



## FORD AXOD

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## **INTRODUCTION FORD AXOD**

The AXOD is an automatic four speed, front wheel drive transaxle with fourth gear being overdrive. This unit is equipped with a Torque Converter Clutch which is electronically controlled by the EEC-IV computer system. Once all processor conditions are met, the torque converter may apply in either third or fourth speeds. All other automatic shifts are hydraulically controlled.

Ford Motor Company used the AXOD from 1986 thru 1990 in the Ford Taurus and the Mercury Sable, and from 1988 thru 1990 in the Lincoln Continental.

Beginning in model year 1991, the AXOD was replaced by the AXOD-E transaxle which controls line pressure, all shifts and TCC electronically. Please see the ATSG manual on the AXOD-E transaxle for more information on that unit.

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and illustrations that have made this booklet possible.*

*The information and part numbers contained in this booklet have  
been carefully compiled from industry sources known for their  
reliability, but ATSG does not guarantee its accuracy.*

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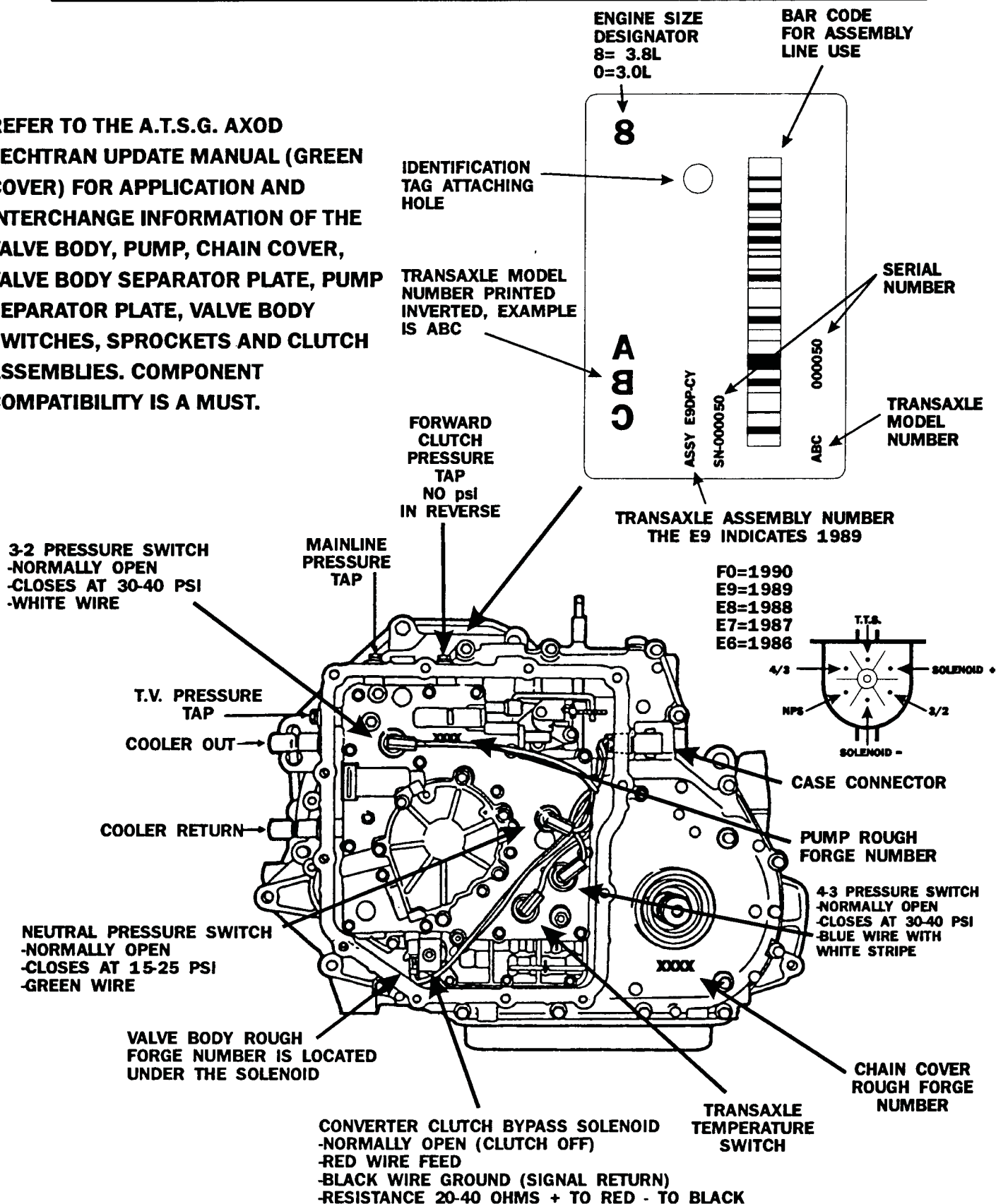
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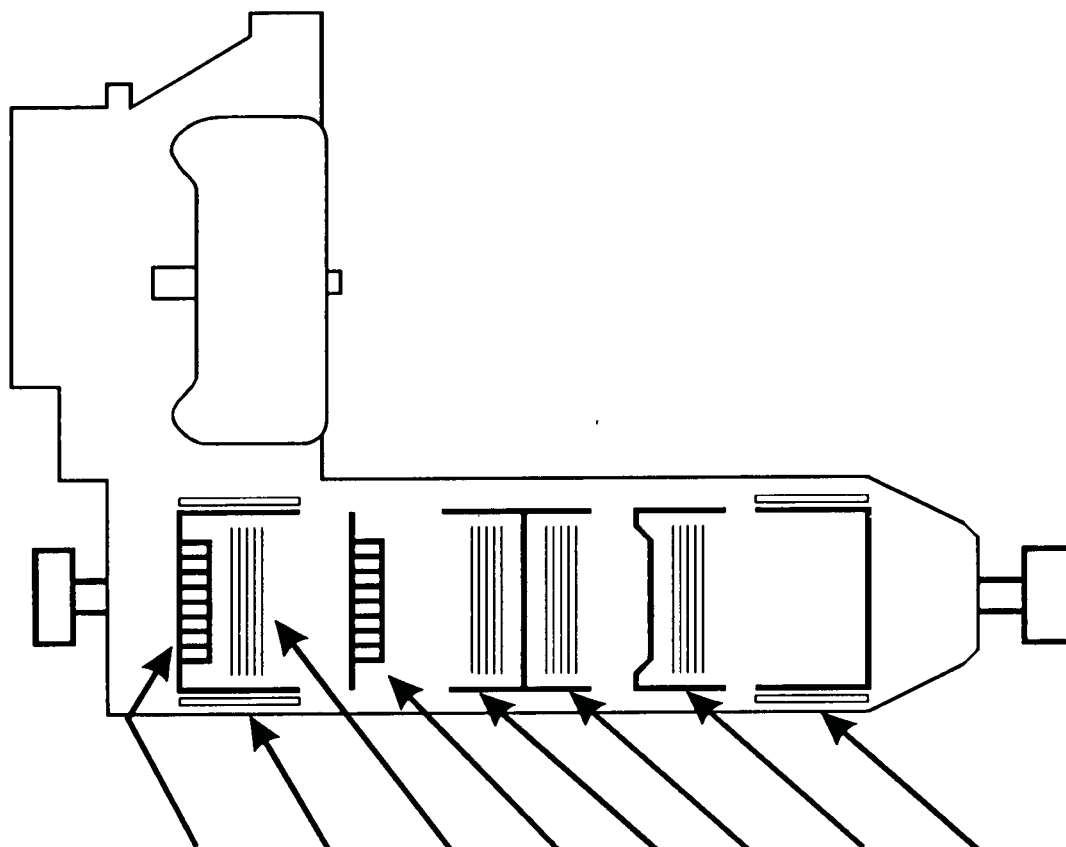
## TRANSAXLE AND COMPONENT IDENTIFICATION

REFER TO THE A.T.S.G. AXOD  
TECHTRAN UPDATE MANUAL (GREEN  
COVER) FOR APPLICATION AND  
INTERCHANGE INFORMATION OF THE  
VALVE BODY, PUMP, CHAIN COVER,  
VALVE BODY SEPARATOR PLATE, PUMP  
SEPARATOR PLATE, VALVE BODY  
SWITCHES, SPROCKETS AND CLUTCH  
ASSEMBLIES. COMPONENT  
COMPATIBILITY IS A MUST.



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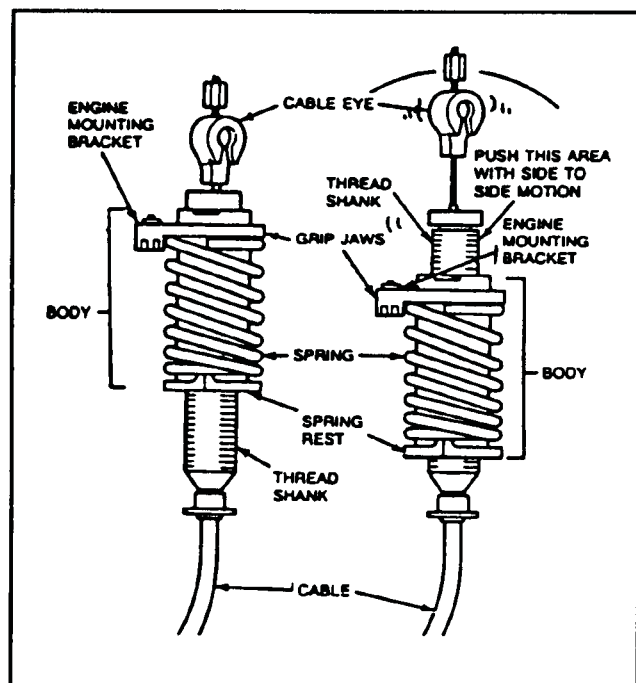
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SELECTOR POSITION	GEAR	LOW SPRAG	OVERDRIVE BAND	FORWARD CLUTCH	DIRECT ONE-WAY CLUTCH	DIRECT CLUTCH	INTER-MEDIATE CLUTCH	REVERSE CLUTCH	LOW/INT. BAND	GEAR RATIO
<b>R</b>	<b>REVERSE</b>	<b>ON</b>		<b>ON</b>				<b>ON</b>		<b>2.263:1</b>
<b>OD</b>	<b>1st</b>	<b>ON</b>		<b>ON</b>					<b>ON</b>	<b>2.77:1</b>
	<b>1st decel</b>			<b>ON*</b>					<b>ON</b>	<b>FREEWHEEL</b>
	<b>2nd</b>			<b>ON*</b>			<b>ON</b>		<b>ON</b>	<b>1.543:1</b>
	<b>3rd</b>			<b>ON*</b>	<b>ON</b>	<b>ON</b>	<b>ON</b>			<b>1.000:1</b>
	<b>3rd decel</b>	<b>ON</b>		<b>ON</b>		<b>ON</b>	<b>ON</b>			<b>1.000:1</b>
	<b>4th</b>		<b>ON</b>			<b>ON*</b>	<b>ON</b>			<b>.694:1</b>
<b>D</b>	<b>1st</b>	<b>ON</b>		<b>ON</b>					<b>ON</b>	<b>2.77:1</b>
	<b>1st decel</b>			<b>ON*</b>					<b>ON</b>	<b>FREEWHEEL</b>
	<b>2nd</b>			<b>ON*</b>			<b>ON</b>		<b>ON</b>	<b>1.543:1</b>
	<b>3rd</b>			<b>ON*</b>	<b>ON</b>	<b>ON</b>	<b>ON</b>			<b>1.000:1</b>
	<b>3rd decel</b>	<b>ON</b>		<b>ON</b>		<b>ON</b>	<b>ON</b>			<b>1.000:1</b>
	<b>1st</b>	<b>ON</b>		<b>ON</b>		<b>ON*</b>			<b>ON</b>	<b>2.77:1</b>
<b>1</b>	<b>1st decel</b>			<b>ON*</b>	<b>ON</b>	<b>ON</b>			<b>ON</b>	<b>2.77:1</b>

RANGE	MAIN LINE PRESSURE				T.V. PRESSURE	
	3.0L ENGINE		3.8L ENGINE		IDLE	STALL
	IDLE	STALL	IDLE	STALL		
P, N	81-95		80-91	-		
R	93-152	242-279	93-152	248-289		
OD, D	81-95	158-183	80-91	182-213	12-14	85-95
L	112-169	158-183	112-169	158-183		

# DIAGNOSIS AND TESTING



## THROTTLE PRESSURE ADJUSTMENTS

1. Attach 0-100 p.s.i. pressure gauge to T.V. pressure port. (page 3)
2. Connect T.V. cable eye to throttle control lever link and attach cable body to chain cover.
3. With T.V. cable mounted in engine bracket, make sure threaded shank is fully retracted. To retract shank, hold spring rest and wiggle top of thread shank while pressing shank toward spring. (figure 2)
4. Attach end of T.V. cable to throttle body.
5. Rotate throttle lever to W.O.T. position and release. Threaded shank must show movement or "ratchet" out of grip jaws. If no movement is observed, inspect T.V. cable system for broken or disconnected components and repeat procedure.
6. Block wheels, firmly apply parking brake, apply service brakes. Warm up engine so that it is not at fast idle. Select Drive position and fine adjust T.V. cable until gauge reads 12-14 p.s.i. at idle.
7. Check for a maximum T.V. pressure of 85-95 p.s.i. at wide open throttle.

**NOTE;** If the T.V. pressure is adjusted too low the T.V. system goes to a "fail safe" mode of maximum T.V. pressure and will hydraulically bind the T.V. cable. To readjust the cable, the engine must be shut off to hydraulically "unlock" the cable.

## STALL TEST

The stall test checks the operation of the converter one-way clutch, forward clutch, low one-way clutch, reverse clutch, low-intermediate band, and engine performance

**NOTE:** The stall test should only be performed with the engine and transaxle at normal operating temperatures.

**WARNING: APPLY THE SERVICE AND PARKING BRAKES FIRMLY WHILE PERFORMING EACH STALL TEST**

1. Connect a tachometer to the engine.
2. After testing each of the following ranges (O.D., D, 1, R), move the selector to N (neutral) and run the engine for about 15 seconds to allow the converter to cool before testing the next range

**CAUTION:** Do not maintain WOT in any gear range for more than 5 seconds.

Press accelerator to floor (WOT) each range. Record rpm reached in each range, Stall speeds be 1950-2275.

**CAUTION:** If engine rpm recorded by the tachometer exceeds the maximum specified rpm, release accelerator immediately, clutch or band slippage is indicated.

If the stall speeds were too high, refer to the following Stall Speed Diagnosis chart. If stall speeds were too low, first check engine tune-up. If engine is OK, remove torque converter and check converter reactor one-way clutch for slippage.

## STALL SPEED TOO HIGH

Range	Possible Source
①, D, 1	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Low One-Way Clutch</li> <li>• Low/Intermediate Band or Servo</li> </ul>
R	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Low One-Way Clutch</li> <li>• Reverse Clutch</li> </ul>

## CONVERTER CLUTCH TEST

1. Connect a tachometer to the vehicle.
2. After normal operating temperatures are reached, maintain a constant vehicle speed of about 50 mph, and tap the brake pedal with the left foot.
3. Engine rpm should increase when the brake pedal is tapped, and decrease about 5 seconds after the pedal is released. If this does not occur, refer to converter clutch diagnosis.

## DIAGNOSIS AND TESTING

### SHIFT POINT TEST

This test verifies that the governor pressure and shift control valves are operating properly.

### ROAD TEST

1. Bring engine and transaxle up to normal operating temperature.

2. Operate the vehicle with the transmission selector in the O.D. range.

3. Apply minimum throttle pressure.

The transaxle should shift in the following order

- 1-2
- 2-3
- converter lock-up
- 3-4

NOTE: Converter will remain locked up when transaxle shifts into fourth.

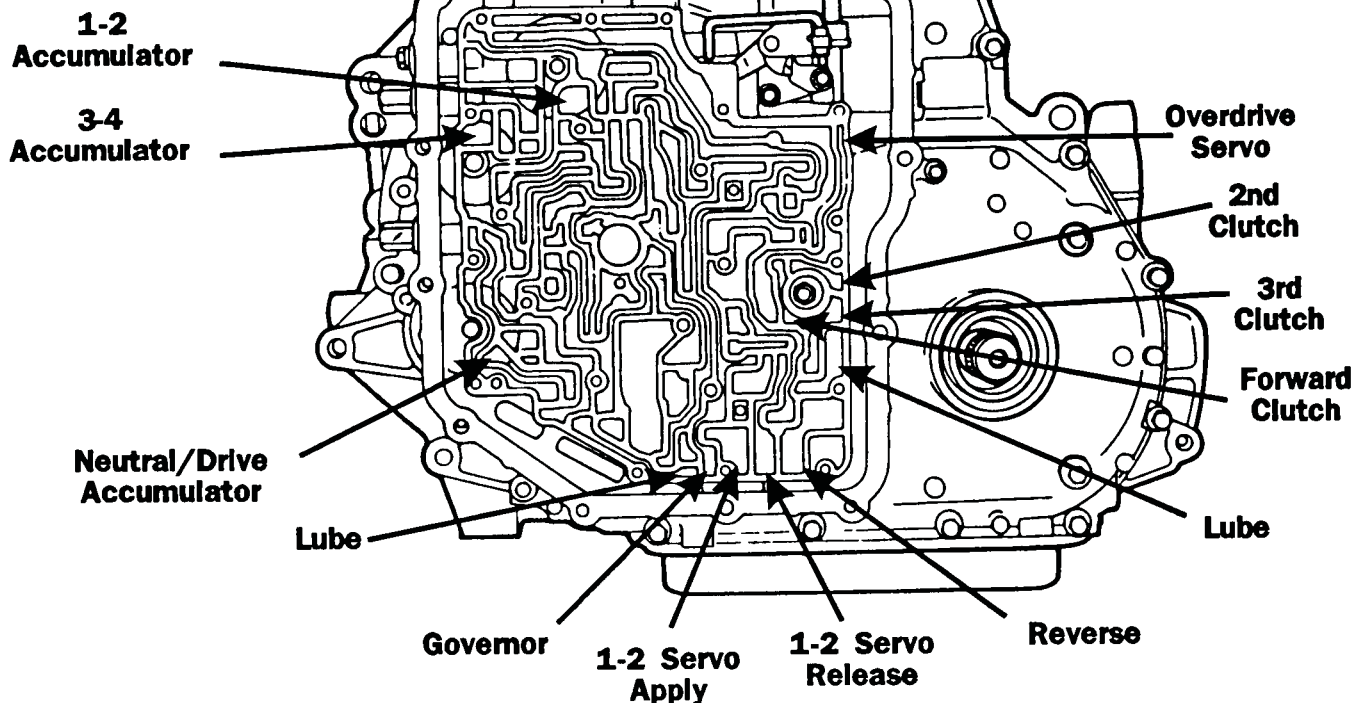
4. Stop vehicle and move the selector to the D range. Repeat step 3. Transaxle will make all upshifts except 3-4 and converter clutch apply should occur above 27mph.

5. Depress accelerator pedal to floor (WOT). Transaxle should shift from third to second, or third to first depending on vehicle speed and converter clutch should release. NOTE: With transmission selector in O.D. a 4-3 WOT down shift can be obtained regardless of vehicle speed.

6. With vehicle speed above 30mph, move selector from the D range to 1 (LOW RANGE), and remove your foot from the accelerator pedal. Transaxle should immediately down shift to second gear. When vehicle speed drops below 20mph, transaxle should down shift into first gear.

7. If transaxle fails to upshift and/or down shift as outlined, refer to the diagnostic chart in this manual.

**USE 50 PSI  
FOR TESTING**



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## DIAGNOSIS AND TESTING

USE 50psi FOR TESTING

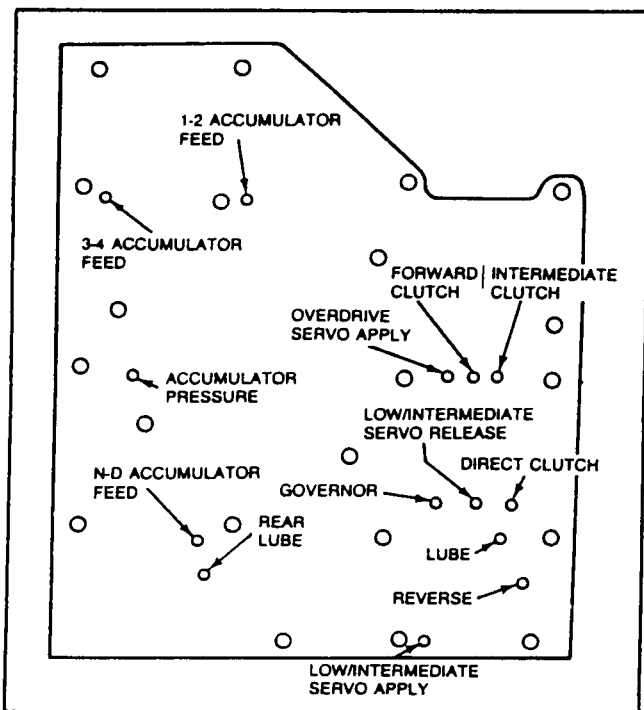


Figure 64 — AXOD Test Plate T86P-7006-B

Remove valve body and install the air pressure test plate (T86P-7006-B Figure) with a valve body gasket. Use a low pressure of 50psi for testing.

### Forward Clutch

Apply air pressure to forward clutch test port. A dull thud can be heard, or movement of piston felt when clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

### Governor

Apply air pressure to governor test port and listen for a sharp clicking or whistling noise. The noise indicates proper governor movement. Block governor weights out with vacuum hose, recheck for air leaks, remove vacuum hose.

### Direct Clutch

Apply air pressure to direct clutch test port. A dull thud can be heard, or movement of piston felt on case as clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

### Overdrive Servo

Apply air pressure to overdrive servo apply test port. Operation of servo is indicated by a tightening of overdrive band around overdrive drum. Because of the cushioning effect of the servo release spring, application of band may not be heard or felt. The servo should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing servo piston to return to release position.

### Intermediate Clutch

Apply air pressure to intermediate clutch test port. A dull thud can be heard, or movement of piston can be felt on case as clutch piston is applied. If clutch seal(s) are leaking, a hissing sound will be heard.

### Low-Intermediate Servo

Apply air pressure at low-intermediate servo feed test port. The low-intermediate band should tighten around sun gear of rear planetary gear set. Because of the cushioning effect of the servo release spring, application of band may not be heard or felt. The servo should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing servo piston to return to release position. Apply air pressure to low-intermediate servo release test port while continuing to pressurize the apply port. Servo piston should return to the release position. The band should loosen and a dull thud should be heard. Release the feed test port. The release test port should hold pressure without leakage. Any leakage or failure of piston movement requires servo service.

### Lube and Rear Lube

Apply air pressure to lube and rear lube test ports. These passages can only be checked for blockage. If either passage holds air pressure, remove service tool plate and check for an obstruction or damage.

### 1-2, 3-4 and N-D Accumulators

Apply air pressure to each accumulator feed test port. Accumulator should apply. Because of the cushioning effect of the accumulator release spring, application of accumulator may not be felt or heard. The accumulator should hold air pressure without leakage and a dull thud should be heard when air pressure is removed, allowing accumulator to return to release position.

## DIAGNOSIS AND TESTING

Use the following diagnosis charts to diagnose problems in the transaxle.

CONDITION	POSSIBLE SOURCE	ACTION
Oil Leak	1. Side pan or bottom pan. • Low bolt torque. • Damaged gasket or pan rail. • Distorted pan. • Damaged seal.	1. Service as required.
	2. TV cable, fill tube or electrical bulkhead connector. • Loose fit/damaged case.	2. Service as required.
	3. Manual shaft. • Damaged seal.	3. Replace seal.
	4. Governor cover and servo covers. • Damaged O-Ring seal.	4. Replace O-Ring seal.
	5. Cooler fittings or pressure taps. • Low torque, damaged threads.	5. Service as required.
	6. Cooler or converter seal. • Damaged seal assembly, or garter spring missing. • Weld seam leaking.	6. Service as required.
	7. Halfshaft seals. • Damaged seal assembly, or garter spring missing.	7. Replace seal.
	8. Speedometer cable or speed sensor. • Damaged O-Ring seal.	8. Replace O-Ring seal.
Oil Venting or Foaming	1. Oil level (venting). • Transaxle overfilled.	1. Drain and fill transaxle to proper level.
	2. Transmission fluid. • Contaminated with antifreeze or engine overheating.	2. Determine source of leak. Service as required.
	3. Bi-metallic element stuck open.	3. Replace element.
	4. Oil filter. • Damaged O-Rings.	4. Replace filter O-Rings.
High or Low Oil Pressure (Verify With Gauge)  SEE ATSG BULLETIN 91-48, 90-17, 90-15, 89-61, 89-57, 89-52, 89-17, 88-64, 88-13, 87-50, 87-47, 87-21, 86-45	1. Oil level. • Oil level too low or too high.	1. Drain or fill transaxle as necessary.
	2. TV cable/linkage • Stuck, damaged or in fail-safe	2. Service as required, if in fail-safe, shut engine off and readjust cable
	3. Pressure regulator valve or spring. • Nicked scored bore or valve. • Damaged spring.	3. Determine source of damage. Service as required.
	4. Pressure relief valve. • Damaged or missing spring, missing ball.	4. Service as required.



## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
High or Low Oil Pressure (Verify With Gauge) — Continued	5. Oil pump assembly. <ul style="list-style-type: none"> <li>• Slide stuck, seals damaged, vanes damaged.</li> <li>• Pump driveshaft broken or damaged.</li> </ul>	5. Determine source of damage. Service as required.
No 1-2 Shift (First Gear Only)  SEE ATSG BULLETIN 91-48, 90-17, 89-52, 89-42, 89-14, 87-50, 87-21	1. Governor assembly. <ul style="list-style-type: none"> <li>• Weights binding.</li> <li>• Springs damaged.</li> <li>• Gears damaged.</li> <li>• Governor shaft seal damaged or missing.</li> <li>• Governor valve (ball) stuck or missing.</li> <li>• Governor tube leaking/damaged.</li> </ul>	1. Perform governor test. Service as required.
	2. Intermediate Clutch Assembly. <ul style="list-style-type: none"> <li>• Clutch plates damaged/missing.</li> <li>• Piston or seals damaged.</li> <li>• Ball check assembly stuck/missing.</li> <li>• Clutch cylinder damaged.</li> </ul>	2. Determine source of contamination or damage. Inspect welds. Service as required.
	3. Direct/Intermediate clutch hub. <ul style="list-style-type: none"> <li>• Seals damaged/missing or holes blocked.</li> </ul>	3. Determine source of contamination or damage. Service as required.
	4. Driven sprocket support. <ul style="list-style-type: none"> <li>• Seals damaged/missing or holes blocked.</li> </ul>	4. Determine source of contamination or damage. Service as required.
	5. 1-2 shift valve. <ul style="list-style-type: none"> <li>• Stuck, nicked or damaged.</li> </ul>	5. Determine source of contamination or damage. Service as required.
	6. 1-2 throttle delay valve. <ul style="list-style-type: none"> <li>• Stuck, nicked or damaged.</li> </ul>	6. Determine source of contamination or damage. Service as required.
	7. 1-2 Acc. capacity mod valve <ul style="list-style-type: none"> <li>• Stuck, damaged or spring too soft</li> </ul>	7. Determine source of contamination or damage. Service as required.
	8. No. 9 check ball. <ul style="list-style-type: none"> <li>• Missing ball.</li> </ul>	8. Replace check ball.
	9. Control assembly. <ul style="list-style-type: none"> <li>• Bolts too loose or too tight.</li> </ul>	9. Tighten bolts to specification.
	10. Carrier damaged.	10. Inspect welds. Service as required.
	11. Intermediate clutch tap plug loose/missing.	11. Service as required.
1-2 Shift Feels Harsh or Soft  SEE ATSG BULLETIN 91-49, 91-48, 90-15, 89-60, 89-52, 89-51, 89-42, 88-58	1. Oil Pressure <ul style="list-style-type: none"> <li>• High or low oil pressure.</li> </ul>	1. Perform control pressure test. Service as required.
	2. 1-2 Acc. regulator valve <ul style="list-style-type: none"> <li>• Stuck, nicked, damaged</li> <li>• Spring missing, damaged or too soft</li> </ul>	2. Determine source of contamination or damage. Service as required.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
1-2 Shift Feels Harsh or Soft — Continued	3. 1-2 Accumulator capacity modulator valve. • Valve stuck, nicked or damaged. • Spring missing or damaged.	3. Determine source of contamination or damage. Service as required.
	4. 1-2 Accumulator assembly. • Piston stuck or damaged. • Seal damaged or missing. • Springs damaged or missing.	4. Determine source of contamination or damage. Service as required.
1-2 Shift Speed High or Low  SEE ATSG BULLETIN 91-48, 90-15, 89-59, 89-52,	1. Governor Pressure. • Weights binding. • Springs damaged. • Gear damaged. • Shaft seal or valve stuck or missing. • Governor tube leaking/damaged.	1. Perform governor test. Service as required.
	2. Control Assembly: TV control valve, TV plunger, TV line modulator valve, 1-2 throttle delay valve. • Valve(s) stuck, nicked or damaged. • Spring(s) missing or damaged.	2. Determine source of contamination. Service as required.
No 2-3 Shift (1-2 Shift OK)  SEE ATSG BULLETIN 91-48, 89-42, 89-40, 89-14, 88-55, 88-25	1. Governor assembly. • Weights binding. • Springs damaged. • Gear damaged. • Shaft seal or valve stuck or missing. • Governor tube leaking/damaged.	1. Perform governor test. Service as required.
	2. Low/Intermediate servo. • Wrong apply rod (too long). • Servo bore or piston damaged. • Piston seals damaged/missing. • Missing/broken return spring or retaining clip.	2. Install correct apply rod, if required. Determine source of contamination. Service as required.
	3. Direct clutch assembly. • Clutch plates damaged/missing. • Piston or seals damaged. • Ball check assembly stuck or missing. • Cylinder damage.	3. Determine source of contamination or damage. Service as required.
	4. Direct/Intermediate clutch hub. • Seals damaged or missing or holes blocked.	4. Determine source of contamination. Service as required.
	5. Driven sprocket support. • Seals damaged or missing or holes blocked.	5. Determine source of contamination. Service as required.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
No 2-3 Shift (1-2 Shift OK) — Continued	6. Direct one-way clutch assembly. • Damaged cage/rollers/springs. • Missing rollers. • Misassembled on inner race.	6. Disassemble and inspect. Service as required.
	7. Control assembly. • Bolts too loose or too tight.	7. Tighten to specification.
	8. 2-3 shift valve. • Valve stuck, nicked or damaged.	8. Determine source of contamination. Service as required.
	9. No. 4 check ball missing.	9. Service as required.
	10. Bypass solenoid. • Not energized during wide open throttle upshift.	10. Refer to Electrical System Diagnosis in this Section.
	11. Case servo release passage. • Blocked.	11. Determine source of blockage. Service as required.
	12. Servo release tube. • Leaking. • Improperly installed.	12. Service as required.
	13. Direct clutch pressure tap plug loose/missing.	13. Service as required.
2-3 Shift Feels Harsh or Soft SEE ATSG BULLETIN 91-49, 91-48, 90-17, 90-15, 89-60, 89-59, 89-52, 89-42, 89-14, 88-55, 88-25, 87-50, 87-21	1. Low oil pressure.	1. Perform control pressure test. Service as required.
	2. Low/intermediate servo. • Wrong apply rod length. • Piston, seal, springs or rod damaged.	2. Install correct apply rod, if required. Determine source of damage. Service as required.
	3. 2-3 servo regulator valve. • Valve stuck, nicked or damaged. • Spring damaged.	3. Determine source of contamination or damage. Service as required.
	4. Backout valve. • Valve stuck, nicked or damaged. • Spring damaged.	4. Determine source of contamination or damage. Service as required.
2-3 Shift Speed High or Low SEE ATSG BULLETIN 91-48, 90-15, 89-59, 89-52, 89-42	1. Governor pressure. • Weights binding. • Springs damaged. • Gear damaged. • Shaft seal or valve damaged or missing. • Governor tube leaking/damaged.	1. Perform governor pressure test. Service as required.
	2. TV cable. • Damaged. • Disconnected.	2. Service cable as required.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
2-3 Shift Speed High or Low — Continued	3. Control assembly: TV control valve, TV plunger, TV line modulator valve, 2-3 throttle modulator valve. <ul style="list-style-type: none"> <li>• Valve(s) stuck, nicked or damaged.</li> <li>• Spring(s) missing or damaged.</li> <li>• Governor tube leaking.</li> </ul>	3. Determine source of contamination or damage. Service as required.
No 3-4 Shift SEE ATSG BULLETIN 91-48, 90-15, 90-14, 89-52, 89-42	1. Governor assembly. <ul style="list-style-type: none"> <li>• Weights binding.</li> <li>• Springs damaged.</li> <li>• Gear damaged.</li> <li>• Shaft seal or valve leaking or missing.</li> </ul>	1. Perform governor test. Service as required.
	2. Overdrive band assembly not holding.	2. Perform air pressure test. Service as required.
	3. Overdrive servo assembly. <ul style="list-style-type: none"> <li>• Wrong apply rod (too long).</li> <li>• Servo bore or piston damaged.</li> <li>• Piston seals damaged or missing.</li> <li>• Missing or broken return spring or retaining clip.</li> </ul>	3. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	4. Forward clutch assembly. <ul style="list-style-type: none"> <li>• Damaged return springs/piston.</li> </ul>	4. Determine source of damage. Service as required.
	5. Front ring gear. <ul style="list-style-type: none"> <li>• Damaged.</li> </ul>	5. Determine source of damage. Service as required.
	6. Control assembly too loose or too tight.	6. Tighten bolts to specification.
	7. 3-4 shift valve. <ul style="list-style-type: none"> <li>• Valve stuck, nicked or damaged.</li> <li>• Spring damaged.</li> </ul>	7. Determine source of contamination or damage. Service as required.
	8. 3-4 modulator valve. <ul style="list-style-type: none"> <li>• Valve stuck, nicked or damaged.</li> <li>• Spring missing.</li> </ul>	8. Determine source of contamination or damage. Service as required.
	9. 4-3 scheduling valve. <ul style="list-style-type: none"> <li>• Valve stuck, nicked or damaged.</li> <li>• Spring missing.</li> </ul>	9. Determine source of contamination. Service as required.
3-4 Shift Feels Harsh or Soft SEE ATSG BULLETIN 91-48, 90-17, 90-15, 90-14, 89-60, 89-59, 89-52, 88-58, 87-50, 87-21	1. Oil pressure too high or too low.	1. Perform control pressure test.
	2. 3-4 Accumulator assembly. <ul style="list-style-type: none"> <li>• Accumulator piston stuck or damaged.</li> <li>• Piston seal missing or damaged.</li> <li>• Springs missing or damaged.</li> </ul>	2. Determine source of contamination. Service as required.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
3-4 Shift Feels Harsh or Soft — Continued	3. No 14 ball check. • Ball missing.	3. Replace check ball.
3-4 Shift Speed High or Low  SEE ATSG BULLETIN 91-48, 90-15, 89-59, 89-52, 89-42	1. Governor Pressure. • Weights binding. • Springs damaged. • Gear damaged. • Shaft seal or valve missing or damaged. • Governor tube leaking.	1. Perform governor test. Service as required.
	2. TV cable. • Damaged. • Disconnected.	2. Service TV cable as required.
	3. Control assembly: TV control valve, TV plunger, TV line modulator valve, 3-4 modulator valve. • Valve(s) stuck, nicked or damaged. • Spring(s) missing or damaged.	3. Determine source of contamination or damage. Service as required.
No Converter Clutch Apply  SEE ATSG BULLETIN 91-48, 90-16, 89-69	1. Transaxle electrical system or electronic engine control. • No lock-up signal. • By-pass solenoid damaged or inoperative. • Bulkhead connector damaged. • Pinched wires. • 4-3 pressure switch, 3-2 pressure switch inoperative.	1. Refer to Electrical System Diagnosis in this Section.
	2. Channel Plate. • Converter clutch blowoff ball check not seating or damaged.	2. Determine source of contamination or damage. Service as required.
	3. Turbine shaft. • Damaged seals.	3. Determine source of contamination. Service as required.
	4. Bypass clutch control valve. • Bypass clutch control valve stuck. • Bypass plunger stuck.	4. Determine source of contamination. Service as required.
	5. Pump shaft seals. • Missing or damaged.	5. Determine source of contamination or damage. Service as required.
	6. Valve body pilot sleeve. • Damaged/misaligned.	6. Determine source of damage. Service as required.
Converter Clutch Does Not Release  SEE ATSG BULLETIN 91-48, 90-16, 89-69	1. Electronic engine control. • No unlock signal. • Bypass solenoid damaged or inoperative.	1. Refer to Electrical System Diagnosis in this Section.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
Converter Clutch Does Not Release — Continued	2. Bypass Clutch Control Valve or Plunger Valve. • Valve stuck, nicked or damaged.	2. Determine source of contamination. Service as required.
4-3 Downshifts Harsh	1. Overdrive servo assembly. • Incorrect servo apply rod length. • Damaged servo piston or seal. • Damaged or missing springs.	1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
3-2 Downshift Harsh SEE ATSG BULLETIN 91-48, 90-17, 90-15, 89-52, 89-42, 87-50, 87-21	1. Low/intermediate servo assembly. • Damaged or missing springs. • Incorrect servo apply rod length.	1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.
	2. 3-2 Control valve. • Valve stuck, nicked or damaged.	2. Determine source of contamination. Service as required.
	3. No. 5 ball check. • Ball missing.	3. Replace ball check.
3-1, 2-1 Downshift Harsh SEE ATSG BULLETIN 91-48, 90-17, 90-15, 89-52, 89-42, 88-62, 87-50, 87-21	1. Low/intermediate servo assembly. • Damaged servo piston or seal. • Damaged or missing springs. • Incorrect servo apply rod length.	1. Install correct apply rod, if required. Determine source of damage. Service as required.
	2. No. 9 ball check. • Ball missing (3-1 only).	2. Replace ball check.
No Drive in Drive Range SEE ATSG BULLETIN 90-16, 89-61, 89-57, 89-17, 88-64, 88-62, 88-13, 87-47, 86-45	1. Oil level low.	1. Service as required.
	2. Oil pressure. • Pressure too low.	2. Perform control pressure test. Service as required.
	3. Manual linkage. • Misadjusted, disconnected, damaged, broken, bent, missing TV linkage.	3. Service as required.
	4. Oil pump assembly. • Oil pump worn or damaged. • Oil pump drive shaft damaged.	4. Determine source of damage. Service as required.
	5. Drive chain assembly. • Damaged/broken.	5. Determine source of damage. Service as required.
	6. Drive sprocket. • Sprocket shaft to converter turbine spline damaged.	6. Determine source of damage. Service as required.
	7. Driven sprocket. • Sprocket shaft to direct/intermediate clutch hub damaged.	7. Determine source of damage. Service as required.



## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
No Drive in Drive Range — Continued	8. Forward clutch assembly. • Burned or missing clutch plates. • Damaged piston seals or pistons. • Forward clutch ball check assembly missing or damaged. • Driven sprocket support seals damaged/missing or holes blocked. • Direct intermediate clutch hub seals damaged/missing or holes blocked.	8. Determine source of contamination or damage. Service as required.
	9. Low one-way clutch. • Improperly assembled. • Damaged sprag.	9. Determine source of damage. Service as required.
	10. Front sun gear/shell. • Damaged.	10. Determine source of damage. Service as required.
	11. Front and rear carrier. • Damaged pinions/lugs to rear ring gear.	11. Determine source of damage. Service as required.
	12. Rear ring gear. • Damaged gear/lugs to forward carrier.	12. Determine source of damage. Service as required.
	13. Low/Intermediate band assembly. • Burned. • Broken ends.	13. Determine source of damage. Service as required.
	14. Low/Intermediate servo assembly. • Wrong apply rod (too short). • Piston/seal/rod damaged.	14. Install correct apply rod, if required. Determine source of contamination. Service as required.
	15. Low/Intermediate servo oil tubes. • Damaged (leaking oil). • Damaged case bores.	15. Service as required.
	16. Final drive assembly or final drive sun gear shaft. • Damaged pinions/gears.	16. Determine source of damage. Service as required.
	17. Output shaft. • Damaged splines/misassembled with axles.	17. Determine source of damage. Service as required.
	18. Halfshaft. • Damaged splines. • Disengaged from transaxle.	18. DETERMINE SOURCE OF DAMAGE AND SERVICE.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
<b>No Reverse</b>  <b>SEE ATSG BULLETIN 88-62</b>	1. Low oil pressure or low oil level. • See note at bottom of the page.	1. Perform control pressure test. Check oil level.
	2. Manual linkage. • Misadjusted, disconnected, damaged, broken, bent, missing TV linkage.	2. Service as required. Refer to Section 17-02.
	3. Oil pump assembly. • Oil pump damaged. • Oil pump drive shaft damaged.	3. Determine source of damage. Service as required.
	4. Drive chain assembly. • Damaged or broken.	4. Service as required.
	5. Drive sprocket. • Sprocket shaft-to-converter turbine spline damaged.	5. Determine source of damage. Service as required.
	6. Driven sprocket. • Sprocket shaft-to-direct/intermediate clutch hub damaged.	6. Determine source of damage. Service as required.
	7. Reverse clutch. • Burned or missing plates.	7. Determine source of damage. Service as required.
	8. Forward clutch assembly. • Burned or missing clutch plates. • Damaged piston seals or pistons. • Forward clutch ball check assembly missing or damaged. • Driven sprocket support seals damaged/missing or holes blocked. • Direct intermediate clutch hub seals damaged/missing or holes blocked.	8. Disassemble and inspect clutch assembly. Service as required.
	9. Low one-way clutch. • Improperly assembled. • Damaged sprag.	9. Service as required.
	10. Front and rear carriers. • Damaged pinions/lugs to rear ring gear.	10. Determine source of damage. Service as required.
	11. Reverse apply tube. • Leaking. • Improperly installed.	11. Service as required.

NOTE: NO PRESSURE WILL SHOW ON THE FORWARD CLUTCH PRESSURE TAP IN REVERSE.

## DIAGNOSIS AND TESTING

CONDITION	POSSIBLE SOURCE	ACTION
No Park Range	<ol style="list-style-type: none"> <li>1. Damaged park mechanism. <ul style="list-style-type: none"> <li>• Chipped or broken parking pawl or park gear.</li> <li>• Broken park pawl return spring.</li> <li>• Bent or broken actuating rod.</li> <li>• Manual linkage misadjusted.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Determine source of damage. Service as required.</li> </ol>
Harsh Neutral to Reverse or Harsh Neutral to Drive SEE ATSG BULLETIN 91-48, 90-17, 89-60, 88-62, 88-58, 87-50, 87-21	<ol style="list-style-type: none"> <li>1. Low/Intermediate servo assembly. <ul style="list-style-type: none"> <li>• Damaged or missing springs.</li> <li>• Incorrect servo apply rod length.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Install correct apply rod, if required. Determine source of contamination or damage. Service as required.</li> </ol>
	<ol style="list-style-type: none"> <li>2. 3-2 Control valve. <ul style="list-style-type: none"> <li>• Valve stuck, nicked or damaged.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>2. Determine source of contamination. Service as required.</li> </ol>
	<ol style="list-style-type: none"> <li>3. No. 5 ball check. <ul style="list-style-type: none"> <li>• Ball missing.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>3. Replace ball check.</li> </ol>
	<ol style="list-style-type: none"> <li>4. Neutral-Drive Accumulator Assembly. <ul style="list-style-type: none"> <li>• Accumulator piston stuck.</li> <li>• Accumulator seal damaged or missing.</li> <li>• Accumulator springs damaged or missing.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>4. Determine source of contamination. Service as required.</li> </ol>
	<ol style="list-style-type: none"> <li>5. No. 1 ball check. <ul style="list-style-type: none"> <li>• Ball missing (harsh reverse).</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>5. Replace ball check.</li> </ol>
	<ol style="list-style-type: none"> <li>6. Main control separator plate. <ul style="list-style-type: none"> <li>• Thermal elements do not close when warm.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>6. Service as required.</li> </ol>
Transaxle overheats	<ol style="list-style-type: none"> <li>1. Excessive tow loads.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check Owner's Manual for tow restriction.</li> </ol>
	<ol style="list-style-type: none"> <li>2. Improper fluid level.</li> </ol>	<ol style="list-style-type: none"> <li>2. Perform fluid level check.</li> </ol>
	<ol style="list-style-type: none"> <li>3. Incorrect engine idle or performance.</li> </ol>	<ol style="list-style-type: none"> <li>3. Turn or adjust engine idle.</li> </ol>
	<ol style="list-style-type: none"> <li>4. Improper clutch or band application, or oil pressure control system.</li> </ol>	<ol style="list-style-type: none"> <li>4. Perform control pressure test.</li> </ol>
	<ol style="list-style-type: none"> <li>5. Restriction in cooler or lines.</li> </ol>	<ol style="list-style-type: none"> <li>5. Service restriction.</li> </ol>
	<ol style="list-style-type: none"> <li>6. Seized converter one-way clutch.</li> </ol>	<ol style="list-style-type: none"> <li>6. Replace converter.</li> </ol>
	<ol style="list-style-type: none"> <li>7. Dirty or sticking valve body.</li> </ol>	<ol style="list-style-type: none"> <li>7. Clean, service or replace valve body.</li> </ol>
Transaxle fluid leaks	<ol style="list-style-type: none"> <li>1. Improper fluid level.</li> </ol>	<ol style="list-style-type: none"> <li>1. Perform fluid level check.</li> </ol>
	<ol style="list-style-type: none"> <li>2. Leakage at gaskets, seals, etc.</li> </ol>	<ol style="list-style-type: none"> <li>2. Remove all traces of lubrication on exposed surfaces of transaxle. Check the vent for free-breathing. Operate transaxle at normal temperatures and inspect for leakage. Service as required.</li> </ol>

# DIAGNOSIS AND TESTING

## Electrical System

The following tests are to be performed if a problem is found with the transaxle. Before these tests are performed, the Electronic Engine Control (EEC IV) Self-Test in the Engine/Emission Diagnosis\* manual should be performed to determine if any service codes for the transaxle appear. If any of the following service codes appear during the self-test, the AXOD drive cycle test for continuous codes should be performed:

### Service Codes

- **39** — Transaxle converter by-pass clutch not operating properly.
- **59** — 4/3 pressure switch circuit failed open.
- **62** — 4/3 and/or 3/2 pressure switch circuit failed closed. If code appears in Key On, Engine Off test, 3/2 circuit failed. If code appears in Engine Running test, 4/3 circuit failed. If code appears in both tests, both circuits failed.
- **69** — 3/2 circuit failed open.
- **89** — Transaxle converter by-pass clutch solenoid failed always open or always closed.

The following service codes are not transaxle related, but can affect converter clutch by-pass operation:

- **29** — Vehicle speed sensor (VSS) not functioning.
- **74** — Brake On/Off (BOO) switch always open or brake not applied during Engine Running On-demand self-test.
- **75** — Brake On/Off (BOO) switch always closed.

The following service code is for a transaxle component that may cause faulty engine idle speed control if not working properly:

- **57** — Neutral pressure (NPS) switch failed in NEUTRAL (open). The NPS is a normally open switch that closes with hydraulic pressure. Failure of the transaxle to engage in D or R would result in service code 57. Check for proper hydraulic function before testing electrical components.

After performing the EEC IV Self-Test, the following Drive Cycle for checking AXOD continuous codes must be performed.

1. Record and zero EEC IV Self-Test codes.
2. Warm engine to operating temperature.
3. With transaxle in D range, lightly accelerate from a stop to 64 km/h (40 mph), to allow transaxle to shift into third gear. Hold speed and throttle opening steady for a minimum of 15 seconds (30 seconds above 4,000 feet altitude).
4. Shift transaxle to (D) range and accelerate from 64 km/h (40 mph) to 80 km/h (50 mph), to allow transaxle to shift to fourth gear. Hold speed and throttle position steady for a minimum of 15 seconds.
5. With transaxle in fourth and maintaining steady speed and throttle opening, lightly apply and release brakes (to operate brakelamps). Then, hold speed and throttle opening steady for an additional 15 seconds minimum.
6. Brake to a stop and remain stopped for a minimum of 20 seconds with transaxle in (D) range.
7. Perform EEC IV Self-Test and record continuous codes.

If any of the following continuous codes appear, refer to the Diagnosis chart for that code:

**NOTE:** If any other continuous codes appear, service those codes first as they could affect the electrical operation of the transaxle.

### DIAGNOSIS CHART INDEX

Service Code	Pinpoint Test
39	A
59	B
62	C
69	D
89	E
57	F

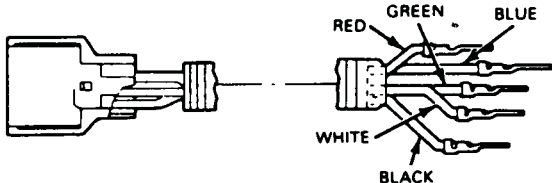
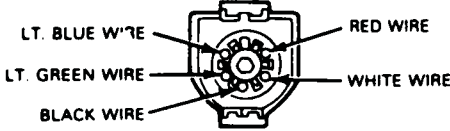
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\* Can be purchased as a separate item.

