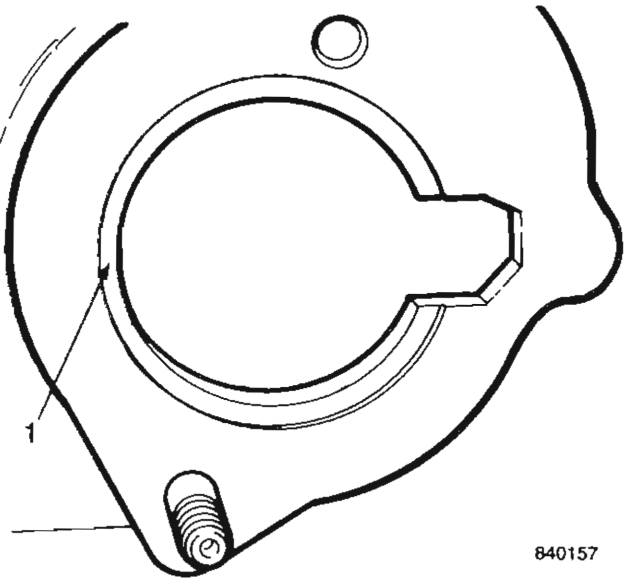
Install a replacement thermostat, gasket and the housing.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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.



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.

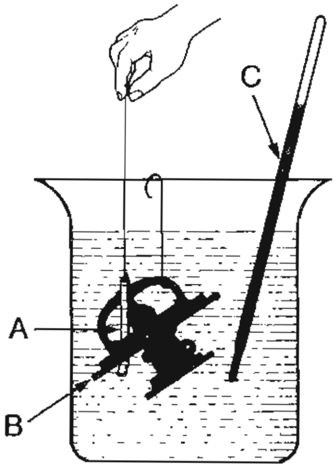
Fill the cooling system to the correct level with the required coolant mixture. Refer to Coolant.

Testing

Remove the thermostat. Refer to Thermostat Replacement.

Insert a 0.076-mm (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

41959

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.

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 Replacement.

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)

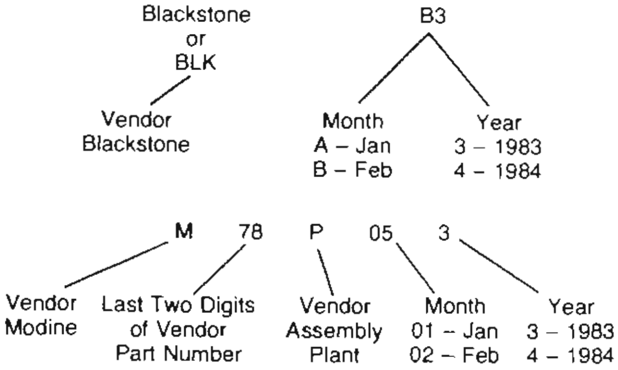
840158

RADIATOR

Identification

Radiators are identified by a Jeep part number and the vendor build code number embossed on the upper tank.

Radiator Identification



60336

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 or 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.

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.

Replacement

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.

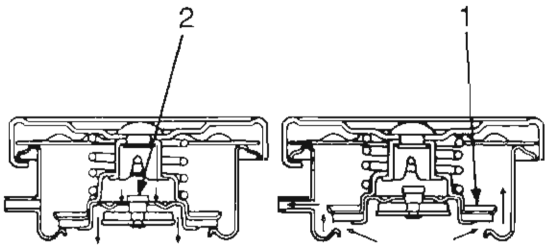
Connect the coolant recovery hose, if equipped.

Install the radiator cap.

SEE
I.S.
NOTES

Pressure Cap

The radiator pressure cap consists of a pressure valve (1) and a vacuum valve (2).



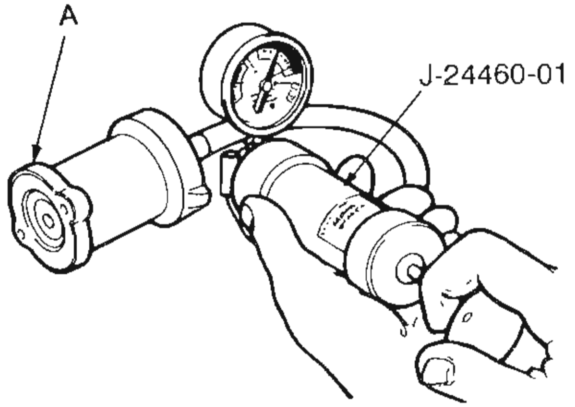
840159

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.



42836

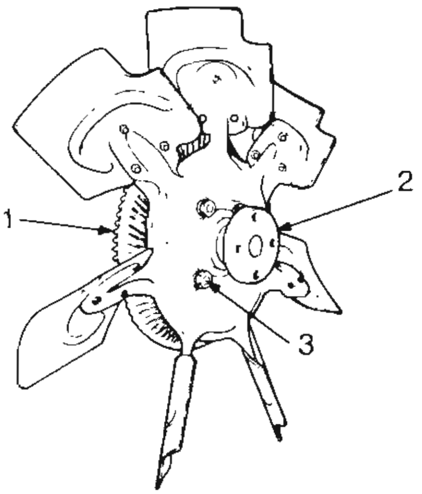
Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 82.7 - 103.4 kPa (12 - 15 psi).

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.

SEE I.S. NOTES

FAN

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)

42415

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.

Replacement

Removal

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.

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 6.35 mm (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.

Attach the replacement unit. Tighten the bolts with 24 N·m (18 ft-lbs) torque.

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.

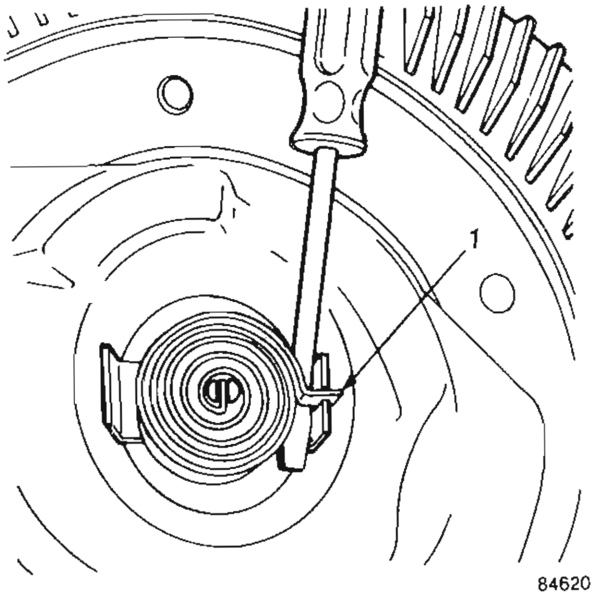
Install the shroud attaching screws and tighten, if removed.

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.



The gap between the end of the coil and the clip on the housing should be approximately 13 mm (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 3.18-mm (1.8-in) diameter hole in the top center of the fan shroud.

CAUTION: Ensure there is adequate clearance from the fan blades.

SEE I.S. NOTES

Insert a dial thermometer, -18°C to 105°C (0°F to 220 °F) with a 20-mm (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.

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

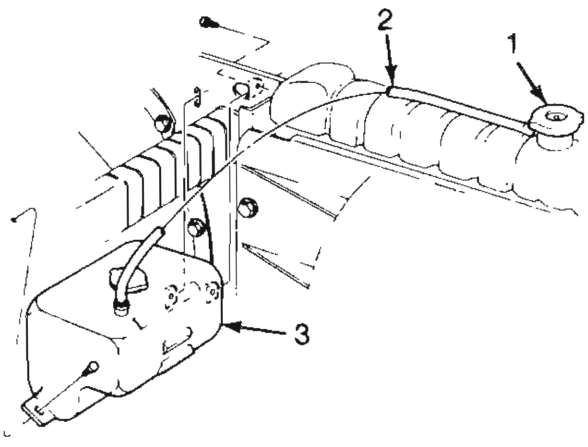
In some extreme situations, the engine fan blades may contact the shroud. An examination for proper engine mounting should isolate the problem. If not, examine the shroud position.

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).



840161A(J)

Coolant Recovery Bottle Replacement

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.

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.

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

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).

SEE I.S. NOTES

Installation

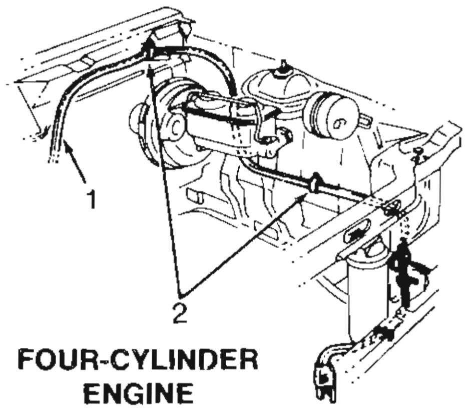
NOTE: Do not waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

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.

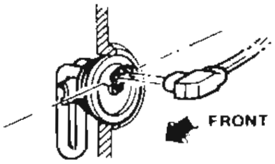
Drain the coolant from the engine. Observe the NOTE and WARNING above.

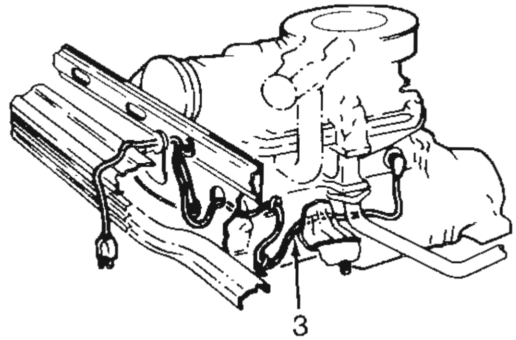
CAUTION: Use care when tightening the cylinder block heater attaching parts. Improper tightening may damage the seal or allow the heater to loosen, resulting in coolant loss and engine damage.

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.



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

840162(J)

From the front of the vehicle, route the heater (female) 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.

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 anti-freeze/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

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.

SEE I.S. NOTES

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

840163

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 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 equipped). If this does not occur frequently, it is considered normal.

Refer to the applicable diagnosis chart for specific cooling system faults.

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.

81189A

SEE I.S. NOTES

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.
	(22) Viscous fan drive failed.	(22) Replace unit.
LOW TEMPERATURE INDICATION—UNDERCOOLING	(1) Thermostat stuck open.	(1) Replace thermostat.
	(2) Faulty gauge or sending unit.	(2) Repair or replace faulty component.
COOLANT LOSS—BOILOVER	**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.*

Service Diagnosis (Continued)

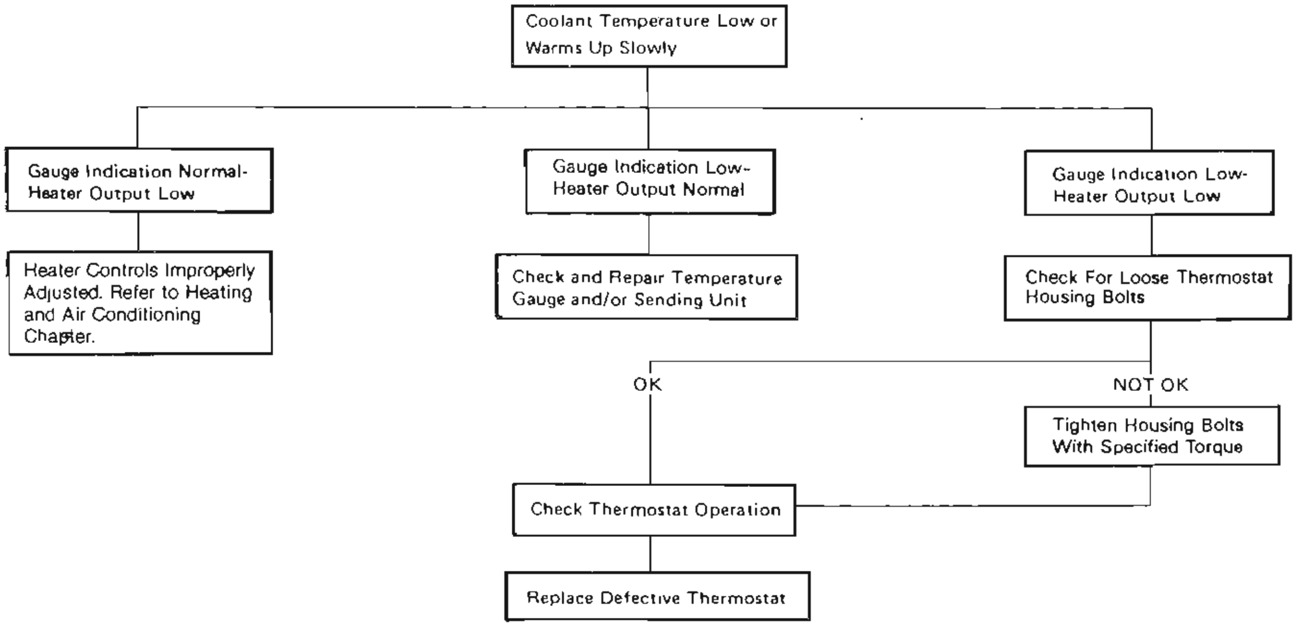
Condition	Possible Cause	Correction
COOLANT LOSS — BOILOVER (Continued)	(7) Faulty head gasket.	(7) Replace head gasket.
	(8) Cracked head, manifold, or block.	(8) Replace as necessary.
	(9) Faulty radiator cap.	(9) Replace cap.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER(S)	(1) Faulty head gasket.	(1) Replace head gasket.
	(2) Crack in head, manifold or block.	(2) Replace as necessary.
COOLANT RECOVERY SYSTEM INOPERATIVE	(1) Collant level low.	(1) Replenish coolant to FULL mark.
	(2) Leak in system.	(2) Pressure test to isolate leak and repair as necessary.
	(3) Pressure cap not tight or seal missing, or leaking	(3) Repair as necessary.
	(4) Pressure cap defective.	(4) Replace cap.
	(5) Overflow tube clogged or leaking.	(5) Repair as necessary.
	(6) Recovery bottle vent restricted.	(6) Remove restriction.
NOISE	(1) Fan contacting shroud.	(1) Reposition shroud and inspect engine mounts.
	(2) Loose water pump impeller.	(2) Replace pump.
	(3) Glazed fan belt.	(3) Apply silicone or replace belt.
	(4) Loose fan belt.	(4) Adjust fan belt tension.
	(5) Rough surface on drive pulley.	(5) Replace pulley.
	(6) Water pump bearing worn.	(6) Remove belt to isolate. Replace pump.
	(7) Belt alignment.	(7) Check pully alignment. Repair as necessary.
NO COOLANT FLOW THROUGH HEATER CORE	(1) Restricted return inlet in water pump.	(1) Remove restriction.
	(2) Heater hose collapsed or restricted.	(2) Remove restriction or replace hose.
	(3) Restricted heater core.	(3) Remove restriction or replace core.
	(4) Restricted outlet in thermostat housing.	(4) Remove flash or restriction.
	(5) Intake manifold bypass hole in cylinder head restricted.	(5) Remove restriction.
	(6) Faulty heater control valve.	(6) Replace valve.
	(7) Intake manifold coolant passage restricted.	(7) Remove restriction or replace intake manifold.

81189C

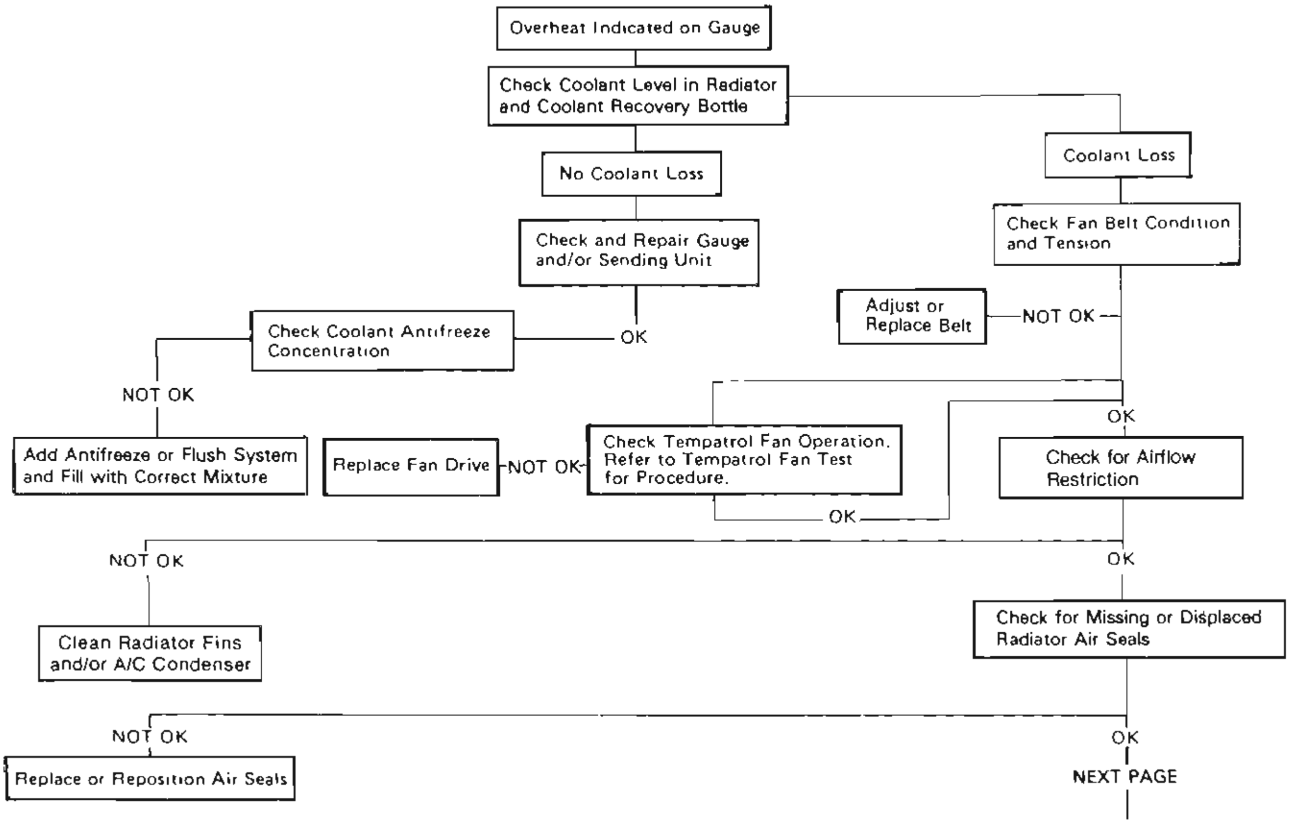
SEE I.S. NOTES

SEE I.S. NOTES

Low Coolant Temperature Diagnosis Guide

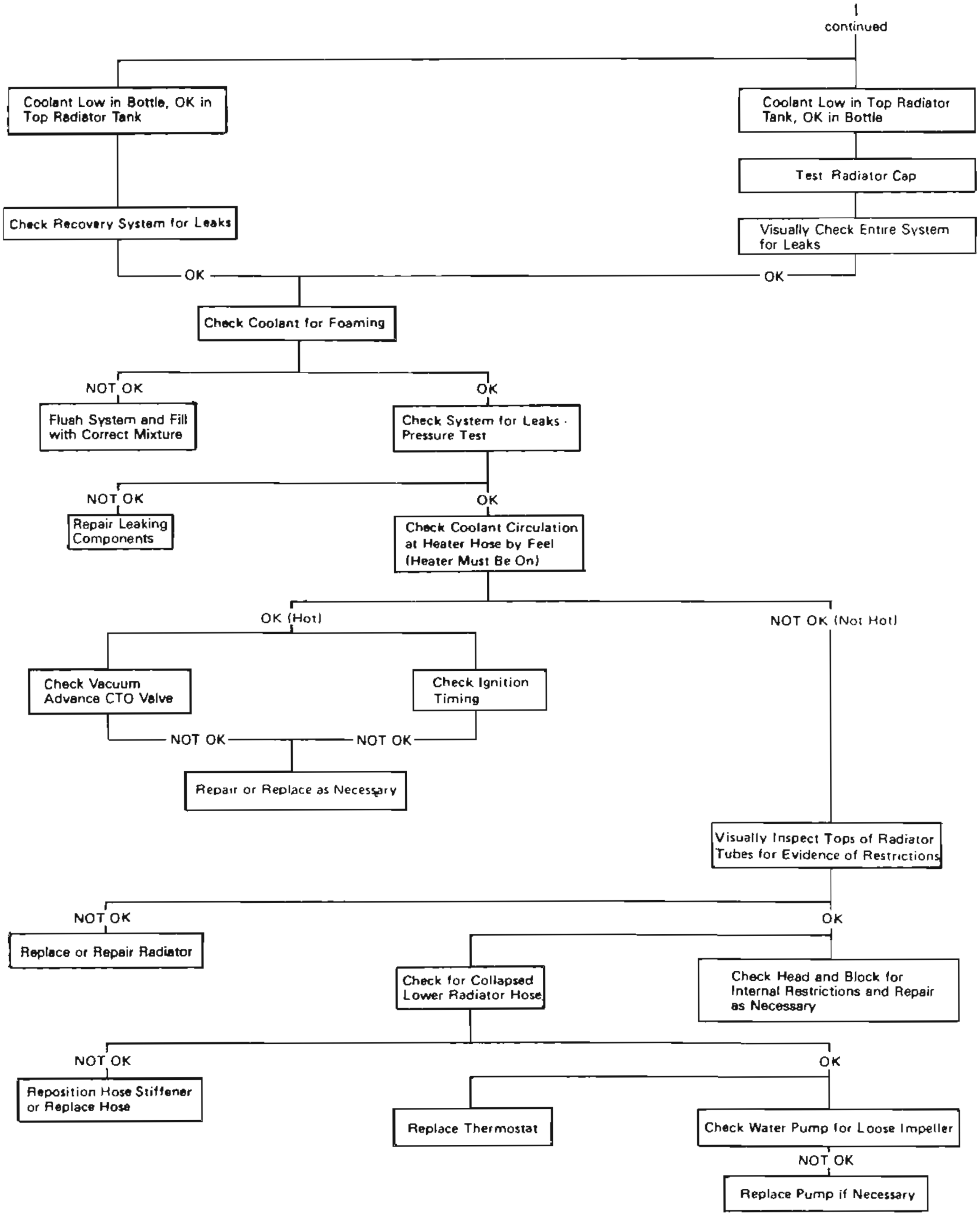


Engine Overheating Diagnosis Guide



70172-A

Engine Overheating Diagnosis Guide (Continued)



SEE I.S. NOTES

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.

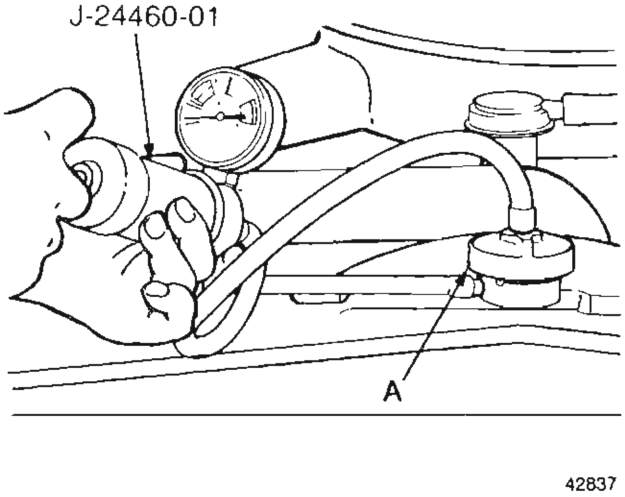
NOTE: Push down on the cap to disengage it from the stop tabs.

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 (if equipped) 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.



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 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.

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.

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.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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 6.3 mm (1/4 in) of the top of the thermostat housing.

CAUTION: Avoid overheating. Do not operate the engine for an excessive period of time. Open the draincock immediately after the test to eliminate 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.

DRIVE BELT ADJUSTMENTS

General

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 Gauge Tool J-23600 or J-29550 if accessibility is limited (e.g., A/C compressor drive belt). Use Gauge Tool J-23600-B for serpentine drive belts.

If necessary, adjust the drive belt.

Re-test tension after the adjustment.

Adjustments

Alternator and Fan (Without Air Conditioner) – All Engines

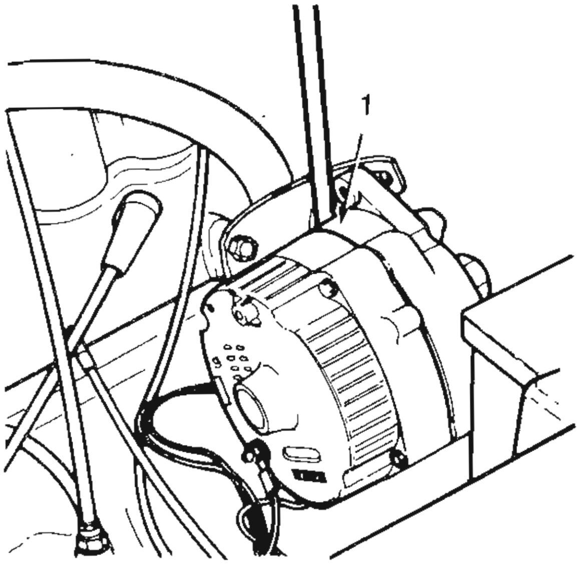
Position Tension Gauge Tool J-23600 or J-29550 on the upper section of the belt midway between the alternator pulley and the fan pulley.

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)
- 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



840164

Alternator (With Air Conditioner) – Six-Cylinder Engine

Position Tension Gauge Tool J-29550 on a section of the belt left of the alternator and below the A/C compressor.

Test the belt tension according to manufacturer's instructions.

NOTE: Battery removal is not necessary when using Tension Gauge Tool J-29550.

Adjust the belt tension to the specification if less than 400 N (90 lb-f).

SEE I.S. NOTES

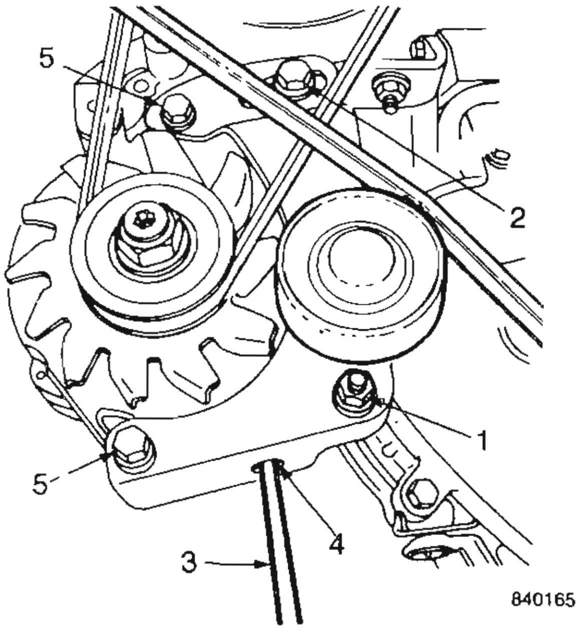
SEE I.S. NOTES

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 12.7-mm (1/2-in) square hole to facilitate adjustments from above the alternator with a 12-mm (1/2-in) drive rachet and extension.

- 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 – Six-Cylinder Engine

Position Tension Gauge Tool J-23600 or J-29550 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 12-mm (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

Power Steering Pump – All Engines

Position Tension Gauge Tool J-23600 or J-29550 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 12-mm (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

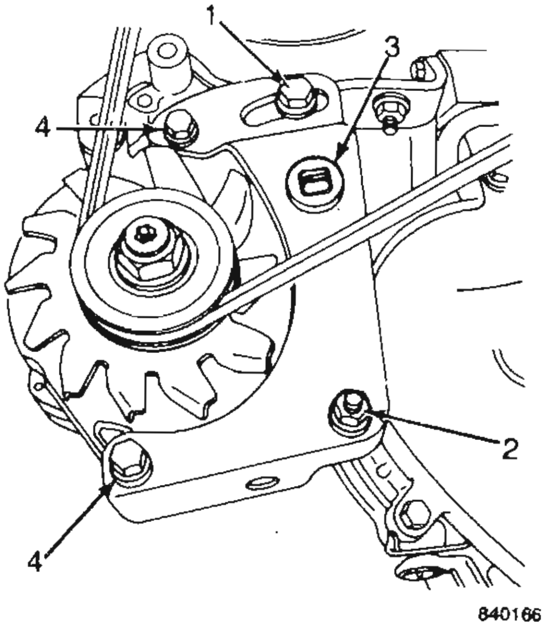
Serpentine Drive Belt

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).

Adjustment procedure:



- from the underside of the engine compartment, loosen the alternator adjustment (1) and pivot bolts (2)
- do not loosen the bracket attaching bolts (4)
- insert the drive lug of a 12-mm (1/2-in) drive ratchet into the adjustment hole (3) in the alternator mounting bracket and pivot the bracket to tighten the belt
- tighten the adjustment and pivot bolts 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.

Serpentine Drive Belt Diagnosis

Condition	Possible Cause	Correction
TENSION SHEETING FABRIC FAILURE (WOVEN FABRIC ON OUTSIDE CIRCUMFERENCE OF BELT HAS CRACKED OR SEPARATED FROM BODY OF BELT)	(1) Grooved or backside idler pulley diameters are less than minimum recommended.	(1) Replace pulley(s) not conforming to specification.
	(2) Tension sheeting contacting (rubbing) stationary object.	(2) Correct rubbing condition.
	(3) Excessive heat causing woven fabric to age.	(3) Replace belt.
	(4) Tension sheeting splice has fractured.	(4) Replace belt.
NOISE (OBJECTIONAL SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	(1) Belt slippage.	(1) Adjust belt.
	(2) Bearing noise.	(2) Locate and repair.
	(3) Belt misalignment.	(3) Align belt/pulley(s).
	(4) Belt-to-pulley mismatch.	(4) Install correct belt.
	(5) Driven component inducing vibration.	(5) Locate defective driven component and repair.
	(6) System resonant frequency inducing vibration.	(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.	(1) Remove foreign objects from pulley grooves.
	(2) Installation damage.	(2) Replace belt.
	(3) Drive loads in excess of design specifications.	(3) Adjust belt tension.
	(4) Insufficient internal belt adhesion.	(4) Replace belt.
RIB OR BELT WEAR (BELT RIBS CONTACT BOTTOM OF PULLEY GROOVES)	(1) Pulley(s) misaligned.	(1) Align pulley(s).
	(2) Mismatch of belt and pulley groove widths.	(2) Replace belt.
	(3) Abrasive environment.	(3) Replace belt.
	(4) Rusted pulley(s).	(4) Clean rust from pulley(s).
	(5) Sharp or jagged pulley groove tips.	(5) Replace pulley.
	(6) Rubber deteriorated.	(6) Replace belt.
LONGITUDINAL BELT CRACKING (CRACKS BETWEEN TWO RIBS)	(1) Belt has mistracked from pulley groove.	(1) Replace belt.
	(2) Pulley groove tip has worn away rubber-to-tensile member.	(2) Replace belt.

81102A

Serpentine Drive Belt Diagnosis (Continued)

Condition	Possible Cause	Correction
BELT SLIPS	(1) Belt slipping because of insufficient tension.	(1) Adjust tension.
	(2) Belt or pulley subjected to substance (belt dressing, oil, ethylene glycol) that has reduced friction.	(2) Replace belt and clean pulleys.
	(3) Driven component bearing failure.	(3) Replace faulty component bearing.
	(4) Belt glazed and hardened from heat and excessive slippage.	(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.	(1) Adjust belt tension.
	(2) Pulley(s) not within design tolerance.	(2) Replace pulley(s).
	(3) Foreign object(s) in grooves.	(3) Remove foreign objects from grooves.
	(4) Excessive belt speed.	(4) Avoid excessive engine acceleration.
	(5) Pulley misalignment.	(5) Align pulley(s).
	(6) Belt-to-pulley profile mismatched.	(6) Install correct belt.
	(7) Belt cordline is distorted.	(7) Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE REPLACEMENT BELT IS INSTALLED)	(1) Excessive tension.	(1) Replace belt and adjust tension to specification.
	(2) Tensile members damaged during belt installation.	(2) Replace belt.
	(3) Belt turnover.	(3) Replace belt.
	(4) Severe pully misalignment.	(4) Align pulley(s).
	(5) Bracket, pulley, or bearing failure.	(5) Replace defective component and belt.
CORD EDGE FAILURE (TENSILE MEMBER EXPOSED AT EDGES OF BELT OR SEPARTED FROM BELT BODY)	(1) Excessive tension.	(1) Adjust belt tension.
	(2) Drive pulley misalignment.	(2) Align pulley.
	(3) Belt contacting stationary object.	(3) Correct as necessary.
	(4) Pulley irregularities.	(4) Replace pulley.
	(5) Improper pulley construction.	(5) Replace pulley.
	(6) Insufficient adhesion between tensile member and rubber matrix.	(6) Replace belt and adjust tension to specifications.

81102B

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.	(1) Replace pulley(s).
	(2) Backside bend flat pulley(s) diameter less than minimum.	(2) Replace pulley(s).
	(3) Excessive heat condition causing rubber to harden.	(3) Correct heat condition as necessary.
	(4) Excessive belt thickness.	(4) Replace belt.
	(5) Belt overcured.	(5) Replace belt.
	(6) Excessive tension.	(6) Adjust belt tension.

81102C

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-10174-01	Main Jet Removal and Installation Tool		■
J-9789-C	Universal Carburetor Gauge Kit		■
J-23738	Hand Operated Vacuum Pump		■
ET-501-82	FFB System Tester	■	
ET-501-84	FFB System Tester Adapter	■	
	Tach/Dwell Meter		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Fuel Pump Mounting Bolts	22 N·m (16 ft-lbs)	18-26 N·m (13-19 ft-lbs)
Fuel Pipe-To-Fuel Pump Fitting	25 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Carburetor-To-Intake Manifold Nuts	19 N·m (14 ft-lbs)	16-27 N·m (12-20 ft-lbs)

MODEL YFA CARBURETOR

General

The 2.46 liter (150 CID) four-cylinder engine is equipped with a model YFA carburetor.

This carburetor has an integral mixture control (MC) solenoid that provides the proper air/fuel ratio by controlling the intake airflow.

The MC solenoid is controlled by the micro computer unit (MCU).

Specifications

SEE I.S. NOTES

Model YFA Carburetor Calibrations

List Number	7700	7702
Throttle Bore Size	43mm (1.69 in)	43mm (1.69 in)
Main Venturi Size	38mm (1.50 in)	38mm (1.50 in)
Fuel Inlet Diameter	2.38mm (0.0935 in)	2.38mm (0.0935 in)
Low Speed Jet	0.9mm (0.035 in)	0.9mm (0.035 in)
Bypass Air Bleed	1.15mm (0.046 in)	1.15mm (0.046 in)
Economizer	1.35mm (0.055 in)	1.3mm (0.052 in)
Idler Air Bleed	1.25mm (0.049 in)	1.25mm (0.049 in)
Metering Rod Jet Number	120W-2410	120W-2407
Metering Rod Jet Size	2.8mm (0.110 in)	2.7mm (0.107 in)
Metering Rod Number	75W-8522	75W-8525
Step Up Limiter Shim	None	None
Nozzle Bleed	1.65mm (0.0645 in)	1.65mm (0.0645 in)
Anti-Perc Bleed	1.0mm (0.040 in)	1.0mm (0.040 in)
Pump Discharge Nozzle (Jet)	2.4mm (0.096 in)	2.4mm (0.096 in)
Vacuum Spark Port	1.0mm (0.040 in)	1.0mm (0.040 in)
Spark Port Location Above Closed Throttle	1.0mm (0.040 in)	1.0mm (0.040 in)
Thermostatic Pump Bleed	0.5mm (0.021 in)	0.5mm (0.021 in)

840215(J)

Model YFA Carburetor Specifications

List Number	Application	Float Level		Initial Choke Valve Clearance		Fast Idle Cam Setting Index		Automatic Choke Cover Setting		Choke Unloader	Fast Idle Speed (Step 2)	
		Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To			Set To	OK Range
7700	150 Man 50-S	0.600	0.570 to 0.630	0.240	0.225 to 0.255	0.175	0.160 to 0.190	N/A TR		0.370	2000*	± 100
7702	150 Man High Alt	0.600	0.570 to 0.630	0.240	0.225 to 0.255	0.175	0.160 to 0.190	N/A TR		0.370	2000*	± 100

*EGR valve disconnected and the engine fully warm.
TR – Tamper Resistant.

84630(J)

SE
I.S.
NOTES

SEE I.S. NOTES

Replacement

Removal

Remove the air cleaner.

Identify and mark all the hoses attached to the carburetor for aid during installation.

Remove the control shaft from the throttle lever.

Disconnect the in-line fuel filter, external bowl vent hose, vacuum hoses, pullback spring and all electrical connectors.

Remove the carburetor retaining nuts and remove the carburetor.

Remove the carburetor mounting gasket from the spacer.

Installation

Clean the gasket mounting surfaces on the spacer and carburetor.

Install a replacement gasket on the spacer.

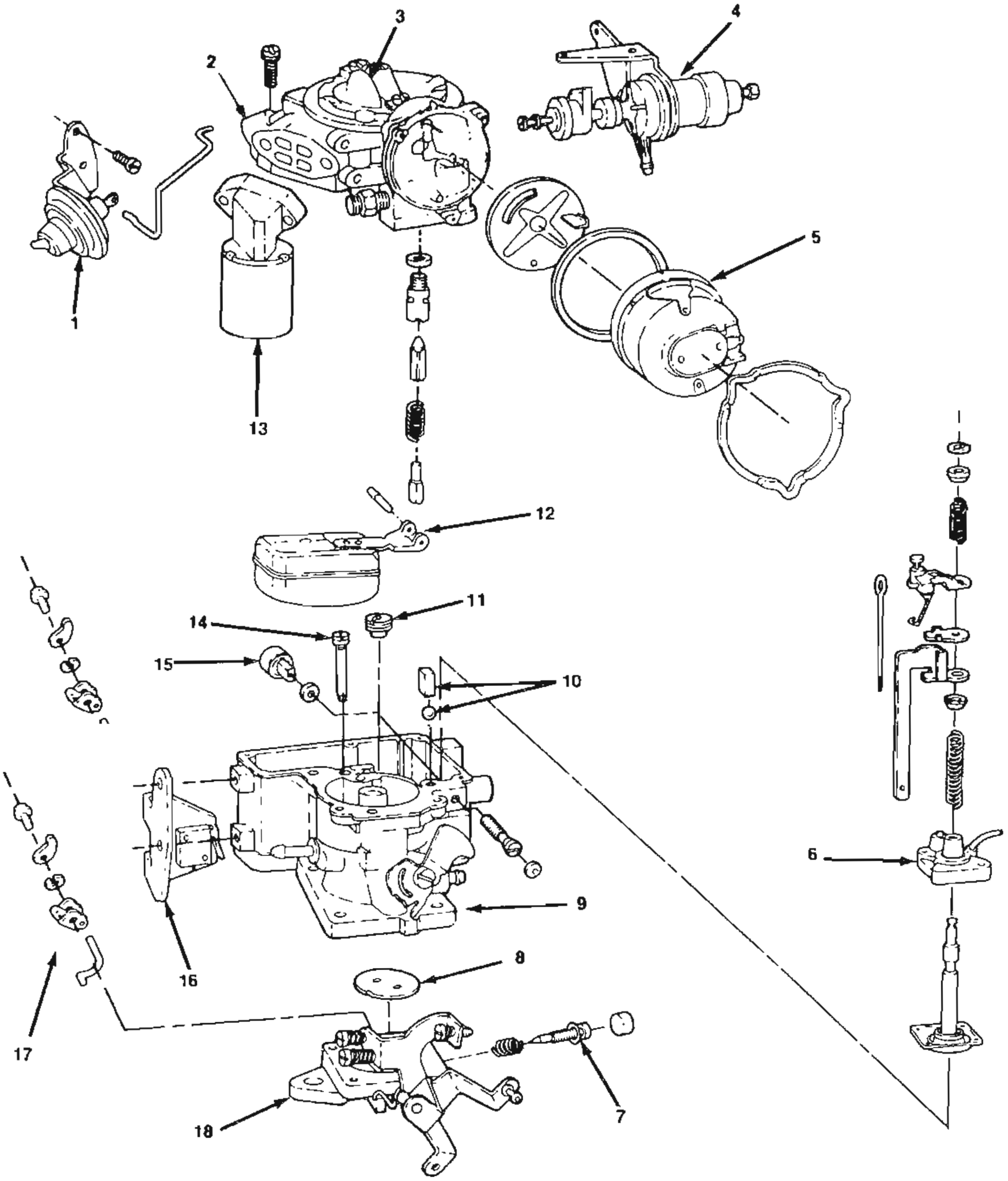
Position the carburetor on the spacer and gasket. Secure it with the retaining nuts.

Connect the in-line fuel filter, control shaft, pullback spring, vacuum hoses, external bowl vent hose and all the electrical connectors.

Install the air cleaner.

Adjust the curb idle speed and fast idle speed. Refer to the Service Adjustment Procedures.

Carburetor Overhaul



1. Vacuum Break
2. Air Horn
3. Choke Plate
4. Sole-Vac Throttle Positioner
5. Choke Assembly
6. Accelerator Pump Assembly
7. Idle Mixture Screw with O-ring
8. Throttle Plate
9. Main Body
10. Accelerator Pump Check Ball and Weight
11. Main Metering Jet
12. Float Assembly
13. Mixture Control Solenoid
14. Low Speed Jet
15. Accelerator Pump Vent Valve
16. Wide Open Throttle (WOT) Switch
17. Throttle Shaft and Lever
18. Throttle Body

84643

SEE I.S. NOTES

The following procedures apply to a complete overhaul with the carburetor removed from the engine.

A complete disassembly is not necessary when performing adjustments.

In most instances, service adjustments of the individual circuits can be completed without removing the carburetor from the engine.

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection, and replacement of all gaskets and worn or damaged parts.

It also includes curb idle speed adjustment, idle mixture adjustment (if removal of the adjustment screw was 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.

NOTE: 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 and filter for contamination as the carburetor is disassembled.

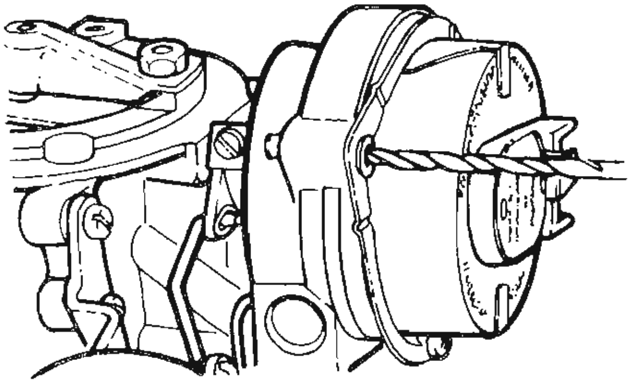
Disassembly

NOTE: The choke cover is not adjustable.

CAUTION: This procedure below must be followed to retain the original rivet hole size.

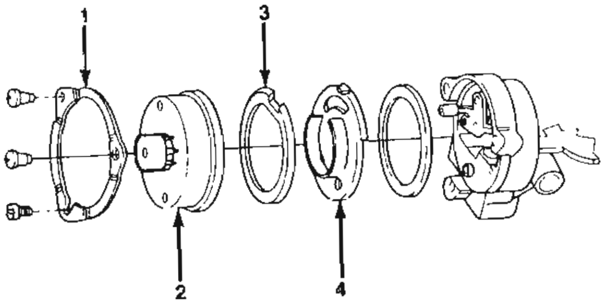
Remove the choke cover:

- drill out the rivet heads with a 3-mm (1/8-in) or No. 30 drill bit
- after the rivet heads are removed, drive out the remaining portion of the rivets with a 3-mm (1/8-in) punch



840178

- remove the screw holding the retainer



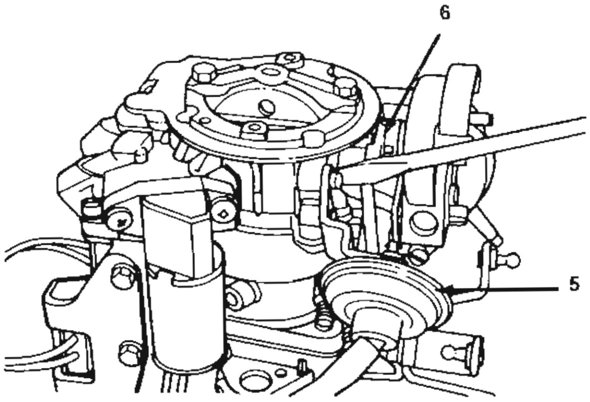
84644

Continue the choke cover removal by removing the following:

- retainer (1)
- thermostat spring housing assembly (2)
- spring housing gasket (3)
- locking and indexing plate (4)

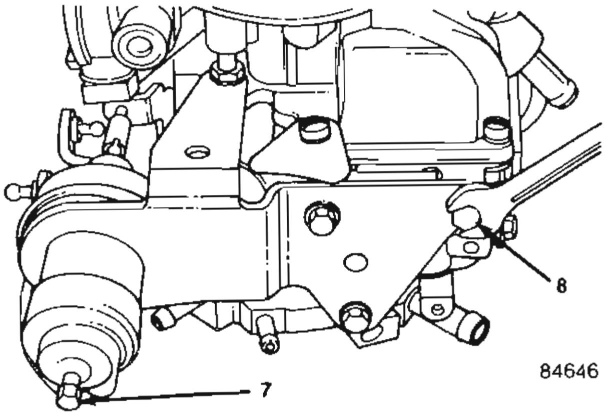
Remove the vacuum break (5).

Disengage and remove the vacuum break connector link (6) from the choke shaft lever.



84645

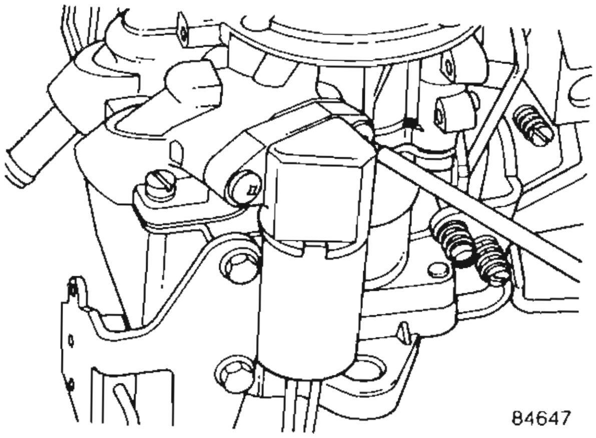
Remove the Sole-Vac throttle positioner (7) and the mounting bracket (8).



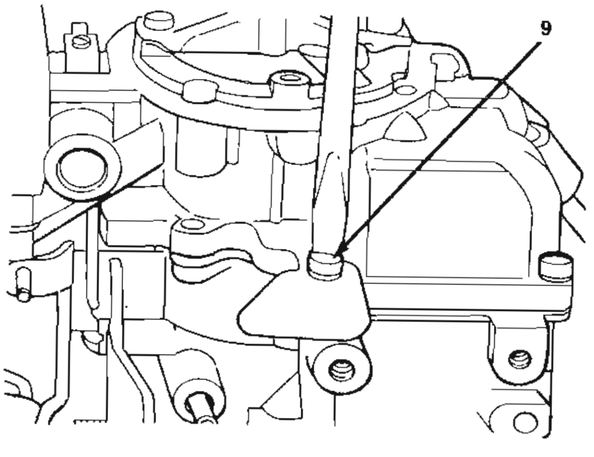
84646

SEE I.S. NOTES

Remove the mixture control (MC) solenoid from the air horn.


84647

Remove the air horn attaching screws (9).

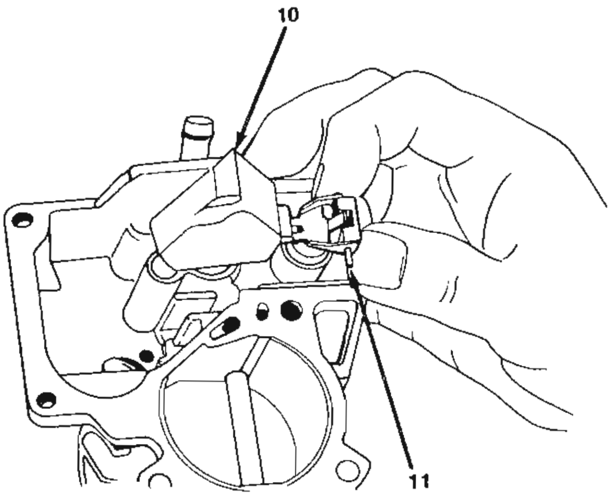


84648

Remove the fast idle cam link.

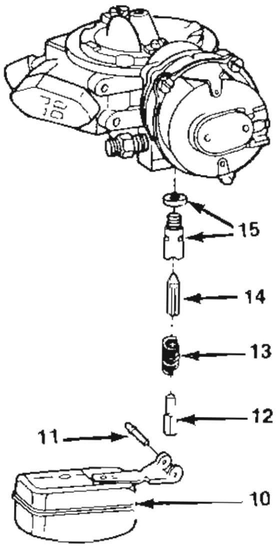
Remove the air horn and gasket from the carburetor main body.

To remove the float (10) from the air horn, hold the air horn bottom side up and remove the float pin (11) and float (10).



84651

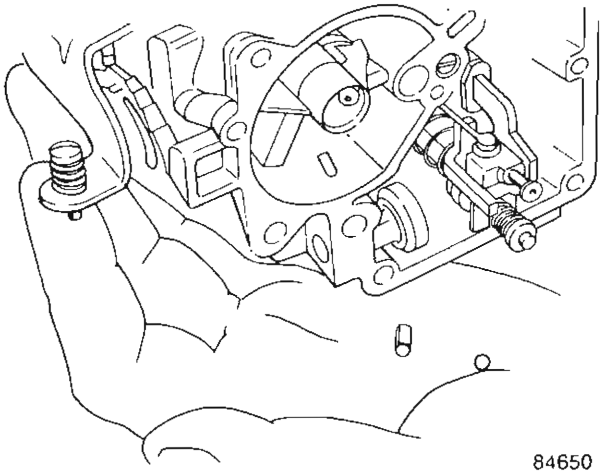
Invert the air horn, and catch the needle pin (12), spring (13) and needle (14).



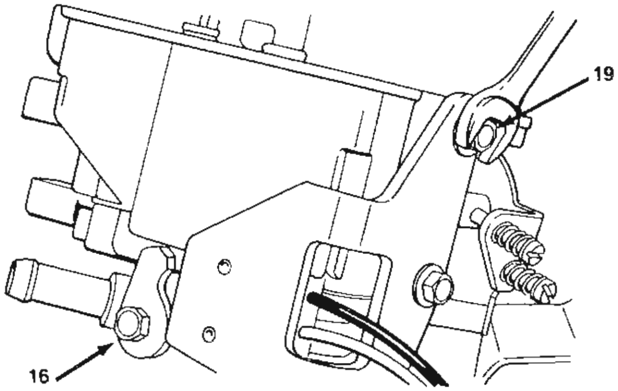
84649

Remove the needle seat and gasket (15).

To remove the accelerator pump check ball and weight, turn the main body casting upside down and catch the pump check ball and weight.

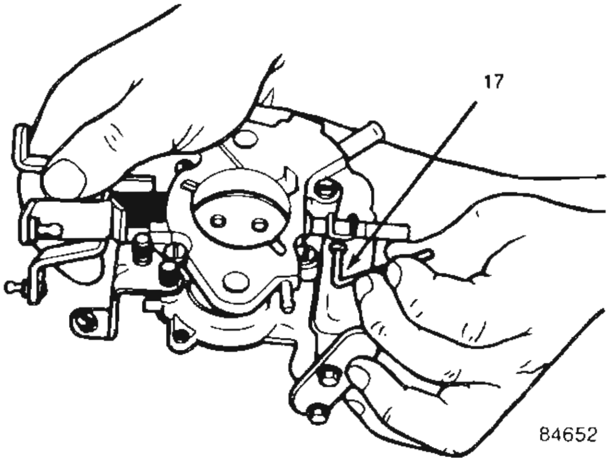

84650

Remove the throttle shaft retaining bolt (16) and wide-open throttle (WOT) switch actuator.



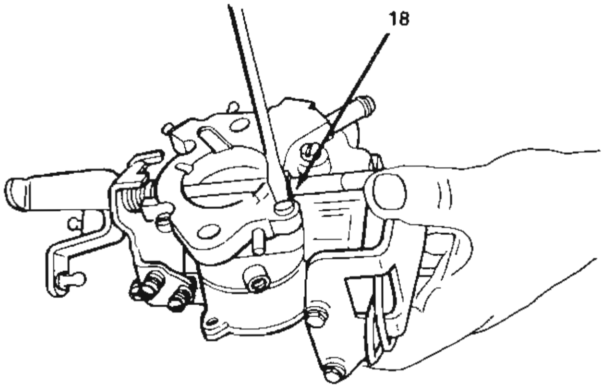
84653

Loosen the throttle shaft arm screw (17) and remove the arm and pump connector link.



84652

Remove the retaining screws (18) and separate the throttle body from the main body.

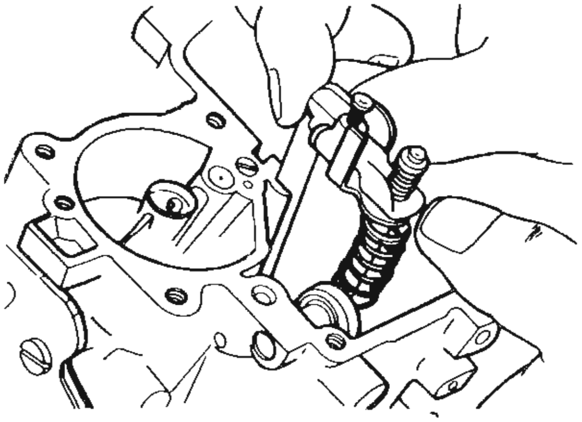


84654

Remove the wide-open throttle switch and mounting bracket (19).

Remove the accelerator pump housing screws from the main body.

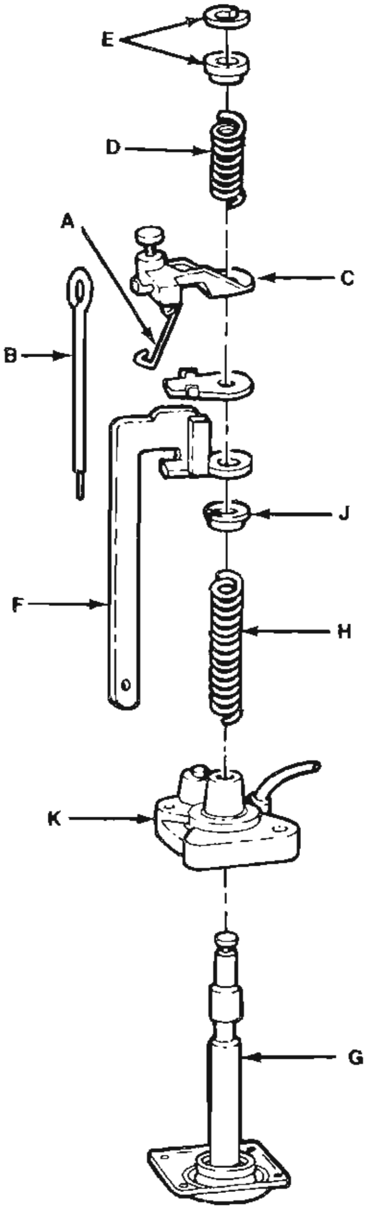
Lift out the pump assembly, pump lifter link and metering rod as a unit.



84655

To disassemble the pump, use the following procedure:

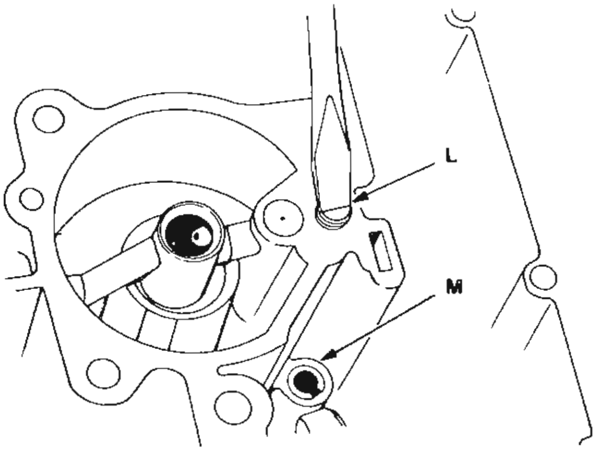
- disengage the metering rod arm spring (A) from the metering rod (B)
- remove the metering rod (B) from the metering rod assembly (C)
- compress the upper pump spring (D), and remove the spring retainer and cup (E)
- remove the upper spring (D), metering rod arm assembly (C) and pump lifter link (F) from the pump diaphragm shaft (G)
- compress the pump diaphragm spring (H), and remove the pump diaphragm spring retainer (J), spring (H) and pump diaphragm housing assembly from the pump diaphragm shaft assembly (K)



84656

Remove the low speed jet (L).

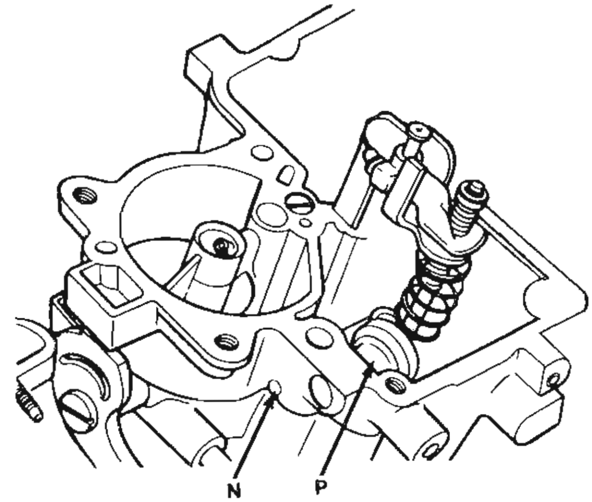
Remove the main metering jet (M).



84657

With a sharp punch, remove the accelerator pump bleed valve plug (N) from outside the main body casting.

Loosen the bleed valve screw, and remove the valve (P).

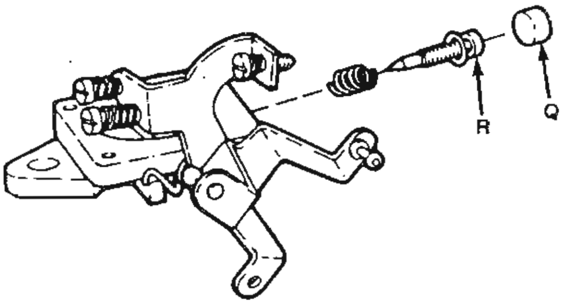


84658

Drill out and remove the tamper resistant plug (Q).

After removing the plug, count and record the number of turns required to lightly seat the idle mixture screw.

Remove the idle mixture screw, O-ring and spring (R).

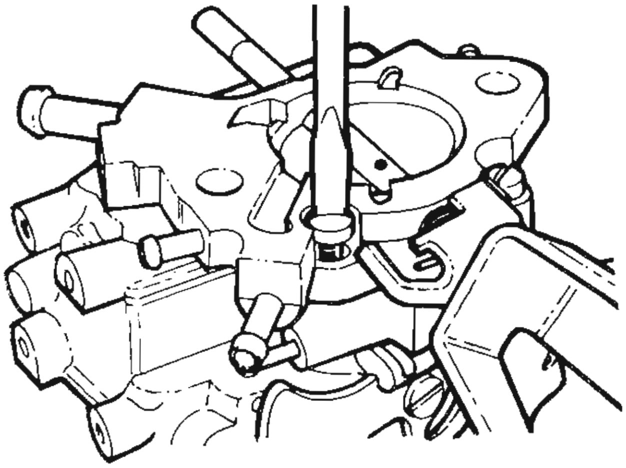


84659

SEE I.S. NOTES

SEE I.S. NOTES

Assembly



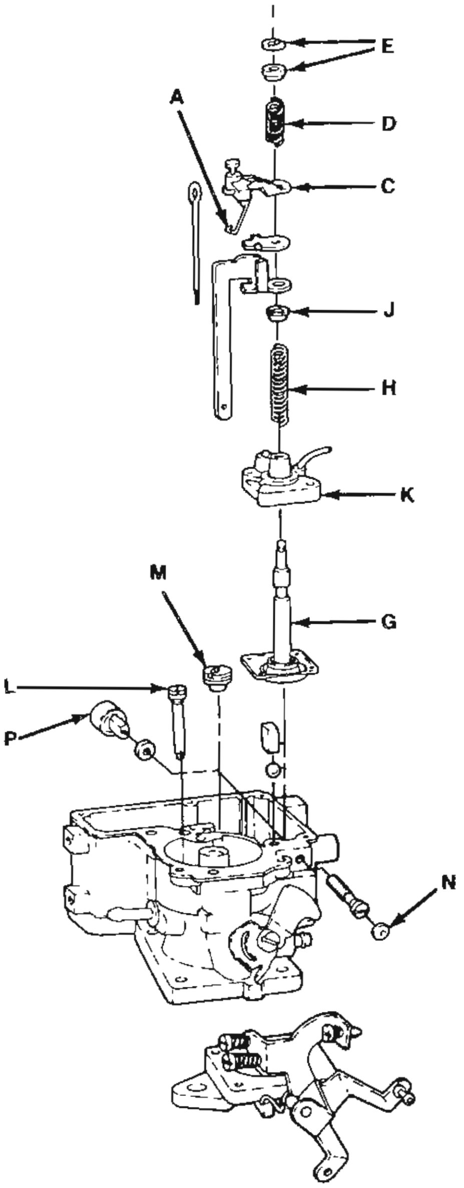
840193

Attach the throttle body to the main body with the retaining screws.

NOTE: Use LOCTITE® on the retaining screws.

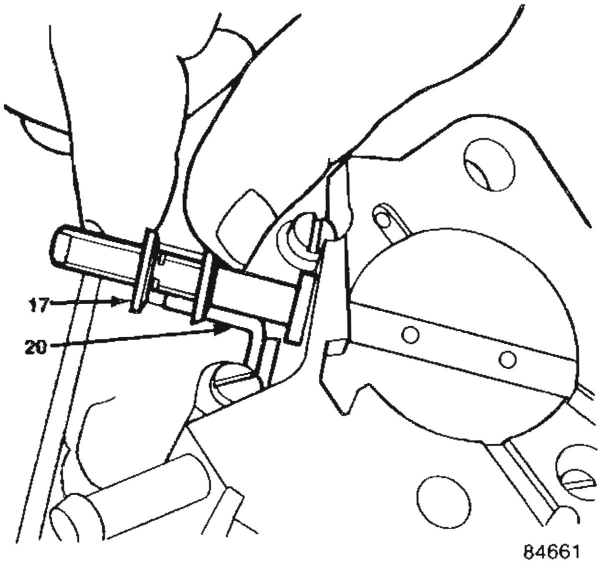
Install the following:

- low speed jet (L)
- main metering jet (M)
- pump bleed valve (P) and plug (N)
- accelerator pump assembly
- pump passage tube



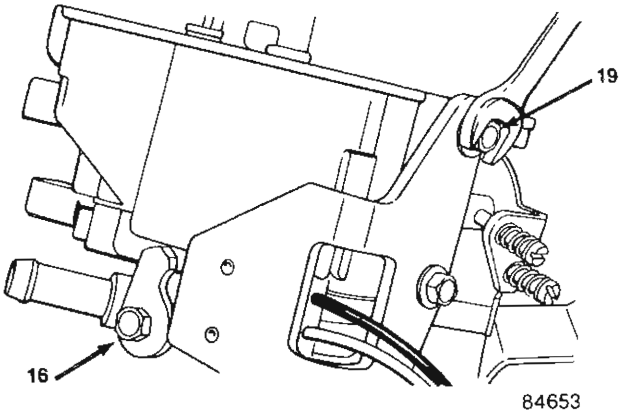
84660

Install the throttle shaft arm and retaining screw (17), and pump connector link (20).



Install the following components:

- wide-open throttle (WOT) switch actuator
- throttle shaft retaining bolt (16)
- wide-open throttle (WOT) switch and bracket (19)



SEE I.S. NOTES

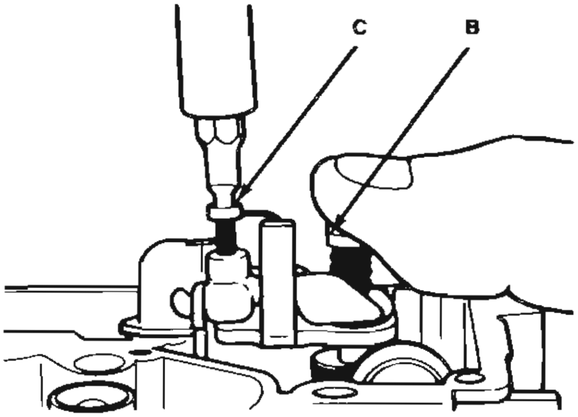
Metering Rod Adjustment –

Before adjusting the metering rod, ensure that the idle speed adjustment screw allows the throttle plate to close tightly in the throttle bore.

Press down on top of the pump diaphragm shaft (B) until the assembly bottoms.

While holding the pump diaphragm down, adjust the metering rod by turning the metering rod adjustment screw (C) counterclockwise until the metering rod lightly bottoms in the main metering jet.

Turn the metering rod adjustment screw (C) clockwise one turn for the final adjustment.

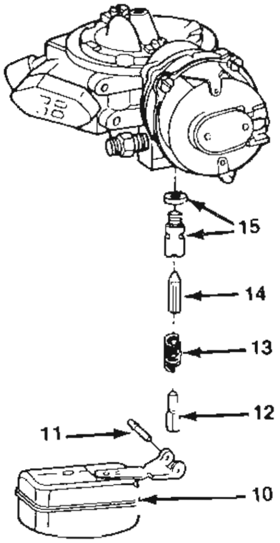


84632

Float Level Adjustment –

Install the needle pin (12), spring (13), needle (14), seat and gasket (15).

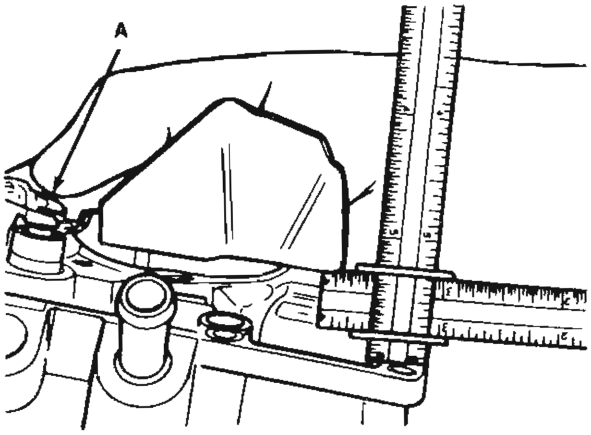
Install the float (10) and pin (11).



84649

Invert the air horn assembly.

Measure the clearance from the top of the float to the bottom of the air horn with a float level gauge.



84631

The float arm should be resting on the needle pin.

Bend the float arm (A) as necessary to adjust the float level. Refer to the Specifications chart for the correct clearance.

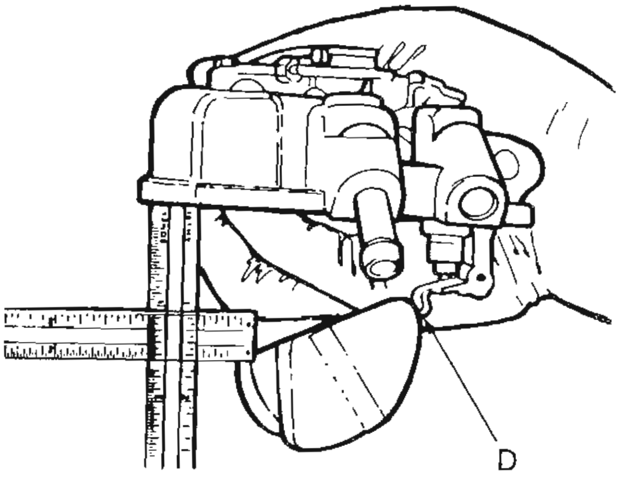
Float Drop Adjustment –

Hold the air horn upright, and let the float hang freely.

Measure the maximum clearance from the toe end of the float to the casting surface.

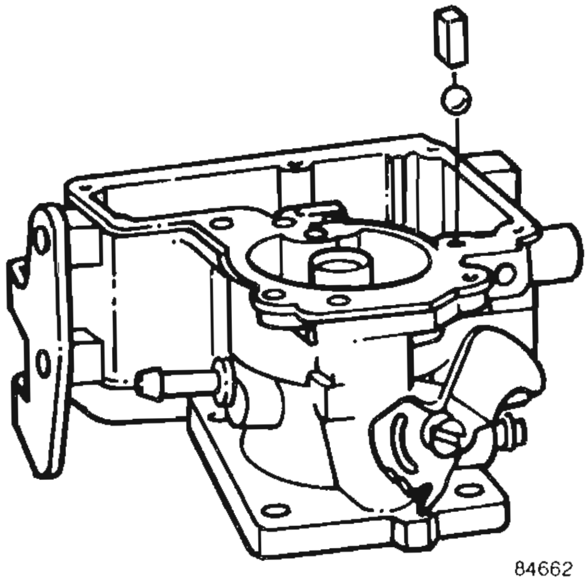
Hold the air horn at eye level while measuring.

To adjust, bend the tab (D) at the end of the float arm to obtain the specified dimension. Refer to the Specifications chart.



840199

Install the accelerator pump check ball and weight.



84662

Attach the air horn (9) and gasket to the main body.

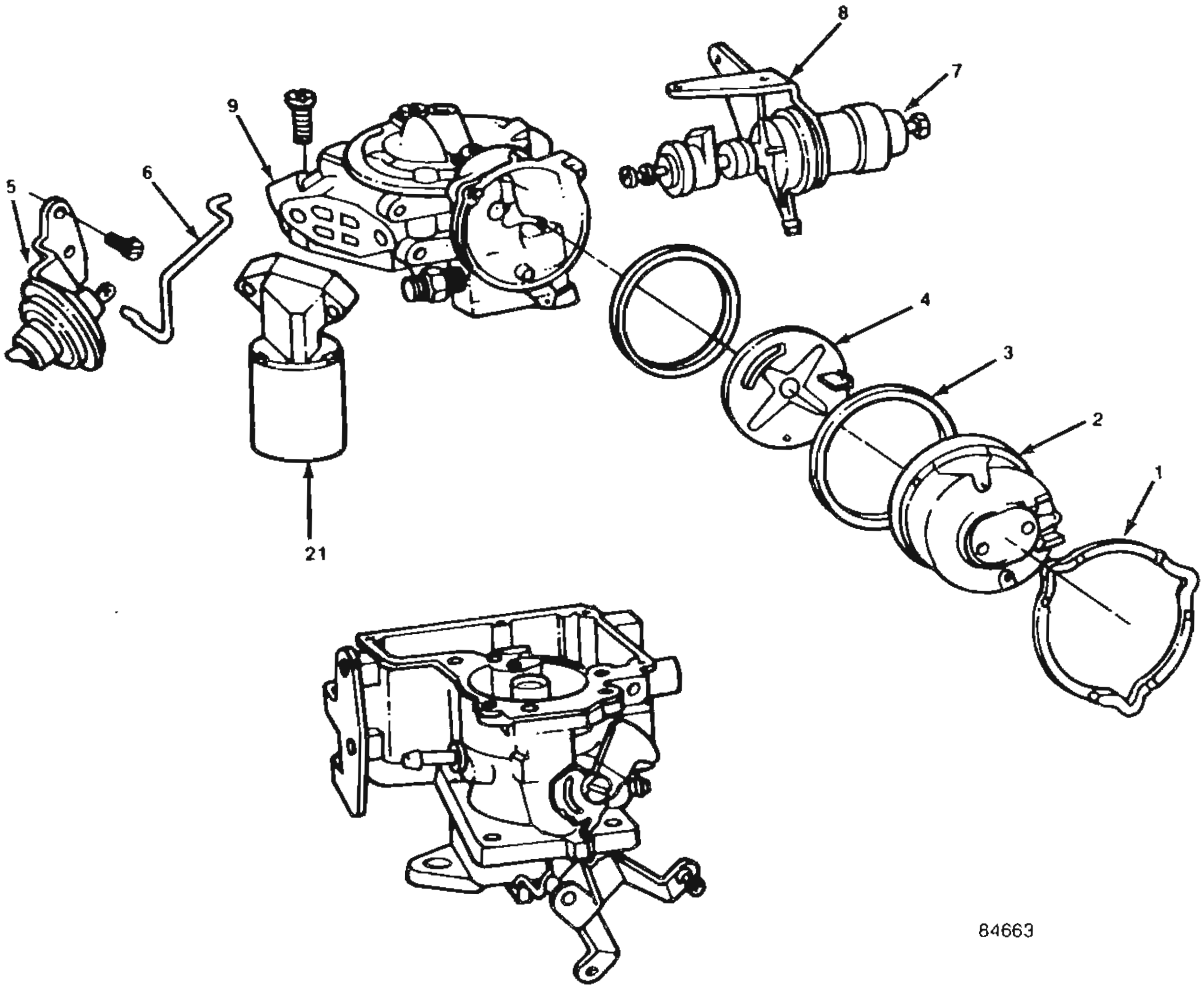
Install the fast idle cam link.

Install the Sole-Vac throttle positioner (7) and mounting bracket (8).

Install the mixture control (MC) solenoid (21) and gasket.

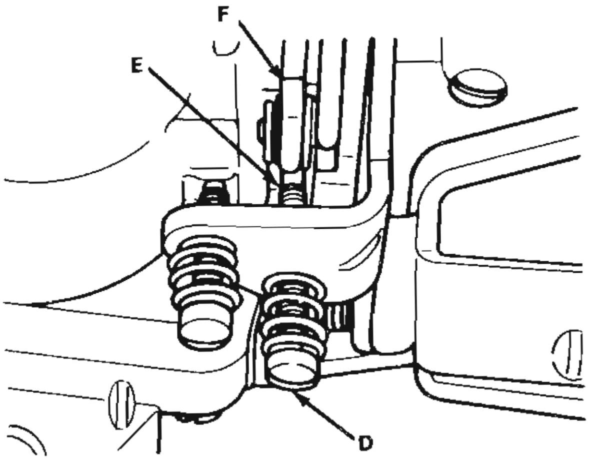
Install the choke cover locking and indexing plate (4), choke cover and housing gasket (3), choke cover and housing assembly (2), retainer (1) and replacement breakaway screws.

Install the vacuum break connector link (6), vacuum break (5) and attaching screws.



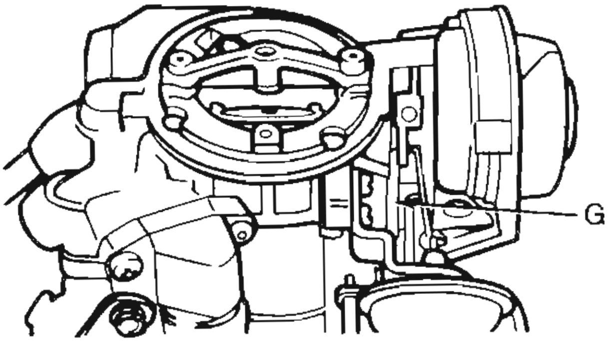
Fast Idle Cam Index Adjustment –

Position the fast idle adjustment screw (D) on the second step (E) of the fast idle cam (F) and against the shoulder of the high step.



84634

Adjust by bending the fast idle cam link (G) to obtain the specified clearance between the lower edge of the choke plate and the carburetor air horn.



84635

SEE I.S. NOTES

SEE I.S. NOTES

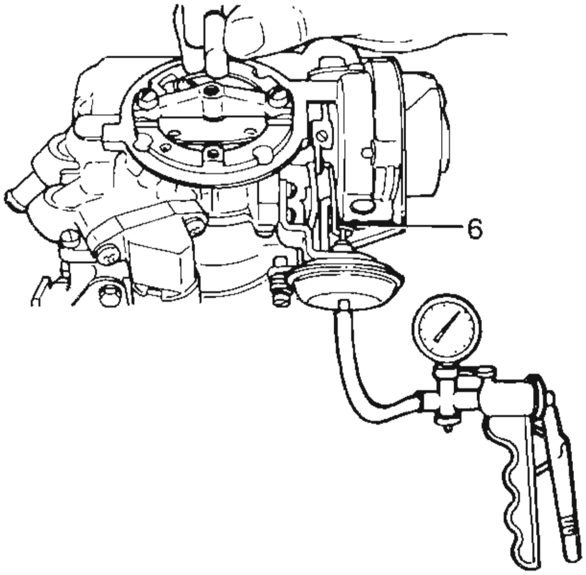
Initial Choke Valve Clearance Adjustment –

Position the fast idle adjustment screw on the top step of the fast idle cam.

Seat the vacuum break with an external vacuum source (vacuum pump).

Measure the distance between the choke plate and the air horn.

To adjust, bend the vacuum break connector link (6). Refer to the Specifications chart.



84633

Choke Unloader Adjustment –

Hold the throttle (H) wide open.

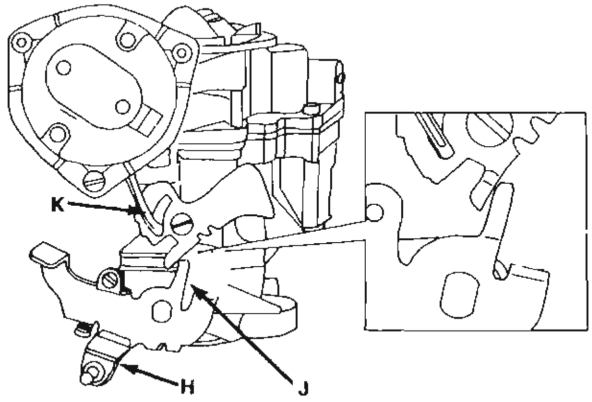
Insert the specified plug gauge and apply light pressure to close the choke valve.

Measure the distance between the choke valve and the air horn wall. Refer to the Specifications chart for the correct dimension.

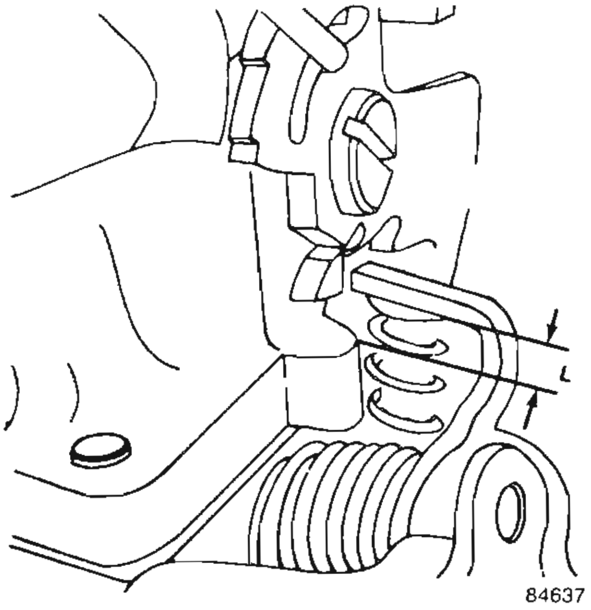
Adjust by bending the choke unloader tang (J), which contacts the fast idle cam (K).

Do not bend the tang so that it binds or interferes with any other component.

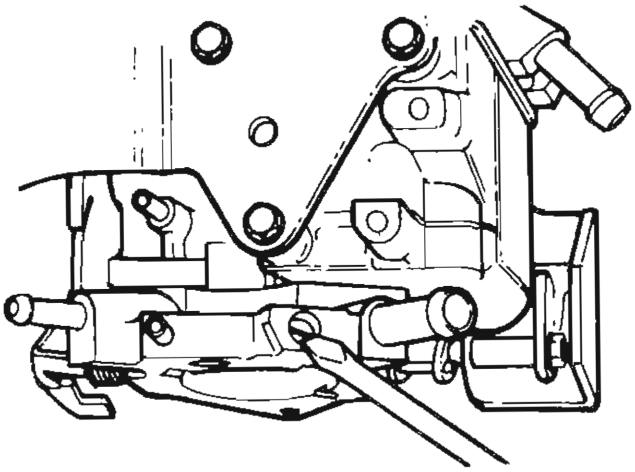
Bend toward the cam (K) to increase the clearance (L) and away from the cam to decrease the clearance (L).



84636



Initial Idle Mixture Adjustment –



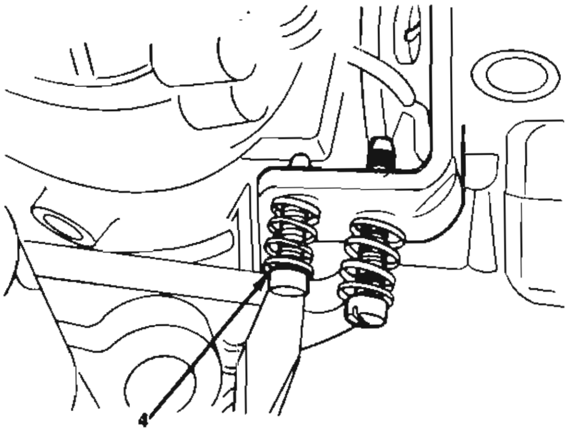
Install and position the idle mixture adjustment screw at the same number of turns from the lightly seated position as recorded during disassembly.

After carburetor installation, refer to the Service Adjustment Procedures for the final idle mixture adjustment.

TRC (Anti-Diesel) Adjustment –

The TRC (anti-diesel) adjustment screw is statically set at 3/4 of a turn from the throttle valve closed position during factory assembly and normally does not require readjustment.

To adjust, turn the adjustment screw (4) counterclockwise to the throttle valve closed position and then clockwise 3/4 of a turn.



Install the carburetor on the engine and perform the idle speed and mixture adjustments. Refer to the Service Adjustment Procedures.

SEE
I.S.
NOTES

SEE I.S. NOTES

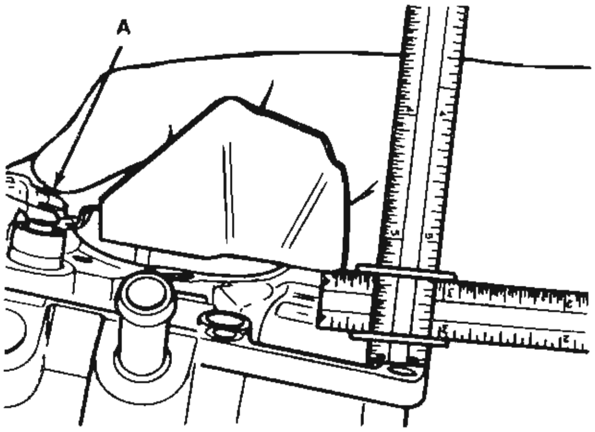
Service Adjustment Procedures

Float Level Adjustment

Remove the air horn and gasket from the carburetor.

Invert the air horn assembly.

Measure the clearance from the top of the float to the bottom of the air horn with a float level gauge.



84631

The float arm should be resting on the needle pin.

Bend the float arm (A) as necessary to adjust the float level. Refer to the Specifications chart for the correct clearance.

Attach the air horn and gasket to the main body.

Float Drop Adjustment

Remove the air horn and gasket from the carburetor.

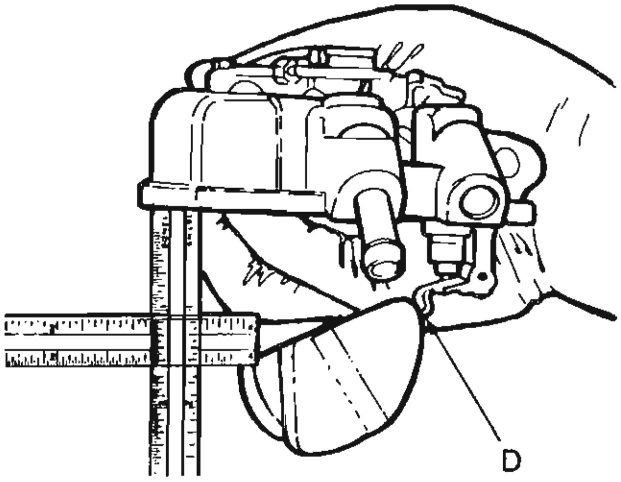
Hold the air horn upright, and let the float hang freely.

Measure the maximum clearance from the toe end of the float to the casting surface.

Hold the air horn at eye level while measuring.

To adjust, bend the tab (D) at the end of the float arm to obtain the specified dimension.

Attach the air horn and gasket to the main body.



840199

Metering Rod Adjustment

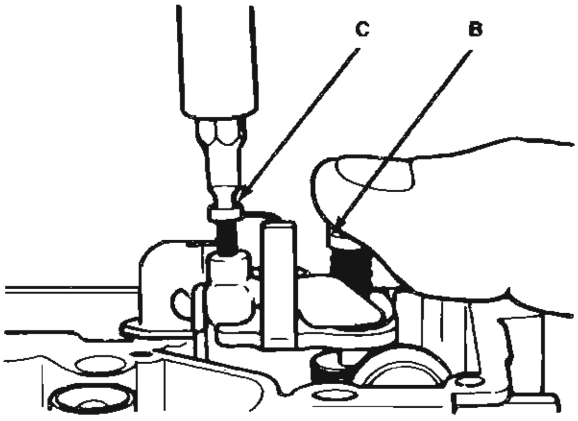
Remove the air horn and gasket from the carburetor.

Before adjusting the metering rod, ensure that the idle speed adjustment screw allows the throttle plate to close tightly in the throttle bore.

Press down on top of the pump diaphragm shaft (B) until the assembly bottoms.

While holding the pump diaphragm down, adjust the metering rod by turning the metering rod adjustment screw (C) counterclockwise until the metering rod lightly bottoms in the main metering jet.

Turn the metering rod adjustment screw (C) clockwise one turn for the final adjustment.



84632

Attach the air horn and gasket to the main body.

Adjust the curb idle speed to the specified rpm.

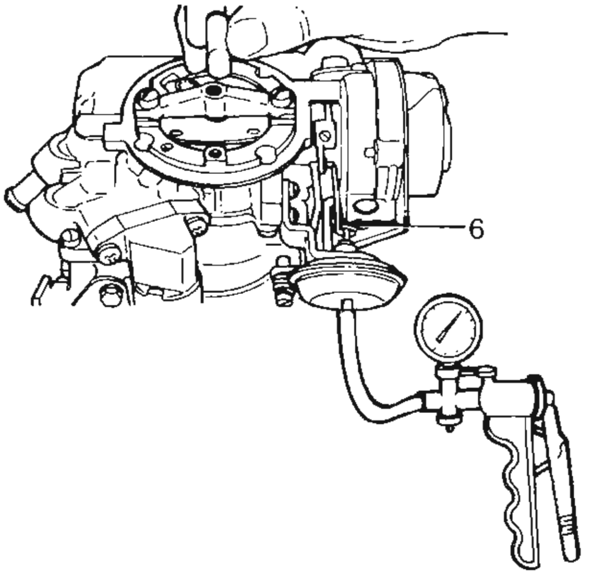
Initial Choke Valve Clearance Adjustment

Position the fast idle adjustment screw on the top step of the fast idle cam.

Seat the vacuum break with an external vacuum source (vacuum pump).

Measure the distance between the choke plate and the air horn.

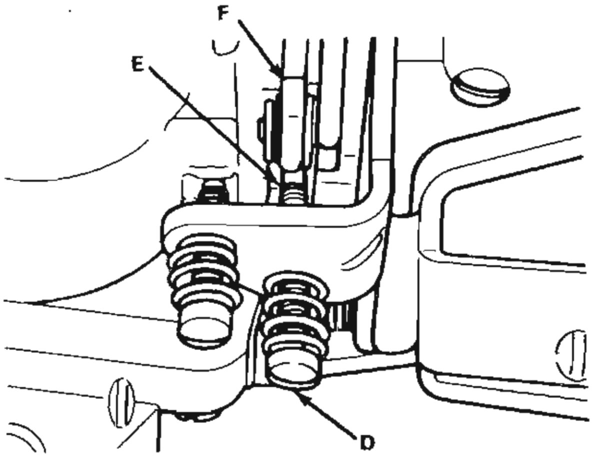
To adjust, bend the vacuum break connector link (6). Refer to the Specifications chart.



84633

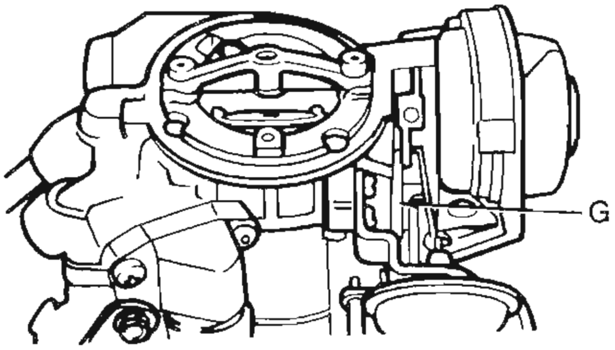
Fast Idle Cam Index Adjustment

Position the fast idle adjustment screw (D) on the second step (E) of the fast idle cam (F) and against the shoulder of the high step.



84634

Adjust by bending the fast idle cam link (G) to obtain the specified clearance between the lower edge of the choke plate and the carburetor air horn. Refer to the Specifications chart.



84635

Choke Unloader Adjustment

Hold the throttle (H) wide open.

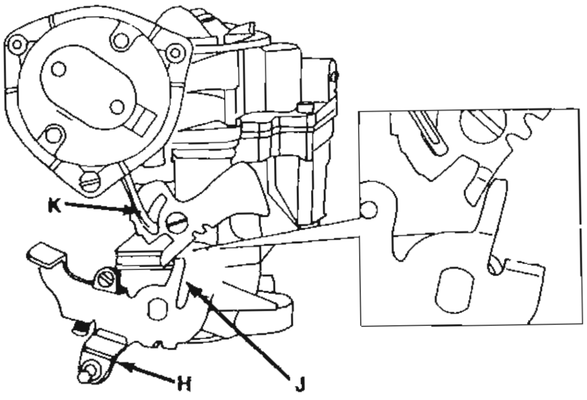
Insert the specified plug gauge and apply light pressure to close the choke valve.

Measure the distance between the choke valve and the air horn wall. Refer to the Specifications chart for the correct dimension.

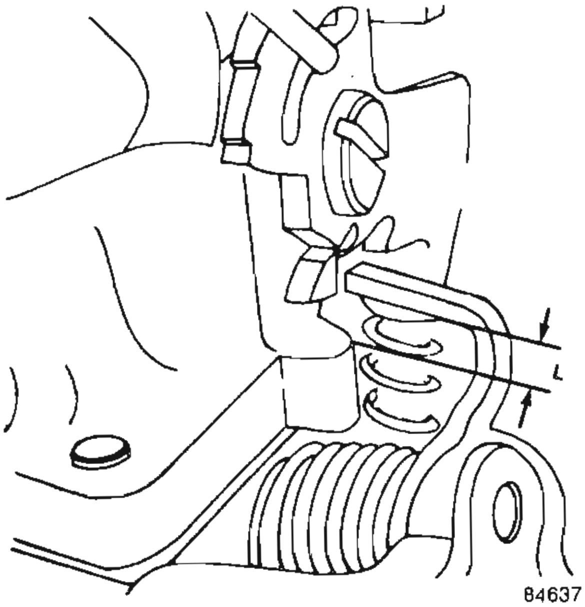
Adjust by bending the choke unloader tang (J), which contacts the fast idle cam (K).

Do not bend the tang so that it binds or interferes with any other component.

Bend toward the cam (K) to increase the clearance (L) and away from the cam to decrease the clearance (L).



84636



84637

Choke Adjustment

The choke adjustment is preset during factory assembly and should not normally require readjustment. The choke should be serviced only during major carburetor overhaul.

SEE I.S. NOTES

Idle Mixture Adjustment

NOTE: The idle mixture is preset during factory assembly and should not normally require readjustment. The idle mixture adjustment screw has a tamper resistant plug to prohibit easy access to the screw. Idle mixture adjustment should normally be required only after major carburetor overhaul. However, if adjustment is necessary because of the results of system diagnosis, contamination, replacement of components, etc., it can be adjusted according to the procedure outlined below.

The mixture control (MC) solenoid dwell (indicated on a dwell meter) is used as a reference for the adjustment.

With the engine at idle speed, it is normal for the MC solenoid dwell to increase and decrease fairly consistently over a relatively narrow range (e.g., 5 degrees).

However, it may occasionally vary by as much as 10 to 15 degrees momentarily because of temporary abrupt mixture changes.

The MC solenoid dwell specified in the procedure is the average for the most consistent variation.

The engine must be allowed to stabilize at idle speed (750 rpm) before the MC solenoid dwell is acceptable as a reference for the adjustment.

SEE I.S. NOTES

NOTE: The MC solenoid dwell is an indication of the ON to OFF time ratio (i.e., solenoid energized time-to-deenergized time ratio).

If the idle mixture adjustment screw tamper resistant plug has not been removed, the carburetor must be removed from the engine for access to the plug. Refer to the carburetor removal procedure.

If the tamper resistant plug is in place, invert the carburetor and place it on a suitable holding fixture.

Remove the plug:

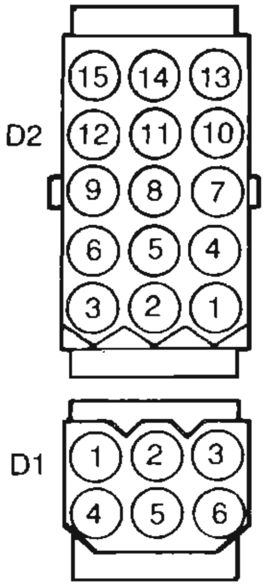
- center-punch the plug
- drill a hole in the center of the plug with a 1/8-inch or No. 30 drill bit
- screw a 1/8-inch self-tapping screw into the center of the plug
- pull the screw outward to remove the plug from the carburetor

Install the carburetor on the engine. Do not install the air cleaner and gasket. Refer to the carburetor installation procedure.

Connect a tachometer to the ignition coil TACH wire connector.

Connect a dwell meter to the MC solenoid test terminals in the diagnostic connector (D2-14 and D2-7).

Turn the dwell meter selector to SIX-CYLINDER.



86332

Place the transmission in the neutral position.

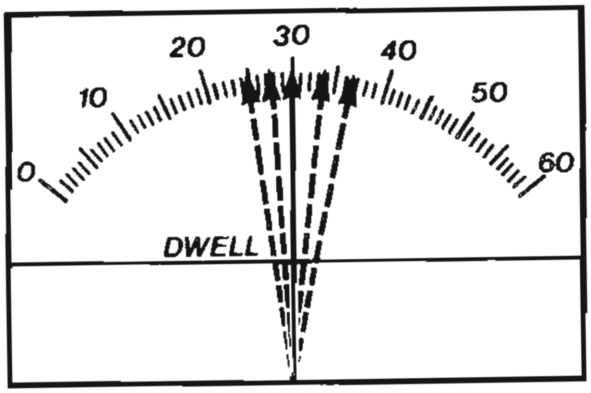
Disconnect and plug the canister purge vacuum hose at the canister.

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 it at fast idle speed for at least three minutes to allow the CEC (feedback) system to switch to CLOSED LOOP operation.

Return the engine to idle speed and adjust the carburetor for an idle speed of 750 rpm (N). Refer to the idle speed adjustment procedure.

Adjust the idle mixture adjustment screw to obtain an average dwell of 30 degrees (25 to 35 degrees).



83076B

If the the dwell is too low, slowly turn the screw counterclockwise (out). If the dwell is too high, slowly turn the screw clockwise (in).

Allow time for the system to react and stabilize after each movement of the adjustment screw. The feedback system is very sensitive to adjustment.

Observe the final dwell indication with the adjustment tool removed.

If the specified dwell cannot be obtained by adjustment, inspect the carburetor idle circuit for air leaks, restrictions, etc. Repair as necessary.

Connect the canister purge hose.

Adjust the idle speed to the specification listed on the Vehicle Emission Control Information Label. Refer to the idle speed adjustment procedure.

Stop the engine. Disconnect the tachometer and dwell meter.

Plug the idle mixture adjustment screw opening with RTV sealant.

Install the gasket and air cleaner.

Fast Idle Speed Adjustment

Disconnect and plug the EGR valve vacuum hose at the valve.

Connect a tachometer to the ignition coil TACH wire connector.

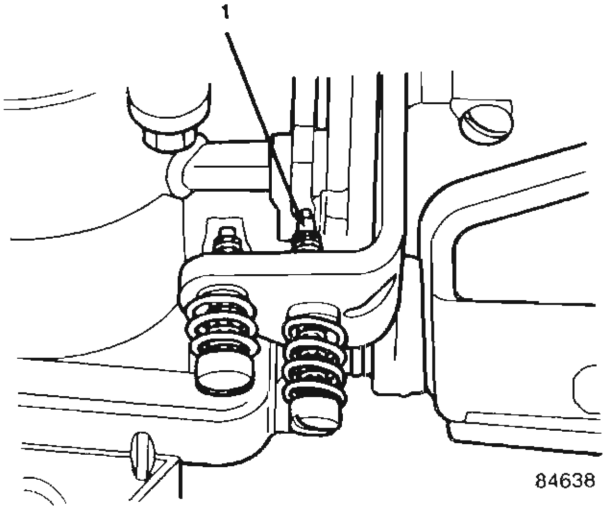
Place the transmission in the neutral position.

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 allow it to attain the normal operating temperature.

Position the fast idle speed adjustment screw on the second step (1) of the fast idle speed cam.

Turn the fast idle adjustment screw into contact with the fast idle cam until an engine speed of approximately 1500 rpm is achieved.



NOTE: Always check the specifications listed on the Vehicle Emission Control Information Label located under the hood.

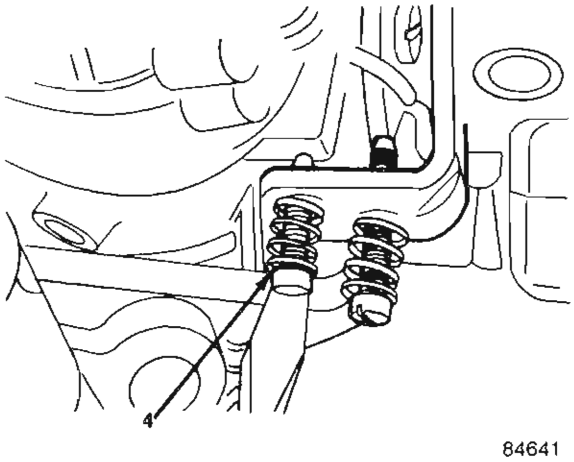
Allow the throttle to return to curb idle speed and connect the EGR valve vacuum hose.

Stop the engine and disconnect the tachometer.

TRC (Anti-Diesel) Adjustment

The TRC (anti-diesel) adjustment screw is statically set at 3/4 of a turn from the throttle valve closed position during factory assembly and normally does not require readjustment.

To adjust, turn the adjustment screw (4) counterclockwise to the throttle valve closed position and then clockwise 3/4 of a turn.



Sole-Vac Vacuum Actuator Adjustment

Connect a tachometer to the ignition coil TACH wire connector.

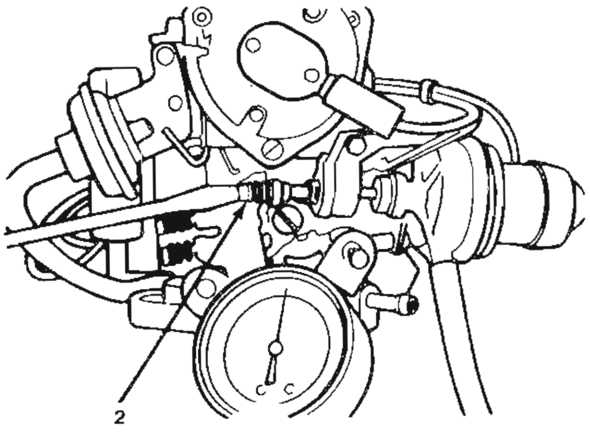
Place the transmission in the neutral position.

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 allow it to attain the normal operating temperature.

Connect an external vacuum source (vacuum pump) and apply 34-51 kPa (10-15 in Hg) of vacuum to the Sole-Vac vacuum actuator.

Adjust the vacuum actuator (2) until an engine speed of approximately 1000 rpm is achieved.



84639

NOTE: Always check the specifications on the Vehicle Emission Control Information Label located under the hood.

NOTE: The Sole-Vac curb idle speed should be adjusted following the vacuum actuator adjustment.

Stop the engine and remove the vacuum source and tachometer.

Sole-Vac Curb Idle Speed Adjustment

Connect a tachometer to the ignition coil TACH wire connector.

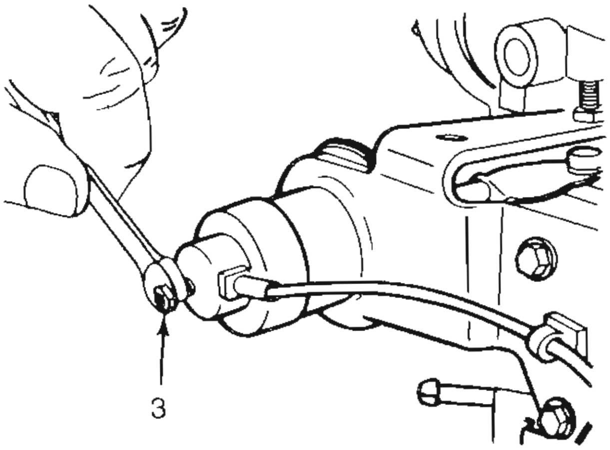
Place the transmission in the neutral position.

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 allow it to attain the normal operating temperature.

Disconnect and plug the vacuum actuator vacuum hose.

Turn the hex-head curb idle speed adjustment screw (3) until an engine speed of approximately 500 rpm is achieved.



84640

NOTE: Always check the specifications listed on the Vehicle Emission Control Information Label located under the hood.

Stop the engine and remove the tachometer. Connect the vacuum actuator vacuum hose.

MODEL BBD CARBURETOR

SEE I.S. NOTES

The 4.2 liter (258 CID) six-cylinder engine is equipped with a Model BBD two-venturi, feedback type carburetor.

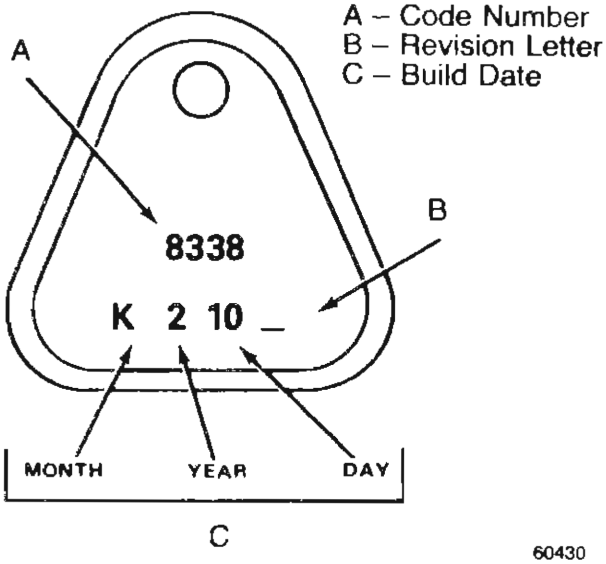
The stepper motor included with this carburetor has two tapered metering pins. Each metering pin is moved in and out of the carburetor air cavity to achieve the proper air/fuel ratio.

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

90745

90745

Model BBD Carburetor Specifications

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 Un-loader	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	(Min.)	Set To	OK Range			
8383	87 88 (50 ST.)	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	1/2-1½	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	87 88 (50 ST)	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	1/2-1½	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

840234

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

840235

Replacement

Removal

SEE I.S. NOTES

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.

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.

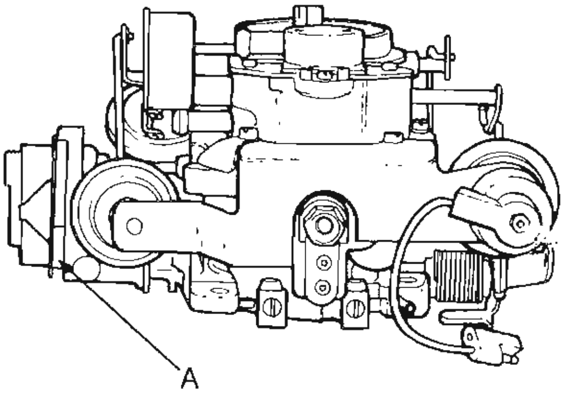
Adjust the engine idle speed, idle mixture (if necessary) and idle speed control (Sole-Vac) solenoid. Refer to Idle Speed and Mixture Adjustment procedures.

Choke Mechanism Service

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.

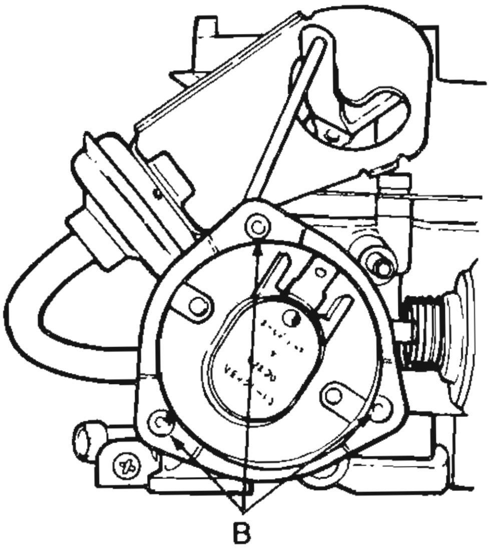
Note and record the color and position of the choke housing index key (A) for assembly reference. The key color indicates the basic choke setting.



840218

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.



840219

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.

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.

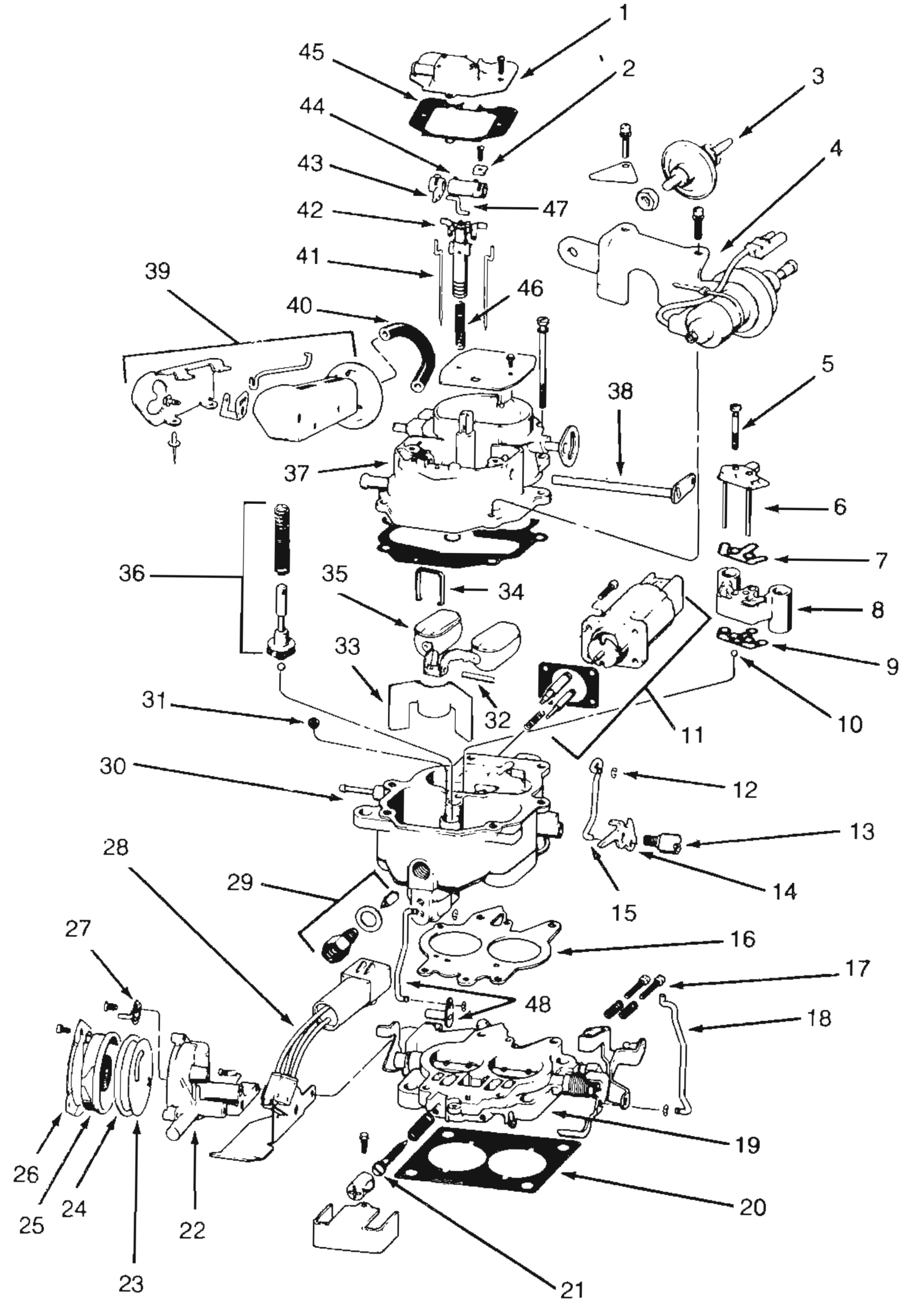
Position the choke cover at the following basic setting as indicated by index key color:

- 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.

SEE I.S. NOTES

MODEL BBD CARBURETOR (EXPLODED)



840217

Overhaul

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

86353

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, inspection and replacement of all gaskets, and worn or damaged components. 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.

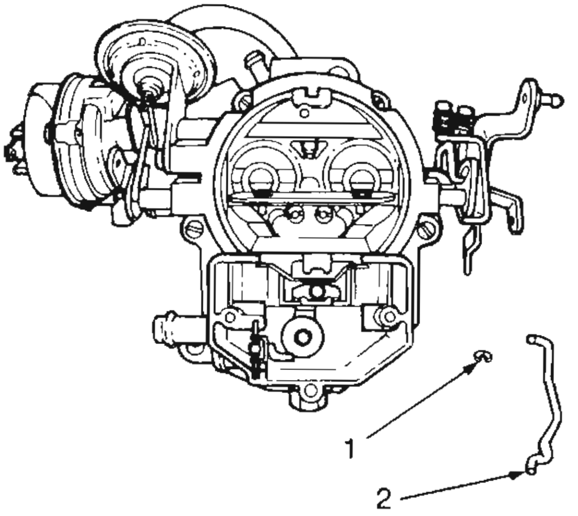
NOTE: Flooding, hesitation on acceleration, and other performance problems are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing a problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the bowl contents for contamination as the carburetor is disassembled.

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.



840220

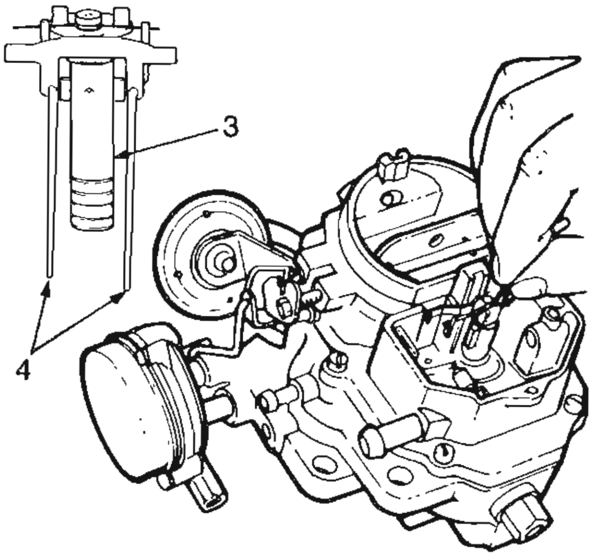
Remove the cover and gasket from the top of the air horn.

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.



840221

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.

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.

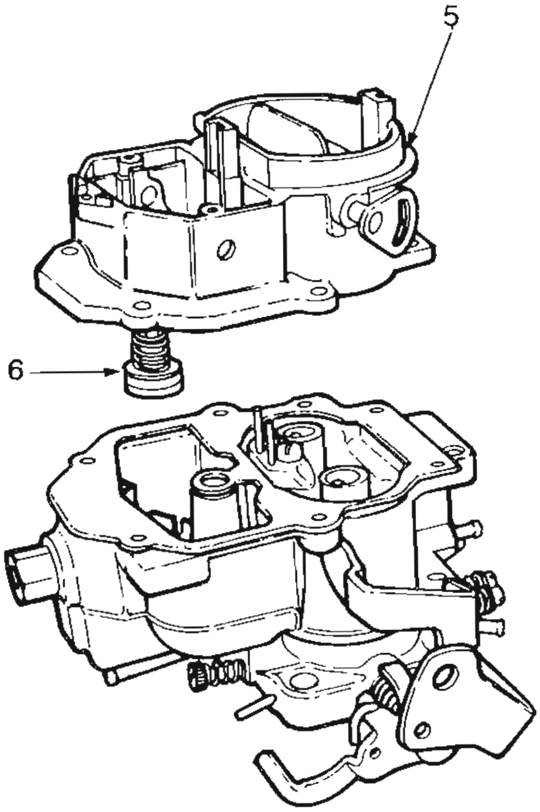
Remove the air horn retaining screws and lift the air horn (5) straight up and away from the main body.

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.

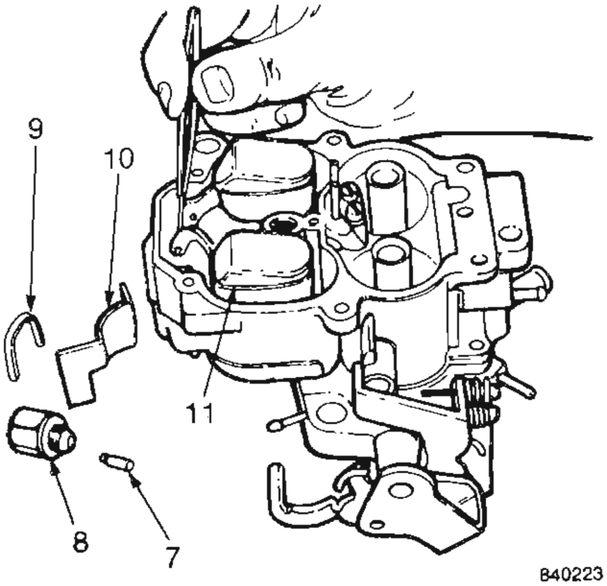
Remove the fuel inlet needle valve (7), seat (8) and gasket from the main body.



840222

SEE I.S. NOTES

Lift out the float fulcrum pin retainer (9) and baffle (10). Lift out the floats (11) and fulcrum pin.



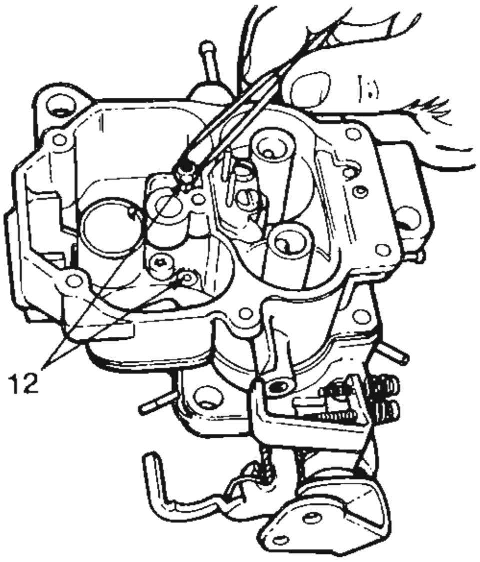
840223

Remove main metering jets (12).

Remove the venturi cluster screws. Lift the venturi cluster and gaskets away from the main body. Discard the gaskets.

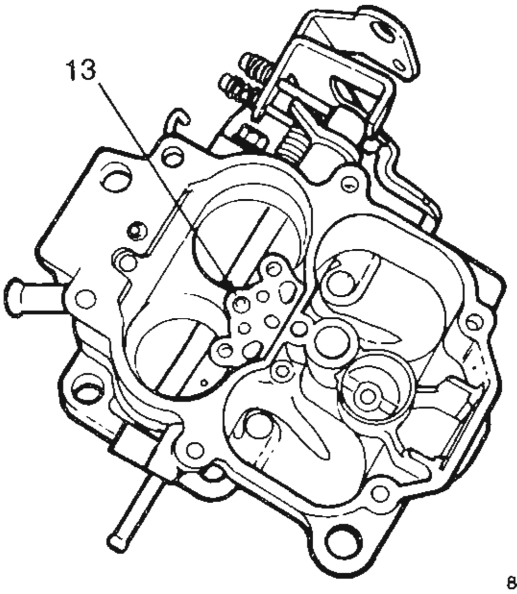
Do not remove the idle orifice tubes or main vent tubes from the cluster.

Clean the tubes with cleaning solvent and dry with compressed air.



840224

Invert the carburetor main body and drop out the accelerator pump discharge check valve ball (13).



840225

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.

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.

SEE
I.S.
NOTES

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.

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.

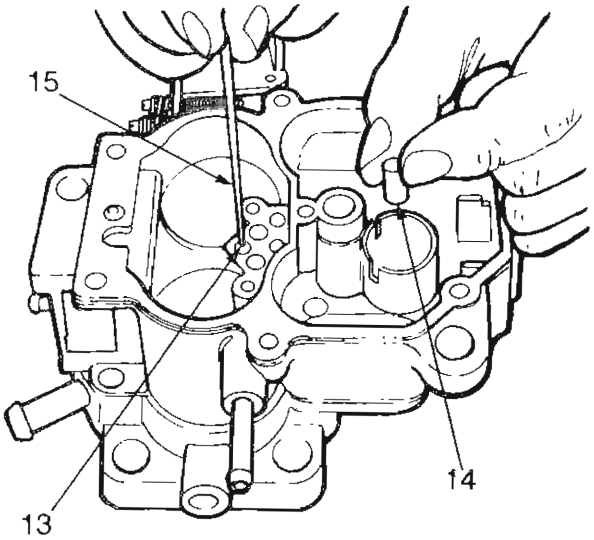
Turn the screws out the same number of turns counted and recorded during disassembly.

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 13 mm (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



840226

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.

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.

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.

SEE I.S. NOTES

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.

Service Adjustment Procedures

Float Level Adjustment

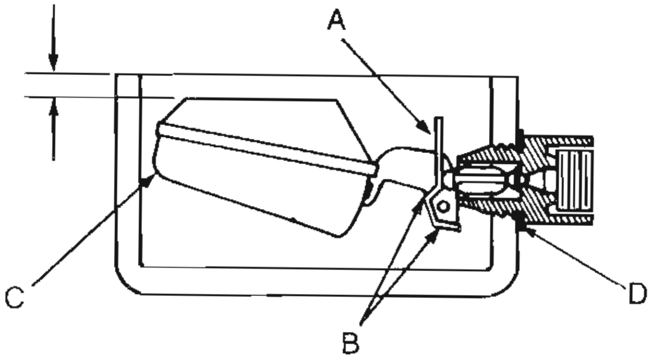
Remove the air horn.

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

60497

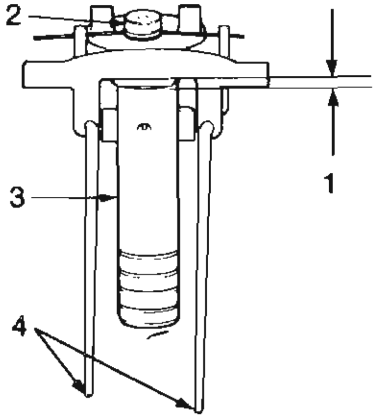
Install the air horn.

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

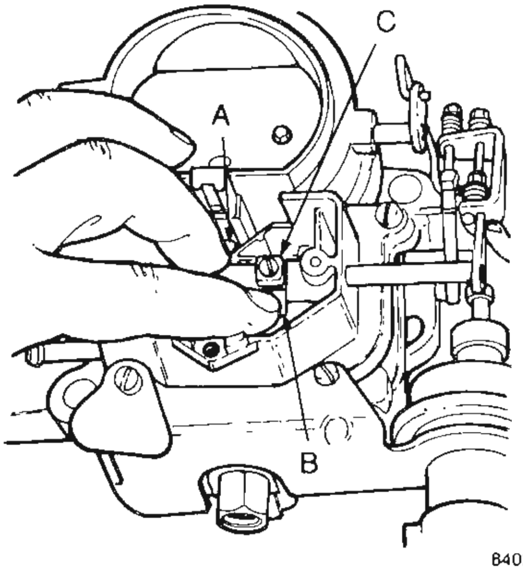
840227

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).



840228

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.

SEE I.S. NOTES

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.

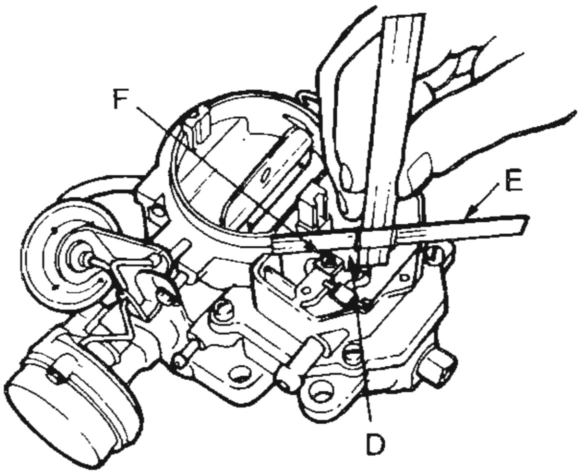
Open the choke valve so that the fast idle cam allows the throttle valves to seat in the bores.

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.



840229

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.

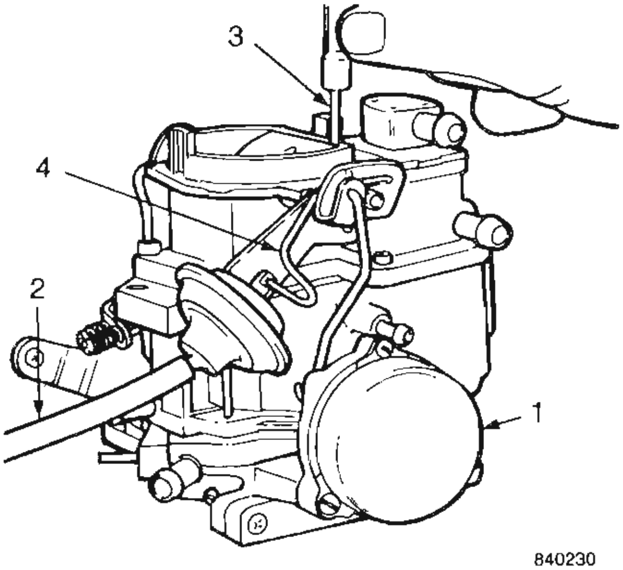
Use Tool J-23738 or any vacuum source that provides vacuum of at least 64 kPa (19 in. Hg) and apply vacuum to force the diaphragm against the stop (2).

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.



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).

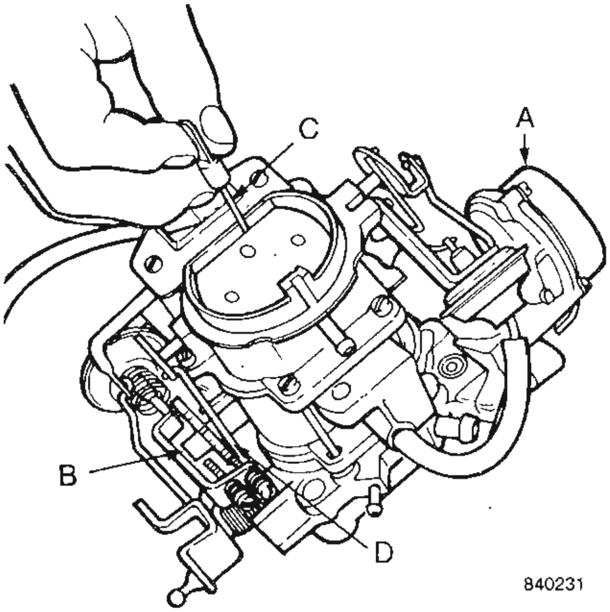
Measure the distance between the choke valve and the air horn wall with a plug gauge (C). Refer to the Specifications chart for the correct dimension.

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.



SEE I.S. NOTES

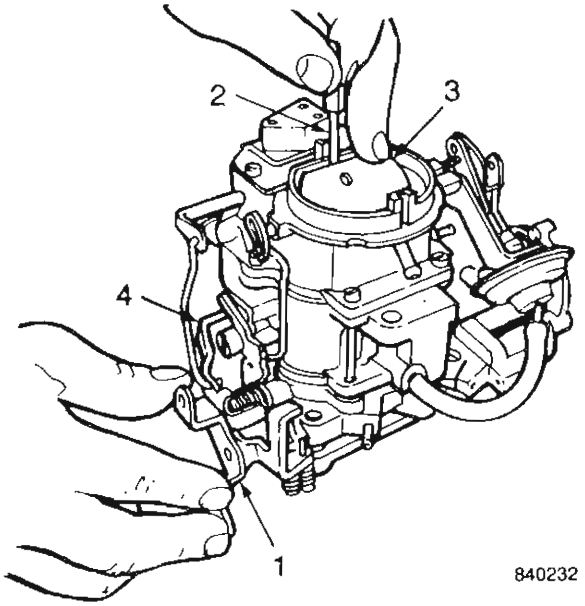
Choke Unloader Adjustment

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.



Fuel Bowl Vent Adjustment

This is not a precise adjustment. It 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.

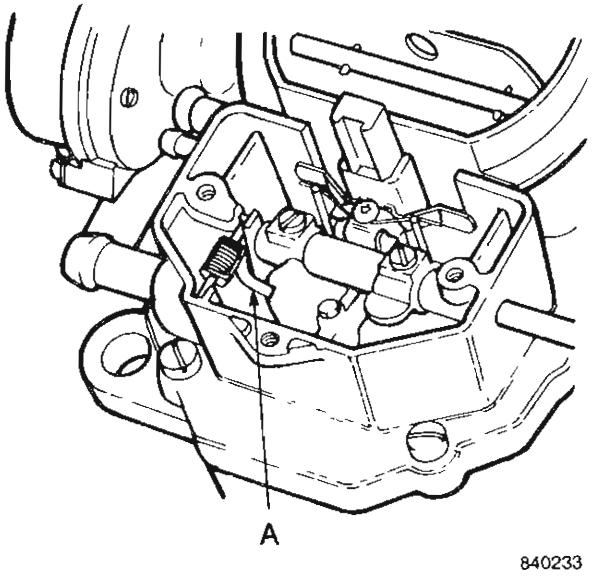
Open the throttle and position the fast idle speed adjustment screw on the high step of the cam.

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.

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).

SEE I.S. NOTES

SEE I.S. NOTES

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 Vacuum Pump Tool J-23738, or equivalent.

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.

Turn the mixture screw(s) richer (counterclockwise) 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.

SEE I.S. NOTES

SEE I.S. NOTES

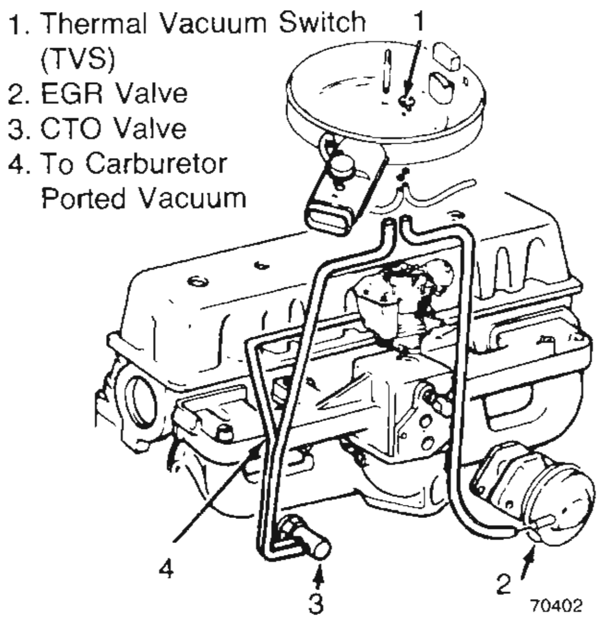
GENERAL

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

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.

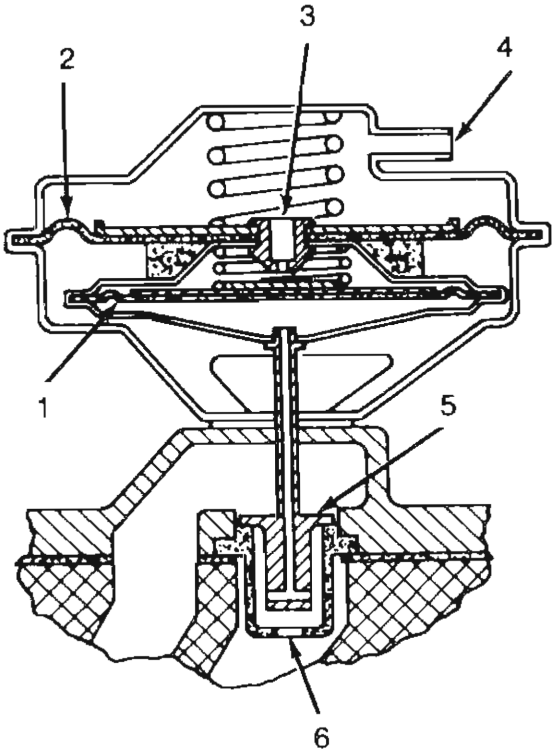
Visually inspect the exhaust system if leaks are suspected.

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.

A distinct movement should be noticed in the EGR valve control diaphragm (1).



1. Control Diaphragm
2. Power Diaphragm
3. Vent Valve
4. Vacuum Hose Nipple
5. Pintle
6. Control Flow Area

840237

If the diaphragm does not move, the probable causes are:

- a defective vacuum hose to the EGR valve
- a defective EGR valve diaphragm
- a 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.

SEE I.S. NOTES

Replacement

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.

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.

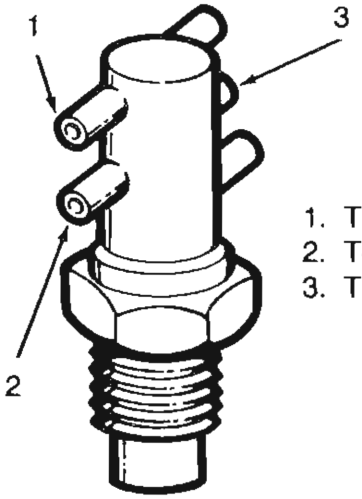
EGR SYSTEM CTO VALVE

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

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.

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.

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.

Replacement

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.

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.

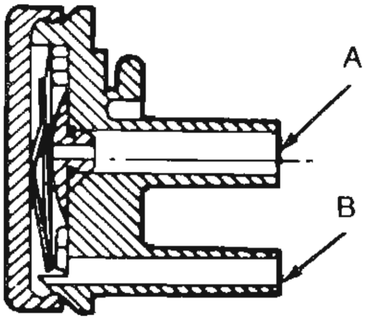
SEE I.S. NOTES

SEE I.S. NOTES

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.



A - To EGR - CTO Valve
B - To EGR Valve

90756

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.

Replacement

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.

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.

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 61 cm (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.

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

90840

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.

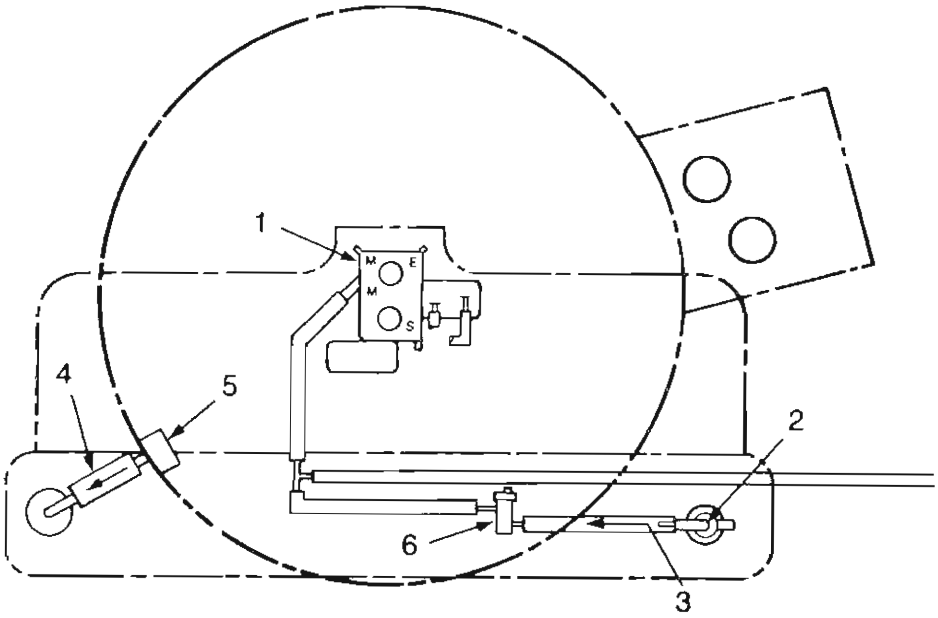
Replace the delay valve if the functional test indicated it to be defective. Otherwise, install the delay valve in its original position.

SEE
I.S.
NOTES

SEE I.S. NOTES

GENERAL

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 the air cleaner housing.



1. Carburetor
2. PCV Valve
3. PCV Air Out
4. PCV Air In
5. PCV Filter
6. PCV Solenoid

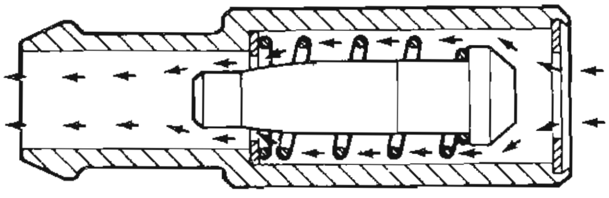
840239

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.

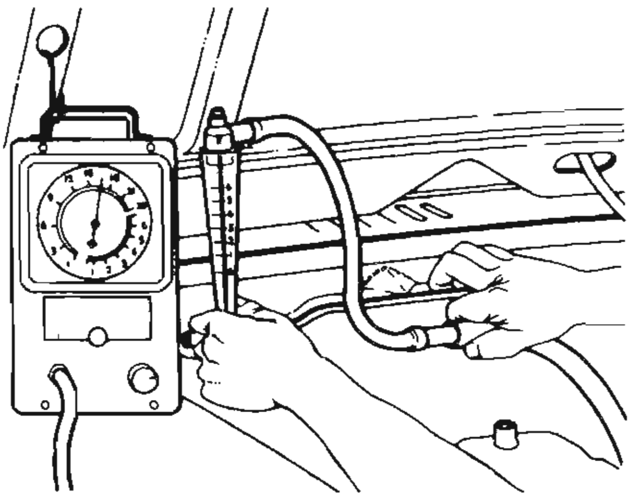


42017

Remove the valve from the grommet in the cylinder head cover.

Connect the plastic hose of PCV Valve Tester J-23111 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.



80009

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)

90751

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.

PCV AIR INLET FILTER MAINTENANCE

SEE I.S. NOTES

Perform the air inlet filter maintenance at the intervals specified in the Maintenance Schedule.

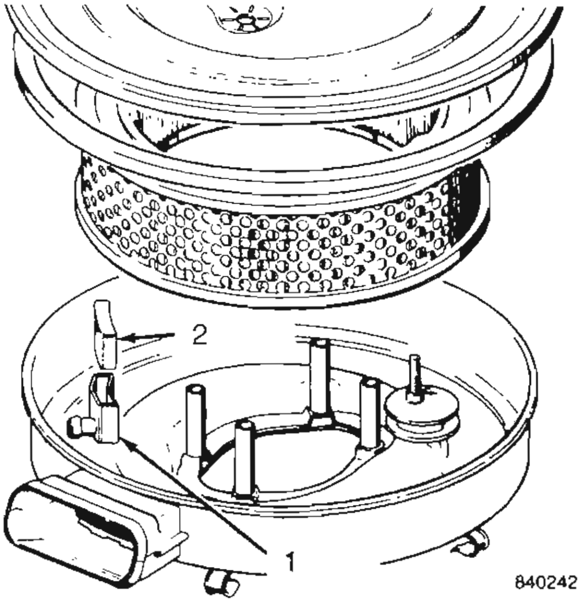
Replacement

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.

Replace or clean the filter and retainer in kerosene.

Install the filter and retainer in the air cleaner housing.



SEE
I.S.
NOTES

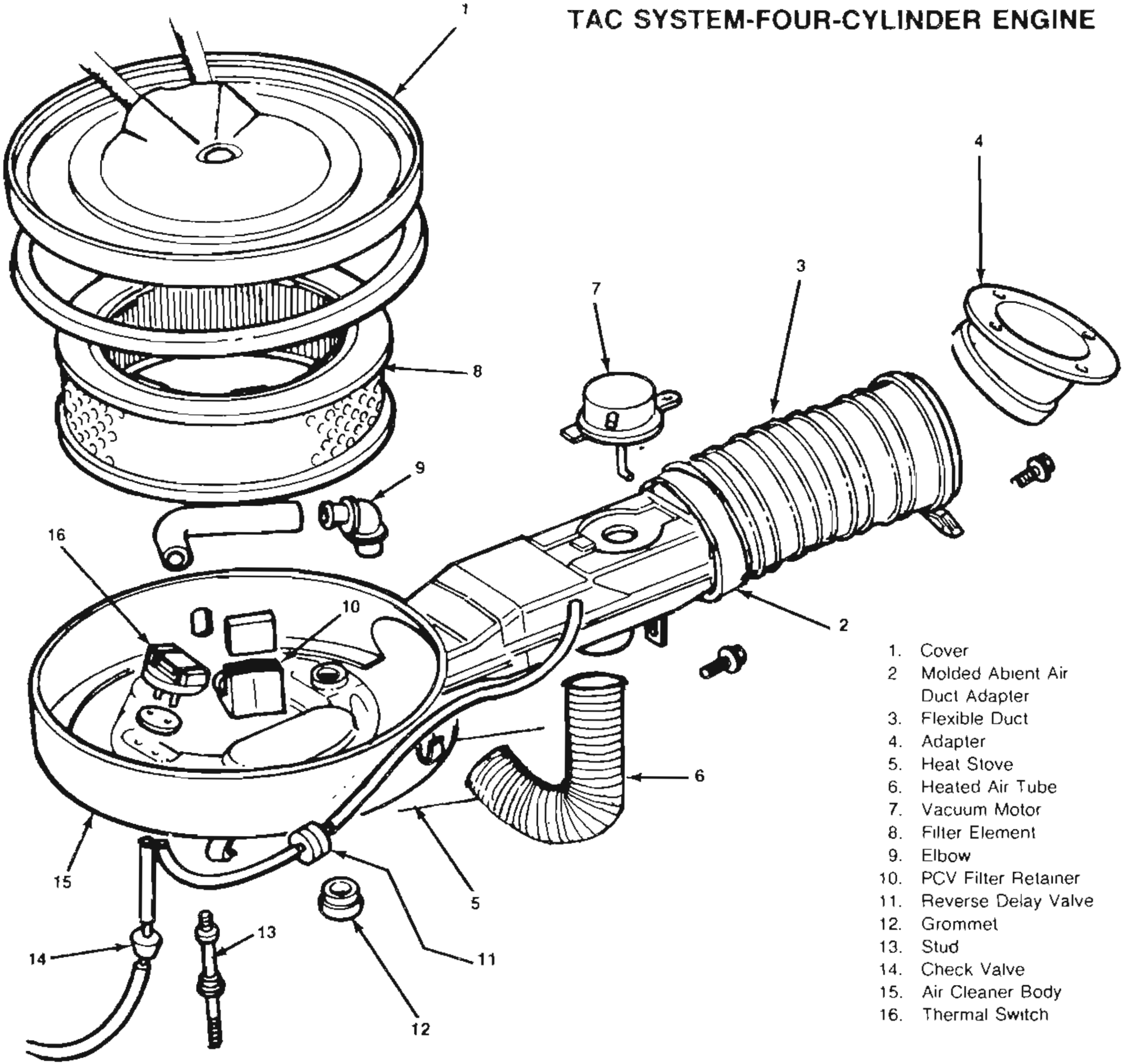
GENERAL

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.

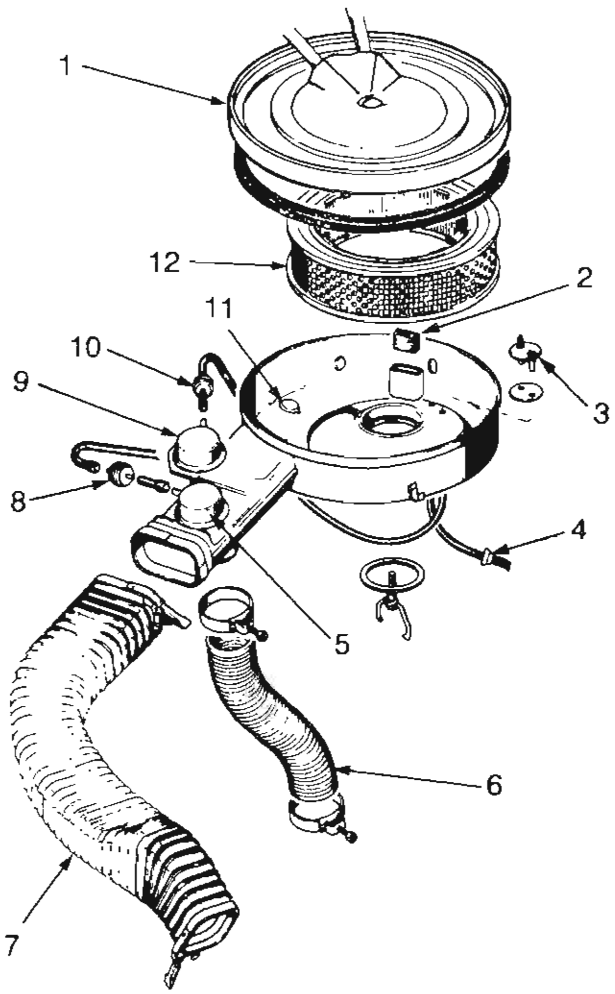
SEE I.S. NOTES

TAC SYSTEM-FOUR-CYLINDER ENGINE



1. Cover
2. Molded Abient Air Duct Adapter
3. Flexible Duct
4. Adapter
5. Heat Stove
6. Heated Air Tube
7. Vacuum Motor
8. Filter Element
9. Elbow
10. PCV Filter Retainer
11. Reverse Delay Valve
12. Grommet
13. Stud
14. Check Valve
15. Air Cleaner Body
16. Thermal Switch

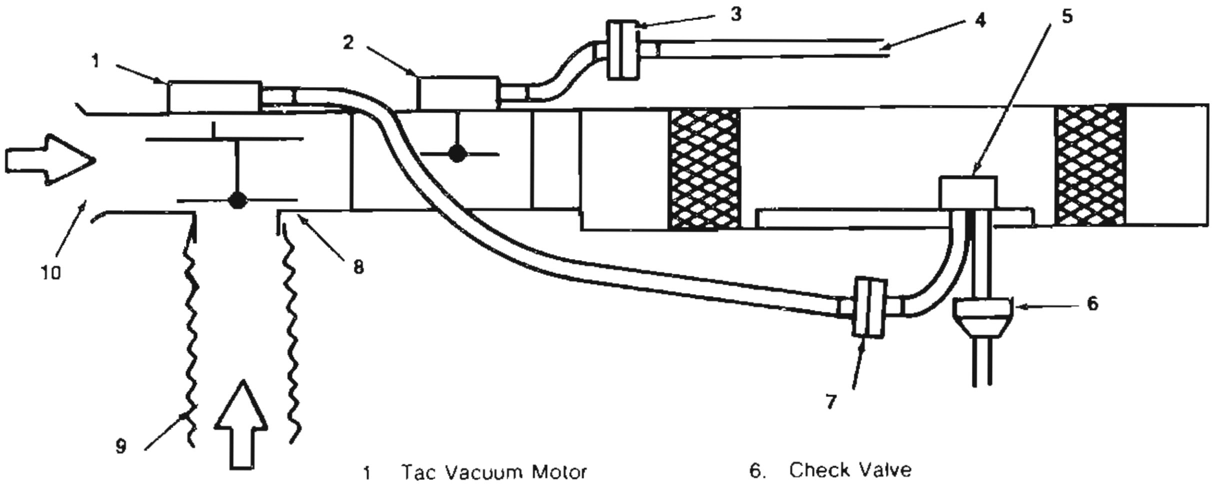
TAC SYSTEM – SIX-CYLINDER ENGINE



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

85037

SEE I.S. NOTES



1. Tac Vacuum Motor
2. Trap Door Vacuum Motor
3. Reverse Delay Valve
4. Vacuum Source
5. Thermal Switch
6. Check Valve
7. Reverse Delay Valve
8. Air Valve
9. Heated Air
10. Ambient Air

85038

TAC SYSTEM FUNCTIONAL TESTS

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 start the engine.

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.

Replacement

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.

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.

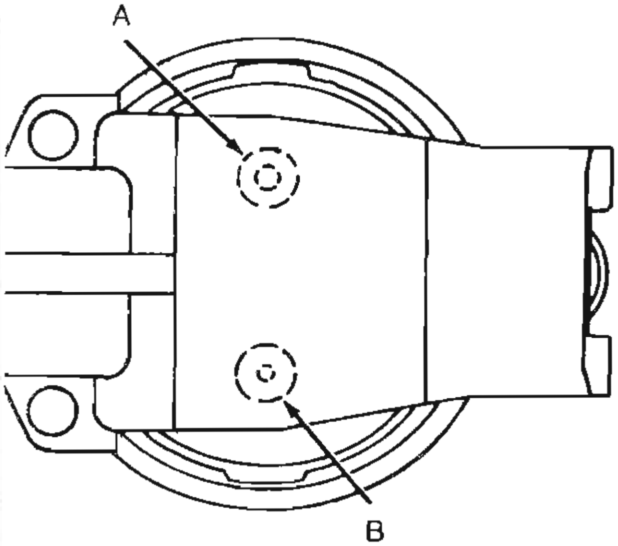
Replacement

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.

SEE I.S. NOTES

Remove the air cleaner housing.

Disconnect the hoses from the switch.



A - To Vacuum Motor
B - To Vacuum Source

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.

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.

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.

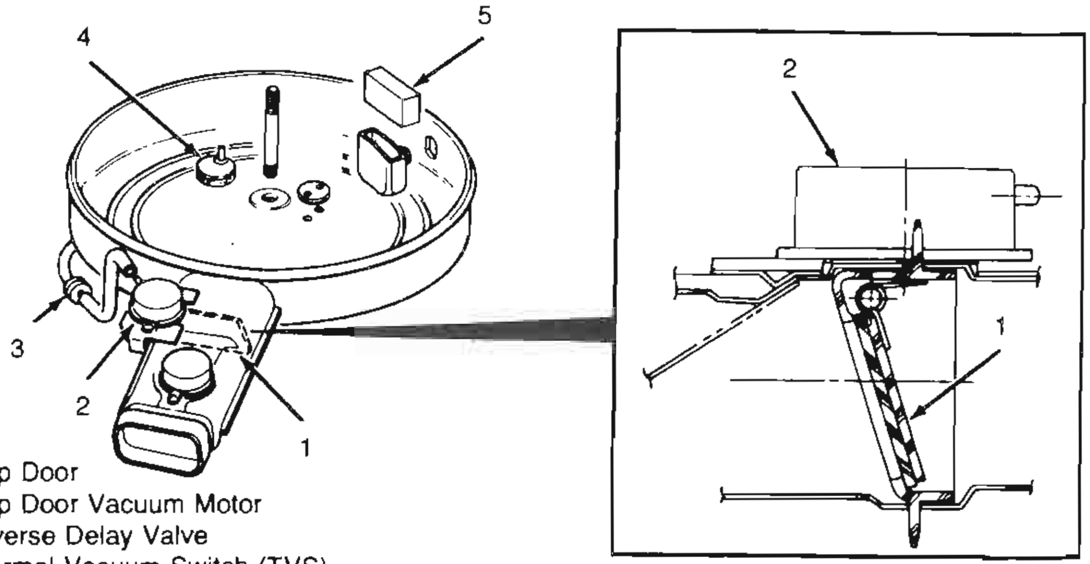
If the door does not open, apply vacuum directly to the vacuum motor (2) on air cleaner intake duct.

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.

SEE
I.S.
NOTES



1. Trap Door
2. Trap Door Vacuum Motor
3. Reverse Delay Valve
4. Thermal Vacuum Switch (TVS)
5. PCV Filter

840245

If the vacuum hose in 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 Replacement

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.

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.

COMPUTERIZED EMISSION CONTROL (CEC) FUEL FEEDBACK SYSTEMS

The CEC Feedback System for both four- and 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.

Each system uses the microcomputer 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.

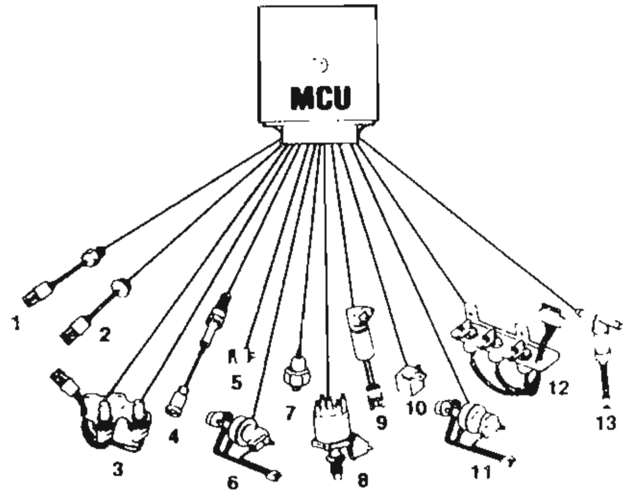
It continues to operate the system and the output components in the open loop mode until such time when the engine operating conditions indicate that the closed loop mode of operation is appropriate.

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.



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. Closed Throttle Switch (Four-Cylinder Engine)
7. Knock Sensor
8. Distributor
9. Mixture Control Solenoid-Stepper Motor
10. Idle Relay
11. Sole-Vac Throttle Positioner
12. Upstream and Downstream Solenoids
13. PCV Solenoid

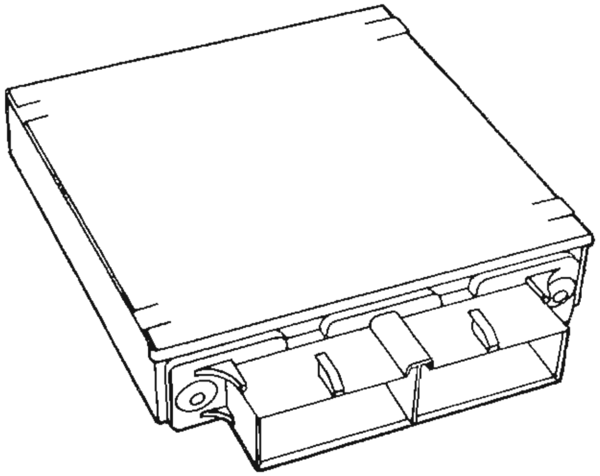
85046

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.



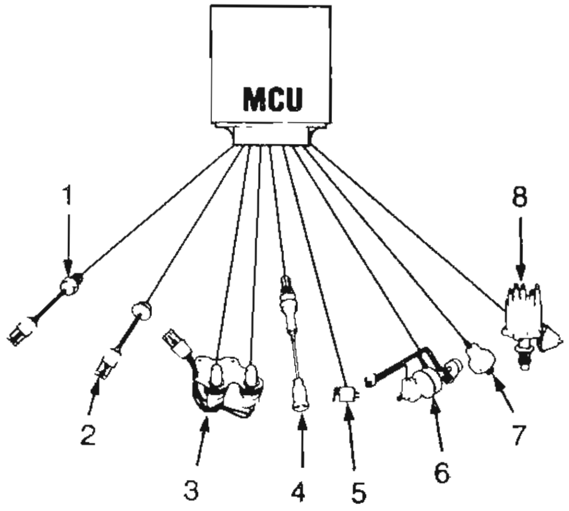
85050

SEE
I.S.
NOTES

SEE I.S. NOTES

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. Closed Throttle Switch (Four-Cylinder Engine)
7. Knock Sensor
8. Distributor

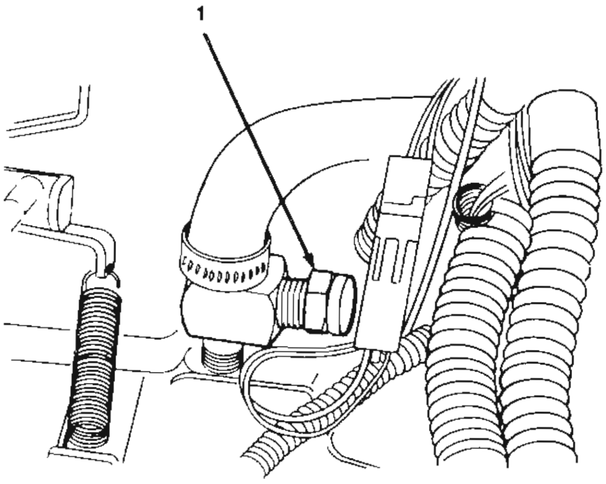
85051

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 135°F (57°C), the switch is open, indicating a cold engine condition. When the engine coolant is sufficiently warmed, 135°F (57°C) and above, the switch closes.

NOTE: The switching temperatures are nominal values.



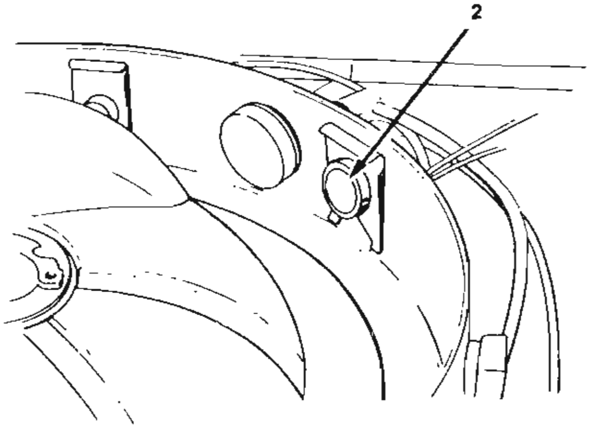
85052

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 50°F (10°C).

Above 65°F (18°C), it provides an open circuit to indicate a warm engine start-up condition to the MCU.



Four-and Ten-Inch Hg Vacuum Switches

The 4-inch Hg (3A) (ported vacuum) and 10-inch Hg (3B) (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.

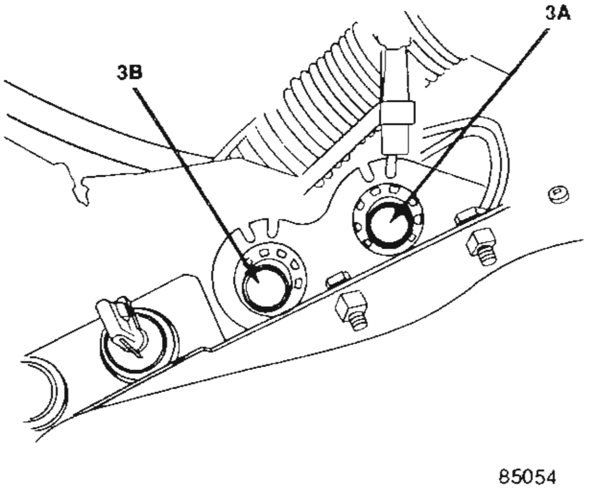
The 4-inch Hg vacuum switch is controlled by ported vacuum. Its electrical contact is normally in the open position when the vacuum level is less than 4 inch Hg. When the vacuum level is 4 inch Hg or greater, the switch closes.

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.



SEE I.S. NOTES

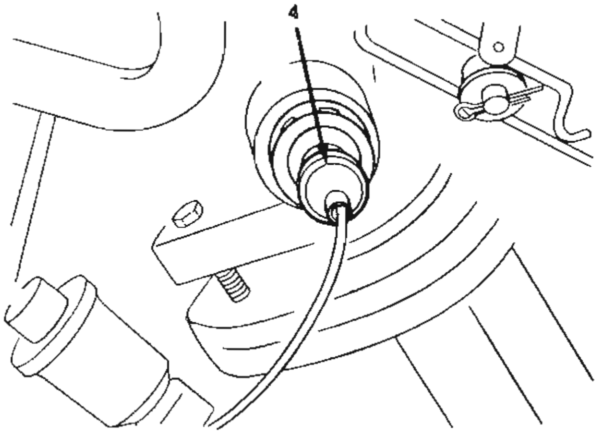
Oxygen Sensor

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.



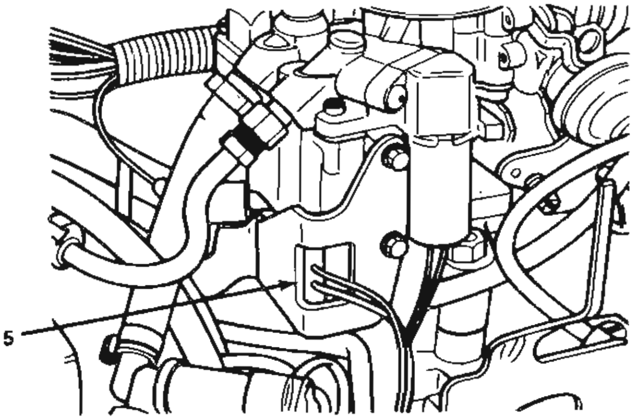
85055

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.



85056

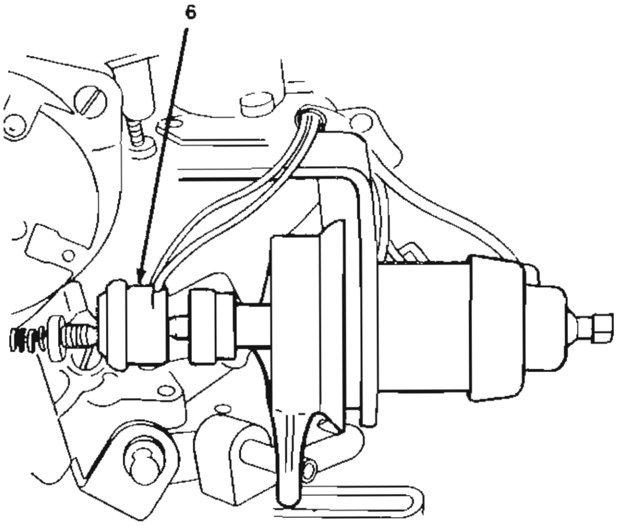
SEE I.S. NOTES

Closed Throttle Switch (Four-Cylinder Engine)

The closed throttle switch (6) is integral with the Sole-Vac throttle positioner.

It is an electrical switch that is attached to the vacuum actuator portion of the Sole-Vac.

When the throttle is in the closed position, the switch indicates a closed throttle condition to the MCU.

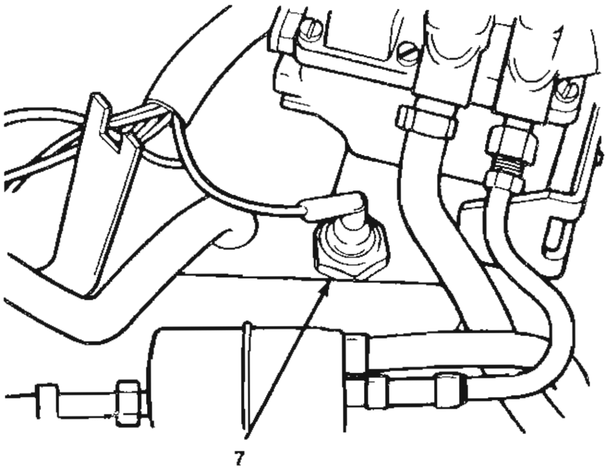


85057

Knock Sensor

The knock sensor (7) is a tuned piezoelectric crystal transducer that is located in the cylinder head.

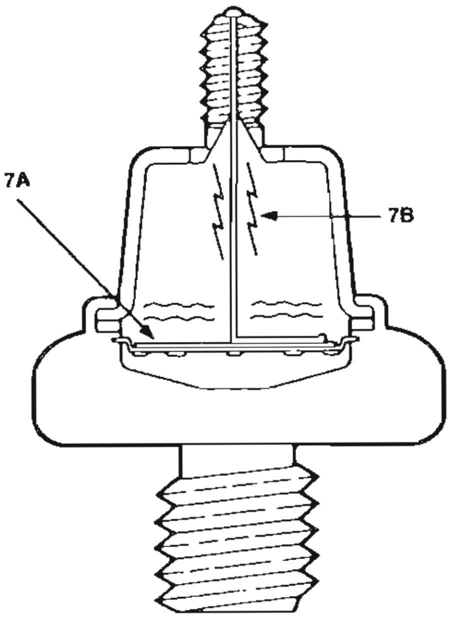
The knock sensor provides the MCU with an electrical voltage that is produced by oscillations that correspond to its center frequency (5,550 Hz).



85058

Vibrations from engine knock (ping) causes the crystal (7A) inside the sensor to oscillate and produce the electrical voltage (7B).

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

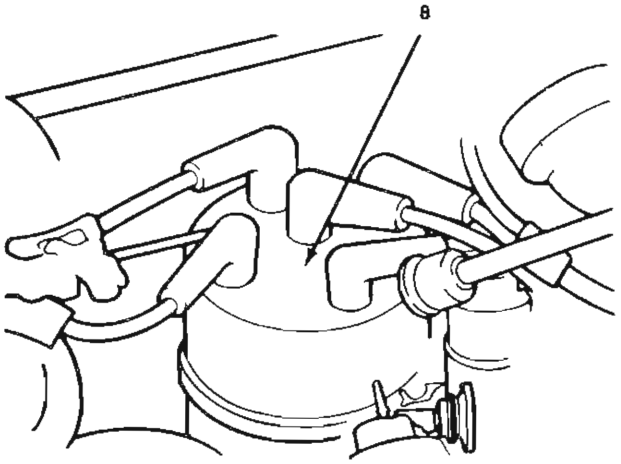
The MCU also changes the ignition timing according to the engine speed (tach) voltage input provided by the distributor (8).

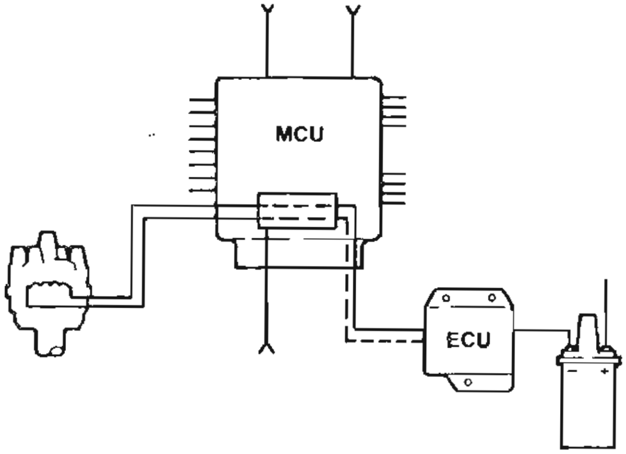
SEE I.S. NOTES

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.





85060

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.

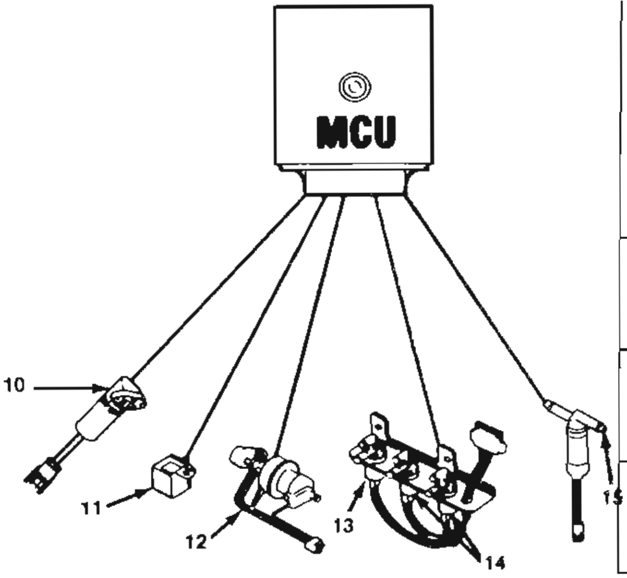
The jumper wire is normally not connected to engine ground. For vehicles operated above 6 400 meters (4,000 feet), the jumper wire must be connected to engine ground.

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.

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

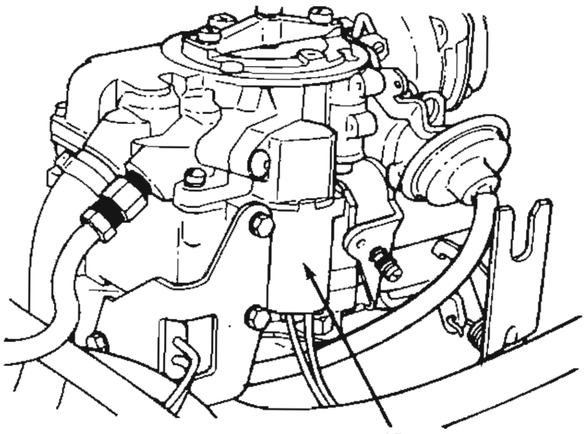
85062

SEE I.S. NOTES

Mixture Control Solenoid (Four-Cylinder Engine)

The Mixture Control (MC) solenoid (10) is an integral part of the Model YFA carburetor.

The MCU operates the MC solenoid to provide the proper air/fuel ratio by controlling the amount of air allowed to mix with the fuel.



85063

During open loop operation, the air supplied by the MC solenoid is pre-programmed.

During closed loop operation, the MCU operates the MC solenoid in reaction to the input from the oxygen (O_2) sensor and the other MCU inputs (i.e., engine operating conditions) to provide additional or less air for the air/fuel mixture.

Air from the solenoid is distributed to the carburetor idle circuit and main metering circuit where it mixes with the fuel.

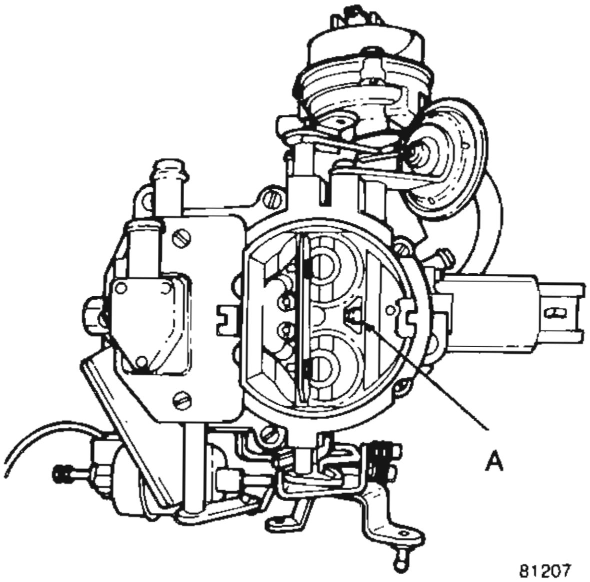
Stepper Motor (Six-Cylinder Engine)

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.



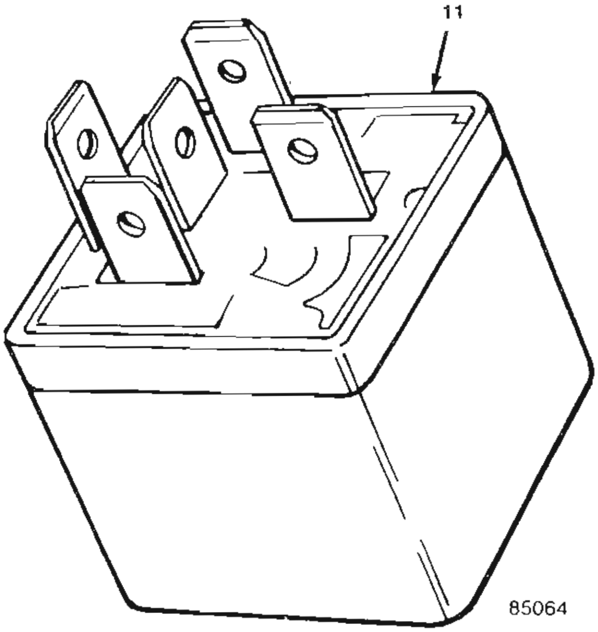
81207

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

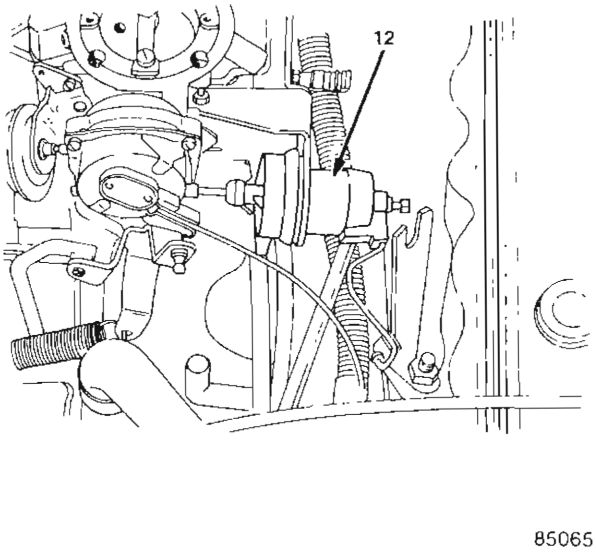
The Sole-Vac throttle positioner (12) is attached to the carburetor.

The Sole-Vac throttle positioner consists of a closed throttle switch, a holding solenoid and a vacuum actuator.

The holding solenoid maintains the throttle position.

The vacuum actuator provides additional engine idle speed when the air conditioner is in use (six-cylinder engine only).

The vacuum actuator is also activated during deceleration and if the steering wheel is turned to the full-stop position for vehicles equipped with power steering (four-cylinder engine only).



SEE I.S. NOTES

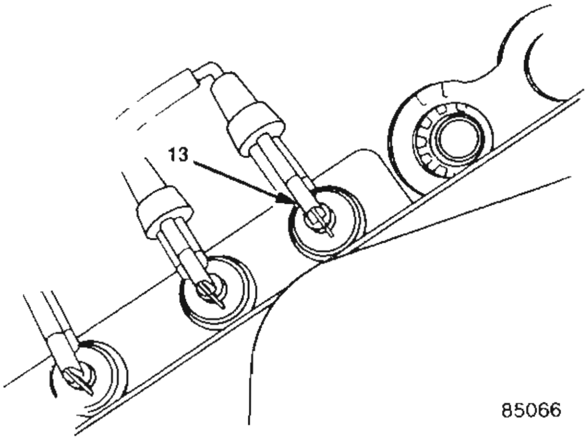
Idle Solenoid

The idle solenoid is located on the same bracket as are the upstream and downstream solenoids (Pulse Air System).

The bracket is located on the left front inner fender panel (four-cylinder engine) and on top of the cylinder head cover (six-cylinder engine).

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.

The idle solenoid is identified by the red connecting wires.



Upstream and Downstream Solenoids

The upstream and downstream solenoids (Pulse Air System) distribute air to the exhaust pipe and catalytic converter.

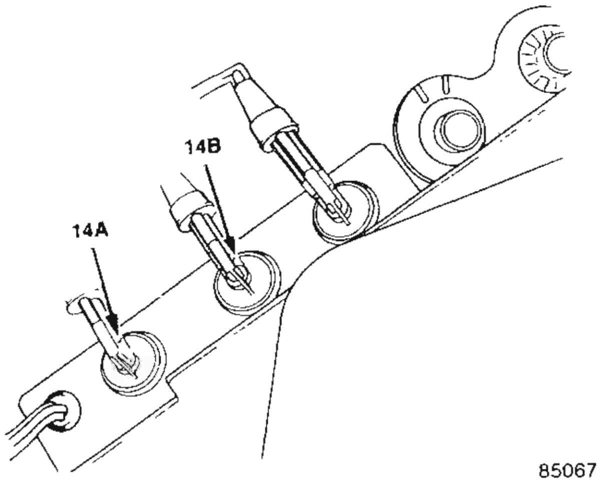
The upstream (14A) and downstream (14B) solenoids are located on a bracket attached to the left inner front fender panel (four-cylinder engine) and on top of the cylinder head cover (six-cylinder engine).

The idle solenoid is also located on the same bracket.

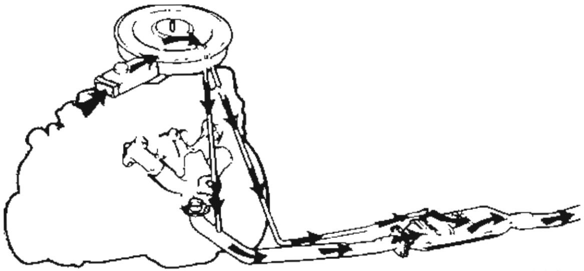
The upstream and downstream solenoids are energized by the MCU. The MCU energizes the upstream solenoid to route air into the exhaust pipe at a location after the oxygen sensor.

When energized by the MCU, the downstream solenoid routes air into the second bed of the dual-bed catalytic converter (TWC-COC).

The additional air routed into the system by the solenoids reacts with the exhaust gases to reduce undesirable emissions.



85067



85068

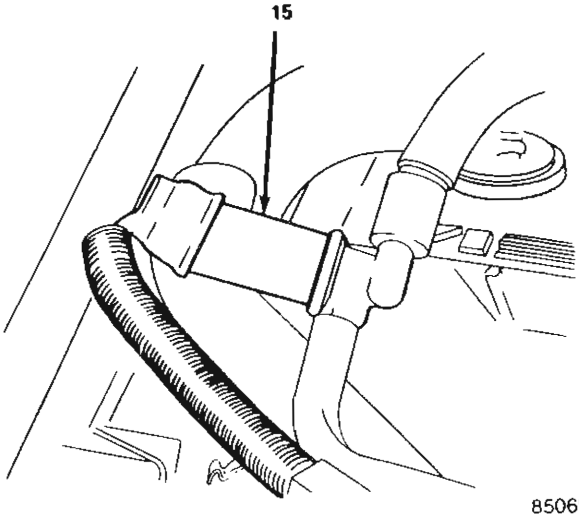
Positive Crankcase Ventilation (PCV) Valve Shut-Off Solenoid

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 anti-diesel relay system (four-cylinder engine only) is designed to prevent engine dieseling. The system consists of an anti-diesel relay and an anti-diesel delay relay.

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

SEE I.S. NOTES

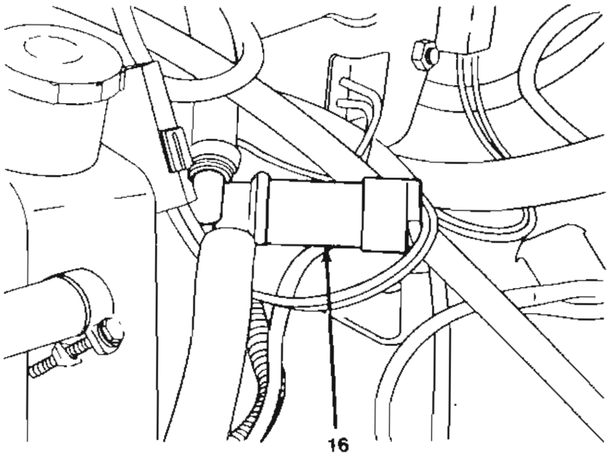
SEE I.S. NOTES

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.

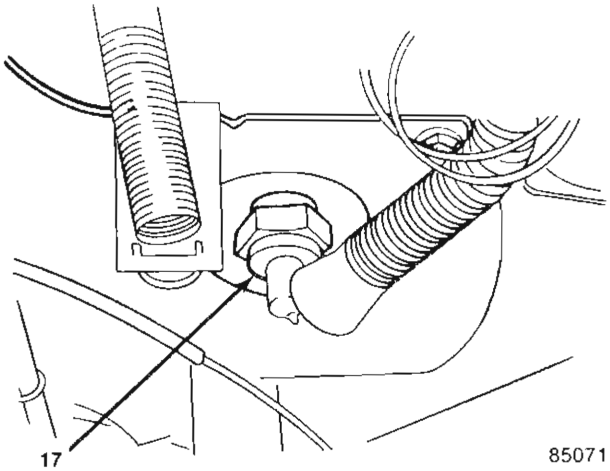


Intake Manifold Heater Switch

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 160°F (71°C), 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.



Operation

Each CEC Fuel Feedback System has four modes of operation.

- key-on
- start-up
- warm-up
- cruise

Key-On Mode

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 relay (four-cylinder engine only)

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)
- 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 135°F (57°C)
- wide-open throttle switch open
- thermal electric switch opens at 65°F (18°C)
- closed throttle switch closed (four-cylinder engine only)

SEE I.S. NOTES

SEE I.S. NOTES

- manifold heater switch opens at 160°F (71°C) (the manifold heater is off)

- mixture control (MC) solenoid or stepper motor controlled by the MCU to provide a preprogrammed 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 vacuum actuator activated if the air conditioner is in operation (six-cylinder engine only); also activated during deceleration or if the steering wheel is turned to full-stop position for vehicles equipped with power steering (four-cylinder engine only)

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 (O_2) 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

- closed throttle switch indicates the throttle position (four-cylinder engine only)

- shift indicator light operated by the MCU (four-cylinder engine only) based on the inputs (when the transmission is placed in 4th gear, the 4th gear switch opens the circuit to the shift indicator light)

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.

An electronic Fuel Feedback Tester (ET-501-82 and ET-501-84) 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 0.250-inch thick and 15 inches × 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.

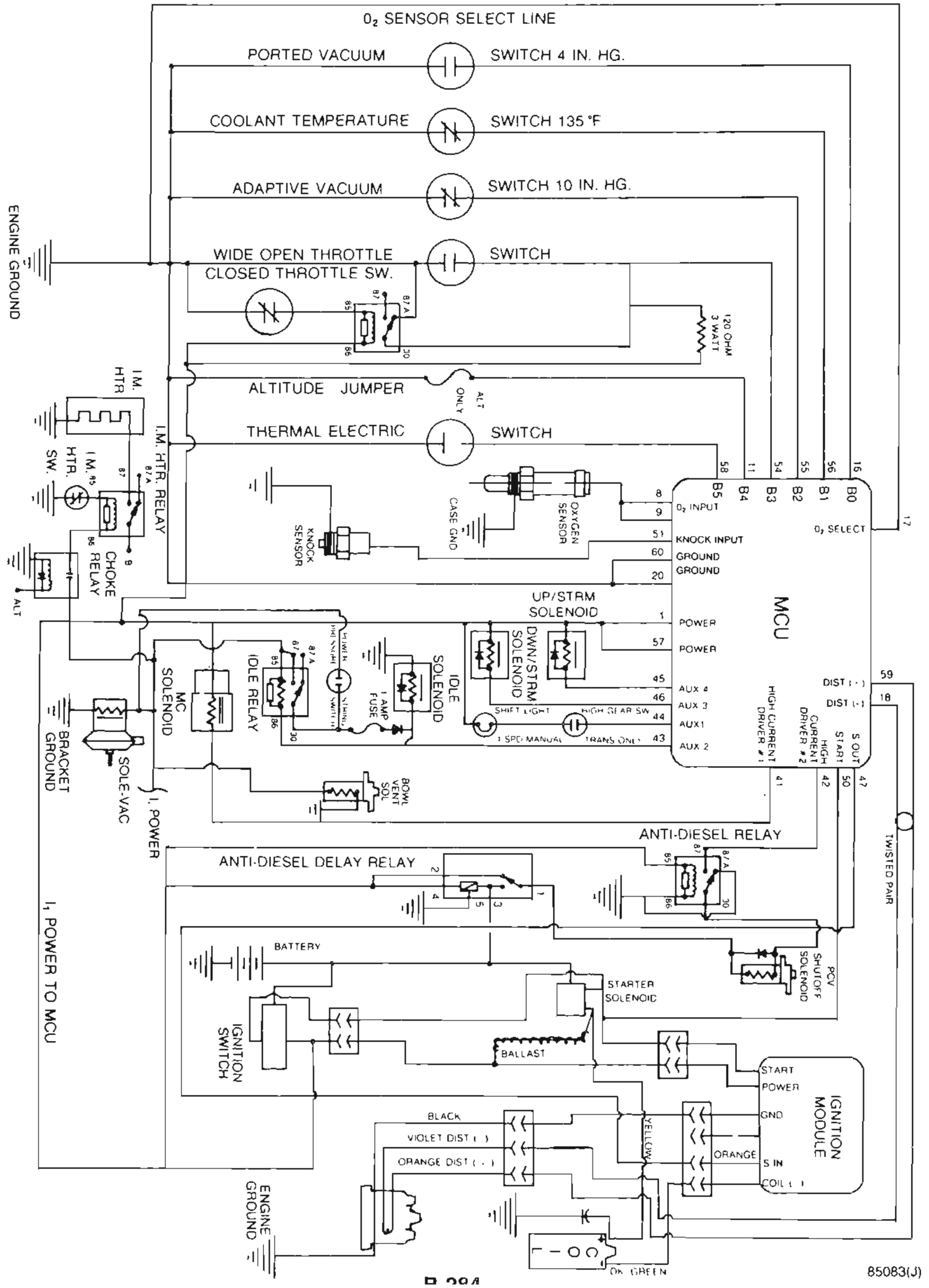
These include:

- 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

SEE I.S. NOTES

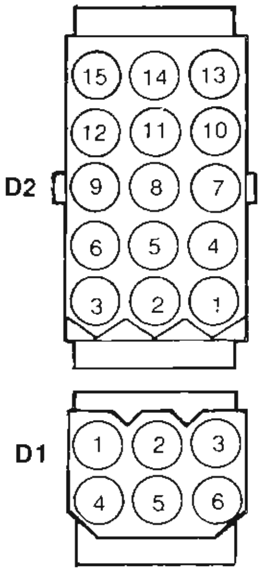
SEE I.S. NOTES

FOUR-CYLINDER ENGINE CEC SYSTEM



85083(J)

DIAGNOSTIC CONNECTORS

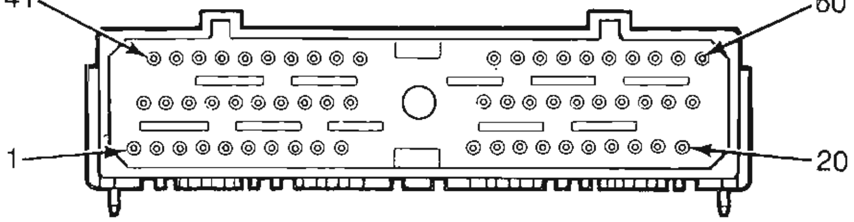


D2 Pin	Function	Definition	MCU Pin
1	PCV Shut-Off Sol.	High Current 2	42
2	Shift Light	Aux 1*	44
3	Altitude Jumper Wire	B4	11
4	I_1 Power	Power	1 & 57
5	Downstream Sol.	Aux 3	46
6	WOT Switch	B3	54
7	Ground	Ground	20 & 60
8	Upstream Sol.	Aux 4	45
9	10 In. Hg. Vac. Sw.	B2	55
10	Thermal Elect. Sw.	B5	53
11	Sole-Vac	I_3 Power	—
12	Coolant Temp. Sw.	B1	56
13	Idle Relay	Aux 2	43
14	MC Sol.	High Current 1	41
15	4 in. Hg. Vac. Sw.	B0	16

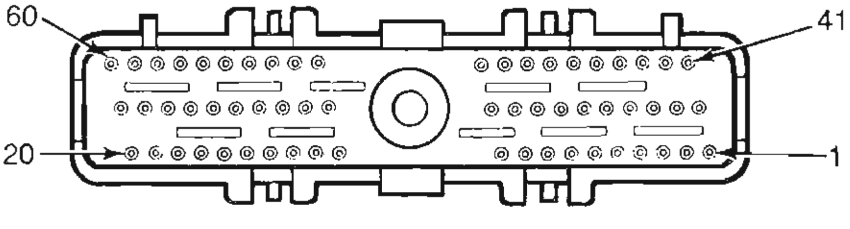
D1 Pin	Function	Definition	
1	Tach	Ign. Coil Neg.	—
2	Electric Choke	After Oil Pres. Sw.	—
3	Body Gnd.	Extra Gnd. Reference	—
4	Start	Start Circuit	47
5	Idle Solenoid	Idle Relay Voltage	—
6	Not Used		—

*NOTE: Aux 1 must be present at the diagnostic connector regardless of the presence of a shift light

MCU CONNECTOR



WIRE HARNESS CONNECTOR

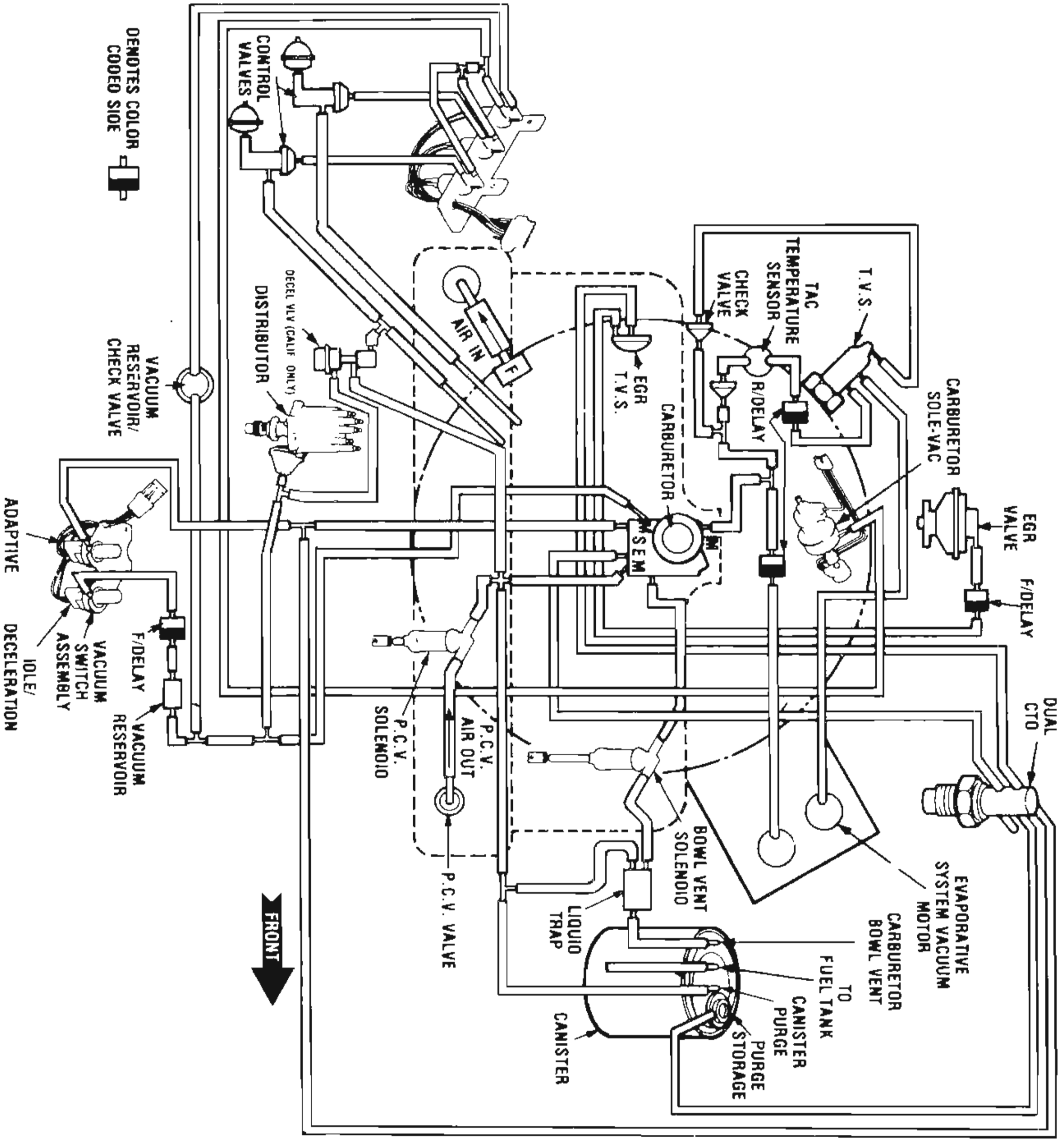


85084(J)

SEE I.S. NOTES

FOUR-CYLINDER ENGINE VACUUM DIAGRAM

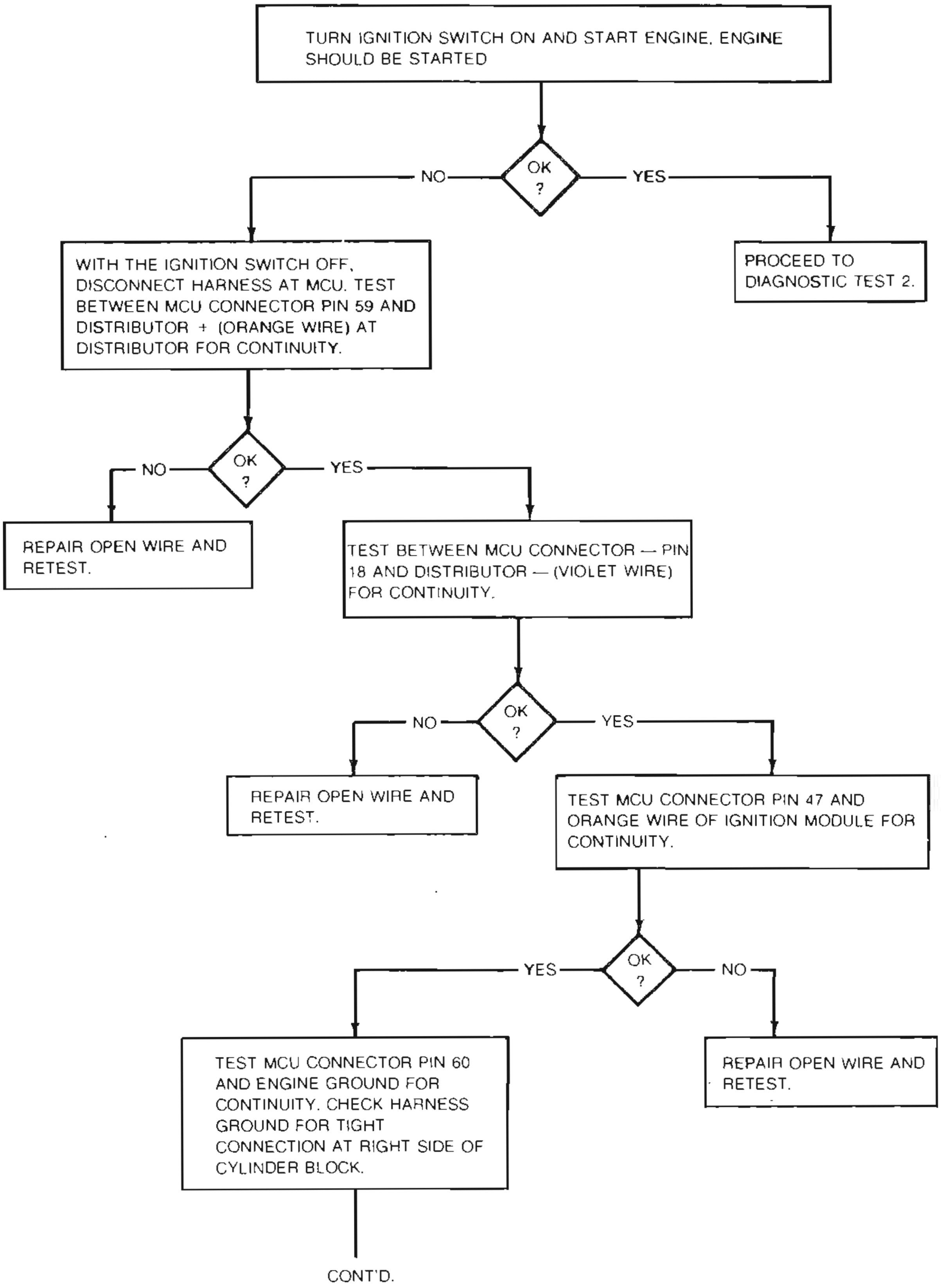
SEE
I.S.
NOTES



85085(J)

CEC SYSTEM — FOUR-CYLINDER ENGINE
DIAGNOSTIC TEST 1

OPERATIONAL TEST



TURN IGNITION SWITCH ON AND START ENGINE. ENGINE SHOULD BE STARTED

PROCEED TO DIAGNOSTIC TEST 2.

WITH THE IGNITION SWITCH OFF, DISCONNECT HARNESS AT MCU. TEST BETWEEN MCU CONNECTOR PIN 59 AND DISTRIBUTOR + (ORANGE WIRE) AT DISTRIBUTOR FOR CONTINUITY.

REPAIR OPEN WIRE AND RETEST.

TEST BETWEEN MCU CONNECTOR — PIN 18 AND DISTRIBUTOR — (VIOLET WIRE) FOR CONTINUITY.

REPAIR OPEN WIRE AND RETEST.

TEST MCU CONNECTOR PIN 47 AND ORANGE WIRE OF IGNITION MODULE FOR CONTINUITY.

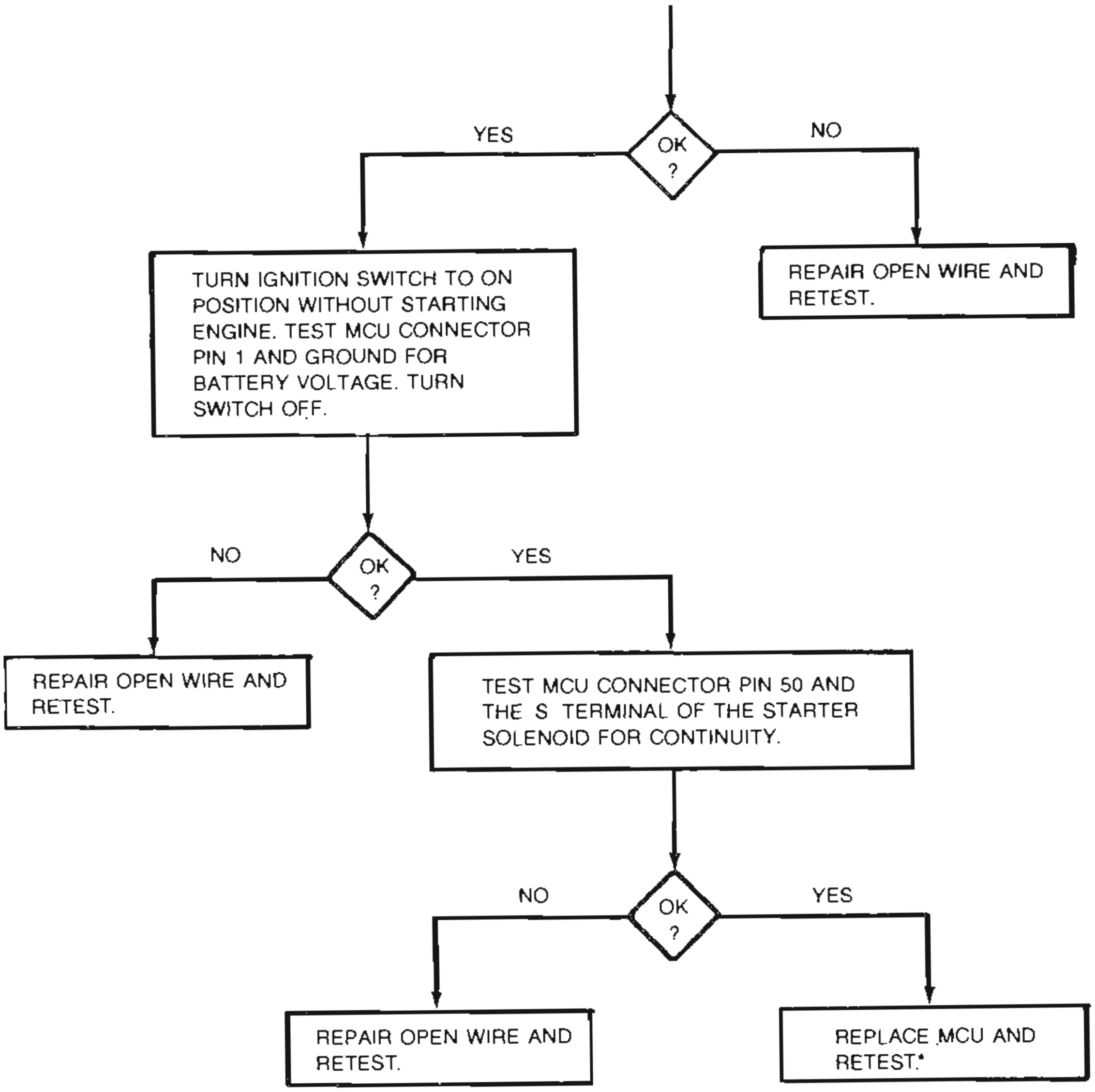
TEST MCU CONNECTOR PIN 60 AND ENGINE GROUND FOR CONTINUITY. CHECK HARNESS GROUND FOR TIGHT CONNECTION AT RIGHT SIDE OF CYLINDER BLOCK.

REPAIR OPEN WIRE AND RETEST.

83085A

SEE I.S. NOTES

CONTINUED FROM PREVIOUS PAGE



REPAIR OPEN WIRE AND RETEST.

TURN IGNITION SWITCH TO ON POSITION WITHOUT STARTING ENGINE. TEST MCU CONNECTOR PIN 1 AND GROUND FOR BATTERY VOLTAGE. TURN SWITCH OFF.

REPAIR OPEN WIRE AND RETEST.

TEST MCU CONNECTOR PIN 50 AND THE S TERMINAL OF THE STARTER SOLENOID FOR CONTINUITY.

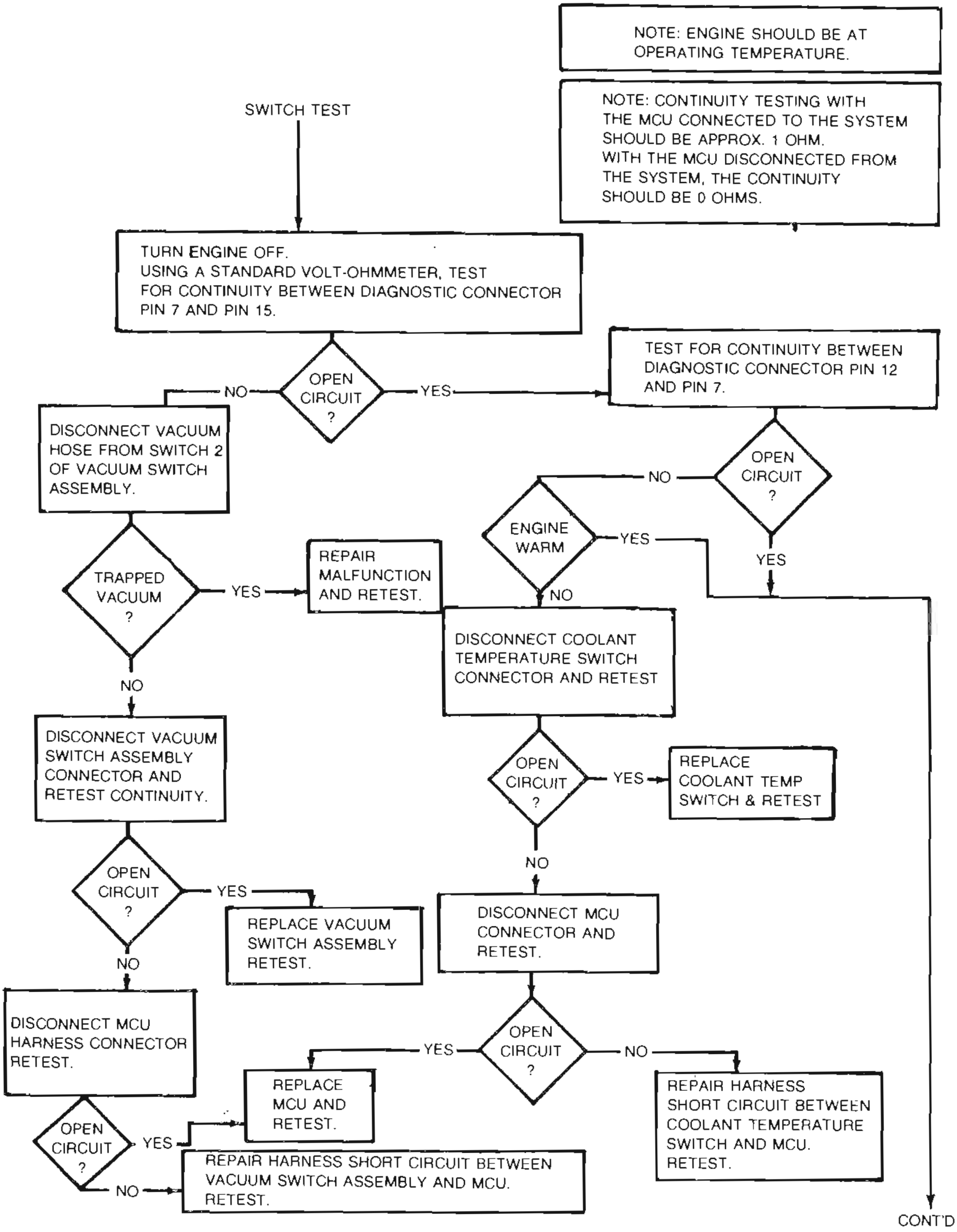
REPAIR OPEN WIRE AND RETEST.

REPLACE MCU AND RETEST.*

*NOTE: BEFORE REPLACING MCU, IF ENGINE FAILS TO START, CHECK FOR FAILURE OF IGNITION MODULE, COIL, DISTRIBUTOR, ETC. REFER TO IGNITION SYSTEMS –CHAPTER C.

83085B

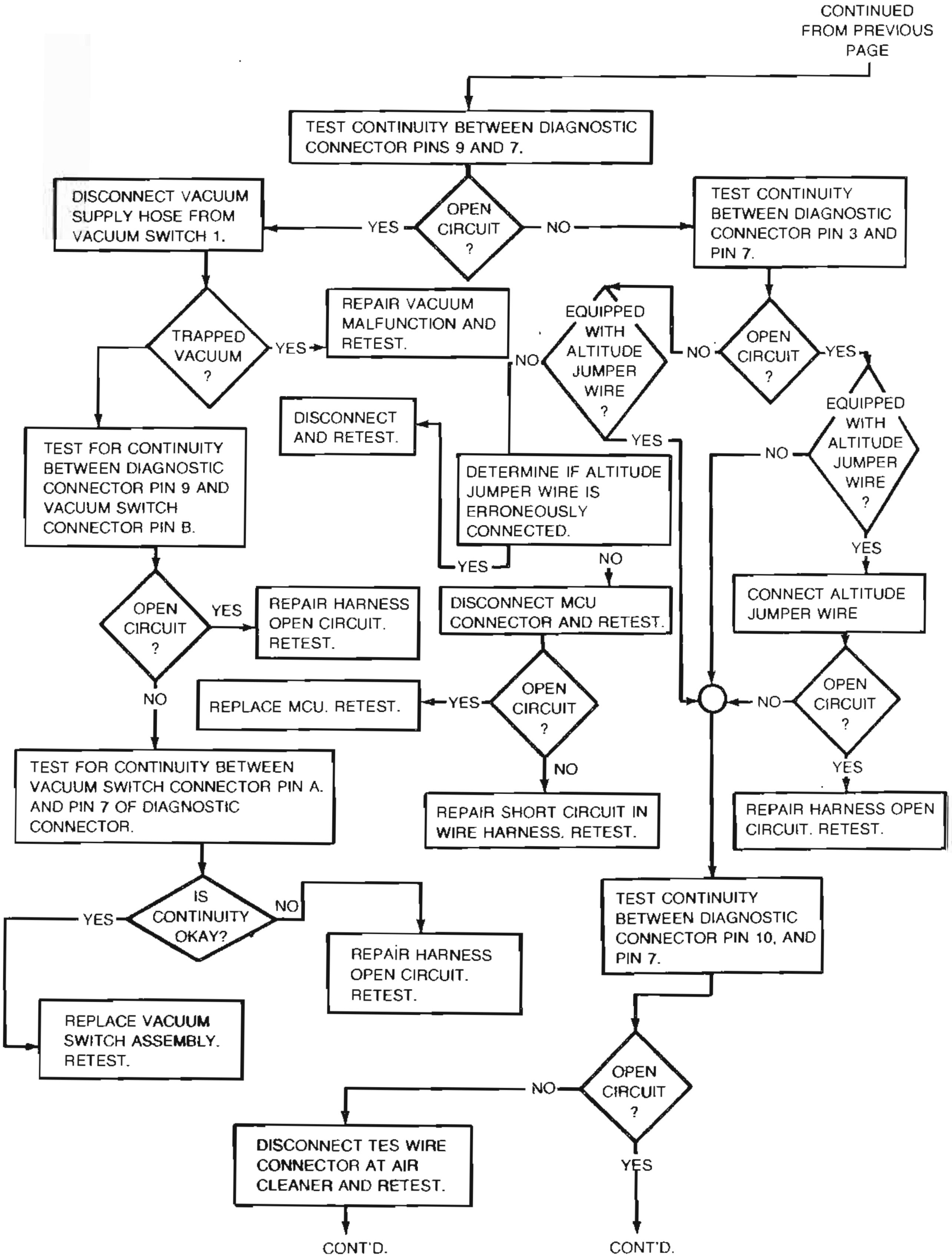
DIAGNOSTIC TEST 2



CONT'D

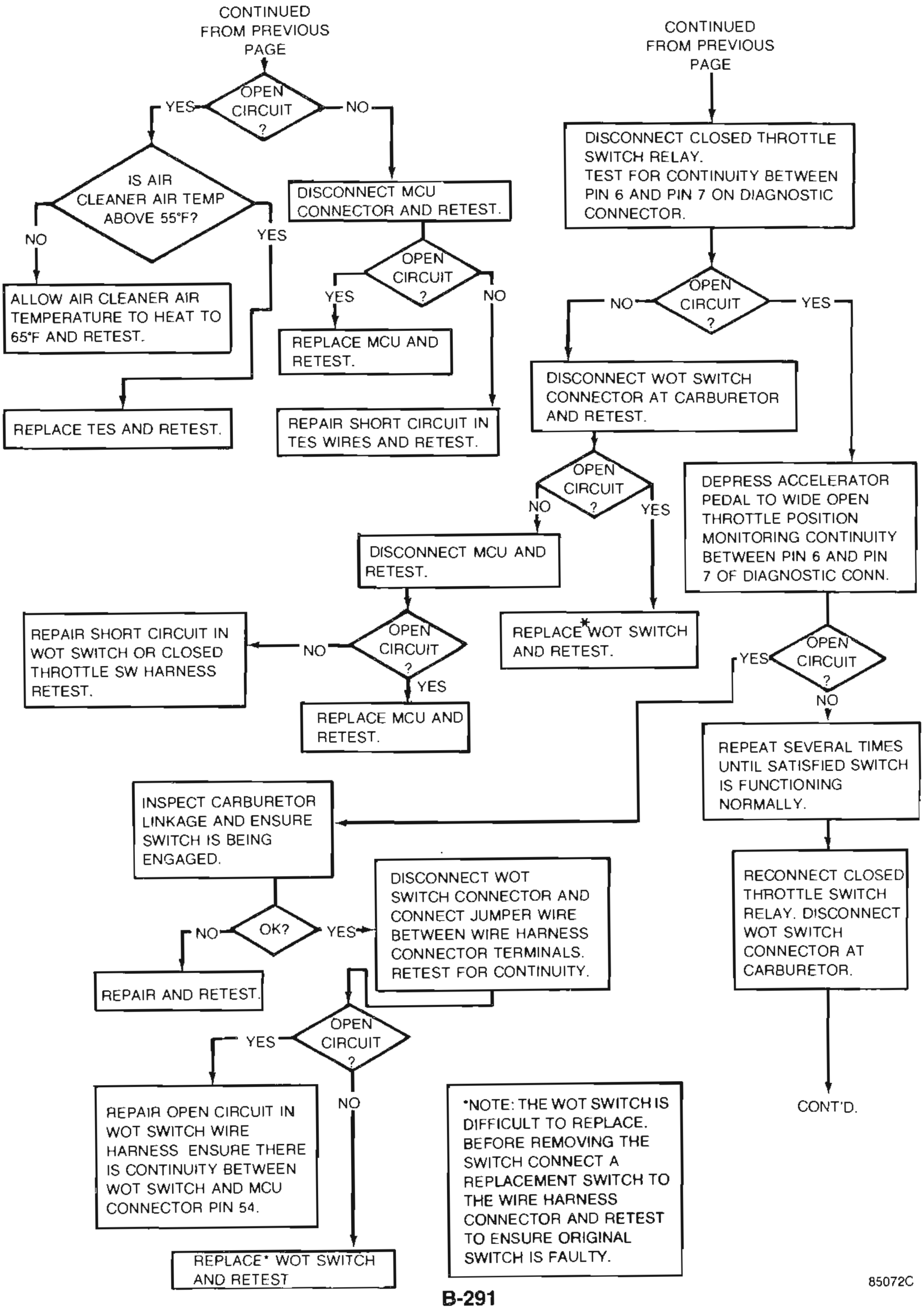
85072A

SEE I.S. NOTES



85072B

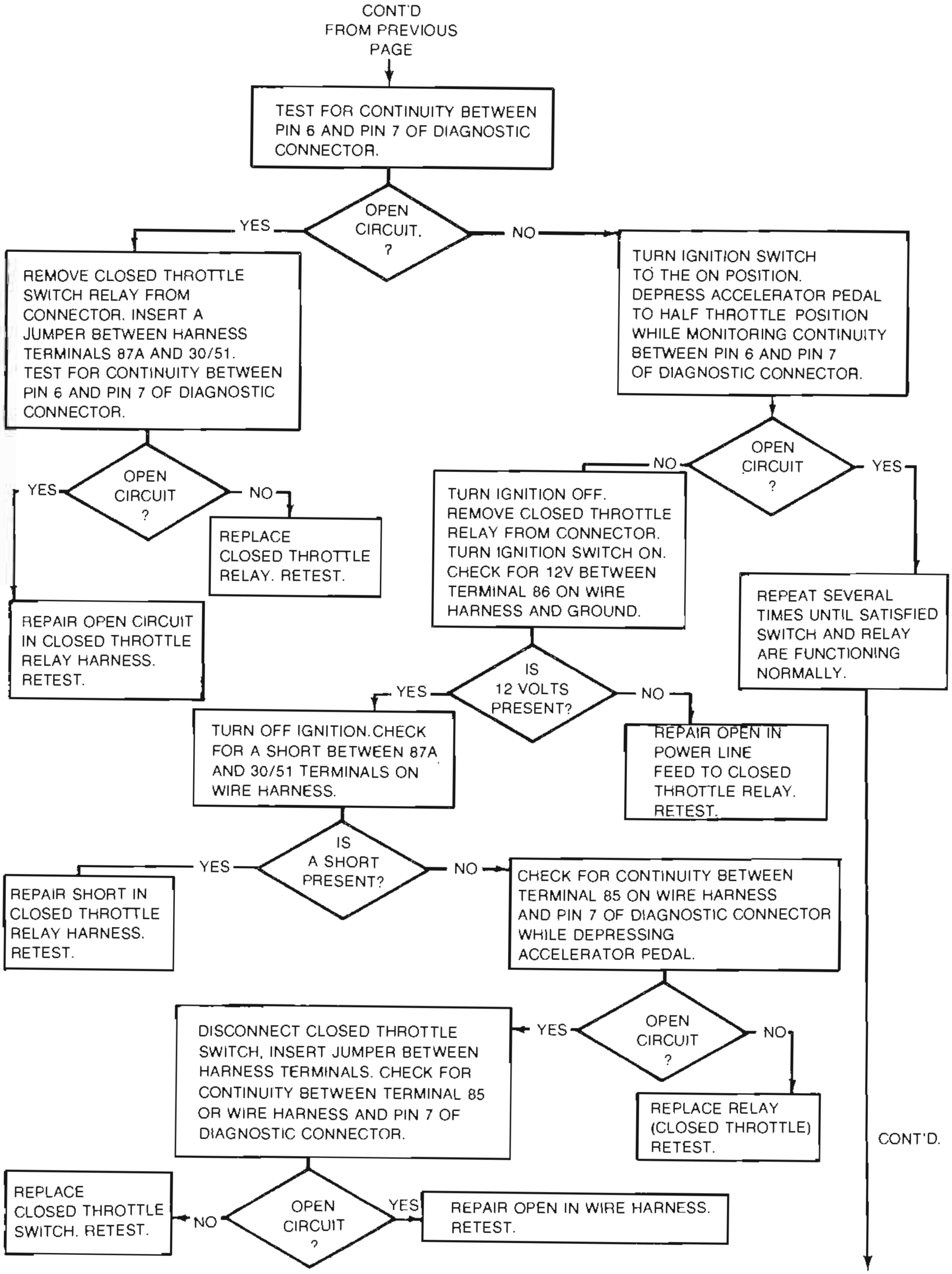
SEE I.S. NOTES



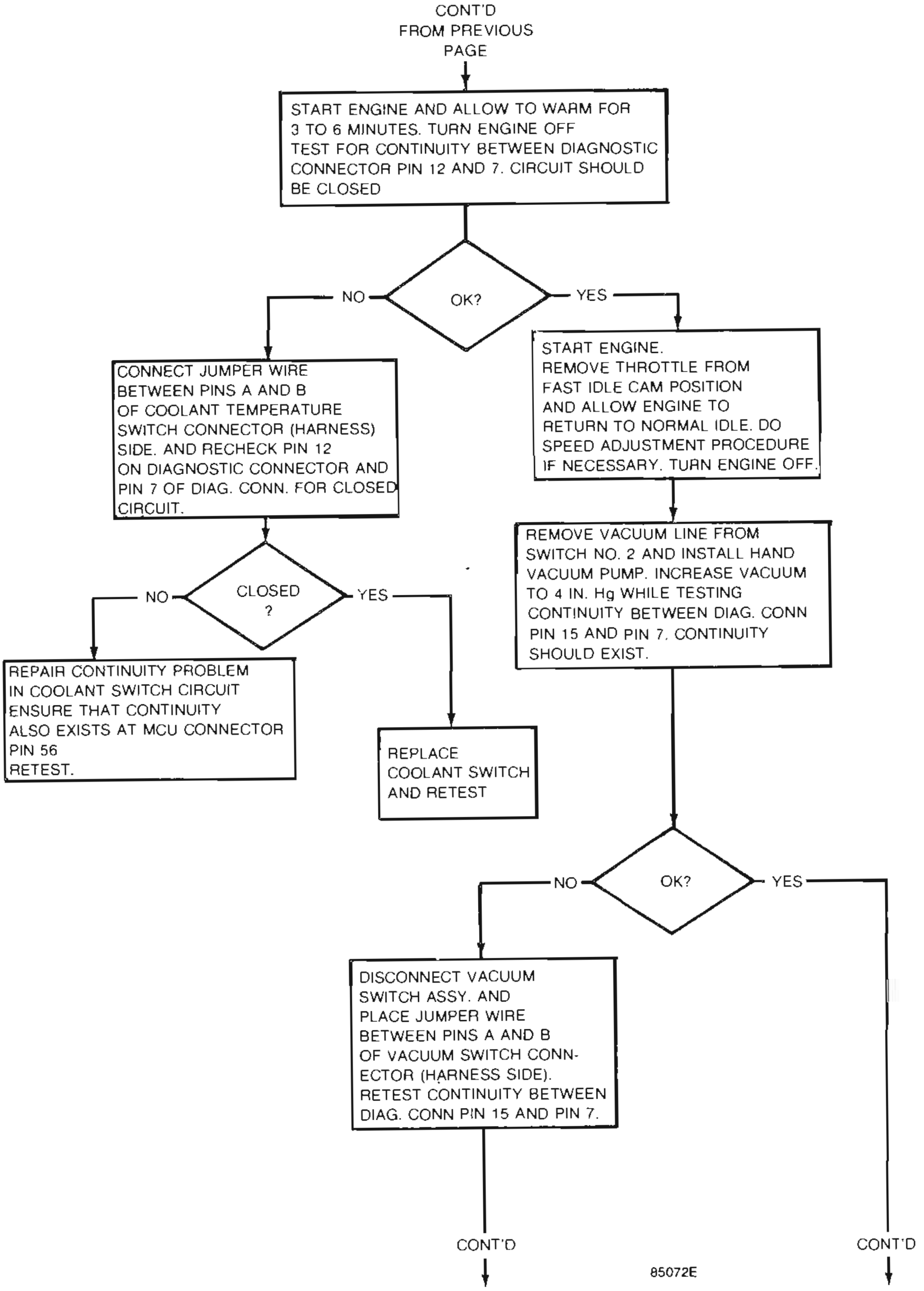
*NOTE: THE WOT SWITCH IS DIFFICULT TO REPLACE. BEFORE REMOVING THE SWITCH CONNECT A REPLACEMENT SWITCH TO THE WIRE HARNESS CONNECTOR AND RETEST TO ENSURE ORIGINAL SWITCH IS FAULTY.

85072C

SEE I.S. NOTES



85072D



START ENGINE AND ALLOW TO WARM FOR 3 TO 6 MINUTES. TURN ENGINE OFF TEST FOR CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR PIN 12 AND 7. CIRCUIT SHOULD BE CLOSED

CONNECT JUMPER WIRE BETWEEN PINS A AND B OF COOLANT TEMPERATURE SWITCH CONNECTOR (HARNESS) SIDE. AND RECHECK PIN 12 ON DIAGNOSTIC CONNECTOR AND PIN 7 OF DIAG. CONN. FOR CLOSED CIRCUIT.

REPAIR CONTINUITY PROBLEM IN COOLANT SWITCH CIRCUIT ENSURE THAT CONTINUITY ALSO EXISTS AT MCU CONNECTOR PIN 56 RETEST.

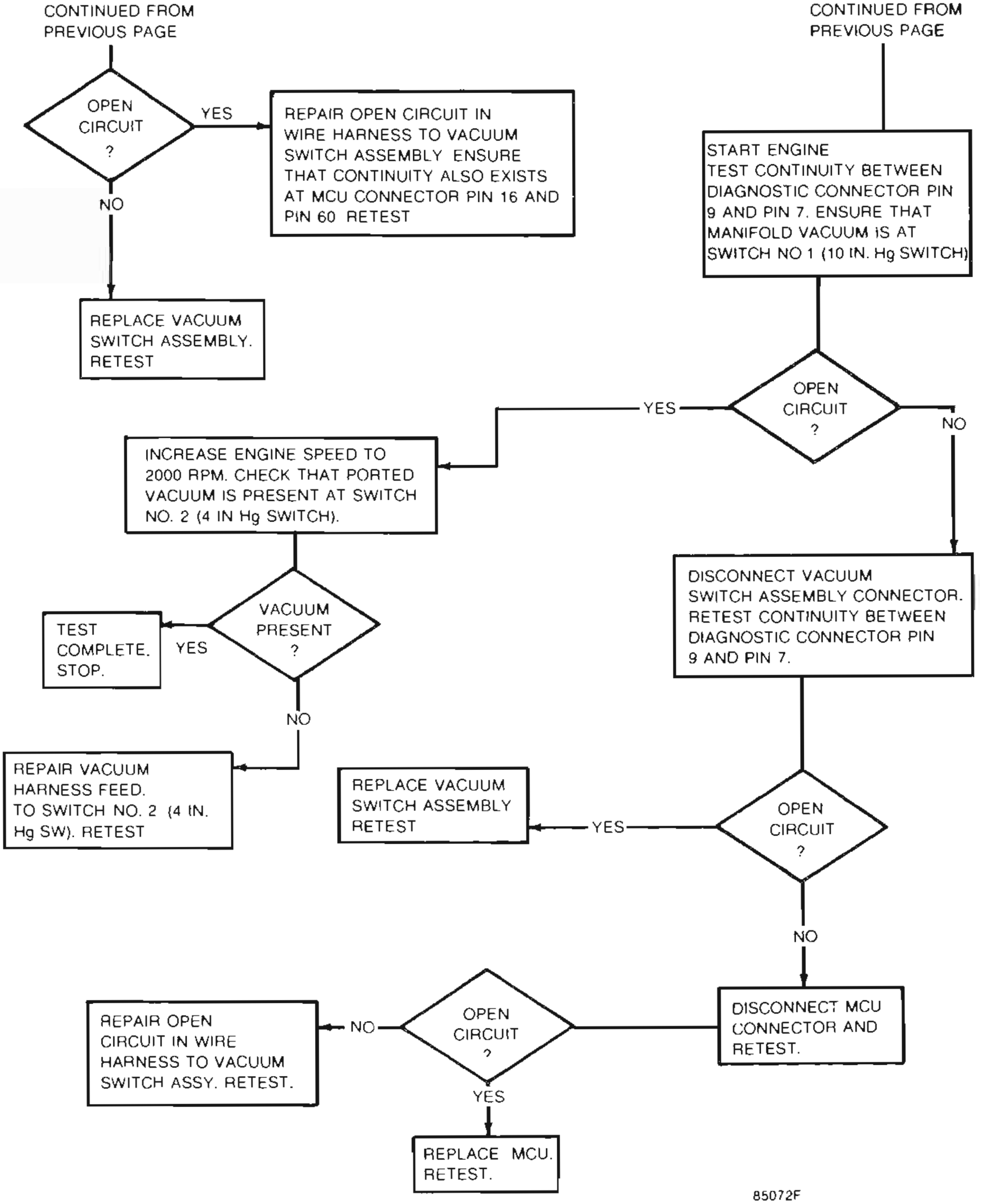
REPLACE COOLANT SWITCH AND RETEST

START ENGINE. REMOVE THROTTLE FROM FAST IDLE CAM POSITION AND ALLOW ENGINE TO RETURN TO NORMAL IDLE. DO SPEED ADJUSTMENT PROCEDURE IF NECESSARY. TURN ENGINE OFF.

REMOVE VACUUM LINE FROM SWITCH NO. 2 AND INSTALL HAND VACUUM PUMP. INCREASE VACUUM TO 4 IN. Hg WHILE TESTING CONTINUITY BETWEEN DIAG. CONN PIN 15 AND PIN 7. CONTINUITY SHOULD EXIST.

DISCONNECT VACUUM SWITCH ASSY. AND PLACE JUMPER WIRE BETWEEN PINS A AND B OF VACUUM SWITCH CONNECTOR (HARNESS SIDE). RETEST CONTINUITY BETWEEN DIAG. CONN PIN 15 AND PIN 7.

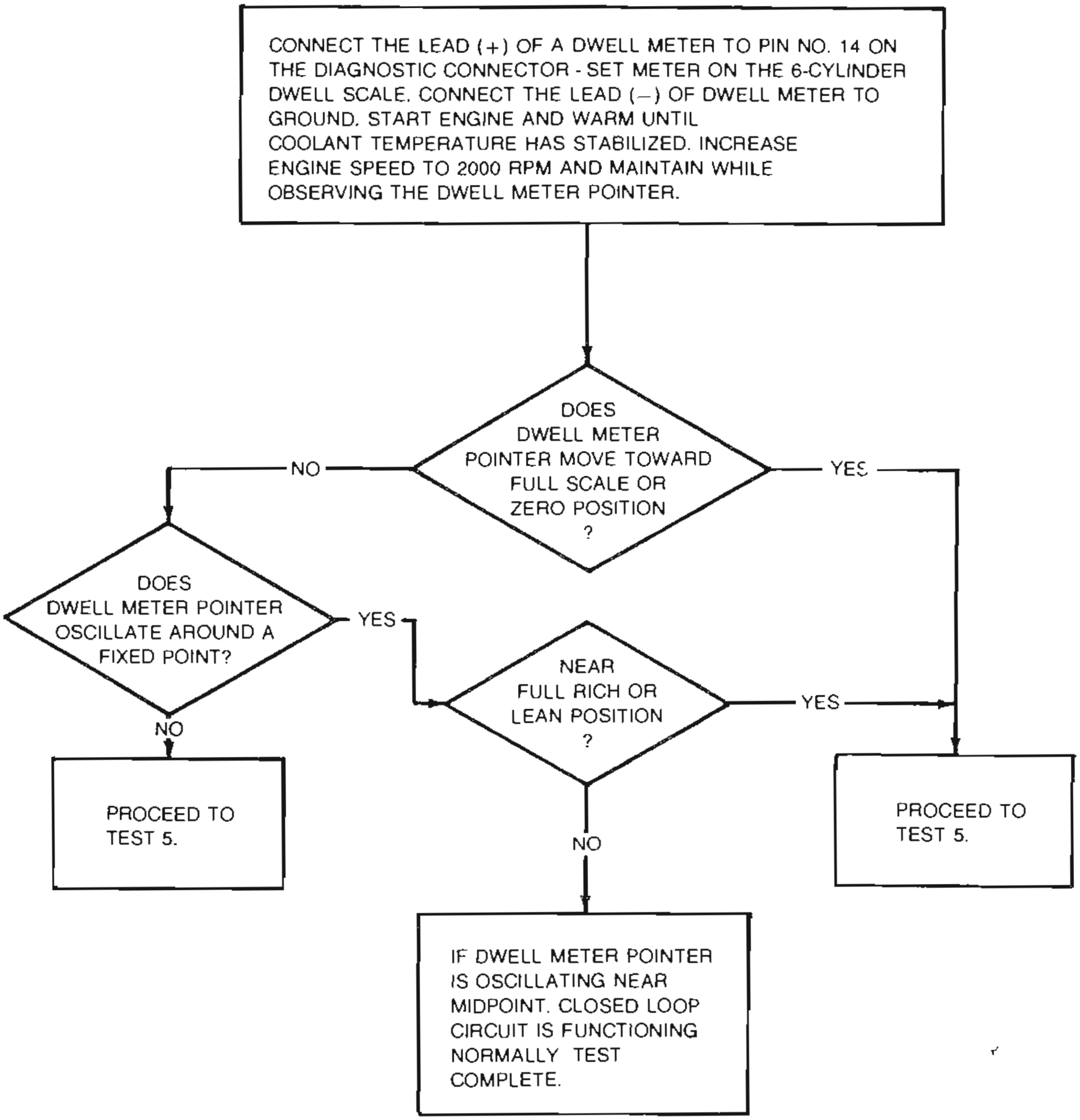
SEE I.S. NOTES


CONTINUED FROM PREVIOUS PAGE
OPEN CIRCUIT ?
YES
REPAIR OPEN CIRCUIT IN WIRE HARNESS TO VACUUM SWITCH ASSEMBLY ENSURE THAT CONTINUITY ALSO EXISTS AT MCU CONNECTOR PIN 16 AND PIN 60 RETEST
NO
REPLACE VACUUM SWITCH ASSEMBLY. RETEST
CONTINUED FROM PREVIOUS PAGE
START ENGINE TEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR PIN 9 AND PIN 7. ENSURE THAT MANIFOLD VACUUM IS AT SWITCH NO 1 (10 IN. Hg SWITCH)
OPEN CIRCUIT ?
YES
NO
INCREASE ENGINE SPEED TO 2000 RPM. CHECK THAT PORTED VACUUM IS PRESENT AT SWITCH NO. 2 (4 IN Hg SWITCH).
VACUUM PRESENT ?
YES
TEST COMPLETE. STOP.
NO
REPAIR VACUUM HARNESS FEED. TO SWITCH NO. 2 (4 IN. Hg SW). RETEST
DISCONNECT VACUUM SWITCH ASSEMBLY CONNECTOR. RETEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR PIN 9 AND PIN 7.
OPEN CIRCUIT ?
YES
REPLACE VACUUM SWITCH ASSEMBLY RETEST
NO
DISCONNECT MCU CONNECTOR AND RETEST.
OPEN CIRCUIT ?
NO
REPAIR OPEN CIRCUIT IN WIRE HARNESS TO VACUUM SWITCH ASSY. RETEST.
YES
REPLACE MCU. RETEST.
85072F

SEE I.S. NOTES

DIAGNOSTIC TEST 3

CLOSED LOOP OPERATIONAL TEST.



CONNECT THE LEAD (+) OF A DWELL METER TO PIN NO. 14 ON THE DIAGNOSTIC CONNECTOR - SET METER ON THE 6-CYLINDER DWELL SCALE. CONNECT THE LEAD (–) OF DWELL METER TO GROUND. START ENGINE AND WARM UNTIL COOLANT TEMPERATURE HAS STABILIZED. INCREASE ENGINE SPEED TO 2000 RPM AND MAINTAIN WHILE OBSERVING THE DWELL METER POINTER.

DOES DWELL METER POINTER MOVE TOWARD FULL SCALE OR ZERO POSITION ?

DOES DWELL METER POINTER OSCILLATE AROUND A FIXED POINT?

NEAR FULL RICH OR LEAN POSITION ?

PROCEED TO TEST 5.

PROCEED TO TEST 5.

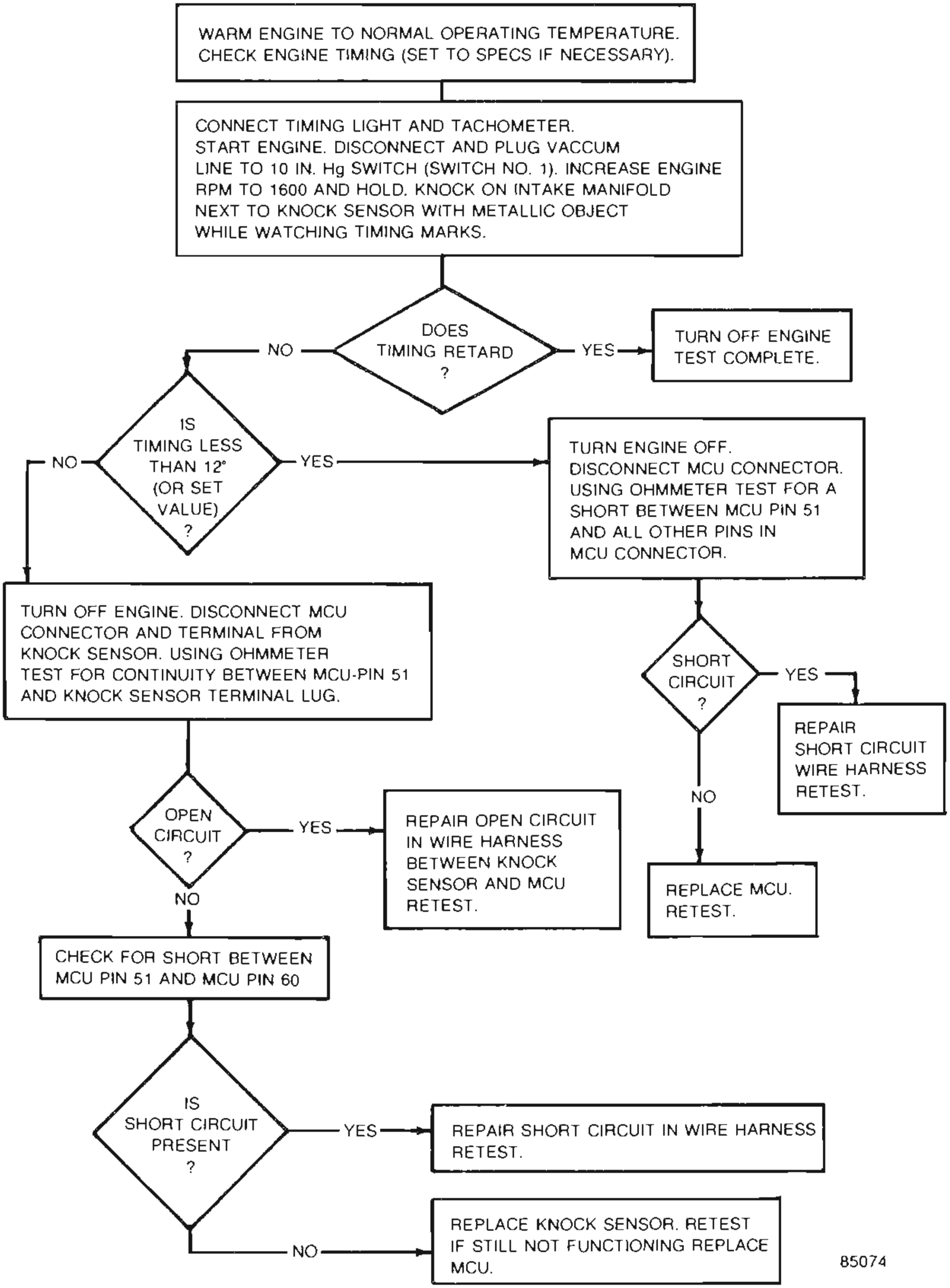
IF DWELL METER POINTER IS OSCILLATING NEAR MIDPOINT. CLOSED LOOP CIRCUIT IS FUNCTIONING NORMALLY TEST COMPLETE.

85073

SEE I.S. NOTES

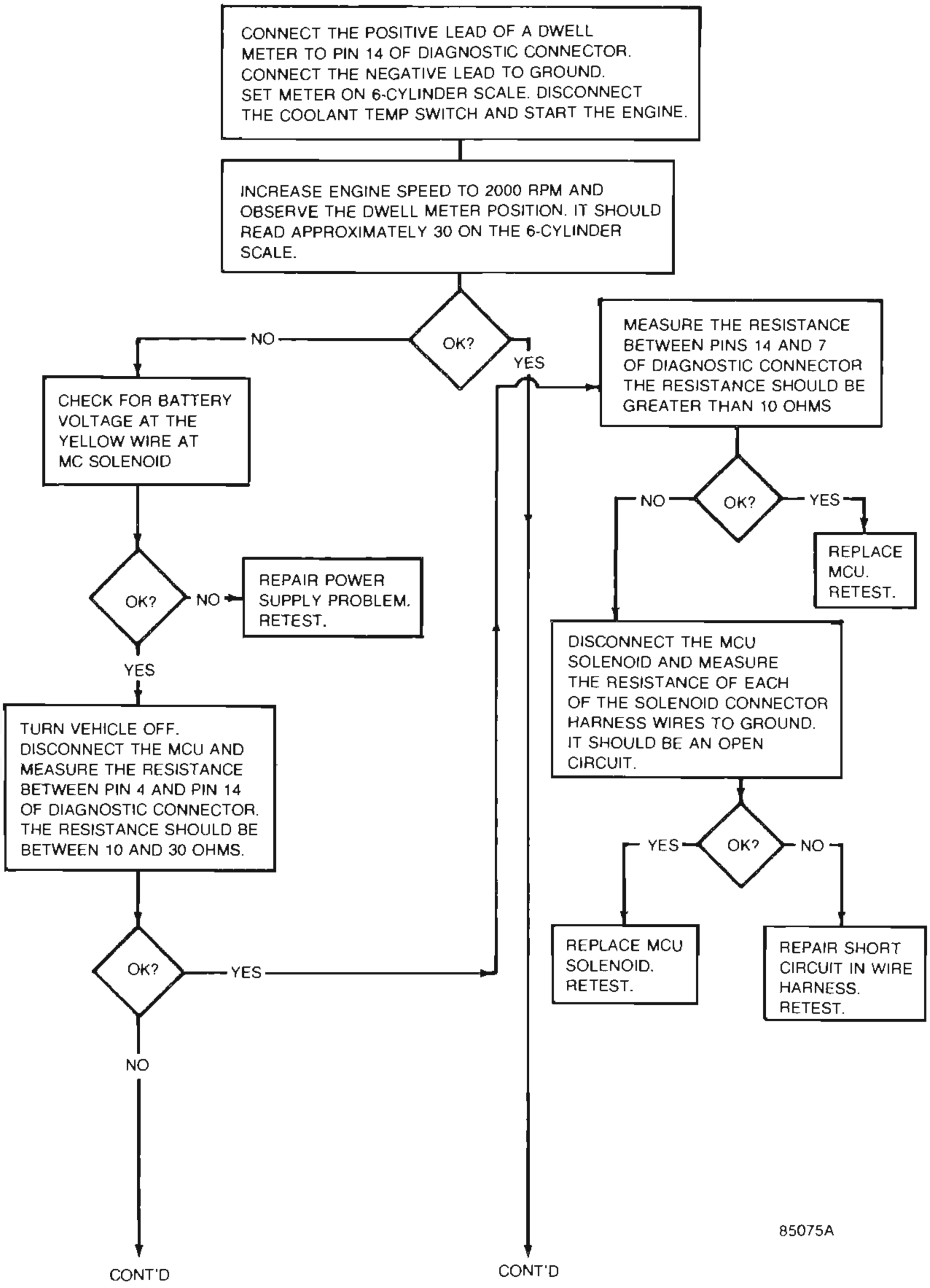
DIAGNOSTIC TEST 4.

KNOCK SENSOR TEST



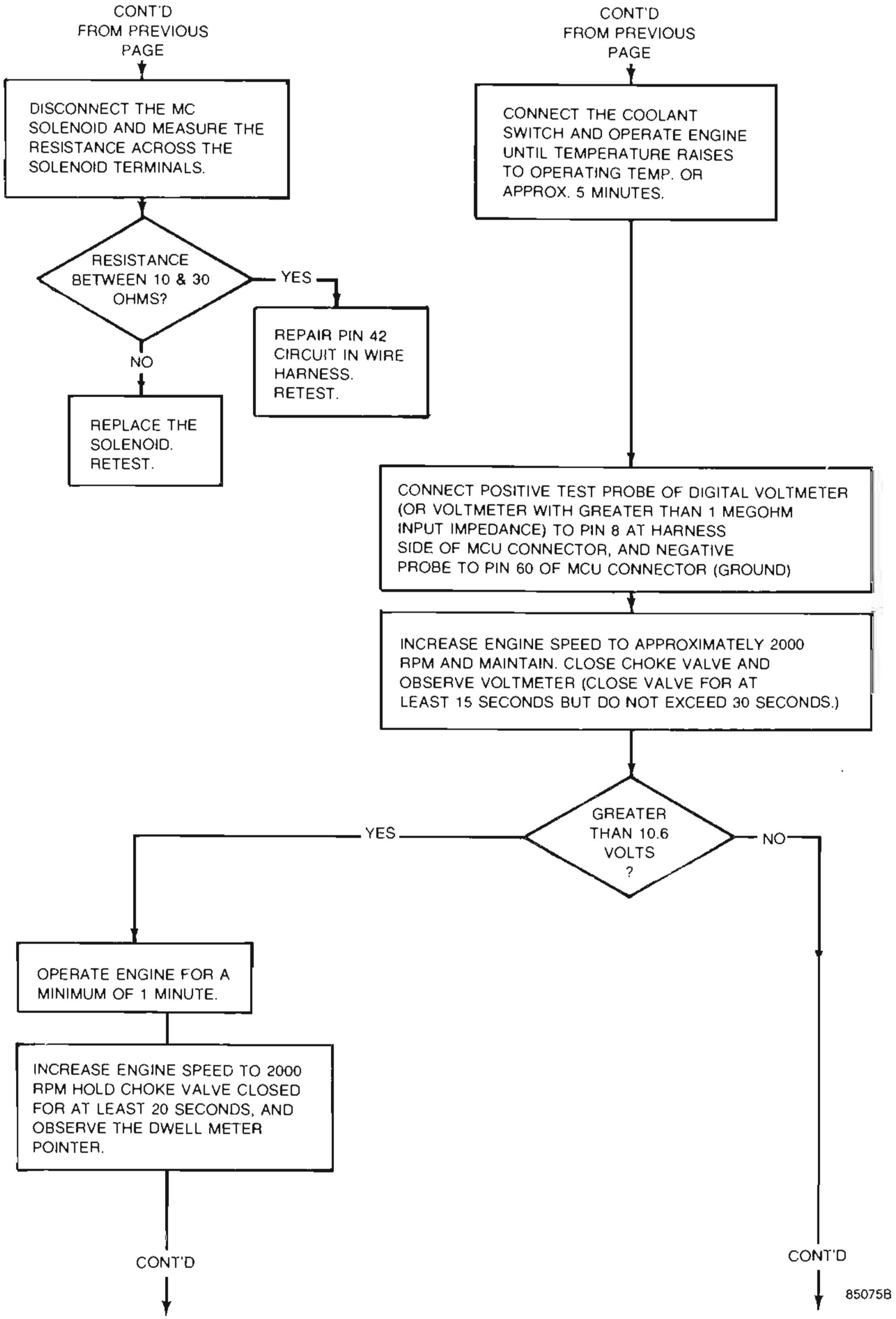
DIAGNOSTIC TEST 5

OXYGEN SENSOR AND CLOSED LOOP TEST.

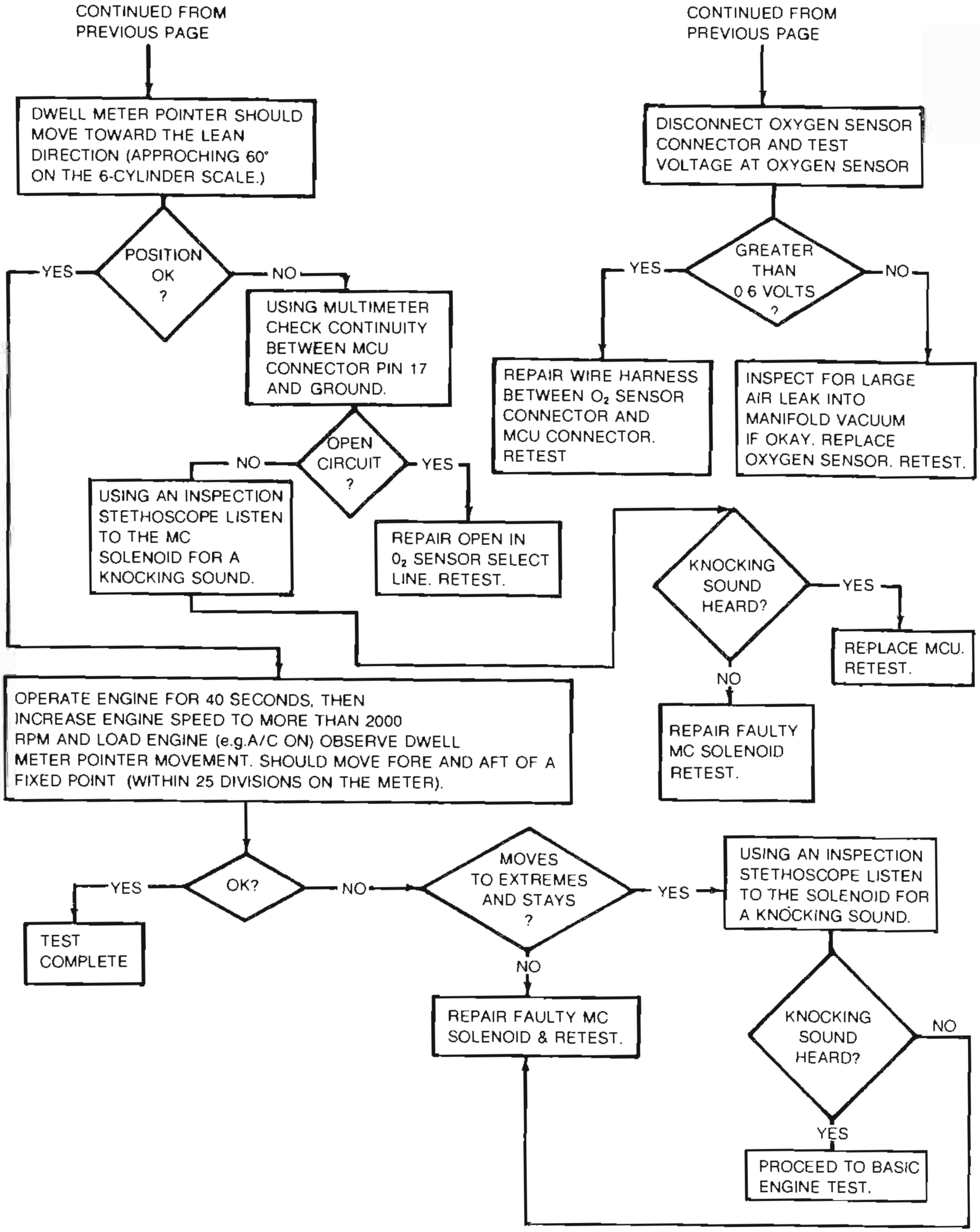


SEE I.S. NOTES

SEE I.S. NOTES

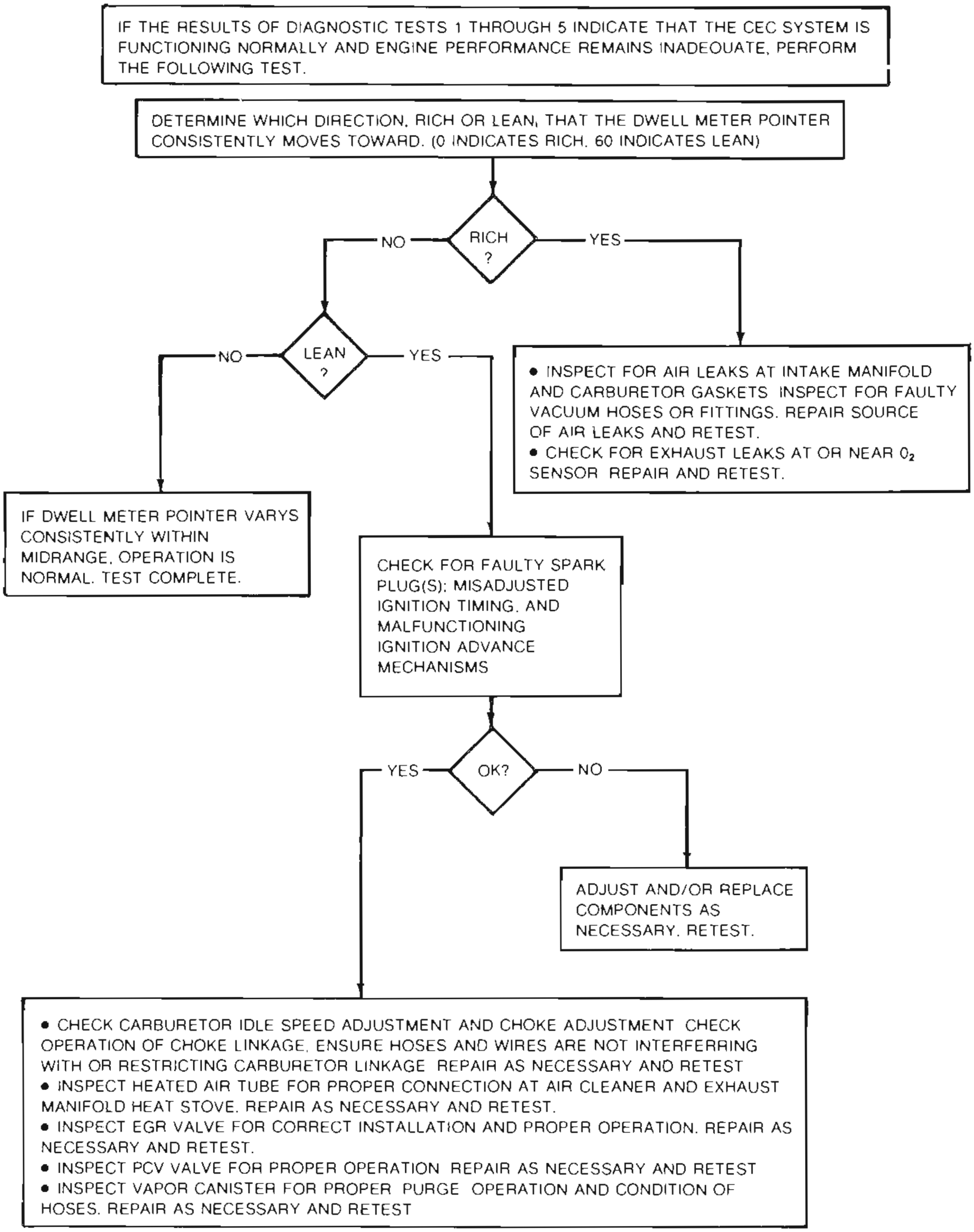


85075B


CONTINUED FROM PREVIOUS PAGE
DWELL METER POINTER SHOULD MOVE TOWARD THE LEAN DIRECTION (APPROCHING 60° ON THE 6-CYLINDER SCALE.)
POSITION OK ?
YES
NO
USING MULTIMETER CHECK CONTINUITY BETWEEN MCU CONNECTOR PIN 17 AND GROUND.
OPEN CIRCUIT ?
NO
YES
USING AN INSPECTION STETHOSCOPE LISTEN TO THE MC SOLENOID FOR A KNOCKING SOUND.
REPAIR OPEN IN O₂ SENSOR SELECT LINE. RETEST.
CONTINUED FROM PREVIOUS PAGE
DISCONNECT OXYGEN SENSOR CONNECTOR AND TEST VOLTAGE AT OXYGEN SENSOR
GREATER THAN 0.6 VOLTS ?
YES
NO
REPAIR WIRE HARNESS BETWEEN O₂ SENSOR CONNECTOR AND MCU CONNECTOR. RETEST
INSPECT FOR LARGE AIR LEAK INTO MANIFOLD VACUUM IF OKAY, REPLACE OXYGEN SENSOR. RETEST.
KNOCKING SOUND HEARD?
YES
REPLACE MCU. RETEST.
NO
REPAIR FAULTY MC SOLENOID RETEST.
OPERATE ENGINE FOR 40 SECONDS, THEN INCREASE ENGINE SPEED TO MORE THAN 2000 RPM AND LOAD ENGINE (e.g.A/C ON) OBSERVE DWELL METER POINTER MOVEMENT. SHOULD MOVE FORE AND AFT OF A FIXED POINT (WITHIN 25 DIVISIONS ON THE METER).
OK?
YES
TEST COMPLETE
NO
MOVES TO EXTREMES AND STAYS ?
YES
USING AN INSPECTION STETHOSCOPE LISTEN TO THE SOLENOID FOR A KNOCKING SOUND.
NO
REPAIR FAULTY MC SOLENOID & RETEST.
KNOCKING SOUND HEARD?
NO
YES
PROCEED TO BASIC ENGINE TEST.

85075C

BASIC ENGINE TEST



IF THE RESULTS OF DIAGNOSTIC TESTS 1 THROUGH 5 INDICATE THAT THE CEC SYSTEM IS FUNCTIONING NORMALLY AND ENGINE PERFORMANCE REMAINS INADEQUATE, PERFORM THE FOLLOWING TEST.

DETERMINE WHICH DIRECTION, RICH OR LEAN, THAT THE DWELL METER POINTER CONSISTENTLY MOVES TOWARD. (0 INDICATES RICH, 60 INDICATES LEAN)

- INSPECT FOR AIR LEAKS AT INTAKE MANIFOLD AND CARBURETOR GASKETS. INSPECT FOR FAULTY VACUUM HOSES OR FITTINGS. REPAIR SOURCE OF AIR LEAKS AND RETEST.
- CHECK FOR EXHAUST LEAKS AT OR NEAR O_2 SENSOR. REPAIR AND RETEST.

IF DWELL METER POINTER VARYS CONSISTENTLY WITHIN MIDRANGE, OPERATION IS NORMAL. TEST COMPLETE.

CHECK FOR FAULTY SPARK PLUG(S); MISADJUSTED IGNITION TIMING, AND MALFUNCTIONING IGNITION ADVANCE MECHANISMS

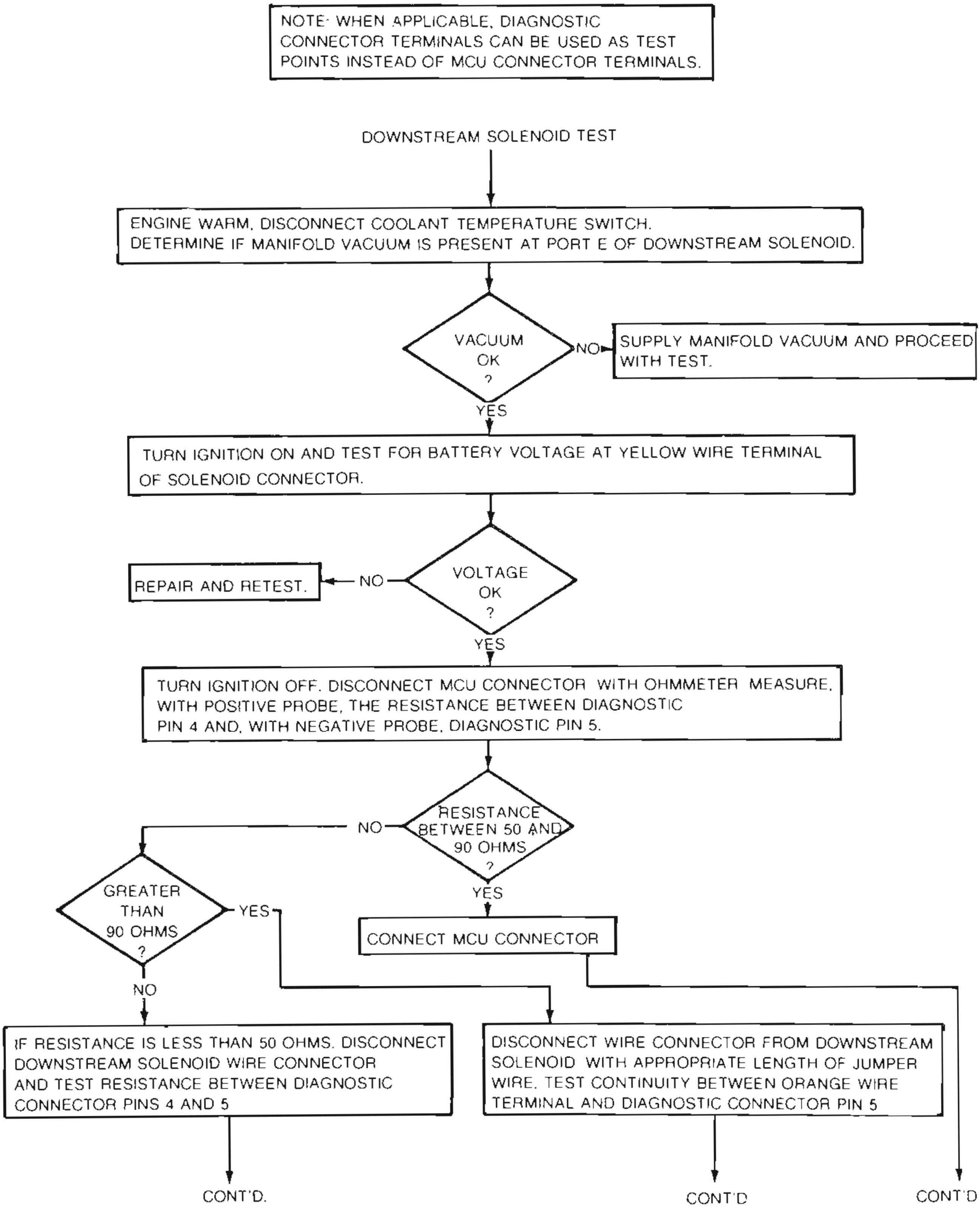
ADJUST AND/OR REPLACE COMPONENTS AS NECESSARY. RETEST.

- CHECK CARBURETOR IDLE SPEED ADJUSTMENT AND CHOKE ADJUSTMENT. CHECK OPERATION OF CHOKE LINKAGE. ENSURE HOSES AND WIRES ARE NOT INTERFERRING WITH OR RESTRICTING CARBURETOR LINKAGE. REPAIR AS NECESSARY AND RETEST.
- INSPECT HEATED AIR TUBE FOR PROPER CONNECTION AT AIR CLEANER AND EXHAUST MANIFOLD HEAT STOVE. REPAIR AS NECESSARY AND RETEST.
- INSPECT EGR VALVE FOR CORRECT INSTALLATION AND PROPER OPERATION. REPAIR AS NECESSARY AND RETEST.
- INSPECT PCV VALVE FOR PROPER OPERATION. REPAIR AS NECESSARY AND RETEST.
- INSPECT VAPOR CANISTER FOR PROPER PURGE OPERATION AND CONDITION OF HOSES. REPAIR AS NECESSARY AND RETEST.

85076

DIAGNOSTIC TEST 6

SEE I.S. NOTES



NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.

DOWNSTREAM SOLENOID TEST

ENGINE WARM, DISCONNECT COOLANT TEMPERATURE SWITCH. DETERMINE IF MANIFOLD VACUUM IS PRESENT AT PORT E OF DOWNSTREAM SOLENOID.

SUPPLY MANIFOLD VACUUM AND PROCEED WITH TEST.

TURN IGNITION ON AND TEST FOR BATTERY VOLTAGE AT YELLOW WIRE TERMINAL OF SOLENOID CONNECTOR.

REPAIR AND RETEST.

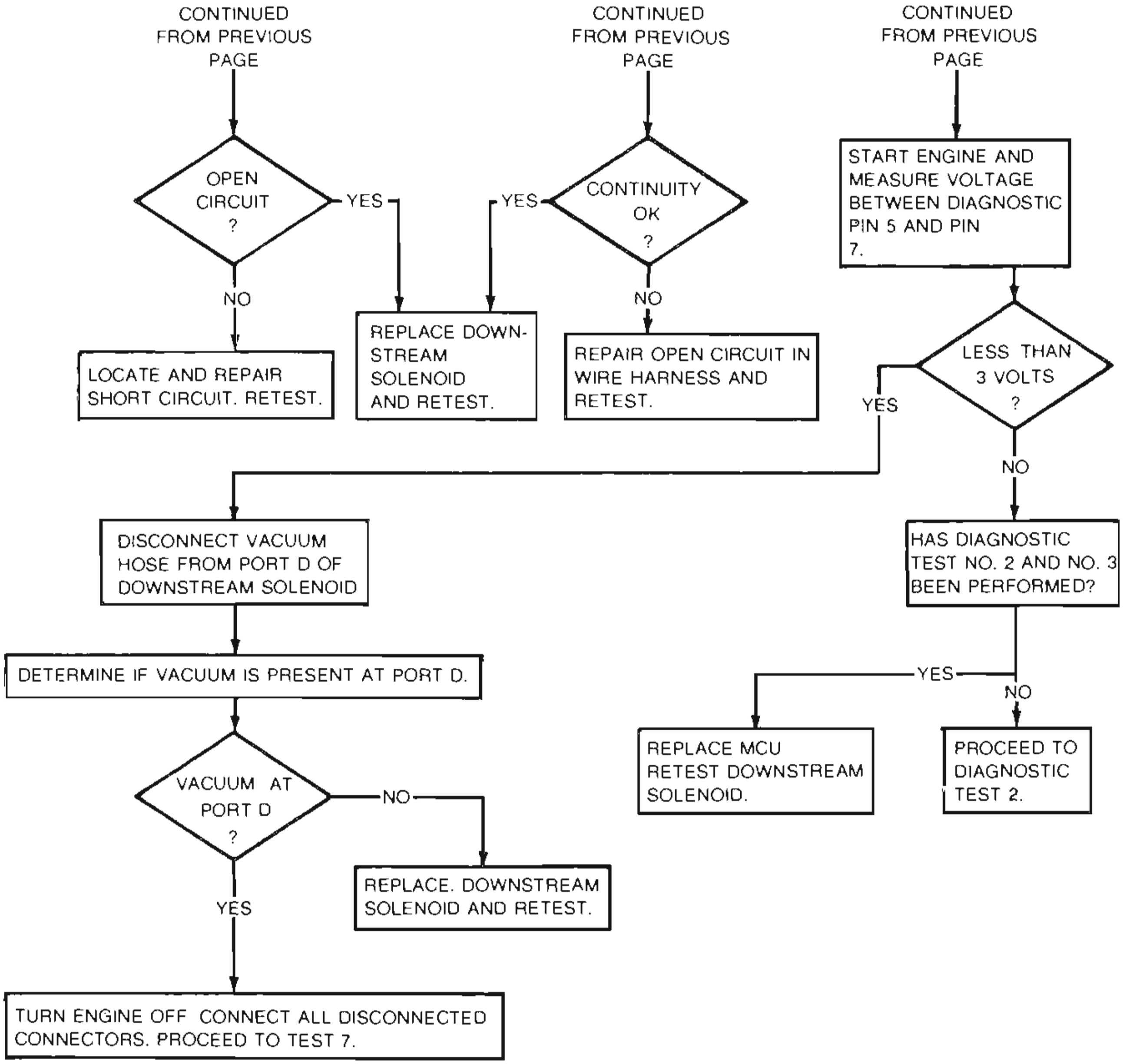
TURN IGNITION OFF. DISCONNECT MCU CONNECTOR. WITH OHMMETER MEASURE, WITH POSITIVE PROBE, THE RESISTANCE BETWEEN DIAGNOSTIC PIN 4 AND, WITH NEGATIVE PROBE, DIAGNOSTIC PIN 5.

CONNECT MCU CONNECTOR

IF RESISTANCE IS LESS THAN 50 OHMS, DISCONNECT DOWNSTREAM SOLENOID WIRE CONNECTOR AND TEST RESISTANCE BETWEEN DIAGNOSTIC CONNECTOR PINS 4 AND 5

DISCONNECT WIRE CONNECTOR FROM DOWNSTREAM SOLENOID. WITH APPROPRIATE LENGTH OF JUMPER WIRE, TEST CONTINUITY BETWEEN ORANGE WIRE TERMINAL AND DIAGNOSTIC CONNECTOR PIN 5

SEE I.S. NOTES

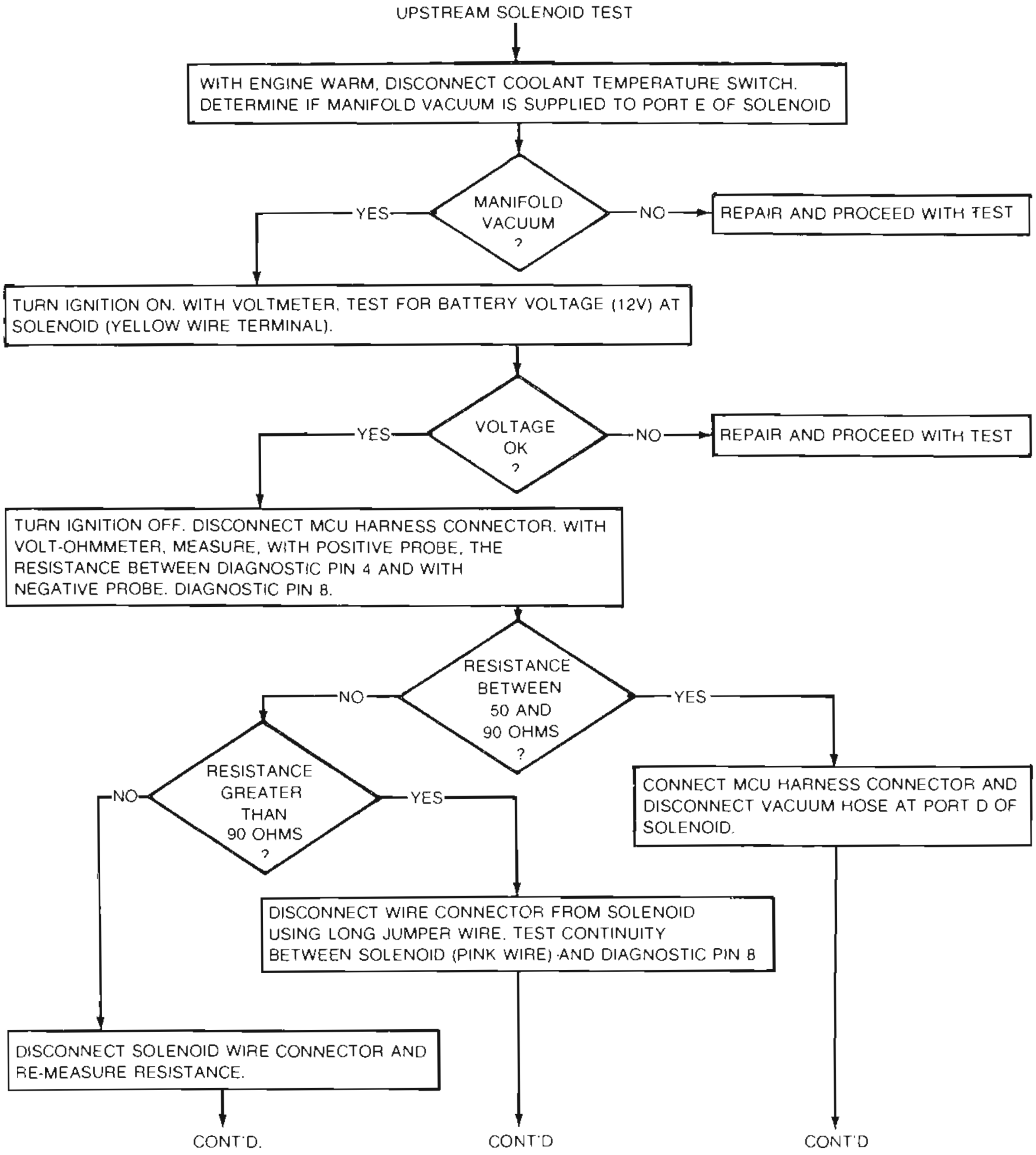


85077B

SEE I.S. NOTES

DIAGNOSTIC TEST 7

NOTE. WHEN APPLICABLE DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.



UPSTREAM SOLENOID TEST

WITH ENGINE WARM, DISCONNECT COOLANT TEMPERATURE SWITCH. DETERMINE IF MANIFOLD VACUUM IS SUPPLIED TO PORT E OF SOLENOID

REPAIR AND PROCEED WITH TEST

TURN IGNITION ON. WITH VOLTMETER, TEST FOR BATTERY VOLTAGE (12V) AT SOLENOID (YELLOW WIRE TERMINAL).

REPAIR AND PROCEED WITH TEST

TURN IGNITION OFF. DISCONNECT MCU HARNESS CONNECTOR. WITH VOLT-OHMMETER, MEASURE, WITH POSITIVE PROBE, THE RESISTANCE BETWEEN DIAGNOSTIC PIN 4 AND WITH NEGATIVE PROBE. DIAGNOSTIC PIN 8.

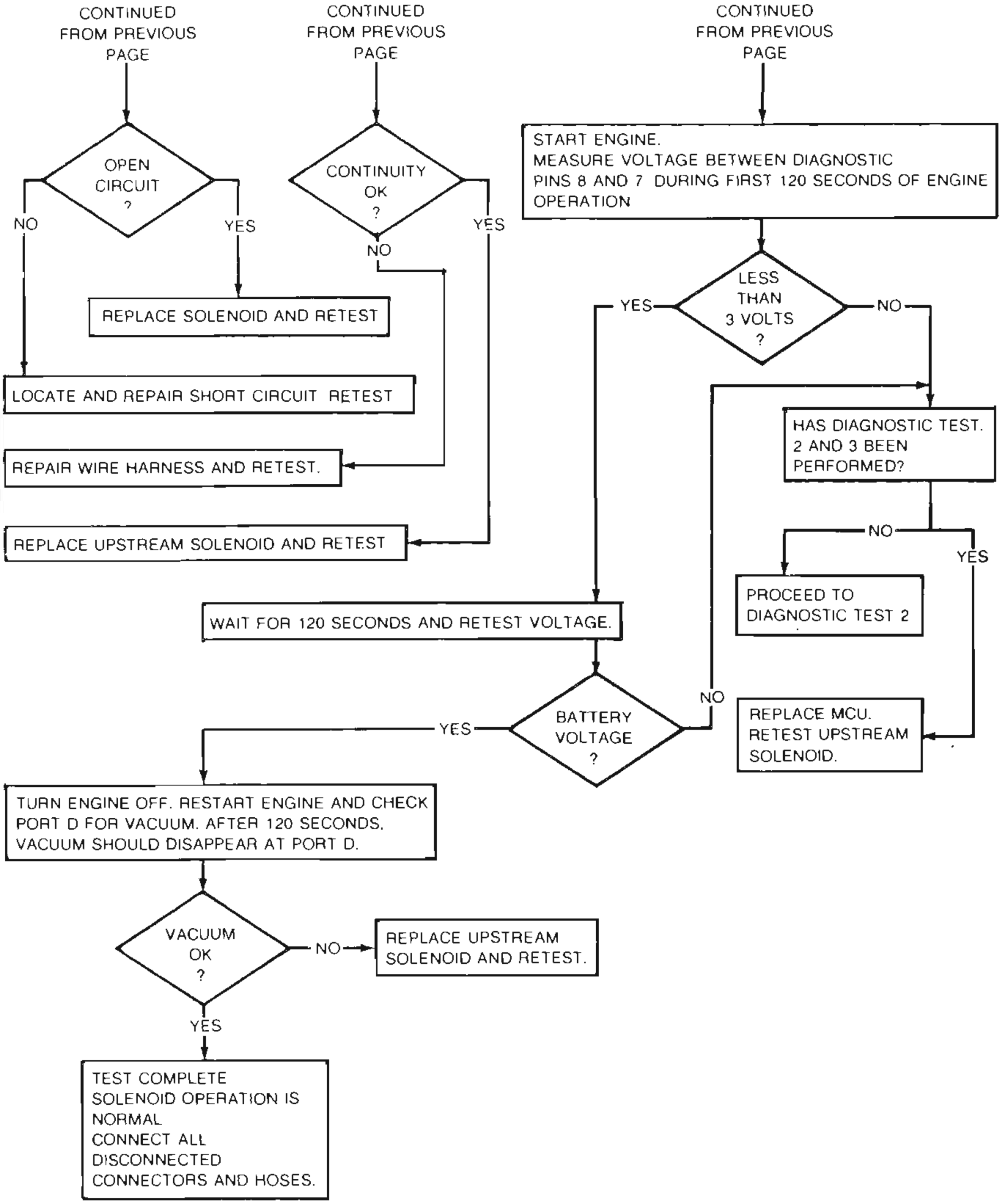
CONNECT MCU HARNESS CONNECTOR AND DISCONNECT VACUUM HOSE AT PORT D OF SOLENOID.

DISCONNECT WIRE CONNECTOR FROM SOLENOID USING LONG JUMPER WIRE. TEST CONTINUITY BETWEEN SOLENOID (PINK WIRE) AND DIAGNOSTIC PIN 8

DISCONNECT SOLENOID WIRE CONNECTOR AND RE-MEASURE RESISTANCE.

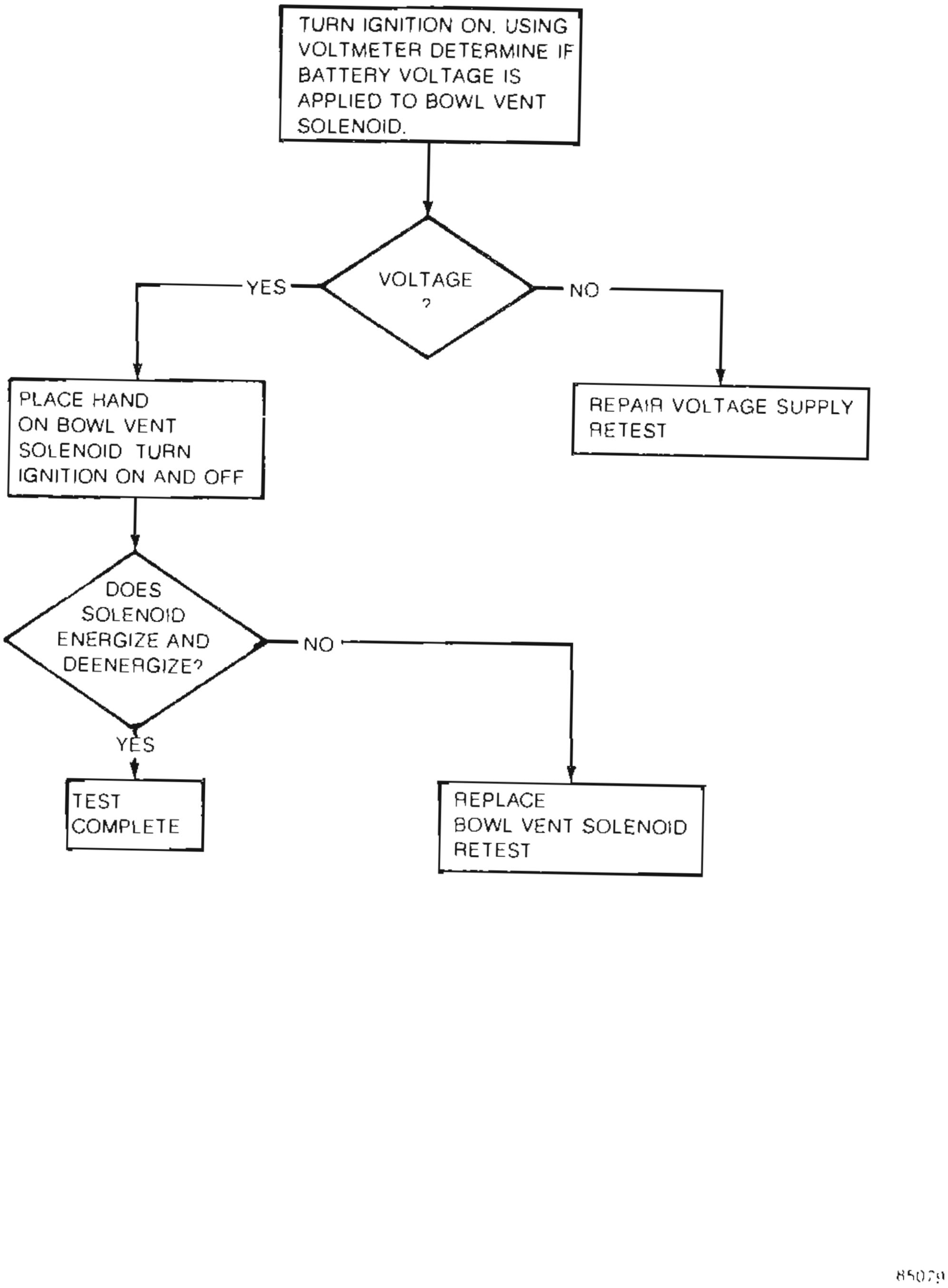
85078A

SEE I.S. NOTES



85078B

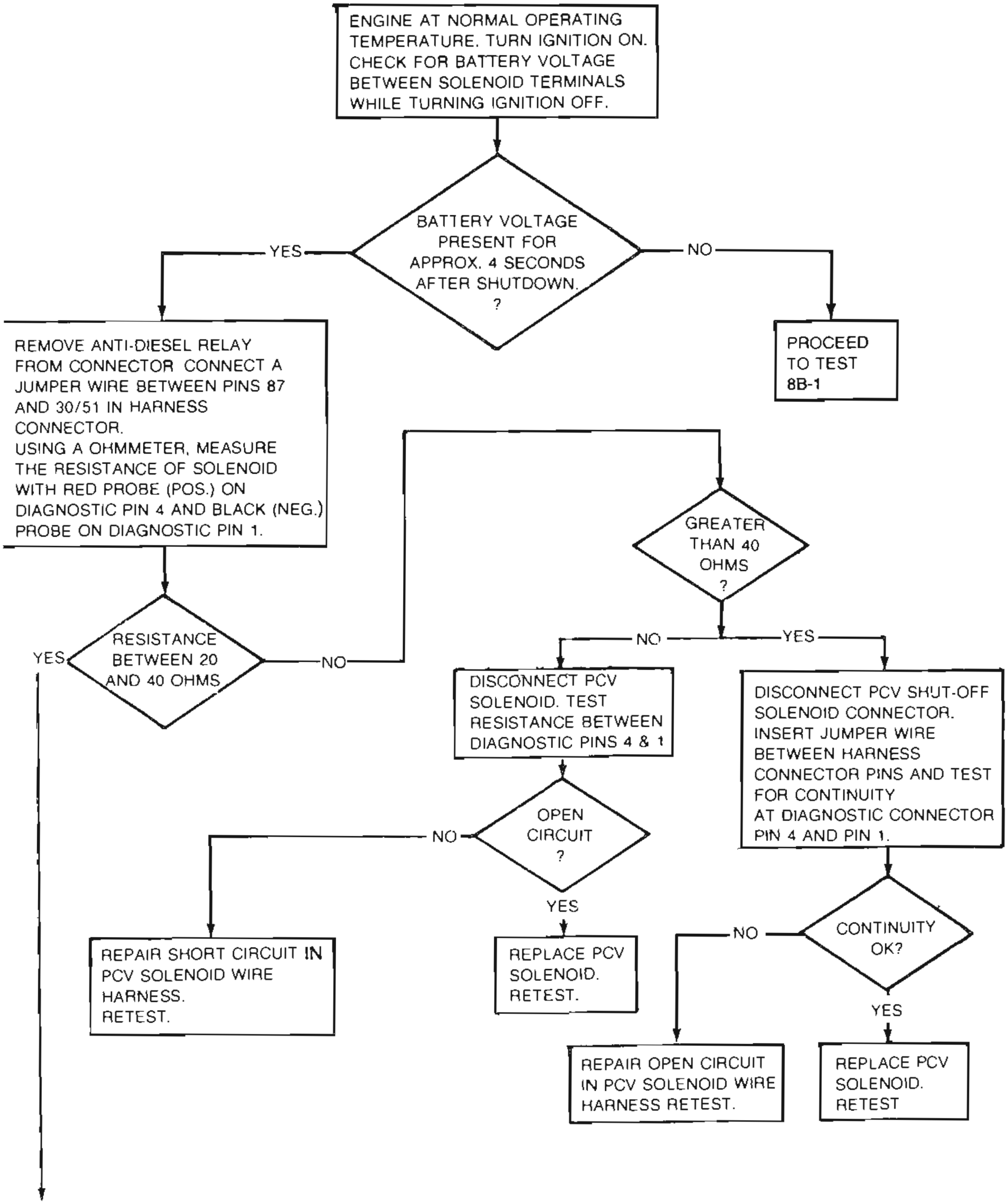
DIAGNOSTIC TEST 8A
BOWL VENT TEST



SEE I.S. NOTES

DIAGNOSTIC TEST 8B

PCV VALVE SHUT-OFF TEST



ENGINE AT NORMAL OPERATING TEMPERATURE. TURN IGNITION ON. CHECK FOR BATTERY VOLTAGE BETWEEN SOLENOID TERMINALS WHILE TURNING IGNITION OFF.

BATTERY VOLTAGE PRESENT FOR APPROX. 4 SECONDS AFTER SHUTDOWN. ?

YES: REMOVE ANTI-DIESEL RELAY FROM CONNECTOR CONNECT A JUMPER WIRE BETWEEN PINS 87 AND 30/51 IN HARNESS CONNECTOR. USING A OHMMETER, MEASURE THE RESISTANCE OF SOLENOID WITH RED PROBE (POS.) ON DIAGNOSTIC PIN 4 AND BLACK (NEG.) PROBE ON DIAGNOSTIC PIN 1.

NO: PROCEED TO TEST 8B-1

RESISTANCE BETWEEN 20 AND 40 OHMS

YES: (continues below)

NO: GREATER THAN 40 OHMS ?

NO: DISCONNECT PCV SOLENOID. TEST RESISTANCE BETWEEN DIAGNOSTIC PINS 4 & 1

OPEN CIRCUIT ?

NO: REPAIR SHORT CIRCUIT IN PCV SOLENOID WIRE HARNESS. RETEST.

YES: REPLACE PCV SOLENOID. RETEST.

YES: DISCONNECT PCV SHUT-OFF SOLENOID CONNECTOR. INSERT JUMPER WIRE BETWEEN HARNESS CONNECTOR PINS AND TEST FOR CONTINUITY AT DIAGNOSTIC CONNECTOR PIN 4 AND PIN 1.

CONTINUITY OK?

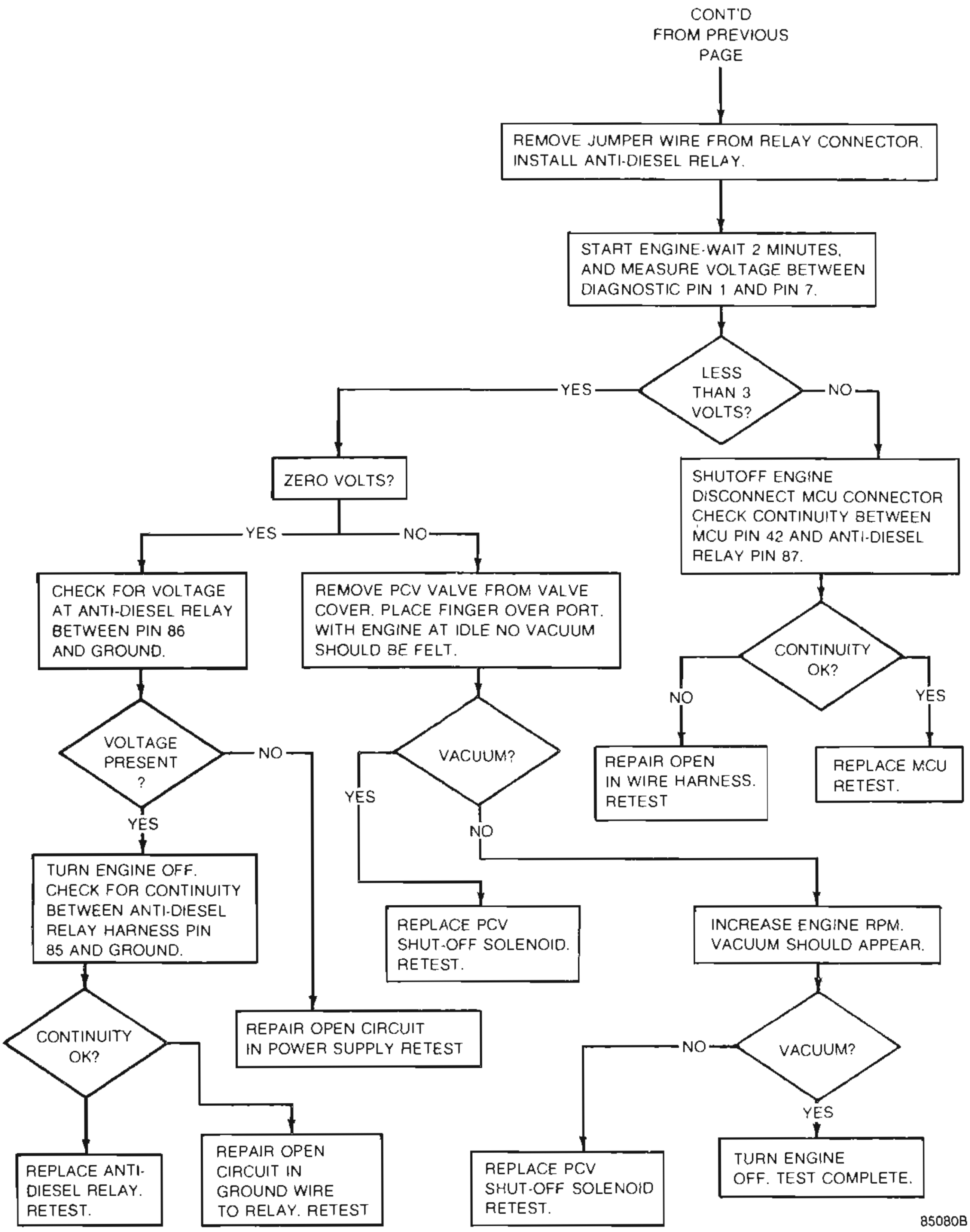
NO: REPAIR OPEN CIRCUIT IN PCV SOLENOID WIRE HARNESS RETEST.

YES: REPLACE PCV SOLENOID. RETEST

8508OA

DIAGNOSTIC TEST 8B (CONT'D)

PCV VALVE SHUT-OFF TEST (CONT'D)



REMOVE JUMPER WIRE FROM RELAY CONNECTOR. INSTALL ANTI-DIESEL RELAY.

START ENGINE-WAIT 2 MINUTES, AND MEASURE VOLTAGE BETWEEN DIAGNOSTIC PIN 1 AND PIN 7.

SHUTOFF ENGINE DISCONNECT MCU CONNECTOR CHECK CONTINUITY BETWEEN MCU PIN 42 AND ANTI-DIESEL RELAY PIN 87.

REPAIR OPEN IN WIRE HARNESS. RETEST

REPLACE MCU RETEST.

CHECK FOR VOLTAGE AT ANTI-DIESEL RELAY BETWEEN PIN 86 AND GROUND.

TURN ENGINE OFF. CHECK FOR CONTINUITY BETWEEN ANTI-DIESEL RELAY HARNESS PIN 85 AND GROUND.

REPLACE ANTI-DIESEL RELAY. RETEST.

REPAIR OPEN CIRCUIT IN GROUND WIRE TO RELAY. RETEST

REPAIR OPEN CIRCUIT IN POWER SUPPLY RETEST

REMOVE PCV VALVE FROM VALVE COVER. PLACE FINGER OVER PORT. WITH ENGINE AT IDLE NO VACUUM SHOULD BE FELT.

REPLACE PCV SHUT-OFF SOLENOID. RETEST.

INCREASE ENGINE RPM. VACUUM SHOULD APPEAR.

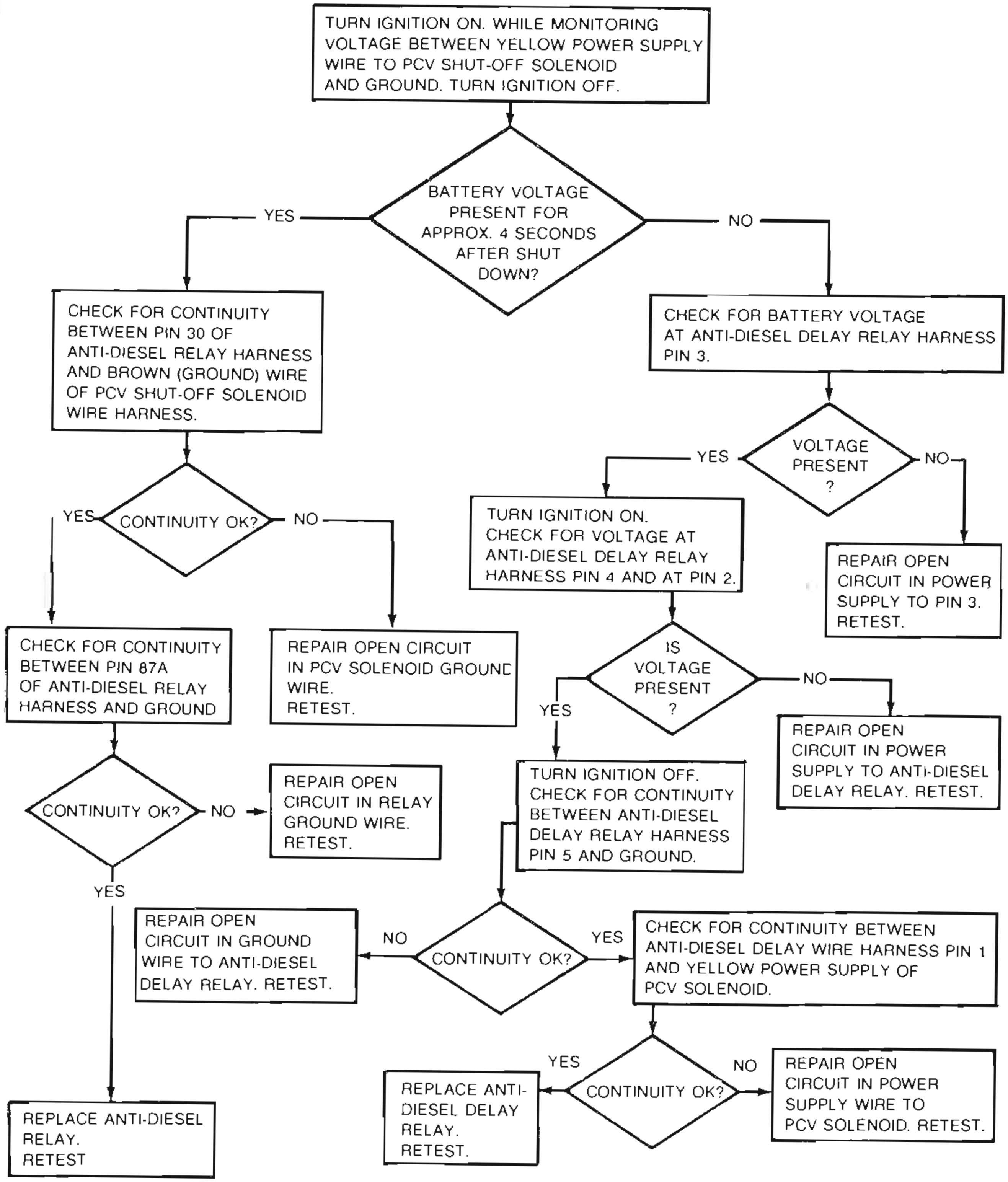
REPLACE PCV SHUT-OFF SOLENOID RETEST.

TURN ENGINE OFF. TEST COMPLETE.

SEE I.S. NOTES

DIAGNOSTIC TEST 8B-1

PCV VALVE SHUT-OFF TEST



TURN IGNITION ON. WHILE MONITORING VOLTAGE BETWEEN YELLOW POWER SUPPLY WIRE TO PCV SHUT-OFF SOLENOID AND GROUND. TURN IGNITION OFF.

BATTERY VOLTAGE PRESENT FOR APPROX. 4 SECONDS AFTER SHUT DOWN?

CHECK FOR CONTINUITY BETWEEN PIN 30 OF ANTI-DIESEL RELAY HARNESS AND BROWN (GROUND) WIRE OF PCV SHUT-OFF SOLENOID WIRE HARNESS.

CONTINUITY OK?

CHECK FOR CONTINUITY BETWEEN PIN 87A OF ANTI-DIESEL RELAY HARNESS AND GROUND

REPAIR OPEN CIRCUIT IN PCV SOLENOID GROUND WIRE. RETEST.

CONTINUITY OK?

REPAIR OPEN CIRCUIT IN RELAY GROUND WIRE. RETEST.

REPLACE ANTI-DIESEL RELAY. RETEST

CHECK FOR BATTERY VOLTAGE AT ANTI-DIESEL DELAY RELAY HARNESS PIN 3.

VOLTAGE PRESENT ?

REPAIR OPEN CIRCUIT IN POWER SUPPLY TO PIN 3. RETEST.

TURN IGNITION ON. CHECK FOR VOLTAGE AT ANTI-DIESEL DELAY RELAY HARNESS PIN 4 AND AT PIN 2.

IS VOLTAGE PRESENT ?

REPAIR OPEN CIRCUIT IN POWER SUPPLY TO ANTI-DIESEL DELAY RELAY. RETEST.

TURN IGNITION OFF. CHECK FOR CONTINUITY BETWEEN ANTI-DIESEL DELAY RELAY HARNESS PIN 5 AND GROUND.

CONTINUITY OK?

REPAIR OPEN CIRCUIT IN GROUND WIRE TO ANTI-DIESEL DELAY RELAY. RETEST.

CHECK FOR CONTINUITY BETWEEN ANTI-DIESEL DELAY WIRE HARNESS PIN 1 AND YELLOW POWER SUPPLY OF PCV SOLENOID.

CONTINUITY OK?

REPLACE ANTI-DIESEL DELAY RELAY. RETEST.

REPAIR OPEN CIRCUIT IN POWER SUPPLY WIRE TO PCV SOLENOID. RETEST.

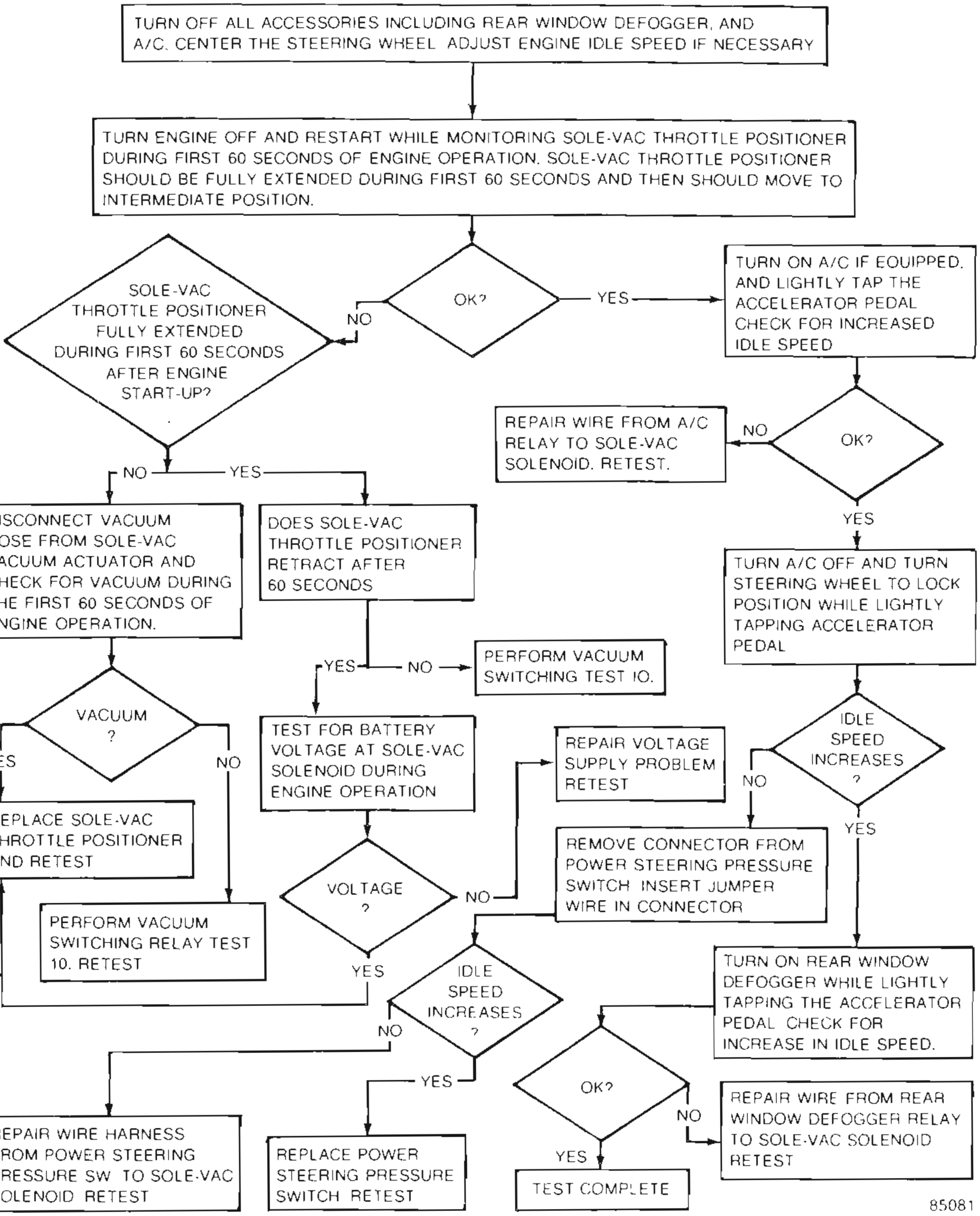
85080C

SEE I.S. NOTES

DIAGNOSTIC TEST 9

IDLE SPEED CONTROL SYSTEM TEST

NOTE. TEST MUST BE PERFORMED WITH ENGINE AT NORMAL OPERATING TEMPERATURE AND AFTER CEC SYSTEM DIAGNOSTIC TESTS ARE COMPLETED.



TURN OFF ALL ACCESSORIES INCLUDING REAR WINDOW DEFOGGER, AND A/C. CENTER THE STEERING WHEEL ADJUST ENGINE IDLE SPEED IF NECESSARY

TURN ENGINE OFF AND RESTART WHILE MONITORING SOLE-VAC THROTTLE POSITIONER DURING FIRST 60 SECONDS OF ENGINE OPERATION. SOLE-VAC THROTTLE POSITIONER SHOULD BE FULLY EXTENDED DURING FIRST 60 SECONDS AND THEN SHOULD MOVE TO INTERMEDIATE POSITION.

OK?

TURN ON A/C IF EQUIPPED. AND LIGHTLY TAP THE ACCELERATOR PEDAL CHECK FOR INCREASED IDLE SPEED

OK?

REPAIR WIRE FROM A/C RELAY TO SOLE-VAC SOLENOID. RETEST.

TURN A/C OFF AND TURN STEERING WHEEL TO LOCK POSITION WHILE LIGHTLY TAPPING ACCELERATOR PEDAL

IDLE SPEED INCREASES ?

TURN ON REAR WINDOW DEFOGGER WHILE LIGHTLY TAPPING THE ACCELERATOR PEDAL CHECK FOR INCREASE IN IDLE SPEED.

OK?

REPAIR WIRE FROM REAR WINDOW DEFOGGER RELAY TO SOLE-VAC SOLENOID RETEST

TEST COMPLETE

REMOVE CONNECTOR FROM POWER STEERING PRESSURE SWITCH INSERT JUMPER WIRE IN CONNECTOR

IDLE SPEED INCREASES ?

REPLACE POWER STEERING PRESSURE SWITCH RETEST

REPAIR WIRE HARNESS FROM POWER STEERING PRESSURE SW TO SOLE-VAC SOLENOID RETEST

SOLE-VAC THROTTLE POSITIONER FULLY EXTENDED DURING FIRST 60 SECONDS AFTER ENGINE START-UP?

DISCONNECT VACUUM HOSE FROM SOLE-VAC VACUUM ACTUATOR AND CHECK FOR VACUUM DURING THE FIRST 60 SECONDS OF ENGINE OPERATION.

VACUUM ?

REPLACE SOLE-VAC THROTTLE POSITIONER AND RETEST

PERFORM VACUUM SWITCHING RELAY TEST 10. RETEST

DOES SOLE-VAC THROTTLE POSITIONER RETRACT AFTER 60 SECONDS

PERFORM VACUUM SWITCHING TEST 10.

TEST FOR BATTERY VOLTAGE AT SOLE-VAC SOLENOID DURING ENGINE OPERATION

VOLTAGE ?

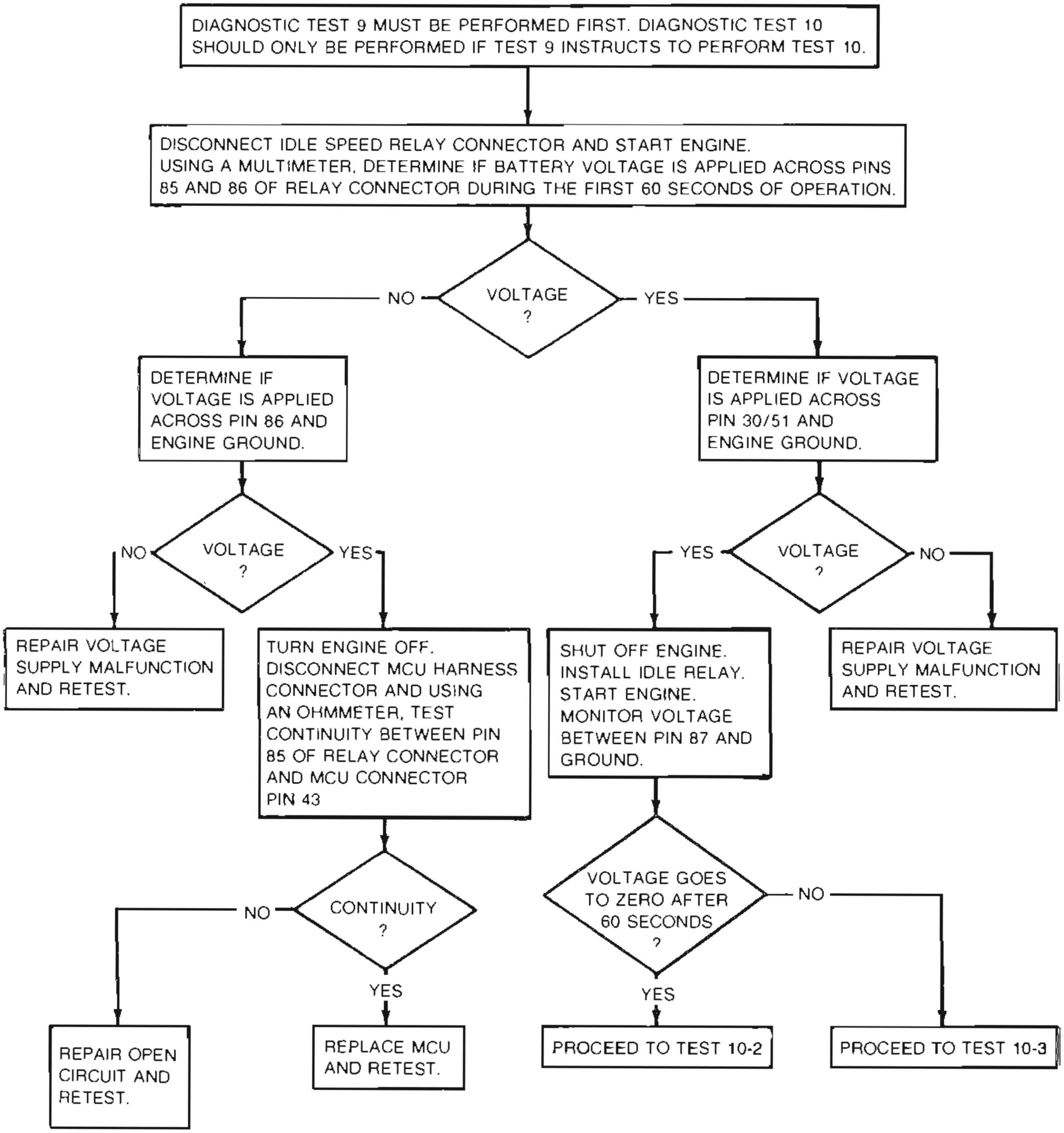
REPAIR VOLTAGE SUPPLY PROBLEM RETEST

85081

SEE I.S. NOTES

DIAGNOSTIC TEST 10-1

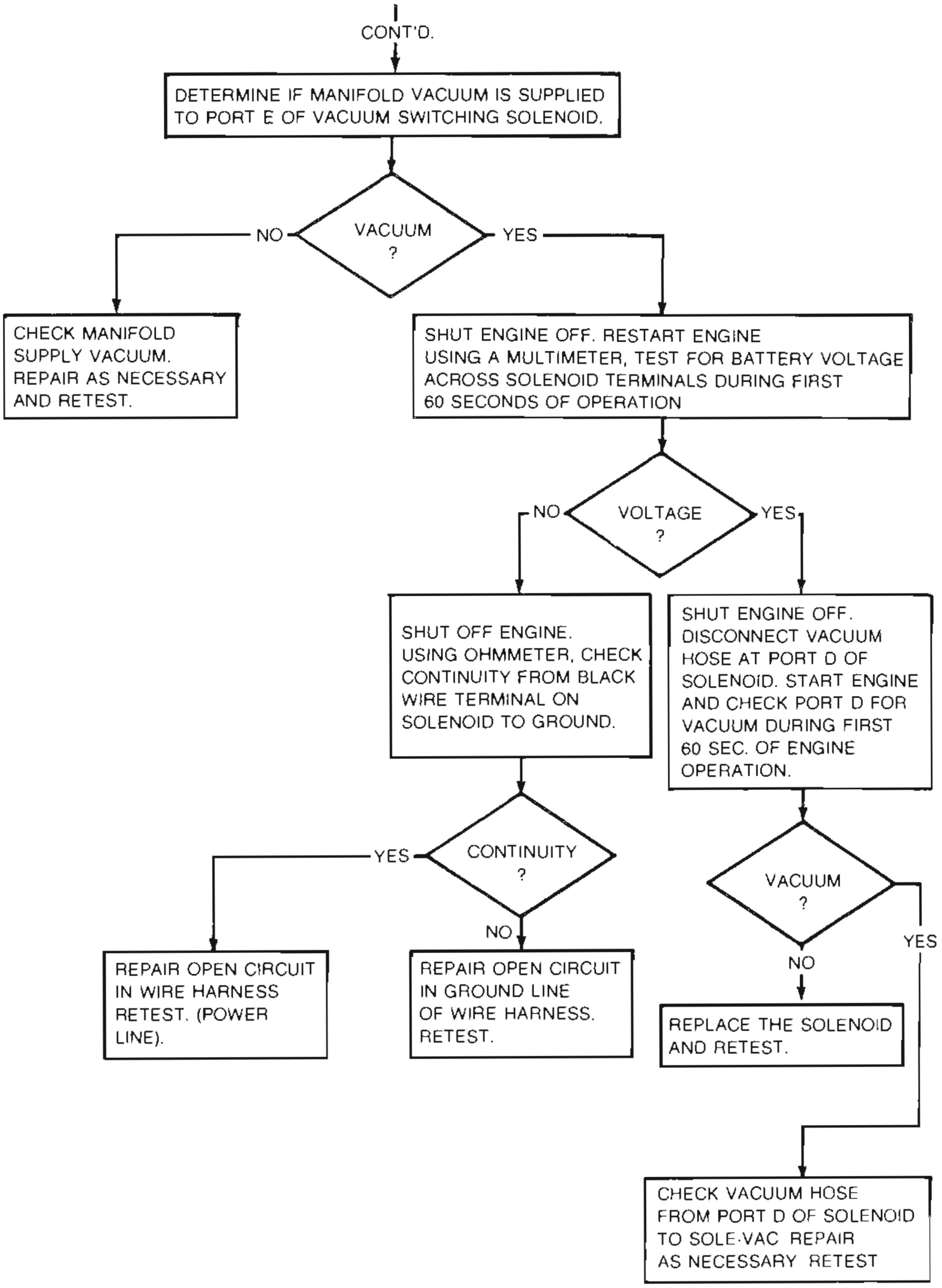
SOLE-VAC VACUUM SWITCHING RELAY TEST



85082A

DIAGNOSTIC TEST 10-2

SOLE-VAC VACUUM SWITCHING RELAY TEST (CONT'D)

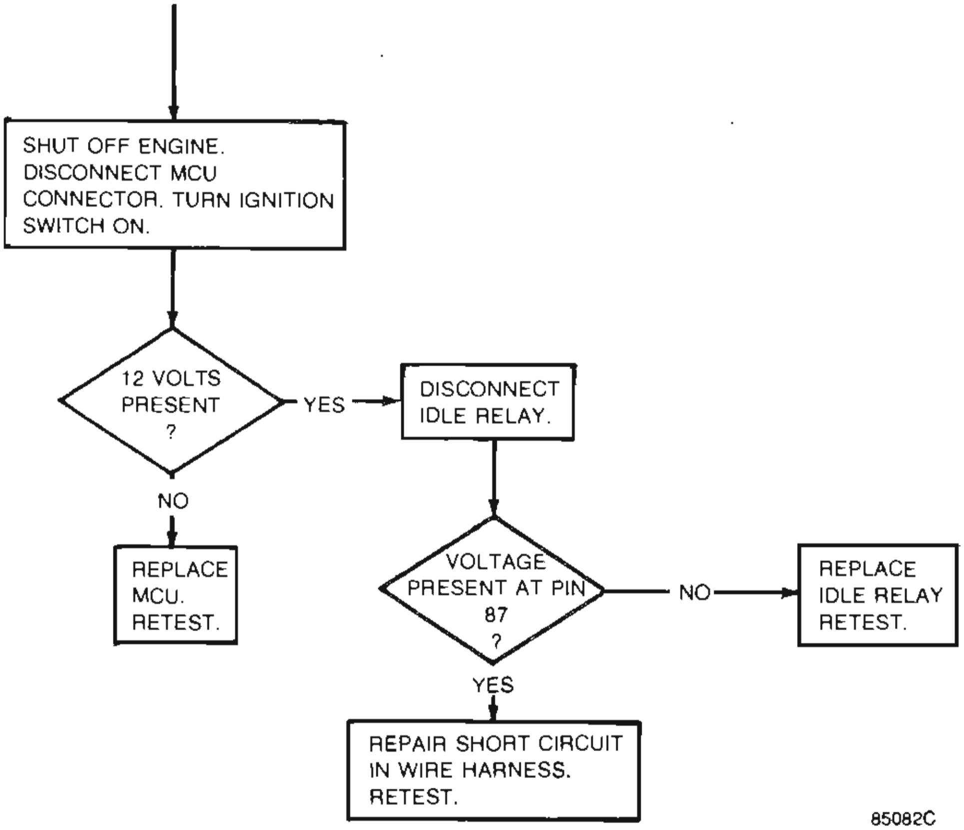


85082B

SEE I.S. NOTES

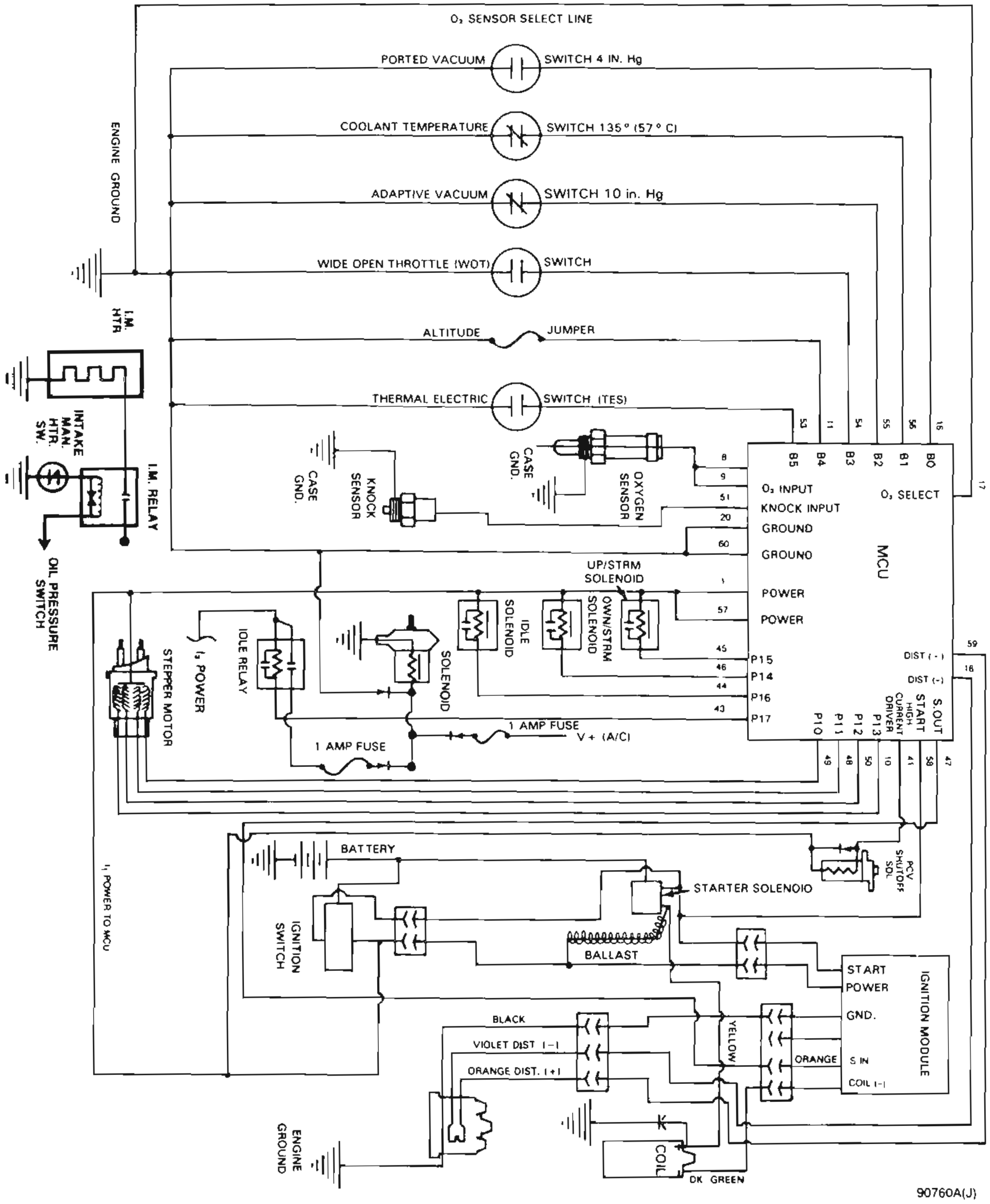
DIAGNOSTIC TEST 10-3

SOLE-VAC VACUUM SWITCHING RELAY TEST (CONT'D)

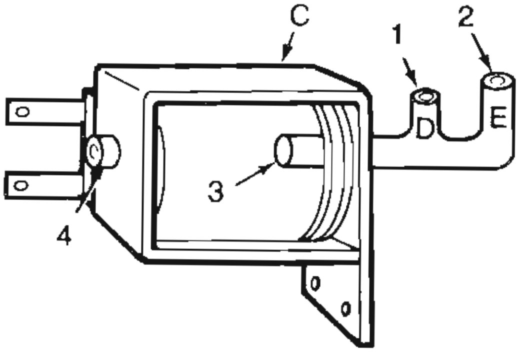


85082C

SIX-CYLINDER ENGINE CEC SYSTEM WIRING DIAGRAM

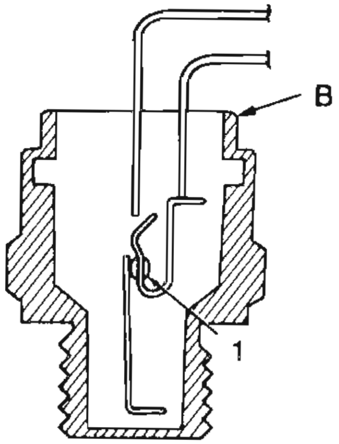


SEE I.S. NOTES



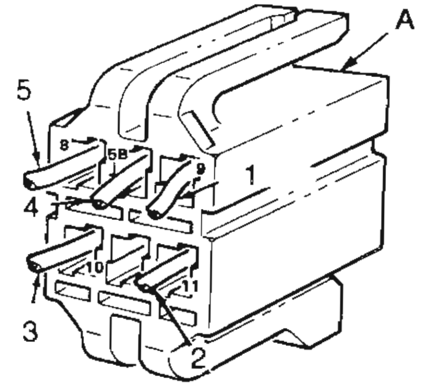
C - Vacuum Switch Solenoid
1 - Common (D)
2 - Normally Closed - NC (E)
3 - Springloaded Pin
4 - Normally Open - NO (Vent)

81147A



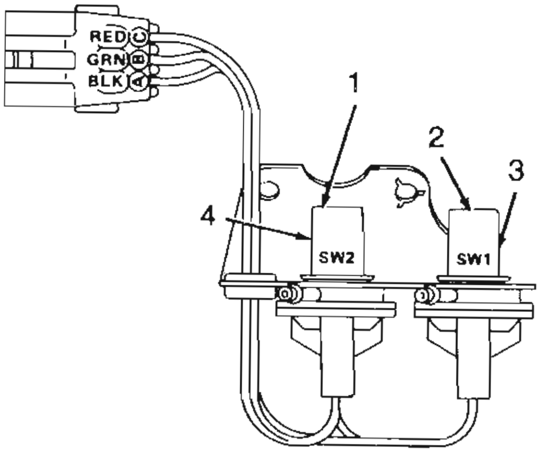
B - Coolant Temperature Switch
1 - Insulator

81146



A - Stepper Motor Connector
1 - Orange
2 - Tan
3 - Violet
4 - Red
5 - Brown

81144

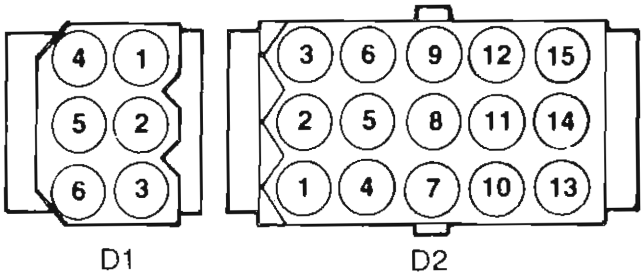


1 - 4-in Hg Vacuum Switch
2 - 10-in Hg Vacuum Switch
3 - Green Color
4 - Natural Color

81147B

SEE I.S. NOTES

DIAGNOSTIC CONNECTORS



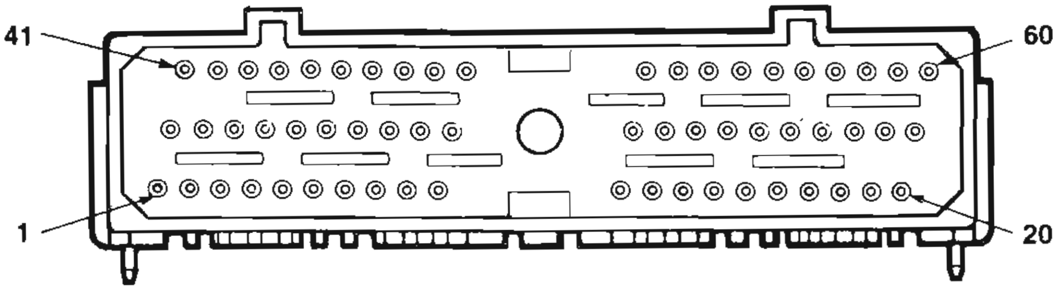
D1

1. TACH
2. ELECTRIC CHOKE
3. GROUND
4. START
5. SOLE-VAC (AFTER RELAY)
6. NOT USED

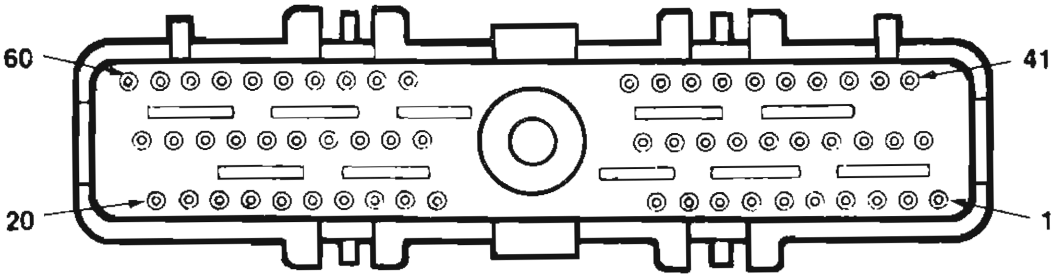
D2

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

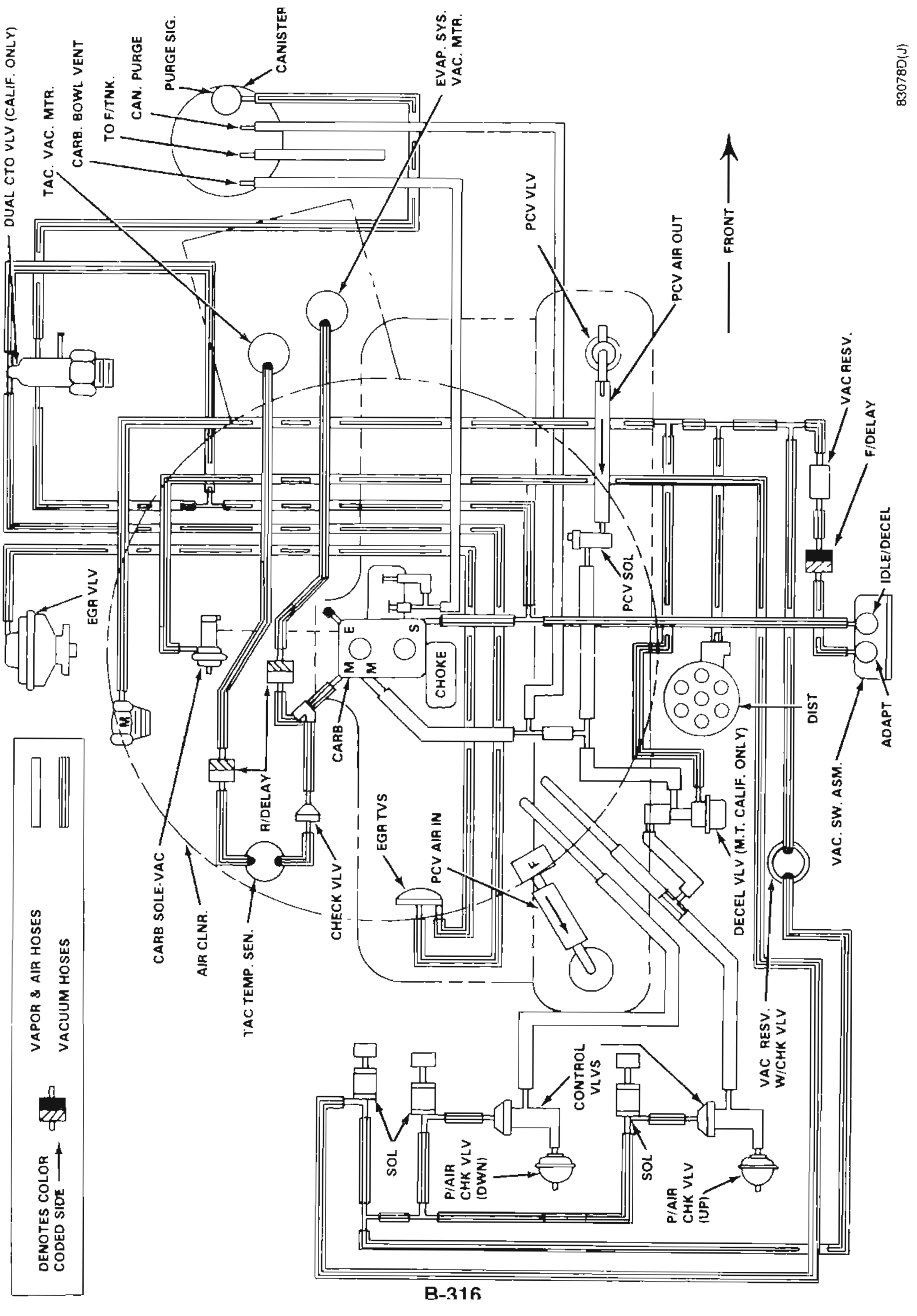


PIN	FUNCTION	PIN	FUNCTION
1	BATTERY	41	HIGH CURRENT 1
2		42	
3		43	P25
4		44	P24
5		45	P15
6		46	P14
7		47	SPOUT
8	O_2 INPUT	48	P11
9	O_2 INPUT	49	P10
10	P13	50	P12
11	B4	51	KNOCK INPUT
12		52	
13		53	B5
14		54	B3
15		55	B2
16	BO	56	B1
17	O_2 SELECT	57	BATTERY
18	DIST (–)	58	START
19		59	DIST (+)
20	GROUND	60	GROUND

83085G

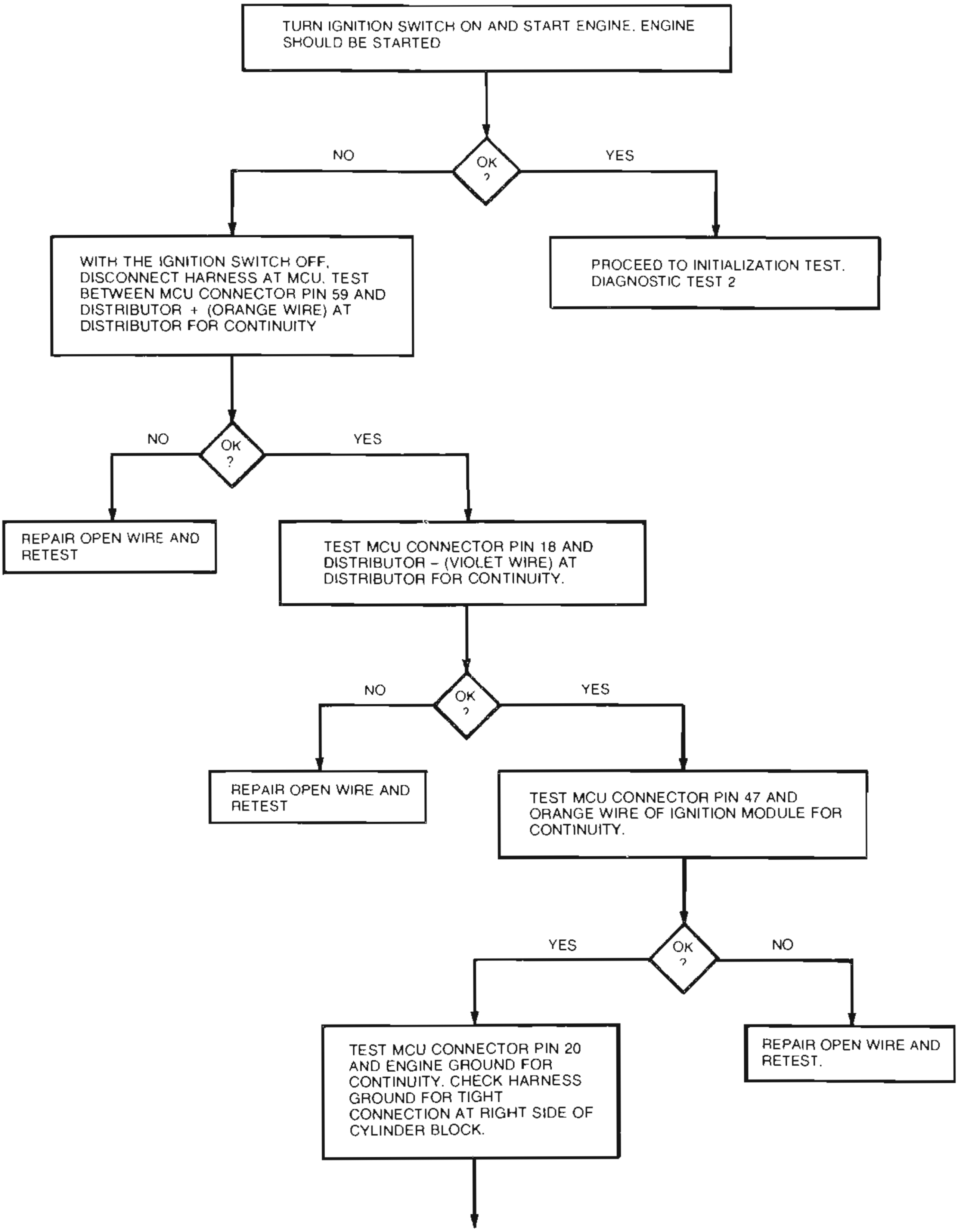
SIX-CYLINDER ENGINE VACUUM DIAGRAM

SEE I.S. NOTES



CEC SYSTEM (SIX-CYLINDER ENGINE)
DIAGNOSTIC TEST 1

OPERATIONAL TEST



TURN IGNITION SWITCH ON AND START ENGINE. ENGINE SHOULD BE STARTED

WITH THE IGNITION SWITCH OFF, DISCONNECT HARNESS AT MCU. TEST BETWEEN MCU CONNECTOR PIN 59 AND DISTRIBUTOR + (ORANGE WIRE) AT DISTRIBUTOR FOR CONTINUITY

PROCEED TO INITIALIZATION TEST. DIAGNOSTIC TEST 2

REPAIR OPEN WIRE AND RETEST

TEST MCU CONNECTOR PIN 18 AND DISTRIBUTOR – (VIOLET WIRE) AT DISTRIBUTOR FOR CONTINUITY.

