SECTION A

TURBO HYDRA-MATIC "400" AUTOMATIC TRANSMISSION 45-46-48-49000 SERIES

CONTENTS

SECTION A
Turbo Hydra-Matic "400" Automatic Transmission
(continued)

DIVISION I

TROUBLE DIAGNOSIS

76-1 SEQUENCE FOR TURBO HYDRO-MATIC 400 TRANSMISSION DIAGNOSIS

1. Check and correct oil level.

2. Check detent switch.

3. Check and correct vacuum line and fittings.

4. Check and correct manual linkage. See Group 73.

5. Install oil pressure gage.

6. Road test car.

a. Road test using all selective ranges, noting when discrepancies in operation or oil pressure occur.

b. Attempt to isolate the unit or circuit involved in the malfunction.

c. If engine performance indicates an engine tune up is required, this should be performed before road testing is completed or transmission correction attempted. Poor engine performance can result in rough shifting or other malfunctions.

76-2 TURBO HYDRA-MATIC 400 TRANSMISSION OIL CHECKING PROCEDURES

Before diagnosis of any transmission complaint is attempted, there must be an understanding of oil checking procedures and what appearance the oil should have. Many times a transmission malfunction can be traced to low oil level, improper reading of dipstick, or oil appearance; therefore, a careful analysis of the condition of oil and the level may eliminate needless repairs.

When checking oil level in the Turbo Hydra-matic 400, the procedure outlined in Paragraph 76-41, subparagraph C, should be observed to obtain the most accurate reading.

Also, when the dipstick is removed, it should be noted whether the oil is devoid of air bubbles or not. Oil with air bubbles gives an indication of an air leak in the suction lines, which can cause erratic operation and slippage. Water in the oil imparts a milky, pink cast to the oil and can cause slipping.

76-3 EXTERNAL OIL LEAKS

A. Determining Source of Oil Leak

Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak can be deceiving due to "wind flow" around the engine and transmission.

The suspected area should be wiped clean of all oil before inspecting for the source of the leak. Red dye is used in the transmission oil at the assembly plant and will indicate if the oil leak is from the transmission.

The use of a "Black Light" to locate the point at which the oil is leaking is helpful. Comparing the oil from the leak to that on the engine or transmission dipstick, when viewed by black light, will determine the source of the leak - engine or transmission.

Oil leaks around the engine and transmission are generally carried toward the rear of the car by the air stream. For example, a transmission oil fill pipe to case leak will sometimes appear as a leak at the rear of the transmission. In determining the source of a leak, proceed as follows:

A "BLACK LIGHT" testing unit can be obtained from your local service tool supplier.

1. Degrease underside of transmission.

2. Road test to get unit at operating temperature. (180 degrees F.)

3. Inspect for leak with engine running.

4. With engine off, check for oil leaks due to the raised oil level caused by drain back.

B. Possible Points of Oil Leaks

1. Transmission Oil Pan Leak

a. Attaching bolts not correctly torqued.

b. Improperly installed or damaged pan gasket.

c. Oil pan gasket mounting face not flat.

2. Case Extension

a. Attaching bolts not correctly torqued.

b. Rear seal assembly damaged or improperly installed.

c. Extension to case, gasket damage or improperly installed.

d. Porous casting. See paragraph C.

e. Output shaft "O" ring damaged.

3. Case Leak

a. Filler pipe "O" ring seal damaged or missing; misposition of filler pipe bracket to engine "loading" one side of "O" ring.

b. Modulator assembly "O" ring seal damaged or improperly installed.

c. Electrical connector "O" ring seal damaged or improperly installed.

d. Governor cover bolts not torqued, gasket damaged or leak between case face and gasket.

e. Speedometer gear "O" ring damaged.

f. Manual shaft lip seal damaged or improperly installed.

g. Parking pawl shaft cup plug damaged, improperly installed.

h. Line pressure band release tap plug loose.

i. Vent pipe (refer to item 5).

j. Porous casting. See subparagraph C.

4. Leak at Front of Transmission

a. Front pump seal leaks.

(1) Seal lip cut. Check converter hub for nicks, etc.

(2) Bushing moved forward and damaged.

(3) Garter spring missing from seal.

b. Front pump attaching bolts loose or bolt seals damaged or missing.

c. Front pump housing "O" ring damaged or cut.

d. Converter leak in weld area.

e. Porous casting (pump).

5. Oil Comes Out Vent Pipe

a. Transmission over-filled.

b. Water in oil.

c. Foreign matter between pump and case or between pump cover and body.

d. Case - porous, front pump cover mounting face shy of stock near breather. See subparagraph C.

e. Pump to case gasket mispositioned.

f. Incorrect dipstick.

g. Cut "O" ring or grommet on filter.

h. Pump - shy of stock on mounting faces, porous casting, breather hole plugged in pump cover.

C. Case Porosity Repair

Turbo Hydra-Matic 400 transmission leaks caused by case porosity have successfully been repaired with the transmission in the car by using the following recommended procedures:

1. Road test and bring the transmission to operating temperature, approximately 180 degrees.

2. Raise car on a hoist or jack stand, engine running and locate source of oil leak. See subparagraph B.

NOTE: *Use of a mirror is helpful in finding leaks.*

3. Shut engine off and thoroughly clean area to be repaired with a cleaning solvent and a brush air dry.

NOTE: *A clean, dry soldering acid brush can be used to clean the area and also to apply the epoxy cement.*

4. Using instructions of the manufacturer, mix a sufficient amount of epoxy, Group 0.423, Part No. 1360016, or equivalent to make repair.

NOTE: *Observe cautions of mfg. in handling.*

5. While the transmission case is still HOT, apply the epoxy to the area to be repaired,

NOTE: *Make certain the area to be repaired is fully covered.*

6. Allow cement to cure for *three hours* before starting engine.

7. Road test and check for leaks.

76-4 VACUUM MODULATOR DIAGNOSIS

The vacuum modulator, see Figure 76-1, has three areas to be checked. If any one of the three (3) areas fail to pass the prescribed checks, the modulator must be replaced.

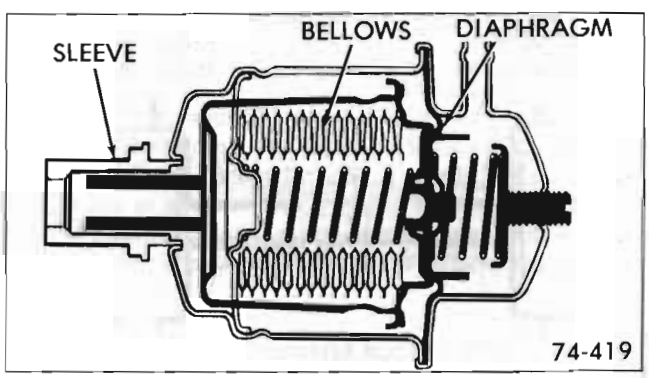

Figure 76-1 - Vacuum Modulator Assembly

1. Bellows Comparison Check

Using a comparison gage, furnished with Dealer Service Information Bulletin 67-I-37, one per dealer, compare the load of a known good modulator *of the same part number* with the modulator in question.

NOTE: *Refer to modulator usage chart in paragraph 76-41, subparagraph A.*

To check bellows load proceed as follows:

a. Insert one end of the comparison gage into the suspected defective modulator sleeve. Insert the opposite end of the gage into a known good modulator *of the same part number* as the suspected defective modulator.

NOTE: *Refer to modulator usage chart in paragraph 76-41, subparagraph a.*

NOTE: *The part number of the modulator assembly is located on the back side of the modulator.*

b. Holding the modulators in a horizontal position, see Figure 76-2, bring them slowly together under pressure.

The modulator bellows in question, if defective, will reach the center line of the comparison gage before the known good modulator lines up with the outer gage line. See Figure 76-3.

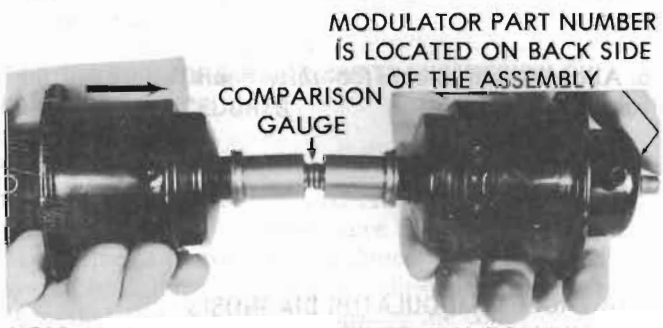

Figure 76-2 - Holding Modulators in Horizontal Position

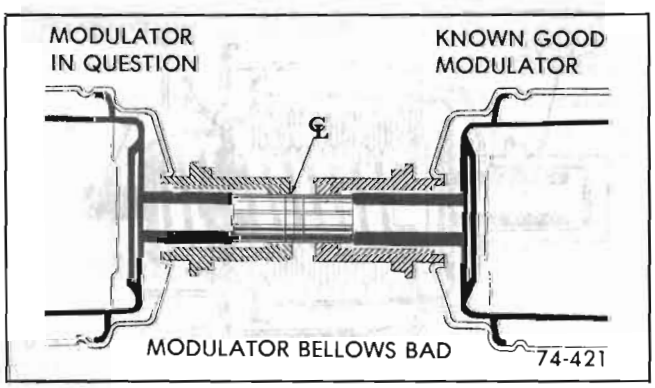

Figure 76-3 - Modulator Bellows (Bad)

If the modulator bellows in question is good, both modulator assemblies will be within the outer gage lines as the assemblies are slowly brought together. See Figure 76-4.

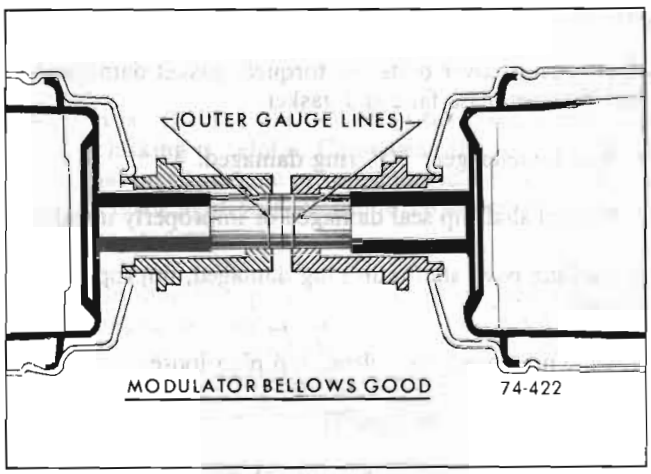

Figure 76-4 - Modulator Bellows (Good)

2. Vacuum Diaphragm Leak Check

Turn modulator so vacuum line stem points downward. If transmission oil comes out, the vacuum diaphragm is defective.

IMPORTANT: *Gasoline and/or water vapor may settle in the vacuum side of the modulator. If this is found WITHOUT the presence of oil, the modulator MUST NOT BE CHANGED.*

Check solution that comes out of the modulator for evidence of lubricity. If the solution does not have the feel of oiliness it can be assumed the solution is a mixture of gas and/or water. The only way transmission oil can be on the vacuum side of the modulator is by a leak in the vacuum diaphragm.

If oil is found, the modulator must be replaced. If oil is not found in the vacuum side of the modulator but the transmission oil level is continually low, *and No external leaks are found,* there is a possibility that a pin hole leak exists in the diaphragm and the modulator should be replaced.

3. Inspection for External Damage

1. Check for dents or cracks in modulator.

2. Check modulator valve sleeve alignment. Roll modulator on a flat surface to determine if the sleeve is concentric to the modulator can. See Figure 76- 5. If the sleeve is bent, runout will be visible, and modulator must be replaced.

If the modulator passes the above checks, the following items should also be checked as a possible cause of the problem.

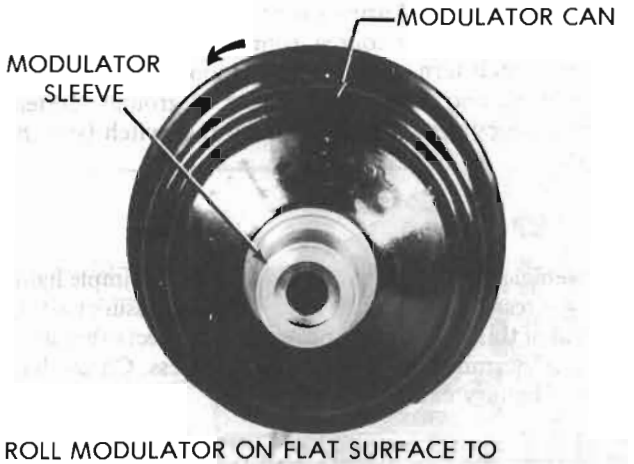

Figure 76-5 - Checking Modulator Sleeve Alignment

1. Check freeness of modulator valve in modulator.

2. Check freeness of modulator valve in transmission case.

3. Check the vacuum line from the manifold to modulator for holes, cracks or dents. Check the rubber hose connections at the modulator and at the intake manifold for leaks.

76-5 TRANSMISSION OIL PRESSURE CHECK TURBO HYDRA-MATIC 400

1. Oil Pressure Check - Road or Normal Operating Conditions

While road testing (with the transmission oil pressure gage attached and the vacuum modulator tube connected) the transmission pressures should check approximately as follows:

L² Range	Min.	Max.
2nd gear — Steady road load	150 (±5) psi	150 (±5) psi

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Gear	Selector Lever Position	Min.	Max.
1st	Drive	60	150
2nd	(Zero throttle to full throttle)	60	150
3rd	Drive Range, (Zero throttle 30 mph)	60	
Rev.	Reverse (full throttle)	220	260

76-A62

2. Oil Pressure Check - Vacuum Modulator Check

The vacuum modulator assembly can be checked by making an oil pressure check as described in parts "A" and "B" of this section. The pressures given are approximate and can vary with changes in atmosphere pressure, but if this method is used as an indication of a source of malfunction, it can be a valuable service tool.

Using procedure "A" the oil pressures should be approximately as shown. Oil pressures taken in this manner, that vary appreciably from the chart, indicate further inspection of the following:

1. Vacuum lines and fittings.

2. Vacuum modulator.

3. Modulator valve.

4. Governor.

5. Pressure regulator.

6. Oil pump.

If the results of procedure "A" indicate further inspection is required, procedure "B" should be followed. If the pressures are appreciably different from those given in "B", a second check should be made with a new modulator assembly or one from a vehicle that is known to be operating standard. On the second check, if the pressures changed and were as shown on the chart, or closer to them, it would indicate a faulty modulator assembly and it should be suspected as a cause or part of the cause of the malfunction.

A. Car Stationary

Transmission oil pressure gage and engine tachometer should be connected. Pressures indicated are with the

vacuum line connected for normal modulator operation and service brakes holding vehicle with engine at 1000 rpm.

Drive Neutral Park	L^2 or L^1	Reverse
60	150	95

76-A63

NOTE: *Pressures are approximate.*

B. Oil pressures indicated are at zero output speed with the vacuum line disconnected from the modulator assembly and with the engine at 1200 RPM.

Alt. of Check (Ft. Above Sea Level)	Drive Neutral Park	L^2 or L^1	Rev.
0	150	150	244
2,000	150	150	233
4,000	145	150	222
6,000	138	150	212
8,000	132	150	203
10,000	126	150	194
12,000	121	150	186
14,000	116	150	179

76-A64

NOTE: *Altitude and pressures are approximate.*

76-6 TRANSMISSION CONTROL SPARK SWITCH CHECKING PROCEDURES

The pressure switch in the Turbo Hydra-matic 400 transmission may be easily checked with a continuity tester which uses either the vehicle's battery or a separate source to power the test lamp or meter.

CAUTION: *To prevent damaging the pressure switch, the tester used must have sufficient resistance that it does not supply the switch with more than .8 amp of current at 12 volts. Test lamps which use size 1893 or smaller bulb, will not damage the switch.*

1. Disconnect electrical wire harness from transmission electrical connector. If using a continuity tester which has a self-contained power source, connect one tester lead to pressure switch terminal of transmission connector (See Figure 76-6), and connect other lead to ground. Tester should show current flowing through the switch (switch closed).

If the vehicle's battery is to be used to power a simple light blub type tester, connect one lamp lead to pressure switch terminal of transmission connector and connect other lead to a "hot" terminal of the car wiring harness. Check that vehicle's battery cables are connected.

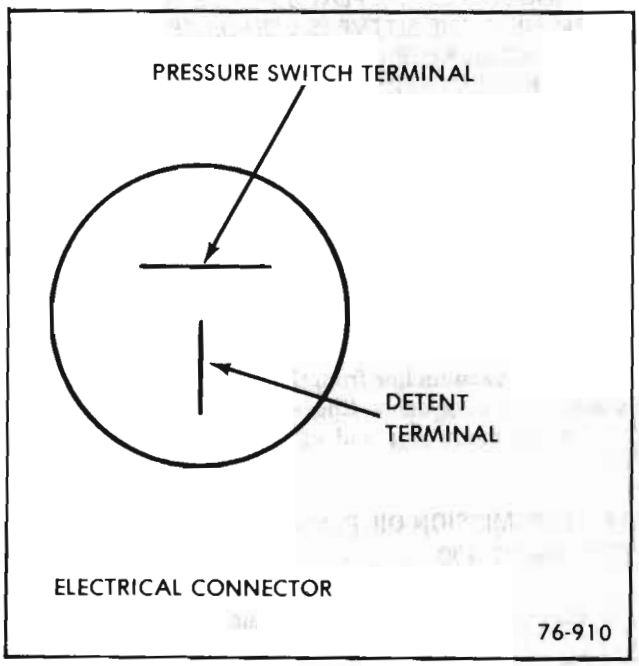


Figure 76-6

2. Set parking brake, apply service brakes, start engine and let it idle. Move transmission selector to "Drive" and tester should show current flowing through switch to ground (switch closed).

3. With brakes still applied, move transmission selector to "Reverse" (which supplies transmission oil pressure to pressure switch) and tester should show no current flowing through switch to ground (switch open).

4. If above test indicates a defective pressure switch circuit, the transmission bottom pan must be removed to service the pressure switch or lead wire assembly.

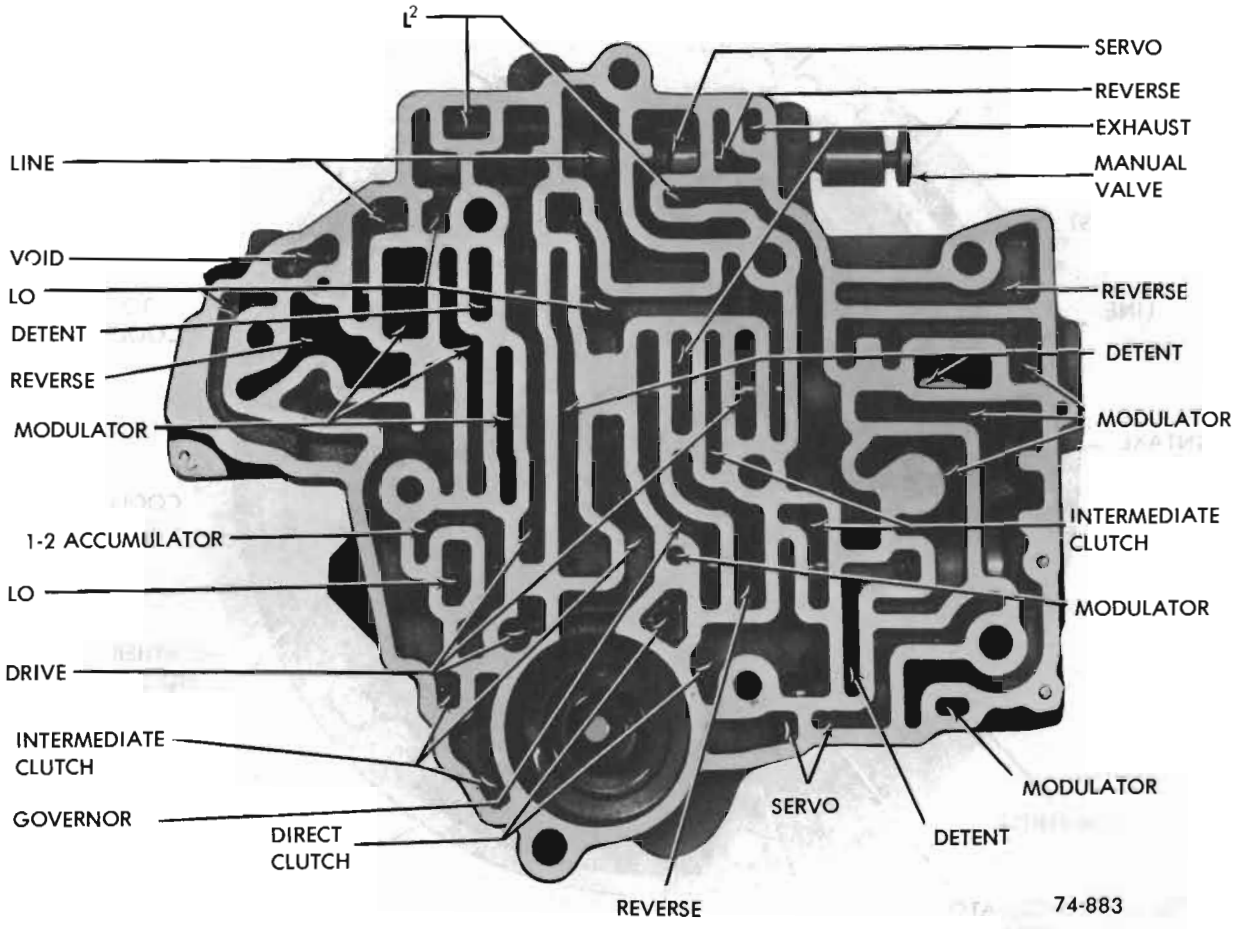


Figure 76-7 - Valve Body

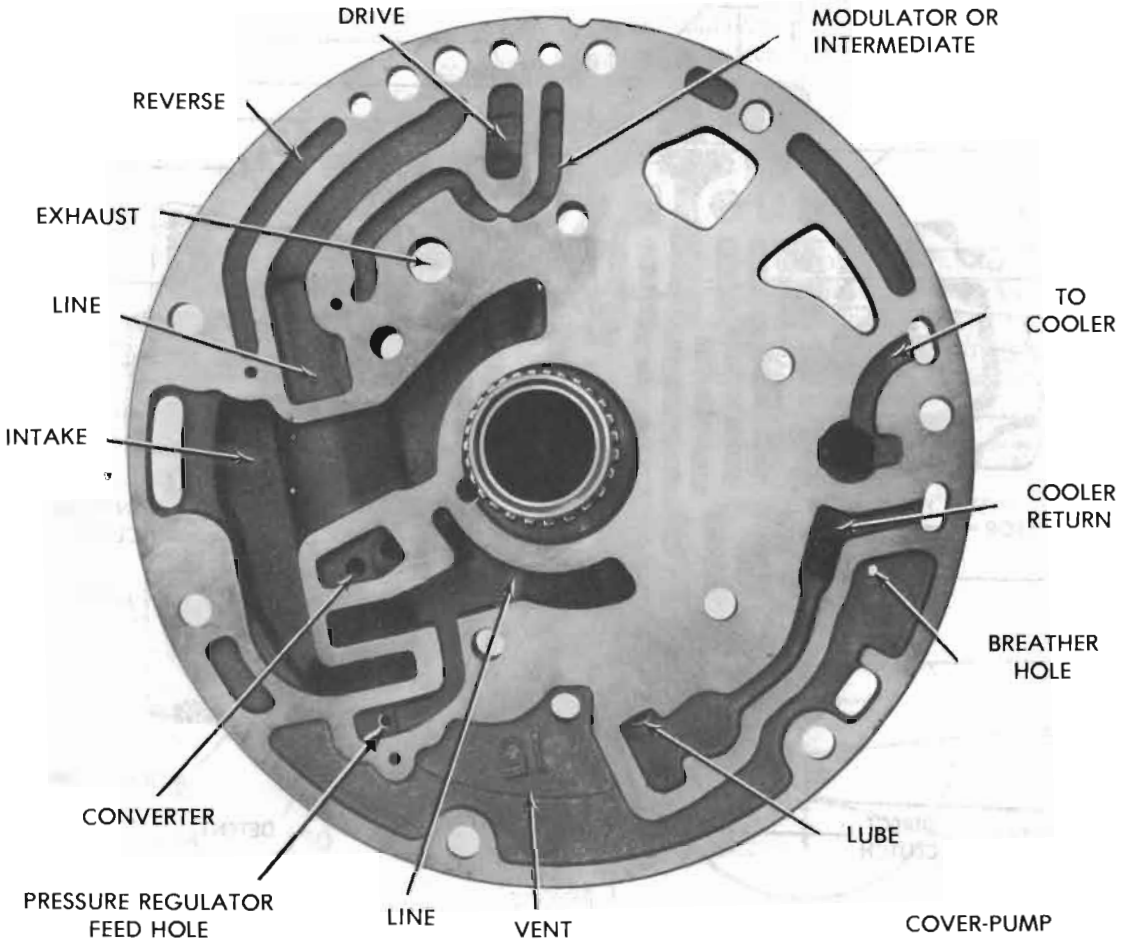


Figure 76-8 - Oil Pump Cover

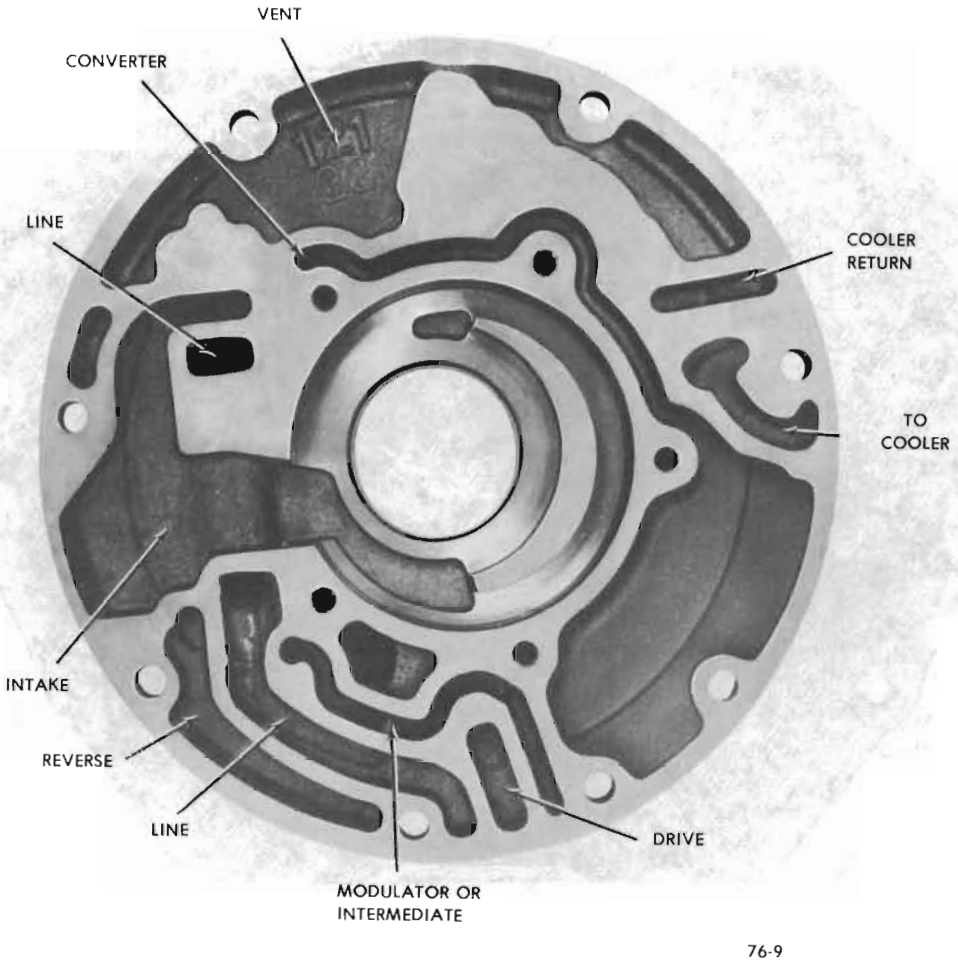


Figure 76-9 - Oil Pump Body

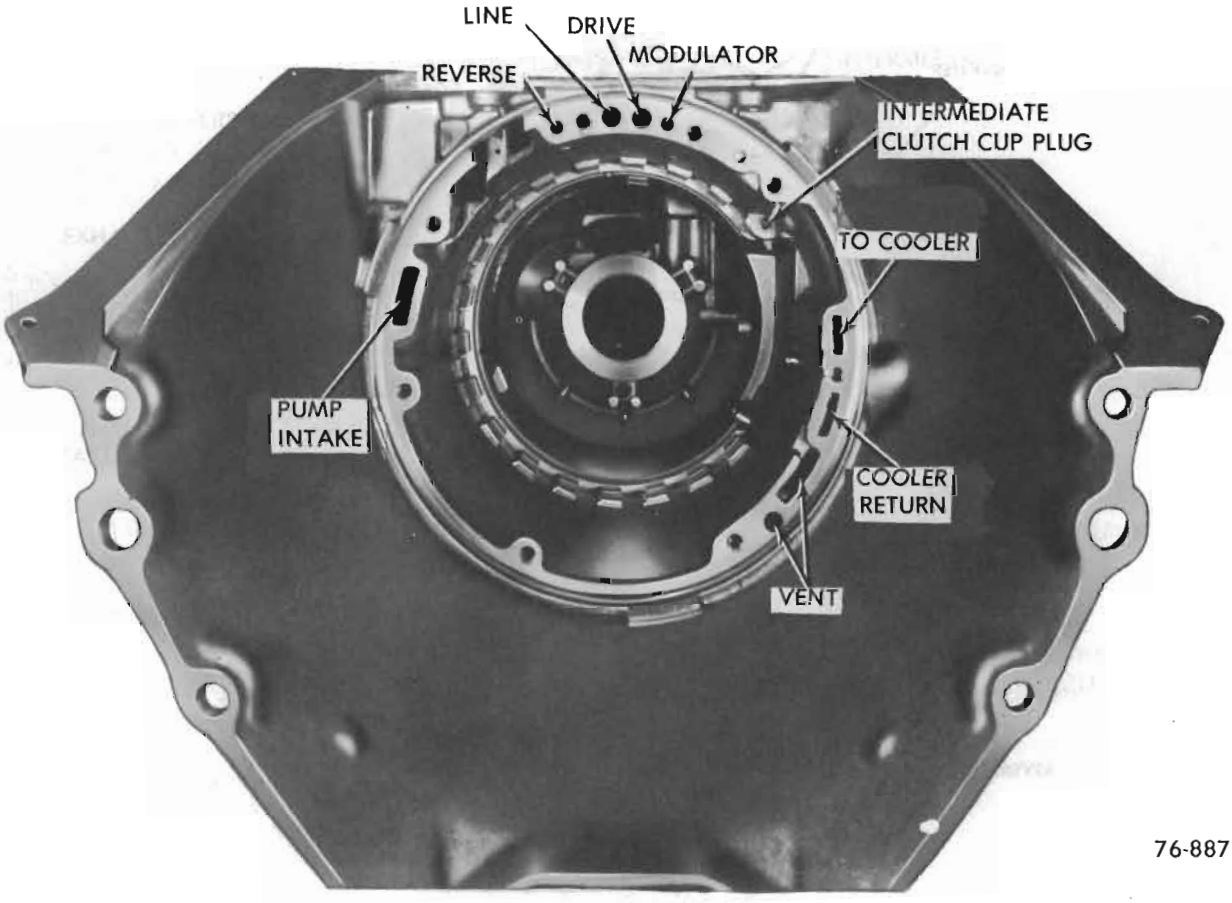


Figure 76-10 - Front of Case

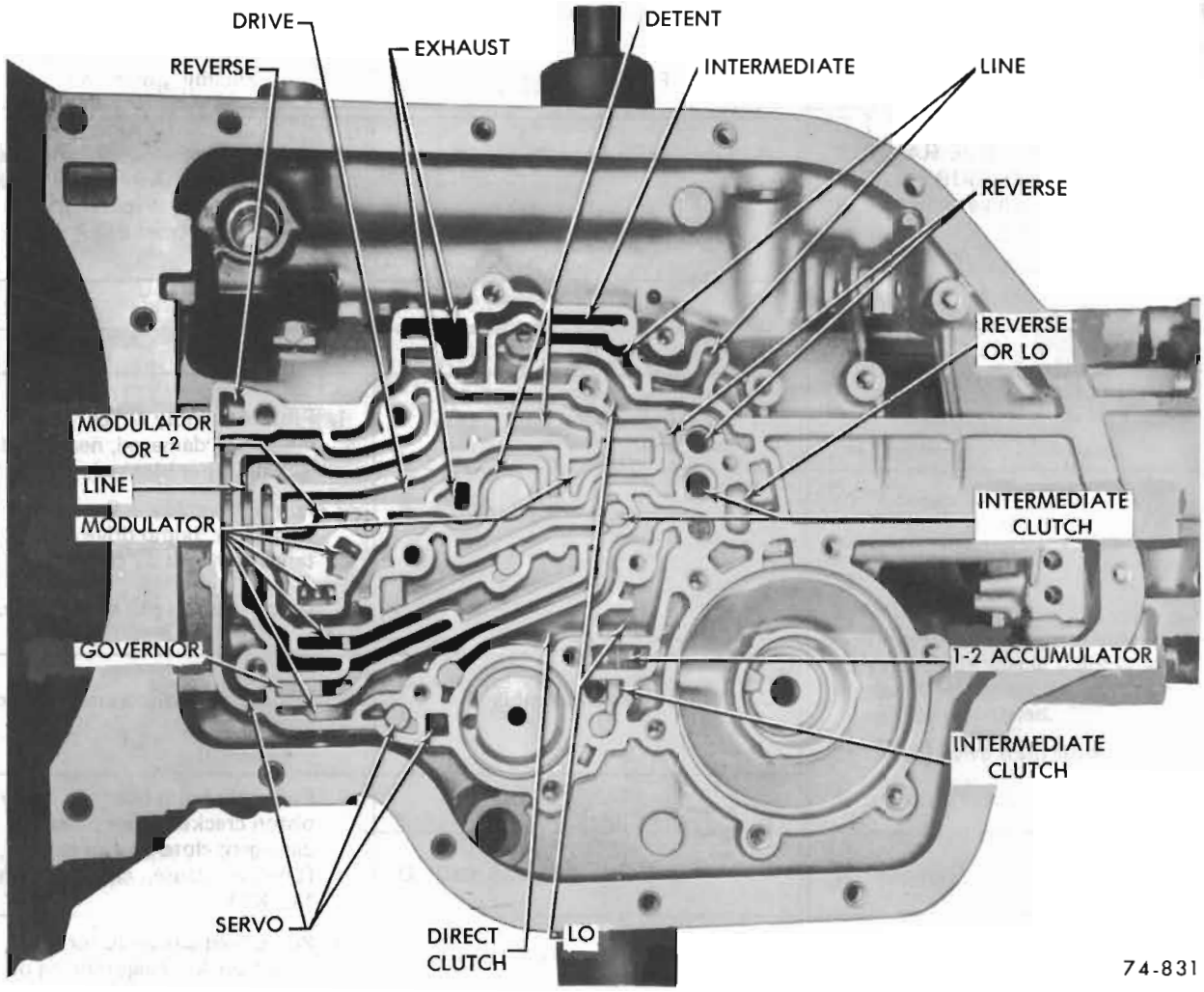


Figure 76-11 - Bottom of Case

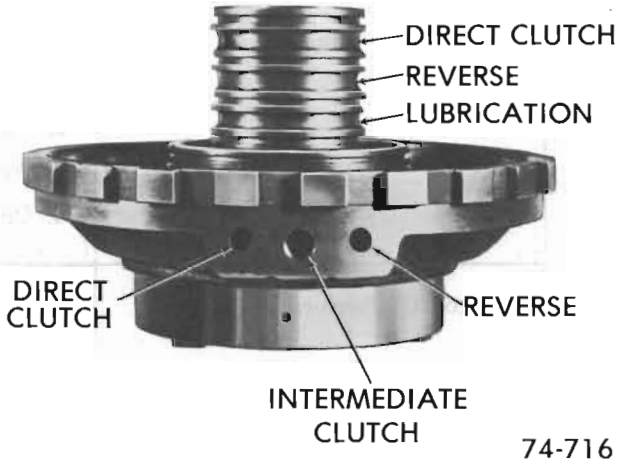


Figure 76-12 - Center Support

76-7 TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART

Problem	Possible Cause	Possible Condition
I. NO DRIVE IN DRIVE RANGE — (INSTALL PRESSURE GAGE).	A. Low Oil Level	1. Correct level — check for external leaks or defective vacuum modulator (leaking diaphragm will evacuate oil from unit).
	B. Manual Linkage Adjustment	1. See Section 73.
	C. Low Oil Pressure — (Refer to par. 76-4).	1. Filter Assembly — "O" ring missing or damaged, neck weld leaking, filter blocked. 2. Pump Assembly — Pressure Regulator, pump drive gear — tangs damaged by converter. 3. Case — porosity in intake bore.
	D. Control Valve Assembly	1. Manual valve disconnected from manual lever.
	E. Forward Clutch	1. Forward clutch does not apply — piston cracked; seals missing, damaged; clutch plates burned, (Look for cause. (See Problem No. XX). 2. Pump feed circuit to forward clutch oil seal rings missing or broken on pump cover; leak in feed circuits; pump to case gasket mispositioned or damaged. Clutch drum ball check stuck or missing.
	F. Roller Clutch Assembly	1. Broken spring or damaged cage.
II. OIL PRESSURE HIGH or LOW (SEE OIL PRESSURE CHECK) Paragraph 76-4.	A. High Oil Pressure	1. Vacuum line or fittings leaking. 2. Vacuum modulator. 3. Modulator valve. 4. Pressure regulator. 5. Oil Pump.
	B. Low Oil Pressure	1. Vacuum line or fittings obstructed. 2. Vacuum modulator.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
II. OIL PRESSURE HIGH or LOW (SEE OIL PRESSURE CHECK) Paragraph 76-4. (Cont'd.)	B. Low Oil Pressure (Cont'd.)	3. Modulator valve. 4. Pressure regulator. 5. Governor. 6. Oil pump.
III. 1-2 SHIFT – FULL THROTTLE ONLY.	A. Detent Switch. See Figures 120-59 and 120-68 for wiring diagrams.	1. Sticking or defective (See Figure 76-39.)
	B. Detent Solenoid	1. Loose. 2. Gasket leaking. 3. Sticks open.
	C. Control Valve Assembly	1. Valve body spacer plate-to-cover gasket – leaking, damaged, incorrectly installed. 2. Detent valve train stuck. 3. 3-2 valve stuck.
*See paragraph 76-3, sub-paragraph c.	D. Case Assembly	1. Porosity.*
IV. FIRST SPEED ONLY, NO 1-2 SHIFT	A. Governor Assembly	1. Governor valve sticking. 2. Driven gear loose, damaged or worn, (check for pin in case and length of pin showing); also check output shaft drive gear for nicks or rough finish, if driven gear shows damage.
	B. Control Valve Assembly	1. 1-2 shift valve train stuck closed. 2. Governor feed channels blocked, leaking, pipes out of position. 3. Valve body spacer plate-to-cover gasket – leaking, damaged, incorrectly installed.
	C. Case	1. Intermediate clutch plug leaking or blown out. 2. Porosity between channels. 3. Governor feed channel blocked, governor bore scored or worn allowing cross pressure leak.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
IV. FIRST SPEED ONLY, NO 1-2 SHIFT (Cont'd.)	D. Intermediate Clutch	1. Clutch piston seals – missing, improperly assembled, cut. 2. Center support – oil rings missing, broken, defective – orifice plug missing.
V. FIRST AND SECOND SPEEDS ONLY, NO 2-3 SHIFT.	A. Detent Solenoid	1. Stuck open (Detent shifts only – the 2-3 shift would occur at very high speeds, being interpeted as no 2-3 shifts). 2. Refer to Figure 76-39.
	B. Detent Switch. See Figures 120-59 and 120-68 for wiring diagrams.	
	C. Control Valve Assembly	1. 2-3 shift train stuck. 2. Valve body spacer plate-to-cover gasket – leaking, damaged, incorrectly installed.
	D. Direct Clutch	1. Center support – oil rings missing, broken, defective. 2. Clutch piston seals – missing, improperly assembled, cut, piston ball check stuck or missing.
VI. DRIVE IN NEUTRAL.	A. Manual Linkage	1. Maladjusted.
	B. Forward Clutch	1. Clutch does not release – (this condition will also cause "No Reverse").
VII. NO DRIVE IN REVERSE, or SLIPS IN REVERSE – (Install Pressure Gage).	A. Low Oil Level	1. Add oil – See Paragraph 76-41 Subparagraph c.
	B. Manual Linkage	1. Misadjusted. Refer to Group 73.
	C. Oil Pressure – (Refer to par. 76-4).	1. Vacuum modulator assembly – defective. 2. Vacuum modulator valve – sticking. 3. Restricted strainer leak at intake pipe grommet, or "O" ring.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
VII. NO DRIVE IN REVERSE, or SLIPS IN REVERSE – (Install Pressure Gage) (Cont'd.)	C. Oil Pressure – (Refer to par. 76-4) (Cont'd.)	4. Pump assembly – regulator or boost valve sticking.
	D. Control Valve Assembly	1. Valve body spacer plate-to-cover gasket – leaking, damaged, incorrectly installed (Other malfunctions may also be indicated.) 2. Low Reverse ball check – Missing from case (This will also cause no overrun braking in L^1 Range). 3. 2-3 Valve train stuck open (This will also cause 1-3 upshift in Drive Range). 4. Reverse feed passage – missing check case passages.
	E. Rear Servo and Accumulator	1. Servo piston seal ring, damaged or missing. 2. Short band apply pin (This may also cause no overrun braking or slips in overrun braking – L^1 Range).
	F. Reverse or Low Band	1. Burned, loose lining, apply pin or anchor pins not engaged, band broken.
	G. Direct Clutch	1. Outer seal damaged or missing. 2. Clutch plates burned – may be caused by stuck ball check in piston. (See problem No. XX)
	H. Forward Clutch	1. Clutch does not release (will also cause Drive in Neutral).
VIII. SLIPS IN ALL RANGES, SLIPS ON START – (Install Pressure Gage)	A. Oil Level Low	1. Add oil – See Paragraph 76-41 subparagraph c.
	B. Oil Pressure (Refer to par. 76-4)	1. Vacuum modulator defective. 2. Vacuum modulator valve sticking. 3. Filter assembly – plugged or leaks; grommet "O" ring missing or damaged.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
VIII. SLIPS IN ALL RANGES, SLIPS ON START – (Install Pressure Gage) (Cont'd.)	B. Oil Pressure (Refer to par. 76-4) (Cont.d.)	4. Pump assembly – regulator or boost valve sticking, cross leak. 5. Pump to case gasket damaged or incorrectly installed.
	C. Case	1. Cross leaks, porosity.
	D. Forward and Direct Clutches Slipping	1. If burned, look for cause. (See Problem No. XX.) 2. Oil seal rings on pump cover broken or worn.
IX. SLIPS 1-2 SHIFT – (Install Pressure Gage)	A. Oil Level Low	1. Add oil – See Paragraph 76-41 subparagraph c.
	B. Oil Pressure (Refer to par. 76-4)	1. Vacuum modulator assembly defective. 2. Modulator valve sticking. 3. Pump pressure regulator valve.
	C. Front Accumulator	1. Oil ring damaged or missing.
	D. Control Valve Assembly	1. 1-2 accumulator valve train sticking. 2. Porosity in valve body or case. 3. Valve body attaching bolts not properly torqued.
	E. Rear Accumulator	1. Oil ring missing or damaged, case bore damaged.
	F. Pump to Case Gasket	1. Mispositioned.
	G. Case	1. Intermediate clutch plug – leaking excessively. 2. Porosity between channels.
	H. Intermediate Clutch	1. Piston seals missing or damaged; clutch plates burned, look for cause. (See Problem No. XX. 2. Center support leak in feed circuit (oil rings damaged or grooves defective), excessive leak between tower and bushing, orifice bleed plug hole (0.20 dia.) blocked. Center support bolt not seated properly in case. 3. Extra waved steel plate – should have only one waved steel plate. No waved plate in "BB" and "OW" models.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
X. ROUGH 1-2 SHIFT – (Install Pressure Gage)	A. Oil Pressure – (Refer to par. 74-4)	1. Vacuum modulator – check for loose fittings, restrictions in line, modulator assembly defective. 2. Modulator valve stuck. 3. Pump – regulator or boost valve stuck. 4. Pump to case gasket – off location or damaged.
	B. Control Valve Assembly	1. 1-2 accumulator valve train. 2. Valve body to case bolts loose. 3. Valve body spacer plate-to-cover gasket off location, wrong gasket or damaged.
	C. Case	1. Intermediate clutch ball missing or not sealing. 2. Porosity between channels.
	D. Rear Servo Accumulator Assembly	1. Oil rings damaged. 2. Piston stuck. 3. Broken or missing spring. 4. Bore damaged.
	E. Intermediate Clutch	1. Extra waved steel plate. No waved plate in "BB" and "OW" models.
XI. SLIPS 2-3 SHIFT – (Install Pressure Gage)	A. Oil Level Low	1. Add oil – See Paragraph 76-41 subparagraph c.
	B. Oil Pressure Low – (Refer to par. 76-4)	1. Modulator assembly. 2. Modulator valve. 3. Pump pressure regulator valve or boost valve; pump to case gasket off location.
	C. Control Valve Assembly	1. Accumulator piston pin – leak at swedge end.
	D. Case	1. Porosity.
	E. Direct Clutch	1. Piston seals leaking, or ball check leak. 2. Center support – oil seal rings damaged; excessive leak between tower and bushing. 3. Extra waved steel plate – should have only one waved plate. No waved plate in "OW" model.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd)

Problem	Possible Cause	Possible Condition
XII. ROUGH 2-3 SHIFT – (Install Pressure Gage)	A. Oil Pressure – High (Refer to par. 76-4)	1. Modulator assembly defective. 2. Modulator valve sticking. 3. Pump – pressure regulator or boost valve inoperative
	B. Front Servo Accumulator or Assembly	1. Front accumulator spring missing, broken. 2. Accumulator piston stuck.
	C. Direct Clutch	1. Extra waved steel plate. No waved plate in "BB" and "OW" models.
XIII. NO ENGINE BRAKING – L^2 – 2nd GEAR	A. Front Servo and Accumulator	1. Servo or accumulator oil rings or bores leaking. 2. Servo piston stuck.
	B. Front Band	1. Front band broken, burned (Check for cause); not engaged on anchor pin and/or servo pin.
XIV. NO ENGINE BRAKING – L^2 – 1st GEAR	A. Control Valve Assembly	1. Lo-Reverse check ball missing from case.
	B. Rear Servo	1. Oil seal ring, bore or piston damaged; leaking apply pressure. 2. Rear band apply pin short, improperly assembled.
	C. Rear Band NOTE: Item A, B, C, will also cause slips in Reverse or no Reverse.	1. Rear band – broken, burned (check for cause), not engaged on anchor pins or servo pin.
XV. NO PART THROTTLE DOWNSHIFT – (INSTALL PRESSURE GAGE)	A. Oil Pressure – (Refers to Par. 76-4 For Oil Pressure Specifications.	1. Vacuum modulator assembly, modulator valve, pressure regulator valve train. (Other malfunctions may also be noticed).
	B. Control Valve Assembly	1. 3-2 valve stuck, spring missing or broken.
XVI. NO DETENT DOWNSHIFTS	A. Control Valve Assembly	1. 3-2 valve stuck, spring missing or broken.
	B. Detent Switch	1. Adjustment, connections fuse.
	C. Solenoid	1. Inoperative, connections.
	D. Control Valve Assembly	1. Detent valve train, sticking.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd.)

Problem	Possible Cause	Possible Condition
XVII. LOW or HIGH SHIFT POINTS – Install Pressure Gage)	A. Oil Pressure – (Refer to par. 76-4)	1. Engine vacuum – check at transmission end of the modulator pipe. 2. Vacuum modulator assembly vacuum line connections at engine and transmission, modulator valve, pressure regulator valve train.
	B. Governor	1. Valve sticking. 2. Feed holes restricted or leaking, pipes damaged or mispositioned. 3. Feed line plugged.
	C. Detent Solenoid	1. Stuck open, loose, etc. (Will cause late shifts).
	D. Control Valve Assembly	1. Detent valve train. 2. 3-2 valve train. 3. 1-2 shift valve train. a. 1-2 regulator valve stuck – (This would cause a constant 1-2 shift point regardless of throttle opening). 4. Valve body spacer plate-to-cover gasket – mispositioned, spacer plate orifice holes missing or blocked.
	E. Case	1. Porosity; intermediate plug leaking, missing.
XVIII. WON'T HOLD IN PARK	A. Manual Linkage	1. Maladjusted.
	B. Internal Linkage	1. Parking brake lever and actuator assembly – defective (Check for chamfer on actuator rod sleeve). 2. Parking pawl broken or inoperative.
XIX. TRANSMISSION NOISY	A. Pump Noise	1. Oil low or high. 2. Cavitation due to plugged Filter, "O" ring damaged, porosity in intake circuit, water in oil. 3. Pump gears – driving gear assembled backwards, gears damaged or defective, crescent interference.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd)

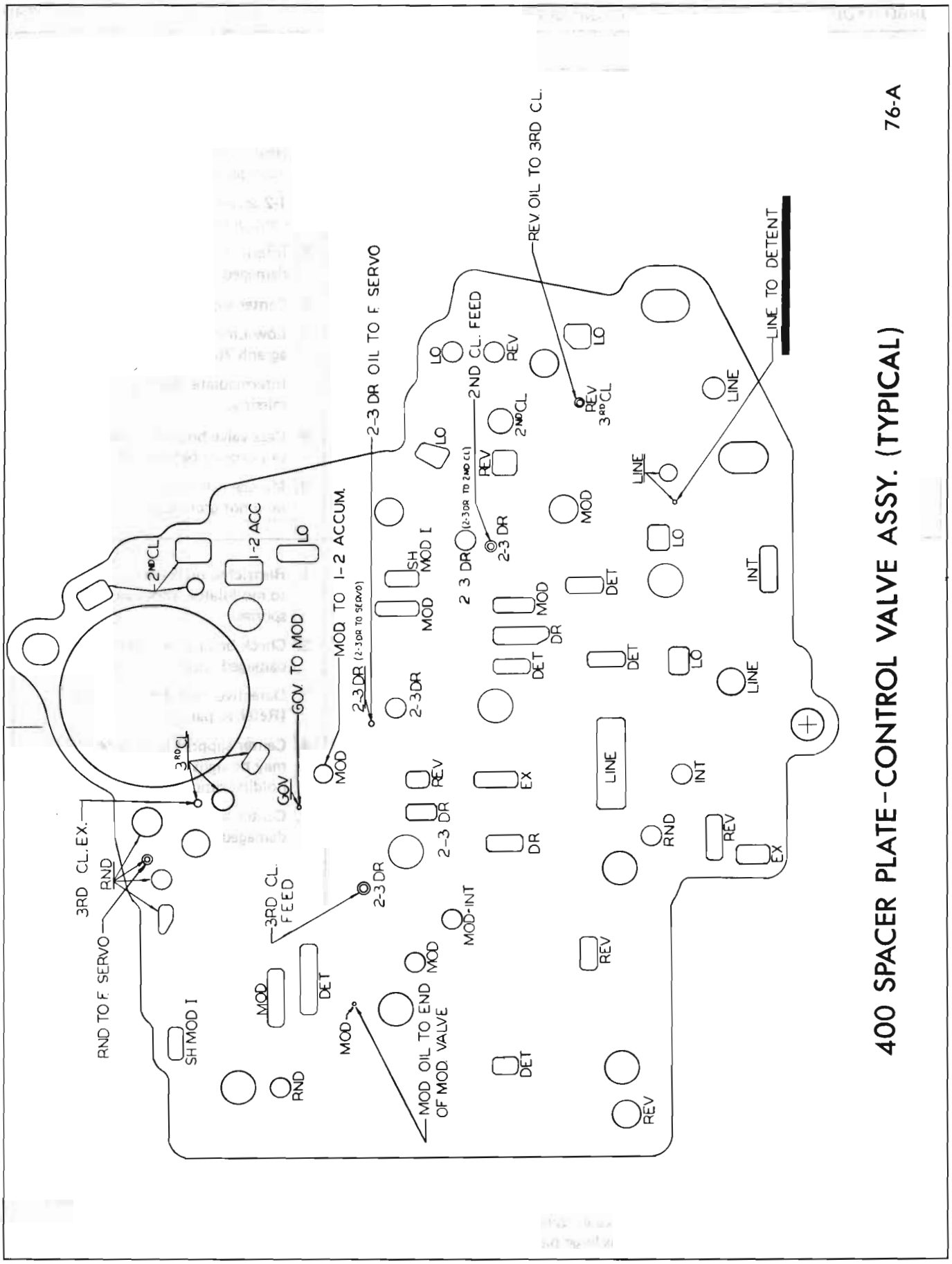
Problem	Possible Cause	Possible Condition
XIX. TRANSMISSION NOISY (Cont'd.)	B. Gear Noise – First, Second, and/or Reverse	1. Transmission grounded to body. 2. Planetary gear set. 3. Thoroughly clean thrust bearings and thrust races, and closely inspect for pitting or roughness.
	C. Clutch Noise – During Application	1. Forward clutch – (Neutral to Drive, Park to Drive); Check clutch plates. 2. Intermediate clutch – (1-2 shift in L^2 and Drive Range); Check clutch plates. 3. Direct clutch – (2-3 shift in Drive Range and in Neutral to Reverse, Park to Reverse); Check clutch plates.
	D. Converter Noise	1. This Condition will occur in R-D-L^2-L^1 Due to damaged Needle Bearings in Converter. Noise Level is generally lower in Park and Neutral.
Problem	**Plates Burnt**	**Possible Condition**
XX. BURNED CLUTCH PLATES	A. Forward Clutch	1. Check ball in clutch housing damaged, stuck or missing. 2. Clutch piston cracked, seals damaged or missing. 3. Low Line Pressure (Refer to paragraph 76-5) 4. Manual valve mispositioned (Refer to paragraph 76-9). 5. Restricted oil feed to forward clutch (Examples: clutch housing to inner and outer areas not drilled, restricted or porosity in pump). 6. Pump cover oil seal rings missing, broken or undersize; ring groove oversize. 7. Case valve body face not flat or porosity between channels. 8. Manual valve bent and center land not ground properly.