# DIAGNOSIS AND TESTING

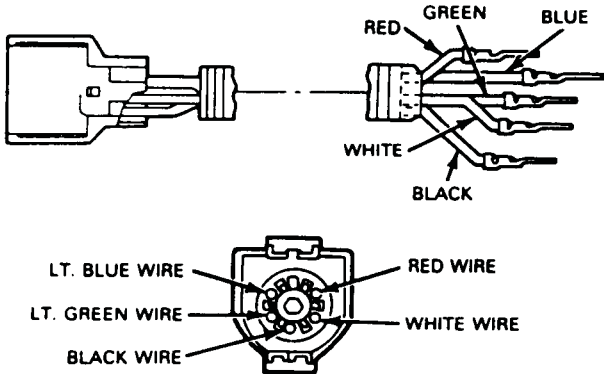
TEST STEP		RESULT	ACTION TO TAKE
<b>A1</b>	<b>CHECK HARNESS CONNECTIONS</b>		
<ul style="list-style-type: none"> <li>• Check that vehicle harness connector is fully engaged on the transaxle connector.</li> <li>• Check that vehicle harness connector terminals are fully engaged in the connector.</li> </ul>		<p>⓪ → GO to A2.</p> <p>ⓧ → SERVICE or REPLACE as required. REPEAT Self-Test.</p>	
<b>A2</b>	<b>CHECK RESISTANCE OF SOLENOID</b>		
<ul style="list-style-type: none"> <li>• Install service jumper harness to transaxle bulkhead connector.</li> <li>• Connect ohmmeter positive lead to red wire and negative lead to black wire.</li> <li>• Check resistance.</li> <li>• Resistance should be between 20-40 ohms.</li> </ul> <div> <p>Diagram illustrating the wiring connections for the solenoid. The top part shows a connector with wires labeled RED, GREEN, BLUE, WHITE, and BLACK. The bottom part shows a solenoid with wires labeled LT. BLUE WIRE, LT. GREEN WIRE, BLACK WIRE, RED WIRE, and WHITE WIRE.</p> </div> <p><b>CAUTION:</b> Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</p>		<p>⓪ → REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>ⓧ → GO to A3.</p>	

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>A3</b>	<b>CHECK BYPASS CLUTCH APPLICATION</b>		
<ul style="list-style-type: none"> <li>Connect service tool jumper harness red wire to battery + power supply.</li> <li>With engine running and transmission in 3rd gear, connect the service tool harness black wire to ground to energize bypass clutch solenoid.</li> </ul>   <p>SERVICE TOOL JUMPER</p> <p><b>CAUTION:</b> Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</p>		<p>Clutch applies — engine speed drops slightly</p> <p>Clutch does not apply — engine speed does not drop slightly</p>	<p>No electrical component failure.</p> <p>Bypass clutch solenoid operating properly.</p> <p>Error code may be indicating a slipping bypass clutch.</p> <p>Refer to torque converter service or transaxle diagnosis. "No Converter Clutch Apply."</p> <p>If transaxle service is required, REPEAT Self-Test after service.</p> <p>GO to A4.</p>
<b>A4</b>	<b>CHECK BYPASS VALVE</b>		
<ul style="list-style-type: none"> <li>Check main control bypass clutch control valve for sticking condition.</li> </ul>		<p>OK</p> <p>OK</p>	<p>GO to A5.</p> <p>SERVICE spool valve as necessary.</p>
<b>A5</b>	<b>CHECK BYPASS VALVE (Continued)</b>		
<ul style="list-style-type: none"> <li>Remove bypass solenoid valve.</li> <li>Check condition of O-ring.</li> <li>Shake valve to check for free armature.</li> </ul>		<p>OK</p> <p>OK</p>	<p>REFER to Torque Converter Service or Transaxle Diagnosis "No Converter Clutch Apply."</p> <p>If transaxle requires service, REPEAT Self-Test after service.</p> <p>REPLACE bypass clutch solenoid. REPEAT Self-Test.</p>

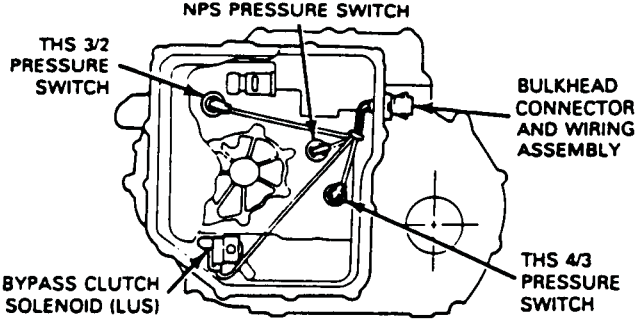


# DIAGNOSIS AND TESTING

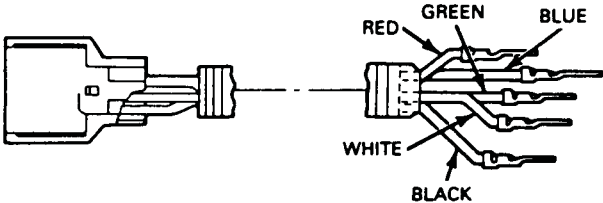
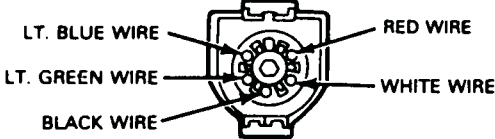
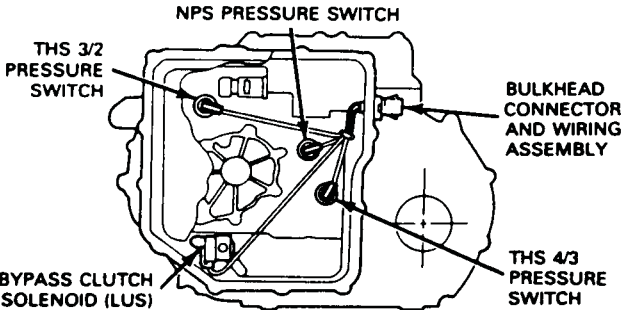
TEST STEP		RESULT	ACTION TO TAKE
<p><b>NOTE:</b> THS 4/3, 3/2 pressure switches are normally open switches that close with hydraulic pressure. Failure of transaxle to engage in DRIVE would result in service code 59; failure of transaxle to shift to 3rd gear would result in service code 69. Check for these proper hydraulic functions before testing electrical parts.</p>			
<b>B1</b>	<b>CHECK WIRING</b>		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>		<p>Ⓚ →</p> <p>Ⓚ →</p>	<p>GO to B2.</p> <p>SERVICE as required. REPEAT Self-Test.</p>
<b>B2</b>	<b>CHECK SWITCH FOR CONTINUITY</b>		
<ul style="list-style-type: none"> <li>Install service jumper harness on transmission bulkhead connector.</li> </ul>  <ul style="list-style-type: none"> <li>Check for continuity between engine ground and blue wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in NEUTRAL, ohmmeter should show NO continuity (infinite resistance).</li> <li>Shift transaxle into DRIVE. Switch should close and resistance should be less than 10 ohms.</li> <li>Switch should stay closed in 1st, 2nd, and 3rd gears, then open in 4th gear.</li> </ul>		<p>Circuit Ⓚ →</p> <p>Circuit Ⓚ →</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>GO to B3.</p>

\*Can be purchased as a separate item.

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>B3</b>	<b>CHECK INTERNAL CONNECTIONS</b>		
<ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with blue wire is firmly connected to THS 4/3 pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 		<p>OK ► GO to B4.</p> <p>✗ OK ► REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>B4</b>	<b>CHECK INTERNAL WIRING</b>		
<ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool blue wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>		<p>OK ► GO to B5.</p> <p>✗ OK ► REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>B5</b>	<b>CHECK THS 4/3 SWITCH</b>		
<ul style="list-style-type: none"> <li>Remove THS 4/3 pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>		<p>(No bubbles) OK ► GO to B6.</p> <p>(Bubbles) ✗ OK ► Diaphragm has failed. REPLACE THS 4/3 pressure switch. REPEAT Self-Test.</p>	
<b>B6</b>	<b>CHECK SWITCH RESISTANCE</b>		
<ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>Measured resistance should be less than 8.0 ohms.</li> </ul>		<p>OK ► Hydraulic circuit supplying pressure to switch may have excessive leakage. REFER to Main Control Assembly Service Section.</p> <p>✗ OK ► REPLACE switch. REPEAT Step B2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.</p>	

# DIAGNOSIS AND TESTING

TEST STEP	RESULT	ACTION TO TAKE
<p><b>NOTE:</b> If code 62 occurs <b>ONLY</b> in "Engine Running" Self-Test, then the 4/3 circuit has failed closed to ground.</p> <p>If code 62 occurs in "Key On, Engine Off" Self-Test, then the 3/2 circuit has failed closed to ground.</p> <p>If code 62 occurs in both Sections of Self-Test, follow this entire procedure to determine which circuit has failed.</p>		
<p><b>C1</b> CHECK WIRING</p> <ul style="list-style-type: none"> <li>Remove vehicle harness connector from the transaxle bulkhead connector and install service tool jumper harness.</li> <li>Measure for continuity between engine ground and white wire (THS 3/2 circuit) with an ohmmeter. Infinite resistance should be measured with engine off.</li> <li>Measure resistance between engine ground and the blue wire (THS 4/3 circuit). Infinite resistance should be measured with the engine off and engine running in NEUTRAL.</li> </ul>   	<p>(Infinite resistance readings)</p> <p>OK</p> <p>GO to C2.</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section. PERFORM service on codes as required.</p> <p>GO to C2.</p>

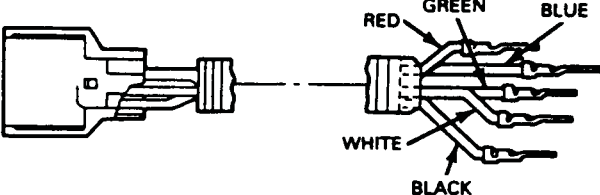
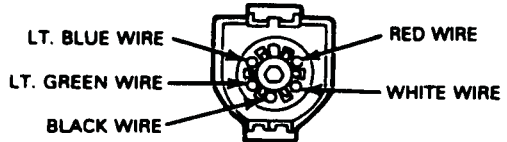
\*Can be purchased as a separate item.

## DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>C2</b>	<b>CHECK INTERNAL WIRING</b>		
<ul style="list-style-type: none"> <li>Remove the oil pan and check for pinched, cut or otherwise grounded wiring.</li> </ul>		Wiring OK, for 3/2 switch	GO to C3.
		Wiring OK for 4/3 switch	GO to C4.
		Wiring is pinched, cut or grounded	REPLACE transaxle bulkhead wiring. REPEAT Self-Test.
<b>C3</b>	<b>CHECK 3/2 SWITCH</b>		
<ul style="list-style-type: none"> <li>Remove wiring connector from 3/2 pressure switch.</li> <li>Measure the pressure switch for continuity to engine ground by connecting one ohmmeter lead to pressure switch terminal and the other ohmmeter lead to the valve body.</li> </ul>		Infinite resistance	GO to C5.
		Continuity to ground	REPLACE 3/2 pressure switch. REPEAT Self-Test.
<b>C4</b>	<b>CHECK 4/3 SWITCH</b>		
<ul style="list-style-type: none"> <li>Remove wiring connector from 4/3 pressure switch.</li> <li>Measure the pressure switch for continuity to engine ground by connecting one ohmmeter lead to pressure switch terminal and the other ohmmeter lead to the valve body.</li> </ul>		Infinite resistance	GO to C5.
		Continuity to ground	REPLACE 4/3 pressure switch. REPEAT Self-Test.
<b>C5</b>	<b>CHECK INTERNAL WIRES</b>		
<ul style="list-style-type: none"> <li>With both wires removed from the pressure switches, check for continuity to ground.</li> <li>Connect one ohmmeter lead to white wire and other ohmmeter lead to ground.</li> <li>Then connect one ohmmeter lead to blue wire and other ohmmeter lead to ground.</li> </ul> <p><b>NOTE: Make sure internal terminals are not resting against any metallic parts.</b></p>		Continuity to ground	REPLACE bulkhead connector. REPEAT Self-Test.
		Infinite resistance	REFER to Engine/Emission Diagnosis* manual, Volume H, Self-Test Section and PERFORM service on codes as required.

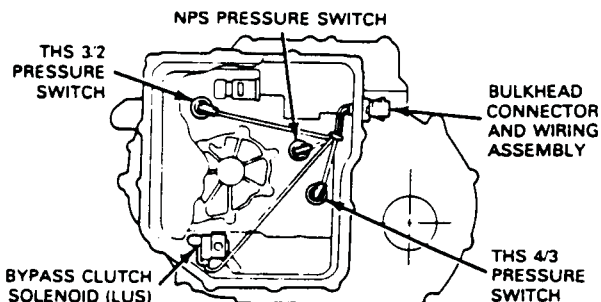
\*Can be purchased as a separate item.

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<p><b>NOTE:</b> The 4/3, 3/2 pressure switches are normally open switches that close with hydraulic pressure. Failure of transaxle to engage in DRIVE would result in service code 59; failure of transaxle to shift to 3rd gear would result in service code 69. Check for these proper hydraulic functions before testing electrical parts.</p>			
<b>D1</b>	<b>CHECK WIRING</b>		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>		<p>OK ►</p> <p>✗ OK ►</p>	<p>GO to D2.</p> <p>SERVICE as required. REPEAT Self-Test.</p>
<b>D2</b>	<b>CHECK SWITCH FOR CONTINUITY</b>		
<ul style="list-style-type: none"> <li>Install service tool jumper harness on transmission bulkhead connector.</li> </ul>   <ul style="list-style-type: none"> <li>Check for continuity between engine ground and white wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in DRIVE, 1st or 2nd gear, ohmmeter should show NO continuity (infinite resistance).</li> <li>When the transaxle shifts to 3rd or 4th gear, the switch should close and resistance should be less than 10 ohms between white wire and engine ground.</li> </ul>		<p>Circuit</p> <p>Circuit</p> <p>OK ►</p> <p>✗ OK ►</p>	<p>REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>GO to D3.</p>

\*Can be purchased as a separate item.

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>D3</b>	<b>CHECK INTERNAL CONNECTIONS</b>		
<ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with white wire is firmly connected to THS 3/2 pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 		<p>OK → GO to D4.</p> <p>✗ → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>D4</b>	<b>CHECK INTERNAL WIRING</b>		
<ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool white wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>		<p>OK → GO to D5.</p> <p>✗ → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
<b>D5</b>	<b>CHECK THS 3/2 SWITCH</b>		
<ul style="list-style-type: none"> <li>Remove THS 3/2 pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>		<p>(No bubbles) OK → GO to D6.</p> <p>(Bubbles) ✗ → Diaphragm has failed. REPLACE THS 3/2 pressure switch. REPEAT Self-Test.</p>	
<b>D6</b>	<b>CHECK SWITCH RESISTANCE</b>		
<ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>Measured resistance should be less than 8.0 ohms.</li> </ul>		<p>(Less than 8.0 ohms) OK → The hydraulic circuit supplying pressure to the switch may have excessive leakage. REFER to Main Control Assembly Service Section.</p> <p>(More than 8.0 ohms) ✗ → REPLACE switch. REPEAT D2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.</p>	



# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>NOTE: Code 39 may also be present. If so, refer to Pinpoint Test for Code 39.</b>			
<b>E1</b>	<b>CHECK HARNESS CONNECTIONS</b>		
<ul style="list-style-type: none"> <li>• Check that vehicle harness connector is fully engaged on the transaxle connector.</li> <li>• Check that vehicle harness connector terminals are fully engaged in the connector.</li> </ul>		(OK) ► GO to E2. (X) ► SERVICE or REPLACE as required. REPEAT Self-Test.	
<b>E2</b>	<b>CHECK RESISTANCE OF SOLENOID</b>		
<ul style="list-style-type: none"> <li>• Install service jumper harness to transaxle bulkhead connector.</li> <li>• Connect ohmmeter positive lead to red wire and negative lead to black wire.</li> <li>• Check resistance.</li> <li>• Resistance should be between 20-40 ohms.</li> </ul> <div> </div> <div> </div> <p><b>CAUTION:</b> Do not connect a power supply with reversed polarity to these wires or solenoid diode will be damaged.</p>		(OK) ► REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required. (X) ► GO to E3.	
<b>E3</b>	<b>CHECK INTERNAL CONNECTIONS</b>		
<ul style="list-style-type: none"> <li>• Remove transaxle side oil pan and check that internal connector is fully engaged in solenoid.</li> </ul>		(OK) ► GO to E4. (X) ► Fully ENGAGE connector and CHECK continuity. If resistance still is not 20-40 ohms, GO to E4. If resistance OK, REPEAT Self-Test.	

\*Can be purchased as a separate item.

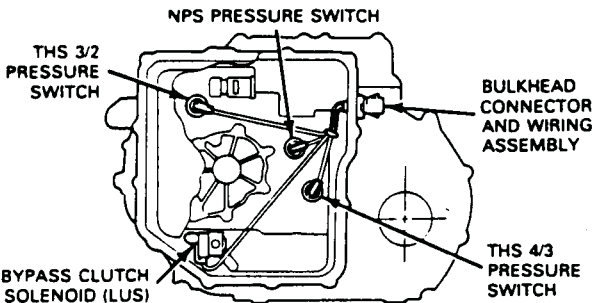
## DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<b>E4</b>	<b>CHECK SOLENOID CONTINUITY</b>		
<ul style="list-style-type: none"> <li>Remove connector from solenoid by pulling on wires at two-way connector.</li> <li>Check solenoid continuity by connecting an ohmmeter positive lead to the positive terminal and the negative lead to the negative terminal of the solenoid. (Polarity symbols + and - are stamped on the solenoid frame.)</li> </ul>		Open circuit (infinite resistance) <div>▶</div>	REPLACE solenoid. REPEAT Self-Test.
		Solenoid OK (20-40 ohms resistance) <div>▶</div>	REPLACE bulkhead connector and wiring assembly. RECONNECT all internal connectors and REPEAT E2. REPLACE oil pan, if OK. REPEAT Self-Test procedure, Key On, Engine Off On Demand Test. Code 89 should no longer appear.

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
<p><b>NOTE:</b> The NPS is a normally open switch that closes with hydraulic pressure. Failure of transaxle to engage in DRIVE or REVERSE would result in service code 57. Check for proper hydraulic functions before testing electrical components.</p>			
<b>F1</b>	<b>CHECK WIRING</b>		
<ul style="list-style-type: none"> <li>Check that vehicle harness connector is fully engaged on the transmission bulkhead connector and that the vehicle harness terminals are fully engaged in connector.</li> </ul>		<p>OK ► GO to F2.</p> <p>✗ OK ► SERVICE as required. REPEAT Self-Test.</p>	
<b>F2</b>	<b>CHECK SWITCH FOR CONTINUITY</b>		
<ul style="list-style-type: none"> <li>Install service jumper harness on transmission bulkhead connector.</li> </ul> <div> </div> <div> </div> <ul style="list-style-type: none"> <li>Check for continuity between engine ground and green wire with an ohmmeter or other low current tester (less than 200 milliamps).</li> <li>With engine running and transaxle in NEUTRAL or PARK, ohmmeter should show NO continuity (infinite resistance).</li> <li>Shift transaxle into REVERSE and DRIVE. Switch should close and resistance should be less than 10 ohms in both ranges.</li> </ul>		<p>Circuit OK ► REFER to Engine/Emissions Diagnosis* manual, Volume H Self-Test Section and PERFORM service on codes as required.</p> <p>Circuit ✗ OK ► GO to F3.</p>	

# DIAGNOSIS AND TESTING

TEST STEP		RESULT	ACTION TO TAKE
F3	CHECK INTERNAL CONNECTIONS		
<ul style="list-style-type: none"> <li>Remove transaxle side oil pan and check that internal connector with green wire is firmly connected to neutral pressure switch. Connector should not pull off easily or fit loosely.</li> </ul> 		<p>OK → GO to F4.</p> <p>✗ → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
F4	CHECK INTERNAL WIRING		
<ul style="list-style-type: none"> <li>Remove connector from pressure switch by pushing on end of connector, while pulling on wire end of connector.</li> <li>Check for continuity in the bulkhead connector by measuring resistance between service tool green wire and terminal inside connector just removed.</li> <li>Resistance should be less than 2.0 ohms.</li> </ul>		<p>OK → GO to F5.</p> <p>✗ → REPLACE bulkhead connector and wiring assembly. REPEAT Self-Test.</p>	
F5	CHECK THS NPS SWITCH		
<ul style="list-style-type: none"> <li>Remove neutral pressure switch and install in a 1/8-27 pipe fitting that can be connected to a low pressure air supply for pressure leak testing and switch closure.</li> </ul> <p><b>CAUTION: Do not test with water since internal switch materials will be damaged.</b></p> <ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied, check for ruptured diaphragm.</li> <li>Submerge switch in transmission oil and check for bubbles flowing out of small vent hole near the switch terminal.</li> </ul>		<p>(No bubbles) OK → GO to F6.</p> <p>(Bubbles) ✗ → Diaphragm has failed. REPLACE THS NPS pressure switch. REPEAT Self-Test.</p>	
F6	CHECK SWITCH RESISTANCE		
<ul style="list-style-type: none"> <li>With 345 kPa (50 psi) air pressure applied to switch, check resistance between switch terminal and switch case.</li> <li>Measured resistance should be less than 8.0 ohms.</li> </ul>		<p>(Less than 8.0 ohms) OK → The hydraulic circuit supplying pressure to the switch may have excessive leakage. REFER to Main Control Assembly Service Section.</p> <p>(More than 8.0 ohms) ✗ → REPLACE switch. REPEAT Step F2. Then, REPEAT Self-Test. Codes 39, 59, 62, 69 and 89 should no longer appear.</p>	

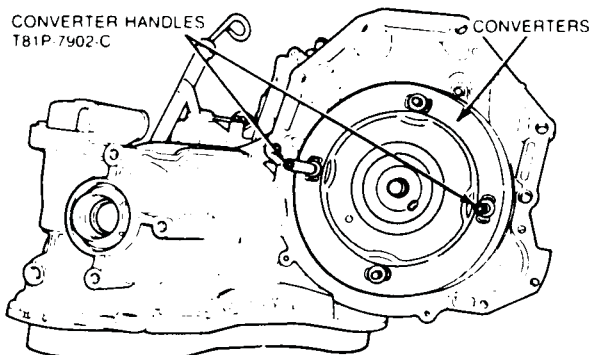
## DISASSEMBLY AND ASSEMBLY

### Transaxle

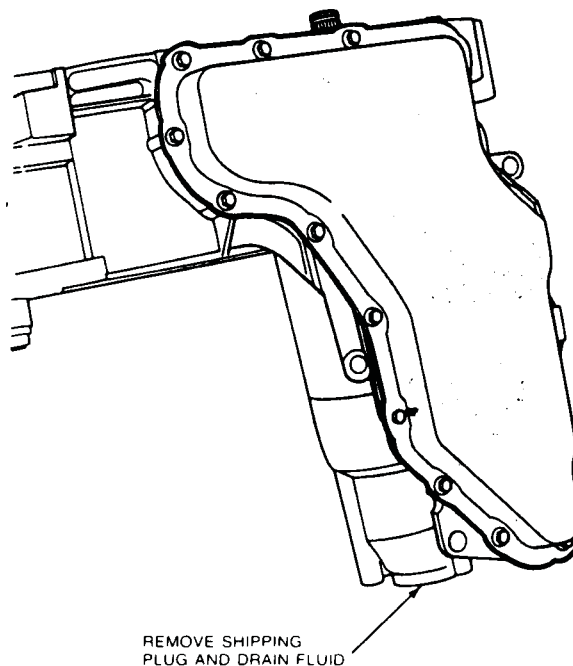
#### Disassembly

1. Install Converter Handles T81P-7902-C or equivalent. Remove converter from transaxle.

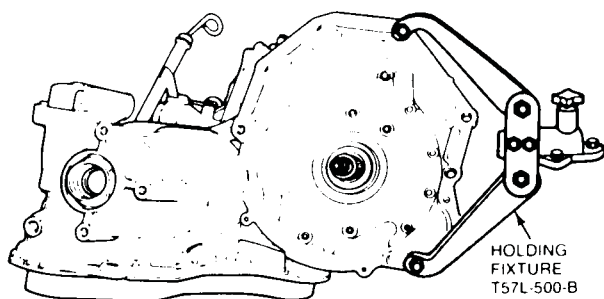
**CAUTION:** The torque converter is heavy. Be careful not to drop it.



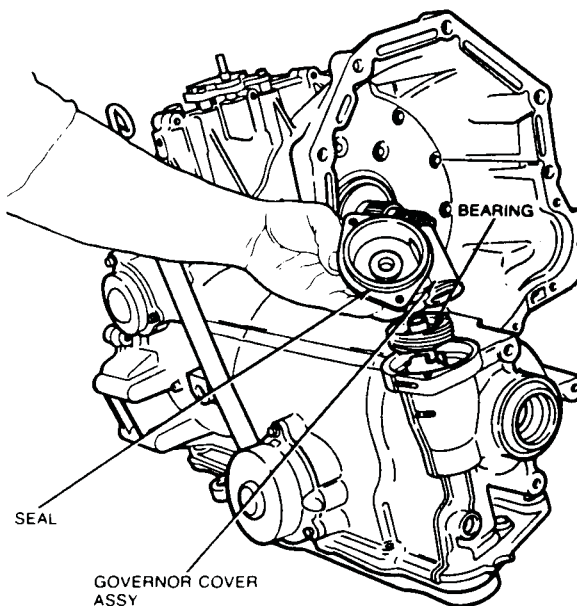
3. Turn transaxle in vertical position. Remove shipping plugs and drain fluid.



2. Mount transaxle in Holding Fixture T57L-500-B or equivalent.



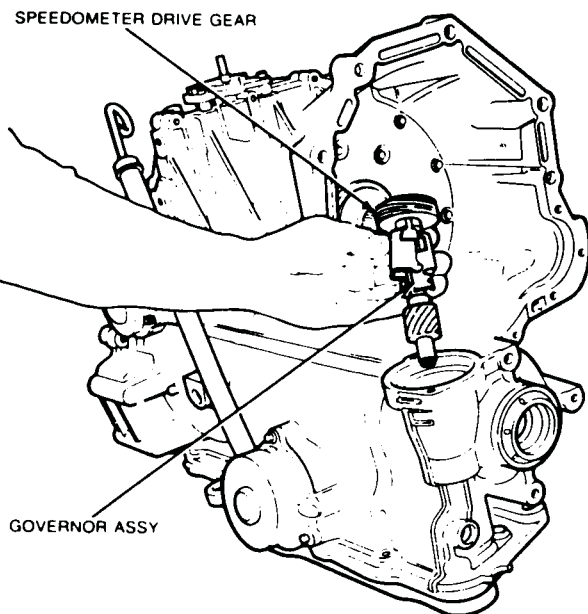
4. Return transaxle to horizontal position.
5. Remove two 8mm governor cover bolts, cover and seal. Discard seal. A new one must be installed during assembly.



DISASSEMBLY AND ASSEMBLY (Continued)

6. Lift governor and speedometer drive gear assembly, and bearing out of case.

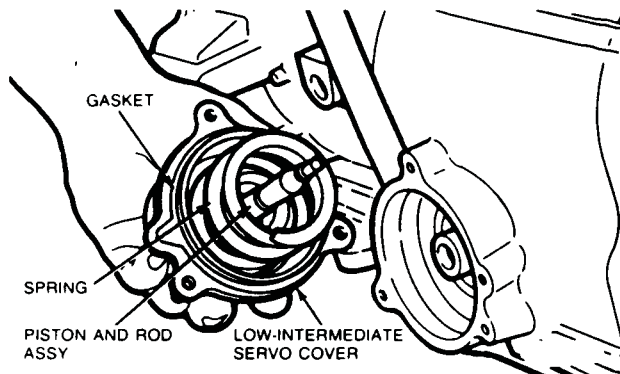
NOTE: Bearing sits on top of speedometer gear.



8. Remove three 8mm low-intermediate servo cover bolts, cover, piston assembly and spring.

9. Remove and discard gasket

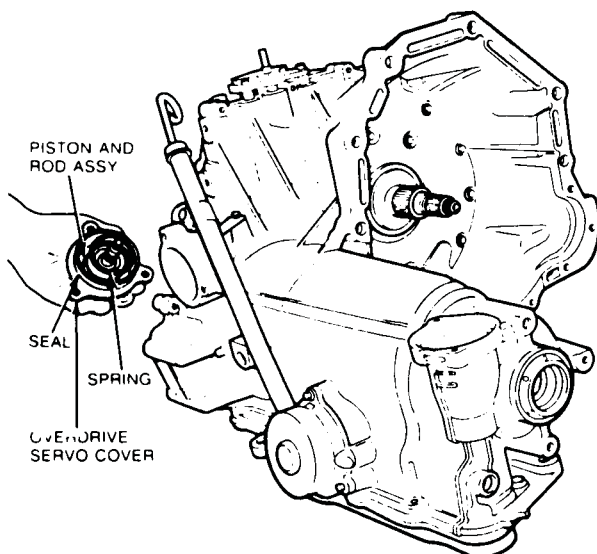
NOTE: Piston assembly and spring may remain in cover.



7. Remove three 8mm overdrive servo cover bolts, cover, piston assembly and spring.

NOTE: Discard O-ring seal on cover.

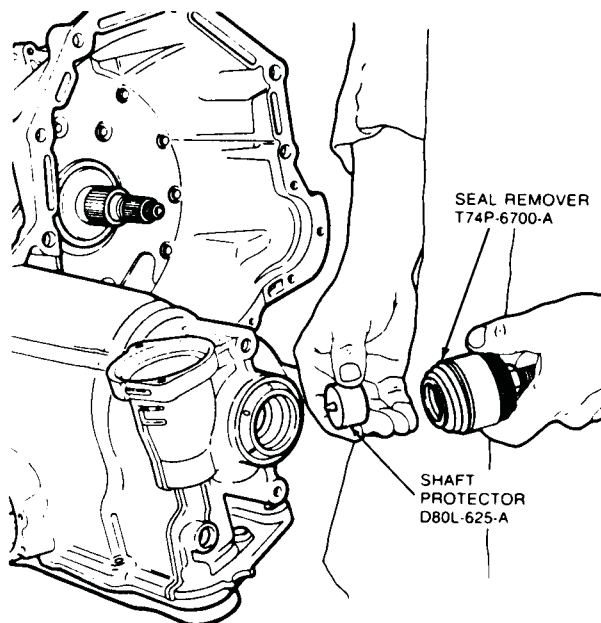
NOTE: Piston assembly and spring may remain in cover.



10. Remove RH output shaft seal as follows:

NOTE: Output shaft seal is a two-piece construction; outer metal protector and inner rubber seal.

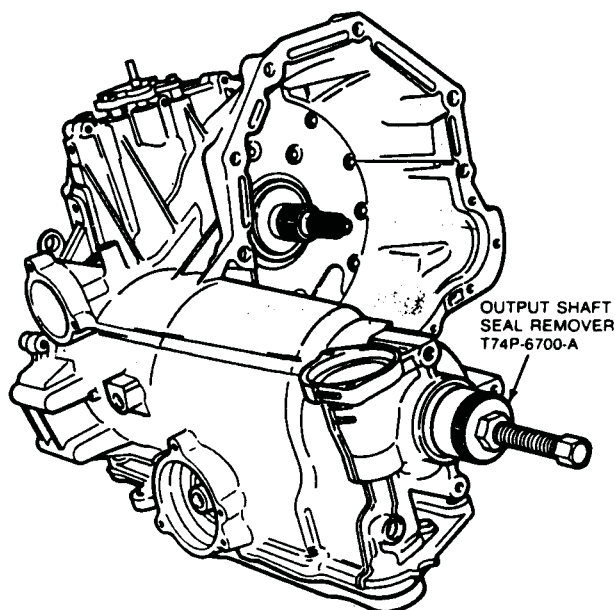
- a. Install Shaft Protector D80L-625-A or equivalent, into output shaft opening.



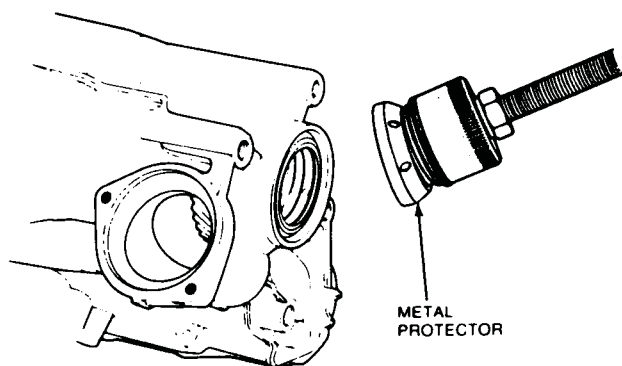


DISASSEMBLY AND ASSEMBLY (Continued)

- b. Screw Output Shaft Seal Remover T74P-6700-A or equivalent, into metal seal protector.

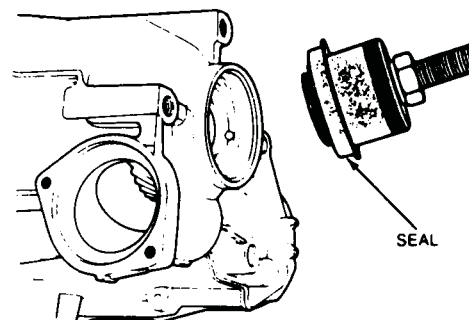


- c. Tighten screw on end of tool until the metal seal protector is removed.

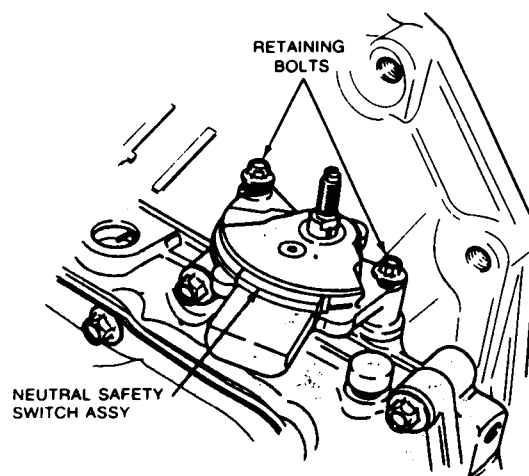


- d. Remove metal seal protector from tool, and install tool into seal.

- e. Tighten screw on the end of tool until seal is removed.

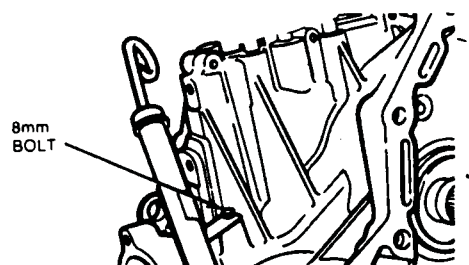


11. Remove two 8mm neutral safety switch retaining bolts and remove switch.

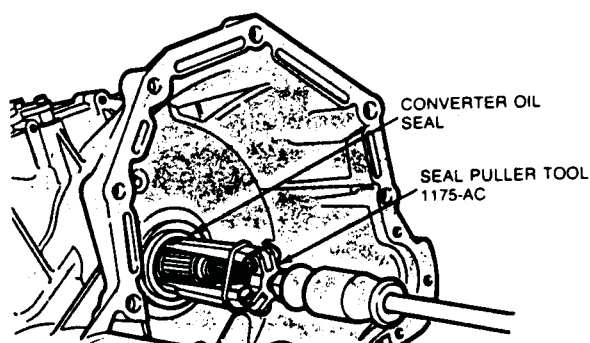


DISASSEMBLY AND ASSEMBLY (Continued)

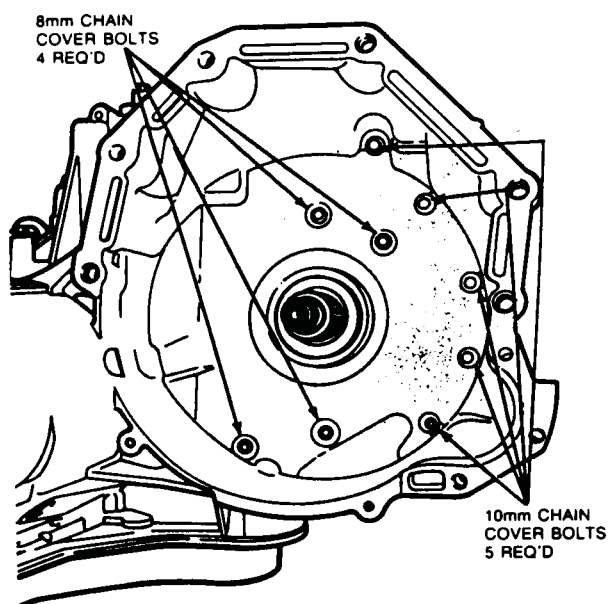
12. Remove one 8mm fluid level dipstick tube attaching bolt and pull tube from case.



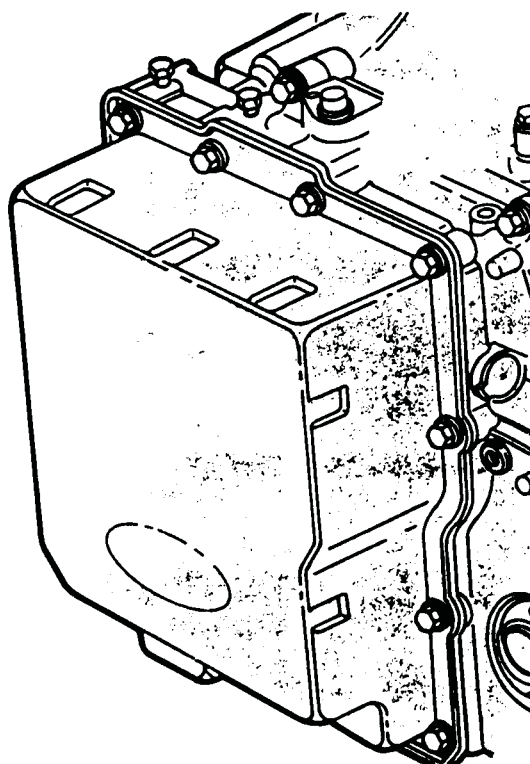
14. Remove converter oil seal using Seal Puller TOOL 1175-AC and Impact Slide Hammer T58L-101-A or equivalent.



13. Remove five 10mm and four 8mm chain cover bolts from inside torque converter housing.



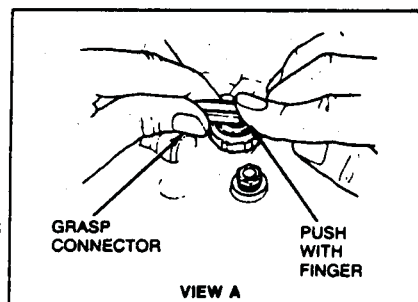
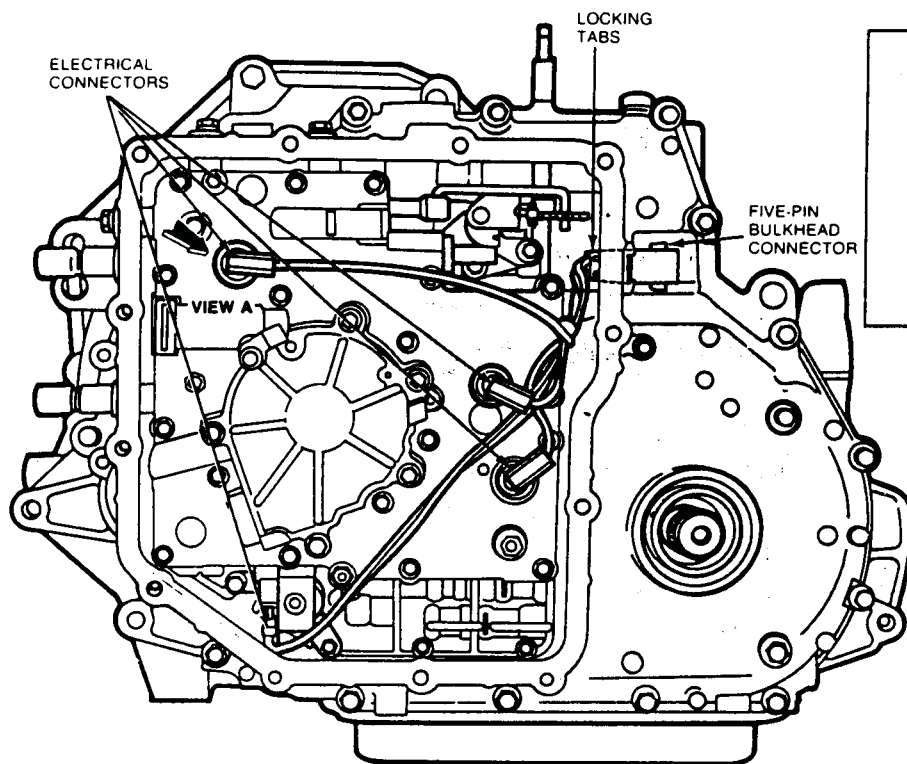
15. Remove twelve 10mm pump and valve body cover (upper reservoir) bolts. Remove cover and discard gasket.



DISASSEMBLY AND ASSEMBLY (Continued)

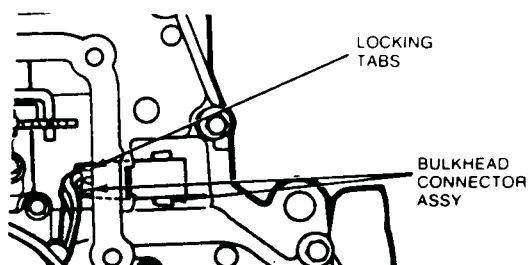
16. Disconnect four electrical connectors from pressure switches and solenoid.

**CAUTION:** Use both hands. Do not pull on wire.

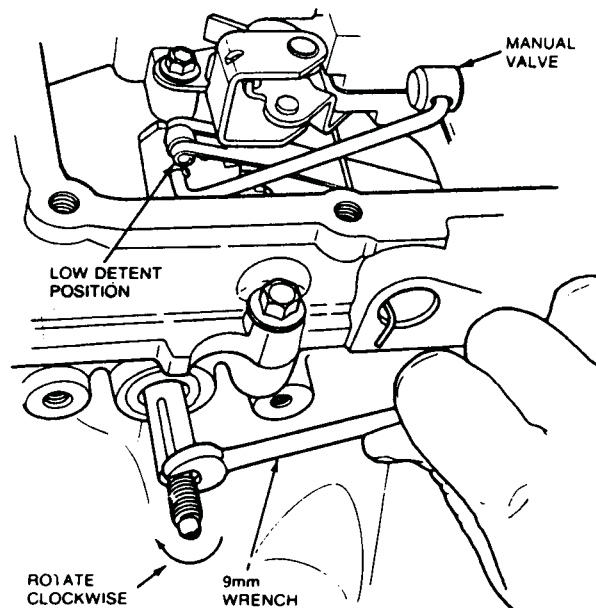


17. Compressing tabs on both sides of bulkhead connector from inside of chain cover, remove connector and wiring from chain cover.

**CAUTION:** Do not pull on wiring. Pull on connector.



18. Using a 9mm wrench on flats on end of manual shaft, rotate shaft clockwise to position manual linkage in LOW detent (valve positioned all the way in).

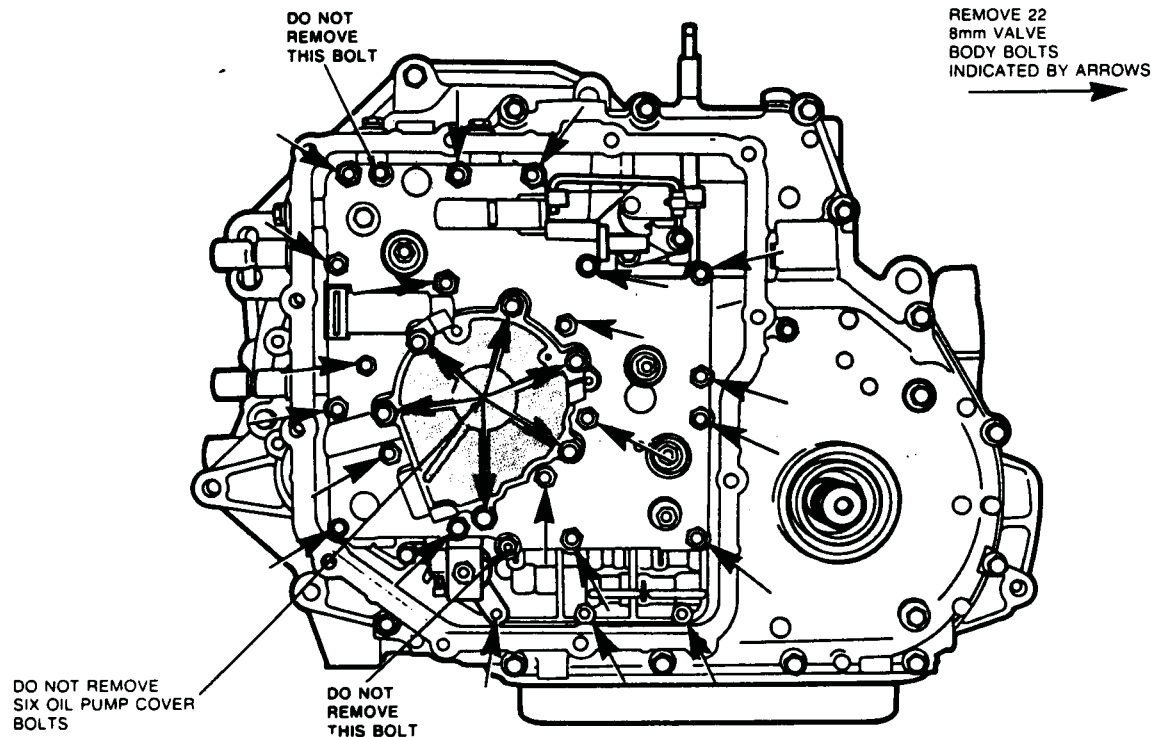


## DISASSEMBLY AND ASSEMBLY (Continued)

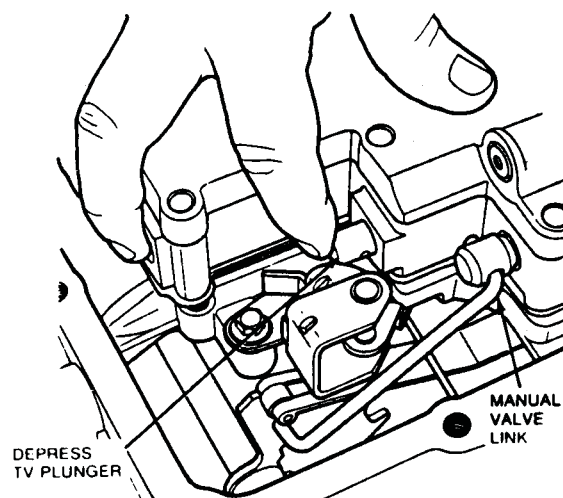
19. Remove 22 8mm oil pump and valve body attaching bolts. Note length and location of bolts.

**CAUTION:** Do not remove the two bolts that retain the oil pump and valve body assembly together.

**CAUTION:** Do not remove oil pump cover bolts.

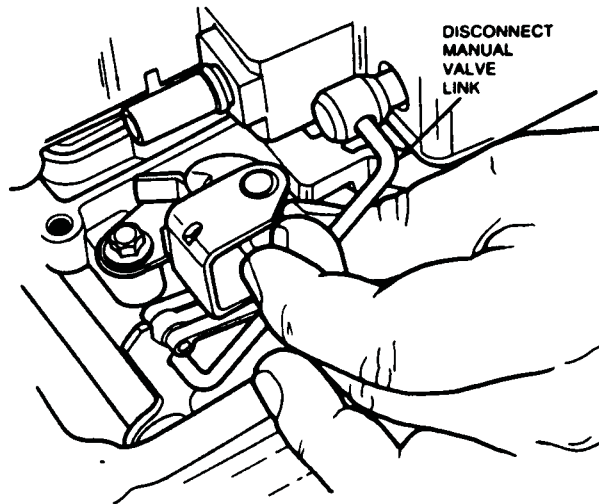


20. Push in TV plunger and pull oil pump and valve body assembly outward to clear throttle valve bracket. Rotate valve body clockwise and remove manual valve link from manual valve.