REPAIR OPEN WIRE AND RETEST

TEST MCU CONNECTOR PIN 47 AND ORANGE WIRE OF IGNITION MODULE FOR CONTINUITY.

TEST MCU CONNECTOR PIN 20 AND ENGINE GROUND FOR CONTINUITY. CHECK HARNESS GROUND FOR TIGHT CONNECTION AT RIGHT SIDE OF CYLINDER BLOCK.

REPAIR OPEN WIRE AND RETEST.

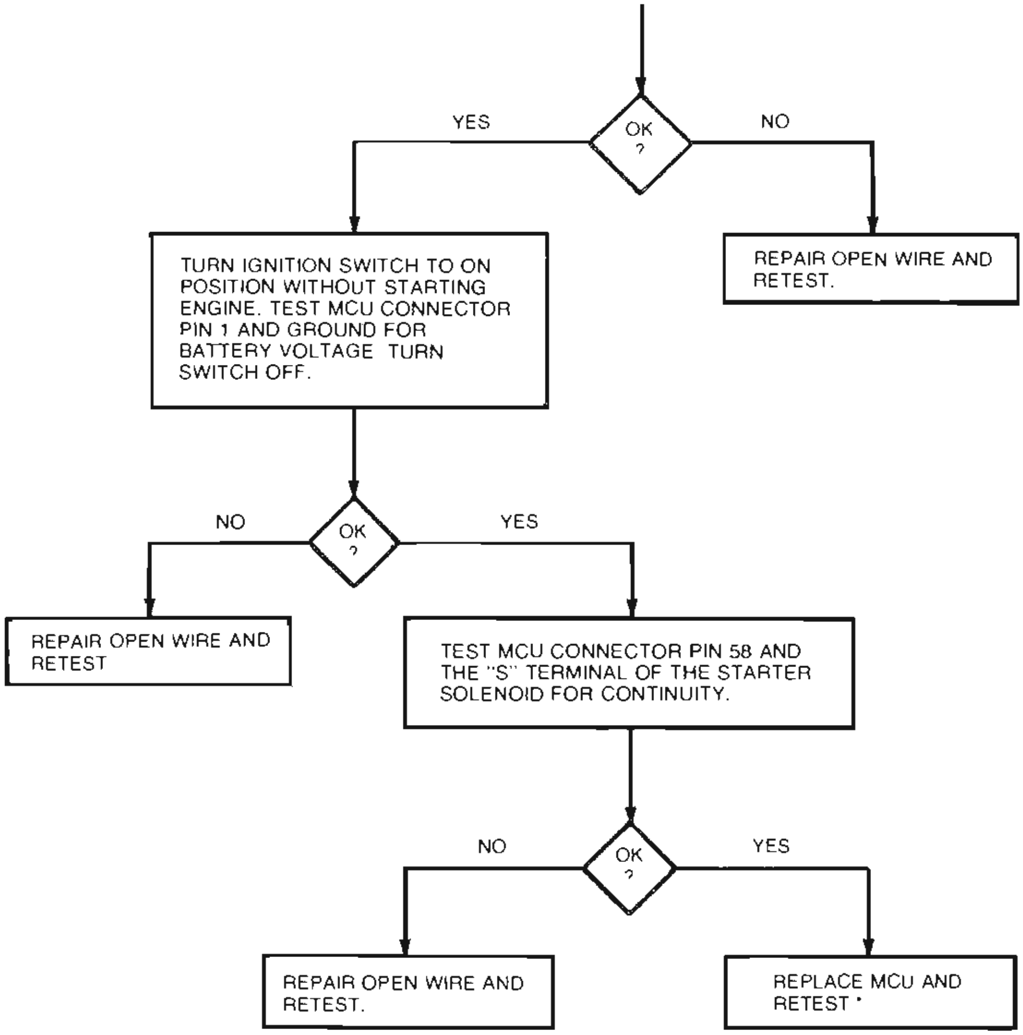
CONT'D

83085A(J)

SEE I.S. NOTES

SEE I.S. NOTES

CONTINUED FROM PREVIOUS PAGE

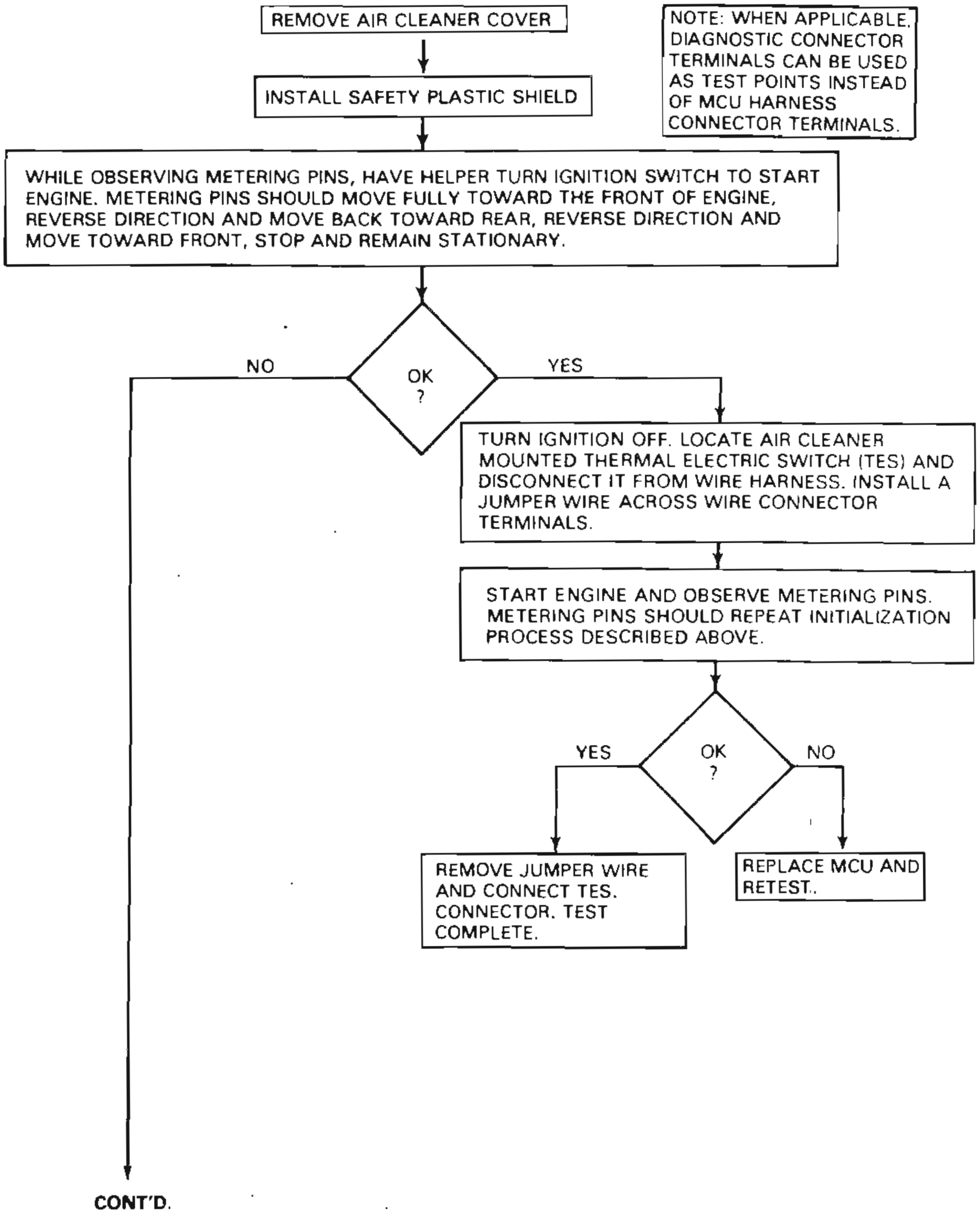


*NOTE: BEFORE REPLACING MCU, IF ENGINE FAILS TO START, CHECK FOR FAILURE OF IGNITION MODULE, COIL, DISTRIBUTOR, ETC REFER TO IGNITION SYSTEMS – CHAPTER C.

83085B(J)

DIAGNOSTIC TEST 2

INITIALIZATION TEST



REMOVE AIR CLEANER COVER

INSTALL SAFETY PLASTIC SHIELD

NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU HARNESS CONNECTOR TERMINALS.

WHILE OBSERVING METERING PINS, HAVE HELPER TURN IGNITION SWITCH TO START ENGINE. METERING PINS SHOULD MOVE FULLY TOWARD THE FRONT OF ENGINE, REVERSE DIRECTION AND MOVE BACK TOWARD REAR, REVERSE DIRECTION AND MOVE TOWARD FRONT, STOP AND REMAIN STATIONARY.

TURN IGNITION OFF. LOCATE AIR CLEANER MOUNTED THERMAL ELECTRIC SWITCH (TES) AND DISCONNECT IT FROM WIRE HARNESS. INSTALL A JUMPER WIRE ACROSS WIRE CONNECTOR TERMINALS.

START ENGINE AND OBSERVE METERING PINS. METERING PINS SHOULD REPEAT INITIALIZATION PROCESS DESCRIBED ABOVE.

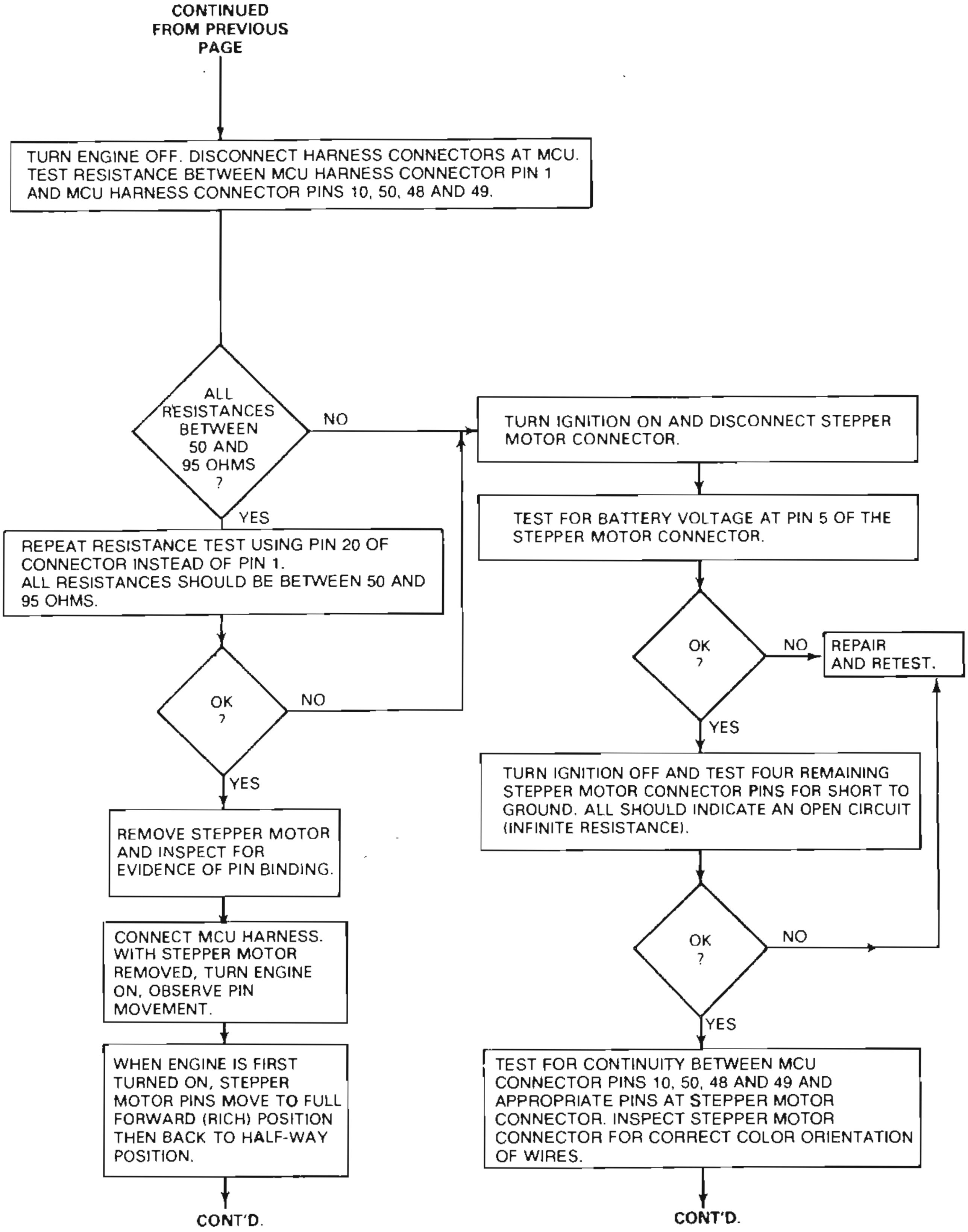
REMOVE JUMPER WIRE AND CONNECT TES. CONNECTOR. TEST COMPLETE.

REPLACE MCU AND RETEST..

CONT'D.

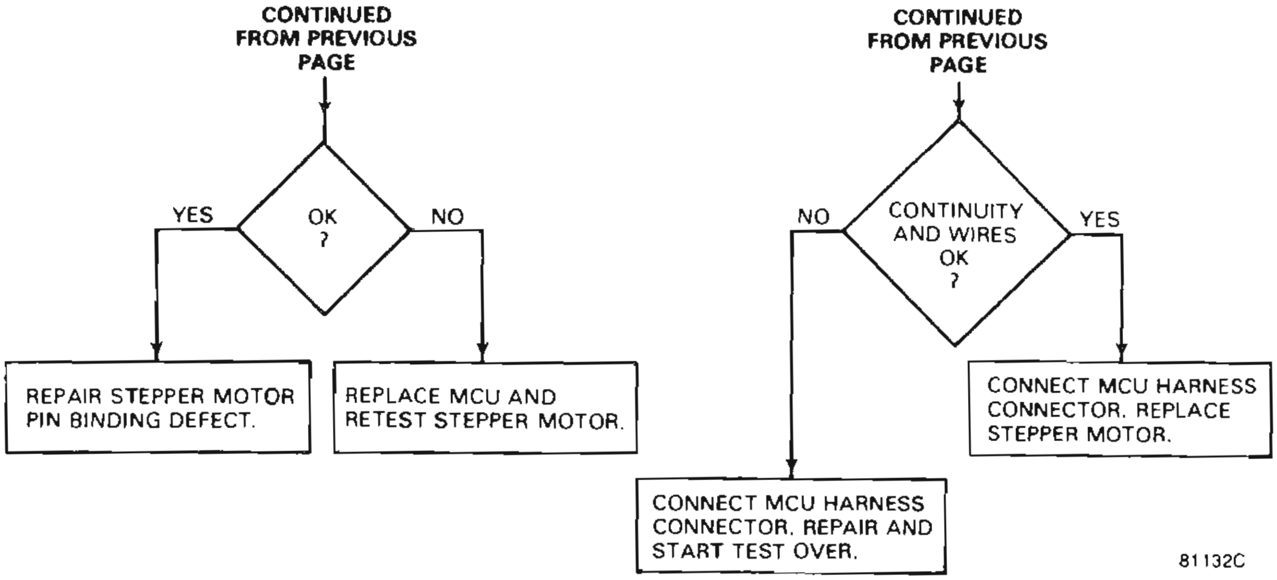
83085D(J)

SEE I.S. NOTES



83085E(J)

SEE I.S. NOTES



81132C

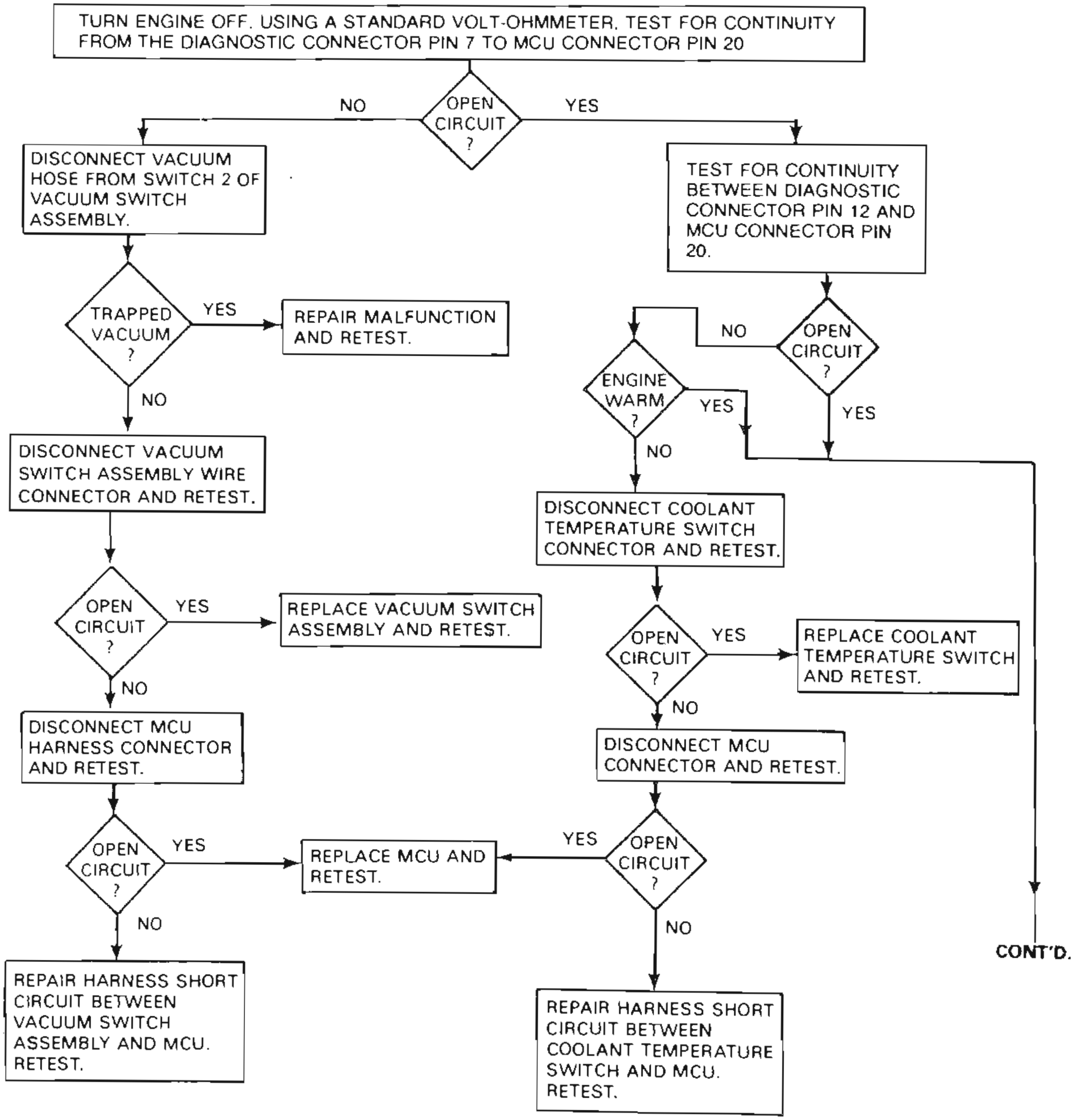
SEE I.S. NOTES

DIAGNOSTIC TEST 3

OPEN LOOP SWITCH TEST

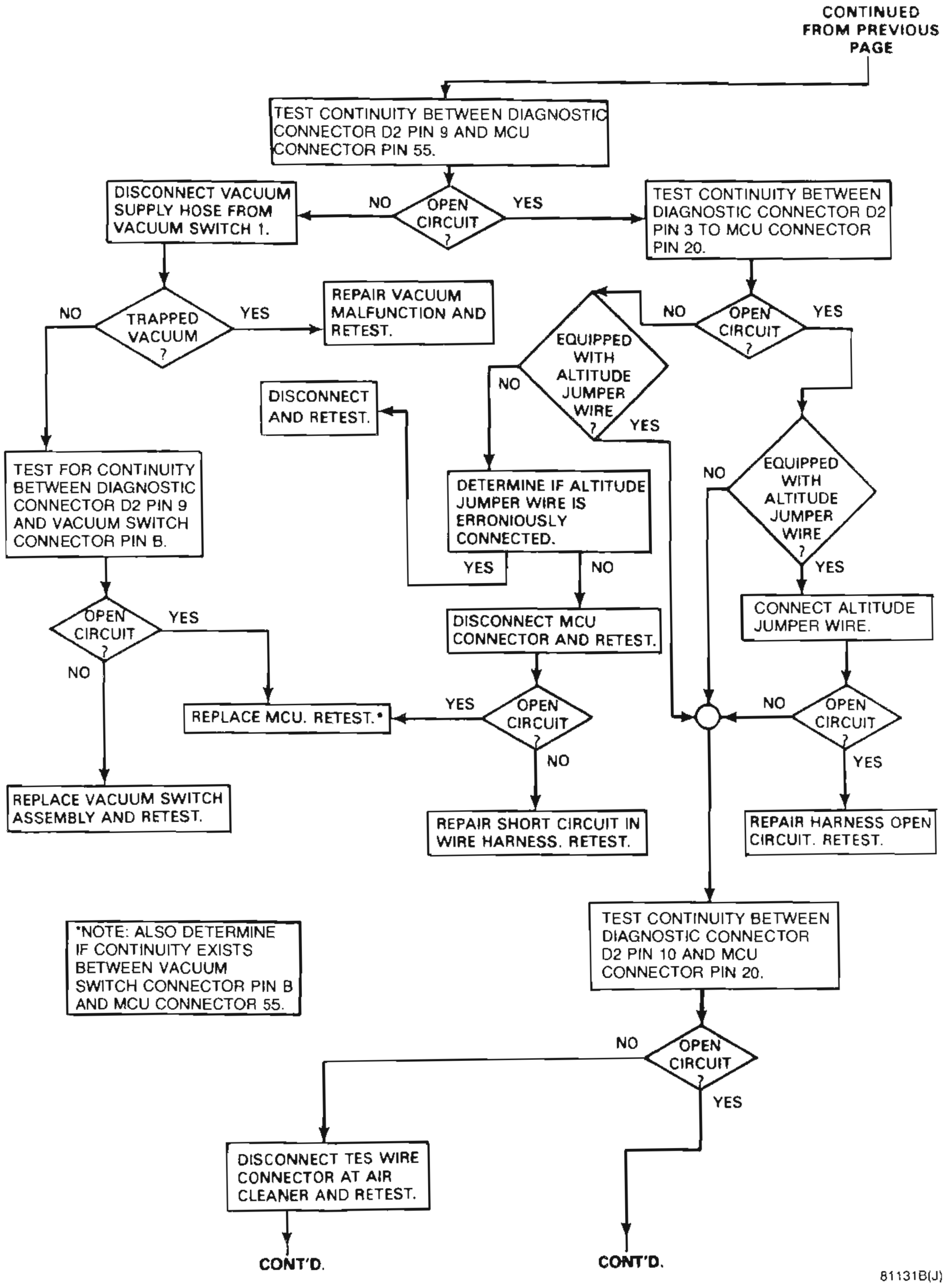
NOTE: ENGINE SHOULD BE AT NORMAL OPERATING TEMPERATURE. ALL CONTINUITY TESTING SHOULD BE DONE WITH MCU DISCONNECTED.

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.

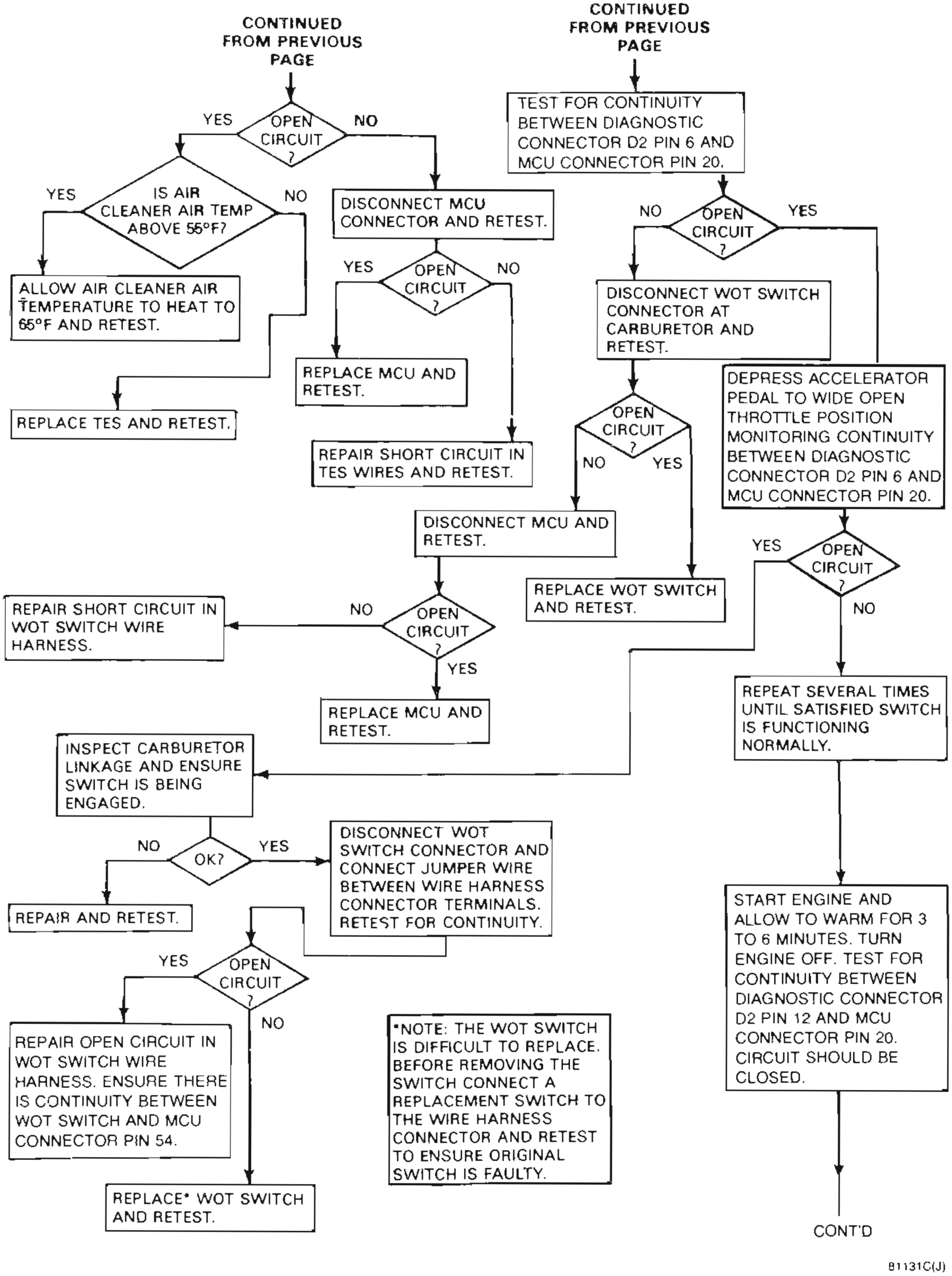


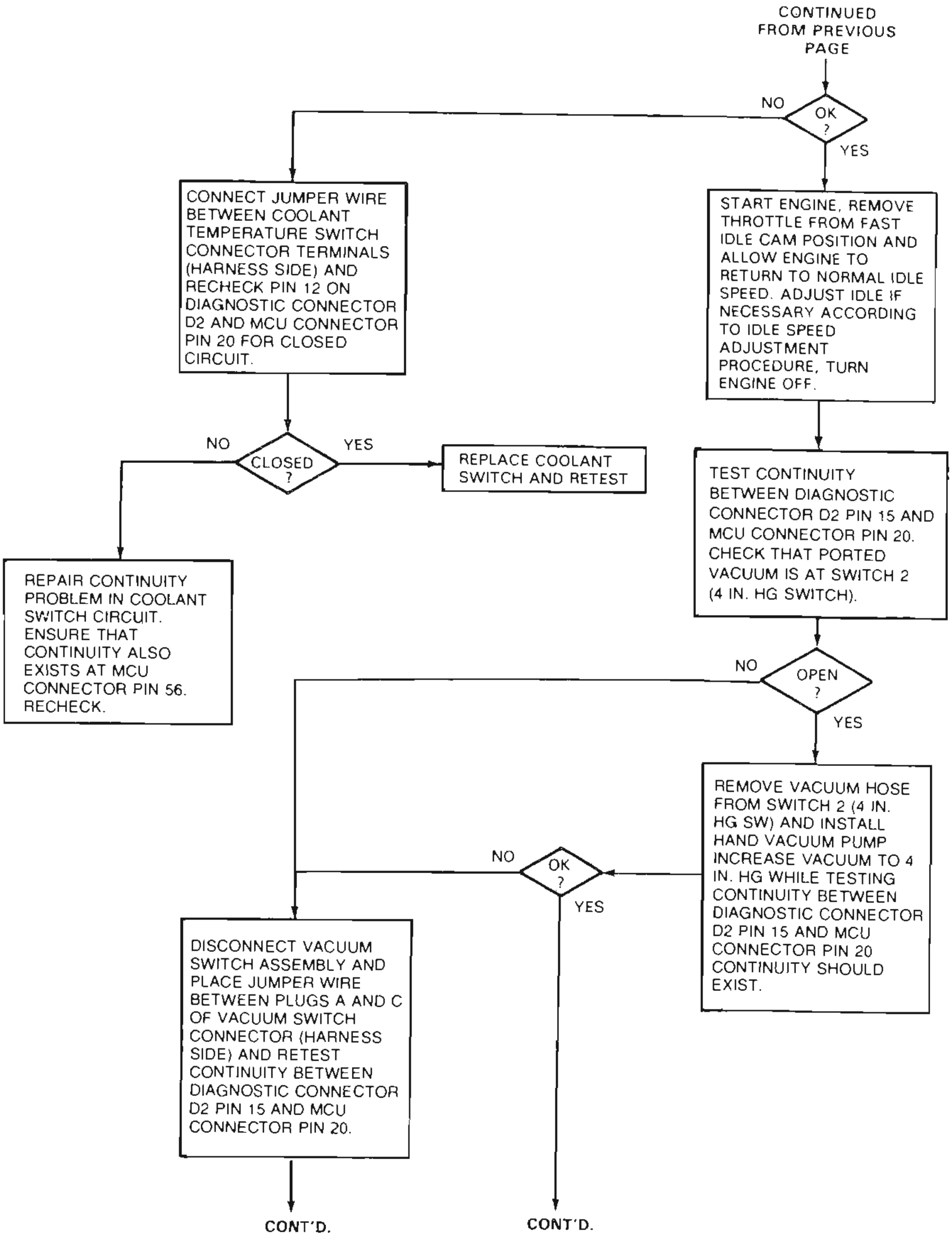
81131A(J)

SEE I.S. NOTES


CONTINUED FROM PREVIOUS PAGE
TEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 9 AND MCU CONNECTOR PIN 55.
OPEN CIRCUIT ?
NO
YES
DISCONNECT VACUUM SUPPLY HOSE FROM VACUUM SWITCH 1.
TEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 3 TO MCU CONNECTOR PIN 20.
TRAPPED VACUUM ?
NO
YES
REPAIR VACUUM MALFUNCTION AND RETEST.
OPEN CIRCUIT ?
NO
YES
EQUIPPED WITH ALTITUDE JUMPER WIRE ?
NO
YES
DISCONNECT AND RETEST.
TEST FOR CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 9 AND VACUUM SWITCH CONNECTOR PIN B.
DETERMINE IF ALTITUDE JUMPER WIRE IS ERRONIOUSLY CONNECTED.
YES
NO
EQUIPPED WITH ALTITUDE JUMPER WIRE ?
NO
YES
CONNECT ALTITUDE JUMPER WIRE.
DISCONNECT MCU CONNECTOR AND RETEST.
OPEN CIRCUIT ?
YES
NO
REPLACE MCU. RETEST.*
OPEN CIRCUIT ?
YES
NO
OPEN CIRCUIT ?
NO
YES
REPLACE VACUUM SWITCH ASSEMBLY AND RETEST.
REPAIR SHORT CIRCUIT IN WIRE HARNESS. RETEST.
REPAIR HARNESS OPEN CIRCUIT. RETEST.
*NOTE: ALSO DETERMINE IF CONTINUITY EXISTS BETWEEN VACUUM SWITCH CONNECTOR PIN B AND MCU CONNECTOR 55.
TEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 10 AND MCU CONNECTOR PIN 20.
OPEN CIRCUIT ?
NO
YES
DISCONNECT TES WIRE CONNECTOR AT AIR CLEANER AND RETEST.
CONT'D.
CONT'D.
81131B(J)

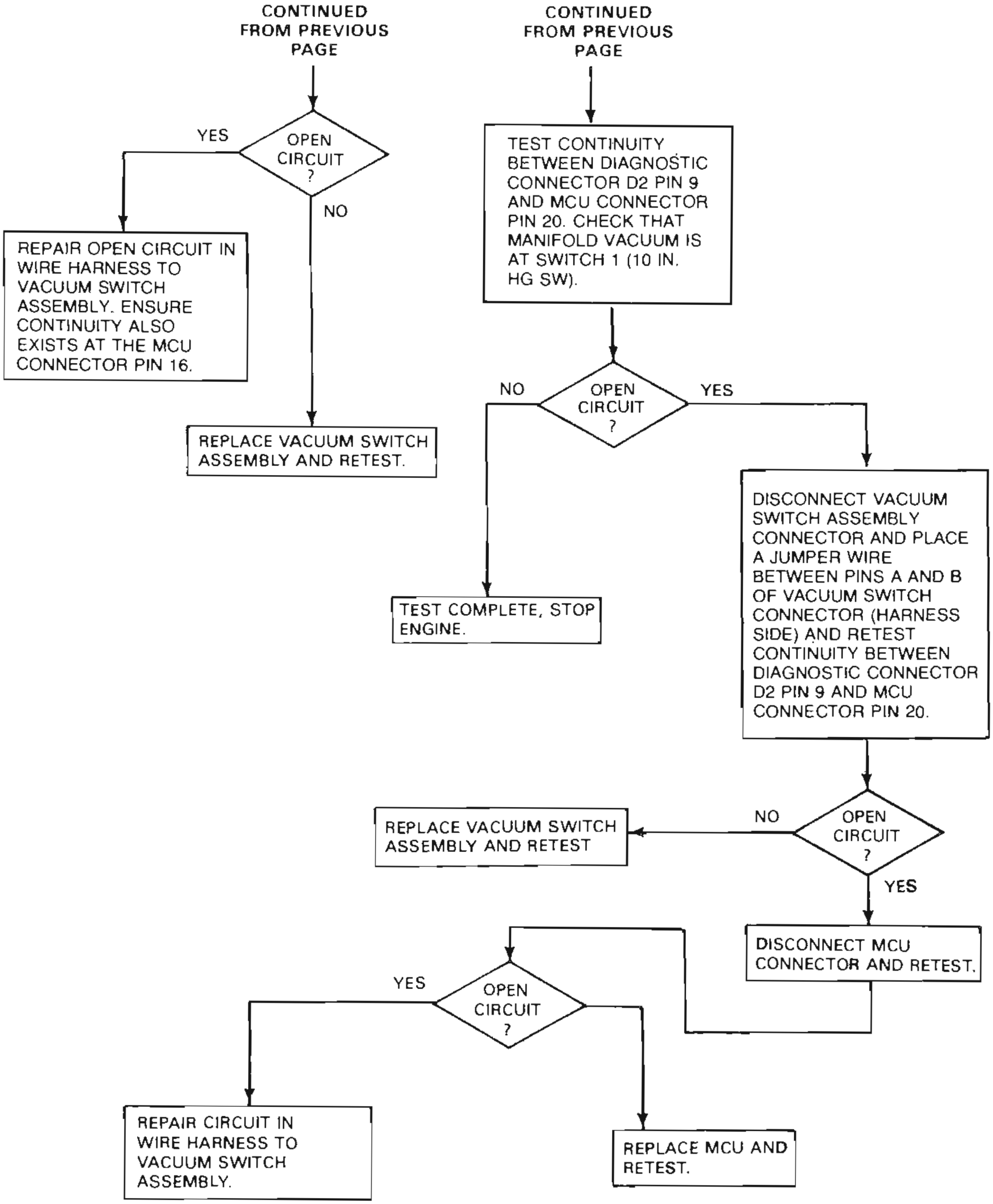
SEE I.S. NOTES


CONTINUED FROM PREVIOUS PAGE
OPEN CIRCUIT ?
YES
NO
IS AIR CLEANER AIR TEMP ABOVE 55°F?
YES
NO
ALLOW AIR CLEANER AIR TEMPERATURE TO HEAT TO 65°F AND RETEST.
REPLACE TES AND RETEST.
DISCONNECT MCU CONNECTOR AND RETEST.
OPEN CIRCUIT ?
YES
NO
REPLACE MCU AND RETEST.
REPAIR SHORT CIRCUIT IN TES WIRES AND RETEST.
CONTINUED FROM PREVIOUS PAGE
TEST FOR CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 6 AND MCU CONNECTOR PIN 20.
OPEN CIRCUIT ?
NO
YES
DISCONNECT WOT SWITCH CONNECTOR AT CARBURETOR AND RETEST.
OPEN CIRCUIT ?
NO
YES
DISCONNECT MCU AND RETEST.
REPLACE WOT SWITCH AND RETEST.
OPEN CIRCUIT ?
NO
YES
REPAIR SHORT CIRCUIT IN WOT SWITCH WIRE HARNESS.
REPLACE MCU AND RETEST.
DEPRESS ACCELERATOR PEDAL TO WIDE OPEN THROTTLE POSITION MONITORING CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 6 AND MCU CONNECTOR PIN 20.
OPEN CIRCUIT ?
YES
NO
REPEAT SEVERAL TIMES UNTIL SATISFIED SWITCH IS FUNCTIONING NORMALLY.
INSPECT CARBURETOR LINKAGE AND ENSURE SWITCH IS BEING ENGAGED.
OK?
NO
YES
REPAIR AND RETEST.
DISCONNECT WOT SWITCH CONNECTOR AND CONNECT JUMPER WIRE BETWEEN WIRE HARNESS CONNECTOR TERMINALS. RETEST FOR CONTINUITY.
OPEN CIRCUIT ?
YES
NO
REPAIR OPEN CIRCUIT IN WOT SWITCH WIRE HARNESS. ENSURE THERE IS CONTINUITY BETWEEN WOT SWITCH AND MCU CONNECTOR PIN 54.
REPLACE* WOT SWITCH AND RETEST.
*NOTE: THE WOT SWITCH IS DIFFICULT TO REPLACE. BEFORE REMOVING THE SWITCH CONNECT A REPLACEMENT SWITCH TO THE WIRE HARNESS CONNECTOR AND RETEST TO ENSURE ORIGINAL SWITCH IS FAULTY.
START ENGINE AND ALLOW TO WARM FOR 3 TO 6 MINUTES. TURN ENGINE OFF. TEST FOR CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 12 AND MCU CONNECTOR PIN 20. CIRCUIT SHOULD BE CLOSED.
CONT'D
81131C(J)


CONTINUED FROM PREVIOUS PAGE
OK ?
NO
YES
CONNECT JUMPER WIRE BETWEEN COOLANT TEMPERATURE SWITCH CONNECTOR TERMINALS (HARNESS SIDE) AND RECHECK PIN 12 ON DIAGNOSTIC CONNECTOR D2 AND MCU CONNECTOR PIN 20 FOR CLOSED CIRCUIT.
START ENGINE, REMOVE THROTTLE FROM FAST IDLE CAM POSITION AND ALLOW ENGINE TO RETURN TO NORMAL IDLE SPEED. ADJUST IDLE IF NECESSARY ACCORDING TO IDLE SPEED ADJUSTMENT PROCEDURE, TURN ENGINE OFF.
NO
CLOSED ?
YES
REPLACE COOLANT SWITCH AND RETEST
TEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 15 AND MCU CONNECTOR PIN 20. CHECK THAT PORTED VACUUM IS AT SWITCH 2 (4 IN. HG SWITCH).
REPAIR CONTINUITY PROBLEM IN COOLANT SWITCH CIRCUIT. ENSURE THAT CONTINUITY ALSO EXISTS AT MCU CONNECTOR PIN 56. RECHECK.
NO
OPEN ?
YES
REMOVE VACUUM HOSE FROM SWITCH 2 (4 IN. HG SW) AND INSTALL HAND VACUUM PUMP INCREASE VACUUM TO 4 IN. HG WHILE TESTING CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 15 AND MCU CONNECTOR PIN 20 CONTINUITY SHOULD EXIST.
NO
OK ?
YES
DISCONNECT VACUUM SWITCH ASSEMBLY AND PLACE JUMPER WIRE BETWEEN PLUGS A AND C OF VACUUM SWITCH CONNECTOR (HARNESS SIDE) AND RETEST CONTINUITY BETWEEN DIAGNOSTIC CONNECTOR D2 PIN 15 AND MCU CONNECTOR PIN 20.
CONT'D.
CONT'D.

81131D(J)

SEE I.S. NOTES



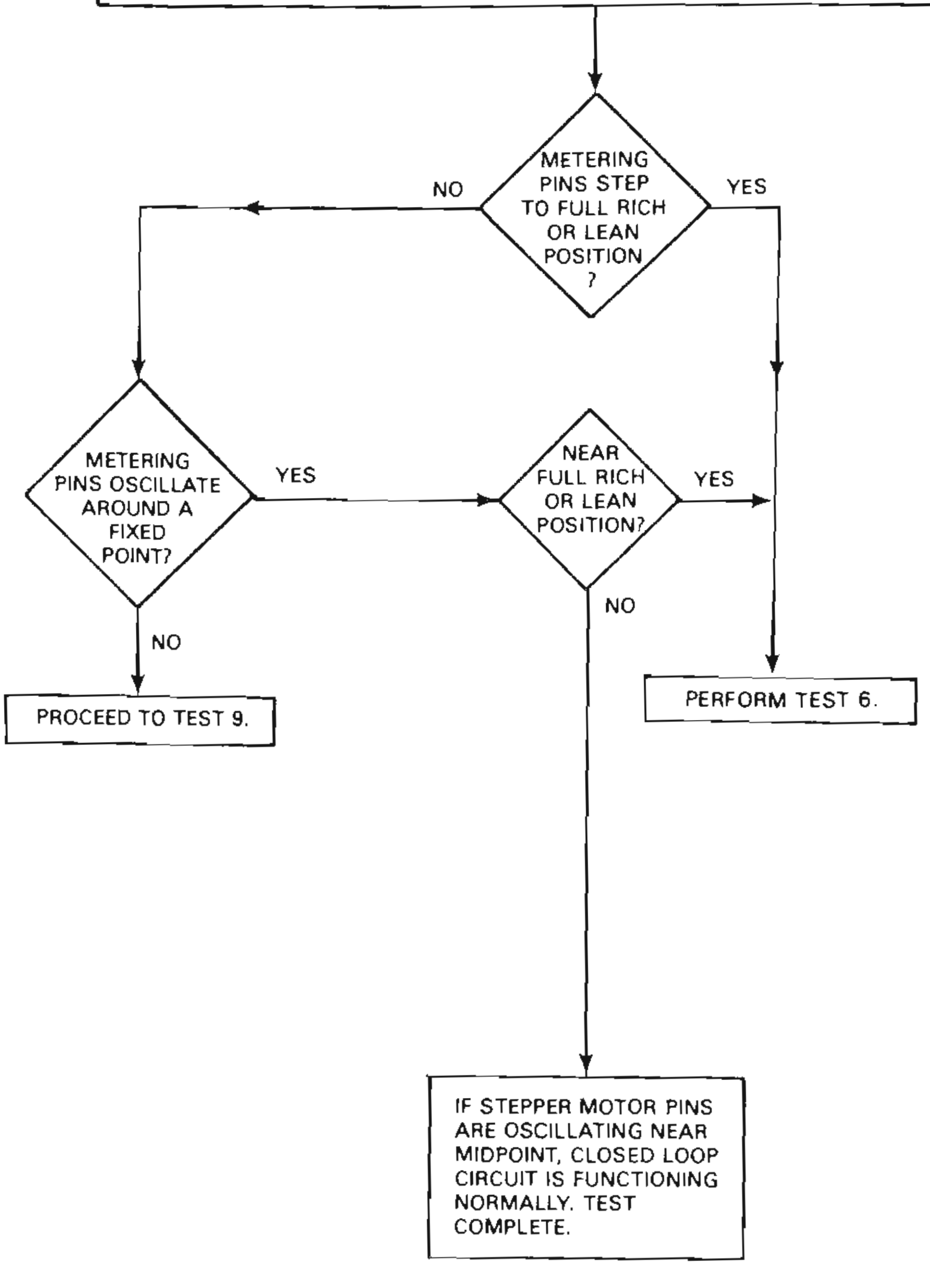
81131E(J)

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.

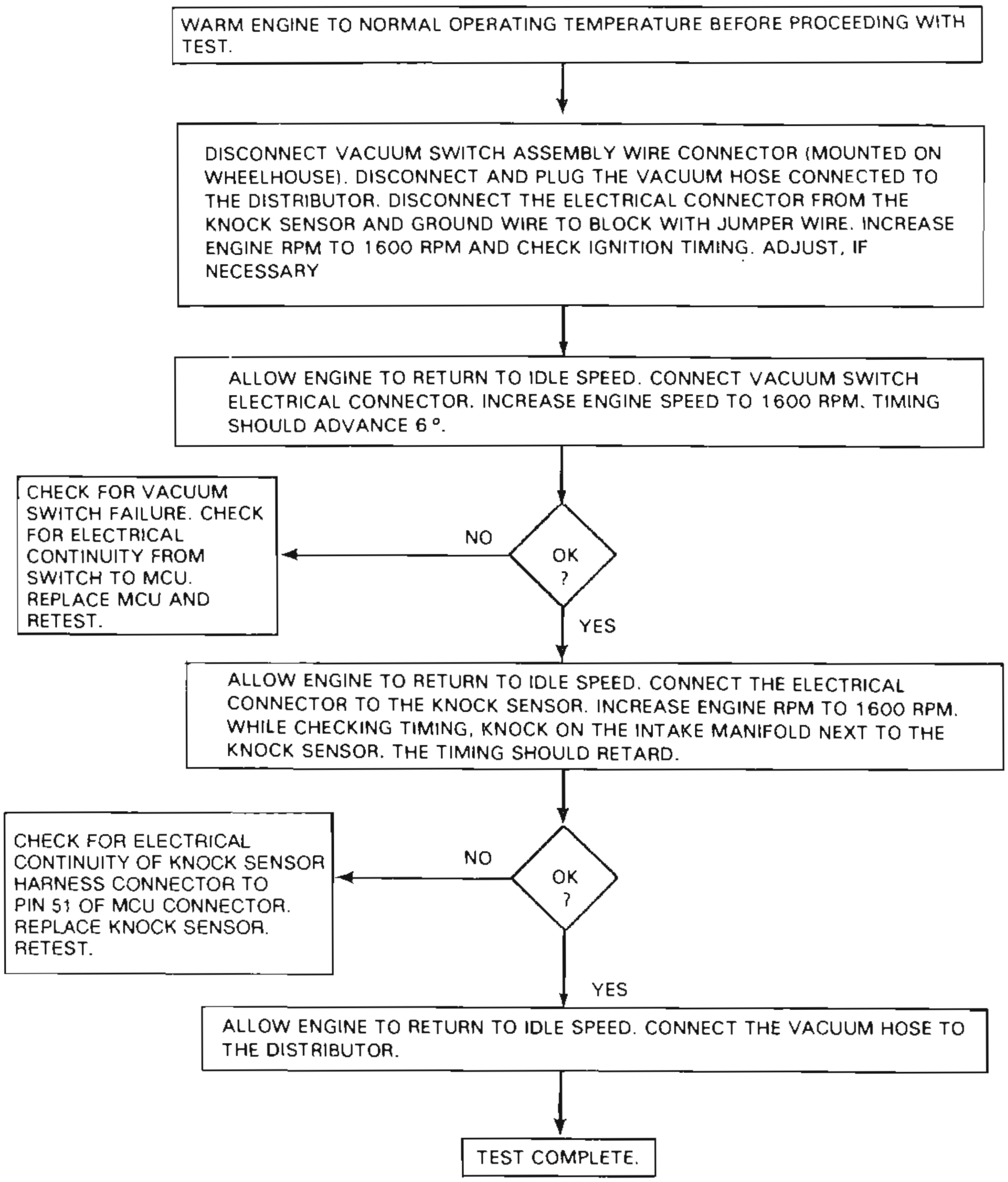


81133

SEE
I.S.
NOTES

DIAGNOSTIC TEST 5

ELECTRONIC IGNITION RETARD TEST



WARM ENGINE TO NORMAL OPERATING TEMPERATURE BEFORE PROCEEDING WITH TEST.

DISCONNECT VACUUM SWITCH ASSEMBLY WIRE CONNECTOR (MOUNTED ON WHEELHOUSE). DISCONNECT AND PLUG THE VACUUM HOSE CONNECTED TO THE DISTRIBUTOR. DISCONNECT THE ELECTRICAL CONNECTOR FROM THE KNOCK SENSOR AND GROUND WIRE TO BLOCK WITH JUMPER WIRE. INCREASE ENGINE RPM TO 1600 RPM AND CHECK IGNITION TIMING. ADJUST, IF NECESSARY

ALLOW ENGINE TO RETURN TO IDLE SPEED. CONNECT VACUUM SWITCH ELECTRICAL CONNECTOR. INCREASE ENGINE SPEED TO 1600 RPM. TIMING SHOULD ADVANCE 6°.

CHECK FOR VACUUM SWITCH FAILURE. CHECK FOR ELECTRICAL CONTINUITY FROM SWITCH TO MCU. REPLACE MCU AND RETEST.

ALLOW ENGINE TO RETURN TO IDLE SPEED. CONNECT THE ELECTRICAL CONNECTOR TO THE KNOCK SENSOR. INCREASE ENGINE RPM TO 1600 RPM. WHILE CHECKING TIMING, KNOCK ON THE INTAKE MANIFOLD NEXT TO THE KNOCK SENSOR. THE TIMING SHOULD RETARD.

CHECK FOR ELECTRICAL CONTINUITY OF KNOCK SENSOR HARNESS CONNECTOR TO PIN 51 OF MCU CONNECTOR. REPLACE KNOCK SENSOR. RETEST.

ALLOW ENGINE TO RETURN TO IDLE SPEED. CONNECT THE VACUUM HOSE TO THE DISTRIBUTOR.

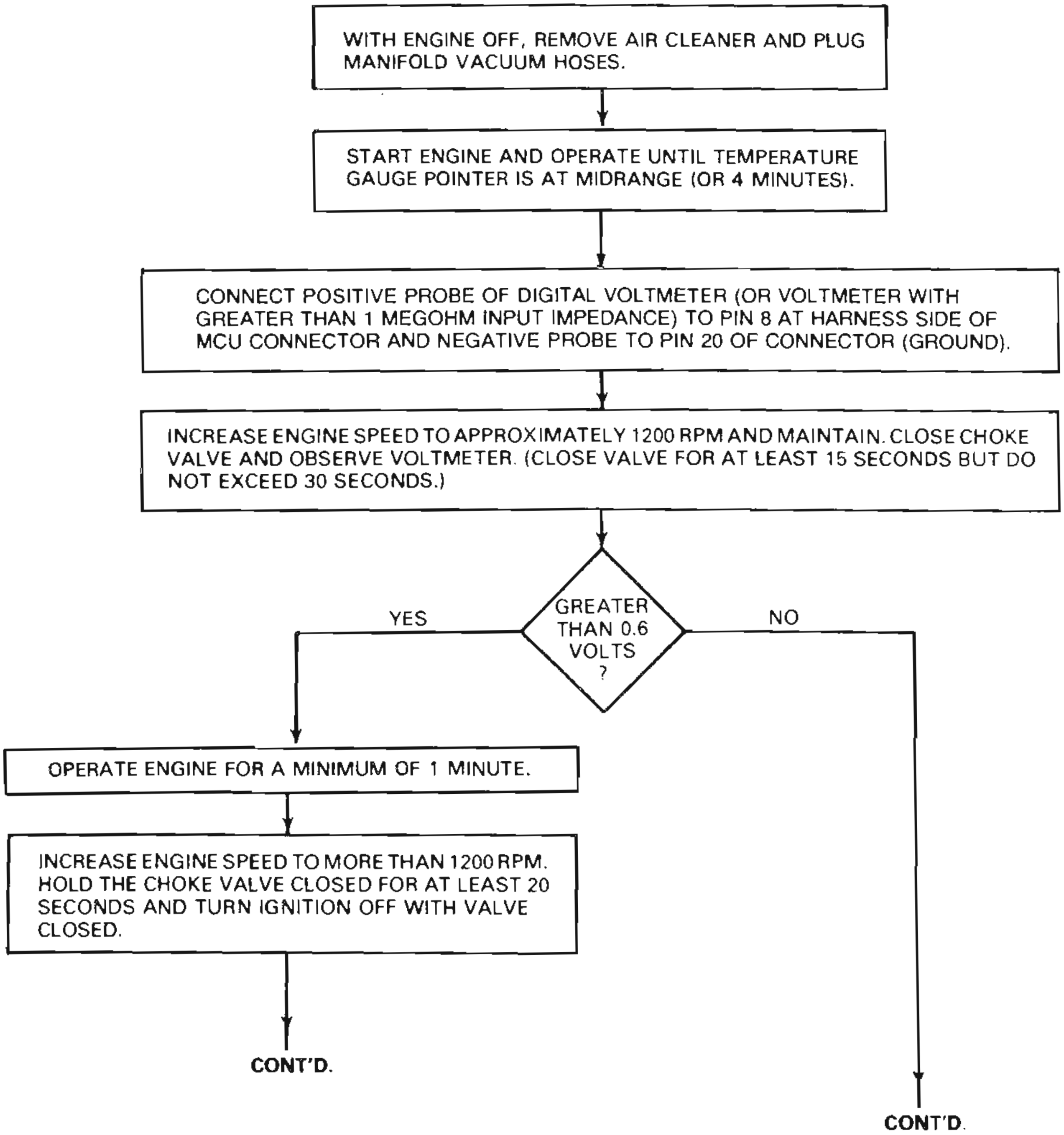
TEST COMPLETE.

83085H(J)

DIAGNOSTIC TEST 6

OXYGEN SENSOR AND
CLOSED LOOP TEST

SEE I.S. NOTES



WITH ENGINE OFF, REMOVE AIR CLEANER AND PLUG MANIFOLD VACUUM HOSES.

START ENGINE AND OPERATE UNTIL TEMPERATURE GAUGE POINTER IS AT MIDRANGE (OR 4 MINUTES).

CONNECT POSITIVE PROBE OF DIGITAL VOLTMETER (OR VOLTMETER WITH GREATER THAN 1 MEGOHM INPUT IMPEDANCE) TO PIN 8 AT HARNESS SIDE OF MCU CONNECTOR AND NEGATIVE PROBE TO PIN 20 OF CONNECTOR (GROUND).

INCREASE ENGINE SPEED TO APPROXIMATELY 1200 RPM AND MAINTAIN. CLOSE CHOKE VALVE AND OBSERVE VOLTMETER. (CLOSE VALVE FOR AT LEAST 15 SECONDS BUT DO NOT EXCEED 30 SECONDS.)

GREATER THAN 0.6 VOLTS ?

YES

OPERATE ENGINE FOR A MINIMUM OF 1 MINUTE.

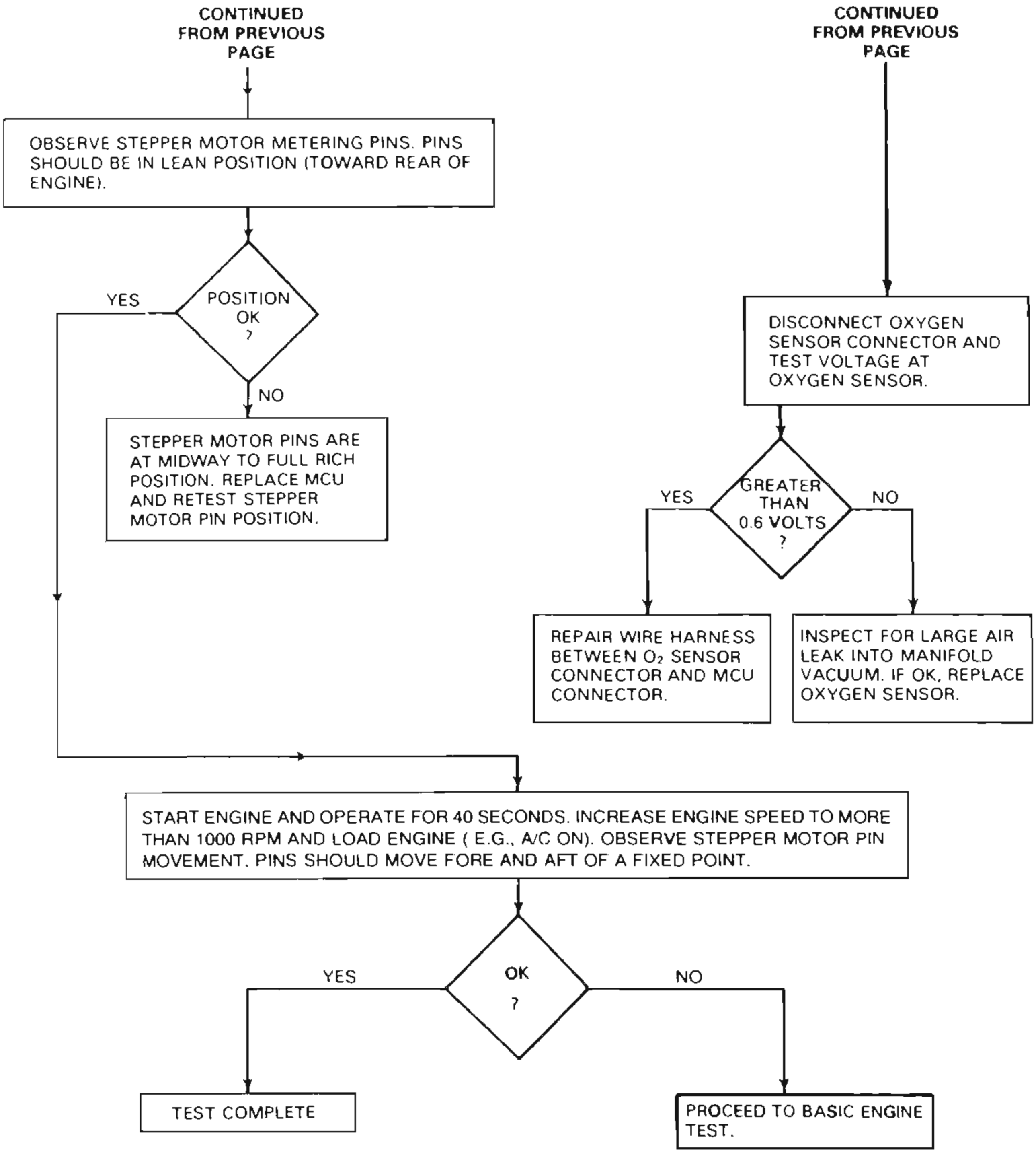
INCREASE ENGINE SPEED TO MORE THAN 1200 RPM. HOLD THE CHOKE VALVE CLOSED FOR AT LEAST 20 SECONDS AND TURN IGNITION OFF WITH VALVE CLOSED.

CONT'D.

NO

CONT'D.

83085J(J)



CONTINUED FROM PREVIOUS PAGE

OBSERVE STEPPER MOTOR METERING PINS. PINS SHOULD BE IN LEAN POSITION (TOWARD REAR OF ENGINE).

POSITION OK ?

YES

NO

STEPPER MOTOR PINS ARE AT MIDWAY TO FULL RICH POSITION. REPLACE MCU AND RETEST STEPPER MOTOR PIN POSITION.

CONTINUED FROM PREVIOUS PAGE

DISCONNECT OXYGEN SENSOR CONNECTOR AND TEST VOLTAGE AT OXYGEN SENSOR.

GREATER THAN 0.6 VOLTS ?

YES

NO

REPAIR WIRE HARNESS BETWEEN O_2 SENSOR CONNECTOR AND MCU CONNECTOR.

INSPECT FOR LARGE AIR LEAK INTO MANIFOLD VACUUM. IF OK, REPLACE OXYGEN SENSOR.

START ENGINE AND OPERATE FOR 40 SECONDS. INCREASE ENGINE SPEED TO MORE THAN 1000 RPM AND LOAD ENGINE (E.G., A/C ON). OBSERVE STEPPER MOTOR PIN MOVEMENT. PINS SHOULD MOVE FORE AND AFT OF A FIXED POINT.

OK ?

YES

NO

TEST COMPLETE

PROCEED TO BASIC ENGINE TEST.

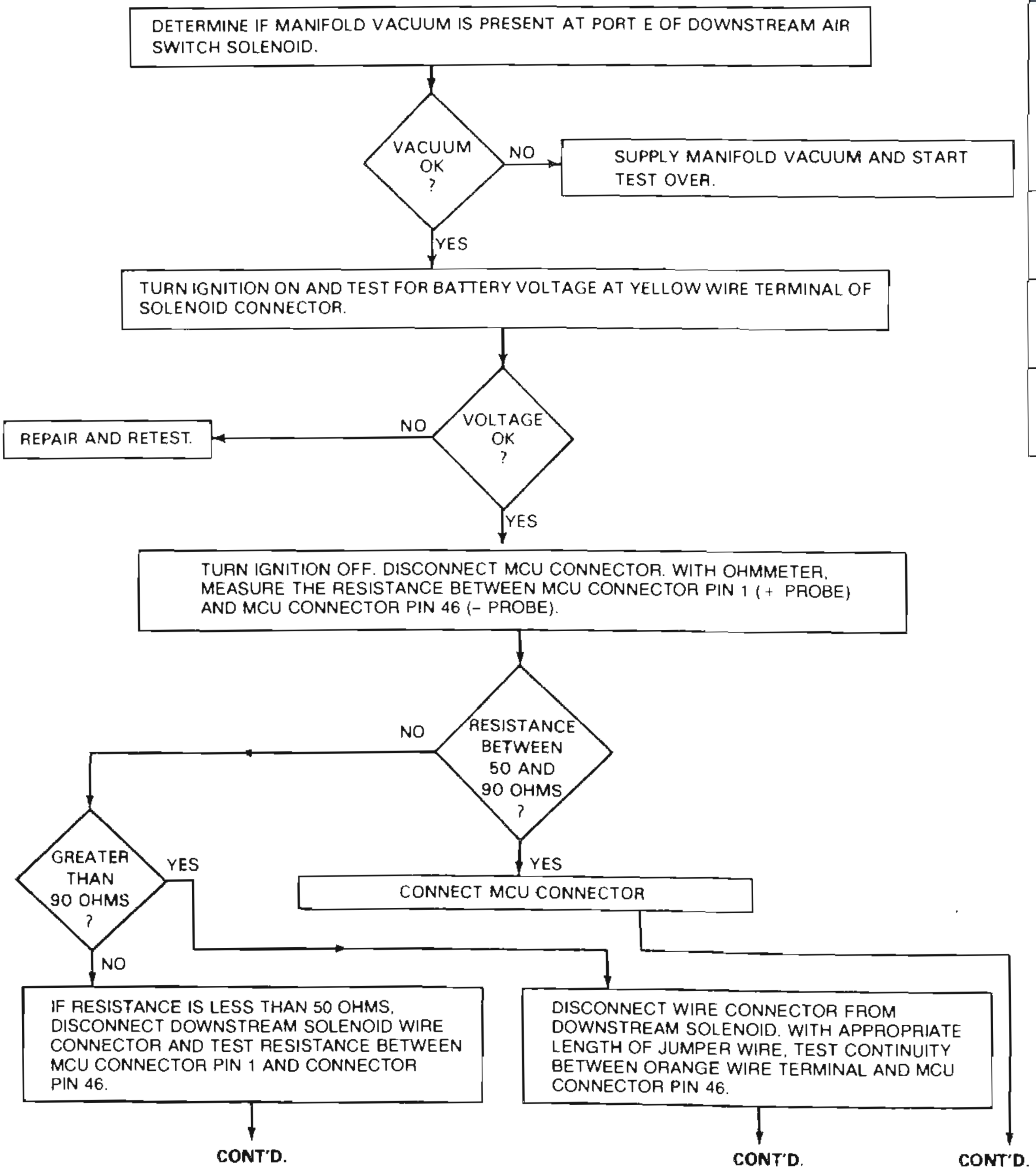
81135B

SEE I.S. NOTES

DIAGNOSTIC TEST 7

DOWNSTREAM SOLENOID TEST

NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.



DETERMINE IF MANIFOLD VACUUM IS PRESENT AT PORT E OF DOWNSTREAM AIR SWITCH SOLENOID.

VACUUM OK ?

SUPPLY MANIFOLD VACUUM AND START TEST OVER.

TURN IGNITION ON AND TEST FOR BATTERY VOLTAGE AT YELLOW WIRE TERMINAL OF SOLENOID CONNECTOR.

VOLTAGE OK ?

REPAIR AND RETEST.

TURN IGNITION OFF. DISCONNECT MCU CONNECTOR. WITH OHMMETER, MEASURE THE RESISTANCE BETWEEN MCU CONNECTOR PIN 1 (+ PROBE) AND MCU CONNECTOR PIN 46 (– PROBE).

RESISTANCE BETWEEN 50 AND 90 OHMS ?

GREATER THAN 90 OHMS ?

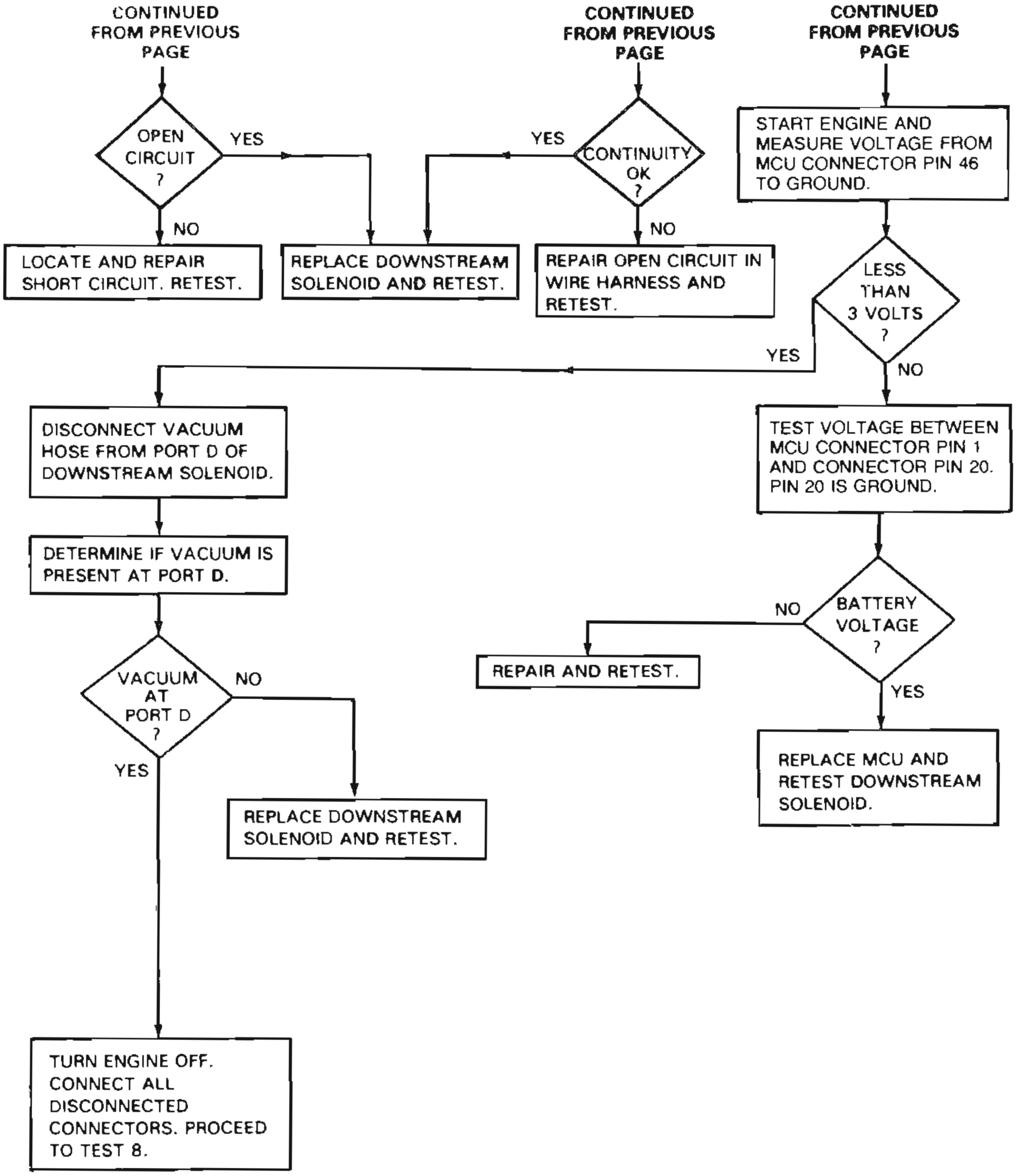
CONNECT MCU CONNECTOR

IF RESISTANCE IS LESS THAN 50 OHMS, DISCONNECT DOWNSTREAM SOLENOID WIRE CONNECTOR AND TEST RESISTANCE BETWEEN MCU CONNECTOR PIN 1 AND CONNECTOR PIN 46.

DISCONNECT WIRE CONNECTOR FROM DOWNSTREAM SOLENOID. WITH APPROPRIATE LENGTH OF JUMPER WIRE, TEST CONTINUITY BETWEEN ORANGE WIRE TERMINAL AND MCU CONNECTOR PIN 46.

83085K(J)

SEE I.S. NOTES

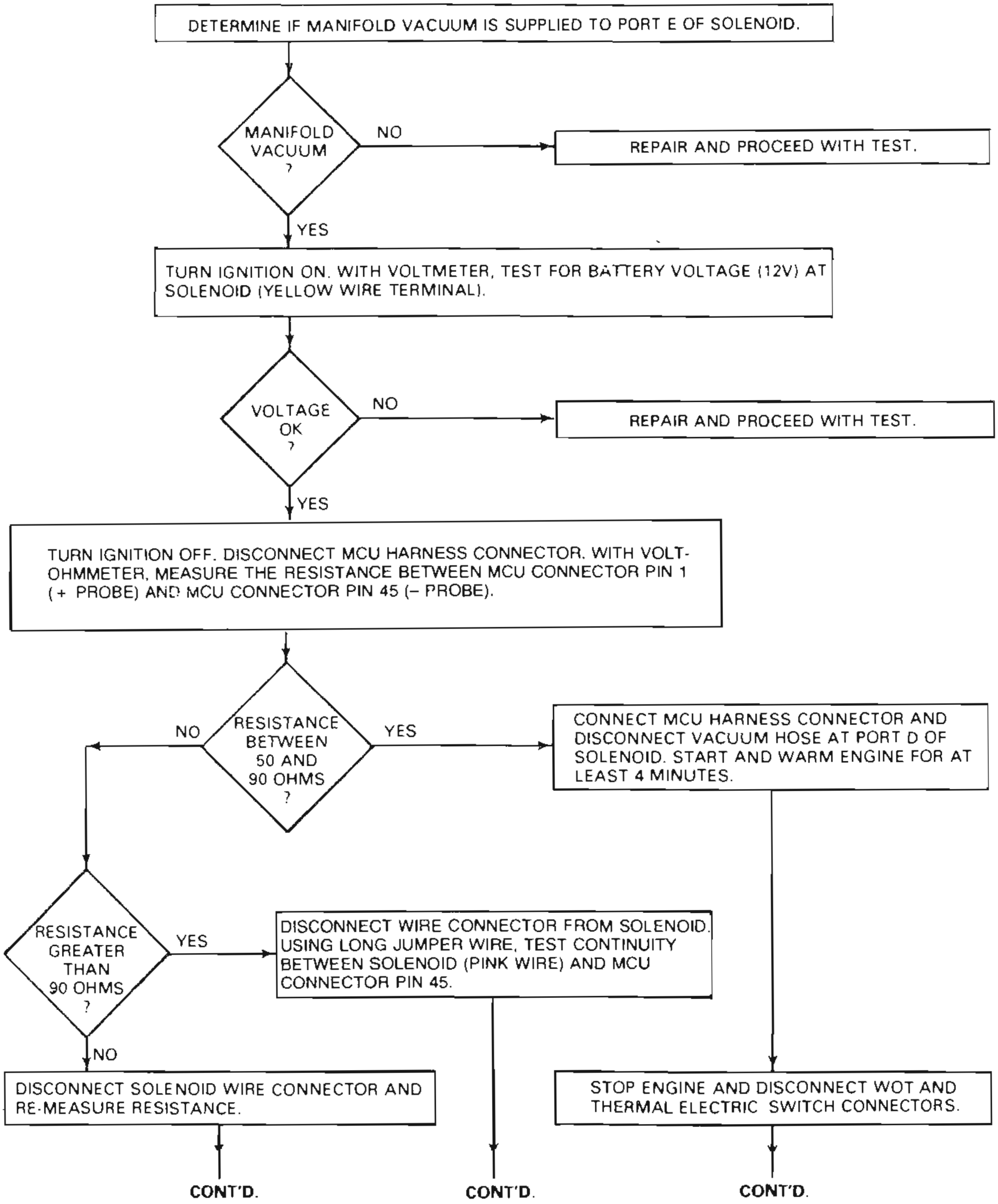


83085L(J)

DIAGNOSTIC TEST 8

UPSTREAM SOLENOID TEST

NOTE: WHEN APPLICABLE, DIAGNOSTIC CONNECTOR TERMINALS CAN BE USED AS TEST POINTS INSTEAD OF MCU CONNECTOR TERMINALS.


DETERMINE IF MANIFOLD VACUUM IS SUPPLIED TO PORT E OF SOLENOID.

MANIFOLD VACUUM ?

REPAIR AND PROCEED WITH TEST.

TURN IGNITION ON. WITH VOLTMETER, TEST FOR BATTERY VOLTAGE (12V) AT SOLENOID (YELLOW WIRE TERMINAL).

VOLTAGE OK ?

REPAIR AND PROCEED WITH TEST.

TURN IGNITION OFF. DISCONNECT MCU HARNESS CONNECTOR. WITH VOLT-OHMMETER, MEASURE THE RESISTANCE BETWEEN MCU CONNECTOR PIN 1 (+ PROBE) AND MCU CONNECTOR PIN 45 (– PROBE).

RESISTANCE BETWEEN 50 AND 90 OHMS ?

CONNECT MCU HARNESS CONNECTOR AND DISCONNECT VACUUM HOSE AT PORT D OF SOLENOID. START AND WARM ENGINE FOR AT LEAST 4 MINUTES.

RESISTANCE GREATER THAN 90 OHMS ?

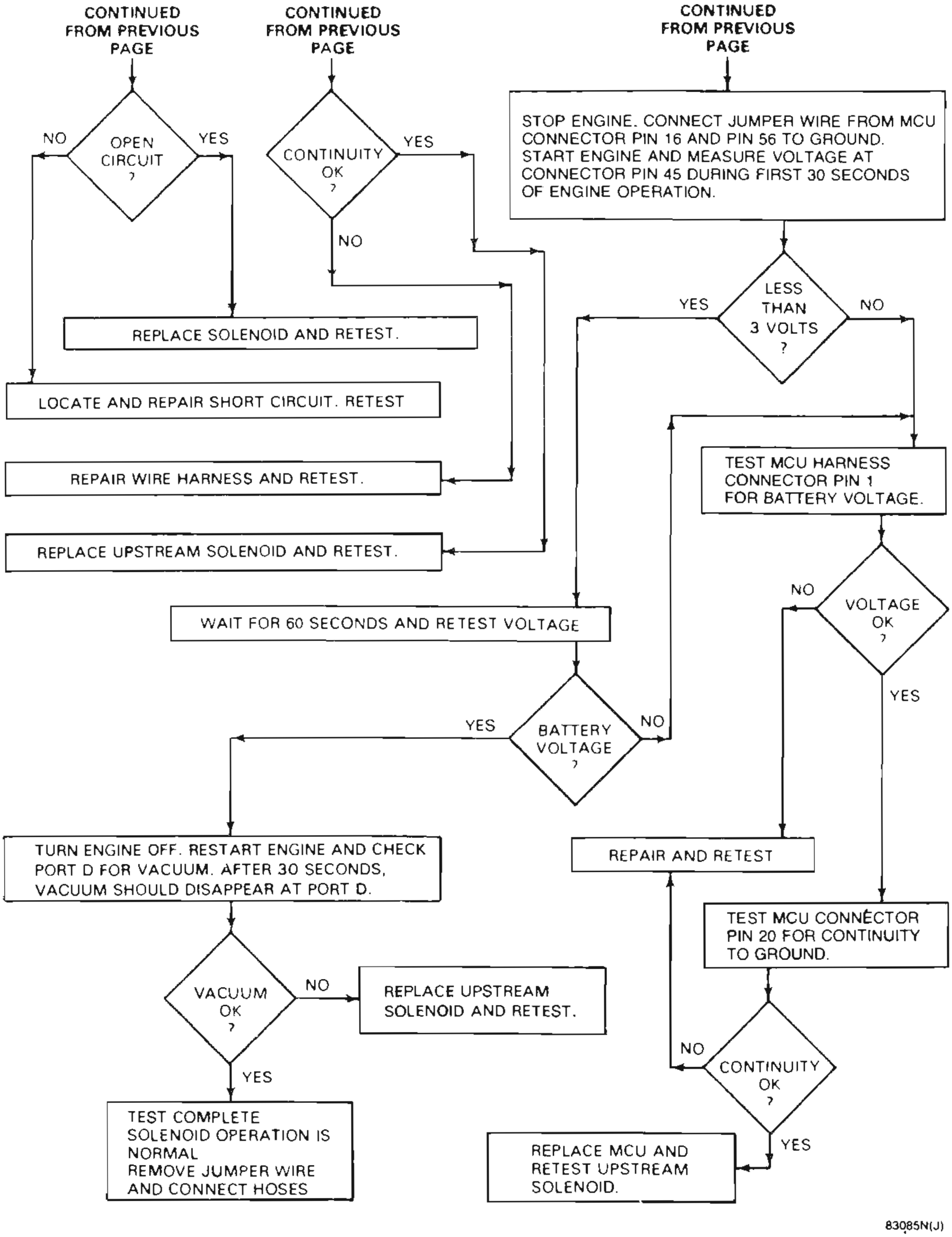
DISCONNECT WIRE CONNECTOR FROM SOLENOID. USING LONG JUMPER WIRE, TEST CONTINUITY BETWEEN SOLENOID (PINK WIRE) AND MCU CONNECTOR PIN 45.

DISCONNECT SOLENOID WIRE CONNECTOR AND RE-MEASURE RESISTANCE.

STOP ENGINE AND DISCONNECT WOT AND THERMAL ELECTRIC SWITCH CONNECTORS.

83085M(J)

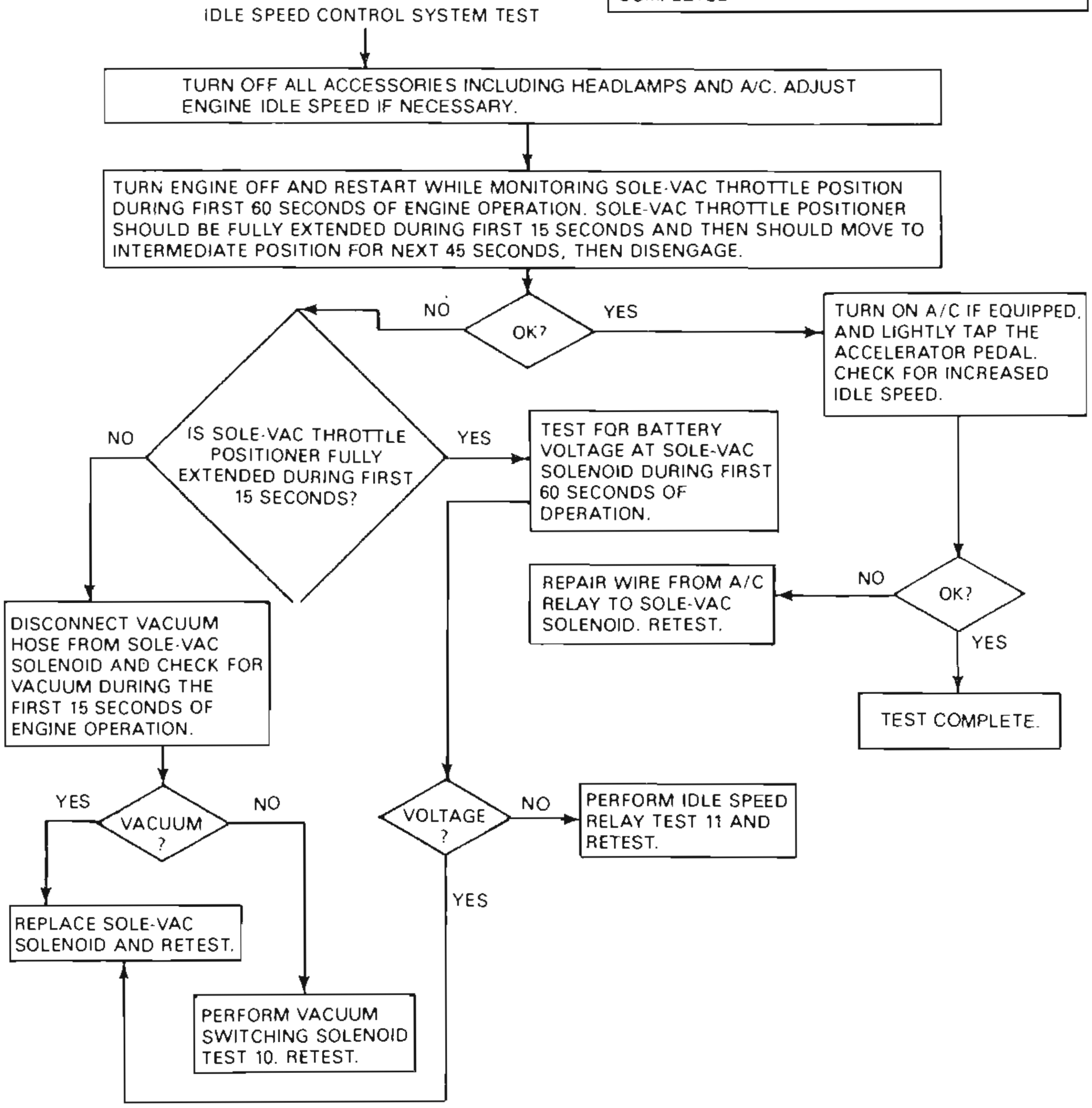
SEE I.S. NOTES


CONTINUED FROM PREVIOUS PAGE
OPEN CIRCUIT ?
NO
YES
CONTINUED FROM PREVIOUS PAGE
CONTINUITY OK ?
YES
NO
CONTINUED FROM PREVIOUS PAGE
STOP ENGINE. CONNECT JUMPER WIRE FROM MCU CONNECTOR PIN 16 AND PIN 56 TO GROUND. START ENGINE AND MEASURE VOLTAGE AT CONNECTOR PIN 45 DURING FIRST 30 SECONDS OF ENGINE OPERATION.
LESS THAN 3 VOLTS ?
YES
NO
REPLACE SOLENOID AND RETEST.
LOCATE AND REPAIR SHORT CIRCUIT. RETEST
REPAIR WIRE HARNESS AND RETEST.
REPLACE UPSTREAM SOLENOID AND RETEST.
TEST MCU HARNESS CONNECTOR PIN 1 FOR BATTERY VOLTAGE.
VOLTAGE OK ?
NO
YES
WAIT FOR 60 SECONDS AND RETEST VOLTAGE
BATTERY VOLTAGE ?
YES
NO
TURN ENGINE OFF. RESTART ENGINE AND CHECK PORT D FOR VACUUM. AFTER 30 SECONDS, VACUUM SHOULD DISAPPEAR AT PORT D.
REPAIR AND RETEST
TEST MCU CONNECTOR PIN 20 FOR CONTINUITY TO GROUND.
VACUUM OK ?
NO
YES
REPLACE UPSTREAM SOLENOID AND RETEST.
CONTINUITY OK ?
NO
YES
TEST COMPLETE SOLENOID OPERATION IS NORMAL REMOVE JUMPER WIRE AND CONNECT HOSES
REPLACE MCU AND RETEST UPSTREAM SOLENOID.
83085N(J)

DIAGNOSTIC TEST 9

NOTE TEST MUST BE PERFORMED WITH ENGINE AT NORMAL OPERATING TEMPERATURE AND AFTER PRECEDING CEC SYSTEM DIAGNOSTIC TESTS ARE COMPLETED

SEE I.S. NOTES

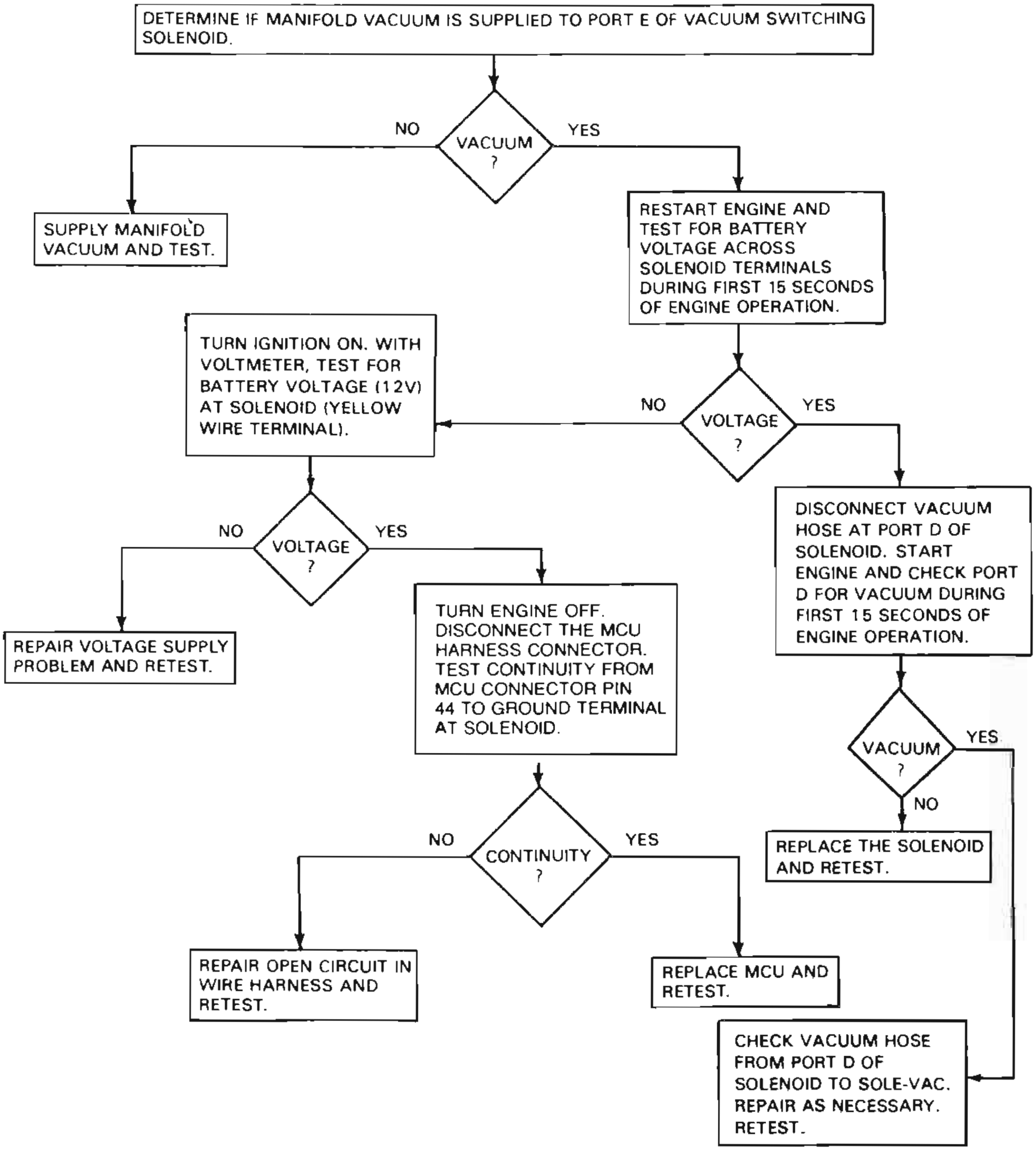


81139A(J)

SEE I.S. NOTES

DIAGNOSTIC TEST 10

SOLE-VAC VACUUM SWITCHING SOLENOID TEST

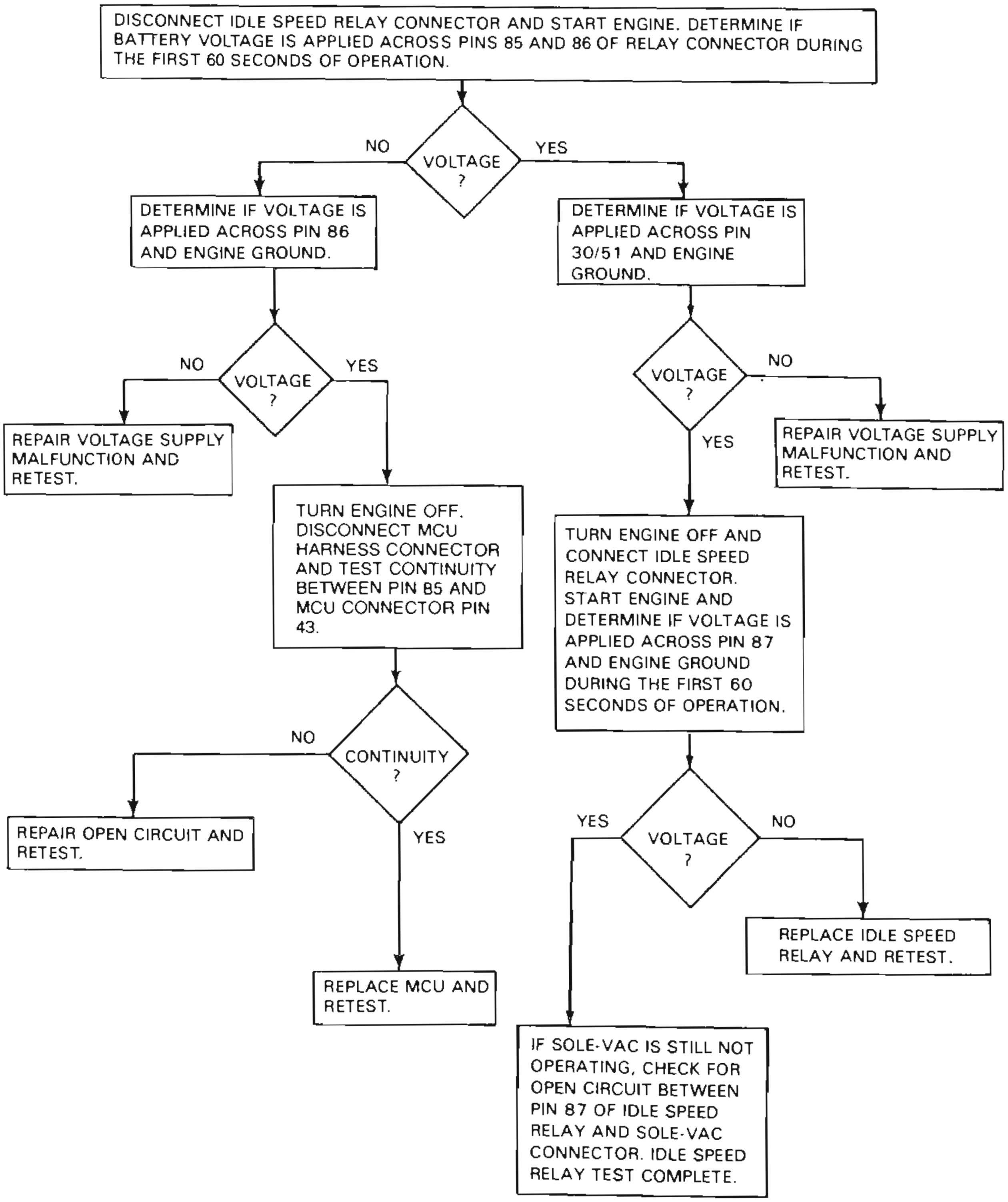


83085P(J)

83085PJ

DIAGNOSTIC TEST 11

SOLE-VAC IDLE SPEED RELAY TEST



DISCONNECT IDLE SPEED RELAY CONNECTOR AND START ENGINE. DETERMINE IF BATTERY VOLTAGE IS APPLIED ACROSS PINS 85 AND 86 OF RELAY CONNECTOR DURING THE FIRST 60 SECONDS OF OPERATION.

DETERMINE IF VOLTAGE IS APPLIED ACROSS PIN 86 AND ENGINE GROUND.

DETERMINE IF VOLTAGE IS APPLIED ACROSS PIN 30/51 AND ENGINE GROUND.

REPAIR VOLTAGE SUPPLY MALFUNCTION AND RETEST.

TURN ENGINE OFF. DISCONNECT MCU HARNESS CONNECTOR AND TEST CONTINUITY BETWEEN PIN 85 AND MCU CONNECTOR PIN 43.

REPAIR VOLTAGE SUPPLY MALFUNCTION AND RETEST.

TURN ENGINE OFF AND CONNECT IDLE SPEED RELAY CONNECTOR. START ENGINE AND DETERMINE IF VOLTAGE IS APPLIED ACROSS PIN 87 AND ENGINE GROUND DURING THE FIRST 60 SECONDS OF OPERATION.

REPAIR OPEN CIRCUIT AND RETEST.

REPLACE MCU AND RETEST.

REPLACE IDLE SPEED RELAY AND RETEST.

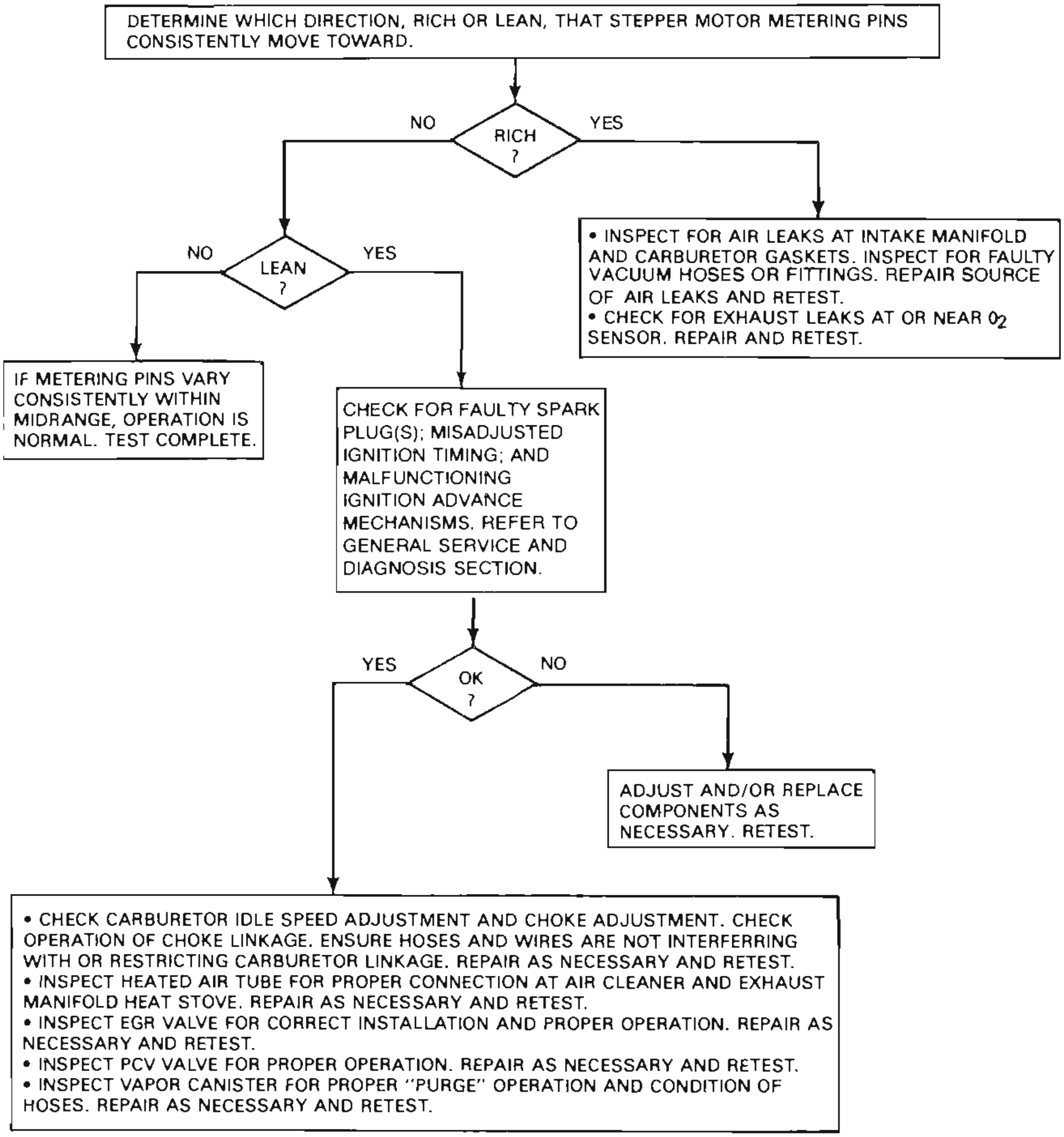
IF SOLE-VAC IS STILL NOT OPERATING, CHECK FOR OPEN CIRCUIT BETWEEN PIN 87 OF IDLE SPEED RELAY AND SOLE-VAC CONNECTOR. IDLE SPEED RELAY TEST COMPLETE.

83085R(J)

SEE
I.S.
NOTES

BASIC ENGINE TEST

IF THE RESULTS OF THE DIAGNOSTIC TESTS INDICATE THAT THE CEC SYSTEM IS FUNCTIONING NORMALLY AND ENGINE PERFORMANCE REMAINS INADEQUATE, PERFORM THE FOLLOWING TEST.



DETERMINE WHICH DIRECTION, RICH OR LEAN, THAT STEPPER MOTOR METERING PINS CONSISTENTLY MOVE TOWARD.

- INSPECT FOR AIR LEAKS AT INTAKE MANIFOLD AND CARBURETOR GASKETS. INSPECT FOR FAULTY VACUUM HOSES OR FITTINGS. REPAIR SOURCE OF AIR LEAKS AND RETEST.
- CHECK FOR EXHAUST LEAKS AT OR NEAR 0_2 SENSOR. REPAIR AND RETEST.

IF METERING PINS VARY CONSISTENTLY WITHIN MIDRANGE, OPERATION IS NORMAL. TEST COMPLETE.

CHECK FOR FAULTY SPARK PLUG(S); MISADJUSTED IGNITION TIMING; AND MALFUNCTIONING IGNITION ADVANCE MECHANISMS. REFER TO GENERAL SERVICE AND DIAGNOSIS SECTION.

ADJUST AND/OR REPLACE COMPONENTS AS NECESSARY. RETEST.

- CHECK CARBURETOR IDLE SPEED ADJUSTMENT AND CHOKE ADJUSTMENT. CHECK OPERATION OF CHOKE LINKAGE. ENSURE HOSES AND WIRES ARE NOT INTERFERRING WITH OR RESTRICTING CARBURETOR LINKAGE. REPAIR AS NECESSARY AND RETEST.
- INSPECT HEATED AIR TUBE FOR PROPER CONNECTION AT AIR CLEANER AND EXHAUST MANIFOLD HEAT STOVE. REPAIR AS NECESSARY AND RETEST.
- INSPECT EGR VALVE FOR CORRECT INSTALLATION AND PROPER OPERATION. REPAIR AS NECESSARY AND RETEST.
- INSPECT PCV VALVE FOR PROPER OPERATION. REPAIR AS NECESSARY AND RETEST.
- INSPECT VAPOR CANISTER FOR PROPER "PURGE" OPERATION AND CONDITION OF HOSES. REPAIR AS NECESSARY AND RETEST.

81209

GENERAL

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.

SEE I.S. NOTES

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)

SEE I.S. NOTES

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. Refer to the removal procedure.

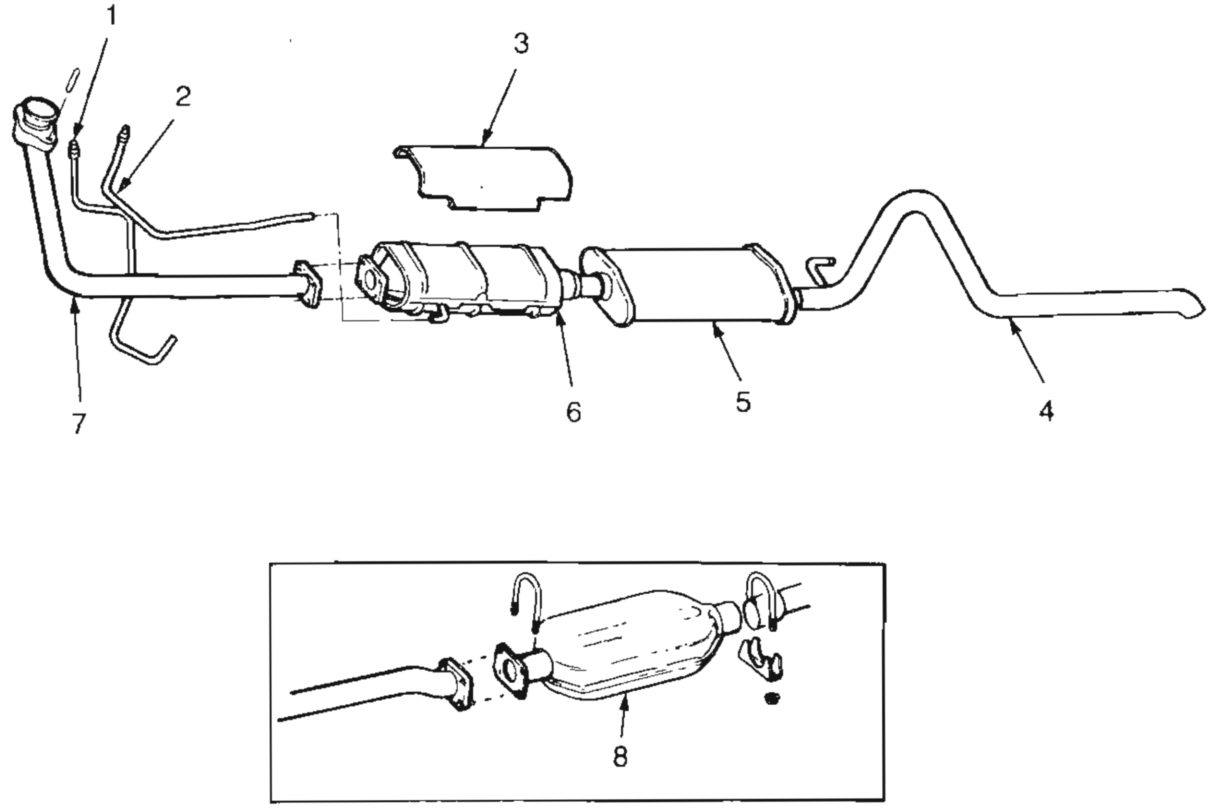
Inspect the ports of the exhaust manifold for casting flash by dropping a length of chain into each port.

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.

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. Refer to the installation procedure.

FOUR-CYLINDER ENGINE EXHAUST SYSTEM

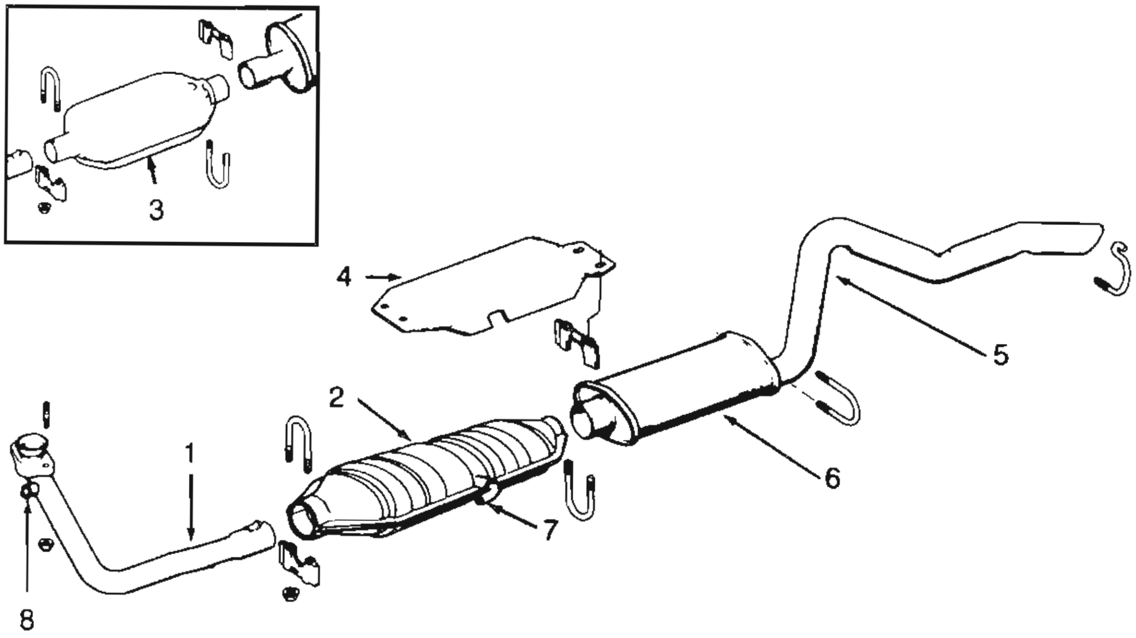


1 - Upstream Air Injection Tube
2 - Downstream Air Injection Tube
3 - Upper Heat Shield
4 - Tail Pipe
5 - Muffler
6 - Catalytic Converter
7 - Exhaust Pipe
8 - Resonator (Canada Only)

84306

SEE I.S. NOTES

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

81193B

EXHAUST MANIFOLDS

Replacement – Four-Cylinder Engine

Removal

WARNING: If the engine has been recently operated, use care to prevent scalding by the hot coolant. The system is pressurized.

NOTE: Do not waste reusable coolant. If the coolant is clean, drain it into a clean container for reuse.

Remove the radiator cap and draincock to drain the coolant.

Remove the air cleaner and the flexible ambient air duct.

Disconnect the fuel pipe, air horn vent hose and Sole-Vac throttle positioner wire connector and vacuum hose.

Disconnect the mixture control solenoid wire connector.

Disconnect the carburetor control shaft from the carburetor.

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.

Disconnect the vacuum advance CTO valve vacuum hoses.

Disconnect the wire connector from the coolant temperature switch located on the intake manifold (rear).

Disconnect the intake manifold heater (1) wire connector.

Remove the carburetor and set to one side.

Disconnect the vacuum hose from the EGR valve.

Remove the power steering mounting bracket and pump assembly, and set aside, if equipped. Do not remove the hoses.

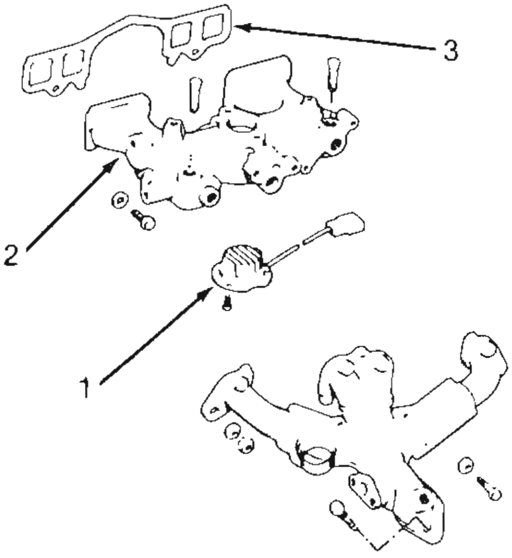
Disconnect the oxygen (O_2) sensor wire connector and remove the O_2 sensor from the exhaust manifold.

Disconnect the EGR valve tube from the intake manifold.

Disconnect the exhaust pipe from the manifold flange.

Remove the intake manifold attaching bolts, nuts and clamps. Remove the intake manifold (2). Discard the gasket (3).

Remove the remaining attaching bolts and remove the exhaust manifold.



84177

If the manifold is being replaced, remove the vacuum advance CTO valve hose clamp and install it on the replacement exhaust manifold.

NOTE: If the manifold is being replaced, ensure all the fittings, hardware, etc., are transferred to the replacement exhaust manifold.

SEE I.S. NOTES

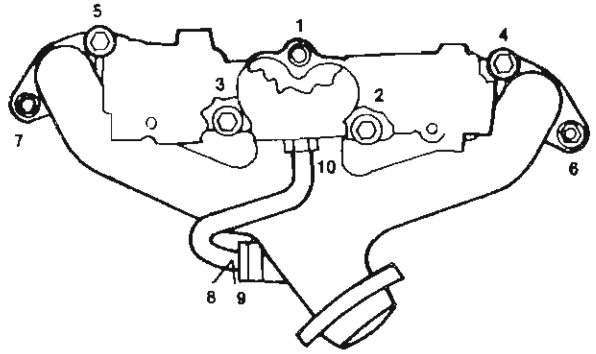
SEE I.S. NOTES

Installation

Position the replacement exhaust manifold over the end studs on the cylinder head. Hold it in place with nuts.

Position the replacement intake manifold gasket on the cylinder head and install the intake manifold.

Tighten the manifold assembly attaching bolts and nuts in sequence with 31 N·m (23 ft-lbs) torque.



84178

Install the exhaust pipe on the manifold flange. Tighten the nuts with 27 N·m (20 ft-lbs) torque.

Install the carburetor on the manifold.

Connect the Sole-Vac vacuum hose and wire connector, mixture control solenoid wire connector, fuel pipe and vent hose to the carburetor.

Install the power steering pump mounting bracket and pump assembly, if removed.

Connect the vacuum hose to the manifold.

Install the drive belts and tighten to the specified tension. Refer to the Cooling Systems section.

Connect the vacuum advance CTO valve vacuum hoses.

Connect the intake manifold heater wire connector. Connect the coolant temperature switch wire connector.

Connect the coolant hoses to the intake manifold.

Connect the EGR valve tube to the intake manifold.

Apply antiseize compound to the threads, install the oxygen sensor in the exhaust manifold and connect the wire connector. Tighten with the specified torque.

Connect the vacuum hose to the EGR valve.

Install the throttle return spring and the carburetor control shaft.

Connect the throttle cable and PCV valve hose.

Fill the cooling system with coolant.

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 air and exhaust leaks.

Install the air cleaner and the ambient air duct.

Replacement – Six-Cylinder Engine

Removal

The exhaust manifold is attached to the cylinder head on the left side of the engine. No gasket is used between the exhaust manifold and the cylinder head.

WARNING: If the engine has been recently operated, use care to prevent scalding by hot coolant. The system is pressurized.

NOTE: Do not waste reusable coolant. If the coolant is clean, drain it into a clean container for reuse.

Remove the radiator cap and draincock to the drain coolant.

Remove the air cleaner and the flexible ambient air duct.

Disconnect the fuel pipe, air horn vent hose and Sole-Vac throttle positioner wire connector and vacuum hose. Disconnect the stepper motor wire connector.

Disconnect the carburetor control shaft from the carburetor.

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.

Disconnect the vacuum advance CTO valve vacuum hoses.

Disconnect the wire connector from the coolant temperature switch located on the intake manifold (rear).

Disconnect the intake manifold heater wire connector.

Disconnect the vacuum hose from the EGR valve.

Disconnect the air control valve vacuum hose from the intake manifold.

Remove the power steering mounting bracket, if equipped.

Detach the power steering pump and set it aside, if equipped. Do not remove hoses.

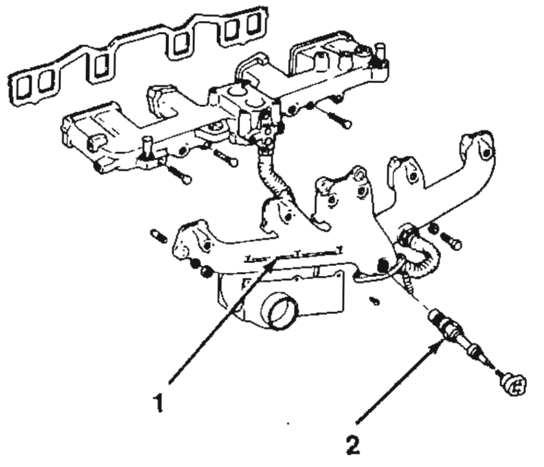
Remove the air conditioner compressor drive belt idler pulley assembly from the cylinder head, if equipped.

Disconnect the throttle valve linkage, if equipped with automatic transmission.

SEE I.S. NOTES

SEE I.S. NOTES

Disconnect the oxygen (O_2) sensor wire connector and remove the O_2 sensor (2) from the exhaust manifold (1).



86318

Disconnect the EGR valve flexible tube from the intake manifold.

Disconnect the exhaust pipe from the manifold flange.

Remove the intake manifold attaching bolts, nuts and clamps. Remove the intake manifold. Discard the gasket.

Remove the remaining attaching bolts and remove the exhaust manifold (1).

If the manifold is being replaced, remove the vacuum advance CTO valve hose clamp and install it on the replacement exhaust manifold.

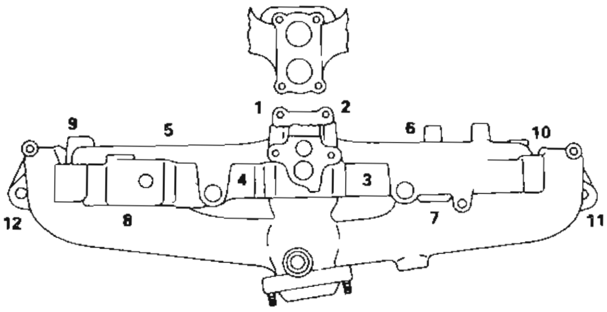
NOTE: If the manifold is being replaced, ensure that all the fittings, hardware, etc., are transferred to the replacement exhaust manifold.

Installation

Position the replacement exhaust manifold over the end studs (11 and 12) on the cylinder head. Hold them in place with nuts.

Position the replacement intake manifold gasket on the cylinder head and install the intake manifold.

Tighten the manifold assembly attaching bolts and nuts in sequence with 31 N·m (23 ft-lbs) torque.



86217

Install the gasket (if used) and connect the exhaust pipe to the manifold flange. Tighten the nuts with 27 N·m (20 ft-lbs) torque.

Connect the Sole-Vac vacuum hose and wire connector, stepper motor wire connector, fuel pipe and vent hose to the carburetor.

Install the air conditioner compressor idler pulley assembly, if removed.

Install the power steering pump mounting bracket, if removed.

Connect the vacuum hose to the manifold.

Connect the throttle valve linkage and adjust (automatic transmission only).

Install the drive belt(s) and tighten to the specified tension. Refer to the Cooling Systems section.

Connect the vacuum advance CTO valve vacuum hoses.

Connect the intake manifold heater wire connector.

Connect the coolant temperature switch wire connector.

Connect the coolant hoses to the intake manifold.

Connect the EGR valve flexible tube to the intake manifold.

Apply antiseize compound to the threads and install the oxygen (O_2) sensor in the exhaust manifold. Connect the wire connector. Tighten with 43 - 52 N·m (32 - 38 ft-lbs) torque.

Connect the vacuum hose to the EGR valve.

Install the throttle return spring and the carburetor control shaft.

Connect the throttle cable and the PCV valve hose.

Fill the cooling system with coolant.

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 air and exhaust leaks.

Install the air cleaner and the ambient air duct.

MUFFLERS

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.

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.

SEE I.S. NOTES

SEE I.S. NOTES

Drive the muffler off the tailpipe.

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.

PIPES

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 Replacement

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.

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.

GENERAL

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.

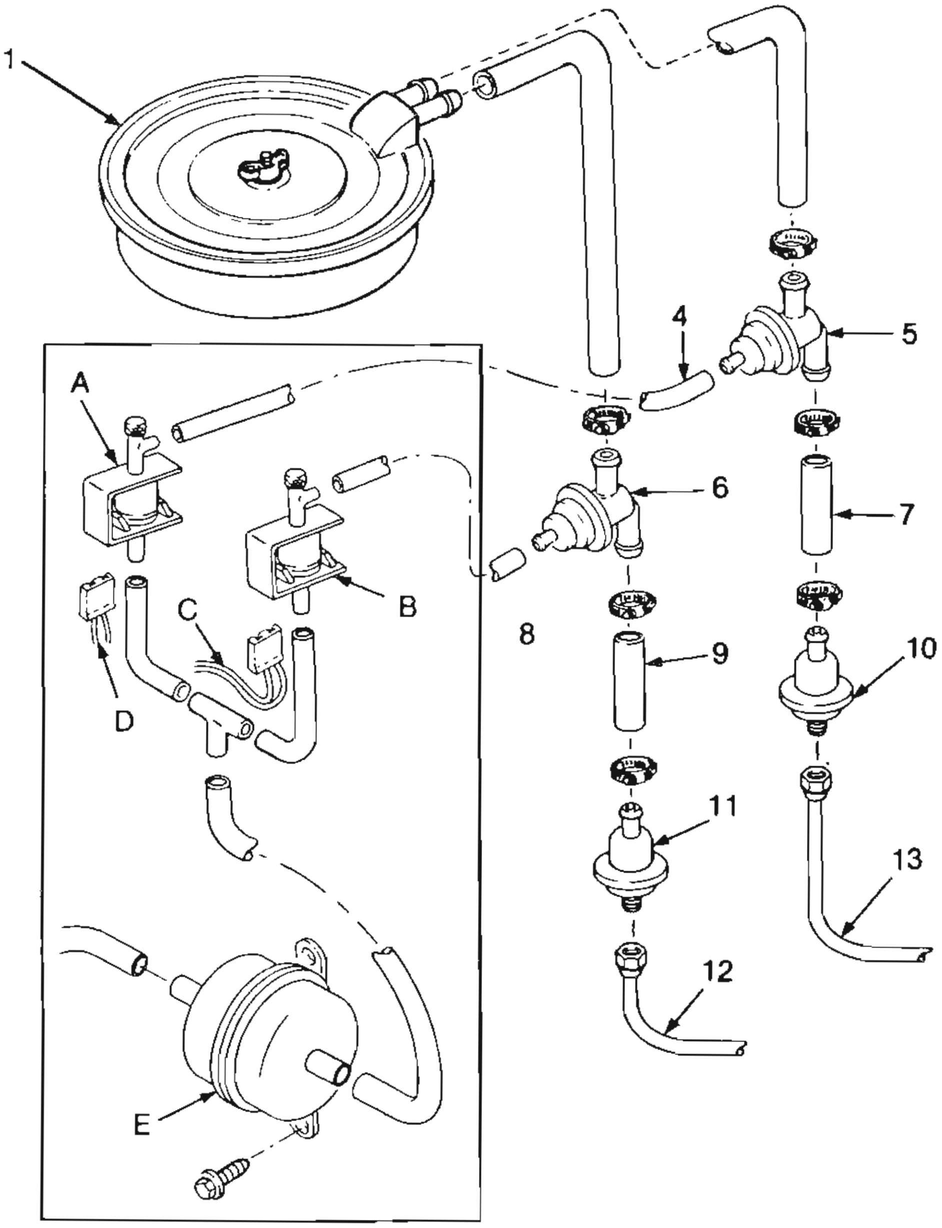
Air Injection Check Valve

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.



- 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

84309

SEE
I.S.
NOTES

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-engergizing the air switch solenoids.

SEE I.S. NOTES

GENERAL

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.

CONVERTER SERVICE

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.

Replacement

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.

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.

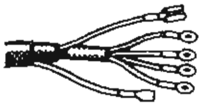
Install the DOWNSTREAM air injection tube and tighten the clamps with 4 - 5 N·m (3 - 4 ft-lbs) torque.

Lower the vehicle.

ELECTRICAL

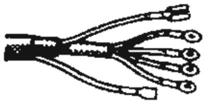
CONTENTS

SEE I.S. NOTES



ELECTRICAL

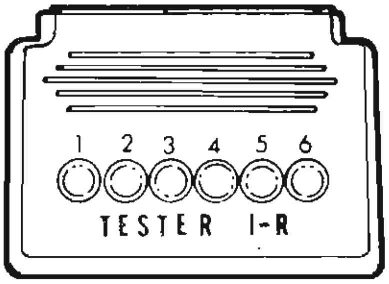
CONTENTS



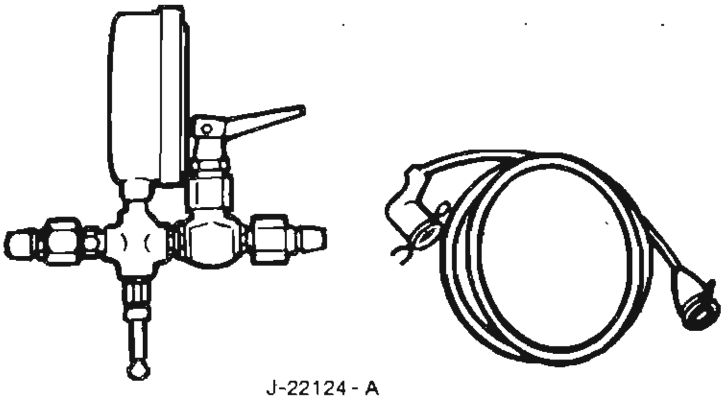
SEE
I.S.
NOTES

SPECIAL TOOLS

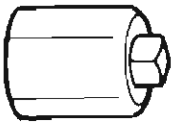
Tool Ref.	Description	Required	Recommended
AMA 21-317	Circuit Tester		■
AMOT ET-502	Digital Multimeter		■
AM PC-1-R	Cruise Command System Tester		■
J-21008	Continuity Lamp		■
J-22124-A	Pressure Gauge and Valve		■
J-22516	Starter Pole Screw Wrench		■
J-23738	Hand Operated Vacuum Pump		■
J-25300-10	Headlight Aimer		■
J-25359-C	Torx Bit and Socket Set		■
J-28509	Distributor Trigger Wheel Puller		■
J-23653	Lock Plate Compressor	■	



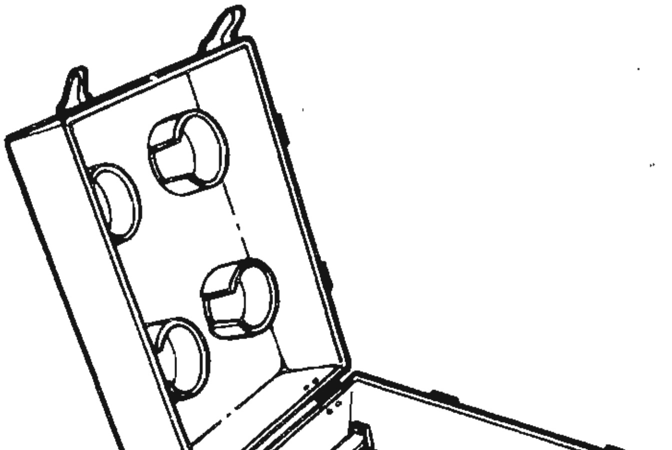
AM PC-1-R

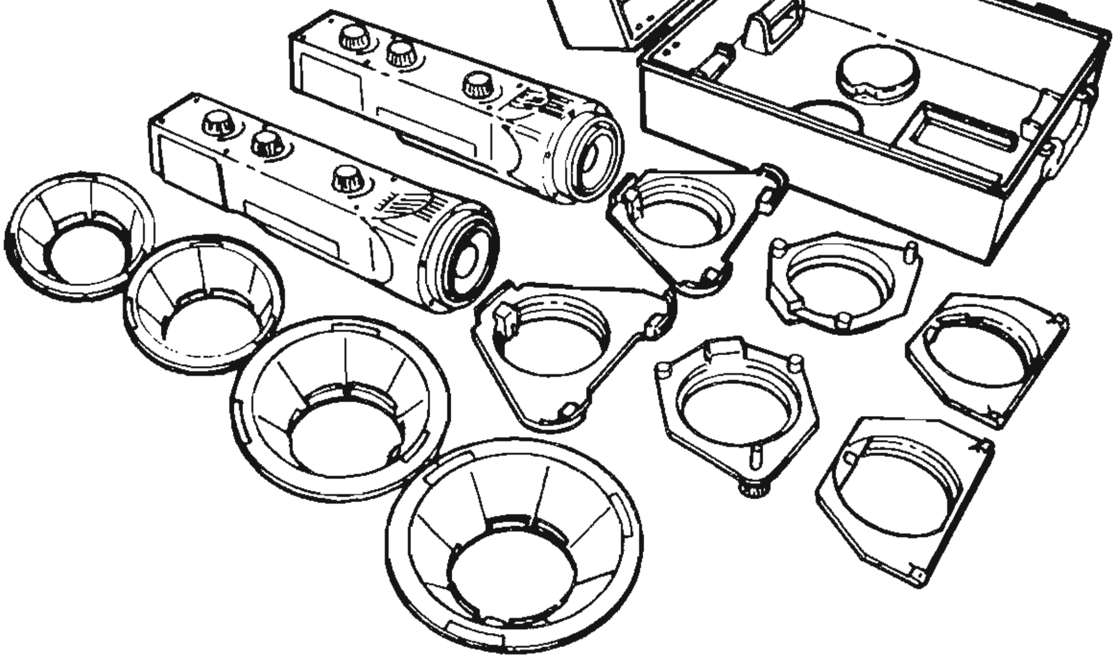


J-22124 - A



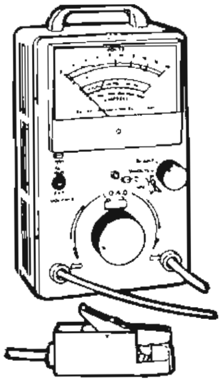
J-22516



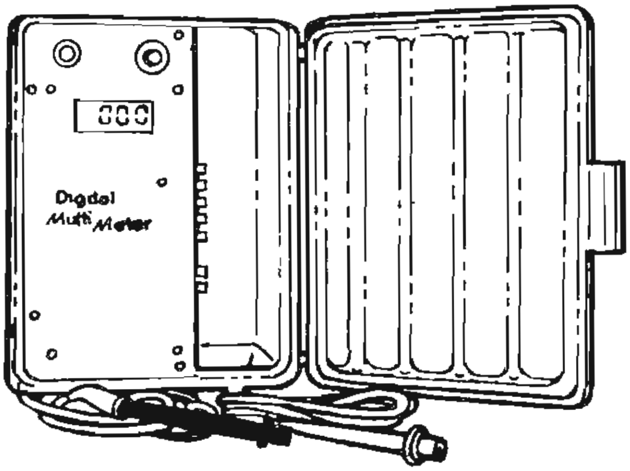


J-25300-10

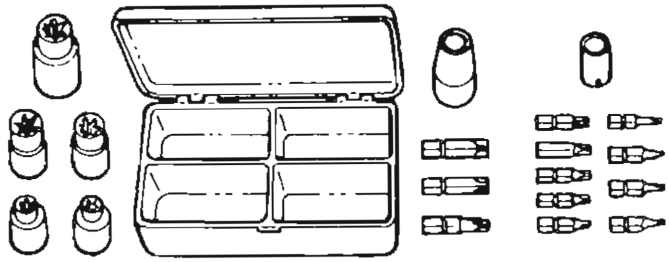
84900A



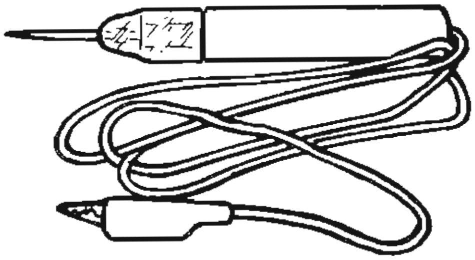
AMA 21-317



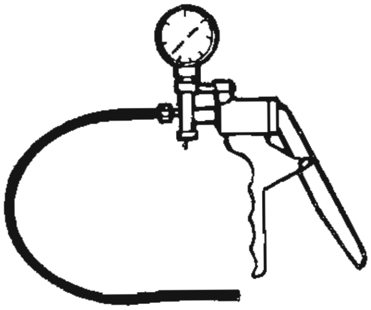
AMOT ET-502



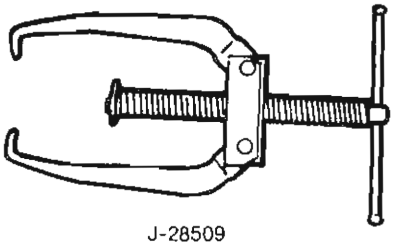
J-25359-C



J-21008



J-23738



J-28509

SEE I.S. NOTES

84900B

GENERAL

The batteries used on 1984 CJ/Scrambler 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.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMA 21-317	Battery Tester		■

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)

SPECIFICATIONS

Battery Specifications

Engine	Group Size	Rating	
150 & 258 Optional	55 56	421 amps 452 amps	75 min. 81 min.

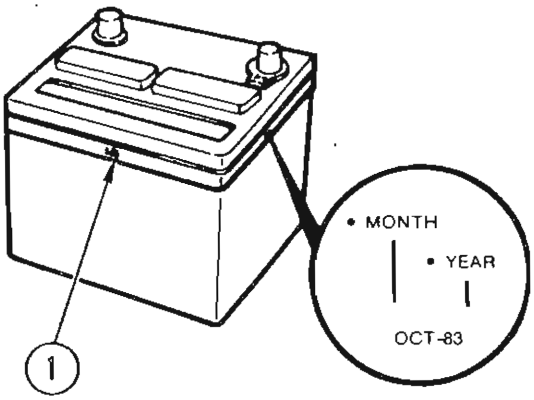
841274

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.

The date code is decoded as follows:

- month: Jan., Feb., etc.
- year: 83-1983, 84-1984



84899

SEE I.S. NOTES

SEE I.S. NOTES

BATTERY REPLACEMENT

Removal

Loosen the cable terminal clamps.

Use a puller to remove the cable terminal clamps, if necessary.

Remove the negative cable terminal clamp first.

WARNING: Use extreme care to prevent dropping the battery and splattering the electrolyte because it can cause severe eye injury and skin burns. Rubber gloves, rubber aprons, protective eye shields and steel-toed shoes will decrease the hazards of this type of accident. Immediate first aid is required for electrolyte splashed into the eyes and on the skin. Electrolyte spills should be neutralized immediately with a solution of sodium bicarbonate (baking soda) and water and then thoroughly rinsed with water.

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.

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.

CAUTION: Ensure the battery tray is clear of loose hardware, tools or debris that could damage the battery case.

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. Reverse polarity will damage the alternator diodes and radio.

Connect and tighten the positive cable first. Then connect and tighten the negative cable.

NOTE: The tapered battery positive terminal (post) is approximately 1.6 mm (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 MAINTENANCE

Always observe the correct polarity when connecting a charger to a battery. Reversed battery connections will damage the alternator diodes and the radio. The battery negative terminal is grounded to the engine and vehicle body.

WARNING: Explosive gases are present within and around the battery at all times. Avoid open flames and sparks. The danger of battery explosion is compounded by the fact that the acid would be splattered in every direction. Wear protective eye shields and clothing when servicing any battery. Ensure the battery has adequate ventilation when charging.

It is important that the battery be fully charged when a new vehicle is delivered. Maintaining a battery at partial charge could shorten its life.

Inspect the electrolyte level in standard equipment batteries at 24 000 km (15,000 mi) intervals and at the beginning of the winter season. Add distilled water to each cell until the level reaches the bottom of the vent well. DO NOT OVERFILL. Operate the engine immediately after adding water (particularly in cold weather) to assure proper mixing of the water and electrolyte.

Inspect to determine the external condition of the battery and the cables periodically.

The holddown should be tight enough to prevent the battery from vibrating or shifting position and causing damage to the battery case.

CAUTION: Keep the filler caps tight to prevent the neutralizing solution from entering the cells.

Take particular care to ensure that the top of the battery is free of acid film and dirt between the battery terminals. For best results when cleaning the battery, wash with a diluted ammonia or soda solution to neutralize any acid present and flush with clean water.

To ensure good electrical contact , the battery cables must be tight on the battery posts. Ensure that the terminal clamps have not stretched. This could cause the clamp ends to become butted together without actually being tight on the post. If the battery posts or cable terminals are corroded, disconnect the cables by loosening the terminal clamp bolts and remove the terminals with the aid of a puller. Do not twist, hammer or pry on a terminal to free it from the battery post. Clean the terminals and posts with a soda solution and a wire brush or a post and terminal cleaner. Connect the cable terminal clamps (positive terminal first) to the battery posts and apply a thin coat of petroleum jelly or grease. Inspect the battery negative cable and body ground cable for condition and good electrical continuity with the engine and body.

Frozen Electrolyte

WARNING: Do not attempt to charge or use a booster on a battery with frozen electrolyte. The frozen battery may explode.

A 75 percent charged battery will not freeze. Maintain batteries at 75 percent charge or more, especially during winter weather. Refer to the Hydrometer Test.

SEE I.S. NOTES

SEE I.S. NOTES

Replace the battery, if the electrolyte becomes either slushy or frozen. A battery in this condition, depending on the severity of the freeze, may accept and retain a charge, and even perform satisfactorily under a load test. However, after 120 - 150 days in service, a reduction in storage capacity and service life will become apparent as the individual plates lose their active material.

Electrolyte Freezing Temperature

Specific Gravity (Corrected to 80° F)	Freezing Temperature
1.270	– 84°F (– 64°C)
1.250	– 62°F (– 52°C)
1.200	– 16°F (– 27°C)
1.150	+ 05°F (– 15°C)
1.100	+ 19°F (– 7°C)

60339

BATTERY CHARGING

General

The relative amount of charge or stored energy is directly proportional to the specific gravity value of the electrolyte. This allows the use of a hydrometer to determine the state of charge or energy storage level of a battery in relation to the maximum possible charge (full charge). Refer to the Hydrometer Test.

NOTE: The specific gravity is a ratio of the density of the electrolyte and the density of pure water.

Dry Charged Battery

WARNING: Before activating a dry-charged battery, carefully read the instructions and poison/danger warning on the electrolyte carton.

Do not remove the seals until the battery is to be activated. Once the seals are removed, the battery must be activated immediately. Discard the seals after removal.

Activation Procedure

Fill each cell with battery electrolyte to the bottom of the well, observing the handling precautions listed on the electrolyte carton.

After the cells are filled, tilt the battery from side to side to release trapped air bubbles.

Recheck the electrolyte level in each cell and add as necessary. The electrolyte level must be above the plates and below the split ring.

NOTE: Filling the cells unevenly will affect the battery capacity and service life.

Install the caps supplied with the battery.

Inspect the battery case for leakage to ensure no damage occurred during the handling.

Boost charge the battery for 15 minutes at 30 amps or slow charge until the battery electrolyte is gassing freely.

Install the battery in the vehicle.

NOTE: Because the battery's apparent state of charge, as indicated by a hydrometer, is depressed for the first few cycles, load testing is the only valid test at the time of activation. Hydrometer testing may be used after the battery has been cycled in service.

The specific gravity of a newly installed AMC/ Jeep battery will be approximately 1.225 (±0.010). The specified gravity will normally rise to 1.250 - 1.265 after a few days in service.

NOTE: The electrolyte is composed of sulfuric acid and water. Approximately 35 percent by weight or 24 percent by volume is acid.

WARNING: Never add pure acid to a battery.

Slow Charge

WARNING: Battery charging generates hydrogen gas, which is highly flammable and explosive. Hydrogen gas is present within and around a battery at all times, even when it is in a discharged condition. Keep open flames and sparks (including cigarettes, cigars, pipes) away from the battery. Always wear eye and skin protection when handling, testing and charging a battery.

WARNING: Do not attempt to charge or use a booster on a battery with frozen electrolyte because this can cause the frozen battery to explode.

Slow charging is the preferred method of recharging a battery. The slow charge method may be safely used, regardless of charge condition of the battery, provided the electrolyte is at the proper level in all cells and is not frozen.

The normal slow charging rate for a lightweight battery is three to five amps. A minimum period of 24 hours is required when charging at this rate. Charge time is inversely proportional to the temperature of the electrolyte.

A battery may be fully charged by the slow charge method unless it is not capable of accepting a full charge. A battery is in a maximum charged condition when all cells are gassing freely and three corrected specific gravity tests, taken at one-hour intervals, indicate no increase in the specific gravity.

Fast Charge

CAUTION: Always disconnect the battery cables before using a fast charger.

A battery may be charged at any rate that does not cause the electrolyte temperature of any cell to exceed 51.7°C (125°F) and does not cause excessive gassing and loss of the electrolyte.

A fast battery charger cannot be expected to fully charge a battery within an hour, but will charge the battery sufficiently so that it may be returned to service. The battery will be fully charged by the vehicle's charging system, provided the engine is operated a sufficient length of time.

Booster Charging

WARNING: If the battery electrolyte is not visible or is frozen, do not attempt to "jump-start" an engine because the battery could rupture or explode. The battery electrolyte must be warmed up to 4.4°C (40°F) and water added, if necessary, before it can be safely charged or the engine "jump-started".

The correct method for starting an engine with a discharged battery requires either a portable starting unit or a booster battery. When using either method, it is essential that the connections be made correctly.

SEE I.S. NOTES

When using a portable starting unit, the voltage must not exceed 16 volts or damage to the battery, alternator or starter motor may result. Because of the accompanying high voltage, a fast charger must not be used for "jump-starting" engines.

Remove the vent caps from the booster battery and cover cap openings with a dampened cloth.

CAUTION: If the engine is being "jump-started" with a battery located in another vehicle, the vehicles must not contact each other.

Connect the jumper cable between the positive posts of the batteries. The positive post has "+" sign stamped into it. POS is also embossed on the battery cover in 3 mm (1/8 in) letters adjacent to the battery post.

Connect one end of a second jumper cable to the negative post of the booster battery. NEG is embossed on the battery cover in 3-mm (1/8- in) letters adjacent to the battery post. Ensure the cable terminal clamps have a good electrical contact with the posts. DO NOT CONNECT THE OTHER END OF THE JUMPER CABLE TO THE NEGATIVE POST OF THE DISCHARGED BATTERY. Connect the cable to a bolt, bracket, nut or other good ground connection on the engine. Do not connect the cable to the carburetor, air cleaner or fuel pipe. Keep the cable clear of the fan, belts and pulleys.

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.

When the engine starts, remove the jumper cables. Disconnect the negative cable from the engine ground location first.

Discard the cloth used to cover the cap openings because it has been exposed to sulfuric acid.

Install the battery caps.

BATTERY TESTING

General

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.

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). Refer to Battery Diagnosis and Repair Simplification (DARS) Chart.

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. 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.

Self-Discharge 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

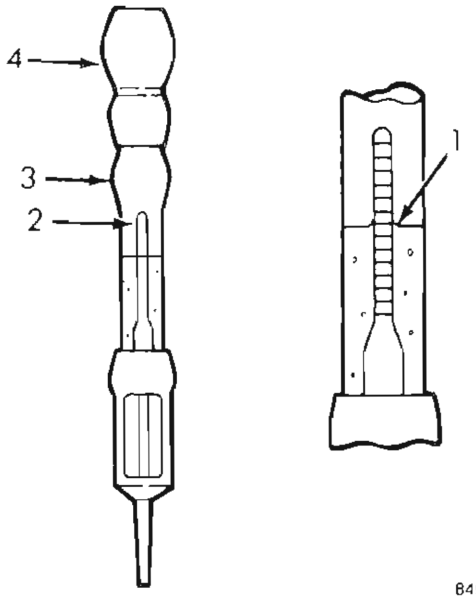
60338

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 tosting, 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. Keep the hydrometer in a vertical position while raising the electrolyte into the hydrometer and observing the specific gravity. Exercise care when inserting the tip of the hydrometer into a cell to avoid damage to the separators. Damaged separators can cause premature battery failure.



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. 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)

SEE
I.S.
NOTES

SEE I.S. NOTES

- 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

State of Charge	Specific Gravity (Cold and Temperate Climates)
Fully Charged	1.265
75% Charged	1.225
50% Charged	1.190
25% Charged	1.155
Discharged	1.120

60340

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.

Heavy Load Test

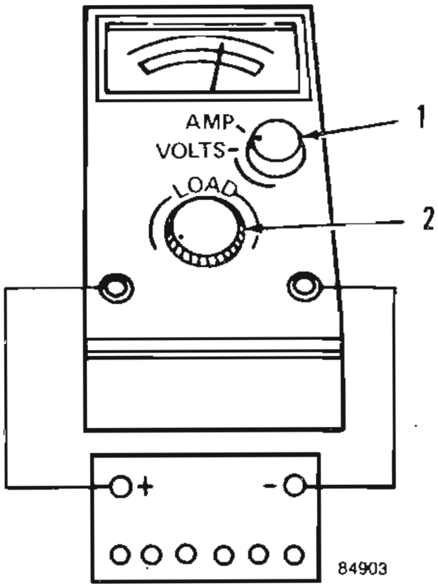
NOTE: The following instructions refer to Amserv Battery-Alternator-Regulator-Starter Motor Tester, model AMA 21-317, or equivalent.

Before performing the Heavy Load Test, the battery must be fully charged. Refer to Slow Charge.

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 as illustrated.



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.

DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

When an engine will not start because the starter motor is inoperative, follow the steps outlined in the DARS Chart to determine if the battery or the starting system is the cause of the malfunction.

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

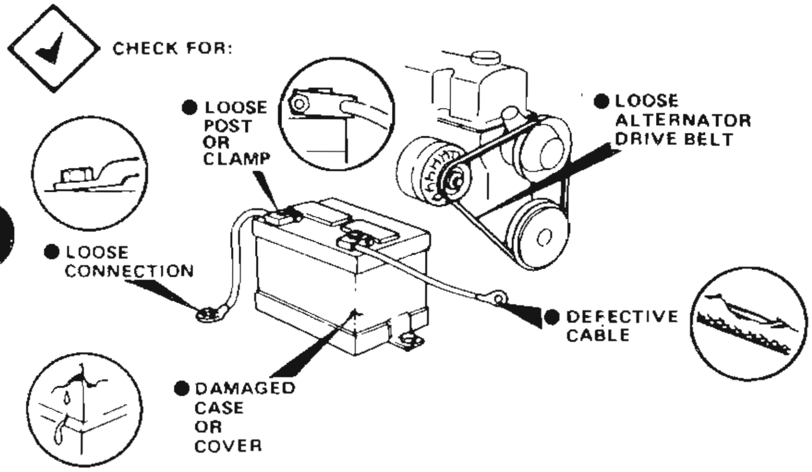
BATTERY DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

PROBLEM: STARTER MOTOR INOPERATIVE

Chart 1

STEP | **SEQUENCE** | **RESULT**

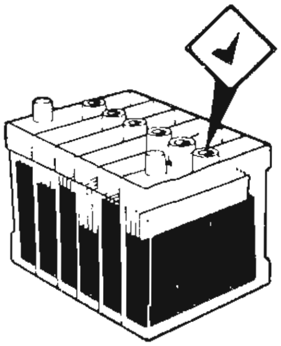
1



REPAIR OR REPLACE IF NECESSARY → **2**

2

- CHECK ELECTROLYTE LEVEL AND TEST SPECIFIC GRAVITY IN EACH CELL AND RECORD.



ELECTROLYTE LEVEL TOO LOW FOR SPECIFIC GRAVITY TEST—ADD WATER. CHARGE BATTERY FOR 10 MIN. AT 20 AMP RATE. TEST SPECIFIC GRAVITY

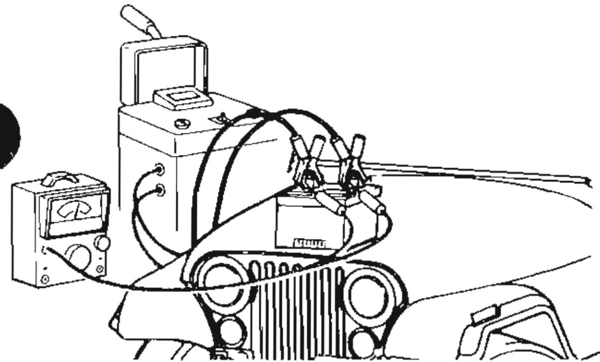
OK → **5**
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE CELLS ARE EQUAL WITHIN 0.050 (50 POINTS)

NOT OK → REPLACE BATTERY → **6**
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE BUT CELLS VARY 0.050 (50 POINTS) OR MORE

NOT OK → **3**
AVERAGE SPECIFIC GRAVITY BELOW 1.225

3

- CONNECT BATTERY CHARGER AND VOLTMETER
- CHARGE BATTERY FOR 3 MINUTES AT 40 AMP RATE
- AT THE END OF 3 MINUTES OBSERVE VOLTMETER WHILE CHARGER IS STILL CHARGING



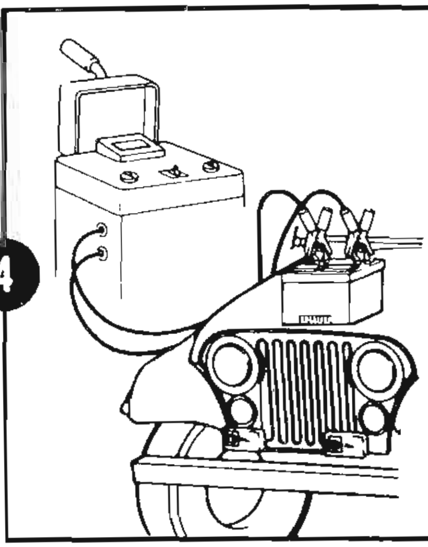
OK → **4**
VOLTAGE IS 15.5 VOLTS OR LESS

NOT OK → SLOW CHARGE BATTERY AT 3 TO 4 AMPS FOR 48 TO 72 HOURS → **5**
VOLTAGE ABOVE 15.5 VOLTS

86386

STEP **SEQUENCE** **RESULT**

4



CHARGE BATTERY AS INDICATED IN CHART. AFTER CHARGE IS COMPLETED, RECHECK SPECIFIC GRAVITY.

AVERAGE SPECIFIC GRAVITY	CHARGE RATE (AMPS)	TIME
LESS THAN 1.125	5	12 HOURS
1.125 TO 1.149	20	90 MIN
1.150 TO 1.174	20	70 MIN.
1.175 TO 1.199	20	50 MIN.
1.200 TO 1.224	20	30 MIN.

OK → 5
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE CELLS ARE EQUAL WITHIN 0.050 (50 POINTS)

~~OK~~ → REPLACE BATTERY → 6
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE BUT CELLS VARY 0.050 (50 POINTS) OR MORE

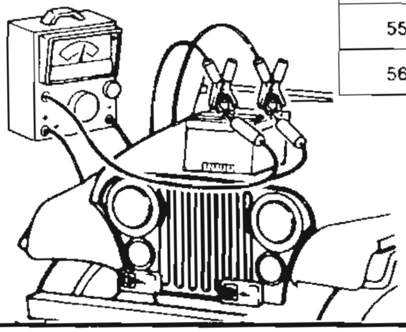
5

- CLEAN BATTERY POSTS AND CABLE TERMINALS
- CONNECT HEAVY LOAD TESTER
- DETERMINE HEAVY LOAD AMPS FROM CHART
- ADJUST TESTER FOR LOAD AMPS
- HOLE LOAD FOR 15 SECONDS
- NOT VOLTS

HEAVY LOAD OUTPUT TEST

HEAVY LOAD CHART

GROUP SIZE	COLOR CODE	RESERVE CAPACITY (MINUTES)	COLD CRANK AMPS	HEAVY LOAD (AMPS)
55	Green	75	421	135
56	Red	81	452	180



- VOLTAGE 9.6 OR MORE → 6
- VOLTAGE LESS THAN 9.6 → REPLACE BATTERY → 6

6

OK ENGINE STARTS → STOP

~~OK~~ ENGINE DOES NOT START → PERFORM STARTER MOTOR DIAGNOSIS LISTED IN STARTING SYSTEMS

SEE I.S. NOTES

86387

GENERAL

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.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMA 21-317	Circuit Tester		■
AMOT ET-502	Digital Multimeter		■
J-21008	Continuity Lamp		■

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)

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 80°F(27°C)
Rotation (Viewing Drive End)	Clockwise
Pully Size	2.43 in (6.18 cm)
4-cylinder Serpentine Drive	Polyvee
Belt Tension	
New Belt	Set to 125-155 lbf (556-689N)
Used Belt	Recheck 90-115 lbf (400-512N)
New Belt (4-cylinder Serpentine Drive)	180-200 lbf (800-890N)
Used Belt (4-cylinder Serpentine Drive)	140-160 lbf (616-704N)

Regulator

Manufacturer	Delco
Model	1116387
Type	Solid State
Adjustment	None

Output Voltage Specifications

Ambient Temperature In Degrees Fahrenheit (C)	Acceptable Voltage Range
0-50 (-18 to 10)	14.3-15.3
50-100 (10 to 38)	13.9-14.9
100-150 (38 to 66)	13.4-14.4
150-200 (66to 93)	13.0-14.1

84904

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.

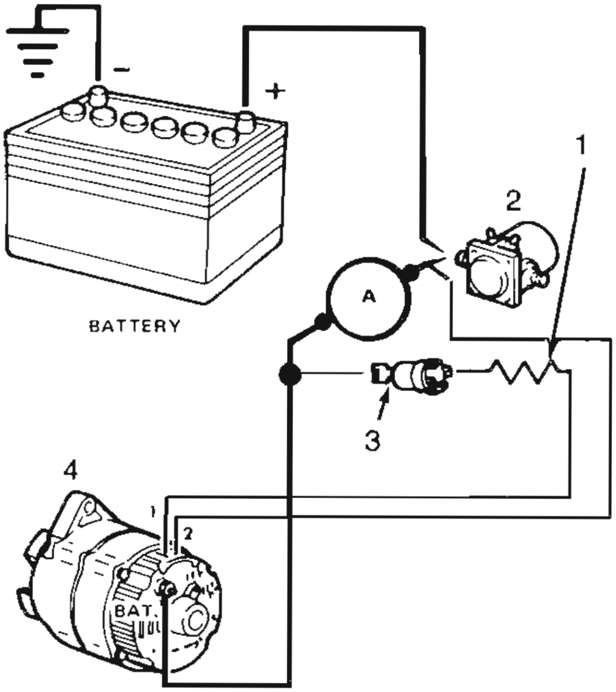
DIAGNOSIS

Close adherence to the following procedures in the order presented will result in locating and correcting charging system malfunctions in the shortest possible time.

A basic wiring diagram for the charging system is shown in the illustration.

SEE
I.S.
NOTES

SEE I.S. NOTES



1. Resistance Wire
2. Solenoid
3. Ignition Switch
4. Alternator

70136A

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
- never drive the alternator with the engine when the ouput terminal circuit is open and the No. 1 and No. 2 wire terminals are connected to 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 negative to negative and positive to positive

NOTE: CJ and Scrambler models are equipped with a voltmeter.

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

Prior to performing any electrical tests, visually inspect all charging system components and wiring for obvious discrepancies.

Visual Inspection

Inspect for clean and tight cable terminal connections at the battery posts, engine block, and starter motor solenoid. Inspect for corrosion and loose wire terminal connections at the alternator, starter motor solenoid, dash panel connector and the charging system indicator. Inspect all wires for cracked or broken insulation. Ensure that the alternator mounting screws are tight and that it is properly grounded. Inspect the electrolyte level in the battery and add water if necessary. 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

Noise from the cooling system can also sound like alternator noise. When testing disconnect and plug the heater hoses to eliminate the possibility of the alternator bracket reproducing heater core noise.

Faulty Ammeter or Voltmeter Operation

Diagnostic procedures for the instrumentation circuits are described in Engine Instrumentation.

Overcharged/Undercharged Battery

For battery undercharged-overcharged diagnosis, refer to the DARS Charts 1 and 2.

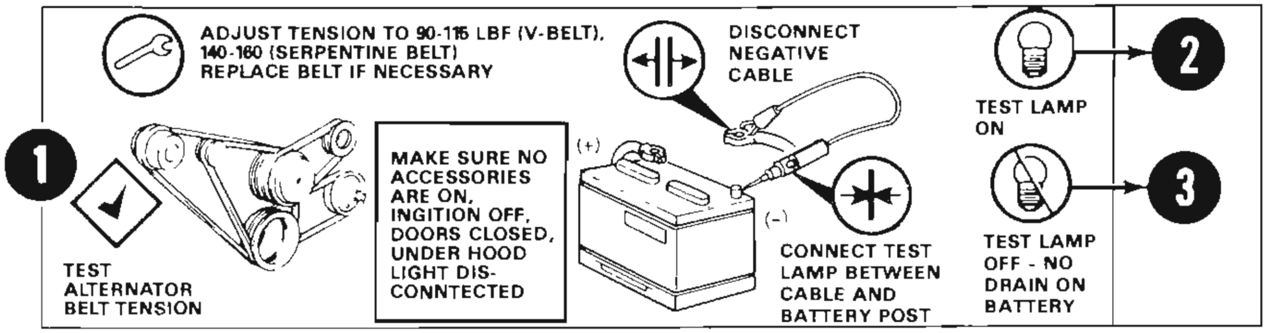
FOUR- AND SIX-CYLINDER ENGINE CHARGING SYSTEM
DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

PROBLEM: BATTERY UNDERCHARGED

Chart 1

SEE I.S. NOTES

STEP **SEQUENCE** **RESULT**



ADJUST TENSION TO 90-115 LBF (V-BELT), 140-160 (SERPENTINE BELT) REPLACE BELT IF NECESSARY

TEST ALTERNATOR BELT TENSION

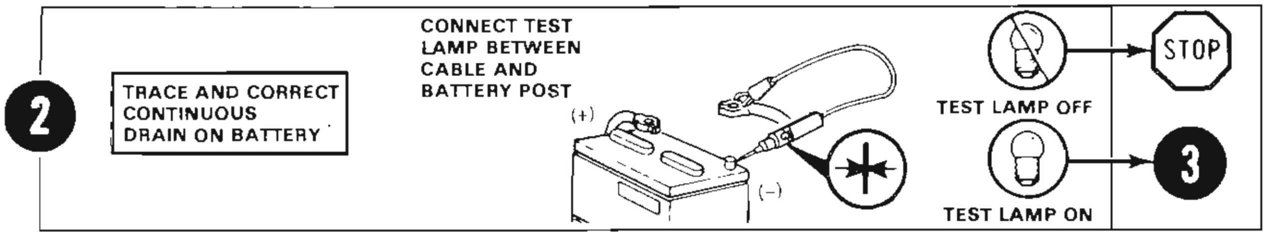
MAKE SURE NO ACCESSORIES ARE ON, INGITION OFF, DOORS CLOSED, UNDER HOOD LIGHT DIS-CONNTECTED

DISCONNECT NEGATIVE CABLE

CONNECT TEST LAMP BETWEEN CABLE AND BATTERY POST

TEST LAMP ON

TEST LAMP OFF - NO DRAIN ON BATTERY

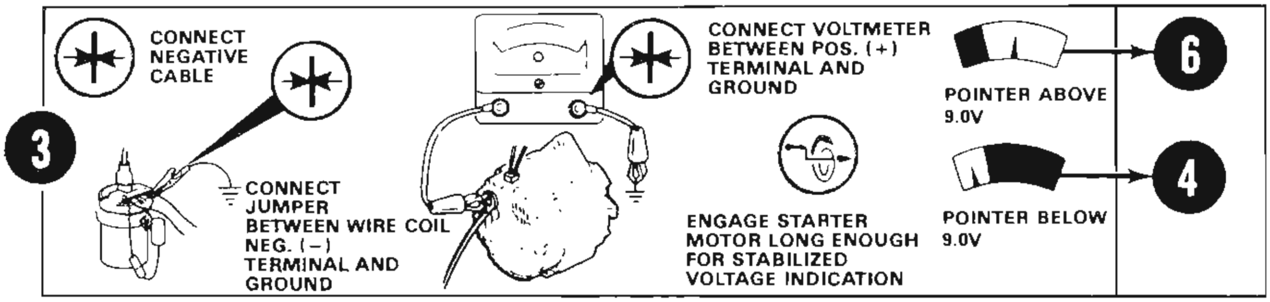


TRACE AND CORRECT CONTINUOUS DRAIN ON BATTERY

CONNECT TEST LAMP BETWEEN CABLE AND BATTERY POST

TEST LAMP OFF

TEST LAMP ON



CONNECT NEGATIVE CABLE

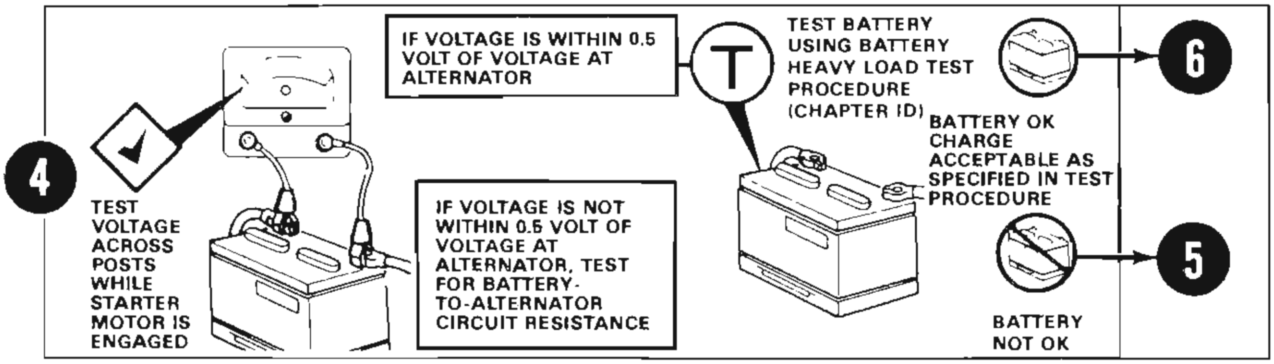
CONNECT JUMPER BETWEEN WIRE COIL NEG. (−) TERMINAL AND GROUND

CONNECT VOLTMETER BETWEEN POS. (+) TERMINAL AND GROUND

ENGAGE STARTER MOTOR LONG ENOUGH FOR STABILIZED VOLTAGE INDICATION

POINTER ABOVE 9.0V

POINTER BELOW 9.0V



TEST VOLTAGE ACROSS POSTS WHILE STARTER MOTOR IS ENGAGED

IF VOLTAGE IS WITHIN 0.5 VOLT OF VOLTAGE AT ALTERNATOR

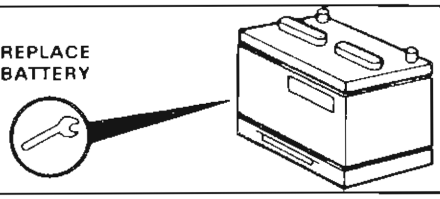
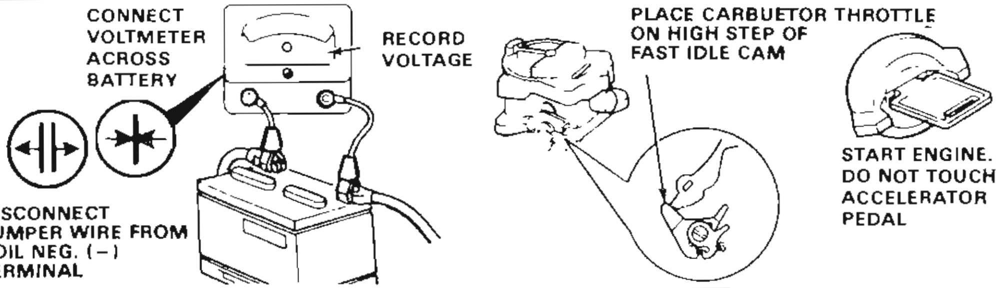
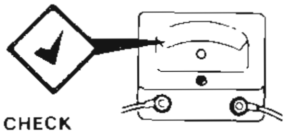
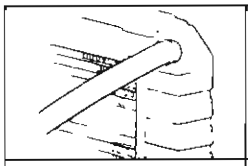
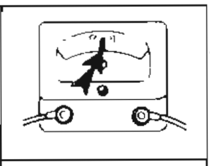
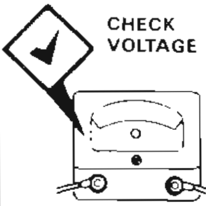
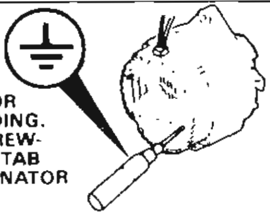
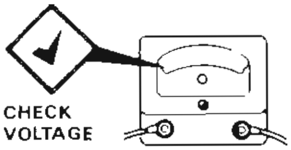
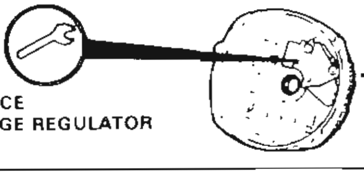
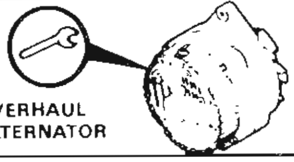
IF VOLTAGE IS NOT WITHIN 0.5 VOLT OF VOLTAGE AT ALTERNATOR, TEST FOR BATTERY-TO-ALTERNATOR CIRCUIT RESISTANCE

TEST BATTERY USING BATTERY HEAVY LOAD TEST PROCEDURE (CHAPTER ID)

BATTERY OK CHARGE ACCEPTABLE AS SPECIFIED IN TEST PROCEDURE

BATTERY NOT OK

70137D

STEP	SEQUENCE	RESULT
5	 REPLACE BATTERY	6
6	 DISCONNECT JUMPER WIRE FROM COIL NEG. (−) TERMINAL CONNECT VOLTMETER ACROSS BATTERY RECORD VOLTAGE PLACE CARBUETOR THROTTLE ON HIGH STEP OF FAST IDLE CAM START ENGINE. DO NOT TOUCH ACCELERATOR PEDAL	7
7	TURN ON ACCESSORIES HEADLIGHTS-HI A/C - HI RADIO BLOWER-TYPE DEFROSTER  CHECK VOLTAGE	IF VOLTAGE IS LOWER THAN IN STEP 6 → 9 IF VOLTAGE IS HIGHER THAN IN STEP 6 → 8
8	TURN OFF ACCESSORIES  WAIT UNTIL UPPER RADIATOR INLET IS HOT AND  VOLTMETER POINTER STOPS  CHECK VOLTAGE	IF VOLTAGE IS LESS THAN 12.5V → 9 IF VOLTAGE IS MORE THAN 15.5V → 10 IF VOLTAGE IS 12V TO 15.5V SEE NOTE BELOW → STOP
9	 GROUND ALTERNATOR FIELD WINDING. TOUCH SCREW-DRIVER TO TAB AND ALTERNATOR BODY  CHECK VOLTAGE	IF VOLTAGE IS HIGHER THAN IN STEP 6 → 10 IF VOLTAGE IS LOWER THAN IN STEP 6 → 11
10	 REPLACE VOLTAGE REGULATOR	STOP
11	 OVERHAUL ALTERNATOR	STOP

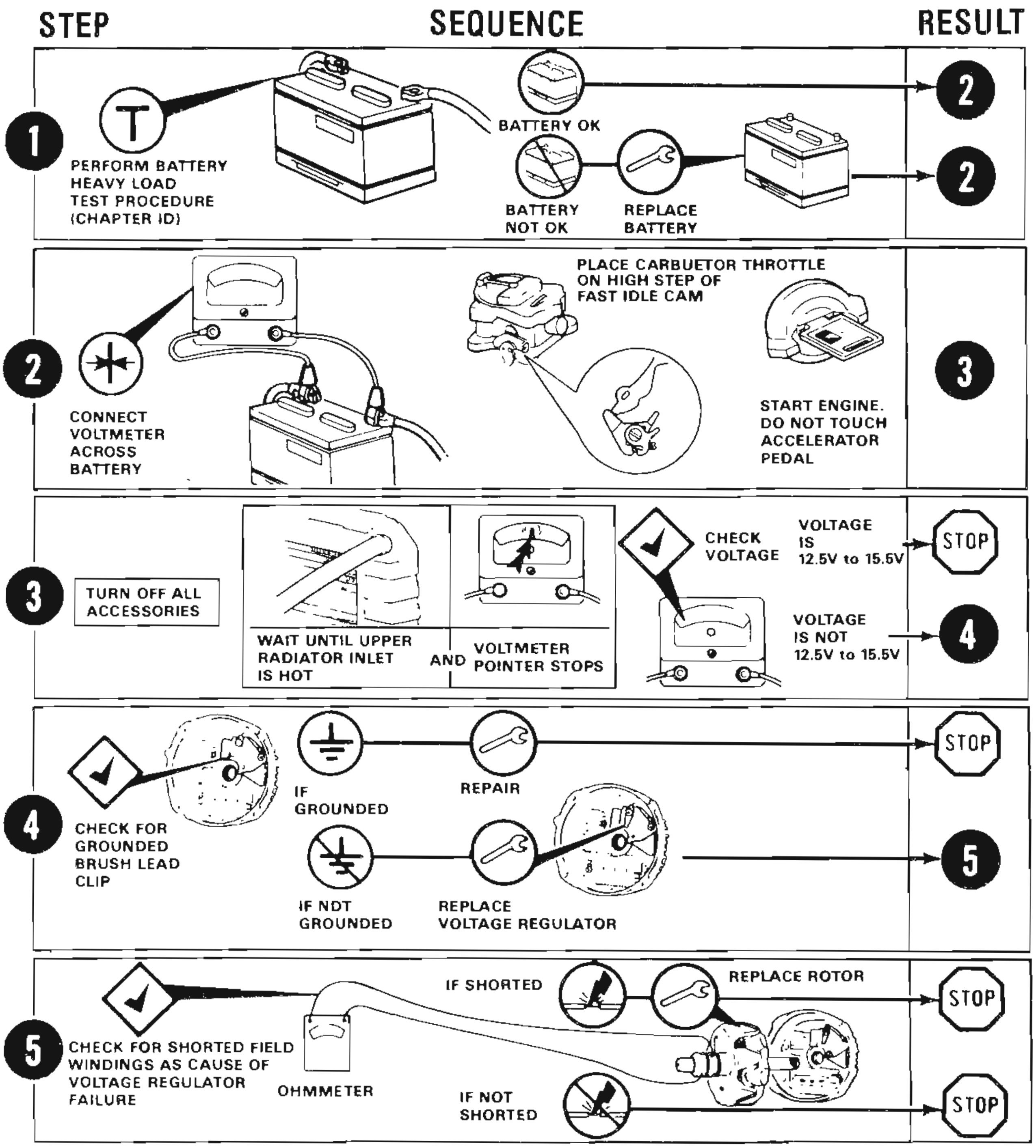
NOTE: IF NO FAULT HAS BEEN FOUND, EXCESSIVE IDLING AND SLOW OR SHORT DISTANCE DRIVING, WITH ALL ACCESSORIES ON, MAY HAVE CAUSED HEAVY DRAIN ON BATTERY — RESULTING IN UNDERCHARGED CONDITION.

70137A

PROBLEM: BATTERY OVERCHARGED (USES TOO MUCH WATER)

Chart 2

SEE I.S. NOTES



70137F

Battery Discharge Through the 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 alternator output wire can result in injury.

Disconnect the battery negative cable. Disconnect the output wire (red) from the alternator output terminal.

Connect the test bulb jumper wires in series with the output wire and 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 the No. 1 and 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.

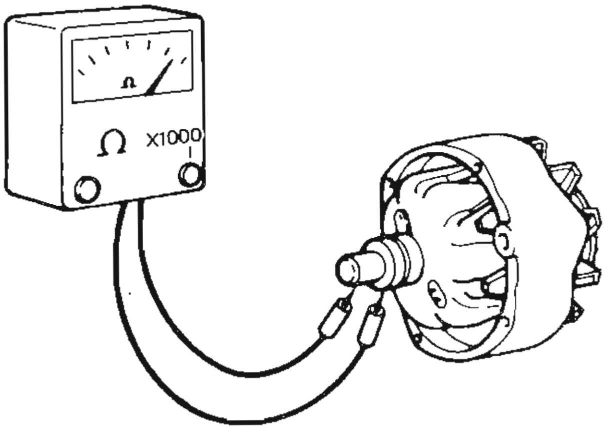
TESTING – OFF-VEHICLE

Rotor (Field) Winding Short Circuit-to-Ground Test

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.

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

SEE I.S. NOTES

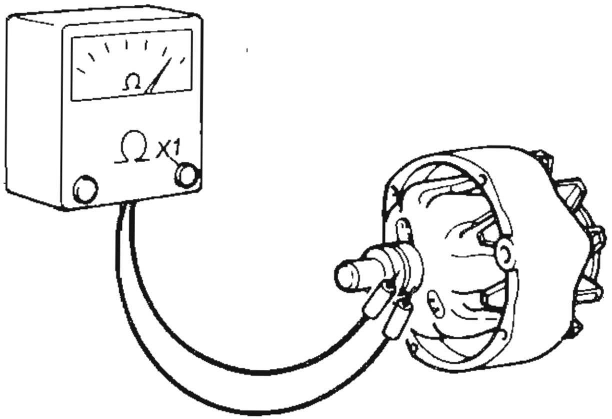
Test Results

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

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.



84910

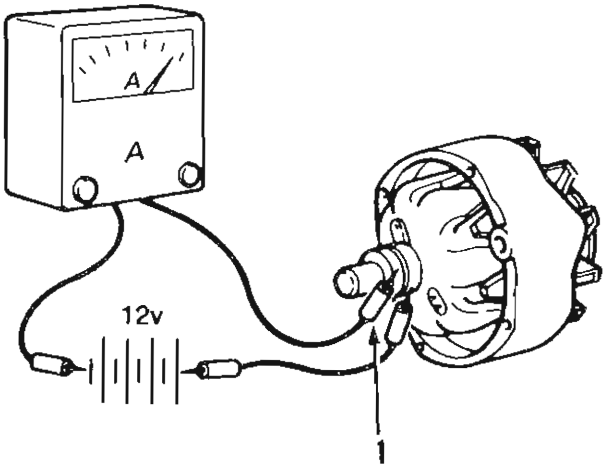
Test Results

If the ohmmeter indicates infinite resistance or the test lamp fails to light, the rotor (field) winding has an open circuit.

Rotor (Field) Winding Internal Short Circuit Test

To perform this test, remove the rotor and front housing from the stator and rear housing assembly. Refer to Alternator Overhaul 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.



84911

Test Results

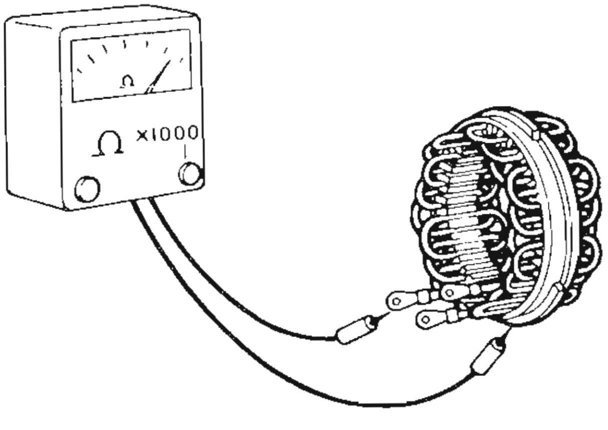
Current flow exceeding 5.0 amps indicates internally shorted windings.

NOTE: The winding resistance and ammeter indication will vary slightly with winding temperature changes. A current flow that is the less than the specified value indicates excessive winding resistance. 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 27°C (80°F), the windings are internally shorted. If the resistance is more than 3.0 ohms at 27°C (80°F), the windings have excessive resistance.

Stator Windings Short Circuit-to-Ground Test

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 for the procedure. 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.



84912

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.

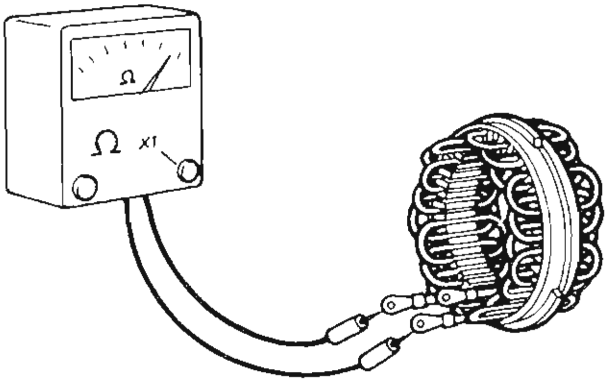
SEE I.S. NOTES

SEE I.S. NOTES

Stator Windings Continuity Test

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

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

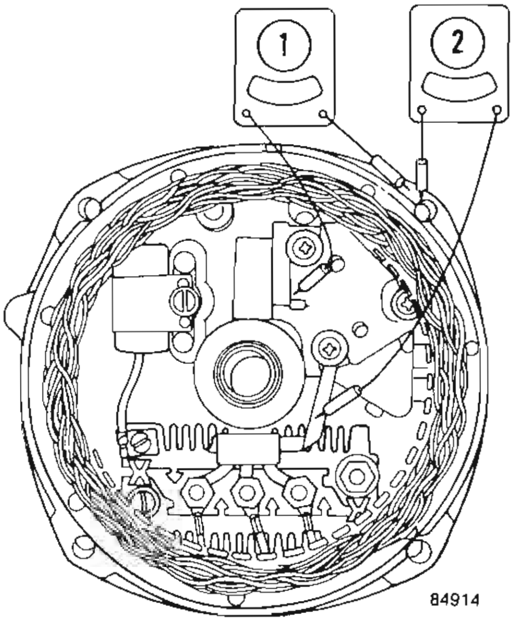
The diode trio is tested in two ways: when installed in the rear housing and when removed from the rear housing.

CAUTION: Do not use high voltage test device, such as a 110-volt test lamp, to test the diode trio.

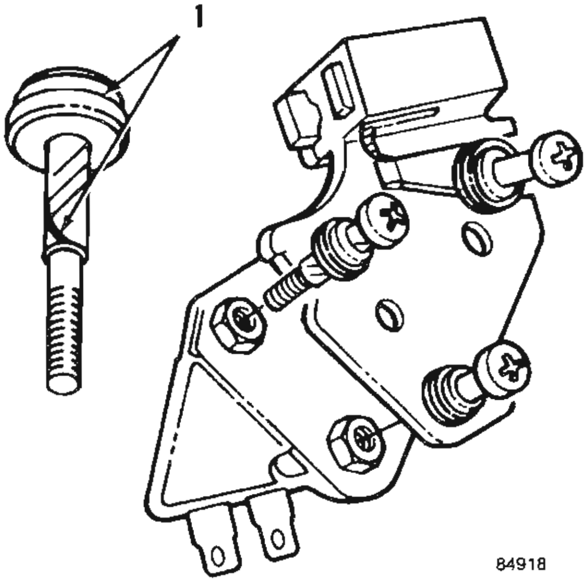
Test with the Trio Installed

Before removing the diode trio, connect an ohmmeter, with the lowest range scale selected, from the brush holder clip, to rear housing (1) and note the resistance.

Reverse the test probe connections (2). 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 (1). If insulator assemblies are correct and both ohmmeter observations are identical, replace the voltage regulator.



SEE I.S. NOTES

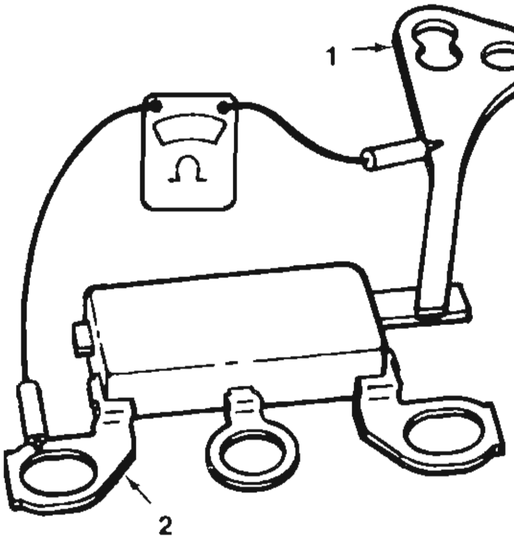
Test with Diode Trio Removed

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 (1) and the other probe to one of the stator winding terminal (2). 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.



84915

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.

Bridge Rectifier Test

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.

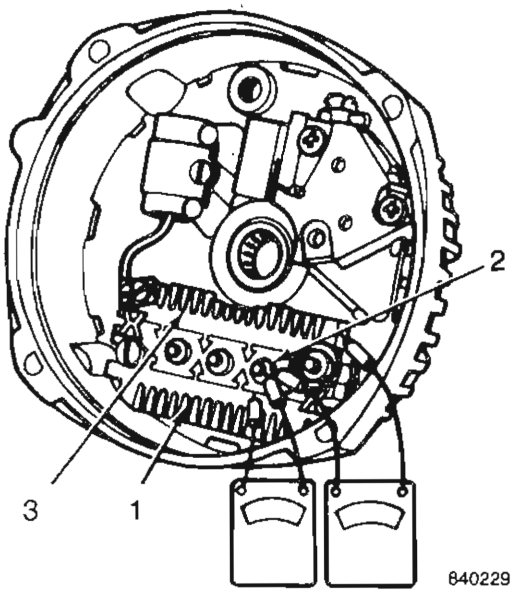
NOTE: Press down firmly on the flat metal area surrounding the thread studs with the ohmmeter test probes.

Firmly touch the ohmmeter test probes to the grounded heat sink (1) and any one of three terminals (2). Note the resistance.

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 (3) and each of the three terminals.



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 REPLACEMENT

Removal

NOTE: All bolt and screw threads are in metric dimensions.

WARNING: Failure to disconnect the battery negative cable before disconnecting the red (output) wire from the alternator can result in injury.

Disconnect the battery negative cable.

Disconnect the two-terminal plug and red wire at the back of the alternator.

Remove the mounting and adjusting bolts, washers and nuts.

Remove the alternator drive belt from the alternator pulley and remove the alternator from the mounting bracket.

Remove the pulley and fan from the alternator, Refer to Alternator Overhaul for procedure.

Installation

Install the original pulley and fan on the replacement alternator. Refer to Alternator Overhaul.

Attach the alternator to the mounting bracket with the washers and bolts. Tighten the bolts finger-tight only.

Install the alternator drive belt.

Tighten the belt to the specified tension. Refer to Cooling Systems in Chapter B for procedure.

Tighten the bolt at the sliding slot bracket with 27 N·m (20 ft-lbs) torque. Tighten the remaining bolts with 41 N·m (30 ft-lbs) torque.

SEE
I.S.
NOTES

Install the two-terminal plug and red (output) wire on the alternator.

Connect the battery negative cable.

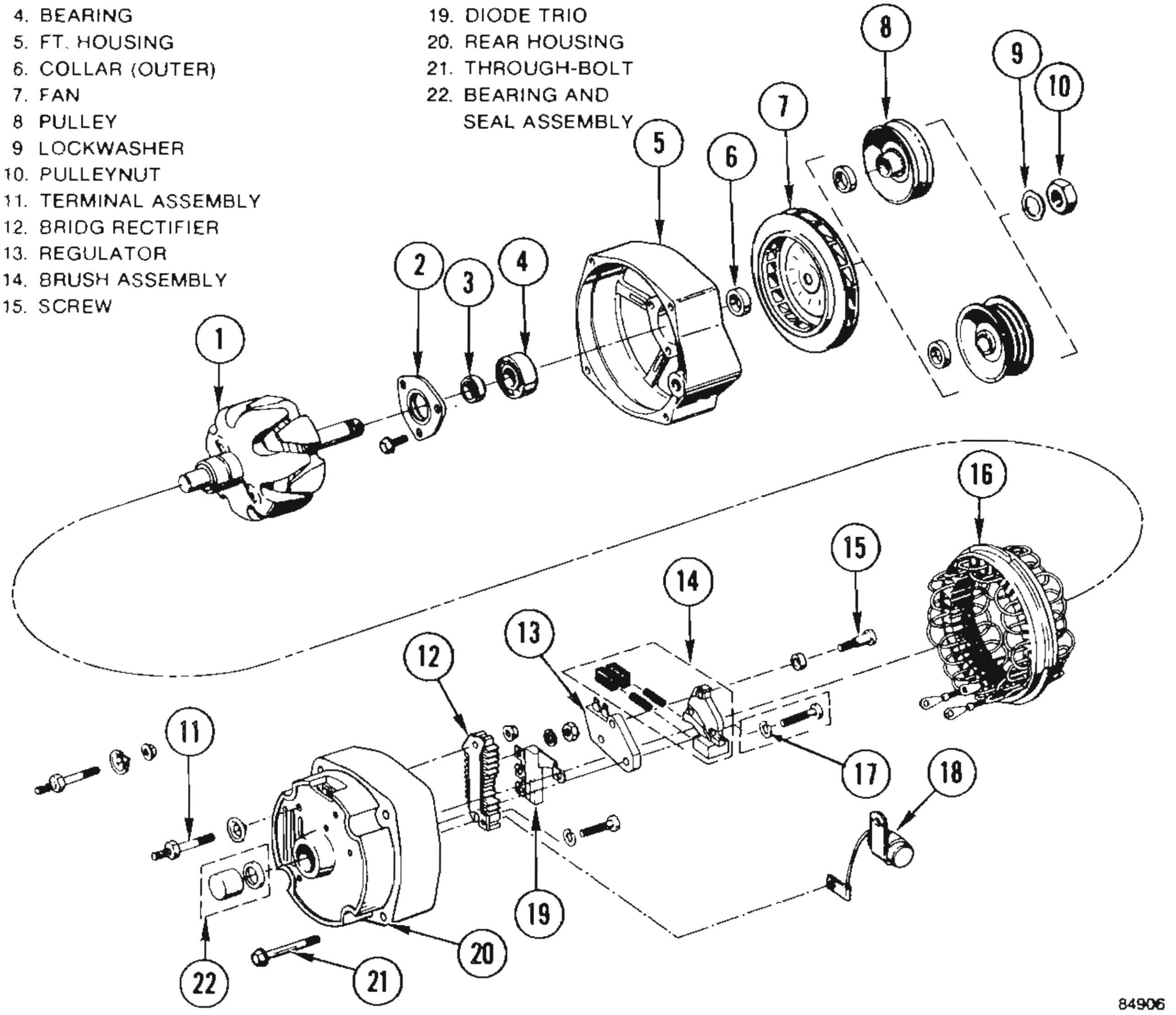
ALTERNATOR OVERHAUL

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.

1. ROTOR
2. FRONT BEARING RETAINER PLATE
3. COLLAR (INNER)
4. BEARING
5. FT. HOUSING
6. COLLAR (OUTER)
7. FAN
8. PULLEY
9. LOCKWASHER
10. PULLEYNUT
11. TERMINAL ASSEMBLY
12. BRIDG 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



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.

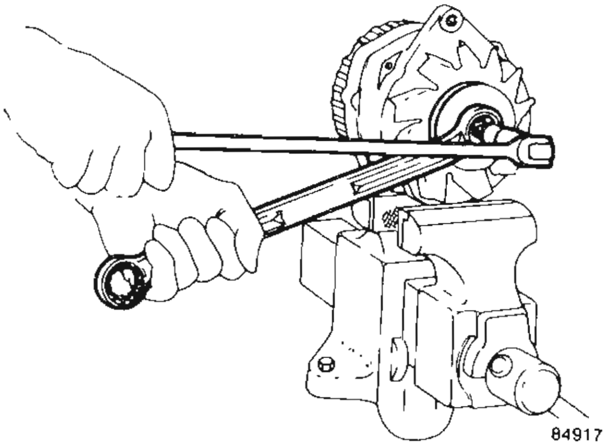
Separate the front housing and rotor assembly from the rear housing and stator assembly by prying the housings apart with a screwdriver.

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.

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. 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.

SEE I.S. NOTES

Press out the front bearing and slinger from the front housing with the appropriate tube or collar.

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.

Cleaning and Inspection

CAUTION: Do not clean the rotor with a degreasing solvent.

Clean the rotor poles by brushing with oleum spirits, or equivalent.

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.

Thoroughly clean the bridge rectifier, diode trio and voltage regulator with a brush and high pressure air.

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.

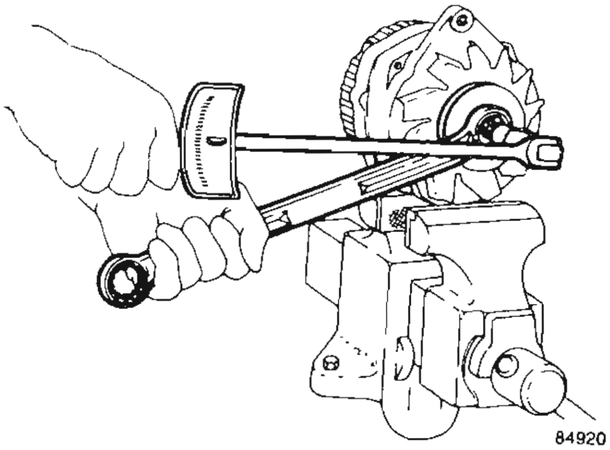
Press the bearing into the housing with the appropriate tube or collar that fits over the outer bearing race.

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 pulley nut. Tighten the nut with 68 N·m (50 ft-lbs) torque.



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.

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.

SEE
I.S.
NOTES

SEE I.S. NOTES

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.

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. Acceptable tension for a V-belt arrangement is 400-512 N (90-115 pounds-force).

NOTE: When using the gauge on a notched belt, position the middle finger of the gauge in the notched cavity of the belt.

NOTE: The tension for the serpentine drive belt is 616-704 N (140-160 pounds-force).

Refer to Chapter B – Engines-Cooling Systems for the drive belt adjustment procedures.

GENERAL

The starting system used with four- and 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 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 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.

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.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMA 21-317	Circuit Tester		■
AMOT ET-502	Digital Multimeter		■
J-22516	Starter Pole Screw Wrench		■

SEE I.S. NOTES

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)

SPECIFICATIONS

Four-Cylinder Engine Starter Motor Specifications

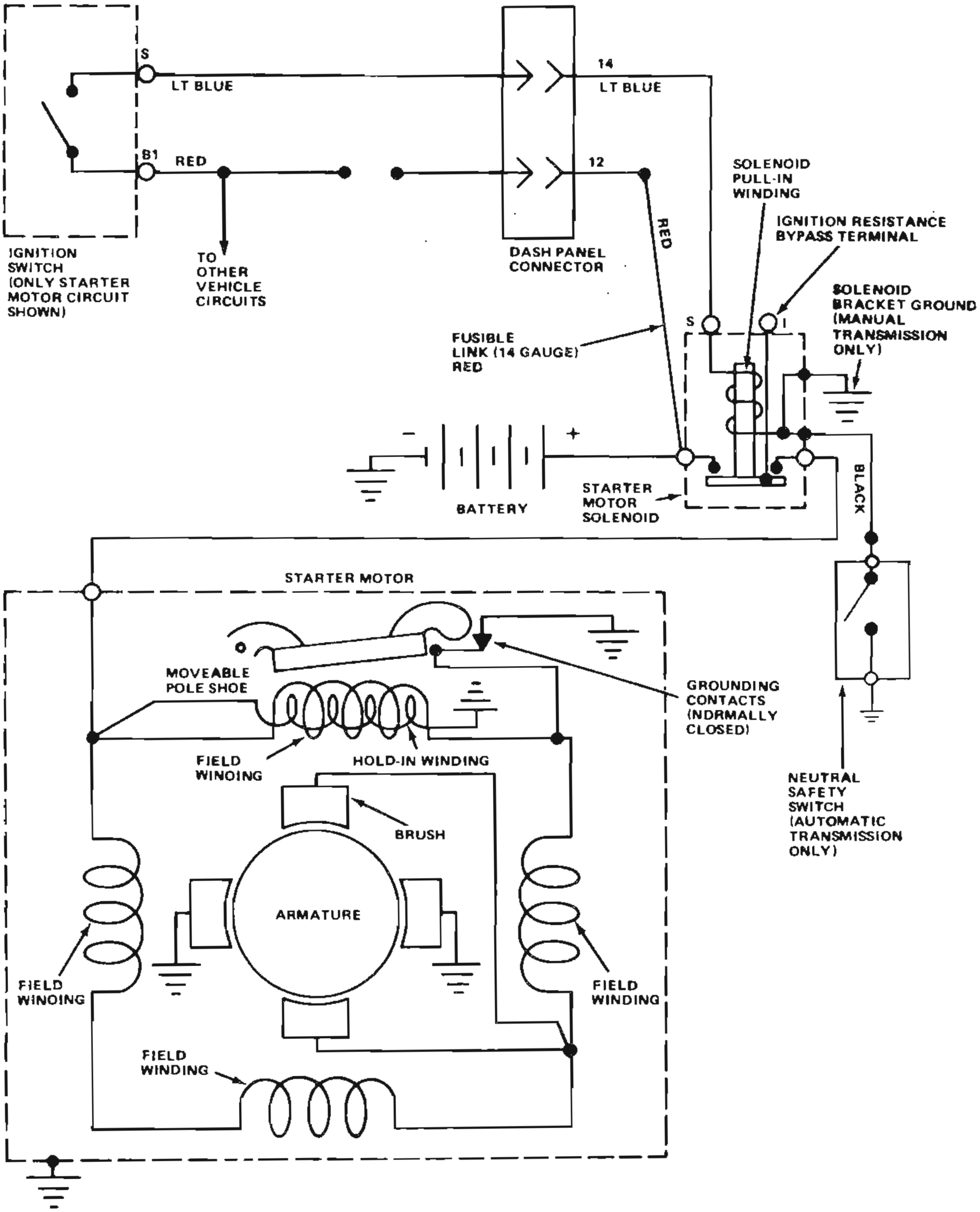
Item	Specifications
Frame diameter	101.6 mm (4.0 in)
Brush Length	12.7 mm (0.5 in)
Wear Limit	6.35 mm (0.25 in)
No Load Test (Free Speed)	
Volts	12
Amps	67
Min. RPM	7380
Max. RPM	9356
Contact Point Clearance	2.5-0.5 mm (0.100-0.020 in) 1.5 mm (0.060 in) preferred

840232

Six-Cylinder Engine Starter Motor 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	12
Amps	67
Min. RPM	7380
Max. RPM	9356
Contact Point Clearance	2.5-0.5 mm (0.100-0.020 in) 1.5 mm (0.060 in) preferred

840233


S
B1
LT BLUE
RED
14
LT BLUE
12
RED
IGNITION SWITCH (ONLY STARTER MOTOR CIRCUIT SHOWN)
TO OTHER VEHICLE CIRCUITS
DASH PANEL CONNECTOR
SOLENOID PULL-IN WINDING
IGNITION RESISTANCE BYPASS TERMINAL
SOLENOID BRACKET GROUND (MANUAL TRANSMISSION ONLY)
FUSIBLE LINK (14 GAUGE) RED
S
I
BATTERY
STARTER MOTOR SOLENOID
BLACK
STARTER MOTOR
MOVEABLE POLE SHOE
GROUNDING CONTACTS (NORMALLY CLOSED)
FIELD WINDING
HOLD-IN WINDING
BRUSH
ARMATURE
FIELD WINDING
FIELD WINDING
FIELD WINDING
NEUTRAL SAFETY SWITCH (AUTOMATIC TRANSMISSION ONLY)

841276

TROUBLESHOOTING

The Service Diagnosis chart may be used to isolate the source of the problem when the starter motor either rotates the engine too slowly, will not rotate the engine or has abnormal drive engagement.

SEE I.S. NOTES

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 either in the fuel system or ignition system.

SERVICE DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER MOTOR ROTATES ENGINE SLOWLY	(1) Battery charge low or battery defective.	(1) Charge or replace battery
	(2) Defective circuit between battery and starter motor.	(2) Clean and tighten, or replace cables.
	(3) Low load current.	(3) Bench-test starter motor. Inspect for worn brushes and weak brush springs.
	(4) High load current.	(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.	(1) Charge or replace battery.
	(2) Faulty solenoid.	(2) Check solenoid ground. Repair or replace as necessary.
	(3) Damage drive pinion gear or ring gear.	(3) Replace damaged gear(s).
	(4) Starter motor engagement weak.	(4) Bench-test starter motor.
	(5) Starter motor rotates slowly with high load current.	(5) Inspect drive yoke pull-down and point gap, check for worn end bushings, check ring gear clearance.
	(6) Engine seized.	(6) Repair engine.
STARTER MOTOR DRIVE WILL NOT ENGAGE (SOLENOID KNOWN TO BE GOOD)	(1) Defective contact point assembly.	(1) Repair or replace contact point assembly.
	(2) Inadequate contact point assembly ground.	(2) Repair connection at ground screw.
	(3) Defective hold-in coil.	(3) Replace field winding assembly.
STARTER MOTOR DRIVE WILL NOT DISENGAGE	(1) Starter motor loose on flywheel housing.	(1) Tighten mounting bolts.
	(2) Worn drive end busing.	(2) Replace bushing.
	(3) Damaged ring gear teeth.	(3) Replace ring gear or driveplate.
	(4) Drive yoke return spring broken or missing.	(4) Replace spring.
STARTER MOTOR DRIVE DISENGAGES PREMATURELY	(1) Weak drive assembly thrust spring.	(1) Replace drive mechanism.
	(2) Hold-in coil defective.	(2) Replace field winding assembly.
LOW LOAD CURRENT	(1) Worn brushes.	(1) Replace brushes.
	(2) Weak brush springs.	(2) Replace springs.

84926

SEE I.S. NOTES

ON-VEHICLE TESTING

Starter Motor Will Not Rotate

Verify the battery and cable condition as underlined under Batteries 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.

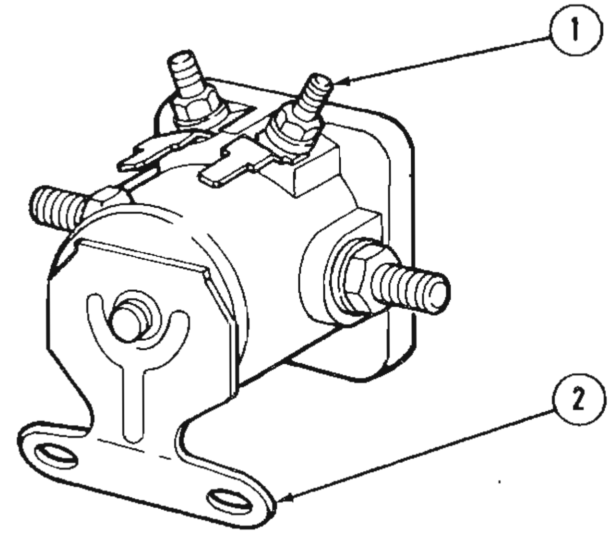
Solenoid Pull-In Coil Winding Test

This test will determine if the solenoid pull-in winding is either shorted or open.

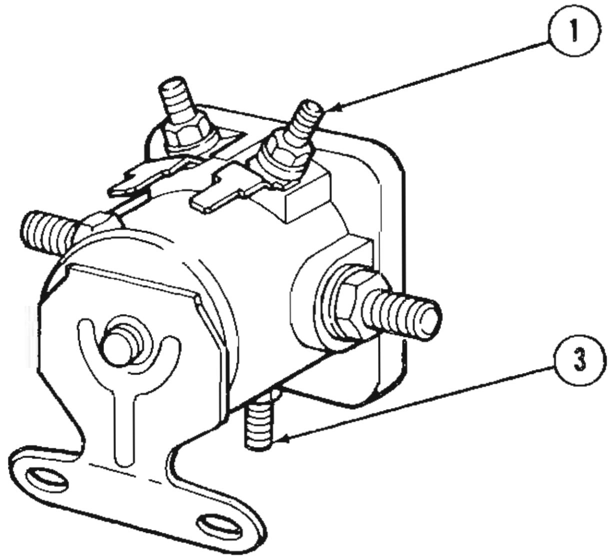
Disconnect the S-terminal wire from the solenoid.

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.



MANUAL TRANSMISSION



AUTOMATIC TRANSMISSION 84928

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

Test Procedure

Follow the steps as outlined in the Starter Motor Voltage Drop Tests (DARS) charts.

SEE I.S. NOTES

STARTER MOTOR VOLTAGE DROP TEST DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

STARTER MOTOR VOLTAGE DROP TESTS

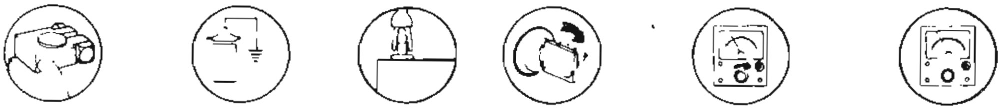
Chart 1

SEE I.S. NOTES

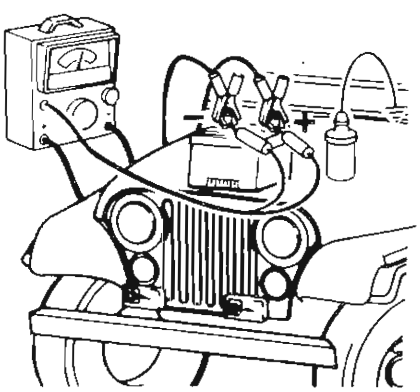
STEP **SEQUENCE** **RESULT**

STARTER MOTOR FULL LOAD CURRENT TEST

1



- CLEAN AND CONNECT BATTERY CABLES
- REMOVE COIL WIRE FROM DISTRIBUTOR AND CONNECT TO GROUND
- CONNECT HEAVY LOAD TESTER
- ENGAGE STARTER MOTOR FOR THREE SECONDS AND OBSERVE VOLTMETER
- TURN LOAD CONTROL UNTIL VOLTMETER INDICATES SAME VOLTAGE AS WHEN STARTER MOTOR WAS ENGAGED
- OBSERVE AMMETER. NOTE AMPS FOR USE IN LATER STEPS.



OK 4&6 CYL – 150-180 AMPS → STOP

NOT OK 4&6 CYL. – ABOVE 180 AMPS
- BATTERY CABLES AND SOLENOID NOT TESTED → 2

OR

- BATTERY CABLE AND SOLENOID REPAIRS COMPLETED – REPAIR STARTER → STOP

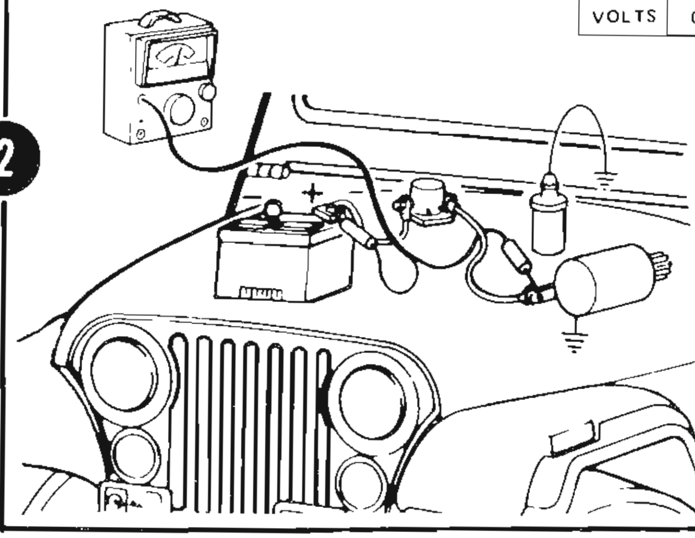
2

VOLTAGE DROP TEST

(NOTE TEST POINTS IN ILLUSTRATION)

- GROUND COIL WIRE
- CONNECT VOLTMETER
- ENGAGE STARTER MOTOR
- OBSERVE VOLTMETER
- COMPARE AMPS FROM STEP 1 AND VOLTS TO CHART

MAXIMUM VOLTAGE DROP BY FULL LOAD AMPERAGE				
AMPS	150-210	215-295	300-420	425-600
VOLTS	0.5 V	0.7 V	1.0 V	1.5 V



OK VOLTAGE AT OR BELOW MAXIMUM → 5

NOT OK VOLTAGE ABOVE MAXIMUM → 3

86384A

STEP **SEQUENCE** **RESULT**

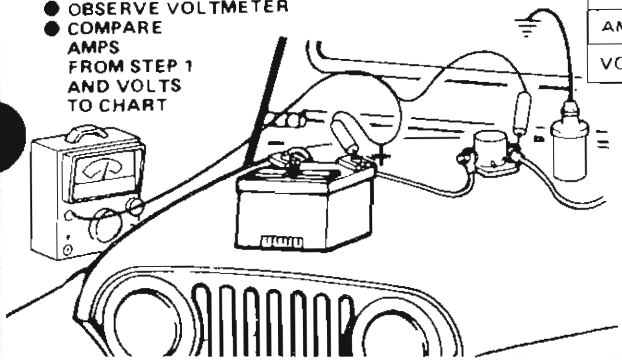
3

VOLTAGE DROP TEST

(NOTE TEST POINTS IN ILLUSTRATION)

- GROUND COIL WIRE
- CONNECT VOLTMETER
- ENGAGE STARTER MOTOR
- OBSERVE VOLTMETER
- COMPARE AMPS FROM STEP 1 AND VOLTS TO CHART

MAXIMUM VOLTAGE DROP BY FULL LOAD AMPERAGE				
AMPS	150-210	215-295	300-420	425-500
VOLTS	0.3 V	0.5 V	0.6 V	0.9 V



OK — VOLTAGE AT OR BELOW MAXIMUM — REPAIR SOLENOID-TO-STARTER MOTOR CABLE → **5**

~~OK~~ — VOLTAGE ABOVE MAXIMUM → **4**

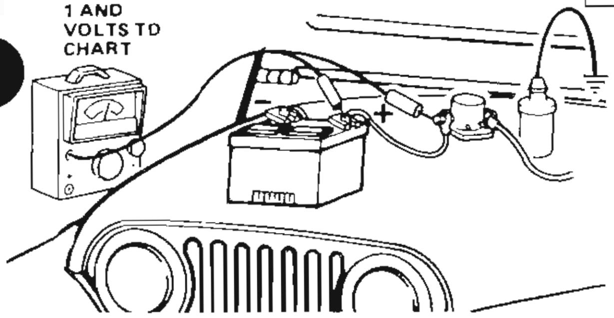
4

VOLTAGE DROP TEST

(NOTE TEST POINTS IN ILLUSTRATION)

- GROUND COIL WIRE
- CONNECT VOLTMETER
- ENGAGE STARTER MOTOR
- OBSERVE VOLTMETER
- COMPARE AMPS FROM STEP 1 AND VOLTS TO CHART

MAXIMUM VOLTAGE DROP BY FULL LOAD AMPERAGE				
AMPS	150-210	215-295	300-420	425-600
VOLTS	0.2V	0.3V	0.4V	0.5V



OK — VOLTAGE AT OR BELOW MAXIMUM — REPAIR SOLENOID → **5**

~~OK~~ — VOLTAGE ABOVE MAXIMUM — REPAIR BATTERY-TO-SOLENOID CABLE → **5**

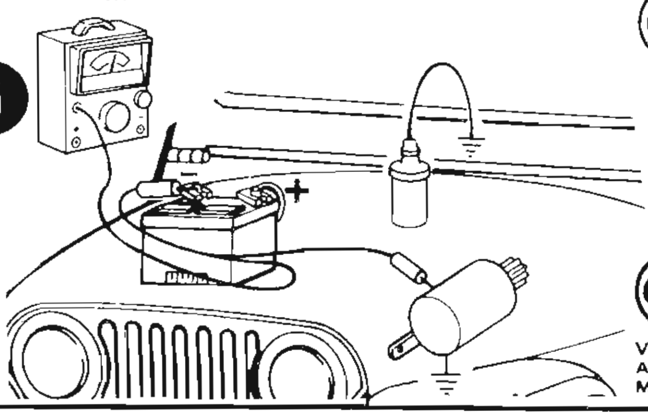
5

VOLTAGE DROP TEST

(NOTE TEST POINTS IN ILLUSTRATION)

- GROUND COIL WIRE
- CONNECT VOLTMETER
- ENGAGE STARTER MOTOR
- OBSERVE VOLTMETER
- COMPARE AMPS FROM STEP 1 AND VOLTS TO CHART

MAXIMUM VOLTAGE DROP BY FULL LOAD AMPERAGE				
AMPS	150-210	215-295	300-420	425-600
VOLTS	0.2V	0.3V	0.4V	0.5V



OK — VOLTAGE AT OR BELOW MAXIMUM

- REPAIRS TO SOLENOID OR CABLES PERFORMED IN A PREVIOUS STEP → **1**
- REPAIRS TO SOLENOID OR CABLES NOT REQUIRED IN A PREVIOUS STEP — REPAIR STARTER MOTOR → STOP

~~OK~~ — VOLTAGE ABOVE MAXIMUM — REPAIR ENGINE-TO-BATTERY CABLE → **1**

SEE I.S. NOTES

86384B

Starter Motor Full Load Current Test

Prior to performing the full load current test, the battery must be fully charged as described in Batteries.

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.

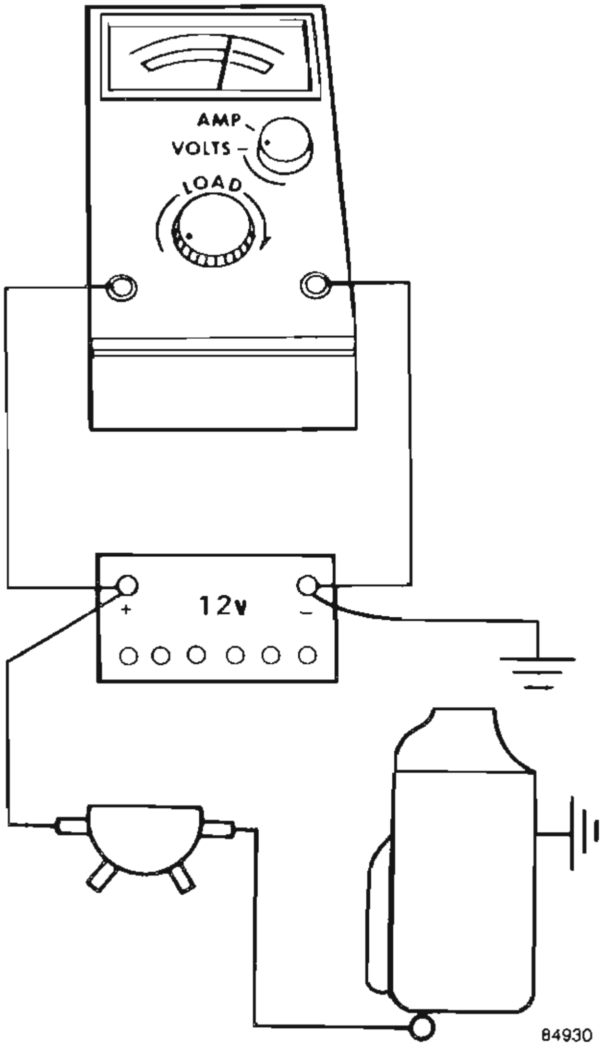
Disconnect and ground the ignition coil secondary wire.

Connect a remote control starter motor switch between the positive battery terminal and the S-terminal on the starter motor solenoid.

CAUTION: 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.



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 four- and 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.

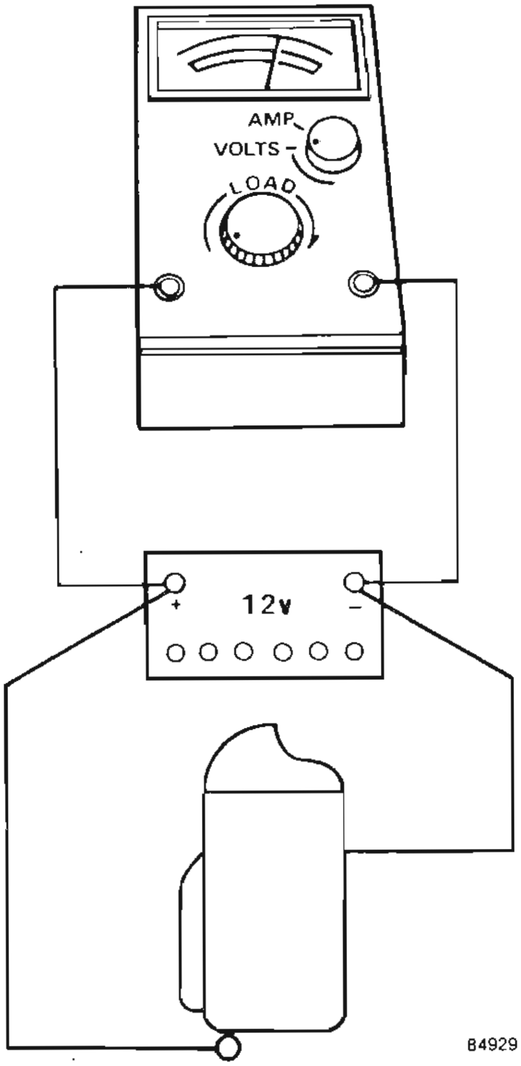
OFF-VEHICLE TESTING

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.



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.

SEE I.S. NOTES

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.

SEE
.S.
NOTES

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.

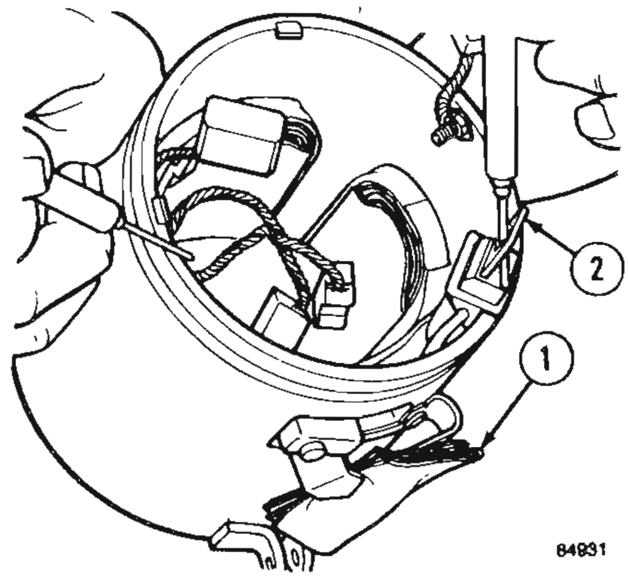
Hold-In Coil Winding Resistance Test

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.

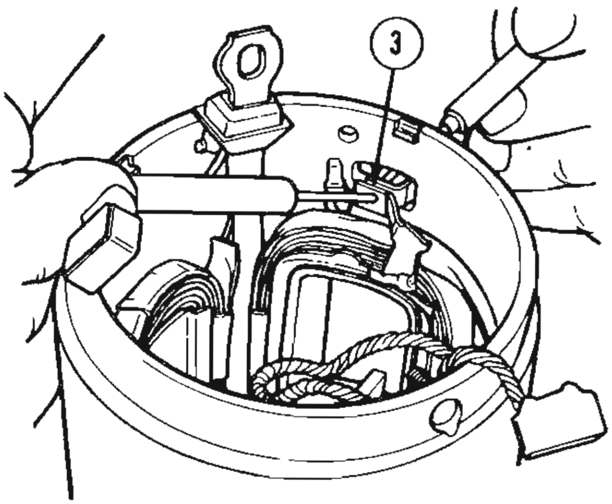
Use an ohmmeter to measure the resistance between the S-terminal (2) and the starter motor frame.

The resistance should be between 2.0 and 3.5 ohms. If the resistance is outside the specification, replace the field winding assembly.



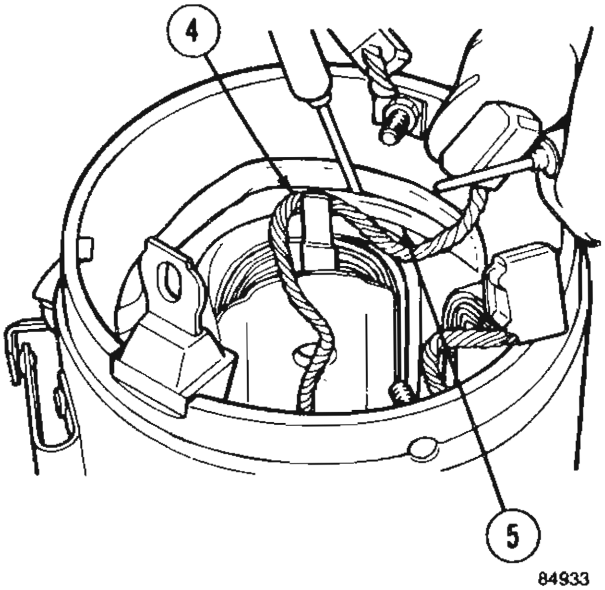
Solenoid Contact Point Connection Test

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.



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.



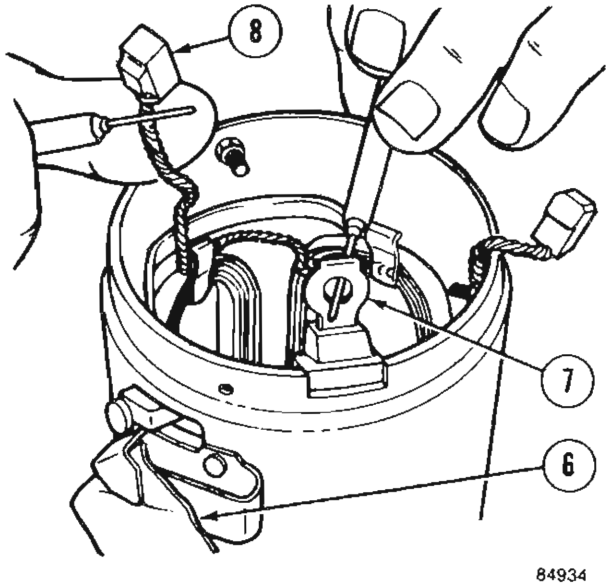
Field Winding Terminal-to-Brush Continuity Test

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).

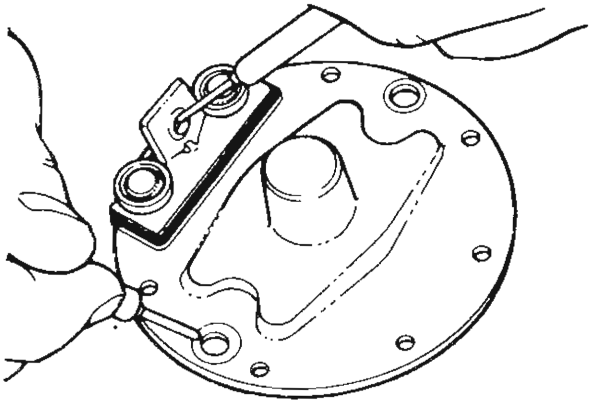
If the resistance is greater than zero ohms, inspect all the solder joints to determine which have excessive resistance. Repair the faulty joint(s) by resoldering with a 600 watt soldering iron.



SEE I.S. NOTES

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.



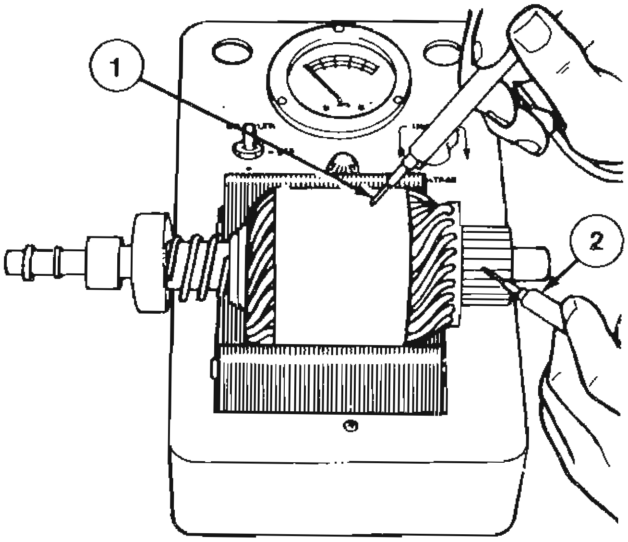
Armature Tests

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.

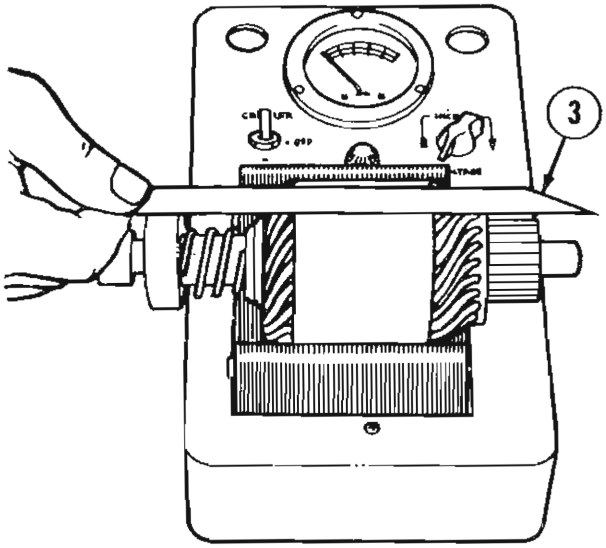


Armature Short Test

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 armature must be replaced.



84937

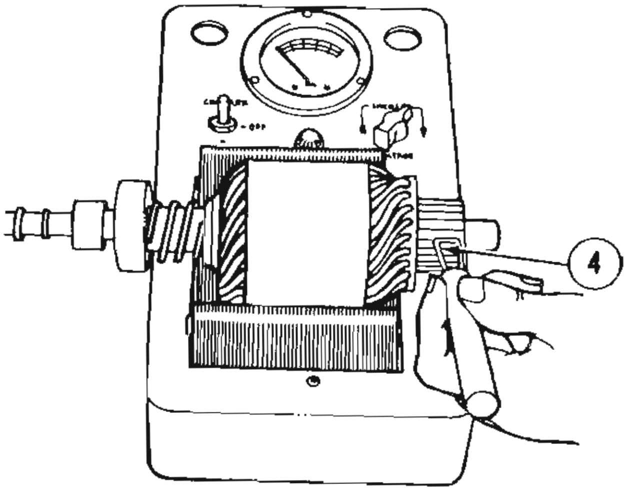
Armature Balance Test

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.



84938

STARTER MOTOR REPLACEMENT – FOUR-CYLINDER

Removal

Disconnect the negative battery cable at the battery.

Disconnect the cable from the starter motor terminal.

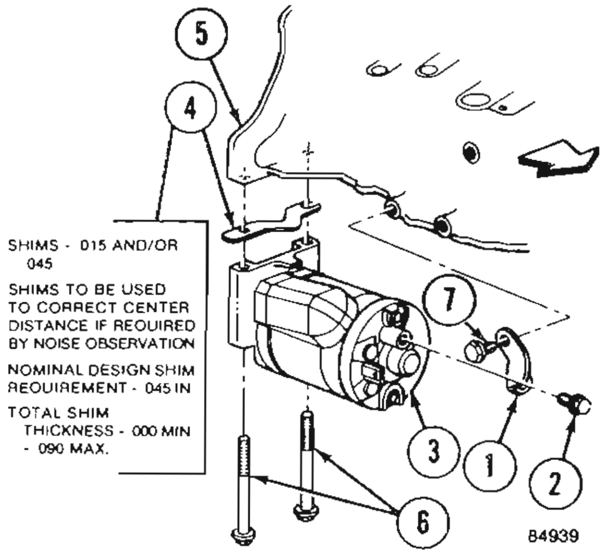
Remove the attaching bolts and remove the starter motor and shims.

SEE I.S. NOTES

Installation

Assemble the bracket (1) and bolt/washer (2) to the starter motor (3).

Install the motor and shim(s) (4) to the cylinder block (5) with dowel bolts (6).



NOTE: The dust cover for the manual transmission clutch mounting must be in place before installing the starter motor.

Install the bracket (1) and the mounting bolt/washer (7) to the engine block.

Tighten all attaching bolts with 18-34 N·m (13-24 ft-lbs).

Attach the cable to the starter motor terminal and tighten the 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.

NOTE: Shims are used to correct the center distance, if required. The total shim thickness should be from 0.000 mm (0.000 in) minimum to 2.3 mm (0.090 in) maximum.

STARTER MOTOR REPLACEMENT – SIX-CYLINDER

Removal

Disconnect the negative battery cable at the battery.

Disconnect the cable from the starter motor terminal.

Remove the attaching screws and remove the starter motor from the flywheel (drive plate) housing.

Installation

NOTE: Ensure that the mounting surfaces are free of burrs and debris.

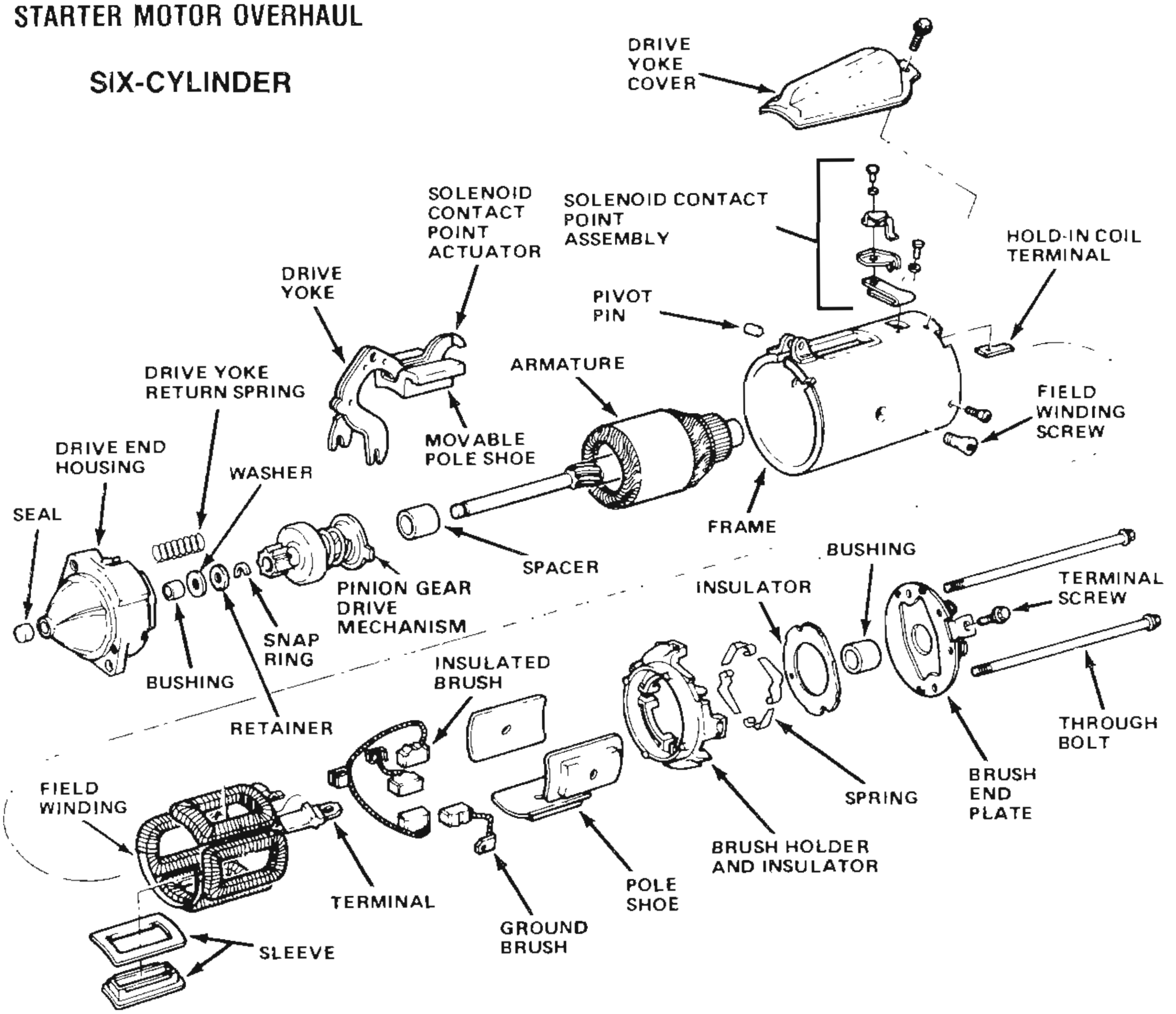
Position the starter motor on the flywheel housing and install the mounting screws and tighten with 24 N·m (18 ft-lbs) torque.

Attach the 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.

STARTER MOTOR OVERHAUL

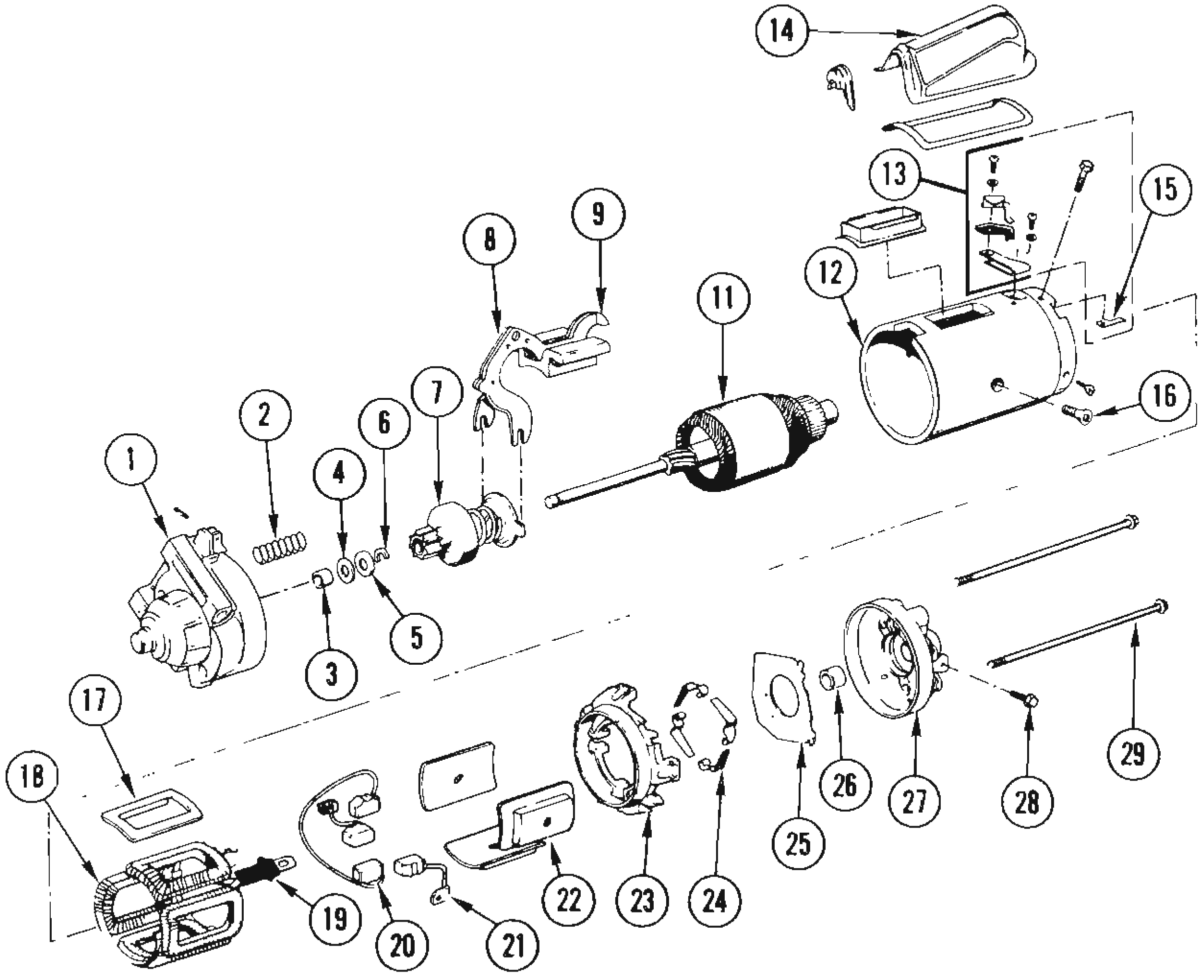
SIX-CYLINDER



Starter Motor—Exploded View

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. Spacer
12. Movable Pole Shoe
13. Armature
14. Pivot Pin
15. Solenoid Contact Point Assembly
16. Drive Yoke Cover
17. Hold-In Coil Terminal
18. Field Winding Screw
19. Bushing
20. Frame
21. Insulator
22. Insulated Brush
23. Field Winding
24. Sleeve
25. Terminal
26. Ground Brush
27. Pole Shoe
28. Brush Holder and Insulator
29. Spring
30. Brush End Plate
31. Through Bolt
32. Terminal Screw

840245



1. DRIVE END HOUSING
2. DRIVE YORK RETURN SPRING
3. BUSHING
4. WASHER
5. RETAINER
6. SNAP RING
7. PINION GEAR DRIVE MECHANISM
8. DRIVE YOKE
9. SOLENOID CONTACT POINT ACTUATOR
10. MOVEABLE POLE SHOE
11. ARMATURE
12. FRAME
13. SOLENOID CONTACT POINT ASSEMBLY
14. DRIVE YOKE COVER
15. HOLD-IN COIL TERMINAL
16. FIELD WINDING SCREW
17. SLEEVE
18. FIELD WINDING
19. TERMINAL
20. INSULATED BRUSH
21. GROUN BRUSH
22. POLE SHOE
23. BRUSH HOLDER AND INSULATOR
24. SPRINGS
25. INSULATOR
26. BUSHING
27. BRUSH END PLATE
28. TERMINAL SCREW
29. THROUGH BOLT

84922

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.

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, 0.125 mm (0.005 in) or more, or has insulation protruding from between the bars, turn it down on a lathe.

Inspect the armature shaft and bushings for scoring and excessive wear.

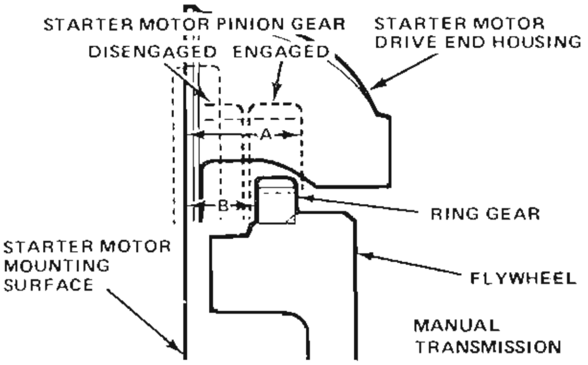
Inspect the drive mechanism pinion gear for damage. If the pinion gear has failed repeatedly, perform the following inspection:

Inspect for a wobbling ring gear. The maximum allowable runout is 0.76 mm (0.030 in). Inspect for broken welds or a broken drive plate (automatic transmission).

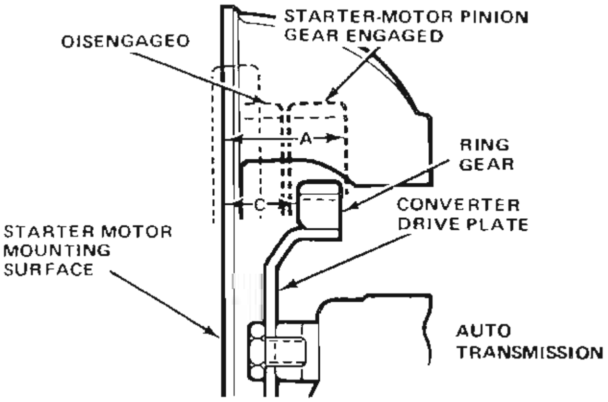
Inspect for foreign objects such as a converter balance weight in the converter housing (automatic transmission).

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES



ENGINE	FLYWHEEL			
	A		B	
4-CYLINDER	21.1 mm TO 23.1 mm	0.8350 in. TO 0.9000 in.	9.7 mm TO 12.0 mm	0.3830 in. TO 0.4745 in.
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		C	
4-CYLINDER	21.1 mm TO 23.1 mm	0.8350 in. TO 0.9000 in.	9.7 mm TO 12.0 mm	0.3830 in. TO 0.4745 in.
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.

841278

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 two places on a four-cylinder and three places on a six-cylinder. The normal wear pattern extends approximately 5 cm (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 6.35 mm (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 Replacement

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.

Clean and tin the surfaces of the contact tab and the field winding terminal strap that are to be soldered.

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.

Solenoid Contact Point Assembly Replacement

Remove the armature and brush holder before starting this procedure.

CAUTION: Do not cut the field winding terminal strap.

Cut the upper contact as close as possible to the contact-point-to-field winding joint.

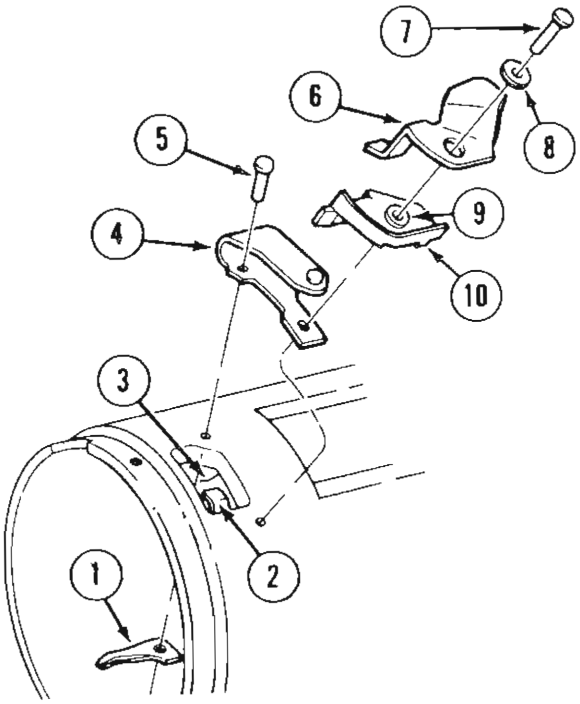
Unsolder the hold-in coil winding terminal wire from the terminal strip.

Remove the field winding screws with an arbor press and Tool J-22516. Remove the pole shoes.

Cut the rivets inside the frame with a chisel. Remove the contact point assembly.

Position the replacement lower (movable) contact on the frame. Position the hold-in coil winding terminal strip inside the frame. Install a copper rivet through the contact, frame and terminal. Upset the rivet.

SEE I.S. NOTES



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

84940

NOTE: Ensure the holes for the second rivet are aligned before upsetting the copper rivet.

Install the plastic insulator, upper contact and fiber washer to the remaining hole in the frame. Install an aluminum rivet and upset.

SEE I.S. NOTES

NOTE: Ensure the upper contact is positioned on the shoulder of the plastic insulator 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. Use a 500-600 watt soldering iron and rosin-core solder.

Bushing Replacement

Drive End Bushing

Support the drive end housing and remove the original bushing and seal.

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

Carefully remove the original bushing with a chisel.

Drive a replacement bushing into the end plate until it is seated, using suitable socket or bushing driver.

Drive Mechanism Replacement

Pry the stop ring off and remove the starter motor drive from the armature shaft.

Apply grease to the armature shaft and end bushings. The replacement drive mechanism is prelubricated.

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.

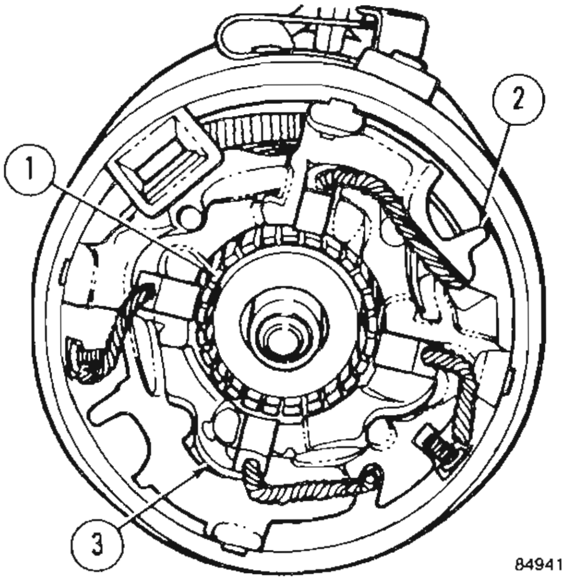
Assembly

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.

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.

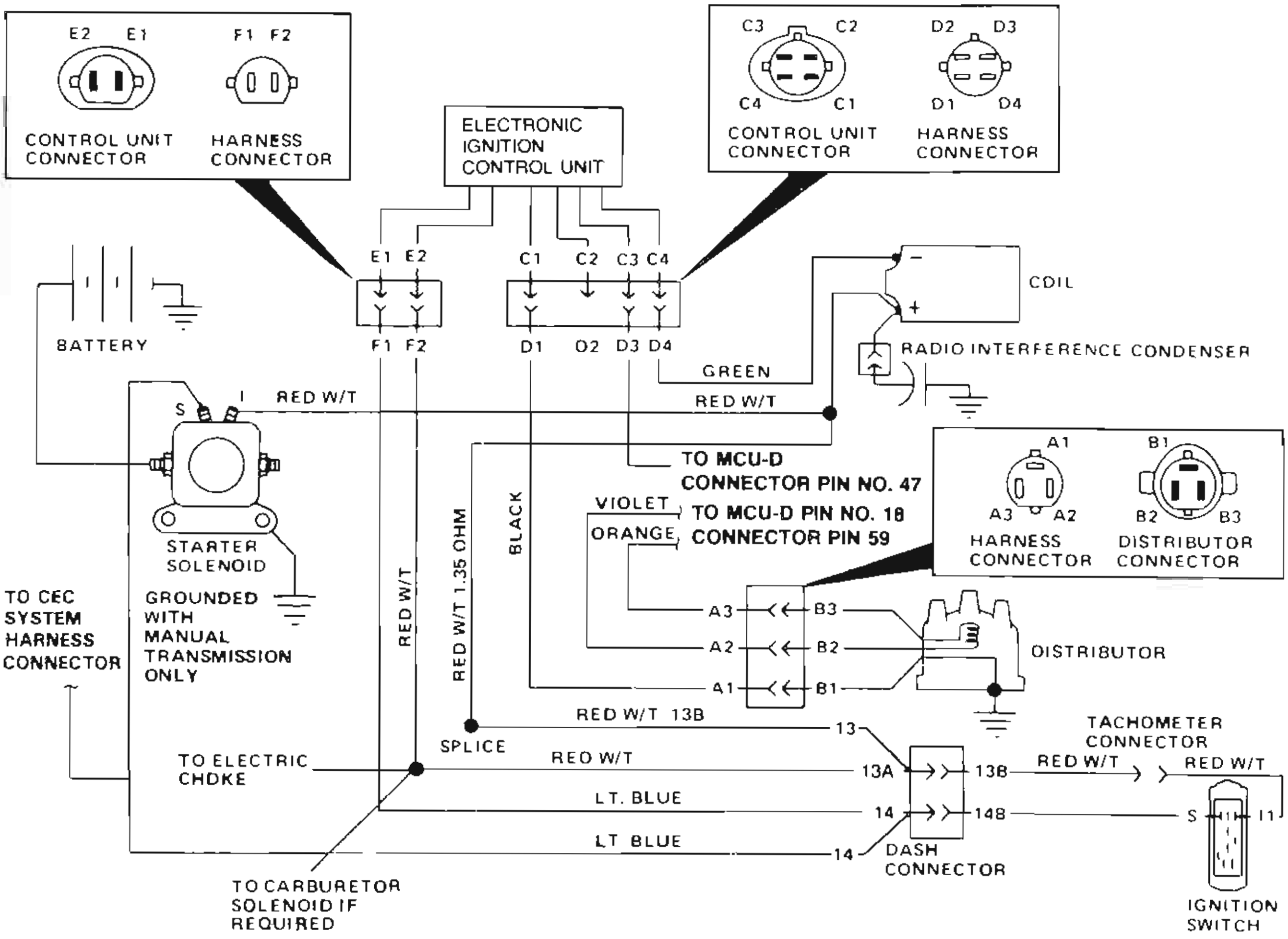
SEE
I.S.
NOTES

SEE I.S. NOTES

GENERAL

The Solid State Ignition (SSI) system is used on both the four- and six-cylinder CJ and Scrambler Models. The SSI system consists of the following major components:

- micro computer unit (MCU)
- electronic ignition control unit
- ignition coil
- resistance wire
- distributor
- knock sensor
- cap and rotor
- spark plugs and wires



70865B

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMOT ET-502	Digital Multimeter		■
J-23738	Hand Operated Vacuum Pump		■
J-28509	Trigger Wheel Puller		■

TORQUE SPECIFICATIONS

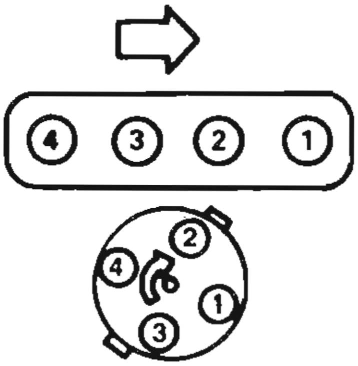
Component	Service Set-To Torque	Service Recheck Torque
Distributor Clamp Screw	23 N·m (17 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Spark Plugs	37 N·m (27 ft-lbs)	30-40 N·m (22-33 ft-lbs)

SPECIFICATIONS

SSI Distributor and Ignition Coil Specifications

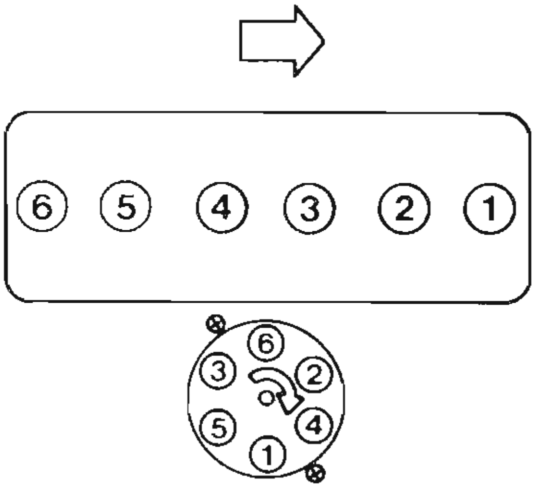
Distributor Pickup Coil	
Resistance	400 to 800 ohms @ 24°C (75°F)
Ignition Coil	
Primary Resistance	1.13 to 1.23 ohms @ 24°C (75°F)
	1.5 ohms @ 93°C (200°F)
Secondary Resistance	7700 to 9300 ohms @ 24°C (75°F)
	12,000 ohms @ 93°C (200°F)
Minimum Open Circuit Output at 1000 rpm	24 kv
Spark Plugs	
Required Voltage at 1000 rpm	5 to 16 kv
Maximum Variation Between Cylinders	3 to 5 kv

840248



Four-Cylinder Engine

84950



Six-Cylinder Engine

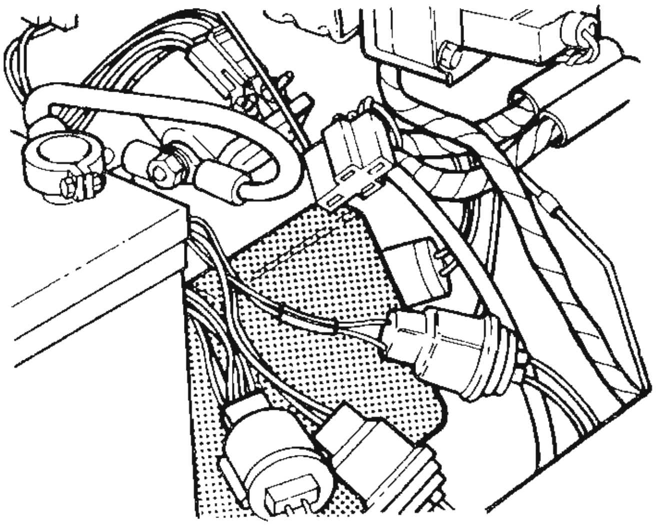
42189A

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.



86311

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.

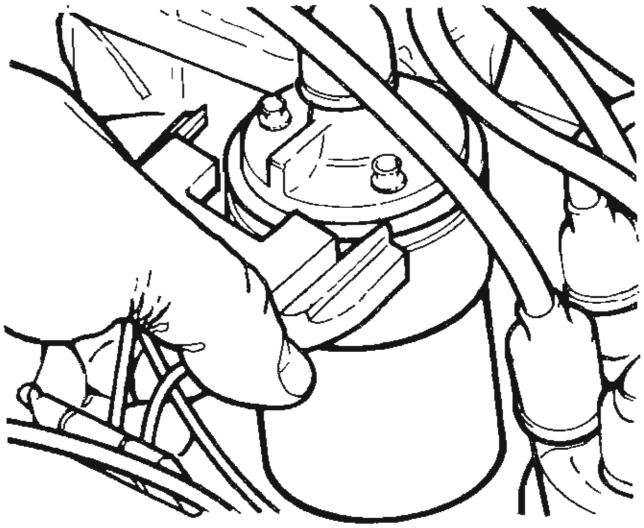
Ignition Coil

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.

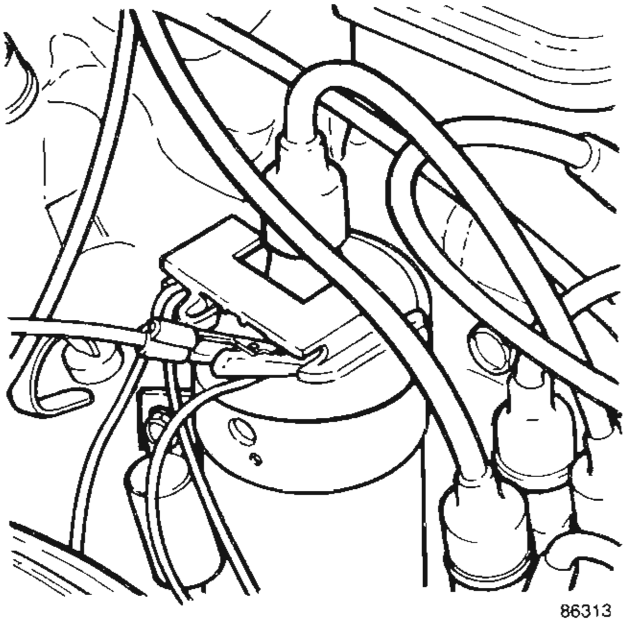
Ignition Coil Connector

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.



86312

When a tachometer is required for engine testing or tune-up, connect it using an alligator jaw-type connector as illustrated.



86313

DIAGNOSIS

For diagnostic purposes, ignition system problems are considered in three categories: complete failure, intermittent failure and spark knock (pre-ignition).

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.

SEE I.S. NOTES

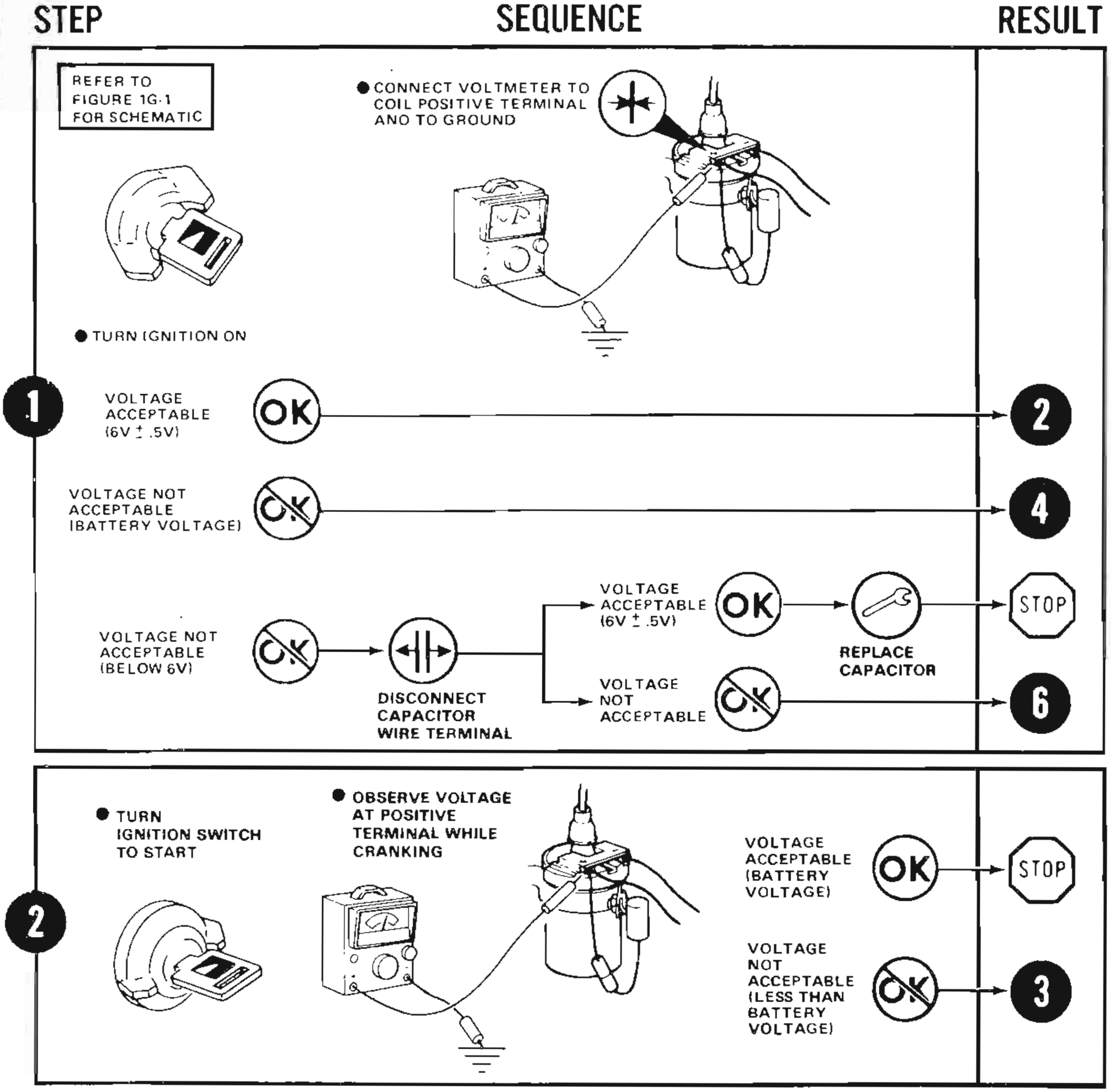
SSI SYSTEM DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

IGNITION COIL PRIMARY CIRCUIT

FUNCTION: CONNECTS BATTERY VOLTAGE TO COIL AND COIL TO GROUND

Chart 1

SEE I.S. NOTES



80699A

Chart 1

STEP | **SEQUENCE** | **RESULT**

SEE I.S. NOTES

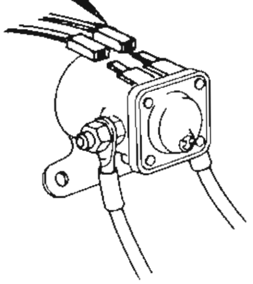
3

- ✓ CHECK FOR SHORT OR OPEN IN WIRE ATTACHED TO STARTER MOTOR SOLENOID I-TERMINAL
- ✓ CHECK STARTER MOTOR SOLENOID AS OUTLINED IN CHAPTER 1F

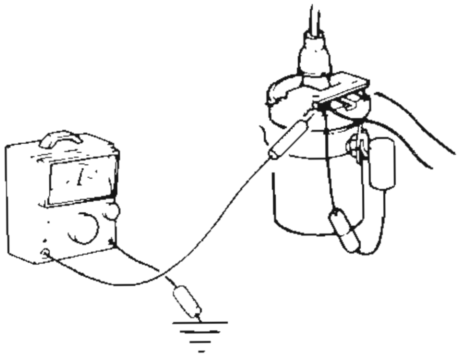
REPAIR AS REQUIRED → STOP

4

DISCONNECT WIRE FROM STARTER MOTOR SOLENOID I-TERMINAL



- IGNITION REMAINS ON
- OBSERVE VOLTAGE AT COIL POSITIVE TERMINAL



VOLTAGE DROPS TO 6V ± .5V → OK → REPLACE STARTER MOTOR SOLENOID → STOP

VOLTAGE REMAINS AT BATTERY VOLTAGE → NOT OK → CONNECT JUMPER BETWEEN COIL NEGATIVE TERMINAL AND GROUND

- VOLTAGE DROPS TO 6V ± .5V → OK → 5
- VOLTAGE DOES NOT DROP → NOT OK → TEST RESISTANCE WIRE → 6

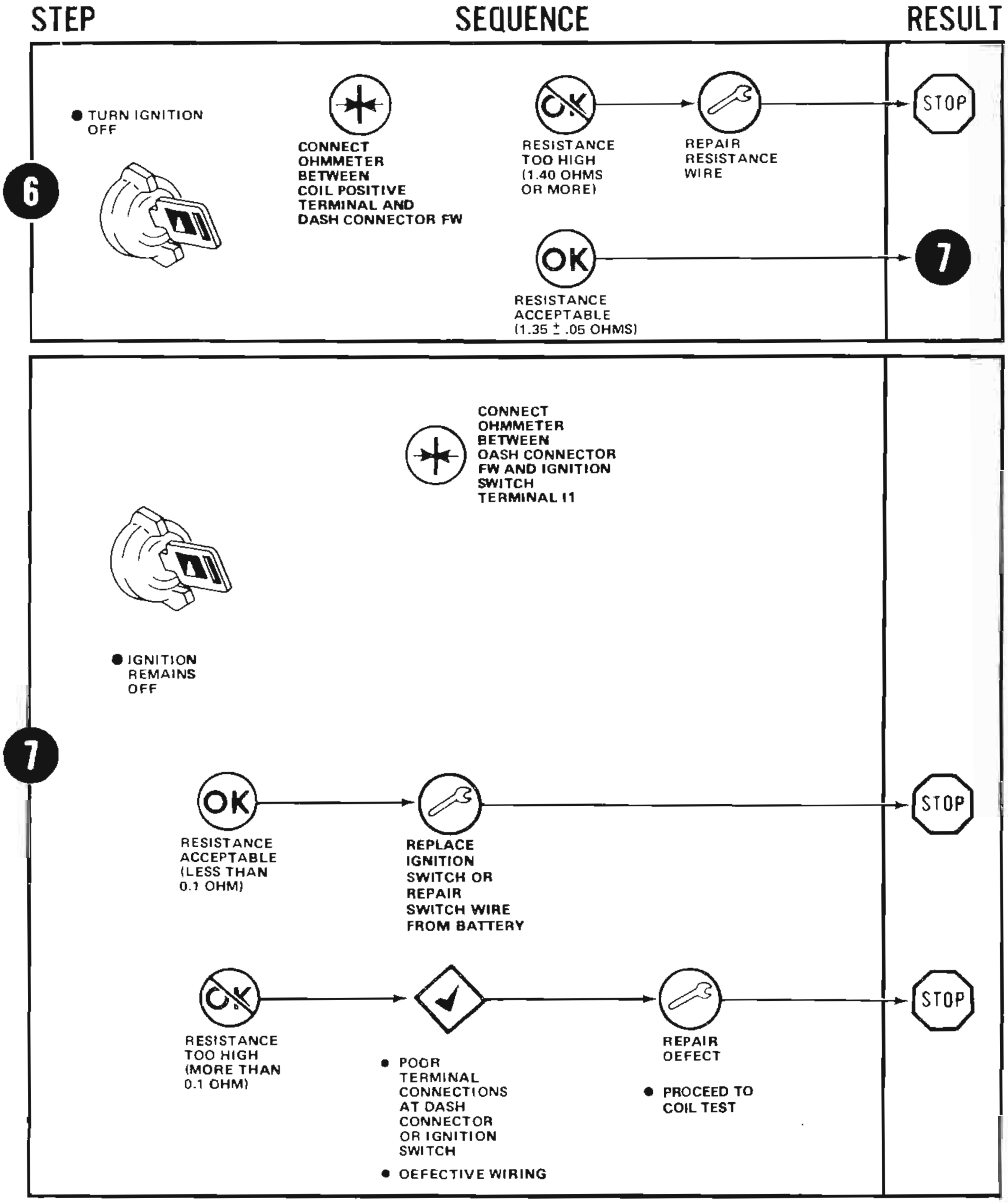
5

CHECK:

- CONTINUITY BETWEEN COIL NEGATIVE TERMINAL AND CONNECTOR OR TERMINAL D4
  - CONTINUITY OK → REPLACE CONTROL UNIT → STOP
- DI CONTINUITY BETWEEN CONNECTOR TERMINAL AND GROUND
  - CONTINUITY NOT OK → LOCATE AND REPAIR OPEN → 2

80699B

Chart 1



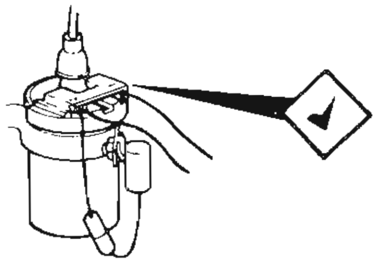
80699C

COIL TEST

Chart 2

STEP **SEQUENCE** **RESULT**

1

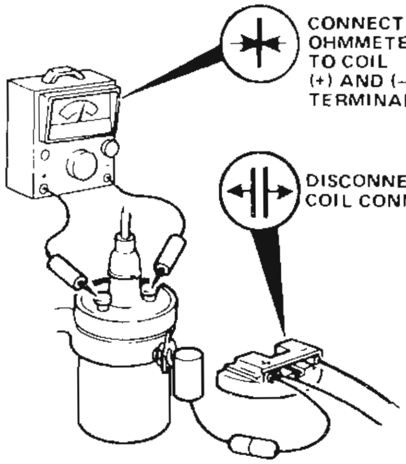


INSPECT COIL FOR OIL LEAKS, OTHER EXTERIOR DAMAGE, AND CARBON TRACKS

OK → 2

NOT OK → REPLACE COIL → STOP

2



CONNECT OHMMETER TO COIL (+) AND (–) TERMINALS

DISCONNECT COIL CONNECTOR

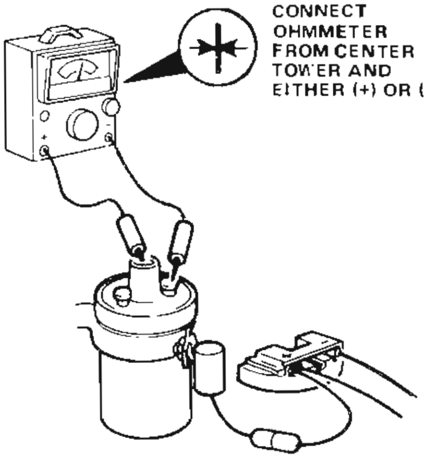
OK → 3

RESISTANCE ACCEPTABLE
(1.13 TO 1.23 OHMS AT 76°F OR 24°C)
(1.6 OHMS AT 200°F OR 93°C)

NOT OK → REPLACE COIL → STOP

RESISTANCE NOT WITHIN LIMITS

3



CONNECT OHMMETER FROM CENTER TOWER AND EITHER (+) OR (–)

OK → STOP

RESISTANCE ACCEPTABLE
(7700 - 9300 OHMS @ 76°F OR 24°C)
(12,000 OHMS @ 200°F OR 93°C)

NOT OK → REPLACE COIL → STOP

RESISTANCE NOT WITHIN LIMITS

SEE I.S. NOTES

80699D

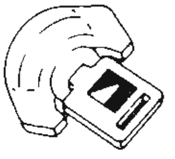
SEE I.S. NOTES

SENSOR CHECK AND CONTROL UNIT CHECK

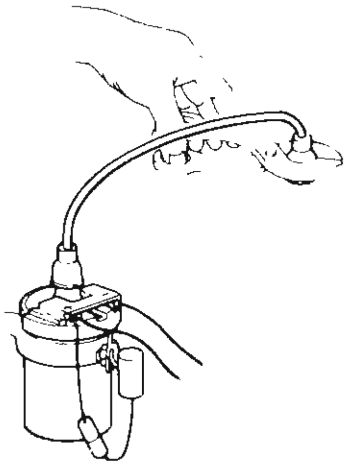
Chart 3

STEP — SEQUENCE — RESULT

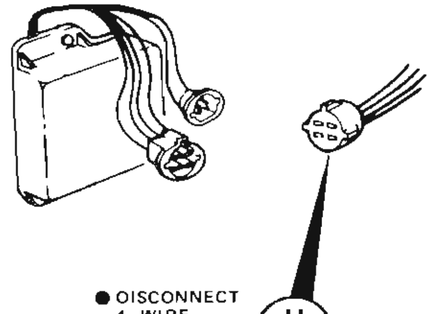
1



● TURN IGNITION ON



● DISCONNECT COIL WIRE FROM CENTER TOWER OF DISTRIBUTOR AND HOLD 1/2 - INCH FROM ENGINE WITH INSULATED PLIERS



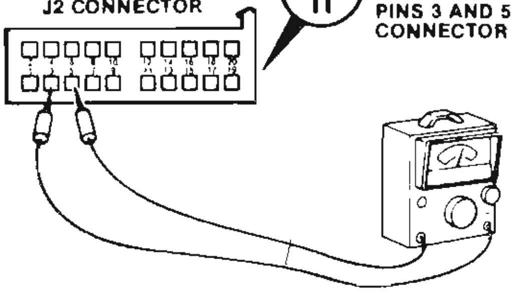
● DISCONNECT 4–WIRE CONNECTOR AT CONTROL UNIT

SPARK AT COIL WIRE (NORMAL) → **2**

NO SPARK → **5**

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) → **6**

OK — OHMMETER DOES NOT INDICATE 400 - 800 OHMS → **3**

3

● DISCONNECT AND RECONNECT 3 - WIRE CONNECTOR AT DISTRIBUTOR

OK — OHMMETER NOW INDICATES 400 - 800 OHMS → **6**

OK — OHMMETER REMAINS OUTSIDE 400 - 800 OHMS → DISCONNECT 3 - WIRE CONNECTOR AT DISTRIBUTOR → **4**

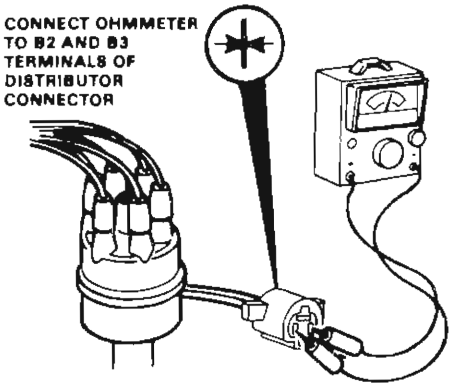
840249

Chart 3

STEP **SEQUENCE** **RESULT**

4

CONNECT OHMMETER TO B2 AND B3 TERMINALS OF DISTRIBUTOR CONNECTOR

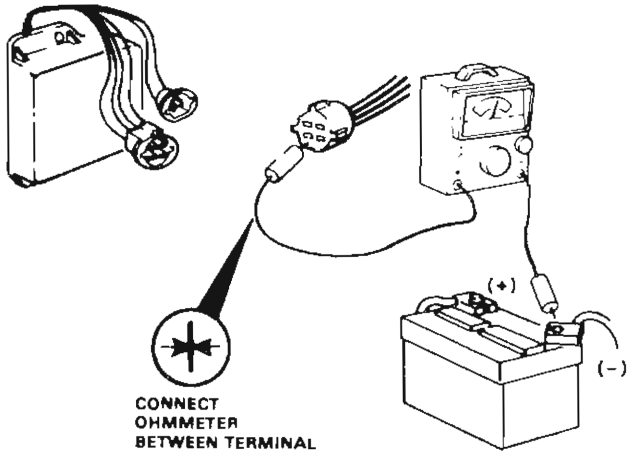


OK — OHMMETER INDICATES 400 - 800 OHMS → REPAIR OR REPLACE HARNESS BETWEEN 3 - WIRE AND 4 - WIRE CONNECTOR → STOP

NOT OK — OHMMETER DOES NOT INDICATE 400 - 800 OHMS → REPLACE PICKUP COIL → STOP

SEE I.S. NOTES

5



CONNECT OHMMETER BETWEEN TERMINAL D1 AND BATTERY NEGATIVE TERMINAL

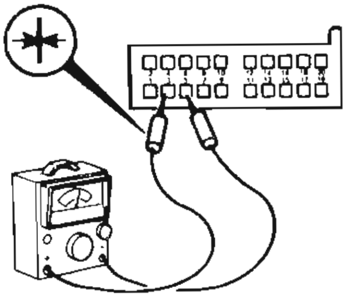
OK — OHMMETER INDICATES ZERO (NOT ABOVE 0.002 OHM) → 2

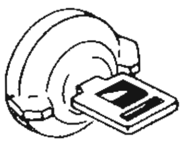
NOT OK — OHMMETER INDICATES ABOVE 0.002 OHM → LOCATE AND REPAIR SOURCE OF BAD GROUND → STOP

- GROUND CABLE RESISTANCE
- DISTRIBUTOR–TO–BLOCK RESISTANCE
- GROUND SCREW IN DISTRIBUTOR TO D1 TERMINAL

6

CONNECT DC VOLTMETER TEST LEADS TO PINS 3 AND 5 OF MCU-D J-2 CONNECTOR





ENGAGE STARTER MOTOR

OK — VOLTMETER FLUCTUATES, INDICATING PROPER PICKUP COIL AND TRIGGER WHEEL OPERATION → STOP

NOT OK — VOLTMETER DOES NOT FLUCTUATE → LOCATE AND REPAIR FAULT → STOP

- DEFECTIVE TRIGGER WHEEL
- DISTRIBUTOR NOT TURNING
- MISSING TRIGGER WHEEL PIN

840250

IGNITION FEED TO ELECTRONIC CONTROL UNIT

NOTE: DO NOT PERFORM CHART 4 WITHOUT PERFORMING CHART 1

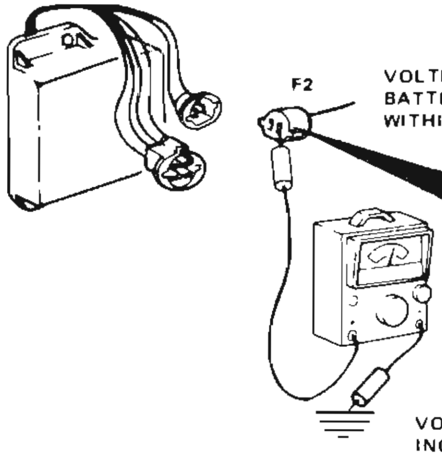
Chart 4

STEP **SEQUENCE** **RESULT**

SEE I.S. NOTES

1

- TURN IGNITION ON



UNPLUG 2-WIRE CONNECTOR AT MODULE AND CONNECT VOLTMETER BETWEEN TERMINAL F-2 AND GROUND

OK → VOLTMETER INDICATES BATTERY VOLTAGE WITHIN 0.2V. → REPLACE CONTROL UNIT → 3

NOT OK → VOLTMETER DOES NOT INDICATE BATTERY VOLTAGE WITHIN 0.2V → 2

2

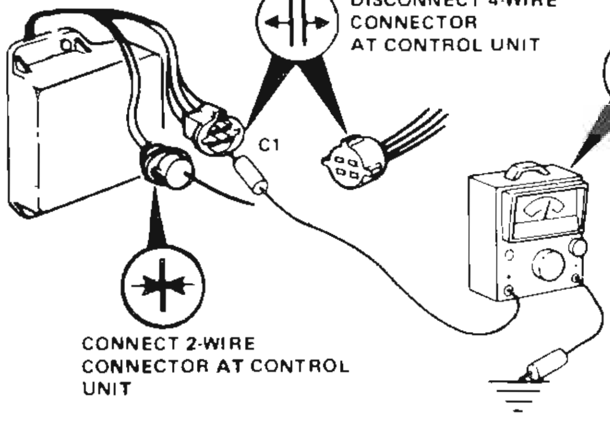
LOCATE AND REPAIR CAUSE OF VOLTAGE REDUCTION

- CORRODED DASH CONNECTOR
- IGNITION SWITCH

OK → SPARK AVAILABLE AT COIL WIRE → STOP

NOT OK → SPARK NOT AVAILABLE AT COIL WIRE → REPLACE CONTROL UNIT → STOP

3



DISCONNECT 4-WIRE CONNECTOR AT CONTROL UNIT

CONNECT 2-WIRE CONNECTOR AT CONTROL UNIT

CONNECT AMMETER BETWEEN TERMINAL C1 AND GROUND

OK → AMMETER INDICATES 1 AMP ± 0.1 → STOP

NOT OK → AMMETER INDICATES HIGHER OR LOWER CURRENT → REPLACE MODULE → STOP

80699G

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 4- and 6-cylinder engines are designed to operate on unleaded fuel. Fuels having an equivalent research octane rating may vary in their antiknock 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 Carburetor and Combustion Area Cleaner 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.

TESTING

Distributor Advance Tests

Centrifugal (Mechanical) Advance Test

Disconnect the vacuum hose from the vacuum advance mechanism and plug.

Connect a timing light to the No. 1 spark plug and a tachometer to the ignition coil "tach" terminal.

SEE
I.S.
N
O
T
E
S

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 light 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 light 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 Section 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.

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 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 or cylinder 3 of a four-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.

DISTRIBUTOR REPLACEMENT

Removal

Unfasten the distributor cap retaining screws. Remove the distributor cap with the coil and spark plug wires connected and place aside.

SEE
I.S.
NOTES

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.

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.

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 light 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 light. 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.

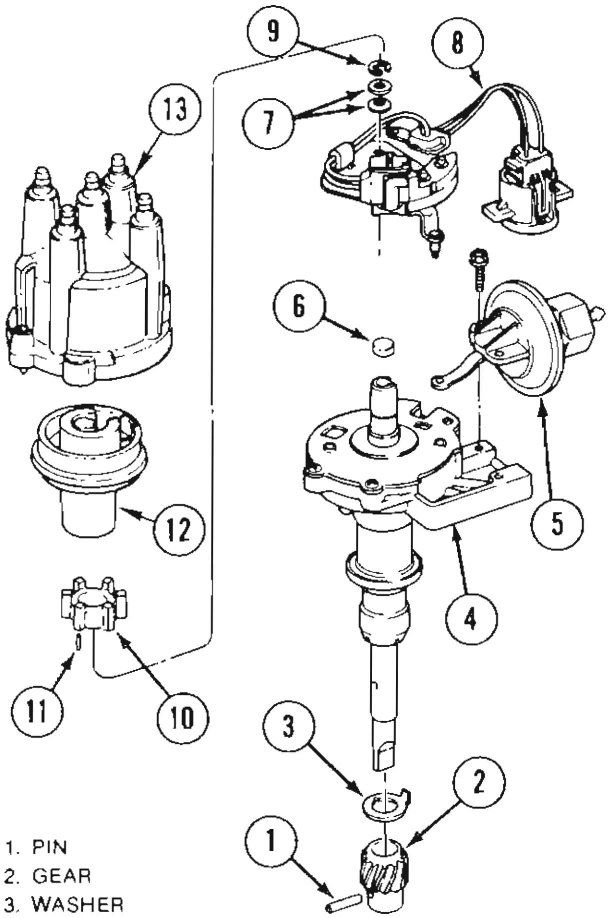
Refer to the Emission Control Information label or Chapter B – Engines- General Service and Diagnosis for ignition timing specifications. When the ignition timing is correct, tighten the distributor holddown bolt and recheck the timing to ensure it did not change.

Disconnect the timing light and connect the vacuum hose to the distributor vacuum advance mechanism.

SEE
I.S.
N
O
T
E
S

DISTRIBUTOR COMPONENT REPLACEMENT

When replacing the pickup coil assembly, trigger wheel or vacuum advance mechanism, 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.



1. PIN
2. GEAR
3. WASHER
4. DISTRIBUTOR BODY
5. VACUUM ADVANCE MECHANISM
6. WICK
7. WASHERS
8. PICK-UP COIL
9. RETAINER
10. TRIGGER WHEEL
11. PIN
12. ROTOR
13. CAP

84955

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.

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.

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.

Installation

If a replacement vacuum advance mechanism is to be installed, calibrate as follows.

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.

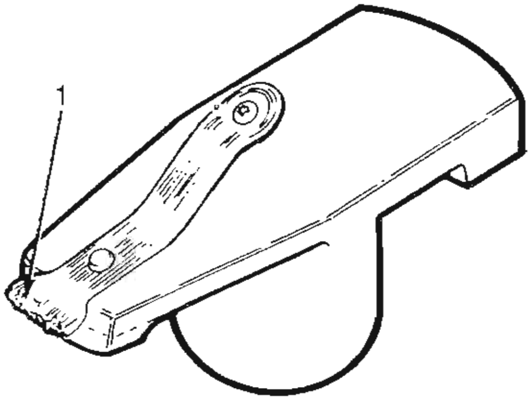
SEE
I.S.
NOTES

SEE I.S. NOTES

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.

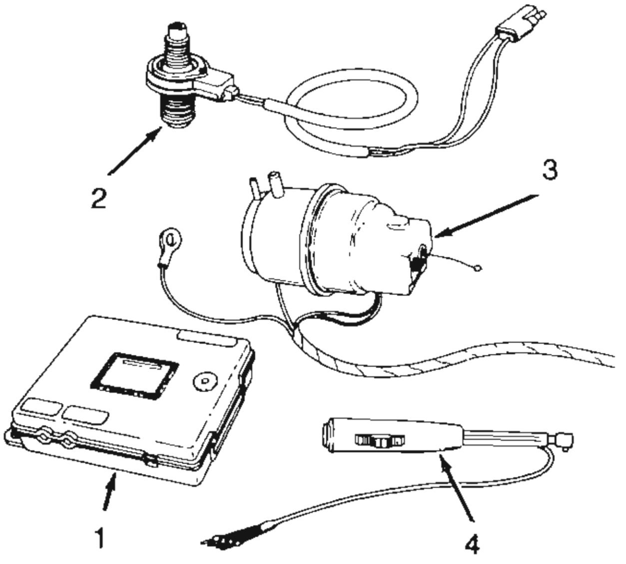
When installing a replacement rotor, apply a thin coat 0.75 - 3 mm (0.03 - 0.12 in) of AMC/Jeep Silicone Dielectric Compound, or equivalent, to the tip of the rotor blade.



840252

GENERAL

The cruise command is a closed loop electromechanical servo system that consists of the following components: electronic regulator (1), speed sensor (2), servo (3), control switch (4), vacuum storage can and check valve and the release mechanisms, which consist of a mechanical vacuum vent and brake lamp switch.



Cruise Command operation is limited to speeds above 48 km/h (30 mph).

WARNING: Do not use the Cruise Command when driving on slippery or congested roads.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AM PC-1-R	Tester		■
J-21008	Continuity Test Lamp		■

DIAGNOSIS

NOTE: Whenever a Cruise Command malfunction occurs, first verify that the Cruise Command wire harness is properly connected to the electronic regulator 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 Test Tool AM PC-1-R is used. For this reason, a loose connection may be misdiagnosed as a regulator malfunction. Also, whenever an electronic regulator is replaced, it will be necessary to adjust the replacement regulator as outlined under Regulator Replacement.

SEE I.S. NOTES

To diagnose Cruise Command system malfunctions, refer to the Service Diagnosis Chart and Testing.

Refer to the Instrument Panels and Components Section in M.R. 255 for details of speedometer cable and gear replacement.

DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
A. SYSTEM DOES NOT ENGAGE IN "ON" POSITION	(1) Restricted vacuum hose or no vacuum.	(1) Locate restriction or air leak and repair.
	(2) Control switch defective.	(2) Replace switch.
	(3) Regulator defective.	(3) Replace regulator.
	(4) Speed sensor defective.	(4) Replace sensor.
	(5) Brake lamps defective.	(5) Replace brake lamp bulbs.
	(6) Brake light switch defective.	(6) Replace switch.
	(7) Brake light switch wire disconnected.	(7) Connect wire to switch.
	(8) Open circuit between brake light switch and brake lamps.	(8) Repair open circuit.
	(9). Mechanical vent valve position improperly adjusted.	(9) Adjust vent valve position.
B. RESUME FEATURE INOPERATIVE	(1) Defective servo ground connection.	(1) Check servo ground wire connection and repair as necessary.
	(2) Control switch defective.	(2) Replace switch.
C. ACCELERATE FUNCTION INOPERATIVE	(1) Accelerate circuit in regulator inoperative.	(1) Replace regulator.
	(2) Control switch defective.	(2) Replace switch.
D. SYSTEM RE-ENGAGES WHEN BRAKE PEDAL OR CLUTCH (MANUAL TRANSMISSION) IS RELEASED	(1) Regulator defective.	(1) Replace regulator.
	(2) Mechanical vent valve not opening.	(2) Adjust position or replace valve.
	(3) Kink in mechanical vent valve hose.	(3) Reroute hose to remove kink.
	(4) Brake light switch defective.	(4) Adjust or replace switch.
E. THROTTLE DOES NOT RETURN TO IDLE POSITION	(1) Improper linkage adjustment.	(1) Adjust properly.
	(2) No slack in lost motion link.	(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.

85464

SEE I.S. NOTES

DIAGNOSIS (cont.)

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 light 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 IN 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 vent valve at brake pedal.	(1) Check hoses and connections. Repair as necessary. (2) Replace vent valve.

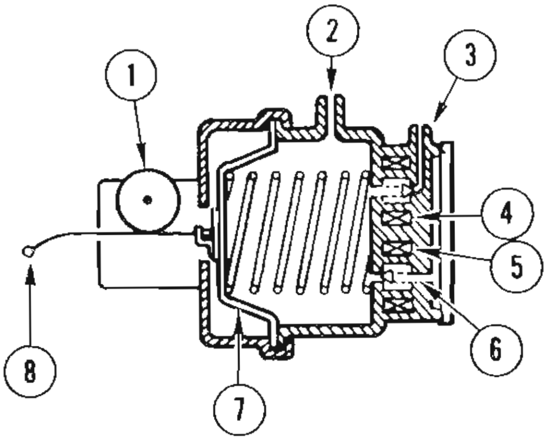
85464A

TESTING

Perform the following tests as part of the service diagnosis to determine the cause of the malfunction and the correction required.

Servo Test

NOTE: This test can be performed with the servo installed in the vehicle.



1. THROTTLE POSITION POTENTIOMETER
2. BRAKE PEDAL VACUUM VENT VALVE
3. MANIFOLD VACUUM SOURCE
4. VACUUM CHARGE VALVE SOLENOID COIL
5. VACUUM VENT VALVE SOLENOID COIL
6. ATMOSPHERE (VENT VALVE)
7. DIAPHRAM
8. TO THROTTLE CABLE

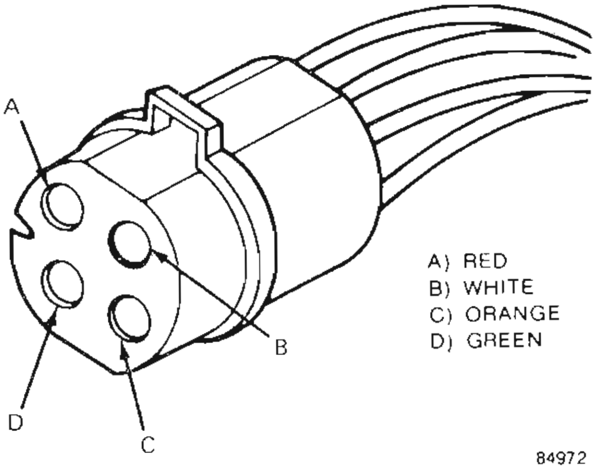
84971

With the ignition switch OFF, disconnect the servo wire harness connector. Remove the vacuum hose from the brake pedal vent valve nipple on the servo.

Disconnect the servo cable from the throttle linkage at the carburetor.

Test the servo for short circuits to ground.

- connect the ohmmeter negative (black) probe to the servo mounting stud
- touch the ohmmeter positive (red) probe to the red, the orange and then the white wire terminal of the servo wire harness connector. Observe the ohmmeter during each test. Infinite resistance should be indicated for each wire terminal
- if the ohmmeter indicates less than infinite resistance on any wire terminal, the servo has a short circuit to ground and must be replaced. The short circuit will also damage the regulator and it must be replaced



A) RED
B) WHITE
C) ORANGE
D) GREEN

84972

SEE I.S. NOTES

NOTE: With no load (or insufficient load), the solid state circuitry in the regulator will be damaged by excessive current flow.

If the servo does not have a short circuit(s) to ground, continue with the test.

Connect a vacuum gauge to the brake pedal vent valve nipple.

Connect a jumper wire from the chassis ground to the orange wire terminal in the servo wire harness connector.

Connect one end of a second jumper wire to the battery positive (+) terminal. Do not connect the other end at this time.

WARNING: Use extreme caution when the engine is operating. Do not stand in direct line with the fan. Do not put hands near pulleys, belts or fan. Do not wear loose clothing.

With the transmission in Park or Neutral, start the engine.

Momentarily connect the jumper wire attached to the battery positive terminal simultaneously to the red and white wire terminals in the servo wire harness connector. Vacuum should be indicated on the gauge while the jumper wire is in contact with the red and white wire terminals.

Perform this same test several times to ensure the solenoid valves are functioning normally.

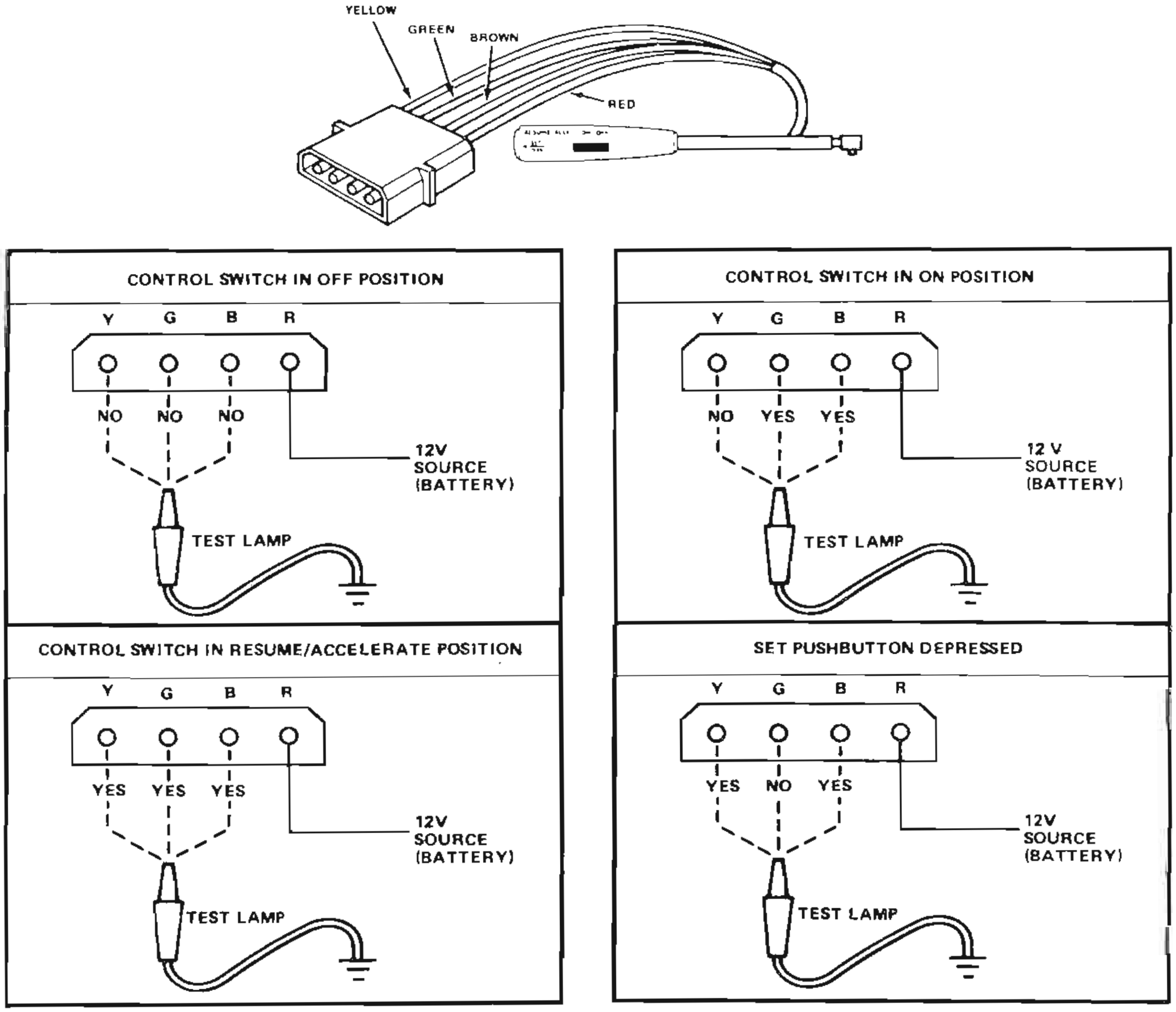
NOTE: With 12V (battery voltage) applied, the solenoid charge valve is open and the solenoid vent valve is closed. With no voltage applied, the solenoid charge valve is closed and the solenoid vent valve is open.

Turn the engine OFF and remove the jumper wires.

If the servo is defective, replace it. Otherwise, connect the vacuum hose, wire harness connector and throttle linkage to the servo.

Control Switch Continuity Test

Use a 12-volt test lamp to test the control switch continuity. Connect the tester to the wires as indicated in the Control Switch Test illustration.



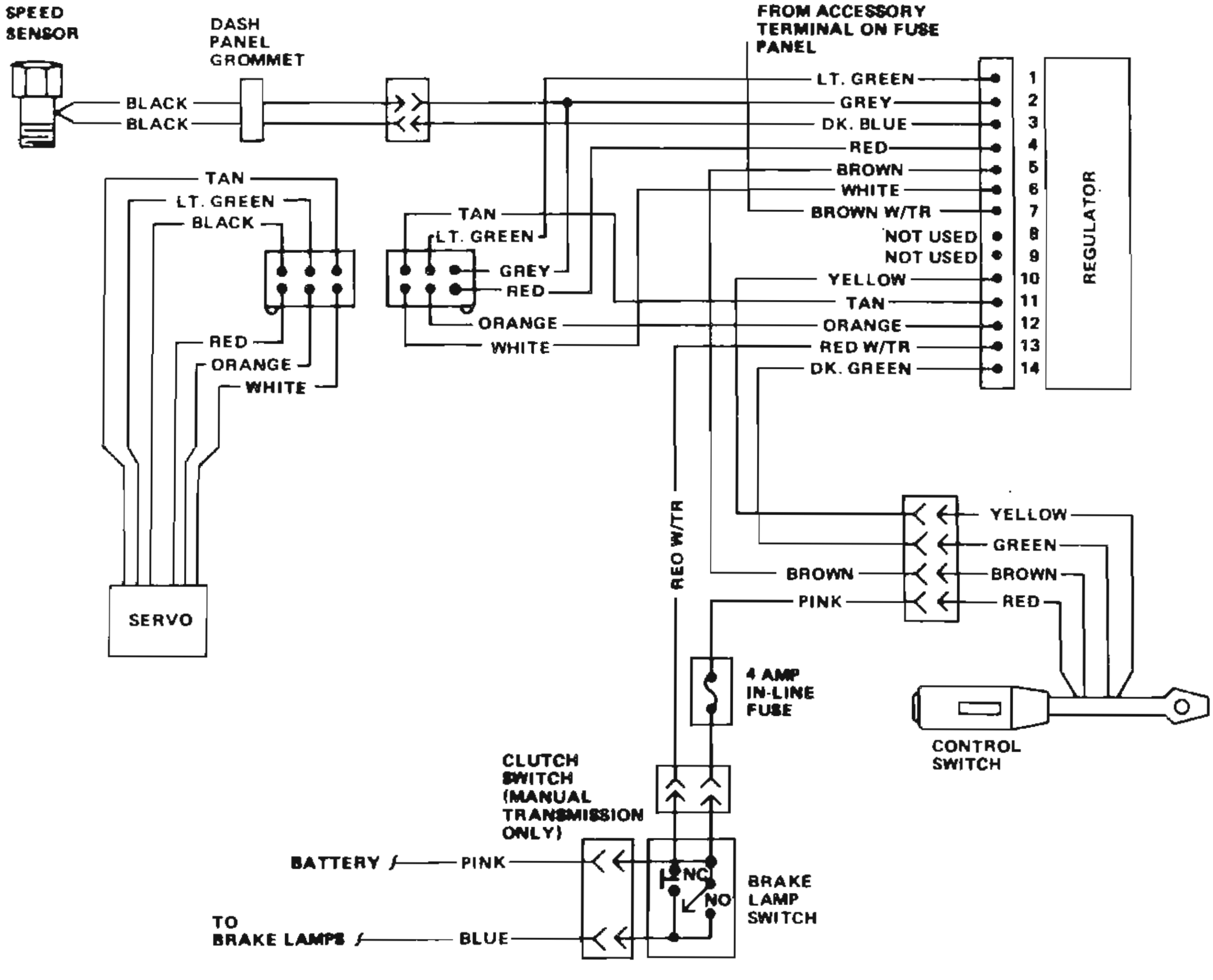
80694

SEE
I.S.
NOTES

SEE I.S. NOTES

Circuitry Tests

Perform the following tests as part of the service diagnosis to determine the cause and correction of a cruise command system malfunction. Refer to the Cruise Command Wiring diagram.

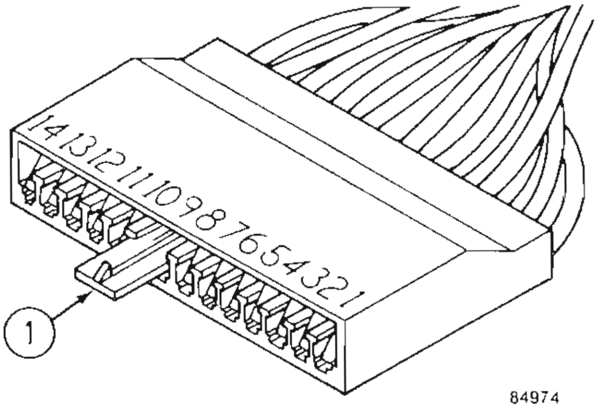


80695B

Regulator Wire Harness Connector

Disconnect the wire harness connector at the regulator by using a suitable thin tool to depress the tab inside the hole on regulator identified by "Terminal Release" (1).

Verify that each wire is installed in the correct location according to the color. Refer to the Cruise Command wiring diagram.



84974

Speed Sensor Test

Disconnect the speed sensor wire harness connector.

Connect a voltmeter set on the low AC scale to the speed sensor wire connector terminals.

Raise the front and rear wheels of the vehicle off the ground and support the vehicle with jack stands.

Operate the engine (wheels spinning freely) at 48 km/h (30 mph) and note the voltage. The voltage should be approximately 0.9 volt. Increases of 0.1 volt per each 16 km/h (10 mph) increase in speed should also be indicated.

Turn off the engine and slowly halt the wheels.

Disconnect the voltmeter.

Replace the speed sensor, if defective.

Connect the speed sensor wire harness connector.

Remove the safety stands and lower the vehicle.

TESTING WITH AM PC-1-R TESTER

A Cruise Command system test can be quickly and accurately performed with the Cruise Command System Tester Tool AM PC-1-R.

Remove the wire harness connector from the regulator.

Connect the Cruise Command system tester to the wire harness connector.

Perform the five tests listed in the Cruise Command Diagnosis Chart for a rapid diagnosis of the Cruise Command System.

Tester AM PC-1-R

The tester lamps are associated with the following components, circuits, etc.

- Lamp 1 – Power source, fuse and ground and ON-OFF and SET-SPEED contacts in control switch.
- Lamp 2 – Speed sensor, associated wiring harness and terminals and connectors.
- Lamp 3 – Brake light or clutch switch adjustment, associated wiring harness and terminals and connectors.
- Lamp 4 – Throttle position potentiometer (feedback voltage), associated wiring harness and terminals and connectors.
- Lamp 5 – Servo vent valve, RESUME/ACCEL contacts in the control switch, associated wiring harness and terminals and connectors.
- Lamp 6 – Servo charge valve, RESUME/ACCEL contacts in the control switch, associated wiring harness and terminals and connectors.

Cruise Control Diagnosis Chart

TEST AND CONDITIONS	TEST LAMP RESULTS	CHECK—REPAIR
(1) Test for Correct Power Source Connection	All Lamps Off	None
Ignition Switch—Off Control Switch—Off	One or More Lamps On	Remove brown wire (5) at regulator connector from direct source of voltage or repair defective control switch.
(2) Test for System Electrical Continuity	Lamps 1, 2, 3, & 4 On, Lamps 5 & 6 Off	None
Ignition Switch—On Control Switch—On	Lamp 1 Off	Check for blown fuse in brake light switch to control switch circuit. Check red, brown & green wires at control switch connector for continuity to switch. Check dark green wire (14) at regulator connector for continuity to regulator.
	Lamp 2 Off	Check speed sensor for correct output voltage. Check grey & dark blue wire at speed sensor connector for continuity to regulator connector. Check terminals 2, 3, 5 & 7 at regulator connector for proper connection to wires.
	Lamp 3 Off Lamp 4 Off	Check brake light switch adjustment. Check for defective connection at terminals 2 & 11 on regulator connector. Check operation of throttle position feedback potentiometer on servo.
(3) Test for Servo Charge Valve Solenoid Continuity Ignition Switch—On Control Switch—On Set Speed Switch - Depressed	Lamp 2, 3, 4, 5 & 6 On Lamp 1 Off Lamp 4 will dim when servo moves throttle to wide open position with engine operating.	None
WARNING: If engine is operating servo will move throttle to wide open position.	Lamp 2 Off	Refer to Test 2, Lamp 2 Off
	Lamp 3 Off	Refer to Test 2, Lamp 3 Off.
	Lamp 4 Off	Refer to Test 2, Lamp 4 Off.

85466

SEE I.S. NOTES

TEST AND CONDITIONS	TEST LAMP RESULTS	CHECK—REPAIR
(3) Con't.	Lamp 5 Off	Check for defective connection at terminals 4 & 12 on regulator connector. Replace defective servo.
	Lamp 6 Off	Check for defective connection at terminals 6 & 12 on regulator connector. Replace defective servo.
	All lamps Off after depressing set speed switch or moving control switch to resume/acceleration position.	Check for blown fuse. Check for short circuits in red, pink & brown wire circuits at control switch. Replace defective servo.
(4) Test for System Disengagement with Brake Pedal Depressed Ignition Switch—On Control Switch—On Brake Pedal Depressed	Lamps 1, 2, & 4 On Lamps 3, 5 & 6 Off Lamp 3 On when brake pedal is released.	None
	Lamp 1 Off	Refer to test 2, Lamp 1 Off.
	Lamp 2 Off	Refer to Test 2, Lamp 2 Off.
	Lamp 4 off	Refer to Test 2, Lamp 4 Off.
	Lamp 3 Off when brake pedal is released.	Refer to Test 2, Lamp 3 Off.
(5) Test Resume/Acceleration Function of Control Switch Ignition Switch—On Control Switch—On Move control switch to resume/acceleration position. WARNING: If engine is operating, servo will move throttle to wide open position	All Lamps On Lamp 4 will dim when servo moves throttle to wide open position with engine operating.	None
	Lamp 1 Off	Refer to Test 2, Lamp 1 Off.
	Lamp 2 Off	Refer to Test 2, Lamp 2 Off.
	Lamp 3 Off	Refer to Test 2, Lamp 3 Off.
	Lamp 4 Off	Refer to Test 2, Lamp 4 Off.
	Lamp 5 Off	Refer to Test 3, Lamp 5 Off.
	Lamp 6 Off	Refer to Test 3, Lamp 6 Off.
	All Lamps Off	Refer to Test 3, All Lamps Off.

85467

ADJUSTMENTS

Regulator Adjustment

Regulator adjustments are pre-set by the manufacturer but, if all other components of the system appear to be functioning normally and the cruise command remains inoperative, perform the following adjustments to determine if the regulator is functional.

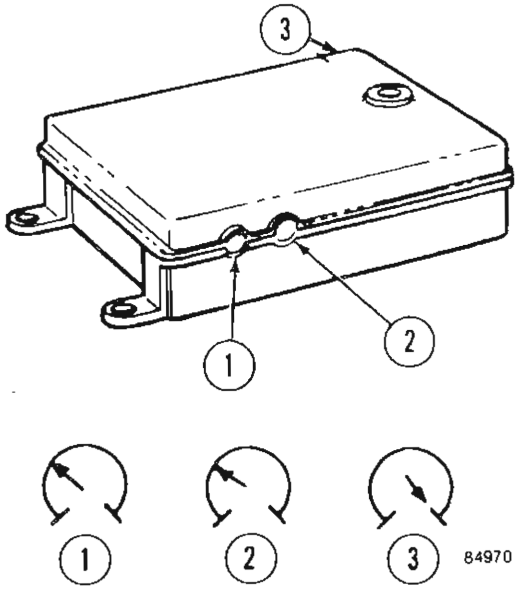
Remove the regulator attaching screws or tie straps and move the regulator downward for adjustment access.

CAUTION: The adjustment potentiometers are extremely delicate. Insert the screwdriver into the slots very carefully and do not push hard or turn hard against the wiper arm stops. The potentiometer wiper arms have a maximum turning angle of 270 degrees (three-quarter turn).

Turn the centering adjustment (1) to the 10 o'clock position.

Turn the low speed adjustment (2) to the 10 o'clock position.

Turn the sensitivity adjustment (3) full clockwise.



NOTE: The adjustments may not be precisely correct for the vehicle, but will be acceptable to determine if the regulator is functioning. The need for more precise adjustments can be determined by a road test.

If the adjustments have no effect on the Cruise Command operation, replace the regulator.

NOTE: The regulator is the only component of the system that cannot be isolated and tested separately. It must be tested while connected to the components of the system.

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

To adjust the regulator for engagement speed complaints, drive the vehicle on a level road surface and check operation.

If the actual engagement speed is 3.2 km/h (2 mph) or more above the selected engagement speed, stop the vehicle, turn the regulator centering screw approximately 1/16 of a turn counterclockwise and check the engagement speed again. Readjust the speed as needed. If the actual engagement speed is 3.2 km/h (2 mph) or more below the selected engagement speed, stop the vehicle, turn the regulator centering screw 1/16 of a turn clockwise and check the engagement speed again.

Vacuum (Mechanical) Vent Valve Adjustment

Depress the brake or clutch pedal and hold in the depressed position.

Move the vacuum vent valve toward the bracket on the pedal as far as possible.

Release the brake or clutch pedal.

COMPONENT REPLACEMENT

Regulator Replacement

The regulator is mounted on a bracket under the instrument panel near the headlamp switch. Remove the screws or tie straps and unplug the connector. Insert a suitable thin tool to depress the tab inside the hole on the regulator identified by "Terminal Release." To install, plug the connector into the regulator and install the screws.

Servo Replacement

Removal

Remove the retaining nuts and cable housing from the servo.

Spread the clip that connects the cable to the servo and remove.

Disconnect the vacuum hoses from the servo.

Remove the retaining nut and servo from the bracket. Note the position of the ground cable.

Disconnect the wire harness connector under the instrument panel. Carefully maneuver the wire harness through the dash panel and remove the servo.

Installation

Install the servo and nut on the bracket. Tighten with 7 N·m (60 in-lbs) torque. Ensure the ground cable is positioned on the stud.

Maneuver the wire harness through the dash panel and connect the connector.

Attach the cable to the servo and squeeze the clip to retain the cable.

NOTE: Mounting studs are not equally spaced from the hole in the servo. Ensure the housing is installed correctly.

Connect the vacuum hoses.

Servo Cable Replacement

Removal

Remove the clip and washer from the pin on the bellcrank and remove the lost motion link.

Squeeze the tabs that retain the cable housing in the bracket and remove the cable from the bracket.

Remove the retaining nuts and the cable housing from the servo.

Spread the clip that connects the cable to the servo and remove.

Installation

Attach the cable to the servo and squeeze the clip to retain the cable.

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 and install the washer and lock clip.

Control Switch Replacement

The Cruise Command control switch assembly is integral with the turn signal lever. The switch is not repairable. The switch and harness assembly can be replaced only as a complete unit.

Removal

Remove the following items:

- horn cover
- steering wheel
- anti-theft cover
- locking plate and horn contact

Remove the hazard warning knob.

Disconnect the four-wire harness connector located behind the instrument panel.

If equipped with a tilt steering column remove the wires from the connector. Fold back and tape two of the four wires to the wire harness.

Tie or tape string to the wire harness.

If equipped with a standard steering column, tie or tape string to the wire harness connector.

Remove the turn signal/control switch lever retaining screw from the steering column.

Carefully pull the wire harness up through and out of the steering column.

Remove the string from the wire harness.

SEE
I.S.
N
O
T
E
S

Installation

Test the operation of the replacement Cruise Command control switch assembly by connecting it to the system before installing it in the steering column. Refer to Control Switch Continuity Test.

SEE I.S. NOTES

Remove the wires from the connector. Tape two of the four wires back along the wire harness (tilt column only) and tape or tie the harness to the string that was attached to the original wire harness before removal.

Pull the replacement harness down through the steering column. On tilt steering columns, the harness must pass through the hole on the left side of the steering shaft.

NOTE: It may be necessary to loosen the steering column mounting screws for easier routing of the harness.

Install the turn signal/control switch assembly and the hazard warning switch knob.

Install the harness wires in the connector (tilt column only) and connect the connector to the system.

Install the locking plate, horn contact and anti-theft cover.

Install the steering wheel and horn cover.

Install the lower steering column cover, if removed for access.

Test the Cruise Command operation.

GENERAL

This section is divided into three parts. The first part, Specifications, contains the gauge and sending unit specifications, and schematics for each gauge circuit.

The second part, Instrumentation Diagnosis, covers the test procedures and replacement procedures.

The third part, Diagnosis and Repair Simplification (DARS) charts, contains pictorial guides for diagnosing instrumentation malfunctions.