TURBO HYDRA-MATIC 400 TROUBLE DIAGNOSIS CHART (Cont'd)

Problem	Plates Burnt	Possible Condition
XX. BURNED CLUTCH PLATES (Cont'd.)	B. Intermediate Clutch	1. Constant bleed orifice in center support missing. 2. Rear accumulator piston oil ring, damaged or missing. 3. 1-2 accumulator valve stuck in control valve assembly. 4. Intermediate clutch piston seal damaged or missing. 5. Center support bolt loose. 6. Low Line pressure (Refer to paragraph 76-5). 7. Intermediate clutch plug in case missing. 8. Case valve body face not flat or porosity between channels. 9. Manual valve bent and center land not ground properly.
	C. Direct Clutch	1. Restricted orifice in vacuum line to modulator (Poor vacuum response.) 2. Check ball indirect clutch piston damaged, stuck or missing. 3. Defective modulator bellows. (Refer to paragraph 76-4). 4. Center support bolt loose. (Bolt may be tight in support but not holding support tight to case.) 5. Center support oil rings or grooves damaged or missing. 6. Clutch piston seals damaged or missing. 7. Front and rear servo pistons and seals damaged. 8. Manual valve bent and center land not cleaned up. 9. Case valve body face not flat or porosity between channels. 10. Intermediate sprag clutch installed backwards. 11. 3-2 Valve, 3-2 spring or 3-2 spacer pin installed in wrong location in 3-2 valve bore. 76-61

NOTE: Burned clutch plates can be caused by incorrect usage of clutch plates. Also anti-freeze in transmission fluid can cause severe damage, such as large pieces *of composition clutch plate material peeling off.*

NOTE: If direct clutch plates and front band are burned, check manual linkage. (Refer to Group 73).



400 SPACER PLATE-CONTROL VALVE ASSY. (TYPICAL)

76-A

DIVISION II

DESCRIPTION AND OPERATION

76-8 DESCRIPTION

The Turbo Hydra-matic 400 Automatic Transmission, see Figure 76-38, is a fully automatic unit consisting primarily of a 3-element hydraulic torque converter and a compound planetary gear set. Three multiple- disc clutches, one (1) one way roller clutch, one (1) one way sprag clutch and two bands provide the friction elements required to obtain the desired function of the compound planetary gear set.

The 3-element torque converter consists of a pump, turbine and a stator assembly. The stator is mounted on a one way roller clutch which will allow the stator to turn clockwise but not counterclockwise.

The torque converter housing is filled with oil and is attached to the engine crankshaft by a flywheel, thus always rotates at engine speed. The converter pump is an integral part of the converter housing, therefore the pump blades, rotating at engine speed set the oil within the converter into motion and direct it to the turbine, causing the turbine to rotate.

As the oil passes through the turbine it is traveling in such a direction that if it were not *redirected* by the stator it would hit the rear of the converter pump blades and impede its pumping action. So at low turbine speeds, the oil is redirected by the stator to the converter pump in such a manner that it actually assists the converter pump to deliver power, or multiply engine torque.

As turbine speed increases, the direction of the oil leaving the turbine changes and flows against the rear side of the stator vanes in a clockwise direction. Since the stator is now impeding the smooth flow of oil, its roller clutch releases and it revolves freely on its shaft. Once the stator becomes inactive, there is no further multiplication of engine torque within the converter. At this point, the converter is merely acting as a fluid coupling as both the converter pump and turbine are being driven at approximately the same speed - or at a one-to-one ratio.

A hydraulic system, pressurized by a gear type pump, provides the working pressure required to operate the friction elements and automatic controls.

External control connections to transmission are:

Manual Linkage - To select the desired operating range.

Engine Vacuum - To operate a vacuum modulator unit.

12 Volt Electrical Signal - To operate an electrical detent solenoid.

A vacuum modulator is used to automatically sense any change in the torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator, which controls line pressure, so that all torque requirements of the transmission are met and smooth shifts are obtained at all throttle openings.

The detent solenoid is activated by a signal from the detent switch that is connected to the throttle linkage. When the throttle is fully open, the switch on the linkage is closed, energizing the detent solenoid and causing the transmission to downshift at speeds below approximately 70 MPH.

The selector quadrant has six selector positions: P, R, N, D, L2, L1.

P. - Park position positively locks the output shaft to the transmission case by means of a locking pawl to prevent the vehicle from rolling either direction. This position should be selected whenever the driver leaves the vehicle. The engine may be started in Park position.

R. - Reverse range enables the vehicle to be operated in a reverse direction.

N. - Nuetral position enables the engine to be started and run without driving the vehicle.

D. - Drive range is used for all normal driving conditions and maximum economy.

Drive range has three gear ratios, from the starting ratio to direct drive. Detent downshift is available for safe passing by depressing the accelerator to the floor.

L2 - L2 range adds new performance for congested traffic or hilly terrain. L2 range has the same starting ratio as drive range, but prevents the transmission from shifting above second gear to retain second gear acceleration when extra performance is desired. L2 range can also be used for engine braking. L2 range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second gear until the vehicle speed or the throttle are changed to obtain first gear operation in the same manner as in drive range.

L1 - L1 range can be selected at any vehicle speed and the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 30-40 MPH, depending on axle ratio. The transmission will then downshift into first gear. Under no circumstances will it again upshift while the selector lever is in L1 range.

L1 range prevents the transmission from shifting out of first gear. This is particularly beneficial for maintaining maximum engine braking when continuous first gear operation is desirable.

76-9 HYDRAULIC OPERATION, FUNCTIONS OF VALVES AND HYDRAULIC CONTROL UNITS

A. Pressure Control

The transmission is automatically controlled by a hydrau-

lic system. Hydraulic pressure is supplied by the transmission gear type oil pump, which is engine driven. Main line pressure is controlled by a pressure regulator valve train located in the pump. This regulator controls line pressure automatically, in response to a pressure signal from a modulator valve, in such a way that the torque requirements of the transmission are met and smooth shifts are obtained at all throttle openings. See Figure 76-13.

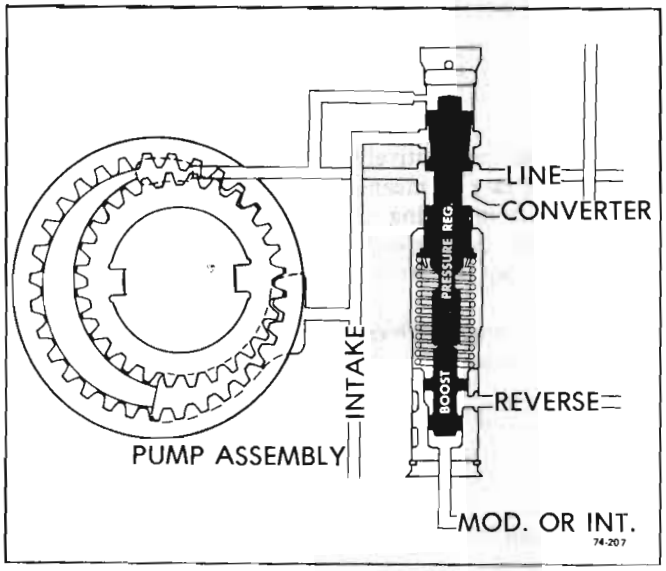


Figure 76-13 - Pump and Pressure Regulator Valve

To control line pressure properly, modulator pressure is used which varies in the same manner as torque input to the transmission. Since the converter torque output is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum which is an indicator of engine torque and carburetor opening. It is decreased by governor pressure with increase in vehicle speed because converter torque ratio also decreases.

B. Vacuum Modulator Assembly

The engine vacuum signal is provided by the vacuum modulator, which consists of an evacuated metal bellows, a diaphragm and two springs. These are so arranged that when installed, the bellows and its external spring apply a force which acts on the modulator valve. This force acts on the modulator valve so that it increases modulator pressure. Engine vacuum and the internal spring act in the opposite direction to decrease modulator, or low engine vacuum high modulator pressure; high engine vacuum, and low modulator pressure. See Figure 76-14.

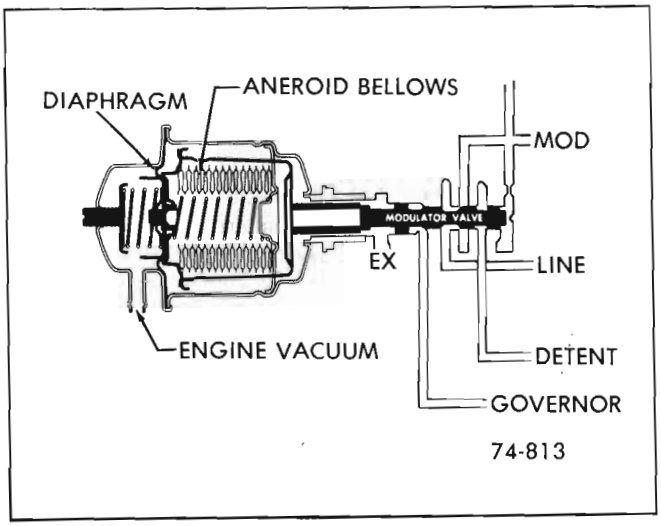


Figure 76-14 - Vacuum Modulator Assembly

To reduce the effect of altitude on shift points, the effective area of the diaphragm is made somewhat larger than that of the bellows. Atmospheric pressure then acts on the resulting differential area to reduce modulator pressure.

C. Governor Assembly

The vehicle speed signal to the modulator valve is supplied by the transmission governor, which is driven by the output shaft. The governor consists of two flyweights and a regulator valve. Centrifugal force of the flyweights is imposed on the regulator valve causing it to regulate a pressure signal that increases with speed. See Figure 76-15.

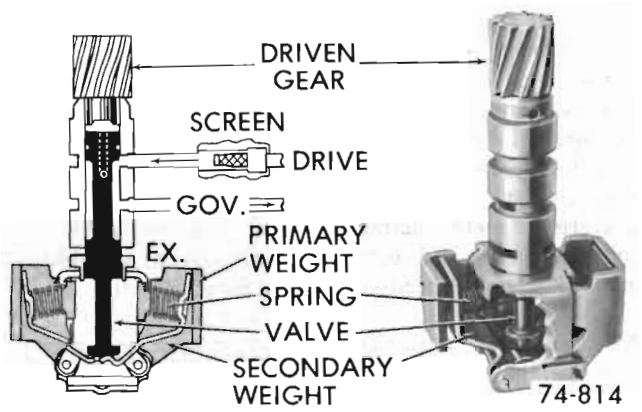


Figure 76-15 - Governor Assembly

To increase the accurcy of the governor signal at low speeds, the flyweights are so designed that their effective mass is greater at speeds below approximately 720 output RPM than it is above this speed.

This is done by dividing each flyweight into two parts and arranging them so that the primary weights act through preloaded springs on the secondary weights, which in turn acts on the valve. At approximately 720 RPM the cen-

trifugal force on each primary weight exceeds the spring force and the primary weights move to a grounded stop. With the primary weights grounded, the force on the governor regulator valve is equal to the spring forces, plus the centrifugal force on the secondary weights.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as vehicle speed increases.

1. *Pressure Regulator*

a. Regulates line pressure according to a fixed spring force and forces controlled by modulator and reverse pressure. See Figure 76-13.

b. Controls the flow of oil that charges the torque converter, feeds the oil cooler and provides lubrication for the transmission.

2. *Manual Valve*

Establishes the range of transmission operation, i,e. P, R, N, D, L2, L1, as selected by the vehicle operator through the manual control lever. See Figure 76-16.

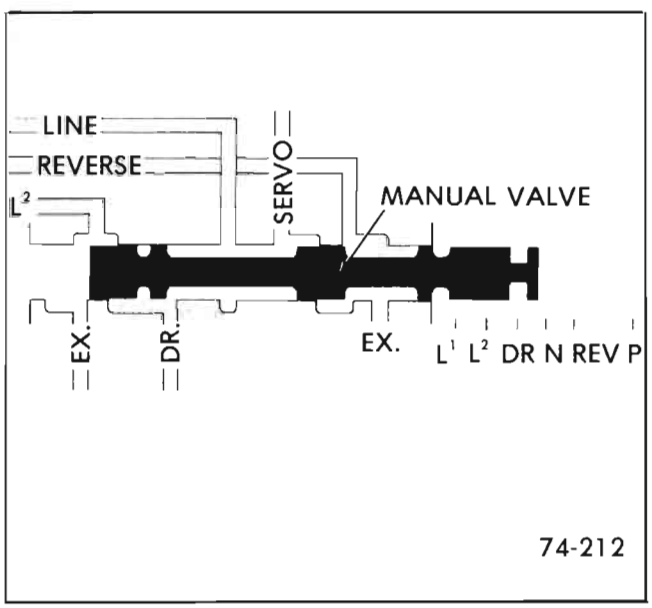


Figure 76-16 Manual Valve

3. *Governor Assembly*

Generates a speed sensitive oil pressure that increases with output shaft or vehicle speed. Governor pressure is used to vary the shift points and modulator pressure regulation. See Figure 76-15.

4. *Modulator Valve*

Regulates line pressure to modulator pressure that varies with torque to the transmission. See Figure 76-14. It senses forces created by:

a. The vacuum modulator bellows that increases modulator pressure.

b. Engine vacuum acting on a diaphragm to decrease modulator pressure.

c. Governor pressure which is generated by the governor assembly. Governor pressure tends to decrease modulator pressure.

5. *1-2 Shift Valve*

Controls the oil pressure that causes the transmission to shift from 1-2 or 2-1. Its operation is controlled by governor pressure, low oil pressure, detent pressure, modulator pressure, and spring force. See Figure 76-17.

6. *1-2 Regulator Valve*

Regulates modulator pressure to a pressure proportional to modulator pressure, tending to keep the 1-2 shift valve in the downshift position. See Figure 76-17.

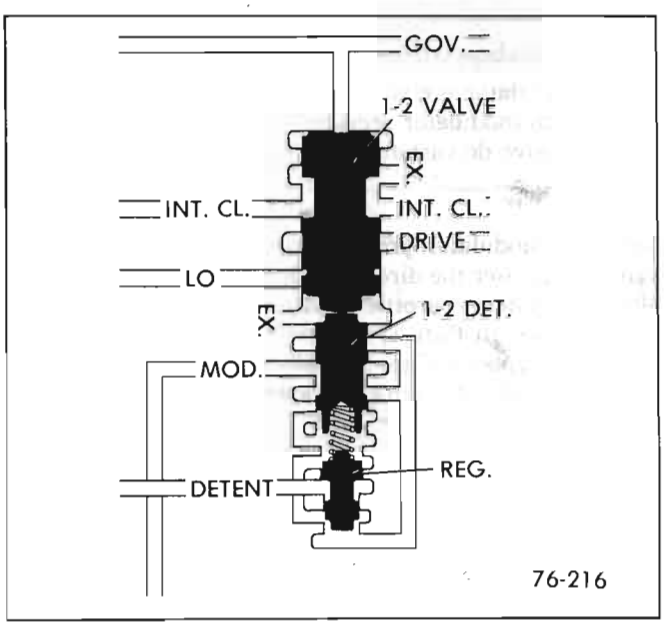


Figure 76-17 - 1-2 Shift Valve and 1-2 Detent Valve and Regulator Valve (Typical)

7. *1-2 Detent Valve*

Senses regulated modulator pressure tending to hold the 1-2 shift valve in the downshift position and provides an area for detent pressure for detent 2-1 shifts. See Figure 76-17.

8. *2-3 Shift Valve*

Controls the oil pressure that causes the transmission to shift from 2-3 or 3-2. Its operation is controlled by modulator, L2, governor and detent pressure as well as a spring force. See Figure 76-18.

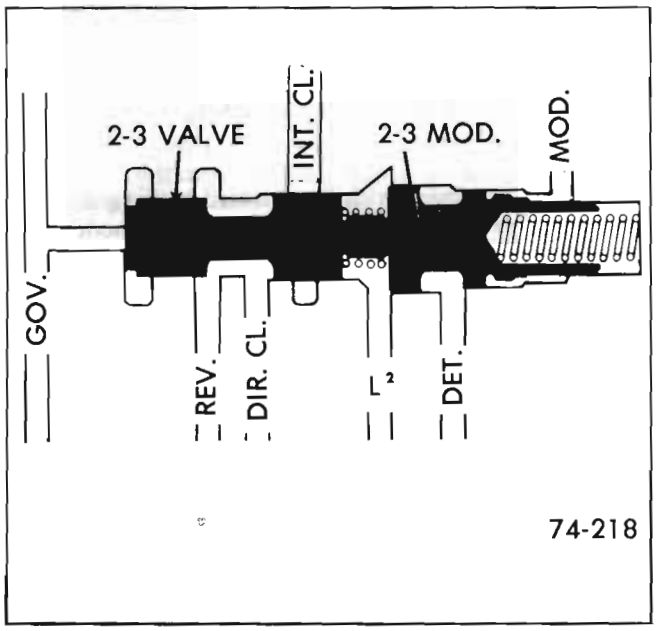


Figure 76-18 - 2-3 Valve and 2-3 Modulator Valve Train (Typical)

9. *2-3 Modulator Valve*

Senses modulator pressure to apply a variable force proportional to modulator pressure which tends to hold the 2-3 shift valve downshifted. See Figure 76- 18.

10. *3-2 Valve*

Shuts off modulator pressure from acting on the shift valve trains after the direct clutch has been applied. This allows fairly heavy throttle operation in third gear without downshifting. In third speed, modulator pressure or detent pressure above 87 psi will provide part throttle downshift forces. (Resulting in a 3- 2 downshift at less than wide open throttle) See Figure 76-19.

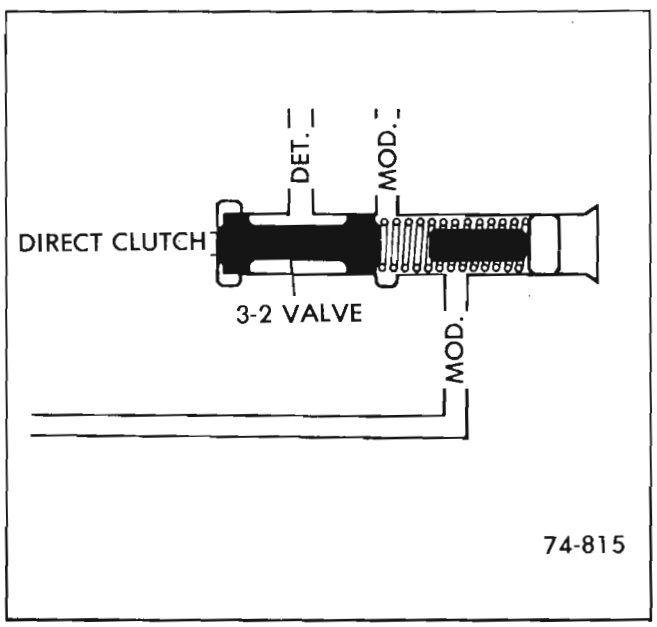


Figure 76-19 - 3-2 Valve

11. *Detent Valve*

Shifts when line oil is exhausted at the end of the valve when the detent solenoid is energized, thus allowing the detent regulator valve to regulate. This directs detent pressure to the 1-2 accumulator valve, 1-2 regulator and 2-3 modulator valves, 3-2 valve, and the vacuum modulator valve. See Figure 76-20.

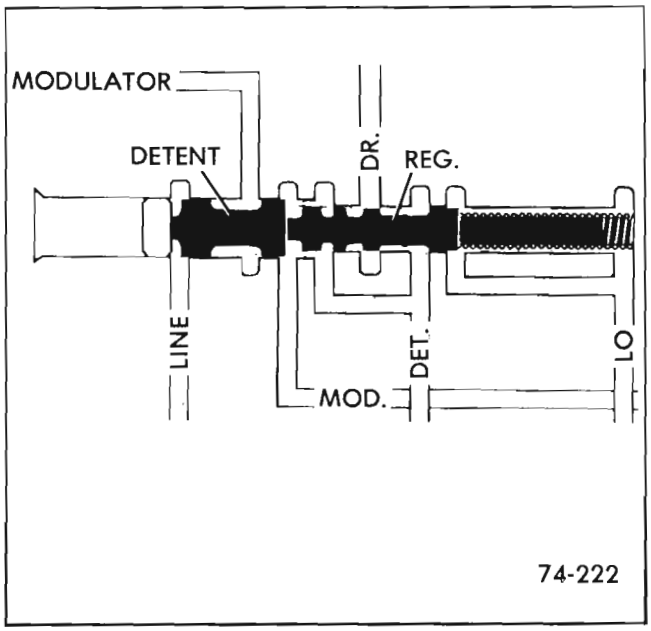


Figure 76-20 - Detent Valve and Detent Regulator Valve

12. *Detent Regulator Valve*

When the detent valve shifts, the detent regulator is free to allow drive oil to enter the detent passage and thus becomes regulated to a value of 70 psi. Detent pressure will also flow into the modulator passage which flows to the 2-3 modulator valve, 3-2 valve and the 1-2 detent valve. Lo oil moves the detent regulator open to drive oil allowing drive oil to enter the modulator and detent passages. See Figure 76-20.

13. *Front Servo*

The front servo, see Figure 76-21, applies the front overrun band to provide engine braking in 2nd gear in L2 Range. It is also used as an accumulator for the application of the direct clutch and in conjunction with a series of check balls and controlling orifices is a part of the timing for the release of the direct clutch.

To prevent the application of the front overrun band in Neutral, Drive and Reverse ranges, oil is directed from the manual valve to the release side of the servo piston.

In Drive range the servo release oil from the manual valve also acts to charge the servo in preparation for the application of the direct clutch.

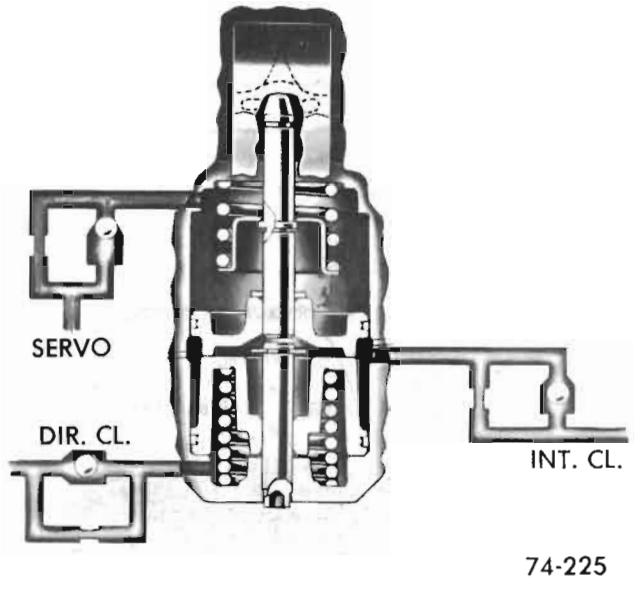


Figure 76-21 - Front Servo

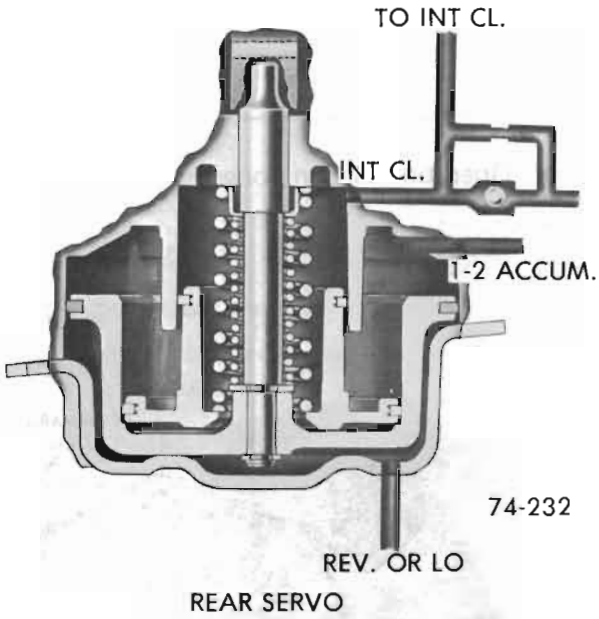


Figure 76-22 - Rear Servo

Direct clutch oil is directed to the front servo accumulator piston where spring force plus direct clutch pressure stroke the piston up against the force of servo release oil. This lowers the clutch apply pressure during the shift for a smooth engagement.

The release of the direct clutch and the exhausting of the front servo accumulator is slowed down by three check balls and three orifices which permits a soft return of the drive load to the intermediate sprag and also allows engine RPM to increase during a detent 3-2 downshift in preparation for the lower gear ratio, which results in a smooth shift and better acceleration.

14. *Rear Servo*

The rear servo, see Figure 76-22, applies the rear band for overrun engine braking in L1 range 1st gear. It applies the band in Reverse to hold the reaction carrier to provide the reverse gear ratio.

15. *1-2 Accumulator*

1-2 accumulator oil charges the rear servo accumulator in 1st gear in preparation for the apply of the intermediate clutch on the 1-2 shift.

The valve train consists of a 1-2 primary valve and spring, a 1-2 accumulator valve and spring and plug. See Figure 76-23.

1-2 accumulator oil pressure is a two-stage pressure which increases as modulator pressure increases to obtain greater flexibility in obtaining the desired curve during the 1-2 shift for various engine requirements.

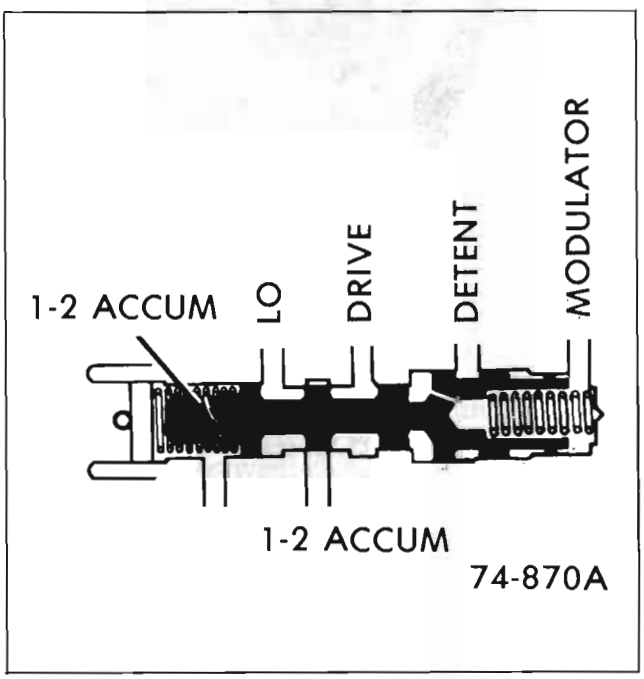
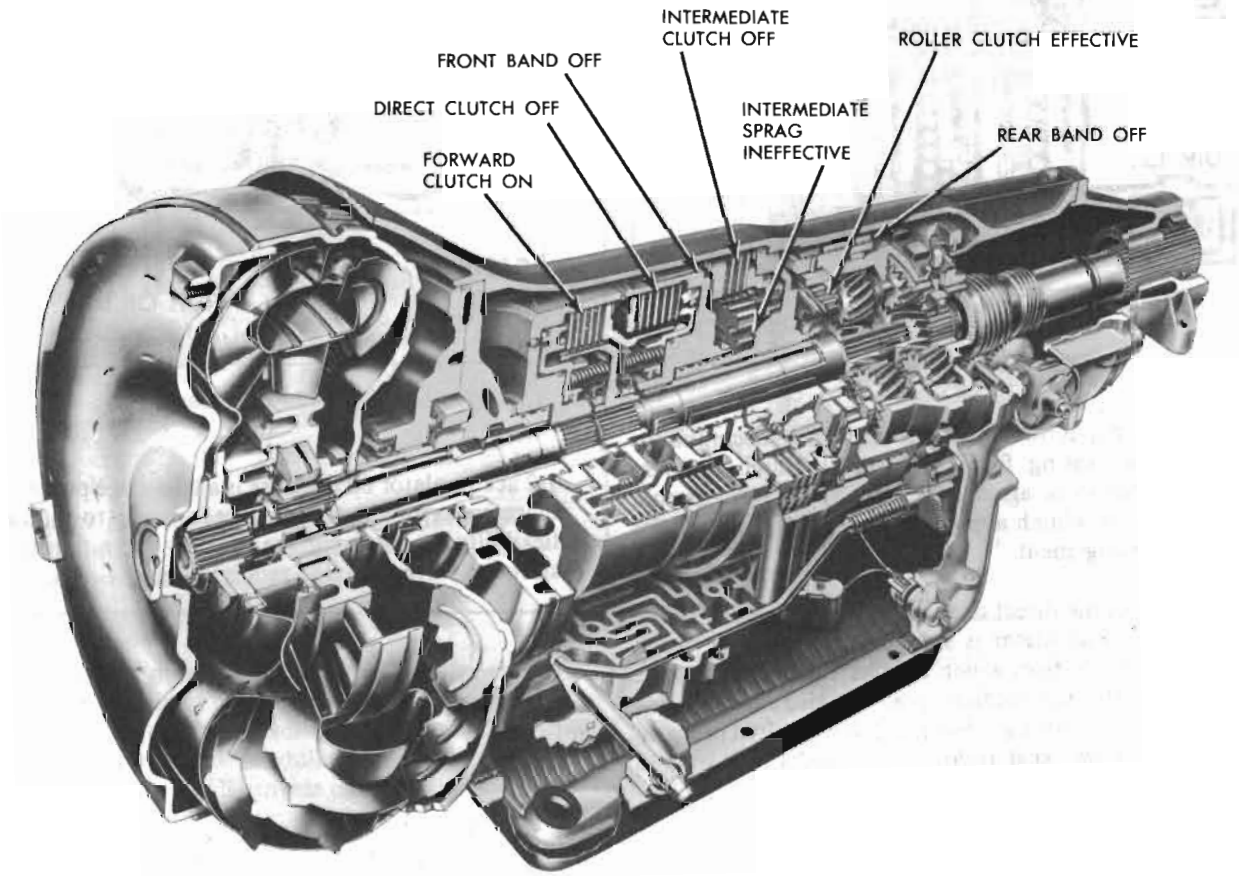


Figure 76-23 - 1-2 Accumulator Valve Train (Typical)

76-10 MECHANICAL OPERATION

a. Operation of Components in Drive Range — First Gear



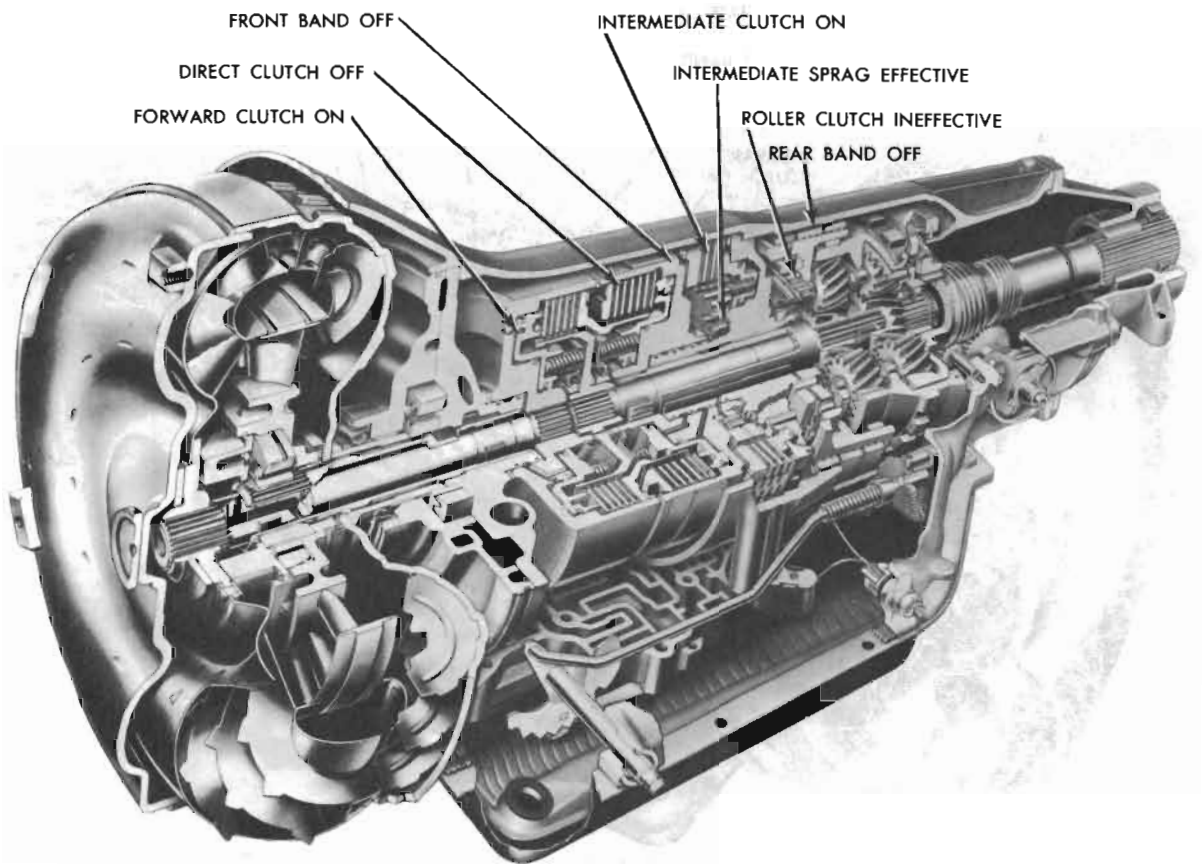
With the selector lever in Drive Range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2.:1. at stall).

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and one-way roller clutch assembly to the transmission case. (Approximate stall ratio = 5.:1.)

76-864A

Figure 76-24 - Drive Range - First Gear

b. Operation of Components in Drive Range — Second Gear



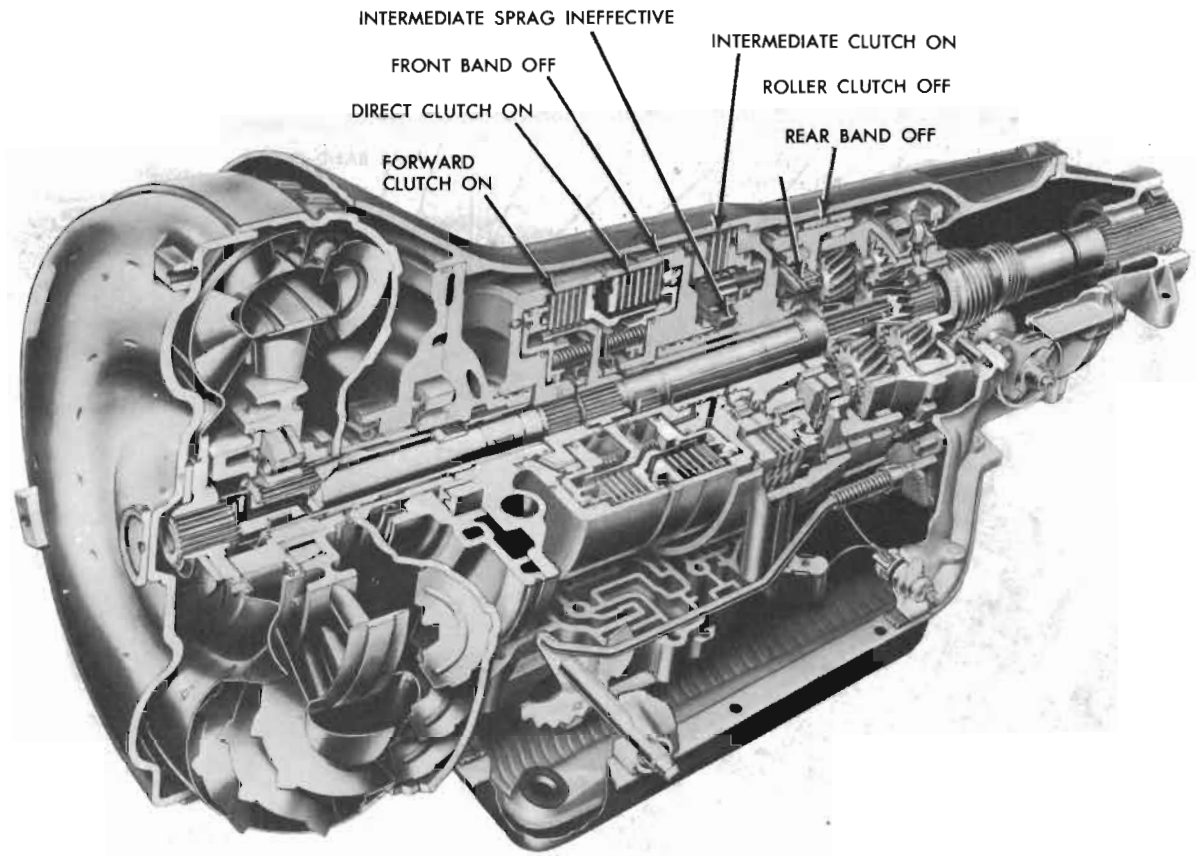
In second gear, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1.

76-865A

Figure 76-25 - Drive Range - Second Gear

c. Operation of Components in Drive Range — Third Gear

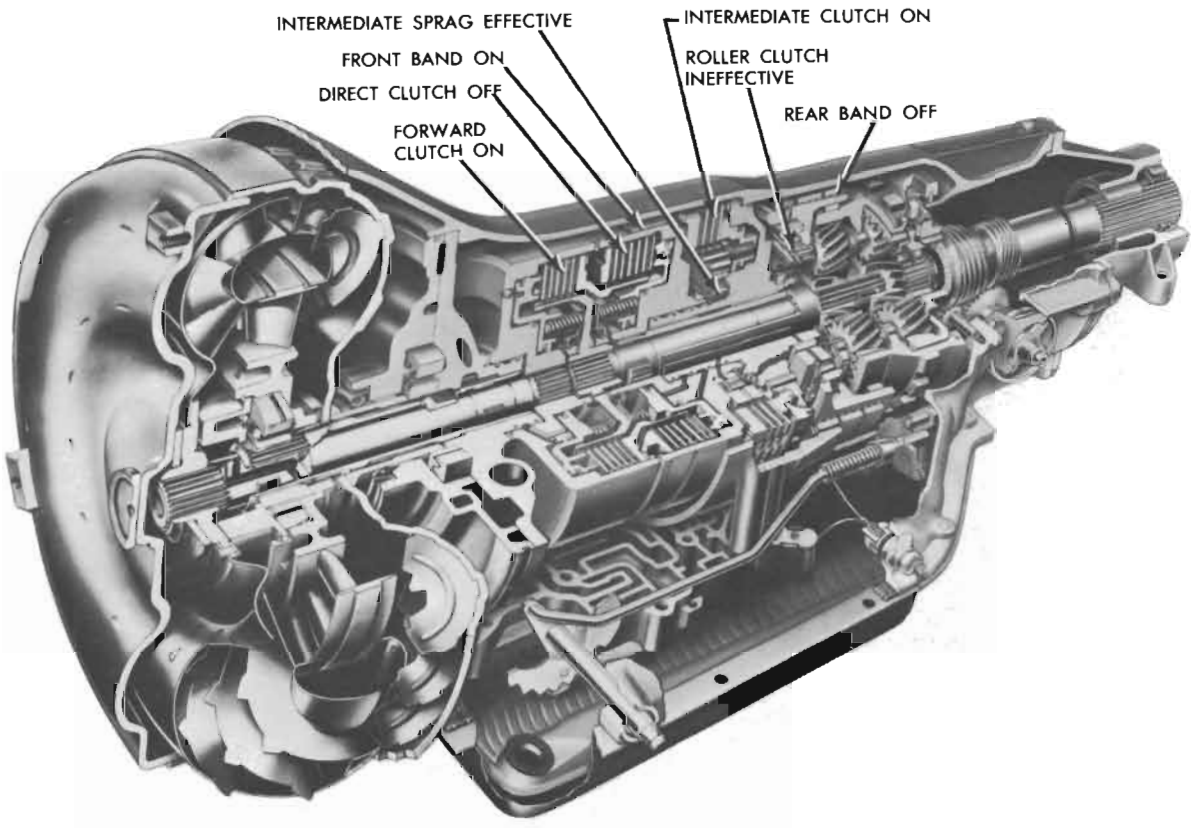


In direct drive, engine torque is transmitted to the converter through the forward clutch to the mainshaft and rear internal gear. Because the direct clutch is applied, equal power is also transmitted to the sun gear shaft and the sun gear. Since both the sun gear and internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive or a ratio of 1:1.

76-866A

Figure 76-26 - Drive Range - Third Gear

d. Operation of Components in Low – L^2 Range – Second Gear



In second gear, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

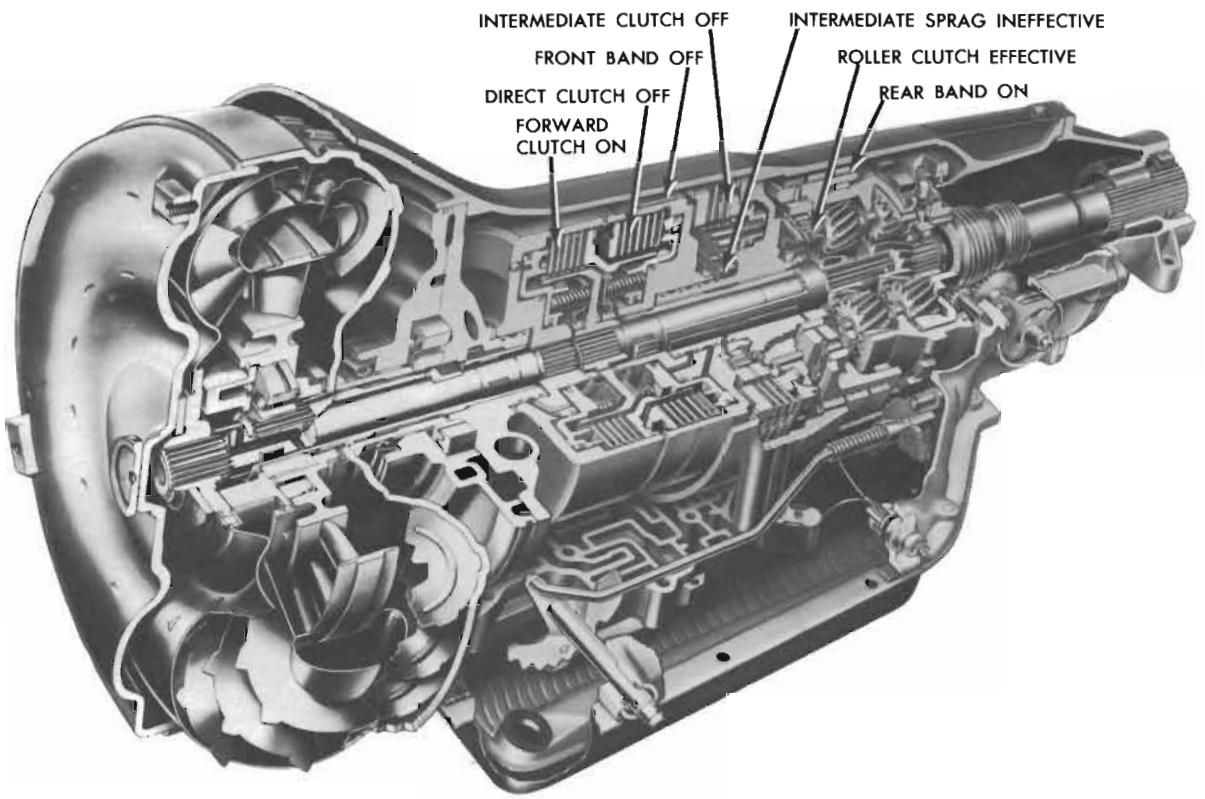
Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1.

In L^2 Range second gear, overrun braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag.

76-867A

Figure 76-27 - L2 Range - Second Gear

e. Operation of Components in Low — L¹ Range — First Gear



With the selector lever in L¹ Range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2.:1. at stall.)

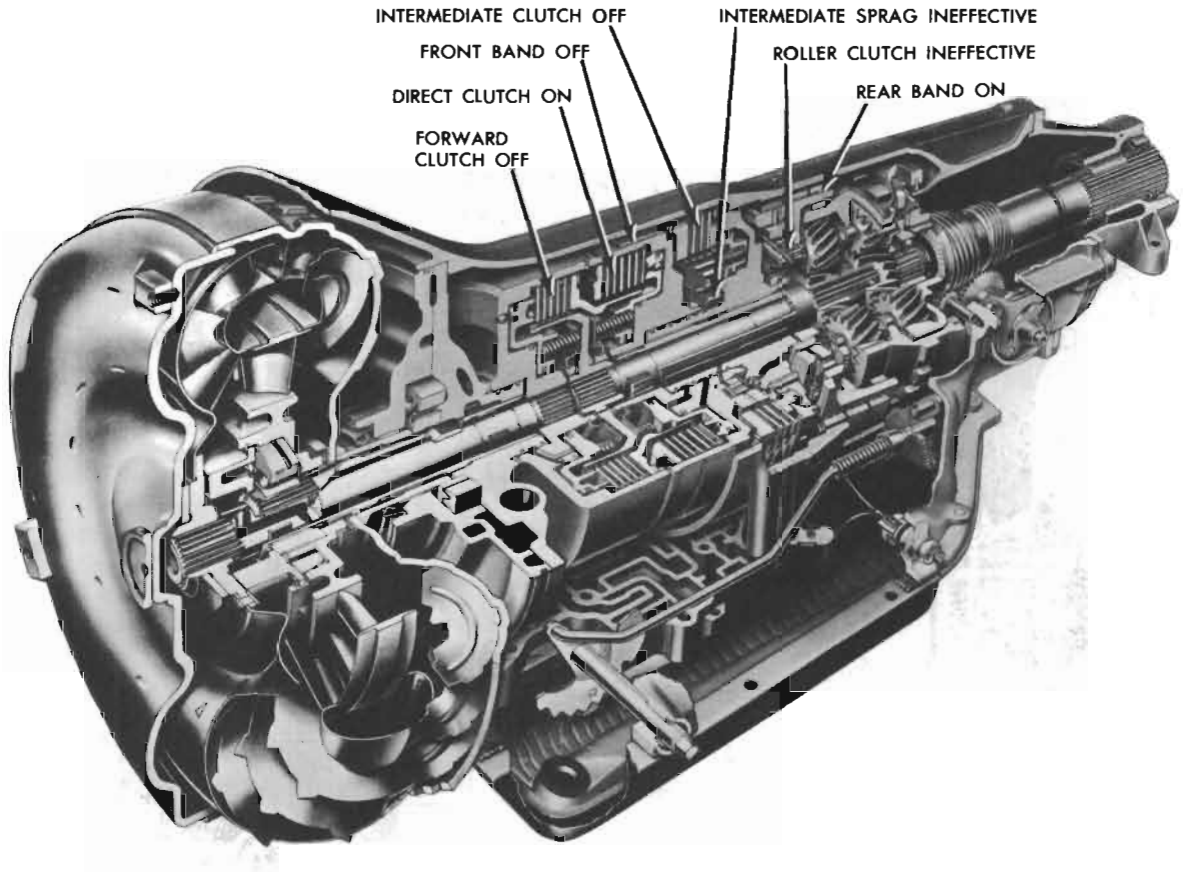
Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and the one way clutch. (Total stall ratio = approximately 5.:1.)

Downhill or overrun braking is provided in L¹ Range by applying the rear band as this prevents the reaction carrier from overrunning the one way clutch.

76-915

Figure 76-28 - L1 Range - First Gear

f. Operation of Components in Reverse



In Reverse, the direct clutch is applied to direct turbine torque to the sun gear shaft and sun gear. The rear band is also applied, holding the reaction carrier.

Clockwise torque to the sun gear causes the front pinions and front internal gear to turn counter-clockwise in reduction. The front internal gear is connected directly to the output shaft, thus providing the reverse output gear ratio of approximately 2.:1. The approximate reverse torque multiplication at stall (converter and gear ratios) is approximately 4.:1.

76-868A

Figure 76-29 - Reverse

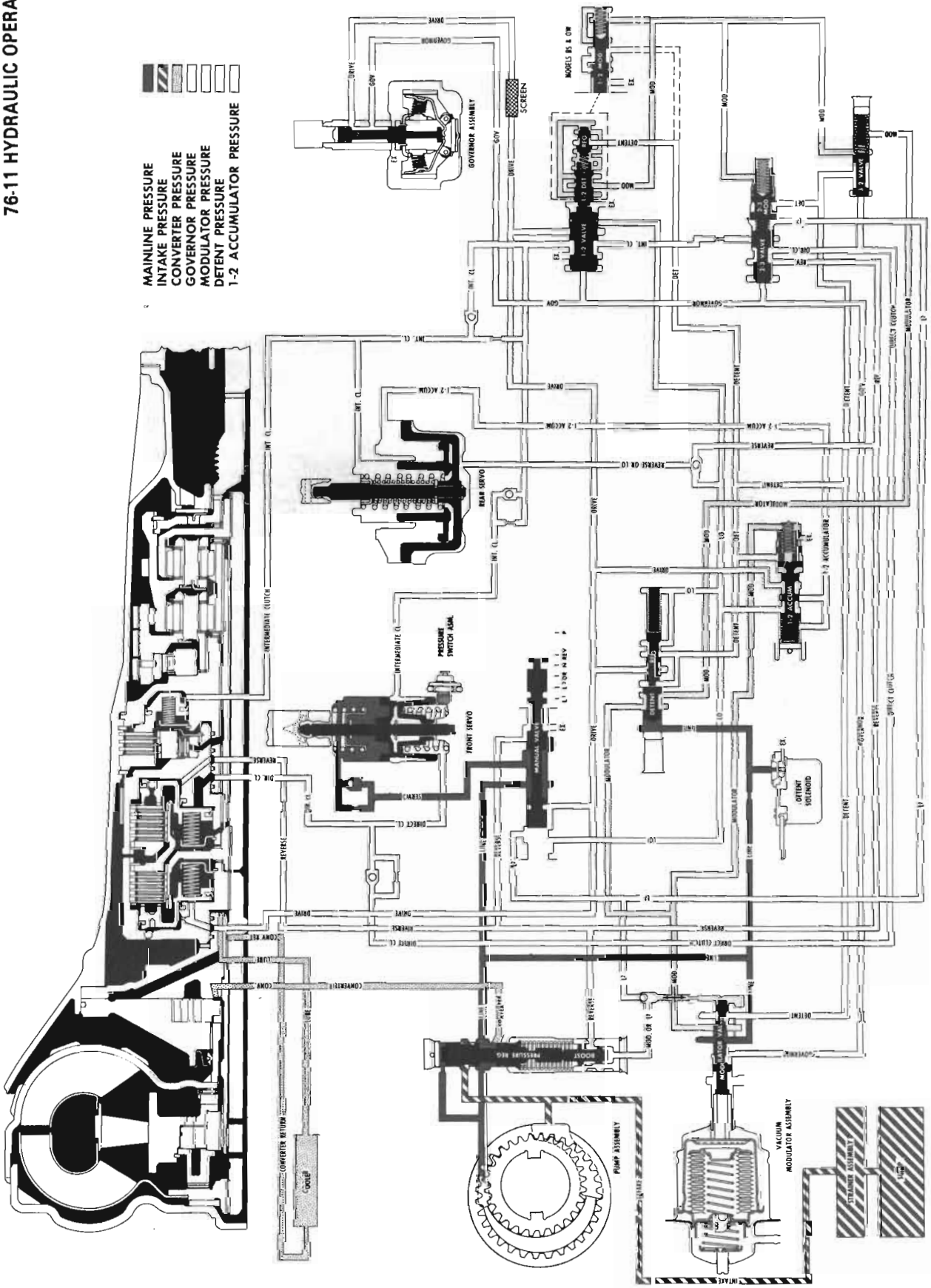


Figure 76-30 - Park or Neutral

a. Operation of Controls
Park or Neutral (throttle closed)

Forward Clutch	— Off	Front Band	— Off	Intermediate Sprag	— Ineffective
Direct Clutch	— Off	Rear Band	— Off	Detent Solenoid	— De-energized
Intermediate Clutch	— Off	Roller Clutch	— Ineffective		

Whenever the engine is running at idle with the selector lever in "P" or "N", oil from the pump is directed to the: (See Figure 76-30).