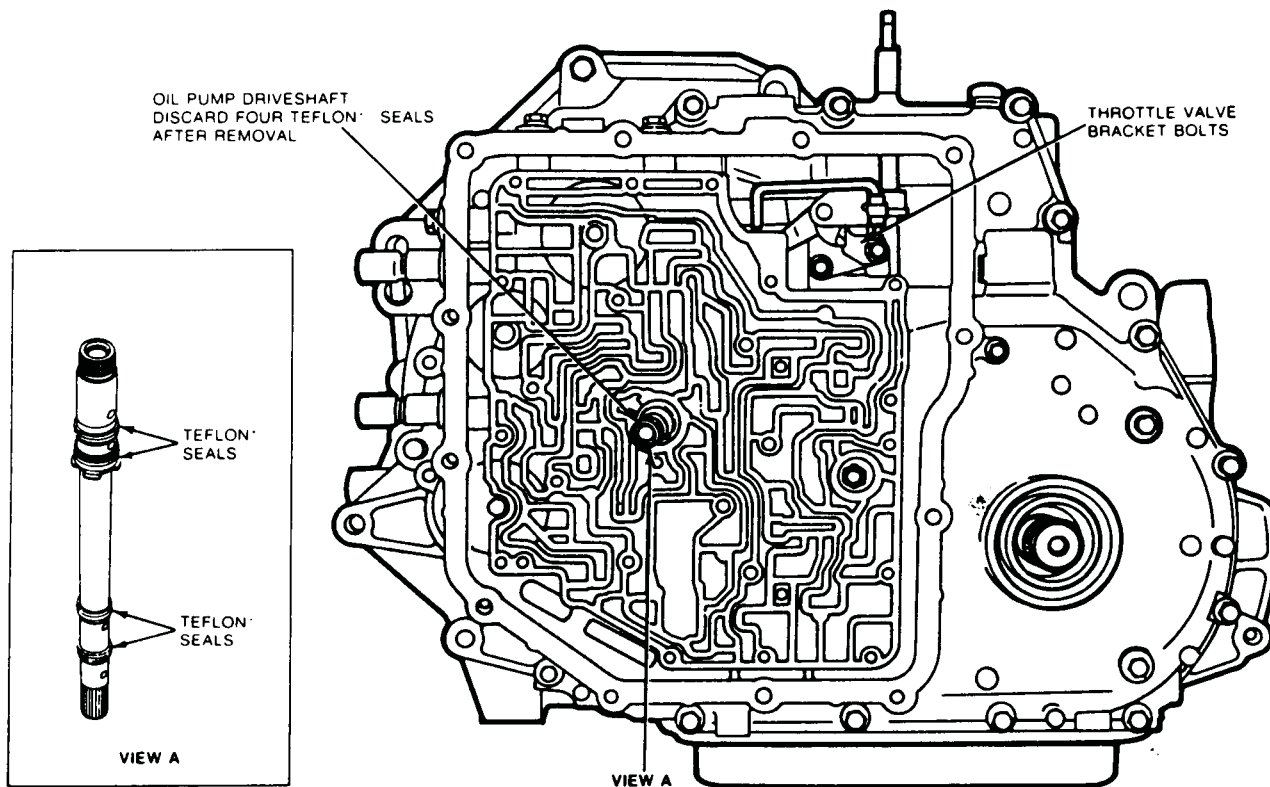


DISASSEMBLY AND ASSEMBLY (Continued)

21. Disconnect manual valve link from detent lever and remove pump and valve body assembly.

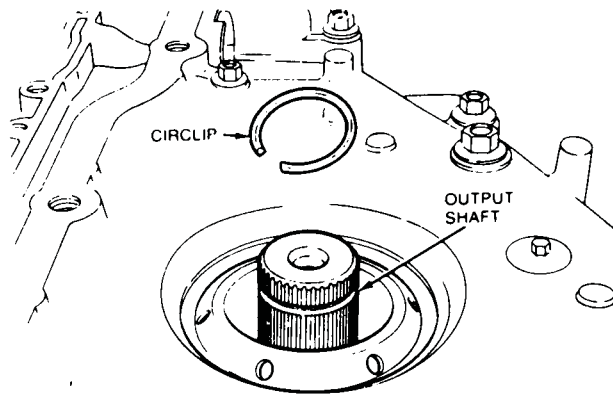


22. Remove two 8mm throttle valve bracket bolts from chain cover and remove bracket.
23. Pull oil pump driveshaft out of case. Remove and discard four Teflon® seals from pump shaft.

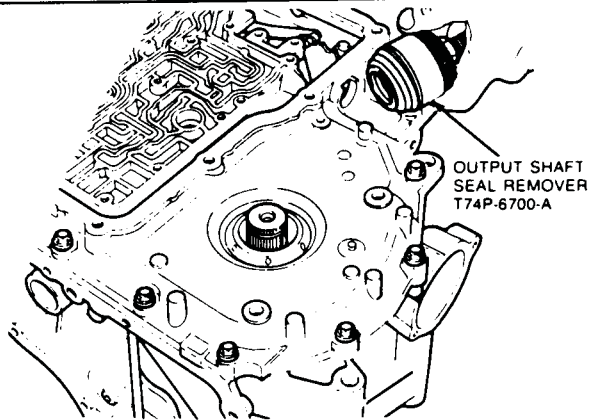


DISASSEMBLY AND ASSEMBLY (Continued)

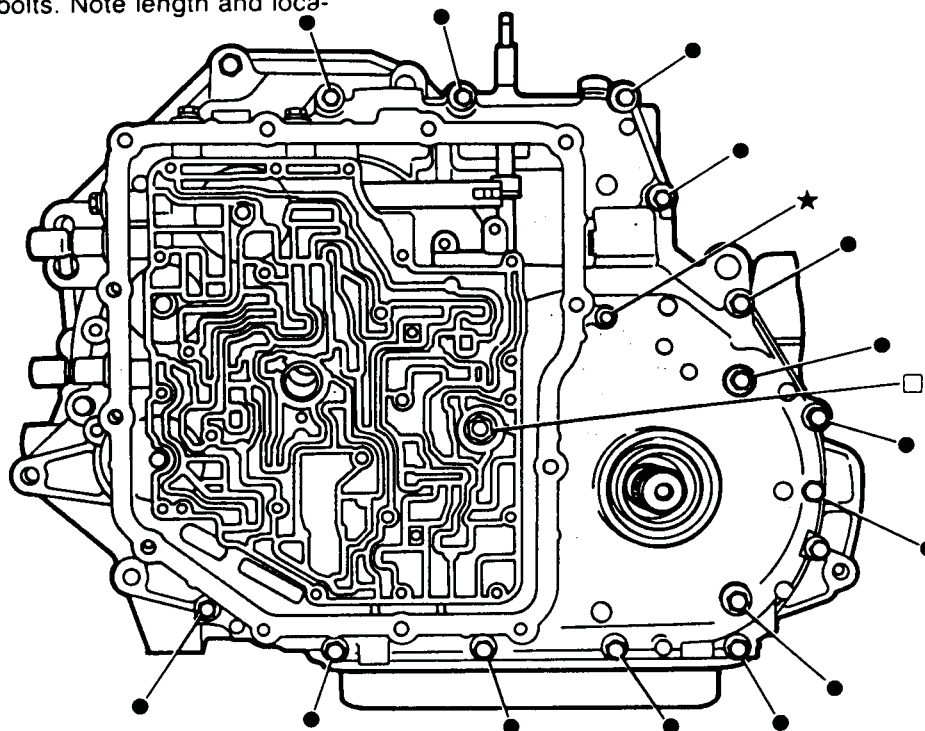
24. Rotate transaxle into vertical position.
25. Remove and discard output shaft circlip.



26. Remove LH output shaft seal as follows:
  - a. Screw T74P-6700-A or equivalent, into metal seal protector.
  - b. Tighten screw on the end of tool until metal seal protector is removed.
  - c. Remove metal seal protector from tool and install tool into seal.
  - d. Tighten screw on the end of tool until seal is removed.



27. Remove fourteen 10mm, one 13mm and one 8mm chain cover bolts. Note length and location of bolts.



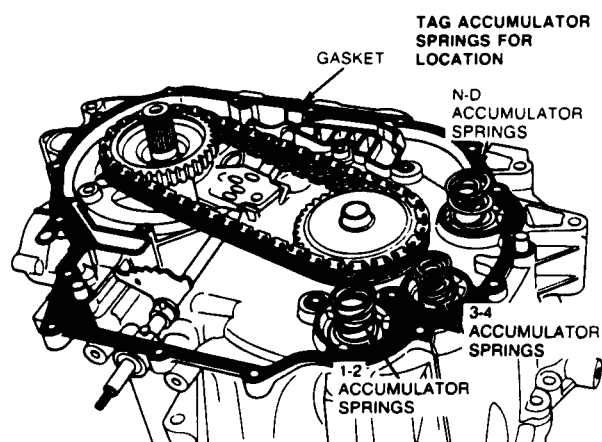
- ★ = 8mm BOLT  
● = 10mm BOLTS  
□ = 13mm BOLT



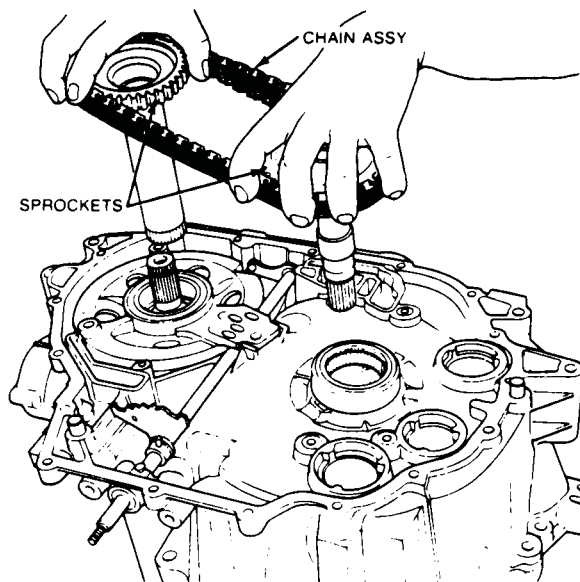
## DISASSEMBLY AND ASSEMBLY (Continued)

28. Remove chain cover and tag accumulator springs to be sure they are installed in their correct positions during assembly.

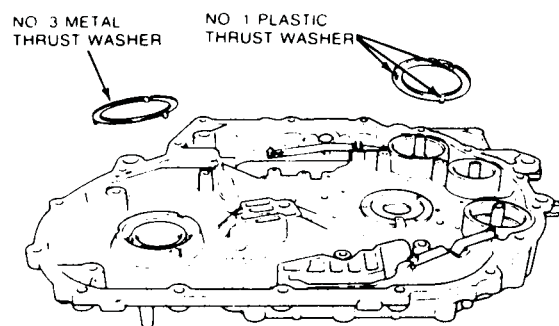
29. Remove and discard chain cover gasket.



31. Simultaneously, lift out both sprockets with chain assembly.

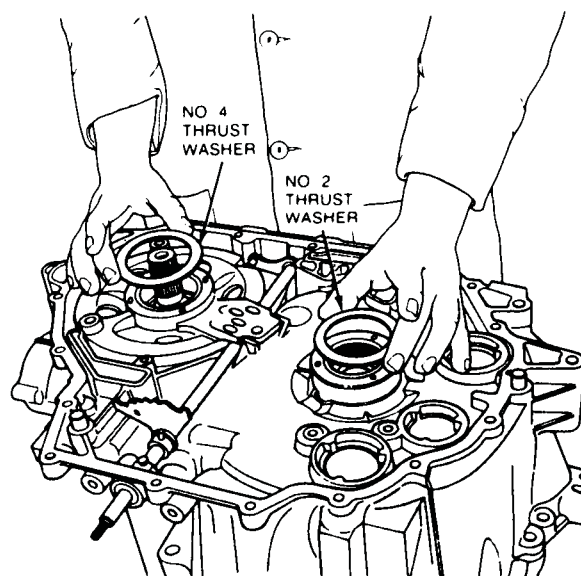


30. Remove No. 1 and No. 3 thrust washers from chain cover.



32. Remove No. 2 thrust washer from drive sprocket support and No. 4 thrust washer from driven sprocket support.

NOTE: No. 4 thrust washer may remain on driven sprocket.

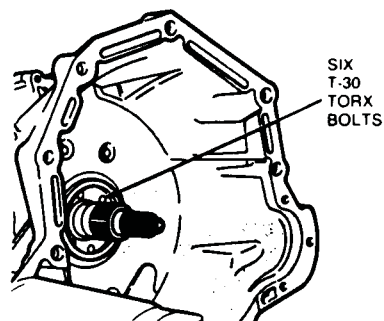
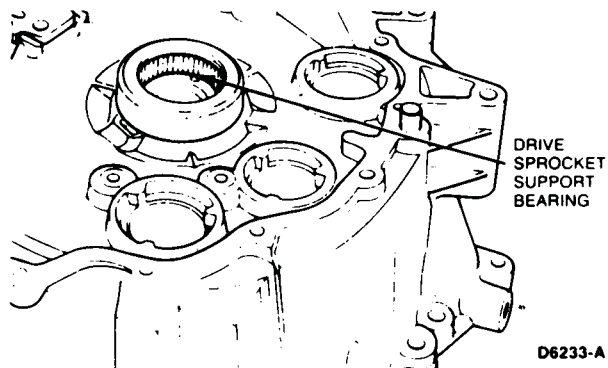




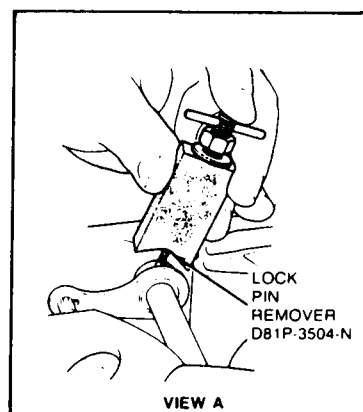
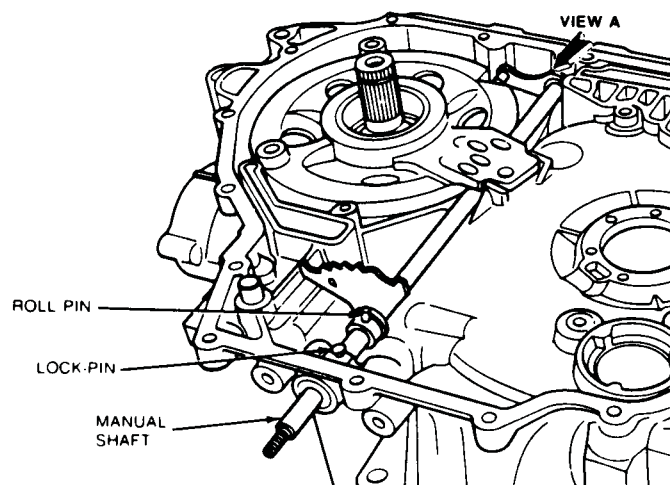
DISASSEMBLY AND ASSEMBLY (Continued)

33. Inspect drive sprocket support bearing to determine if it needs to be replaced.

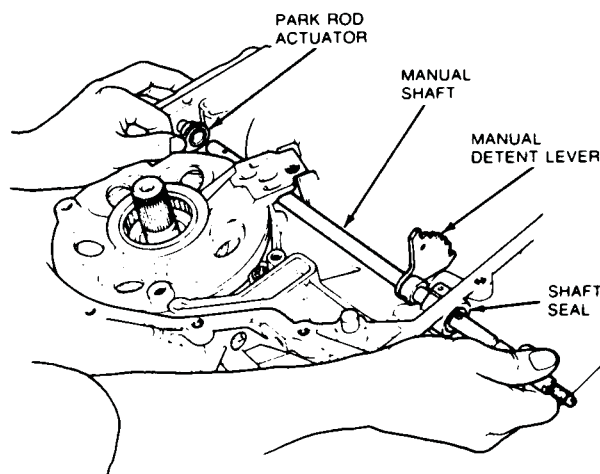
If bearing is OK, remove six T-30 Torx® bolts attaching support to case.



34. Remove and discard lock pin and two roll-pins from manual shaft using Lock Pin Remover D81P-3504-N or equivalent, being careful not to damage any machined surfaces.



35. Slide manual linkage shaft out of case. Then, pry seal out of case.



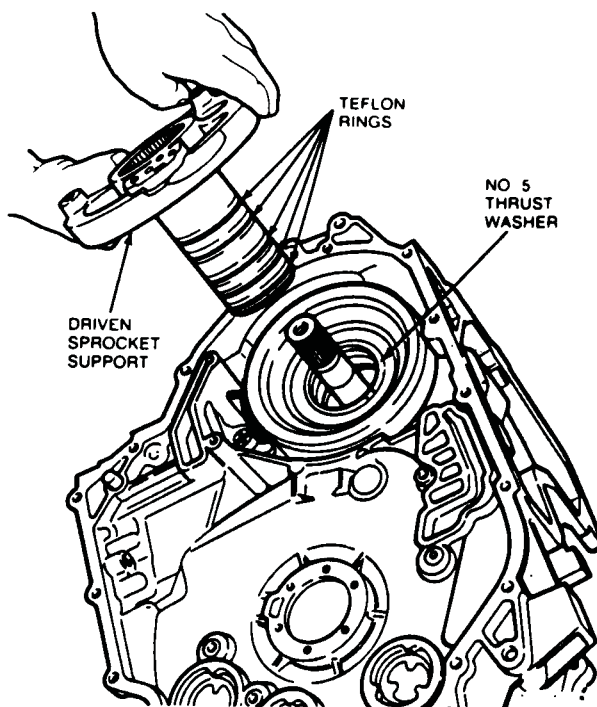
# DISASSEMBLY AND ASSEMBLY (Continued)

36. Remove driven sprocket support assembly and remove five Teflon® seals from support.

37. Remove No. 5 selective thrust washer.

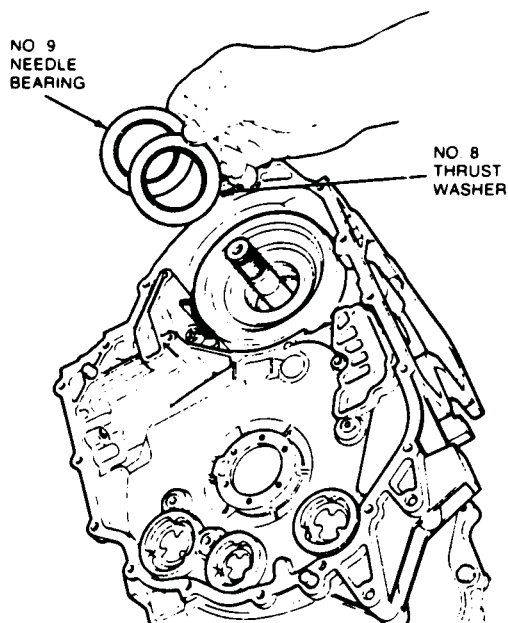
NOTE: Thrust washer may remain on sprocket support assembly.

NOTE: If support is binding it may be necessary to back out reverse clutch anchor bolt.

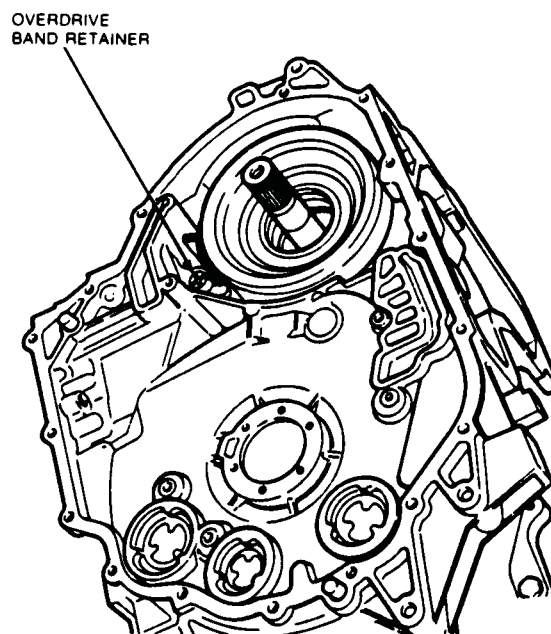


38. Using a wire hook, remove No. 8 selective thrust washer and No. 9 needle bearing from bottom of cylinder.

NOTE: Thrust washer and needle bearing may remain on driven sprocket support assembly when it is removed.

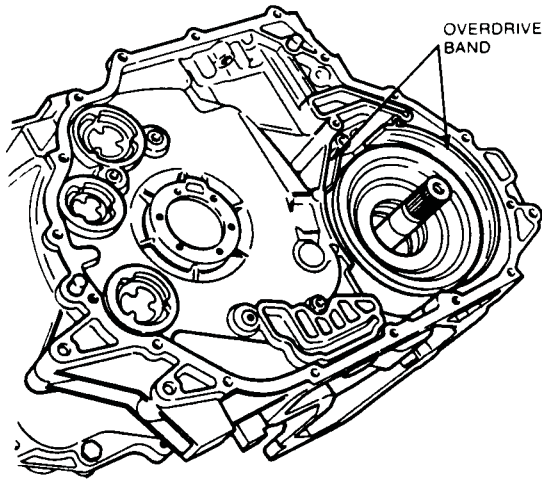


39. Remove plastic overdrive band retainer.

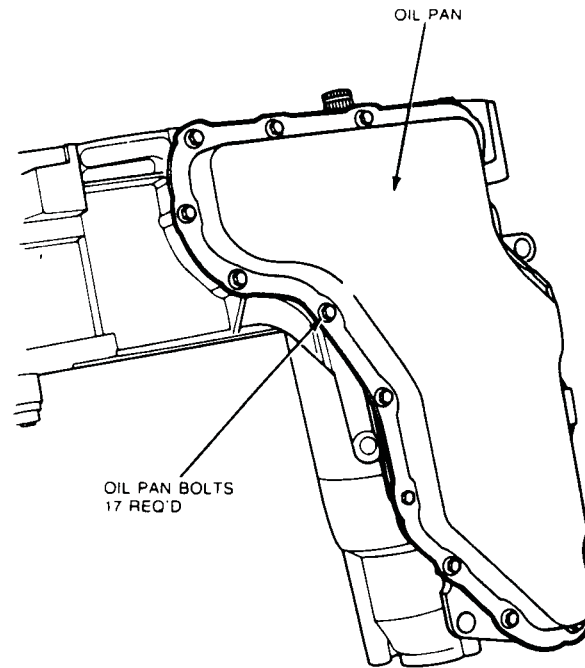


DISASSEMBLY AND ASSEMBLY (Continued)

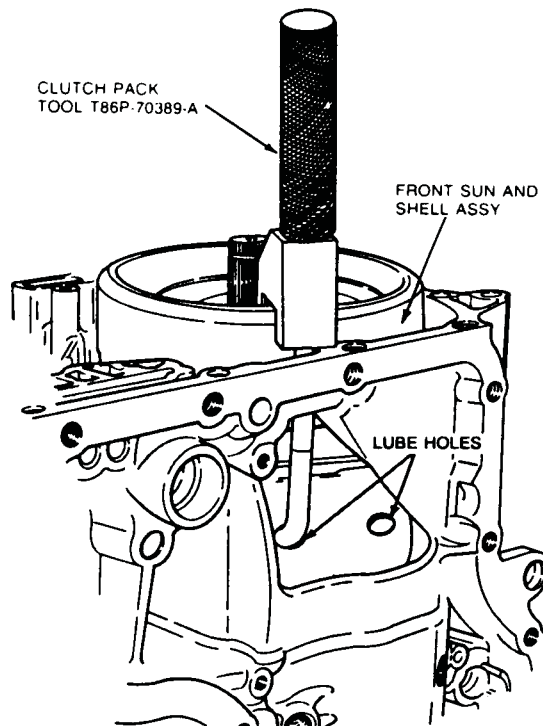
40. Remove overdrive band.



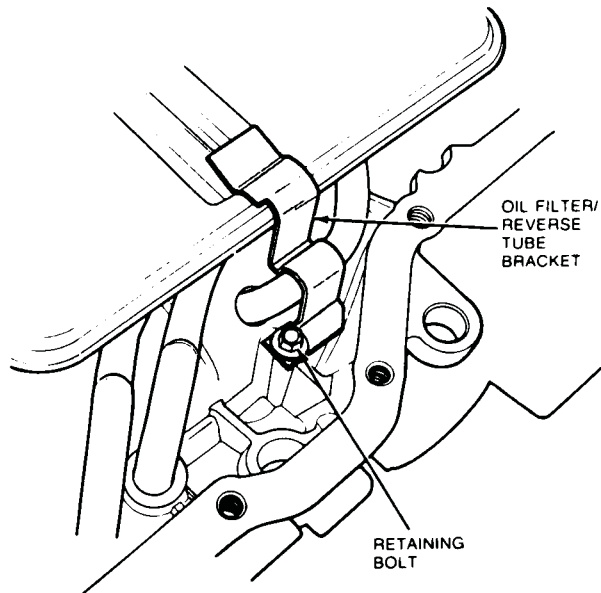
42. Remove seventeen 8mm oil pan cover bolts, remove cover and discard gasket.



41. Using Clutch Pack Tool T86P-70389-A or equivalent, install hook-end of tool into one of the six lube holes in front sun and shell assembly. Position notched block over edge of assembly and tighten handle. **Do not** over-tighten handle. Lift assembly out of case.



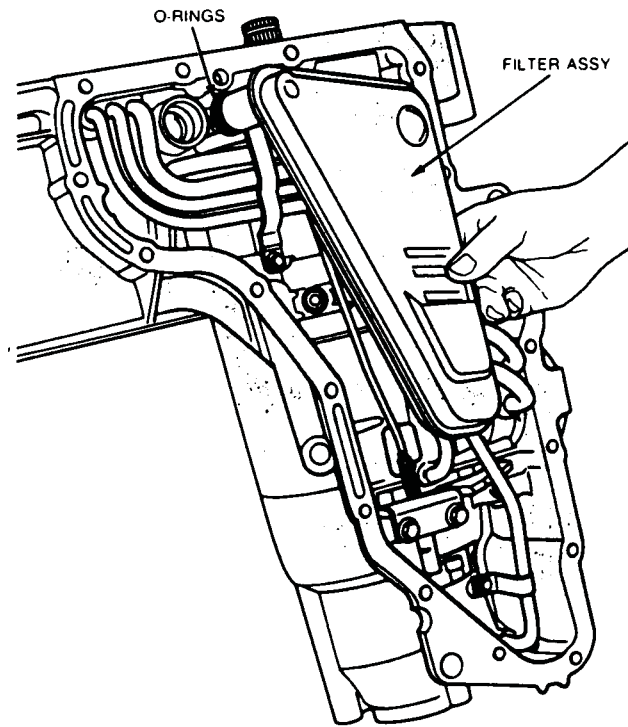
43. Remove reverse apply tube/oil filter bracket bolt and bracket.



DISASSEMBLY AND ASSEMBLY (Continued)

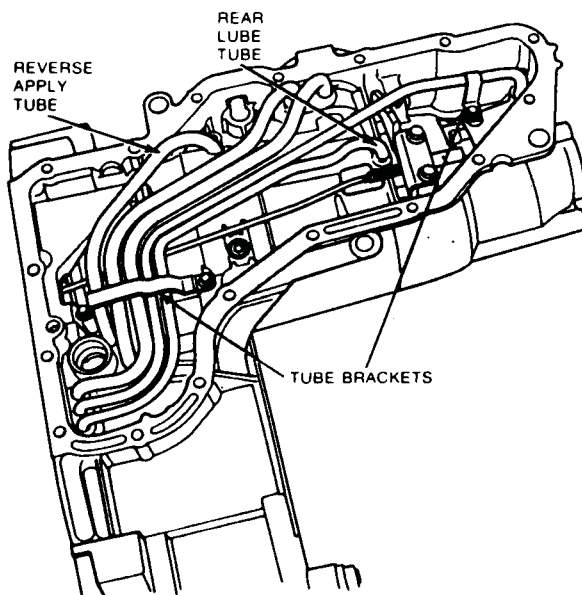
44. Remove oil filter screen and discard two O-rings.

NOTE: O-rings may stick inside case.



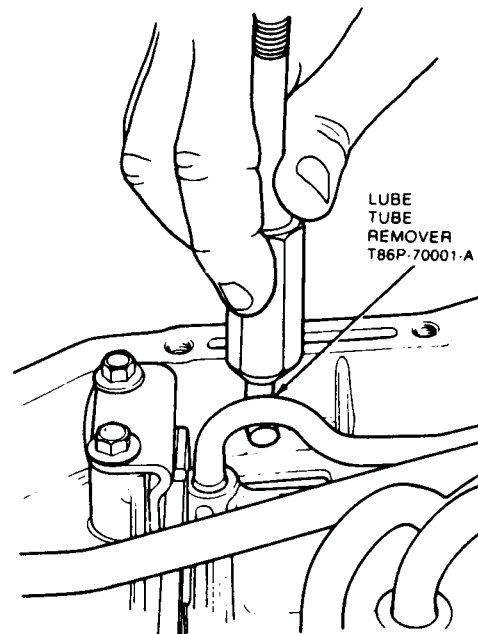
45. Remove tube bracket bolts and brackets.

NOTE: For complete transaxle disassembly, the reverse apply tube **must** be removed prior to removing the reverse clutch. The rear lube tube must also be removed and the rear lube tube seal must be replaced whenever the differential is removed.



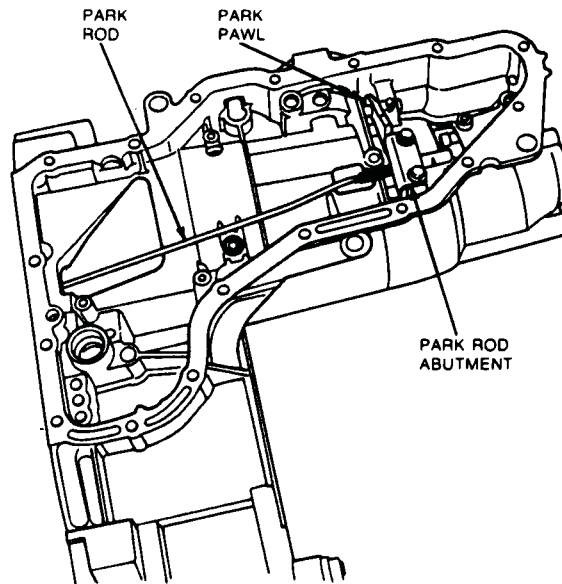
46. If necessary, remove lube tubes using Lube Tube Remover T86P-70001-A and Impact Slide Hammer T59L-100-B or equivalent.

NOTE: Tubes are held in with Loctite.

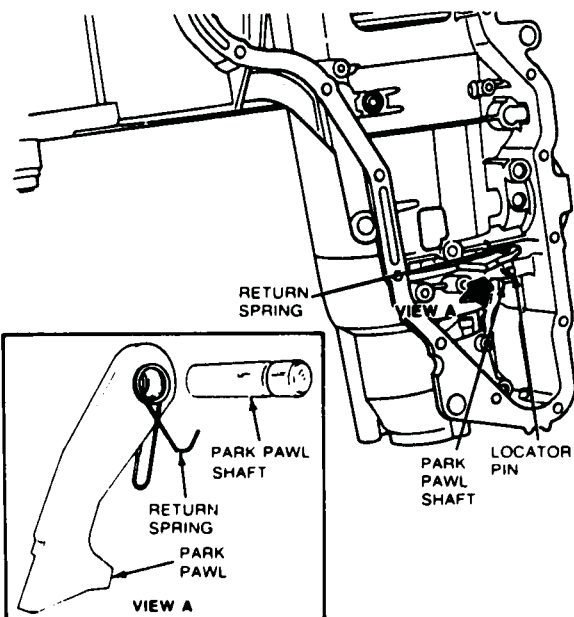


DISASSEMBLY AND ASSEMBLY (Continued)

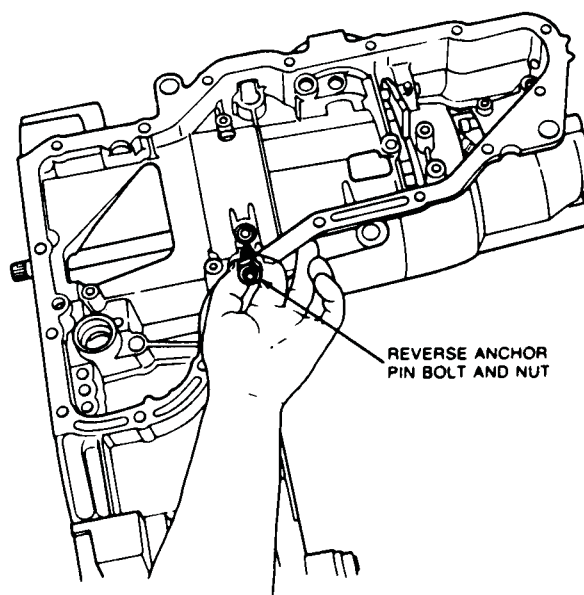
47. Remove two 8mm park rod abutment bolts and remove park rod by lifting rod to clear abutment and lower from case.



48. Remove park pawl shaft locator pin.  
49. Use magnet to remove park pawl shaft, and remove park pawl and return spring.

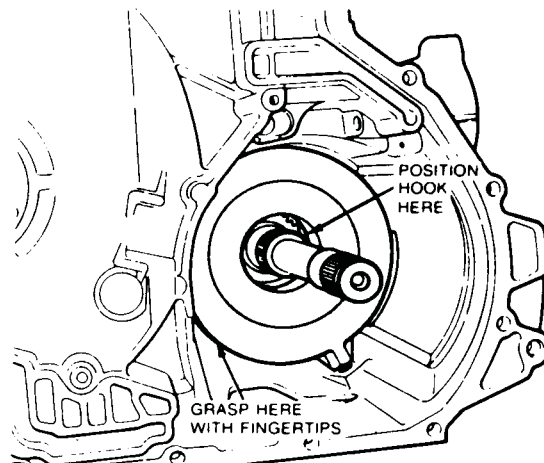


50. Loosen 19mm reverse anchor pin nut and remove 6mm Allen head bolt.

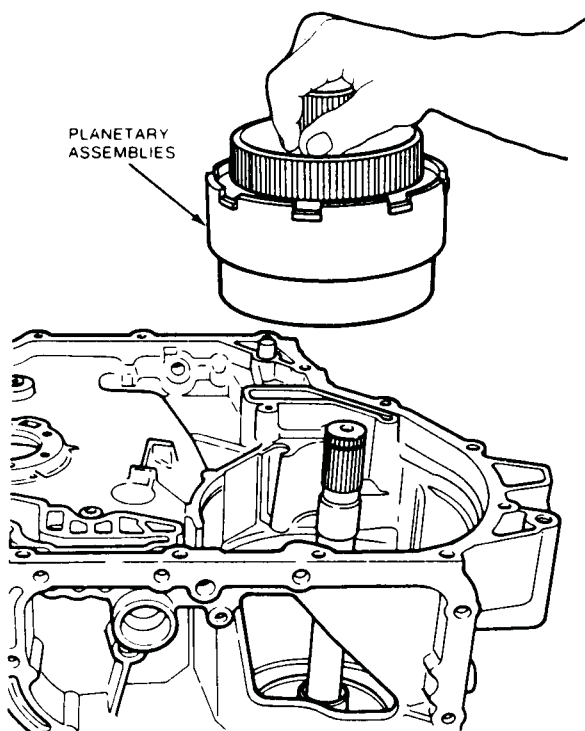


DISASSEMBLY AND ASSEMBLY (Continued)

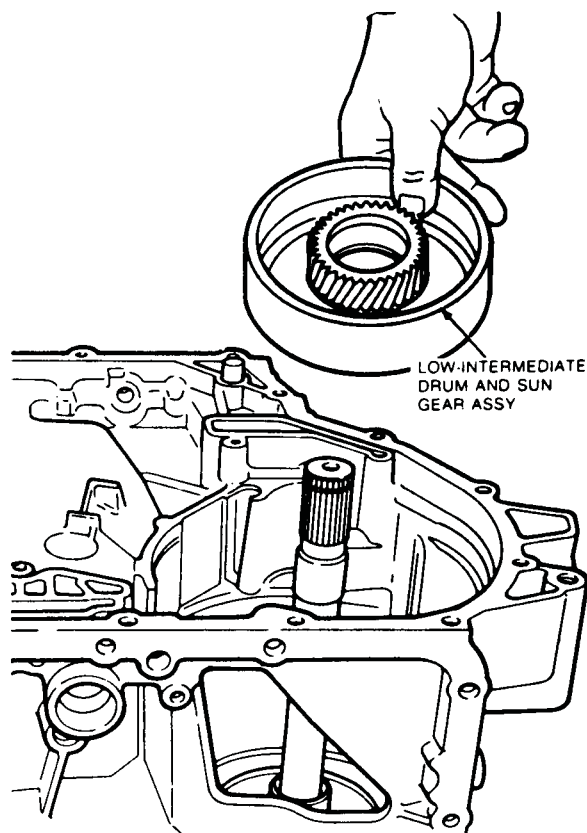
51. Rotate transaxle to the horizontal position.
52. Locate hook portion of Clutch Pack Tool T86P-70389-A or equivalent on inner diameter of reverse clutch cylinder. Grasp outer diameter of cylinder with fingertips and slide clutch assembly out of case.



53. Rotate transaxle to vertical position. Holding the front planetary shaft, lift out both front and rear planetary assembly.



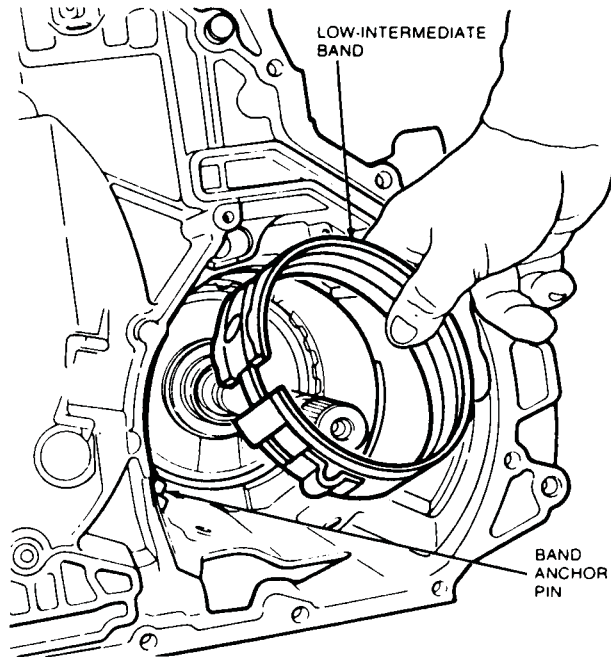
54. Lift out low-intermediate drum and sun gear assembly.



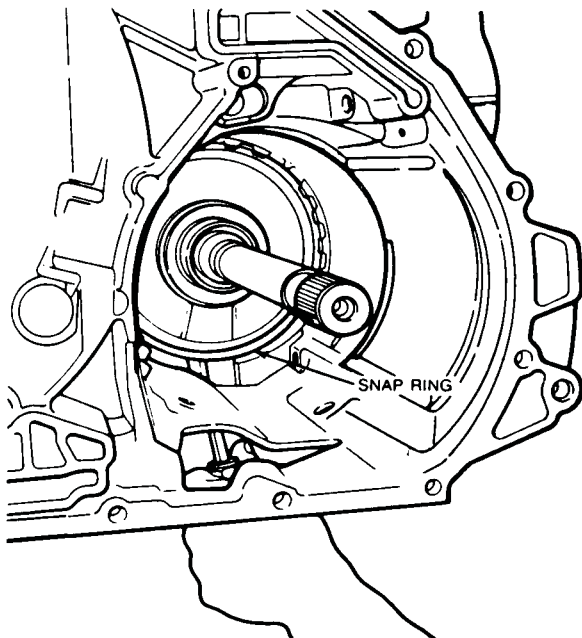


DISASSEMBLY AND ASSEMBLY (Continued)

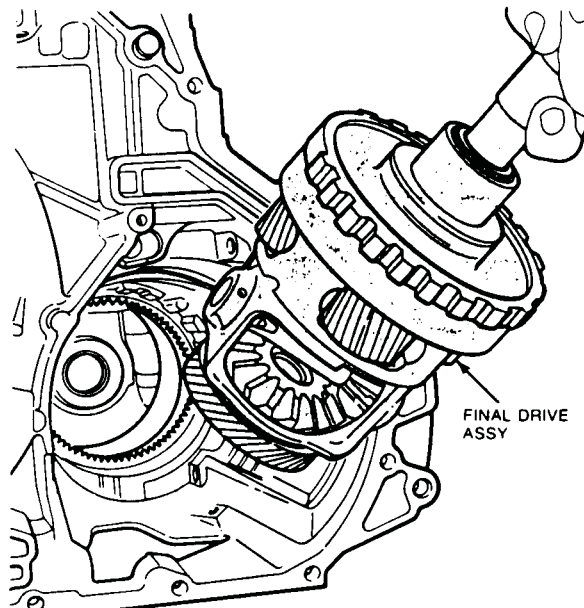
55. Remove low-intermediate band.



56. Remove final drive gear assembly snap ring from case using a screwdriver inserted through side of case.



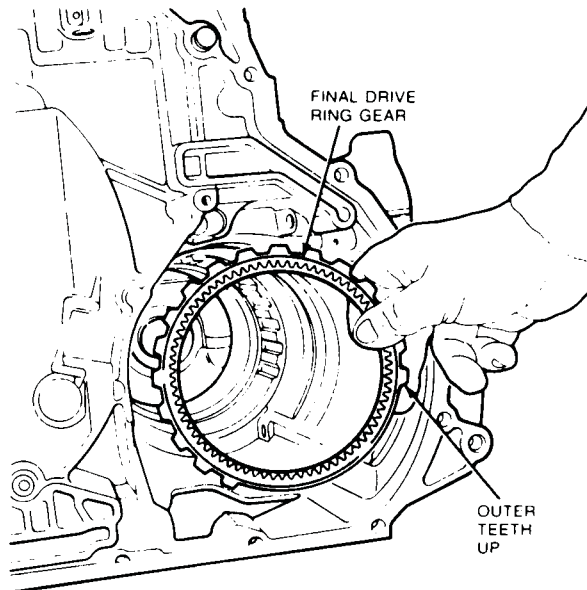
57. Lift out final drive assembly using output shaft.





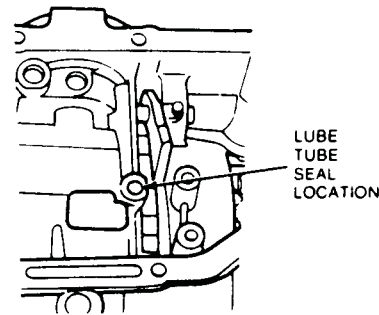
DISASSEMBLY AND ASSEMBLY (Continued)

58. Remove final drive ring gear from case.



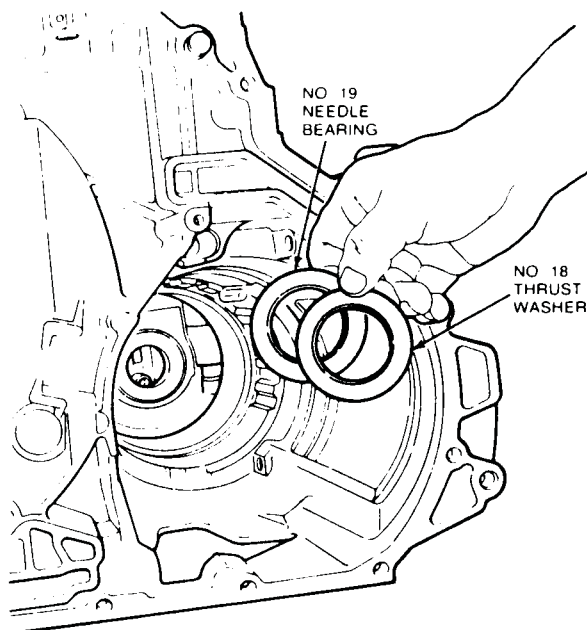
60. Remove and discard rear lube tube seal using a 3/8-inch diameter rod or drift. Tap seal toward inside of case.

**CAUTION:** This must be done whenever differential is removed from case.



59. Remove No. 18 thrust washer and No. 19 needle bearing.

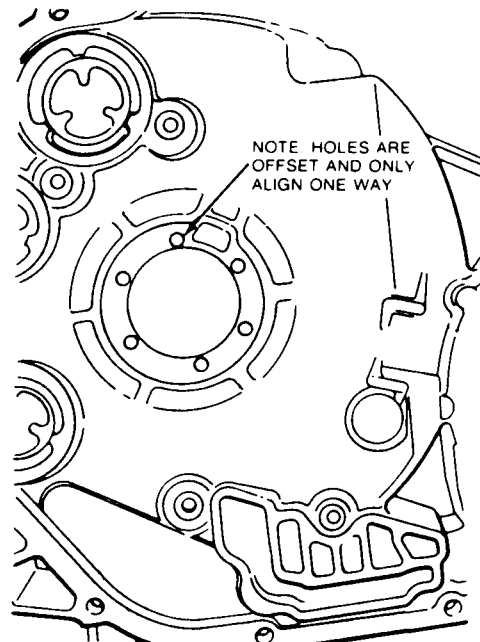
**NOTE:** No. 18 thrust washer may remain on the final drive assembly next to governor drive gear.



**Assembly**

1. Position case in horizontal position.
2. If removed, install drive sprocket support. Install six (T-30) Torx® bolts and tighten to 9-12 N·m (6-8 lb-ft).

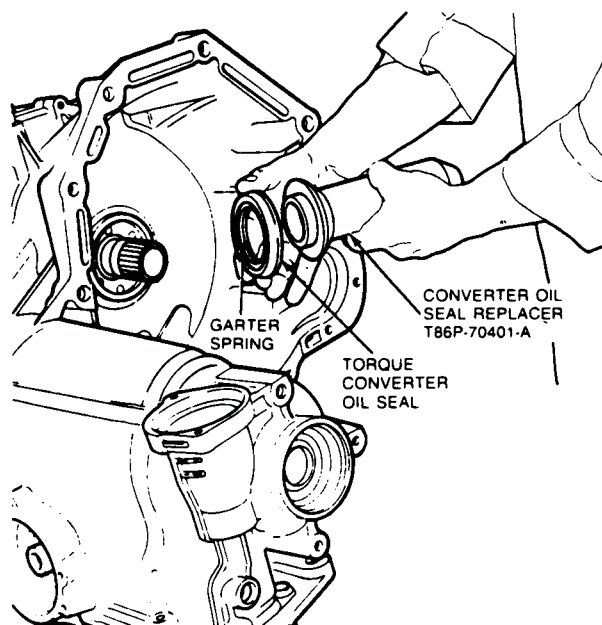
**NOTE:** Bolt holes are offset. Sprocket support can only be aligned one way.



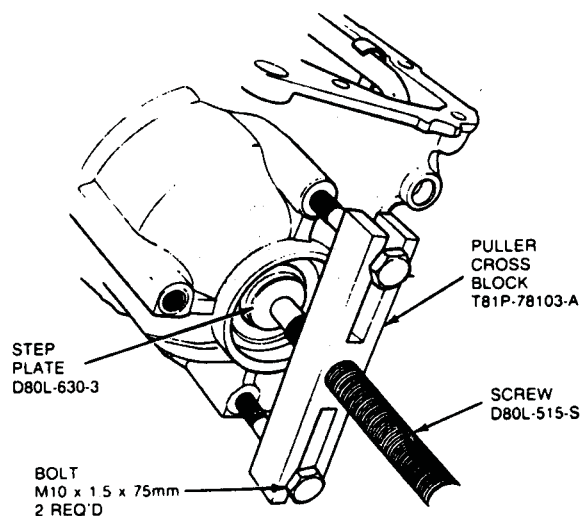
DISASSEMBLY AND ASSEMBLY (Continued)

3. Install converter oil seal using Converter Oil Seal Replacer T86P-70401-A or equivalent.

NOTE: After installation, verify presence of garter spring on seal.

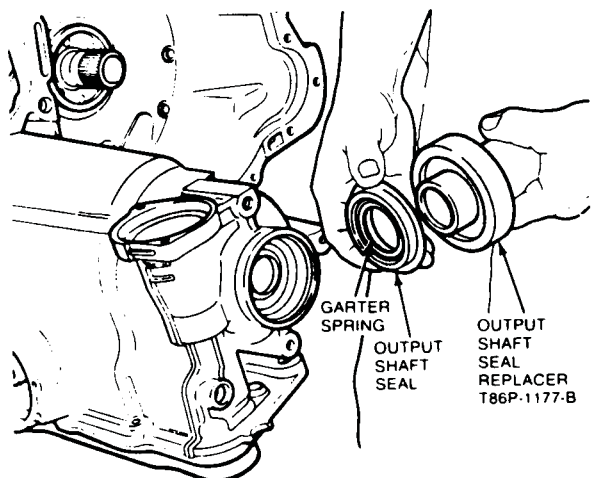


5. Install Puller Crossblock T81P-78103-A, Screw D80L-515-S, Step Plate D80L-630-3 and two D80L-522-A bolts or equivalent, over RH output shaft opening. Tool will be used later to perform selective thrust washer checks.

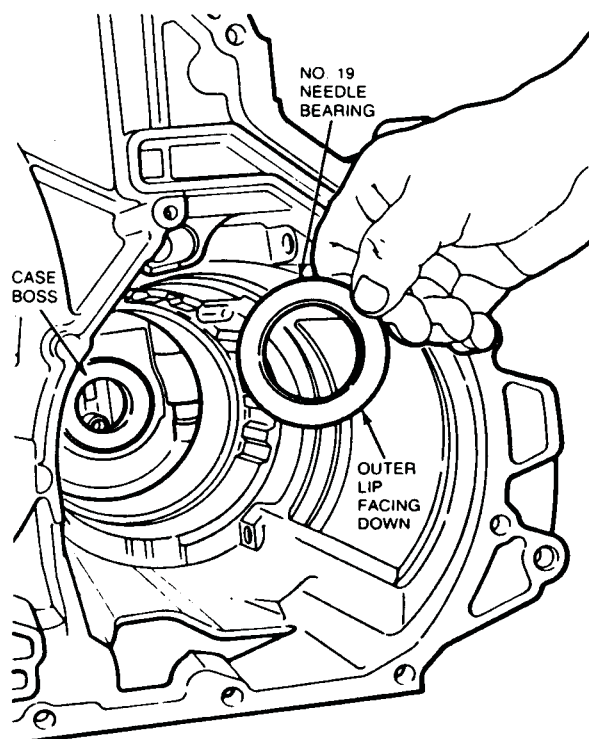


4. Install RH output shaft seal using Output Shaft Seal Replacer T86P-1177-B or equivalent.

NOTE: After installation, verify presence of garter spring on seal.