NOTE: All reference pertaining to CJ vehicles includes Scrambler vehicles.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMOT ET-502	Digital Multimeter		■
J-8681	Short Tester		■
J-21008	Continuity Test Lamp		■
J-24538	Universal Gauge Tester		■

SPECIFICATIONS

Voltmeter Calibrations (Volts)

ACTUAL	INDICATED
12.4	11.7 to 12.3
14.4	13.8 to 14.2

NOTE: Indicated Voltage Observed from Drivers Seat

Tachometer Calibrations (RPM)

ACTUAL	INDICATED
500	380 to 620
1500	1380 to 1620
4500	4330 to 4620

Fuel Gauge Sending Unit Resistance (Ohms)

E	1/2	F
73	23	10

Fuel Gauge Resistance (Internal)

TEST POINTS	OHMS
S to Ground	68 to 72
S to I	19 to 21
S to A	19 to 21
I to A	ZERO
I to Ground	49 to 51
A to Ground	49 to 51

Coolant Temperature Gauge Resistance (Internal)

S to A	19 to 21 ohms

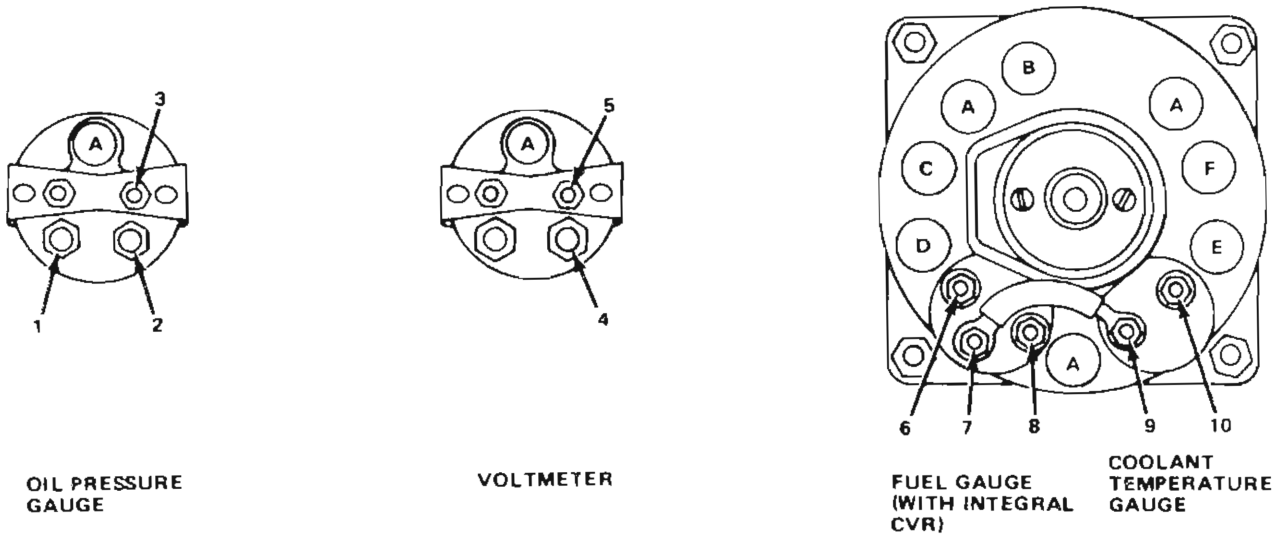
Coolant Temperature Gauge Sending Unit Resistance (Ohms)

C	BEGINNING OF BAND	END OF BAND	H
73	36	13	9

Oil Pressure Gauge Sending Unit Resistance (Ohms)

PSI	0	20	40	60	80
OHMS	234-246	149-157	100.5-105.5	65-69	32.5-34.5

86374



TERMINAL STUDS

1. OIL PRESSURE GAUGE S-TERMINAL
2. OIL PRESSURE GAUGE I-TERMINAL
3. OIL PRESSURE GAUGE GROUND
4. VOLTMETER +-TERMINAL
5. VOLTMETER GROUND
6. FUEL GAUGE S-TERMINAL
7. FUEL GAUGE A-TERMINAL
8. FUEL GAUGE I-TERMINAL
9. COOLANT TEMPERATURE GAUGE S-TERMINAL
10. COOLANT TEMPERATURE GAUGE A-TERMINAL

LAMPS

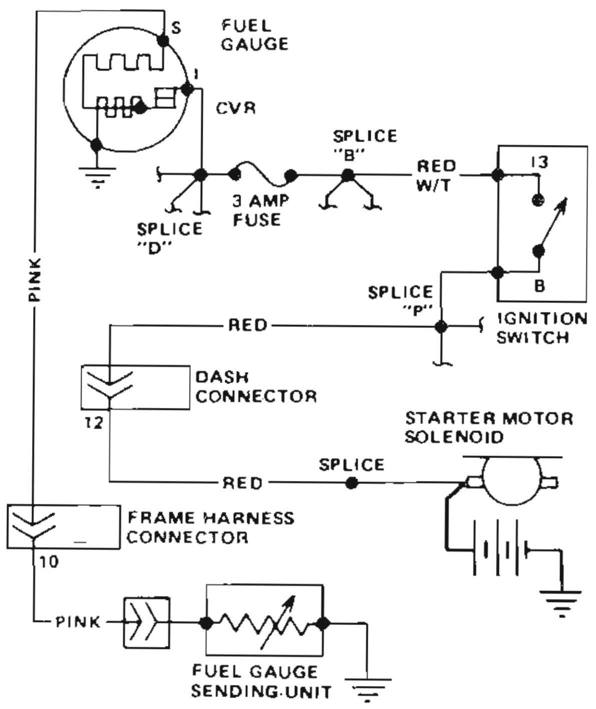
A ILLUMINATION
B HIGH BEAM
C RIGHT TURN
D FOUR-WHEEL DRIVE
E BRAKE
F LEFT TURN

80125

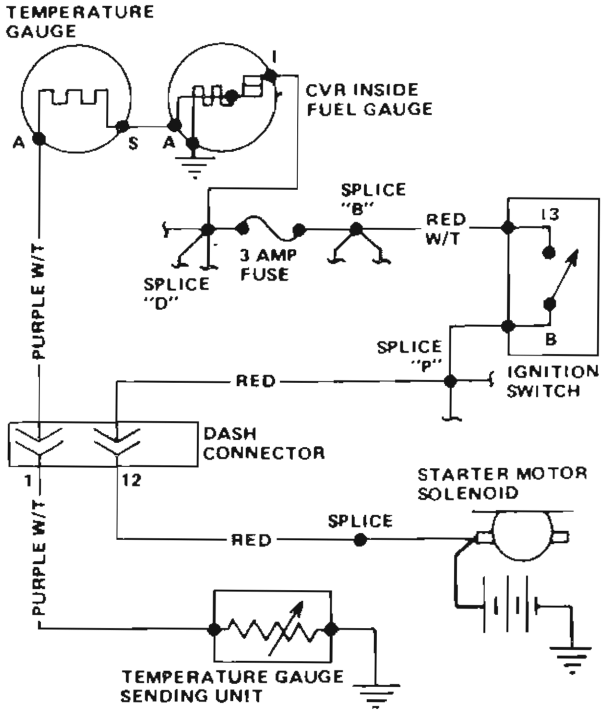
SEE I.S. NOTES

SEE I.S. NOTES

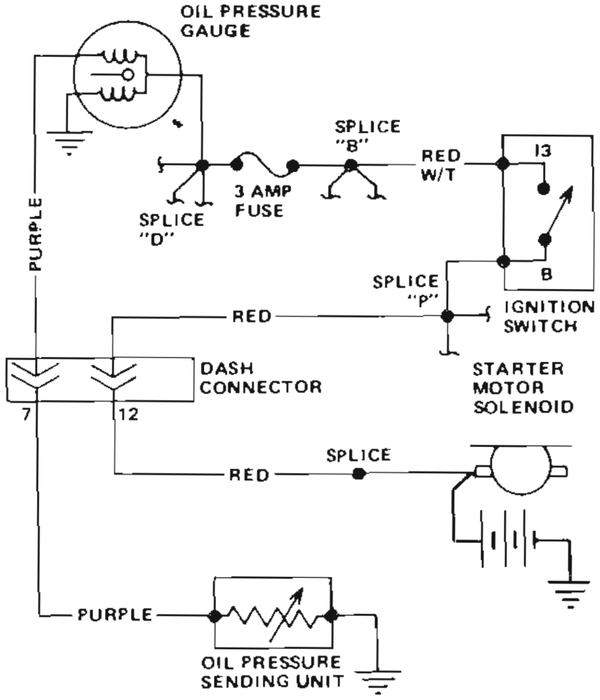
Fuel Gauge Circuit



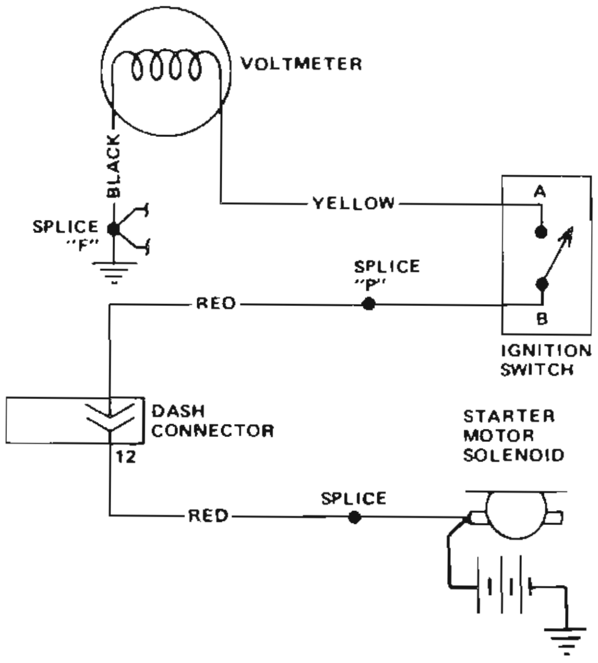
Coolant Temperature Gauge Circuit



Oil Pressure Gauge Circuit

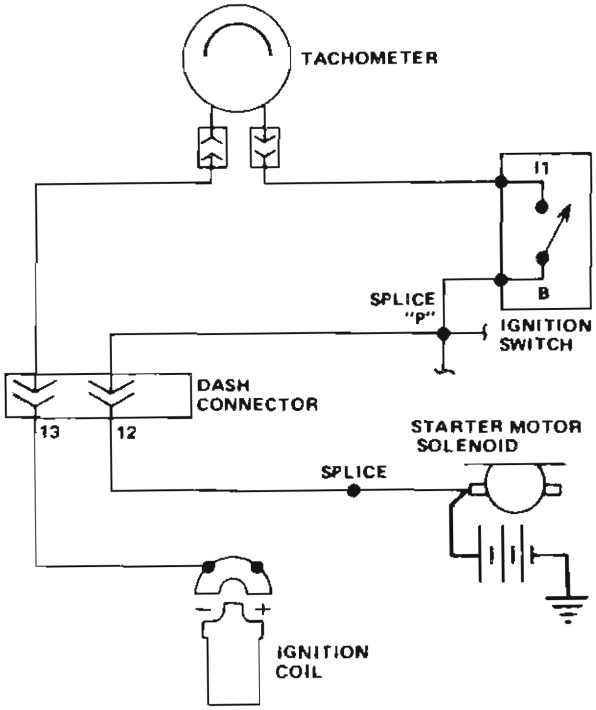


Voltmeter Circuit



86375

Tachometer Circuit

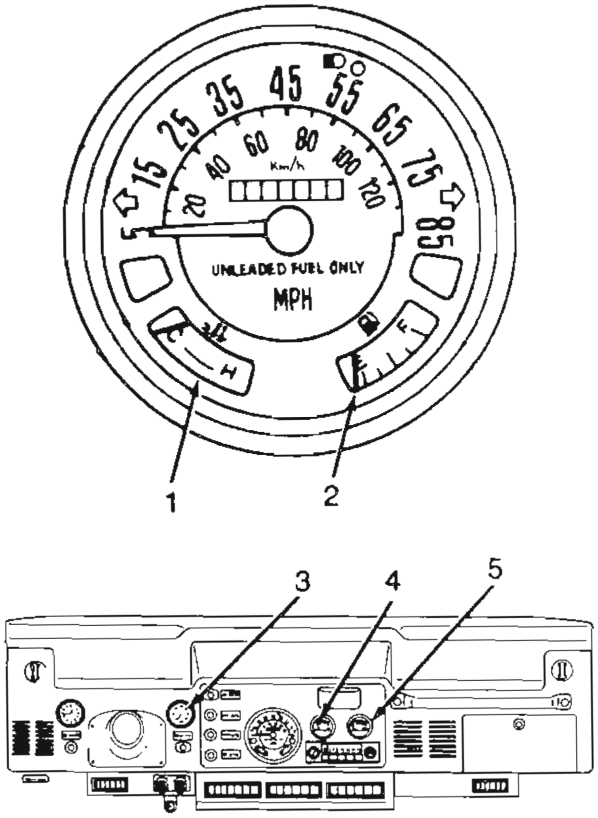


86376

DIAGNOSIS

Improper operation of electrical gauges or meters can usually be traced to either faulty electrical wiring continuity, improperly calibrated components or high resistance caused by loose or corroded connections.

A common diagnostic procedure is to bypass a suspected component, wire or connection with a jumper wire. If the system functions normally with the jumper wire installed, the problem usually is within the bypassed circuit, wire, connection or component.



1. Temperature Gauge
2. Fuel Gauge
3. Tachometer
4. Voltmeter
5. Oil Pressure Gauge

841282

SEE I.S. NOTES

Test Equipment

Several gauge tests require the use of Universal Gauge Tester J-24538. This instrument provides a wide range of variable resistance. If the tester is not available, a suitable substitute can be constructed with an accurate ohmmeter and a spare fuel gauge sending unit.

Attach one ohmmeter test probe to the sending unit terminal.

Attach the other ohmmeter test probe to the sending unit ground wire.

Refer to the applicable Sending Unit Resistance (Ohms) charts for the resistance values that apply to the gauge being tested. To calibrate, move the float arm and mark the appropriate resistance values on the sending unit case.

Disconnect the ohmmeter probes. Attach a jumper wire to the sending unit terminal. The tester is now calibrated and ready for use.

Voltmeter Diagnosis

Connect a test voltmeter of known accuracy across the battery terminals.

Turn the ignition switch on.

Compare the voltage indication of the test voltmeter with that of the voltmeter installed in the vehicle. Replace the voltmeter if the voltage indications vary more than the calibration tolerance listed in Specifications.

Fuel Gauge Diagnosis

Movement of the fuel in the tank can be caused by driving up or down long hills, driving on rough roads or by rapidly accelerating or braking. The fuel level float, moving up and down erratically by the motion of the fuel, may temporarily cause the fuel gauge to indicate incorrectly. These conditions should be considered before a fault is suspected in the indicating system. Abnormal indications are all variations of three basis malfunctions:

- pointer does not move
- pointer moves but indicates a fuel level that does not correspond with the actual fuel level in the fuel tank
- pointer moves to the top of the scale and remains there
- pointer pulsates

Refer to DARS Chart 1 for a systematic method of locating the causes of these abnormal conditions. Charts 2 and 3 provide additional procedures that should be used only as directed in Chart 1.

Oil Pressure Gauge Diagnosis

An oil pressure gauge malfunction can result in any one of the following conditions:

- pointer does not move
- pointer moves but indicates an oil pressure that does not correspond with the actual oil pressure
- pointer moves to the top of the scale and remains there
- pointer pulsates

Refer to the DARS Chart 4 for a systematic method of locating the causes of these abnormal conditions.

Calibration Test

If an oil pressure gauge is suspected of indicating pressure that does not correspond with the actual oil pressure, perform a calibration test before performing the electrical diagnosis procedures in DARS Chart 4.

Remove the oil pressure sending unit from the cylinder block. Install a T-fitting in the cylinder block. Connect the sending unit to the T-fitting.

Connect the oil pressure test gauge to the T-fitting.

Start the engine. Compare the pressure indicated on the vehicle gauge with that on the test gauge. Conduct the comparison at idle and at higher engine speeds. If both gauge indications are the same (within 10 percent), the vehicle gauge is acceptable. If the gauge is not within specification, perform the gauge test as outlined in DARS Chart 4.

After performing the test, remove the T-fitting, install the sending unit and inspect for oil leaks.

Coolant Temperature Gauge Diagnosis

Before performing a coolant temperature gauge diagnosis, ensure that the cooling system is functioning normally. Overheating can be caused by a low coolant level, restrictions, loose or broken drive belt(s), defective water pump or incorrect ignition timing. Undercooling can be caused by a stuck thermostat (in the open position). These conditions should be considered before suspecting an actual malfunction in the coolant temperature gauge system. A coolant temperature gauge malfunction can result in any one of the following conditions.

- pointer does not move
- pointer moves but indicates a coolant temperature that does not correspond with the actual coolant temperature
- pointer moves to the top of the scale and remains there
- pointer pulsates

Refer to DARS Chart 5 for a systematic method of locating the causes of these abnormal conditions. Charts 2 and 3 provide additional procedures that should be used only as directed in Chart 5.

Tachometer Diagnosis

Test the accuracy of a tachometer by comparing it with the rpm indications of a test tachometer of known accuracy. A service (TACH) terminal is located on the ignition coil connector for the test tachometer connection. Refer to Ignition Systems. Tachometers are not adjustable. Replace if inaccurate.

INSTRUMENT CLUSTER REPLACEMENT

Removal

Disconnect the battery negative cable.

Disconnect the speedometer cable from the speedometer.

Remove the four attaching nuts and pull the cluster from the mounting studs.

SEE
I.S.
NOTES

Note the positions of all the lamps. Note the wire colors for reference during installation.

Remove the gauge/meter wires and lamps.

Installation

Install the gauge and meter wires and lamps in the cluster.

Position the cluster on the mounting studs and install the attaching nuts.

Connect the speedometer cable.

Connect the battery negative cable.

Reset the clock, if equipped.

GAUGE AND METER REPLACEMENT

Fuel Gauge

Remove the cluster.

Carefully uncrimp the lip of the outer bezel. Remove the outer bezel, glass and glass retaining bezel.

Remove the attaching screws from the speedometer housing. Remove the speedometer and face plate assembly.

Remove the attaching nuts, insulator and fuel gauge.

NOTE: If may be necessary to carefully move the lamp guard aside.

Install the replacement fuel gauge, insulator and attaching nuts. Place the toothed lockwasher on the A-terminal. Ensure the gauge is properly centered in the face plate opening, then tighten the nuts.

Inspect all the lamp guards for correct position. Install the speedometer and face plate assembly. Install the attaching screws and washers.

Examine the glass for fingerprints and debris. Clean as necessary.

Install the glass, glass retaining bezel and outer bezel. Crimp the outer bezel lip in four places.

Install the cluster.

With the ignition switch on, observe the fuel gauge for proper operation.

Coolant Temperature Gauge

Remove the cluster.

Carefully uncrimp the lip of the outer bezel. Remove the outer bezel, glass and glass retaining bezel.

Remove the attaching screws from the speedometer housing. Remove the speedometer and face plate assembly.

Remove the attaching nuts and remove the insulator and coolant temperature gauge.

NOTE: It may be necessary to carefully move the lamp guard aside.

Install the replacement gauge, insulator and attaching nuts. Place the toothed lockwasher on the S-terminal. Ensure the gauge is properly centered in the face plate opening, then tighten the nuts.

Inspect all the lamp guards for correct position. Install the speedometer and face plate assembly. Install the attaching screws and washers.

Examine the glass for fingerprints and debris. Clean as necessary.

Install the glass, glass retaining bezel and outer bezel. Crimp the outer bezel in four places.

Start the engine and observe the coolant temperature gauge for proper operation.

Voltmeter

Disconnect the illumination lamp and wire connectors. Note the wire locations for installation reference.

Remove the retaining nuts and bracket behind the instrument panel.

Remove the gauge from the instrument panel.

Position the replacement gauge in the instrument panel opening.

Install the bracket and nuts.

Connect the wires to their original locations and install the lamp.

Start the engine and observe the voltmeter for proper operation.

Oil Pressure Gauge

Remove the illumination lamp and disconnect the wire connectors.

Remove the retaining nuts and bracket behind the instrument panel.

Remove the gauge from the instrument panel.

Position the replacement gauge in the instrument panel opening.

Install the bracket and nuts.

Connect the wire connectors and install the lamp.

Start the engine and observe the oil pressure gauge for proper operation.

Tachometer

Disconnect the following wire connectors:

- black ground wire
- orange illumination lamp wire
- red and red with tracer wires

Remove the screw and retaining cup.

Remove the tachometer from the instrument panel.

SEE I.S. NOTES

NOTE: It is possible to start the engine with the tachometer removed. With a jumper wire, connect the harness wire connectors (that were originally connected to the tachometer) together.

SEE I.S. NOTES

Install the replacement tachometer, cup and screw.

Connect the wire connectors and ground wires.

Start the engine and observe the tachometer for proper operation.

Constant Voltage Regulator (CVR) Replacement

The CVR is contained in the fuel gauge housing. If the CVR is defective, replace the fuel gauge. Refer to Fuel Gauge Replacement.

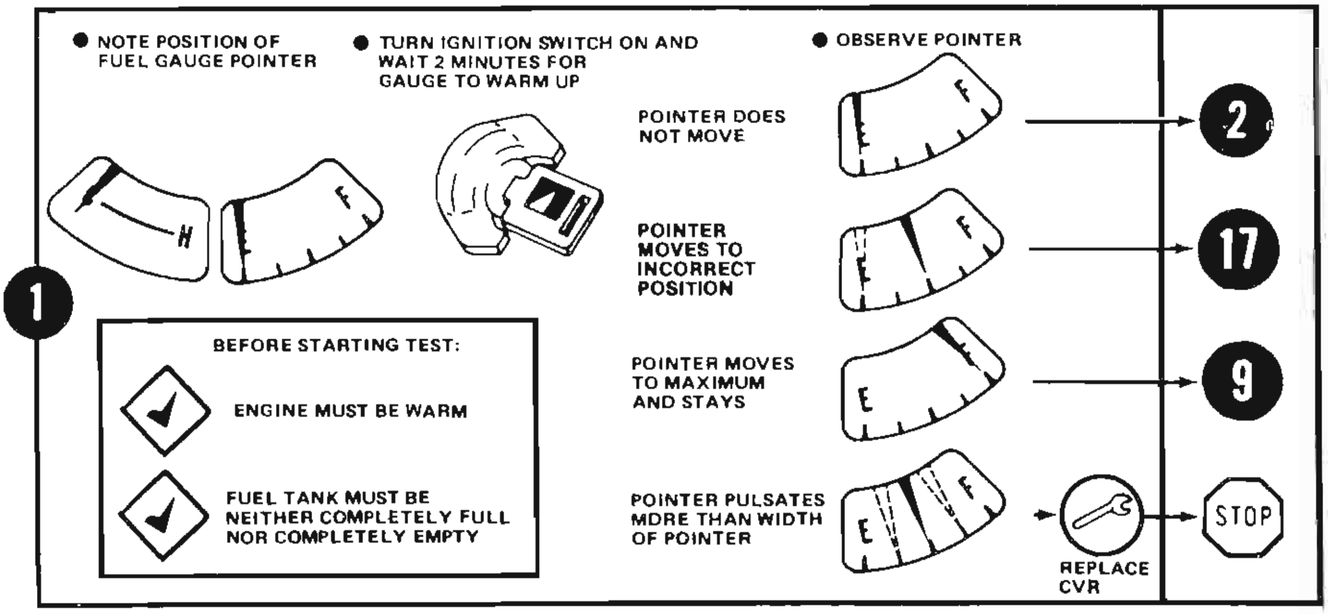
DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

PROBLEM: FUEL GAUGE NOT FUNCTIONING PROPERLY

Chart 1

SEE I.S. NOTES

STEP | SEQUENCE | RESULT



- NOTE POSITION OF FUEL GAUGE POINTER
- TURN IGNITION SWITCH ON AND WAIT 2 MINUTES FOR GAUGE TO WARM UP
- OBSERVE POINTER

POINTER DOES NOT MOVE → 2

POINTER MOVES TO INCORRECT POSITION → 17

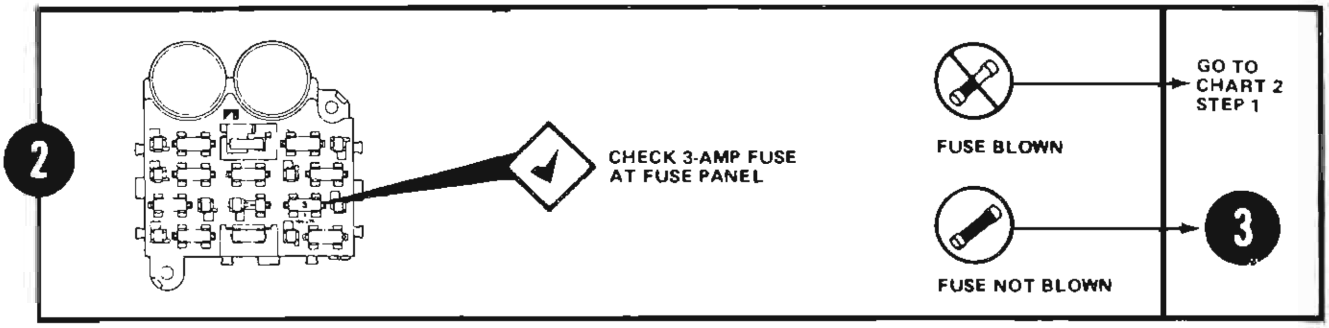
POINTER MOVES TO MAXIMUM AND STAYS → 9

POINTER PULSATES MORE THAN WIDTH OF POINTER → REPLACE CVR → STOP

BEFORE STARTING TEST:

✓ ENGINE MUST BE WARM

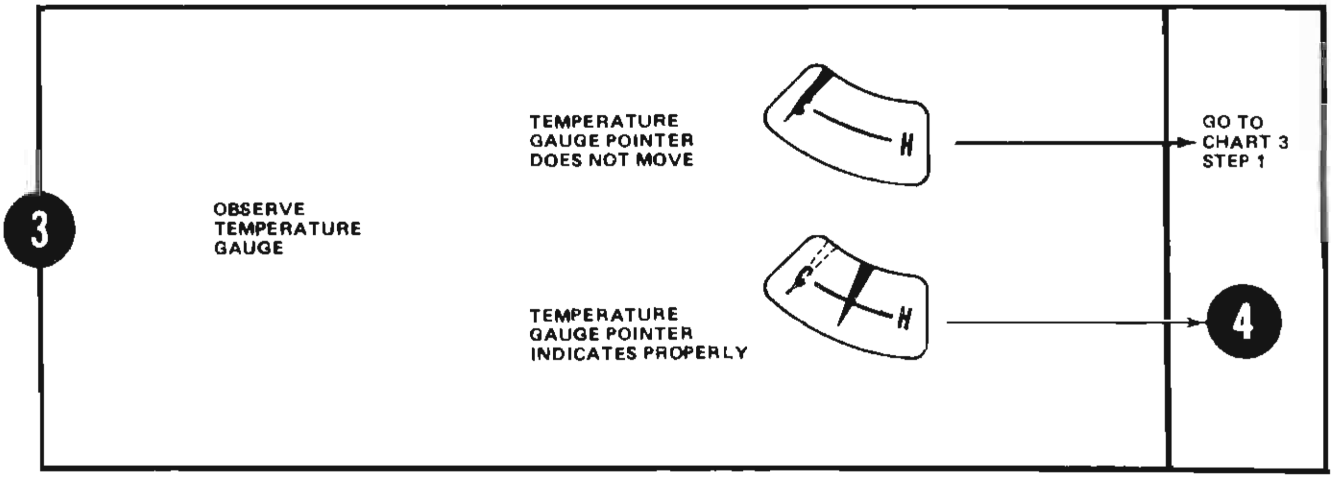
✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY



✓ CHECK 3-AMP FUSE AT FUSE PANEL

FUSE BLOWN → GO TO CHART 2 STEP 1

FUSE NOT BLOWN → 3



OBSERVE TEMPERATURE GAUGE

TEMPERATURE GAUGE POINTER DOES NOT MOVE → GO TO CHART 3 STEP 1

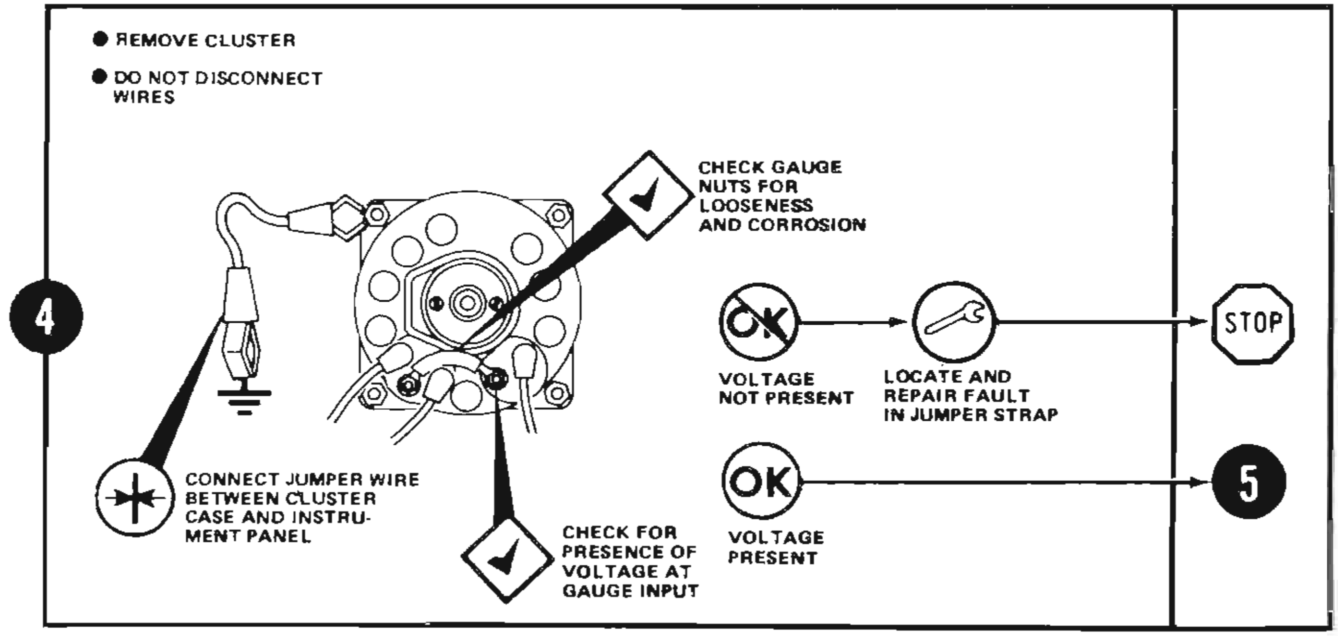
TEMPERATURE GAUGE POINTER INDICATES PROPERLY → 4

86377A

SEE I.S. NOTES

Chart 1

STEP **SEQUENCE** **RESULT**



- REMOVE CLUSTER
- DO NOT DISCONNECT WIRES

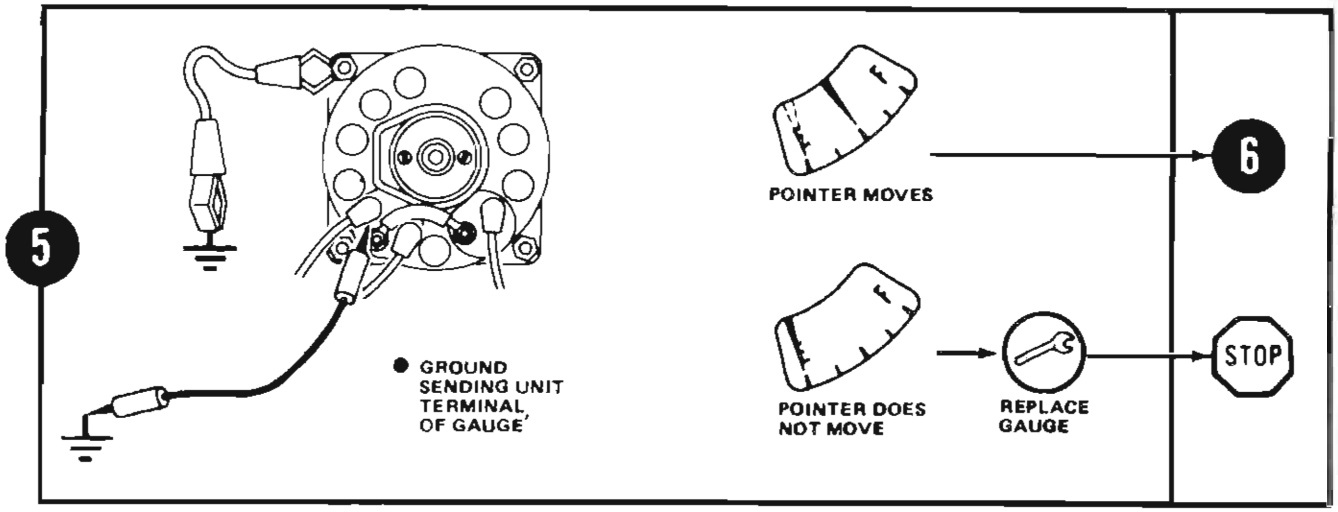
CONNECT JUMPER WIRE BETWEEN CLUSTER CASE AND INSTRUMENT PANEL

CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION

CHECK FOR PRESENCE OF VOLTAGE AT GAUGE INPUT

VOLTAGE NOT PRESENT → LOCATE AND REPAIR FAULT IN JUMPER STRAP → STOP

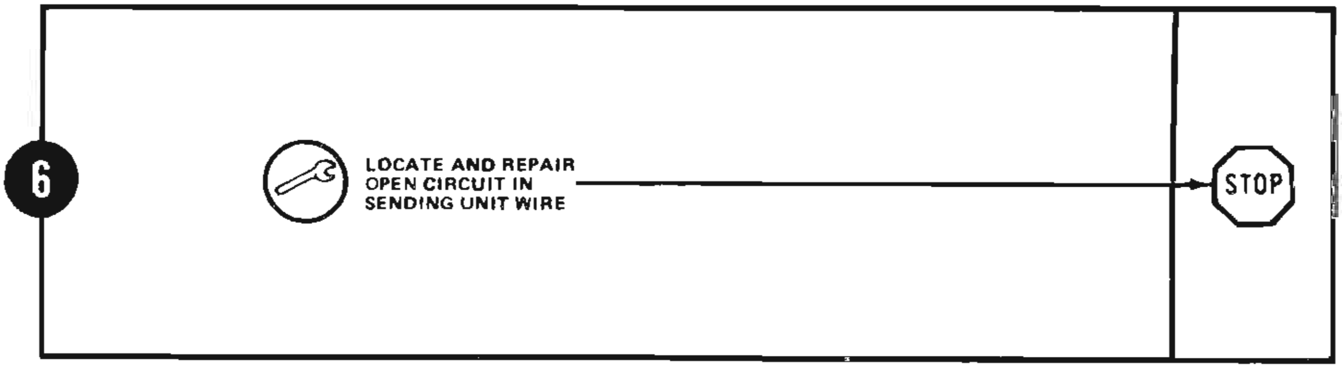
VOLTAGE PRESENT → 5



- GROUND SENDING UNIT TERMINAL OF GAUGE

POINTER MOVES → 6

POINTER DOES NOT MOVE → REPLACE GAUGE → STOP



LOCATE AND REPAIR OPEN CIRCUIT IN SENDING UNIT WIRE → STOP

86377B

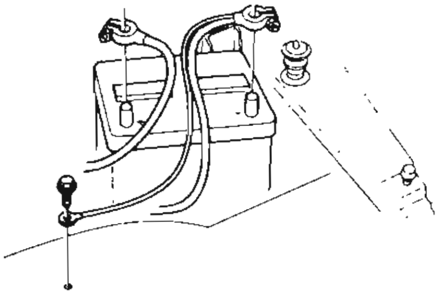
Chart 1

STEP **SEQUENCE** **RESULT**

7

CHECK BATTERY GROUND CABLE

- BROKEN
- MISSING
- CORRODED
- SCREWS LOOSE, MISSING



GROUND NOT OK → 8

GROUND OK → 9

8

REPAIR GROUND

POINTER DROPS FROM MAXIMUM

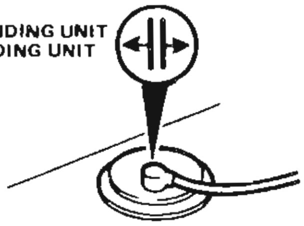
→ STOP

POINTER REMAINS AT MAXIMUM

→ 9

9

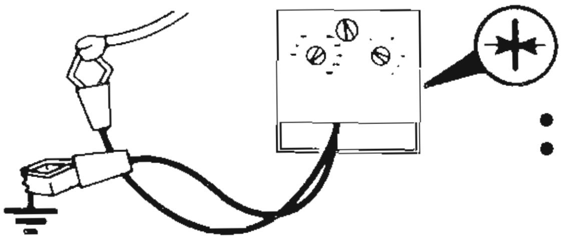
DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT



POINTER DROPS FROM MAXIMUM → 10

POINTER REMAINS AT MAXIMUM →

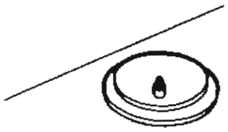
10



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION SWITCH ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART.

OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.



GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 11

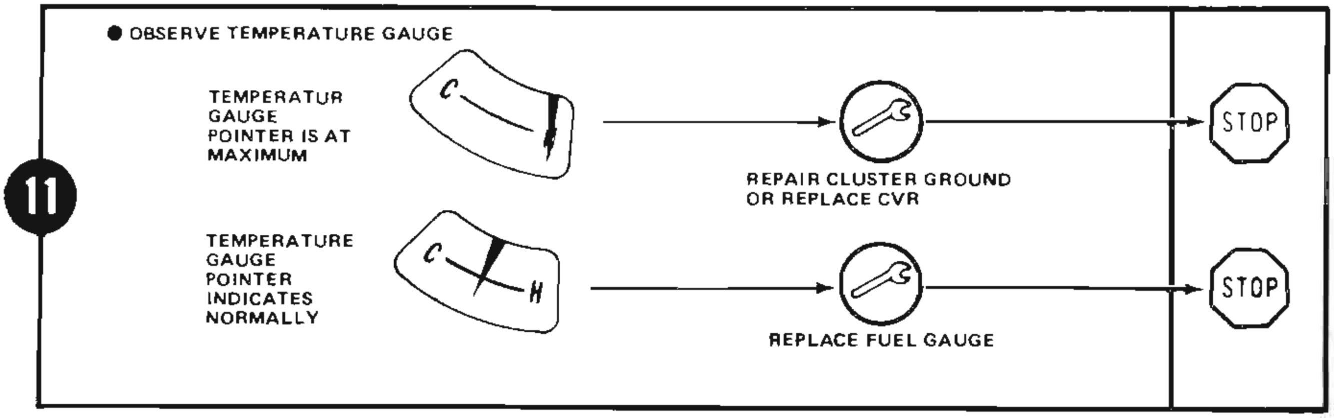
GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → 12

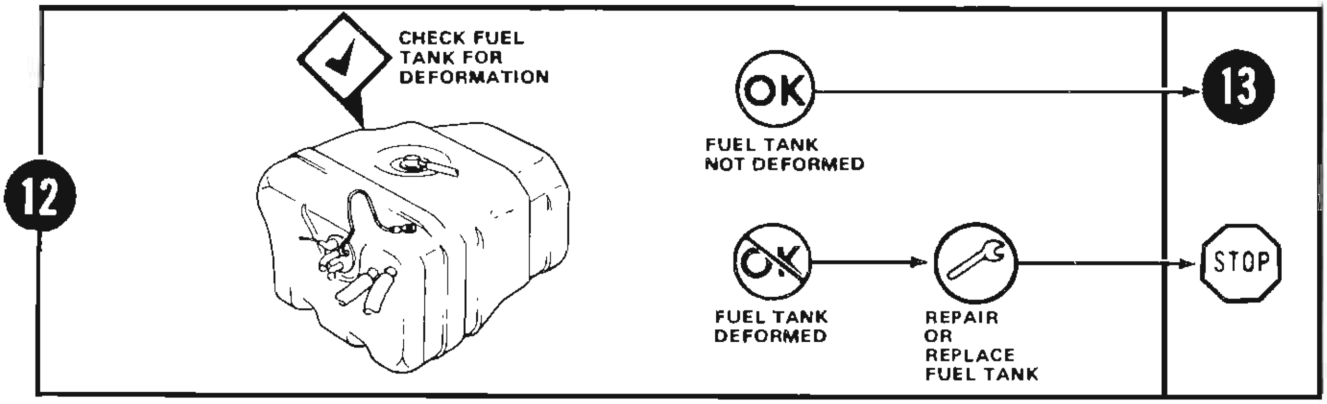
SEE I.S. NOTES

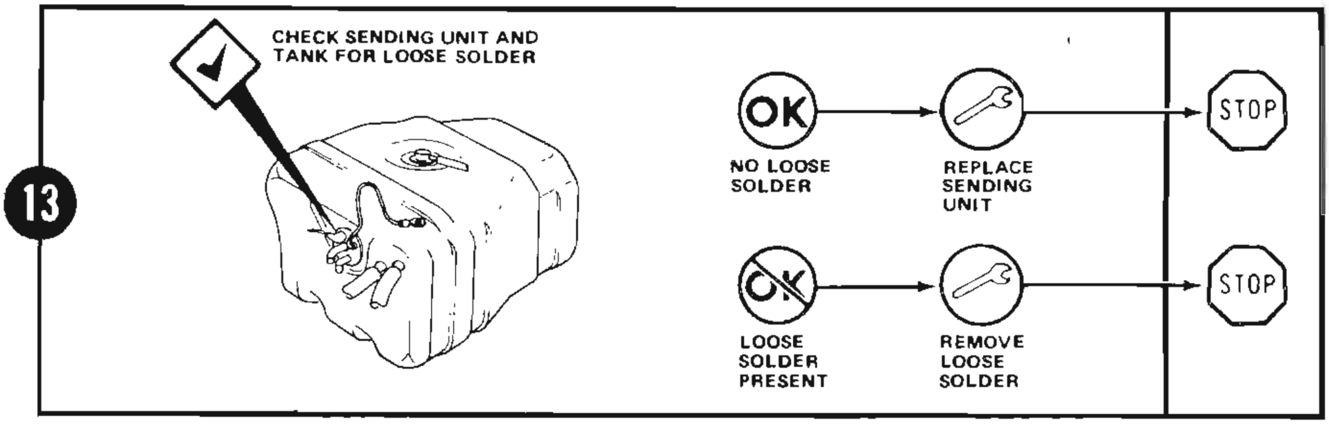
SEE I.S. NOTES

Chart 1

STEP **SEQUENCE** **RESULT**





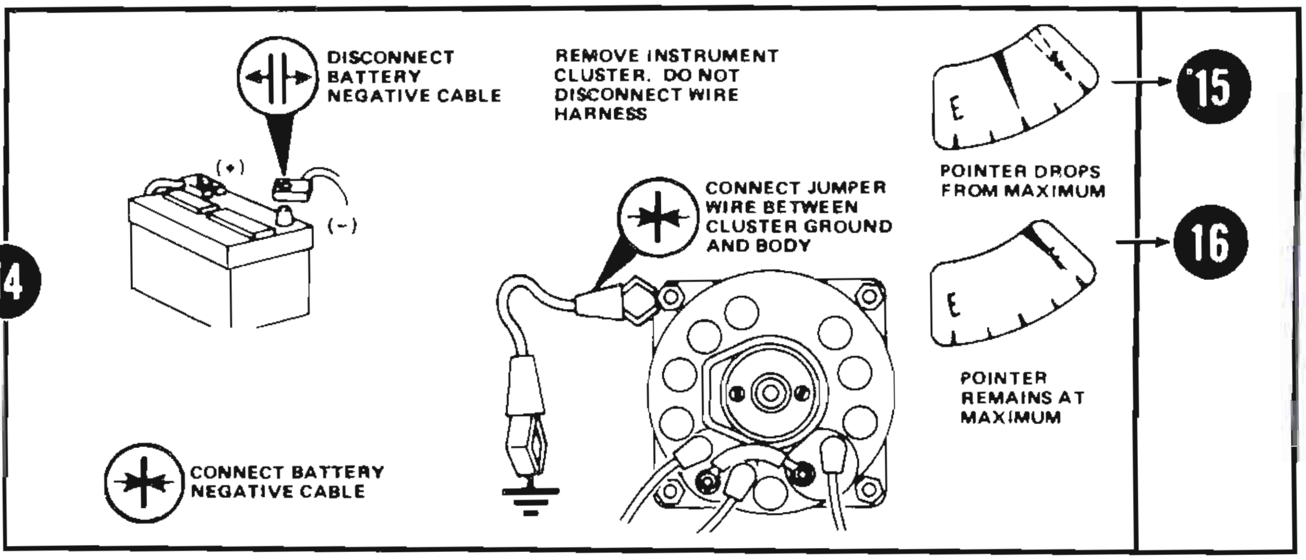


86377D

Chart 1

STEP **SEQUENCE** **RESULT**

14


DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER. DO NOT DISCONNECT WIRE HARNESS

CONNECT JUMPER WIRE BETWEEN CLUSTER GROUND AND BODY

CONNECT BATTERY NEGATIVE CABLE

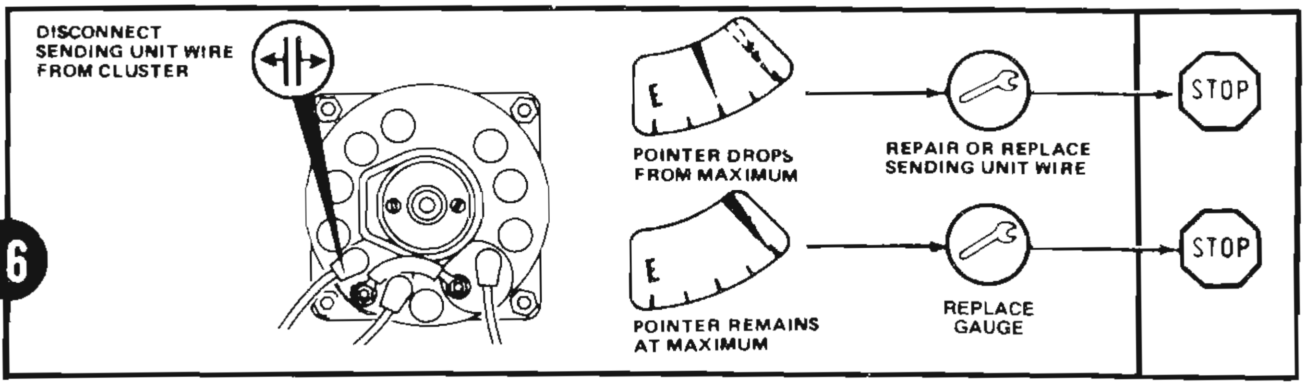
POINTER DROPS FROM MAXIMUM → 15

POINTER REMAINS AT MAXIMUM → 16

15


REPAIR INSTRUMENT PANEL GROUND → STOP

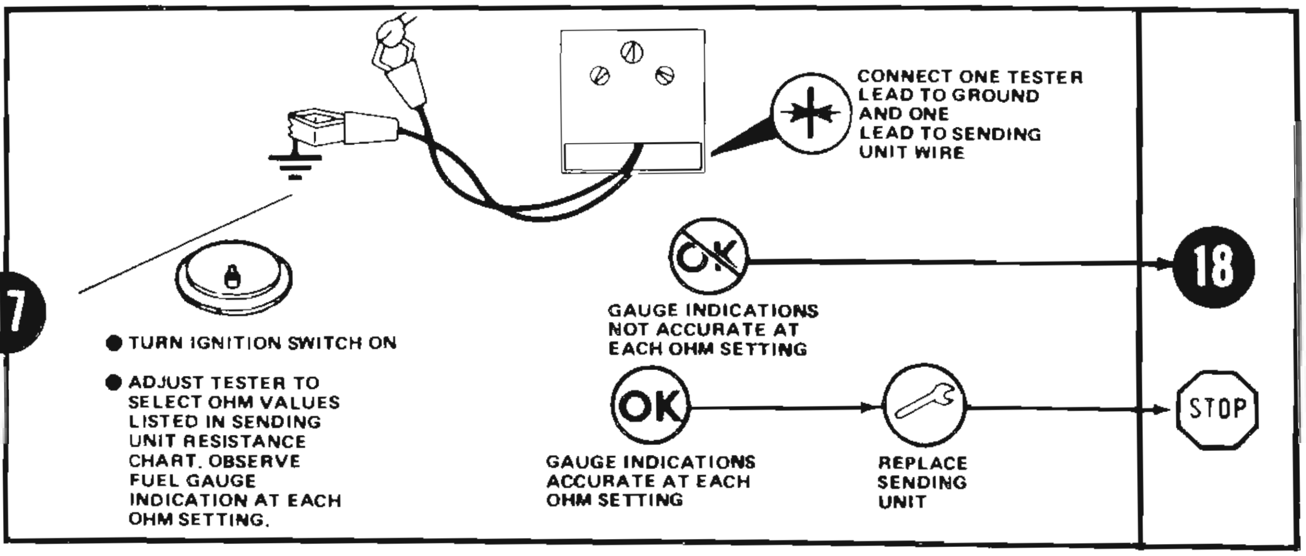
16


DISCONNECT SENDING UNIT WIRE FROM CLUSTER

POINTER DROPS FROM MAXIMUM → REPAIR OR REPLACE SENDING UNIT WIRE → STOP

POINTER REMAINS AT MAXIMUM → REPLACE GAUGE → STOP

17


CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION SWITCH ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART. OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 18

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

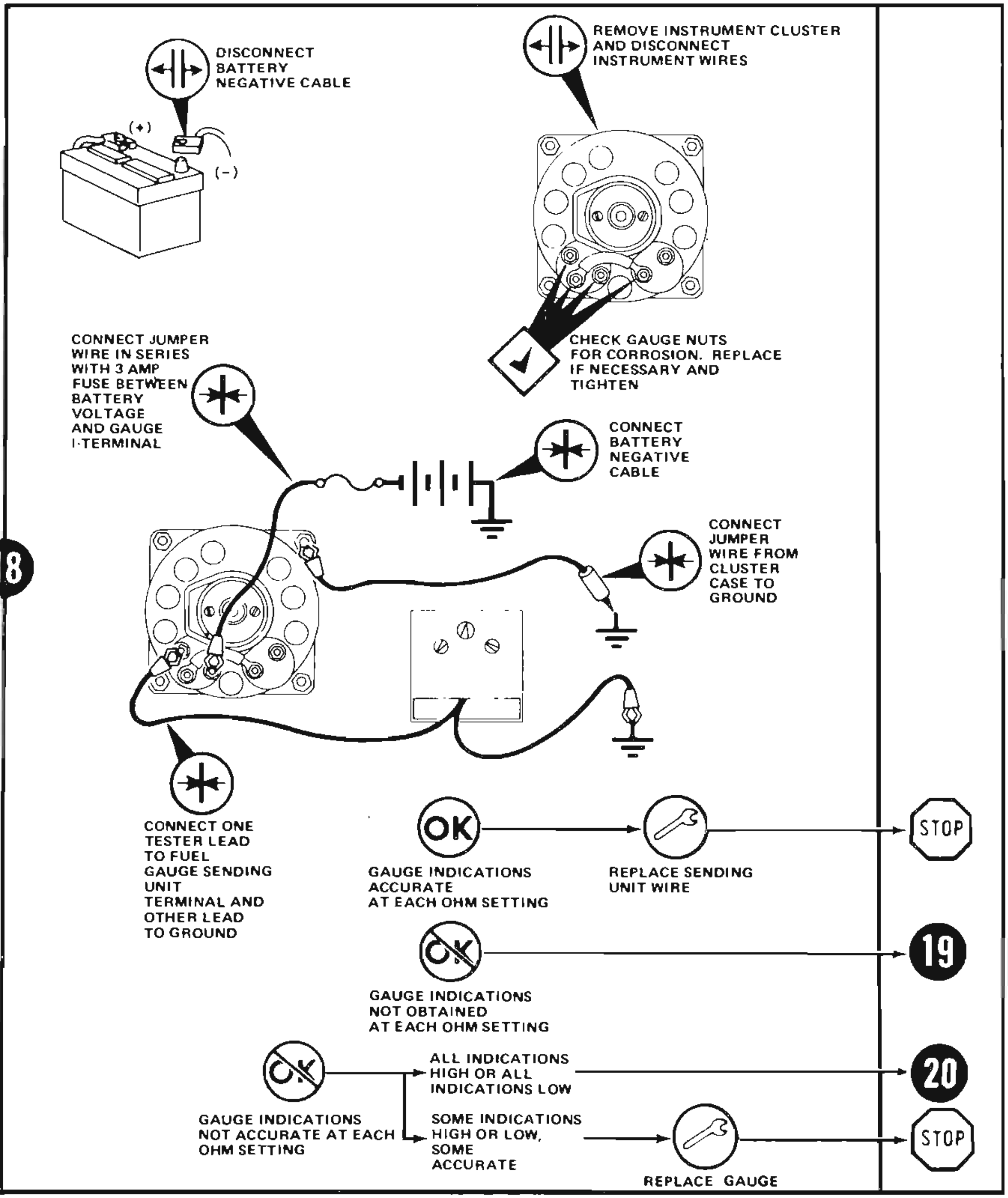
86377E

SEE I.S. NOTES

Chart 1

STEP **SEQUENCE** **RESULT**

18



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRES

CHECK GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES WITH 3 AMP FUSE BETWEEN BATTERY VOLTAGE AND GAUGE I-TERMINAL

CONNECT BATTERY NEGATIVE CABLE

CONNECT JUMPER WIRE FROM CLUSTER CASE TO GROUND

CONNECT ONE TESTER LEAD TO FUEL GAUGE SENDING UNIT TERMINAL AND OTHER LEAD TO GROUND

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT WIRE → STOP

GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING → 19

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

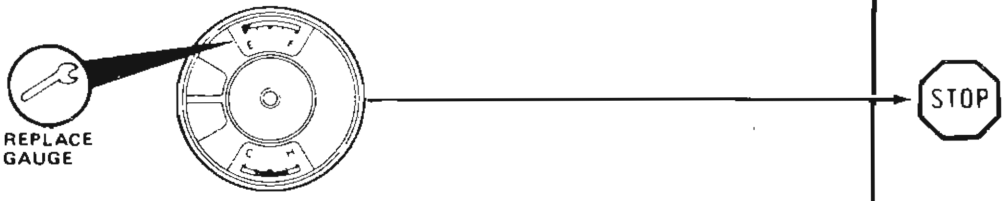
- ALL INDICATIONS HIGH OR ALL INDICATIONS LOW → 20
- SOME INDICATIONS HIGH OR LOW, SOME ACCURATE → REPLACE GAUGE → STOP

86377F

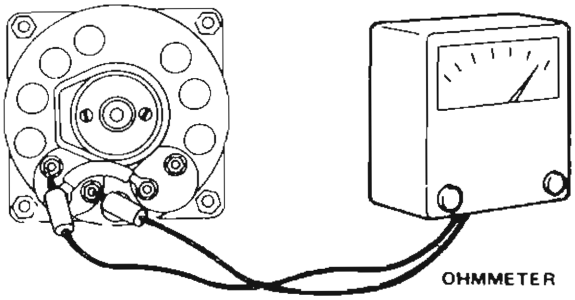
Chart 1

STEP **SEQUENCE** **RESULT**

19



20



CONNECT OHMMETER LEADS TO GAUGE INPUT TERMINAL AND GAUGE SENDING UNIT TERMINAL

- COMPARE OHMMETER INDICATIONS WITH VALUES LISTED IN GAUGE RESISTANCE CHART

OK GAUGE RESISTANCE CORRECT → REPLACE CVR (INTEGRAL WITH FUEL GAUGE) → STOP

~~OK~~ GAUGE RESISTANCE INCORRECT → REPLACE GAUGE → STOP

SEE I.S. NOTES

86377G

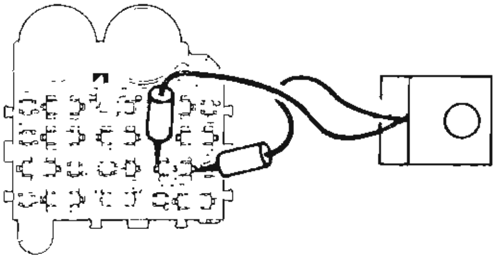
PROBLEM: GAUGE FUSE BLOWN

Chart 2

STEP **SEQUENCE** **RESULT**

SEE I.S. NOTES

1



CONNECT SHORT TESTER J-8681

OK — SHORT NOT INDICATED → 2

SHORT INDICATED → 3

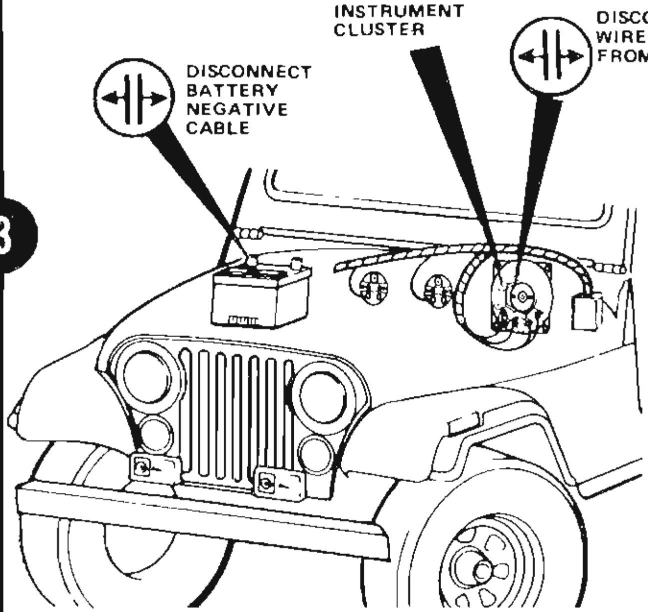
2

CHECK FOR INTERMITTENT SHORT

- RED IGNITION WIRE TO GAUGES

SHORT INDICATED → REPAIR AS NECESSARY → STOP

3



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER

DISCONNECT INSTRUMENT WIRE HARNESS CONNECTOR FROM GAUGES

CHECK FOR SHORT AT GAUGE FUSE

CONNECT BATTERY NEGATIVE CABLE

SHORT INDICATED → 5

OK — SHORT NOT INDICATED → 6

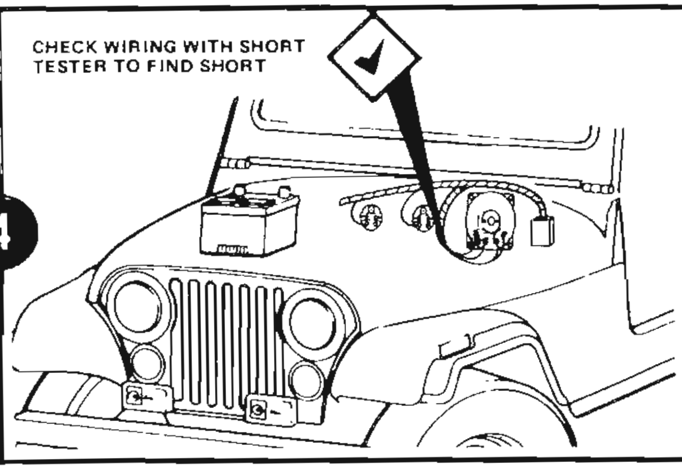
86378A

Chart 2

STEP **SEQUENCE** **RESULT**

4

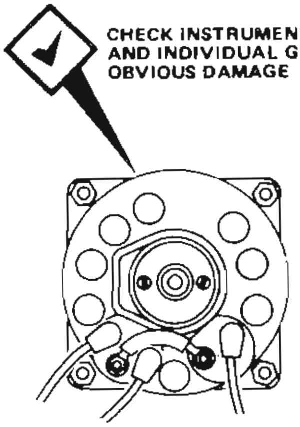
CHECK WIRING WITH SHORT TESTER TO FIND SHORT



REPLACE SHORTED WIRE HARNESS → STOP

5

CHECK INSTRUMENT CLUSTER AND INDIVIDUAL GAUGES FOR OBVIOUS DAMAGE



OK — DAMAGE NOT EVIDENT → REPLACE CVR → STOP

~~OK~~ — DAMAGE EVIDENT → REPLACE DAMAGED COMPONENT → STOP

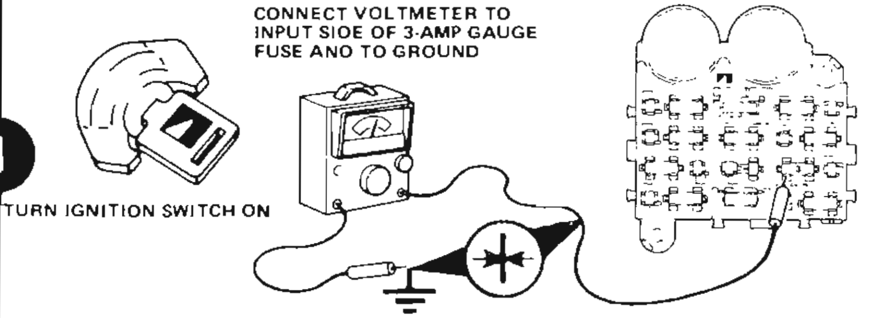
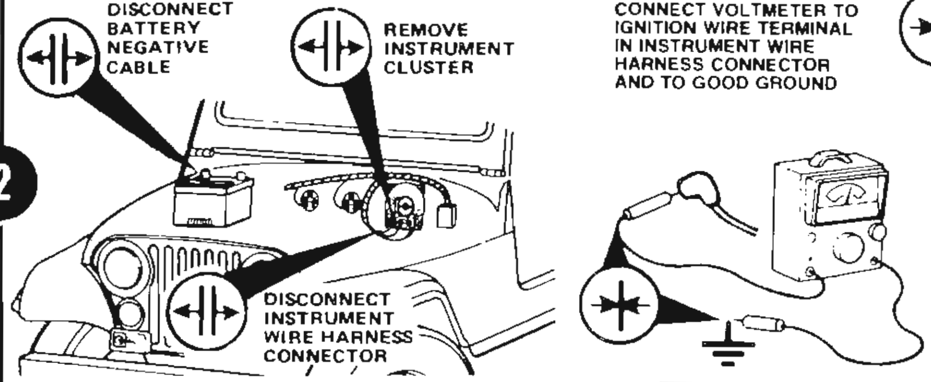
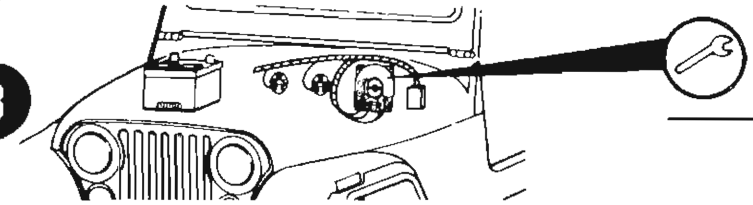
SE
I.S.
NOTES

863788

PROBLEM: FUEL GAUGE AND COOLANT TEMPERATURE GAUGE BOTH MALFUNCTION

Chart 3

SEE I.S. NOTES

STEP	SEQUENCE	RESULT
1	 TURN IGNITION SWITCH ON CONNECT VOLTMETER TO INPUT SIDE OF 3-AMP GAUGE FUSE AND TO GROUND RECORD VOLTMETER INDICATION	2
2	 DISCONNECT BATTERY NEGATIVE CABLE REMOVE INSTRUMENT CLUSTER DISCONNECT INSTRUMENT WIRE HARNESS CONNECTOR CONNECT VOLTMETER TO IGNITION WIRE TERMINAL IN INSTRUMENT WIRE HARNESS CONNECTOR AND TO GOOD GROUND CONNECT BATTERY NEGATIVE CABLE ● VOLTMETER INDICATION DIFFERENT FROM STEP 1	3
	● VOLTMETER INDICATION SAME AS STEP 1	4
3	 REPAIR OR REPLACE INSTRUMENT PANEL WIRE HARNESS	STOP
4	 REPLACE CVR (INTEGRAL WITH FUEL GAUGE)	STOP

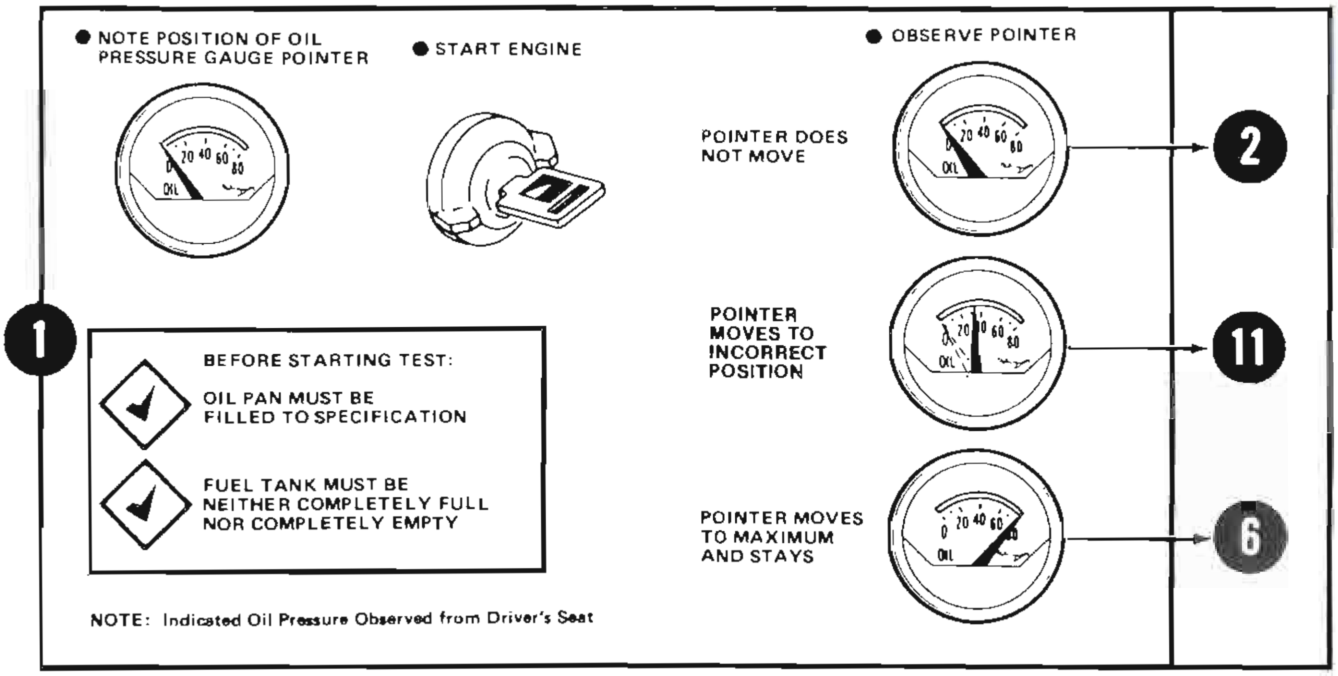
86379A

PROBLEM: OIL PRESSURE GAUGE NOT FUNCTIONING PROPERLY

Chart 4

SEE I.S. NOTES

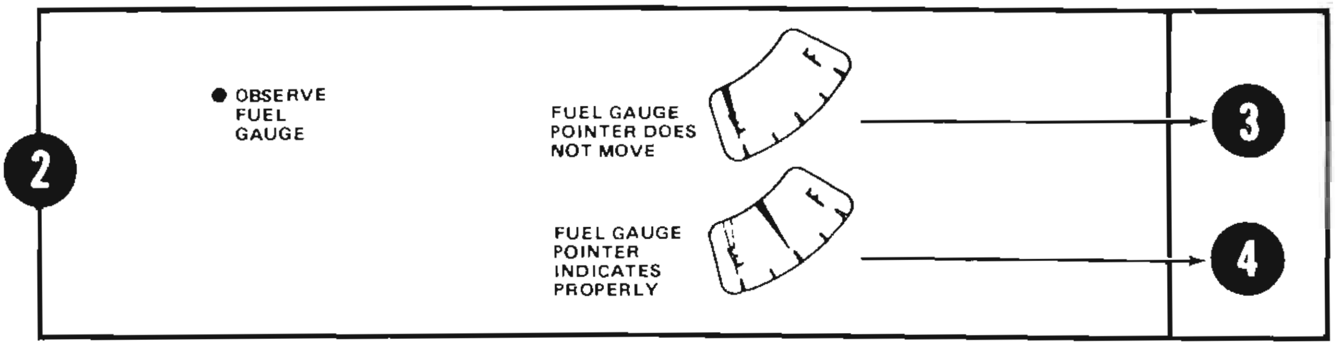
STEP **SEQUENCE** **RESULT**

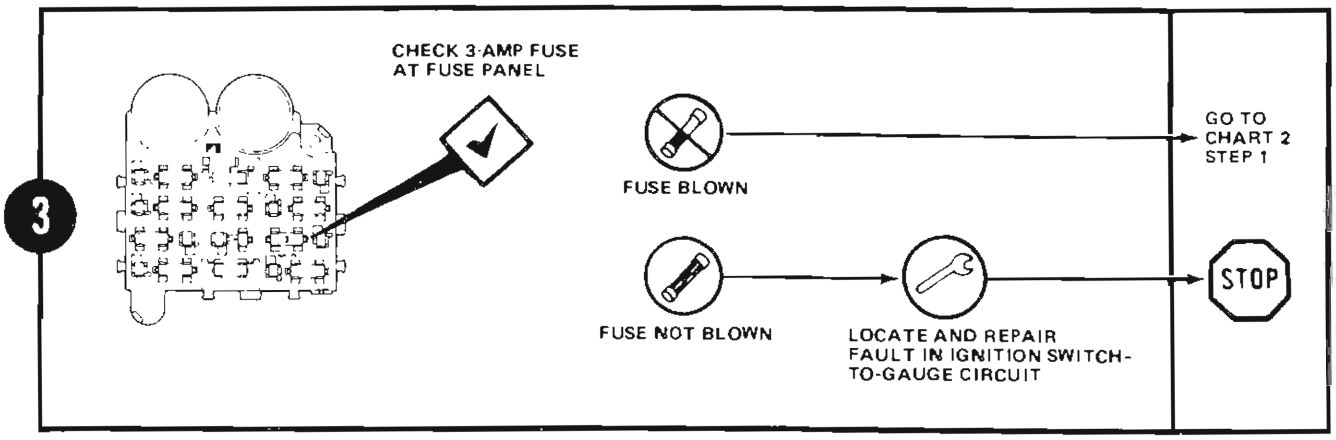


BEFORE STARTING TEST:

- ✓ OIL PAN MUST BE FILLED TO SPECIFICATION
- ✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY

NOTE: Indicated Oil Pressure Observed from Driver's Seat





80314A

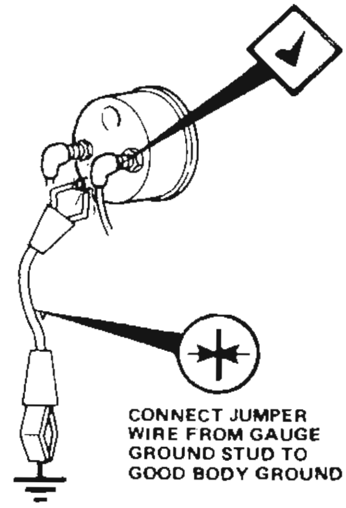
SEE I.S. NOTES

Chart 4

STEP **SEQUENCE** **RESULT**

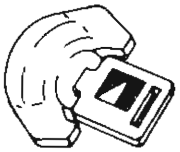
4

- REMOVE OIL PRESSURE GAUGE
- DO NOT DISCONNECT GAUGE WIRES



CHECK FOR PRESENCE OF VOLTAGE AT GAUGE I-TERMINAL

CONNECT JUMPER WIRE FROM GAUGE GROUND STUD TO GOOD BODY GROUND

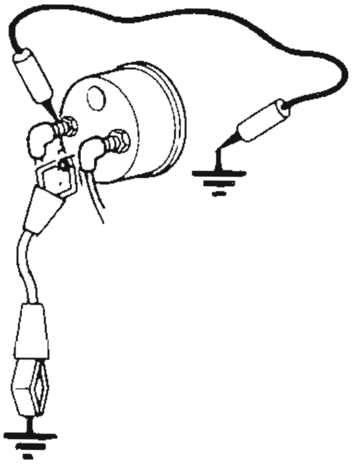


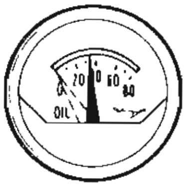
TURN IGNITION SWITCH ON

VOLTAGE NOT PRESENT → NOT OK → LOCATE AND REPAIR FAULT IN IGNITION SWITCH-TO-OIL PRESSURE GAUGE CIRCUIT → STOP

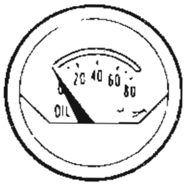
VOLTAGE PRESENT → OK → 5

5





POINTER MOVES → LOCATE AND REPAIR OPEN IN SENDING UNIT CIRCUIT → STOP

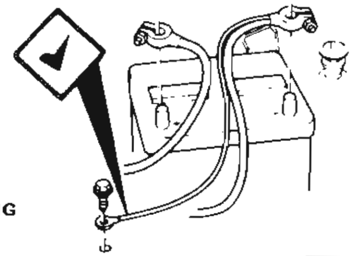


POINTER DOES NOT MOVE → REPLACE GAUGE → STOP

6

CHECK BATTERY GROUND CABLE

- BROKEN
- MISSING
- CORRODED
- SCREW LOOSE, MISSING



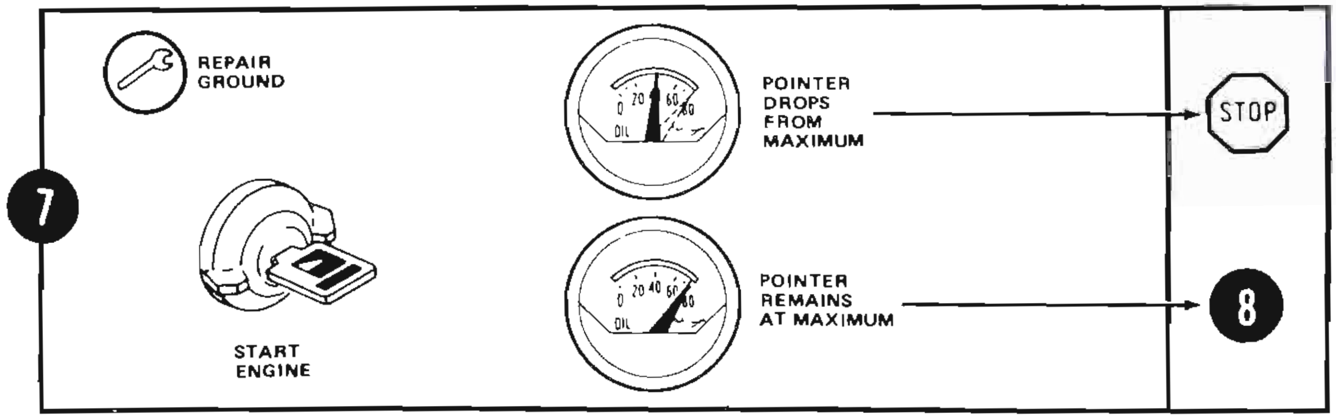
GROUND NOT OK → 7

GROUND OK → 8

80314B

Chart 4

STEP **SEQUENCE** **RESULT**

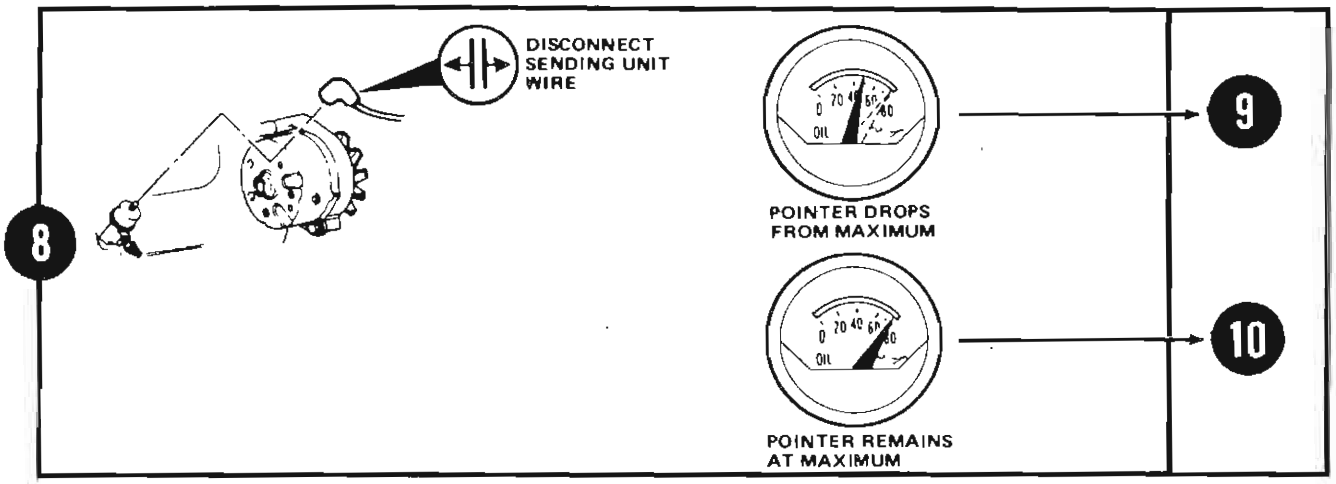


REPAIR GROUND

START ENGINE

POINTER DROPS FROM MAXIMUM → STOP

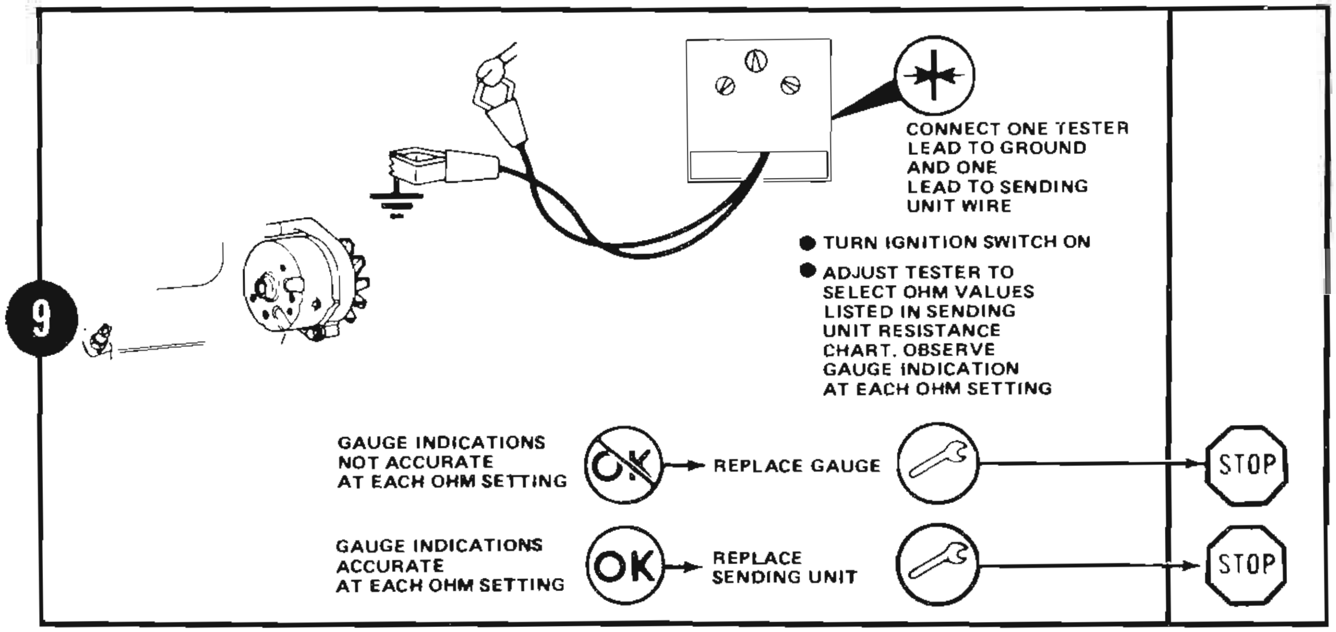
POINTER REMAINS AT MAXIMUM → 8



DISCONNECT SENDING UNIT WIRE

POINTER DROPS FROM MAXIMUM → 9

POINTER REMAINS AT MAXIMUM → 10



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION SWITCH ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART. OBSERVE GAUGE INDICATION AT EACH OHM SETTING

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → REPLACE GAUGE → STOP

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

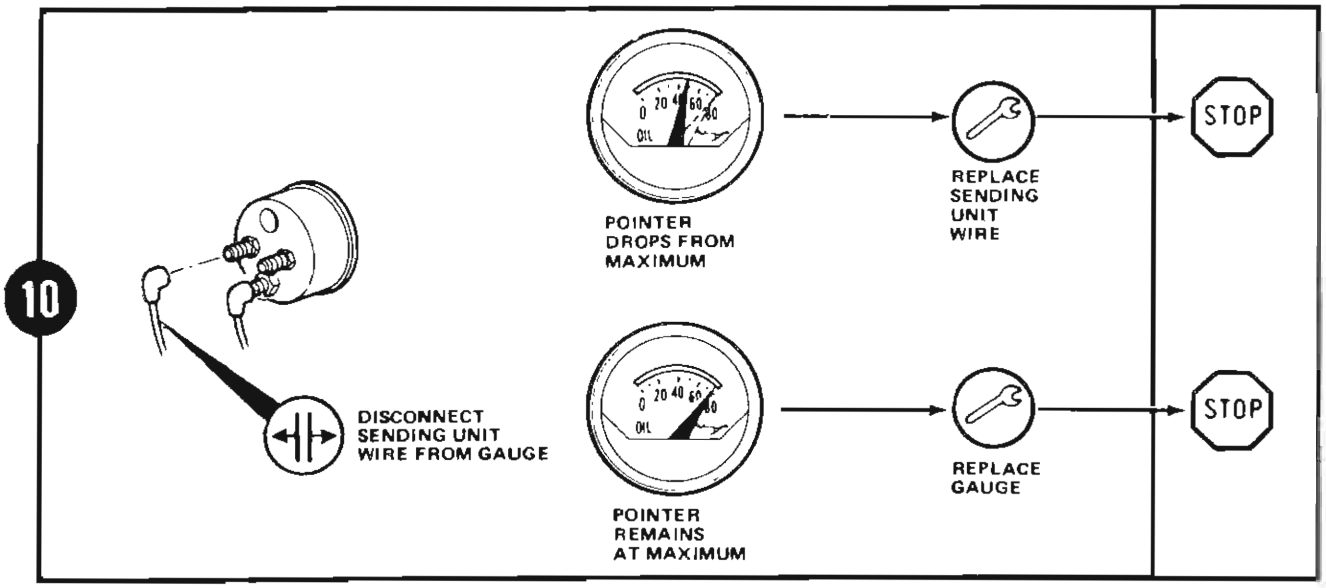
80314C

SEE I.S. NOTES

SEE
I.S.
NOTES

Chart 4

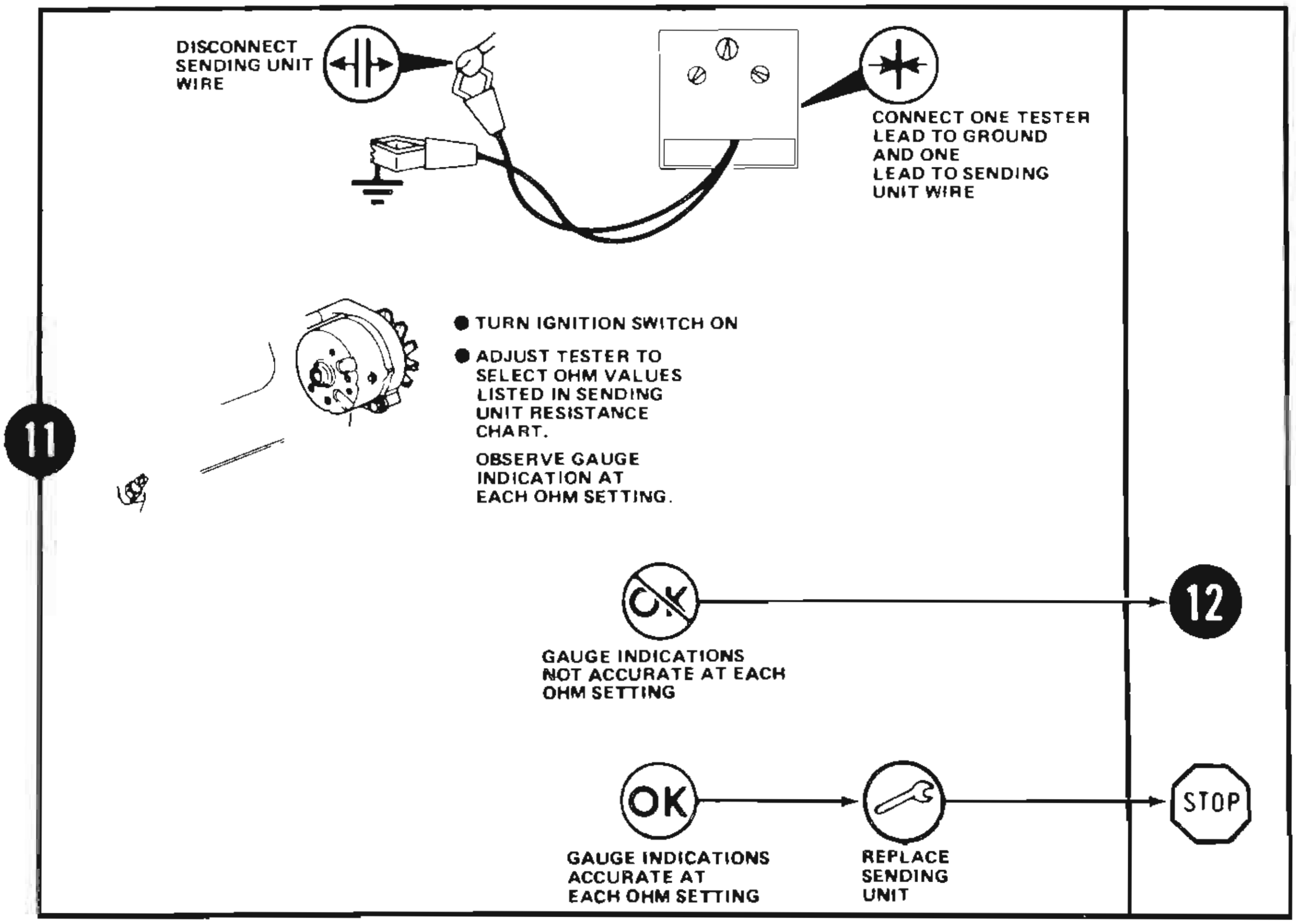
STEP **SEQUENCE** **RESULT**



DISCONNECT SENDING UNIT WIRE FROM GAUGE

POINTER DROPS FROM MAXIMUM → REPLACE SENDING UNIT WIRE → STOP

POINTER REMAINS AT MAXIMUM → REPLACE GAUGE → STOP



DISCONNECT SENDING UNIT WIRE

CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- ● TURN IGNITION SWITCH ON
- ● ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART.

OBSERVE GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 12

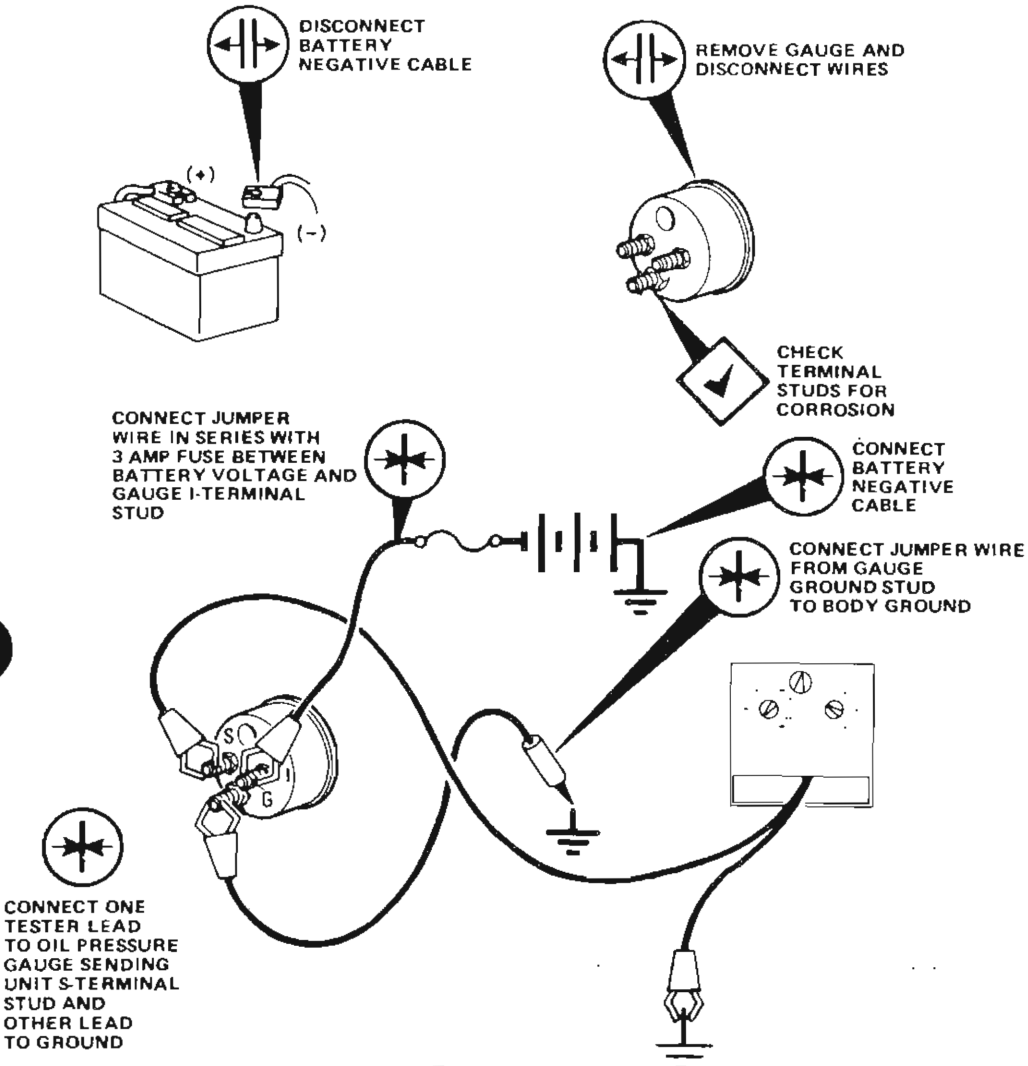
GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

80314D

Chart 4

STEP **SEQUENCE** **RESULT**

12



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE GAUGE AND DISCONNECT WIRES

CHECK TERMINAL STUDS FOR CORROSION

CONNECT JUMPER WIRE IN SERIES WITH 3 AMP FUSE BETWEEN BATTERY VOLTAGE AND GAUGE I-TERMINAL STUD

CONNECT BATTERY NEGATIVE CABLE

CONNECT JUMPER WIRE FROM GAUGE GROUND STUD TO BODY GROUND

CONNECT ONE TESTER LEAD TO OIL PRESSURE GAUGE SENDING UNIT S-TERMINAL STUD AND OTHER LEAD TO GROUND

GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING — OK → REPLACE SENDING UNIT WIRE → STOP

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING — ~~OK~~ → REPLACE WIRE TO "I" TERMINAL → STOP

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING — ~~OK~~ → REPLACE GAUGE → STOP

SEE I.S. NOTES

80314E

PROBLEM: COOLANT TEMPERATURE GAUGE NOT FUNCTIONING PROPERLY

Chart 5

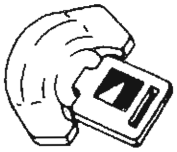
SEE I.S. NOTES

STEP **SEQUENCE** **RESULT**

1

- NOTE POSITION OF COOLANT TEMPERATURE GAUGE POINTER

- TURN IGNITION SWITCH ON AND WAIT 2 MINUTES FOR GAUGE TO WARM UP



BEFORE STARTING TEST:

✓ ENGINE MUST BE WARM

✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY

- OBSERVE POINTER

POINTER DOES NOT MOVE

→ 2

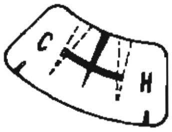
POINTER MOVES TO INACCURATE POSITION

→ 14

POINTER MOVES TO MAXIMUM AND STAYS

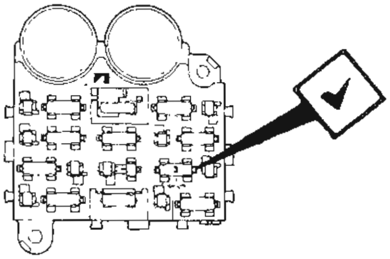
→ 6

POINTER PULSATES MORE THAN WIDTH OF POINTER



→ REPLACE CVR → STOP

2



CHECK 3-AMP FUSE AT FUSE PANEL

FUSE BLOWN → GO TO CHART 2 STEP 1

FUSE NOT BLOWN → 3

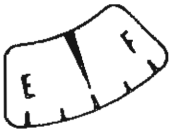
3

- OBSERVE FUEL GAUGE

FUEL GAUGE POINTER DOES NOT MOVE

→ GO TO CHART 3 STEP 1

FUEL GAUGE POINTER INDICATES PROPERLY



→ 4

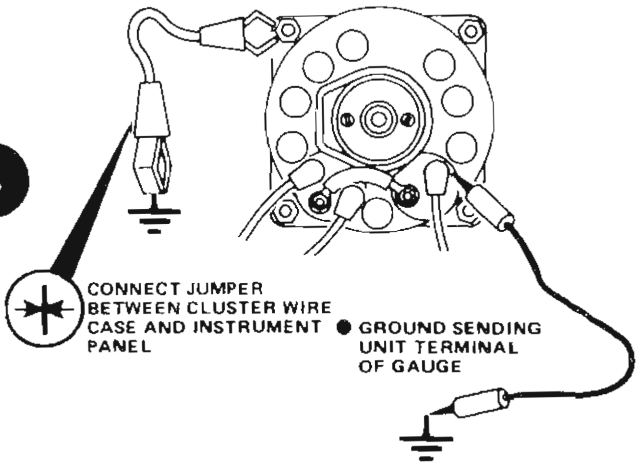
86380A

Chart 5

STEP	SEQUENCE	RESULT

4

- REMOVE CLUSTER
- DO NOT DISCONNECT INSTRUMENT WIRES



CONNECT JUMPER BETWEEN CLUSTER WIRE CASE AND INSTRUMENT PANEL

- GROUND SENDING UNIT TERMINAL OF GAUGE

POINTER MOVES → 5

POINTER DOES NOT MOVE → REPLACE GAUGE → STOP

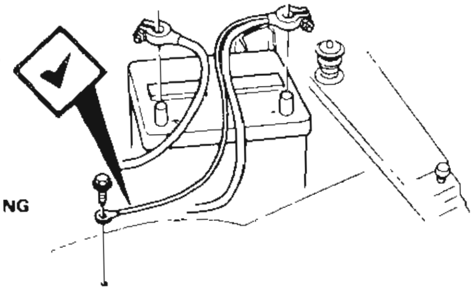
5

LOCATE AND REPAIR OPEN CIRCUIT IN SENDING UNIT WIRE → STOP

6

CHECK BATTERY GROUND CABLE

- BROKEN
- MISSING
- CORRODED
- SCREWS LOOSE, MISSING



GROUND NOT OK → 7

GROUND OK → 8

7

REPAIR GROUND

POINTER DROPS FROM MAXIMUM → STOP

POINTER REMAINS AT MAXIMUM → 8

SEE I.S. NOTES

86380B

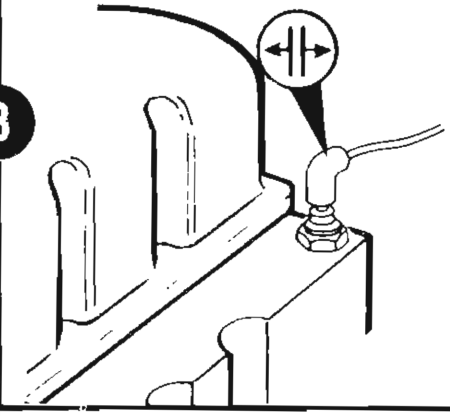
SEE I.S. NOTES

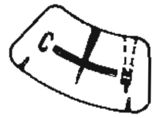
Chart 5

STEP | **SEQUENCE** | **RESULT**

8

DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT

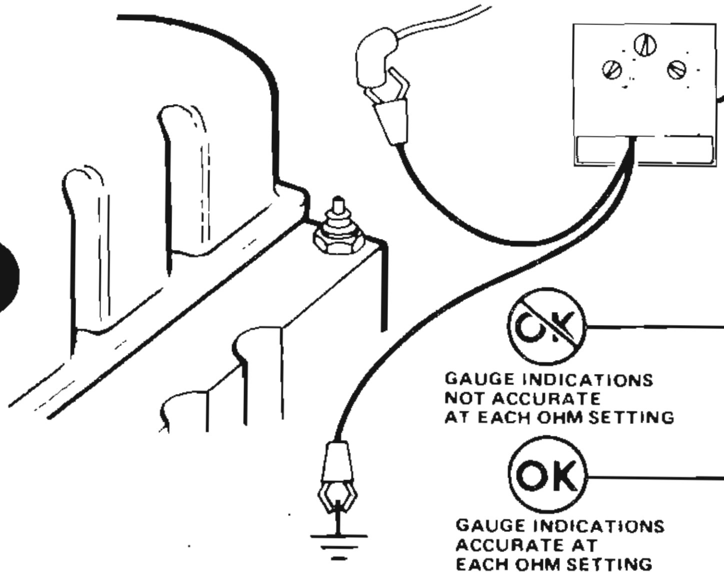




POINTER DROPS FROM MAXIMUM → **9**

POINTER REMAINS AT MAXIMUM → **11**

9



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION SWITCH ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART. OBSERVE GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → **10**

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

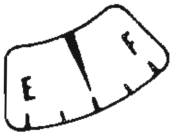
10

- OBSERVE FUEL GAUGE

FUEL GAUGE POINTER IS AT MAXIMUM

REPAIR CLUSTER GROUND OR REPLACE CVR (INTEGRAL WITH TEMPERATURE GAUGE) → STOP

FUEL GAUGE POINTER INDICATES NORMALLY



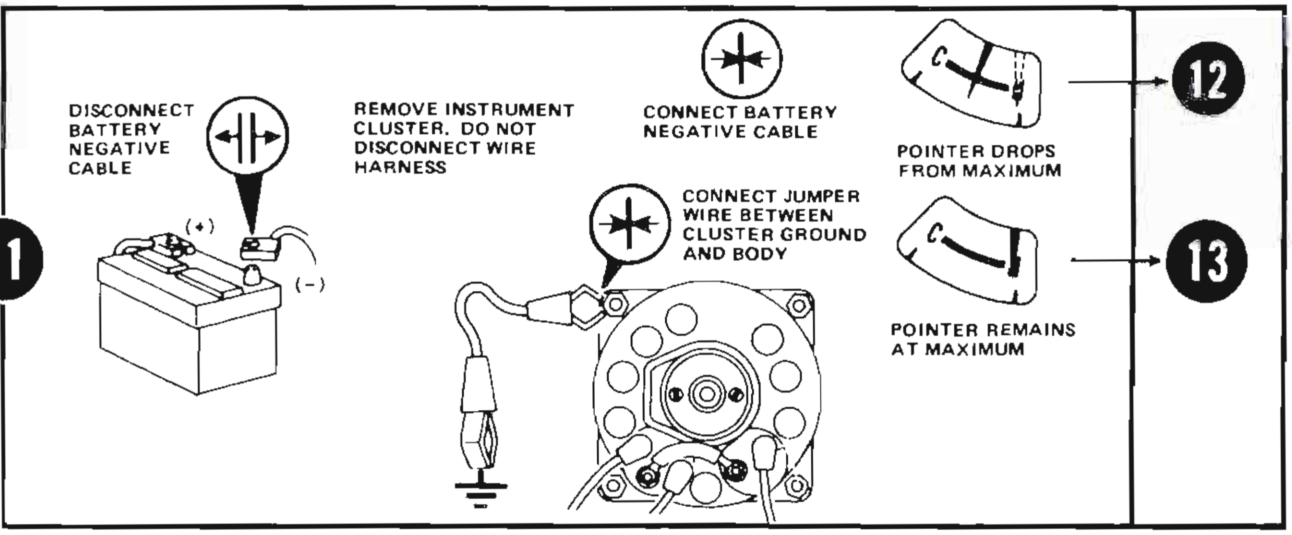
REPLACE TEMPERATURE GAUGE → STOP

86380C

Chart 5

STEP **SEQUENCE** **RESULT**

11



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER. DO NOT DISCONNECT WIRE HARNESS

CONNECT BATTERY NEGATIVE CABLE

CONNECT JUMPER WIRE BETWEEN CLUSTER GROUND AND BODY

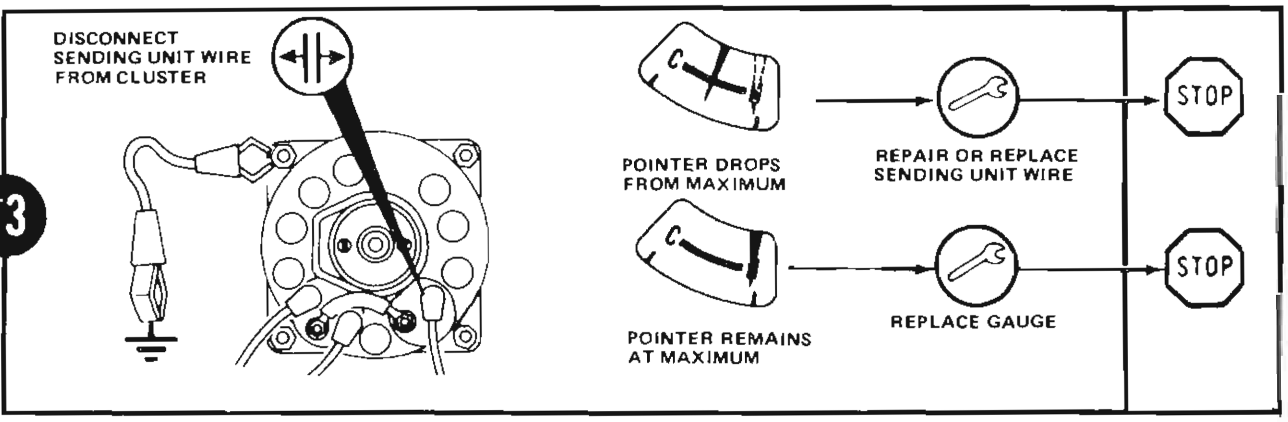
POINTER DROPS FROM MAXIMUM → 12

POINTER REMAINS AT MAXIMUM → 13

12

REPAIR INSTRUMENT PANEL GROUND → STOP

13

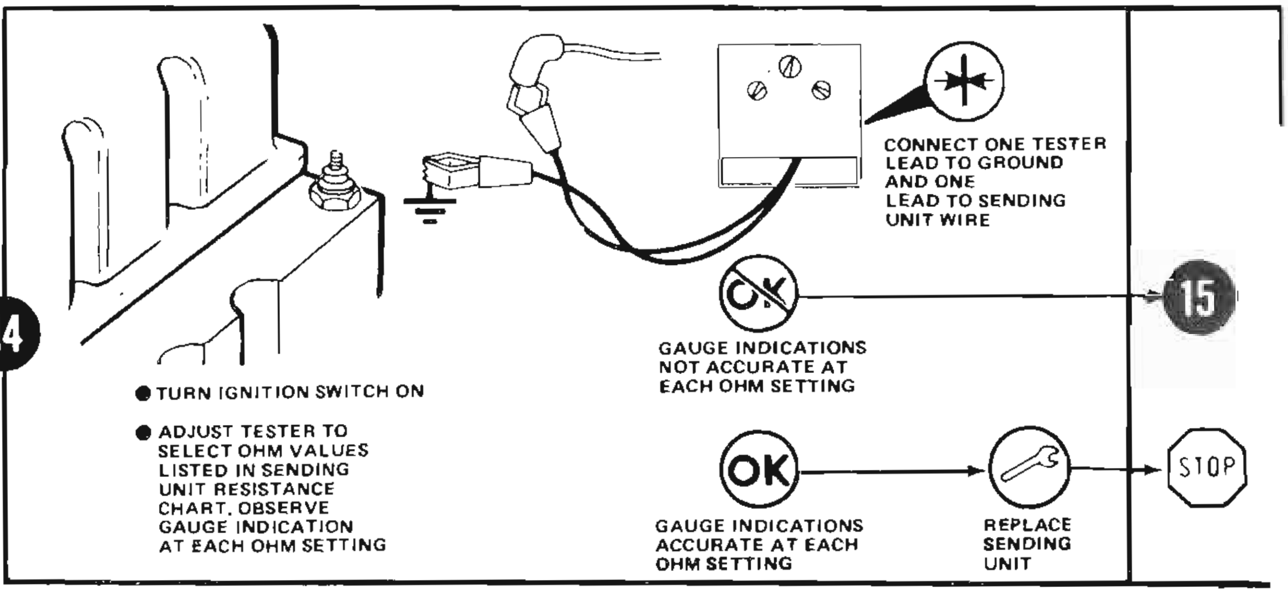


DISCONNECT SENDING UNIT WIRE FROM CLUSTER

POINTER DROPS FROM MAXIMUM → REPAIR OR REPLACE SENDING UNIT WIRE → STOP

POINTER REMAINS AT MAXIMUM → REPLACE GAUGE → STOP

14



- TURN IGNITION SWITCH ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE CHART. OBSERVE GAUGE INDICATION AT EACH OHM SETTING

CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 15

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

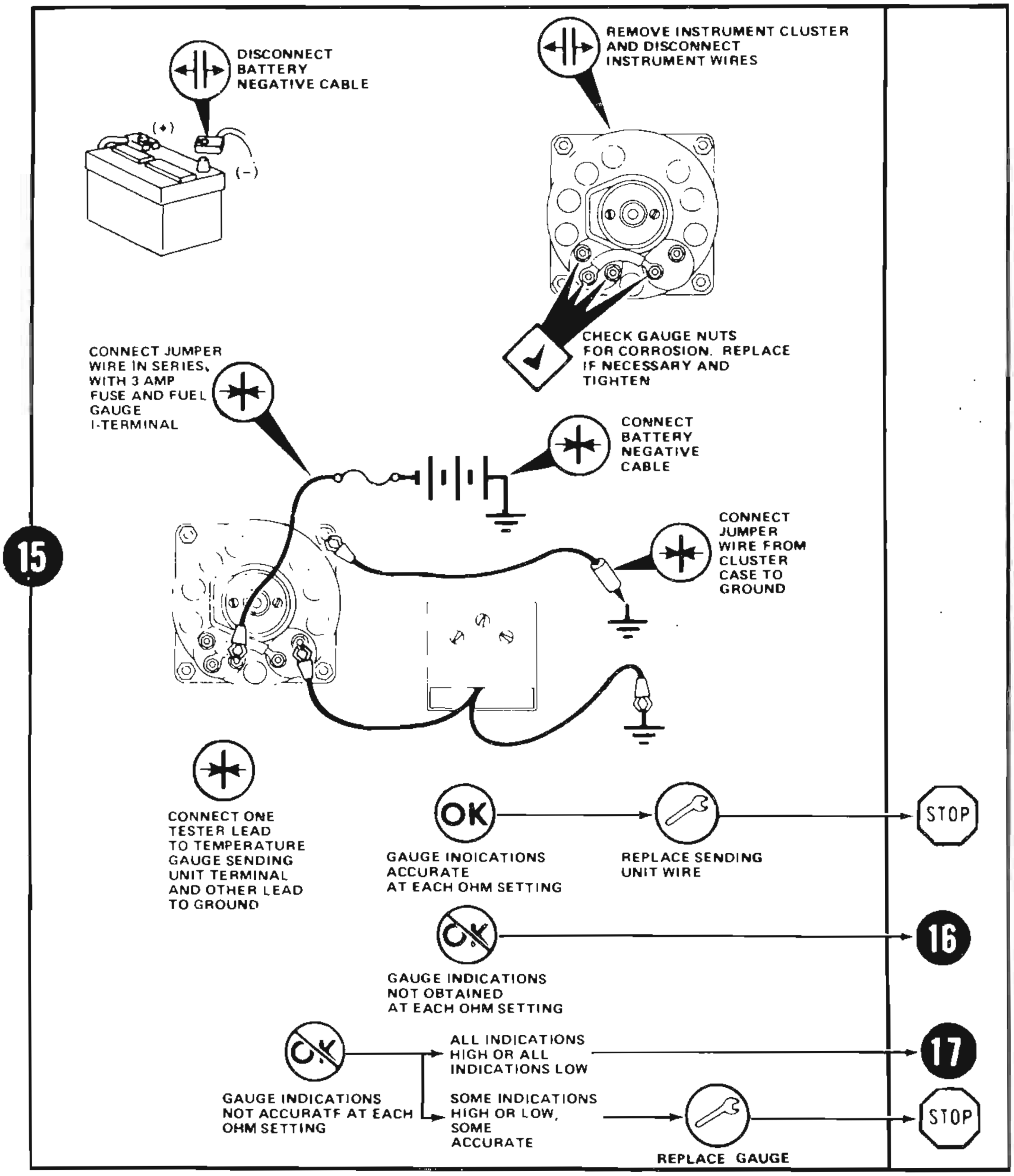
SEE I.S. NOTES

86380D

Chart 5

STEP **SEQUENCE** **RESULT**

SEE I.S. NOTES



15

DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRES

CHECK GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES, WITH 3 AMP FUSE AND FUEL GAUGE I-TERMINAL

CONNECT BATTERY NEGATIVE CABLE

CONNECT JUMPER WIRE FROM CLUSTER CASE TO GROUND

CONNECT ONE TESTER LEAD TO TEMPERATURE GAUGE SENDING UNIT TERMINAL AND OTHER LEAD TO GROUND

OK — GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT WIRE → STOP

~~OK~~ — GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING → 16

~~OK~~ — GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

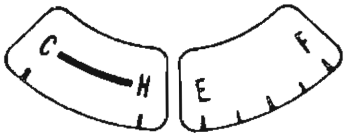
- ALL INDICATIONS HIGH OR ALL INDICATIONS LOW → 17
- SOME INDICATIONS HIGH OR LOW, SOME ACCURATE → REPLACE GAUGE → STOP

86380E

Chart 5

STEP **SEQUENCE** **RESULT**

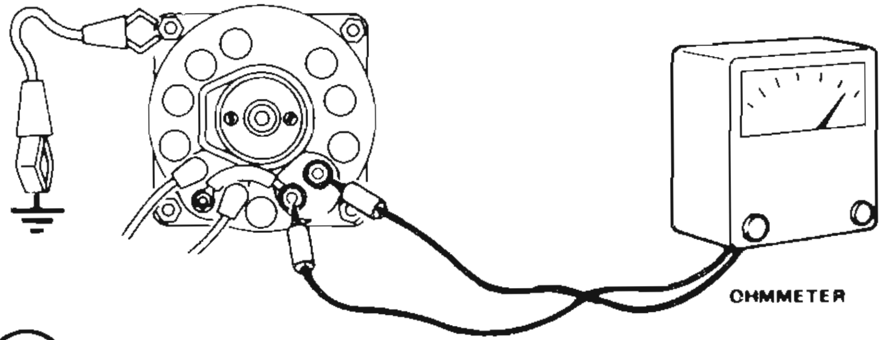
16



REPLACE GAUGE → STOP

SEE I.S. NOTES

17



CONNECT OHMMETER LEADS TO GAUGE INPUT TERMINAL AND GAUGE SENDING UNIT TERMINAL

- COMPARE OHMMETER RESISTANCE INDICATIONS WITH VALUES LISTED IN GAUGE RESISTANCE CHART

OK GAUGE RESISTANCE CORRECT → REPLACE CVR (INTEGRAL WITH TEMPERATURE GAUGE) → STOP

~~OK~~ GAUGE RESISTANCE INCORRECT → REPLACE GAUGE → STOP

86380F

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
AMOT ET-502	Digital Multimeter		■
J-21008	Continuity Lamp		■
J-21232-01	Steering Wheel Puller		■
J-23653	Headlight Aimer		■
J-25300-01	Lock Plate Compressor	■	

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)

SPECIFICATIONS

EXTERIOR LIGHTING

	Number of Bulbs/Bulb Trade Number
Headlights	2/6014 or W6014
Front Parking and Turn Signal Lights	2/1157 NA*
Front Side Marker	2/194
Stop-Tail-Turn Signal	2/1157
Rear Side Marker	2/158
Back-Up Light	2/1156
Engine Compartment Light	1/105

*NA = Natural Amber

86389

INTERIOR LIGHTING

	Number of Bulbs/Bulb Trade Number
Dome Light	1/212
Courtesy Lights	2/89
Auto Trans Selector	1/1892
Instrument Cluster	4/53
Voltmeter & Oil Pressure	1/1895

86390

EXTERIOR LIGHTING

Headlamps

Replacement

Remove the attaching screw and pull the bezel out slightly at the bottom and push up to disengage the upper retaining tab.

Loosen the screws in the headlamp retaining ring; rotate the ring to disengage it from the screws.

Pull the headlamp out and disconnect the wire harness.

Install the replacement headlamp.

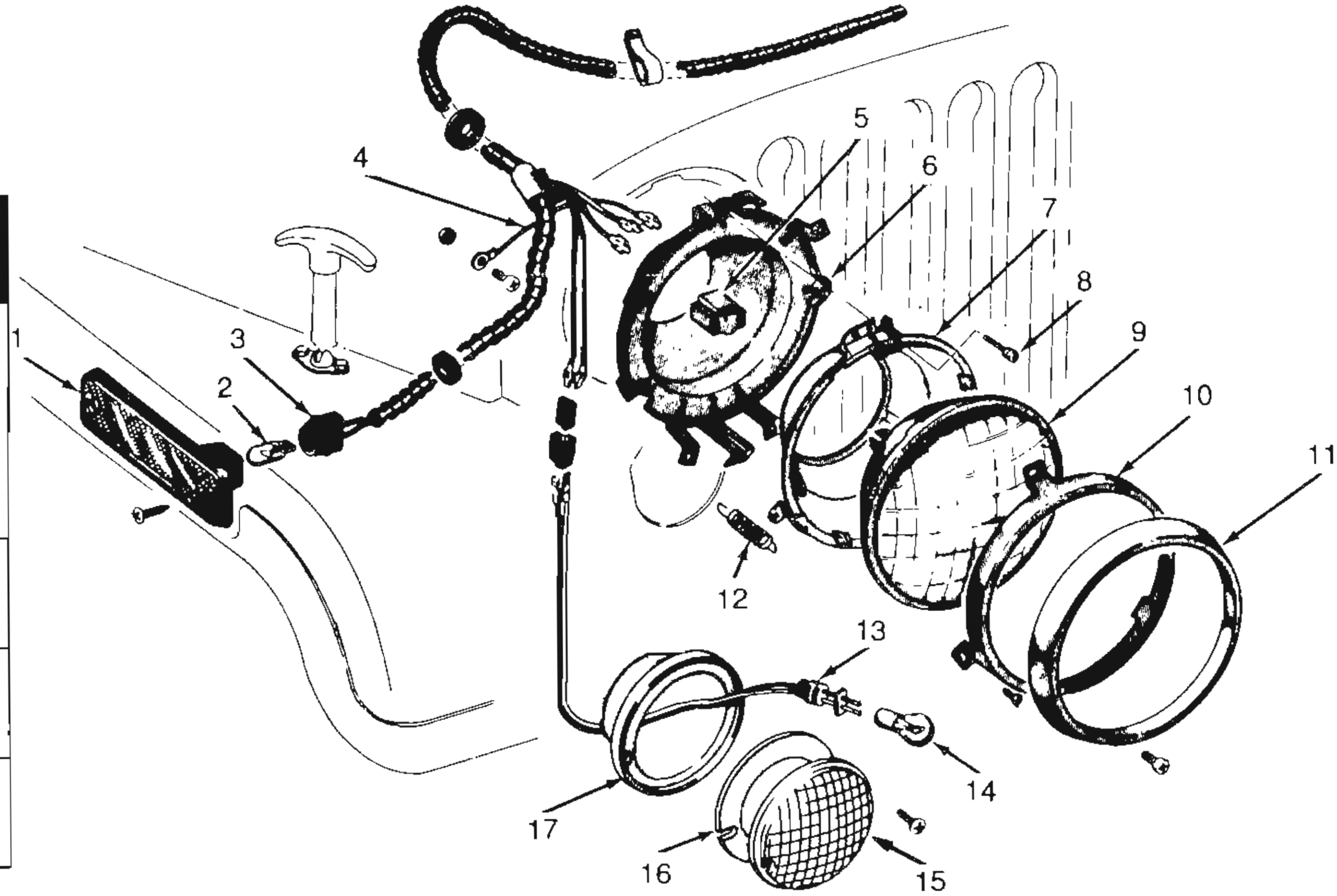
Install the retaining ring and tighten the screws.

Install the headlamp bezel and attaching screw.

Check the headlamp aim following the procedure outlined in this section.

SEE I.S. NOTES

SEE I.S. NOTES



1. Lamp
2. Bulb
3. Harness
4. Lighting Ground Wire
5. Terminal
6. Body
7. Shell
8. Adjusting Screw
9. Bulb
10. Retaining Ring
11. Door
12. Adjusting Spring
13. Harness
14. Bulb
15. Lens
16. Gasket
17. Housing

841289

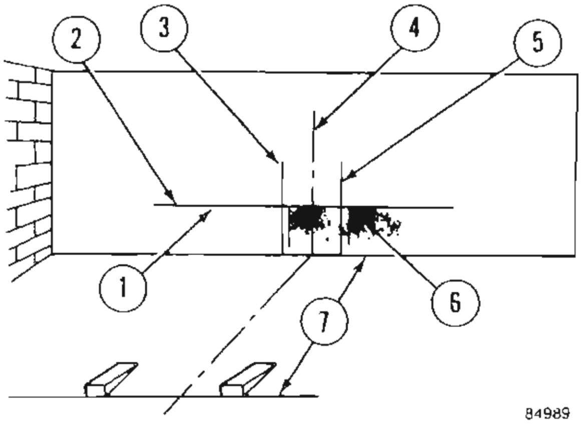
Headlamp Aiming Procedure

Lamps must be aimed on low beam. They may be aimed either with mechanical aimers or by using a screen. Use Headlight Aimer J-25300-01 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.



1 HEIGHT OF LAMP CENTERS
2 HORIZONTAL TAPE
3 VERTICAL TAPE LEFT LAMP CENTER
4 VERTICAL CENTERLINE
5 VERTICAL TAPE RIGHT LAMP CENTER
6 ZONE OF GREATEST INTENSITY
7 25 FEET

Position the vehicle perpendicular to the screen and with the headlamps directly over the reference line.

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.

Remove the headlamp bezels.

Clean the headlamps.

Turn the headlamps on LOW beam.

NOTE: Cover the lamp not being aimed.

SEE I.S. NOTES

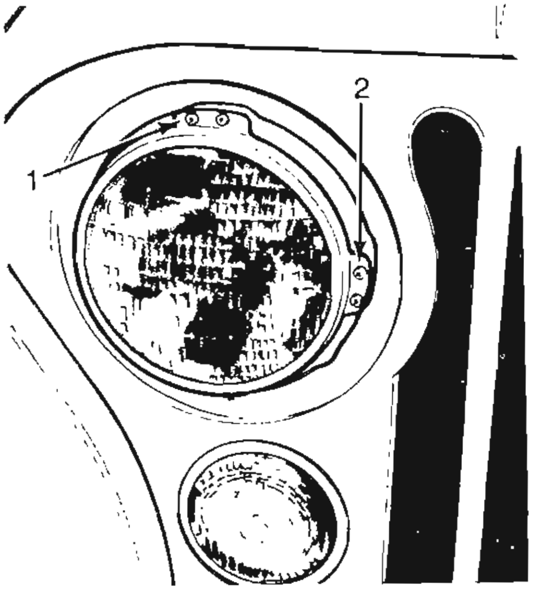
Turn the vertical aiming screw (1) counterclockwise until the lamp beam is considerably lower than the horizontal reference line on the screen.

Turn the screw clockwise until the top edge of the high intensity area is even with the horizontal line.

Turn the horizontal aiming screw (2) counterclockwise until the beam is off the centering tape.

Turn the same screw clockwise until the left edge of the high intensity area is 10.2 cm (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.



841290

Front Parking, Side Marker and Directional Lamps

Parking and Directional Bulb

Remove the lens attaching screws.

Remove the lens.

Replace the bulb.

Parking Lamp Assembly

Remove the lens attaching screws.

Remove the lens and gasket.

Remove the housing from the front panel.

Disconnect the wire connector from the harness.

Side Marker Bulbs

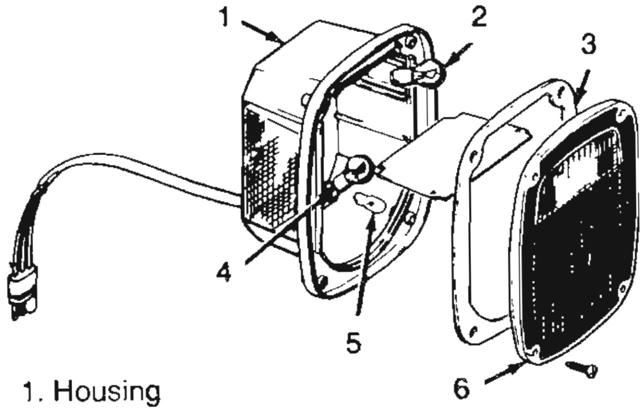
Reach under the fender and twist the socket a quarter turn counterclockwise to remove socket from the housing.

Replace the bulb.

Rear Directional, Side Marker, Stop and Taillamps

Taillamp Bulb Replacement

Remove the lens attaching screws, lens and gasket. Remove bulb and install a replacement bulb. Clean the lens and reflector before installing.



1. Housing
2. Backup Lamp Bulb
3. Gasket
4. Tail-Stop Directional Lamp Bulb
5. Side Marker Lamp Bulb
6. Lens

841291

Taillamp Housing Replacement

Disconnect the wiring, remove the taillamp lens, and remove the screws attaching the taillamp assembly body and remove.

Side Marker Bulb Replacement

Remove the lens attaching screws, lens and gasket. Clean the lens and reflector before installing.

Pull the side marker bulb straight out of the socket.

To install the new bulb, push straight into the socket.

Position the lens gasket and lens and install the screws.

Back Up Lamp

To replace the bulb remove the taillamp lens.

Remove old bulb and install new bulb.

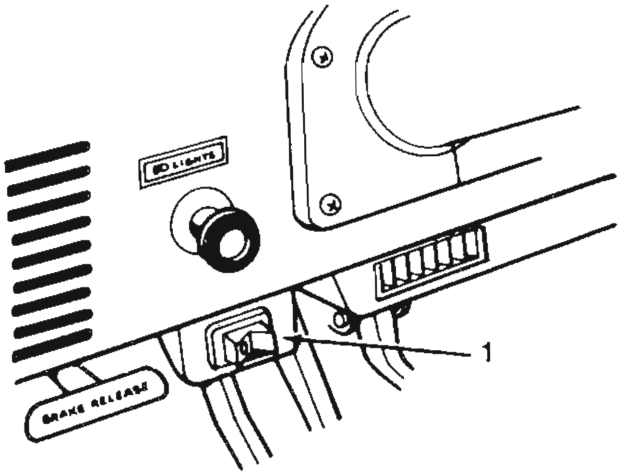
License Plate Lamp

The left taillamp illuminates the license plate.

Fog Lamps

The switch (1) is located on the far left side of the instrument panel.

NOTE: Fog lamps are turned off by the circuit relay when the high beam driving lamps are turned on. The circuit relay is located on the right front wheelhouse panel near the blower motor.



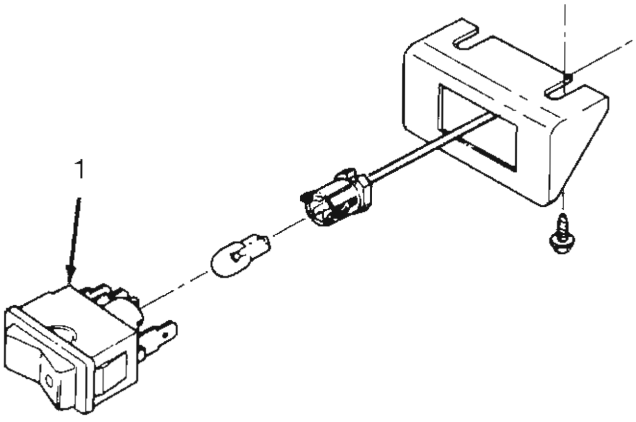
841262

SEE I.S. NOTES

Switch Replacement

Remove the switch (1) from the instrument panel and disconnect the electrical harness.

Connect the harness to the replacement switch and install the switch in the instrument panel.



841264

Aiming Fog Lamps

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 light beams on the wall should be the same size as the distance between the lamps on the front bumper
- the vertical height of the light beams on the wall should be 10.2 (4 in) less than the height of the lamps on the front bumper

Tighten the lamp attaching hardware.

Install the lamp stone shields.

Lamp Element Replacement

Remove the lamp stone shields.

Remove the screws attaching the bezel to the lamp body. Remove the bezel from the lamp body.

Remove the lens and reflector assembly from the lamp body.

Remove the bulb holder from the lens and reflector assembly.

Remove the lamp element from the bulb holder .

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 lamp element.

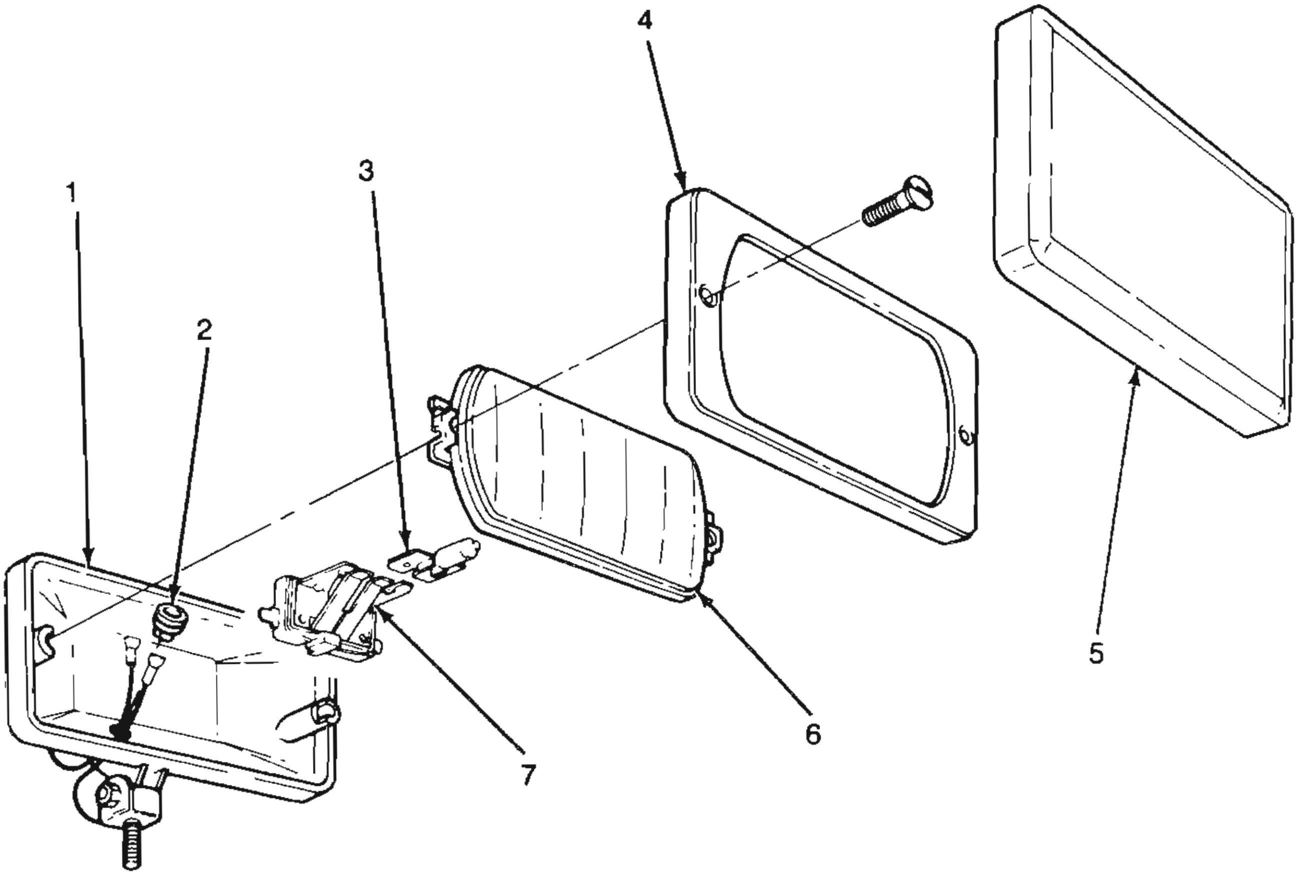
Install the bulb holder in the lens and reflector assembly.

Position the lens and reflector assembly in the lamp body with the top of the lens at the top of the lamp body.

Position the bezel on the lamp body and install the attaching screws.

Install the stone shield on the lamp.

SEE I.S. NOTES

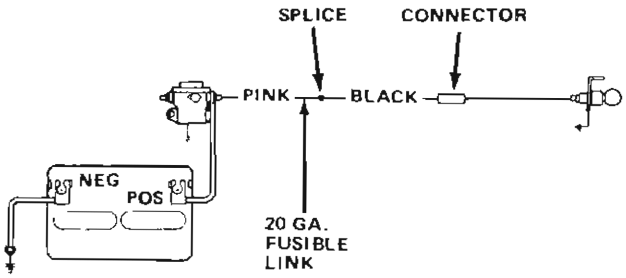


1. Body
2. Grommet
3. Element
4. Bezel
5. Stone Shield
6. Lens and Reflector
7. Bulb Holder

841263

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.



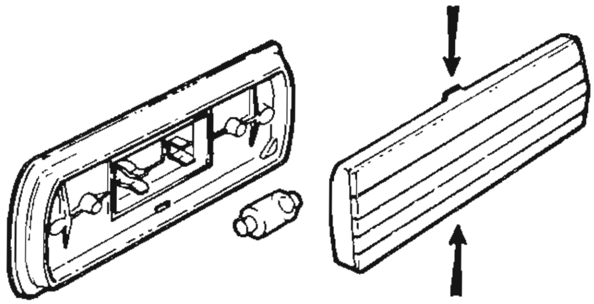
60426

INTERIOR LIGHTING SYSTEMS

Courtesy Lamps/Dome Lamps

CJ and Scrambler models equipped with a hardtop have a dome lamp located above the liftgate. When removing the hardtop, disconnect the wire connector located on the left C-pillar. On the CJ-7 limited model, the dome lamp and courtesy lamps are operated by door pillar switches. On all other models, the lamp is operated by turning the headlamp switch knob counterclockwise to the stop.

The dome lamp lens can be removed by squeezing the lens together to disengage the retaining tabs. The dome lamp assembly can be removed after removing the attaching screws.



841265

Instrument Cluster Lamps

The instrument cluster lamps are covered under Engine Instrumentation section.

SWITCHES

Headlamp Switch

Replacement

Disconnect the harness connector plug (1) from the switch.

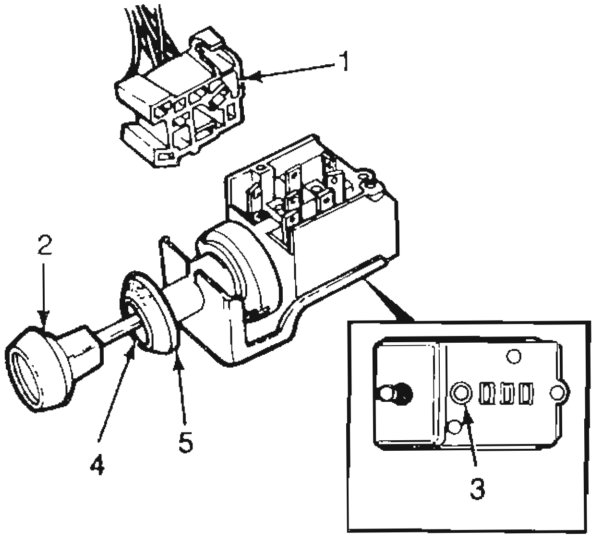
Pull the control knob (2) out to the second position.

From behind the instrument panel, depress the knob release button (3) and pull the knob out of the switch.

Remove the retaining nut (4) and chrome bezel (5).

Remove the switch through the rear of the instrument panel.

When installing the switch, make sure the harness connector plug on the switch is secure.



841254

Dimmer Switch

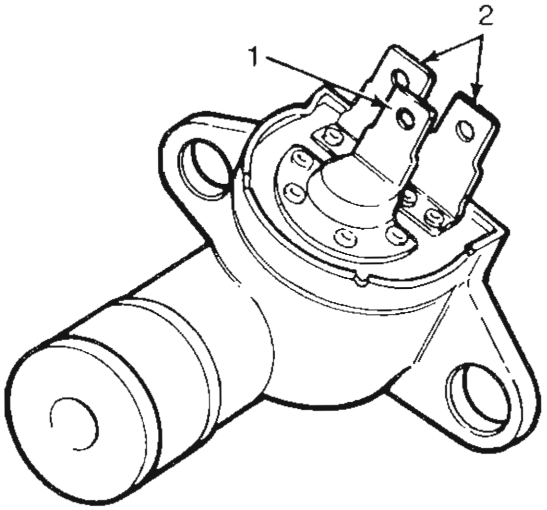
Replacement

Remove the harness plug from the switch.

Remove the screws attaching the dimmer switch to the floorboard.

Remove the switch.

Check the operation of the dimmer switch with Continuity Lamp J-21008. Connect one continuity lamp lead to the switch input terminal (1). Probe each output terminal (2) with the other continuity lamp lead. The current flow should alternate from one output terminal to the other as the switch is operated.



841255

Directional Signal Switch

The most frequent causes of failure in the directional signal system are loose connections and burned out bulbs. A flashing rate approximately twice the normal rate usually indicates a shorted bulb is in the circuit.

If a three-lamp flasher is installed in a vehicle having only two lamp bulbs per side, the lamps will light but will not flash. If a two-lamp flasher is used on a vehicle having three lamps, 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.

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

If the fuse checks okay, substitute a known good flasher. If a new flasher does not cure the problem, check the signal system wiring connections at the fuse and at the steering column connector.

NOTE: If the brake stoplamps function properly, the rear signal bulbs are okay.

The directional flasher is mounted directly to the fuse panel.

Switch Removal

Disconnect the battery negative cable.

Remove the horn center button by pulling straight out.

Remove the screws, bushing, receiver and spring.

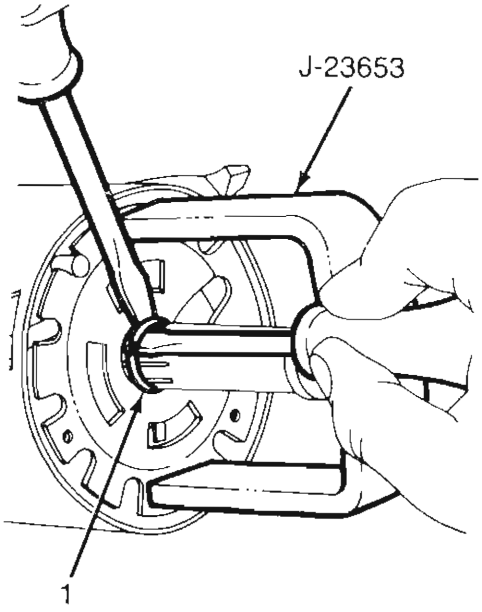
Remove the steering wheel nut. Note the alignment of the steering wheel to the steering shaft index marks for later installation.

Remove the steering wheel with Steering Wheel Puller J-21232-01.

Lift the lock plate cover.

Use Lock Plate Compressor Tool J-23653 to depress the lock plate.

Pry the round wire snap ring (1) from the steering shaft groove.



840282

Remove the lock plate compressor tool, snap ring, lock plate, directional signal canceling cam, upper bearing preload spring and thrust washer from the steering shaft.

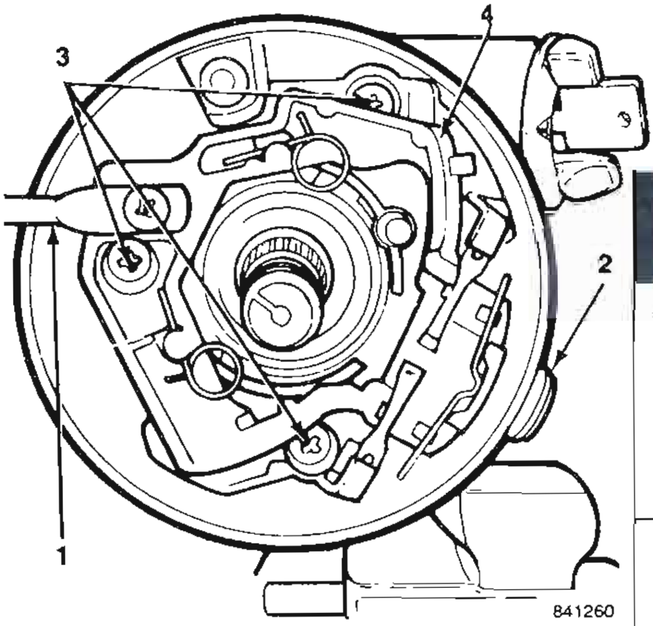
Place the directional signal actuating lever (1) in the right turn position and remove the lever retaining screw.

Depress the hazard warning light switch (2), located on the right side of the column adjacent to the key lock, and remove the button by turning in a counterclockwise direction.

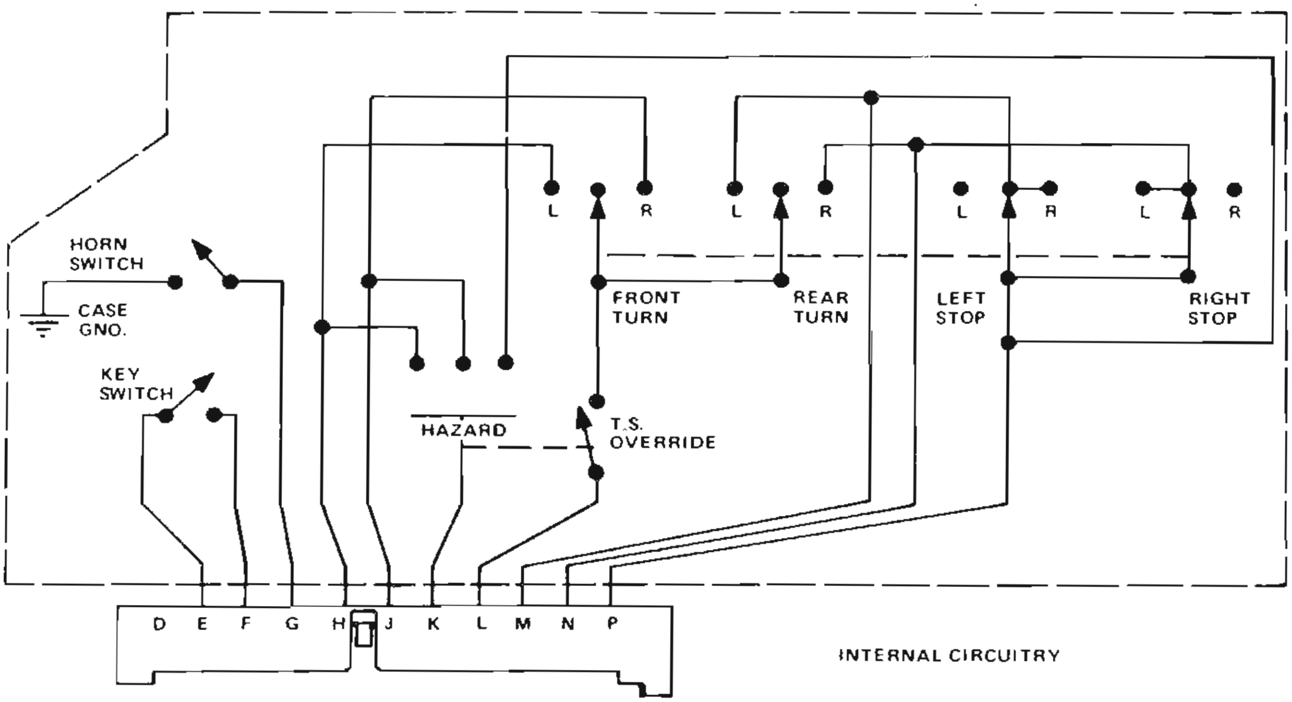
Remove the directional signal wire harness connector block from its mounting bracket on the right side of the lower column.

NOTE: On vehicles equipped with an automatic transmission, use a stiff wire, such as a paper clip, to depress the lock tab which retains the shift quadrant lamp wire in the connector block.

Remove the directional signal switch retaining screws (3) and pull the directional signal switch (4) and wire harness from the column.



SEE I.S. NOTES



INTERNAL CIRCUITRY

70465

Switch Installation

Guide the wire harness into position and carefully align the switch assembly.

NOTE: Assure that the actuating lever pivot is correctly aligned and seated in the upper housing pivot boss prior to installing the retaining screws.

Install the directional signal lever and actuate the directional signal switch to assure correct operation.

Place the thrust washer, spring, and directional signal canceling cam on the upper end of the steering shaft.

Align the lock plate splines with the steering shaft splines and place the lock plate in position with the directional signal canceling cam shaft protruding through the dogleg opening in the lock plate.

Install the snap ring.

Install the lock plate cover.

Install the steering wheel. Align the mark on the steering wheel with the previously noted mark on the housing.

Install the washer and nut. Tighten the nut with the specified torque.

Install the spring. The raised side of the spring must be up.

Install the receiver and bushing. The receiver must be free to move after the bushing screws are tightened.

Line up the notch on the receiver with the nib on the horn button. Push the button in until it snaps into place.

Backup Lamp Switch

Switch Adjustment and Replacement – Manual Transmission

The backup lamp switch is threaded into the right rear corner of the transmission cover housing. The backup lamp switch is actuated by the reverse shift rail.

The backup lamp switch is not serviceable or adjustable and must be replaced as a unit.

NOTE: Jumper wires are used at the neutral safety switch connector and the automatic transmission backup lamp switch connector to complete the circuit on vehicles equipped with manual transmission.

Switch Adjustment and Replacement – Automatic Transmission

A combination backup and neutral safety switch is mounted on the steering column. This switch is adjustable. If defective, the switch must be replaced.

To adjust the backup lamp switch, place the transmission shift lever in the R position. Loosen (do not remove) the two switch attaching screws. 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 N and P positions. The engine must not start in the R, D, 2 or 1 position.

SEE
I.S.
NOTES

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.

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.

The four-way flasher can only be canceled by pulling out on the flasher switch knob.

Refer to Directional Signal Switch for the four-way flasher switch removal or replacement procedure.

The battery feed for the four-way flasher system is in the fuse panel.

Stoplamp Switch

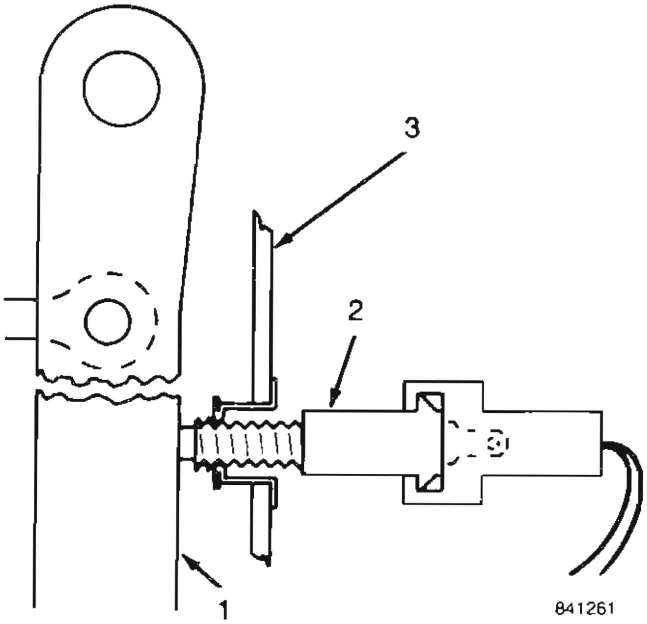
Adjustment

Depress the brake pedal (1) and hold in the depressed position.

Push the stoplamp switch (2) completely into the mounting bracket (3) until the switch bottoms.

Release the brake pedal and allow it to return to the undepressed position. The brake pedal will push the switch to the properly adjusted position.

Check the switch operation. The stoplamps should operate after 9.53 - 15.88 mm (3/8 - 5/8 in) of pedal travel.



Stoplamp Switch Electrical Test

This test requires a voltmeter.

Ground one lead of the voltmeter.

Probe each connection of the stoplamp switch with the other lead of the voltmeter.

- with the switch plunger depressed (brake not applied), one switch connector should indicate voltage and the other should not
- with the switch plunger released (brake applied), both switch leads should show voltage

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-21008	Continuity Lamp		■

WIRING HARNESS COMPONENTS

Main Harness Connector

All models have a main wiring harness connector 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. 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. Do not use string-type body caulk as a sealer.

Fusible Links

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.

They are used to prevent major harness damage in the event a short circuit, short to ground or overload condition occurs.

CJ and Scrambler models are equipped with fusible links, located in the engine compartment.

Each link is of a fixed value for the specific load. Replacement links are listed in the parts catalog.

NOTE: 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 Replacement

Disconnect the battery negative cable.

Follow one end of the link to the terminal end. Follow the remaining end to the wire harness.

Remove the harness tape approximately 5 cm (2 in) from where the link enters the harness; the soldered splice will be visible.

Determine which circuit(s) may have caused the failure. Test the circuit(s) using an ohmmeter or test light until the ground condition is located and corrected.

Unsolder the link from the harness; solder the replacement link to the harness wire(s).

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

SEE I.S. NOTES

Tape the harness using plastic electrical tape.

Route the wire as originally installed and make the connection.

Connect the battery negative cable and check the operation of the circuit(s) involved.

IGNITION SWITCH

The ignition switch is mounted on the steering column and is connected to the key lock assembly by a remote lock rod.

Removal

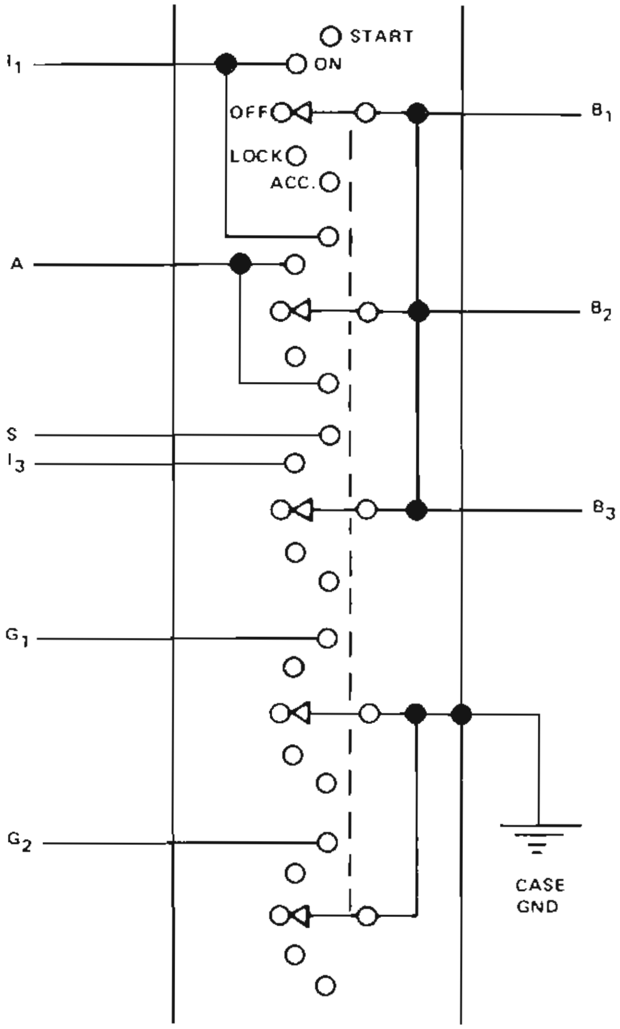
Place the key lock in the OFF – LOCK position and remove the two switch attaching screws.

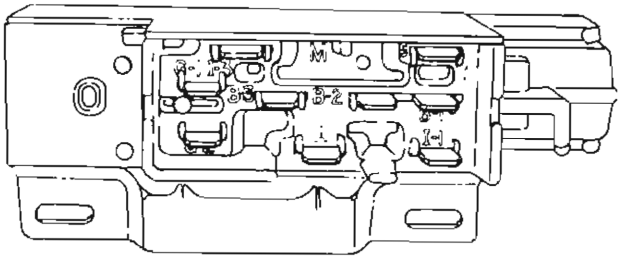
Disconnect the switch from the remote rod.

Disconnect the harness connector and remove the switch from the steering column.

Testing

The ignition switch terminals are shown in the illustration.





60140

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.

The ignition switch slide bar positions can be easily identified by first locating the alignment hole located in the flat portion of the switch adjacent to the terminals. Starting from the alignment hole end of the 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 release when the key is released.

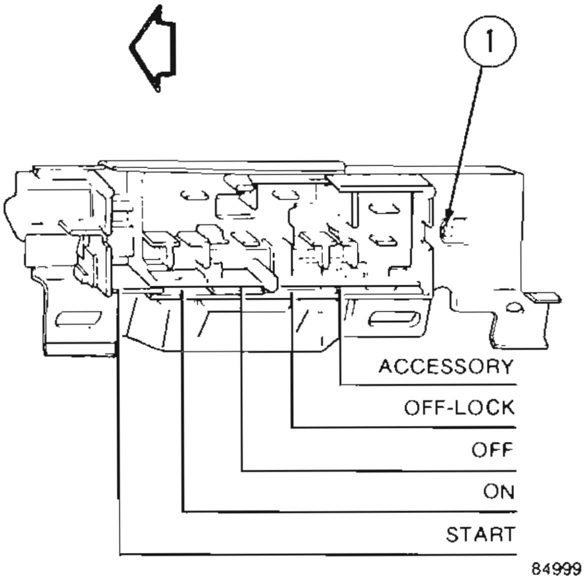
No electrical resistance should be indicated (test lamp on) between two connected terminals. The maximum voltage drop between any two connected terminals should not exceed 12.5 millivolts per amp. For example: If a 10-amp load is drawn through the switch, the maximum voltage drop should be 10 x 0.0125 or 0.125 volt.

Installation – Standard Column

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) and install the switch to the steering column, being careful not to move the slider out of the detent.



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 and then the black connector to the switch.

Install the steering tube cover.

Installation – Tilt Column

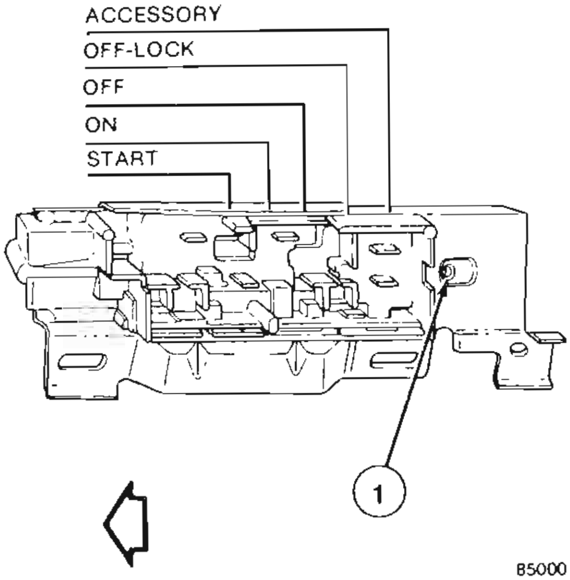
With the actuator rod disconnected, position the switch as shown in the illustration.

SEE I.S. NOTES

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 in the slider hole (1).



85000

Install the 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 the lash in the actuator rod, while holding the key in the ACCESSORY position. Be careful not to move the slider out of the detent.

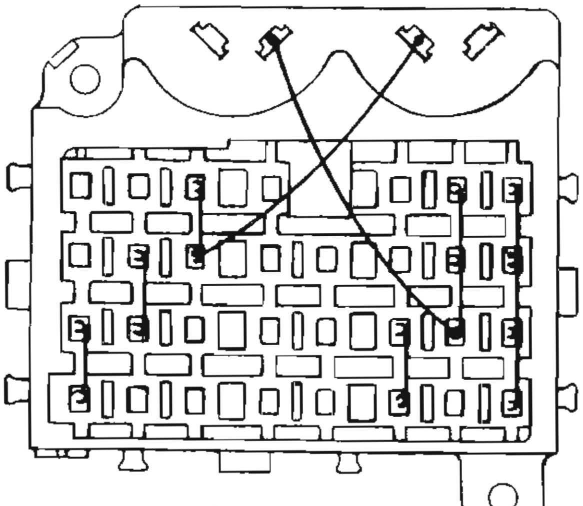
Tighten the attaching screws securely.

Connect the white connector and then the black connector to the ignition switch.

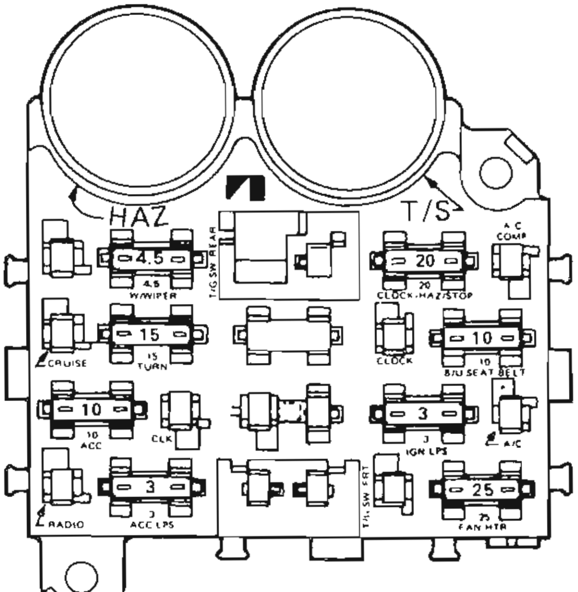
Install the steering tube cover, if removed.

FUSE PANEL

The fuse panel is located on the passenger compartment side of the dash panel, attached to the main harness connector.



REAR VIEW



FRONT VIEW

90199

CIRCUIT BREAKERS

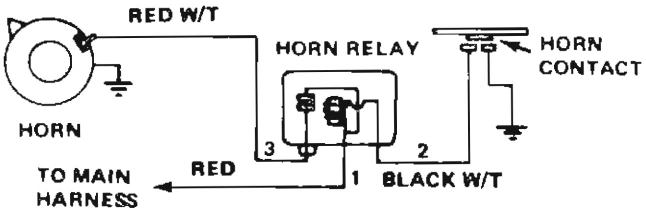
Headlamps are protected by a 24-amp circuit breaker located in the headlamp switch.

GENERAL

The horn circuit includes the horn(s), horn relay, battery, steering column wiring harness, horn ring, and the body sheet metal.

CJ and Scrambler horns are located on the inner left wheelhouse.

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.



80264

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-21008	Continuity Lamp		■

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)

SEE 1.S. NOTES

SPECIFICATIONS

Item	Current Flow
Horn	4-5 Amps

70446

DIAGNOSIS AND REPAIR

In case of horn system failure, proceed as follows.

Using a test light or voltmeter, check for battery voltage in the red lead to relay before the individual components are tested or replaced.

A lack of voltage indicates that the fusible link or harness is open and the cause of the failure must be determined and repaired prior to installing a replacement fusible link or other components.

The replacement fusible link is supplied in the proper length with a terminal connector on one end.

Inspect the wiring between the horn, relay and battery for loose connections, faulty insulation, corroded terminals, or an improper ground connection at the horn base.

NOTE: Be sure the clip on the horn assembly bracket cuts through the inner wheelhouse to ensure a good ground.

If the horn does not operate when the ring or button is depressed, ground the No. 2 terminal of the horn relay with a jumper lead. If the horn operates, this indicates proper operation of the horn and relay.

Inspect the horn ring switch and the wire from the switch to relay carefully for the source of the trouble.

CAUTION: Do not ground the red lead.

If the horn does not operate, ground the No. 2 terminal and connect a jumper lead from the horn relay terminals 1 to 3.

If the horn now operates, a faulty horn relay is indicated.

If it does not operate, check the wiring and connections between the horn relay terminal No. 3 and the horn for continuity.

Connect a jumper lead from the horn base to the vehicle chassis or engine and repeat the above tests.

If the horn now operates, remove the attaching screw, horn and mounting bracket; clean the mating surfaces.

Install the horn, mounting bracket and attaching screw; tighten the screw with 20 N·m (15 ft-lbs) torque.

If the horn still does not operate, the horn is inoperative and must be replaced.

To check for a bad component ground, place a voltmeter between the component and the ground. If a sizeable voltage is shown on the meter, repair the poor ground connection.

Continuous horn operation is usually caused by an improper ground in the horn ring or button wiring.

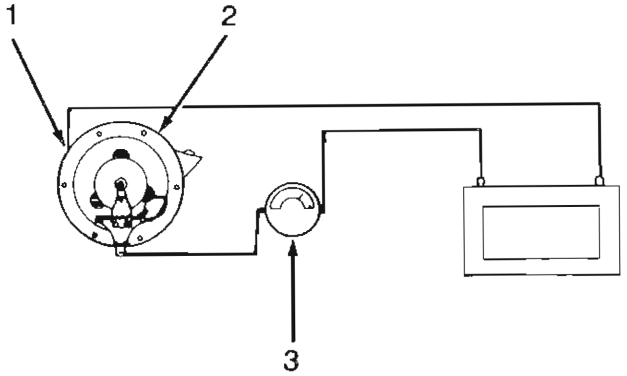
ADJUSTMENT

Adjust the current by turning the adjusting screw counterclockwise to decrease the current until the specified current is reached. Current adjustment is very sensitive. Therefore, care must be taken not to turn the horn adjustment screw too far. Turn the screw only 1/10 of a turn at one time.

Check for normal battery voltage (about 12.6 volts).

Connect an ammeter series between the horn and battery and read the current as shown in the illustration.

Adjust the current to 4.5 amps.



1. Ground
2. Horn
3. Ammeter

A42233

NOTE: Do not stuff rags or other materials in the horn protector to muffle the sound while adjusting, as this changes the vibration frequency and would give a raise in the current setting. When adjusting a set of horns, each horn should be connected and adjusted separately. Then check for tone by operating them as a pair.

SEE
I.S.
NOTES

GENERAL

All CJ and Scrambler models are equipped with a two-speed, electric wiper motor.

The motor is mounted on the lower left corner of the windshield.

SEE I.S. NOTES

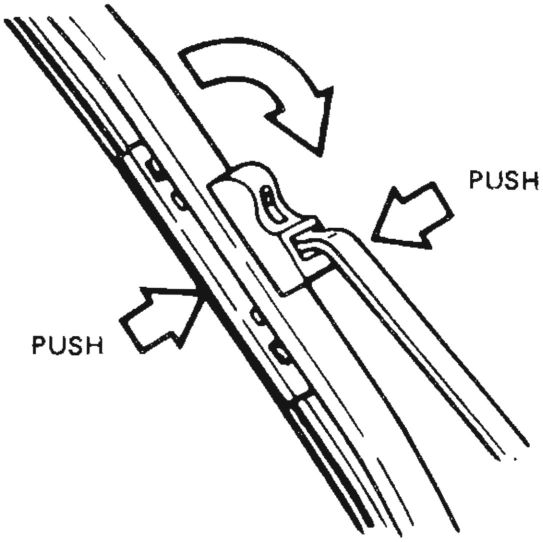
SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-21008	Continuity Lamp		■
J-22128	Remover Tool		■

WIPER BLADE REPLACEMENT

The wiper blade assembly is removed from the wiper arm by holding the blade away from the windshield, and pushing it firmly against the tip of the arm to compress the locking spring and disengage the retaining pin. At the same time, pivot the blade clockwise to unhook it from the end of the arm.

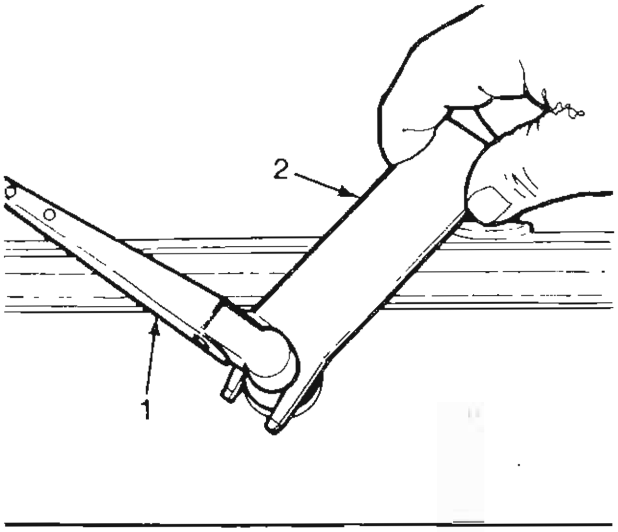
To install, place the blade assembly on the wiper arm and snap the blade assembly into position.



86383

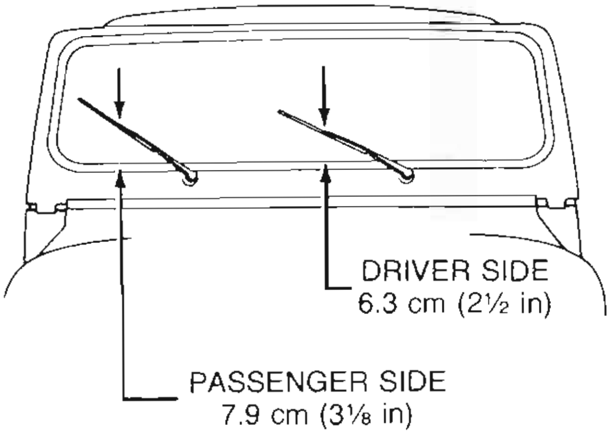
WIPER ARM REPLACEMENT

Remove the windshield wiper arm (1) from the pivot shaft body with Remover Tool J-22128 (2).



841294

To install, push the wiper arm over the pivot shaft. Be sure the pivot shaft is in the Park position and the wiper arm is positioned correctly on the windshield.



841295

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.

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.

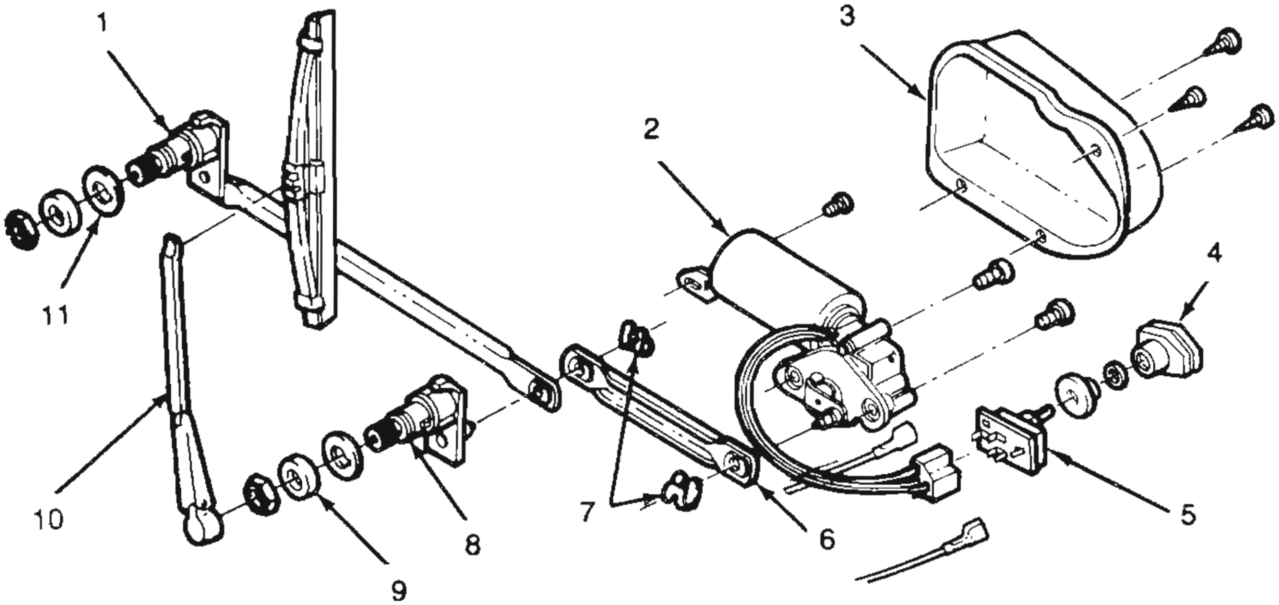
Raise the windshield to the upright position and install the left and right windshield holddown knobs.

Install the nuts attaching the pivots to the windshield frame.

SEE I.S. NOTES

Install the left and right wiper arms.

Install the necessary top components on the windshield frame.



1. Pivot Shaft and Arm
2. Crank and Motor
3. Motor Cover
4. Control Knob
5. Switch
6. Drive Link
7. Clips
8. Pivot Shaft
9. Escutcheon
10. Wiper Arm
11. Gasket

841292

CONTROL SWITCH

The control switch is mounted on the instrument panel. The switch is a through-type multi-position switch which does not require grounding for proper operation.

The two-speed wiper motor is energized for continuous wiping action by turning the control knob in a clockwise direction.

The electric washer pump is operated by depressing the wiper control knob.

Removal

On models with air conditioning, remove the screws attaching the evaporator assembly to the instrument panel and lower the evaporator assembly.

Remove the wiper control knob.

Remove the nut and switch.

Mark the wire color locations on the switch and disconnect the wires.

Installation

Connect the wires to the switch, in the proper location as noted previously.

Position the switch in the instrument panel and install the attaching nut.

Install the control knob.

Install the evaporator assembly, if removed.

Diagnosis

The wiper motor may be operated independently of the switch to aid in determining defective components.

NOTE: The wiper motor must be grounded for proper operation and during all wiper tests.

With the ignition switch on, check for 12-volts at the switch terminal B. If the 12-volt test lamp lights but the wiper motor does not operate, connect a jumper wire from the ground strap on the motor to a good body ground. If the motor still does not operate, disconnect the wiring from the switch. Using a jumper wire, connect switch terminals 2 and B. This connection should give low speed operation. If the wiper motor does not operate in low speed, there is an open in the green wire, a defective internal motor connection or a stuck low speed brush.

To obtain high speed, connect a jumper wire between terminals 3 and B. If the wiper motor fails to operate, there is an open in the red wire, a defective internal motor connection, or a stuck high speed brush.

With the wiper blades in a position other than Park, connect a jumper wire between terminals 1 and B. The wiper blades should run on low speed and stop in the Park position. If the motor does not run after making the jumper connection, there is an open in the black wire, a defective internal motor connection, a misaligned or damaged set of contact points or a bad connection through the park point set to the low speed brush. If the wiper motor runs but does not park, the cam on the drive gear is not sufficiently breaking the contact points.

If wiper motor operation is intermittent, a defective solder joint, wiring connection, body ground or worn brush may cause the condition.

SEE I.S. NOTES

SEE I.S. NOTES

INTERMITTENT WIPERS

Switch

Removal

On models with air conditioning, remove the screws attaching the evaporator assembly to the instrument panel and lower the evaporator assembly.

Remove the wiper control knob.

Remove the slotted trim nut on the front of the switch.

Push the switch through the instrument panel, disconnect from the harness and remove the ground wire strap at the instrument cluster attaching stud.

Installation

Connect the ground strap to the instrument cluster attaching stud. Connect the switch to the harness and push the switch through the instrument panel.

Install the slotted trim nut on the front of the switch and tighten.

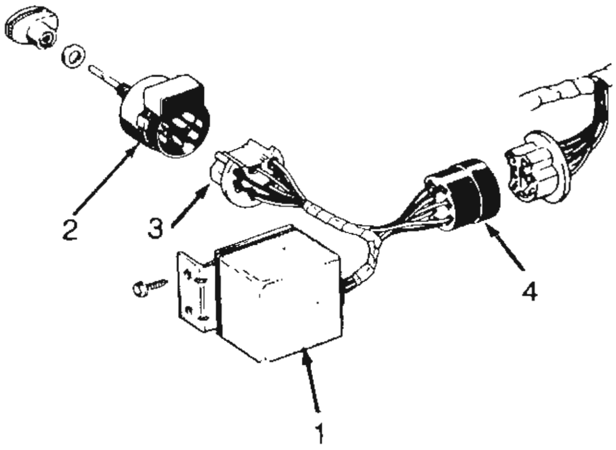
Align the control knob and push on the shaft.

Install the evaporator assembly, if removed.

Intermittent Governor

To check the intermittent governor accurately requires electronic testing equipment. However, if the intermittent wipe cycle is not satisfactory, check the related components such as the motor, control switch and connecting wires. If all components function properly, install a new governor.

The electronic governor assembly (1) is contained in a 5-cm (2-in) cube which is attached to an instrument panel bracket adjacent to the wiper control switch (2). The 15.2-cm (6-in) governor lead (3) plugs into the wiper control switch and the shorter , 10.1-cm (4-in) lead (4) plugs into the instrument panel harness.



86388

WIPER MOTOR

The wiper motor is protected by a 4.5-amp circuit breaker in the fuse panel.

Removal

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.

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.

WASHER PUMP

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 ground wire. It is energized by a yellow feed wire from the single blade terminal on the control switch.

SEE I.S. NOTES

COMPON

NAME	LOCATION ON VEHICLE	DIAGRAM Z
A/C Blower Motor	In A/C evaporator/blower under I/P	21F
A/C Blower Resistor	In A/C evaporator/blower under I/P	21E
A/C Blower Switch	In A/C evaporator/blower under I/P	21D
A/C Compressor Clutch	In compressor RH side of engine	21E
A/C Thermostat Control	In A/C evaporator/blower under I/P	21E
Air Lamp	Behind I/P LH center	14B
Alternator	RH side of engine	2A
Anti-Diesel Delay Relay	LH rear engine compartment	6A
Anti-Diesel Relay	LH rear engine compartment	6B
Back Up Lamp Switch	In transmission LH side	10B
Battery	RH rear corner of engine compartment	1A, 3A
Bowl Vent Solenoid	LH side of engine at front	7C
Brake Warning Indicator Switch	LH side of engine compartment on brake valve	15C
Choke Heater	In carburetor LH side of engine	5C, 11C
Choke Relay	RH front of engine compartment	4B
Choke Switch	RH side of engine	10B
Cigar Lighter	On I/P center	26E
Clock	On I/P LH side	26D
Closed Throttle Relay	Center rear engine compartment	6A
Closed Throttle Resistor	In electronic engine control harness	6B
Closed Throttle Switch	LH side of engine in carburetor	6B
Clutch Switch	Above clutch pedal	7B, 23D
Coolant Temperature Switch	LH rear side of engine	7B, 13B
Courtesy Lamps	Under I/P at RH and LH ends	25E
Cruise Fuse	Above brake pedal in harness	23E
Cruise Regulator	Under I/P at LH end	22E
Cruise Servo	In engine compartment	23E
Cruise Switch	LH side of steering column	23E
Defroster Lamp	Behind I/P LH center	14B
Diagnostic Connector D1	RH rear engine compartment	5A
Diagnostic Connector D2	RH rear engine compartment	4A
Dimmer Switch	Inside car on floor LH side	28E
Diode Assy.	Center rear engine compartment	6C, 11C
Distributor	RH side of engine	3B, 9C
Door Switches	In door jambs	25E
Downstream Solenoid	LH wheelhouse panel (4-cylinder)	6A, 11B
Electronic Control Unit	Under RH side of I/P	5B-8B, 11E 13B
Fan Lamp	Behind I/P LH center	14B
Fog Lamp Reley	RH wheelhouse panel neer blower motor	27E
Fog Lamp Switch	Below instrument panel LH side	28E
Four-Wheel Drive Indicator Switch	In transfer case	15C
Fuel Gauge	In instrument cluster	16B
Fuel Gauge Sender	In fuel tank LH side under car	16C
Fuse Block	Under RH side of I/P	10B, 10A, 21D, 23
Fuse Link A	RH front of engine compartment	2A, 4A
Fuse Link B	RH front of engine compartment	2A
Hazard Flasher	On fuse block	30D
Heater Blower	RH front side of dash	22E
Heater Blower Resistor	In heater on dash et center	22E
Heater Blower Switch	On I/P LH center	22E
Horn	Front of engine compartment	31E
Horn Relay	Under I/P LH side	32E
Idle Reley	Center rear engine compartment	5C, 11C
Idle Solenoid	LH wheelhouse panel (4-cylinder)	6A, 11B
Ignition Coil	RH side of engine	10C
Ignition Module	RH side of engine compartment	3C, 9C
Ignition Switch	RH side of steering column	16A
Instrument Cluster	On I/P center	28F
Intermittent Wiper Governor	Behind wiper switch	20E
Knock Sensor	LH rear side of engine	7B
Light Switch	On LH side at I/P	28E
Light Switch Lamp	Behind I/P LH end	14C
Low Freon Switch	RH side of engine in refrigerant line	21D
Manifold Heater	LH rear of engine in inteke manifold	4C
Manifold Heater Relay	Center reer engine compartment	4C, 10C
Manifold Heater Switch	LH rear of engine	5C, 10C
Marker Lamps	Front of vehicle	29F
Mixture & Control Solenoid	LH side of engine	7A
Multi-Function Switch	LH side of steering column	23D, 30E

NT LOCATIONS

E

NAME	LOCATION ON VEHICLE	DIAGRAM ZONE
Neutral Safety Switch	In transmission LH side	4C, 10C
Oil Pressure Gauge	On I/P RH center	15B
Oil Pressure Sensor	RH side of engine	15C
Oxygen Sensor	Rear of engine on exhaust manifolo	6C, 12C
Parking Brake Switch	LH side under I/P	15B
P.C.V. Shutoff Solenoid	LH side of engine	7B, 12B
Power Steering Pressure Switch	LH front of engine compartment	5C
Radio	On I/P RH center	25F-27F
Resistance Wire (15.0 ohms)	In engine harness at alternator	3A
Solenoid Vacuum	LH side of engine on carburetor	6C, 12C
Speed Sensor	In speedometer cable	23E
Starter Solenoid	RH side of engine compartment	9B
Starter Motor	Lower rear of engine	3B, 9B
Stepper Motor	LH side of engine in carburetor	12B
Stop Lamp Switch	Above brake pedal	23D, 30D
Tachometer	On I/P LH center	16B, 27D
Temperature Gauge	In instrument cluster	16B
Temperature Lamp	Behind I/P LH center	14B
Thermal Electric Switch	LH rear side of engine in air cleaner	7B
Turn Flasher	On fuse block	30D
Turn Lamps	On fuse block	29F
Turn Signal/Hazard/Horn Switch	LH side of steering column	29D
Up-Shift Switch	In transmission LH side	17B
Upstream Solenoid	LH wheelhouse panel (4-cylinder)	5B
	Rear top of engine (6-cylinder)	11B
Vacuum Switch	Center rear of engine compartment	8B
Voltmeter	On I/P RH center	16B, 15B
Washer Pump	In washer fluid reservoir	19D
Wide-Open Throttle (WOT) Switch	LH side of engine in carburetor	7B
Wiper Motor	LH front side of dash	18E
Wiper Switch	On I/P right of steering column	19E
Wiper Switch Lamp	Behind I/P LH center	14F

CONNECTOR LOCATIONS

See In-Line Connector Views on reverse side of this page (single pin connectors not shown).

CONNECTOR NO.	LOCATION ON VEHICLE	DIAGRAM ZONE
C100	Lower LH side of dash behind fuse block	1A, 4A, 3B, 4B, 6A, 10B, 15B, 16B, 17B, 19E, 21D, 22E, 24E, 25D, 29F, 28E, 29E, 31E
C102	Under LH side of I/P near fusa block	24F, 29E, 31E
C103	Under LH side of I/P near fuse block	25D, 25E
C108	Under LH side of I/P above fuse block	20E, 28E
C110 (Single Pin)	Under LH side of I/P	25D
C111 (Single Pin)	Under LH side of I/P	25E
C120 (Single Pin)	Under I/P near steering column	4B, 10B
C132	On LH "C" pillar	26E, 26D, 26E
C134 (Single Pin)	Under car at rear LH	16B
C142 (Single Pin)	Front of dash at center	25D
C143	Front of dash at center	5C, 5B, 11B, 11C
C146	Front of dash RH side	3B, 9B, 15B, 24E
C151 (Single Pin)	RH side of engine near coil	4C
C158	Front of dash LH side	15B, 15C
C161 (Single Pin)	Front LH bahind headlamp	28F
C166	Front LH behind bumper	28F
C167	Front RH behind bumper	27F
C187	Front of dash RH side	17B
C202 (Single Pin)	RH side of engine at front	21E
C222 (Single Pin)	Under LH side of I/P near fuse block	26D, 27D

.0D

CIR

Air Co
Blowe
Charg
Cruise
EEC -
EEC -
Fog L
Fuse I
Groun
Hazar
Headl
Horn
Instru
Instru
Interio
Park L
Radio
Stop L
Tacho
Turn
Wiper
Wiper

CIRCUIT INDEX

CIRCUIT	ZONE
Air Conditioning	21
Blower Controls	22
Charging System	1-2
Cruise Control	23
EEC — 6-Cylinder	5-8
EEC — 4-Cylinder	9-13
Fog Lamps	28
Fuse Block Details	1-3
Ground Distribution	32-33
Hazard Lamps	30
Headlamps	28
Horn	31-32
Instrument Cluster	14-17
Instrument Panel Illumination	14-17
Interior Lamps	25-26
Park Lamps	29
Radio (Stereo)	25-27
Stop Lamps	30-31
Tachometer	16, 27
Turn Lamps	29
Wiper/Washer (Intermittent)	19-20
Wiper/Washer (Standard)	18

HARNESS CODES

CODE	HARNESS
A	Engine Forward Lamp
B	Engine
C	Electronic Engine Control
D	Instrument Panel
E	Body Lamps
R	(Miscellaneous Engine Compartment)
R6	Fog Lamps
R9	Low Freon
R10	Alternator Jumper
R11	Brake Warning
S	(Miscellaneous Instrument Panel)
S1	Courtesy Lamp
S3	Windshield Wiper
S5	Cruise Control
S7	Fog Lamps
S8	Radio Jumper
S10	Clock/Tachometer
S11	A/C Control
T	(Miscellaneous Body)
T5	Fuel Sender

WIRE COLOR CODES

CODE	COLOR	CODE	COLOR
BLK	Black	PNK	Pink
BLU	Blue	RED	Red
BRN	Brown	VIO	Violet
GRN	Green	WHT	White
GRY	Gray	YEL	Yellow
ORN	Orange		

GROUND LOCATIONS

For details see Ground Distribution on reverse side of this page.

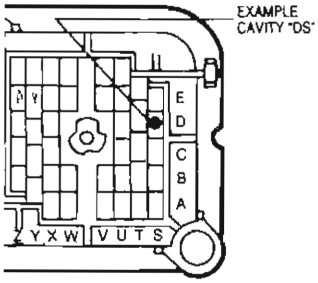
GROUND NO.	LOCATION ON VEHICLE	DIAGRAM ZONE
G1	Underhood near battery	1A, 3A, 9A
G100		
G101	Underhood near LH headlamp	28F
G102	Underhood near LH headlamp	28F
G103	Underhood near RH headlamp	28F
G104	Under I/P LH side	27E, 32E
G105	Front of dash at center	5C
G106	Underhood RH side near coil	8B, 33E
G107	Underhood RH side near coil	13C
G108	Underhood RH side near coil	10C
G110	Under I/P LH side	26E
G111	Under I/P LH side	27E
G112	Under car LH rear	16C

IN-L

CAVITY	INST. PANE
AW	V10 W/T
AX	LT BLU
BS	BLACK
BU	BLACK
BW	RED W/T
BX	BRN
BY	RED W/T
BZ	V10
CS	ORN
CX	RED
CY	LT BRN
CZ	RED
DA	YEL
DY	ORN
DZ	WHT W/
ES	GRN W/T
ET	GRY
EU	RED W/T
EV	GRY W/T
EY	RED
EZ	ORN
FU	WHT
FV	GRN
FW	V10
FX	ORN

IE CONNECTORS

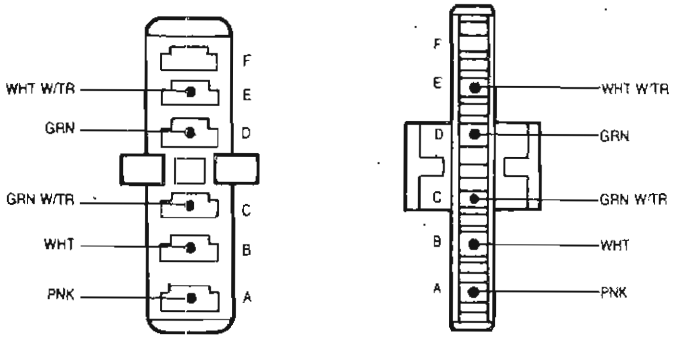
C100



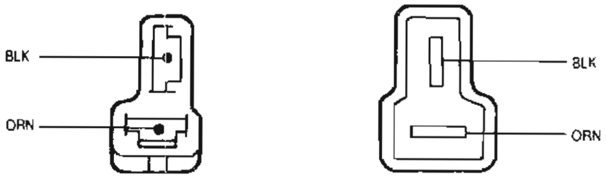
VIEWED FROM DASH PANEL

ENGINE	FUNCTION
V10 W/TR	ENGINE TEMPERATURE
LT BLU	START
BLACK	BRAKE WARNING
BLACK	BRAKE WARNING
RED W/TR	IGNITION FEED
BRN	A/C COMPRESSOR
	HEADLAMP ON
V10	ENGINE OIL PRESSURE
ORN	FOG LAMP FEED
RED	ELECTRONIC ENGINE CONTROL FEED
LT BRN	HEATER BLOWER MOTOR FEED
RED	FUSED IGNITION ON FEED
YEL	WINDSHIELD WASHER PUMP FEED
ORN	UNDERHOOD LAMP FEED
WHT W/TR	BACKUP LAMP FEED
GRN W/TR	LH FRONT TURN LAMP FEED
GRY	LH HEADLAMP LO BEAM FEED
RED W/TR	HORN FEED
GRY W/TR	LH HEADLAMP HI BEAM FEED
RED	BATTERY FEED
ORN	4-WHEEL DR IND LAMP
WHT	PARK AND MARKER LAMP FEED
GRN	RH FRONT TURN LAMP FEED
DK GRN	TACHOMETER COIL SIGNAL
	EMISSION MAINT. LAMP

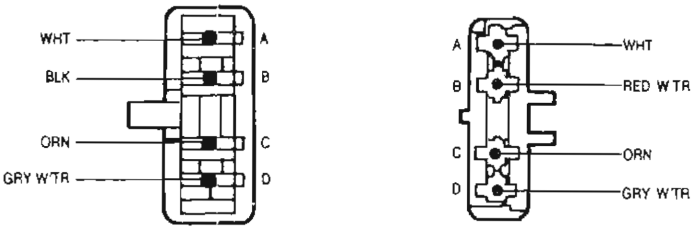
C102



C103



C106

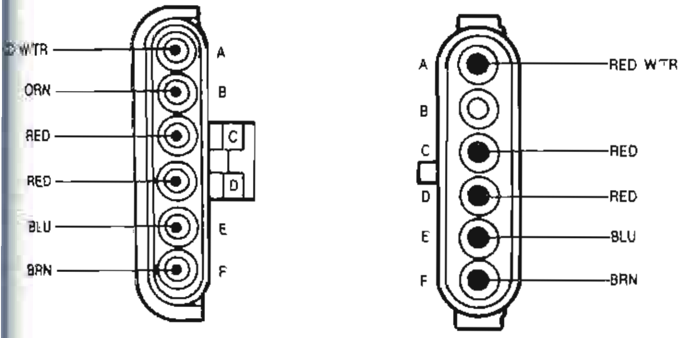


C123

C132

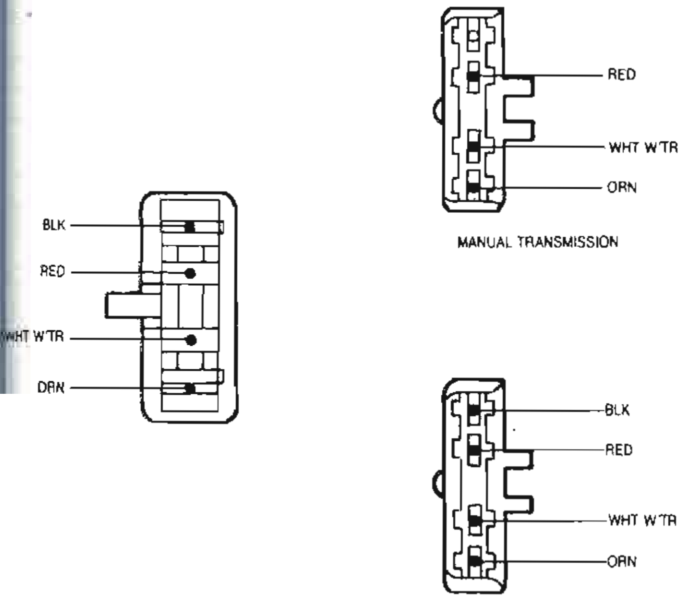
C158

C143



C166

C146

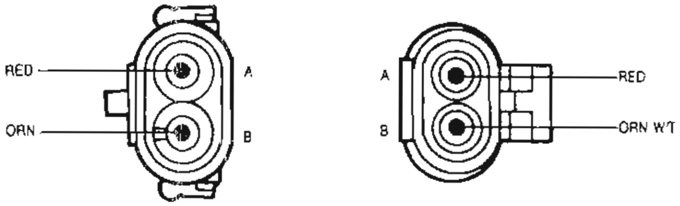


MANUAL TRANSMISSION

AUTOMATIC TRANSMISSION

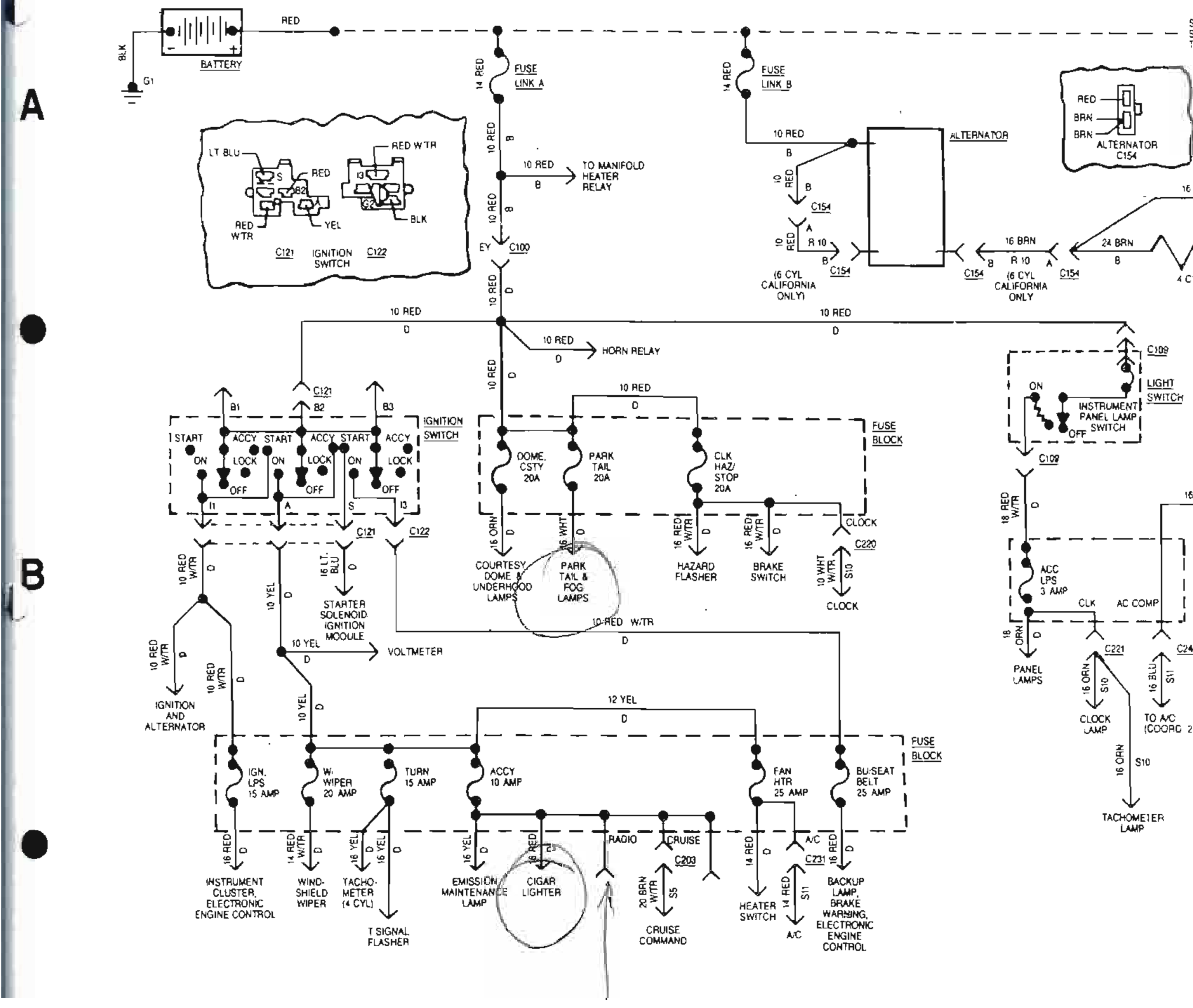
C167

C187

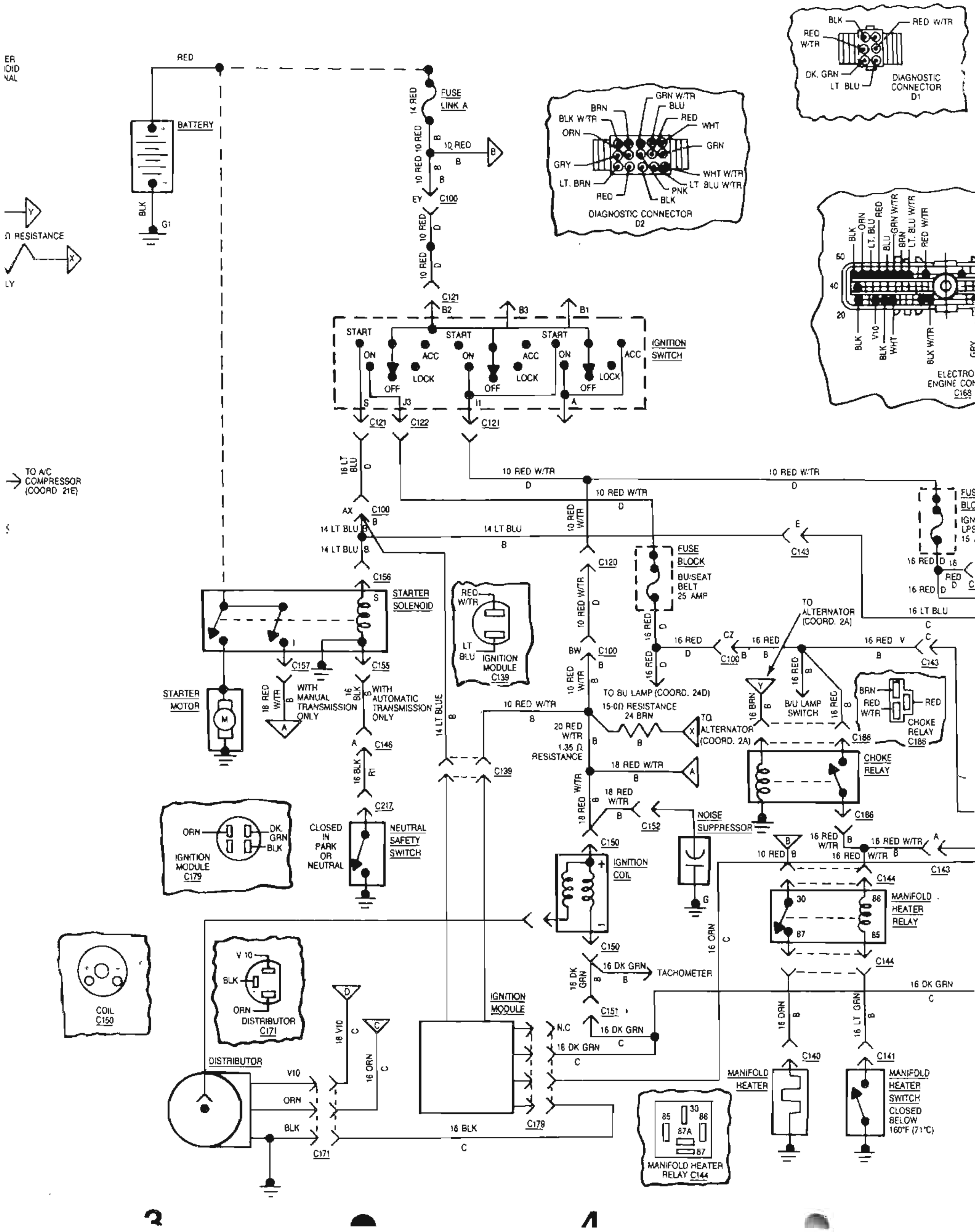


4-CYLINDER

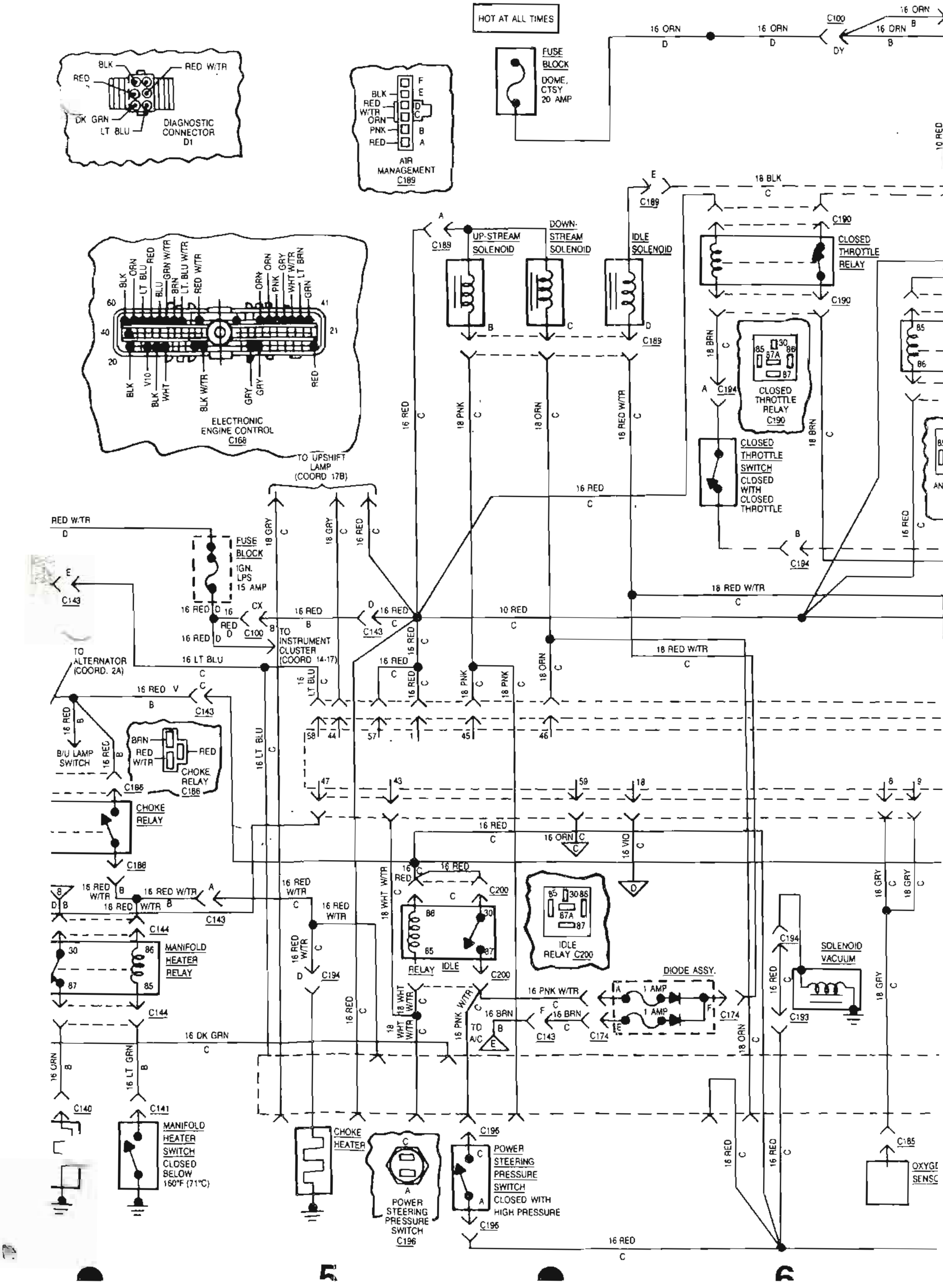
BATTERY POWER DISTRIBUTION CHARGE

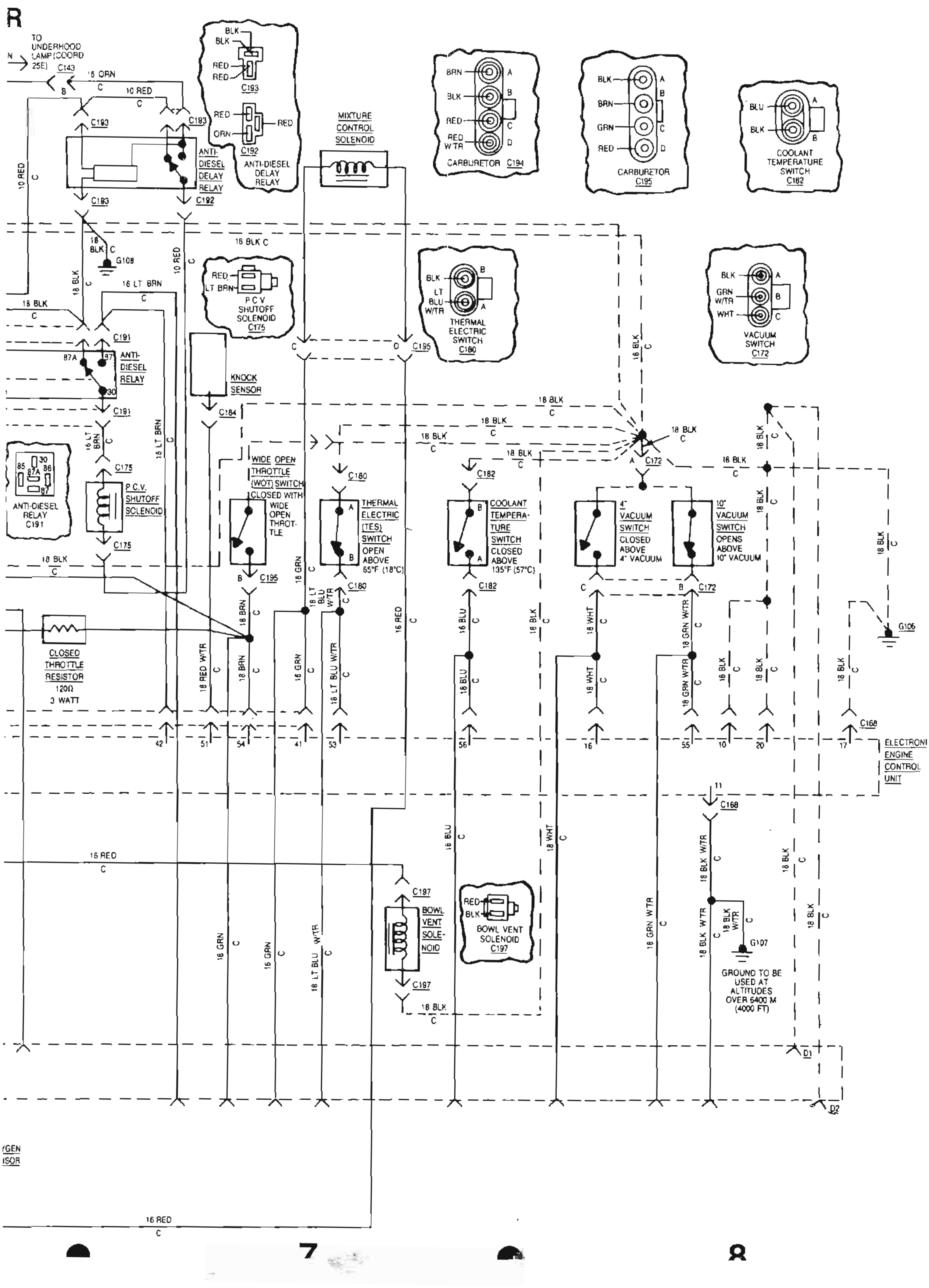


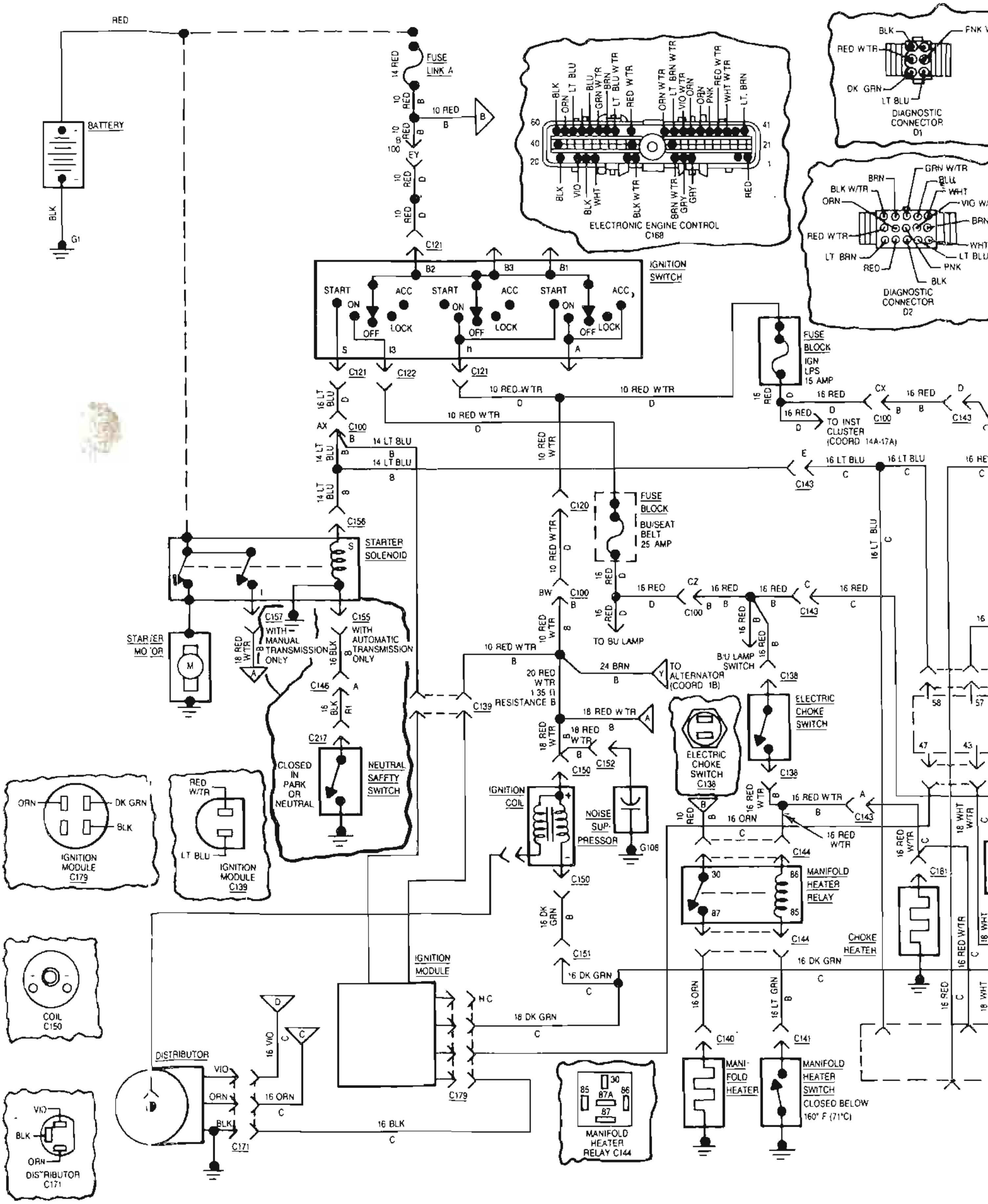
?


ER
OID
IAL
Ω RESISTANCE
LY
TO A/C COMPRESSOR (COORD 21E)
RED
BATTERY
BLK
G1
14 RED
FUSE LINK A
10 RED
10 RED
B
10 RED
B
EY
C100
10 RED
D
10 RED
D
C121
B2
B3
B1
START
ON
ACC
LOCK
OFF
IGNITION SWITCH
S
J3
I1
A
C121
C122
C121
16 LT BLU
D
AX
C100
14 LT BLU
14 LT BLU
B
14 LT BLU
C156
STARTER SOLENOID
STARTER MOTOR
I
C157
C155
18 RED W/TR
B
WITH MANUAL TRANSMISSION ONLY
16 BLK
WITH AUTOMATIC TRANSMISSION ONLY
14 LT BLUE
A
C146
16 BLK
R1
C217
CLOSED IN PARK OR NEUTRAL
NEUTRAL SAFETY SWITCH
ORN
DK. GRN
BLK
IGNITION MODULE C179
COIL C150
V 10
BLK
ORN
DISTRIBUTOR C171
DISTRIBUTOR
V10
ORN
BLK
C171
18 V10
C
16 ORN
C
D
C
IGNITION MODULE
16 BLK
C
C178
N.C
16 DK GRN
C
RED W/TR
LT BLU
IGNITION MODULE C139
C139
DIAGNOSTIC CONNECTOR D2
GRN W/TR
BRN
BLU
BLK W/TR
RED
ORN
WHT
GRN
GRY
WHT W/TR
LT. BRN
LT BLU W/TR
PNK
RED
BLK
BLK
RED W/TR
RED W/TR
DK. GRN
LT BLU
DIAGNOSTIC CONNECTOR D1
ELECTRO ENGINE CON C168
10 RED W/TR
D
10 RED W/TR
D
10 RED W/TR
D
10 RED W/TR
C120
10 RED W/TR
D
FUSE BLOCK
BU/SEAT BELT 25 AMP
16 RED
D
BW
C100
10 RED W/TR
B
16 RED
D
CZ
C100
16 RED
B
TO BU LAMP (COORD. 24D)
15-0Ω RESISTANCE 24 BRN
TO ALTERNATOR (COORD. 2A)
10 RED W/TR
B
20 RED W/TR
1.35 Ω RESISTANCE
18 RED W/TR
B
18 RED W/TR
B
C152
NOISE SUPPRESSOR
G
C150
IGNITION COIL
C150
16 DK GRN
B
TACHOMETER
C151
16 DK GRN
C
E
C143
16 LT BLU
16 RED
V
C143
TO ALTERNATOR (COORD. 2A)
Y
16 BRN
B
16 RED
B
B/U LAMP SWITCH
16 RED
B
BRN
RED
RED W/TR
RED
CHOKE RELAY C186
C188
CHOKE RELAY
C186
16 RED W/TR
B
16 RED W/TR
B
C143
10 RED
16 RED W/TR
C144
30
86
87
85
MANIFOLD HEATER RELAY
C144
16 ORN
C
16 DK GRN
C
16 ORN
B
16 LT GRN
B
C140
C141
MANIFOLD HEATER
MANIFOLD HEATER SWITCH
CLOSED BELOW 160°F (71°C)
85
30
86
87A
87
MANIFOLD HEATER RELAY C144
FUS BLO
IGN LPS 15
16 RED
16 RED
D
3
4

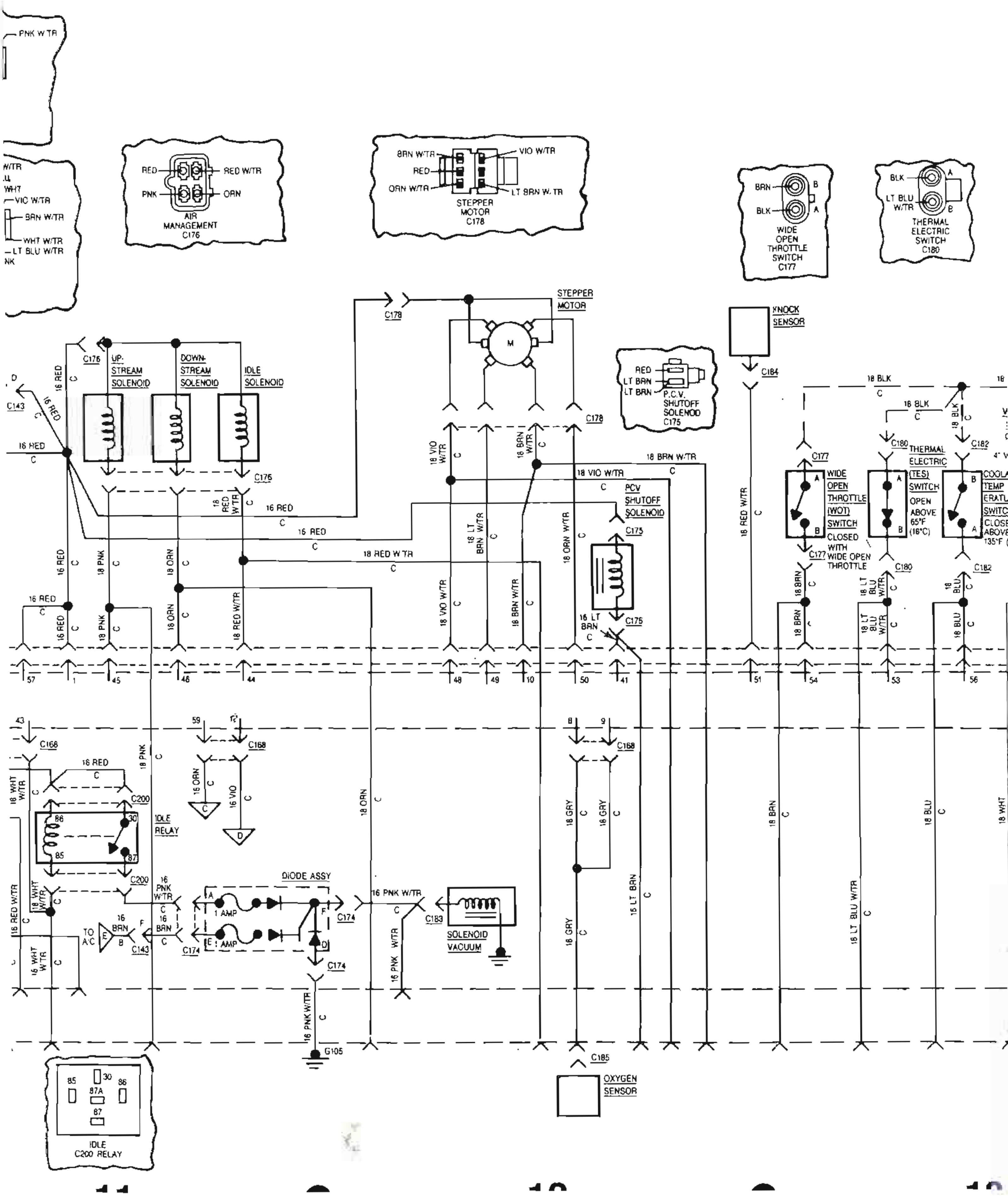
ELECTRONIC ENGINE CONTROL 4 CYLINDER



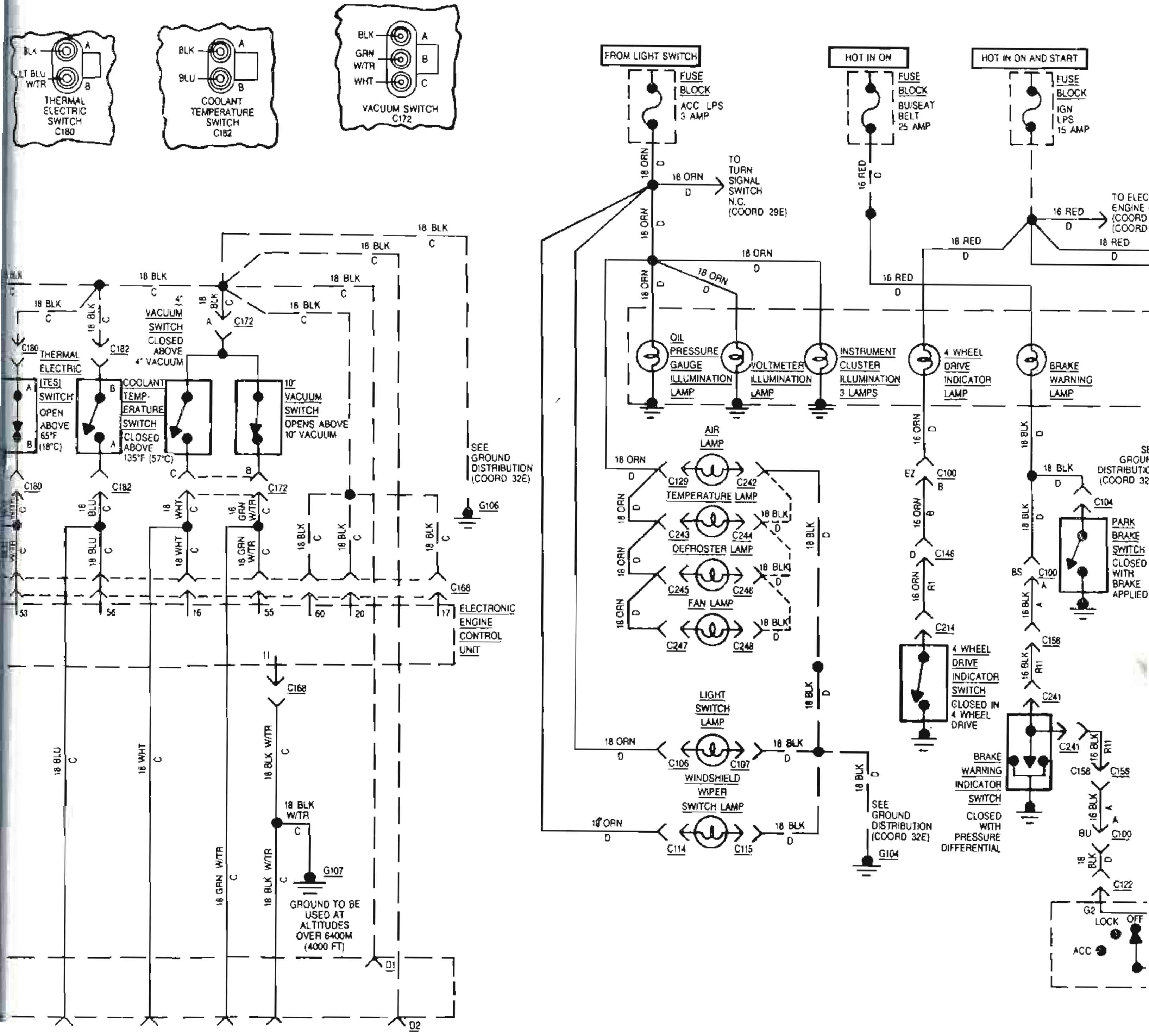

R
TO UNDERHOOD LAMP (COORD 25E)
C143
16 ORN
10 RED
C183
ANTI-DIESEL DELAY RELAY
C192
BLK
RED
ORN
C193
ANTI-DIESEL DELAY RELAY
MIXTURE CONTROL SOLENOID
BRN
GRN
RED W/TR
CARBURETOR C194
CARBURETOR C195
BLU
COOLANT TEMPERATURE SWITCH C182
18 BLK
G108
16 LT BRN
RED
LT BRN
P C V SHUTOFF SOLENOID C175
THERMAL ELECTRIC SWITCH C180
LT BLU W/TR
GRN W/TR
WHT
VACUUM SWITCH C172
C191
87A
87
30
85
86
ANTI-DIESEL RELAY
ANTI-DIESEL RELAY C191
KNOCK SENSOR
C184
16 LT BRN
C175
P.C.V. SHUTOFF SOLENOID
WIDE OPEN THROTTLE (WOT) SWITCH CLOSED WITH WIDE OPEN THROTTLE
THERMAL ELECTRIC (TES) SWITCH OPEN ABOVE 65°F (18°C)
COOLANT TEMPERATURE SWITCH CLOSED ABOVE 135°F (57°C)
4" VACUUM SWITCH CLOSED ABOVE 4" VACUUM
10" VACUUM SWITCH OPENS ABOVE 10" VACUUM
G106
CLOSED THROTTLE RESISTOR 120Ω 3 WATT
18 BRN
18 GRN
18 LT BLU W/TR
16 RED
16 BLU
18 WHT
18 GRN W/TR
18 RED W/TR
42
51
54
41
53
56
16
55
10
20
17
11
C168
ELECTRONIC ENGINE CONTROL UNIT
18 BLK W/TR
18 BLK W/TR
G107
GROUND TO BE USED AT ALTITUDES OVER 6400 M (4000 FT)
C197
BOWL VENT SOLENOID
BOWL VENT SOLENOID C197
D1
D2
OXYGEN SENSOR
7
8


RED
BATTERY
BLK
G1
14 RED
FUSE LINK A
10 RED
B
10 RED
B
100
EY
D
C121
IGNITION SWITCH
B2
B3
B1
START
ACC
ON
OFF
LOCK
S
I3
I1
A
C122
10 RED W/TR
D
16 LT BLU
D
AX
C100
14 LT BLU
B
C156
STARTER SOLENOID
STARTER MOTOR
M
C157
WITH MANUAL TRANSMISSION ONLY
18 RED W/TR
C155
WITH AUTOMATIC TRANSMISSION ONLY
16 BLK
C146
C217
CLOSED IN PARK OR NEUTRAL
NEUTRAL SAFETY SWITCH
C139
ELECTRONIC ENGINE CONTROL
C168
BLK
ORN
LT BLU
BLU
GRN W/TR
BRN
LT BLU W/TR
RED W/TR
ORN W/TR
LT BRN W/TR
VIO W/TR
PNK
WHT W/TR
LT. BRN
VIO
WHT
BLK W/TR
BRN W/TR
GRY
60
40
20
41
21
1
DIAGNOSTIC CONNECTOR D1
PNK
DK GRN
LT BLU
DIAGNOSTIC CONNECTOR D2
GRN W/TR
WHT
VIO W/TR
LT BRN
FUSE BLOCK
IGN LPS 15 AMP
16 RED
CX
TO INST CLUSTER (COORD 14A-17A)
C143
E
16 LT BLU
C
C120
FUSE BLOCK
BU/SEAT BELT 25 AMP
BW
CZ
TO BU LAMP
B/U LAMP SWITCH
C138
24 BRN
TO ALTERNATOR (COORD 1B)
20 RED W/TR 1.35 Ω RESISTANCE
18 RED W/TR
C152
C150
IGNITION COIL
NOISE SUPPRESSOR
G108
ELECTRIC CHOKE SWITCH
C138
16 ORN
16 RED W/TR
C144
MANIFOLD HEATER RELAY
30
87
86
85
CHOKE HEATER
16 DK GRN
C151
C181
18 WHT W/TR
16 WHT
58
57
47
43
IGNITION MODULE
C179
18 DK GRN
H C
C140
C141
16 LT GRN
MANIFOLD HEATER
MANIFOLD HEATER SWITCH CLOSED BELOW 160° F (71°C)
87A
MANIFOLD HEATER RELAY C144
DISTRIBUTOR
VIO
ORN
BLK
16 VIO
16 ORN
16 BLK
C171
IGNITION MODULE C179
IGNITION MODULE C139
COIL C150
DISTRIBUTOR C171

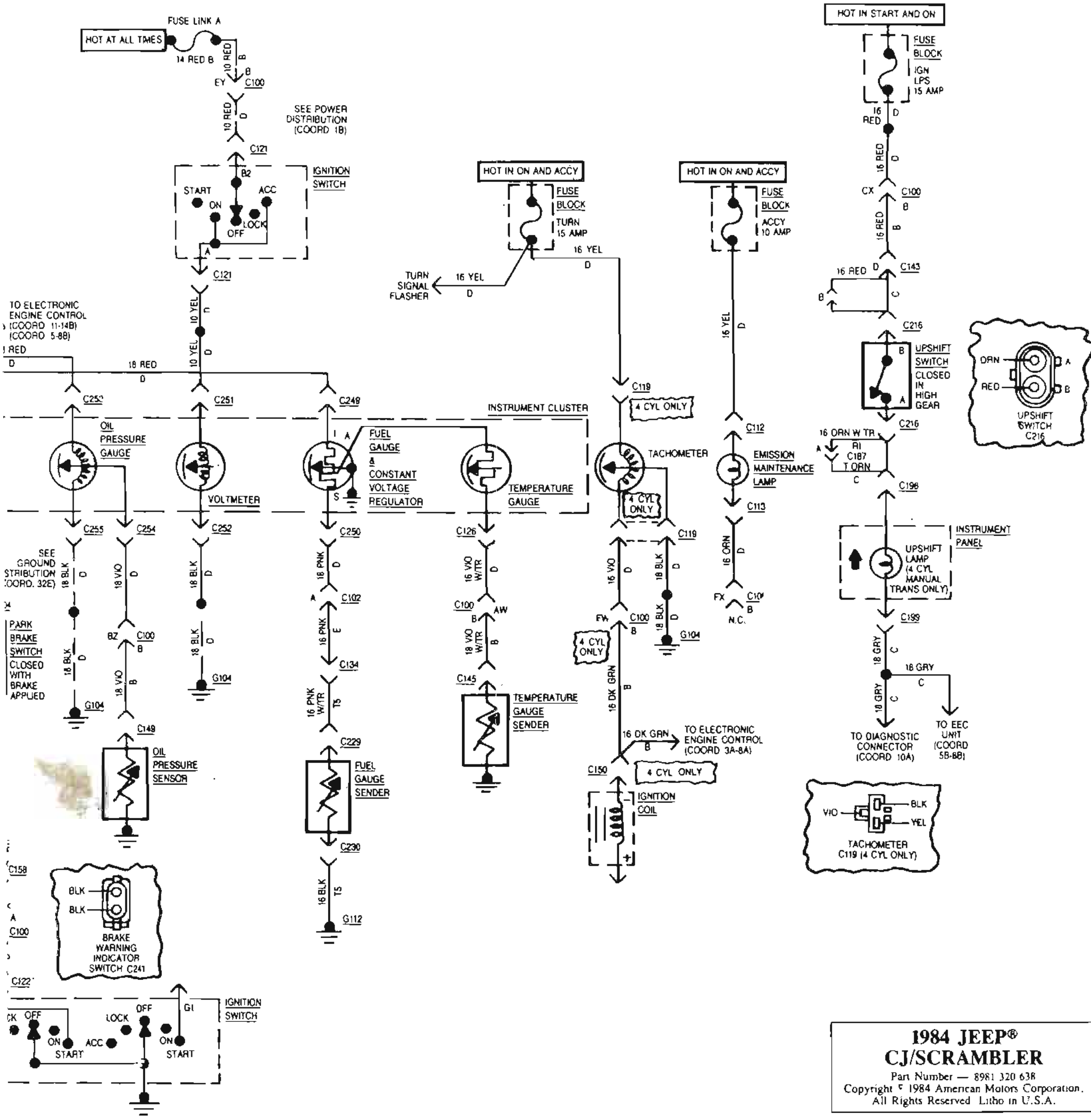
ONIC ENGINE CONTROL 6 CYLINDER



INSTRUMENT

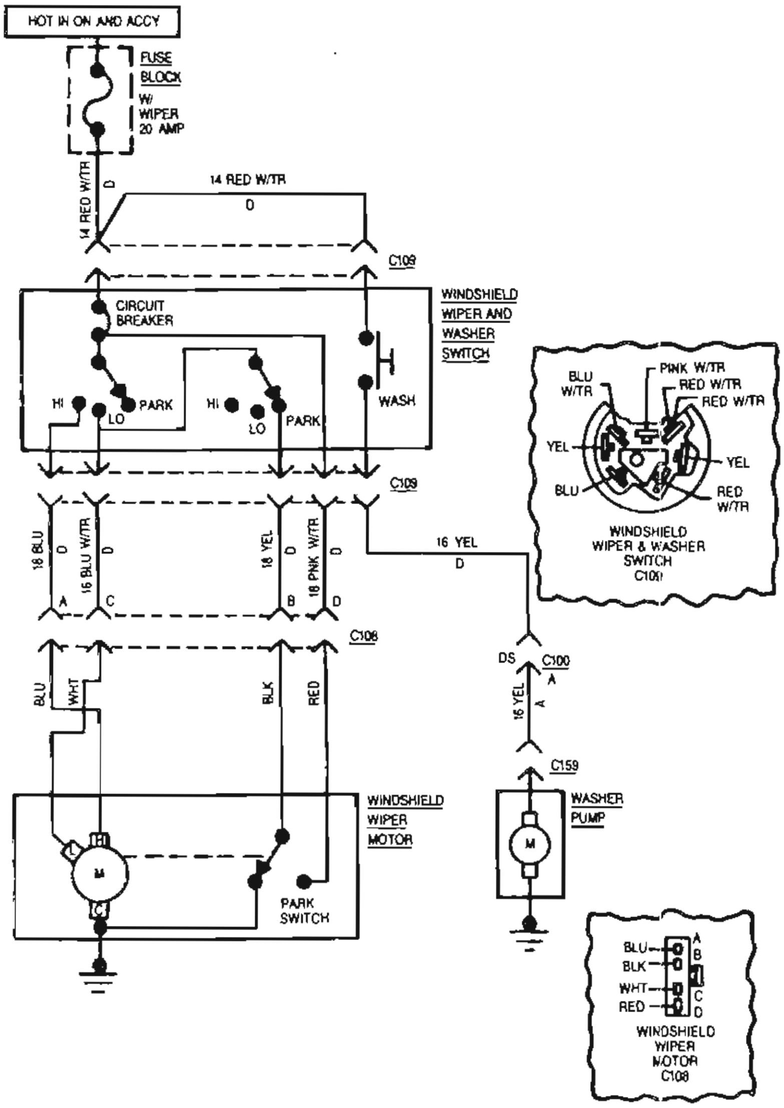

BLK
LT BLU W/TR
A
B
THERMAL ELECTRIC SWITCH C180
BLK
BLU
COOLANT TEMPERATURE SWITCH C182
BLK
GRN W/TR
WHT
VACUUM SWITCH C172
FROM LIGHT SWITCH
FUSE BLOCK
ACC LPS 3 AMP
HOT IN ON
FUSE BLOCK
BU/SEAT BELT 25 AMP
HOT IN ON AND START
FUSE BLOCK
IGN LPS 15 AMP
18 ORN
16 ORN
TO TURN SIGNAL SWITCH N.C. (COORD 29E)
16 RED
TO ELEC ENGINE (COORD (COORD
18 RED
OIL PRESSURE GAUGE ILLUMINATION LAMP
VOLTMETER ILLUMINATION LAMP
INSTRUMENT CLUSTER ILLUMINATION 3 LAMPS
4 WHEEL DRIVE INDICATOR LAMP
BRAKE WARNING LAMP
18 BLK
4" VACUUM SWITCH CLOSED ABOVE 4" VACUUM
THERMAL ELECTRIC (TES) SWITCH OPEN ABOVE 65°F (18°C)
COOLANT TEMPERATURE SWITCH CLOSED ABOVE 135°F (57°C)
10" VACUUM SWITCH OPENS ABOVE 10" VACUUM
C180
C182
C172
SEE GROUND DISTRIBUTION (COORD 32E)
G106
18 BLU
18 WHT
18 GRN W/TR
C168
53
56
16
55
60
20
17
ELECTRONIC ENGINE CONTROL UNIT
11
18 BLK W/TR
G107
GROUND TO BE USED AT ALTITUDES OVER 6400M (4000 FT)
D1
D2
AIR LAMP
C129
C242
TEMPERATURE LAMP
C243
C244
DEFROSTER LAMP
C245
C246
FAN LAMP
C247
C248
LIGHT SWITCH LAMP
C106
C107
WINDSHIELD WIPER SWITCH LAMP
C114
C115
SEE GROUND DISTRIBUTION (COORD 32E)
G104
EZ
C100
C146
C214
4 WHEEL DRIVE INDICATOR SWITCH CLOSED IN 4 WHEEL DRIVE
16 BLK
C104
PARK BRAKE SWITCH CLOSED WITH BRAKE APPLIED
SEE GROUND DISTRIBUTION (COORD 32
BS
C158
C241
BRAKE WARNING INDICATOR SWITCH CLOSED WITH PRESSURE DIFFERENTIAL
BU
C122
G2
LOCK
OFF
ACC

NTS AND INSTRUMENT PANEL ILLUMINATION

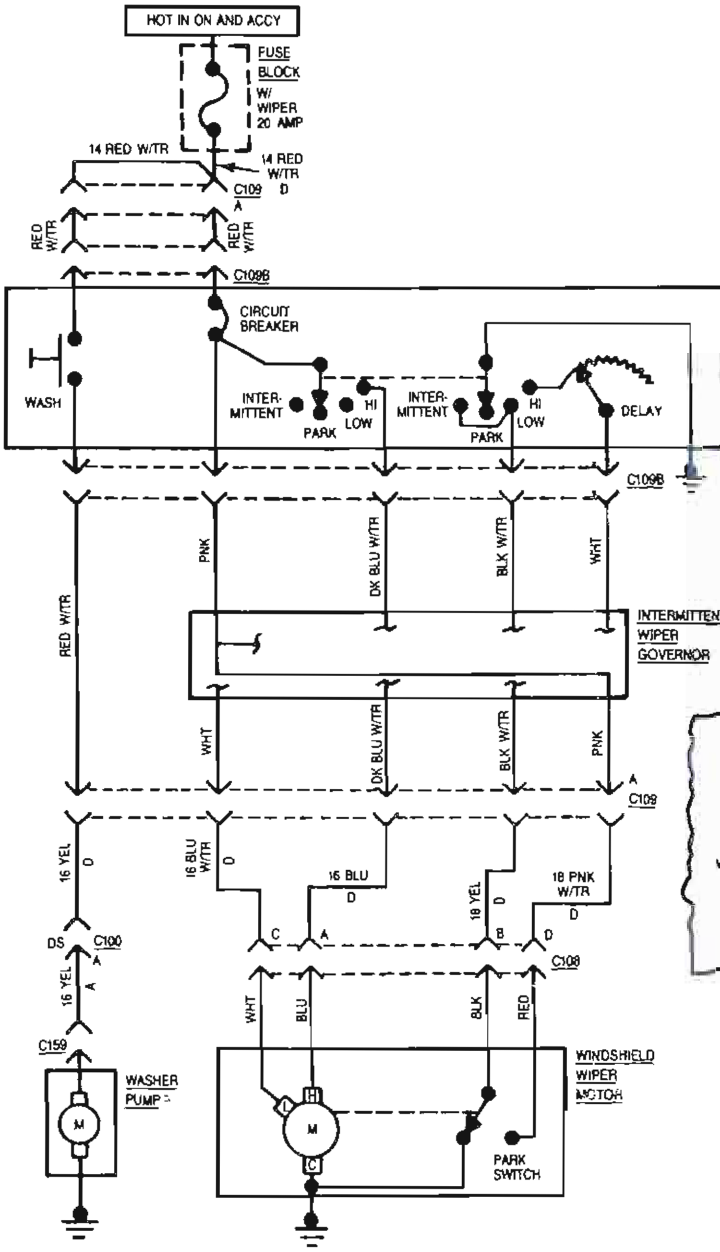


1984 JEEP®
CJ/SCRAMBLER
Part Number — 8981 320 638

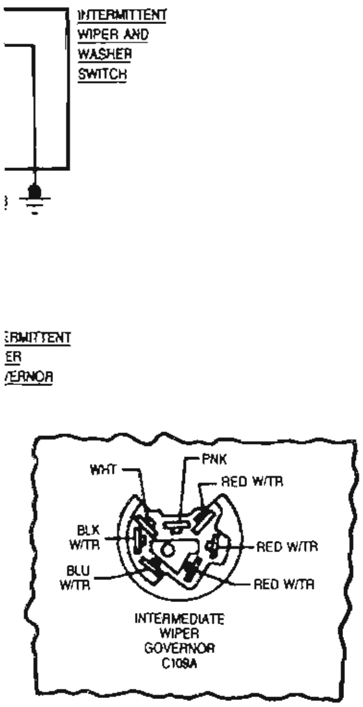
WINDSHIELD WIPER

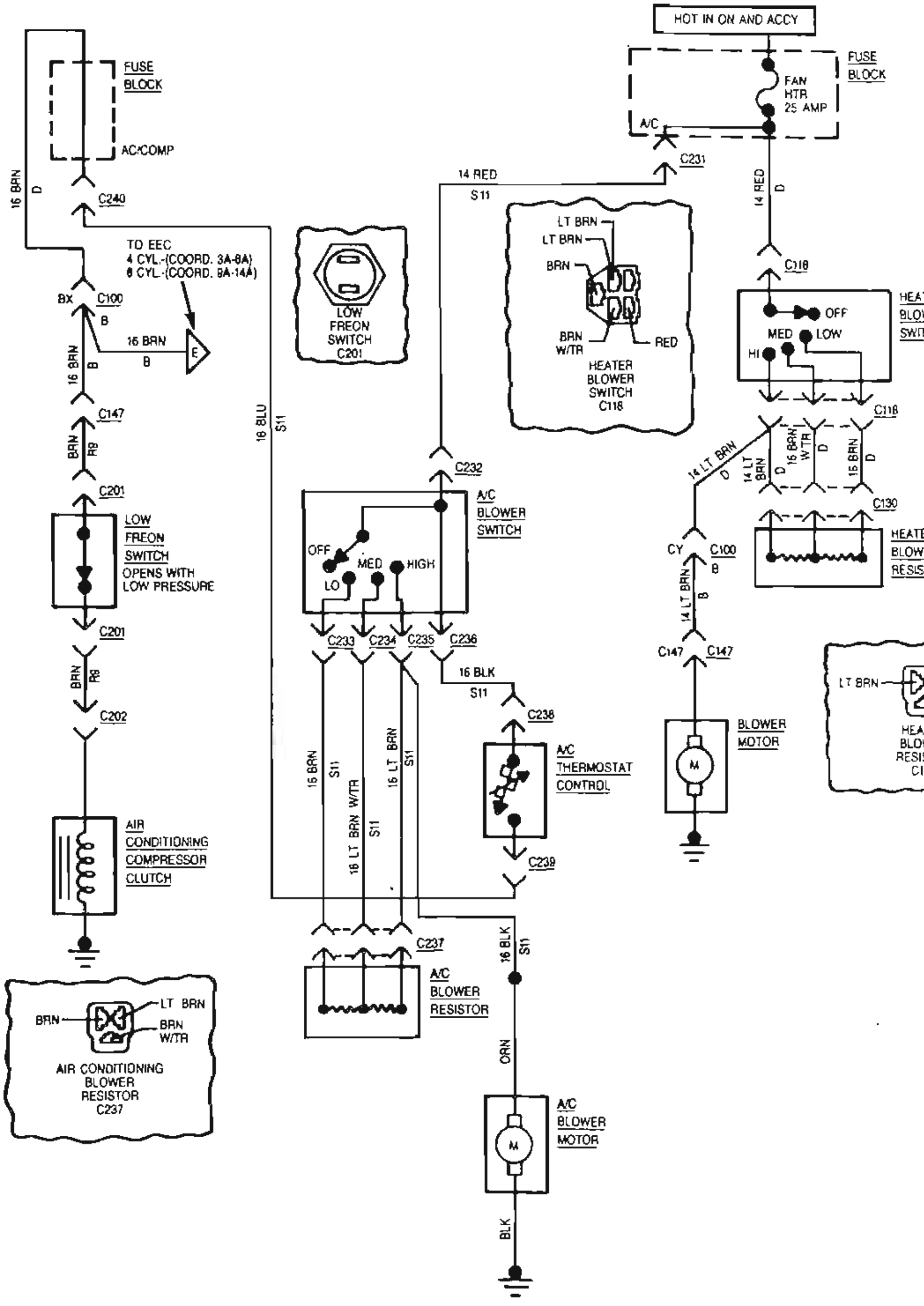


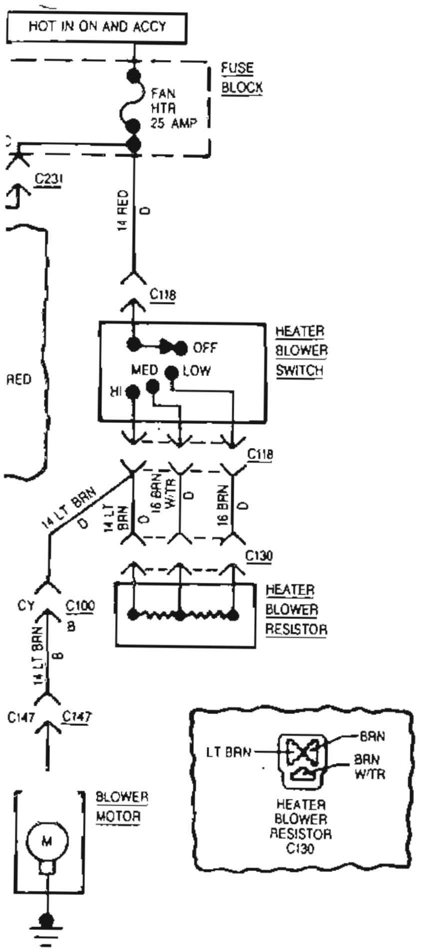
INTERMITTENT WINDSHIELD

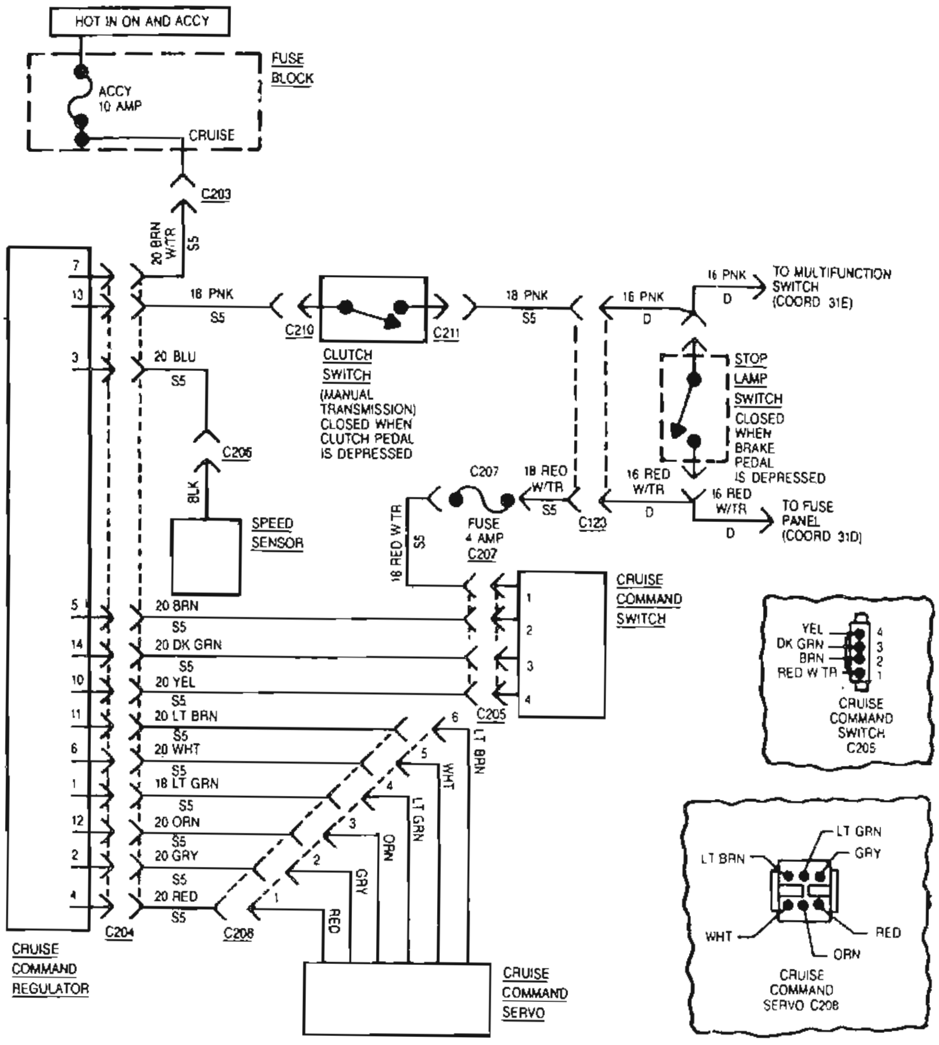


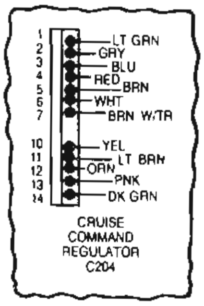
AIR CONDITIONING



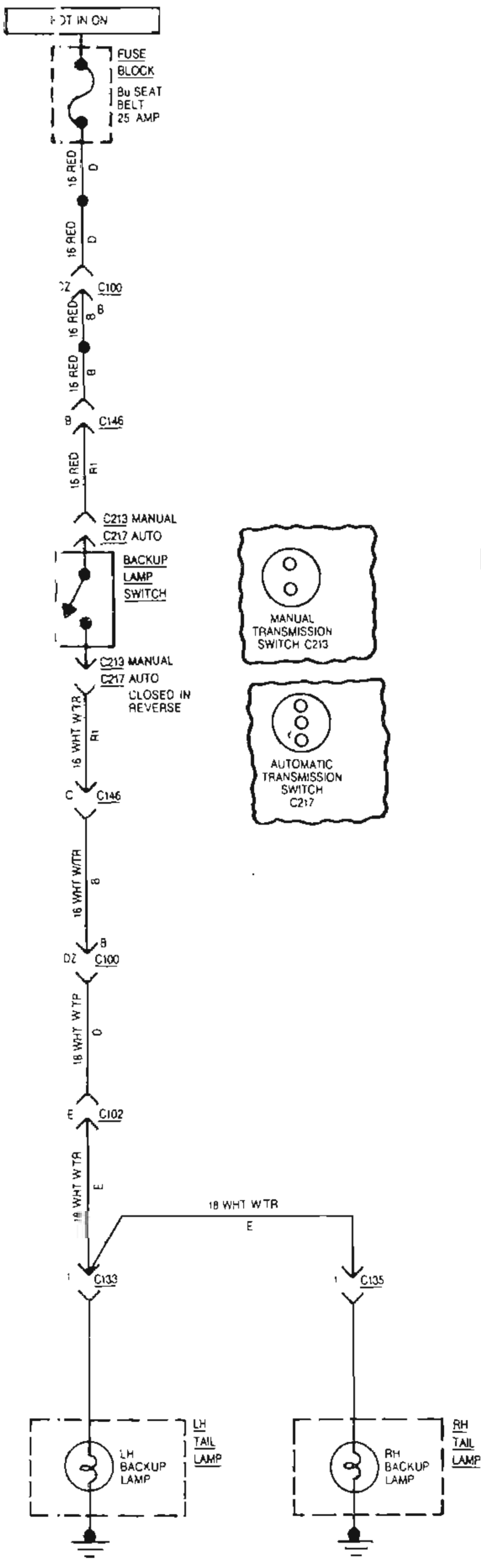



HOT IN ON AND ACCY
FUSE BLOCK
FAN HTR 25 AMP
C231
14 RED
D
C118
HEATER BLOWER SWITCH
OFF
MED
LOW
HI
RED
C118
14 LT BRN
D
14 LT BRN
16 BRN W/TR
16 BRN
D
C130
HEATER BLOWER RESISTOR
CY
C100
B
14 LT BRN
B
C147
C147
BLOWER MOTOR
M
LT BRN
BRN
BRN W/TR
HEATER BLOWER RESISTOR C130

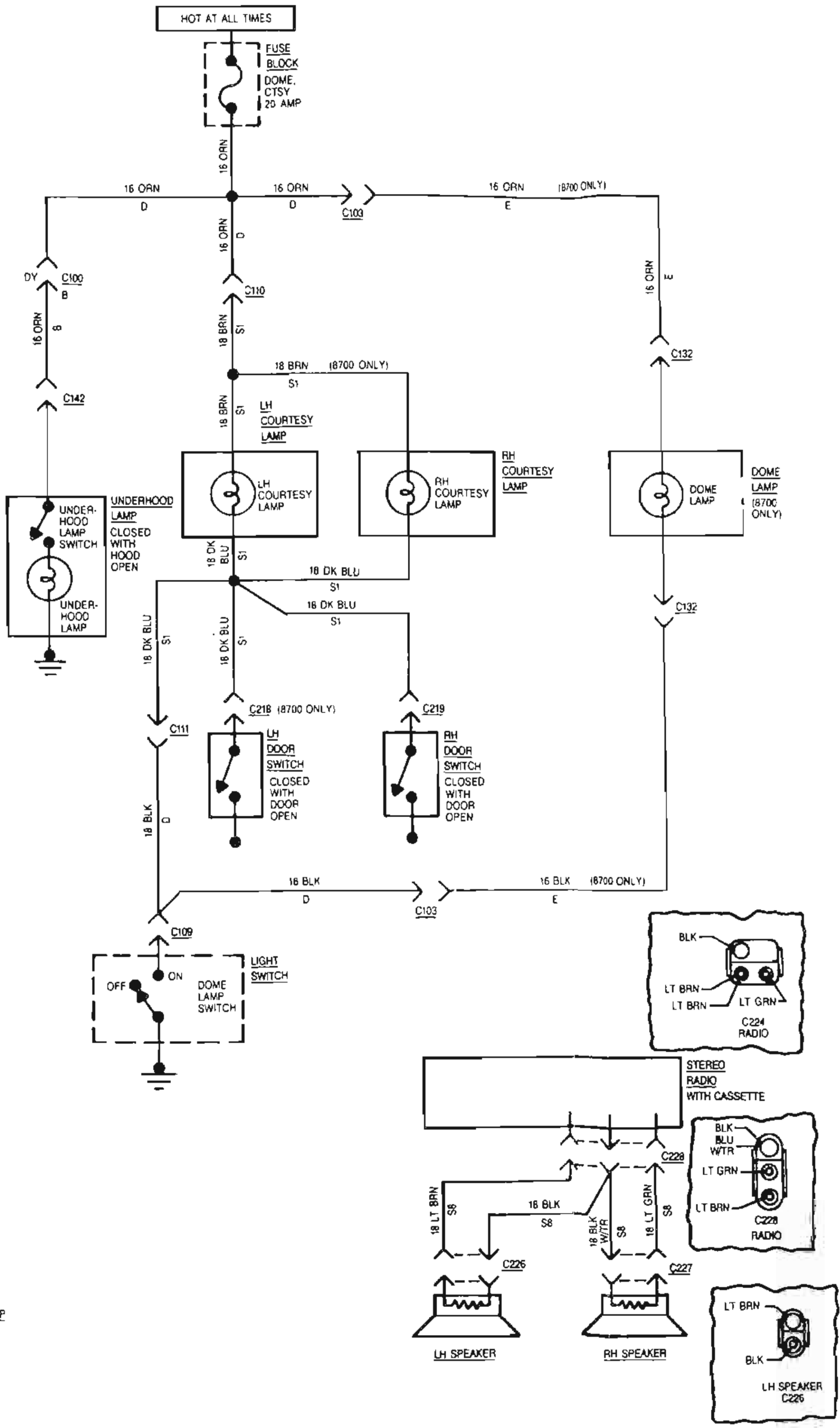

HOT IN ON AND ACCY
FUSE BLOCK
ACCY 10 AMP
CRUISE
C203
20 BRN W/TR
S5
7
13
3
5
14
10
11
6
1
12
2
4
18 PNK
S5
C210
CLUTCH SWITCH
(MANUAL TRANSMISSION) CLOSED WHEN CLUTCH PEDAL IS DEPRESSED
C211
18 PNK
S5
16 PNK
D
16 PNK
D
TO MULTIFUNCTION SWITCH (COORD 31E)
STOP LAMP SWITCH
CLOSED WHEN BRAKE PEDAL IS DEPRESSED
20 BLU
S5
C206
BLK
SPEED SENSOR
C207
18 RED W/TR
S5
FUSE 4 AMP C207
C123
16 RED W/TR
D
16 RED W/TR
D
TO FUSE PANEL (COORD 31D)
18 RED W TR
S5
20 BRN
S5
20 DK GRN
S5
20 YEL
S5
20 LT BRN
S5
20 WHT
S5
18 LT GRN
S5
20 ORN
S5
20 GRY
S5
20 RED
S5
C204
C208
C205
CRUISE COMMAND SWITCH
1
2
3
4
6
5
4
3
2
1
LT BRN
WHT
LT GRN
ORN
GRY
RED
CRUISE COMMAND REGULATOR
CRUISE COMMAND SERVO
YEL
DK GRN
BRN
RED W TR
4
3
2
1
CRUISE COMMAND SWITCH C205
LT GRN
GRY
LT BRN
WHT
RED
ORN
CRUISE COMMAND SERVO C208


1
2
3
4
5
6
7
10
11
12
13
14
LT GRN
GRY
BLU
RED
BRN
WHT
BRN W/TR
YEL
LT BRN
ORN
PNK
DK GRN
CRUISE COMMAND REGULATOR C204

BACKUP LAMP



UNDERHOOD LAMP, COURTESY LAMPS, DOME LAMP



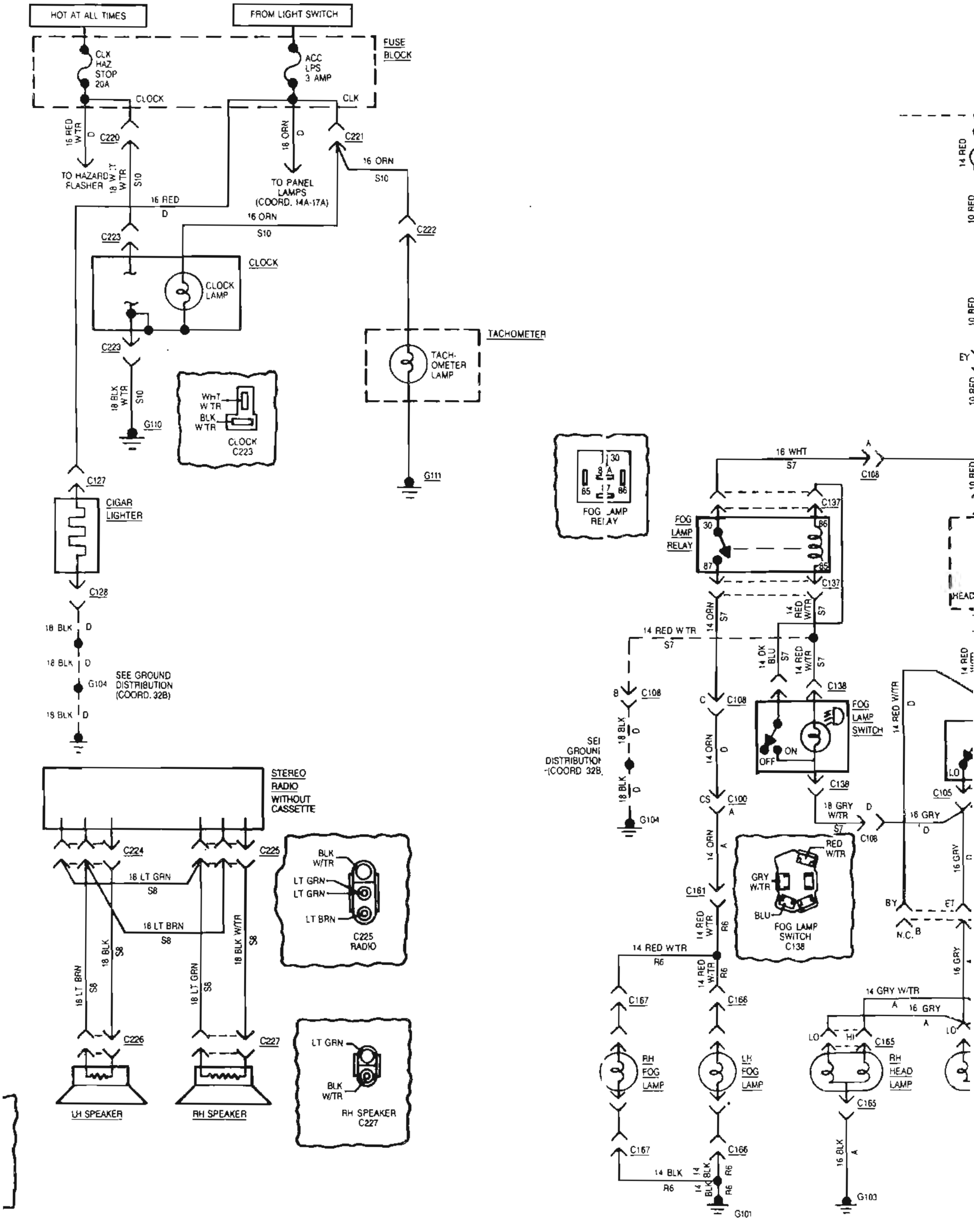
CIGAR LIGHTER

CLOCK

RADIO

TACHOMETER LAMP

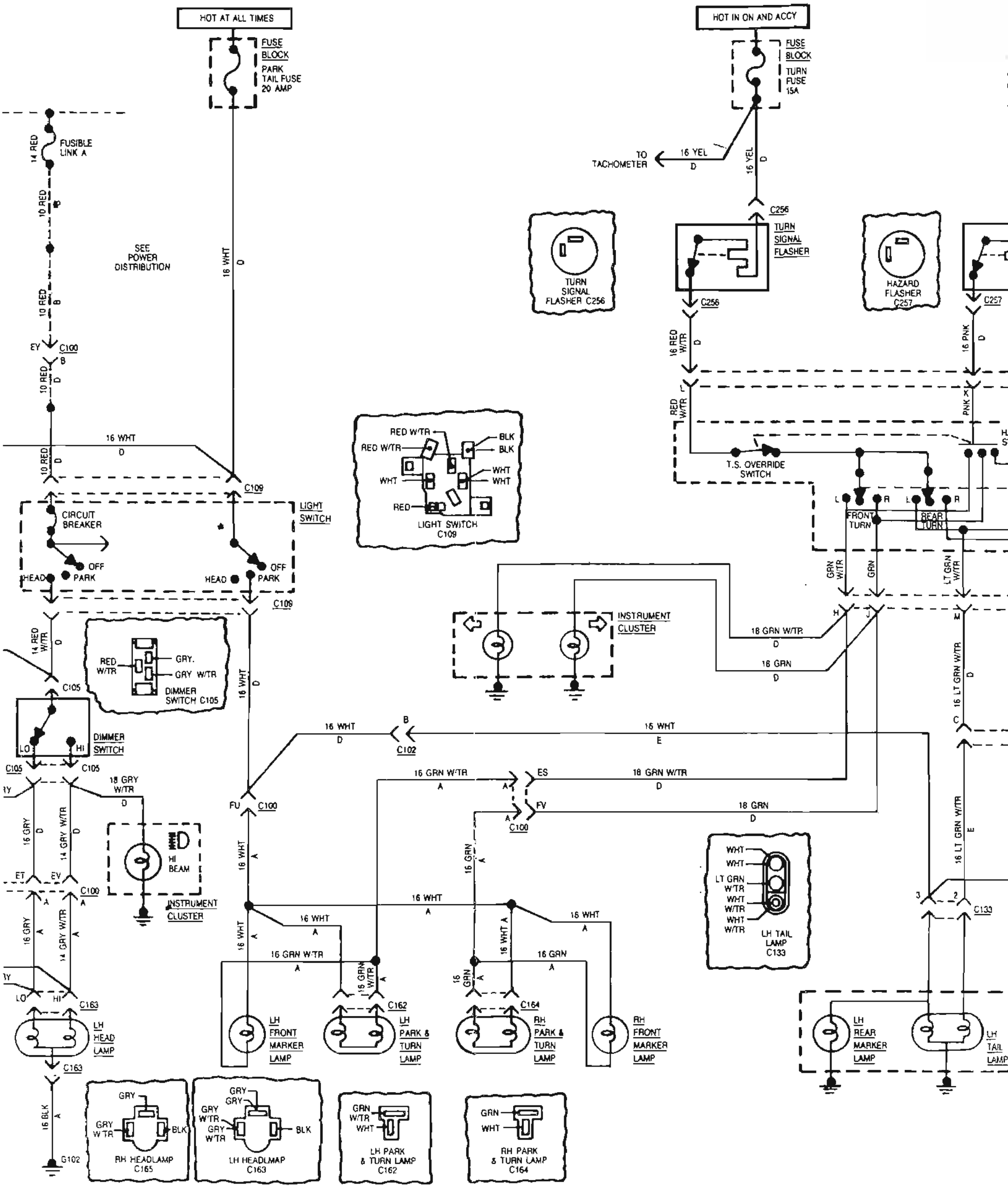
FOG LAMPS HEA



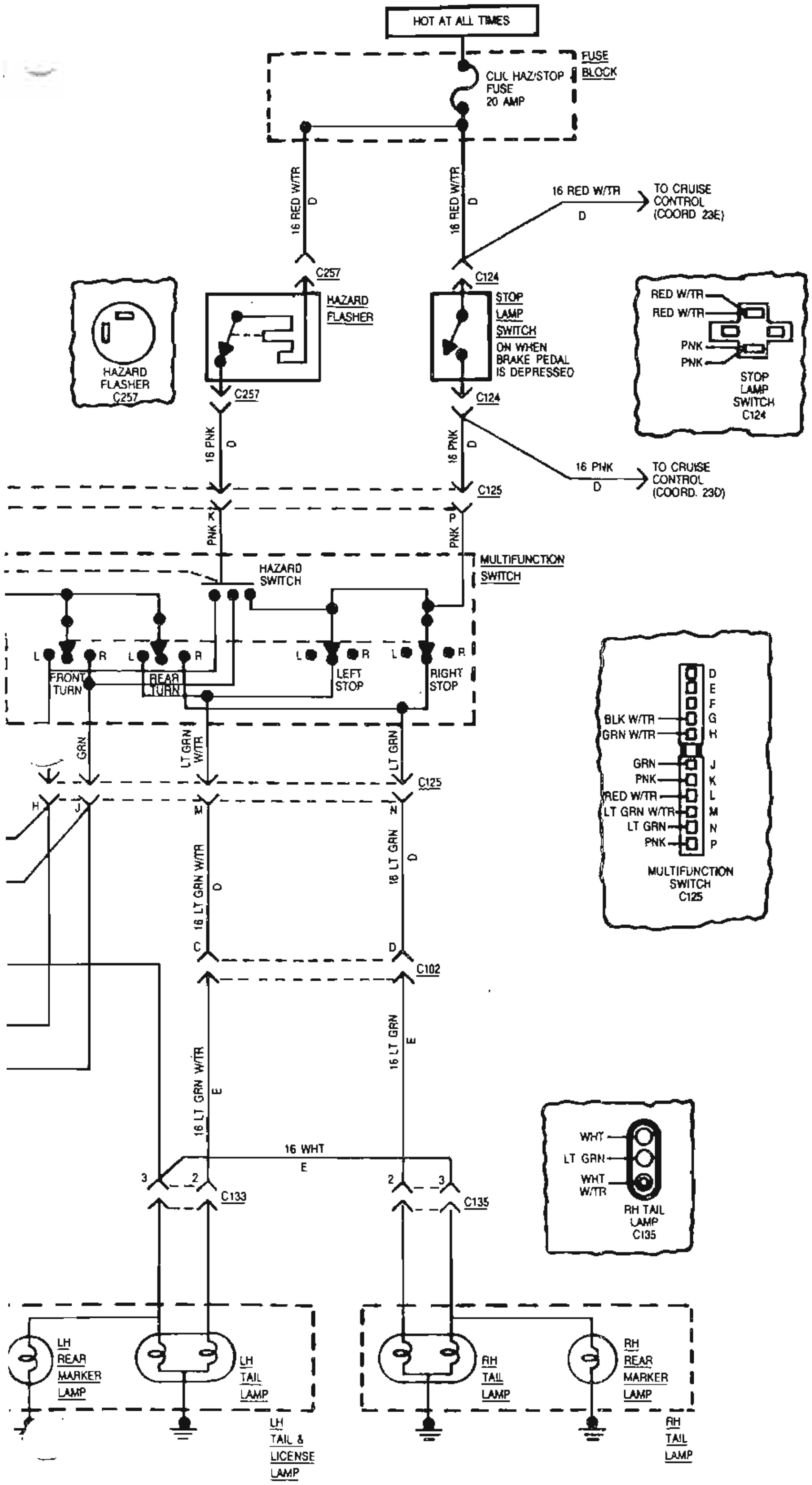
EADLAMPS

FRONT PARK AND TURN LAMPS

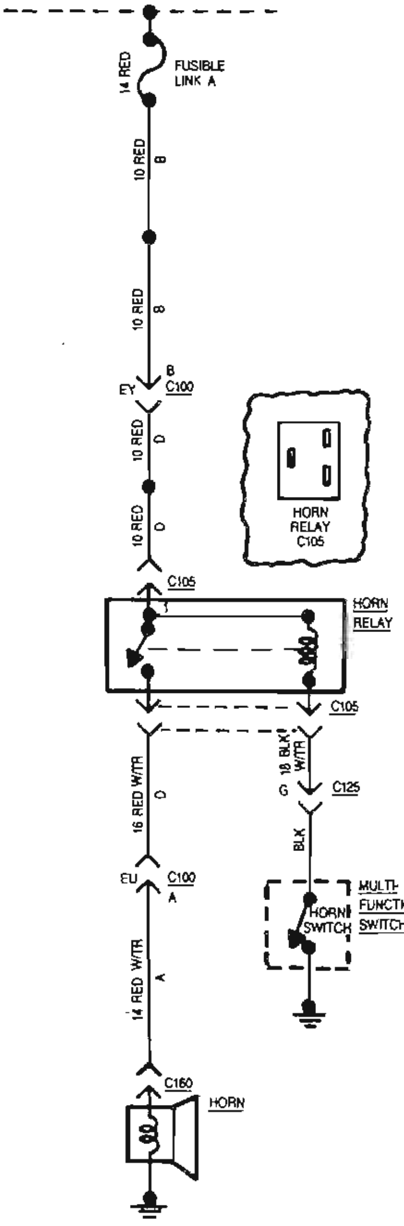
REAR LAMPS



REAR LAMPS

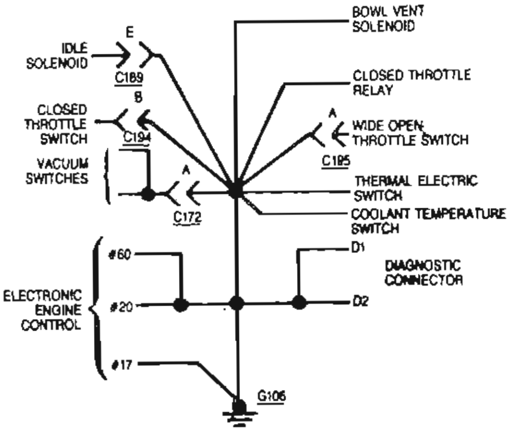


HORN

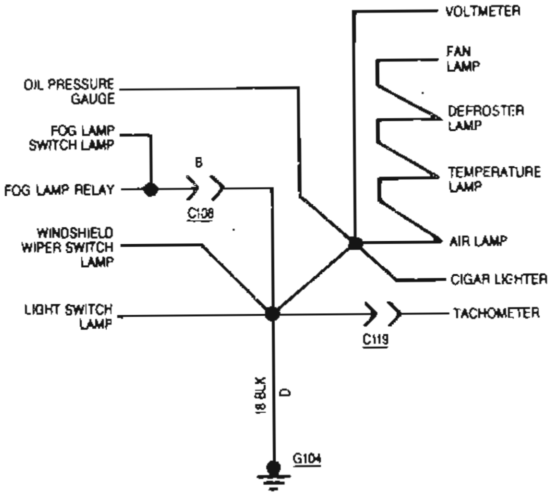


GROUNDS

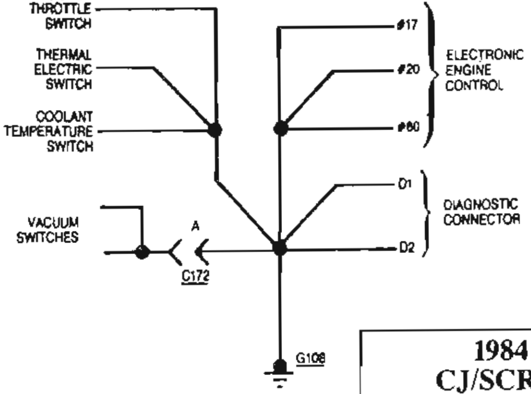
4 CYLINDER ELECTRONIC ENGINE CONTROL GROUND



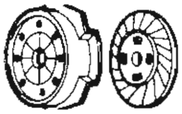
INSTRUMENT PANEL GROUND



6 CYLINDER ELECTRONIC ENGINE CONTROL GROUND

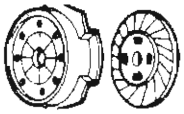


1984 JEEP®
CJ/SCRAMBLER
Part Number — 8981 320 638



CLUTCH

CONTENTS



SEE
I.S.
NOTES

GENERAL DESCRIPTION

Clutch Assembly

The clutch assembly consists of a diaphragm-style clutch cover and a single dry-disc driven plate. The cover consists of a one-piece diaphragm spring with integral release fingers. The clutch driven plate consists of a steel hub with four integral cushion springs and the friction material which is riveted to the hub.

A 26.7 cm (10.5 in) diameter diaphragm-type clutch cover is used on six-cylinder CJ and Scrambler models. The clutch cover and driven plate diameter on the 4-cylinder models measures 246 mm (9.687 in).

The hydraulic-clutch operating system consists of a clutch master cylinder, a slave cylinder and an interconnecting hydraulic line. The clutch cylinder is mounted on the dash panel next to the brake master cylinder. The slave cylinder is mounted on the clutch cover housing. The clutch master cylinder is connected directly to the clutch pedal. The slave cylinder is connected to the throwout lever.

Throwout Bearing

On the CJ and Scrambler models equipped with the 2.5 liter four-cylinder engine, the throwout bearing contact face is slightly crowned. The six-cylinder throwout bearing contact face is flat.

NOTE: On all models, the clutch cover driven plate and throwout bearing are serviced as assemblies only. Do not attempt to disassemble any of these components to effect repairs. If any of these components are damaged or severely worn, replace the component as an assembly only.

Clutch Hydraulic Fluid

The hydraulic fluid that operates the system is contained in the clutch cylinder reservoir. When adding fluid to, or refilling the system after service operations, use AMC/Jeep brake fluid, or equivalent, marked SAE J-1703 or DOT 3 only. Do not use any type of mineral or paraffin base oils in the system. These fluids will damage the rubber parts in the clutch master and slave cylinders.

Clutch Hydraulic Fluid Level

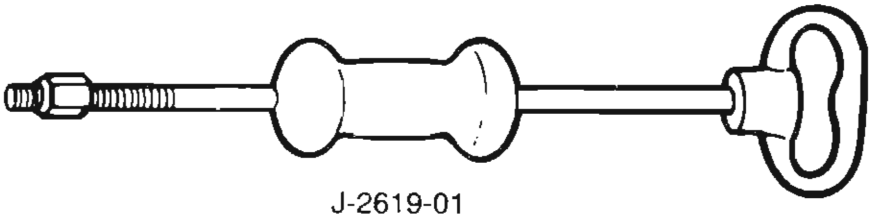
The desired fluid level is indicated on the side of the clutch master cylinder. When refilling the system, fill the master cylinder reservoir to the level indicated on the side of the reservoir only. Do not overfill the reservoir.

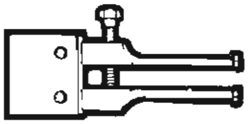
SEE
I.S.
NOTES

SEE I.S. NOTES

SPECIAL TOOLS

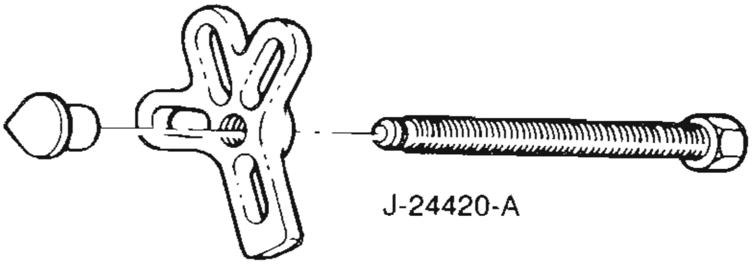
Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-5822	Remover Tool		■
J-5824-01 & J-33169	Clutch Alignment Tool		■
J-8001	Dial Indicator Set		■
J-24420-A	Universal Puller		■

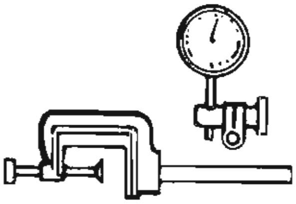

J-2619-01


J-5822


J-33169


J-5824-01


J-24420-A


J-8001

86373

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Clutch Bellcrank Pivot	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Clutch Housing-to-Engine Block Bolt (6-Cyl)		
Top	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Bottom	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Clutch Housing-to-Engine Dowel Bolt Nut (Six-Cylinder)	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Clutch Pedal Rebound Bumper, Bolt, Nut, and Lockwasher Assembly-to-Pedal	54 N·m (40 ft-lbs)	47-61 N·m (35-45 ft-lbs)
Clutch Pedal Shaft Locknut	45 N·m (33 ft-lbs)	41-49 N·m (30-36 ft-lbs)
Starter Motor-to-Clutch Housing Bolt (Six-Cylinder)	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Transmission Case-to-Clutch Housing Bolt	74 N·m (55 ft-lbs)	68-81 N·m (50-60 ft-lbs)
Clutch Cover Bolts (4-Cyl)	31 N·m (23 ft-lbs)	27-35 N·m (20-26 ft-lbs)
Clutch Master Cylinder-to-Dash (4-Cyl)	26 N·m (19 ft-lbs)	20-31 N·m (15-23 ft-lbs)
Hydraulic Fluid Line Fitting-to-Master Cylinder	15 N·m (11 ft-lbs)	14-16 N·m (10-12 ft-lbs)
Hydraulic Fluid Line Fitting-to-Slave Cylinder	21 N·m (16 ft-lbs)	18-25 N·m (13-18 ft-lbs)

SPECIFICATIONS

Clutch Specifications

Model	Engine (CID)	Clutch Diameter	Release Lever Height (Above Gauge Hub)	Pedal Free Play
CJ-7 Scrambler	150	2.46 mm (9.687 in)	40.5 to 43.7 mm (1.595 to 1.720)	N/A
	258	26.7 cm (10½ in.)	51.8 to 68.6 mm (2.04 to 2.16)	25.4 to 31.7 mm (1 to 1¼ in.)

840613

Clutch Housing Alignment Specifications

Clutch Housing Bore to Crankshaft Centerline	0.25 mm (0.010 max.)
Clutch Housing Transmission Mounting Face to Crankshaft Centerline	0.25 mm (0.010 max.)
Clutch Housing to Transmission Adapter Bore to Crankshaft Centerline	0.25 mm (0.010 max.)
Clutch Housing to Transmission Adapter Face to Crankshaft Centerline	0.25 mm (0.010 max.)
Flywheel Runout at Face	0.12 mm (0.005 max.)

840614

SEE I.S. NOTES

Clutch problems can generally be assigned to one of the following categories, defined as:

- clutch chatter
- clutch slippage or inadequate clutch pedal free play
- clutch drag or inadequate clutch release
- clutch pedal pulsation
- clutch-related vibration
- clutch area noises

Each category is described in common complaint language and followed by simplified diagnosis and repair procedures.

NOTE: Before performing any of the following diagnosis and repair procedures, adjust the pedal free play on vehicles with six-cylinder engines and be sure the clutch pedal returns to the pedal stop completely. On four-cylinder and Scrambler models, check the hydraulic cylinders and connecting line for damage and leakage.

CLUTCH CHATTER

Clutch chatter can be described as a shaking or shuddering sensation felt throughout the vehicle. Chatter usually develops when the clutch cover pressure plate makes initial contact with the driven plate and ceases when the clutch is fully engaged (clutch pedal released). Check the clutch operation as follows.

WARNING: The following test requires clutch engagement to the point of vehicle movement. Do not allow anyone to stand at the front or rear of the vehicle during this test.

Start the engine, press the clutch pedal to the floor and shift the transmission into first gear.

Increase the engine speed to 1200 - 1500 rpm and slowly release the clutch pedal. When the pressure plate makes initial contact with the driven plate, note the clutch operation. Press the clutch pedal to the floor and release the accelerator pedal.

Shift the transmission into reverse and repeat the procedure outlined in the previous step.

If clutch chatter does not develop in either gear range, increase the engine speed to 1700 - 2200 rpm and repeat the previous two steps. If clutch chatter does not develop after performing the tests outlined in these steps, the problem may be improper operation by the owner. If clutch chatter does develop, proceed to the next step.

Raise the vehicle on a hoist.

Check for loose or broken front or rear engine support cushions. Tighten or replace them as necessary. Check for loose clutch housing-to-engine or housing adapter-to-transmission attaching bolts. Tighten them as necessary. Refer to the torque specifications in this section. Check for binding, worn, bent or broken clutch linkage components. Lubricate or replace the components as necessary.

If the components inspected are in good condition, proceed to the next step. If one or more problems were discovered and corrected, lower the vehicle and repeat the first step.

If chatter is still evident, proceed to the next step.

Remove the transmission and clutch components.

NOTE: Whenever the clutch components are removed, remove the pilot bushing lubricating wick, soak the wick in engine oil and reinstall the wick before assembly.

Check for oil or grease contamination of the driven plate. If contaminated, correct the cause of contamination and replace the driven plate.

Check the clutch cover for broken or collapsed apply springs and inspect the surface of the pressure plate for deep scoring, cracks, heat checking, or warping (check the surface with a straightedge). Replace the clutch cover if it exhibits any of these conditions. Do not replace the clutch cover if the cover is in good condition.

Clean oil and dirt from the cover with mineral spirits and allow to air dry.

Sand the pressure plate surface lightly with a fine emery cloth.

CAUTION: When performing the next step, apply lubricant to the pivots sparingly. Excessive lubrication could result in grease contamination of the pressure plate and driven plate surfaces.

Lubricate the release lever pilots and check the release lever height. Adjust the height if necessary.

Inspect the crankshaft pilot bushing. Replace the bushing if worn, deeply scored or discolored.

NOTE: Soak the replacement bushing in engine oil before installation.

Inspect the condition of the splines on the transmission clutch shaft and in the driven plate hub. If the splines are worn, galled, chipped or broken, replace the clutch shaft or the driven plate. Remove corrosion, rust, or burrs from the splines using an oilstone or a fine-tooth file. Install the driven plate on the clutch shaft. The plate must move freely on the shaft.

If all the clutch components are in good condition, proceed to the next step. If one or more components were determined to be faulty, repair them as necessary and proceed to the next step.

Check the clutch housing alignment. Correct the alignment if necessary and proceed to the next step.

Apply a thin film of chassis lubricant to the transmission clutch shaft splines. Do not apply lubricant to the shaft pilot hub.

Install the pilot bushing lubricating wick and install the clutch components and transmission.

NOTE: Do not replace the throwout bearing unless it is defective or damaged. Refer to Clutch Area Noises.

CLUTCH SLIPPAGE OR INADEQUATE CLUTCH LINKAGE FREE PLAY

WARNING: Do not permit anyone to stand in front of the vehicle during this test.

CAUTION: Do not allow the clutch to be engaged for more than five seconds at a time; failure to comply with this cautionary measure could result in damage to clutch components.

SEE I.S. NOTES

SEE I.S. NOTES

Clutch slippage can be described as a condition in which the engine overspeeds but does not generate any increase in torque supplied to the wheels. Clutch slippage occurs when the driven plate is not gripped firmly between the flywheel and clutch cover pressure plate and rotates or slips between them at high torque. Clutch slippage can occur during initial acceleration or during subsequent shifts. Check the clutch operation as follows.

Block the wheels and apply the parking brake.

Operate the engine until it reaches the normal operating temperature.

Shift the transmission into third gear and increase the engine speed to 2000 rpm.

Slowly release the clutch pedal until the clutch is fully engaged.

If the engine stalls within five seconds, the clutch is not defective. If the engine continues to run, proceed to the next step.

Raise the vehicle on a hoist. Check the clutch linkage for binding, worn, broken, or bent components. Lubricate or replace them as necessary. If all components inspected are in good operating condition, proceed to the next step.

If one or more problems were discovered and corrected during the inspection in the previous step, repeat the first four steps. If the clutch slippage is corrected, discontinue the repair. If the slippage persists, proceed to the next step.

Remove the transmission and the clutch components.

NOTE: Whenever the transmission is removed, also remove the pilot bushing lubricating wick, soak the wick in engine oil, and reinstall the wick before assembly.

Inspect the driven plate. If 2 mm (1/16 in) or less friction material remains above the rivet heads, or the plate is severely glazed or contaminated with oil or grease, replace the driven plate.

NOTE: If the driven plate is contaminated, determine the cause and make the correction before proceeding.

Inspect the clutch cover. If the cover is heat-checked, has broken or collapsed springs, or exhibits signs of overheating (e.g., has blue coloration), replace the cover. If the cover does not exhibit any of these conditions, do not replace it.

Clean oil and dirt from the cover using mineral spirits and allow the cover to air dry.

Sand the pressure plate surface lightly using a fine emery cloth.

CAUTION: When performing the next step, apply lubricant to the pivots sparingly. Excessive lubrication could result in grease contamination of the driven plate and pressure plate surfaces.

Lubricate the cover release lever pivots and check and adjust the release lever height as necessary.

CAUTION: The throwout bearing has retaining springs which position the bearing on the throwout lever. Check these springs to determine whether they are bent or broken, or whether there is any distortion or loss of tension. Replace the bearing if these springs are damaged. However, do not replace the throwout bearing unless it is actually defective or damaged.

Check the throwout bearing mounting surface of the transmission front bearing cap for galling, deep scores, or roughness.

Install the throwout bearing on the bearing cap and check for smooth fore/aft movement. Replace the bearing or the bearing cap as necessary if bind occurs.

Fill the throwout bearing groove with chassis grease and apply a thin coat of grease to the bearing mounting surface of the front bearing cap.

Apply a thin film of chassis grease to the transmission clutch shaft splines. Do not apply grease to the shaft pilot hub.

Install the pilot bushing and the lubricating wick.

Install the clutch components and the transmission.

Lower the vehicle.

CLUTCH DRAG OR INADEQUATE CLUTCH RELEASE

Clutch drag can be described as a condition in which the clutch driven plate, and consequently the transmission clutch shaft, does not come to a complete stop after the clutch pedal is depressed (clutch disengaged). Clutch drag can cause gear clash when shifting into reverse or hard or difficult shifting. Check the clutch operation as follows.

NOTE: Occasionally, the clutch driven plate and clutch shaft will require approximately five seconds to lose momentum and come to a complete stop after initial clutch disengagement. This is normal and should not be mistaken for clutch drag.

Start the engine, depress the clutch pedal fully, and shift the transmission into first gear.

Shift the transmission into neutral but do not release the clutch pedal.

Wait five to ten seconds and shift the transmission into reverse. If the shift is smooth with no gear clash, the clutch operation is normal. If shifting into reverse produces gear clash, proceed to the next step.

Raise the vehicle on a hoist. Check the clutch linkage for binding, worn, broken or bent components. Lubricate or replace the components as necessary. If the components are in good operating condition, proceed to the next step. If one or more problems were discovered and repaired, lower the vehicle and repeat the first three steps. If the clutch now operates correctly, discontinue the repair. If the clutch drag persists, proceed to the next step.

Remove the transmission and clutch components.

NOTE: Whenever the transmission is removed, also remove the pilot bushing lubricating wick, soak the wick in engine oil, and reinstall the wick before assembly.

Observe the wear pattern on the driven plate. If the wear pattern is uneven (e.g., two areas heavily worn on one side, two only partially worn on the opposite side), or has opposing wear patterns on the front and reverse side, the driven plate is warped and should be replaced.

Inspect the clutch cover assembly. If the clutch cover assembly has worn, bent, or broken release levers or lever pivots, is heavily scored, or warped, replace the clutch cover assembly. If the cover assembly does not exhibit any of these conditions, do not replace it.

SEE I.S. NOTES

SEE I.S. NOTES

Clean oil and dirt from the clutch cover with a solvent and allow the cover to air dry.

Sand the pressure plate surface lightly using a fine emery cloth.

Lubricate the cover release lever pivots with chassis grease.

NOTE: Apply lubricant to the pivots sparingly. Excessive lubricant could result in grease contamination of the pressure plate and driven plate surfaces.

Inspect the crankshaft pilot bushing for heavy scoring, an angular wear pattern, or discoloration. Replace as necessary. Be sure to soak the bushing in engine oil before installation.

NOTE: If the pilot bushing displays an angular-type wear pattern, check and correct the clutch housing alignment before proceeding.

Inspect the condition of the splines on the transmission clutch shaft and in the driven plate hub. If severely worn, galled, or corroded, replace the clutch shaft or driven plate. Corrosion, rust, or burrs can be removed from the splines using an oilstone or fine-tooth file. Install the driven plate on the clutch shaft. The driven plate must move freely on the shaft.

If the components inspected in the previous steps are in good condition, proceed to the next step. If one or more problems were discovered during the inspection procedure, repair as necessary and proceed to the next step.

Check the clutch housing alignment. Correct the alignment if necessary and proceed to the next step.

Apply a thin film of chassis grease to the transmission clutch shaft splines. Do not apply grease to the shaft pilot hub.

Install the pilot bushing lubricating wick.

Install the transmission and clutch components.

Lower the vehicle.

CLUTCH PEDAL PULSATION

Clutch pedal pulsation can be described as a rapid up-and-down or pumping-type movement of the pedal that is not accompanied by any noise.

Pulsation is usually caused by incorrect clutch release lever height or clutch housing misalignment. Check the clutch operation as follows.

Start the engine, slowly depress the clutch pedal until the throwout bearing makes initial contact with the clutch release levers, and check for pulsation.

NOTE: Some minor pulsation is normal.

Continue to depress the clutch pedal while checking for pulsation until the pedal is fully depressed.

If pulsation is not evident or is minor, discontinue the repair. If pulsation is very rapid and can be felt throughout the vehicle, refer to Clutch Related Vibrations. If the vehicle displays pulsation symptoms, proceed to the next step.

Remove the transmission and the clutch components.

Remove the pilot bushing lubricating wick and soak the wick in engine oil.

Inspect the clutch cover release levers. If the levers are bent or excessively worn, replace the clutch cover and skip the next step. If the release levers are in good condition, clean oil and dirt from the clutch cover assembly using mineral spirits, allow the assembly to air dry and proceed to the next step.

Sand the clutch cover pressure plate surface lightly using a fine emery cloth.

Lubricate the clutch cover release lever pivots lightly with chassis grease.

NOTE: Apply lubricant to the pivots sparingly. Excessive lubrication could result in grease contamination of the driven plate and pressure plate surface.

Check and adjust the clutch cover release lever height if necessary.

NOTE: If the release lever height cannot be adjusted, the levers are bent and the cover must be replaced.

Check the clutch housing alignment. Refer to the Clutch Housing Alignment section. Correct the alignment if necessary and proceed to the next step.

Apply a thin film of chassis grease to the transmission clutch shaft splines but do not apply grease to the shaft pilot hub.

Install the pilot bushing lubricating wick.

Install the clutch components and transmission.

CLUTCH RELATED VIBRATIONS

Clutch related vibrations differ from pedal pulsations in frequency and magnitude. They usually occur in relatively high engine speeds (over 1500 rpm), are not affected by clutch pedal position, and can be felt throughout the vehicle.

Although clutch related vibrations are usually caused by clutch component imbalance, this condition occurs very infrequently because the clutch cover and driven plate are balanced as a unit during assembly. At this time, the cover and plate are installed on the crankshaft/flywheel assembly and given a final fine-tune balance before installation in the vehicle.

Replacement of clutch components to correct vibrations should be performed only after exhausting all other possibilities. Check the clutch operation as follows.

Raise the vehicle on a hoist and check the engine front support cushion interlocks for grounding. Repair as necessary. Check the other engine components (e.g., the exhaust manifold, valve cover, etc.) for grounding on the body or frame. If one of these components is grounded, repair the component and check for vibration. If the vibration ceases, stop the repair. If the vibration continues, lower the vehicle and proceed to the next step.

Disconnect the accessory drive belts one at a time, start the engine, and check for vibration. If the vibration stops after the removal of a drive belt, the cause of the vibration is related to the accessory driven by the belt or by the belt itself. Repair as necessary. If vibration persists after checking all the belts and accessories, proceed to the next step.

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

Raise the vehicle on a hoist and remove the transmission and clutch housing.

Support the engine firmly.

Check for loose flywheel mounting bolts. Tighten the bolts with 142 N·m (105 ft-lbs) torque if necessary and operate the engine. If the vibration ceases, stop the repair. If the vibration is still evident, proceed to the next step.

Check the flywheel face runout while holding the crankshaft end play to zero. If the runout is 0.12 mm (0.005 in) or less, proceed to the next step. If the runout exceeds 0.12 mm (0.005 in), replace the flywheel and operate the engine. If the vibration ceases, stop the repair. If the vibration is still evident, proceed to the next step.

Check for a damaged crankshaft vibration dampener. If the dampener is in good condition, proceed to the next step. If the dampener is damaged, replace the dampener and operate the engine. If the vibration ceases, stop the repair. If the vibration is still evident, proceed to the next step.

Check for clutch cover imbalance as follows.

Remove the clutch cover and driven plate from the flywheel.

Start and operate the engine at the speed where the vibration occurred.

If the vibration ceases, replace the clutch cover and recheck the operation. If the operation is now OK, install the clutch housing and transmission.

Lower the vehicle.

CLUTCH AREA NOISES

Throwout Bearing Noise

Throwout bearing noises can be described as whirring, grating, or grinding noises that occur when the clutch pedal is depressed (clutch disengaged).

These noises usually continue until the clutch pedal is fully released (clutch engaged) and the bearing is no longer in contact with the clutch cover release levers.

Throwout bearing noise is corrected by replacing the bearing as outlined in this section.

NOTE: The throwout bearing should not be replaced as a matter of course when servicing the clutch cover or driven plate. Replace the bearing only if defective.

Transmission Clutch Shaft or Countershaft Bearing Noise

Transmission clutch shaft or countershaft bearing noises can be described as whirring, grating, or grinding noises which cease when the clutch pedal is depressed (clutch disengaged) or when the transmission is shifted into gear. These noises are most noticeable when the clutch pedal is fully released and the transmission is in neutral.

Correction of these noises will require transmission removal and replacement of the problem bearing(s).

Crankshaft Pilot Bushing Noise

Pilot bushing noises can be described as squealing, howling, or elephant-type trumpeting noises which are most noticeable when the engine is cold. These noises occur during the first few inches of clutch pedal travel as the pedal is being released (partial clutch engagement) with the transmission in gear. It can also occur in very cold weather when the pedal is fully depressed (clutch disengaged) and the engine is started with the transmission in neutral.

To correct the pilot bushing noise, replace the bushing as outlined in this section.

SEE
I.S.
N
O
T
E
S

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-5822	Remover Tool		■
J-5824-01	Clutch Alignment Tool		■

SEE
1.S.
NOTES

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Clutch Bellcrank Pivot	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Clutch Housing-to-Engine Block Bolt (6-Cyl)		
Top	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Bottom	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Clutch Housing-to-Engine Dowel Bolt Nut (Six-Cylinder)	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Clutch Pedal Rebound Bumper, Bolt, Nut, and Lockwasher Assembly-to-Pedal	54 N·m (40 ft-lbs)	47-61 N·m (35-45 ft-lbs)
Clutch Pedal Shaft Locknut	45 N·m (33 ft-lbs)	41-49 N·m (30-36 ft-lbs)
Starter Motor-to-Clutch Housing Bolt (Six-Cylinder)	24 N·m (18 ft-lbs)	16-34 N·m (12-25 ft-lbs)
Transmission Case-to-Clutch Housing Bolt	74 N·m (55 ft-lbs)	68-81 N·m (50-60 ft-lbs)

CLUTCH ADJUSTMENTS

Clutch pedal free play should be checked and adjusted at the intervals specified in the Mechanical Maintenance Schedule, or whenever diagnosis indicates adjustment is needed. To adjust clutch pedal free play, proceed in the following manner.

Lift the clutch pedal upward and against the pedal stop.

Raise the vehicle.

On all models, loosen the release rod adjuster jamnut.

Turn the release rod adjuster in or out to obtain the specified clutch pedal free play.

Tighten the release rod jamnut.

Lower the vehicle.

CLUTCH ASSEMBLY REMOVAL

Remove the transmission.

Remove the starter motor.

Remove the throwout bearing.

Remove the clutch housing.

Mark the position of the clutch cover on the flywheel for assembly alignment reference.

CAUTION: The clutch cover bolts must be loosened evenly and in rotation to avoid cover distortion. The cover is a steel stamping and could be warped if improperly removed resulting in clutch chatter when installed.

Loosen the clutch attaching bolts one or two turns at a time and in rotation to relieve the spring tension on the cover.

Remove the clutch cover bolts and remove the cover and the driven plate from the flywheel.

NOTE: Observe which side of the driven plate faces the flywheel before removing the plate. Paint or chalk the alignment marks on the plate for assembly reference.

Remove the pilot bushing lubricating wick and soak the wick in engine oil.

Inspect and service the clutch components.

CLUTCH ASSEMBLY INSTALLATION

Check and correct the clutch cover release lever height if necessary. Lubricate the release lever pivots sparingly. Do not over lubricate the pivots.

Install the pilot bushing lubricating wick in the crankshaft bore.

CAUTION: When performing the next step, be sure that the correct side of the driven plate faces the flywheel. Refer to the reference marks placed on the driven plate during clutch removal.

Insert Clutch Alignment Tool J-5824-01 or the spare clutch shaft in the driven plate hub and mount the assembled plate and tool on the flywheel. Be sure the alignment tool is fully seated in the pilot bushing.

SEE
I.S.
NOTES

SEE I.S. NOTES

Position the clutch cover on the flywheel and over the driven plate and alignment tool. Align the cover and flywheel according to the reference marks made during clutch removal and install the cover attaching bolts finger-tight only.

Tighten the cover attaching bolts alternately and evenly with 54 N·m (40 ft-lbs) torque to avoid distorting the cover. Be sure to maintain cover-to-plate alignment while tightening the bolts.

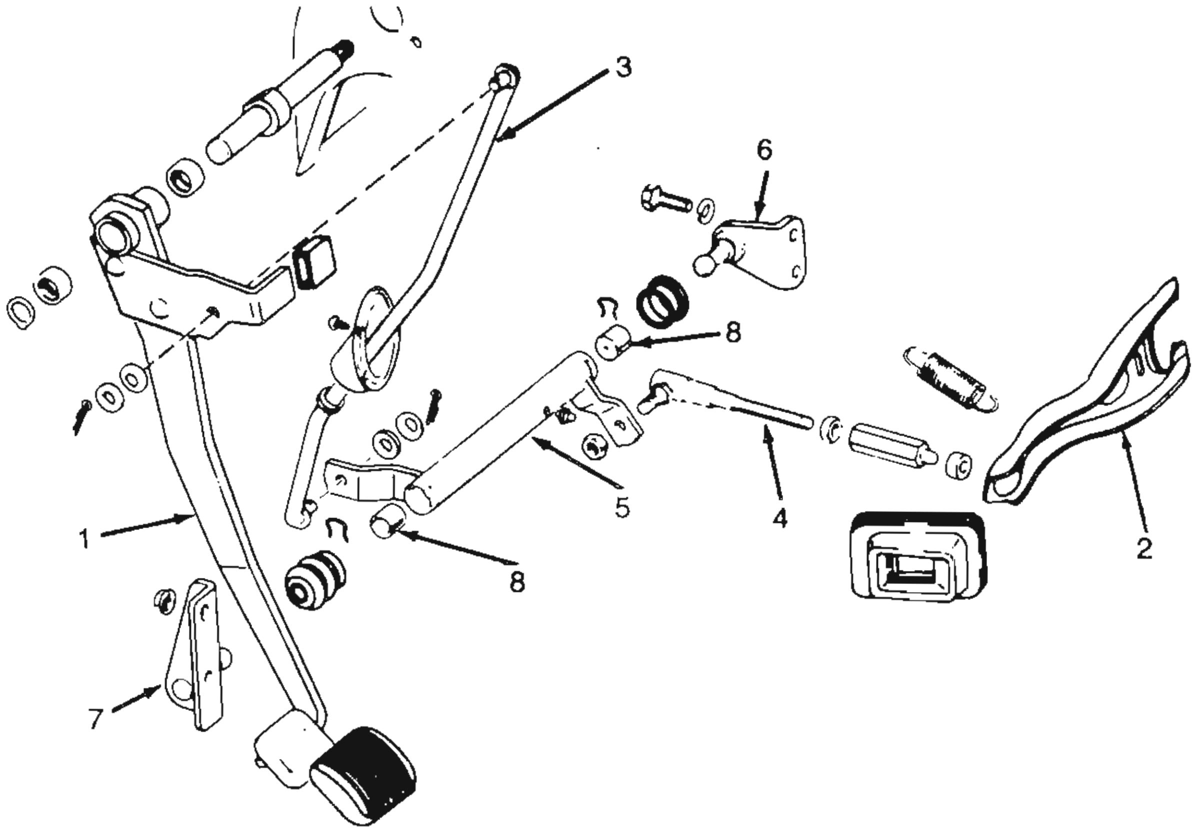
Install the clutch housing and tighten the housing attaching bolts with the specified torque.

Install the starter motor.

Install the throwout bearing. Be sure the bearing springs are engaged in the throwout lever.

Install the transmission.

CLUTCH COMPONENT INSPECTION AND SERVICE



86372

Clutch Linkage

The suspended type clutch pedal (1) is connected to the throwout lever (2) through the clutch push rod (3), bellcrank over and inner levers and release rod (4).

The throwout bearing is mounted on the transmission front bearing cap and acts directly against the clutch cover release levers to engage and disengage the clutch. The bearing is actuated by a throwout lever mounted in the clutch housing. The lever pivots on a steel ball mounted inside the clutch housing.

The bellcrank (5) pivots on ball studs mounted in the inner (6) and outer (7) support brackets. Idler bushings (8), installed in each end of the bellcrank, provide bearing surfaces for the ball studs.

Clutch Linkage Lubrication

The clutch linkage ball studs are the only linkage components that require periodic lubrication. The studs should be lubricated at the intervals specified in the Mechanical Maintenance Schedule.

The bellcrank has a lubrication fitting to facilitate ball stud lubrication. Whenever lubrication is necessary, proceed as follows:

- raise the vehicle
- fill the lube gun with lithium-base chassis grease
- connect the lube gun nozzle to the bellcrank fitting and lubricate the ball studs
- remove the lube gun and lower the vehicle

Driven Plate

Inspect the friction material for excessive wear, or charred, cracked, broken or loose friction material.

Check the driven plate steel hub and cushion springs for distortion, cracks, or breakage. Replace the driven plate if it exhibits any of these conditions.

NOTE: Do not replace the driven plate if only the cushion springs appear loose. This is a normal condition when the plate is removed from the vehicle and the springs are not under load.

Clutch Cover

Inspect the cover for cracks, distortion, broken or collapsed apply springs and for broken, bent, loose, or excessively worn release levers. Inspect the pressure plate surface for deep scores, cracks, heat checking or discoloration, and for evidence of warping (use a straightedge to check pressure plate surface flatness). Replace the cover as an assembly if it exhibits any of these conditions.

NOTE: The centrifugal rollers in the clutch cover may rattle when the cover is removed and not under load. Do not replace the cover if this occurs; it is a normal condition.

Throwout Bearing

CAUTION: The throwout bearings are permanently lubricated during manufacture. Do not wash or immerse the bearings in solvent as the bearing lubricant could be dissolved. Clean the bearing by wiping it with shop towels.

SEE I.S. NOTES

A simple throwout bearing design is used on CJ-7 and Scrambler vehicles. The bearing is retained on the throwout lever by tension springs.

Inspect the bearing for excessive wear and deep scoring on the release lever contact surface, looseness on the sleeve, or discoloration which indicates overheating.

SEE I.S. NOTES

Check the sleeve bore for excessive wear or burrs which could cause it to bind on the front bearing cap. Rotate the bearing on the sleeve. The bearing must rotate freely and not bind. When rotating the bearing, also listen for grinding or grating sounds which indicate that the internal rollers are worn or damaged.

Check the bearing tension springs for distortion or breakage. Replace the bearing if it exhibits any of these conditions.

Transmission Front Bearing Cap

Inspect the bearing cap for deep scoring or excessive wear. Replace the bearing cap if worn or scored and inspect the throwout bearing sleeve for burrs, wear or other damage which could cause a bind condition. Replace the bearing cap or throwout bearing if either exhibits these conditions.

Crankshaft Pilot Bushing

Inspect the bushing for excessive wear, deep scoring, cracks, or looseness. Replace the bushing if worn or damaged.

Bushing Removal

NOTE: If a new bushing is to be installed, soak the replacement bushing in engine oil during bushing removal.

Remove the bushing lubricating wick.

Fill the crankshaft bore and pilot bushing with chassis grease.

Insert the clutch aligning tool into the bushing and tap the end of the tool with a lead hammer. Hydraulic pressure generated by the compressed grease will force the bushing out of the crankshaft bore.

NOTE: If the bushing proves difficult to remove using the hydraulic method, remove the bushing using Puller Tool J-5822 and Slide Hammer J-2619-01.

Remove all the grease from the crankshaft bore and clean the bore thoroughly.

Bushing Installation

Install the replacement pilot bushing on Clutch Alignment Tool J-5824-01.

Install the bushing in the crankshaft bore using the clutch alignment tool as a bushing driver. Keep the bushing straight during installation and be sure it is fully seated.

Install the bushing lubricating wick.

Flywheel

Inspect the flywheel surfaces for cracks, deep scoring, excessive wear, heat checking, discoloration, and excessive face runout or distortion.

Check the face runout using a dial indicator. Runout must not exceed 0.12 mm (0.005 in) with the crankshaft end play held to zero. Use a straightedge to check surface flatness.

Inspect the ring gear teeth for cracks, breakage, or excessive wear. If the ring gear teeth are severely milled (worn), also check the starter motor drive teeth for similar wear or damage.

Check the flywheel attaching bolt torque and tighten the bolts with 142 N·m (105 ft-lbs) torque, if necessary. Replace the flywheel if it exhibits any of the conditions described.

Transmission Clutch Shaft

Install the driven plate on the clutch shaft. The driven plate must move freely on the shaft splines. If the splines have burrs, remove them using a file or oilstone. If the driven plate does not move freely on the splines, incomplete clutch release will occur resulting in hard shifting. Replace the clutch shaft if worn or damaged.

CLUTCH HOUSING ALIGNMENT

Clutch housing misalignment is caused by excessive face or bore runout of the clutch housing or housing-to-transmission adapter. Misalignment will cause improper clutch release, driven plate failure, front transmission bearing failure, premature crankshaft pilot bushing wear, and clutch noise and vibration. In severe cases, misalignment will cause gear jump-out on deceleration. If these malfunctions occur, the rear face and bore of the clutch housing or housing-to-transmission adapter must be checked for excessive runout.

Alignment Check

NOTE: Use the following procedure when the vehicle is not equipped with a clutch housing-to-transmission adapter.

Remove the transmission.

Remove the clutch housing, clutch cover and driven plate.

Remove one flywheel attaching bolt.

Obtain a ½-20 x 9-inch bolt and a ½-20 nut for use as a dial indicator support.

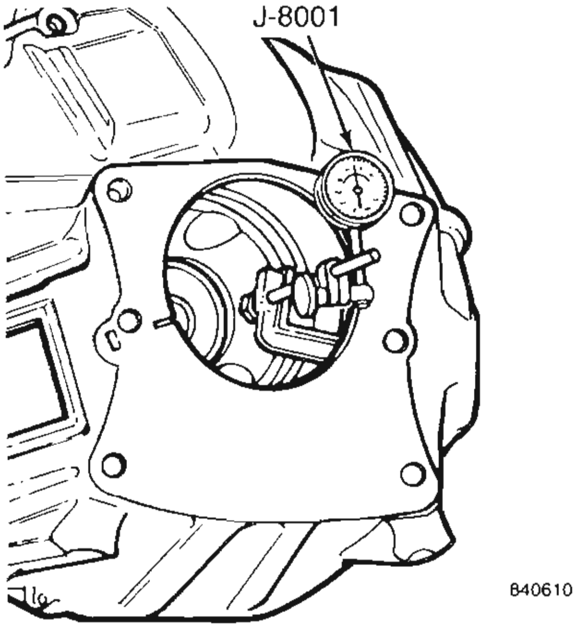
Thread the nut onto the bolt until 10 or 12 bolt threads are exposed.

Thread the bolt into the crankshaft attaching bolt hole and tighten the nut to secure the bolt.

Install the clutch housing on the engine and tighten the housing, attaching the bolts with the specified torque.

SEE I.S. NOTES

Mount the Dial Indicator, J-8001, on the 9-inch bolt. The indicator stylus must contact the rear face of the clutch housing approximately 3.2 mm (1/8 in) from the edge of the bore.



Rotate the crankshaft and check the face runout of the housing. The face runout must not exceed 0.25 mm (0.010 in) total indicator reading at any point throughout 360° rotation.

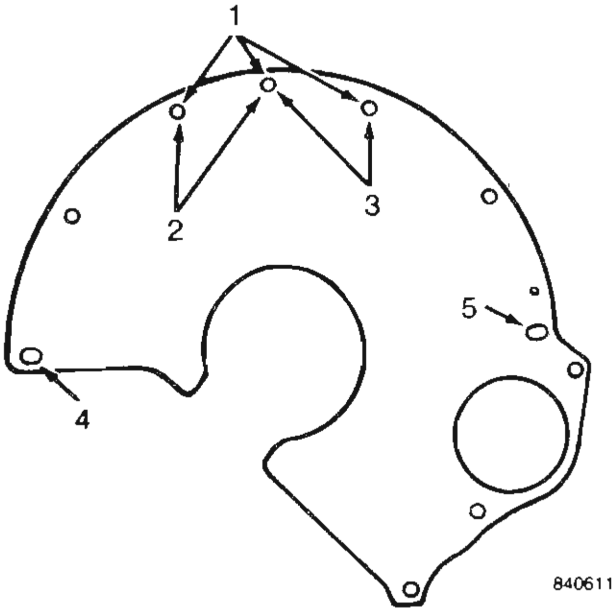
NOTE: Crankshaft end play must be held to zero to obtain an accurate face runout reading. Move and hold the crankshaft forward or rearward using a pry bar to remove end play.

If the face runout is over the specified limits, correct the runout as follows.

Move the dial indicator aside and loosen the clutch housing attaching bolts.

Insert shims between the housing and engine-to-housing spacer as required to correct the runout.

Install the shims at point 1 to align the top of the housing with the bottom of the housing. Install the shims at points 2, 4, 3 or 5 to correct the runout at either side of the clutch housing. The shims installed at points 4 and 5 will also align the housing from the bottom to the top.



Tighten the housing attaching bolts with the specified torque.

Reposition the dial indicator stylus on the housing face and recheck the face runout.

The total face runout of the clutch housing must not exceed 0.25 mm (0.010 in). Relocate the shims as necessary to correct the runout.

Check the clutch housing bore alignment by positioning the dial indicator stylus on the inside diameter of the housing bore.

Hold the crankshaft end play to zero, rotate the crankshaft and note the dial indicator reading at four equally spaced points. The bore runout must not exceed 0.25 mm (0.010 in) total indicator reading at any point.

NOTE: Any change in the face alignment will also change the bore alignment. In some cases, it is possible to correct the bore alignment simply by correcting the face alignment. Where it is impossible to correct the bore alignment to a maximum of 0.25 mm (0.010 in) runout (after changing the face alignment), replace the clutch housing.

CLUTCH PEDAL

Removal

Disconnect the battery negative cable.

Remove the snap ring on the end of the pedal shaft and remove the clutch pedal.

Disconnect the clutch pedal push rod from the clutch pedal and remove the clutch pedal.

Installation

Lubricate the bushings in the replacement clutch pedal with Lubriplate, or an equivalent lubricant.

Connect the clutch pedal push rod to the replacement clutch pedal.

Install the clutch pedal on the pedal shaft and install the snap ring on the end of the shaft.

Connect the clutch pedal push rod to the bellcrank.

Connect the battery negative cable.

Check and adjust the clutch pedal free play, if necessary.

SEE
I.S.
NOTES

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-5822	Removal Tool		■
J-24420-A	Universal Puller		■
J-33169	Clutch Alignment Tool		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Clutch Cover Bolts	31 N·m (23 ft-lbs)	27-35 N·m (20-26 ft-lbs)
Clutch Master Cylinder-to-Dash	26 N·m (19 ft-lbs)	20-31 N·m (15-23 ft-lbs)
Hydraulic Fluid Line Fitting-to-Master Cylinder	15 N·m (11 ft-lbs)	14-16 N·m (10-12 ft-lbs)
Hydraulic Fluid Line Fitting-to-Slave Cylinder	21 N·m (16 ft-lbs)	18-25 N·m (13-18 ft-lbs)

CLUTCH ADJUSTMENTS

The clutch hydraulic mechanism is self-adjusting. Free play adjustments are not required nor is there any provision for such an adjustment.

CLUTCH ASSEMBLY REMOVAL

Remove the transmission-transfer case assembly. Refer to the Transmission Removal section.

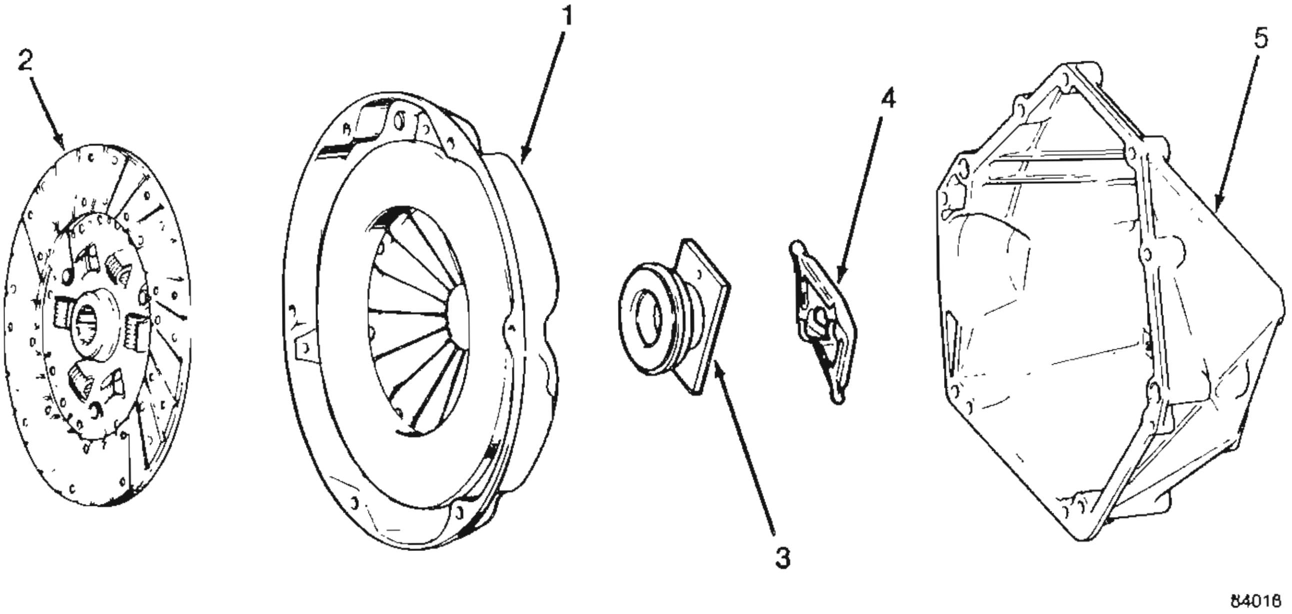
Mark the position of the clutch cover (1) on the flywheel for assembly alignment reference.

CAUTION: The clutch cover bolts must be loosened evenly and in rotation to avoid distorting the cover. The cover is a steel stamping and could be warped if removed improperly. If warped, the cover will cause clutch chatter after assembly.

Loosen the clutch cover attaching bolts one or two turns at a time and in rotation to relieve spring tension on the cover.

Remove the clutch cover bolts and remove the cover and clutch driven plate (2) from the flywheel.

Remove the pilot bushing lubricating wick from the bushing bore in the crankshaft and soak the wick in clean engine oil.



CLUTCH ASSEMBLY INSTALLATION

Install the pilot bushing lubricating wick.

Insert Clutch Alignment Tool J-33169 in the hub of the clutch driven plate (2) and position the plate on the flywheel. Be sure that the alignment tool is fully seated in the pilot bushing.

NOTE: Be sure that the side of the driven plate, marked flywheel side, is positioned against the flywheel.

Position the clutch cover (1) on the flywheel and over the driven plate.

Align the driven plate and the clutch cover using the alignment tool and install the cover attaching bolts finger-tight only.

CAUTION: To avoid warping the clutch cover, tighten the cover attaching bolts a few turns at a time only.

Tighten the clutch cover bolts alternately and evenly with the specified torque.

CLUTCH COMPONENT INSPECTION AND SERVICE

Clutch Pilot Bushing Removal

Remove the clutch assembly. Refer to Clutch Assembly Removal in this section.

Obtain and lubricate the replacement pilot bushing with engine oil.

Remove the pilot bushing lubricating wick and soak the wick in engine oil.

Remove the old bushing using Removal Tool J-5822 and Slide Hammer J-2619-01.

Clutch Pilot Bushing Installation

CAUTION: The bushing and installer tool must be kept parallel with the crankshaft centerline during installation to prevent damage to the bushing.

Install the pilot bushing lubricating wick in the bushing bore in the crankshaft.

SEE I.S. NOTES

Install the replacement pilot bushing in the crankshaft bushing bore using the Clutch Alignment Tool J-33169.

Remove the bushing installer tool.

Install the clutch, transmission and transfer case assemblies.

Clutch Throwout Bearing And Lever Removal

Remove the transmission-transfer case assembly. Refer to the Transmission Removal section.

Remove the throwout bearing (3) and lever (4) as an assembly.

Remove the throwout bearing from the lever.

Clutch Throwout Bearing And Lever Installation

Install the throwout bearing (3) in the lever (4). Be sure that the bearing retaining springs are engaged in the lever.

Position the throwout lever on the pivot ball in the clutch housing (5) and connect the lever spring to the lever.

Install the transmission-transfer case assembly. Refer to the Transmission Removal section.

CLUTCH MASTER CYLINDER

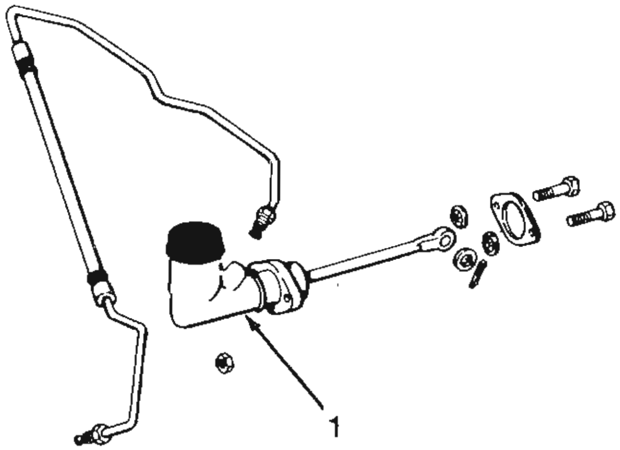
Removal

Disconnect the hydraulic line at the clutch master cylinder (1).

Cap the hydraulic line and the cylinder opening to prevent dirt entry.

Remove the cotter pin and the washer that retain the cylinder push rod on the clutch pedal and slide the rod off the pedal pivot.

Remove the nuts attaching the clutch cylinder to the mounting studs on the dash panel and remove the cylinder.



84017

Installation

Install the clutch master cylinder (1) on the dash panel mounting studs. Tighten the cylinder attaching nuts with the specified torque.

Connect the hydraulic line to the clutch master cylinder.

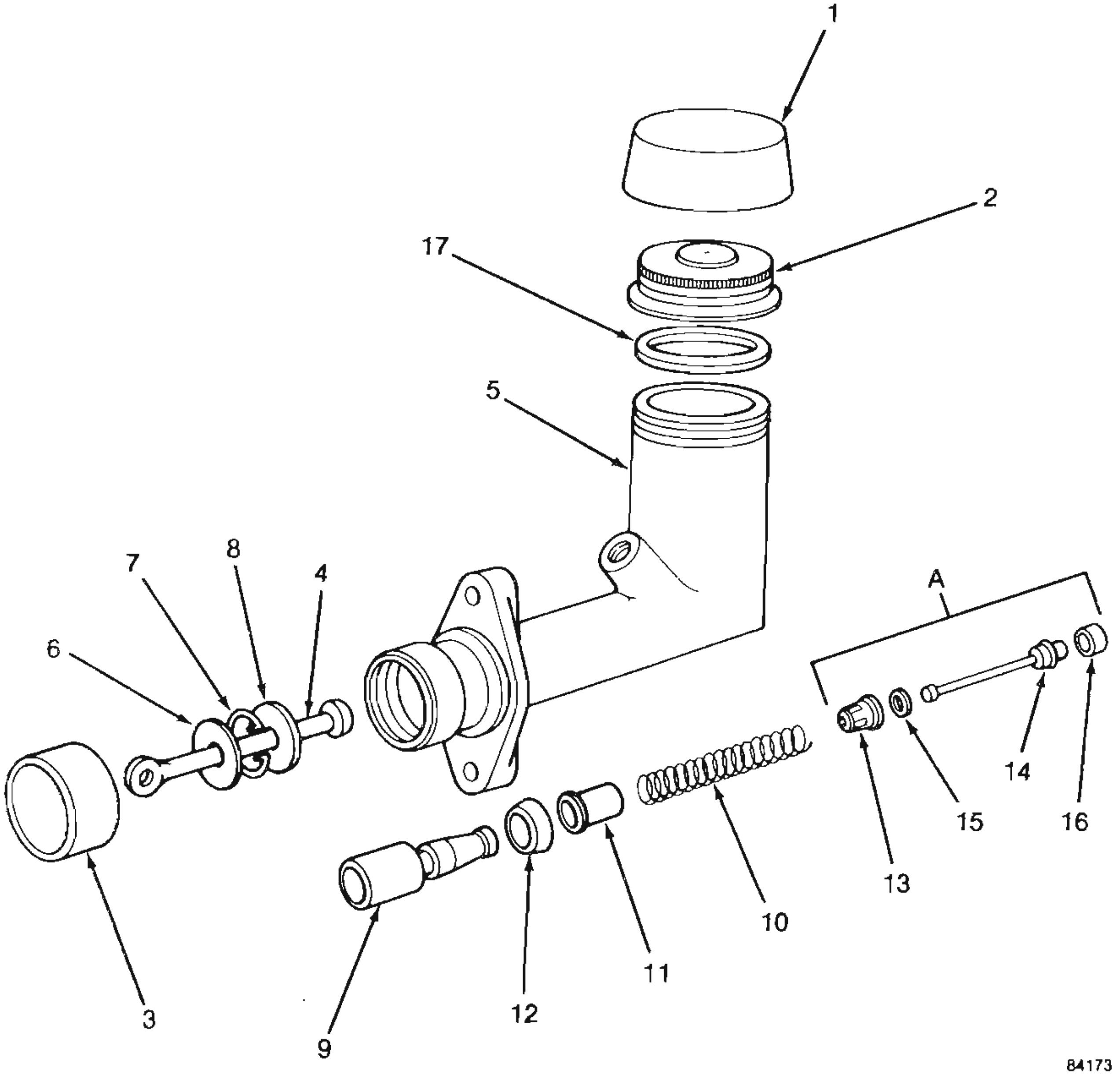
Install the master cylinder push rod on the clutch pedal pivot and install the retaining washer and cotter pin.

Fill the clutch cylinder reservoir with brake fluid to the level indicated on the side of the reservoir. Use only AMC/Jeep brake fluid, or equivalent, marked SAE J-1703 or DOT 3, to fill the reservoir.

Install the reservoir cap and bleed the clutch hydraulic system.

SE
I.S
NOTES

Disassembly



1. Rubber Outer Cover
2. Reservoir Cap
3. Dust Boot
4. Push Rod
5. Clutch Master Cylinder
6. Push Rod Seal
7. Retaining Snap Ring
8. Retaining Washer
9. Plunger
10. Valve Spring
11. Valve Stem Retainer
12. Plunger Seal
13. Spring Retainer
14. Valve Stem
15. Spring Washer
16. Stem Tip Seal
17. Cap Seal

A. Valve Stem Assembly

Remove the rubber outer cover (1) and the reservoir cap (2). Place the cap and cover on a clean, lint-free paper or cloth.

NOTE: It is not necessary to remove the rubber outer cover from the reservoir cap unless the cover is damaged.

Remove the dust boot (3) covering the push rod (4). Use a screwdriver to pry the boot off the clutch master cylinder (5). Discard the boot after removal.

Unseat the push rod seal (6) and remove the snap ring (7) that retains the push rod in the cylinder. Use needlenose pliers to compress the ends of the snap ring and then remove this ring from the cylinder bore. Discard the snap ring after removal.

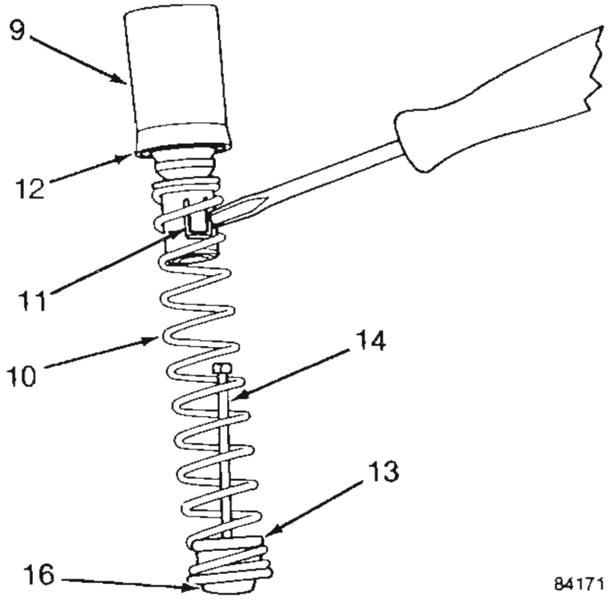
Remove the push rod, the retaining washer (8) and the push rod seal as an assembly. Remove and discard the seal.