1. Pressure Regulator Valve
2. Converter
   a. Oil Cooler
   b. Lubrication System
3. Manual Valve
4. Detent Valve
5. Detent Solenoid
6. Vacuum Modulator Valve
7. Front Servo (Neutral Only)

Cooling and Lubrication

Oil flows from the pump to the pressure regulator valve which regulates the pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter. Oil from the converter, termed converter return oil, is directed to the transmission cooler. Oil from the cooler is directed to the transmission lubrication system.

Line pressure acts on the:

1. Manual Valve
2. Detent Valve
3. Detent Solenoid
4. Modulator Valve
5. Front Servo Piston (Neutral Only)

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator and 1-2 accumulator primary valve and passes through the detent valve and 3-2 valve to the 1-2 detent valve and 2-3 modulator valve.

SUMMARY

The converter is filled and all clutches and bands are released. The transmission is in Neutral.

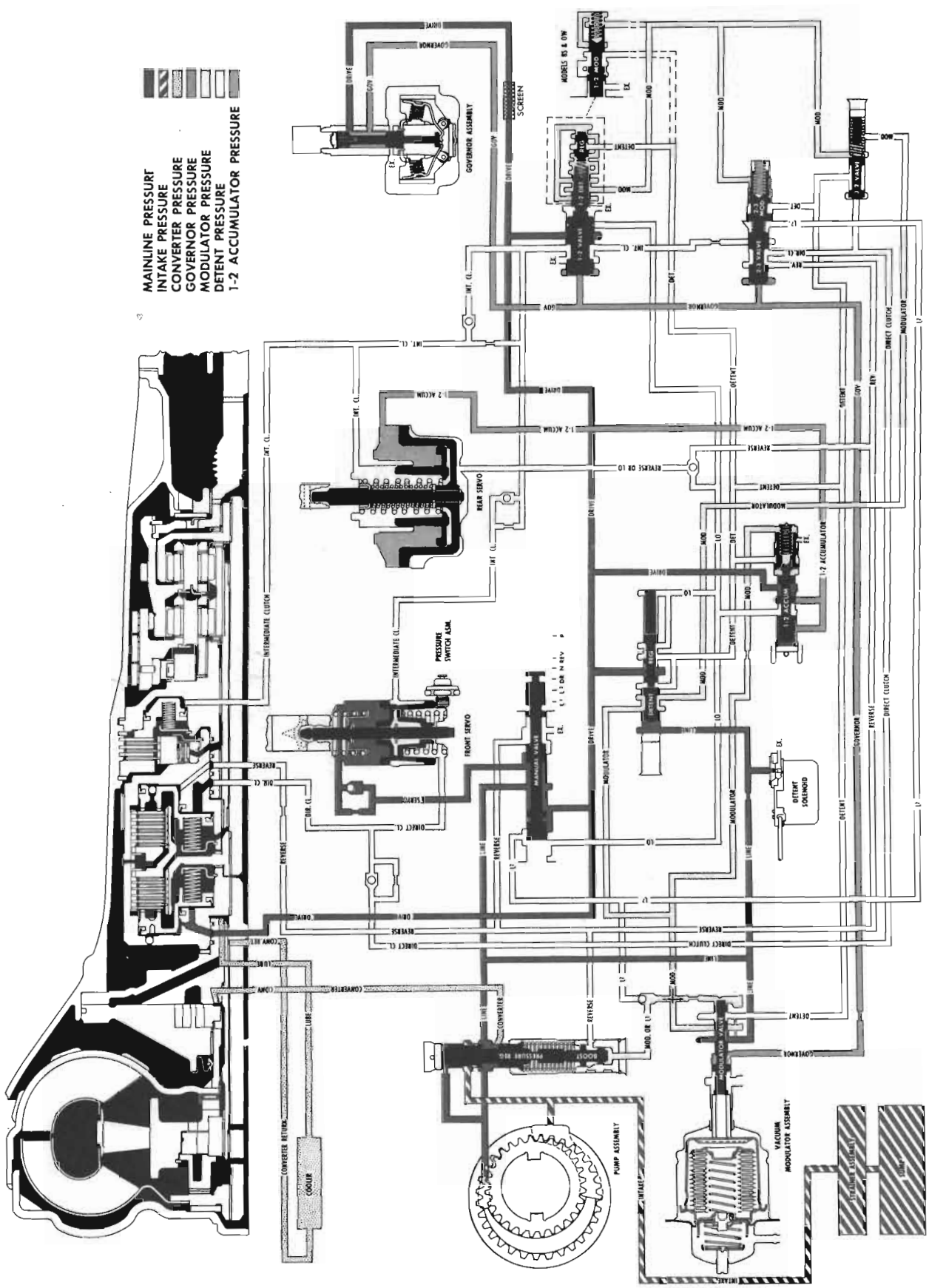


Figure 76-31 - Drive Range - First Gear

b. Operation of Controls
Drive Range — First Gear

Forward Clutch — On
Direct Clutch — Off
Intermediate Clutch — Off
Front Band — Off
Rear Band — Off
Roller Clutch — Effective
Intermediate Sprag — Ineffective
Detent Solenoid — De-energized

When the selector lever is moved into Drive position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the: (See Figure 76-31).

1. Forward Clutch
2. 1-2 Shift Valve
3. Governor Assembly
4. 1-2 Accumulator Valve
5. Detent Regulator Valve

Basic Control

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to insure a smooth shift from Park, Neutral and Reverse to Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure, called governor oil, increases with vehicle speed and acts against the ends of the 1-2 and 2-3 shift valves and an area on the modulator valve.

Drive oil is also regulated to another variable pressure at the 1-2 accumulator valve. This pressure, called 1-2 accumulator oil, is controlled by modulator oil and is directed to the rear servo. 1-2 Accumulator oil at the rear servo acts on the accumulator piston.

Summary

The converter is filled. The forward clutch is applied. The transmission is in first gear.

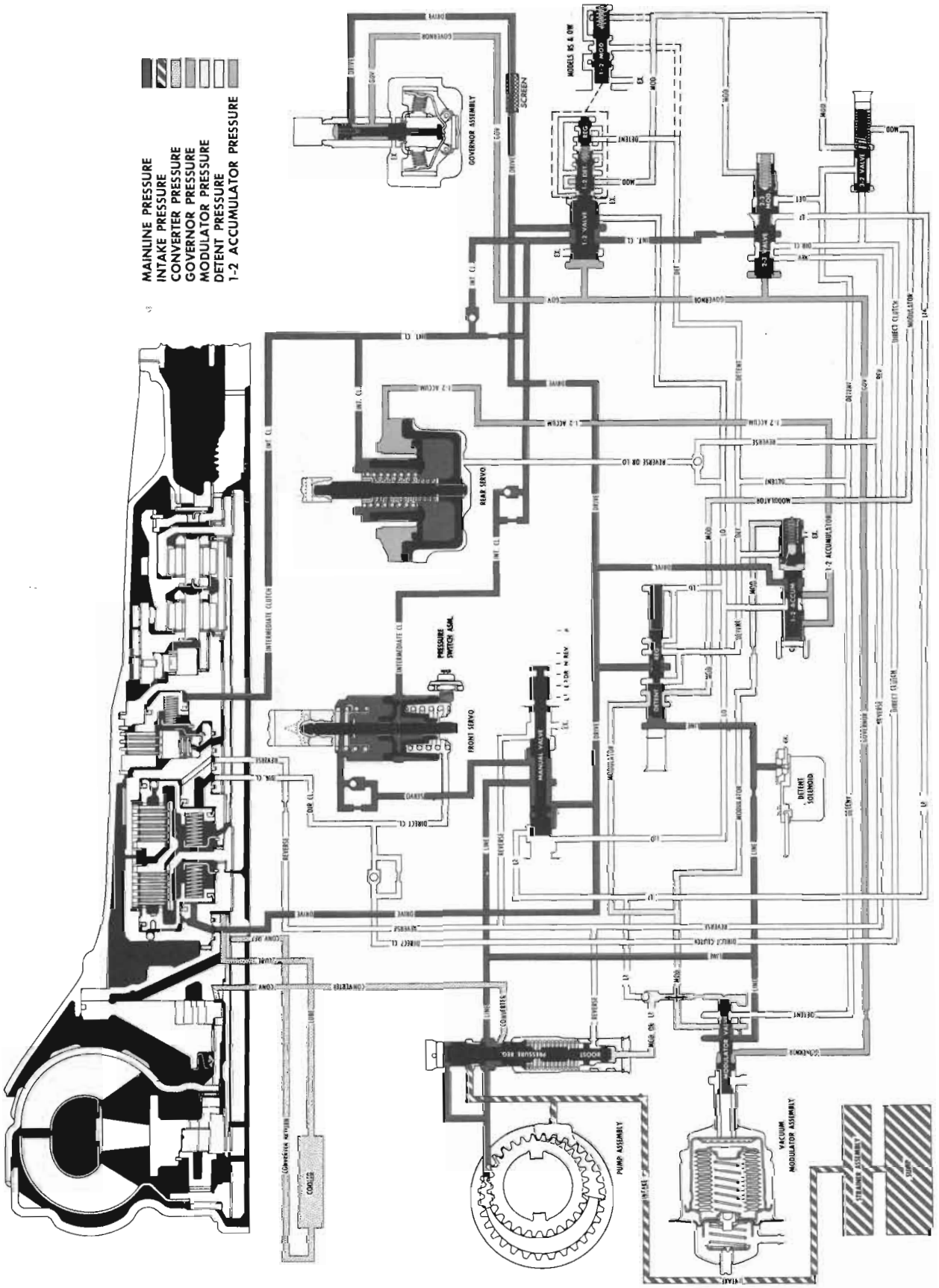


Figure 76-32 - Drive Range - Second Gear

c. Operation of Controls
Drive Range — Second Gear

Forward Clutch	— On	Front Band	— Off	Intermediate Sprag	— Effective
Direct Clutch	— Off	Rear Band	— Off	Detent Solenoid	— De-energized
Intermediate Clutch	— On	Roller Clutch	— Ineffective		

As both vehicle speed and governor pressure increase, the force of governor oil acting on the 1-2 shift valve will overcome the force of re-regulated modulator oil pressure. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage. Oil in this passage is called intermediate clutch oil. (See Figure 76-32).

Intermediate clutch oil from the 1-2 shift valve is directed to the:

1. Intermediate Clutch
2. Rear Servo
3. Front Servo and Accumulator Pistons
4. 2-3 Shift Valve

Basic Control

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch piston to apply the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1-2 shift for a smooth clutch apply. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2-3 shift valve.

SUMMARY

The forward and intermediate clutches are applied. The transmission is in second gear.

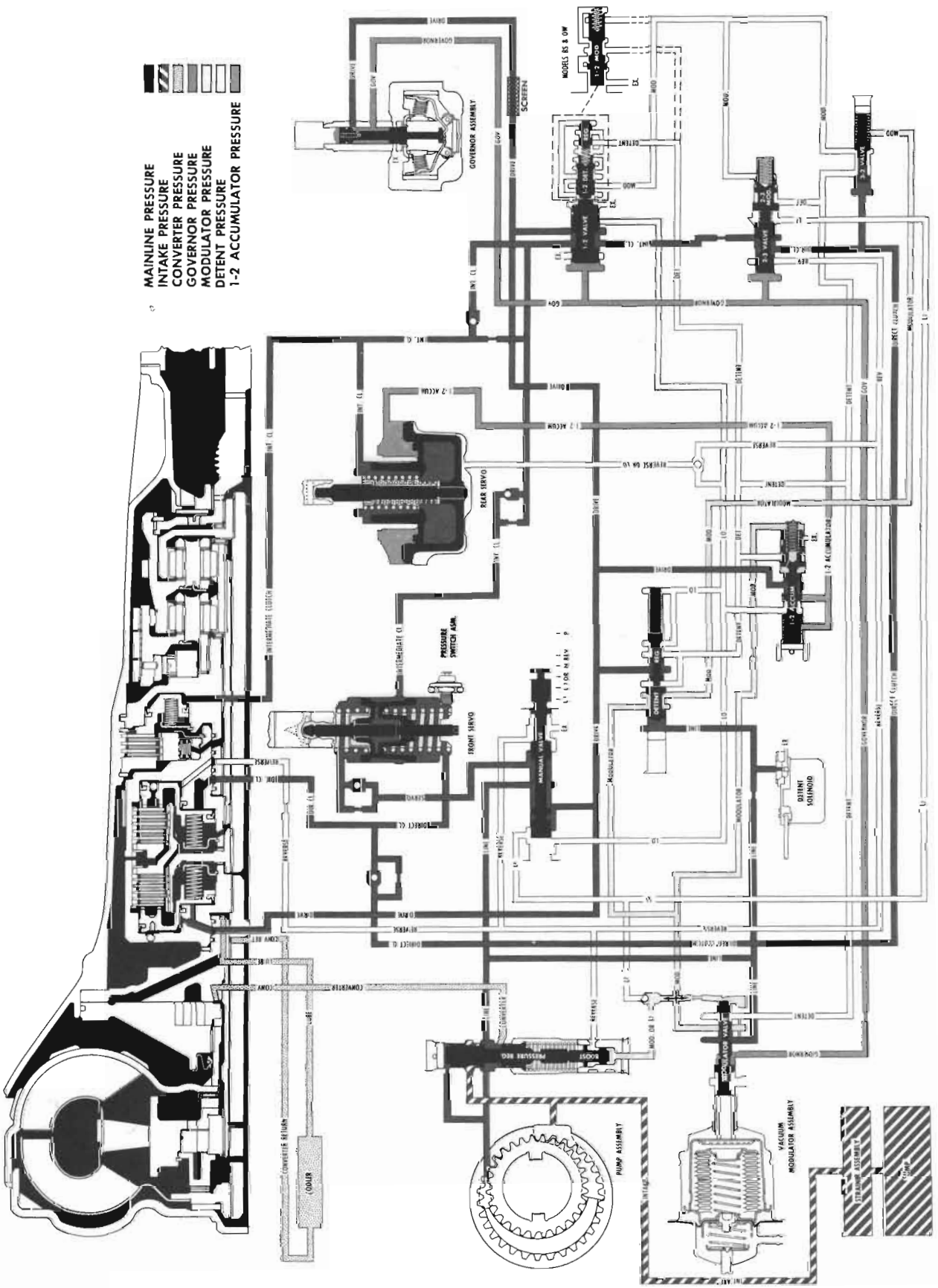


Figure 76-33 - Drive Range - Third Gear

d. Operation of Controls
Drive Range — Third Gear

Forward Clutch	— On	Front Band	— Off	Intermediate Sprag	— Ineffective
Direct Clutch	— On	Rear Band	— Off	Detent Solenoid	— De-energized
Intermediate Clutch	— On	Roller Clutch	— Ineffective		

As vehicle speed and governor pressure increase, the force of governor oil acting on the 2-3 shift valve overcomes the force of the 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage. This oil is termed direct clutch oil. (See Figure 76-33).

Direct clutch oil from the 2-3 shift valve is directed to the:

1. Direct Clutch
2. Front Accumulator Piston
3. 3-2 Valve

Basic Control

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. The pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch apply.

Direct Clutch oil is also supplied to the 3-2 valve to move against modulator pressure. This cuts off modulator oil to the 1-2 detent and 2-3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the converter during medium throttle operation without downshifting.

SUMMARY

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive).

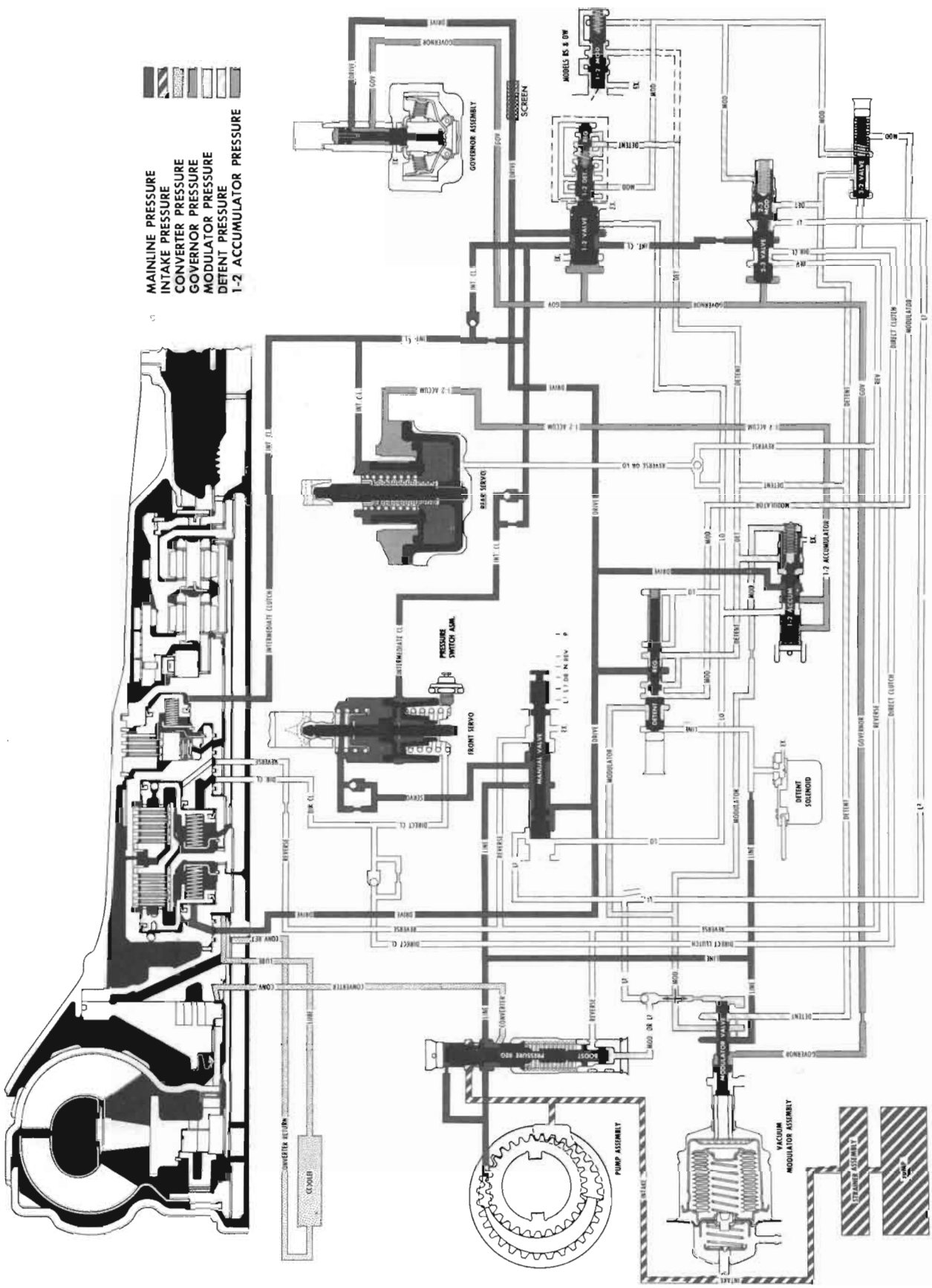


Figure 76-34 - Detent Downshift - Valves in Second Gear Positio

e. Operation of Controls
Detent Down Shift — Valves in Second Gear Position

Forward Clutch	— On	Front Band	— Off	Intermediate Sprag	— Effective
Direct Clutch	— Off	Rear Band	— Off	Detent Solenoid	— Energized
Intermediate Clutch	— On	Roller Clutch	— Ineffective		

While operating at speeds below approximately 70 MPH a forced detent 3-2 downshift is possible by depressing the accelerator fully. This engages an electrically operated switch and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a smaller orifice. (See Figure 76-34).

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 psi and called detent oil. Detent oil is then routed to the:

1. Modulator Passage
2. 1-2 Regulator Valve
3. 2-3 Modulator Valve
4. 3-2 Valve
5. 1-2 Primary Accumulator Valve
6. Vacuum Modulator Valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve below approximately 70 MPH, shifting the transmission to second gear.

A detent 2-1 downshift can also be accomplished below approximately 20 MPH because detent oil is directed to the 1-2 regulator valve, regulating or exhaust port. This allows detent oil to act on the 1-2 regulator and 1-2 detent valve to close the 1-2 shift valve, shifting the transmission to first gear.

To insure intermediate clutch durability during 1-2 upshifts under detent conditions, detent oil is directed to the 1-2 accumulator primary valve to increase 1-2 accumulator oil pressure acting on the rear servo accumulator piston.

Detent oil is also directed to the modulator valve to prevent modulator pressure from regulating below 70 psi at high speeds or at high altitudes.

PART THROTTLE 3-2 DOWNSHIFTS

Forward Clutch — Applied

Roller Clutch — Ineffective

Direct Clutch — Released in 2nd

Direct Clutch — Applied in 3rd

Front Band — Released

Rear Band — Released

Intermediate Clutch — Applied

Intermediate Sprag — Effective in 2nd

Intermediate Sprag — Ineffective in 3rd

A part throttle 3-2 downshift can be accomplished below approximately 33 mph by depressing the accelerator far enough to raise modulator pressure to approximately 87 psi. Modulator pressure and the 3-2 valve spring will move the 3-2 valve against direct clutch oil and allow modulator oil to act on the 2-3 modulator valve. This moves the 2-3 valve train against governor oil and shifts the transmission to second speed.

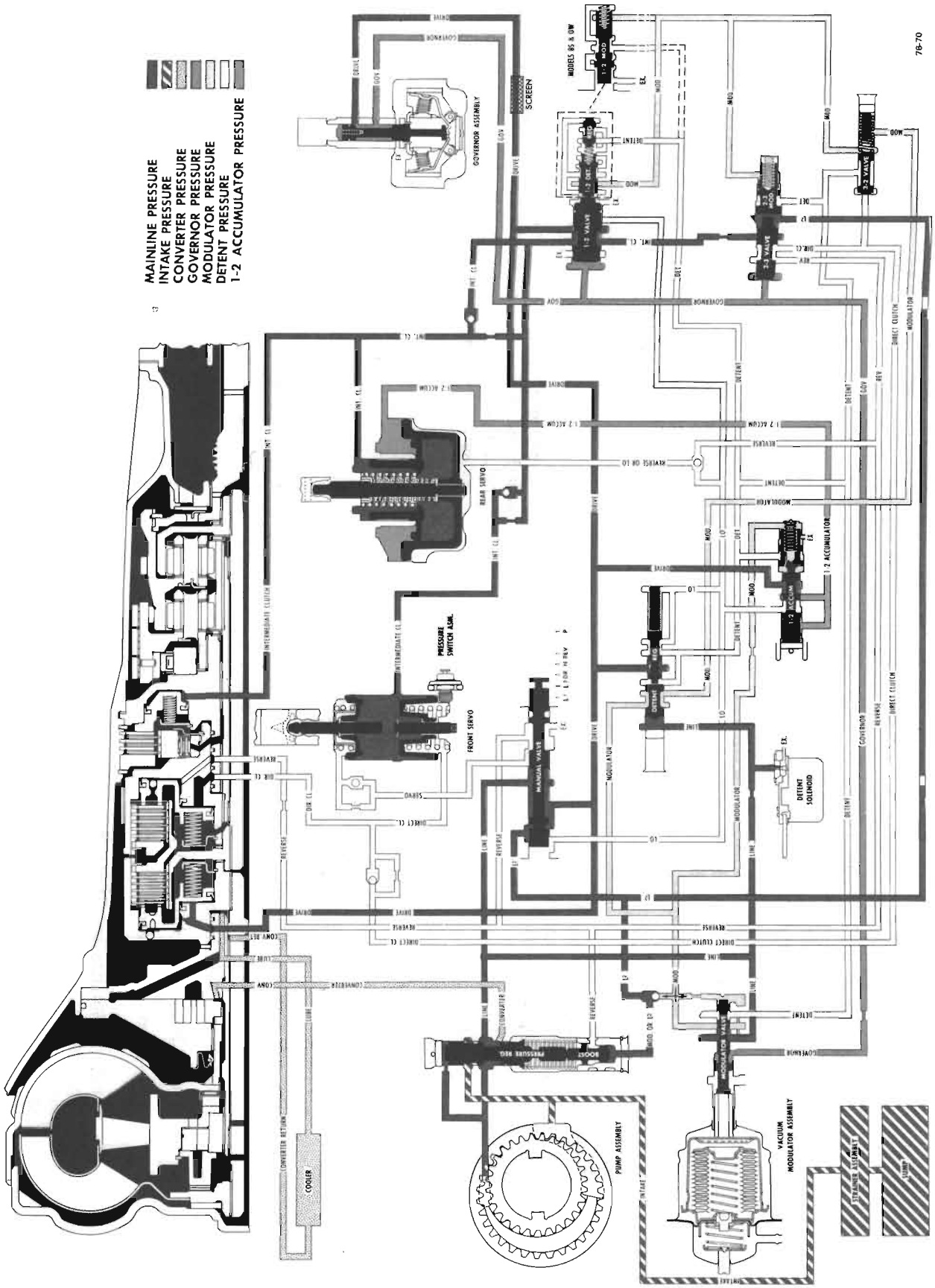


Figure 76-35 - L2 Range -Valves in Second Gear Position

f. Operation of Controls
L^2 Range — Valves in Second Gear Position

Forward Clutch	— On	Front Band	— On	Intermediate Sprag	— Effective
Direct Clutch	— Off	Rear Band	— Off	Detent Solenoid	— De-energized
Intermediate Clutch	— On	Roller Clutch	— Ineffective		

A 3-2 downshift can be accomplished by moving the selector lever from Drive to L^2 Range. When the selector lever is in the L^2 Range, L^2 oil from the manual valve is directed to the: (See Figure 76-35).

1. Pressure Boost Valve
2. 2-3 Shift Valve

L^2 oil at the boost valve will increase line pressure to 150 psi. This increased L^2 oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve in L^2 Range. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second gear — L^2 Range, it cannot upshift to third gear regardless of vehicle speed.

SUMMARY

The forward and intermediate clutches and front band are applied. The transmission is in second gear — L^2 Range.

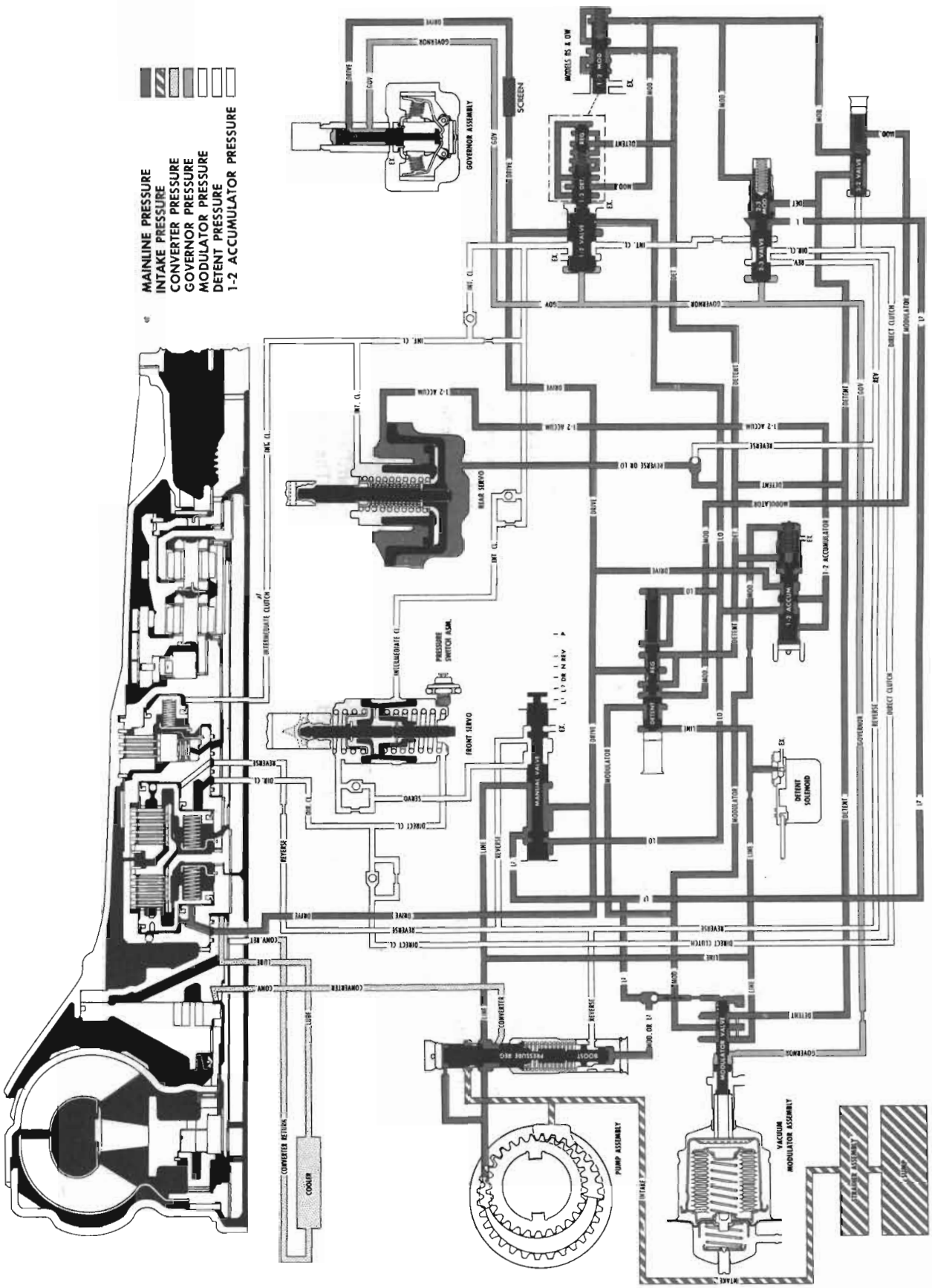


Figure 76-36 - L1 Range - First Speed - Valves in First Gear Position

g. Operation of Controls
L¹ Range — First Gear — Valves in First Gear Position

Forward Clutch	— On	Front Band	— Off	Intermediate Sprag	— Ineffective
Direct Clutch	— Off	Rear Band	— On	Detent Solenoid	— De-energized
Intermediate Clutch	— Off	Roller Clutch	— Effective		

Maximum downhill braking can be attained at speeds below 40 mph with the selector lever in L¹ Range as this directs Lo oil from the manual valve to the: (See Figure 76-36).

1. Rear Servo
2. 1-2 Accumulator Valve
3. Detent Regulator
4. 1-2 Shift Valve

Basic Control

Lo oil flows past a ball check to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band apply.

Lo oil acts on the detent regulator valve. Combined with the detent spring, Lo oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes governor oil and Lo oil on the 1-2 shift valve at any vehicle speed below approximately 30-40 MPH and the transmission will shift to first gear.

With the transmission in first speed — L¹ Range, the transmission cannot upshift to second gear regardless of vehicle or engine speed. The forward clutch and rear band are applied. The transmission is in first gear — L¹ Range.

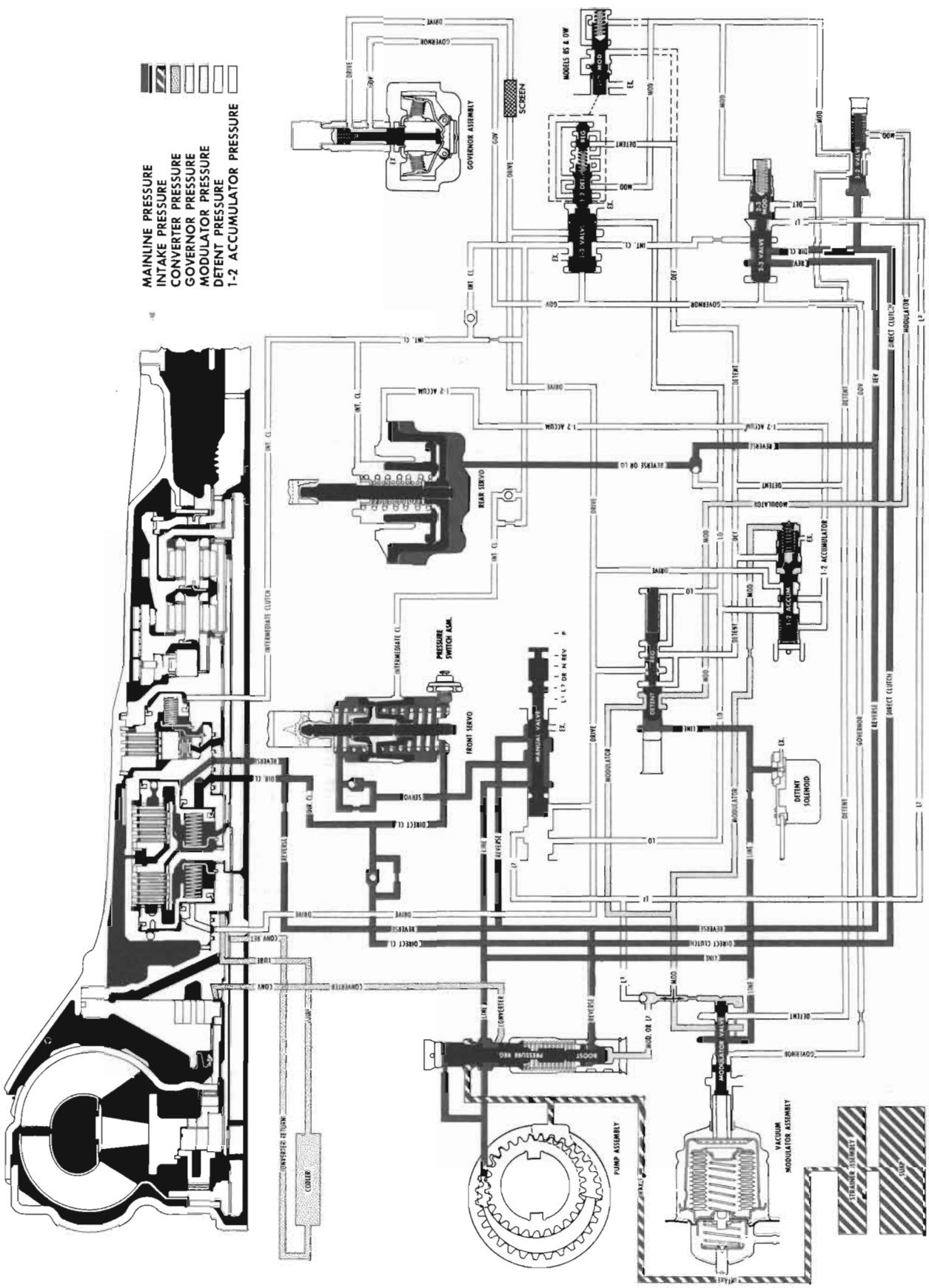


Figure 76-37 - Reverse

h. Operation of Controls
Reverse

Forward Clutch	— Off	Front Band	— Off	Intermediate Sprag	— Ineffective
Direct Clutch	— On	Rear Band	— On	Detent Solenoid	— De-energized
Intermediate Clutch	— Off	Roller Clutch	— Ineffective		

When the selector lever is moved to the Reverse position, the manual valve is repositioned to allow line pressure to enter the reverse circuit. Reverse oil then flows to the: (See Figure 76-37).

1. Direct Clutch
2. 2-3 Shift Valve
3. Rear Servo Piston
4. Pressure Boost Valve

Basic Control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply direct clutch.

Reverse oil seats a check ball and flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil also acts on the pressure boost valve to boost line pressure.

SUMMARY

The direct clutch and rear band are applied. The transmission is in Reverse.

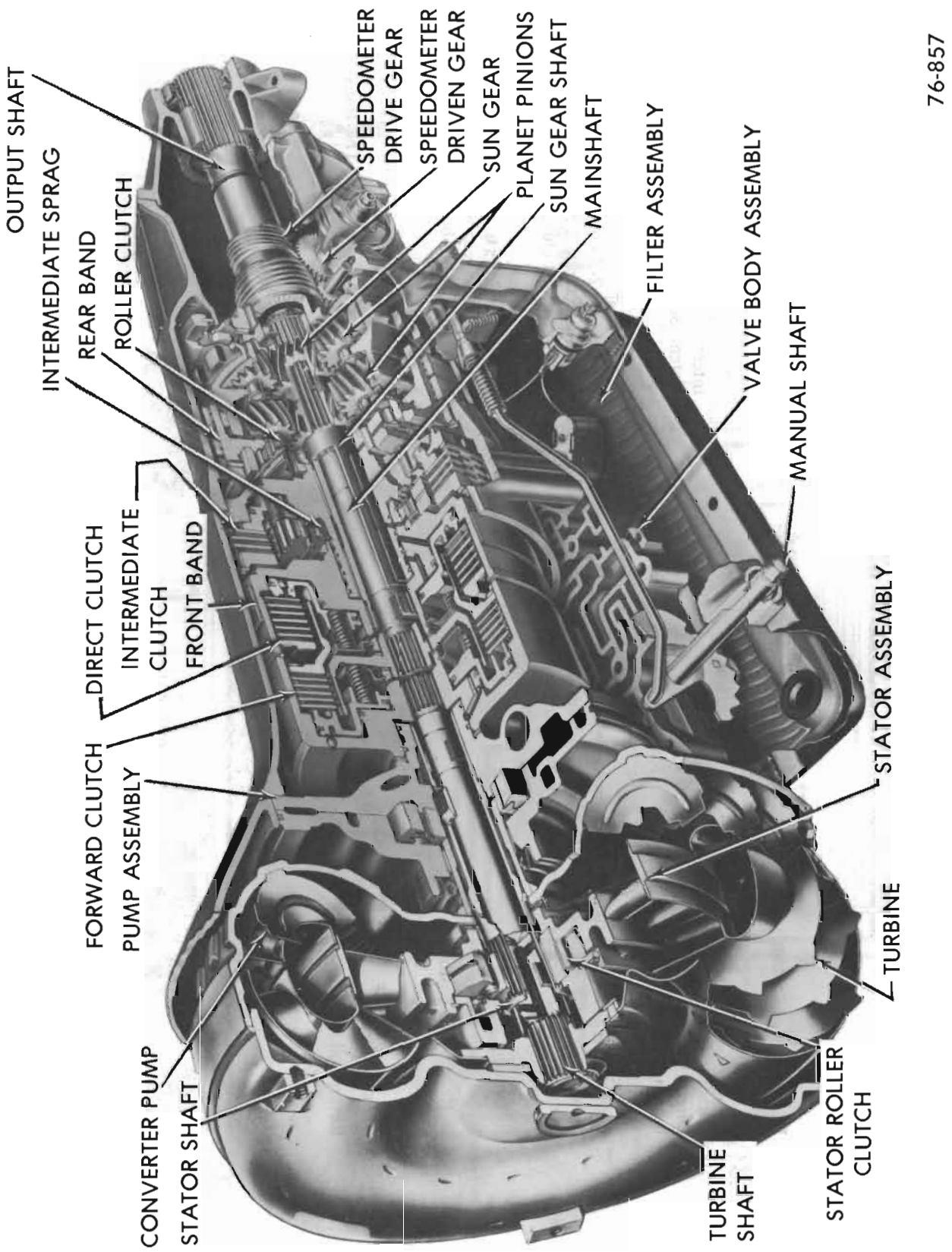


Figure 76-38 - Cross Section of Transmission

DIVISION III

ADJUSTMENTS AND MINOR SERVICE

76-12 DETENT SWITCH ADJUSTMENT

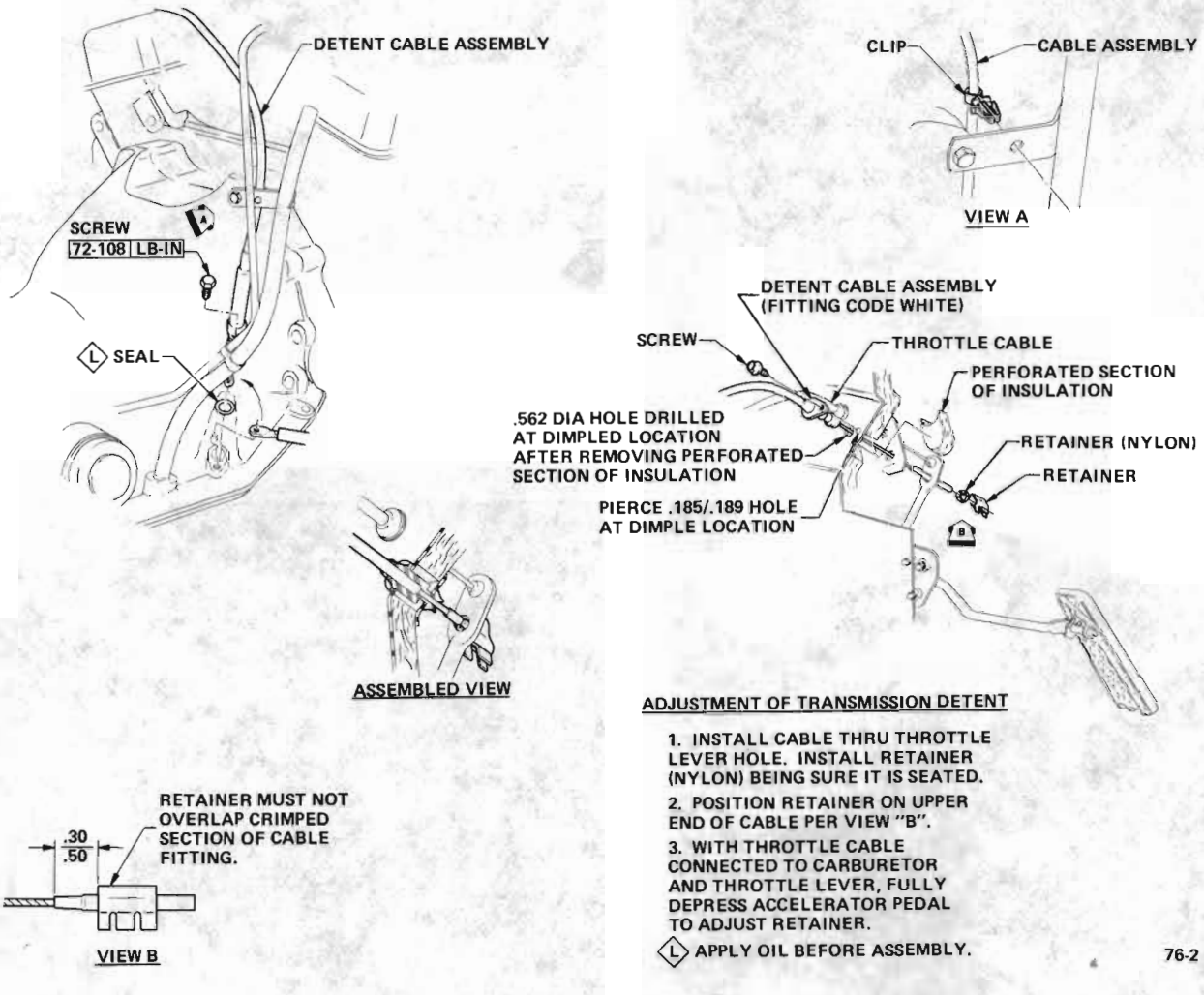


Figure 76-39 - Detent Switch Adjustment

76-13 REMOVAL OF CONVERTER AND VACUUM MODULATOR

1. With transmission in portable jack, remove J-21366. Remove converter assembly, by pulling straight out.

NOTE: *The converter contains a large amount of oil.*

2. Install Holding Fixture J-8763-01 on the transmission so that the modulator assembly will be located on the side of the holding fixture that is nearest the bench.

3. Install fixture and transmission into Holding Tool Base, J-3289-20, with bottom pan facing up. See Figure 76-40.

4. Remove modulator assembly attaching bolt and retainer. See Figure 76-41.

5. Remove modulator assembly and "O" ring seal from case. See Figure 76-42.

6. Remove modulator valve from transmission case.

76-14 REMOVAL OF GOVERNOR, SPEEDOMETER DRIVEN GEAR, OIL PAN, AND FILTER

NOTE: *The following operations can be performed with transmission in vehicle.*

Figure 76-40

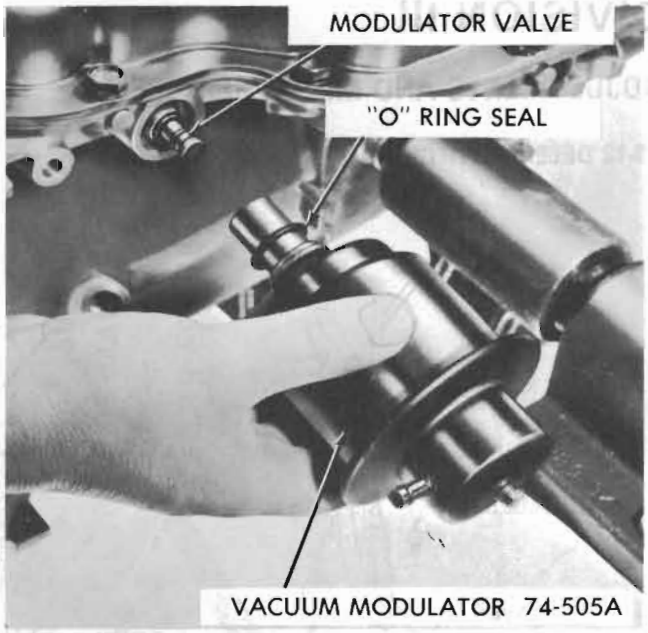


Figure 76-42

Figure 76-41

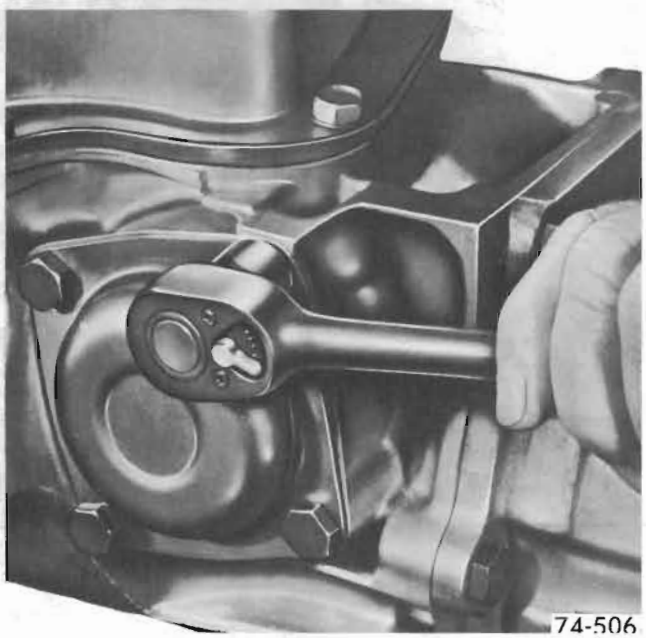


Figure 76-43

1. Remove attaching bolts, governor cover and gasket. See Figure 76-43.

2. Withdraw governor assembly from case. See Figure 76-44.

3. Remove speedometer driven gear attaching bolt and retainer. See Figure 76-45.

4. Withdraw speedometer driven gear assembly from case. See Figure 76-46.

5. Remove oil pan attaching bolts.

6. Remove oil pan and gasket. Discard gasket.

7. Remove the filter assembly retainer bolt. See Figure 76-47.

Figure 76-44

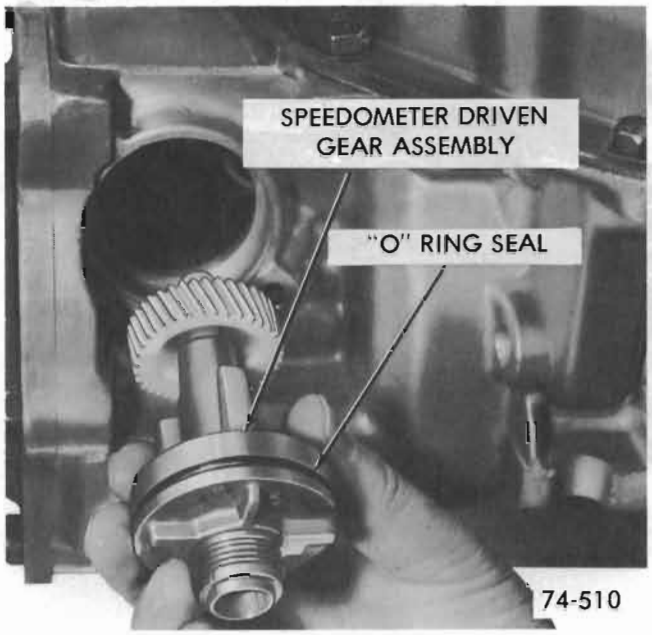


Figure 76-46

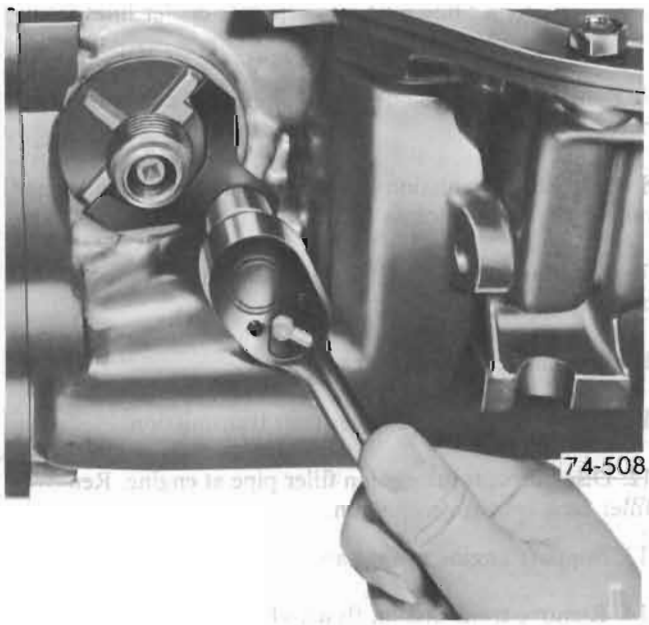


Figure 76-45

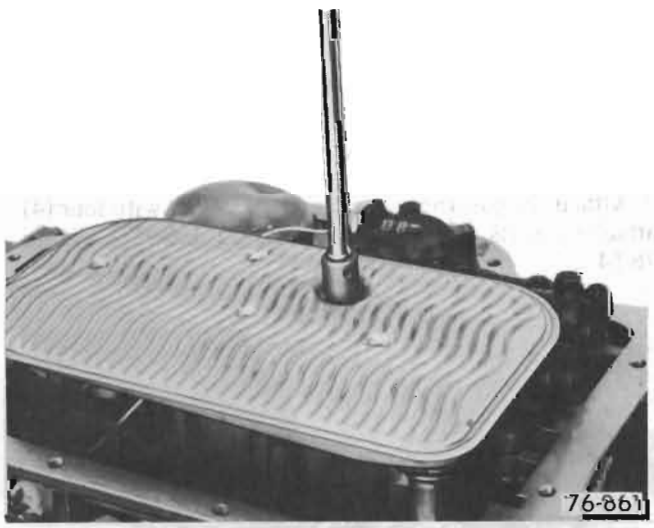


Figure 76-47

8. Remove filter and intake pipe assembly. Discard filter. See Figure 76-48.

9. Remove intake pipe to case "O" ring seal and discard. See Figure 76-48.

76-15 INSTALLATION OF OIL FILTER

1. Install new case to intake pipe "O" ring on intake pipe and new filter assembly. See Figure 76- 48.

2. Install filter and intake pipe assembly attaching filter to valve body assembly with retainer bolt. Torque to 10 lb. ft. See Figure 76-47.