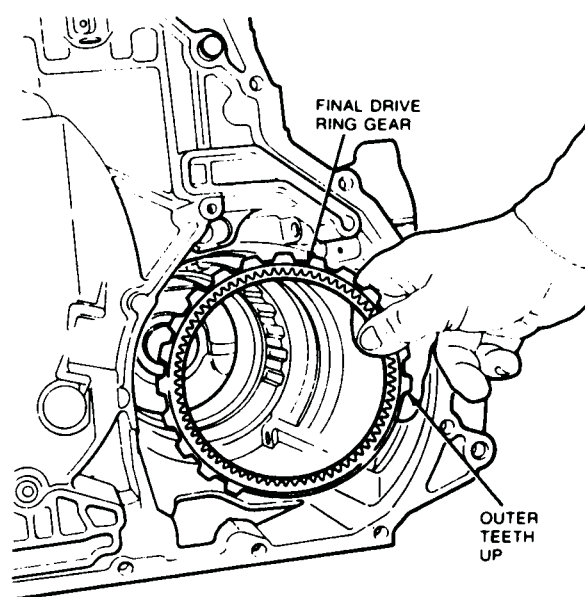


6. Install No. 19 needle bearing over case boss with flat side facing up, outer lip facing down.



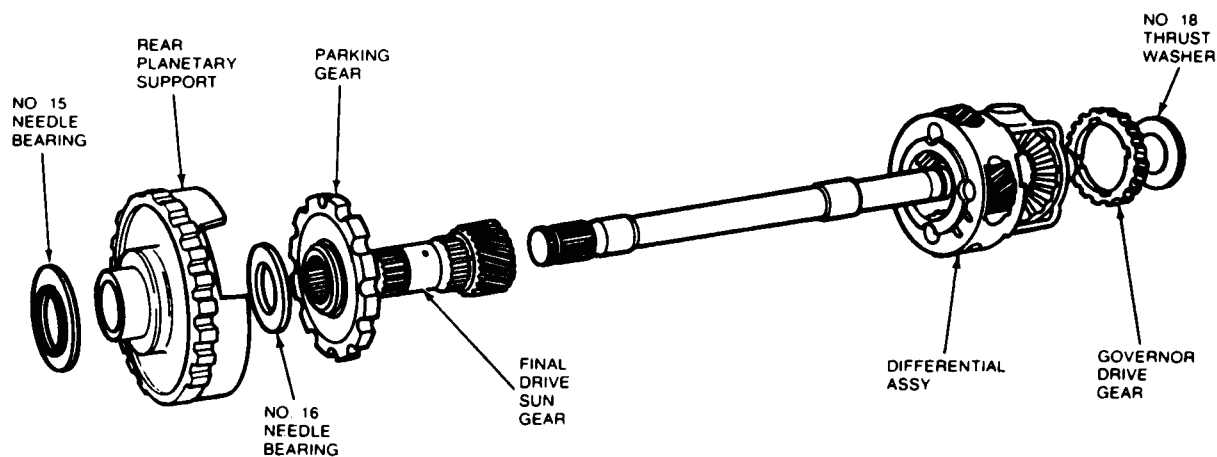
# DISASSEMBLY AND ASSEMBLY (Continued)

7. Install final drive ring gear with external splines up. Using a hammer handle if necessary, tap gently to fully seat into case splines.



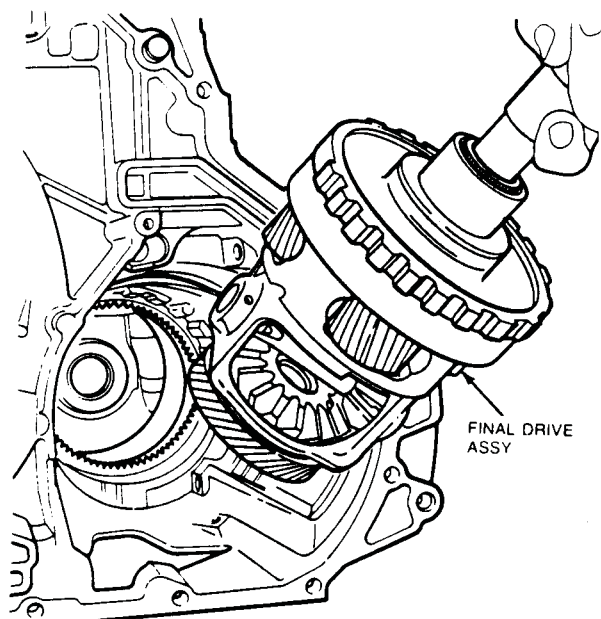
8. Assemble the following components:

- Governor drive gear.
- Differential assembly.
- Final drive sun gear.
- Parking gear.
- No. 16 needle bearing.
- Rear planetary support.
- No. 15 needle bearing.

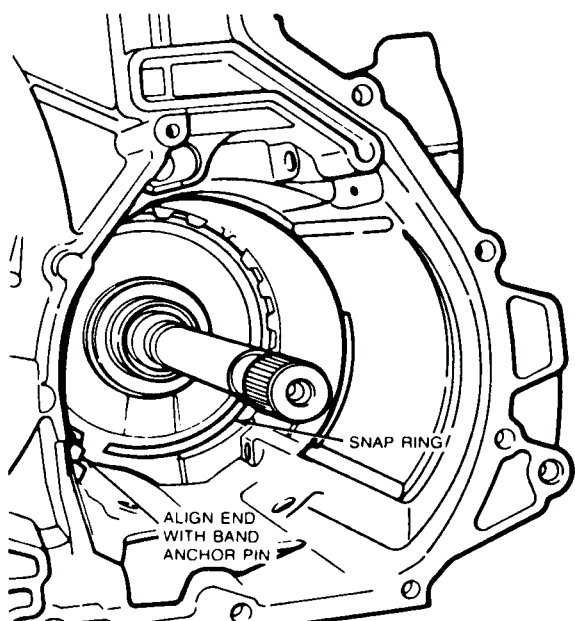


# DISASSEMBLY AND ASSEMBLY (Continued)

9. Position No. 18 selective thrust washer on differential assembly using grease to hold in place. Lower final drive assembly into case.

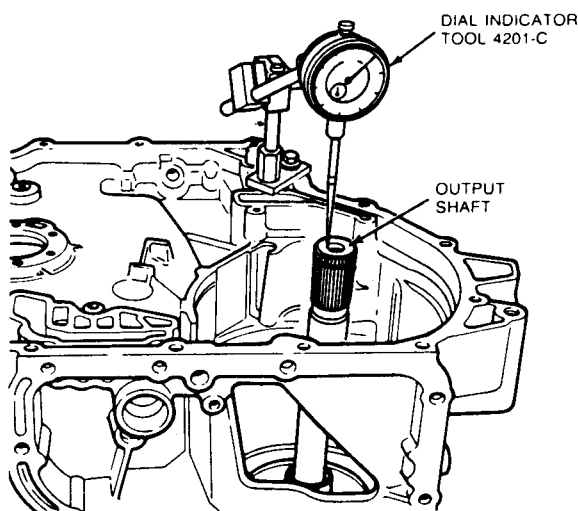


10. Install snap ring and align end of snap ring with low-intermediate band anchor pin.



11. Perform end clearance check as follows:

- Mount Dial Indicator TOOL 4201-C or equivalent with stylus on end of output shaft.
- Back out screw on tool installed in Step 5 until it no longer touches shaft.
- Zero dial indicator.
- Tighten screw to 4-5 N·m (35-44 lb-in).
- Observe reading on dial indicator.



The clearance should be 0.1-0.65mm (.004-.025 inch). If the clearance is not within specification, selective thrust washers are available in the following thicknesses:

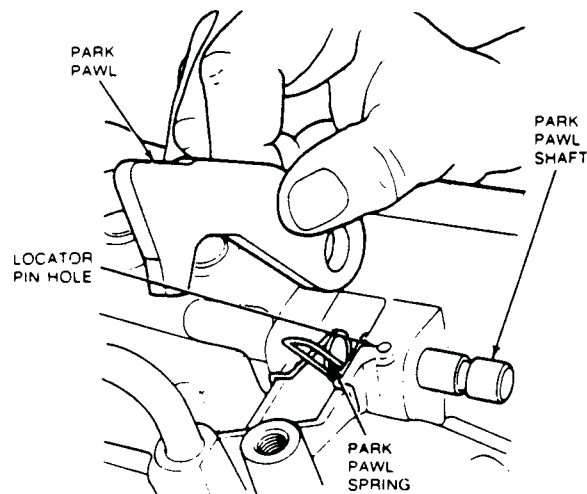
- 1.25-1.15mm Orange
- 1.50-1.40mm Purple
- 1.75-1.65mm Yellow

12. After installing the correct thrust washer, recheck the clearance.

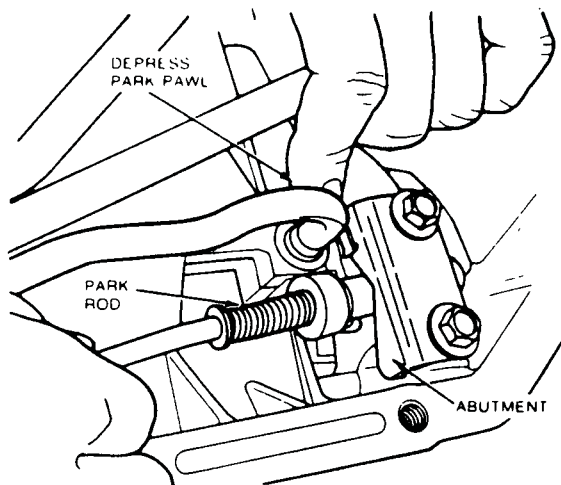
**NOTE:** After completing end clearance check, back off screw on tool and leave tool in position for No. 5 and No. 8 selective thrust washer clearance check to be performed later.

DISASSEMBLY AND ASSEMBLY (Continued)

13. Position transaxle in vertical position.
14. Install park pawl, return spring, park pawl shaft and locator pin.

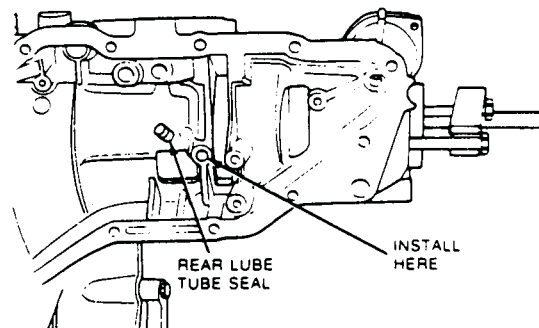


15. Install park rod actuating lever and park rod in case. Install park rod abutment and start abutment bolts. Push in park pawl and locate rod between pawl and abutment.

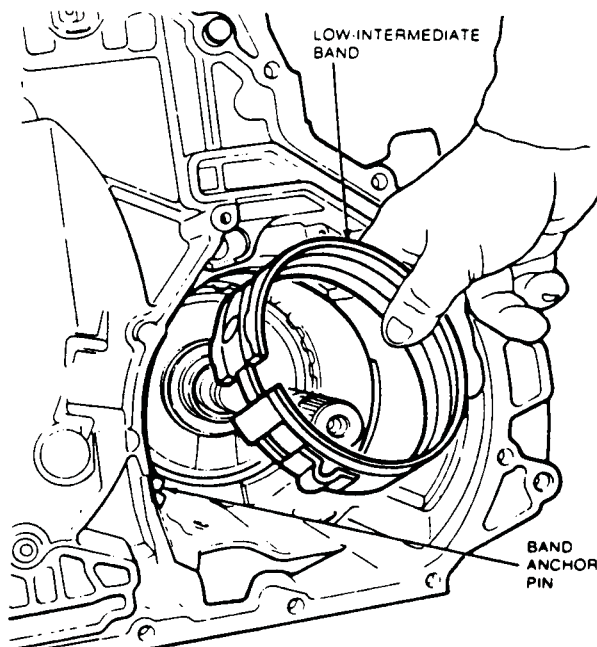


16. Using a 3/8-inch rod or drift, gently install lube tube seal in case. Seal should be flush against rear support.

**MAKE SURE SEAL  
IS ALL THE WAY DOWN**

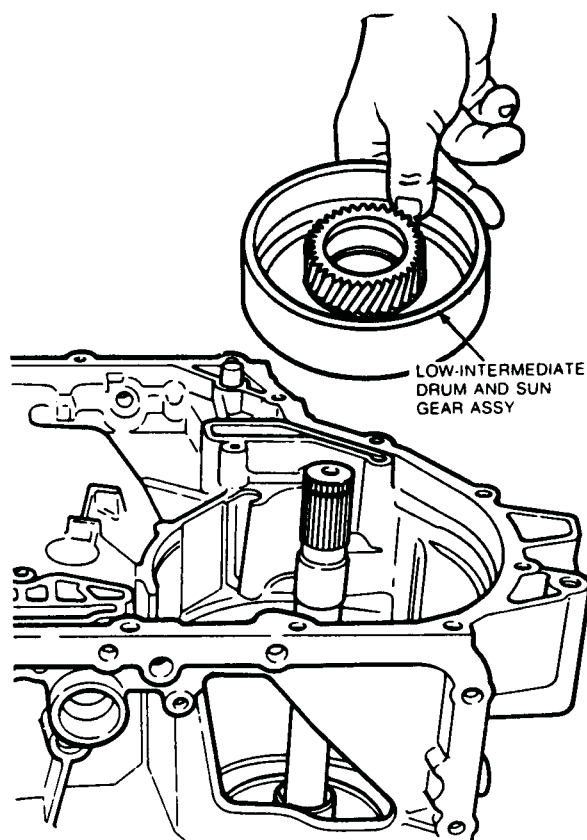


17. Install No. 15 needle bearing on rear planetary support.
18. Install low-intermediate band into case and position against anchor pin.

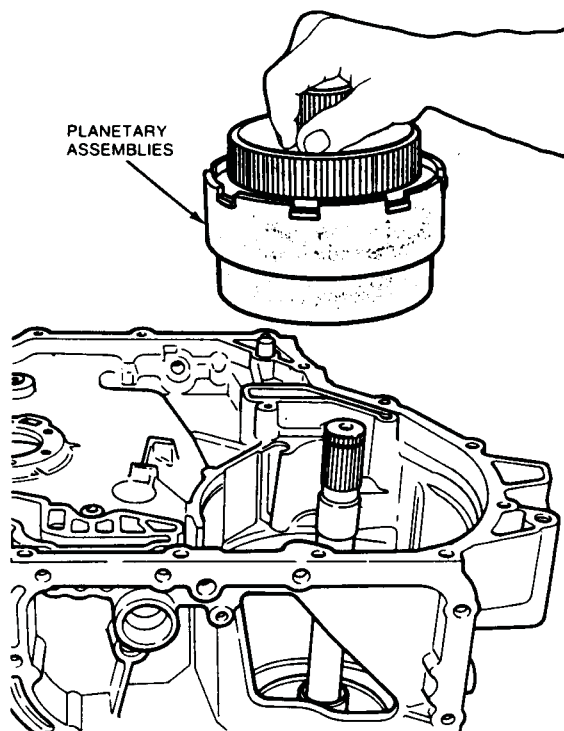


# DISASSEMBLY AND ASSEMBLY (Continued)

19. Install low-intermediate drum and sun gear.

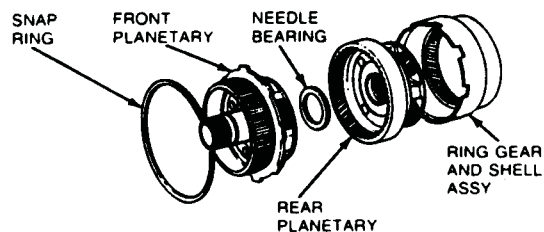


21. After assembling components, carefully slide assembly over output shaft.



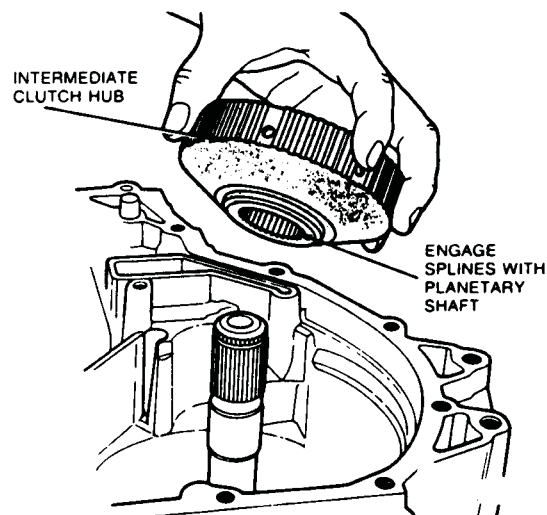
20. Assemble the following components:

- Ring gear and shell assembly.
- Rear planetary.
- No. 13 needle bearing.
- Front planetary.
- Snap ring.



22. Lower reverse clutch into case and start clutch plate engagement.

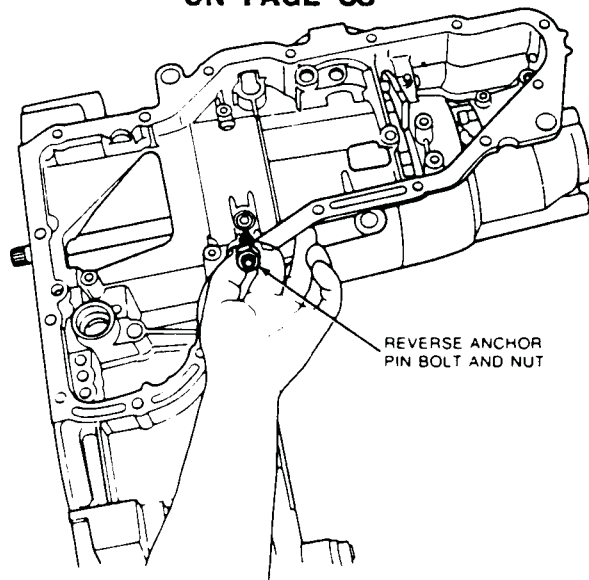
NOTE: To seat reverse clutch, the intermediate clutch hub can be used as a tool to complete clutch plate engagement. Rotating planet with hub will allow clutch splines to engage.



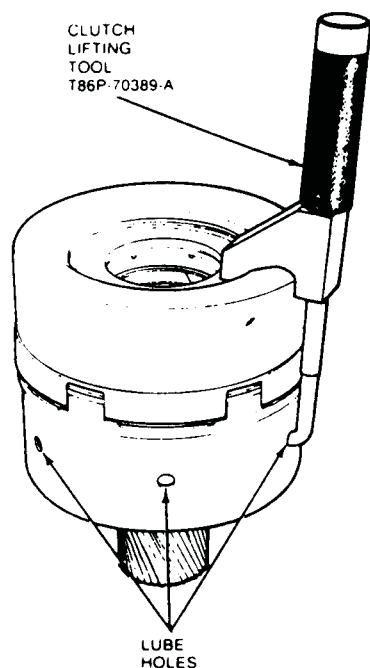


DISASSEMBLY AND ASSEMBLY (Continued)

23. Start reverse anchor pin bolt but do not tighten.  
**SEE TIGHTENING PROCEDURE  
ON PAGE 58**

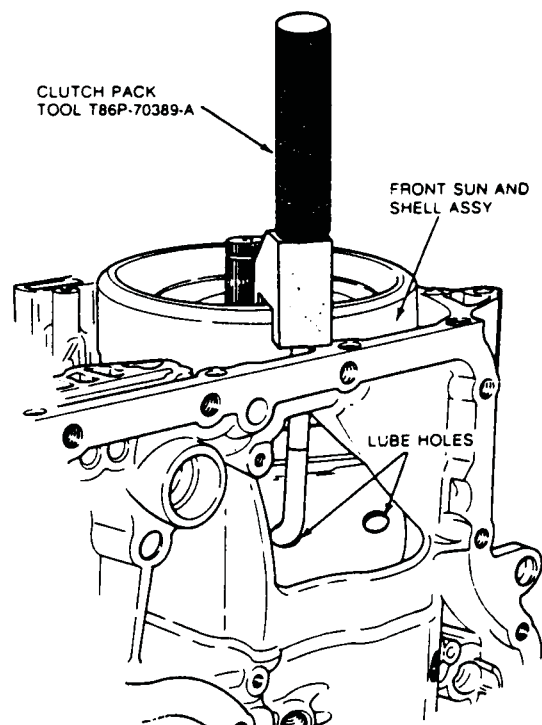


24. Assemble forward, direct and intermediate clutch assembly. Attach Clutch Pack Tool T86P-70389-A or equivalent, to assembly.

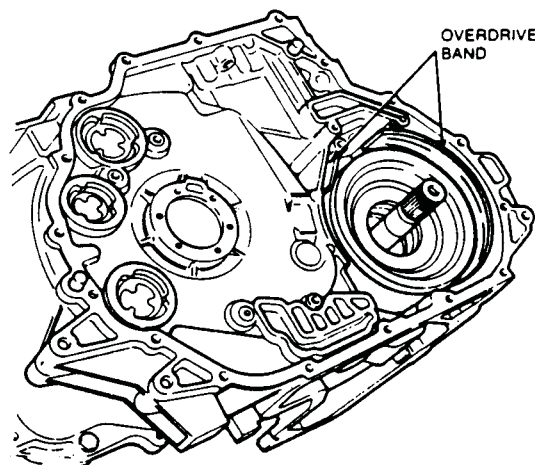


25. Lower assembly into case, aligning shell and sun gear splines into forward planetary.

**CAUTION:** Ensure the assembly is fully seated before removing tool.



26. Install overdrive band into case.

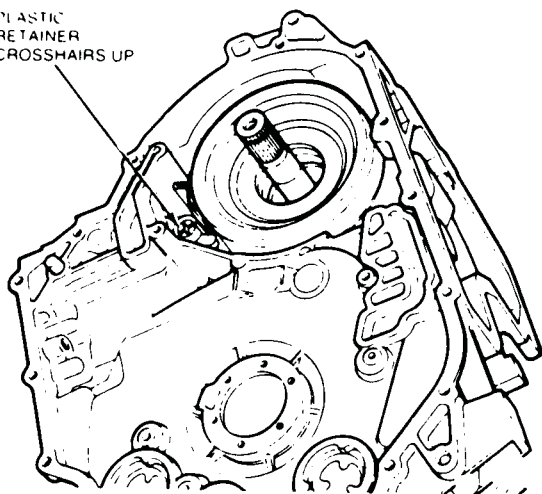




## DISASSEMBLY AND ASSEMBLY (Continued)

27. Install plastic retainer with cross hairs facing up.

PLASTIC  
RETAINER  
CROSSHAIRS UP

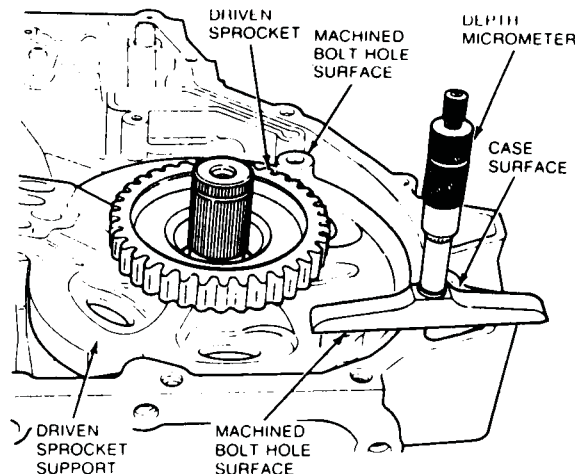


**NOTE:** Perform Steps 28 through 33 to check the drive sprocket end clearance for No. 5 and No. 8 selective thrust washers.

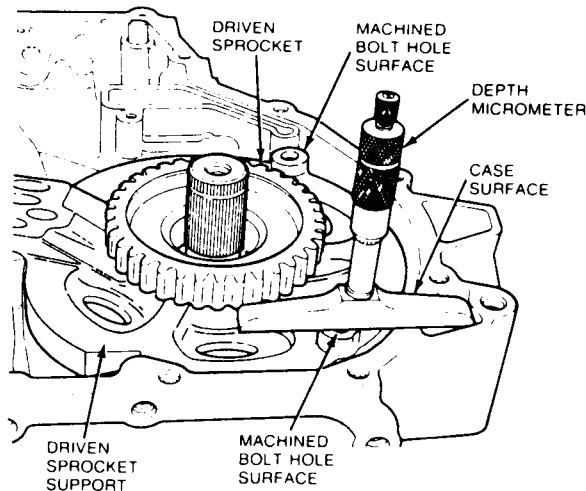
28. Using Guide Sleeve Tool D80L-522-A or equivalent, tighten screw to 13.5 N·m (10 lb-ft).
29. If not already removed, remove all five Teflon® seals from driven sprocket support assembly.
30. Install No. 9 needle bearing over output shaft, with outer lip facing up. Then install No. 8 selective thrust washer.
31. Install driven sprocket support and driven sprocket.
32. To measure No. 8 thrust washer clearance, it first must be determined if machined bolt hole surfaces on driven sprocket support are above or below case machined surface.

If machined bolt hole surfaces are above case machined surface, place depth micrometer on machined bolt hole surface on driven sprocket support. Measure distance to case machined surface. Measure at both support bolt hole machined surfaces and determine average from both readings. If reading exceeds 0.21mm (0.008 inch), refer to No. 8 Thrust Washer

Selection chart below to determine correct thrust washer to install. Install correct thrust washer, repeat measurement and record reading. Go to Step 33.



If machined bolt hole surfaces are below case machined surface, place depth micrometer on case machined surface and measure distance to driven sprocket support machined bolt hole surfaces. Measure at both support bolt hole machined surfaces and determine average from both readings. If reading exceeds 0.46mm (0.018 inch), refer to No. 8 Thrust Washer Selection chart below to determine correct thrust washer to install. Install correct thrust washer, repeat measurement and record reading. Go to Step 33.

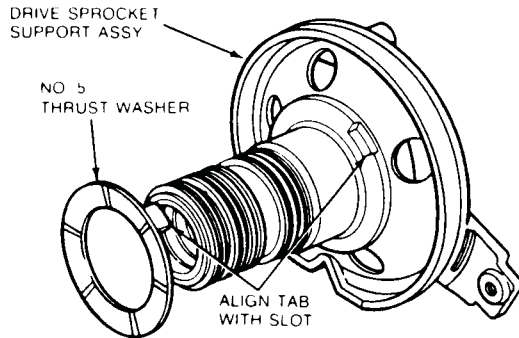


**NO. 8 THRUST WASHER SELECTION**

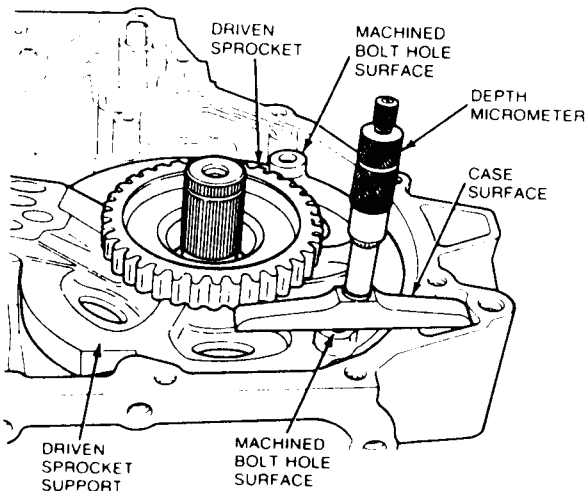
Thrust Washer Thickness		Color
mm	Inches	
1.53-1.43	0.060-0.056	Natural
1.78-1.68	0.070-0.066	Dark Green
2.02-1.92	0.079-0.075	Light Blue
2.27-2.17	0.089-0.085	Red

## DISASSEMBLY AND ASSEMBLY (Continued)

33. Remove driven sprocket, driven sprocket support, No. 8 selective thrust washer and No. 9 needle bearing.
34. Install No. 5 thrust washer on driven sprocket support, aligning tab on washer with slot in driven sprocket support. Apply grease to thrust washer to help hold it in position.



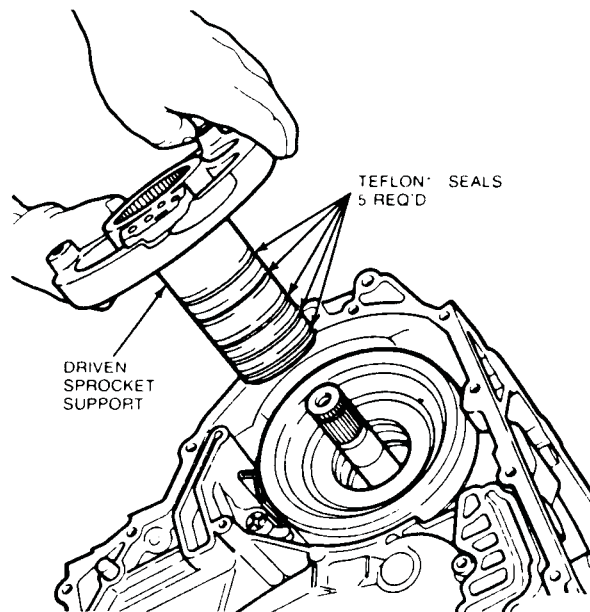
35. Install driven sprocket support without No. 8 thrust washer and No. 9 needle bearing.
36. Position depth micrometer on machined case surface and measure distance between driven sprocket support machined bolt hole surface and case surface. Measure at both bolt hole machined surfaces and determine average from both readings. The difference between this reading and the reading for No. 8 thrust washer recorded in Step 32 must be greater than zero but less than 0.85mm (0.033 inch). If measurement exceeds specification, refer to No. 5 Thrust Washer Selection chart to determine the correct thrust washer to install.



## NO. 5 THRUST WASHER SELECTION

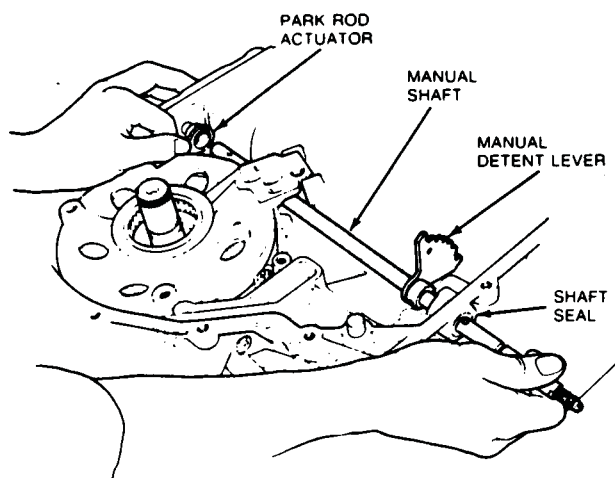
Thrust Washer Thickness		Color
mm	Inches	
2.28-2.18	0.090-0.086	Green
2.53-2.43	0.099-0.095	Black
2.77-2.67	0.109-0.105	Natural
3.02-2.92	0.118-0.115	Red

37. Remove driven sprocket support and install No. 9 needle bearing and correct No. 8 thrust washer.
38. Install Teflon\* seals on driven sprocket support.
39. Install correct No. 5 thrust washer on driven sprocket support and install driven sprocket support. Apply grease to thrust washer to help hold it in position.

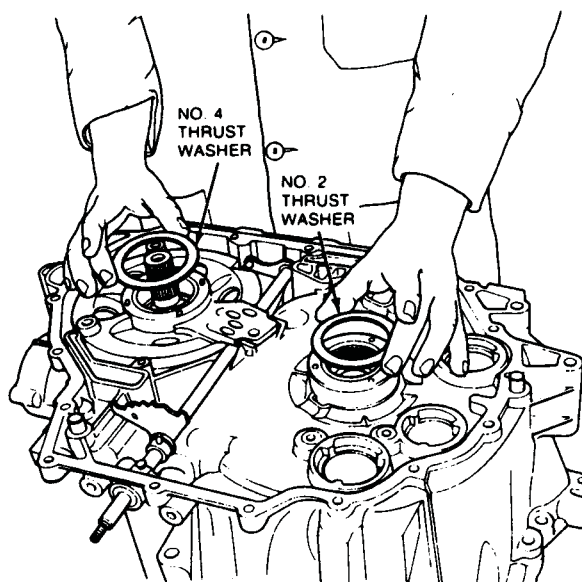


# DISASSEMBLY AND ASSEMBLY (Continued)

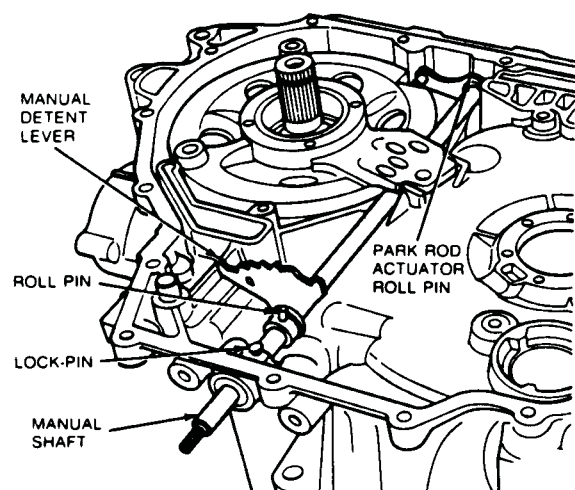
40. Install manual shaft seal by tapping into case.
41. Start manual shaft through seal and slide manual detent lever onto shaft.
42. Slide manual shaft through park rod actuating lever, and tap into case hole.



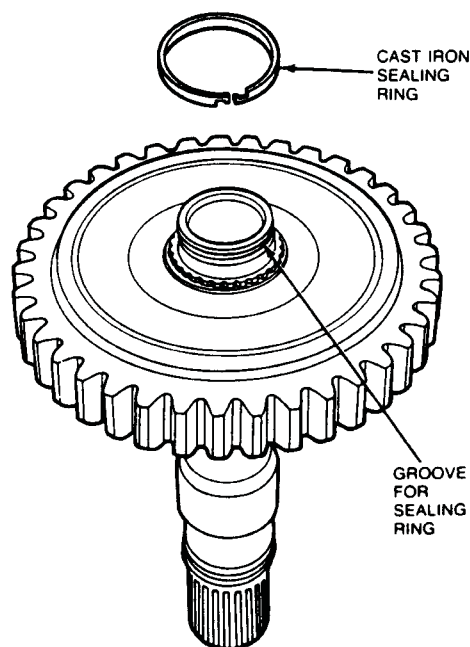
45. Install No. 2 and No. 4 tabbed thrust washers onto drive and driven sprocket supports. Align tabs on thrust washers with holes in sprocket supports. Apply grease to washers to help hold in position.



43. Install new manual shaft lock pin through case hole, aligning with groove in shaft.
44. Install new roll pins in detent lever and park rod actuating lever.

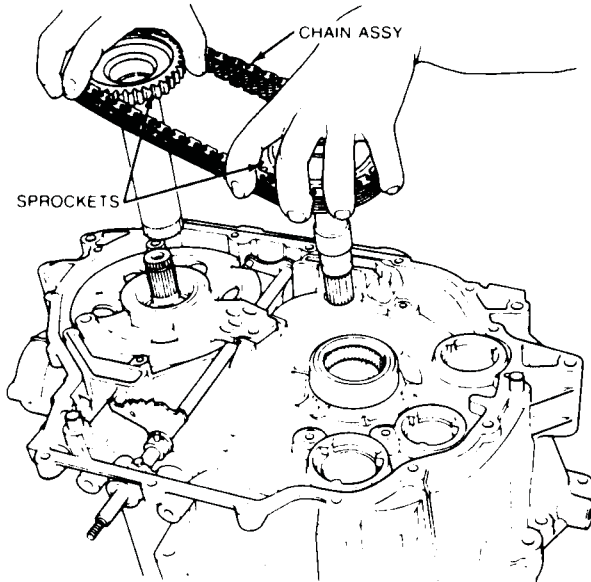


46. Lubricate and install input shaft cast iron sealing ring onto input shaft.

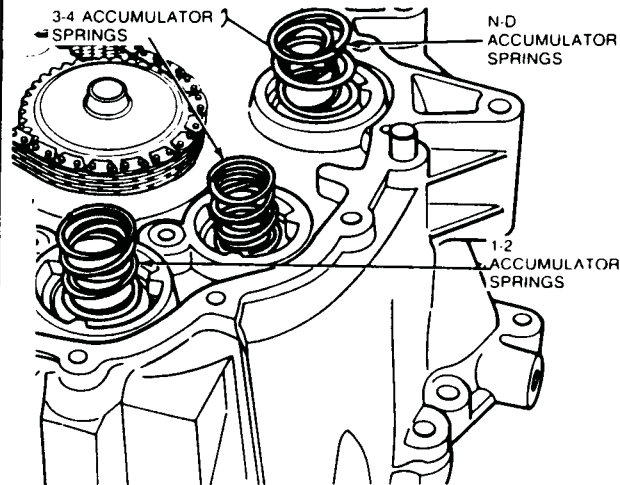


# DISASSEMBLY AND ASSEMBLY (Continued)

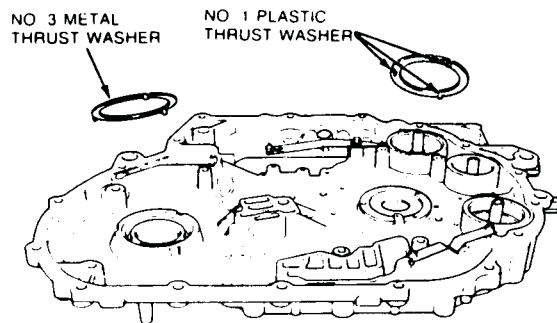
47. Install chain on drive and driven sprockets. Lower assembly into sprocket supports, rotating sprockets to ensure that they are fully seated.



49. Install new chain cover gasket.
50. Install accumulator springs in correct position.

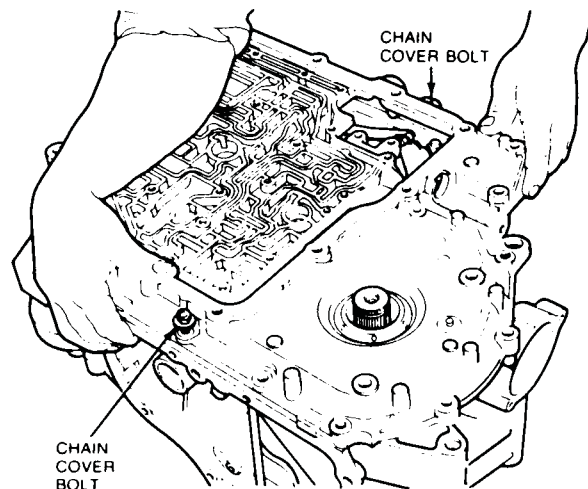


48. Install No. 1 and No. 3 thrust washers on chain cover being sure tabs align with slots in chain cover.



51. Inspect chain cover alignment pins on case.
52. Carefully align chain cover input shaft bore with input shaft. Apply gentle downward pressure on chain cover to overcome accumulator spring pressure and start two chain cover bolts.

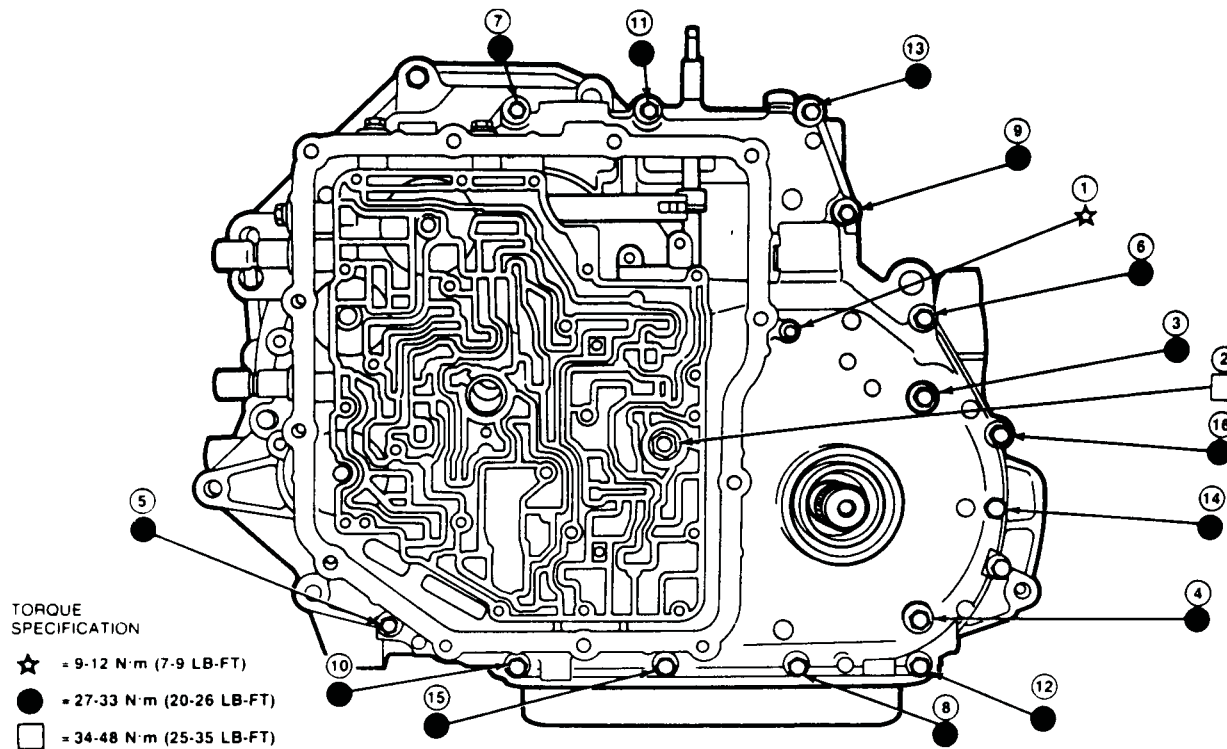
**CAUTION:** Be extremely careful to prevent damage to the input shaft cast iron sealing ring.



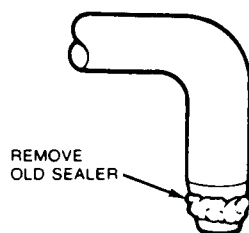
## DISASSEMBLY AND ASSEMBLY (Continued)

53. Start remaining chain cover bolts and tighten 10mm bolts to 27-33 N·m (20-26 lb-ft). Tighten 8mm bolt to 9-12 N·m (6-8 lb-ft). Tighten 13mm bolt to 34-48 N·m (25-35 lb-ft). Tighten bolts in sequence shown.

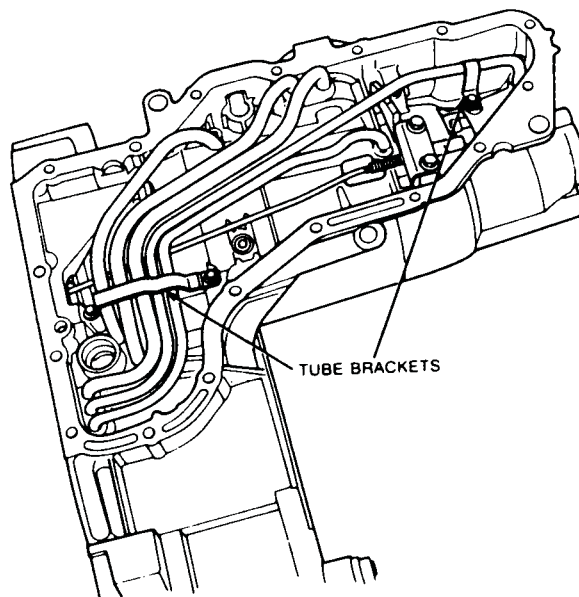
NOTE: After installing chain cover, input shaft should have some end play and should rotate freely. If it will not rotate freely, remove chain cover and inspect cast iron seal for damage.



54. Tighten park rod abutment bolts to 27-30 N·m (20-22 lb-ft).
55. Tighten reverse drum 6mm Allen head anchor bolt to 10-12 N·m (7.5-9 lb-ft) and 19mm locknut to 34-47 N·m (25-35 lb-ft).
56. Remove old sealer from lube tubes.



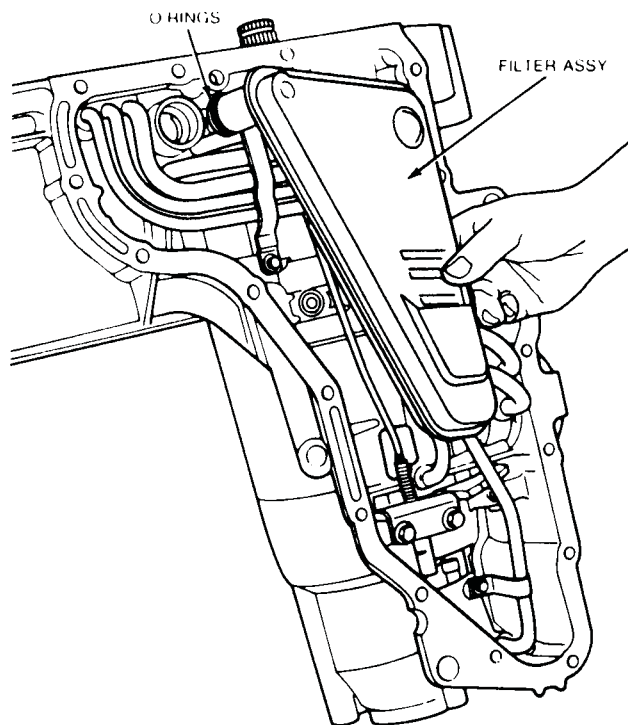
57. Install tubes in position and tap lightly until fully seated. Apply Threadlock 262 E2FZ-19554-B or equivalent around tube-to-case surface.
58. Install tube retaining brackets.



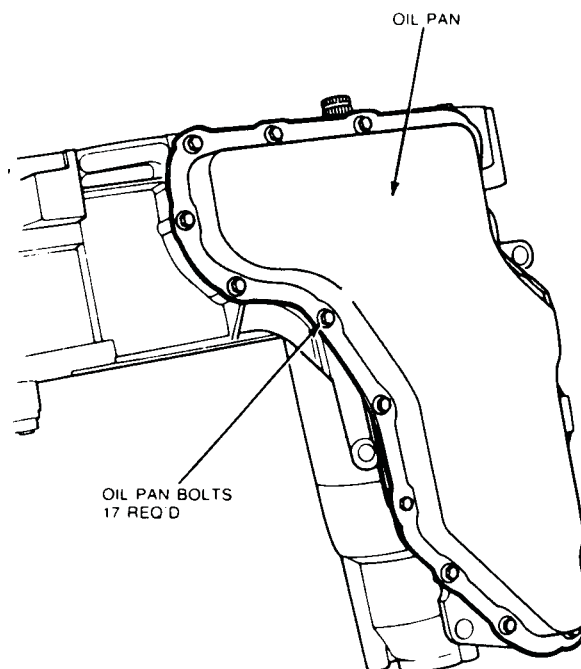


DISASSEMBLY AND ASSEMBLY (Continued)

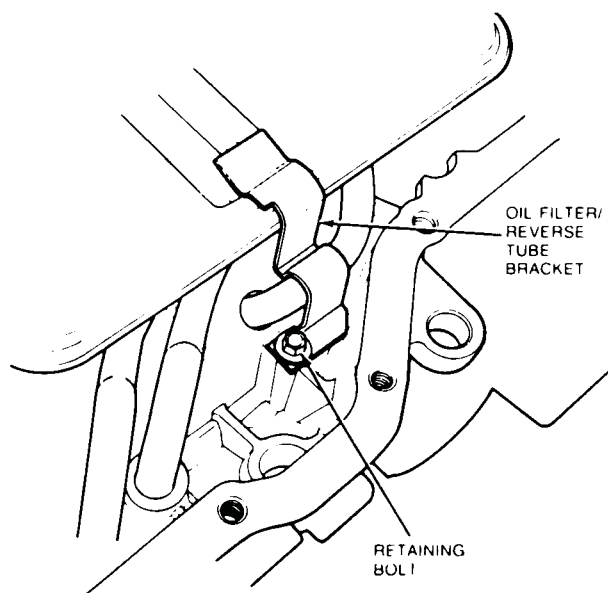
59. Install two O-rings onto oil filter and press oil filter into case.



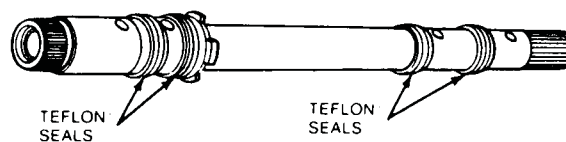
61. Install new oil pan gasket on case and install oil pan. Tighten bolts to 14-16 N·m (10-12 lb-ft).



60. Install reverse apply tube/oil filter bracket.

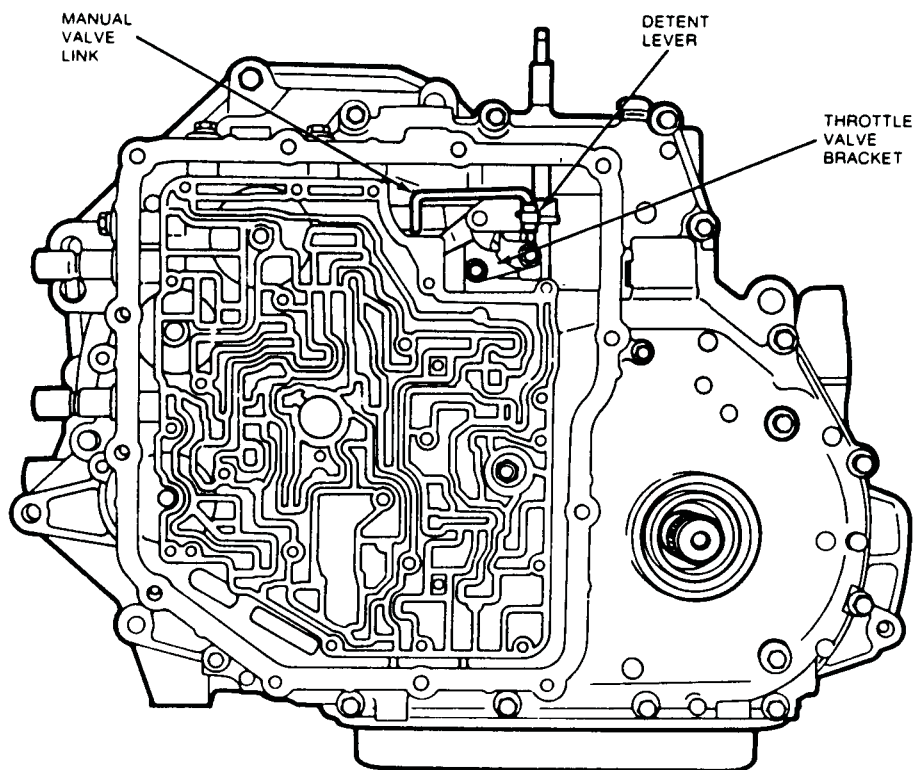


62. Install four new Teflon® seals on pump driveshaft and install shaft.

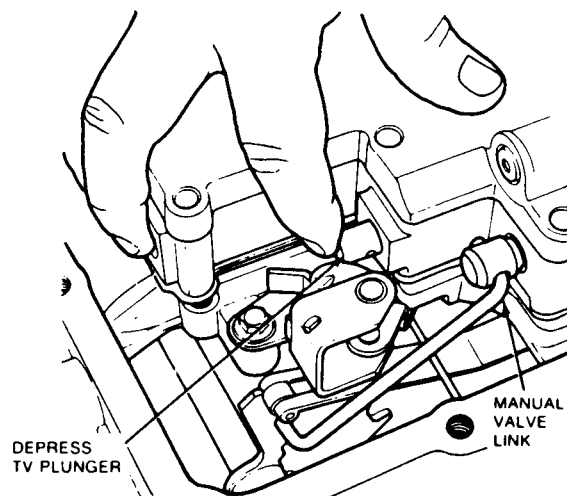


DISASSEMBLY AND ASSEMBLY (Continued)

63. Install TV bracket with TV link through hole in case. Tighten bolts to 9-12 N·m (7-9 lb-ft). Connect manual valve link to detent lever.