Remove the plunger (9), the valve spring (10) and the valve stem assembly (A) from the cylinder bore.

Tap the cylinder body lightly on a wood block to dislodge the valve stem assembly from the bore.

Compress the valve spring slightly and pry the tab of the valve stem retainer (11) upward to release the retainer, the spring and the stem assembly from the plunger.

NOTE: The retainer tab is located in the rectangular slot in the side of the stem retainer. Use a small, thin blade screwdriver to pry the tab upward.



Remove the seal (12) from the plunger. Discard the seal after removal.

Remove the spring retainer (13) and the valve stem (14) from the valve spring.

Remove the valve stem from the retainer, and remove the spring washer (15) and the stem tip seal (16) from the end of the valve stem.

Discard the stem tip seal and the spring washer.

Clean all the parts thoroughly with brake fluid or brake cleaning solvent only.

Inspect the clutch master cylinder bore for cracks, porosity, wear, deep scoring or nicks, and severe corrosion or pitting. If the bore exhibits any of these conditions, replace the clutch master cylinder.

SEE I.S. NOTES

SEE I.S. NOTES

Assembly

Lubricate the bore of the clutch master cylinder (5) with brake fluid.

Position the replacement seals (12, 16) on the plunger (9) and the valve stem (14). Be sure that the lip of the plunger seal faces the stem end of the plunger. Also be sure that the stem tip seal is positioned so that the seal shoulder fits in the undercut at the end of the valve stem.

Install the replacement spring washer (15) on the valve stem.

Install the plastic spring retainer (13) on the valve stem and over the spring washer. Be sure that the large end of the retainer is facing the end of the stem.

Install the valve spring (10) over the stem and the seat spring on the valve stem retainer (11).

Install the assembled valve spring, the retainer and the valve stem assembly (A) on the plunger.

Compress the spring against the plunger. When the end of the valve stem passes through the valve stem retainer and seats in the small bore in the end of the plunger, bend the retainer tab on the valve stem retainer downward to lock the stem and retainer on the plunger.

Lubricate the spring and plunger assembly with brake fluid and insert the assembly (spring end first) into the cylinder bore.

Install the replacement seal (6) and dust boot (3) on the push rod (4).

Lubricate the ball-end of the push rod and the seal and lip of the dust boot with the lubricant supplied in the clutch master cylinder overhaul kit.

Insert the push rod and retaining washer (8) into the cylinder bore.

Secure the push rod and retainer in the bore using the replacement snap ring (7) supplied in the overhaul kit.

Slide the push rod seal up against the retaining snap ring and install the dust boot on the end of the cylinder. Be sure that the boot lip is seated in the undercut on the end of the cylinder.

Remove and discard the old cap seal (17) from the reservoir cap (2) and install the new seal supplied in the kit.

Install the rubber outer cover (1) on the reservoir cap, if it has been removed.

SLAVE CYLINDER

Removal

Raise the vehicle.

Disconnect the hydraulic line at the slave cylinder.

Remove the bolts attaching the slave cylinder to the clutch cover housing and remove the cylinder.

Installation

Lubricate the throwout lever socket with chassis lubricant.

Align the push rod (2) with the throwout lever, position the slave cylinder on the clutch cover housing and install the cylinder attaching bolts.

Tighten the bolts securely.

Connect the hydraulic line to the slave cylinder.

Lower the vehicle.

Fill the reservoir with brake fluid and bleed the hydraulic system.

Disassembly

Clean the outside of the slave cylinder thoroughly.

Remove the boot (1) from the cylinder.

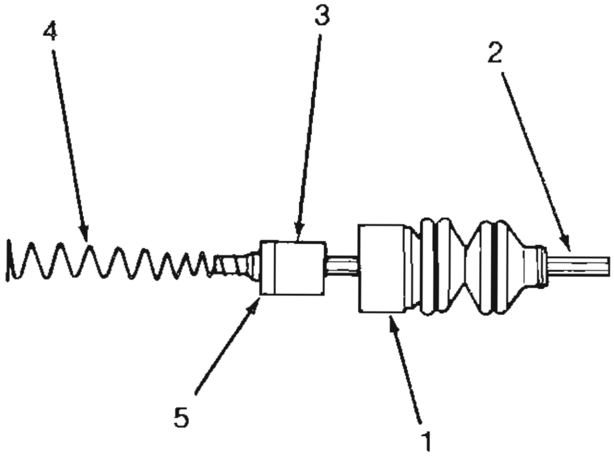
Remove the cylinder push rod (2), boot, plunger (3) and spring (4) as an assembly.

Remove the spring and seal (5) from the plunger.

Remove the snap ring that retains the push rod in the plunger and remove the push rod and boot.

Remove the boot from the push rod.

Clean the parts with brake fluid.



84172

Assembly

Install the replacement boot (1) on the push rod (2).

Install the push rod in the plunger (3) and install the replacement push rod retaining snap ring.

Install the spring (4) on the plunger.

Lubricate the cylinder bore and the seal (5) with brake fluid.

Install the assembled plunger, spring and push rod in the cylinder.

Install and secure the boot on the cylinder.

CLUTCH HYDRAULIC SYSTEM BLEEDING

Fill the reservoir with brake fluid.

Raise the vehicle.

Remove the slave cylinder from the clutch cover housing and remove the push rod.

SEE I.S. NOTES

Compress the slave cylinder plunger using tool J-24420-A or equivalent.

Attach one end of a rubber hose to the slave cylinder bleed screw. Place the opposite end of the hose in a glass container filled halfway with brake fluid. Be sure the hose end is submerged in fluid.

Loosen the bleed screw.

Have an assistant press and hold the clutch pedal to the floor. Tighten the bleed screw and release the pedal.

Repeat the bleeding operation until the fluid entering the container is free of bubbles.

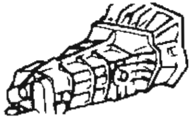
NOTE: Do not allow the reservoir to run out of fluid during the bleeding operation.

Remove the tool from the slave cylinder and install the push rod.

Install the slave cylinder in the clutch cover housing and install the attaching nuts.

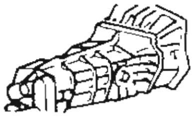
Lower the vehicle.

Adjust the reservoir fluid level to the level indicated on the reservoir after completing the bleeding operation.



GEARBOXES

CONTENTS



SEE
I.S.
NOTES

Three manual transmission models are used in Jeep vehicles, the Model T4, the Model T5 and the Model T-176.

The Model T4 and T-176 are 4-speed, constant mesh units providing synchromesh engagement in all forward gear ranges. The Model T5 is a 5-speed constant mesh unit providing synchromesh engagement in all forward gear ranges.

The Model T4 is used with four- and six-cylinder engines. The Model T5 is optional on four- and six-cylinder models. The Model T-176 is used with six-cylinder engines.

All transmission models are floor shift units. Column shift units are not available in any Jeep model.

The shift mechanism on all transmission models is located within the shift control housing which also serves as the transmission top cover. The shift mechanism does not require adjustment and can be serviced independently of the transmission.

A spring and plunger-type backup lamp switch is used on all models. The switch is located in the transmission case and is actuated by the reverse shift rail. The switch does not require adjustment and is serviced as an assembly only.

One transfer case model, the Model 300, is used on Jeep CJ and Scrambler vehicles. It is a gearbox unit having the gears positioned in a layshaft-type arrangement.

The Model 300 has a cast iron case, four gear positions and employs an external floor-mounted gearshift linkage for range control. Manual locking front hubs are standard equipment with this transfer case.

The Model 300 is a part-time, four-wheel drive unit providing four-wheel high and low ranges, a Neutral position and two-wheel high range. The four-wheel high and low ranges are undifferentiated.

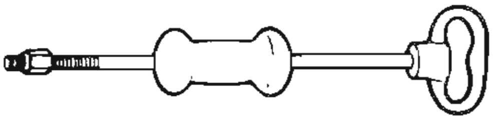
In four-wheel low range, the reduction ratio is 2.6:1.

SEE I.S. NOTES

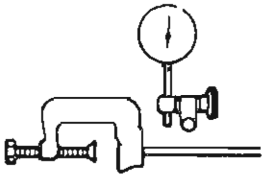
SEE
I.S.
NOTES

SPECIAL TOOLS

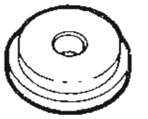
Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-8001	Dial Indicator Set		■
J-8092	Driver Handle		■
J-8614-01,02,03	Holder and Remover Companion Flange		■
J-9276-3	Rear Output Shaft Front Cup Installer	■	
J-22912-01	Bearing Remover		■
J-25142	Intermediate Shaft Needle Bearing Aligning Arbor		■
J-25152	Bearing Puller Set		■
J-25160	Output Shaft Oil Seal Installer	■	
J-25167	Shift Rod Oil Seal Thimble and Driver Installer Tools		■
J-25175	Shift Rod Oil Seal Remover Tools		■
J-25180	Output Shaft Oil Seal Remover		■
J-25233	Front Bearing Cap Seal Installer		■
J-29168	Front Output Shaft Bearing Remover	■	
J-29179	Rear Output Shaft Needle Bearing Installer	■	
J-29181	Front Output Shaft Cup Installer	■	
J-29182	Rear Output Shaft Cup Installer	■	
J-29184	Input Shaft Support Set Installer	■	
J-29342	Countershaft Arbor Tool		■
J-29343	Reverse Idler Shaft Arbor Tool		■
J-29344	Front Bearing Puller		■
J-29345	Bearing Starter		■
J-29369-1	Needle Bearing Puller		■



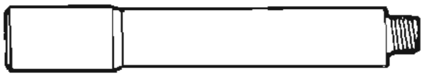
J-2619-01



J-8001

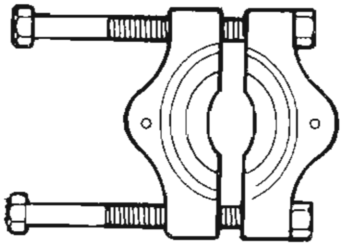


J-9276-3



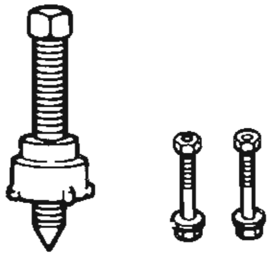
J-8092

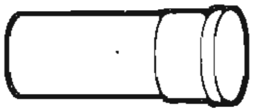
J-29342



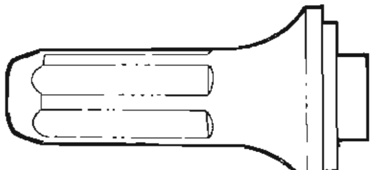
J-22912-01

J-8614-02
J-8614-03

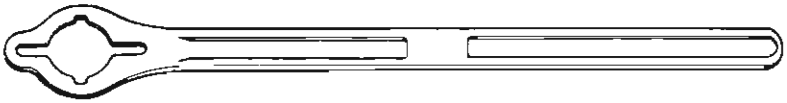




J-25142

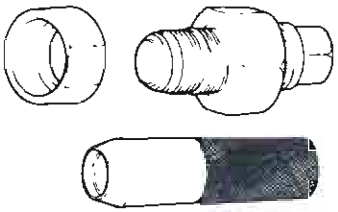


J-25160

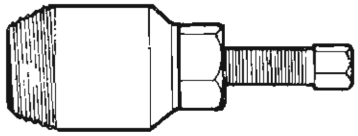


J-8614-01

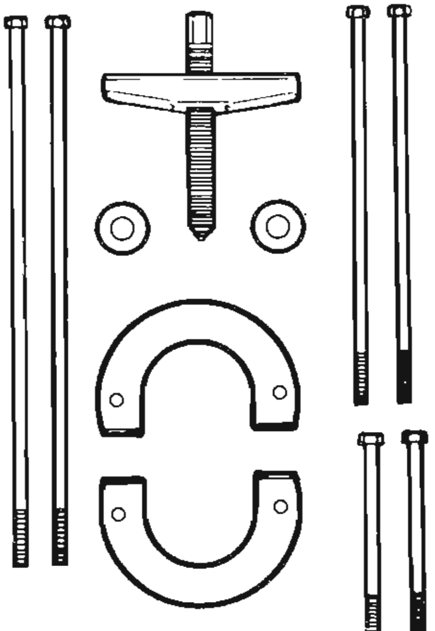
J-25167



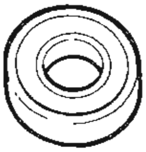
J-25175



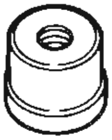
J-25180



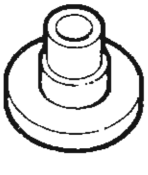
J-25152



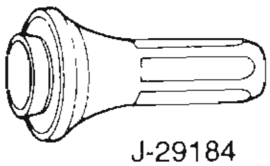
J-25233



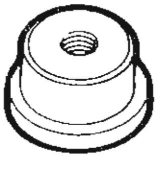
J-29168



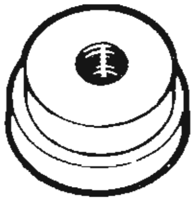
J-29179



J-29184



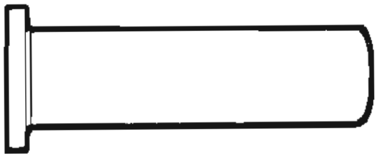
J-29181



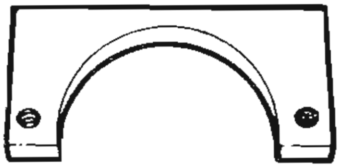
J-29182

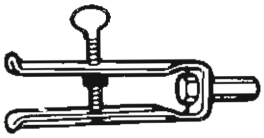
841012

SEE
I.S.
NOTES


J-29343


J-29345


J-29344


J-29369-1

86391

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Model T4/T5 Transmission		
Backup Lamp Switch	20 N·m (15 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Fill Plug	31 N·m (23 ft-lbs)	20-41 N·m (15-30 ft-lbs)
Shift Control Housing Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Transmission-to-Clutch Housing Bolt	75 N·m (55 ft-lbs)	61-65 N·m (45-65 ft-lbs)
Universal Joint Clamp Strap Bolt	19 N·m (14 ft-lbs)	16-24 N·m (12-18 ft-lbs)
Model T-176 Transmission		
Backup Lamp Switch	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Drain and Fill Plugs	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Front Bearing Cap Bolts	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Shift Housing-to-Transmission Case Bolts	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Support Plate Bolts	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)
Model 300 Transfer Case		
Bottom Cover Bolts	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Cover Plate Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front Bearing Cap Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front/Rear Yoke Locknuts	163 N·m (120 ft-lbs)	163-203 N·m (120-150 ft-lbs)
Input Shaft Support Screws	14 N·m (10 ft-lbs)	9-14 N·m (7-10 ft-lbs)
Lockplate Bolts	31 N·m (23 ft-lbs)	27-34 N·m (20-25 ft-lbs)
Shift Fork Setscrews	19 N·m (14 ft-lbs)	16-24 N·m (12-18 ft-lbs)

SEE I.S. NOTES

SEE I.S. NOTES

SPECIFICATIONS

Model T4 Transmission

Lubrication	
Level	to bottom of fill hole
Inspect Correct Fill Levels	5 000 mi 5 mo 8 000 km initially then every 7,500 mi 7½ mo 12 000 km thereafter
Recommended Lubricants	AMC Jeep Manual Transmission Fluid Part No 8983 000 000
Lubricant Capacity Dry Transmission	
U S Measure	3.9 pints
Imperial Measure	3 2 pints
Metric Measure	1 8 liters

Model T5 Transmission

Lubrication	
Level	to bottom of fill hole
Inspect Correct Fill Levels	5,000 mi 5 mo 8 000 km initially, then every 7,500 mi 7½ mo 12 000 km thereafter
Recommended Lubricants	AMC Jeep Manual Transmission Fluid Part No 8983 000 000
Lubricant Capacity Dry Transmission	
U S Measure	4 5 pints
Imperial Measure	3 7 pints
Metric Measure	2 1 liters

Model T-176 Transmission

Lubrication	
Level	to bottom of fill hole
Inspect Correct Fill Levels	5.000 mi/5 mo/8 000 km initially, then every 7,500 mi 7½ mo 12 000 km thereafter
Recommended Lubricants	AMC-Jeep Manual Transmission Fluid Part No 8983 000 000
Lubricant Capacity Dry Transmission	
U S Measure	3 5 pints
Imperial Measure	2.9 pints
Metric Measure	1.7 liters

Model 300 Transfer Case

Transfer Case Type	4 position, dual range part time 4 wheel drive unit with integral low range
Torque Transmittal Mode	Constant mesh gearbox with layshaft gear arrangement
Low Range Reduction Ratio	2.6.1 gear reduction
Drive Positions and Shift Controls	2H, 4H, 4L and Neutral. Ranges selected via floor mounted shift lever 4H and 4L ranges are undifferentiated
Case Configuration	One piece cast iron with aluminum front/rear bearing caps
Lubricant Capacity and Type	1.9 liters (4 pts) AMC/Jeep Manual Transmission Fluid Part No 8983 000 000

841102

Transmission Gear Ratios

ENGINE-VEHICLE MODEL	T4					T5					
	1st	2nd	3rd	4th	REV.	1st	2nd	3rd	4th	5th	REV.
4-Cylinder CJ-7, Scrambler	4.03:1	2.37:1	1.50:1	1.00:1	3.76:1						
4-Cylinder CJ-7, Scrambler*						4.03:1	2.37:1	1.50:1	1:00:1	0.86:1	3.76:1
6-Cylinder CJ-7, Scrambler	4.03:1	2.37:1	1.50:1	1.00:1	3.76:1						
6-Cylinder CJ-7, Scrambler						4.03:1	2.37:1	1.50:1	1.00:1	0.76:1	3.76:1

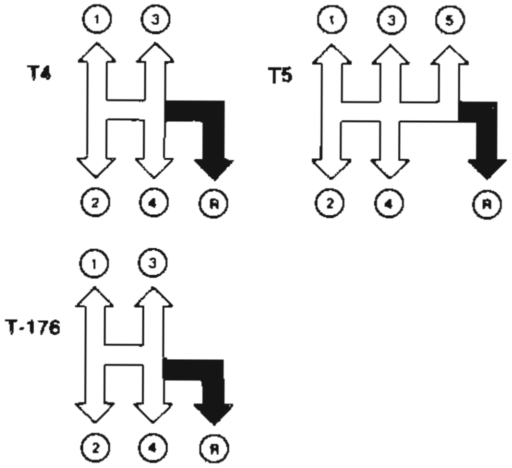
*with 4.10 axle ratio

ENGINE-VEHICLE MODEL	T-176				
	1st	2nd	3rd	4th	REV.
6-Cylinder CJ-7, Scrambler	3.82:1	2.29:1	1.46:1	1.00:1	3.82:1

841103

SEE
I.S.
N
O
T
E
S

Gearshift Pattern Chart



840994

TRANSMISSION LUBRICANTS

The only recommended lubricant for T4, T5 and T-176 transmission models is AMC/Jeep Manual Transmission Fluid, Part no. 8983 000 000.

When refilling or adding lubricant to the transmission, fill the transmission until the lubricant level is at the lower edge of the fill plug hole only. Lubricant capacities for the transmission models are:

- T4: 1.7 liters (3.5 pints)
- T5: 1.9 liters (4.0 pints)
- T-176: 1.7 liters (3.5 pints)

SEE I.S. NOTES

IDENTIFICATION

On T4 and T5 model transmissions, an identification tag displaying the Jeep part number is attached to the right side of the adapter housing by an adapter housing-to-transmission case bolt. On T-176 transmissions, the identification tag is bolted to the shift control lever housing near the left rear corner of the housing.

The information on this tag is necessary to obtain the correct replacement parts. Be sure the tag is securely attached in the original location after completing all service operations.

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
TRANSMISSION SHIFTS HARD	(1) Clutch adjustment incorrect	(1) Adjust clutch.
	(2) Clutch linkage or cable binding	(2) Lubricate or repair as necessary.
	(3) Shift rail binding	(3) Check for mispositioned selector arm roll pin, loose cover bolts, worn shift rail bores, worn shift rail, distorted oil seal, or extension housing not aligned with case. Repair as necessary.
	(4) Internal bind in transmission caused by shift forks, selector plates, or synchronizer assemblies	(4) Remove, disassemble and inspect transmission. Replace worn or damaged components as necessary.
	(5) Clutch housing misalignment	(5) Check runout at rear face of clutch housing.
	(6) Incorrect lubricant	(6) Drain and refill transmission.
	(7) Block rings and/or cone seats worn	(7) Blocking ring to gear clutch tooth face clearance must be 0.030 inch or greater. If clearance is correct it may still be necessary to inspect blocking rings and cone seats for excessive wear. Repair as necessary.
GEAR CLASH WHEN SHIFTING FROM ONE GEAR TO ANOTHER	(1) Clutch adjustment incorrect	(1) Adjust Clutch.
	(2) Clutch linkage or cable binding	(2) Lubricate or repair as necessary.
	(3) Clutch housing misalignment	(3) Check runout at rear of clutch housing.
	(4) Lubricant level low or incorrect lubricant	(4) Drain and refill transmission and check for lubricant leaks if level was low. Repair as necessary.
	(5) Gearshift components, or sychronizer assemblies worn or damaged	(5) Remove, disassemble and inspect transmission. Replace worn or damaged components as necessary.
TRANSMISSION NOISY	(1) Lubricant level low or incorrect lubricant	(1) Drain and refill transmission. If lubricant level was low, check for leaks and repair as necessary.
	(2) Clutch housing-to-engine, or transmission-to-clutch housing bolts loose	(2) Check and correct bolt torque as necessary.
	(3) Dirt, chips, foreign material in transmission	(3) Drain, flush, and refill transmission.
	(4) Gearshift mechanism, transmission gears, or bearing components worn or damaged	(4) Remove, disassemble and inspect transmission. Replace worn or damaged components as necessary.
	(5) Clutch housing misalignment	(5) Check runout at rear face of clutch housing.

SEE I.S. NOTES

840995

SEE I.S. NOTES

Condition	Possible Cause	Correction
JUMPS OUT OF GEAR	(1) Clutch housing misalignment	(1) Check runout at rear face of clutch housing.
	(2) Gearshift lever loose	(2) Check lever for worn fork. Tighten loose attaching bolts.
	(3) Offset lever nylon insert worn or lever attaching nut loose	(3) Remove gearshift lever and check for loose offset lever nut or worn insert. Repair or replace as necessary.
	(4) Gearshift mechanism, shift forks, selector plates, interlock plate, selector arm, shift rail, detent plugs, springs or shift cover worn or damaged	(4) Remove, disassemble and inspect transmission cover assembly. Replace worn or damaged components as necessary.
	(5) Clutch shaft or roller bearings worn or damaged	(5) Replace clutch shaft or roller bearings as necessary.
	(6) Gear teeth worn or tapered, synchronizer assemblies worn or damaged, excessive end play caused by worn thrust washers or output shaft gears	(6) Remove, disassemble, and inspect transmission. Replace worn or damaged components as necessary.
	(7) Pilot bushing worn	(7) Replace pilot bushing.
WILL NOT SHIFT INTO ONE GEAR	(1) Gearshift selector plates, interlock plate, or selector arm, worn, damaged, or incorrectly assembled	(1) Remove, disassemble, and inspect transmission cover assembly. Repair or replace components as necessary.
	(2) Shift rail detent plunger worn, spring broken, or plug loose	(2) Tighten plug or replace worn or damaged components as necessary.
	(3) Gearshift lever worn or damaged	(3) Replace gearshift lever.
	(4) Synchronizer sleeves or hubs, damaged or worn	(4) Remove, disassemble and inspect transmission. Replace worn or damaged components.
LOCKED IN ONE GEAR — CAN NOT BE SHIFTED OUT	(1) Shift rail(s) worn or broken, shifter fork bent, setscrew loose, center detent plug missing or worn	(1) Inspect and replace worn or damaged parts.
	(2) Broken gear teeth on countershaft gear, clutch shaft, or reverse idler gear	(2) Inspect and replace damaged part.
	(3) Gearshift lever broken or worn, shift mechanism in cover incorrectly assembled or broken, worn damaged gear train components	(3) Disassemble transmission. Replace damaged parts or assemble correctly.

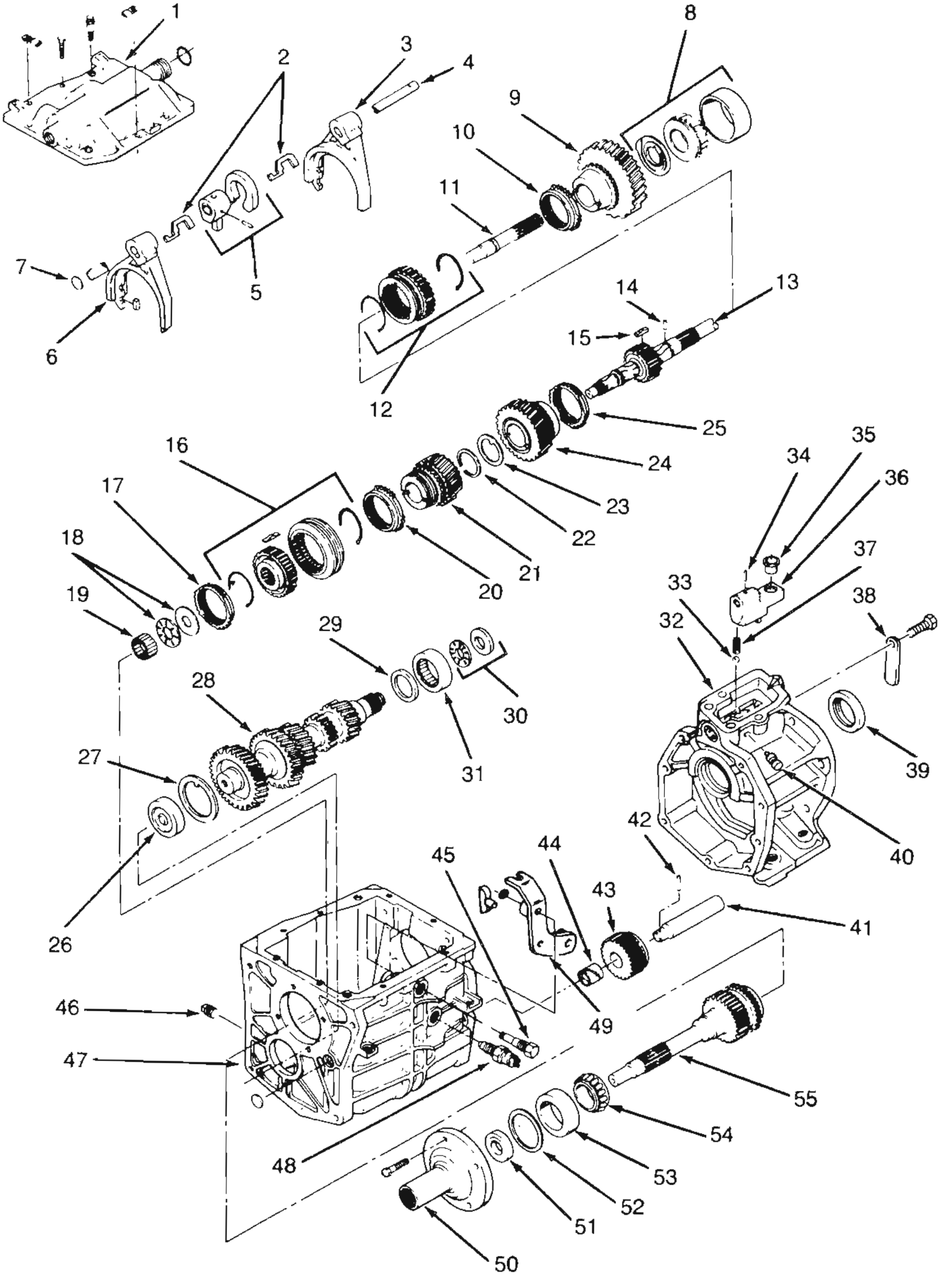
840996

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 difficult shifting.	(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 or 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 SAE 85W-90 gear lubricant 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 SAE 85W-90 gear lubricant 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 in Neutral, then shift back into 4L position.
	(2) Shift linkage loose or binding.	(2) Tighten, lubricate, or repair linkage as necessary.
	(3) Shift fork cracked, inserts worn, or fork is binding on shift rail.	(3) 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, 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

841112

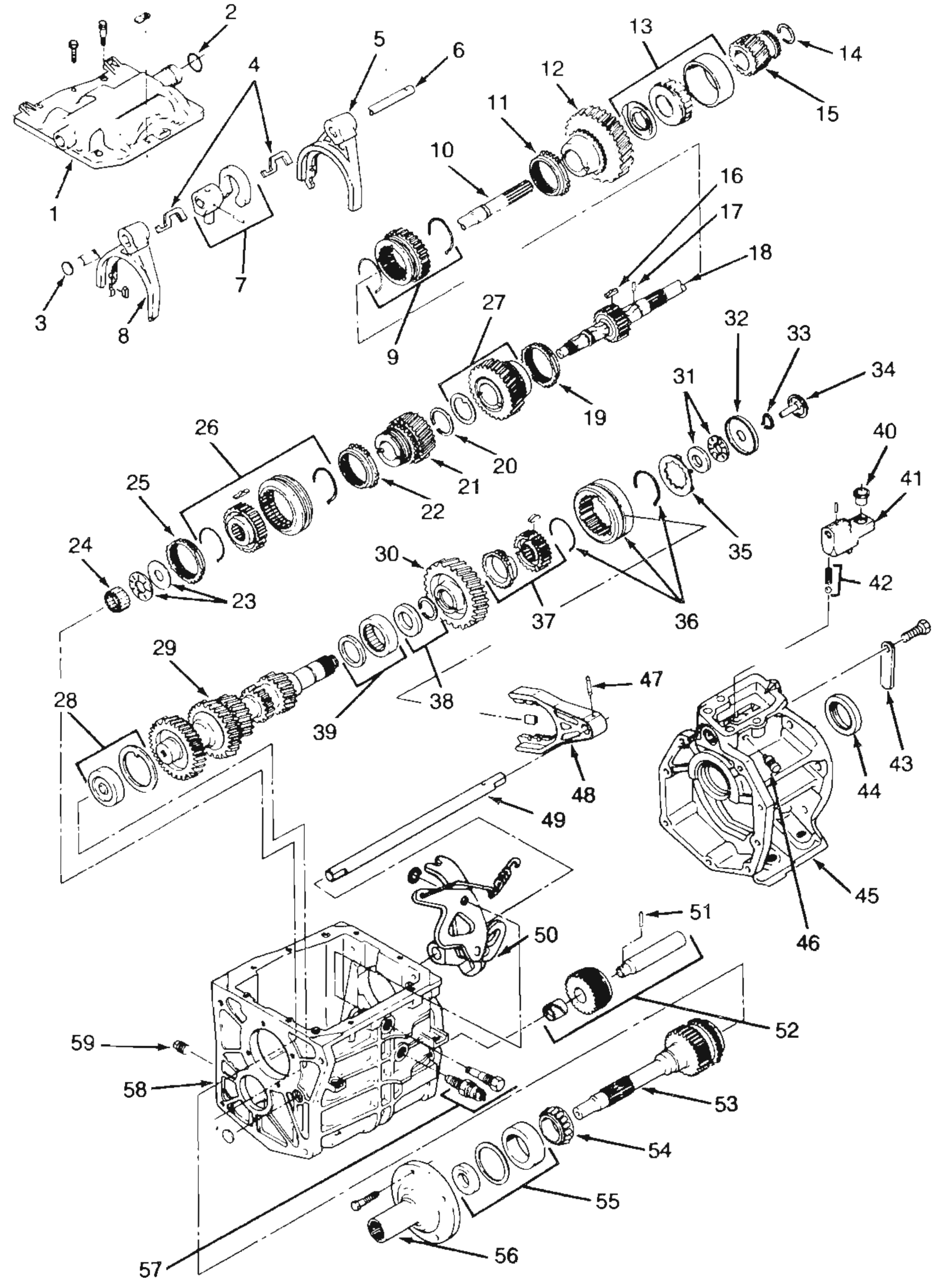
SEE I.S. NOTES



T4 Four-Speed Transmission

1 - Transmission Cover
2 - Selector Plate
3 - First-Second Shift Fork
4 - Shift Rail
5 - Selector Arm Interlock Plate and Pin
6 - Third-Fourth Shift Fork
7 - Plug
8 - Thrust Washer, Rear Bearing and Cup
9 - First Gear
10 - Blocking Ring
11 - Output Shaft
12 - Reverse Sliding Gear and Insert Spring
13 - Output Shaft
14 - First Gear Pin
15 - Synchronizer Insert
16 - Third-Fourth Synchronizer Spring, Hub, Insert and Sleeve
17 - Blocking Ring
18 - Needle Thrust Bearing and Race
19 - Clutch Shaft Needle Roller Bearing
20 - Third-Fourth Blocking Ring
21 - Third Gear
22 - Snap Ring
23 - Thrust Washer
24 - Second Speed Gear
25 - Blocking Ring
26 - Front Countershaft Bearing
27 - Front Countershaft Thrust Washer
28 - Countershaft Gear
29 - Rear Countershaft Spacer
30 - Needle Thrust Bearing and Race
31 - Rear Countershaft Bearing
32 - Adapter Housing
33 - Detent Ball
34 - Pin
35 - Damper Sleeve
36 - Offset Lever
37 - Detent Spring
38 - Identification Tag
39 - Adapter Housing Seal
40 - Breather
41 - Reverse Idler Gear Shaft
42 - Pin
43 - Reverse Idler Gear
44 - Bushing
45 - Reverse Lever Pivot Bolt
46 - Drain Plug
47 - Transmission Case
48 - Reverse Lamp Switch
49 - Reverse Lever Fork
50 - Front Bearing Cap
51 - Oil Seal
52 - Shim
53 - Front Bearing Cup
54 - Front Bearing
55 - Clutch Shaft

SEE I.S. NOTES



T5 Five-Speed Transmission

86382

1 - Transmission Cover
2 - O-Ring
3 - Plug
4 - Selector Plate
5 - First-Second Shift Fork
6 - Shift Rail
7 - Selector Arm, Interlock Plate and Pin
8 - Third-Fourth Shift Fork
9 - Reverse Sliding Gear and Insert Spring
10 - Output Shaft
11 - Blocking Ring
12 - First Gear
13 - Thrust Washer, Rear Bearing and Cup
14 - Snap Ring
15 - Fifth Speed Driven Gear
16 - Synchronizer Insert
17 - First Gear Pin
18 - Output Shaft
19 - Blocking Ring
20 - Snap Ring
21 - Third Gear
22 - Third-Fourth Blocking Ring
23 - Needle Thrust Bearing and Race
24 - Clutch Shaft Needle Roller Bearing
25 - Blocking Ring
26 - Third-Fourth Synchronizer Spring, Hub, Insert and Sleeve
27 - Second Speed Gear and Thrust Washer
28 - Front Countershaft Bearing and Thrust Washer
29 - Countershaft Gear
30 - Fifth Gear
31 - Needle Thrust Bearing and Race
32 - Thrust Race
33 - Snap Ring
34 - Funnel
35 - Insert Retainer
36 - Fifth Gear Synchronizer Sleeve and Insert Spring
37 - Fifth Gear Synchronizer Insert, Hub and Blocking Ring
38 - Snap Ring and Spacer
39 - Rear Countershaft Bearing and Spacer
40 - Damper Sleeve
41 - Offset Lever
42 - Detent Spring and Ball
43 - Identification Tag
44 - Housing Seal
45 - Adapter Housing
46 - Breather
47 - Pin
48 - Fifth Speed Shift Fork
49 - Fifth Speed Reverse Rail
50 - Fifth Speed Reverse Shift Lever
51 - Pin
52 - Reverse Idler Gear, Bushing and Shaft
53 - Clutch Shaft
54 - Front Bearing
55 - Front Bearing Cap Oil Seal, Shim and Cup
56 - Front Bearing Cap
57 - Fifth Reverse Lever Pivot Bolt and Lamp Switch
58 - Transmission Case
59 - Drain Plug

SEE I.S. NOTES

TORQUE SPECIFICATIONS

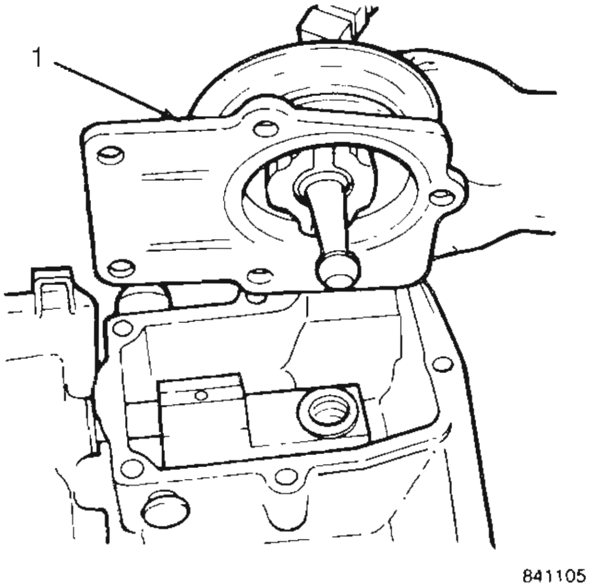
Component	Service Set-To Torque	Service Recheck Torque
Backup Lamp Switch	20 N·m (15 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Fill Plug	31 N·m (23 ft-lbs)	20-41 N·m (15-30 ft-lbs)
Shift Control Housing Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Transmission-to-Clutch Housing Bolt	75 N·m (55 ft-lbs)	61-65 N·m (45-65 ft-lbs)
Universal Joint Clamp Strap Bolt	19 N·m (14 ft-lbs)	16-24 N·m (12-18 ft-lbs)

SEE I.S. NOTES

REMOVAL

Remove the screws attaching the transmission shift lever boot to the floorpan and slide the boot upward on the lever.

Remove the bolts attaching the transmission shift lever housing (1) to the transmission and remove the lever and housing.



Raise the vehicle.

Mark the rear propeller shaft and transfer case yoke for assembly alignment reference.

Disconnect the rear propeller shaft at the transfer case yoke. Move the shaft aside and secure it to the underbody with wire.

Position the safety stand under the clutch housing to support the engine.

Remove the nuts and bolts attaching the rear crossmember to the frame rails and rear support cushion and remove the crossmember.

Disconnect the speedometer cable.

Disconnect the backup lamp switch wire.

Disconnect the four-wheel drive indicator switch wire.

Disconnect the transfer case vent hose at the transfer case.

Mark the front propeller shaft and transfer case yoke for assembly alignment reference.

Disconnect the front propeller shaft from the transfer case yoke. Move the shaft aside and secure it to the underbody with wire.

Remove the transfer case shift lever as follows:

- remove the shifter shaft retaining nut
- remove the cotter pins that retain the shift control link pins in the shift rods and remove the pins
- remove the shifter shaft and disengage the shift lever from the shift control links
- slide the lever upward in the boot to move the lever out of the way

Support the transmission-transfer case assembly with a transmission jack. Use a safety chain to secure the assembly on the jack.

Remove the bolts attaching the transmission to the clutch housing and remove the transmission-transfer case assembly.

Remove the bolts attaching the transfer case to the transmission and remove the transfer case.

Clean the old gasket material and sealer from the mating surfaces of the transmission and transfer case.

Remove the pilot bushing lubricating wick from the bushing and soak the wick in engine oil. Use long needlenose pliers to remove the wick from the bushing.

INSTALLATION

Install the pilot bushing lubricating wick and align the throwout bearing with the splines in the driven plate hub.

Shift the transmission into gear using the shift lever or a long screwdriver. This prevents the clutch shaft from rotating during installation and makes the clutch shaft-to-driven plate spline alignment easier.

Mount the transmission on the transmission jack. Raise the transmission and align the transmission clutch shaft with the splines in the driven plate hub.

Install the transmission. When the transmission is seated on the clutch housing, install and tighten the transmission-to-clutch housing bolts with 75 N·m (55 ft-lbs) torque.

Apply Permatex Number 3 sealer, or an equivalent, to both sides of the replacement transmission-to-transfer case gasket and position the gasket on the transfer case.

Mount the transfer case on the transmission jack. Raise the transfer case and align the transmission output shaft and transfer case input shaft splines.

Install the transfer case on the transmission. Install and tighten the transfer case attaching bolts with 41 N·m (30 ft-lbs) torque.

SEE
I.S.
NOTES

SEE I.S. NOTES

Install:

- the transfer case shift lever
- the shifter shaft
- the link pins
- the control link assembly

Connect the front propeller shaft to the transfer case yoke. Tighten the clamp strap bolts with 20 N·m (15 ft-lbs) torque. Be sure the shaft and yoke are aligned according to the reference marks made during disassembly.

Connect the vent hose to the transfer case.

Connect the wire to the four-wheel drive indicator switch.

Connect the speedometer cable.

Install the rear crossmember. Tighten the crossmember attaching nuts and bolts with 41 N·m (30 ft-lbs) torque.

Remove the safety stand used to support the engine.

Connect the rear propeller shaft to the transfer case yoke. Tighten the clamp strap bolts with 20 N·m (15 ft-lbs) torque. Be sure the shaft and yoke are aligned according to the reference marks made during disassembly.

Check and correct the transmission and transfer case lubricant levels, if necessary.

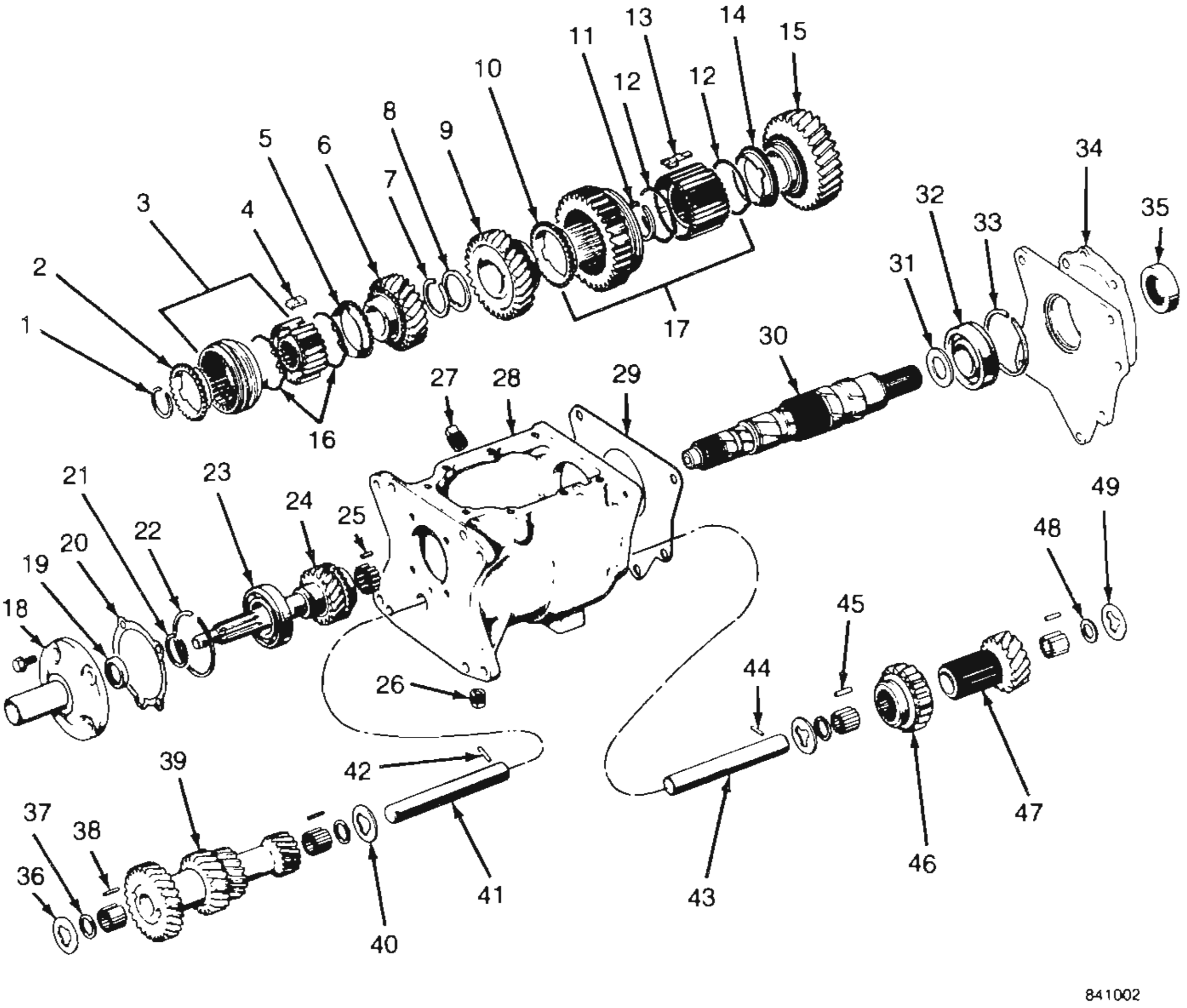
Lower the vehicle.

Install the shift lever and housing on the transmission and tighten the housing bolts with 14 N·m (10 ft-lbs) torque.

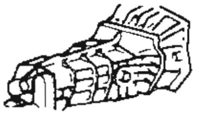
Use RTV sealant, or an equivalent, to seal the housing to the transmission case. Be sure the shift lever is properly engaged with the offset lever before tightening the housing bolts.

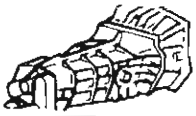
Position the shift lever boot on the floorpan and install the boot attaching screws.

NOTE: For overhaul procedures, refer to B.V. T4/5.



1 - Third-Fourth Gear Snap Ring
2 - Fourth Gear Synchronizer Ring
3 - Third-Fourth Gear Clutch Assembly
4 - Third-Fourth Gear Plate
5 - Third Gear Synchronizer Ring
6 - Third Speed Gear
7 - Second Gear Snap Ring
8 - Second Gear Thrust Washer
9 - Second Speed Gear
10 - Second Gear Synchronizer Ring
11 - Main Shaft Snap Ring
12 - First-Second Synchronizer Spring
13 - Low-Second Plate
14 - First Gear Synchronizer Ring
15 - First Gear
16 - Third-Fourth Synchronizer Spring
17 - First-Second Gear Clutch Assembly
18 - Front Bearing Cap
19 - Oil Seal
20 - Gasket
21 - Snap Ring
22 - Lock Ring
23 - Front Ball Bearing
24 - Clutch Shaft
25 - Roller Bearing
26 - Drain Plug
27 - Fill Plug
28 - Case
29 - Gasket
30 - Spline Shaft
31 - First Gear Thrust Washer
32 - Rear Ball Bearing
33 - Snap Ring
34 - Adapter Plate
35 - Adapter Seal
36 - Front Countershaft Gear Thrust Washer
37 - Roller Washer
38 - Rear Roller Bearing
39 - Countershaft Gear
40 - Rear Countershaft Thrust Washer
41 - Countershaft
42 - Pin
43 - Idler Gear Shaft
44 - Pin
45 - Idler Gear Roller Bearing
46 - Reverse Idler Sliding Gear
47 - Reverse Idler Gear
48 - Idler Gear Washer
49 - Idler Gear Thrust Washer





SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25152	Bearing Puller Set		■
J-25233	Front Bearing Cap Seal Installer		■
J-29342	Countershaft Arbor Tool		■
J-29343	Reverse Idler Shaft Arbor Tool		■
J-29344	Front Bearing Puller		■
J-29345	Bearing Starter		■

SEE I.S. NOTES

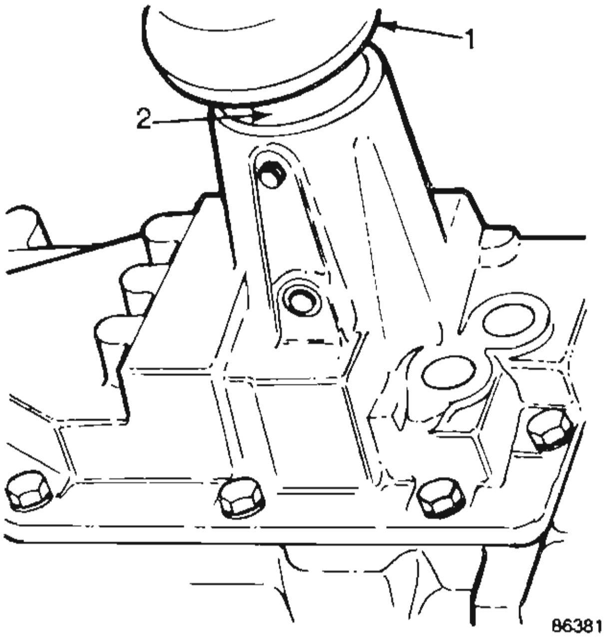
TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Backup Lamp Switch	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Drain and Fill Plugs	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Front Bearing Cap Bolts	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Shift Housing-to-Transmission Case Bolts	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Support Plate Bolts	24 N·m (18 ft-lbs)	20-27 N·m (15-20 ft-lbs)

REMOVAL

Remove the screws attaching the transmission shift lever boot (1) to the floorpan and slide the boot upward on the lever.

Press and turn the transmission shift lever retainer (2) counterclockwise to release the lever. Remove the lever, boot, spring and seat as an assembly.



Raise the vehicle.

Mark the rear propeller shaft and transfer case yoke for assembly alignment reference.

Disconnect the rear propeller shaft at the transfer case yoke. Move the shaft aside and secure it to the underbody with wire.

Position the safety stand under the clutch housing to support the engine.

Remove the nuts and bolts attaching the rear crossmember to the frame rails and rear support cushion and remove the crossmember.

Disconnect the speedometer cable.

Disconnect the backup lamp switch wire.

Disconnect the four-wheel drive indicator switch wire.

Disconnect the transfer case vent hose at the transfer case.

Mark the front propeller shaft and transfer case yoke for assembly alignment reference.

Disconnect the front propeller shaft from the transfer case yoke. Move the shaft aside and secure it to the underbody with wire.

Remove the transfer case shift lever as follows:

- remove the shifter shaft retaining nut
- remove the cotter pins that retain the shift control link pins in the shift rods and remove the pins
- remove the shifter shaft and disengage the shift lever from the shift control links
- slide the lever upward in the boot to move the lever out of the way

Support the transmission-transfer case assembly with a transmission jack. Use a safety chain to secure the assembly on the jack.

Remove the bolts attaching the transmission to the clutch housing and remove the transmission-transfer case assembly.

Remove the bolts attaching the transfer case to the transmission and remove the transfer case.

Clean the old gasket material and sealer from the mating surfaces of the transmission and transfer case.

Remove the pilot bushing lubricating wick from the bushing and soak the wick in engine oil. Use long needlenose pliers to remove the wick from the bushing.

SEE I.S. NOTES

INSTALLATION

Install the pilot bushing lubricating wick and align the throwout bearing with the splines in the driven plate hub.

Shift the transmission into gear using the shift lever or a long screwdriver. This prevents the clutch shaft from rotating during installation and makes the clutch shaft-to-driven plate spline alignment easier.

Mount the transmission on the transmission jack. Raise the transmission and align the transmission clutch shaft with the splines in the driven plate hub.

Install the transmission. When the transmission is seated on the clutch housing, install and tighten the transmission-to-clutch housing bolts with 75 N·m (55 ft-lbs) torque.

Apply Permatex Number 3 sealer, or an equivalent, to both sides of the replacement transmission-to-transfer case gasket and position the gasket on the transfer case.

Mount the transfer case on the transmission jack. Raise the transfer case and align the transmission output shaft and transfer case input shaft splines.

Install the transfer case on the transmission. Install and tighten the transfer case attaching bolts with 41 N·m (30 ft-lbs) torque.

Install:

- the transfer case shift lever
- the shifter shaft
- the link pins
- the control link assembly

Connect the front propeller shaft to the transfer case yoke. Tighten the clamp strap bolts with 20 N·m (15 ft-lbs) torque. Be sure the shaft and yoke are aligned according to the reference marks made during disassembly.

Connect the vent hose to the transfer case.

Connect the wire to the four-wheel drive indicator switch.

Connect the speedometer cable.

Install the rear crossmember. Tighten the crossmember attaching nuts and bolts with 41 N·m (30 ft-lbs) torque.

Remove the safety stand used to support the engine.

Connect the rear propeller shaft to the transfer case yoke. Tighten the clamp strap bolts with

20 N·m (15 ft-lbs) torque. Be sure the shaft and yoke are aligned according to the reference marks made during disassembly.

Check and correct the transmission and transfer case lubricant levels, if necessary.

Lower the vehicle.

Install the shift lever and housing on the transmission and tighten the housing bolts with 14 N·m (10 ft-lbs) torque.

Use RTV sealant, or an equivalent, to seal the housing to the transmission case. Be sure the shift lever is properly engaged with the offset lever before tightening the housing bolts.

Position the shift lever boot on the floorpan and install the boot attaching screws.

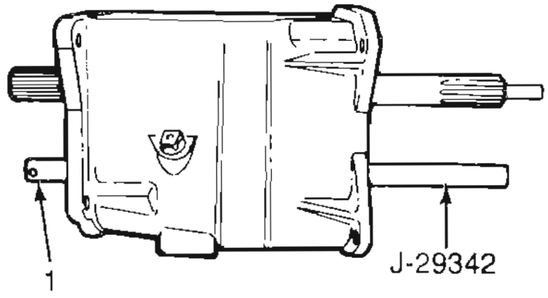
DISASSEMBLY

Remove the shift control housing.

NOTE: Two of the housing attaching bolts are dowel-type alignment bolts. Note the location of these bolts for assembly reference.

Drain the lubricant from the transmission case if not drained during removal.

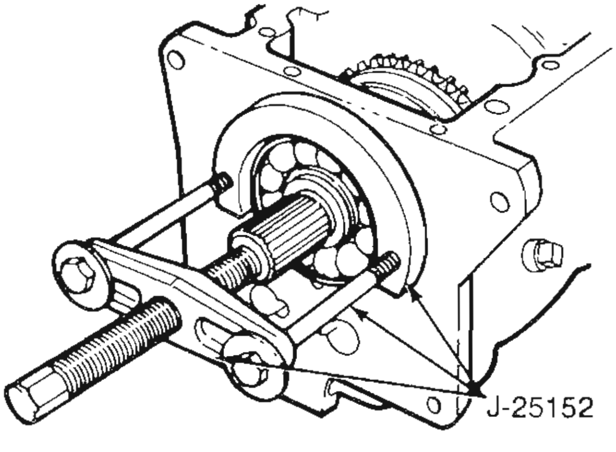
Remove the countershaft (1) using Arbor Tool J-29342. Tap the countershaft out the rear of the case.



840998

Remove the locating ring and retaining snap ring from the rear bearing.

Remove the rear bearing using Puller Set J-25152.



840999

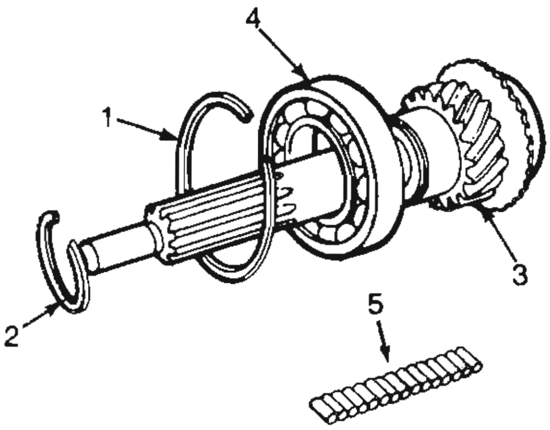
SEE
I.S.
NOTES

Scribe or punch alignment reference marks in the front bearing cap and transmission case.

Remove the front bearing cap and gasket.

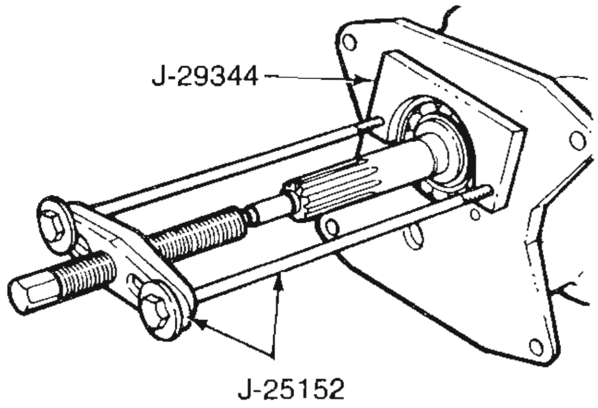
Remove and discard the front bearing cap oil seal. Use a screwdriver to pry the seal out of the cap.

Remove the locating ring (1) and retaining snap ring (2) from the front bearing.



841000

Remove the clutch shaft (3) and front bearing (4) using Adapter J-29344 and Puller Set J-25152.



841001

Remove the fourth gear synchronizer ring from the clutch shaft or synchronizer hub.

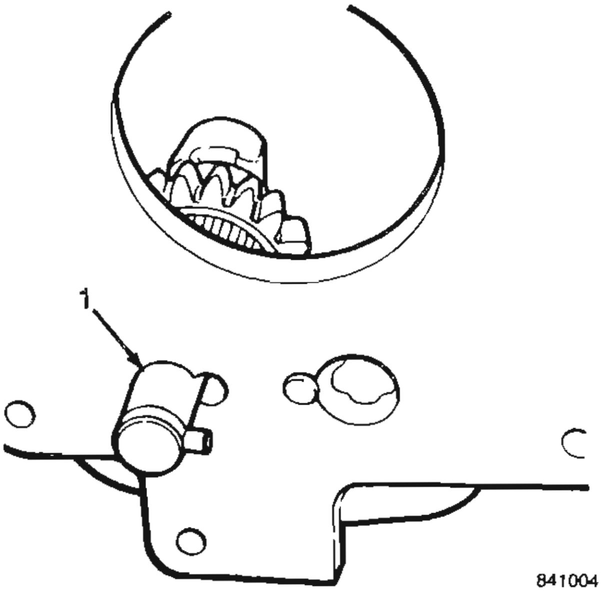
Remove the mainshaft pilot bearing rollers (5) from the clutch shaft.

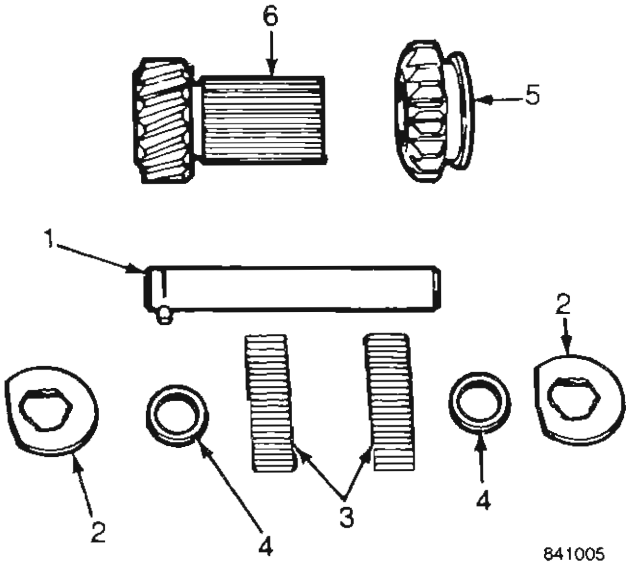
Remove the mainshaft and geartrain assembly. Move the third-fourth synchronizer sleeve to the neutral position. Tilt the rear end of the shaft downward and lift the front end of the shaft upward and out of the case.

Remove the countershaft gear and arbor tool as an assembly.

Remove the countershaft gear thrust washers and any mainshaft pilot bearing rollers that may have fallen into the case during the clutch shaft removal.

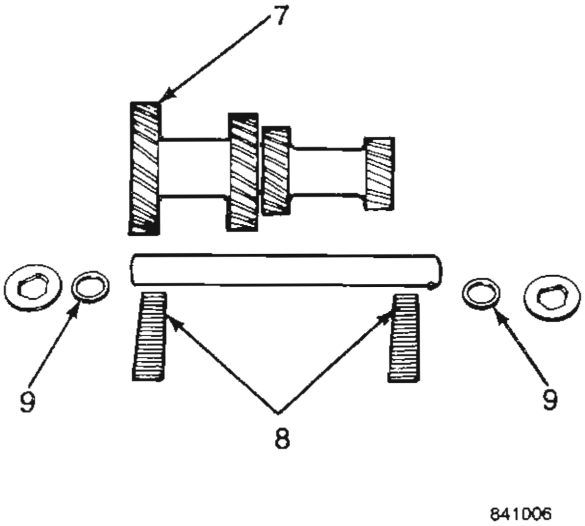
Remove the reverse idler gear assembly. Tap the idler gear shaft (1) out the rear of the case. Remove the gear assembly thrust washers (2).





Remove the 44 needle bearings (3) and the bearing retainers (4) from the gear assembly. Remove the sliding gear (5) from the idler gear (6). Note the position of the sliding gear for assembly reference.

Remove the arbor tool from the countershaft gear (7) and remove the 42 needle bearings (8) and the bearing retainers (9).



Mainshaft Geartrain Disassembly

Remove the third-fourth synchronizer snap ring from the front end of the mainshaft.

Remove the third-fourth synchronizer assembly from the mainshaft. Slide the hub out of the sleeve. Remove the insert springs and three inserts and blocking ring. Note the position of the insert springs for assembly reference.

Remove the third gear from the mainshaft.

Remove the second gear snap ring from the mainshaft and remove the second gear and blocking ring.

Remove the tabbed thrust washer from the mainshaft.

SEE I.S. NOTES

Remove the snap ring from the first-second synchronizer hub. Remove the hub and reverse gear and sleeve as an assembly. Mark the hub and sleeve for assembly reference. Remove the insert springs from the hub, remove the three inserts, and remove the sleeve and gear from the hub.

Remove the first gear thrust washer from the rear of the shaft and remove the first gear and blocking ring (if the ring was not previously removed).

CLEANING AND INSPECTION

Thoroughly wash all parts in solvent and dry using compressed air. However, do not dry the bearings with compressed air. Air dry the bearings or wipe them dry using a clean shop cloth only.

Clean the needle and clutch shaft roller bearings by either wrapping the bearings in a clean cloth and submerging them in solvent, or by placing them in a shallow parts cleaning tray and covering them with solvent. Allow the bearings to air dry on a clean cloth.

Inspect the transmission components. Replace any components that exhibit the following conditions.

Case

- cracks in bores, sides, bosses or at bolt holes
- stripped threads in bolt holes
- nicks, burrs, rough surfaces in shaft bores or on gasket surfaces

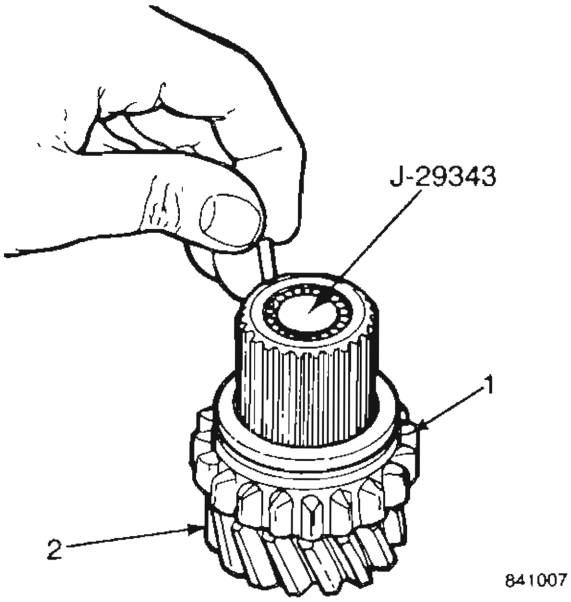
Gear, Shaft and Synchronizer Assemblies

- broken, chipped or worn gear teeth
- damaged splines on mainshaft, synchronizer hubs or sleeves
- broken or worn teeth, excessive wear and damage or blocking rings
- bent or broken synchronizer inserts
- damaged needle bearings or bearing bores in the reverse idler or countershaft gear
- wear or galling of the mainshaft, countershaft, clutch shaft or idler gear shafts
- worn thrust washers
- nicked, broken, or worn mainshaft or clutch shaft splines
- bent, distorted, broken or weak snap rings
- rough, galled, worn or broken front or rear bearing

ASSEMBLY

Lubricate the reverse idler gear shaft bore and sliding gear (1) with transmission lubricant. Install the sliding gear on the reverse idler gear (2).

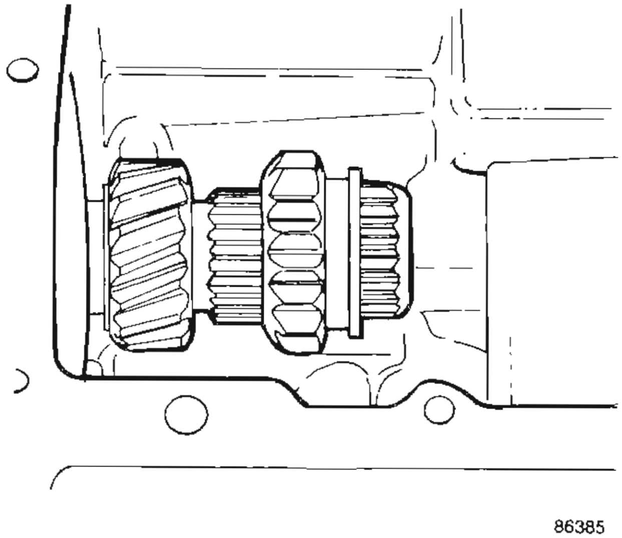
Install Arbor Tool J-29343 in the reverse idler gear and install 22 needle bearings and one bearing retainer at each end of the gear.



Coat the reverse idler gear thrust washer surfaces with petroleum jelly and install the thrust washers in the case.

NOTE: The thrust washers have flats on them. Be sure to install the washers so these flats will face the mainshaft. Also, be sure to engage the thrust washer locating tabs in the case locating slots.

Install the reverse idler gear assembly. Align the gear bore, thrust washers and case bores, and install the reverse idler gear shaft from the rear of the case. Be sure to seat the roll pin in the shaft, align the roll pin with the counterbore in the case and push the shaft into the rear of the case.



Measure the reverse idler gear end play by inserting a feeler gauge between the thrust washer and the gear. The end play should be 0.10 - 0.45 mm (0.004 - 0.018 in). If the end play exceeds 0.45 mm (0.018 in), remove the idler gear and replace the thrust washers.

Coat the countershaft gear bore, needle bearings and bearing bores in the gear with petroleum jelly. Insert the arbor tool in the bore of the gear and install 21 needle bearings and one retainer in each end of the gear.

Coat the countershaft gear thrust washer surfaces with petroleum jelly and position the thrust washers in the case.

NOTE: Be sure to engage the locating tabs on the thrust washers in the locating slots in the case.

SEE I.S. NOTES

Insert the countershaft into the rear case bore just far enough to hold the rear thrust washer in position. This will prevent the washer from being displaced when the countershaft gear is installed.

Install the countershaft gear. Align the gear bore, thrust washers, and bores in the case and install the countershaft part way into the case. Be sure the arbor tool enters the shaft bore at the front of the case.

NOTE: Do not remove the countershaft arbor tool completely.

Measure the countershaft gear end play by inserting a feeler gauge between the washer and the gear. The end play should be 0.10 - 0.45 mm (0.004 - 0.018 in). If the end play exceeds 0.45 mm (0.018 in), remove the gear and replace the thrust washers. After the correct end play has been obtained, reinstall the arbor tool in the countershaft gear and allow the gear to remain at the bottom of the case. Leave the countershaft in the rear case bore to hold the rear thrust washer in place.

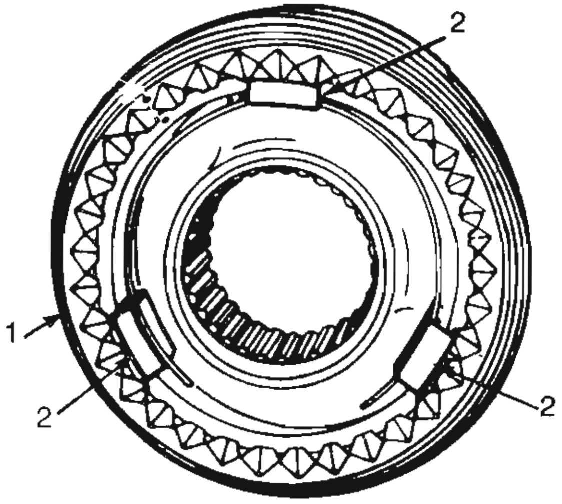
NOTE: The countershaft gear must remain at the bottom of the case to provide sufficient clearance for installation of the mainshaft and clutch shaft assemblies.

Lubricate the mainshaft, synchronizer assemblies and gear bores with the transmission lubricant.

Assemble the first-second synchronizer hub and reverse gear and sleeve. Refer to the exploded view.

Install the gear and sleeve (1) on the hub and place the assembly flat on a workbench.

Drop the inserts (2) into the hub slots.



841008

Install the insert spring. Position the loop end of the spring in one insert, compress the spring ends and insert the spring ends under the lips of the remaining two inserts. Be sure the spring is under the lip of each insert.

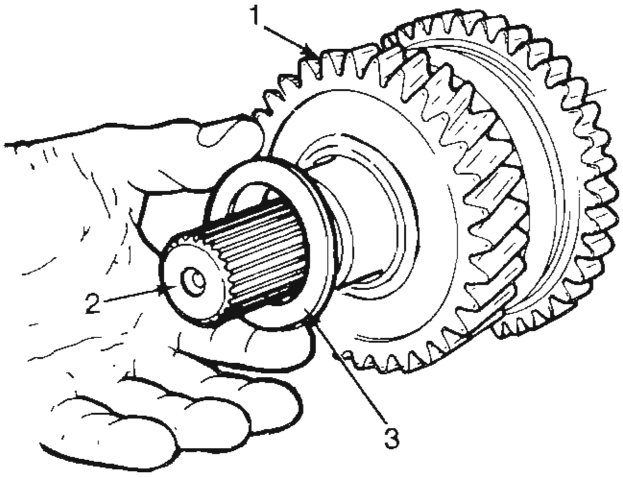
Turn the assembly over and install the remaining insert spring as described in the previous step.

NOTE: Install this spring so that the open end faces 180° opposite the first spring.

Install the assembled first-second synchronizer hub and reverse gear and sleeve on the mainshaft.

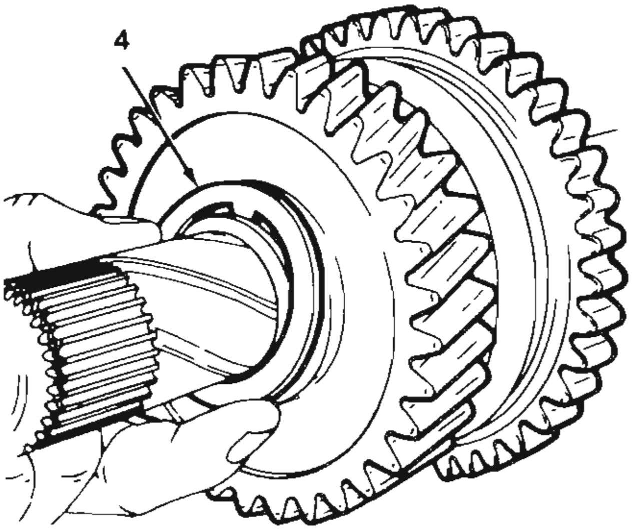
Install the new first-second synchronizer snap ring on the mainshaft.

Install the first gear (1) and blocking ring on the rear of the mainshaft (2) and install the first gear thrust washer (3).



841009

Install the new tabbed thrust washer (4) on the mainshaft. Be sure the washer tab is seated in the mainshaft tab bore. The tabbed thrust washer sharp edge must face outward.



841010

Install the second gear and blocking ring on the mainshaft and install the new tabbed thrust washer and new second gear snap ring. Install the third gear and blocking ring on the mainshaft.

Assemble the third-fourth synchronizer. Refer to the exploded view.

Install the sleeve on the synchronizer hub. Use the reference marks to align the parts.

Place the assembled hub and sleeve flat on a workbench and drop the inserts into the hub slots.

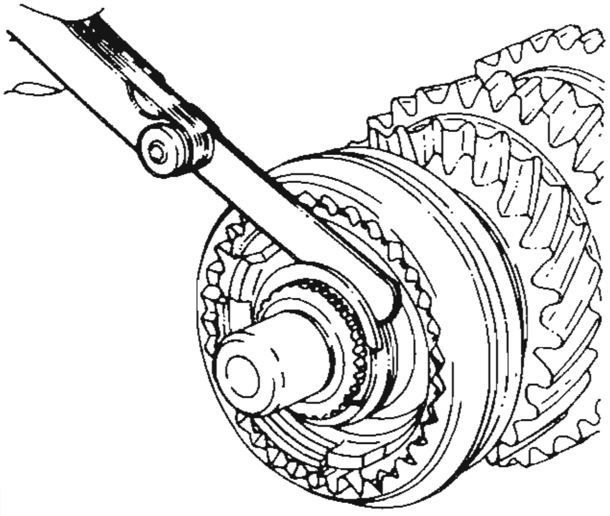
Install the insert spring. Position the loop end of the spring in one insert, compress the spring ends and insert the spring ends under the lips of the remaining two inserts.

Turn the assembly over and install the remaining insert spring as described in the previous step; however, position this spring so the open end faces 180° opposite the first spring.

Install the assembled third-fourth synchronizer assembly on the mainshaft.

SEE
I.S.
NOTES

Install the new third-fourth synchronizer retaining snap ring on the mainshaft and measure the end play between the synchronizer hub and snap ring.


60559

NOTE: The end play should be 0.10 - 0.35 mm (0.004 - 0.014 in). If the end play exceeds the limits, replace the mainshaft thrust washers and snap rings.

Install the mainshaft geartrain assembly in the case. Be sure the synchronizers are in the neutral position so the sleeves will clear the top of the case when the assembly is installed.

Install the locating snap ring on the front bearing and install the front bearing part way onto the clutch shaft.

NOTE: Do not install the bearing completely at this time as the shaft will not clear the countershaft gear.

CAUTION: Do not use chassis grease or a similar heavy grease in the clutch shaft bore. Use petroleum jelly only. Heavy grease will plug the lubrication holes in the shaft and prevent proper lubrication of the roller bearing.

Coat the bearing bore in the clutch shaft and mainshaft pilot roller bearings with petroleum jelly.

Install 15 roller bearings in the clutch shaft bearing bore.

Coat the blocking ring surface of the clutch shaft with transmission lubricant and position the blocking ring on the shaft.

Support the mainshaft assembly and insert the clutch shaft through the front bearing bore in the case. Seat the mainshaft pilot hub in the clutch shaft roller bearings and tap the front bearing and clutch shaft into the case using a rawhide mallet.

Install the front bearing cap and tighten the cap bolts finger-tight only.

Position the rear bearing on the mainshaft. Do not install the bearing locating ring at this time. Start the bearing into the shaft and into the case bore using Tool J-29345. Remove the tool and complete the bearing installation using a rawhide mallet. When the bearing is fully seated on the shaft, install the bearing retaining snap ring.

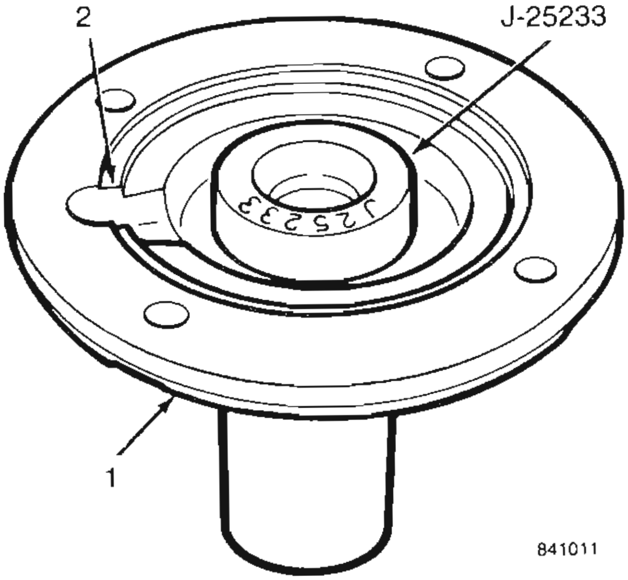
NOTE: In order to seat the rear bearing on the mainshaft, the bearing must be tapped into the case deeper than the locating snap ring would allow. For this reason, do not install the locating snap ring until after the bearing is fully seated on the shaft and the retaining snap ring is installed.

SEE
I.S.
NOTES

Remove the front bearing cap (1), seat the front bearing fully on the clutch shaft and install the bearing retaining snap ring.

Apply a thin film of sealer to the front bearing cap gasket and position the gasket on the case. Be sure the gasket notch is aligned with the oil return hole in the case.

Remove the front bearing cap oil seal using a screwdriver and install the replacement oil seal using Tool J-25233.



Install the front bearing cap. Tighten the cap bolts with 16 N·m (12 ft-lbs) torque.

Install the locating ring on the rear bearing. If necessary, reseat the bearing in the case using a rawhide mallet.

CAUTION: When installing the countershaft, be careful not to damage the thrust washers. Be sure they are aligned with the case bores and gear bores before tapping the countershaft into place.

Install the countershaft as follows:

- turn the transmission case on end, positioning the case at the edge of the workbench with the clutch shaft pointing downward; be sure the countershaft bore in the front of the case is accessible
- have an assistant hold the case in position
- align the countershaft gear bores with the thrust washers and case bores and tap the shaft into place; do not let the arbor tool drop on the floor while the shaft is being installed

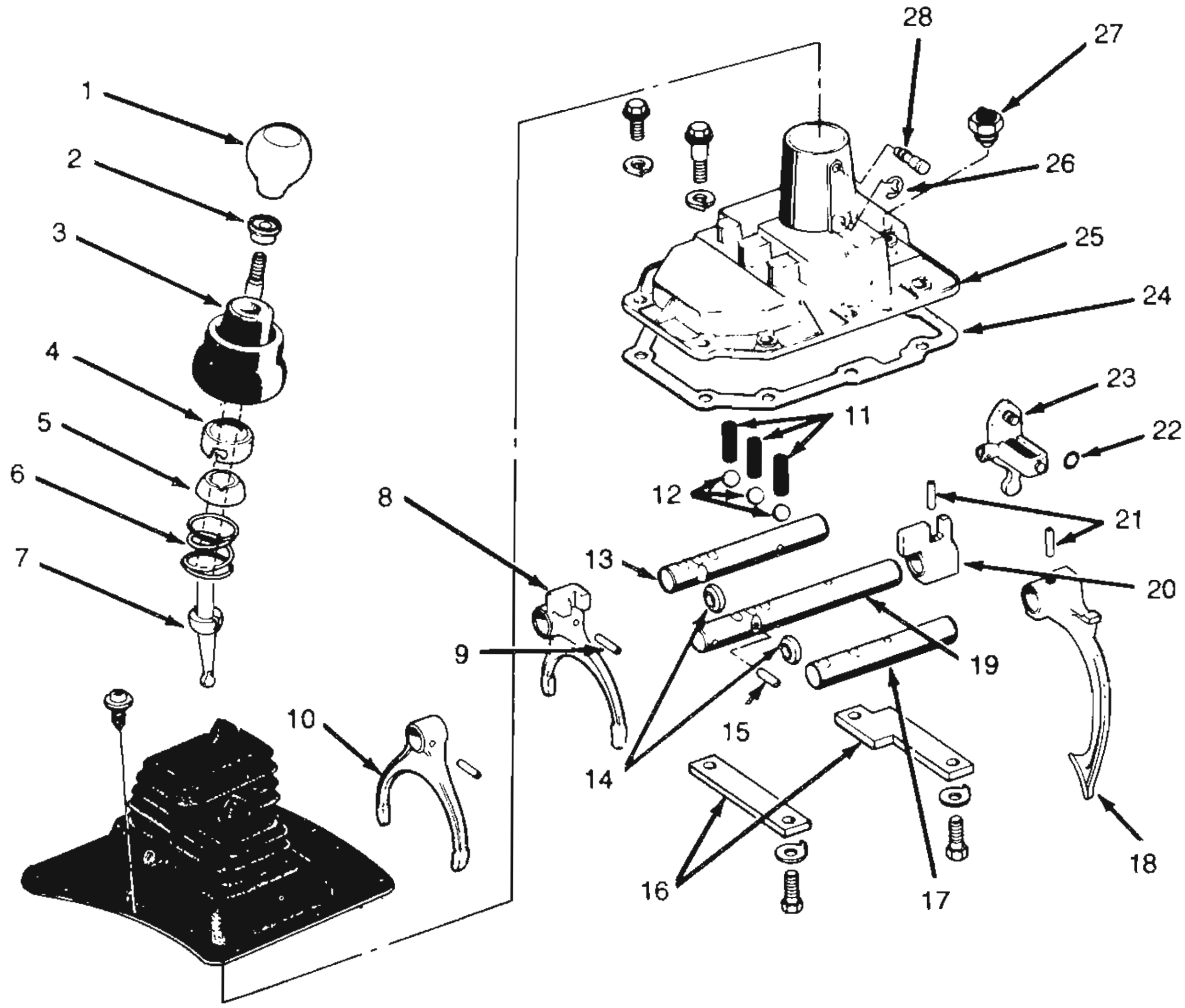
Shift the synchronizer sleeves into all the gear positions and check the operation. If the clutch shaft and mainshaft appear to bind in the Neutral position, check for synchronizer rings sticking on the tapered portion of the gears. Use a screwdriver to free any sticking blocking rings.

Fill the transmission with 1.7 liters (3.5 pts) of AMC/Jeep Manual Transmission Fluid, Part no. 8983 000 000.

Position the new shift control housing gasket on the case and install the control housing. Tighten the housing bolts with 16 N·m (12-ft-lbs) torque.

SEE I.S. NOTES

SHIFT CONTROL HOUSING



1 - Shift Lever Knob
2 - Nut
3 - Shift Lever Cover
4 - Transmission Control Housing Cap
5 - Spring Retainer
6 - Spring
7 - Shift Lever
8 - First-Second Shift Fork
9 - Interlock Pin
10 - Third-Fourth Shift Fork
11 - Poppet Springs
12 - Poppet Balls
13 - First-Second Shift Rail
14 - Shifter Interlock Rings
15 - Interlock Pin
16 - Shift Rail Support Plate
17 - Reverse Shift Rail
18 - Reverse Fork
19 - Third-Fourth Shift Rail
20 - Third-Fourth Shift Lug
21 - Interlock Pin
22 - O-Ring
23 - Reverse Rocker Arm Assembly
24 - Gasket
25 - Transmission Case Cover
26 - E-Clip
27 - Backup Lamp Switch
28 - Fulcrum Pin (2)

SEE I.S. NOTES

Disassembly

Remove the shift lever cover (3), control housing cap (4), and retainer (5).

Remove the shift lever (7) and spring (6).

Position the transmission case cover (25) in a vise so the shift forks are facing upward. Use wood blocks to protect the cover from the vise jaws and do not overtighten the vise.

Place all the shift forks in the Neutral position.

Remove:

- the shift rail support plate attaching bolts and tabbed washers
- the support plates (16)
- the first-second shift rail (13)
- the third-fourth shift rail (19)
- the shift lug (20)
- the interlock pins (21)
- the reverse shift rail (17)
- the poppet balls (12)
- the shifter interlock rings (14)
- the poppet springs (11)
- the fulcrum pins (28)
- the reverse rocker arm assembly (23)

Remove the cover from the vise.

Clean all the components in solvent and dry them using compressed air.

Inspect all the components. Replace any components that are nicked,cracked, broken or excessively worn.

NOTE: Do not discard the spacer on the reverse gear shift rail (17). This spacer was added to prevent reverse gear overtravel and must remain in place on the shift rail.

Assembly

CAUTION: To avoid damaging the cover, do not overtighten the vise jaws.

Clamp the transmission case cover (25) in a vise using protective wooden blocks, and install the fulcrum pins (28) in the cover.

Install the replacement O-ring oil seal on the reverse arm assembly (23).

Install the assembly and clip.

Lubricate the shift rails and shift rail grooves in the cover with petroleum jelly.

Install the poppet springs (11) in the transmission case cover bores.

Install the poppet balls (12) (one on each spring).

Position the reverse gear shift rail (17) and fork (18) on the reverse rocker arm in the transmission case cover.

NOTE: Be sure the notch on the shift rail is positioned over the reverse poppet ball and that the reverse rocker arm is engaged in the reverse fork slot.

Install the third-fourth shift rail (19) and shift fork assembly in the transmission case cover (25).

NOTE: Be sure the interlock pin (15) is in position in the shift rail before further assembly.

Install the first-second shift rail (13) and fork (8) assembly. Be sure the shift rail notch is over the poppet ball in the transmission case cover.

SEE I.S. NOTES

Install the shifter interlock rings (14) in the cover and between the poppet balls.

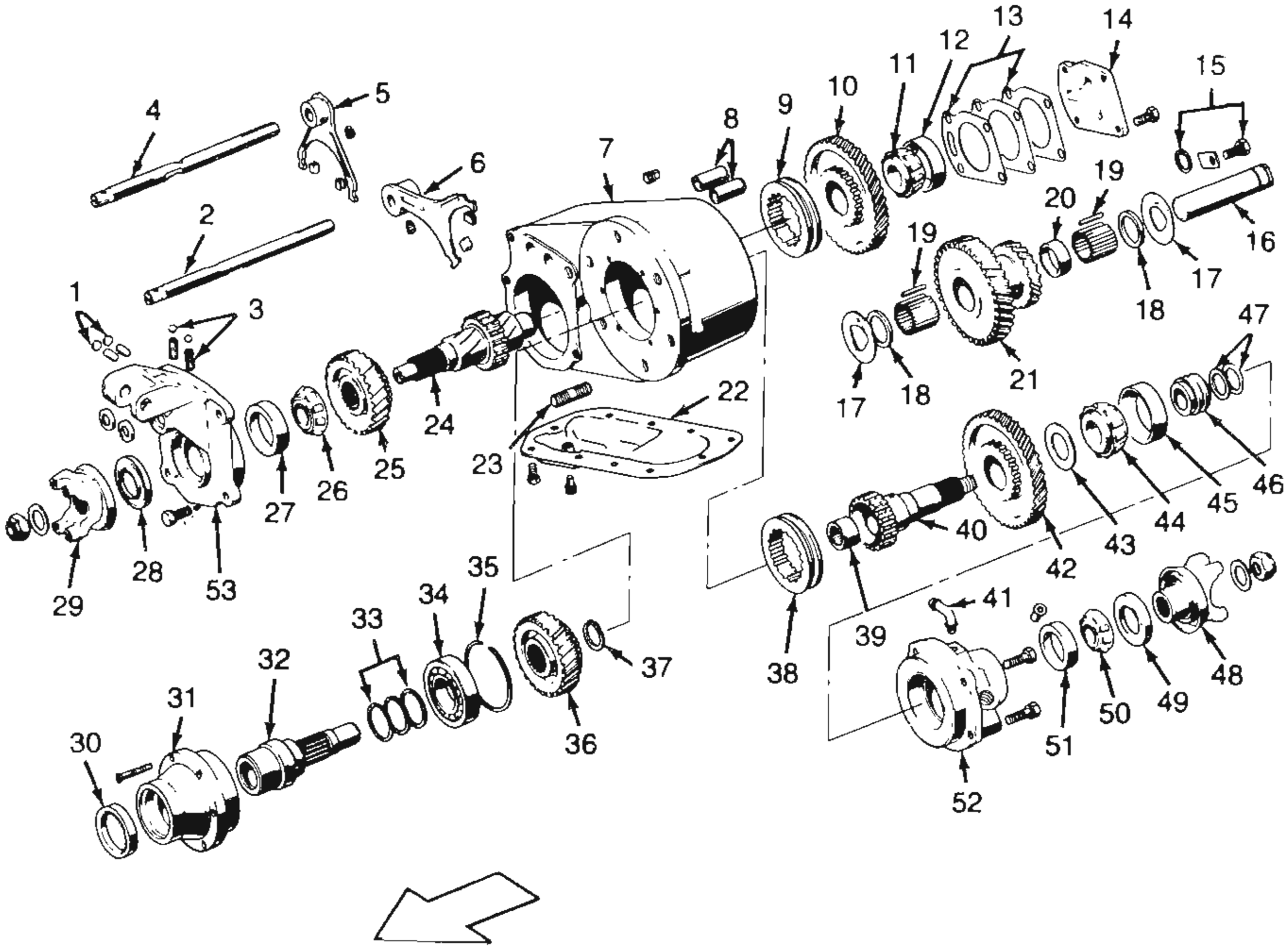
Press downward on the shift rails to compress the poppet balls and springs. Use a wood block that is long enough to contact all three shift rails to press the rails downward evenly.

While holding the shift rails downward, position the shift rail retaining plates on the housing and install the plate attaching bolts and tabbed washers finger-tight.

Remove the wood block and tighten the shift rail retaining bolts with 16-19 N·m (12-15 ft-lbs) torque. Be sure the tabbed washers are in the correct position before bending the washer tabs.

Check the shift rail operation. Each rail must slide smoothly in the cover groove. Be sure it is not possible to overshift into another gear position. After checking the shift operation, place the forks in the third gear position.

Install the shift lever (7), spring (6), spring retainer (5) and control housing cap (4). Push the cap downward and turn the lever retainer clockwise to install and seat.



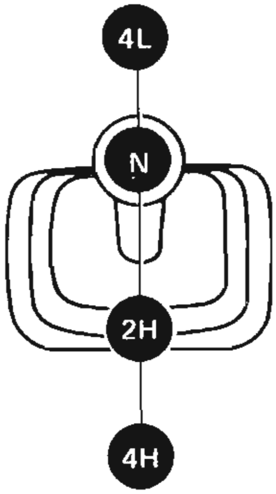
841106

1 - Interlock Plugs and Interlocks
2 - Shift Rod – Rear Output Shaft Fork
3 - Poppet Balls and Springs
4 - Shift Rod – Front Output Shaft Fork
5 - Front Output Shaft Shift Fork
6 - Rear Output Shaft Shift Fork
7 - Transfer Case
8 - Thimble Covers
9 - Clutch Sleeve – Front Output Shaft
10 - Clutch Gear – Front Output Shaft
11 - Bearing – Front Output Shaft Rear
12 - Race – Front Output Shaft Bearing
13 - End Play Shims – Front Output Shaft
14 - Cover Plate
15 - Lock Plate, Bolt and Washer
16 - Intermediate Gear Shaft
17 - Thrust Washer
18 - Bearing Spacer (Thin)
19 - Intermediate Gear Shaft Needle Bearings
20 - Bearing Spacer (Thick)
21 - Intermediate Gear
22 - Bottom Cover
23 - Stud (Case-to-Trans.)
24 - Front Output Shaft
25 - Front Output Shaft Gear
26 - Front Output Shaft Bearing (Front)
27 - Front Output Shaft Bearing Race
28 - Oil Seal
29 - Front Yoke
30 - Seal
31 - Support – Input Shaft
32 - Input Shaft
33 - Shims
34 - Input Shaft Bearing
35 - Input Shaft Bearing Snap Ring
36 - Rear Output Shaft Gear
37 - Snap Ring
38 - Clutch Sleeve – Rear Output Shaft
39 - Input Shaft Rear Bearing (Needle or Pilot Bearing)
40 - Rear Output Shaft
41 - Vent
42 - Clutch Gear – Rear Output Shaft
43 - Thrust Washer
44 - Bearing – Rear Output Shaft Front
45 - Race – Rear Output Shaft Bearing
46 - Speedometer Drive Gear
47 - End Play Shims
48 - Rear Yoke
49 - Rear Output Shaft Oil Seal
50 - Bearing – Rear Output Shaft Rear
51 - Bearing Race
52 - Rear Bearing Cap
53 - Front Bearing Cap

SEE I.S. NOTES

Transfer Case Shift Pattern

Transfer case shifting is controlled by a floor-mounted shift lever located on the floorpan transmission tunnel. The shift pattern is in a straight line for all CJ and Scrambler models. The shift knob sequence is 4H (four-wheel high), 2H (two-wheel high), N (Neutral) and 4L (four-wheel low).



841110

Identification

An identification tag that displays the vendor and Jeep part numbers is attached to the intermediate shaft lockplate bolt. This information is necessary to obtain correct service replacement parts.

Lubrication

The Model 300 lubricant should be changed and the level inspected at the intervals specified in the Maintenance Schedule. When adding lubricant or refilling the transfer case after service, use AMC/Jeep Manual Transmission Fluid, Part no. 8983 000 000 only. The lubricant capacity of the Model 300 is 1.9 liters (4 pts).

NOTE: Before attempting to repair a suspected transfer case malfunction, check all other driveline components. The actual cause of a problem may instead be related to such items as the front hubs, axles, propeller shafts, wheels and tires, transmission, engine or clutch. If all driveline components are in good condition and operating properly, refer to the Service Diagnosis Chart for further information.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-8001	Dial Indicator Set		■
J-8092	Driver Handle		■
J-8614-01,02,03	Holder and Remover Companion Flange		■
J-9276-3	Rear Output Shaft Front Cup Installer	■	
J-22912-01	Bearing Remover		■
J-25142	Intermediate Shaft Needle Bearing Aligning Arbor		■
J-25160	Output Shaft Oil Seal Installer	■	
J-25167	Shift Rod Oil Seal Thimble and Driver Installer Tools		■
J-25175	Shift Rod Oil Seal Remover Tools		■
J-25180	Output Shaft Oil Seal Remover		■
J-29168	Front Output Shaft Bearing Remover	■	
J-29179	Rear Output Shaft Needle Bearing Installer	■	
J-29181	Front Output Shaft Cup Installer	■	
J-29182	Rear Output Shaft Cup Installer	■	
J-29184	Input Shaft Support Set Installer	■	
J-29369-1	Needle Bearing Puller		■

SEE I.S. NOTES

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Bottom Cover Bolts	20 N·m (15 ft-lbs)	14-27 N·m (10-20 ft-lbs)
Cover Plate Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front Bearing Cap Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Front/Rear Yoke Locknuts	163 N·m (120 ft-lbs)	163-203 N·m (120-150 ft-lbs)
Input Shaft Support Screws	14 N·m (10 ft-lbs)	9-14 N·m (7-10 ft-lbs)
Lockplate Bolts	31 N·m (23 ft-lbs)	27-34 N·m (20-25 ft-lbs)
Shift Fork Setscrews	19 N·m (14 ft-lbs)	16-24 N·m (12-18 ft-lbs)

SEE I.S. NOTES

TRANSFER CASE SHIFT LINKAGE

Removal – Manual or Automatic Transmission

Remove the screws that attach the shift lever boot (1) to the floorpan.

Remove the shift lever knob (2) and slide the boot up and off the lever (3).

Raise the vehicle.

Remove the shifter shaft retaining nut (4).

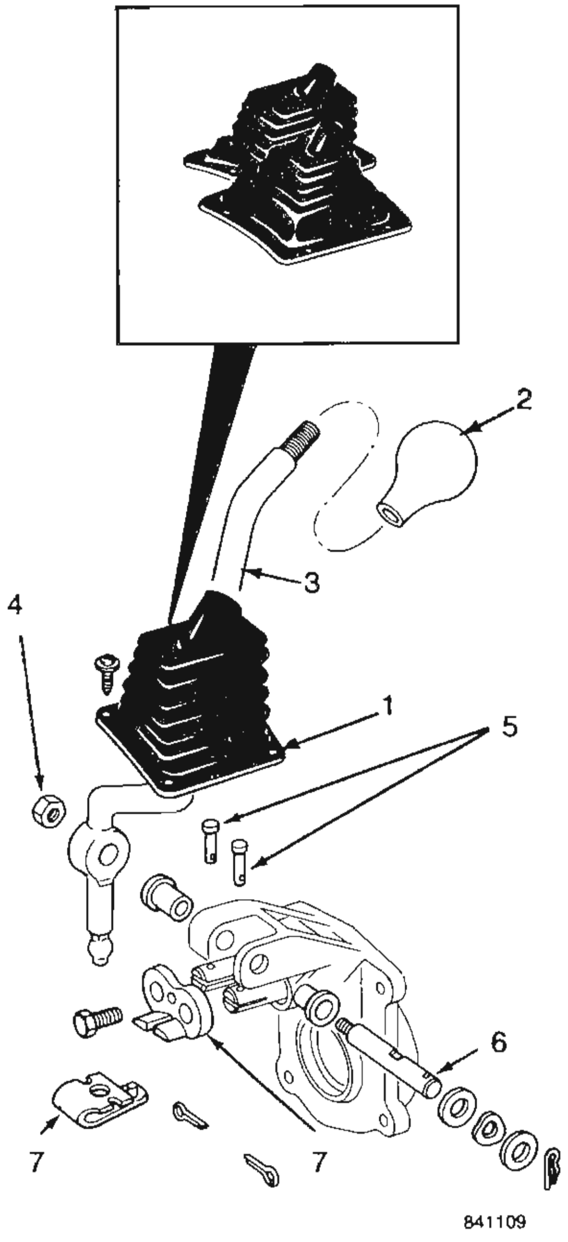
Remove the cotter pins that retain the link pins (5) in the shift rods and remove the link pins. Discard the old cotter pins.

Remove the shifter shaft (6) from the shift lever.

NOTE: On some models, the shifter shaft is threaded onto the shift lever and must be unthreaded to remove it. On other models, the shaft is removed simply by sliding it out of the lever and front cover bosses.

Remove the shift lever.

Remove the shift control links (7) from the shift rods. Clean and inspect the linkage components. Replace any component that is broken, bent, cracked or excessively worn or scored.



Installation – Manual or Automatic Transmission

Install the shift control links (7).

Install the shift lever (3).

Install the shifter shaft (6) in the front cover bosses and shift lever.

Install and tighten the shifter shaft retainer nut (4).

Install the link pins (5) in the shift rods. Secure the pins with new cotter pins.

Lower the vehicle.

Install the boot (1) on the shift lever.

Install the knob (2) on the shift lever.

Position the boot on the floorpan and install the boot attaching screws.

REMOVAL

On models with a manual transmission, remove the shift lever knob, trim ring and boot from the transmission and transfer case shift levers.

Remove the floor covering, if equipped, and remove the transmission access cover from the floorpan.

Raise the vehicle and drain the lubricant from the transfer case.

Position the support stand under the clutch housing to support the engine and transmission and remove the rear crossmember.

Disconnect the front and rear propeller shafts at the transfer case. Mark the propeller shaft yokes for assembly reference.

Disconnect the speedometer cable at the transfer case.

SEE I.S. NOTES

If necessary, disconnect the parking brake cable at the equalizer. Disconnect the exhaust pipe support bracket at the transfer case, if equipped.

Remove the bolts attaching the transfer case to the transmission and remove the transfer case.

INSTALLATION

Shift the transfer case to the 4L position.

Rotate the transfer case output shaft by turning the yoke until the transmission output shaft gear engages the transfer case input shaft. Move the transfer case forward until the case seats against the transmission.

SEE I.S. NOTES

CAUTION: Be sure the transfer case is flush against the transmission. Severe damage to the transfer case will result if the attaching bolts are tightened while the transfer case is cocked or in a bind.

Install the transfer case attaching bolts. Tighten the bolts with 41 N·m torque (30 ft-lbs).

Fill the transfer case with AMC/Jeep Manual Transmission Fluid Part no. 8983 000 000.

Connect the speedometer driven gear to the transfer case.

Connect the transfer case shift lever and control links to the transfer case shift rods.

Connect the front and rear propeller shafts to the transfer case. Be sure to align the shafts-to-yokes using the reference marks made during removal. Tighten the shaft-to-yoke clamp strap nuts with 21 N·m (16 ft-lbs) torque.

Install the rear crossmember and remove the support stand from under the clutch housing.

Connect the parking brake cable to the equalizer and connect the exhaust pipe support bracket to the transfer case if disconnected.

Lower the vehicle.

Install the transmission access cover plate on the floorpan.

Install the floor covering, if equipped.

Install the boots, trim rings and shift knobs.

IN-VEHICLE SERVICE

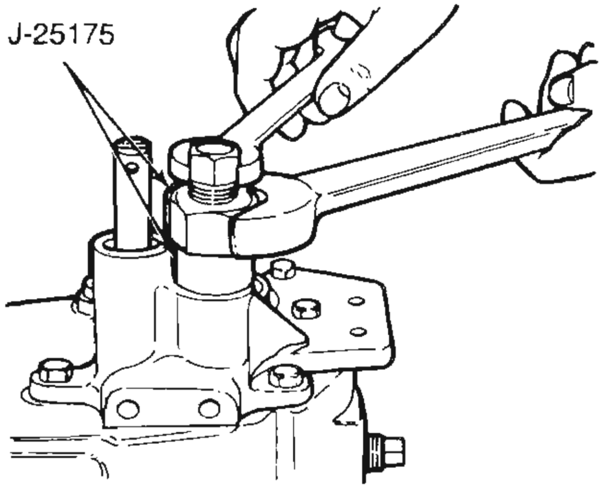
Shift Rod Oil Seal Removal

If the left-side shift rod seal is to be replaced, shift the transfer case into the 4L position.

Raise the vehicle.

Remove the clevis pins connecting the control links to the transfer case shift rods.

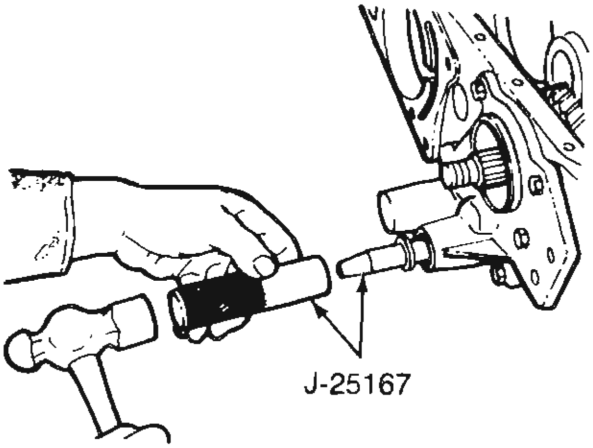
Remove the shift rod oil seal using Tool J-25175.



841113

Shift Rod Oil Seal Installation

Install the replacement seal using Thimble and Driver Tool J-25167.



841114

Install the clevis pins connecting the control links to the transfer case shift rods. Use the replacement cotter pins to secure the pins.

Lower the vehicle.

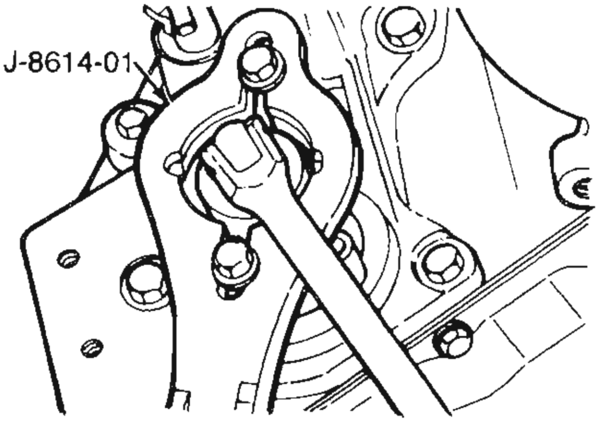
Front/Rear Yoke Oil Seal Removal

Raise the vehicle.

Place a support stand under the transmission and remove the rear crossmember.

Disconnect the front or rear propeller shaft at the transfer case yoke. Place alignment marks on the shaft and yoke for assembly reference before disconnecting the shaft.

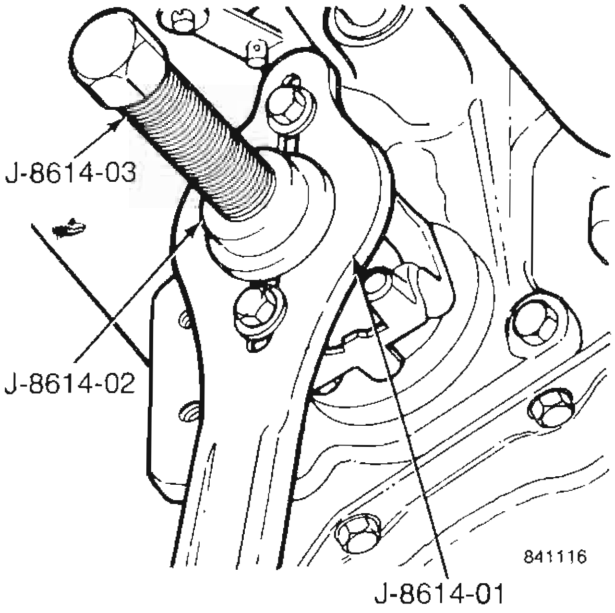
Remove the transfer case yoke nut and washer using Tool J-8614-01.



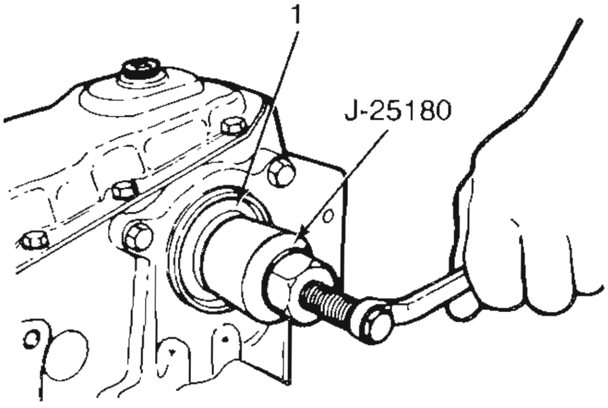
841115

SEE I.S. NOTES

Remove the transfer yoke using Tools J-8614-01, -02, -03.



Remove the oil seal (1) using Tool J-25180.



Front/Rear Yoke Oil Seal Installation

Install the replacement seal using Tool J-25160.

Install the yoke, washer and nut. Tighten the nut with 163 N·m (120 ft-lbs) torque. Use Tool J-8614-01 to hold the yoke while tightening the nut.

Rear Bearing Cap/Speedometer Drive Gear Removal

Disconnect the rear propeller shaft at the transfer case yoke. Tie the shaft to the frame with wire.

Disconnect the speedometer cable.

Remove the speedometer driven gear sleeve and driven gear.

Remove the transfer case vent hose.

Remove the output shaft yoke using Tools J-8614-01, -02, -03.

Remove the bearing cap-to-transfer case bolts and remove the bearing cap.

NOTE: The bearing cap has been coated with a sealant. Use a putty knife to break the seal, and work the knife around the bearing cap to loosen and remove it.

Remove the shims and speedometer drive gear from the output shaft.

SEE I.S. NOTES

NOTE: Keep the shims together for use in assembly.

Remove the speedometer driven gear bushing from the bearing cap, if necessary.

Rear Bearing Cap/Speedometer Drive Gear Installation

Install the speedometer driven gear bushing if the bushing was removed.

Install the speedometer drive gear and shims on the shaft.

Apply a bead of Loctite 515, or an equivalent sealant, to the mating surface of the cap and install the cap. Use two cap screws to align the bolt holes. Use a plastic mallet to tap the cap into position.

Tighten the bearing cap bolts with 47 N·m (35 ft-lbs) torque.

Install the output shaft yoke and tighten the locknut with 163 N·m (120 ft-lbs) torque. Use Tool J-8614-01 to hold the yoke while tightening the nut.

Check the rear output shaft end play as follows:

- attach Dial Indicator J-8001 to the bearing cap and position the indicator stylus against the output shaft
- pry the output shaft back and forth to check the end play; the end play should be 0.025 - 0.127 mm (0.001 - 0.005 in)
- if the end play is not correct, remove or add shims between the speedometer drive gear and the output shaft rear bearing

Install the transfer case vent hose.

Install the speedometer driven gear sleeve and driven gear.

Install the speedometer cable.

Install the rear propeller shaft. Tighten the clamp strap bolts with 21 N·m (16 ft-lbs) torque.

DISASSEMBLY

Remove the shift lever assembly.

Remove the bottom cover. See exploded view.

NOTE: The bottom cover has been coated with a sealant. Use a putty knife to break the seal, and work the knife around the bottom cover to loosen and remove it. Do not wedge the cover off.

Remove the front and rear yokes using Tool J-8614-01. Discard the yoke locknuts.

SEE I.S. NOTES

SEE I.S. NOTES

Remove the socket head screws attaching the input shaft support (1) to the case and remove the support, rear output shaft gear (2) and input shaft (3) as an assembly.

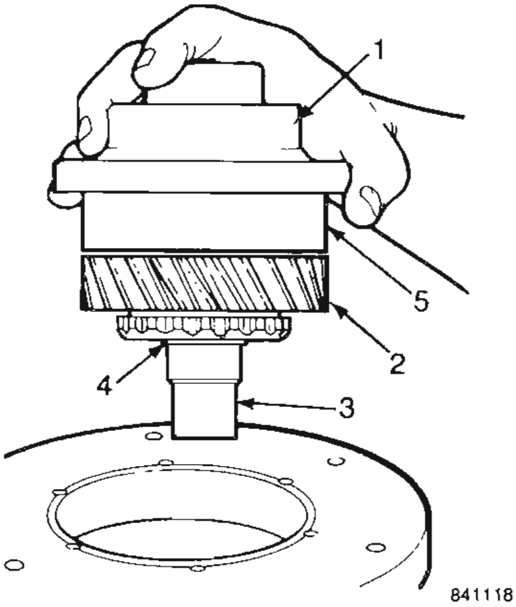
NOTE: The support has been coated with a sealant. Use a putty knife to break the seal, and work the knife around the support to loosen and remove it.

Remove the rear output shaft clutch sleeve from the case.

Remove and discard the snap ring (4) retaining the rear output shaft gear on the input shaft and remove the gear.

Remove and discard the input shaft bearing snap ring.

Remove the input shaft and bearing (5) from the support. Tap the end of the input shaft with a plastic mallet to aid removal.



Remove the input shaft bearing and end play shims from the shaft using an arbor press.

Remove the input shaft oil seal from the support. Discard the seal.

Remove the intermediate shaft lockplate bolt and lockplate.

Remove the intermediate shaft. Tap the shaft out of the case using a brass punch and plastic mallet.

Remove and discard the intermediate shaft O-ring seal.

Remove the intermediate gear assembly and thrust washers.

NOTE: The thrust washers have locating tabs which must fit in the notches in the case at assembly.

Remove the needle bearings and bearing spacers from the intermediate gear.

NOTE: There are 48 needle bearings and three bearing spacers in the intermediate gear.

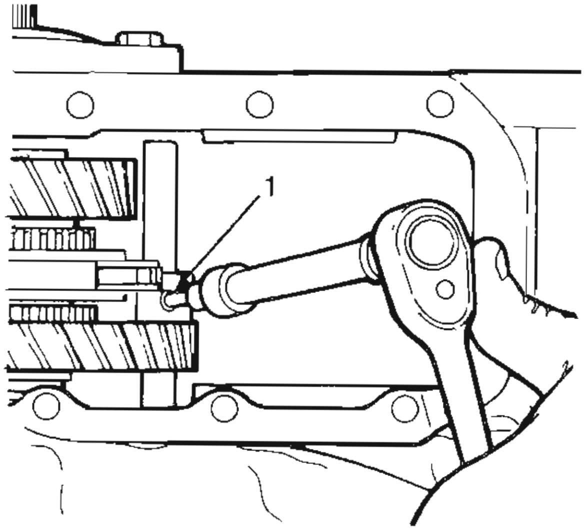
Remove the rear bearing cap attaching bolts and remove the cap. Use a plastic mallet to tap on the output shaft to aid in the cap removal.

NOTE: The rear bearing cap has been coated with a sealant. Use a putty knife to break the seal, and work the knife around the cap to loosen and remove it.

Remove the end play shims and speedometer drive gear from the rear output shaft.

Remove and discard the rear output shaft oil seal. Remove the bearings and bearing races from the rear bearing cap.

Remove the setscrews (1) retaining the front and rear output shaft shift forks on the shift rods.



841119

Remove the shift rods. Insert a punch through the clevis pin holes in the rods and rotate the rods while pulling them out of the case.

NOTE: When the shift rods are free of the front cap, take care to avoid losing the shift rod poppet balls and springs.

Remove the shift forks from the case.

Remove the bolts attaching the front cap-to-case and remove the front cap.

NOTE: The front cap has been coated with a sealant. Use a putty knife to break the seal, and work the knife around the cap to loosen and remove it.

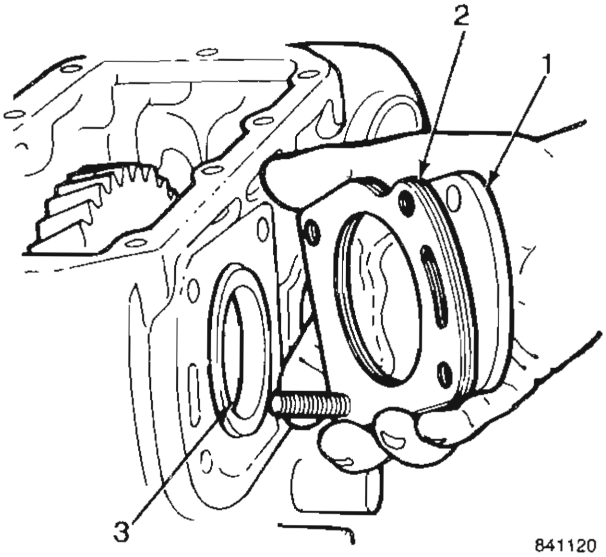
Remove the front output shaft and shift rod oil seals from the front cap. Discard the seals.

Remove the front bearing race from the front bearing cap using Tools J-29168 and J-8092.

Remove the cover plate bolts and remove the plate (1) and end play shims (2) from the case. Keep the shims together for assembly.

Move the front output shaft toward the front of the case.

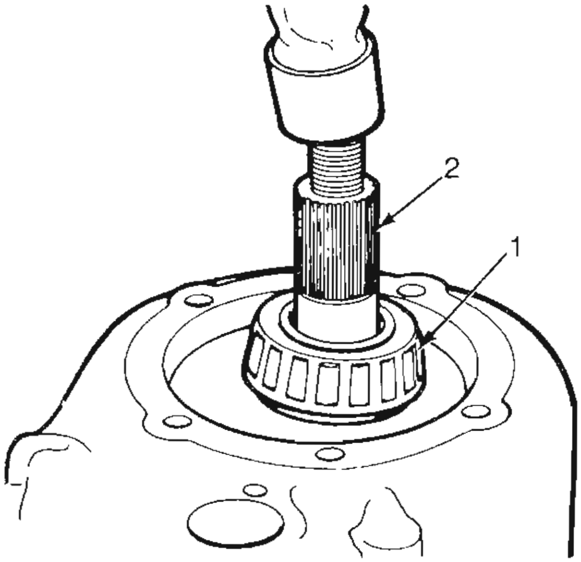
Remove the front output shaft rear bearing race (3) from the case.



841120

SEE
I.S.
NOTES

Remove the rear output shaft front bearing (1). Position the case on wood blocks. Seat the clutch gear on the case interior surface and tap the shaft (2) out of the bearing using a rawhide mallet.



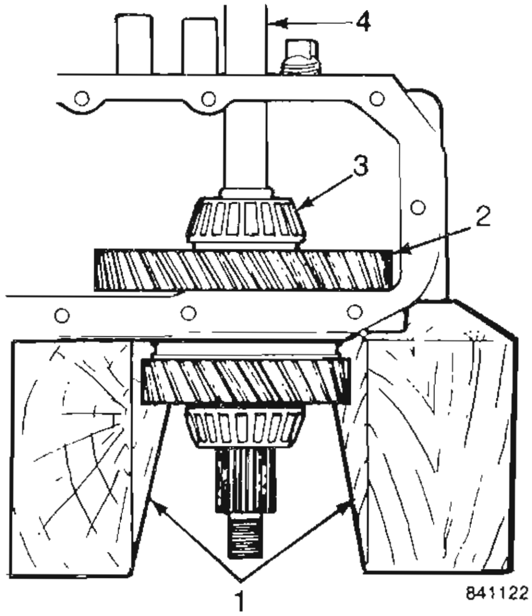
841121

NOTE: If the bearing proves difficult to remove, remove it using an arbor press and a suitable press tool to press the shaft out of the bearing.

CAUTION: When performing the following steps, be sure to support the case with wood blocks (1) positioned at either side of the case bore. This is necessary to avoid damaging the case.

Remove the rear output shaft front bearing, thrust washer, clutch gear (2) and output shaft from the case.

Remove the front output shaft rear bearing (3) using an arbor press and suitable press tool (4).



841122

Remove the transfer case from the arbor press and remove the front output shaft, clutch gear and sleeve and shaft rear bearing from the case.

Remove the front output shaft front bearing using Tool J-22912-01 and the arbor press.

Remove the front output shaft gear from the shaft.

Remove the input shaft rear needle bearing from the rear output shaft using Tools J-29369-1 and J-2619-01. Support the output shaft in a vise while removing the bearing.

Remove the shift rod thimbles. Use a 3/8-in drive, 7/16-in socket and extension to tap the shift rod thimbles out of the case.

CLEANING AND INSPECTION

Clean the case and all components in solvent. Remove all old sealing material from the case and bearing cap mating surfaces. Dry all components except the bearings, using compressed air.

Use caution when cleaning the case mating surfaces. Do not scratch or mar these surfaces in any way. However, minor surface irregularities can be removed with sandpaper. Do not dry any bearings with compressed air. Use clean shop towels only.

Inspect all parts for signs of excessive wear or damage. Replace gears that are cracked, chipped, broken or excessively worn. Replace any bearings that are worn, pitted, scored, flat-spotted or brinelled. Replace any shaft that has damaged splines, threads or bearing surfaces. Check the shift rods and rod bores in the case for wear or damage. Minor scratches or nicks on the rods may be cleaned with a crocus cloth.

ASSEMBLY

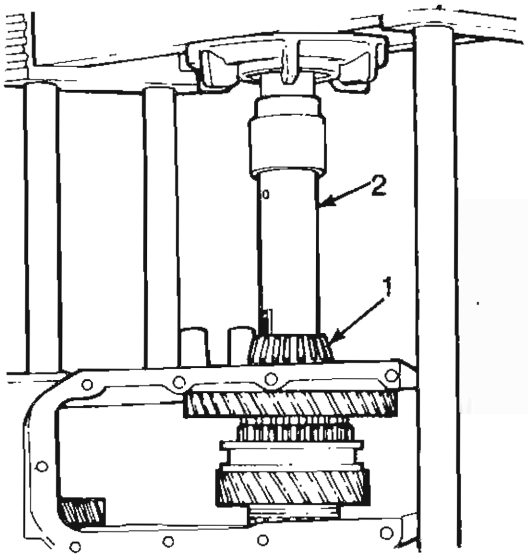
Install the shift rod thimbles. Apply Loctite 220, or an equivalent sealant, to the thimbles before installation.

Install the front output shaft gear on the front output shaft. Be sure the clutch teeth on the gear face the shaft gear teeth.

Install the front bearing on the front output shaft using the arbor press and a suitable press tool. Be sure the bearing is seated against the gear.

Install the front output shaft in the case and install the clutch sleeve and clutch gear on the shaft.

Install the front output shaft rear bearing (1) using the arbor press and a suitable press tool (2).



NOTE: Install an old yoke nut on the shaft to avoid damaging the threads.

Install the input shaft rear needle bearing in the rear output shaft using Tools J-29179 and J-8092.

Position the rear output shaft clutch gear in the case and insert the rear output shaft into the gear.

Install the thrust washer and front bearing on the rear output shaft using the arbor press and a suitable press tool.

Install the shims and bearing on the input shaft using the arbor press and a suitable press tool.

Install the new input shaft oil seal in the input shaft support using Tool J-29184.

SEE I.S. NOTES

Install the input shaft and bearing in the support and install the new bearing snap ring.

Install the rear output shaft gear on the input gear and install the new gear retaining snap ring.

Measure the clearance between the input gear and gear retaining snap ring using a feeler gauge. The clearance should not exceed 0.076 mm (0.003 in). If the clearance is over tolerance, disassemble the input shaft and add shims between the input shaft and the shaft bearing.

Install the clutch sleeve on the rear output shaft.

Apply Loctite 515, or an equivalent sealant, to the mating surface of the input shaft support and install the assembled support, shaft and gear in the case. Use two support bolts to align the support on the case and tap the support into position using a plastic mallet.

Install and tighten the socket head screws in the support with 14 N·m (10 ft-lbs) torque.

Install the rear bearing cap front bearing race using Tools J-9276-3 and J-8092.

Install the rear bearing cap rear bearing race using Tools J-29182 and J-8092.

Position the rear output shaft rear bearing in the rear bearing cap.

Install the rear output shaft yoke oil seal using Tool J-25160.

Install the speedometer gear and end play shims on the rear output shaft.

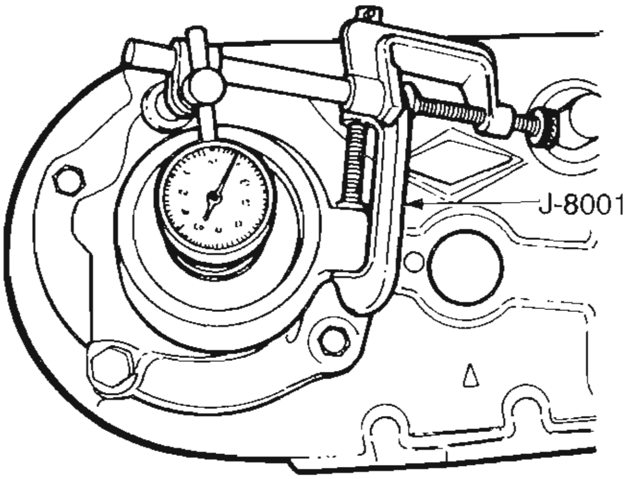
Install the rear bearing cap. Apply Loctite 515, or an equivalent sealant, to the mating surface of the cap. Use two cap bolts to align the bolt holes and tap the rear cap into place using a plastic mallet.

Install and tighten the rear bearing cap bolts with 47 N·m (35 ft-lbs) torque.

Install the rear output shaft yoke. Tighten the replacement locknut with 163 N·m (120 ft-lbs) torque. Use Tool J-8614-01 to hold the yoke while tightening the nut.

Check the rear output shaft end play as follows:

- clamp Dial Indicator J-8001 onto the bearing cap; position the indicator stylus so it contacts the end of the shaft



841124

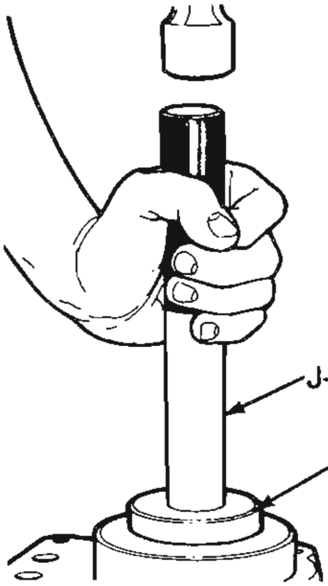
- pry the output shaft back and forth to check the end play which should be 0.025 - 0.127 mm (0.001 - 0.005 in)
- if the end play is not correct, remove or add shims between the speedometer drive gear and the output shaft rear bearing

Install the front output shaft rear bearing race.

Install the front output shaft end play shims and cover plate. Tighten the cover plate bolts with 47 N·m (35 ft-lbs) torque.

NOTE: Apply Loctite 220, or an equivalent sealant, to the bolt threads before installation.

Install the front output shaft front bearing race using Tools J-8092 and J-29181.



Install the front output shaft yoke oil seal using Tool J-25160.

Install the shift rod oil seals using Tools J-25167 and J-8092.

Install the front bearing cap. Apply Loctite 515, or an equivalent sealant, to the mating surface of the cap before installation. Use two bolts to align the cap and case bolt holes and tap the cap into position on the case using a plastic mallet.

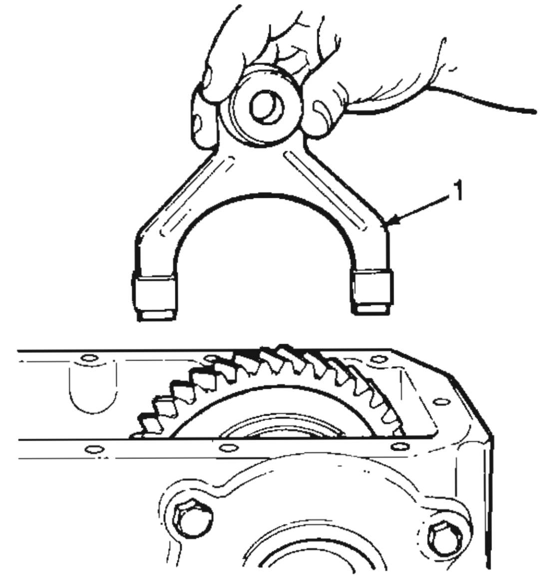
Install and tighten the bearing cap bolts with 47 N·m (35 ft-lbs) torque.

Check the front output shaft end play as follows:

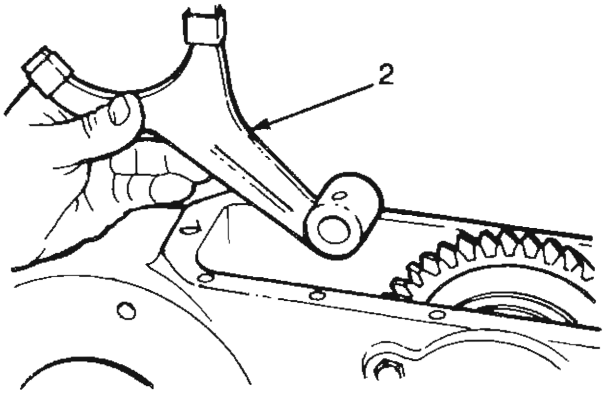
- seat the rear bearing cup against the cover plate by tapping the end of the front output shaft with a plastic mallet
- mount the dial indicator on the front bearing cap and position the indicator stylus against the end of the output shaft
- pry the shaft back and forth to check the end play; the end play should be 0.025 - 0.129 mm (0.001 - 0.005 in)
- if the end play is not correct, remove or add shims between the cover plate and the case; if shims are added, seat the rear bearing cup as outlined above before checking the end play again

Install the front output shaft yoke. Tighten the new locknut with 163 N·m (120 ft-lbs) torque. Use Tool J-8614-01 to hold the yoke while tightening the nut.

Insert the front (1) and rear (2) output shaft shift forks into the case.



841126



841127

Install the front output shaft shift rod poppet ball and spring in the front bearing cap.

Compress the poppet ball and spring and install the front output shaft shift rod part way in the case.

Insert the front output shaft shift rod through the shift fork.

Align the setscrew hole in the shift fork and rod. Install and tighten the setscrew with 19 N·m (14 ft-lbs) torque.

Install the rear output shaft shift rod poppet ball and spring in the front bearing cap.

Compress the ball and spring and install the rear output shaft shift rail part way in the case.

NOTE: Before installing the shift rail, be sure the front output shaft shift rod is in Neutral and that the interlocks are seated in the front bearing cap bore.

Insert the rear output shaft shift rod through the shift fork.

Align the setscrew holes in the fork and rod. Install and tighten the setscrew with 19 N·m (14 ft-lbs) torque.

Insert Tool J-25142 in the intermediate gear and install the needle bearings and spacers in the gear.

Install the intermediate gear thrust washers in the case. Be sure the washer tangs are aligned with the grooves in the case.

NOTE: The thrust washers can be held in place with petroleum jelly.

Install the new O-ring seal on the intermediate shaft.

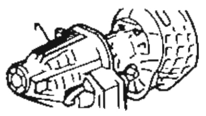
Position the intermediate gear in the case.

Install the intermediate shaft in the case bore. Tap the shaft into the gear until the shaft forces Tool J-25142 out of the case. Use a plastic mallet to tap the shaft into place.

Install the intermediate shaft lockplate and bolt. Tighten the bolt with 31 N·m (23 ft-lbs) torque.

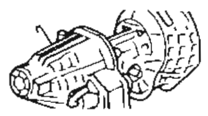
Install the bottom cover and replacement gasket. Apply Loctite 515, or an equivalent sealant, to the mating surface of the cover. Install and tighten the cover bolts with 20 N·m (15 ft-lbs) torque.

SEE I.S. NOTES

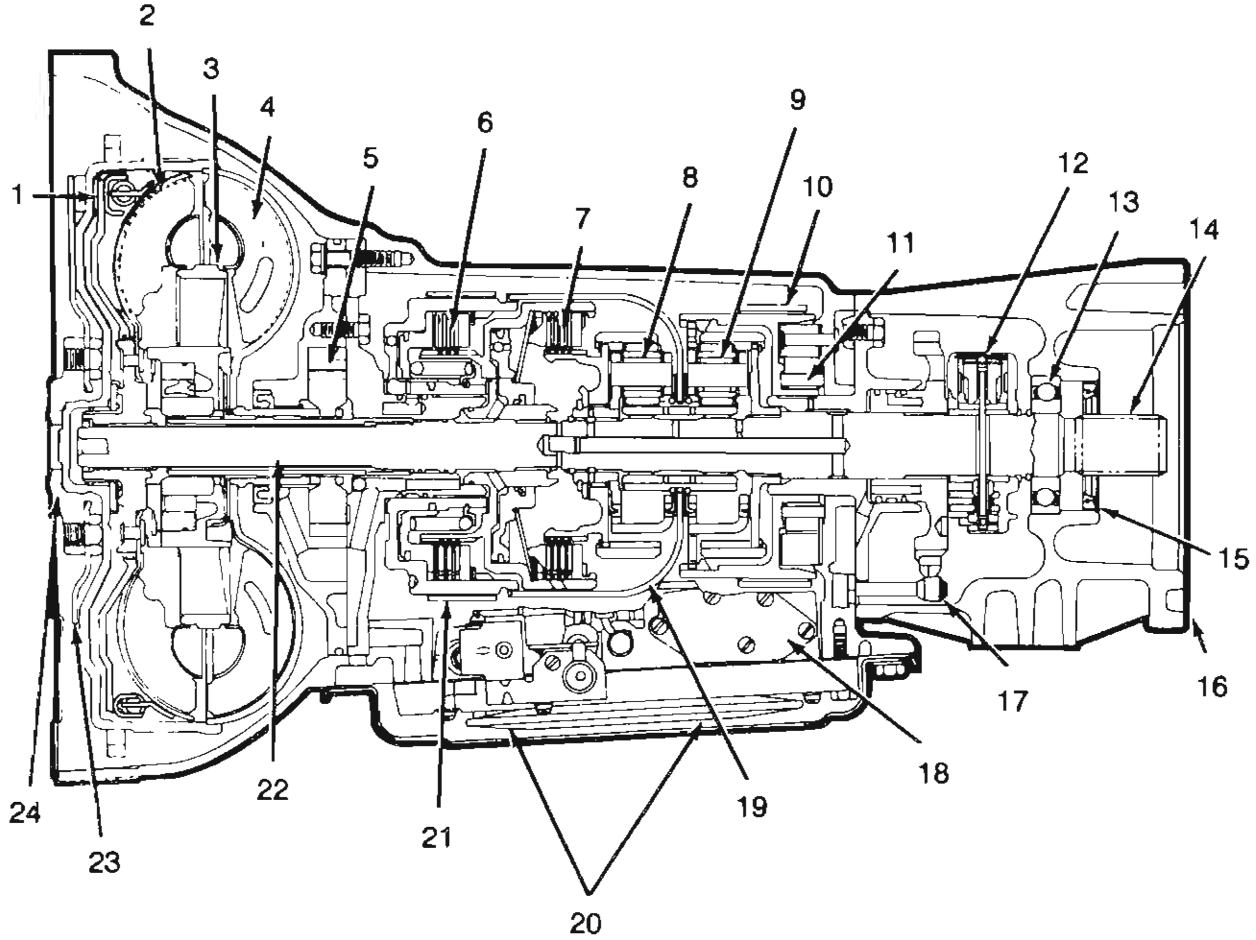


AUTOMATIC TRANSMISSION

CONTENTS



SEE I.S. NOTES



840186

1 - Lockup Clutch
2 - Turbine
3 - Stator
4 - Impeller
5 - Oil Pump
6 - Front Clutch
7 - Rear Clutch
8 - Front Planetary Gear Set
9 - Rear Planetary Gear Set
10 - Low and Reverse (Rear) Band
11 - Overrunning Clutch
12 - Governor
13 - Bearing
14 - Output Shaft
15 - Seal
16 - Adapter Housing
17 - Parking Lock Assembly
18 - Valve Body
19 - Sun Gear Driving Shell
20 - Oil Filter
21 - Kickdown (Front) Band
22 - Input Shaft
23 - Flexible Drive Plate
24 - Engine Crankshaft

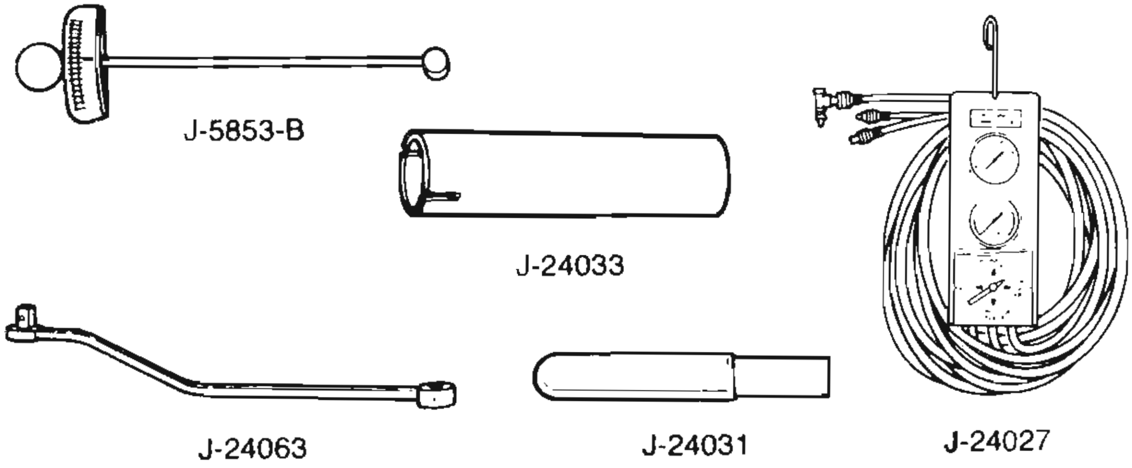
SEE
I.S.
N
O
T
E
S

The Model 999 automatic transmission is used in both the Jeep CJ-7 and Scrambler models. It is a fully automatic, three-speed transmission with a lock-up torque converter.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-5853-B	Torque Wrench Beam-Type (0 - 250 in-lbs) or Equivalent Torque Wrench		■
J-24027	Pressure Test Set	■	
J-24031	Kickdown Valve Gauge	■	
J-24033	Pump Rotor Alignment Tool	■	
J-24063	Kickdown Band Adjustment Adapter	■	

SEE I.S. NOTES



86393

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)	129-163 N·m (95-120 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 Starter 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 (160 in-lbs)	30-41 N·m (22-30 ft-lbs)
Valve Body Screw	4 N·m (35 in-lbs)	
Valve Body-to-Transmission Case Screw	11 N·m (100 in-lbs)	

SEE
I.S.
NOTES

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.**

840193

SEE
I.S.
NOTES

Fluid Capacity and Gear Ratios

Fluid Capacity – Transmission and Torque Converter 999	8 liters (17 pints)
Cooling Method	Water-Heat Exchanger in Radiator Lower Tank
Fluid Pressure and Lubrication – All Models	Rotor-Type Pump
Gear Ratios – 999	
First	2.74:1
Second	1.55:1
Third	1.00:1
Reverse	2.20:1

840603

Fluid Levels

Fill to "Add One Pint" mark on dipstick. Use AMC/Jeep/Renault, or equivalent Dexron II® Automatic transmission fluid.

NOTE: Check fluid level with gearshift selector lever in N (Neutral) position and with fluid at normal operating temperature.

84074

Band Adjustments

	999
Front Band Turns*	2
Rear Band Turns*	4

NOTE: *999 backed off from
8 N·m (72 in-lb)

840604

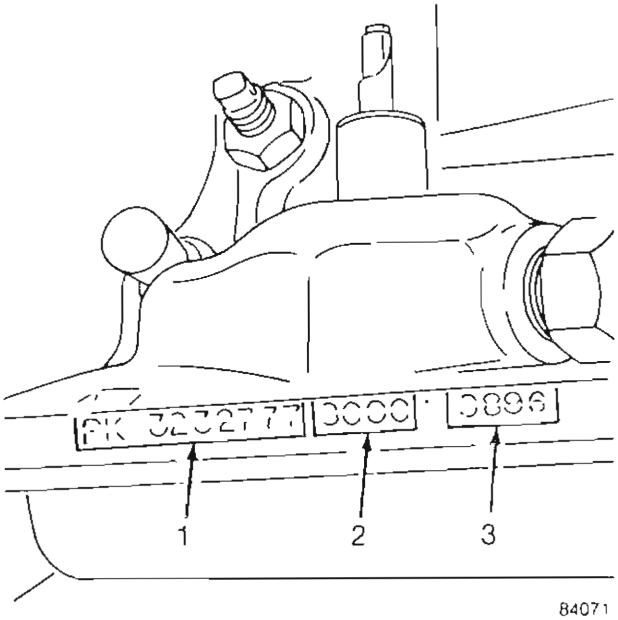
Fluid Capacity

The fluid capacity for the Model 999 transmission is 8 liters (17 pints) and reflects the combined or total amount required for both the transmission and torque converter.

TRANSMISSION AND TORQUE CONVERTER IDENTIFICATION

Transmission Code and Part Numbers

A seven-digit transmission part number (1) is stamped on the left side of the case just above the oil pan mating surface. This number is followed by a four-digit code number (2) which indicates the date of manufacture. The final four-digit number group (3) stamped on the case represents the transmission serial number.



84071

Torque Converter Identification

Because the lockup mechanism is completely enclosed within the converter and not visible, lockup converters have an identifying decal attached to the front cover. The decal is circular in shape and states the converter type and stall ratio, such as Lockup and LS (low stall) or HS (high stall).

Torque Converter Service

The torque converter is a welded assembly and is not serviceable. If diagnosis indicates a malfunction has occurred, or if the converter becomes contaminated with foreign material, replace the converter as an assembly only. Do not attempt to repair or flush the unit. In addition, never attempt to interchange lockup and conventional converters. The transmission input shaft and valve body required for lockup operation are different.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-24027	Pressure Test Set	■	

GENERAL

Automatic transmission malfunctions are generally the result of poor engine performance, incorrect fluid level, incorrect linkage adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or mechanical component malfunctions.

SEE I.S. NOTES

In all automatic transmission repair, the logical and proper procedure is diagnosis before disassembly. A systematic diagnosis procedure is important in avoiding repair delays caused by incorrect or unnecessary repairs.

The diagnosis and test procedures outlined in this section should be performed in the following sequence to achieve the maximum effect:

- preliminary diagnosis
- road test
- hydraulic pressure test
- air pressure test
- stall test
- analysis of test results and consultation of diagnosis guides and charts for cause of malfunction

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure is for vehicles that are driveable. There is an alternate procedure for vehicles that will not back up or move forward.

Diagnosis on a Vehicle That Is Driveable

Check the fluid level and condition.

Adjust the throttle and gearshift linkage before road testing if the complaint was based on delayed, erratic or harsh shifts.

Road test the vehicle and note the transmission operating characteristics. The road test must also include testing of the lockup torque converter operation.

Perform the stall test if the complaint was based on sluggish, low-speed acceleration or abnormal throttle opening requirements to maintain highway speeds with the engine in good tune.

Perform the hydraulic pressure tests.

Perform the air pressure test of the clutch and band operation.

Diagnosis on a Vehicle That Will Not Back Up or Move Forward

Check the fluid level and condition.

Check for a broken or disconnected throttle linkage.

Check for broken cooler lines and loose or missing pressure port plugs.

Raise the vehicle, start the engine, shift the transmission into gear and note the following:

- if the propeller shaft(s) turns but the axle wheels do not, the problem is in the differential or axle shafts
- if the propeller shaft(s) does not turn and the transmission is noisy, stop the engine, remove the oil pan, and check for debris; if debris is not found, remove the transmission and check for a broken drive plate or drive plate-to-converter bolts, broken converter hub, broken input or output shaft, broken oil pump, or stripped torque converter turbine hub splines
- if the propeller shaft(s) does not turn and the transmission is not noisy, perform the hydraulic pressure test to determine if the problem is a malfunction of a hydraulic or mechanical component

FLUID LEVEL AND CONDITION

WARNING: When checking the fluid level or performing other underhood operations with the engine running, observe the following precautions to avoid possible personal injury. Keep hands away from hot or rotating engine components or accessories. Do not wear loose articles of clothing that could become entangled in rotating engine components or accessories.

Check the fluid level and condition as follows.

Drive the automobile until the transmission fluid is at the normal operating temperature of approximately 79.4°C (175°F).

NOTE: To avoid false readings, which could result in an over- or under-fill condition, do not check the fluid level until the fluid is at operating temperature.

Shift the transmission into the Neutral position.

NOTE: The transmission fluid level is checked in neutral because the converter fills more rapidly in this position.

Apply the parking brake.

Operate the engine at idle speed.

Wipe dirt from the filler cap and tube before removing the dipstick.

Remove the dipstick and check the fluid level. The fluid level is correct when it is between the ADD ONE PINT and FULL marks on the dipstick.

Add or drain fluid as necessary to bring the fluid to the correct level. If the level was low, check the transmission for leaks.

Check the condition of the fluid.

The fluid should be dark red in color and free of dirt or debris.

If the fluid is badly discolored, smells burned, contains metal or friction material particles and transmission problems were experienced, the transmission may require an overhaul.

A low fluid level allows the pump to take in air along with the fluid. As in any hydraulic system, aerated fluid will cause hydraulic pressures to be low and develop slower than normal.

If the transmission is overfilled, the gears churn the fluid into foam, aerating the fluid and causing the same conditions that occur with a low fluid level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and servo operation. Foaming can also result in the fluid escaping from the transmission vent where it may be mistaken for a leak.

FLUSHING OIL COOLER AND COOLER LINES

If the transmission or the lockup clutch failure has contaminated the fluid, the oil cooler should be reverse flushed to ensure that the metal particles or sludged oil are not later transferred back into the reconditioned transmission.

Disconnect both of the cooler lines at the radiator.

Dislodge any foreign material at the inlet side of the cooler with a small screwdriver.

Reverse flush the cooler with a combination of mineral spirits and pulsating air (shop air) under pressure.

Treat the cooler lines separately and ensure that they are clear by flowing mineral spirits or automatic transmission fluid through them.

Remove the leftover mineral spirits from the cooler and cooler lines by flowing automatic transmission fluid through them.

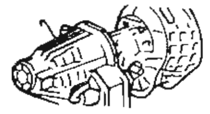
The cooler flow should now be checked by connecting the cooler tubes and placing the rear cooler tube into a 0.9 liter (1 qt) container. Overfill the transmission by 0.9 liter (1 qt). Watching a clock, start the engine (run at curb idle) and run in the neutral position for exactly 20 seconds. If the cooler flow is less than 0.9 liter (1 qt) in 20 seconds, replace the radiator or have the radiator bottom cooler professionally reconditioned.

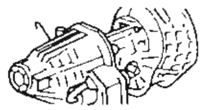
NOTE: After completing any repairs that have required draining the transmission fluid, add 2.8 liters (3 qts) of AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II® to the transmission before starting the engine.

THROTTLE LINKAGE

The throttle linkage adjustment is important to proper operation. This adjustment positions a valve which controls the shift speed, shift quality and part of the throttle downshift sensitivity. If the setting is too short, early shifts and slippage between the shifts may occur. If the linkage setting is too long, shifts may be delayed and part throttle downshifts may be very sensitive.

This adjustment is so important that the use of a throttle lever holding spring is necessary to remove slack in the linkage during adjustment. Refer to Throttle Linkage Adjustment in the In-Vehicle Service and Adjustment Section.





GEARSHIFT LINKAGE

The gearshift linkage adjustment is important because the linkage positions the manual valve in the valve body. Incorrect adjustment will result in creeping in Neutral, premature clutch wear, delayed engagement in any gear, or a no-start in the Park or Neutral position.

Proper operation of the neutral start switch will provide a quick check of the linkage adjustment as follows.

Insert the key in the ignition lock and turn the lock to the ON position to unlock the column and gearshift lever.

Move the gearshift lever slowly until it clicks into the Park detent in the shift selector gate.

Turn the ignition lock cylinder to the Start position and start the engine. If the starter operates, the Park position is correct.

Stop the engine.

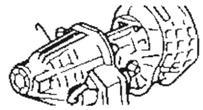
Move the gearshift lever slowly toward Neutral until the lever engages in the edge of the Neutral detent in the shift selector gate.

Turn the ignition lock cylinder to the Start position and start the engine. If the starter operates, the Neutral position is correct and the linkage is properly adjusted.

If the starter failed to operate in Park or Neutral, or if the gearshift lever had to be moved back and forth to achieve a start in either position, a linkage adjustment is required. Refer to Gearshift Linkage Adjustment in the In-Vehicle Service and Adjustment Section.

LOCKUP TORQUE CONVERTER SERVICE DIAGNOSIS

Preliminary diagnosis of a transmission malfunction in Jeep CJ-7 and Scrambler models must include a test of the lockup torque converter. Since it is possible for transmission or lockup torque converter problems to be mistaken for one another, attention must be paid to the torque converter operation during a comprehensive road test. The Lockup Torque Converter Service Diagnosis Chart provides a basis for analyzing the road test results.

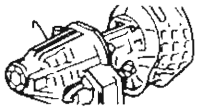


SEE I.S. NOTES

Lockup Torque Converter Service Diagnosis

Condition	Possible Cause	Correction
NO LOCKUP	(1) Faulty oil pump.	(1) Replace oil pump.
	(2) Sticking governor valve.	(2) Repair or replace as necessary.
	(3) Valve body malfunction. (a) Stuck switch valve. (b) Stuck lockup valve. (c) Stuck fail-safe valve.	(3) Repair or replace valve body or its internal components as necessary.
	(4) Failed locking clutch.	(4) Replace torque converter.
	(5) Leaking turbine hub seal.	(5) Replace torque converter.
	(6) Faulty input shaft or seal ring.	(6) Repair or replace as necessary.
WILL NOT UNLOCK	(1) Sticking governor valve.	(1) Repair or replace as necessary.
	(2) Valve body malfunction. (a) Stuck switch valve. (b) Stuck lockup valve. (c) Stuck fail-safe valve.	(2) Repair or replace valve body or its internal components as necessary.
STAYS LOCKED UP AT TOO LOW A SPEED IN DIRECT	(1) Sticking governor valve.	(1) Repair or replace as necessary.
	(2) Valve body malfunction. (a) Stuck switch valve. (b) Stuck lockup valve. (c) Stuck fail-safe valve.	(2) Repair or replace valve body or its internal components as necessary.
LOCKS UP OR DRAGS IN LOW OR SECOND	(1) Faulty oil pump.	(1) Replace oil pump.
	(2) Valve body malfunction. (a) Stuck switch valve. (b) Stuck fail-safe valve.	(2) Repair or replace valve body or its internal components as necessary.
SLUGGISH OR STALLS IN REVERSE	(1) Faulty oil pump.	(1) Replace oil pump as necessary.
	(2) Plugged cooler, cooler lines or fittings.	(2) Flush or replace cooler and flush lines and fittings.
	(3) Valve body malfunction. (a) Stuck switch valve. (b) Faulty input shaft or seal ring.	(3) Repair or replace valve body or its internal components as necessary.

86336



Lockup Torque Converter Service Diagnosis (cont'd.)

Condition	Possible Cause	Correction
LOUD CHATTER DURING LOCKUP ENGAGEMENT (COLD)	(1) Faulty torque converter.	(1) Replace torque converter.
	(2) Failed locking clutch.	(2) Replace torque converter.
	(3) Leaking turbine hub seal.	(3) Replace torque converter.
VIBRATION OR SHUDDER DURING LOCKUP ENGAGEMENT	(1) Faulty oil pump.	(1) Repair or replace oil pump as necessary.
	(2) Valve body malfunction.	(2) Repair or replace valve body or its internal components as necessary.
	(3) Faulty torque converter.	(3) Replace torque converter.
	(4) Engine needs tune-up.	(4) Tune engine.
VIBRATION AFTER LOCKUP ENGAGEMENT	(1) Faulty torque converter.	(1) Replace torque converter.
	(2) Exhaust system strikes underbody.	(2) Align exhaust system.
	(3) Engine needs tune-up.	(3) Tune engine.
	(4) Throttle linkage misadjusted.	(4) Adjust throttle linkage.
VIBRATION WHEN REVVED IN NEUTRAL	(1) Torque converter out of balance.	(1) Replace torque converter.
OVERHEATING: OIL BLOWS OUT OF DIP STICK TUBE OR PUMP SEAL	(1) Plugged cooler, cooler lines or fittings.	(1) Flush or replace cooler and flush lines and fittings.
	(2) Stuck switch valve.	(2) Repair switch valve in valve body or replace valve body.
SHUDDER AFTER LOCKUP ENGAGEMENT	(1) Faulty oil pump.	(1) Replace oil pump.
	(2) Plugged cooler, cooler lines or fittings.	(2) Flush or replace cooler and flush lines and fittings.
	(3) Valve body malfunction.	(3) Repair or replace valve body or its internal components as necessary.
	(4) Faulty torque converter.	(4) Replace torque converter.
	(5) Fail locking clutch.	(5) Replace torque converter.
	(6) Exhaust system strikes underbody.	(6) Align exhaust system.
	(7) Engine needs tune-up.	(7) Tune engine.
	(8) Throttle linkage misadjusted.	(8) Adjust throttle linkage.

84089

SEE I.S. NOTES

SEE I.S. NOTES

ROAD TEST

Before road testing, be sure that the fluid level and the throttle and gearshift linkage adjustments have been checked and corrected, if necessary.

Observe the engine performance during the test. On Jeep CJ-7 and Scrambler models, be sure the transfer case and front axle are operating correctly. An engine or transfer case malfunction will have an adverse effect on the transmission operation.

In addition, operate the transmission in all gearshift positions to check for slippage and shift variations. Note whether the shifts are harsh, spongy, delayed, early or whether part throttle downshifts are sensitive.

Watch closely for slippage or engine speed flare-up which usually indicates clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul may be necessary to restore normal operation.

In most cases, a slipping clutch or band can be determined by noting the transmission operation in all gearshift lever positions and by comparing which internal units are applied in those positions. The Clutch and Band Application Chart provides a basis for analyzing road test results.

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				•			•		•
Converter Lockup Clutch						•			

84078

Analysis of the Road Test

Refer to the Clutch and Band Application Chart and note which elements are in use 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 front 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 the transmission slips in third gear, either the front clutch or the rear clutch is slipping. By selecting another gear which does not use one of these units, the slipping clutch can be determined. For example, if the transmission also slips in reverse, the front clutch is slipping. If the transmission does not slip in reverse, the rear clutch is slipping.

This process of elimination can be used to determine the slipping unit and to check the operation. The key is the proper use of the Clutch and Band Application Chart.

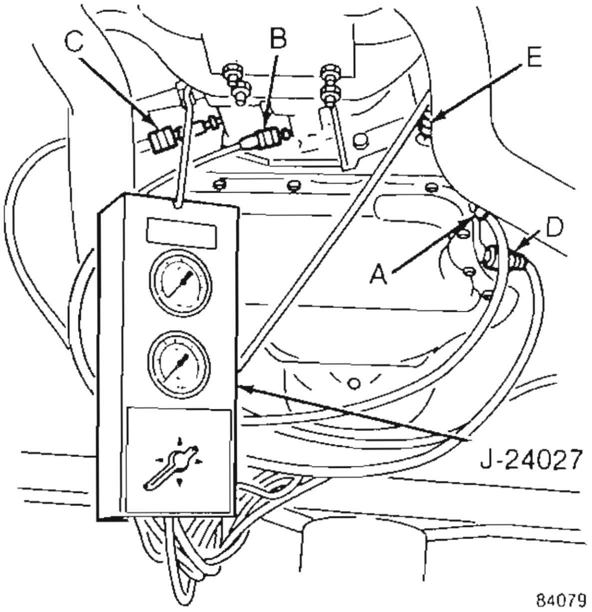
Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until the hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless the condition is obvious, such as no drive in D range, first gear only, do not disassemble the transmission until the hydraulic and air pressure tests have been performed.

HYDRAULIC PRESSURE TESTS

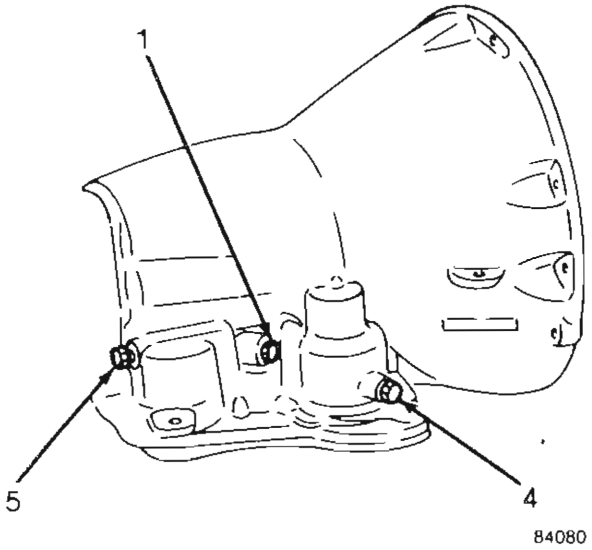
The hydraulic pressure tests are performed using Test Set J-24027. The set consists of five color-coded pressure hoses, a 2 758 kPa (400 psi) capacity pressure gauge and a 689 kPa (100 psi) capacity pressure gauge.

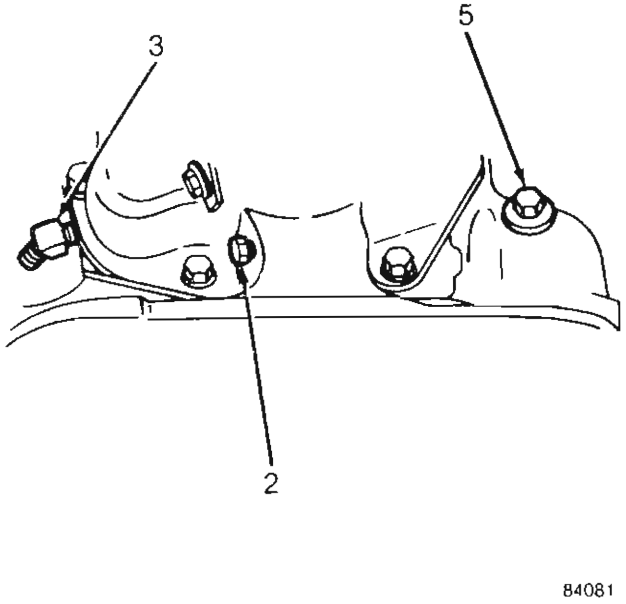
The high pressure gauge is used to record rear servo pressure on R and 1 positions only and the low pressure gauge is used for all other readings. The test set permits simultaneous connection to all the pressure ports and allows sequential or independent pressure readings as desired.



SEE I.S. NOTES

Pressure Test Port Location





The accumulator line pressure port (1) is located on the right side of the case between the front and rear servo castings just above the oil pan mating surface. Connect the blue hose (A) here.

The governor pressure port (2) faces the left side in the front lower center section of the adapter housing. Connect the black hose (B) here.

Lubrication pressure is measured by installing a T-fitting in the fluid cooler return line (3) on the left side at the rear edge of the case halfway to the top of the case. Connect the white hose (C) here. If inaccessible, use a T-fitting at the radiator cooler return line.

The front servo release pressure port (4) is located on the right side of the case just behind the filler tube opening and just above the oil pan mating surface. Connect the yellow hose (D) here.

The rear servo apply pressure port (5) is on the right side of the case, facing rearward and just above the oil pan mating surface. Connect the red hose (E) here.

Hydraulic Pressure Test Procedure

Before the test, check and correct the fluid level and control linkage adjustments. 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 transmission pressure ports. Compare the test results with the following hydraulic pressure test specifications and diagnosis charts.

Test One

This test checks the pump output, pressure regulator valve operation, front and rear clutch and oil filter condition by measuring the transmission operating pressure at the accumulator and front servo pressure ports in the D range.

Turn the test gauge selector handle to the line pressure position.

Start and operate the engine at idle speed, move the gearshift lever to the D range and note the line pressure.

At idle, the pressure should be 372 - 414 kPa (54 - 60 psi).

Increase the engine rpm to 1600 and slowly move the valve body throttle lever fully forward, then fully rearward. With the lever in the forward position, the pressure should be 372 - 414 kPa (54 - 60 psi) and gradually increase to 648 kPa (94 psi) when the lever is moved rearward.

Turn the test gauge selector handle to the front servo apply position.

Operate the engine at 1000 rpm. Allow the transmission to upshift into third gear, and note the front servo pressure. The pressure should not vary from the previously noted line pressure by more than 21 kPa (3 psi).

Slowly move the throttle linkage to the full throttle position and note the front servo pressures just prior to and after the transmission downshifts. The servo pressure should increase, then drop to 0 after downshift.

Test Two

This test checks the pump output, pressure regulation, front clutch and rear servo condition by measuring and comparing the pressure at the rear servo and the accumulator pressure ports in gear range 1 and 2.

Turn the test gauge selector handle to the line pressure position.

Move the gearshift lever to the 1 range, operate the engine at 1000 rpm, and slowly move the valve body throttle lever fully forward then fully to the rear. With the lever in the forward position, the pressure should be 372 - 414 kPa (54 - 60 psi) and gradually increase to 621 - 662 kPa (90 - 96 psi) as the lever is moved to the rear.

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 to the rear. Compare the pressure at the servo with the pressure at the accumulator port. The servo pressure should not vary from the accumulator port pressure by more than 21 kPa (3 psi).

Turn the test gauge selector handle to the line pressure position.

Place the gearshift lever in the 2 range and operate the engine at 1000 rpm.

Slowly move the valve body throttle lever fully forward, then fully to the rear and note the pressures. With the lever in the forward position, the pressure should be 372 - 414 kPa (54 - 60 psi) and gradually increase to 621 - 662 kPa (90 - 96 psi) as the lever is moved to the rear.

Test Three

This test checks the pump output, pressure regulation, front clutch and rear servo condition by measuring and comparing the operating pressure at the rear servo pressure port in Reverse.

NOTE: For this test, only the high pressure gauge in the test set is used. Since the gauge hose is connected directly to the rear servo, it is not necessary to move the test gauge selector handle to any specific position.

Operate the engine at idle speed. Move the gearshift lever to Reverse, and note the reading on the high pressure gauge. The pressure should be approximately 1 103 kPa (160 psi) at idle.

Slowly increase the engine speed to 1600 rpm and note the reading on the high pressure gauge again. As the engine speed is increased, the pressure should also increase to approximately 1 862 kPa (270 psi).

Operate the engine at idle speed. Move the gearshift lever from Reverse to Drive, and note the reading on the high pressure gauge. The pressure should drop to zero when the gearshift 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 the governor operation by measuring the governor pressure response to the changes in the engine speed. It is usually not necessary to check the governor operation unless the shift speeds are incorrect or if the transmission will not downshift.

Turn the test gauge selector handle to the governor pressure position.

Move the gearshift lever to the D range. Operate the engine at idle speed and note the pressure. The pressure should be 10.3 kPa (0 - 1½ psi) maximum. If the pressure exceeds the maximum, the governor valve or weights are sticking open.

Slowly increase the engine speed and observe the speedometer and test gauge pressure. The governor pressure should increase in proportion to the vehicle speed, approximately 69 kPa per 1.6 kph (1 psi per 1 mph). The pressure rise should be smooth and drop back to 10.3 kPa (0 - 1½ psi) when the throttle is closed.

Test Five

This test checks the lubrication pressure which is measured by connecting the white test gauge hose to a T-fitting that has been inserted in the left-side cooler line. This test is especially important if the transmission is noisy, if unexplained rear clutch failure has occurred or if fluid is forced out of the fill tube when 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 handle to the lubrication pressure position.

Start and operate the engine at idle speed. Move the gearshift lever to the D range and note the pressure.

The pressure at idle should be 35 - 103 kPa (5 - 15 psi).

Increase the engine speed to 1000 rpm and slowly move the valve body throttle lever fully forward and then fully to the rear. With the lever forward, the pressure should be 35 - 103 kPa (5 - 15 psi). With the lever to the rear, the pressure should be 68 - 207 kPa (10 - 30 psi).

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 over 0-10.3 kPa (0 - 1-1/2 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

840191

NOTE: Governor operational problems should be diagnosed using the road test and hydraulic pressure test procedures.

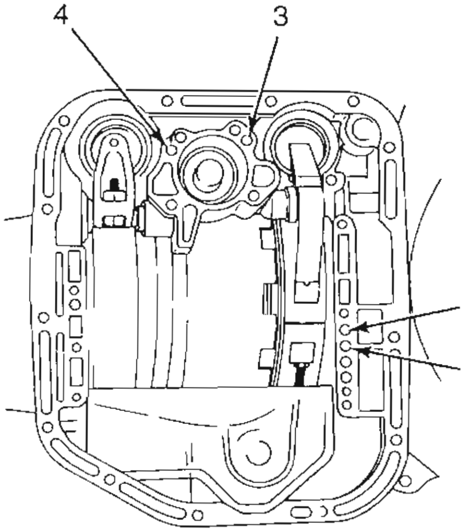
SEE I.S. NOTES

SEE I.S. NOTES

AIR PRESSURE TESTS

CAUTION: Use dry, filtered compressed air only when performing air pressure tests. Pressures of 207 - 689 kPa (30 - 100 psi) are required to perform the tests.

Air pressure testing is used as a diagnostic tool before transmission removal and also as a method of confirming proper clutch, band and servo operation after repair. The tests involve substituting air pressure for fluid pressure by applying air pressure to the appropriate case passages after the valve body has been removed.



84082

Front Clutch Test

Place one or two fingers on the clutch housing 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. While air pressure is applied, check for excessive air leakage.

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 can be felt and a soft thud may be heard as the clutch applies. While air pressure is applied, check for excessive or unusual air leakage.

Front Servo Test

Apply air pressure to the front servo apply passage (3). The servo rod should extend and cause the band to tighten around the drum. While air pressure is applied, check for excessive air leakage. Spring tension should release the servo when air pressure is removed.

Rear Servo Test

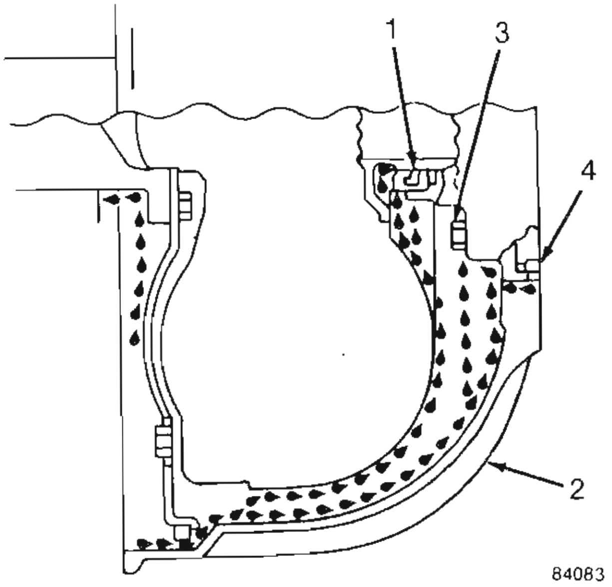
Apply air pressure to the rear servo apply passage (4). The servo rod should extend and cause the band to tighten around the drum. While air pressure is applied, check for excessive air leakage. Spring tension should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two facts must be established before attempting repair. First, it must be verified that a leak condition does actually exist and second, the real source of the leak must be determined. Failure to establish these facts beforehand can result in incorrect and unnecessary repairs.

In some cases, suspected converter housing fluid leaks may not be leaks at all. They may be the result of residual fluid in the converter housing or excess fluid spilled during factory filling or initial transmission operation. These conditions may be incorrectly diagnosed as fluid leaks.

Converter housing area leaks may have several sources. Through careful observation, it is possible to locate the leak source before removing the transmission. The paths various types of fluid leaks follow are shown and described as follows.



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.

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 the fluid level and condition. Refer to Fluid Level and Condition.

Raise and support the vehicle.

Inspect the transmission and correct any external leaks from the oil pan gasket, fill tube, cooler line fittings, pressure test port plugs and the case-to-extension or adapter housing gasket.

Wipe all the fluid from the converter housing area.

Operate the engine at 2000 rpm for two minutes and observe the converter housing for a fluid accumulation pattern.

If the fluid accumulation pattern is not evident, proceed to the next step.

If a circular pattern develops, it indicates a defective or damaged torque converter. Correct the leak by replacing the converter.

If a trickle develops, it indicates an oil pump leak caused by one or more of the following conditions:

- pump drainback hole obstructed
- pump housing vent obstructed

SEE I.S. NOTES

- pump bushing or converter hub scored, nicked, pitted or burred
- oil pump O-ring, gasket or seal leak
- front band lever pin plug loose or plug threads in the case are stripped

Correct these conditions as outlined in the following steps.

Remove the transmission and converter.

Tighten the front band adjusting screw until the band is tight around the front clutch retainer. This will prevent the front clutch assembly from also coming out when the oil pump is removed and damaging the clutch discs.

SEE I.S. NOTES

Remove the oil pump and oil seal.

Inspect the pump housing drainback and vent holes for obstructions. If the drainback hole cannot be opened using thin wire, replace the pump housing. Check the vent hole by blowing solvent through the vent. If the vent cannot be opened, replace the pump housing.

Inspect the condition of the pump housing and the converter hub. If the bushing is scored, replace it and polish the hub using fine sandpaper.

Install a replacement oil pump 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 sealer, to the plug threads and tighten the plug with 17 N·m (150 in-lbs) torque.

Adjust the front band.

Install the transmission and the converter.

Remove the supports and lower the vehicle.

STALL TEST

WARNING: Never allow anyone to stand in front of the vehicle when performing a stall test. In addition, always block the front wheels and have the parking and service brakes fully applied during the test.

Stall testing determines the maximum engine rpm obtainable at full throttle with the rear wheels locked and the transmission in Drive. Stall testing also checks the holding ability of the converter-stator overrunning clutch and both transmission clutches. When stall testing is completed, refer to the Stall Speed Specifications Chart and the stall speed diagnosis guides.

Stall Test Procedure

Connect a tachometer to the engine.

Check and adjust the transmission fluid level. Refer to Fluid Level and Condition.

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.

CAUTION: When performing the next step, do not hold the throttle open any longer than necessary and never 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 the Neutral position for at least 20 seconds to cool the transmission fluid.

Open the throttle completely and record the maximum engine rpm registered on the tachometer.

If the engine speed exceeds the maximum shown in the stall speed chart, release the accelerator immediately. This indicates that transmission clutch slippage is occurring.

Shift the transmission into the Neutral position. Operate the engine for 20 seconds. Stop the engine. Shift the transmission into the Park position, and release the brakes.

Compare the test results with the Stall Speed Chart and refer to the Stall Test Diagnosis.

Stall Test Diagnosis

Stall Speed Too High

If the stall speed exceeds the specifications by more than 200 rpm, transmission clutch slippage is indicated.

Stall Speed Too Low

Low stall speeds with a properly tuned engine indicate a torque converter stator clutch problem. The condition should be confirmed by road testing prior to converter replacement. If the stall speeds are 250 - 350 rpm below the minimum specified in the chart, and the vehicle operates properly at highway speeds but has poor low speed acceleration, the stator overrunning clutch is slipping and the torque converter should be replaced.

Stall Speed Normal

If the stall speeds are normal but road testing shows that an abnormally high throttle opening is required to maintain highway speeds even though the low speed acceleration is normal, the stator overrunning clutch is seized and the torque converter must be replaced.

Noise

A whining or siren-like noise caused by fluid flow is normal during a stall test. Loud metallic noises from loose internal parts or interference within the assembly indicate a defective torque converter. To confirm that a noise is originating from within the converter, operate the vehicle at light throttle in Drive and Neutral on a hoist and listen for noise coming from the torque converter housing.

When the stall test is completed, compare the test speeds recorded with those listed in the Stall Speed Specifications Chart.

Stall Speed Specifications Chart

Transmission Model	Engine RPM
258-999	1850-2150

86392

SERVICE DIAGNOSIS

The diagnosis charts provide a quick reference for transmission diagnosis. A step-by-step approach to diagnosing and correcting transmission malfunctions is used.

The In-Vehicle Procedures Chart lists problem conditions that can be corrected with the transmission in the vehicle. The Out-of-Vehicle Procedures Chart lists problems that require transmission removal and disassembly.

The In-Vehicle Procedures should always be performed first. Do not remove the transmission unless the In-Vehicle Procedures fail to correct the problem.

Service Diagnosis Charts

The Conditions column in each chart describes the most frequently encountered malfunctions. Each problem condition is cross-referenced to the necessary service procedures.

The code letters in the boxes at the top of each chart identify the individual service procedures. These code letters correspond to descriptions of the various procedures, which appear on the pages immediately following the charts.

Capital letters A through T denote In-Vehicle Procedures. Lower case letters a through j denote Out-of-Vehicle Procedures.

The numbers in the boxes adjacent to the Conditions column cross-reference each problem condition to the necessary service procedures. These numbers also show the order in which the various service procedures should be performed.

As an example, assume that the problem condition is Harsh Engagement in R-D-2-1. First, locate the problem description in the Conditions column; then note which service procedures are indicated. As shown in the chart, procedures B, D, E, G, N, Q are required. Next, note the numbers which indicate the sequence in which these procedures are to be performed. In this case, the correct order will be D, B, E, G, Q, N. Finally, refer to the service procedure descriptions, which appear on the pages immediately following the charts, for details of each procedure.

Become familiar with both charts and the procedures required. Some conditions require in-vehicle service only, others require out-of-vehicle service only, and some require a combination of both.

Service Diagnosis

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

86337

SEE
I.S.
NOTES

In-Vehicle Procedures

A – Fluid Level and Condition: The fluid should be at the full mark with the engine idling. The fluid should not be milky and full of bubbles, nor should it be dark and smell burned. Use AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II®.

B – Throttle Linkage: Check for smooth travel. Clean the linkage pivot points as necessary, but do not lubricate them and then adjust to the specifications.

C – Gearshift Linkage: Adjust to the specifications.

D – Engine Idle Adjustment: Set to the specifications.

E – Hydraulic Pressures: Perform the hydraulic pressure test to determine if the operating pressures are within the specifications. Repair the hydraulic components as necessary. Check and correct the throttle and line pressure settings, if required.

F – Front Band: Adjust to the specifications.

G – Rear Band: Adjust to the specifications.

H – Neutral Start Switch: Check the wires and connections. Test the switch. See if the valve body manual lever grounds the switch in the P and N positions. If not OK, check the ground strip at the valve body manual lever. If OK, check the starting circuit.

I – Park Lock: Check the condition of the lock rod, lock rod ball, sprag reaction plug, governor support, and the sprag shaft. Replace the parts as required.

J – Transmission Oil Cooler: Check the lines and cooler for obstructions, or leaks (look for transmission fluid in the radiator coolant, or 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 the parts as necessary.

L – Governor Valve: Clean and inspect all parts. Check the weights, shaft and valve for burrs, nicks, scores or binding. Check the spring for collapsed or distorted coils and snap rings for distortion. Check the filter for dirt and debris. Inspect the body for cracks or warpage. Check the torque on the governor and output shaft support bolts.

M – Oil Filter: Inspect and replace, if clogged.

N – Valve Body: Remove, disassemble, clean thoroughly and inspect the valves and plugs for nicks, scratches, burrs and rounded edges on the valve lands. Check the bores for scratches; the springs for collapsed coils; and all mating surfaces for nicks, burrs or warpage. Reassemble and install, tightening all the screws to the exact specifications.

O – Front Servo and Linkage: Inspect the piston for wear, cracks and worn or broken seal rings. Check the springs for collapsed or broken coils. Check the servo bore for scratches, nicks or wear. Check the lever, strut and band for damage. Check the lever shaft for wear, looseness in the case, or for a leaking O-ring.

P – Rear Servo and Linkage: Inspect the piston for wear, cracks, a worn or broken seal ring, or a damaged seal. Check the springs for collapsed or broken coils. Check the servo bore for scratches, nicks or wear. Check the lever and band for damage. Check the lever shaft for wear or looseness in the case.

Q – Accumulator: Clean and inspect for broken seal rings, a scratched bore or a broken or collapsed spring. Check the piston for cracks or evidence of it cocking in the bore.

R – Air Pressure Test: Remove the valve body and use air pressure to apply the clutches and bands to check the operation.

S – Engine Tune and Performance: Verify proper engine operation. Be sure the compression meets the specifications and the fuel and ignition systems are functioning properly.

T – Stall Test: Perform the stall test to check the holding ability of the converter and transmission clutches.

SEE
I.S.
NOTES

Service Diagnosis

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 (Creeks 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	

86338

SEE I.S. NOTES

SEE I.S. NOTES

Out-of-Vehicle Procedures

a – Converter Drive Plate: Check the plate for flatness, cracks at the mounting bolt holes, loose attaching bolts or damaged ring gear teeth. A broken drive plate may indicate engine-to-transmission misalignment caused by loose, missing or misaligned dowels.

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.

d – Front Clutch: Clean and inspect all parts. Examine the retainer and piston for scores and scratches; discs and plates for wear; return springs for collapsed coils; and the seal rings for damage. The vent check ball in the retainer must operate freely.

e – Rear Clutch: Inspect all rear clutch parts as outlined under the front clutch procedure.

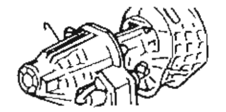
f – Planetary Gear Set: Clean and inspect the annulus gear, planet pinion carrier assembly and sun gear for worn thrust washers, damaged gear teeth and excessive pinion end clearance. Examine the bushings in the sun gear for excessive wear.

g – Rear Band: Inspect the band for wear and for good bonding of the lining to the band. Inspect the lining for burn marks, glazing, uneven wear patterns, flaking or if the band grooves are worn away at any portion of the band. Replace the band, if it exhibits any of these conditions.

h – Overrunning Clutch: Clean and inspect the clutch parts for brinelled clutch rollers or cam, or 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, burned-oxidized fluid or debris, replace the converter. Do not attempt to clean or flush the converter.

j – Seal Rings: Inspect the seal rings on the reaction shaft support and governor support for wear, cracks or breakage. Inspect the ring grooves on both support assemblies for nicks, burrs or distortion. Inspect the bores in the front clutch retainer and output shaft support for nicks, grooves, wear, cracks or scratches.



SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-5853-B	Torque Wrench Beam-Type (0 to 250 in-lbs) or Equivalent Torque Wrench		■
J-24063	Kickdown Band Adjustment Adapter	■	

NOTE: The front and rear servos may be removed, reconditioned, installed and adjusted with the transmission in the vehicle. For removal, inspection and installation procedures, refer to the T.A. 700 - 900 Manual.

GEARSHIFT LINKAGE ADJUSTMENT

Raise the vehicle.

Loosen the shift rod trunnion jamnuts.

Remove the lockpin retaining the shift rod trunnion to the bellcrank and disengage the trunnion and shift rod at the bellcrank.

Place the gearshift lever in the Park position and lock the steering column.

Move the valve body manual lever rearward into the Park detent. Be sure the lever is moved rearward as far as possible. The 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 in the park gear.

Adjust the shift rod trunnion to obtain 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 in order to obtain a proper adjustment. Eliminate lash by pulling downward on the shift rod and pressing upward on the outer bellcrank.

Move the gearshift lever to the Park and Neutral positions and check the engine starting. The engine should start in these positions only. The engine must not start in any gear position other than Park or Neutral. If the engine does not start or starts in R, D, 2 or 1, the adjustment is incorrect or the neutral switch is defective.

Check the steering lock for ease of operation.

Lower the vehicle.

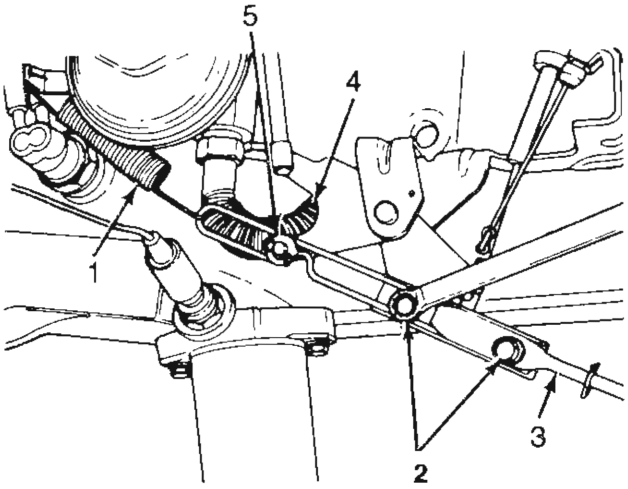
SEE
I.S.
NOTES

SEE I.S. NOTES

THROTTLE LINKAGE ADJUSTMENT

Disconnect the throttle control rod spring.

Use the throttle control rod spring (1) to hold the adjusting link in the forward position against the nylon washer.



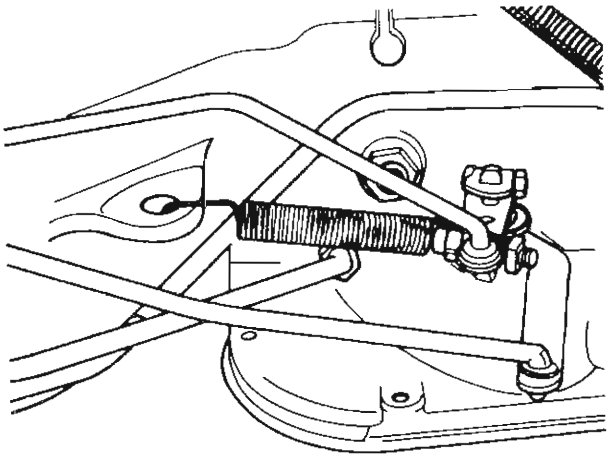
840605

Block the choke open and set the carburetor throttle off the fast idle cam.

Raise the vehicle.

Loosen both retaining bolts (2) on the throttle control adjusting link (3). DO NOT REMOVE THE SPRING CLIP (4) AND NYLON WASHER (5).

Use the spare throttle return spring to hold the transmission throttle lever forward against the stop. Hook one end of the spring on the throttle lever and the other end in the cast boss on the side of the torque converter housing.



86394

Push on the end of the link to eliminate lash and pull the clamp to the rear so the bolt in the rod bottoms in the rear of the slot in the rod. Tighten the clamp to the link using the forward bolt.

Pull the throttle control rod rearward so the bolt in the rod bottoms in the front of the slot in the rod. Tighten the rear retaining bolt.

Remove the spare throttle return spring from the throttle lever.

Lower the vehicle.

Remove the throttle control rod spring from the adjusting link and install it on the control rod.

FRONT BAND ADJUSTMENT

The front band adjusting screw is located on the left side of the transmission case just above the manual valve and throttle control levers. To adjust the front band, proceed in the following manner.

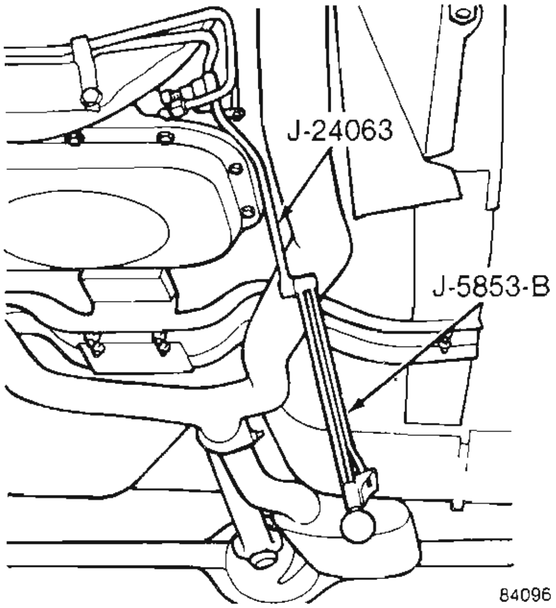
Raise the vehicle.

Loosen the adjusting screw locknut and back off the locknut five turns.

Check the adjusting screw rotation. The screw must turn freely in the case. Lubricate the adjusting screw threads if the screw binds.

CAUTION: In the following step, if Adapter Tool J-24063 is not used, the band adjusting screw must be tightened with 8 N·m (72 in-lbs) torque.

Tighten the adjusting screw with 4 N·m (36 in-lbs) torque using Torque Wrench J-5853-B, Adapter Tool J-24063 and a 5/16 square socket.



Back off the adjusting screw 2½ turns.

Tighten the adjuster screw locknut with 47 N·m (35 ft-lbs) torque. Do not allow the adjuster screw to rotate when tightening the locknut.

Lower the vehicle.

REAR BAND ADJUSTMENT

The rear band adjustment is an internal adjustment. The transmission oil pan must be removed to gain access to the band adjusting screw. To adjust the rear band, proceed in the following manner.

Raise the vehicle.

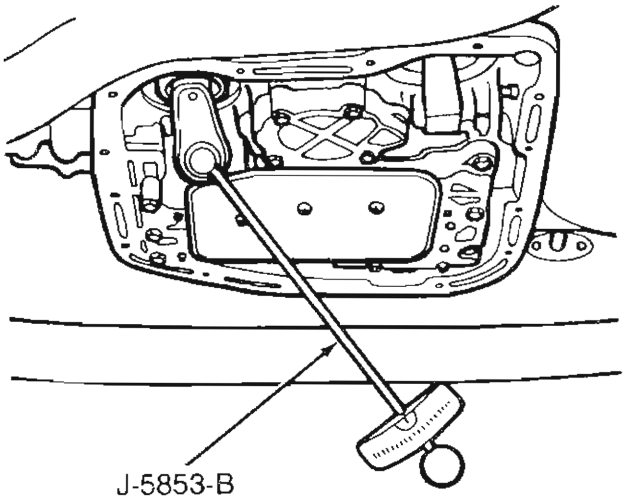
Remove the oil pan and drain the fluid.

Inspect the fluid and filter for a heavy accumulation of friction material or metal particles which indicate worn or damaged parts. However, a very light accumulation of this material is normal.

SEE I.S. NOTES

Adjust the band as follows:

- remove the adjusting screw locknut
- tighten the adjusting screw with 5 N·m (41 in-lbs) using Torque Wrench, J-5853-B, or equivalent and a 1/4 hex-head socket wrench



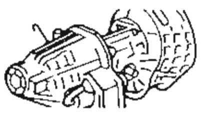
84097

- back off the adjusting screw four turns
- hold the adjusting screw in position and install the locknut; tighten the locknut with 47 N·m (35 ft-lbs) torque

Install the oil pan and a replacement pan gasket. Tighten the oil pan bolts with 17 N·m (150 in-lbs) torque.

Lower the vehicle.

Fill the transmission with AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II®. Refer to Fluid Level and Condition for the refill procedure.



REMOVAL

Raise the vehicle.

Remove the oil pan and drain the fluid.

Inspect the fluid and the filter for friction material or metal particles which indicate worn or damaged parts.

Remove the three screws attaching the filter to the valve body and remove the filter.

INSTALLATION

Install a replacement filter and tighten the filter attaching screws with 4 N·m (35 in-lbs) torque.

Clean and install the oil pan and a replacement pan gasket. Tighten the pan bolts with 17 N·m (150 in-lbs) torque.

Lower the vehicle.

Fill the transmission with AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II®. Refer to Fluid Level and Condition for the refill procedure.

SEE
I.S.
NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-24031	Kickdown Valve Gauge	■	

SEE I.S. NOTES

REMOVAL

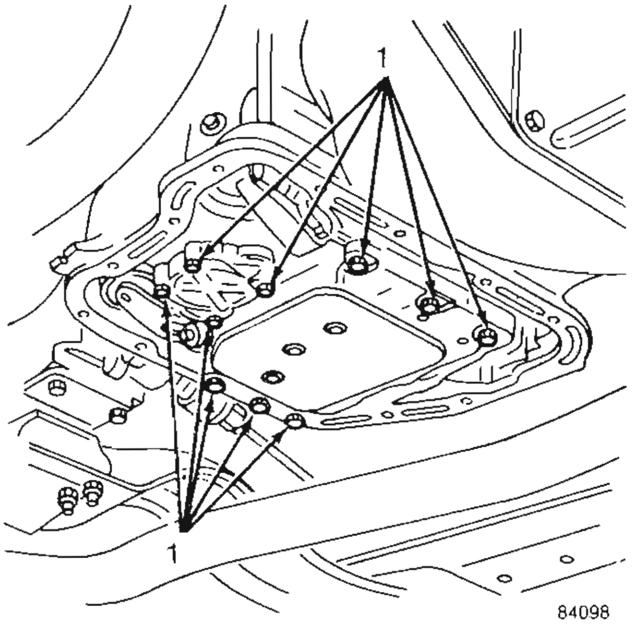
Raise the vehicle.

Remove the oil pan and drain the fluid.

Loosen the clamp bolts and remove the throttle and manual valve control levers from the valve body shafts.

Remove the neutral start switch from the case.

Remove the valve body attaching screws (1).



Lower the valve body. Pull it forward to disengage the park lock rod, and remove it.

NOTE: It may be necessary to rotate the output shaft before the park lock rod will clear the park sprag.

Remove the oil filter.

VALVE BODY HYDRAULIC CONTROL PRESSURE ADJUSTMENTS

There are two hydraulic control pressure adjustments that can be performed on the valve body:

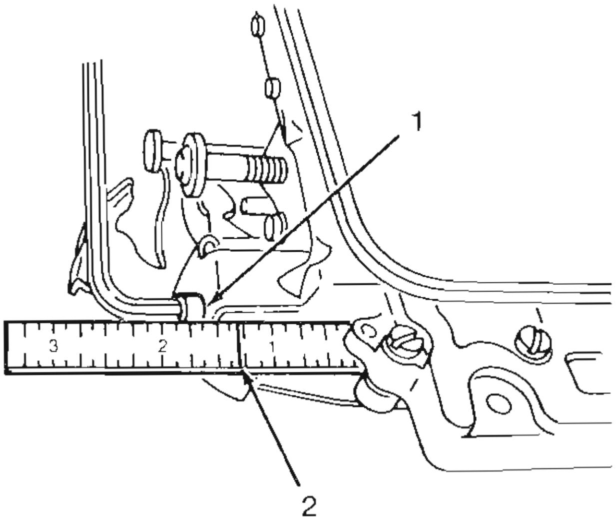
- line pressure adjustment
- throttle pressure adjustment

Because the line and throttle pressure are interdependent (each affects the shift quality and timing), both adjustments must be performed properly and in the correct sequence which is the line pressure adjustment first, and then the throttle pressure adjustment.

Line Pressure Adjustment

Measure the distance from the valve body to the inner edge of the adjusting screw (1) using an accurate steel scale.

The distance measured (2) should be 33.4 mm (1-5/16 in).



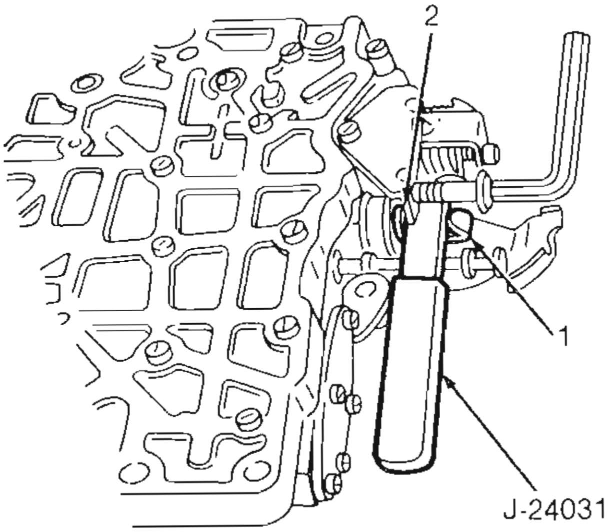
84163

If adjustment is required, turn the adjusting screw in or out to obtain the 33.4 mm (1-5/16 in) setting.

NOTE: The 33.4 mm (1-5/16 in) 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 9 kPa (1-2/3 psi). Turning the adjusting screw counterclockwise increases the pressure while turning the screw clockwise decreases the pressure.

Throttle Pressure Adjustment

Insert Gauge Tool J-24031 between the throttle lever (1) cam and the kickdown valve (2).



84101

Push the gauge tool inward to compress the kickdown valve against the spring and to bottom the throttle valve in the valve body.

Maintain 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.

SEE I.S. NOTES

INSTALLATION

Clean all the mating surfaces. Be sure burrs are removed from the transmission case and the valve body steel plate surfaces.

Position the accumulator spring on the valve body.

Insert the park lock rod through the opening in the rear of the case.

SEE I.S. NOTES

Position the knob on the end of the lock rod against the reaction plug in the sprag and exert pressure on the rod to the rear to force the rod past the sprag. Rotate the output shaft, if necessary.

Align and install the valve body. Install the attaching screws finger-tight only.

Install the neutral safety switch.

Move the manual valve (in the valve body) to the neutral position. Align the valve body as necessary to align the neutral finger of the manual lever with the neutral switch plunger.

Tighten the valve body attaching screws alternately and evenly with 11 N·m (100 in-lbs) torque.

Install the oil filter. Tighten the attaching screws with 4 N·m (35 in-lbs) torque.

Install the manual and throttle valve control levers and tighten the clamp bolts. Check both shafts for binding after tightening the bolts.

Install the oil pan and a replacement gasket. Tighten the oil pan bolts with 17 N·m (150 in-lbs) torque.

Lower the vehicle.

Fill the transmission with AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II®. Refer to Fluid Level and Condition for the refill procedure.

Adjust the gearshift and throttle linkage.

REMOVAL

1 Raise the vehicle.

Mark the propeller shaft yokes for assembly alignment reference.

Disconnect the front-rear propeller shafts at the transfer case.

Disconnect the speedometer cable at the transfer case.

Place the support stand under the transmission converter housing.

Remove the rear crossmember.

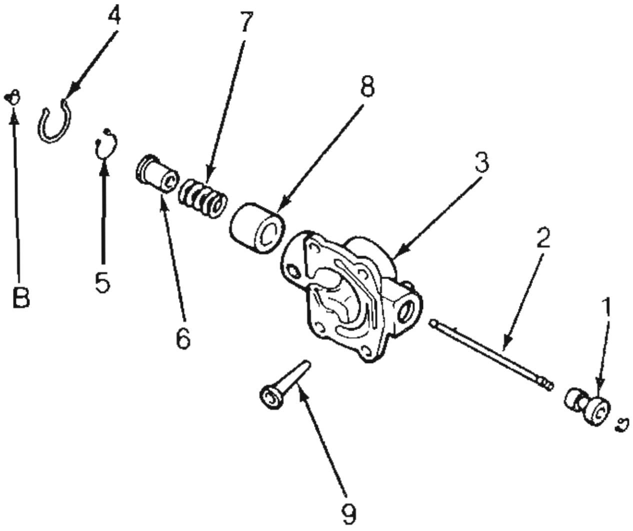
Disconnect the parking brake cable at the equalizer and disconnect the exhaust pipe support brackets, if necessary.

Remove the bolts attaching the transfer case to the transmission adapter housing and remove the transfer case.

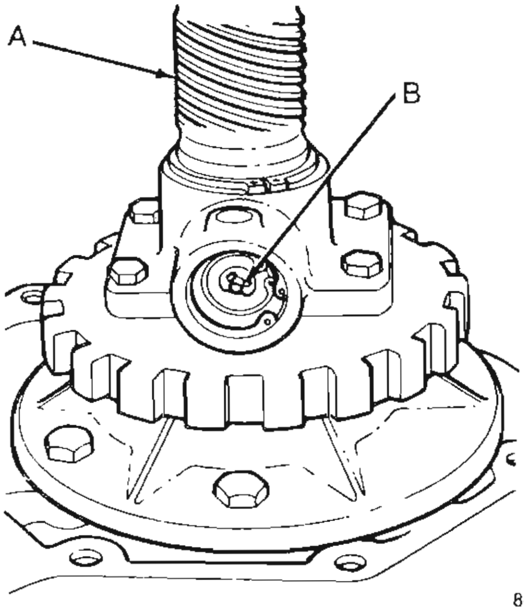
Remove the bolts attaching the adapter housing to the transmission and remove the adapter housing.

Rotate the transmission output shaft (A) until the governor weight faces downward.

Remove the E-clip (B) from the weight end of the governor valve shaft.



84103



84102

Remove the governor valve (1) and valve shaft (2) from the governor body (3).

Remove the snap ring that retains the governor body-park gear assembly on the output shaft.

SEE I.S. NOTES

DISASSEMBLY

Remove the large snap ring (4) from the weight end of the governor body (3).

Remove the weight assembly.

Remove the small snap ring (5) from the governor weight assembly.

Separate the inner weight (6), spring (7) and outer weight (8).

Identify the spring with the tag.

If the park gear or the governor body is to be replaced, straighten the lock tabs and remove the bolts attaching the body gear.

Remove the governor filter screen (9).

CLEANING AND INSPECTION

Thoroughly clean all governor parts in a suitable cleaning solution but do not use any type of caustic cleaning solution.

The weights and valves should fall freely in their bores when clean and dry. Rough surfaces and burrs may be polished using crocus cloth.

Inspect the governor weight spring for distortion. Replace the spring, if damaged.

Clean the filter in solvent and dry it with compressed air. Replace the filter screen, if damaged.

Inspect the park gear for chipped or worn gear teeth or damaged ring grooves. Replace the gear, if damaged.

Check the bolt torque on the output shaft support attaching bolts. If loose, cross-leakage and loss of governor pressure can occur.

ASSEMBLY

If the governor body (3) was separated from the park gear, install the filter screen (9), assemble the body and support, and install the attaching bolts finger-tight.

NOTE: Do not tighten the bolts with a specified torque until the assembly is installed on the output shaft (A).

Install the governor weights and the spring (7) inside of the outer weight (8) and install the small snap ring (5).

Install the weight assembly in the body (3).

Install the large snap ring (4).

INSTALLATION

Position the governor body-park gear assembly on the output shaft (A).

Align the governor valve shaft hole in the body with the hole in the output shaft and install the assembly.

Install the snap ring in the governor body (3).

Install the body-to-gear attaching bolts and tighten with 11 N·m (100 in-lbs) torque.

Bend the ends of the lock tabs against the bolt heads.

Install the governor valve (1) on the valve shaft (2).

Insert the assembly into the body (3) and through the governor weights.

Install the retaining E-clip (B).

Install and tighten the adapter housing bolts with 32 N·m (24 ft-lbs) torque.

Install the transfer case.

Install the rear crossmember.

Connect the speedometer cable.

Connect the exhaust support brackets and brake cable, if removed.

Connect the propeller shafts. Align the assembly reference marks and tighten the clamp bolts with 19 N·m (14 ft-lbs) torque.

Adjust the gearshift and throttle linkage.

Lower the vehicle.

Fill the transmission with AMC/Jeep/Renault Automatic Transmission Fluid or equivalent labeled Dexron II®. Refer to Fluid Level and Condition for the refill procedure.

SEE I.S. NOTES

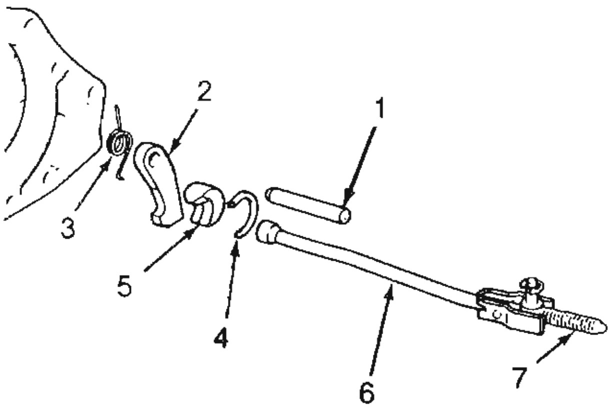
DISASSEMBLY

Remove the adapter housing and transfer case as outlined in the Governor Valve Section.

Slide the shaft (1) out of the housing and remove the park sprag (2) and spring (3).

Remove the snap ring (4) and slide the reaction plug and pin assembly (5) out of the housing.

SEE I.S. NOTES



84104

INSPECTION

Check the sprag shaft (1) for scores and for free movement in the housing and sprag (2). Check the sprag and control rod springs (3, 7) for loss of tension or distortion. Check the square lug on the sprag for broken edges.

Check the lugs on the governor support (park gear) for broken edges. Check the knob on the end of the control rod for nicks, burrs and free turning.

ASSEMBLY

Install the reaction plug and pin assembly (5) in the housing and install the snap ring (4).

Position the sprag (2) and spring (3) in the housing and install the shaft (1).

Be sure the square lug on the sprag is facing the park gear and that the spring is positioned so that it moves the sprag away from the gear.

Install the transfer case and adapter housing as outlined in the Governor Valve Section.

The neutral starting section of the switch is contained in the center terminal of the three-terminal switch. It provides a ground for the starter solenoid circuit through the gearshift lever in the Park and Neutral positions only.

The two outside terminals of the neutral switch are for the backup lamp switch circuit. Refer to the wiring diagrams at the end of this volume for the switch circuitry.

NEUTRAL START CIRCUIT

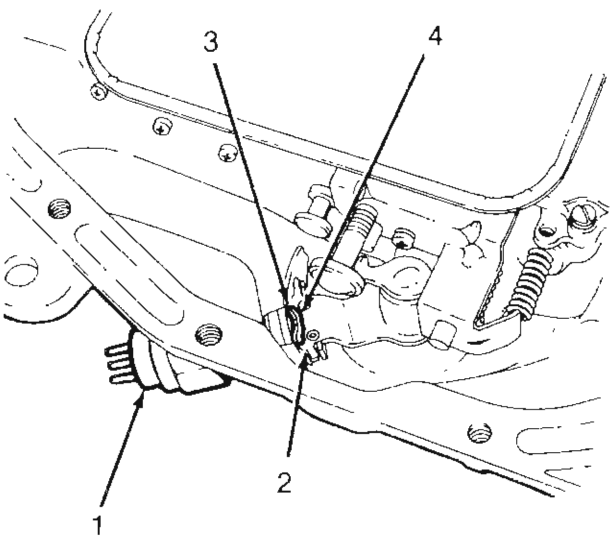
Removal

Remove the wiring connector from the switch (1) and test for continuity between the center terminal pin and the transmission case. Continuity should exist only when the transmission is in the Park or Neutral position.

If the tests indicate that the switch may be defective, check the gearshift linkage adjustment before replacing the switch.

Remove the switch from the transmission. Allow the transmission fluid to drain into the container.

Move the gearshift lever to the Park (2) and Neutral (3) positions. Inspect the switch operating lever fingers and the manual lever and shaft for proper alignment with the switch opening in the case.



Installation

Install the switch and the switch seal in the transmission case. Tighten the switch with 35 N·m (24 ft-lbs) torque.

Test the switch continuity.

Correct the transmission fluid level as required. Refer to Fluid Level and Condition for the refill procedure.

BACKUP LAMP CIRCUIT

Remove the wiring connector from the switch and test for continuity between the two outside pins.

Continuity should exist when the transmission is in the Reverse position (4) only.

Continuity should not exist from either pin to the transmission case in reverse.

Replace the switch if tests prove that the switch is defective.

SEE
I.S.
NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-24033	Pump Rotor Alignment Tool	■	

EE
.S.
NOTES

TRANSMISSION REMOVAL

Disconnect the fan shroud, if equipped.

Disconnect the transmission fill tube at the upper bracket.

Raise the vehicle.

Remove the inspection cover from the converter housing.

Remove the transmission fill tube.

Remove the starter.

Mark the propeller shafts and axle yokes for assembly alignment reference.

Disconnect the propeller shafts at the transfer case yokes. Secure the shafts to the frame rails with wire.

Drain the transfer case lubricant and disconnect the speedometer cable at the transfer case.

Disconnect the gearshift and throttle linkage.

Disconnect the wires at the neutral start switch.

Mark the converter drive plate and converter for assembly alignment reference.

Remove the bolts attaching the converter to the drive plate. Rotate the crankshaft and drive plate using a ratchet handle and socket on the crankshaft front pulley bolt to gain access to the drive plate bolts.

Support the transmission-transfer case assembly using a transmission jack. Retain the transmission on a jack with a safety chain.

Remove the bolts attaching the rear crossmember to the transmission.

Remove the rear crossmember.

Lower the transmission slightly and disconnect the oil cooler lines at the transmission.

Remove the bolts attaching the transmission to the engine.

Move the transmission and converter to the rear to clear the crankshaft.

Hold the converter in position and lower the transmission assembly until the converter housing clears the engine.

Remove the transfer case from the transmission.

If necessary, the following items can now be serviced:

- torque converter
- torque converter drive plate
- oil pump seal
- engine core hole plugs
- engine oil galley plugs

CAUTION: If the transmission was removed to correct a malfunction that generated sludge or heavy accumulation of metal particles or friction material, the oil cooler and cooler lines must be flushed thoroughly and the torque converter replaced. Do not attempt to flush the converter if it is contaminated. Refer to Diagnosis – Test Procedures in this section for the procedure for flushing the oil cooler and lines.

TRANSMISSION INSTALLATION

Install the transfer case on the transmission.

If the torque converter was removed, insert Pump Aligning Tool J-24033 in the pump rotor until the rotor drive lugs engage the slots in the tool.

Rotate the tool until the drilled hole in the tool is vertical and remove the tool.

Rotate the converter until the pump drive slots in the converter hub are vertical and carefully insert the converter hub into the pump. Be sure the drive lugs of the pump inner rotor are properly engaged in the drive slots of the converter hub.

Raise the transmission and align the converter with the drive plate. Refer to the assembly alignment marks.

Move the transmission forward.

Raise, lower or tilt the transmission to align the converter housing pilot holes with the dowels in the engine.

Install two converter housing lower attaching bolts and tighten the bolts to pull the housing to the engine.

Install the drive plate-to-converter attaching bolts.

Install the remaining converter housing-to-engine attaching bolts. Tighten all bolts with 38 N·m (28 ft-lbs) torque.

Connect the oil cooler lines.

Install the rear support cushion on the transmission.

Raise the transmission and install the rear crossmember.

Remove the transmission jack.

Install the speedometer cable.

Install the inspection cover.

Install the exhaust pipes and support brackets, if removed.

Install the starter.

Connect the wires to the neutral switch.

SEE
I.S.
NOTES

Connect the gearshift and throttle linkage.

Install the propeller shafts. Refer to the alignment marks made during removal.

Connect the front exhaust pipes and the catalytic converter support bracket bolts, if removed.

Fill the transfer case to the correct level with the specified lubricant.

Lower the vehicle.

Fill the transmission to the correct level.

Adjust the gearshift linkage.

Road test the vehicle to check the transmission operation.

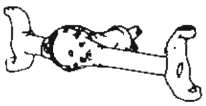
SEE I.S. NOTES

STEERING AND FRONT AXLE

CONTENTS

SEE
I.S.
N
O
T
E
S

STEERING AND FRONT AXLE



CONTENTS

SEE I.S. NOTES

STEERING AND FRONT AXLE

GENERAL INFORMATION

GENERAL

Four different steering column designs are used on CJ and Scrambler vehicles. Models with an automatic transmission use a nontilt column with a column mounted gearshift mechanism. Models with a manual transmission use a nontilt column with an ignition key release lever. A six-position tilt column is available as an option on all models.

All steering columns used on Jeep vehicles have anti-theft and energy-absorbing features. Each column is designed to compress under impact.

The ignition lock cylinder and ignition switch are mounted on the column. When the lock cylinder is turned to the LOCK position, the ignition switch and steering shaft cannot be operated. On models with an automatic transmission, the lock mechanism also prevents operation of the column-mounted gearshift mechanism.

A center slip-type (telescoping) intermediate shaft is used on all models. It is attached to the steering gear with a flexible coupling and to the steering column with a universal joint.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-4245	Snap Ring Pliers		■
J-5755	Pinion Bearing Installer Sleeve		■
J-5590	Bearing Cup Installer		■
J-5822	Bearing Cup Puller		■
J-6217	Connector Seat Installer		■
J-6221	Adjuster Plug Bearing Remover and Installer		■
J-6222	Adjuster Plug Seal Protector		■
J-6632-01	Pitman Arm Puller		■
J-7079-02	Driver Handle (Non-Threaded)		■
J-7624	Spanner Wrench		■
J-7754	Torque Wrench (0-25 in-lbs)		■
J-7818	Tool		■
J-8001	Dial Indicator Set		■
J-8092	Driver Handle (Threaded)		■

SEE
I.S.
NOTES

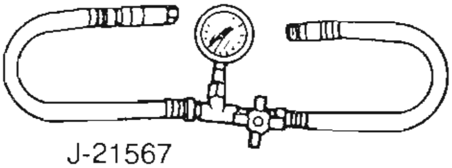
SPECIAL TOOLS (Cont'd)

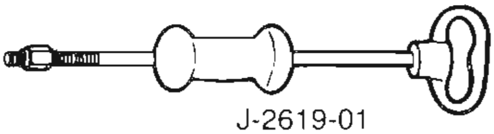
Tool Ref.	Description	Required	Recommended
J-8608	Pinion Rear Bearing Cup Installer		■
J-8611-01	Pinion Front Bearing Cup Installer		■
J-8614-01, 02, 03	Yoke Holding Tool		■
J-8642	Shaft Seal Protector		■
J-8841	Seal Installer		■
J-8842	Seal Remover		■
J-9233	Pinion Oil Seal Remover		■
J-21232	Steering Wheel Puller		■
J-21551	Pitman Shaft Bearing Remover and Installer		■
J-21552	Rack Piston Arbor		■
J-21553	Pitman Shaft Seal Installer		■
J-21554	Adjuster Plug Seal Installer		■
J-21567	Pressure Testing Gauge Assembly		■
J-21784	Differential Bearing Installer		■
J-21786	Pinion Rear Bearing Remover		■
J-21787	Pinion Front Bearing Cup Remover		■
J-21854-01	Steering Shaft Snap Ring Remover/ Installer		■
J-22175A	Bearing Installer		■
J-22569	Pivot Pin Puller		■
J-22575	Pinion Nut Socket		■
J-22635	Pin Remover and Installer		■
J-22697	Pinion Rear Bearing Installer		■
J-22888	Bearing Puller Set		■
J-22912-01	Bearing Remover		■
J-23072	Shift Tube Remover		■
J-23073	Shift Tube Installer		■
J-23074	Steering Column Holding Fixture		■
J-23600-B	Belt Tension Gauge		■

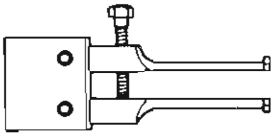
SEE I.S. NOTES

SPECIAL TOOLS (Cont'd)

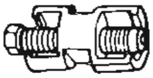
Tool Ref.	Description	Required	Recommended
J-23674	Axle Shaft Bearing Remover-Installer		■
J-24430	Pinion Bearing Installer Sleeve		■
J-24433	Bearing Cup Installer		■
J-25101	Bearing Installer		■
J-25131	Seal Installer		■
J-25133	Puller		■
J-25135-01	Tool		■
J-25180	Puller		■
J-25215	Bearing Remover		■
J-26941	Tool		■
J-29170	Differential Bearing Remover Tool Set		■
J-5223-4	Arbor	■	
J-5223-20	Gauge Block and Plunger	■	
J-5223-24	Clamp	■	
J-5223-25 or 26	Discs	■	
J-5223-29	Bolt	■	
J-6893-03	Socket Tool	■	
J-21788	Axle Shaft Oil Seal Installer	■	
J-22661	Pinion Seal Installer	■	
J-23447	Wrench Nut	■	
J-23653	Lock Plate Compressor	■	
J-24385-01	Axle Housing Spreader	■	
J-24385-15	Adapter	■	
J-25033-B	Installer	■	
J-25104	Bearing Installer	■	
J-25211-1	Plate	■	
J-25211-2	Cup	■	
J-25211-3	Button	■	
J-25211-4	Adapter	■	
J-29785-A	Remover	■	

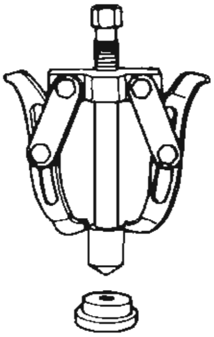

J-21567

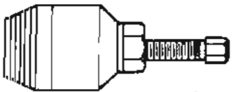

J-2619-01


J-5822

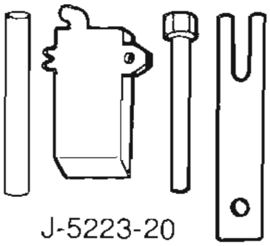

J-25033-B


J-29785-A


J-22888-D

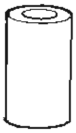

J-9233

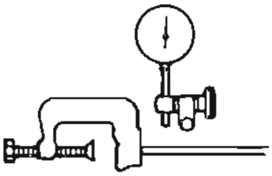

J-7624

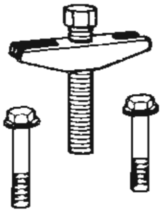

J-5223-20

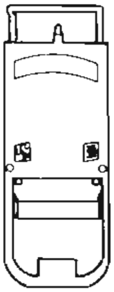

J-6632-01


J-4245


J-8841

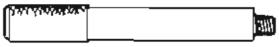

J-8001

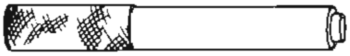

J-21232

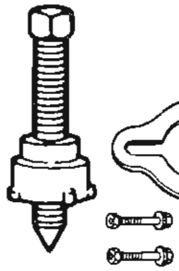

J-23600-B

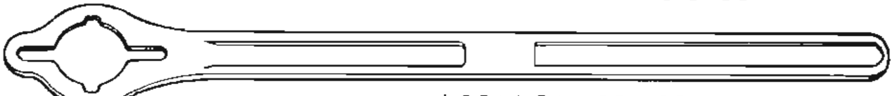
SEE
I.S.
NOTES


J-6221


J-8092

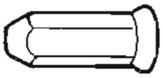

J-5755



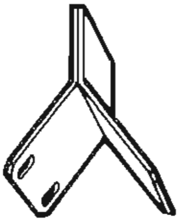

J-8614-01; -02; -03

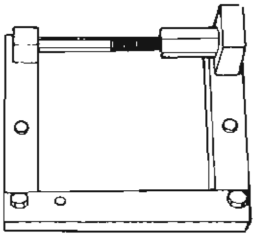

J-21551


J-8642

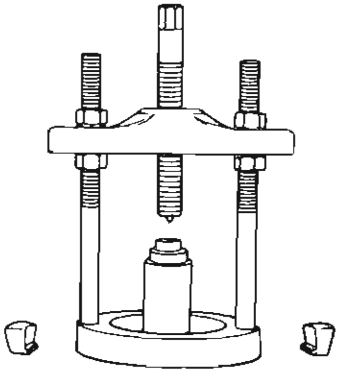

J-21553


J-6217


J-23074


J-24385-01


J-21552

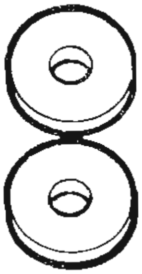

J-29721

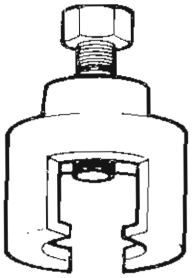

J-22635

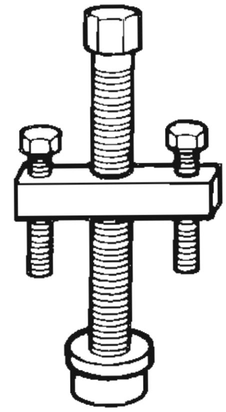

J-23653-A


J-21854-1

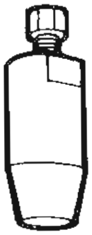
84677C


J-5223-26

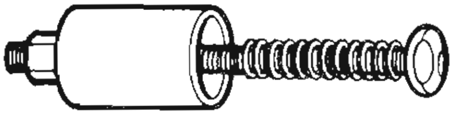

J-6632-01


J-23072


J-7818

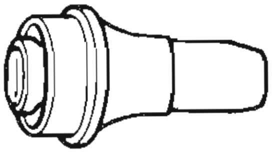

J-8842


J-22635

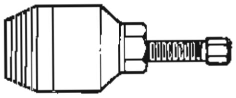

J-23073


J-5223-4


J-22175-A


J-25104


J-5590


J-9233


J-7624


J-8092

86346A

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-21232	Steering Wheel Puller		■
J-21854-1	Steering Shaft Snap Ring Remover/Installer		■
J-22569	Pivot Pin Puller		■
J-22635	Pin Remover and Installer		■
J-23072	Shift Tube Remover		■
J-23073	Shift Tube Installer		■
J-23074	Steering Column Holding Fixture		■
J-23653-A	Lock Plate Compressor	■	

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Clamp Bolt, Flexible Coupling	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Clamp Bolt, Intermediate Shaft	61 N·m (45 ft-lbs)	54-75 N·m (40-55 ft-lbs)
Clamp Bolt, Steering Shaft U-Joint	61 N·m (45 ft-lbs)	54-75 N·m (40-55 ft-lbs)
Column Mounting Bracket Bolt	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Column Mounting Bracket-to-Instrument Panel Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Cover Screws (Std. Col.)	7 N·m (60 in-lbs)	5-7 N·m (50-65 in-lbs)
Cover Screws (Tilt Col.)	11 N·m (100 in-lbs)	10-12 N·m (95-105 in-lbs)
Housing Screws (Std. Col.)	7 N·m (60 in-lbs)	5-7 N·m (55-65 in-lbs)
Housing Screws (Tilt Col.)	11 N·m (100 in-lbs)	10-12 N·m (95-105 in-lbs)
Ignition Switch Mounting Screws	4 N·m (35 in-lbs)	3-5 N·m (30-40 in-lbs)

TORQUE SPECIFICATIONS (Cont'd)

Component	Service Set-To Torque	Service Recheck Torque
Lock Sector Tension Spring Screw	4 N·m (35 in-lbs)	3-5 N·m (30-40 in-lbs)
Shroud Screws (Man. Trans. Col.)	2 N·m (18 in-lbs)	2-3 N·m (14-22 in-lbs)
Steering Wheel Nut	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Support Screws (Tilt Col.)	7 N·m (60 in-lbs)	5-7 N·m (50-65 in-lbs)
Tilt Lever Screw	4 N·m (35 in-lbs)	3-5 N·m (30-40 in-lbs)
Toe Plate Screws	14 N·m (10 ft-lbs)	14-24 N·m (10-18 ft-lbs)
Turn Signal Lever Screw	2 N·m (15 in-lbs)	1-3 N·m (12-20 in-lbs)
Turn Signal Switch Screws	4 N·m (35 in-lbs)	3-5 N·m (28-40 in-lbs)

SERVICE DIAGNOSIS

When diagnosing steering column malfunctions, refer to the Service Diagnosis charts for the probable cause and correction procedures. To simplify use of the charts, they are divided into the various sub-systems within the column such as ignition system, lock mechanism, turn signal switch and electrical.

SEE I.S. NOTES

Service Diagnosis—Lock System

Condition	Possible Cause	Correction
WILL NOT LOCK	(1) Lockbolt spring broken or defective.	(1) Replace lock bolt spring.
HIGH EFFORT (REQUIRED TO TURN IGNITION KEY AND LOCK CYLINDER)	(1) Lock cylinder defective.	(1) Replace lock cylinder.
	(2) Ignition switch defective.	(2) Replace ignition switch.
	(3) Rack preload spring broken or deformed.	(3) Replace preload spring.
	(4) Burr on lock sector, lock rack, housing, support or remote rod coupling.	(4) Remove burr.
	(5) Bent sector shaft.	(5) Replace shaft.
	(6) Defective lock rack.	(6) Replace lock rack.
	(7) Remote rod bent, deformed.	(7) Replace rod.
	(8) Ignition switch mounting bracket bent.	(8) Straighten or replace.
	(9) Distorted coupling slot in lock rack (tilt column).	(9) Replace lock rack.
WILL STICK IN "START"	(1) Remote rod deformed.	(1) Straighten or replace.
	(2) Ignition switch mounting bracket bent.	(2) Straighten or replace.
KEY CANNOT BE REMOVED IN "OFF-LOCK"	(1) Ignition switch is not adjusted correctly.	(1) Adjust switch.
	(2) Defective lock cylinder.	(2) Replace lock cylinder.
LOCK CYLINDER CAN BE REMOVED WITHOUT DEPRESSING RETAINER	(1) Lock cylinder with defective retainer.	(1) Replace lock cylinder.
	(2) Burr over retainer slot in housing cover or on cylinder retainer.	(2) Remove burr.

SEE I.S. NOTES

60659A

Service Diagnosis—Lock System (continued)

Condition	Possible Cause	Correction
HIGH EFFORT ON LOCK CYLINDER BETWEEN "OFF" AND "OFF-LOCK"	(1) Distorted lock rack.	(1) Replace lock rack.
	(2) Burr on tang of shift gate (automatic column).	(2) Remove burr.
	(3) Gearshift linkage not adjusted.	(3) Adjust linkage.

Service Diagnosis—Steering Column

Condition	Possible Cause	Correction
NOISE IN COLUMN	(1) One click when in "off-lock" position and the steering wheel is moved (all except automatic column).	(1) Normal—lock bolt is seating.
	(2) Coupling bolts not tightened.	(2) Tighten pinch bolts.
	(3) Lack of grease on bearings or bearing surfaces.	(3) Lubricate with chassis grease.
	(4) Upper shaft bearing worn or broken.	(4) Replace bearing assembly.
	(5) Lower shaft bearing worn or broken.	(5) Replace bearing. Check shaft and replace if scored.
	(6) Column not correctly aligned.	(6) Align column.
	(7) Coupling pulled apart.	(7) Replace coupling.
	(8) Broken coupling lower joint.	(8) Repair or replace joint and align column.
	(9) Steering shaft snap ring not seated.	(9) Replace snap ring. Check for proper seating in groove.
	(10) Shroud loose on shift bowl. Housing loose on jacket—will be noticed with ignition in "off-lock" and when torque is applied to steering wheel.	(10) Position shroud over lugs on shift bowl. Tighten mounting screws.

SEE
I.S.
NOTES

Service Diagnosis—Steering Column (Continued)

Condition	Possible Cause	Correction
HIGH STEERING SHAFT EFFORT	(1) Column misaligned.	(1) Align column.
	(2) Defective upper or lower bearing.	(2) Replace as required.
	(3) Tight steering shaft universal joint.	(3) Repair or replace.
	(4) Flash on I.D. of shift tube at plastic joint (tilt column only).	(4) Replace shift tube.
	(5) Upper or lower bearings siezed.	(5) Replace bearings.
LASH IN MOUNTED COLUMN ASSEMBLY	(1) Column mounting bracket bolts loose.	(1) Tighten bolts.
	(2) Broken weld nuts on column jacket.	(2) Replace column jacket.
	(3) Column capsule bracket sheared.	(3) Replace bracket assembly.
	(4) Column bracket to column jacket mounting bolts loose.	(4) Tighten to specified torque.
	(5) Loose lock shoes in housing (tilt column only).	(5) Replace shoes.
	(6) Loose pivot pins (tilt column only).	(6) Replace pivot pins and support.
	(7) Loose lock shoe pin (tilt column only).	(7) Replace pin and housing.
	(8) Loose support screws (tilt column only).	(8) Tighten screws.
HOUSING LOOSE (TILT COLUMN ONLY)	(1) Excessive clearance between holes in support or housing and pivot pin diameters.	(1) Replace pivot pins and support.
	(2) Housing support-screws loose.	(2) Tighten screws.
STEERING WHEEL LOOSE—EVERY OTHER TILT POSITION (TILT COLUMN ONLY)	(1) Loose fit between lock shoe and lock shoe pivot pin.	(1) Replace lock shoes and pivot pin.

SEE
I.S.
NOTES

60659C

Service Diagnosis—Steering Column (Continued)

Condition	Possible Cause	Correction
STEERING COLUMN NOT LOCKING IN ANY TILT POSITION (TILT COLUMN ONLY)	(1) Lock shoe siezed on pivot pin.	(1) Replace lock shoes and pin.
	(2) Lock shoe grooves have burrs or are filled with foriegn material.	(2) Clean or replace lock shoes.
	(3) Lock shoe springs weak or broken.	(3) Replace springs.
NOISE WHEN TILTING COLUMN (TILT COLUMN ONLY)	(1) Upper tilt bumpers worn.	(1) Replace tilt bumper.
	(2) Tilt spring rubbing in housing.	(2) Lubricate with chassis grease.
ONE CLICK WHEN IN "OFF-LOCK" POSITION AND THE 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 (AUTOMATIC AND TILT COLUMN ONLY)	(1) Column not correctly aligned.	(1) Align column.
	(2) Lower bearing not aligned correctly.	(2) Assemble correctly.
	(3) Lack of grease on seal or lower bearing areas.	(3) Lubricate with chassis grease.
IMPROPER TRANSMISSION SHIFTING—AUTOMATIC AND TILT COLUMN ONLY	(1) Sheared shift tube joint.	(1) Replace shift tube.
	(2) Improper transmission gearshift linkage adjustment.	(2) Adjust linkage.
	(3) Loose lower shift lever.	(3) Replace shift tube.

60659D

SEE I.S. NOTES

Service Diagnosis—Ignition System

Condition	Possible Cause	Correction
IGNITION SWITCH ELECTRICALLY INOPERATIVE	(1) Loose or defective switch connector.	(1) Tighten or replace connector.
	(2) Feed wire open (fusible link).	(2) Repair or replace.
	(3) Defective ignition switch.	(3) Replace ignition switch.
ENGINE WILL NOT CRANK	(1) Ignition switch not adjusted properly.	(1) Adjust switch.
IGNITION SWITCH WILL NOT ACTUATE MECHANICALLY	(1) Defective ignition switch.	(1) Replace switch.
	(2) Defective lock sector.	(2) Replace lock sector.
	(3) Defective remote rod.	(3) Replace remote rod.
IGNITION SWITCH CANNOT BE ADJUSTED CORRECTLY	(1) Remote rod deformed.	(1) Repair, straighten or replace.

60659E

Service Diagnosis—Turn Signal

Condition	Possible Cause	Correction
TURN SIGNAL WILL NOT CANCEL	(1) Loose switch mounting screws.	(1) Tighten screws.
	(2) Switch or anchor bosses broken.	(2) Replace switch.
	(3) Broken, missing or out of position detent, or cancelling spring.	(3) Reposition springs or replace switch as required.
TURN SIGNAL DIFFICULT TO OPERATE	(1) Turn signal lever loose.	(1) Tighten mounting screw.
	(2) Switch yoke broken or distorted.	(2) Replace switch.
	(3) Loose or misplaced springs.	(3) Reposition springs or replace switch.
	(4) Foreign parts and/or materials in switch.	(4) Remove foreign parts and/or material.
	(5) Switch mounted loosely.	(5) Tighten mounting screws.
TURN SIGNAL WILL NOT INDICATE LANE CHANGE	(1) Broken lane change pressure pad or spring hanger.	(1) Replace switch.
	(2) Broken, missing or misplaced lane change spring.	(2) Replace or reposition as required.
	(3) Jammed wires.	(3) Loosen mounting screws, reposition wires and retighten screws.
TURN SIGNAL WILL NOT STAY IN TURN POSITION	(1) Foreign material or loose parts impeding movement of switch yoke.	(1) Remove material and/or parts.
	(2) Defective switch.	(2) Replace switch.

Service Diagnosis — Turn Signal (Continued)

Condition	Possible Cause	Correction
HAZARD SWITCH CANNOT BE PULLED OUT	(1) Foreign material between hazard support cancelling leg and yoke.	(1) Remove foreign material. (a) No foreign material impeding function of hazard switch—replace turn signal switch.
NO TURN SIGNAL LIGHTS	(1) Inoperative turn signal flasher.	(1) Replace turn signal flasher.
	(2) Defective or blown fuse.	(2) Replace fuse.
	(3) Loose chassis to column harness connector.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch to chassis and operate switch by hand. If vehicle lights now operate normally, signal switch is inoperative.	(4) Replace signal switch.
	(5) If vehicle lights do not operate check chassis wiring for opens, grounds, etc.	(5) Repair chassis wiring as required.
INSTRUMENT PANEL TURN INDICATOR LIGHTS ON BUT NOT FLASHING	(1) Burned out or damaged front or rear turn signal bulb.	(1) Replace bulb.
	(2) If vehicle lights do not operate, check light sockets for high resistance connections, the chassis wiring for opens, grounds, etc.	(2) Repair chassis wiring as required.
	(3) Inoperative flasher.	(3) Replace flasher.
	(4) Loose chassis to column harness connection.	(4) Connect securely.
	(5) Inoperative turn signal switch.	(5) Replace turn signal switch.

Service Diagnosis — Turn Signal (Continued)

Condition	Possible Cause	Correction
INSTRUMENT PANEL TURN INDICATOR LIGHTS ON BUT NOT FLASHING (CONT'D)	(6) To determine if turn signal switch is defective, substitute new switch into circuit and operate switch by hand. If the vehicle's lights operate normally, signal switch is inoperative.	(6) Replace turn signal switch.
STOP LIGHT NOT ON WHEN TURN INDICATED	(1) Loose column to chassis connection.	(1) Connect securely.
	(2) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If brake lights work with switch in the turn position, signal switch is defective.	(2) Replace signal switch.
	(3) If brake lights do not work check connector to stop light sockets for grounds, opens, etc.	(3) Repair connector to stop light circuits using service manual as guide.
TURN INDICATIOR PANEL LIGHTS NOT FLASHING	(1) Burned out bulbs.	(1) Replace bulbs.
	(2) High resistance to ground at bulb socket.	(2) Replace socket.
	(3) Opens, grounds in wiring harness from front turn signal bulb socket to indicator lights.	(3) Locate and repair as required.
TURN SIGNAL LIGHTS FLASH VERY SLOWLY	(1) High resistance ground at light sockets.	(1) Repair high resistance grounds at light sockets.
	(2) Incorrect capacity turn signal flasher or bulb.	(2) Replace turn signal flasher or bulb.

SEE I.S. NOTES

Service Diagnosis—Turn Signal (Continued)

Condition	Possible Cause	Correction
TURN SIGNAL LIGHTS FLASH VERY SLOWLY (CON'T.)	(3) If flashing rate is still extremely slow, check chassis wiring harness from the connector to light sockets for high resistance.	(3) Locate and repair as required.
	(4) Loose chassis to column harness connection.	(4) Connect securely.
	(5) Disconnect column to chassis connector. Connect new switch into system without removing old. Operate switch by hand. If flashing occurs at normal rate, the signal switch is defective.	(5) Replace turn signal switch.
HAZARD SIGNAL LIGHTS WILL NOT FLASH—TURN SIGNAL FUNCTIONS NORMALLY	(1) Blown fuse.	(1) Replace fuse.
	(2) Inoperative hazard warning flasher.	(2) Replace hazard warning flasher in fuse panel.
	(3) Loose chassis-to-column harness connection.	(3) Connect securely.
	(4) Disconnect column to chassis connector. Connect new switch into system without removing old. Depress the hazard warning lights. If they now work normally, turn signal switch is defective.	(4) Replace turn signal switch.
	(5) If lights do not flash, check wiring harness "K" lead for open between hazard flasher and connector. If open, fuse block is defective.	(5) Repair or replace brown wire or connector as required.

SEE
I.S.
NOTES

60659J

STEERING WHEEL

Removal

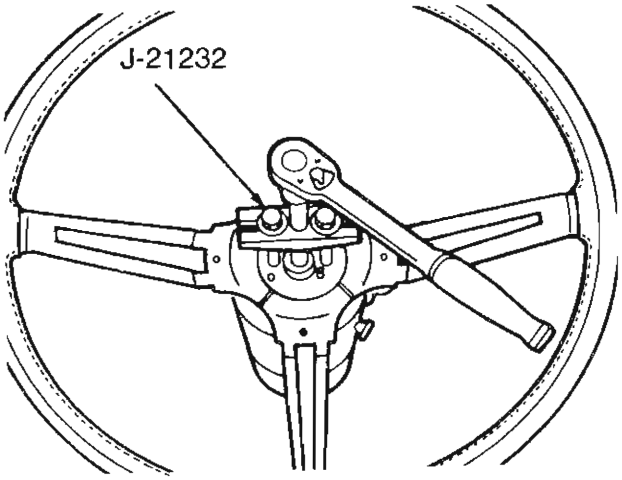
Disconnect the battery negative cable.

Remove the horn button and horn ring internal parts.

Remove the steering wheel nut. Note the alignment marks on the steering shaft and steering wheel. Paint alignment marks on the shaft and the wheel, if none are present.

Remove the steering wheel using Puller Tool J-21232 or equivalent.

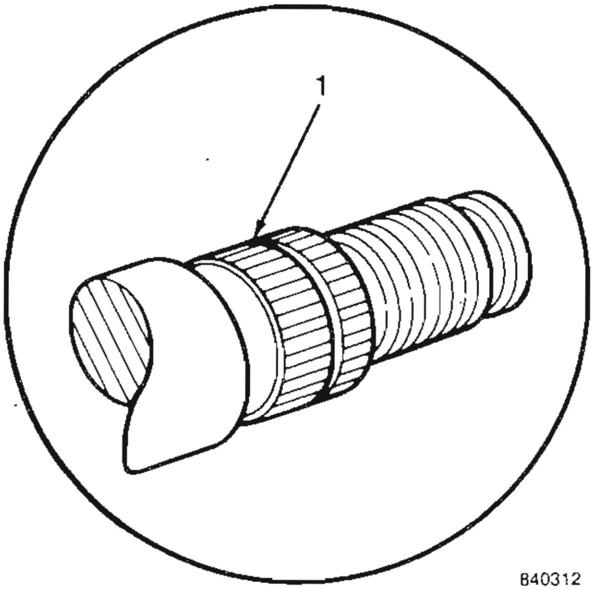
CAUTION: Do not strike the end of the shaft with a hammer, this could shear or loosen the plastic retainers which maintain the energy-absorbing feature built into the column.



840311

Installation

CAUTION: All steering shafts have metric steering wheel nut threads. Inspect and identify the shaft nut thread-type before installing a replacement nut. Metric shafts have an identifying groove (1) in the shaft steering wheel splines.



840312

Align the steering shaft and steering wheel marks. Install the wheel on the shaft.

Install and tighten the steering wheel nut with 41 N·m (30 ft-lbs) torque.

Install the horn ring parts and horn button.

Install the center-type horn button by indexing the projection on the rubber retaining ring with the notch in the cup and push the cup down to engage the ring.

Connect the battery negative cable.

Reset the clock, if equipped.

SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

Sport Steering Wheel Skirt Replacement

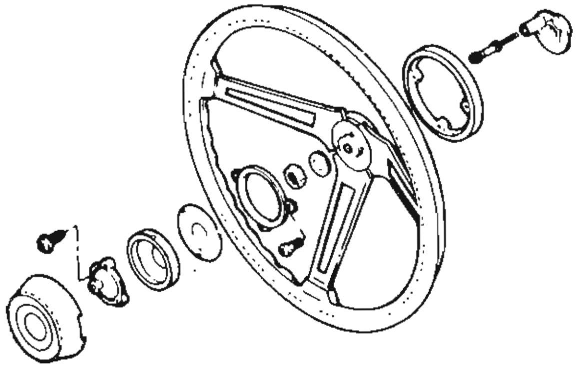
Disconnect the battery negative cable.

Place the wheels in a straight-ahead position.

Remove the horn button. Pull straight up on the button to remove it.

Remove the steering wheel nut.

Remove the receiver bushing attaching screws and remove the bushing, horn button receiver and contact plate.



84688

Remove the steering wheel using Tool J-21232 or equivalent.

Remove the receiver insulator attaching screws and remove the insulator and skirt.

Color coat the replacement skirt.

Align and install the replacement skirt and receiver insulator on the steering wheel and install the insulator attaching screws.

Align the reference marks on the steering shaft and wheel and install the wheel.

Install the contact plate and horn button receiver. Install the receiver so the horn button locating notch is at the 12 o'clock position.

Install the receiver bushing and bushing attaching screws.

Install the steering wheel nut. Tighten the nut with 41 N·m (30 ft-lbs) torque.

Install the horn button. Align the button tab with the receiver notch and press the button down until seated.

Connect the battery negative cable.

Reset the clock, if equipped.

STEERING COLUMN REMOVAL

CAUTION: Handle the column carefully when it is removed from the vehicle. A sharp blow on the end of the steering shaft or shift levers, leaning on the column assembly, or dropping the assembly could shear or loosen the plastic fasteners that maintain rigidity of the energy-absorbing components in the column.

Disconnect the battery negative cable.

On vehicles with an automatic transmission, disconnect the transmission shift rod at the steering column shift lever.

Remove the left side air conditioning duct, if equipped.

Remove the steering column-to-intermediate shaft U-joint pinch bolt.

CAUTION: Do not attempt to separate the intermediate shaft and steering column at this time. If separated, the plastic connector injected into the intermediate shaft could be damaged.

Remove the steering column-to-instrument panel bezel.

Remove the bolts attaching the steering column mounting bracket to the instrument panel.

Remove the bolts attaching the steering column mounting bracket to the steering column and remove the bracket.

CAUTION: To avoid damaging the mounting bracket breakaway capsules, store the bracket in a safe place until service operations are completed.

Remove the top and bottom toeplates.

Disconnect the wiring harness at the ignition switch.

Disconnect the Cruise Command wiring harness connector, if equipped.

Separate the steering column from the intermediate shaft and remove the steering column.

INSTALLATION

CAUTION: Use only the specified screws, bolts and nuts when servicing the column. Tighten all the fasteners with the specified torque only. Bolts and screws longer than specified must not be used as they may prevent the column from compressing under impact.

Install the steering column in the vehicle and connect the column to the intermediate shaft.

Install the intermediate shaft-to-column U-joint pinch bolt. Tighten the bolt with 61 N·m (45 ft-lbs) torque.

Install the top and bottom toeplates but do not tighten the attaching bolts completely.

Install the mounting bracket on the steering column and tighten the bracket attaching bolts with 27 N·m (20 ft-lbs) torque.

Align the steering column mounting bracket and instrument panel and loosely install the mounting bracket-to-instrument panel bolts.

SEE
I.S.
NOTES

Pull the steering column upward and tighten the column mounting bracket-to-instrument panel bolts with 27 N·m (20 ft-lbs) torque. Be sure to maintain upward pressure on the column when tightening the bolts.

Tighten the toeplate bolts with 14 N·m (10 ft-lbs) torque.

Install both halves of the steering column-to-instrument panel bezel.

On vehicles with an automatic transmission, connect the transmission shift rod to the steering column shift lever. Check the operation of the gearshift manual linkage and adjust the linkage, if necessary. Refer to Chapter F – Automatic Transmission.

SEE I.S. NOTES

Connect the Cruise Command wire harness connector, if equipped.

Connect the wiring harness connectors to the ignition switch. Install the white connector first and the black connector last.

Connect all the electrical components and check for the proper operation.

Install any instrument panel trim and left side air conditioning duct, if equipped.

Connect the battery negative cable.

Reset the clock, if equipped.

Steering Column Alignment

Loosen all the toeplate screws.

Remove the instrument panel-to-steering column trim.

Loosen the column mounting bracket-to-instrument-panel attaching bolts.

Pull the steering column upward. Maintain an upward pressure and tighten the instrument panel-to-column mounting bracket bolts with 27 N·m (20 ft-lbs) torque.

Install the lower clamp bracket and tighten the bolts with 27 N·m (20 ft-lbs) torque.

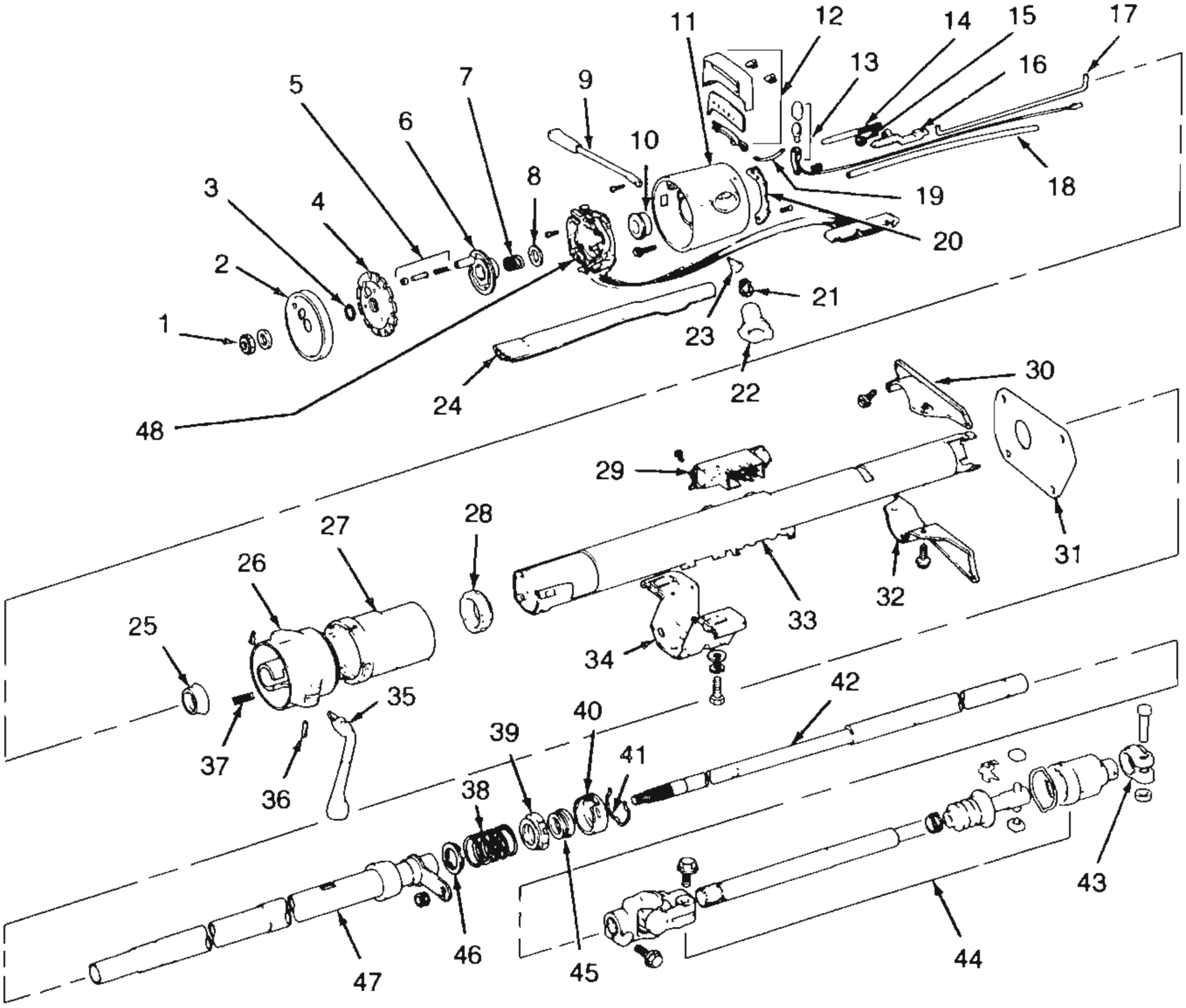
Tighten the toeplate screws with 14 N·m (10 ft-lbs) torque.

Install the instrument panel trim.

On vehicles with an automatic transmission, check the gearshift manual linkage for proper operation. Refer to Chapter F – Automatic Transmission.

STANDARD COLUMN OVERHAUL

Steering Column – Automatic Transmission

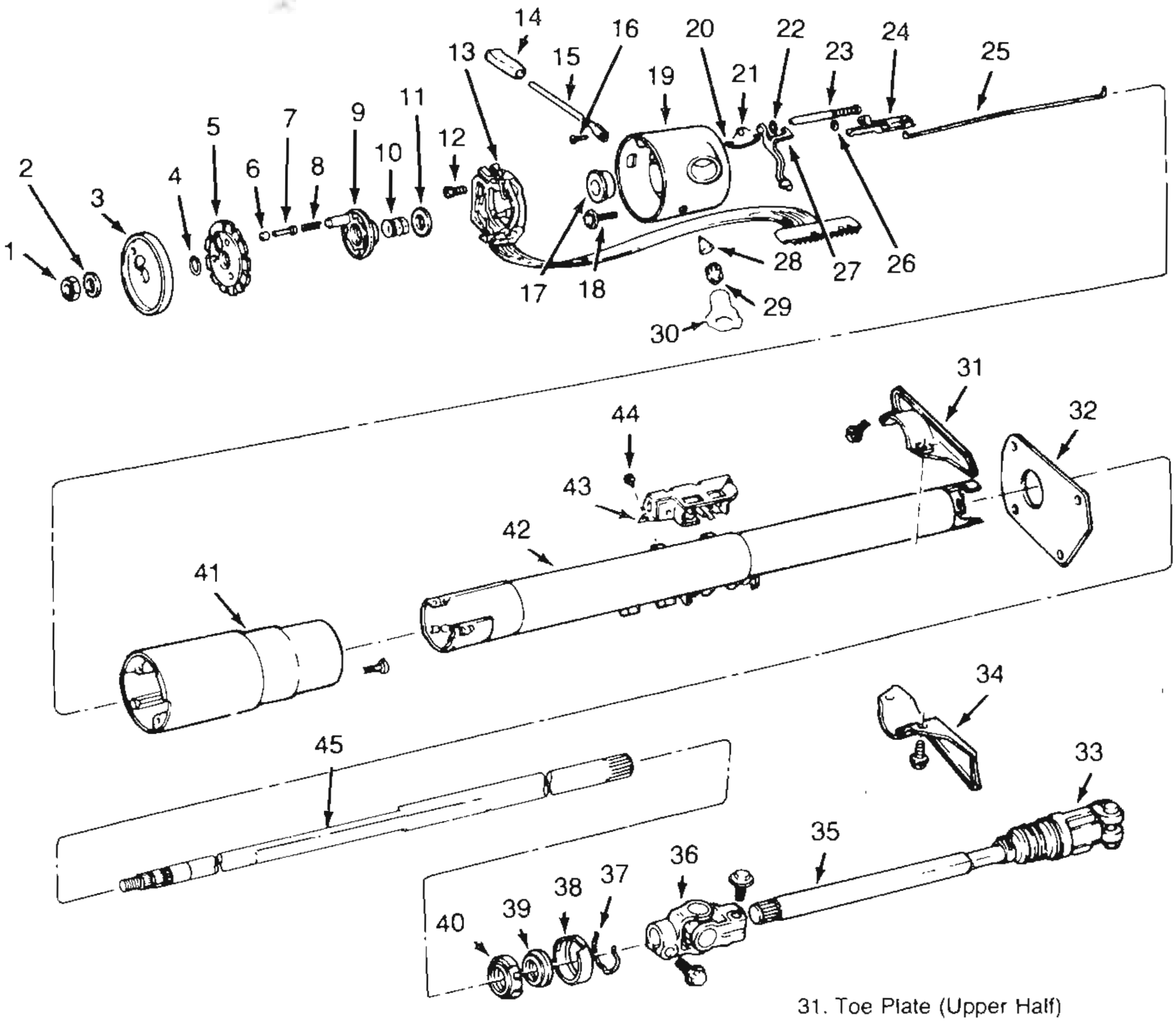


1. Steering Wheel Nut
2. Lock Plate Cover
3. Steering Shaft Snap Ring
4. Lock Plate
5. Horn Contact Retainer, Pin, and Spring
6. Canceling Cam
7. Preload Spring
8. Thrust Washer
9. Turn Signal Lever
10. Thrust Cup
11. Housing
12. Shift Quadrant Assembly
13. Quadrant Light
14. Lock Bolt
15. Spring Washer
16. Lock Rack
17. Remote Rod
18. Harness Protector
19. Rack Preload Spring
20. Shift Gate Lock
21. Sector
22. Ignition Lock Cylinder
23. Hazard Warning Knob
24. Harness Protector
25. Bearing
26. Shift Bowl
27. Shroud
28. Bearing
29. Ignition Switch
30. Toe Plate
31. Seal
32. Toe-Plate
33. Jacket
34. Column Mounting Bracket
35. Shift Lever
36. Pin
37. Spring
38. Spring
39. Thrust Washer
40. Retainer
41. Lock Ring
42. Steering Shaft
43. Clamp
44. Intermediate Shaft Assembly
45. Lower Bearing
46. Retainer Washer
47. Shift Tube
48. Turn Signal Switch

840768

SEE
I.S.
NOTES

Steering Column – Manual Transmission



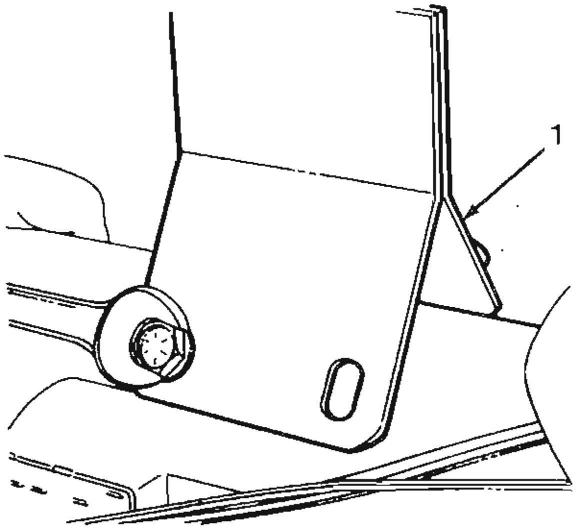
1. Steering Wheel Nut
2. Washer
3. Lock Plate Cover
4. Steering Shaft Snap Ring
5. Lockplate
6. Retainer
7. Horn Contact Pin
8. Spring
9. Canceling Cam
10. Upper Bearing Preload Spring
11. Thrust Washer
12. Turn Signal Switch Screw (3)
13. Turn Signal Switch
14. Turn Signal Lever Knob
15. Turn Signal Lever
16. Turn Signal Lever Screw
17. Upper Bearing
18. Housing Retaining Screw (4)
19. Housing
20. Rack Preload Spring
21. Key Release Lever Spring
22. Wave Washer
23. Lock Bolt
24. Lock Rack
25. Remote Rod
26. Spring Washer
27. Key Release Lever
28. Hazard Warning Switch Knob
29. Lock Sector
30. Lock Cylinder
31. Toe Plate (Upper Half)
32. Seal
33. Intermediate Shaft Coupling
34. Toe Plate (Lower Half)
35. Intermediate Shaft
36. Intermediate Shaft-to-Steering Shaft U-Joint
37. Snap Ring
38. Retainer
39. Lower Bearing
40. Lower Bearing Adapter
41. Shroud
42. Jacket
43. Ignition Switch
44. Ignition Switch Screw (2)
45. Steering Shaft

60684

SEE
I.S.
NOTES

Column Disassembly

NOTE: Steering column removal is not necessary if only the lockplate cover, lockplate, steering shaft snap ring, canceling cam, turn signal, upper bearing preload spring or lock cylinder are to be serviced. However, the column must be removed in order to service any of the remaining components. If the column is removed, remove the column-to-instrument panel mounting bracket and install Support Fixture Tool J-23074 (1). Mount the column in a vise by clamping the support fixture flange in the vise.



84691

Place the front wheels in a straight-ahead position.

Disconnect the battery negative cable.

Cover the painted areas of the column.

Remove the steering wheel.

Remove the gearshift lever retaining pin and remove the lever, if equipped with an automatic transmission.

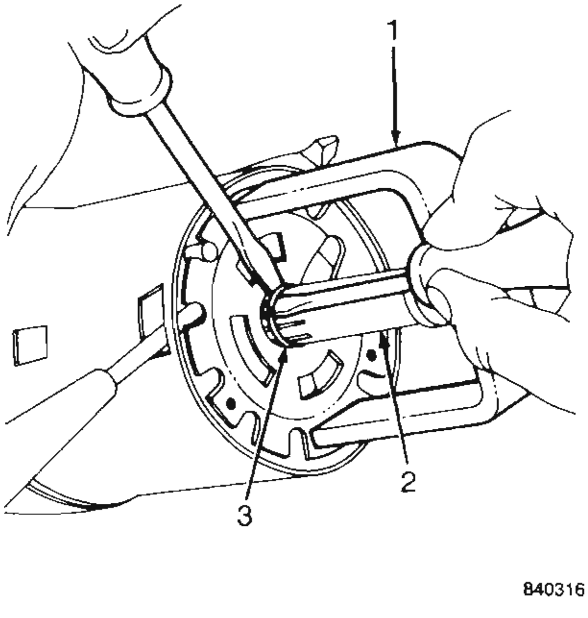
Remove the lockplate cover. Use two screwdrivers to pry the cover off the lockplate and out of the column.

WARNING: The lockplate is under strong spring tension. Do not attempt to remove the steering shaft snap ring without using the compressor tool.

Compress the lockplate and unseat the steering shaft snap ring using Compressor Tool J-23653-A (1). The shaft has metric threads. Replace compressor tool standard forcing screw with Metric Forcing Screw J-23653-4 (2) before installing the tool on the steering shaft.

Remove the lockplate compressor tool and snap ring (3). Discard the snap ring.

SEE
I.S.
NOTES



840316

CAUTION: When the steering shaft snap ring is removed, the shaft is free in the column. During bench overhaul, remove the shaft by pulling it out from the lower end of the column. Do not allow the shaft to fall out whenever the column is removed from the vehicle.

Remove the lockplate, canceling cam, upper bearing preload spring and thrust washer from the shaft.

Remove the hazard warning switch knob. Press the knob inward and unthread the knob from the column.

If equipped with an automatic transmission, use a stiff wire or paper clip to compress the lock tab retaining the shift quadrant light wire in the connector block and disconnect the wire.

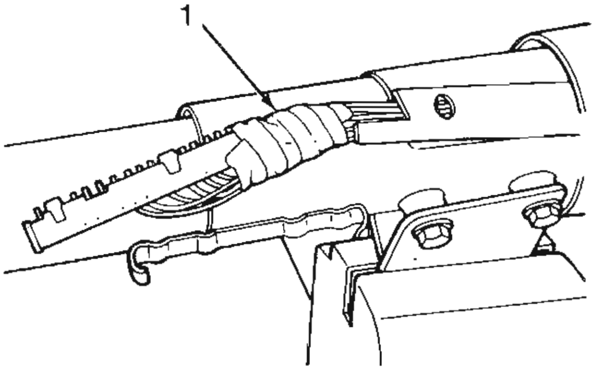
Remove the turn signal lever attaching screw and remove the lever.

On vehicles with Cruise Command, disconnect two of the four wires at the switch connector. Fold the wires back along the harness. Tape the wires to the harness and tape a length of string to the harness to aid removal.

Disconnect the turn signal switch wire harness connector from the bracket at the lower end of the steering column.

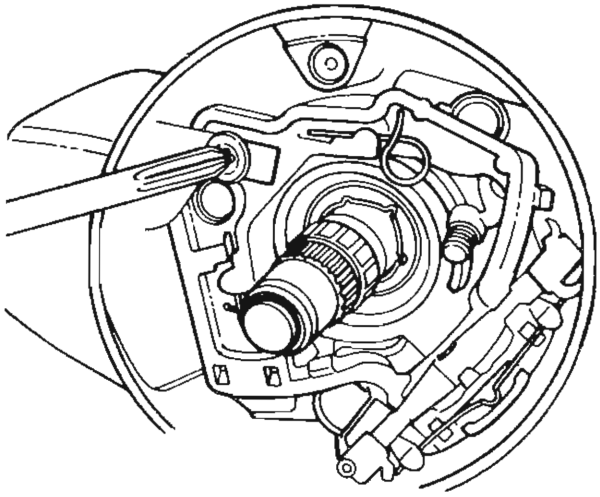
Wrap tape (1) around the turn signal switch harness connector to prevent snagging during removal.

SEE I.S. NOTES



84694

Remove the turn signal switch attaching screws and remove the switch. Pull the switch and harness straight up and out of the housing.

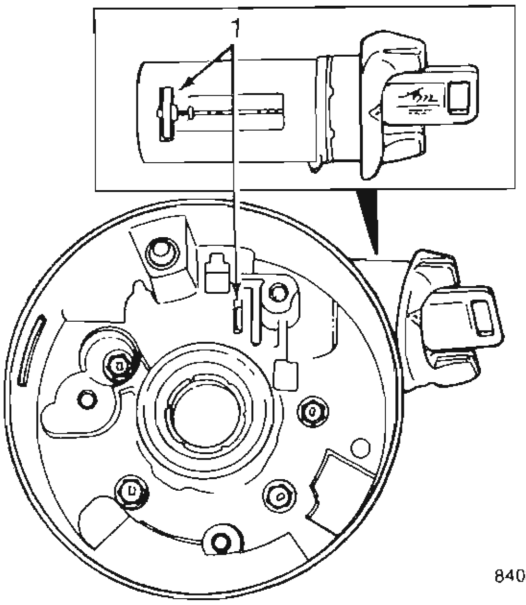


84695

On vehicles with Cruise Command, remove the turn signal lever and switch and remove the switch harness using the string previously taped in place.

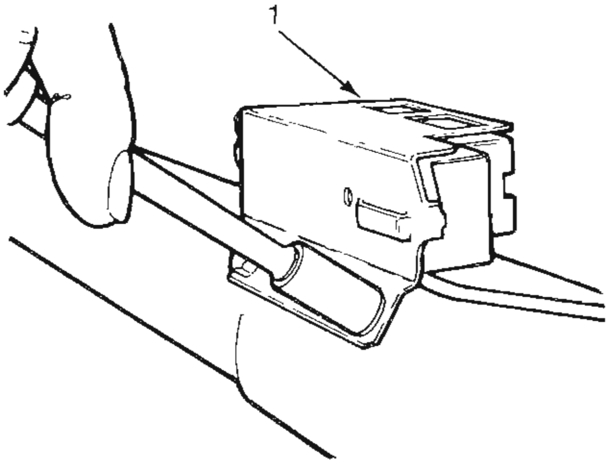
Turn the ignition lock cylinder (clockwise) two detent positions beyond the OFF-LOCK position.

Compress the lock cylinder retaining tab (1) using a thin-bladed screwdriver and remove the lock cylinder from the column.



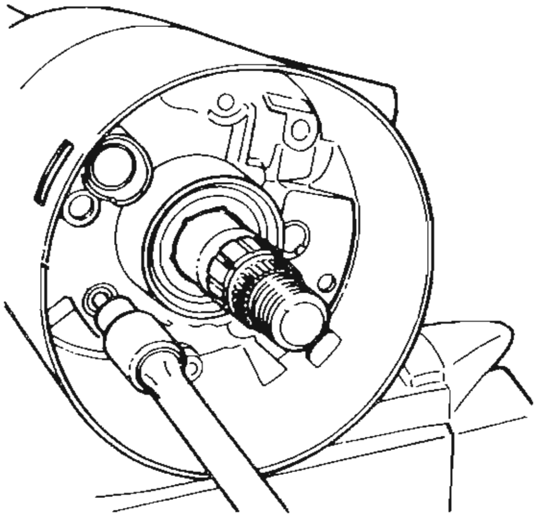
840319

Remove the ignition switch (1) from the lower end of the column.



840766

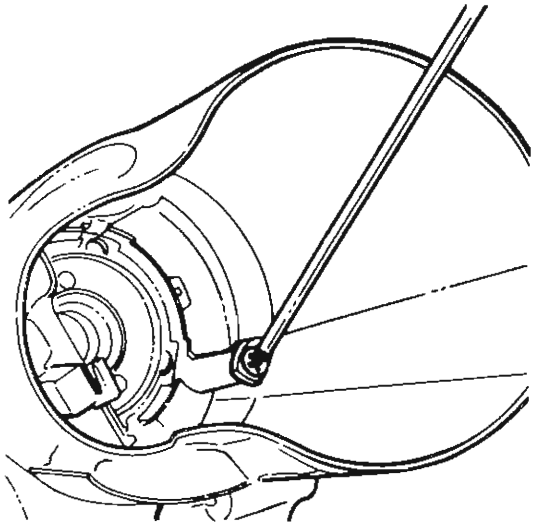
Remove the screws attaching the housing and shroud to the column jacket and remove the housing and shroud.



84699

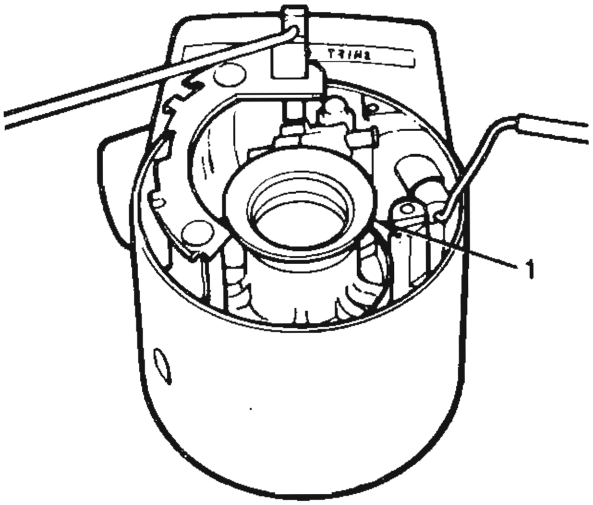
Disengage the remote rod from the lock rack.

Remove the screws attaching the shroud to the housing and remove the housing from the shroud.


84700

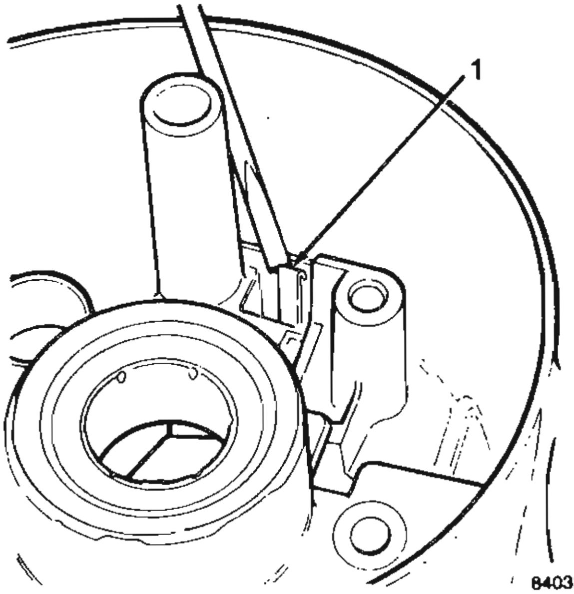
NOTE: On vehicles with automatic transmission, the remote rod and shift quadrant light wire will be removed as an assembly along with the upper housing.

Remove the thrust cup (1) from the upper housing.



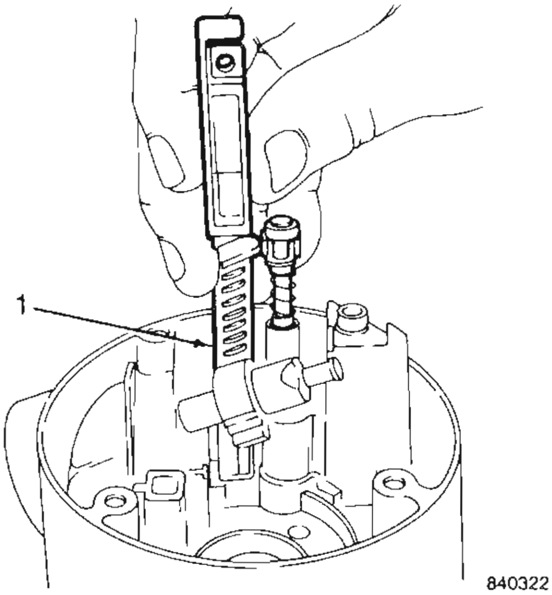
840770

Remove the wave washer from the key release lever pivot. Remove the key release lever and spring (1).

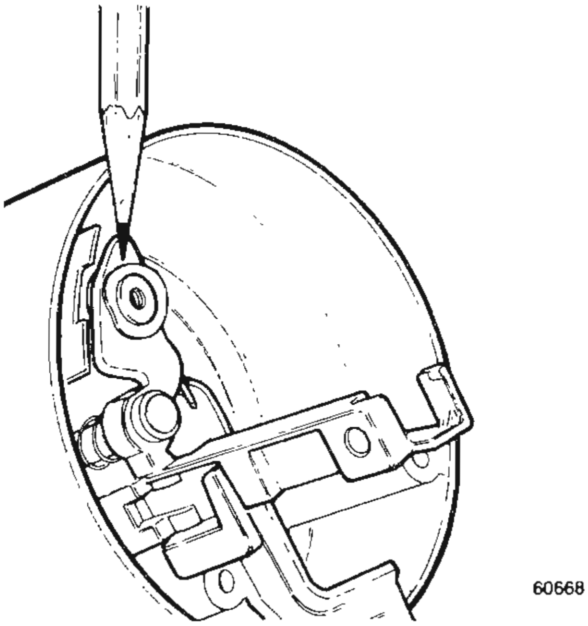


840321

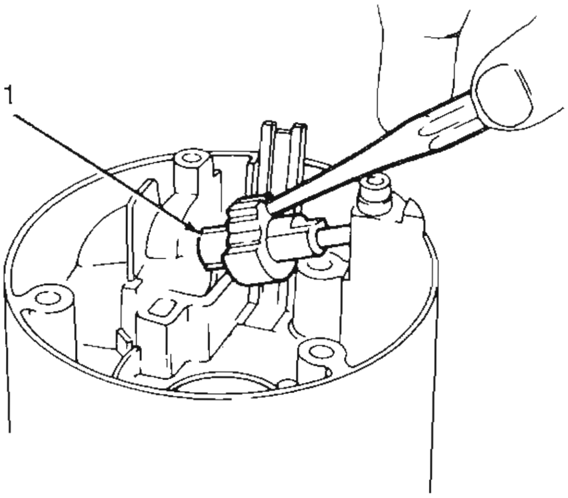
Remove the lock rack and lock bolt assembly (1).



Remove the rack preload spring.

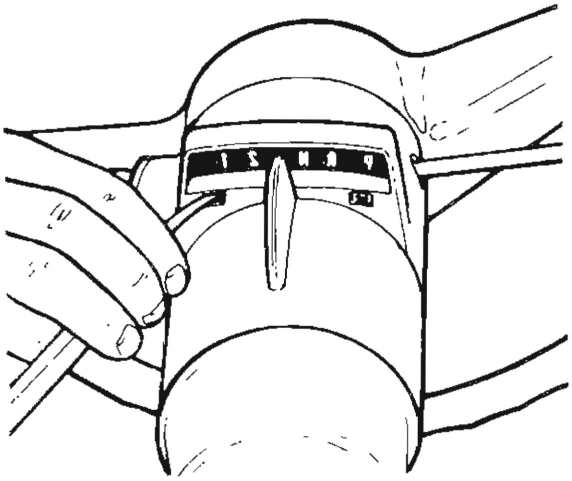


Remove the lock sector (1) through the lock cylinder hole in the housing. Push on the block tooth of the sector with a blunt punch to remove.



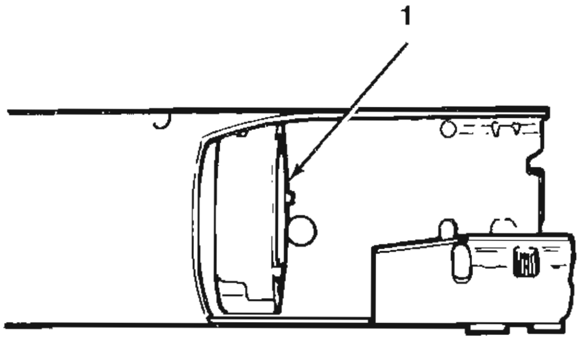
On vehicles with automatic transmission:

- remove the shift gate lock from the upper housing and examine the lock detents for wear, replace if excessively worn
- remove the shift quadrant which is retained by two clips which must be pried out with a small punch



AJ42059

- remove the shift quadrant light cover. Remove the screw retaining the socket assembly and remove the assembly
- remove the shift bowl from the column jacket
- remove the nylon lower bowl bearing (1) from the upper end of the column tube



840772

NOTE: Although the preceding steps can be performed with the column mounted in the vehicle, the following steps can be performed only after the column has been removed.

Remove the column from the vehicle, if necessary, and mount the column in a vise using Support Fixture Tool J-23074.

Remove the steering shaft, if not removed previously.

Remove the spring clip from the lower bearing retainer and remove the retainer, bearing and adapter.

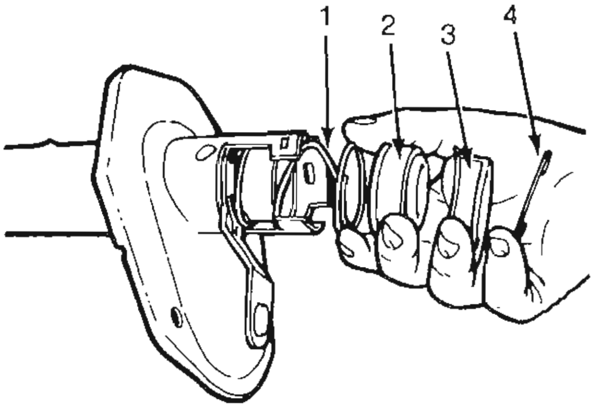
Column Assembly

CAUTION: Use only the specified screws, bolts and nuts when servicing the column and tighten all fasteners with recommended torque values only to maintain the energy-absorbing (compressing) action of the column. Incorrect length screws or bolts 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 also be tightened to the proper torque so that the bracket will breakaway under impact.

Coat all the friction and bearing surfaces with chassis grease before assembly.

On vehicles equipped with automatic transmission:

- install the shift tube
- install the nylon washer in the lower end of the shift tube with the flat side of the washer facing the upper end of the tube
- install the preload spring (1), lower bearing (2) (with the metal face toward the retainer (3), bearing retainer and retainer ring (4)



NOTE: FLOOR SHIFT STEERING COLUMNS HAVE NO THRUST WASHER OR SPRING

840773

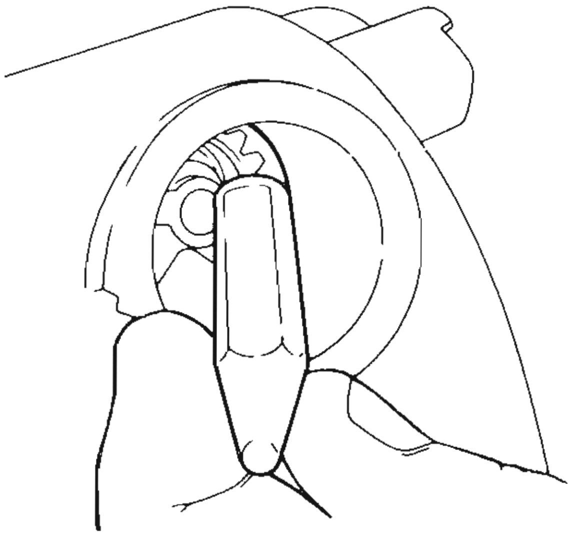
- install the nylon lower bowl bearing in the upper end of the jacket

NOTE: The bearing must be installed with the smaller inside diameter facing the lower end of the jacket and with the bearing notches engaged in the three locator crimps in the column.

- align the shift bowl with tube splines and install the bowl

Install the lock sector on the sector shaft. Install the sector through the lock cylinder hole in the housing.

Use a blunt tool to press the sector onto the shaft. Be sure that the sector turns freely after installation.



84704

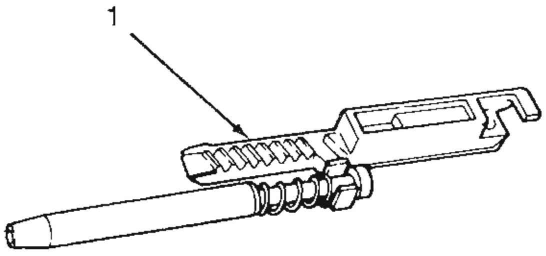
Install the rack preload spring.

The bowed side of the spring must bear against the lock rack when the rack is installed.

On vehicles equipped with automatic transmission , install the shift gate lock and the two countersunk attaching screws. Tighten the screws with 5 N·m (45 in-lbs) torque.

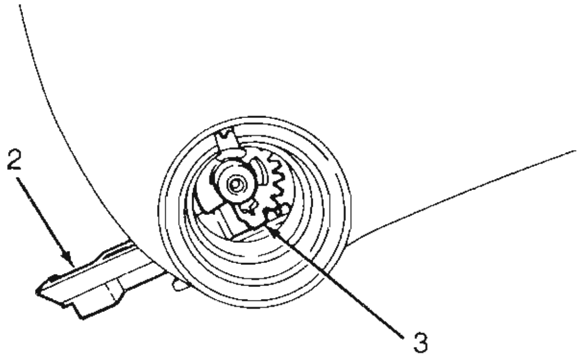
- install the shift quadrant lamp and the lamp cover
- install the shift quadrant indicator and press the retainer clips into place with the flat side toward the bowl

Assemble the lock bolt and lock rack (1).



84705

Install the assembled lock bolt and lock rack in the housing. Mate the block tooth of the lock rack (2) with the block tooth of the sector (3).



84706

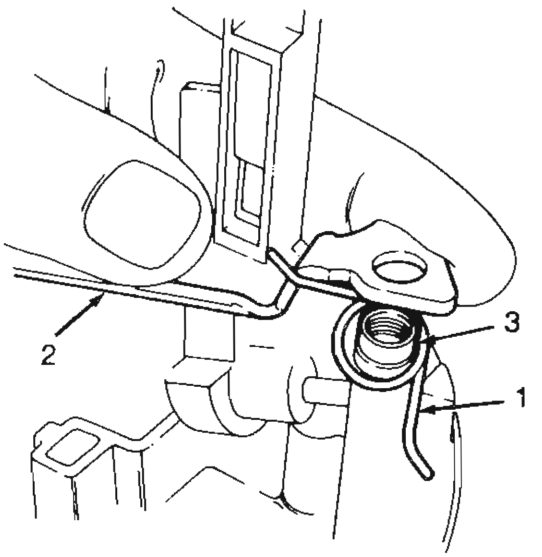
On vehicles equipped with automatic transmission:

- install the nylon thrust cup in the upper housing with the flared end of the cup facing outward
- rotate the shift bowl counterclockwise to the stop and install the upper housing. Tighten the housing attaching screws with 7 N·m (60 in-lbs) torque

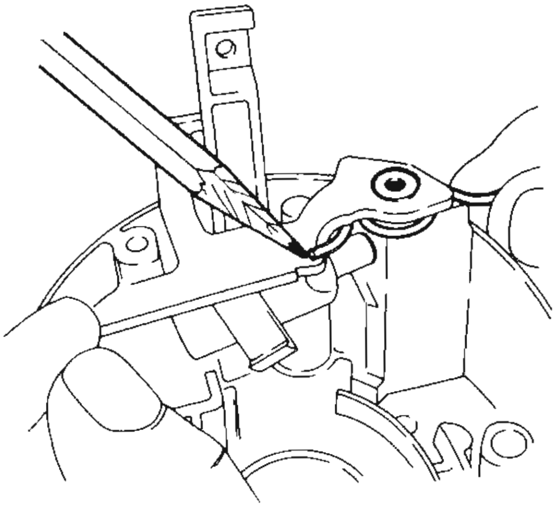
NOTE: The shift bowl must be in the Park position and the rack pulled downward before the upper housing can be installed.

- guide the shift quadrant lamp wire and remote lock rod into position between the shift bowl and column jacket

Install the key-release lever return spring (1) over the post in the housing. Insert the release lever finger (2) in the lock rack slot and position the hole in the lever over threaded hole in the housing post (3). Be sure the inner end of the spring contacts the release lever.

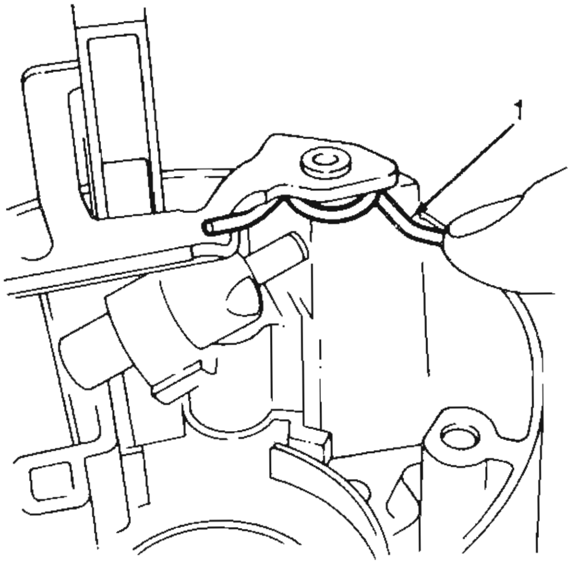


84707



84708

Raise the key-release lever slightly and install the end of release lever spring (1) between lever and housing boss.



84709

SEE I.S. NOTES

Coat the wave washer with the chassis grease and install the washer on the post and over the release lever.

Position the shroud on the housing and install the attaching screws. Tighten the screws with 2 N·m (18 in-lbs) torque. Do not displace the release lever wave washer when assembling the shroud and housing.

Install the remote rod on the lock rack. Insert the short hooked end of the rod in the lock rack.

Install the assembled shroud and housing on the column and install the attaching screws. Tighten the screws with 7 N·m (60 in-lbs) torque.

Install the lock cylinder in the housing. Insert the key in the lock. Hold the cylinder sleeve and rotate the key clockwise until the key stops (this retracts the actuator).

Insert the lock cylinder in the housing bore with the cylinder tab aligned with the keyway in the housing. Push the cylinder in until it bottoms. Rotate the key counterclockwise until the drive section of the cylinder mates with the sector. Push the cylinder in fully until the tab engages in the housing groove.

Turn the lock cylinder clockwise to stop, then counterclockwise to the OFF-UNLOCK position.

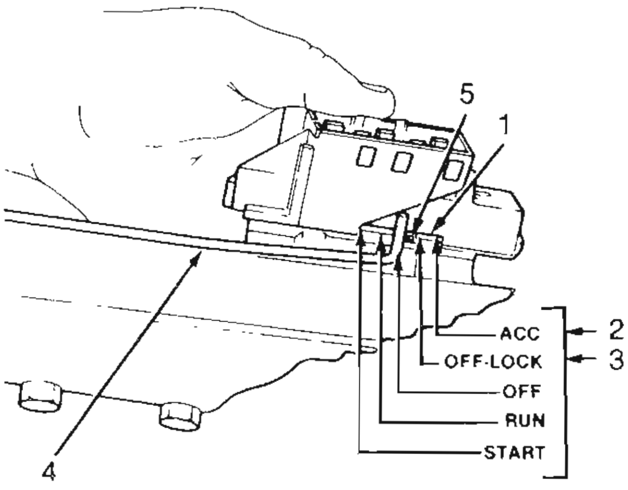
To install the ignition switch position the switch on the column jacket.

Move the switch slider (1) to the extreme left to the ACCESSORY position (2).

Move the slider two positions to the right from the ACCESSORY position to the OFF-UNLOCK (3) position.

Insert the remote rod (4) into the hole (5) in the switch slider.

Position the switch on the column and install the attaching screws. Tighten the screws with 4 N·m (35 in-lbs) torque.



840328

Install the lower bearing, bearing adapter, retainer and snap ring in the lower end of the column.

Install the steering shaft through the lower end of the column and into the upper bearing in the housing.

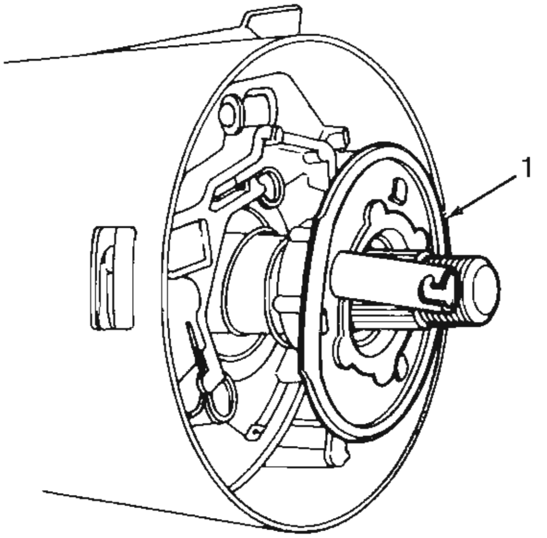
Install the turn signal switch and wire harness. Fold the wires against the connector and feed the connector through the housing and shroud.

Align the turn signal switch in the housing and install the switch attaching screws. Tighten the screws with 4 N·m (35 in-lbs) torque.

On vehicles with Cruise Command, install the lever and switch assembly. Use the string previously taped in place to guide the wires into the housing. Remove the string and tape. Connect the wires to the switch terminal and install the lever by pushing it straight in.

Install the turn signal lever attaching screw.

Install the thrust washer, upper bearing preload spring and canceling cam (1) on the steering shaft. Position canceling cam as shown.



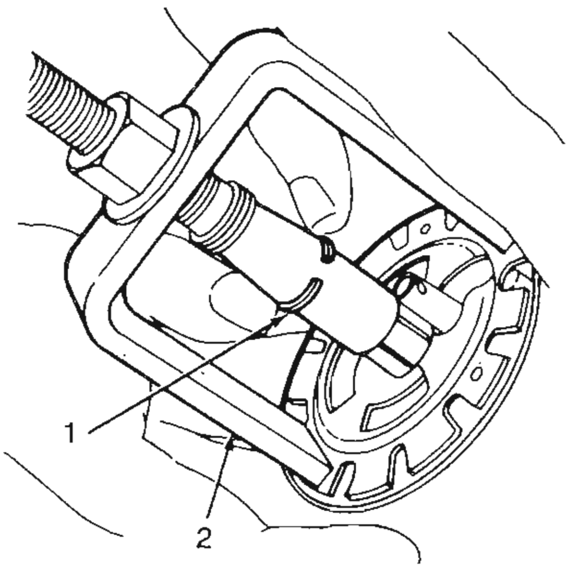
84712

Install the hazard warning switch knob.

Position the lockplate on the steering shaft.

Install the replacement steering shaft snap ring (1) on the sleeve of Compressor Tool J-23653-A (2) and install the tool on the steering shaft.

Compress the lockplate and install the snap ring in the steering shaft groove.



840330

SEE
I.S.
NOTES

Remove the compressor tool. Be sure the snap ring is fully seated before removing the tool.

Install the lockplate cover.

Install the gearshift lever, if equipped.

Remove Support Fixture Tool J-23074, if installed.

Connect the column wiring harness connectors and install the harness protector.

Install the steering wheel.

Install and tighten the nut with 41 N·m (30 ft-lbs) torque.

SEE I.S. NOTES

Install and tighten the column bracket-to-instrument panel bolts with 27 N·m (20 ft-lbs) torque.

Tighten the toeplate bolts with 14 N·m (10 ft-lbs) torque.

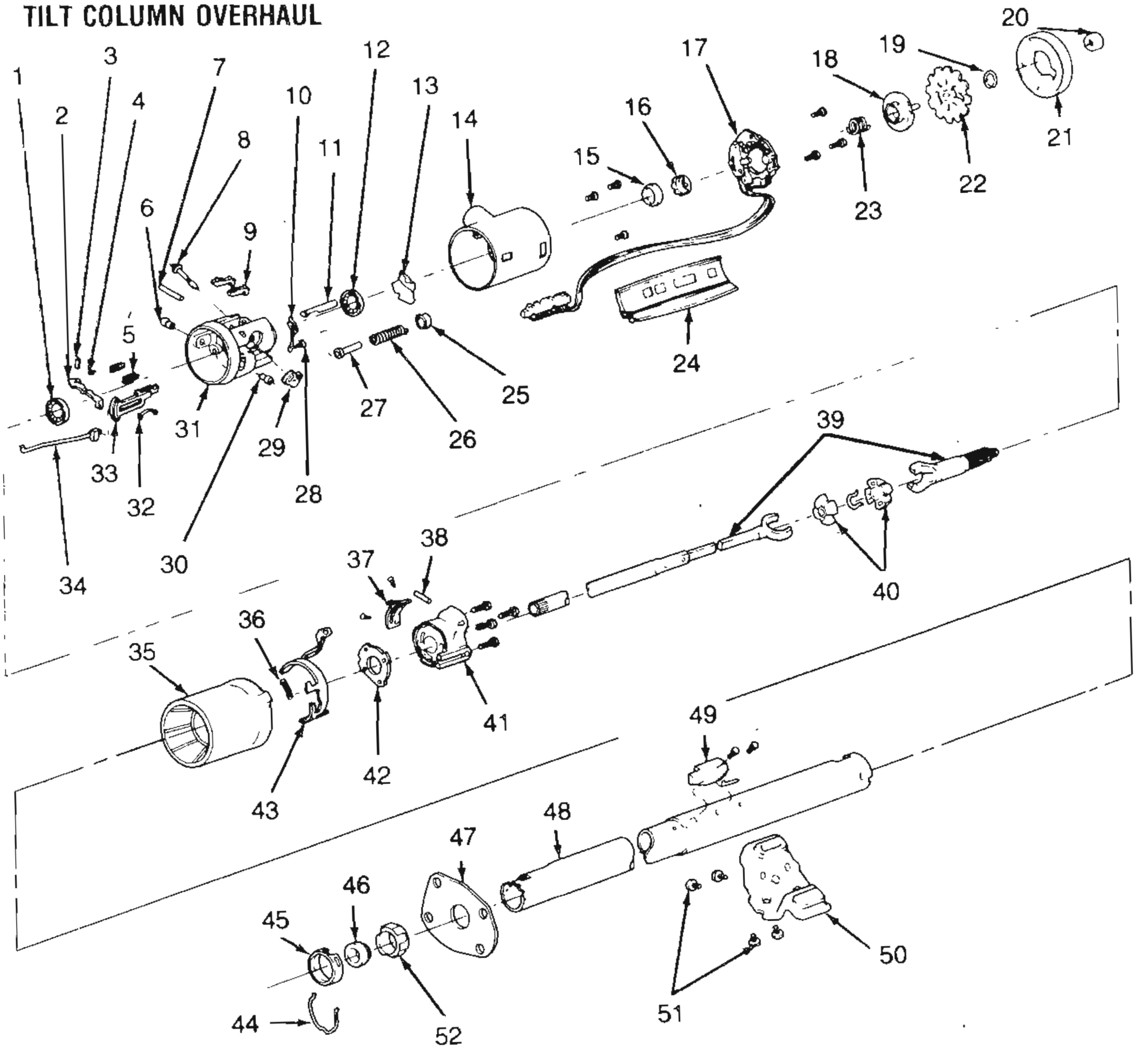
Install the steering column finish panel.

Remove the protective covering from the column painted areas.

Connect the battery negative cable.

Reset the clock, if equipped.

TILT COLUMN OVERHAUL

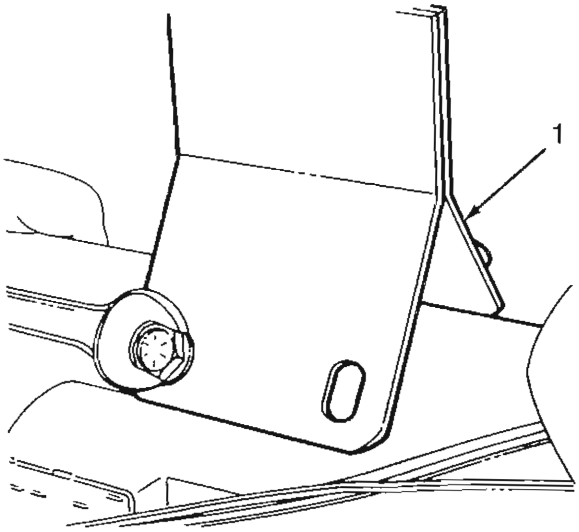


1. Lower Bearing
2. Release Lever
3. Release Lever Pin
4. Release Lever Spring
5. Lock Shoe Springs
6. Pivot Pins
7. Lock Shoe Pin
8. Sector Shaft
9. Lock Shoes
10. Lock Sector Tension Spring
11. Lock Bolt
12. Upper Bearing
13. Tilt Lever Shield
14. Cover
15. Upper Bearing Race
16. Upper Bearing Seat
17. Turn Signal Switch
18. Canceling Cam
19. Steering Shaft Snap Ring
20. Steering Wheel Nut
21. Lock Plate Cover
22. Lock Plate
23. Upper Bearing Preload Spring
24. Harness Protector
25. Tilt Spring Retainer
26. Tilt Spring
27. Tilt Spring Guide
28. Tension Spring Retaining Screw
29. Lock Sector
30. Pivot Pins
31. Housing
32. Rack Preload Spring
33. Lock Rack
34. Remote Rod
35. Shroud
36. Release Lever Spring
37. Retainer Plate
38. Dowel Pin
39. Steering Shaft
40. Steering Shaft Spherical Joint
41. Support
42. Retainer Plate
43. Key Release Lever
44. Spring Clip
45. Lower Bearing Retainer
46. Lower Bearing
47. Toe Plate Seal
48. Column Jacket
49. Ignition Switch
50. Column Mounting Bracket
51. Column Mounting Bracket Bolts
52. Bearing Adapter

841306

SEE
I.S.
NOTES

NOTE: Although the tilt column can be disassembled down to the housing with the column mounted in the vehicle, the column must be removed if disassembly is to be more extensive. If the column is removed for service, use Support Fixture Tool J-23074 (1) to mount the column in a vise.



84691

Disassembly

Place the front wheels in a straight-ahead position.

Disconnect the battery negative cable.

Cover the painted areas of the column.

Remove the steering wheel.

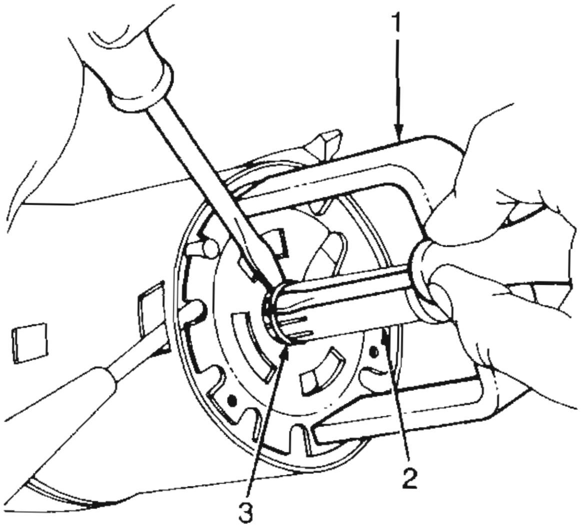
Remove the gearshift lever retaining pin and remove the lever, if equipped with an automatic transmission.

Remove the lockplate cover. Use two screwdrivers to pry the cover off the lockplate and out of the column.

WARNING: The lockplate is under strong spring tension. Do not attempt to remove the steering shaft snap ring without using the compressor tool.

Compress the lockplate and unseat the steering shaft snap ring using Compressor Tool J-23653-A (1). The shaft has metric threads. Replace compressor tool standard forcing screw with Metric Forcing Screw J-23653-4 (2) before installing the tool on the steering shaft.

Remove the lockplate compressor tool and snap ring (3). Discard the snap ring.



840316

CAUTION: When the steering shaft snap ring is removed, the shaft is free in the column. During bench overhaul, remove the shaft by pulling it out from the lower end of the column. Do not allow the shaft to fall out whenever the column is removed from the vehicle.

SEE I.S. NOTES

Remove the lockplate, canceling cam, upper bearing preload spring and thrust washer from the shaft.

Remove the hazard warning switch knob. Press the knob inward and unthread the knob from the column.

If equipped with an automatic transmission, use a stiff wire or paper clip to compress the lock tab retaining the shift quadrant light wire in the connector block and disconnect the wire.

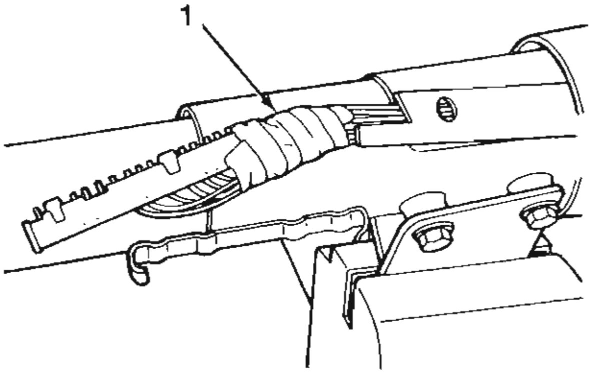
Remove the turn signal lever attaching screw and remove the lever.

On vehicles with Cruise Command, disconnect two of the four wires at the switch connector. Fold the wires back along the harness. Tape the wires to the harness and tape a length of string to the harness to aid removal.

Remove the tilt wheel lever.

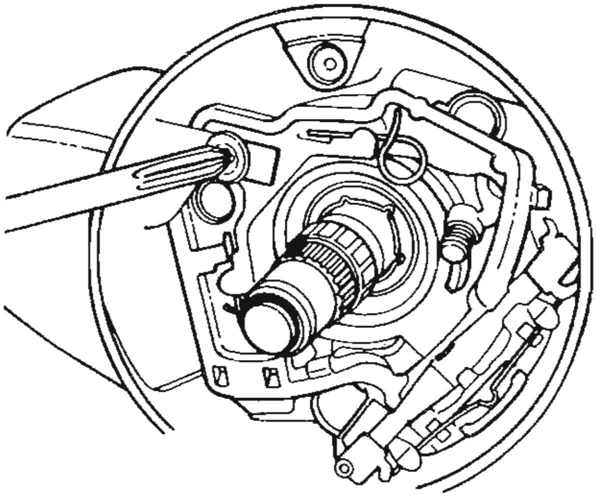
Disconnect the turn signal switch wire harness connector from the bracket at the lower end of the steering column.

Wrap tape (1) around the turn signal switch harness connector to prevent snagging during removal.



84694

Remove the turn signal switch attaching screws and remove the switch. Pull the switch and harness straight up and out of the housing.

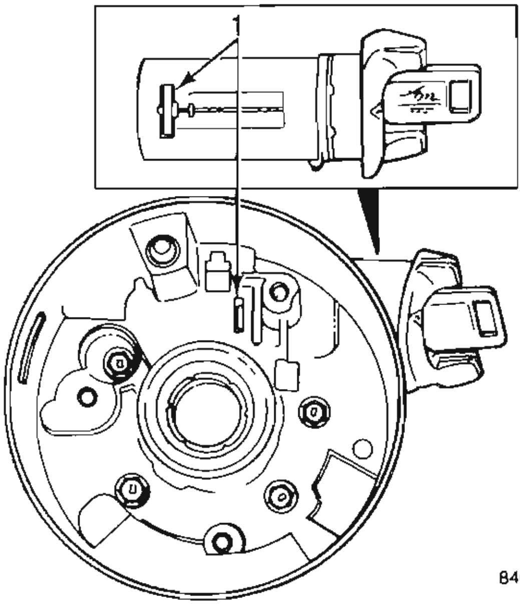


84695

On vehicles with Cruise Command, remove the turn signal lever and switch and remove the switch harness using the string previously taped in place.

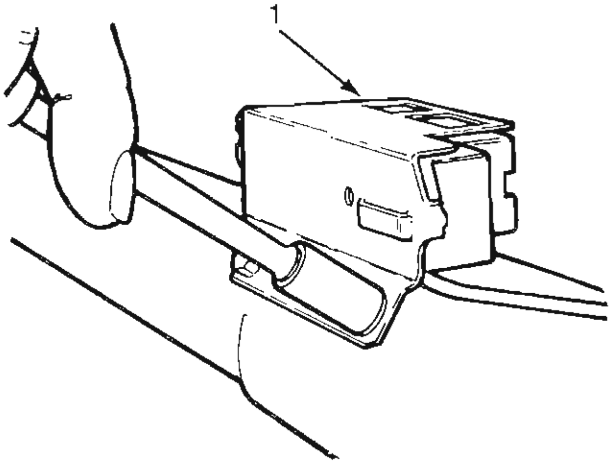
Turn the ignition lock cylinder (clockwise) two detent positions beyond the OFF-LOCK position.

Compress the lock cylinder retaining tab (1) using a thin-bladed screwdriver and remove the lock cylinder from the column.



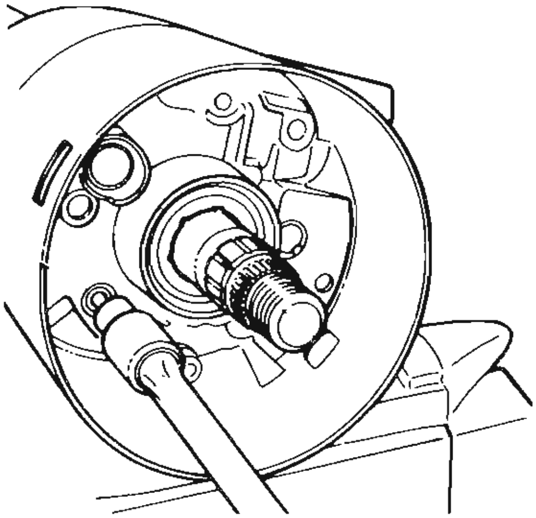
840319

Remove the ignition switch (1) from the lower end of the column.



840766

Remove the screws attaching the housing to the column jacket and remove the housing.

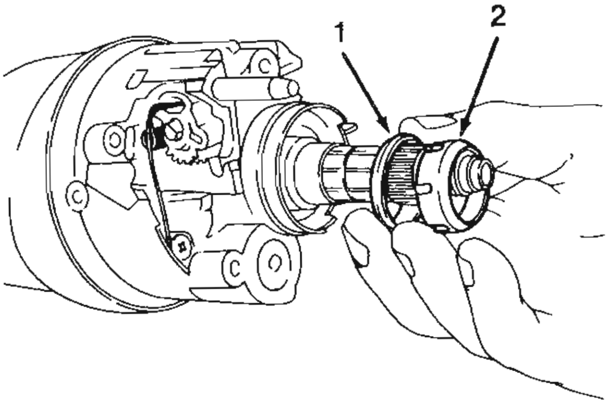


84699

Disengage the remote rod from the lock rack.

NOTE: On vehicles with automatic transmission, the remote rod and shift quadrant light wire will be removed as an assembly along with the upper housing.

Remove the upper bearing race (1) and bearing seat (2) from the steering shaft.

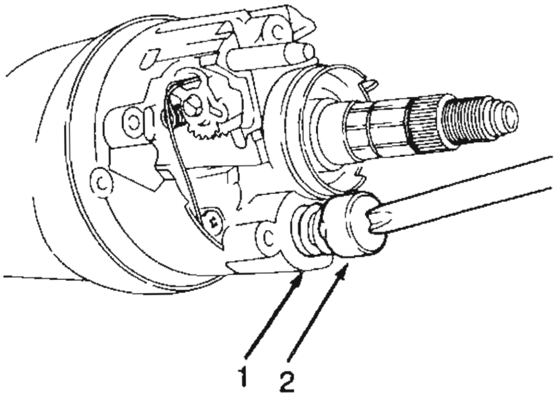


84745

Reinstall the tilt lever and place the column in the full upward tilt position.

WARNING: The tilt spring guide is under strong spring pressure.

Remove the tilt spring (1), guide and retainer (2) using a screwdriver. Press the retainer in and turn it counterclockwise until the retainer tabs align with the housing lugs. Be sure the screwdriver blade just fits into the retainer slot.



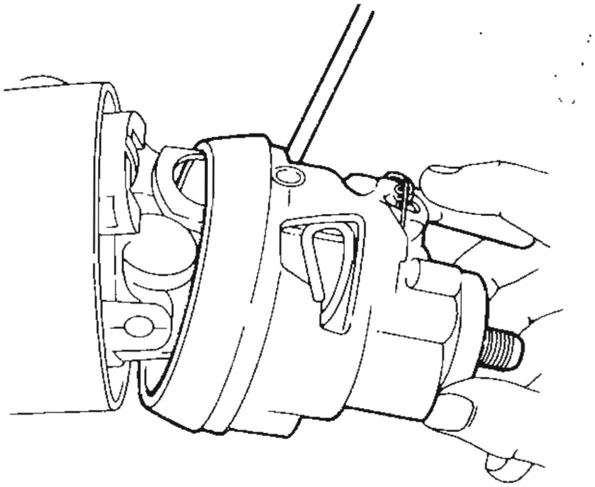
840334

Place the housing in the center (nontilt) position.

Remove the housing pivot pins using Tool J-21854-1 or equivalent.

SEE I.S. NOTES

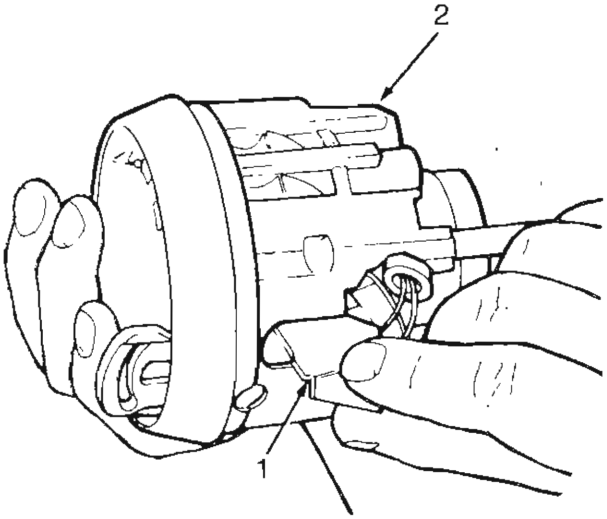
Raise the tilt lever to disengage the lock shoes and remove the housing. Pull the housing up to disengage the shoes and turn the housing clockwise to separate the lock rack from the remote rod.



84729

Remove tilt lever from housing.

Remove the tilt lever shield (1) from the housing (2).

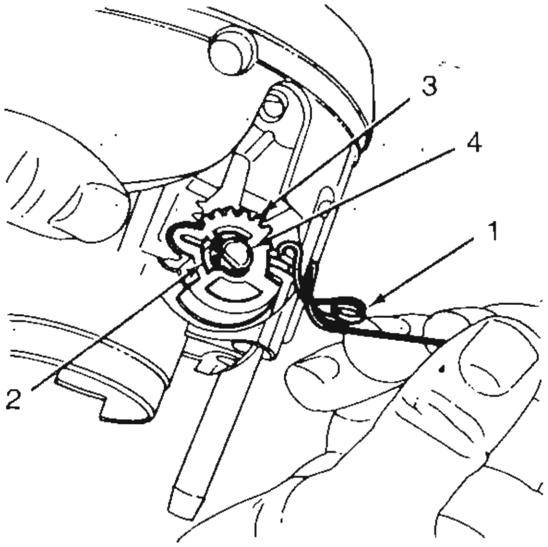


840335

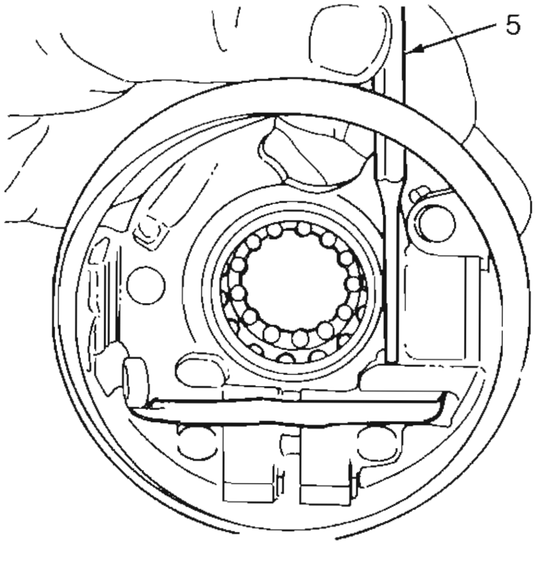
Remove the lock sector spring retaining screw and the spring (1). Rotate the spring in a clockwise direction to remove it from the bolt.

Remove the lock sector retaining ring (2).

Remove the lock sector (3) and sector shaft (4). Tap the shaft through the sector and out of the housing using a hammer and punch (5).



840336

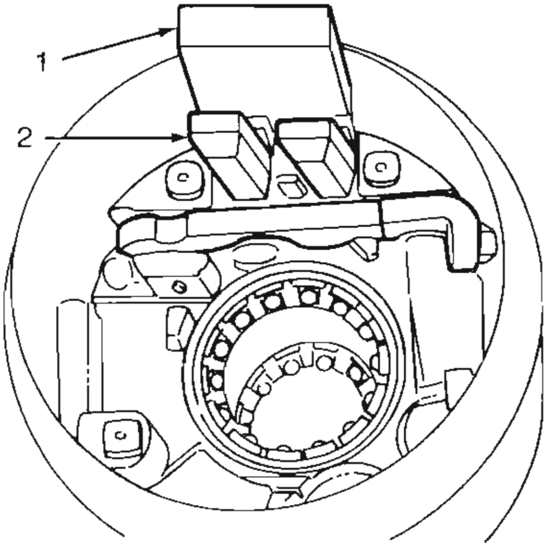


840337

SEE I.S. NOTES

Remove the lock bolt, lock rack, rack preload spring, spring shim, if equipped, and remote rod from the housing.

Insert a wedge (1) between the lock shoes (2) and the housing to relieve the spring tension on the tilt and lock shoe pins.



840338

Remove the tilt lever pin from the housing using Tool J-22635 or a pin punch.

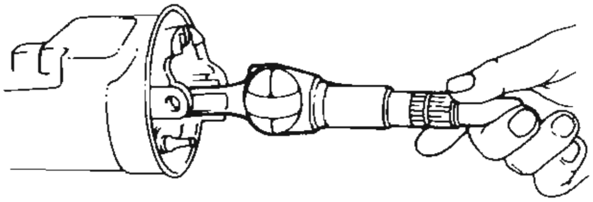
Remove the lock shoe pin from the housing using Tool J-22635 or a pin punch and remove the lock shoes, springs and wedge.

Remove the housing upper and lower bearings and races only if damaged or worn. If the bearings and races must be replaced, remove the bearings and races using a hammer and punch.

NOTE: Discard the housing bearings and races if removed. They are not reusable.

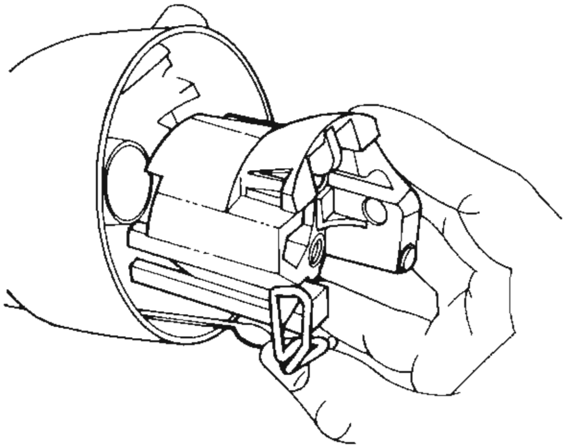
Disconnect the steering shaft at the intermediate shaft coupling.

Remove the steering shaft through the upper end of the column.



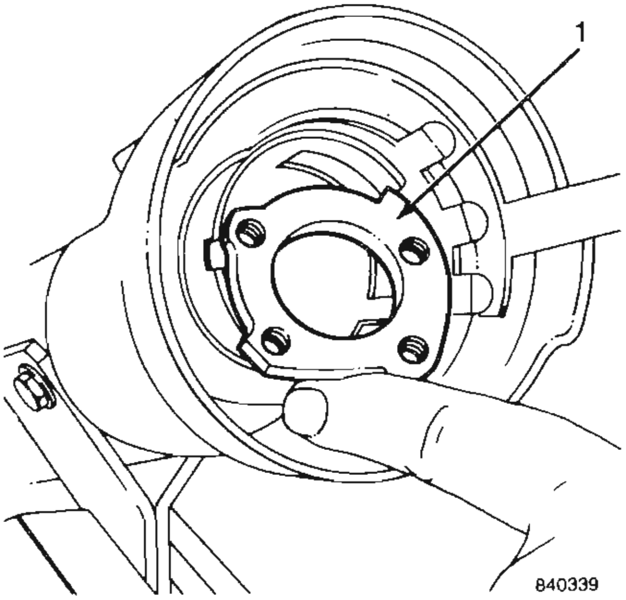
80579

Remove the support attaching bolts and remove the support.

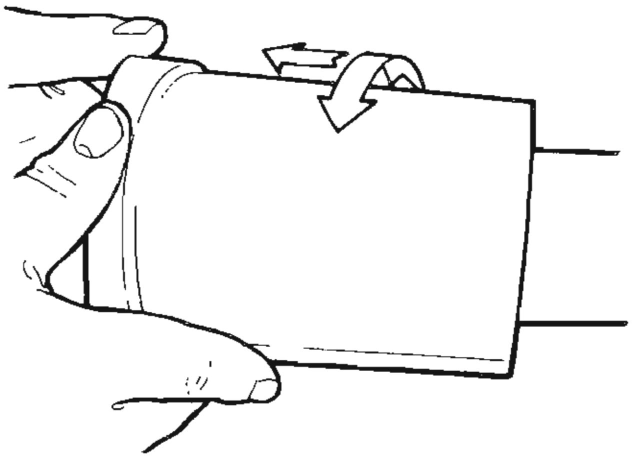


84735

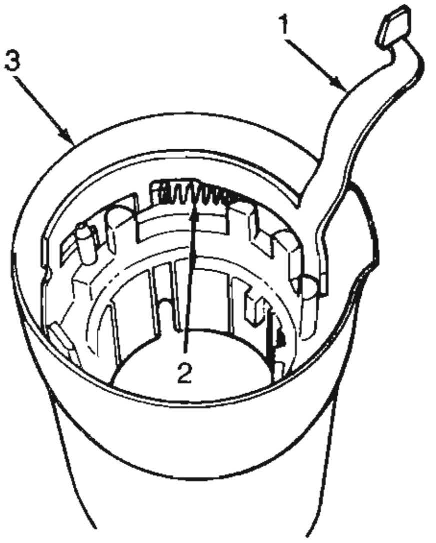
Remove the retainer plate (1). Tip the upper end of the plate to the rear and turn the plate counterclockwise to remove.



Remove the shroud using a twisting-pulling motion.



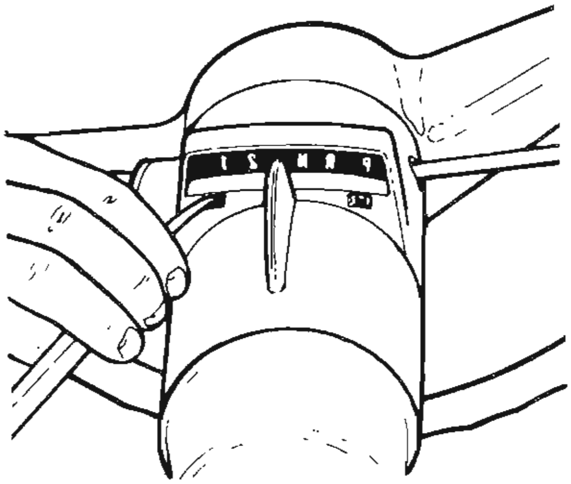
Remove the key release lever (1) and lever spring (2) from the shroud (3). Tip the lever forward and lift up to remove (manual transmission only).



SEE
I.S.
NOTES

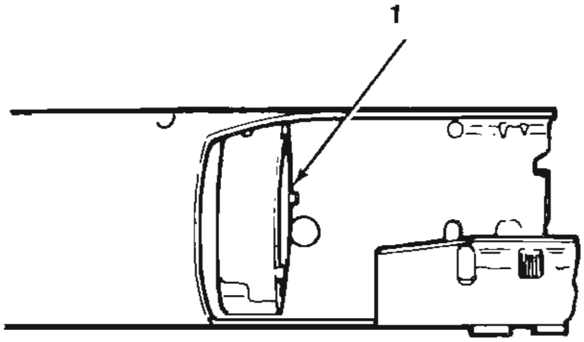
On vehicles with automatic transmission:

- remove the shift gate lock from the upper housing and examine the lock detents for wear, replace if excessively worn
- remove the shift quadrant which is retained by two clips which must be pried out with a small punch



AJ42059

- remove the shift quadrant light cover. Remove the screw retaining the socket assembly and remove the assembly
- remove the shift bowl from the column jacket
- remove the nylon lower bowl bearing (1) from the upper end of the column tube



840772

Disconnect the ignition switch wire harness connector and remove the switch from the column.

Remove the snap ring, retainer and bearing assembly from the lower end of the column.

Column Assembly

CAUTION: Use only the specified screws, bolts and nuts when servicing the column and tighten all fasteners with recommended torque values only to maintain the energy-absorbing (compressing) action of the column. Incorrect length screws or bolts 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 also be tightened to the proper torque so that the bracket will breakaway under impact.

SEE I.S. NOTES

SEE I.S. NOTES

Lubricate all bearing, friction and thrust surfaces with chassis grease.

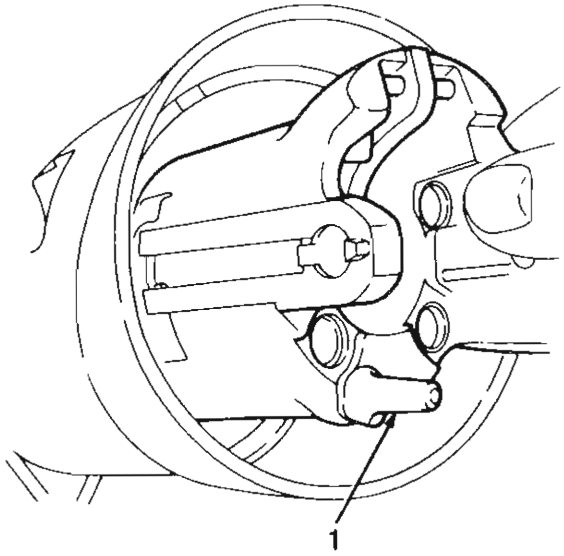
Install the bearing assembly, bearing retainer and snap ring in the lower end of the column.

Install the key release lever spring on the lever and install the assembled lever and spring in the shroud, if equipped.

Align and install the shroud on the column jacket.

Install the retainer plate. Tip the plate toward the 12 o'clock position, slide it under the jacket opening, and seat it in the column jacket notches.

Align the column jacket "V" notch with the corresponding "V" on the support (1) and install the support in the column. Press the key release lever down while pressing the support into place to seat the support fully.



840342

Install all support attaching screws finger-tight. Then tighten the screws alternately and evenly with 7 N·m (60 in-lbs) torque.

Install the remote rod in the support. Guide the rod through the upper end of the shroud and insert it into the rod slot in the support.

On vehicles equipped with automatic transmission , install the shift gate lock and the two countersunk attaching screws. Tighten the screws with 5 N·m (45 in-lbs) torque.

- install the shift quadrant lamp and the lamp cover
- install the shift quadrant indicator and press the retainer clips into place with the flat side toward the bowl

Install the steering shaft in the column.

Install the replacement bearings in the housing, if removed. Be sure to lubricate the bearings with chassis grease before installation.

Install the lock shoes, lock shoe springs and lock shoe pin in the housing. Use a 4.5 mm (0.180 in) diameter rod to align the lock shoes and pin during installation.

Install the release lever, lever spring and lever pin in the housing. Insert wedges between the housing and lever to relieve spring tension and ease pin installation.

Install the sector in the housing. Lightly tap the shaft into the housing using a punch.

Install the lock sector on the shaft. Lightly tap the sector onto the shaft until the shaft snap ring groove is exposed. Install the sector retaining snap ring.

Install the lock bolt in the housing and engage the bolt in 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 and spring retaining screw. Tighten the screw with 4 N·m (35 in-lbs) torque.

Align and install the assembled housing on the support. Hold the lock shoes in the disengaged position to ease housing installation.

Align the pivot pin holes in the housing and support. Install the pivot pins. Press the housing down when first installing the pins to prevent damaging the pin holes in the support. When pins are started in both the housing and the support, seat the pins fully using a hammer and punch.

Insert the tilt lever in the housing and place the housing in the full up tilt position.

Lubricate the tilt guide and spring liberally with chassis grease and install the tilt spring on the guide.

Insert the assembled tilt spring and guide in the housing. Install the guide retainer on the spring. Engage the retainer lock tabs with the housing lugs by pressing the retainer down and turning clockwise using a screwdriver.

Install the tilt lever shield in the housing.

Remove the tilt lever.

Install the cover on the housing. Align and install the cover attaching screws. Tighten the screws with 7 N·m (60 in-lbs) torque.

Install the turn signal switch. Guide the switch harness and connector through the column and position the switch in the housing. Do not install the switch screws at this time.

On vehicles with Cruise Command, install the lever and switch assembly. Use the string previously taped in place to guide the wires into the housing. Remove the string and tape. Connect the wires to the switch terminal and install the lever by pushing it straight in.

Insert the hazard warning knob in the signal switch. Press the knob in. Align and install the signal switch attaching screws. Tighten the screws with 4 N·m (35 in-lbs) torque. Be sure the signal switch is properly seated before tightening the screws.

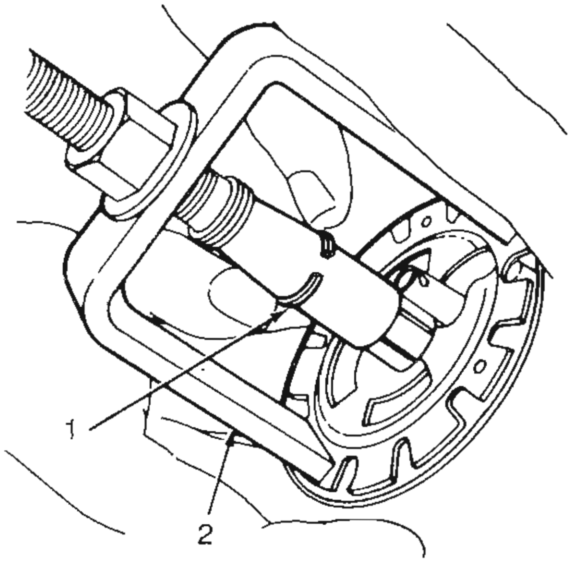
Thread the hazard warning knob into the signal switch and pull the knob out.

Install the upper bearing race and seat it in the housing.

Install the upper bearing preload spring, canceling cam and lockplate.

SEE
I.S.
NOTES

Install the replacement steering shaft snap ring (1) on the sleeve of Compressor Tool J-23653-A (2) and install the tool on steering shaft.



840330

Compress the lockplate and seat snap ring in the steering shaft groove.

Remove the compressor tool. Be sure the snap ring is completely seated before removing the tool.

Install the tilt and turn signal levers.

Install the ignition lock cylinder. Hold the cylinder sleeve; turn the knob clockwise against the stop; align the cylinder tab with the housing keyway and insert the cylinder in the housing. Turn the cylinder knob counterclockwise until the cylinder mates with the lock sector and push the cylinder in until the retainer snaps into place.

Insert the key in the lock cylinder and turn the cylinder to the OFF-UNLOCK position.

Install the ignition switch.

Move the switch slider to the ACCESSORY position then back two clicks to the OFF-UNLOCK position. The remote rod hole in the slider should be almost at the center.

Insert the remote rod into the slider hole and install the switch on the column jacket.

Move the switch down to eliminate switch-to-remote rod lash and tighten the switch attaching screws with 4 N·m (35 in-lbs) torque.

Position the switch harness protectors, if equipped, over the harness and snap the protectors into place on the column.

Install the lockplate cover.

Install the gear selector lever and pin, if equipped.

Install the steering wheel. Tighten the steering wheel nut with 41 N·m (30 ft-lbs) torque.

Install the horn cover.

Install the column mounting bracket and tighten the attaching bolts with 27 N·m (20 ft-lbs) torque.

Install column in vehicle if removed.

Remove the protection from the painted areas of the column.

Connect the battery negative cable.

Reset the clock, if equipped.

SEE
I.S.
NOTES

TURN SIGNAL SWITCH

Removal

Disconnect the battery negative cable.

Cover the painted areas of the steering column.