3. Install a new pan gasket on oil pan. Install attaching bolts and torque 10-13 lb. ft.

76-16 INSTALLATION OF MODULATOR VALVE AND VACUUM MODULATOR

1. Install modulator valve into the case, stem end out. See Figure 76-42.

2. Install the "O" ring seal on the vacuum modulator.

3. Install the vacuum modulator into the case.

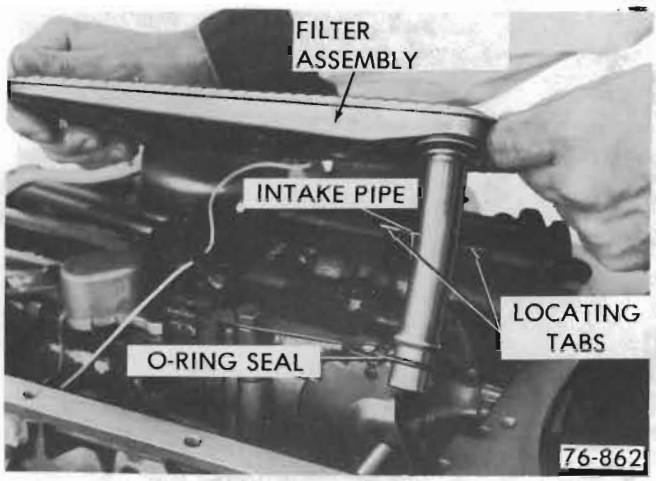


Figure 76-48

4. Install the modulator retainer and attaching bolt. Torque bolt to 15-20 lb.ft. See Figure 76-41.

76-17 INSTALLATION OF GOVERNOR ASSEMBLY

1. Install governor assembly into case. See Figure 76-44.

2. Attach the governor cover and new gasket with four (4) attaching bolts. Torque bolts to 15-20 lb.ft. See Figure 76-54.

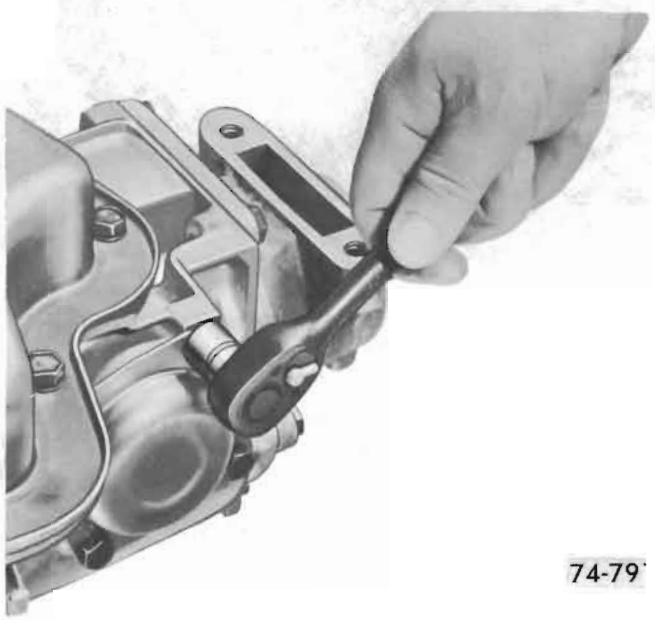


Figure 76-54

DIVISION IV

REMOVAL AND INSTALLATION

76-18 TRANSMISSION ASSEMBLY - REMOVAL AND INSTALLATION

A. Removal

1. Raise vehicle and provide support for front and rear of car.

2. Disconnect front exhaust crossover pipe if necessary.

3. Disconnect propeller shaft.

4. Place suitable jack under transmission and fasten transmission securely to jack.

5. Remove vacuum line from vacuum modulator. See Figure 76-55.

6. Loosen cooler line nuts and separate cooler lines from transmission. See Figure 76-56.

7. Remove transmission mounting pad to cross member bolts.

8. Remove transmission cross member support to frame rail bolts. Remove cross member.

9. Disconnect electrical wire harness from transmission electrical connector.

10. Disconnect speedometer cable.

11. Disconnect shift linkage from transmission.

12. Disconnect transmission filler pipe at engine. Remove filler pipe from transmission.

13. Support engine at oil pan.

14. Remove transmission flywheel cover pan to case tapping screws. REMOVE FLYWHEEL COVER PAN.

15. Mark flywheel and converter pump for reassembly in same position, and remove three converter pump to flywheel bolts.

16. Remove transmission case to engine block bolts.

17. Move transmission rearward to provide clearance between converter pump and crankshaft. Install Converter Holding Tool J-21366 to retain converter. Lower transmission and move to bench.

B. Installation

1. Assemble transmission to suitable transmission jack

and raise transmission into position. Rotate converter to permit coupling of flywheel and converter with original relationship. Remove J-21366.

2. Install transmission case to engine block bolts. Torque to 30-40 lb. ft. Dot not overtighten.

CAUTION: *Converter assembly must rotate freely by hand after converter pilot has been pushed forward into the engine crankshaft pilot hole.*

3. Install flywheel to converter pump bolts. Torque to 25-35 lb. ft.

4. Install transmission cross member support. Install mounting pad to cross member.

5. Remove transmission jack and engine support.

6. Install transmission flywheel cover pan with tapping screws.

7. Install transmission oil filler pipe using a new "O" ring.

8. Reconnect speedometer cable.

9. Connect electrical wire harness to transmission electrical connector.

10. Install propeller shaft.

11. Reinstall front exhaust crossover pipe, if removed.

12. Install oil cooler lines to transmission. See Figure 76-56.

13. Install vacuum line to vacuum modulator.

14. Fill transmission with fluid as described in Paragraph 76-41, subparagraph C.

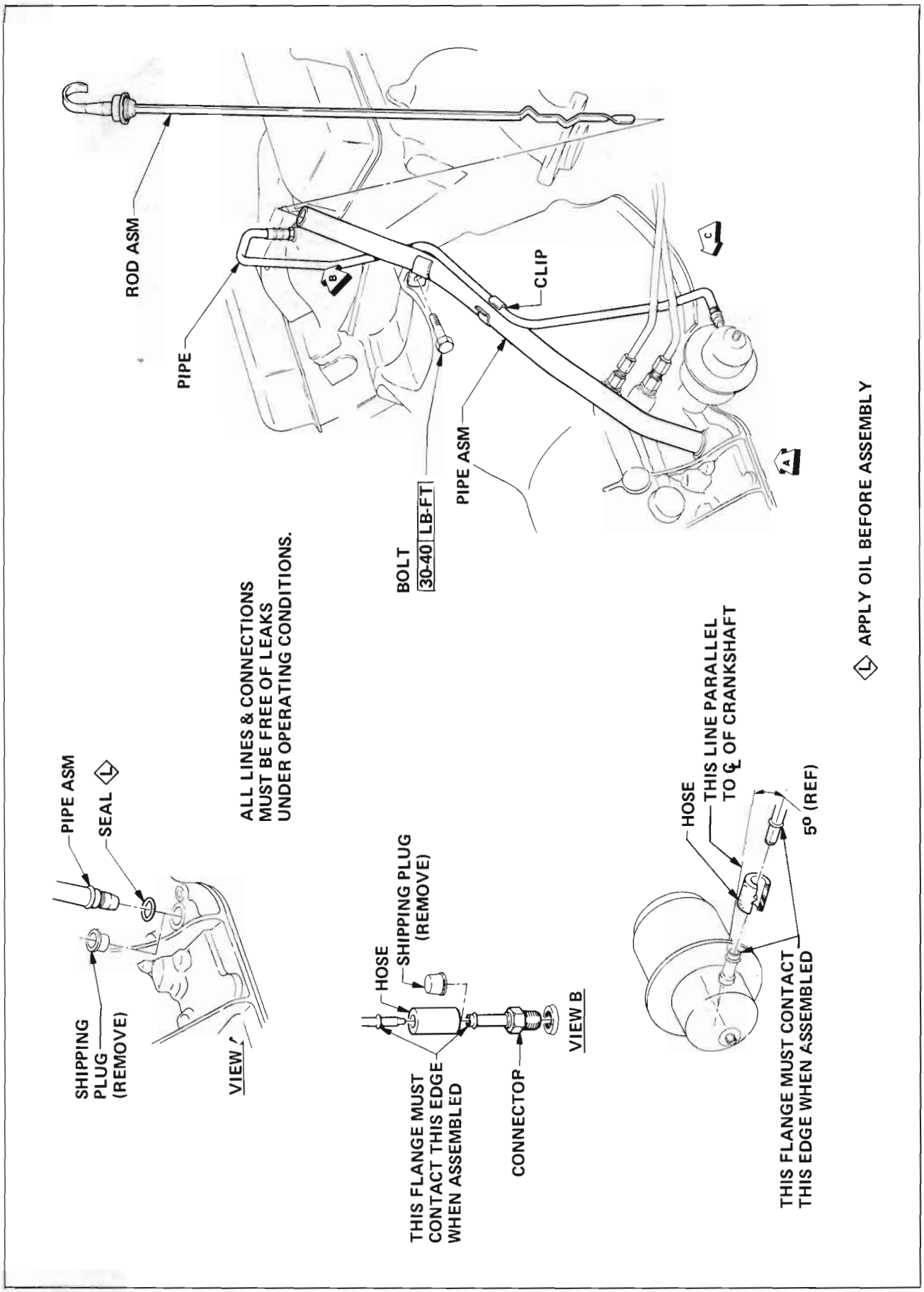


Figure 76-55 - Vacuum Modulator Line and Dipstick

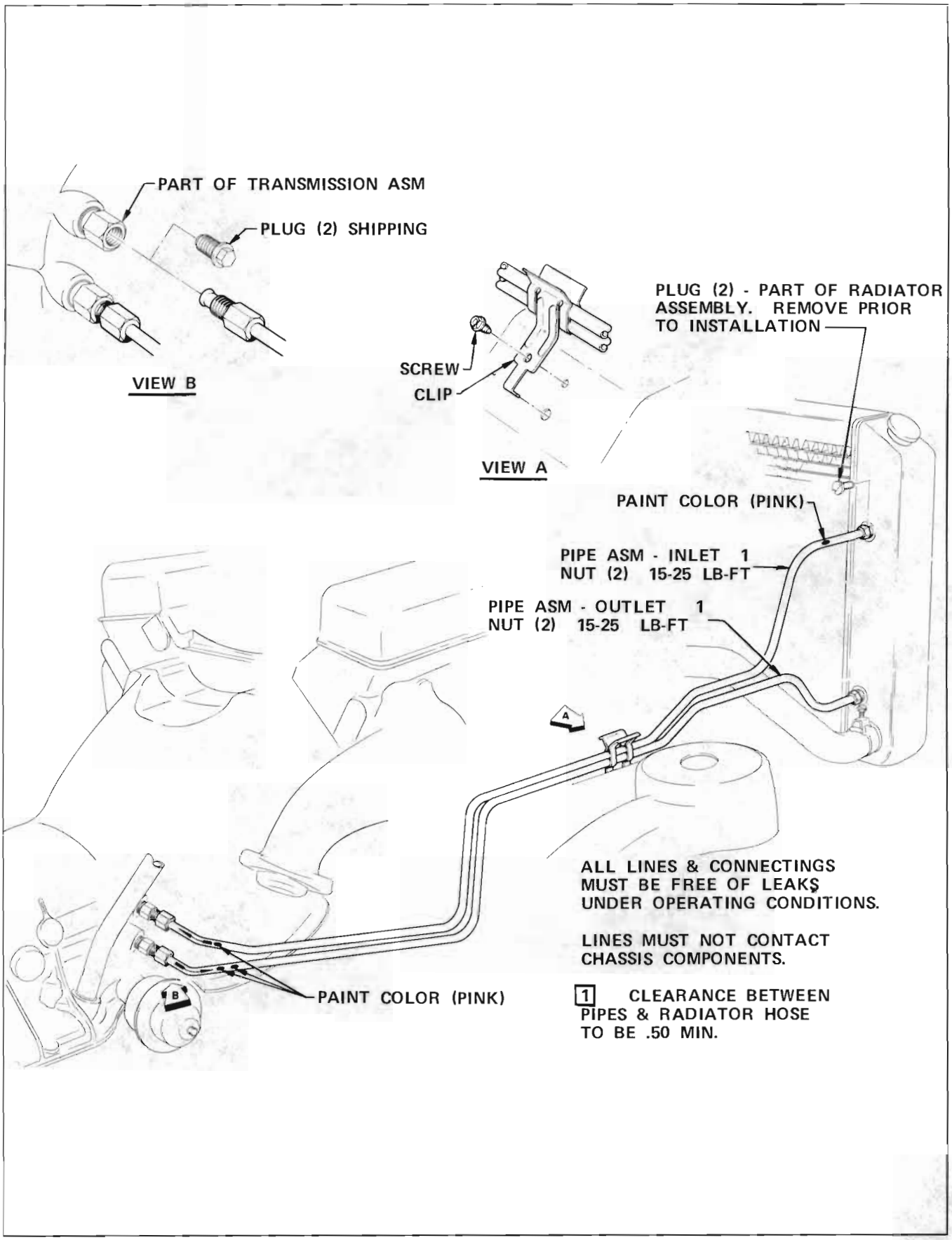


Figure 76-56 - Oil Cooler Lines

DIVISION V

OVERHAUL AND MAJOR SERVICE

76-19 REMOVAL OF PRESSURE SWITCH ASSEMBLY, VALVE BODY ASSEMBLY, GOVERNOR PIPES, AND DETENT SPRING ASSEMBLY

NOTE: *The following operations can be performed with transmission in vehicle.*

1. Disconnect the lead wire assembly from the pressure switch assembly. See Figure 76-57.

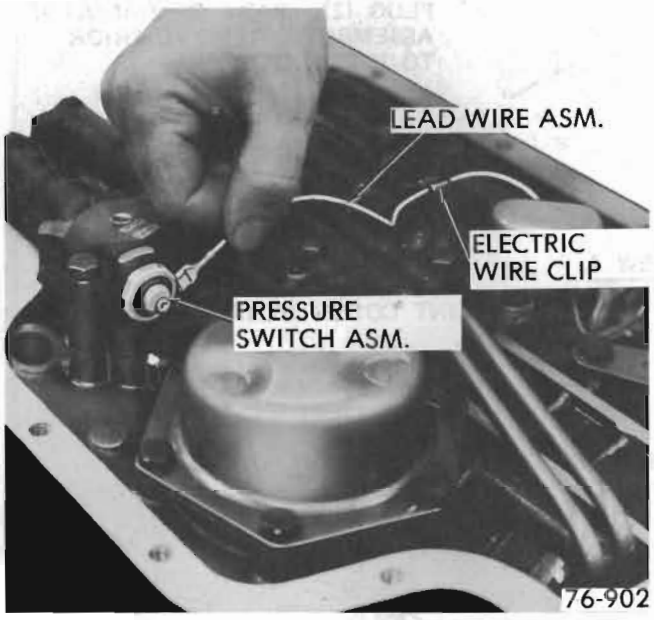


Figure 76-57

2. If necessary, remove the pressure switch assembly. See Figure 76-58.

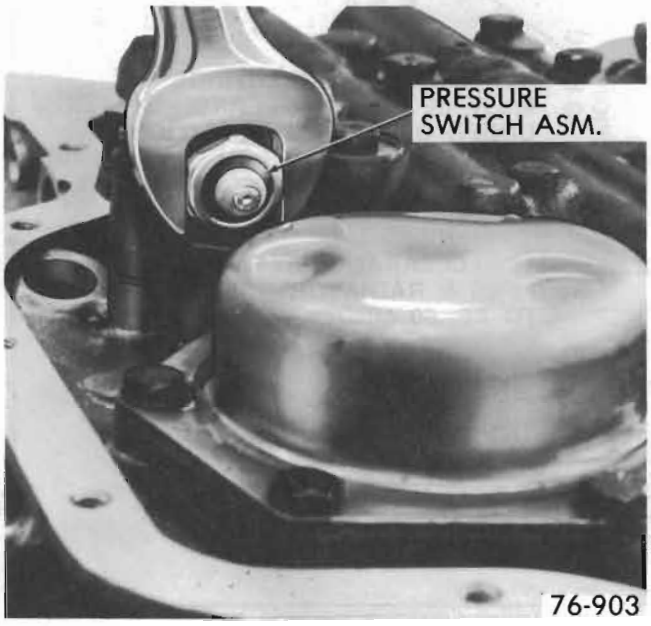


Figure 76-58

3. Remove valve body attaching bolts and detent roller and spring assembly. See Figure 76-59.

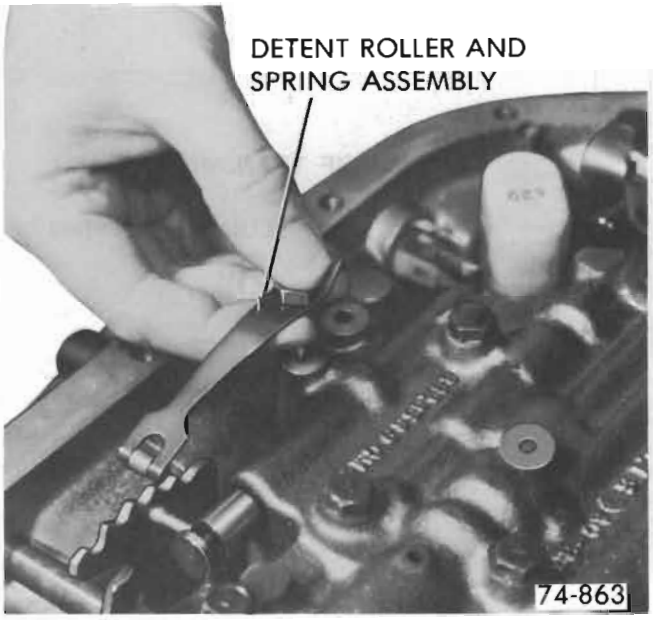


Figure 76-59

NOTE: *Do not remove solenoid attaching bolts.*

NOTE: *If transmission is in vehicle, front servo group may drop out as control valve assembly is removed.*

4. Remove valve body assembly and governor pipes. See Figure 76-60.

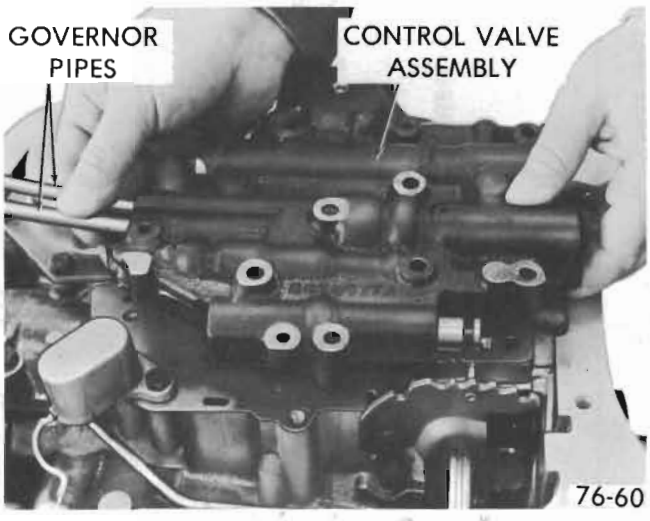


Figure 76-60

NOTE: *Do not allow manual valve to fall out of valve body assembly.*

5. Remove governor screen assembly from governor feed pipe in case or from end of governor feed pipe. See Figure 76-61. Clean screen in clean solvent and air dry.

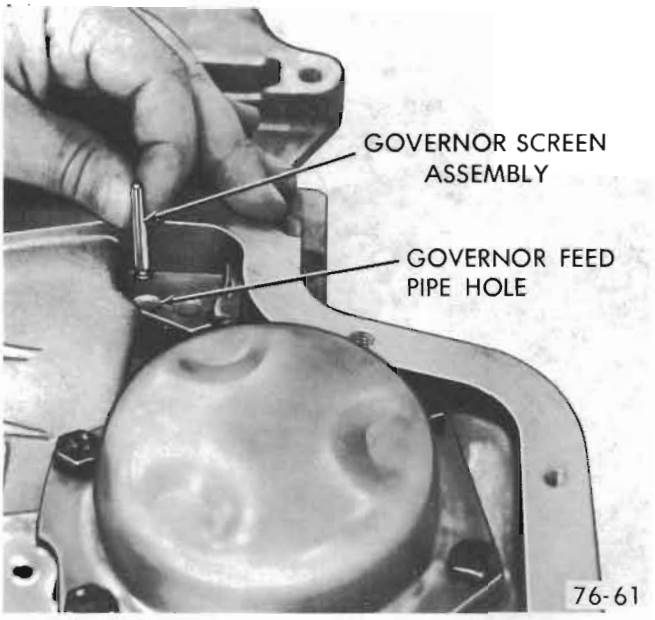


Figure 76-61

6. Remove governor pipes from valve body assembly. See Figure 76-62.

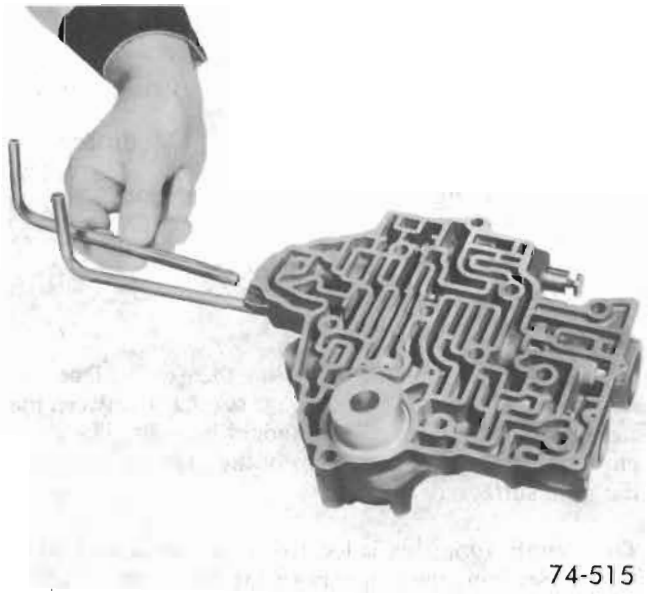


Figure 76-62

7. Disconnect detent solenoid wire from case connector. See Figure 76-63.

76-20 REMOVAL OF SERVO, CASE CONNECTOR, VALVE BODY SPACER, GASKET FRONT SERVO, MANUAL DETENT, AND PARK LINKAGE

NOTE: *The following operations can be performed with the transmission in the vehicle.*

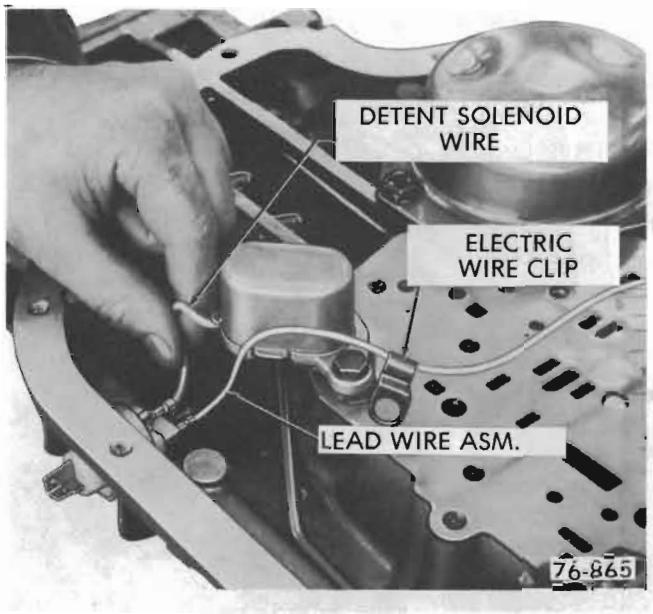


Figure 76-63

1. Remove rear servo cover attaching bolts, servo cover, and gasket. (Discard gasket). See Figure 76- 64.

Figure 76-64

2. Remove rear servo assembly from case. See Figure 76-65.

3. Remove servo accumulator spring. See Figure 76-66.

4. Check band apply Pin.

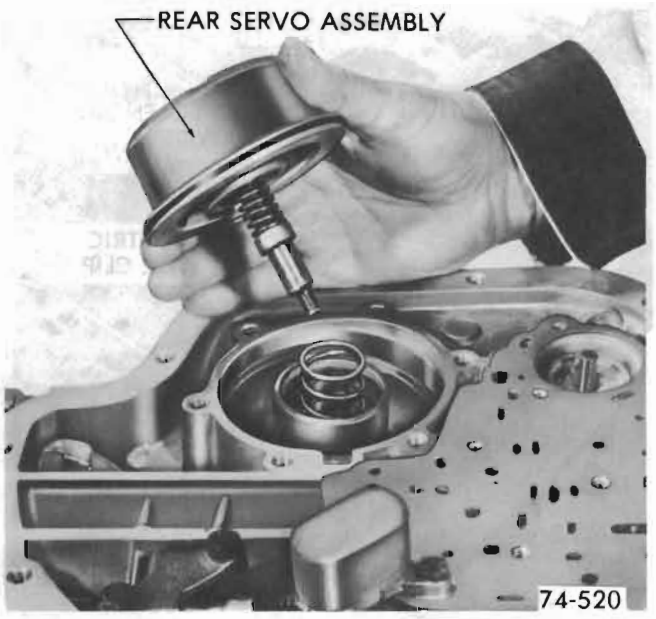


Figure 76-65

Figure 76-66

a. Attach band apply pin Selection Gage J-21370-6 with J-21370-5, to transmission case with attaching bolts. Torque 6-10 lb.ft.

b. Apply 25 lb.ft. torque and *select proper pin to be used during assembly of transmission.* See Figure 76-67.

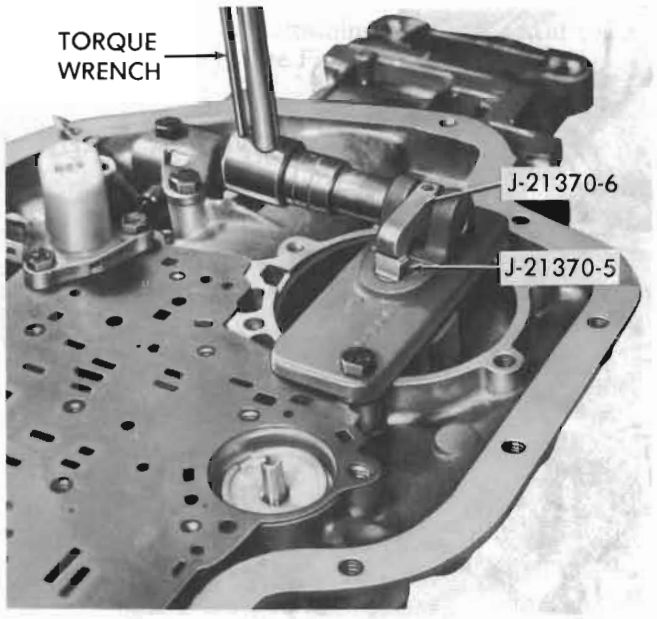


Figure 76-67

There are three selective pins identified as follows:

Pin Identification	Pin Size
3 Rings	Long
2 Rings	Medium
1 Ring	Short

76-47

If both steps of J-21370-5 are below the gage surface, the long pin should be used. If the gage surface is between the steps, the medium length pin should be used. The short pin should be used if both steps of the gage pin are above the gage surface.

The identification ring is located on the band lug end of the pin. Selecting the proper pin is the equivalent of adjusting the band.

NOTE: *If a new pin is required, make note of pin size required, and remove gage from transmission case.*

5. Compress fingers on electrical connector sleeve and withdraw. See Figure 76-68.

CAUTION: *If the transmission is in the vehicle, be careful when the detent solenoid is removed, as it prevents the spacer plate and gasket and check balls from dropping down.*

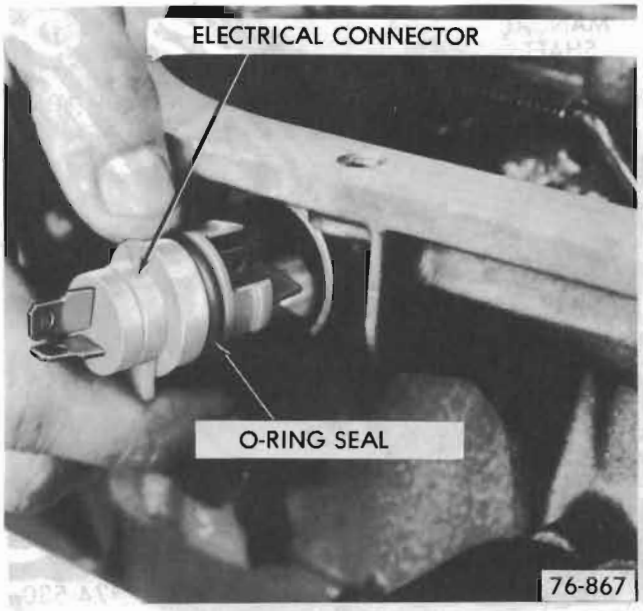


Figure 76-68

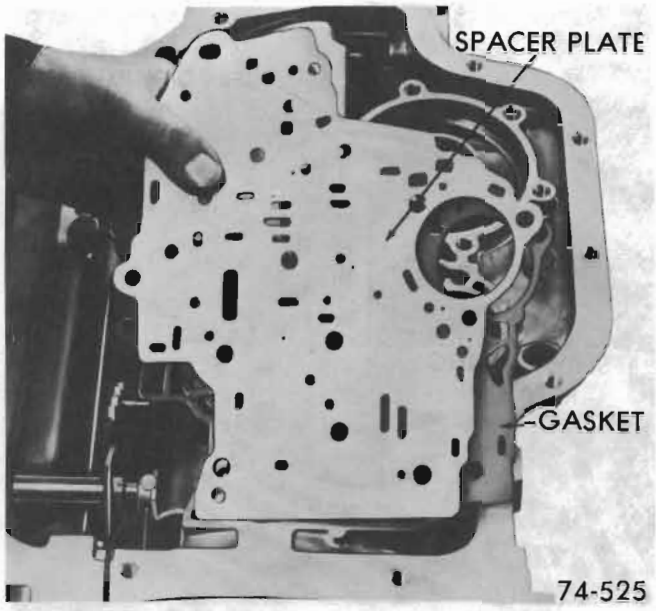


Figure 76-70

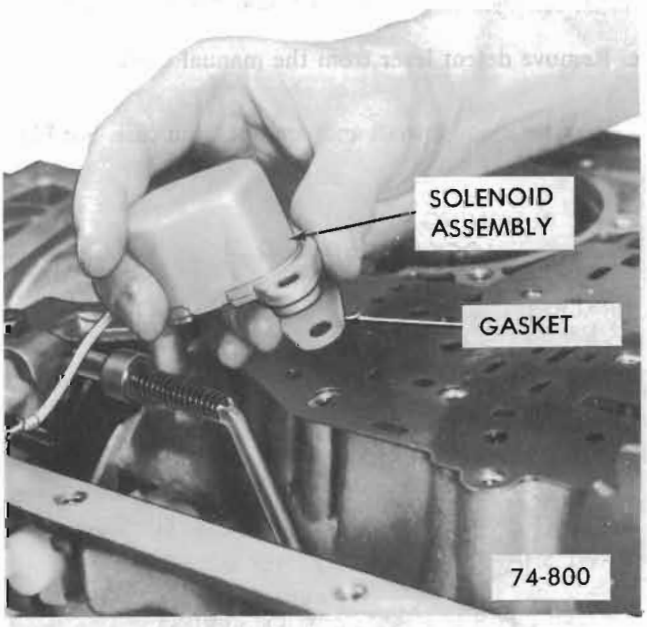


Figure 76-69

8. Remove six (6) check balls from cored passages in transmission case. See Figure 76-71.

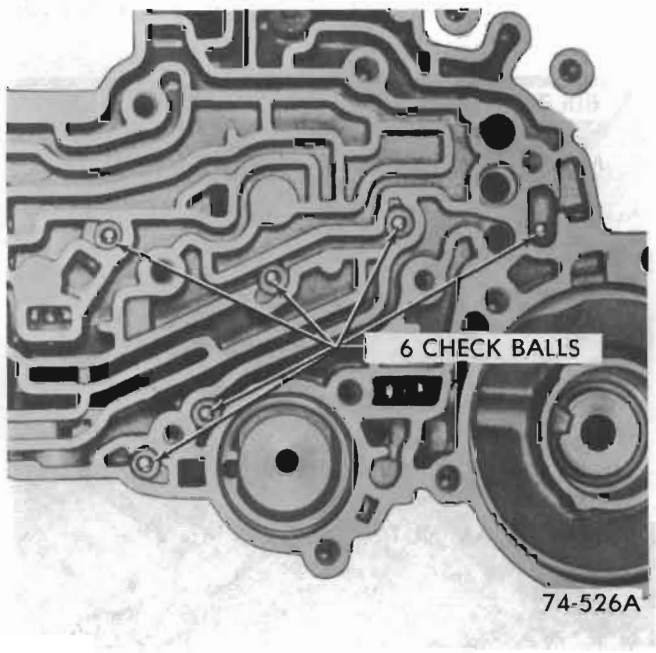


Figure 76-71

6. Remove detent solenoid attaching bolts, solenoid assembly, and gasket. See Figure 76-69.

7. Remove valve body assembly spacer plate and gasket. See Figure 76-70.

9. Remove front servo piston, retainer ring, servo pin, spring retainer, and spring from transmission. See Figure 76-72.

10. If it becomes necessary to remove the internal manual linkage proceed as follows:

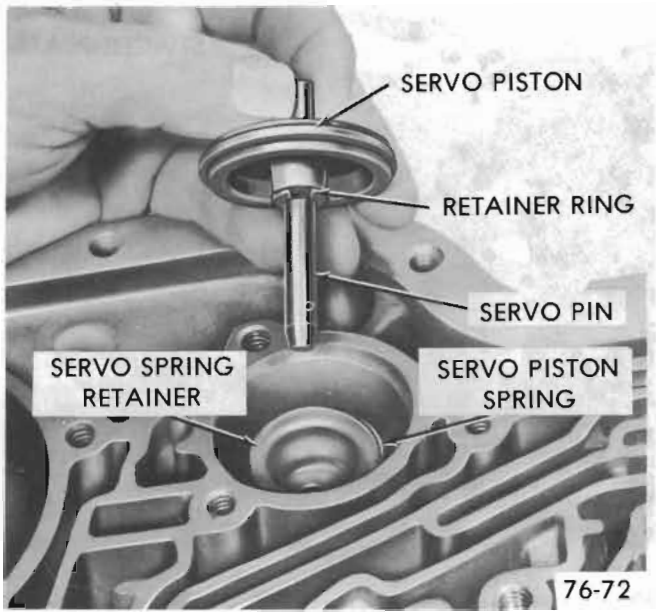


Figure 76-72

a. Unthread jam nut holding detent lever to manual shaft. See Figure 76-73.

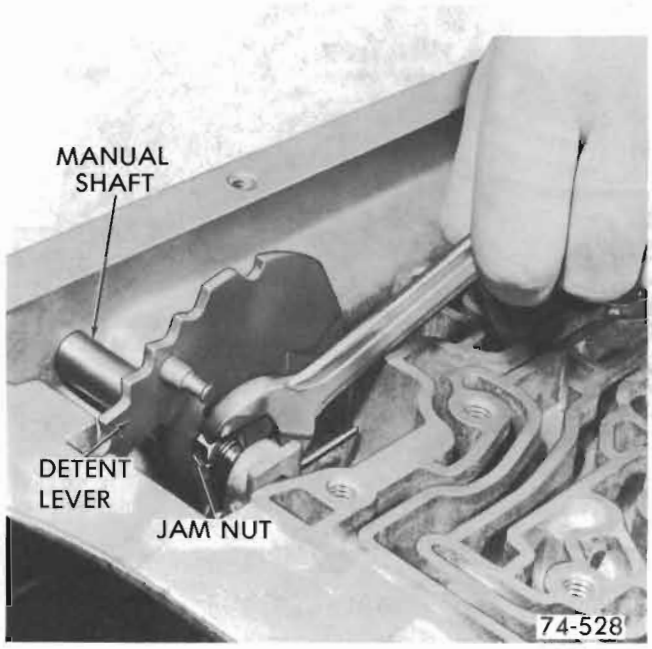


Figure 76-73

CAUTION: *Do not lose jam nut as it becomes free from shaft.*

b. Remove manual shaft retaining pin from case. See Figure 76-74.

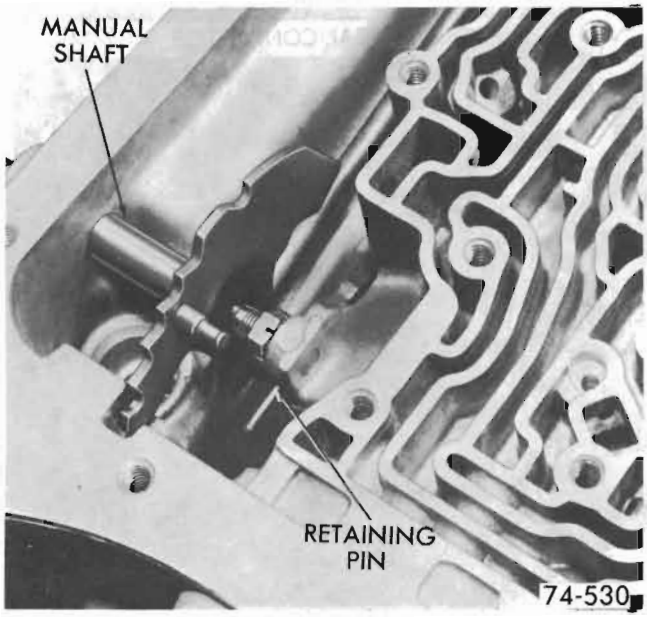


Figure 76-74

NOTE: *It may be necessary to bend pin to remove.*

c. Remove detent lever from the manual shaft.

d. Remove manual shaft and jam nut from case. See Figure 76-75.

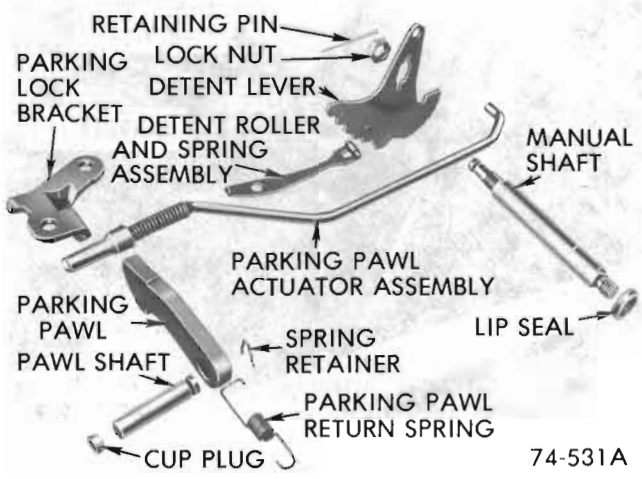


Figure 76-75

NOTE: *If necessary remove manual shaft to case lip seal.*

e. Remove parking pawl actuator rod and detent lever assembly.

f. Remove attaching bolts and parking lock bracket. See Figure 76-76.

Figure 76-76

g. Remove parking pawl return spring. See Figure 76-77.

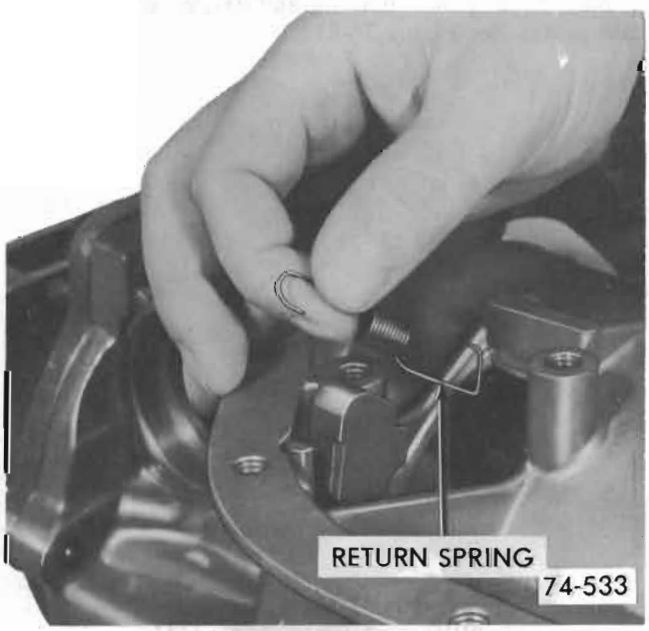


Figure 76-77

NOTE: *The following steps are to be completed only if one or more of the parts involved require replacement.*

h. Remove parking pawl shaft retainer. See Figure 76-78.

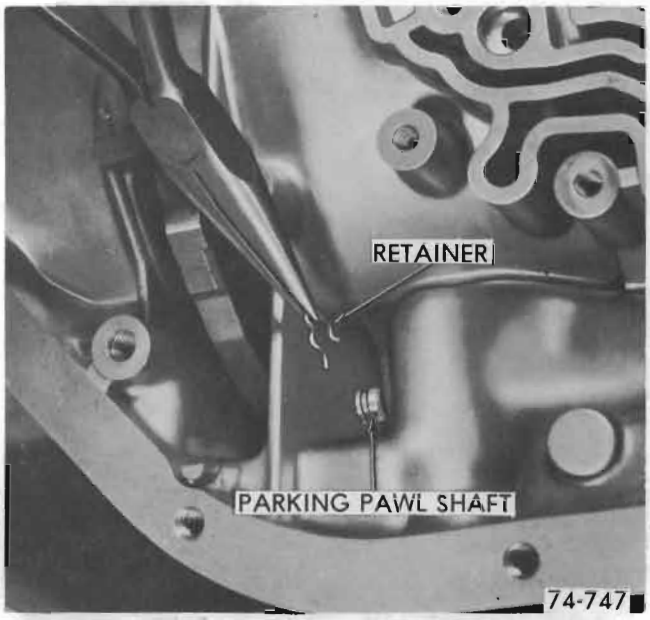


Figure 76-78

i. Remove parking pawl shaft cup plug by inserting a screwdriver between the parking pawl shaft and the case rib, and prying outward. See Figure 76-79.

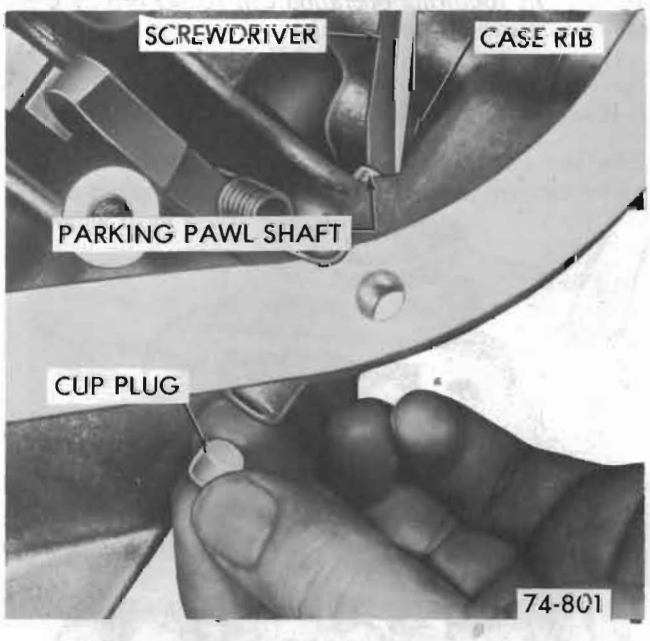


Figure 76-79

j. Remove parking pawl shaft, and parking pawl. See Figure 76-80.

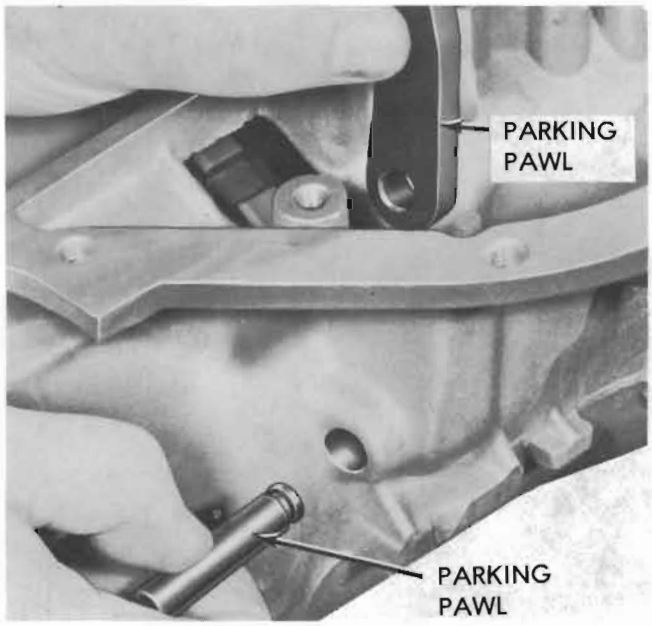


Figure 76-80

76-21 REMOVAL OF REAR OIL SEAL AND EXTENSION HOUSING

NOTE: *The following operation can be performed with the transmission in the vehicle.*

1. If necessary to replace, pry the rear oil seal from the

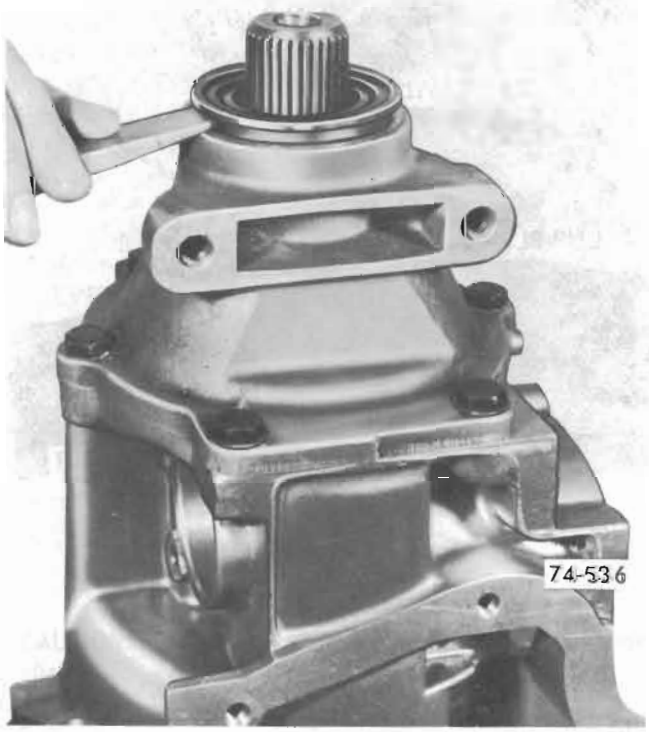


Figure 76-81

2. Remove extension housing to case attaching bolts. See Figure 76-82.

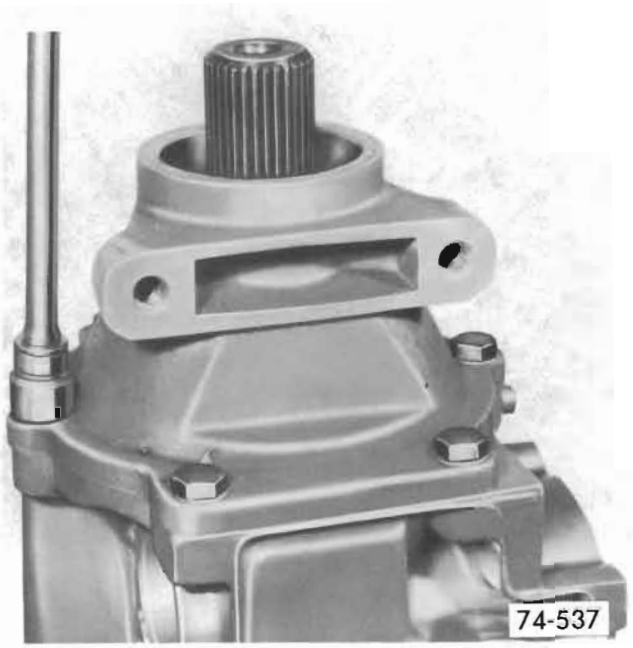


Figure 76-82

3. Remove extension housing and extension housing to case gasket. See Figure 76-83.

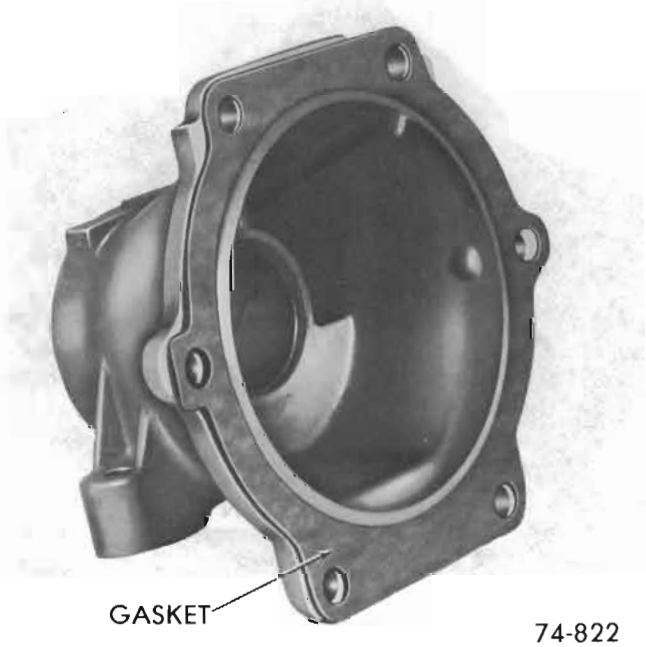


Figure 76-83

76-21A FRONT UNIT END PLAY CHECKING PROCEDURE

1. Check front unit end play as follows:

a. Remove one front pump attaching bolt.

b. Install a 5/16-18 threaded slide hammer bolt or J-7004, into bolt hole in pump. See Figure 76-84.

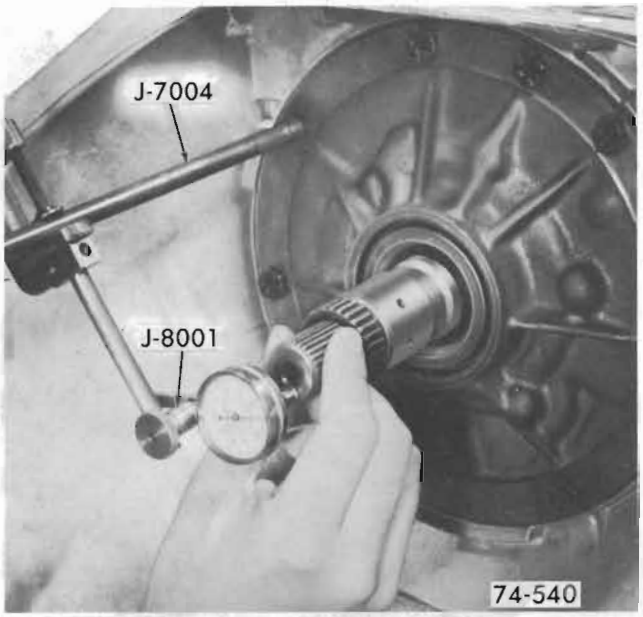


Figure 76-84

c. Mount dial indicator on the rod and index indicator to register with end of turbine shaft. See Figure 76-84.

d. Push turbine shaft rearward.

e. Push output shaft forward.

f. Set dial indicator to Zero.

g. Pull turbine shaft forward.

Read the resulting travel or end play which should be .003" - .024".

The selective washer controlling this end play is the washer located between the pump cover and the forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select the proper washer from the chart below.

Thickness	Color
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

NOTE: *An oil soaked washer may tend to discolor so that it will be necessary to measure the washer for its actual thickness.*

76-22 REMOVAL OF OIL PUMP, FORWARD CLUTCH, INTERMEDIATE CLUTCH AND GEAR UNIT ASSEMBLY

1. If seal replacement is necessary, pry seal from pump. See Figure 76-85.

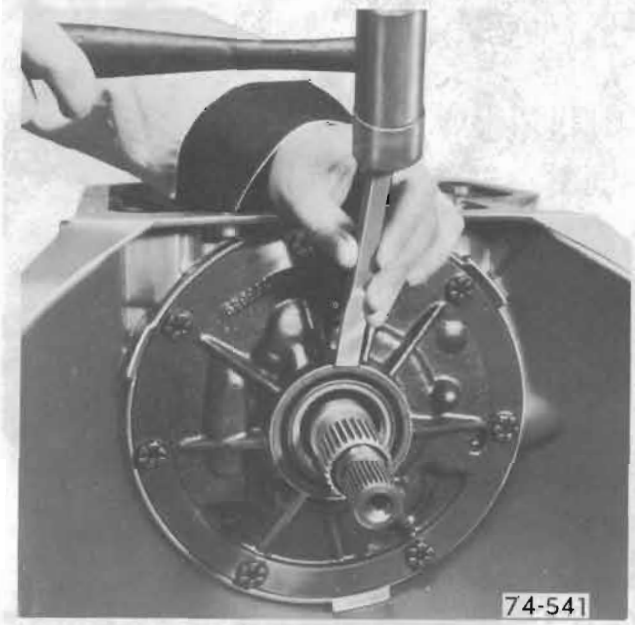


Figure 76-85

2. Remove pump attaching bolts.

3. Install threaded slide Hammers, J-7004, into bolt holes in the pump body, tighten jam nuts and remove pump assembly from case. See Figure 76-86.