64. Start oil pump and valve body over pump shaft and connect manual valve link to manual valve. Hold TV plunger in, to clear TV bracket, and install oil pump and valve body into position.

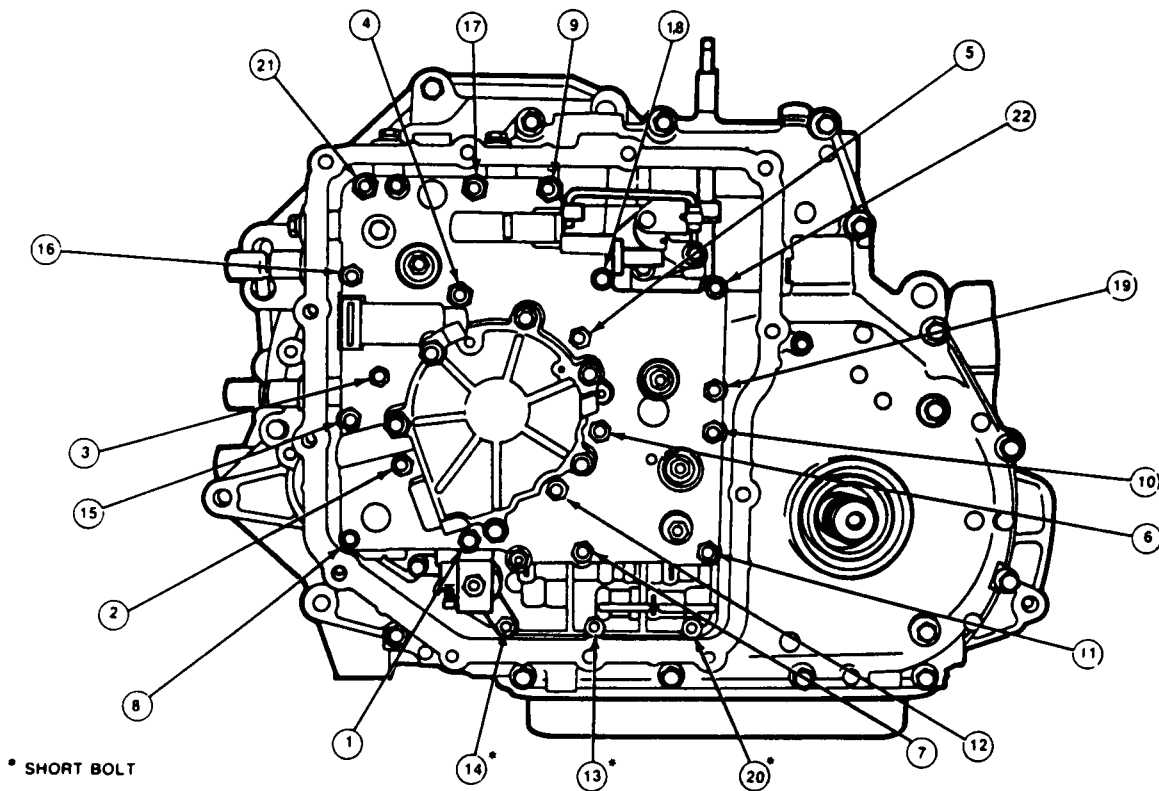




DISASSEMBLY AND ASSEMBLY (Continued)

65. Install 22 valve body bolts and tighten in sequence to 9-12 N·m (7-9 lb-ft).

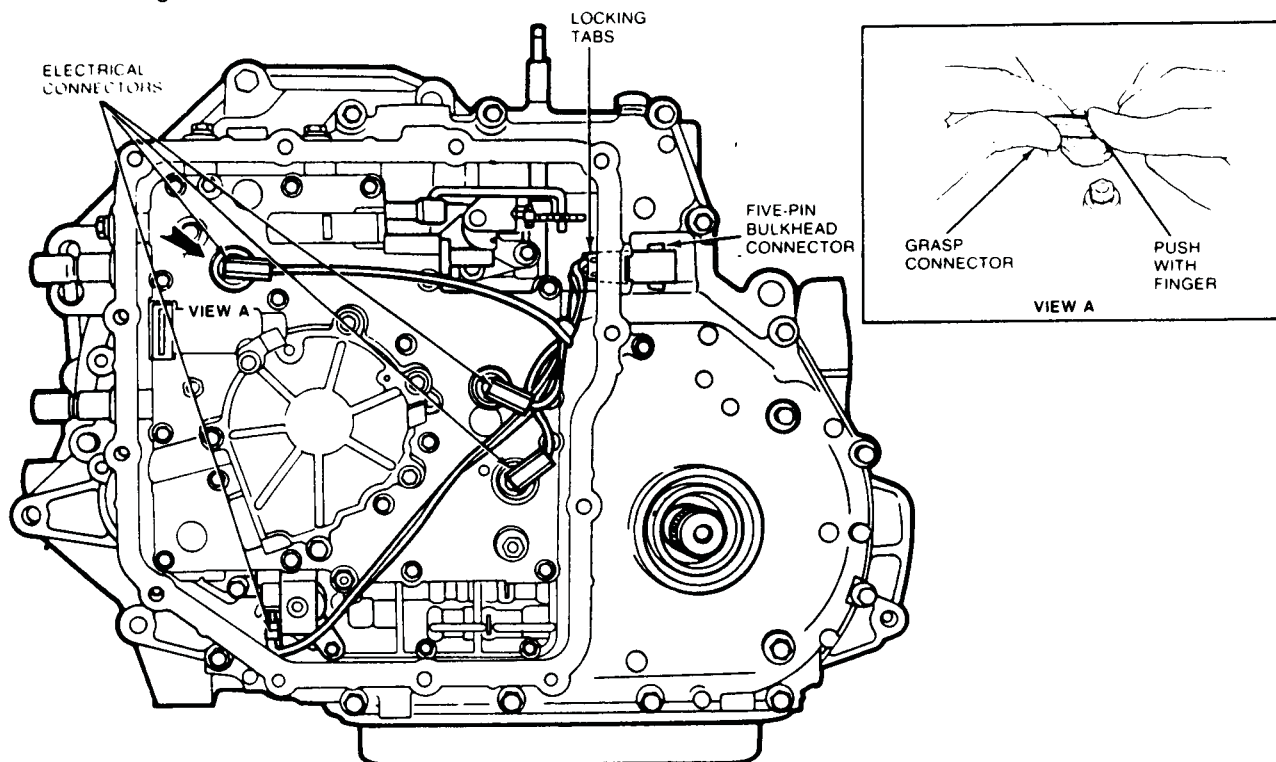
NOTE: Install three short bolts where indicated.



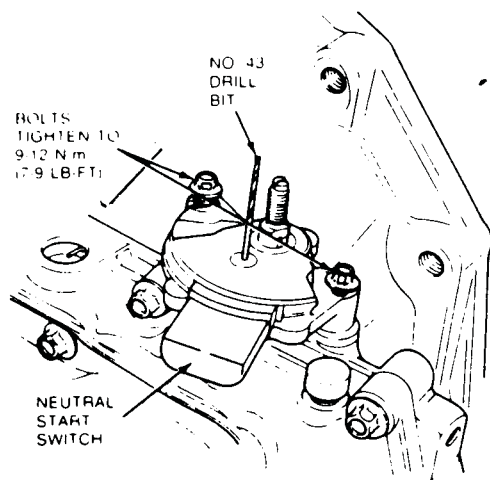
## DISASSEMBLY AND ASSEMBLY (Continued)

66. Install bulkhead connector into case, making sure locking tabs on bulkhead assembly are secure. Install four electrical connectors on proper switches and solenoids until a slight "click" is felt.

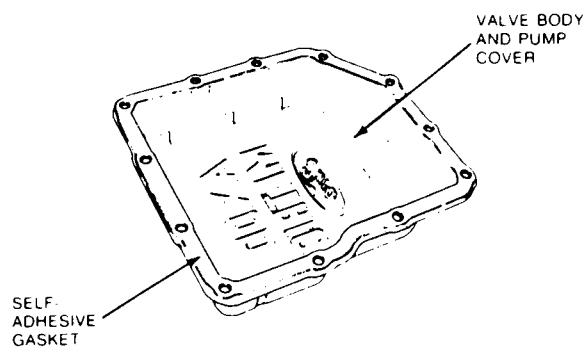
NOTE: Wires are exact length and cannot be interchanged.



67. Install neutral start switch. With manual shaft in neutral detent, align switch using a No. 43 (.089 inch) drill bit or equivalent. Tighten to 9-12 N·m (7-9 lb·ft).



68. Install new self-adhesive oil pump and valve body cover gasket onto cover.



## DISASSEMBLY AND ASSEMBLY (Continued)

69. Install cover and tighten to 9-12 N·m (7-9 lb-ft).

70. Rotate transaxle to horizontal position.

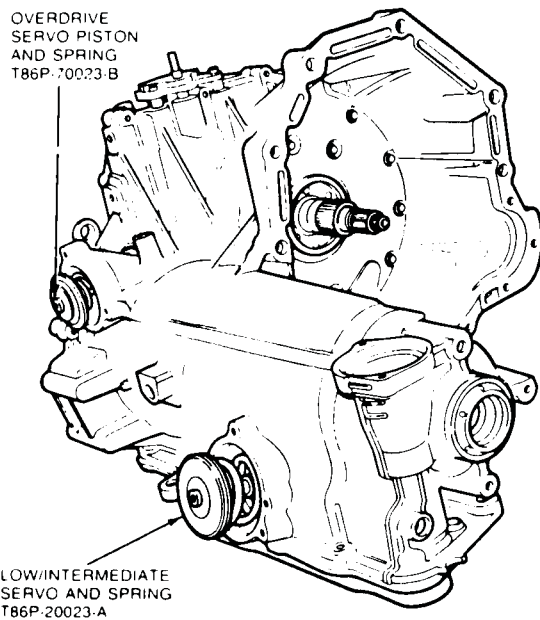
71. Perform servo travel check as follows:

NOTE: This procedure applies to both the overdrive servo and the low-intermediate servo.

NOTE: The following procedure should be performed only if one of the components listed below is being replaced during assembly of the transaxle:

- Transaxle case.
- Band assembly.
- Drum and sun gear assembly.
- Servo piston rod.
- Servo piston.

72. Install Spring in case from Overdrive Servo Rod Tool T86P-70023-B or low/intermediate servo rod Tool T86P-70023-A or equivalent.



73. Install servo piston and rod in case.

NOTE: On low/intermediate servo, install without piston seal.

74. Install Servo Rod Tool T86P-70023-B (Overdrive Servo) or T86P-70023-A (low-intermediate Servo) or equivalent, and secure in case using servo cover bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft).

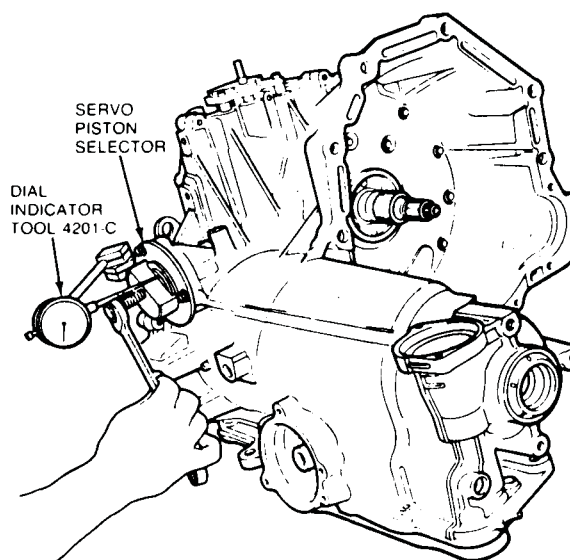
75. Tighten gauge disc screw to 1.13 N·m (10 lb-in). For Overdrive servo 3.4 N·m (30 lb-in) for low/intermediate servo.

76. Mount Dial Indicator TOOL-4201-C or equivalent, and position stylus through hole in gauge disc. Make certain indicator stylus has contacted servo piston on a flat surface. Do not contact step on piston. Zero dial indicator.

77. Back off gauge disc screw until piston movement stops and read dial indicator. The amount of piston travel as indicated on dial indicator will determine the rod length to be installed. For Overdrive servo, reading should be 1.8-3.8mm (0.070-0.149 inch). For low/intermediate servo, reading should be 5.5-6.5mm (0.216-0.255 inch).

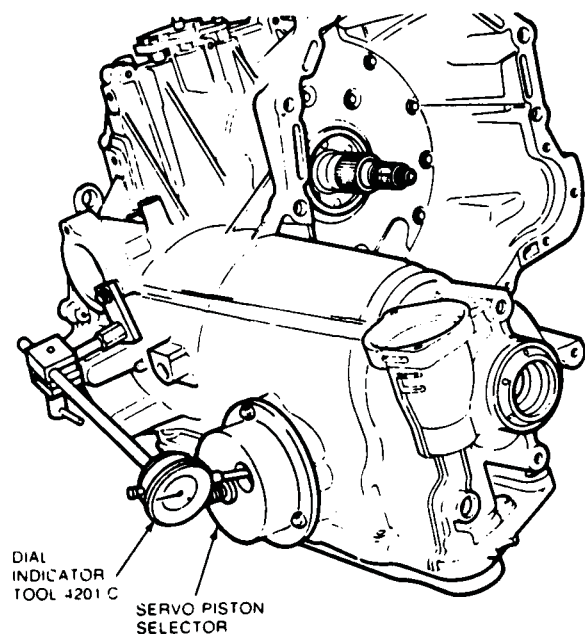
NOTE: If a new low/intermediate band is installed, reading should be 5-6mm (0.196-0.236 inch).

### Overdrive Servo Travel Check

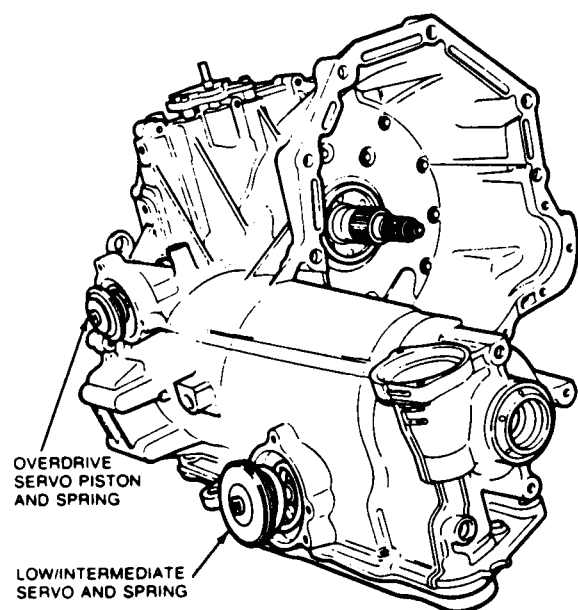


# DISASSEMBLY AND ASSEMBLY (Continued)

## Low Intermediate Servo Travel Check



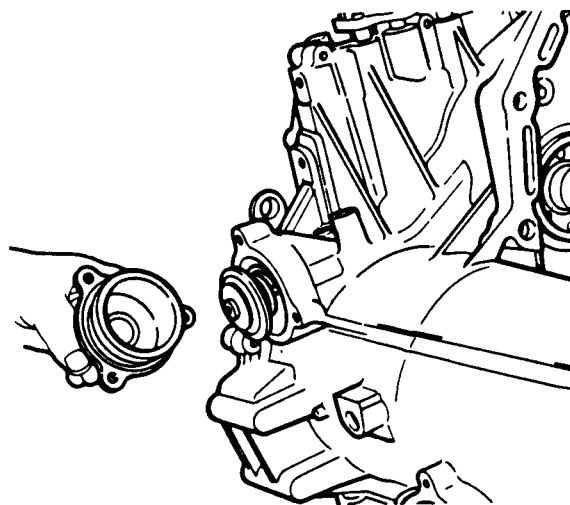
78. Select a new piston rod using the measurement obtained in Step 78. Install new piston rod and repeat Steps 73 through 78 to verify amount of piston travel.
79. Install seals on low/intermediate servo piston.
80. Install servo pistons and springs being sure they are fully seated.



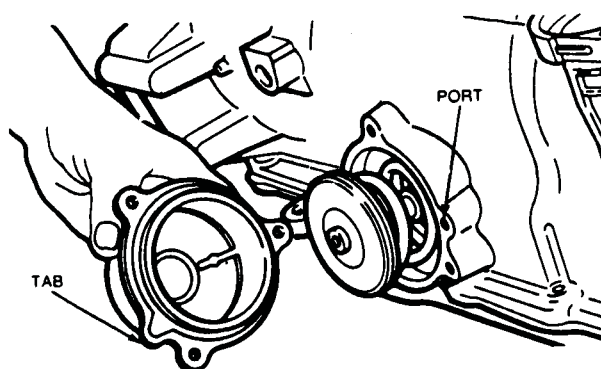
81. Install servo covers for Overdrive and low/intermediate servo using new seals for Overdrive servo or gasket for low/intermediate servo. Tighten cover bolts to 9-12 N·m (7-9 lb-ft).

**CAUTION:** Be sure to align tab on low/intermediate servo cover with port on case. Tighten bolts two to three turns at a time to prevent cocking servo cover.

## Overdrive Servo Cover



## Low-Intermediate Servo Cover



82. Install dipstick tube grommet and dipstick tube in case. Tighten attaching bolt to 9-12 N·m (7-9 lb-ft).

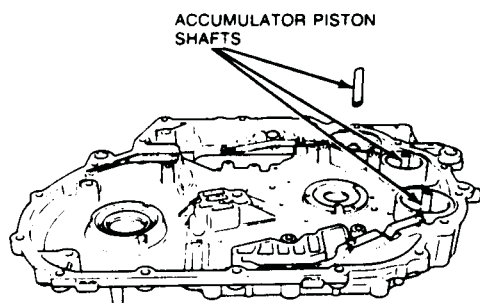
## DISASSEMBLY AND ASSEMBLY (Continued)

### Sub-Assemblies

#### Chain Cover

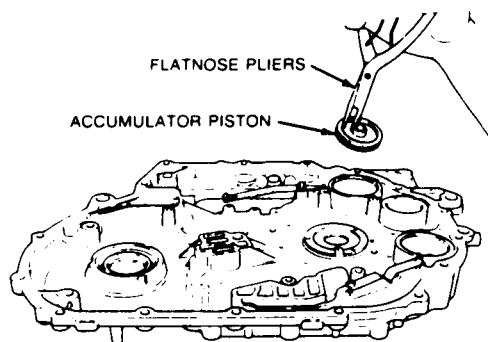
##### Disassembly

1. Remove three accumulator piston shafts.



2. Using flatnose pliers, remove three accumulator pistons.

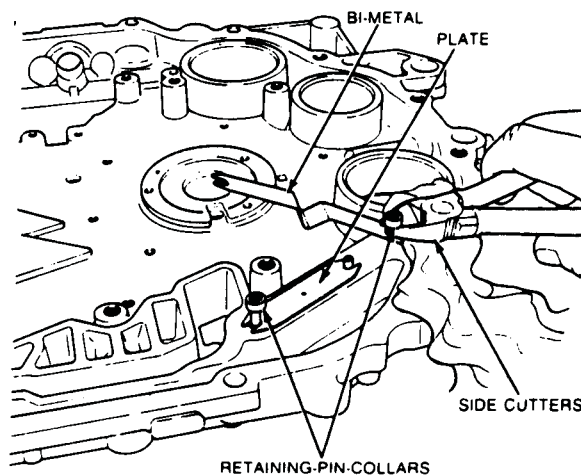
**CAUTION:** Do not use any objects in piston shaft bore for removal.



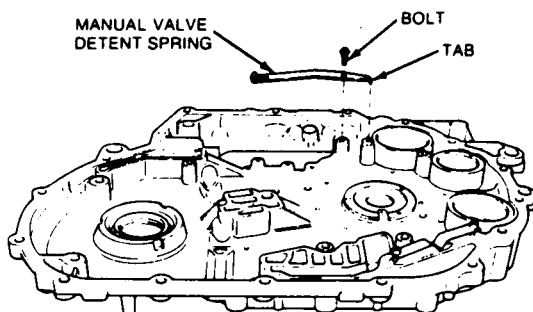
3. Using side cutters, carefully remove bimetal retaining pin collars and remove bimetal and plate.

**CAUTION:** Use care not to damage machined case surfaces or bi-metallic strips.

4. Pull retaining pins from cover.

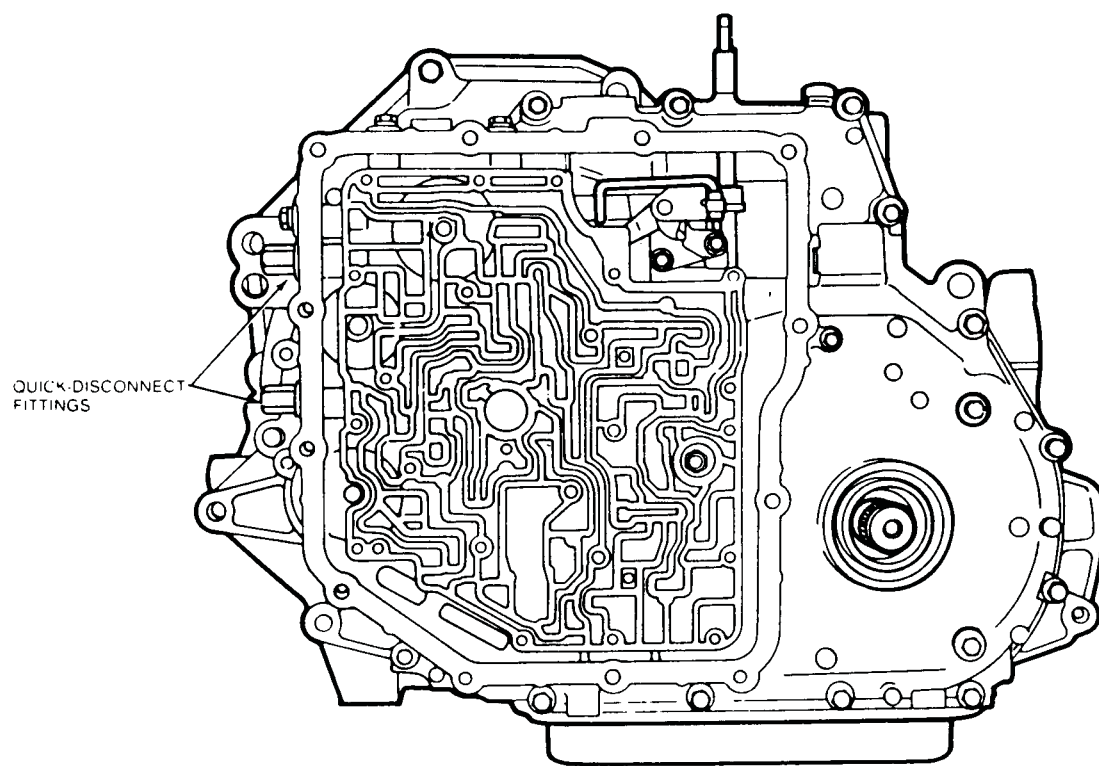


5. Remove 8mm manual valve detent spring bolt and spring.

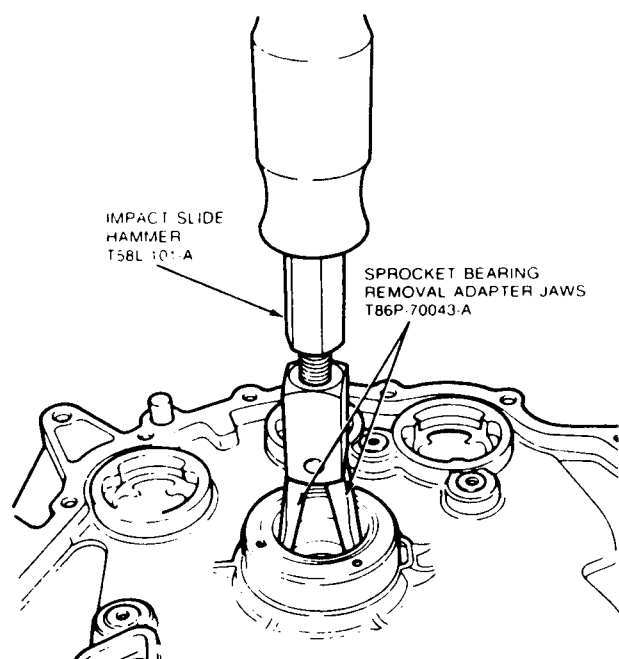


## DISASSEMBLY AND ASSEMBLY (Continued)

6. Remove quick-connect oil cooler fittings.

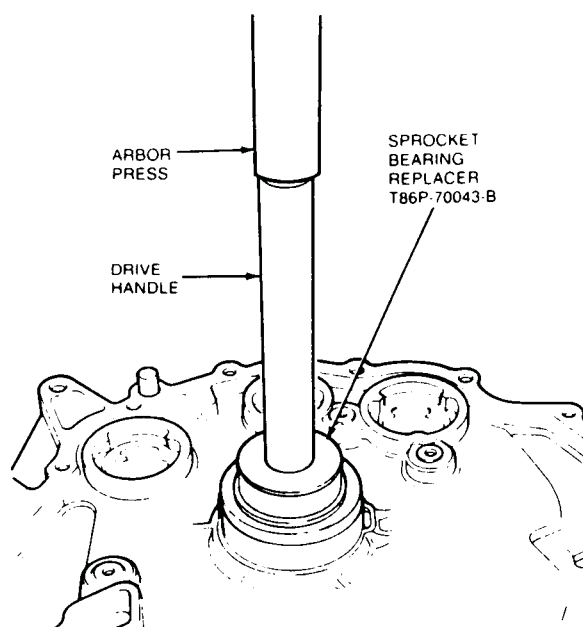


7. Remove drive sprocket support needle bearing using Sprocket Bearing Removal Adapter Jaws T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.



### Assembly

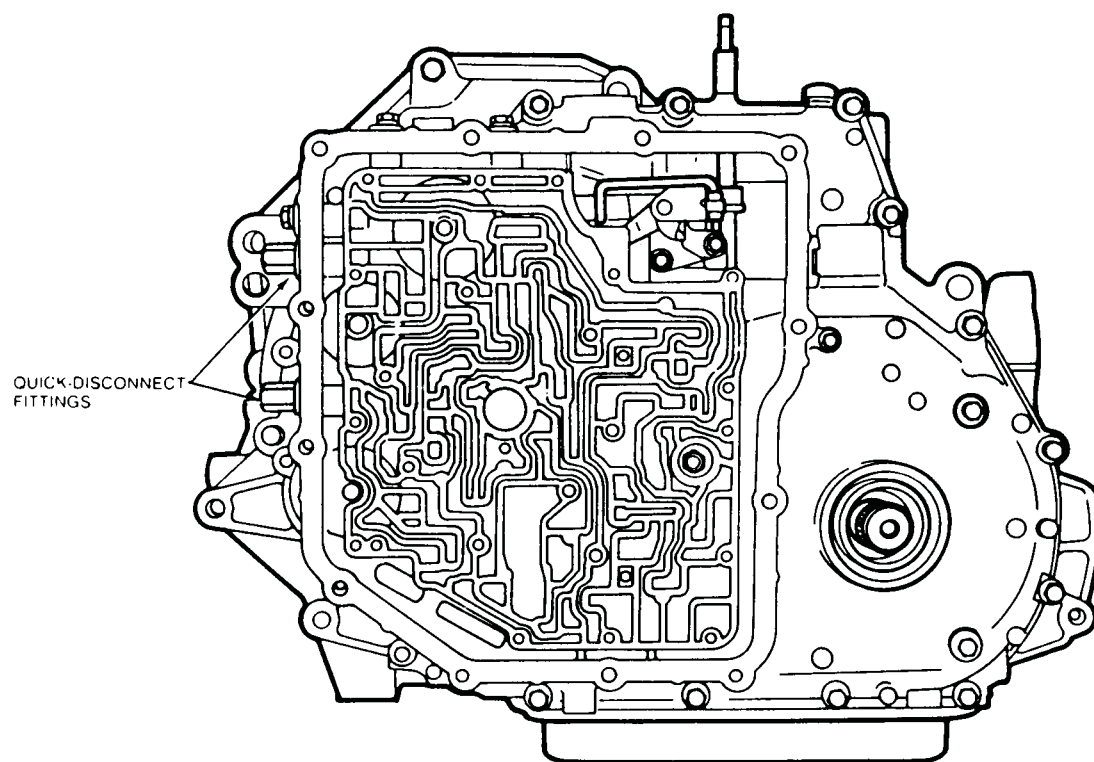
1. Using an arbor press, install drive sprocket support needle bearing using Sprocket Bearing Replacer T86P-70043-B or equivalent.





DISASSEMBLY AND ASSEMBLY (Continued)

2. Install quick-connect oil cooler fittings.

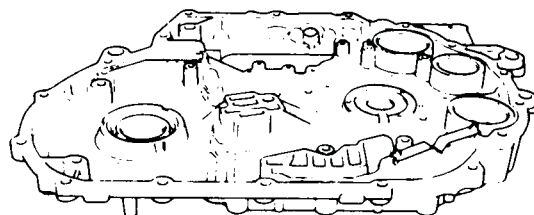


3. Install manual valve detent spring and position tab in locator hole. Tighten bolt to 9-12 N·m (7-9 lb-ft).

MANUAL VALVE  
DETENT SPRING

BOLT

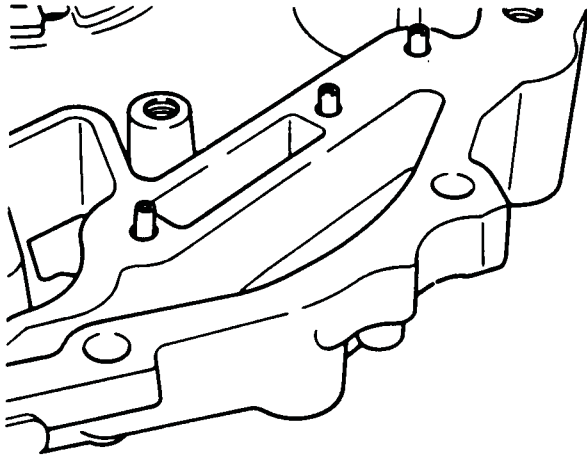
TAB



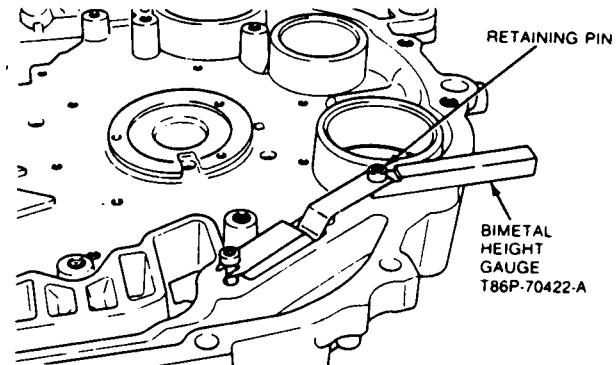


DISASSEMBLY AND ASSEMBLY (Continued)

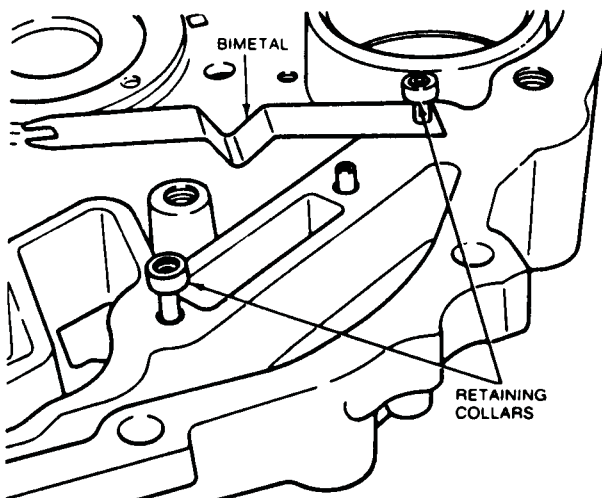
4. Start bimetal retaining pins in cover.



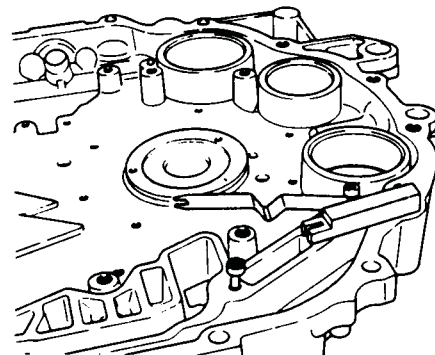
6. Place Bimetal Height Gauge T86P-70422-A or equivalent, against retaining pin and under bimetal.
7. Gently tap retaining collar onto pin until it seats against tool edge.



5. Place end of bimetal with hole over front retaining pin. Install bimetal retaining collars.

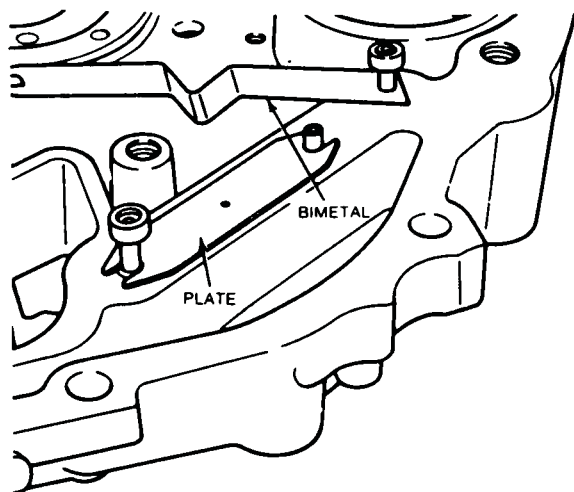


8. Engage slotted end of bimetal under rear retaining pin and retaining collar and repeat Steps 6 and 7 for slotted end of bimetal.
9. Remove slotted end of bimetal and use Bimetal Height Gauge T86P-70422-A or equivalent to set center pin at correct height.

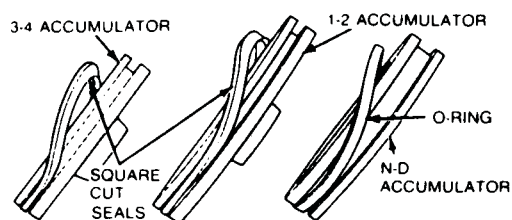


## DISASSEMBLY AND ASSEMBLY (Continued)

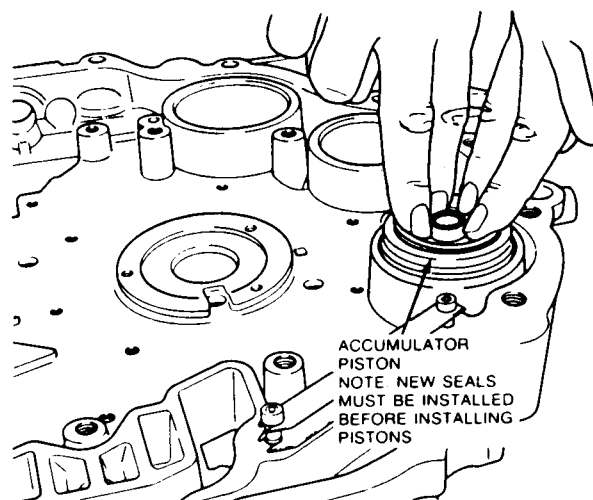
10. Position plate slotted ends onto rear and middle retaining pins. Install slotted end of bimetal under retaining collar.



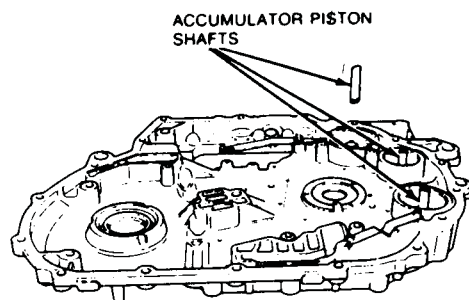
11. Install new seals and O-rings on accumulator pistons.



12. Install accumulator pistons into their proper cylinder.



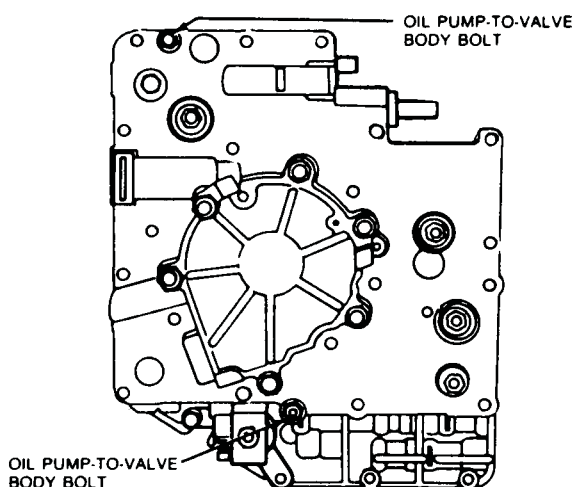
13. Install three accumulator piston shafts.



## Oil Pump and Valve Body Assembly

### Disassembly

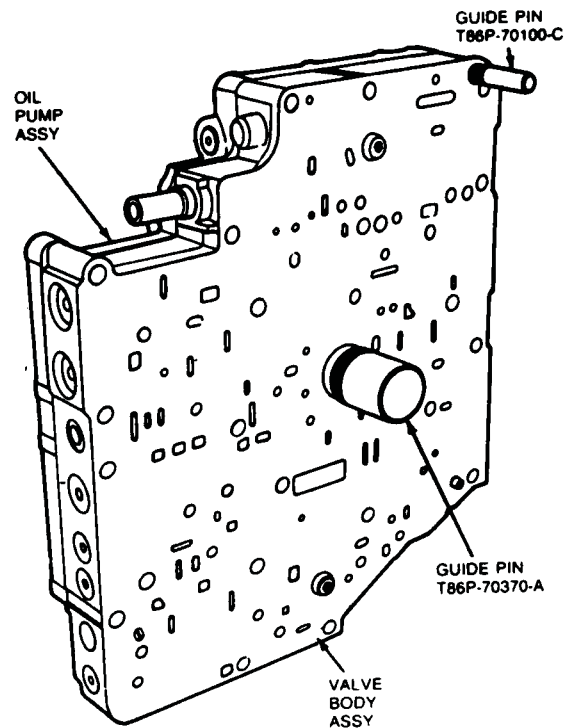
Remove two 8mm bolts attaching oil pump-to-valve body and separate valve body from oil pump. Remove gasket.



## DISASSEMBLY AND ASSEMBLY (Continued)

### Assembly

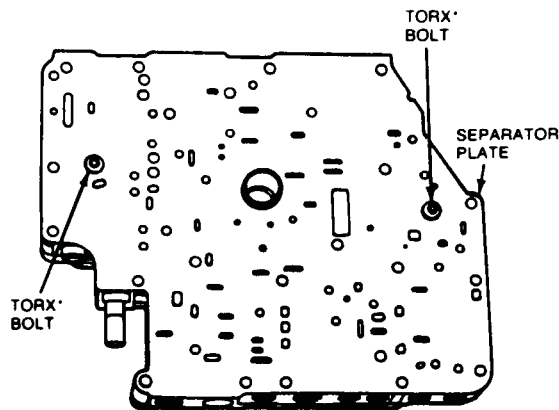
1. Position valve body on oil pump using a new gasket.
2. Insert Valve Body-to-Oil Pump Guide Pins T86P-70370-A and T86P-70100-C or equivalent, as shown. Install two valve body-to-oil pump retaining bolts and tighten to 9-12 N·m (7-9 lb-ft).



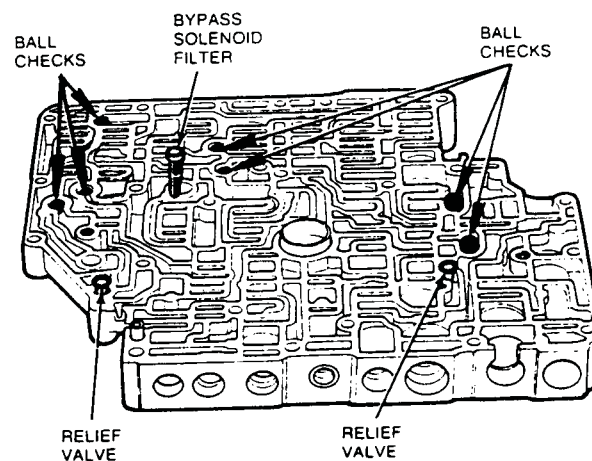
### Valve Body

#### Disassembly

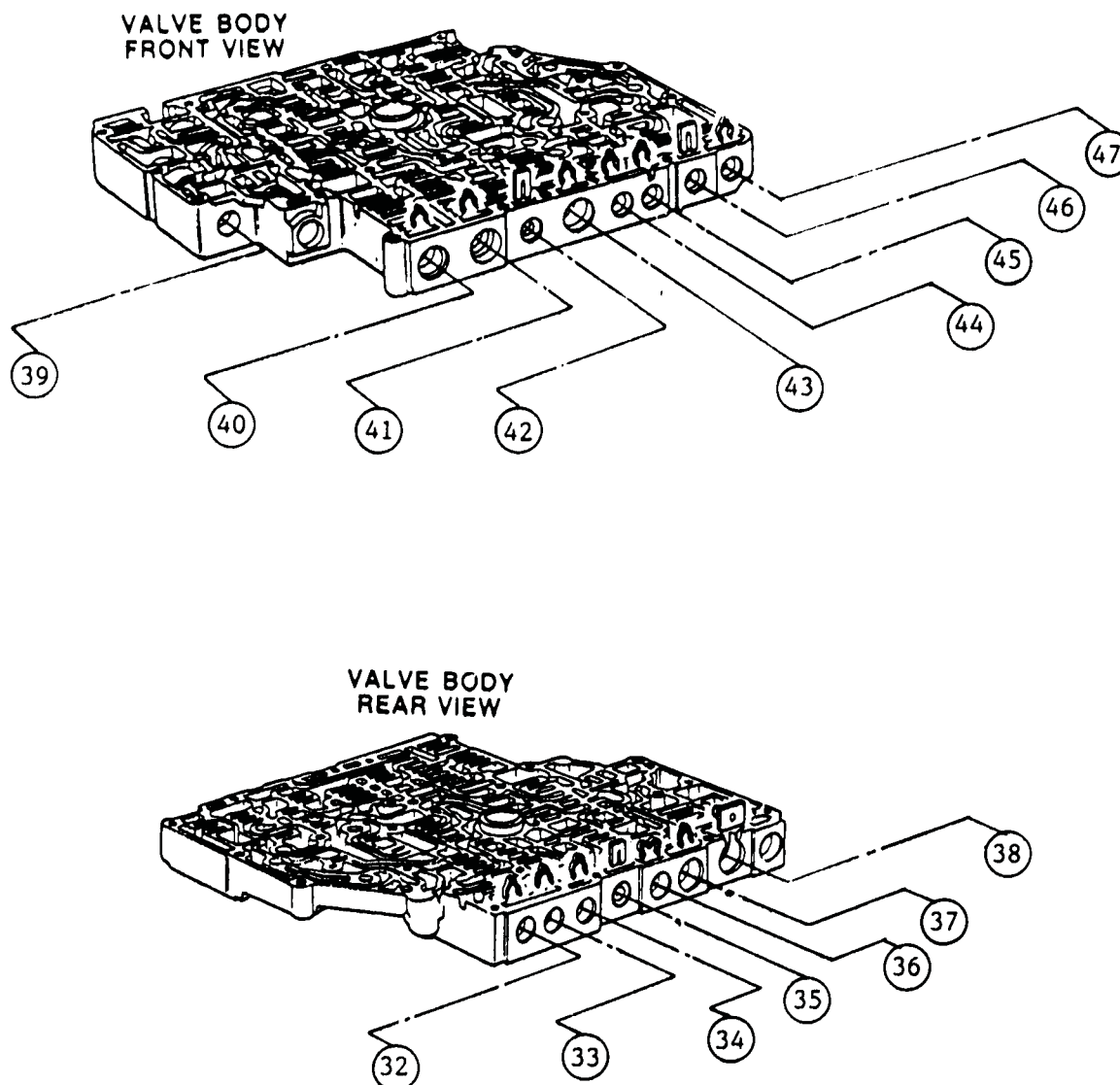
1. Place valve body on bench with separator plate up, and remove two Torx® bolts retaining separator plate to valve body.
2. Remove separator plate and gasket.



3. Remove seven ball checks, two relief valves and by-pass solenoid filter. Clean filter.



## AXOD VALVE BODY BORE NUMBERS



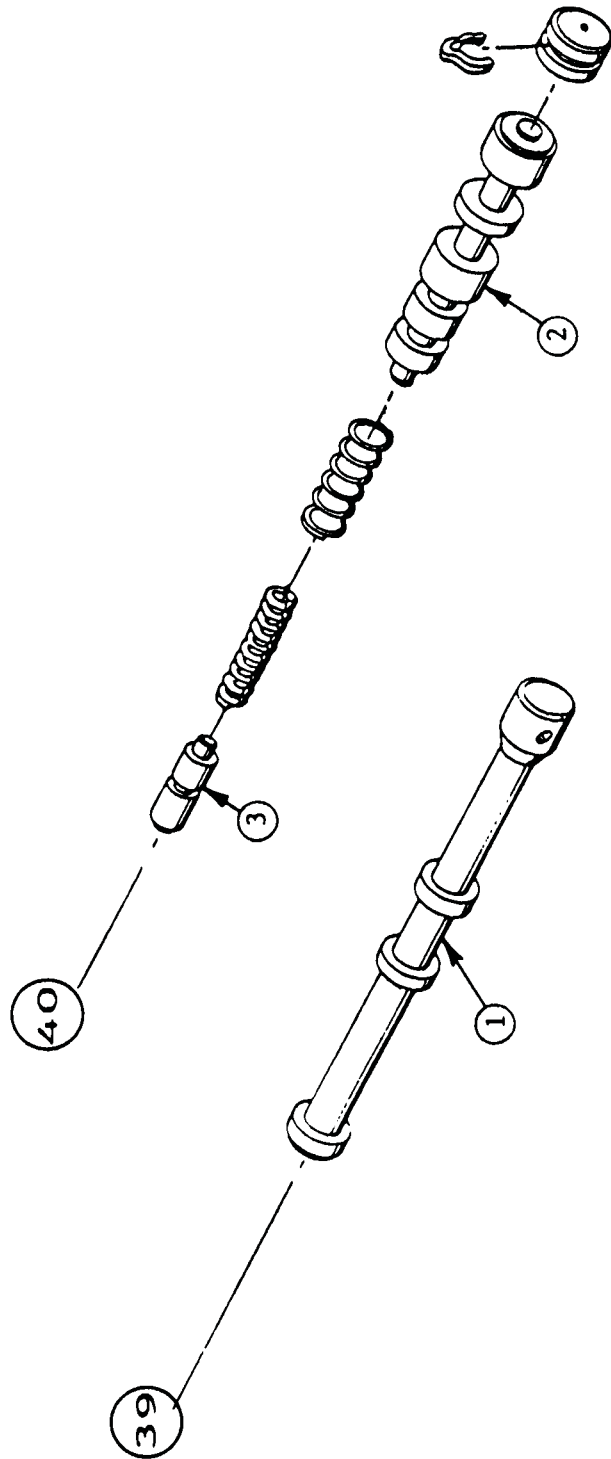
ON THIS PAGE WE HAVE ASSIGNED NUMBERS TO ALL OF THE VALVE BODY BORES AND RE-DRAWN THE VALVES AND SPRINGS IN THEIR PROPER LOCATIONS, WITH EACH VALVE ORIENTED PROPERLY, AND IDENTIFIED, AS SHOWN ON THE FOLLOWING PAGES. "ALL" OF THE MANUALS PRESENTLY IN PRINT ARE WRONG.

USE THIS BULLETIN TO PROPERLY ASSEMBLE THE AXOD VALVE BODY.