On vehicles with a tilt column, place the column in the Neutral (straight) position.

Remove the steering wheel. Refer to Steering Wheel Removal.

Remove the steering column-to-instrument panel trim.

Remove the lockplate cover.

Compress the lockplate and unseat the steering shaft snap ring using Compressor Tool J-23653-A.

Remove the compressor tool and snap ring. Discard the snap ring.

Remove the lockplate, canceling cam and upper bearing preload spring and thrust washer.

Place the turn signal switch lever in the right turn position and remove the actuator arm and switch retaining screws.

Press the hazard warning light switch button in and remove it by turning it counterclockwise.

Loosen the toeplate bolts.

Disconnect the turn signal switch wire harness connector from the column connector. Lift the locking tab and separate the signal switch harness from the instrument panel harness.

Remove the switch assembly.

Installation

Install the turn signal switch. Tighten the screws with 4 N·m (35 in-lbs) torque.

Install the upper bearing preload spring, canceling cam and lock plate on the steering shaft.

Install the replacement steering shaft snap ring on the sleeve of Compressor Tool J-23653-A and install the tool on the steering shaft.

Compress the lock plate and seat the steering shaft snap ring in the shaft groove. Remove the compressor tool after snap ring installation.

Install the lock plate cover.

Install the steering wheel and install the replacement steering wheel nut. Tighten the nut with 34 N·m (25 ft-lbs) torque.

Connect the signal switch connectors at the base of the column and install the harness protector.

Install and tighten the column-to-mounting bracket bolts with 27 N·m (20 ft-lbs) torque.

Install and tighten the column mounting bracket-to-instrument panel bolts with 27 N·m (20 ft-lbs) torque.

SEE
I.S.
NOTES

Install the column bezel.

Tighten the toeplate bolts with 14 N·m (10 ft-lbs) torque.

Remove the protective covering from the painted areas of the column.

Connect the battery negative cable.

Reset the clock, if equipped.

IGNITION LOCK CYLINDER SERVICE

SEE I.S. NOTES

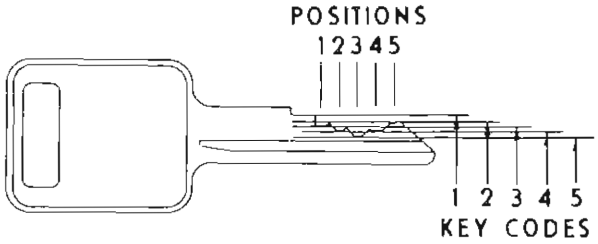
Conditions Requiring Service

Key Lost – Key Code Number Known

The key code may be converted to a five-digit number to determine key bitting. This number can be obtained from the catalogs furnished by key cutting machine manufacturers or by contacting the AMC regional sales office.

Lock Cylinder Defective – Ignition Key Available – No Key Code Number

Service replacement lock cylinders are supplied as uncoded cylinders less tumblers only. Tumblers are ordered under five different part numbers, one for each depth of cut available.



70087

Key Lost – Key Code Lost

Contact a Jeep dealer, preferably the selling dealer if possible, and provide the dealership personnel with the vehicle VIN number. The selling dealer may still have a record of the key codes. If not, the key numbers assigned to that vehicle may be obtained from the AMC regional sales office.

Lock Cylinder Removal

Refer to Steering Column Overhaul.

Disassembly

NOTE: In the following procedure, all references to turning the key clockwise or counterclockwise are made as if viewed from the key end of the cylinder.

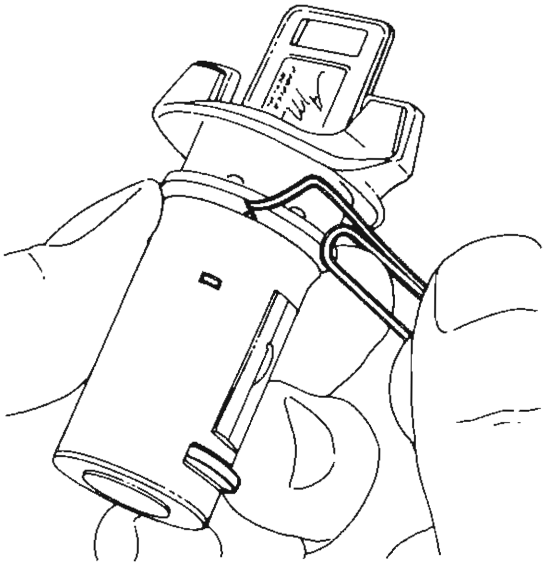
Insert the ignition key in the lock cylinder.

Hold the lock sleeve and turn the lock cylinder to the LOCK position.

Fabricate a plunger pin compressor tool from a paper clip. Make a 90 degree bend in one end of the clip about 6 mm (1/4 in) from the end.

Turn the lock cylinder to the ACCESSORY position. The brass plunger pins in the lock sleeve should now bear against the stop lug on the lock cylinder.

Compress the brass plunger pin using paper clip compressor tool.

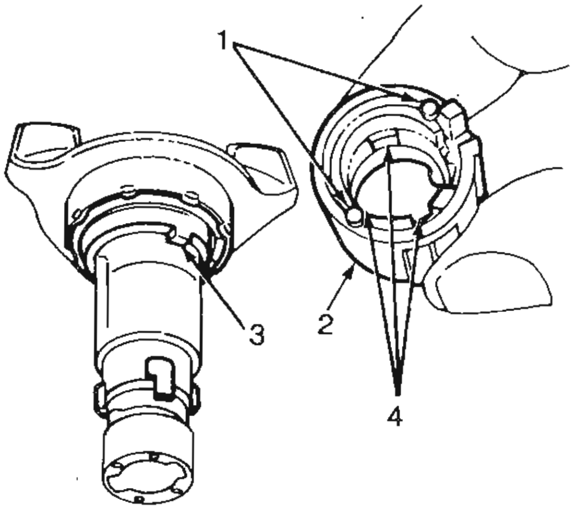


840343

NOTE: There are two brass pins (1) and two staking marks on the lock sleeve (2). The brass pin that must be compressed in order to separate the cylinder and sleeve is positioned just above the stake mark located just above and to the left of the retaining tab.

Hold the brass plunger pin in a compressed position and turn the lock cylinder clockwise.

Stop turning the lock cylinder when it springs up slightly. The locking lugs (3) on the cylinder are not aligned with the locking grooves (4) in the sleeve.



840344

Remove the ignition key to allow the buzzer pin to retract and to reset the buzzer actuator.

Turn the lock cylinder and sleeve upside down.

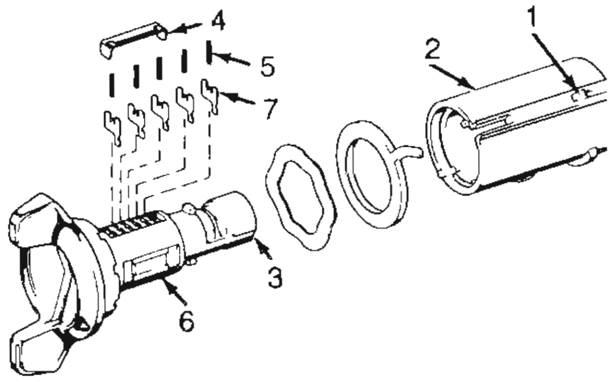
Using the wire hook, lift the nylon stop (1) on the lock sleeve (2) and remove the cylinder from the sleeve.

If the lock cylinder does not release from the sleeve easily, the buzzer actuator has not retracted fully. Jarring the cylinder on a work bench will free the actuator and permit removal.

Pry the tumbler retainer (4) from the lock cylinder and remove the tumbler springs (5).

Pull the side bar (6) out slightly and remove the tumblers (7).

SEE I.S. NOTES



840345

Key Coding

To determine the tumblers needed when the key code is not available, use the key code diagram. Refer to Key Lost – Key Code Lost.

Place the key over the coding diagram with the uncut side of the key aligned exactly with the diagram. Each of the five positions will align with a notch on a key.

Starting at the head of the key blade, determine and record the lowest level (tumbler number) that is visible in position one and in the remaining four positions.

After the tumbler number sequence has been determined, assemble the lock cylinder.

Starting at the key end of the lock cylinder, insert the tumblers in the proper slots in the order required by the key code.

Pull the side bar out only enough to allow the tumblers to drop completely into place.

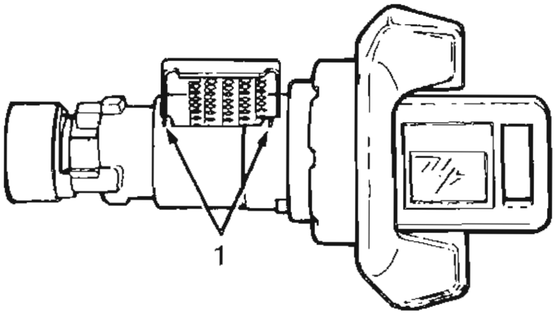
Install one tumbler spring in the hole above each tumbler.

Insert the tumbler retainer so two end prongs slide into the slots of either end of the cylinder.

Press the retainer down.

To determine if the tumblers have been assembled correctly, insert the key into the lock cylinder. If the tumblers have been properly installed, the side bar will drop down. If the side bar does not drop down, remove the key, spring retainer, springs and tumblers and recheck the coding of the key and tumbler assembly.

When the cylinder is correctly assembled, stake the spring retainer at each end (1) with a punch to retain it.



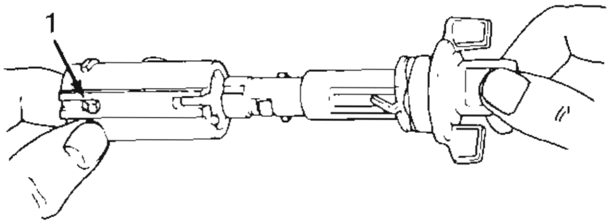
840346

Assembly

Insert the key completely into the cylinder then pull the key out two notches.

Place the wave washers and anti-theft ring in position.

Push the nylon stop (1) in the lock cylinder down and hold the nylon stop in the lock sleeve up with the left forefinger.



840347

Align the anti-theft ring tang and lock cylinder side bar with the slot in the wall of the sleeve and install the cylinder in the sleeve.

Push the key in and turn clockwise to lock the cylinder in the sleeve.

Installation

Refer to Steering Column Overhaul for the lock cylinder installation procedures.

SEE I.S. NOTES

GENERAL

The manual steering gear used on Jeep vehicles is a recirculating ball design. The steering gear wormshaft and ball nut are in line with the steering shaft in the column. The steering ratio of this unit is 24:1.

The steering gear wormshaft and column steering shaft are connected by a removable flexible coupling. The coupling permits independent removal of the steering gear or column.

The steering gear ball nut is mounted on the wormshaft and is driven through steel ball bearings which circulate in the spiral grooves machined in the wormshaft and ball nut. The bearings act as a rolling thread between the wormshaft and ball nut. The ball nut is directly engaged by the pitman shaft sector teeth.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-5755	Bearing Cup Installer		■
J-5822	Bearing Cup Puller		■
J-6632-01	Pitman Arm Puller		■
J-7754	Torque Wrench		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Intermediate Shaft Coupling Clamp Bolt	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Pitman Arm Nut	251 N·m (185 ft-lbs)	217-285 N·m (160-210 ft-lbs)
Steering Gear Mounting Bracket-to-Gear Bolts	95 N·m (70 ft-lbs)	81-108 N·m (60-80 ft-lbs)
Steering Gear Mounting Bracket-to-Tie Plate Bolt	75 N·m (55 ft-lbs)	68-81 N·m (50-60 ft-lbs)
Side Cover Bolts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Adjuster Screw Locknut	31 N·m (23 ft-lbs)	24-37 N·m (18-27 ft-lbs)
Worm Bearing Adjuster Locknut	122 N·m (90 ft-lbs)	95-149 N·m (70-110 ft-lbs)

SPECIFICATIONS

Manual Steering Gear Adjustments

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) (in addition to above)
Total Steering Gear Preload	18 in.-lbs. (2.0 N·m) total (maximum)

Steering Gear Specifications

Manual Steering Gear Lubricant	Multi-purpose chassis grease
Manual Steering Gear Ratio	24:1
Manual Steering Gear Type	Recirculating Ball

84679

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
HARD OR ERRATIC STEERING	(1) Incorrect tire pressure	(1) Inflate tires to recommended pressures
	(2) Insufficient or incorrect lubrication	(2) Lubricate as required (refer to Maintenance Section
	(3) Suspension, or steering linkage parts damaged or misaligned	(3) Repair or replace parts as necessary
	(4) Improper front wheel alignment	(4) Adjust incorrect wheel alignment angles
	(5) Incorrect steering gear adjustment	(5) Adjust steering gear
	(6) Sagging springs	(6) Replace springs
PLAY OR LOOSENESS IN STEERING	(1) Steering wheel loose	(1) Inspect shaft splines and repair as necessary. Tighten attaching nut and stake in place
	(2) Steering linkage or attaching parts loose or worn	(2) Tighten, adjust, or replace faulty components
	(3) Pitman arm loose	(3) Inspect shaft splines and repair as necessary. Tighten attaching nut and stake in place
	(4) Steering gear attaching bolts loose	(4) Tighten bolts
	(5) Loose or worn wheel bearings	(5) Adjust or replace bearings
	(6) Steering gear adjustment incorrect or parts badly worn	(6) Adjust gear or replace defective parts
WHEEL SHIMMY OR TRAMP	(1) Improper tire pressure	(1) Inflate tires to recommended pressures
	(2) Wheels, tires, or brake rotors out-of-balance or out-of-round	(2) Inspect and replace or balance parts
	(3) Inoperative, worn, or loose shock absorbers or mounting parts	(3) Repair or replace shocks or mountings
	(4) Loose or worn steering or suspension parts	(4) Tighten or replace as necessary
	(5) Loose or worn wheel bearings	(5) Adjust or replace bearings
	(6) Incorrect steering gear adjustments	(6) Adjust steering gear
	(7) Incorrect front wheel alignment	(7) Correct front wheel alignment
TIRE WEAR	(1) Improper tire pressure	(1) Inflate tires to recommended pressures
	(2) Failure to rotate tires	(2) Rotate tires
	(3) Brakes grabbing	(3) Adjust or repair brakes

SEE I.S. NOTES

84749A

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
TIRE WEAR (Continued)	(4) Incorrect front wheel alignment	(4) Align incorrect angles
	(5) Broken or damaged steering and suspension parts	(5) Repair or replace defective parts
	(6) Wheel runout	(6) Replace faulty wheel
	(7) Excessive speed on turns	(7) Make driver aware of condition
VEHICLE LEADS TO ONE SIDE	(1) Improper tire pressures	(1) Inflate tires to recommended 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)	(2) Install tires of same cord construction and reasonably even tread depth, design, and wear pattern
	(3) Incorrect front wheel alignment	(3) Align incorrect angles
	(4) Brakes dragging	(4) Adjust or repair brakes
	(5) Pulling due to uneven tire construction	(5) Replace faulty tire

84749B

SEE I.S. NOTES

STEERING GEAR SERVICE (ON VEHICLE)

Steering Gear Adjustment

Adjustments are generally made to compensate for normal wear in the gear or to correct a handling problem caused by improper adjustment. Correct adjustment results in a definite drag or preload but does not cause excessive steering effort through any point of the turn.

CAUTION: Adjust the steering gear in the following sequence only. Failure to do so could result in damage to the gear or improper steering response. Always adjust the worm bearing preload first; then adjust the pitman shaft overcenter drag torque last.

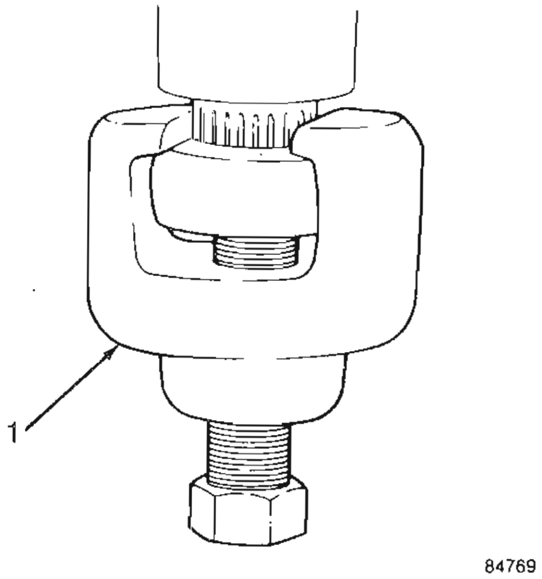
Worm Bearing Preload and Pitman Shaft Overcenter Drag Torque

Raise the vehicle and remove the crossmember cover, if equipped.

Check and correct the steering gear mounting bolt torque, if necessary.

Mark the pitman arm and steering gear pitman shaft for assembly reference.

Remove the pitman arm nut and remove the pitman arm using Puller J-6632-01 (1).



Loosen the pitman adjusting screw locknut and back off the adjusting screw two or three turns.

Remove the horn button and cover. Slowly turn the steering wheel in one direction until stopped by the gear; then turn the wheel back 1/2 turn.

CAUTION: Do not turn the steering wheel hard against the stop when the linkage is disconnected. This could result in damage to the steering gear ball return guides.

Install the socket and inch-pound torque wrench on the steering wheel nut. Measure the worm bearing preload by rotating the steering wheel through a 90° arc (1/4 turn). The preload should be 0.6-1 N·m (5-8 in-lbs).

NOTE: Steering column misalignment or damage will affect torque readings. If the rotating torque is exceptionally high, check the column alignment. If the alignment is correct, remove the gear, determine the problem area, and repair as necessary.

If a preload adjustment is necessary, loosen the worm bearing adjuster locknut and turn the adjuster clockwise to increase the preload or counterclockwise to decrease the preload.

When the desired preload is obtained, tighten the adjuster locknut with 122 N·m (90 ft-lbs) torque and check the preload again. Correct the preload as necessary.

Adjust the pitman shaft overcenter drag torque.

CAUTION: Do not attempt to adjust the pitman shaft overcenter drag torque until after the worm bearing preload has been adjusted.

Rotate the steering wheel slowly from stop-to-stop and count the total number of steering wheel turns.

Turn the steering wheel back 1/2 the total number of turns to place the gear on the center: then turn the wheel 1/2 turn 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 (this is overcenter drag torque). The drag torque should equal the worm bearing preload torque plus .5-1 N·m (4-10 in-lbs) but must not exceed a total of 2 N·m (18 in-lbs).

Example:

The worm bearing preload is adjusted to 0.7 N·m (6 in-lbs) torque. The overcenter drag torque is adjusted to 0.8 N·m (7 in-lbs) in addition to the worm bearing preload. This makes a total of 1 N·m (13 in-lbs) which is acceptable.

If adjustment is required, loosen the pitman shaft adjusting screw locknut and loosen or tighten the adjusting screw to obtain the desired drag torque.

Tighten the pitman shaft adjusting screw locknut to 34 N·m (25 ft-lbs) after adjusting the drag torque and recheck the drag torque again. Correct the adjustment if necessary.

Install the pitman arm. Index the arm to the shaft using the alignment marks made at disassembly.

WARNING: The pitman arm nut must be securly staked to the sector shaft for proper retention.

Tighten the pitman arm nut with 251 N·m (185 ft-lbs) torque and stake the nut to the shaft threads in one place.

Lower the vehicle.

Correct the steering wheel-to-steering shaft alignment if necessary and install the horn button cover.

Pitman Shaft Seal Replacement

Raise and support the vehicle. Place the front wheels straight ahead.

Mark the pitman arm and shaft for assembly reference and remove the pitman arm using puller J-6632-01.

Remove the seal using a pointed tool or screwdriver with a small blade.

Inspect the condition of the gear lubricant. If it is contaminated or full of metal particles, remove and overhaul the gear.

Wrap the pitman shaft splines with shimstock to protect the replacement seal during installation.

Lubricate the lip of the replacement seal with chassis lubricant. Slide the seal over the shimstock and into the seal seat in the gear housing. Complete the seal installation by tapping the seal into place using a small plastic mallet.

Install the pitman arm onto the shaft. Align the arm and shaft using the reference marks made during removal.

Install the pitman arm nut and tighten to specification.

WARNING: The pitman arm nut must be securely staked to the sector shaft for proper retention.

Remove the supports and lower the vehicle.

Side Cover and Gasket Replacement

Raise the vehicle.

Remove the pitman shaft adjusting screw locknut.

Remove the side cover attaching bolts.

Turn the pitman shaft adjusting screw clockwise to remove the cover from the screw.

Inspect the condition of the gear lubricant. If contaminated and full of metal particles, remove and overhaul the gear.

Coat the replacement side cover gasket with chassis lubricant and position the gasket on the replacement side cover.

Slide the pitman shaft adjusting screw out of the T-slot in the pitman shaft. Do not lose the adjusting screw shim.

Thread the adjusting screw into the side cover to a depth of 2-3 threads. Turn the screw counterclockwise to start it into the cover.

Install the adjusting screw in the pitman shaft T-slot, align the bolt holes in the cover and gear housing, and turn the adjusting screw counterclockwise until the side cover seats against the housing.

Install and tighten the side cover attaching bolts with 41 N·m (30 ft-lbs) torque.

Install the pitman shaft adjusting screw locknut finger-tight only.

Adjust the worm bearing preload and pitman shaft overcenter drag torque.

Check and correct the gear lubricant level as necessary.

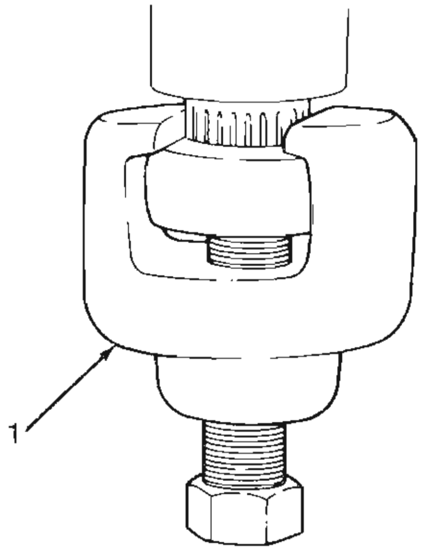
Lower the vehicle.

STEERING GEAR REMOVAL

Remove the intermediate shaft-to-wormshaft coupling clamp bolt and disconnect the intermediate shaft.

Remove the pitman arm nut and lockwasher.

Remove the pitman arm nut; mark the arm and shaft for reference; and, remove the pitman arm using Tool J-6632-01 (1).



84769

Raise the left side of the vehicle slightly to relieve the tension on the left front spring and place the support stand under the frame and remove the crossmember cover, if equipped.

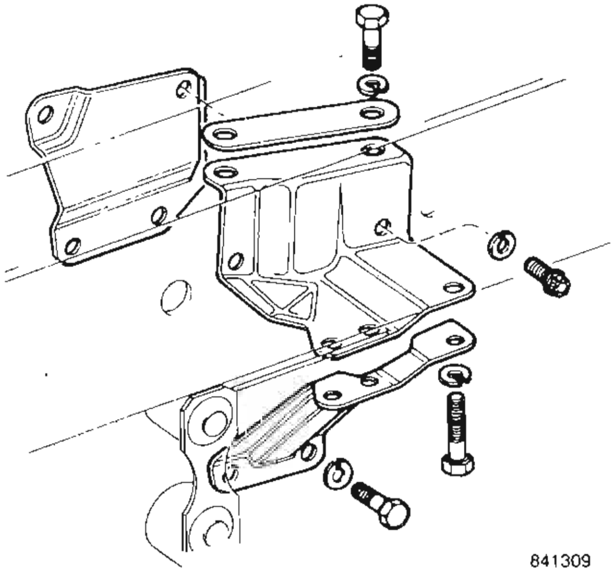
Remove the bolts attaching the steering gear lower bracket to the frame.

Remove the bolts attaching the steering gear upper bracket to the frame rail and remove the gear.

Remove the Torx Head upper bracket bolt using a 22.86 cm (9 in) extension and Torx Bit External Socket Tool J-25359-21.

Remove the remaining bolts attaching the upper bracket to tie plate and lower bracket to the steering gear and remove the brackets from the gear.

Remove the gear retaining bolts, then remove the steering gear.



841309

STEERING GEAR INSTALLATION

NOTE: Proper tension of the steering gear is important. Some of the following steps in gear installation require the application of Loctite 271 or a similar material to the attaching bolt threads. Wherever indicated, use Loctite 271 Adhesive/ Sealant, or an equivalent. Before applying this material, first clean all the bolt threads thoroughly to remove dirt and grease and apply the material to the bolt threads no more than five minutes before installation.

Apply Loctite 271, or an equivalent, to all the steering gear mounting bracket attaching bolts.

SEE
I.S.
N
O
T
E
S

Position the tie plate and upper and lower mounting brackets on the steering gear and install the mounting bracket-to-gear attaching bolts. Tighten the hex-head bolts with 95 N·m (70 ft-lbs) torque. Tighten the torx head bolt with 75 N·m (55 ft-lbs) torque using Torx Head External Socket Tool J-25359-2I.

Apply Loctite 271, or an equivalent, to all the steering gear-to-frame and crossmember mounting bolts.

Align and engage the intermediate shaft coupling with the steering gear wormshaft splines.

Position the steering gear on the frame and install the remaining gear mounting bolts. Tighten the bolts with 75 N·m (55 ft-lbs) torque and install the crossmember cover, if equipped.

Install the intermediate shaft coupling clamp bolt and nut. Tighten the nut with 61 N·m (45 ft-lbs) torque.

Install the pitman arm on the pitman shaft and install the lockwasher and pitman arm nut. Tighten the nut with 251 N·m (185 ft-lbs) torque.

Remove the support stand and hydraulic jack.

NOTE: After the steering gear is installed, it may produce a slightly rough feel. To eliminate this roughness, turn the gear full left and right for 10 to 15 complete cycles.

SEE
I.S.
NOTES

STEERING GEAR DISASSEMBLY

Remove the steering gear from the vehicle.

Mount the steering gear in a vise on a mounting boss only.

Rotate the wormshaft stop-to-stop and count the total number of turns. Turn the wormshaft back 1/2 of the total number of turns to center the shaft and nut.

Remove the pitman shaft adjuster screw locknut, and then remove the side cover attaching bolts, cover, and gasket.

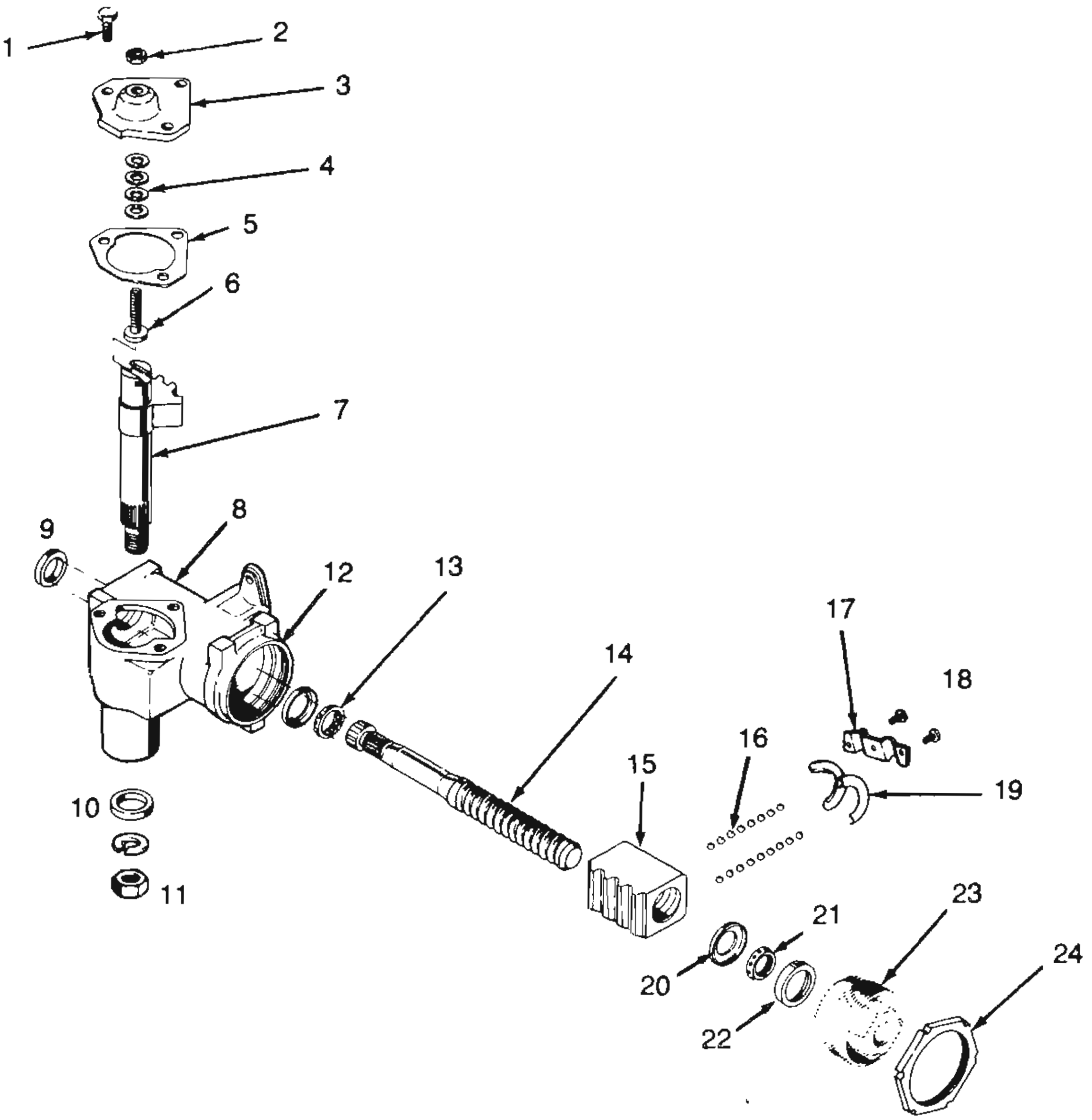
Slide the adjuster screw and shim out of the pitman shaft.

Retain the shim and screw for end play measurement during assembly.

Remove the pitman shaft, worm bearing adjuster locknut, and worm bearing adjuster.

Remove the wormshaft and the ball nut.

CAUTION: During service operations, do not allow the ball nut to rotate freely and bottom at either end of the wormshaft. This can damage the tangs at the ends of the ball guides.



1. Side Cover Bolts
2. Adjuster Screw Nut
3. Side Cover
4. Adjuster Screw Shims
5. Side Cover Gasket
6. Adjuster Screw
7. Pitman Shaft
8. Housing
9. Wormshaft Seal
10. Pitman Shaft Seal
11. Pitman Shaft Nut
12. Wormshaft Upper Bearing Cup
13. Wormshaft Upper Bearing
14. Wormshaft
15. Ball Nut
16. Balls
17. Ball Guide Clamp
18. Ball Guide Clamp Screws
19. Ball Guides
20. Lower Bearing Retainer
21. Wormshaft Lower Bearing
22. Wormshaft Lower Bearing Cup
23. Worm Bearing Adjuster
24. Worm Bearing Adjuster Locknut

84752A

Wormshaft and Ball Nut

Disassembly

Remove the upper bearing from the wormshaft.

Remove the ball guide clamp attaching screws and then remove the clamp and ball guides. Separate the guide halves and retain the ball bearings that remained in the guides during removal.

Remove the remaining ball bearings from the ball nut circuits by rotating the wormshaft back and forth until the bearings drop out onto a cloth.

NOTE: There are a total of 50 ball bearings in the ball nut with 25 in each circuit.

Remove the wormshaft from the ball nut.

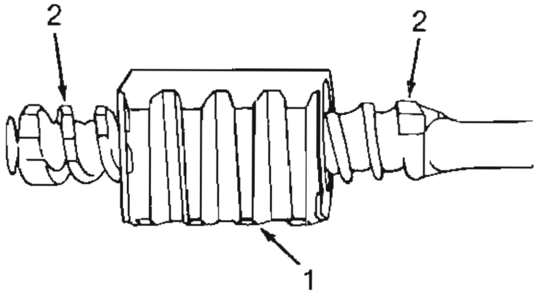
SEE I.S. NOTES

Cleaning and Inspection

Wash all the parts in solvent and dry them using clean cloths or compressed air. Inspect all the components for wear, scoring, cracks, nicks or surface pitting and also check the upper bearing and ball bearings for flat spots. If the upper bearing is damaged, the upper bearing cup must also be replaced.

Assembly

Position the ball nut with the ball guide holes facing upward and the deep side of the ball nut teeth facing downward (1). Install the wormshaft in the ball nut and thread the shaft into the nut until an equal number of shaft threads are visible at each end of the nut (2).



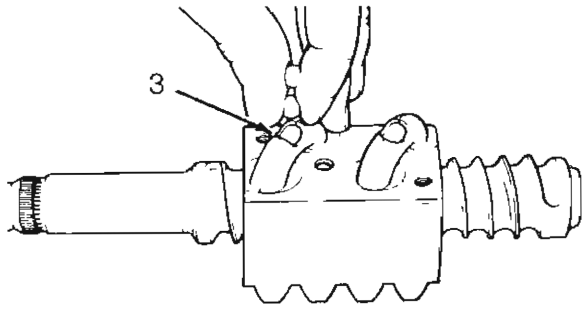
84753

CAUTION: The ball nut teeth are machined to a greater width and depth on one side. When assembling the wormshaft and ball nut, position the ball nut so the wider-deeper side of the teeth will face the housing side cover opening after installation.

Install one bearing in each ball guide hole. Move the wormshaft up/down and side-to-side until the bearings roll into the ball nut threads under the wormshaft and support the wormshaft.

Assemble and install the ball guides in the ball nut.

Divide the remaining 48 ball bearings into two groups and install 24 bearings in each ball nut circuit. Insert the bearings into the ball nut circuits through the holes in ball guides (3).



84754

NOTE: To ease ball bearing installation, rotate the wormshaft back and forth slightly while inserting the bearings.

Position the ball guide clamp on the ball nut and install the clamp attaching screws. Tighten to specification.

Lubricate the wormshaft threads with chassis lubricant and thread the shaft in and out of the ball nut to circulate the lubricant.

CAUTION: To avoid damaging the tangs on the ball guide ends, do not allow the wormshaft to bottom in either direction.

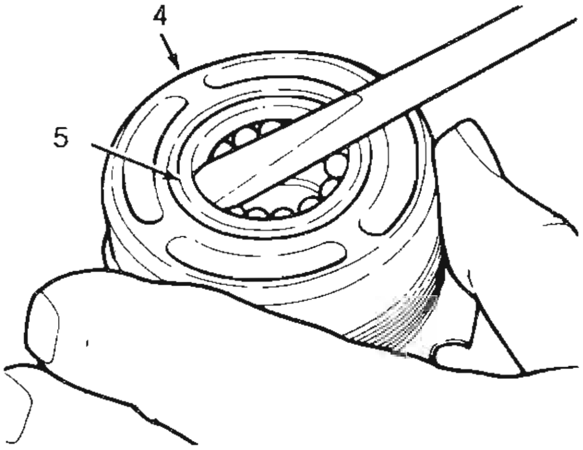
Lubricate the wormshaft upper bearing with chassis lubricant and install the bearing on the wormshaft.

Worm Bearing Adjuster

Disassembly

Remove the wormshaft lower bearing retainer (4) from the worm bearing adjuster. Pry the retainer out of the adjuster (5).

Remove the wormshaft lower bearing from the adjuster.



84755

Cleaning and Inspection

Clean the parts in solvent and dry using clean cloths only. Inspect all components for wear and damage and replace as necessary.

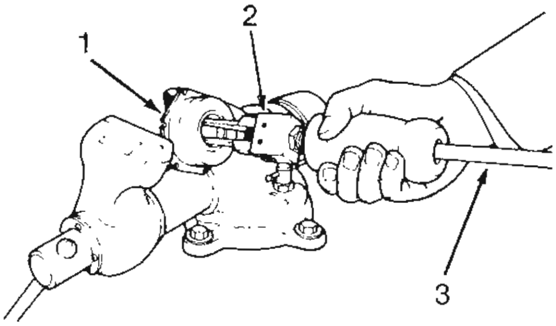
SEE I.S. NOTES

Assembly

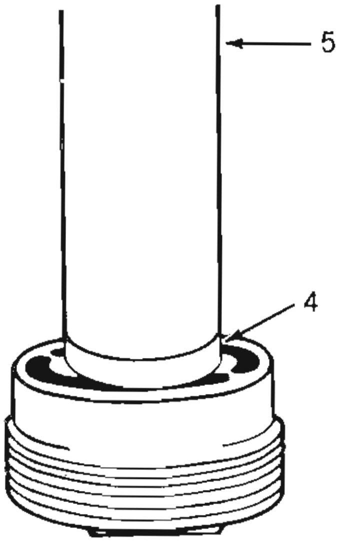
If lower bearing cup is to be replaced, remove the original cup and install a replacement as follows.

- install the spare locknut (1) on the worm bearing adjuster and clamp the adjuster in a vise; clamp the vise jaws on the locknut only
- assemble Puller Tool J-5822 (2) and Slide Hammer Tool J-2619-01 (3)
- position the puller legs under the bearing cup and tighten the puller screw to expand and hold the legs in position
- bump outward with a slide hammer weight to remove the bearing cup
- remove the adjuster from the vise and remove the spare locknut from the adjuster
- install the replacement bearing cup (4) in the adjuster using Tool J-5755 (5)

SEE I.S. NOTES



84756



84757

Lubricate the lower bearing and install the bearing into the adjuster.

Install the lower bearing retainer into the adjuster. If necessary, tap the retainer lightly with a plastic mallet to seat it.

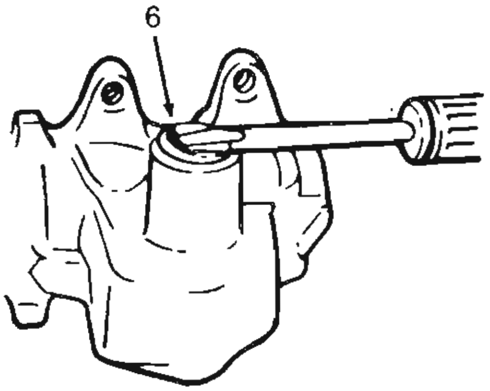
Steering Gear Housing and Pitman Shaft

Disassembly

Remove the pitman shaft and the wormshaft seals from the housing.

Pry the seals from the housing (6).

Remove the adjuster screw and shim from the pitman shaft T-slot (if not removed previously). Retain the screw and shim for end play check.



84758

Cleaning and Inspection

Clean the housing and pitman shaft with solvent and dry using clean cloths or compressed air.

Inspect the housing for cracks, porosity, damaged threads and gasket surface scoring or distortion.

Inspect the pitman shaft bore contact surface and the sector teeth for wear, pitting, or other damage.

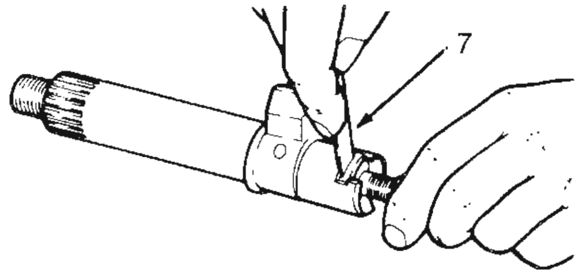
Insert the pitman shaft in the housing bore and check for shaft or housing bore wear. The shaft should exhibit a smooth, bind free fit and not display any visible side play when installed in the bore.

If the shaft appears loose and 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, replace the pitman shaft.

Measure adjuster screw fit and end play in the pitman shaft T-slot. When installed, the screw must rotate freely and not bind in any position.

Measure end play by inserting a feeler gauge (7) between the screw head and the T-slot surface.

End play must not exceed 0.05 mm (0.002 in). If the end play exceeds the specified limit, select and install a replacement shim that will provide the specified clearance.



84759

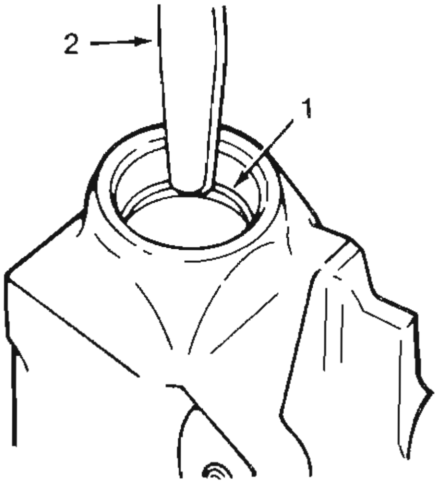
Inspect the wormshaft upper bearing and bearing cup for wear, looseness, flat spots, pitting, cracks, or other damage. If either the bearing or bearing cup is damaged, both parts must be replaced.

If the cup is loose in the housing, trial fit a replacement cup. If the replacement cup is also loose, replace the housing. If the replacement cup fits properly, replace only the bearing cup.

SEE I.S. NOTES

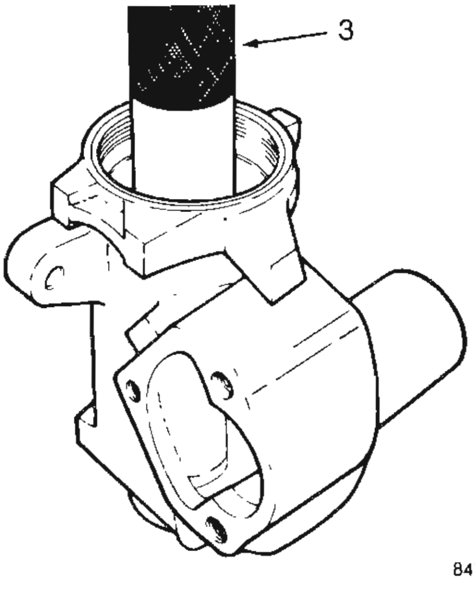
Assembly

If the wormshaft upper bearing cup (1) is to be replaced, remove the original cup using a hammer and a brass punch (2).



84760

Install a replacement bearing cup using Installer Tool J-5755 (3).



84761

NOTE: Do not install the wormshaft or pitman shaft seals at this time.

STEERING GEAR ASSEMBLY

Lubricate all of the components with chassis lubricant.

Place the gear housing in a vise. Clamp the jaws onto the housing mounting bosses only.

Install the wormshaft and ball nut into the housing.

CAUTION: Be sure the ball nut is installed with the deep side of the ball nut teeth facing the side cover opening.

Install the worm bearing adjuster into the housing and tighten the adjuster only enough to remove the wormshaft end play.

Install the locknut on the worm bearing adjuster but do not tighten the locknut at this time.

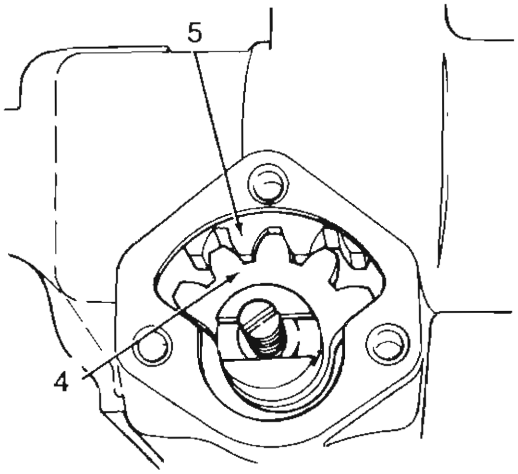
Pack the steering gear housing with as much chassis lubricant as possible.

NOTE: In order to pack the maximum amount of lubricant into the housing, the ball nut must be moved 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.

SEE I.S. NOTES

Lubricate the pitman shaft (4) with a chassis lubricant and install the shaft into the housing. Engage the center tooth of the shaft into the center groove of the ball nut (5).



84762

Coat the replacement side cover gasket with chassis lubricant and position the gasket on the housing side cover opening.

Install the end play shim onto the adjuster screw and thread the screw into the side cover to a depth of 2-3 threads.

Slide the adjuster screw into the pitman shaft T-slot and turn the screw counterclockwise to thread it into the cover. Stop turning the screw when the side cover almost contacts the gasket.

Install the cover attaching bolts finger-tight only. Then tighten the adjuster screw until it bottoms and back off the screw 1/2 turn.

Tighten the side cover bolts to the specified torque.

CAUTION: Some type of protective wrap must be used during seal installation. If the seals are installed over exposed shaft splines or threads, the seal lips could be cut or distorted resulting in leakage after assembly.

Install the pitman shaft and wormshaft seals as follows.

- wrap 0.1 mm (0.005-in) thick shim stock (or a single layer of thinnest tape available) around the shaft splines and threads to serve as a seal protector when the seals are installed
- lubricate the seals with a chassis lubricant; start the seals into the housing seal seats by hand; complete the seal installation by tapping the seals into place using a plastic mallet; be sure each seal is fully seated in the housing

Check the gear operation. With adjuster screw backed off, the wormshaft should rotate freely and not bind in either direction.

Also check for seal leaks. If the gear binds, repair as necessary and recheck the operation. If seals leak, replace them and recheck operation.

SPECIAL ADJUSTMENTS (ON BENCH)

The recirculating ball gear requires two adjustments.

- worm bearing preload
- pitman shaft overcenter drag torque

SEE I.S. NOTES

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 and improper steering response. Always adjust worm bearing preload first and pitman shaft overcenter drag torque last.

Worm Bearing Preload Adjustment

Tighten the worm bearing adjuster until it bottoms, then back off the adjuster 1/4 turn.

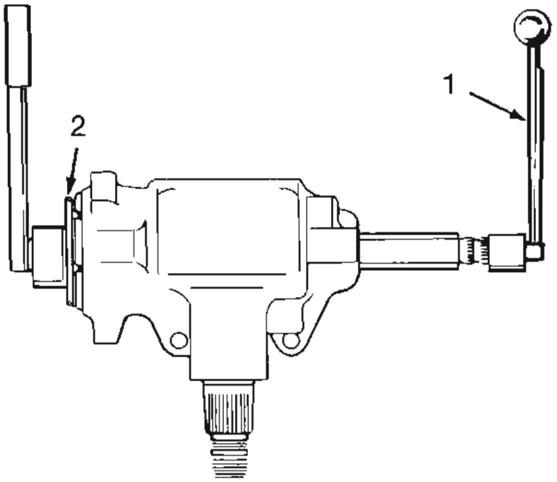
Install the socket and Torque Wrench Tool J-7754-01 (1) on the splined end of the wormshaft.

CAUTION: The preload adjustment must be made with the wormshaft turned back no more than 1/2 turn from either the right or left turn stop positions.

SEE I.S. NOTES

Rotate the wormshaft clockwise to the stop; then back off the shaft 1/2 turn.

Tighten the worm bearing adjuster (2) until the torque required to rotate the wormshaft is 0.6-0.9 N·m (5-8 in-lbs).



84763

Tighten the worm bearing adjuster locknut.

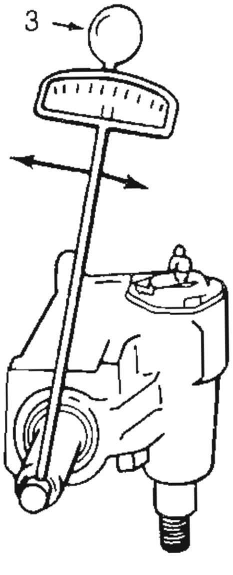
Recheck wormshaft rotating torque and re-adjust, if necessary. Record the worm bearing preload torque reading.

Pitman Shaft Overcenter Drag Torque Adjustment

Rotate the wormshaft from stop-to-stop and count the total number of turns. Turn the wormshaft back 1/2 the total number of turns to place ball nut and pitman shaft in centered position.

Loosen the adjuster screw locknut.

Install the socket and Torque Wrench Tool J-7754-01 (3) on pitman shaft splines and tighten the pitman shaft adjuster screw (while rotating shaft back and forth overcenter) until torque required to rotate the shaft overcenter equals the worm bearing preload setting.



84764

CAUTION: The total amount of overcenter drag torque (worm bearing preload setting plus the additional 0.5-1 N·m (4-10 in-lbs) torque) must not exceed combined total of 2 N·m (16 in-lbs) torque.

Rotate the shaft overcenter and continue tightening the adjuster screw until the drag torque is increased by an additional 0.5-1 N·m (4-10 in-lbs) torque but do not exceed a total of 2 N·m (16 in-lbs) torque.

Hold the adjuster screw in position and tighten the adjuster screw locknut with 31 N·m (23 ft-lbs) torque. Do not allow the screw to turn when tightening the locknut.

NOTE: If the adjuster screw is allowed to turn when the locknut is tightened, the entire drag torque adjustment procedure will have to be performed again.

Recheck the overcenter drag torque and re-adjust, if necessary.

SEE I.S. NOTES

GENERAL

The power steering system consists of a power steering gear, hydraulic pump, and interconnecting hoses. The system fluid supply is contained in a reservoir mounted on the pump. Fluid from the pump is supplied to the gear through the interconnecting pressure and return hoses. The pump is operated by a drive belt mounted on pulleys attached to the pump shaft and engine crankshaft.

CJ and Scrambler models use a constant ratio gear with a 17.5:1 steering ratio.

A vane-type power steering pump with a combination flow control/relief valve is used on all models. The valve is calibrated to open at 7 584 kPa (1100 psi).

The power steering gear is designed to operate manually if a system malfunction should ever occur. This feature provides the driver with continued steering control of the vehicle. In this condition, the like a manual steering gear; hydraulic fluid is bypassed through the gear valve body to allow manual operation.

NOTE: The power steering gear and pump form a closed system. Contaminants or foreign material must not be allowed to enter the system at any point. If either the gear or pump become contaminated, or incur damage extensive enough to produce debris, both components must be disassembled, cleaned and serviced.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-4245	Snap Ring Pliers		■
J-6217	Connector Seat Installer		■
J-6221	Adjuster Plug Bearing Remover and Installer		■
J-6222	Adjuster Plug Seal Protector		■
J-6632-01	Pitman Arm Puller		■
J-7624	Spanner Wrench		■
J-7754	Torque Wrench (0-25 in-lbs)		■
J-8092	Handle		■
J-8642	Shaft Seal Protector		■
J-21551	Pitman Shaft Bearing Remover and Installer		■
J-21552	Rack Piston Arbor		■
J-21553	Pitman Shaft Seal Installer		■
J-21554	Adjuster Plug Seal Installer		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Adjuster Plug Locknut	115 N·m (85 ft-lbs)	102-129 N·m (75-95 ft-lbs)
Flexible Coupling-to-Stubshaft Clamp Bolt	61 N·m (45 ft-lbs)	54-68 N·m (40-50 ft-lbs)
Gear Mounting Bracket-to-Frame Bolts	75 N·m (55 ft-lbs)	68-88 N·m (50-65 ft-lbs)
Hose Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Intermediate Shaft Clamp Bolt/ Nut	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Mounting Bracket-to-Gear Bolts	95 N·m (70 ft-lbs)	81-108 N·m (60-80 ft-lbs)
Pitman Arm Nut*	251 N·m (185 ft-lbs)	230-285 N·m (170-210 ft-lbs)
Pitman Shaft Adjuster Screw Locknut	27 N·m (20 ft-lbs)	24-30 N·m (18-22 ft-lbs)
Return Guide Clamp Bolt	8 N·m (6 ft-lbs)	5-14 N·m (4-10 ft-lbs)
Rack Piston End Plug	102 N·m (75 ft-lbs)	98-104 N·m (72-77 ft-lbs)
Side Cover Bolts	54 N·m (40 ft-lbs)	41-61 N·m (30-45 ft-lbs)

***CAUTION:** The pitman arm nut must be securly staked to the pitman shaft threads in one place for proper retention.

SEE I.S. NOTES

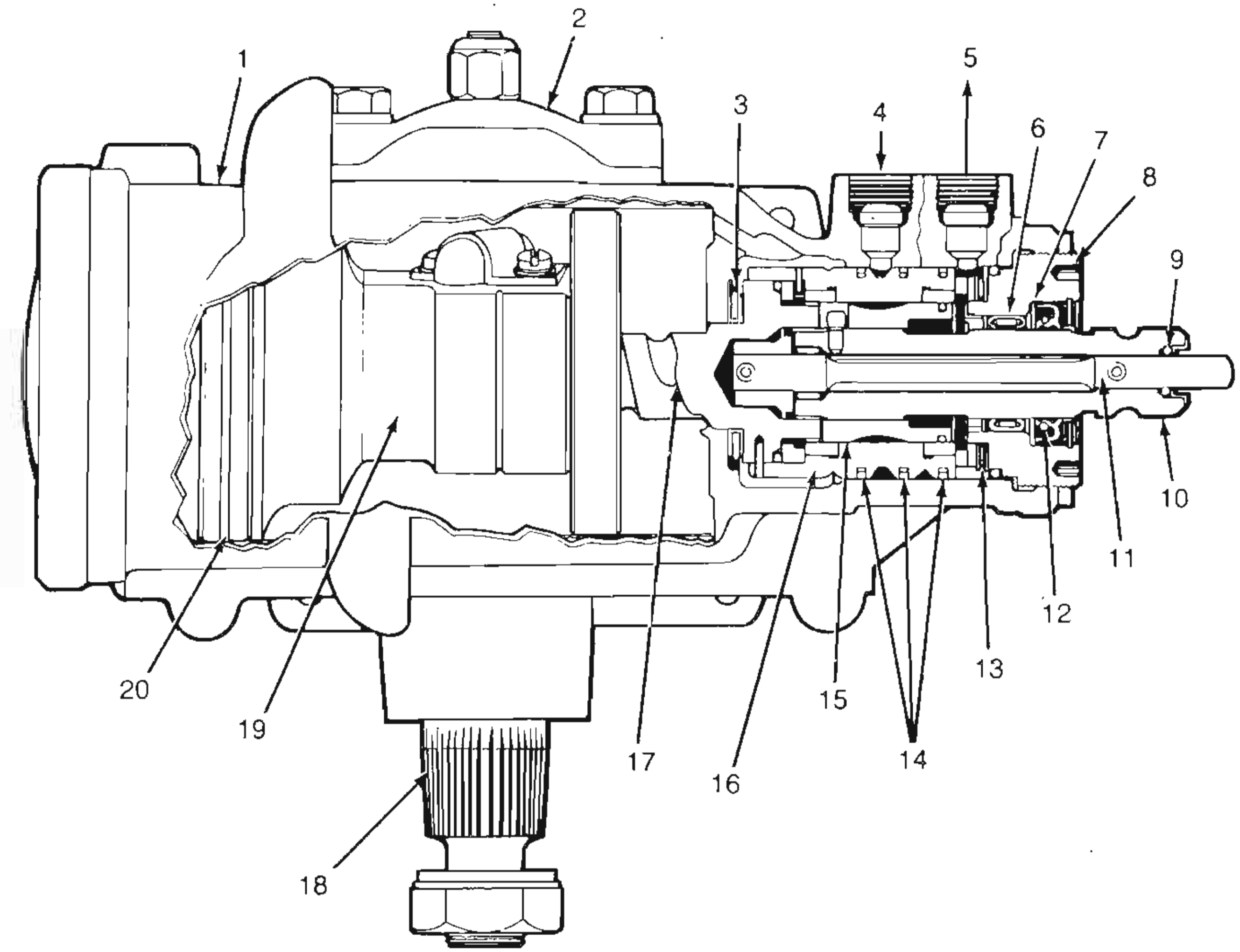
SPECIFICATIONS

Power Steering Gear Specifications

Steering Gear Type	Recirculating ball with hydraulic assist.
Steering Gear Ratio	17.5:1
Steering Gear Hydraulic Fluid	Use AMC Power Steering Fluid, Dexron, or equivalent.
Steering Gear 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	4 to 10 in.-lbs. (0.5-1 N·m) drag torque. Refer to Steering Gear Adjustment.
Pitman Shaft Overcenter drag torque:	
New Gear (less than 400 miles)	4 to 8 in.-lbs. (0.5-1 N·m) in addition to worm bearing preload but not to exceed combined total of 18 in.-lbs. (2 N·m)
Used Gear (over 400 miles)	4 to 5 in.-lbs. (0.5 N·m) in addition to worm bearing preload but not to exceed combined total of 14 in.-lbs. (2 N·m)

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.

84681



1. Gear Housing
2. Side Cover
3. Lower Thrust Bearing and Races
4. Inlet Port
5. Outlet Port
6. Stub Shaft Bearing
7. Adjuster Plug Seal
8. Adjuster Plug
9. Torsion Bar Seal
10. Stub Shaft
11. Torsion Bar
12. Stub Shaft Seal
13. Upper Thrust Bearing
14. Valve Body Seal Rings and Backup O-Rings
15. Spool Valve
16. Valve Body
17. Worm Shaft
18. Pitman Shaft
19. Rack Piston
20. Rack Piston Seal Ring

840349

SERVICE DIAGNOSIS

When diagnosing suspected power steering system malfunctions, refer to the Service Diagnosis charts in this section for probable causes and indicated repair procedures.

Steering problems are often the result of problems not related to the steering gear or pump. Those areas of the steering system which can be easily checked and quickly corrected without disassembly and overhaul of any major components should be inspected first.

Conditions such as hard or loose steering, road shock or vibrations are not always due to the steering gear or pump, but often related to such factors as low tire pressure or front end alignment.

To avoid ineffective or unnecessary repair, do not attempt to correct a malfunction until an accurate diagnosis has been made. Utilize the diagnosis charts, hydraulic pressure test and leak diagnosis procedures before servicing the gear or pump.

SEE I.S. NOTES

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 relationshipbetween this noise and performance of the steering. Hiss may he 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.	(1) Check gear-to-frame mounting screws. Tighten screws to 88 N·m (65 foot pounds) torque.
	(2) Steering linkage looseness.	(2) Check linkage pivot points for wear. Replace if necessary.
	(3) Pressure hose touching other parts of car.	(3) Adjust hose position. Do not bend tubing by hand.
	(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.	(4) Adjust to specifications.
	(5) Loose pitman arm.	(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.	(1) Inflate to specified pressure.
	(2) Lack of lubrication in linkage and ball joints.	(2) Lube linkage and ball joints.
	(3) Lower coupling flange rubbing against steering gear adjuster plug.	(3) Loosen pinch bolt and assemble properly.
	(4) Steering gear to column misalignment.	(4) Align steering column.

SEE I.S. NOTES

Service Diagnosis (continued)

Condition	Possible Cause	Correction
POOR RETURN OF STEERING WHEEL TO CENTER (Continued)	(5) Improper front wheel alignment.	(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) Steering linkage binding.	(6) Replace pivots.
	(7) Ball joints binding.	(7) Replace ball joints.
	(8) Steering wheel rubbing against housing.	(8) Align housing.
	(9) Tight or frozen steering shaft bearings.	(9) Replace bearings.
	(10) Sticking or plugged valve spool.	(10) Remove and clean or replace valve.
	(11) Steering gear adjustments over specifications.	(11) Check adjustment with gear out of car. Adjust as required.
	(12) Kink in return hose.	(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.	(1) Adjust to specifications.
	(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.	(2) Replace valve.
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level.	(1) Add power steering fluid as required.
	(2) Pump belt slipping.	(2) Tighten or replace belt.
	(3) High internal leakage.	(3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level.	(1) Fill as required.
	(2) Loose pump belt.	(2) Adjust tension to specification.
	(3) Steering linkage hitting engine oil pan at full turn.	(3) Correct clearance.
	(4) Insufficient pump pressure.	(4) Check pump pressure. (See pressure test). Replace relief valve if defective.

SEE I.S. NOTES

Service Diagnosis (continued)

Condition	Possible Cause	Correction
	(5) Pump flow control valve sticking.	(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.
	(2) Steering gear loose on frame.	(2) Tighten attaching screws to specified torque.
	(3) Steering linkage joints worn enough to be loose.	(3) Replace loose pivots.
	(4) Worn poppet valve.	(4) Replace poppet valve.
	(5) Loose thrust bearing preload adjustment.	(5) Adjust to specification with gear out of vehicle.
	(6) Excessive overcenter lash.	(6) Adjust to specification with gear out of car.
HARD STEERING OR LACK OF ASSIST	(1) Loose pump belt.	(1) Adjust belt tension to specification.
	(2) Low oil level. **NOTE:** Low oil level will also result in excessive pump noise.	(2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors.
NOTE: IF CHECKS (1) THROUGH (5) DO NOT REVEAL CAUSE OF HARD STEERING, REFER TO PRESSURE TEST	(3) Steering gear to column misalignment.	(3) Align steering column.
	(4) Lower coupling flange rubbing against steering gear adjuster plug.	(4) Loosen pinch bolt and assemble properly.
	(5) Tires not properly inflated.	(5) Inflate to recommended pressure.
	Further possible causes could be:	
	(6) Sticky flow control valve.	In order to diagnose conditions such as listed in (6), (7), (8), (9) a test of the entire power steering system is required.
	(7) Insufficient pump pressure output.	
	(8) Excessive internal pump leakage.	
	(9) Excessive internal gear leakage.	

SEE I.S. NOTES

84767

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.	(1) Remove burrs or dirt or replace. Flush system.
	(2) Pressure plate not flat against cam ring.	(2) Correct.
LOW PRESSURE DUE TO STEERING GEAR	(1) Pressure loss in cylinder due to worn piston ring or badly worn housing bore.	(1) Remove gear from car for disassembly and inspection of ring and housing bore.
	(2) Leakage at valve rings, valve body-to-worm seal.	(2) Remove gear from car for disassembly and replace seals.

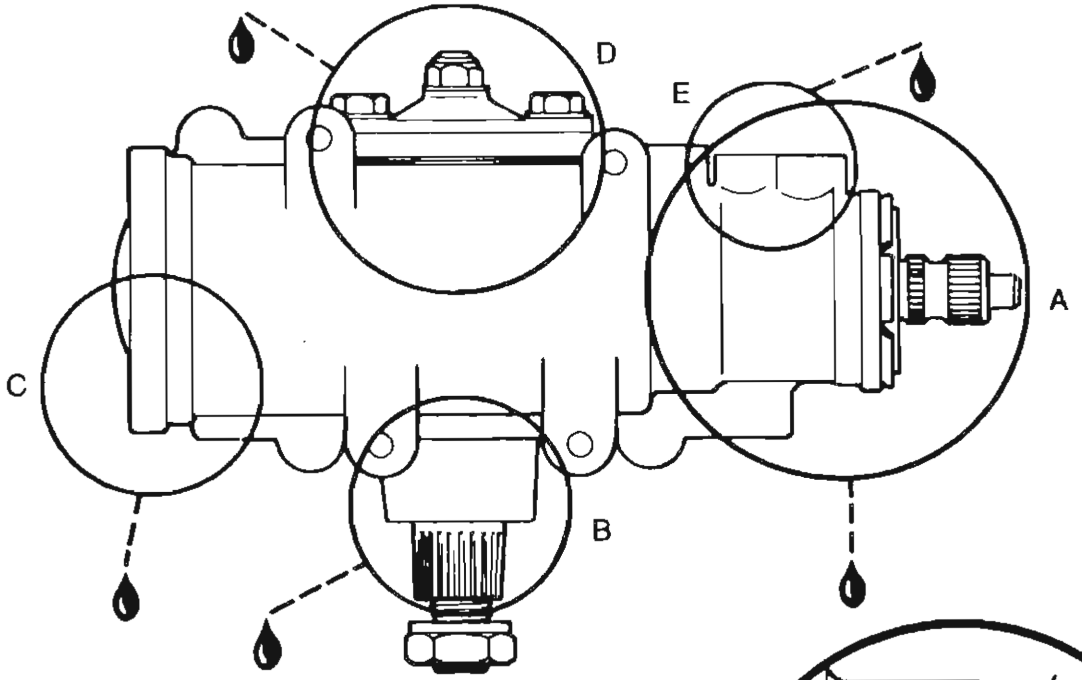
SEE I.S. NOTES

LEAK INSPECTION

The actual source of steering gear fluid leaks should always be determined before attempting repairs. Because an inaccurate diagnosis can result in ineffective repair, proper inspection procedure is necessary. The most common fluid leak sources are shown in the following diagrams.

SEE I.S. NOTES

PUMP LEAK POINTS AND CORRECTIVE ACTION



SEE
I.S.
NOTES

Leak Points

Pay particular attention to the exact source of leakage. Due to the proximity of the various seals, an incorrect diagnosis will result in ineffective repair.

Corrective Action

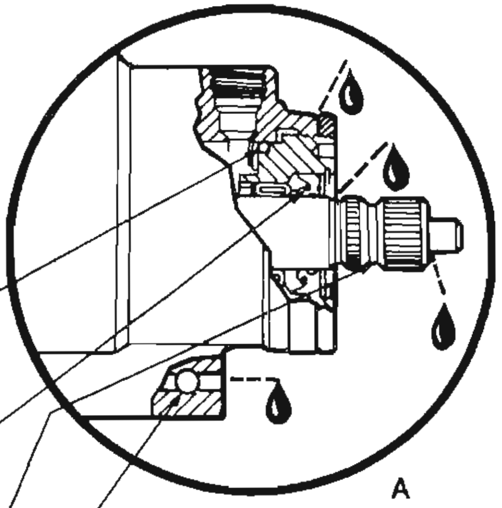
Replace the adjuster plug O-ring seal.

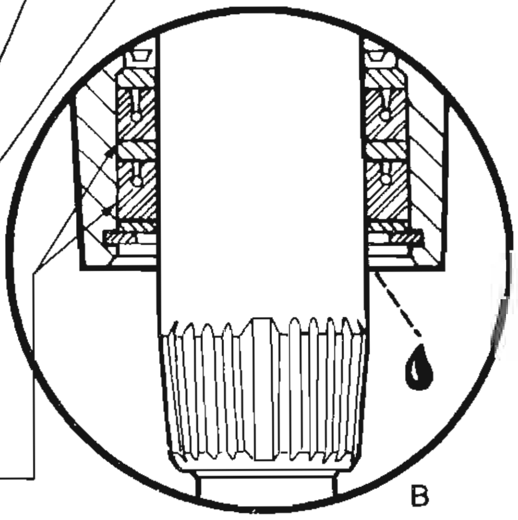
Replace the dust and stub shaft seals.

If seepage is observed between the torsion bar and stub shaft, do not attempt to repair. The rotary valve assembly must be replaced.

Seat the ball in the housing with a blunt-nosed punch. Spray the ball area with Loctite Solvent No. 75559, then dry with compressed air. Cover the ball with Loctite Adhesive Sealant 290. Let cure approximately 2 hours and reinstall the gear in the vehicle.

Replace both pitman shaft seals.





840350

PUMP LEAK POINTS AND CORRECTIVE ACTION

Corrective Action (cont.)

Replace the end plug O-ring seal.

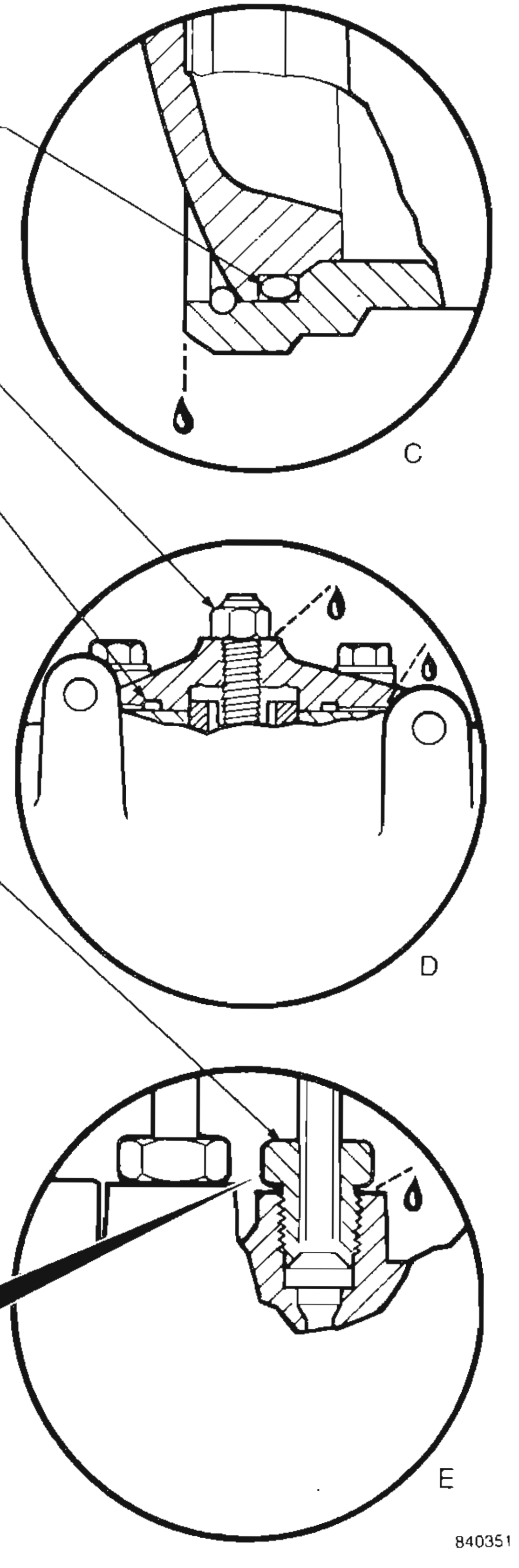
Tighten the nut with 48 N·m (35 ft-lbs). Replace the nut if the leak persists.

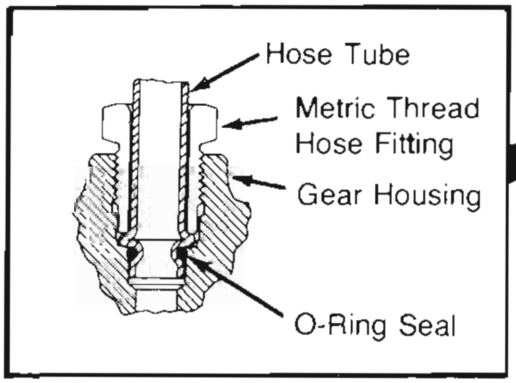
Tighten the side cover bolts with 68 N·m (50 ft-lbs) maximum. Replace the side cover seal if the leak persists. If side cover seal replacement is required, discard the bolts and install the replacement. Whenever the side cover is removed, install the bolts supplied in the overhaul kit.

If the leak continues after tightening the fitting nut to the specified torque:

a. Loosen the nut and rotate the tubing to reseat. Tighten the nut again and recheck. If the leak persists, replace the connector seats.
b. Remove the hose and check the sealing face for cracks. If the flare is cracked, replace the hose. If not cracked, replace the connector seats.
c. Replace the brass connector seats and reface hose flare. Check the threads in the housing and on the fitting nut. If the nut threads are damaged, replace the nut. If the housing threads are damaged, replace both the housing and the nut. Some steering gear units may have metric threaded pressure and return port fittings with O-ring seals.

SEE I.S. NOTES





Leak Inspection Procedure

Raise and support the front of the vehicle.

Clean the exterior surfaces of the gear, pump, hoses and fittings thoroughly.

Check and correct the fluid level in the pump reservoir.

NOTE: If the pump is overfilled, drain the excess fluid from the reservoir to the correct level before proceeding.

Check for aerated fluid (full of bubbles or milky in color). Aerated fluid can cause overflow from the reservoir and be mistaken for a leak.

Check and tighten all hose connections at the gear and pump. Do not exceed 34 N·m (25 ft-lbs) torque at any fitting.

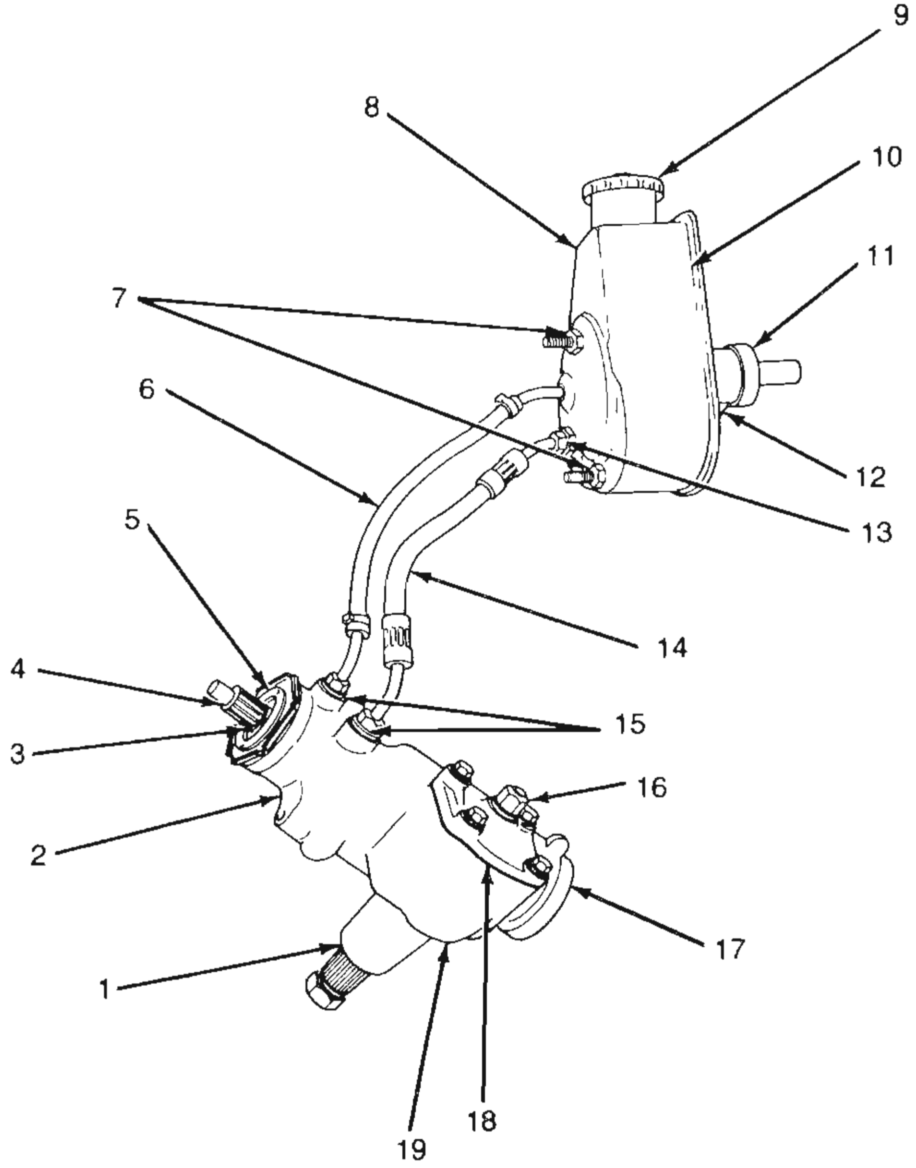
Start the engine. Have a helper turn the wheel left and right several times while locating the source of the leak. Contact the stops momentarily in each direction. Stop the engine when the source of the leak is identified.

Refer to the diagrams for a graphic representation of the various steering gear leak sources and necessary corrective action.

Steering gear leaks can develop in the following areas:

- hose fittings and hoses
- adjuster plug O-ring
- stub shaft seals
- steering gear housing core plug
- torsion bar seal (replace the valve body assembly if the seal leaks)
- side cover locknut and cover gasket
- pitman shaft seals
- end plug gasket
- cracked or porous gear housing

SEE
I.S.
NOTES



1. Pitman Shaft Seal
2. Housing Ball Plug
3. Stub Shaft Seal
4. Torsion Bar O-Ring
5. Adjuster Plug O-Ring
6. Return Hose & Clamps
7. Fitting O-Ring or Stud/Bolt O-Rings
8. Reservoir
9. Reservoir Cap
10. Reservoir O-Ring
11. Pump Shaft Seal
12. Pump Housing
13. Pressure Port Seat or O-Ring Seals
14. Pressure Hose
15. Pressure & Return Port Seats or O-Ring Seals
16. Adjusting Screw Lock Nut
17. End Cover O-Ring
18. Side Cover Seal
19. Gear Housing

840352

ON-VEHICLE SERVICE

Steering Gear Adjustment

Because of the complexity involved in adjusting worm bearing preload and pitman shaft overcenter drag torque plus the friction effect produced by hydraulic fluid, the power steering gear must be adjusted off the vehicle only. Refer to Worm Bearing Preload Pitman Shaft Overcenter Drag Torque Adjustment under Steering Gear Assembly and Adjustment.

Conditions such as shimmy and hard or loose steering may be caused by the following front suspension and steering components:

- steering shaft and coupling alignment
- front end alignment
- worn shock absorbers
- damaged wheel bearings
- wheel unbalance
- worn tires
- incorrect tire pressures

These items should be checked before attempting power steering system repairs.

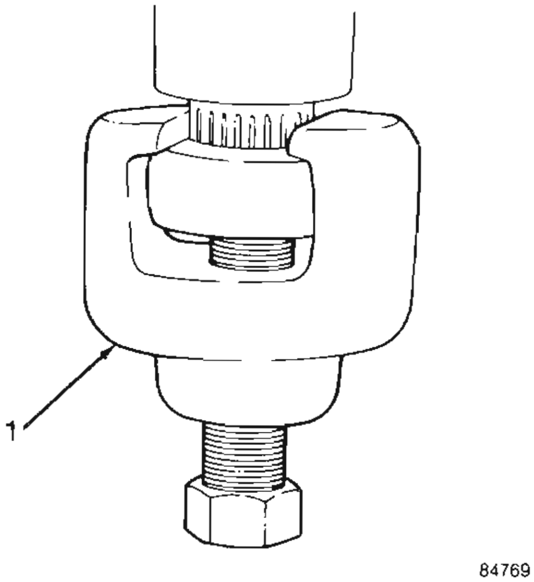
CAUTION: Use power steering fluid only in the power steering system.

Before performing any service operations, check and correct fluid level and condition , belt adjustment and pump pressure.

Pitman Shaft Seal Replacement

Raise and support the front end of the vehicle and place the front wheels in a straight ahead position.

Mark the pitman arm and shaft and remove the pitman arm using Puller J-6632-01 (1).



Position a drain pan under the steering gear.

Remove the seal retaining ring and the outer seal backup washer.

CAUTION: To prevent excessive oil loss and pump wear, do not hold the steering gear in the extreme turn position for more than one or two seconds at a time.

Start the engine and momentarily hold the steering wheel in the extreme left-turn position to actuate the spool valve. This builds pressure on the upper side of the piston and in the pitman shaft chamber to force the pitman shaft seals and the seal backup washers out of the gear.

SEE
I.S.
NOTES

Stop the engine and remove the seals and backup washers from the pitman shaft.

Inspect the outside diameter of the seals for damage to the rubber coverings. If the outside diameter appears scored, inspect the housing for burrs and remove the burrs before installing the replacement seal.

Inspect the pitman shaft seal surfaces for roughness or pitting. If pitted, replace the shaft.

Clean all dirt, rust and corrosion from the pitman shaft and seal areas using crocus cloth.

Lubricate the replacement shaft seals with power steering fluid.

SEE I.S. NOTES

Apply a single layer of thin tape to the pitman shaft splines to avoid damaging the seals.

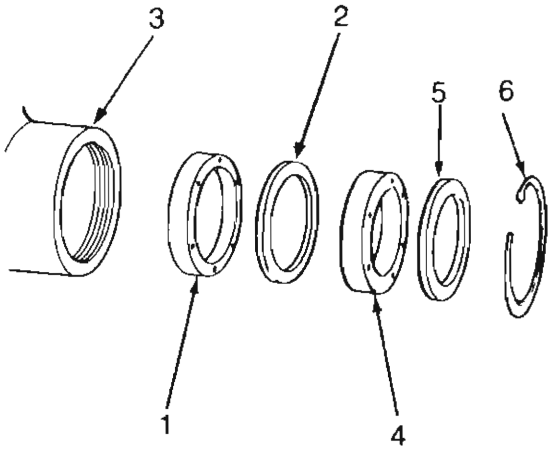
CAUTION: To ensure proper sealing, be sure the seals are seated separately in the bore.

Install the single lip seal (1) first, then the first backup washer (2).

Using Seal Installer Tool J-21553, install the seal and washer into the housing (3) only enough to provide clearance for the remaining seal (4) and backup washer (5).
Do not allow the seal to bottom on the end of the counterbore.

Install the double lip seal and second backup washer using Seal Installer Tool J-21553. Install the seal and backup washer into the housing only far enough to provide clearance for the retaining ring (6).

Install the retaining ring using Snap Ring Plier Tool J-4245. Be sure the ring is seated properly.



840356

Install the pitman arm, lockwasher and nut. Tighten the nut with 251 N·m (185 ft-lbs) torque. Stake the nut to the shaft.

Fill the pump reservoir to the correct level with power steering fluid.

Start the engine and allow the engine 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. Add power steering fluid as required.

Housing End Seal Replacement

Rotate the end cover retainer ring until the end of the ring is positioned over the hole in the side of the housing and force the ring from the groove by inserting a punch through the hole in the housing and unseating the ring.

CAUTION: Do not turn the wheel any farther than necessary or the ball bearings may 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 and turn the wheel back to the center position.

Remove and discard the end plug O-ring seal.

Lubricate the replacement seal with power steering fluid and install the seal on the end plug.

Install the end plug and the end plug retaining ring.

STEERING GEAR REMOVAL

Disconnect the hoses at the gear. Raise and secure the hoses above the pump fluid level to prevent excessive oil spillage and cap the ends of the hoses to prevent entry of dirt.

Remove the clamp bolt and nut attaching the intermediate shaft coupling to the steering gear stub shaft and disconnect the intermediate shaft.

Paint alignment marks on the pitman shaft and pitman arm shaft for reference. Remove the pitman arm using Puller Tool J-6632-01. Discard the pitman arm nut and lockwasher.

Position a drain pan under the steering gear.

Raise and support the left side of the vehicle to relieve tension on the left front spring.

Remove the three steering gear mounting bracket-to-frame bolts.

Remove the two upper steering gear mounting bracket -to-crossmember bolts and remove the steering gear and mounting bracket as an assembly.

Remove the mounting bracket bolts and remove the upper and lower mounting brackets from the gear.

STEERING GEAR INSTALLATION

Apply Loctite or equivalent material to all steering gear mounting bracket attaching bolts.

Position upper and lower mounting brackets on the steering gear and install the bracket attaching bolts. Tighten the bolts with 95 N·m (70 ft-lbs) torque.

Apply Loctite or equivalent material to the steering gear mounting bracket-to-frame and crossmember attaching bolts.

Align and connect the intermediate shaft coupling to the steering gear stub shaft.

Position the assembled steering gear and mounting brackets on the frame and crossmember and install the attaching bolts. Tighten the nuts with 75 N·m (55 ft-lbs) torque.

SEE I.S. NOTES

Remove the supports and lower vehicle.

Install the intermediate shaft coupling-to-steering gear stub shaft bolt and nut and tighten with 61 N·m (45 ft-lbs) torque.

Align and install the pitman arm on the pitman shaft using the reference marks made during removal.

Install a replacement pitman shaft lockwasher and nut and tighten the nut with 251 N·m (185 ft-lbs) torque. Stake the nut in two places to retain it.

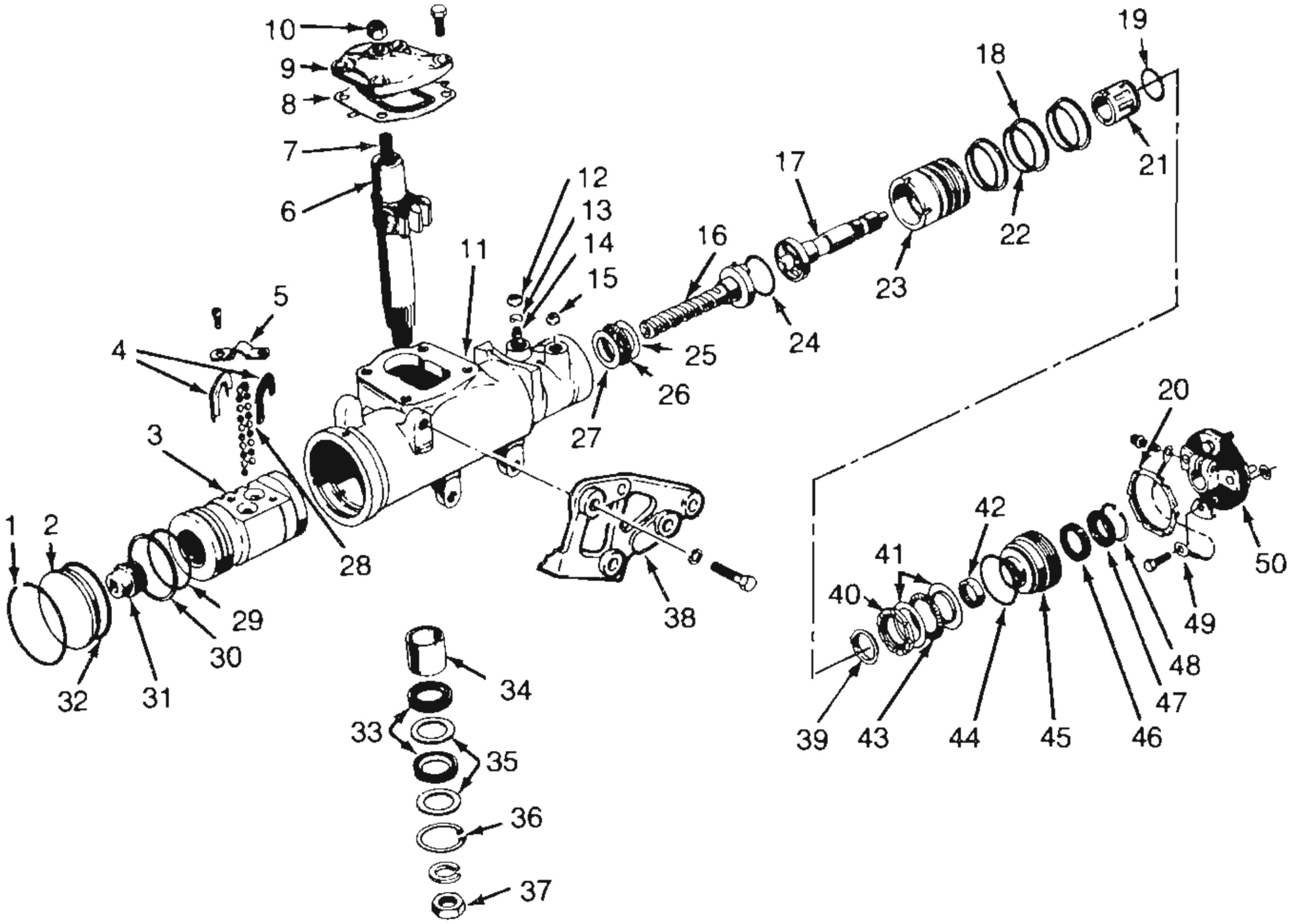
Connect the pressure and return hoses to the steering gear and tighten the hose fittings with 34 N·m (25 ft-lbs) torque.

SEE I.S. NOTES

Fill the pump reservoir with power steering fluid and bleed the air from the system as outlined in Fluid Level and Initial Operation.

STEERING GEAR DISASSEMBLY

CAUTION: Cleanliness is of the utmost importance 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. During disassembly/assembly operations, refer to the illustration for parts sequence and nomenclature. Use protective vise jaws at all times when mounting subassemblies in a vise. At assembly, lubricate all parts with power steering fluid except where noted otherwise.

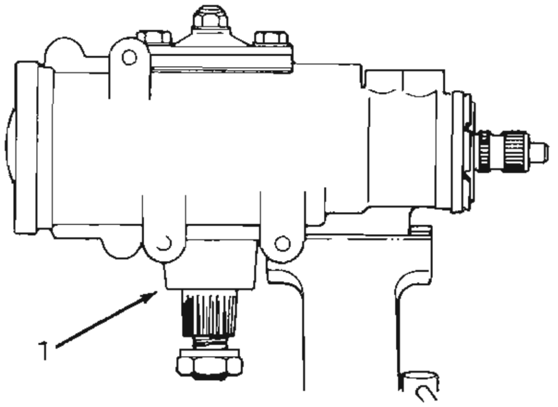


SEE I.S. NOTES

1. Retaining Ring
2. Housing End Plug
3. Rack-Piston
4. Ball Return Guide Halves
5. Clamp
6. Pitman Shaft
7. Adjusting Screw
8. Gasket
9. Side Cover
10. Lock Nut
11. Housing
12. Pressure Port Seat
13. Poppet Valve
14. Spring
15. Return Port Seat
16. Worm
17. Stub Shaft
18. Teflon Rings (3)
19. Damper O-Ring
20. Adjuster Plug Lock Nut
21. Valve Spool
22. Backup O-Rings (3)
23. Valve Body
24. O-Ring
25. Race
26. Thrust Bearing
27. Race
28. Ball Bearings (24)
29. Backup O-Ring
30. Piston Ring
31. Rack-Piston End Plug
32. O-Ring
33. Oil Seals
34. Needle Bearing
35. Washers
36. Retaining Ring
37. Pitman Arm Nut
38. Spacer
39. Bearing Retainer
40. Spacer
41. Races
42. Bearing
43. Thrust Bearing
44. O-Ring
45. Adjuster Plug
46. Oil Seal
47. Washer and Dust Seal
48. Retaining Ring
49. Ground Wire
50. Flexible Coupling

840357

Drain the fluid and mount the gear in a vise with the pitman shaft pointing downward (1). Use the unmachined housing boss as a mounting pad.

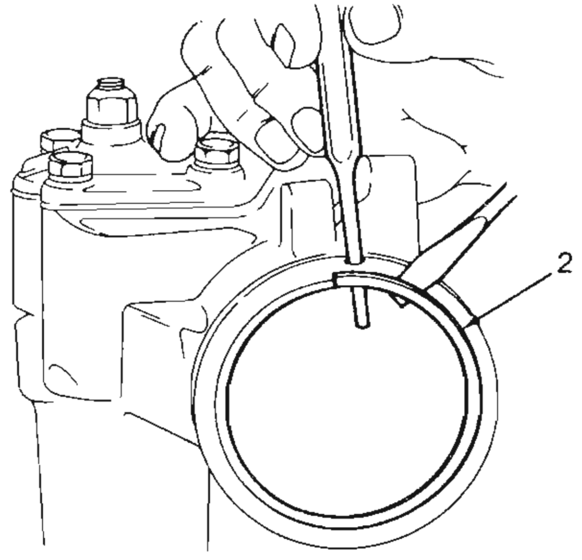


84771

SEE
I.S.
NOTES

Rotate the gear housing end plug retaining ring until one end is positioned over the hole in the housing.

Unseat one end of the ring using a punch and remove the ring (2).



84772

CAUTION: Do not rotate the stub shaft any further than necessary or the ball bearings will drop out of the circuits and cause the pitman shaft and rack piston teeth to disengage. If the teeth become disengaged, remove the side cover and pitman shaft assembly and engage the teeth.

Remove the housing end plug by rotating the stub shaft counterclockwise (using a 12-point deep socket and ratchet handle) until the rack piston forces the end plug out of the housing.

Remove the O-ring seal from the end plug. Discard the seal.

CAUTION: The end plug may break during removal if it is not unseated first by striking it with a plastic-tip hammer.

Turn the stub shaft clockwise 1/2 turn, and remove the rack piston end plug. Strike the plug sharply with a plastic-tip hammer and use a 13 mm (1/2 in) square drive socket handle to remove the plug. Do not use a square drive that is worn or rounded on the bottom corners.

Hold the pitman shaft adjuster screw with an Allen wrench to prevent the screw from turning and remove the adjuster screw locknut. Discard the locknut.

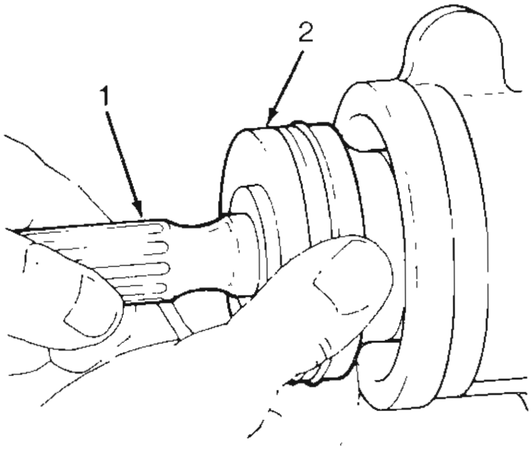
Remove the side cover bolts and lockwashers.

Remove the side cover. Rotate the pitman shaft adjuster screw using an Allen wrench until the side cover can be removed from the screw. Discard the side cover gasket.

Turn the stub shaft until the pitman shaft teeth are centered in the housing. Tap the end of the pitman shaft with a plastic-tip hammer and remove from the housing.

NOTE: Do not disassemble the pitman shaft component parts. They are serviced as an assembly only.

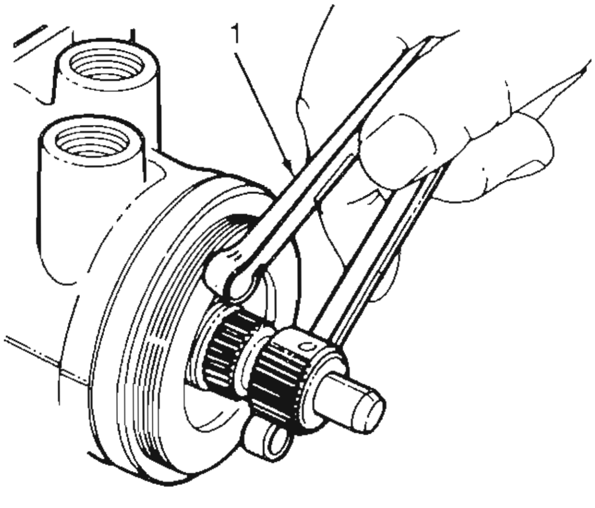
Insert Arbor Tool J-21552 (1) into the rack piston (2) until the tool stops against the end of the wormshaft. Grip the tool firmly, turn the stub shaft counterclockwise to force the rack piston onto the arbor tool, and remove the assembled tool and rack piston from the housing.



840359

Loosen the adjuster plug locknut using a brass drift and remove the locknut.

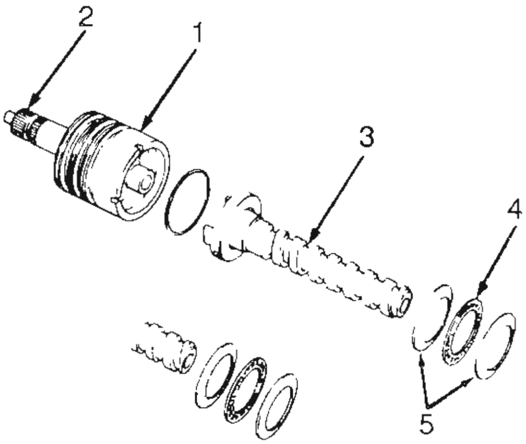
Remove the adjuster plug assembly using Spanner Tool J-7624 (1).



840360

Remove the valve body (1) assembly by pulling outward on the splined end of the stub shaft (2).

Remove the wormshaft (3) lower thrust bearing (4) and conical bearing races (5). Note the position of the races for assembly reference.



840361

SEE
I.S.
NOTES

SUBASSEMBLY OVERHAUL

Gear Housing

Disassembly

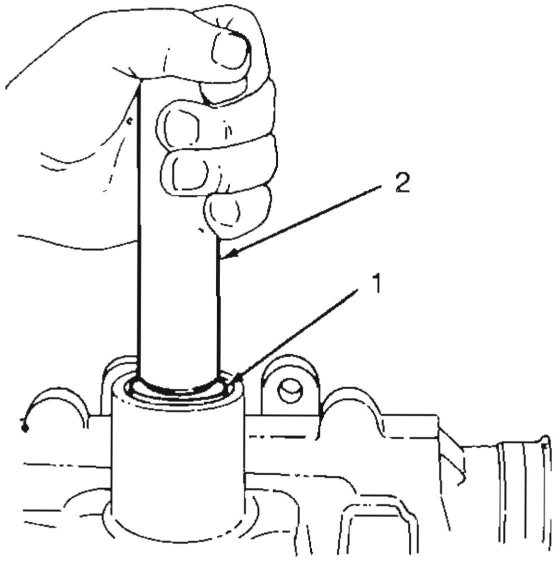
Remove the pitman shaft seal retaining ring using Snap Ring Pliers J-4245 and remove the backup washer.

Remove the pitman shaft seals. Insert a screwdriver between the inner seal and the housing shoulder to pry out the seals.

NOTE: If the inner seal if 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.

NOTE: When removing the bearing, drive the bearing out of the end of the pitman shaft bore. Do not attempt to drive the bearing out through the housing.

Remove the needle bearing from the housing bore using Remover/Installer Tool J-21551 (1) and Driver Handle J-8092 (2).



840362

Cleaning and Inspection

Clean all components throughly in solvent and dry them using compressed air or a lint free towel.

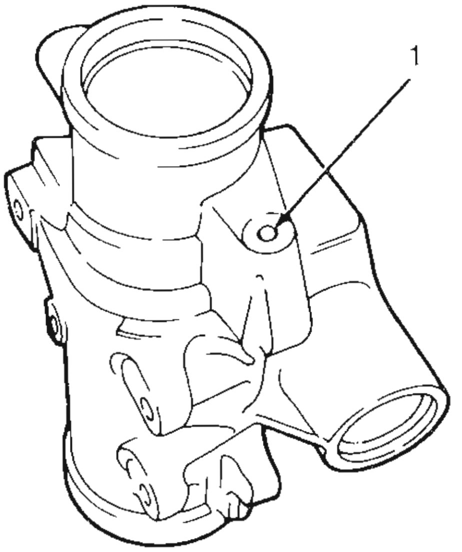
Inspect the housing bore. If it is badly scored or worn, replace the housing. However, slight scratches in the bore usually will not cause any problem at assembly.

Inspect the hose connector seats and poppet check valve. If they are deeply scored, cracked or worn, replace them as described in Hose Connector Seat Replacement.

Inspect the poppet check valve located under the pressure connector seat. Replace the valve if it is scored, cracked, chipped or deformed.

Inspect the ball plug (1) in the housing. If leakage past the ball occurred before disassembly or if it is raised above the housing surface, seat the ball in the housing using a punch; then spray the ball and housing with Loctite Solvent No. 7559, or an equivalent. Dry with compressed air and cover the ball and housing ball area with Loctite 290, or an equivalent sealer. Allow to cure for about two hours before installation.

Inspect the retaining ring grooves and seal surfaces. If they are chipped, scored, cracked or worn, replace the housing.



840363

Assembly

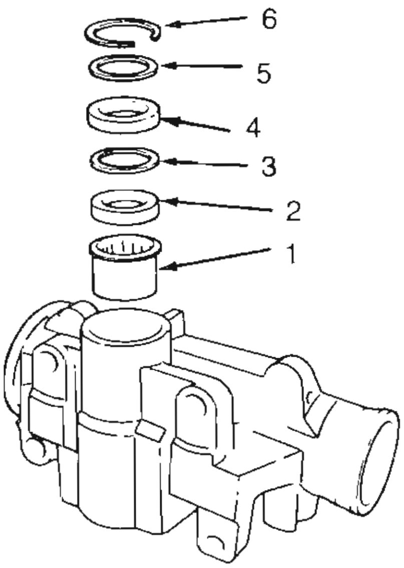
Clean the housing thoroughly in solvent.

Lubricate the housing bore, bearings, seals and washers with power steering fluid.

Install the needle bearing using Bearing Remover/Installer Tool J-21553 and Driver Handle J-8092. Install the bearing (1) in the housing bore until it is approximately 0.76 mm (0.030 in) below the shoulder in the housing bore.

CAUTION: Do not bottom the seal against the end of the housing counterbore.

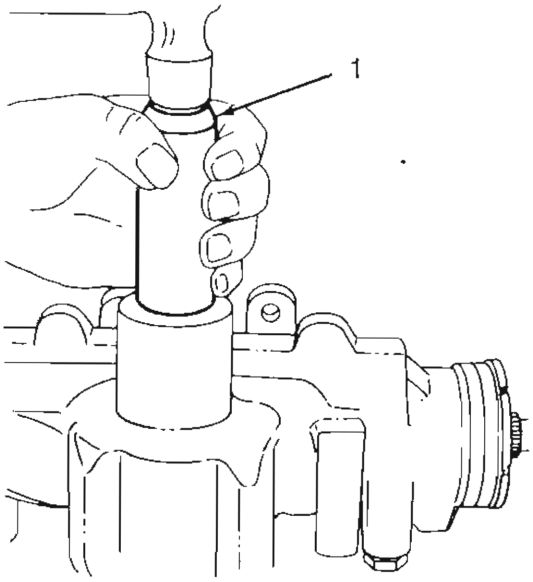
Insert the single lip seal (2) and backup washer (3) in the housing bore. Using Seal Installer Tool J-21553, install the seal and washer in the bore only far enough to provide clearance for the double lip seal (4), backup washer (5), and retaining ring (6).



840365

SEE
I.S.
NOTES

Install the double lip seal and second backup washer using Tool J-21553 (1). Install the seal and backup washer in the bore only far enough to allow clearance for the retaining ring.



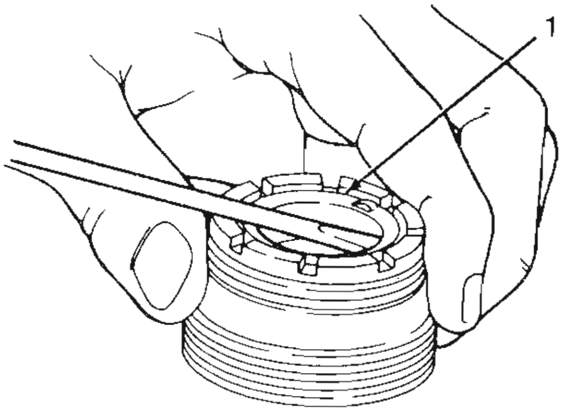
840366

Install the retaining ring. Be sure the ring is completely seated in the housing groove.

Adjuster Plug

Disassembly

Remove the thrust bearing retainer (1) using a screwdriver and discard the retainer. Do not damage the needle bearing bore.



84783

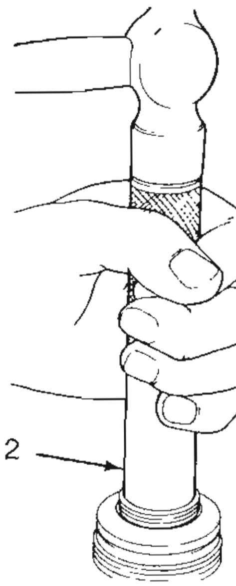
Remove the thrust bearing spacer, thrust bearing and bearing races.

Remove and discard the adjuster plug O-ring seal.

Remove the stub shaft seal retaining ring.

Remove and discard the stub shaft dust seal and oil seal.

Remove the needle bearing using Bearing Remover/Installer Tool J-6221 (2).



84784

Cleaning and Inspection

Clean the adjuster components with solvent and dry them using compressed air.

Inspect the adjuster plug components for wear, scoring, nicks, cuts or distortion. Replace any component that exhibits these conditions.

Assembly

Place the needle bearing on Remover/Installer Tool J-6221 with the bearing manufacturer's identification number facing the tool.

Position the bearing and tool in the bore and install the bearing in the plug until flush with the bottom surface of the stub shaft seal bore.

Lubricate the stub shaft seal and install the seal deep enough to provide clearance for the dust seal and retaining ring.

Lubricate the dust seal with petroleum jelly and install the seal in the adjuster plug with the seal rubber face outward.

Install the retaining snap ring. Be sure the ring is properly seated.

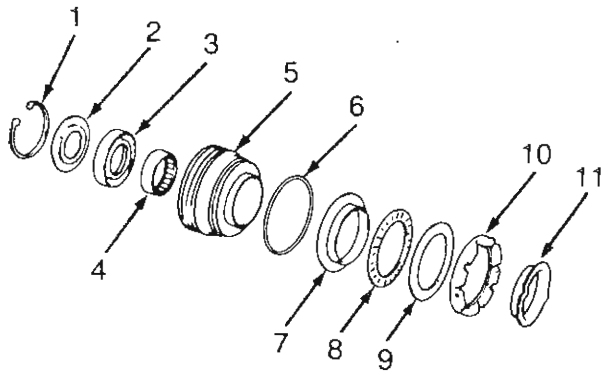
Lubricate the O-ring with petroleum jelly and install in the groove of the adjuster plug.

SEE I.S. NOTES

Install the large thrust washer, upper thrust bearing, small thrust washer and spacer in the plug.

Press the bearing retainer into the needle bearing bore using a brass or wooden drift.

NOTE: The radial location of the spacer notches are not important. However, do not damage the notches during installation.



1. Retaining Ring
2. Dust Seal
3. Oil Seal
4. Needle Bearing
5. Adjuster Plug
6. O-Ring
7. Large Thrust Washer
8. Upper Thrust Bearing
9. Small Thrust Washer
10. Spacer
11. Retainer

840368

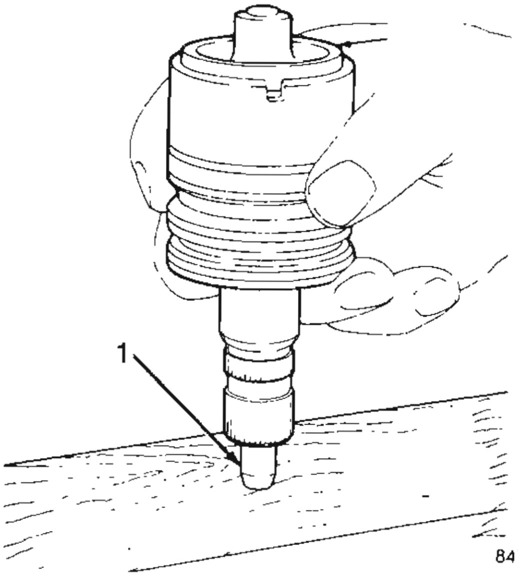
Valve Body and Stub Shaft

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 part 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.

Disassembly

Remove and discard the stub cap-to-wormshaft O-ring.

Hold the valve assembly in both hands with the stub shaft pointing downward and tap the end of the stub shaft lightly against a workbench (1) until the shaft cap separates from the valve body.

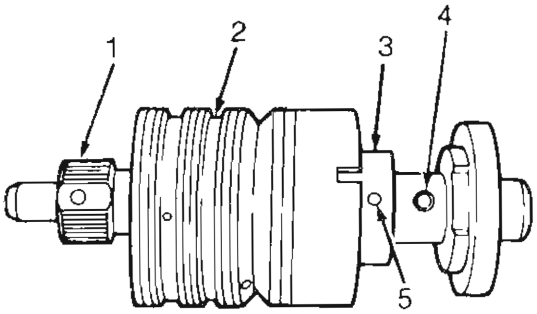


84786

CAUTION: Do not pull the shaft out too far or the spool valve (3) may become cocked in the valve body.

Pull outward on the cap end of the stub shaft (1) until it clears the valve body (2) by approximately 6.35 mm (1/4 in).

Carefully disengage the stub shaft locating pin (4) from the spool valve locating hole (5) and remove the stub shaft assembly.



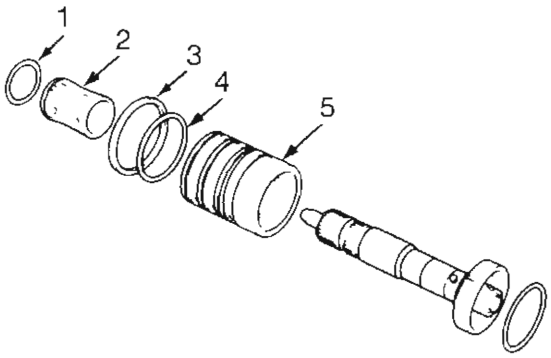
840369

Push the spool valve out the steering column end of the valve body while rotating the valve. If the valve becomes cocked, carefully realign the valve, then remove.

Remove the damper O-ring (1) from the spool valve (2).

Discard the O-ring.

Remove the teflon rings (3) and backup O-rings (4) (located under the teflon rings) from the valve body (5). To remove the rings, carefully cut them using a knife or diagonal pliers.



840370

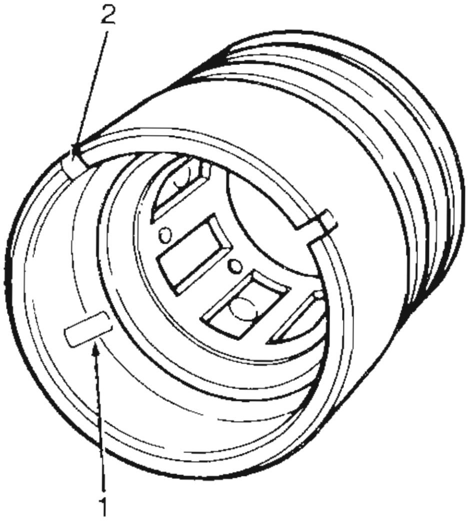
Cleaning and Inspection

Wash all parts in clean solvent and blow out all fluid passages with compressed air. If the spool valve locating pin (1) in the stub shaft or valve body is cracked, excessively worn or broken, replace the entire valve body assembly.

NOTE: Tiny flat spots on either side of the spool valve locating pin-head are normal.

If there are scores, nicks or burrs on the ground surfaces of the stub shaft that cannot be cleaned up with crocus cloth, replace the entire valve body assembly. Inspect the outside diameter of the spool valve and the inside diameter of the valve body for nicks, burrs or wear spots. If irregularities cannot be cleaned up with crocus cloth, replace the entire valve body assembly.

A slight polishing is normal on valve surfaces. If the small notch (2) in the skirt of the valve is excessively worn, replace the entire valve body assembly.



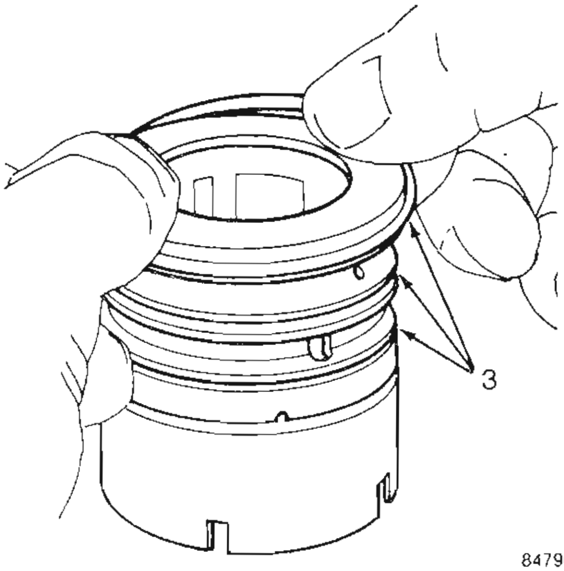
840371

Lubricate the spool valve with power steering fluid and check the fit of the spool valve in the valve body with the spool valve damper O-ring removed. If the spool valve does not rotate freely within the valve body, replace the entire valve body assembly.

Assembly

Lubricate the backup O-ring and teflon rings with power steering fluid.

Install the backup O-rings (3) in the valve body ring grooves and install the teflon rings over the O-rings. Take care to avoid damaging the teflon rings during installation.



84790

NOTE: The teflon rings may appear slightly distorted when installed; however, during operation the heat generated by the power steering fluid will cause them to straighten.

Lubricate the spool valve damper O-ring with petroleum jelly and install the O-ring in the spool valve groove.

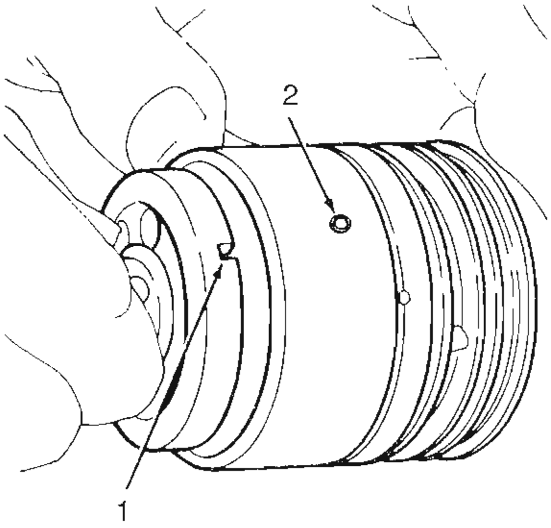
Lubricate the spool valve and valve body with power steering fluid and carefully insert the spool valve in the valve body.

Push the spool valve through the valve body until the stub shaft pin locating hole is visible from the opposite end of the valve body and the spool valve is flush with the notched end of the valve body.

Install the stub shaft assembly carefully into the spool valve until the stub shaft locating pin is aligned with the spool valve locating hole.

CAUTION: Make sure that the shaft cap notch is mated with the valve body pin before installing the valve body in the gear housing.

Align the notch (1) in the shaft cap with the locating pin (2) in the valve body and press the spool valve and stub shaft assembly into the valve body.



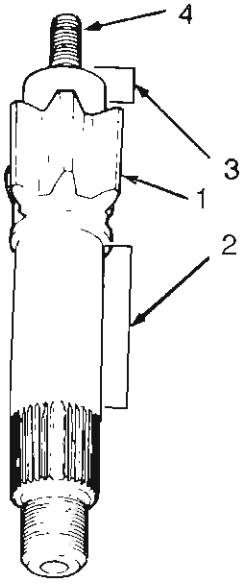
840373

Lubricate the stub shaft cap-to-wormshaft O-ring and install in the valve body.

Pitman Shaft and Side Cover

Inspection

Inspect the bearing surface in the side cover and inspect the pitman shaft sector teeth (1), bearing surfaces (2) and seal surfaces (3). Replace the cover or shaft if severely worn, scored or pitted. If the pitman shaft adjuster screw (4) is loose or worn, replace the pitman shaft assembly.



840374

Rack Piston – Wormshaft

Disassembly

Remove the wormshaft, lower thrust bearing and races from the rack piston.

Cut, remove and discard the seal and back up O-ring from the rack piston.

Remove the return guide clamp.

Place the assembly on clean paper and remove the ball return guides, Arbor Tool J-21552 and wormshaft, and ball bearings. Be sure all 24 ball bearings remain on the paper.

Remove the arbor tool from the wormshaft.

Inspection

Inspect the wormshaft, rack piston grooves and ball bearings for severe wear or scoring. If the wormshaft or rack piston must be replaced, they must be replaced as a matched assembly only.

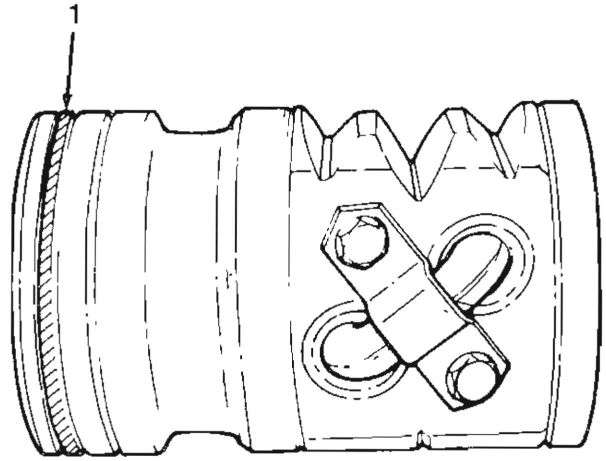
Inspect the ends of the ball return guides, lower thrust bearing, bearing races, wormshaft, rack piston teeth and outer surfaces, and the piston ring and grooves. Replace the complete assembly if any components are worn, scored or pitted.

Assembly

Clean and lubricate all components with power steering fluid.

Install the O-ring in the rack piston groove. Do not allow the O-ring to become twisted during installation.

Install the piston ring (1) over the O-ring.



840375

Install the wormshaft (1) completely into the rack piston.

Install the ball bearings (2) in the rack piston. Alternately install one black ball bearing followed by one silver ball bearing until a total of 18 ball bearings have been installed through the return guide hole nearest the rack piston ring.

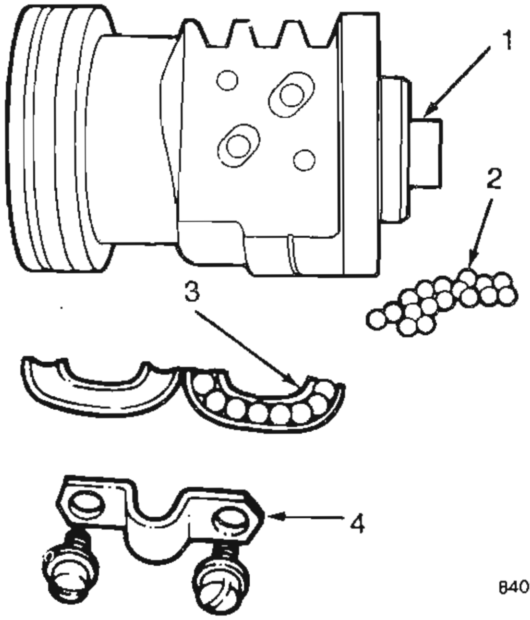
Rotate the wormshaft counterclockwise (viewed from the steering shaft end), to feed the ball bearings into the circuit. After installing each ball bearing, press it downward to provide room for the following ball bearing.

NOTE: The wormshaft will back out of the rack piston as it is rotated and the ball bearings are installed. Do not allow the wormshaft to back out completely.

SEE I.S. NOTES

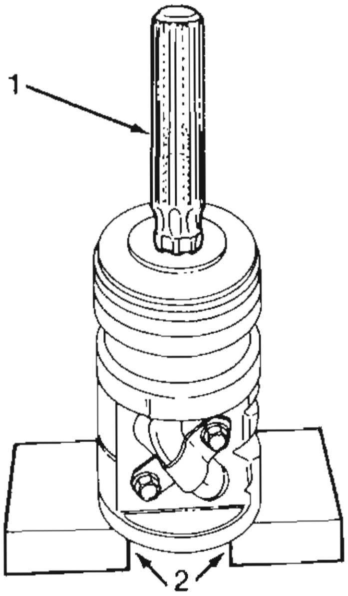
Fill one ball return guide half (3) with petroleum jelly and install the six remaining balls in the guide. Place the other half of the guide in position and insert the assembled guides into the guide return holes in the rack piston. Be sure the ball bearings in the guide are installed alternately (black bearing followed by silver bearing) and are in sequence with the bearings in the rack piston.

Install the ball return guide clamp (4) screws and lockwashers and tighten the screws with 14 N·m (10 ft-lbs) torque.



840376

Insert Arbor Tool J-21552 (1) into the wormshaft and position the assembled rack piston and tool on end. Do not permit the tool to separate from the wormshaft until the rack piston is fully installed on the wormshaft. Be sure to support the rack piston with wood blocks (2) after it is inverted.



84797

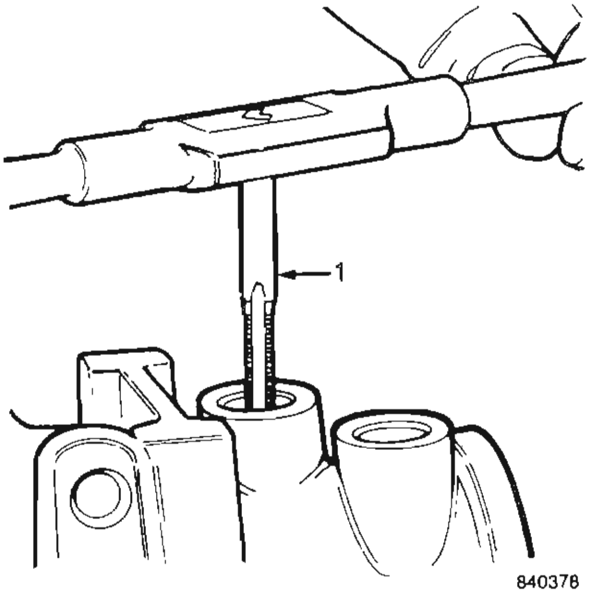
Hose Connector Seats and Poppet Check Valve Replacement – Gears Without Metric Hose Connectors

CAUTION: Because of the possibility of metal chips entering the gear, this procedure must be performed only when the steering gear is removed and disassembled.

SEE I.S. NOTES

Pack the inside of the connector seats in the pressure and return ports with petroleum jelly to prevent chips from lodging in the ports.

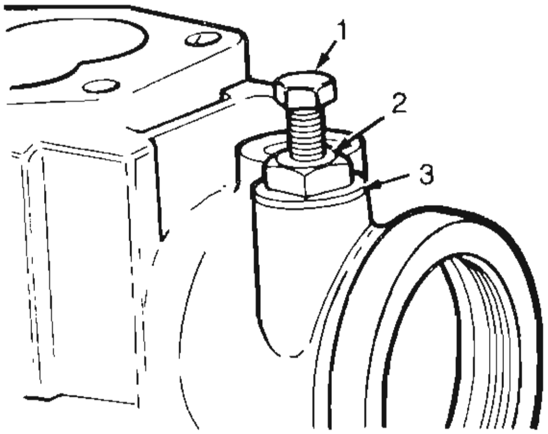
Tap the threads in the connector seats using a 5/16-18 tap (1).



840378

CAUTION: Do not tap the threads too deeply in either hose connector seat or the tap will contact the poppet valve, force it against the housing, and damage it. It is necessary to tap two or three threads deep only.

Thread a 5/16-18 bolt (1), with a nut (2) and flat washer (3) installed on the bolt, into the tapped hole.



840379

Use a wrench to prevent the bolt from rotating and turn the nut clockwise on the bolt to remove the seat. Discard the connector seat.

Clean the housing thoroughly to remove metal chips, dirt and petroleum jelly.

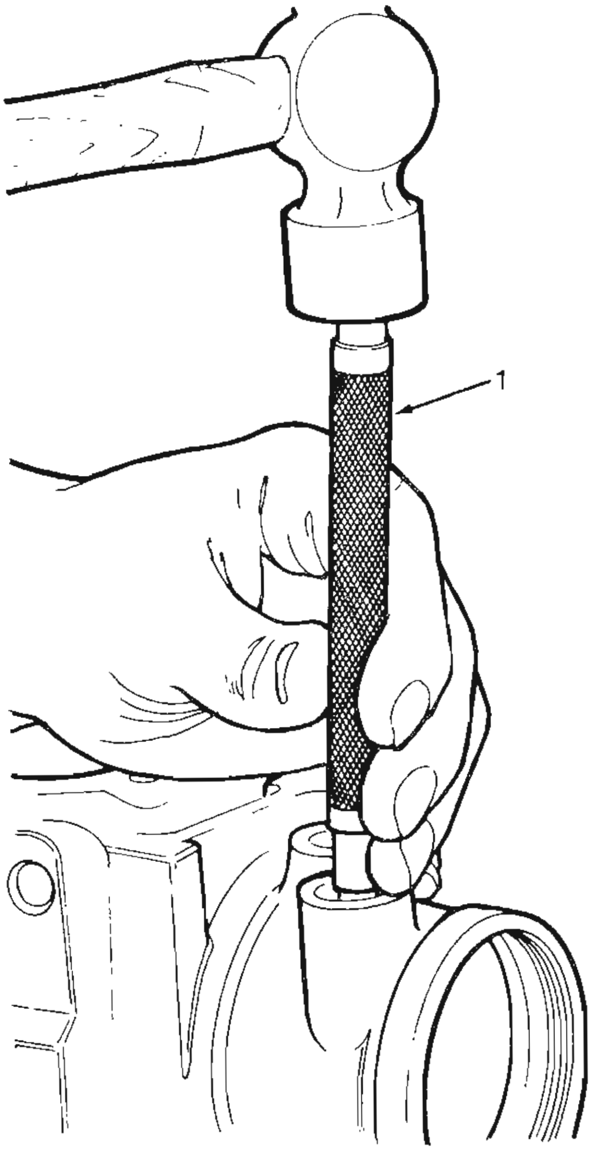
Remove the poppet valve and spring from the pressure port and discard both parts.

Install the replacement poppet valve spring in the pressure port with the large end facing downward. Be sure the spring is seated in the counterbore in the pressure port.

Install the replacement poppet valve over the spring with the valve tangs pointing downward. Be sure the valve is centered on the small end of the spring.

Install the replacement connector seats. Use petroleum jelly to hold the connector seat on the poppet valve in the pressure port and install the connector seats using Tool J-6217 (1).

SEE
I.S.
NOTES



840380

Check the operation of the poppet valve by pushing lightly against the valve using a pencil or small punch. The valve should reseat itself again when the pressure against it is removed.

STEERING GEAR ASSEMBLY AND ADJUSTMENT

NOTE: All parts must be clean and lubricated with power steering fluid (except where noted otherwise) before assembly.

Position the gear housing in a vise with the pitman shaft bore facing downward. Use the unmachined housing boss as a mounting pad.

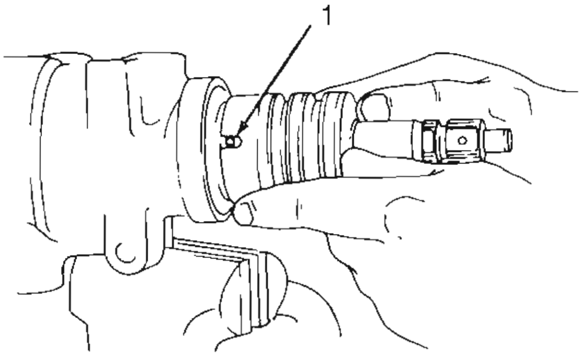
Install the wormshaft lower thrust bearing and bearing races. Install the first bearing race followed by the thrust bearing and second bearing race.

NOTE: Both of the conical bearing races must be installed so that the top of each cone faces the bottom of the gear housing.

Install the stub shaft cap-to-valve body O-ring in the valve body so it is seated against the inner edge of the shaft cap.

Align the narrow notch in the valve body with the pin (1) in the wormshaft and insert the valve body assembly in the gear housing.

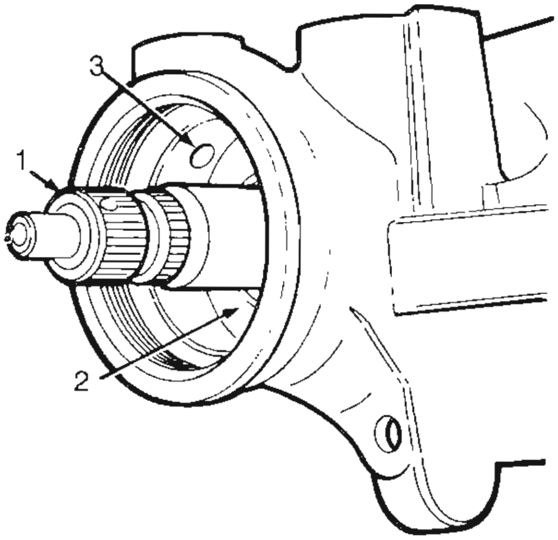
Seat the valve body assembly in the housing.



840381

SEE I.S. NOTES

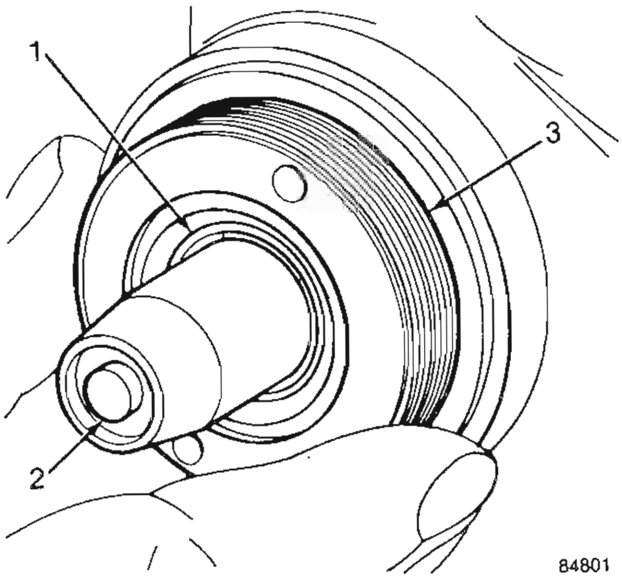
CAUTION: Do not press against the stub shaft (1) to seat the valve body (2). This could cause the stub shaft and cap to separate from the valve body and allow the spool valve damper O-ring to slip into the valve body fluid grooves. Seat the valve body only by pushing on the outer diameter of the valve body itself using the fingertips. Be sure the teflon rings do not bind inside the housing. The valve body assembly is correctly seated when all or most of the fluid return hole (3) in the gear housing is visible.



840382

Install Adjuster Plug Seal Protector Tool J-29810 (1) over the end of the stub shaft (2).

Install the adjuster plug assembly over the end of the stub shaft. Using Spanner Wrench J-7624, tighten the plug (3) until it seats against the valve body. Approximately 27 N·m (20 ft-lbs) torque is required to seat the plug. Remove Seal Protector Tool J-29810 after installing the adjuster plug.



Insert the rack piston in the housing until the wormshaft engages in the valve body and stub shaft. Do not damage the piston seal ring during installation.

Turn the stub shaft clockwise to draw the rack piston into the housing. Do not remove the arbor tool 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 and install on the side cover. Be sure the rubber seal in the gasket is seated in the side cover groove.

Install the side cover on the pitman shaft by threading the cover onto the adjuster screw until the cover bottoms against the pitman shaft.

Install the pitman shaft so the long center sector tooth meshes with the rack piston center groove. Be sure the side cover gasket is in place before installing the side cover on the housing.

Install the side cover bolts and lockwashers. Tighten the bolts with 61 N·m (45 ft-lbs) torque.

Install the adjuster screw locknut halfway on the adjuster screw. Install an Allen wrench in the adjuster screw to prevent the screw from turning while installing the nut.

Install the end plug in the rack piston. Tighten the plug with 102 N·m (75 ft-lbs) torque.

Lubricate and install the housing end plug O-ring on the end plug.

Install and seat the end plug in the housing. If necessary, tap the end plug lightly with a plastic mallet to seat it properly.

Install the end plug retainer ring so the ring end gap is not aligned with the hole in the side of the gear housing. Tap lightly on the plug to be sure the ring is seated properly.

Adjust worm bearing preload and pitman shaft overcenter drag torque as outlined under Steering Gear Adjustment.

Steering Gear Adjustment

The power steering gear requires two adjustments: worm bearing preload and pitman shaft overcenter drag torque.

Worm bearing preload is controlled by the amount of compression force exerted on the conical worm bearing thrust races by the adjuster plug.

Pitman shaft overcenter torque is controlled by the pitman shaft adjuster screw which determines the clearance between the rack piston and pitman shaft sector teeth.

SEE I.S. NOTES

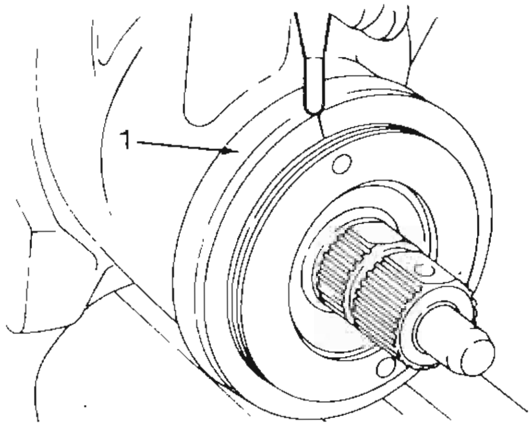
Worm Shaft Bearing Preload

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 and improper steering response. Always adjust worm bearing preload first; then adjust pitman shaft overcenter drag torque.

Seat the adjuster plug firmly in the housing using Spanner Tool J-7624. Approximately 27 N·m (20 ft-lbs) torque is required to seat the housing.

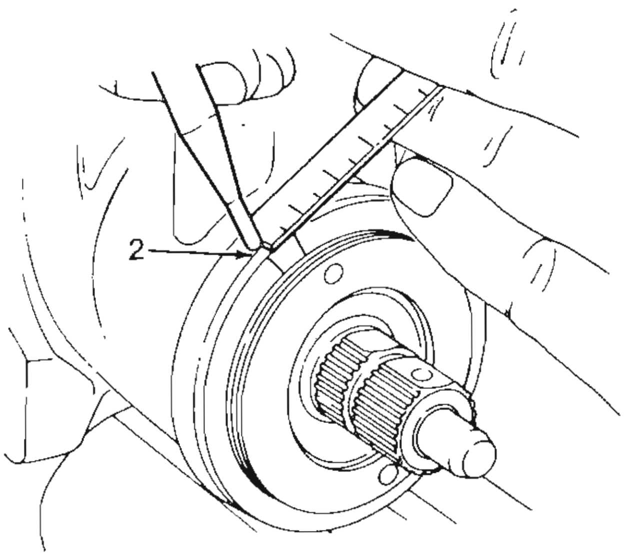
Place an index mark (1) on the gear housing opposite one of the holes in the adjuster plug.

SEE I.S. NOTES



84802

Measure back (counterclockwise) 13 mm (1/2 in) from the index mark and remark the housing (2).



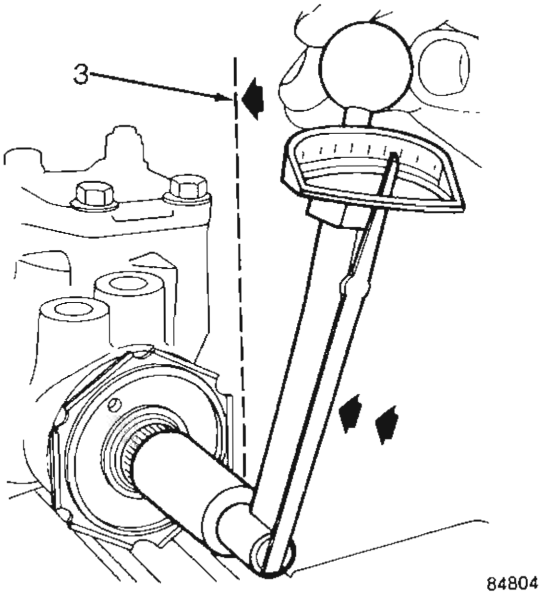
84803

Turn the adjuster plug counterclockwise until the hole in the plug is aligned with the second mark on the housing.

Install the adjuster plug locknut and tighten it with 115 N·m (85 ft-lbs) torque. Be sure the adjuster plug does not turn when tightening the locknut.

Turn the stub shaft clockwise to the stop, then turn the shaft back 1/4 turn.

Using an inch-pound torque wrench with a maximum capacity of 6 N·m (50 in-lbs) and a twelve-point deep socket, measure the torque required to turn the stub shaft. Take the reading with the beam of the torque wrench at, or near, the vertical position (3) while turning the stub shaft at an even rate.



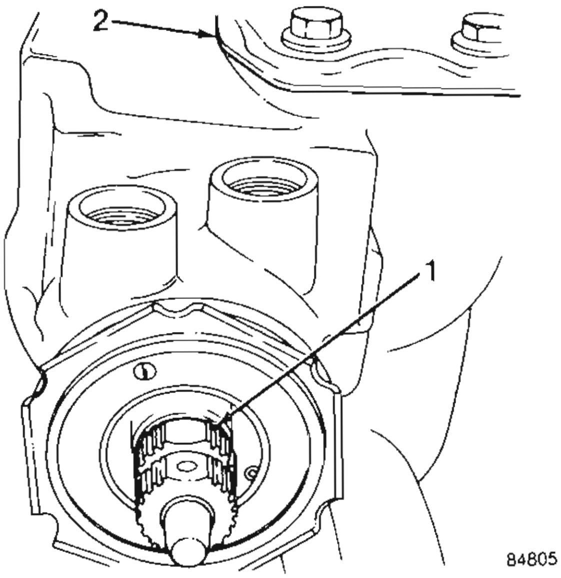
Record the torque reading. Torque required to turn the stub shaft should be 0.45 - 1.13 N·m (4-10 in-lbs). If the reading is above or below the indicated torque, the adjuster plug may not be tightened properly or may have turned when the locknut was tightened; or the gear may be assembled incorrectly; or the thrust bearings and races may be defective.

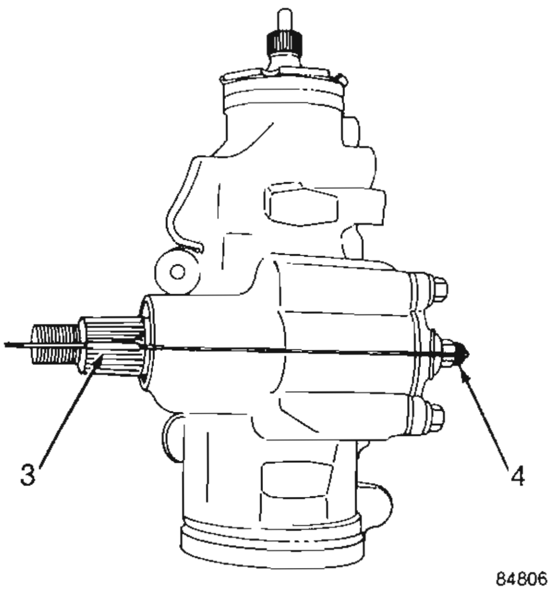
Pitman Shaft Overcenter Drag Torque

Turn the pitman shaft adjuster screw counterclockwise until fully extended, then turn it back one full turn clockwise.

Rotate the stub shaft from stop-to-stop and count the total number of turns. Starting from either stop, turn the stub shaft back 1/2 the total number of turns. This is the gear center.

NOTE: When the gear is centered, the flat on the stub shaft (1) should face upward and be parallel with the side cover (2) and the master spline (3) on the pitman shafts should be in line with the adjuster screw (4).



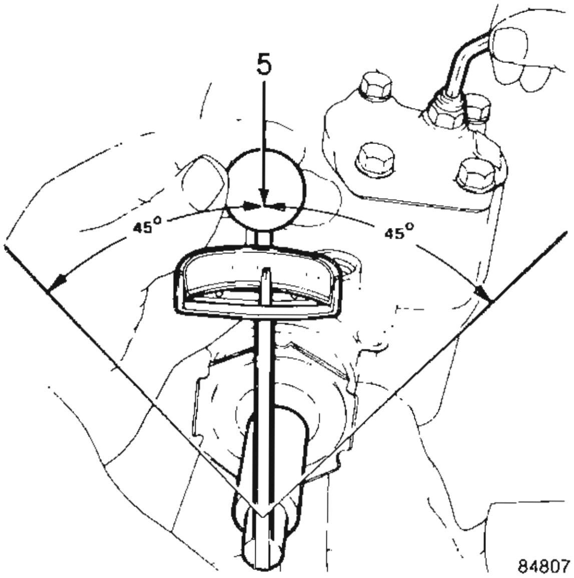


SEE
I.S.
NOTES

SEE I.S. NOTES

Install an inch-pound torque wrench with a maximum capacity of 6 N·m (50 in-lbs) and a twelve-point deep socket on the stub shaft. Place the torque wrench in the vertical position to take a reading.

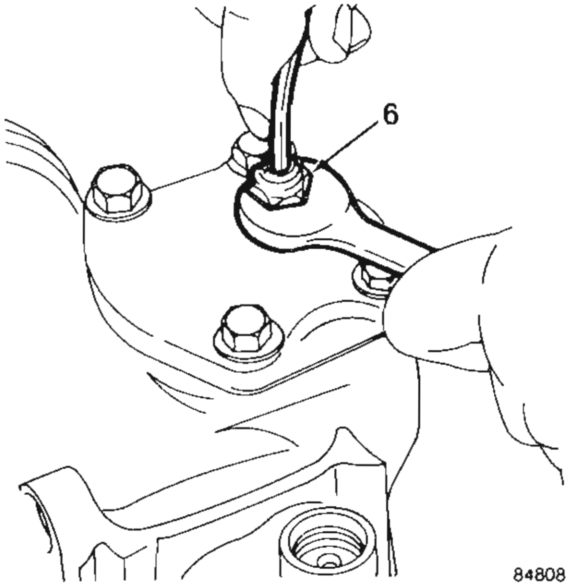
Rotate the torque wrench 45 degrees each side of center (5). Record the highest drag torque measured on or near center.



Adjust overcenter drag torque by turning the pitman shaft adjusting screw clockwise until the desired drag torque is obtained. Adjust drag torque to the following limits:

- on new steering gears, add 0.45 - 0.90 N·m (4-8 in-lbs) torque to the previously measured worm bearing preload torque, but do not exceed a combined total of 2 N·m (18 in-lbs) drag torque
- on used steering gears (640 or more km; 400 or more mi) add 0.5 - 0.6 N·m (4-5 in-lbs) torque to the previously measured worm bearing preload torque, but do not exceed a combined total of 2 N·m (18 in- lbs) torque

Tighten the pitman shaft adjusting screw locknut (6) with 47 N·m (35 ft-lbs) torque after adjusting overcenter drag torque.



Install the gear as outlined in Steering Gear Installation.

Fill the pump reservoir and bleed the gear and pump as outlined in Fluid Level and Initial Operation after completing the overcenter drag torque adjustment.

Fluid Level and Initial Operation

See Power Steering Pump Section in this chapter for procedure.

GENERAL

A vane-type, constant displacement hydraulic pump is used to develop system fluid pressure. The pump has an integral reservoir that contains the system fluid supply.

The reservoir cap is vented to maintain atmospheric pressure within the reservoir and allow air trapped in the system to escape. A dipstick mounted in the reservoir cap is used to check system fluid level.

System operating pressures are maintained by a combination of flow control/relief valve located in the pump. The relief section of the valve prevents excessive system pressure buildup.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-8841	Seal Installer		■
J-8842	Seal Remover		■
J-21567	Pressure Testing Gauge Assembly		■
J-23600-B	Belt Tension Gauge		■
J-25033-B	Installer	■	
J-29785-A	Remover	■	

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Hose Fittings	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Pump Adjusting Bolts-Nuts	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Pump Mounting Bracket Bolts	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Pump Mounting Studs	47 N·m (35 ft-lbs)	41-54 N·m (30-40 ft-lbs)
Pump Union Fitting	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)

SPECIFICATIONS

SEE
I.S.
NOTES

Pump Operating Specifications

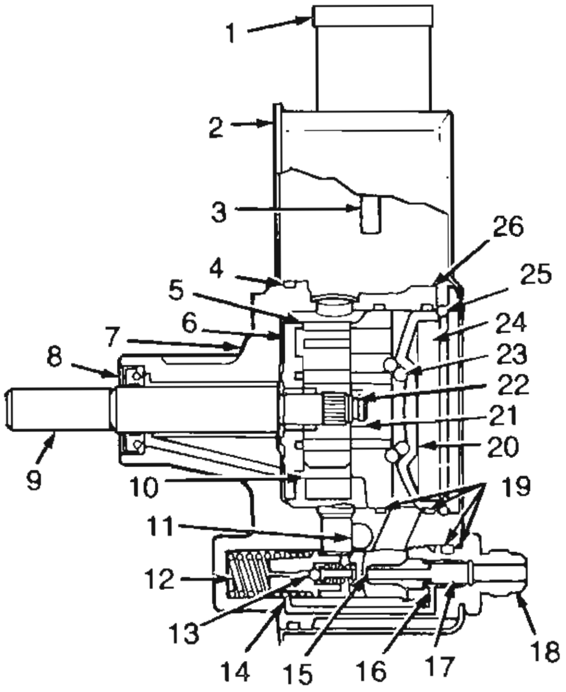
Pump Operating Pressure — PSI

Idle	80-125
Turning	400
Pressure Relief	1100-1200

Lubricants and Fluids .....Use AMC power steering Fluid, or equivalent

	Initial Pounds New Belt ft.-lb.	**Reset Pounds Used Belt ft.-lb.**
Drive Belt Tension Specifications:		
Air Conditioner	120-160	90-115
Air Pump	120-160	90-115
Power Steering Pump	120-160	90-115
Serpentine Drive	180-200	140-160

84682



1. Cap
2. Reservoir
3. Dip Stick
4. O-Ring Seal
5. Pump Ring
6. Thrust Plate
7. Housing
8. Shaft Seal
9. Shaft
10. Vanes
11. Reservoir Hole
12. Spring
13. Pressure Relief Valve
14. Flow Control Valve
15. Exit Hole
16. Orifice
17. Filter
18. Pump Union
19. Seals
20. End Plate
21. Retaining Ring
22. Rotor
23. Spring
24. Discharge Cavity
25. Retaining Ring
26. Pressure Plate

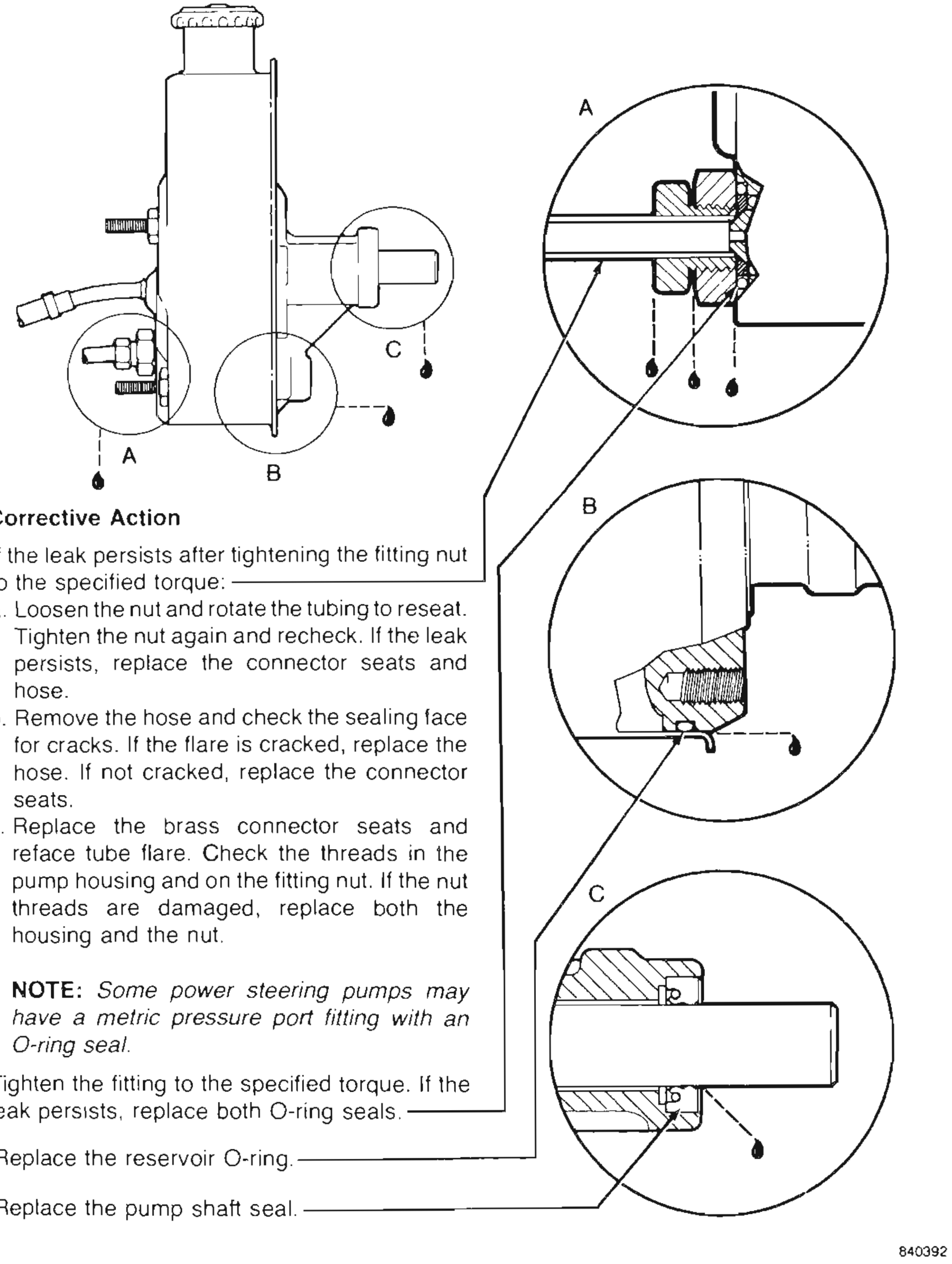
840391

LEAK INSPECTION AND DIAGNOSIS

The location and source of fluid leaks should always be determined before attempting repair. Because an inaccurate diagnosis can result in ineffective repair, a proper inspection procedure is necessary. Refer to the diagrams for the most common pump leak sources.

SEE
I.S.
NOTES

PUMP LEAK POINTS AND CORRECTIVE ACTION



Corrective Action

If the leak persists after tightening the fitting nut to the specified torque:

a. Loosen the nut and rotate the tubing to reseat. Tighten the nut again and recheck. If the leak persists, replace the connector seats and hose.
b. Remove the hose and check the sealing face for cracks. If the flare is cracked, replace the hose. If not cracked, replace the connector seats.
c. Replace the brass connector seats and reface tube flare. Check the threads in the pump housing and on the fitting nut. If the nut threads are damaged, replace both the housing and the nut.

NOTE: *Some power steering pumps may have a metric pressure port fitting with an O-ring seal.*

Tighten the fitting to the specified torque. If the leak persists, replace both O-ring seals.

Replace the reservoir O-ring.

Replace the pump shaft seal.

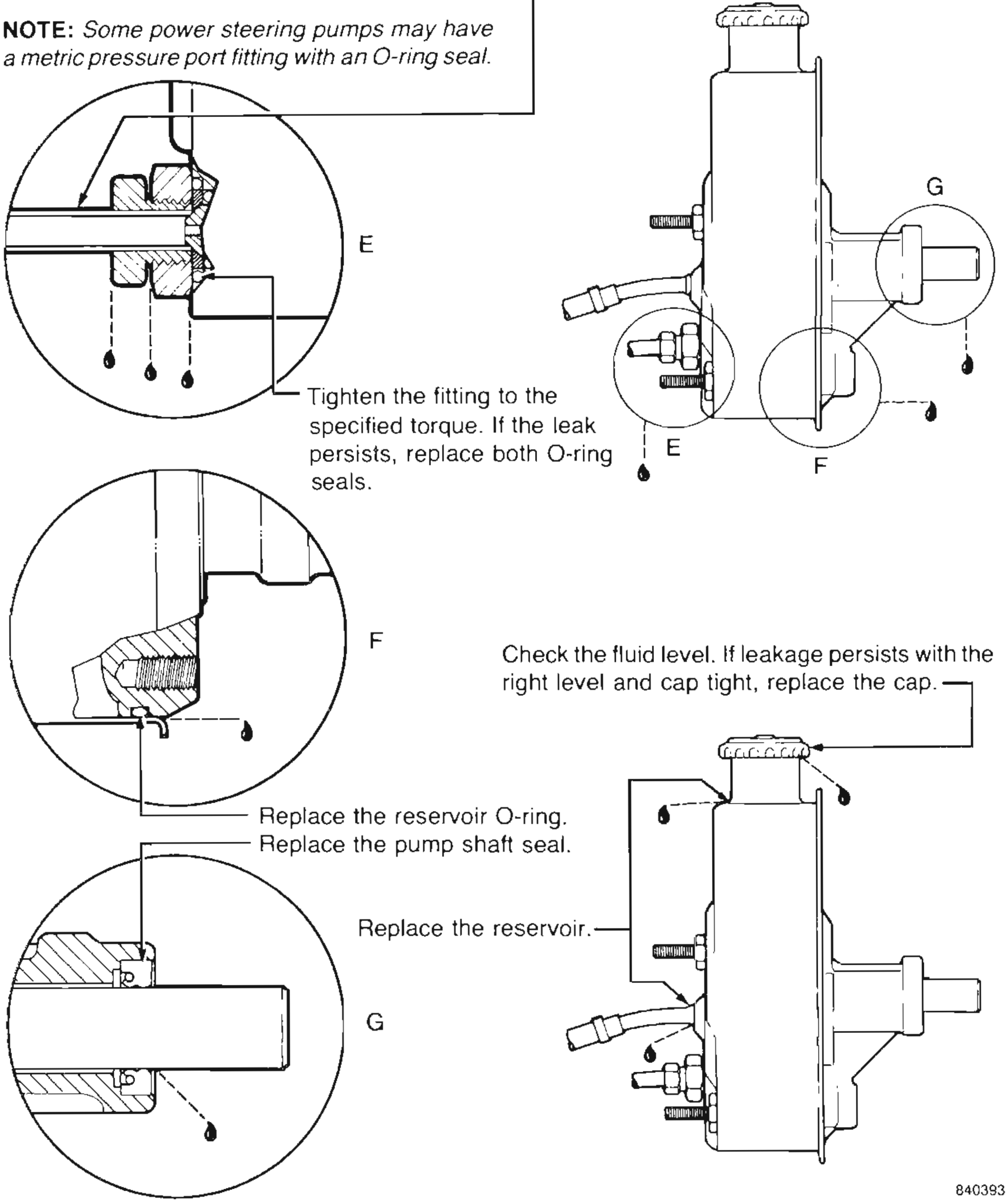
SEE I.S. NOTES

PUMP LEAK POINTS AND CORRECTIVE ACTION

Corrective Action

Tighten the hose fitting nut to the specified torque. If the leak persists, replace the discharge fitting and reface hose tube flare, or hose as required.

NOTE: *Some power steering pumps may have a metric pressure port fitting with an O-ring seal.*



Tighten the fitting to the specified torque. If the leak persists, replace both O-ring seals.

Check the fluid level. If leakage persists with the right level and cap tight, replace the cap.

Replace the reservoir O-ring.

Replace the pump shaft seal.

Replace the reservoir.

SEE
I.S.
NOTES

SEE I.S. NOTES

Leak Inspection Procedure

Raise and support the vehicle.

Wipe the leakage area dry.

Check for an overfilled reservoir. If overfull, drain the fluid from the reservoir to the correct level.

Check for aerated fluid (full of bubbles and milky in color). Aerated fluid can cause overflow from the reservoir and be mistaken for a leak.

Check and tighten all hose connections and union fittings at the pump and gear. Do not exceed 41 N·m (30 ft-lbs) torque at any fitting.

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 the stops in each direction. Stop the engine when the leak source is determined.

Leak Diagnosis

- if the leak occurred between the pump union fitting and hose fitting, tighten or replace the union fitting and hose

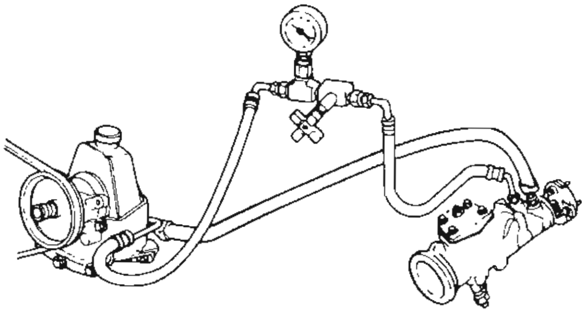
NOTE: Some pumps may be equipped with a metric thread pressure port fitting which requires an O-ring seal.

- if the leak occurred between the pump union fitting and pump body, replace both union O-rings
- if the leak occurred between the reservoir and pump body, replace the reservoir O-ring seal
- if the leak occurred between the pump shaft and seal, replace the seal; also check the pump shaft seal contact area for nicks, gouges, burrs or pitting, all of which can damage the seal
- if the leak is caused by reservoir overflow due to an overfill condition, drain the fluid to the correct level; if the fluid is aerated, check for an overfill condition, air getting into the fluid through the hose connection or reservoir seal, or a sticking flow control valve

HYDRAULIC PRESSURE TEST

The hydraulic pressure test is performed using Test Gauge Set J-21567. When performing the test, refer to the Hydraulic Pressure Test Procedure charts for gauge connections, test procedures and system diagnosis.

The test gauge and valve have 1/4 pipe threads. Any combination of hose fittings is acceptable for gauge connection at the pump or gear, whichever is most convenient. The gauge must, at all times, be connected in the pump pressure line circuit only. Refer to the Hydraulic Pressure Test Procedure charts.



84809

Test Procedure

Check and adjust the pump belt tension as necessary.

Position a drip pan beneath the engine.

Disconnect the power steering pump pressure hose at the pump or at the steering gear (whichever is most convenient). Keep the hose end raised to prevent fluid loss.

Connect the pump pressure hose to Test Gauge Tool J-21567.

CAUTION: Be sure the test gauge is connected into the pressure line circuit between the pump and gear.

Connect the test gauge hose to the power steering pump or steering gear.

Open the test gauge valve completely. Turn the valve counterclockwise to open.

Fill the pump reservoir with power steering fluid as necessary.

Operate the engine until the power steering fluid reaches the normal operating temperature.

Record the initial gauge pressure with the valve open. The initial pressure should be 552 - 862 kPa (80 - 125 psi). If the pressure is 1379 kPa (200 psi) or more, check the hoses for restrictions.

CAUTION: Do not hold the test gauge valve closed for more than five seconds at a time as pump damage could occur.

Close the test gauge valve fully; then open it. Perform this procedure three times and record the highest pressure reading each time the gauge valve is closed.

If the pressures are within 7584 - 8274 kPa (1100 - 1200 psi) and the ranges of three readings are within 345 kPa (50 psi) the pump is functioning within specifications.

For example, if the pressures are 7929, 7998 and 8067 kPa (1150, 1160 and 1170 psi) the ranges are within the 345 kPa (50 psi) allowable variance and pump operation is OK.

CAUTION: 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.

CAUTION: Do not hold the steering wheel against the stops for more than five seconds at a time as pump damage may occur.

If the pressures recorded are high but do not repeat within 345 kPa (50 psi), the flow control valve is sticking. Remove and clean the valve and remove any burrs with crocus cloth or a fine grit hone. If the system contains dirt, flush the system.

If pump performance is within specifications with the valve open, turn the steering wheel to the left and right stops and record the highest pressure. Compare the readings with maximum pump output. If the pump output cannot be repeated at either side of the gear, the gear is leaking internally and must be disassembled and repaired.

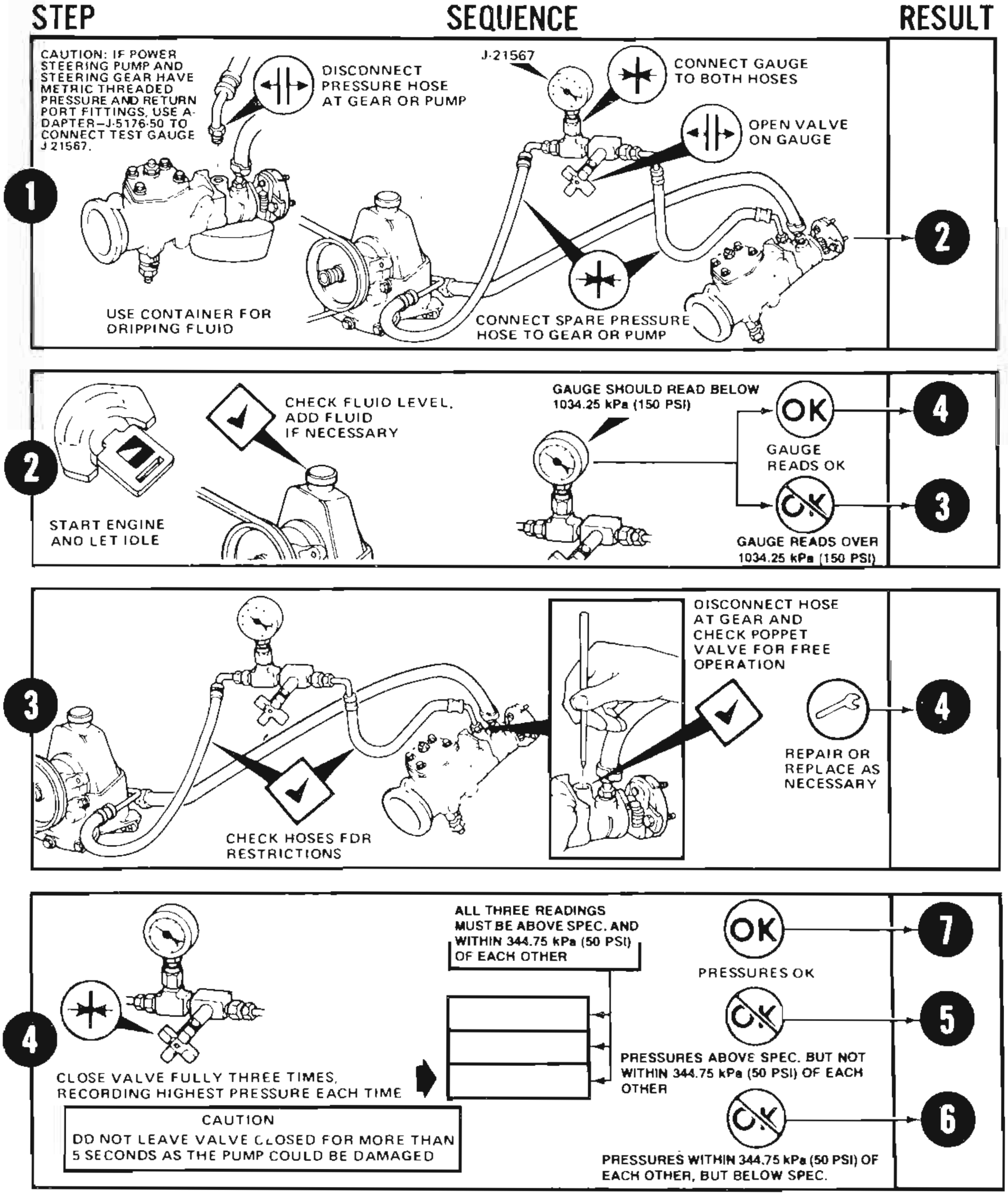
Stop the engine and remove the test gauge.

Connect the pressure hose to the pump (or gear).

Make the necessary repairs and correct the fluid level.

Remove the drip pan.

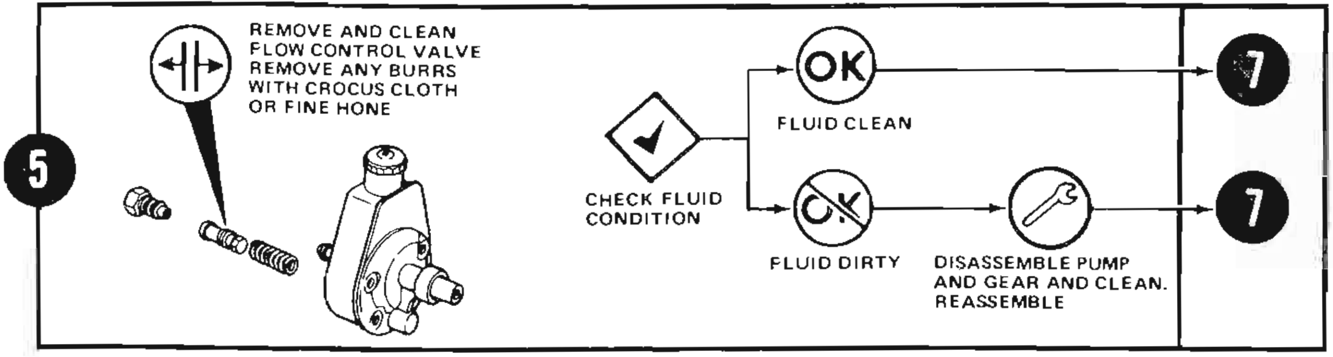
POWER STEERING HYDRAULIC SYSTEM PRESSURE TEST PROCEDURE



840396

SEE I.S. NOTES

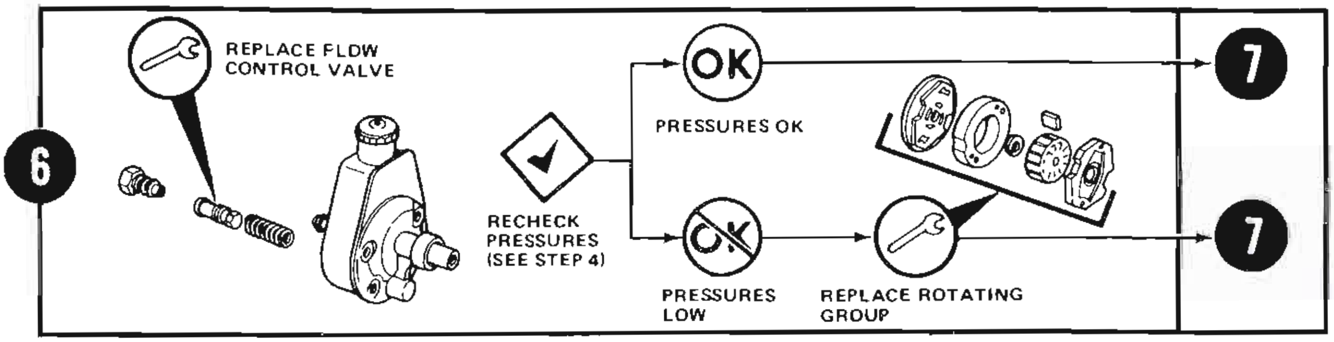
STEP **SEQUENCE** **RESULT**



REMOVE AND CLEAN FLOW CONTROL VALVE REMOVE ANY BURRS WITH CROCUS CLOTH OR FINE HONE

CHECK FLUID CONDITION

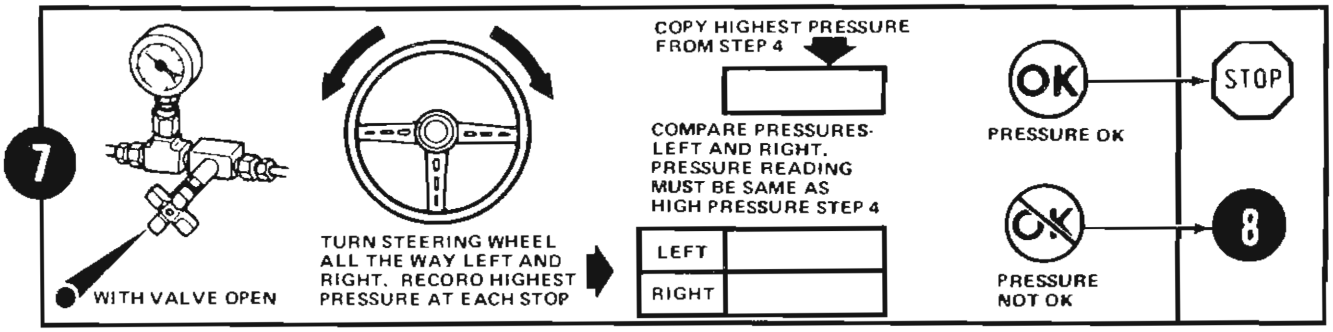
DISASSEMBLE PUMP AND GEAR AND CLEAN. REASSEMBLE



REPLACE FLOW CONTROL VALVE

RECHECK PRESSURES (SEE STEP 4)

REPLACE ROTATING GROUP

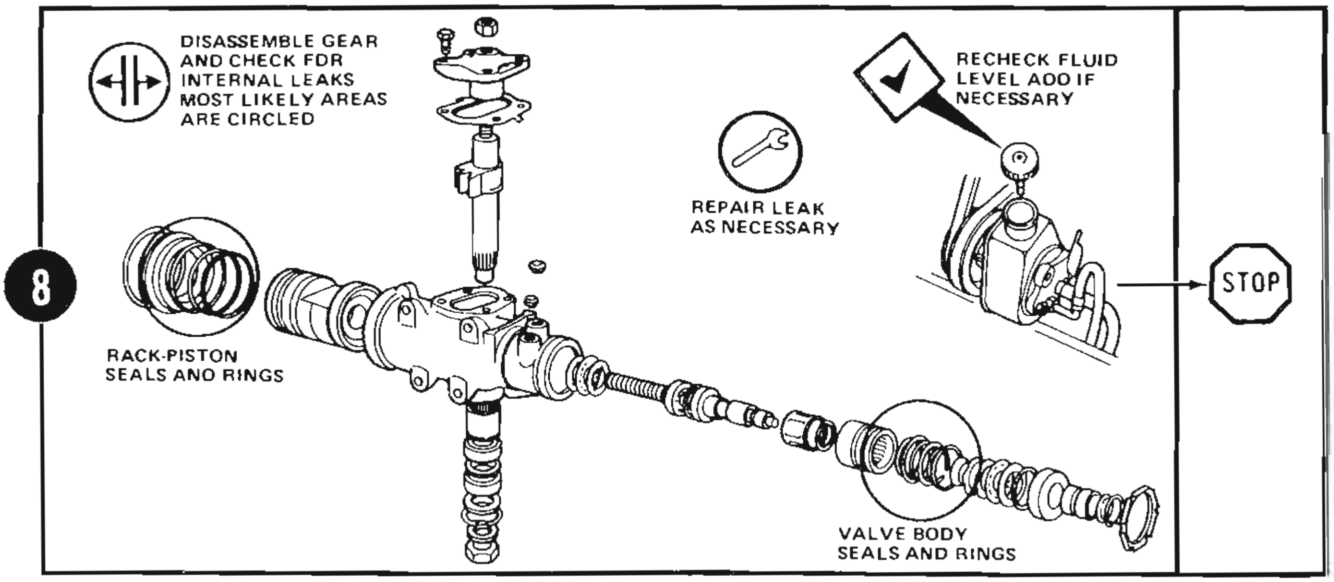


WITH VALVE OPEN

TURN STEERING WHEEL ALL THE WAY LEFT AND RIGHT. RECORD HIGHEST PRESSURE AT EACH STOP

COPY HIGHEST PRESSURE FROM STEP 4

COMPARE PRESSURES-LEFT AND RIGHT. PRESSURE READING MUST BE SAME AS HIGH PRESSURE STEP 4



DISASSEMBLE GEAR AND CHECK FOR INTERNAL LEAKS MOST LIKELY AREAS ARE CIRCLED

RACK-PISTON SEALS AND RINGS

VALVE BODY SEALS AND RINGS

REPAIR LEAK AS NECESSARY

RECHECK FLUID LEVEL ADD IF NECESSARY

80084B

SEE I.S. NOTES

SERVICE 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	(1) Replace parts and flush system
	(2) Extreme wear of cam ring	(2) Replace parts
GROAN NOISE IN STEERING PUMP	(1) Low oil level	(1) Fill reservoir to proper level
	(2) Air in the oil. Poor pressure hose connection	(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	(1) Install properly
	(2) Vanes sticking in rotor slots	(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	(1) Adjust belt tension to specification
	(2) Low oil level in reservoir NOTE: Low oil level will also result in excessive pump noise	(2) Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage. Tighten loose connectors.
	(3) Steering gear to column misalignment	(3) Align steering column
	(4) Lower coupling flange rubbing against steering gear adjuster plug	(4) Loosen pinch bolt and assemble properly
	(5) Tires not properly inflated	(5) Inflate to recommended pressure

SEE I.S. NOTES

84811A

Condition	Possible Cause	Correction
	Further possible causes could be:	
	(6) Sticking flow control valve	In order to diagnose conditions such as listed in (6), (7), (8), (9) a pressure test of the entire power steering system is required.
	(7) Insufficient pump pressure output	
	(8) Excessive internal pump leakage	
	(9) Excessive internal gear leakage	
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 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.	(1) Remove burrs or dirt or replace. Flush system.
	(2) Pressure plate not flat against cam ring	(2) Correct
MOMENTARY INCREASE IN EFFORT WHEN TURNING WHEEL FAST TO RIGHT OR LEFT	(1) Low oil level in pump.	(1) Add power steering fluid as required
	(2) Pump belt slipping	(2) Tighten or replace belt
	(3) High internal leakage	(3) Check pump pressure. (See pressure test)
STEERING WHEEL SURGES OR JERKS WHEN TURNING WITH ENGINE RUNNING ESPECIALLY DURING PARKING	(1) Low oil level	(1) Fill as required
	(2) Loose pump belt	(2) Adjust tension to specification
	(3) Steering linkage hitting engine oil pan at full turn	(3) Correct clearance
	(4) Insufficient pump pressure	(4) Check pump pressure. (See pressure test). Replace flow control valve if defective
	(5) Sticking flow control valve	(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

SEE
I.S.
NOTES

84811B

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

SEE I.S. NOTES

ON-VEHICLE SERVICE

Pump Drive Belt Adjustment

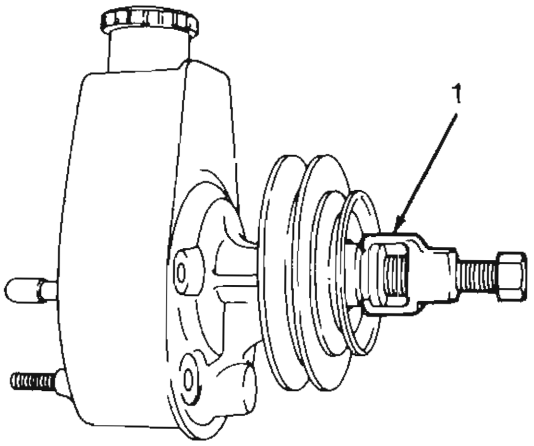
Refer to Chapter B Engine – Cooling Systems for belt adjustment procedures.

Pump Shaft Seal and Pump Pulley Replacement

Position a drip pan under the power steering pump.

Loosen the pump mounting stud nuts (at the rear of the pump mounting bracket), move the pump toward the engine and remove the belt.

Remove the pump pulley using Remover Tool J-29785-A (1).

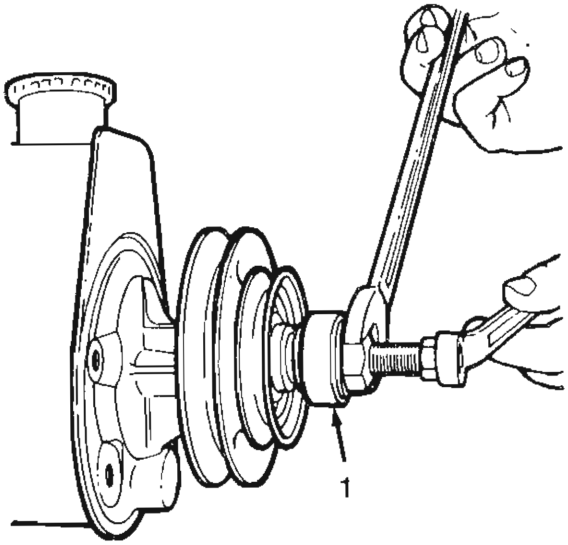


84815

Install Seal Remover Tool J-8842 over the pump shaft, thread the tool into the seal and turn the tool bolt to remove the seal.

Lubricate the replacement seal with power steering fluid and install the seal using Installer Tool J-8841.

Install the pulley using Installer Tool J-25033-B (1).



840401

Install the pump belt. Adjust the belt tension as outlined in Chapter B Engines – Cooling Systems.

Refill the power steering pump reservoir.

Start the engine and check for leaks. If leaks are not evident, stop the engine and add fluid to the reservoir if necessary.

Remove the drip pan.

Flow Control Valve Replacement

Position a drip pan under the engine.

Disconnect the pump pressure hose, cap the hose to prevent dirt entry and excess fluid loss.

Remove the pump union and union fitting and O-ring.

Using a magnet, remove the flow control valve and spring.

Lubricate the replacement flow control valve and union fitting O-ring with power steering fluid.

Insert the replacement flow control valve in the valve spring and install the assembly in the pump housing, spring end first.

Install the pump union and replacement O-ring and tighten the union with 27 N·m (20 ft-lbs) torque.

Connect the hose and tighten the fitting with 27 N·m (20 ft-lbs) torque.

Refill the reservoir, start the engine and check for leaks. If leaks are not evident, stop the engine and remove the drip pan.

PUMP REMOVAL

Remove the air cleaner, if necessary.

Loosen the pump drive belt and remove the belt off the pulley.

Position a drain pan under the power steering pump.

Disconnect the hoses at the pump and cap the fittings.

Remove the power steering pump pivot bolt.

Remove the bolt attaching the lower edge of the pump mounting bracket to the engine block (with A/C).

Remove the pump adjusting bracket stud nuts.

Remove the bolt attaching the pump to the rear mounting bracket.

SEE I.S. NOTES

PUMP INSTALLATION

Connect the hoses to the power steering pump.

Position the power steering pump on the engine block and install the bolt attaching the pump to the rear mounting bracket.

Install the power steering pump adjusting stud nuts.

Install the power steering pump belt on the pump pulley.

Install the bolt attaching the lower edge of the power steering pump mounting bracket to the engine block.

Install the power steering pump pivot bolt.

Install the A/C compressor drive belt pulley and bracket assembly, if equipped. Install the drive belt on the compressor pulley.

Adjust drive belts. Refer to Chapter B – Cooling Systems for procedure and belt tension specifications.

Fill the power steering pump to the correct level and bleed the air from the system. Refer to Fluid Level and Initial Operation.

Install the front adapter plate and aluminum mounting bracket on the power steering pump, if removed.

Install air cleaner, if removed.

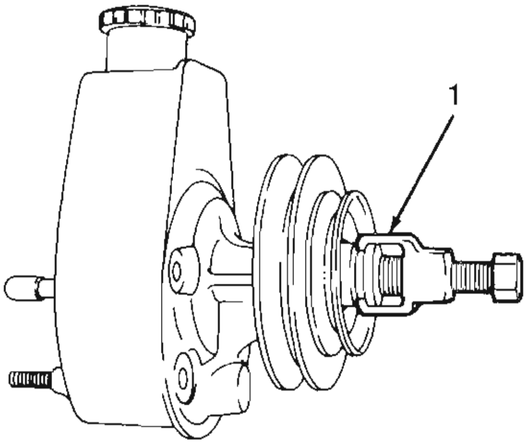
PUMP DISASSEMBLY

Remove the pump mounting brackets as necessary.

Remove the reservoir filler cap and drain the oil from the pump reservoir.

Reinstall the reservoir filler cap and wash the pump exterior in solvent to remove the dirt.

Remove the pump pulley using Tool J-29785-A (1).



84815

CAUTION: Inspect the exposed surface of the pump shaft. Remove all traces of corrosion or nicks and scratches with a crocus cloth before disassembling the pump. This will avoid damaging the pump bushing during disassembly which would necessitate replacement of the entire pump body.

Clamp the pump front hub in a vise so the pump shaft is pointing downward. Do not overtighten the vise as the bearing may be distorted.

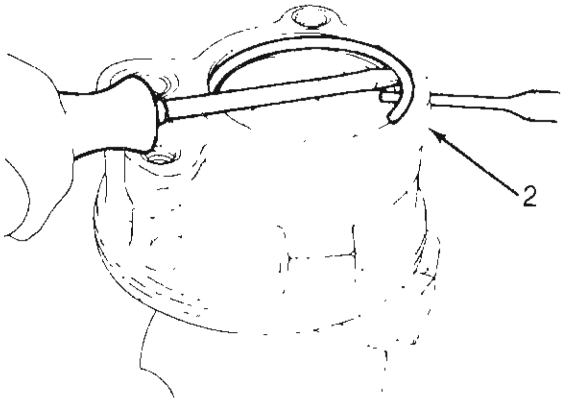
Remove the pump union and mounting studs and discard the seals and O-rings.

Remove the reservoir by rocking it lightly back and forth to unseat the O-ring.

Remove the reservoir O-ring.

Remove the mounting stud and union seals from the counterbored spaces in the housing and discard the seals.

Remove the end plate retaining ring. Insert a small punch in the 3.1 mm (1/8 in) diameter hole in the housing opposite the flow control valve hole, compress the retaining ring using the punch, and remove the ring by inserting a screwdriver under the ring (2) and twisting the screwdriver.



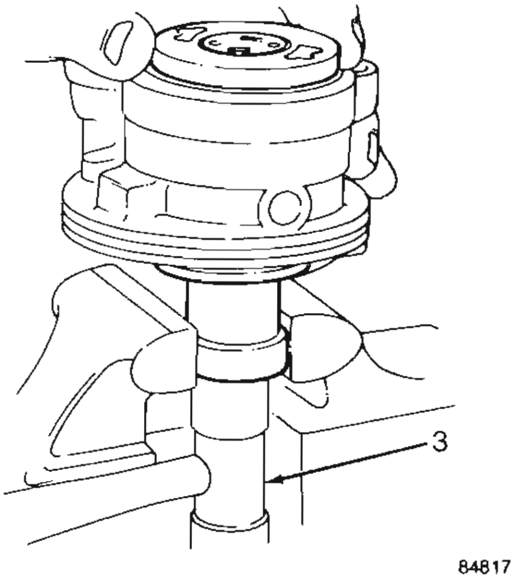
84816

Remove the end plate. If the plate should stick, rock it lightly or tap it with a plastic hammer to loosen.

Remove the pump from the vise.

Remove the flow control valve and valve spring. Turn the pump over and let the valve and spring slide out of the bore.

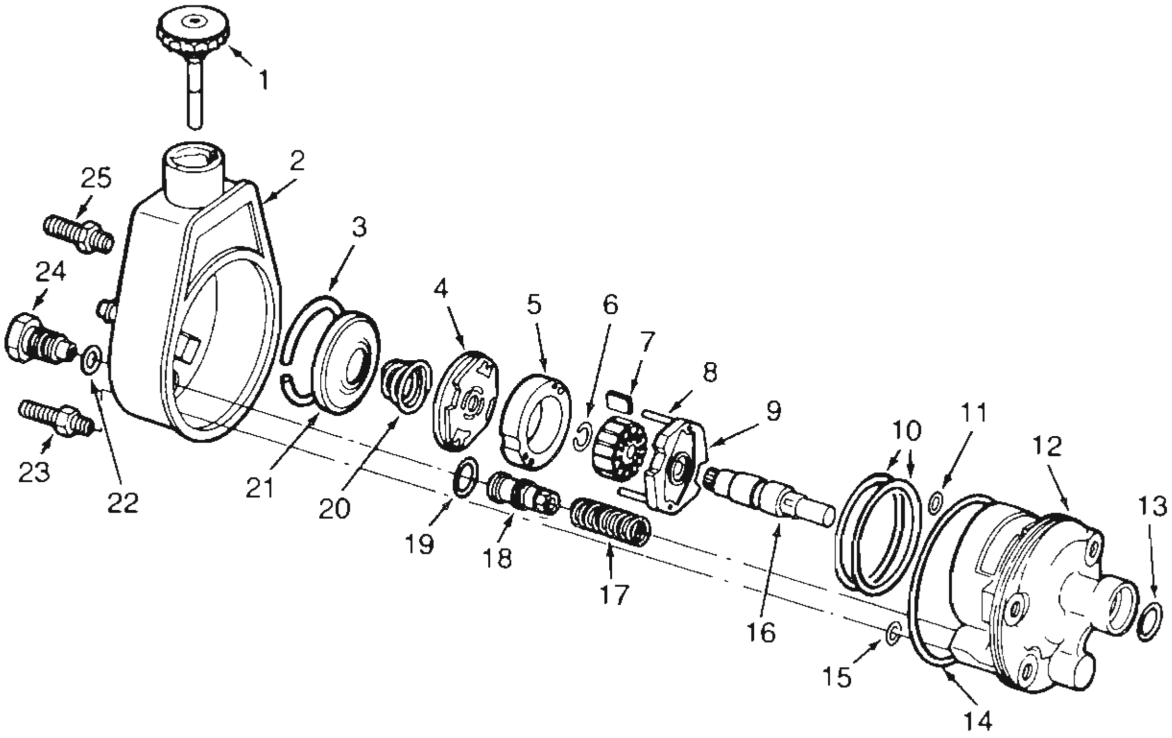
Tap the end of the pump shaft using a plastic hammer (3) until the pressure plate, pump ring, rotor assembly and thrust plate can be removed as an assembly.



Remove the snap ring from the pump shaft and remove the rotor and thrust plate from the shaft. Do not drop the rotor blades.

Remove the end plate O-rings and shaft seal. Do not damage the pump body bore.

SEE I.S. NOTES



1. Cap
2. Reservoir
3. Retaining Ring
4. Pressure Plate
5. Pump Ring
6. Retaining Ring
7. Vane
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

840402

Cleaning and Inspection

Clean all metal parts in solvent. Air dry the parts or wipe them dry with a clean lint-free cloth. Inspect the flow control valve to be sure it slides freely in the pump body bore. If the valve sticks check for dirt or burrs. Burrs may be removed using crocus cloth.

NOTE: The flow control valve is serviced as an assembly only and must not be disassembled.

Check the capscrew in the end of the flow control valve for looseness. If loose, tighten the screw but be careful to avoid damaging machined surfaces.

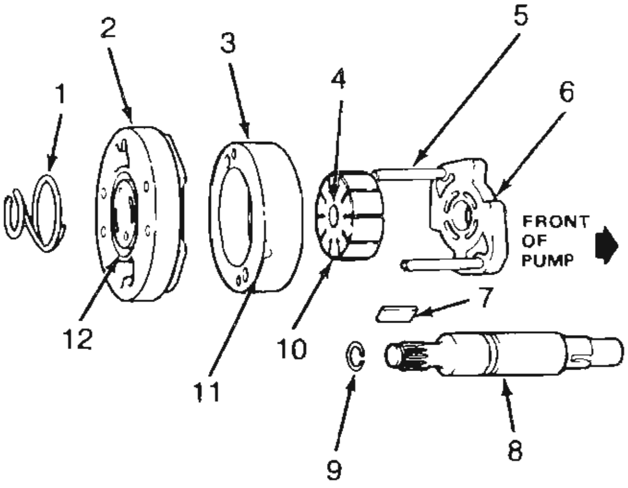
Inspect the pressure plate and pump plate surfaces for flatness and for being parallel with the pump ring. Check all parts for cracks and scoring.

NOTE: A high polish is always present on the rotor pressure plate and thrust plate as a result of normal wear. Do not confuse this with scoring.

Inspect all rotor vanes for free movement in the rotor slots and check the pump drive shaft for worn splines, cracks or other defects.

PUMP ASSEMBLY

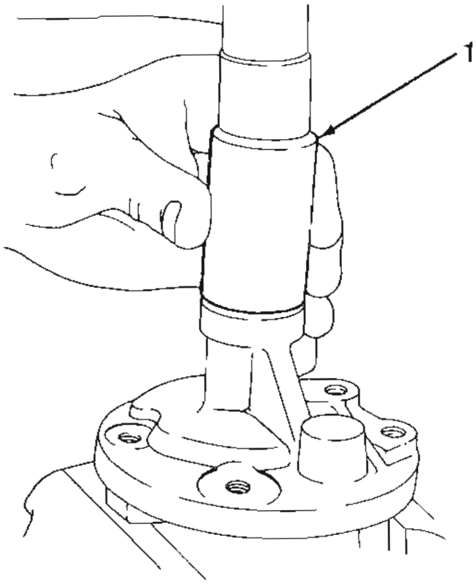
CAUTION: Do not allow dirt to enter the pump during assembly. All parts must be clean and lubricated with power steering fluid. Install replacement seals, snap rings and O-rings only during assembly. Used, damaged or worn seals will cause leaks, noise and rapid wear after assembly.



1. Spring
2. Pressure Plate
3. Pump Ring
4. Hole (Not Countersunk)
5. Pin (2)
6. Thrust Plate
7. Vane
8. Shaft
9. Retaining Ring
10. Rotor
11. Arrow Towards Rear
12. Groove (For Spring)

840404

Install the pump shaft seal using Tool J-8841 (1).

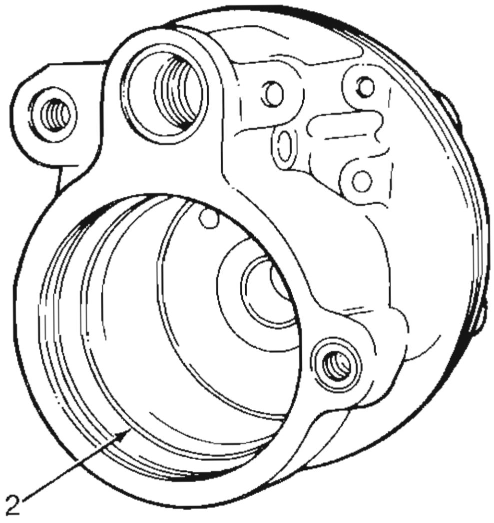


84818

Lubricate the pressure plate, end plate and all replacement O-ring seals with petroleum jelly. Lubricate all other parts with power steering fluid.

Install the pressure plate and install the seal in the third groove of the pump body bore (2).

Clamp the pump body in a vise with the shaft end facing downward. Do not overtighten the vise as bearings could be damaged.



84819

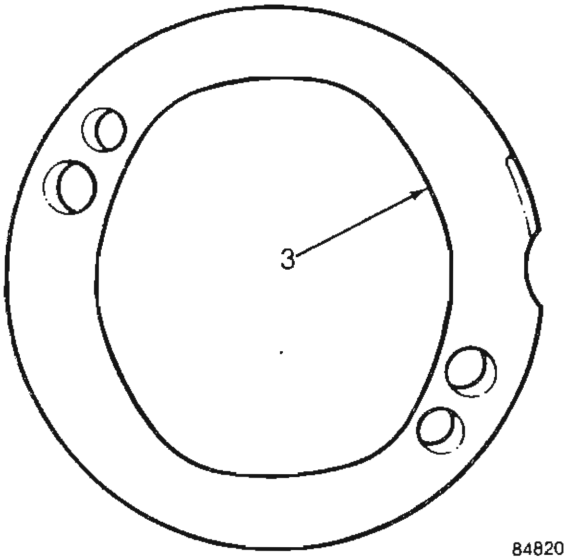
Insert both dowel pins in the thrust plate.

Insert the splined end of the pump shaft through the thrust plate and the rotor and install the snap ring on the shaft. Open the snap ring only enough to slide it over the end of the shaft. The rotor must move freely on the splines.

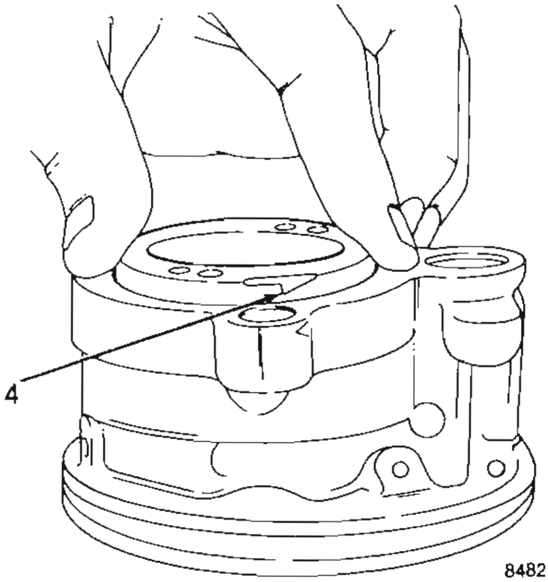
Install the pump shaft assembly in the pump body. Be sure the dowel pins are properly engaged in the thrust plate.

SEE
I.S.
N
O
T
E
S

Install the pump ring (3) on the dowel pins with the pump rotation arrow (4) facing upward.

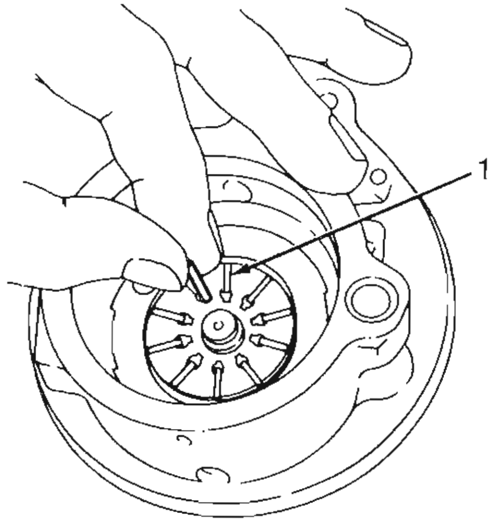


84820



84821

Install all 10 rotor vanes in the rotor slots with the rounded edges of the vanes (1) facing outward.



84822

Lubricate the outside diameter and chamfered edge of the pressure plate with petroleum jelly.

Install the plate on the dowel pins with the plate spring groove facing upward.

Place the large socket on top of the pressure plate and press the plate downward about 1.5 mm (1/16 in) to seat the plate.

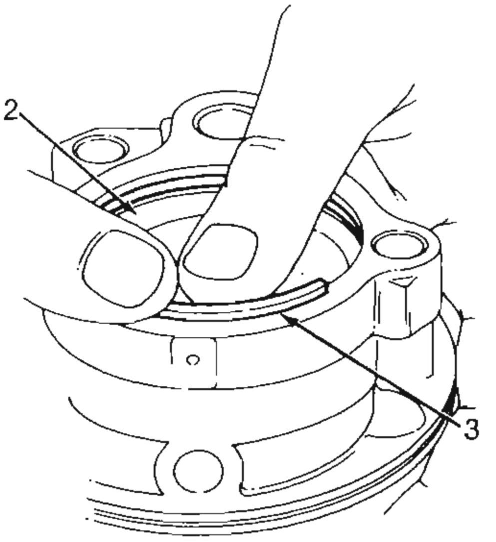
Lubricate the end plate seal with petroleum jelly and install in the second groove of the pump body bore.

Install the spring in the center groove of the pressure plate.

Lubricate the end plate outside diameter with petroleum jelly and install the plate in the pump body.

SEE I.S. NOTES

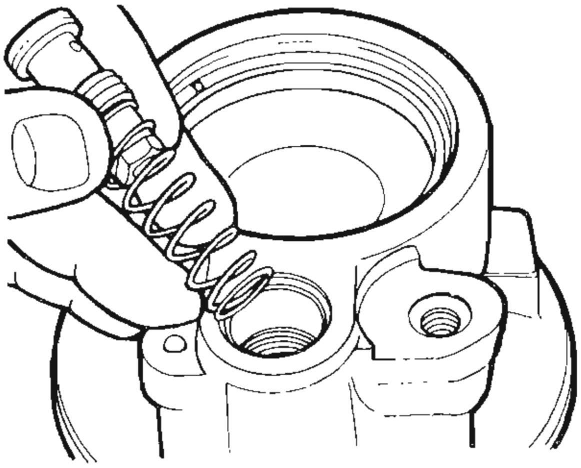
Press the end plate (2) downward and install the end plate retaining ring (3).



84823

Install the spring on the hex-end of the flow control valve.

Install the flow control valve assembly in the pump bore with the hex-end of the valve facing the interior of the bore.



42138

NOTE: When installing the reservoir, take care to avoid damaging the O-ring seal. While applying pressure to the reservoir to seat it, guide the seal into the seal grooves using a wooden or plastic tool.

Install the mounting stud seals and pump union seal in the counterbored holes in the pump body.

Install the reservoir O-ring on the pump body.

Lubricate the inner edge of the reservoir with petroleum jelly and position the reservoir on the pump body. Press the reservoir downward to seat it on the pump body.

Check alignment of the mounting stud seals after seating the reservoir. Realign the seals, if necessary.

Install the mounting studs and tighten the studs with 27 N·m (20 ft-lbs).

Install the seal on the pump union and install the union inflow control valve bore. Tighten the union with 27 N·m (20 ft-lbs) torque.

Install the pump pulley using Tool J-25033-B.

Install the pump, refer to installation.

Fill the pump reservoir and bleed the air from the system, refer to Fluid Level and Initial Operation.

FLUID LEVEL AND INITIAL OPERATION

Fill the pump reservoir with power steering fluid.

Operate the engine until the fluid reaches the normal operating temperature of approximately 77°C (170°F).

Operate the engine at curb idle speed and add fluid to the reservoir until the level is at the COLD mark on the dipstick.

Turn the wheels to the full left-turn position and add fluid to the reservoir until the level is at the COLD mark on the dipstick.

SEE I.S. NOTES

Bleed the system by turning the wheels to the left and right without contacting the steering stops. Maintain the reservoir fluid level just above the pump body. Aerated fluid will have a milky color. Continue to turn the wheels to the left and right until the air is purged from the fluid.

Return the wheels to the straight-ahead position and operate the engine for an additional two to three minutes; then stop the engine.

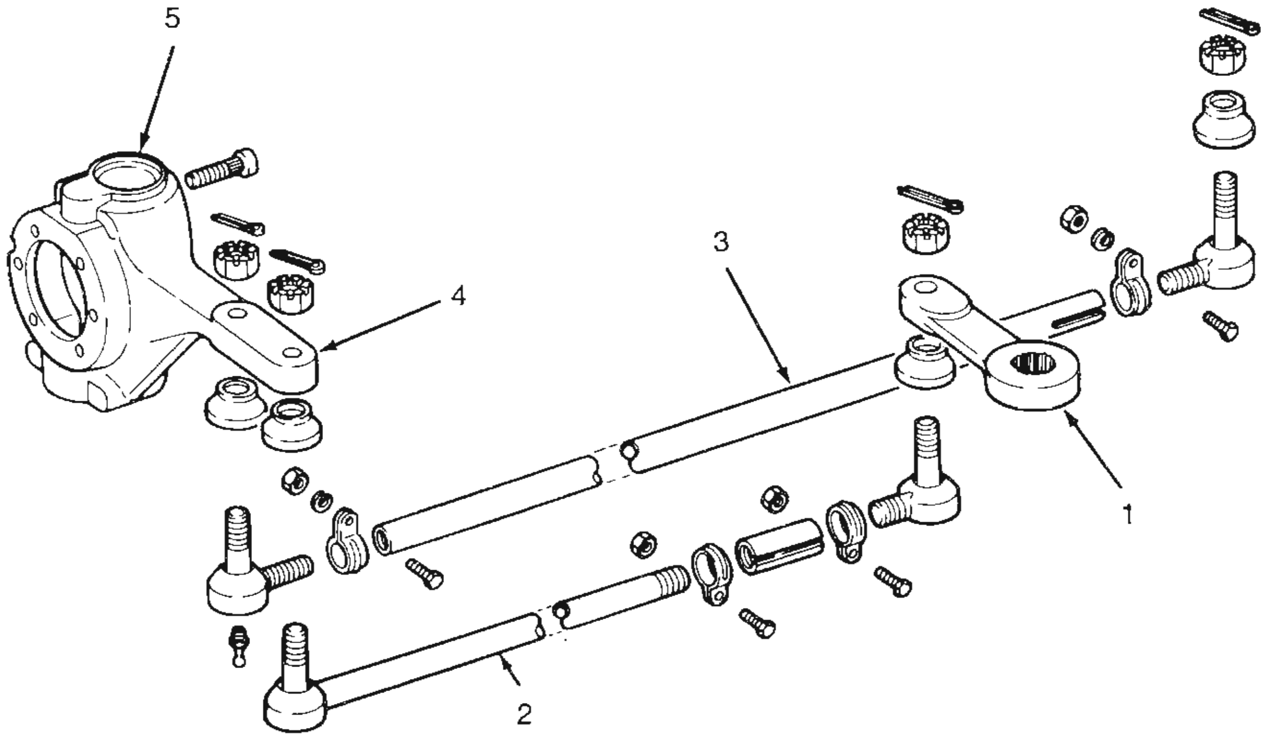
Road test the vehicle to verify proper operation of the power steering system.

Recheck the fluid level. After the system has stabilized at the operating temperature, the fluid level should be at the HOT mark on the dipstick. Add fluid to the reservoir as necessary.

GENERAL

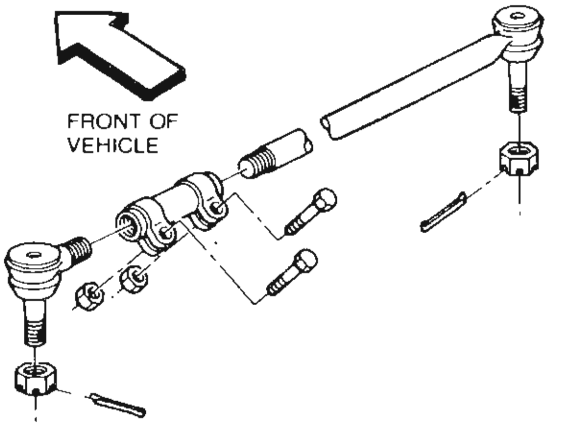
The steering linkage consists of a steering gear pitman arm (1), a connecting rod (2), a tie rod (3), a steering damper and an integral steering arm (4) and steering knuckle (5). Ball ends and adjusting tubes are used on the tie rod and connecting rod for toe-in adjustment and steering wheel alignment.

The connecting rod is attached to the pitman arm at one end and to the tie rod at the opposite end. The tie rod ends are connected to the steering knuckle arms. The steering damper is attached to the tie rod on one end and to a bracket on the left spring tie plate at the opposite end.



840810

The connecting rod is threaded on one end and has a ball-end assembly at the opposite end. An adjusting tube and removable ball end complete the connecting rod assembly. It is attached to the right hand steering arm. The threaded end, with the adjusting tube and removable ball end, is attached to the pitman arm.



840811

SEE I.S. NOTES

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Connecting Rod Clamp Bolt	16 N·m (12 ft-lbs)	14-20 N·m (10-15 ft-lbs)
Connecting Rod End-to-Pitman Arm Nut (9/16-18)	81 minimum (60 minimum)	
Pitman Arm-to-Pitman Shaft Nut	251 N·m (185 ft-lbs)	217-285 N·m (160-210 ft-lbs)
Steering Damper Bracket U-Bolts	16 N·m (12 ft-lbs)	11-20 N·m (8-15 ft-lbs)
Steering Damper Locknut (3/8-24)	30 N·m (22 ft-lbs)	22-38 N·m (16-28 ft-lbs)
Steering Damper Locknut (7/16-20)	41 N·m (30 ft-lbs)	33-49 N·m (24-36 ft-lbs)
Upper Ball Stud Retaining Nut	136 N·m (100 ft-lbs)	
Lower Ball Stud Jamnut	108 N·m (80 ft-lbs)	
Upper Ball Stud Split Ring Seat	68 N·m (50 ft-lbs)	
Tie Rod Clamp Bolt (5/16-24)	16 N·m (12 ft-lbs)	14-20 N·m (10-15 ft-lbs)
Tie Rod Stud Nuts	54 minimum (40 minimum)	
Wheel Nuts	102 N·m (75 ft-lbs)	88-122 N·m (65-90 ft-lbs)

SPECIFICATIONS

Front Wheel Alignment Specifications

Steering Axis Inclination	10°
Caster	+6°
Camber	0°
Toe-in (per side)	0-2.38mm (0-3/32 in)
Turning Angle	30°-31°

840809

TIE ROD

Removal

Remove the cotter pins and retaining nuts at both ends of the tie rod.

Remove the nut attaching the steering damper push rod to the tie rod bracket and move the damper aside.

Remove the tie rod ends from the steering arms using a puller.

NOTE: After removal, the tie rod ends can be removed by loosening the adjusting tube clamp bolts and unthreading the ends.

Installation

Attach the tie rod ends to the steering arms. Tighten the nuts with 68 N·m (50 ft-lbs) torque and install the replacement cotter pins.

Attach the steering damper to the tie rod bracket.

Adjust the toe-in as necessary.

CONNECTING ROD

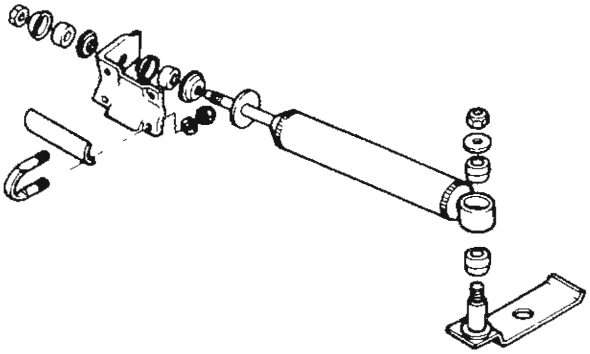
The steering connecting rod can be removed by removing the cotter pins and nuts from both ball ends and removing the rod. The steering connecting rod ball stud ends cannot be disassembled for service.

When installing the steering connecting rod, place the wheels in the straight-ahead position and place the steering arm parallel to the centerline of the vehicle. The steering gear pitman arm must be indexed with the alignment marks on the pitman arm and steering gear shaft and the steering gear must be centered. When the steering arm is correctly positioned, install the connecting rod.

SEE I.S. NOTES

STEERING DAMPER

The steering damper is serviced as an assembly only. If damaged or leaking, replace the damper. However, the rubber mounting bushings used in the damper eyelets or on the push rod can be replaced individually if necessary.



841317

SEE
I.S.
NOTES

Removal

Place the front wheels in the straight-ahead position.

Remove the locknut attaching the damper to the tie plate bracket and lift the damper off the stud.

Remove the locknut attaching the push rod end to the tie rod bracket and remove the damper assembly.

Installation

Insert the rubber bushings in the damper eyelets and on the push rod.

Position the push rod on the tie rod bracket stud and install the attaching parts.

Extend the damper piston rod (by pulling back on the damper body) and install the mounting eyelet on the tie plate bracket stud.

Install and tighten all the locknuts securely.

FRONT WHEEL ALIGNMENT

The alignment should be checked and adjusted using an alignment rack. To ensure the correct alignment, the following inspection is recommended.

Equalize the tire pressures and place the vehicle on a level surface.

Check the steering gear-to-steering column alignment.

Inspect the steering knuckle pivots, spindle and wheel bearings for looseness.

Check for spring sag.

Check the brakes and shock absorbers for proper operation.

Check the steering gear adjustment.

Check the front and rear wheel tracking.

Check for broken spring center bolts.

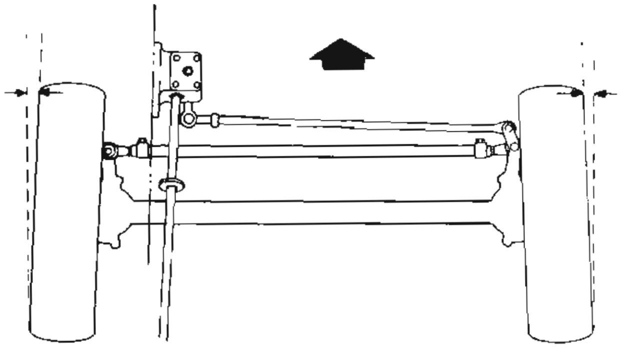
NOTE: Be sure all the front suspension and steering system nuts and bolts are tight before checking the wheel alignment.

Check the caster, camber and toe-in.

Toe-In

The use of an alignment rack to measure toe-in is recommended as shown.

The distance between the rear of the tires should be greater than at the front by 0 - 2.38 mm (0 - 3/32 in).



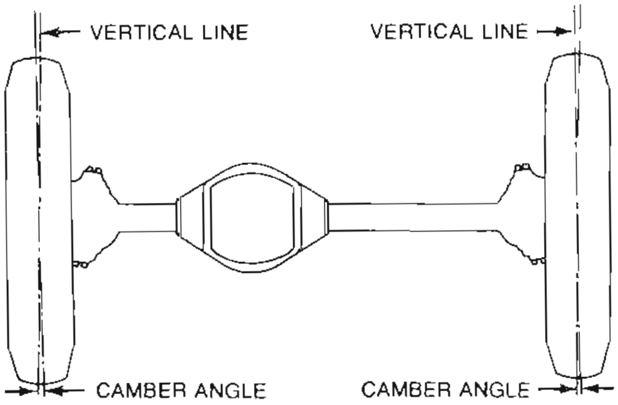
840813

To adjust the toe-in, loosen the adjuster tube clamp bolts and turn the tie rod in or out with a small pipe wrench. The tie rod has both right- and left-handed threads to provide equal adjustment at each wheel. After adjustment, tighten the clamp bolts with the specified torque.

Camber

The correct wheel camber is preset at 0° for all models. Camber cannot be altered by adjustment. It is important that camber be the same on both front wheels. The camber angle should be checked using wheel alignment equipment.

CAUTION: Do not attempt to adjust the camber angle by heating or bending the axle or any suspension components. If the camber is incorrect, the component(s) causing an incorrect camber angle should be replaced.

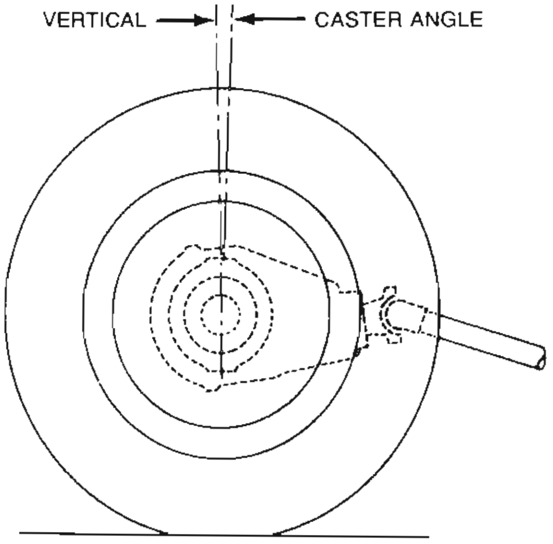


840814

SEE I.S. NOTES

Caster

The axle caster is preset at 6° for CJ models. The caster should be checked using wheel alignment equipment. If the caster is incorrect, adjustment can be made by installing tapered shims between the axle pad and suspension springs.



STEERING WHEEL SPOKE ALIGNMENT

After checking and adjusting the front wheel alignment, align the steering wheel spokes as follows.

Turn the steering wheel until the spokes are in the centered position and clamp the steering wheel in place.

Loosen the connecting rod adjusting tube clamps and turn the tube until the front wheels are in the straight-ahead position.

Tighten the adjusting tube clamps.

Road test and check the steering wheel alignment.

FRONT WHEEL SHIMMY

Front wheel shimmy can be caused by one or more of the following conditions:

- loose front wheel bearings
- worn, unbalanced or out-of-round front tires
- loose steering damper bracket
- steering damper malfunction
- worn or loose tie rod ends
- worn, loose or incorrectly preloaded steering knuckle ball studs
- incorrect tire inflation pressures

The following procedure outlines a method for determining and correcting the causes of wheel shimmy.

Raise the vehicle front end.

Inspect the front tire condition and check and correct the inflation pressures. Check the tires for evidence of unbalance such as cupping, scalloping, flat spots or bald spots. Balance or replace the tires exhibiting these conditions.

Check and correct the front wheel bearing adjustment, if necessary.

Inspect the steering damper mounting brackets or retaining nuts for being loose. If they are loose, tighten the nuts or center bracket on the tie rod and tighten the attaching bolts.

Check the steering damper operation. Disconnect the damper at the tie rod bracket and alternately compress and extend the damper piston fully. The piston action should be smooth and uniform throughout each stroke. Higher resistance on the extension stroke than the compression stroke is a normal condition. Replace the damper if a lack of resistance is evident.

Inspect the tie rod ends. Replace any tie rod end that exhibits excessive play.

Inspect the steering knuckle ball studs. Insert a pry bar between the knuckle and the yoke, adjacent to the ball stud, and pry against each stud. If the studs do not move or appear to be loose in the stud socket, proceed to the next step. If any stud moves or appears loose, reseat both studs in that side of the axle as follows:

- remove the wheels and axle shafts
- loosen the lower ball stud jamnut and remove the cotter pin and slotted nut from the upper ball stud
- unseat both the ball studs by striking them with a lead hammer and remove the upper ball stud split ring seat using Tool J-25158; discard the seat after removal
- remove the lower ball stud jamnut and remove the steering knuckle; discard the jamnut after removal
- clean the split ring seat threads and lower stud taper in the steering knuckle; clean the threads and tapered surfaces of both the ball studs and clean the threads in the upper ball stud retaining nut
- position the knuckle on the axle yoke and install the replacement lower ball stud jamnut finger-tight (only)
- install and tighten the upper ball stud slotted nut with 13-27 N·m (10-20 ft-lbs) torque to draw the lower ball stud into the tapered hole in the axle yoke; do not install the upper ball stud split ring seat at this time
- tighten the replacement lower ball stud jamnut with 108 N·m (80 ft-lbs) torque
- remove the upper ball stud slotted nut and install the replacement split ring seat using Tool J-25158; tighten the seat with 68 N·m (50 ft-lbs) torque; install and tighten the upper ball stud slotted nut with 136 N·m (100 ft-lbs) torque; align and install the cotter pin without loosening the slotted nut
- loosely install the axle shafts and steering spindles and measure the turning effort of each steering knuckle; refer to Ball Stud Preload Measurement; if the turning effort is less than 14 N·m (10 ft-lbs) torque, proceed to the next substep; if the turning effort is more than 14 N·m (10 ft-lbs) torque, replace the upper and lower ball studs and repeat the Ball Stud Preload Correction procedure
- install the axle shafts and repeat the procedure
- install the wheels and lower the vehicle

Road test the vehicle to verify the effectiveness of the repairs.

SEE I.S. NOTES

GENERAL

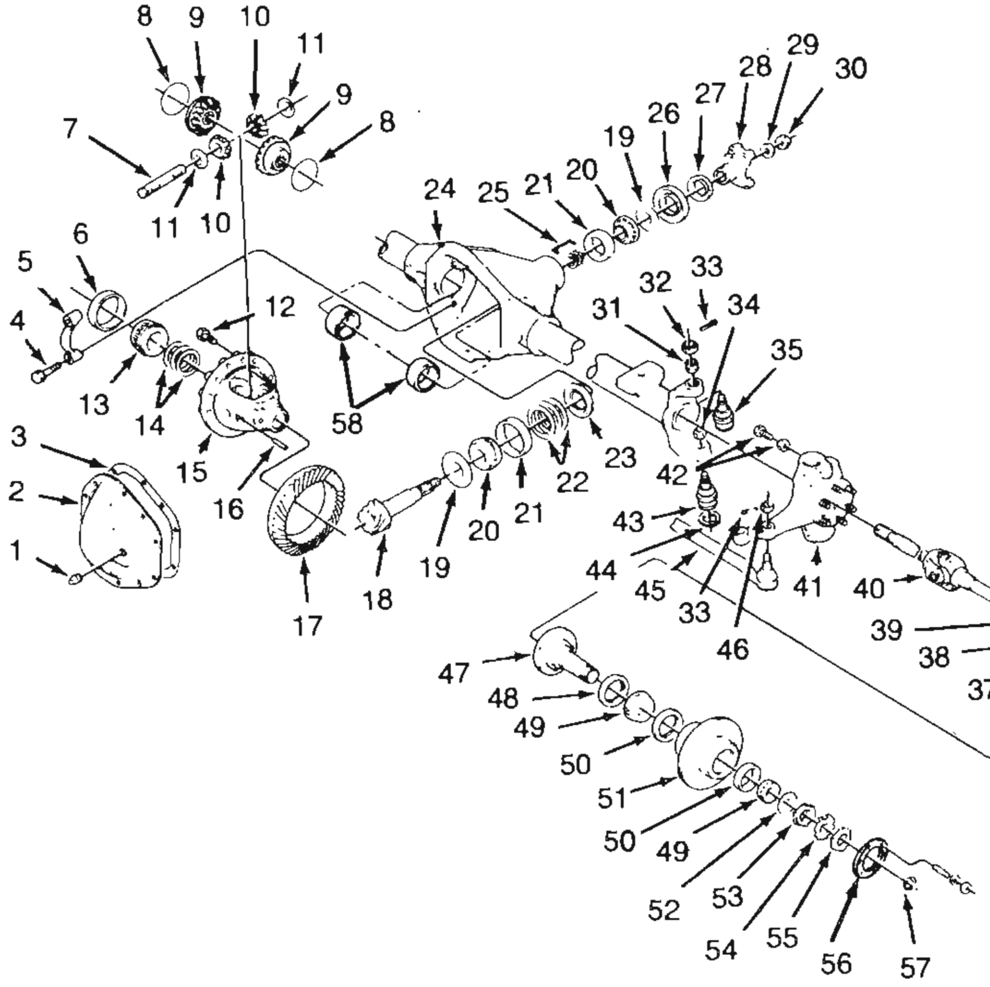
A drive-type front axle with steering knuckles and hypoid differential gears is used on all CJ and Scrambler models.

Engine torque is transmitted to the wheels through full floating, two-piece axle shafts which have connecting universal joints. The axle shafts revolve within and are supported by the steering knuckles. Open end steering knuckles which pivot on ball studs are used on all Jeep front axles.

The Model 30 front axle is used on all CJ and Scrambler models.

On all front axles, toe-in and caster are the only adjustable alignment angles. Camber is built into the axle and cannot be adjusted. Refer to Front End Alignment for adjustment methods.

SEE I.S. NOTES



1. Fill Plug
2. Axle Housing Cover
3. Axle Housing Cover Gasket
4. Differential Bearing Cap Bolt
5. Differential Bearing Cap
6. Differential Bearing Cup (2)
7. Pinion Mate Shaft
8. Thrust Washer
9. Differential Side Gear
10. Differential Pinion Gear
11. Thrust Washer
12. Ring Gear Mounting Bolts
13. Differential Bearing (2)
14. Differential Bearing Preload Shims
15. Differential Case
16. Pinion Mate Shaft Pin
17. Ring Gear
18. Pinion Gear
19. Slinger
20. Pinion Bearing
21. Pinion Bearing Cup
22. Pinion Depth Shims
23. Baffle
24. Axle Housing
25. Pinion Preload Shims
26. Oil Seal
27. Dust Cap
28. Yoke
29. Washer
30. Pinion Nut
31. Upper Ball Stud Split Ring Seat
32. Upper Ball Stud Nut
33. Cotter Pin
34. Lower Ball Stud Jamnut
35. Upper Ball Stud
36. Spindle Bearing
37. Washer
38. Seal
39. Seal Seat
40. Axle Shaft
41. Steering Knuckle
42. Steering Stop Bolt
43. Lower Ball Stud
44. Snap Ring
45. Tie Rod
46. Tie Rod End Nut
47. Spindle
48. Seal
49. Bearing
50. Bearing Cup
51. Hub
52. Tabbed Washer
53. Inner Locknut
54. Lock Washer
55. Outer Locknut
56. Gasket
57. Snap Ring
58. Inner Oil Seal

841319

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-2619-01	Slide Hammer		■
J-5590	Pinion Bearing Installer Sleeve		■
J-7079-2	Driver Handle (Non-Threaded)		■
J-7818	Tool		■
J-8001	Dial Indicator Set		■
J-8092	Driver Handle (Threaded)		■
J-8608	Pinion Rear Bearing Cup Installer		■
J-8611-01	Pinion Front Bearing Cup Installer		■
J-8614-01, 02 & 03	Yoke Holding and Remover Tool		■
J-9233	Pinion Oil Seal Remover		■
J-21784	Differential Bearing Installer		■
J-21786	Pinion Rear Bearing Remover		■
J-21787	Pinion Front Bearing Cup Remover		■
J-22175	Bearing Installer		■
J-22575	Pinion Nut Socket		■
J-22697	Pinion Rear Bearing Installer		■
J-22888	Bearing Puller Set		■
J-22912-01	Bearing Remover		■
J-23674	Axle Shaft Bearing Remover-Installer		■
J-23738	Hand Operated Vacuum Pump		■
J-24430	Pinion Bearing Installer Sleeve		■
J-24433	Bearing Cup Installer		■
J-25101	Bearing Installer		■
J-25131	Seal Installer		■
J-25133	Puller		■
J-25135-01	Tool		■

SEE I.S. NOTES

SPECIAL TOOLS (Cont'd)

Tool Ref.	Description	Required	Recommended
J-25180	Puller		■
J-25215	Puller		■
J-26941	Bearing Remover		■
J-29170	Tool		■
J-29721	Differential Bearing Remover Tool Set		■
J-5223-4	Arbor	■	
J-5223-20	Gauge Block and Plunger	■	
J-5223-24	Clamp	■	
J-5223-25 or -26	Discs	■	
J-5223-29	Bolt	■	
J-6893-03	Socket Tool	■	
J-21788	Axle Shaft Oil Seal Installer	■	
J-22661	Pinion Seal Installer	■	
J-23447	Wrench Nut	■	
J-24385-01	Axle Housing Spreader	■	
J-24385-15	Adapter	■	
J-25104	Bearing Installer	■	
J-25211-1	Plate	■	
J-25211-2	Cup	■	
J-25211-3	Button	■	
J-25211-4	Adapter	■	

SEE I.S. NOTES

TORQUE SPECIFICATIONS – FRONT AXLE

Component	Service Set-To Torque	Service Recheck Torque
Axle Housing Cover Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Connecting Rod End Nut	54 N·m min. (40 ft-lbs min.)	—
Lower Ball Stud Jam Nut	115 N·m min. (85 ft-lbs min.)	—
Tie Rod End Nut	54 N·m min. (40 ft-lbs min.)	—
Shock Absorber Lower Mounting Stud Nut	61 N·m (45 ft-lbs)	48-68 N·m (35-50 ft-lbs)
Spring Pivot Bolts	136 N·m (100 ft-lbs)	109-163 N·m (80-120 ft-lbs)
Spring Shackle Bolts/Nuts	33 N·m (24 ft-lbs)	24-41 N·m (18-30 ft-lbs)
Spring Clip U-Bolt Nuts:		
9/16-18	136 N·m (100 ft-lbs)	115-142 N·m (85-105 ft-lbs)
1/2-20	75 N·m (55 ft-lbs)	61-81 N·m (45-65 ft-lbs)
Upper Ball Stud Split Ring Seat	68 N·m (50 ft-lbs)	—
Upper Ball Stud Retaining Nut	136 N·m (100 ft-lbs)	—
Universal Joint Strap Bolt	22 N·m (16 ft-lbs)	20-26 N·m (15-19 ft-lbs)
Wheel Retaining Nuts	109 N·m (80 ft-lbs)	88-122 N·m (65-90 ft-lbs)
Differential Bearing Cap Bolts	75 N·m (55 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Ring Gear-to-Case Bolts	54 N·m min. (40 ft-lbs min.)	61-88 N·m (45-65 ft-lbs)
Pinion Nut	271 N·m (210 ft-lbs)	285-298 N·m (200-220 ft-lbs)
Wheel Lug Nuts	108 N·m (80 ft-lbs)	88-122 N·m (65-90 ft-lbs)

SEE I.S. NOTES

SPECIFICATIONS

Front Axle Specifications

Axle Type:	
Model 30	Drive-type, full-floating axle with open end steering knuckles mounted on ball studs
Axle Application:	
Model 30 Front Axle	CJ-7, Scrambler
Axle Ring Gear Diameter:	
Model 30	18.09 cm (7.125 in)
Front Axle Lubricants:	Jeep Axle Lubricant or equivalent of SAE 75W-90 A.P.I. Grade GL-5 quality, Grade MIL-L-2105C
Lubricant Capacity:	
Model 30	1.18 liters(2.5 pints)
Turning Angle:	
CJ-7, Scrambler	30-31 degrees

841318

AXLE TESTING AND DIAGNOSIS

General

When diagnosing an axle or front drive hub noise condition, obtain a complete description of the noise and driving conditions when the noise occurred. A preliminary road test with the owner demonstrating the complaint condition is recommended.

Transmitting engine torque to the wheels will produce some noise in all axles. Slight axle noises confined to a brief speed range or specific period are considered normal.

Before road testing, check and correct the tire inflation pressures and axle lubricant levels.

Tire Noise Diagnosis

Because certain types of tire tread wear or tread patterns may produce objectionable noises, drive the vehicle on various types of road surfaces and listen for a change in the noise. If the noise varies with the type of road surface, the tires may be causing the noise.

Wheel Bearing Diagnosis

Worn, loose, or damaged wheel bearings can be confused with axle noises. Wheel bearing noise is usually more noticeable when coasting at lower speeds. Applying the brakes gently while the vehicle is moving will usually change wheel bearing noise. Another test involves turning the vehicle alternately left and right while moving straight ahead at a relatively low speed. This manuever side-loads the bearings and should cause the problem bearing to become noisier.

AXLE TEST AND DIAGNOSIS

Before testing the axle, drive the vehicle a distance sufficient to warm the axles and axle lubricant. During the test, operate the transmission and transfer case in every gear combination.

Axle noises are usually related to vehicle speed rather than engine rpm or transmission gear range.

Axle noises may be classified into two types: gear noise and bearing noise.

Gear noise is often described as a whine or high-pitched resonating sound. It is usually more pronounced at certain vehicle speeds and

SEE I.S. NOTES

within a narrow speed range under a drive (accelerating load), coast (decelerating load), or float (constant speed) condition.

Axle bearing noise is usually constant and the pitch is related to vehicle speed.

Backlash

Excessive driveline backlash may be the result of backlash in the transmission, transfer case, propeller shaft yokes or slip joint splines, universal joints, ring and pinion gears, differential gears, front axle shaft splines or universal joints, or rear axle shaft splines.

SEE
I.S.
NOTES

Other Axle Conditions

A knocking noise heard at low speed or when coasting may be caused by loose fitting differential side gears. If this condition is encountered, operate the vehicle at the speed where the noise is loudest and apply the brakes lightly. If loose fitting gears are causing the problem, the noise level will usually decrease when the brakes are applied.

Differential gear noise is considered normal when spinning a wheel with an on-the-vehicle wheel balancer, or when the wheels are spinning on icy or other types of low traction surface.

Whenever axle noise is caused by worn or damaged bearings, do not replace the gears unless they are also worn or damaged. Similarly, if the axle gears are causing noise, do not replace the bearings unless they are worn or damaged.

AXLE IDENTIFICATION

On Model 30 front axles, the axle code number is cast into the bottom surface of the differential housing.

The axle build date and manufacturer's build date are stamped on the right-side axle tube adjacent to the axle housing cover.

The axle build date is decoded as follows: The first number represents the month, the second number the day of the month, the third number the year, the letter the shift, and the last number is the assembly line. If there are two build dates, the latter date will indicate when the brake components were installed.

The gear ratio tag attached to the left side of the axle housing cover indicates the Jeep manufacturing reference part number and the numerical tooth combination of the ring and pinion gears.

Axle Ratio and Code Letter Chart

Differential Type	Gear Ratio	Code Letter	Pinion-to-Drive Gear Teeth
Standard	2.73	D	15/41
Standard	3.31	B	13/43
Standard	3.54	A	11/39
Standard	3.73	GG	11/41
Standard	4.10	C	10/41

88399

AXLE HOUSING SERVICE

The front axle housing should be inspected periodically for weld cracks or other damage that could cause loss of lubricant, affect driving characteristics, or result in front end misalignment.

NOTE: If the vehicle is driven through water that is deep enough to cover the front hubs, the steering knuckles and brake components should be disassembled and inspected for water-dirt contamination and water damage. All the components should be cleaned thoroughly, examined carefully, and lubricated as necessary before assembly. During the inspection, pay particular attention to the axle bearings, spindle bearings and brake components. Damaged or contaminated parts should be replaced.

FRONT WHEEL ALIGNMENT

Toe-in and caster are the only adjustable front alignment angles. Camber is built into the axle during manufacture and cannot be adjusted.

An alignment rack should be used to check the alignment angles. The use of a rack will ensure more accurate readings and avoid the possibility of incorrect adjustments.

Toe-in is adjusted by lengthening or shortening the steering tie rod. Caster is adjusted by installing tapered shims between the front axle spring mounting pad and front spring. Refer to Front Wheel Alignment for measurement and adjustment procedures.

HIGH STEERING EFFORT

High steering effort or slow return of the steering mechanism after turns may be the result of excessive steering knuckle ball stud preload. If this condition occurs and all other items affecting the steering effort are functioning normally, the ball stud preload should be checked as follows.

Ball Stud Preload Measurement

Raise the vehicle.

Remove the front wheels.

If the vehicle has a steering damper, disconnect the damper at the tie rod and move the damper aside.

Unlock the steering column.

Disconnect the steering connecting rod. Disconnect the connecting rod at the right-side steering knuckle.

Remove the cotter pin and retaining nut attaching the tie rod to the right-side steering knuckle. Discard the cotter pin.

Rotate both the steering knuckles through a complete arc several times. Work from the right side of the vehicle to rotate the knuckles.

Assemble a socket and 68 N·m (0-50 ft-lbs) capacity torque wrench and install the wrench on the tie rod retaining nut.

NOTE: The torque wrench must be positioned at a 90 degree angle to the steering knuckle arm to obtain an accurate reading.

Rotate the knuckles slowly and steadily through a complete arc and measure the torque required to rotate the knuckles:

- if the reading is less than 34 N·m (25 ft-lbs), turning effort is within the specifications and

SEE I.S. NOTES

the fault is not in the steering knuckle; check the steering gear, pump and column

- if the reading is more than 34 N·m (25 ft-lbs), turning effort is excessive; proceed to the next step

Disconnect the tie rod from both the steering knuckles.

Install a 12.7 × 25.4 mm (1/2 × 1 in) bolt, flat washer, and nut in the tie rod stud mounting hole in one steering knuckle. Tighten the bolt and nut securely.

Assemble and install the socket and 68 N·m (0-50 ft-lbs) capacity torque wrench on the bolt previously installed in the steering knuckle.

NOTE: The torque wrench must be positioned at a 90 degree angle to the steering knuckle arm.

Rotate the steering knuckle slowly and steadily through a complete arc and measure the torque required to turn the knuckle.

Install the bolt, flat washer, nut, torque wrench and socket on the opposite steering knuckle and measure the torque required to rotate the knuckle:

- if the reading is less than 14 N·m (10 ft-lbs), the steering effort is within the specifications and the fault is not in the knuckle ball studs; check for tight or damaged tie rod ends, lubricate or replace them as necessary, and proceed to the next step
- if the torque reading is more than 14 N·m (10 ft-lbs), the turning effort is excessive; proceed to the Ball Stud Preload Correction procedure

SEE I.S. NOTES

Install the tie rod. Tighten the tie retaining nuts with 47 N·m (35 ft-lbs) torque and install the replacement cotter pins.

Install the connecting rod. Tighten the connecting rod retaining nuts with 81 N·m (60 ft-lbs) torque.

Install the front wheels.

Lower the vehicle.

Ball Stud Preload Correction

Remove the front axle shafts as outlined in this section.

Loosen the lower ball stud jamnut.

Remove the cotter pin and slotted nut from the upper ball stud.

Unseat the upper and lower ball studs by striking the studs with a lead hammer.

Remove the upper ball stud split ring seat using Tool J-23447. Discard the seat after removal.

Remove the lower ball stud jamnut and remove the steering knuckle. Discard the jamnut after removal.

Clean the upper ball stud split ring seat threads, lower ball stud taper in the steering knuckle, threads and tapered surfaces of the ball studs, and upper ball stud retaining nut threads.

Position the steering knuckle on the axle and install the replacement lower ball stud jamnut finger-tight only.

Install and tighten the upper ball stud slotted nut with 13-27 N·m (10-20 ft-lbs) torque to draw the lower ball stud into the tapered hole in the axle yoke. Do not install the upper ball stud split ring seat at this time.

Tighten the replacement lower ball stud jamnut with 108 N·m (80 ft-lbs) torque.

Remove the upper ball stud slotted nut and install the replacement split ring seat using Tool J-23447. Tighten the seat with 68 N·m (50 ft-lbs) torque.

Install the slotted nut on the upper ball stud. Tighten the nut with 136 N·m (100 ft-lbs) torque. Align and install the cotter pin without loosening the slotted nut.

NOTE: If the cotter pin holes in the nut and stud are not aligned, tighten the nut (only) to align the holes. Never loosen the nut to align the holes.

Install the front axle shafts and steering spindles loosely and measure the turning effort of each steering knuckle as described in Ball Stud Preload Measurement:

- if the turning effort is less than 14 N·m (10 ft-lbs) torque, proceed to the next step
- if the turning effort is more than 14 N·m (10 ft-lbs) torque, replace the upper and lower ball studs and repeat the Ball Stud Preload Correction procedure

NOTE: If the Ball Stud Preload Correction Procedure is repeated, tighten the split ring seat with 68 N·m (50 ft-lbs) torque. Also, tighten the slotted nut on the upper ball stud with 108 N·m (80 ft-lbs) torque.

Install the front axle shafts.

Connect the tie rod to the steering knuckle arms. Tighten the tie rod end retaining nuts with 61 N·m (45 ft-lbs) torque and install the replacement cotter pins.

Attach the connecting rod to the tie rod. Tighten the connecting rod end retaining nut with 81 N·m (60 ft-lbs) torque.

Connect the steering damper to the tie rod, if equipped.

Install the front wheels. Tighten the wheel retaining nuts with 108 N·m (80 ft-lbs) torque.

Lower the vehicle.

PINION SEAL AND YOKE

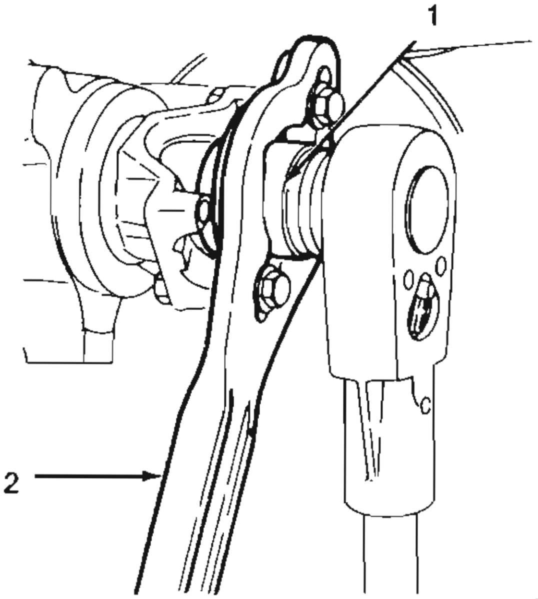
Removal

Raise the vehicle.

Mark the propeller shaft and yoke for assembly alignment reference and disconnect the propeller shaft from the yoke.

SEE I.S. NOTES

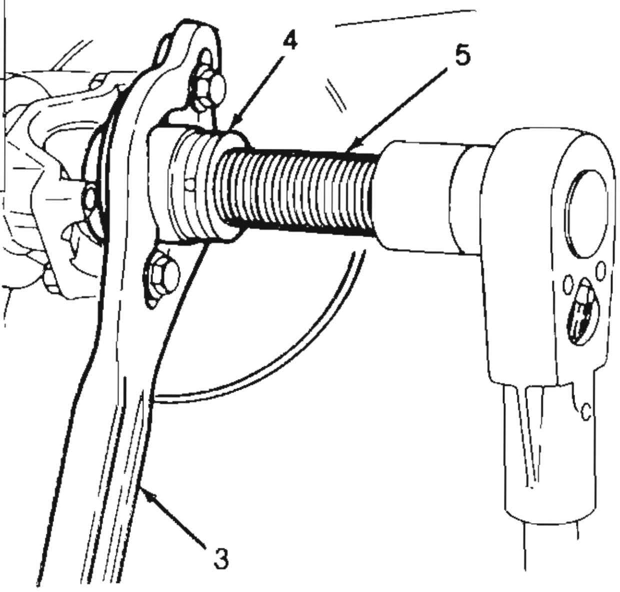
Remove the pinion nut and washer using a socket (1), breaker bar, and Tool J-8614-01 (2).



41425A

Remove the yoke using Tools J-8614-01 (3), -02 (4), -03 (5).

Remove the pinion seal using Tool J-25180.



41426A

SEE I.S. NOTES

Installation

Install the replacement seal using Tool J-25104.

Install the yoke.

Install the pinion washer and nut. Tighten the nut with 285 N·m (210 ft-lbs) torque.

Align the reference marks on the propeller shaft and yoke and connect the shaft to the yoke. Tighten the shaft-to-yoke attaching bolts or nuts with 22 N·m (16 ft-lbs) torque.

Lower the vehicle.

AXLE SHAFT

Removal

Raise the vehicle.

Remove the disc brake caliper.

Remove the bolts attaching the front hub to the axle and remove the hub body and gasket.

Remove the retaining ring from the axle shaft.

Remove the hub clutch and bearing assembly from the axle.

Straighten the lip of the lock washer.

Remove the outer locknut, lock washer, inner locknut and tabbed washer. Use Tool J-25103 to remove the locknuts.

Remove the outer bearing and remove the disc brake rotor.

Remove the disc brake caliper adapter and splash shield.

Remove the axle spindle.

Remove the axle shaft and universal joint assembly.

Installation

Clean all the parts thoroughly.

Install the axle shaft and universal joint assembly. Insert the splined end of the axle shaft into the differential side gear and push the shaft into place.

Install the axle spindle.

Install the splash shield and disc brake caliper adapter.

Lubricate and install the outer bearing in the disc brake rotor.

Install the disc brake rotor on the spindle.

Install the tabbed washer and inner locknut. Tighten the locknut with 68 N·m (50 ft-lbs) torque; then back off the locknut 1/6 turn (45°-65°). Rotate the wheel while tightening the inner locknut to seat the bearings evenly. Use Tool J-25103 to tighten the locknut.

Install the lock washer and outer locknut. Tighten the locknut with 68 N·m (50 ft-lbs) torque and bend the lip of the lock washer over the nut.

Install the hub clutch and bearing assembly on the axle shaft.

Install the retaining ring on the axle shaft.

Install the gasket and hub body on the axle and install the hub attaching bolts. Tighten the bolts with 41 N·m (30 ft-lbs) torque. Tighten the bolts alternately and evenly.

Install the disc brake caliper.

Lower the vehicle.

AXLE SHAFT UNIVERSAL JOINT

Replacement

Remove the axle shaft.

Remove the snap rings from the universal joint bearing cups.

Press on the end of one bearing cup to press the opposite bearing from the yoke half.

Turn the yoke over and press the remaining bearing cup out of the yoke by pressing on the exposed end of the bearing cross journal.

CAUTION: To avoid damaging the bearing, remove the bearing using a brass drift having a flat face that is approximately .79-mm (1/32-in) smaller in diameter than the hole in the axle shaft yoke.

Repeat the above step to remove the remaining bearing cups. Remove the bearing cross journal by sliding it to one side and lifting it out.

Clean the parts in solvent. Inspect the parts after cleaning. Replace any part that exhibits excessive wear or damage.

Pack the bearing cups 1/3 full of bearing lubricant and install the bearing rollers.

Install the bearing cross journal. Hold the bearing cups in the vertical position to prevent the bearings from dropping out.

Install the bearing cups in the axle shaft yoke halves and seat them firmly against the bearing shoulders.

SEE I.S. NOTES

Press the bearing cups on the journal from the opposite side until it is firmly seated.

Repeat the previous steps to install the opposite bearing cups on the cross journal.

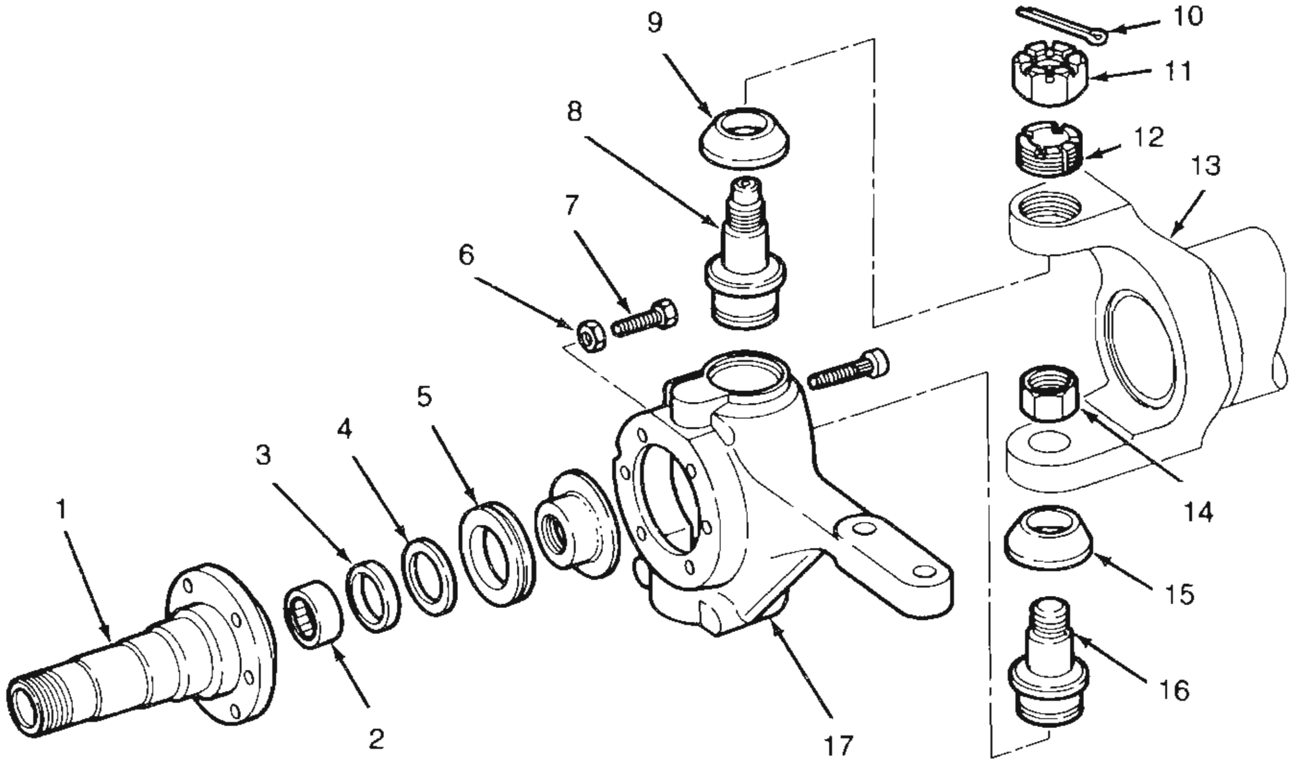
Install the snap rings on the bearing cups.

NOTE: If the universal joint binds when assembled, tap the yoke lightly to relieve any pressure on the bearings at each end of the journal.

Install the axle shaft.

STEERING KNUCKLE REMOVAL

NOTE: The open-end steering knuckle pivots on ball studs. Ball stud replacement requires removal of the axle shaft and steering knuckle.



1. Spindle
2. Spindle Bearing
3. Seal
4. Retainer
5. Seal
6. Locknut
7. Turning Angle Stop Screw
8. Upper Ball Stud
9. Seal
10. Cotter Pin
11. Upper Ball Stud Nut
12. Upper Ball Stud Split Ring Seat
13. Axle Yoke
14. Lower Ball Stud Jamnut
15. Seal
16. Lower Ball Stud
17. Steering Knuckle

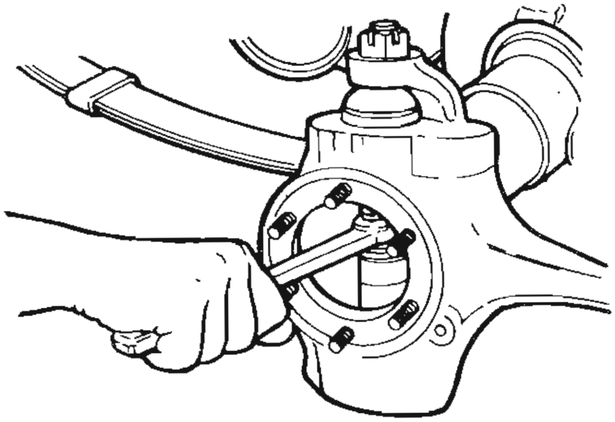
840831

SEE
I.S.
NOTES

Remove the axle shaft.

Disconnect the tie-rod end at the steering knuckle arm.

Remove and discard the lower ball stud jamnut.



840832

Remove the cotter pin from the upper ball stud and loosen the stud nut until the top edge of the nut is flush with the top of the stud.

Unseat the upper and lower ball studs using a lead hammer.

Remove the upper ball stud nut and steering knuckle.

Remove the upper ball stud split ring seat using Tool J-25158.

STEERING KNUCKLE BALL STUDS

Lower Ball Stud Removal

Remove the lower ball stud snap ring.

Clamp the knuckle assembly securely in a vise with the upper ball stud pointing downward.

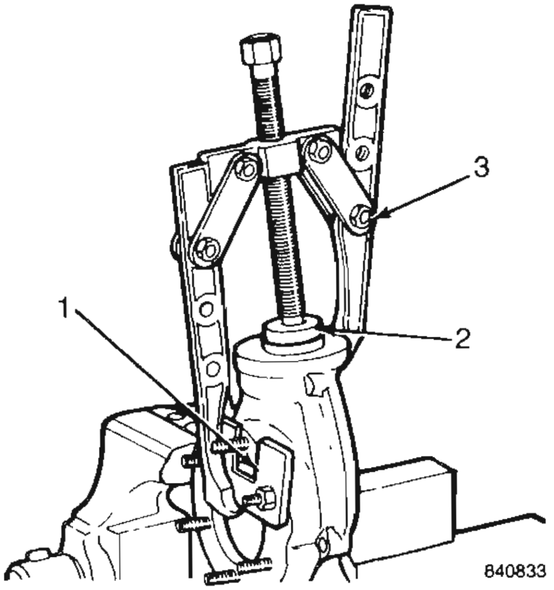
Attach Plate J-25211-1 (1) to the spindle mating surface of the knuckle assembly.

Position Button J-25211-3 (2) on the lower ball stud.

Assemble and install Puller J-25215 (3) on the steering knuckle. Hook one puller arm in Plate J-25211-1 and hook the opposite arm in the knuckle.

Tighten the puller screw to press the lower stud out of the knuckle.

Remove the tools used to press the stud from the knuckle.



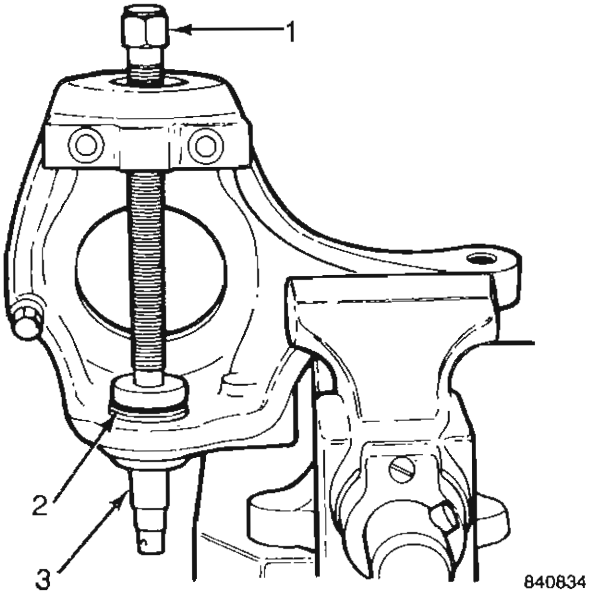
840833

Upper Ball Stud Removal

Remove both the arms from Puller J-25215 (1).

Place Button J-25211-3 (2) on the upper ball stud (3).

Install Adapter J-25211-4 on the nut-end of the puller screw so the adapter shoulder faces the nut-end of the screw.



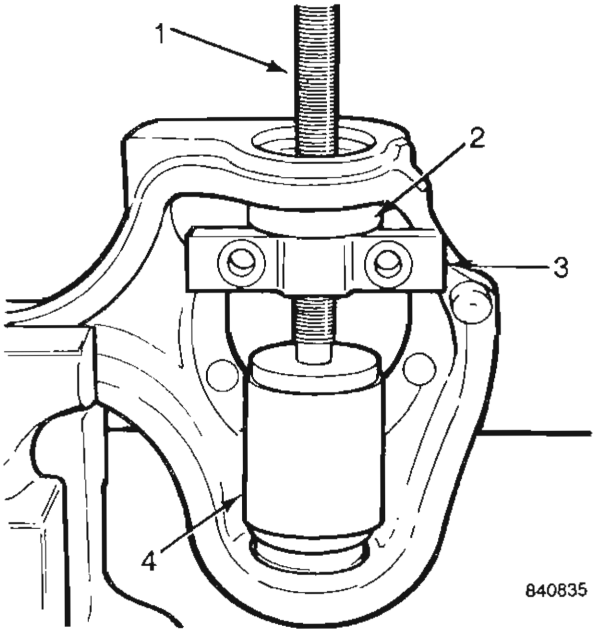
Insert the nut-end of the puller screw (1) through the upper ball stud hole in the knuckle and hold the adapter (2) and frame (3) against the knuckle.

Place Installer Cup (4) J-25211-2 on the ball stud.

Tighten the puller screw to press the lower ball stud into the steering knuckle.

Install the replacement lower ball stud retaining snap ring.

Remove the tools used to install the lower ball stud.



SEE I.S. NOTES

Upper Ball Stud Installation

Install both the arms on Puller J-25215 (1).

Position the replacement upper ball stud in the steering knuckle.

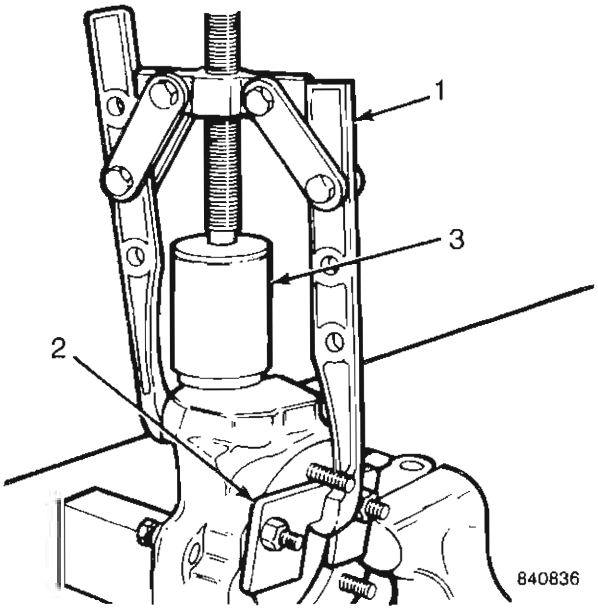
Install Plate J-25211-1 (2) on the spindle mounting studs.

Position Installer Cup J-25211-2 (3) on the upper ball stud.

Install the assembled Puller J-25215 on the steering knuckle. Hook one puller arm in the plate and hook the opposite arm in the knuckle. Be sure the puller screw is centered on the installer cup.

Tighten the puller screw to press the ball stud into the steering knuckle.

Remove the upper ball stud installation tools.



STEERING KNUCKLE INSTALLATION

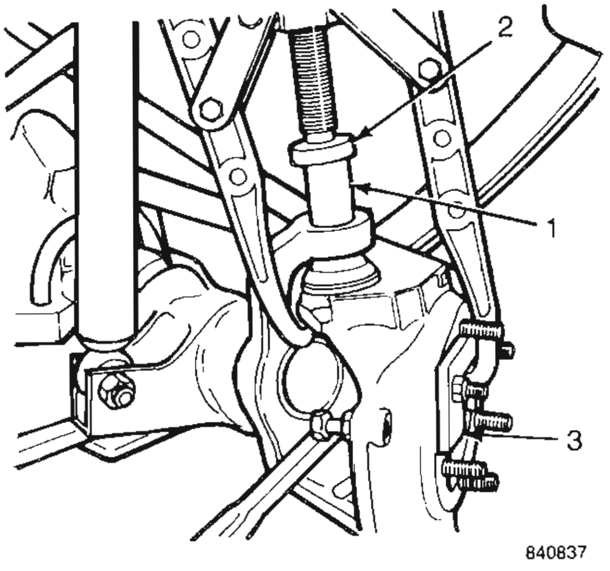
Install the upper ball stud split ring seat in the axle yoke. The top of the seat should be flush with the top of the yoke.

Install the steering knuckle on the axle yoke and install the lower ball stud jamnut finger-tight only.

Position and align Nut Wrench J-23447 (1), Button J-25211-3 (2), Plate J-25211-1 (3) and Puller J-25212.

Tighten the screw of Puller J-25212 until the lower ball stud is held firmly in its seat and install the jamnut. Tighten the jamnut with 115 N·m (85 ft-lbs) torque.

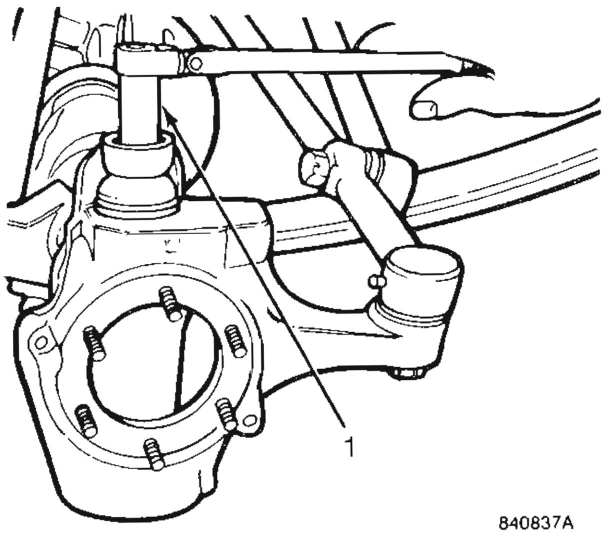
Remove the puller and plate.



SEE I.S. NOTES

Tighten the upper ball stud split ring seat with 68 N·m (50 ft-lbs) torque using Tool J-23447 (1).

Install the upper ball stud nut. Tighten the nut with 136 N·m (100 ft-lbs) torque and install the replacement cotter pin.



NOTE: If the cotter pin holes do not align, tighten the nut until the holes are aligned. Never loosen the nut to align the holes.

Connect the steering tie rod. Tighten the tie rod endnuts with 68 N·m (50 ft-lbs) torque and install the replacement cotter pins.

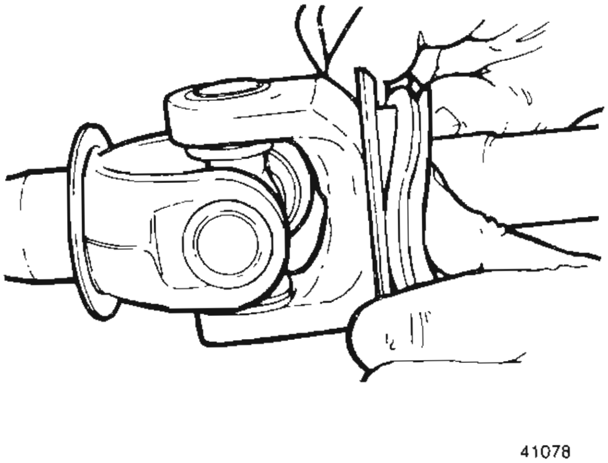
Check and correct the front axle turning angle as necessary. Refer to Turning Angle Adjustment.

AXLE SHAFT SEAL

Replacement

Remove the axle shaft. Refer to the axle shaft removal procedure.

Remove the seal from the axle shaft.



Remove the bronze thrust washer. If the washer is worn, replace it.

Clean dirt and foreign matter from the seal area.

Install the bronze washer with the chamfered side toward the axle shaft seal.

Install the replacement seal with the seal lip facing the spindle.

Pack the wheel bearing lubricant around the thrust face of the shaft and seal and fill the area of the spindle with wheel bearing lubricant also.

Install the axle shaft, Refer to the axle shaft installation procedure.

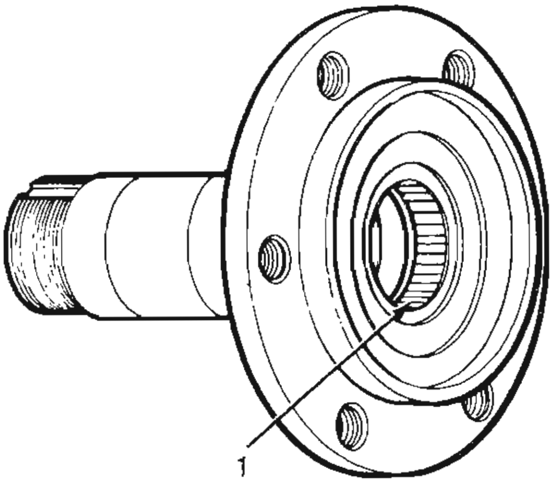
SEE I.S. NOTES

SEE I.S. NOTES

SPINDLE BEARING

Replacement

NOTE: Front axle spindles are equipped with a needle roller bearing (1) that is located in the spindle flange bore.



840838

Wrap the machined surfaces of the spindle with tape and mount the spindle in a vise. Do not clamp the spindle in the vise until protective tape is applied to the spindle surfaces.

Remove the needle bearing using an internal-type puller.

Clean dirt and foreign matter from the spindle bearing surface.

Install the replacement bearing using a bearing driver.

Pack the needle bearing with wheel bearing lubricant.

AXLE HOUSING INNER OIL SEAL

Model 30 front axles have inner oil seals that are located inside the housing. The seals are installed in counterbores machined into the shaft bores in the housing center section.

The axle housing inner seals are serviceable items but require differential removal in order to replace them. Refer to Differential Overhaul – Model 30 Axle in the Standard Differential section for removal/installation procedures.

AXLE REMOVAL

Raise and support the front end. Position the frame stands under the frame rails at the rear of the front springs.

Remove the wheels.

Mark the propeller shaft and axle yoke for assembly alignment reference.

Disconnect the propeller shaft at the axle yoke. Secure the shaft to the frame rail using wire.

Disconnect the connecting rod at the steering knuckles.

Disconnect the shock absorbers at the axle housing.

On vehicles equipped with a stabilizer bar, remove the nuts attaching the stabilizer bar connecting links to the spring tie plates.

Disconnect the breather tube at the axle housing.

Disconnect the stabilizer bar link bolts at the spring clips.

Remove the disc brake calipers, rotors and brake shields.

Remove the U-bolts and tie plates.

Support the axle assembly on a hydraulic jack and raise the jack slightly to relieve spring tension.

Loosen the nuts attaching the rear spring shackles to the springs.

Remove the bolts attaching the front spring shackles to the springs and lower the springs to the floor.

Remove the hydraulic jack and axle assembly from underneath the vehicle.

AXLE INSTALLATION

Support the axle assembly on a hydraulic jack and position the axle under the vehicle.

Raise the springs and install the shackle bolts in the front springs and shackles. Install the shackle bolt retaining nuts hand-tight.

Lower the hydraulic jack until the axle is supported by the front springs and rotate the axle into position on the springs.

Install the spring U-bolts and tie plates.

On vehicles equipped with a sway bar, mount the sway bar connecting links on the tie plates.

Tighten the spring shackle bolts with 33 N·m (24 ft-lbs) torque.

On vehicles equipped with a stabilizer bar, install the nuts attaching the stabilizer bar connecting links to the tie plates.

Tighten the spring pivot bolts with 136 N·m (100 ft-lbs) torque.

Install the brake shields, rotors and brake calipers.

Connect the breather tube.

Connect the shock absorbers.

Connect the steering connecting rod at the steering knuckles. Use replacement cotter pins to secure the nuts.

Connect the propeller shaft to the yoke. Align the shaft and yoke using the alignment marks made during removal.

Install the wheels.

Remove the support stands and lower the vehicle.

Check the front wheel alignment.

Check the turning angle.

TURNING ANGLE ADJUSTMENT

The turning angle stopscrews are located at the rear of the steering knuckle just above the axle centerline. If adjustment is necessary, proceed as follows.

SEE I.S. NOTES

Loosen the locknut on the turning angle stopscrew.

Using a turntable to measure the angle, adjust the stopscrew to obtain the proper turning angle (see Specifications).

Tighten the stopscrew locknut.

NOTE: Turning the adjusting screw inward increases the turning angle. Turning the screw outward decreases the turning angle.

Turning Angle Specifications

Set the turning angle at 30-31 degrees.

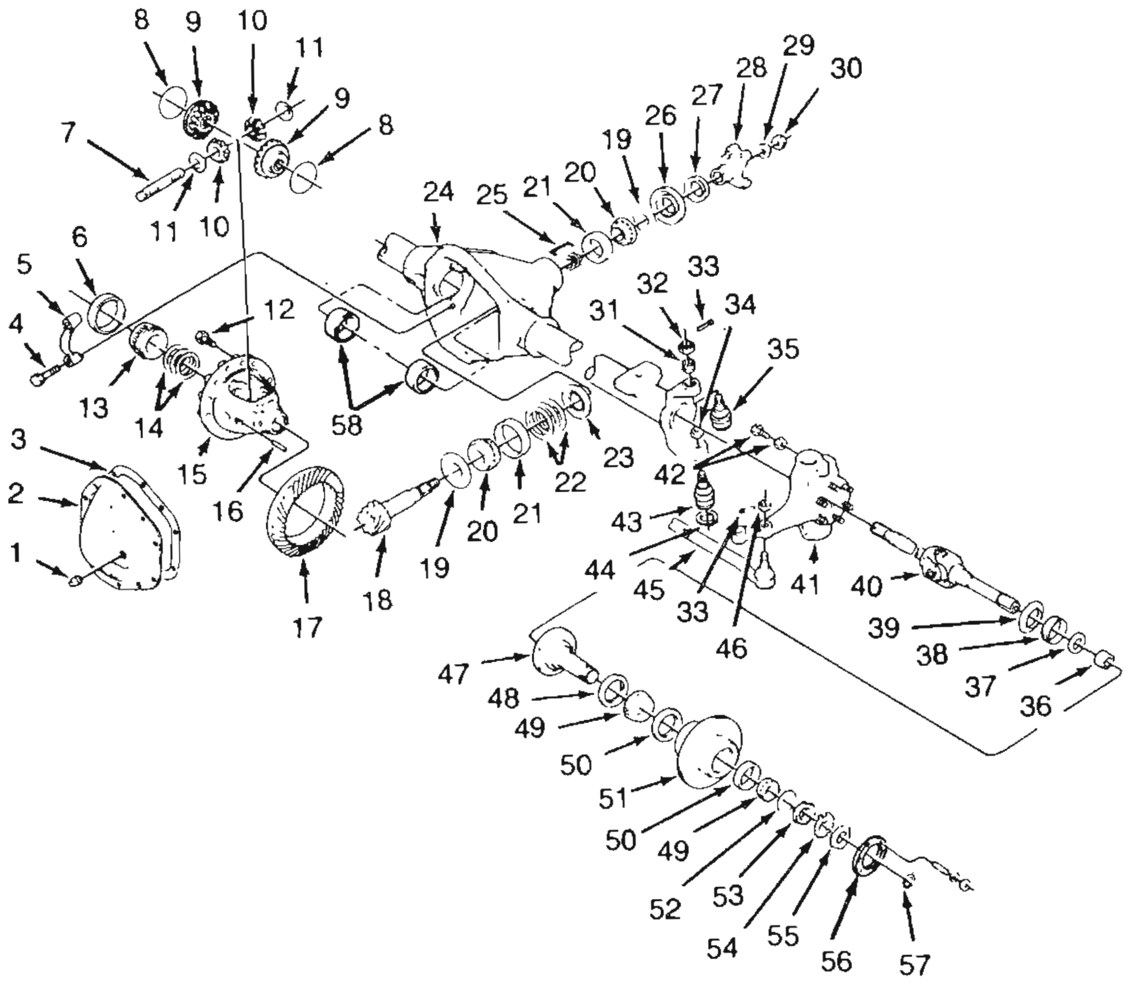
DIFFERENTIAL OVERHAUL

Specifications

Differential Specifications
Model 30 Front Axle

Differential Bearing Preload	0.38mm (.015 in)
Differential Side Gear-to-Case Clearance	0.000-0.15mm (.000-.006 in)
Ring Gear	0.12-0.22mm (.005-.009 in)
Pinion Bearing Break-Away Preload	
Original Bearings	2-3 N·m (15-25 in-lbs)
New Bearings	2-5 N·m (20-40 in-lbs)

841321



1. Fill Plug
2. Axle Housing Cover
3. Axle Housing Cover Gasket
4. Differential Bearing Cap Bolt
5. Differential Bearing Cap
6. Differential Bearing Cup (2)
7. Pinion Mate Shaft
8. Thrust Washer
9. Differential Side Gear
10. Differential Pinion Gear
11. Thrust Washer
12. Ring Gear Mounting Bolts
13. Differential Bearing (2)
14. Differential Bearing Preload Shims
15. Differential Case
16. Pinion Mate Shaft Pin
17. Ring Gear
18. Pinion Gear
19. Slinger
20. Pinion Bearing
21. Pinion Bearing Cup
22. Pinion Depth Shims
23. Baffle
24. Axle Housing
25. Pinion Preload Shims
26. Oil Seal
27. Dust Cap
28. Yoke
29. Washer
30. Pinion Nut
31. Upper Ball Stud Split Ring Seat
32. Upper Ball Stud Nut
33. Cotter Pin
34. Lower Ball Stud Jamnut
35. Upper Ball Stud
36. Spindle Bearing
37. Washer
38. Seal
39. Seal Seat
40. Axle Shaft
41. Steering Knuckle
42. Steering Stop Bolt
43. Lower Ball Stud
44. Snap Ring
45. Tie Rod
46. Tie Rod End Nut
47. Spindle
48. Seal
49. Bearing
50. Bearing Cup
51. Hub
52. Tabbed Washer
53. Inner Locknut
54. Lock Washer
55. Outer Locknut
56. Gasket
57. Snap Ring
58. Inner Oil Seal

841319

SEE
I.S.
NOTES

SEE I.S. NOTES

Disassembly

NOTE: It is not necessary to remove the axle assembly to overhaul the differential.

Raise the vehicle, drain the lubricant and remove the axle shafts.

NOTE: Lower the right spring.

Remove the front shock absorber at the tie plate only.

Remove the stabilizer bar connecting link to the tie plate attaching nut.

Remove the U-bolts and tie plate.

Loosen the nuts attaching the rear spring shackle to the spring.

Support the axle housing with a jackstand.

Remove the bolts attaching the spring shackle to the spring and lower the spring.

Remove the axle housing cover.

Mark the differential bearing caps for assembly alignment reference. Use a centerpunch to mark the caps.

Loosen but do not remove the differential bearing cap bolts.

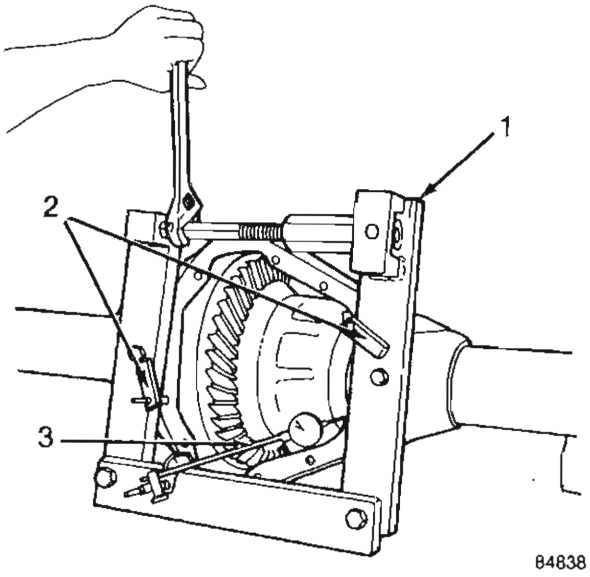
Install Axle Housing Spreader Tool 24385-01 (1). Be sure to install holddown clamps (2) to keep the sreader tool in position.

Mount a dial indicator (3) on the axle housing. Zero the indicator and be sure the indicator stylus contacts one side of the opening in the housing.

Spread the housing no more than 0.50 mm (0.020 in). Measure the amount the housing is spread using the dial indicator mounted previously.

CAUTION: Do not exceed the specified 0.50 mm (0.020 in) when spreading the housing. If the housing is overspread, it could be distorted or damaged necessitating replacement.

When the housing has been spread 0.50 mm (0.020 in) remove the dial indicator.



Remove the differential bearing caps. Tag the caps for assembly reference.

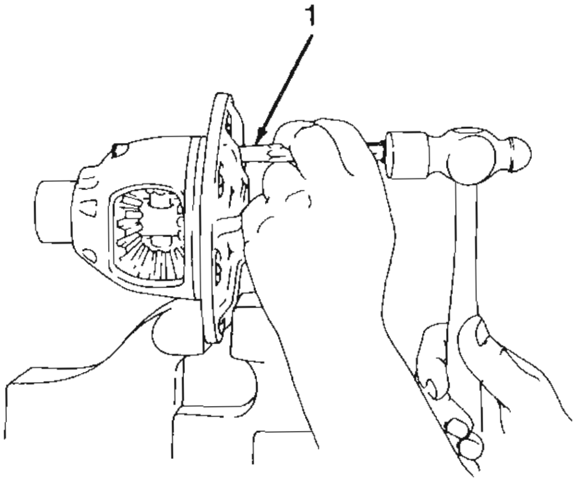
Remove the differential assembly using pry bars. Position the pry bars under the ring gear bolt head and under the differential case.

CAUTION: Remove the spreader tool immediately after removing the differential to avoid the possibility of distorting the housing or causing it to take a set.

Remove and discard the ring gear attaching bolts.

Remove the ring gear from the differential case using a brass drift and hammer. Do not attempt to wedge the gear off the case as the case will be damaged in the process.

Remove the pinion mate shaft lockpin using a small punch (1).



Remove the pinion mate shaft and thrust block.

Rotate the pinion gears until the gears are aligned with the case opening and remove the pinion gears and thrust washers.

Remove the side gears and thrust washers.

Pinion Gear Removal

Mark the propeller shaft for assembly reference and remove the shaft.

Remove and discard the pinion nut and yoke. Use Tool J-8614-01, -02 and -03 as necessary.

Remove the dust cap from the pinion gear.

Remove the pinion gear. Strike the end of the gear using a rawhide hammer to force the pinion out of the pinion gear bearing and housing.

NOTE: The pinion bearing preload adjusting shims may remain on the pinion shaft, or stick to the bearing remaining in the housing, or it may fall out. Collect, tag, and retain these shims for assembly.

Remove the pinion front bearing, slinger, and seal. Use a 5 × 5 cm (2 × 2 in) piece of wood or length of pipe to drive the bearing, slinger, and seal out of the housing. Discard the seal after removal.

SEE I.S. NOTES

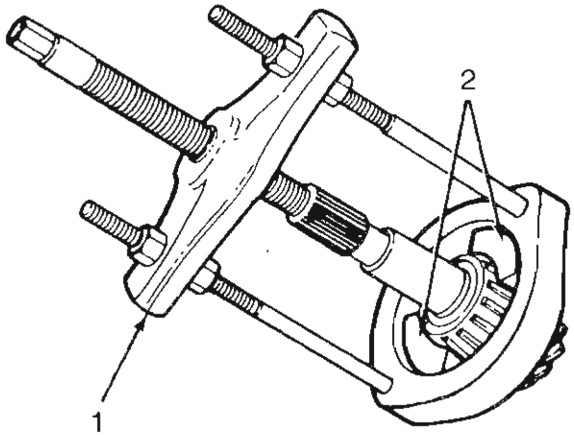
SEE I.S. NOTES

Pinion Rear Bearing Removal

Assemble and install Bearing Remover Set J-29721 (1) on the bearing and gear.

Insert the bearing remover adapters (2) into the remover base from the top and position the adapters 180° apart.

Tighten the remover tool forcing screw and remove the bearing.



840424

Differential Bearing Removal

Install Bearing Remover Tool J-29721 and adapters on the case and bearing.

NOTE: Use Remover Tool Adapter J-29721-9.

Position the chamfered edge of the remover tool adapters between the bearing race and the case.

Tighten the remover tool bolt until the chamfered edges of the adapters are well under the bearing race.

Tighten the remover tool forcing screw and remove the bearing.

Repeat the operations to remove the opposite bearing.

NOTE: When using this tool, be sure the differential case is secure. When the bearing is removed the differential case can drop if not supported.

Pinion Bearing Cup Removal

Remove the pinion rear bearing cup. Use a brass drift and hammer to tap the cup out of the housing.

Remove the pinion depth shims from the rear bearing cup bore in the housing. Retain the shims for assembly reference even if bent or distorted.

Remove the pinion front bearing cup. Use a brass drift and hammer to tap the cup out of the housing.

Cleaning and Inspection

Clean all the parts in solvent. Allow the bearings to air dry. Dry other parts with compressed air.

Inspect all the bearings and cups for pitting, galling, flat spots or cracks. Replace any bearing or cup that exhibits any of these conditions.

Inspect the differential case for an elongated, or enlarged pinion mate shaft bore. The machined thrust washer surface areas and counterbores must be smooth and free of nicks, gouges, cracks or burrs. Inspect the case for cracks or other visible damage. Replace the case if it exhibits any of these conditions.

Inspect the pinion mate shaft for excessive wear, scoring or galling. The shaft must be smooth and concentric. Replace the shaft if it is worn or damaged.

Inspect the side gears and pinion gears. All the gear teeth must display a uniform contact pattern. Inspect the gears and gear teeth for cracks, scoring, excessive wear or galling. Replace all the gears if any gear exhibits these conditions. Inspect the side gear and pinion gear thrust washers for wear, scoring, galling or distortion. Replace the washers if they exhibit any of these conditions.

Inspect the pinion mate shaft lockpin for damage or for being loose in the case. Replace the pin or differential case as necessary.

Inspect the ring and pinion gears for worn or chipped teeth, cracks, damaged bearing journals or damaged attaching bolt threads. If replacement is necessary, the gears must be replaced as a matched set only.

Inspect the differential case for cracks, worn shaft and pin bores, or other damage which might necessitate replacement. If raised metal was produced on the bearing cup bore shoulders during bearing cup removal, flatten the raised portion using a blunt punch.

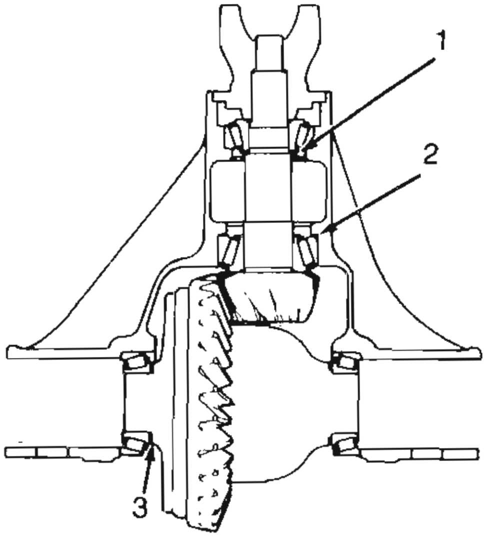
Inspect the pinion yoke for cracks, worn splines, and pitted, rough or corroded seal contact surfaces. Repair or replace the yoke as necessary.

Inspect the pinion differential bearing shim packs for broken, damaged, or distorted shims. Replace shims as necessary during assembly.

Differential Assembly

Pinion Gear Installation and Depth Adjustment

Pinion gear depth is the distance, measured in millimeters (inches), from the end face of the pinion gear to the axle shaft centerline. This dimension is controlled by shims installed between the pinion rear bearing and axle housing.



1. Bearing Preload Shim Pack
2. Pinion Depth Shim
3. Differential Bearing Shim Packs

J42312

Ring and pinion gear sets are factory tested to detect machining variances. Tests are started at a standard setting which is then varied to obtain the most desirable tooth contact pattern and quietest operation. When this setting is determined, identifying numbers are etched on the ring and pinion.

SEE I.S. NOTES

The ring gear receives one number. The pinion gear receives two numbers which are separated by a + or a - sign. The ring gear number and the first number on the pinion gear identify the gears as a matched set. Do not attempt to use a set with differing numbers. This is not a matched set.

The second number on the pinion indicates the pinion position in relation to the centerline of the axle shafts where the tooth contact was best and the operation the quietest. This number represents pinion depth variance and is the amount, in thousandths of an inch, that the set varied from the standard setting.

The standard for axle Model 30 is 5.71 cm (2.250 in).

SEE I.S. NOTES

If the pinion is marked +2, the gear set varied from the standard by +0.05 mm (+0.002 in) and will require 0.05 mm (0.002 in) less shims than a set marked zero (0). When a set is marked +, the distance from the pinion button face to the axle shaft centerline must be more than the standard setting. If the pinion is marked -3, the set varied from standard by -0.07 mm (-0.003 in) and will require 0.07 mm (0.003 in) more shims than a set marked zero. When a set is marked zero, the distance from the pinion button face to the axle shaft centerline must be less than the standard setting.

Pinion Variance Chart

This chart will help determine the approximate starter shim thickness needed for the initial pinion depth measurement. However, the chart will not provide the exact shim thickness required for the final adjustment and must not be used as a substitute for an actual pinion depth measurement.

To use the chart, proceed as follows:

- measure the thickness of the original pinion depth shim
- note the pinion depth variance numbers marked on the old and new pinion gears
- refer to the Old and New Pinion Marking columns in the chart; the chart box where the old and new pinion depth columns intersect is the approximate amount of change required to obtain the desired starter shim thickness

For example, if the old pinion is marked -3 and the new pinion +2, the chart procedure would be as follows: Refer to the Old Pinion Marking column at the left side of the chart and locate the -3 figure in this column. Then read to the right, across the chart, until under the +2 figure in the New Pinion Marking column. The box where the two columns intersect will provide the amount of shim thickness required. In this case, the number in the intersecting box is -0.12 mm (-0.005 in) which represents the amount to be subtracted from the original shim thickness. If the box number had been a + figure, this amount would be added to the original shim thickness.

CAUTION: Front axle differentials use an oil slinger between the pinion gear bearing and the pinion head. This slinger must be installed in order to measure and adjust the pinion depth correctly.

Measure the thickness of the pinion depth shim removed during disassembly.

Record the pinion depth variance numbers on the old and new pinion gears.

Refer to the pinion variance chart and determine the amount to be added to or subtracted from the original shim to arrive at the starter shim thickness.

Pinion Variance Chart

Old Pinion Marking	New Pinion Marking								
	– 4	**– 3**	**– 2**	**– 1**	**0**	**+ 1**	**+ 2**	**+ 3**	**+ 4**
+ 4	+ 0.008	+ 0.007	+ 0.0006	+ 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

84130

CAUTION: Do not use or assume that the starter shim thickness will be the final shim setting. An actual pinion depth measurement must be performed and the final shim thickness adjusted as necessary.

Install the pinion bearing cup in the housing bore using Driver Handle J-7079-02 and Installer J-25101.

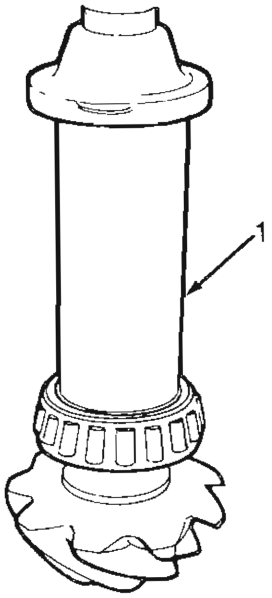
Install the starter shim in the rear bearing bore of the housing. Be sure the shim is centered in the cup bore. If the shim is chamfered, the chamfer must face toward the housing bore – not toward the pinion head.

Install the pinion rear bearing cup in the housing bore using Driver Handle J-7079-02 and Installer J-25101.

On front axle differentials, install the oil slinger on the pinion gear. Be sure the slinger is seated on the pinion head before installing the rear bearing.

Install the rear bearing on the pinion using Installer Sleeve J-5590 (1).

Install the pinion gear in the axle housing.



840426

SEE I.S. NOTES

Install the pinion front bearing, pinion yoke, washer and original pinion nut on the pinion. Tighten the nut only enough to remove end play and provide 1 - 2 N·m (10 - 15 in-lbs) of drag torque when the pinion is rotated.

NOTE: Do not install the pinion seal, slinger, or dust cap at this time. The pinion will be removed after measuring and adjusting pinion depth.

Note the pinion depth variance marked on the pinion gear. If the number is preceded by a plus (+) sign, add that amount (in thousandths) to the standard setting for the axle model being overhauled. If the number is preceded by a minus (-) sign, subtract that amount (in thousandths) from the standard setting. The result of the addition or subtraction is the desired pinion depth. Record this figure for further reference.

SEE I.S. NOTES

NOTE: If the gear is marked 0 (zero), use the standard setting.

Assemble Gauge Arbor J-5223-4 and Discs J-5223-26.

Install the assembled arbor (1) and discs (2) in the differential bearing cup bores. Be sure the discs are firmly seated in the bearing cup bores.

Install the differential bearing caps over the discs and tighten the cap bolts securely, but not with the specified torque.

Install Gauge Block J-5223-20 (3). Position the block so the plunger is directly under Arbor J-5223-4 and the flat surface on the anvil side of the block is seated on the end face of the pinion.

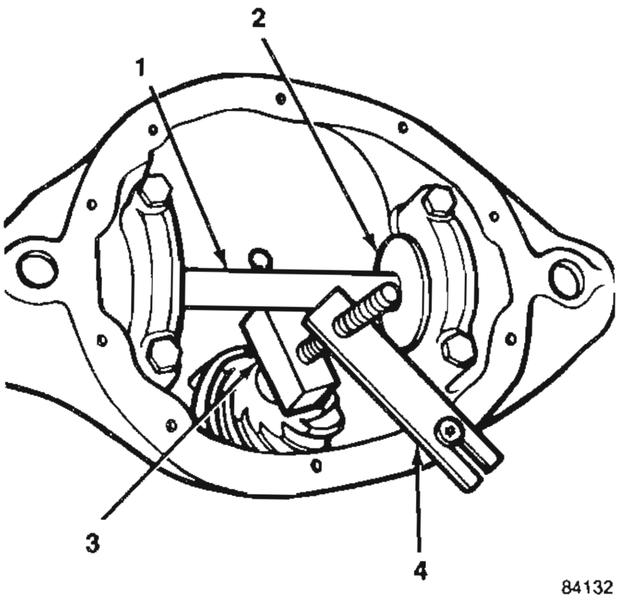
CAUTION: To avoid false readings, do not allow the anvil to contact the pinion gear at any point.

Assemble Bolt J-5223-29 and Clamp J-5223-24 (4) and mount the tools on the axle housing. Use the housing cover bolt to attach the clamp to the housing.

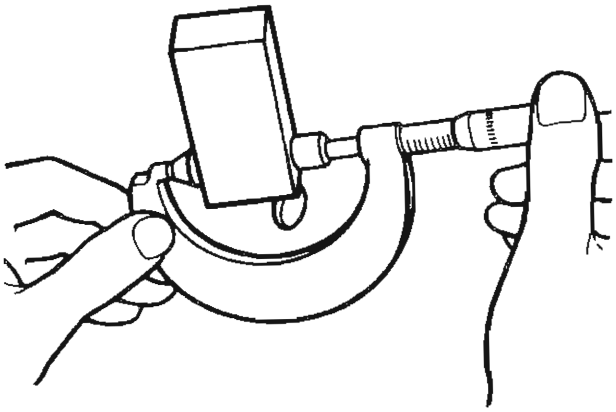
Extend the clamp bolt until it presses against the gauge block. Align the gauge block plunger with the center of the gauge arbor and tighten the clamp bolt until it presses against the block with enough force to prevent the block from moving.

Loosen the gauge block thumbscrew and release the plunger. When the plunger contacts the arbor tool, tighten the thumbscrew to lock the plunger in position. Do not disturb the plunger position.

Remove the clamp and bolt from the axle housing.



Remove the gauge block and measure the distance from the end of the anvil to the end of the plunger using a 7.62 cm (3 in) micrometer. This dimension represents the measured pinion depth. Record this dimension for assembly reference.



84133

NOTE: If the measured pinion depth equals the desired pinion depth, the installed shim thickness is correct and further adjustment is not required.

Remove the bearing caps and remove the arbor tool and discs.

Remove the pinion gear, rear bearing cup, and depth shim from the axle housing.

Measure the thickness of the depth shim just removed from the housing and add this dimension to the measured pinion depth obtained in the previous step. From this total, subtract the desired pinion depth. The result represents the shim thickness required to adjust the pinion depth.

NOTE: The desired pinion depth is the standard setting plus or minus the pinion depth variance.

The following example illustrates the procedure for determining the correct shim thickness.

Example – Pinion Depth Variance is Plus (+)

Step 1 – Determine desired pinion depth.

Add the pinion depth variance (marked on the pinion gear) to the standard setting. The result is the desired pinion depth.

Standard Setting – 57.1 mm (2.250)
Pinion Depth Variance – +0.10 mm (+0.004)
Desired Pinion Depth – 57.2 mm (2.254)

Step 2 – Determine the total measured pinion depth.

Add the measured pinion depth to the measured shim thickness. The result is the total measured pinion depth.

Measured Pinion Depth – 56.5 mm (2.224)
Starter Shim Thickness – +2.71 mm (+0.107)
Total Measured Pinion Depth – 59.2 mm (2.331)

Step 3 – Determine the correct shim thickness.

Subtract the desired pinion depth from the total measured pinion depth. The result is the correct shim thickness.

Total Measured Pinion Depth 59.2 mm (2.331)
Desired Pinion Depth – 57.2 mm (2.254)
Correct Shim Thickness – 1.96 mm (0.077)

SEE I.S. NOTES

Remove the pinion gear, rear bearing cup and starter shim.

Install the correct thickness pinion depth shim in the housing bearing cup bore and reinstall the rear bearing cup.

Pinion Bearing Preload Adjustment

Install the pinion bearing preload shims.

Install the pinion gear, front bearing, oil slinger, if equipped, yoke, washer, and old pinion nut. Tighten the nut with 352 N·m (260 ft-lbs) torque.

Measure the torque required to rotate the pinion gear using a 0-6.25 N·m (0-50 in-lb) torque wrench. The rotating torque should be 2-5 N·m (20-40 in-lbs) with new bearings, or 1-2 N·m (10-20 in-lbs) with the original bearings. Add shims to decrease the preload or subtract shims to increase the preload.

Remove the pinion nut, washer, and yoke when the pinion bearing preload is adjusted.

Install the new pinion oil seal using Tool J-25104.

Install the yoke and pinion washer.

Install the new pinion nut. Tighten the nut with 285 N·m (210 ft-lbs) torque.

Differential Side Gear Adjustment

Install the thrust washers on the side gears and install the gears in the case.

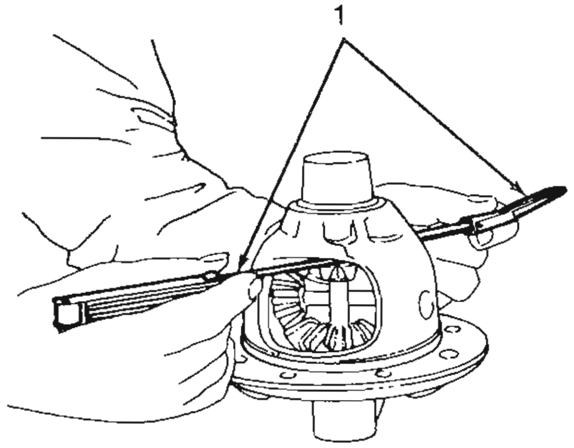
Install the thrust washers on the differential pinion gears and install the gears in the case.

Install the thrust block and pinion mate shaft pin in the case.

Position the differential case on end.

Tap the differential case lightly on a flat surface to settle the gears into position in the case.

Measure the clearance between the case side gears using two feeler gauges (1). The clearance between the gears and case must be 0.00 - 0.15 mm (0.000 - 0.006 in).



84846

If the clearance between the gears and the case exceeds 0.15 mm (0.006 in), replace the complete differential case.

If the differential case is replaced, check the side gear clearance again.

Install the ring gear on the differential case and start two bolts in the holes 180 degrees apart. Tighten the bolts evenly to seat the ring gear.

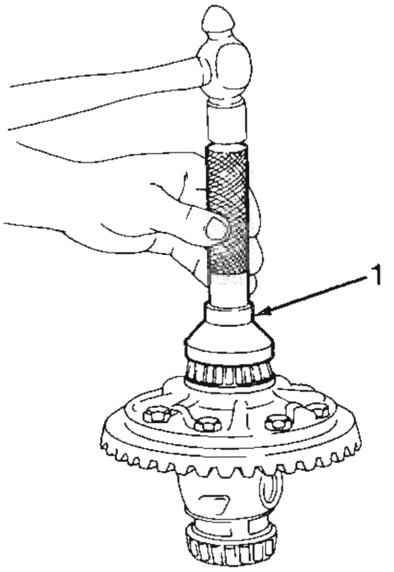
Install the remaining bolts and tighten with 74 N·m (55 ft-lbs) torque.

Differential Bearing Preload and Ring Gear Backlash Adjustment

NOTE: Differential bearing preload is controlled by shims located between the differential case and the bearings.

Remove the old differential bearing shims if not removed previously.

Install the differential bearings using Driver Handle J-7079-2 and Installer J-22175 (1).



Install the bearing cups on the differential bearings.

Install the differential in the axle housing.

Install the bearing caps and tighten the cap bolts securely but not with the specified torque.

Hold the ring gear in contact with the pinion gear and pry the differential bearing cups toward the center of the case using a screwdriver.

Insert various thickness feeler gauges between each bearing cup and axle housing until the ring gear backlash is 0.02 - 0.05 mm (0.001 - 0.002 in) with the feeler gauges installed. The feeler gauges must be installed at both sides of the differential and at the same time to obtain an accurate measurement.

Assemble a shim pack that will provide the desired backlash. Check the backlash again. If it is OK, tag and retain the shims for assembly.

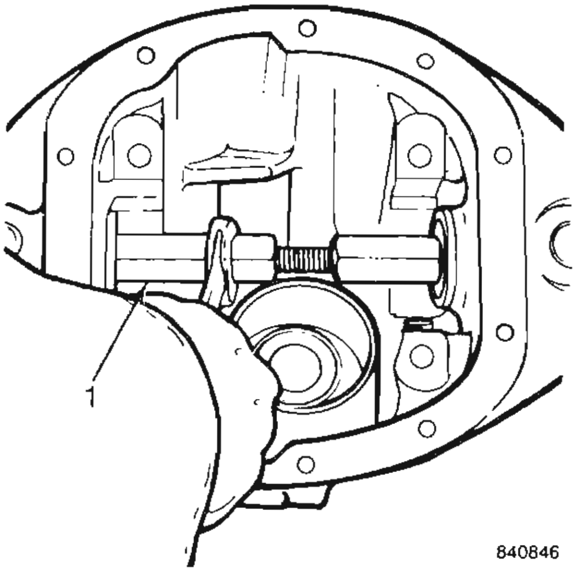
Remove the differential case.

Add an additional 0.38 mm (0.015 in) thickness shim to the shim pack to be installed on the tooth side of the ring gear.

Remove the differential bearings. Refer to the removal procedures outlined in Differential Disassembly.

Install the shim packs on the appropriate sides of the differential case and reinstall the differential bearings.

NOTE: When overhauling a front axle differential, check the axle housing inner oil seals. If seal replacement is required, install the replacement seals using Tool J-28648 (1).



Mount Spreader Tool J-24383-01 and Dial Indicator J-8001 on the housing. Spread the housing no more than 0.50 mm (0.020 in). Do not exceed 0.50 mm (0.020 in) to avoid damaging the housing.

Remove the dial indicator when the housing has been spread the desired amount.

Lubricate the differential bearings with axle lubricant and install the differential bearing cups on the bearings.

Install the differential in the housing. Use a rawhide mallet to seat the differential. Be sure the ring and pinion gear teeth mesh completely.

Remove the axle housing spreader tool.

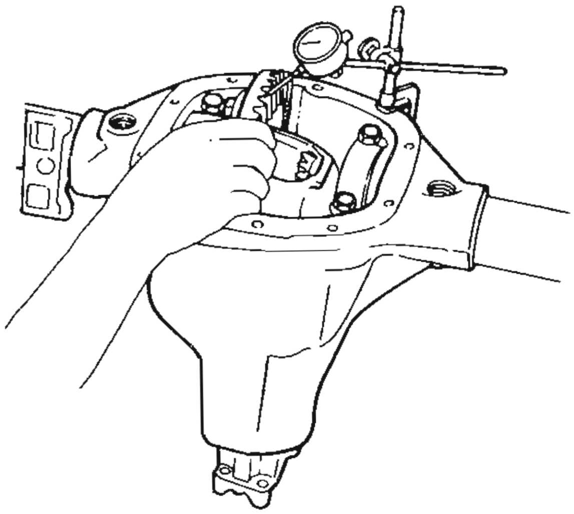
Apply sealing compound to the bearing cap bolt threads and install the bolts. Tighten the bolts with 54 N·m (40 ft-lbs) torque.

Remount Dial Indicator J-8001 on the housing and measure the ring gear backlash. Measure the backlash at two points. The backlash should be 0.12 - 0.25 mm (0.005 - 0.010 in). If the backlash is incorrect, add or subtract shims from the differential bearing shim packs until the correct backlash is obtained.

NOTE: Changing the position of a 0.12 mm (0.005 in) shim from one side to the other will change the amount of backlash approximately 0.07 mm (0.003 in).

Measure the ring gear runout. If the runout exceeds 0.15 mm (0.006 in), the case may be distorted, or there is dirt between the case and the gear, or the ring gear bolts are loose. Check and correct them as necessary.

SEE I.S. NOTES



84848

Raise the spring and install the front spring shackle to the spring attaching bolts.

Remove the jack stand.

Install the tie plate and U-bolts. Tighten the U-bolt nuts as follows:

1/2-20 – 75 N·m (55 ft-lbs)

9/16-18 – 136 N·m (100 ft-lbs)

Tighten the spring shackle to the spring attaching bolts on CJ and Scrambler models with 33 N·m (24 ft-lbs) torque.

Install the stabilizer bar link to the tie plate attaching nut.

Install the shock absorber. Tighten the shock absorber to the tie plate retaining nut with 61 N·m (45 ft-lbs) torque.

Install the axle shafts.

Install the axle housing cover.

Fill the axle with the specified lubricant.

SEE I.S. NOTES

GENERAL

Manual front drive hubs are standard equipment on Jeep vehicles with a Model 300 part-time four-wheel drive transfer case only. Hub model M253 is used on CJ and Scrambler models.

SPECIFICATIONS

Front Drive Hub Specifications

Hub Application	
M 253	CJ, Scrambler Models
Hub Type	2-position, manually operated locking hub
Lubricant	Use Jeep All-Purpose Chassis Lubricant or an equivalent lithium base, waterproof EP-type chassis lubricant

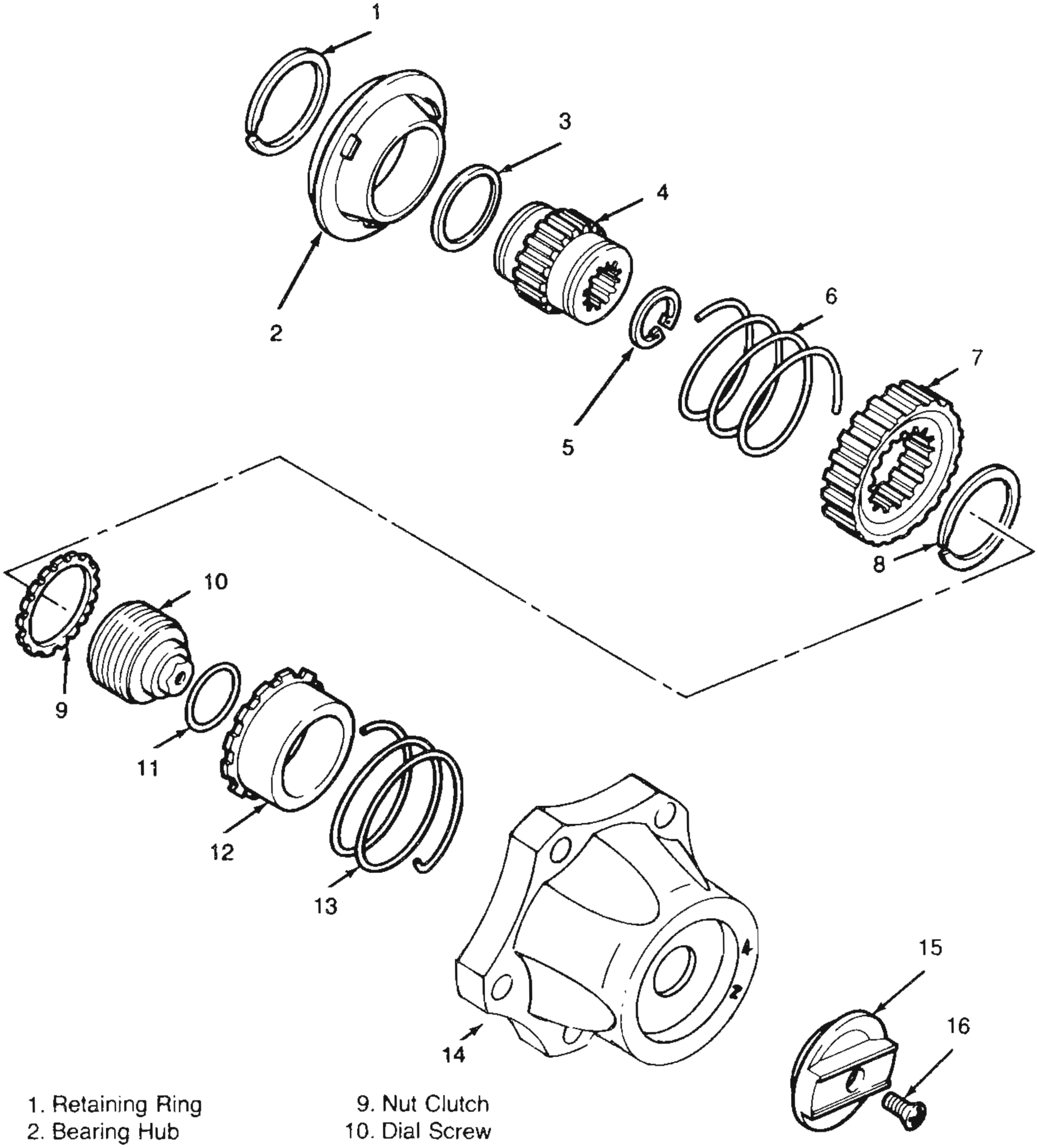
841322

SEE I.S. NOTES

LUBRICATION

Use Jeep all-purpose chassis lubricant, or an equivalent lithium base, waterproof, EP-type chassis lubricant. When servicing the front drive hubs, apply a light coating of chassis lubricant to the hub internal components. Do not pack the hubs full of lubricant; apply a light coating only.

After operation in dusty areas or if the hubs become immersed in water, the hubs, as well as the wheel end components, should be removed, cleaned and lubricated. This should avoid the possibility of premature wear or damage caused by foreign material in the hubs or by lubricant washout.



1. Retaining Ring
2. Bearing Hub
3. Wear Washer
4. Hub Shaft
5. Retaining Ring
6. Compressor Spring
7. Ring Clutch
8. Retaining Ring
9. Nut Clutch
10. Dial Screw
11. O-Ring
12. Clutch Cup
13. Compressor Spring
14. Hub
15. Control Dial
16. Screw

841320

SEE I.S. NOTES

SEE I.S. NOTES

DIAGNOSIS

The manual front drive hubs used on Jeep vehicles should provide efficient and satisfactory operation when used and maintained properly. However, if a problem should occur, refer to the following diagnosis and repair procedures.

Control Dials Hard to Turn or Will Not Engage Completely

If the control dials become hard to turn or will not engage completely, the problem is usually due to a lack of lubricant, or dirt, water or foreign material in the hub cavity or in the dials themselves. In these cases, the repair involves removing, cleaning and lubricating the hubs. However, in some cases, this condition may simply be the result of driveline torque load on the hub clutch. This situation is remedied by raising the vehicle front end and turning the front wheels forward or reverse to relieve the load.

If the problem is the result of internal damage to the hub body or clutch, the damaged component will have to be replaced to restore proper operation. Refer to Hub Service.

Noisy Operation

Chatter, clicking, grating or similar type noises from the hubs may be the result of dirt, water or foreign material in the hub. This condition can be caused by a lack of hub maintenance, loose attaching bolts or screws, or damaged hub gaskets. Noise can become especially prevalent after folding streams or after operation in sandy areas. Service correction involves cleaning and lubricating the hubs.

However, if inspection indicates the problem is the result of damaged internal components, the damaged components will have to be replaced to restore proper operation. Refer to Hub Service.

Lubricant Leaks

Generally, lubricant leaks are caused by loose hub attaching bolts or screws, damaged hub gaskets or a damaged hub body or clutch assembly. Leakage may also be caused by over lubricating during service or normal maintenance operations. In each case, the hub should be removed, inspected and repaired as necessary.

Hub Internal Damage

Axle or hub clutch or hub body component damage may be the result of improper hub usage or maintenance. The vehicle should never be moved unless the hub control dials are fully engaged. In addition, on vehicles equipped with manual hubs, the vehicle should not be operated with the transfer case in the low range and the hubs in the 4×2 or Free position. This places high torque loads on the rear axle.

If the hubs are not maintained properly, full engagement of the control dials may not occur. This can lead to accelerated wear or damage to hub internal components. If the vehicle is driven through water deep enough to cover the hubs or in sandy, dusty areas, the hubs should be cleaned and lubricated thoroughly.

HUB SERVICE

Model M253 front drive hubs are serviced as either a complete assembly or subassembly such as the hub body or hub clutch assembly only. Do not attempt to disassemble these units. If the entire hub or a subassembly has malfunctioned, replace the hub assembly or the problem subassembly as a unit only.

Although the front drive hubs are serviced as assemblies or subassemblies only, the hubs may be removed for cleaning inspection and lubrication purposes. Refer to the Hub Removal/ Installation procedures for details.

HUB REMOVAL/INSTALLATION

Removal – Model M253

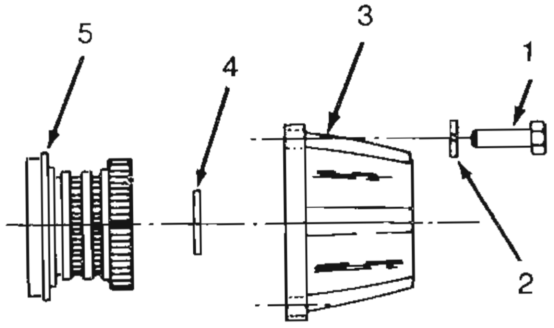
Remove the bolts (1) and tabbed lockwashers (2) attaching the hub body (3) to the axle hub. Retain the bolts and washer.

Remove the hub body and gasket. Discard the gasket.

CAUTION: Do not turn the hub control dial after removing the hub body.

Remove the retaining ring (4) from the axle shaft.

Remove the hub clutch and bearing assembly (5).



840849

Clean the hub components in solvent. Dry them using compressed air, clean shop towels, or air dry. Be sure the old lubricant, dirt, water or other foreign materials are flushed out.

Inspect the hub components for signs of wear or damage. Service the components as necessary.

SEE I.S. NOTES

Installation – Model M253

CAUTION: Do not turn the hub dial until after the hub has been installed. The hub clutch nut and cup can be damaged severely if the dial is rotated while the hub is off the vehicle.

Lubricate the hub components with Jeep all-purpose chassis lubricant or an equivalent. Refer to the Lubrication section. Apply a light coat of lubricant only. Do not pack the hub with lubricant.

Install the hub clutch and bearing assembly on the axle shaft.

Install the retaining ring on the axle shaft.

SEE I.S. NOTES

Position the new gasket on the hub body and install the hub body and gasket.

Align the bolt holes in the axle and hub body and install the bolts and tabbed lockwashers. Tighten the bolts with 41 N·m (30 ft-lbs) torque.

Raise the vehicle front end.

Turn the hub control dials to the 4 × 2 position and rotate the wheels. The wheels should rotate freely. If the wheels drag, check the hub installation. Also, be sure the control dials are fully engaged in the 4 × 2 position.

Lower the vehicle.

GENERAL

The rear axle is a semi-floating type with a 19.2 cm (7 9/16 in) diameter ring gear.

The rear axle housing consists of a nodular cast iron center section and two steel axle tubes (1) which are pressed into the center section (2).

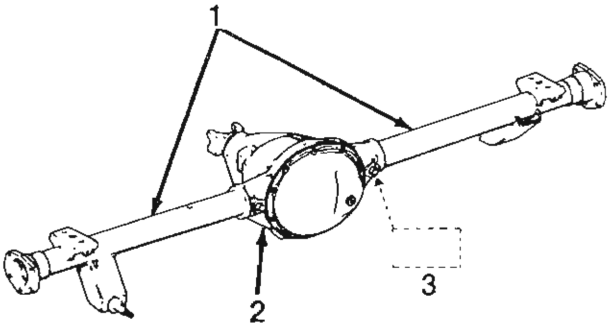
The ring and pinion gears and the differential assembly are contained within the iron axle housing.

A vent fitting and hose assembly are mounted on one of the axle tubes to relieve internal pressure build-up.

The axle shafts, oil seals and axle shaft bearings are contained within the axle tubes.

The rear drum brake support plates are attached to the mounting flanges at the axle tube outboard ends.

The differential assembly consists of a cast iron case containing two differential side gears, two differential pinion gears, and a pinion shaft on which the pinion gears are mounted. The differential side and pinion gears are in constant mesh.



84111

AXLE IDENTIFICATION

Code letters are used to identify the size and gear ratio of the rear axles. The code letter is stamped on the right-hand axle tube boss (3) of each rear axle center section. Refer to the Axle Identification Chart for letter decoding.

Axle Ratio and Code Letter Chart

Differential Type	Gear Ratio	Code Letter	Pinion-to-Drive Gear Teeth
Standard	2.73	D	15/41
Trac-Lok	2.73	DD	15/41
Standard	3.31	B	13/43
Trac-Lok	3.31	BB	13/43
Standard	3.54	A	11/39
Trac-Lok	3.54	AA	11/39
Standard	3.73	H	11/41
Trac-Lok	3.73	HH	11/41
Standard	4.10	C	10/41
Trac-Lok	4.10	CC	10/41

86401A

SEE I.S. NOTES

SPECIAL TOOLS

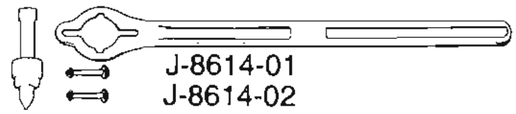
Tool Ref.	Description	Required	Recommended
J-2092	Axle Shaft End Play Tool		■
J-21579	Axle Shaft Puller		■
J-21784	Differential Bearing Installer		■
J-21786	Pinion Rear Bearing Remover		■
J-21787	Pinion Front Bearing Cup Remover		■
J-22575	Pinion Nut Socket		■
J-22697	Pinion Rear Bearing Installer		■
J-22888-02	Bearing Puller Set		■
J-22912-01	Bearing Remover		■
J-23674	Axle Shaft Bearing Remover-Installer		■
J-24430	Bearing Installer		■
J-24433	Pinion Bearing Installer Sleeve		■
J-2498	Axle Shaft Remover		■
J-24649-1	Yoke Runout Gauge		■
J-25101	Bearing Cup Installer		■
J-25109-01	Axle Hub Puller		■
J-25131	Seal Installer		■
J-25135-01	Axle Shaft Installer		■
J-25133	Puller		■
J-2619-01	Slide Hammer		■
J-28648	Differential Seal Installer Models 44-60		■
J-29721	Differential Bearing Remover Tool Set		■
J-5590	Pinion Bearing Installer Sleeve		■
J-7079-2	Driver Handle (Non-Threaded)		■
J-8001	Dial Indicator Set		■

SEE
I.S.
NOTES

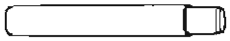
SPECIAL TOOLS (Cont'd)

Tool Ref.	Description	Required	Recommended
J-8092	Driver Handle (Threaded)		■
J-8614-01, 02, 03	Yoke Holding and Remover Tool		■
J-8608	Pinion Rear Bearing Cup Installer		■
J-8611-01	Pinion Front Bearing Cup Installer		■
J-8646-2	Forcing Screw		■
J-9233	Pinion Seal Remover		■
J-5223-04	Arbor	■	
J-5223-20	Gauge Block and Plunger	■	
J-5223-24	Clamp	■	
J-5223-25 or -26	Discs	■	
J-5223-29	Bolt	■	
J-21788	Axle Shaft Oil Seal Installer	■	
J-23447	Wrench Nut	■	
J-23781-3	Gear Rotating Tool	■	
J-23781-7	Step Plate	■	
J-24385-01	Axle Housing Spreader	■	
J-24385-15	Adapter	■	
J-22661	Seal Installer	■	
J-25211-1	Plate	■	
J-25211-2	Cup	■	
J-25211-3	Button	■	
J-25211-4	Adapter	■	

SEE I.S. NOTES



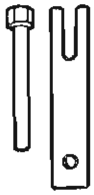
J-8614-01
J-8614-02
J-8614-03



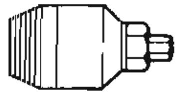
J-5223-4

J-8608

J-8611-01

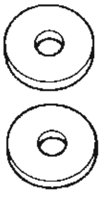


J-5223-24

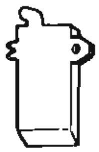


J-9233

J-8092

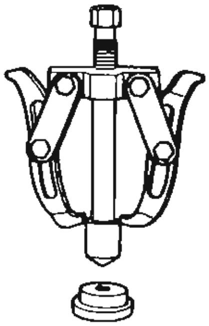


J-5225-25

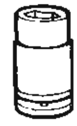


J-5223-20

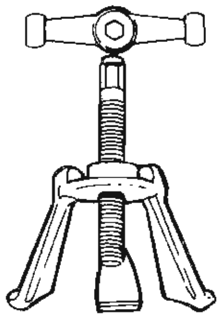
J-2092



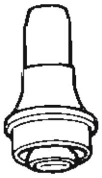
J-22888-02



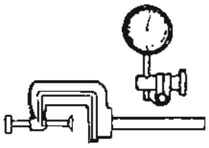
J-22575



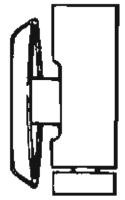
J-25109-01



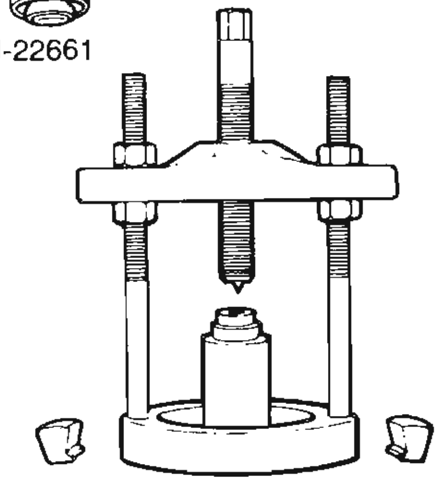
J-22661



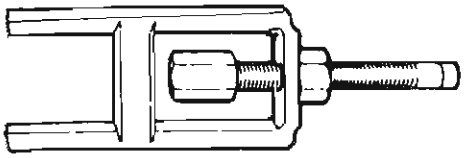
J-8001



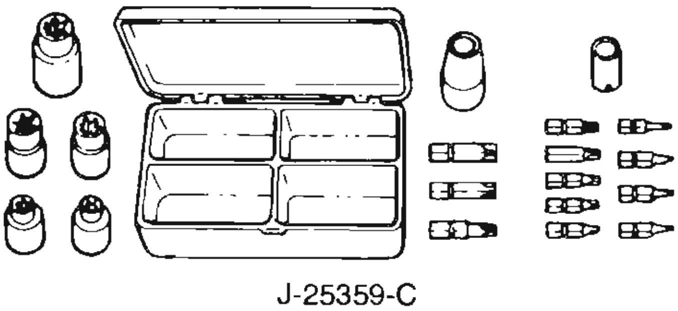
J-24649-1



J-29721



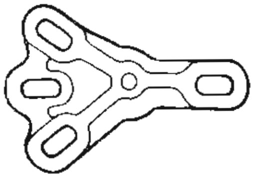
J-2498



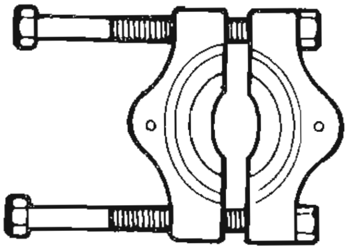
J-25359-C

SEE I.S. NOTES

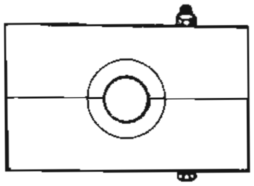
86357A



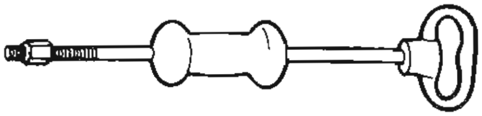
J-21579



J-22912-01



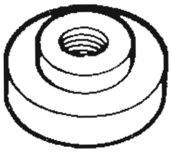
J-23674



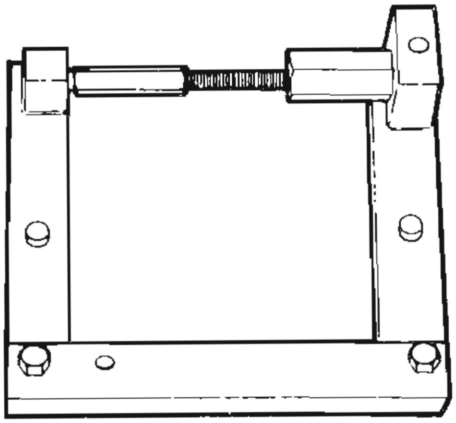
J-2619-01

J-23447

J-21787



J-25135-01



J-24385-01

J-5590

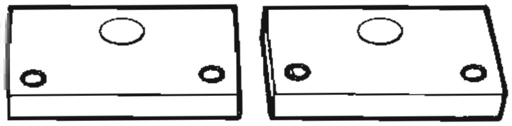
J-28648

J-25211-1

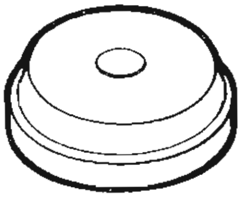
J-25211-3

J-21784

SEE I.S. NOTES



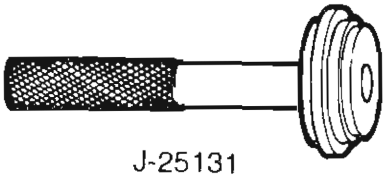
J-24385-15



J-25101

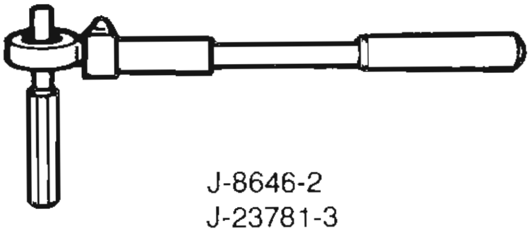
J-25211-2

J-22697



J-25131

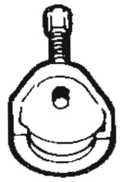
J-25211-4



J-8646-2
J-23781-3

J-23781-7

J-21786



J-25133

86357B

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Axle Hub-to-Shaft Nut	339 N·m (250 ft-lbs) min.	
Axle Housing Cover Bolts	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Brake Support Plate Bolts	43 N·m (32 ft-lbs)	34-47 N·m (25-40 ft-lbs)
Pinion Nut	2-3 N·m (17-25 in-lbs)	
Shock Absorber Lower Stud Nut	61 N·m (45 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Spring Clip U-Bolt Nut:		
9/16-18	136 N·m (100 ft-lbs)	115-142 N·m (85-105 ft-lbs)
1/2-20	75 N·m (55 ft-lbs)	61-88 N·m (45-65 ft-lbs)
Spring Shackle Bolts/Nuts	33 N·m (24 ft-lbs)	24-41 N·m (18-30 ft-lbs)
Spring Pivot Bolts Nuts (All)	136 N·m (100 ft-lbs)	115-163 N·m (80-120 ft-lbs)
Styled Wheel Hub Cap	4 N·m (32 in-lbs)	3-5 N·m (24-40 in-lbs)
Universal Joint Clamp Strap Bolts	22 N·m (16 ft-lbs)	20-26 N·m (15-19 ft-lbs)
Univeral Joint Flange Bolts/Nuts	47 N·m (35 ft-lbs)	34-61 N·m (25-45 ft-lbs)
Wheel Retaining Nuts	108 N·m (80 ft-lbs)	88-122 N·m (65-90 ft-lbs)

SEE I.S. NOTES

Rear Axle Specifications

Axle Type:	
AMC/Jeep	Drive-type, semi-floating axle with tapered axle shaft
Axle Ring Gear Diameter:	
AMC/Jeep	22.19 cm (8.875-inches)
Rear Axle Lubricants:	Jeep Axle Lubricant or equivalent of SAE 75W-90 A.P.I. Grade GL-5 quality, or axle lubricant grade MIL-L-2105 C
Lubricant Capacity:	
AMC/Jeep	2.25 liters (4.75 pints)

840939

SPECIFICATIONS

GENERAL DESCRIPTION
Specifications

	USA	Metric
Pinion Depth Standard Setting	2.547 inch	64-69 mm
Pinion Bearing Preload	15-25 in-lbs	2.3 N·m
Ring and Pinion Backlash	.005-.009 in. (.008 preferred)	.13-.23 mm (.20 preferred)
Differential Bearing Preload	.008 inch	.20 mm
Differential Case Face Runout	.002 inch	.05 mm
Axle Shaft End Play	.004-.008 in. (.006 preferred)	.10-.20 mm (.15 preferred)
Differential Side Gear to Case Clearance	.000-.007 inches	.0-.17 mm

84113

AXLE HUB REPLACEMENT

Removal

Apply the parking brake and shift the transmission into first gear, or Park if equipped with automatic transmission.

Remove the axle shaft dust cap.

Remove and discard the cotter pin retaining the axle shaft nut.

Remove the axle shaft nut.