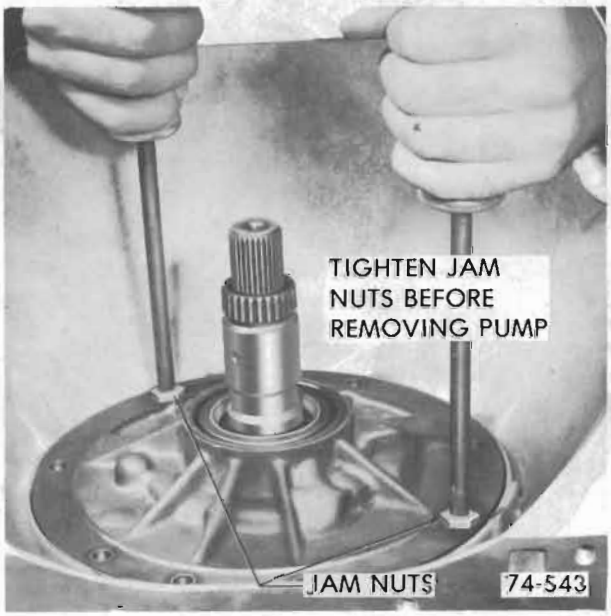


Figure 76-86

4. Remove and discard pump to case oil seal ring and gasket.

5. Remove forward clutch and turbine shaft assembly from transmission. See Figure 76-87.

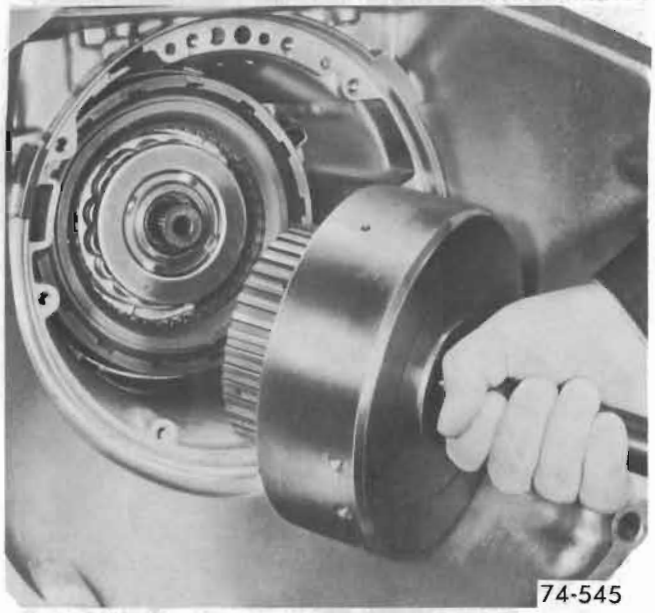


Figure 76-87

6. Remove forward clutch hub to direct clutch housing thrust washer, if it did not come out with forward clutch housing assembly.

7. Remove direct clutch assembly. See Figure 76-88.

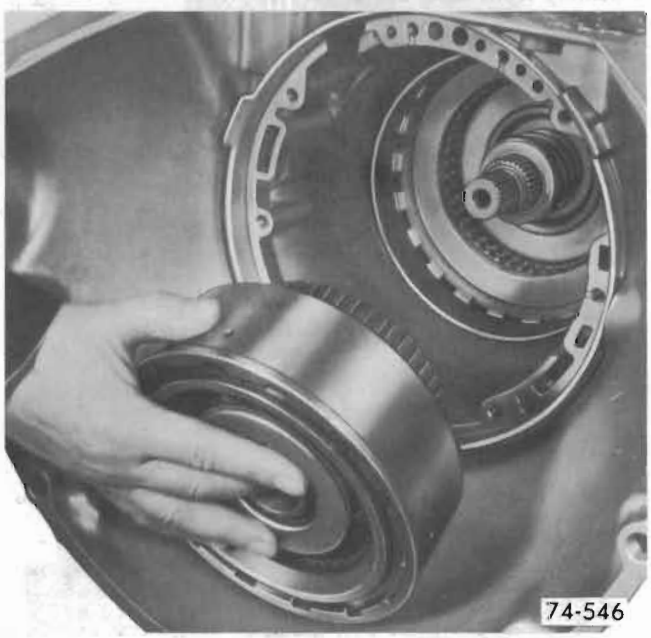


Figure 76-88

8. Remove front band assembly.

9. Remove sun gear shaft. See Figure 76-89.

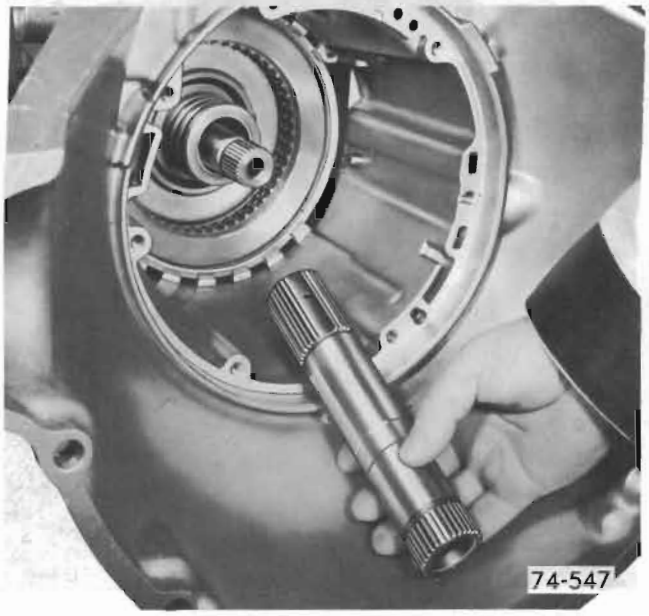


Figure 76-89

10. Check rear end play as follows:

a. Install J-7004 into an extension housing attaching bolt hole.

b. Mount dial indicator, on Slide Hammer Bolt J-7004 and index with end of the output shaft. See Figure 76-90.

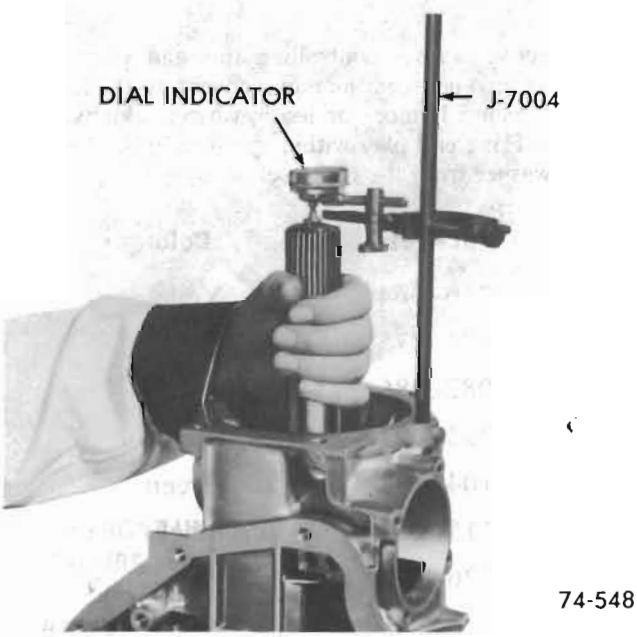


Figure 76-90

c. Move output shaft in and out to determine end play. End play should be from .007" - .019". The selective washer controlling this end play is the steel washer having 3 lugs that is located between the thrust washer and the rear face of the transmission case.

If different washer thickness is required to bring the end play within specification, it can be selected from the following chart.

Thickness	Notches and/or Numeral	
.074-.078	None	1
.082-.086	1 Tab Side	2
.090-.094	2 Tabs Side	3
.098-.102	1 Tab O.D.	4
.106-.110	2 Tabs O.D.	5
.114-.118	3 Tabs O.D.	6

76-49

11. Remove center support to case bolt using a 3/8" 12 point thin wall deep socket. See Figure 76-91.

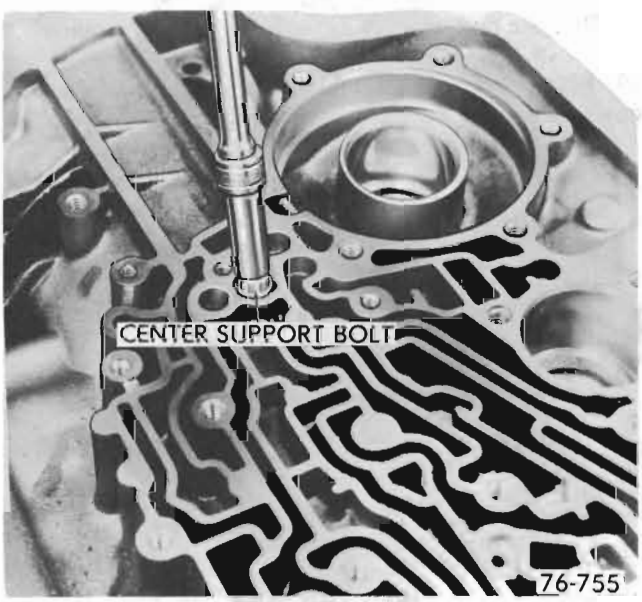


Figure 76-91

12. Remove intermediate clutch backing plate to case snap ring. See Figure 76-92.

13. Remove intermediate clutch backing plate, 3 composition and 3 steel clutch plates. See Figure 76-93.

14. Inspect condition of composition and steel plates. *Do not diagnose a composition drive plate by color.*

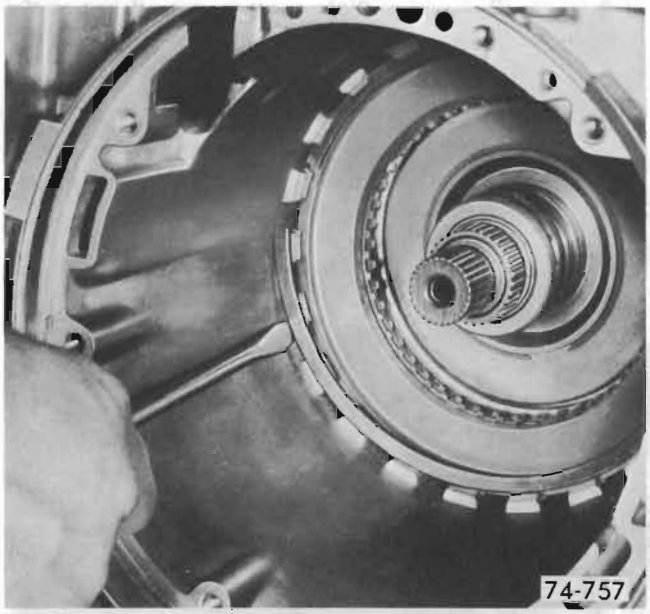


Figure 76-92

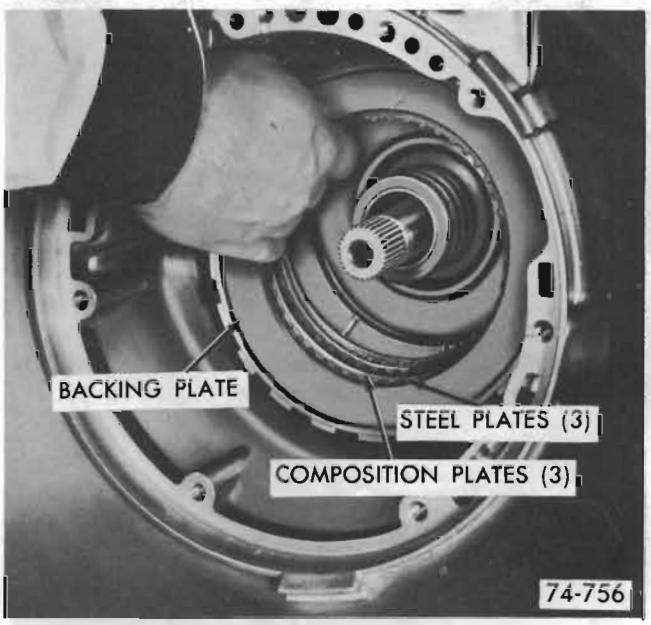


Figure 76-93

A. Dry composition plates with compressed air and inspect the composition surface for:

1. Pitting and flaking
2. Wear
3. Glazing
4. Cracking
5. Charring
6. Chips or metal particles imbedded in lining

If a composition drive plate exhibits any of the above conditions, replacement is required.

B. Wipe steel plates dry and check for heat discoloration. If the surface is smooth and an even color smear is indicated, the plates should be reused. If severe heat spot discoloration or surface scuffing is indicated, the plates must be replaced.

15. Remove center support to case retaining snap ring. See Figure 76-94.

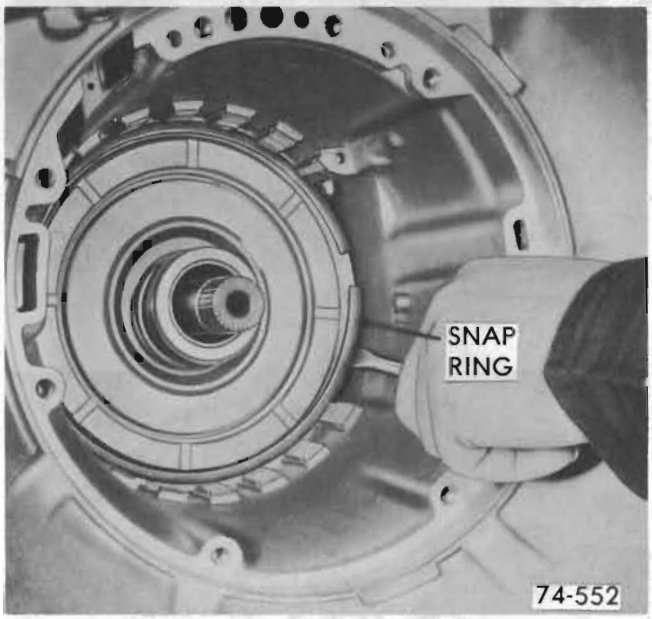


Figure 76-94

16. Remove entire gear unit assembly by lifting with J-21795 and J-7004 Slide Hammer. See Figure 76- 95.

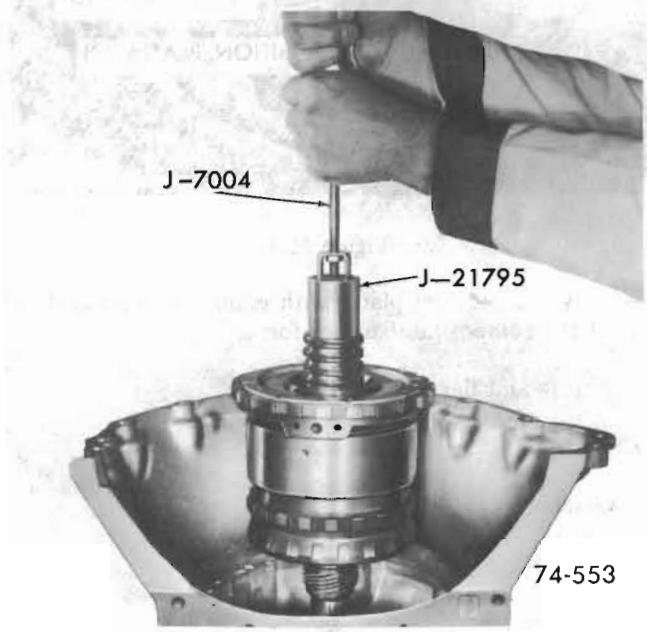


Figure 76-95

17. Remove output shaft to case thrust washer from rear of the output shaft or inside case. See Figure 76-96.

Figure 76-96

18. Remove output shaft to yoke "O" ring if required.

19. Place gear unit assembly with output shaft facing down in hole in work bench. See Figure 76-97.

Figure 76-97

20. Remove rear unit selective washer from the transmission case. See Figure 76-98.

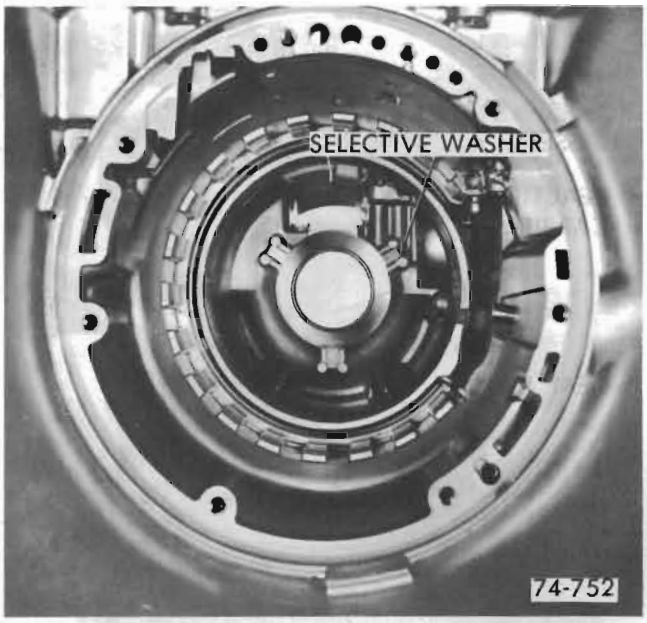


Figure 76-98

21. Remove support to case spacer. See Figure 76-99.

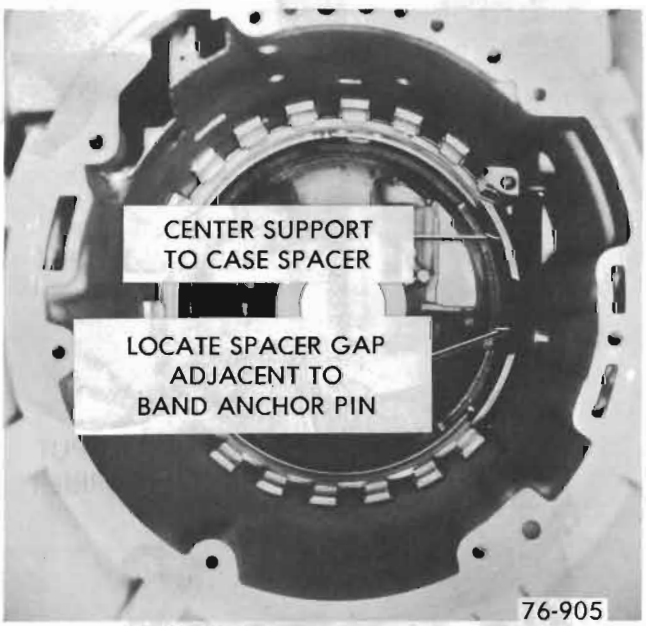


Figure 76-99

22. Remove rear band assembly. See Figure 76- 100.

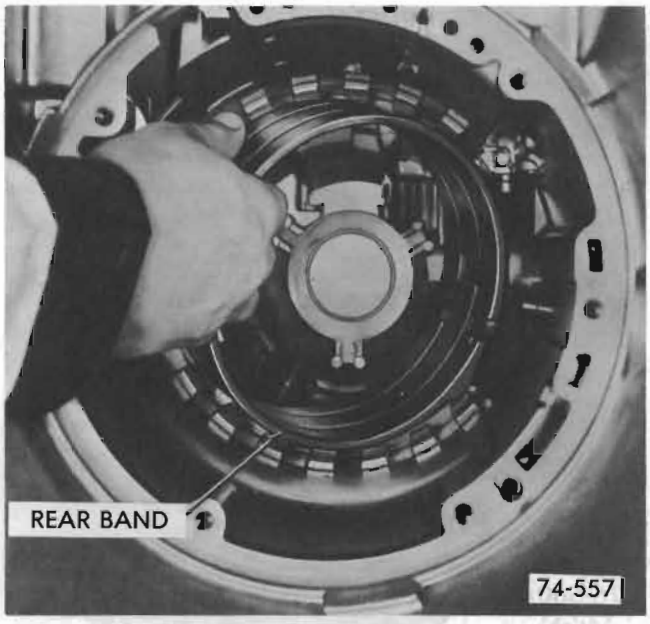


Figure 76-100

76-23 GEAR UNIT ASSEMBLY (See Figure 76-288)

A. Disassembly

1. Remove center support assembly. See Figure 76-101.

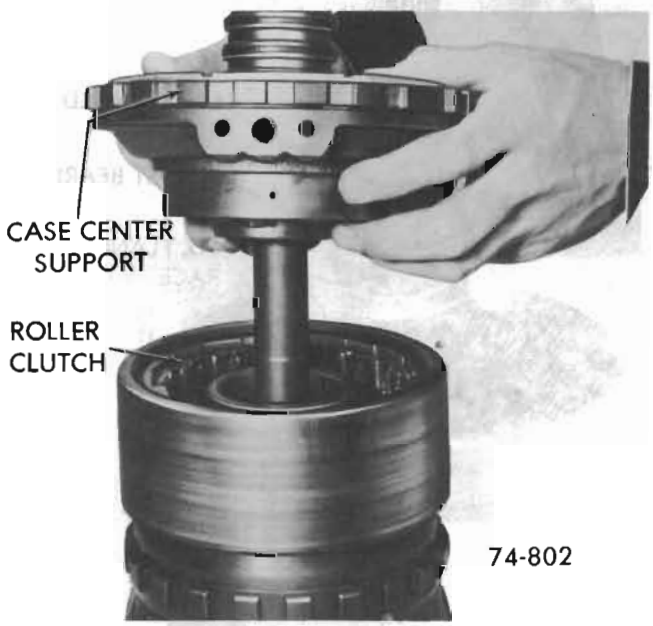


Figure 76-101

2. Remove center support to reaction carrier thrust washer. See Figure 76-102.

Figure 76-102

3. Remove center support to sun gear races and thrust bearing. See Figure 76-103.

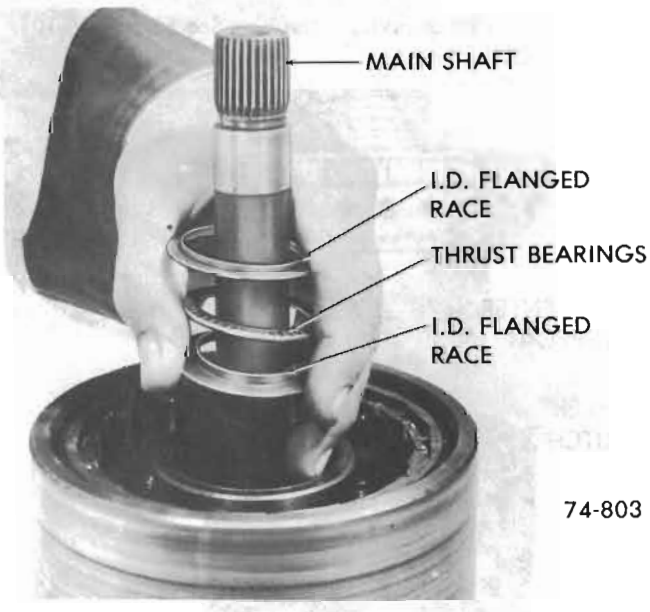


Figure 76-103

NOTE: *One of races may have been removed with the center support.*

4. Remove reaction carrier and roller clutch assembly. See Figure 76-104.

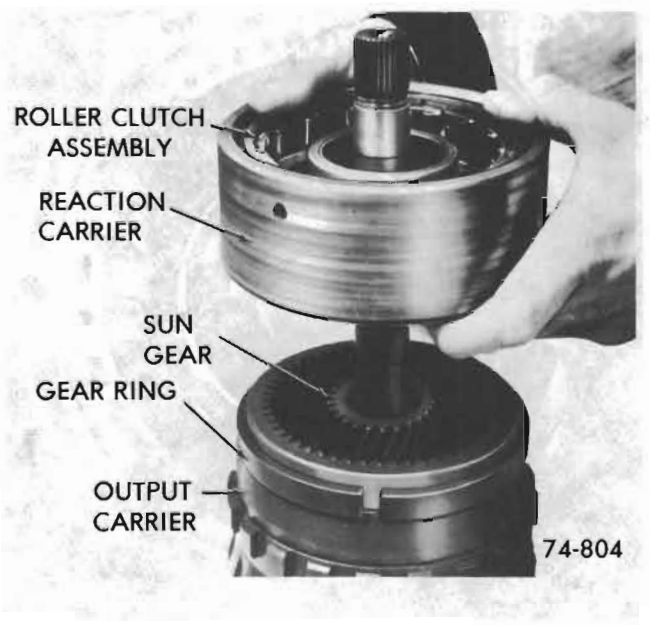


Figure 76-104

5. Remove front internal gear ring from output carrier assembly. See Figure 76-105.

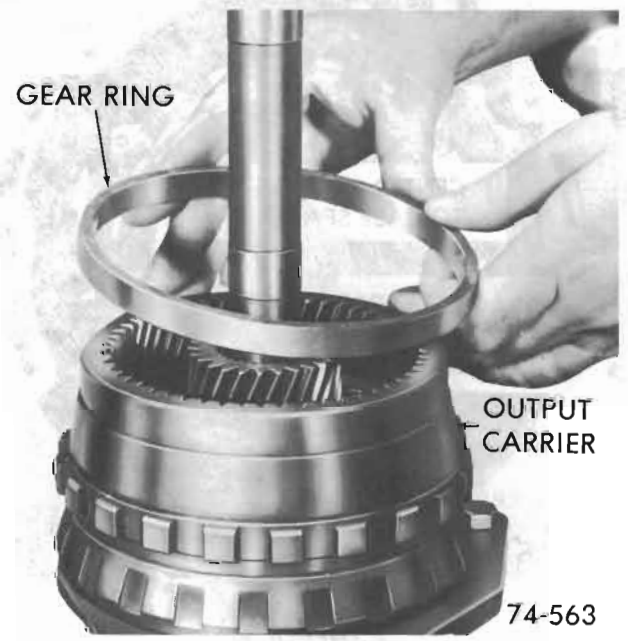


Figure 76-105

6. Remove sun gear. See Figure 76-106.

7. Remove reaction carrier to output carrier thrust washer. See Figure 76-107.

Figure 76-106

Figure 76-107

8. Turn assembly over and place mainshaft through hole in work bench.

9. Remove output shaft to rear carrier snap ring. See Figure 76-108.

Figure 76-108

10. Remove output shaft.

NOTE: *If replacement of the speedometer drive gear is necessary remove in the following manner.*

a. *Steel Speedometer Gear:* Install steel Speedometer Gear Removing Tool J-21427 and J-9578, on output shaft and remove speedometer drive gear. See Figure 76-109.

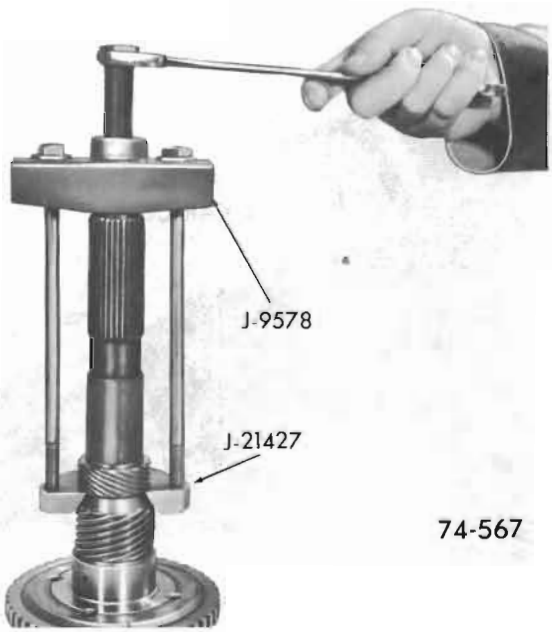


Figure 76-109

b. Install new steel speedometer drive gear. Press to 5-21/32″ for "BS", "BB", and "OW" models,

and 11-15/32" for "BC" and "BT" models. See Figure 76-110.

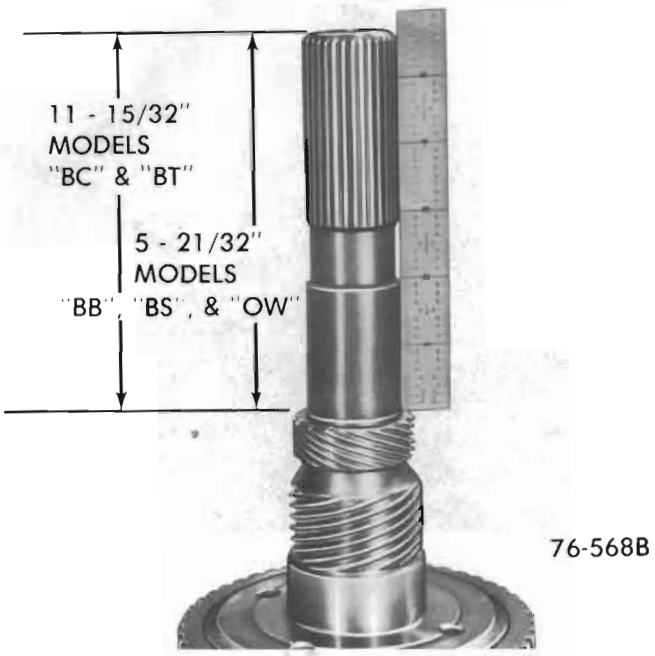


Figure 76-110

c. *Nylon Speedometer Drive Gear:* Depress retaining clip and slide nylon gear off output shaft. See figure 76-111.

d. To install, place retaining clip (square end toward flange of shaft) into hole in output shaft. See Figure 76-111.

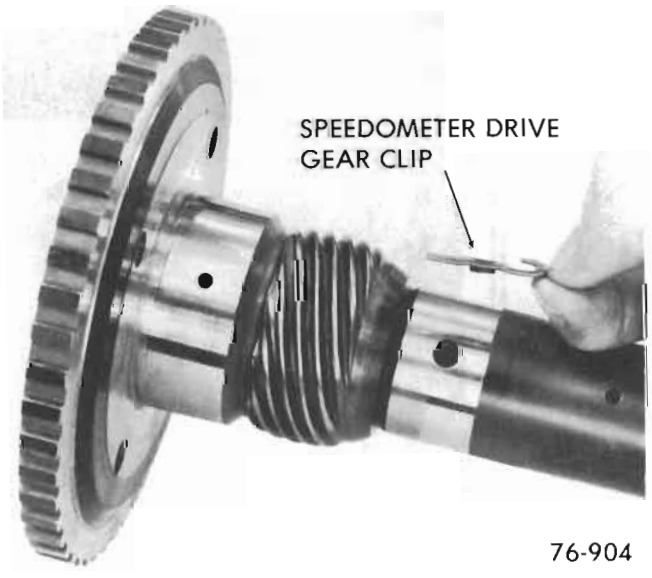


Figure 76-111

e. Align slot in speedometer drive gear with retaining clip and install gear. See Figure 76-112.

NOTE: *The nylon speedometer drive gear is installed at the factory only. All service replacement gears are steel. When a service gear is required, discard the retaining clip and proceed as described in step b above.*

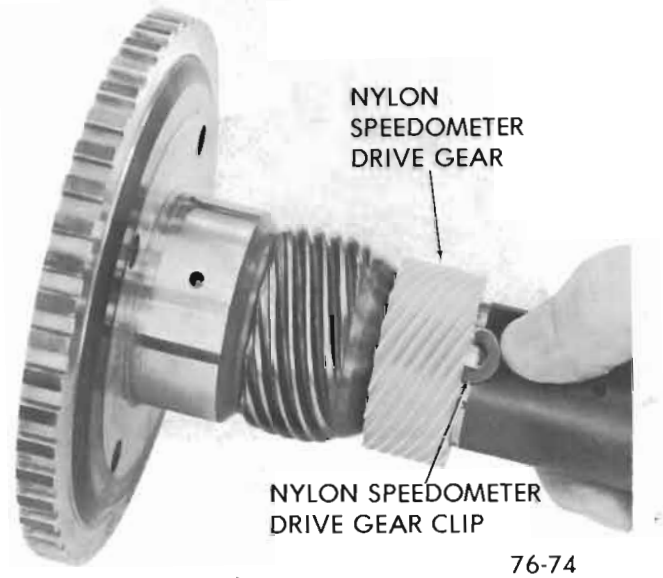


Figure 76-112

11. Remove output shaft to rear internal gear thrust bearing and two (2) races. See Figure 76-113.

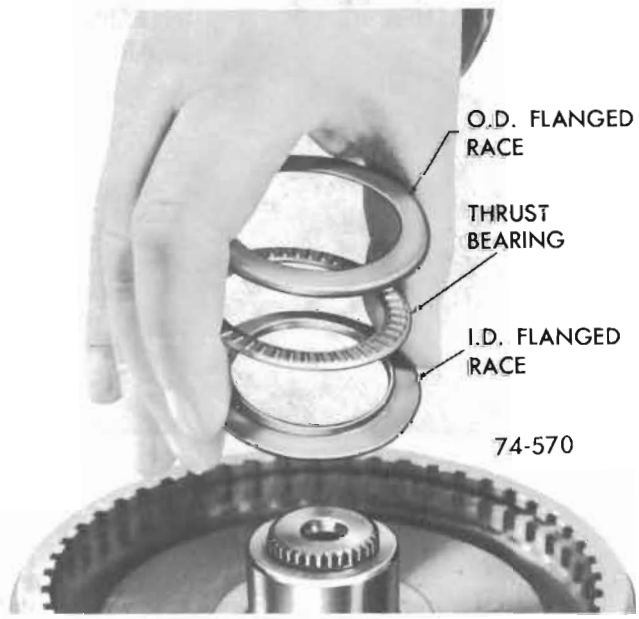


Figure 76-113

12. Remove rear internal gear and mainshaft. See Figure 76-114.

Figure 76-114

NOTE: *Do not drop bearings.*

13. Remove rear internal gear to sun gear thrust bearing and two (2) races. See Figure 76-115.

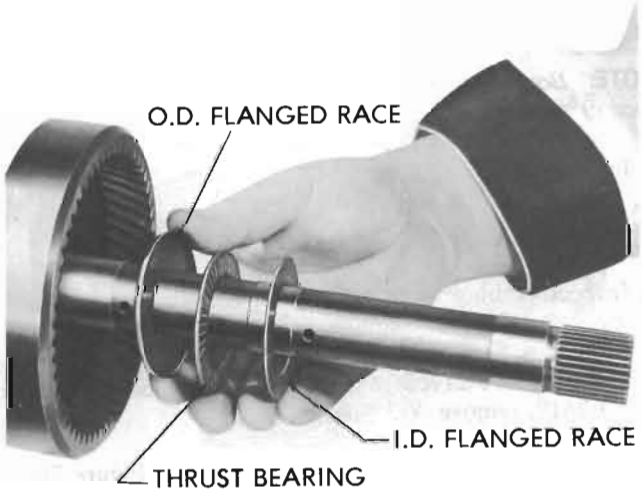


Figure 76-115

14. To remove mainshaft, remove the rear internal gear to mainshaft snap ring. See Figure 76-116.

B. Pinion Replacement Procedure

1. Support carrier assembly on its front face.

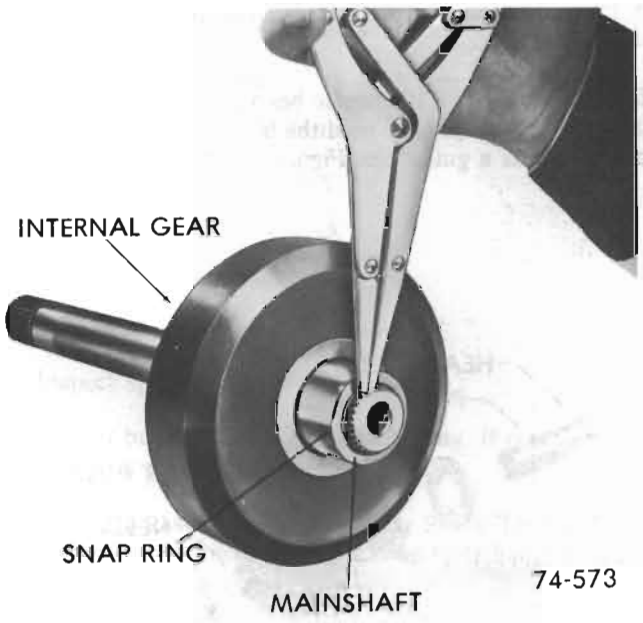


Figure 76-116

2. Using a 1/2 inch diameter drill, remove the stake marks from the end of the pinion pin, or pins, to be replaced. This will reduce the probability of cracking the carrier when pinion pins are pressed out.

CAUTION: *Do not allow drill to remove any stock from the carrier, as this will weaken the part and future failure would be probable.*

3. Using a tapered punch, drive or press the pinions out of the carrier. See Figure 76-117.

Figure 76-117

4. Remove pinions, thrust washers and needle roller bearings.

5. Inspect pinion pocket thrust faces for burrs and remove if present.

6. Install eighteen (18) needle bearings into each pinion, using petroleum jelly to hold the bearings in place. Use a pinion pin as a guide. See Figure 76-118.

Figure 76-118

7. Place a bronze and steel thrust washer on each side of pinion so steel washer is against pinion, hold them in place with petroleum jelly.

8. Place pinion assembly in position in the carrier and install a pilot shaft through the rear face of the assembly to hold the parts in place.

Figure 76-119

9. Drive a new pinion pin into place while rotating pinion from the front, being sure that the headed end is flush or below the face of the carrier. See Figure 76-119.

10. Place a large punch in a bench vise to be used as an anvil while staking the opposite end of the pinion pin in three places. See Figure 76-120.

Figure 76-120

NOTE: *Both ends of the pinion pins must lie below the face of the carrier or interference may occur.*

C. Inspection

Output Shaft

1. Inspect bushing for wear or galling. If replacement is necessary proceed as follows:

a. Thread Tool J-21465-16 into bushing using Slide Hammer J-2619, remove. See Figure 76-121.

b. Using Tool J-21465-1 install bushing. See Figure 76-122.

2. Inspect bearing and thrust washer surfaces for damage.

3. Inspect governor drive gear for rough or damaged teeth.

4. Inspect splines for damage.

5. Inspect orificed cup plug in the lubrication passage.

6. Inspect drive lugs for damage.

Inspection of Rear Internal Gear

1. Inspect gear teeth for damage or wear.

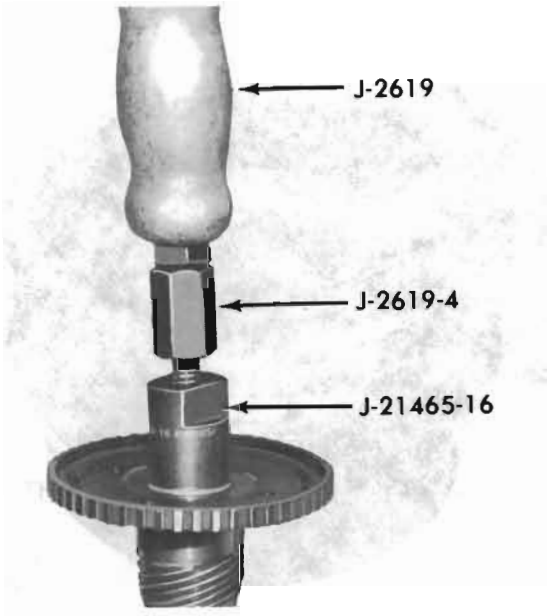


Figure 76-121

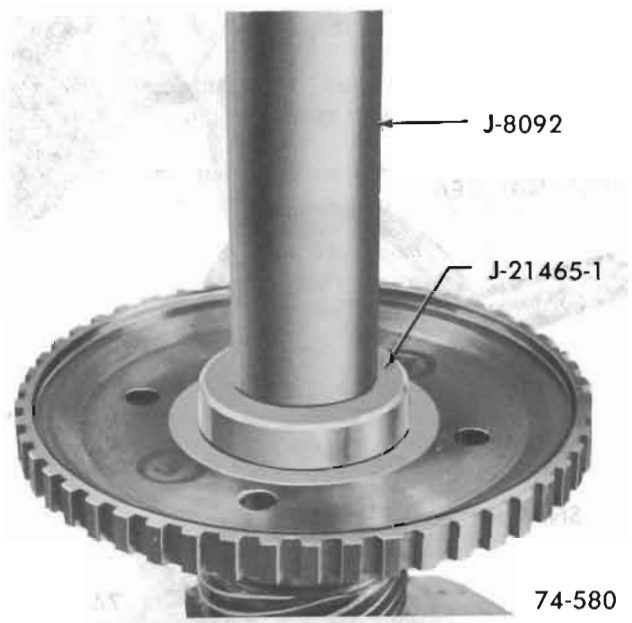


Figure 76-122

2. Inspect splines for damage.

3. Inspect gear for cracks.

D. Mainshaft–Inspection

1. Inspect shaft for cracks or distortion.

2. Inspect splines for damage.

3. Inspect ground bushing journals for damage.

4. Inspect snap ring groove for damage.

5. Be sure oil lubrication holes are open.

Inspection of Sun Gear

1. Inspect gear teeth for damage or wear.

2. Inspect splines for damage.

3. Inspect the gear for cracks.

Inspection of Sun Gear Shaft

1. Inspect shaft for cracks or splits.

2. Inspect splines for damage.

3. Inspect bushings for scoring or galling. If replacement is necessary proceed as follows:

a. Thread J-21465-15 into Sun Gear Shaft. Thread Slide Hammer J-2619 into remover. Clamp slide hammer handle into vise. Grasp sun gear shaft and remove bushing.

b. Using Installer J-21465-5 and Drive Handle 8092, install new bushing.

NOTE: *This procedure applies to bushings in both ends of shaft.*

4. Inspect ground bushing journals for damage.

5. Be sure the oil lubrication hole is open.

Inspection of reaction Carrier, Roller Clutch and Output Carrier Assembly

1. Inspect band surface on reaction carrier for signs of burning or scoring.

2. Inspect roller clutch outer race for scoring or wear. See Figure 76-123.

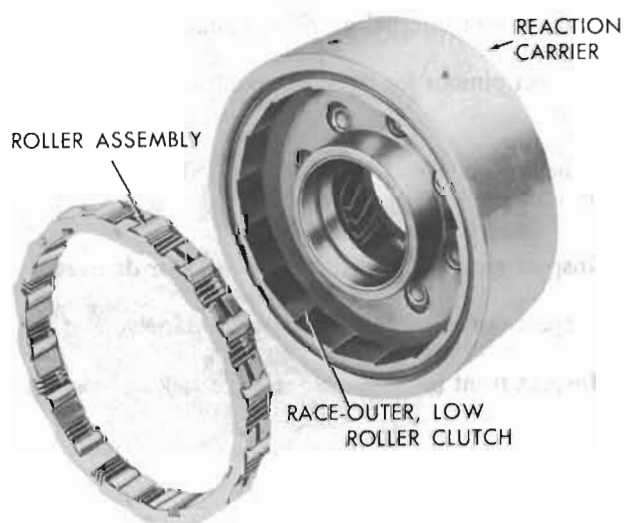


Figure 76-123

3. Inspect thrust washer surfaces for signs of scoring or wear.

4. Inspect bushing for damage. If bushing is damaged the reaction carrier must be replaced.

5. Inspect pinions for damage, rough bearings or excessive tilt.

6. Check pinion end play. Pinion end play should be .009" - .024". See Figure 76-124.

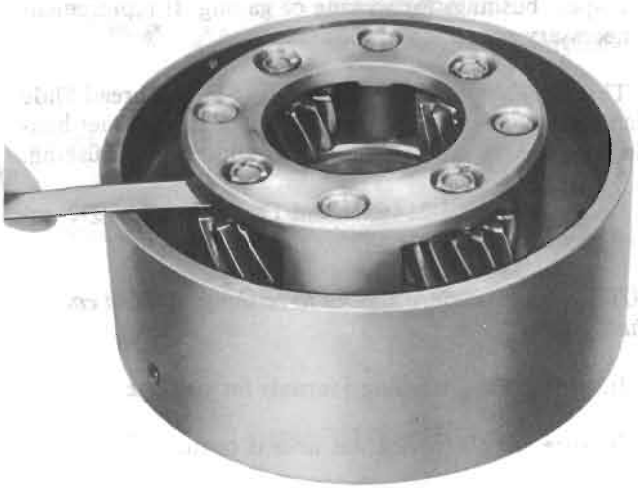


Figure 76-124

7. Inspect roller clutch for damaged members.

8. Inspect roller cage and retaining springs for damage.

9. Inspect front internal gear for damaged teeth.

10. Inspect pinions for damage, rough bearings or excessive tilt.

11. Check pinion end play. Pinion end play should be .009" - .024". See Figure 76-125.

12. Inspect parking pawl lugs for cracks or damage.

13. Inspect output locating splines for damage.

14. Inspect front internal gear ring for flaking or cracks.

E. Installation

Install rear internal gear on end of mainshaft having snap ring groove.

Install internal gear retaining snap ring. See Figure 76-126.

Figure 76-125

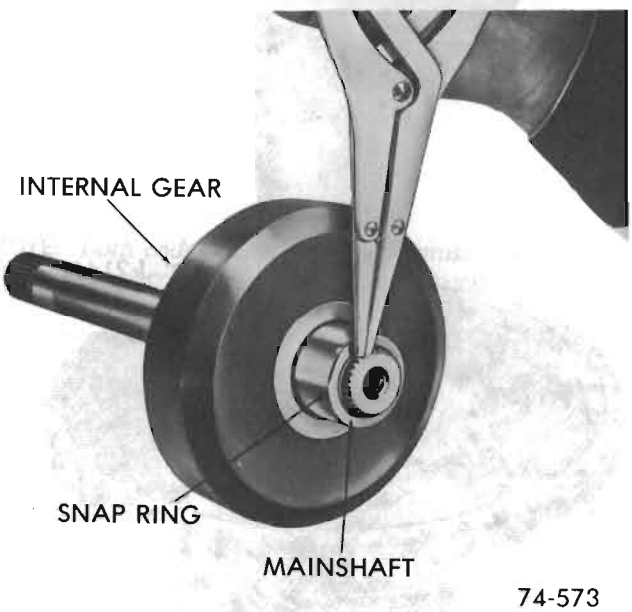


Figure 76-126

3. Install sun gear to internal gear thrust races and bearings against the inner face of the rear internal gear as follows: and retain with petroleum jelly. See Figure 76-127.

a. Place large race against the internal gear with flange facing forward or up.

b. Place thrust bearing against race.

c. Place small race against bearing with inner flange facing into the bearing or down.

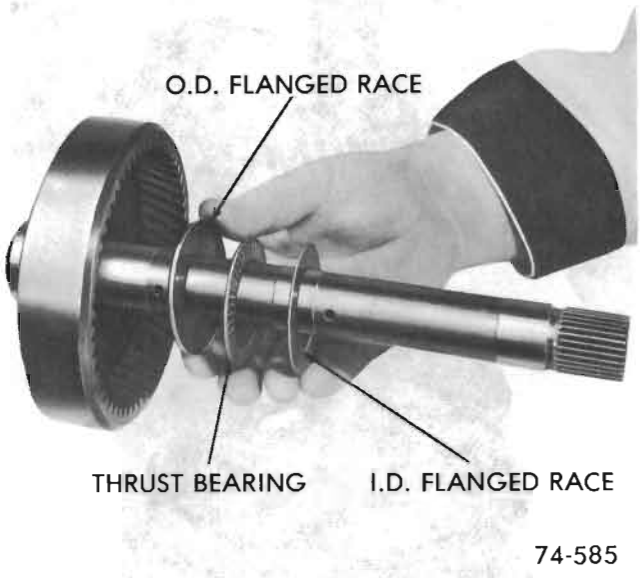


Figure 76-127

4. Install output carrier over the mainshaft so that the pinions mesh with rear internal gear.

5. Place above portion of "build-up" through hole in bench so that mainshaft hangs downward.

6. Install rear internal gear to output shaft thrust races and bearing as follows; and retain with petroleum jelly. See Figure 76-128.

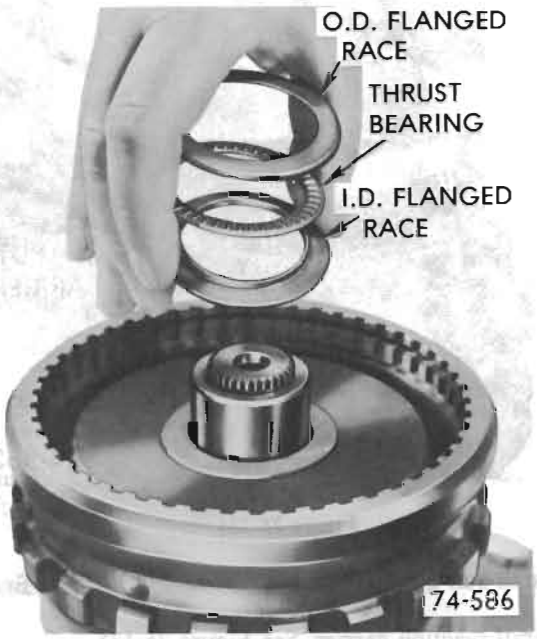


Figure 76-128

a. Place small diameter race against internal gear with center flange facing up.

b. Place bearing on race.

c. Place second race on bearing with outer flange cupped over bearing.

7. Install output shaft into output carrier assembly. See Figure 76-129.

Figure 76-129

8. Install output shaft to output carrier snap ring. See Figure 76-130.

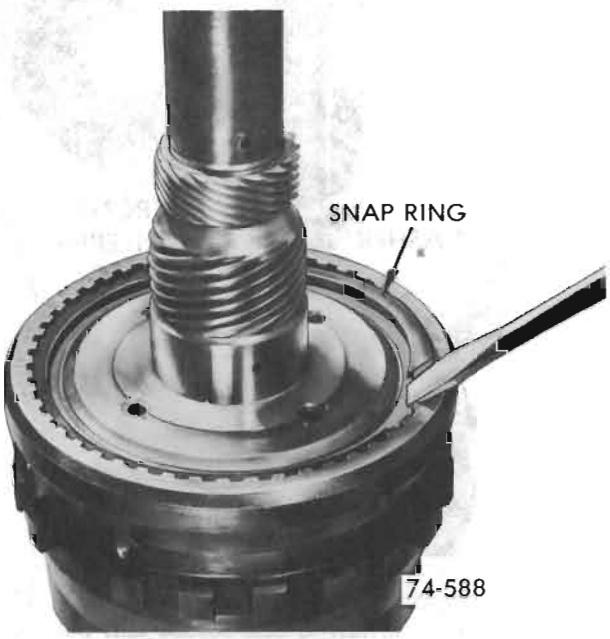


Figure 76-130

9. Lubricate with petroleum jelly and install output shaft to case thrust washer and turn unit over. See Figure 76-131.

Figure 76-131

10. Install output shaft "O" ring seal.

11. Lubricate with petroleum jelly and install reaction carrier to output carrier thrust washer with tabs facing down in pockets. See Figure 76-132.

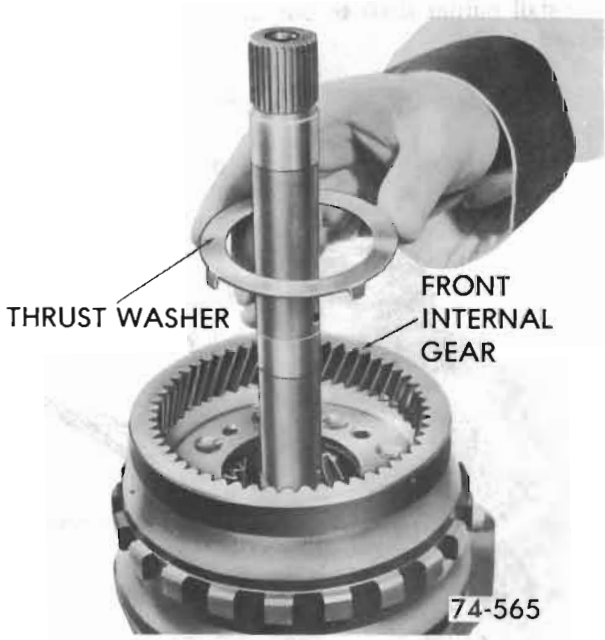


Figure 76-132

12. Install sun gear splines with inner chamfer down. See Figure 76-133.

Figure 76-133

13. Install gear ring over output carrier. See Figure 76-134.

Figure 76-134

14. Install sun gear shaft with longest splined- end first.

15. Install reaction carrier. See Figure 76-135.

NOTE: *When a new output carrier and/or reaction carrier is being installed, and if the front internal gear ring prevents assembly of the carriers, replace the front internal gear with the SERVICE ring.*

Figure 76-135

16. Lubricate with petroleum jelly and install center support to sun gear thrust races and bearing as follows: See Figure 76-136.

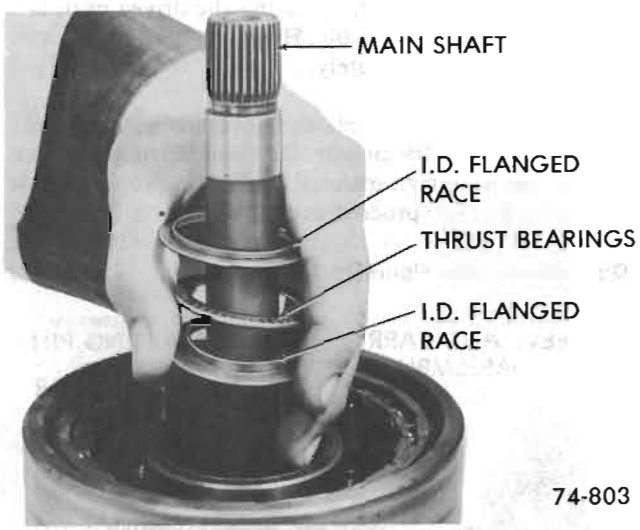


Figure 76-136

a. Install large race, center flange up over the sun gear shaft.

b. Install thrust bearing against race.

c. Install second race, center flange up.