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Figure 1

AUTOMATIC TRANSMISSION SERVICE GROUP

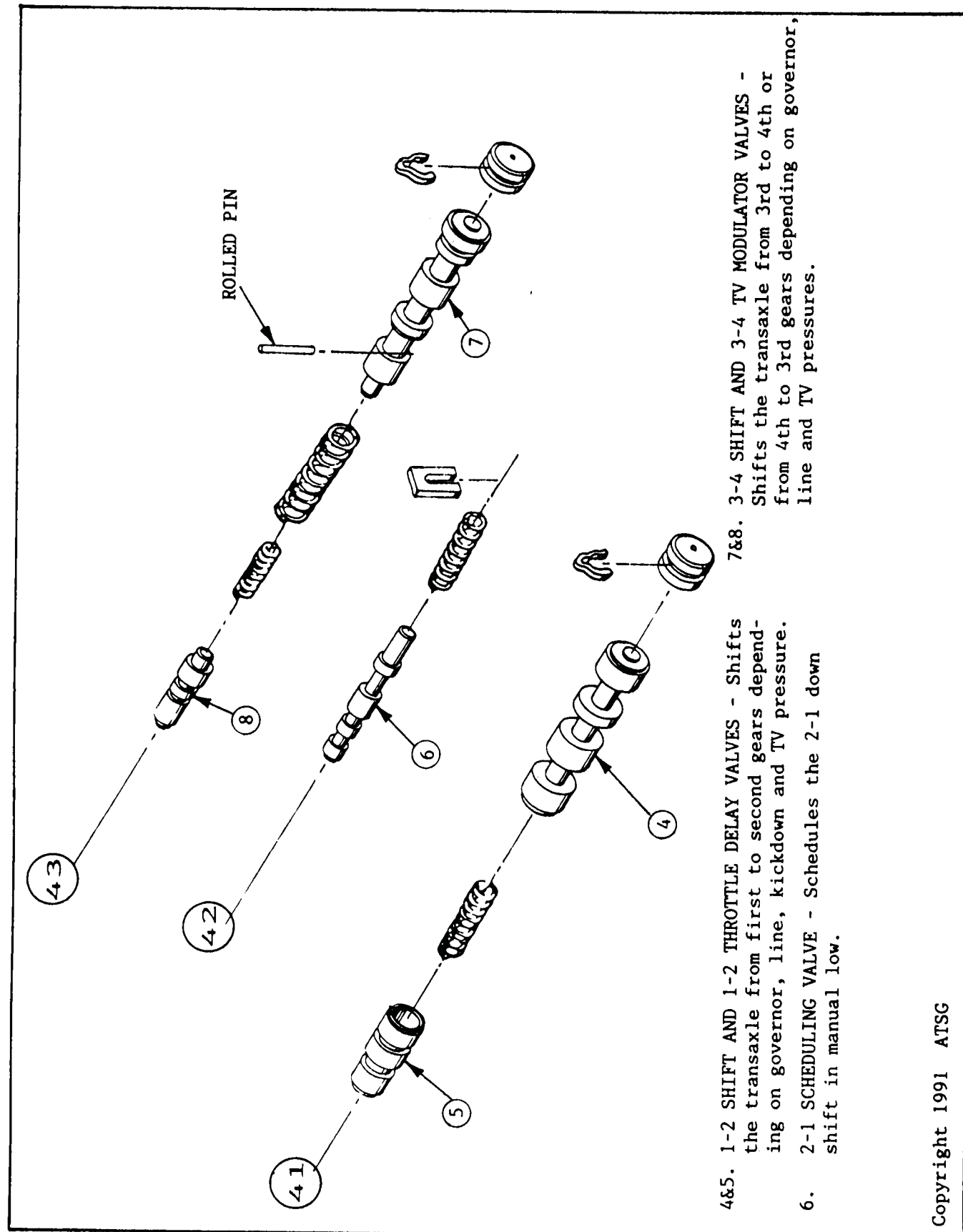


1. MANUAL VALVE - Connected mechanically to the shift selector lever. Directs line pressure to the various circuits depending on the range selected by the driver.

2&3. 2-3 SHIFT AND 2-3 TV MODULATOR VALVES - Shifts the transaxle from second to third or from third to second gears depending on governor, line, kickdown and TV pressures.

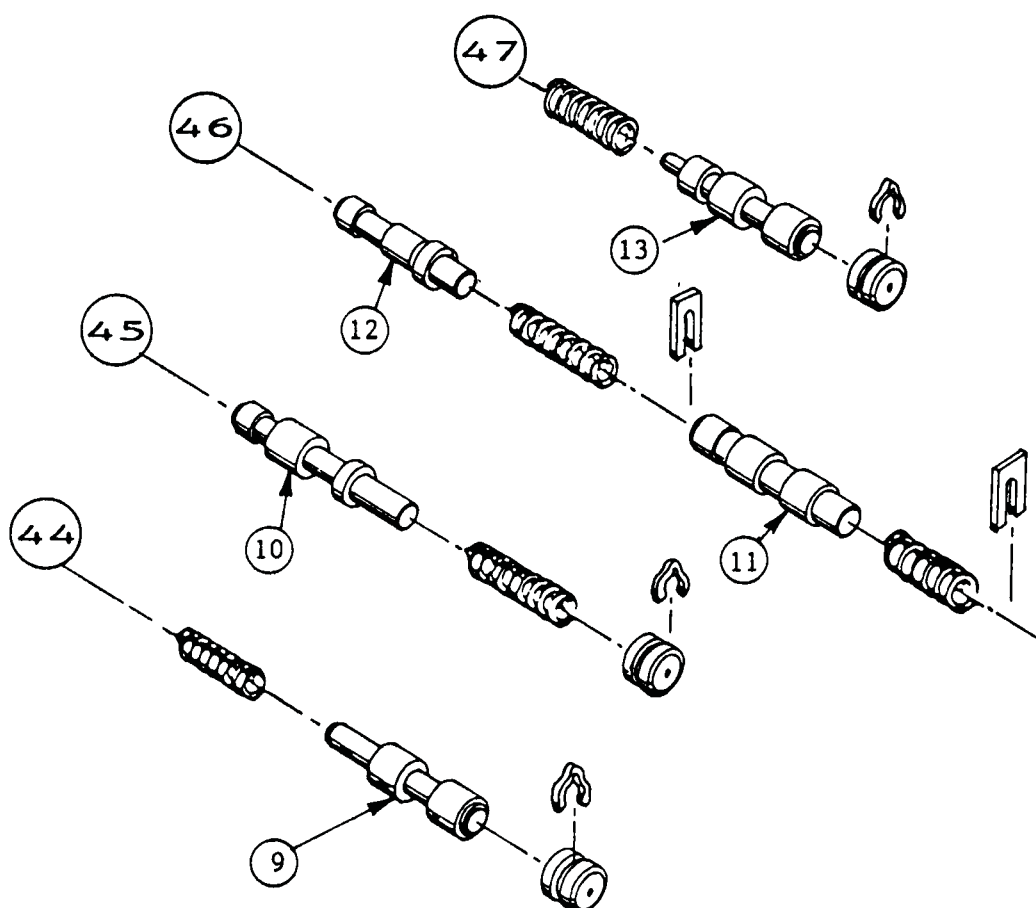
Figure 2

AUTOMATIC TRANSMISSION SERVICE GROUP



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Figure 3  
AUTOMATIC TRANSMISSION SERVICE GROUP

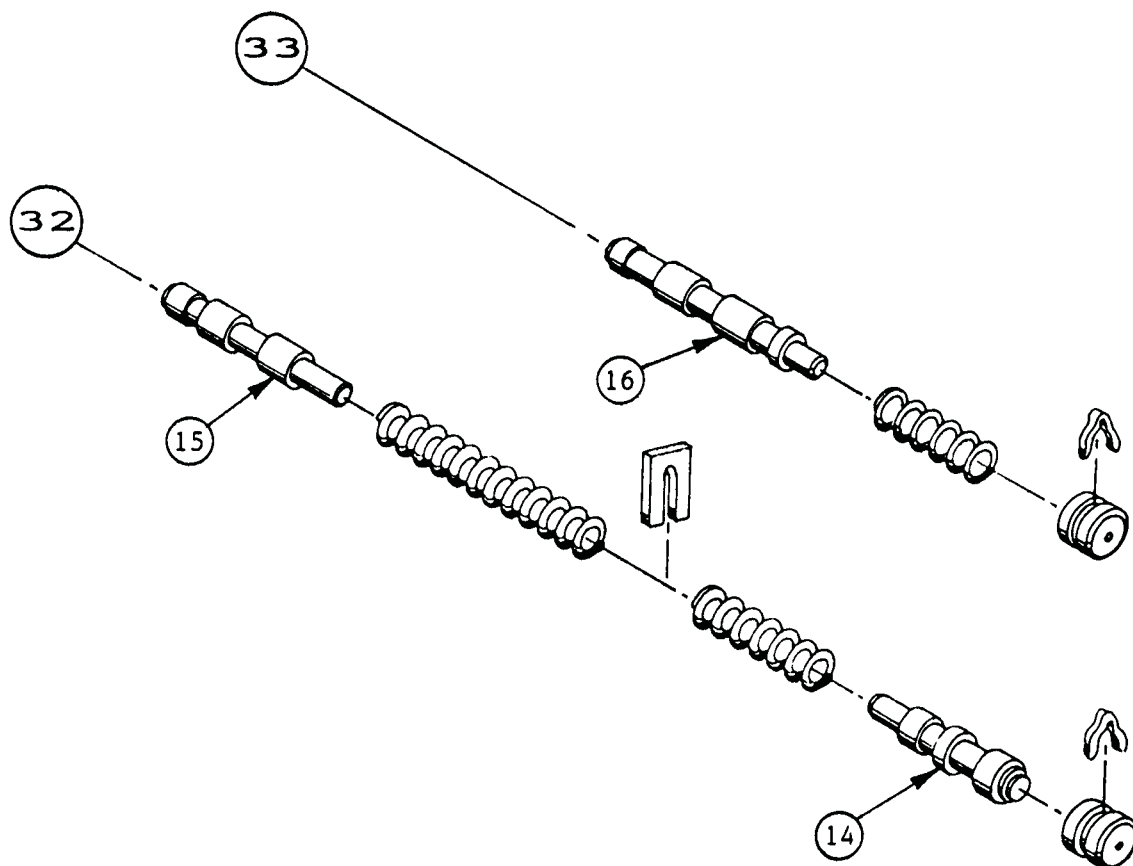


9. 2-4 INHIBIT VALVE - Prevents a 2-4 upshift by directing line pressure to hold the 3-4 shift valve in the down shifted position whenever the direct clutch circuit is not pressurized.
10. 3-2 CONTROL VALVE - Controlled by governor pressure, and controls the timing of the 3-2 downshift by regulating the rate at which the direct clutch releases and the 1-2 band applies.
11. TV LIMIT VALVE - Limits TV pressure to a maximum of 82-87 PSI.
12. N/D ENGAGEMENT VALVE - Controls the orifices used to apply the 1-2 band for a N/D engagement by absorbing some of the apply oil during the engagement.
13. 2-3 SERVO REGULATOR VALVE - Regulate 1-2 servo apply pressure controlling the action of 1-2 servo release as an accumulator for the 2-3 shift.

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Figure 4  
AUTOMATIC TRANSMISSION SERVICE GROUP

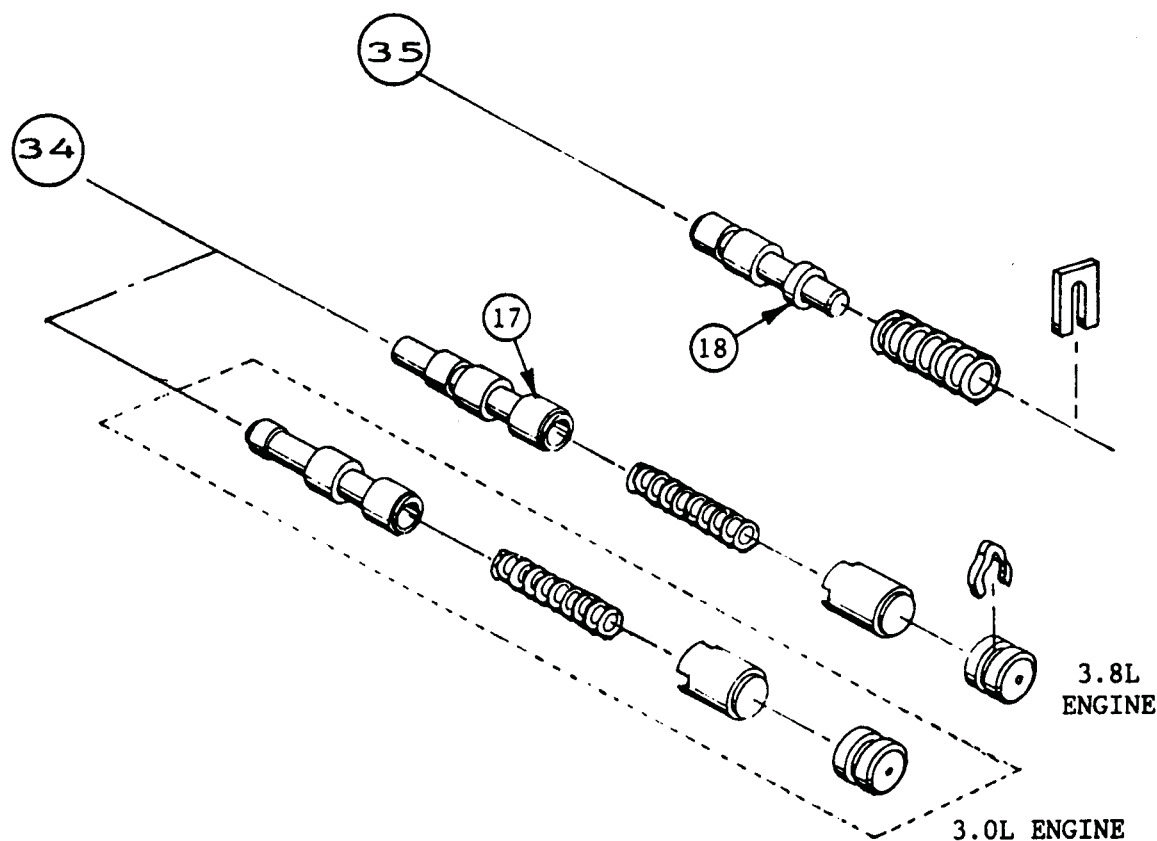




- 14. TV/LINE MODULATOR VALVE - Modifies TV pressure for control of line pressure to more closely match engine torque and transaxle capacity requirements.
- 15. 4-3 SCHEDULING VALVE - Prevents fourth gear operation at high TV pressure.
- 16. BACKOUT VALVE - Controls the orifices used for the 2-3 and 3-4 upshifts based on the backout signal from the manual valve. Also prevents a 3-2 downshift at closed throttle.

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Figure 5  
AUTOMATIC TRANSMISSION SERVICE GROUP



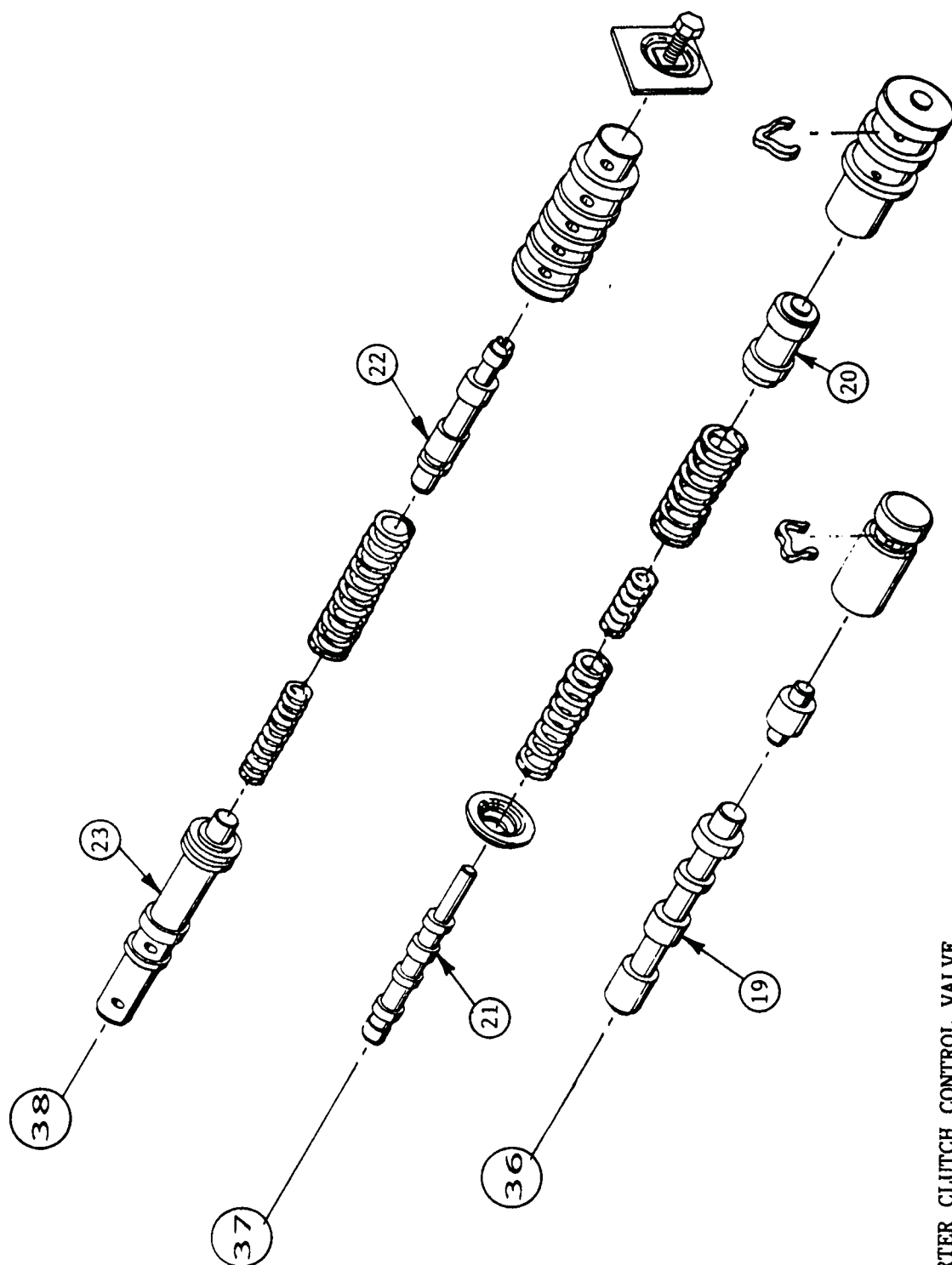
17. ACCUMULATOR REGULATOR VALVE - Regulates 1-2 and 3-4 accumulator back pressure proportional to line pressure.  
 NOTE: Notice that there are two different valves found in this bore, one type for 3.0L engines, and one type for 3.8L engines.
18. CONVERTER CLUTCH REGULATOR VALVE - Limits converter clutch apply pressure to a maximum of 100 PSI.

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Figure 6  
 AUTOMATIC TRANSMISSION SERVICE GROUP



# Technical Service Information



- 19. CONVERTER CLUTCH CONTROL VALVE.
- 20. MAIN REGULATOR BOOST VALVE.
- 21. MAIN REGULATOR VALVE.
- 22. THROTTLE VALVE (TV).
- 23. THROTTLE VALVE PLUNGER.

FUNCTIONAL DESCRIPTION OF THESE VALVES IS ON THE FOLLOWING PAGE.

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Figure 7  
AUTOMATIC TRANSMISSION SERVICE GROUP



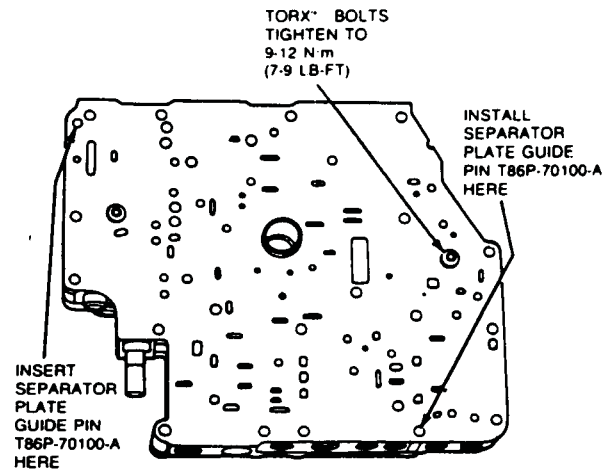
## Technical Service Information

19. CONVERTER CLUTCH CONTROL VALVE - Exhausts or pressurizes the converter clutch to apply or release the clutch based on the state of converter clutch solenoid pressure (Signal Oil). Regulates converter clutch pressure proportional to solenoid pressure during release of the converter clutch. Controls lube and cooler flow orifices based on the state of the converter clutch.
20. MAIN REGULATOR BOOST VALVE - Exerts a force on the main regulator valve controlling line pressure based on reverse and TV/Line modulator pressures.
21. MAIN REGULATOR VALVE - Regulates line pressure by controlling pump output. Controlled by cutback (L234) signal, spring preload, and the force exerted by the main regulator boost valve.
22. THROTTLE VALVE (TV) - regulates TV pressure proportional to throttle plunger position, or throttle opening.
23. THROTTLE PLUNGER - Mechanically connected to the accelerator pedal, and as the pedal is depressed, the plunger compresses the TV plunger spring causing the throttle valve to increase TV pressure. The plunger position also controls the opening of the backout and kickdown ports.

## DISASSEMBLY AND ASSEMBLY (Continued)

### Assembly

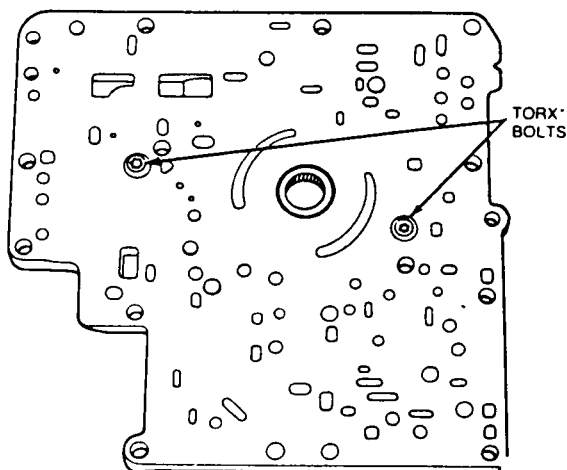
1. Install by-pass solenoid filter.
2. Assemble valves and springs into valve body.
3. Install ball checks, relief valves and by-pass solenoid filter. Refer to illustration under Disassembly, Step 3.
4. Install separator plate with new gasket on valve body.
5. Install Separator Plate Guide Pins T86P-70100-A or equivalent as shown. Install two Torx® bolts in valve body as shown and tighten to 9-12 N·m (7-9 lb-ft).



### Oil Pump

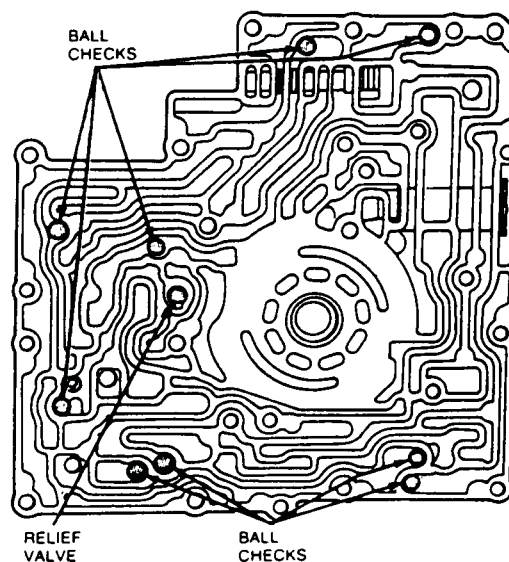
#### Disassembly

1. Remove two Torx® bolts retaining separator plate to oil pump housing.



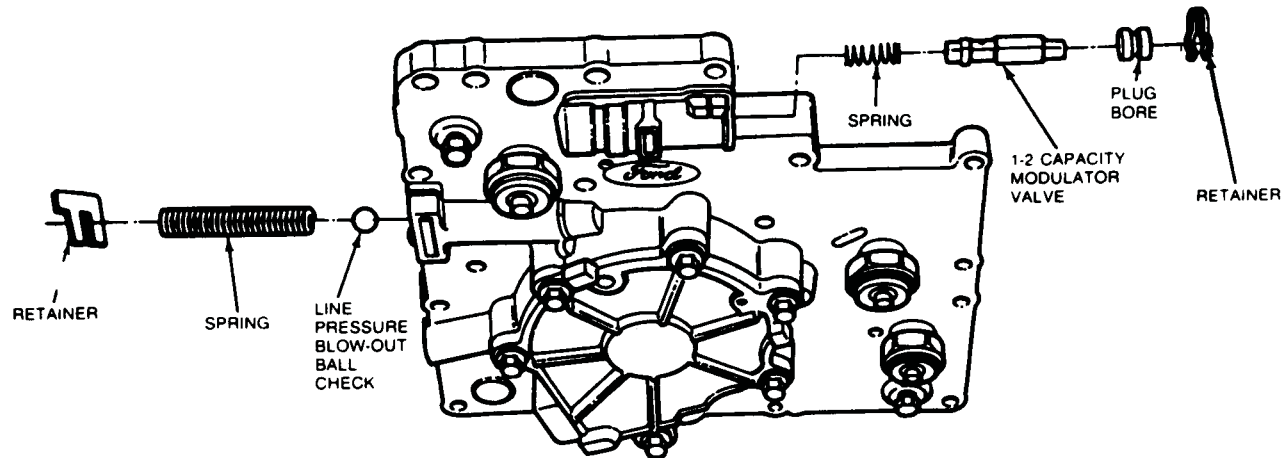
2. Remove ball checks and relief valve.

**SEE PAGE 86 FOR  
PROPER CHECK BALL  
LOCATIONS**

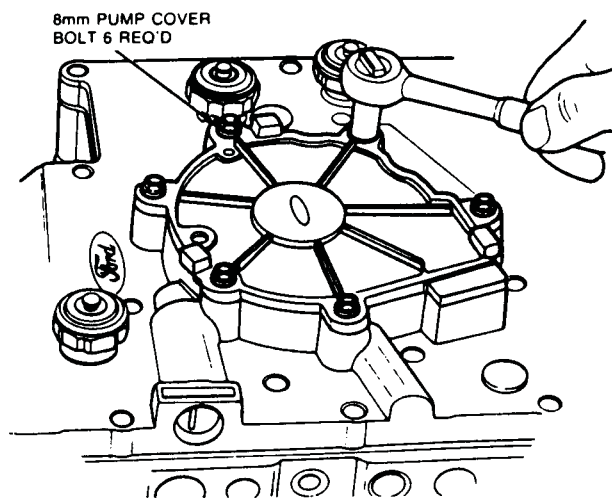


**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Remove retaining clip for line pressure blowoff ball and spring.
4. Remove 1-2 capacity modulator retainer, plug bore, valve and spring.



5. Remove six bolts retaining pump cover to pump housing and remove.

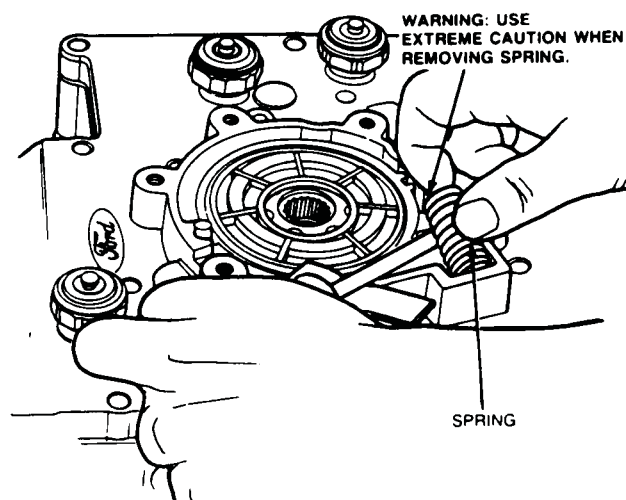




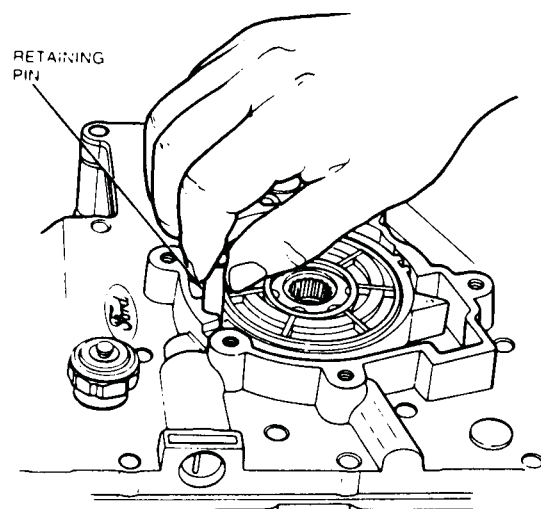
# DISASSEMBLY AND ASSEMBLY (Continued)

6. Remove bore spring by prying spring out of housing.

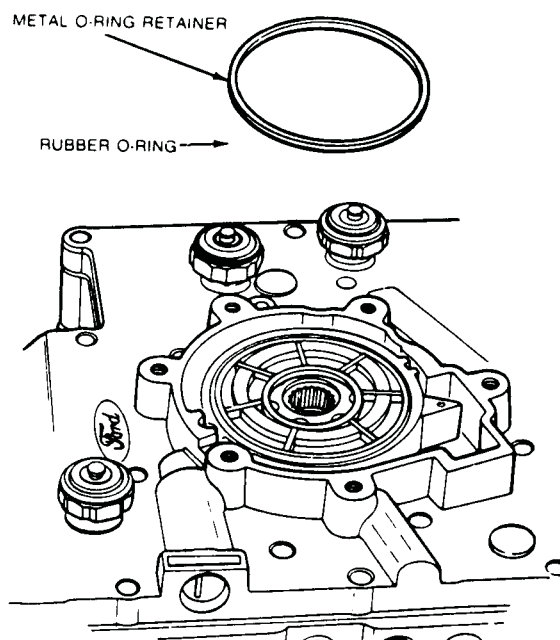
**WARNING: USE EXTREME CAUTION WHEN REMOVING SPRING TO PREVENT PERSONAL INJURY. PLACE A PIECE OF CARDBOARD OR SUITABLE MATERIAL UNDER SCREWDRIVER TO PREVENT DAMAGE TO HOUSING GASKET SURFACE.**



7. Remove outside vane support retaining pin.

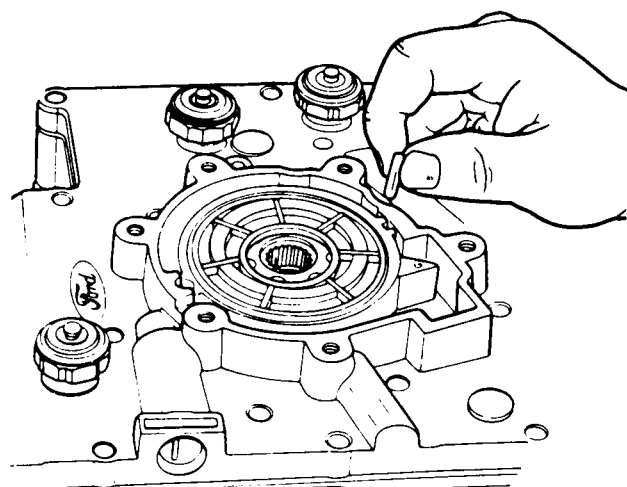


8. Remove metal O-ring retainer and O-ring from outer vane support. Discard O-ring.

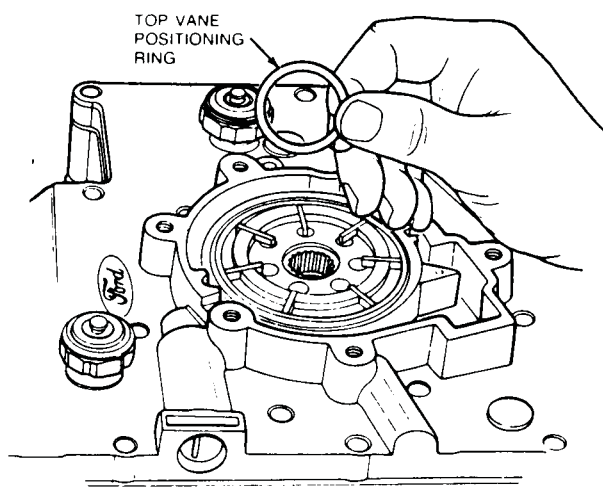


DISASSEMBLY AND ASSEMBLY (Continued)

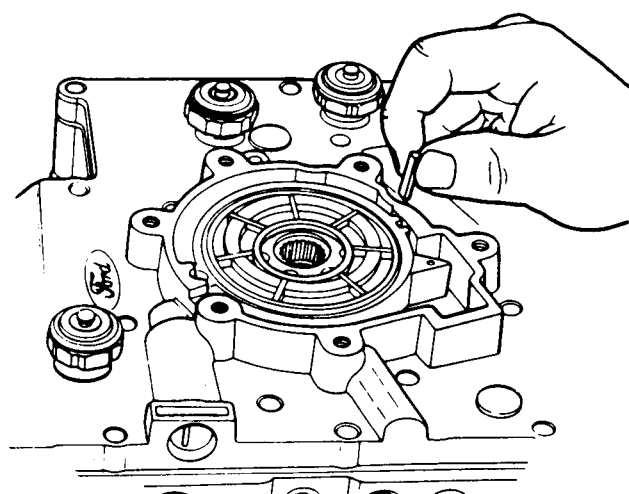
9. Remove and discard side seal.



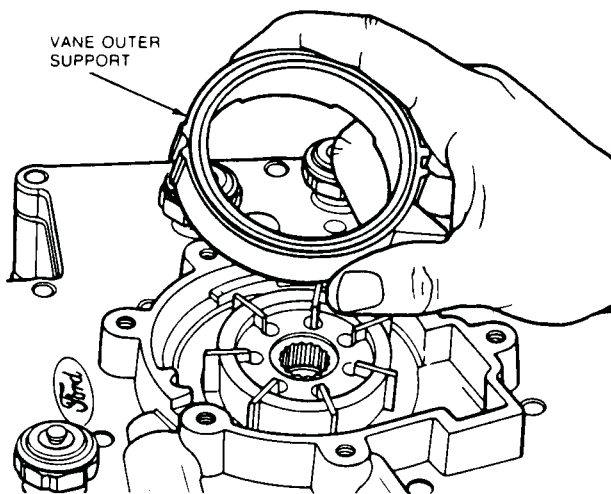
11. Remove top vane positioning ring.



10. Remove side seal support.

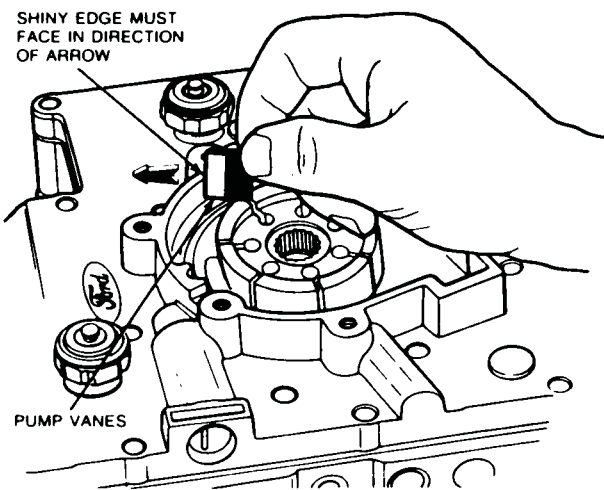


12. Remove outer vane support.

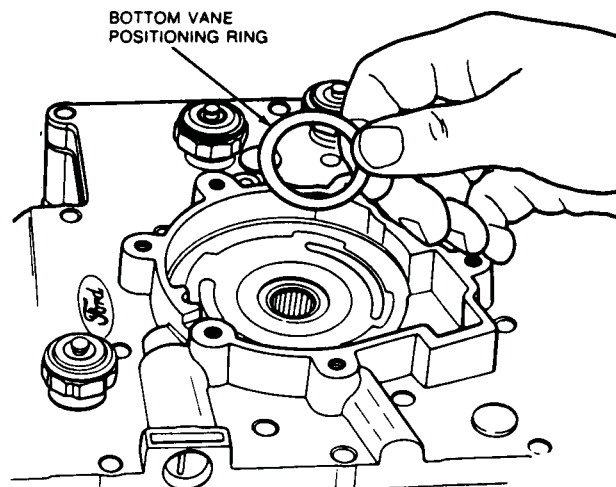


**DISASSEMBLY AND ASSEMBLY (Continued)**

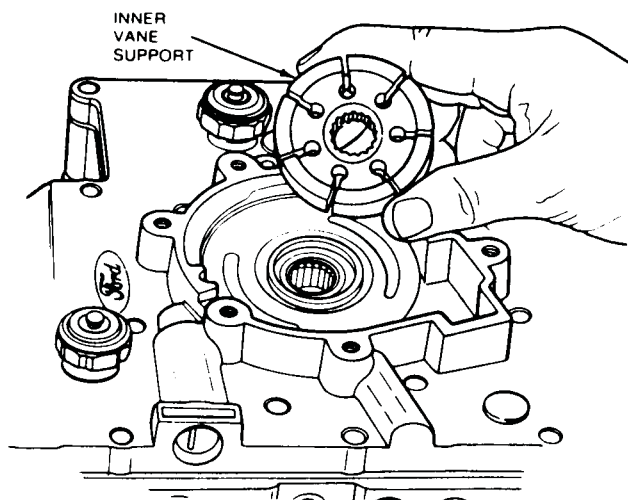
13. Remove seven vanes from rotor.



15. Remove bottom vane positioning ring.



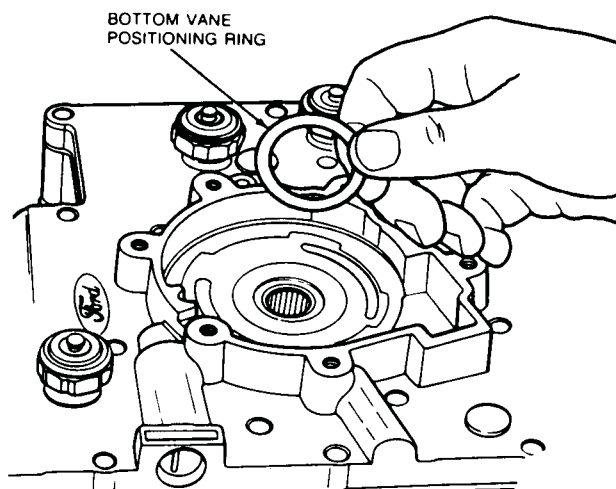
14. Remove inner vane support.



**Assembly**

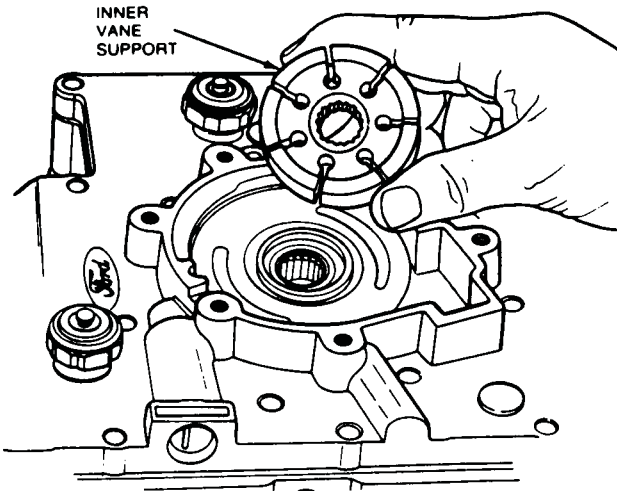
NOTE: The only serviceable parts in the oil pump are the seals. If any other parts of the oil pump are damaged or worn, the entire pump assembly must be replaced.

1. Install bottom vane positioning ring.



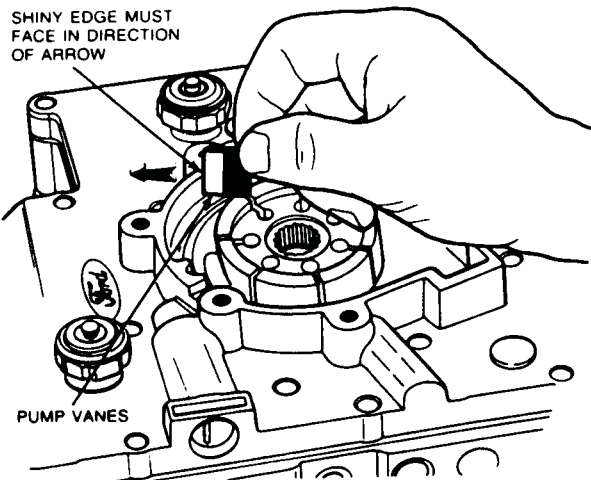
DISASSEMBLY AND ASSEMBLY (Continued)

2. Install inner vane support with small inside diameter counter bore facing up.

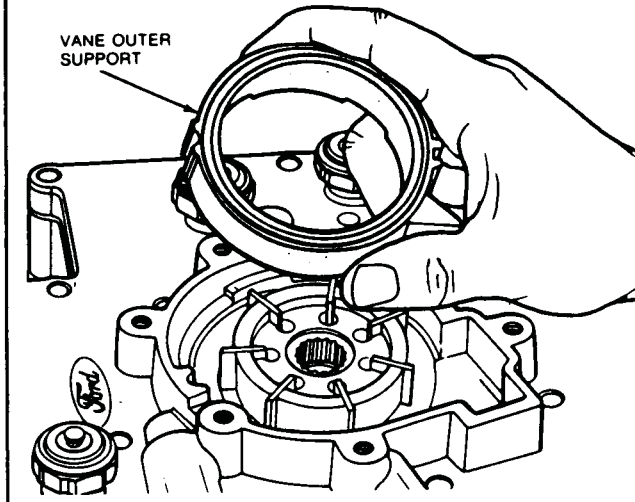


3. Install seven vanes in inner vane support.

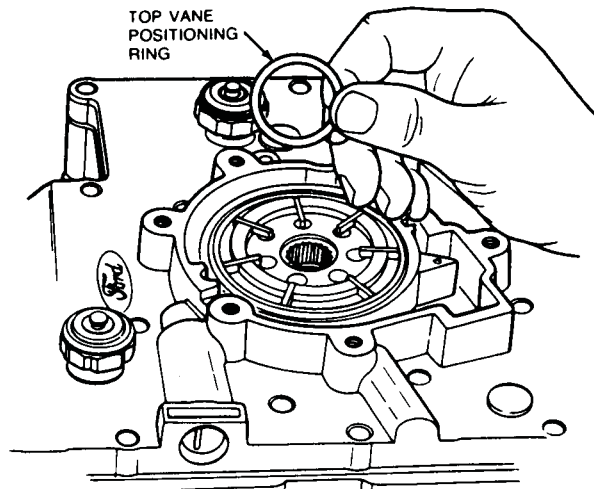
NOTE: Shiny portion of vane blade is installed toward outer vane support.



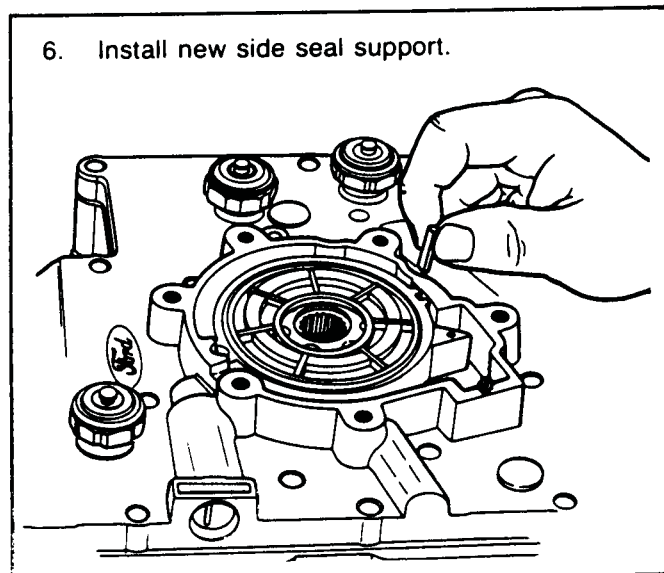
4. Install outer vane support.



5. Install top vane positioning ring.

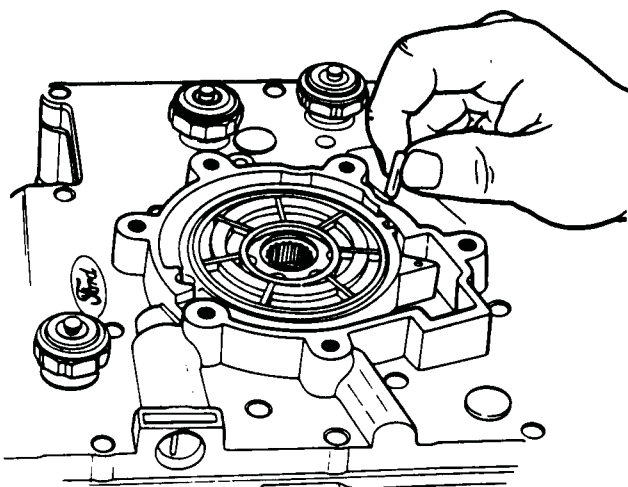


6. Install new side seal support.

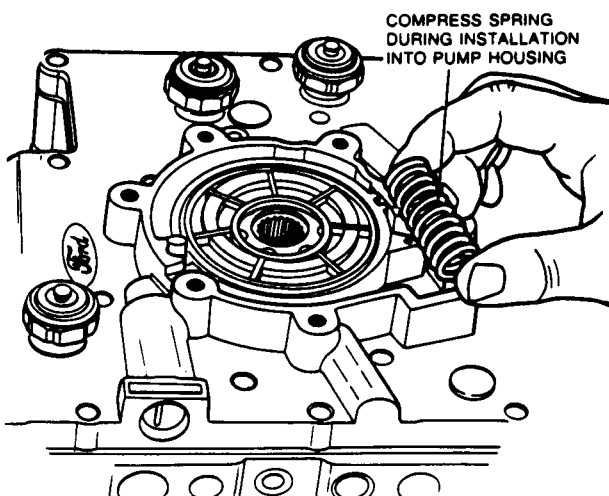


DISASSEMBLY AND ASSEMBLY (Continued)

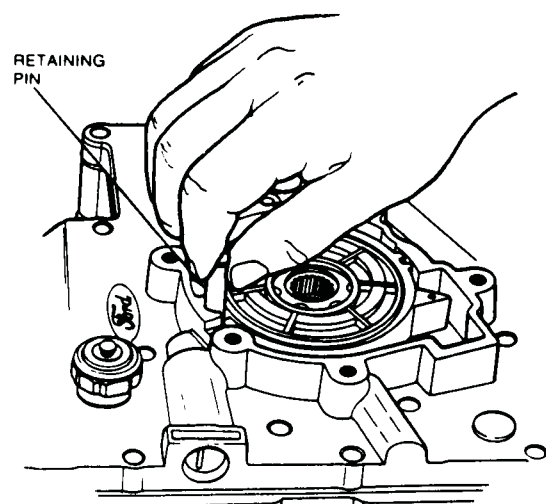
7. Install new side seal.



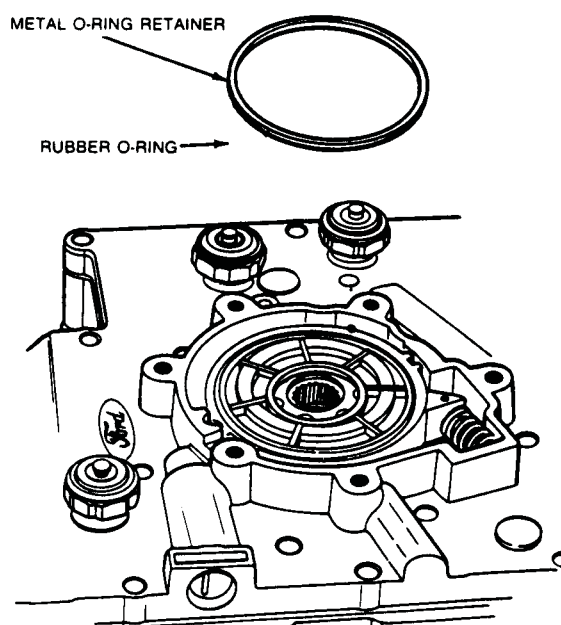
9. Install bore spring between case and tab on outer vane support.