Raise and support the rear of the vehicle.

Remove the wheels and remove the brake drum retaining screws.

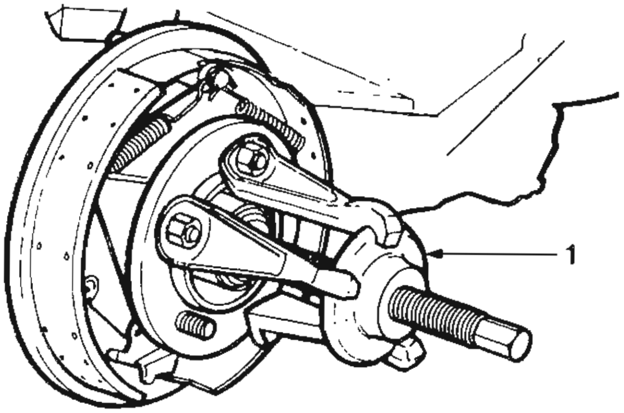
Release the parking brake.

Remove the brake drum.

CAUTION: Do not use a knockout type puller to remove the hub. This type of puller may damage the rear wheel bearings and differential thrust block.

SEE
I.S.
NOTES

Remove the axle hub using Puller J-25109-01 (1).



SEE I.S. NOTES

Inspection

Inspect the hub for loose or distorted wheel mounting studs and inspect the keyway and tapered bore for wear, damaged serrations or cracks. Replace the hub if worn or damaged.

Installation

NOTE: The methods for installing original and replacement hubs are different. Refer to the following two procedures for the appropriate installation method.

Original Hub Installation

Align the keyway in the hub with the axle shaft key and slide the hub onto the shaft as far as possible.

Install the axle shaft thrust washer and nut.

Install the brake drum and drum retaining screws. If the brakeshoes were retracted to ease drum removal, adjust the drum-to-brakeshoe clearance before installing the drum. Refer to the Service Brake Adjustment section.

Install the wheel.

Lower the vehicle.

Apply the parking brake.

Tighten the axle shaft nut with 339 N·m (250 ft-lbs) torque.

Install a replacement cotter pin in the nut. If the cotter pin hole is not aligned, tighten the nut to the next castellation. Do not loosen the nut to align the cotter pin hole.

Release the parking brake.

Raise vehicle, remove wheel and install axle shaft dust cap and reinstall the wheel and lower vehicle.

Replacement Hub Installation

NOTE: When a replacement axle shaft is installed, a replacement hub must also be installed. However, a replacement hub may be installed on an original axle shaft if the shaft serrations are not worn or damaged.

Align the keyway in the hub with the axle shaft key and slide the hub onto the shaft as far as possible.

Lubricate two thrust washers with chassis grease and install the washers on the end of the shaft.

Install the axle shaft nut.

Install the brake drum and retaining screws. If the brakeshoes were retracted to ease drum removal, adjust the brakeshoe-to-drum clearance before installing the drum. Refer to the Service Brake Adjustment section.

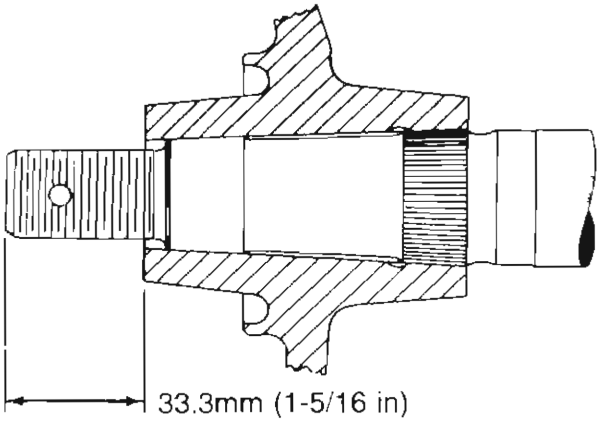
Install the wheel.

Lower the vehicle.

Apply the parking brake.

CAUTION: The hub must be pressed onto the axle shaft to the specified dimension in order to form the hub serrations properly.

Tighten the axle shaft nut until the distance from the hub outer face to the axle shaft outer end is 33 mm (1-5/16 in).



840480A

Remove the axle shaft nut and one thrust washer.

Reinstall the axle shaft nut. Tighten the nut with 339 N·m (250 ft-lbs) torque.

Install a replacement cotter pin. If the cotter pin hole is not aligned, tighten the nut to the next castellation. Do not loosen the nut to align the cotter pin hole.

Raise vehicle, remove wheel and install axle shaft dust cap and reinstall the wheel and lower vehicle.

AXLE SHAFT AND BEARING REPLACEMENT

Removal

Remove the axle hub. Refer to Axle Hub Replacement in this chapter.

Disconnect the parking brake cable at the equalizer.

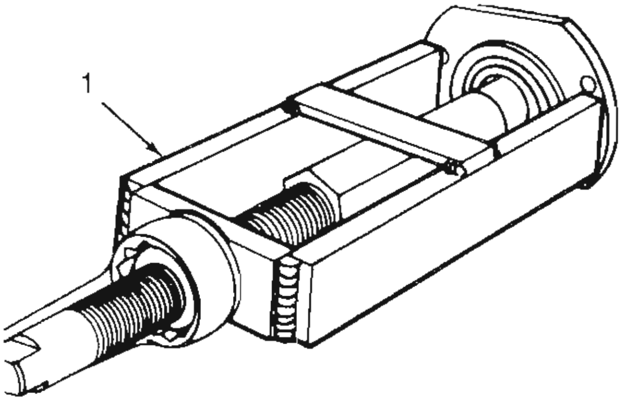
Disconnect the brake line at the wheel cylinder.

Remove the brake support plate assembly, axle shaft oil seal and retainer, and remove the axle shaft end play shims if the left side shaft is being removed.

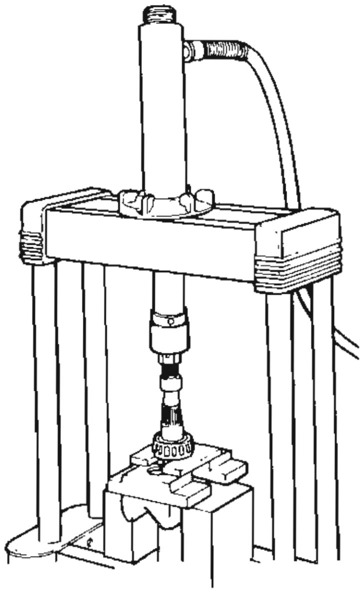
NOTE: The axle shaft end play shims are installed on the left side of the axle only.

SEE I.S. NOTES

Remove the axle shaft and bearing using Tool J-2498 (1).



840481



840482

CAUTION: On models equipped with a Trac-Lok differential, do not rotate the differential gears unless both axle shafts are in place. If one shaft is removed and the remaining shaft is rotated, the side gear splines will become misaligned and prevent installation of the replacement shaft.

Remove and discard the axle shaft inner oil seal.

Remove the axle shaft bearing using an arbor press.

NOTE: The bearing is a press-fit on the axle shaft and must be removed using an arbor press only. Do not attempt to remove the bearing by any other method.

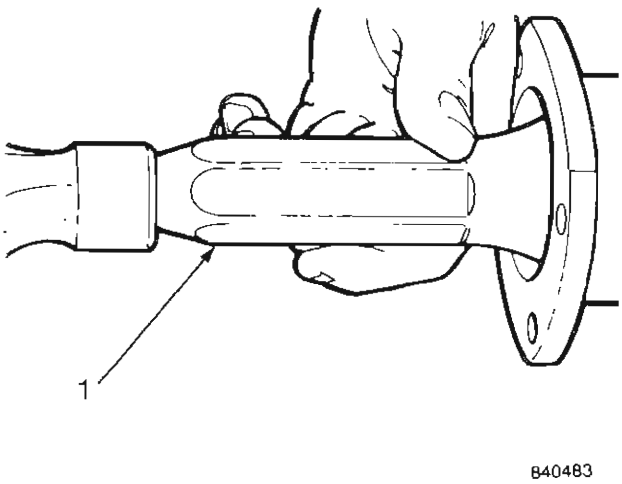
Installation

NOTE: Tapered shaft axle bearings do not have any provision for lubrication after assembly and must be packed with a high-quality wheel bearing lubricant before installation.

If the axle shaft bearing is to be replaced, pack the bearing with a generous amount of wheel bearing lubricant and press the bearing onto the shaft. The small diameter of the bearing must face toward the outer tapered end of the shaft.

Coat the lip of the inner oil seal with axle lubricant and coat the outer surface of the seal metal retainer with a non-hardening sealant.

Install the inner oil seal using Tool J-21788 (1).



Install the axle shaft(s). Align the splined ends of the shaft(s) with the splined bores in the differential side gears.

Install the axle shaft outer bearing cup.

Inspect and replace the brake support plate if the plate is bent, distorted, has worn edges or if bolt holes are elongated. Refer to the Support Plate Replacement section.

NOTE: During assembly, apply a silicone-type sealer to the axle tube flange and brake support plate mounting area to prevent entry of dust and water.

Install the original end play shims, oil seal and retainer, and support plate. Tighten the support plate attaching bolts with 47 N·m (35 ft-lbs) torque.

NOTE: The oil seal and retainer are located on the outside the axle tube flange and the support plate.

Connect the brake line to the wheel cylinder.

Bleed and adjust the brakes.

Check and adjust the axle shaft end play as outlined in the Axle Shaft End Play Adjustment section.

AXLE SHAFT END PLAY ADJUSTMENT

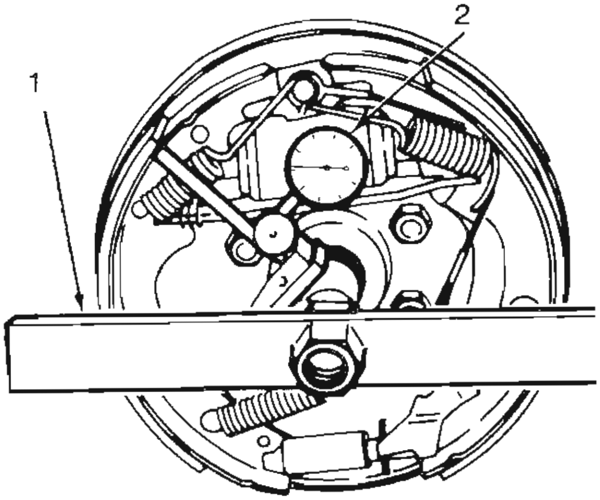
Axle shaft endplay is adjusted at the left side axle shaft only.

Strike the ends of the axle shafts with a lead hammer to seat the bearing cups against the support plates.

SEE I.S. NOTES

Thread Axle Shaft End Play Tool J-2092 (1) onto the shaft.

Mount a dial indicator (2) on the support plate or end play tool, and measure end play while pushing and pulling on the axle shaft.



840484A

End play should be 0.10 - 0.20 mm (0.004 - 0.008 in) with 0.15 mm (0.006 in) preferred.

Correct the end play as necessary by adding shims to increase end play, or removing shims to decrease end play.

NOTE: The axle shaft end play shims are installed on the left side of the axle only. Add or remove shims at the left side only to adjust end play.

Install the axle hub, brake drum and wheel as outlined in Axle Hub Replacement.

Bleed and adjust the brakes. Refer to Brake Bleeding procedure in Chapter K.

PINION SEAL OR AXLE YOKE REPLACEMENT

Removal

Raise and support the vehicle.

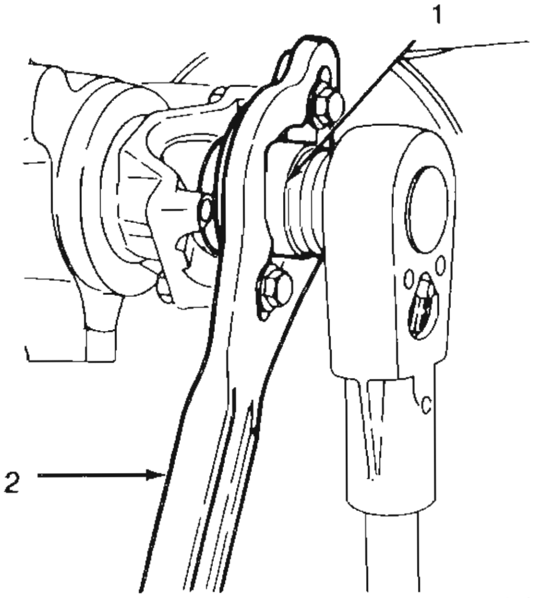
Remove the rear wheels and brake drums.

Mark the propeller shaft and axle yokes for assembly reference.

Disconnect the propeller shaft from the axle yoke.

Rotate the pinion several revolutions, then using an inch-pound torque wrench, measure and record the torque required to rotate the pinion gear.

Remove and discard the pinion nut using a socket or Tool J-22575 (1) and Remover Tool J-8614-01 (2).



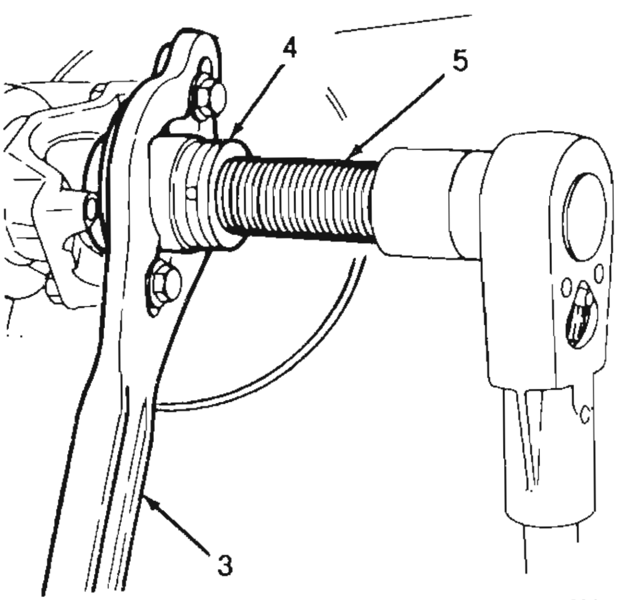
41425A

SEE I.S. NOTES

Mark the axle yoke and pinion gear for assembly reference.

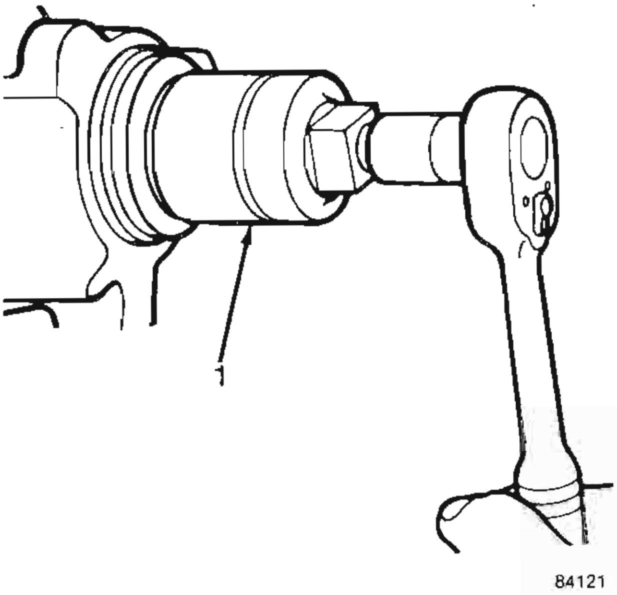
Position a drain pan under the yoke axle housing.

Remove the axle yoke, using Tools J-8614-01 (3), -02 (4), -03 (5).



Inspect the seal surface of the yoke. If damaged or grooved, replace the yoke.

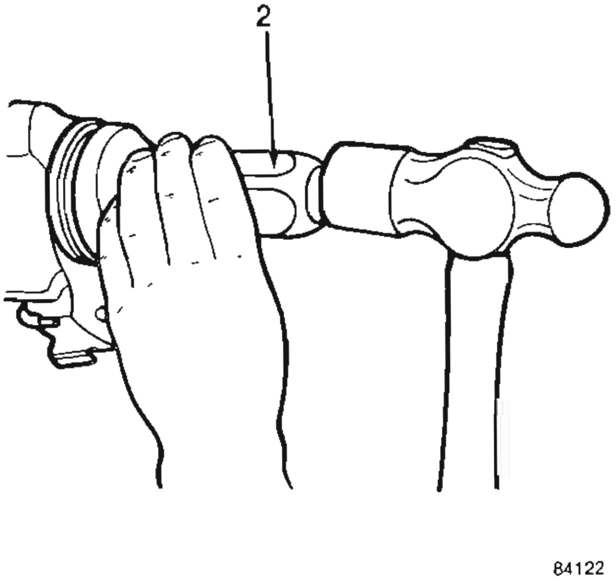
Remove the pinion oil seal using Tool J-9233 (1).



Installation

Coat the replacement seal lip with axle lubricant.

Install the seal using Tool J-25104 (2).



SEE
I.S.
N
O
T
E
S

Install the axle yoke on the pinion. Align the yoke and pinion using the reference marks made at disassembly.

CAUTION: Do not overtighten, or loosen and retighten the pinion nut. If the desired torque is exceeded, the pinion nut and collapsible spacer must be replaced and the pinion bearing preload reset.

Install and tighten the replacement pinion nut only enough to remove end play using Tools J-8614-01 and J-22575. Do not overtighten the nut.

Rotate the pinion several times and check the preload torque with an inch-pound torque wrench. The required torque is the previously recorded amount plus 0.56 N·m (5 in-lbs). Continue to tighten the nut in small increments and recheck the torque until it equals the disassembly torque readings plus 0.56 N·m (5 in-lbs).

SEE I.S. NOTES

Install the propeller shaft. Align the propeller shaft and axle yokes using the reference marks made at disassembly.

Install the brake drums and wheels.

Fill the axle to the edge of the fill hole with the specified lubricant.

Lower the vehicle.

AXLE ASSEMBLY

Removal

Apply the parking brake and shift a manual transmission into first gear, or an automatic transmission into Park.

Remove and discard the cotter pins from the axle shaft nuts.

Remove the axle shaft nuts.

Raise and support the rear of the vehicle. Place support stands under the rear frame side sills.

Remove the wheels.

Remove the brake drum retaining screws.

Release the parking brake and remove the brake drums.

Remove the axle hub using Puller J-25109-01.

Disconnect the brake lines at the wheel cylinders.

Remove the support plates, oil seals and retainers, and end play shims.

NOTE: The axle shaft end play shims are installed at the left side of the axle only.

Remove the axle shafts using Tool J-2498.

Remove the axle housing cover and drain the lubricant. Install the cover after the lubricant has drained.

Disconnect the parking brake cables at the equalizer.

Mark the propeller shaft and axle yokes for assembly reference.

Disconnect the propeller shaft at the axle yoke.

Disconnect the flexible brake hose at the body floorpan bracket.

Disconnect the vent hose at the axle tube.

Support the rear axle using a hydraulic jack.

Disconnect the shock absorbers at the spring tie plates.

Remove the spring U-bolts, spring plates and spring clip plate if equipped with a stabilizer bar.

Lower the hydraulic jack and remove the axle.

Installation

Support the rear axle using a hydraulic jack and position the axle between the springs.

Raise the jack until the axle is below the springs.

Install the spring plates, spring clip plate, if equipped with a stabilizer bar, and U-bolts. Tighten the U-bolt nuts with 74 N·m (55 ft-lbs) torque.

NOTE: Be sure the spring centering bolt heads are seated in the axle spring seat locating holes before tightening the U-bolt nuts.

Lower and remove the hydraulic jack.

Connect the shock absorbers to the spring plates.

Connect the flexible brake hose at the floorpan bracket.

Connect the vent hose at the axle tube.

Connect the propeller shaft to the axle yoke. Align the shaft and axle yokes using the reference marks made during disassembly. Tighten the clamp strap bolts with 19 N·m (14 ft-lbs) torque.

Install the axle shafts and bearing cups.

Install the support plate and brakeshoes, oil seals and retainers, and end play shims.

NOTE: The end play shims are installed on the left side of the axle only.

Check and adjust the axle shaft end play as necessary. Refer to the end play adjustment procedure outlined under Axle Shaft and Bearing Replacement.

Connect the brake lines at the wheel cylinders.

Align the keyways in the axle hubs with the keys in the shafts and slide the hubs onto the shafts as far as possible.

Install the thrust washers and nuts on the axle shafts.

Install the brake drums and drum retaining screws.

NOTE: If the brakeshoes were retracted to ease drum removal, adjust the brakeshoe-to-drum clearance as outlined under Service Brake Adjustment in Chapter K.

Bleed the brake hydraulic system as outlined under Brake Bleeding in Chapter K.

SEE
I.S.
NOTES

Install the wheels.

Lower the vehicle.

Apply the parking brake.

Tighten the axle shaft nuts. If the original axle hub is installed, tighten the nut with 339 N·m (250 ft-lbs) torque. If a replacement hub is installed, refer to the procedure for installing the replacement hub outlined under Axle Hub Replacement.

Install the replacement cotter pins in the axle shaft nuts. If the holes in the nut and the shaft do not align, tighten the nut to align the holes only. Do not loosen the nut to align the holes.

Fill the rear axle to the edge of the fill hole with the specified lubricant.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-8001	Dial Indicator Set		■
J-8092	Driver Handle		■
J-8592	Driver Handle		■
J-8608	Pinion Rear Bearing Cup Installer		■
J-8611-01	Pinion Front Bearing Cup Installer		■
J-8614-01, -02, -03	Holder and Remover Tool		■
J-9233	Pinion Oil Seal Remover		■
J-9349	Cup Remover		■
J-9351	Cup Remover		■
J-21002	Bearing Installer		■
J-22575	Nut Socket		■
J-22888-02	Differential Bearing Remover		■
J-5223-4	Gauge Arbor	■	
J-5223-20	Gauge Block	■	
J-5223-24	Holding Screw	■	
J-6381-2	Discs	■	
J-22661	Pinion Oil Seal Installer	■	

SEE I.S.
NOTES

TORQUE SPECIFICATIONS

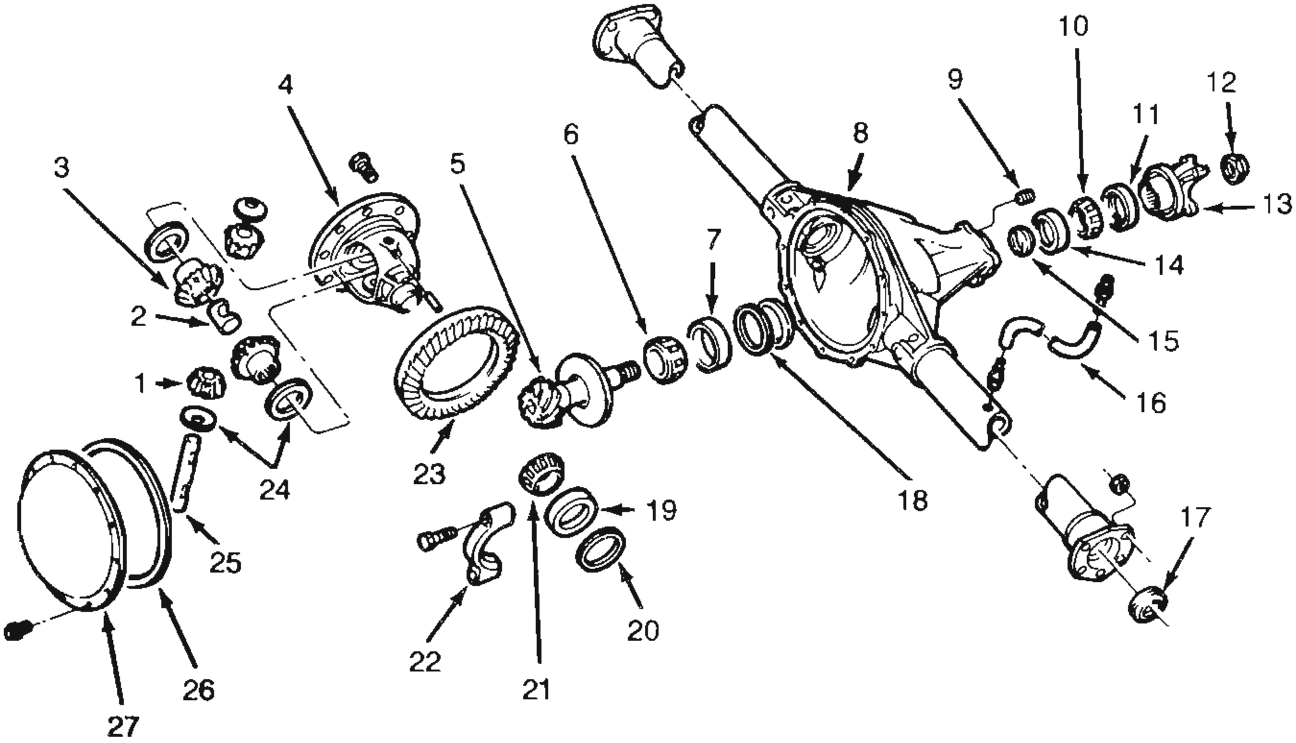
Component	Service Set-To Torque	Service Recheck Torque
Axle Housing Cover Bolts	19 N·m (170 in-lbs)	17-21 N·m (150-190 in-lbs)
Brake Tube-to-Rear Wheel Cylinder	11 N·m (97 in-lbs)	10-12 N·m (90-105 in-lbs)
Differential Bearing Cap Bolts	10 N·m (87 in-lbs)	9-11 N·m (80-95 in-lbs)
Ring Gear-to-Case Bolt	142 N·m (105 ft-lbs)	135-149 N·m (95-115 ft-lbs)
Rear Brake Support Plate Bolts	43 N·m (32 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Axle Shaft-to-Hub Nuts	339 N·m (250 ft-lbs) min.	339 N·m (250 ft-lbs) min.
Clamp Strap Bolts	18 N·m (16 ft-lbs)	14-24 N·m (15-19 ft-lbs)

SEE
I.S.
NOTES

SPECIFICATIONS
Rear Axle Specifications

Axle Type:	
AMC/Jeep	Drive-type, semi-floating axle with tapered axle shaft
Axle Ring Gear Diameter:	
AMC/Jeep	22.19 cm (8.875-inches)
Rear Axle Lubricants:	Jeep Axle Lubricant or equivalent of SAE 75W-90 A.P.I. Grade GL-5 quality, or axle lubricant grade MIL-L-2105 C
Lubricant Capacity:	
AMC/Jeep	2.25 liters (4.75 pints)

840939



1. Differential Pinion Gear
2. Thrust Block
3. Differential Side Gear
4. Differential Case
5. Pinion Gear
6. Pinion Rear Bearing
7. Bearing Cup
8. Housing
9. Fill Plug
10. Pinion Front Bearing
11. Oil Seal
12. Pinion Nut
13. Yoke
14. Bearing Cup
15. Collapsible Spacer
16. Vent Assembly
17. Oil Seal
18. Pinion Depth Shim
19. Bearing Cup
20. Shim
21. Differential Bearing
22. Bearing Cap
23. Ring Gear
24. Thrust Washers
25. Pinion Mate Shaft
26. Gasket
27. Cover

840900

SEE I.S. NOTES

DISASSEMBLY

NOTE: It is not necessary to remove the rear axle in order to remove and overhaul the differential. However, the vehicle underbody should be cleaned to prevent dirt contamination when installing the differential after completing service operations.

Remove the axle shaft dust caps.

Remove the axle shaft nuts.

Raise and support the rear of the vehicle.

Remove the axle housing cover and drain the lubricant.

Remove the wheels, brake drums, hubs, axle shafts, oil seals and bearing end play shims.

SEE I.S. NOTES

Mark the differential bearing caps with a center punch for assembly reference.

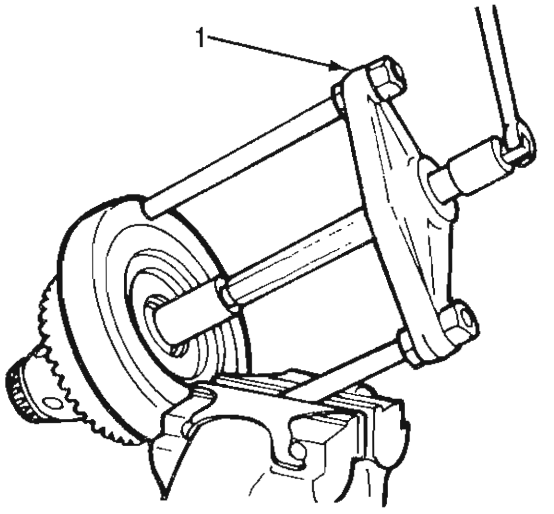
Loosen the bearing cap attaching bolts until only several threads are engaged and pull the bearing caps away from the bearings. This will prevent the differential from falling out or sustaining possible damage when it is pried out of the axle housing.

Pry the differential loose in the axle housing.

Remove the bearing caps and remove the differential.

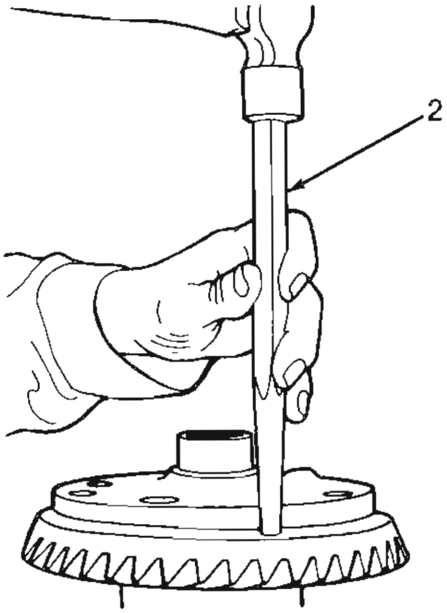
Tie the differential bearing shims to their respective bearing caps and cups to prevent misplacement.

Remove the differential bearings from the case using Tool J-29721 (1) and adapters. When using this tool, be sure the differential case is secure. When the bearing is removed the differential case can drop if not supported.



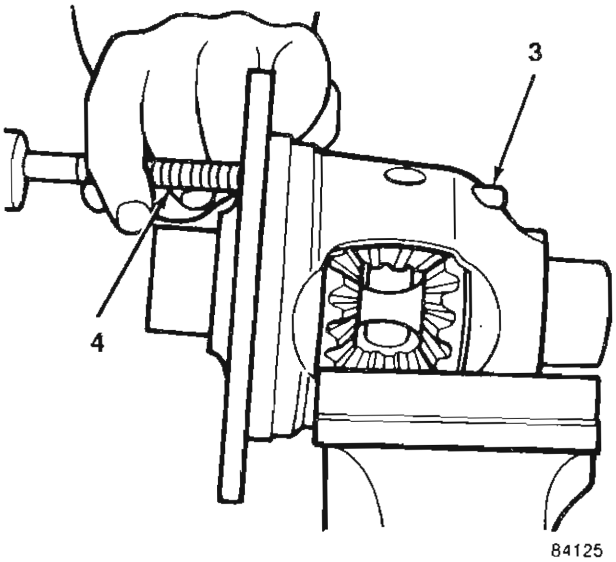
840901

Remove the ring gear-to-case bolts and remove the gear from the case using a brass drift and hammer (2). Do not nick the drive gear mating face of the case or drop the gear. Do not attempt to chisel or wedge the gear from the case.



84124

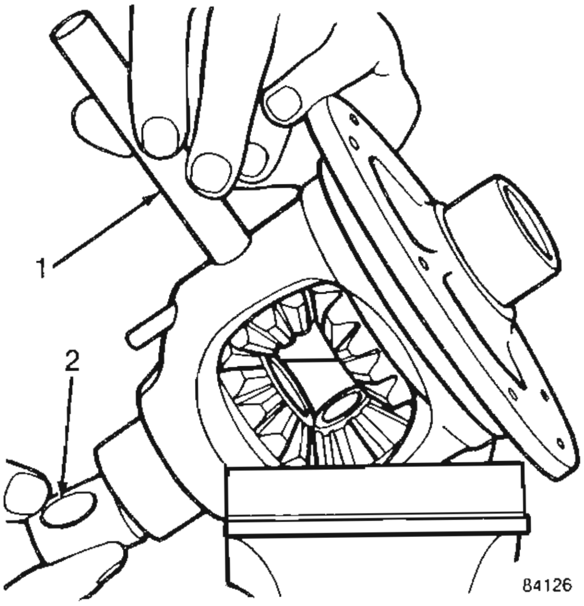
Remove the pinion shaft lockpin (3) using a punch that is 76-mm long by 5-mm in diameter (3-in. long by 3/16-in. in diameter) (4).



Measure and record the differential side gear-to-case, clearance for assembly reference. Insert equal thickness feeler gauges between each gear and case to measure the clearance.

NOTE: To ensure an accurate measurement, do not remove either feeler gauge until the clearance at both gears has been measured.

Remove the pinion shaft (1) using a punch and hammer and remove the thrust block (2).



Rotate the pinion gears on the side gears until the pinion gears are aligned with the case opening. Remove the pinion gears and thrust washers and remove the side gears and thrust washers.

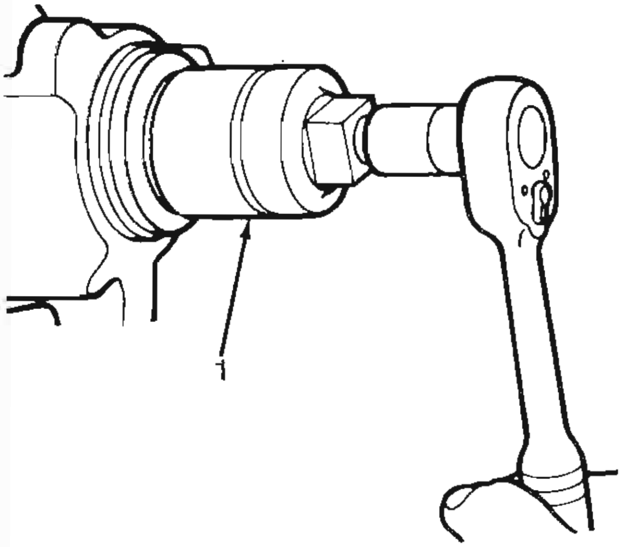
Remove the pinion nut using Tools J-8614-01.

Remove the axle yoke using Tools J-8614-01, 02 and 03.

Install the axle housing cover to prevent the pinion gear from falling out of the housing during removal.

SEE I.S. NOTES

Remove the pinion seal using Tool J-9233 (1).



84121

Tap the end of the pinion gear with a fiber hammer until the gear is driven out of the front bearing; remove the front bearing and spacer.

NOTE: A collapsible spacer is used to control the pinion gear bearing preload. Discard this spacer; it is not reusable.

Remove the housing cover, pinion gear and rear bearing from the housing.

Remove the pinion gear rear bearing cup using Driver Handle J-8092 and Cup Remover J-21786.

Remove the pinion depth adjustment shim(s) from the housing bore.

NOTE: The pinion depth adjustment shim(s) are located under the pinion rear bearing cup. Tag and retain the shim(s) for assembly reference.

CAUTION: Keep the cup remover tools squarely in the cup bore to avoid damaging the bore.

Remove the pinion front bearing cup using Driver Handle J-8092 and Cup Remover J-21787.

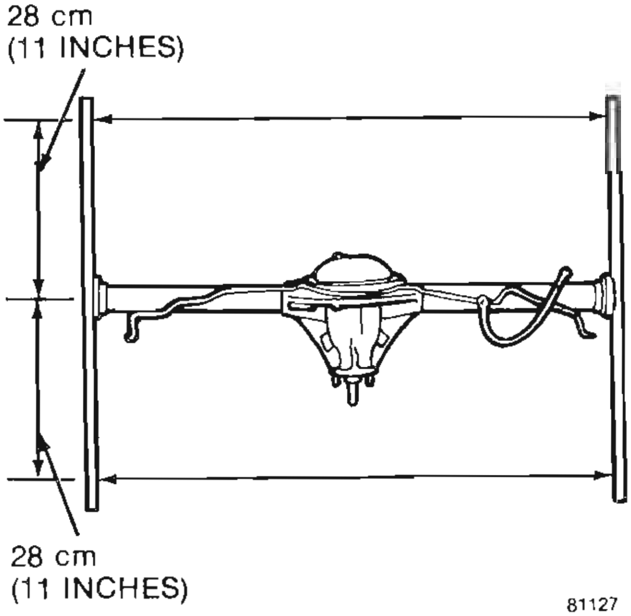
CLEANING AND INSPECTION

Clean each part thoroughly in solvent. Towel dry bearings or allow them to air dry, do not use compressed air to dry bearings as damage might result. Dry all other parts with compressed air or shop towels.

If the parts are not to be assembled immediately, cover them to prevent dust or dirt contamination.

Axle Housing

Check the axle housing alignment. Place two straightedges across the tube flanges and measure the distance between the flange ends. If the straightedges are parallel within 2 mm (3/32 in) at a distance of 28 cm (11 in) from the tube centerline, the axle housing is serviceable.



81127

SEE I.S. NOTES

Perform this inspection with the straightedges placed in horizontal and vertical positions.

Inspect the housing for cracks and sand holes. Replace the housing if it is cracked or porous. Check for burrs and deep scratches or nicks on the gasket and oil seal surfaces. An oil stone or fine tooth file may be used to remove nicks or burrs. The bearing cup bores should be carefully inspected for nicks or burrs that may have been created during bearing cup removal. Inspect and clean the axle tubes and inspect the vent to be sure that it is not obstructed. Check housing for bent or loose tubes or other physical damage.

Differential Pinion Shaft

Whenever one rear wheel is stationary and the opposite wheel is spinning, the differential pinion shaft is subjected to high torque loads. Inspect the shaft for scoring and wear. The shaft should be a press fit of 0.00 - 0.25 mm (0.000 - 0.010 in) in the case. Replace the shaft if worn or scored.

Thrust Block

Inspect the thrust block for excessive wear, distortion, and cracks. A worn or distorted thrust block will affect axle shaft end play. Replace the thrust block if damaged.

Differential Pinions

Inspect the pinion teeth for excessive wear or chipping. Install a new pinion shaft in the pinion bores to see if they are worn or out-of-round. Replace the pinions if damaged or worn. Discard the old thrust washers. Use only new thrust washers during assembly.

Differential Side Gears

Inspect the side gears for worn, cracked or chipped teeth. The gears should fit snugly on the axle shaft splines. Also inspect the fit of the gears in the differential case bore. With the gears installed, side clearance must not exceed 0.18 mm (0.007 in). Excessive side clearance must be corrected to avoid driveline backlash resulting in a "clunk" noise when the transmission is initially engaged in Drive or Reverse (with automatic transmission).

Differential Case

Inspect the bearing surfaces for nicks or burrs. Small nicks or burrs may be removed using an oil stone or fine tooth file. Inspect the thrust washer surfaces for excessive wear. If the surfaces are worn and grooved, replace the case.

Ring and Pinion Gears

Inspect the gears to be sure they are a matched set. The first number on the pinion and the number on the ring gear must be the same.

Inspect the gear teeth for wear, cracks or chipping. Inspect all bearing surfaces for wear or roughness, and the pinion shaft splines for damage caused by a worn or loose axle yoke.

Whenever replacement of a ring or pinion gear is necessary, always replace both gears. They must be installed in matched sets only. Replacement ring and pinion sets also include new ring gear attaching bolts. Use these bolts during assembly.

SEE I.S. NOTES

Differential and Pinion Gear Bearings

Inspect the bearing and cups for excessive wear, overheating, chipping, scoring or flat spotting. Replace both the cup and bearing if the preceding conditions are evident.

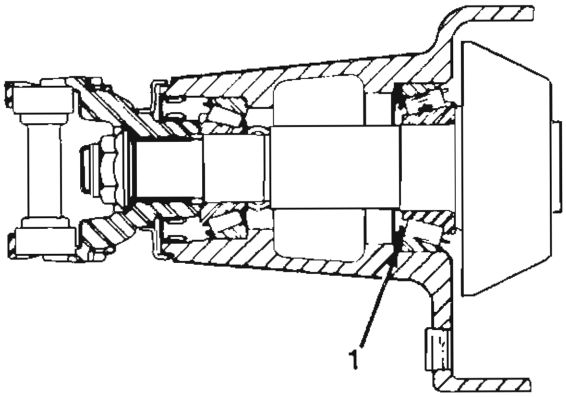
ASSEMBLY AND ADJUSTMENT

Pinion Gear Depth Measurement and Adjustment

Pinion gear depth must be measured and adjusted before final assembly installation of the gear.

Pinion depth is the distance (in inches) between the pinion gear end face and axle shaft centerline. It is controlled by shims installed between the pinion rear bearing cup and axle housing (1).

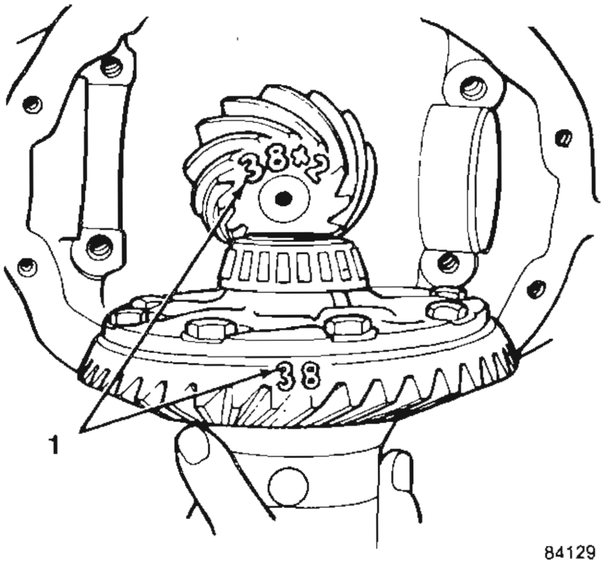
SEE I.S. NOTES



84128

Ring and pinion gear sets are factory tested to detect machining variances. Tests are started at a standard setting which is varied until optimum tooth contact and quiet operation are obtained. When the optimum setting for a gear set is achieved, the gears are identified as a matched set with hand-etched numbers.

The ring gear receives one number. The pinion receives two numbers (1) separated by a plus (+) or minus (-) sign. The second pinion number indicates pinion position in relation to the axle shaft centerline, where tooth contact was best and operation quietest. This number represents pinion depth variance and is the amount in thousandths of an inch that the set varied from the standard setting.



84129

The standard setting dimension for 23 cm (8⅞ in) axles is 6.46 cm (2.547 in).

Pinion gears are marked plus or minus the amount, in thousandths of an inch, the gear varied from the standard setting.

For example, if a pinion is marked 2, the gear varied from standard by 0.05 mm (0.002 in) and will require less shims than a set marked zero. A plus marking means the distance from the pinion end face to the axle shaft centerline must be more than standard.

If a pinion is marked -3, the set varied from standard by -0.08 mm (-0.003 in) and will require more shims than a set marked zero. A minus marking means the distance from the pinion end face to the axle shaft centerline must be less than standard.

NOTE: On some factory installed gear sets, an additional 0.25 or 0.51 mm (0.010 or 0.020 in) may have been machined off the pinion end face. This does not affect gear operation but does affect pinion gear marking and depth adjustment. Pinion gears machined in this fashion have different identifying numbers. For example, if the pinion is marked 23, the number 2 indicates that 0.51 mm (0.020 in) was removed from the end face and the number 3 is the pinion depth variance. If the pinion is marked 16, the number 1 indicates that 0.25 mm (0.010 in) was removed from the pinion end face and the number 6 is the pinion depth variance. These gear sets are factory installed items exclusively. Service replacement sets are machined to standard settings only. In addition, service replacement gear sets marked 9, or -9 or more, or sets with mismatched identifying numbers must be returned to the parts distribution center. Do not attempt to install these gear sets.

Pinion Variance Chart

This chart will help determine the approximate "starter shim" thickness needed for initial pinion depth measurement. However, the chart will not provide the exact shim thickness required for final depth adjustment and must not be used as a substitute for an actual pinion depth adjustment.

To use the chart, proceed as follows:

- measure the thickness of the original depth shim
- note the pinion variance numbers marked on the new and old pinion gears
- refer to the New and Old Pinion Marking columns in the chart; the number in the chart box where the old and new depth variances intersect will provide the approximate amount of shim change needed for starter thickness

SEE I.S. NOTES

Pinion Variance Chart

Old Pinion Marking	New Pinion Marking								
	−4	**−3**	**−2**	**−1**	**0**	**+1**	**+2**	**+3**	**+4**
+4	+0.008	+0.007	+0.0006	+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

84130

SEE I.S. NOTES

For example, if the old pinion is marked -3 and the new pinion 2, the procedure is as follows: Refer to the Old Pinion Marking column (left side of the chart) and locate the -3 figure in this column. Then read to the right (across the chart) until under the 2 figure in the New Pinion Marking column. The number in the box where the two columns intersect is the amount of shim thickness change required. In this case, the intersecting box number is -0.13 mm (-0.005 in), which represents the amount to be subtracted from the old shim thickness. If the number had been a figure, this amount would be added to the old shim thickness.

Pinion Depth Measurement and Adjustment

Measure the thickness of the original pinion depth shim.

Note the pinion depth variance numbers marked on the old and new pinion gears.

Determine the starter shim thickness. Refer to the Pinion Variance Chart and determine the amount to be added to or subtracted from the original shim thickness for starter shim thickness.

NOTE: The starter shim thickness must not be used as a final shim setting. An actual pinion depth measurement must be performed and the final shim thickness adjusted as necessary.

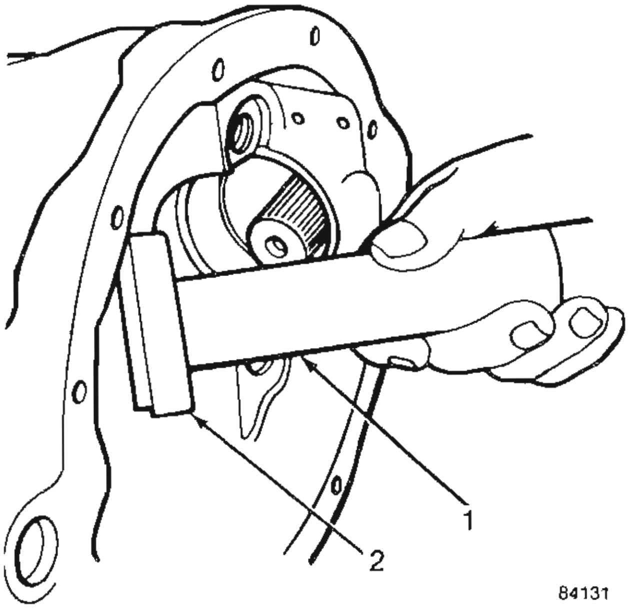
Install the rear bearing on the pinion gear with the large diameter of the bearing cage facing the pinion head and press the bearing against the rear face of the pinion head.

Clean the pinion bearing bores in the axle housing thoroughly. This is important to correct depth measurement and adjustment.

Install the starter shim in the housing bearing cup bore. Be sure the shim is centered in the bore.

NOTE: If the shim is chamfered on one side, be sure the chamfered side faces the bottom of the bearing cup bore.

Install the pinion rear bearing cup using Tools J-8092 (1) and J-8608 (2).



Install the pinion front bearing cup using Tools J-8092 and J-8611-01.

Install the pinion gear in the rear bearing cup.

Install the pinion front bearing and axle yoke on the pinion gear. Do not install the oil seal or collapsible spacer at this time.

Install the original pinion nut on the pinion. Tighten the nut only enough to remove bearing end play.

NOTE: Do not install a new pinion nut and collapsible spacer at this time as the pinion gear must be removed after depth measurement.

Note the depth variance marked on the pinion gear. If the number is preceded by a sign, add the number to the standard setting. If the number is preceded by a - sign, subtract the number from the standard setting. The result of the addition or subtraction is the desired pinion depth. Record this figure for assembly reference.

Measure the existing pinion depth as outlined in the following steps.

Assemble Gauge Arbor J-5223-4 (1) and Discs J-5223-23 (2).

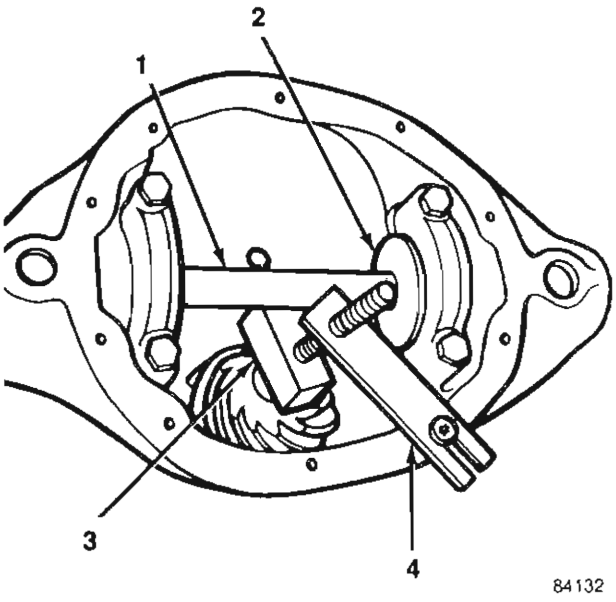
Install the assembled gauge arbor and discs squarely in the differential bearing bores.

Install the differential bearing caps over the discs and tighten the cap bolts securely. Be sure the gauge discs are completely seated before installing the bearing caps.

Position Gauge Block J-5223-20 (3) on the raised rear face of the pinion gear. Do not allow the gauge block anvil to contact the pinion gear teeth.

SEE I.S. NOTES

Mount the gauge tool clamp strap and Holding Screw Tool J-5223-24 (4) on the housing. Extend the holding screw until it bears firmly against the gauge block to hold the block in position.

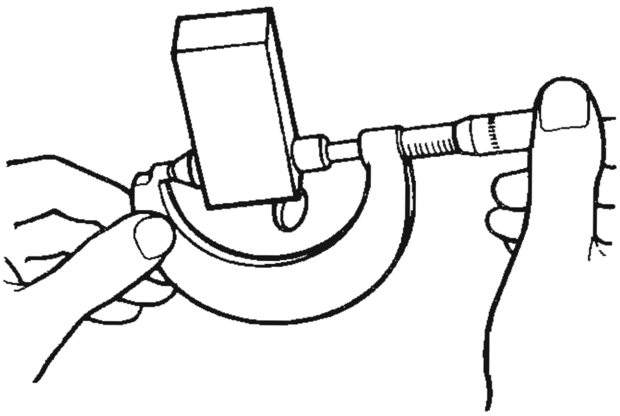


Loosen the thumbscrew in the end of the gauge block and allow the spring-loaded plunger to contact the gauge arbor at the center of the arbor shaft.

Lock the plunger in the gauge block by tightening the thumbscrew. Be careful not to disturb the plunger position.

Remove the differential bearing caps and remove the gauge arbor and discs.

Remove the gauge block and measure the distance from the end of the anvil to the top of the plunger head using a 51-76 mm (2-3 in) micrometer. This dimension represents the measured pinion depth. Record the measurement for assembly reference.



84133

Remove the pinion nut and axle yoke from the pinion gear.

Remove the pinion gear and the front bearing.

Remove the pinion rear bearing cup.

Remove the starter pinion depth shim from the housing and measure the shim thickness.

Add the starter shim thickness to the measured pinion depth, then subtract the desired pinion depth from this total. The result represents the actual shim thickness needed for correct pinion depth adjustment.

NOTE: Refer to the following examples for an illustration of how the measurement procedure is performed.

Example I

Step 1

Standard pinion depth setting – 6.46 cm (2.547 in)
Pinion depth variance – +0.17 mm (+0.007 in)
Desired pinion depth – 6.48 cm (2.554 in)

Step 2

Measured pinion depth – 6.47 cm (2.550 in)
Add starter shim thickness – +2.48 mm (+0.098 in)
Total thickness depth – 6.72 cm (2.648 in)

Step 3

Total thickness depth – 6.72 cm (2.550 in)
Subtract desired pinion depth – -6.48 mm (-2.554 in)
Correct shim thickness – 2.38 cm (0.094 in)

Example II

Step 1

Standard pinion depth setting – 6.46 cm (2.550 in)
Pinion depth variance – -0.07 mm (-0.003 in)
Desired pinion depth – 6.46 cm (2.554 in)

Step 2

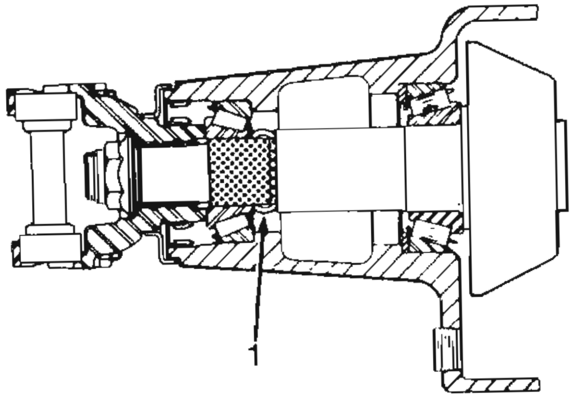
Measured pinion depth – 6.45 cm (2.542 in)
Add starter shim thickness – +2.43 mm (+0.096 in)
Total thickness depth – 6.70 cm (2.638 in)

Step 3

Total thickness depth – 6.70 cm (2.638 in)
Subtract desired pinion depth – -6.46 mm (-2.544 in)
Correct shim thickness – 2.38 cm (0.094 in)

Pinion Gear Installation and Bearing Preload Adjustment

NOTE: The pinion gear bearing must be preloaded to compensate for expansion caused by heat and load during operation. Preload is maintained by a collapsible spacer installed between the front bearing and a shoulder on the pinion gear (1).



84134

Install the correct thickness pinion depth shim in the rear bearing cup bore in the housing. Be sure the shim is centered in the bore.

NOTE: If one side of the shim is chamfered, install the shim so the chamfered side faces the bottom of the bearing cup bore.

Install the pinion rear bearing cup in the housing bearing cup bore.

SEE
I.S.
NOTES

Install the pinion gear in the rear bearing cup.

Install the replacement collapsible spacer on the pinion gear.

Install the front bearing on the pinion gear.

Install the replacement pinion oil seal using Installer J-22661.

Install the pinion yoke.

Thread the replacement pinion nut on the gear.

Tighten the pinion nut only enough to remove bearing end play using Tools J-8614-01 and J-22575. Rotate the pinion when tightening the nut to seat the bearing evenly.

CAUTION: Do not exceed the specified preload torque and do not loosen the pinion nut to reduce preload if the desired torque is exceeded.

Continue tightening the pinion nut in small increments to collapse the spacer and preload bearings. When a very slight increase in pinion turning effort is noted, stop tightening the nut and remove the tools.

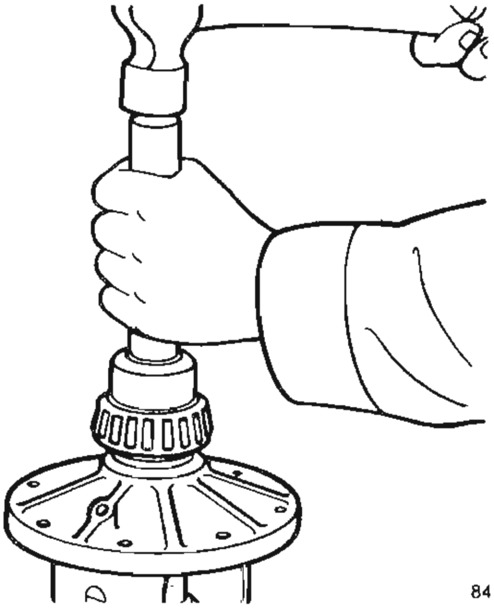
Check the pinion rotating torque using an inch-pound torque wrench. The rotating torque must be 2-3 N·m (15-25 in-lbs).

If the specified preload torque is exceeded, remove the pinion nut, yoke, oil seal and collapsible spacer and install the replacement collapsible spacer and seal. Install the yoke and replacement pinion nut and adjust the preload torque again.

SEE I.S. NOTES

Differential Bearing Installation

Install the differential bearings on the case using Driver Handle J-8092 and Bearing Installer J-21784.



Differential Pinion and Side Gear Installation

Install the thrust washers on the side gears.

Install the assembled side gears and washers in the differential case.

Install replacement thrust washers on the differential pinions. To ease installation, mate the washer lips with the shaft bores in the pinions (to help maintain washer position during installation).

Install the assembled differential pinions and thrust washers. Mesh the pinions with the side gears so the shaft bores in the pinions are aligned.

Rotate the side gears until the shaft bores in the pinions are aligned with the shaft bores in the case.

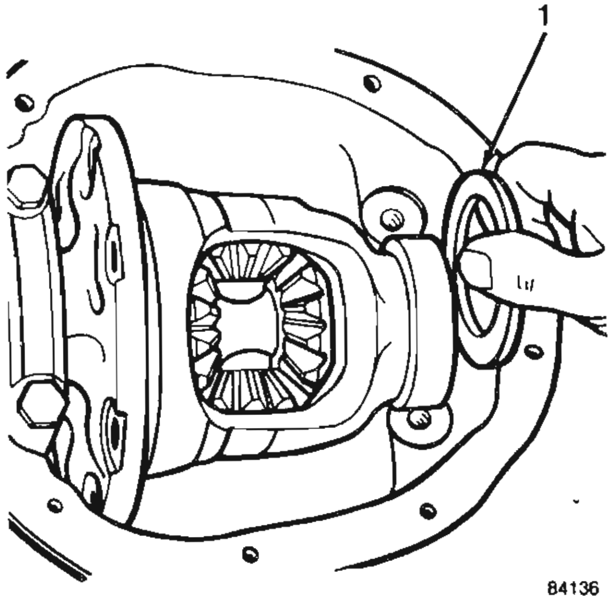
Install the thrust block. Align the bore in the block with the pinion shaft bores in the case.

Install the differential pinion shaft. Be sure to align the lockpin bore in the shaft with the lockpin bore in the case and install the lockpin.

Differential Bearing End Play Adjustment

Place a bearing cup over each differential bearing and install the differential assembly in the axle housing.

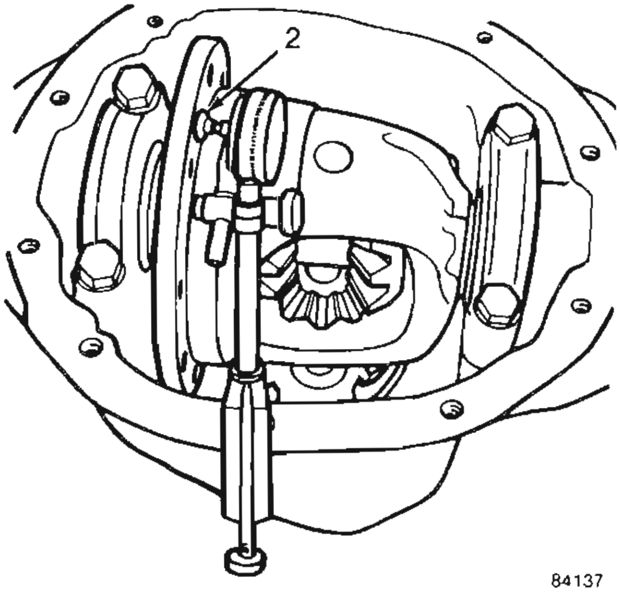
Install 2-mm (0.080-in) shims on each side of the differential bearing cup and the housing (1).



84136

Install the bearing caps and finger-tighten the bolts.

Mount the dial indicator so the indicator stylus contacts the ring gear mounting face of the case (2).



84137

Using an appropriate pry tool, pry between the shims and the housing. Pry the assembly to one side and zero the dial indicator. Pry the assembly to the opposite side and read the dial indicator. Do not attempt to zero or read the indicator while prying.

The amount read on the dial indicator is the shim thickness that must be added to arrive at zero preload and zero end play. Repeat the procedure for accuracy.

Install shims as necessary to adjust the bearing end play. Be sure to install the same thickness shim at each bearing.

NOTE: End play shims are available in thickness ranges of 0.25 - 0.05 mm (0.080 - 0.110 in) in 0.05-mm (0.002-in) increments.

SEE I.S. NOTES

When bearing end play is eliminated, a slight bearing drag should be noticed.

Install the bearing caps and tighten the bolts to the specified torque.

Attach the dial indicator to the axle housing and check the ring gear mounting face of the differential case for runout. Runout must not exceed 0.05 mm (0.002 in). Replace the case if runout exceeds the specified limit.

Remove the bearing caps and remove the differential assembly. Retain the shims used to eliminate bearing side play.

Ring Gear Installation

SEE I.S. NOTES

Position the ring gear on the differential case and align the bolt holes.

Install the ring gear attaching bolts and tighten the bolts alternately and evenly to seat the gear on the case.

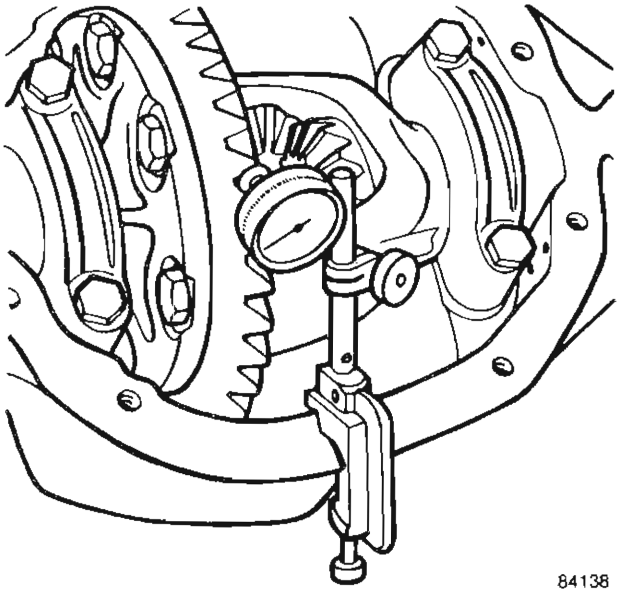
Tighten the ring gear bolts with 75 N·m (55 ft-lbs) torque.

Ring Gear Backlash Adjustment

Install the differential assembly and the previously selected bearing end play shims in the housing.

Install the differential bearing cap bolts and tighten the bolts with the specified torque.

Mount Dial Indicator Set J-8001 on the housing. Position the indicator stylus so it contacts the drive side of the ring gear tooth at a right angle to the tooth.



Move the ring gear backward and forward and note the backlash registered on the dial indicator. The backlash should be 0.13 - 0.23 mm (0.005 - 0.009 in), with 0.20 mm (0.008 in) desired.

Adjust the backlash as follows: To increase the backlash, install a thinner shim at the ring gear side of the case and a thicker shim at the opposite side. To decrease the backlash, reverse the procedure. However, do not change the total thickness of the shims.

Example

The bearing sideplay was removed with 2.28-mm (0.090-in) shims on each side totaling 4.57 mm (0.180 in). The backlash is checked and found to be 0.28 mm (0.011 in). To correct the backlash, add 0.10 mm (0.004 in) to the shims at the ring gear side of the differential and subtract the same amount from the shims at the opposite side of the differential.

The result is a 2.38-mm (0.094-in) shim on the ring gear side and a 2.18-mm (0.086-in) shim on the opposite side. The backlash will be approximately 0.18 - 0.20 mm (0.007 - 0.008 in). However, the total shim thickness remains at 4.57 mm (0.180 in).

Remove the differential assembly after adjusting the backlash.

Differential Bearing Preload Adjustment

NOTE: The differential bearings must be preloaded to compensate for heat and loads during operation. The bearings are preloaded by increasing the existing shim thickness at each bearing by 0.10 mm (0.004 in) for a total of 0.20 mm (0.008 in).

CAUTION: Do not distort the shims by hammering them into the housing.

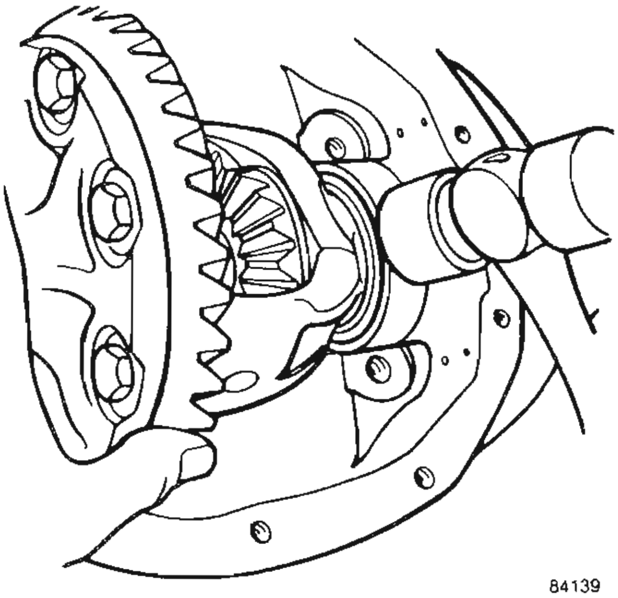
Install the differential bearing preload and side play shims in the axle housing bearing bores.

Install the bearing cups on the differential bearings. The cups must cover the bearing rollers completely.

Position the differential so that the bearings just enter the axle housing bearing bores.

NOTE: Tipping the bearing cups slightly will ease entry of the cups into the bores. Keep the differential assembly square in the housing and push it in as far as possible.

Tap the outer edge of the bearing cups with a rawhide mallet until the differential assembly is seated in the housing.



84139

Install and align the differential bearing caps using the reference punch marks made at disassembly. Tighten the bearing cap bolts with 118 N·m (87 ft-lbs) torque.

Preloading the differential bearings may change the backlash setting. Recheck the backlash and correct if necessary.

SEE I.S. NOTES

Axle Assembly

Install the axle housing cover.

Install the propeller shaft. Align the yoke and the shaft using the reference marks made at disassembly.

Install the axle shafts, oil seals and retainers, shaft bearing end play shims, brake support plates, hubs, drums and wheels.

Check and correct the axle shaft end play as necessary. Refer to Axle Shaft End Play Adjustment procedure in this chapter.

Fill the axle with AMC/Jeep Rear Axle Lubricant, 75W-90, grade API GL-5.

Connect all brake lines and bleed the brakes.

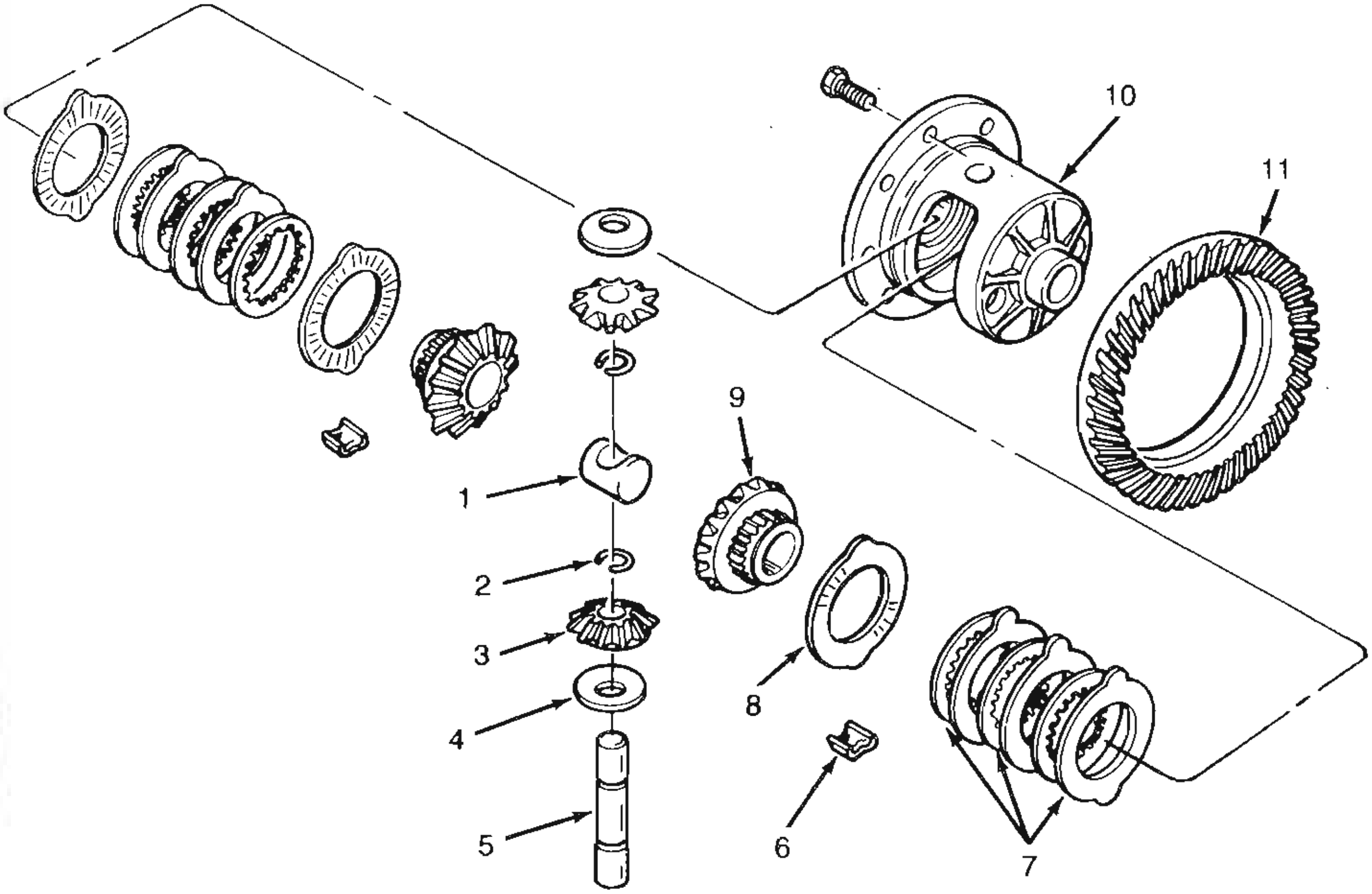
Remove the supports and lower the Vehicle.

SEE I.S. NOTES

GENERAL

The Trac-Lok limited slip differential is available as an option on Jeep vehicles equipped with the Model 300. Trac-Lok is used in rear axles only.

SEE
I.S.
NOTES



1. Thrust Block
2. Snap Ring
3. Pinion Gear
4. Thrust Washer
5. Pinion Shaft
6. Retainer Clip
7. Clutch Pack
8. Belleville Spring
9. Side Gear
10. Case
11. Ring Gear

840916

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-23781-3	Gear Rotating Tool	■	
J-23781-7	Step Plate	■	
J-8646-2	Forcing Screw	■	

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Axle Housing Cover Bolts	19 N·m (170 in-lbs)	17-21 N·m (150-190 in-lbs)
Brake Tube-to-Rear Wheel Cylinder	11 N·m (97 in-lbs)	10-12 N·m (90-105 in-lbs)
Differential Bearing Cap Bolts	10 N·m (87 in-lbs)	9-11 N·m (80-95 in-lbs)
Ring Gear-to-Case Bolt	142 N·m (105 ft-lbs)	135-149 N·m (95-115 ft-lbs)
Rear Brake Support Plate Bolts	43 N·m (32 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Axle Shaft-to-Hub Nuts	339 N·m (250 ft-lbs) min.	
Clamp Strap Bolts	22 N·m (16 ft-lbs)	20-26 N·m (15-19 ft-lbs)

SEE I.S. NOTES

LUBRICATION

Use Jeep axle lubricant, or an equivalent marked SAE 75W-90, grade GL-5 in Trac-Lok axles. In addition, the only acceptable method for cleaning the Trac-Lok differential is by disassembling the unit and wiping it clean using shop towels.

NOTE: The Trac-Lok differential is serviced at the same time intervals as the standard differential.

Trac-Lok Lubricant Change

Warm the axle lubricant. Operate the vehicle in gear, on a hoist, with the wheels off the floor for a minimum of five minutes at 48 km/h (30 mph).

WARNING: Never attempt to operate a Trac-Lok equipped vehicle in gear with only one wheel raised. The vehicle could propel itself off the jack and cause damage or personal injury.

Stop the engine and raise the vehicle on a hoist.

Remove the axle housing cover drain plug or cover and drain the lubricant while it is warm. If the cover is removed, discard the cover gasket.

Remove any residual lubricant from the axle housing using shop cloths.

Install the drain plug. If the axle housing cover was removed, clean the cover and housing mating surfaces and apply Jeep Gasket-In-A-Tube, or an equivalent sealer to the cover and housing mating surfaces. Install the cover and cover bolts. Tighten the cover bolts with 27 N·m (20 ft-lbs) torque.

Refill the axle housing with specified lubricant only.

Operate the vehicle on the road for approximately 16 km (10 mi). Make at least ten figure-eight turns to flush the old lubricant out of the clutch packs.

Return the vehicle to the shop and raise the vehicle on the hoist.

Drain and replace the axle lubricant again. If the axle housing cover is removed, be sure to clean the cover and housing mating surfaces and reapply Jeep Gasket-In-A-Tube, or an equivalent sealer to the mating surfaces before reinstalling the cover.

Lower the vehicle.

Road test the vehicle and verify the proper Trac-Lok operation.

NOTE: If a slight chatter occurs after flushing and refilling the Trac-Lok differential, drive the vehicle an additional 16 - 32 km (10 - 20 mi) or until the chatter stops. If the chatter persists after 32 or more km (20 or more mi) of driving, an overhaul may be necessary.

DIAGNOSIS

If noisy or rough operation such as chatter occurs when turning corners, the most probable cause is incorrect or contaminated lubricant. Before removing the Trac-Lok unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to the lubricant change procedure under Lubrication. A complete lubricant drain and refill with the specified lubricant will usually correct chatter.

Trac-Lok Operational Test

Trac-Lok operation can be checked quickly using the following test.

SEE I.S. NOTES

Position one wheel on solid, dry pavement and the opposite wheel on ice, mud, grease or a similar low traction surface.

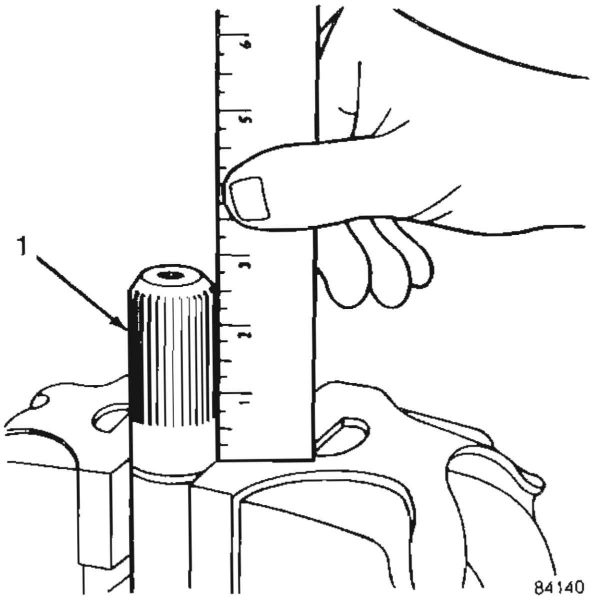
Increase the engine rpm gradually to obtain the maximum traction prior to breakaway. The ability to move the vehicle effectively will demonstrate the proper performance.

NOTE: If the test is performed on extremely slick surfaces such as ice or grease-coated surfaces, some question may exist as to proper performance. In these extreme cases, a properly performing Trac-Lok will provide greater pulling power by lightly applying the parking brake.

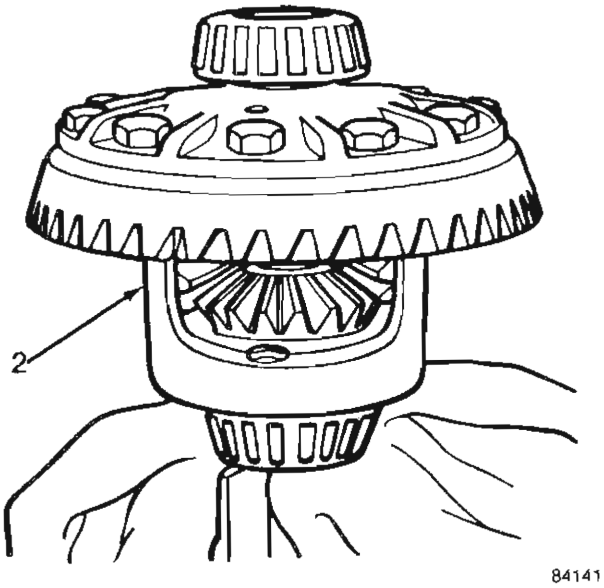
OVERHAUL

Remove the differential as outlined in the Standard Differential Overhaul section in this chapter.

Install one axle shaft in a vise with the spline end facing upward and tighten the vise. Do not allow more than 7 cm (2¾ in) of the shaft to extend above the top of the vise (1). This prevents the shaft from fully entering the side gear and interfering with the step plate tool.



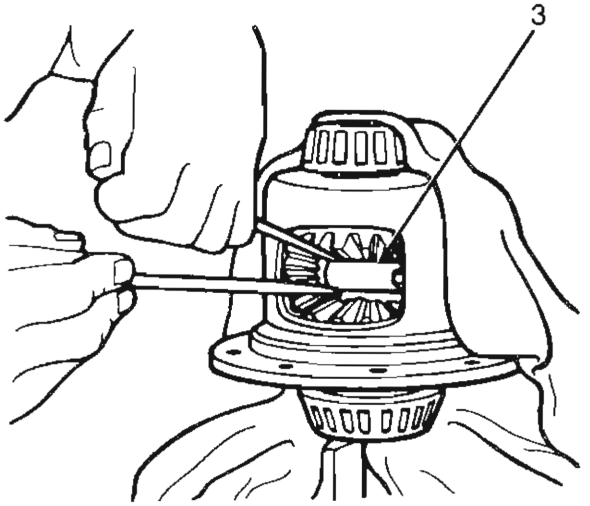
Mount the differential case on the axle shaft with the ring gear bolt heads facing upward (2).



Place shop towels under the ring gear to protect the gear when it is removed. Remove and discard the ring gear bolts and remove the ring gear from the case using a rawhide hammer.

Remove the differential case from the axle shaft, remove the ring gear and remount the differential case on the axle shaft.

Using two screwdrivers, disengage and remove the snap rings from the pinion mate shaft (3).

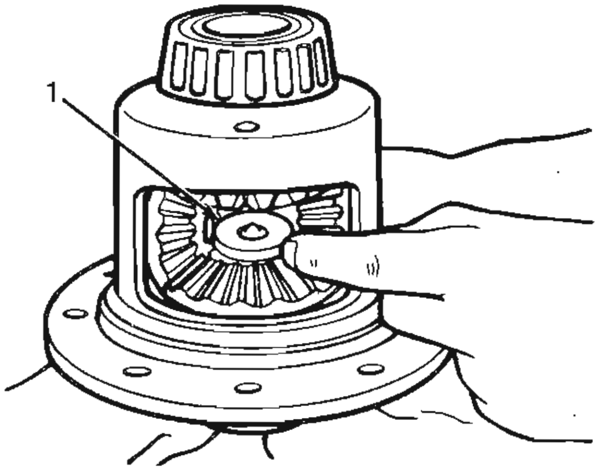


84142

Remove the pinion mate shaft using a hammer and a brass drift.

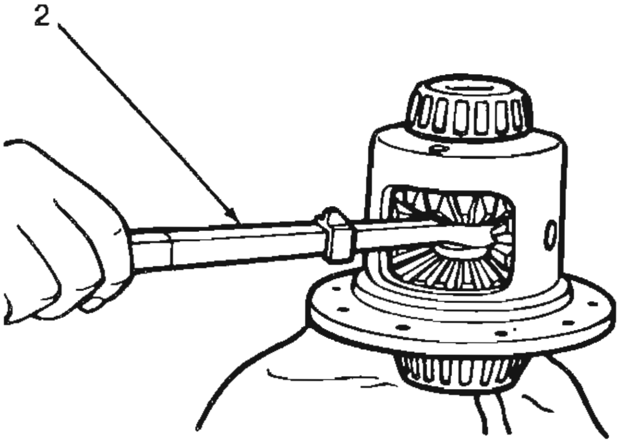
NOTE: Gear Rotating Tool J-23781 is required to perform the following steps. The tool consists of three parts: gear rotating tool, forcing screws, and step plate.

Install Step Plate Tool J-23781-7 on the lower differential side gear (1).



84143

Position the pawl end of Gear Rotating Tool J-23781-3 (2), on the step plate.



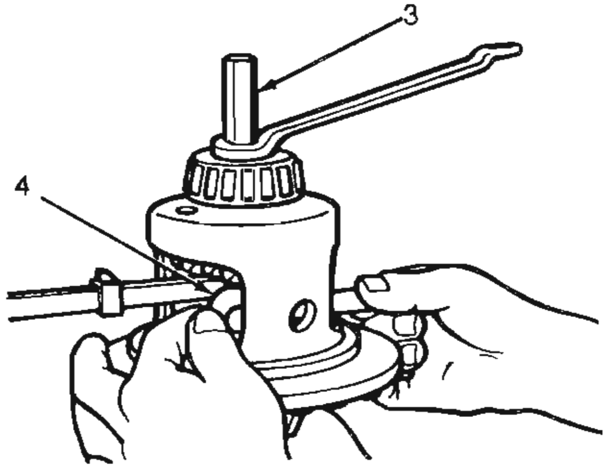
84144

Insert Forcing Screw Tool J-8646-2 through the top of the case and thread into the gear rotating tool.

NOTE: Before using Forcing Screw Tool J-8646-2, apply a daub of grease to the centering hole in the step plate and oil the threads of the forcing screw.

Center the forcing screw in the step plate and tighten the screw to move the differential side gears away from the differential pinion gears (3).

Remove the differential pinion gear thrust washers (4).

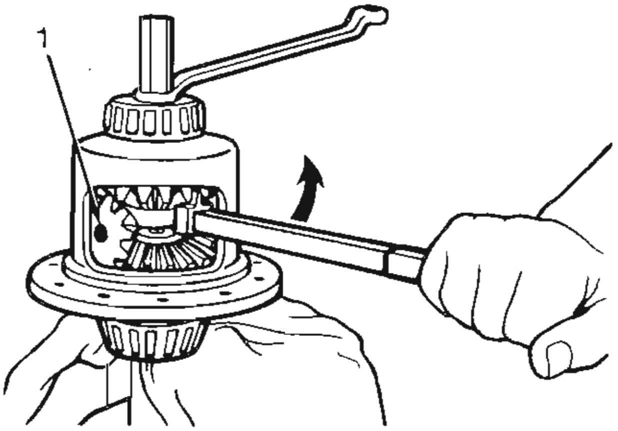


84145

Tighten the forcing screw until a slight movement of the differential pinion gears is observed.

Insert the pawl end of the gear rotating tool between the teeth of one differential side gear. Pull the handle of the tool to rotate the side gears and pinion gears. Remove the pinion gears as they appear in the case opening (1).

NOTE: It may be necessary to adjust the tension applied on the Belleville springs using Forcing Screw Tool J-8646-2 before the gears can be rotated in the case.

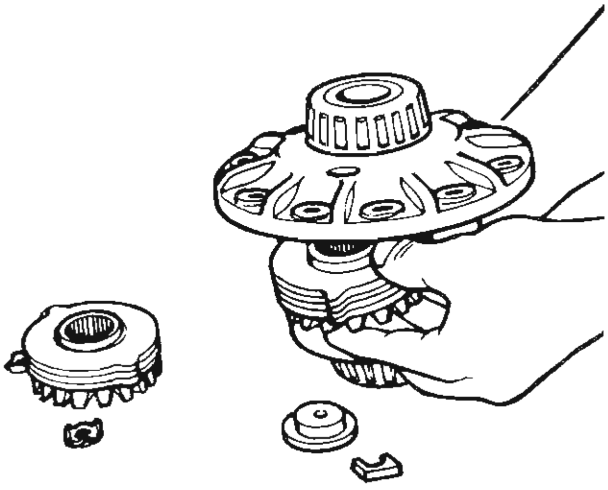


84146

SEE I.S. NOTES

Retain the upper side gear and clutch pack in the case by holding a hand on the bottom of the rotating tool while removing the forcing screw. Remove the rotating tool, upper side gear, and clutch pack.

Remove the differential case from the axle shaft. Invert the case with the flange or ring gear side up and remove the step plate, lower side gear, and clutch pack from the case. Remove the retainer clips from both clutch packs to allow the separation of plates and discs.



SEE I.S. NOTES

INSPECTION

Clutch Plates and Disc

If any one member of either clutch pack shows evidence of excessive wear or scoring, the complete clutch pack must be replaced on both sides.

Differential Side and Pinion Gears

The gear teeth should be checked for extreme wear or possible cracks. The external teeth of the side gear which hold the clutch pack should also be checked for wear or cracks. If replacement of one gear is required due to wear, both side gears, pinion gears, and thrust washers must be replaced.

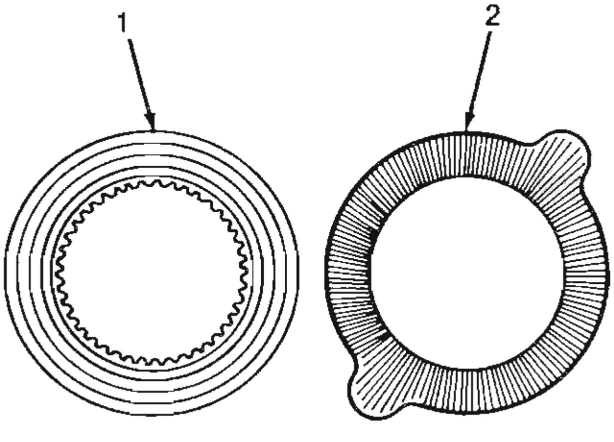
Pinion Mate Shaft

If excessive wear is evident on any one of the retainer clips, all clips should be replaced.

Differential Case

If scoring, wear, or metal pickup is evident on the machined surfaces, then replacement of the case is necessary.

Examples of the radial groove clutch plate (1) and the concentric groove disc (2) are shown.



ASSEMBLY

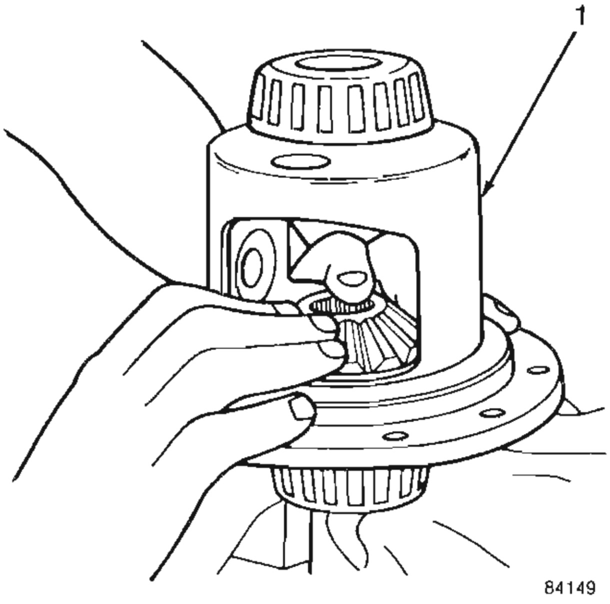
Lubricate all differential components with the specified axle lubricant.

Install the replacement or original clutch pack components in the same position as when removed.

Install the clutch retainer clips on the ears of the clutch plates. Be sure the clutch packs are completely assembled and seated on the ears of the plates.

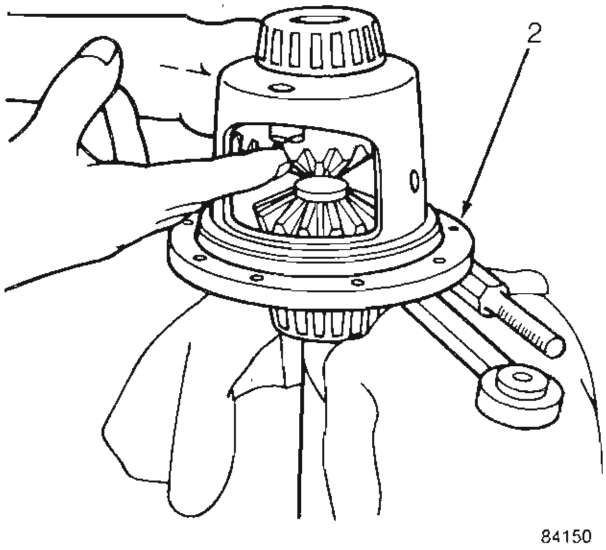
Install the clutch packs on the differential side gears and install the assembly in the case.

NOTE: Be sure the clutch pack stays assembled on the side gear splines and that the retainer clips are completely seated in the case pockets. To prevent the pack from falling out of the case, it will be necessary to hold them in place by hand while mounting the case on the axle shaft (1).



CAUTION: When installing the differential case on the axle shaft, be sure that the splines of the side gears are aligned with those of the axle shaft. Be sure the clutch pack is still properly assembled in the case after installing the case on the axle shaft.

Mount the case assembly on the axle shaft (2).

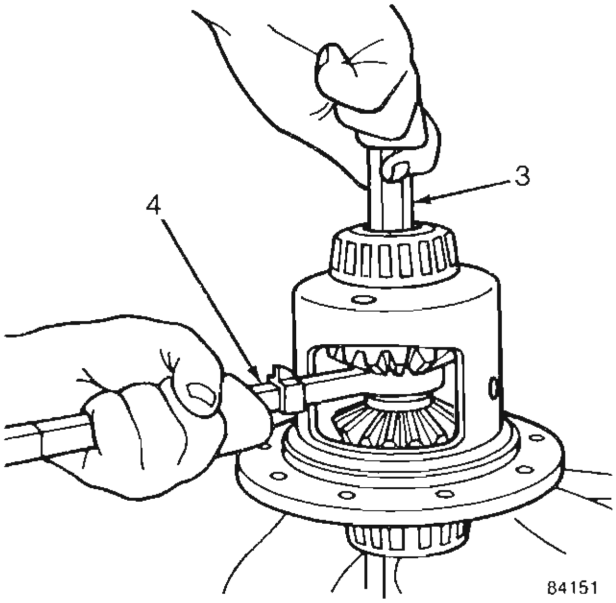


Install the step plate tool in the side gear.

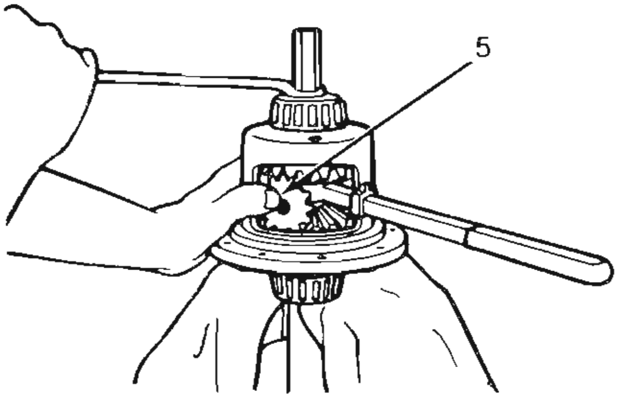
Install the remaining clutch pack and side gear.

SEE
I.S.
NOTES

Position the gear rotating tool in the upper side gear. Keep the side gear and rotating tool in position by holding them with your hand. Insert the forcing screw (3) through the top of the case and thread it into the rotating tool (4).



Install both the differential pinion gears in the case. Hold the gears in place by hand (5).



84152

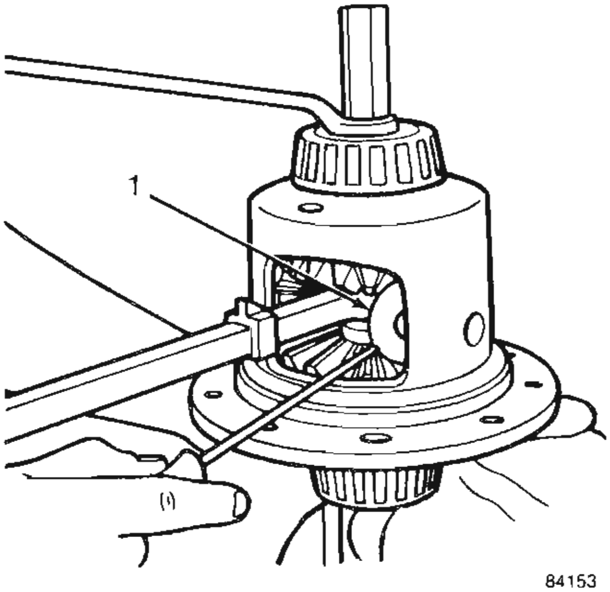
Tighten the forcing screw to compress the Belleville Springs and provide clearance between the teeth of the pinion gears and the side gears.

Position the pinion gears in the case and insert the rotating tool pawl between the side gear teeth. Rotate the side gears by pulling on the tool handle and install the pinion gears.

NOTE: If the side gears will not rotate, the Belleville Spring load will have to be adjusted. If adjustment is necessary, loosen or tighten the forcing screw slightly until the gears will rotate.

Align the shaft bores in both pinion gears with the case bores. Lubricate both sides of the pinion gear thrust washers and install the thrust washers (1).

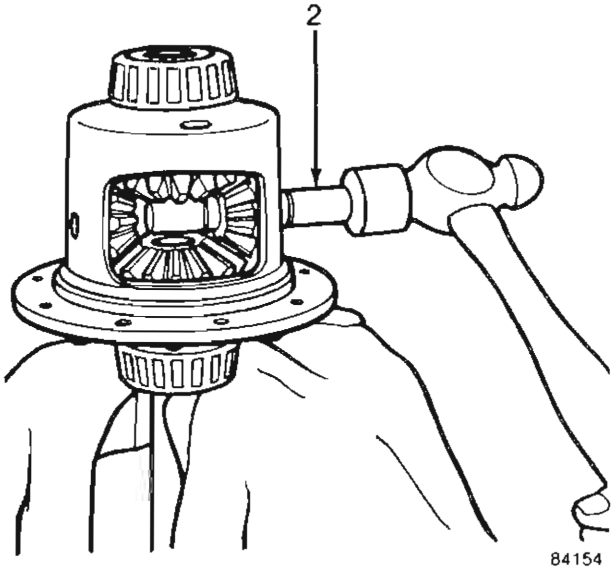
Tighten or loosen the forcing screw to permit thrust washer installation.



SEE I.S. NOTES

Remove the forcing screw, rotating tool, and step plate.

Lubricate the pinion mate shaft (2), install the shaft and snap rings.



Remove the case from the axle shaft and install the ring gear on the case.

NOTE: Use replacement ring gear bolts only. Do not reuse the original bolts.

Install the Trac-Lok differential assembly in the axle housing. Follow the service procedures previously outlined in Standard Differential Overhaul to complete differential and axle assembly servicing.

SERVICE REPLACEMENT

If the Trac-Lok unit must be replaced as an assembly, replace the unit as follows:

Remove the differential bearings and shims.

Remove the ring gear from the case and install the original ring gear on the replacement differential assembly.

Inspect the shims and bearings and replace as necessary.

Install the shims and differential bearings.

Lubricate the differential bearings with rear axle gear lubricant and install the differential assembly in the axle housing.

Follow the service procedures previously outlined in Standard Differential Overhaul to complete the differential and axle assembly servicing.

SEE I.S. NOTES

GENERAL

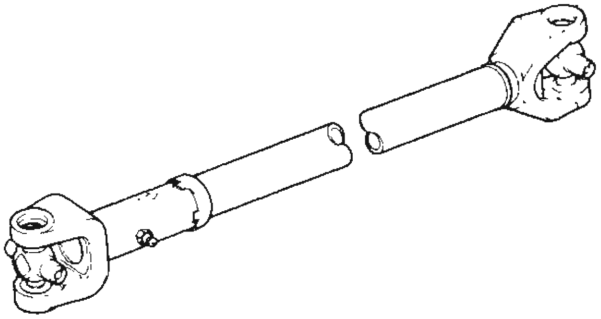
Jeep vehicles use tubular propeller shafts to transmit engine torque from the transfer case to the front and rear axles. Universal joints connect each shaft to the transfer case and axle yokes. A splined slip yoke is used at one end of each propeller shaft to compensate for variations in shaft length caused by suspension spring movement.

Because of the various driveline combinations available on Jeep vehicles, several different propeller shaft and universal joint designs are required.

Propeller Shaft Application

The front propeller shaft on CJ and Scrambler models is connected to both the axle and transfer case yokes with single cardan universal joints. A slip yoke is used at the axle end of the shaft.

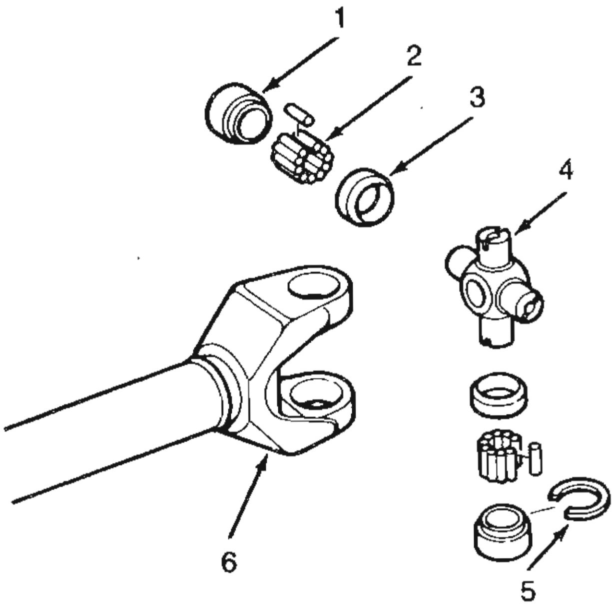
SEE I.S. NOTES



80330

The rear propeller shaft on CJ and Scrambler models is similar to the front shaft in appearance and construction. Single cardan universal joints connect the shaft to both the axle and transfer case yokes and the slip yoke is located at the transfer case end of the shaft.

The single cardan joint is used for most applications and consists of a single spider with four sets of needle bearings and four bearing seals, bearing caps, and bearing cap retainers. Clamp straps are used to attach the joint to the axle and transfer case yokes.



1. Bearing Cap
2. Needle Bearings
3. Seal
4. Spider
5. Retaining Clip
6. Yoke

840922

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-24649-1	Yoke Runout Gauge		■
J-25512-2	Lube Fitting Adapter Tool		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Pinion Yoke Nut	Add 0.56 N·m (5 in-lbs) torque measured at disassembly.	
Universal Joint Clamp Strap Bolt	20 N·m (15 ft-lbs)	18-24 N·m (13-18 ft-lbs)

Universal Joint Angle Chart

	Front		**Rear**	
	OK Range	**Set-To**	**OK Range**	**Set-To**
CJ/ Scrambler	3°-5°	4°	4°-6°	5°

840942

SEE
I.S.
NOTES

DRIVELINE VIBRATION

Driveline vibration may be caused by the propeller shaft, axle yokes, universal joints or universal joint angle.

Vibration caused by the propeller shaft(s) may be the result of:

- undercoating on the shaft tube
- excessive shaft runout
- worn or damaged propeller shaft yokes or universal joints
- cracked or broken seam welds at either end of the shaft
- dents, bends or twisted shaft tube
- worn or damaged shaft bearing yokes
- loose universal joint clamp strap bolts
- Tight, loose or binding slip yoke
- tight, worn, binding or damaged universal joint
- loose yoke retaining nut

Vibration caused by the drive pinion yoke may be due to:

- loose clamp strap bolts
- tight, loose, binding or worn slip yoke
- worn or damaged universal joint spider
- worn or damaged needle bearings or bearing caps

Vibration caused by axle, transfer case, engine or suspension components may be the result of:

- loose yoke retaining nut
- excessive yoke runout
- incorrect universal joint angle
- bent, worn, broken or loose torque reaction bracket or engine rear crossmember
- damaged or loose suspension springs or suspension components
- loose engine or transmission/transfer case support cushions or crossmembers, broken spring mounting pad (on axle), broken spring center bolt or damaged engine driven accessories or drive belts

Driveline Vibration Diagnosis

If a driveline vibration condition should develop, do not initiate corrective procedures until the vibration source has been determined. This is important in avoiding unnecessary or ineffective repairs. The following Diagnosis and Repair (DARS) Charts will help to isolate the most common causes of driveline vibration.

SEE I.S. NOTES

Driveline Vibration Diagnosis and Repair (DARS) Charts

PROBLEM: DRIVE LINE VIBRATION

STEP | **SEQUENCE** | **RESULT**

1

WHEEL/TIRE CONDITION

1. CHECK FOR BENT, CRACKED WHEELS AND CUPPED OR DAMAGED TIRES.
2. CHECK FOR MISMATCHED TIRE SIZES OR TREAD PATTERNS.
3. CHECK AND CORRECT TIRE INFLATION PRESSURES AS NEEDED.
4. ROAD TEST IF REPAIR OR REPLACEMENT WAS NEEDED.

CORRECTION NEEDED – ROAD TEST	OK	STOP
CORRECTION NOT NEEDED	OK	2
CORRECTION NEEDED – ROAD TEST	~~OK~~	2

2

ROAD TEST

DRIVE 8-16 KM/H (5-10 MPH) ABOVE VIBRATION RANGE–THEN–SHIFT TO NEUTRAL, LET ENGINE IDLE AND COAST–THROUGH VIBRATION RANGE

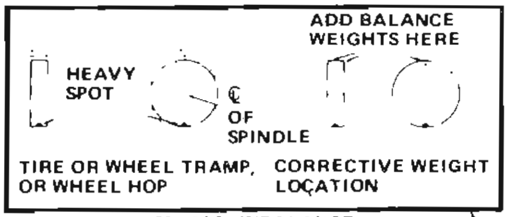
ROAD TEST

VIBRATION GONE	OK	STOP
VIBRATES DURING COAST-THROUGH	~~OK~~	3
VIBRATION STOPS DURING COAST-THROUGH (IN NEUTRAL)	~~OK~~	4

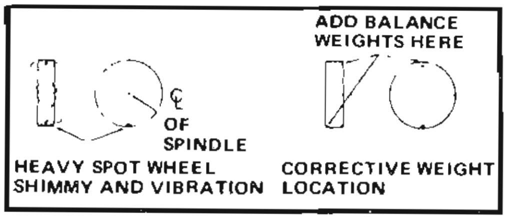
SEE I.S. NOTES

3

WHEEL / TIRE BALANCE



STATIC UNBALANCE



DYNAMIC UNBALANCE

CORRECT AS NECESSARY AND ROAD TEST (MAX. WHEEL WEIGHT ALLOWANCE IS 283 GRAMS (10 OUNCES)

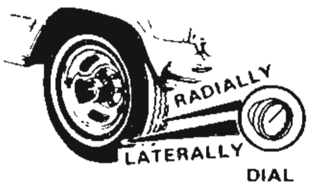
IF CORRECTION WAS NEEDED-REPEAT ROAD TEST	OK	STOP
ROAD TEST OR NO CORRECTION NEEDED.	~~OK~~	4

840924

STEP | **SEQUENCE** | **RESULT**

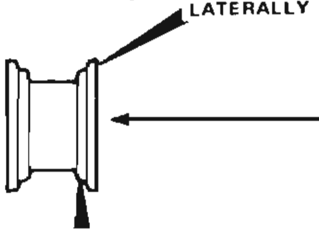
4

CHECK TIRE RUNOUT



TIRE RADIAL RUNOUT:	
RADIAL TIRES	0.080
CONVENTIONAL TIRES	0.105
TIRE LATERAL RUNOUT:	
ALL TIRES	0.100
WHEEL RUNOUT:	
LATERAL/RADIAL	0.045

CHECK WHEEL RUNOUT



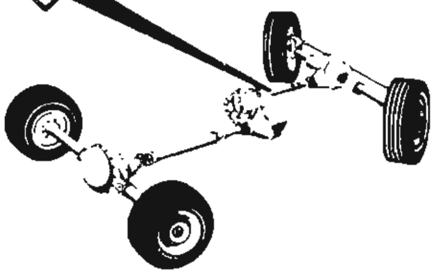
NO CORRECTION NEEDED — OK → 5

CORRECTION NEEDED — NOT OK ↓

REPAIR OR REPLACE AS NECESSARY — ROAD TEST → 2

5

CHECK FRONT PROPELLER SHAFT OPERATION



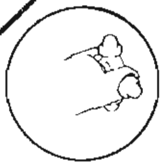
1. REMOVE REAR PROPELLER SHAFT (ALIGN MARK SHAFT AND AXLE YOKE FOR ASSEMBLY REFERENCE.
2. ROAD TEST MODEL 300 IN 4-H.

ROAD TEST 2 →

- VIBRATION GONE OR NOTICEABLY REDUCED — OK → 6
- NO CHANGE IN VIBRATION LEVEL — NOT OK → 10

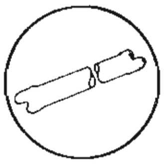
6

CHECK REAR PROPELLER SHAFT CONDITION



WORN, BINDING BRINELLED U-JOINTS

WORN, LOOSE BINDING SLIP YOKE



BENT TUBE

EXCESSIVE PAINT OR UNDERCOATING ON TUBE

OK → 7

NOT OK ↓

REPAIR OR REPLACE SHAFT ↓

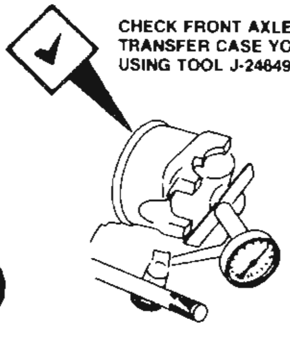
ROAD TEST 2 →

- OK → STOP
- NOT OK → 7

840925

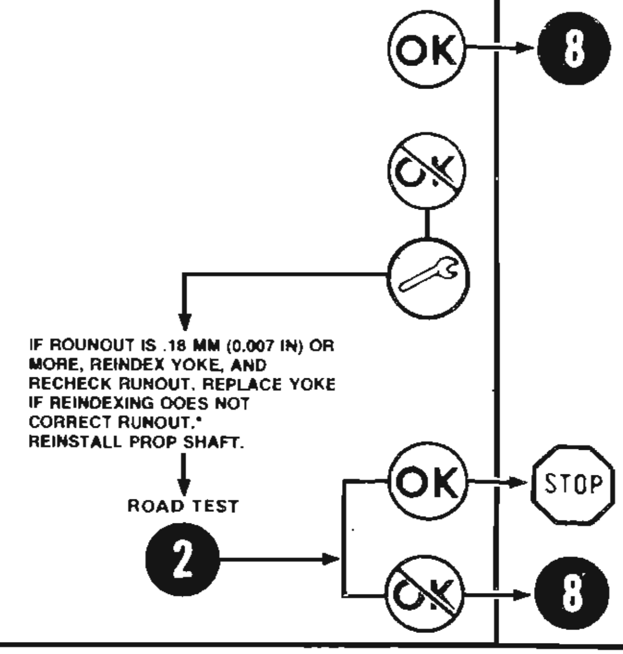
STEP **SEQUENCE** **RESULT**

7



CHECK FRONT AXLE PINION AND TRANSFER CASE YOKE RUNOUT USING TOOL J-24849-1 OR EQUIVALENT

MAXIMUM ALLOWABLE RUNOUT AT EITHER YOKE IS 0.15 MM (0.006 IN)

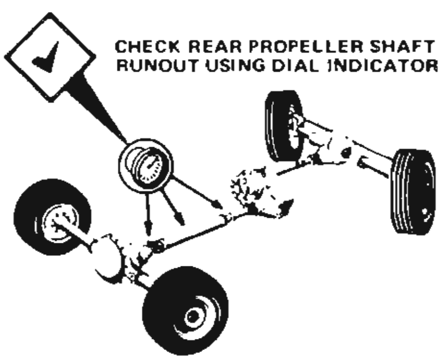


IF ROUNOUT IS .18 MM (0.007 IN) OR MORE, REINDEX YOKE, AND RECHECK RUNOUT. REPLACE YOKE IF REINDEXING DOES NOT CORRECT RUNOUT.* REINSTALL PROP SHAFT.

ROAD TEST

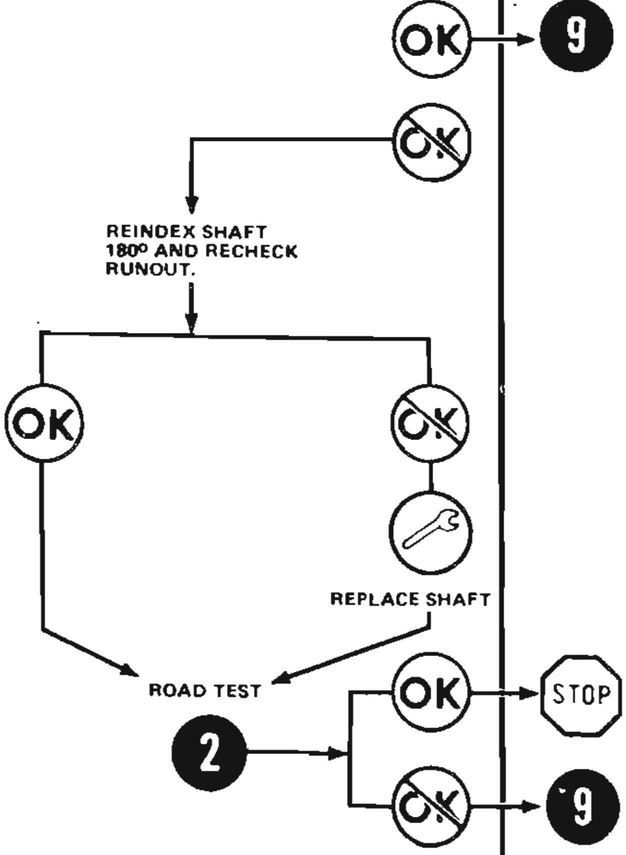
*REPLACEMENT YOKE RUNOUT SHOULD BE CHECKED ALSO.

8



CHECK REAR PROPELLER SHAFT RUNOUT USING DIAL INDICATOR.

MAXIMUM ALLOWABLE RUNOUT OF SHAFT IS .38 MM (.015 IN) TOTAL INDICATOR RUNOUT AT ENDS AND CENTER OF SHAFT. AT SHAFT ENDS, MEASURE RUNOUT 7.6 CM (3 IN) FROM SHAFT WELD SEAMS.



REINDEX SHAFT 180° AND RECHECK RUNOUT.

REPLACE SHAFT

ROAD TEST

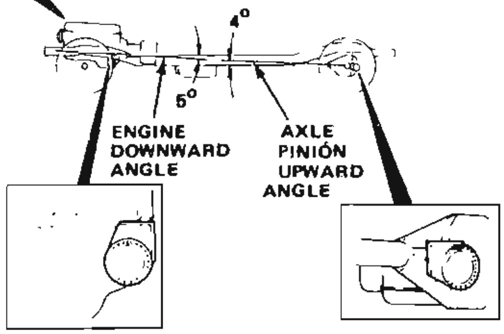
SEE I.S. NOTES

840926

STEP **SEQUENCE** **RESULT**

9

CHECK REAR AXLE PINION UPWARD ANGLE AND ENGINE DOWNWARD ANGLE USING MAGNETIC BASE PROTECTOR



REAR AXLE PINION ANGLE MUST BE ½° TO 1½° (1° PREFERRED) BELOW ENGINE ANGLE. USE APPROPRIATE SHIMS TO CORRECT ANGLE

OK → 10

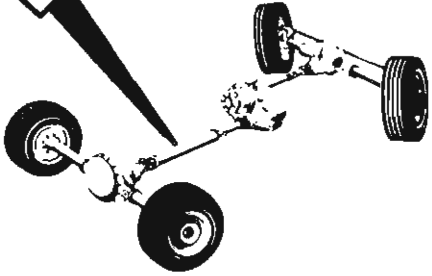
NOT OK → ADJUST ANGLES AS NEEDED → ROAD TEST 2

- OK → STOP
- NOT OK → 10

10

CHECK REAR PROPELLER SHAFT OPERATION

1. REMOVE FRONT PROPELLER SHAFT (ALIGN MARK SHAFT AND AXLE YOKES FOR ASSEMBLY REFERENCE).
2. ROAD TEST WITH 300 IN 4H.



ROAD TEST 2

- VIBRATION GONE OR NOTICEABLY REDUCED — OK → 11
- NO CHANGE IN VIBRATION LEVEL — NOT OK → 12

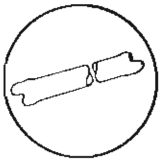
SEE I.S. NOTES

11

CHECK FRONT PROPELLER SHAFT CONDITION

WORN, BINDING BRINELLED U-JOINT

WORN, LOOSE BINDING SLIP YOKE



BENT TUBE

EXCESSIVE PAINT OR UNDERCOATING ON TUBE

OK → 12

NOT OK → REPAIR OR REPLACE SHAFT → ROAD TEST 2

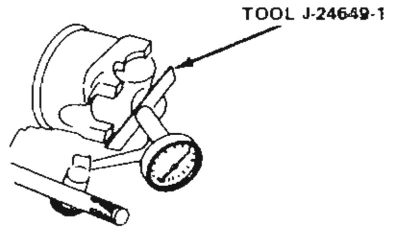
- OK → STOP
- NOT OK → 13

840927

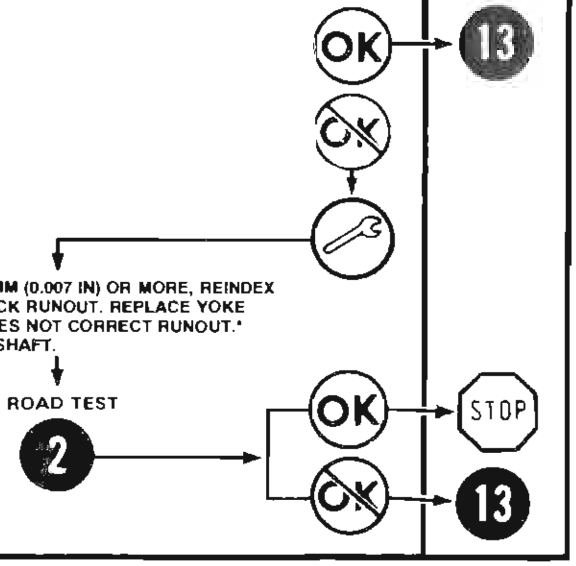
STEP **SEQUENCE** **RESULT**

12

CHECK REAR AXLE PINION AND TRANSFER CASE YOKE RUNOUT USING TOOL J-24649-1



MAXIMUM ALLOWABLE RUNOUT AT EITHER YOKE IS 0.15 MM (0.006 IN)

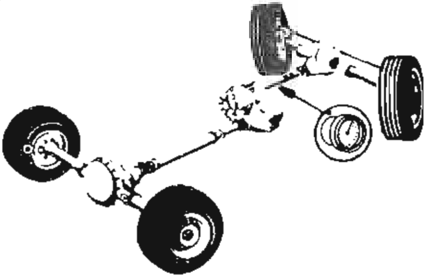


IF RUNOUT IS .18 MM (0.007 IN) OR MORE, REINDEX YOKE AND RECHECK RUNOUT. REPLACE YOKE IF REINDEXING DOES NOT CORRECT RUNOUT.* REINSTALL PROP SHAFT.

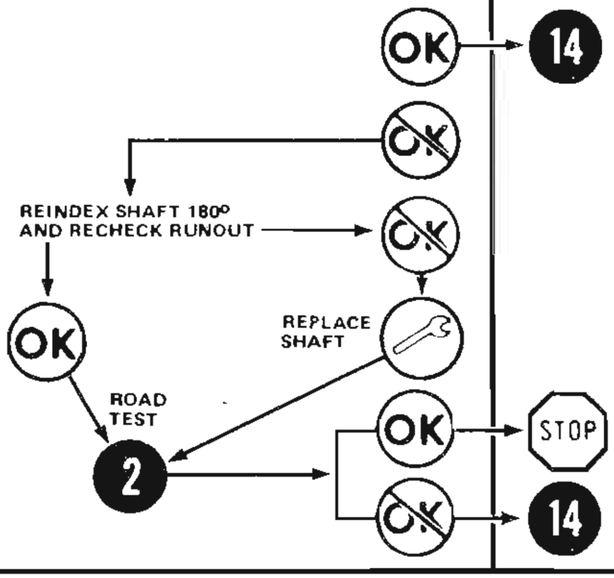
*REPLACEMENT YOKE RUNOUT SHOULD BE CHECKED ALSO

13

CHECK FRONT PROPELLER SHAFT RUNOUT USING DIAL INDICATOR



MAXIMUM ALLOWABLE RUNOUT OF SHAFT IS .38 MM (.015 IN) TOTAL INDICATOR RUNOUT AT ENDS AND CENTER OF SHAFT. AT SHAFT ENDS, MEASURE RUNOUT 7.6 CM (3 IN) FROM SHAFT WELD SEAMS.

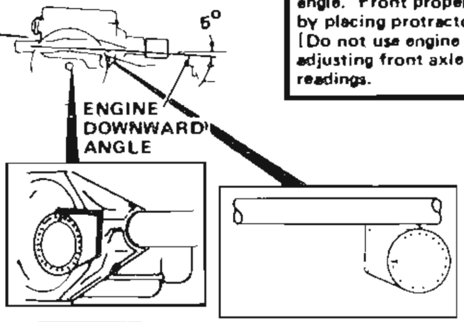


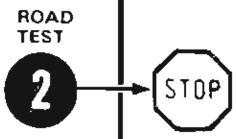
14

CHECK FRONT AXLE PINION AND FRONT PROPELLER SHAFT ANGLES USING MAGNETIC BASE PROTECTOR

NOTE: Front axle pinion angle is measured using same procedure as rear axle pinion angle. Front propeller shaft angle is measured by placing protractor on front driveshaft. [Do not use engine downward angle as base for adjusting front axle pinion angle.] Record readings.

FRONT AXLE PINION ANGLE MUST BE ½° TO 1½° (1° PREFERRED) ABOVE FRONT PROPELLER SHAFT ANGLE. USE APPROPRIATE SHIMS TO OBTAIN CORRECT ANGLE





SEE I.S. NOTES

UNIVERSAL JOINT ANGLE MEASUREMENT AND ADJUSTMENT

When torque is transmitted through single cardan universal joints operating at an angle, the rotating speeds of the driving and driven yoke will differ. In operation, the driving yoke rotates at a constant speed while the driven yoke speeds up and slows down twice every revolution.

This difference in driven yoke rotating speed is proportional to the operating angle of the universal joint. In effect, the greater the universal joint operating angle, the greater the speed fluctuation of the driven yoke.

If fluctuation is excessive, driveline vibration will occur. As a result, the universal joint operating angles must be controlled to minimize this effect.

SEE I.S. NOTES

LUBRICATION

The propeller shaft slip yoke and universal joints on all Jeep vehicles require periodic lubrication. Refer to the Maintenance Schedule for specific details.

Lubricant Type

When lubricating the slip yokes and universal joints, use Jeep Chassis Lubricant or an equivalent lithium-base chassis grease only.

Lubrication Intervals

On CJ and Scrambler models, the slip yoke and universal joints must be lubricated at 8 000 km (5000 mi) or 5-month intervals in normal service and at 4 000 km (2500 mi) or 2.5 month intervals for heavy-duty service.

Lubrication Fittings

Externally mounted lubrication fittings are located in the slip yokes and single cardan universal joint spiders for lubrication purposes.

CAUTION: It is important that the recommended lubricant.and lubrication schedule be adhered to. Failure to comply with lubrication requirements may result in premature wear of the propeller shaft components.

PROPELLER SHAFT SERVICE

Removal – Front Shaft

Raise the vehicle.

Mark the propeller shaft yokes, transfer case output shaft yoke and axle yoke for assembly alignment reference.

Disconnect the propeller shaft at the axle and transfer case yokes and remove the shaft.

Installation – Front Shaft

Align the reference marks on the propeller shaft and yokes and install the propeller shaft.

Tighten the clamp strap bolts with 20 N·m (15 ft-lbs) torque.

Lower the vehicle.

Removal – Rear Shaft

Raise the vehicle.

Mark the propeller shaft, transfer case yoke or flange, and axle yoke for assembly alignment reference.

Disconnect the shaft at the transfer case and axle yokes and remove the shaft.

Installation – Rear Shaft

Align the reference marks on the propeller shaft yokes and install the shaft.

Tighten the clamp strap bolts with 20 N·m (15 ft-lbs) torque.

Lower the vehicle.

UNIVERSAL JOINT SERVICE

The single and double cardan universal joints are serviced as assemblies. Both universal joint types can be disassembled for inspection and replacement purposes.

Disassembly – Single Cardan Joint

If the slip yoke universal joint is to be replaced, paint alignment marks on the slip yoke and propeller shaft for assembly reference and remove the slip yoke from the shaft.

Remove the loose bearing caps from the spider and apply penetrating oil to the bearing caps seated in the shaft yoke.

Mount the propeller shaft or slip yoke in the vise.

CAUTION: Do not clamp the propeller shaft tube in the vise. Clamp only the forged portion of the slip yoke or propeller shaft yoke in the vise. Also, to avoid distorting either of the yokes, do not overtighten the vise.

Remove the bearing cap retainers. Tap the ends of the bearing caps with a hammer to relieve pressure on the retainers if necessary.

Reposition the shaft in the vise so the yoke is supported on the vise jaws.

Tap the end of one bearing cap with a hammer until the opposite bearing cap is driven out of the yoke. Reposition the shaft yoke in the vise and tap the exposed end of the spider to drive the remaining bearing cap out of the yoke.

Remove the spider from the yoke.

Cleaning and Inspection

Clean the yoke bearing cap bores with solvent and a wire brush. Be sure to remove all rust, corrosion or dirt. Wash the bearing caps, bearings and spider in solvent and wipe them dry with a shop cloth.

Inspect the bearing caps, needle bearings and bearing surfaces of the spider for evidence of brinneling, excessive wear, flat spots, scoring or cracks. Replace the complete assembly if any part exhibits these conditions.

Assembly – Single Cardan Joint

Lubricate all the needle bearings, bearing caps and bearing surfaces of the spider with chassis grease. Also apply a thin film of grease to the exterior surface of the bearing caps.

Install the bearing cap seals on the spider.

Install one bearing and needle bearing assembly part-way into the shaft yoke.

Position the spider in the shaft yoke and install the opposite bearing cap and needle bearing assembly in the yoke.

Support the yoke on the vise jaws and seat both the bearing caps in the yoke using a hammer.

Install the bearing cap retainers. Tap the ends of the bearing caps to seat the caps fully if the retainers are difficult to install.

Install the two remaining bearing cap and needle bearing assemblies on the spider. Use a rubber band or tape to retain these caps on the spider until the shaft is to be installed.

SEE I.S. NOTES

SUSPENSION

CONTENTS

SEE
I.S.
N
O
T
E
S

SUSPENSION

GENERAL INFORMATION

Jeep vehicles are equipped with American and metric size, tubeless-type pneumatic tires, available in load ranges SL, B, C and D. Standard equipment tires are of radial-ply construction.

Standard equipment wheels are safety rim, drop center-types constructed entirely of steel. Optional wheels, which are available on most models, consist of forged aluminum wheels, wide rim spoke-type sport wheels and chrome-plated steel wheels.

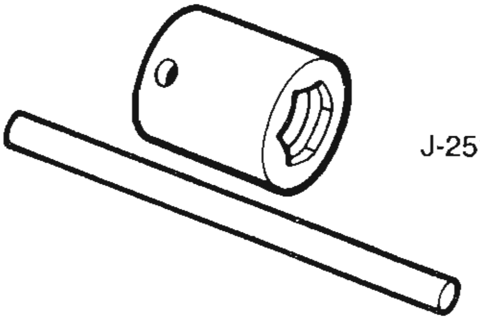
Steel wheels are of two-piece construction consisting of a rim and center section (spider). The two sections are welded together to form a seamless, air-tight assembly.

Original equipment wheels and tires are tested and selected to provide the best all around performance for normal operation. To obtain the optimum wheel/tire performance, the tire inflation pressures must be maintained at the recommended levels and the wheel/tire condition should be checked regularly.

Jeep vehicles are equipped with semi-elliptic leaf springs and dual-action hydraulic shock absorbers at the front and rear. A front axle stabilizer bar is standard on CJ and Scrambler models with the molded hard top. A front stabilizer bar is optional on all other CJ and Scrambler models.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25103	Wheel Bearing Nut Wrench		■



86395

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Caliper Mounting Pins	20 N·m (15 ft-lbs)	20-24 N·m (15-18 ft-lbs)
Wheel Retaining Nuts	115 N·m (85 ft-lbs)	88-122 N·m (65-90 ft-lbs)
Outer Locknut	68 N·m (50 ft-lbs)	68 N·m min. (50 ft-lbs min)
Inner Locknut (Adjusting Nut)	68 N·m (50 ft-lbs)*	68 N·m min. (50 ft-lbs min)
Shock Absorber Upper Locknut (7/16-20)	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Shock Absorber Lower Locknut (1/2-20)	61 N·m (45 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Spring Pivot Bolts	136 N·m (100 ft-lbs)	108-163 N·m (80-120 ft-lbs)
Spring Shackle Nuts	33 N·m (24 ft-lbs)	24-41 N·m (18-30 ft-lbs)
Spring U-Bolt Nuts (9/16-18)	136 N·m (100 ft-lbs)	115-142 N·m (85-105 ft-lbs)
Spring U-Bolt Nuts (1/2-20)	75 N·m (55 ft-lbs)	61-88 N·m (45-65 ft-lbs)
Stabilizer Bar Mounting Bracket Bolts (All)	47 N·m (35 ft-lbs)	37-61 N·m (27-45 ft-lbs)
Wheel Nuts	115 N·m (85 ft-lbs)	88-122 N·m (65-90 ft-lbs)
Spring Center Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Stabilizer Bar Link Nuts	75 N·m (55 ft-lbs)	65-84 N·m (48-62 ft-lbs)

*Back off 1/6 turn (45° - 65°) while rotating the wheel

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25103	Wheel Bearing Nut Wrench		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Caliper Mounting Pins	20 N·m (15 ft-lbs)	20-24 N·m (15-18 ft-lbs)
Wheel Retaining Nuts	115 N·m (85 ft-lbs)	88-122 N·m (65-90 ft-lbs)
Outer Locknut	68 N·m (50 ft-lbs)	68 N·m min. (50 ft-lbs min)
Inner Locknut (Adjusting Nut)	68 N·m (50 ft-lbs)*	68 N·m min. (50 ft-lbs min)

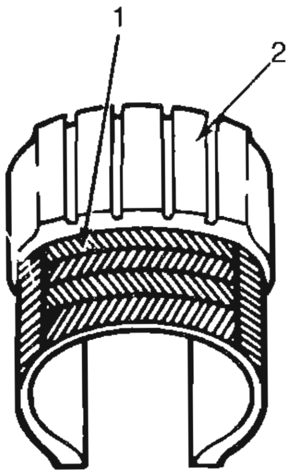
*Back off 1/6 turn (45° - 65°) while rotating the wheel

SE
I.S
N
O
T
E
S

GENERAL

Tire Construction

Standard equipment tires on the CJ-7 and Scrambler models are of the radial-ply construction. Radial-ply tires have belts (1) under the tread (2) which encircle the tire and extend from tread shoulder to tread shoulder. However, these tires are constructed with the body cord plies at right angles to the tread centerline. The plies cross the tread centerline at an angle of approximately 90 degrees. Because the body cord plies radiate from the tread centerline, this type of construction is designated radial-ply.



840626

Radial tires are identified by the code letter R which appears in the size description imprinted on the tire sidewall. Bias-ply and bias-belted tires do not have such a code letter. For example, P225/75R-15 or HR 78-15 for radial tires as compared to H78-15 for similar size bias-ply or bias-belted tires.

NOTE: As a result of their unique construction, radial tires have a highly flexible sidewall. This flexibility is responsible for the characteristic sidewall "bulge" which makes the tire appear to be underinflated. This is a normal condition for radial tires. Do not attempt to reduce this bulge by overinflating the tire. The only way to be sure a tire is properly inflated is to use an accurate and reliable tire pressure gauge. Check and adjust inflation pressures in accordance with the information provided in the Tire Inflation Pressure Chart in this section.

SEE I.S. NOTES

Tire Size and Load Rating

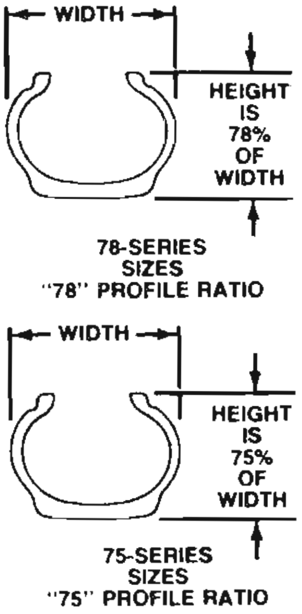
American and metric tire sizes and tire load range ratings are indicated in the combination of letters and numbers imprinted on the tire sidewall such as: P225/75R-15 load range SL, H78-15 load range B, G78-15 load range D, and 9.50 - 16.5 load range D. The load range rating replaces the ply rating system formerly used to denote tire load capacity. Original equipment tires used on Jeep vehicles are available in load range ratings SL, B, C and D.

NOTE: The SL load range applied to the P225/75R-15 metric tire is equivalent to the current load range B rating.

Conventional size American tires are identified with numbers only such as 9.50 - 16.5. These numbers indicate approximate tire width and rim diameter in inches. For example, 9.50 represents tire sidewall-to-sidewall width, and 16.5 represents the nominal wheel rim diameter required.

The newer American tire sizes are based on the tire profile ratio and use letter-number combinations such as H78-15. In this case, the letter H represents the tire industry specifications for the load and inflation schedule for tires in this letter classification. The number 78 indicates the tire section height as determined by the ratio of the section height to the sidewall-to-sidewall width. The height divided by the width equals the size or profile ratio. In this case, the height of an H78 tire is equal to 78 percent of the width. This formula applies to all profile series tires. The number 15 denotes the wheel rim diameter required.

Metric size tires also use letter-number combinations to indicate size and type. For example, with the P225/75R-15 tire, the letter P indicates tire use is for passenger vehicle applications, 225 is the sidewall-to-sidewall width in millimeters, 75 is the profile ratio (height equals 75% of width), R indicates radial-ply construction, and 15 indicates the required wheel rim diameter, stated in inches.



70223

Tire Inflation Pressure and Capacity

The original equipment tires used on Jeep vehicles are selected and tested to meet the operating requirements within the tire capacity. The recommended load capacities and inflation pressures for full or reduced load operation are listed in the Tire Inflation Pressure Chart, as shown. This information is also provided in the owner's manual and on a label attached to the interior surface of the glove box door.

Tire Inflation Pressure Chart (psi)

					Normal Load ①				Maximum Load ②				
Model	GVW Rating		Tire Size	Load Range	Sustained Driving Over 65 mph (105 km/h)		Under 65 mph (105 km/h)		Sustained Driving (105 km/h) (105 km/h)		Under 65 mph Over 65 mph		Wheel Size (105 km/h)
	lbs.	kg			Front	Rear	Front	Rear	Front	Rear	Front	Rear	
CJ/ Scrambler	3750	1700	P205/75R15	SL	33	33	30	30	35 ③*	35*	35 ③	35	15 × 5.5
			P215/75R15	SL	31	31	28	28	35 ③*	35*	35 ③	35	15 × 7
	4150	1882	P235/75R15 ④	SL	31	31	28	28	35 ③*	35*	35 ③	35	

NOTE: Inflate tires while cold, before running. Do not reduce pressure if tires are warm.
① Normal Load: Driver and one passenger.
② Maximum Load: Gross Vehicle Weight Rating (GVWR).
③ Reduce inflation pressure by 5 psi for Scrambler only.
④ Standard for Renegade and Laredo.
* Speed limited to 75 mph (121 km/h).

840625

SEE I.S. NOTES

Tire inflation pressures are selected to be compatible with the load capacity, ride, and handling characteristics of a specific vehicle. In cases where a slightly softer ride is preferred, the driver may use reduced load pressures but must not exceed 88 km/h (55 mph) or the reduced load vehicle capacity.

When a sustained high speed operation is anticipated, the tires may be inflated to the recommended full load inflation pressures plus an additional 14 kPa (2 psi). However, the inflation pressures must not exceed the maximum recommended pressures.

Tire pressures should be checked and adjusted to recommended levels on a weekly basis. This is especially important when extreme changes of 20 degrees or more in average seasonal temperatures occur, and is especially important on vehicles with Selec-Trac.

Check and adjust the inflation pressures only when the tires are cold or driven for less than 3.2 km (2 mi) at speeds below 64 km/h (40 mph), or after the vehicle has been parked for three or more hours.

Do not reduce the inflation pressures if the tires are hot or driven over 3.2 km (2 mi) at speeds above 64 km/h (40 mph). At this stage, the tire pressures may increase as much as 41 kPa (6 psi) over cold inflation pressures due to air expansion caused by heat buildup in the tire.

When checking and adjusting the inflation pressures, always use a reliable and accurate gauge to ensure the proper inflation levels.

Polyspare Tire

The polyspare lightweight spare tire is optionally available on CJ and Scrambler models. Operation of the tire at speeds over 80 km/h (50 mph) and travel in excess of 160 continuous km (100 mi) is not recommended.

The Polyspare tire is mounted on a standard type 15×6-inch steel wheel. The correct inflation pressure is 221 kPa (32 psi) and the tire can be inflated with conventional inflation equipment. Installation and removal of the Polyspare tire do not require special tools and the anticipated tread life is approximately 4 800 km (3000 mi).

SEE I.S. NOTES

Radial, Wide Tread and Snow Tire Applications

CAUTION: Tires installed on Jeep four-wheel drive vehicles must all be of equal circumference to maintain satisfactory operation. They must also be the same size, tread pattern, make, construction and inflation pressure. Intermixing tires of different size or construction will cause unusual handling, noisy operation and accelerated wear of driveline components.

Radial, wide tread, mud and snow, or conventional tires must be installed in complete sets only. Different tire types must not be intermixed at any time.

Wide tread tires must be installed in complete sets and only when there is adequate clearance for the tire in the wheel well. Refer to the Tire Inflation Pressure Chart for tire sizes allowable on each model.

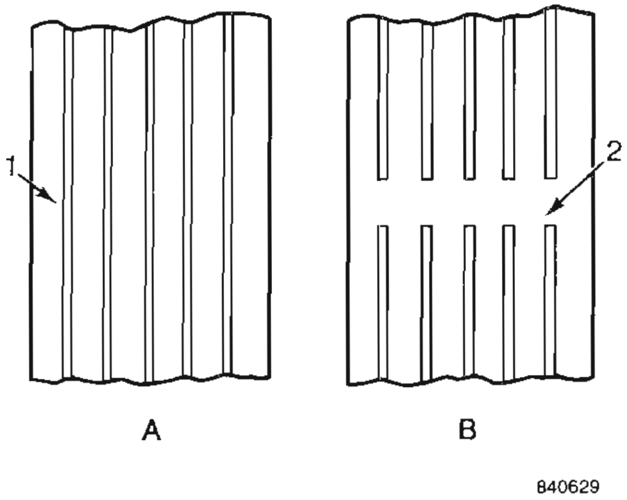
Radial tires must never be intermixed with bias-ply or bias-belted tires on any vehicle. Intermixing these tires will produce an adverse effect on vehicle handling and cornering stability. In an emergency situation, tires may be intermixed but only for the duration of the emergency and only if vehicle speed is kept below 64 km/h (40 mph).

Mud and snow tires must not be intermixed with conventional tread tires on any vehicle. These tires must also be of the same size, tread pattern, make, construction and inflation pressure. In addition, never mix bias-ply or bias-belted snow tires with radial-ply mud or snow tires.

TIRE MAINTENANCE AND CONDITION

To maximize tire performance, inspect the tires frequently for signs of incorrect inflation and uneven wear which may indicate a need for balancing, rotation or alignment. Tires should also be inspected frequently for cuts, abrasions, stone bruises, blisters or for objects imbedded in the tire. Weekly inspection intervals are recommended as a minimum. More frequent inspections are recommended when extreme temperature changes occur or where road surfaces are rough or occasionally littered with debris.

As a further check of tire condition, tread wear indicators are molded into the bottom of the tread grooves. These indicators appear in the form of 13 mm (1/2 in) wide bands across the tread when it has worn to a thickness of 1.58 mm (1/16 in) or less. The tire should be replaced when these bands become visible. The following illustration shows tread that is still good (1) and tread that is worn out (2).

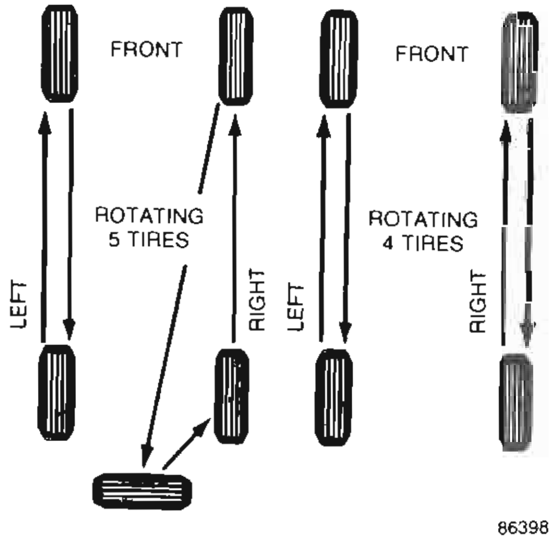


Clean the tires using a mild soap and water solution only and rinse thoroughly with water. Do not use caustic solutions or abrasive materials. To clean white sidewalls and raised letters and numbers, use an approved whitewall cleaner only. Do not use steel wool, wire brushes or materials having a mineral oil base such as gasoline, paint thinner or turpentine. These materials are harmful to the tires and will also discolor the white sidewalls and raised figures.

Tire Rotation

To equalize wear, tires should be rotated at the intervals specified in the Mechanical Maintenance Schedule. The first rotation is the most important in setting the stage for even tread wear. After rotation, adjust the tire inflation pressures to the levels recommended in the Tire Inflation Pressure Chart.

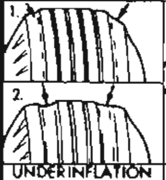
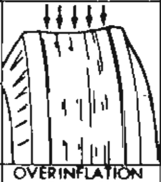
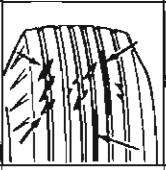
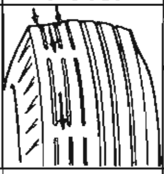
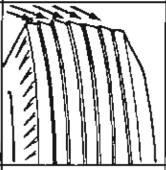
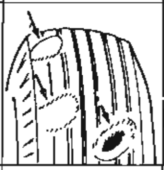
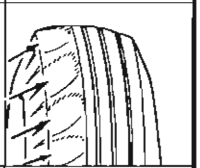
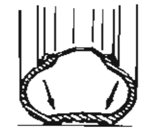
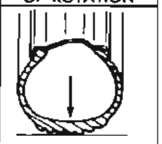
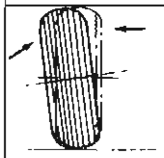
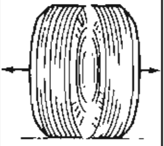
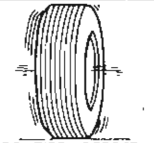
Radial tires are rotated on the same side, front-to-rear. Radial tires are not rotated in the same manner as conventional tires.



Abnormal Tire Wear

Abnormal tire wear may be caused by incorrect inflation pressures, tire-wheel imbalance, worn suspension components, improper brake operation, bent wheels, front wheel alignment or excessive speed on turns.

In most cases, inspection of the tire wear patterns will reveal the cause of abnormal wear. The following illustration shows the various types of wear patterns and the necessary corrective action.

	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
CONDITION							
CAUSE	UNDERINFLATION OR LACK OF ROTATION 	OVERINFLATION OR LACK OF ROTATION 	UNDERINFLATION OR EXCESSIVE SPEED	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL  OR TIRE DEFECT	LACK OF ROTATION OR WORN OR OUT-OF-ALIGNMENT SUSPENSION
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES		REPLACE TIRES	REPLACE FRONT AXLE HOUSING IF NECESSARY	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION

41409(J)

SEE I.S. NOTES

Tire Roughness

Roughness, vibration, tramp, shimmy and thump are usually caused by excessive wheel or tire runout, cupped tires or wheel/tire imbalance. These problem conditions may be caused by operation over rough or undulating road surfaces. Driving the vehicle on different road surfaces will usually help determine if the road surfaces or tires are causing the problem.

Always road test the vehicle to determine the exact nature of the problem. Drive the vehicle for at least 11 km (7 mi) to warm the tires and remove temporary flat spots that may have formed while the vehicle was parked. Note the tire condition and wear, and check and adjust the inflation pressures to the recommended levels before road testing.

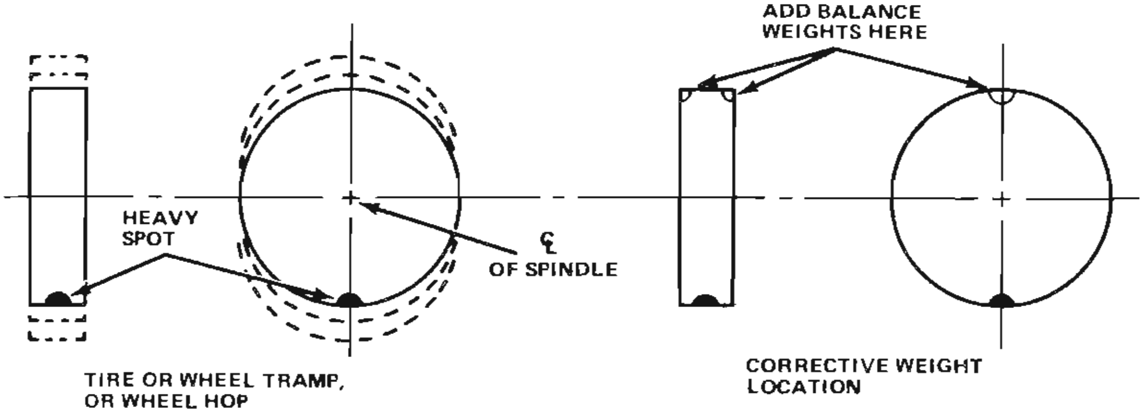
Tire Tramp

Tramp is caused by wheel/tire static imbalance or by excessive lateral runout of the tire or wheel.

The most effective method for checking static balance is by using off-vehicle balancing equipment.

Static balance is the result of an equal distribution of wheel and tire weight around the circumference of the tire. In this case, weight is distributed around the spindle in such a manner that the assembly lacks the tendency to rotate by itself when mounted on the arbor of a balancing machine.

Static imbalance occurs when an unequal portion of weight is concentrated at one point on the tire and wheel. It causes a vibratory-type pounding action which is referred to as tramp or hop.

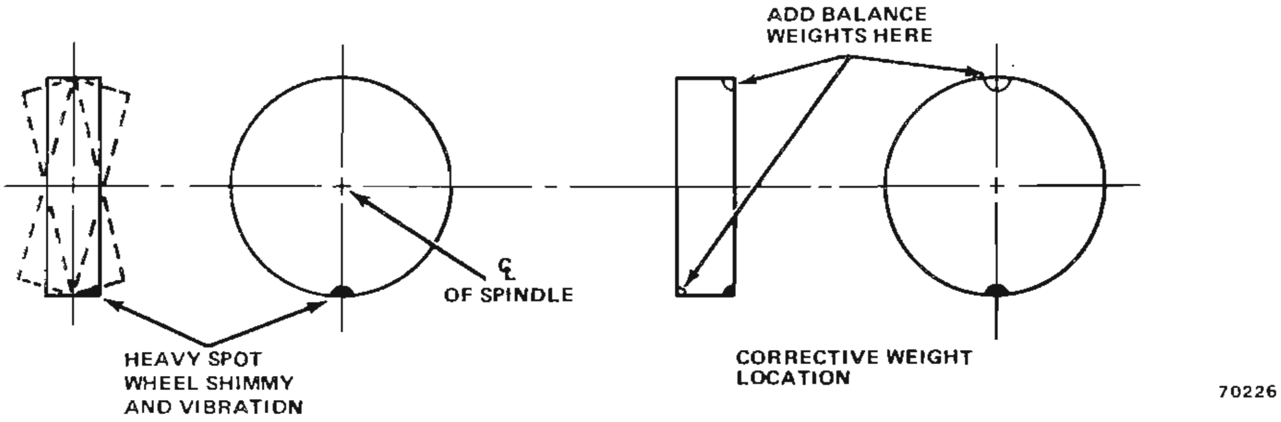


SEE I.S. NOTES

Dynamic balance is the result of an equal distribution of wheel/tire weight around the plane of rotation. This causes the wheel to rotate smoothly around the axis that bisects the wheel and tire centerline.

Dynamic imbalance occurs when unequal forces are concentrated at opposing points on the tire circumference. It will cause shimmy and vibration at medium and high speeds.

The most effective method for balancing wheels and tires is by using equipment that will correct both static and dynamic balance. Dynamic, two-plane balancing equipment is preferred.



Since procedures vary with different machines, follow the equipment manufacturer's operating instructions explicitly to obtain satisfactory results.

SEE I.S. NOTES

WARNING: On-vehicle type wheel balancers may be used on the rear wheels of vehicles equipped with a Trac-Lok differential, but only after raising the rear end and removing the wheel opposite the one being balanced. In addition, do not exceed 56 km/h (35 mph) on the speedometer when spinning the wheels. As a result of differential action, actual wheel speed is double the speed indicated on the vehicle speedometer. The centrifugal force generated by a tire spinning at high speed could cause damage and personal injury.

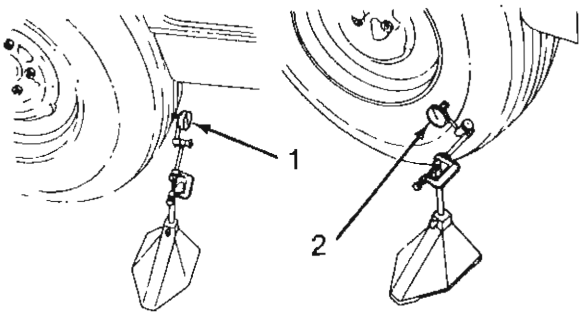
Wheel and Tire Runout

Excessive radial or lateral runout of a wheel or tire can cause roughness, vibration, tramp, tire wear and steering wheel tremor.

Before checking runout, drive the vehicle for at least 11 km (7 mi) to remove temporary flat spots that may have formed in the tires. Flat spots must be removed to avoid false readings when measuring runout.

Measure runout using a dial indicator. All measurements should be made on the vehicle with the tires inflated to the recommended levels and with the wheel bearings adjusted to specifications.

Measure radial runout at the center and outside ribs of the tread face (1). Measure lateral runout at the tire sidewall just above the buffing rib on the sidewall (2).



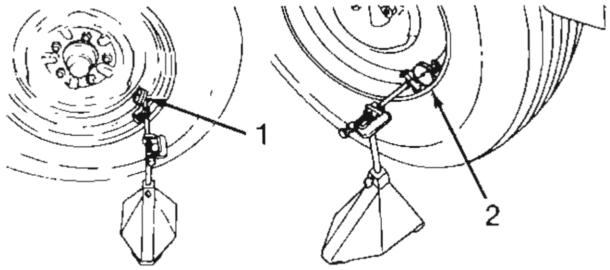
84862

On conventional tires, radial runout should not exceed 2.66 mm (0.105 in) and lateral runout should not exceed 2.03 mm (0.080 in). Mark the high points of lateral or radial runout for reference.

On radial tires, radial runout should not exceed 2.03 mm (0.080 in) and lateral runout should not exceed 2.54 mm (0.100 in).

If the tire radial or lateral runout exceeds the specified limits, it will be necessary to check wheel runout to determine whether the wheel or tire is at fault.

Wheel radial runout is measured at the wheel rim just inside of the wheel cover retaining nibs (1). Wheel lateral runout is measured at the wheel rim bead flange just inside the curved lip of the flange (2). Mark the high points of radial or lateral runout for reference.



84863

Wheel runout should not exceed 0.88 mm (0.035 in). Wheel lateral runout should not exceed 1.14 mm (0.045 in).

Tire and Wheel Runout Specifications

Tire Radial Runout:	
Conventional Tire	2.66 mm (0.105 in)
Radial Tire	2.03 mm (0.080 in)
Tire Lateral Runout (All)	2.54 mm (0.100 in)
Wheel Radial Runout (All)	1.14 mm (0.045 in)
Wheel Lateral Runout (All)	1.14 mm (0.045 in)

840624

SEE I.S. NOTES

If tire runout exceeds the specified limits but wheel runout is within limits, runout may be reduced to an acceptable level by changing the tire position on the wheel so that the previously marked high points are 180° apart.

NOTE: On vehicles with disc brakes, excessive wheel lateral runout may be caused by excessive rotor hub-to-bore runout. Refer to the Rotor Inspection procedure in Chapter K, Brakes.

Vibration

Vibration may be caused by tire and wheel imbalance or runout, incorrect wheel bearing adjustment, loose or worn suspension or steering components, worn or defective tires, certain tire tread patterns, incorrect universal joint angles, worn universal joints, excessive propeller shaft runout or yoke runout, rotor or brakedrum runout, loose engine or transmission supports, or by engine operated accessories.

Vibration Categories

There are two types of vibration, mechanical vibration and audible vibration.

Mechanical vibrations are felt through the seats, floorpan or steering wheel and usually produce some visible motion in the rearview mirror, fenders, dash panel or steering wheel.

Audible vibrations are heard or sensed above normal background noise and may or may not be accompanied by a mechanical vibration. In some cases they occur as a droning or drumming noise while in other cases they produce a buffeting sensation that is felt or sensed by the driver rather than heard.

Vibration Sensitivity

Mechanical and audible vibrations are sensitive to changes in the engine torque, vehicle speed or engine speed. They usually occur within one, or sometimes two well-defined ranges in terms of vehicle speed, engine rpm and torque application.

- Torque Sensitive – this means that the condition can be improved or worsened by accelerating, decelerating, coasting or maintaining a steady vehicle speed and application of the engine torque
- Vehicle Speed Sensitive – this means that the vibration occurs at the same speed and is not affected by the engine torque, engine rpm or transmission gear selected
- Engine Speed Sensitive – this means that the vibration occurs at varying vehicle speeds when a different transmission gear is selected; it can sometimes be isolated by increasing or decreasing engine speed with the transmission in the Neutral position

Vibration Diagnosis

A proper vibration diagnosis should always begin with a road test. Corrective measures should not be attempted until the vibration type, magnitude and speed range have been established by a road test.

During the road test, the vehicle is driven on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

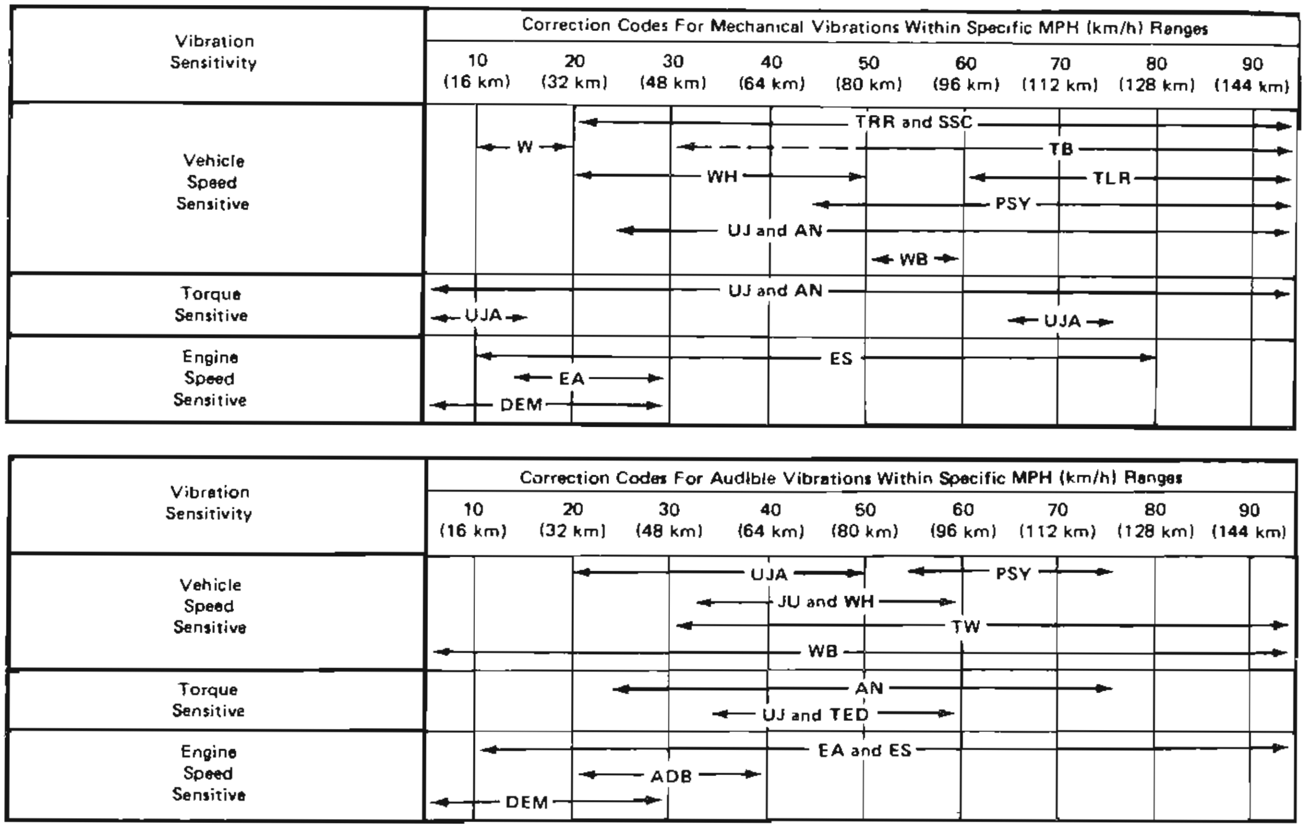
- the speed range in which the vibration occurs
- the type of vibration – mechanical or audible
- whether the vibration is affected by changes in the vehicle speed, engine rpm or engine torque
- the type of vibration sensitivity – whether torque sensitive, engine speed sensitive or vehicle speed sensitive

When the vibration category, type of sensitivity and the range have been determined, refer to the Vibration Diagnosis Chart for probable causes.

Consider correcting only those items coded on the charts that are related to the problem condition.

Refer to the following correction codes for a description of the various corrective procedures.

Vibration Diagnosis Chart



840623

Vibration Diagnosis Chart Codes

TRR – Tire and Wheel Radial Runout. Vehicle speed sensitive mechanical vibration. It is not a cause of vibration below 32 km/h (20 mph). The speed required to cause vibration increases as the runout decreases.

WH – Wheel Hop. Vehicle speed sensitive mechanical vibration. It is not a cause of vibration below 32 km/h (20 mph). It generates rapid up-down movement in the steering wheel and dash panel. Most noticeable in the 32 - 64 km/h (20 - 40 mph) speed range. It is caused by tires having the radial runout of more than 1.14 mm (0.045 in). Tire balance is ineffective and the faulty tire should be replaced.

TB – Tire Balance. Vehicle speed sensitive mechanical vibration. Static imbalance not a cause of vibration below 46 km/h (30 mph). Dynamic imbalance not a cause of vibration below 64 km/h (40 mph).

TLR – Tire and Wheel Lateral Runout. Vehicle speed sensitive mechanical vibration. Not a cause of vibration below 80 - 88 km/h (50 - 55 mph) unless runout is extreme. Generates front end shimmy if extreme.

TW – Tire Wear. Vehicle speed sensitive mechanical vibration. Abnormal wear causes vibration in the 50 - 88 km/h (30 - 55 mph) range and may generate whine noise at high speed changing to growl noise at low speed.

W – Radial Tire Waddle. Normal condition with radial tires. Construction causes side-to-side motion at speeds up to 24 km/h (15 mph). Rotate tires to reduce the condition. Replace tires if the condition is extremely severe.

UJA – Universal Joint Angles. Incorrect angles cause mechanical vibration below 32 km/h (20 mph) changing to mechanical and/or audible vibration at 56 - 88 km/h (35 - 55 mph). Torque sensitive vibration.

UJ – Universal Joints. If needle bearings, bearing cups or bearing ends of spiders are worn, damaged, overtightened or loose, they will cause mechanical vibration at almost any speed. Torque and vehicle speed sensitive vibration.

PSY – Propeller Shaft and Yokes. Not a cause of vibration below 56 km/h (35 mph). Excessive runout, imbalance, missing balance weights, undercoating on shaft tube, dents or bends in the tube will cause mechanical vibration at 56 km/h (35 mph) and above. Torque and vehicle speed sensitive vibration.

WB – Wheel Bearings. Loose bearings cause shimmy-like vehicle speed sensitive mechanical vibration at 56 km/h (35 mph) and above. Rough or damaged bearings will also generate growl noise at low speed or whine noise at high speed.

AN – Axle Noise. Axle not a cause of vibration unless axle shaft is bent or front axle shaft U-joint is damaged. Worn or damaged axle gears or bearings will cause noise in varying speed ranges in relation to amount of engine torque applied.

SSC – Suspension and Steering Components. Worn, damaged or loose suspension components (steering damper, steering knuckles, pitman arm, springs, spring U-bolts or center bolts, shocks, tie rod ends, etc.) can cause mechanical or audible vibrations at many speeds. Can be torque and vehicle speed sensitive.

EA – Engine Driven Accessories. Loose or broken AC compressor, power steering pump, water pump, air pump, alternator, etc. can cause engine speed sensitive mechanical vibration. Usually apparent when the transmission is shifted into the Neutral position and the engine rpm is increased.

ADB – Accessory Drive Belts. Loose, worn belts can cause engine speed sensitive audible vibration that sounds like droning, fluttering or rumbling noise.

DEM – Damaged Engine or Transmission Mounts. If loose, worn or broken, can allow the engine, transmission or engine accessories to contact the body causing noise and vibration.

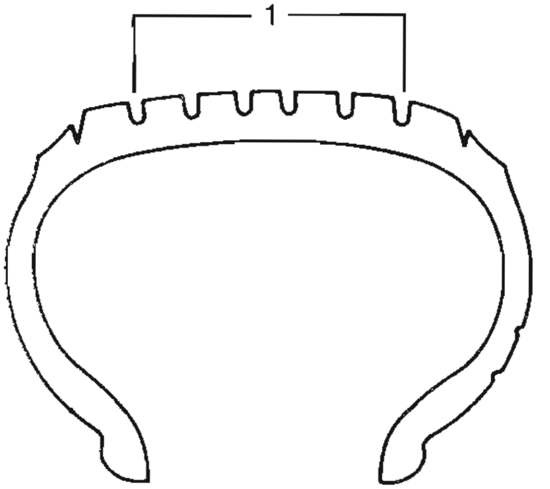
ES – Exhaust System. Loose or broken components may contact the body causing noise. In addition, mispositioned components (e.g., muffler, converter, pipes, hangers) may also contact the body or driveline components causing noise.

SEE I.S. NOTES

TIRE REPAIR

Punctured tires should be removed from the wheel and permanently repaired from the inside using a combination repair plug and vulcanized patch. When repairing punctures, always follow the manufacturer's instructions for repair kit installation.

Punctures are repairable only in the tread area (1).



84860

SEE I.S. NOTES

Never attempt to repair punctures in the tire shoulders or sidewalls. In addition, never attempt to repair any tire that has sustained the following damage:

- bulges or blisters
- ply separations
- broken, cut or cracked beads
- fabric cracks or cuts
- tires worn to the fabric or if wear indicators are visible
- punctures larger than 6 mm (1/4 in) in diameter

Externally applied repair plugs, blowout patches and aerosol sealants should be considered as emergency-type repairs only. Tires repaired in this fashion should not be driven at speeds over 64 km/h (40 mph) or for more than 121 km (75 mi) before a permanent repair is made.

WHEEL MAINTENANCE AND CONDITION

The condition of the wheels should be checked frequently. Replace any wheel that is cracked, bent, severely dented, has excessive runout or has broken welds. The tire inflation valve should also be inspected frequently for wear, leaks, cuts or looseness and should be replaced if damaged or worn.

Clean all the wheels with a mild soap and water solution only and rinse thoroughly with water. Never use abrasive or caustic materials, especially on aluminum or chrome-plated wheels, as the surface will be etched or the plating severely damaged. After cleaning aluminum or chrome-plated wheels, apply a coating of protective wax to preserve the finish and lustre.

WHEEL BALANCING

Wheel balancing may be performed using on- or off-vehicle equipment. However, when using on-vehicle balancing equipment, observe the following precautions:

- on vehicles with a Trac-Lok rear axle, do not use on-vehicle equipment to balance the rear wheels; instead, remove the wheels and balance them off the vehicle using a two-plane, dynamic balancer

- on vehicles with front hubs, place the hubs in the 4 × 2 or Free position before balancing the front wheels
- before balancing the wheels on a vehicle equipped with a Model 300 transfer case, shift the transmission and transfer case into the Neutral position

Because of their unique construction, radial tires are sometimes less responsive to certain balancing techniques. In some cases, dynamic two-plane, off-vehicle type balancing equipment will provide the most satisfactory results with radial tires.

When balancing aluminum or chrome-plated wheels, take care to avoid damaging the wheel surface when installing the balance weights. Use the self-adhering type weights on aluminum wheels only and install them on the back side of the wheel whenever possible.

WHEEL BEARING ADJUSTMENT

Wheel bearing adjustment is very important because it establishes the operating clearance of the wheel bearings. A tight adjustment preloads the bearings excessively, causing them to overheat. A loose adjustment allows the hub to shift position as the bearing load varies during acceleration, braking and cornering. A loose bearing adjustment can produce shimmy, vibration and low brake pedal heights as a result of the disc brakeshoe being pushed back due to rotor wobble.

Front Wheel Bearing Adjustment

Raise the vehicle.

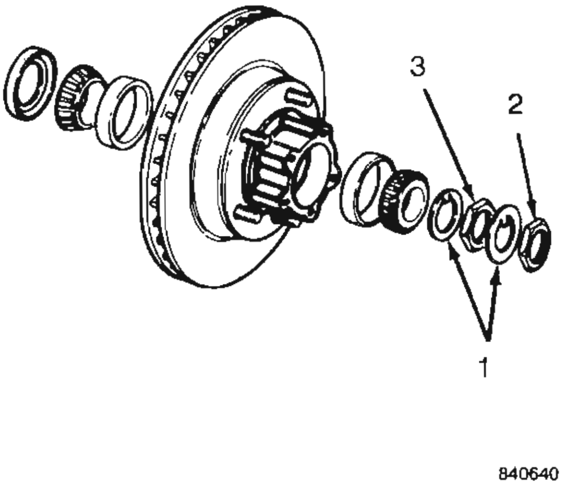
Remove the bolts attaching the front hub to the rotor hub and remove the hub body and gasket.

Remove the snap ring from the axle shaft and remove the hub clutch assembly.

Straighten the lip of the outer locknut tabbed washer (1).

Remove the outer locknut (2) and tabbed washer.

Loosen and then tighten the inner locknut (3) with 68 N·m (50 ft-lbs) torque using a Wheel Bearing Nut Wrench, Tool J-25103 or equivalent. Rotate the wheel while tightening the nut to seat the bearing properly.



Back off the inner locknut 1/6 turn (45° - 65°) while rotating the wheel. The wheel must rotate freely and not display any lateral movement.

Install the tabbed washer and outer locknut.

Tighten the outer locknut with 68 N·m (50 ft-lbs) torque using a Wheel Bearing Nut Wrench, Tool J-25103 or equivalent, and bend the lip of the tabbed washer over the locknut.

Recheck the bearing adjustment. The wheel must rotate freely and not display any lateral movement.

Install the hub clutch assembly on the axle shaft.

Install the snap ring on the axle shaft.

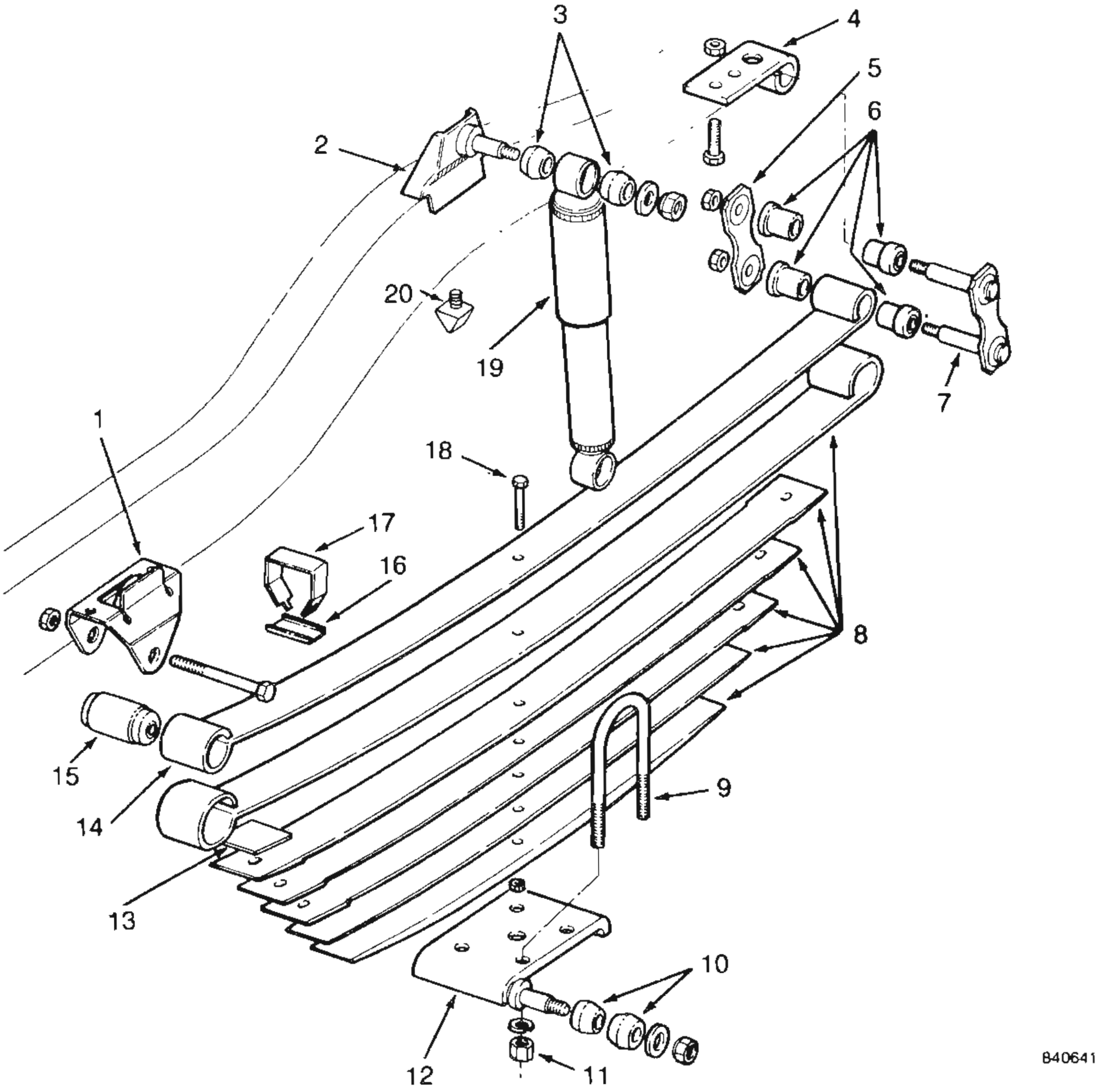
Install the gasket and hub body. Tighten the hub bolts with 41 N·m (30 ft-lbs) torque.

Lower the vehicle.

SEE I.S. NOTES

Rear Wheel Bearing Adjustment

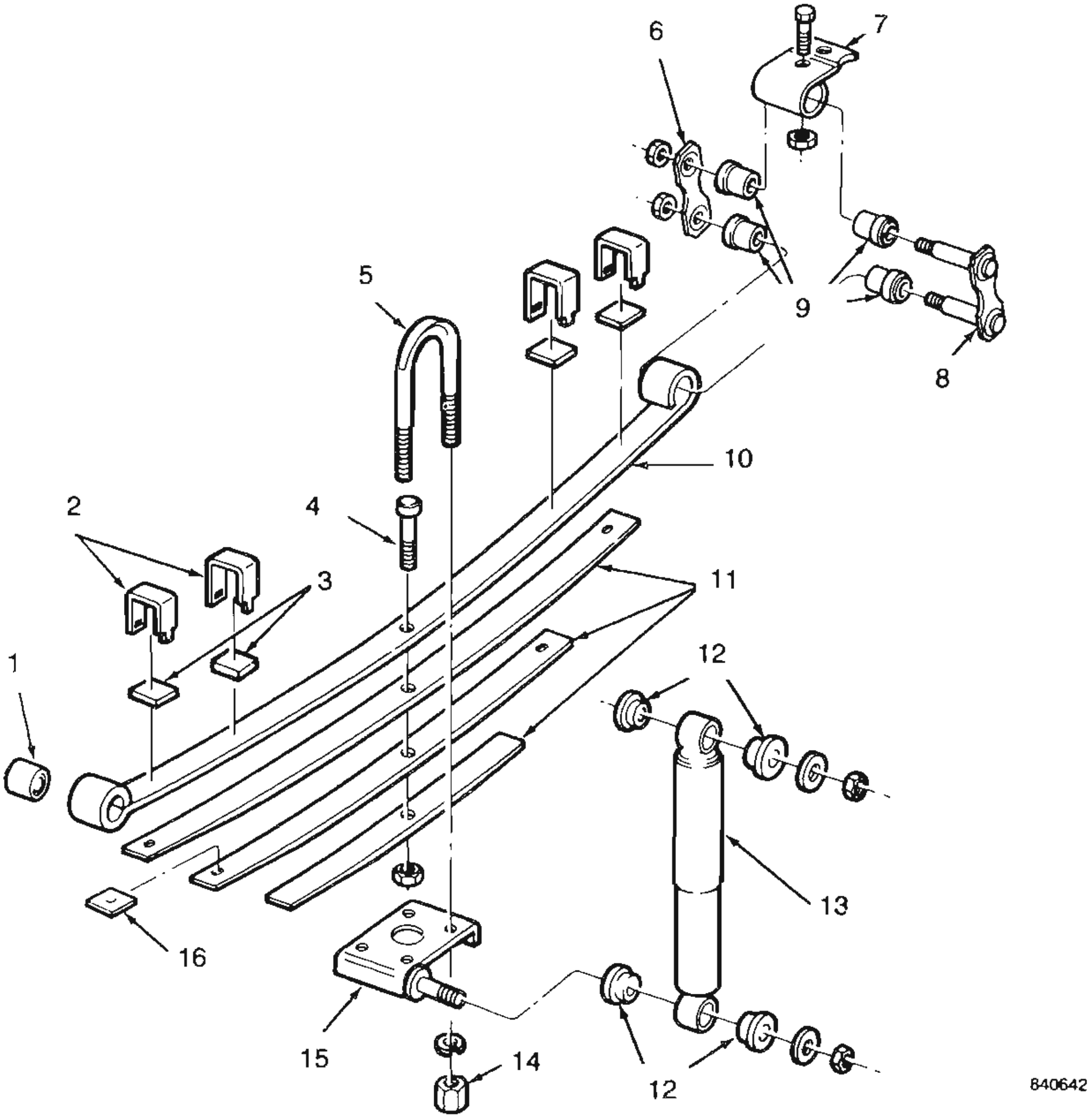
The tapered axle shafts used in CJ and Scrambler models (AMC/Jeep axle) require correct axle shaft end play to maintain proper bearing operating clearances. Refer to Chapter H, Rear Axle, for end play measurement and adjustment procedures.



1 - Spring Hanger
2 - Shock Bracket
3 - Shock Absorber Bushings
4 - Spring Hanger
5 - Shackle Plate
6 - Spring Shackle Bushings
7 - Spring Shackle
8 - Spring Leaves
9 - U-Bolt
10 - Shock Absorber Bushings

11 - U-Bolt Nut
12 - Tie Plate
13 - Insulator
14 - Main Leaf
15 - Spring Eye Bushing
16 - Insulator
17 - Rebound Clip
18 - Center Bolt
19 - Shock Absorber
20 - Jounce Bumper

Front Spring and Shock Absorber



1 - Spring Eye Bushing
2 - Rebound Clips
3 - Insulators
4 - Center Bolt
5 - U-Bolt
6 - Shackle Plate
7 - Spring Hanger
8 - Spring Shackle
9 - Spring Shackle Bushings
10 - Main Leaf
11 - Spring Leaves
12 - Bushings
13 - Shock Absorber
14 - U-Bolt Nut
15 - Tie Plate
16 - Insulator

Rear Spring and Shock Absorber

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Shock Absorber Upper Locknut (7/16-20)	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Shock Absorber Lower Locknut (1/2-20)	61 N·m (45 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Spring Pivot Bolts	136 N·m (100 ft-lbs)	108-163 N·m (80-120 ft-lbs)
Spring Shackle Nuts	33 N·m (24 ft-lbs)	24-41 N·m (18-30 ft-lbs)
Spring U-Bolt Nuts (9/16-18)	136 N·m (100 ft-lbs)	115-142 N·m (85-105 ft-lbs)
Spring U-Bolt Nuts (1/2-20)	75 N·m (55 ft-lbs)	61-88 N·m (45-65 ft-lbs)
Stabilizer Bar Mounting Bracket Bolts (All)	47 N·m (35 ft-lbs)	37-61 N·m (27-45 ft-lbs)
Wheel Nuts	115 N·m (85 ft-lbs)	88-122 N·m (65-90 ft-lbs)
Spring Center Bolts	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Stabilizer Bar Link Nuts	75 N·m (55 ft-lbs)	65-84 N·m (48-62 ft-lbs)

GENERAL

On CJ-7 and Scrambler models, the front and rear suspension springs are mounted parallel to the frame side rails. The forward end of the front springs and the rear end of the rear springs are attached to the frame by pivoting shackles. The opposite spring ends are attached to the frame by fixed pivot bolts. All the spring ends have silent-block type rubber bushings which do not require lubrication.

The multi-leaf rear springs used on CJ and Scrambler models are mounted below the axle.

The leaf springs on all Jeep models are attached to the axle by U-bolts and tie plates and are positioned on the axle by spring saddles welded to the axle tubes. The spring center bolts and spring clips are used to align and hold the spring leaves in position. If the vehicle is used for severe, off-road operation, the springs should be examined periodically for broken or shifted leaves, loose or missing clips, and broken center bolts.

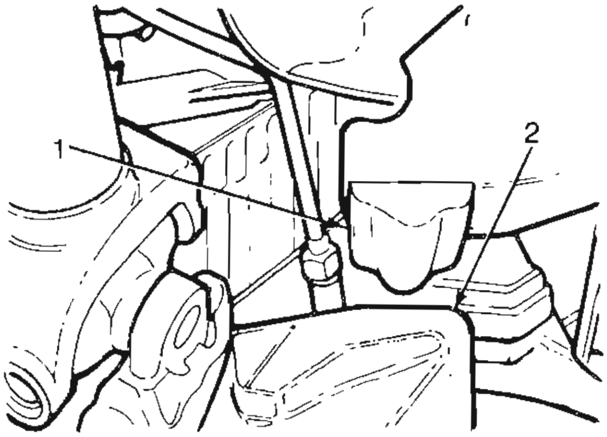
Squeaking noises can be generated when movement between the spring bushings and metal parts occurs. This noise can usually be eliminated by tightening the spring attaching bolts with the specified torque. However, if squeak noises persist after bolt tightening, check for a bushing that is loose in the spring eye, or misaligned (not centered in the spring eye), or spring misalignment caused by damaged suspension components. Repair as necessary if any of these conditions are discovered.

The spring eye bushings do not require any type of lubrication. Do not attempt to eliminate the bushing noises by lubricating them. Grease and mineral oil-base lubricants can cause deterioration of the bushing rubber.

SEE I.S. NOTES

SUSPENSION JOUNCE AND WINDUP BUMPERS

A front axle windup bumper (1) is used on CJ and Scrambler models only. The bumper consists of a stamped bracket with a rubber bumper attached to it. The bracket is attached to the inner side of the right frame rail, adjacent to and just above the front axle housing. During severe operation when extreme spring movement and front axle travel occur, the bumper contacts a pad (2) on the front axle housing to prevent excessive housing movement.



840643

SEE I.S. NOTES

All models are equipped with frame-mounted jounce bumpers located at the front and rear of the vehicle suspension. The bumpers are attached to the underside of the frame rails and are positioned over, and in line with, the axle tubes.

SHOCK ABSORBERS

The hydraulic, dual-action shock absorbers used on Jeep vehicles are designed to control suspension spring movement. The shock absorber upper ends are attached to brackets located on the frame rails. The lower ends are attached to the spring tie plate or axle tube. Rubber bushings are installed in the shock mounting eyes to dampen road shock and noise.

Squeak noises from the shock bushings can be generated if movement between the bushings and metal parts occurs. This noise can usually be eliminated by tightening the shock mounting nuts. However, if squeak noises persist, check for damaged or worn bushings, or damaged shock mounting components. Repair as necessary if any of these conditions are discovered.

The shock absorber bushings do not require any type of lubrication. Do not lubricate the bushings in an attempt to reduce the bushing noises. Grease or mineral oil-base lubricants can cause deterioration of the bushing rubber.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced as an assembly. To test a unit, hold it in an upright position and work the shock piston up and down four or five times. Shock action throughout each stroke should be smooth and produce an equal amount of resistance in each direction.

Removal

Raise the vehicle.

Position the hydraulic jack under the axle and raise the axle to relieve the springs of the axle weight.

Remove the washers and locknuts attaching the shock absorber to the upper and lower mounting pins.

Remove the shock absorber and remove the bushings from the shock mounting eyes.

Installation

Install the replacement bushings in the shock mounting eyes. Install the bushings dry, do not lubricate them.

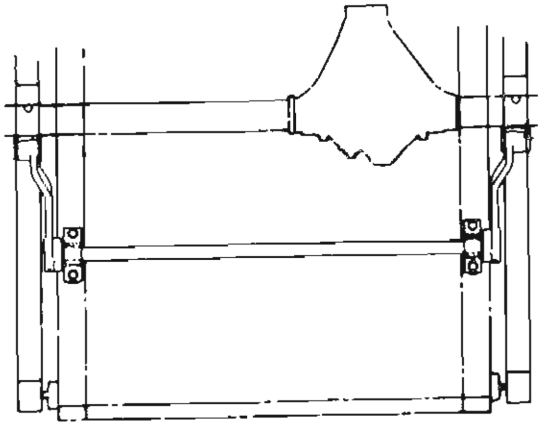
Position the replacement shock absorber on mounting pins.

Install the shock absorber attaching washers and locknuts. Tighten the locknuts with the specified torque.

Lower the vehicle and remove the hydraulic jack.

STABILIZER BAR

The stabilizer bar extends across the front underside of the frame and is attached to the frame rails by clamps and rubber bushings.



J42641

The ends of the bar extend rearward to a position above the front springs and are connected to the axle and springs by connecting links.

FRONT SPRING

Removal

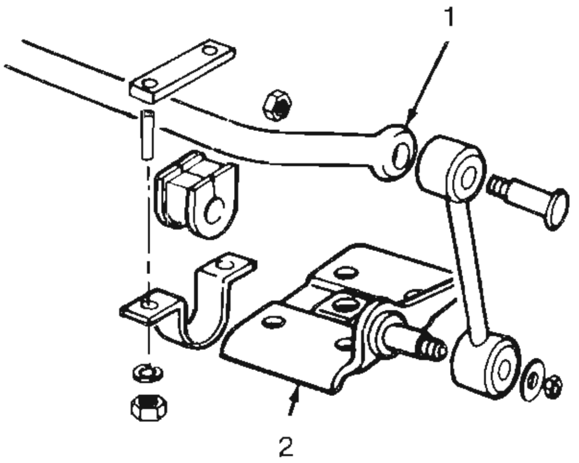
Raise the vehicle.

Support the vehicle using safety stands placed under the frame rails.

Position a hydraulic jack under the axle and raise the axle to relieve the springs of the axle weight.

Disconnect the stabilizer bar (1), if equipped.

Remove the spring U-bolts and tie plates (2).



840636

Remove the bolt attaching the spring front eye to the shackle.

Remove the bolt attaching the spring rear eye to the spring hanger.

Remove the spring.

NOTE: The spring can be disassembled by removing the spring rebound clips and spring center bolt. If the spring bushings are to be removed, refer to Spring Bushing Replacement.

Installation

Position the spring rear eye in the hanger bracket and loosely install the attaching bolt and nut. Do not tighten the bolt at this time.

Position the spring front eye in the shackle and loosely install the attaching bolt and nut. Do not tighten the bolt at this time.

Position the axle on the spring and install the spring tie plate (2) and U-bolts. Tighten the U-bolt nuts with the specified torque.

Connect the stabilizer bar (1), if equipped.

Remove the hydraulic jack used to support the axle weight.

Remove the support stands and lower the vehicle.

Tighten the spring front and rear attaching bolts and nuts with the specified torque.

REAR SPRING

Removal

Raise the vehicle.

Support the vehicle using safety stands placed under the frame rails.

Position a hydraulic jack under the axle and raise the axle to relieve the springs of the axle weight.

Remove the tie plate U-bolts.

Remove the bolt attaching the spring rear eye to the shackle.

Remove the bolt attaching the spring front eye to the mounting bracket on the frame.

Remove the spring.

NOTE: The spring can be disassembled by removing the spring rebound clips and spring center bolt. If the spring bushings are to be removed, refer to Spring Bushing Replacement.

Installation

Position the spring front eye in the frame mounting bracket and loosely install the attaching bolt and nut. Do not tighten the bolt at this time.

SEE I.S. NOTES

Position the spring rear eye in the shackle and loosely install the attaching bolt and nut. Do not tighten the bolt at this time.

Install the spring tie plate and U-bolts. Tighten the U-bolt nuts with the specified torque.

Remove the hydraulic jack used to support the axle.

Remove the support stands and lower the vehicle.

Tighten the spring eye mounting bolts and nuts with the specified torque.

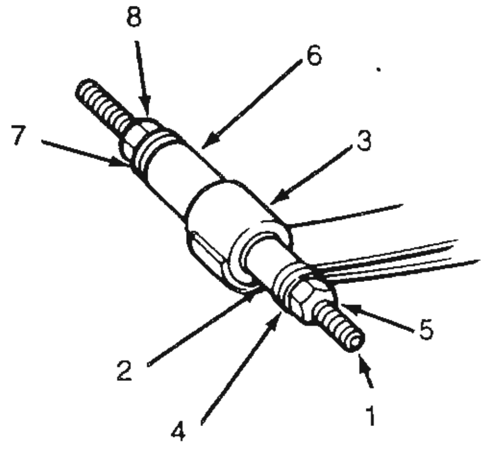
Support the vehicle using safety stands placed under the frame rails.

SPRING BUSHING

Small Bushing Replacement

Insert a 0.95 by 20.3-cm (3/8 by 8-in) length of threaded rod (1) halfway through the bushing.

Place a suitable size socket (2) on one end of the rod with the open end of the socket toward the bushing. The socket will serve as the bushing driver.



840637

NOTE: The socket must be large enough in diameter to bear against the metal outer sleeve on the bushing but still be small enough to pass through the spring eye (3).

Install one flat washer (4) and one hex nut (5) on the rod behind the socket.

Install a 5.08-cm (2-in) long section of the suitable size pipe (6) on the opposite end of the threaded rod. The pipe will serve as the bushing receiver.

NOTE: The inside diameter of the pipe must be large enough to accommodate the bushing but still seat against the spring eye surface properly.

Install one flat washer (7) and one hex nut (8) on the rod to secure the pipe section. Be sure the flat washer is large enough in diameter to support and maintain alignment of the pipe section.

SEE I.S. NOTES

Tighten both the hex nuts finger-tight and align all the components.

NOTE: Be sure the socket is positioned in the spring eye and aligns with the bushing. The pipe section must butt against the spring eye surface so the bushing can pass through it. The socket will act as a press ram and press the bushing out of the spring eye.

Tighten the nut at the socket end of the rod until the bushing is pressed out of the spring eye.

Remove the bushing tools and old bushing.

Install the replacement bushing on the threaded rod.

Assemble and align the bushing tools as outlined in the previous steps.

Align the bushing with the spring eye and press the bushing into the eye.

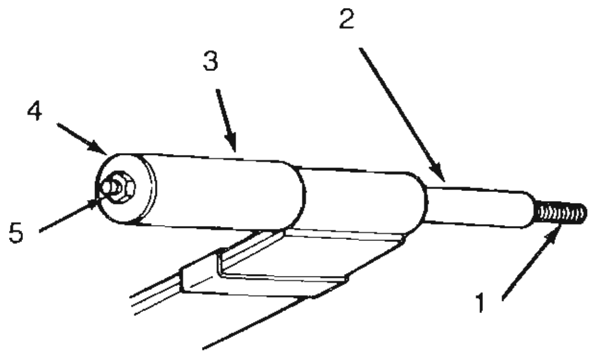
Loosen the bushing tools and check the bushing position. The bushing must be centered in the spring eye. The ends of the bushing must be flush or slightly below the side surfaces of the spring eye.

If the bushing is not centered, reinstall the bushing tools and correct the bushing position as necessary.

Large Bushing Replacement

Insert a 1.27 by 27.9-cm (1/2 by 11-in) length of threaded rod (1) halfway through the bushing.

Install the suitable size deep socket on one end of the rod (2) with the open end of the socket toward the bushing. The socket will serve as the bushing driver.



840638

NOTE: The socket must be large enough in diameter to bear against the metal outer sleeve on the bushing but still be small enough to pass through the spring eye.

Install one flat washer and one hex nut on the rod behind the socket.

Install a 7.62-cm (3-in) long section of suitable size pipe (3) on the opposite end of the rod. The pipe will serve as the bushing receiver.

NOTE: The inside diameter of the pipe must be large enough to accommodate the bushing but still seat against the spring eye surface properly.

SEE I.S. NOTES

Install the flat washer (4) and one hex nut (5) on the rod behind the pipe section. Be sure the flat washer is large enough in diameter to support and maintain the alignment of the pipe section.

Tighten both the nuts finger-tight and align all the components.

NOTE: Be sure the socket is positioned in the spring eye and aligns with the bushing. The pipe section must butt against the spring eye so that the bushing can pass through it. The socket will act as a press ram and press the bushing out of the spring eye and into the section of pipe.

Tighten the nut at the socket and press the bushing out of the spring eye.

Remove the tools and the old bushing.

Install the replacement bushing on the threaded rod and assemble the bushing tools as outlined in the previous steps.

Align the bushing with the spring eye and press the bushing into the eye.

Loosen the tools and check the bushing position. The bushing must be centered in the spring eye. The ends of the bushing must be flush with or slightly below the side surfaces of the spring eye.

If the bushing is not centered, reinstall the tools and correct the bushing position as necessary.

SEE
I.S.
NOTES

BRAKE SYSTEM

CONTENTS

SEE I.S. NOTES

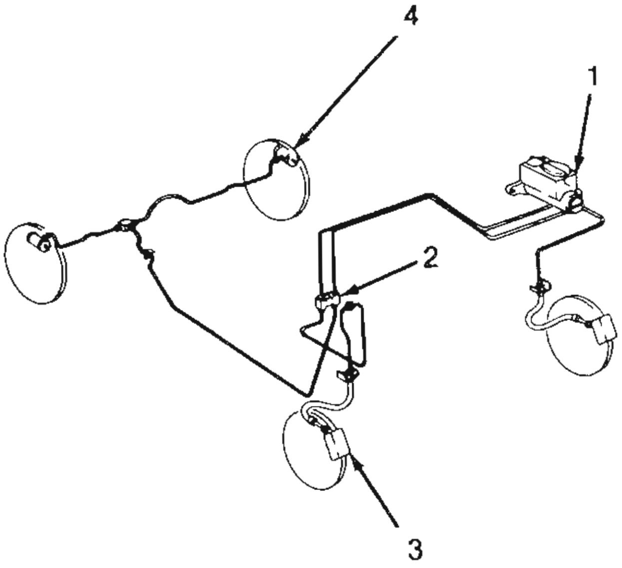
BRAKE SYSTEM

GENERAL DESCRIPTION

The brake system utilizes front disc and rear drum braking surfaces.

The brake hydraulic system consists of a dual reservoir master cylinder (1), combination valve (2), front disc brake calipers (3), rear drum brake wheel cylinders (4), and the connecting brake pipes, hoses and fittings.

The primary piston in the master cylinder transfers pressure to the front brakes. The secondary master cylinder piston transfers pressure to the rear brakes.

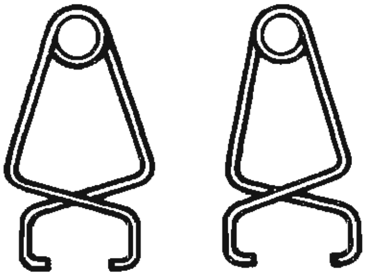


70166

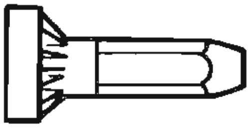
SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-8002	Wheel Cylinder Clamps		■
J-8057	Brake Spring Plier Tool or Equivalent		■
J-21177-01	Drum Brake Clearance Gauge		■
J-25103	Wheel Bearing Nut Wrench		■
J-26869	Metering Valve Tool (Type-W Valve)		■
J-33028	Dust Boot Installer	■	

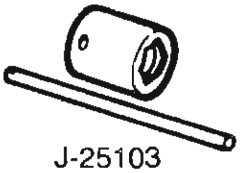
SEE I.S. NOTES



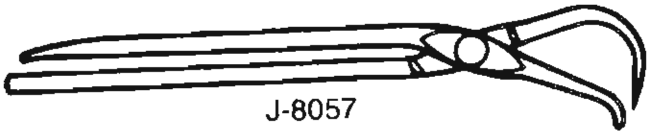
J-8002



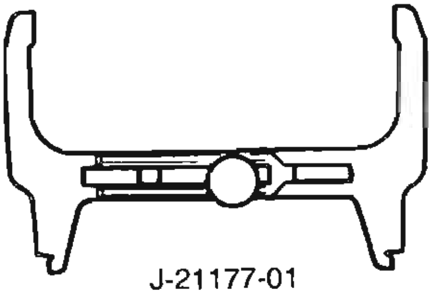
J-33028



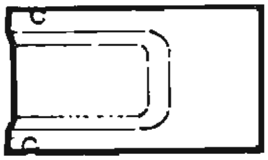
J-25103



J-8057



J-21177-01



J-26869

SEE
I.S.
NOTES

86402

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Caliper Brake Line Fitting	18 N·m (160 in-lbs)	17-19 N·m (150-170 in-lbs)
Bleeder Screw (1/4 - 28)	5 N·m (45 in-lbs)	5-6 N·m (40-50 in-lbs)
Bleeder Screw (3/8 - 24)	10 N·m (90 in-lbs)	5-16 N·m (40-140 in-lbs)
Brake Support Plate Mounting Bolts/Nuts	45 N·m (33 ft-lbs)	41-47 N·m (30-35 ft-lbs)
Caliper Anchor Bracket-to-Steering Knuckle	136 N·m (100 ft-lbs)	122-149 N·m (90-110 ft-lbs)
Master Cylinder Mounting Bolts/Nuts	41 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Master Cylinder-to-Power Unit Mounting Bolts	34 N·m (25 ft-lbs)	27-41 N·m (20-30 ft-lbs)
Power Brake Unit-to-Dash Mounting Bolts/Nuts	30 N·m (22 ft-lbs)	24-34 N·m (18-25 ft-lbs)
Brake Line-to-Caliper Fitting Bolt	34 N·m (25 ft-lbs)	27-41 N·m (20-30 ft-lbs)
Brake Line-to-Wheel Cylinder Fitting	18 N·m (160 in-lbs)	14-23 N·m (120-200 in-lbs)
Parking Brake Cable Clamp-to-Support Plate Bolts (5/16 - 18)	14 N·m (10 ft-lbs)	11-16 N·m (8-12 ft-lbs)
Wheel Nuts	102 N·m (75 ft-lbs)	88-108 N·m (65-80 ft-lbs)
Brake Pedal-to-Power Unit Push Rod Bolt/Nut	47 N·m (35 ft-lbs)	34-54 N·m (25-40 ft-lbs)
Caliper Mounting Pins	40 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Wheel Bearing Outer Locknut (All)	68 N·m (50 ft-lbs) min.	
Wheel Bearing Inner Locknut (Bearing Adjuster)	68 N·m (50 ft-lbs)*	

*Back off 1/6 turn while rotating the wheel.

SEE I.S. NOTES

SPECIFICATIONS

Caliper Piston Diameter:	
CJ Scrambler Models	6.60 cm (2.6 in)
Minimum Rotor Thickness:	
CJ Scrambler Models	20.7 mm (0.815 in)
Rotor Diameter:	
CJ Scrambler Models	29.7 cm (11.7 in)
Rotor Hub-To-Bore Runout Limit	0.25 mm (0.010 in)
Rotor Lateral Runout Limit	0.12 mm (0.005 in)
Rotor Thickness Variation	0.02 mm (0.001 in)
Brake Drum Radial Runout Limit	0.12 mm (0.005 in)
Brake Drum Internal Diameter Limit:	
CJ Scrambler Models	25.5 cm (10.060 in)
Brake Lining Wear Limits:	
Riveted Lining	Replace when worn to within 0.79 mm (1/32 in) of rivet heads
Bonded Lining	Replace when worn to thickness of approximately 1.58 mm (1/16 in) or less

86403

SEE I.S. NOTES

Brake Size and Application Chart

Model	Master Cylinder Bore Diameter	Front Brakes		Rear Brakes		Power Brake Unit Type
		Brake Size and Type	Caliper Piston Diameter	Brake Size and Type	Wheel Cyl. Diameter	
CJ Scrambler	25.4 mm (1.00)	29.7 cm (11.7 Disc.)	6.60 cm Single Piston (2.6)	25.4 × 4.44 cm (10 × 1.75) Drum	22.2 mm (.875)	20.3 cm Single Diaphragm (8.00)

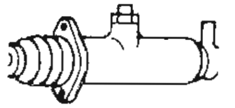
840895

BRAKE FLUID

When refilling or adding brake fluid to the hydraulic system, use Jeep Brake Fluid or an equivalent grade marked SAE J1703 or DOT 3 only.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids will damage the rubber cups and seals. If system contamination is suspected, check the fluid in the reservoir for dirt, discoloration, or separation of the fluid into distinct layers. Drain and flush the hydraulic system with clean brake fluid if contamination is suspected.

SEE I.S. NOTES



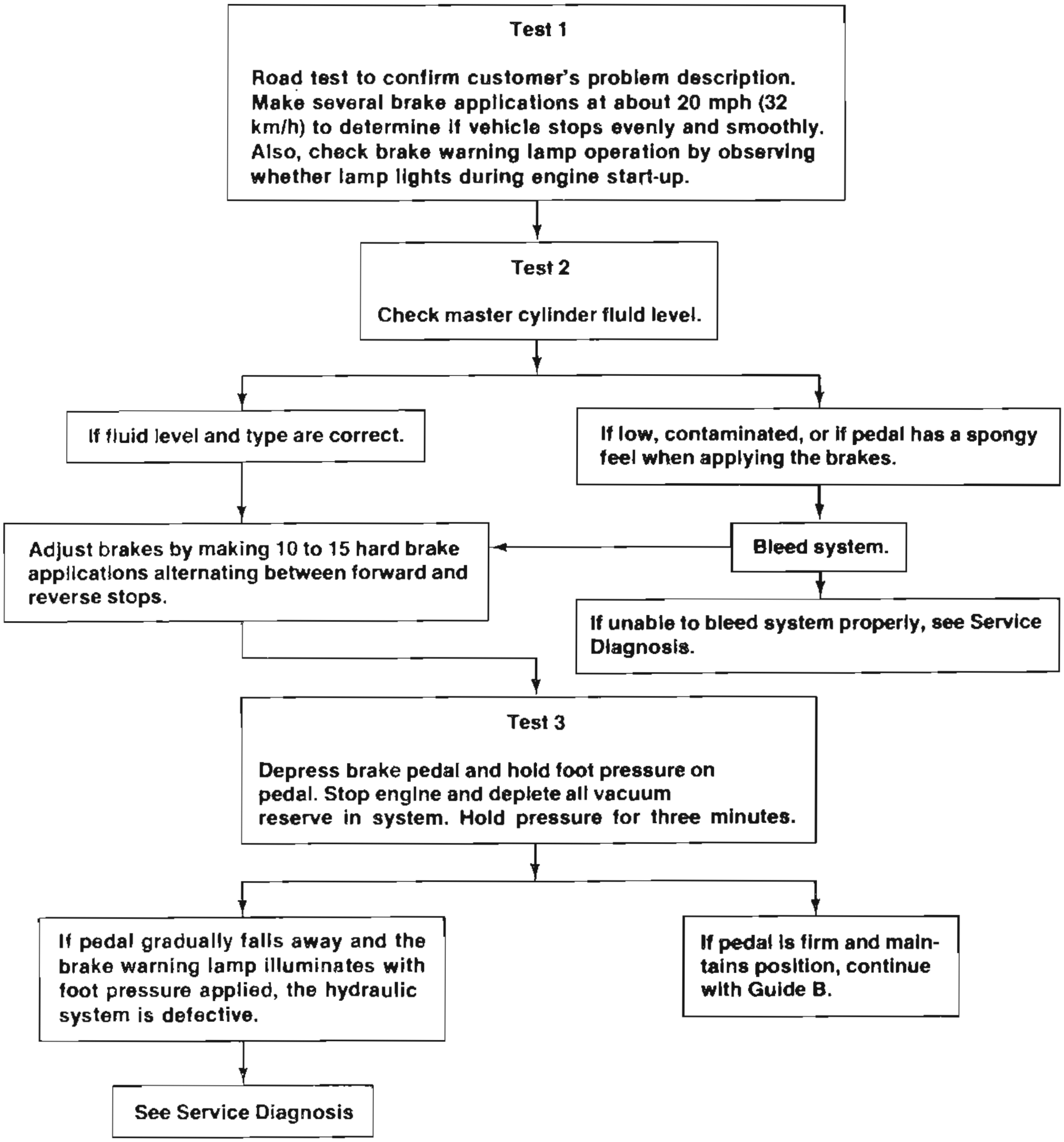
DIAGNOSIS GUIDES

The charts depicted on the following pages provide information which helps identify and solve brake system problems.

Use Guides A and B to identify a problem(s).

After the problem is identified, the Service Diagnosis charts following Guides A and B may be used to determine the corrective action to use.

BRAKE DIAGNOSIS GUIDE A



Test 1

Road test to confirm customer's problem description. Make several brake applications at about 20 mph (32 km/h) to determine if vehicle stops evenly and smoothly. Also, check brake warning lamp operation by observing whether lamp lights during engine start-up.

Test 2

Check master cylinder fluid level.

If fluid level and type are correct.

If low, contaminated, or if pedal has a spongy feel when applying the brakes.

Adjust brakes by making 10 to 15 hard brake applications alternating between forward and reverse stops.

Bleed system.

If unable to bleed system properly, see Service Diagnosis.

Test 3

Depress brake pedal and hold foot pressure on pedal. Stop engine and deplete all vacuum reserve in system. Hold pressure for three minutes.

If pedal gradually falls away and the brake warning lamp illuminates with foot pressure applied, the hydraulic system is defective.

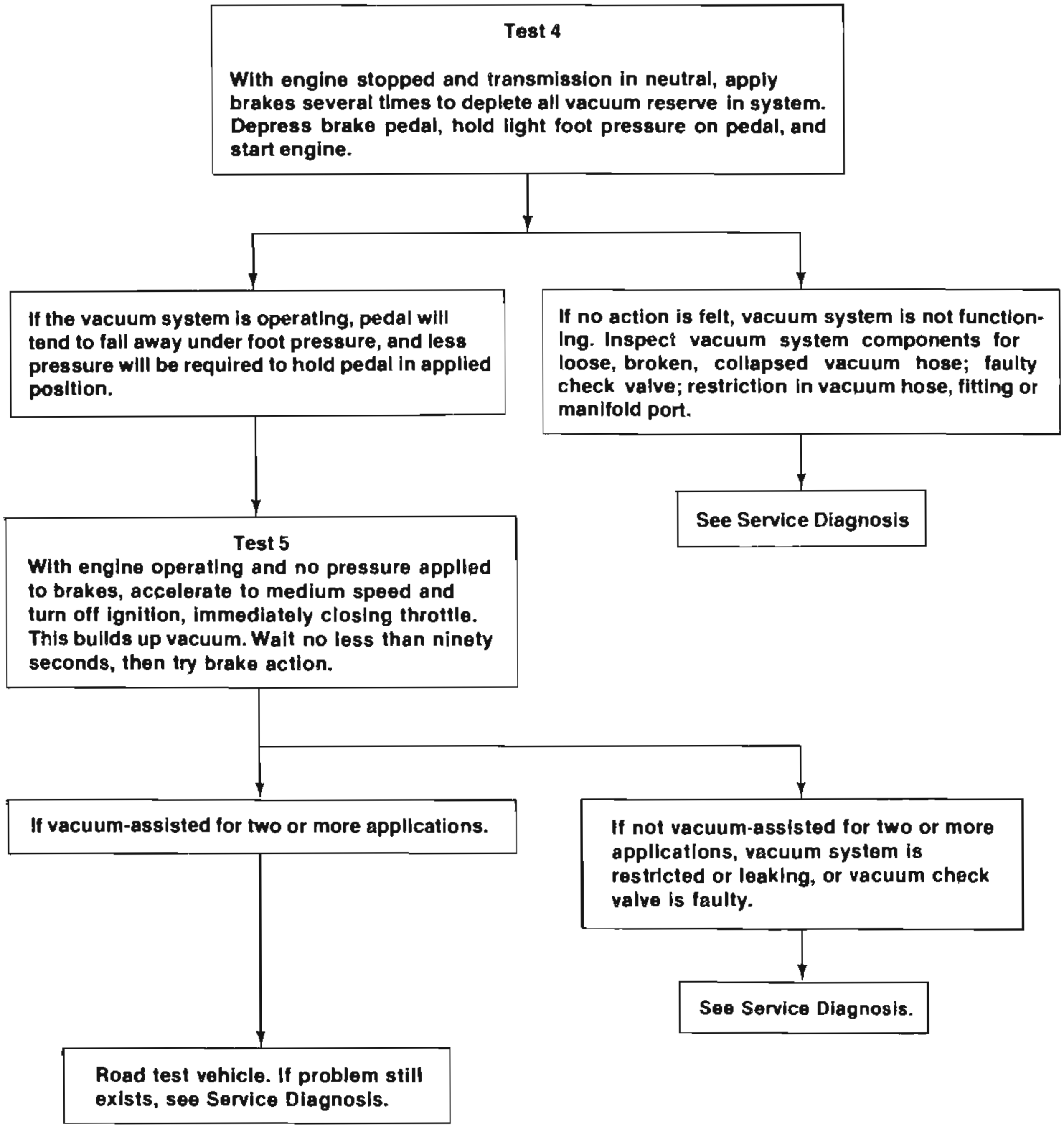
If pedal is firm and maintains position, continue with Guide B.

See Service Diagnosis

SEE
I.S.
NOTES

84022

BRAKE DIAGNOSIS GUIDE B



Test 4

With engine stopped and transmission in neutral, apply brakes several times to deplete all vacuum reserve in system. Depress brake pedal, hold light foot pressure on pedal, and start engine.

If the vacuum system is operating, pedal will tend to fall away under foot pressure, and less pressure will be required to hold pedal in applied position.

If no action is felt, vacuum system is not functioning. Inspect vacuum system components for loose, broken, collapsed vacuum hose; faulty check valve; restriction in vacuum hose, fitting or manifold port.

See Service Diagnosis

Test 5

With engine operating and no pressure applied to brakes, accelerate to medium speed and turn off ignition, immediately closing throttle. This builds up vacuum. Wait no less than ninety seconds, then try brake action.

If vacuum-assisted for two or more applications.

If not vacuum-assisted for two or more applications, vacuum system is restricted or leaking, or vacuum check valve is faulty.

See Service Diagnosis.

Road test vehicle. If problem still exists, see Service Diagnosis.

SEE
I.S.
NOTES

84023

SERVICE DIAGNOSIS

For each problem listed, follow the sequence listed in the left column for possible causes and the right column for corrections. The most probable causes are listed in descending order.

The diagnosis involves the following malfunctions:

A. LOW BRAKE PEDAL
(Excessive pedal travel required for braking action.)

B. LOW BRAKE PEDAL
(Pedal may go to floor with steady pressure applied.)

C. LOW BRAKE PEDAL
(Pedal goes to floor on first application — o.k. on subsequent applications.)

D. FADING BRAKE PEDAL
(Pedal height decreases with steady pressure applied.)

E. DECREASING BRAKE PEDAL TRAVEL (Pedal travel required for braking action decreases and may be accompanied by a hard pedal.)

F. SPONGY BRAKE PEDAL
(Pedal has abnormally soft, springy, spongy feel when depressed.)

G. HARD BRAKE PEDAL
(Excessive pedal pressure required to stop vehicle. May be accompanied by brake fade.)

H. GRABBING BRAKES
(Severe reaction to brake pedal pressure.)

I. DRAGGING BRAKES
(Slow or incomplete release of brakes.)

J. VEHICLE MOVES TO ONE SIDE WHEN BRAKES ARE APPLIED

K. CHATTER OR SHUDDER WHEN BRAKES ARE APPLIED
(Pedal pulsation and roughness may also occur.)

L. NOISY BRAKES
(Squealing, clicking, scraping sound when brakes are applied.)

M. PULSATING BRAKE PEDAL

SEE
I.S.
NOTES

A. LOW BRAKE PEDAL (Excessive pedal travel required for braking action.)

POSSIBLE CAUSES	CORRECTIONS
(1) Excessive clearance between rear linings and drums caused by inoperative automatic adjusters.	(1) Make 10 to 15 alternate forward and reverse brake stops to adjust brakes. If brake pedal does not come up, repair or replace adjuster parts as necessary.
(2) Worn rear brakelining.	(2) Inspect and replace lining if worn beyond minimum thickness specification.
(3) Bent, distorted brakeshoes, front or rear.	(3) Replace brakeshoes in axle sets.
(4) Air in hydraulic system.	(4) Remove air from system. Refer to Brake Bleeding.

84024

B. LOW BRAKE PEDAL (Pedal may go to floor with steady pressure applied.)

POSSIBLE CAUSES	CORRECTIONS
(1) Fluid leak in hydraulic system.	(1) Fill master cylinder to fill line; have helper apply brakes and check calipers, wheel cylinders, differential valve tubes, hoses and fittings for leaks. Repair or replace as necessary.
(2) Air in hydraulic system.	(2) Remove air from system. Refer to Brake Bleeding.
(3) Incorrect or non-recommended brake fluid (fluid evaporates at below normal temp).	(3) Flush hydraulic system with clean brake fluid. Refill with correct-type fluid.
(4) Master cylinder piston seals worn, or master cylinder bore is scored, worn or corroded.	(4) Repair or replace master cylinder.

C. LOW BRAKE PEDAL (Pedal goes to floor on first application — o.k. on subsequent applications.)

POSSIBLE CAUSES	CORRECTIONS
(1) Disc brake pads sticking on abutment surfaces of anchor plate. Caused by a build-up of dirt, rust, or corrosion on abutment surfaces.	(1) Clean abutment surfaces.

SEE I.S. NOTES

D. FADING BRAKE PEDAL (Pedal height decreases with steady pressure applied.)

POSSIBLE CAUSES	CORRECTIONS
(1) Fluid leak in hydraulic system.	(1) Fill master cylinder reservoirs to fill mark, have helper apply brakes, check calipers, wheel cylinders, differential valve, tubes, hoses, and fittings for fluid leaks. Repair or replace parts as necessary.
(2) Master cylinder piston seals worn, or master cylinder bore is scored, worn or corroded.	(2) Repair or replace master cylinder.

E. DECREASING BRAKE PEDAL TRAVEL (Pedal travel required for braking action decreases and may be accompanied by a hard pedal.)

POSSIBLE CAUSES	CORRECTIONS
(1) Caliper or wheel cylinder pistons sticking or seized.	(1) Repair or replace the calipers, or wheel cylinders.
(2) Master cylinder compensator ports blocked (preventing fluid return to reservoirs) or pistons sticking or seized in master cylinder bore.	(2) Repair or replace the master cylinder.
(3) Power brake unit binding internally.	(3) Test unit according to the following procedure. (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 power unit. Observe for backward movement of brake pedal. (e) If the pedal moves backward, the power unit has an internal bind — replace power unit.

SEE I.S. NOTES

F. SPONGY BRAKE PEDAL (Pedal has abnormally soft, springy, spongy feel when depressed.)

POSSIBLE CAUSES	CORRECTIONS
(1) Air in hydraulic system.	(1) Remove air from system. Refer to Brake Bleeding.
(2) Brakeshoes bent or distorted.	(2) Replace brakeshoes.
(3) Brakelining not yet seated with drums and rotors.	(3) Burnish brakes.
(4) Rear drum brakes not properly adjusted.	(4) Adjust brakes

G. HARD BRAKE PEDAL (Excessive pedal pressure required to stop vehicle. May be accompanied by brake fade.)

POSSIBLE CAUSES	CORRECTIONS
(1) Loose or leaking power brake unit vacuum hose.	(1) Tighten connections or replace leaking hose.
(2) Incorrect or poor quality brakelining.	(2) Replace with lining in axle sets.
(3) Bent, broken, distorted brakeshoes.	(3) Replace brakeshoes.
(4) Calipers binding or dragging on mounting pins. Rear brakeshoes dragging on support plate.	(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.
(5) Caliper, wheel cylinder, or master cylinder pistons sticking or seized.	(5) Repair or replace parts as necessary.
(6) Power brake unit vacuum check valve malfunction.	(6) Test valve according to the following procedure. (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 unit has internal bind.	(7) Test unit according to the following procedure. (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, power unit vacuum system is operating normally. Test power unit as outlined in item (3) within E, Decreasing Brake Pedal Travel. If power unit exhibits a bind condition, replace the power unit.

84027

SEE
I.S.
NOTES

G. HARD BRAKE PEDAL (cont'd.)

POSSIBLE CAUSES	CORRECTIONS
(8) Master cylinder compensator ports (at bottom of reservoirs) blocked by dirt, scale, rust, or have small burrs (blocked ports prevent fluid return to reservoirs).	(8) Repair or replace master cylinder. **CAUTION:** Do not attempt to clean blocked ports with wire, pencils, or similar implements. Use compressed air only.
(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.

SEE I.S. NOTES

H. GRABBING BRAKES (Severe reaction to brake pedal pressure.)

POSSIBLE CAUSES	CORRECTIONS
(1) Brakelining(s) contaminated by grease or brake fluid.	(1) Determine and correct cause of contamination and replace brakeshoes in axle sets.
(2) Parking brake cables incorrectly adjusted or seized.	(2) Adjust cables. Replace seized cables.
(3) Incorrect brakelining or lining loose on brakeshoes.	(3) Replace brakeshoes in axle sets.
(4) Caliper anchor plate bolts loose.	(4) Tighten bolts.
(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.
(6) Incorrect or missing power brake reaction disc.	(6) Install correct disc.
(7) Rear brake support plates loose.	(7) Tighten mounting bolts.

84028

I. DRAGGING BRAKES (Slow or incomplete release of brakes)

POSSIBLE CAUSES	CORRECTIONS
(1) Brake pedal binding at pivot.	(1) Loosen and lubricate.
(2) Power brake unit has internal bind.	(2) Inspect for internal bind as outlined in item (3) within 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.

J. VEHICLE MOVES TO ONE SIDE WHEN BRAKES ARE APPLIED

POSSIBLE CAUSES	CORRECTIONS
(1) Incorrect front tire pressure.	(1) Inflate to recommended cold (reduced load) 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) Support plate bent or loose on one side.	(5) Tighten or replace support plate.
(6) Brakelining not yet seated with drums or rotors.	(6) Burnish brakelining.
(7) Caliper anchor plate loose on one side.	(7) Tighten anchor plate bolts.
(8) Caliper piston sticking or seized.	(8) Repair or replace caliper.
(9) Brakelinings water soaked.	(9) Drive vehicle with brakes lightly applied to dry linings.

SEE I.S. NOTES

84029

J. VEHICLE MOVES TO ONE SIDE WHEN BRAKES ARE APPLIED (cont'd.)

POSSIBLE CAUSES	CORRECTIONS
(10) Loose suspension component attaching or mounting bolts.	(10) Tighten suspension bolts. Replace worn suspension components.
(11) Brake combination valve failure.	(11) Replace combination valve.

K. CHATTER OR SHUDDER WHEN BRAKES ARE APPLIED (Pedal pulsation and roughness may also occur.)

POSSIBLE CAUSES	CORRECTIONS
(1) Brakeshoes distorted, bent, contaminated, or worn.	(1) Replace brakeshoes in axle sets.
(2) Caliper anchor plate or support plate loose.	(2) Tighten mounting bolts.
(3) Excessive thickness variation of rotor(s).	(3) Refinish or replace rotors in axle sets.

L. NOISY BRAKES (Squealing, clicking, scraping sound when brakes are applied.)

POSSIBLE CAUSES	CORRECTIONS
(1) Bent, broken, distorted brakeshoes.	(1) Replace brakeshoes in axle sets.
(2) Excessive rust on outer edge of rotor braking surface.	(2) Remove rust.
(3) Brakelining worn out — shoes contacting drum or rotor.	(3) Replace brakeshoes and lining in axle sets. Refinish or replace drums or rotors.
(4) Broken or loose holdown or return springs.	(4) Replace parts as necessary.
(5) Rough or dry drum brake support plate ledges.	(5) Lubricate support plate ledges.
(6) Cracked, grooved, or scored rotor(s) or drum(s).	(6) Replace rotor(s) or drum(s). Replace brakeshoes and lining in axle sets if necessary.
(7) Incorrect brakelining and/or shoes (front or rear).	(7) Install specified shoe and lining assemblies.

SEE I.S. NOTES

M. PULSATING BRAKE PEDAL

POSSIBLE CAUSE	CORRECTION
(1) Out of round drums or excessive lateral runout in disc brake rotor(s).	(1) Refinish or replace drums, re-index rotors or replace.

84030

DESCRIPTION

The brakelamp switch is mounted on a flange attached to the brake pedal support bracket. A spring-loaded plunger in the switch opens and closes the stoplamp circuit.

When the brake pedal is in the released position, the pedal arm contacts the switch plunger, holding it in the OFF position. When the brake pedal is pressed, the spring loaded plunger extends with brake pedal movement until the switch is in the ON position.

ADJUSTMENT

On models with air conditioning, remove the screws attaching the evaporator housing to the instrument panel and move the housing away from the panel.

Press and hold the brake pedal in the applied position.

Push the brakelamp switch through the mounting bracket until it stops against the brake pedal bracket.

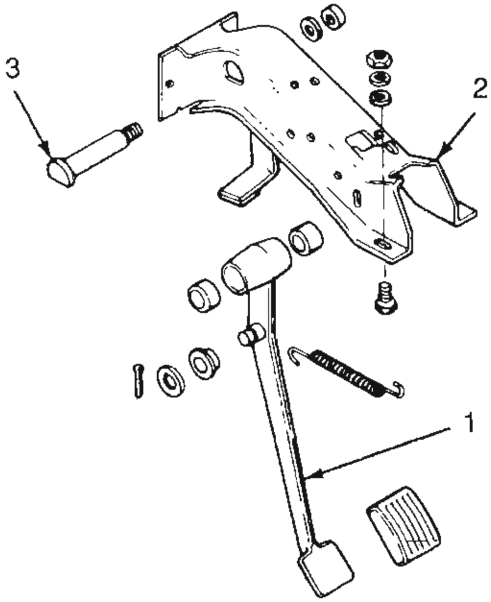
Release the brake pedal to set the switch in the proper position.

Check the switch position. The switch plunger should be in the ON position and activate the brakelamps after 9.52 - 15.87 mm (3/8 - 5/8 in) brake pedal travel. Measure the pedal travel from the center of the brake pedal pad.

On models with air conditioning, reposition the evaporator housing on the panel and install the housing attaching screws.

SEE I.S. NOTES

A suspended brake pedal is used on all models. The pedal (1) is attached to the pedal support bracket (2) by a pivot bolt (3). The pivot bolt serves as both attaching part and pivoting member for the pedal.



840877

The pedal linkage should be lubricated and inspected regularly for binding, looseness or excessive play. Binding can cause improper pedal release which may result in brake drag and rapid lining wear. In addition, worn pedal linkage may cause a low pedal condition or frequent need for brake adjustment.

Pedal free play should be 1.58 - 6.35 mm (1/16 - 1/4 in). Inadequate free play can result in brake drag or grab while excessive free play can produce a low pedal condition.

Free play on models with nonpower brakes is governed by the pedal push rod length which is preset during production. The push rod is not adjustable on these models and under normal circumstances should not require further attention. Power brake equipped vehicles utilize a single push rod in the power unit which is also preset during production and is not adjustable.

When replacing a power unit, use the push rod supplied with the replacement power unit because it has been properly gauged for use with the replacement unit. Pedal free play for power brake equipped vehicles is the same as for vehicles with non-power brakes.

SEE I.S. NOTES

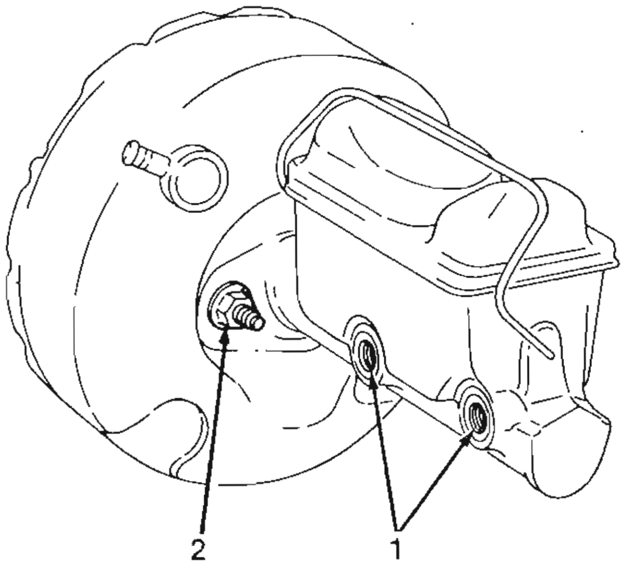
TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Master Cylinder-to-Brake Booster Nuts	34 N·m (25 ft-lbs)	27-41 N·m (20-30 ft-lbs)

REMOVAL

Disconnect the brake pipe fittings from the master cylinder at the indicated locations (1).

Remove the nuts (2) attaching the master cylinder to the power booster and remove the master cylinder.



INSTALLATION

Attach the master cylinder to the power booster. Install the attaching nuts (2). Tighten the nuts with the specified torque.

Connect the brake pipe fittings to the master cylinder at the indicated locations (1).

Fill the master cylinder reservoirs to within 6.3 mm (1/4 in) of each rim with brake fluid (specified DOT 3, or J1703 Brake Fluid).

Bleed the brake hydraulic system (refer to the bleeding procedures at the end of this chapter).

SEE
I.S.
N
O
T
E
S

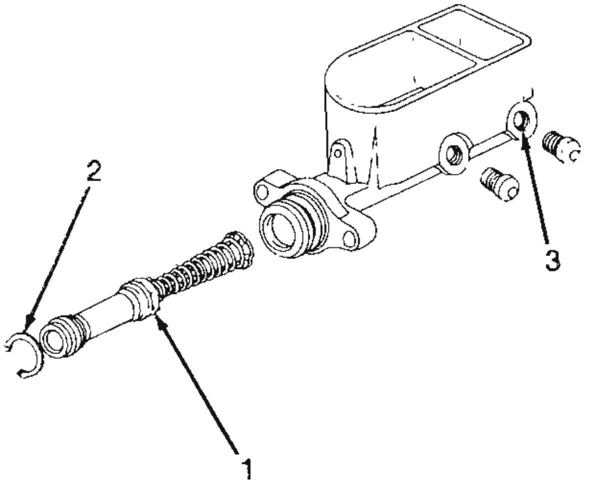
DISASSEMBLY

Drain the master cylinder fluid reservoirs and place the unit in a vise.

On models with non-power brakes, remove the boot.

Press the primary piston (1) inward and remove the snap ring (2).

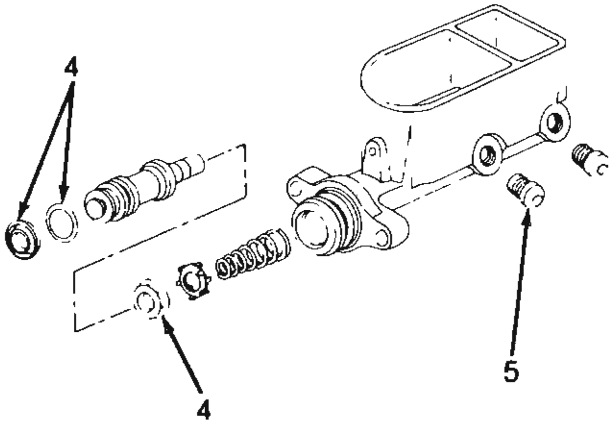
Discard the primary piston.



84032

Apply air pressure at the secondary outlet port (3) to remove the secondary piston assembly.

Remove and discard the secondary piston seals (4).



84033

Replace the outlet port tube seats, if necessary, according to the following procedure:

- enlarge the hole in the seats (5) using a 5.1 mm (13/64-in) drill bit
- place a flat washer on each outlet port and thread a 1/4 - 20 × 3/4 screw into the seat
- tighten the screw until the seat is loose and remove the seat
- install the seats using spare tube fitting nuts to press the seats into place
- remove chips or burrs and clean, rinse and dry the master cylinder components with brake cleaning fluid and compressed air

SEE I.S. NOTES

CLEANING AND INSPECTION

CAUTION: Clean the master cylinder components with brake fluid or brake cleaning solvent only. Do not use any solvent containing mineral oil such as gasoline, kerosene, alcohol or motor oil. Mineral oil is very harmful to the rubber piston seals.

Clean the master cylinder components using brake fluid or brake cleaning solvent only. Use filtered compressed air to dry the parts and to blow out all passages and ports in the master cylinder.

Inspect the master cylinder. Replace the cylinder if the piston bore is severely scored, corroded, pitted or if the housing is cracked, porous or has sustained other damage.

Check the compensator and bypass ports at the bottom of the reservoirs. If they are plugged or dirty, clean them using brake cleaning solvent and compressed air only. Do not use wire or similar implements to clean or open these ports. Wire could develop a burr in the port and also push it into the piston bore.

Inspect the piston assemblies and return springs. Replace the pistons if they are scored, galled, worn, cracked or broken; or if the return springs are broken, bent, collapsed, distorted or fatigued.

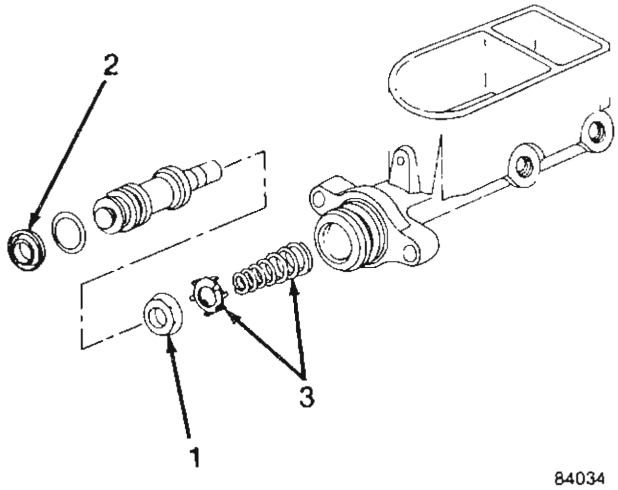
Inspect the tube seat in the outlet ports. Replace the seats only if they are cracked, scored, loose or cocked in the outlet port bore. If the seats must be replaced, remove and install them as outlined under Master Cylinder Assembly.

ASSEMBLY

Install the secondary piston seals. The seal lip (1) on the rear seal must face the interior of the piston bore.

The front seal lip (2) must face outward, away from the inside of the piston bore.

Install the seal retainer and return spring (3) on the secondary piston.

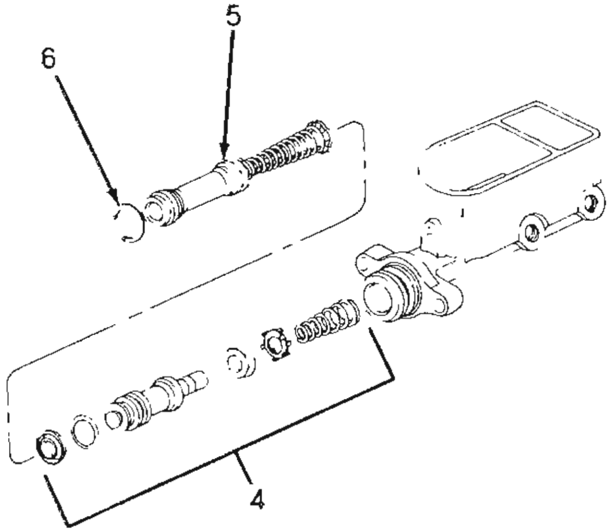


SEE
I.S.
NOTES

Install:

- the secondary piston assembly (4)
- the primary piston assembly (5)
- the boot on models with non-power brakes

Push the primary piston inward and install the snap ring (6).



84035

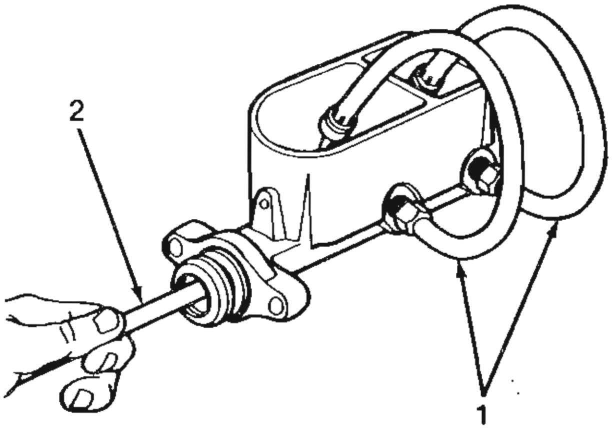
Bleed the master cylinder.

Mount the master cylinder in a vise and fill the reservoirs.

Fabricate two bleed tubes (1) and install them in the outlet ports.

Using a push rod or a wooden dowel (2) slowly compress and release the piston assemblies. Allow the pistons to return via spring pressure.

Continue to compress and release the pistons until air bubbles cease to appear in the fluid.



84036

SEE I.S. NOTES

If necessary, lightly tap the master cylinder with a rubber mallet to aid the release of air bubbles.

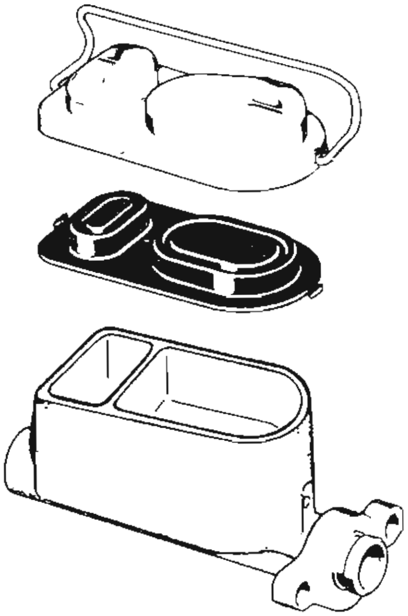
Remove the bleed tubes, cap and outlet ports and install the reservoir cover.

FLUID LEVEL

CAUTION: Always clean the master cylinder and cover before checking the fluid level. Otherwise, the fluid could become contaminated. Check the master cylinder cover seal and replace it if it shows damage or deterioration. Do not allow dirt or moisture to enter the fluid reservoirs.

The master cylinder fluid level should be checked at least four times a year or every 8 046 km (5,000 mi).

When refilling or adding fluid to the system, fill the master cylinder fluid reservoirs to within 6.35 mm (1/4 in) of each reservoir rim.



SEE
I.S.
N
O
T
E
S

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Master Cylinder-to-Brake Booster Nuts	34 N·m (25 ft-lbs)	27-41 N·m (20-30 ft-lbs)
Brake Booster-to-Dash Panel Nuts	30 N·m (22 ft-lbs)	24-34 N·m (18-25 ft-lbs)

CAUTION: If diagnosis indicates an internal malfunction in the power brake unit, service the unit as an assembly only. Do not attempt to disassemble, repair or adjust any power brake unit. If a unit must be replaced, use the master cylinder push rod supplied with the replacement unit. This push rod has been preset and gauged for use with the replacement unit.

REMOVAL

Disconnect the power booster push rod (1) at the brake pedal assembly.

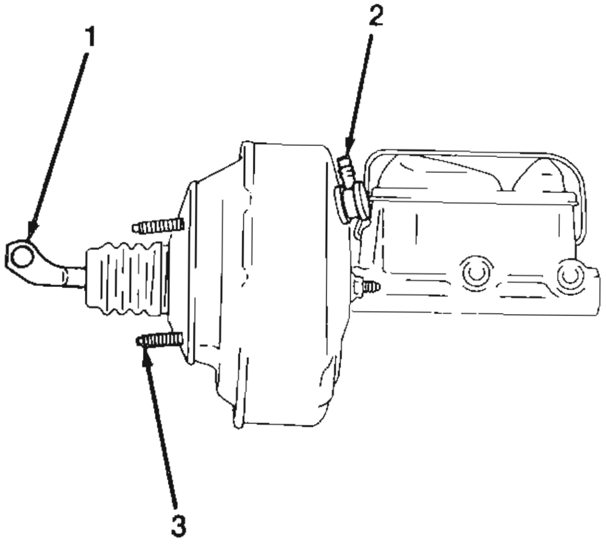
Remove:

- the vacuum hose from the power booster check valve (2)
- the nuts attaching the master cylinder to the booster
- the master cylinder from the booster

Place the master cylinder aside without disconnecting the brake pipe fittings.

Remove the nuts and lockwashers from the studs (3) attaching the power unit to the dash panel.

Remove the power booster.



84037

INSTALLATION

Attach the power booster to the dash panel.

Tighten the mounting stud nuts with the specified torque.

Install the vacuum hose on the booster check valve (2).

Connect the booster push rod (1) to the brake pedal assembly.

Attach the master cylinder to the booster. Install the attaching nuts and tighten with the specified torque.

Check the brake operation before driving the vehicle.

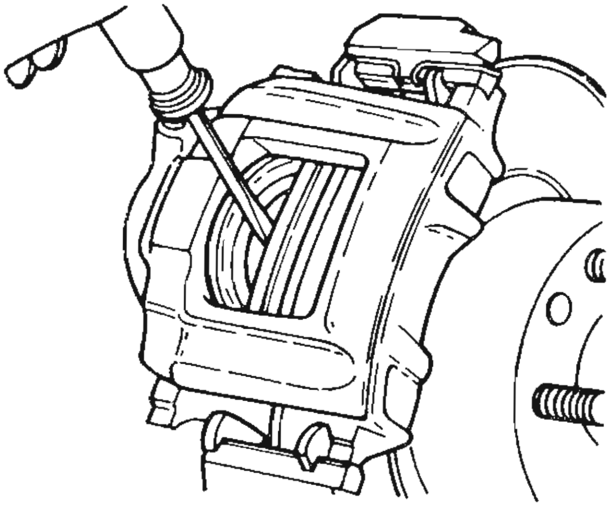
SEE I.S. NOTES

REMOVAL

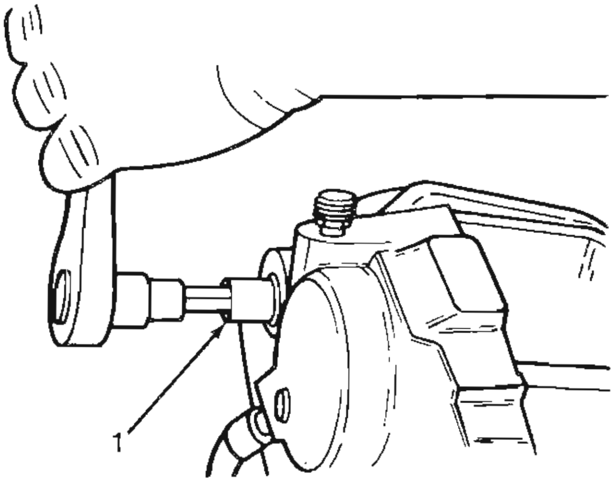
Discard two-thirds of the brake fluid from the master cylinder reservoirs. Do not drain the reservoirs completely.

Loosen the wheel lug nuts, raise and support the front of the vehicle and remove both front wheels.

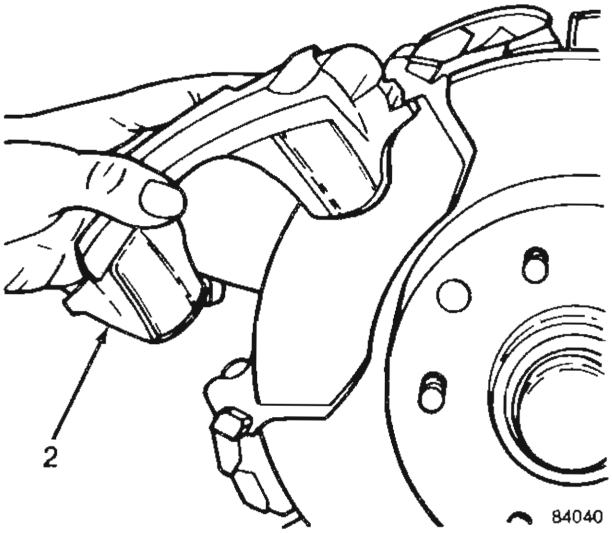
Press the caliper piston to the bottom of the piston bore with a pry tool or C-clamp.



Remove the caliper mounting pins (1) and the caliper.

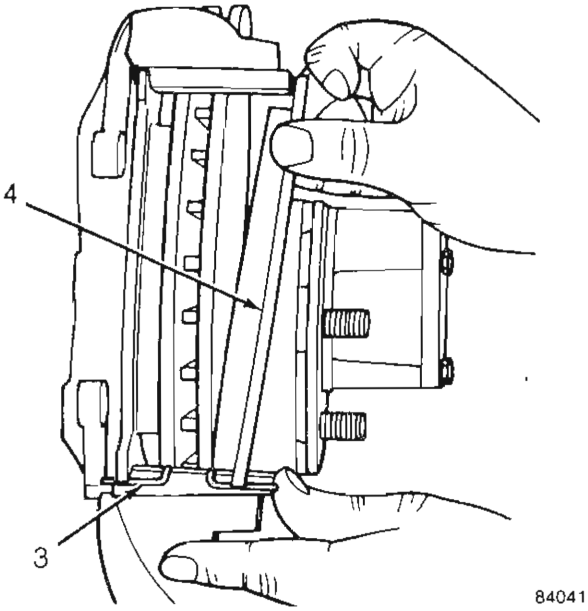


Suspend the caliper (2) from the suspension spring to avoid causing the brake hose to support the weight of the caliper.

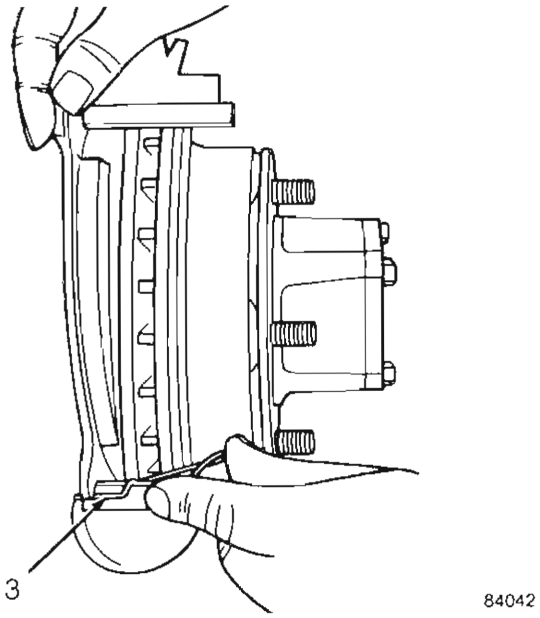


SEE I.S. NOTES

Hold the anti-rattle clip (3) against the caliper anchor plate and remove the outboard brake pad (4).



Remove the inboard brake pad and the anti-rattle clip (3).

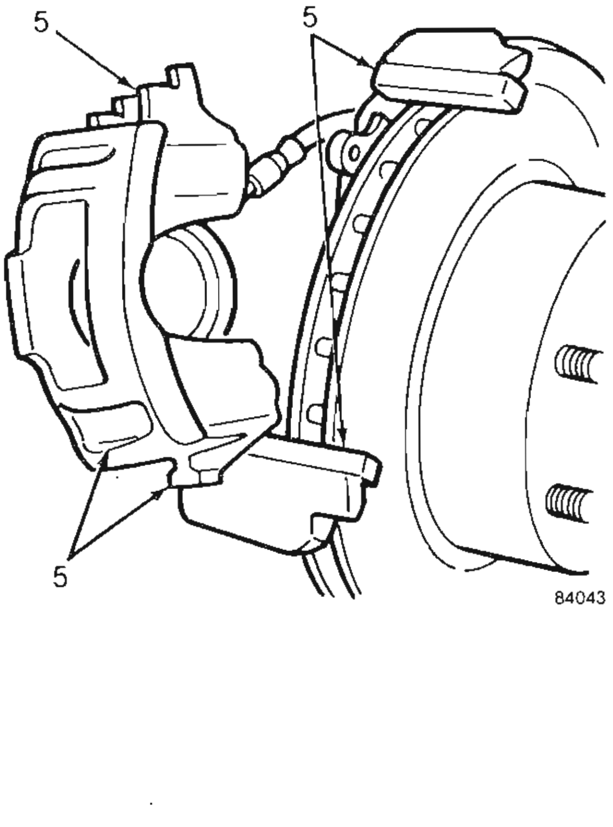


Do not use compressed air to clean the outside of the caliper casting. Use a clean, dry shop towel and wipe the outside without disturbing the dust boot.

If the caliper has indications of leakage, overhaul it (refer to Front Brake Caliper Assembly and Disassembly in this chapter).

Clean the abutment surfaces (5) of the anchor plate and caliper with a wire brush or crocus cloth.

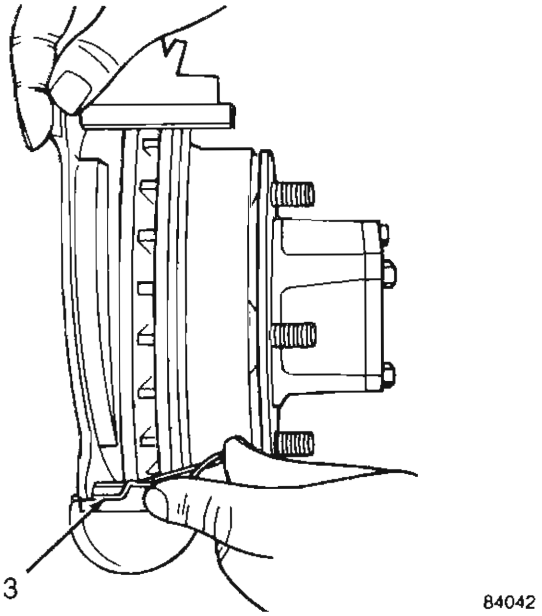
Lubricate the abutment surfaces with brake caliper lubricant.



SEE I.S. NOTES

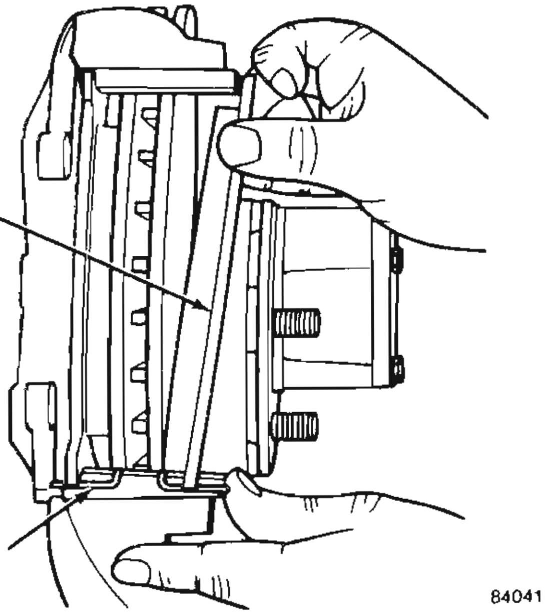
INSTALLATION

Install the anti-rattle clip (3) on the trailing end of the anchor plate. The split end of the clip must face away from the rotor.



Position the inboard and outboard brake pads (4) in place while holding the clip (3).

SEE I.S. NOTES



CAUTION: Protect the caliper dust boot during caliper installation. A damaged boot can cause eventual piston seizure.

Install the caliper and the caliper mounting pins. Tighten the pins with the specified torque.

Fill the master cylinder reservoirs to the full level.

Press firmly on the brake pedal to seat the brake pads.

Install the wheels, lower the vehicle and check the master cylinder fluid level. Check and correct the fluid level if necessary.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25103	Wheel Bearing Nut Wrench		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Caliper Mounting Pins	40 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Wheel Lug Nuts	102 N·m (75 ft-lbs)	88-108 N·m (65-80 ft-lbs)
Wheel Bearing Outer Locknut	68 N·m (50 ft-lbs) min.	
Outer Bearing Inner Locknut	68 N·m (50 ft-lbs)*	

*Back off 1/6 turn while rotating the wheel.

REMOVAL

Raise and support the vehicle.

Remove the wheel.

Remove the caliper. Refer to Rear Brakeshoe Removal and Installation.

Remove the bolts attaching the hub body to the hub clutch and remove the hub body.

Remove the retaining ring from the axle shaft and remove the hub clutch and bearing assembly.

Straighten the lip of the outer locknut retaining washer.

Remove the outer locknut and retaining washer and remove the inner locknut and retaining washer.

Remove the hub and rotor.

Remove the wheel bearings from the rotor.

INSPECTION

Raise and support the front of the vehicle.

Remove the front wheels.

Remove the caliper (do not disconnect the brake line).

SEE
I.S.
NOTES

Inspect the rotor braking surfaces. If the surfaces are only lightly rusted or scored, proceed to the next step. If the surfaces are severely scored, cracked, chipped, excessively worn or have hard spots (a series of shiny or dark colored spots), replace the rotor.

If the rotor surfaces are only lightly scaled, rusted or scored, remove the rotor bearings and seal from the rotor. Clean the rotor hub bearing surfaces and mount the rotor in the brake lathe. Clean the surfaces using flat sanding discs while the rotor is turning in the lathe.

Remove the rotor from the lathe.

Check the rotor thickness at the center of the lining contact area. The thickness must be larger than the minimum (replacement) specifications and provide sufficient stock for refinishing if necessary.

If the rotor is within the limits, proceed to the next step. If the rotor is less than the minimum thickness specification or if refinishing would leave it below the minimum thickness specification, replace the rotor.

SEE I.S. NOTES

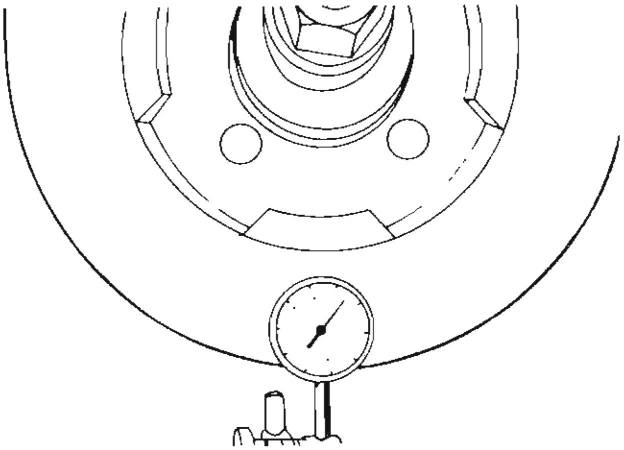
Install the bearings and seal in the rotor.

Install the rotor on the steering spindle and check the runout and thickness variation. Refer to the Specifications for the correct tolerances.

MEASUREMENT

The maximum rotor lateral (face) runout is 0.12 mm (0.005 in). Measure the runout by proceeding in the following manner.

- mount the dial indicator on the support stand or steering spindle



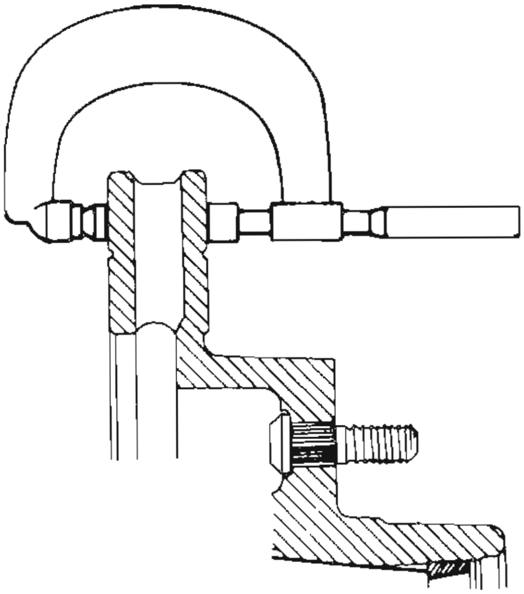
840077

- position the indicator stylus so it contacts the center of the rotor lining contact area and zero indicator
- turn the rotor 360° and note the indicator reading; the runout must not exceed the limit stated in the Specifications
- refinish the rotor if the runout exceeds the stated limit; replace the rotor if the runout is so severe that machining would cause the rotor to fall below the minimum (replacement) thickness specification; refer to Rotor Specifications
- if the runout is within the limits, proceed to the next step

NOTE: Excessive lateral runout will cause rotor wobble resulting in chatter, vibration and pedal pulsation.

Measure the rotor thickness variation by proceeding in the following manner:

- measure the variation using a micrometer or two dial indicators


840078

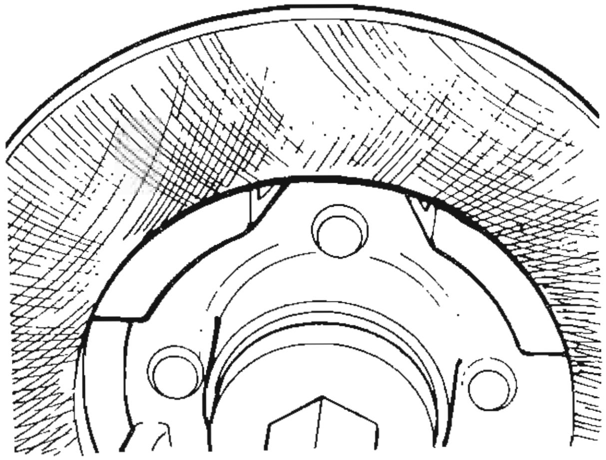
- take readings at four or more equally spaced points around the rotor circumference and 25 mm (1 in) inward from the outer edge of the rotor
- the thickness variation, from point-to-point, must not vary by more than the limit stated in the Rotor Specifications
- refinish the rotor if the thickness variation exceeds the stated limit; replace the rotor if machining will not correct the variation or if machining would cause the rotor to fall below the minimum thickness specification

NOTE: Excessive thickness variation will cause pedal pulsation and vibration when the brakes are applied.

REFINISHING

CAUTION: Do not attempt to refinish the rotor if machining would cause the part to fall below the minimum (replacement) thickness specification for that rotor. Refer to the Specifications.

Rotor refinishing should only be performed using equipment that will machine both of the rotor surfaces simultaneously (machining one side at a time can produce a tapered rotor). The correct surface finish is 15 - 80 micro-inches and there must be no tool marks (grooves) after machining. The following illustration shows the correct rotor finish (nondirectional crosshatch pattern).


840080

NOTE: If a rotor is glazed or highly polished, sanding the rotor may not produce the required rotor finish. It may be necessary to turn the rotor to meet the finish requirements.

To ensure a correct surface finish, follow the lathe manufacturer's recommendations for feed and speed; either sharpen or replace the dull cutting tool bits before machining the rotor.

SEE I.S. NOTES

Remove the rotor from the steering spindle.

Remove the bearings and seal from the rotor and clean the bearing surfaces in the rotor hub thoroughly.

Mount the rotor in the lathe according to the manufacturer's instructions and install the anti-chatter band.

Sharpen or replace the cutting tool bits as necessary.

Machine the rotor as necessary and according to the lathe manufacturer's instructions only. Make two cuts if required and do not remove more than 0.18 mm (0.007 in) at a time.

NOTE: If one disc brake assembly requires a new set of brakeshoes, the shoes on the other assembly must also be replaced to ensure even braking.

INSTALLATION

SEE I.S. NOTES

Lubricate the wheel bearings with an EP-type, waterproof wheel bearing lubricant.

Install the wheel bearings and replacement grease seal in the rotor.

Install the rotor.

Install the tabbed inner washer and inner locknut.

Install the wheel but do not tighten the wheel nuts completely.

Tighten the inner locknut with 68 N·m (50 ft-lbs) torque using Wheel Bearing Nut Wrench, Tool J-25103 or equivalent. Rotate the wheel while tightening the locknut to seat the bearings uniformly.

Back off the inner locknut 1/6 turn (45° - 65°).

Install the outer tabbed washer and outer locknut. Tighten the outer locknut to a minimum of 68 N·m (50 ft-lbs) torque and bend the lip of the tabbed washer over the locknut.

Install the hub clutch and bearing assembly on the axle shaft.

Install the retaining ring on the axle shaft.

Install the new gasket on the hub body and install the body on the clutch and bearing assembly.

Align the bolt holes in the hub body and rotor hub and install the hub attaching bolts and tabbed lockwashers. Tighten the bolts with 41 N·m (30 ft-lbs) torque.

Install the caliper. Refer to Rear Brakeshoe Removal and Installation.

Lower the vehicle.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-33028	Dust Boot Installer	■	

TORQUE SPECIFICATIONS

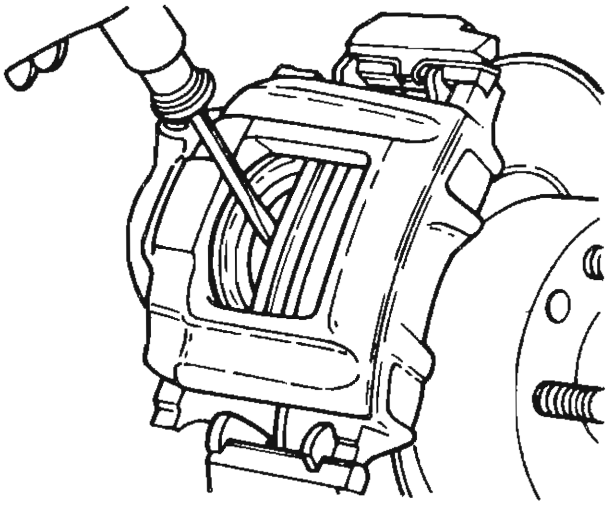
Component	Service Set-To Torque	Service Recheck Torque
Caliper Mounting Pins	40 N·m (30 ft-lbs)	34-47 N·m (25-35 ft-lbs)
Wheel Lug Nuts	102 N·m (75 ft-lbs)	88-109 N·m (65-80 ft-lbs)
Brake Caliper Hose	34 N·m (25 ft-lbs)	34-38 N·m (25-28 ft-lbs)

REMOVAL

Drain and discard two-thirds of the brake fluid from the master cylinder reservoirs.

Raise and support the front of the vehicle. Remove the wheel lug nuts and wheel.

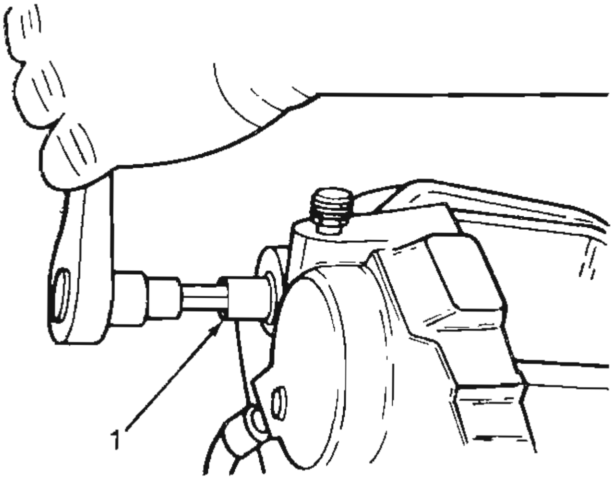
Press the caliper piston to the bottom of the piston bore with a pry tool or C-clamp.



Remove the brake hose at the caliper and cap the hose. Discard the brake hose washer.

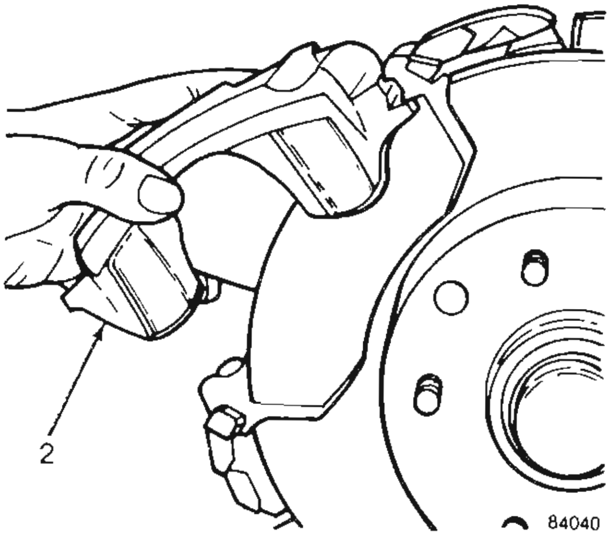
SEE I.S. NOTES

Remove the caliper mounting pins (1).



84039

Lift the caliper (2) out of the anchor plate and off the rotor.



84040

INSTALLATION

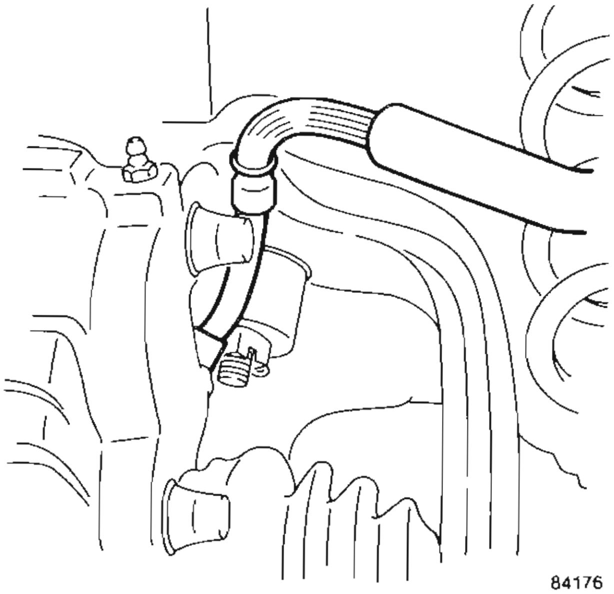
Install the caliper (2) over the anchor plate.

Install the caliper mounting pins (1) and tighten them with the specified torque.

NOTE: When installing the mounting pins, be sure not to push the rubber bushing out of position as it may result in a higher than normal caliper slide force.

Install a replacement washer on the brake hose.

CAUTION: In the next step, when connecting to the caliper, position the hose, as shown, so that it will not interfere with other front end and steering components.



84176

Install the brake hose and bleed the system.

Install the wheel and wheel lug nuts and tighten with the specified torque.

Lower the vehicle and check and correct the fluid level in the master cylinder.

Test the brake system for proper operation.

DISASSEMBLY

CAUTION: Disassemble and overhaul the brake calipers only in a clean work area. Do not scratch the caliper piston bore during the overhaul procedures.

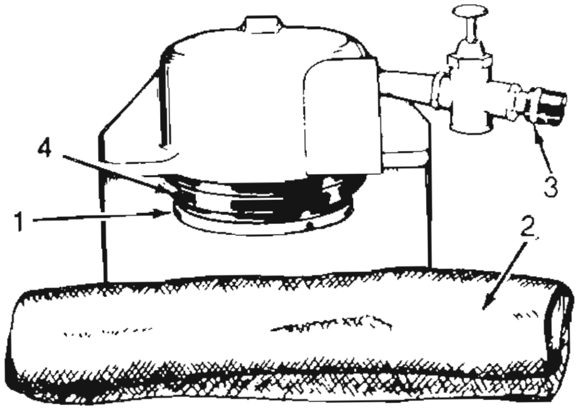
Clean the outside of the caliper with brake cleaning solvent.

Drain the fluid from the caliper and pad the caliper piston (1) with clean shop cloths (2).

CAUTION: Do not, under any circumstances, place fingers in front of the piston in an attempt to catch or protect it. In addition, use only enough air pressure to ease the piston out of the bore. Excessive air pressure can eject the piston with enough force to cause damage or injury.

Apply compressed air at the fluid inlet port (3) and slowly pressurize the caliper to ease the piston out of the bore.

Use a screwdriver to remove the dust boot (4). Discard the boot.



A42884

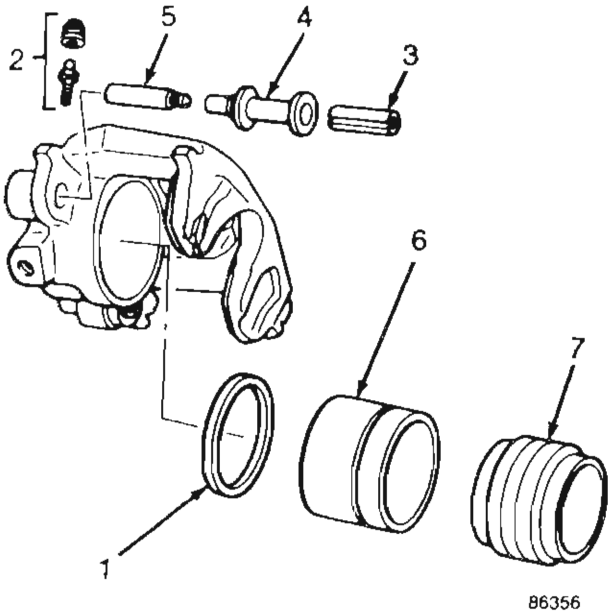
CAUTION: Do not scratch the caliper piston bore during the overhaul procedures.

SEE I.S. NOTES

Remove the piston seal (1) with a suitable tool made of wood or plastic. Discard the seal.

Remove the bleeder screw (2).

Remove the inner (3) and outer bushings (4) from the caliper mounting ears and discard.



Clean all the components with brake cleaning fluid and compressed air.

Replace the mounting pins (5) if they are corroded or have damaged threads.

Replace the caliper piston (6) if it is damaged or corroded.

Replace the caliper if the piston bore is damaged or corroded.

CLEANING AND INSPECTION

Clean all the parts in brake cleaning solvent or clean brake fluid only. Blow out all the caliper passages using filtered compressed air only.

Replace the mounting pins, if corroded, or if the threads are damaged. Do not attempt to clean or polish the mounting pins with abrasives as the protective plating will be removed.

Inspect the caliper piston. Replace the piston if it is nicked, scratched, corroded, or if the protective plating has worn off.

CAUTION: Do not attempt to refinish the piston in any way. The outside diameter is the sealing surface and is manufactured to very close tolerances. Removal of the nickel-chrome protective plating will lead to pitting, corrosion and eventual piston seizure.

Inspect the piston bore. Replace the caliper if the bore is nicked, scratched, worn, cracked, or badly corroded. However, minor stains or corrosion can be removed using crocus cloth.

CAUTION: Do not use emery cloth or similar abrasives on the piston bore. If the bore cannot be cleaned using a crocus cloth, replace the caliper. Clean the caliper thoroughly with brake fluid or brake cleaning solvent if the bore was polished.

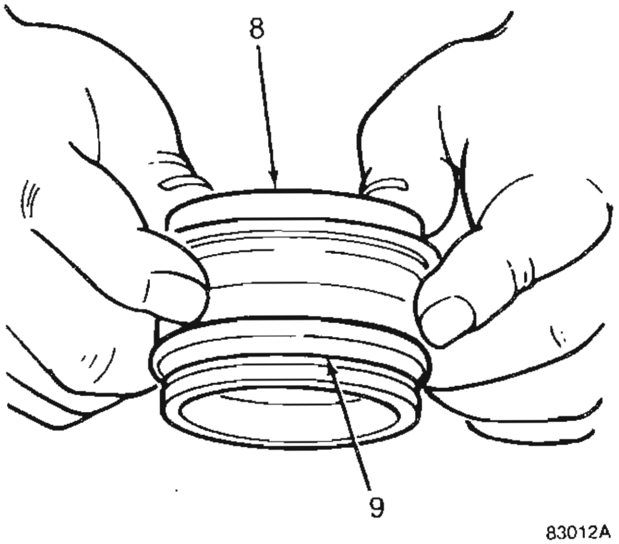
ASSEMBLY

Lubricate the piston bore and replacement piston seal (1) with brake fluid.

Install the seal in the bore groove by hand. Lubricate the piston (6) with brake fluid.

Install a replacement dust boot (7) on the piston. Slide the metal retainer part (8) of the boot over the open end of the piston and pull the boot rearward until the boot lip seats in the piston groove (9).

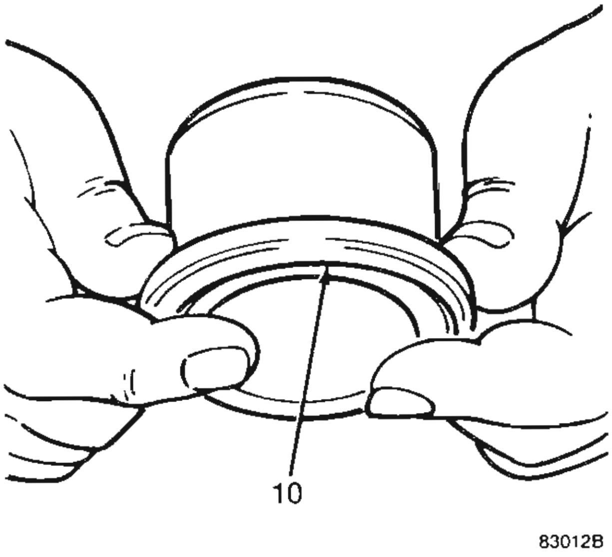
SEE
I.S.
NOTES



83012A

CAUTION: Be very careful to avoid tearing or dislodging the dust boot when installing the caliper. A damaged boot will expose the caliper piston to road splash resulting in corrosion and eventual piston seizure.

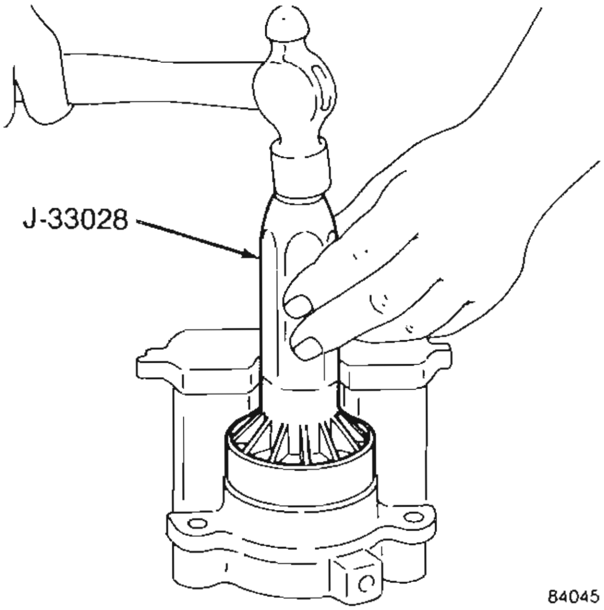
Push the metal retainer part (8) of the boot forward until the retainer is flush with the rim at the open end of the piston. Snap the seal fold (10) into place.



83012B

Install the piston into the caliper bore. Do not unseat the piston seal.

Press the piston to the bottom of the caliper bore. Seat the metal retainer part of the dust boot in the counterbore at the upper end of the bore with tool J-33028.



84045

Install the bleeder screw and replacement inner and outer bushings in the caliper mounting ears.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-8002	Wheel Cylinder Clamps		■
J-8057	Brake Spring Plier Tool or Equivalent		■
J-21177-01	Drum Clearance Gauge		■

REMOVAL

Raise and support the rear of the vehicle.

Remove:

- the lug nuts
- the wheel
- the brakedrum

Install a wheel cylinder clamp, J-8002 on the wheel cylinder.

Remove the U-clip and washer (1) from the parking brake lever pivot pin. Discard the U-clip.

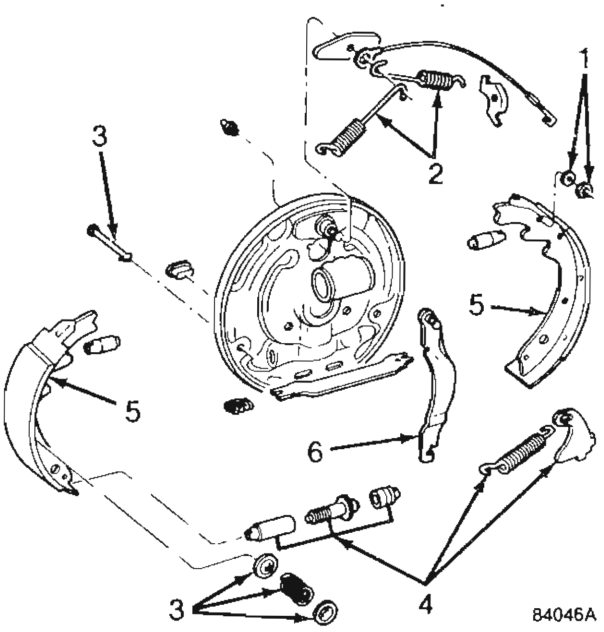
Remove the primary and secondary return springs (2) with the Brake Spring Plier Tool, J-8057 or equivalent.

Remove the spring retainers, holddown springs and retaining pins (3).

Remove the adjuster lever, adjuster screw and spring (4) from the brakeshoes (5).

Remove the brakeshoes.

SEE I.S. NOTES



CLEANING AND INSPECTION

Clean all parts except the brakelining and brakedrums with brake cleaning solvent. To remove the brake fluid contamination, clean all parts except the brakelining with denatured alcohol. Do not attempt to clean contaminated brakelining. Contaminated brakelining must be replaced. Final cleaning of the brakedrums must be performed using a soap and water solution only.

To inspect, pull back the wheel cylinder dust boots and check for evidence of leakage. If evidence of leakage is noted, the cylinder should be disassembled, inspected and overhauled. Refer to the procedure outlined under Wheel Cylinder.

Polish the brake support plate ledges with fine emery cloth and inspect them for deep grooves that could restrict shoe movement. If grooves exist after polishing, the brake support plate must be replaced. Any attempt to remove the grooves by grinding may result in improper brakeshoe-to-drum contact.

Inspect the lining wear pattern. If wear across the width of the lining is uneven, the drums should be checked for distortion (e.g., flare, bellmouth or barrel-shape), the shoes for correct positioning, and the support plate for distortion.

Inspect all springs for evidence of overheating (discoloration) and fractures. The self-adjusting cables should be inspected for kinks, fraying or elongation of the eyelet.

Inspect the adjuster screws for freedom of rotation. Also inspect the adjuster lever for wear and distortion. Replace any brake parts that are worn or damaged.

INSTALLATION

Lubricate the following parts with molydisulphide grease:

- support plate ledges
- anchor pins
- adjuster cable guides
- adjuster screw and pivot
- parking brake lever and lever pivot pin

Connect the parking brake lever (6) to the secondary brakeshoe (5) with the washer and a replacement U-clip (1).

Remove the wheel cylinder clamp, J-8002 from the wheel cylinder.

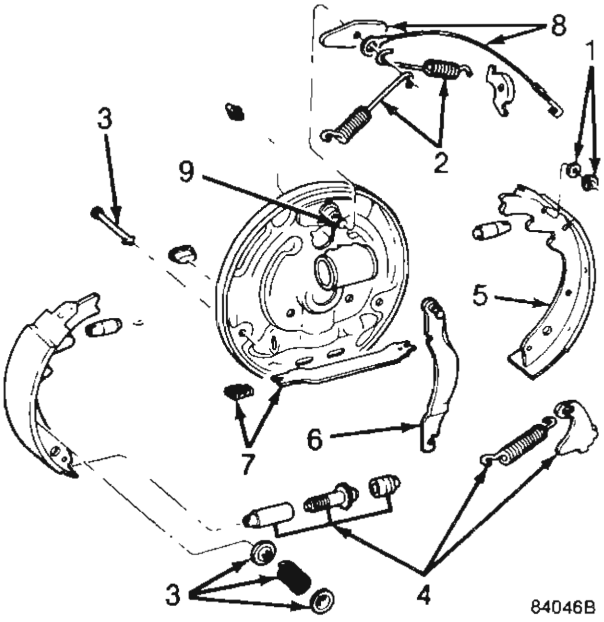
Install the brakeshoes with the holddown spring, pin and retainers (3).

Install the parking brake lever strut and spring (7).

Install the guide plate and adjuster cable (8) on the anchor pin (9).

Install the primary and secondary return springs (2) with the cable guide.

Install the adjuster screw, spring and lever (4), and connect to the cable.



SEE
I.S.
N
O
T
E
S

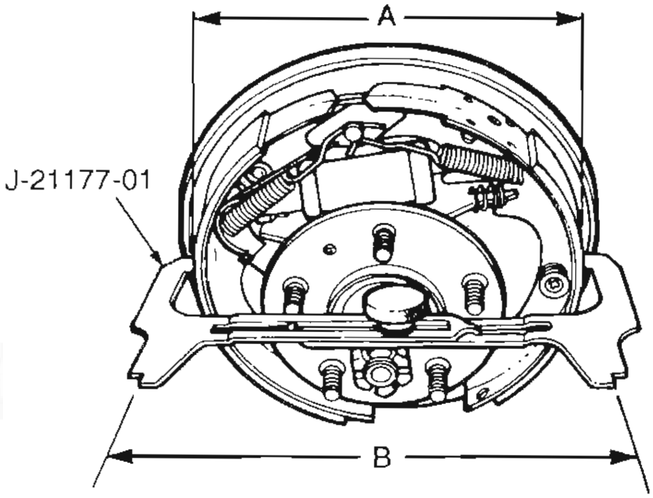
ADJUSTMENT

If the wheel brake units have been disassembled for any reason, an initial adjustment must be made before installing the drum.

To adjust the rear brakeshoes with the drums removed, use the Brake Clearance Gauge, Tool J-21177-01 to preset the brakeshoe adjustment.

Adjust the brakeshoes to the gauges, as shown at (A).

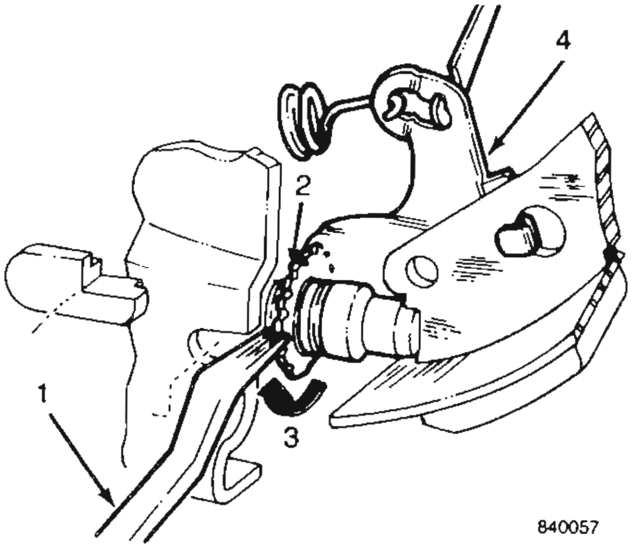
Measure the brakedrum, as shown at (B).



840056

To adjust the brakeshoes with the drums in place, remove the access slot covers at the rear of the support plates.

Using a brake adjusting tool (1) or a screwdriver, rotate the adjuster screw (2) until the road wheel is locked. Tighten the adjuster screw by rotating it in the direction shown (3).



840057

Mark the adjuster screw and back off one complete revolution.

Back off the adjuster screw by inserting a piece of 3.1 mm (1/8 in) welding rod (or similar tool) past the adjuster screw to force the adjuster lever (4) off the screw, and rotate the adjuster screw with the tool.

Install the rubber access slot cover after the adjustment.

WARNING: After assembling and adjusting the brakes, check for proper brake operation before moving the vehicle.

Check the brake pedal travel. Drive the vehicle in Reverse and make 10 - 15 firm brake applications. Make one forward brake application between each Reverse application to equalize the adjustment.

SPECIAL TOOLS

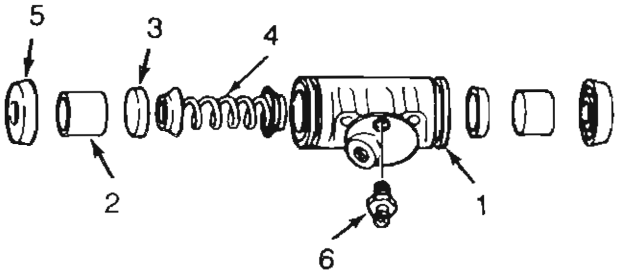
Tool Ref.	Description	Required	Recommended
J-8002	Wheel Cylinder Clamp		■
J-8057	Brake Spring Plier Tool or Equivalent		■

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Rear Wheel Cylinder Pipe Fitting	18 N·m (160 in-lbs)	14-16 N·m (120-144 in-lbs)
Rear Wheel Cylinder Attaching Bolts	20 N·m (180 in-lbs)	15-26 N·m (130-230 in-lbs)
Wheel Lug Nuts	102 N·m (75 ft-lbs)	88-108 N·m (65-80 ft-lbs)

The rear drum brake wheel cylinder (1) consists of a cast iron housing containing two pistons (2), two rubber piston cups (3), and a compression spring (4) with integral piston cup expanders. A rubber boot (5) is used at each end of the cylinder to prevent entry of dirt and water. Each cylinder is also equipped with a bleeder screw (6) to facilitate brake bleeding.

The compression spring holds the piston cups tightly against the pistons and the integral expanders hold the piston cups tightly against the cylinder walls to prevent air from entering when the brakes are released.



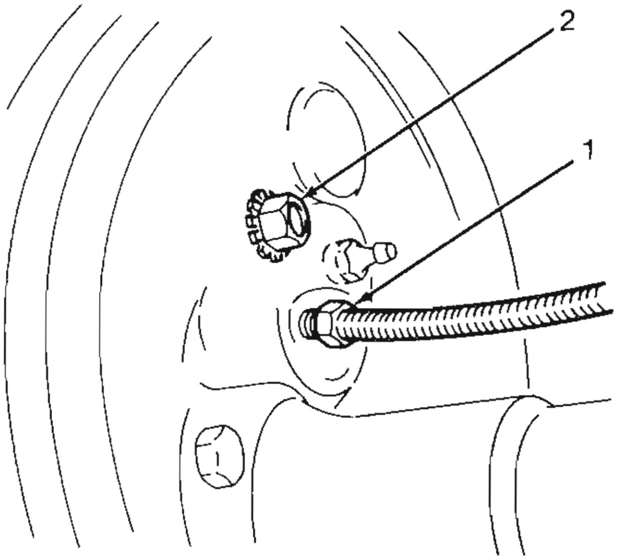
SEE I.S.
N
O
T
E
S

SEE I.S. NOTES

REMOVAL

Raise and support the rear of the vehicle and remove:

- the wheel lug nuts
- the wheel
- the brakeshoes
- the pipe fitting (1) from the wheel cylinder
- the wheel cylinder attaching bolts (2), and the wheel cylinder



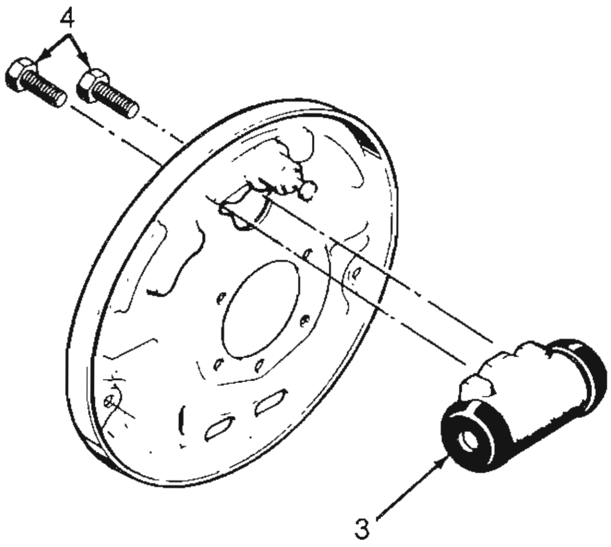
84047

INSTALLATION

CAUTION: Wipe the end of the pipe fitting (1) to remove foreign matter before connecting it to the wheel cylinder.

Position the wheel cylinder (3) on the backing plate and connect the pipe fitting to the wheel cylinder. Hand tighten the connection only.

Install the wheel cylinder attaching bolts (4). Tighten the mounting bolts with the specified torque.



84048

Using a pipe fitting wrench, tighten the brake pipe fitting at the wheel cylinder with the specified torque.

Install the brakeshoes.

Adjust the brakes, center the shoes and install:

- the brake drum
- the wheel
- the wheel lug nuts

Tighten the wheel lug nuts with the specified torque.

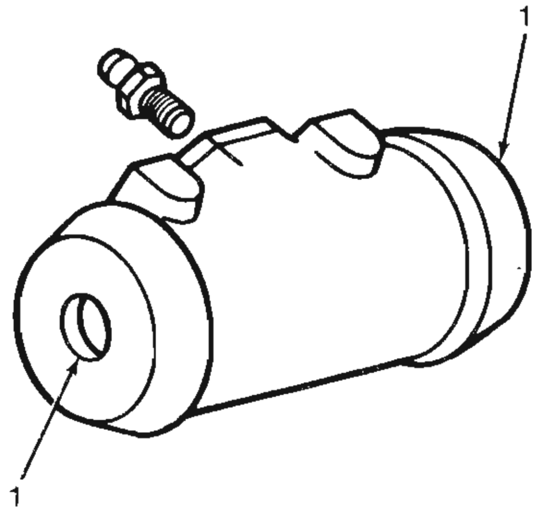
Bleed the brake hydraulic system, lower the vehicle and test the brakes.

DISASSEMBLY

CAUTION: The wheel cylinders should not be disassembled unless there is evidence of excessive brake fluid leakage.

NOTE: Wheel cylinder removal is necessary only for cylinder replacement. An overhaul may be performed with the cylinder attached to the brake backing plate.

Carefully pull the lower edges of the wheel cylinder boots (1) away from the cylinder and determine whether or not the interior is wet with brake fluid. Excessive fluid in this area indicates leakage past the wheel cylinder piston cups and the necessity for overhaul.

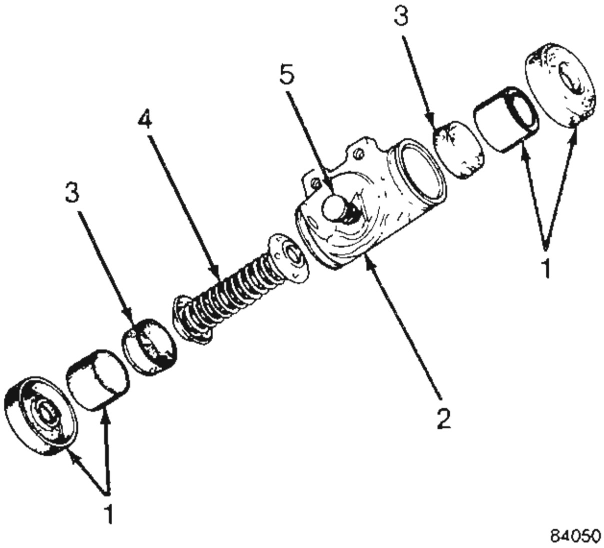


84049

NOTE: A small amount of fluid is normally present behind the boots to provide piston lubrication. This does not indicate the necessity for overhaul.

Remove:

- the brakeshoes from the backing plate
- the boot and piston (1) from each end of the cylinder casting (2)
- the wheel cylinder rubber cups (3) and the spring and expander assemblies (4) from the cylinder bore
- the bleeder screw (5)



84050

Discard all the original rubber components and wash the other components in brake cleaning fluid.

Inspect the pistons and the cylinder bore for scratches, scores or other visible damage. Replace damaged pistons and hone the cylinder bore if necessary.

CLEANING AND INSPECTION

CAUTION: Clean the wheel cylinder components with brake fluid or brake cleaning solvent only. Do not use any solvent containing mineral oil such as gasoline, kerosene, alcohol or motor oil. Mineral oil is very harmful to the rubber piston cups.

Clean all parts except the dust boots using brake fluid or brake cleaning solvent only. Wipe the dust boots clean using a shop cloth only. Use filtered compressed air to dry the parts and to blow out all passages in the wheel cylinder housing.

Inspect all the components. Replace the cylinder if the piston bore is scored, scratched or pitted, or if the bleeder screw threads are stripped or galled.

SEE I.S. NOTES

Replace the pistons if they are scored, worn or corroded.

Replace the compression spring and expanders if the spring is distorted, broken, lacks tension or if the expanders have separated from the spring.

Replace the dust boots if they are cut, cracked, torn or distorted.

ASSEMBLY

CAUTION: Always install replacement piston cups to ensure proper brake action. Do not attempt to reuse the original cups at any time. In addition, use compression springs equipped with the integral expanders only. If expanders are not used, brake operation could be impaired.

Install all components included in the wheel cylinder repair kit.

Apply a light coating of brake fluid to the wheel cylinder bore and the internal components.

Install:

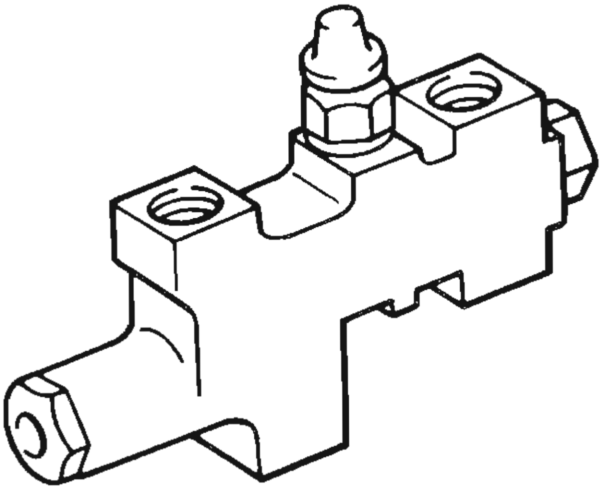
- the return spring and expander assembly (4)
- the wheel cylinder rubber cups (3)
- the boots and pistons (1) on each end of the cylinder
- the bleeder screw (5)

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Combination Valve Pipe Fittings	19 N·m (168 in-lbs)	18-20 N·m (160-175 in-lbs)

A combination pressure differential/rear brake proportioning valve is used on all CJ and Scrambler models.

The valve is mounted on the inner side of the left frame rail.



84051

VALVE OPERATION

The pressure differential valve section activates the brake warning lamp on the instrument panel if a pressure loss in the front or rear hydraulic system should occur. This feature is provided as a method for alerting the driver if such a system malfunction should occur.

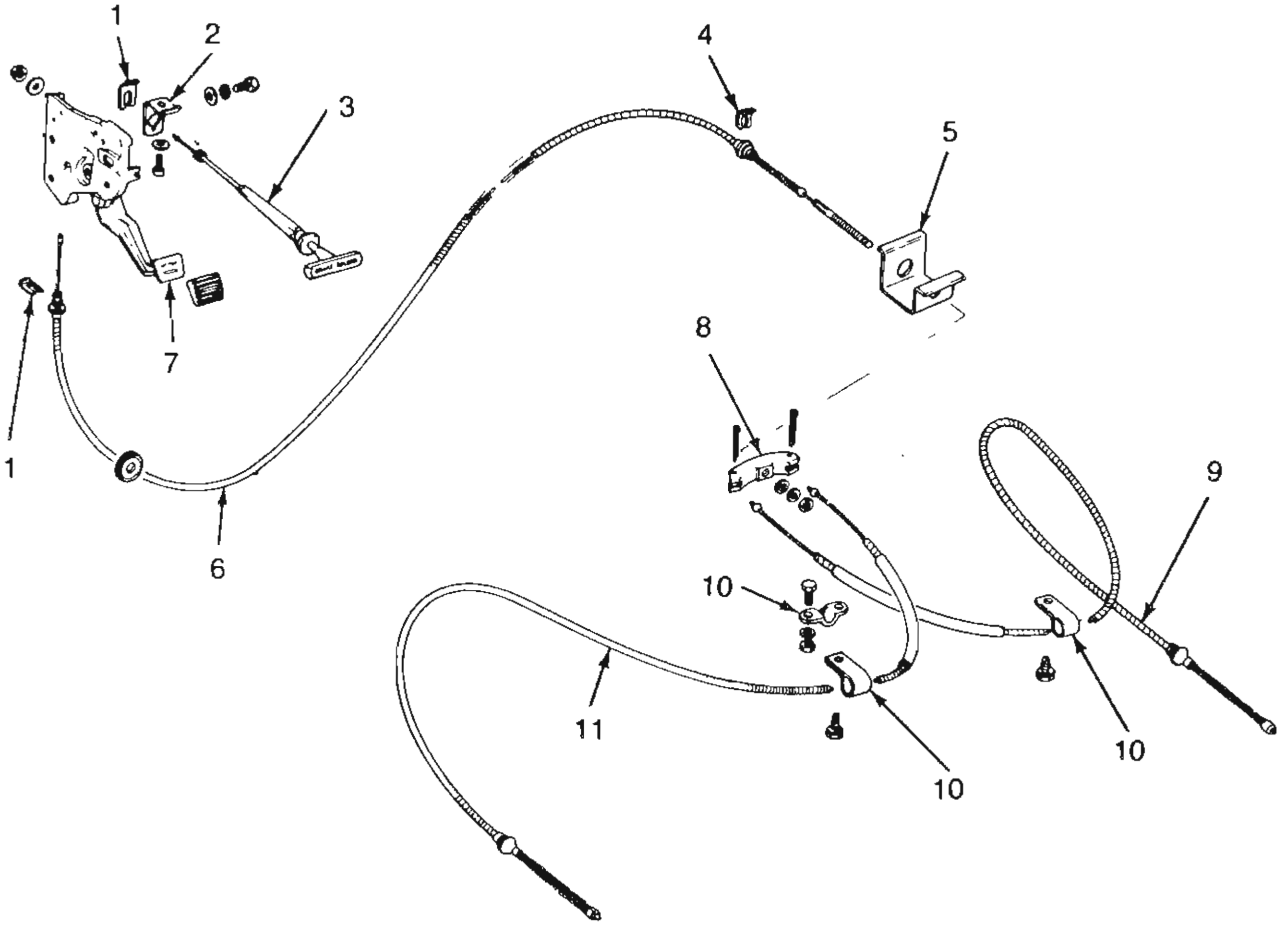
Until the ignition lock cylinder is turned to the OFF position, the lamp will remain illuminated until the cause of the problem is corrected and the valve recentered.

The pressure differential valve is a hydraulic reset-type and does not require removal for brake bleeding.

VALVE SERVICE

The combination valve is serviced as an assembly only. Do not attempt to repair any combination valve.

SEE
I.S.
NOTES



1 - Clip
2 - Handle Bracket
3 - Release Cable and Handle
4 - Clip
5 - Bracket
6 - Front Cable

7 - Parking Brake Assembly
8 - Equalizer
9 - Right Rear Cable
10 - Clamp
11 - Left Rear Cable

ADJUSTMENT

NOTE: The service brakes must be adjusted before adjusting the parking brakes.

Release the parking brakes.

Loosen the equalizer locknuts to release tension on the cables.

Inspect all the cables for binds, kinks or a frayed condition. Replace the damaged cables.

Tighten the equalizer locknut until a slight drag is produced at the wheels.

Loosen the equalizer locknut until the wheels rotate freely and the brake drag is eliminated.

Tighten the equalizer locknuts securely.

Check the parking brake operation.

PARKING BRAKE CABLES

Removal – Rear Cable

Raise the vehicle.

Loosen the cable adjuster locknuts at the equalizer.

Remove the necessary cable locating clamps, the cotter pin retaining the cable in the equalizer, and remove the cable end from the equalizer.

Remove the clip retaining the cable in the frame bracket and unhook the locating spring from the cable.

Disassemble the necessary rear drum brake unit as outlined in this section.

Compress the cable lock tabs at the brake support plate using a small hose clamp and remove the cable.

Installation – Rear Cable

Insert the cable in the support plate and pull the cable through the plate until the cable lock tabs engage in the support plate.

Reassemble the rear drum brake unit as outlined in this section.

Engage the cable end in the equalizer, install the cable retaining cotter pin, and install the necessary cable locating clamps.

Insert the cable in the frame bracket, install the cable-to-bracket retainer clip in the cable ferrule, and engage the cable end in the center cable connector.

Tighten the cable adjuster locknuts and adjust the parking brakes as outlined in this section.

Lower the vehicle.

Removal – Front Cable

Raise the vehicle.

Remove the equalizer from the front cable.

Remove the clip retaining the cable to the frame bracket.

Lower the vehicle.

Disconnect the front cable return spring at the parking brake lever assembly if equipped.

Roll the carpet back and remove the front cable ferrule-to-parking brake lever assembly retaining clip.

Disengage the cable end from the parking brake lever assembly.

Remove the cable.

If the cable is to be replaced, remove the insulator or grommet from the lever end of the cable.

Installation – Front Cable

Install the front cable through the floorpan and install the cable grommet or insulator in the floorpan.

Install the cable ferrule-to-parking brake lever assembly retaining clip and reposition the carpet.

Engage the cable end in the parking brake lever assembly and install the cable return spring if equipped.

Install the clip retaining the cable to the frame bracket.

Raise the vehicle.

Install the cable equalizer and locknuts. Be sure the cable is properly positioned in the frame bracket as well as the equalizer.

Adjust the parking brakes as outlined in this section.

Lower the vehicle.

SEE I.S. NOTES

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-26869	Metering Valve Tool (Type-W Valve)		■

Bleed the hydraulic system whenever diagnosis indicates there is air in the system.

If only half of the dual brake system has been serviced, it is usually necessary to bleed only that half of the system.

However, if a firm pedal cannot be obtained after bleeding half the system, bleed the entire system.

If the fluid is contaminated, flush the system with fresh brake fluid until clear fluid only can be forced from the calipers and wheel cylinders.

CAUTION: Clean the master cylinder and cover before adding fluid. Always prevent dirt from entering the fluid reservoirs.

Use fresh brake fluid that conforms to SAE J1703F and DOT 3 or DOT 4 only when filling or bleeding the system.

The brake hydraulic system may be bled manually or by using a pressure tank and adapters.

PRESSURE BLEEDING

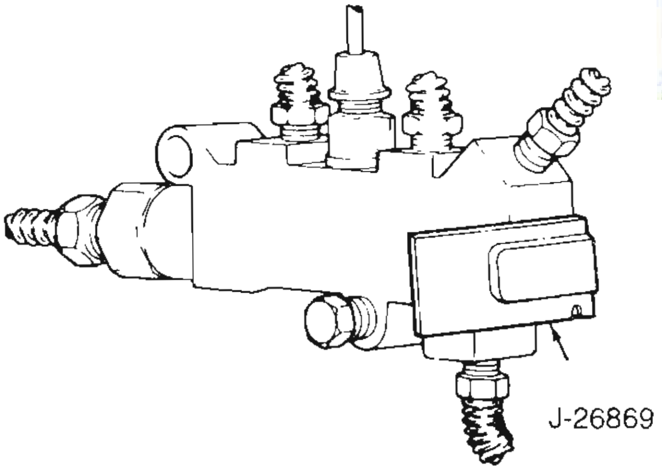
Release the air from the pressure tank and remove the valve core from the air valve on the tank.

Fill the tank to the stated capacity with the specified brake fluid.

Install the valve core in the tank air valve and close the tank-to-master cylinder fluid supply valve.

Reduce the shop air line pressure and fill the tank to the manufacturer's recommended operating pressure. A tank pressure of 103 - 138 kPa (15 - 20 psi) is normally more than sufficient to bleed the system.

Remove the dust cover from the metering valve stem and install Metering Valve Tool, J-26869 on the stem to hold the valve open.



840663

SEE
I.S.
NOTES

Install the bleeding adapter assembly on the master cylinder. There must be an airtight seal between the reservoir and the adapter gasket.

Connect the fluid supply hose to the fluid supply valve in the tank.

Remove the hose fitting from the master cylinder adapter and install it in the quick-disconnect fitting on the fluid supply hose.

Place the end of the fluid supply hose in a clean container and slowly open the fluid valve in the tank to bleed air from the tank and hose.

Close the valve when fluid flows clear and free of air bubbles.

Refill the tank if the operating pressure falls below the recommended minimum.

Remove the adapter fitting from the hose and install it in the master cylinder adapter.

Connect the fluid supply hose-to-adapter fitting and open the tank fluid supply valve.

Bleed the brake calipers and cylinders in the following sequence:

- right rear
- left rear
- right front
- left front

Bleed one wheel cylinder or caliper at a time.

Install a rubber hose on the bleed fitting at the caliper or wheel cylinder being bled. Submerge the free end in a container partially filled with brake fluid.

Open the bleed fitting three-quarters of a turn and close it when the fluid flows clear and free of air bubbles.

After bleeding the brake calipers and cylinders, disconnect the fluid supply hose at the adapter fitting and remove the master cylinder adapter assembly.

Remove tool J-26869 from the combination valve.

Discard the fluid removed during bleeding.

Fill the master cylinder reservoir to within 6.35 mm (1/4 in) of each reservoir rim.

Release the air pressure from the tank and close the fluid supply valve.

Test the brake system for proper operation.

MANUAL BLEEDING

Fill the master cylinder to within 6.35 mm (1/4 in) of each reservoir rim.

Remove the dust cover from the metering valve stem and install Metering Valve Tool J-26869 on the stem to hold the valve open.

SEE I.S. NOTES

Bleed the brake calipers and cylinders in the following sequence:

- right rear
- left rear
- right front
- left front

Bleed one wheel cylinder or caliper at a time.

Install a rubber hose on the bleed fitting at the caliper or wheel cylinder to be bled and submerge the free end of the hose in a container partially filled with brake fluid.

Open the bleed fitting 3/4 of a turn.

With the aid of a helper:

- press the brake pedal to the floor
- tighten the bleed fitting
- slowly release the brake pedal

Repeat the bleeding operation until the fluid flows clear and free of air bubbles.

Check the master cylinder fluid level frequently during bleeding and refill it as necessary.

Do not allow the master cylinder to be depleted of fluid at any time, otherwise air will be forced into the hydraulic system.

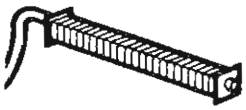
Discard all fluid removed during the bleeding operation.

Remove Metering Valve Tool J-26869 from the combination valve.

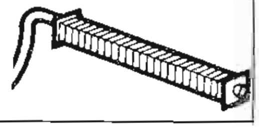
Fill the master cylinder reservoirs to within 6.35 mm (1/4 in) of each reservoir rim.

Test the brake system for proper operation.

SEE
I.S.
NOTES



HEATING AND AIR CONDITIONING



CONTENTS

SE
I.S
NOTES

GENERAL

A blend-air type heating system is used for all CJ and Scrambler vehicles.

The blend-air method of heating utilizes a constant coolant flow system that allows engine coolant to flow continuously through the heater core.

The temperature of the heated air entering the passenger compartment is controlled by regulating the quantity of air that flows through the heater core air passages and blending it with a controlled amount of cool, fresh air that bypasses the heater core.

HEATER AND DEFROSTER OPERATION

The heater is an extension of the engine cooling system and depends on normal engine operating temperature and airflow through the cowl fresh air intake to heat the interior of the vehicle.

During heater operation, close the fresh air vent.

The air control knob operates a door in the fresh air intake duct, which allows air to enter the heater housing.

When the knob is pushed in, no air will enter the heater. As the knob is pulled out to the first position (HEAT), the door opens, allowing airflow to the heater.

The air control knob (1) must be pulled to the HEAT position to operate the heater.

The temperature control knob (2) operates the blend air door in the heater housing.

At the full OUT position, all the air is directed through the heater core, providing maximum heat flow.

At the full IN position, all the air is directed around the heater core, providing unheated fresh air.

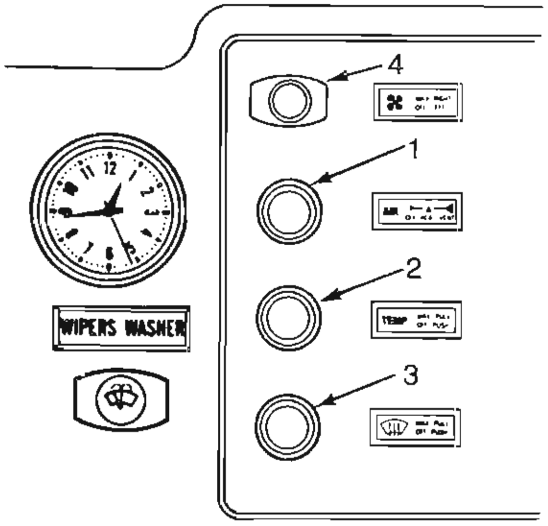
Any in-between position of the control allows a blend of cool, fresh outside air and heated air.

The defrost control knob (3) must be pushed in for the blended air to enter through the floor heat duct.

When the defrost control knob is pulled out completely, all airflow will be directed through the defroster duct and onto the windshield.

Any in-between position of the defrost control divides the airflow between the defroster duct and the floor heat duct.

If additional airflow is required, the blower motor control (4) should be turned to one of the three available speeds.



60357

FRESH AIR VENTILATION

The fresh air ventilating system directs outside air through the air inlet to a door in the left end of the air inlet to provide air to the driver's side and also through a door on the right side of the heater to provide air to the passenger side.

These doors are cable and linkage controlled.

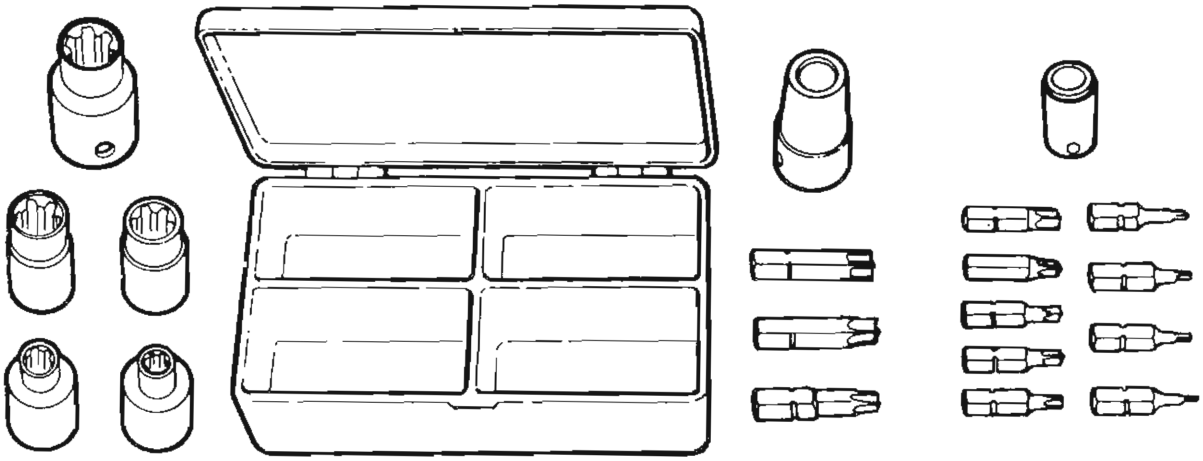
When the air control knob is pulled all the way out to the vent position, the driver's vent door is opened by linkage on the air inlet and the passenger vent door is opened by a cable that is attached to the linkage on the air inlet.

When the air control is pushed in, no air will enter the vehicle.

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25359-C	Torx Bit and Socket Set		■

SEE I.S. NOTES



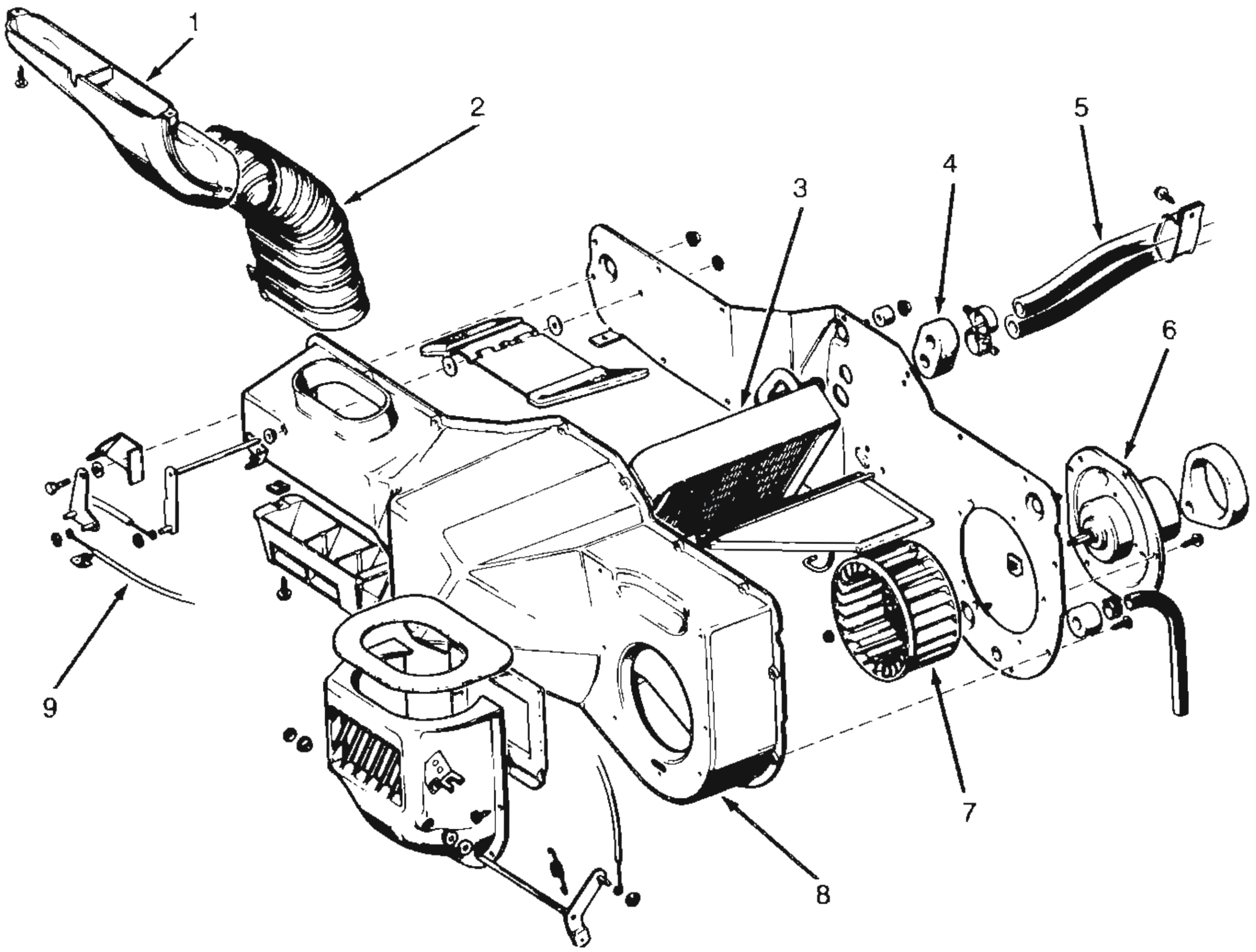
J-25359-C

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

80587A

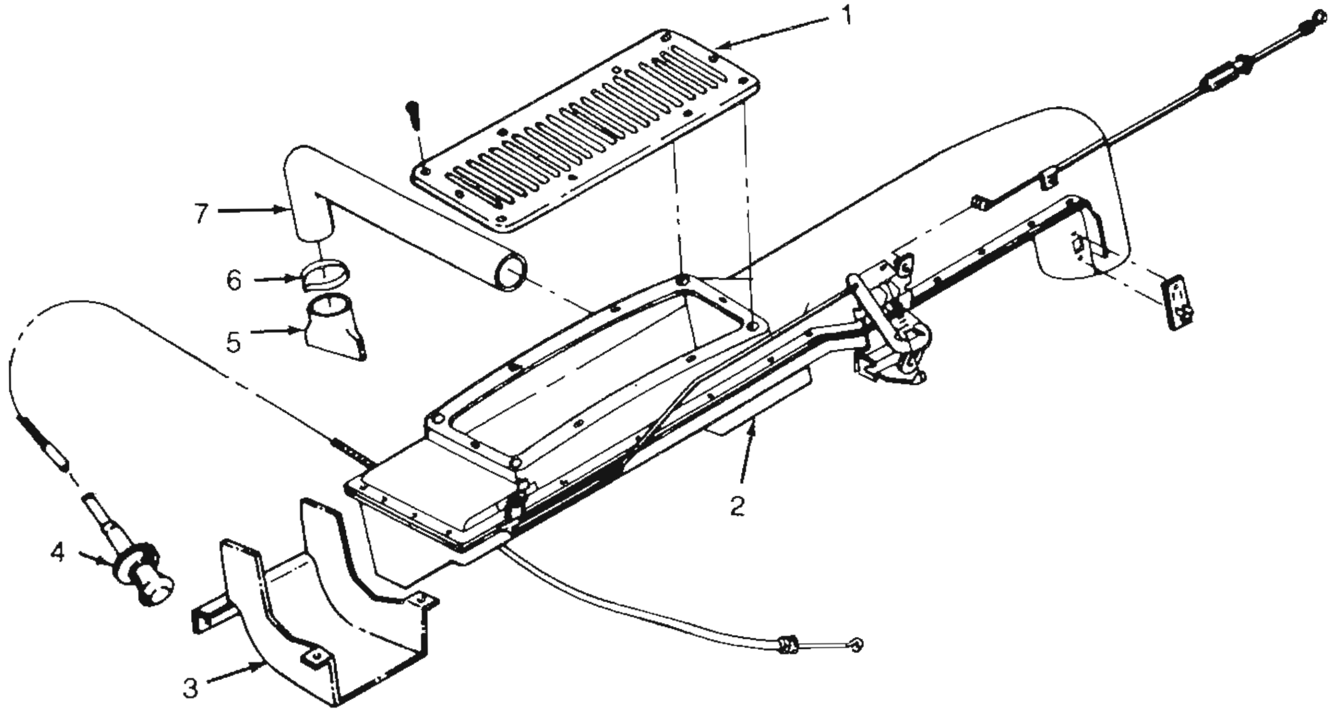
SEE I.S. NOTES



1. Defroster Nozzle
2. Defroster Duct
3. Heater Core
4. Seal
5. Hose
6. Blower Motor
7. Fan
8. Heater Housing
9. Cable

81200A

SEE I.S. NOTES



- 1. Cover Panel
- 2. Fresh Air Intake Duct
- 3. Fresh Air Vent
- 4. Duct Control
- 5. Cap
- 6. Hose Clamp
- 7. Drainage Hose

J42629

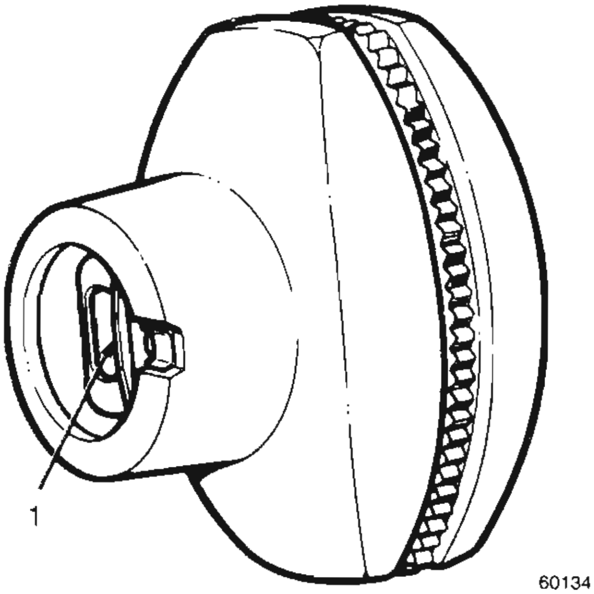
FAN CONTROL SWITCH

Removal

Rotate the knob until the slot in the neck of the knob is visible.

Insert a small bladed screwdriver in the slot and depress the spring metal clip (1) toward the knob.

This will relieve the tension on the spring metal clip and allow the knob to slide off the shaft.



Remove the retaining nut and trim ring.

Remove the switch from the instrument panel and disconnect the wires.

Installation

Connect the wires and position the switch in the instrument panel.

Install the trim ring and retaining nut.

Install the control knob.

CONTROL CABLES

Adjustment

The only cable that is adjustable is the cable from the air inlet linkage to the passenger side vent door at the right side of the heater.

This cable has a turnbuckle adjustment located approximately 15.24 cm (6 in) above the cable attachment to the right side of the heater.

Adjust this cable until the passenger vent door is closed when the air control knob is pushed in.

NOTE: If the cable is adjusted beyond the closed door position, it will cause a bind in the linkage and may prevent the driver's side vent door from closing.

Replacement

Disconnect the cable from the door and housing.

NOTE: The control cables are retained on the backside of the instrument panel by plastic tabs. To disengage the cables from the instrument panel, press the plastic tabs together and pull out the cable.

Remove the cable from the instrument panel.

Remove the cable-to-damper door.

Route the replacement cable through the hole in the instrument panel.

Connect the cable to the door and housing.

Install the cable on the damper door.

Check the operation.

HEATER CORE

The heater core housing must be removed to gain access to the heater core.

Removal

WARNING: Do not loosen the radiator drain-cock when the cooling system is hot and pressurized because serious burns from hot coolant can result.

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 damper door control cables.

Disconnect the blower motor wire.

Disconnect the defroster duct.

Remove the nuts from the heater core housing studs in the engine compartment.

Remove the heater core housing assembly by tilting it down to disengage it from the air inlet duct and pulling it to the rear of the vehicle.

Remove the heater core from the housing.

Installation

Install the heater core in the housing.

Position the heater core housing and install the attaching nuts.

NOTE: Ensure that the seals around the core pipes and blower motor are in position before attaching the heater core housing to the dash panel. Do not over-tighten the heater-to-dash panel nuts because this can cause distortion of the heater assembly. Tighten until two threads are visible beyond the nut.

Connect the defroster duct.

Connect the blower motor wire.

Connect and adjust the damper door control cables.

Connect the heater hoses.

Refill the cooling system.

Check the heater operation.

BLOWER MOTOR

The heater core housing must be removed before the blower motor can be removed.

Removal

Remove the heater core housing. Refer to the removal procedure.

Remove the blower motor-to-heater housing attaching screws and remove the blower motor.

SEE I.S. NOTES

Installation

Position the blower motor in the heater core housing assembly and install the attaching screws.

Install the heater core housing. Refer to the installation procedure.

Check the blower motor and heater control operation.

DEFROSTER DUCT

Removal

Disconnect the battery negative cable.

WARNING: Do not loosen the radiator draincock when the cooling system is hot and pressurized because serious burns from hot coolant can result.

Drain approximately 1.9 liters (2 qts) of coolant from the radiator. Drain the coolant into a clean container.

SEE I.S. NOTES

Remove the heater hoses.

Remove the screw attaching the heater housing to the bracket.

Remove the nuts attaching the heater housing to the dash panel from within the engine compartment.

Disconnect the speedometer cable.

Remove the glove box.

Tilt the heater core housing back, pull it to the rear and lower it.

Disconnect the heater control cables.

Remove the fresh air cover panel from the cowl.

Remove the fresh air intake duct assembly.

Lower the windshield.

Remove the screws from the defroster duct and remove the defroster duct and tube.

Installation

Position the defroster duct and install the attaching screws and tube.

Raise the windshield and secure it.

Install the fresh air intake duct assembly.

Install the fresh air cover panel on the cowl.

Install the heater control cables.

Position the heater core housing on the dash panel.

Install the nuts attaching the housing to the dash panel.

Install the glove box.

Install the speedometer cable.

Install the screw attaching the heater core housing to the bracket.

Connect the heater hoses.

Refill the radiator.

Connect the battery negative cable.

FRESH AIR INTAKE DUCT

Removal

Disconnect the battery negative cable.

WARNING: Do not loosen the radiator draincock when the cooling system is hot and pressurized because serious burns from hot coolant can result.

Drain approximately 1.9 liters (2 qts) of coolant from the radiator. Drain the coolant into a clean container.

Remove the heater hoses.

Remove the screw attaching the heater core housing to the bracket.

Remove the nuts attaching the housing to the dash panel from within the engine compartment.

Disconnect the speedometer cable.

Remove the glove box.

Tilt the heater core housing back and pull to the rear of the lower housing.

Disconnect the heater control cables.

Remove the fresh air cover panel from the cowl.

Remove the fresh air intake duct assembly.

Installation

Position the defroster duct and install the attaching screws and tube.

Raise the windshield and secure it.

Install the fresh air intake duct assembly.

Install the fresh air cover panel on the cowl.

Install the heater control cables.

Position the heater core housing on the dash panel.

Install the nuts attaching the housing to the dash panel.

Install the glove box.

Install the speedometer cable.

Install the screw attaching the heater core housing to the bracket.

Connect the heater hoses.

Refill the radiator.

Connect the battery negative cable.

SE
I.S.
NOTES

GENERAL

A factory installed air conditioner system is not available for CJ and Scrambler vehicles equipped with a four-cylinder engine.

All information in this section is in reference to vehicles equipped with a six-cylinder engine.

When driving at normal highway speeds, the CJ and Scrambler air conditioner system will operate at maximum efficiency.

When encountering stop-and-go conjested driving conditions, a slight reduction in cooling efficiency generally will be experienced.

It is recommended that an intermediate temperature and the high fan position be used for average city driving and that an intermediate temperature and medium fan position be used for highway driving.

When driving at a relatively high speed for an extended period of time, the evaporator may possibly frost over, resulting in a temporary loss of cooling.

Should this occur, simply turn the TEMP knob (1) to OFF and allow the blower to operate for a few minutes to defrost the evaporator.

Then turn the TEMP knob to a position that is not as cold as the position where the frosting occurred.

To maintain maximum cooling efficiency, periodically remove bugs and other foreign matter from the condenser and radiator fins. Do not install a bug screen or other screen material in front of the condenser and radiator.

SEE I.S. NOTES

Liquid deposits under a vehicle, at a location below the evaporator housing, is frost condensation draining from the system and is normal.

The engine temperature gauge pointer will indicate a slightly higher than normal temperature when the air conditioner system is operating. However, should excessive overheating occur:

- check the condition of all coolant hoses
- check the radiator for rust or scaling conditions
- ensure that the condenser is free of bugs and other foreign matter

The air conditioner can also be used for fast, efficient defogging of windows during cool, damp weather.

The condenser is mounted ahead of the radiator and the remaining components are in the engine compartment.

The compressor is a rotary, five-cylinder, belt-driven pump. An electromagnetic clutch couples the compressor to the drive pulley.

The drive pulley freewheels when the compressor is not in use.

The START position in the ignition switch automatically disconnects all accessories, including the A/C system, to reduce battery load and provide easier starting.

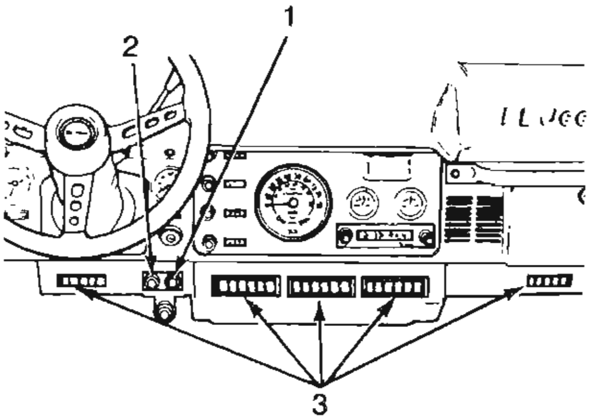
OPERATION

General

For fast, maximum efficiency, purge the vehicle of hot air by driving the equivalent of two or three city blocks.