17. Lubricate with petroleum jelly and install center support to reaction carrier thrust washer into recess in center support. See Figure 76-137.

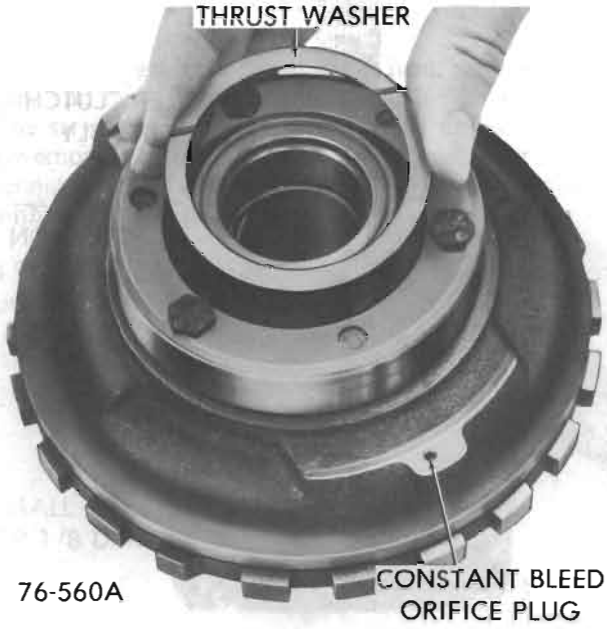


Figure 76-137

18. Install rollers in roller clutch cage, by compressing energizing spring with forefinger and inserting roller from outer side. See Figure 76-138.

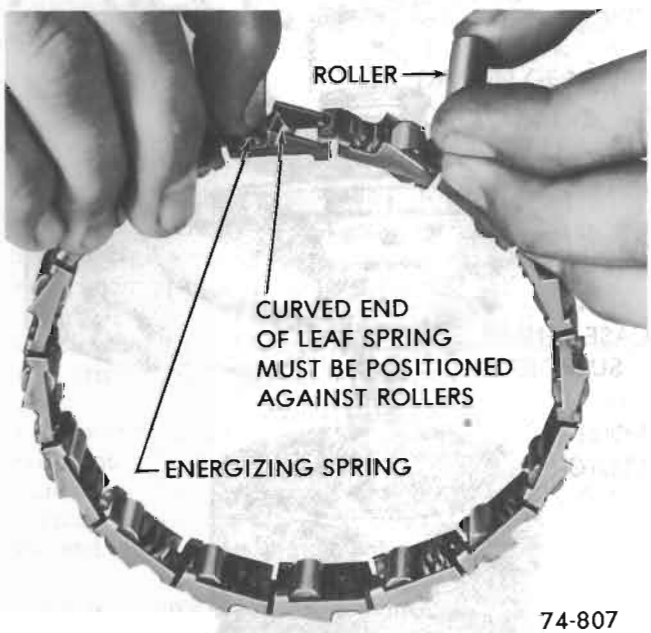


Figure 76-138

NOTE: *Make certain that energizing springs are not distorted, and that curved end of leaf of springs are positioned against rollers.*

19. Install roller clutch assembly into reaction carrier. See Figure 76-139.

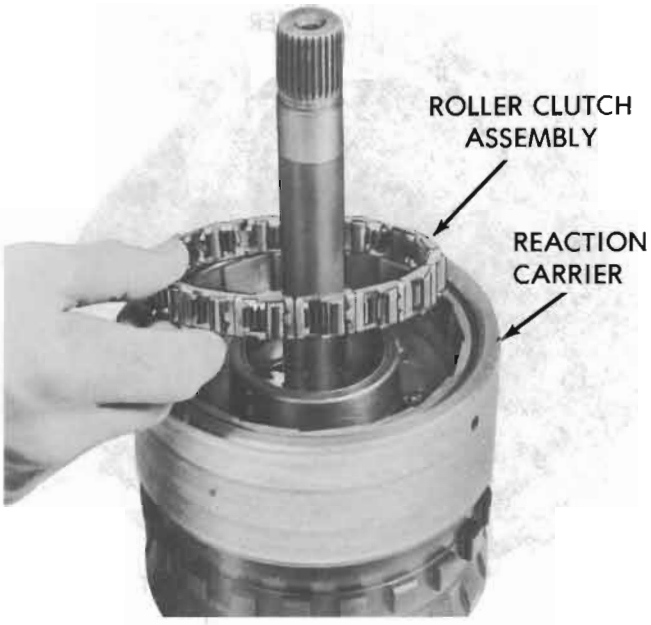


Figure 76-139

20. Install center support into roller clutch in reaction carrier. See Figure 76-140.

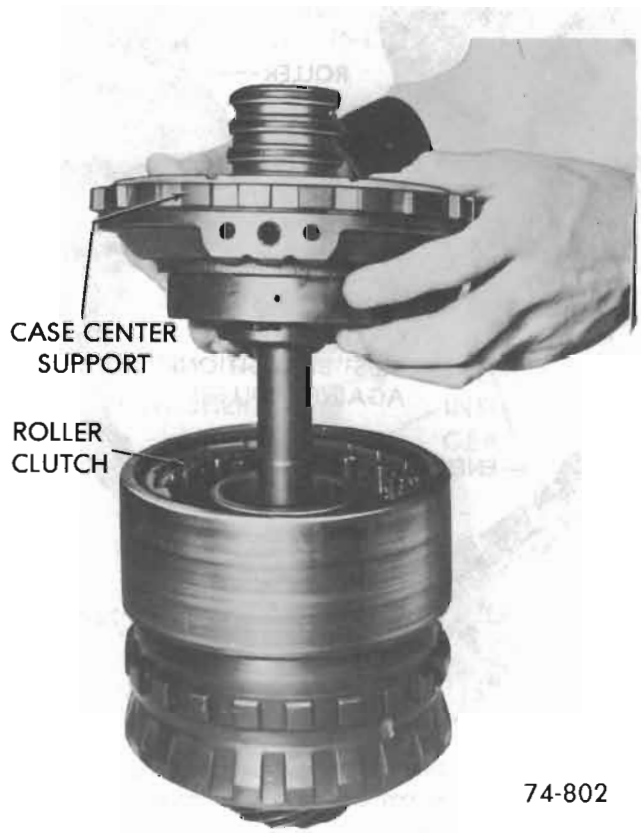


Figure 76-140

NOTE: *With reaction carrier held, center support should turn counterclockwise only. See Figure 76-141.*

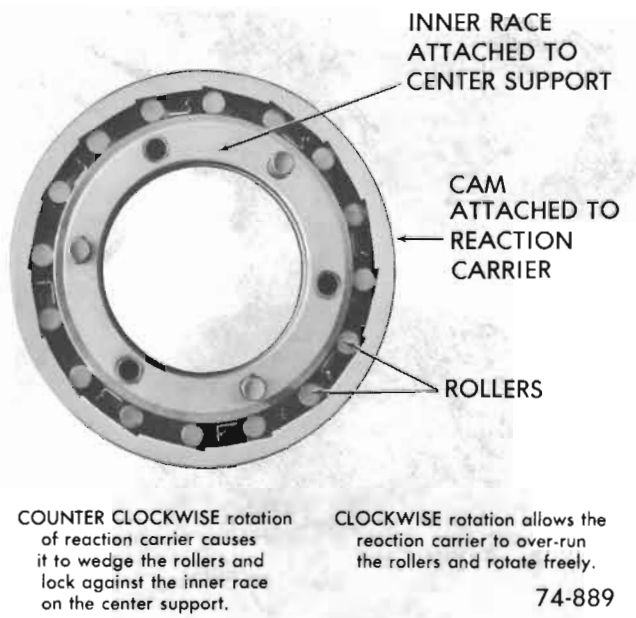


Figure 76-141

76-24 GOVERNOR ASSEMBLY

All components of the governor assembly, with the exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including the driven gear, is serviced as a complete assembly. However, the driven gear can also be serviced separately.

It is necessary to disassemble the governor assembly in order to replace the driven gear. Disassembly may also be necessary due to foreign material causing improper operation. In such cases, proceed as follows:

A. Disassembly (See Figure 76-142)

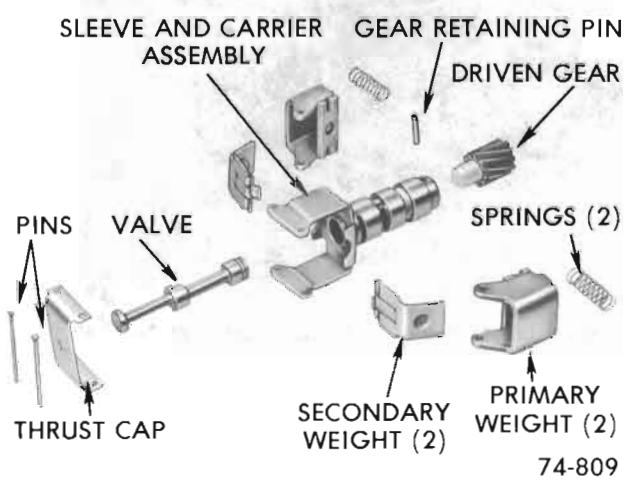


Figure 76-142

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified.

2. Remove governor valve from governor sleeve. Be careful not to damage valve.

3. Perform the following inspections and replace governor driven gear, if necessary.

B. Inspection

1. Wash all parts in cleaning solvent, air dry and blow out all passages.

2. Inspect governor sleeve for nicks, burrs, scoring or galling.

3. Check governor sleeve for free operatin in bore of transmission case.

4. Inspect governor valve for nicks, burrs, scoring or galling.

5. Check governor valve for free operation in bore of governor sleeve.

6. Inspect governor driven gear for nicks, burrs, or damage.

7. Check governor driven gear for looseness on governor sleeve.

8. Inspect governor weight springs for distortion or damage.

9. Check governor weights for free operation in their retainers.

10. Check valve opening at entry (.020 inch minimum) with a feeler gage, holding governor as shown in Figure 76-143, with governor weights extended completely outward. For exhaust (.020" minimum) governor weights must be completely inward.

Figure 76-143

C. Governor Driven Gear Replacement

To facilitate governor repair in the field, governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retainer split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch or 1/8" drill rod. See Figure 76-144.

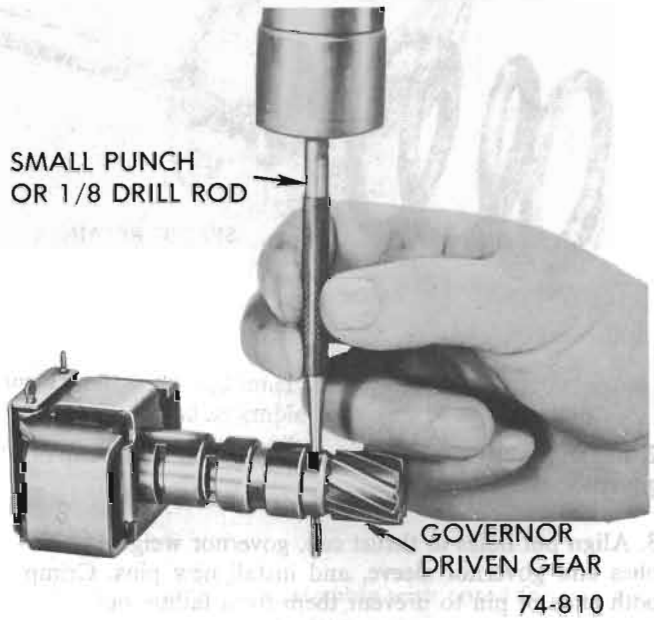


Figure 76-144

2. Support governor on 7/64 inch plates installed in exhaust slots of governor sleeve, place in press, and with a long punch, press gear out of sleeve.

3. Carefully clean governor sleeve of chips that remain from original gear installation.

4. Support governor on 7/64 inch plates, installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.

5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90 degrees from existing hole, center punch, and then while supporting governor in press, drill new hole through sleeve and gear using a standard (1/8 inch) drill.

6. Install retaining pin.

7. Wash governor assembly thoroughly to remove any chips that may have collected.

D. Assembly (See Figure 76-142)

1. Install governor valve in bore of governor sleeve.

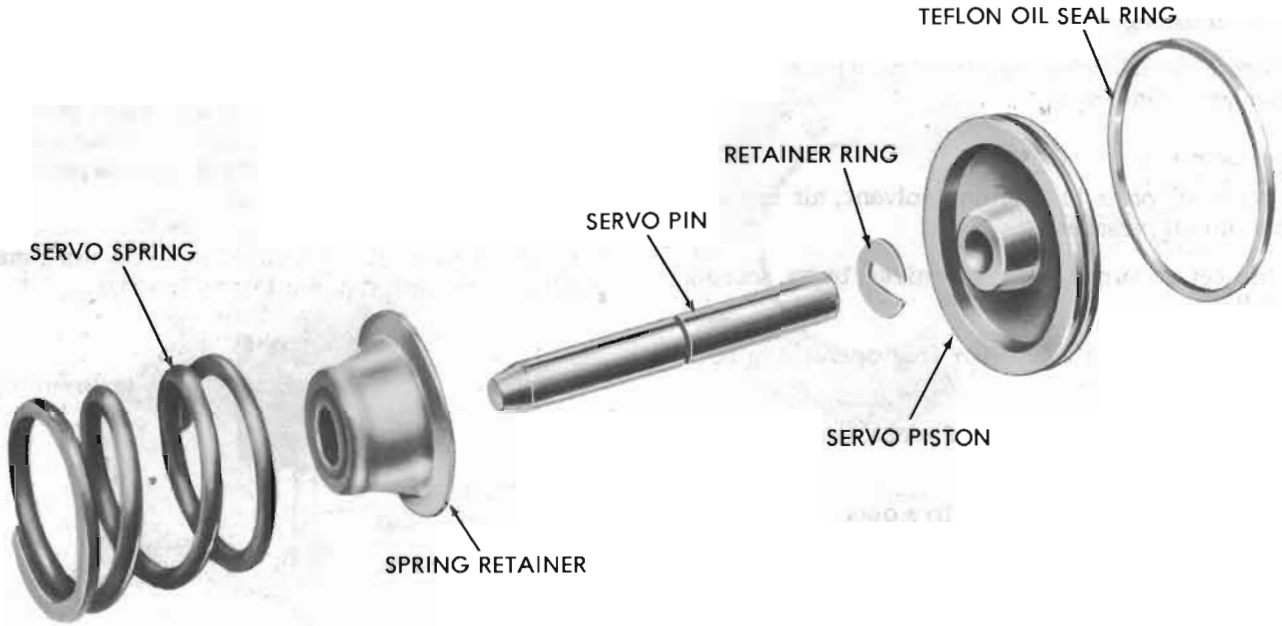


Figure 76-145

2. Install governor weights and springs, and thrust cap on governor sleeve.

3. Align pin holes in thrust cap, governor weight assemblies and governor sleeve, and install new pins. Crimp both ends of pin to prevent them from falling out.

4. Check governor weight assemblies for free operation on pins and governor valve for free operation in governor sleeve.

76-25 FRONT SERVO INSPECTION

NOTE: *See Figure 76-145. Do not remove the teflon oil seal ring from the front servo piston, unless the oil seal ring requires replacement. For Service, the oil seal ring will be aluminum.*

CAUTION: *The spring retainer, servo pin, retainer ring, and servo piston are new for 1971. These individual parts are not interchangeable with the pre-1971 parts.*

1. Inspect servo pin for scores and cracks. See Figure 76-145.

2. Inspect piston and oil seal ring for damage.

3. Check fit of servo pin in piston.

76-26 REAR SERVO ASSEMBLY

A. Disassembly

1. Remove rear accumulator piston from rear servo piston.

2. Remove "E" ring retaining rear servo piston to band apply pin. See Figure 76-146.

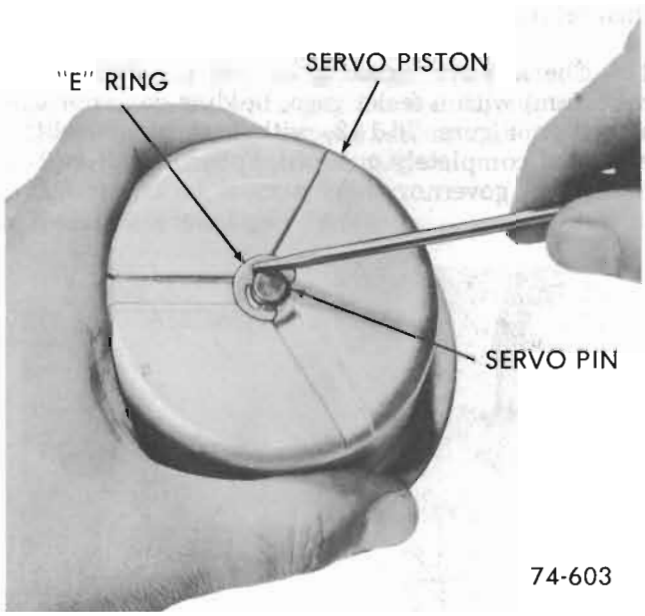


Figure 76-146

3. Remove rear servo piston and seal from band apply pin. See Figure 76-147.

B. Inspection

1. Inspect freedom of accumulator ring in piston.

2. Inspect fit of band apply pin in servo piston.

Figure 76-147

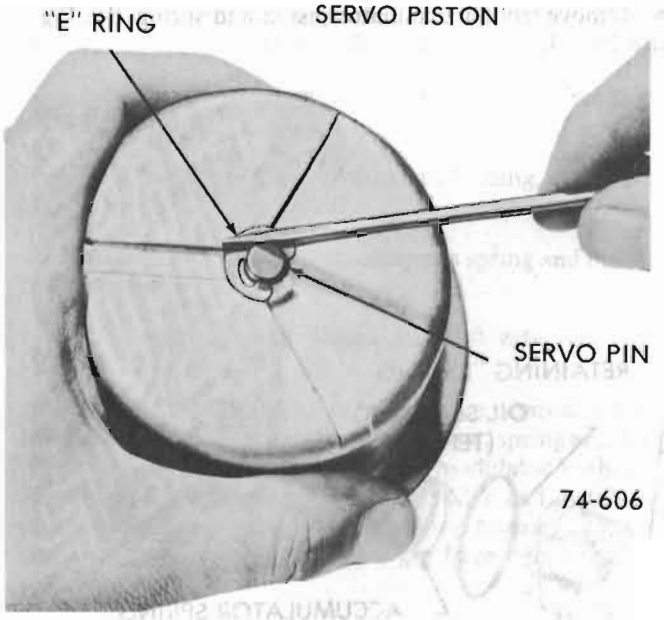


Figure 76-149

3. Inspect band apply pin for scores and cracks.

C. Reassembly

1. Install spring retainer, spring and washer on band apply pin. See Figure 76-148.

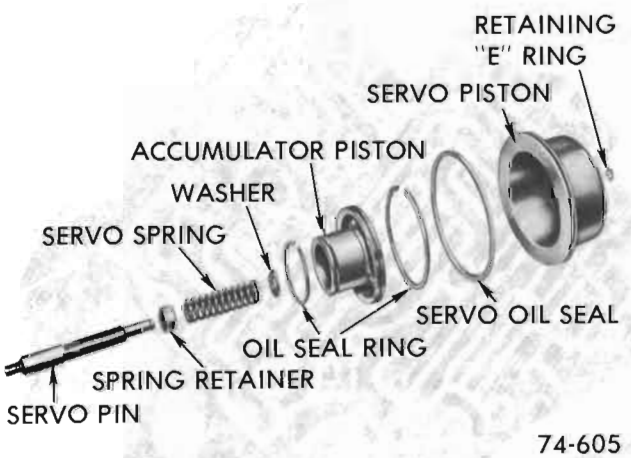


Figure 76-148

NOTE: *If new pin is required, install here.*

2. Install band apply pin retainer, spring and washer into bore of servo piston and secure with "E" ring. See Figure 76-149.

3. Install oil seal ring on servo piston, if removed.

4. Install outer and inner oil rings on accumulator piston, if removed, and assemble into bore of servo piston.

76-27 VALVE BODY ASSEMBLY

A. Disassembly

1. Position valve body assembly with cored face up and servo pocket nearest operator.

2. Remove manual valve from upper bore.

3. Install special Tool J-21885 on accumulator piston and remove retaining "E" ring. See Figure 76-150.

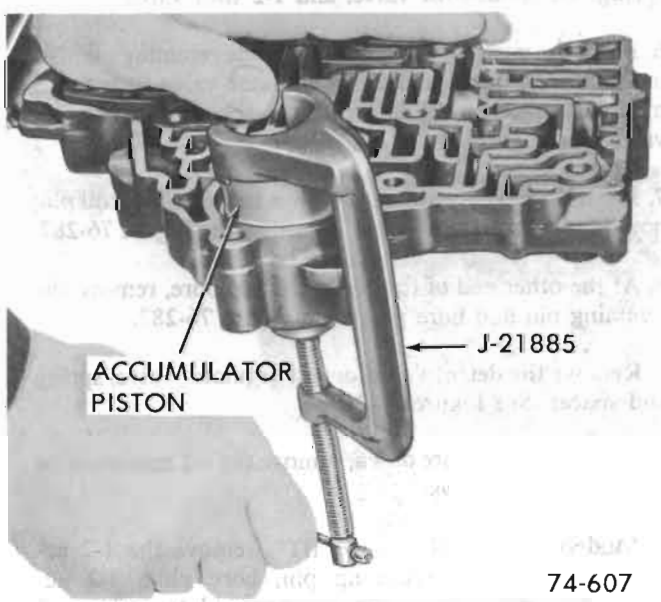


Figure 76-150

4. Remove front accumulator piston and spring. See Figure 76-151.

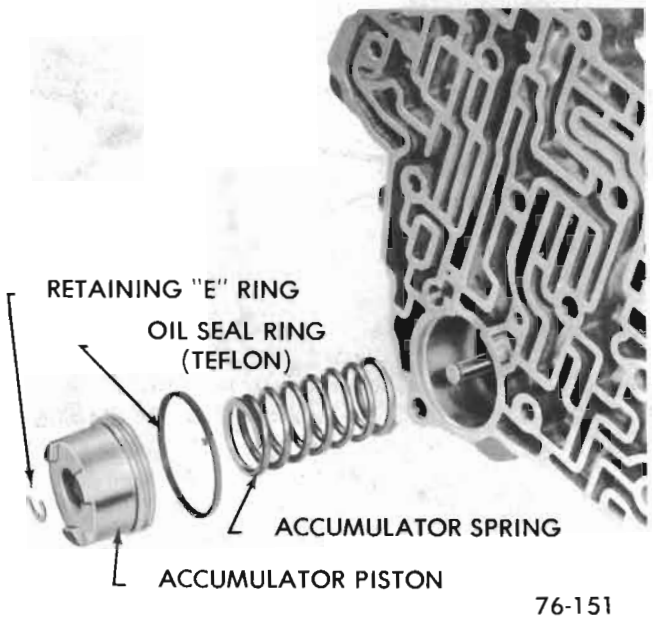


Figure 76-151

5. On the right side, top bore, remove 1-2 valve train as follows:

a. Model "BC", remove the retaining pin, 1-2 modulator bushing, 1-2 regulator valve, 1-2 regulator spring, 1-2 detent valve, and 1-2 shift valve. See Figure 76-287.

b. Models "BS", "BB", "BT", and "OW" remove the retaining pin, 1-2 modulator bushing, 1-2 modulator valve spring, 1-2 modulator valve, and 1-2 shift valve.

6. From the next bore down, remove the retaining pin; 2-3 modulator bushing, and 2-3 modulator valve spring, 2-3 modulator valve, 3-2 intermediate spring and the 2-3 valve. See Figure 76-287.

7. From the next bore down, remove the retaining roll pin, bore plug, spacer, spring and 3-2 valve. See Figure 76-287.

8. At the other end of the assembly, top bore, remove the retaining pin and bore plug. See Figure 76-287.

9. Remove the detent valve, detent regulator valve, spring and spacer. See Figure 76-287.

10. From the next bore down, remove the 1-2 accumulator valve train as follows:

a. Models "BS", "BC", and "BT", remove the 1-2 accumulator grooved retaining pin, bore plug, 1-2 accumulator secondary spring, 1-2 accumulator valve, 1-2 accumulator bushing, 1-2 primary accumulator valve, and 1-2 accumulator primary spring. See Figure 76-287.

b. Models "BB" and "OW", remove 1-2 accumulator grooved retaining pin, bore plug, 1-2 accumulator secondary spring, and 1-2 accumulator valve. See Figure 76-287.

B. Inspection

NOTE: *See Figure 76-151. Do not remove the teflon oil seal ring from the front accumulator piston, unless the oil seal ring requires replacement. For service, the oil seal ring will be cast iron.*

CAUTION: *The front accumulator piston is new for 1971, and it is not interchangeable with the pre-1971 piston.*

1. Inspect all valves for scoring, cracks and free movement in their respective bores.

2. Inspect the body for cracks, scored bores, interconnected oil passages and flatness of mounting face.

3. Check all springs for distortion or collapsed coils.

4. Inspect piston and oil seal ring for damage.

C. Reassembly

1. Install front accumulator spring and piston into valve body.

2. Install special Tool J-21885 and compress spring and piston. Secure with retaining "E" ring. See Figure 76-153.

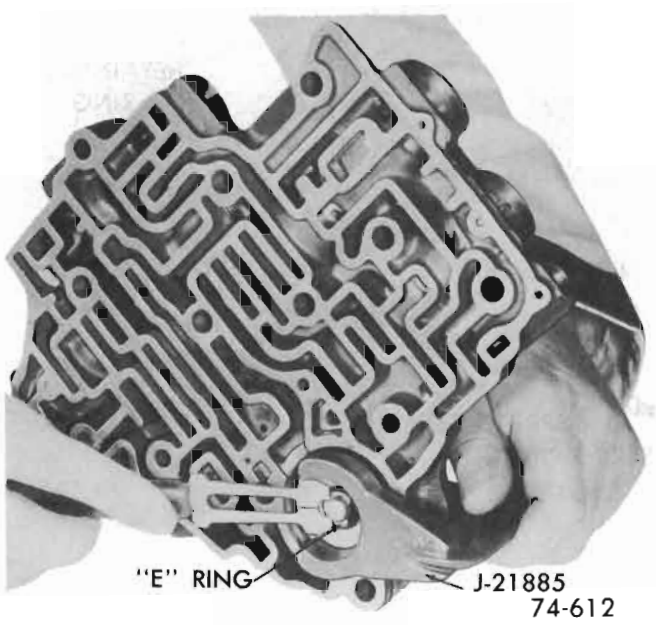


Figure 76-153

NOTE: *Align piston and ring when entering bore.*

3. Install the 1-2 accumulator valve train into lower left bore as follows:

a. Models "BS", "BC", and "BT", install the 1-2 accumulator primary spring and primary valve into the valve bore using a retaining pin to temporarily hold the spring and valve in their operating position. Install the 1-2 accumulator valve, stem end out, and the 1-2 accumulator secondary spring into the 1-2 accumulator bushing. Install the bushing into the bore and, using the bore plug, compress the spring until the grooved retaining pin can be inserted from the cast surface side of the valve body with the grooved end entering the pin hole last. Tap the retaining pin with a hammer until the pin is flush with the cast surface side of the valve body. Remove the temporary retaining pin.

b. Models "BB" and "OW", install the 1-2 accumulator valve, stem end out, and the 1-2 accumulator secondary spring. Install the bore plug and install the grooved retaining pin from cast surface side of the valve body with grooved end entering the pin hole last. Tap the retaining pin with a hammer until the pin is flush with the cast surface side of the valve body.

4. In the next bore up, install the detent spring and spacer. Compress spring and secure with small screwdriver. See Figure 76-154.

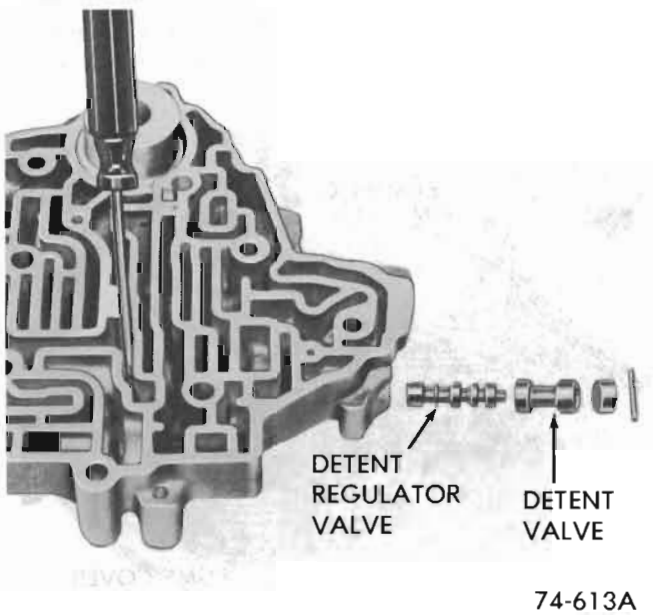


Figure 76-154

5. Install the detent regulator valve. Wide land first. See Figure 76-154.

6. Install the detent valve, narrow land first. See Figure 76-154.

7. Remove the screwdriver as the bore plug (hole out) and retaining pin are installed. See Figure 76- 154.

8. In the lower right hand bore, install the 3-2 valve. See Figure 76-287.

9. Install the spacer, spring bore plug (hole out) and retaining pin. See Figure 76-287.

10. In the next bore up, install the 2-3 valve, stem end out, and 3-2 intermediate spring. See Figure 76- 287.

11. Install the 2-3 modulator valve into bushing. See Figure 76-287.

12. Install the 2-3 modulator valve and bushing, into valve body bore. See Figure 76-287.

13. Install the 2-3 valve spring, compress spring and install retaining pin.

14. In the next bore up, install 1-2 shift valve train as follows:

a. Model "BC", install the 1-2 shift valve, stem end out. Install 1-2 regulator valve, larger stem first, spring and 1-2 detent valve, hole end first, into 1- 2 modulator bushing, aligning spring in bore of 1-2 detent valve and install in upper right bore of valve body. Compress bushing, against spring and secure with retaining pin from cored side of valve body.

b. Models "BS", "BB", "BT", and "OW", install the 1- 2 shift valve, stem end out. Install the 1-2 modulator spring and 1-2 modulator valve into the 1-2 modulator bushing. Install parts into upper right bore of valve body. Compress bushing against spring and secure with retaining pin from cored side of valve body.

15. Install the manual valve with detent pin groove to the right. See Figure 76-287.

76-28 OIL PUMP ASSEMBLY

A. Disassembly

1. Place pump assembly through hole in bench.

2. Compress the regulator boost valve bushing against the pressure regulator spring and remove the snap ring using J-5403 pliers. See Figure 76-155.

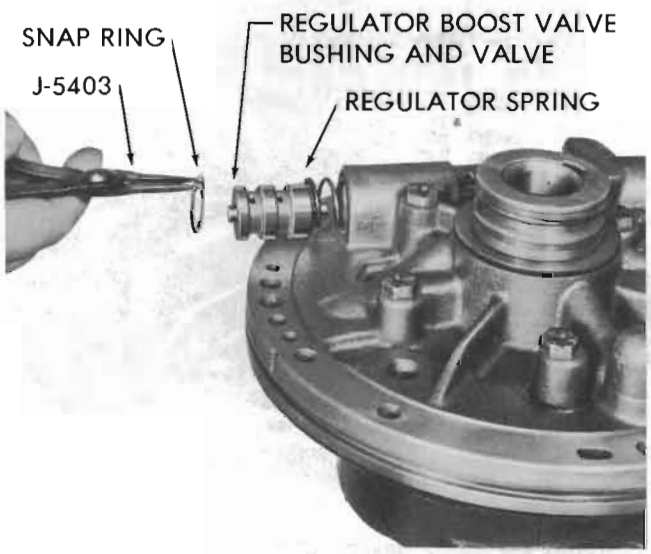


Figure 76-155

3. Remove the regulator boost valve bushing and valve.

4. Remove the pressure regulator spring.

5. Remove the regulator valve, spring retainer and spacer(s), if present. See Figure 76-156.

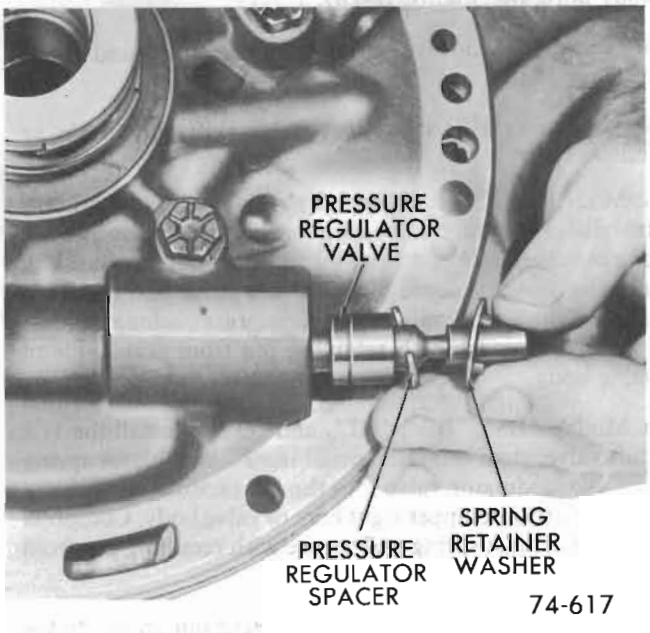


Figure 76-156

6. Remove the pump cover to body attaching bolts. See Figure 76-157.

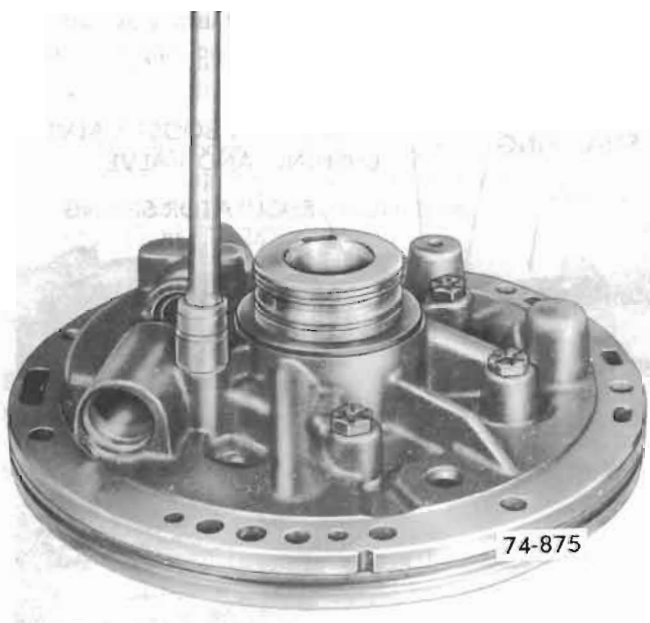


Figure 76-157

7. Remove pump cover from body. See Figure 76- 158.

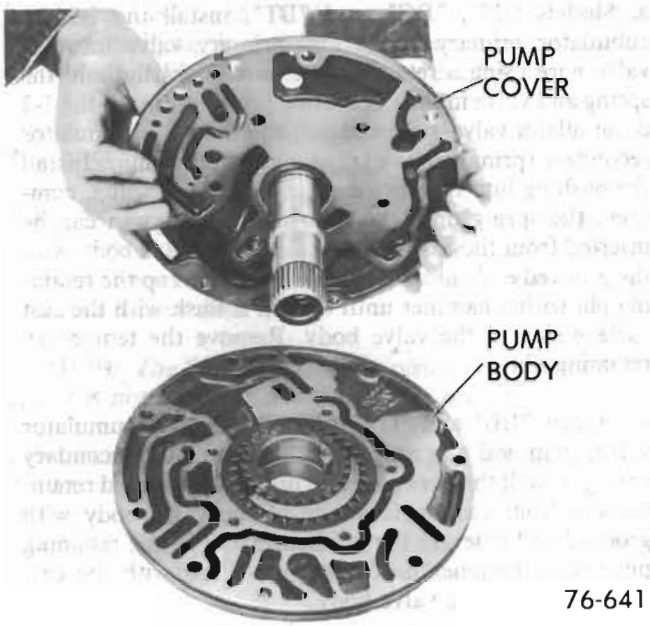


Figure 76-158

8. Remove the retaining pin and bore plug from the pressure regulator bore. See Figure 76-159.

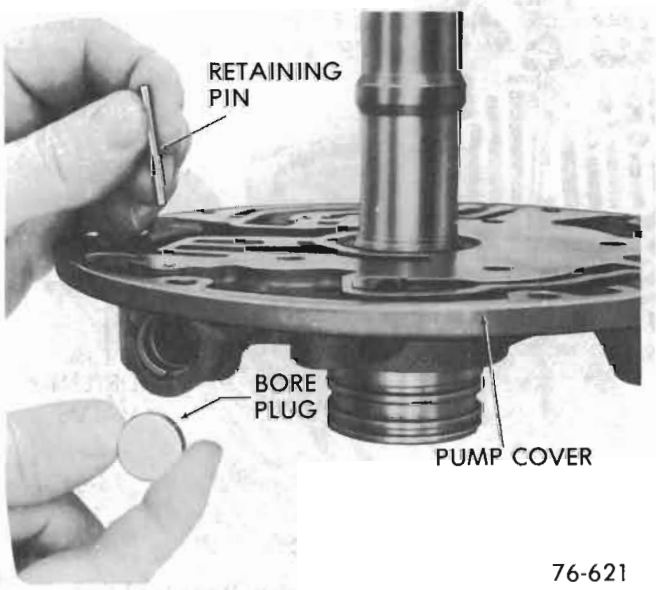


Figure 76-159

9. Remove two hook type oil rings from the pump cover. See Figure 76-160.

10. Remove the pump to forward clutch housing selective washer.

11. Mark drive and driven gears for reassembly in same position and remove drive gear. See Figure 76- 161.

Figure 76-160

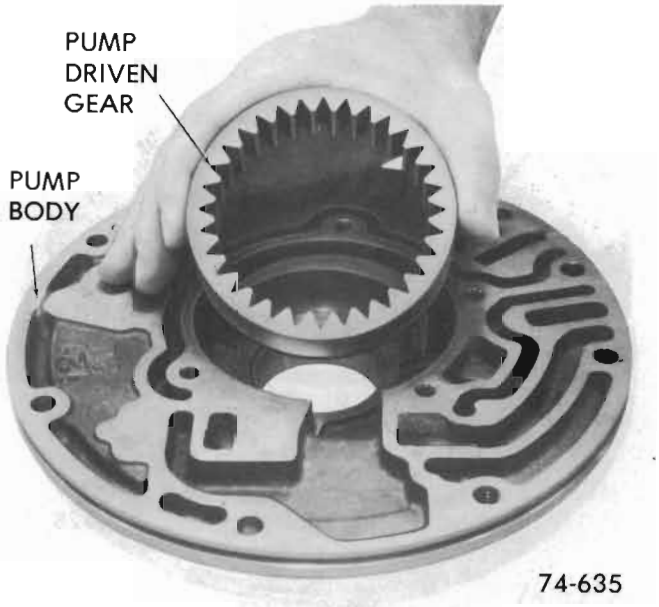


Figure 76-162

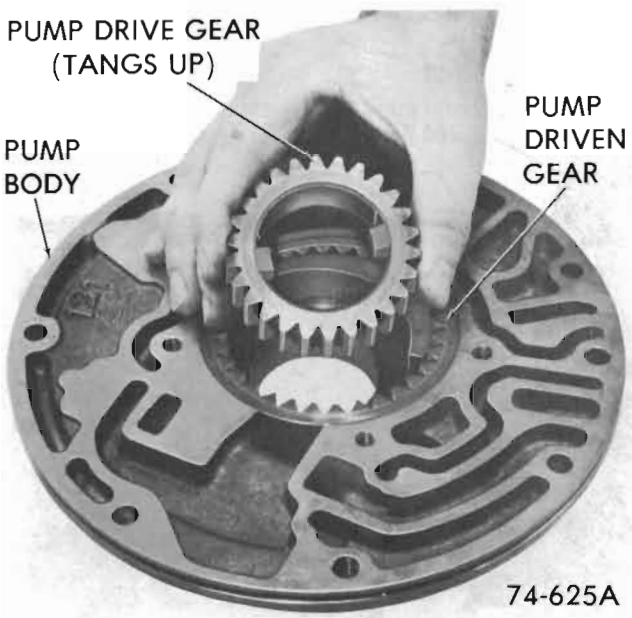


Figure 76-161

12. Remove driven gear from pump body. See Figure 76-162.

B. Inspection

NOTE: *The 1971 solid type pressure regulator valve does not contain oil holes and an orifice cup plug like the previous pressure regulator valve. The solid style valve must only be used in the pump cover with the squared off pressure regulator boss (pressure boost bushing end). See Figure 76-160A. The previous pressure regulator valve with the oil holes and orifice cup plug will be used to service either type pump cover.*

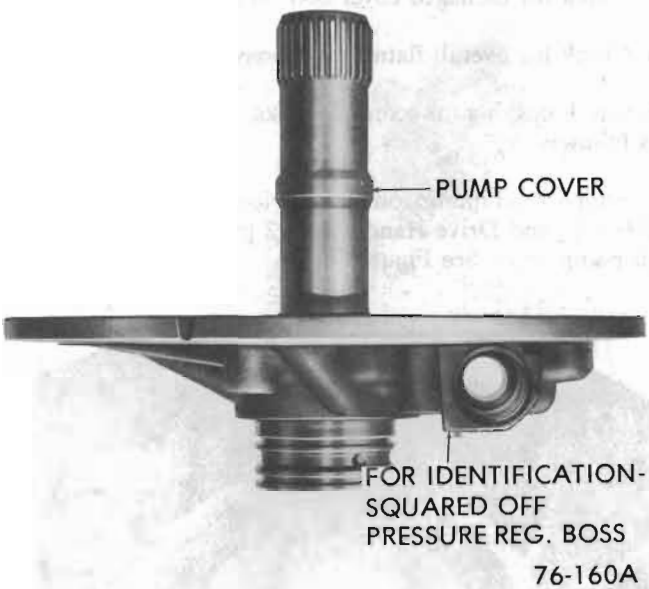


Figure 76-160A

1. Inspect the gear pocket and crescent for scoring, galling or other damage.

2. Place pump gears in pump and check the following clearance.

a. Pump body face to gear face clearance. Clearance should be .0008" - .0035". See Figure 76-163.

Figure 76-163

3. Check face of pump body for scores or nicks.

4. Check oil passages. See Figure 76-9.

5. Check for damaged cover bolt attaching threads.

6. Check for overall flatness of pump body face.

7. Check bushing for scores or nicks. If damaged replace as follows:

a. Support oil pump on wood blocks. Using Tool J-21465-17 and Drive Handle J-8092 press bushing out of oil pump body. See Figure 76-164.

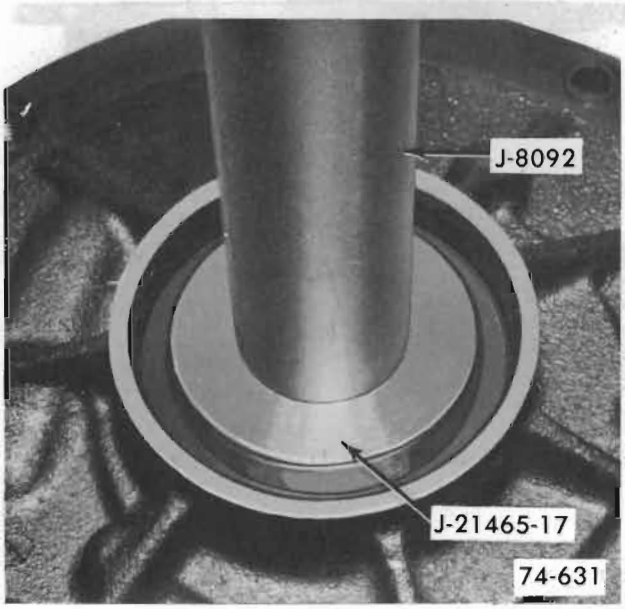


Figure 76-164

b. Using Tool J-21465-17 drive bushing into pump body from gear pocket face until it is flush to .010 below machined surface.

8. Inspect the pump attaching bolt seals for damage, replace if necessary.

9. Inspect pump cover face for overall flatness.

10. Check for scores or chips in pressure regulator bore.

11. Check that all passages are open and not interconnected. See Figure 76-8.

12. Check for scoring or damage at pump gear face.

13. Inspect stator shaft for damaged splines or scored bushings.

If replacement of bushing is necessary proceed as follows:

a. Thread J-21465-15 into stator shaft bushing. Thread Slide Hammer J-2619 into remover. Clamp slide hammer handle into vise. Grasp stator shaft and remove bushing. See Figure 76-165.

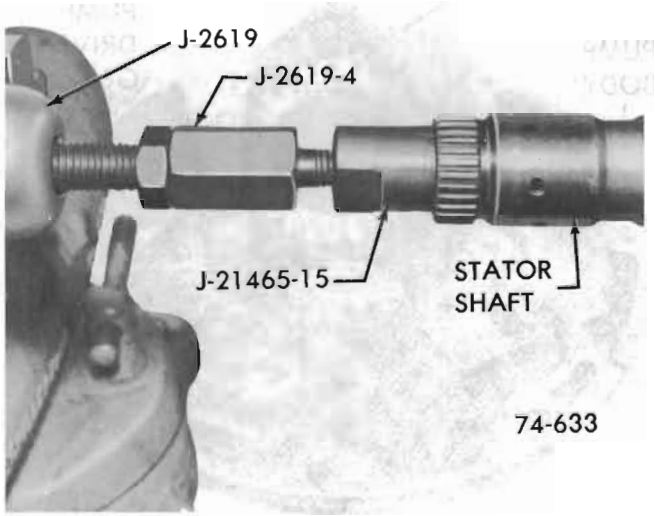


Figure 76-165

b. Using Installer J-21465-3 install bushing in front of shaft. See Figure 76-166.

c. See Figure 76-166 for installation of bushing in rear of shaft.

14. Inspect oil ring grooves and rings for damage or wear.

15. Inspect selective washer thrust face for wear or damage.

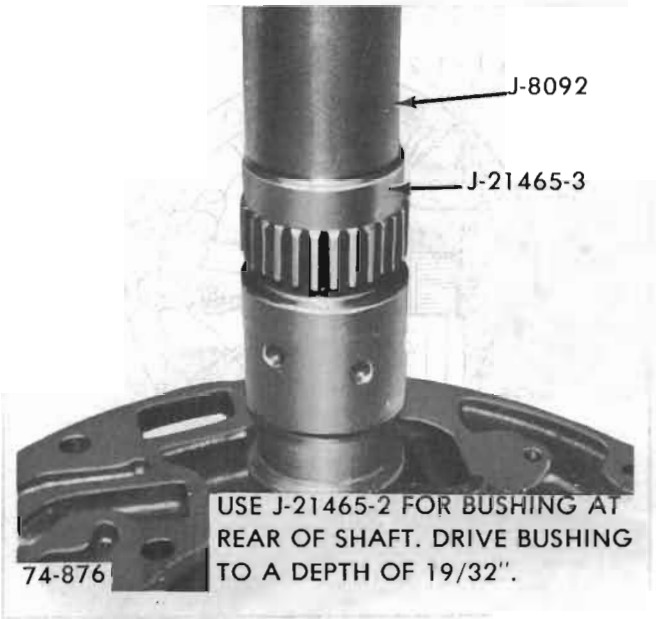


Figure 76-166

16. Inspect pressure regulator and boost valve for free operation.

C. Reassembly

1. Install drive and driven pump gears into the pump body with alignment marks up. See Figures 76- 167 and 76-168.

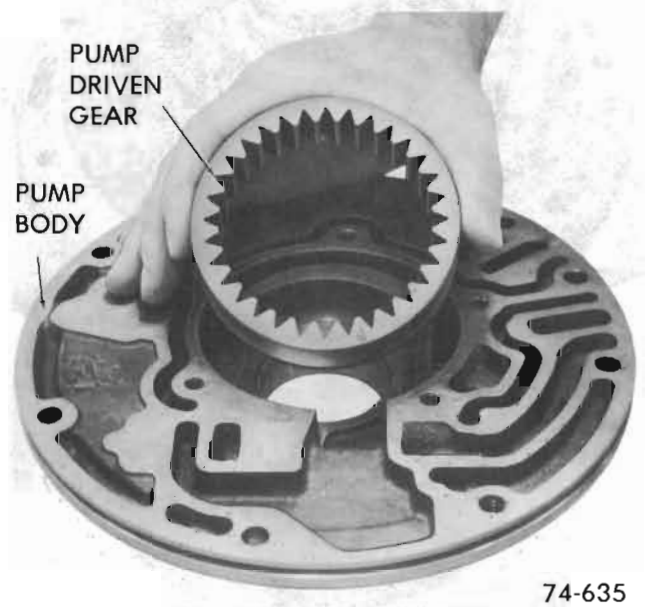


Figure 76-167

CAUTION: *Install the drive gear with drive tangs up.*

2. Install pressure regulator spring retainer, spacer(s) if used, and spring into the pressure regulator bore. See Figure 76-169.

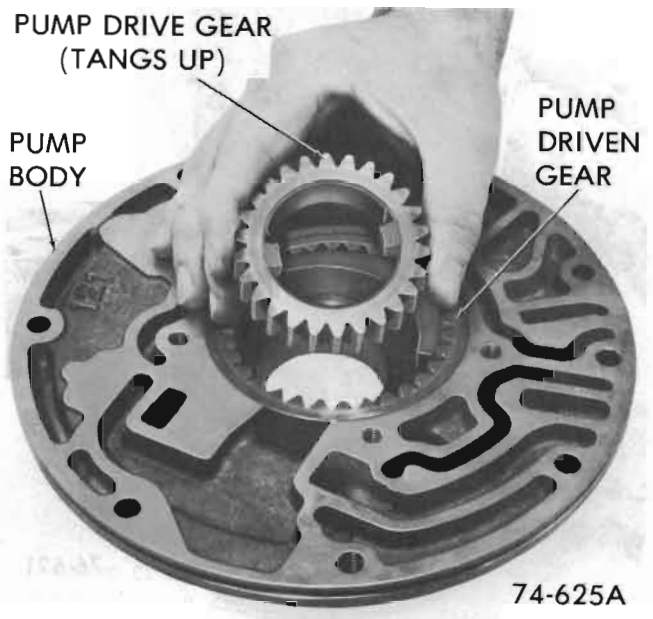


Figure 76-168

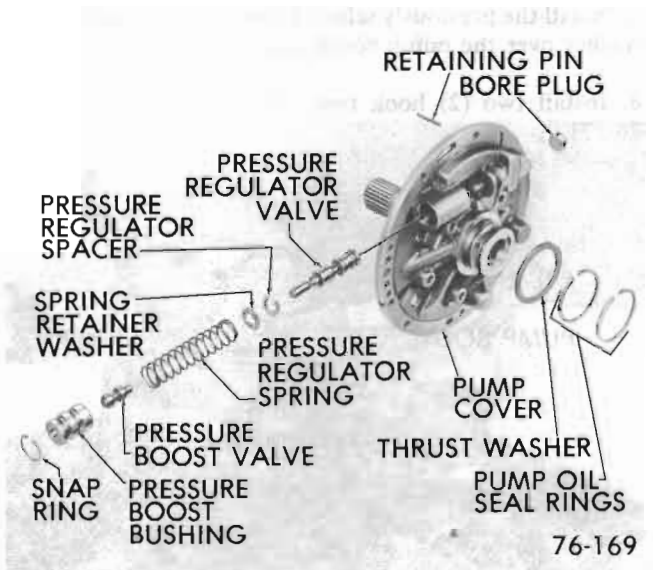


Figure 76-169

3. Install the pressure regulator valve from opposite end of bore, stem end first.

4. Install the boost valve into the bushing, stem end out, and install both parts into the pump cover by compressing the bushing against the spring.