8. Install outer vane support retaining pin.

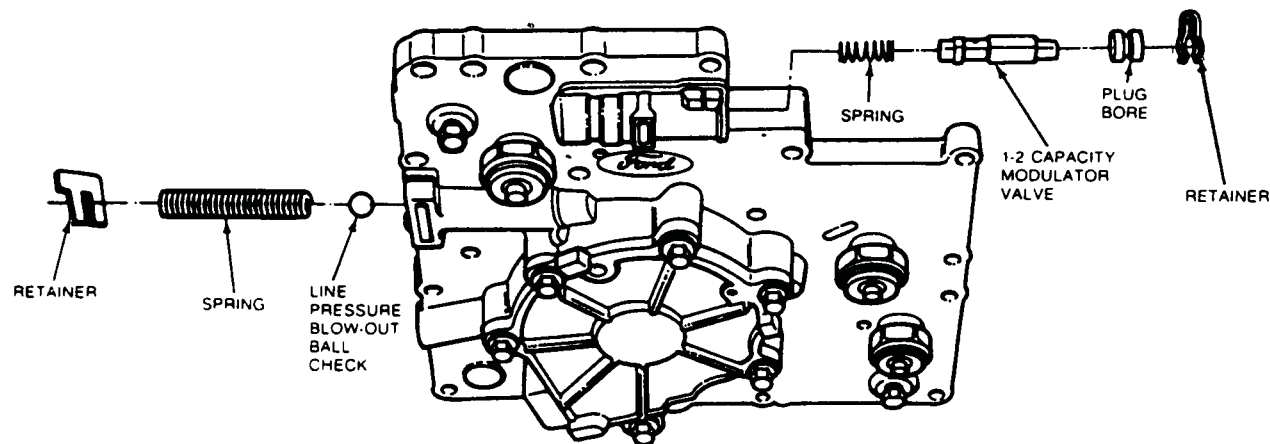


10. Install new O-ring in groove in outer vane support. Then, install metal O-ring retainer.



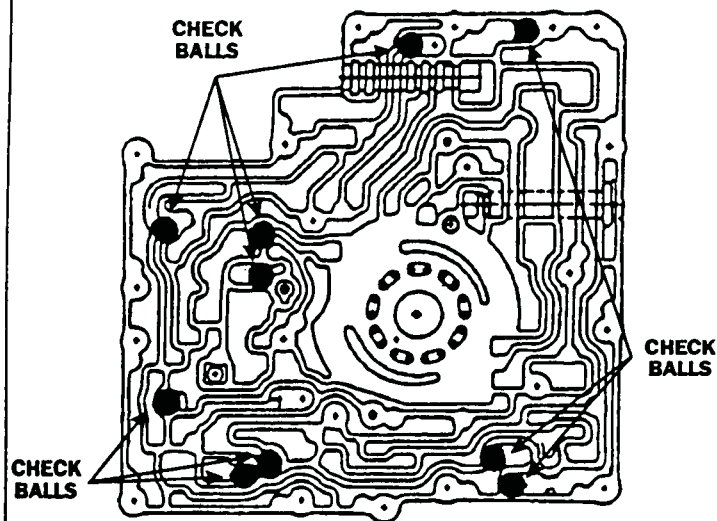
# DISASSEMBLY AND ASSEMBLY (Continued)

11. Install oil pump cover on oil pump housing and install six retaining bolts. Tighten bolts to 9-12 N·m (7-9 lb-ft).
12. Install line pressure blow-off ball and spring, and 1-2 capacity modulator valve spring, valve and plug bore in pump housing and install retaining clips.

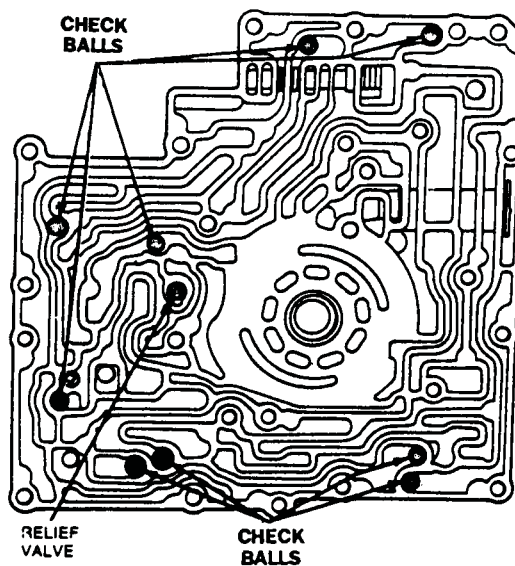


13. Install ball checks and relief valve.

10 BALL PUMP



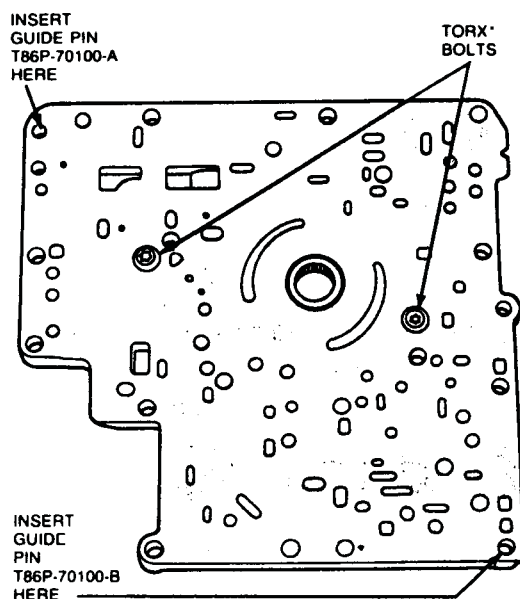
9 BALL PUMP



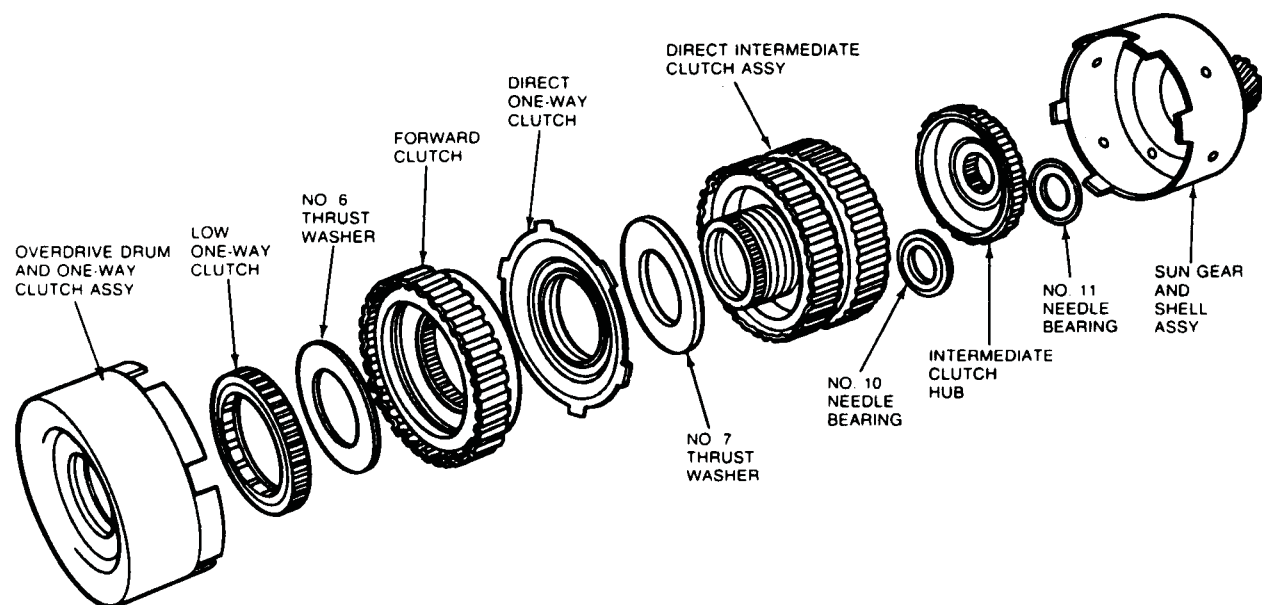


# DISASSEMBLY AND ASSEMBLY (Continued)

14. Position separator plate on pump housing using a new gasket. Insert Separator Plate Guide Pins T86P-70100-A and T86P-70100-B or equivalent as shown. Then, install two Torx® bolts and tighten bolts to 9-12 N·m (7-9 lb-ft). Remove guide pins.



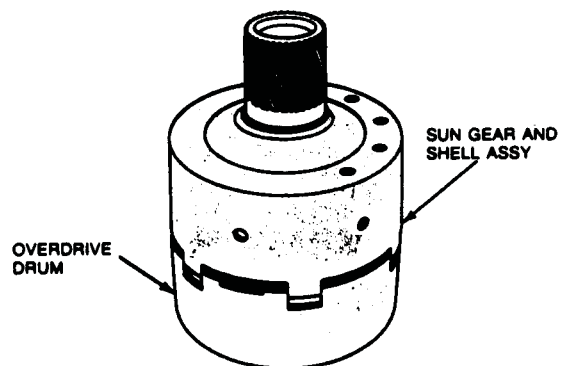
## Shell Assembly, Forward, Direct and Intermediate Clutches



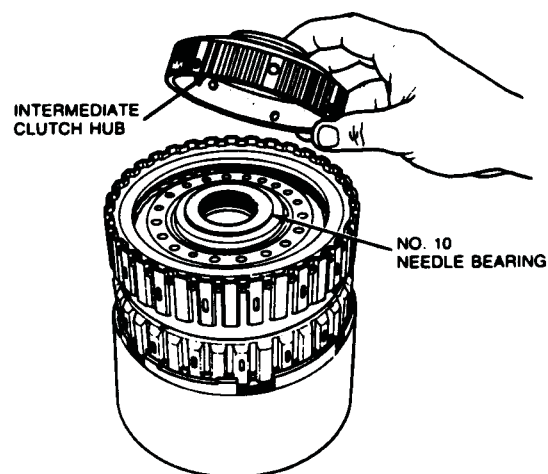
# DISASSEMBLY AND ASSEMBLY (Continued)

## Disassembly

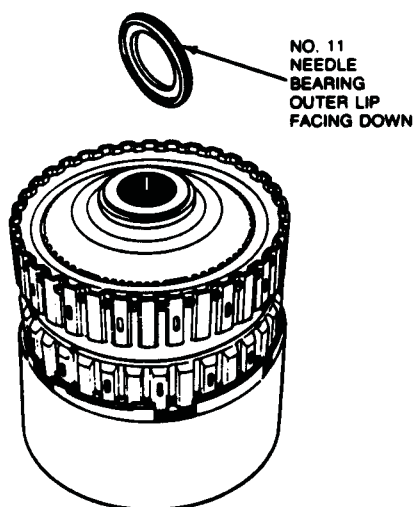
1. Set assembly on overdrive drum.
2. Remove sun gear and shell assembly.



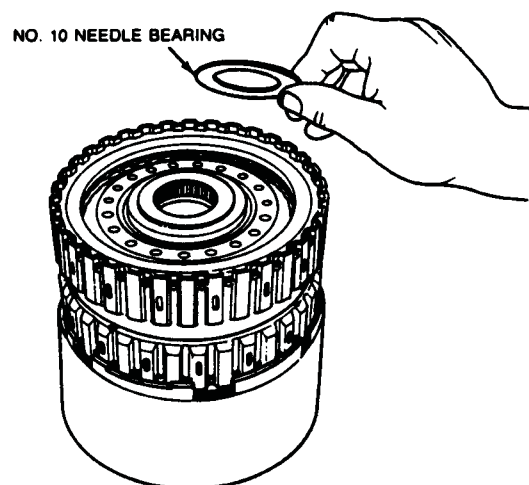
4. Remove intermediate clutch hub.



3. Remove No. 11 needle bearing.



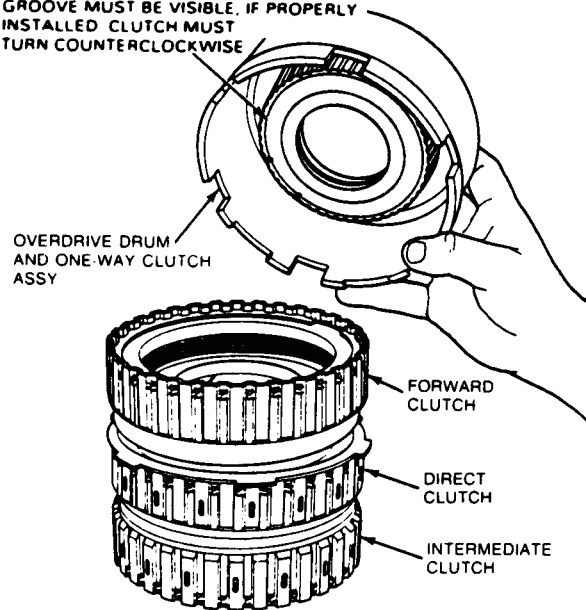
5. Remove No. 10 needle bearing.



DISASSEMBLY AND ASSEMBLY (Continued)

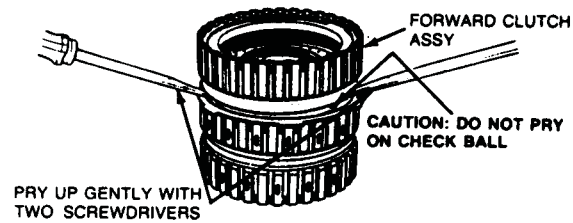
6. Turn assembly onto intermediate cylinder hub.
7. Remove overdrive drum and one-way clutch assembly.

NOTE ONE WAY CLUTCH OUTER RACE GROOVE MUST BE VISIBLE. IF PROPERLY INSTALLED CLUTCH MUST TURN COUNTERCLOCKWISE

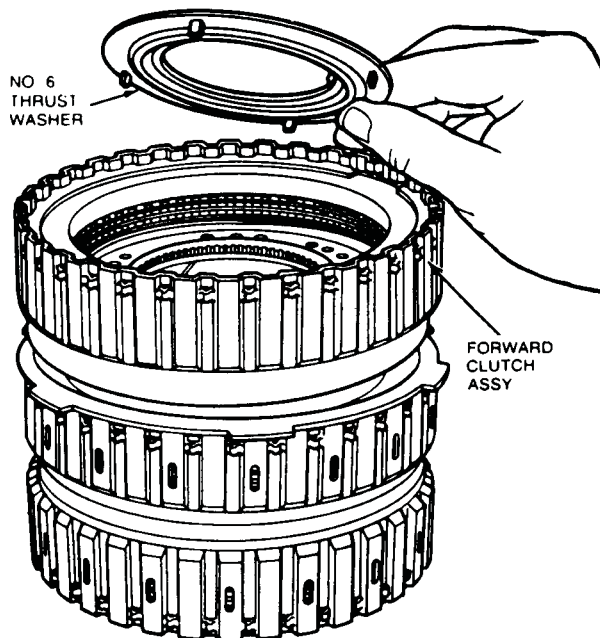


9. Remove forward clutch assembly by prying up on each side with two screwdrivers.

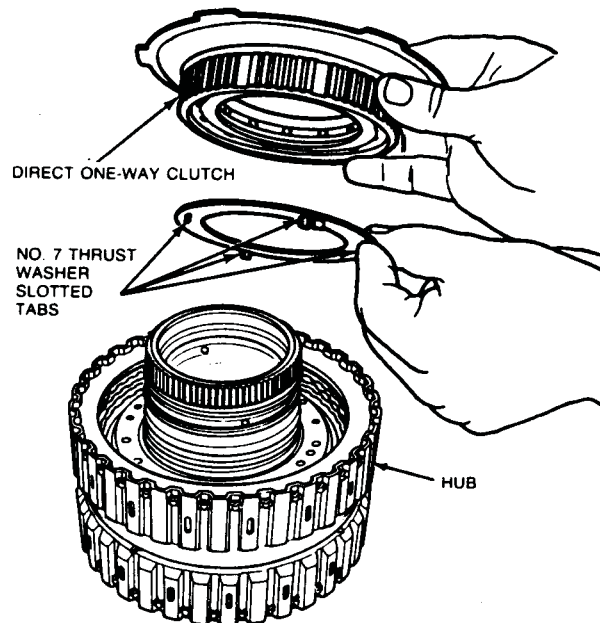
NOTE: Direct clutch hub O-ring seals retain forward clutch on hub. Pry evenly and do not locate screwdriver ends on or near forward clutch check ball.



8. Remove No. 6 thrust washer.



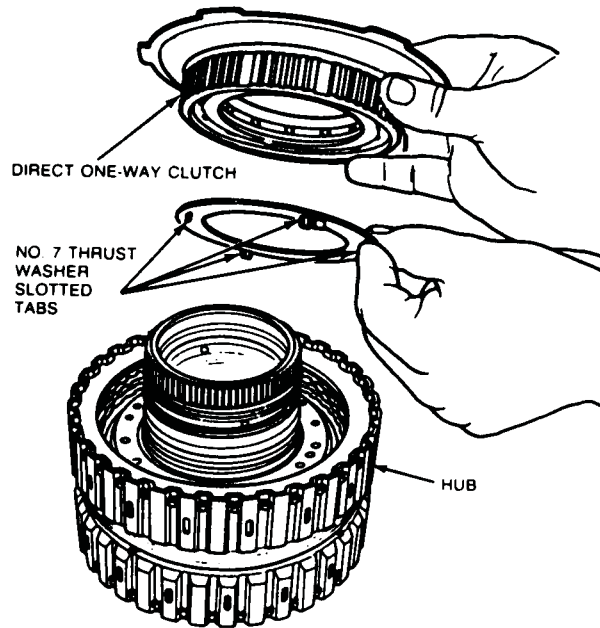
10. Remove direct one-way clutch and No. 7 thrust washer.



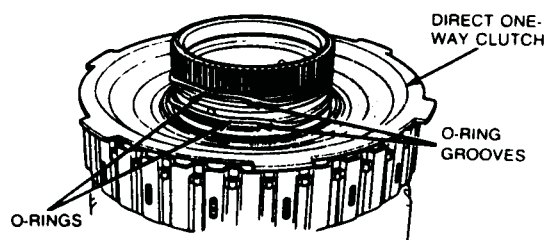
# DISASSEMBLY AND ASSEMBLY (Continued)

## Assembly

1. Set on intermediate clutch cylinder.
2. Install No. 7 thrust washer into direct clutch bearing sure tabs are aligned with slots in direct clutch.
3. Install direct one-way clutch and align onto clutch pack splines.

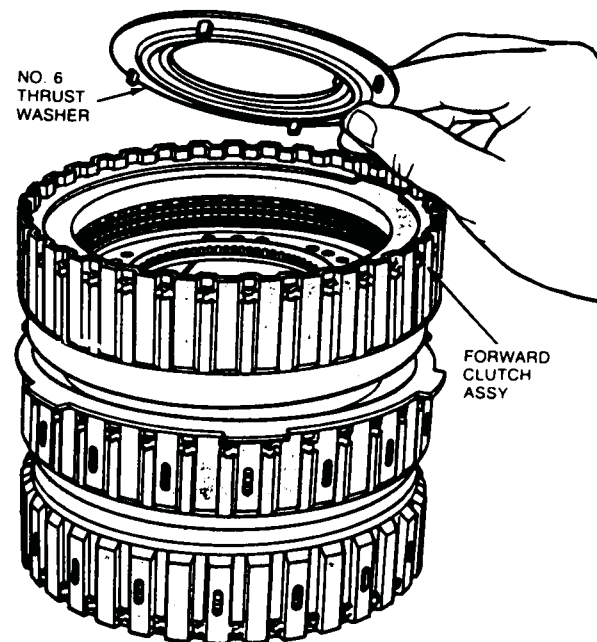


4. Install two O-ring seals.



5. Install forward clutch assembly. Use caution not to damage the O-ring seals on direct clutch hub.

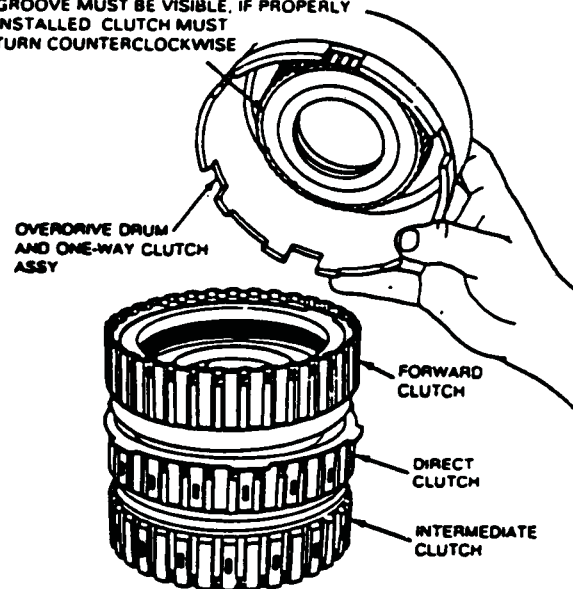
6. Install No. 6 thrust washer.



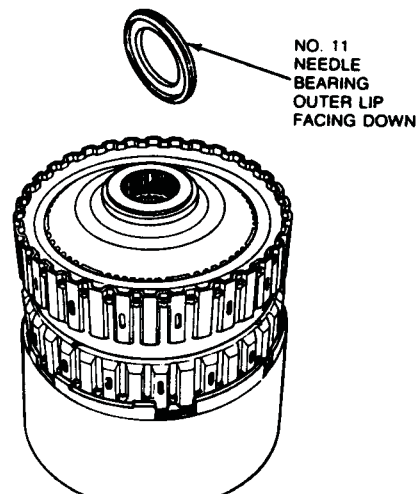
DISASSEMBLY AND ASSEMBLY (Continued)

7. Install overdrive drum and one-way clutch assembly.

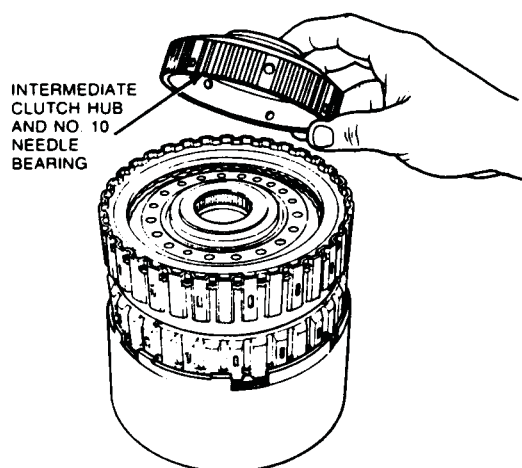
NOTE ONE-WAY CLUTCH OUTER RACE GROOVE MUST BE VISIBLE. IF PROPERLY INSTALLED CLUTCH MUST TURN COUNTERCLOCKWISE



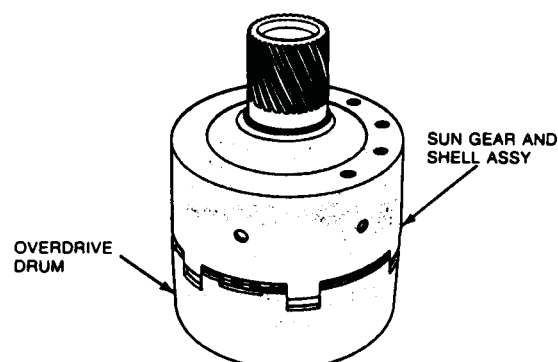
11. Install No. 11 needle bearing with outer lip facing down.



8. Turn assembly over and set on overdrive drum.
9. Install No. 10 needle bearing using grease to hold in place.
10. Install intermediate clutch hub with No. 10 needle bearing.

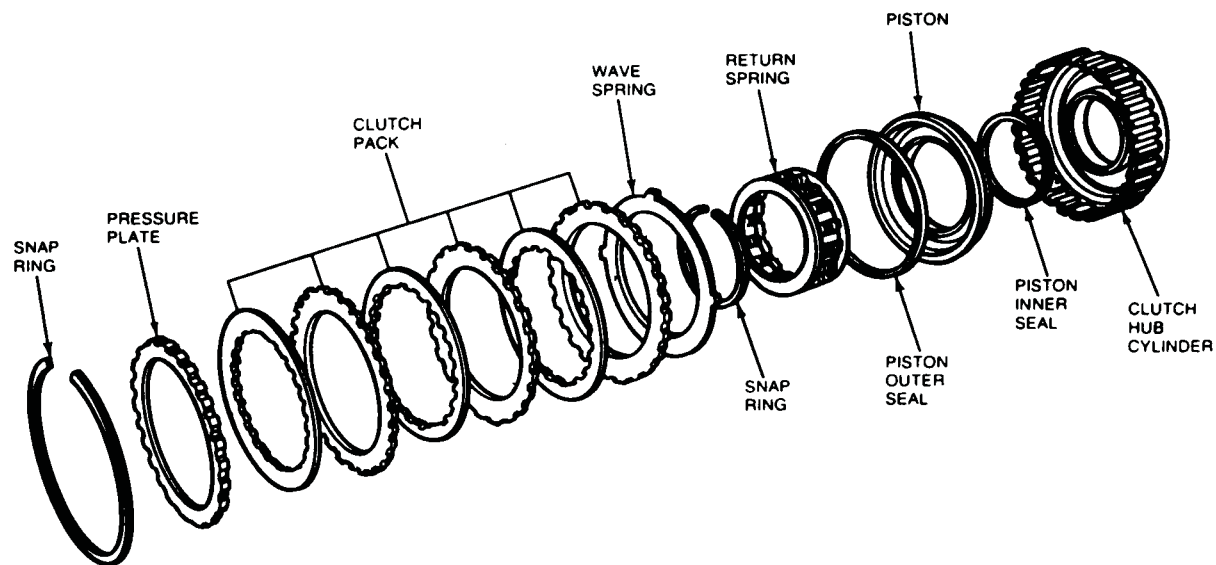


12. Install sun gear and shell assembly.



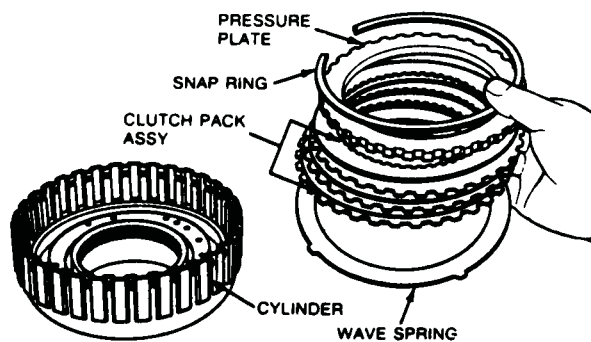
# DISASSEMBLY AND ASSEMBLY (Continued)

## Forward Clutch

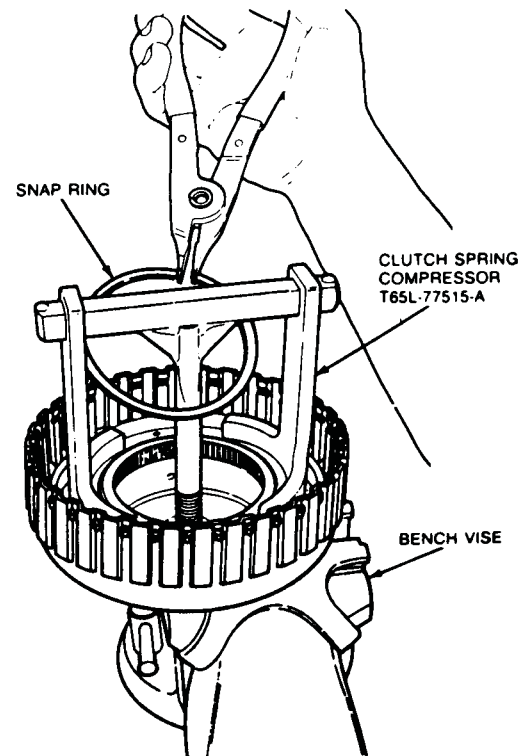


## Disassembly

1. Remove snap ring, pressure plate, clutch pack and wave spring.

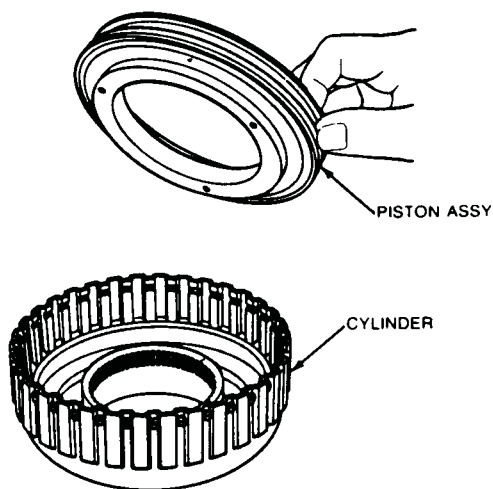


2. Remove snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



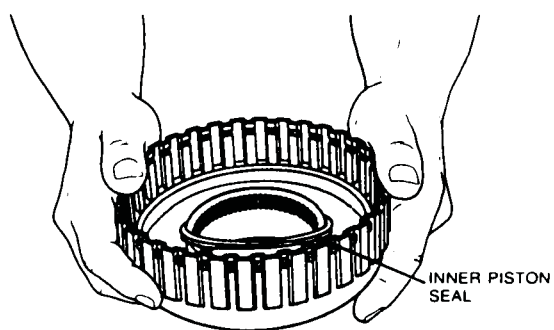
# DISASSEMBLY AND ASSEMBLY (Continued)

3. Remove piston assembly from hub.

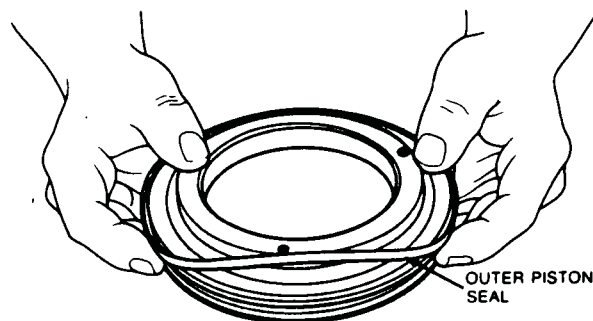


4. Remove piston inner and outer seals.

## Inner Piston Seal

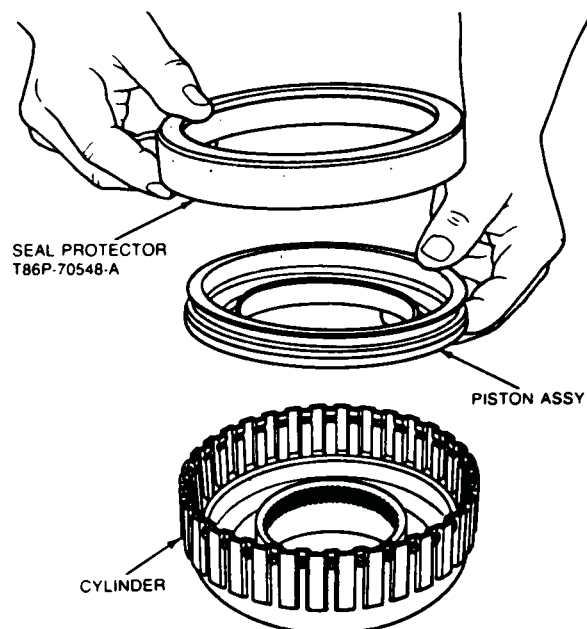


## Outer Piston Seal



## Assembly

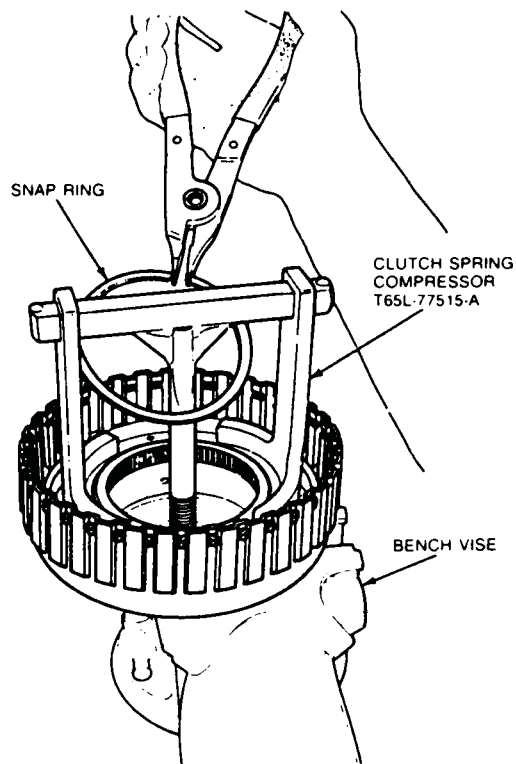
1. Install inner and outer piston seals (lip seal facing toward bottom of cylinder) and install piston assembly using Clutch Seal Lip Protector T86P-70548-A or equivalent.



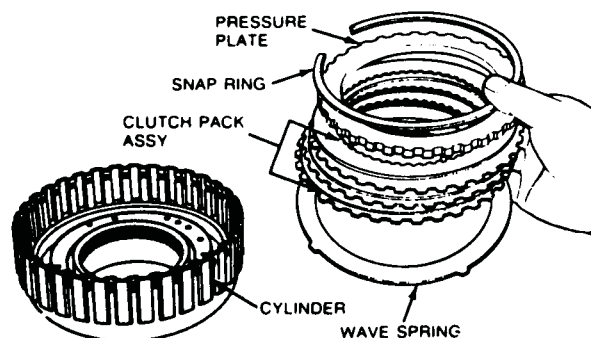


# DISASSEMBLY AND ASSEMBLY (Continued)

2. Install return spring and snap ring using Clutch Spring Compressor T65L-77515-A or equivalent.



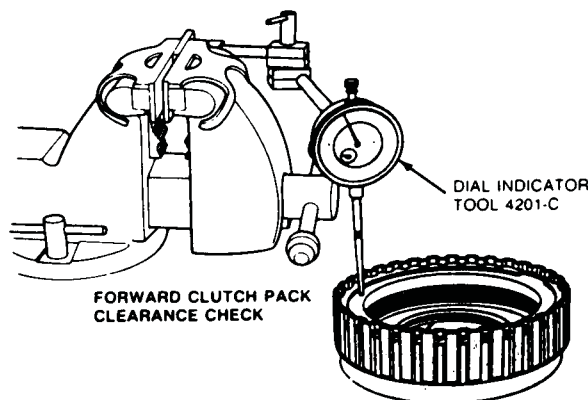
3. Install wave spring, clutch pack, pressure plate and snap ring.



4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with at least 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be 1.89-1.40mm (0.075-0.055 inch). If the clearance is not within specifications, selective snap rings are available in the following thicknesses:

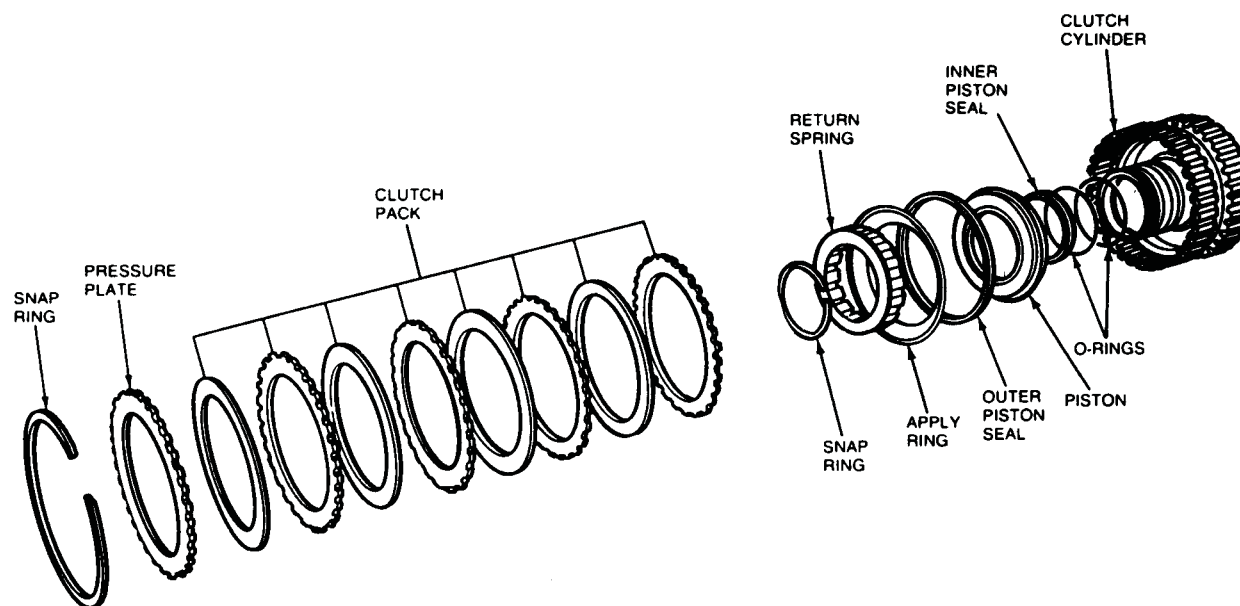
- 1.24-1.54mm (0.049-0.053 inch)
- 1.60-1.70mm (0.063-0.067 inch)
- 1.95-2.05mm (0.077-0.081 inch)
- 2.30-2.40mm (0.091-0.094 inch)
- 2.75mm (0.104-0.104 inch)

After installing the correct snap ring recheck the clearance.



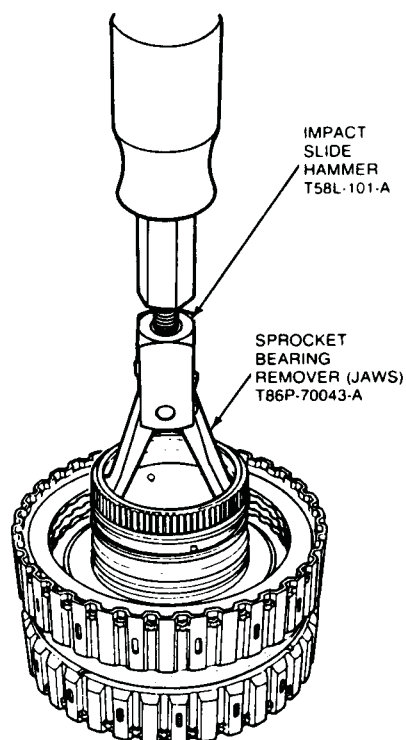
# DISASSEMBLY AND ASSEMBLY (Continued)

## Direct Clutch

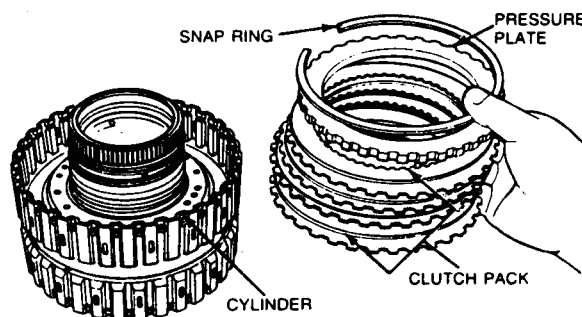


## Disassembly

1. If required remove direct/intermediate cylinder bushing using Sprocket Bearing Removal Adapter Jaws T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.

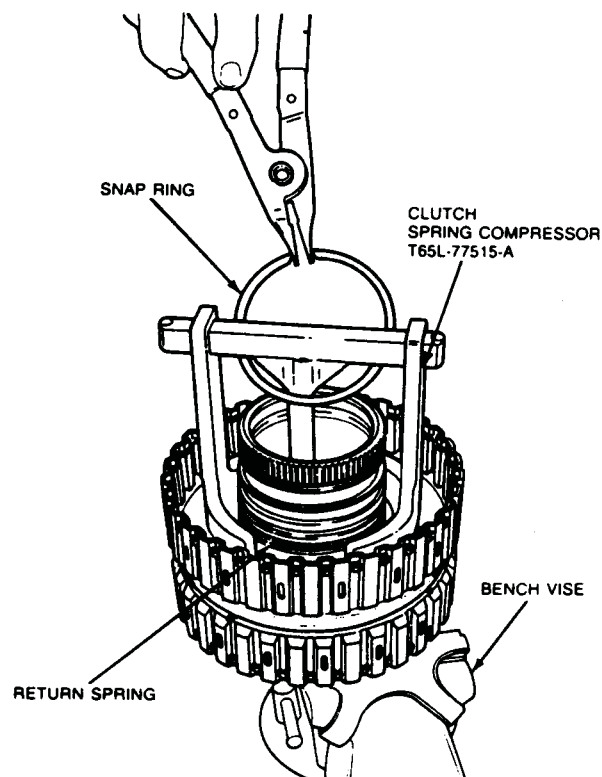


2. Remove snap ring, pressure plate and clutch pack.

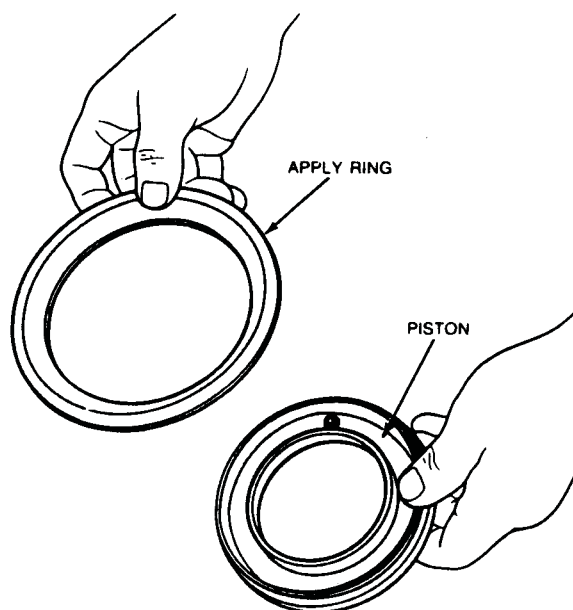


DISASSEMBLY AND ASSEMBLY (Continued)

3. Remove snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.

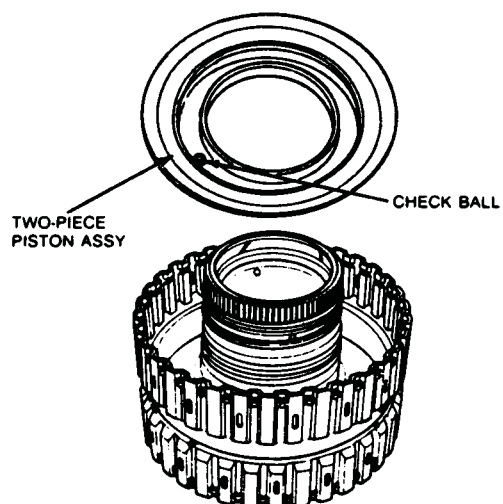


5. Disassemble two-piece piston.

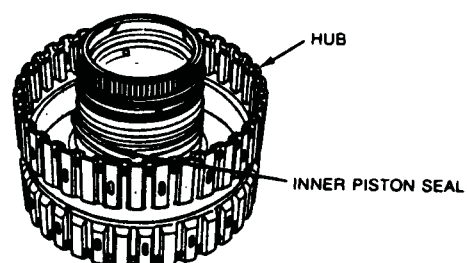


6. Remove piston inner and outer lip seals.

4. Remove two-piece piston assembly.

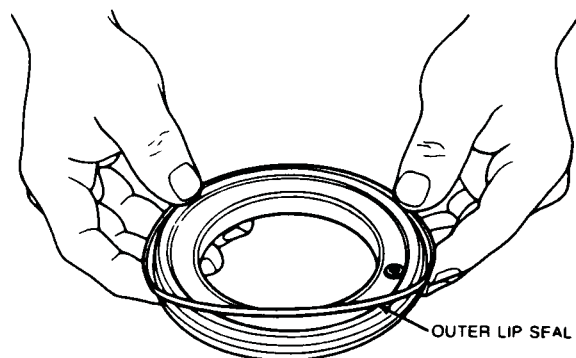


Inner Piston Seal

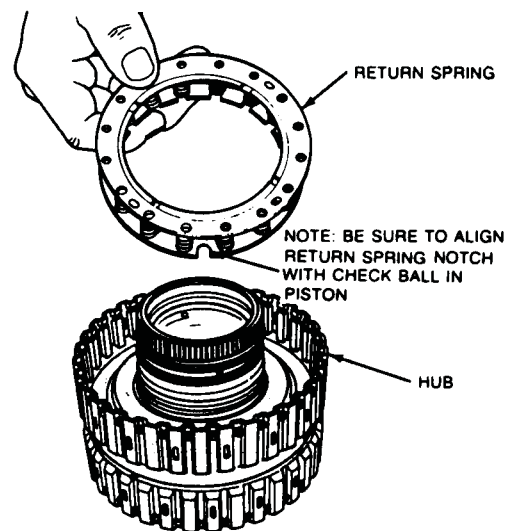


# DISASSEMBLY AND ASSEMBLY (Continued)

## Outer Piston Seal

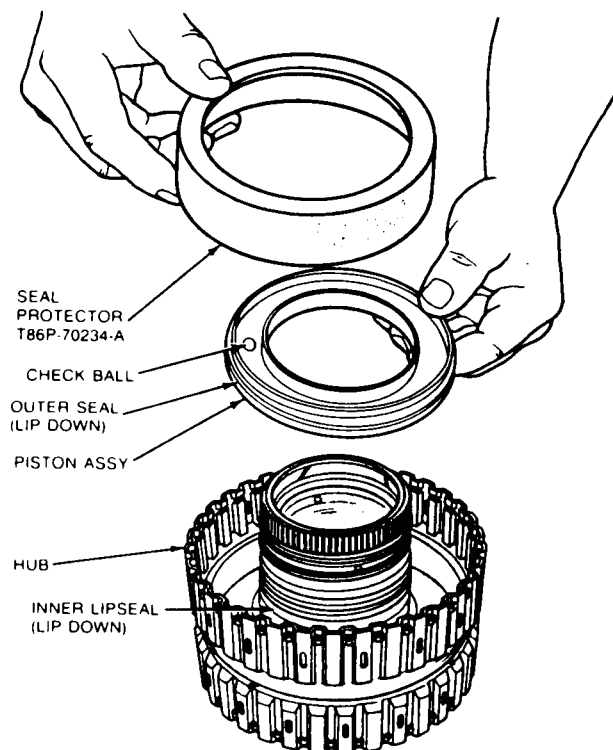


2. Install piston outer ring.
3. Verify free movement of check ball.
4. Install return spring in cylinder aligning return spring notch with check ball in piston.

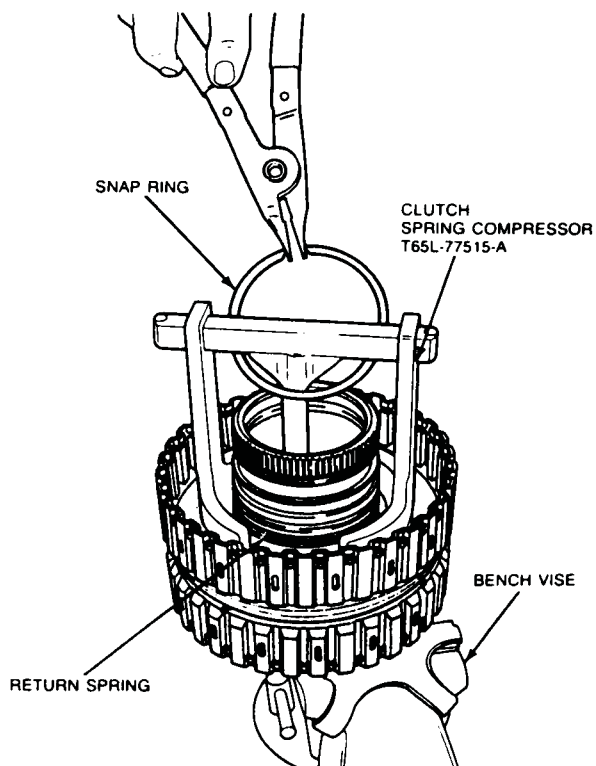


## Assembly

1. Install inner and outer piston lip seals (lip seals facing toward bottom of cylinder) and install into hub using Piston Seal Lip Protector T86P-70234-A or equivalent.

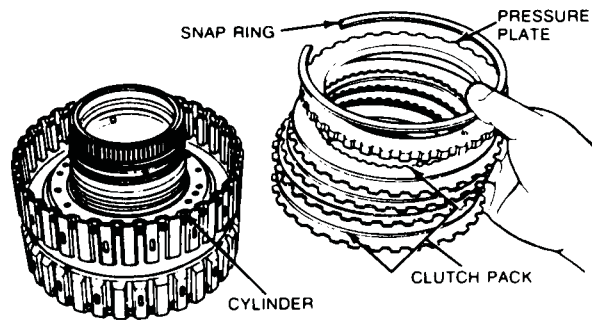


5. Install snap ring using Clutch Spring Compressor T65L-77515-A or equivalent.

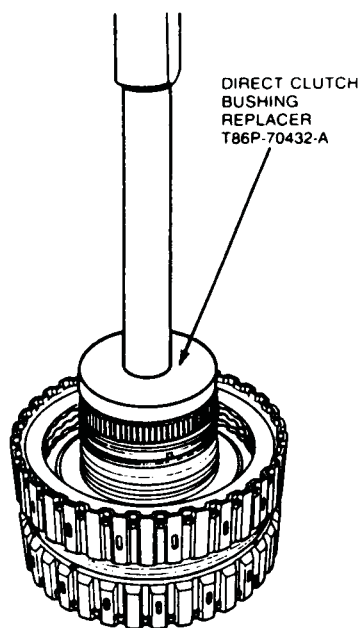


DISASSEMBLY AND ASSEMBLY (Continued)

6. Install clutch pack, pressure plate and snap ring into cylinder.



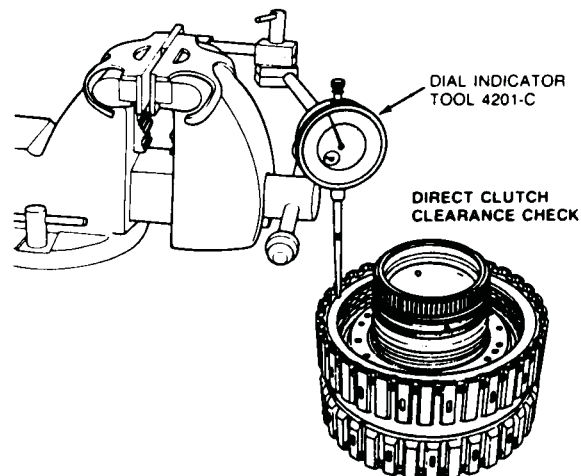
7. If removed, install direct clutch bushing using Clutch Bearing Replacer T86P-70373-A or equivalent.



8. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: (3-Plate) 0.69-1.13mm (0.027-0.044 inch), (4-Plate) 0.97-1.53mm (0.038-0.060 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

1.24-1.34mm (0.049-0.053 inch)  
 1.66-1.76mm (0.065-0.069 inch)  
 2.08-2.18mm (0.082-0.086 inch)  
 2.50-2.60mm (0.098-0.102 inch)  
 2.92-3.02mm (0.115-0.119 inch)

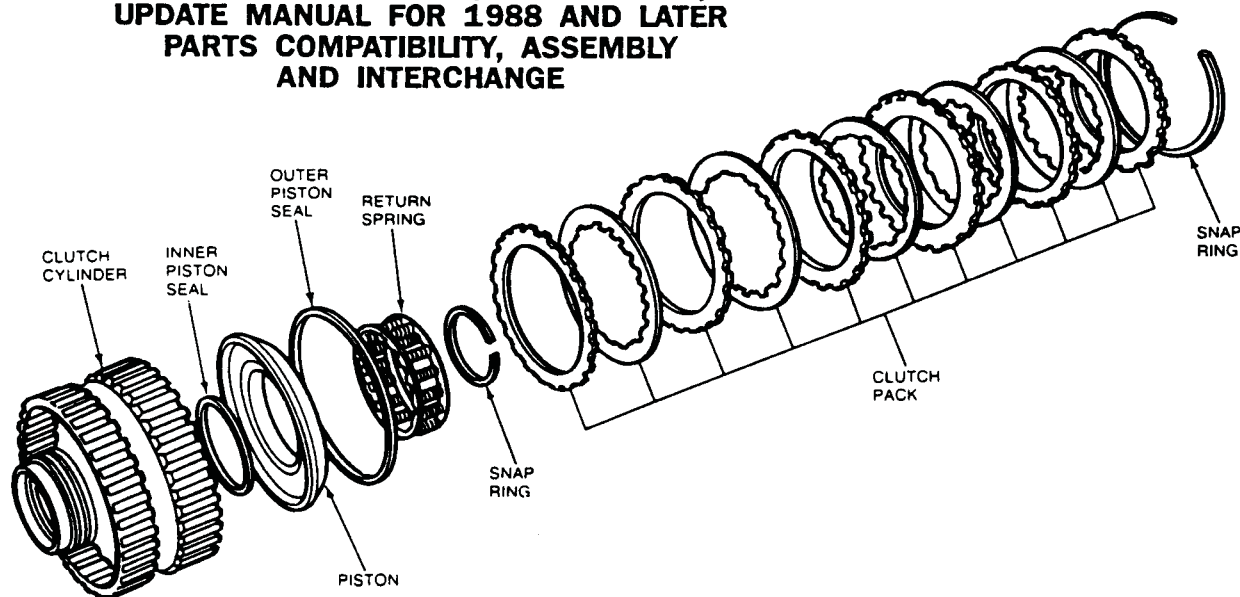
After installing the correct snap ring, recheck the clearance.



# DISASSEMBLY AND ASSEMBLY (Continued)

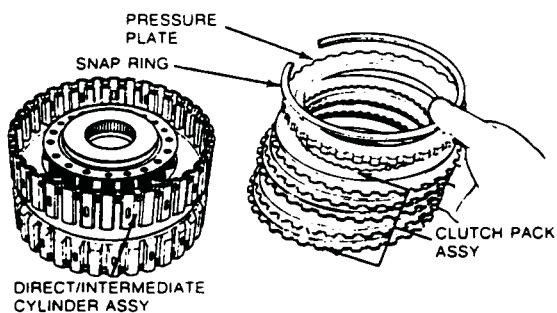
## Intermediate Clutch

**SEE ATSG TECHTRAN (GREEN COVER)  
UPDATE MANUAL FOR 1988 AND LATER  
PARTS COMPATIBILITY, ASSEMBLY  
AND INTERCHANGE**

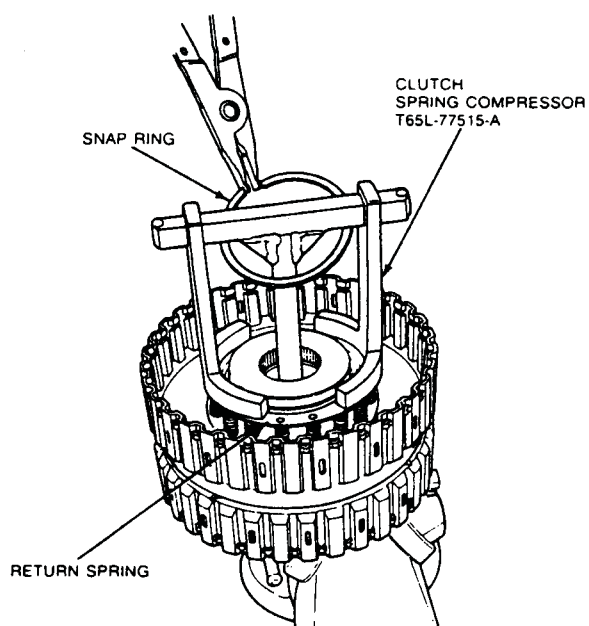


## Disassembly

1. Remove snap ring, pressure plate and clutch pack assembly.

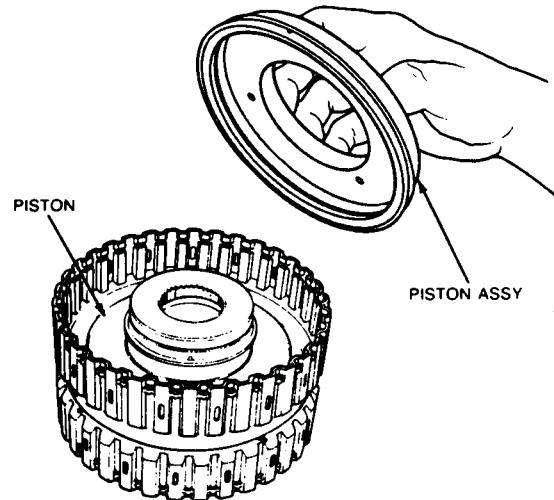


2. Remove snap ring and return spring, using Clutch Spring Compressor T65L-77515-A or equivalent.



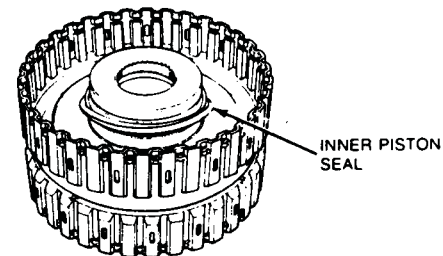
**DISASSEMBLY AND ASSEMBLY (Continued)**

3. Remove piston assembly.



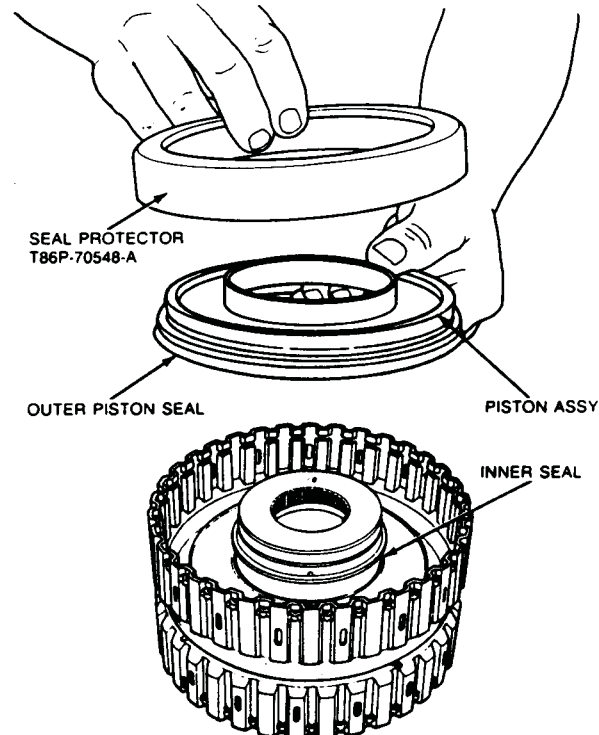
4. Remove piston inner and outer seals.

**Inner Piston Seal**

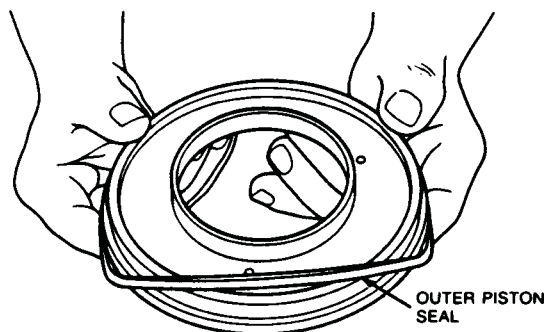


**Assembly**

1. Check for free movement of check ball in cylinder. Install inner lip seal on cylinder hub and outer piston lip seal (lips facing towards bottom of cylinder) on piston and install piston using Clutch Seal Lip Protector T86P-70548-A or equivalent.



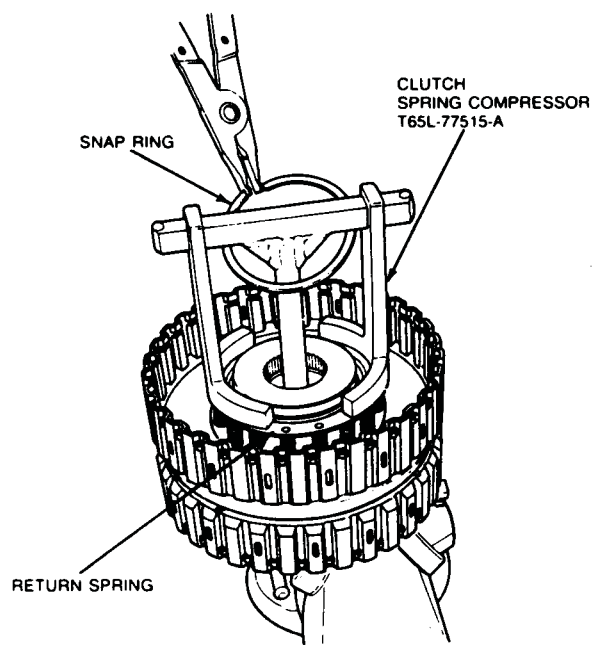
**Outer Piston Seal**



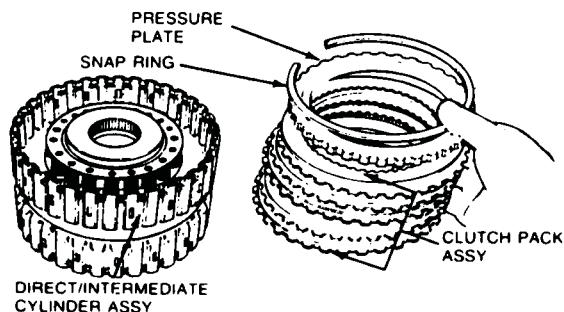


## DISASSEMBLY AND ASSEMBLY (Continued)

2. Install snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



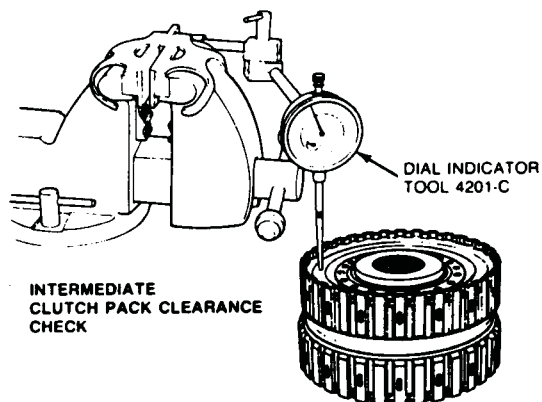
3. Install clutch pack, pressure plate and snap ring.



4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero the dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: (4-Plate) 0.89-1.31mm (0.035-0.052 inch), (5-Plate) 1.61-1.69mm (0.46-0.067 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

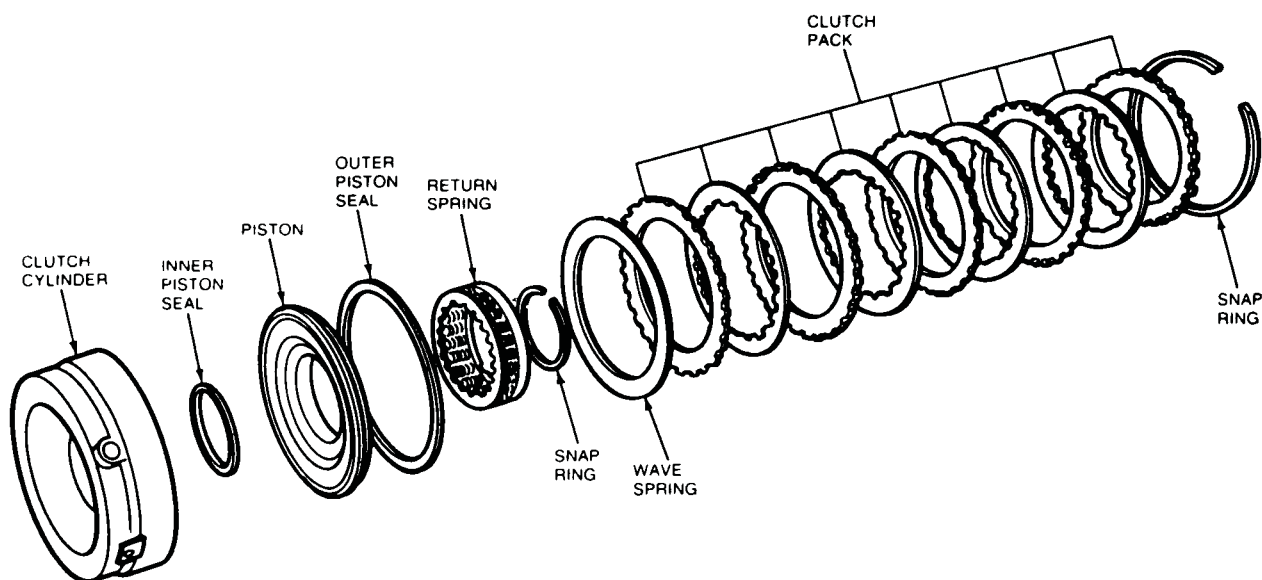
1.11-1.21mm (0.044-0.048 inch)  
 1.51-1.61mm (0.059-0.063 inch)  
 1.91-2.01mm (0.075-0.079 inch)  
 2.31-2.41mm (0.091-0.095 inch)  
 2.71-2.81mm (0.107-0.111 inch)

After installing the correct snap ring, recheck the clearance.



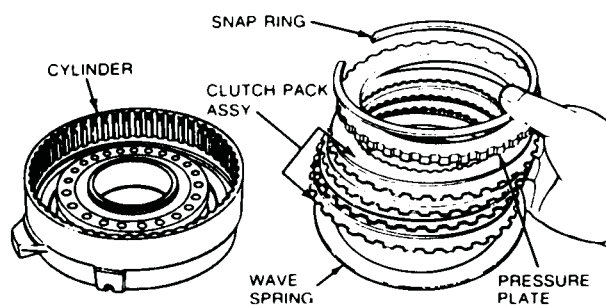
# DISASSEMBLY AND ASSEMBLY (Continued)

## Reverse Clutch

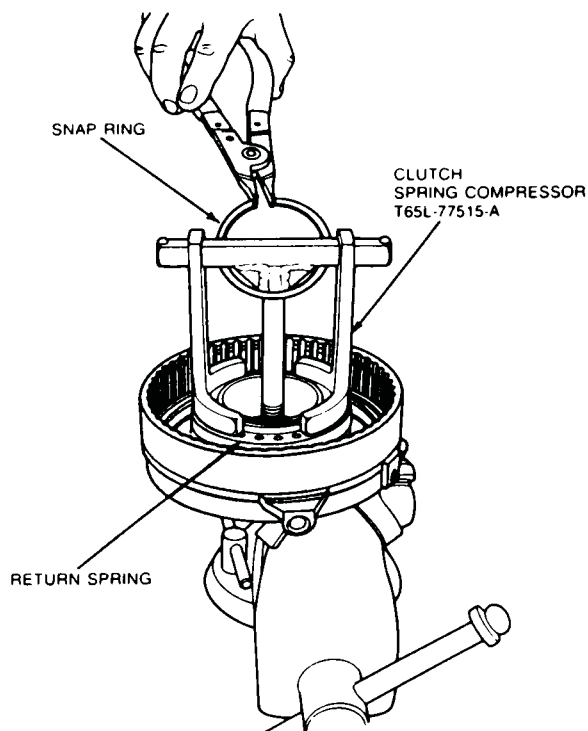


## Disassembly

1. Remove snap ring, pressure plate, clutch pack and wave spring.



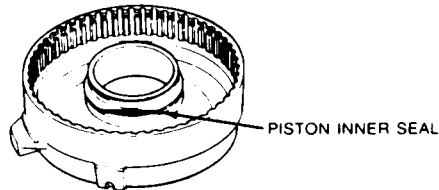
2. Using Clutch Spring Compressor T65L-77515-A or equivalent, remove snap ring and return spring.



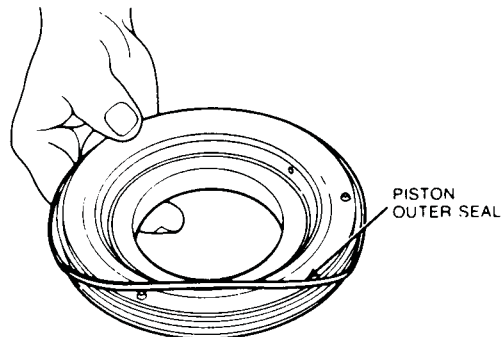
3. Lift out piston and remove piston inner and outer seals.

# DISASSEMBLY AND ASSEMBLY (Continued)

## Piston Inner Seal

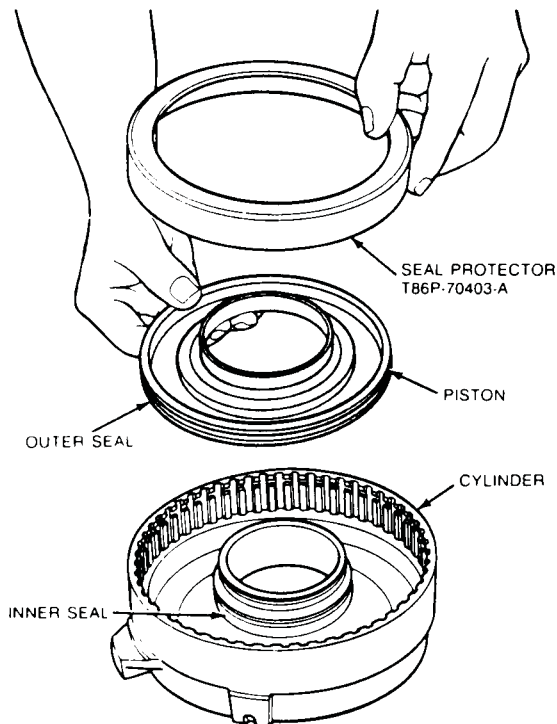


## Piston Outer Seal

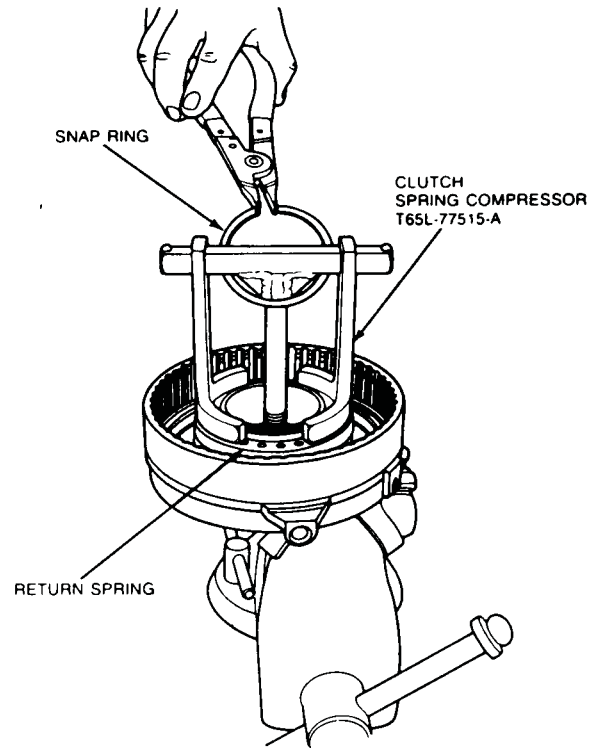


## Assembly

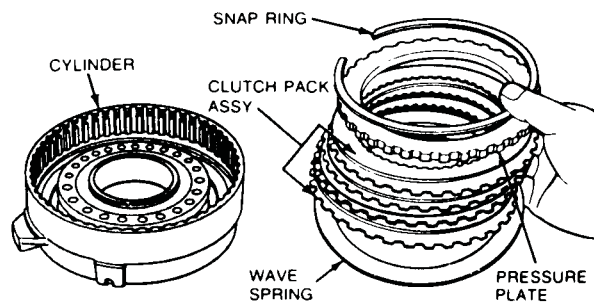
1. Install inner and outer piston lip seals, (lips facing toward bottom of cylinder) and install piston using Clutch Seal Lip Protector T86P-70403-A or equivalent.



2. Install snap ring and return spring using Clutch Spring Compressor T65L-77515-A or equivalent.



3. Install wave spring, clutch pack, pressure plate and snap ring.

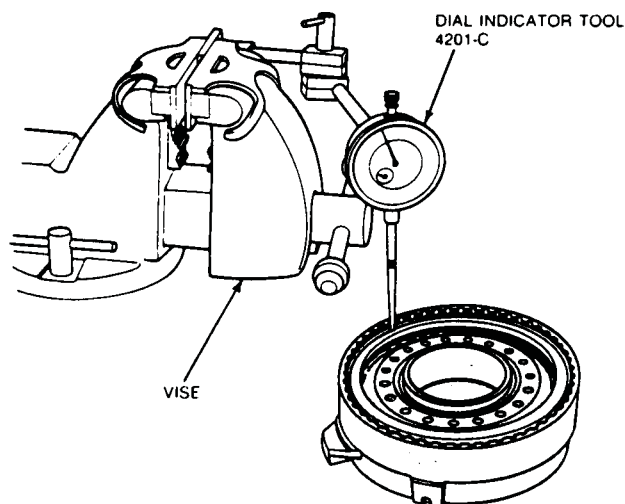


**DISASSEMBLY AND ASSEMBLY (Continued)**

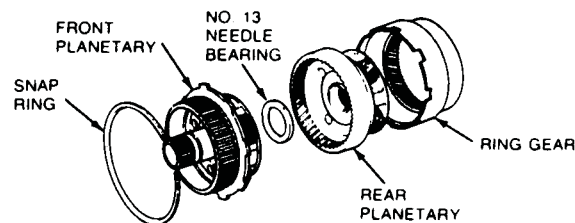
4. Check clutch pack clearance using Dial Indicator TOOL 4201-C or equivalent. Push downward on the clutch pack with 44N (10 lbs) of force. Release pressure and zero dial indicator. Lift pressure plate to the bottom of the snap ring. Note dial indicator reading. Take two readings, 180 degrees apart, and determine the average of the two readings. The clearance should be: 0.97-1.63mm (0.038-0.064 inch). If the clearance is not within specification, selective snap rings are available in the following thicknesses:

1.52-1.62mm (0.059-0.064 inch)  
 1.98-2.08mm (0.078-0.081 inch)  
 2.45-2.55mm (0.096-0.100 inch)  
 2.92-3.02mm (0.115-0.118 inch)

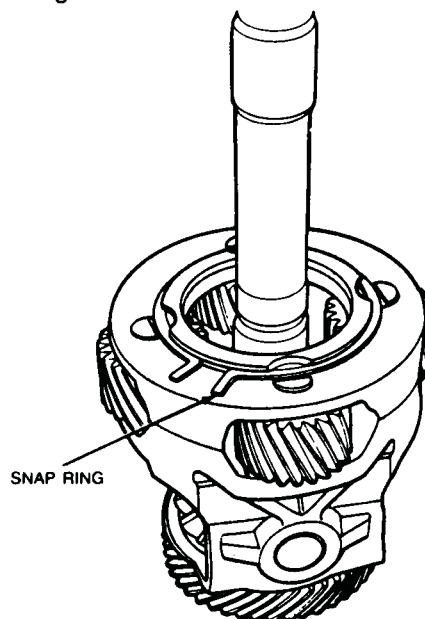
After installing the correct snap ring, recheck the clearance.

**Planetary Assembly****Disassembly and Assembly**

1. Remove snap ring.
2. Remove front planetary.
3. Remove No. 13 needle bearing.
4. Remove rear planetary from shell and ring gear assembly.
5. To assemble, reverse Steps 1 through 4.

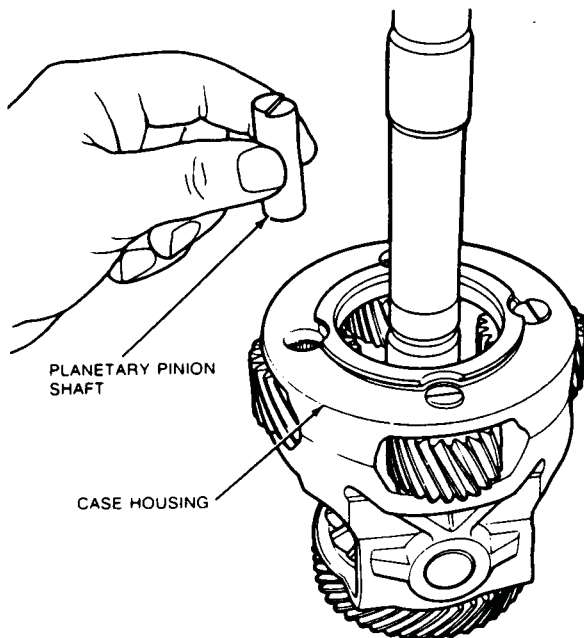
**Differential and Gear Set****Disassembly**

1. Remove planetary pinion shaft retaining snap ring.

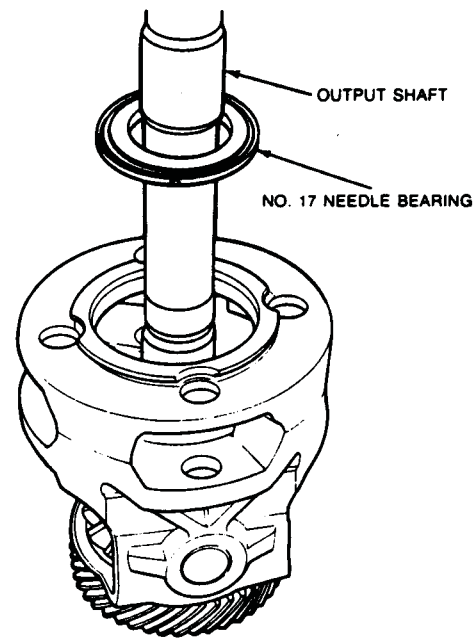


DISASSEMBLY AND ASSEMBLY (Continued)

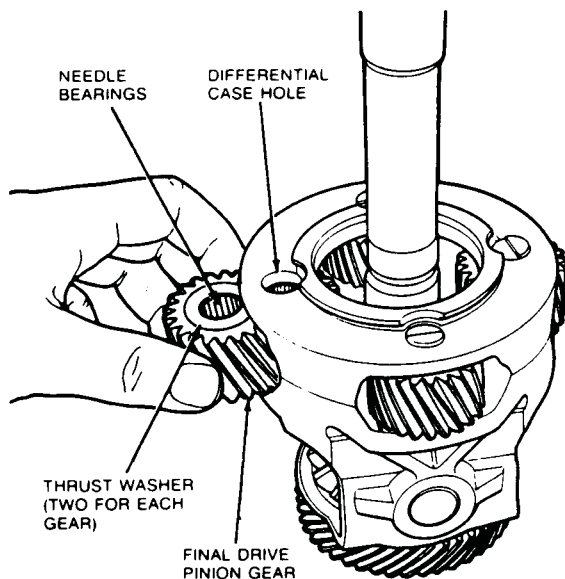
2. Using a magnet, work planetary pinion shafts out of differential case housing.



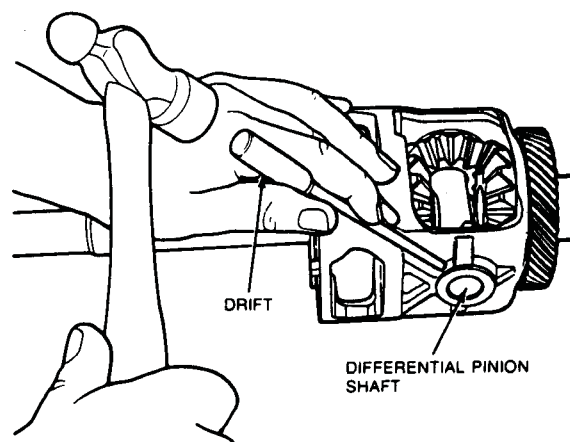
5. Remove No. 17 needle bearing from top of differential planetary assembly.



3. Slide out pinion gears and thrust washers.  
4. Inspect needle bearings and pinion shafts. Replace, if necessary.

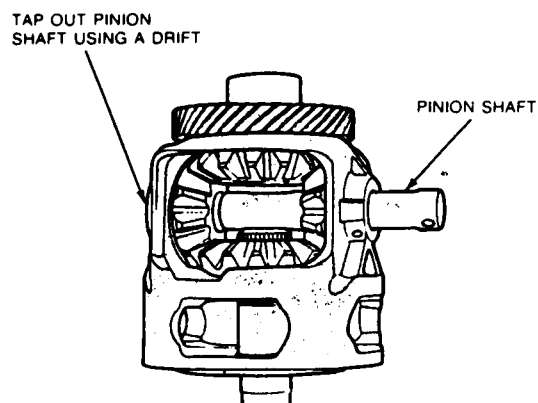


6. Using a drift, drive out differential pinion shaft roll pin.

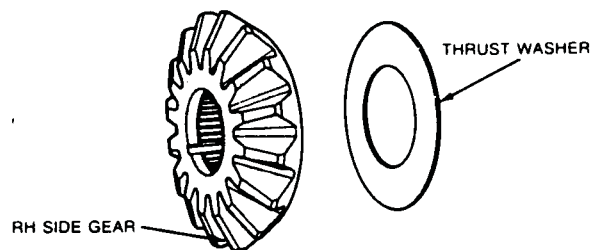


DISASSEMBLY AND ASSEMBLY (Continued)

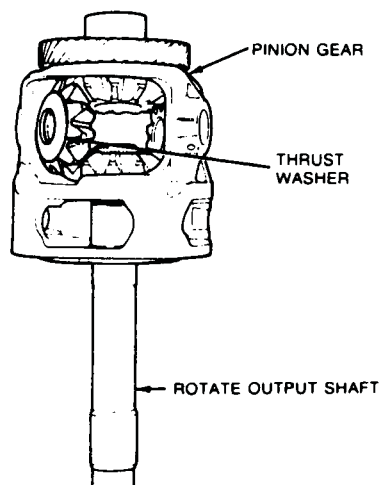
7. Tap out pinion shaft using a drift.



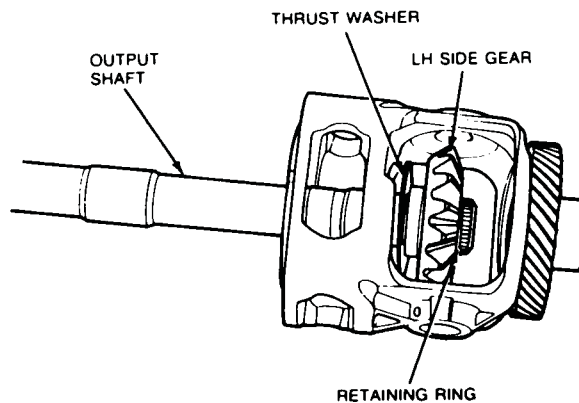
9. Remove RH side gear and thrust washer.



8. Remove pinion gears and thrust washers by rotating output shaft.



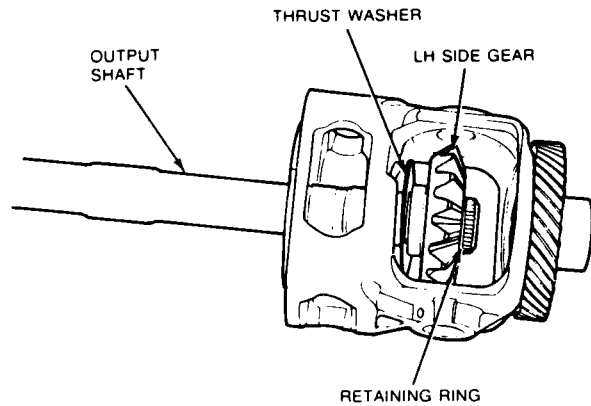
10. Push output shaft toward center of housing, and slide LH side gear upward to gain access to retaining ring.
11. Remove retaining ring and slide output shaft out of differential case. Remove pinion gear and thrust washer.



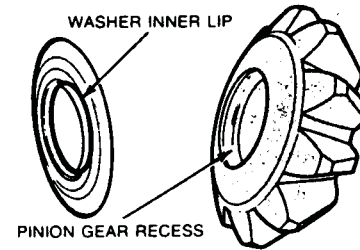
# DISASSEMBLY AND ASSEMBLY (Continued)

## Assembly

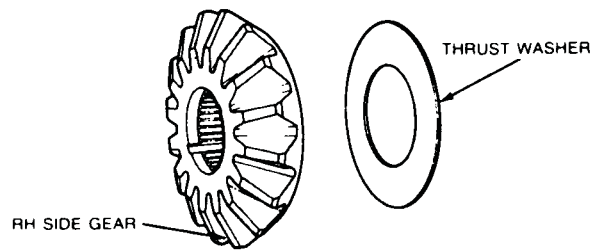
1. With output shaft inside of differential case, slide thrust washer and LH side gear onto output shaft.
2. Install retaining ring and slide gear down over retaining ring.



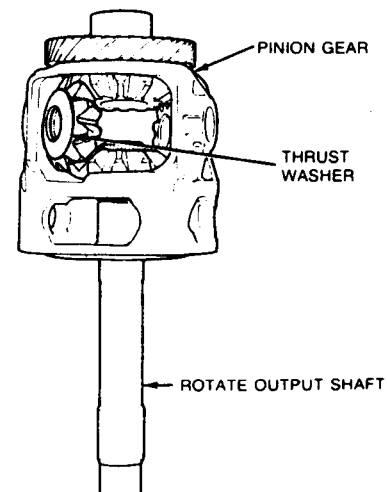
4. Install thrust washers on pinion gears being sure inner lips on washers are seated in recess in pinion gears.



3. Install thrust washer and RH side gear into differential case.



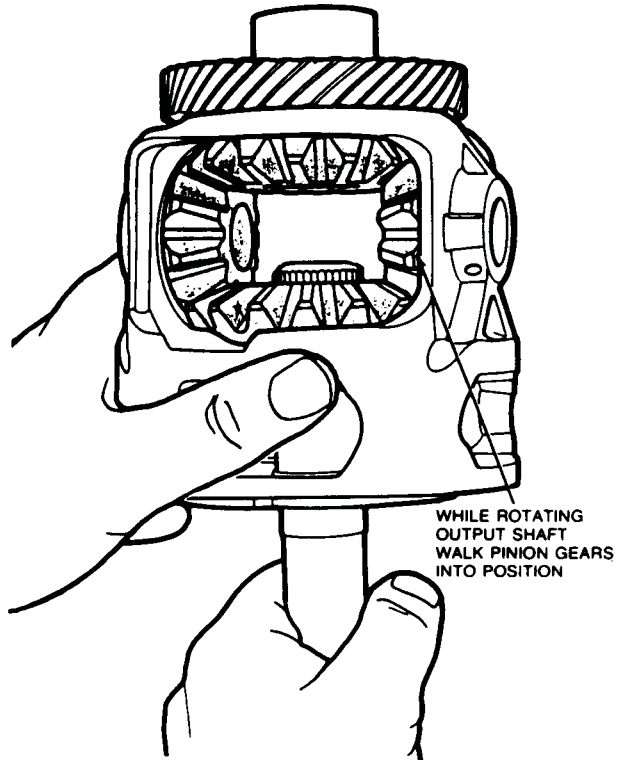
5. Position pinion gears on side gears being sure teeth on all gears are engaged and rotate output shaft.



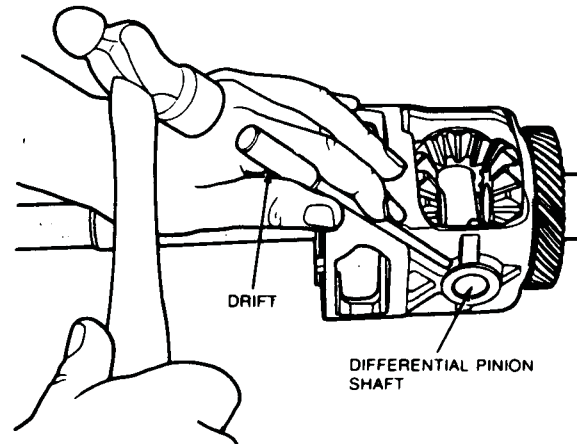


**DISASSEMBLY AND ASSEMBLY (Continued)**

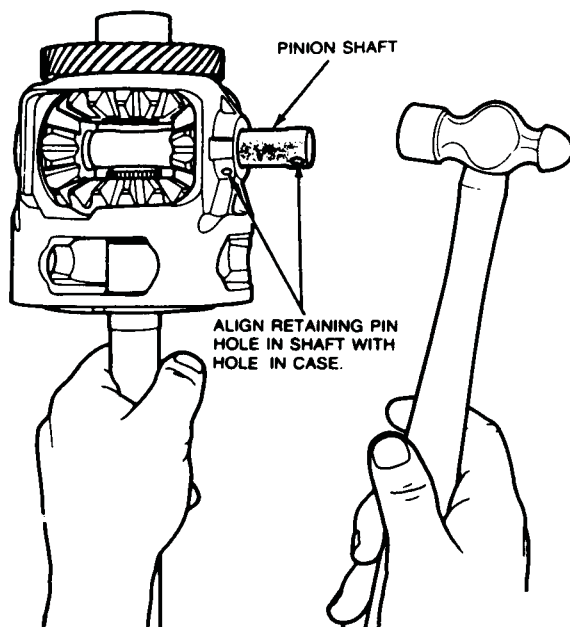
6. While rotating the output shaft, walk pinion gears into position.



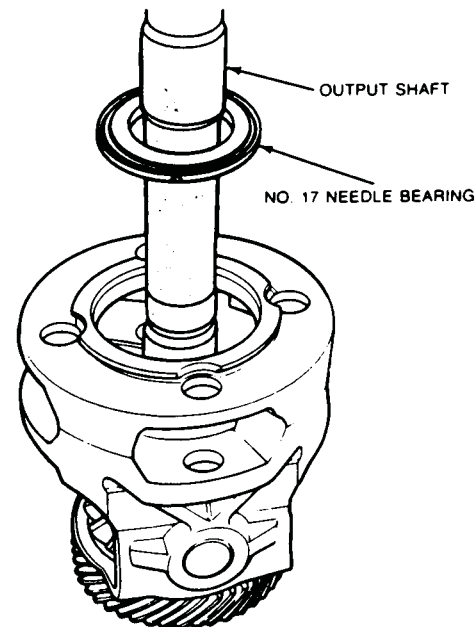
8. Using a drift, tap in differential pinion shaft roll pin.



7. Tap pinion shaft through differential case and pinion gears, making sure to align retaining pin hole in shaft with hole in differential case.



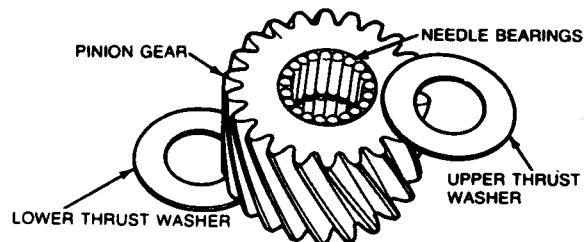
9. Install No. 17 needle bearing over output shaft and seat on planetary housing with positioning tabs facing up.



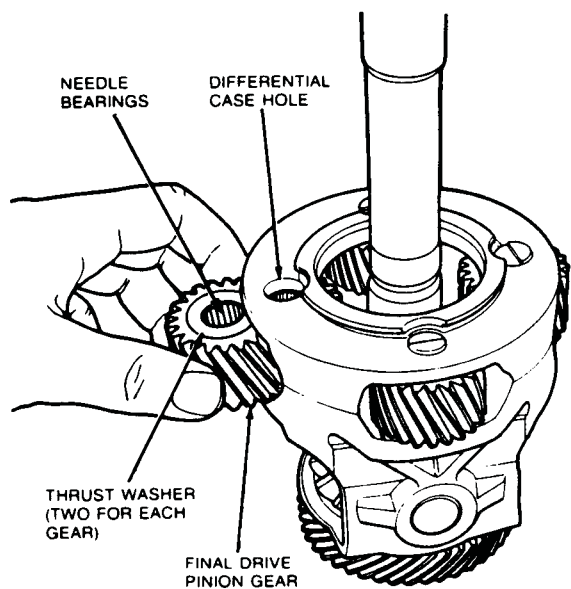
# DISASSEMBLY AND ASSEMBLY (Continued)

10. Install upper and lower pinion gear thrust washers onto pinion gear.

NOTE: It may be necessary to use a little grease to hold thrust washers, needle bearings and spacer in position. Install and align final drive pinion gears with differential case holes.

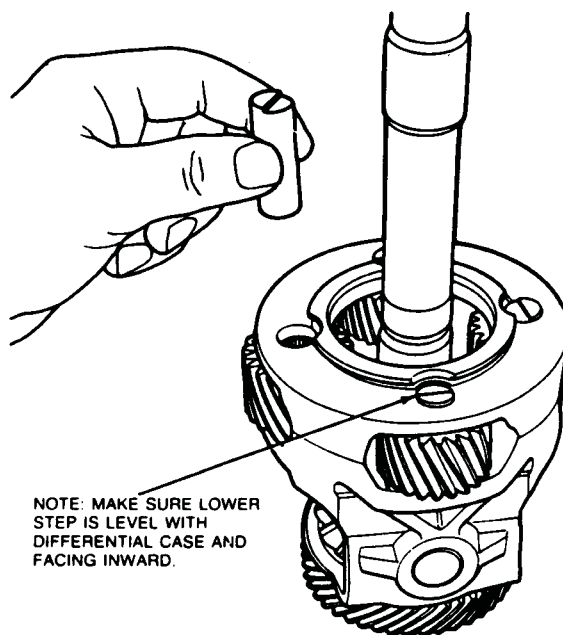


NOTE: Make sure all needle bearings, thrust washers and spacer are in position.



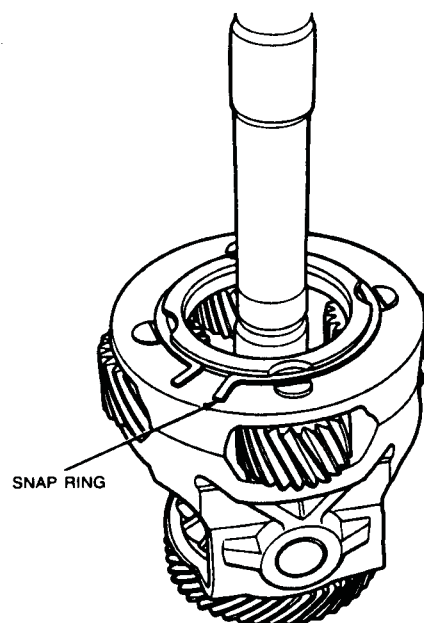
11. Push final drive pinion shafts through differential case and gears until lower step on shaft is level with differential case.

NOTE: Use care when installing pinion shafts to prevent disturbing needle bearings.



NOTE: MAKE SURE LOWER STEP IS LEVEL WITH DIFFERENTIAL CASE AND FACING INWARD.

12. Install final drive pinion shaft retaining ring in differential case grooves.



## DISASSEMBLY AND ASSEMBLY (Continued)

### Low-Intermediate Servo

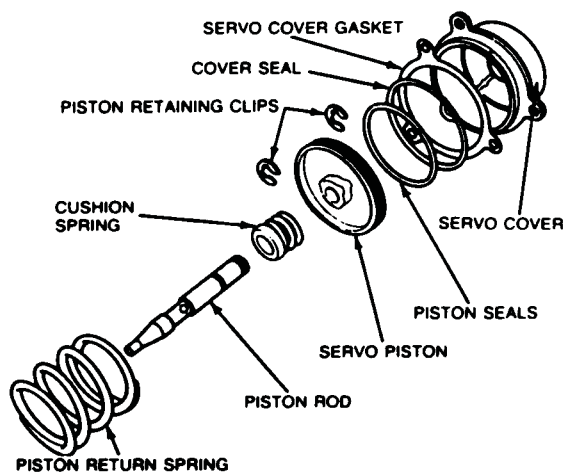
#### Disassembly

1. Remove three 8mm cover bolts.
2. Remove piston return spring.
3. Remove servo piston and rod from cover.
4. Remove piston rod retaining clips and remove rod and cushion spring.
5. Remove servo piston seal.
6. Remove seal and gasket from cover.

#### Assembly

1. Install front piston rod retaining clip on piston rod.
2. Install cushion spring and piston.
3. Compress assembly and install rear piston rod rear retaining clip.
4. Install servo piston seal.
5. Install cover seal and gasket.
6. Lubricate piston seals with petroleum jelly.
7. Install cover seal and gaskets.
8. Install piston return spring on piston rod.
9. Install assembled servo components into case and install cover.

NOTE: Make sure return spring is correctly positioned in case.



10. Install three 8mm cover bolts. Tighten to 9-12 N·m (6.6-8.8 lb-ft).

### Overdrive Servo

#### Disassembly

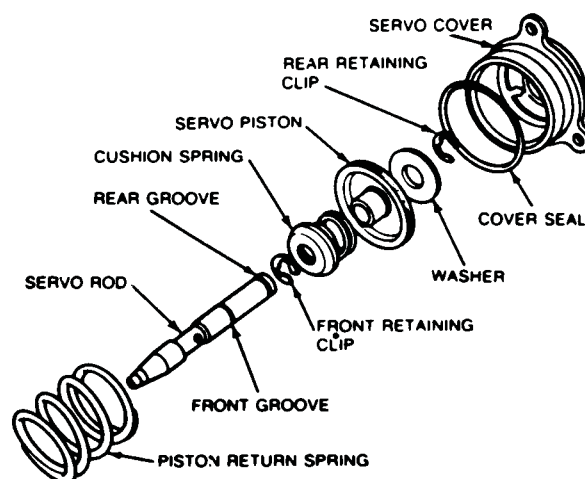
1. Remove three 8mm cover bolts, and remove return spring and rod.
2. Remove servo piston from cover.
3. Remove rear piston rod retaining clip and remove washer.
4. Remove servo piston and seal.
5. Remove cushion spring.
6. Remove front piston rod retaining clip.
7. Remove cover seal.

#### Assembly

1. Install front piston rod retaining clip on piston rod.
2. Install cushion spring, piston and washer.
3. Compress assembly and install rear piston rod rear retaining clip.
4. Lubricate piston seal with petroleum jelly.
5. Install cover seal.
6. Install assembled servo components into case and install cover.

NOTE: Make sure return spring is correctly positioned in case.

7. Install three 8mm cover bolts. Tighten to 9-12 N·m (6.6-8.8 lb-ft).

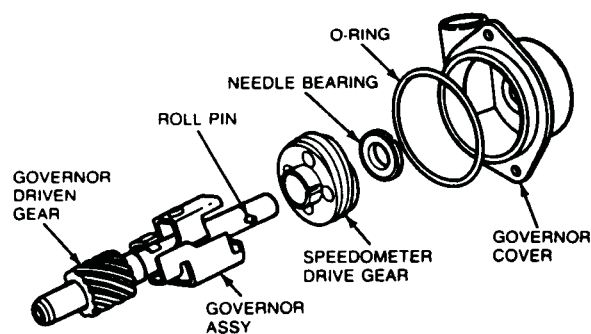


## DISASSEMBLY AND ASSEMBLY (Continued)

### Governor Assembly

#### Disassembly

1. Remove two 8mm cover bolts and remove cover.
2. Remove seal and discard.
3. Remove the following components as an assembly:
  - Speedometer drive gear bearing.
  - Speedometer drive gear.
  - Governor assembly.
4. Remove speedometer drive bearing and gear from governor shaft.



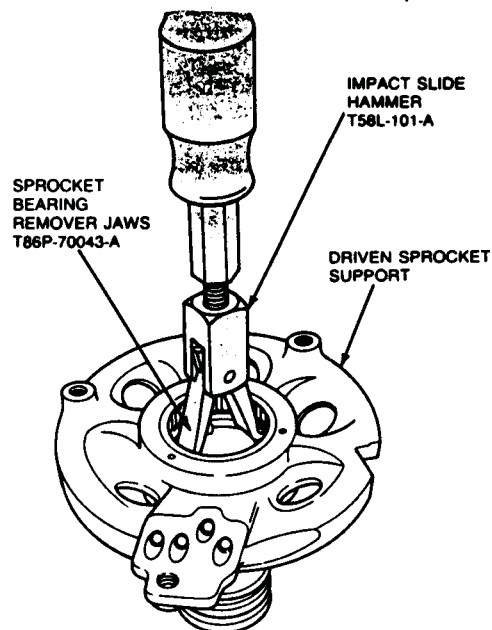
#### Assembly

1. Push speedometer drive gear onto governor shaft aligning slots in gear with shaft roll pin.
2. Install speedometer drive gear bearing on speedometer drive gear with outer race facing up.
3. Install new seal and cover.
4. Install two 8mm cover bolts. Tighten to 9-12 N·m (6.6-8.8 lb-ft).

### Driven Sprocket Support

#### Disassembly

Remove driven sprocket support needle bearing using Sprocket Bearing Remover T86P-70043-A and Impact Slide Hammer T58L-101-A or equivalent.



#### Assembly

Press driven sprocket support needle bearing using sprocket bearing replacer with handle T86P-70043-B or equivalent.