During this time, place the TEMP control (1) in the MAX position and the FAN control (2) in the HI position. This permits the evaporator to precool in hot weather.

Adjust the air outlets to obtain the desired airflow distribution by moving the louver levers (3) left, right, up or down.



1. Temperature Control Knob
2. Fan Control Knob
3. Adjustable Air Outlet Louvers

70521

Airflow can be adjusted for quick delivery to a specific spot or for gentle diffusion of air throughout the vehicle.

When the interior of the vehicle has cooled to the desired temperature, the FAN knob may be set to obtain the desired volume of air from the air outlets.

The TEMP knob may be rotated to vary the temperature. It may be necessary to experiment with the TEMP knob to determine the positions best suited to various driving conditions.

Generally, an intermediate temperature and high fan speed is comfortable for city driving, and a lower fan speed is comfortable for open road driving.

Operate the engine well above idle speed for more efficient cooling when the vehicle is not in motion.

System Operation

The compressor increases the pressure and temperature of the system refrigerant.

The heated refrigerant vapor then moves to the condenser where it cools by transferring heat to the air passing over the condenser fins.

As the refrigerant cools in the condenser, it condenses into a liquid.

The highly pressurized liquid refrigerant then moves to the receiver/drier.

The receiver/drier is a reservoir that furnishes refrigerant to the expansion valve at all times.

From the receiver/drier, the high-pressure liquid refrigerant moves to the expansion valve.

The expansion valve meters refrigerant into the evaporator where a low pressure is maintained by the inlet (suction) side of the compressor.

As the refrigerant enters the evaporator, it immediately begins to boil by absorbing heat from the air passing over the evaporator core.

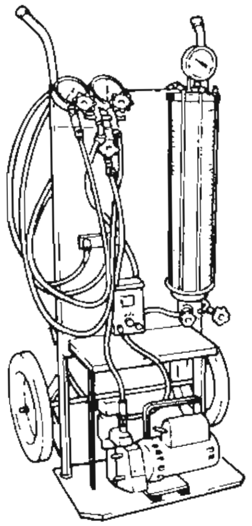
Having given up its heat to boil the refrigerant, the cooled air passes into the passenger compartment of the vehicle.

From the evaporator, the vaporized refrigerant moves back to the compressor to repeat the cycle.

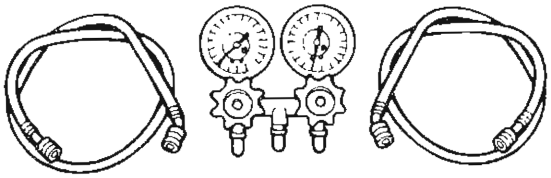
SPECIAL TOOLS

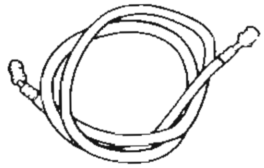
Tool Ref.	Description	Required	Recommended
J-6084	Halide Torch Leak Detector		■
J-23500-01	Portable Service Station		■
J-25359-C	Torx Bit and Socket Wrench Set		■
J-23575	Pressure Gauge and Manifold Assembly		■
J-5453	Goggles		■
J-6105	1/4-inch Ratchet		■
J-6272-02	Multi-Refrigerant Can Opener		■
J-26933	Electronic Leak Detector		■
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		■

SEE
.S.
NOTES

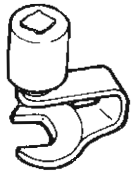


J-23500-01

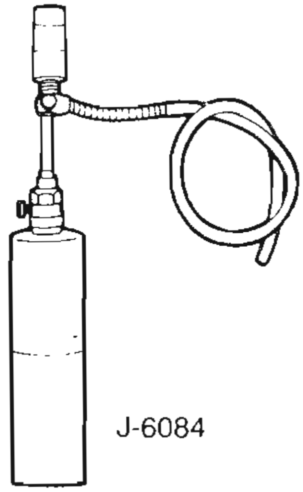




J-23575

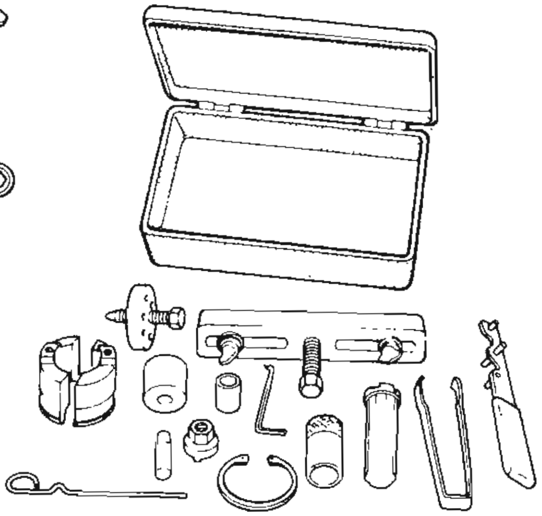


J-29642-10



J-6084

J-6105

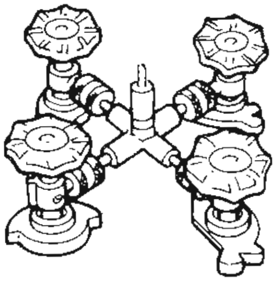


J-29642-A

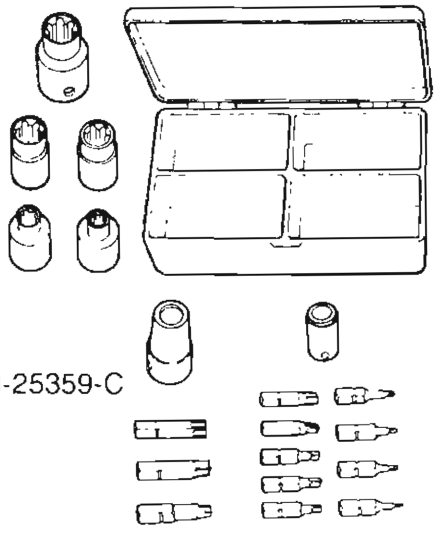
J-5453

J-25498

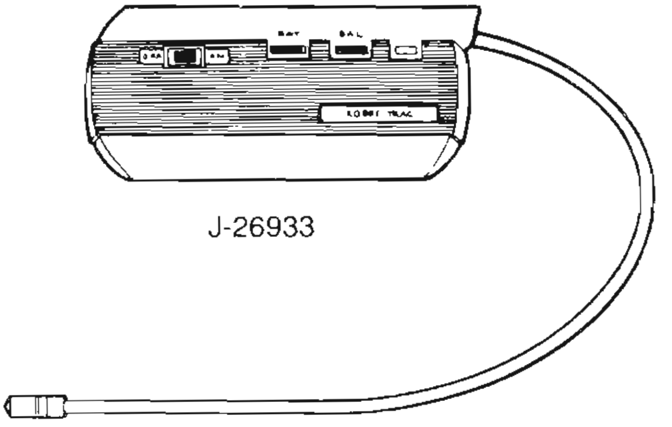
J-25499



J-6272-02



J-25359-C



J-26933

SEE
I.S.
NOTES

840431

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
A/C Service Valve (Rototype)	20 N·m (15 ft-lbs) (Wet Torque)	17-24 N·m (13-17 ft-lbs)
Clutch Retaining Nut	37 N·m (27 ft-lbs)	34-39 N·m (25-30 ft-lbs)
Cylinder Head Cap Screws	33 N·m (24 ft-lbs)	30-34 N·m (22-25 ft-lbs)
Discharge/Inlet (Suction) Hose Fitting	27 N·m (20 ft-lbs)	24-30 N·m (18-22 ft-lbs)
Oil Filler Plug	10 N·m (7 ft-lbs)	8-12 N·m (6-9 ft-lbs)

REFRIGERANT SAFETY PRECAUTIONS

The refrigerant used for automotive air conditioner systems is dichlorodifluoromethane, commonly known as Refrigerant-12 or R-12.

It 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 at all ambient temperatures and pressures.

The vapor is heavier than air, nonflammable and nonexplosive. It is nonpoisonous except when in direct contact with open flame, and is noncorrosive except when combined with water.

Observe the following precautions when involved with R-12.

- R-12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts
- for this reason, extreme care must be taken to prevent any liquid refrigerant 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. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. (R-12 is rapidly absorbed by oil). Next, wash the eyes with a weak solution of boric acid. Call a doctor immediately, even if irritation has ceased after the first aid treatment.

WARNING: Do not heat R-12 above 51.7°C (125°F).

- in most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant to the system

SEE
I.S.
NOTES

- a bucket or large pan of warm water not exceeding 51.7°C (125°F) is all the heat required for this purpose

- do not heat the refrigerant container with a blow torch or any other means that would raise the refrigerant temperature above the maximum allowable temperature

- do not weld, steam clean or heat the system components or refrigerant hoses

CAUTION: Keep the R-12 container upright when charging the system to remove the vapor rather than the liquid.

- when charging the refrigeration system, 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: Always work in a well-ventilated area.

- always maintain good ventilation in the working area

- discharge the refrigerant into the service bay exhaust system or outside the building

- large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation

- although R-12 vapor is normally nonpoisonous, it can be changed into a very poisonous gas if allowed to come in contact with an open flame

- do not discharge large quantities of refrigerant in an area having an open flame

- a poisonous gas is produced when using a halide torch leak detector

- avoid inhaling the fumes from a leak detector

CAUTION: Do not allow liquid refrigerant to touch bright metal.

- refrigerant will tarnish bright metal and chrome surfaces

- avoid splashing refrigerant on any surface

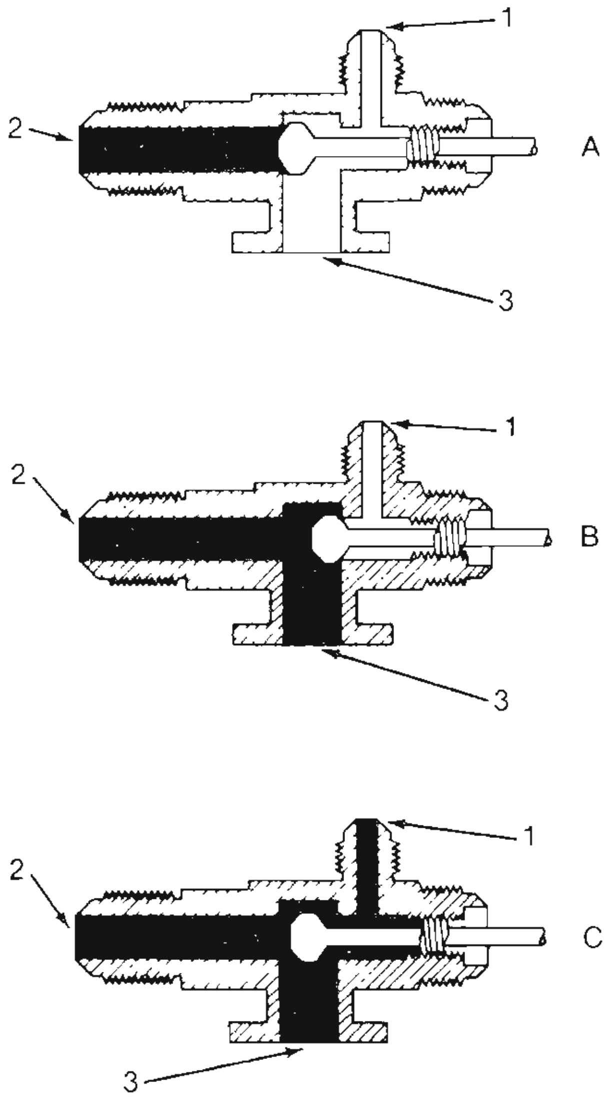
- refrigerant in combination with moisture is very corrosive and can cause extensive damage to all metal surfaces

SERVICE VALVES

The discharge and inlet (suction) service valves are mounted directly on the compressor head.

The valves are used for diagnosis, charging, discharging and evacuating the system, and for isolating the system during component removal and installation.

The service valves are three-position valves. In the normal operating position, the valve stem (A) is turned counterclockwise to the back-seated (full-out) position.



SEE I.S. NOTES

1. To Service Port
2. To Hose
3. To Compressor

85985

When the valve stem (B) is turned clockwise to the front-seated (full-in) position, the the compressor is isolated from the system. This position is used for removing the compressor or for checking the compressor oil level.

When the valve stem (C) is mid-positioned, the gauge port is open. This position is used for charging, discharging, evacuating and checking the system pressure.

Discharge Service Valve Adapters

When it is necessary to connect a service hose to the discharge service valve, one of the adapters listed in the chart is required.

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

83093

PRESSURE GAUGE AND MANIFOLD ASSEMBLY

Connecting a Pressure Gauge and Manifold Assembly

Remove the protective caps from the service valves.

Close both hand valves on the gauge and manifold assembly.

Connect the compound gauge hose to the compressor inlet (suction) service valve (low-side).

Connect the high pressure gauge hose to the discharge service valve (high-side).

Turn both of the service valve stems to mid-position. The gauges will indicate the high and low side pressures respectively.

Purge any air from the high side test hose by opening the high side hand valve on the manifold for three to five seconds (the center connection on the manifold must be open).

Purge any air from the low side test hose by opening the low side hand valve on the manifold for three to five seconds (the center connection on the manifold must be open).

The system may be operated with the gauge manifold assembly connected in the manner described above. The gauges will indicate the respective operating pressures.

SYSTEM PRESSURE CHECK

The pressures developed on the high side and the low side of the compressor indicate whether or not the system is operating properly.

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.

Attach the pressure gauge and the manifold assembly.

Close both hand valves on the gauge and manifold assembly.

Turn both service valve stems to mid-position.

Operate the air conditioner system with the engine at 1500 rpm and the controls set for full cooling.

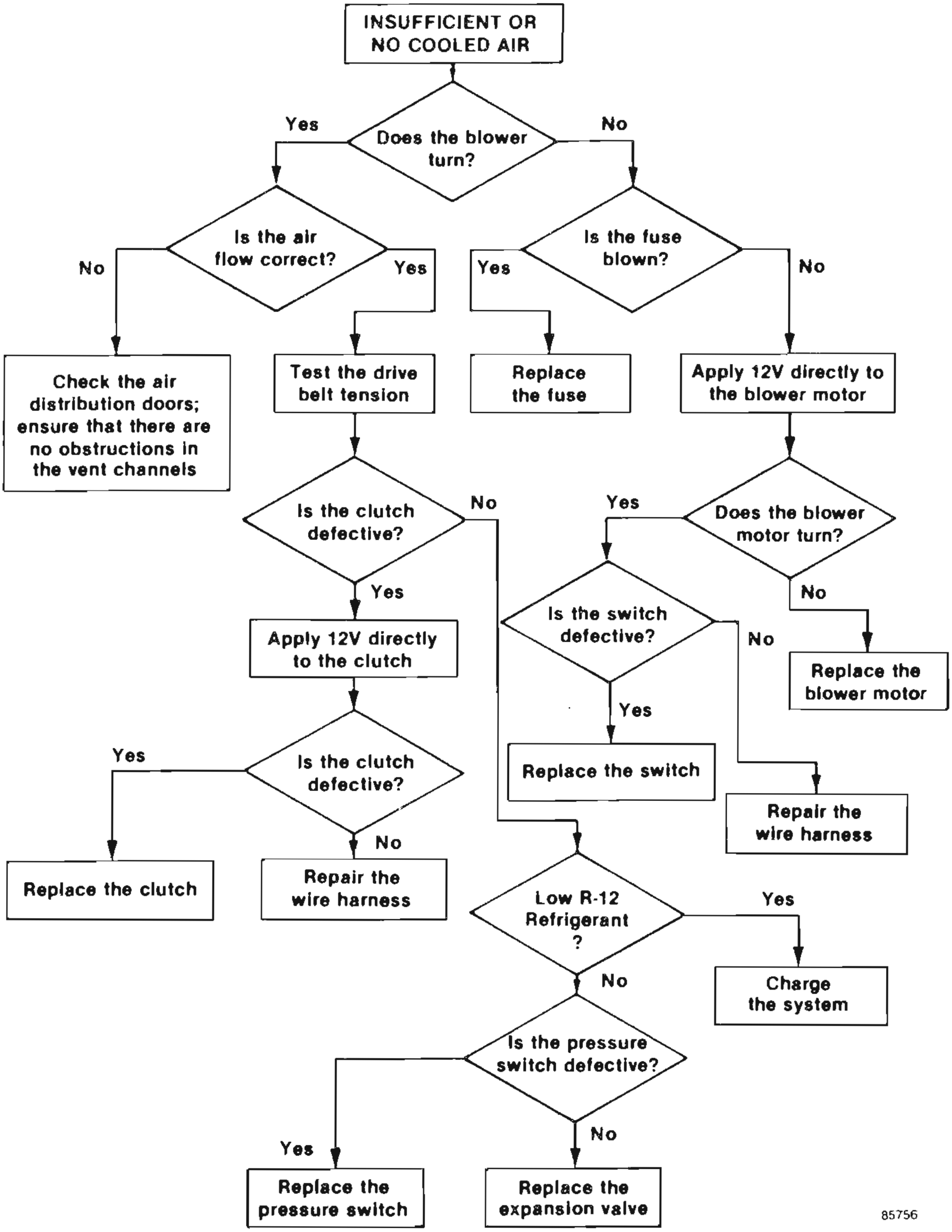
Insert a thermometer into the discharge air outlet and observe the air temperature. The temperature should be approximately 7.1°C (45°F) or less.

Observe the high and low side pressures.

If pressures are abnormal, refer to the Pressure and Performance Diagnosis Charts.

SEE I.S. NOTES

A/C SYSTEM DIAGNOSIS



SEE I.S. NOTES

Pressure Diagnosis

Condition	Possible Cause	Correction
LOW SIDE LOW – HIGH SIDE LOW	(1) System refrigerant is low.	(1) Evacuate, leak test and charge the system.
	(2) Expansion valve is restricted.	(2) Replace the expansion valve.
LOW SIDE HIGH – HIGH SIDE LOW	(1) Internal leak in the compressor – worn.	(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) Cylinder head gasket is leaking.	(2) Install a replacement cylinder head gasket.
	(3) Expansion valve is defective.	(3) Replace the expansion valve.
	(4) Drive belt slipping.	(4) Adjust the belt tension.
LOW SIDE HIGH – HIGH SIDE HIGH	(1) Condenser fins obstructed.	(1) Clean the condenser fins.
	(2) Air in the system.	(2) Evacuate, leak test and charge the system.
	(3) Expansion valve is defective.	(3) Replace the expansion valve.
	(4) Loose or worn fan belts.	(4) Adjust or replace the belts as necessary.
LOW SIDE LOW – HIGH SIDE HIGH	(1) Expansion valve is defective.	(1) Replace the expansion valve.
	(2) Restriction in the refrigerant hose.	(2) Check the hose for kinks – replace if necessary.
	(3) Restriction in the receiver/drier.	(3) Replace the receiver/drier.
	(4) Restriction in the condenser.	(4) Replace the condenser.
LOW SIDE AND HIGH SIDE NORMAL (INADEQUATE COOLING)	(1) Air in the system.	(1) Evacuate, leak test and charge the system.
	(2) Moisture in the system.	(2) Evacuate, leak test and charge the system.

70146

SEE I.S. NOTES

Performance Diagnosis

Condition	Possible Cause	Correction
COMPRESSOR NOISE	(1) Broken valves.	(1) Replace the valve plate.
	(2) Overcharged.	(2) Discharge, evacuate and install the correct charge.
	(3) Incorrect oil level.	(3) Isolate the compressor and check the oil level. Correct as necessary.
	(4) Piston slap.	(4) Replace the compressor.
	(5) Broken rings.	(5) Replace the compressor.
	(6) Drive belt pulley bolts are loose.	(6) Tighten with the correct torque specification.
EXCESSIVE VIBRATION	(1) Incorrect belt tension.	(1) Adjust the belt tension.
	(2) Clutch loose.	(2) Tighten the clutch.
	(3) Overcharged.	(3) Discharge, evacuate and install the correct charge.
	(4) Pulley is misaligned.	(4) Align the pulley.
CONDENSATION DRIPPING IN THE PASSENGER COMPARTMENT	(1) Drain hose plugged or improperly positioned.	(1) Clean the drain hose and check for proper installation.
	(2) Insulation removed or improperly installed.	(2) Replace the insulation on the expansion valve and hoses.
FROZEN EVAPORATOR COIL	(1) Faulty thermostat.	(1) Replace the thermostat.
	(2) Thermostat capillary tube improperly installed.	(2) Install the capillary tube correctly.
	(3) Thermostat not adjusted properly.	(3) Adjust the thermostat.

70147

SEE I.S. NOTES

SYSTEM DISCHARGE

The refrigerant should be discharged from the system before replacing any component in the system except the compressor.

Connect the pressure gauge and manifold assembly to the service valves.

Turn both the manifold hand valves to the maximum counterclockwise (open) position.

CAUTION: Do not allow the refrigerant to rapidly discharge because the oil in the compressor and system will be forced out with it.

Open both of the service valves slightly (from back-seated position) and allow the refrigerant to discharge slowly from the system.

SYSTEM EVACUATION

A system with the refrigerant discharged during repair, or one that is excessively low on refrigerant, must be evacuated with a vacuum pump before replacement refrigerant is installed.

The reason for evacuating a system is to remove air and moisture that may have entered the system.

As the vacuum pump lowers the pressure of a closed air conditioner system, the boiling point of the moisture in the system will also be lowered.

When evacuating a system, it is necessary to lower the boiling point of the moisture in the system to a point lower than the ambient (surrounding) temperature to ensure that all the moisture is vaporized.

With an ambient temperature of 23.9°C (75°F) and a vacuum of 99 kPa (29.5 in. Hg), water will boil at a temperature of approximately 12°C (54°F) and complete vaporization of all moisture in the system is assured.

At elevations higher than sea level, it will not be possible to obtain a vacuum gauge indication of 99 kPa (29.5 in. Hg) on the low side.

For each 300 meters (1000 ft) increase in altitude, the vacuum gauge 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 gauge indication of 96 kPa (28.5 in. Hg) will be equivalent to a gauge indication of 99 kPa (29.5 in. Hg) at sea level.

When this vacuum level is attained, a minimum of 30 minutes should be allowed to evacuate the system and ensure complete moisture removal.

Evacuation With J-26695 Vacuum Pump

The J-26695 Vacuum Pump and motor is a self-contained unit equipped with a carrying handle and stand. The unit must be kept upright at all times to prevent oil from spilling.

Connect Pressure Gauge and Manifold Assembly Tool J-23575 to the compressor.

Discharge the system.

Connect the center service hose to the vacuum pump inlet fitting.

Turn both manifold hand valves to the wide open position.

SEE I.S. NOTES

Start the vacuum pump; note the gauge indications.

Operate the pump for a minimum of 30 minutes after attaining the lowest vacuum indication.

Test the system for leaks:

- close both of the manifold hand valves
- turn off the vacuum pump and note the gauge indication
- the gauge pointer should remain stationary at the vacuum level that was indicated when the pump was stopped
- if the gauge pointer returns to zero rapidly, partially charge the system and locate the leak with a leak detector
- repair the leak and repeat the evacuation procedure

If the gauge pointer remains stationary and vacuum is maintained for three to five minutes, resume the evacuation and continue for a minimum of 30 minutes.

Close both the manifold hand valves and stop the vacuum pump.

Disconnect the center service hose from the vacuum pump. The system is now ready for charging.

Evacuation With J-23500-01 Portable Air Conditioner Service Station

A J-23500-01 Portable Air Conditioner Service Station is a completely portable station equipped with a vacuum pump, metering-charging cylinder, refrigerant supply, gauges, hoses and hand control valves.

The control switch for the vacuum pump is mounted on the front of the charging station. It should be in the OFF position before inserting the plug into the power source.

CAUTION: Ensure that the system is completely depressurized before evacuating. With the system pressurized, refrigerant may enter the vacuum pump and damage it.

Close all the hand valves.

Connect the red charging hose (1) to the discharge service valve port on the compressor.

Connect the blue charging hose (2) to the inlet (suction) service valve port on the compressor.

Discharge the system and leave the inlet (suction) and discharge service valves in the mid-position.

Connect the vacuum pump hose to the vacuum pump inlet.

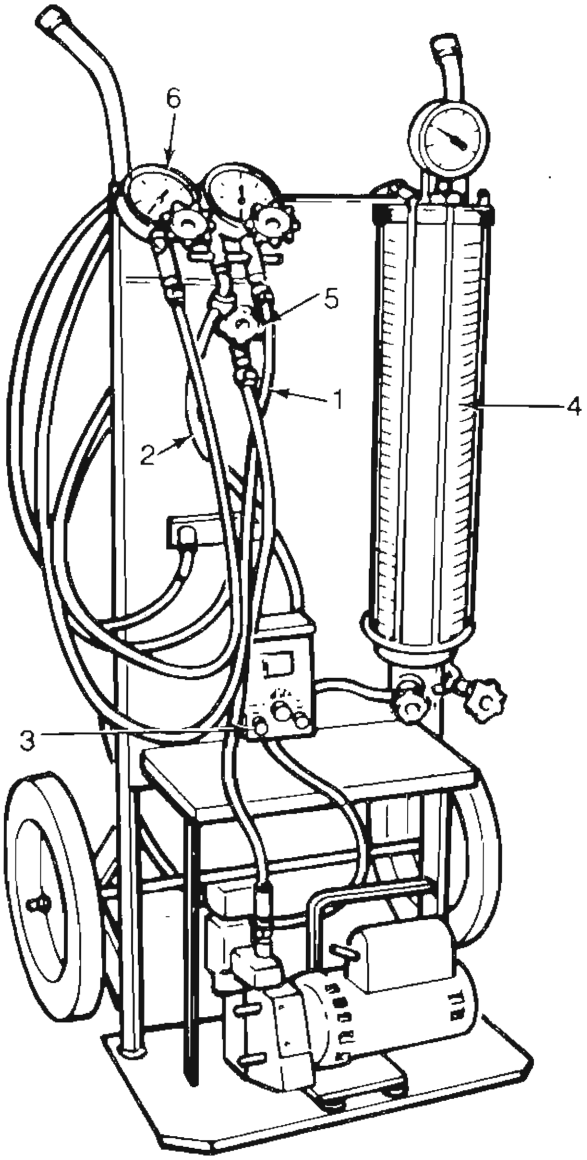
Open the low pressure hand control valve and high pressure hand control valves on the charging station.

Start the vacuum pump (3) and open the vacuum control valve; note the gauge indication.

Operate the pump for a minimum of 30 minutes after attaining the lowest vacuum level.

Fill the charging cylinder (4) while the system is evacuating.

Close the vacuum control valve (5) and stop the vacuum pump. Observe the blue gauge (6) to determine if a leak exists. If a leak does not exist, the system is now ready for charging.

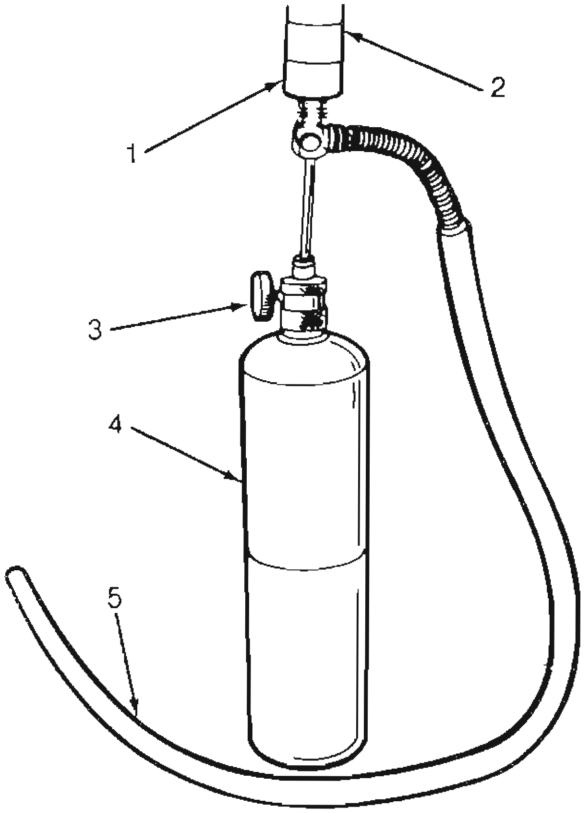


840439

LEAK TESTS

Halide Torch Leak Detection

External leaks can be detected and isolated with Halide Torch Tool J-6084.



1. Reactor Plate
2. Stove
3. Gas Control Knob
4. Gas Cylinder
5. Search Hose

84441

The torch burns propane fuel and is equipped with a search hose.

When air is drawn into the hose by the torch, it contacts a heated copper reactor ring in the torch.

If refrigerant is present in the air, the normally light blue flame will change to green or a purplish-blue color.

Leak Test Procedure

Open the torch valve and ignite the torch. Adjust the flame just 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 refrigerant.

Move the search hose slowly under all connections, joints and seals.

Because refrigerant is heavier than air, leaks may be more readily detected on the lower side of the areas being tested.

Watch for a flame color change. This will indicate the area of a leak.

WARNING: When R-12 refrigerant contacts an open flame, phosgene gas is produced. Never inhale the vapor emitted from the Halide Torch because it is poisonous.

Repair the leak(s) as required.

Evacuate the system after all the leaks are corrected.

Charge the system.

SEE I.S. NOTES

Electronic Leak Detection

External leaks can also be detected and isolated with Electronic Leak Detector Tool J-26933.

This leak detector is an electronic instrument designed to detect R-12 refrigerant leaks as small as one-half ounce per year.

The 45.7-cm (18-in) flexible probe provides accessibility to otherwise inaccessible areas.

Follow the manufacturer's calibration instructions (included with the unit) to prepare the electronic leak detector for proper operation.

NOTE: The Electronic Leak Detector Tool J-26933 will not expose the user to phosgene gas vapor or fumes.

Leak Test Procedure

Remove the flexible probe from its case.

Activate the tester OFF/ON switch.

Place the flexible probe tip near the leak port and adjust the BAT thumbwheel a few teeth until the light illuminates and then goes out when the tip is removed from the leak port.

Move the flexible probe slowly under all suspected leaks from connections, joints and seals.

Because R-12 refrigerant is heavier than air, leaks may be detected more readily on the lower side of areas being checked.

When a leak is detected, its presence will be indicated by the illuminated white indicator light.

NOTE: If the probe tip is held too long near the leak, the white indicator light will go out.

Repair the leaks, as required.

Evacuate the system after all the leaks are corrected.

Charge the system.

FLUSHING

Procedure

Install the compressor (if removed) and connect the service valves and hoses.

NOTE: The system must be in a discharged state.

Close all control valves of Portable Air Conditioning Service Station J-23500-01 and connect red high pressure hose to the compressor discharge service valve.

WARNING: Wear goggles to protect the eyes.

Open the refrigerant drum valve.

Bleed the charging cylinder with the valve located on the back of the control panel directly above the cylinder.

When 0.9 kg (2 lbs) of refrigerant is in the charging cylinder, close the bleed valve.

Close the refrigerant drum valve.

Disconnect the receiver/drier from the condenser.

Place a shop towel on the condenser outlet to absorb the oil that will be forced from the system.

Center the compressor discharge valve.

Fully open the high pressure valve on the control panel and allow the liquid 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 high pressure valve on the control panel.

Check the compressor oil level.

A replacement receiver/drier should be installed and the system evacuated before charging.

SEE I.S. NOTES

SYSTEM CHARGE

Charge Capacity

The recommended charge is 0.9 kg (2 lbs) of R-12 refrigerant.

NOTE: Replacement of a hose, receiver/drier, condenser, expansion valve or evaporator core requires the addition of 28 grams (one ounce) of AMC Compressor Oil (8132400), or equivalent, to the system.

Charging With Multi-Refrigerant Can Opener Tool J-6272-02

The following charging procedure is based on the use of Pressure Gauge and Manifold Assembly J-23575 and Multi-Refrigerant Can Opener J-6272-02.

WARNING: Wear goggles to protect your eyes.

Connect Pressure Gauge and Manifold Assembly J-23575 and evacuate the system. Keep both the service valves in mid-position.

Close both gauge hand valves.

Disconnect the service hose from the vacuum pump and connect it to the center of Multi-Refrigerant Can Opener J-6272-02. Close the four petcock valves on the dispenser.

Attach the necessary number of refrigerant cans to the opener. Refer to Charge Capacity for the proper weight of the refrigerant necessary to fully charge the system.

Open one petcock valve. Loosen the center service hose at the pressure gauge and manifold assembly to allow the refrigerant to purge air from the hose. Tighten the service hose connection and close the petcock valve.

Open the suction gauge hand valve and one petcock valve. Do not open the discharge (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 place the air conditioner control levers in the maximum cooling positions. The compressor will operate and help charge the inlet (suction) side of the system.

NOTE: The refrigerant cans may be placed upright in warm water with a maximum temperature of 51.7°C (125°F) to speed up the charging process.

When the first refrigerant can is empty, open another petcock valve to continue charging the system.

Continue charging until the specified amount of refrigerant is in the system.

The frost line on the refrigerant can will indicate what portion of the refrigerant in the can has entered the system.

This may be used as a guide when a system requires a fraction of a full can.

NOTE: If an accurate scale is available, weigh the refrigerant cans before and during the charging procedure to ensure that the correct amount of refrigerant is being used.

When the system is fully charged, close the suction gauge hand valve and all the petcock valves.

Operate the system five to ten minutes to allow it to normalize and to determine if the system will cycle properly.

Charging With Portable Air Conditioner Service Station J-23500-01

NOTE: Fill the charging cylinder.

Ensure that the refrigerant drum is inverted and the valve is open.

Open the right hand valve at the base of the charging cylinder and fill with the required amount of refrigerant to charge the system.

Liquid refrigerant will be observed rising in the charging cylinder sight glass.

Slightly open the valve at the top of the cylinder when the pressure in the charging cylinder equals the pressure in the supply tank.

This relieves the head pressure and allows the refrigerant to continue filling the cylinder.

Observe the pressure gauge at the top of the cylinder and rotate the plastic shroud until the pressure heading column corresponds with the gauge pressure in line with the sight glass.

NOTE: If the pressure gauge at the top of the cylinder indicates, for example, 483 kPa (70 psi), locate the column with the pressure heading of 483 (70) and rotate the shroud so the 483 (70) column aligns with the sight glass.

When the refrigerant reaches the correct level in the sight glass, close both the right hand valve at the base of the cylinder and the refrigerant drum valve.

Ensure that the top cylinder valve is fully closed.

NOTE: If bubbles appear in the sight glass, tilt the charging station back momentarily.

Connect the heating element cord to the power pack heating element receptacle and turn the heater switch ON.

SE
I.S.
N
O
T
E
S

Allow the refrigerant to heat (building up pressure proportionately) for about 10 minutes while the vacuum pump is operating.

WARNING: Wear goggles to protect your 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.

Allow the required charge of refrigerant to enter the high side of the system.

When a full charge has entered 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 the system operation.

CAUTION: Observe the gauges with the high and low pressure valves on the charging station closed. The low pressure gauge could be damaged if both the high and low pressure valves of the manifold are opened. The high pressure developed in the discharge side (high side) of the compressor would peg the low pressure gauge pointer and damage the gauge.

Close all the valves on the charging station and close the refrigerant drum valve when all the operations are completed.

Upon completion of the operational check, back-seat the inlet (suction) and discharge service valves to their normal operating position by turning them fully counterclockwise.

Disconnect the high and low pressure charging hoses from the compressor with care.

A small amount of refrigerant remaining in the hoses will escape.

Position the charging hoses on the charging station hose holder to keep air and dirt out of them.

Open the valve at the top of the cylinder to remove the remaining refrigerant.

NOTE: The charging cylinder is not designed to store refrigerant.

Replace the quick seal caps on the compressor service valves when service is completed.

CONTROL PANEL

Fan Switch

The fan switch may be serviced by removing the access plate located on the lower evaporator core housing below the control panel.

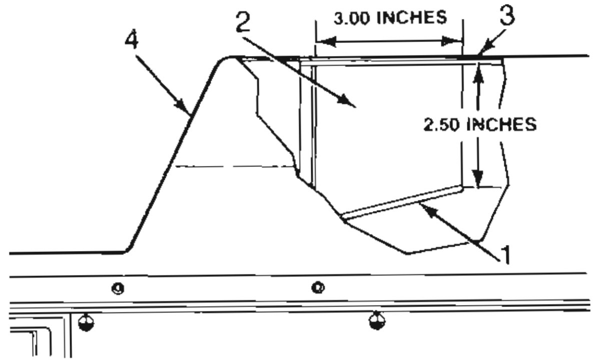
TEMPERATURE CONTROL THERMOSTAT

To service the temperature control thermostat, the evaporator core housing must be disassembled.

SEE I.S. NOTES

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.



1. Capillary Tube – Insert into Coil a Minimum of 5.1 cm (2 in)
2. Evaporator Coil
3. Insulation
4. Upper Part of Case

41094

CONDENSER

Removal

Discharge the refrigerant from the system. Refer to the discharge procedure.

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 because serious burns from hot coolant can result.

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 open connections to prevent entry of dirt and moisture.

From the underside of the vehicle, disconnect the receiver/drier-to-evaporator hose fitting from the receiver/drier.

Remove the condenser and receiver/drier as an assembly.

Remove the receiver/drier from the condenser, if necessary.

Installation

If removed, attach the receiver/drier to the condenser.

Place the condenser in position and connect the receiver/drier-to-evaporator hose fitting to the receiver/drier.

Install the condenser attaching screws.

Connect the pressure pipe fitting to the condenser.

Install the radiator and fan shroud.

SEE
I.S.
N
O
T
E
S

Fill the cooling system.

Evacuate, charge and leak test the system. Refer to the procedures.

SIGHT GLASS

A sight glass (1) is located in the receiver/drier-to-evaporator hose at the receiver/drier end.

The sight glass provides a visual check of the system refrigerant level.

A continuous stream of bubbles will appear in the sight glass if the system is not properly charged.

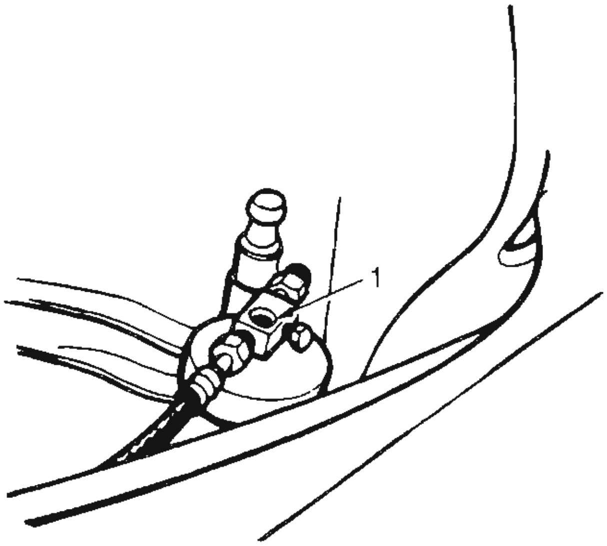
Properly charged and completely discharged systems will appear similar in the sight glass because of the lack of bubbles.

To distinguish between the two situations, cycle the compressor clutch off and on with the engine operating at 1500 rpm.

During the time the clutch is off, bubbles will appear if there is refrigerant in the system and will disappear when the clutch is on.

If no bubbles appear when the clutch is cycled off, there is no refrigerant in the system because some bubbles would appear if the system was fully charged.

If the system is discharged, it will be necessary to perform a leak test, repair as required, evacuate and charge the system.



81078(J)

RECEIVER/DRIER

Removal

Discharge the refrigerant from the system according to the discharge procedure.

NOTE: Discharge the system slowly to prevent loss of compressor oil.

Disconnect the evaporator and condenser hose fittings from the receiver/drier.

Remove the attaching screws from the bracket and remove the receiver/drier.

Installation

Attach the receiver/drier to the bracket.

Connect the evaporator and condenser hose fittings to the receiver/drier.

Evacuate, charge and leak test the system. Refer to the procedures.

EVAPORATOR HOUSING

Removal

NOTE: It is not necessary to discharge the system to service the blower motor. The evaporator housing may be lowered from the instrument panel to gain access to the blower motor attaching screws.

Discharge the system. Refer to the procedure.

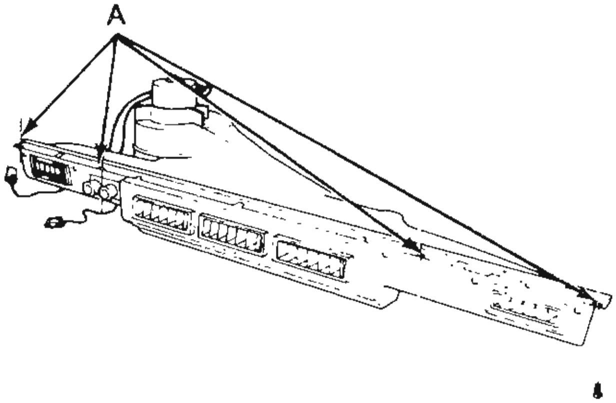
NOTE: Discharge the system slowly to prevent loss of compressor oil.

Disconnect the inlet (suction) hose fitting from the compressor.

Disconnect the receiver/drier-to-evaporator hose fitting.

Remove the hose clamps and dash grommet retaining screws.

Remove the evaporator housing-to-instrument panel attaching screws (A) and the evaporator housing-to-mounting bracket screw.

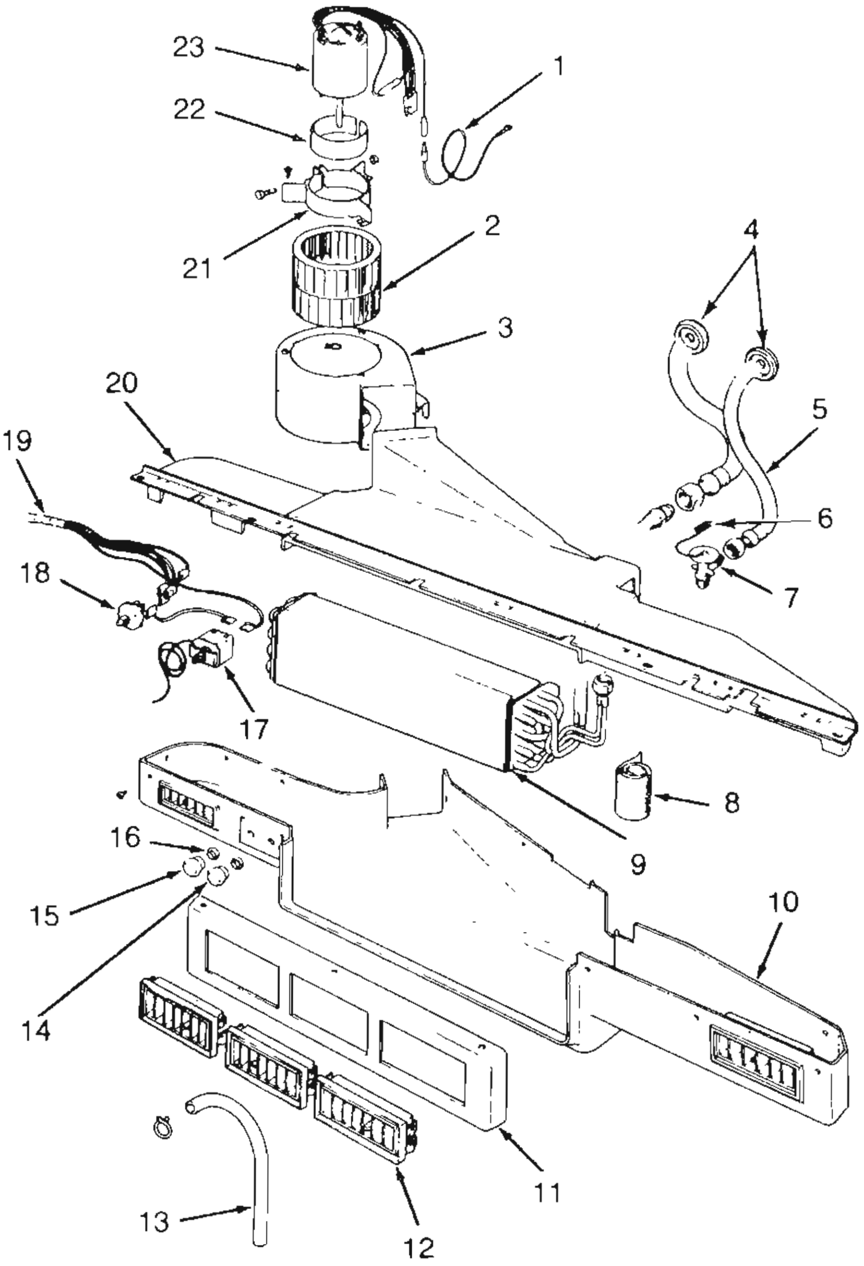


70529

Lower the evaporator housing and pull the hoses and grommet through the opening.

The blower motor, blower motor housing, and evaporator core can be serviced after the evaporator housing is removed.

SEE
I.S.
NOTES



1. Wire
2. Blower Fan
3. Blower Housing
4. Grommet
5. Hose
6. Capillary Tube
7. Expansion Valve
8. Insulation
9. Evaporator Core
10. Lower Housing
11. Panel
12. Louver
13. Drain Tube
14. Temperature Control Knob
15. Fan Control Knob
16. Nut
17. Thermostat
18. Switch
19. Harness
20. Upper Housing
21. Bracket
22. Insulation
23. Blower Motor

70530

SEE I.S. NOTES

Installation

Push the hoses through the grommet opening, install the grommet by pushing it toward the engine compartment and fasten it to the dash panel with the two attaching screws.

Raise the evaporator housing, install the evaporator housing-to-instrument panel attaching screws and the evaporator housing-to-mounting bracket screw.

Install the hose clamps and grommet attaching screws.

Connect the receiver/drier-to-evaporator hose fitting.

Connect the inlet (suction) hose fitting to the compressor.

Evacuate, charge and leak test the system. Refer to the procedures.

EXPANSION VALVE

Replacement

The expansion valve is preset and should not be adjusted. A defective valve requires replacement.

Discharge the system. Refer to the discharge procedure.

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 inlet (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.

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: Ensure that the capillary tube is clamped tight and has a 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. Refer to the procedures.

MAGNETIC CLUTCH

The magnetic clutch consists of a stationary electromagnetic coil and a rotating pulley and plate assembly.

The electromagnetic coil is retained on the compressor with a snap ring and is slotted to maintain its position.

The pulley and plate assembly are mounted on the compressor shaft.

When the compressor is not in operation, 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.

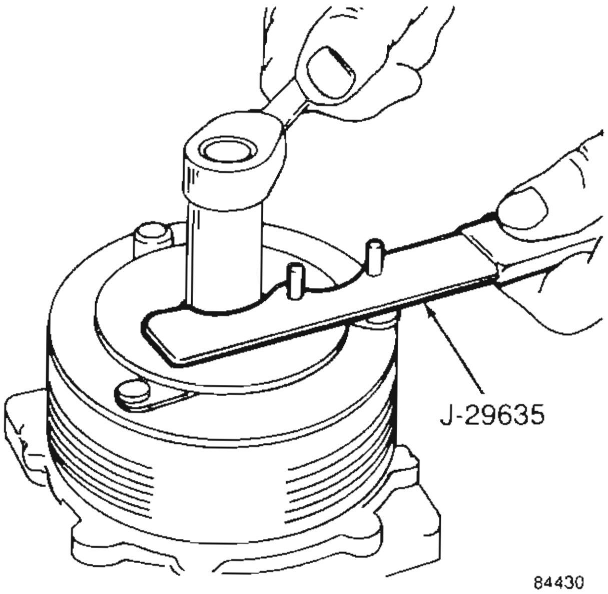
Noise Diagnosis

When a magnetic clutch assembly is suspected of being the source of unusual noises, follow the diagnosis sequence listed in the A/C System Troubleshooting chart.

SEE I.S. NOTES

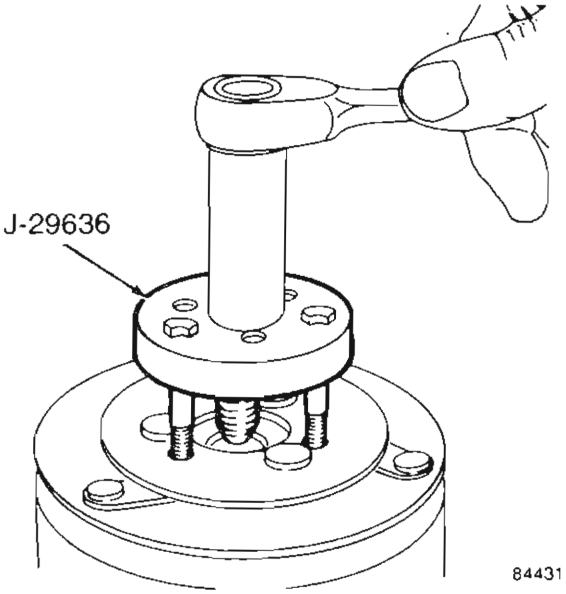
Removal

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.

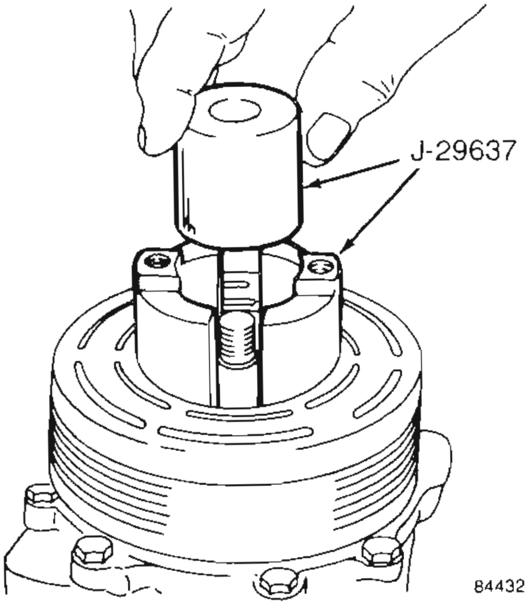
Remove the clutch plate using Clutch Plate Puller J-29636 and remove the key from the shaft.



Remove the internal bearing snap ring.

Remove the external front snap ring.

Remove the rotor pulley assembly using Rotor Pulley Puller J-29637.



Insert the lip of the jaws into the internal bearing snap ring groove.

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 then remove the electromagnetic coil.

Installation

Install the electromagnetic coil.

NOTE: The coil flange protrusion must align with the hole in the front housing to prevent coil movement and correctly locate the wire.

CAUTION: Do not clamp the compressor in a vise with the jaw on the compressor body.

Support the compressor by four mounting ears on the rear of the compressor.

Align the rotor assembly squarely on the front housing hub. Use a suitable driver to drive the rotor assembly onto the shaft.

Install the internal bearing snap ring and then the external bearing snap ring.

NOTE: All snap rings have a straight 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.

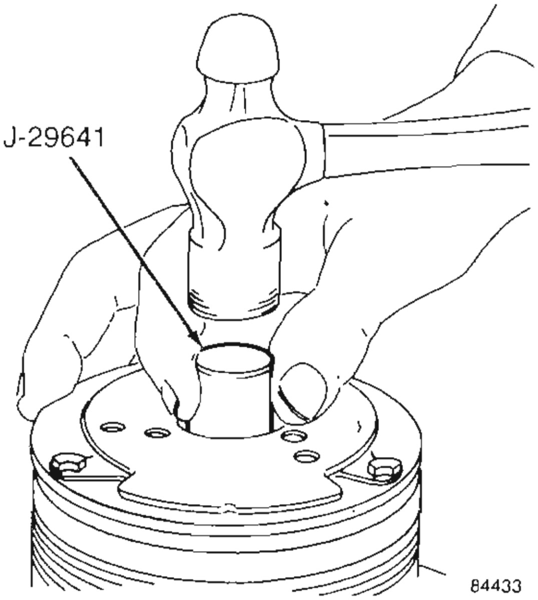
Install the front plate assembly using the original clutch shims on the compressor shaft.

Install the compressor shaft key.

Align the front plate keyway with the compressor shaft key and use Clutch Face Installer J-29641 to tap the front plate onto the shaft until it contacts the clutch shims.

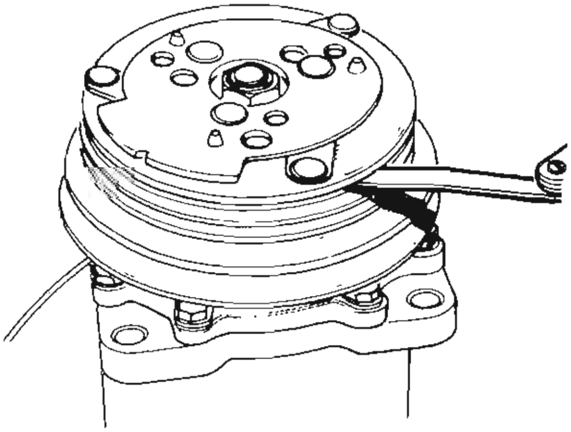
SEE
I.S.
NOTES

NOTE: When installing the front plate, a distinct change in the sound will be heard when the front plate contacts the shims.



Install the hex nut and tighten with 37 N·m (27 ft-lbs) torque.

Check the air gap around the perimeter of the clutch plate and pulley with a feeler gauge.



The air gap should consistently be 0.41-0.79 mm (0.016-0.031 in).

If the air gap varies, pry up lightly at minimum variations and tap down at maximum variations.

If the air gap is not as specified, remove the hex nut and front plate and add or subtract shims as necessary.

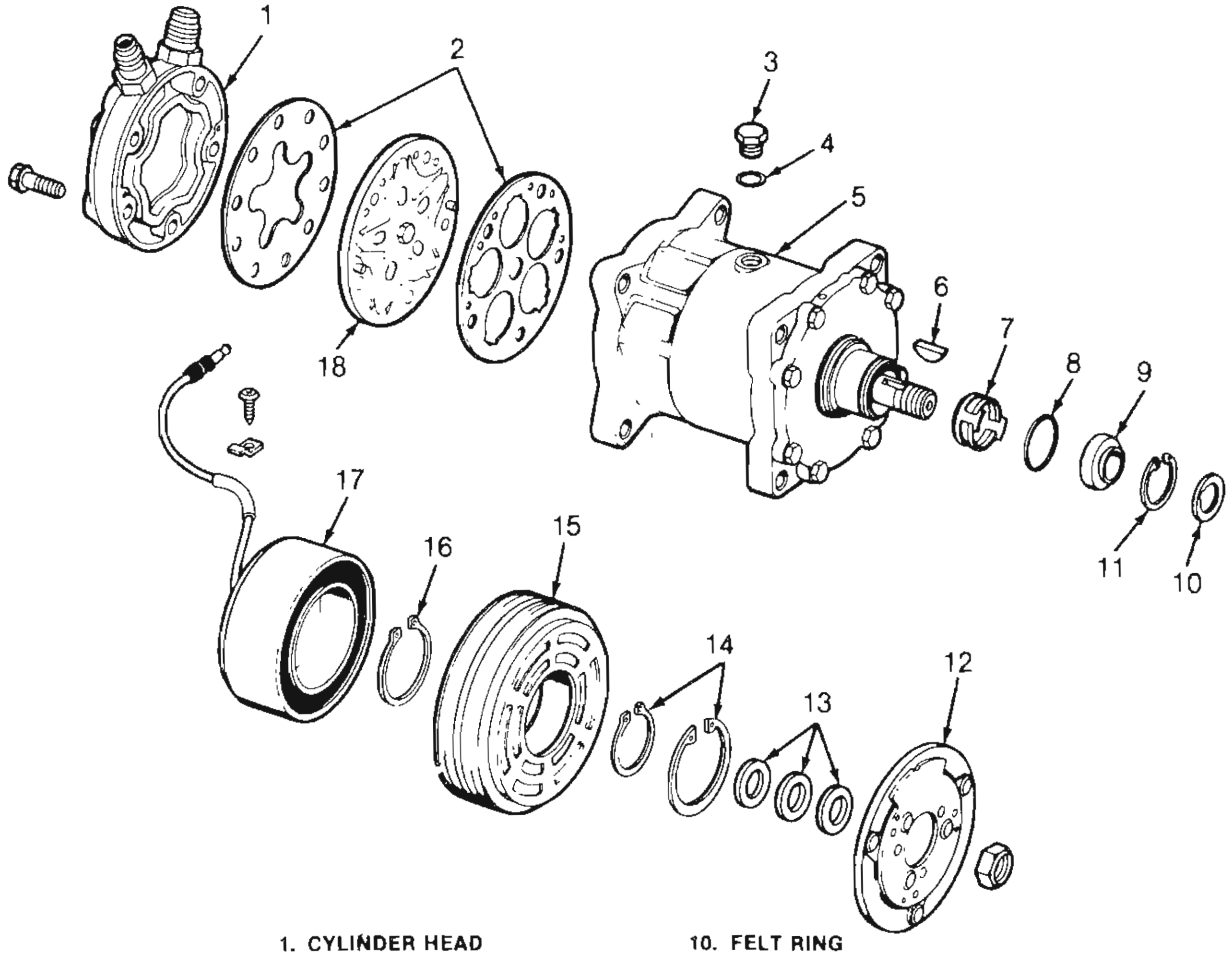
NOTE: The air gap is determined by the spacer shims. When assembling existing or replacement clutch components try the original shims first. When installing a replacement clutch on a replacement compressor, use a 1.02-, 0.51- and 0.13-mm (0.040-, 0.020- and 0.005-in) shim.

COMPRESSOR

The compressor used with all six-cylinder engines is a five-cylinder rotary unit.

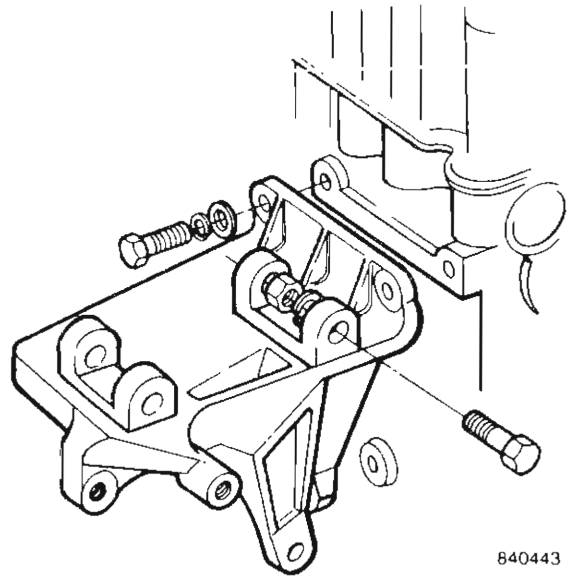
SEE I.S. NOTES

Components and Mounting



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

86912



Service Valve Leak Diagnosis

The compressor should be at operating temperature to achieve an accurate test.

Install Pressure Gauge and Manifold Assembly J-23575.

Front-seat the inlet (suction) and discharge service valves by turning them clockwise.

Discharge the refrigerant remaining in the compressor by opening the inlet (suction) service valve slowly.

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.

SEE I.S. NOTES

Start the engine and operate the compressor. Pressure will build up rapidly. Stop the engine/compressor at 1 035-1 380 kPa (150-200 psi).

NOTE: The pressure should be maintained if the discharge valve is operating properly. A loss of pressure indicates a leaking compressor discharge valve or 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 eliminate the need for recharging when performing compressor service.

Connect Pressure Gauge and Manifold Assembly J-23575.

Close both gauge hand valves and 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 conditioner system.

Turn the inlet (suction) service valve slowly clockwise toward the front-seated position.

When the pressure is reduced to zero or less, stop the engine and compressor and quickly finish front-seating the inlet (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.

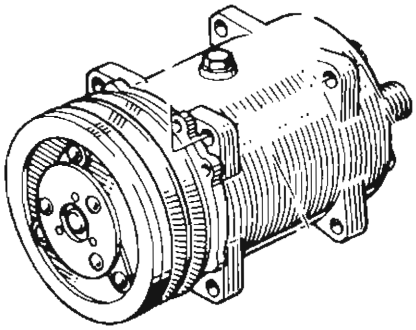
The service valves can be removed from the compressor.

When installing or removing service valves from a compressor, Tool J-29642-11 must be used to loosen or tighten the connecting fitting.

Compressor Removal

Disconnect the battery negative cable.

Isolate the compressor according to the isolation procedure previously described.



80139

Remove the discharge and inlet (suction) hoses from the compressor. Plug or tape all the hose fitting openings.

Remove the drive belt(s) by loosening the idler pulley (or alternator for engines equipped with a serpentine drive).

Remove the bolts and remove the compressor from the mounting bracket.

NOTE: If the compressor is being replaced. remove the magnetic clutch.

Compressor Installation

NOTE: If a replacement compressor is being installed: check the oil, add oil if necessary and install the magnetic clutch on the compressor.

Install the compressor on the mounting bracket.

Install the drive belt(s).

Tighten the drive belt(s) to the specified tension. Refer to Chapter B – Engines.

Remove all tape or plugs from the hoses and connect the discharge and inlet (suction) hoses.

Connect the battery negative cable.

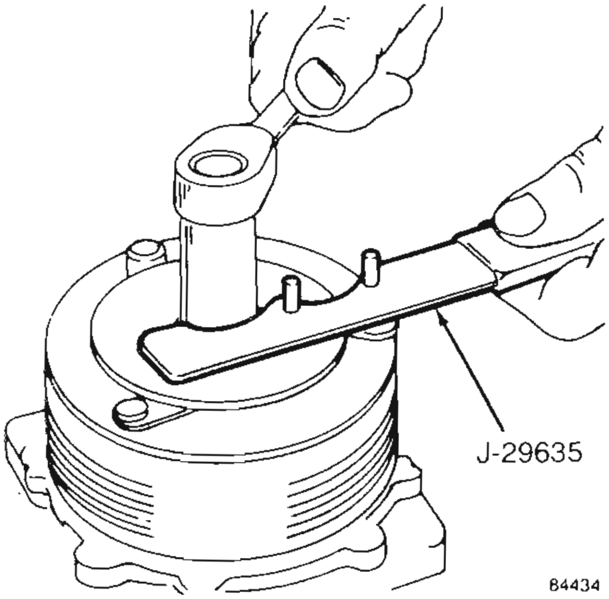
Evacuate, charge and test the system for leaks.

If equipped, reset the clock to the correct time.

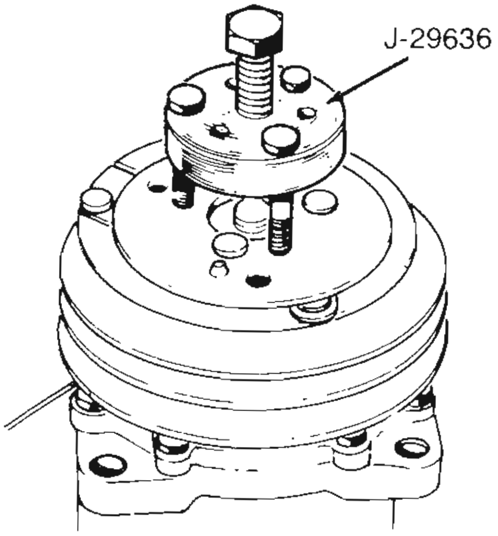
Front Seal Replacement

Remove the compressor. Refer to the removal procedure.

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 nut.



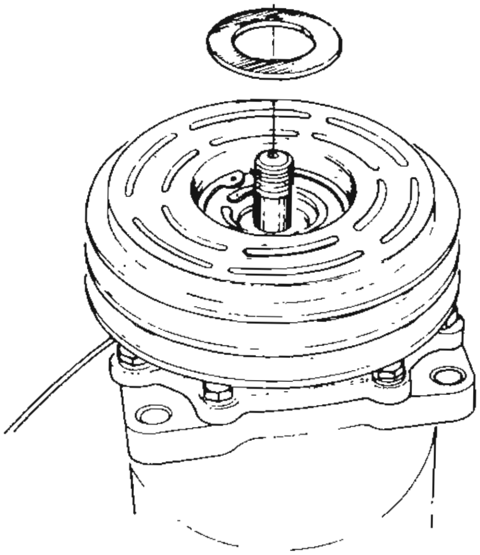
Remove the clutch plate using Puller J-29636 and remove the key from the shaft.



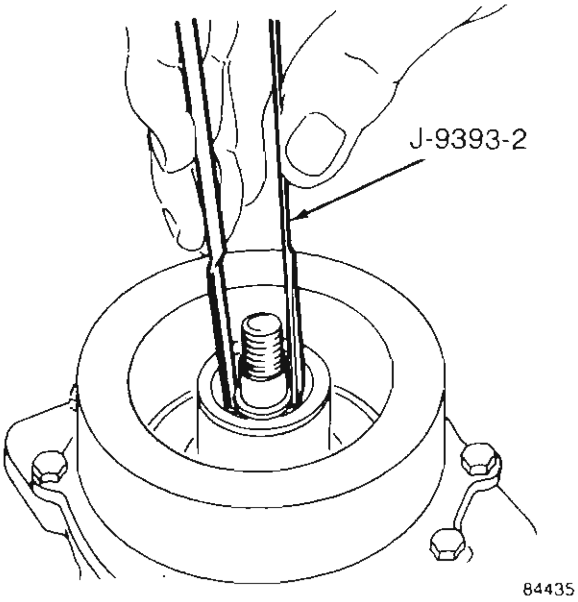
Insert snap ring pliers into the two holes in the felt ring metal retainer and lift out the felt ring.

Remove the clutch shims. Use O-Ring Hook J-9553-01 and a small screwdriver to prevent the shim from binding on the shaft.

Remove the shaft seal seat retaining snap ring with pliers.

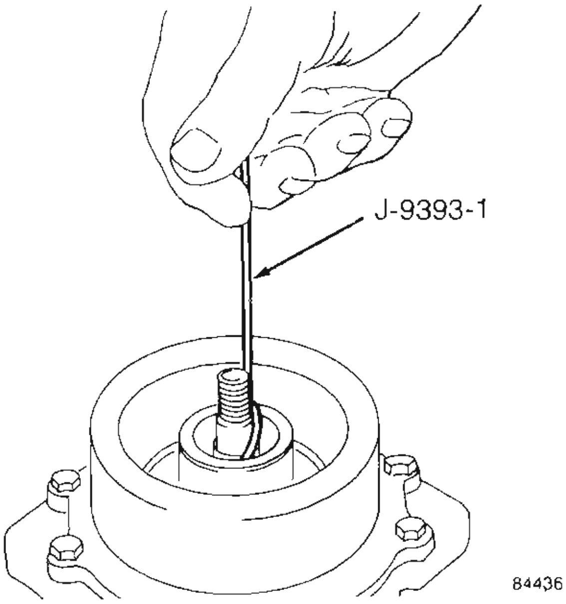


Remove the shaft seal seat using Seal Retainer Tongs J-9393-2.

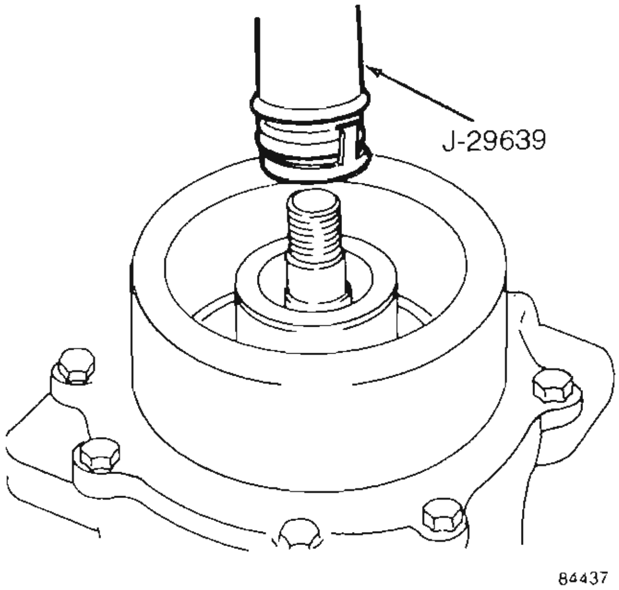


CAUTION: When removing the shaft seal O-ring, do not scratch the O-ring groove with the O-ring hook.

Use O-Ring Hook J-9553-01 to remove the shaft seal O-ring.



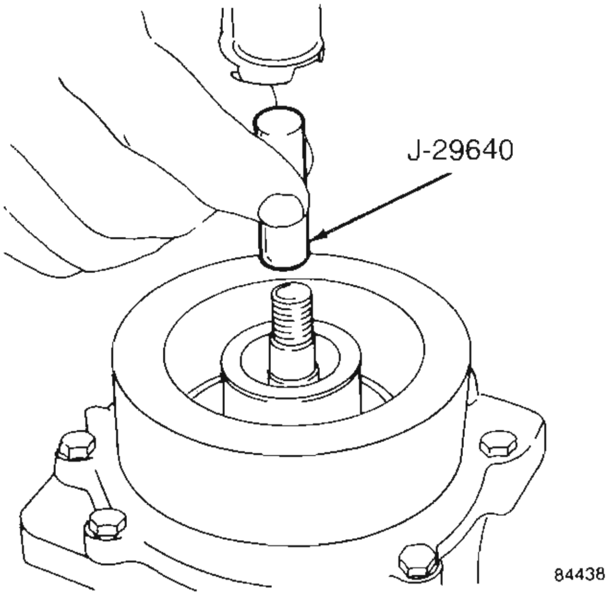
Insert Seal Installation and Removal Tool J-29639 into the seal bore. Press down against the seal spring. Twist the tool until it engages in the slots in the seal cage. Lift the seal out.



Clean the seal cavity thoroughly with a lint-free or synthetic cloth and clean compressor oil. Then blow out with clean dry air.

NOTE: Ensure that all foreign material is removed from the seal bore prior to seal installation.

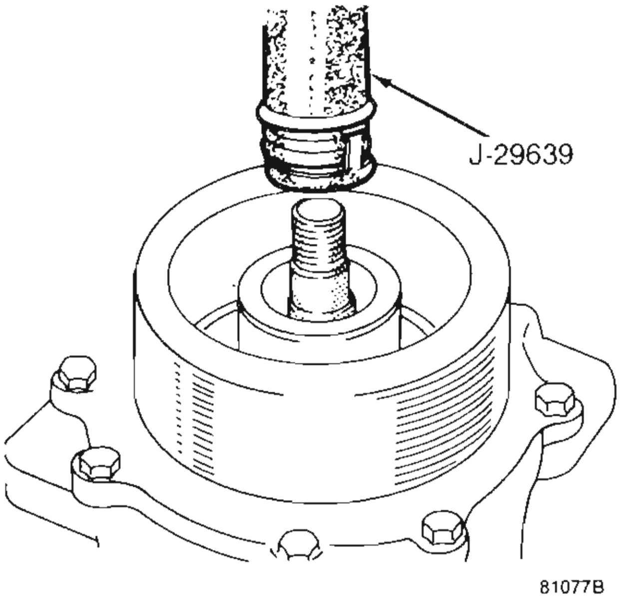
Insert Seal Sleeve Protector J-29640 over the compressor shaft.



CAUTION: Do not touch the replacement seal lapping surfaces.

Dip the mating surfaces of the seal lapping surfaces in clean compressor oil.

Engage the slots of Seal Removal and Installation Tool J-29639 in the slots in the seal cage and insert the seal assembly firmly into place in the compressor seal cavity.

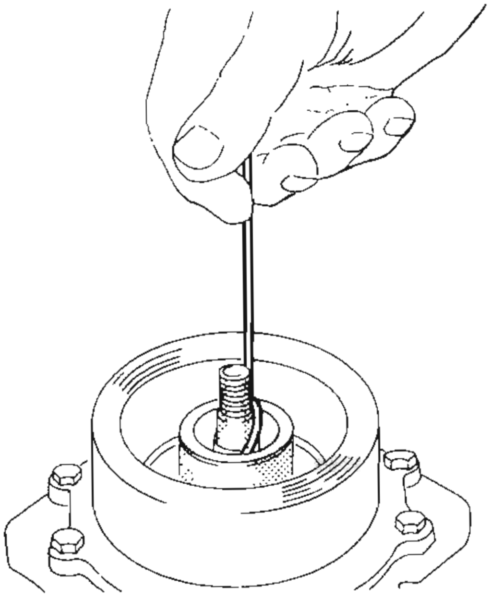


Twist the tool in the opposite direction to disengage the tool from the seal cage.

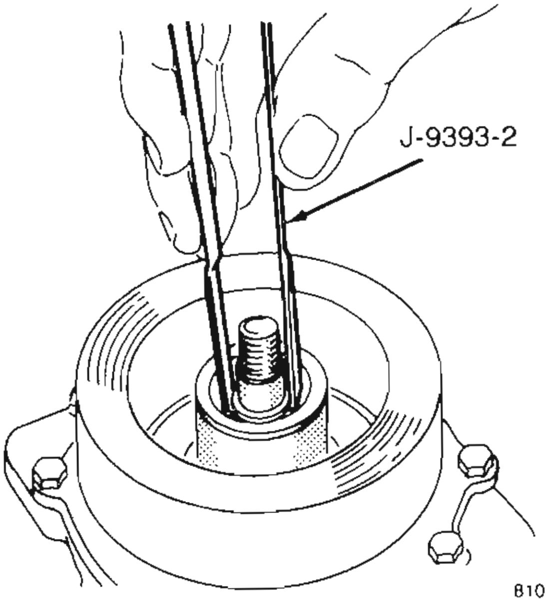
CAUTION: When installing the shaft seal O-ring, do not scratch the O-ring groove with the O-ring hook.

SEE I.S. NOTES

Coat the O-ring with clean compressor oil and carefully place it in the seal groove with O-Ring Hook J-9553-01.



Coat the seal retainer with clean compressor oil and install it with Seal 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).

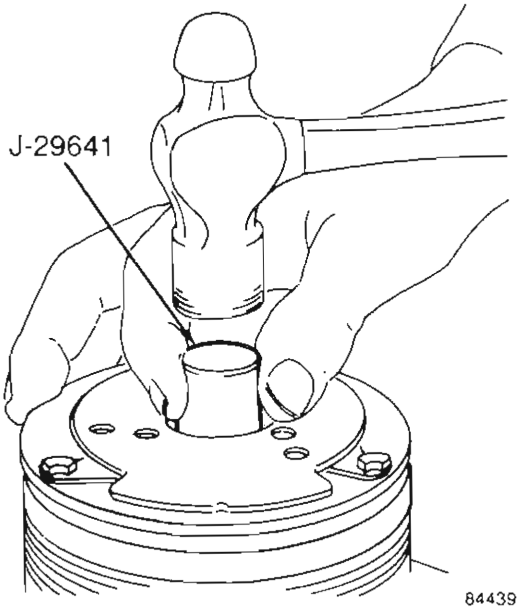
NOTE: It may be necessary to lightly tap the snap ring to seat it in its groove.

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.

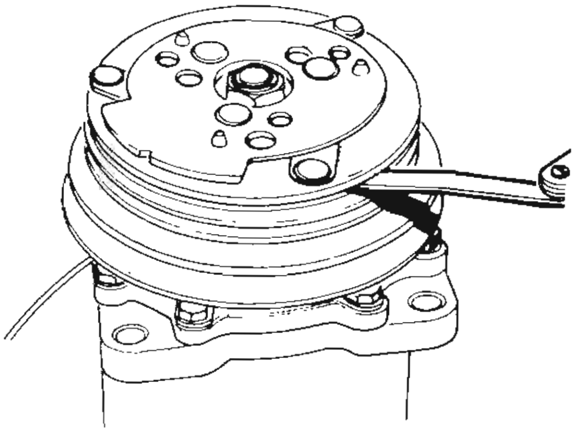
Use Clutch Face Installation Tool J-29641 to tap the front plate on the shaft until it contacts the clutch shims.



Install the shaft nut and tighten with 34-41 N·m (25-30 ft-lbs) torque.

SEE I.S. NOTES

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).



86923

If the air gap is not consistent around the perimeter of the plate, pry up lightly at the areas of minimum variation and tap down lightly at the areas of maximum variation.

If the air gap is not between 0.41 and 0.79 mm (0.016 and 0.031 in), add or subtract shims as necessary.

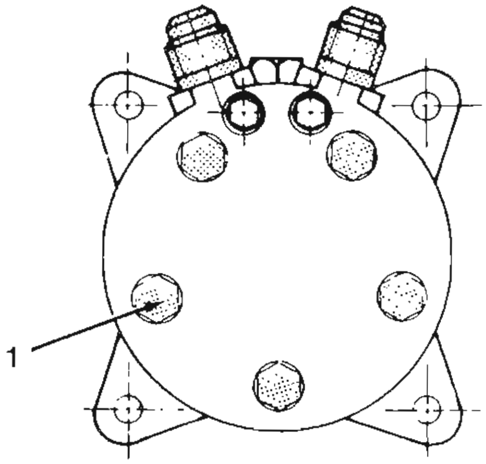
NOTE: The air gap is controlled by the shim thickness. When installing a replacement or a previously installed clutch assembly, try the original shims first. When installing a replacement clutch on a replacement compressor (that previously did not have a clutch), use 1.02-, 0.51- and 0.13-mm (0.040-, 0.020- and 0.005-in) shims.

SEE I.S. NOTES

Cylinder Head, Valve Plate and Gasket

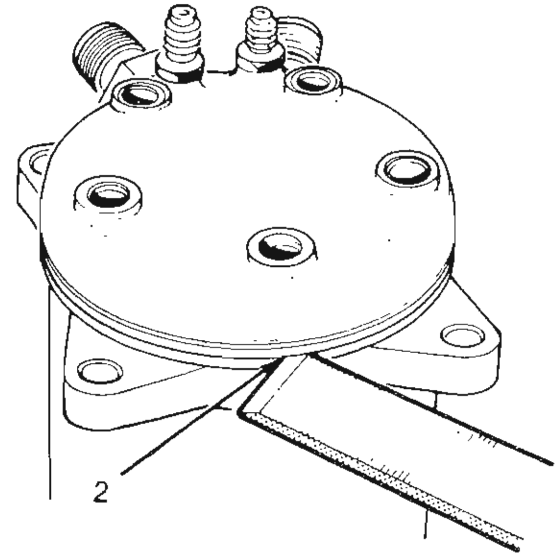
Removal

Remove all the cylinder head capscrews (1) from the cylinder head.



87025

Use a small hammer and gasket scraper (2) to tap the outer edge of the cylinder head until it is separated from the valve plate. Inspect for damage.

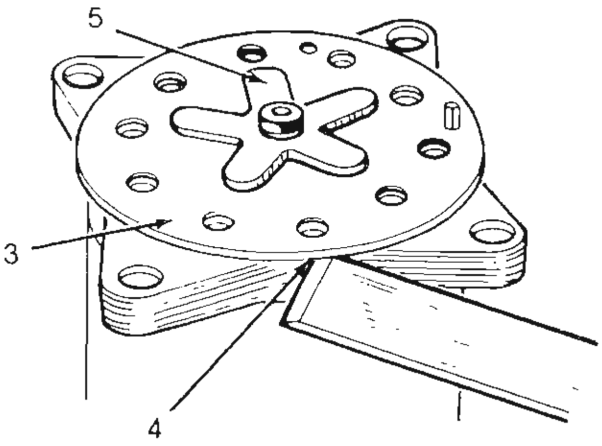


86927

NOTE: The cylinder head gasket normally remains with the valve plate.

Position the gasket scraper between the outside edge of the valve plate (3) and cylinder block (4) and lightly tap the valve plate until it becomes loose.

NOTE: Do not remove the valve (5) from the valve plate.



86926

Inspect the reed valves and the discharge retainer. Replace any damaged portion.

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 retained and installed, carefully remove the gasket material with a gasket scraper.

Inspect the cylinder head for fitting and thread damage. Replace the cylinder head if damaged.

Inspect the service ports on the back of the cylinder head. Remove the valve core with a valve core tool to inspect.

Remove the service port to inspect the O-ring; if damaged, replace the O-ring.

Installation

Coat the valve plate gasket with clean compressor oil.

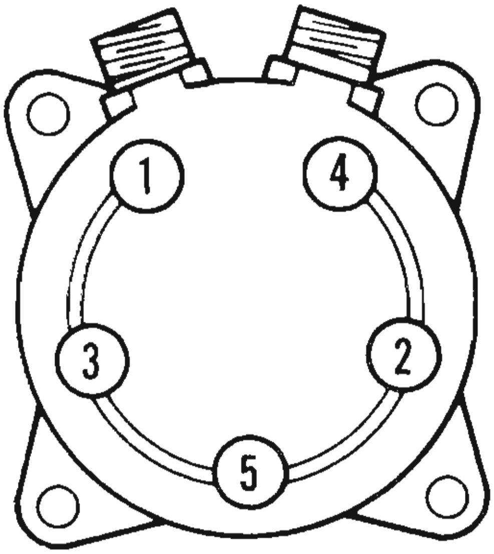
Install the valve plate gasket.

NOTE: Align the valve plate gasket with the locating pin holes and the oil orifice in the cylinder block.

Install the cylinder head with the fittings pointing up or in line with the oil filler plug.

Insert the cylinder head capscrews and tighten finger-tight.

Follow the tightening sequence and tighten the cylinder head bolts with 33 N·m (24 ft-lbs) torque.



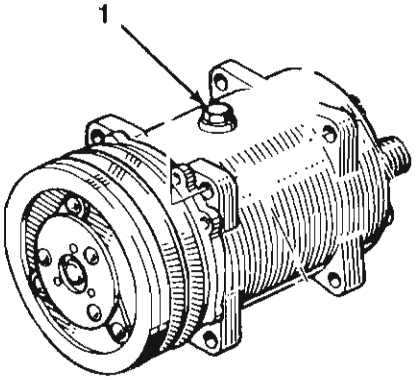
84440

Checking The Oil Level

When there has been an obvious loss of compressor oil or a component has been replaced (including the compressor), the oil must be checked in the compressor after the repair has been made.

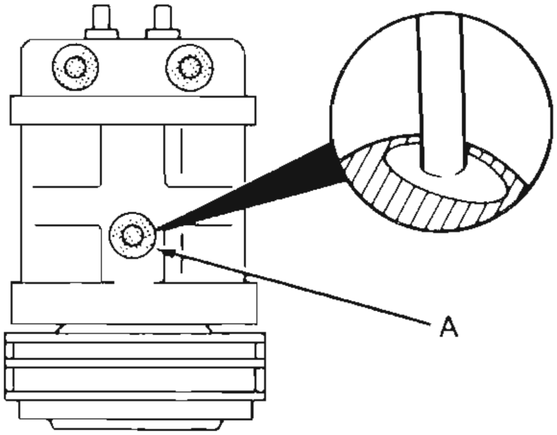
Check the oil level according to the following procedure:

- remove the oil filler plug (1)



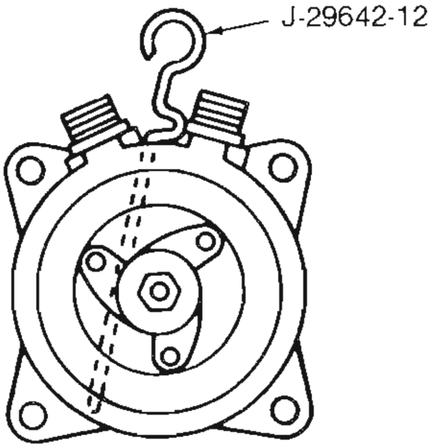
80139

- 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



81203C

- insert Dipstick J-29642-12 into the oil filler plug hole to the right of the piston connecting rod until the dipstick stop contacts the compressor housing



84429

- remove the dipstick and count the number of increments covered with oil

- when properly filled, the compressor should contain between four and six increments of oil

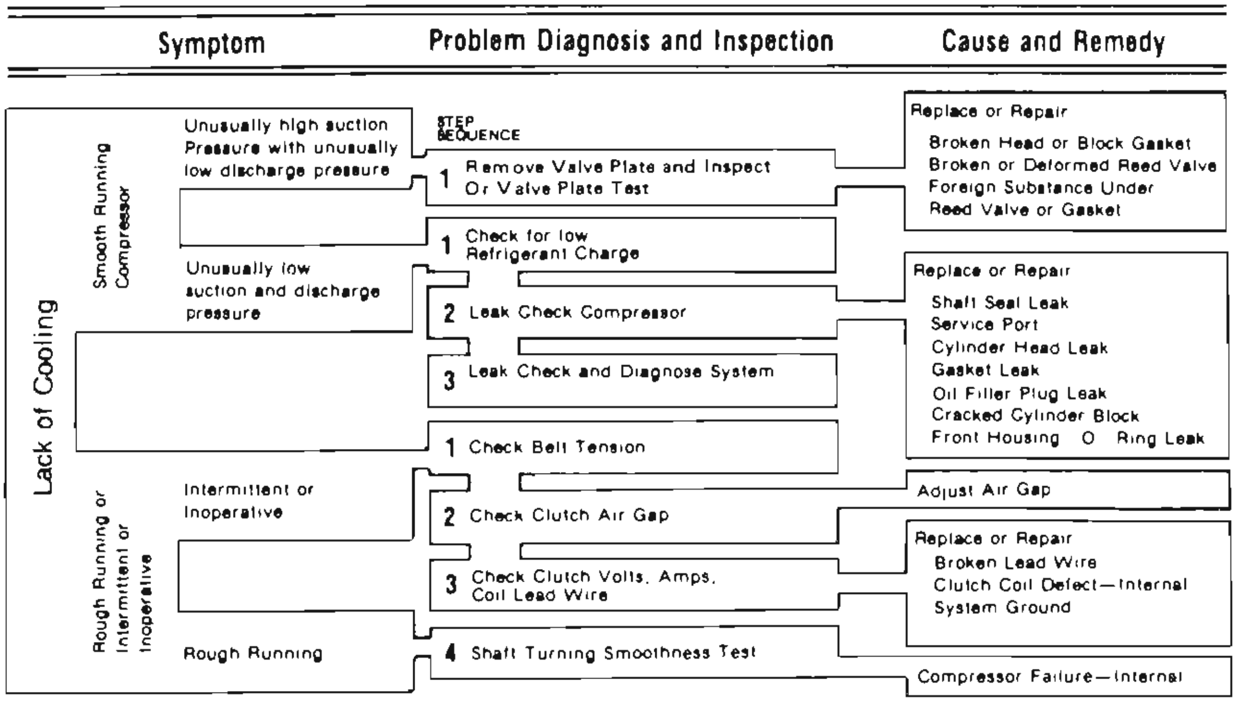
CAUTION: The compressor rotates at very high speed. Satisfactory operation is dependent on sufficient lubrication. However, excess oil will hinder the cooling efficiency.

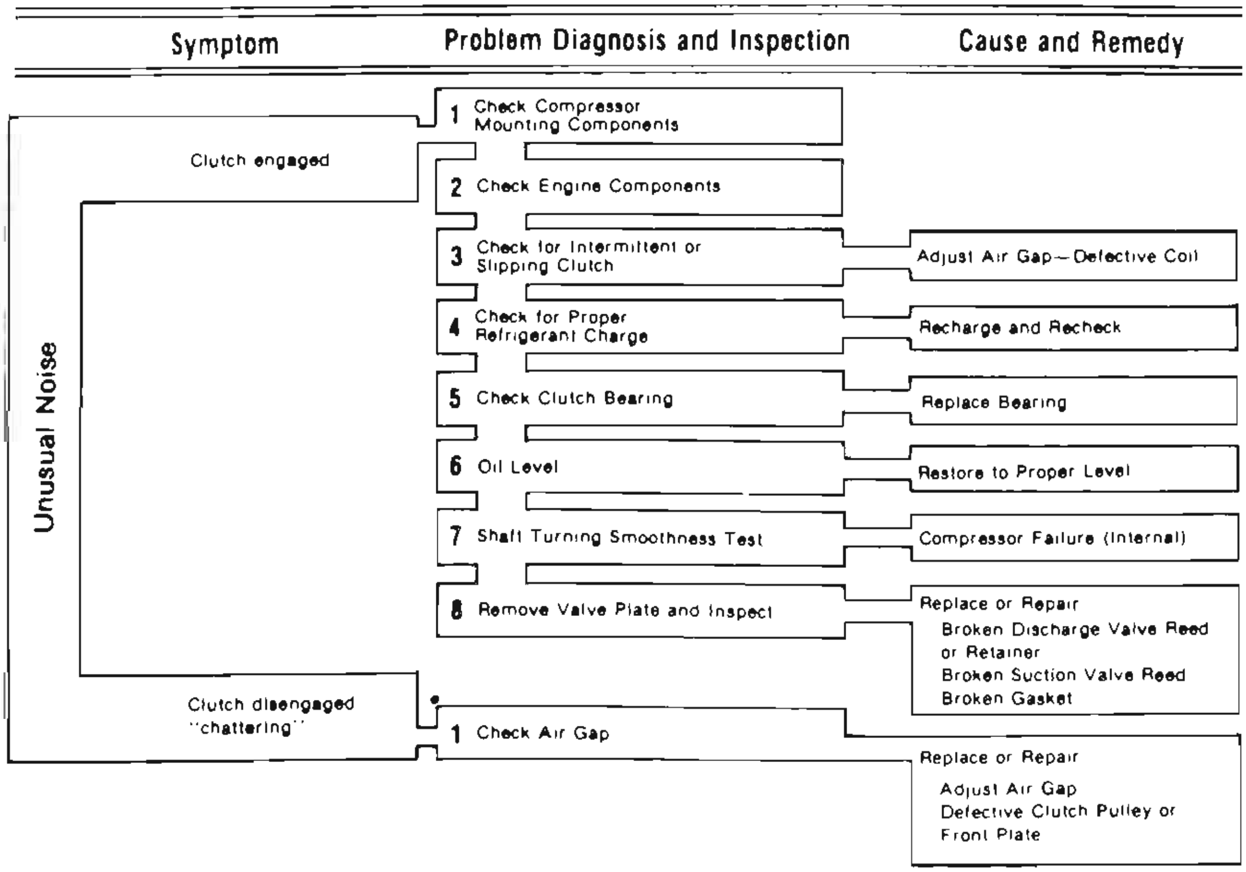
- correct the oil level as necessary

- install the oil filler plug

TROUBLESHOOTING CHART

During diagnosis follow the procedures in the sequence shown until a defect is found. Then perform the repair in the Cause and Remedy Section. If this repair does not fully solve the problem, proceed to the next Inspection Step.





84442

EE
.S.
NOTES

ACCESSORIES

CONTENTS

SEE
I.S.
NOTES

CJ MODELS (OPTIONAL ON SCRAMBLER)

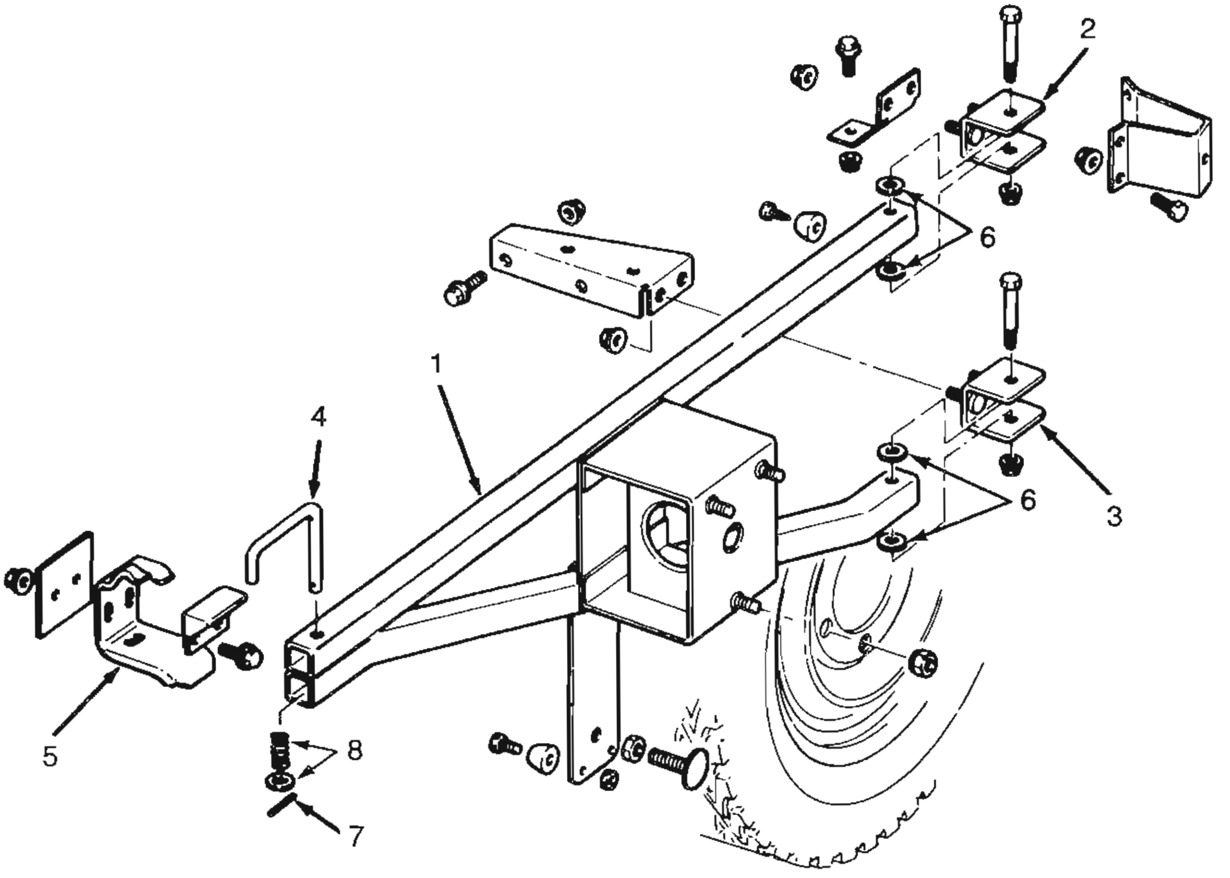
Removal

Remove the spare tire from the carrier (1).

Remove the hinge pin nuts and bolts from the upper and lower hinges at (2) and (3).

Unlatch the handle (4) from the latch bracket (5) and remove the carrier and hinge spacer washers (6).

Remove the pin (7) attaching the latch handle to the carrier and remove the handle and the spring and washer (8).



840951

SEE I.S. NOTES

Installation

Position the spring, washer and handle in the carrier and install the attaching pin.

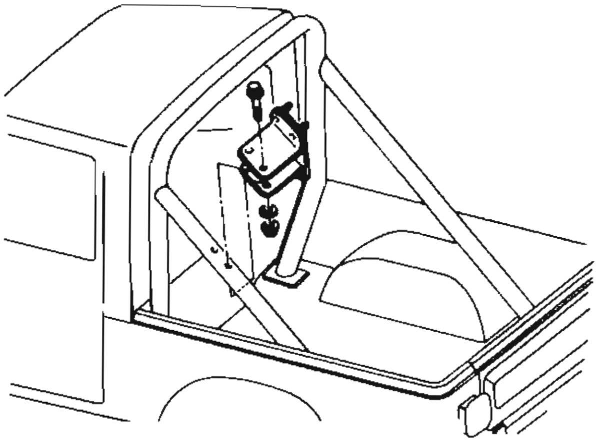
Position the hinge spacer washers and carrier in the upper and lower hinges and the latch handle in the latch bracket.

Install the hinge pin bolts and nuts in the upper and lower hinges.

Install the spare tire on the carrier.

SCRAMBLER MODELS

Scrambler Models utilize a standard equipment tire carrier that is attached to the roll bar. When a service operation necessitates, remove the nuts, washers and bolts and remove the tire mount.



840952

SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-25070	Heat Gun		■
J-25359-C	Torx Bit Tool		■

CJ MODELS

Removal

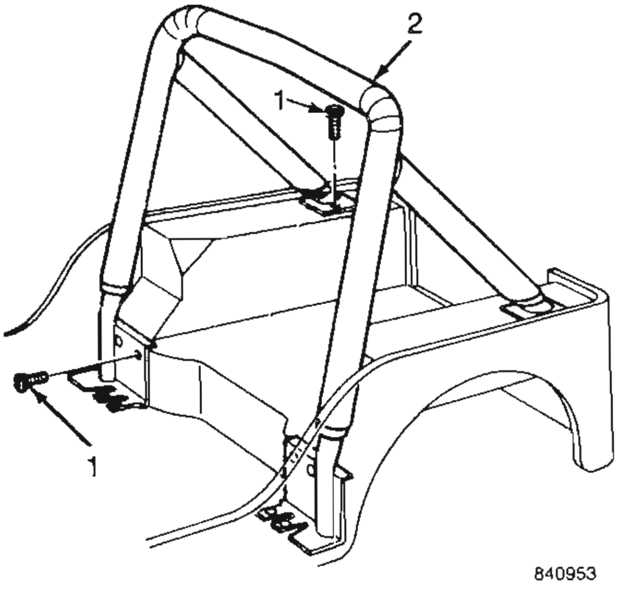
Remove the left front seat assembly.

Remove the hardtop or fold the soft top back, if equipped.

Tilt the right front seat to the forward position.

Remove the necessary carpeting, if equipped.

Remove the screws (1) attaching the roll bar (2) to the body using Torx Bit Tool J-25359-C.



Heat the area around the mounting brackets (to soften the sealer) with Heat Gun J-25070 and remove the roll bar assembly.

Installation

Position the roll bar on the body and align the screw holes with the body.

Install the screws attaching the roll bar to the body using Torx Bit Tool J-25359-C.

NOTE: Do not tighten the attaching screws until the roll bar is completely installed and properly aligned.

Align the roll bar assembly and tighten all attaching hardware using Torx Bit Tool J-25359-C.

Install the left front seat assembly.

Install the carpeting, if removed.

Install the hardtop or soft top, if equipped.

SEE I.S. NOTES

SCRAMBLER MODELS

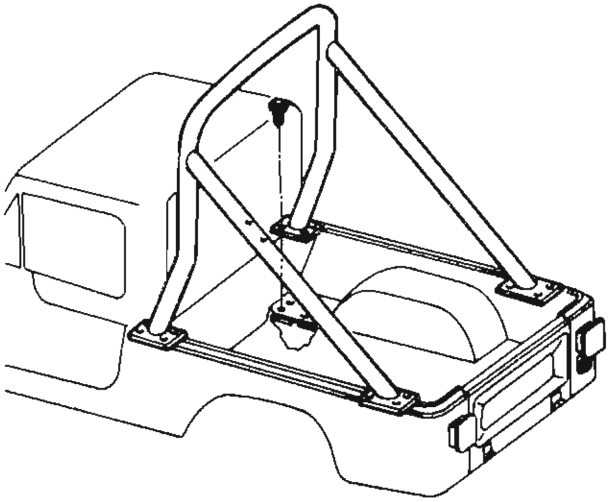
Removal

Remove the spare tire from the roll bar, if equipped.

Remove the wooden side rails from both sides of the cargo box, if equipped.

Remove the roll bar attaching screws.

Remove the roll bar from the vehicle using a chain hoist or with the aid of a helper.



840954

NOTE: If the roll bar is being replaced, it is necessary to transfer the spare tire mount to the replacement roll bar.

Installation

Position and install the roll bar in the cargo box. Use a chain hoist or a helper to raise and install the roll bar.

Install and tighten the roll bar attaching screws with 34 N·m (25 ft-lbs) torque.

Install the wooden side rails, if equipped.

Install the spare tire on the roll bar, if equipped.

SEE I.S. NOTES

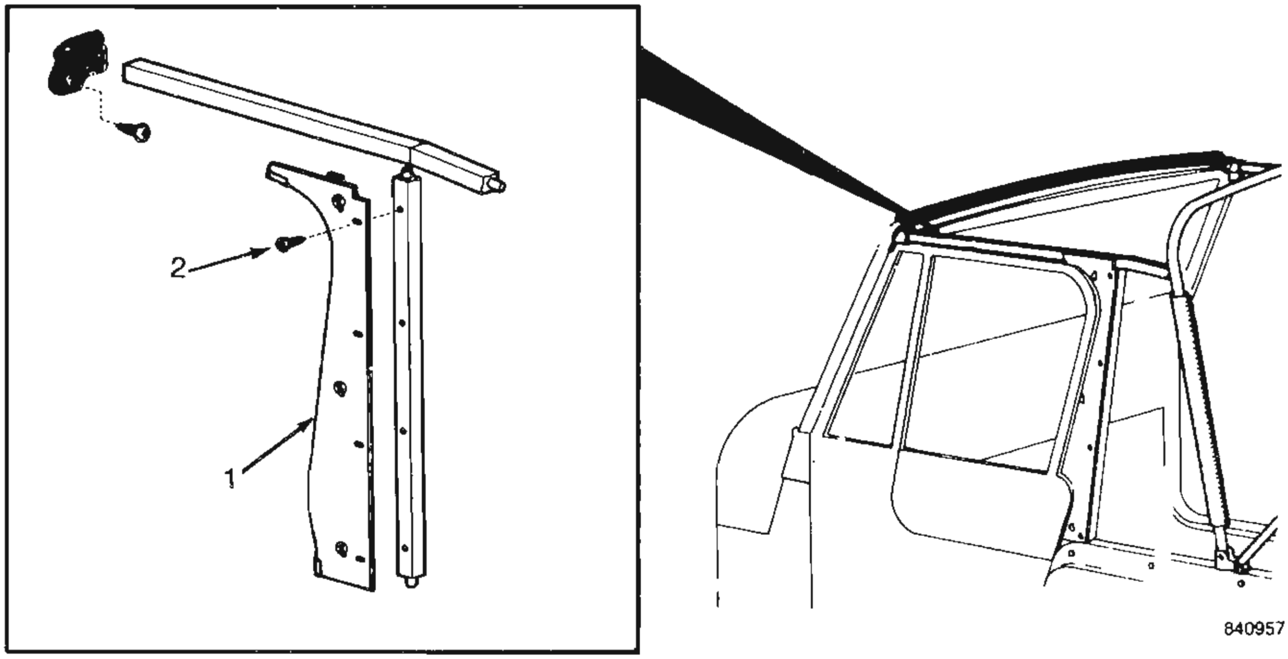
GENERAL

A soft top with metal doors is available on the CJ-7 and Scrambler models. This option offers the convenience of a soft top with the security of metal doors. The adjustment of the doors remains the same as if equipped with a hardtop.

It is possible to adjust the soft top at the rear of the door to achieve an air-tight seal between the door and the soft top.

ADJUSTMENT

Unsnap the soft top from the vertical support blade (1).



Loosen the adjusting screws (2).

Reposition the vertical support blade.

Tighten the adjusting screws.

Reposition and snap the soft top into place.

SEE I.S. NOTES

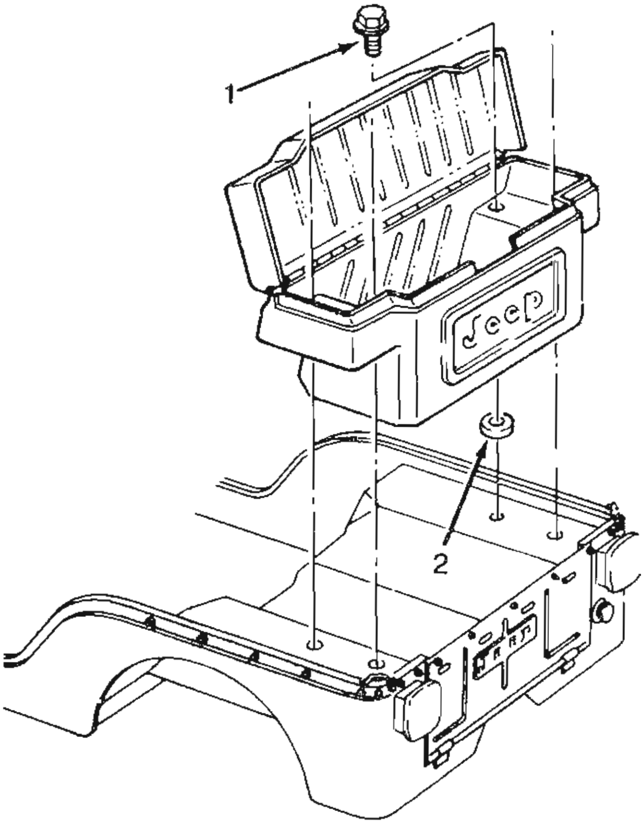
GENERAL

A storage compartment is available on all CJ models.

The storage compartment can be locked with a key. It is also bolted to the body side panels for added security.

Removal

Open the storage compartment and remove the attaching screws and washers (1).



840958

Remove the storage compartment assembly.

Remove the rubber washers (2) from the wheelhouse.

Installation

Position the rubber washers on the storage compartment mounting holes.

Position the storage compartment assembly in the vehicle and align the holes with the rubber washers and holes in the wheelhouse.

Install the storage compartment attaching screws and washers, tighten with 14 - 20 N·m (10 - 15 ft-lbs) torque.

LOCK CYLINDER

Removal

Open the storage compartment and remove the screw retaining lock rods.

Remove the lock rods from the lock cylinder.

Remove the nut from the lock cylinder.

Remove the lock cylinder.

Installation

Position the lock cylinder into the storage compartment.

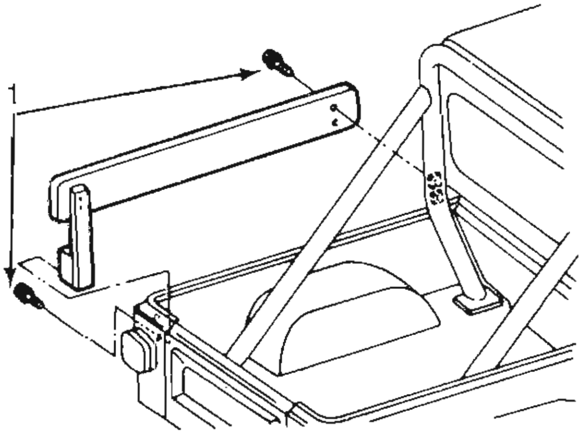
Install the nut on the lock cylinder and tighten.

Install the lock rods onto the lock cylinder and tighten the retaining screw.

SEE
I.S.
NOTES

GENERAL

Wooden side rails are available for the Scrambler models equipped with a roll bar. The rails are attached to the roll bar in front and the body side panel in back.



840959

Scrambler Models

Removal

SEE I.S. NOTES

Remove the bolts (1) at the roll bar and body side panel.

Remove the wooden rail.

Installation

Position the rail.

Install the bolts at the roll bar and body side panel.

Wood Refinishing

Remove the side rails from the vehicle.

Strip the original finish from the rails using a quality chemical stripping agent such as Savogran, B/X, Zip-Strip, or an equivalent varnish remover.

Sand the side rail surfaces with medium grit sandpaper to smooth the surfaces and remove all traces of the old finish.

Wash the side rails with a 50/50 solution of household bleach and water to remove and prevent mildew formation. Allow the rails to dry thoroughly after washing.

Apply one or two coats of wood sealer to the side rails and allow the sealer to dry thoroughly.

Repaint the decorative grooves in the side rails with an air dry-type enamel. Have the owner select the paint, if necessary.

Apply a minimum of two coats of an exterior grade polyurethane or marine spar varnish to the side rails. Be sure to follow the manufacturer's instructions for varnish application.

Install the side rails when the varnish coats have dried thoroughly.

GENERAL

All radios are a solid state design and have 3.2 ohms impedance. All radios operate with the ignition switch in the ON or Accessory positions. A standard nonadjustable, whiptype antenna is used on all models.

NOTE: The radio manufacture date, model and serial numbers are stamped on the radio case.

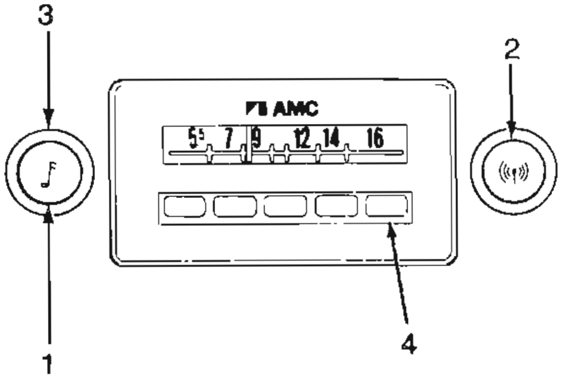
SPECIAL TOOLS

Tool Ref.	Description	Required	Recommended
J-23724	Cassette Test Tape		■

BASIC OPERATION

AM Radio

The AM radio has a volume control (1) and a manual station tuning knob (2). The bass/treble tone is controlled by the inner ring (3) on the volume control located on the left side of the radio. Stations may be selected by either the manual tuning knob or the five pushbuttons (4) that can be individually set. This radio has one dash mounted speaker and the dial light intensity is controlled by the rheostat in the headlight switch.

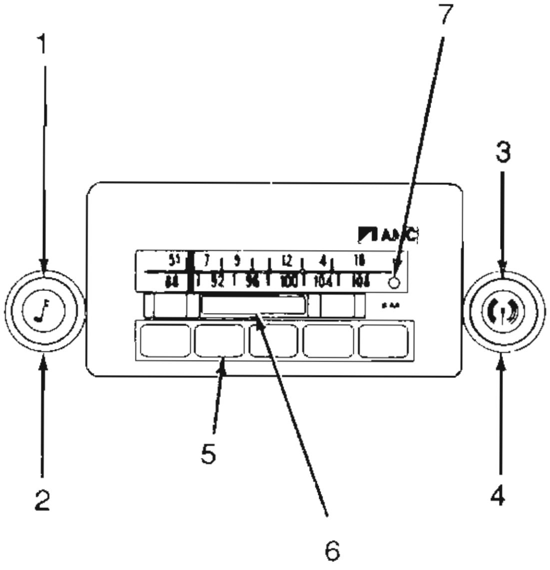


840039

SEE
I.S.
N
O
T
E
S

AM/FM Multiplex Radio

The AM/FM multiplex radio controls consist of the following:

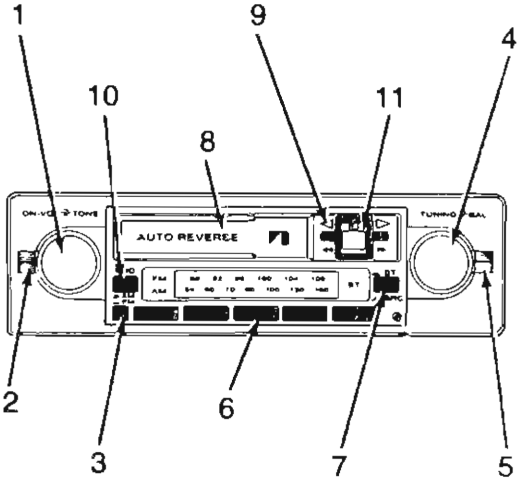


840945

- Volume Control (1) – this knob controls the ON/OFF and volume; pull out and turn to control the left-to-right balance.
- Bass/Treble Control (2) – this inner ring on the volume control adjusts the base or treble tone.
- Manual Station Tuning (3) – turning this knob selects the station desired.
- Front/Rear Fader (4) – front and rear balance is controlled by turning the ring behind the manual station tuning knob.
- Pushbuttons (5) – to set the pushbuttons, pull out one button, select a station with the manual station tuner and push in the pushbutton to "lock-in" the selected station.
- AM/FM Slide Switch (6) – to select the AM or FM band, move the switch left or right.
- Green Stereo Indicator (7) – when illuminated, a stereo FM radio signal is being received.

AM/FM/Cassette Stereo Radio

The AM/FM/cassette stereo radio is a combination AM/FM radio with a cassette cartridge tape player. The controls consist of the following:



840960

- On/Off/Volume control switch (1) – to turn the unit on, turn the knob clockwise until a click is heard; continue rotating the knob clockwise until the volume reaches the desired level
- tone control (2) – the inner ring on the On/Off/ Volume control switch, controls the treble/ bass levels

SEE
I.S.
NOTES

- AM/FM band switch (3) – push this switch to select the desired band; for the AM band, the switch is in the disengaged position indicated by an amber light; for the FM band, the switch is engaged by pushing in on the switch until it is engaged which is indicated by a green light

- manual tuning control (4) – turn the manual tuning control knob until the desired frequency is indicated by the pointer on the tuner face

- balance control (5) – the inner ring on the manual tuning knob controls the front/rear balance

- pushbuttons (6) – to pre-set a pushbutton, select either the AM or FM band, pull the pushbutton out, select the desired station with the manual tuning control and then push the pushbutton in to lock-in the station; this procedure can be repeated to select a total of five stations

NOTE: If the radio is in the AM mode and a pushbutton set for a FM station is pushed, the radio will not switch to the FM mode. The AM/FM band switch must be used to change the band.

- SCR-stereo switch (7) – when this switch is in the out position, normal FM stereo reception occurs; in this mode, if weak reception occurs, the radio may switch from stereo to monaural reception; to obtain a gradual, inaudible change from stereo to monaural reception in a weak reception area, push the SCR switch to engage it

The cassette tape player controls are as follows:

- cassette door (8) – insert the cassette into the door opening to switch the unit from the radio mode to the tape mode

- tape direction indicators (9) – one tape direction indicator light will glow when the tape player is in use to indicate the tape direction of travel

- tone control (2) – the inner ring on the ON/OFF/Volume control switch regulates the treble/bass levels

- program switch (10) – by pushing this switch the tape track is switched to the next track

- fast forward/rewind/eject control (11) – moving the lever to the right rewinds the tape; moving it to the left advances the tape forward; pushing in on the control will eject the tape

Tape Head and Capstan Cleaning

Accumulation of iron oxide from the tape onto the tape head can cause poor playback and up and down tape travel. The head and drive capstan should be cleaned whenever the unit is serviced, or when poor playback or tape travel is noted.

A head cleaning tape can be used to clean the head. If the problem continues, the unit will have to be removed for cleaning by an authorized radio repair service facility.

RADIO REPLACEMENT

Removal

Disconnect the battery negative cable.

Remove the radio knobs and shaft nuts, and radio bezel if equipped.

Disconnect the antenna, speaker(s) and power lead.

Remove the radio from beneath the instrument panel.

Installation

Position the radio and connect the antenna, speaker(s) and power lead.

Install the radio bezel, if removed, shaft nuts and knobs.

Connect the battery negative cable.

Reset the clock, if equipped.

Bulb Replacement

AM Radio

Removal

Remove the radio knobs and attaching nuts.

SEE I.S. NOTES

Remove the dial cover retainers and remove the cover.

Rotate the manual tuning control to move the pointer to the extreme left or right.

Remove the dial light deflector clips and remove the deflector.

Remove the bulb and bulb diffuser.

Installation

Install the diffuser on the replacement bulb and install the bulb.

Install the dial light deflector.

Install the dial cover.

Install the radio attaching nuts and knobs.

AM/FM Cassette Radio Dial Illumination

The dial illumination bulb for this radio must be replaced by a radio repair shop.

Radio Bulb Chart

	Number of Bulbs/ Bulb Trade Number
Radio	
AM	1/168
AM/FM	1/168
AM/FM Tape	—

86400

ANTENNA TRIMMER

The antenna trimmer adjustment is necessary to match the radio circuit to the antenna on all radios. The adjustment should also be checked whenever radio reception is unsatisfactory.

Adjuster Location

NOTE: Remove the radio face plate, when equipped, to gain access to the trimmer adjusting screw.

- AM and AM/FM radio: just to the right of the pushbuttons
- AM/FM stereo with cassette tape player: just to the right of the pushbuttons

Trimmer Adjustment

When the trimmer is properly adjusted, the volume control will be turned to the medium volume position and the greatest volume possible will be obtained. The radio should be tuned to a weak AM station which may or may not be understandable when the trimmer adjustment is being made.

Switch the radio to the AM band.

Allow the radio to operate for a few seconds.

Turn the manual station control knob to the 1600 KC range and find a weak radio signal. Turn the volume control to a medium setting.

Engage the small slotted screw with a standard screwdriver.

Turn the screw left or right until the greatest volume level can be obtained without touching the volume control.

RADIO INTERFERENCE

General

The object of this diagnosis is to present a systematic approach to troubleshooting interference (noise) problems. First, determine if the noise is normal for common radio reception characteristics. If the noise is abnormal, the following procedures outline methods of determining the interference point of entry and elimination.

There are two major ways interference enters the radio – the antenna and the A-line or power feed wire to the radio.

Interference Entry – Antenna

Disconnect the antenna. If this causes the noise to stop, the problem is reduced to three possibilities:

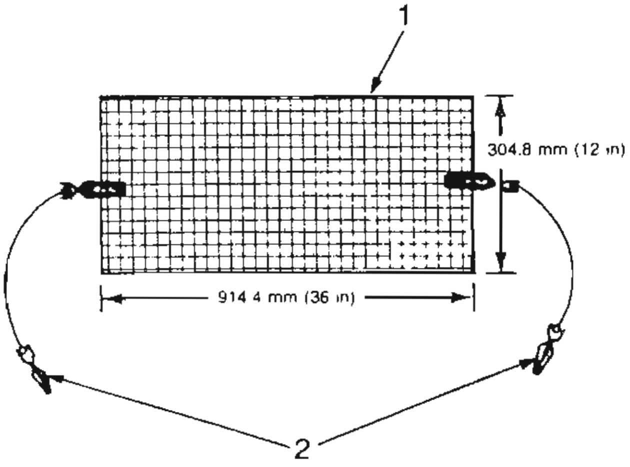
- a defective antenna – refer to the Radio Antenna Ohmmeter Tests
- noise radiated upward from the instrument panel
- noise radiated from the engine compartment

SEE I.S. NOTES

Noise Radiated Upward from the Instrument Panel

This noise can be determined by fabricating a tool from a piece of aluminum or copper screen approximately 914.4 mm (36 in) by 304.8 mm (12 in).

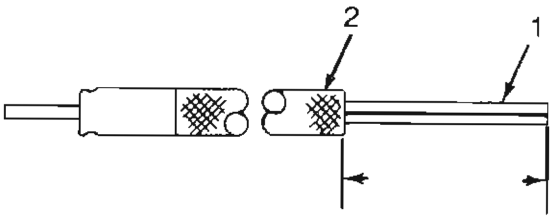
Lay the screen (1) across the top of the dash and attach the clips (2) to the body grounds. If the noise is diminished or disappears, the noise is being radiated up through the instrument panel.



840046

To determine exactly where the noise source is, a useful noise probe can be improvised from an antenna lead-in cable.

To make the probe, cut or remove the lead-in from the antenna at the antenna, remove approximately 50.8 mm (2 in) of the outer plastic covering (1) and the woven wire shield (2).



840047

Disconnect the original antenna lead-in and plug in the noise probe.

Turn the radio on and use the probe to discover a hotspot or source of noise. Do not touch the end of the probe with your hand as this would give an incorrect indication. As the probe comes closer to the noise source, loudness of the noise will increase.

If the source is found to be the switch, connect a 0.5-mfd capacitor from the power feed side of the switch to a good chassis ground.

Gauges and sender units generally can be silenced by installing 0.5-mfd capacitors at the terminals. Install a 0.5-mfd capacitor at the battery terminal of the CVR or a 0.1-mfd, radio-type capacitor directly across the CVR terminals.

SEE I.S. NOTES

If the source is found to be a wire, reroute the wire, or wrap a piece of wire screen around the wire or wire harness and attach one or more ground leads to the wire screen. It also may be possible to screen off the area found to be radiating noise and ground the screen.

If the noise is found to be an electric motor, install a 0.25-mfd coaxial (feed-through) capacitor in series with the motor.

Noise Radiated from the Engine Compartment

These noises can be separated into three areas:

- primary ignition noise
- secondary ignition noise
- alternator whine (radiated)

Primary Ignition Noise

This type of noise generally affects the AM band. The noise usually appears as:

- frequency varying with the engine rpm
- loudness varying with the engine rpm
- stops instantly when the ignition is turned to the OFF position and turned to the Accessory position

The first two classifications are usually the result of poor grounds on the coil capacitors or a wire routing problem. Cleaning the grounds or rerouting the wires may solve the problem.

The extra long antenna lead-in prepared as a noise probe may be used as a hotspot probe. Remove the ignition coil and its mounting bracket. Clean the paint off the bracket and the engine block, then assemble tightly. In many cases, this helps reduce the amount of interference radiated from the ignition system. Also, the installation of a hood bonding strap or device will help reduce the interference radiated from the ignition system. Be sure to check the coil polarity.

In some rare cases, extra suppression may be required if the vehicle is operating in fringe areas. For those special cases, perform the following steps.

Install a 0.1-mfd coaxial capacitor as close as possible to the coil battery terminal, not distributor terminal. Do not use an ordinary bypass capacitor.

Install a 0.005-mfd, 1000-volt ceramic disc capacitor at the coil distributor terminal.

Install a 0.5-mfd coaxial capacitor at the alternator output terminal. Be sure it is rated to handle the maximum alternator voltage.

Secondary Ignition Noise

Secondary ignition noise will always affect FM and if severe enough, may also affect AM. Normally one of two conditions will be found in the radio:

- ignition noise all across FM band (and possible on AM)
- ignition noise (loud) in between stations but not on a strong station

SEE
I.S.
N
O
T
E
S

When these conditions exist in the radio, the problem is more than likely the result of:

- distributor cap carbon ball eroded, or cracked or loose cap
- rotor with a burned carbon contact spot
- secondary wire not seated in the coil or distributor
- defective coil
- an oil film on some of the lead terminals
- copper core secondary wiring
- defective or improper spark plugs

If a wire was found not seated, remove the wire and check for a carboned end. It is not advisable to repair an end terminal on the carbon core wire; replace the entire cable.

If the noise in question sounds like one or two cylinders and definitely not all of them, then the problem is after the coil. Using the fabricated noise probe, which plugs into the radio, have someone sit in the vehicle and listen to the radio. Move the probe from plug to plug. The person in the vehicle should notice an appreciable increase in the noise when the defective plug is reached.

If the vehicle has copper core secondary wiring, these wires should be replaced with original equipment, carbon-core resistor wires.

SEE
I.S.
NOTES

Alternator Whine (Antenna)

Alternator whine can be described as an annoying, high-pitched whistle, or a siren-type sound that increases and decreases with engine rpm. Methods of eliminating alternator whine and engine interference noise are as follows.

Install front fender ground straps.

Install hood bonding strap or device.

Run offending wire through shielded (grounded) cable.

Clean the alternator slip rings and be sure brushes are making good contact.

A-Line (Power Feed Wire to Radio)

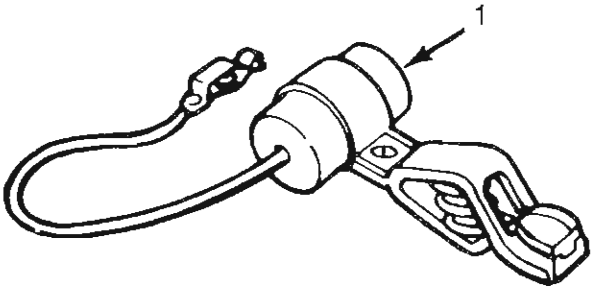
If disconnecting the antenna did not eliminate the radio noise, the noise is probably on the A-line.

Motor noise on the A-line is usually the result of voltage spikes on this line being so large that the input filter circuit in the radio cannot handle them. There are two ways to handle this problem.

Locate the cause of line noise and eliminate it.

Add external filters to reduce the spikes to a point where the radio filter can handle the spikes.

A grounded capacitor (1) touched to all hot electrical connections will often identify the offenders.



840048

The fabricated noise probe also can be used to find hotspots.

In general, any adjacent metal parts which are separated by mastic or paint must be connected together electrically.

Effective bonding requires more than physically clean surfaces and self-tapping screws. Tooth-type lockwashers must be used to cut into the surface layers of metal. Grounding straps must be as short and as heavy as possible.

A-line noise is normally the result of:

- alternator whine (A-line)
- wiring harness too close to the ignition wiring
- radio noise suppressor
- poor radio grounding

Alternator Whine (A-Line)

Alternator whine does not stop instantly when the key is turned quickly to the accessory position at fast idle. It is a high pitched whine which increases with rpm. Correct the alternator whine as follows.

Install a 0.5- to 2.0-mfd bypass capacitor from the alternator output terminal to the ground.

Install a coaxial capacitor in alternator output wire.

Replace the alternator diodes.

Wiring Harness Close to Ignition Wiring

Noise carried to the radio can normally be corrected as follows.

Relocate the harness wiring away from the ignition wires.

Install 0.5-mfd capacitors on each fuse panel lead. Be sure the capacitor is grounded.

Instrument Cluster Radio Noise Suppressor

A noise suppressor is installed on every vehicle equipped with a radio. This suppressor (choke) is plugged into the back of the cluster on the printed circuit board. Be sure the choke has not been installed over the copper strip installed on vehicle not originally equipped with a radio.

Tap on the instrument panel with the ignition in the ON position and the Accessory position to activate the CVR point movement. If noise only occurs in the ON position, repair the noise suppressor as follows.

Remove the radio choke.

Remove the plastic covering.

Unsolder one end of the coil wire and remove approximately 16.3 cm (6½ in) of wire.

Resolder the wire end.

Wrap the coil with several turns of plastic electrical tape and install the choke.

Poor Radio Ground

To check for a poor ground, attach a jumper wire to the radio case and connect the jumper to a good chassis ground. If there is no change in radio noise, the radio has a good ground.

If the noise changed, check for loose mounting screws and a poor ground.

Other Sources of Interference

Speaker Leads

To determine if the speaker leads are inducing or picking up noise, lay the wires on top of the carpet with the wires separated. If the noise is gone, the harness is at fault. Perform one or more of the following.

Separate the coil wires by installing a loom over each of the wires.

Install a 0.001-mfd, thumbnail-type capacitor across each speaker.

Speaker-induced noise will normally not occur on front-mounted instrument panel speaker systems. It is more apt to occur on four-speaker systems and when fader control is in the mid-position.

Defective Radio

Exchange with known good radio to determine if the radio is defective.

Wheel and Tire Static

Wheel static is another source of interference. This is a running noise most likely to be encountered when the vehicle is in motion on a hard, dry-surfaced road. The noise will remain when the vehicle is coasting with the engine and all electrical equipment turned off. The static occurs in the front wheels due to insulating film produced by the lubricant in the wheel bearings.

In some instances, static discharges take place between the tire and the road surface. An antistatic powder kit is available from radio supply houses which applies conducting material to the inside surface of the tire to eliminate noise from this source. Tire static can be checked by washing the tire with water. The water provides a conduction path to ground for the discharges. Tire static is most likely to be encountered during hot, dry seasons.

Turn Signals and Stop Lamps

The turn signal flasher and the switch in the stop lamp circuit may cause popping noises in the radio. In most cases, the noises are interference due to arcing in the contacts. The correction is a

SEE I.S. NOTES

0.5-capacitor installed at the battery connection of the switch or the flasher. It is less likely, but possible, that the low frequency components of the interruptions are reaching audio stages of the radio. The test is to check if the noise is present with the volume control turned down. If so, install a 1000-mfd condenser.

Horn Noise

The diagnosis and cure for a growling noise in the radio when the horn is operated is the same as for Turn Signals and Stop Lamps. The suppressor capacitors are installed at the point where the battery lead feeds the horn relay.

Be sure the horn relay cover is not loose.

Accessories

Electric windshield wipers, blower motors, window regulator motors, or any brush-type motors, generally can be suppressed by installing 0.25-mfd capacitors at the terminals.

ANTENNAS

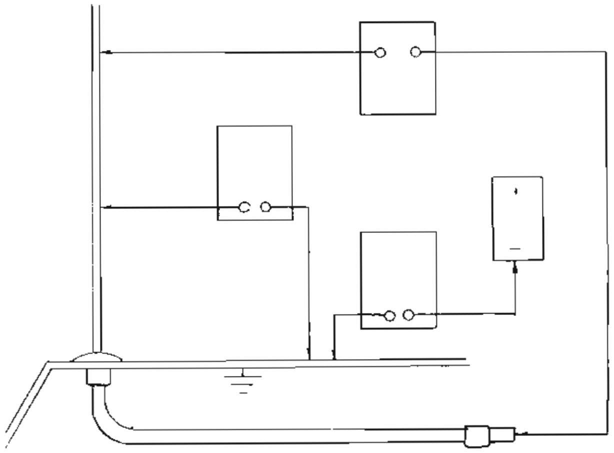
AM and AM/FM Models

The mast of the antenna is not grounded. The base of the antenna is grounded to the vehicle sheet metal. The coaxial shield (the wire mesh) surrounding the center conductor wire of the antenna lead-in cable is grounded to the radio and the antenna base.

Tests

There are three antenna tests to be made with the use of an ohmmeter:

- mast to ground
- tip of the mast to the tip of the conductor
- body ground to the battery ground



85118

SE
I.S.
NOTES

Mast-to-Ground Test

Touch one ohmmeter lead to the tip of the antenna mast and the other lead to the antenna base. With the antenna installed in the radio, there should be continuity (approximately 15 ohms).

Disconnect the antenna from the radio and repeat the procedure.

There should not be any continuity with the antenna disconnected from the radio.

Tip of Mast-to-Tip of Conduct Test

Disconnect the antenna from the radio.

Touch one ohmmeter lead to the mast tip and the other lead to the tip of the lead-in (part inserted into the radio). There should be continuity (fraction of an ohm).

Body Ground-to-Battery Ground Test

Touch one ohmmeter lead to the fender and the remaining lead to the battery negative post. The resistance should be extremely low (less than one ohm).

SEE I.S. NOTES

SPEAKERS

General

All standard speakers have an impedance of 3.2 ohms. A speaker should be replaced with a speaker with the proper part number. If the exact replacement is not available, select a speaker which matches the ohm value of the original speaker.

The stereo speaker system consists of two speakers. One is mounted behind the left side of the instrument panel. The other is mounted behind the instrument panel, between the glove box and the instrument cluster.

Speaker Repairs

A speaker, once it has been damaged, is usually not repairable and should be replaced with a new unit. When speakers exhibit abnormal sound characteristics, check for:

- loose mounting
- audio distortion, particularly on the low frequency notes and at high volume
- rattles and buzzes caused by foreign material hitting or rubbing against the speaker cone
- raspy noises caused by foreign matter inside the speaker, restricting free movement of the speaker cone
- muffled sound caused by the speaker opening obstruction

Use a light to check the speaker opening(s).

If the entire speaker is not visible through the speaker grille openings, remove the obstruction.

Speaker Harness Test

Ground Condition

Disconnect the speaker feed wires at the radio connector and each individual speaker.

NOTE: When connecting the speaker harness to the radio, be sure the antenna lead-in cable is fully engaged in the radio socket.

Connect one lead of the ohmmeter to the speaker feed wire and the other lead to a good ground. An infinity reading should be indicated. Check each individual speaker wire in this manner.

If a reading is indicated on the ohmmeter, the wire being checked is shorted to a ground.

NOTE: Grounded speaker harnesses are generally caused by screws piercing a wire harness.

Short Condition

Disconnect the speaker feed wires at the radio connector and at each individual speaker.

Connect the ohmmeter leads to the speaker feed wires at the radio connector.

An infinity reading should be indicated.

If resistance is indicated on the ohmmeter, the feed wires being checked are shorted.

Speaker Test

Speakers may be isolated for grounds by testing the impedance with an ohmmeter. The specified value should match the ohm value stamped on the radio chassis.

SPEAKER REPLACEMENT

To remove the AM speaker, remove the four attaching nuts from the mounting studs.

NOTE: On vehicles equipped with air conditioning, the evaporator must be lowered for removal of the speaker.

On models equipped with the two-speaker stereo radio system, the speakers can be removed by removing the four retaining nuts from each speaker.

NOTE: On vehicles equipped with air conditioning, the evaporator must be lowered for removal of the passenger side speaker.

SEE
I.S.
NOTES

I. S. NOTES

NUMBER	SECTION	SUBJECT
1E	ENGINES	Altitude performance adjustments
2E	ENGINES	Broken cylinder head bolt
3E	ENGINES - FUEL SYSTEMS	Four-Cylinder engine cold operation
4E	GENERAL	Workshop manual update
5E	SUSPENSION	Suspension spring identification and application
6E	ENGINES	Exhaust manifold stud damage - 2.46L engines
7E	GENERAL	Workshop manual update and revisions
8E	SUSPENSION	Rear ride height adjustment
9E	ENGINES	New crankshaft rear main bearing oil seal

I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

INDEX

January 1987
English Edition

1984 – 1986 Jeep CJ7/Scrambler Vehicles

I.S. NOTE COMPILATION

Attention: Workshop, Parts Department

I.S. NOTES 1E – 8E

This I.S. NOTE COMPILATION includes all I.S. Notes published for the January, 1984 Edition of the M.R. 252 Workshop Manual, 8981 320 374.

I.S. Notes compiled cover the period:

January 1, 1984 – December 31, 1986

An I.S. NOTE INDEX is also included which lists all related materials:

- MR 252 I.S. Notes
- MR 171 I.S. Notes

FILING INSTRUCTIONS:

This I.S. NOTE COMPILATION replaces individual I.S. Notes relating to the Jeep CJ-7/Scrambler vehicles from 1984 through 1986.

I.S. NOTE SUBJECT	MR 252 I.S. NOTE	MR 171 I.S. NOTE	PART NUMBER
A – GENERAL			
Workshop Manual Update – 1985	4E	–	8980 000 260
Workshop Manual Update – 1986	7E	–	8980 000 757
B – ENGINES			
Altitude Performance Adjustments	1E	–	8980 000 109
Broken Cylinder Head Bolt	2E	–	8980 000 172
Four-Cylinder Engine Cold Operation .	3E	–	8980 000 220
C – ELECTRICAL			
NO I.S. NOTES ISSUED.			
D – CLUTCH			
NO I.S. NOTES ISSUED.			
E – GEARBOX/TRANSFER CASE			
NO I.S. NOTES ISSUED.			
F – AUTOMATIC TRANSMISSIONS			
NO I.S. NOTES ISSUED.			

I.S. NOTE SUBJECT	MR 252 I.S. NOTE	MR 171 I.S. NOTE	PART NUMBER

G – STEERING AND FRONT AXLE

NO I.S. NOTES ISSUED.

H – REAR AXLE

NO I.S. NOTES ISSUED.

J – SUSPENSION

I.S. NOTE SUBJECT	MR 252 I.S. NOTE	MR 171 I.S. NOTE	PART NUMBER
Rear Ride Height Adjustment	8E	–	8980 001 014
Suspension Spring Identi./ Appli.	5E		8980 000 631

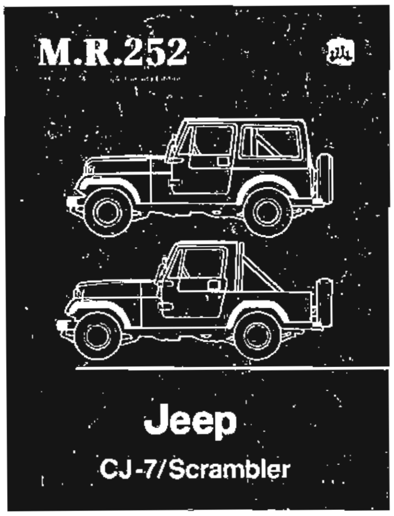
K – BRAKES

NO I.S. NOTES ISSUED.

L – HEATING AND AIR CONDITIONING

NO I.S. NOTES ISSUED.

M – ACCESSORIES



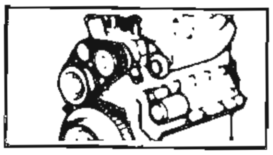
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE-INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

1E

JANUARY 1984
ENGLISH EDITION

1984 JEEP CJ/SCRAMBLER



ENGINE

Attention: Workshop, Parts Department.

ALTITUDE PERFORMANCE ADJUSTMENTS

Information

This I.S. Note outlines adjustments for optimum engine performance on 1984 Jeep CJ and Scrambler 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 CJ/Scrambler 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 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 through the Milwaukee National Parts Distribution Center.

ADJUSTMENT PROCEDURES

1. 150 C.I.D. FOUR-CYLINDER MODELS WITH MANUAL AND/OR AUTOMATIC TRANSMISSION AND 258 C.I.D. SIX-CYLINDER MODELS WITH AUTOMATIC TRANSMISSION

On the above 1984 six-cylinder and four-cylinder CJ/Scrambler models originally certified 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. Remove the tape securing the black with tracer altitude circuit ground wire to the MCU harness.
2. Attach the altitude circuit ground wire 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 and reset engine idle speed to the setting indicated on the same label.
4. Install Vehicle Emission Control Information Update label, part number 8983 100 009, next to the original label.

These adjustments apply to all 1984 Jeep six-cylinder automatic and four-cylinder manual/automatic models originally certified 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 1984 CJ/Scrambler six-cylinder automatic and four-cylinder manual/automatic models originally certified 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. Disconnect the black with tracer altitude circuit ground wire from the engine ground screw near the ignition coil. Tape the wire to the MCU harness securely and be sure the wire eyelet is completely covered with tape.
2. 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.
3. Install Vehicle Emission Control Information Update label, part number 8983 100 010, next to the original label.

These adjustments apply to all 1984 CJ/Scrambler six-cylinder automatic and four-cylinder manual/automatic models that were originally certified 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.

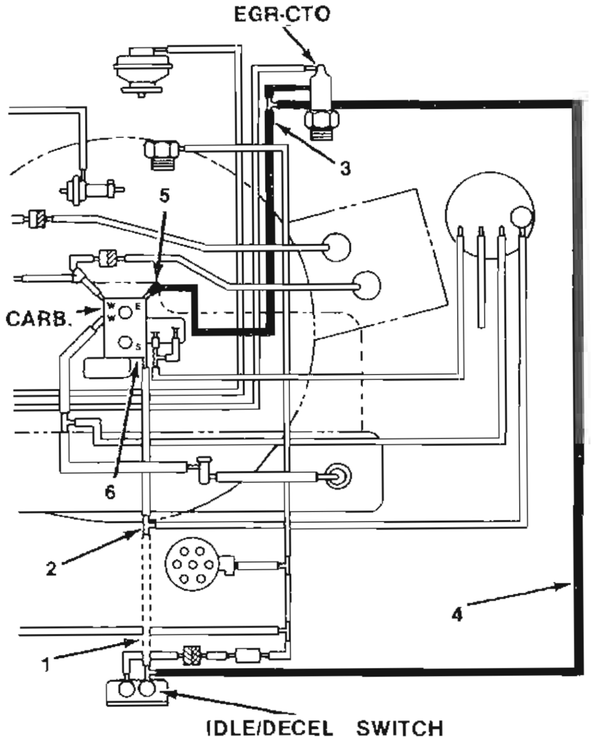
NOTE: *Whenever these vehicles are returned to operations at altitudes above 4,000 feet, the MCU circuit jumper wire must be reconnected, the ignition timing and engine idle speed must be reset to original specifications and the Vehicle Emission Control Information Update label removed.*

2. SIX-CYLINDER MODELS WITH MANUAL TRANSMISSION

On 1984 CJ/Scrambler six-cylinder manual transmission models originally certified 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 the altitude circuit ground wire in the underhood MCU harness connected to an engine ground screw. In addition, the idle/decel switch must be connected to the carburetor EGR port instead of the spark port.

1. Untape the black with tracer altitude circuit ground wire from the MCU harness.
2. Attach the ground wire to the engine ground screw near the ignition coil.
3. Reconnect the idle/decel switch to the carburetor EGR port as follows (Fig. 1).
   a. Disconnect vacuum line 1 from the idle/decel switch and from tee connector 2 (Fig. 1). Place this line in the glovebox for future reuse — 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 1-1/4 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 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, 8983 100 009, next to the original label.



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).

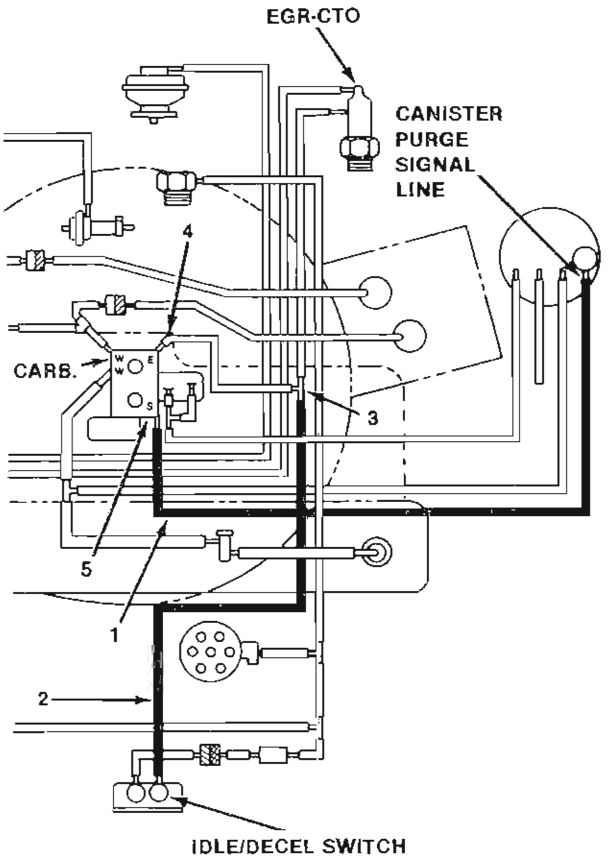
Fig. 1 Modifying Low Altitude Model for High Altitude Operation

These adjustments apply to 1984 CJ/Scrambler six-cylinder manual transmission models originally certified 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 altitudes circuit ground wire must be disconnected, 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.*

On 1984 CJ/Scrambler six-cylinder manual transmission models originally certified 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. Disconnect the altitude circuit ground wire from the engine ground screw and tape the wire to the MCU harness. Be sure the wire eyelet is covered with tape.



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

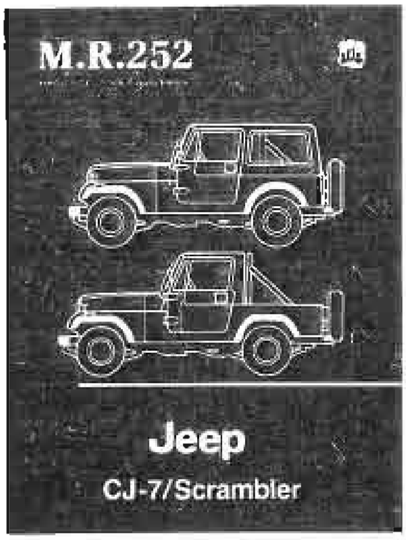
2. Connect the idle/decel switch to the carburetor spark port as follows (Fig. 2).
   a. Cut and install tee connector 321 0891 in vacuum line 1. Position the connector about 1-1/4 inches from the spark port end of the line.
   b. Disconnect vacuum line 2 from tee connector 3. Then reconnect line 2 to the tee connector just installed in vacuum line 1.
   c. Plug open end of tee connector 3 with cap 813 2325.
3. 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.
4. Install Vehicle Emission Control Information Update label, 8993 100 010, next to the original label.

These adjustments apply to 1984 CJ/Scrambler six-cylinder manual transmission models originally certified 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.*

Filing Instructions

File this I.S. Note in the plastic binder supplied with your M.R. 252 manual.



M.R.252

Jeep

CJ-7/Scrambler

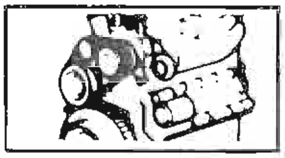
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE-INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

2E

MARCH 1984
ENGLISH EDITION

CJ/SCRAMBLER



ENGINES

Attention: Workshop, Parts Department

BROKEN CYLINDER HEAD BOLT

Information

Some bolts used on the spark plug side of the cylinder head in 2.46L four-cylinder engines and 4.2L in-line six-cylinder engines, were improperly hardened and may break under the bolt head or in the bolt thread area. The engines with suspect bolts are coded as follows:

Four-Cylinder - 310U06 through 310U14

Six-Cylinder - 310C06 through 310C14

NOTE: The engine code is stamped on a machined surface on the distributor side of the block (Fig. 1).

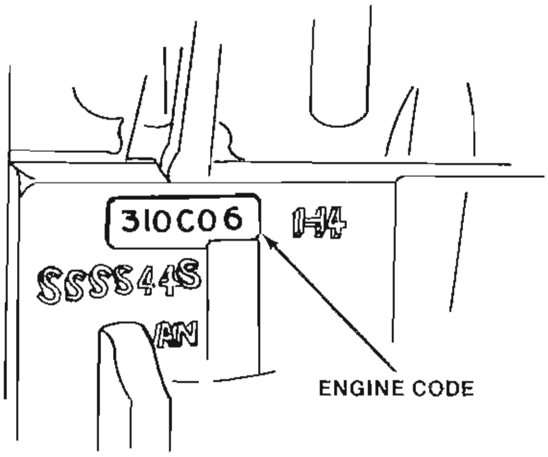
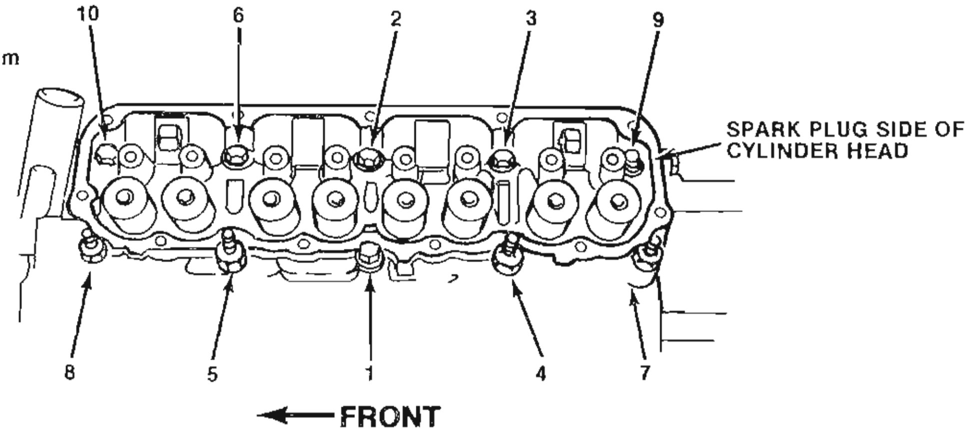


Fig. 1 Engine Code Location

Be sure to follow the bolt tightening sequence and torque specifications indicated in Figure 2 when replacing the bolts.

Whenever a broken bolt is found, all of the bolts on the spark plug side of the head (Fig. 2), should be replaced with new bolts, 400 6593. Four-cylinder engines require five bolts. Six-cylinder engines require seven.

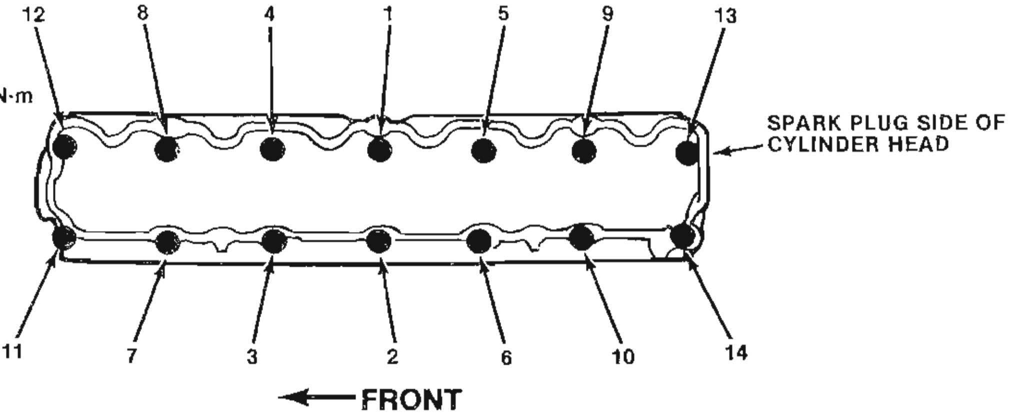


TIGHTEN ALL BOLTS (EXCEPT NO. 8) TO 115 N·m (85 FT. LBS.) TORQUE.

NOTE: COAT THREADS OF NO. 8 BOLT WITH SEALER AND TIGHTEN TO 102 N·m (75 FT. LBS.) TORQUE.

SPARK PLUG SIDE OF CYLINDER HEAD

4-CYLINDER ENGINE



TIGHTEN ALL BOLTS (EXCEPT NO. 11) TO 115 N·m (85 FT. LBS.) TORQUE.

NOTE: COAT THREADS OF NO. 11 BOLT WITH SEALER AND TIGHTEN TO 102 N·m (75 FT. LBS.) TORQUE.

SPARK PLUG SIDE OF CYLINDER HEAD

6-CYLINDER ENGINE

Fig. 2 Bolt Tightening Sequence and Torque Specifications

Filing Instructions

Record this I.S. Note on pages B-88 and B-155 and file it in your M.R. 252 binder.

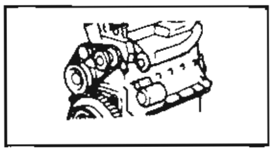
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE-INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

3E

MAY 1984
ENGLISH EDITION

CJ/SCRAMBLER



ENGINES — FUEL SYSTEMS

Attention: Workshop and Parts Department

FOUR-CYLINDER ENGINE COLD OPERATION

Information

The choke on some 1984 four-cylinder YFA carburetors, may open too quickly after cold starts resulting in poor cold engine operation.

Service correction involves changing choke opening time as outlined in the following procedure.

Procedure

1. Remove the carburetor as outlined on page B-208 of the M.R. 252 manual.
2. Disconnect the vacuum break supply hose from the vacuum supply tube in the carburetor base (Fig. 1).
3. Increase the diameter of the orifice in the vacuum supply tube with a 7/64-in. (0.109-in.) drill bit (Fig. 1).

   NOTE: Be sure to remove all chips with compressed air after drilling out the orifice.

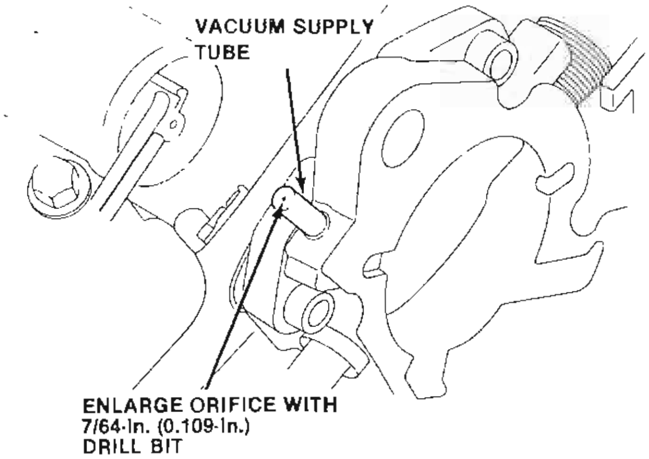


Fig. 1

4. Cut the vacuum break supply hose in two equal lengths and connect delay valve, 323 7293, to the two hose ends (Fig. 2).

NOTE: Install the valve with the brown side toward the vacuum break and the black side toward the supply tube.

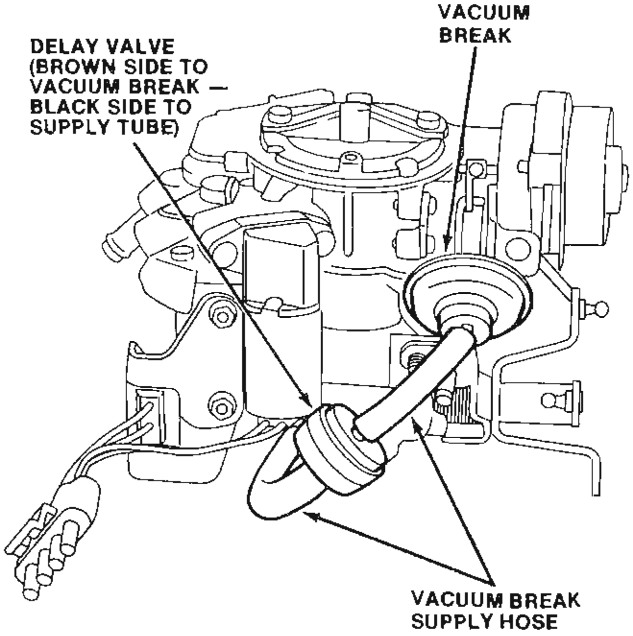


Fig. 2

5. Reset initial choke valve clearance to 0.275/0.280-in. (6.98/7.11 mm) as outlined on page B-225 of the M.R. 252 manual.

6. Reset fast idle cam index adjustment to 0.185-in. (4.62 mm) as outlined on page B-226 of the M.R. 252 manual.

7. Reset choke unloader adjustment to 0.300-in. (8.62 mm) as follows:

   a. Hold the throttle lever (H) fully open and apply pressure on the choke valve toward the closed position (Fig. 3).

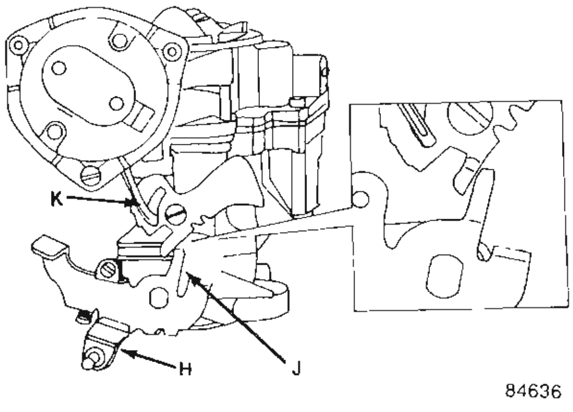


Fig. 3

b. Measure the clearance between the **upper** edge of the choke valve and the air horn wall (Fig. 4).

NOTE: It is not necessary to remove the air cleaner bracket when measuring the clearance between the choke valve and the air horn wall. Position the gauge next to the bracket.

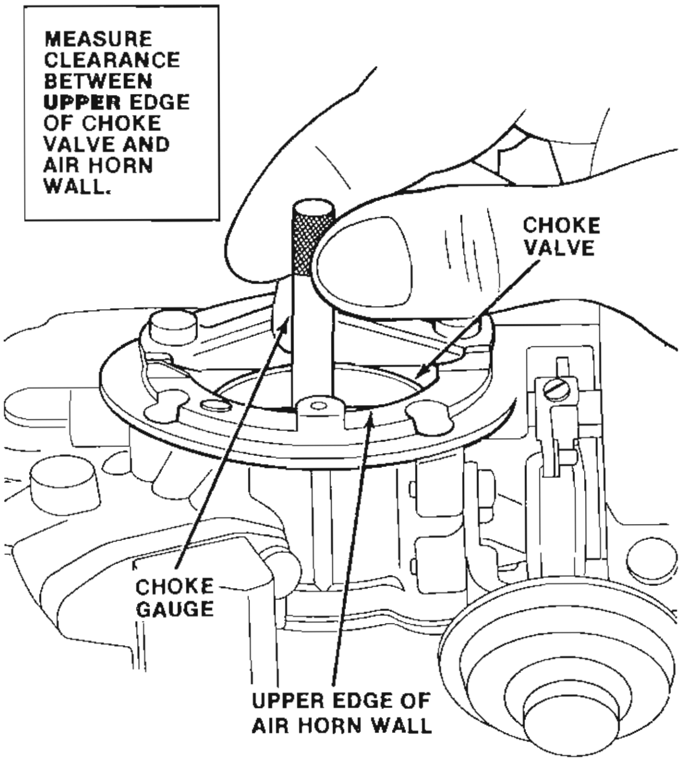


Fig. 4

c. Adjust by bending the unloader tang (J), which contacts the fast idle cam (K) (Fig. 3). Bend toward cam (K) to increase clearance and away from cam (K) to decrease clearance (Fig. 5).

CAUTION: Do not bend unloader tang (J) downward from a horizontal plane. After making adjustment, be sure the unloader tang has at least 0.070-inch clearance (L) from the main body flange when the throttle is fully open (Fig. 5).

d. Operate the throttle and check unloader tang (J) to ensure it does not bind or contact any part of the carburetor casting or linkage.

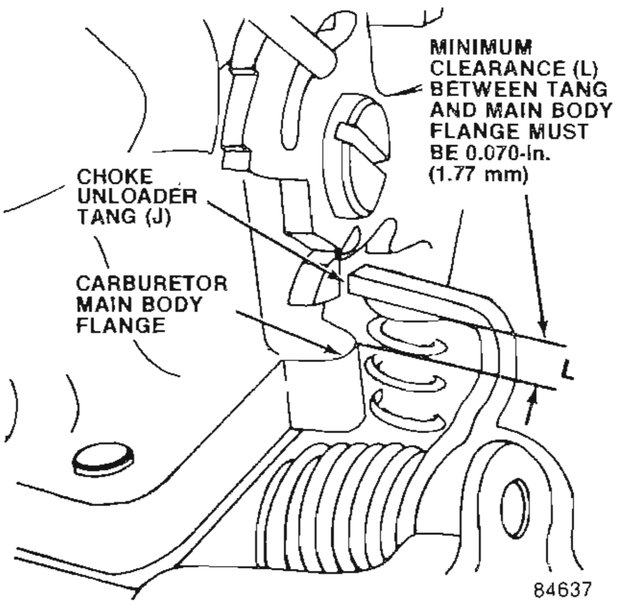


Fig. 5

8. Install the carburetor as outlined on page B-208 of the M.R. 252 manual. Then check for full throttle opening when throttle is operated by accelerator pedal.

9. Adjust fast idle speed, sole-vac vacuum actuator, and curb idle speed as outlined on pages B-229 through B-231 of the M.R. 252 manual.

Parts

Description	**Quantity**	**Part Number**
VALVE, DELAY	1	323 7293
GASKET, Carburetor Base	2	8953 000 617

S.R.T. Information

Operation Description	**T.I.C.**	**Operation Number**	**S.R.T.**
CO. CHOKE SYSTEM, YFA CARBURETOR — RECALIBRATE (Inc. idle speeds and choke unloader adjustment)	1-222	1999	1.5

Filing Instructions

Record this I.S. on pages B-207 and B-229 through B-231 and file it in your M.R. 252 binder.

I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE-INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

4E

AUGUST 1984
ENGLISH EDITION

1985 CJ/SCRAMBLER

R 0000
000
0000000

GENERAL

Attention: Workshop

WORKSHOP MANUAL UPDATE

Information

This I.S. Note contains updated servicing information and specifications unique to **1985 CJ/Scramber models.**

Only these items unique to 1985 models are outlined in this I.S. Note. All other specifications and service procedures in the M.R. 252 are unchanged.

Record this I.S. Note and the various revision and updates on the indicated M.R. 252 pages.

Model YFA Carburetor Specifications — Page B-207

The following new specifications are for YFA carburetors on 1985 CJ/Scrambler models with 2.46L, I-4 engines.

Record this I.S. Note and make a note of the new specifications on page B-207.

MODEL YFA CARBURETOR SPECIFICATIONS

List Number	Application	Float Level Set To	Float Level OK Range	Initial Choke Valve Clearance Set To	Initial Choke Valve Clearance OK Range	Fast Idle Cam Setting Index Set To	Fast Idle Cam Setting Index OK Range	Automatic Choke Cover Setting Set To	Automatic Choke Cover Setting	Choke Unloader (1)	Fast Idle Speed Set To	Fast Idle Speed OK Range
7704	150 Man 49-S	0.600	0.570 to 0.630	0.280	0.265 to 0.295	0.175	0.160 to 0.190	N/A TR		0.300	2000*	± 100
7706	150 Man High Alt	0.600	0.570 to 0.630	0.280	0.265 to 0.295	0.175	0.160 to 0.190	N/A TR		0.300	2000*	± 100

* EGR valve disconnected and the engine fully warm.
TR - Tamper Resistant
(1) Measured between *upper* edge of air horn wall and choke plate.

Initial Choke Valve Clearance Adjustment — Page B-225

The vacuum break on 1985 YFA carburetors has a bleed hole on the rear side of the diaphragm housing.

When adjusting initial choke valve clearance, it will be necessary to cover the bleed hole with tape before seating the vacuum break with a hand operated vacuum pump; then remove the tape after completing adjustment.

Record this I.S. Note and 1985 servicing information on page B-225.

Idle Speeds — Page B-205 and B-231

Idle speeds for 1985 2.46L, I-4 engines with the YFA carburetor are printed on the Vehicle Emission Control Information Label located in the engine compartment. Refer to the idle speed specifications on this label when adjustment is necessary.

Filing Instructions

Record this I.S. Note on the indicated pages and file it in your M.R. 252 binder.

I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

5E

MARCH 1985
ENGLISH EDITION

1984-85 CJ/SCRAMBLER

SUSPENSION

Attention: Workshop, Parts Department

SUSPENSION SPRING IDENTIFICATION AND APPLICATION

The **CJ suspension** is available in three classifications: Standard, Soft Ride, and Heavy Duty. The **Scrambler** suspension is available in two classifications: Standard and Heavy Duty.

The Standard suspension is designed for moderate off-road operation as well as normal everyday driving.

The Soft Ride suspension offers a smoother ride on models operated principally on paved road surfaces.

The Heavy Duty suspension is recommended for trailer towing, snow plowing and extended off-road operation along with normal everyday driving.

Vehicle Attitude

A side-to-side body height variance of approximately 19 mm (3/4 in.) at the frame rails (measured from frame to ground) is acceptable. Body height measurement points are outlined (Fig. 1).

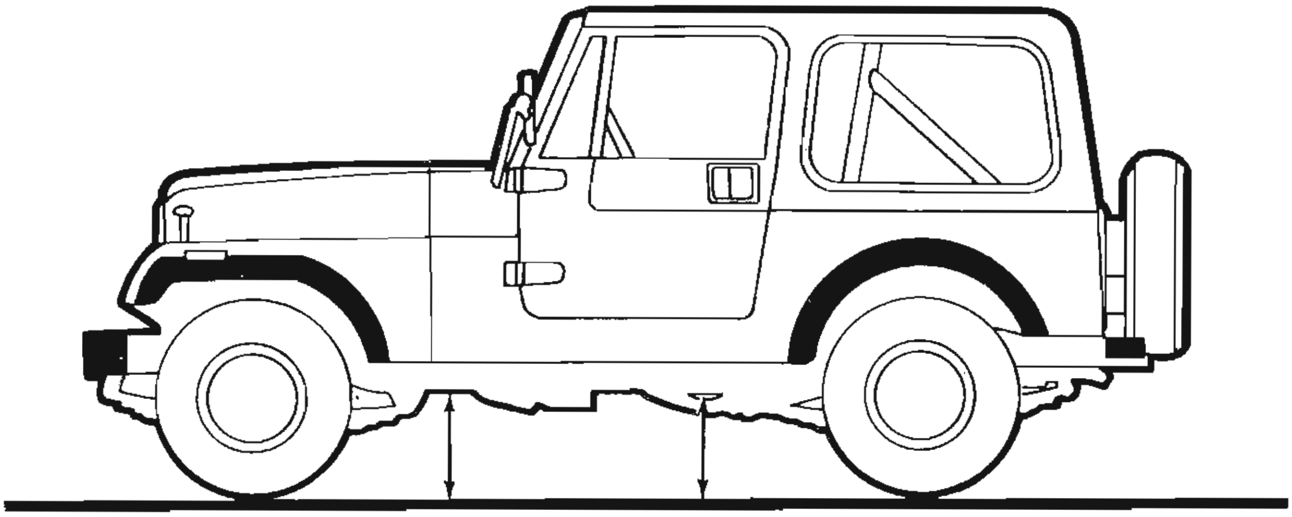


Fig. 1

VEHICLE ATTITUDE

Spring Identification

The part numbers for the front and rear springs are stamped on the underside of the bottom spring leaf (Fig. 2).

NOTE: Only the last four numbers of the spring part number are visible with the spring installed. However, these last four numbers are the only ones needed for spring identification.

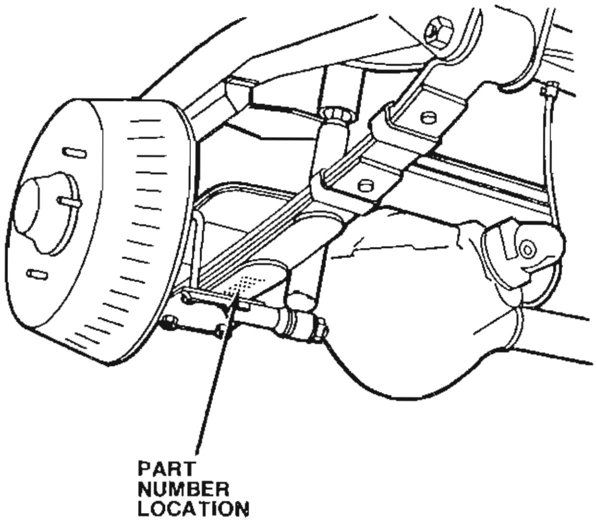


Fig. 2

SPRING APPLICATION

Front and rear spring applications for 1984-85 CJ/Scrambler models are outlined in the following application charts.

CJ FRONT SPRING APPLICATION

CLASSIFICATION		PART NUMBER
4 CYL	Standard Soft Ride Heavy Duty	536 3228 536 3632 536 4385
6 CYL	Standard Soft Ride Heavy Duty	536 3229 536 3933 536 3850

CJ REAR SPRING APPLICATION

CLASSIFICATION		PART NUMBER	
		Hard Top	Soft Top
4 CYL	Standard Soft Ride Heavy Duty	536 3332 536 3636 536 4386	536 3330 536 3636 536 4386
6 CYL	Standard Soft Ride Heavy Duty	536 3331 536 3935 536 3855	536 3332 536 3935 536 4386

SCRAMBLER FRONT SPRING APPLICATION

CLASSIFICATION		PART NUMBER
4 CYL	Standard	536 3228
	Heavy Duty	536 4385
6 CYL	Standard	536 3229
	Heavy Duty	536 3850

SCRAMBLER REAR SPRING APPLICATION

CLASSIFICATION		PART NUMBER
4 CYL	Standard	536 3331
	Heavy Duty	536 3855
6 CYL	Standard	536 3331
	Heavy Duty	536 3855

Filing Instructions

- Record this I.S. Note on page J-21.
- File it in the M.R. 252 binder.

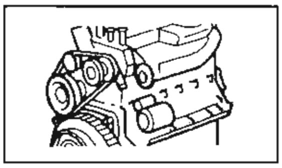
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

6E

MARCH 1985
ENGLISH EDITION

1984-85 CJ/SCRAMBLER MODELS



ENGINES

Attention: Workshop, Parts Department

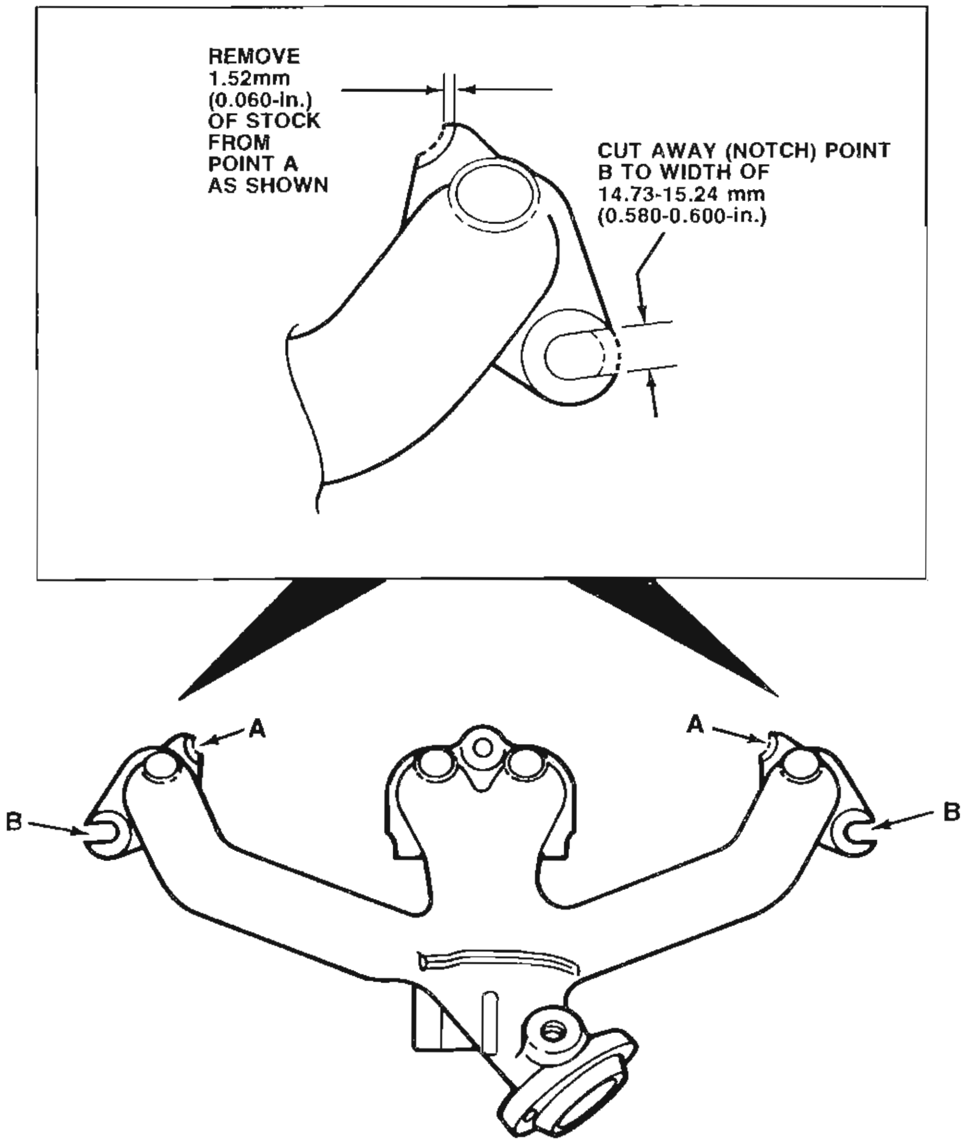
EXHAUST MANIFOLD STUD DAMAGE – 2.46L ENGINES

The exhaust manifold end studs on some **1984-85 CJ/Scrambler** model 2.46L engines may become bent or broken if the manifold is misaligned during service repairs.

Remove, modify and install the manifold as outlined in the following procedure to avoid stud damage.

PROCEDURE

1. Remove the intake manifold as outlined on pages B-82 and B-83 of the M.R. 252.
2. Remove the exhaust manifold as outlined on page B-85 of the M.R. 252.
3. Inspect the exhaust manifold retaining studs. Replace any that are broken or bent.
4. Check flatness of the exhaust manifold mating surface with a straightedge and 0.38 mm (0.015-in) feeler gauge. Replace the manifold if the feeler gauge can be inserted between the manifold and straightedge at any point.
5. Modify the original or replacement exhaust manifold stud flanges as follows:
   a. Remove the oxygen sensor from the manifold and mount the manifold in a vise.
   b. File or grind 1.52 mm (0.060-in) of stock from the manifold flange at point (A) as shown in the illustration.



c. Cut away (notch) the exhaust manifold stud flanges at points (B) as shown in the illustration. Do both ends of the manifold. Use a hack saw, file or die grinder to modify the flanges.

d. Reinstall the oxygen sensor in the manifold.

6. Install the exhaust manifold as outlined on page B-85 of the M.R. 252. Be sure the retaining studs are centered in the manifold stud notches before tightening the stud nuts.

7. Install the intake manifold as outlined on pages B-83 and B-84 of the M.R. 252.

8. Refill the cooling system.

Parts

DESCRIPTION	QUANTITY	PART NUMBER
MANIFOLD, Exhaust	1 (if required)	324 2625
STUD, Exhaust Manifold Retaining	AR	400 3917
GASKET, Intake Manifold	1	324 2854
NUT, Exhaust Manifold Stud	AR	535 1688
WASHER, Exhaust Manifold Stud Nut	AR	317 3077

S.R.T. Information

OPERATION DESCRIPTION	NUMBER	TIME	TIC
CO. MANIFOLD, EXHAUST – R&R	1092	2.5	1-138
SO. EXHAUST MANIFOLD – MODIFY	0104	0.4	1-138

Filing Instructions

- Record this I.S. Note on page B-83.
- File it in the M.R. 252 binder.

I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

7E

JULY 1985
ENGLISH EDITION

1986 CJ MODELS

GENERAL

Attention: Workshop, Parts Department

WORKSHOP MANUAL UPDATE AND REVISIONS

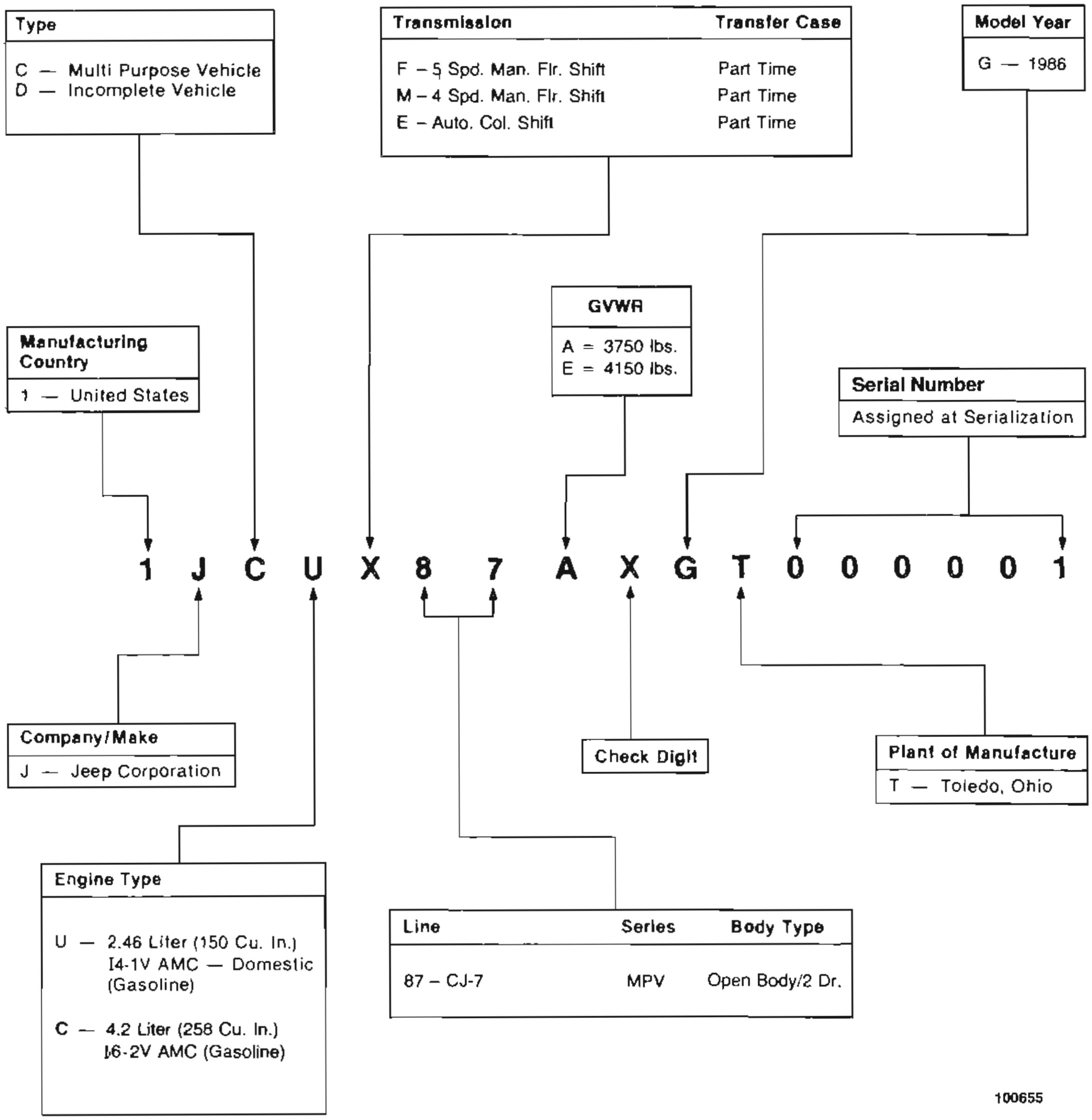
This I.S. Note contains information unique to 1986 Jeep CJ models. Only those items that apply to 1986 CJ models are outlined in this I.S. Note. All other service information in the M.R. 252 remains unchanged. The only M.R. 252 section affected by these updates/revisions is the specification and identification section of the GENERAL chapter.

Filing Instructions

- File this I.S. Note in the M.R. 252 Manual

VEHICLE IDENTIFICATION NUMBER (VIN)

The 17-character Vehicle Identification Number (VIN) is imprinted on a plate attached to the top of the instrument panel. The plate is located on the driver's side of the panel near the base of the windshield.



100655

I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

8E

JUNE 1986
ENGLISH EDITION

1976-86 CJ-7 MODELS

SUSPENSION

Attention: Workshop, Parts Department

REAR RIDE HEIGHT ADJUSTMENT

A rear ride height adjustment kit is now available for service use on 1976-86 CJ-7 models. The kit provides a method of adjusting rear ride height on models with a side-to-side height variance.

Rear ride height measurement and kit installation (if necessary) are as follows:

PROCEDURE

Rear Ride Height Measurement

1. Position the vehicle on a level surface.
2. Check and adjust tire inflation pressures as necessary.
3. Check spring and spring shackle action by jouncing the vehicle at all four corners. The springs and shackles should operate freely and not bind.

NOTE: Rust buildup on the spring leaves may cause a spring to bind. Lubricate the ends of any rusty spring leaves with engine oil.

4. Jounce the vehicle front and rear end to be sure the springs are in a neutral position.
5. Check rear ride height at both sides of the vehicle. Measure height from the floor to the top-center of each wheel opening.
6. Compare the heights recorded at each rear wheel opening. A side-to-side variance of less than 19 mm (3/4 inch) is normal and adjustment is not required. However, if side-to-side variance is greater than specified, adjust height as outlined in the Rear Ride Height Kit Installation procedure.

Rear Ride Height Kit Installation

1. Raise and support the vehicle.

2. Determine which kit is required by measuring axle tube diameter.

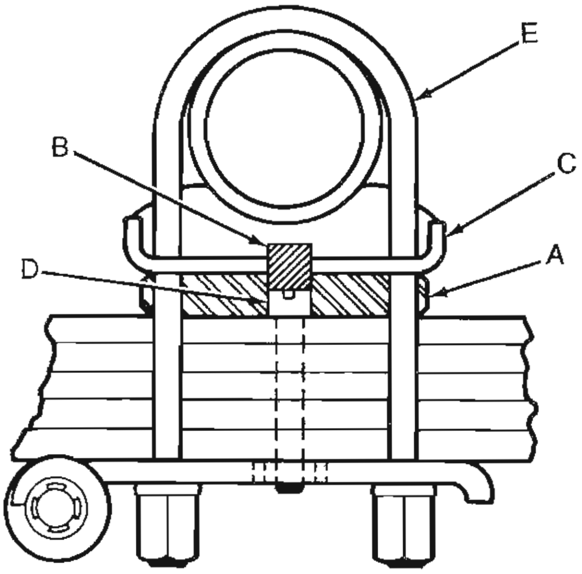
   a. AMC axles have a 63.5 mm (2½ inch) diameter tube. Use kit 8983 100 043.

   b. Dana axles have a 69.8 mm (2¾ inch) diameter tube. Use kit 8983 100 044.

NOTE: The adjustment spacer (A) and locating peg (B) in the kit are installed on the side having the **highest** measured ride height. For example, if left side height is 31 inches and right side height is 32 inches, install the spacer on the side that measured 32 inches to lower that side.

3. Remove the original spring U-bolts from the side to be adjusted.

4. Raise the axle enough to install the spacer (A) and locating peg (B) between the axle spring seat (C) and the top spring leaf.



5. Align the the spacer (A) on the spring top leaf and seat it on the the spring center bolt (D).

6. Insert the locating peg (B) in the spacer (A) as shown.

7. Lower the axle and seat the locating peg (B) in the axle spring seat (C).

8. Install the longer U-bolts (E) supplied in the kit. Tighten 9/16 inch diameter U-bolts to 136 N·m (100 ft-lbs) torque. Tighten 1/2 inch diameter U-bolts to 75 N·m (55 ft-lbs) torque.

9. Remove the supports and lower the vehicle.

PARTS INFORMATION

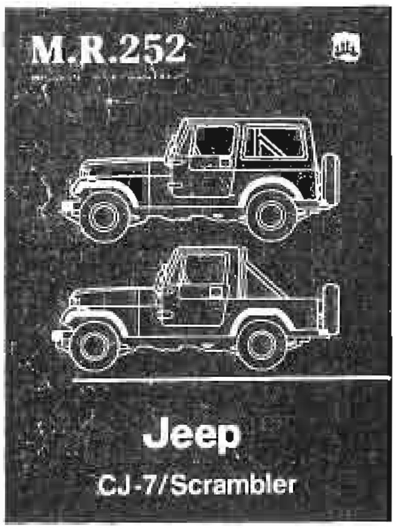
DESCRIPTION	QUANTITY	PART NUMBER
KIT, Rear Ride Height Adjustment		
AMC Axle (2½ in. tube)	1	8983 100 043
Dana Axle (2¾ in. tube)	1	8983 100 044

SRT INFORMATION

OPERATION DESCRIPTION	NUMBER	TIME	TIC
CO. KIT, REAR RIDE HEIGHT ADJUSTMENT – INSTALL Incl. Ride Height Measurement	0306	0.6	3-362

FILING INSTRUCTIONS

Record this I.S. Note on page J-21 and file it in the M.R. 252 Manual.



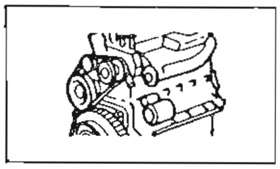
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

9E

APRIL 1987
ENGLISH EDITION

CJ/SCRAMBLER WITH
2.46L ENGINE



ENGINES

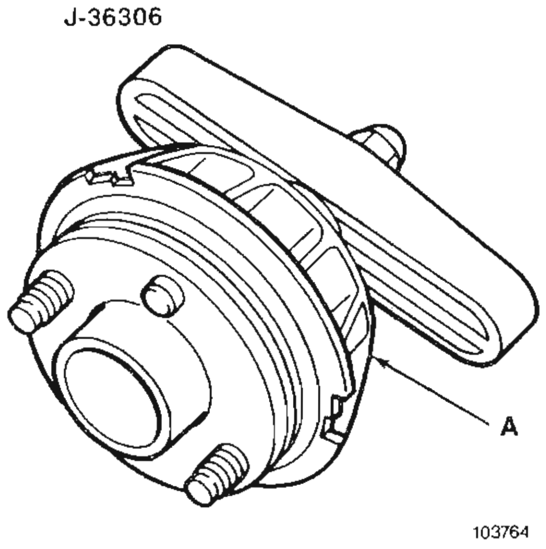
Attention: Workshop, Parts Department

NEW CRANKSHAFT REAR MAIN BEARING OIL SEAL

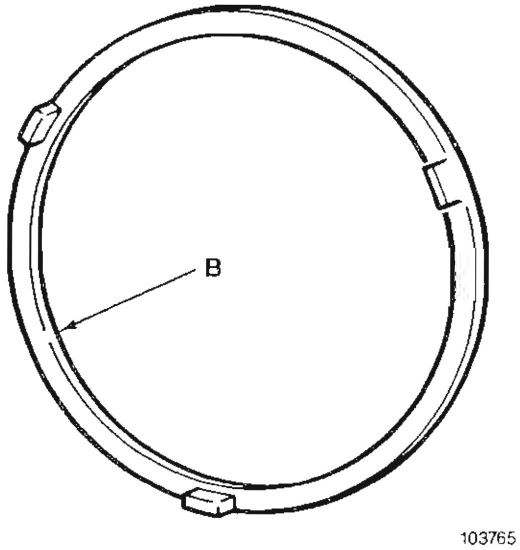
A new crankshaft rear main bearing oil seal with improved sealing characteristics and a new seal installation tool have been released for the 2.46 Liter four-cylinder engine.

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.

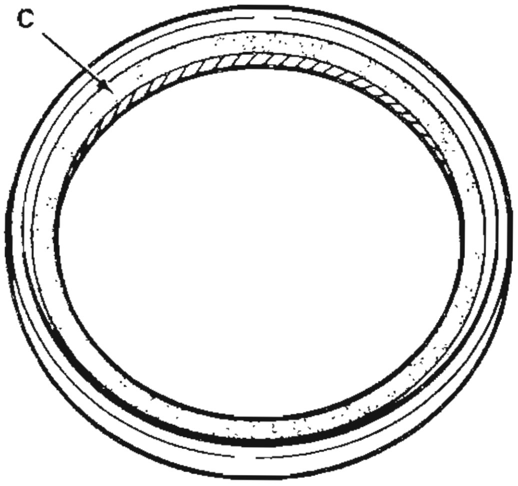
This new rear main bearing oil seal is used in production on engines built December 8, 1986 and later.



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.



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.

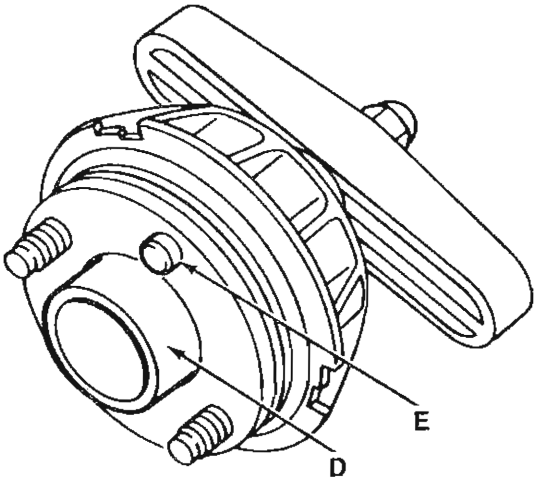
4. Back off the plastic wing nut on tool J-36306 until it contacts the nut.

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.

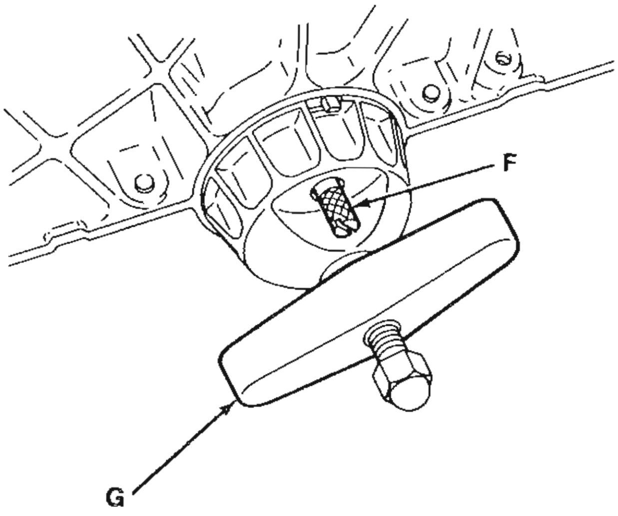
7. The tool pilot (D) fits into the flywheel pilot hole in the back of the crankshaft. The dowel on the tool (E) fits into the small hole in the crankshaft.



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.

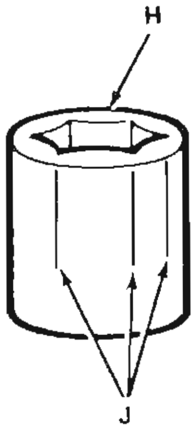
11. Ensure that the dust shield is not curled under. If it is, lightly pull the lip out with a small screwdriver.

12. Install the converter drive plate or flywheel with replacement bolts.

13. Tighten the converter bolts to 54 N·m (40 ft-lbs) torque and then turn an additional 60°.

14. Tighten the flywheel bolts to 68 N·m (50 ft-lbs) torque and then turn an additional 60°.

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

15. After all the bolts have been pre-tightened to the specific torque, place the specially marked socket over each bolt.

16. 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.

17. Tighten each bolt until the next 60° mark on the socket is aligned with the pencil mark on the flywheel or drive plate.

18. 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-103 and B-104 of M.R. 252 and file it in the manual.

AMC | Jeep®

Service Manual

Model 700/900 Series

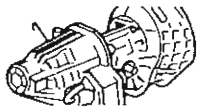
TRANSMISSION

August 1983 U.S.A./Canada Edition

8981 320 381

Litho in U.S.A.

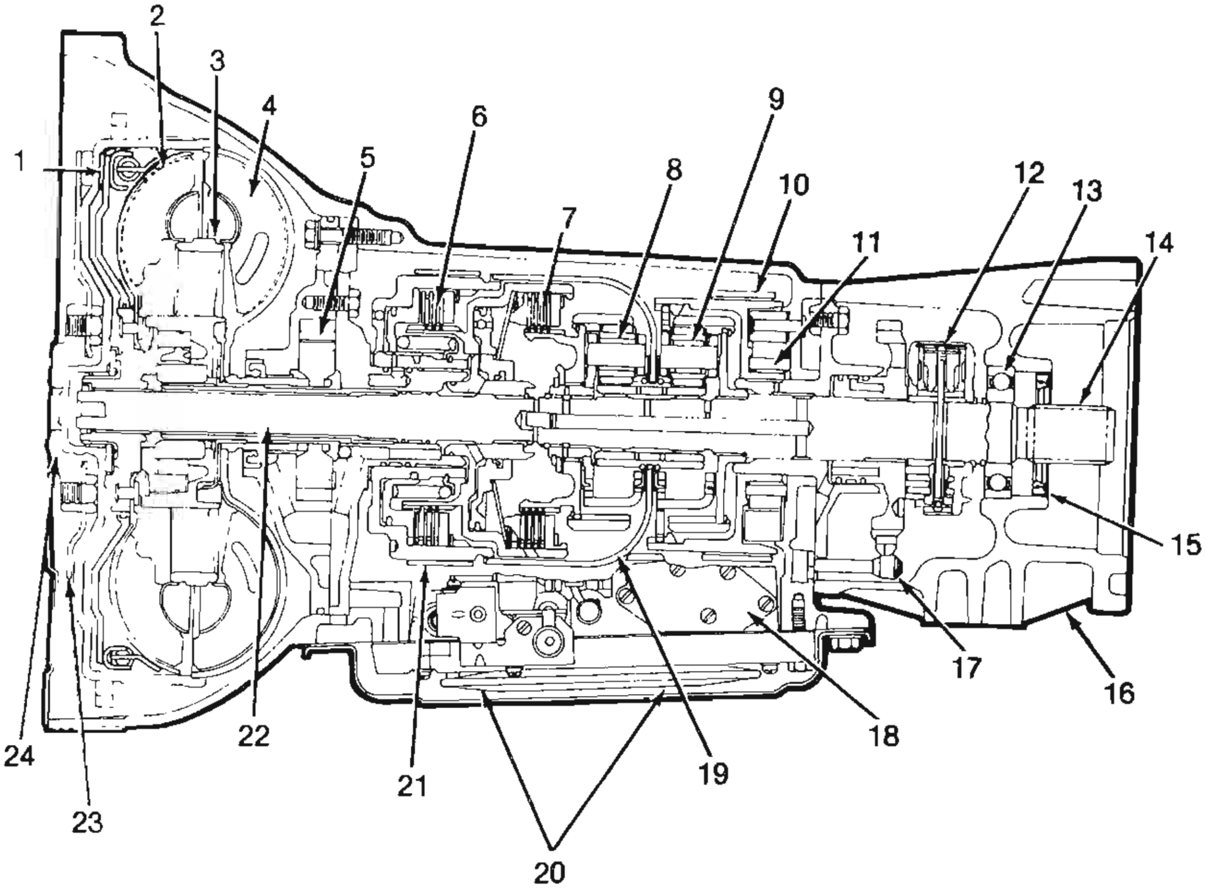
SEE
I.S.
NOTES



GENERAL

SEE I.S. NOTES

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.



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

84448

SEE I.S. NOTES

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	■	

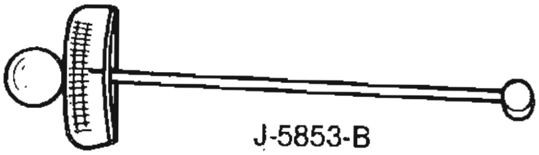
SEE I.S. NOTES

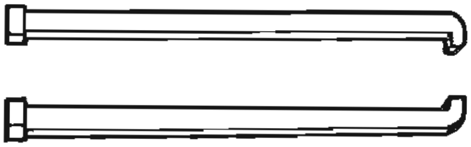
SPECIAL TOOLS continued

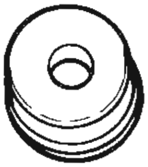
Tool Ref.	Description	Required	Recommended
J-24032	Reaction Shaft Bushing Installer	■	
J-24033	Pump Rotor Alignment Tools	■	
J-24036-A	Reaction Shaft Bushing Remover	■	
J-24037-A	Reaction Shaft Bushing Remover (727)	■	
J-24038	Reaction Shaft Bushing Installer (727)	■	
J-24039	Front Clutch Retainer Bushing Remover and Installer (727)	■	

SEE
I.S.
NOTES

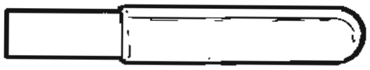

J-24044

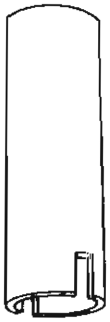

J-5853-B

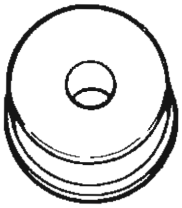

J-22205


J-24039


J-24038

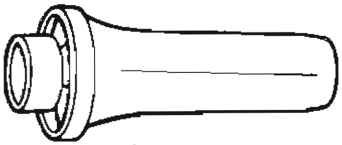

J-24031

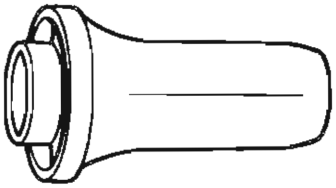

J-24045

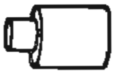

J-24055

84449

SEE I.S. NOTES

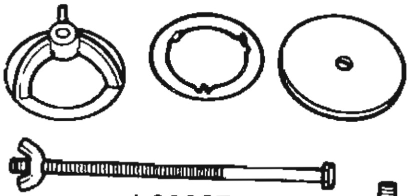

J-9617


J-21055-01


J-24040-A

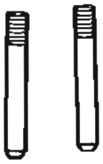

J-24064

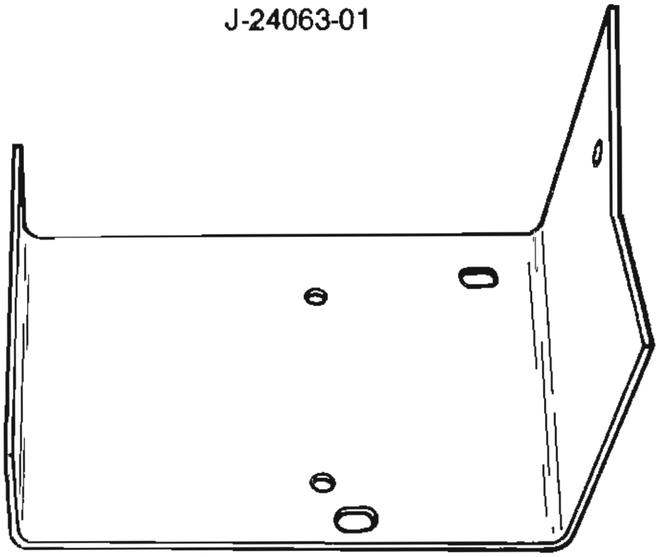

J-24049-A

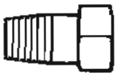

J-23327


J-24063-01

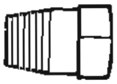

J-24108-A

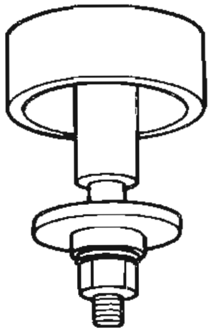

J-3387-2

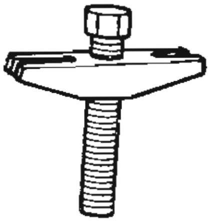

J-24026


J-24036-A


J-24041-A

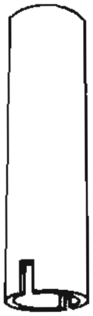

J-24037-A

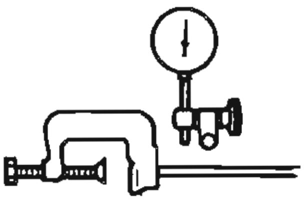

J-24042


J-21232-01


J-24032


J-24048


J-24033


J-8001

84450

SEE
I.S.
NOTES

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 0.71 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	727
Number of Front Clutch Plates	4	4	5	4
Number of Front Clutch Discs	4	4	5	4
Number of Rear Clutch Plates	3	3	3	3
Number of Rear Clutch Discs	4	4	4	4

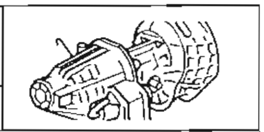
	MODEL 904 HO		MODEL 998		MODEL 999		MODEL 727	
	U.S. Measure	Metric Measure	U.S. Measure	Metric Measure	U.S. Measure	Metric Measure	U.S. Measure	Metric Measure
Torque Converter Diameter..........	260 mm (10.2 in.)		10.75 in				10.75 in.	
Oil Capacity — Transmission and Torque Converter	15.8 pts.	7.5 ltrs.	17 pts.	7.9 ltrs.	17 pts.	7.9 ltrs	17 pts.	7.9 ltrs.
Cooling Method — All Models	Water-Heat Exhanger (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.	
Ouput 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. .068 to .070 In. .076 to .078 in.		.060 to .062 in. .068 to .070 in. .076 to .078 in		.060 to .062 in. .068 to .070 In. .076 to .078 In.		.060 to .062 in. .074 to .076 in. .088 to .090 in.	
Output Shaft (Forward End)	.040 to .044 in. .048 to .052 in. .059 to .065 in.		.040 to .044 in. .048 to .052 in. .059 to .065 in.		.040 to .044 In. .048 to .052 in. .059 to .065 in.		.048 to .052 in. .055 to .059 in. .062 to .066 in.	

84451

SEE I.S. NOTES

TORQUE SPECIFICATIONS

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)	–



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

84452

SEE T.S. NOTES

TRANSMISSION DISASSEMBLY

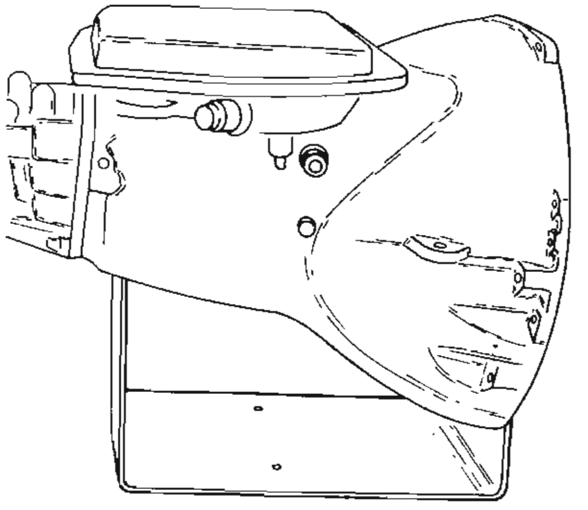
CAUTION: Cleanliness during disassembly and assembly is necessary to avoid a further malfunction after assembly. Before removing any of the transmission subassemblies, plug all openings and thoroughly clean the transmission exterior. Steam cleaning equipment is preferable for this purpose. During disassembly, 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.

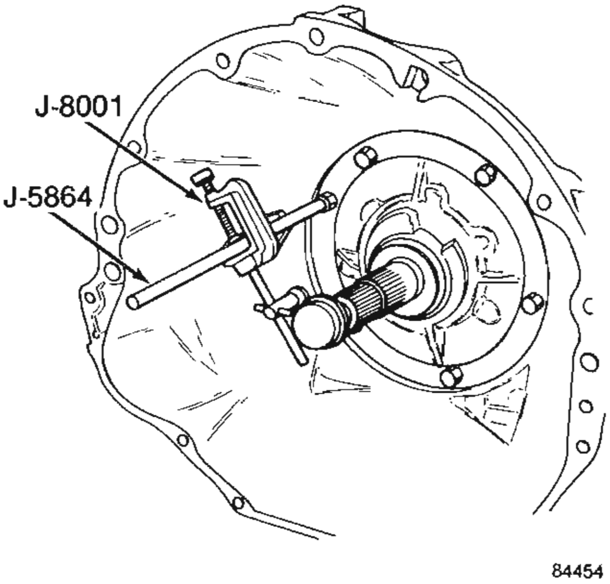
Mount the transmission in Holding Fixture J-24026.



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.



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.

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).

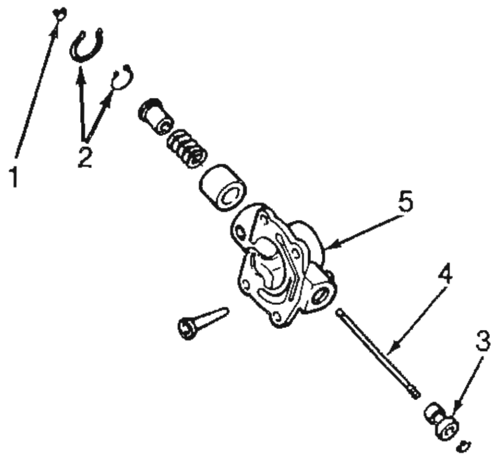
Remove the valve (3) and the shaft (4) from the governor body (5).

Rotate the output shaft until the governor weight faces downward.

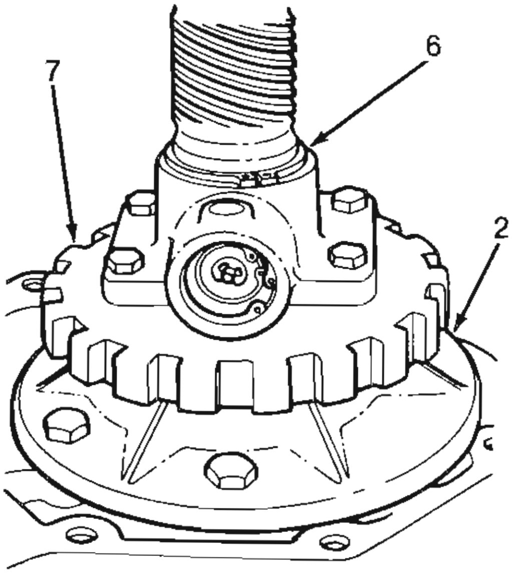
Remove the snap ring located behind the governor body (6).

Remove the governor body and the park gear assembly from the output shaft (7).

SEE I.S. NOTES



84455



84456

SEE I.S. NOTES

Oil Pump and Reaction Shaft Support

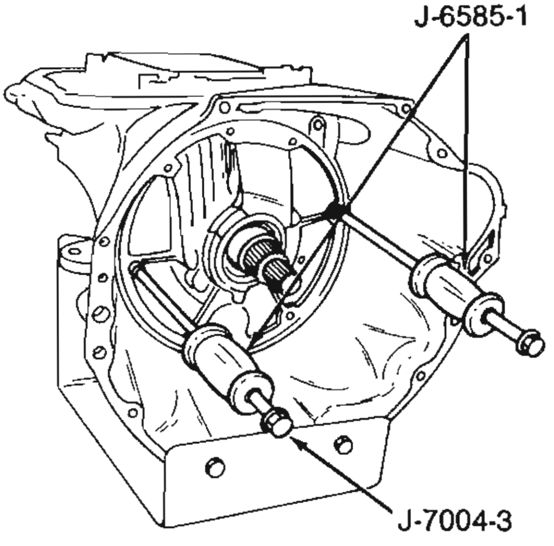
Tighten the front band adjusting screw until the band is tight around the front clutch retainer. This prevents the front clutch assembly from coming out with the pump and damaging the clutch discs.

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.

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.

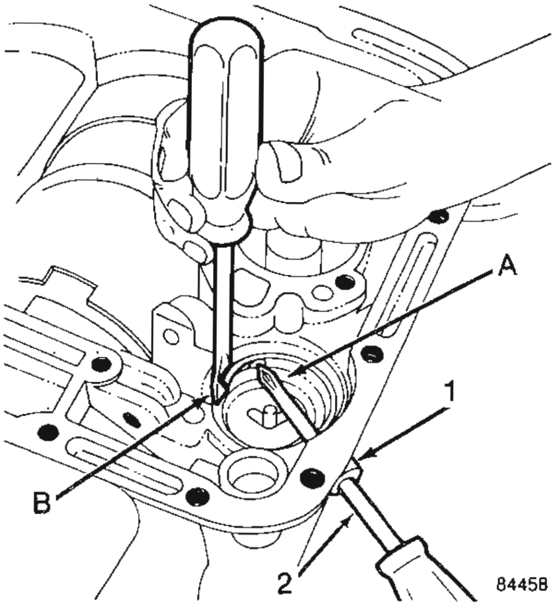
Compress the rod guide and remove the screwdriver.

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.

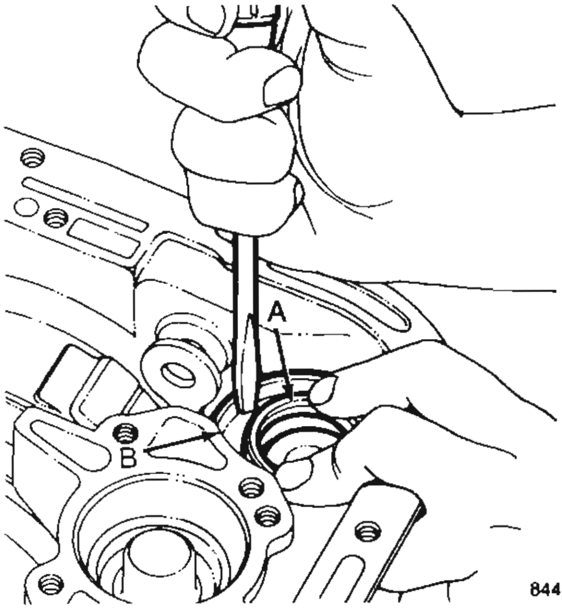


SEE I.S. NOTES

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.



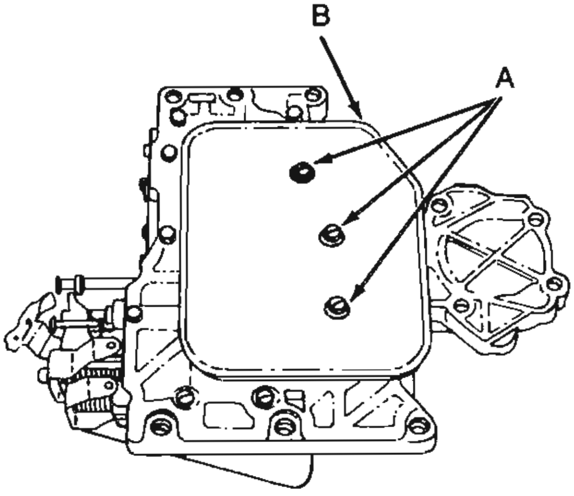
SUBASSEMBLY OVERHAUL

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.



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.

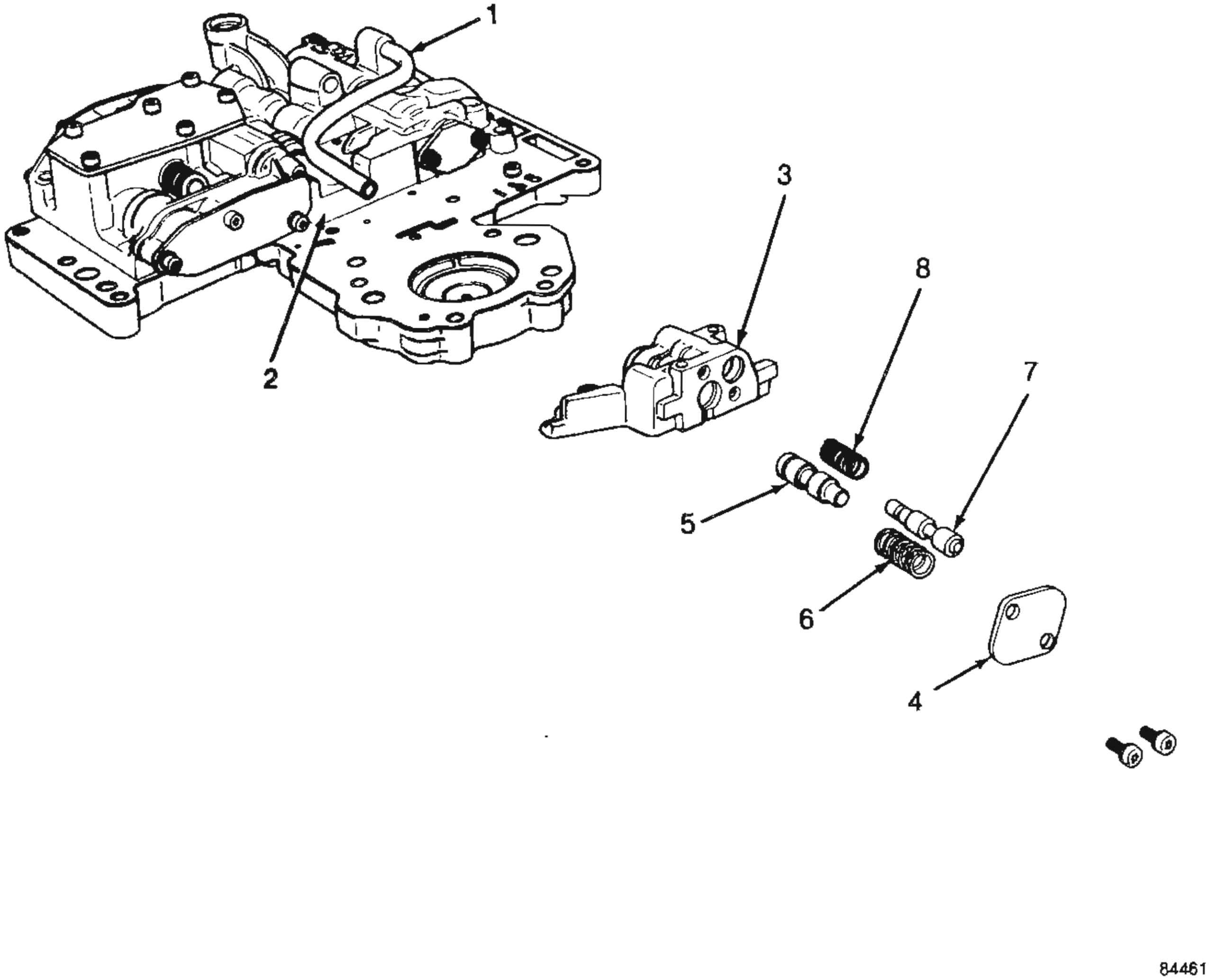
Slide the lockup module oil tube (1) out of valve body (2) and remove the tube and module (3) as an assembly.

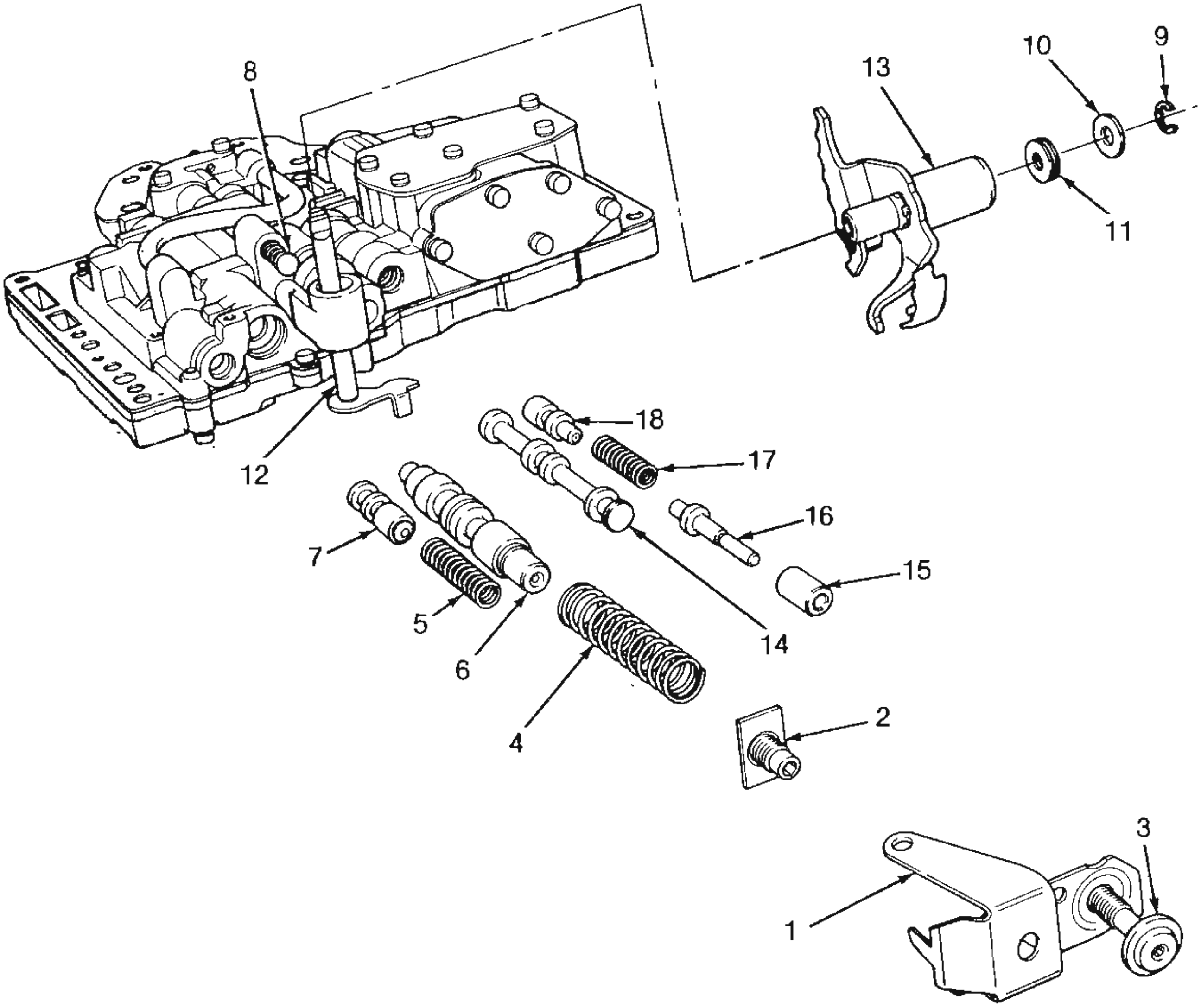
Remove the end plate from the module (4).

Remove the lockup valve (5) and the spring (6).

Remove the fail-safe valve (7) and the spring (8).

SEE
I.S.
NOTES





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).

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.

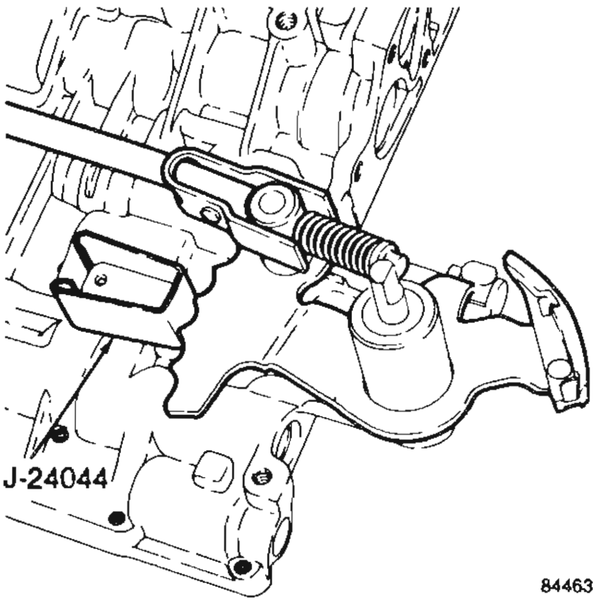
Remove the E-clip and park control rod from the manual lever.

Remove the retainer tool, detent ball, and spring.

Tag the spring for assembly reference.

Remove the manual valve (14).

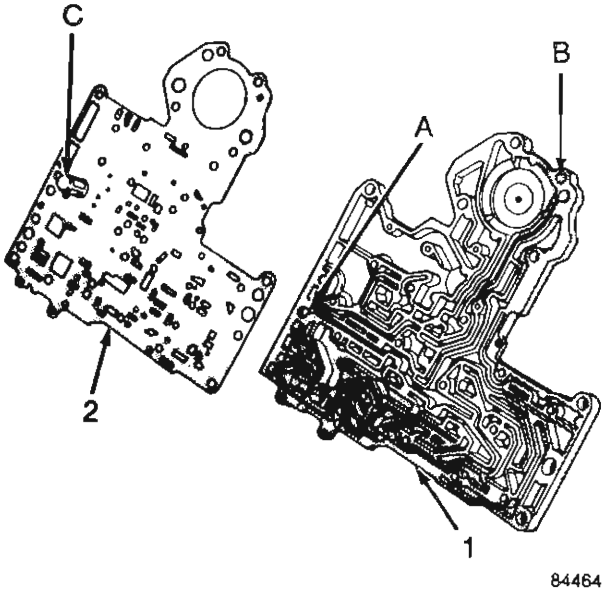
Remove the kickdown detent (15), kickdown valve (16), throttle valve spring (17), and the throttle valve (18). Tag the spring for assembly reference.



Remove the transfer plate assembly retaining screws and remove the transfer plate (1) assembly.

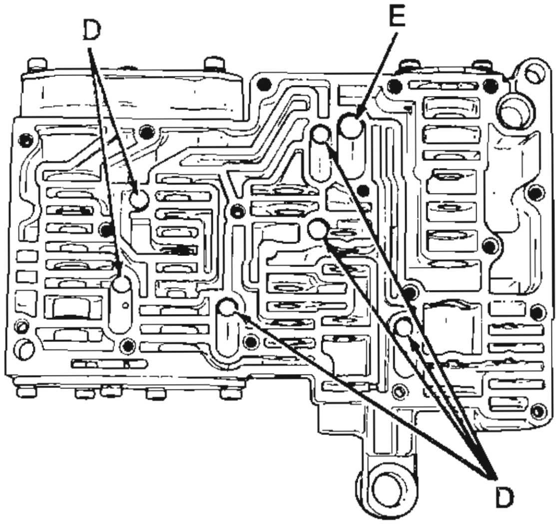
Remove the screws attaching the separator plate (2) to the transfer plate and separate these parts.

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.



SEE I.S. NOTES

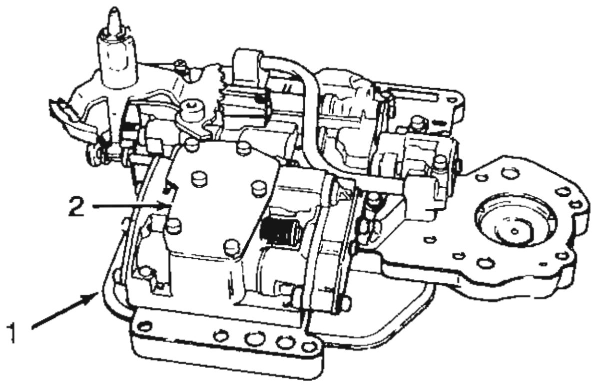
Remove the check balls from the valve body.



Check Ball Size Chart
A = 11/32 Inch Diameter B = 1/4 Inch Diameter

84465

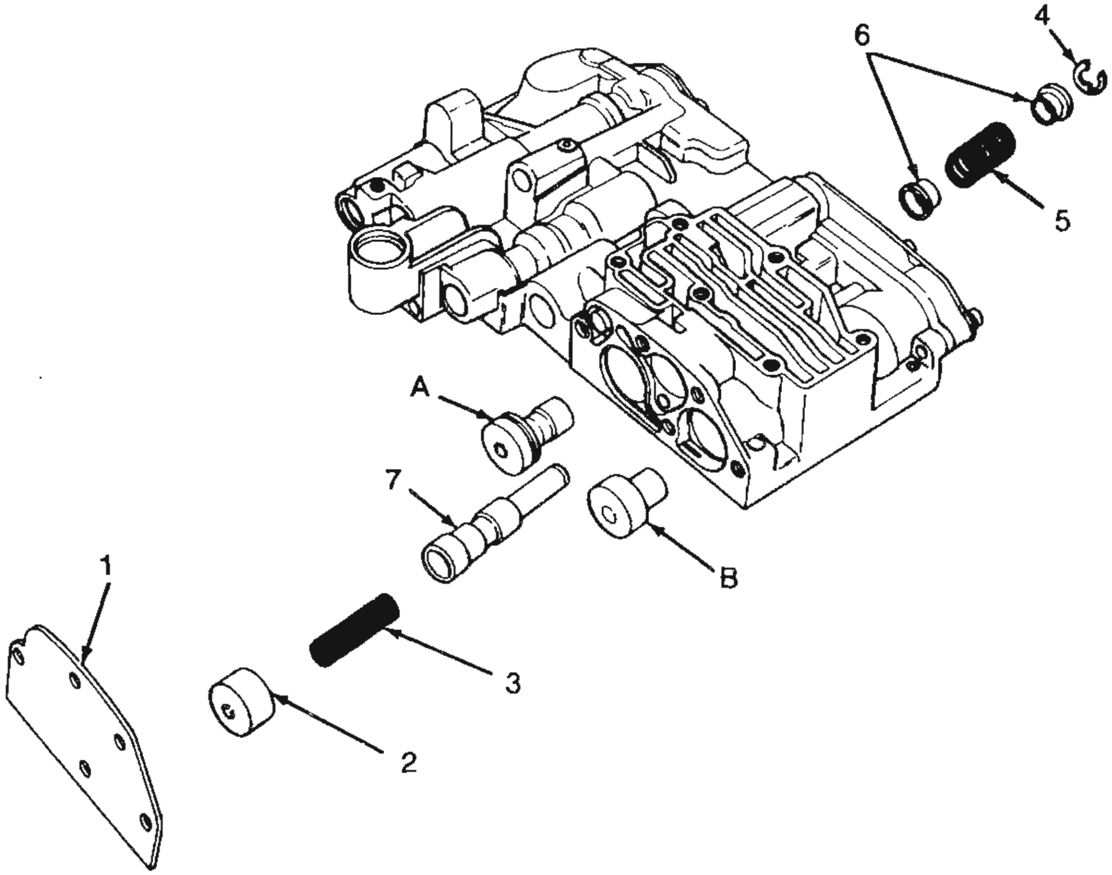
Turn the valve body (1) over and remove the shuttle valve cover plate (2).



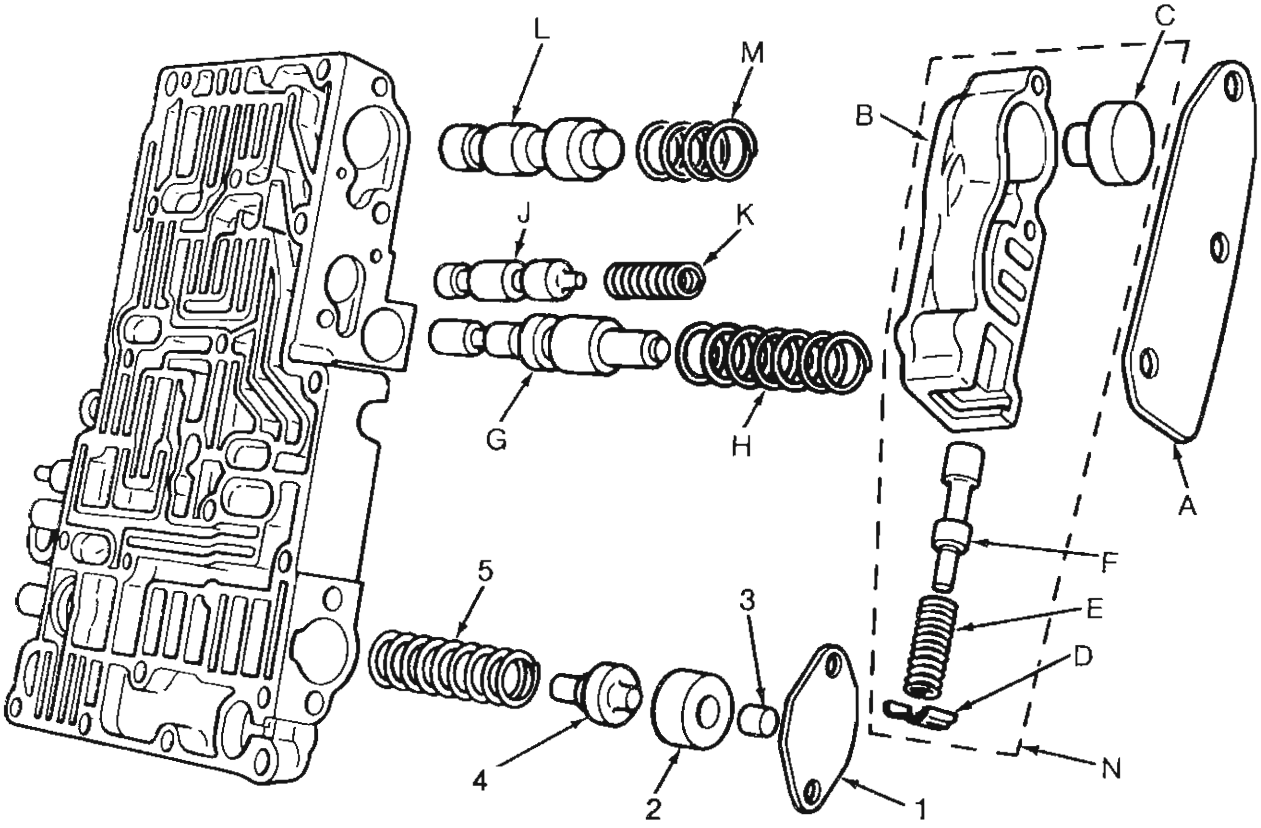
84466

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).



84467



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.

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.

SEE I.S. NOTES

Assembly

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).

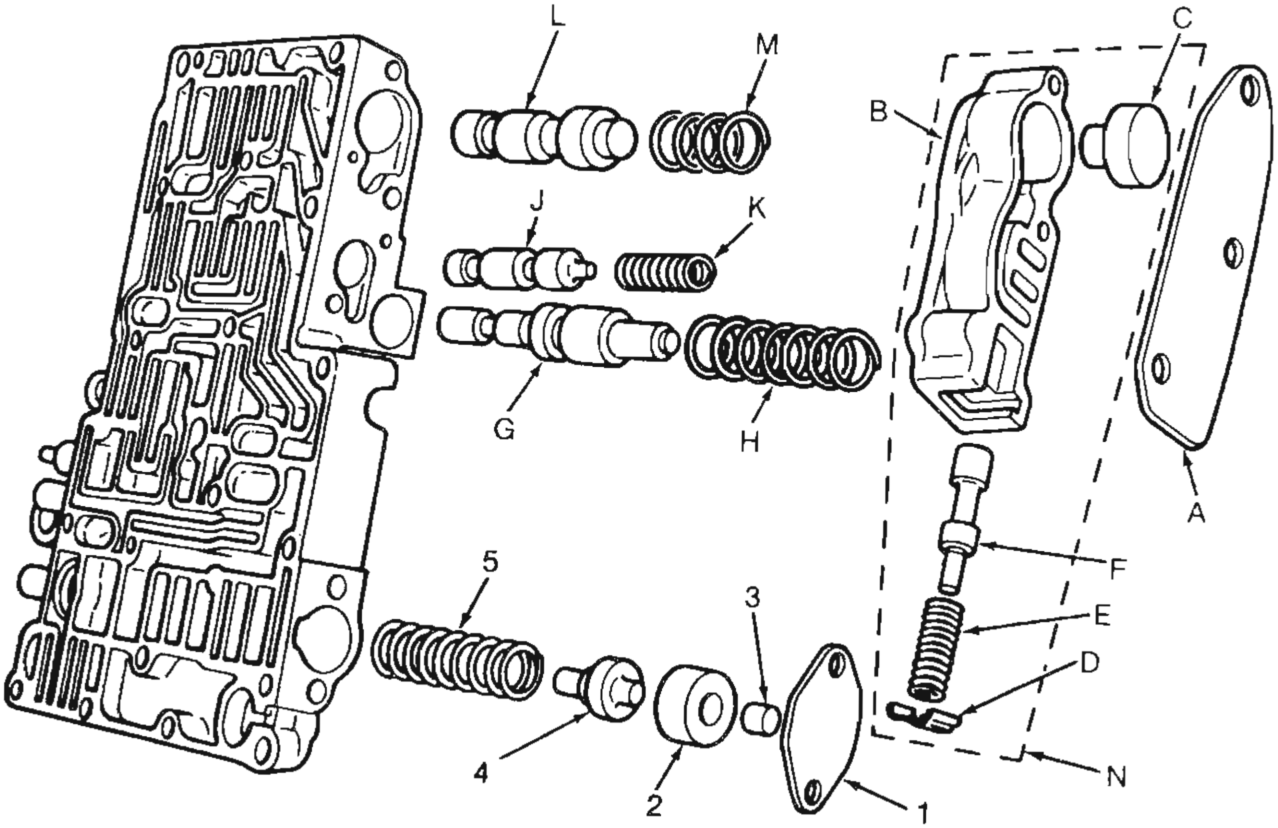
Assemble and install the downshift housing assembly in the following sequence:

(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.

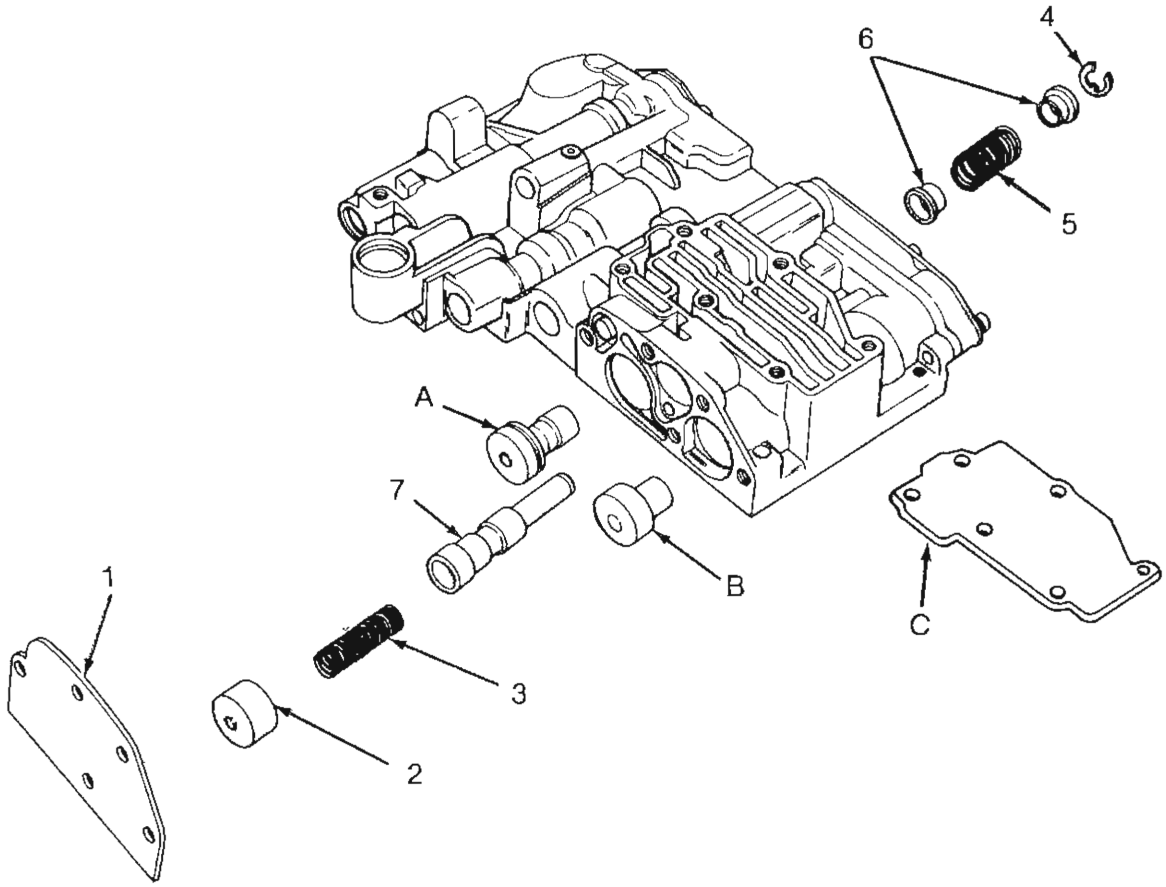
Install the throttle pressure regulator valve spring (5) and plug (4).

Install the line pressure regulator valve sleeve (2) and plug (3).

Install the line pressure regulator valve end plate (1).



84469



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).

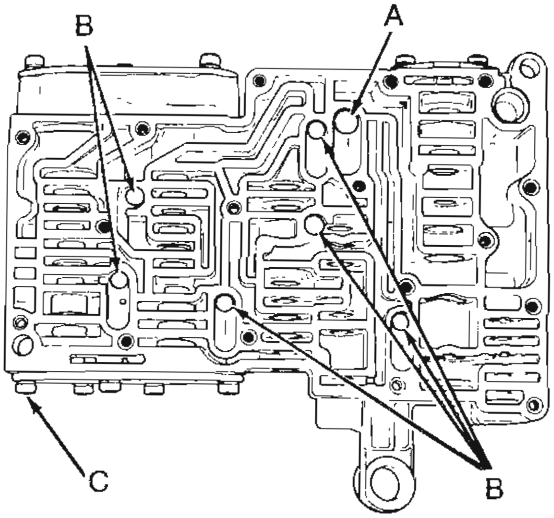
Install the shuttle valve cover plate (C) and tighten the screws to 4 N·m (35 in-lbs) torque.

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).

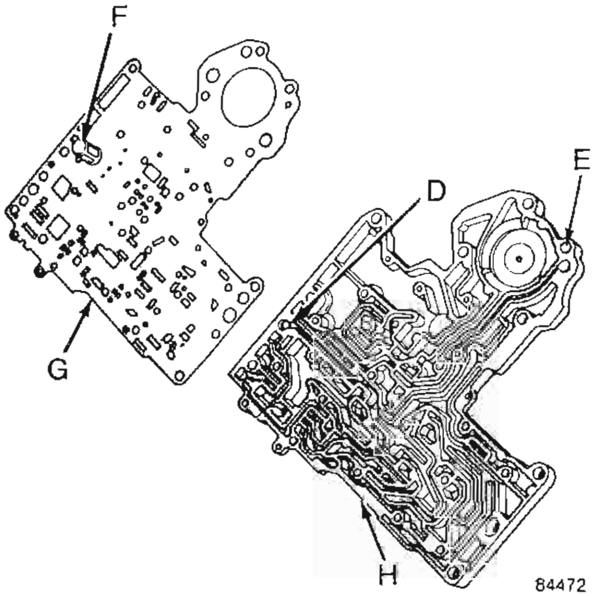


84471

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.

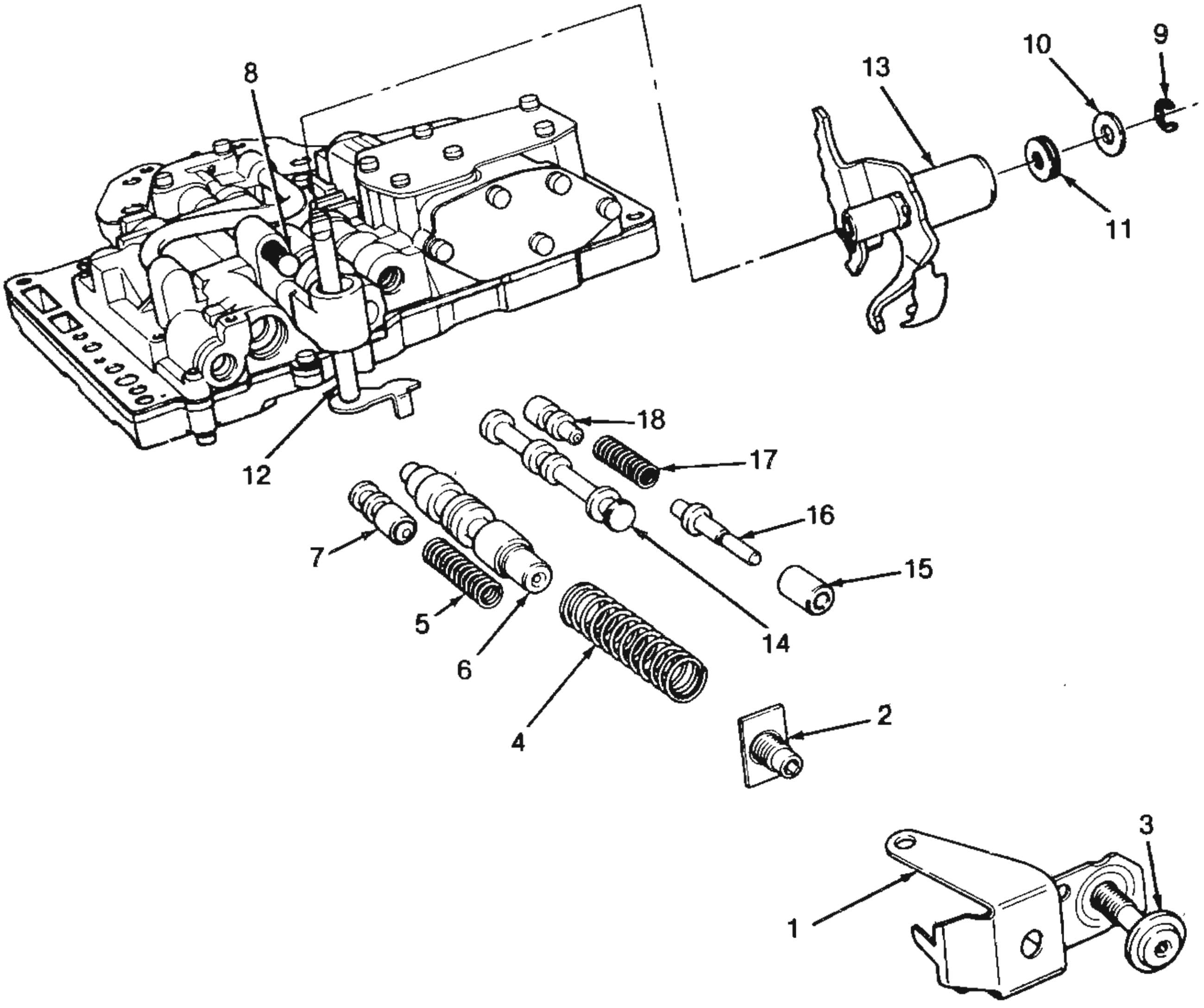


84472

Check Ball Size Chart
A = 11/32 Inch Diameter B = 1/4 Inch Diameter

84473

SEE I.S. NOTES



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.

Remove the detent ball retainer tool.

Install the line pressure and torque converter control valves.

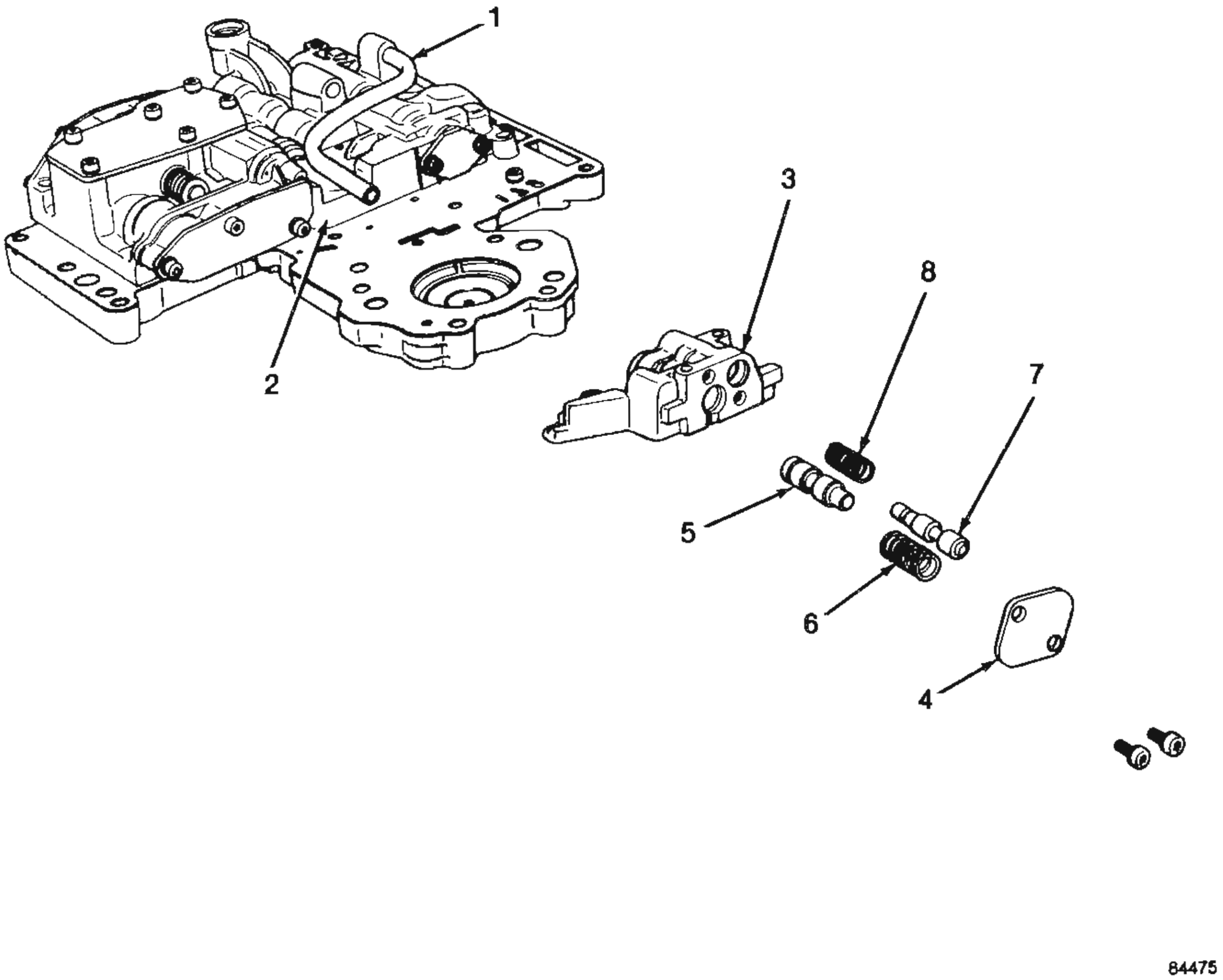
Install the torque converter and line pressure regulator valve springs (4) (5).

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.

SEE I.S. NOTES


1
2
3
8
7
5
6
4
84475

SEE
I.S.
NOTES

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

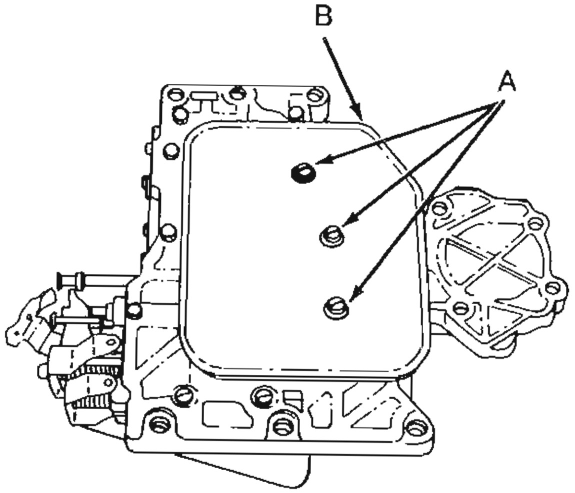
Disassembly

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

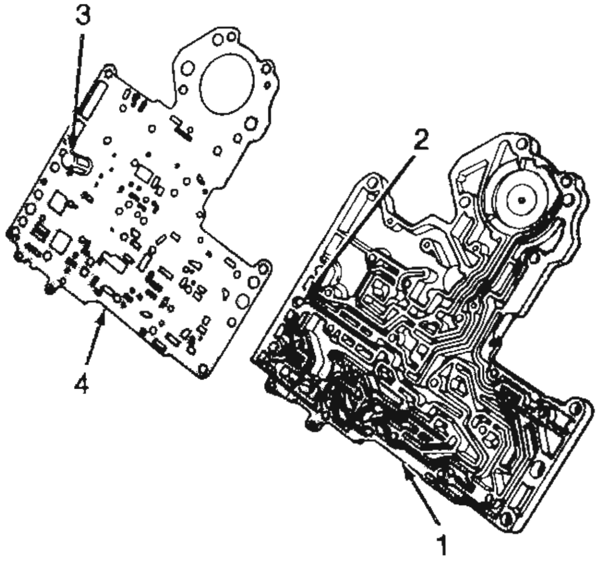
Remove the transfer plate assembly retaining screws and remove the transfer plate assembly (1).

Remove the screws attaching the stiffener and separator plates to the transfer plate and separate these parts.

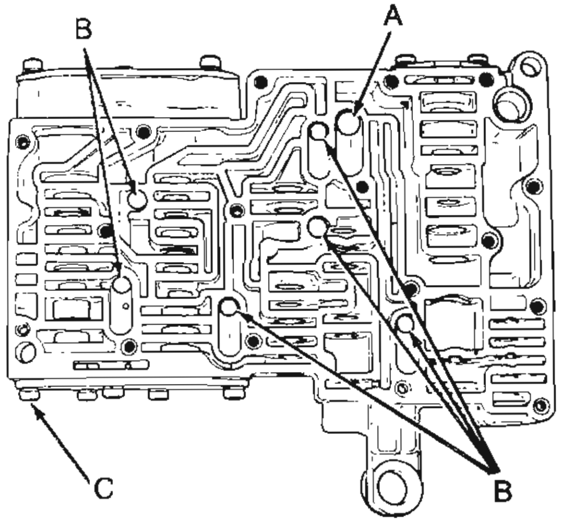
SEE I.S. NOTES

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.

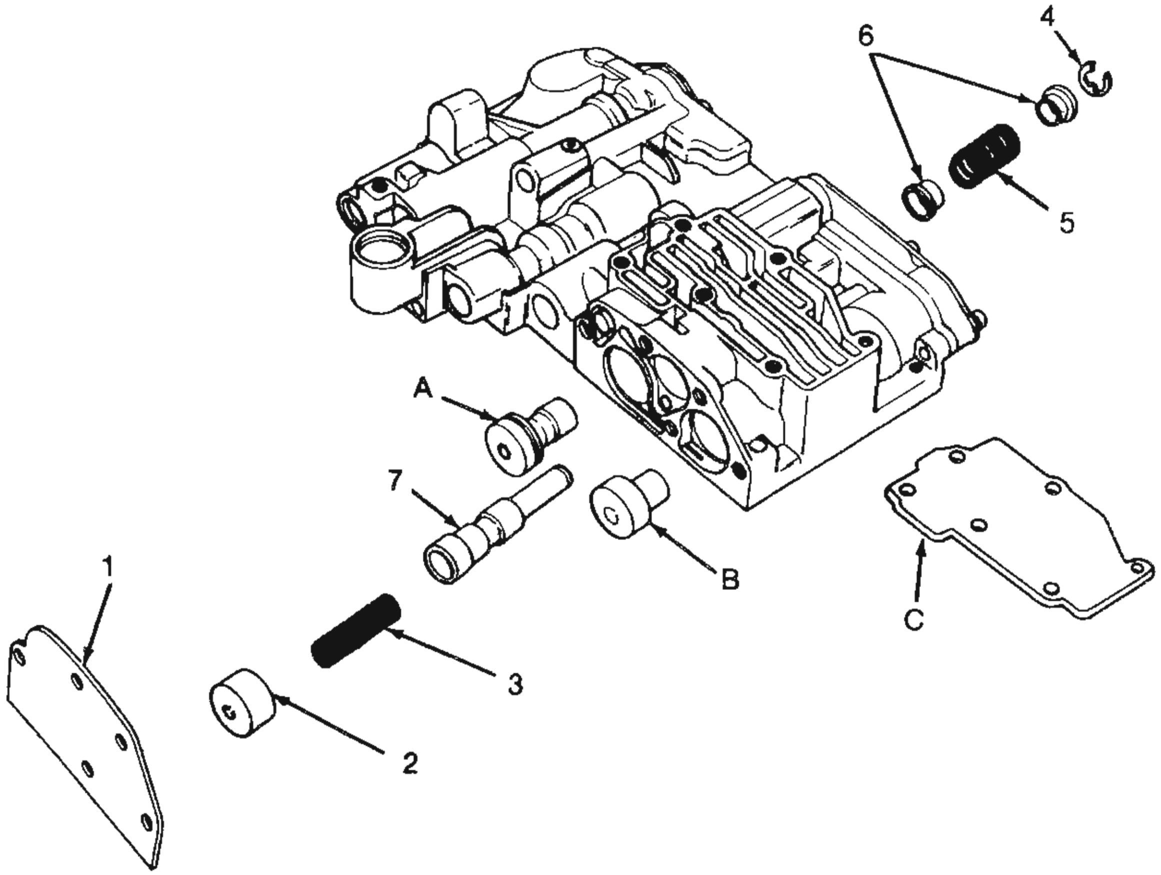


84477



Check Ball Size Chart
A = 11/32 Inch Diameter
B = 1/4 Inch Diameter

84478

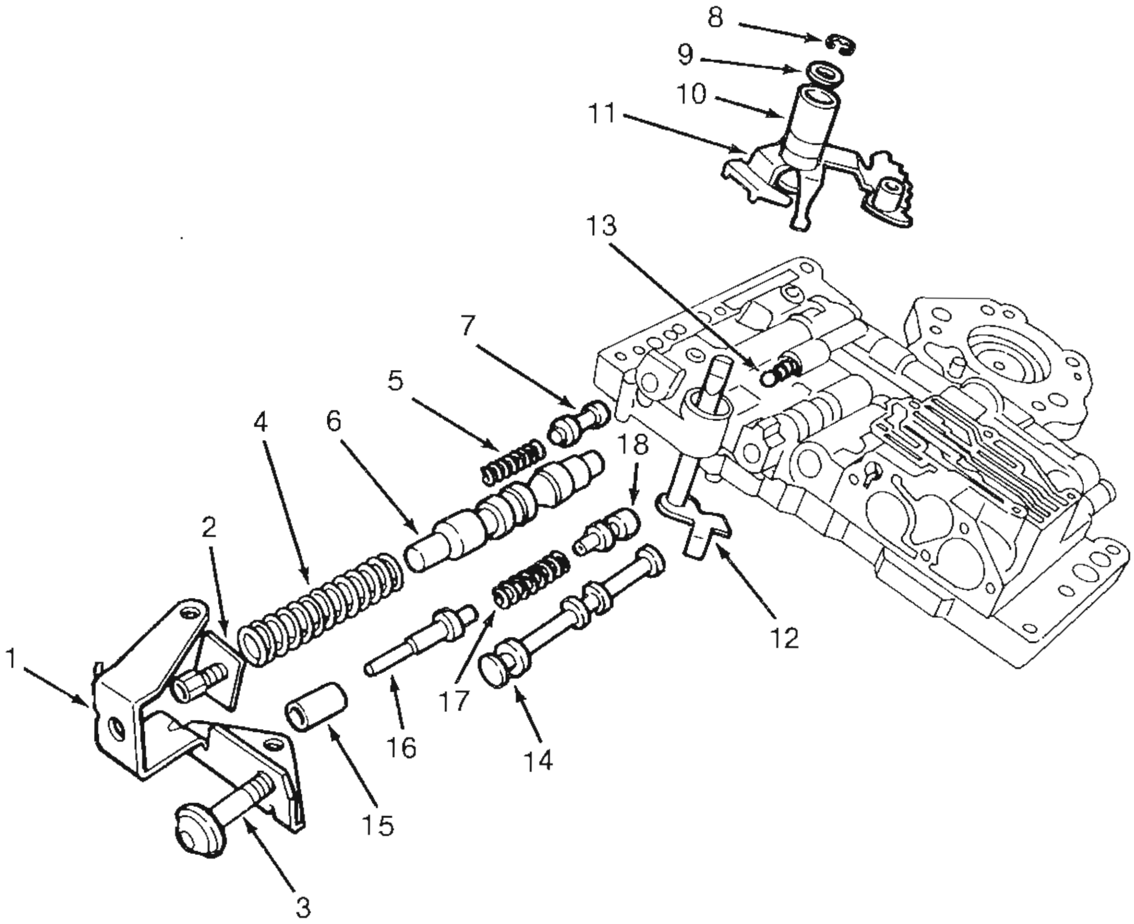


Turn the valve body over and remove the shuttle valve cover plate.

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).

SEE
1.S.
NOTES



Remove the screws attaching the line pressure adjusting screw bracket and retainer (I) 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.

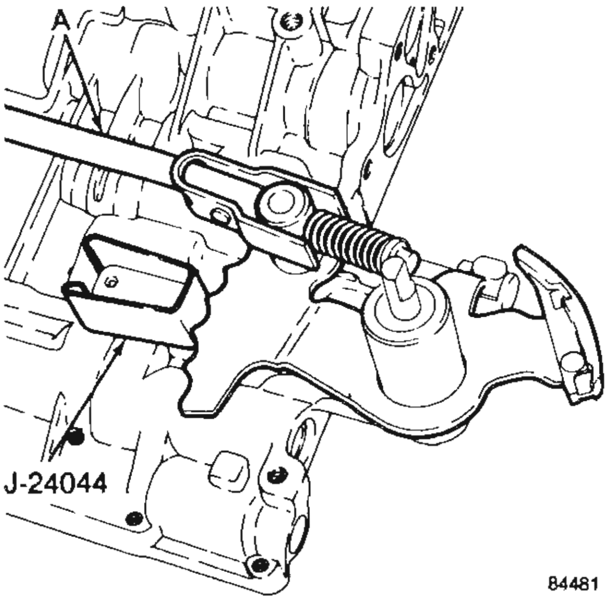
Install the Detent Ball Retainer Tool J-24044 around the detent ball casing.

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).



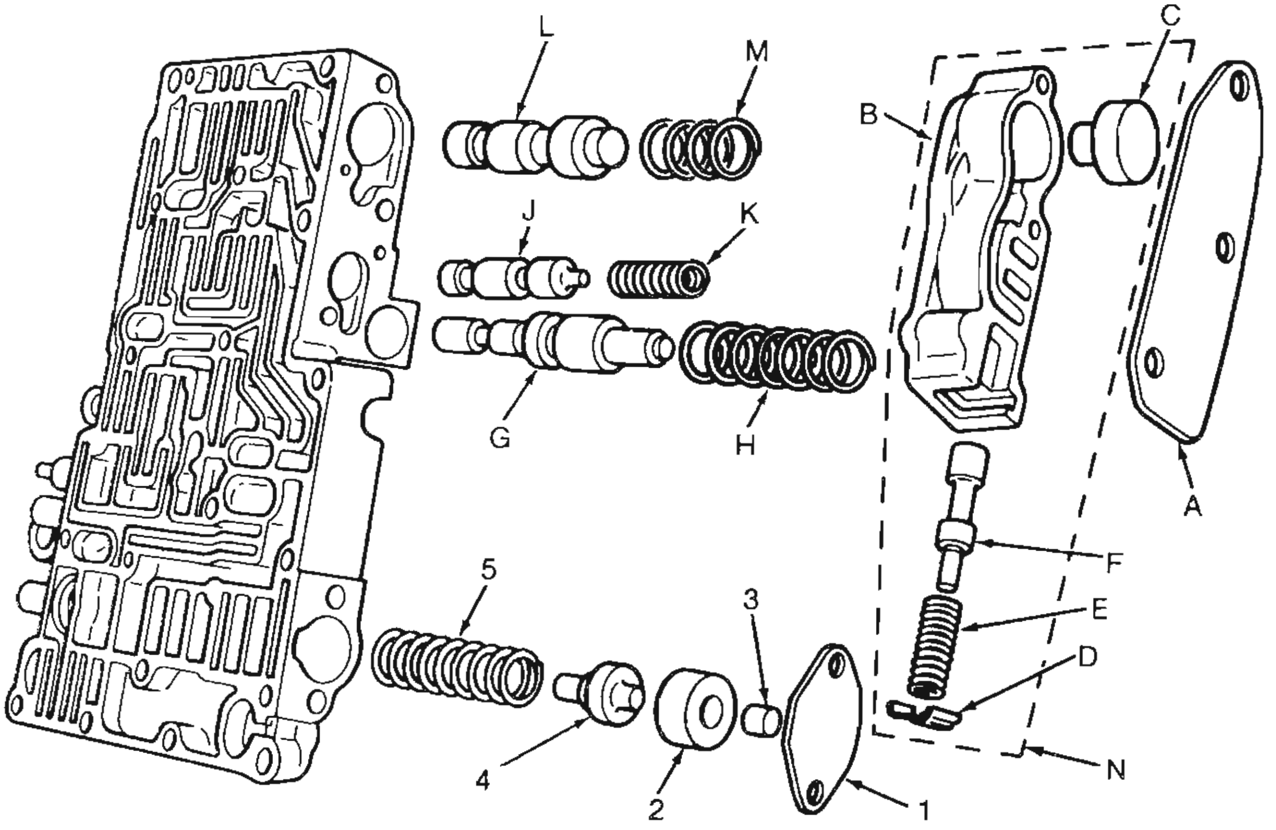
CAUTION: The detent ball retainer tool is holding the ball against spring pressure. Shield the ball casing area with one hand before removing the retainer tool and detent ball.

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.

EE
.S.
NOTES



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.

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 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.

SEE
I.S.
NOTES

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.

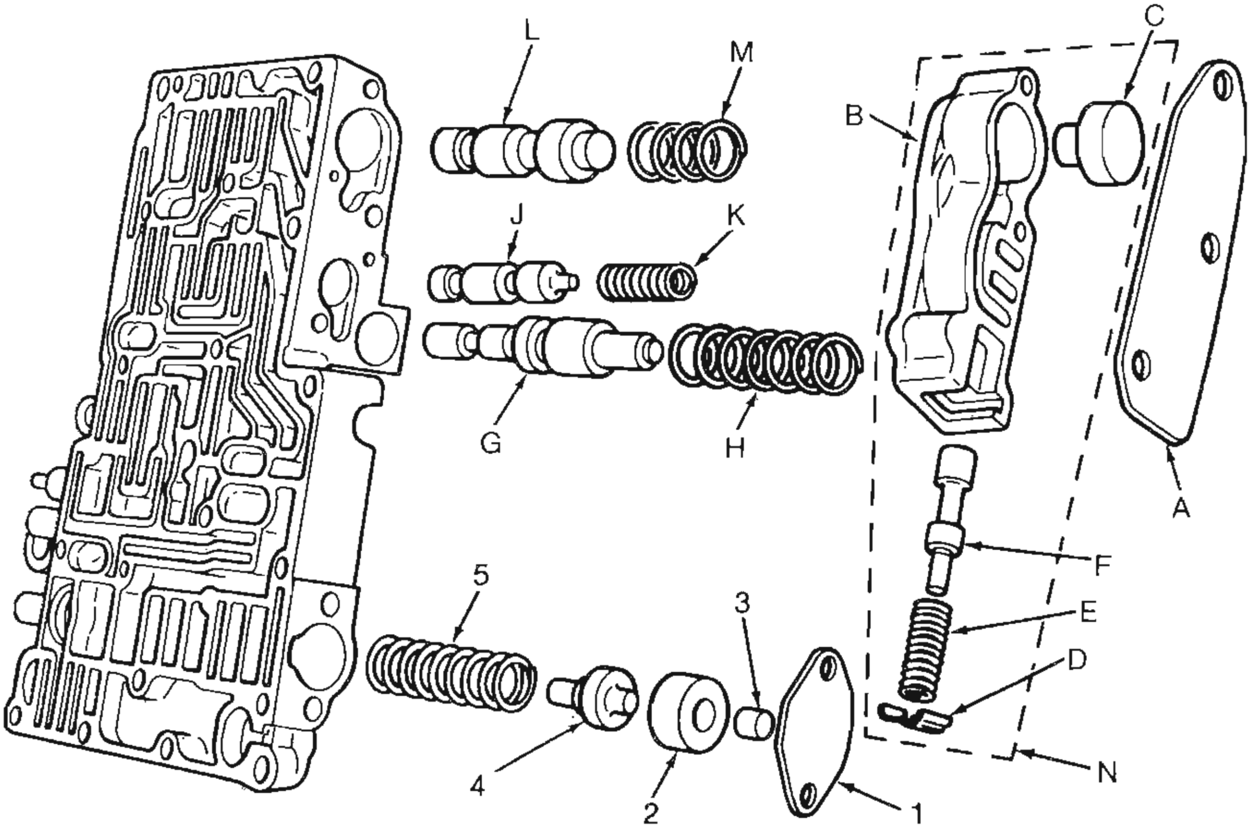
Assemble and install the downshift housing assembly in the following sequence:

(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.

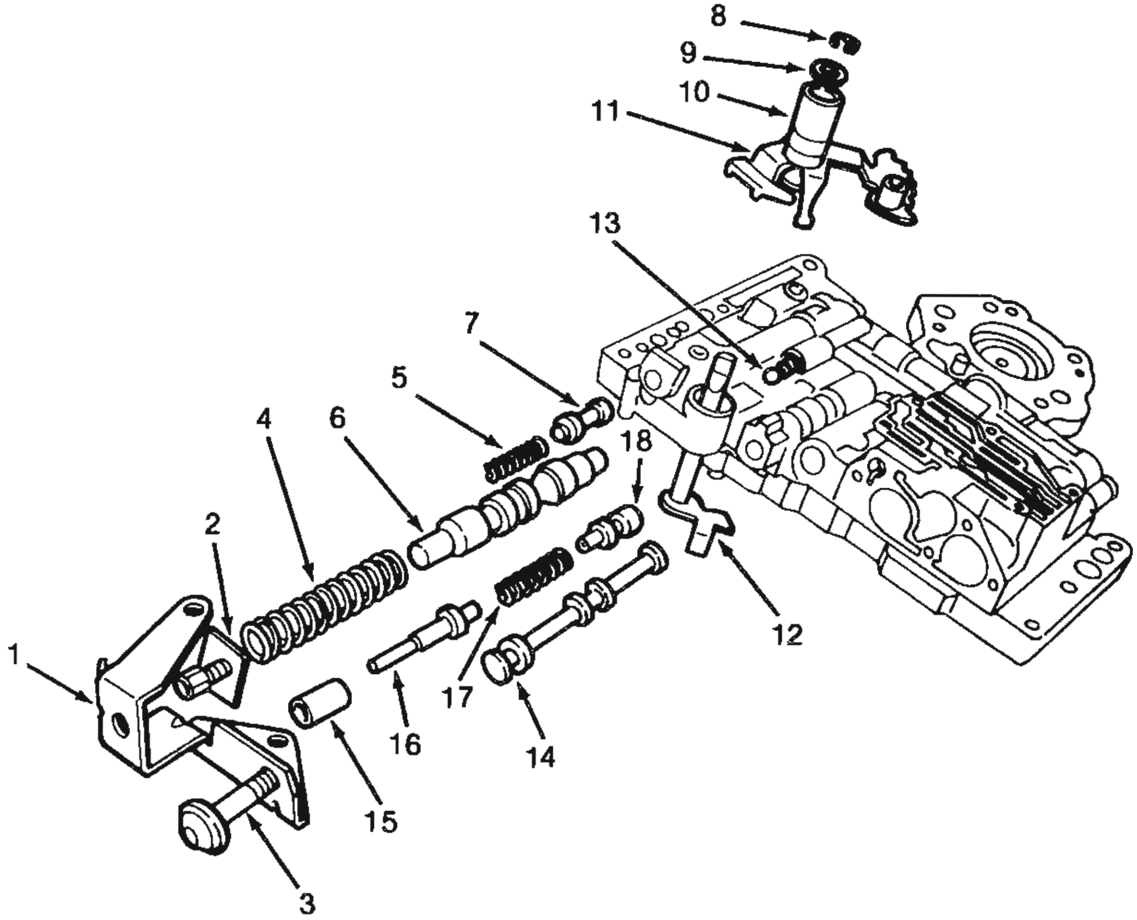
Install the throttle pressure regulator valve spring (5) and plug (4).

Install the line pressure regulator valve plug (3) and sleeve (2).

Install the line pressure regulator valve end plate (1).


L
M
C
B
J
K
G
H
A
F
5
3
E
D
N
4
2
1

84482



84483

SEE I.S. NOTES

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.

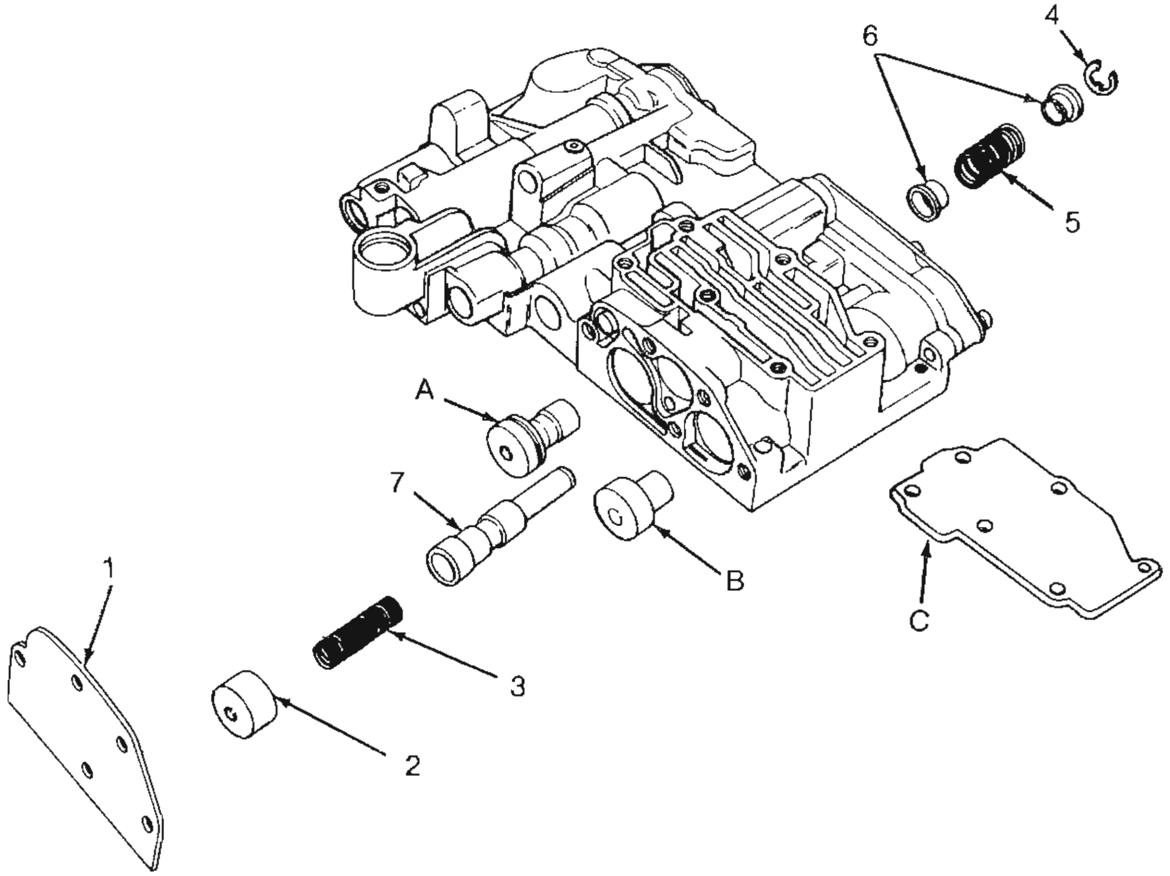
Remove the detent ball retainer tool.

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.



84484

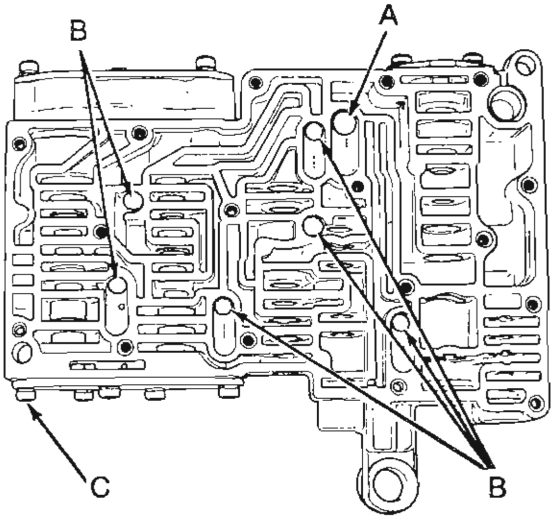
Install the 1-2 (A) and 2-3 (B) shift valve governor plugs.

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.

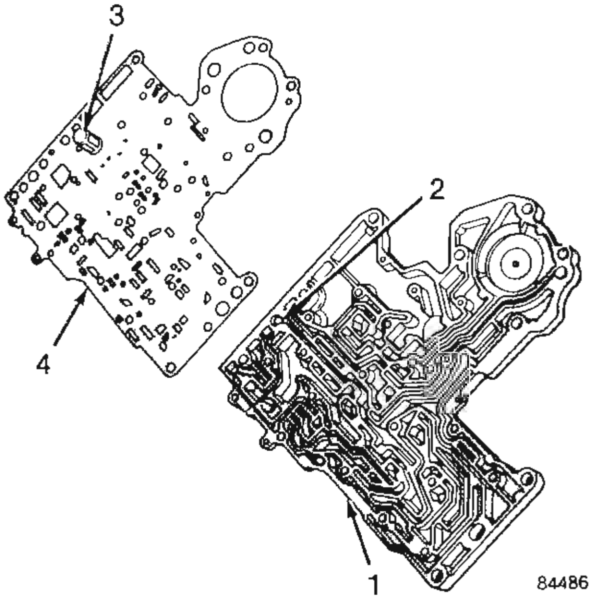
Install the spring guides (6), shuttle valve secondary spring (5) and E-clip (4).

Install the shuttle valve cover plate (C) and tighten the screws to 4 N·m (35 in-lbs) torque.



Check Ball Size Chart
A = 11/32 Inch Diameter B = 1/4 Inch Diameter

84485



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.

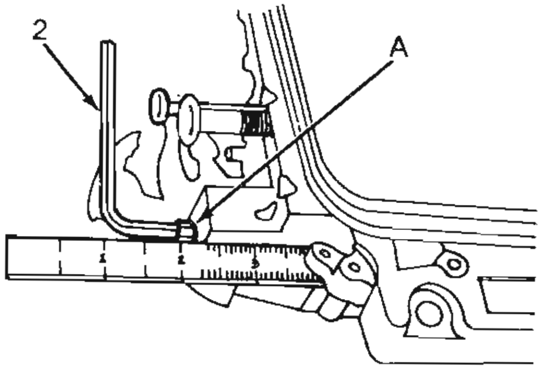
NOTE: If pressures were satisfactory before disassembly, do not change the line or throttle pressure adjusting screw settings.

SEE I.S. NOTES

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

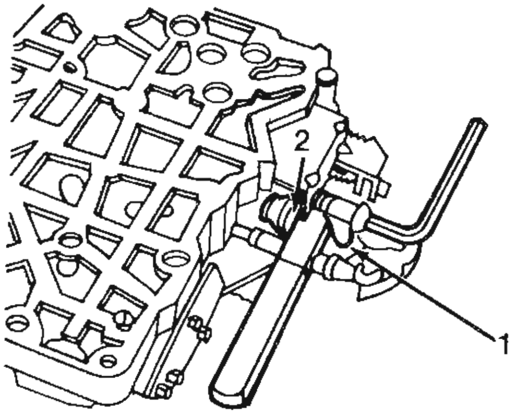
Line Pressure Adjustment

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.



84488

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.

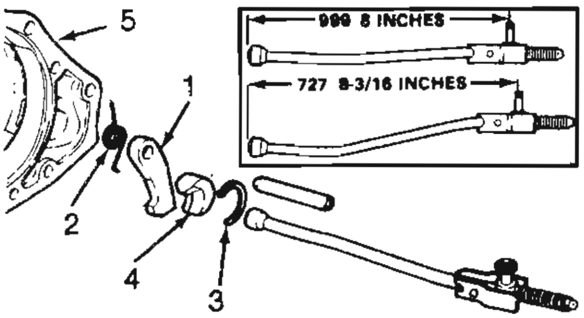
Install the replacement bearing in the housing and install the snap rings.

Install the replacement seal in the housing. Seat the seal flush with the edge of the seal bore in the housing.

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

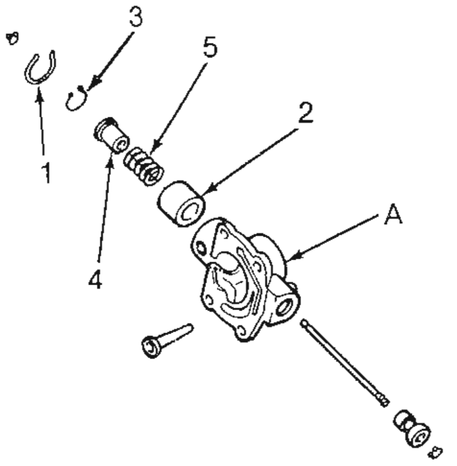
Remove the large snap ring (1) from the weight end of the governor body (A).

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.



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

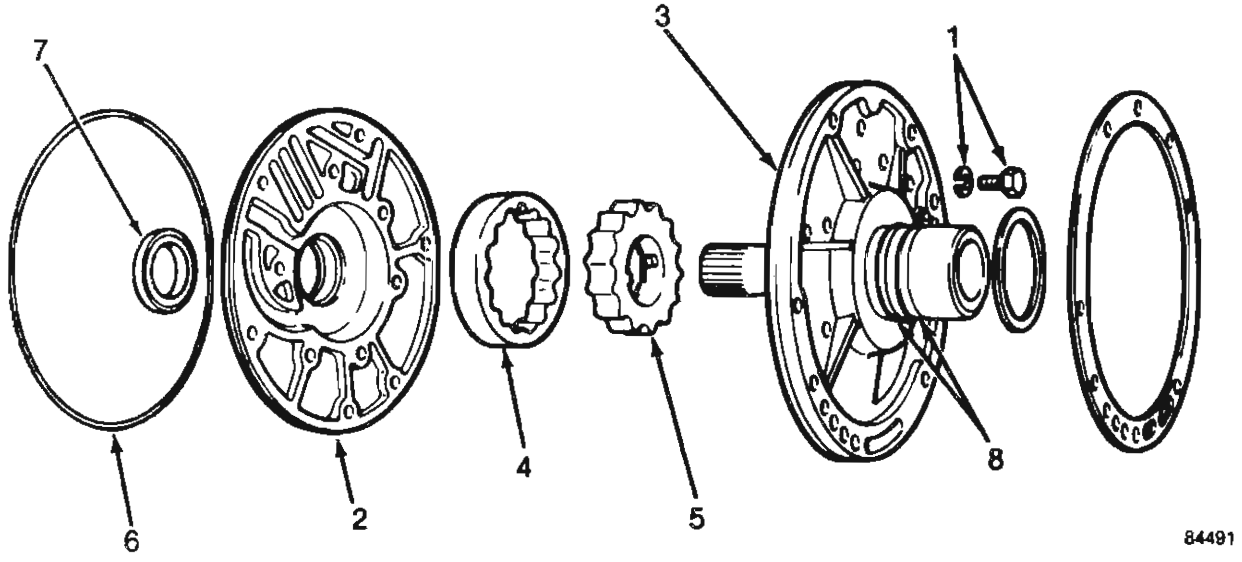
If the governor body was separated from park gear, assemble the parts and install the attaching bolts finger-tight.

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).



Oil Pump and Reaction Shaft Support – 900 Series

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.

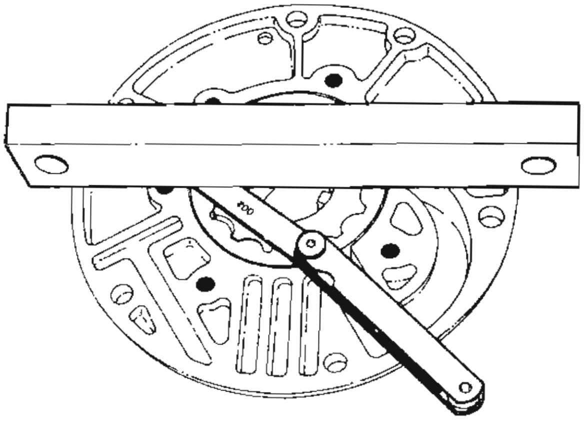
Remove the O-ring (6), seal (7) using a blunt punch.

Remove the front clutch seal rings (8) from the support.

Inspection

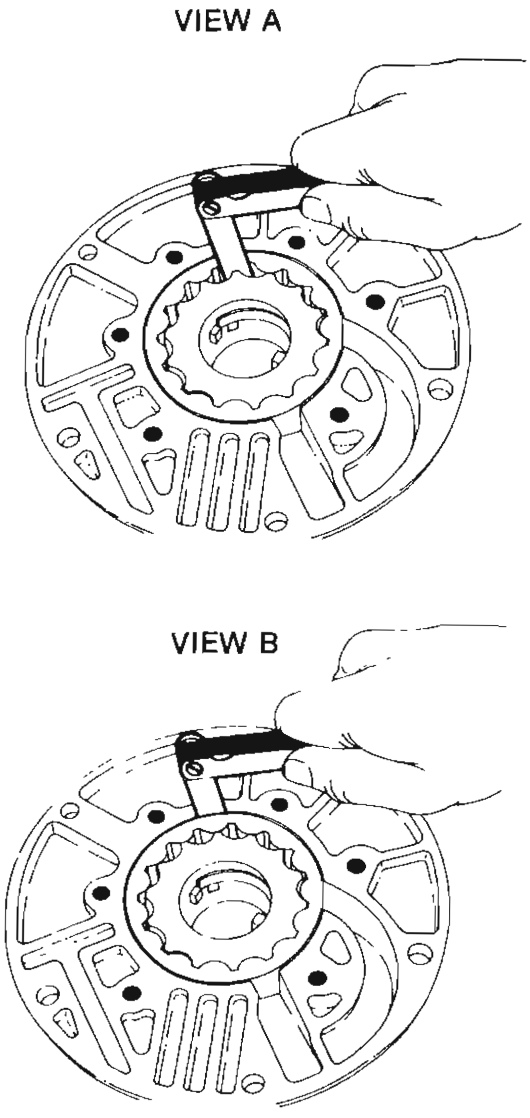
Inspect the front clutch seal ring grooves for burrs, nicks, or cracked edges. Inspect the front clutch retainer-to-reaction shaft support thrust washer for wear. The washer should be 1.09 to 1.14 mm (0.043 to 0.045 in) thick. Inspect all machined surfaces on the pump housing and support for nicks and 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).



84492

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).



84493

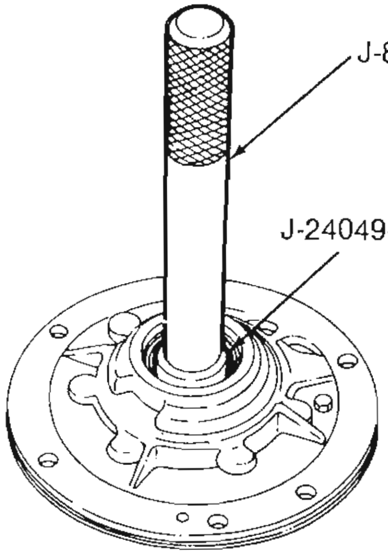
Measure the clearance between the outer surface of the outer rotor and the pump bore. The clearance should be 0.10 to 0.20 mm (0.004 to 0.008 in) (View B).

EE
.S.
NOTES

Pump Bushing Replacement

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.

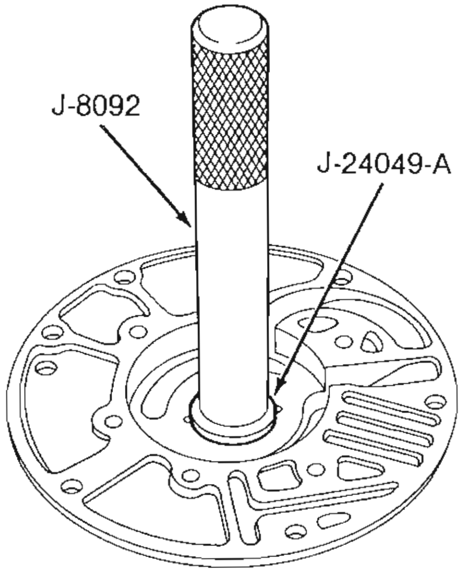


84494

NOTE: Be careful to keep the tool straight in the bore during removal.

Position replacement bushing on Installer Tool J-24049-A.

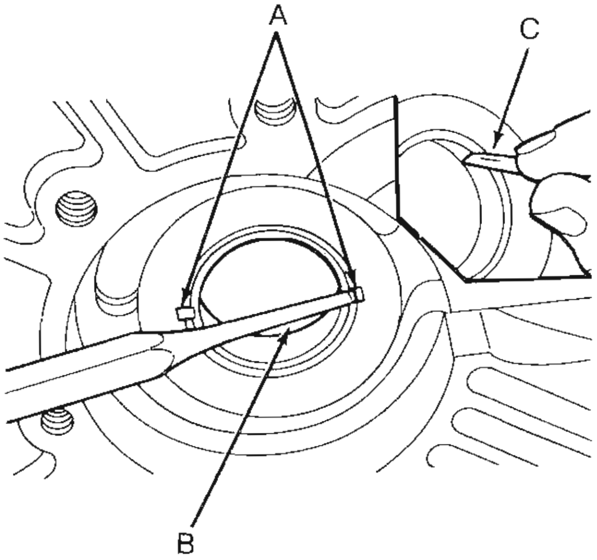
Turn the pump housing over and install the bushing straight into the housing until the edge of bushing is flush with the bore.



84495

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.



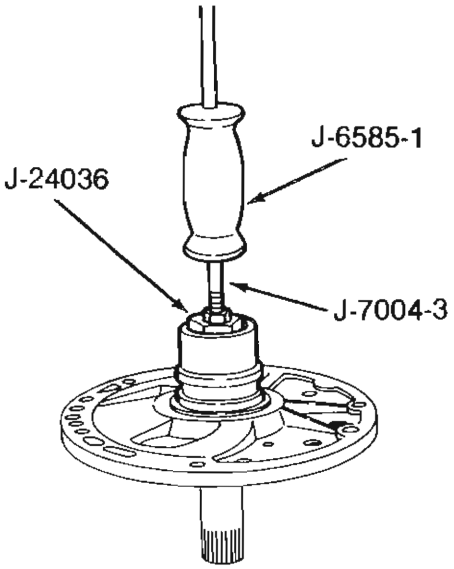
84496

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.

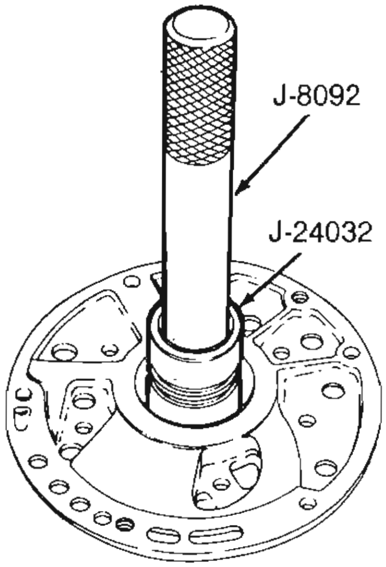
Bump outward with the slide hammers to remove the bushing.

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.



84498

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.

SEE
I.S.
NOTES

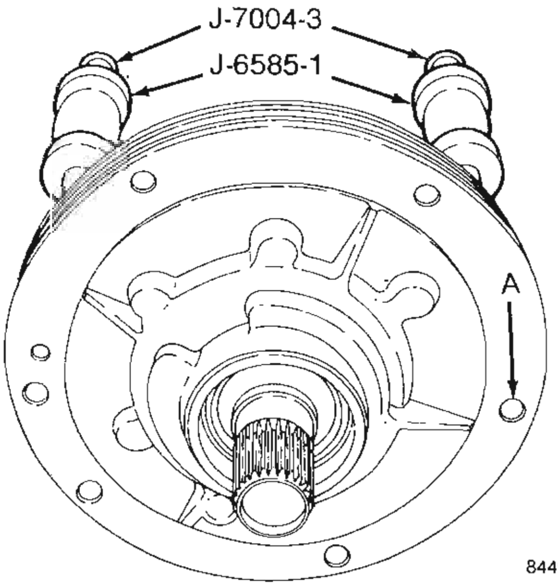
Assembly

Position the pump housing on a smooth flat surface and install the pump rotors.

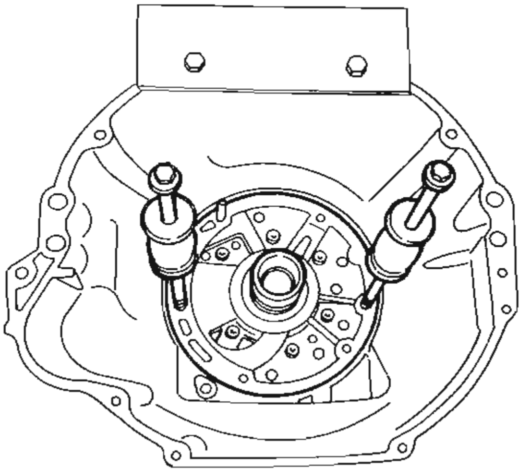
NOTE: New rotors may be installed with either face up. Used rotors must be installed as removed. Refer to reference marks made during disassembly.

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).



84499



84500

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.

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).

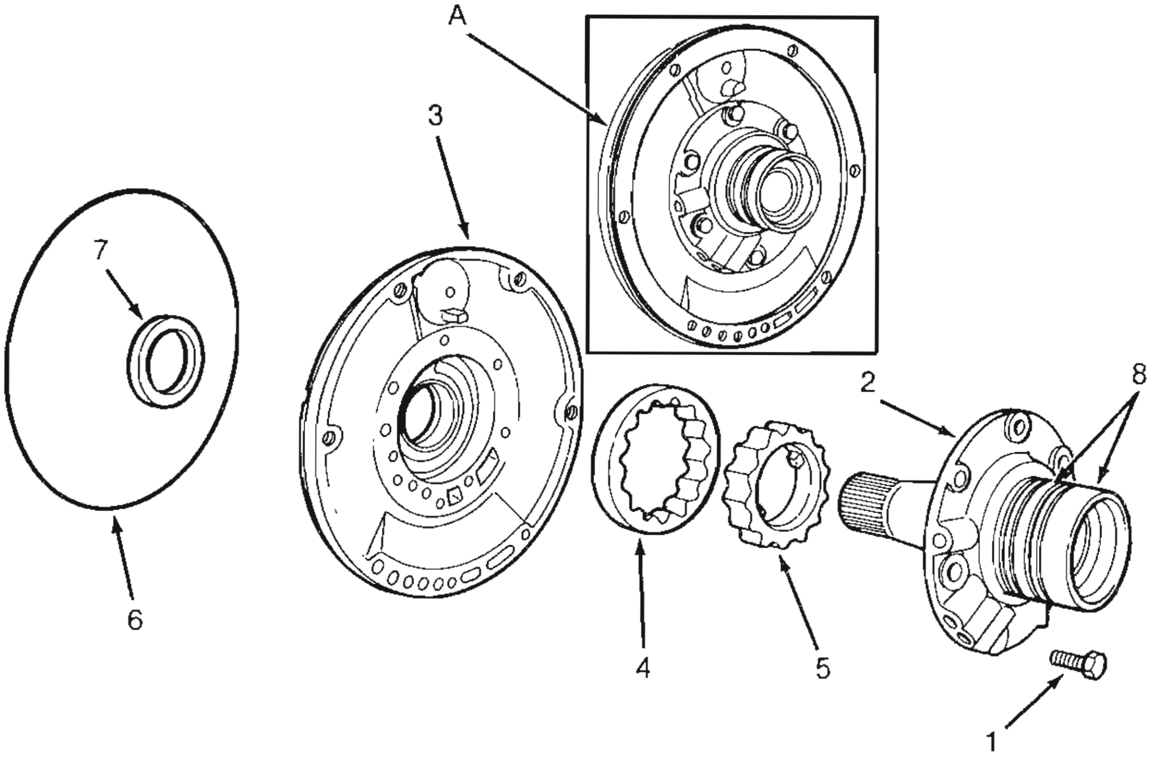
Mark the rotors for assembly alignment reference.

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.



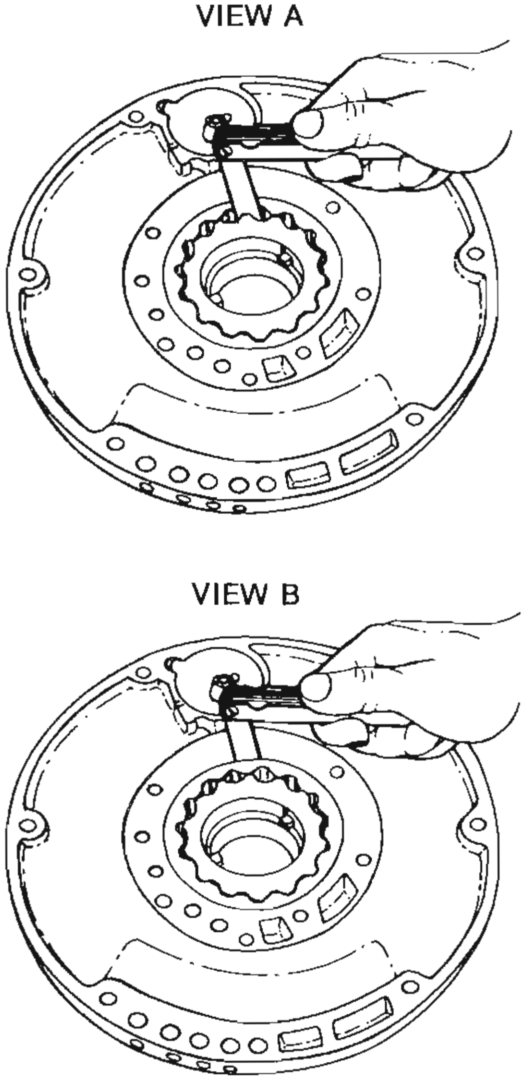
EE
.S.
NOTES

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).

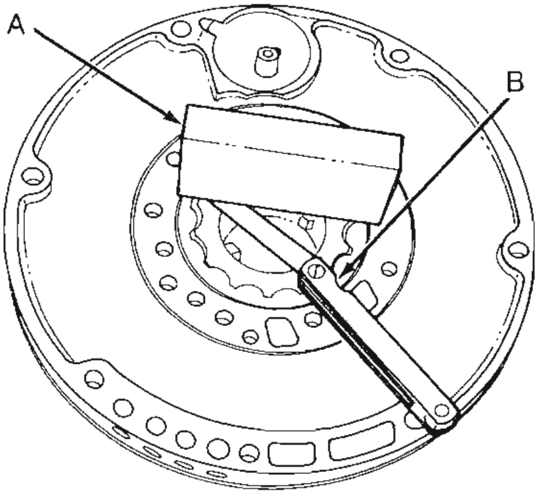


VIEW A

VIEW B

84503

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).

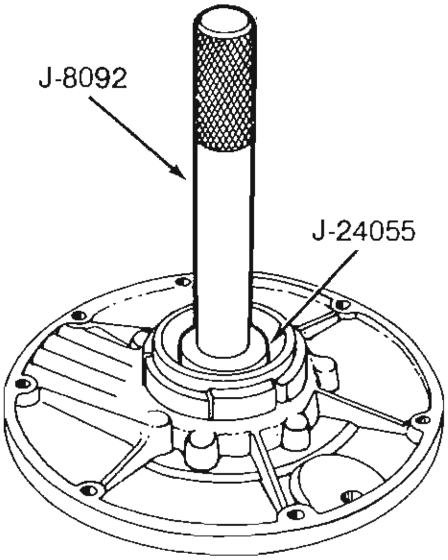


84502

Pump Bushing Replacement

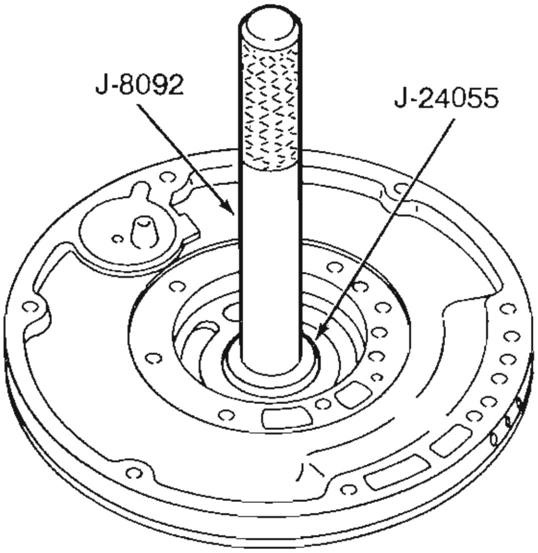
Place the pump housing, with the reaction shaft support mating surface facing downward, on a flat, level surface.

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.

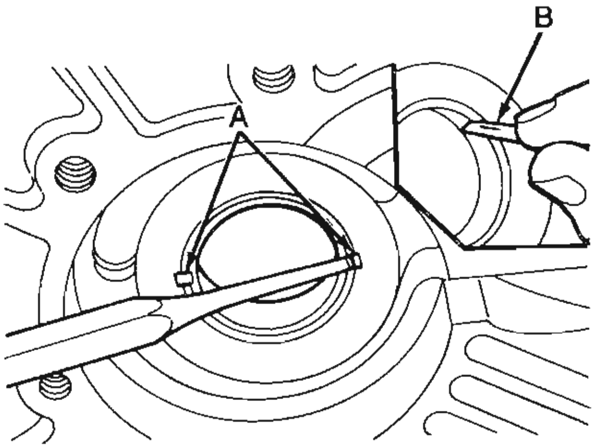


84505

Turn the pump housing over and install the bushing straight into the housing until the edge of the bushing is flush with the bore.

EE
.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.

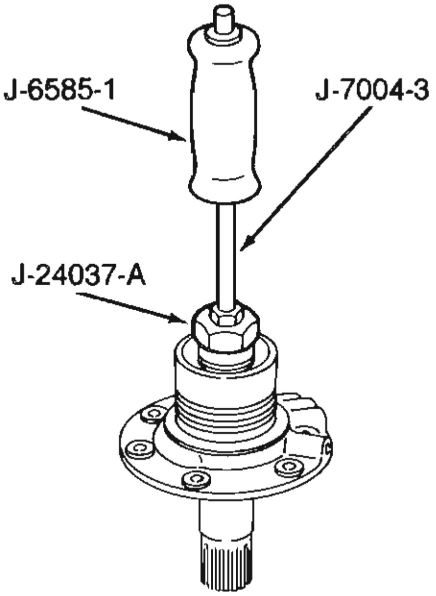
Clean the pump housing thoroughly after bushing installation.

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.

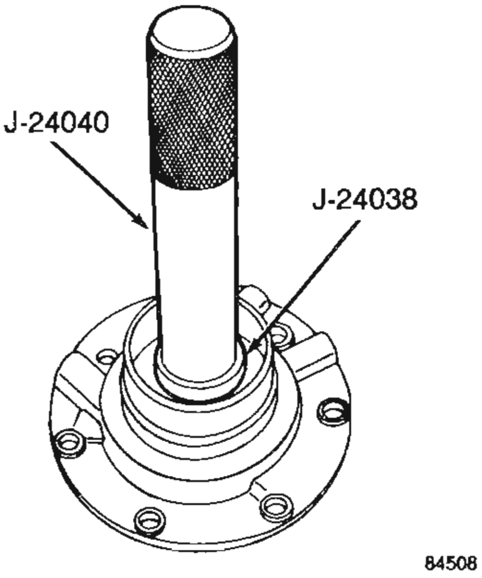
Install Slide Hammer Bolts Tool J-7004-3 and J-6585-1 into the remover tool. Bump outward with the slide hammers to remove bushing.

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.

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.

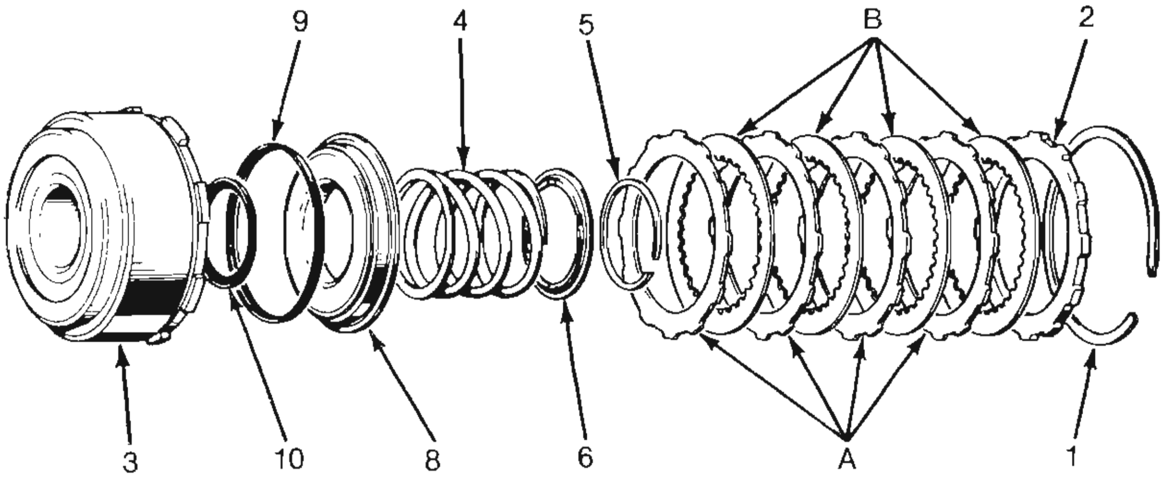
Thoroughly clean the reaction shaft support assembly.

Front Clutch – 900 Series

Disassembly

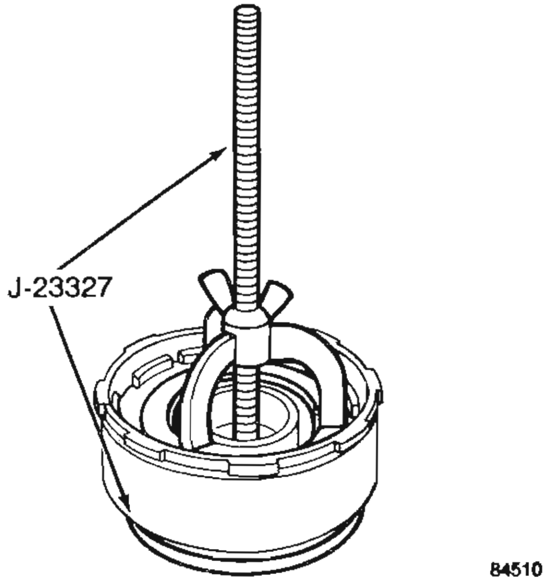
Remove the large waved snap ring (1) which secures the pressure plate (2) in the clutch retainer (3).

Remove the steel plates (A) and the clutch plates (B).



84509

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.

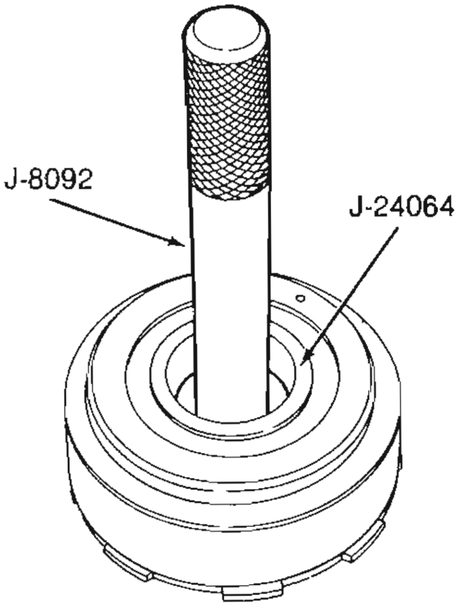
Inspect the seal ring surfaces inside the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of the rings. Inspect the clutch retainer bushing for scores and wear and inspect the inner bore surface for wear from the reaction shaft support seal rings and lands.

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.

Retainer Bushing Replacement

Place the clutch retainer, with the open end facing down, on a clean, smooth surface.

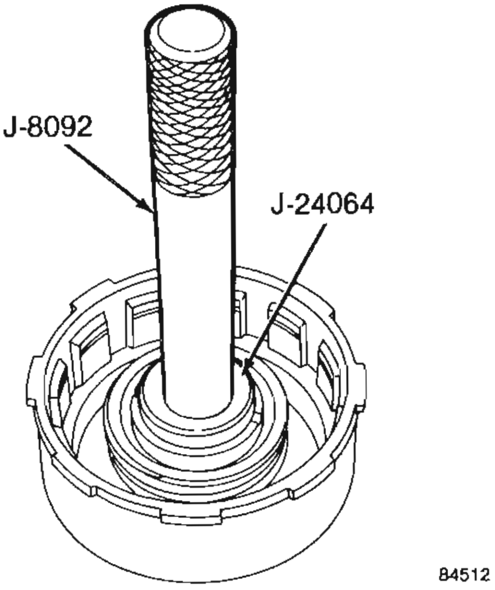
Insert the Bushing Remover/Installer Tool J-24064 in bushing.



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.

Compress the spring and seat the snap ring in the clutch hub groove.

Remove the compressor tool.

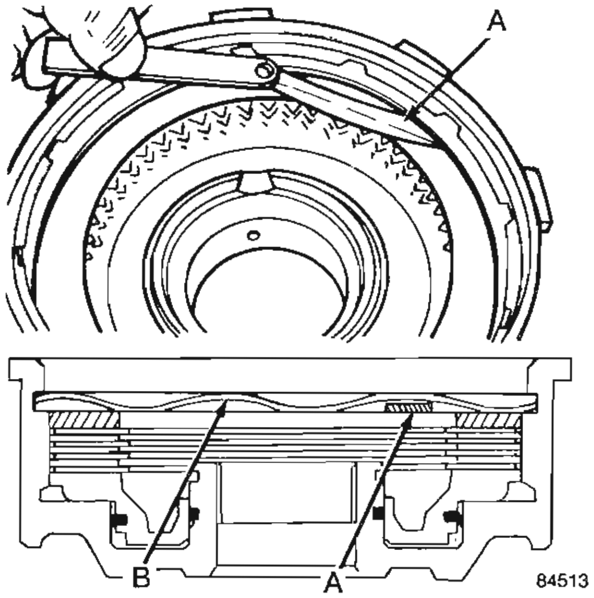
Lubricate the clutch plates and discs with transmission fluid.

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:

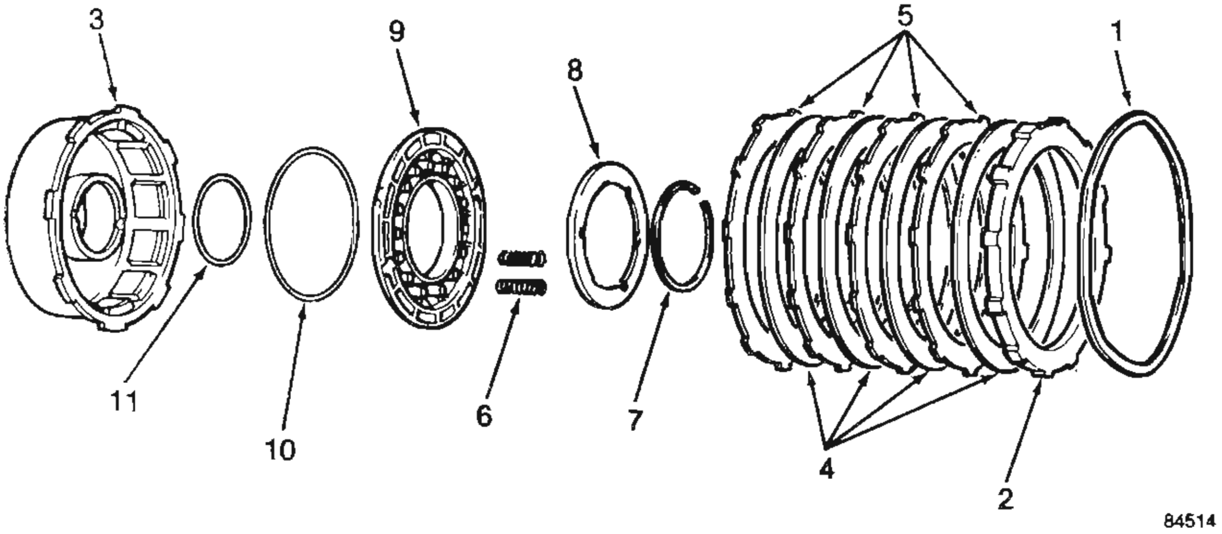
Lined Plate	2.11 to 2.24 mm (0.083 to 0.088 in)
Steel Plate	1.68 to 1.80 mm (0.066 to 0.071 in)
Pressure Plate	5.44 to 5.54 mm (0.214 to 0.218 in)

Any component not meeting the listed thickness specification must be replaced in order to obtain the correct clutch park clearance.

Front Clutch – Model 727

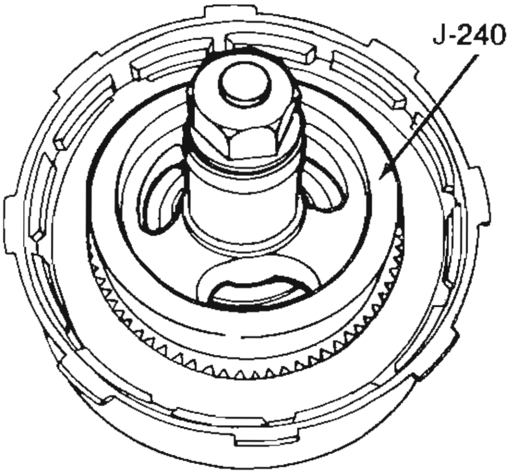
Disassembly

Remove the large waved snap ring (1) that retains the pressure plate (2) in the clutch piston retainer (3).



Remove the pressure plate (4) and clutch plates (5).

Install the Compressor Tool J-24042 over the piston spring retainer.



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.

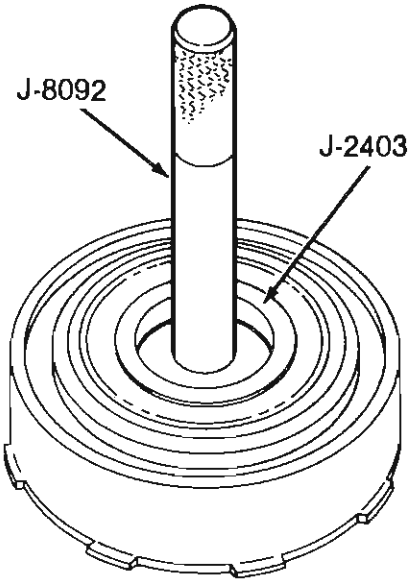
Inspect the seal ring surface inside the clutch retainer for nicks or deep scratches. Light scratches will not interfere with sealing of the rings. Inspect the clutch retainer bushing for scores and wear from the reaction shaft support sealing rings and lands.

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.

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.

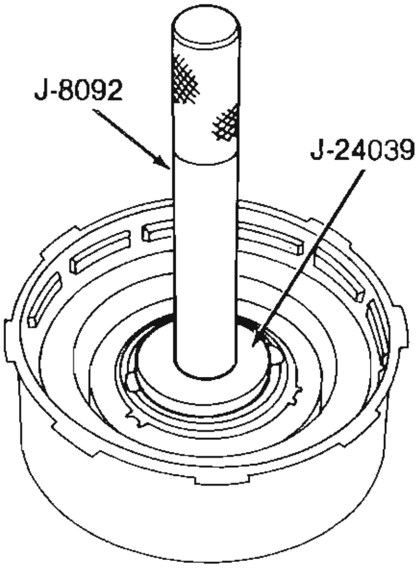


84516

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

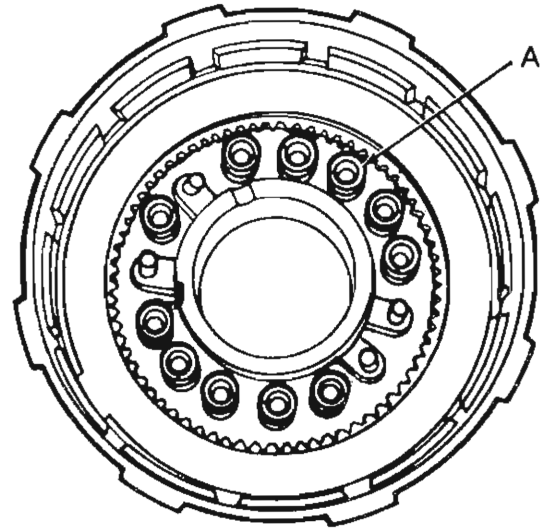
Lubricate the inner seal with petroleum jelly and install it on hub of clutch retainer.

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.



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.

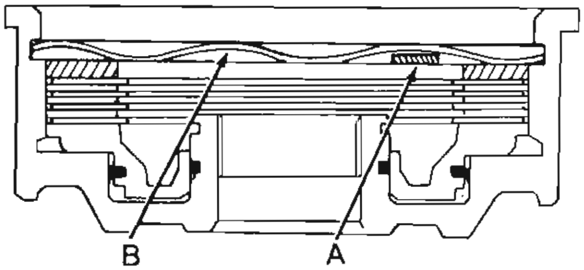
Compress the springs and seat snap ring in the hub groove.

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.

Rear Clutch – 900 Series

SEE
I.S.
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.

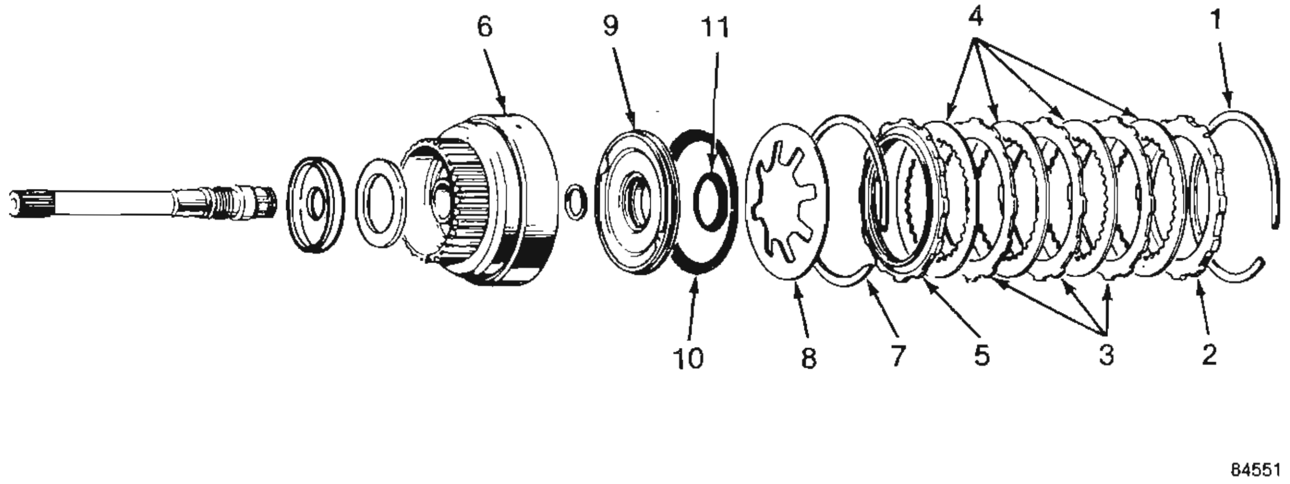
Lift the pressure plate (2), clutch plates (3) (4), and inner pressure plate (5) out of the retainer (6).

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.



SEE I.S. NOTES

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

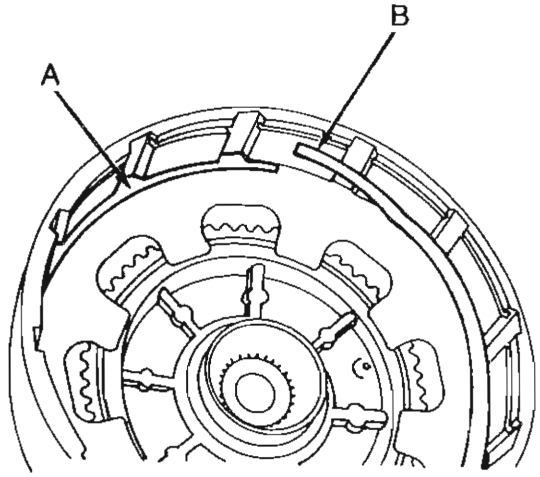
Press the input shaft into the piston retainer (if removed) and install the snap ring.

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

SEE I.S. NOTES

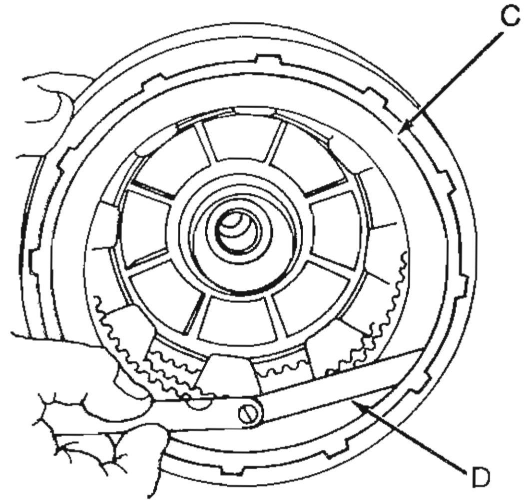
Install the inner pressure plate. The raised side of plate should rest on the piston spring and the flat surface should face the open end of the retainer.

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.



84521

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.

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.

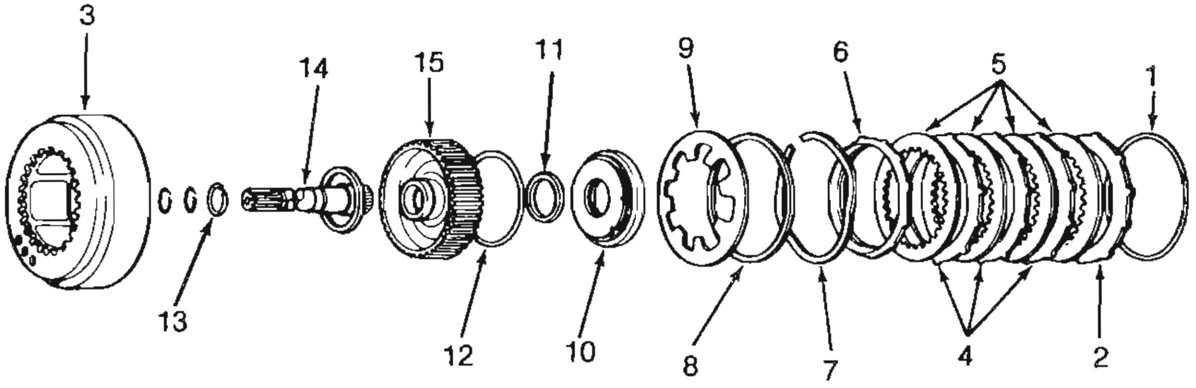
Remove the pressure plate (2), clutch plates (4) (5), and inner pressure plate (6).

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.



84522

SEE I.S. NOTES

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

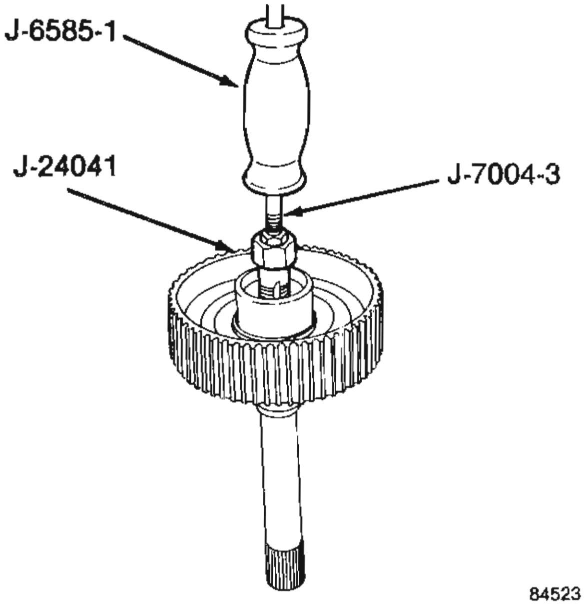
Clamp the input shaft in a vise using brass protective jaws.