5. Install the retaining snap ring.

6. Install the pressure regulator valve bore plug and retaining pin into opposite end of bore. See Figure 76-170.

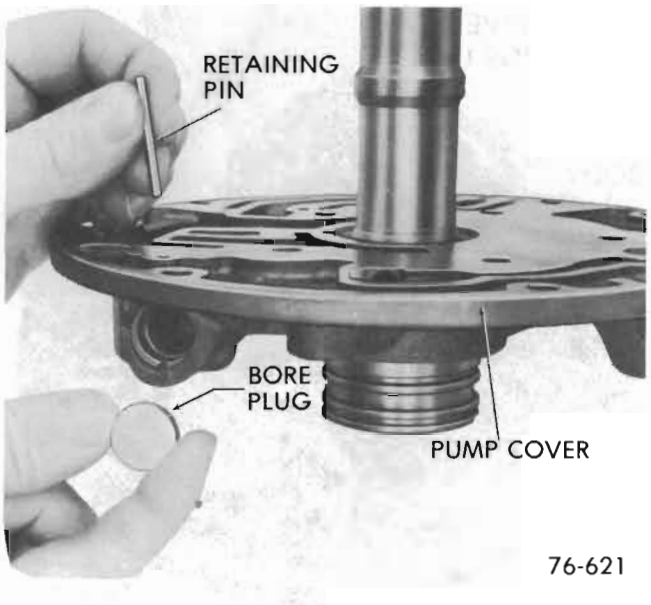


Figure 76-170

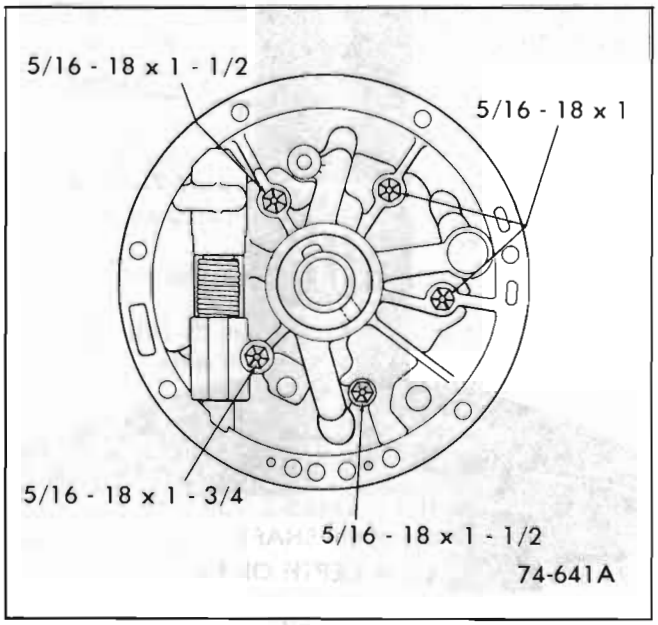


Figure 76-173

7. Install the previously selected front unit selective thrust washer over the pump cover delivery sleeve.

8. Install two (2) hook type oil seal rings. See Figure 76-171.

Figure 76-171

9. Assembly pump cover to pump body.

10. Install bolts as shown in Figure 76-173.

NOTE: *Leave bolts one turn loose at this time.*

11. Place Pump Aligning Strap, J-21368, over pump body and cover, and tighten tool. See Figure 76-174.

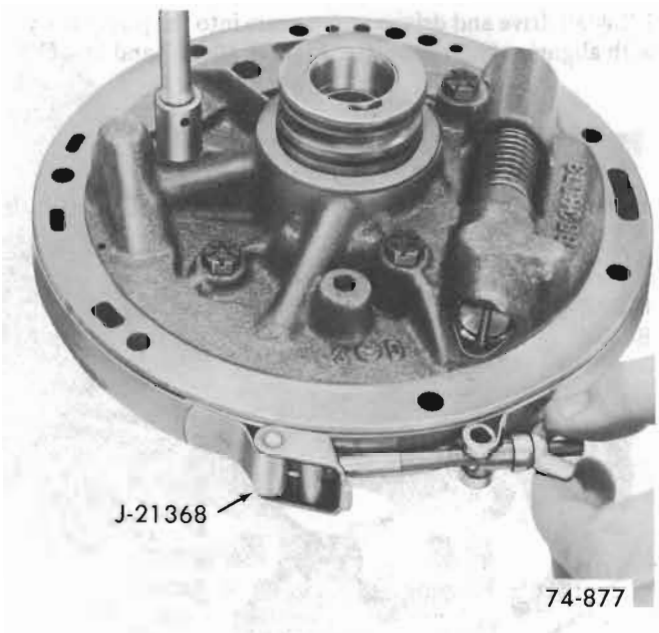


Figure 76-174

12. Tighten pump cover bolts. Torque to 15- 20 lb.ft.

13. Install pump to case "O" ring seal.

76-29 FORWARD CLUTCH ASSEMBLY

A. Disassembly

1. Place forward clutch and turbine shaft in hole in bench

and remove the forward clutch housing to direct clutch hub snap ring. See Figure 76-175.

Figure 76-175

2. Remove the direct clutch hub. See Figure 76- 176.

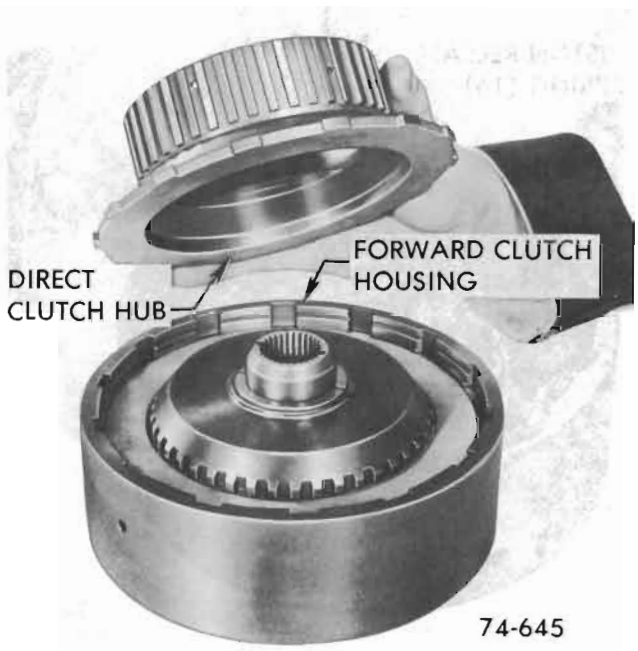


Figure 76-176

3. Remove the forward clutch hub and thrust washers. See Figure 76-177.

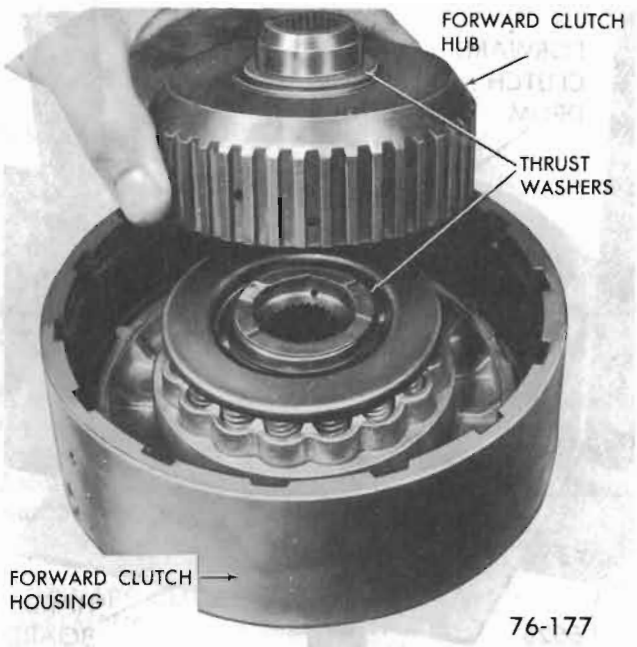


Figure 76-177

4. Remove five (5) radial groove composition and five (5) steel clutch plates. See Figure 76-178.

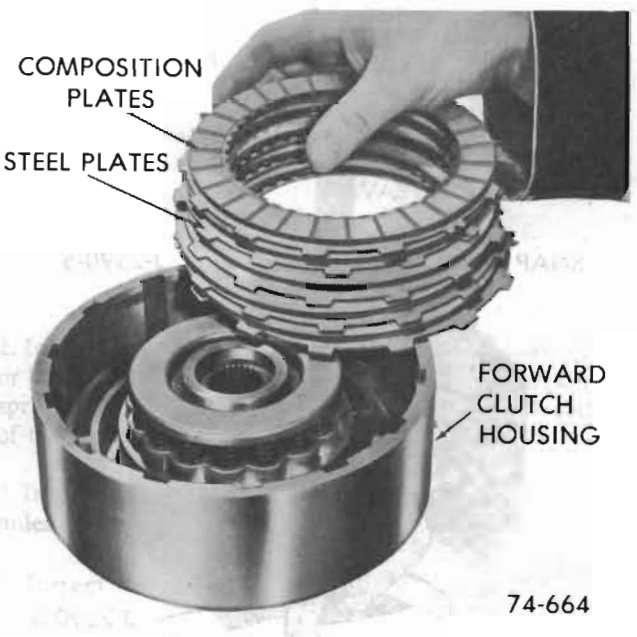


Figure 76-178

5. If necessary remove turbine shaft. See Figure 76-179.

6. Using J-2590 clutch spring compressor, compress the spring retainer and remove the snap ring. See Figure 76-180.

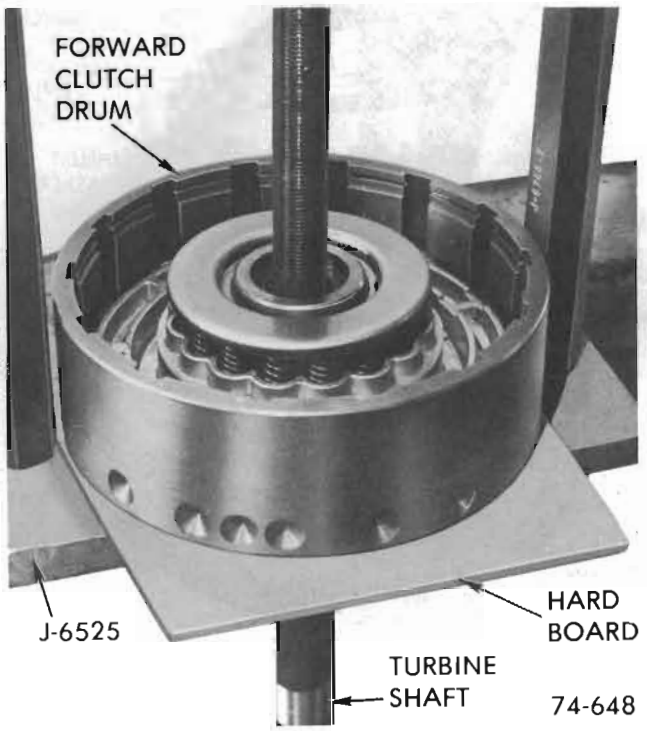


Figure 76-179

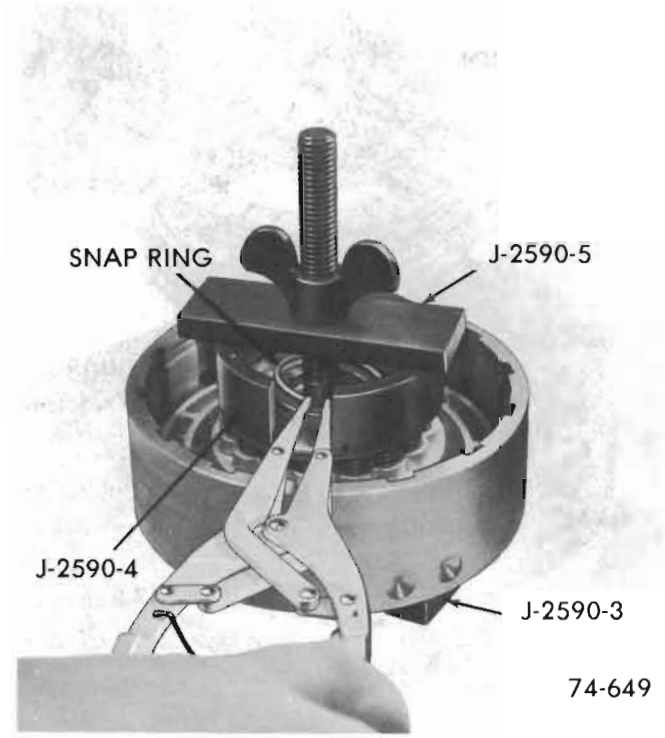


Figure 76-180

NOTE: *If turbine shaft is not removed, compress spring retainer as shown in Figure 76-181.*

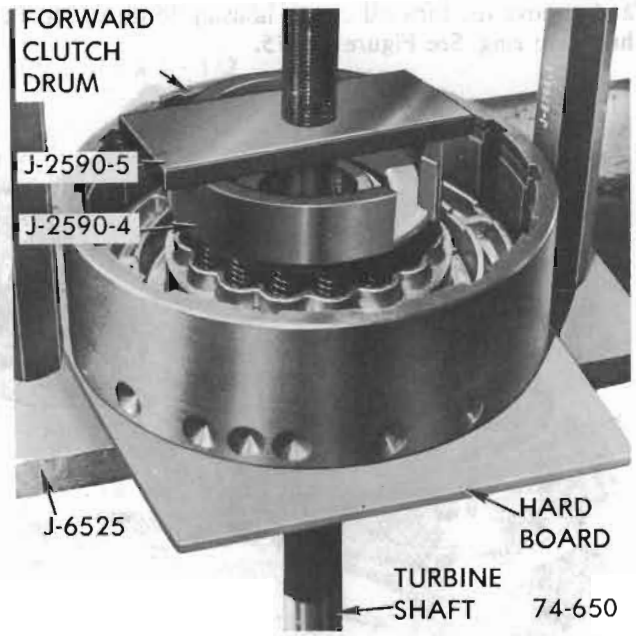


Figure 76-181

7. Remove tools, snap ring, spring retainer and sixteen clutch release springs. See Figure 76-182.

NOTE: *Keep these springs separate from the direct clutch release springs.*

Figure 76-182

8. Remove clutch piston.

9. Remove inner and outer clutch piston seals. See Figure 76-183.

Figure 76-183

10. Remove center piston seal from the forward clutch housing. See Figure 76-184.

Figure 76-184

B. Inspection

1. Inspect condition of composition-faced and steel plates. *Do not diagnose a composition plate by color.*

A. Dry composition-faced with compressed air and inspect the composition surfaces for:

1. Pitting and flaking

2. Wear

3. Glazing

4. Cracking

5. Charring

6. Chips or metal particles imbedded in lining

If a composition-faced plate exhibits any of the above conditions, replacement is required.

B. Wipe steel plates dry and check for heat discoloration. If the surface is smooth and an even color smear is indicated, the plates should be reused. If severe heat spot discoloration or surface scuffing is indicated, the plates must be replaced. See Figure 76-185.

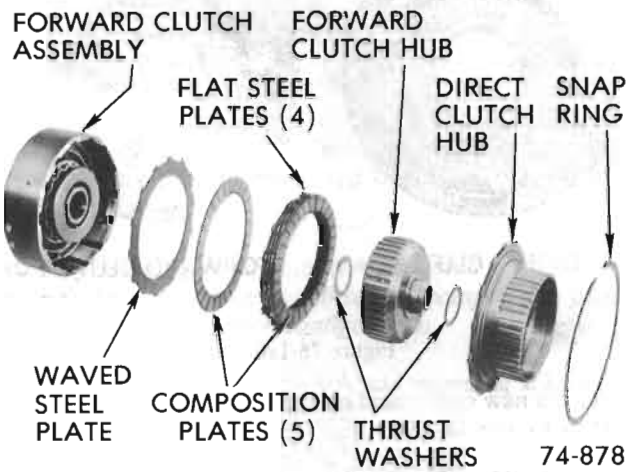


Figure 76-185

2. Inspect the 16 return springs. Evidence of extreme heat or burning in the area of the clutch may have caused the springs to take a heat set and would justify replacement of the springs.

3. Inspect clutch hubs for worn splines, proper lubrication holes and worn thrust faces.

4. Inspect the piston for cracks.

5. Inspect clutch housing for wear, scoring, open oil passages and free operation of the ball check.

6. Inspect turbine shaft.

a. Inspect for open lubrication passages at each end.

b. Inspect splines for damage.

c. Inspect ground bushing journals for damage.

d. Inspect shaft for cracks or distortion.

NOTE: *Turbine shaft and clutch housing are serviced separately.*

C. Reassembly

1. Place new inner, and outer oil seals on clutch piston, lips face away from spring pockets. See Figure 76-183.

NOTE: *The forward and direct clutch pistons have identical inside and outside diameters. It is possible to reverse the pistons during reassembly, therefore care should be exercised to make certain the proper piston be installed in the clutch assemblies as shown in Figure 76-186. The forward clutch piston can be identified by the blind hole in the clutch apply face of the piston.*

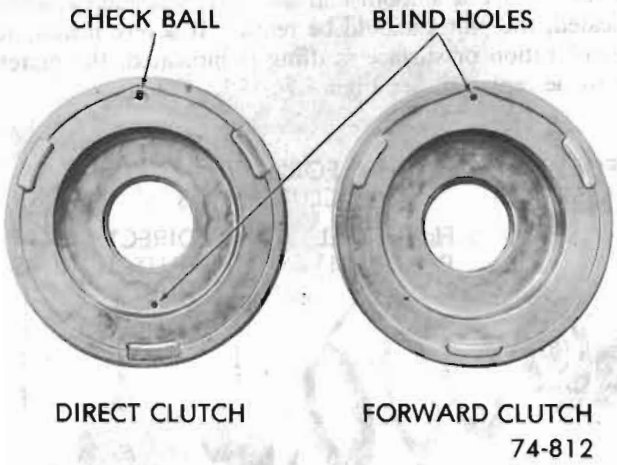


Figure 76-186

2. Place a new center seal on the clutch housing, lip faces up. See Figure 76-184.

3. Place Seal Protector Tool J-21362, over clutch hub and install outer clutch piston Seal Protector J-21409, into clutch drum and install piston. See Figure 76-187.

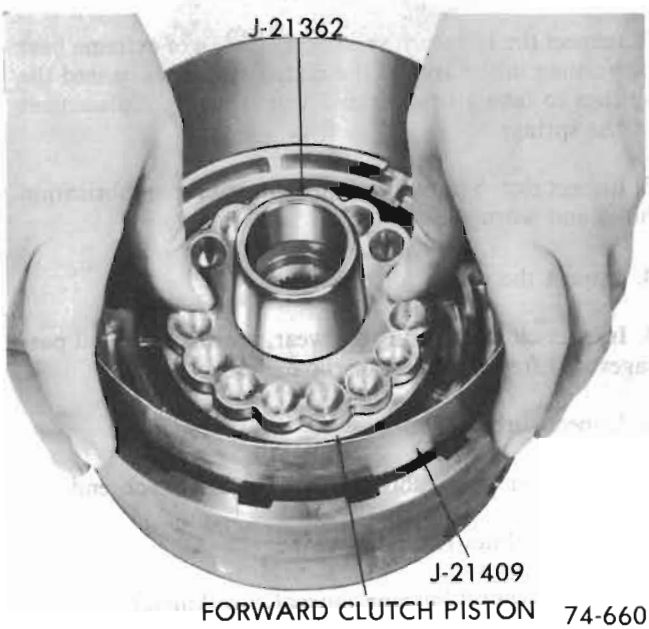


Figure 76-187

4. Install clutch release springs into pockets in piston. See Figure 76-188.

Figure 76-188

5. Place spring retainer and snap ring on springs.

6. Compress springs using Clutch Compressor Tool J-2590, and install snap ring. See Figure 76-189.

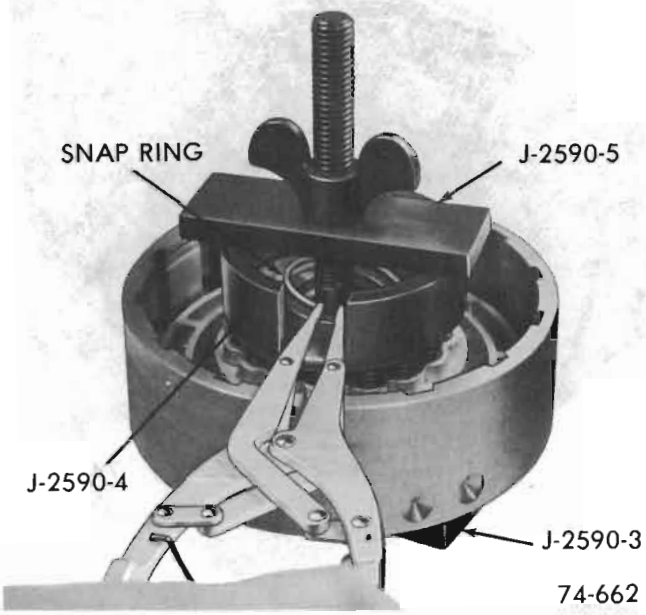


Figure 76-189

NOTE: *If turbine shaft was not removed, install retainer as shown in Figure 76-179.*

7. If removed, install turbine shaft into forward clutch drum. See Figure 76-190.

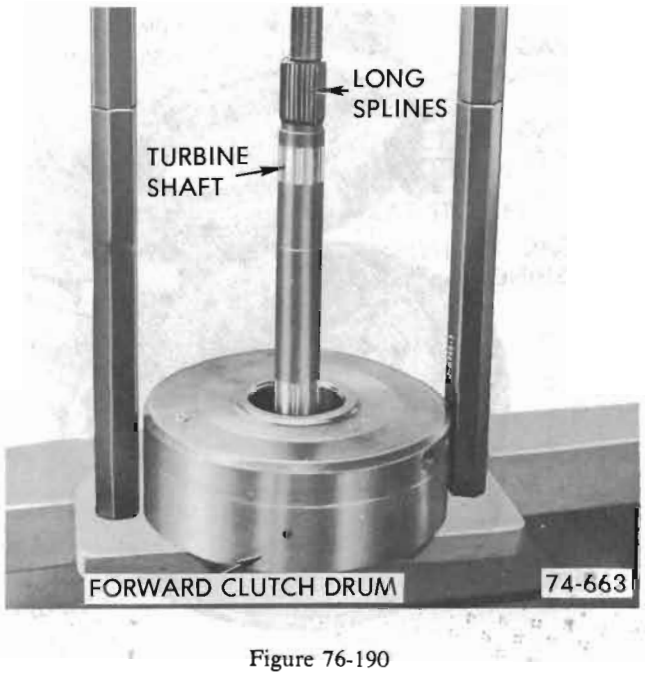


Figure 76-190

8. Install the forward clutch hub thrust washers on forward clutch hub. Retain with petroleum jelly. See Figure 76-191.

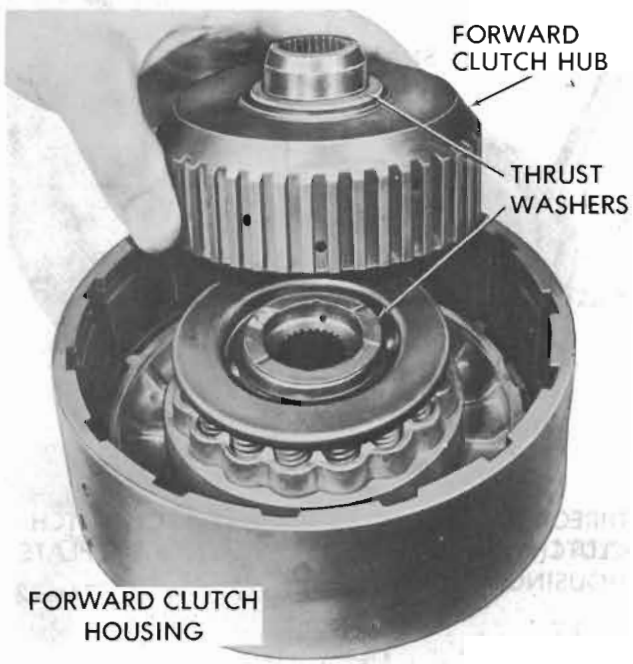


Figure 76-191

9. Place forward clutch hub into forward clutch housing. See Figure 76-191.

10. Oil and install five (5) radial groove composition, four (4) flat steel clutch plates and one (1) waved steel plate (plate with "U" notches), starting with waved steel and alternating composition and steel plates. See Figure 76-192.

Figure 76-192

CAUTION: *Do not confuse the flat steel clutch plate (plate with "V" notch) with the waved steel clutch plate (plate with "U" notch.)*

NOTE: *Radially groved composition clutch plates are installed at the factory only. All service composition plates have the smooth surface configuration.*

11. Install the direct clutch hub and retaining snap ring. See Figure 76-193.

Figure 76-193

12. Place forward clutch housing on pump delivery sleeve and air check clutch operation. See Figure 76-194.

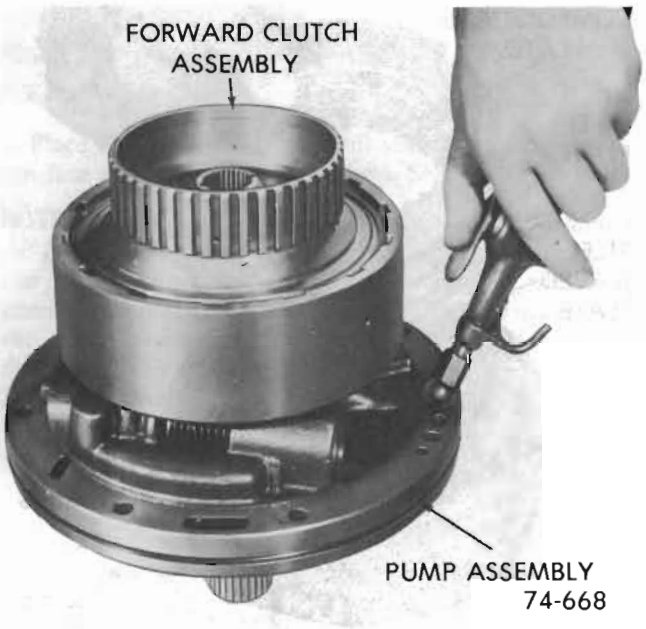


Figure 76-194

Figure 76-196

76-30 DIRECT CLUTCH AND INTERMEDIATE SPRAG

A. Disassembly

1. Remove sprag retainer snap ring and retainer. See Figure 76-195.

Figure 76-195

2. Remove sprag outer race, bushings and sprag assembly. See Figure 76-196.

3. Turn unit over and remove backing plate to clutch housing snap ring. See Figure 76-197.

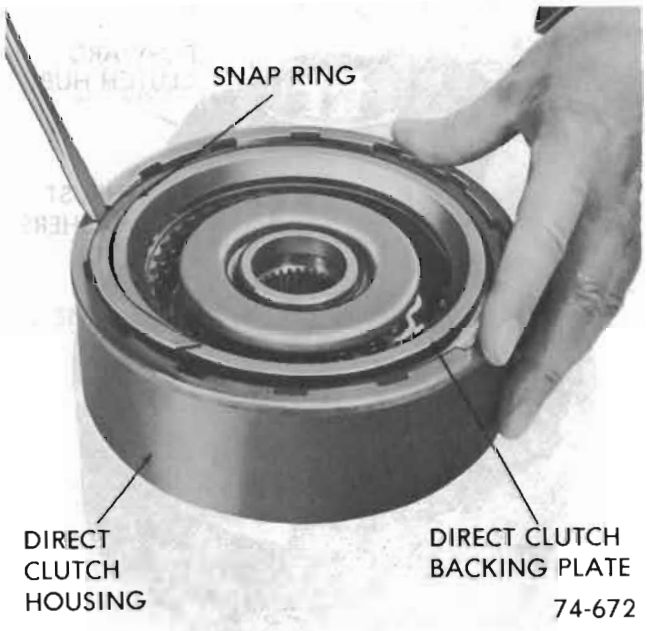


Figure 76-197

4.a. Models "BA", "BB", and "OW", remove direct clutch backing plate, six (6) composition-faced and six (6) steel clutch plates.

b. Models "BC" and "BT", remove direct clutch backing plate, five (5) composition-faced, and five (5) steel clutch plates.

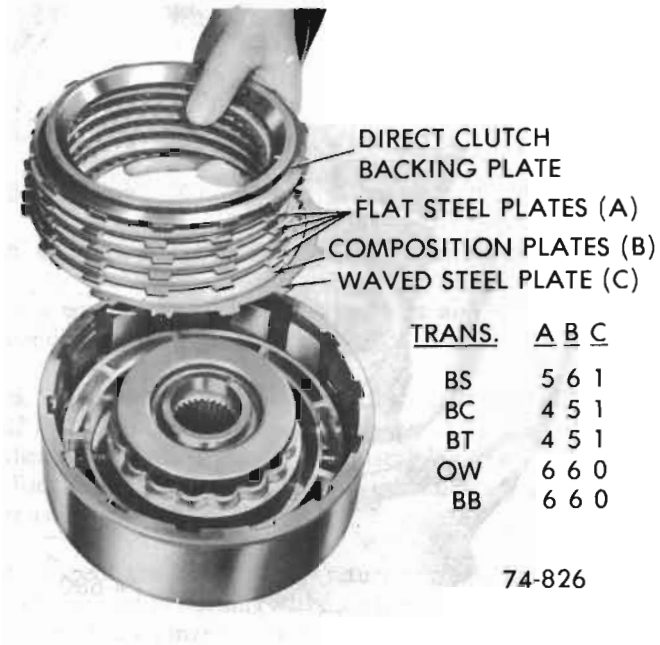


Figure 76-198

5. Using Tool J-2590, compress spring retainer and remove snap ring. See Figure 76-199.

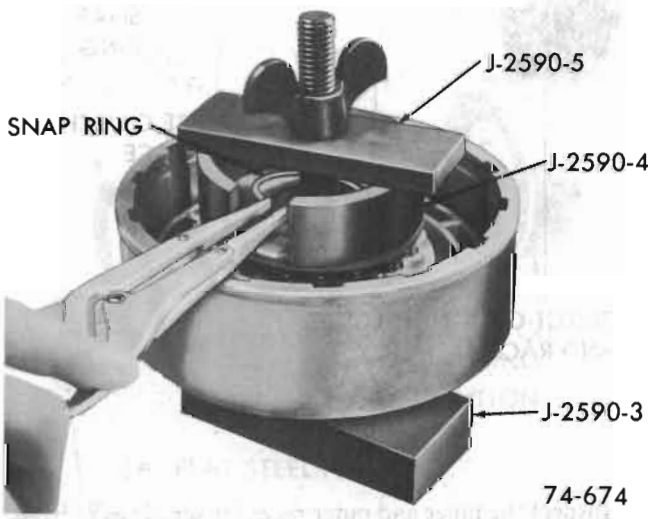


Figure 76-199

6. Remove retainer and fourteen (14) piston release springs. See Figure 76-200.

NOTE: *Keep these springs separate from foreward clutch release springs.*

7. Remove direct clutch piston. See Figure 76-201.

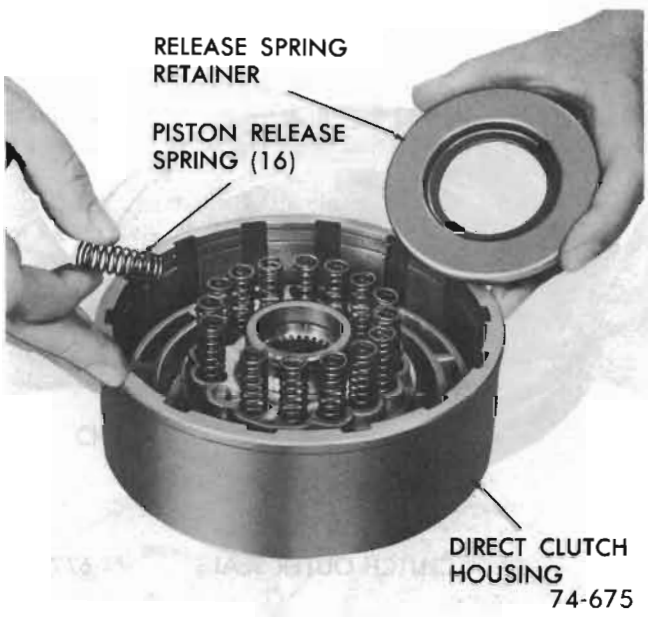


Figure 76-200

Figure 76-201

8. Remove outer seal from piston. See Figure 76-202.

9. Remove inner seal from piston. See Figure 76-203.

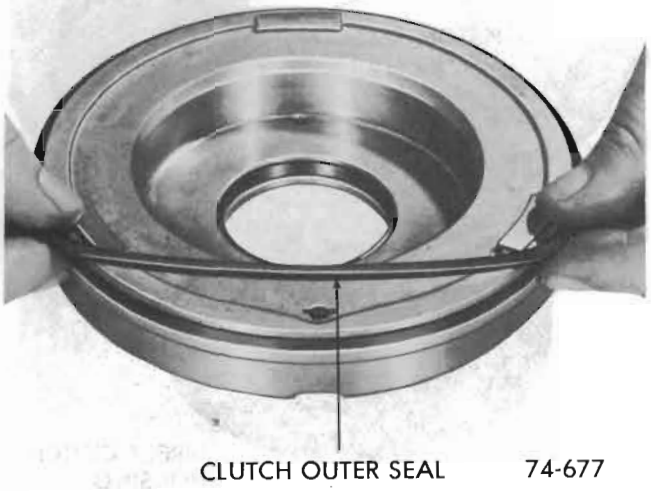


Figure 76-202

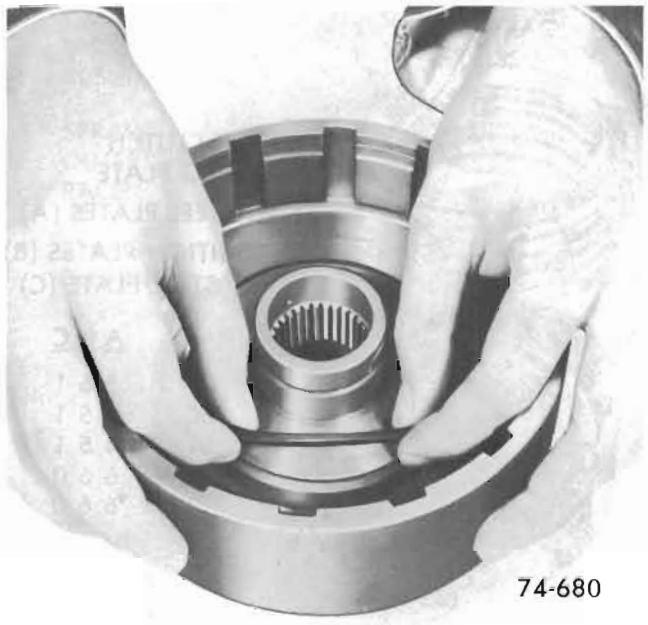


Figure 76-204

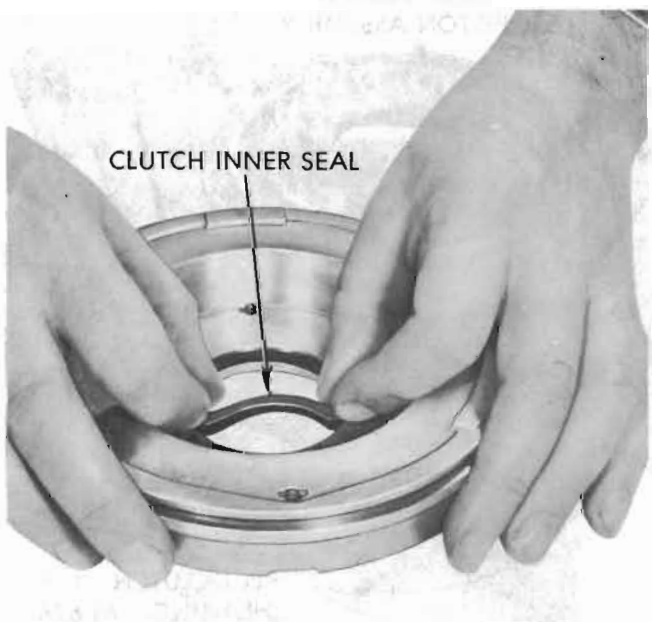


Figure 76-203

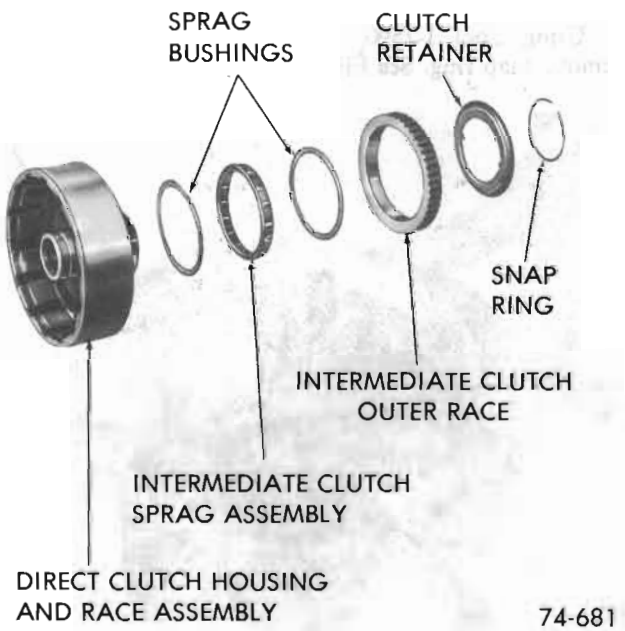


Figure 76-205

10. Remove center piston seal from direct clutch housing. See Figure 76-204.

B. Inspection

1. Inspect sprag assembly for popped or loose sprags. See Figure 76-205.

2. Inspect sprag bushings for wear or distortion.

3. Inspect the inner and outer races for scratches or wear.

4. Inspect clutch housing for cracks, wear, proper opening of oil passages or wear on clutch plate drive lugs.

5. Inspect condition of composition and steel plates. *Do not diagnose a composition-faced plate by color.*

A. Dry composition plates with compressed air and inspect the composition surface for:

1. Pitting and flaking

2. Wear

3. Glazing

4. Cracking

5. Charring

6. Chips or metal particles imbedded in lining

If a composition-faced plate exhibits any of the above conditions, replacement is required.

B. Wipe steel plates dry and check for heat discoloration. If the surface is smooth and an even color smear is indicated, the plates should be reused. If severe heat spot discoloration or surface scuffing is indicated, the plates must be replaced.

6. Inspect the fourteen (14) return springs. Evidence of extreme heat or burning in the area of the clutch may have caused the springs to take a heat set and would justify replacement of the springs.

NOTE: *The fourteen (14) direct clutch release springs are not serviced. If one of more of these springs require replacement, discard all of them and install the sixteen (16) Service direct clutch release springs.*

NOTE: *See Figure 76-198 for "A", "B", and "C" callouts on Figure 76-206.*

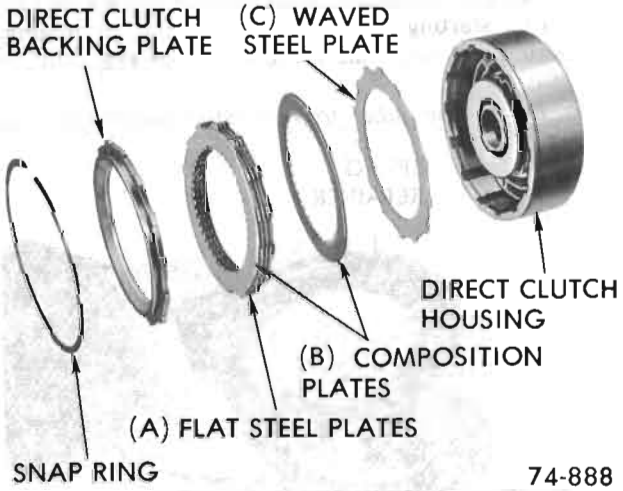


Figure 76-206

7. Inspect the backing plate for scratches or other damage.

8. Inspect the clutch piston for cracks and free operation of the ball check.

C. Reassembly

1. Install a new inner clutch piston seal on piston with lip facing away from spring pockets. Make certain correct piston is used. See Figure 76- 203.

2. Install a new outer clutch piston seal with lip away from spring pockets. See Figure 76-202

NOTE: *Make certain the piston has a ball check (Models "BB" and "OW" direct clutch piston has two (2) check balls). The piston with a blind hole is for the forward clutch assembly. See Figure 76-207.*

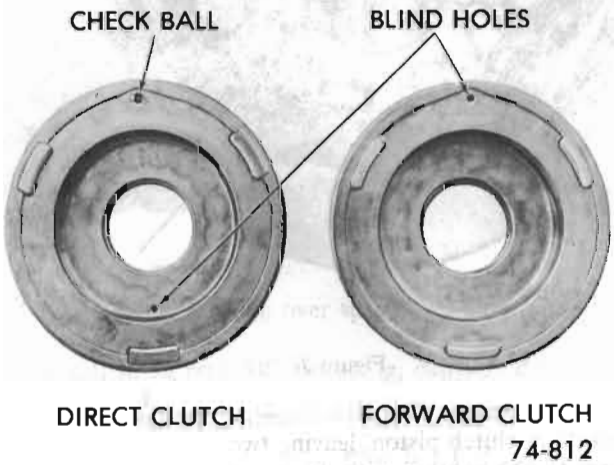


Figure 76-207

3. Install a new center seal on clutch housing with lip of seal facing up. See Figure 76-204.

CAUTION: *The direct clutch housing for the "BS", "BB", and "OW" models use the six (6) plate direct clutch assembly. This housing can be identified by the elimination of the I.D. chamfer on the clutch plate end of the housing and/or a groove in the face at the base of the tower. See Figure 76-208. Should replacement of the direct clutch housing become necessary, extreme care must be taken in obtaining the correct part for the model involved.*

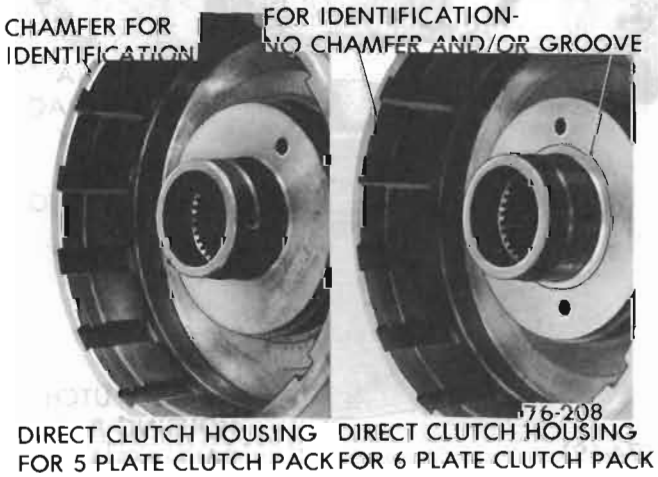


Figure 76-208 Direct Clutch Housing Identification

4. Place Seal Protectors, Tools J-21362 - Inner, J- 21409 - Outer, over hub and clutch housing and install clutch piston. See Figure 76-209.

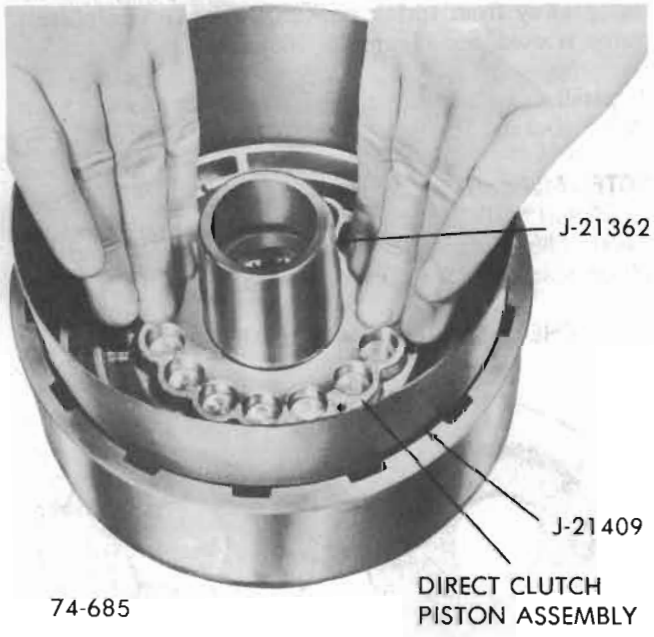


Figure 76-209

5. Install fourteen (14) clutch release springs into spring pockets in clutch piston, leaving two (2) pockets directly opposite one another with no springs.

6. Place spring retainer and snap ring on springs.

7. Using Tool J-2590, install snap ring. See Figure 76-199.

8.a. Model "BS", lubricate with transmission fluid and install six (6) composition-faced, five (5) flat steel, and one (1) waved steel plate (plate with "U" notch), starting with

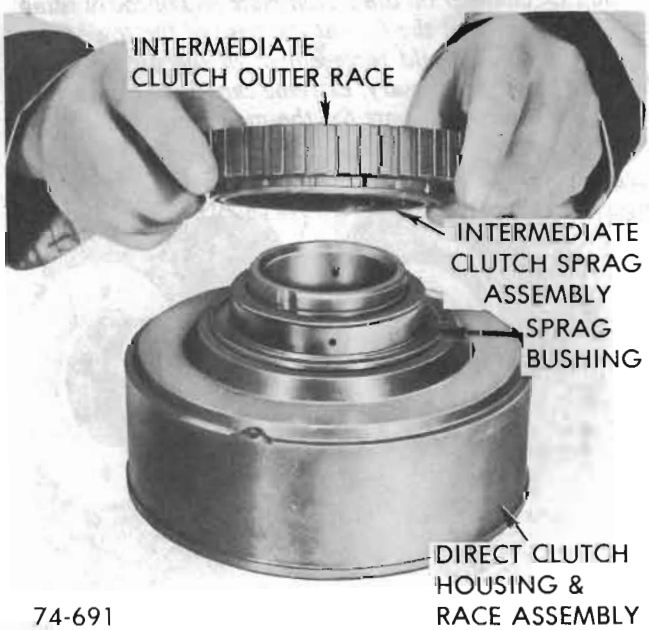


Figure 76-212

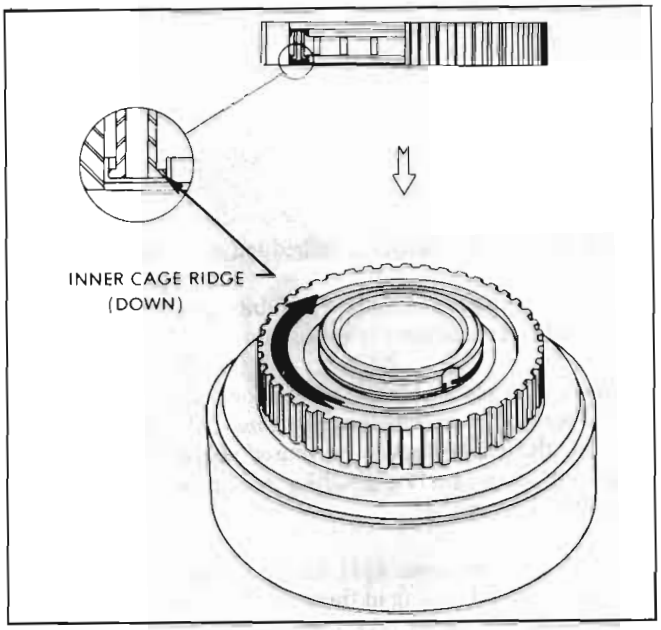


Figure 76-213

the waved steel and alternating composition and steel plates. See Figure 76-198.

b. Models "BC" and "BT", lubricate with transmission fluid and install five (5) composition-faced, four (4) flat steel, and one (1) waved steel plate (plate with "U" notch), starting with the waved steel and alternating composition and steel plates. See Figure 76-198.

c. Models "BB" and "OW", lubricate with transmission fluid and install six (6) composition-faced and six (6) flat steel plates, starting with the flat steel and alternating composition and steel plates. See Figure 76-198.

NOTE: *Do not use radial groove compositon plates here.*

Figure 76-214

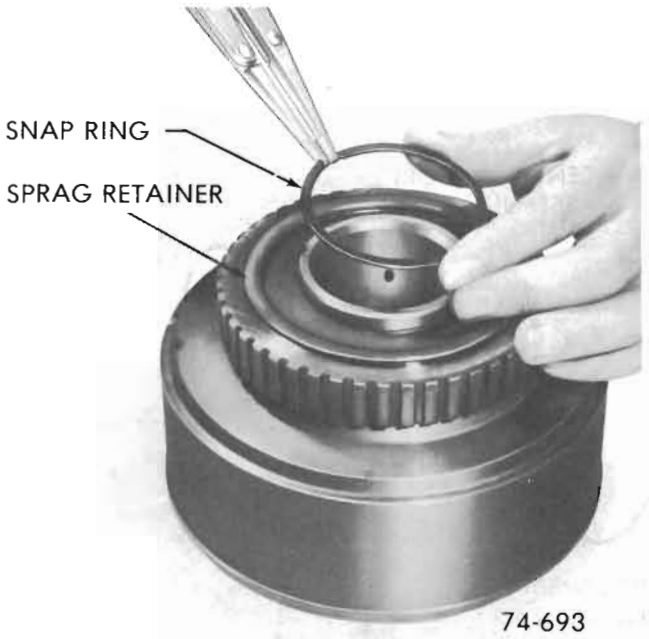


Figure 76-215

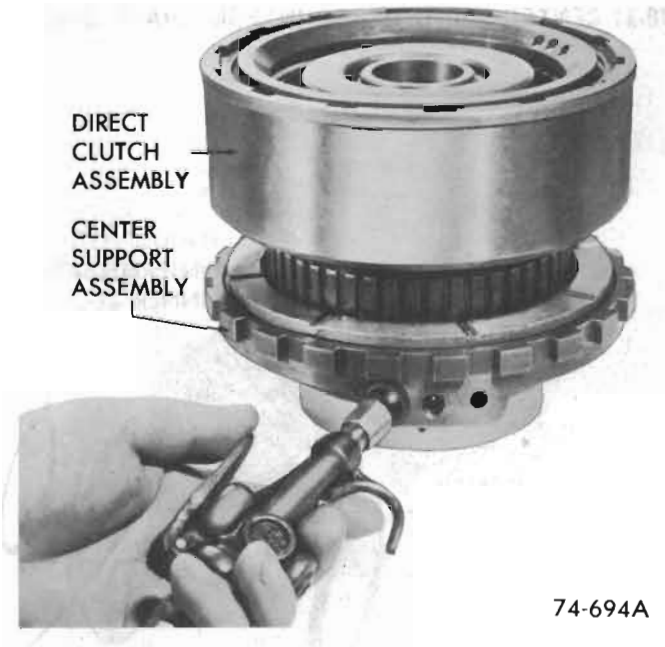


Figure 76-216

9. Install the clutch backing plate.

10. Install the backing plate retaining snap ring. See Figure 76-197.

11. Turn unit over and install one sprag bushing, cup side up, over inner race.

12. Install sprag assembly into outer race.

13. With ridge on inner cage facing down start sprag and outer race over inner race with clockwise turning motion. See Figure 76-212.

NOTE: *Outer race should not turn counterclockwise after installation. See Figure 76- 213.*

14. Install sprag bushing over sprag, cup side down.

15. Install sprag retainer over sprag, cup side down. See Figure 76-214.

16. Install sprag retainer snap ring. See Figure 76-215.

17. Place direct clutch assembly over center support and air check operation of direct clutch. See Figure 76-216.

NOTE: *If air is applied through the reverse passage, (right oil feed hole) it will escape from the direct clutch passage (left oil feed hole). This is considered normal. Apply air through left oil feed hole to actuate piston and move direct clutch.*

76-31 CENTER SUPPORT AND INTERMEDIATE CLUTCH (See Figure 76-217)

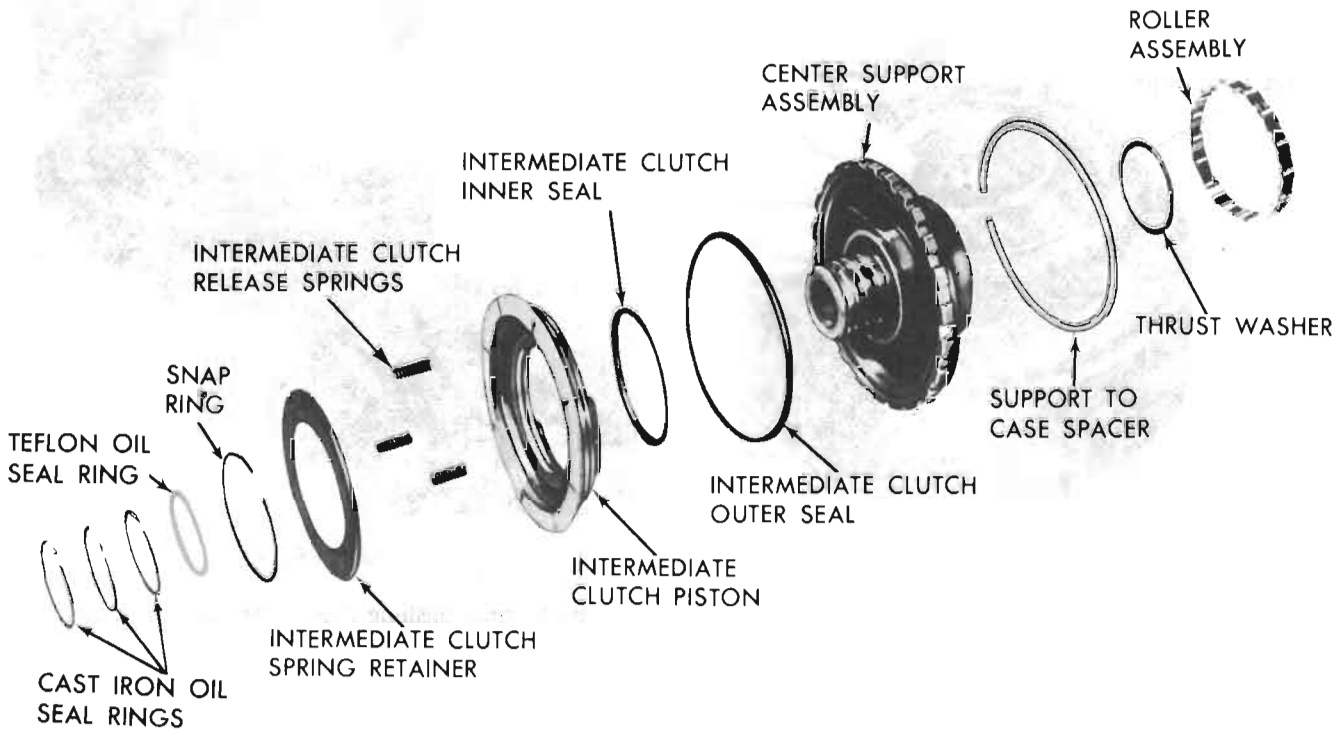


Figure 76-217

A. Disassembly

1. Remove three (3) hook type cast iron oil seal rings from the center support. Do not remove the teflon oil seal ring unless replacement is required. All Service center support oil seal rings are hood type cast iron. See Figure 76-218.