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.

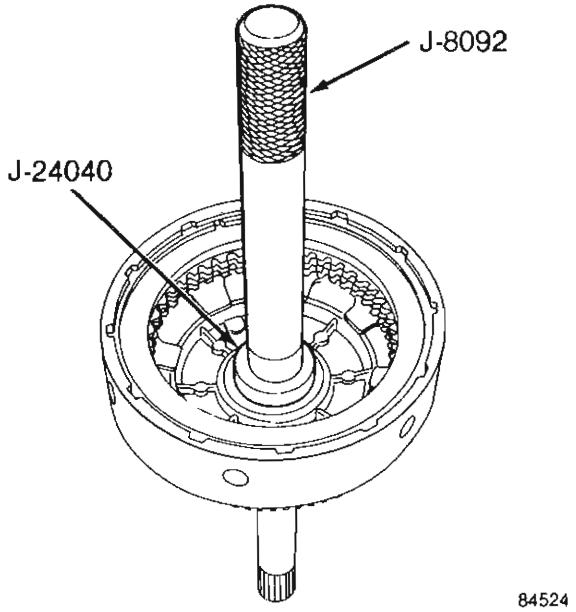
Grip the old bushing with pliers and remove it from the tool.

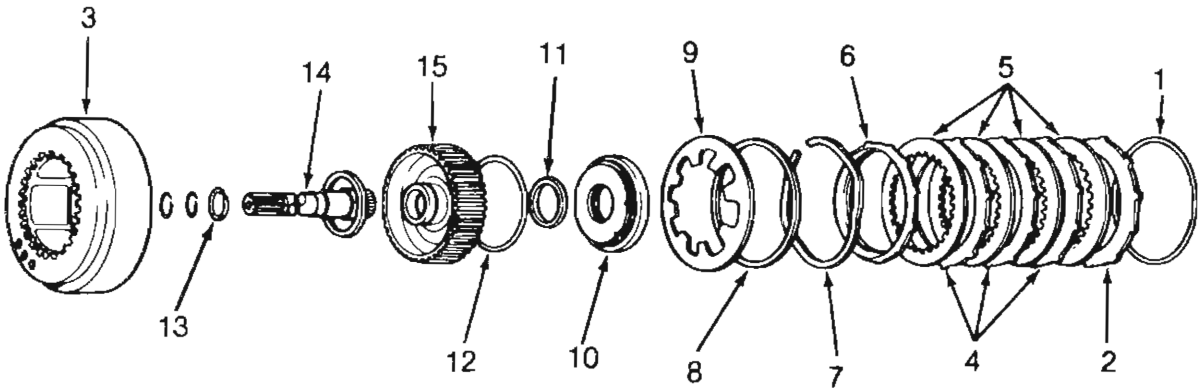
NOTE: Be careful to protect the remover tool threads when using the tool.

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.





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).

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.

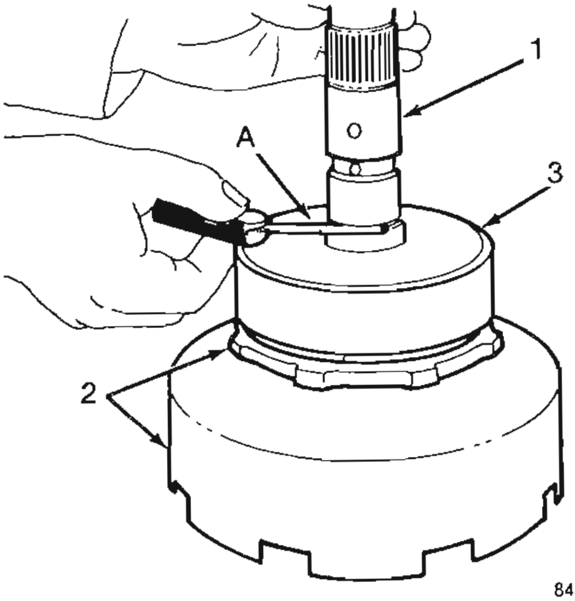
Planetary Gear Assembly – 900 Series

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.

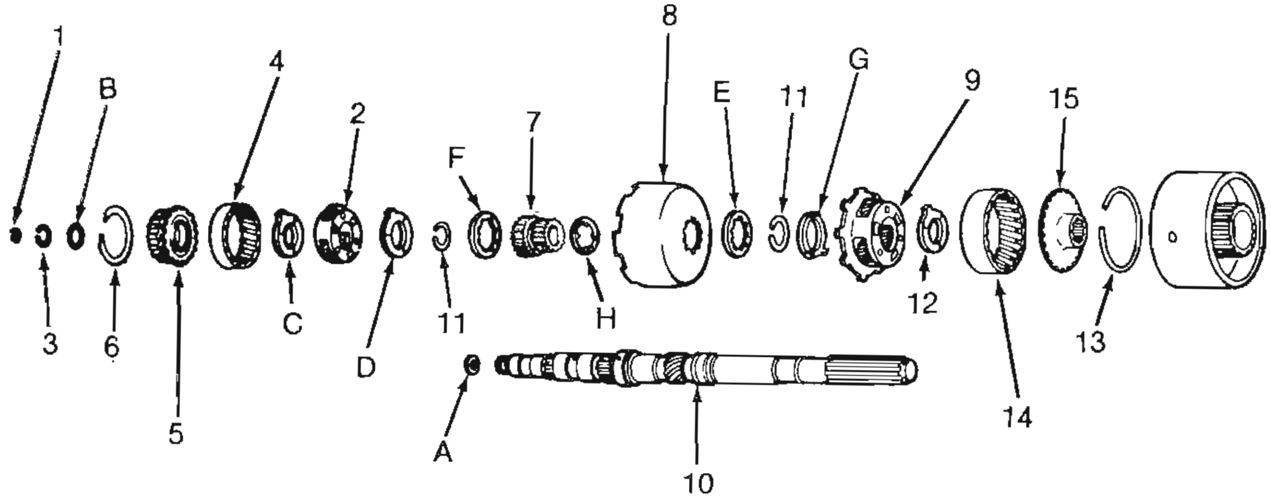
Push the rear annulus gear support (3) downward on the output shaft.



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.

SEE
I.S.
NOTES



Disassembly

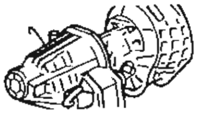
Remove the thrust washer (A) from the forward end of the output shaft (10).

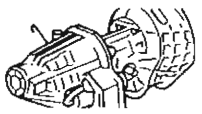
Remove the selective snap ring (1) from the forward end of the output shaft.

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.





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.

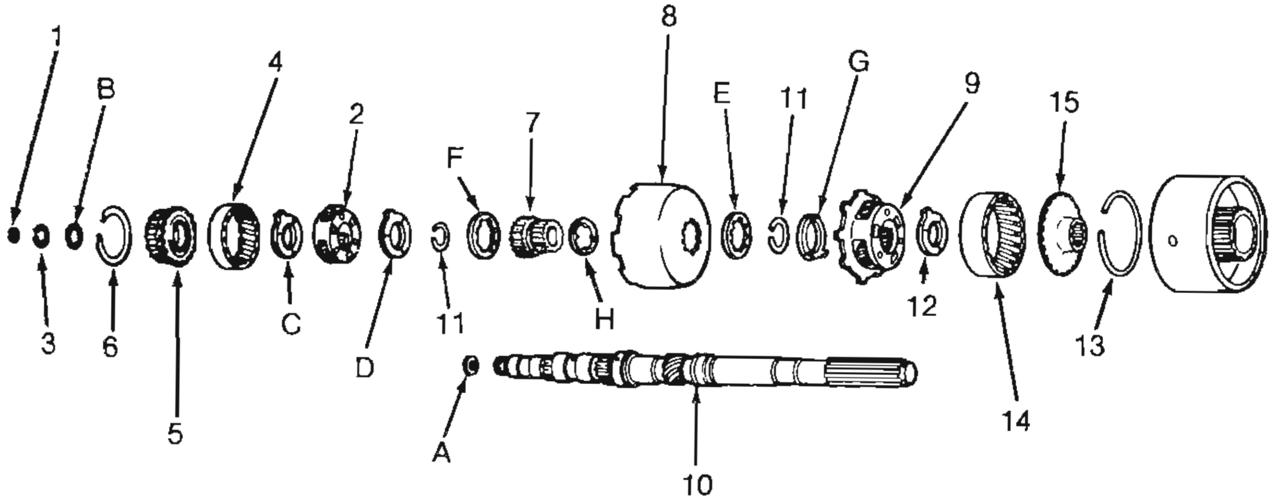
Inspect all the thrust washers and plates. Replace all the thrust washers and plates that are damaged or worn below thickness specifications.

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.

SEE
I.S.
NOTES



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).

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.

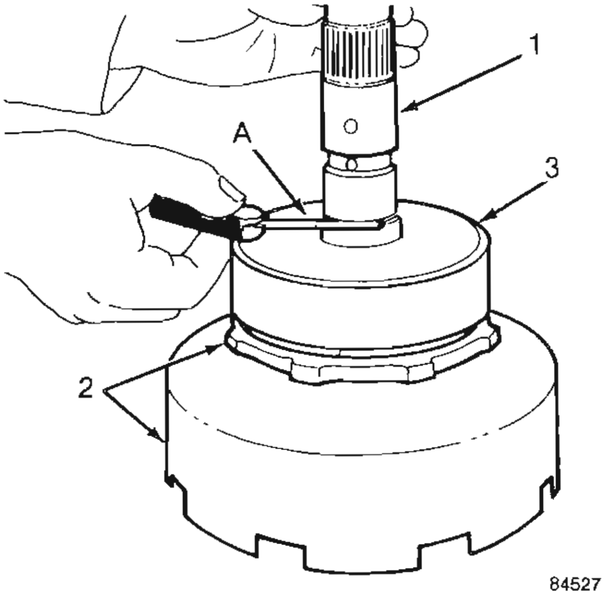
Install the thrust washer (A) on the output shaft.

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).

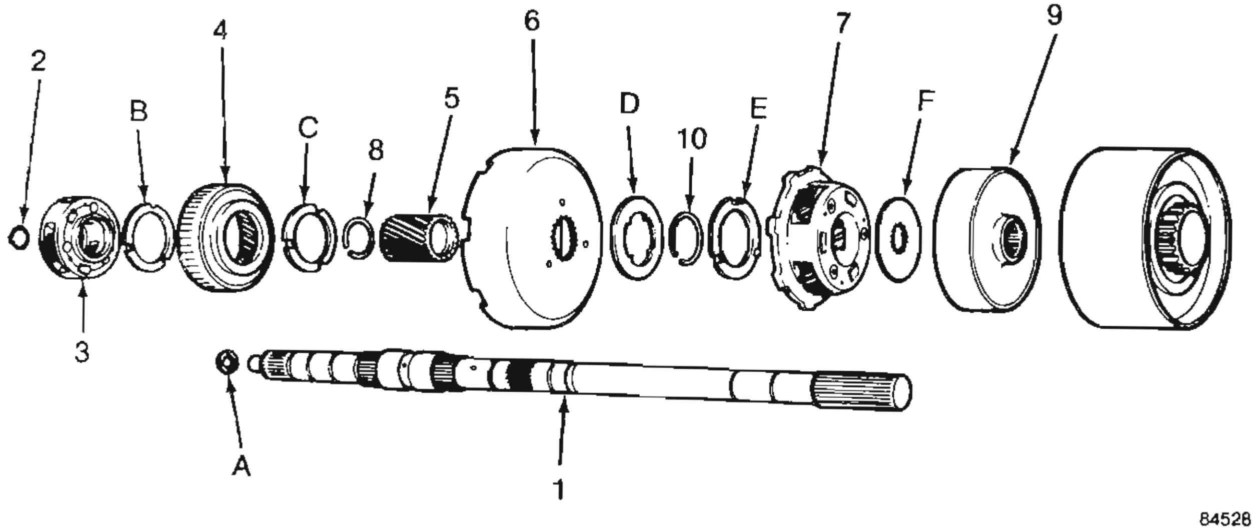
Support the front end of output shaft on a wooden block and place the assembly (2) in the upright position.

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.

SEE I.S. NOTES

SEE I.S. NOTES



Disassembly

Remove the thrust washer (A) from the foward 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.

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 foward 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.

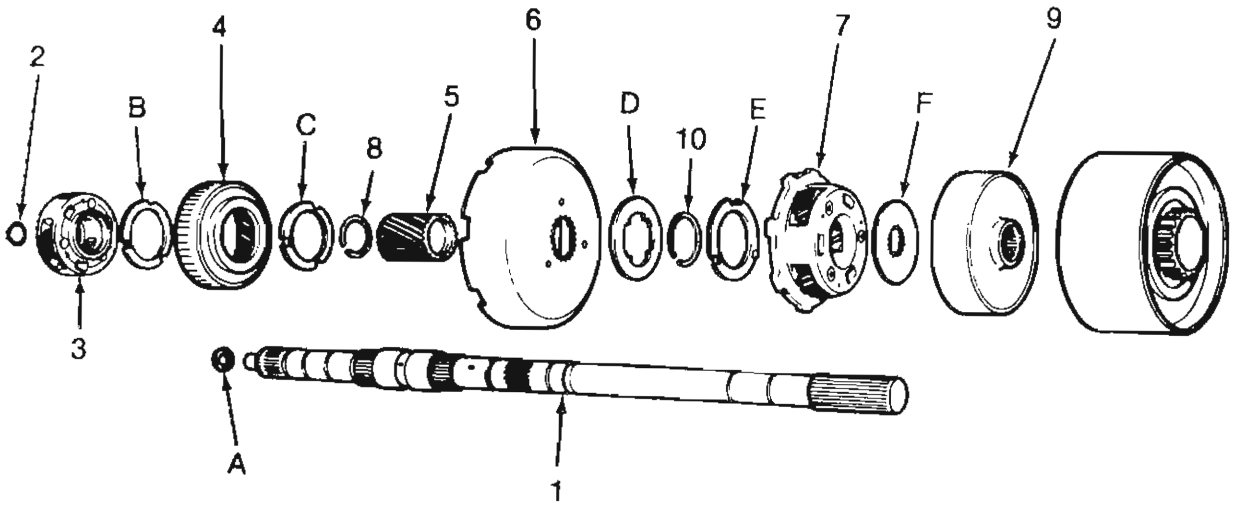
Inspect the sun gear bushings for wear and scores. Replace the sun gear if the bushings are damaged.

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.

SEE
I.S.
NOTES



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.

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

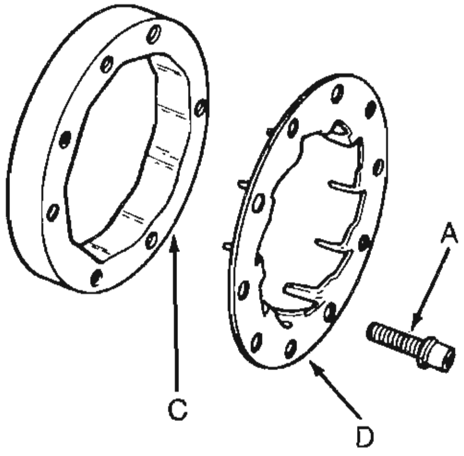
Inspect the clutch rollers for smooth, round surfaces. They must be free of flat spots and chipped teeth.

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.

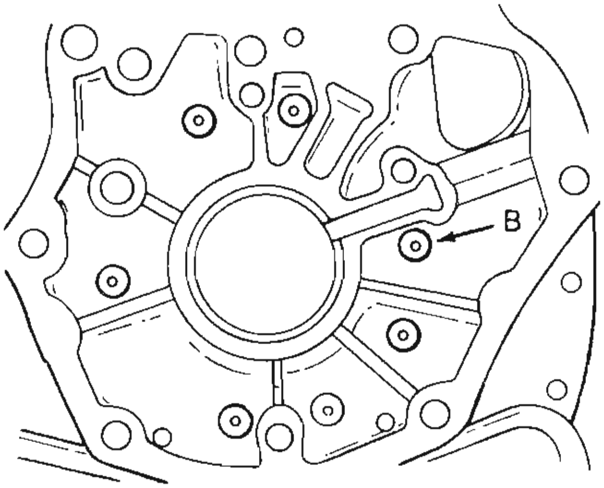


84529

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.



84530

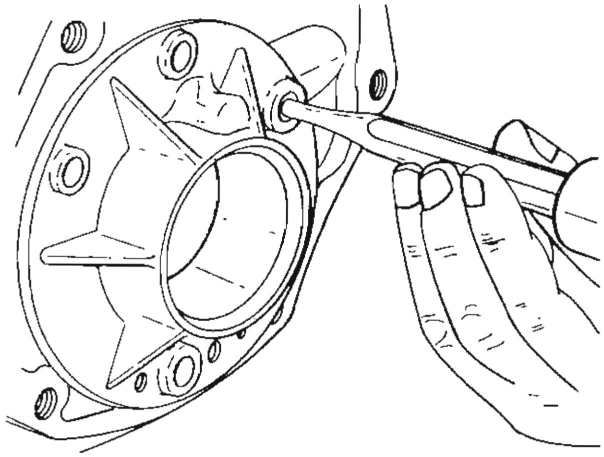
SEE I.S. NOTES

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.

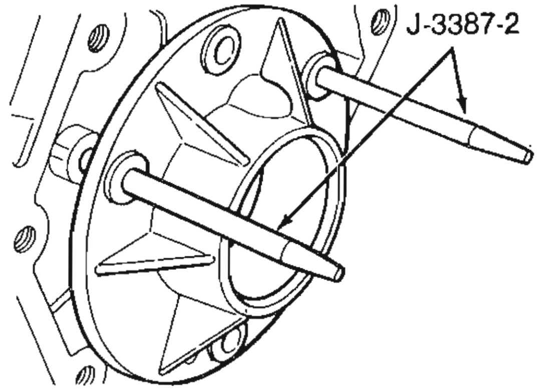
Thread the retaining screws and washers into the cam.

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).

SEE I.S. NOTES

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.

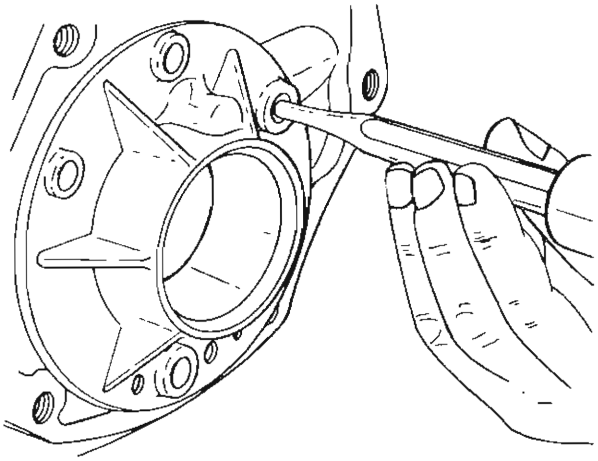
Cam Replacement – Model 727

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.

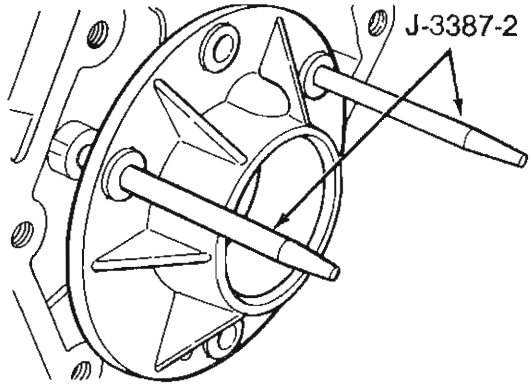


84533

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

SEE I.S. NOTES

Install the support in the case using a wooden block and hammer.

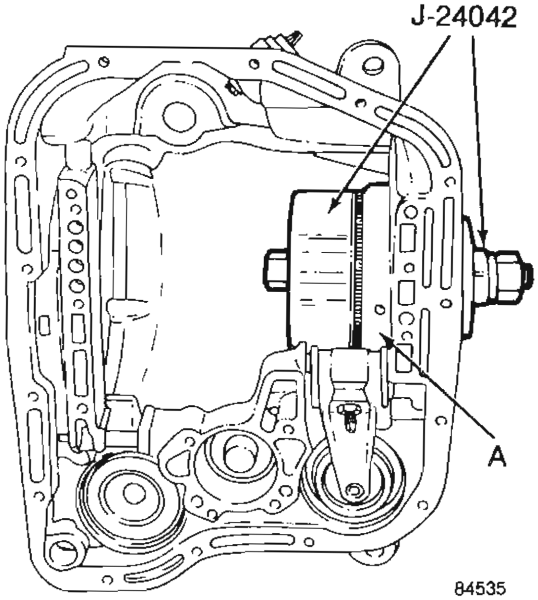
Clean all burrs, chips, and foreign material from the cam (A) area in the case.

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.

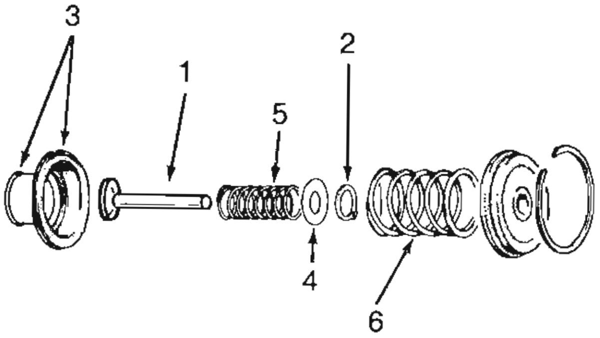
Remove Tool J-24042.

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

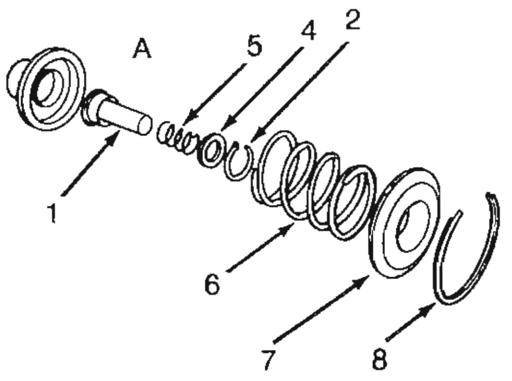
NOTE: The front servo in model 727 transmissions requires further disassembly after removal from the servo bore.

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.

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 0-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).

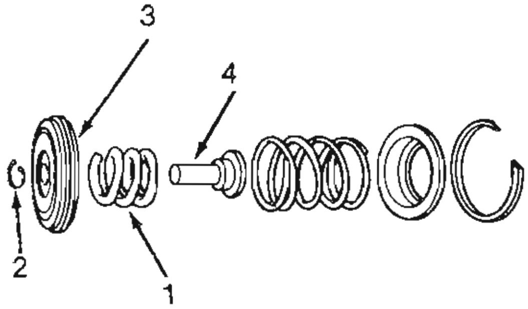
SEE I.S. NOTES

Rear Servo

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).

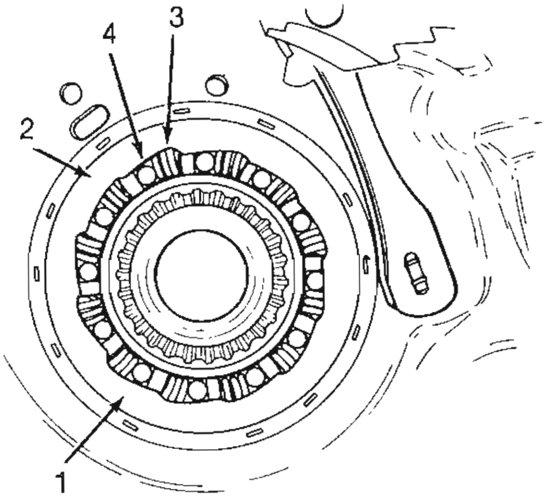
TRANSMISSION ASSEMBLY

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

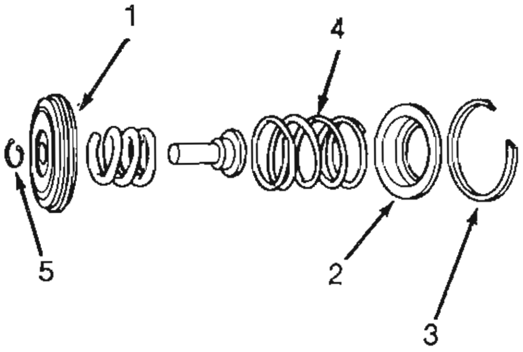
Rear Servo

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).

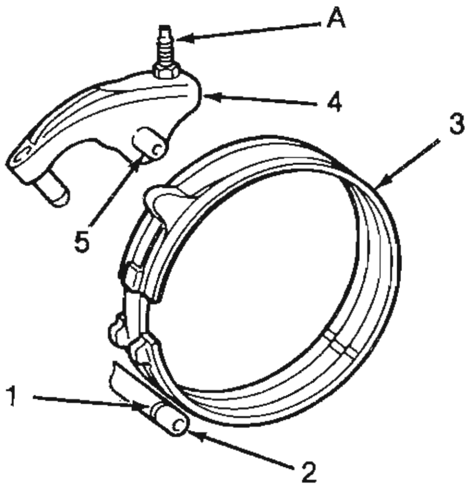


84540

SEE I.S. NOTES

Rear Band – 900 Series

NOTE: The model 900 series transmission has a double wrap band supported at two points by a reaction pin mounted in the case. It is actuated at one point by the rear servo adjusting screw (A).



84541

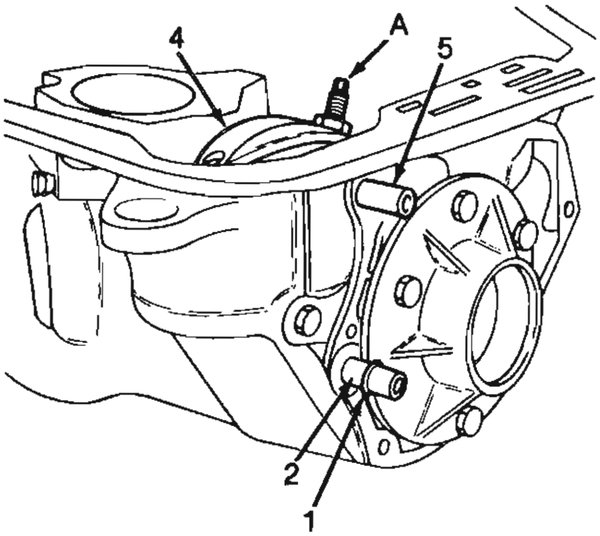
Install the replacement O-ring (1) on the reaction pin (2) and insert the pin into the case until the pin is flush with the gasket surface.

Position the band (3) in the case so both band lugs rest against the reaction pin.

Install the low-reverse drum in the overrunning clutch hub and into the rear band.

Install the band operating lever (4) and pivot pin.

NOTE: When installed, the lever adjusting screw (A) should touch the center lug of the band and the pivot pin should be flush with the case.



84542

SEE I.S. NOTES

Rear Band – Model 727

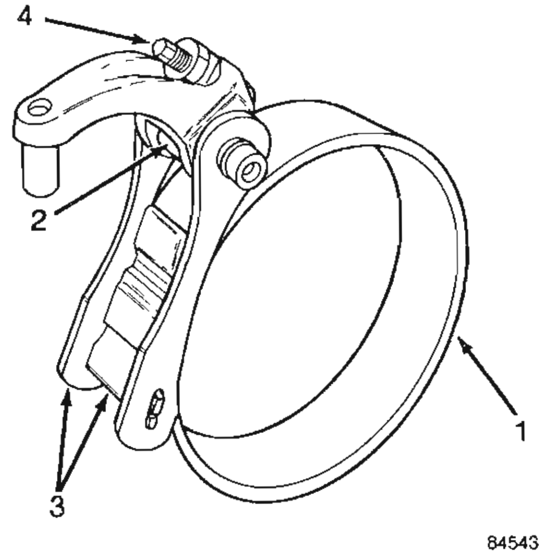
Install the rear band (1) in the case.

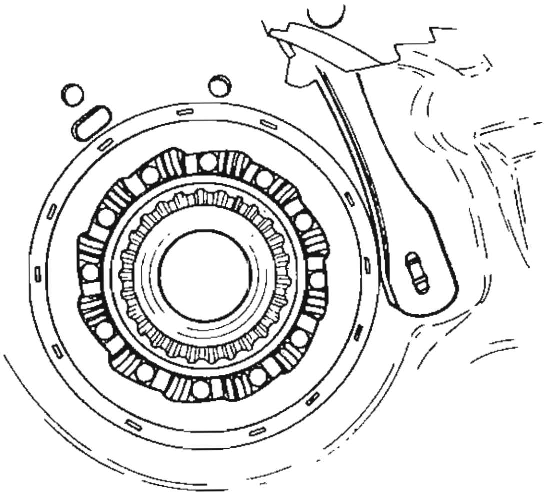
Install the short strut (2), and connect the long link and anchor (3) in the band.

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.





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).

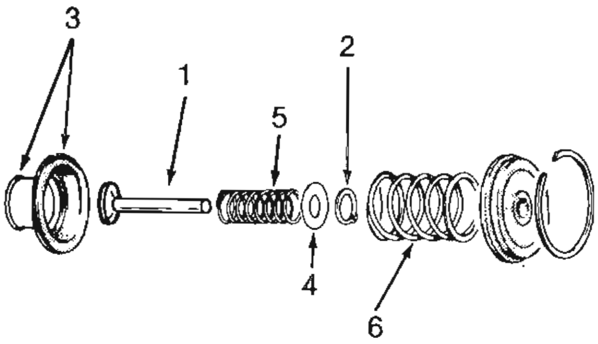
Install the spring (5), flat washer (4) and snap ring (2).

Insert the servo piston assembly into the case bore.

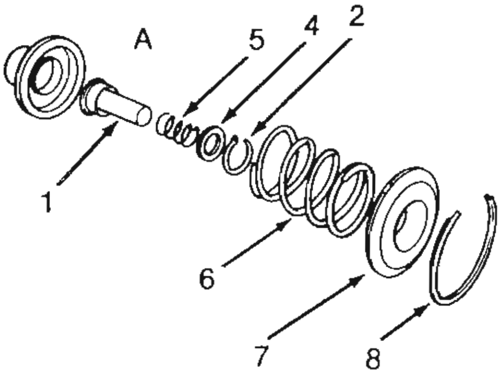
Install the piston rod, spring(s)(6) and guide (7).

Compress the piston spring(s) with a large C-clamp and install the snap ring (8).

Remove the C-clamp.



84536



84537

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.

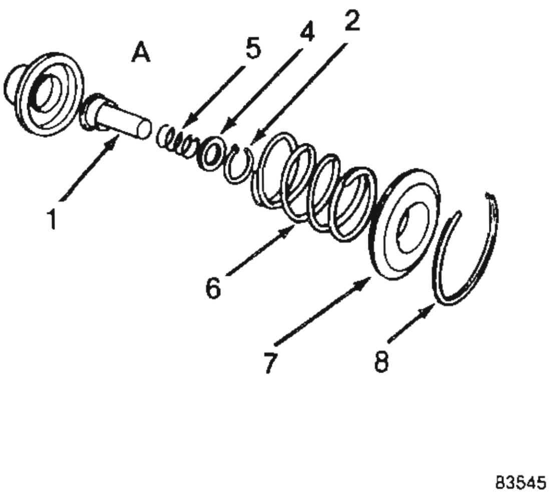
Carefully insert the ouput shaft into the hole and support the transmission in an upright position on the output shaft support flange.

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.



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.

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.

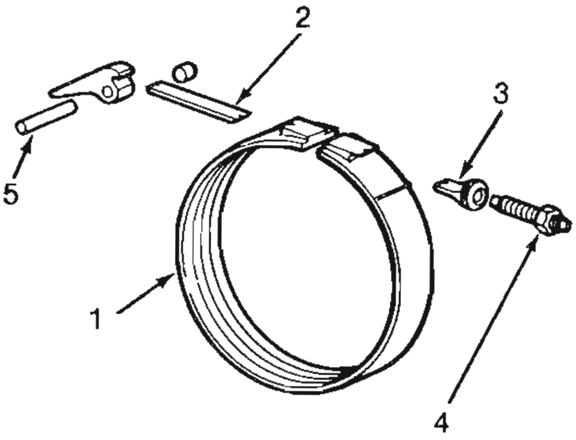
NOTE: Be sure the front clutch drive lugs are fully engaged in the driving shell slots.

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

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.

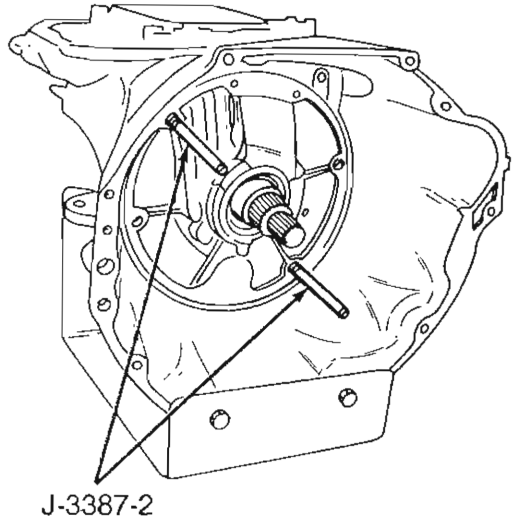
SEE
I.S.
NOTES

Thrust Washer Chart — Model 727

Thickness (Inch)	Color
0.061 - 0.063	Natural (Brown)
0.084 - 0.086	Red
0.102 - 0.104	Yellow

83548

SEE I.S. NOTES



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.

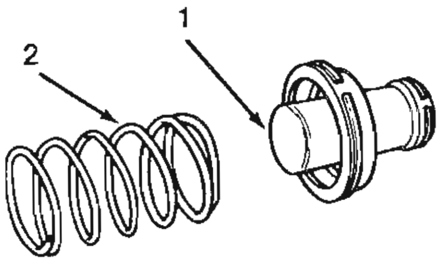
Install the bearing snap rings.

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.

SEE I.S. NOTES

SEE I.S. NOTES

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.

AMC | Jeep®

Component Service Manual

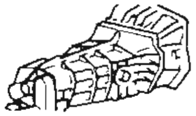
MANUAL TRANSMISSION

T4/5

Application	Model
Eagle	35/38
CJ-7	87
Scrambler	88
Cherokee	77/78
Wagoneer	75

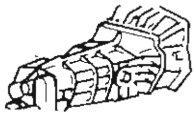
NOVEMBER 1983 **U.S.A./CANADA EDITION**

8981 320 380



T4/5 MANUAL TRANSMISSION

CONTENTS



SEE
I.S.
NOTES

GENERAL

The T4 four-speed and T5 five-speed transmissions are used with AMC/Jeep vehicles that are equipped with either a four-cylinder or six-cylinder engine.

These transmissions provide synchromesh engagement in all forward gear positions. Reverse gear is not synchronized. All forward gears are helical cut and are in constant mesh.

Both transmissions are designed and manufactured with metric dimensions. Therefore, when repairing these transmissions, use only the specified metric dimensioned fasteners.

The transmission case, cover and adapter housing for both transmissions are cast aluminum. An internal, single-rail shift mechanism is located in the cover.

Transmission Identification

Both transmissions have an identification tag attached at the rear of the transmission case that provides the AMC/Jeep and vendor part numbers. This information is essential when ordering replacement parts. If the tag is removed during service operations, ensure that it is securely attached to the transmission case at the original location after completion of the service operations.

Special Identification

Vehicles manufactured for sale in the states of Georgia and Tennessee have certain components identified by a nonrepeating number. For both transmissions, the number is stamped on a boss located on the left side of the transmission case.

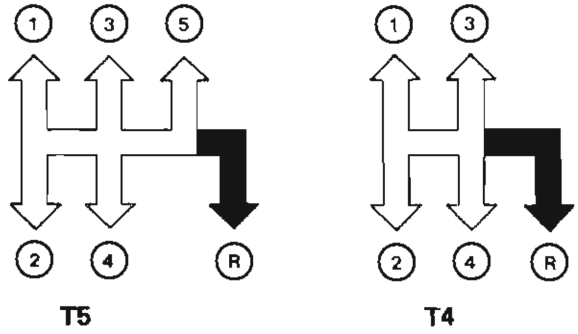
The number used for Canadian manufactured vehicles is the body sequence number preceded by a C (for Canada) and followed by 83 or 84 to identify the year of manufacture. The sequence number begins and ends with an asterisk (*) to prevent alteration by extension.

Gearshift Patterns

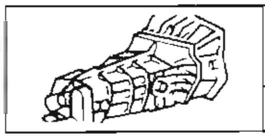
The gearshift pattern for the four forward gears of four-speed transmissions is an H configuration. An additional position for reverse gear is included as well as a separate position for the fifth gear with five-speed transmissions. An interlock mechanism prevents accidental engagement of reverse gear when shifting from any of the forward gears.

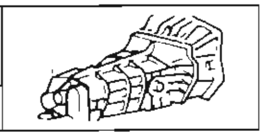
To shift to reverse gear for both T4 and T5 transmissions, press the gearshift lever to the extreme right and rearward. To shift from reverse gear, move the gearshift lever back to the neutral detent position.

SEE
I.S.
NOTES



90640





Lubrication

The specified lubricant for both T4 and T5 transmissions is AMC/Jeep/Renault Manual Transmission Fluid (P/N 8983 000 000). Do not use any other type of fluid when adding to or refilling a transmission.

Capacities

T4: 1.7 liters (3.5 U.S. pints)
T5: 1.9 liters (4.0 U.S. pints)

SEE I.S. NOTES

CAUTION: Do not use any gear lubricants containing lead, sulphur, or chlorine compounds. These chemicals are not compatible with the lubrication requirements for AMC/Jeep manual transmissions.

SPECIFICATIONS

Lubrication

Level	to bottom of fill hole

Recommended Lubricant — AMC/Jeep/Renault Manual Transmission Fluid (P/N 8983 000 000)

Lubricant Capacity — T4

U.S. Measure	3.5 pints
Imperial Measure	2.9 pints
Metric Measure	1.7 liters

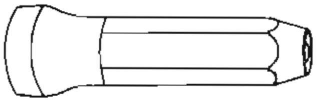
Lubricant Capacity — T5

U.S. Measure	4.0 pints
Imperial Measure	3.7 pints
Metric Measure	1.9 liters

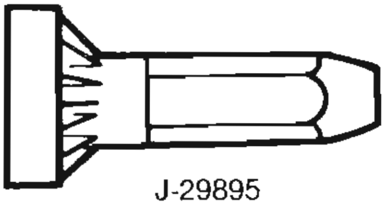
86226

SPECIAL TOOLS

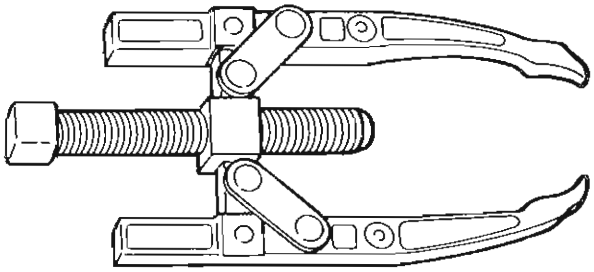
Tool Ref	Description	Required	Recommended
J-26625	Front Bearing Cap Seal Installation Tool	■	
J-29895	Rear Countershaft Bearing Installation Tool	■	
J-25215	Puller Assembly		■
J-33032	Protector Sleeve	■	
J-29721	Bearing Removal Set		■
J-29721-9	Adapter (P/O J-29721)		■
J-22912-01	Bearing Removal Tool		■
J-26628-1	Oil Seal Installation Tool	■	
J-26628-2	Oil Seal Protector	■	
J-6133-01	Bearing Installation Tool		■
J-29184	Seal Installation Tool	■	
J-8001	Dial Indicator		■



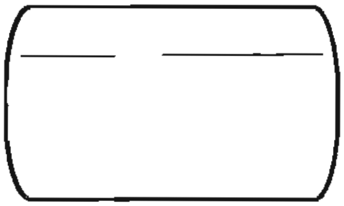
J-26625



J-29895

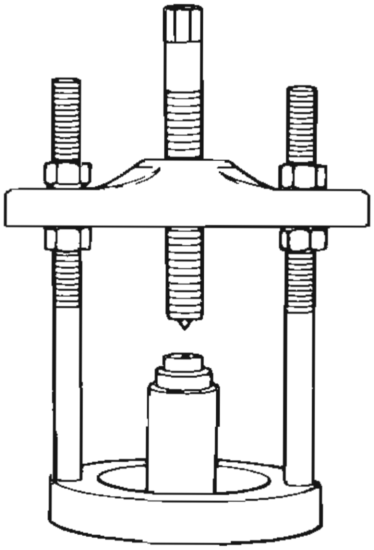


J-25215

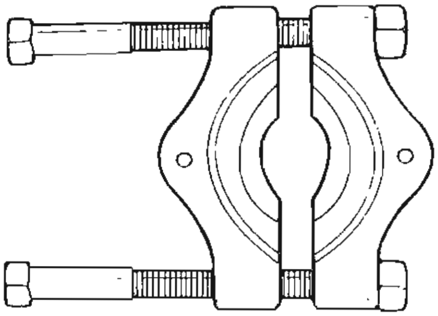


J-33032

SEE I.S. NOTES

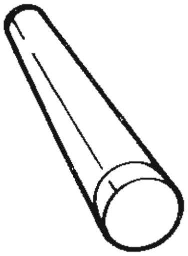


J-29721

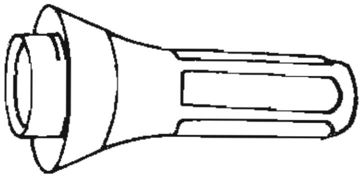


J-22912-01

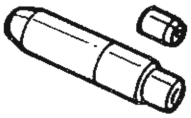
J-29721-09



J-6133-01



J-29184



J-26628-1,2

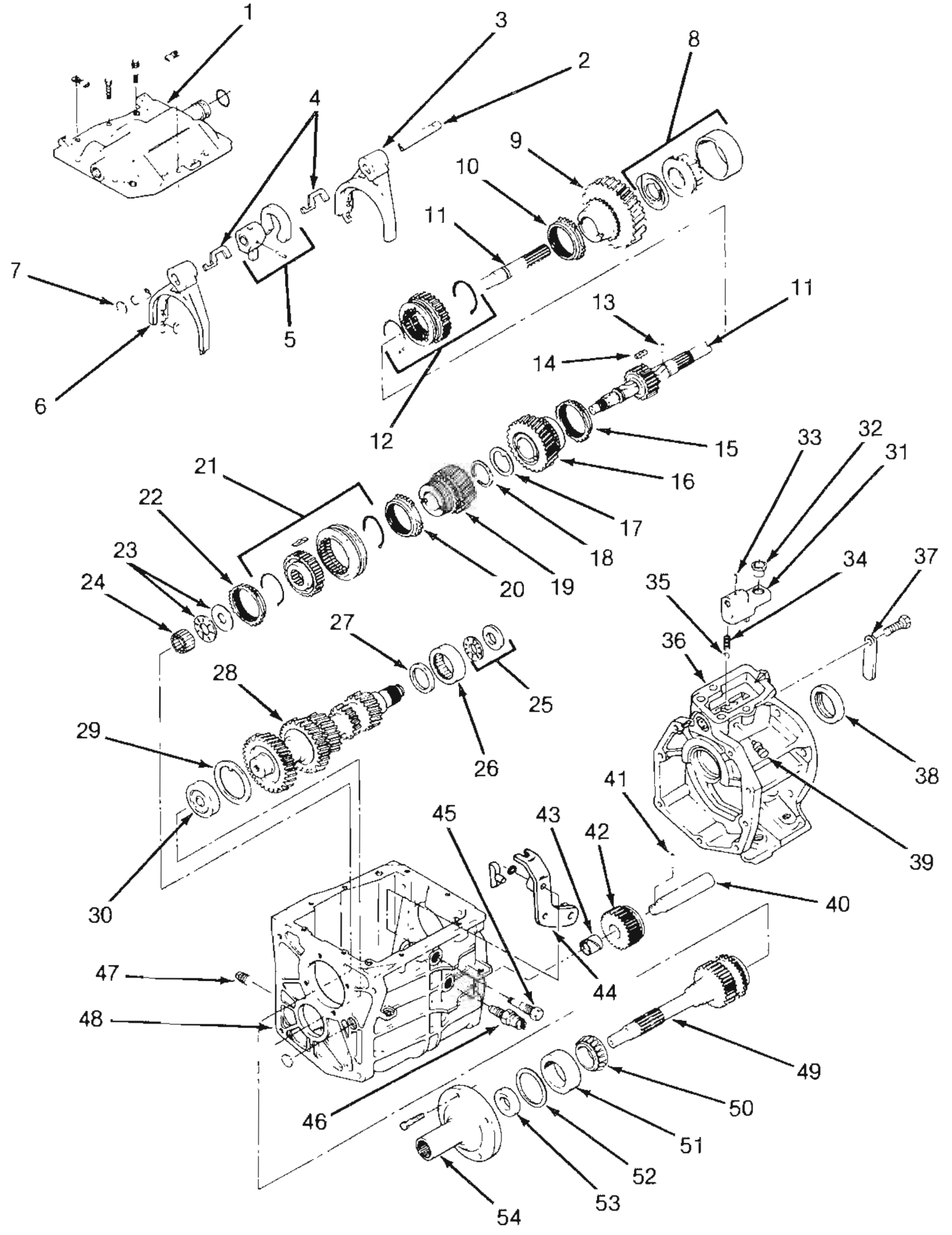
86225

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Adapter Housing Bolt	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Backup Lamp Switch	20 N·m (15 ft-lbs)	16-24 N·m (12-18 ft-lbs)
Filler Plug	31 N·m (23 ft-lbs)	20-41 N·m (15-30 ft-lbs)
Front Bearing Cap Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Shift Control Housing Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Reverse Gear Shift Lever Pivot Pin Bolt	58 N·m (43 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Transmission Cover Bolt	12 N·m (7 ft-lbs)	8-15 N·m (6-11 ft-lbs)

SEE I.S. NOTES

T4 MANUAL TRANSMISSION (EXPLODED)



81197A

SEE
I.S.
NOTES

T4 MANUAL TRANSMISSION (EXPLODED)

LEGEND

1. TRANSMISSION COVER
2. SHIFT RAIL
3. FIRST-SECOND GEAR SHIFT FORK
4. SELECTOR PLATE
5. SELECTOR ARM INTERLOCK PLATE AND PIN
6. THIRD-FOURTH GEAR SHIFT FORK
7. PLUG
8. THRUST WASHER, REAR BEARING AND CUP
9. FIRST GEAR
10. FIRST GEAR BLOCKING RING
11. OUTPUT SHAFT
12. REVERSE SLIDING GEAR AND INSERT SPRINGS
13. FIRST GEAR PIN
14. SYNCHRONIZER INSERT
15. SECOND GEAR BLOCKING RING
16. SECOND GEAR
17. THRUST WASHER
18. SNAP RING
19. THIRD GEAR
20. THIRD GEAR BLOCKING RING
21. THIRD-FOURTH GEAR SYNCHRONIZER SPRING, HUB, INSERT AND SLEEVE
22. FOURTH GEAR BLOCKING RING
23. NEEDLE THRUST BEARING AND RACE
24. CLUTCH SHAFT NEEDLE ROLLER BEARING
25. COUNTERSHAFT NEEDLE THRUST BEARING AND RACE
26. COUNTERSHAFT REAR BEARING
27. COUNTERSHAFT REAR SPACER
28. COUNTERSHAFT GEAR
29. COUNTERSHAFT FRONT THRUST WASHER
30. COUNTERSHAFT FRONT BEARING
31. OFFSET LEVER
32. DAMPER SLEEVE
33. ROLL PIN
34. DETENT SPRING
35. DETENT BALL
36. ADAPTER HOUSING
37. IDENTIFICATION TAG
38. ADAPTER HOUSING SEAL
39. VENT
40. REVERSE IDLER GEAR SHAFT
41. ROLL PIN
42. REVERSE IDLER GEAR
43. BUSHING
44. REVERSE GEAR LEVER FORK
45. REVERSE GEAR LEVER PIVOT PIN BOLT
46. BACKUP LAMP SWITCH
47. DRAIN PLUG
48. TRANSMISSION CASE
49. CLUTCH SHAFT
50. FRONT BEARING
51. FRONT BEARING RACE
52. SHIM
53. OIL SEAL
54. FRONT BEARING CAP

SEE I.S. NOTES

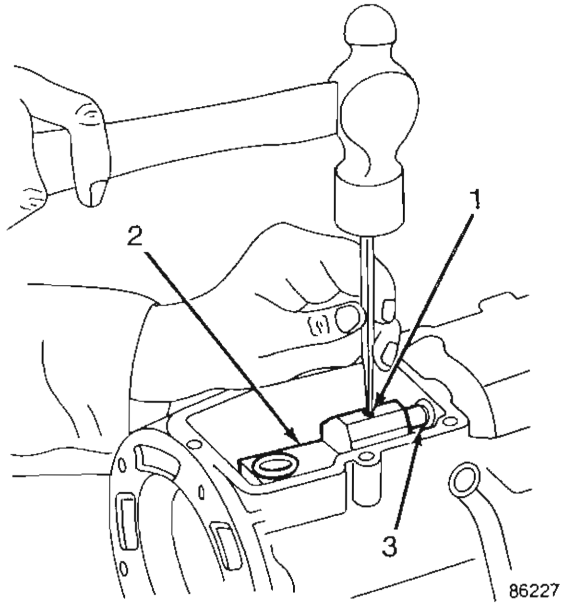
81197B

TRANSMISSION DISASSEMBLY

CAUTION: Except for the gearshift lever attaching bolts and the filler plug, all the bolts and threaded holes used in the T4 transmission case have metric dimensioned lengths and threads. If replacement bolts are required during overhaul, use only bolts that have the same thread size and length as the original bolts.

Remove the drain bolt from the transmission case and drain the lubricant.

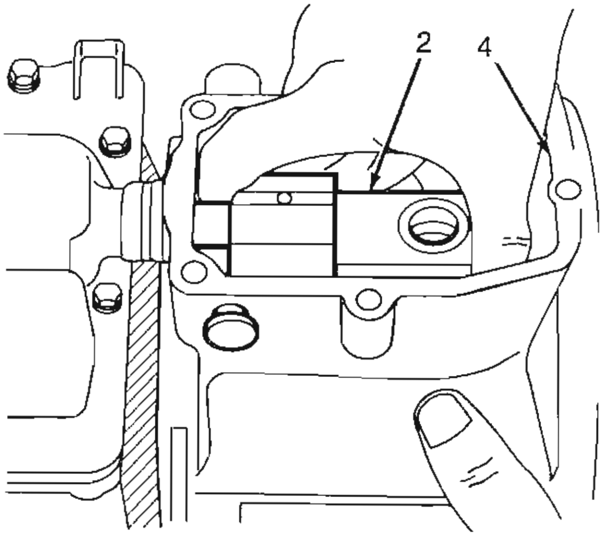
Use a pin punch and hammer to remove the roll pin (1) attaching the offset lever (2) to the shift rail (3).



86227

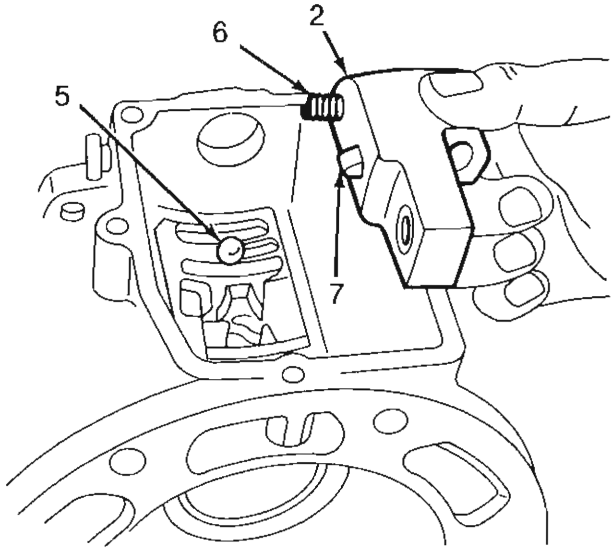
Remove the adapter housing-to-transmission case bolts and remove the housing (4) and offset lever (2) as an assembly.

CAUTION: Do not attempt to remove the offset lever while the adapter housing is still bolted in place. The lever has a positioning lug (7) engaged in the housing detent plate that prevents moving the lever far enough rearward for removal.



86228

Remove the detent ball (5) and spring (6) from the offset lever (2) and remove the roll pin (1) from the adapter housing or offset lever.



86229

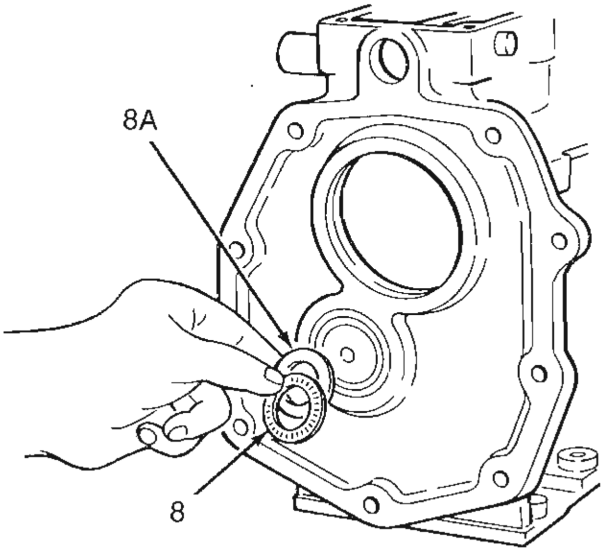
SEE I.S. NOTES

SEE
I.S.
NOTES

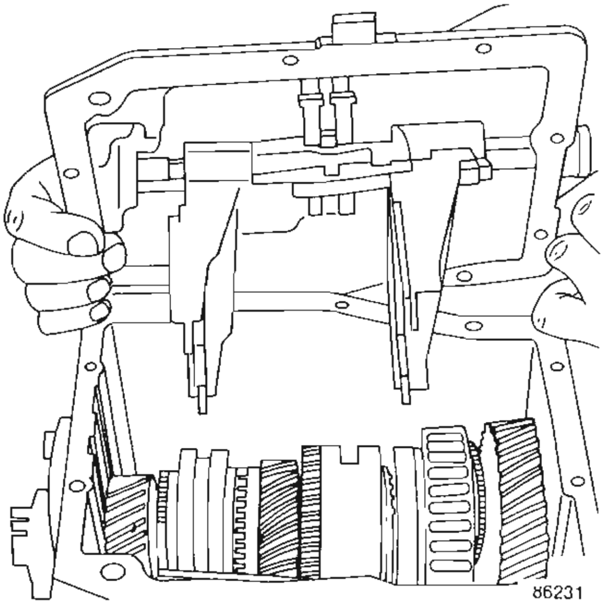
Remove and retain the countershaft rear thrust bearing (8) and race (8A).

Remove the transmission cover and shift fork assembly attaching bolts and remove the cover.

NOTE: Two of the transmission cover bolts are dowel-type alignment bolts. Note the location of these bolts for assembly reference.

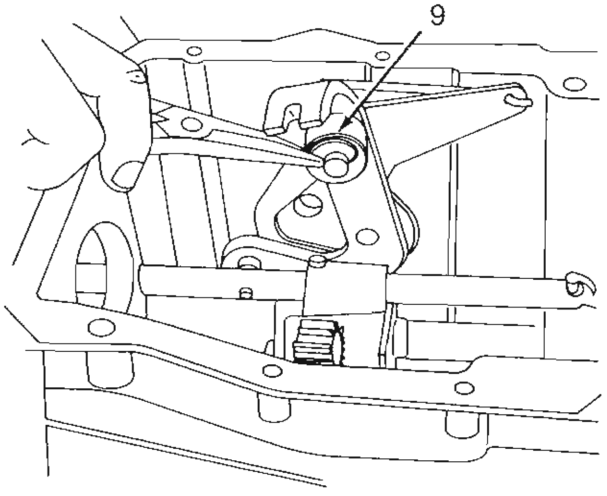


86230



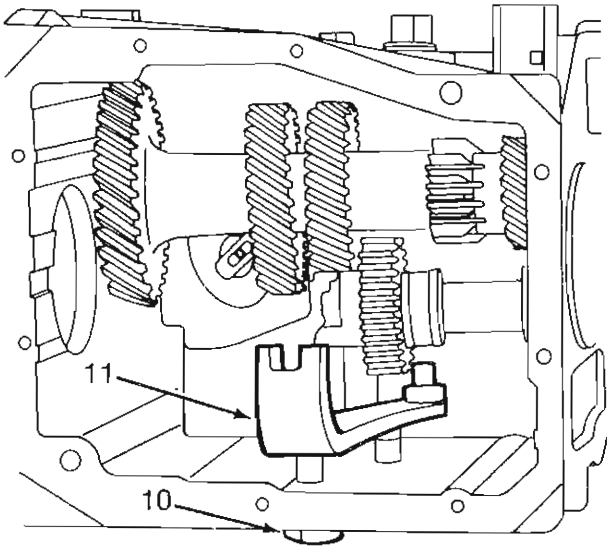
86231

Remove the C-clip (9) attaching the reverse gear lever to the reverse gear lever pivot pin bolt.



86232

Remove the reverse gear lever pivot pin bolt (10) and remove the reverse gear lever and reverse gear lever fork (11) as an assembly.

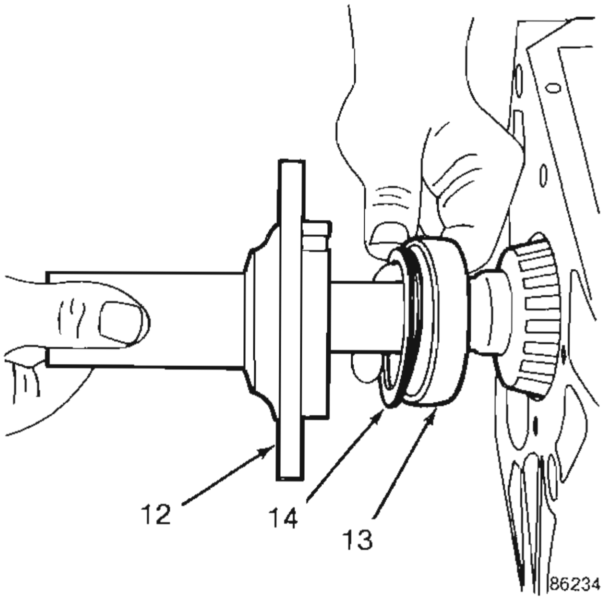


86233

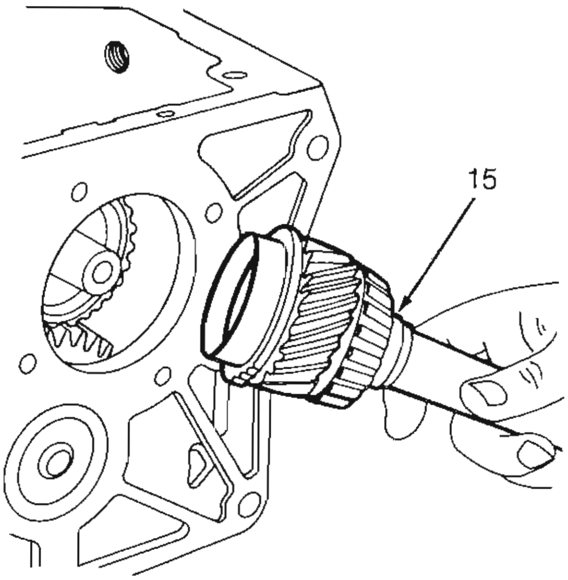
Mark the position of the front bearing cap (12) on the transmission case with a center punch, remove the front bearing cap bolts and remove the front bearing cap (12).

Remove the front bearing race (13) and end-play shims (14) from the front bearing cap. Remove the oil seal from the bearing cap with a pry tool.

Rotate the clutch shaft (15) until the flat on the gear teeth is facing the countershaft and remove the clutch shaft.



86234



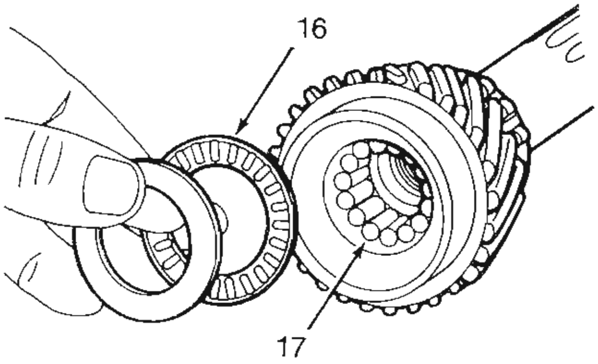
86235

Remove the thrust bearing race and bearing (16) and the 15 needle roller bearings (17) from the clutch shaft.

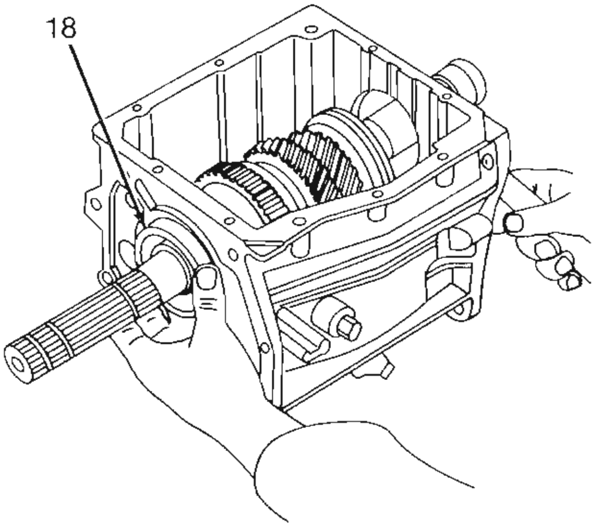
Remove the output shaft bearing race (18). Tap the front of the output shaft with a rubber or plastic mallet, if necessary.

Tilt the output shaft assembly upward and remove it from the transmission case.

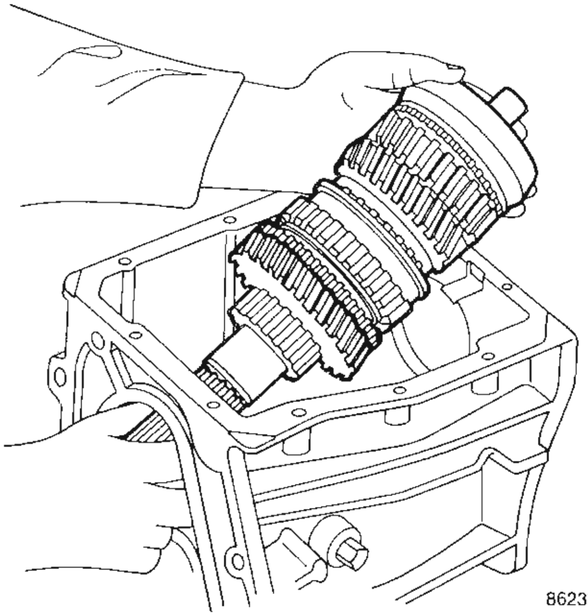
SEE I.S. NOTES



86236

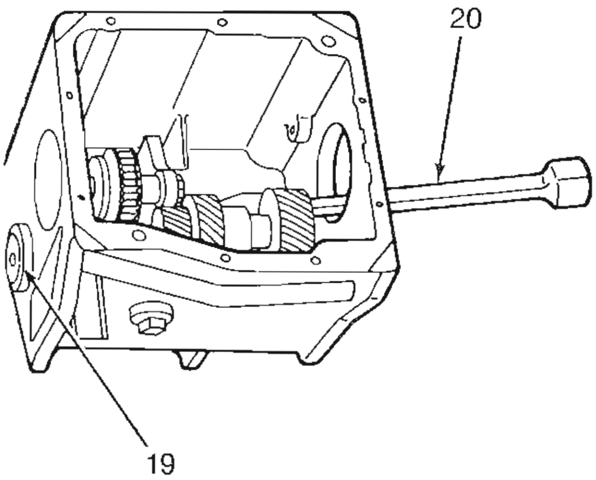


86237



86238

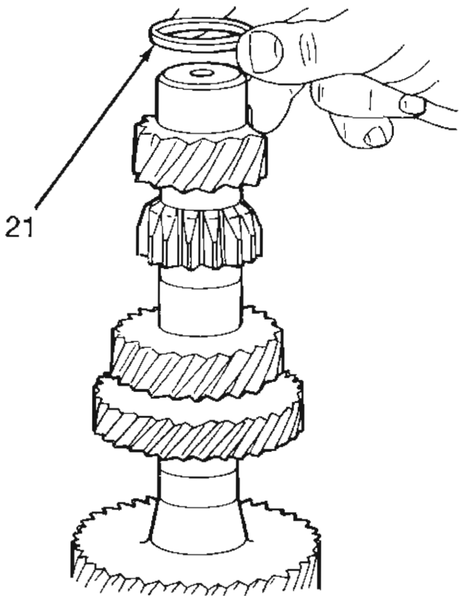
Remove the countershaft rear bearing (19) with a brass drift (20) and arbor press. Note the position of the bearing for assembly reference. The bearing identification numbers face outward when the bearing is correctly installed.



86239

Move the countershaft rearward, tilt it upward and remove it from the case. Remove the countershaft front thrust washer from the case. Note the position of the washer for assembly reference.

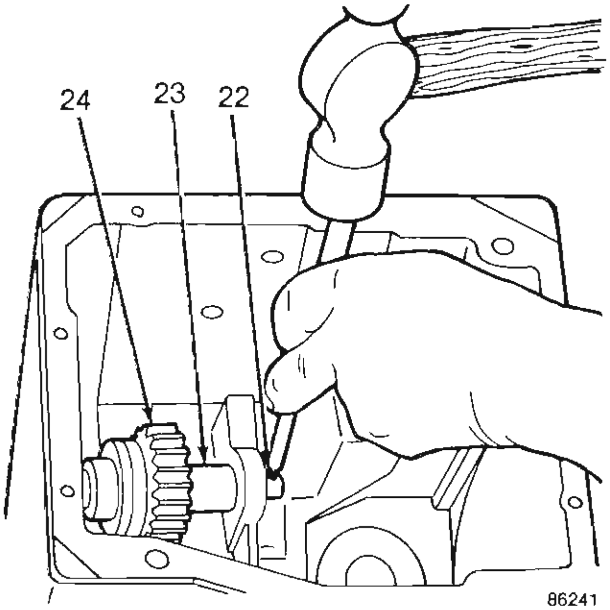
Remove the countershaft rear bearing spacer (21).



86240

Remove the reverse idler gear shaft roll pin (22) with a hammer and pin punch.

Remove the reverse gear idler shaft (23) and gear (24). Note the position of the gear for assembly reference.



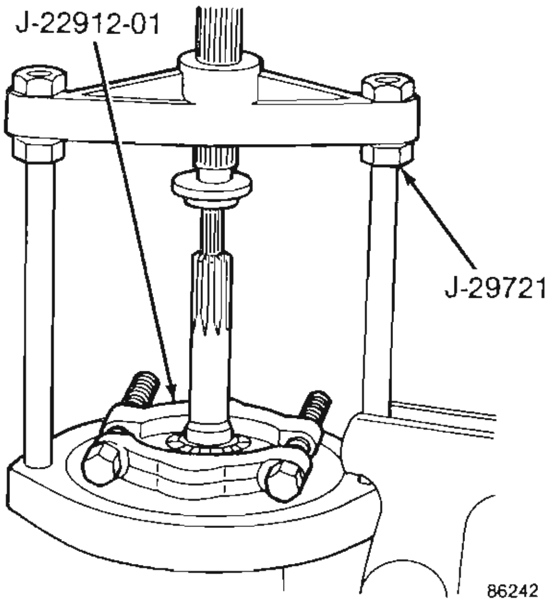
SEE
I.S.
NOTES

Remove the countershaft front bearing with an arbor press.

Remove the clutch shaft front bearing with Bearing Removal Tools J-29721 and J-22912-01.

Remove the adapter housing rear oil seal with a flat drift and hammer.

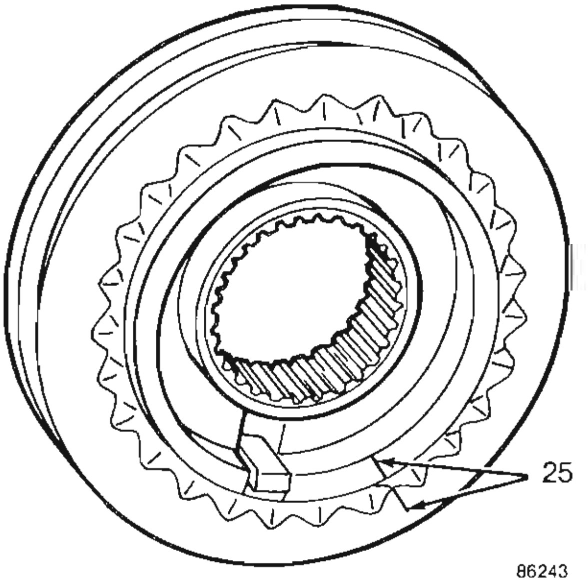
Remove the backup lamp switch from the transmission case.



Disassembly – Output Shaft Geartrain

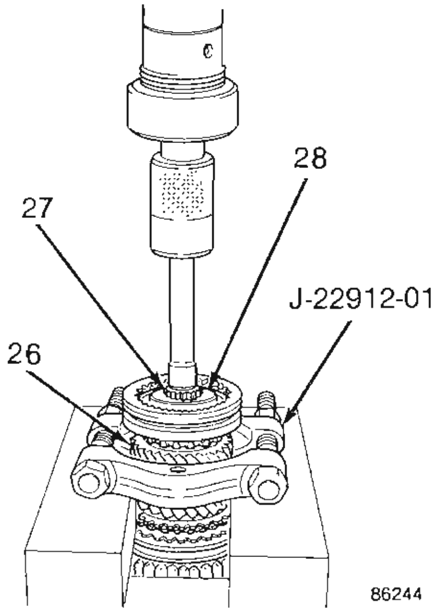
Remove the thrust bearing washer from the front end of the output shaft.

Scribe alignment marks (25) on the third-fourth gear synchronizer hub and sleeve for assembly reference.

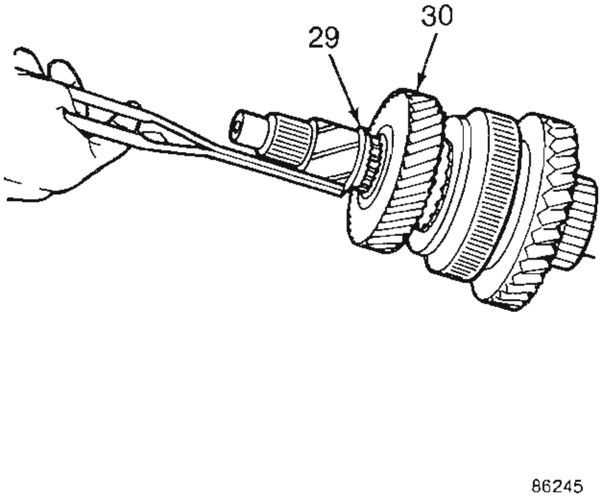


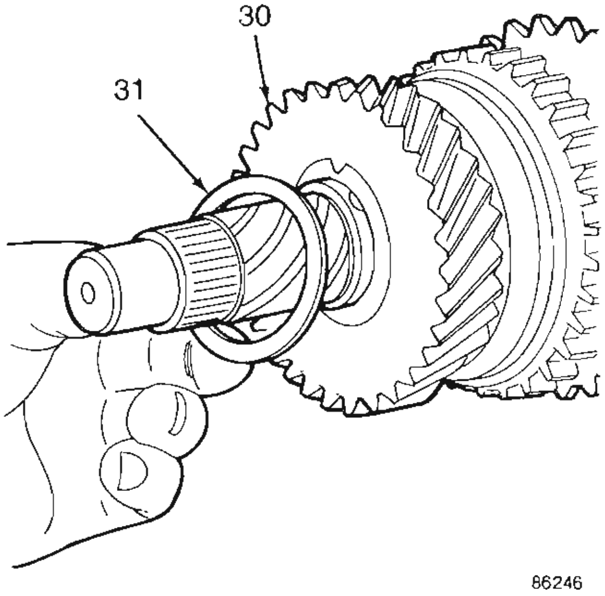
Position the jaws of a split-type puller (e.g., Tool J-22912-01) between the third and second gears on the output shaft. Ensure that the puller jaws exert force firmly against the back of the third gear (26).

Place the output shaft (27) geartrain assembly in an arbor press and remove the third-fourth gear synchronizer hub and sleeve (28) and third gear (26) as an assembly.



Remove the snap ring (29) that retains the second gear (30) on the shaft. Remove the tabbed second gear thrust washer (31) and second gear (30).

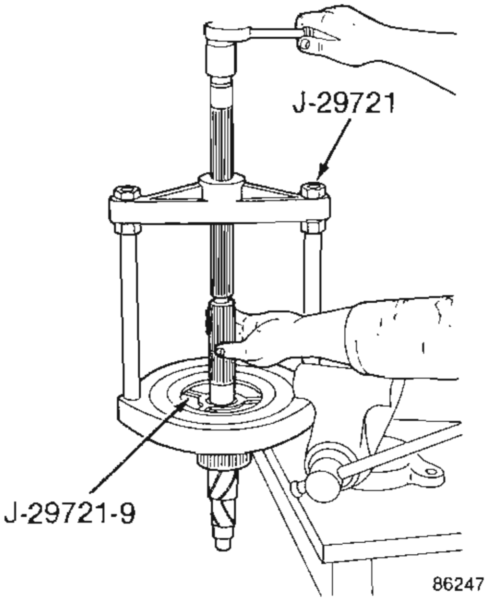




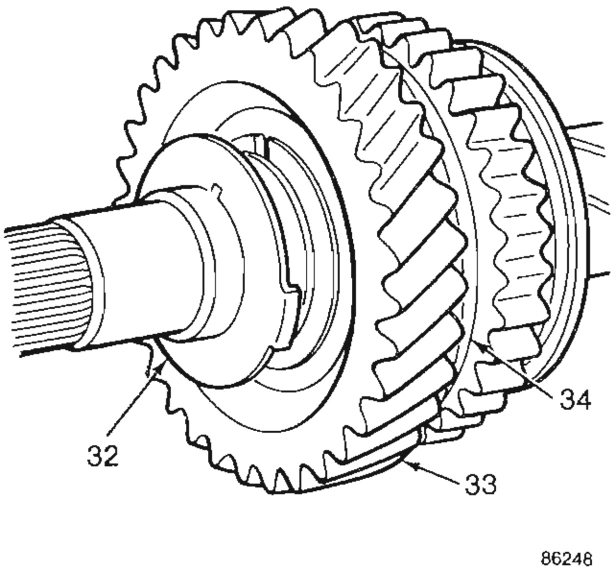
SEE
I.S.
N
O
T
E
S

SEE I.S. NOTES

Remove the output shaft bearing with Puller Set J-29721 and Adapter J-29721-9.

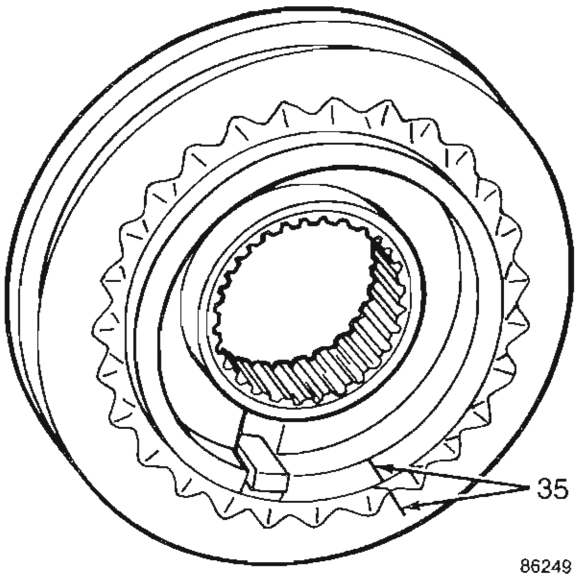


Remove the first gear thrust washer (32), first gear roll pin, first gear (33) and blocking ring (34). Use diagonal (side) cutters to remove the roll pin.



NOTE: The first gear journal may have the recently adopted hour glass shape.

Scribe alignment marks (35) on the first-second gear synchronizer sleeve and output shaft hub for assembly reference.

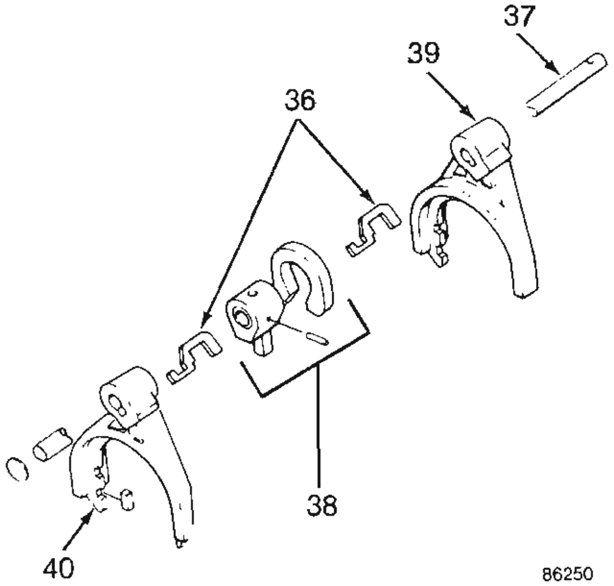


Remove the insert spring and inserts from the first-reverse sliding gear and remove the gear from the output shaft hub.

CAUTION: Do not attempt to remove the first-second-reverse gear hub from the output shaft. The hub and shaft are machined and assembled as a matched set during manufacture to ensure concentricity.

Disassembly – Transmission Cover Components

Place the selector arm plates (36) and shift rail (37) in a neutral position (centered).

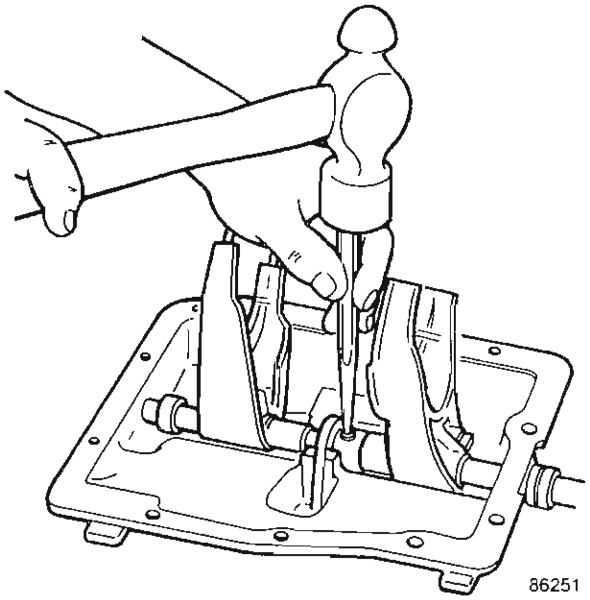


Rotate the shift rail (37) counterclockwise until the selector arm (38) disengages from the selector arm plates (36) and the selector arm roll pin (38) is accessible.

Pull the shift rail (37) rearward until the selector arm (38) contacts the first-second gear shift fork (39).

Remove the selector arm roll pin (38) with a 5-mm (3/16-in.) diameter pin punch and remove the shift rail (37).

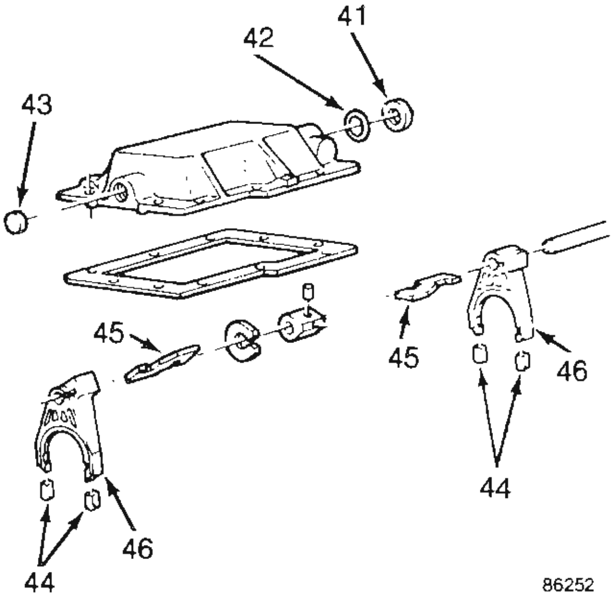
Remove the shift forks (39 and 40), selector arm plates (36), selector arm, roll pin, and interlock plate (38).



Remove the shift rail oil seal (41) and O-ring (42) with a pry tool.

Remove the shift rail plug (43) with a hammer and punch.

Remove the nylon inserts (44) and selector arm plates (45) from the shift forks (46). Note the position of the inserts and plates for assembly reference.



CLEANING AND INSPECTION

Thoroughly clean all the components in solvent and dry them with compressed air. Do not dry the front or rear bearing with compressed air. Allow them to air dry or wipe them dry with a clean shop cloth.

Clean the needle thrust and roller bearings by wrapping them in a cloth and submerging the cloth and bearings in solvent. Or, place them in a shallow parts cleaning tray and cover them with solvent. Allow the bearings to air dry or wipe them with a clean shop cloth.

SEE I.S. NOTES

Inspect the transmission case, cover and adapter housing. Replace any of these components if they have any of the following defects.

- cracks in the bores, sides, bosses or bolt holes
- stripped threads in the bolt holes
- nicks, burrs, or rough surfaces in the shaft bores or on the gasket surfaces

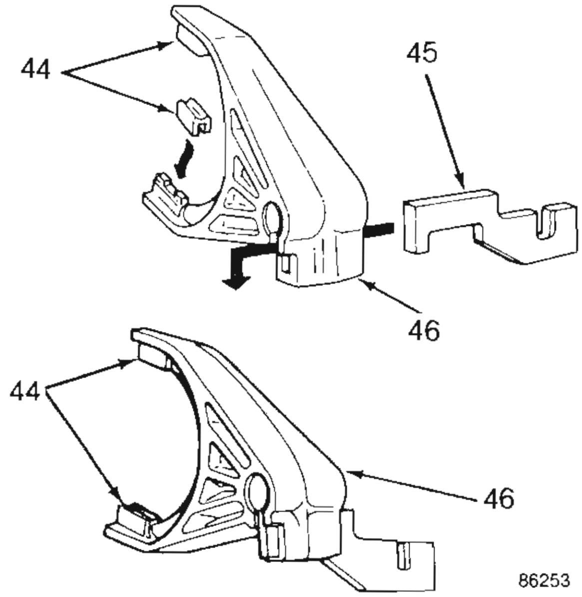
Inspect the geartrain and shift mechanism. Replace any components that have any of the following defects.

- broken, chipped or worn gear teeth
- bent or broken inserts
- weak or broken insert springs
- damaged roller thrust or needle bearings, or damaged bearing bores in the countershaft gear or clutch shaft
- worn or loss of surface metal from the countershaft and hub, clutch shaft or reverse idler gear shaft
- worn thrust washers
- nicked, broken or worn output or clutch shaft splines
- bent, distorted or weak snap rings
- worn bushing in the reverse idler gear
- rough, loss of surface metal or broken front/rear bearing
- worn shift fork inserts
- broken, cracked or worn shift forks
- bent, worn or loss of surface metal from the shift rail
- worn, bent or broken selector arms, plates or interlock
- worn, bent, broken or stripped offset lever, or worn lever insert

TRANSMISSION ASSEMBLY

Assembly – Transmission Cover Components

Install the nylon inserts (44) and selector arm plates (45) in the shift forks (46).



Coat the edges with sealant and install the shift rail plug (43).

Coat the shift rail (37) and shift rail bores with petroleum jelly and insert the shift rail in the cover. Insert the rail until the end is flush with the inside edge of the cover.

Position the first-second gear shift fork (39) in the cover with the fork offset facing the rear of the cover and insert the shift rail through the fork.

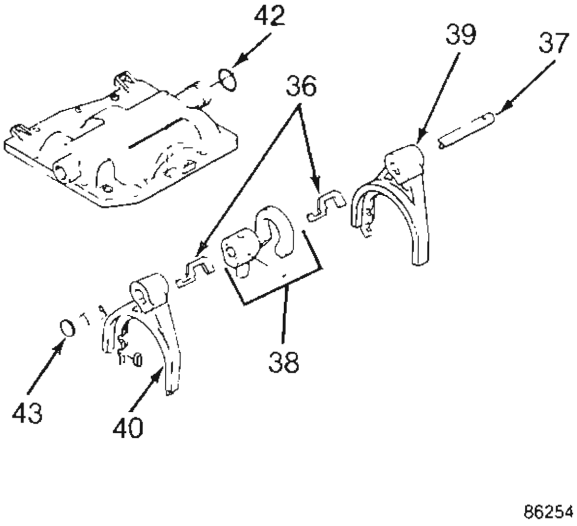
NOTE: The first-second gear shift fork is the larger of the two forks.

Position the selector arm and C-shaped interlock plate (38) in the cover and insert the shift rail (37) through the arm. The widest part of the interlock plate must face away from the cover, and the selector arm roll pin must face downward and toward the rear of the cover.

Position the third-fourth gear shift fork (40) in the cover with the fork offset facing the rear of the cover. The third-fourth gear shift fork selector arm plate must be positioned under the first-second gear shift fork selector plate.

Insert the shift rail (37) through the third-fourth gear shift fork (40) and into the shift rail front bore in the cover.

SEE
I.S.
N
O
T
E
S



Rotate the shift rail (37) until the selector arm plate (36) at the forward end of the rail faces away from (but parallel with) the cover.

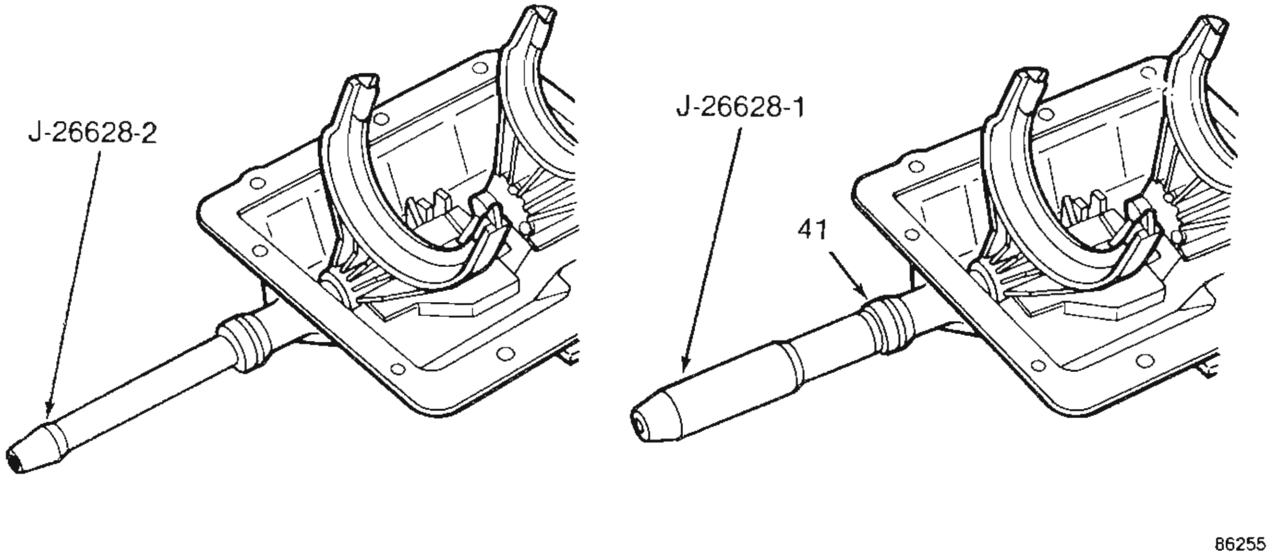
Align the roll pin holes in the selector arm (38) and shift rail and install the roll pin. Ensure that the roll pin is installed flush with the surface of the selector arm to prevent the pin from contacting the selector arm plates during shifts.

Install the O-ring (42) in the groove in the shift rail oil seal.

Install the shift rail oil seal according to the following procedure:

- position Oil Seal Protector Tool J-26628-2 over the threaded end of the shift rail
- lubricate the oil seal lip (41) with petroleum jelly and slide the seal over the protector tool and onto the shift rail
- seat the oil seal (41) in the transmission cover with Oil Seal Installation Tool J-26628-1

SEE I.S. NOTES



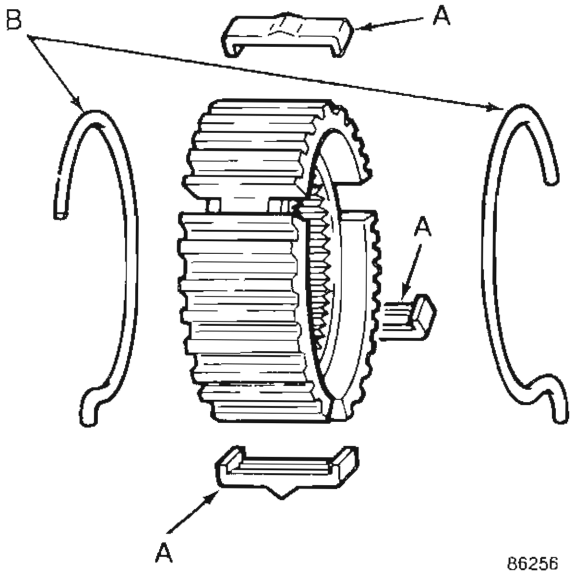
Assembly – Output Shaft Geartrain

NOTE: If any output shaft gear is replaced, the countershaft gear must also be replaced to maintain proper gear mesh and avoid noisy operation.

Coat the output shaft and gear bores with transmission lubricant.

Install and align the first-second gear synchronizer sleeve on the output shaft hub. Use the reference marks scribed during disassembly.

Install the 3 first-second gear synchronizer inserts (A) and the 2 insert springs (B) in the first-reverse gear synchronizer sleeve. Engage the tang end of each insert spring in the same synchronizer insert but position the open ends of the springs so that they face 180 degrees (opposite) from each other. Ensure that the sleeve and hub are aligned. Use the reference marks scribed during disassembly.

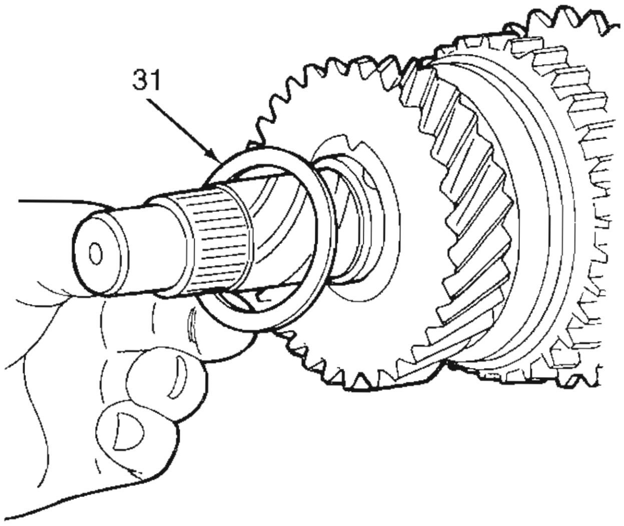


86256

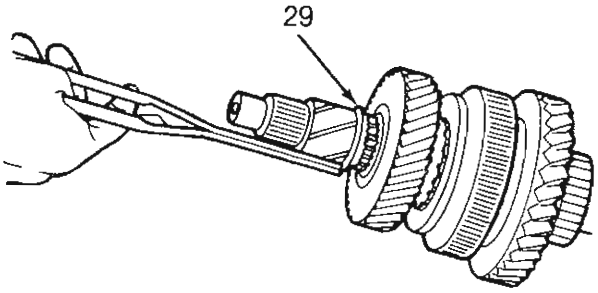
Install the blocking ring and second gear on the output shaft.

Install the tabbed thrust washer (31) and the second gear snap ring (29) on the output shaft. Ensure that the washer tab is properly seated in the output shaft notch.

Install the blocking ring and first gear on the output shaft.



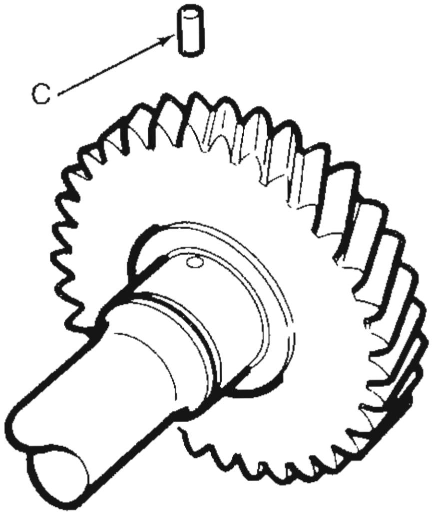
86257



86258

SEE
I.S.
NOTES

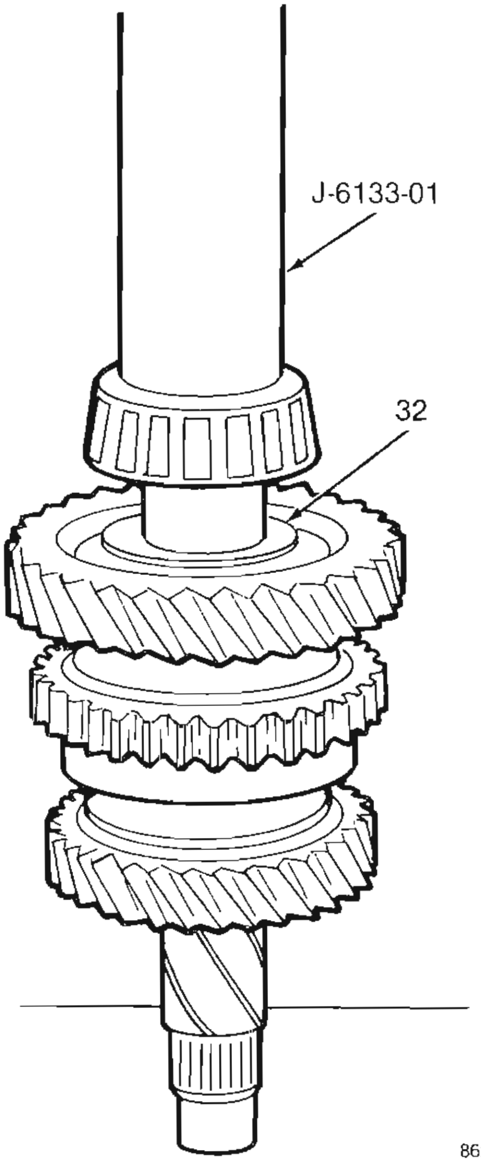
Install the first gear roll pin (C) in the output shaft.



86259

Install the first gear thrust washer (32).

Install the rear bearing on the output shaft with Tool J-6133-01.



86260

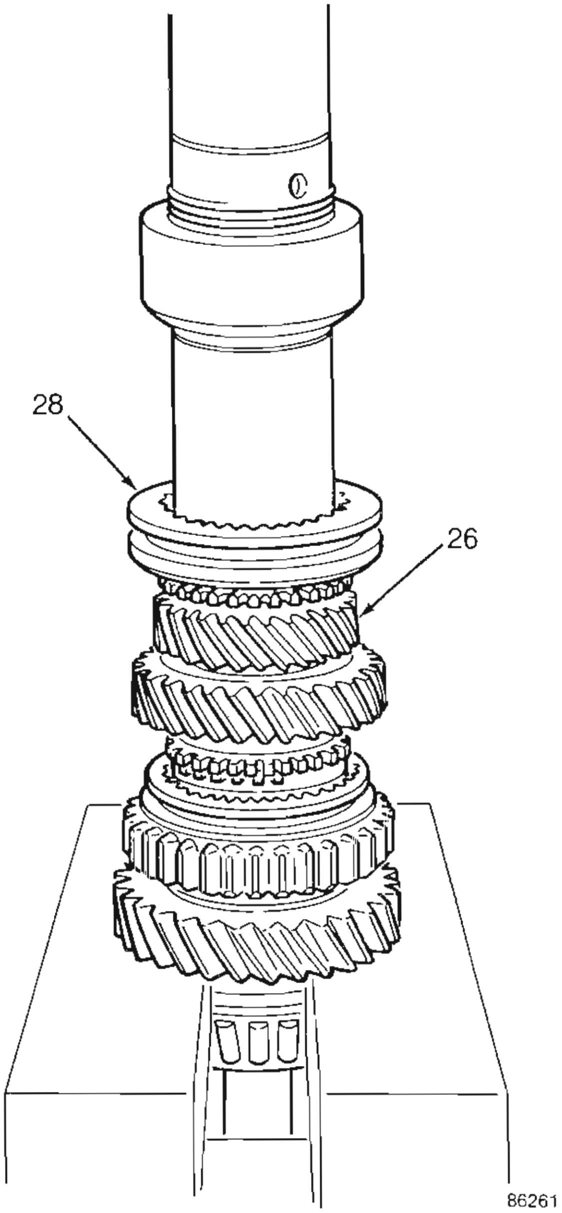
Install the third gear (26) on the output shaft and install the blocking ring on the third gear.

Align the scribe marks on the third-fourth gear synchronizer hub and sleeve (28) and output shaft, and start the hub onto the output shaft.

Press the third-fourth gear synchronizer hub and sleeve (28) onto the output shaft (until seated) with an arbor press.

NOTE: Ensure that the blocking ring is aligned with the third-fourth gear synchronizer sleeve before seating the hub and sleeve.

Install the fourth gear blocking ring in the third-fourth gear synchronizer sleeve.

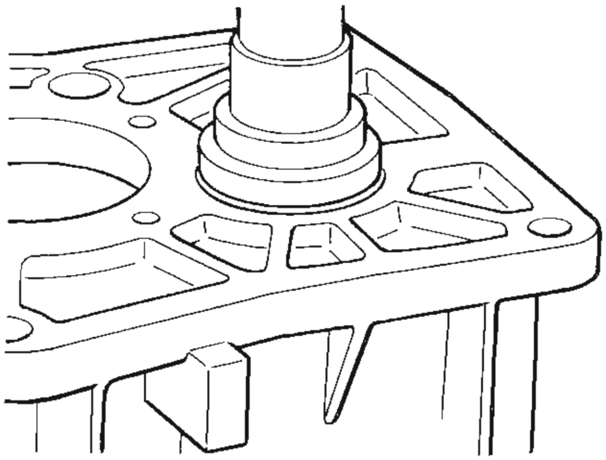


SEE I.S. NOTES

Assembly – Transmission Case

CAUTION: Except for the gearshift lever attaching bolts and filler plug, all bolts and threaded holes used in the T4 transmission have metric dimensions. Do not attempt to substitute with a different thread-type or size bolt if an original bolt is damaged or lost.

Coat the countershaft front bearing outer cage with Loctite 601, or equivalent, and install the countershaft front bearing (flush with the case) with an arbor press.

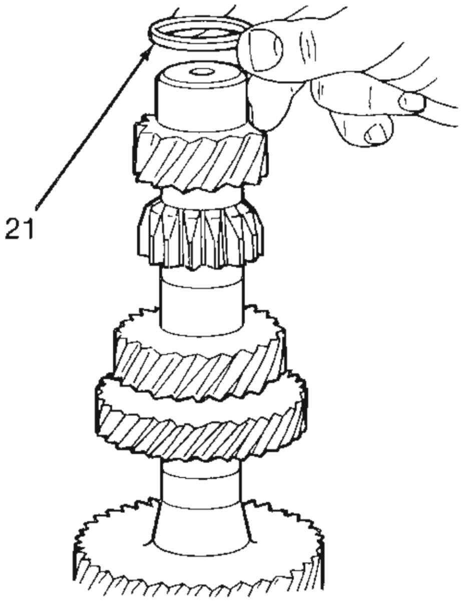


86262

Coat the countershaft tabbed thrust washer with petroleum jelly. Install the thrust washer so that the tab engages the corresponding depression in the case.

Turn the transmission case so that it is on its end and install the countershaft in the front bearing bore.

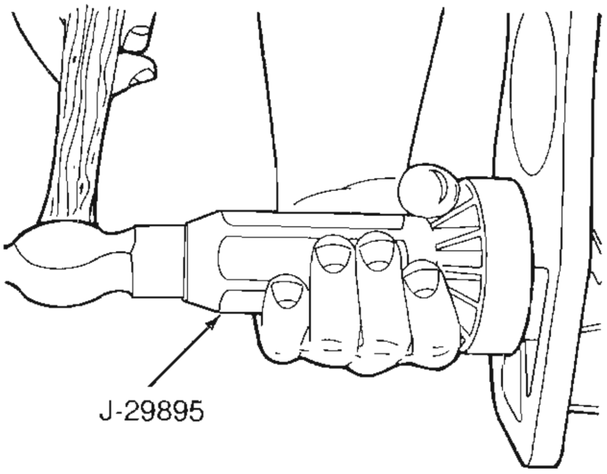
Install the countershaft rear bearing spacer (21).



86240

Coat the countershaft rear bearing with petroleum jelly and install the bearing with Installation Tool J-28895 and a hammer.

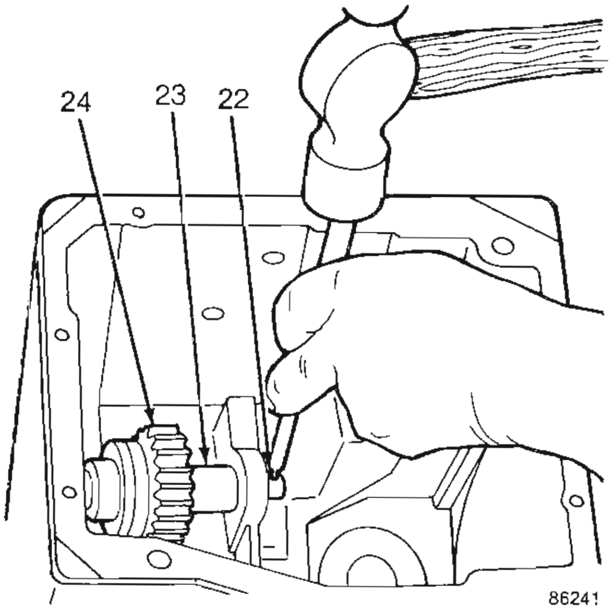
NOTE: When correctly installed, the countershaft rear bearing extends 3 mm (0.125 in.) beyond the case surface.



86263

Position the reverse idler gear (24) in the transmission case with the shift lever groove facing the rear of the case. Install the reverse idler gear shaft (23) from the rear of the case and install the retaining roll pin (22) in the shaft.

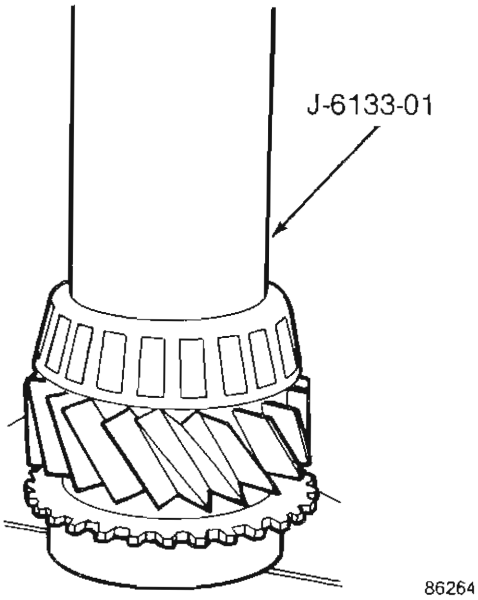
Install the assembled output shaft in the transmission case.

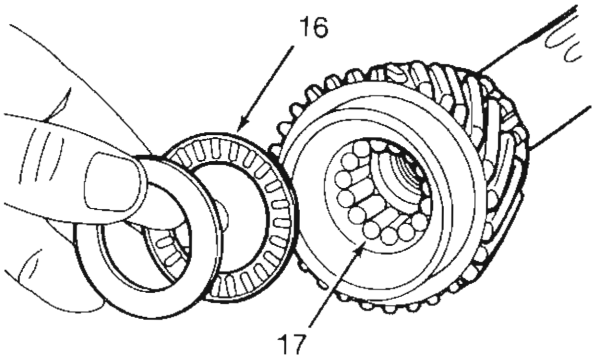


Install the clutch shaft front bearing on the clutch shaft with Tool J-6133-01 and an arbor press.

Coat the 15 pilot roller bearings (17) with petroleum jelly and install them on the clutch shaft.

Install the thrust bearing and race (16) on the clutch shaft.





86236

SEE
I.S.
NOTES

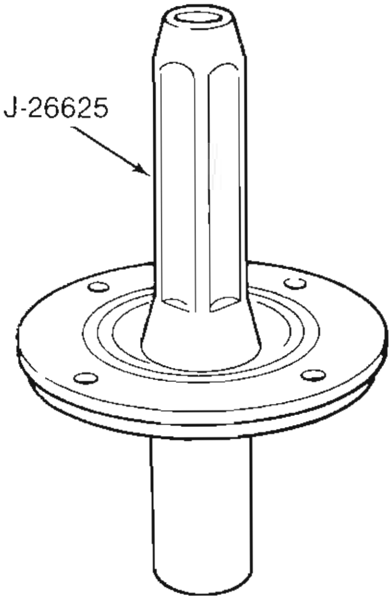
Install the fourth gear blocking ring on the output shaft.

Install the output shaft rear bearing race.

Install the clutch shaft in the transmission case and engage the shaft in the third-fourth gear synchronizer sleeve and blocking ring.

Install a replacement oil seal in the front bearing cap with Tool J-26625.

SEE I.S. NOTES

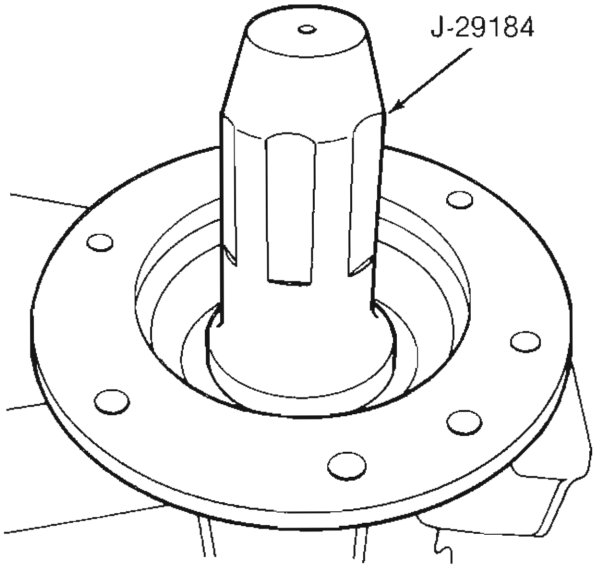


86265

Install a replacement rear oil seal in the adapter housing with Tool J-29184.

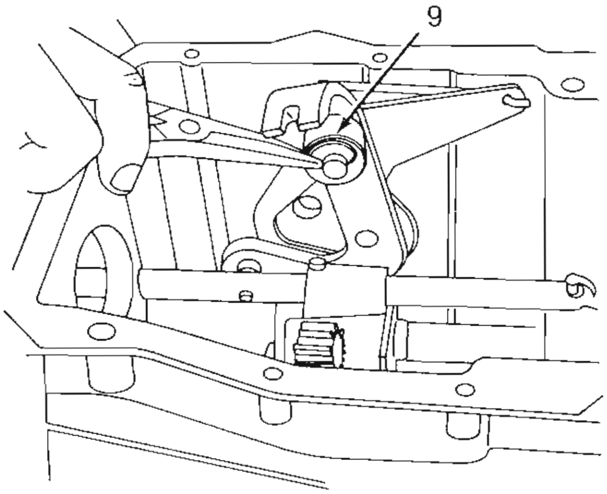
Install the front bearing race in the front bearing cap. Do not install the shims at this time.

Install the front bearing cap. Do not apply sealant at this time.



86266

Coat the reverse gear shift lever pivot pin bolt threads with Loctite sealant. Install the reverse gear shift lever, pivot pin bolt and retaining C-clip (9). Ensure that the reverse gear shift lever fork is engaged in the reverse idler gear. Tighten the shift lever pivot pin bolt with 58 N·m (43 ft-lbs) torque.



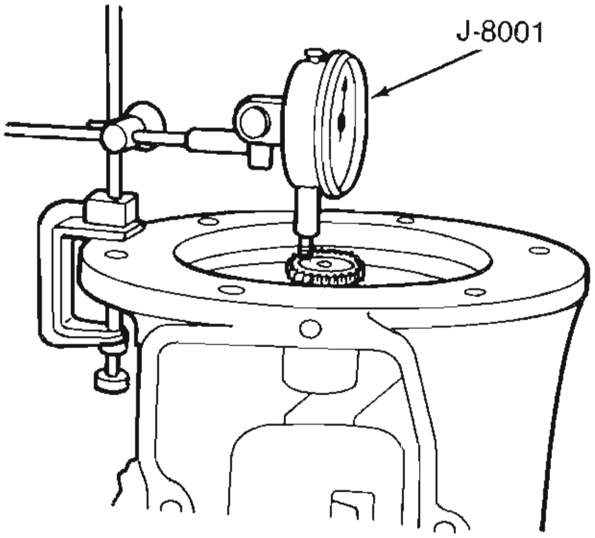
86232

Coat the countershaft rear bearing race and thrust bearing with petroleum jelly and install them in the adapter housing.

Temporarily install the adapter housing. Do not apply sealant or tighten the bolts with the final torque at this time.

Turn the transmission case on its end. Position Dial Indicator Tool J-8001 on the adapter housing with the indicator stylus on the end of the output shaft.

Rotate the clutch and output shafts and zero the dial indicator pointer.



Pull upward on the output shaft until the end play is eliminated. Note the end play on the dial indicator.

NOTE: To completely eliminate the output shaft and clutch shaft end play, the bearings must be preloaded from 0.03 to 0.13 mm (0.001 to 0.005 in.).

Select a shim pack that is 0.03 to 0.13 mm (0.001 to 0.005 in.) thicker than the end play measured above.

Place the transmission horizontally on a workbench and remove the front bearing cap and front bearing race.

Add shims to the bearing cap to obtain the necessary preload. Install the bearing race in the cap.

Apply a bead of RTV sealant on the transmission case mating surface for the front bearing cap. Install the front bearing cap with the reference marks (scribed during disassembly) aligned. Tighten the retaining bolts with 18 N·m (13 ft-lbs) torque.

Measure the end play. There must be no end play.

Remove Dial Indicator Tool J-8001 from the adapter housing.

Remove the adapter housing.

Move the shift forks on the transmission cover and synchronizer rings inside the transmission to the neutral position.

Apply a bead of RTV sealant to the transmission case mating surface for the cover.

Lower the cover, at a slightly off center attitude, onto the transmission case while aligning the shift forks and synchronizer sleeves. Center the cover on the transmission case to engage the reverse gear lever fork and install the two dowel bolts in the cover. Install the remaining bolts and tighten all the cover bolts with 12 N·m (9 ft-lbs) torque.

EE
S.
NOTES

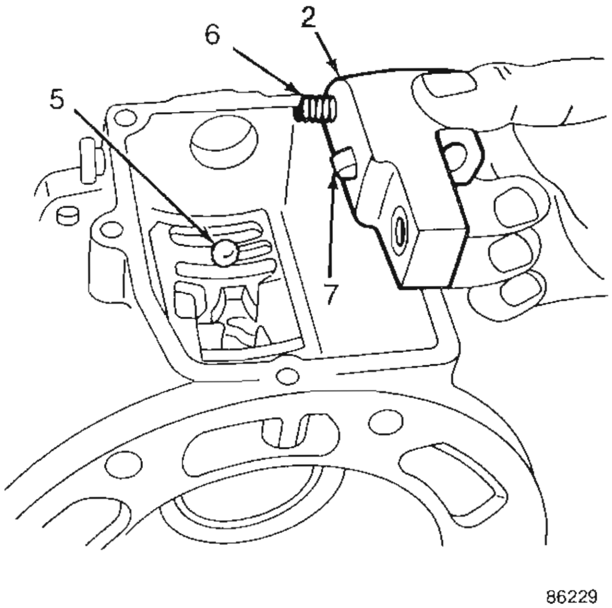
NOTE: The offset lever-to-shift rail roll pin hole will be in a vertical position when the cover is installed correctly.

Apply a bead of RTV sealant on the adapter housing-to-transmission case mating surface.

Install the adapter housing over the output shaft and shift rail at a position where the shift rail just enters the shift cover opening.

Install the detent spring (6) in the offset lever (2). Place the detent ball (5) in the neutral guide plate detent. Apply force on the detent ball with the detent spring and offset lever, slide the offset lever onto the shift rail and seat the adapter housing against the transmission case.

NOTE: The offset lever and shift rail roll pin holes should be aligned and in a vertical position at this time.

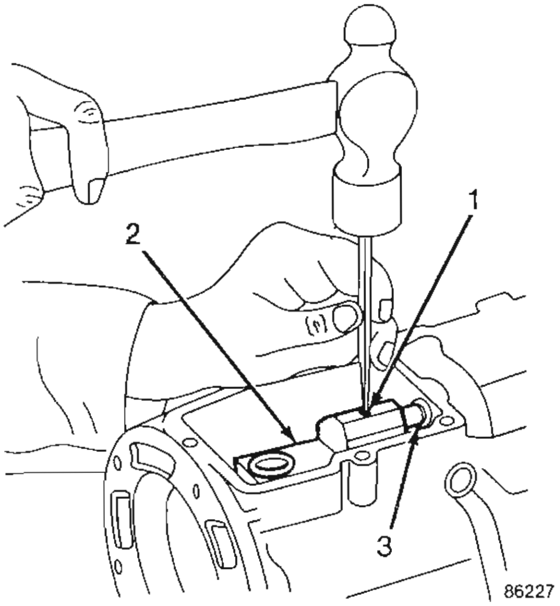


Install and tighten the adapter housing retaining bolts with 27 N·m (20 ft-lbs) torque.

Install the roll pin (1) in the offset lever (2) and shift rail (3).

Install the damper sleeve in the offset lever.

Coat the backup lamp switch threads with RTV sealant, install the switch in the transmission case and tighten with 20 N·m (15 ft-lbs).



Install the drain bolt.

SPECIAL TOOLS

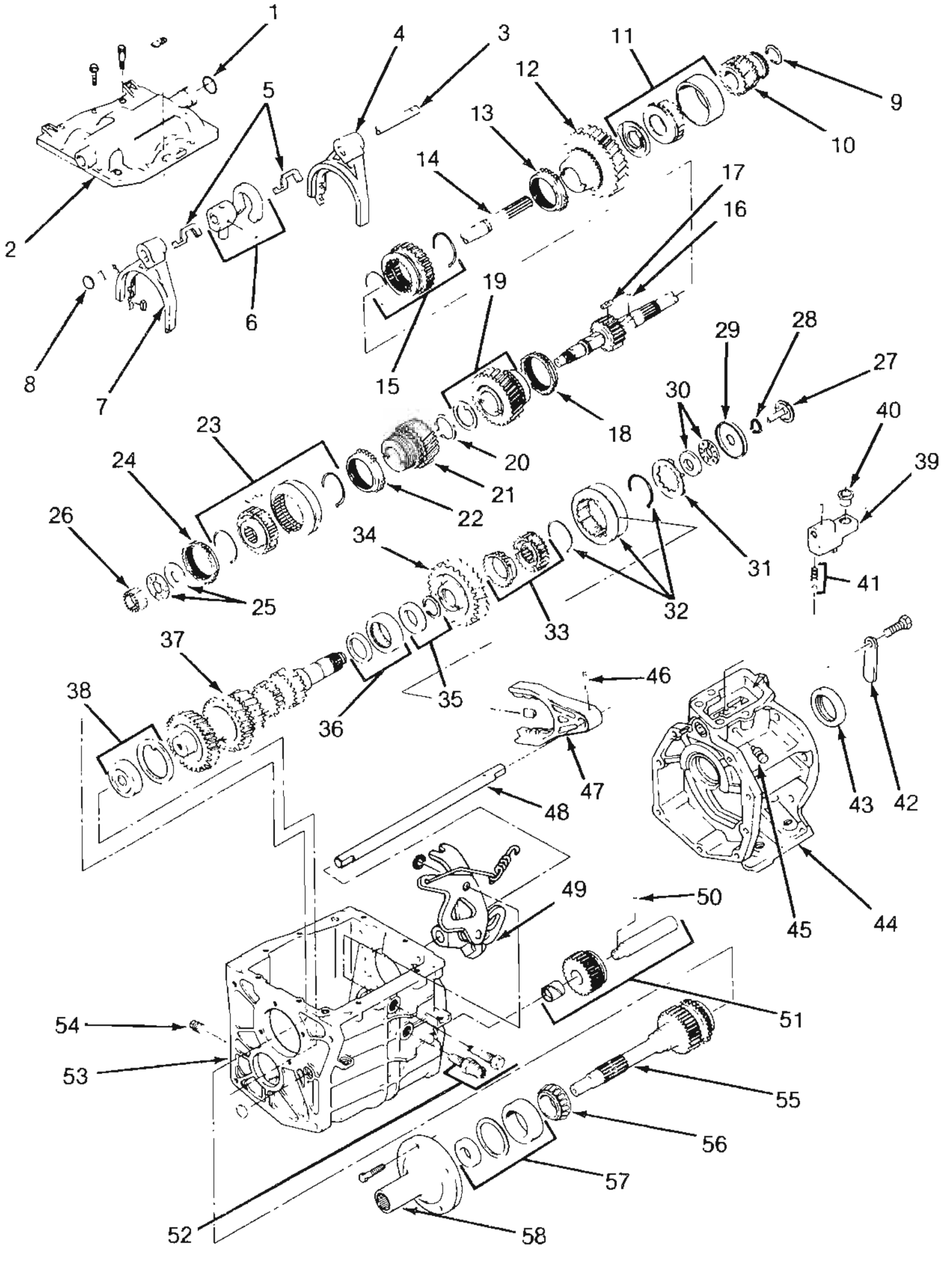
Tool Ref.	Description	Required	Recommended
J-26625	Front Bearing Cap Seal Installation Tool	■	
J-29895	Rear Countershaft Bearing Installation Tool	■	
J-25215	Puller Assembly		■
J-33032	Protector Sleeve	■	
J-29721	Bearing Removal Set		■
J-29721-9	Adapter–P/O J-29721		■
J-22912-01	Bearing Removal Tool		■
J-26628-1	Oil Seal Installation Tool	■	
J-26628-2	Oil Seal Protector	■	
J-6133-01	Bearing Installation Tool		■
J-29184	Seal Installation Tool	■	
J-8001	Dial Indicator		■

SEE
I.S.
NOTES

TORQUE SPECIFICATIONS

Component	Service Set-To Torque	Service Recheck Torque
Adapter Housing Bolt	27 N·m (20 ft-lbs)	20-34 N·m (15-25 ft-lbs)
Backup Lamp Switch	20 N·m (15 ft-lbs)	16-24 N·m (12-18 ft-lbs)
Filler Plug	31 N·m (23 ft-lbs)	20-41 N·m (15-30 ft-lbs)
Front Bearing Cap Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Shift Control Housing Bolt	18 N·m (13 ft-lbs)	15-20 N·m (11-15 ft-lbs)
Fifth-Reverse Gear Shift Lever Pivot Pin Bolt	58 N·m (43 ft-lbs)	47-68 N·m (35-50 ft-lbs)
Transmission Cover Bolt	12 N·m (9 ft-lbs)	8-15 N·m (6-11 ft-lbs)

T5 MANUAL TRANSMISSION (EXPLODED)



86268A

T5 MANUAL TRANSMISSION (EXPLODED)

LEGEND

1. O-RING
2. TRANSMISSION COVER
3. SHIFT RAIL
4. FIRST-SECOND GEAR SHIFT FORK
5. SELECTOR PLATE
6. SELECTOR ARM, INTERLOCK PLATE AND PIN
7. THIRD-FOURTH GEAR SHIFT FORK
8. PLUG
9. SNAP RING
10. FIFTH DRIVEN GEAR
11. THRUST WASHER, REAR BEARING AND CUP
12. FIRST GEAR
13. FIRST GEAR BLOCKING RING
14. OUTPUT SHAFT
15. REVERSE SLIDING GEAR AND INSERT SPRINGS
16. ROLL PIN
17. SYNCHRONIZER INSERT
18. SECOND GEAR BLOCKING RING
19. SECOND GEAR AND THRUST WASHER
20. SNAP RING
21. THIRD GEAR
22. THIRD GEAR BLOCKING RING
23. THIRD-FOURTH GEAR SYNCHRONIZER SPRINGS, HUB, INSERT AND SLEEVE
24. FOURTH GEAR BLOCKING RING
25. NEEDLE THRUST BEARING AND RACE
26. CLUTCH SHAFT NEEDLE ROLLER BEARING
27. FUNNEL
28. SNAP RING
29. THRUST BEARING RACE
30. COUNTERSHAFT NEEDLE THRUST BEARING AND RACE
31. INSERT RETAINER
32. FIFTH GEAR SYNCHRONIZER SLEEVE AND INSERT SPRINGS
33. FIFTH GEAR SYNCHRONIZER INSERT, HUB AND BLOCKING RING
34. FIFTH GEAR
35. SNAP RING AND SPACER
36. COUNTERSHAFT REAR BEARING AND SPACER
37. COUNTERSHAFT GEAR
38. COUNTERSHAFT FRONT BEARING AND THRUST WASHER
39. OFFSET LEVER
40. DAMPER SLEEVE
41. DETENT SPRING AND BALL
42. IDENTIFICATION TAG
43. ADAPTER HOUSING SEAL
44. ADAPTER HOUSING
45. VENT
46. ROLL PIN
47. FIFTH GEAR SHIFT FORK
48. FIFTH GEAR AND REVERSE GEAR RAIL
49. FIFTH GEAR-REVERSE GEAR SHIFT LEVER
50. ROLL PIN
51. REVERSE IDLER GEAR, BUSHING AND SHAFT
52. FIFTH GEAR LEVER PIVOT PIN BOLT AND BACKUP LAMP SWITCH
53. TRANSMISSION CASE
54. DRAIN PLUG
55. CLUTCH SHAFT
56. FRONT BEARING
57. FRONT BEARING CAP OIL SEAL, SHIM AND RACE
58. FRONT BEARING CAP

SEE I.S. NOTES

86268B

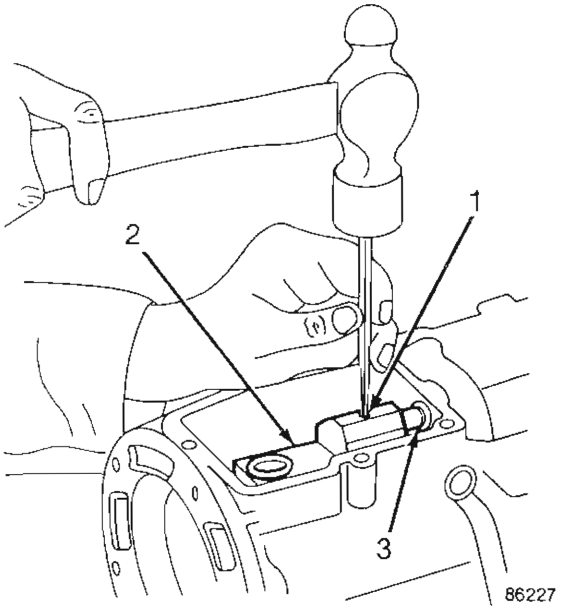
TRANSMISSION DISASSEMBLY

CAUTION: Except for the gearshift lever attaching bolts and filler plug, all the bolts and threaded holes used in the T5 transmission have metric dimensioned threads and sizes. If replacement bolts are required during service, use only those having the same thread type and size as the original bolts.

Remove the drain bolt from the transmission case and drain the lubricant.

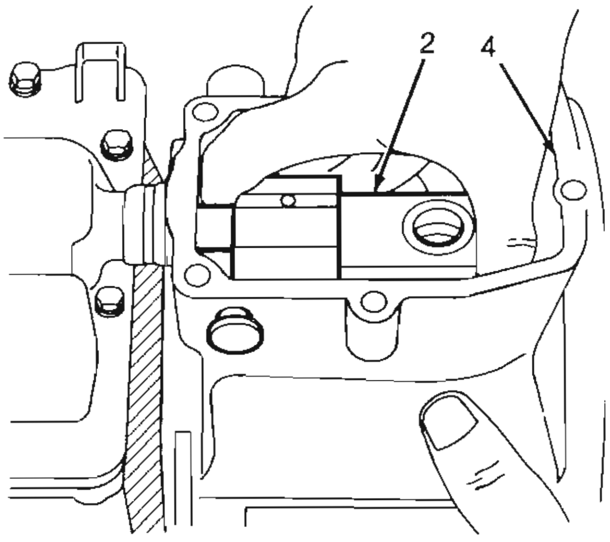
Use a pin punch and hammer to remove the roll pin (1) that attaches the offset lever (2) to the shift rail (3).

:EE
.S.
N
O
T
E
S

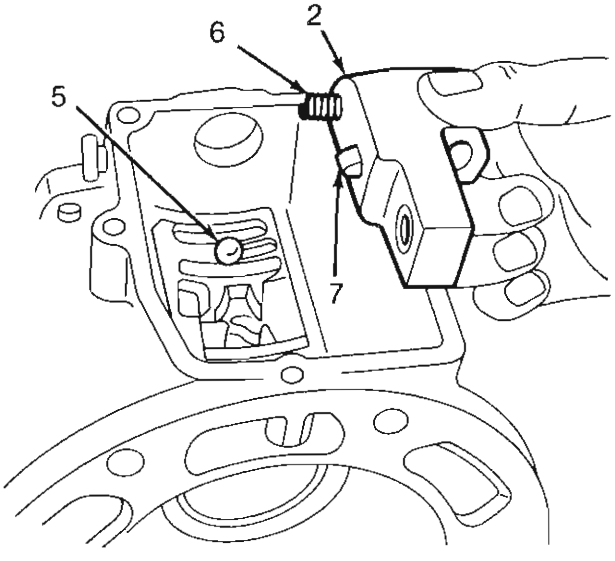


Remove the adapter housing-to-transmission case bolts and remove the housing (4) and offset lever (2) as an assembly.

CAUTION: Do not attempt to remove the offset lever while the adapter housing is bolted in place. The lever has a positioning lug (9) engaged in the housing detent plate that prevents moving the lever far enough forward for removal.

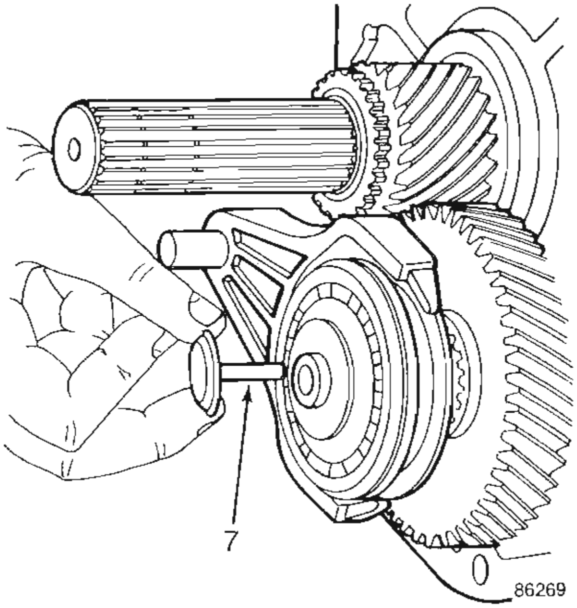


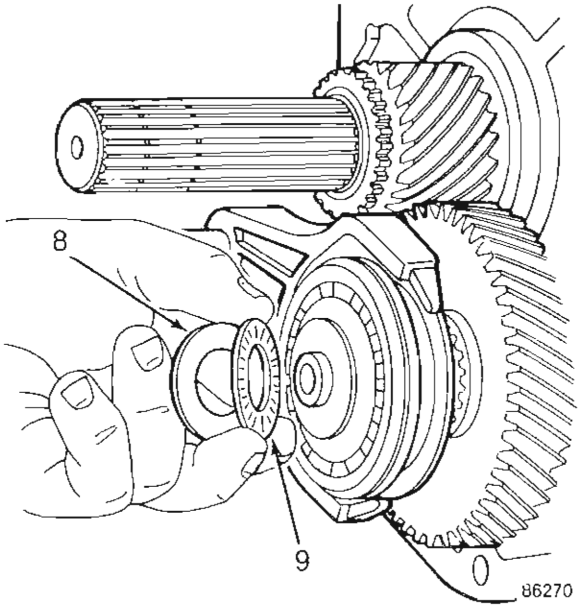
Remove the detent ball (5) and spring (6) from the offset lever (2) and remove the roll pin (1) from the adapter housing or the offset lever.



Remove the plastic funnel (7), thrust bearing race (8) and thrust bearing (9) from the rear of the countershaft.

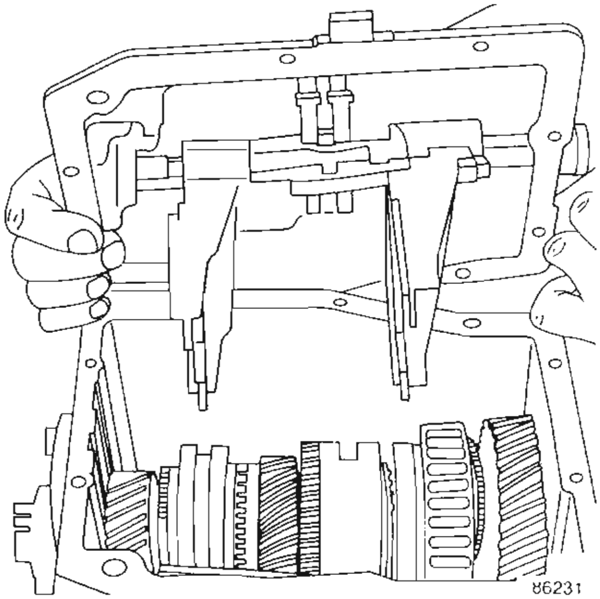
NOTE: The countershaft rear thrust bearing, bearing race and plastic funnel will be located either on the end of the countershaft or inside the adapter housing.





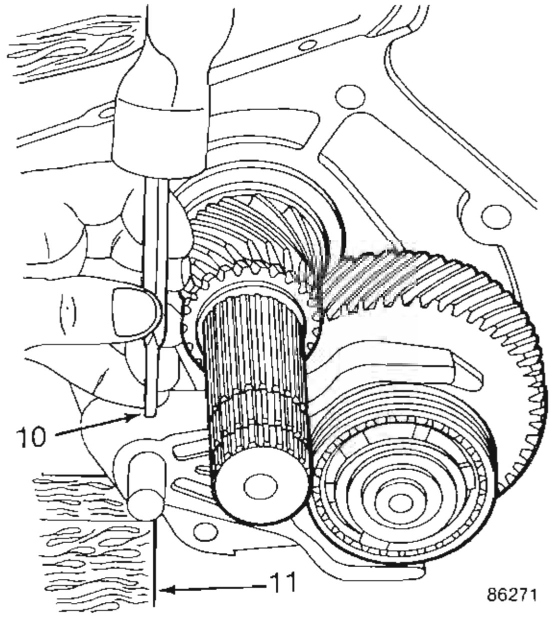
Remove the bolts attaching the transmission cover and shift fork assembly and remove the cover.

NOTE: Two of the transmission cover attaching bolts are alignment-type dowel bolts. Note the location of these bolts for assembly reference.

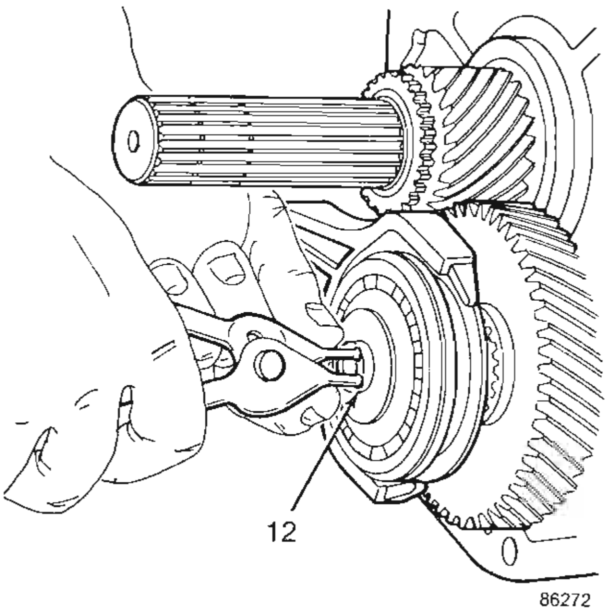


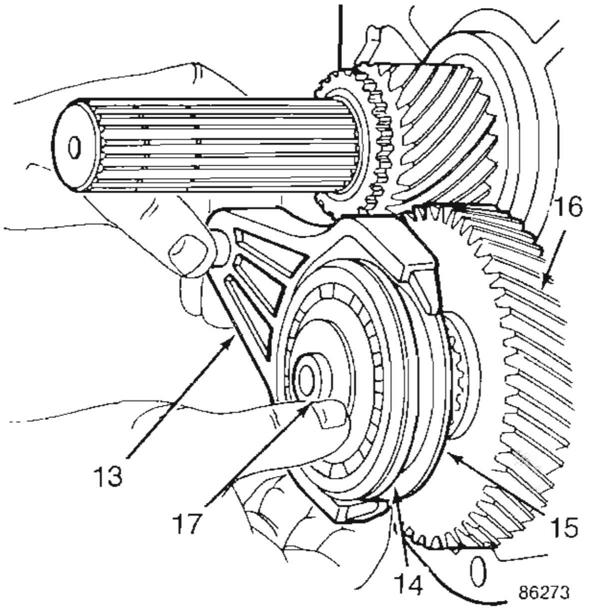
CAUTION: Place a wood block (11) under the fifth gear shift fork during roll pin removal to prevent damage to the fifth-reverse gear shift rail.

Remove the roll pin (10) from the fifth gear shift fork with a hammer and punch.



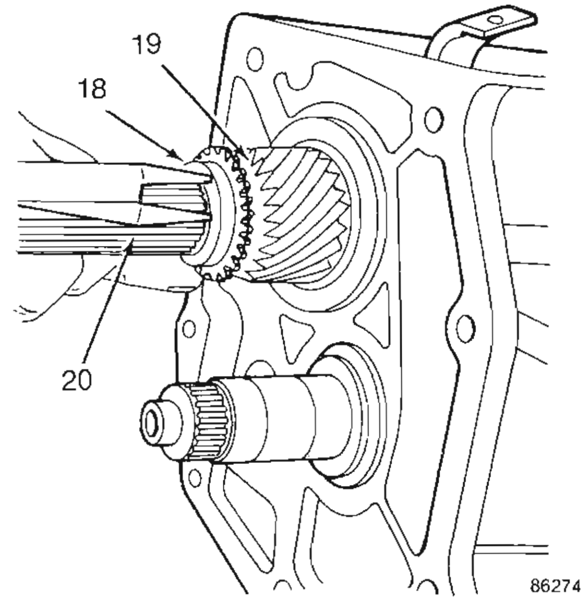
Remove the fifth gear synchronizer snap ring (12), shift fork (13), fifth gear synchronizer sleeve (14), blocking ring (15) and fifth gear (16) from the rear of the countershaft (17).

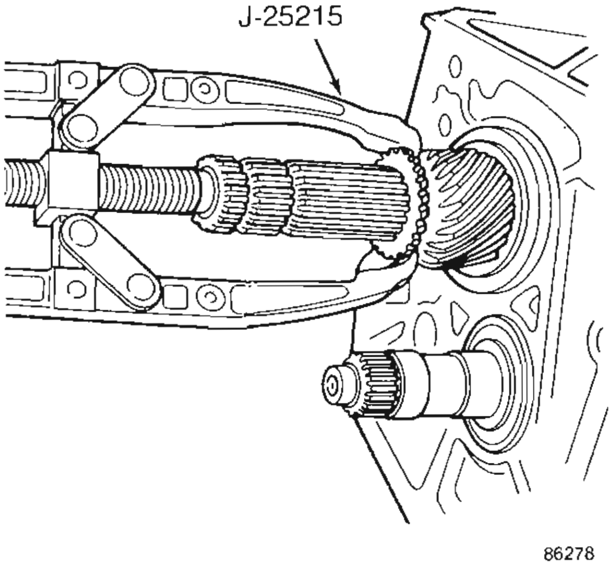




Remove the fifth gear insert retainer synchronizer springs and inserts from the sleeve and hub. Scribe a mark to indicate the position of the hub and sleeve for assembly reference.

Remove the snap ring (18) and fifth driven gear (19) from the rear of the output shaft (20) with Puller Assembly J-25215.

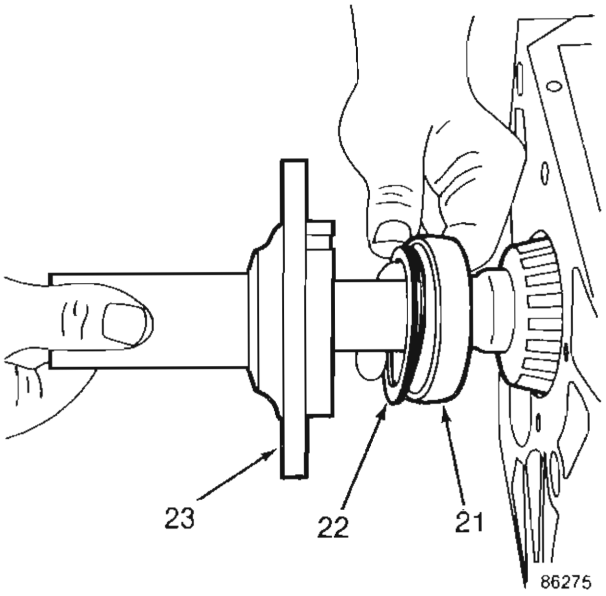




For assembly reference, mark the position of the front bearing cap on the front of the transmission case. Use a hammer and punch to mark both the bearing cap and case.

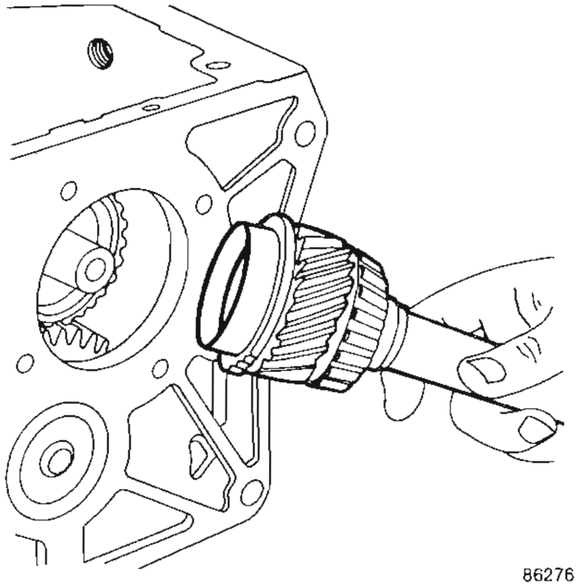
Remove the front bearing cap bolts and the front bearing cap.

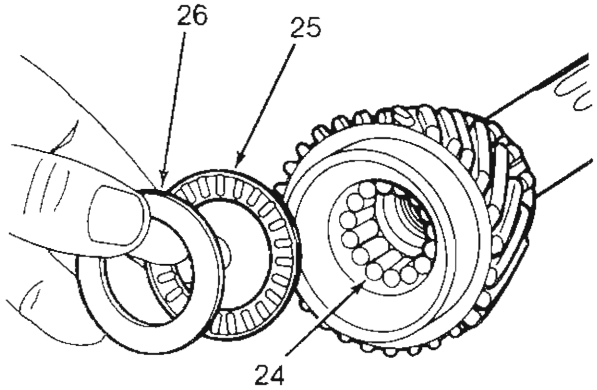
Remove the front bearing race (21) and end play shim(s) (22) from the front bearing cap (23). Remove the oil seal from the bearing cap with a pry tool.



SEE I.S. NOTES

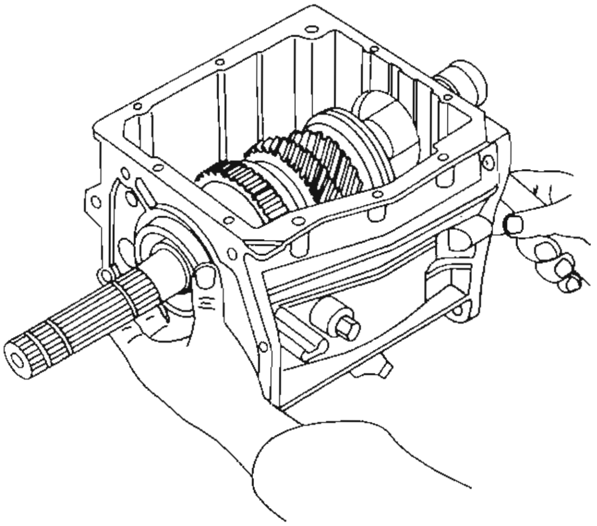
Rotate the clutch shaft until the flat surface on the main drive gear faces the countershaft and remove the clutch shaft from the transmission case. Remove the 15 clutch shaft needle bearings (24), bearing (25) and race (26).

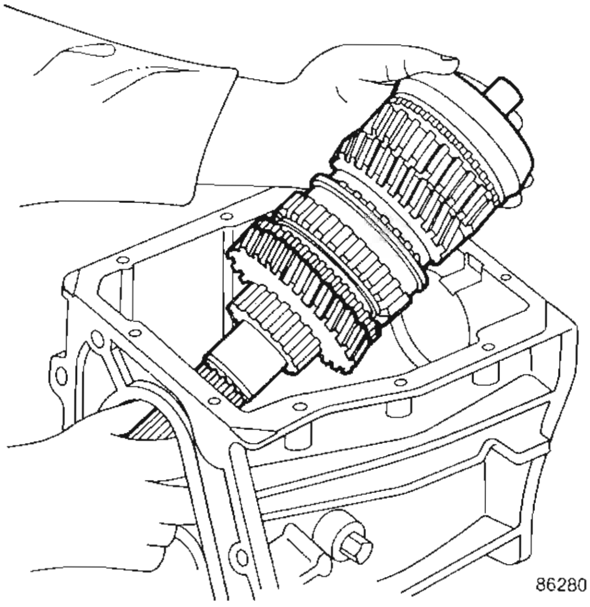

86276



86277

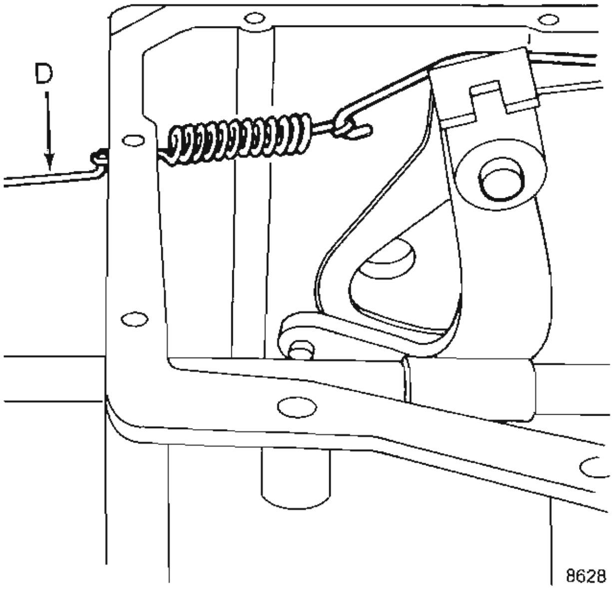
Remove the output shaft rear bearing race and tilt the output shaft assembly upward and remove it from the transmission case.


86279


86280

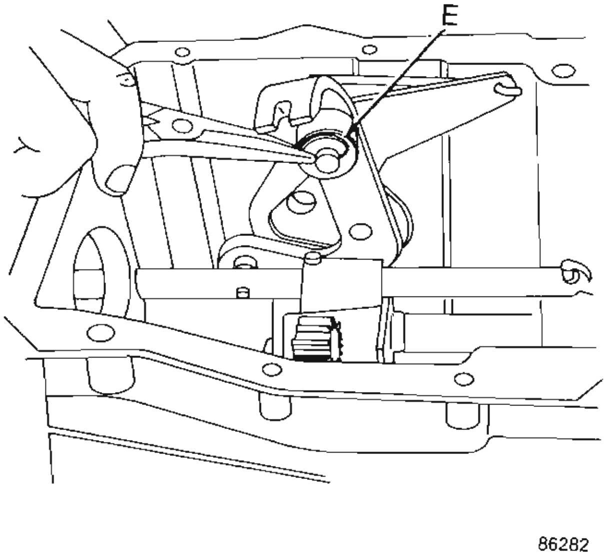
Release the overcenter link spring from the rear of the transmission case.

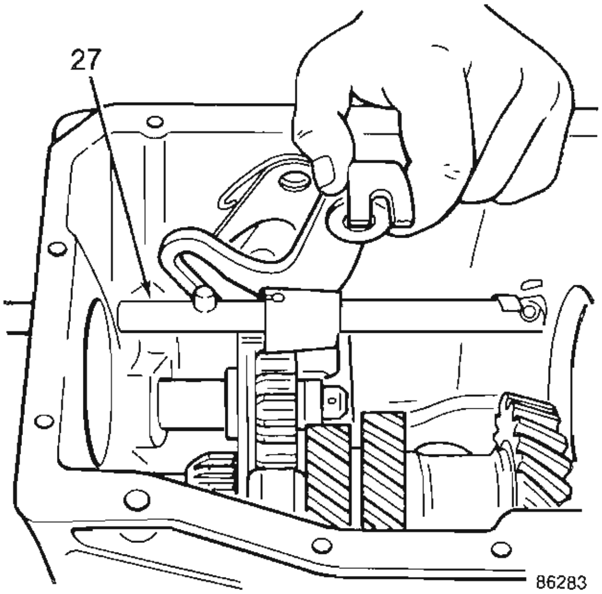
NOTE: Use a mechanic's wire or welding rod (D) to fabricate a spring removal tool similar to that illustrated.



Remove the C-clip (E) attaching the fifth-reverse gear shift lever and fork assembly to the pivot pin bolt.

Rotate the fifth-reverse gear shift rail (27) clockwise (when viewed from the top of the transmission case) to disengage it from the fifth-reverse gear shift lever assembly. Remove the shift rail from the rear of the transmission case.

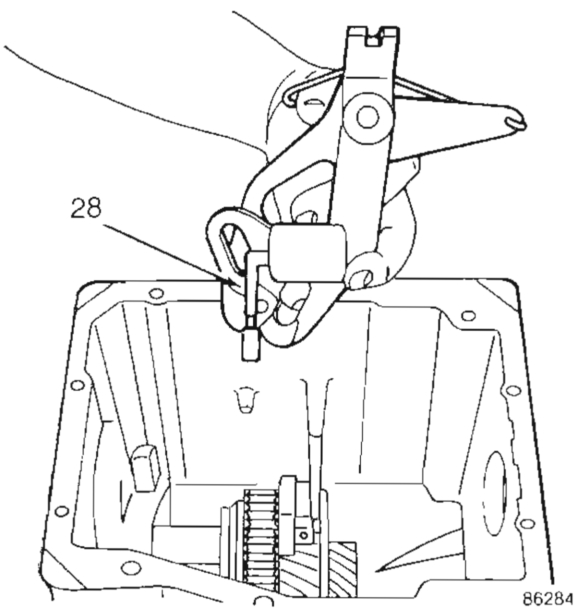


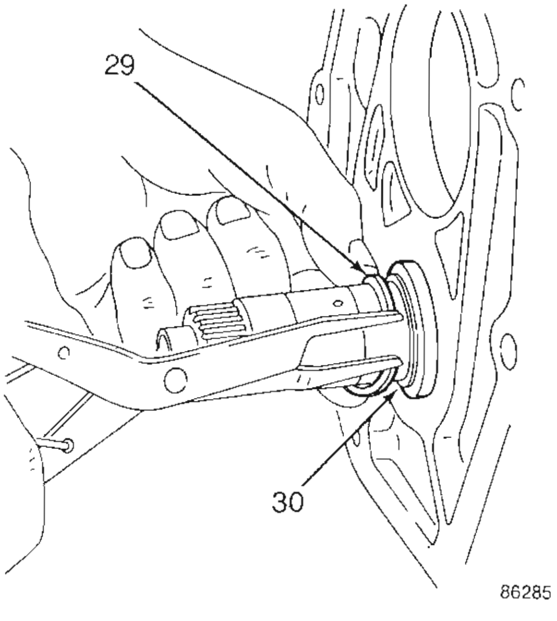


SEE I.S. NOTES

Remove the fifth-reverse gear shift lever and fork assembly (28) pivot pin bolt, detach the fifth-reverse gear shift lever from the reverse idler gear and remove the fifth-reverse gear shift lever and fork assembly from the transmission case.

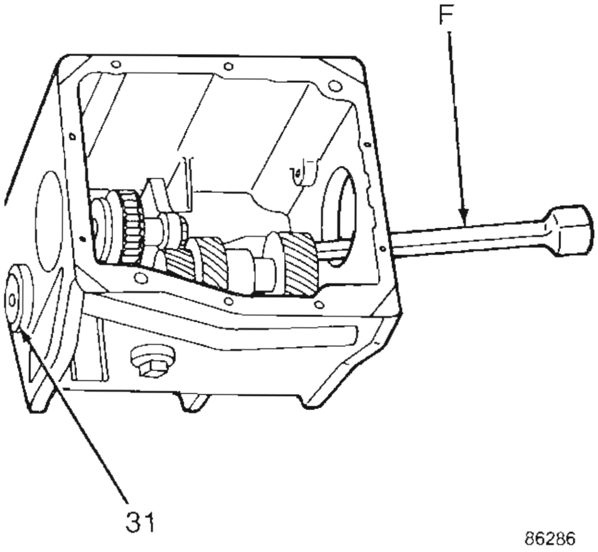
Remove the countershaft rear snap ring (29) and spacer (30).





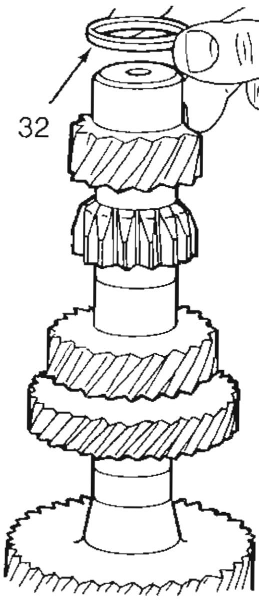
Insert a brass drift (F) through the clutch shaft opening in front of the transmission case and, with an arbor press, carefully press the countershaft assembly rearward to remove the countershaft rear bearing (31).

NOTE: For assembly reference, the bearing identification numbers face outward when the bearing is correctly installed.



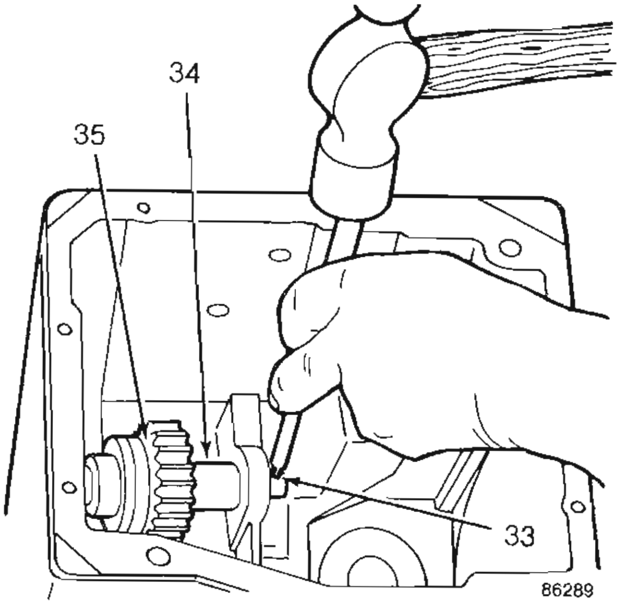
Move the countershaft assembly rearward inside the transmission case, tilt the assembly upward and remove it from the case. Note the position the countershaft front thrust washer for assembly reference and remove it from the case.

Remove the countershaft rear bearing spacer (32).



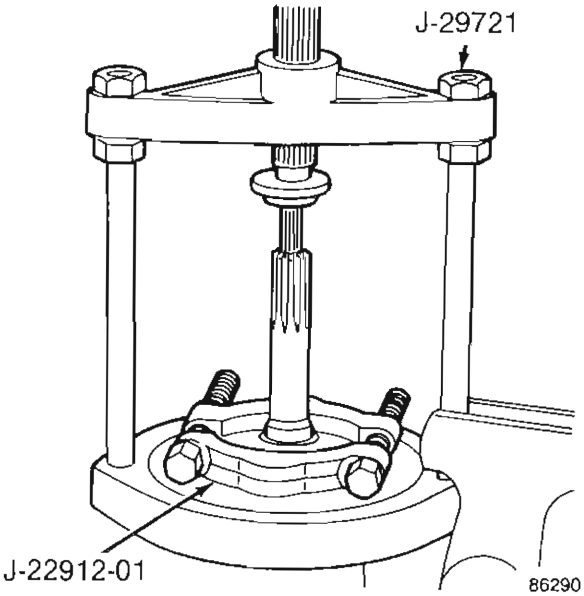
Use a hammer and punch to remove the roll pin (33) from the forward end of the reverse idler gear shaft.

Remove the reverse idler gear shaft (34) and gear (35) from the transmission case. Note the position of the idler gear for assembly reference.



Remove the countershaft front bearing from the transmission case with an arbor press.

Remove the clutch shaft front bearing with Tools J-29721 and J-22912-01.

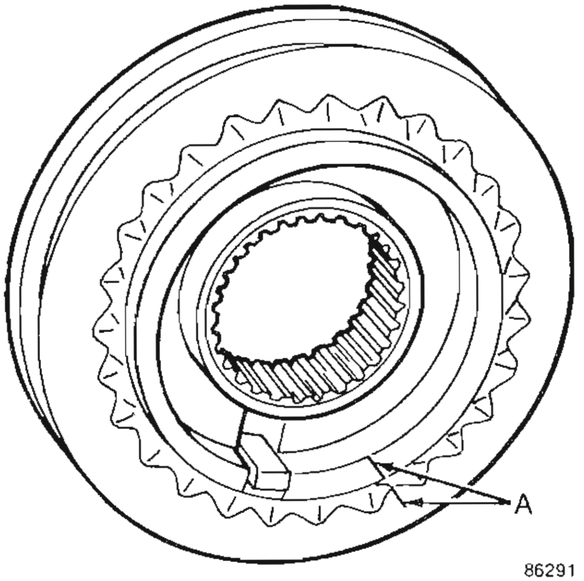


Remove the adapter housing rear oil seal with a flat drift and hammer.

Disassembly – Output Shaft Geartrain

Remove the thrust bearing washer from the front end of the output shaft.

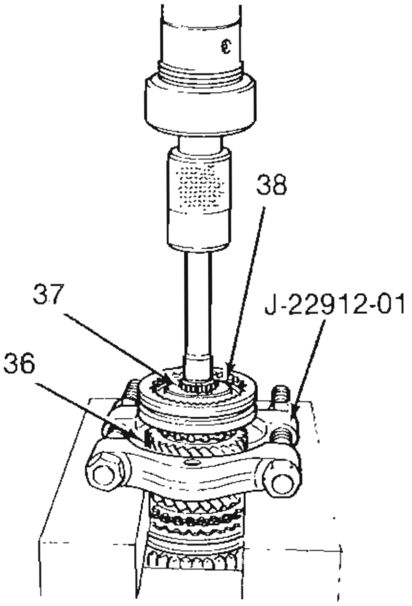
Scribe alignment marks (A) on the third-fourth gear synchronizer hub and sleeve for assembly reference.



86291

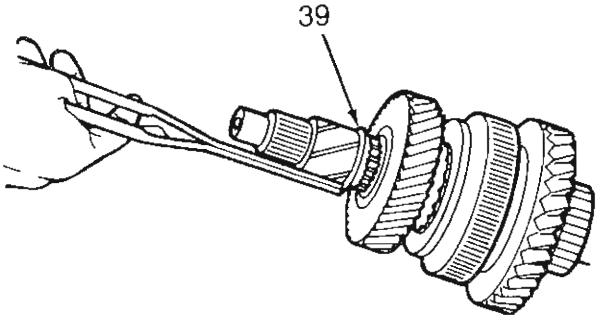
Position the jaws of a split-type puller (e.g., Tool J-22912-01) between the third and second gears on the output shaft. Ensure that the puller jaws exert force firmly against the back of the third gear.

Position the output shaft (37) geartrain assembly in an arbor press and remove the third-fourth gear synchronizer hub and sleeve (38) and third gear (36) as an assembly.

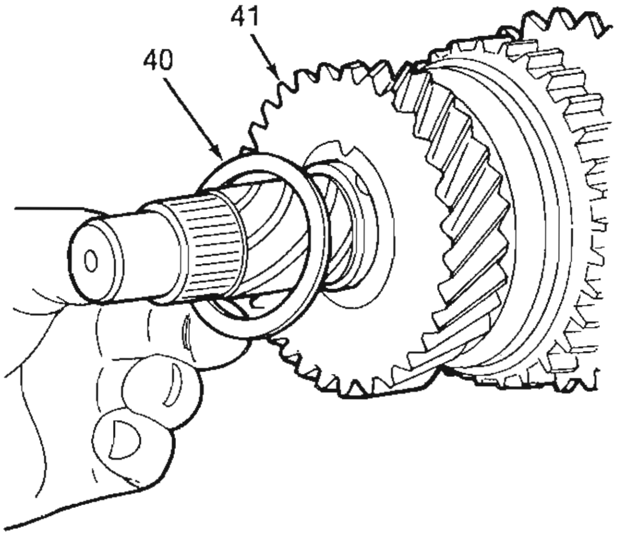


86292

Remove the snap ring (39) retaining the second gear on the shaft and remove the tabbed second gear thrust washer (40) and second gear (41).

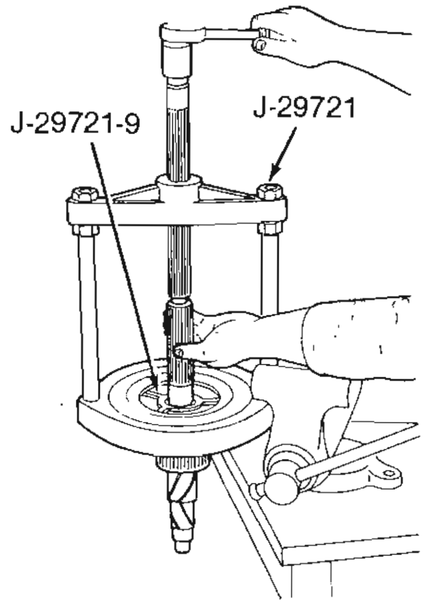


86293



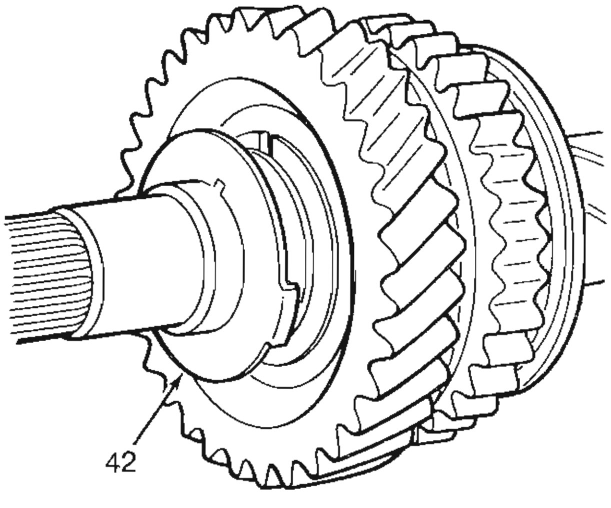
86294

Remove the output shaft rear bearing with Puller Set J-29721 and Adapter J-29721-9.



86295

Remove the first gear thrust washer (42), first gear and blocking ring. Use diagonal (side) cutters to remove the roll pin.



86296

NOTE: Some first gear journals have an hour glass shape.

Scribe alignment marks on the first-second gear synchronizer sleeve and output shaft hub for assembly reference.

Remove the insert spring and inserts from the first-reverse sliding gear and remove the gear from the output shaft hub.

CAUTION: Do not attempt to remove the first-second-reverse gear hub from the output shaft. The hub and shaft are machined and assembled as a matched set during manufacture to ensure concentricity.

Disassembly – Transmission Cover Components

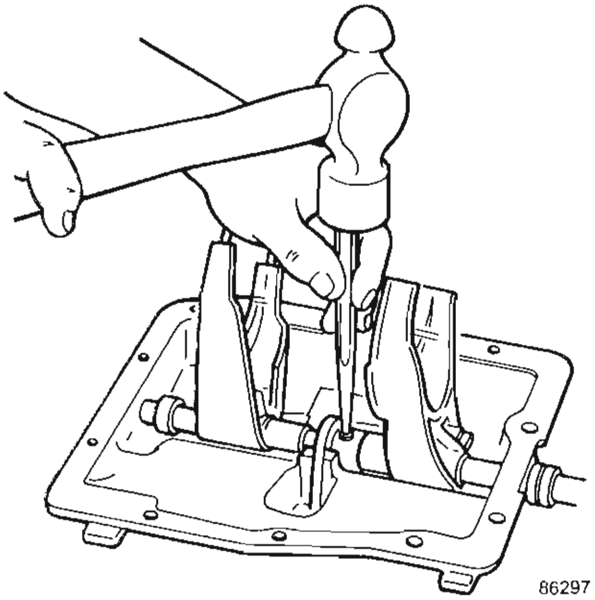
Place the selector arm plates and shift rail in the neutral position (centered).

Rotate the shift rail counterclockwise until the selector arm disengages from the selector arm plates and the selector arm roll pin is accessible.

Pull the shift rail rearward until the selector arm contacts the first-second gear shift fork.

Remove the selector arm roll pin with a 5-mm (3/16-in.) diameter pin punch and remove the shift rail.

SEE I.S. NOTES



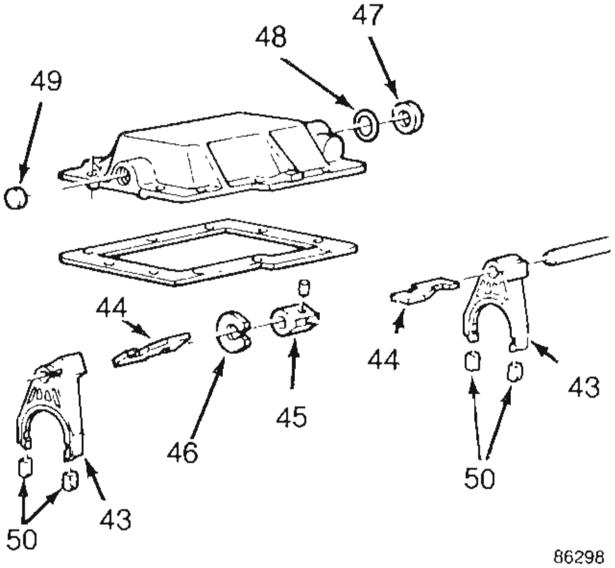
86297

Remove the shift forks (43), selector arm plates (44), selector arm (45), roll pin and interlock plate (46).

Remove the shift rail oil seal (47) and O-ring (48) with a pry tool.

Remove the shift rail plug (49) with a hammer and punch.

Remove the nylon inserts (50) and selector arm plates (44) from the shift forks (43). Note the position of the inserts and plates for assembly reference.



86298

CLEANING AND INSPECTION

Thoroughly clean all the components in solvent and dry them with compressed air. Do not dry the front or rear bearings with compressed air. Allow them to air dry or wipe them dry with a clean shop cloth.

Clean the needle thrust and and roller bearings by wrapping them in a cloth and submerging the cloth and bearings in solvent. Or, place them in a shallow parts cleaning tray and cover them with solvent. Allow the bearings to air dry or wipe them dry with a clean shop cloth.

Inspect the transmission case, cover and adapter housing. Replace these components if they have any of the following defects.

- cracks in the bores, sides, bosses or bolt holes
- stripped threads in the bolt holes
- nicks, burrs, or rough surfaces in the shaft bores or on the gasket surfaces

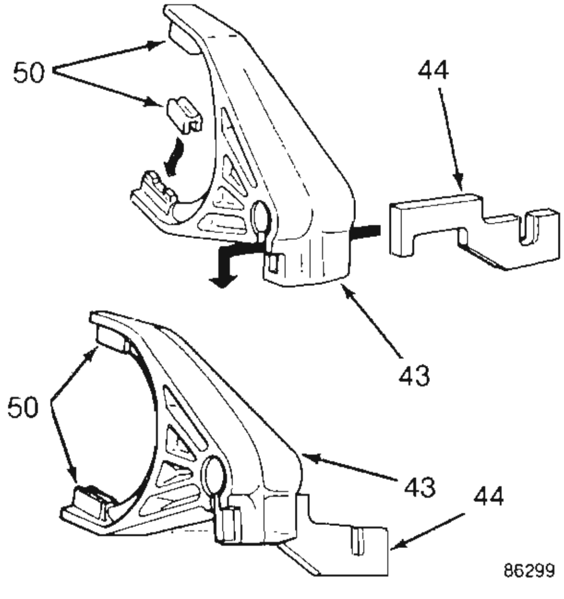
Inspect the geartrain and shift mechanism. Replace any components that have any of the following defects.

- broken, chipped or worn gear teeth
- bent or broken inserts
- weak or broken insert springs
- damaged roller thrust or needle bearings, or damaged bearing bores in the countershaft gear or clutch shaft
- worn or loss of surface metal from the countershaft and hub, clutch shaft or reverse idler gear shaft
- worn thrust washers
- nicked, broken or worn output or clutch shaft splines
- bent, distorted or weak snap rings
- worn bushing in the reverse idler gear
- rough, loss of surface metal or broken front/ rear bearing
- worn shift fork inserts
- broken, cracked or worn shift forks
- bent, worn or loss of surface metal from the shift rail
- worn, bent or broken selector arms, plates or interlock
- worn, bent, broken or stripped offset lever, or worn lever insert

TRANSMISSION ASSEMBLY

Assembly–Transmission Cover Components

Install the nylon inserts (50) and selector arm plates (44) in the shift forks (43).



SEE I.S. NOTES

Coat the edges of the shift rail plug (49) with sealant. Install the shift rail plug.

Coat the shift rail and shift rail bores with petroleum jelly and insert the shift rail in the cover.

Position the first-second gear shift fork (43) in the cover with the fork offset facing the rear of the cover. Insert the shift rail through the fork .

NOTE: The first-second gear shift fork is the larger of the two forks.

Position the selector arm (45) and C-shaped interlock plate (46) in the cover and insert the shift rail through the arm. The widest part of the interlock plate must face away from the cover and the selector arm roll pin hole must face downward and toward the rear of the cover.

SEE I.S. NOTES

Position the third-fourth gear shift fork (43) in the cover with the fork offset facing the rear of the cover. The third-fourth gear shift fork selector arm plate (44) must be positioned under the first-second gear shift fork selector arm plate.

Insert the shift rail through the third-fourth gear shift fork (43) and into the shift rail front bore in the cover.

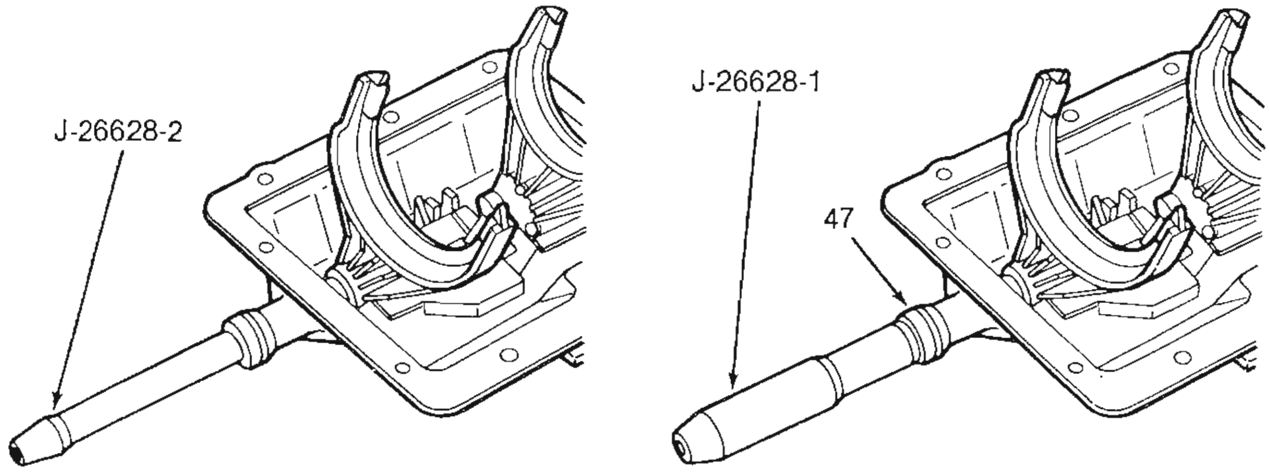
Rotate the shift rail until the selector arm plate at the forward end of the rail faces away from (but parallel with) the cover.

Align the roll pin holes in the selector arm (45) and shift rail and install the roll pin. Ensure that the roll pin is flush with the surface of the selector arm to prevent the pin from contacting the selector arm plates during shifts.

Install the O-ring (48) in the groove in the shift rail oil seal.

Install the shift rail oil seal (47) according to the following procedure:

- position Oil Seal Protector Tool J-26628-2 over the threaded end of the shift rail
- lubricate the oil seal lip with petroleum jelly and slide the seal over the protector and onto the shift rail
- seat the oil seal in the transmission cover with Oil Seal Installation Tool J-26628-1



86300

SEE I.S. NOTES

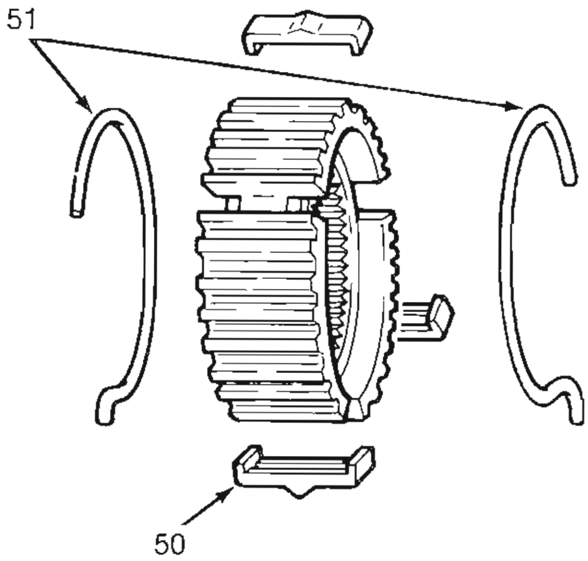
Assembly – Output Shaft Geartrain

NOTE: If any output shaft gear is replaced, the countershaft gear must also be replaced to maintain the proper gear mesh and prevent noisy operation.

Coat the output shaft and gear bores with transmission lubricant.

Install and align the first-second gear synchronizer sleeve on the output shaft hub using the reference marks scribed during disassembly.

Install the 3 first-second gear synchronizer inserts (50) and the 2 insert springs (51) in the first-reverse gear synchronizer sleeve. Engage the tang of each insert spring in the same synchronizer insert but position the open ends of the springs to face 180 degrees (opposite) from each other. Ensure that the sleeve and hub reference marks are aligned.



86301

Install the blocking ring and second gear (41) on the output shaft.

Install the tabbed thrust washer (40) and second gear retaining snap ring (39) on the output shaft.

Ensure that the washer tab is properly seated in the output shaft.

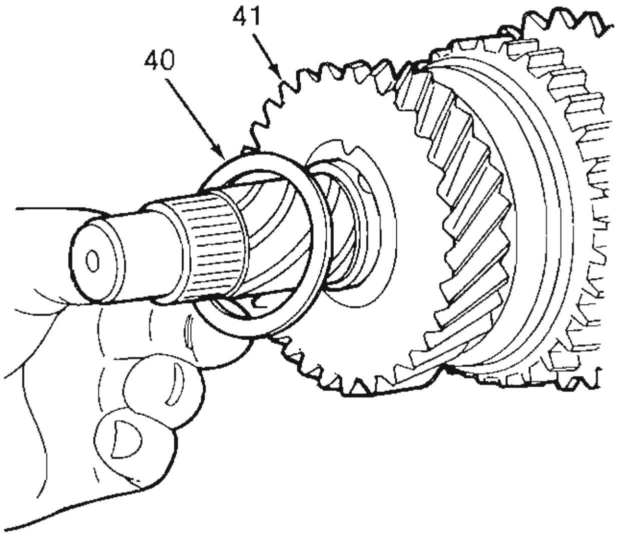
Install the blocking ring and first gear on the output shaft.

Install the first gear roll pin (A) in the output shaft.

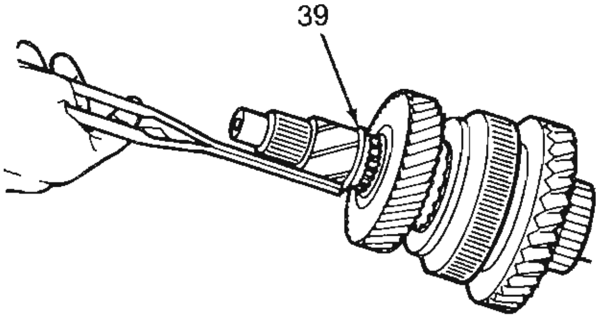
Install the first gear thrust washer (42).

Press the rear bearing on the output shaft with Tool J-6133-01.

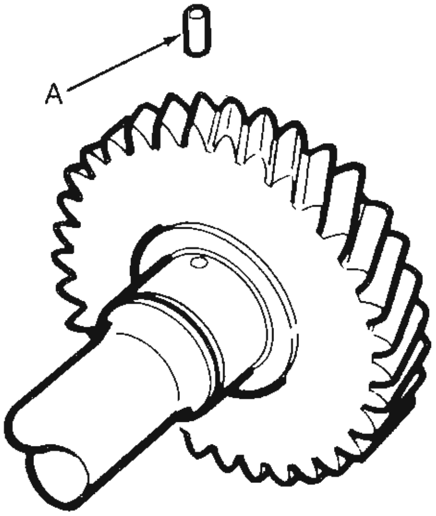
SEE
I.S.
NOTES



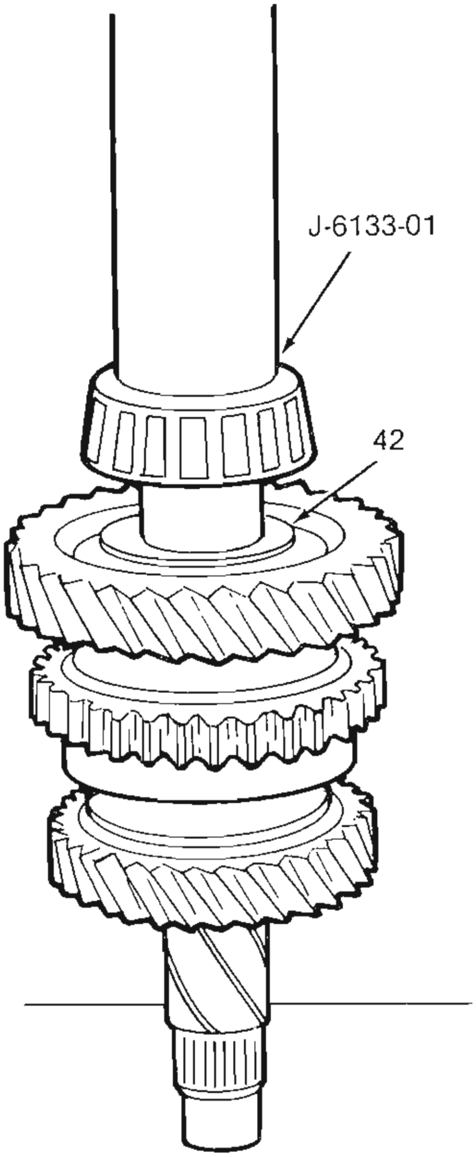
86294



86293



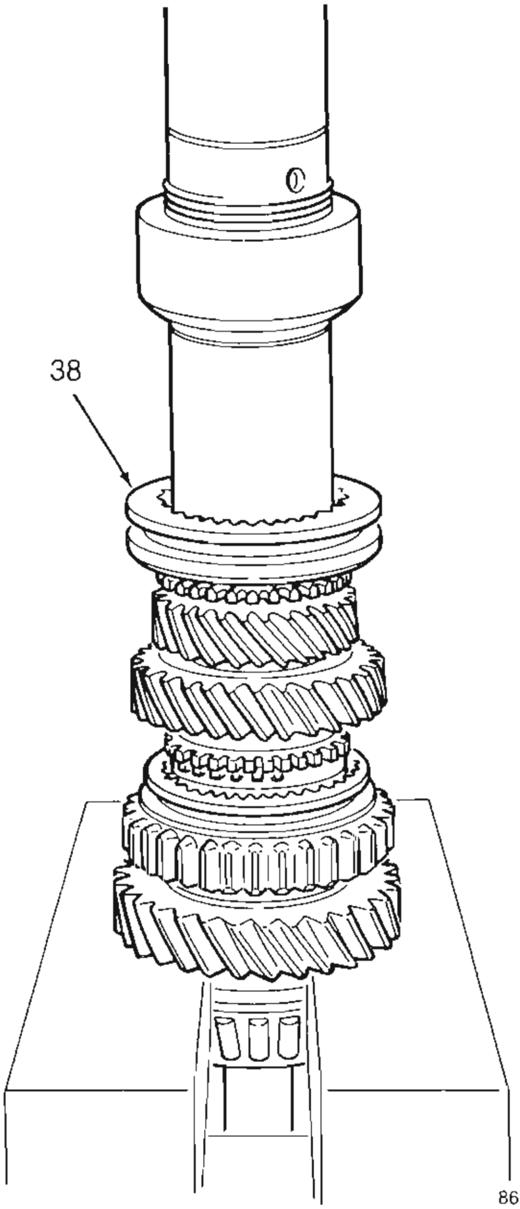
86302



86303

Install the third gear on the output shaft. Install the third-fourth gear blocking ring on the third gear.

Align the reference scribe marks on the third-fourth gear synchronizer hub and sleeve (38) and the output shaft. Start the hub on the output shaft. Press the hub and sleeve on the output shaft (until seated) with an arbor press.



86304

NOTE: Ensure that the blocking ring is aligned with the synchronizer sleeve before seating the hub and sleeve.

Install the fourth gear blocking ring in the third-fourth gear synchronizer sleeve.

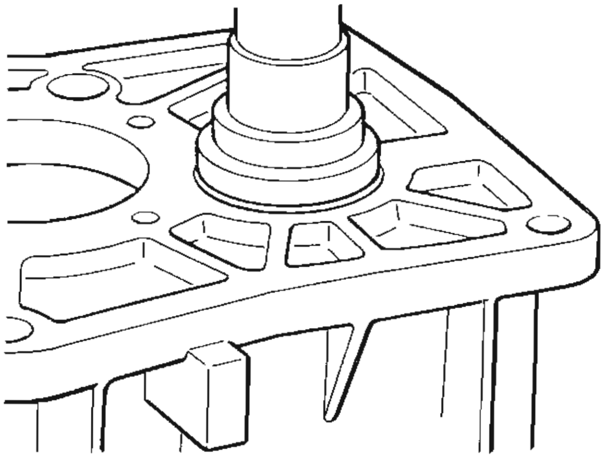
Install the thrust bearing washer on the forward end of the output shaft.

Assembly – Transmission Case

CAUTION: Except for the gearshift lever attaching bolts and filler plug, all bolts and threaded holes used in the T5 transmission have metric dimensions. Do not attempt to substitute with a different thread-type or size bolt if an original bolt is damaged or lost.

Coat the countershaft front bearing outer cage with Loctite 601, or equivalent. Use an arbor press to install the countershaft front bearing flush with the case.

SEE I.S. NOTES

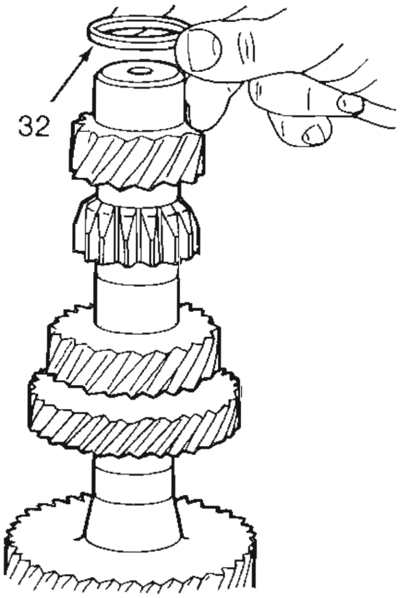


86262

Coat the countershaft tabbed thrust washer with petroleum jelly and install it so that the tab engages the corresponding depression in the case.

Turn the transmission case on its end and install the countershaft in the front bearing bore.

Install the countershaft rear bearing spacer (32).

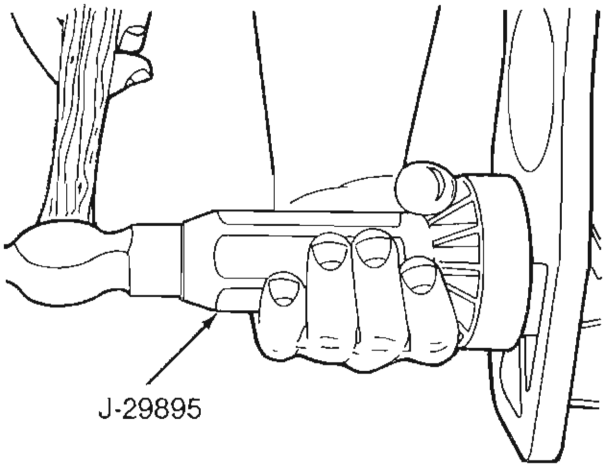


86288

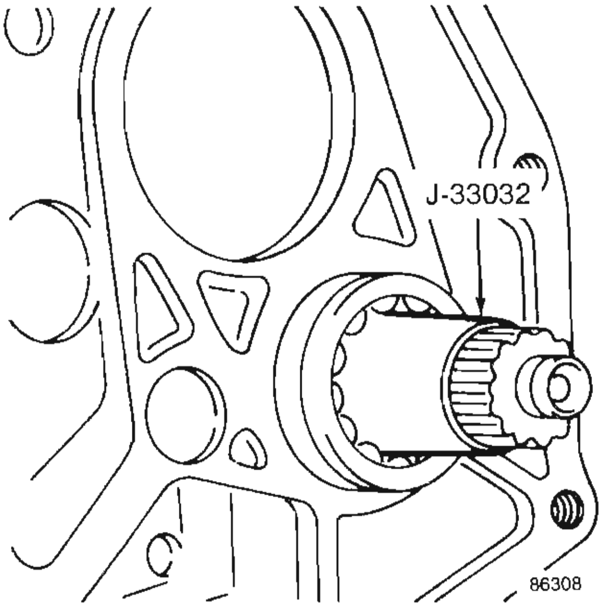
CAUTION: The protector sleeve tool must be used to provide clearance for the needle bearings between the countershaft shoulder and bearing bore.

Coat the countershaft rear bearing with petroleum jelly and install it with Installation Tool J-29895 and Protector Sleeve Tool J-33032.

NOTE: When correctly installed with Tools J-33032 and J-29895, the countershaft rear bearing will extend 3 mm (0.125 in.) beyond the case surface.

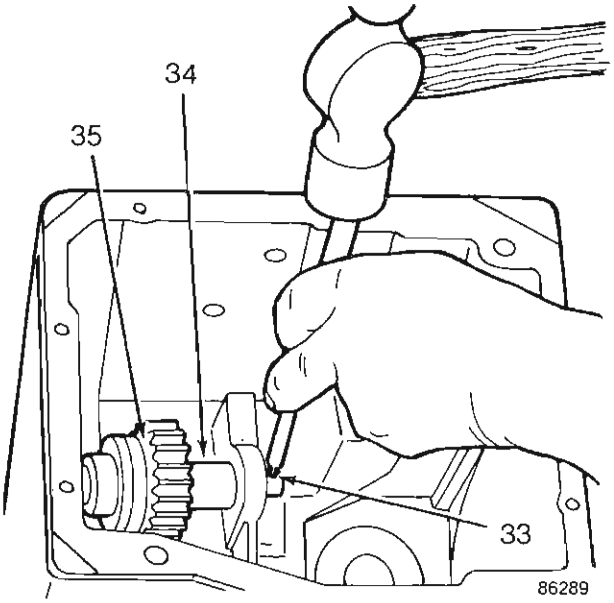


86263



86308

Position the reverse idler gear (35) in the case with the shift lever groove facing the rear of the case. Install the reverse idler gear shaft (34) from the rear of the case. Install the retaining roll pin (33) in the shaft.

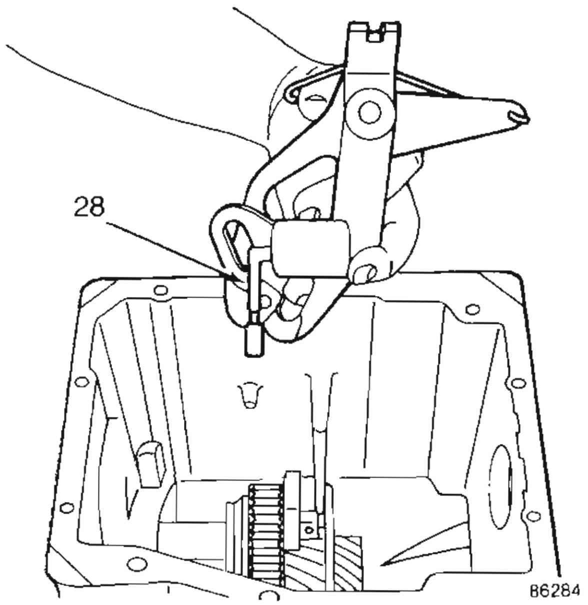


86289

SEE I.S. NOTES

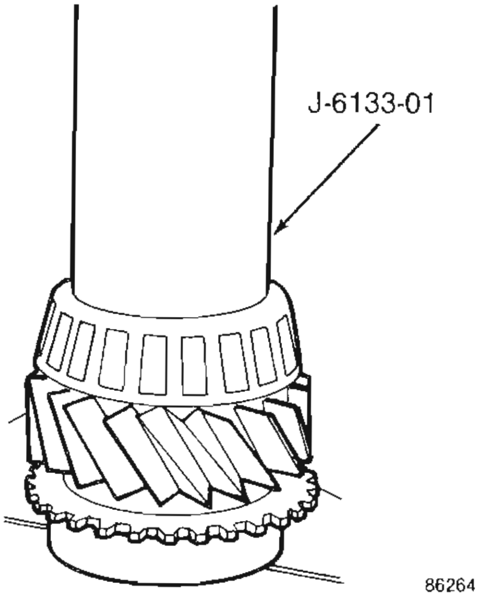
SEE I.S. NOTES

Coat the fifth-reverse gear shift lever pivot pin bolt threads with RTV sealant. Install the fifth-reverse gear shift lever (28), pivot pin bolt and C-clip retainer. Ensure that the reverse gear shift lever fork is engaged with the reverse idler gear. Tighten the shift lever pivot pin bolt with 58 N·m (43 ft-lbs) torque.



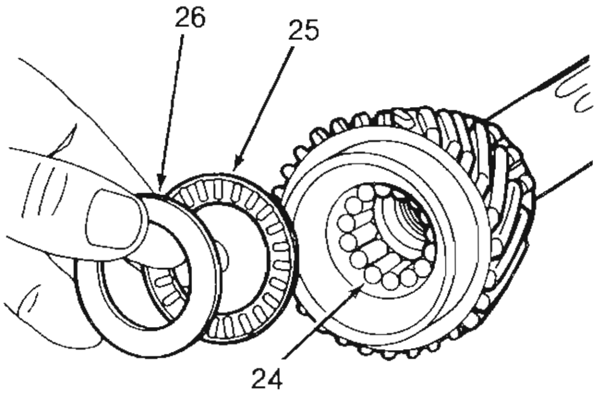
Install the assembled output shaft in the transmission case.

Install the clutch shaft front bearing on the clutch shaft with Tool J-6133-01 and an arbor press.



Coat the 15 pilot roller bearings (24) with petroleum jelly and install them on the clutch shaft.

Install the thrust bearing (25) and race (26) on the clutch shaft.



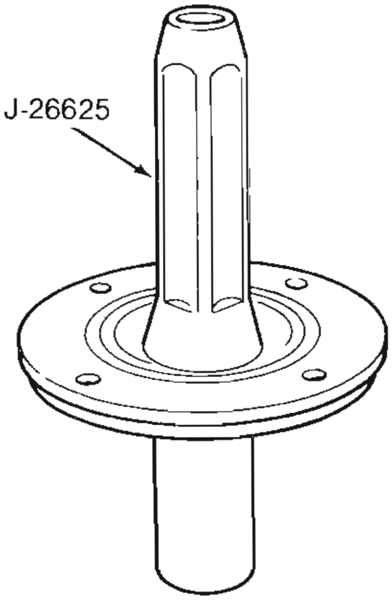
86277

Install the output shaft rear bearing race cap.

Install the fourth gear blocking ring on the output shaft.

Position the clutch shaft in the case and engage it in the third-fourth gear synchronizer sleeve and blocking ring.

Install a replacement oil seal in the front bearing cap with Tool J-26625.



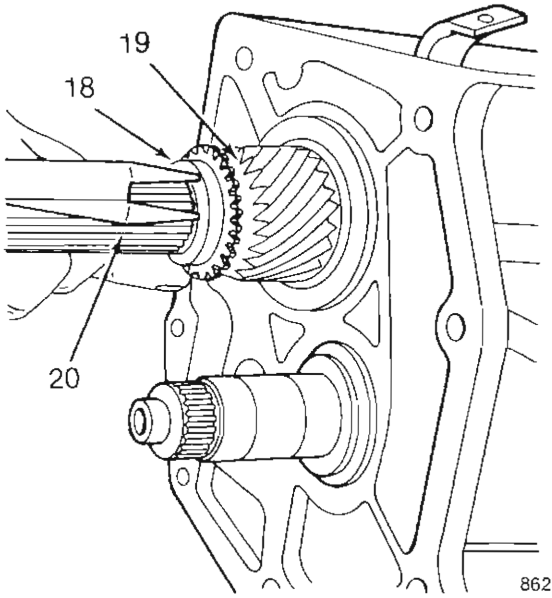
86265

Install the front bearing race in the front bearing cap. Do not install any shims in the front bearing cap at this time.

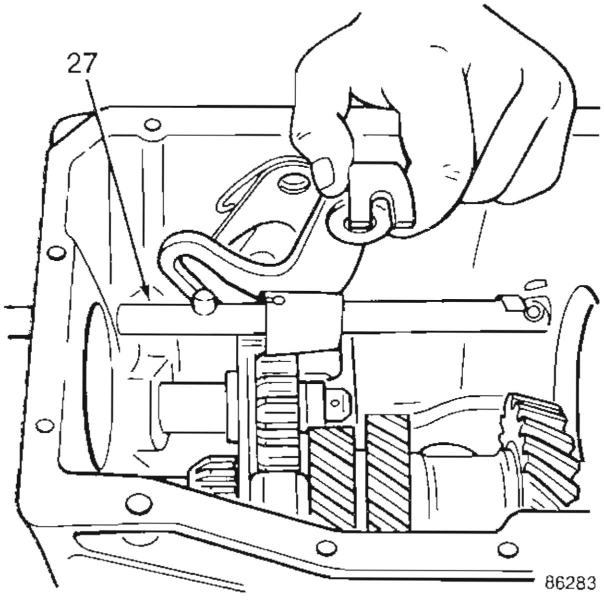
Temporarily install the front bearing cap. Do not apply sealant at this time.

SEE I.S. NOTES

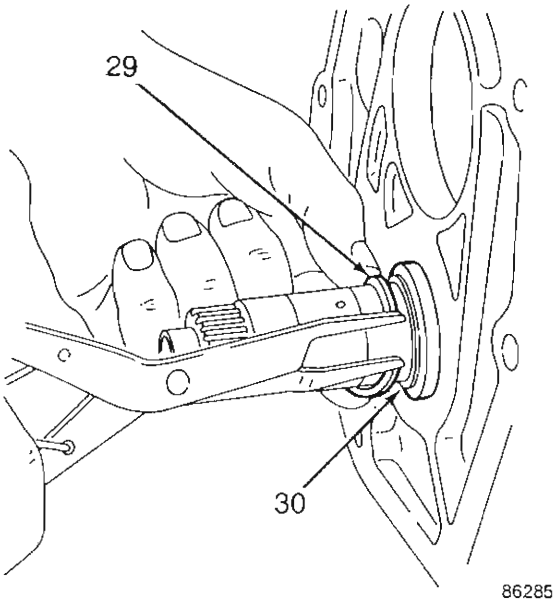
Install the fifth driven gear (19) and retaining snap ring (18) on the rear of the output shaft (20).



Insert the fifth-reverse gear shift rail through the opening in the rear of the case and install it in the fifth-reverse gear shift lever. Rotate the rail (27) during installation to simplify engagement with the lever.

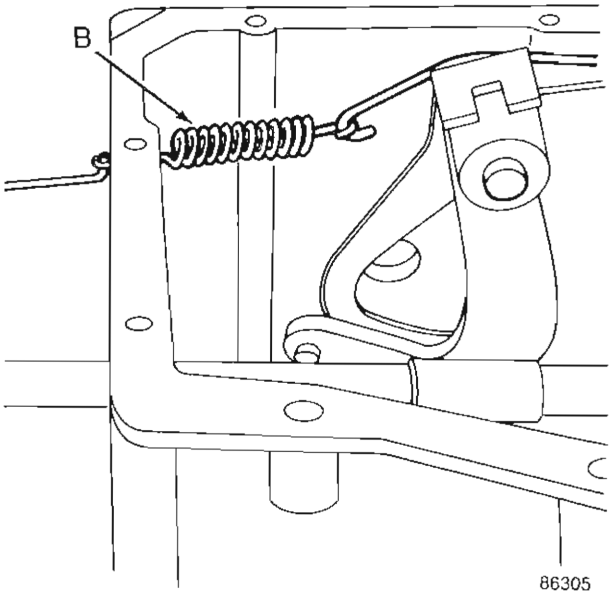


Install the countershaft rear bearing spacer (30) and retaining snap ring (29).



Install the fifth gear on the countershaft.

Install the fifth-reverse gear shift lever over-center link spring (B).

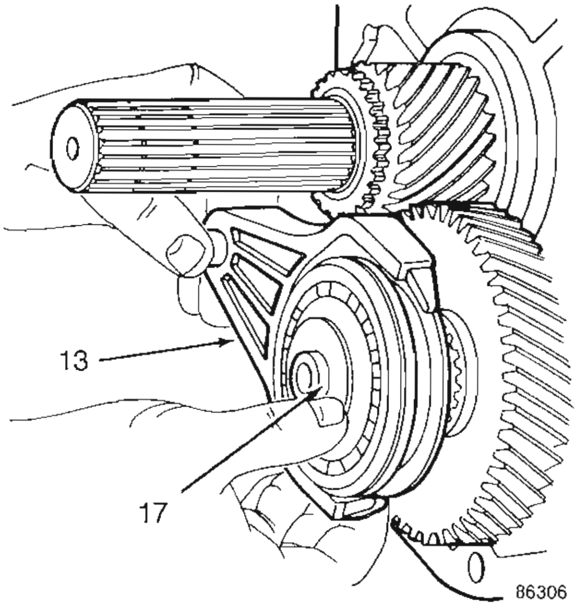


Assemble the fifth gear synchronizer sleeve, insert springs and insert retainer. Use the reference marks scribed during disassembly for alignment.

Install the plastic inserts in the notches on each side of the fifth gear shift fork.

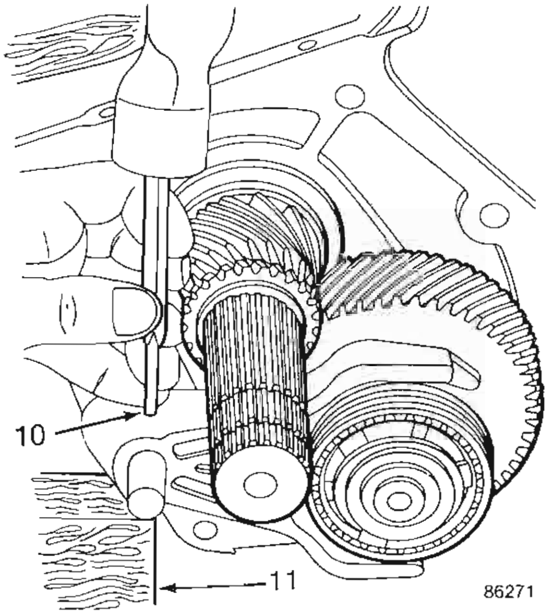
Position the assembled fifth gear synchronizer sleeve on the fifth gear shift fork (13) and slide it onto the countershaft (17) and the fifth-reverse gear shift rail.

NOTE: Ensure that the roll pin hole in the fifth-reverse gear shift rail and fifth gear shift fork are aligned.

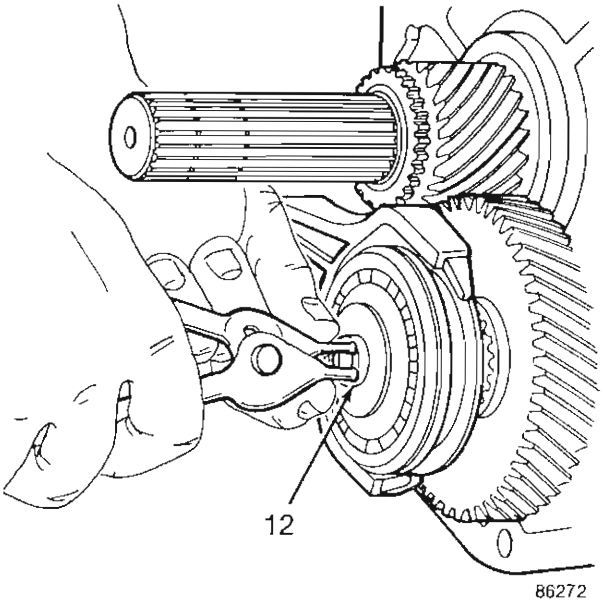


CAUTION: Place a wood block (11) under the fifth gear shift fork during roll pin installation to prevent damage to the fifth-reverse gear shift rail.

Place the assembled fifth-reverse gear shift rail and shift fork on a block of wood (11) and install the retaining roll pin (10).

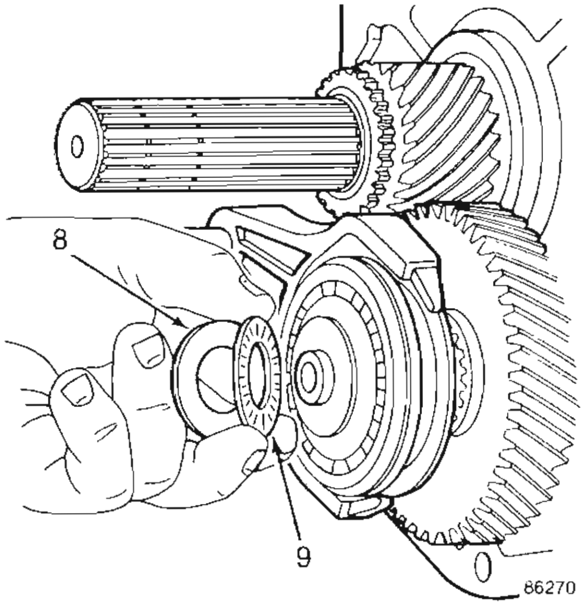


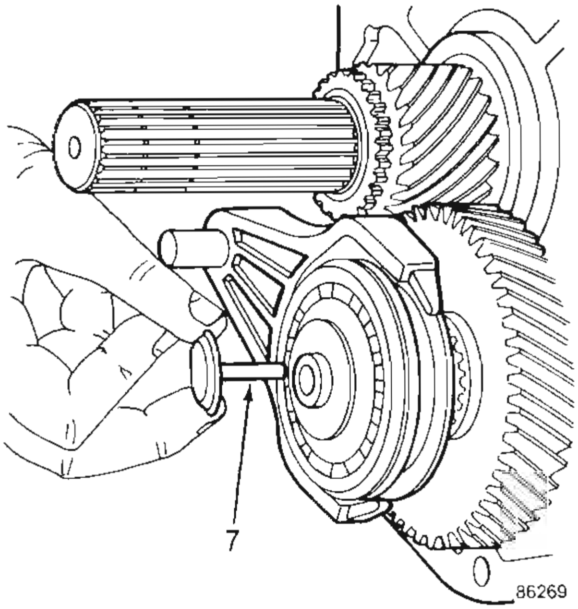
Install the thrust bearing race adjacent to the fifth gear synchronizer hub and install the retaining snap ring (12).



Install the needle-type thrust bearing (9) against the thrust bearing race on the countershaft. Coat both the thrust bearing and race with petroleum jelly.

Install the lipped thrust race (8) over the needle-type thrust bearing. Install the plastic funnel (7) in the hole at the end of the countershaft gear.





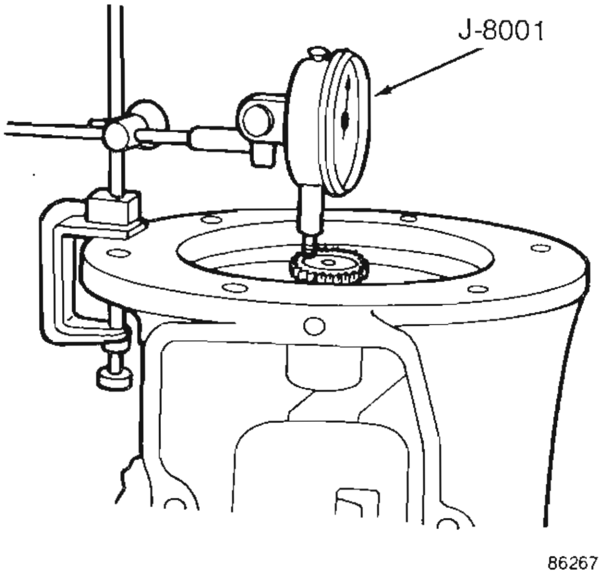
Temporarily install the adapter housing. Do not seal the housing and the case or tighten the bolts with the final torque at this time.

Position the transmission case on its end. Attach a dial indicator (J-8001) on the adapter housing with the indicator stylus located on the end of the output shaft.

Rotate the clutch and output shafts and zero the dial indicator pointer.

Pull upward on the output shaft until the output shaft end play is eliminated. Note the end play dimension indicated on the dial indicator.

NOTE: To completely eliminate the output shaft and clutch shaft end play, the bearings must be preloaded from 0.03 to 0.13 mm (0.001 to 0.005 in.).



Select a shim pack that is 0.03 to 0.13 mm (0.001 to 0.005 in.) thicker than the end play measured above.

Place the transmission horizontally on a workbench and remove the front bearing cap and front bearing race.

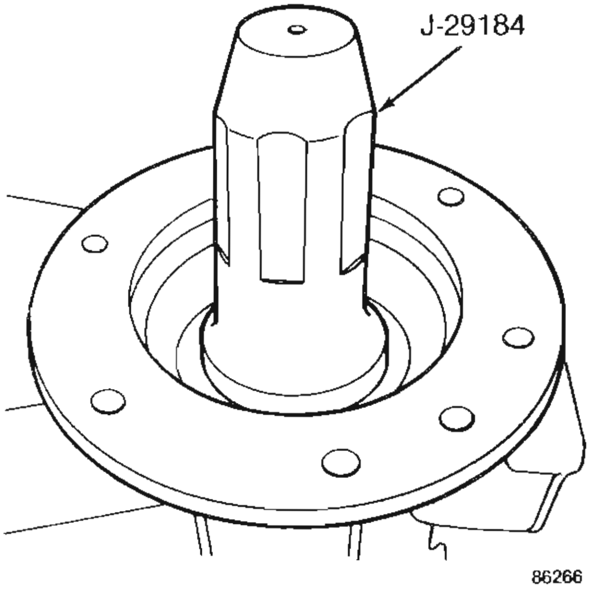
Add shims to the bearing cap to obtain the necessary preload and install the bearing race in the cap.

Apply a bead of RTV sealant on the case mating surface for the cap. Install the front bearing cap. Ensure the reference marks scribed during disassembly are aligned. Tighten the retaining bolts with 18 N·m (13 ft-lbs) torque.

Measure the end play. There must be no end play.

Remove the dial indicator from the adapter housing.

Remove the adapter housing and install the adapter housing rear seal with Tool J-29184.



Move the shift forks on the transmission cover and the synchronizer rings inside the transmission case to the neutral position.

Apply a bead of RTV sealant to the cover mating surface on the transmission case.

Lower the cover, at a slightly off center attitude, onto the transmission case while aligning the shift forks and synchronizer sleeves. Center the cover on the case to engage the reverse gear lever fork and install the two dowel bolts in the cover.

Install the remaining bolts and tighten all the cover bolts with 12 N·m (9 ft-lbs) torque.

NOTE: The offset lever-to-shift rail roll pin hole should be in a vertical position at this time.

SEE I.S. NOTES

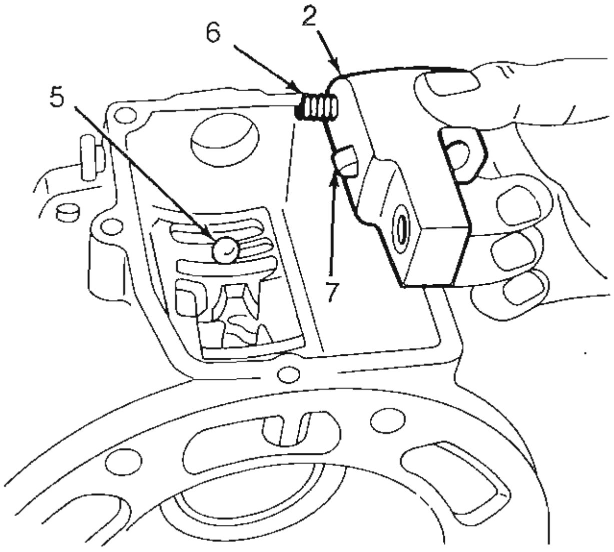
Apply a bead of RTV sealant on the adapter housing-to-transmission case mating surface.

Install the adapter housing over the output shaft and the shift rail at a position where the shift rail just enters the shift cover opening. Install the detent spring (6) in the offset lever (2). Place the detent ball (5) in the neutral guide plate detent. Apply force on the detent ball with the detent spring and offset lever and slide the offset lever onto the shift rail.

Seat the adapter housing on the transmission case.

SEE I.S. NOTES

NOTE: The offset lever and shift rail roll pin holes should be aligned and in the vertical position at this time.



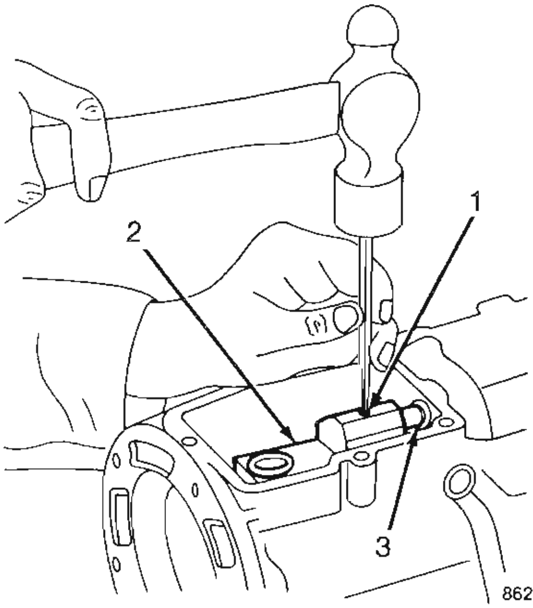
86229

Install and tighten the adapter housing retaining bolts with 27 N·m (20 ft-lbs) torque.

Install the roll pin (1) in the offset lever (2) and shift rail (3).

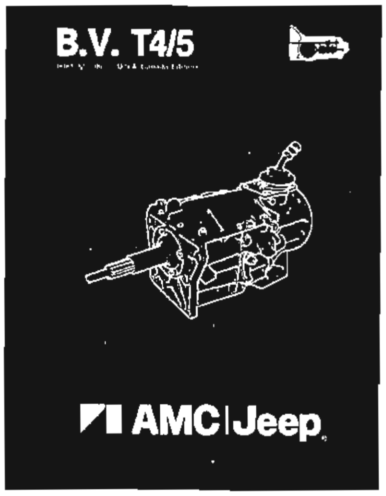
Install the damper sleeve in the offset lever.

Coat the backup lamp switch threads with RTV sealant, install the switch in the transmission case and tighten with 20 N·m (15 ft-lbs) torque.



86227

Install the drain bolt.



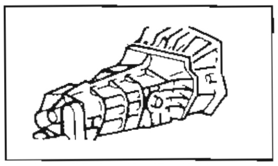
I.S.

INFORMATIONS SERVICE
SERVICE INFORMATION
SERVICE INFORMATIONEN
SERVICE INFORMATION
INFORMACIONES SERVICIO
INFORMAZIONI SERVIZIO
SERVICEINFORMASJONER
SERVICE INFORMATIE
SERVICEINFORMATION
INFORMAÇAO SERVIÇO

1E

JANUARY 1985
ENGLISH EDITION

EAGLE – CJ/SCRAMBLER
CHEROKEE/WAGONEER



GEARBOXES

Attention: Workshop, Parts Department

TRANSMISSION LUBRICANT

A second lubricant has been approved for *limited* use in Eagle, CJ/Scrambler, and Cherokee/Wagoneer T4 and T5 transmissions.

The newly approved second lubricant is SAE 85W-90, API Grade GL-5. It is to be used only for the purpose of **topping off** the transmission **between** drain and refill intervals; and, only if regular approved manual transmission lubricant, P/N 8983 000 000 and P/N 9122 in Canada, is **NOT** available.

When **refilling** T4 and T5 transmissions after overhaul or at the recommended drain intervals, the only approved manual transmission lubricant is P/N 8983 000 000 and P/N 9122 in Canada.

Filing Instructions

- Record this I.S. Note on page 2 of B.V. T4/5 Component Service Manual.
- File it in the B.V T4/5 Component Service Manual binder.

AMC | Jeep®

Component Service Manual

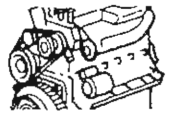
4.0/4.2L
SIX-CYLINDER ENGINE

Application

Cherokee/Wagoneer/Comanche
YJ/Wrangler/CJ-7/Scrambler
Grand Wagoneer/Truck/Eagle

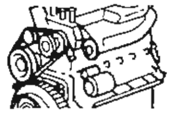
REVISED AUGUST, 1986 U.S.A./Canada Edition

8980 010 422



4.0L/4.2L ENGINE OVERHAUL

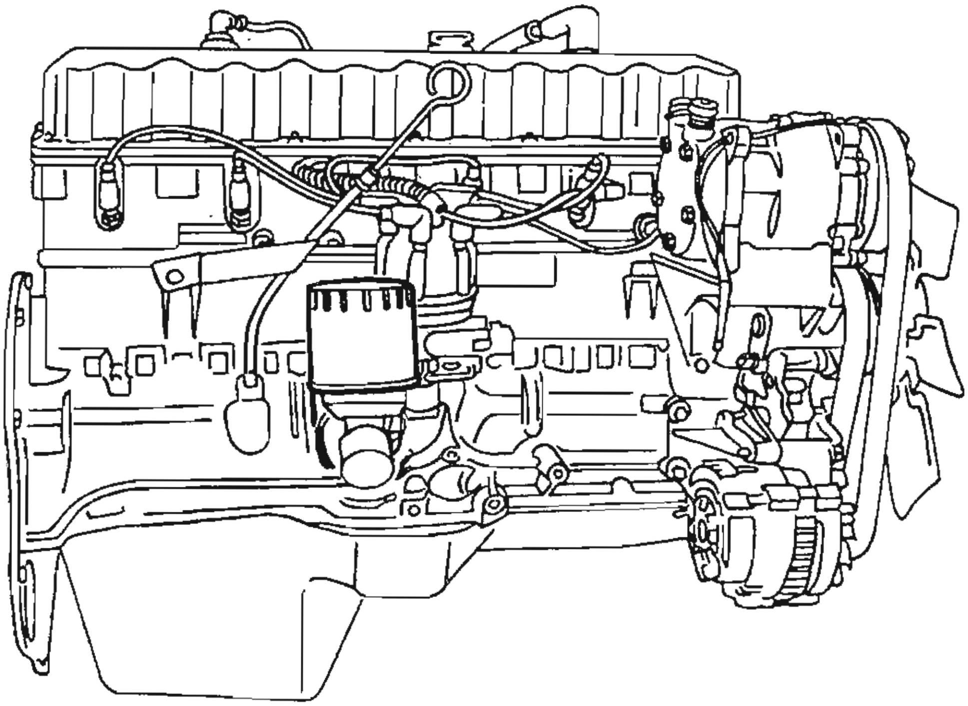
CONTENTS



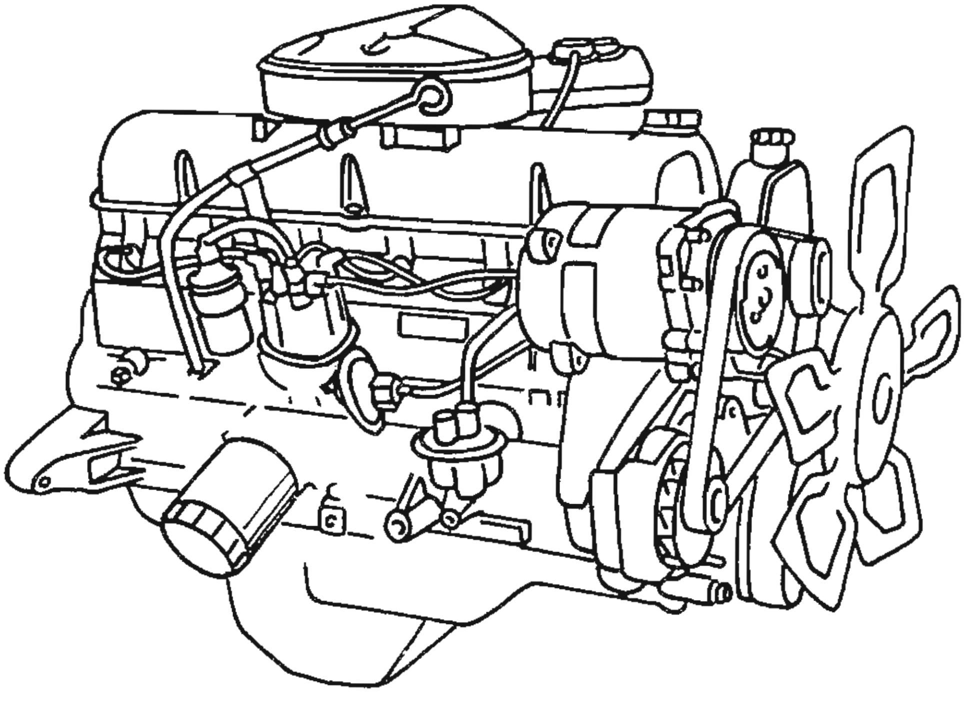
SEE
I.S.
NOTES

SEE I.S. NOTES

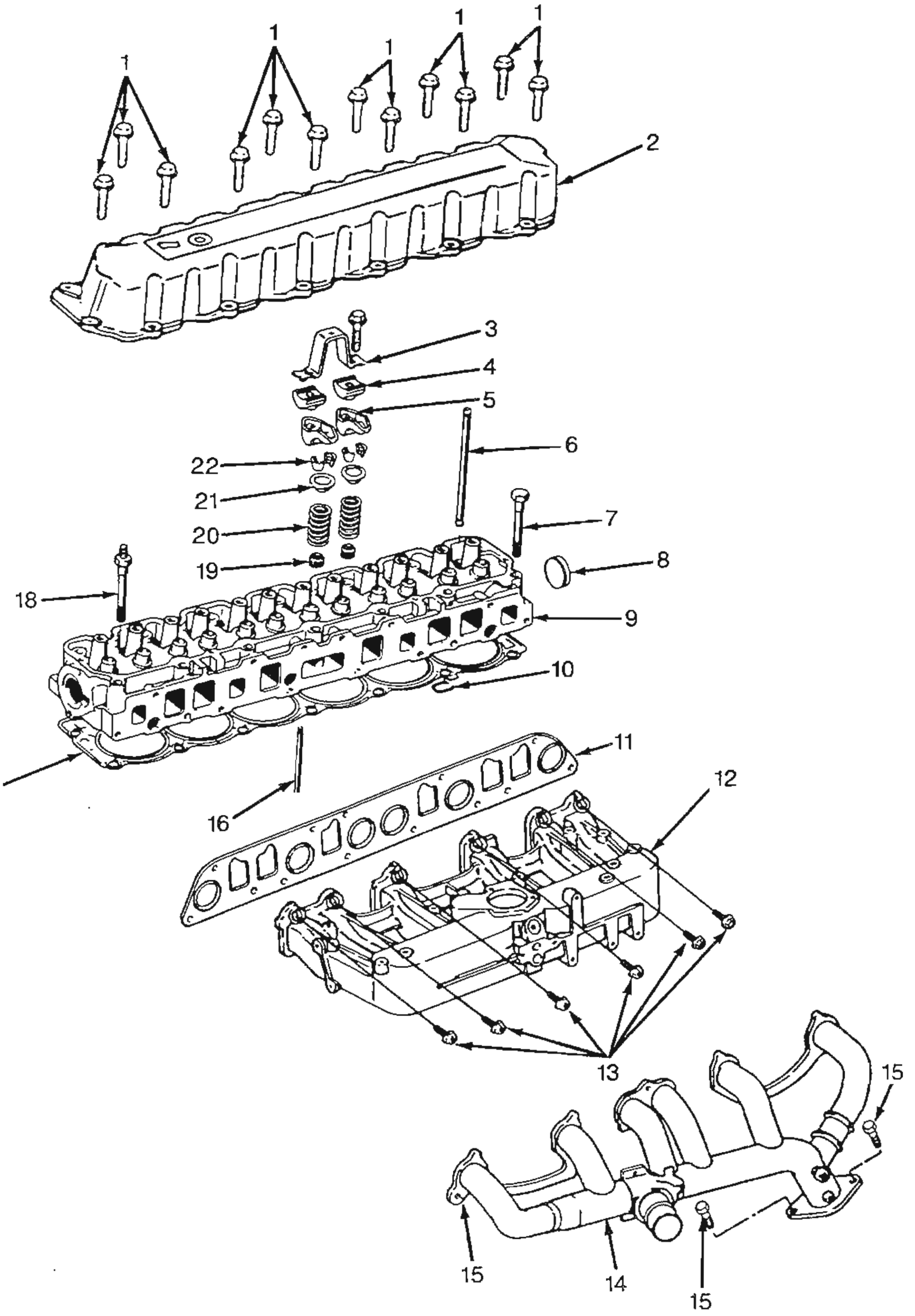
4.0L (243 CID)



4.2L (258 CID)



CYLINDER HEAD ASSEMBLY COMPONENTS – 4.0L



86157A

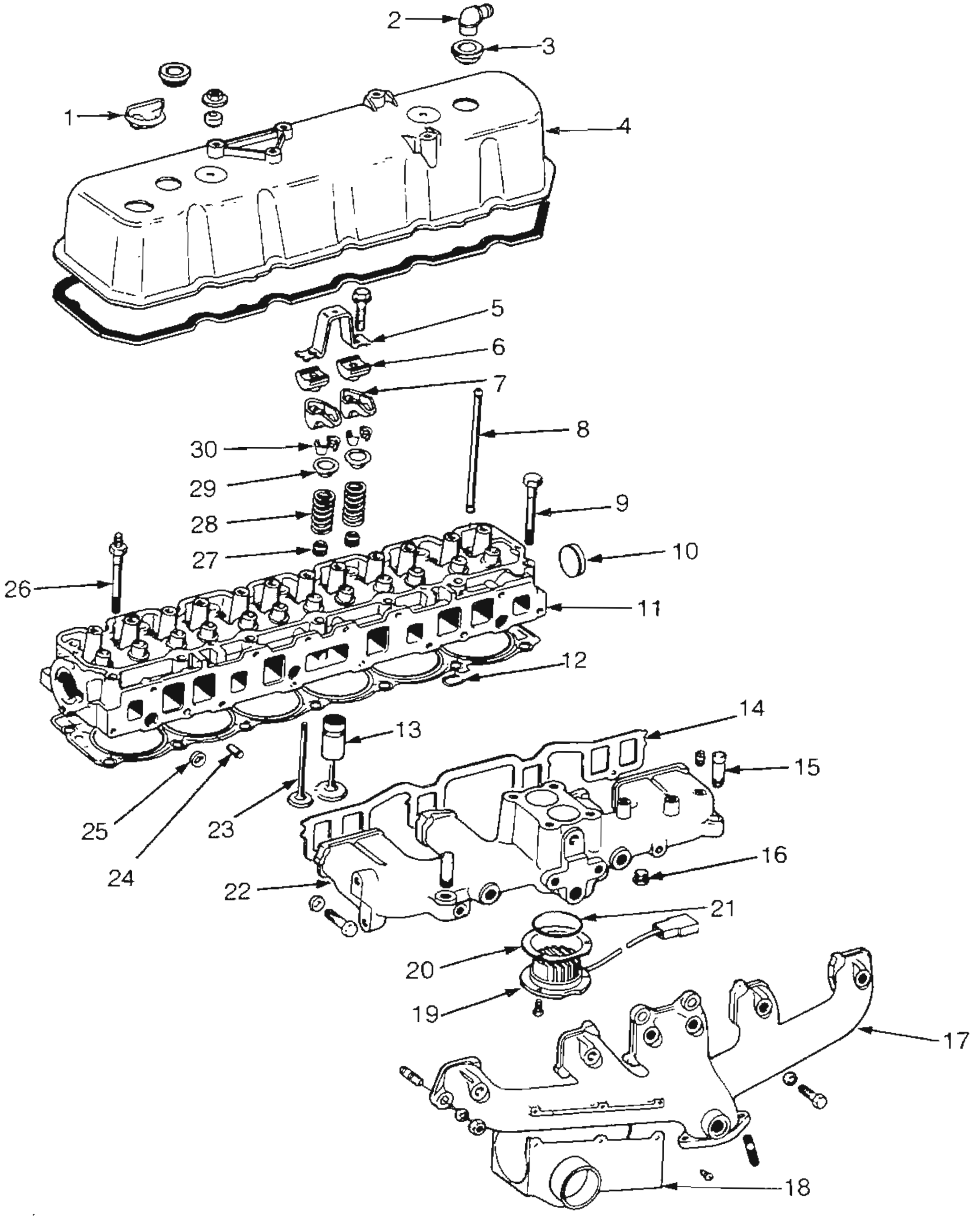
CYLINDER HEAD COMPONENTS - 4.0L

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)

SEE I.S. NOTES

CYLINDER HEAD ASSEMBLY COMPONENTS – 4.2L

SEE I.S. NOTES



86157B

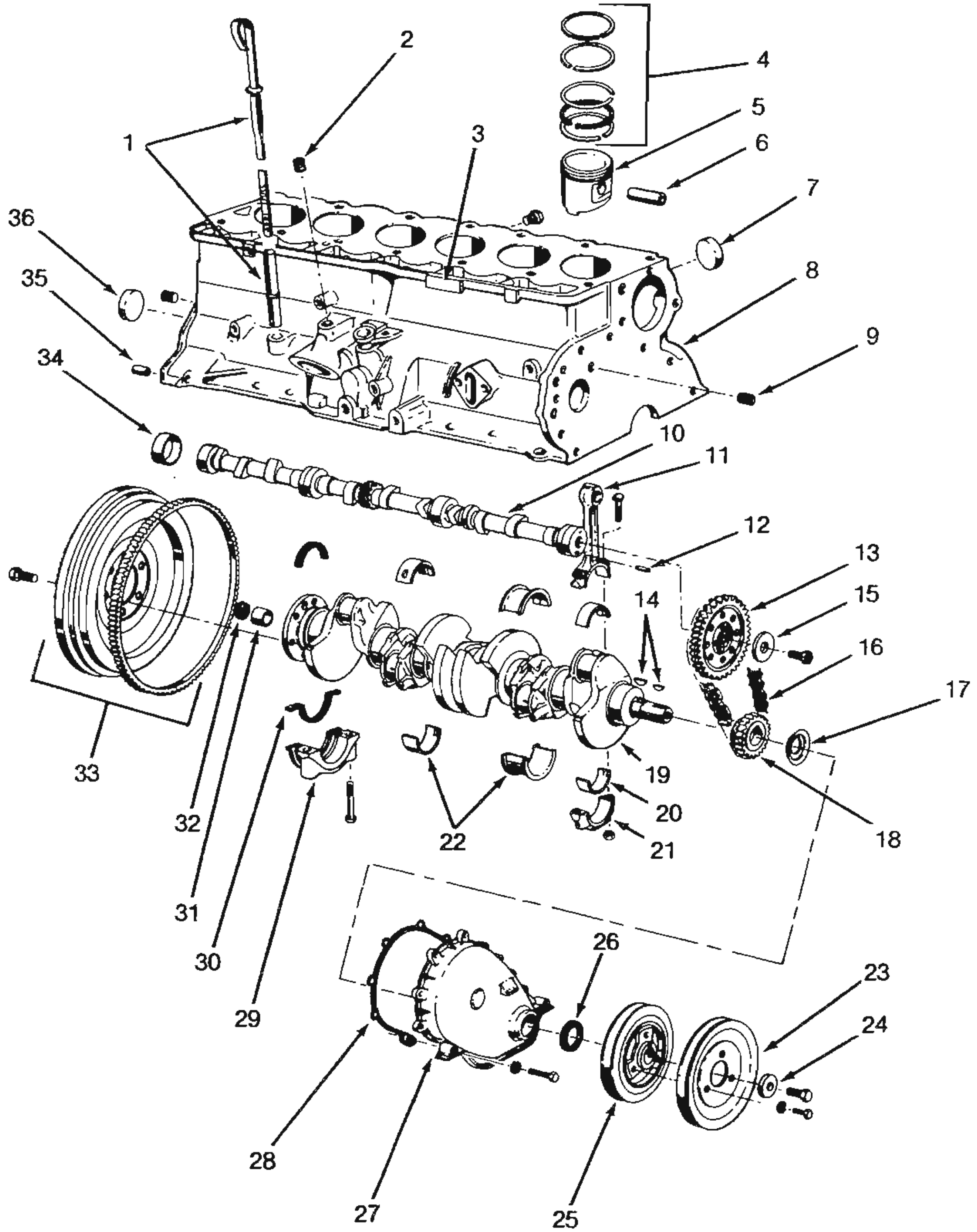
CYLINDER HEAD COMPONENTS – 4.2L

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)

SEE I.S. NOTES

SEE
.S.
NOTES

CYLINDER BLOCK COMPONENTS – 4.0L/4.2L



86158A

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

SEE I.S. NOTES

SEE I.S. NOTES

GENERAL INFORMATION

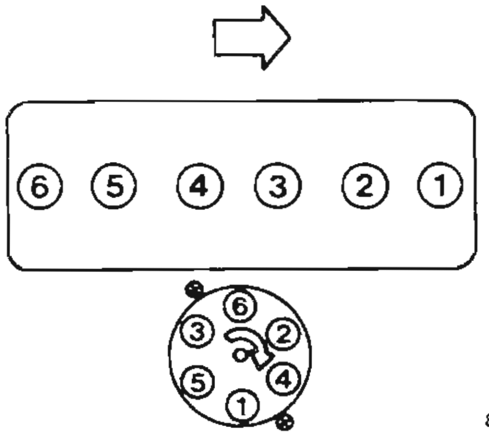
Both the 4.0L (243 CID) and the 4.2L (258 CID) six-cylinder engines are in-line, lightweight, overhead valve engines.

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.

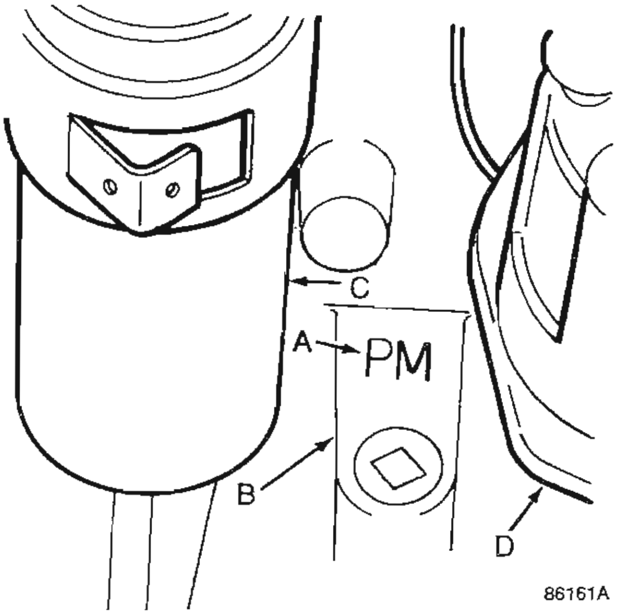
Example:
Kenosha-Built
E-1197277 or *W-1207177*

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.

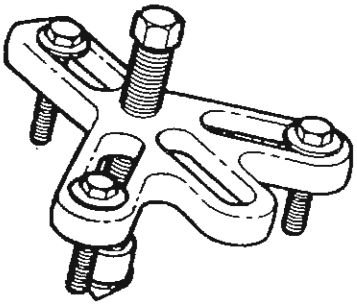
86160

SEE I.S. NOTES

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

SEE I.S. NOTES

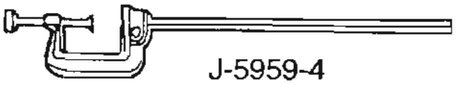


J-24420-B

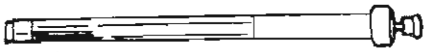
J-22248

J-21882

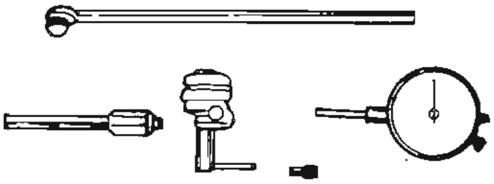
SEE I.S. NOTES



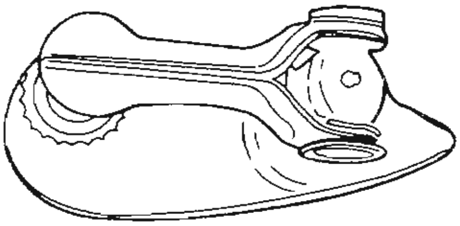
J-5959-4



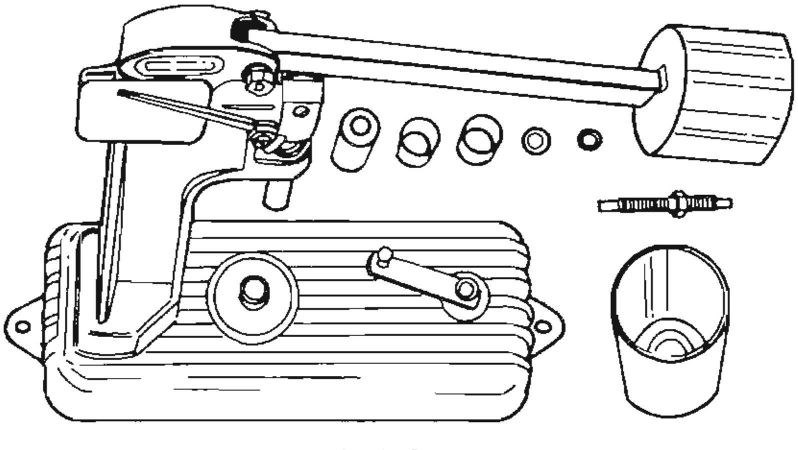
J-21884



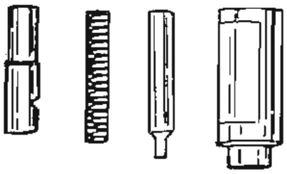
J-8520



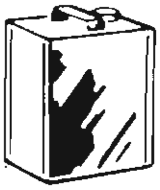
J-8056



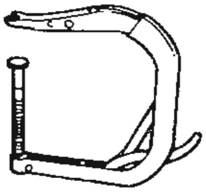
J-5790



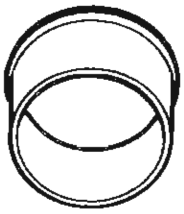
J-21872-1,2,3



J-5268



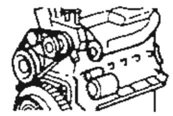
J-8062

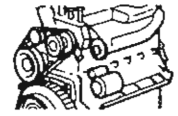


J-5601

J-6042-1,4,5

86223A





TORQUE SPECIFICATIONS

SEE I.S. 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)

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)
Idler Arm Bracket-to-Sill	68 N·m (50 ft-lbs)	47-81 N·m (35-60 ft-lbs)
Idler Pulley Bracket-to-Front Cover Nut	9 N·m (7 ft-lbs)	5-12 N·m (4-9 ft-lbs)
Idler 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)

SEE I.S. NOTES

TORQUE SPECIFICATIONS (Cont'd)

SEE I.S. NOTES

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)

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)

SEE I.S. NOTES

SEE I.S. NOTES

ENGINE SPECIFICATIONS – 4.0L

GENERAL

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

CAMSHAFT	USA Inches*	METRIC Millimeters*
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

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-.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

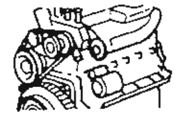
CRANKSHAFT

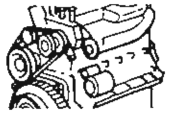
CRANKSHAFT	USA Inches*	METRIC Millimeters*
End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4996-2.5001	63.489-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.0025 (0.002 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

CYLINDER BLOCK	USA Inches*	METRIC Millimeters*
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





ENGINE SPECIFICATIONS – 4.0L (Continued)

CYLINDER HEAD

CYLINDER HEAD	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	EI-IE-IE-EI-EI-IE	
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

LUBRICATION SYSTEM	USA Inches*	METRIC Millimeters*
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

PISTONS	USA Inches*	METRIC Millimeters*
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

ROCKER ARMS, PUSH RODS AND TAPPETS	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio	1.6:1	
Rush 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

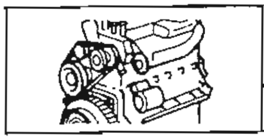
VALVES	USA Inches*	METRIC Millimeters*
Valve Length		
(Tip-to-Gauge Dim. Line)		
(Intake)	4.822-4.837	122.4-122.8
(Exhaust)	4.837-4.852	122.8-123.2
Valve Stem Diameter	3.12	7.9
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.91	48.5
Intake Valve Face Angle	45°	
Exhaust Valve Head Diameter	1.50	38
Exhaust Valve Face Angle	45°	
Maximum Allowable Removed for		
Tip Refinishing	0.010	0.25

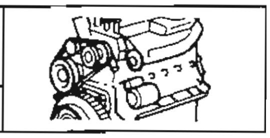
VALVE SPRINGS

VALVE SPRINGS	USA Inches*	METRIC Millimeters*
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
I.S.
NOTES





SEE
I.S.
N
O
T
E
S

ENGINE SPECIFICATIONS – 4.2L

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	USA Inches*	METRIC Millimeters*
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-.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)

8621BB

ENGINE SPECIFICATIONS – 4.2L (Continued)

CYLINDER HEAD

CYLINDER HEAD	USA Inches*	METRIC Millimeters*
Combustion Chamber Volume	64.45-67.45cc	
Valve Arrangement	EI-IE-IE-EI-EI-IE	
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

LUBRICATION SYSTEM	USA Inches*	METRIC Millimeters*
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

PISTONS	USA Inches*	METRIC Millimeters*
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

ROCKER ARMS, PUSH RODS AND TAPPETS	USA Inches*	METRIC Millimeters*
Rocker Arm Ratio	1.6:1	
Rush 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

VALVES	USA Inches*	METRIC Millimeters*
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

VALVE SPRINGS	USA Inches*	METRIC Millimeters*
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

SEE
I.S.
NOTES

86219B

SEE
I.S.
NOTES

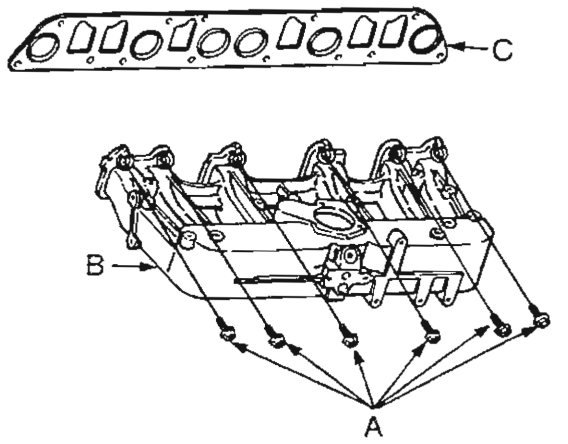
INTAKE MANIFOLD REMOVAL

Remove the intake manifold retaining bolts (A).

Remove the intake manifold (B).

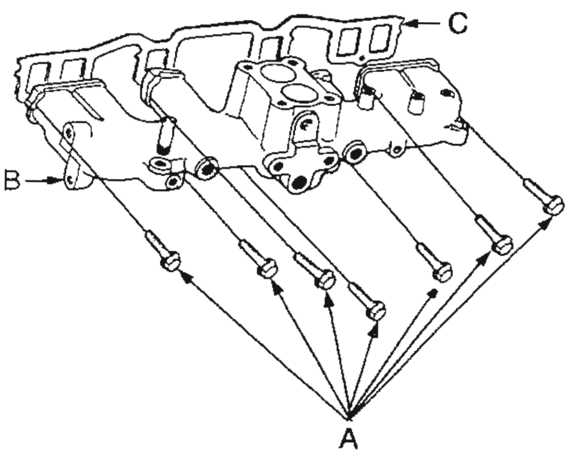
Discard the intake manifold gasket (C).

4.0L



101935A

4.2L



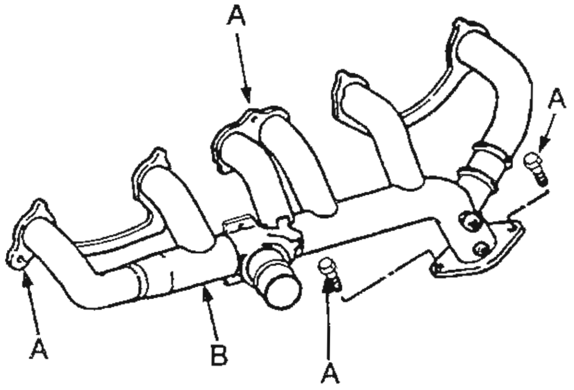
101935B

EXHAUST MANIFOLD REMOVAL

Remove the exhaust manifold retaining bolts (A).

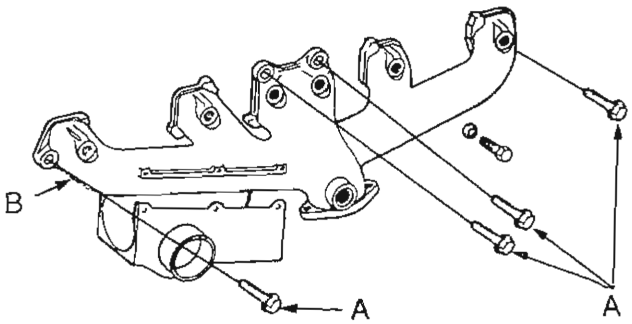
Remove the exhaust manifold (B).

4.0L



101935D

4.2L



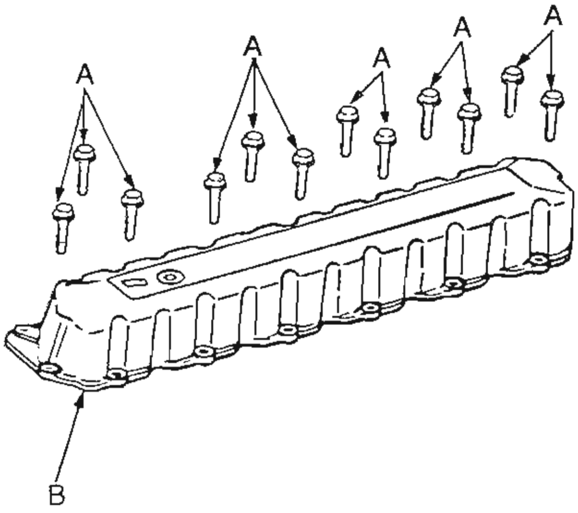
101935C

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



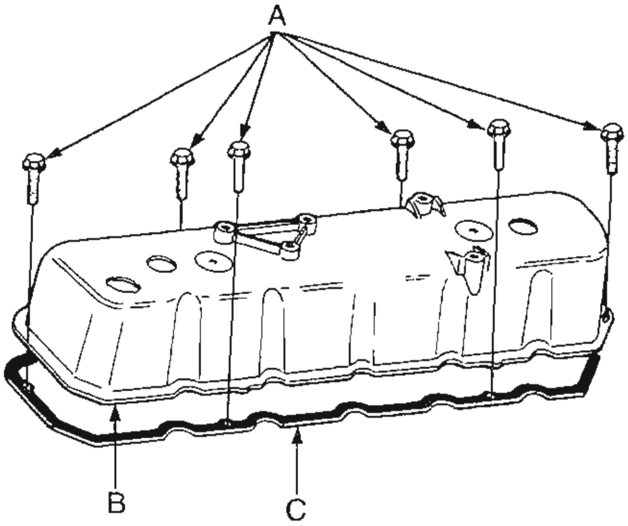
102303A

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



102303B

SEE
I.S.
NOTES

CYLINDER HEAD REMOVAL

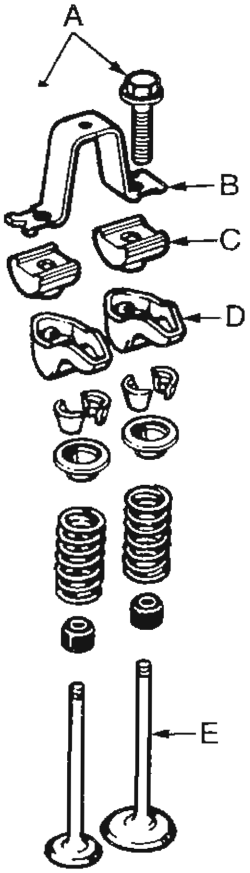
Remove the two capscrews (A) at each bridge (B) and pivot (C) assembly. Alternately loosen the capscrews one turn at a time to avoid damaging the bridge.

SEE I.S. NOTES

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.

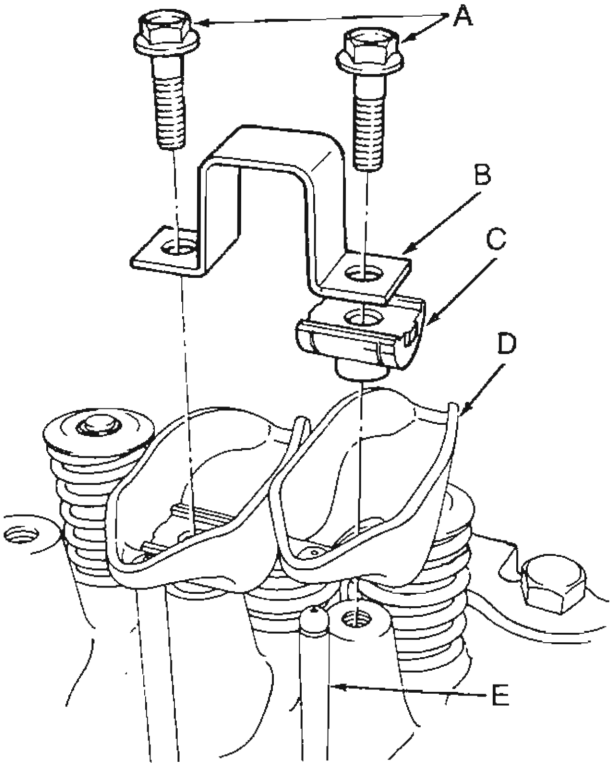
4.0L



101302A

✓

4.2L



101302B

Remove the spark plugs.

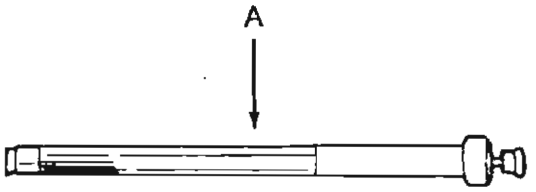
Remove the cylinder head bolts.

Remove the cylinder head.

Remove the cylinder head gasket.

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).



102304A

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.

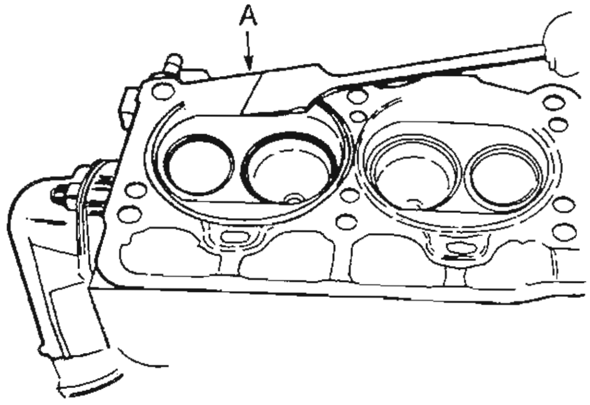
CLEANING AND INSPECTION

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.

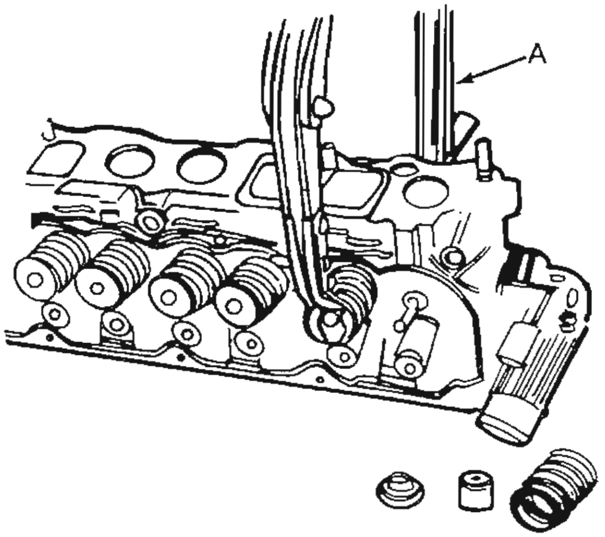
Use a straightedge and a feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to the Specifications.



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 LS. NOTES

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.

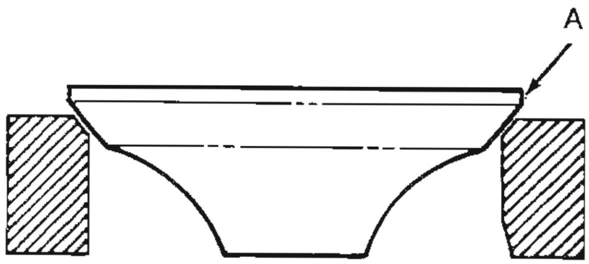
Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

VALVE REFACING

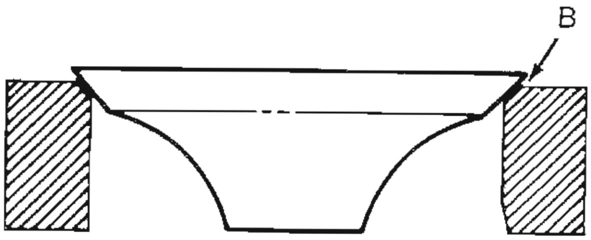
Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

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

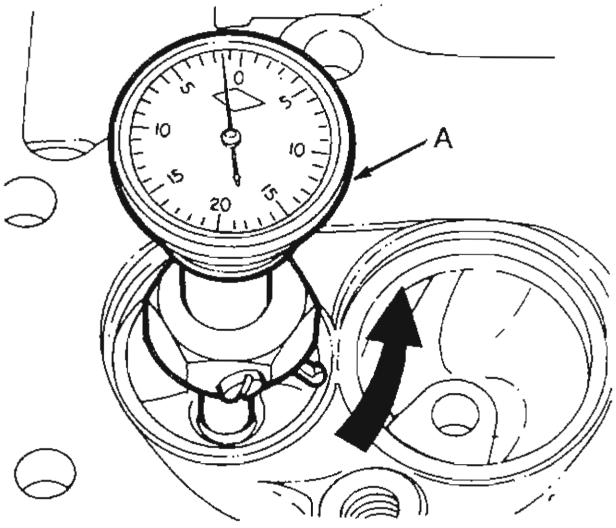
VALVE SEAT REFACING

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

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.)

86167

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.

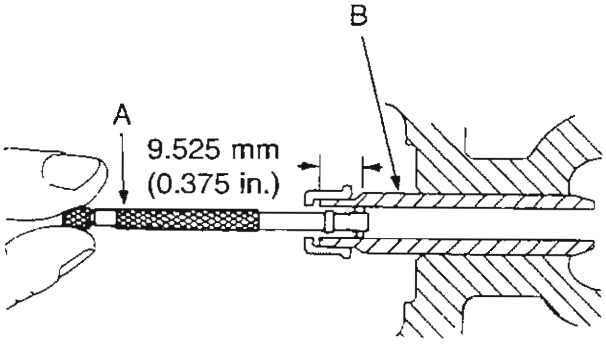
Preferred Method

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.

SEE
I.S.
NOTES



86168A

Remove and measure the telescoping gauge with a micrometer.

Repeat the measurement with contacts lengthwise to the cylinder head.

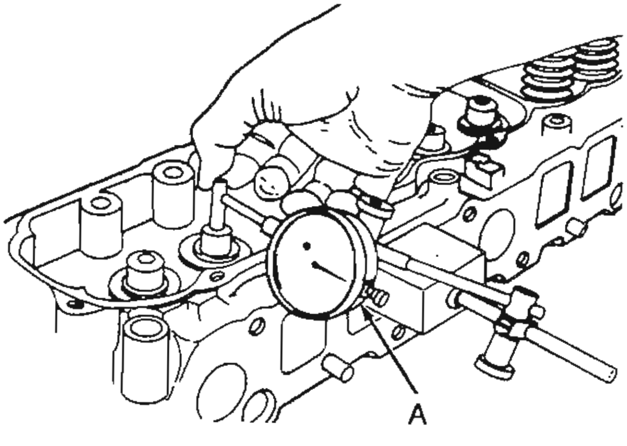
SEE I.S. NOTES

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.

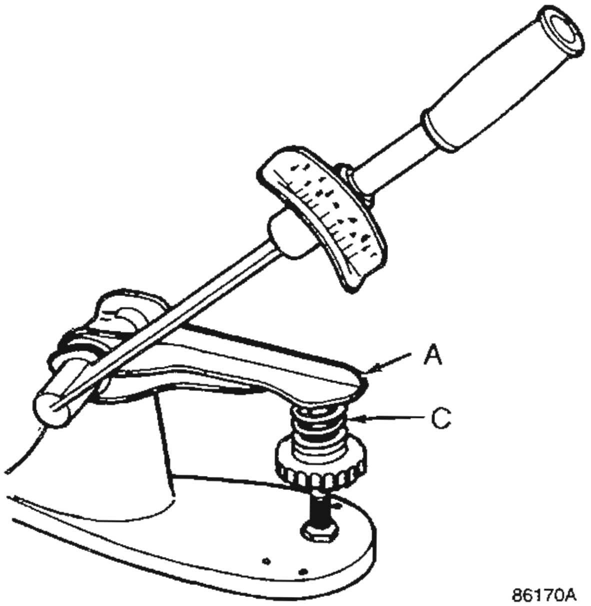


86169A

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.



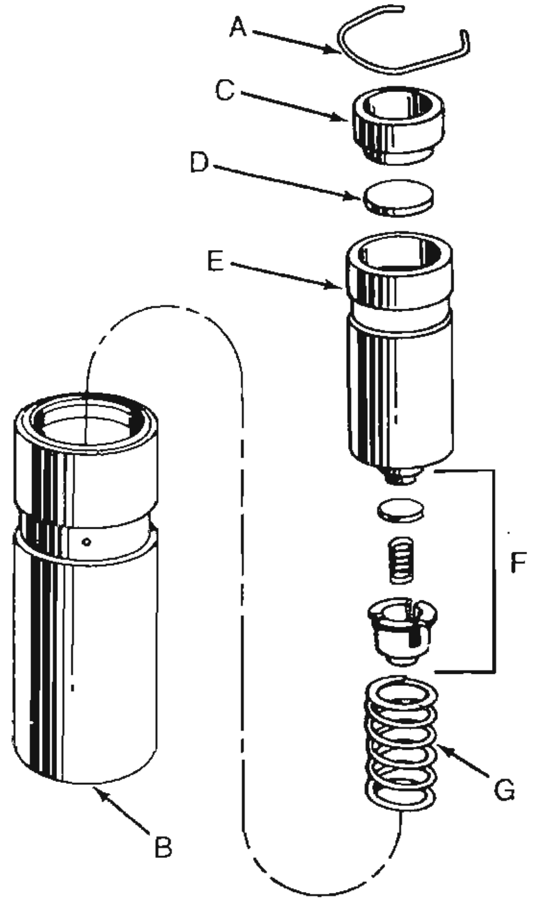
86170A

Replace the valve springs that are not within specifications.

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).



86172A

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)

SEE I.S. NOTES

CLEANING AND INSPECTION

Clean the components of each tappet assembly in cleaning solvent to remove all vamish, 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 tapper assembly in the **CYLINDER BLOCK ASSEMBLY** section, page 55.

WATER PUMP REMOVAL

Remove the water pump from the cylinder block.

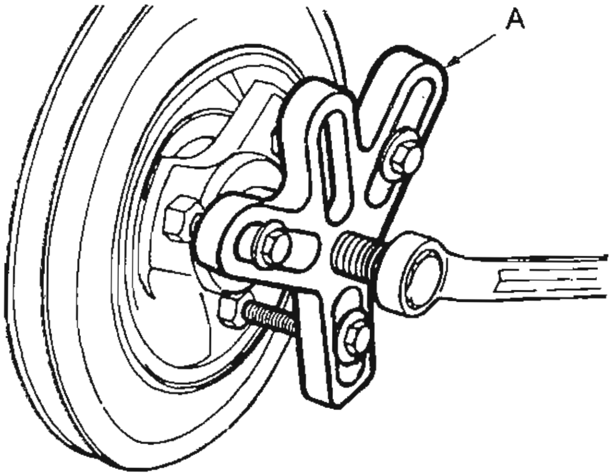
FUEL PUMP

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.

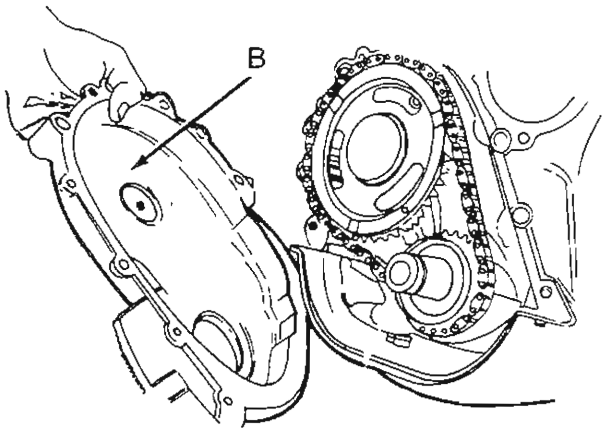


86174A

TIMING CASE COVER REMOVAL

Remove the timing case cover seal using a screwdriver or suitable tool (A).

Remove the timing case cover.



86176A

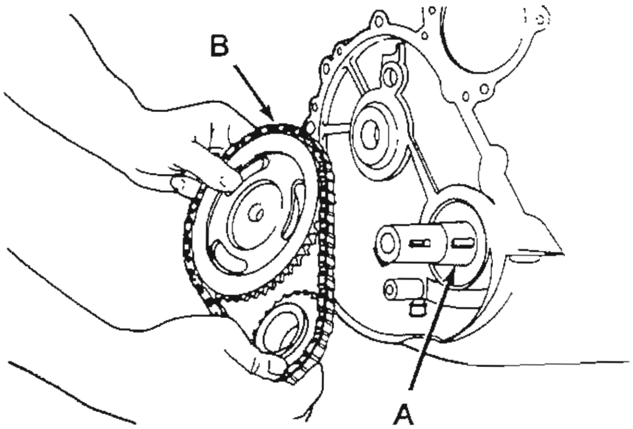
CAMSHAFT REMOVAL

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

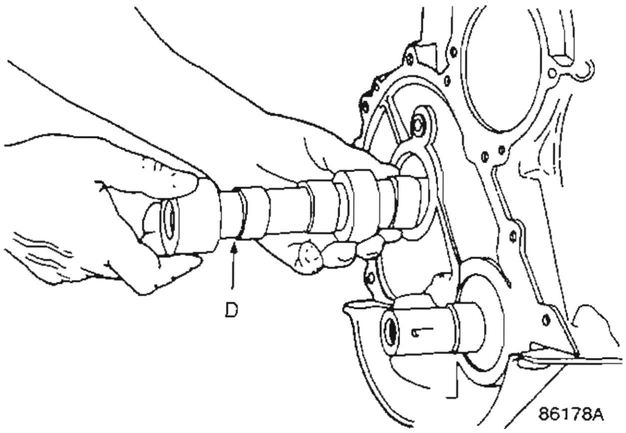
Inspect the cam lobes for wear.

Inspect the bearing journals for uneven wear pattern or finish.

Inspect the bearings for wear.

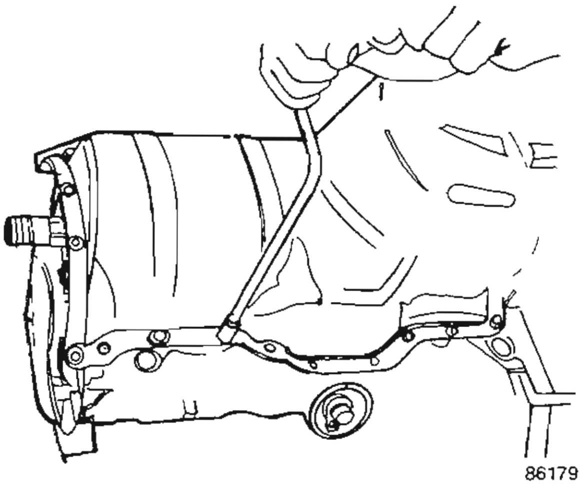
Inspect the distributor drive gear for wear.

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.

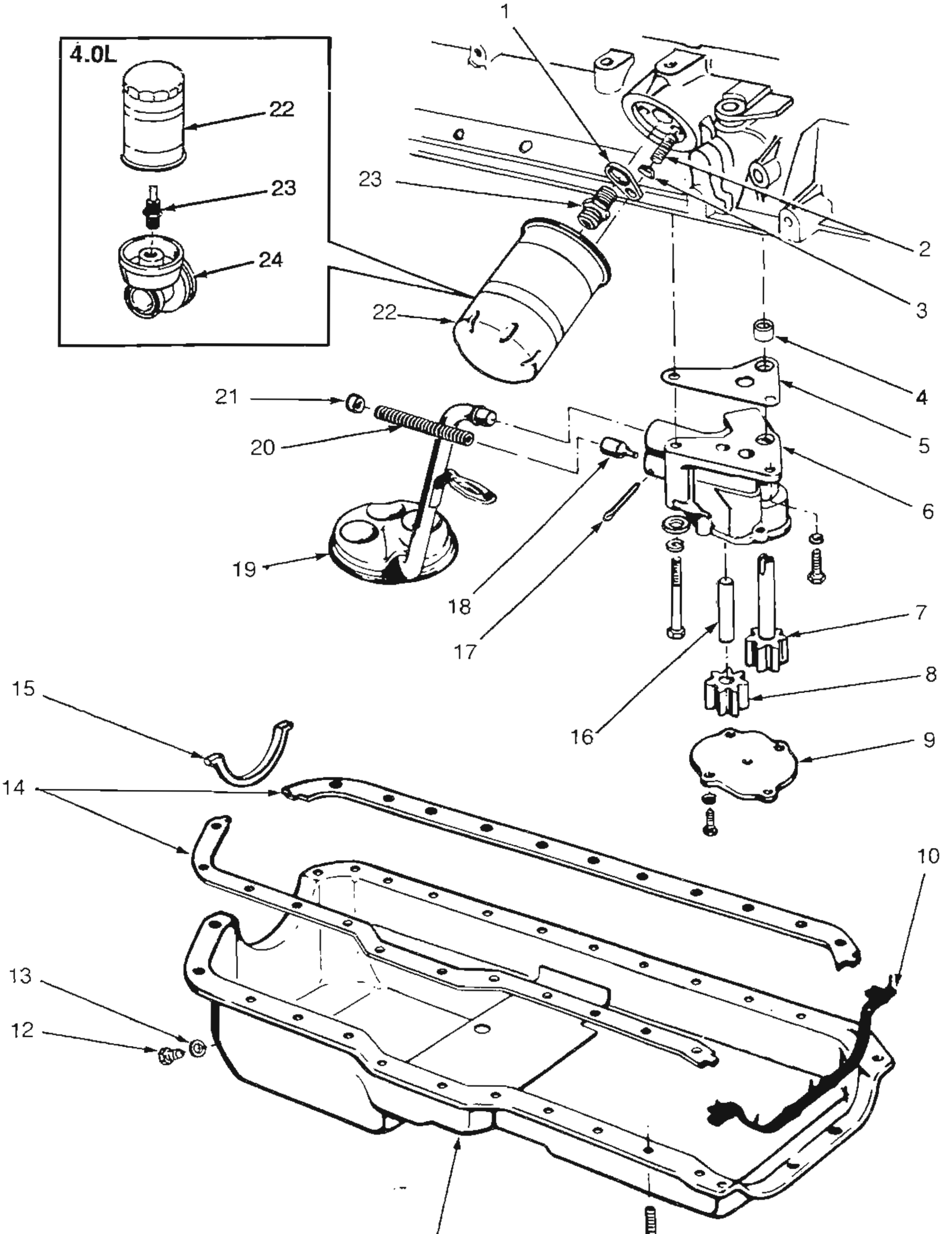
CAUTION: If the oil pump is not to be serviced, do not disturb the position of the oil inlet tube and strainer assembly in the pump body.

If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to ensure an airtight seal.

SEE
I.S.
NOTES

SEE I.S. NOTES

LUBRICATION SYSTEM COMPONENTS – 4.0L/4.2L



LUBRICATION SYSTEM COMPONENTS – 4.0L/4.2L

1. Oil Filter By-Pass Valve Retainer[1]
2. Oil Filter By-Pass Valve Spring[1]
3. Oil Filter By-Pass Valve[1]
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

SEE I.S. NOTES

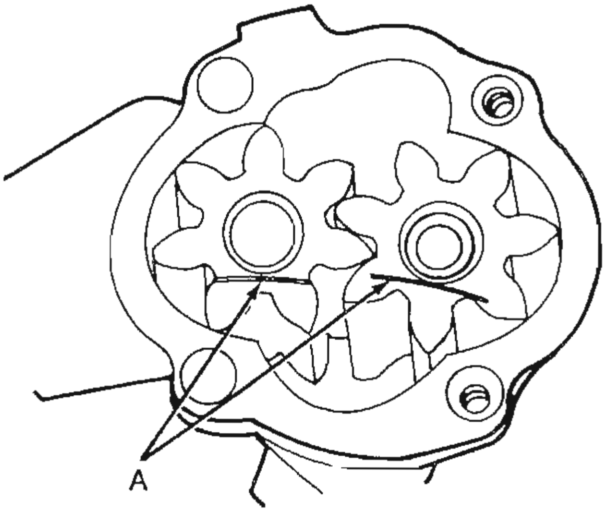
OIL PUMP GEAR END CLEARANCE MEASUREMENT

Remove the cover retaining screws and cover from the pump body.

SEE I.S. NOTES

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.

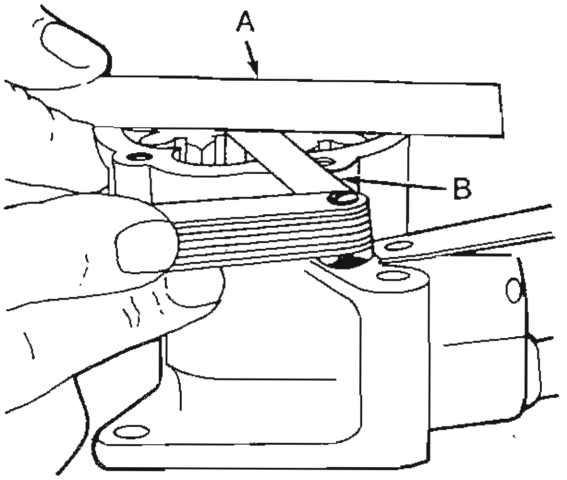
Remove the pump cover and determine the amount of clearance by measuring the width of compressed Plastigage with the scale on the Plastigage envelope.

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.



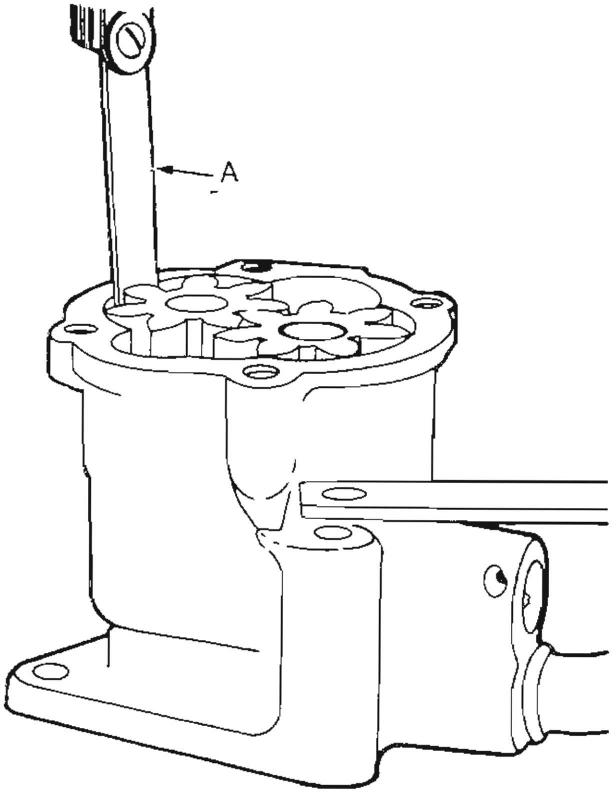
86182A

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.

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.).

SEE I.S. NOTES

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.

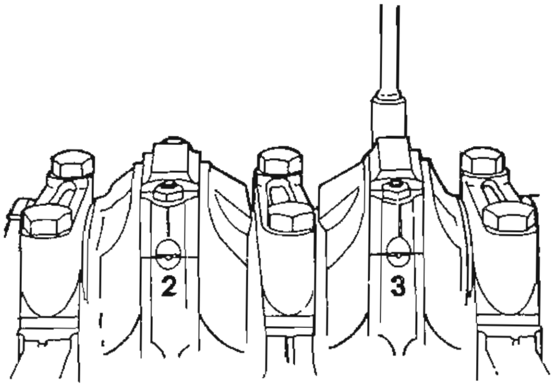
CONNECTING ROD AND PISTON REMOVAL

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.

SEE I.S. NOTES

NOTE: The connecting rods and caps are stamped with the corresponding cylinder number.



86185

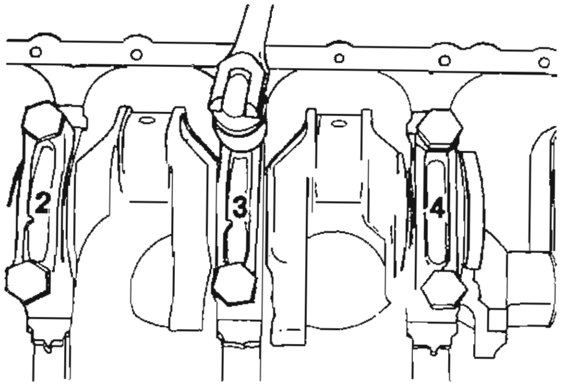
Remove the connecting rod and piston assemblies through the top of the cylinder bores.

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

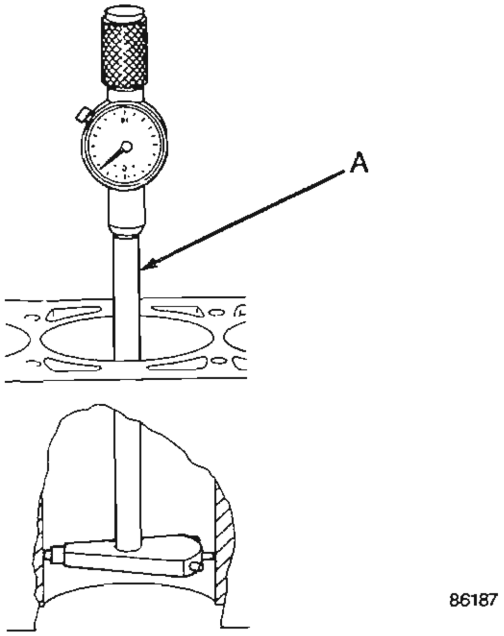
Remove the rear main bearing oil seal.

Remove the crankshaft and upper bearing inserts.

Inspect the crankshaft for scoring.

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.

SEE
I.S.
NOTES

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.

SEE I.S. NOTES

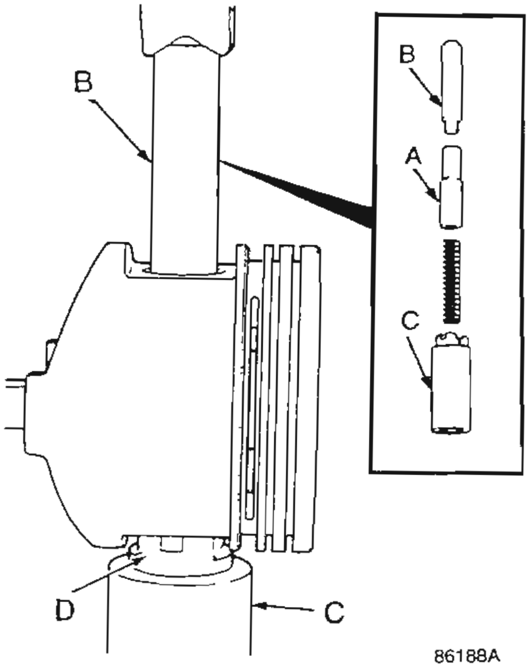
PISTON PIN REMOVAL

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.



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.

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

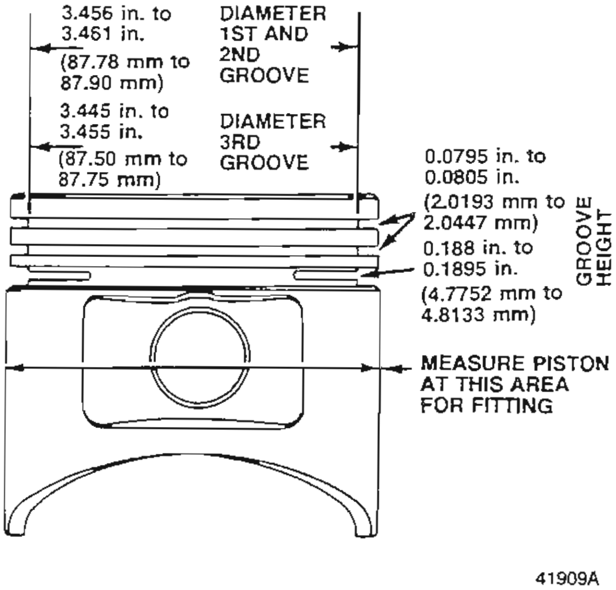
Measure the inside diameter of the cylinder bore at a point 58.725 mm (2.3125 in.) below the top of the bore.

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.

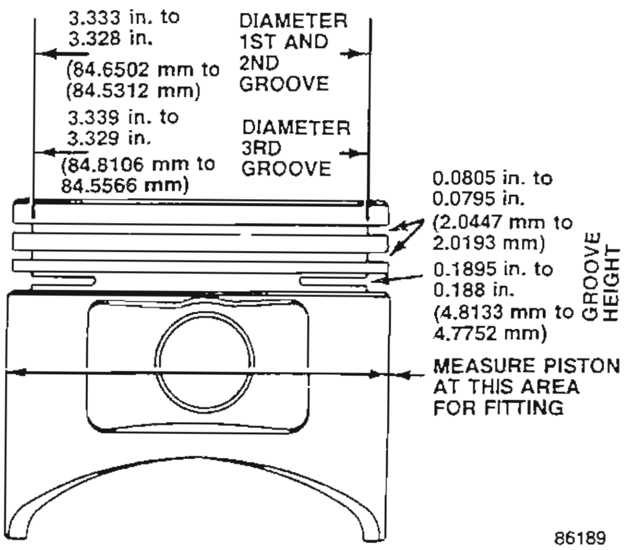
The difference between the cylinder bore diameter and the piston diameter is the piston-to-bore clearance.

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.

SEE
I.S.
NOTES

PISTON RING FITTING

NOTE: The two compression rings are made of cast iron. The oil control ring is a three-piece steel design.

SEE I.S. NOTES

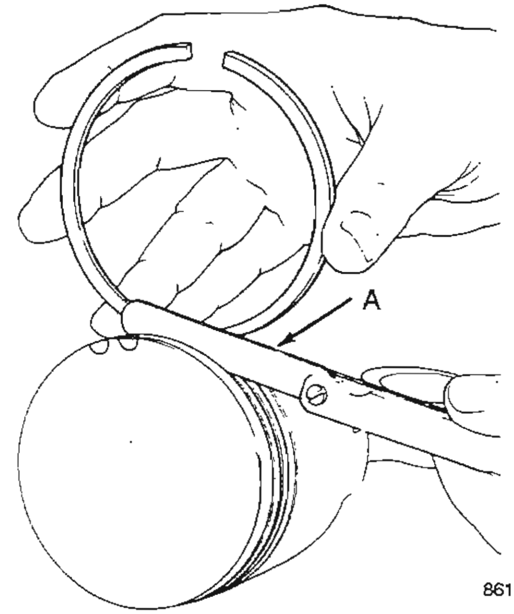
Carefully clean the carbon from all ring grooves.

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

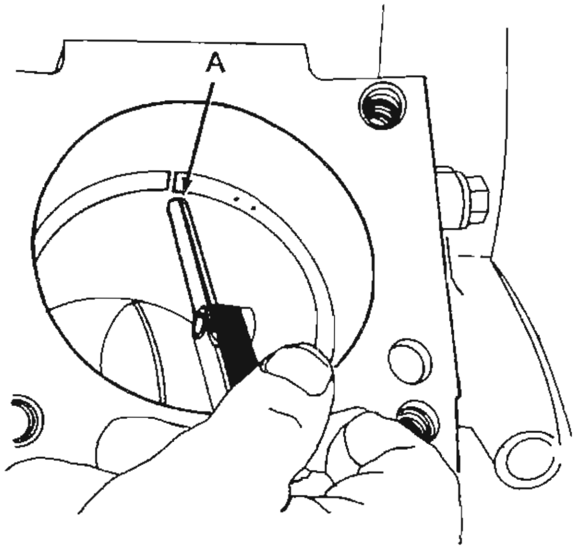
PISTON RING SIDE CLEARANCE MEASUREMENTS

	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

PISTON RING INSTALLATION

Refer to the figure for the position of the ring gaps when installing the piston rings.

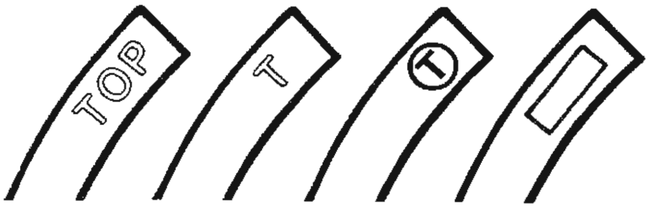
Install the oil control rings according to the instructions in the package. It is not necessary to use a tool to install the upper and lower rails.

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.

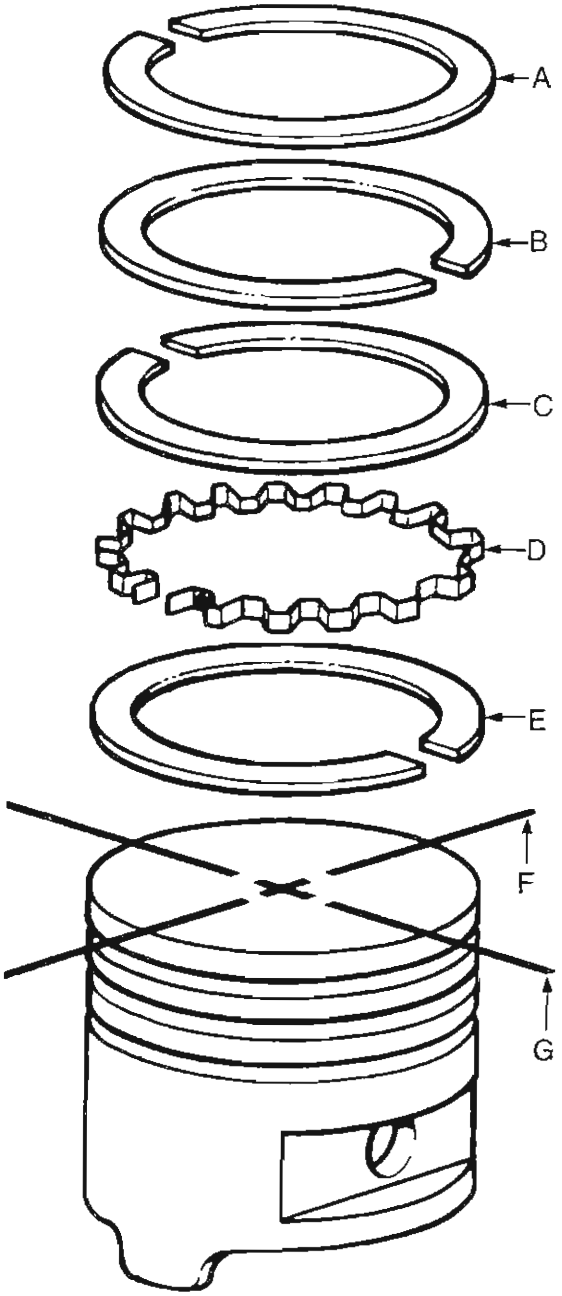
Typical piston ring markings are as follows:



86192A

NOTE: The ring gap position may vary ± 20° from the position illustrated.

The ring gap position is as follows:

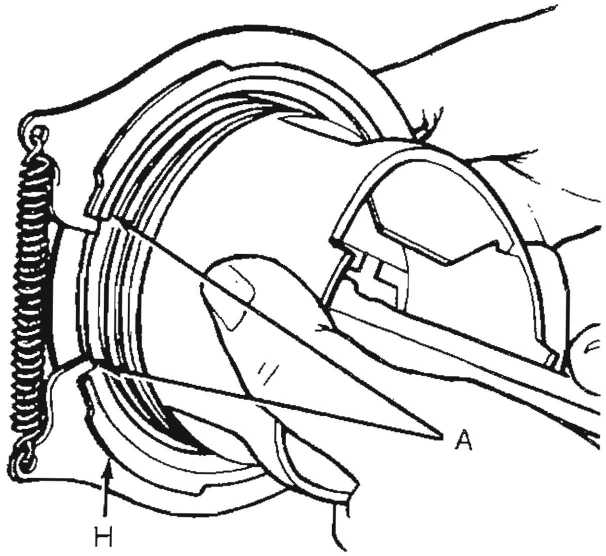


- A. Top Compression Ring
- B. Bottom Compression Ring
- C. Top Oil Control Rail
- D. Oil Rail Expander
- E. Bottom Oil Control Rail
- F. Imaginary Line Through Center of Piston Skirt
- G. Imaginary Line Parallel to Piston Pin

86193A

SEE I.S. NOTES

Install the upper compression ring (A) using the ring installer to expand the ring around the piston. A ring expander (H) is recommended.



86194A

CRANKSHAFT INSTALLATION

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.

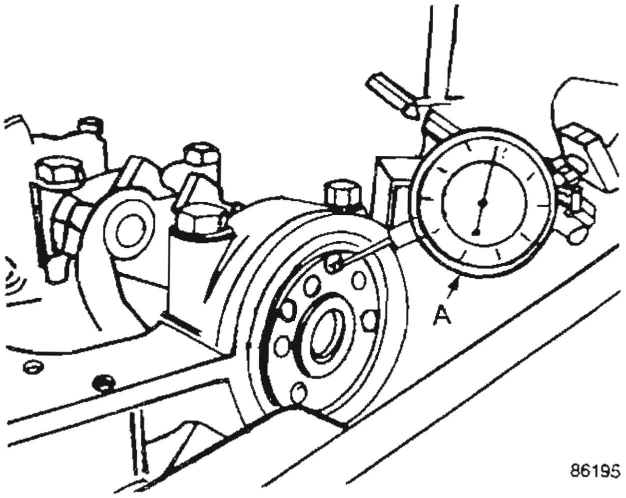
Install the main bearing caps (with the new inserts) in their original positions.

Tighten the bolts to 108 N·m (80 ft-lbs) torque.

NOTE: The bearing caps are numbered front to rear.

CRANKSHAFT END PLAY MEASUREMENT

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.

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

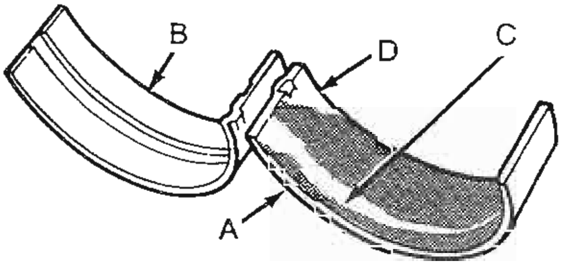
CAUTION: Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 in.) difference in size.

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

SEE
I.S.
NOTES

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.

SEE I.S. NOTES

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.

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.)	Yellow – Standard	Yellow – Standard
	Black – 68.3641-68.3768 mm (2.6915-2.6920 in.)	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.)	Yellow – Standard	Black – 0.025 mm Undersize (0.001 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 – 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 – 0.025 mm Undersize (0.001 in.)	Black – 0.025 mm Undersize (0.001 in.)
	Black – 68.3641-68.3768 mm (2.6915-2.6920 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 (2.4901-2.4986 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 (2.4901-2.4986 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.)

SEE I.S. NOTES

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.

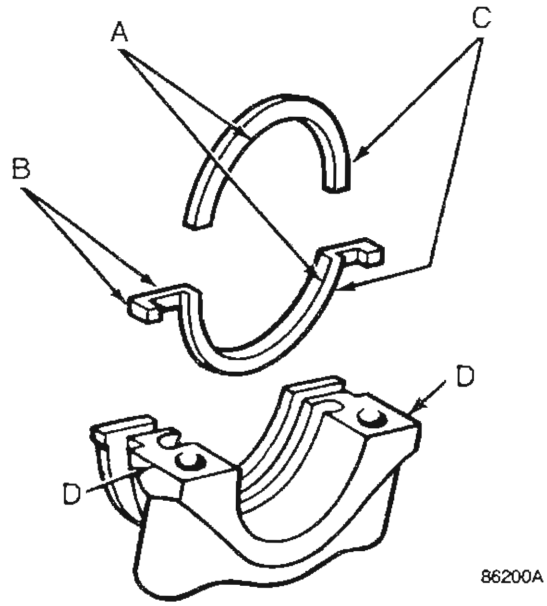
Coat both sides of the lower seal end tabs with RTV sealant (B) (AMC Gasket-in-a-Tube, or equivalent). Do not apply sealant to the lip of the seal.

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.



Install the rear main bearing cap.

Tighten all main bearing bolts to 108 N·m (80 ft-lbs) torque.

CONNECTING ROD INSTALLATION

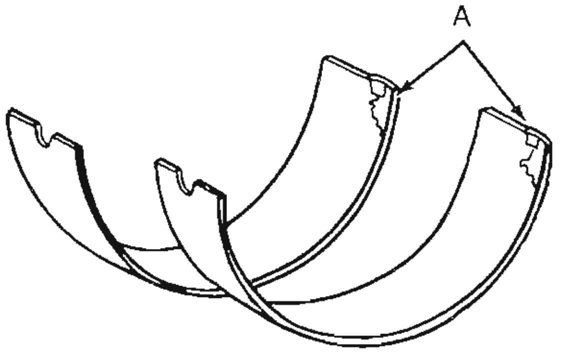
The connecting rods are made of malleable iron and are balanced assemblies with bearing inserts at the crankshaft journal end. The piston pin is 8.9 kN (2 000 pounds-force) press-fitted into the rod.

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.

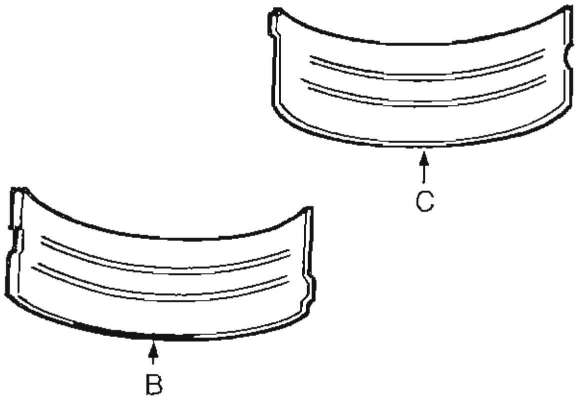
Example of abnormal contact areas (A) caused by locking tabs that have not been fully seated or are bent:



86202A

SEE I.S. NOTES

Example of scoring on the lower (B) and upper (C) bearing surfaces:



86203A

CONNECTING ROD BEARINGS

The connecting rod bearings are two-piece, steel backed, lead-aluminum alloy units.

SEE I.S. NOTES

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.

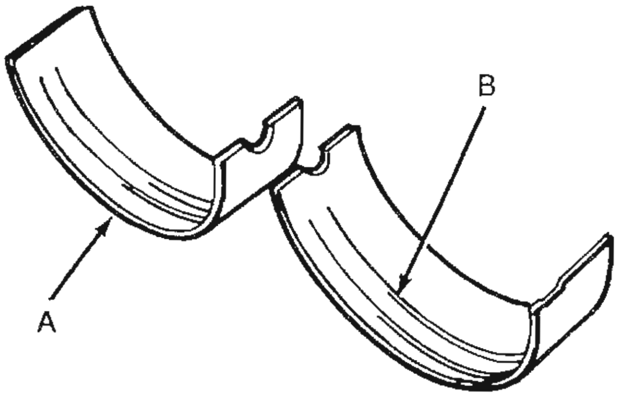
The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the bearing fitting chart.

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.



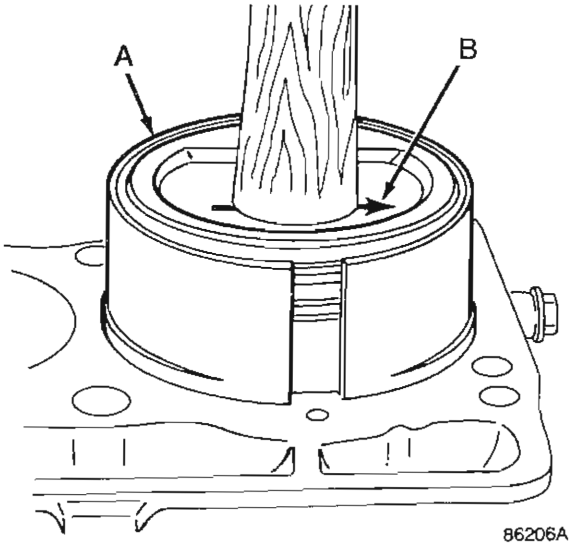
86204

CONNECTING ROD BEARING INSTALLATION

Wipe the journal clean of oil.

Lubricate the upper bearing insert and install in the connecting rod.

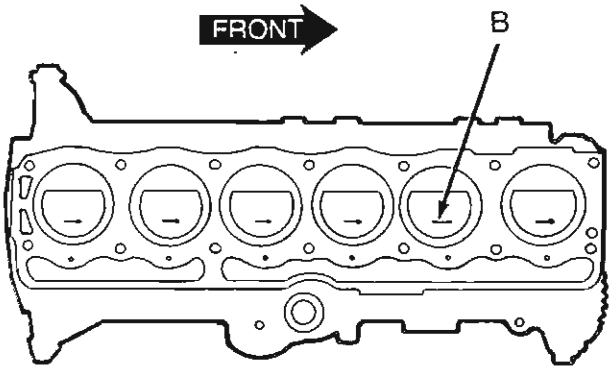
Use the Ring Compressor Tool J-5601 (A), or equivalent, to install the rod and piston assemblies.



86206A

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.

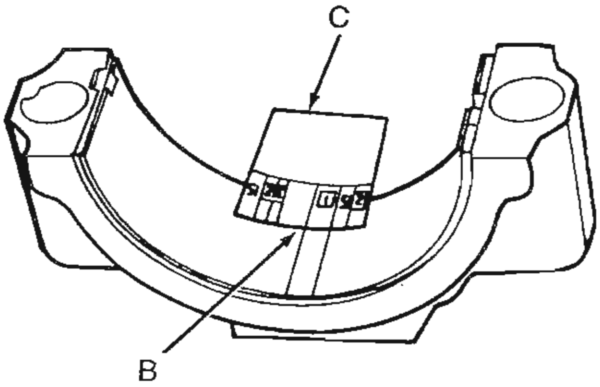
NOTE: Do not rotate the crankshaft. The Plastigage will shift, resulting in an inaccurate indication.

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.).

SEE
I.S.
NOTES



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.

SEE I.S. NOTES

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.

SEE
I.S.
NOTES

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

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.

SEE I.S. NOTES

Install the oil pressure relief valve plunger.

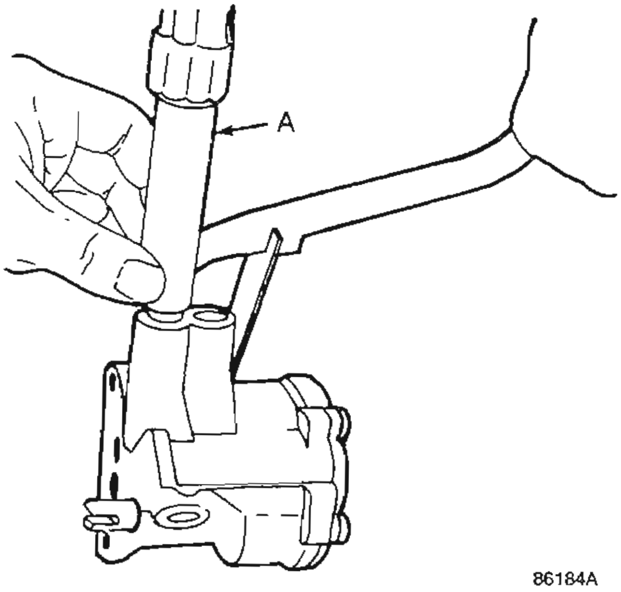
Install the spring.

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.



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

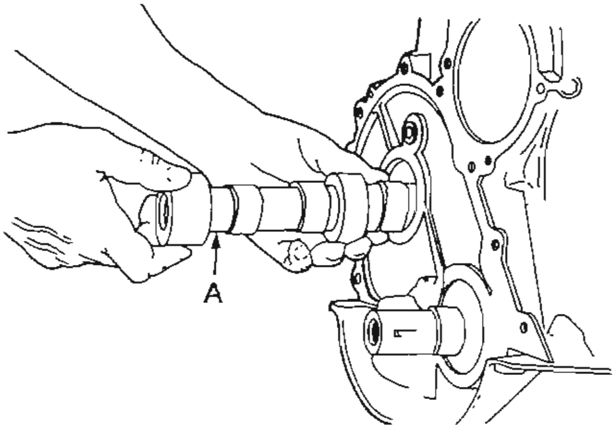
Install the oil pump with a new gasket.

Tighten the short bolts to 14 N·m (10 ft-lbs) torque.

Tighten the long bolts to 23 N·m (17 ft-lbs) torque.

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.

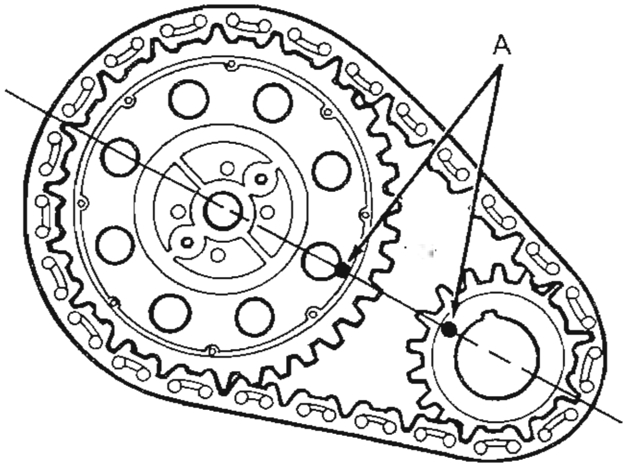
CAMSHAFT INSTALLATION

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

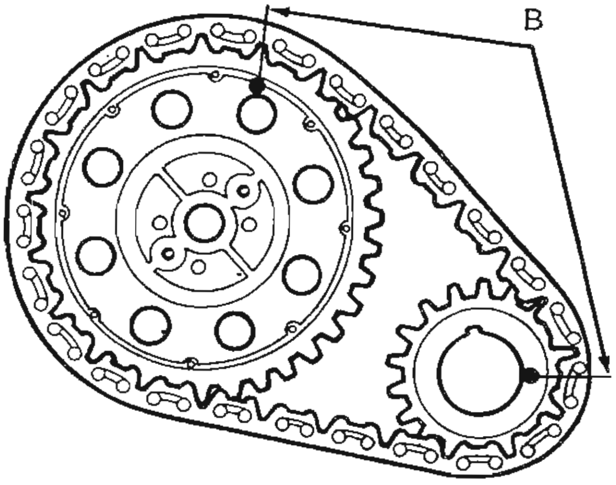
Install the camshaft sprocket retaining bolt and washer and tighten the bolt to 108 N·m (80 ft-lbs) torque.

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.

SEE
I.S.
NOTES

SEE
1.S.
NOTES

Count the number of chain pins between the timing marks of both sprockets. There must be 15 pins (B).

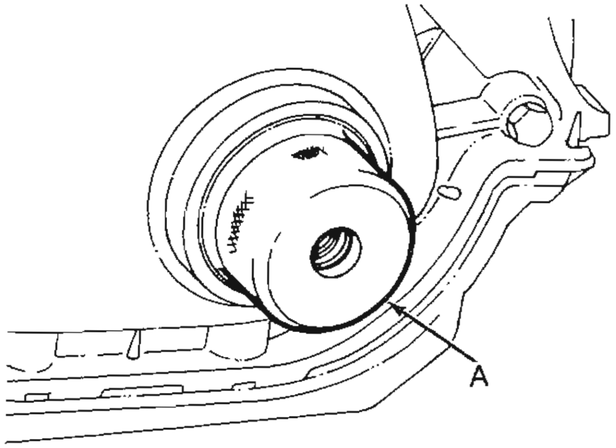


86211A

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

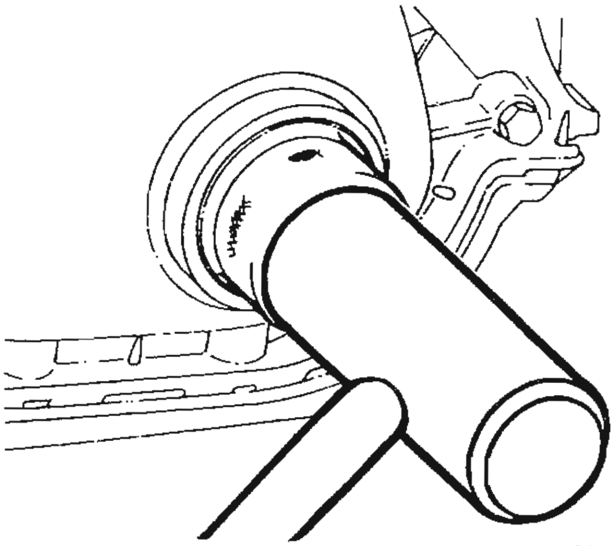
Tighten the cover bolts to 7 N·m (5 ft-lbs) torque, and the oil pan-to-cover bolts to 13 N·m (11 ft-lbs) torque.

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.

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.

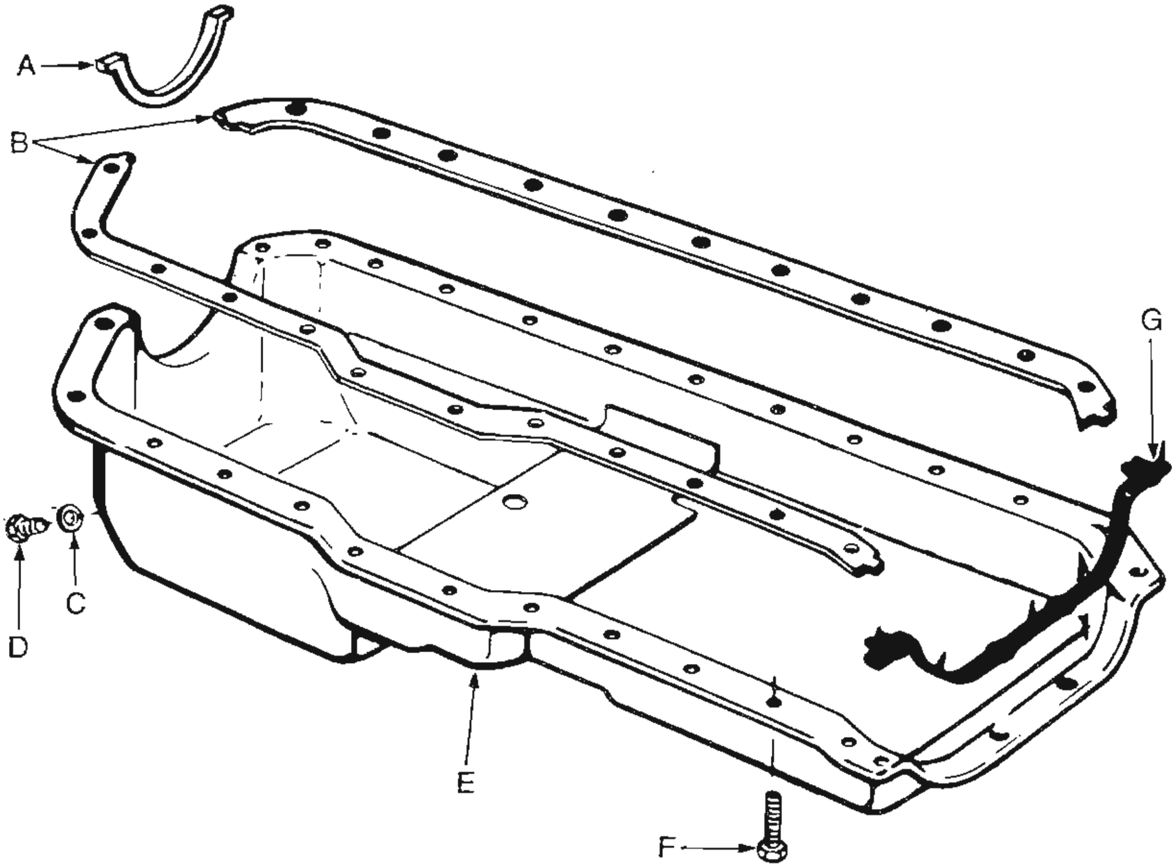
Install the oil pan side gaskets (B) in position on the engine block.

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.

SEE
I.S.
N
O
T
E
S



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

10240

SEE I.S. NOTES

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.

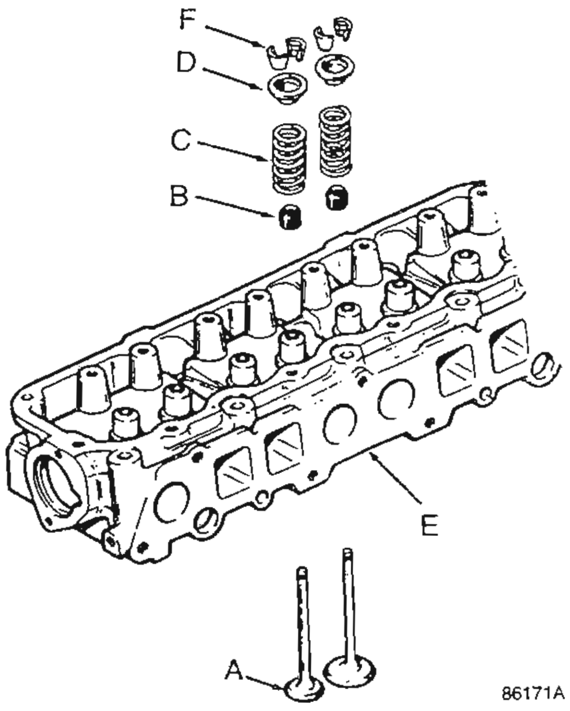
VALVE INSTALLATION

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.



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.

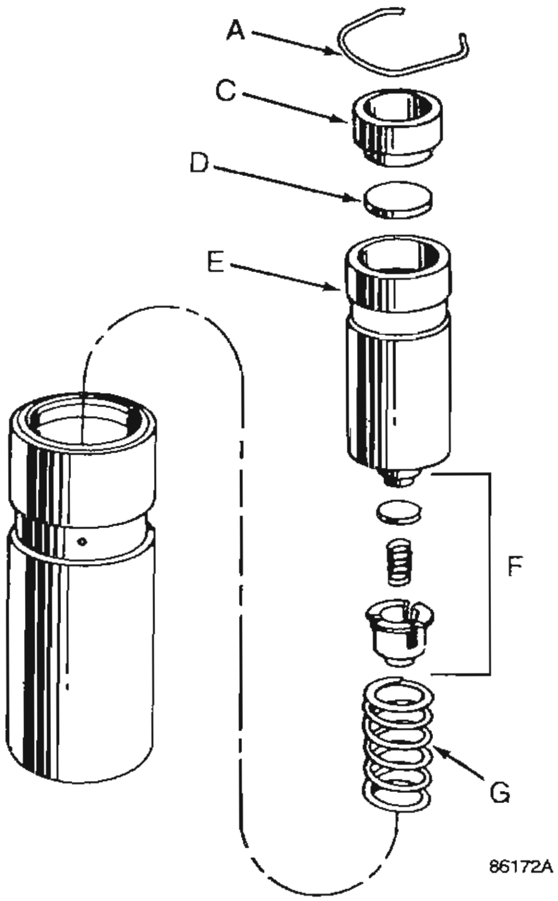
HYDRAULIC VALVE TAPPET ASSEMBLY

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).



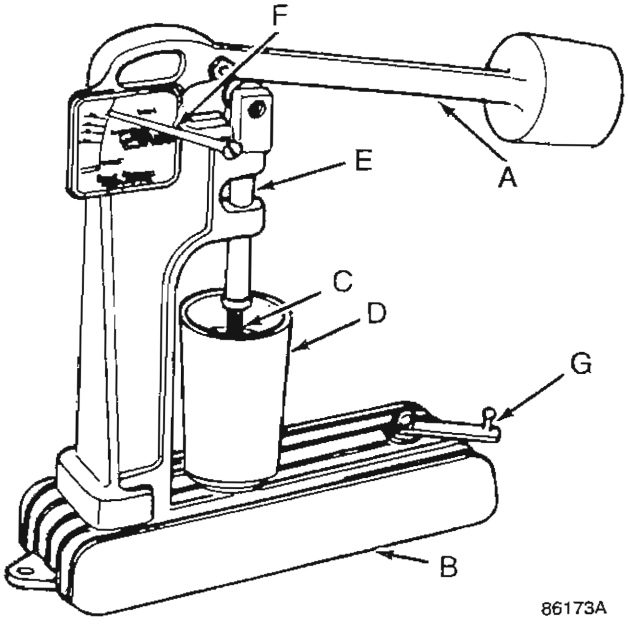
HYDRAULIC VALVE TAPPET LEAK-DOWN TEST

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.

SEE I.S. NOTES

SEE I.S. 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.

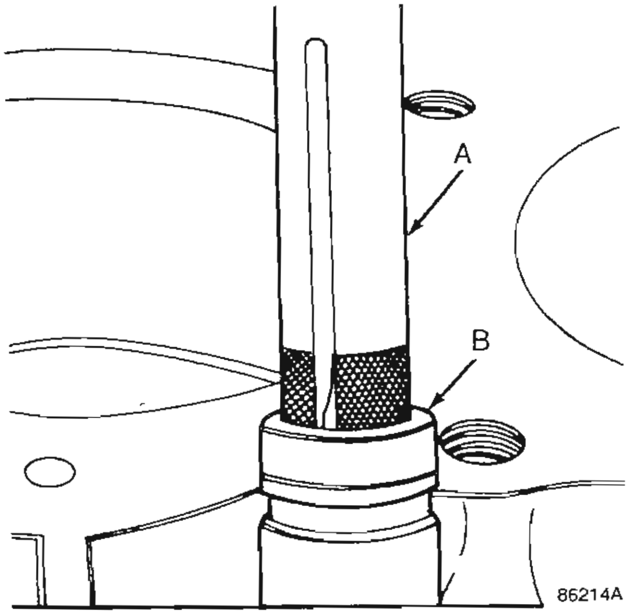
Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark.

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 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.

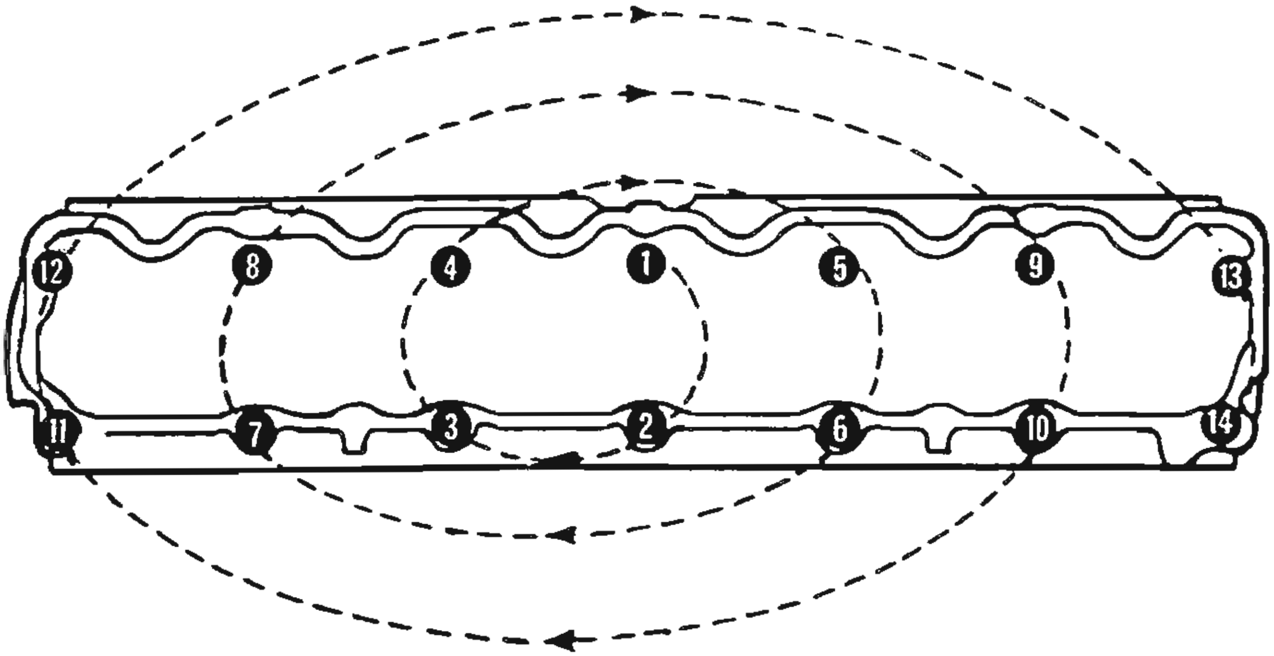
NOTE: Coat the threads of the stud bolt in the number 11 sequence position with Loctite 592 sealer, or equivalent, and tighten to 102 N·m (75 ft-lbs) torque.

Install the spark plugs.

Tighten to 38 N·m (28 ft-lbs) torque.

SEE
I.S.
NOTES

Cylinder Head Bolt Tightening Sequence



86215

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.

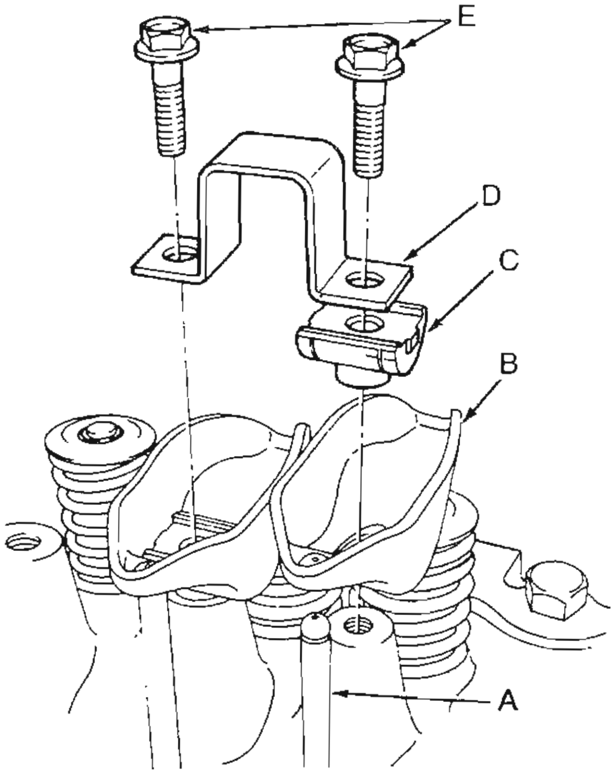
Install the rocker arms (B), pivots (C) and bridge (D) above each cylinder from where they were originally removed.

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.

SEE I.S. NOTES



86216A

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.

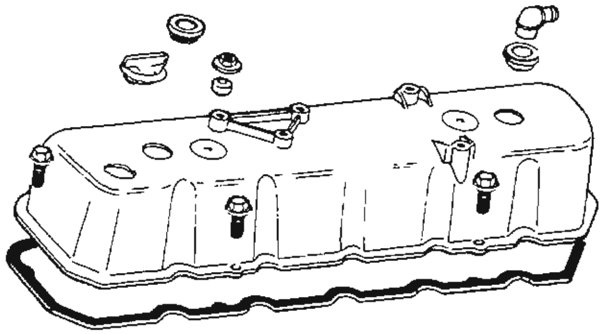
Before the sealant begins to cure, install the cover on the cylinder head. Do not allow the sealant to come into contact with the rocker arms or other valve assembly components.

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.

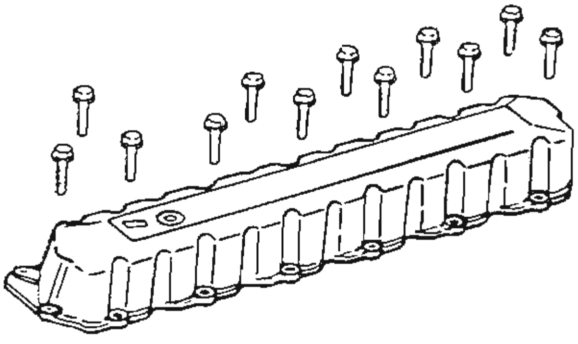
SEE
I.S.
NOTES

4.2L



102305B

4.0L



102303A

INTAKE MANIFOLD INSTALLATION

Attach a new intake manifold gasket (C).

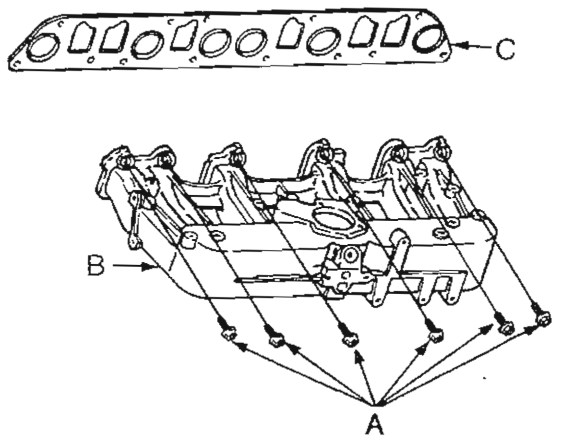
Install the intake manifold (B).

SEE I.S. NOTES

Tighten the intake and exhaust manifold bolts in proper sequence to 31 N·m (23 ft-lbs) torque.

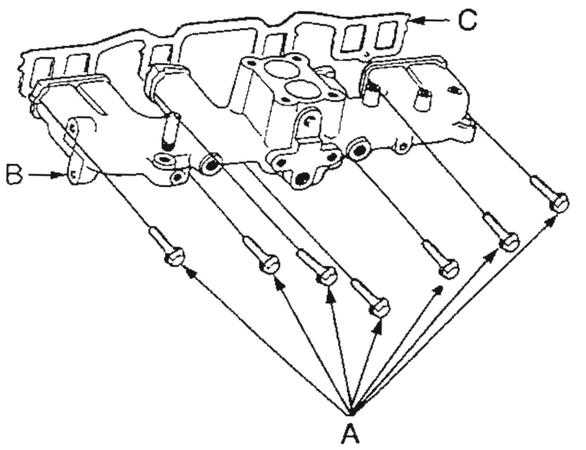
Connect EGR tube.

4.0L



101935A

4.2L

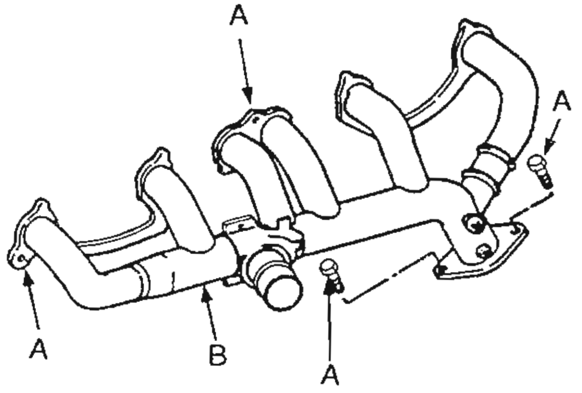


101935B

EXHAUST MANIFOLD INSTALLATION

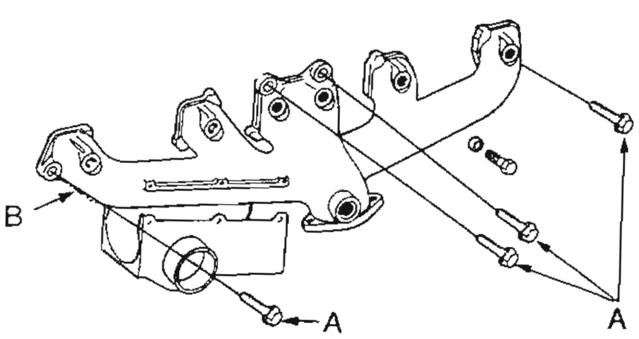
Install the exhaust manifold (A) and finger-tighten the center retaining bolts (B).

4.0L



101935D

4.2L



101935C