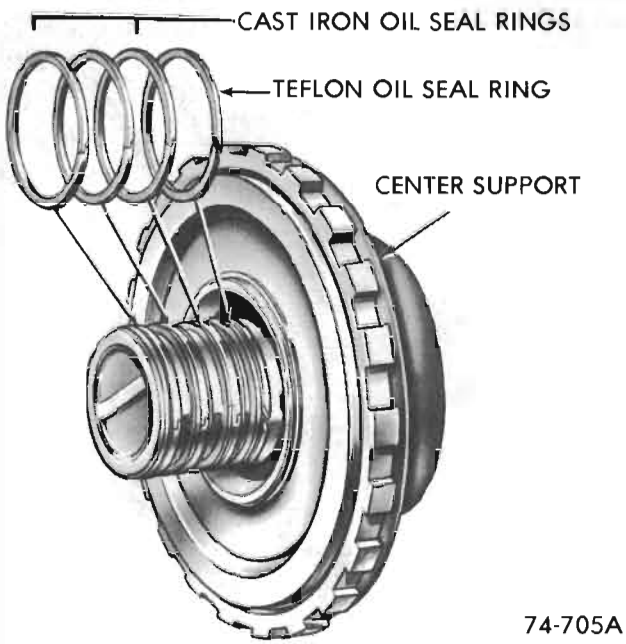


Figure 76-218

2. Using Clutch Compressor J-2590, compress spring retainer and remove snap ring. See Figure 76- 219.

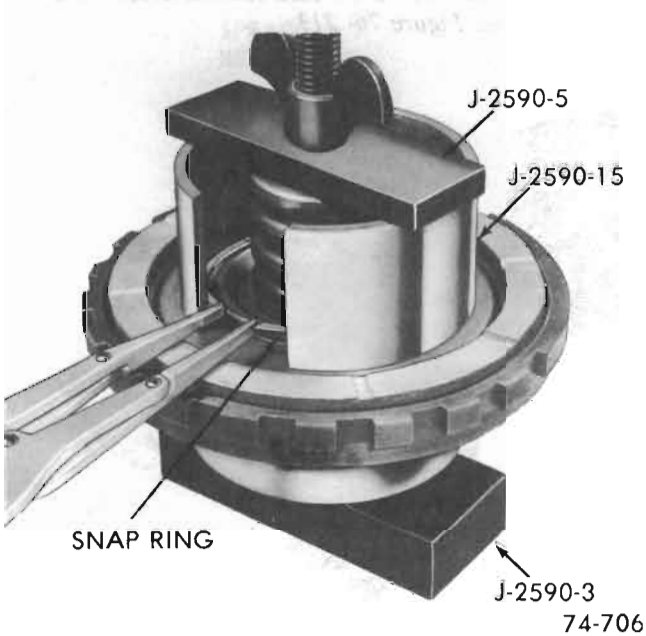


Figure 76-219

3. Remove spring retainer. See Figure 76-220. Remove three (3) clutch release springs. See Figure 76-221.

Figure 76-220

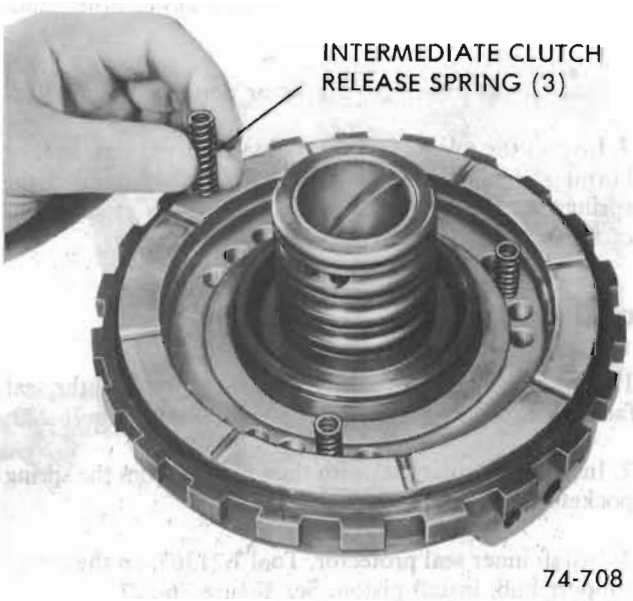


Figure 76-221

4. Remove the intermediate clutch piston. See Figure 76-222.

NOTE: *Do not remove the three (3) bolts retaining the roller clutch inner race to the center support.*

5. Remove the inner piston seal. See Figure 76-223.

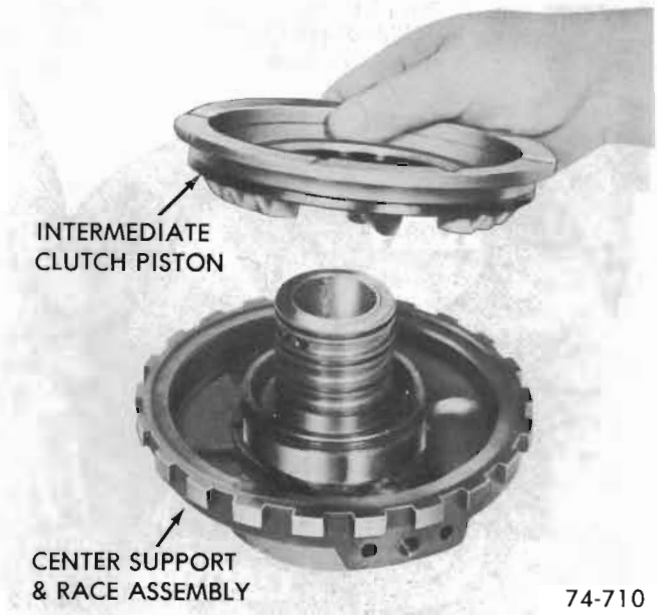


Figure 76-222

Figure 76-223

6. Remove the outer piston seal. See Figure 76- 224.

B. Inspection

1. Inspect the roller clutch inner race for scratches or indentations. Be sure the lubrication hole is open.

2. Inspect the bushing for scoring, wear or galling. If replacement is necessary proceed as follows:

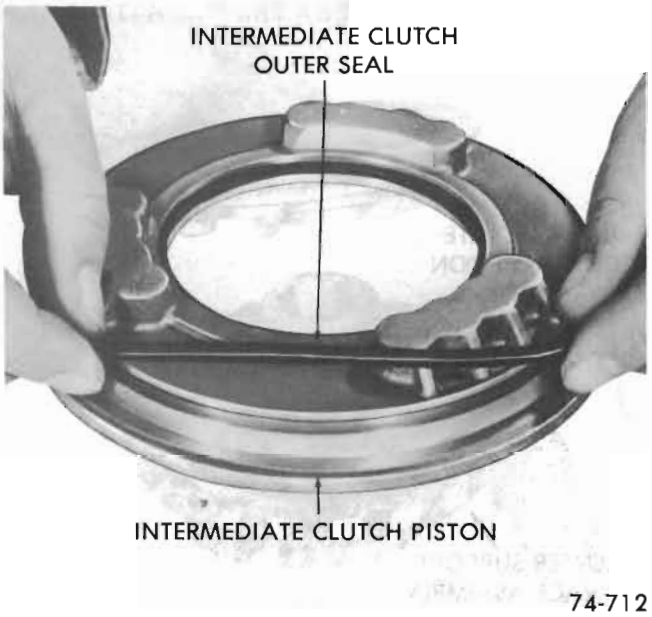


Figure 76-224

a. Using Tool J-21465-6, remove bushing. See Figure 76-225.

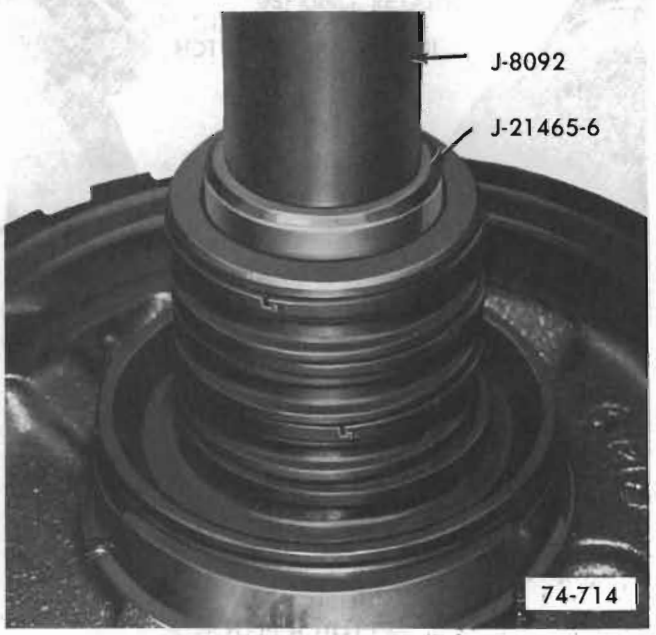


Figure 76-225

b. From front side of center support, align elongated slot in bushing with drilled hole in the oil delivery sleeve closest to the piston. Using Tool J-21465-6 and Drive Handle J-8092, drive bushing squarely into the bore until the bushing is flush to .010" below top of oil delivery sleeve.

2. Check the oil ring grooves and rings for damage.

NOTE: *All Service center support oil seal rings are hook type cast iron.*

3. Air check the oil passages to be sure they are open and not interconnected. See Figure 76-226. Be sure constant bleed plug orifice is open. See Figure 76-137.

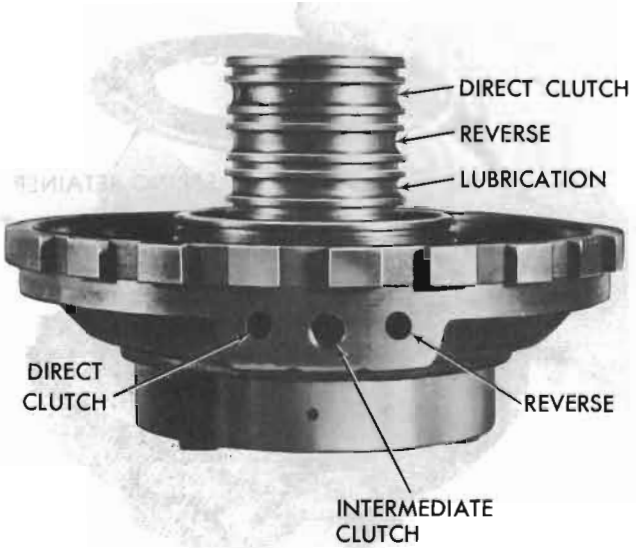


Figure 76-226

4. Inspect piston sealing surfaces for scratches.

5. Inspect the piston seal grooves for nicks or other damage.

6. Inspect the piston for cracks or porosity.

7. Inspect the release springs. Evidence of extreme heat or burning in the area of the clutch may have caused the springs to take a heat set and would justify replacement of the springs.

C. Reassembly

1. Install new inner seal on the piston with lip of the seal facing away from the spring pocket. See Figure 76-223.

2. Install new outer seal with the lip away from the spring pockets. See Figure 76-224.

3. Install inner seal protector, Tool J-21363, on the center support hub, install piston. See Figure 76-227.

4. Install three (3) release springs into the piston, space equally during assembly. See Figure 76-221.

5. Place the spring retainer and snap ring over the springs.

6. Using the Clutch Spring Compressor, J-2590, compress the springs and install the snap ring. See Figure 76-219.

7. Install three (3) hook type cast iron oil seal rings on the center support if the teflon ring was not removed. If the

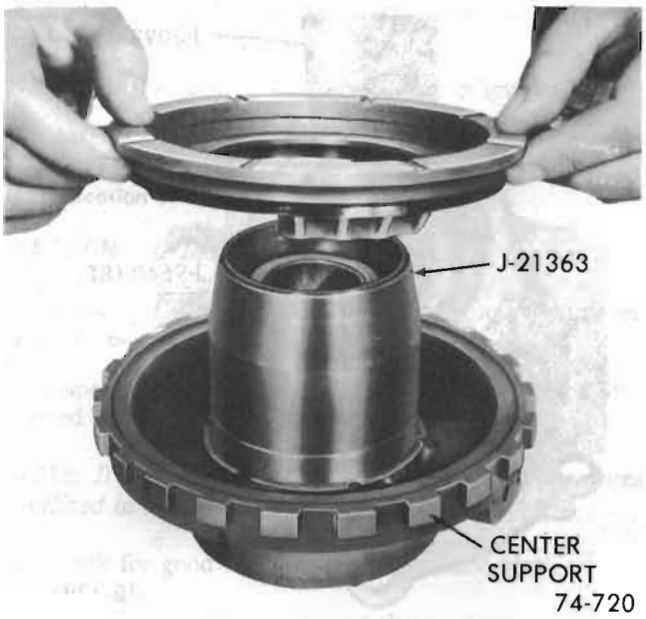


Figure 76-227

teflon ring was removed, install four (4) hook type cast iron oil seal rings. See Figure 76-218.

8. Air check operation of intermediate clutch piston. See Figure 76-231.

Figure 76-231

9. Install center support into roller clutch in reaction carrier. See Figure 76-140.

76-32 INSPECTION OF TRANSMISSION PARTS

A. Case Bushing

1. Inspect case bushing for wear or galling. If replacement is necessary proceed as follows:

a. Thread Extension Handle J-21465-13 into Bushing Remover J-21465-8. Using Drive Handle J-8092 remove bushing. See Figure 76-232.

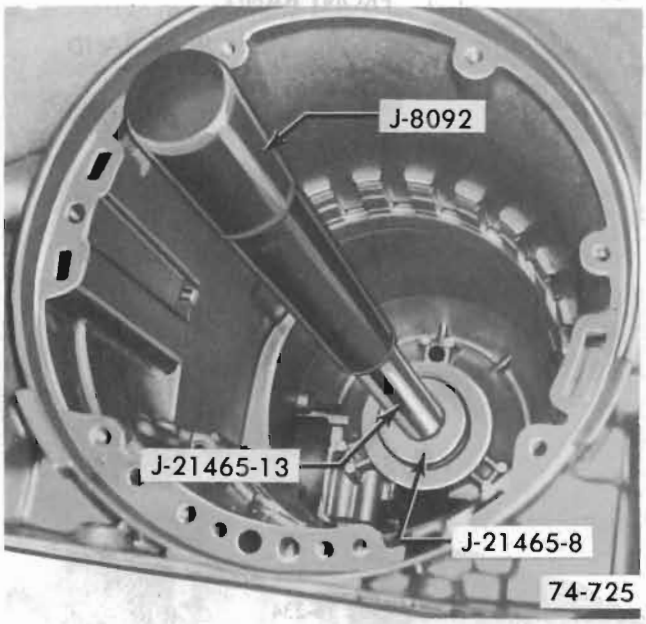


Figure 76-232

b. Using Adapter J-21465-9 on J-21465-8 driver handle and extension J-21465-13, with lube passage facing front of transmission case, install new bushing into case, until .040" - .055" above selective thrust washer face. See Figure 76-233

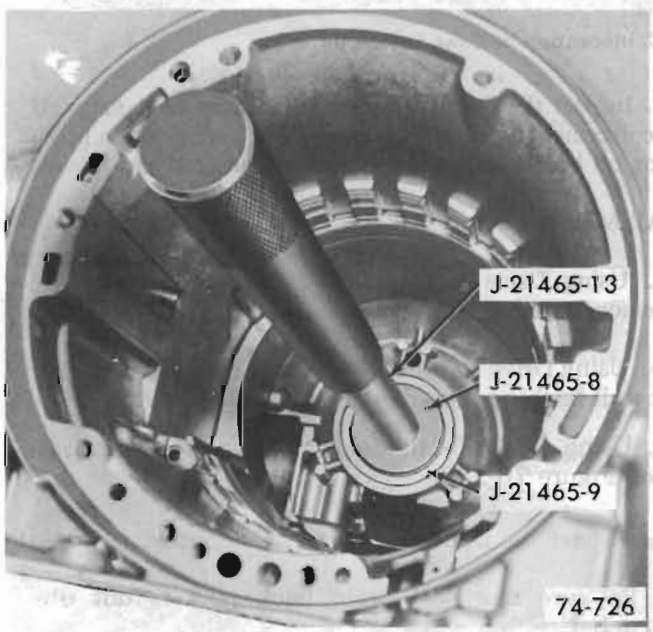


Figure 76-233

c. Using J-21465-10 stake bushing in oil groove.

B. Inspection of Front and Rear Bands and Center Support-to-Case Spacer

1. Inspect the lining for cracks, flaking, burning or looseness. See Figure 76-234.

Figure 76-234

2. Inspect the bands for cracks or distortion.

3. Inspect the end for damage at the anchor lugs or apply lugs.

4. Inspect support to case spacer for burrs or raised edges. If present, remove with a stone or fine sand paper.

C. Inspection of Case Extension

1. Inspect the bushing for excessive wear or damage. If replacement is necessary, remove rear seal, position housing on bench with seal end up, and proceed as follows:

All Models Except "BT"

a. Using Drive Handle J-8092 and Tool J-21465-17, remove bushing. See Figure 76-235.

b. Using Drive Handle J-8092 and Tool J-21465-17, install bushing. See Figure 76-235.

c. Using J-21465-10, stake bushing in oil grooves. See Figure 76-236.

2. Inspect the housing for cracks or porosity.

3. Be sure rear seal drain back port is not obstructed.

D. Inspection of Manual and Parking Linkage

1. Inspect the parking pawl actuator rod for cracks or broken spring retainer lugs. See Figure 76-75.

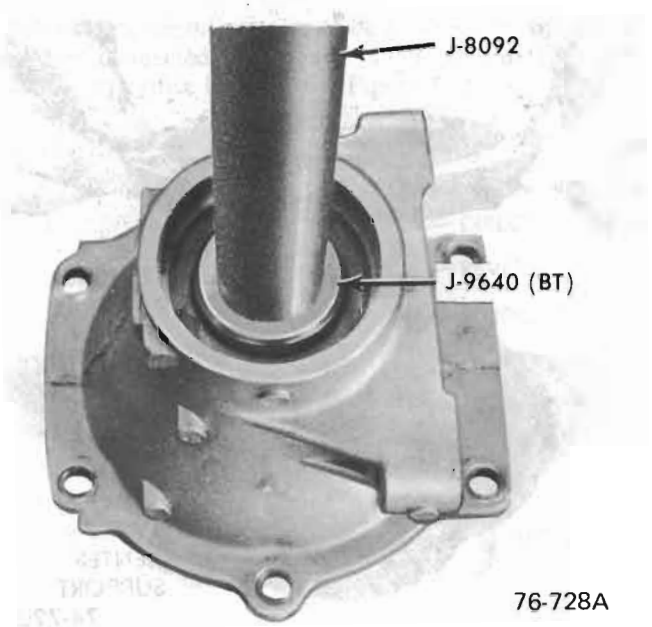


Figure 76-235

Figure 76-236

2. Inspect the actuator spring for damage.

3. Inspect actuator for a free fit on the actuator rod.

4. Inspect the parking pawl for cracks or wear, if removed.

5. Inspect the manual shaft for damaged threads, rough oil seal surface or loose lever.

6. Inspect the inside detent lever for cracks or a loose pin.

7. Inspect the parking pawl shaft for damaged retainer groove if removed.

8. Inspect the parking pawl return spring for deformed coils or ends.

9. Inspect the parking lock bracket for cracks or wear.

10. Inspect detent roller and spring assembly.

E. Inspection of Case Assembly

CAUTION: *If the case assembly requires replacement, make sure the center support-to-case spacer is removed from the old case and reinstalled in the new case. See Figure 76-246.*

1. Inspect case assembly for cracks, porosity or interconnected passages. See Figure 76-11.

NOTE: *If case porosity exists, repair following procedures outlined in Paragraph 76-3, subparagraph C.*

2. Check for good retention of ban anchor pins.

3. Inspect all threaded holes for thread damage.

4. Inspect the intermediate clutch driven plate lugs for damage or brinelling.

5. Inspect the snap ring grooves for damage.

6. Inspect the bore of the governor assembly for scratches or scoring.

7. Inspect the modulator valve bore for scoring or damage.

8. Inspect the cup plug inside the case for good staking and sealing.

F. Inspection of Torque Converter

1. Check converter for leaks as follows: (See Figure 76-237.)

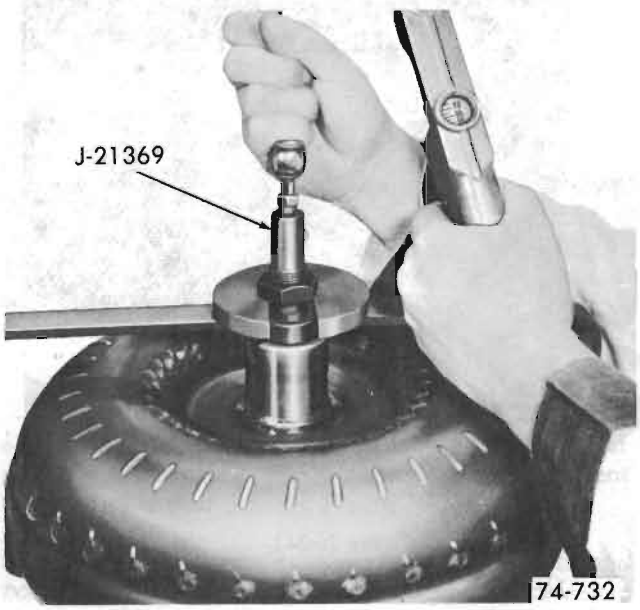


Figure 76-237

a. Install Tool J-21369, and tighten.

b. Fill converter with air; 80 psi.

c. Submerge in water and check for leaks.

2. Check converter hub surfaces for signs of scoring or wear.

3. Check converter end clearance as follows:

a. Install Tool J-21371-2 and tighten brass nut. See Figure 76-238.

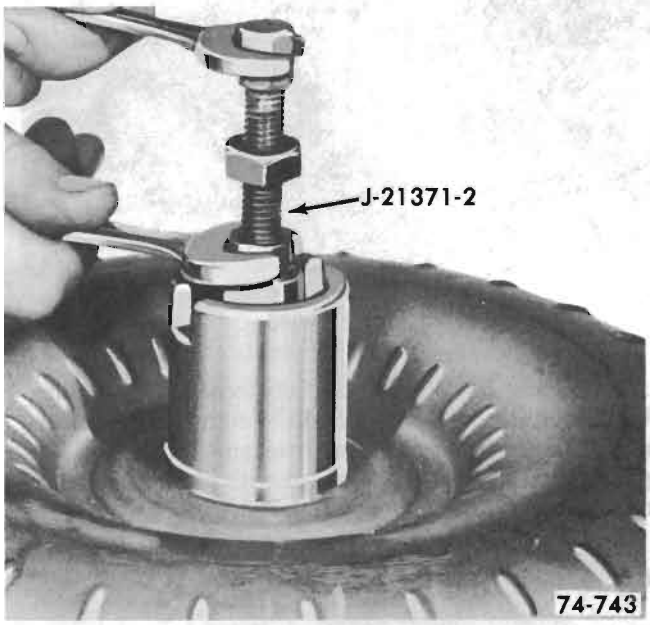


Figure 76-238

b. Install Tool J-21371-3 and tighten hex nut. See Figure 76-239.

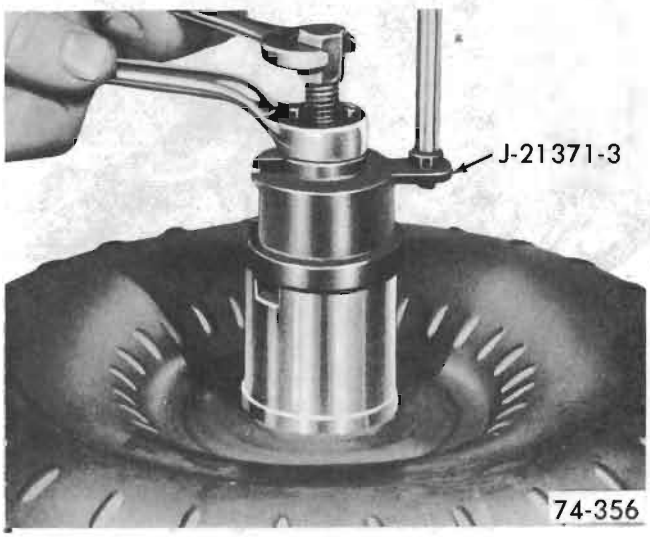


Figure 76-239

c. Install dial indicator set at 0 as shown in Figure 76-240.

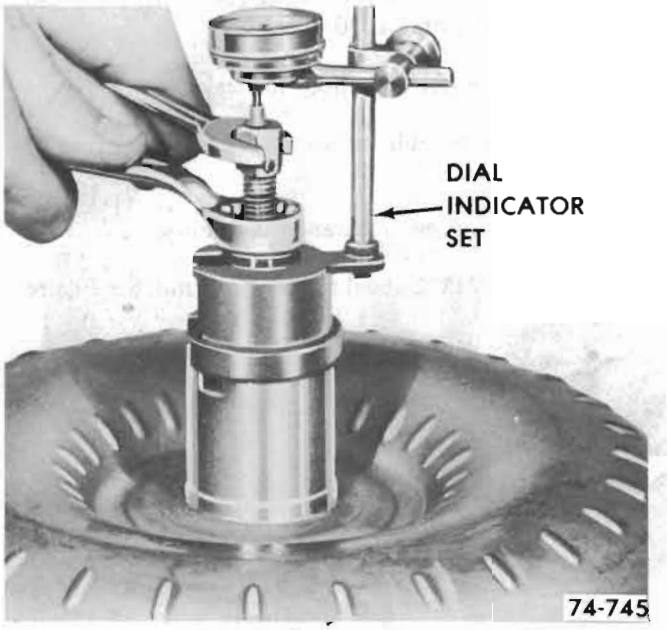


Figure 76-240

d. Loosen hex nut. When nut is fully loosened the reading obtained on the dial indicator will be converter end clearance. If clearance is .050" or over and the oil has the appearance of having been mixed with aluminum paint, replace the converter. See Figure 76-240.

76-33 ASSEMBLY OF MAJOR UNIT

NOTE: *The first three steps can be omitted if the parts involved were not removed on disassembly.*

1. Install the parking pawl, tooth toward the inside case and parking pawl shaft. See Figure 76-241.

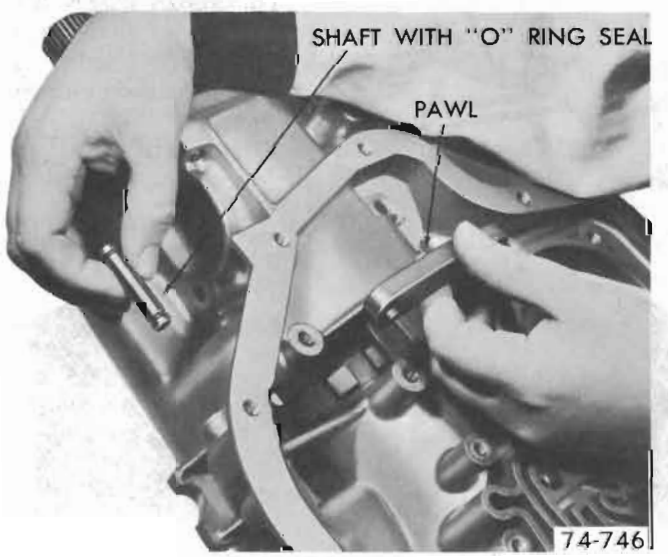


Figure 76-241

2. Install the parking pawl shaft retainer clip. See Figure 76-242.

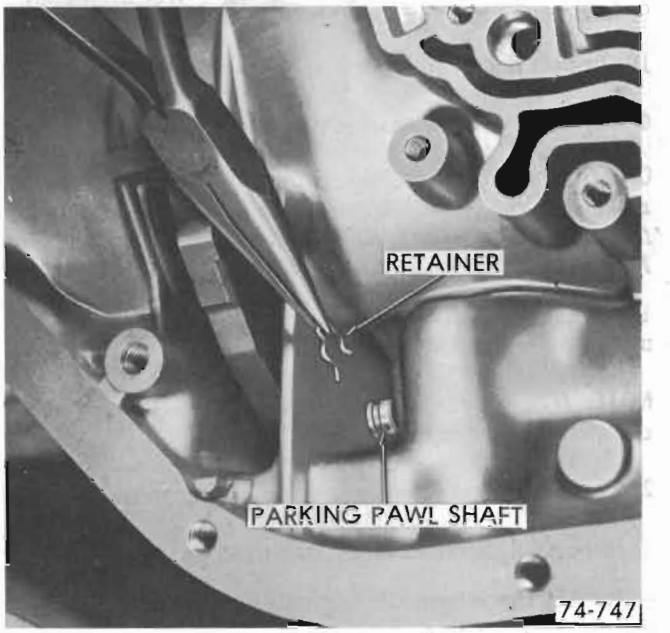


Figure 76-242

3. Install cup plug and drive into case, using a 3/8" dia. rod, until parking pawl shaft bottoms on case rib. See Figure 76-243.

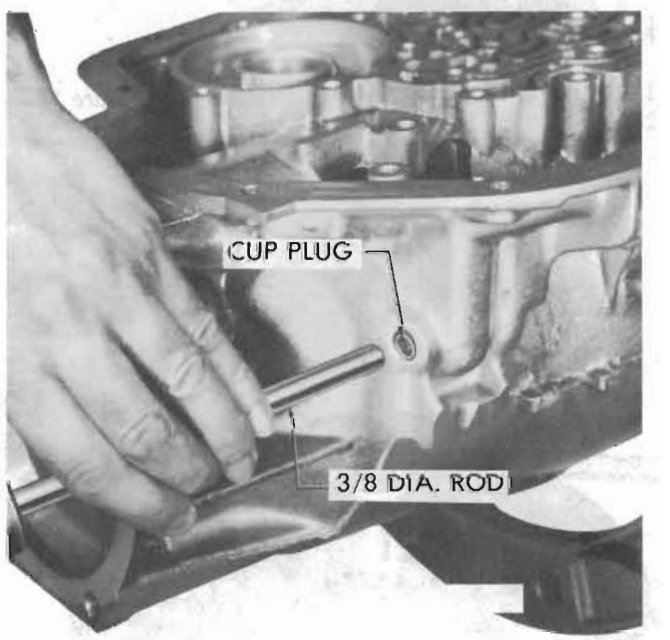


Figure 76-243

4. Install the parking pawl return spring, square end hooked on pawl. See Figure 76-244.

Figure 76-244

5. Install the parking lock bracket, guides over parking pawl, using two attaching bolts torque to 15- 20 lb.ft. See Figure 76-245.

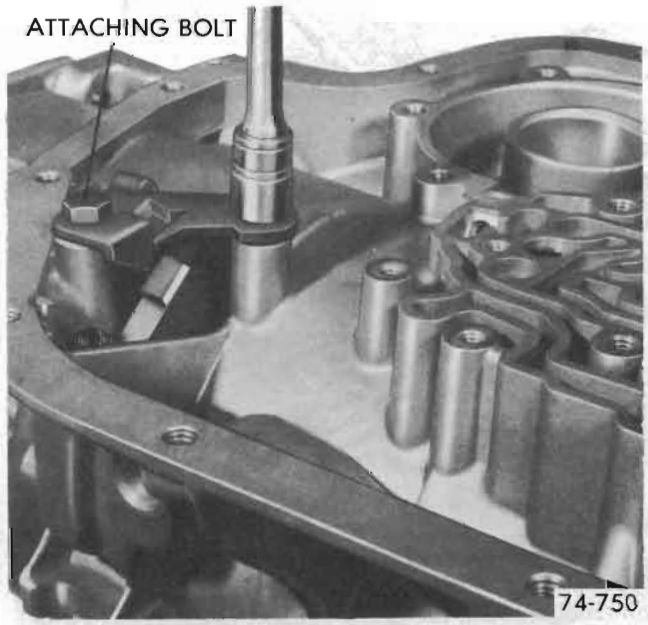


Figure 76-245

6. Install the support to case spacer against the shoulder at the bottom of case splines and the gap located adjacent to the band anchor pin. See Figure 76-246.

CAUTION: *Do not confuse this spacer (.040" thick and both sides flat) with either the center support to case snap ring (one side beveled) or the intermediate clutch backing plate to case snap ring (.093" thick and both sides flat).*

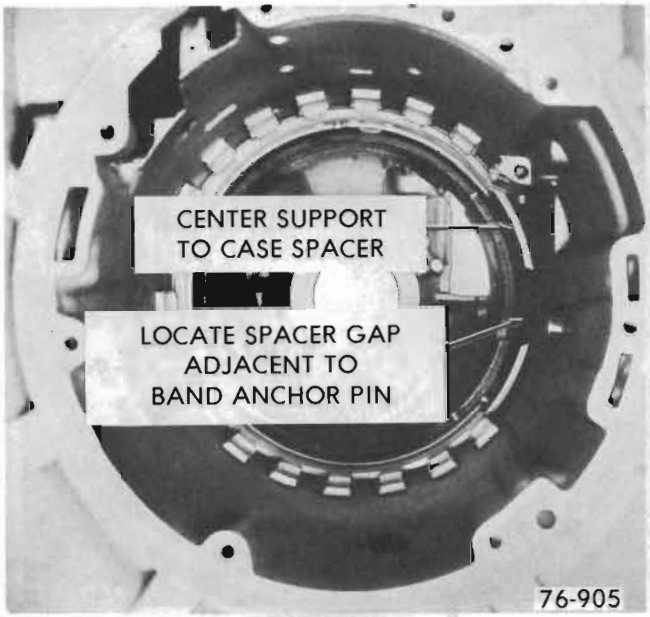


Figure 76-246

7. Install the rear band assembly so that the two lugs index with the two anchor pins. See Figure 76-247. Check band to be sure band ends are seated on lugs.

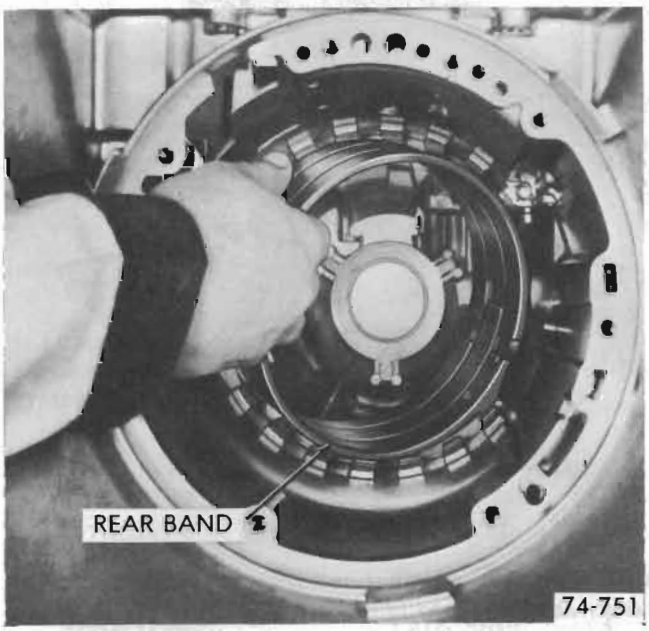


Figure 76-247

8. Lubricate and install gear selective washer into slots provided inside rear of transmission case. See Figure 76-248.

9. Install complete gear unit assembly into case making certain center support bolt hole is properly aligned with hole in case. See figure 76-249.

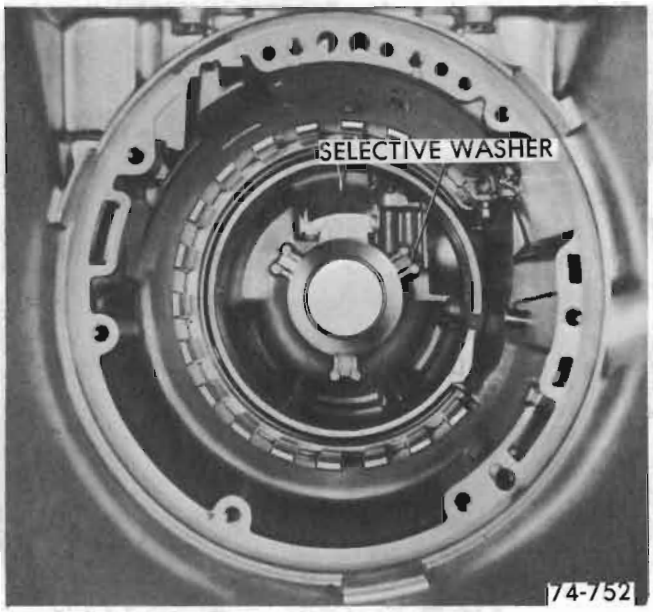


Figure 76-248

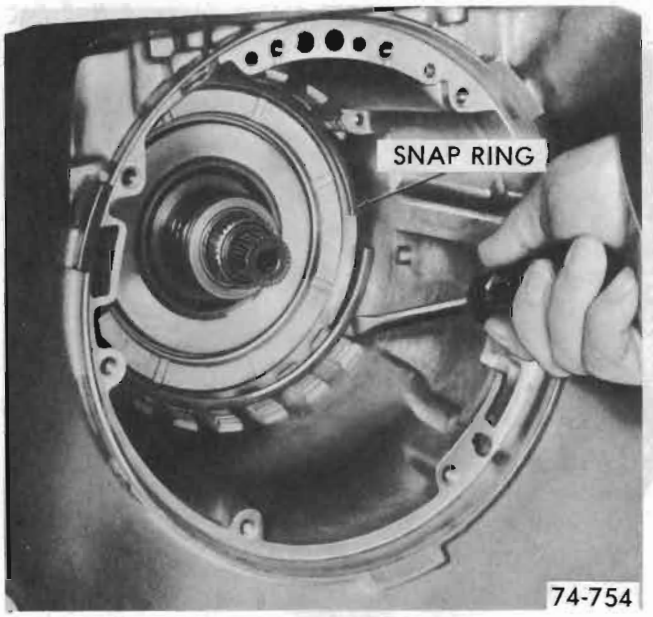


Figure 76-250

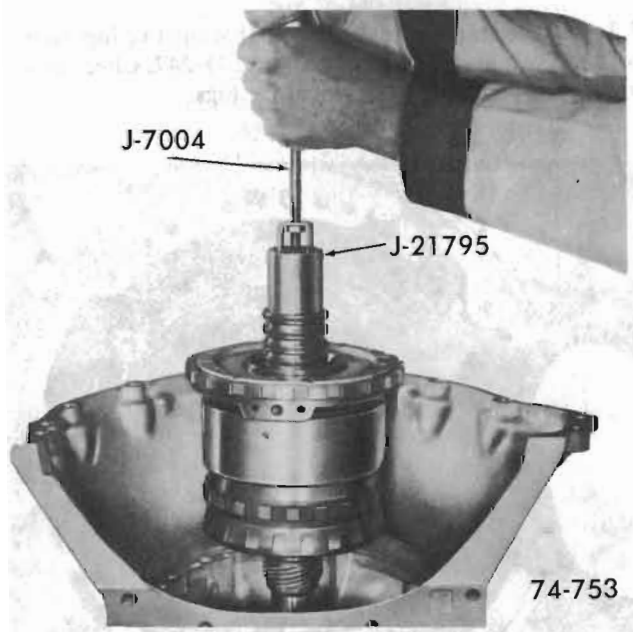


Figure 76-249

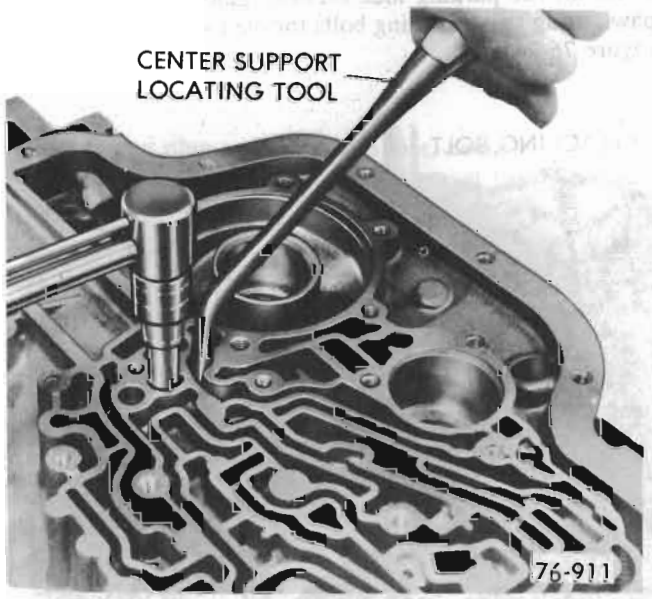


Figure 76-251

NOTE: *Make certain tangs on output shaft to case thrust washer are positioned in pockets. See Figure 76-131.*

10. Install center support to case retaining snap ring with bevel side up, flat side against center support, and locating gap adjacent to band anchor pin. Make certain ring is properly seated in case. See Figure 76-250.

11. Install case to center support bolt by placing the center support locating tool J-23093 into the case direct clutch passage, with the handle of the tool pointing to the right as viewed from the front of the transmission and parallel to the bell housing mounting face. See Figure 76-251.

Apply pressure downward on Tool J-23093 handle which will tend to rotate the center support counter- clockwise as viewed from the front of the transmission. While holding the center support firmly counter clockwise against the case splines, torque the case to center support bolt to 20-25 lb. ft., using a 3/8" 12-point thin wall deep socket.

CAUTION: *When using locating tool, care must be taken not to raise burrs on the case valve body mounting face.*

12. Lubricate with transmission fluid and install three (3) steel and three (3) composition intermediate clutch plates.

Start with waved steel and alternate composition and steel clutch plates. See Figure 76- 252.

NOTE: *No waved plate used in Models "BB" and "OW". Three (3) flat steel plates are used.*

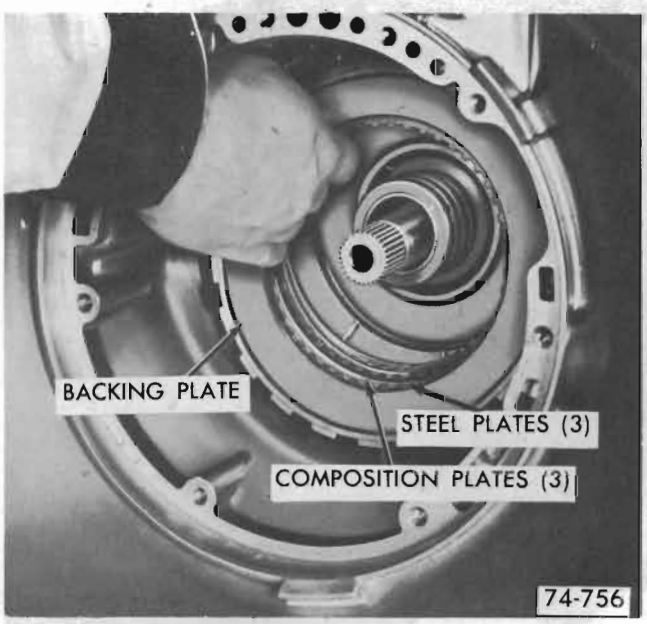


Figure 76-252

13. Install the intermediate clutch backing plate ridge up.

14. Install the intermediate clutch backing plate to case snap ring. Gap in snap ring should be opposite band anchor pin. See Figure 76-253.

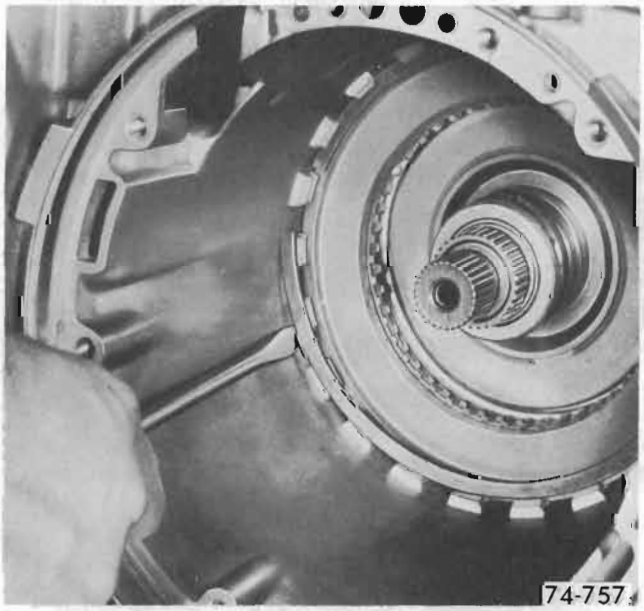


Figure 76-253

NOTE: *Both sides of this snap ring are flat and it is .093" thick.*

15. Check rear end play as follows: See Figure 76 254.

a. Install J-7004 into an extension housing attaching bolt hole. See Figure 76-254.

b. Mount the Dial Indicator, J-8001, on the rod and index with the end of the output shaft.

c. Apply air pressure to apply the intermediate clutch (center oil passage) while moving the output shaft in and out to read the end play. End play should be from .007" - .019". The selective washer controlling this end play is the steel washer having 3 lugs that is located between the thrust washer and the rear face of the transmission case.

Figure 76-254

If a different washer thickness is required to bring the end play within specification, it can be selected from the following chart.

Thickness	Notches and/or Numeral	
.074-.078	None	1
.082-.086	1 Tab Side	2
.090-.094	2 Tabs Side	3
.098-.102	1 Tab O.D.	4
.106-.110	2 Tabs O.D.	5
.114-.118	3 Tabs O.D.	6

16. Install front band with band anchor hole placed over the band anchor pin and apply lug facing servo hole. See Figure 76-255.

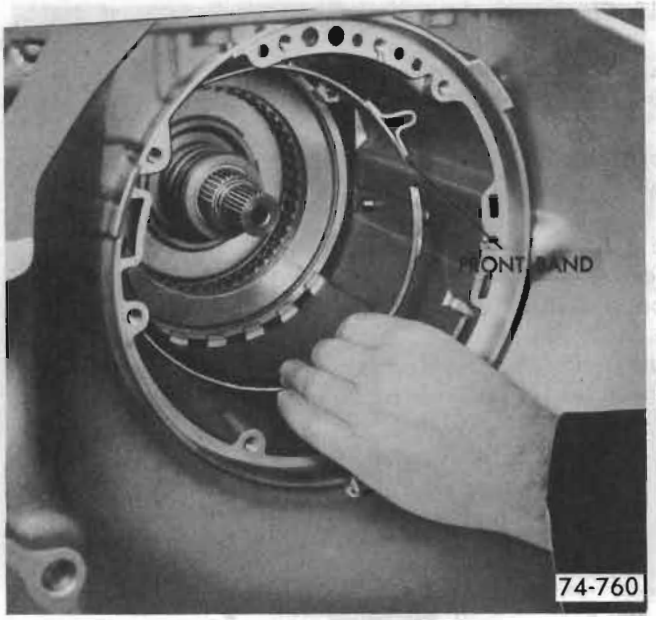


Figure 76-255

17. Install the direct clutch and intermediate sprag assembly. It will be necessary to twist the housing to allow the sprag outer race to index with the composition clutch plates. The housing hub will bottom on the sun gear shaft. See Figure 76-256.

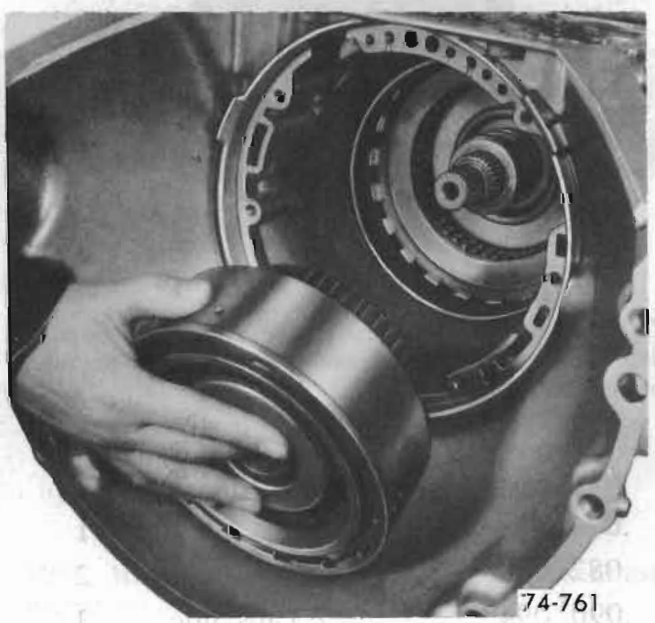


Figure 76-256

NOTE: *Removal of direct clutch, composition and steel plates may be helpful.*

18. Install the forward clutch hub to direct clutch housing thrust washer on the forward clutch hub. Retain with petroleum jelly.

19. Install the forward clutch and turbine shaft assembly, see Figure 76-257, indexing the direct clutch hub so end of the mainshaft will bottom on end of the forward clutch hub. When forward clutch is seated it will be approximately 1-1/4" from pump face in case.

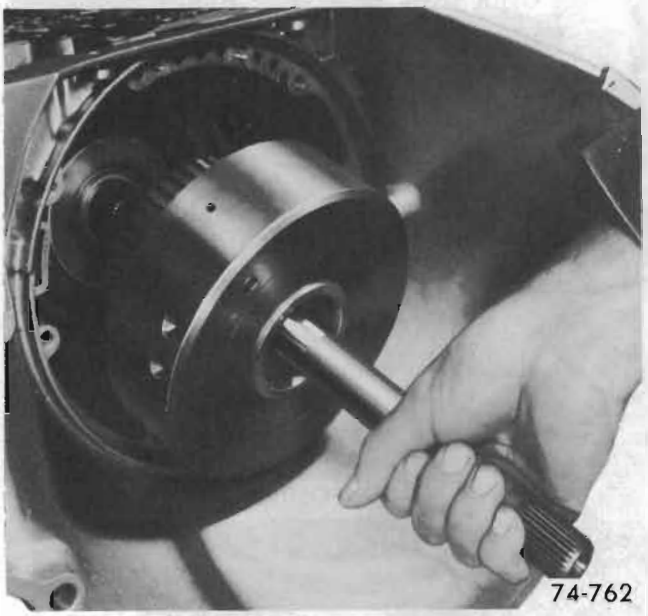


Figure 76-257

20. Install guide pins into transmission case. See Figure 76-258.

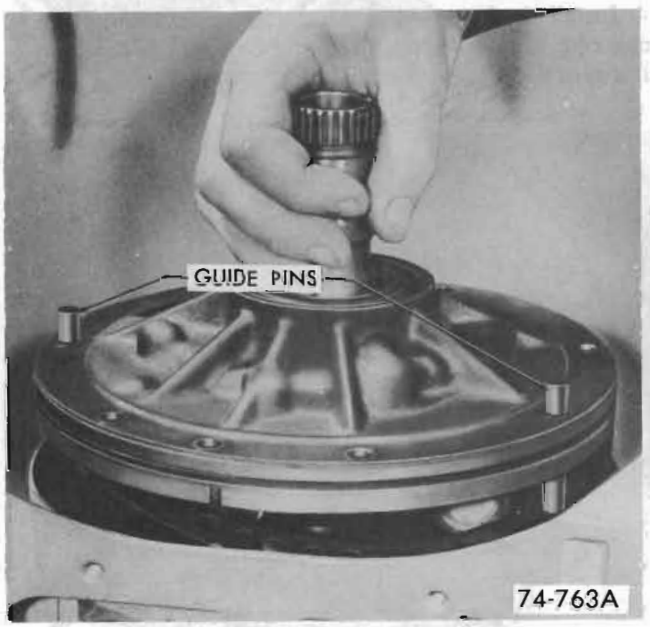


Figure 76-258

21. Install the front pump assembly, gasket and pump and all but one attaching bolt and seal. *Always use new seal on bolt.* Torque 15-20 lb. ft.

NOTE: *If the turbine shaft can not be rotated as the pump is being pulled into place, the forward or direct clutch*

housings have not been properly installed to index with all the clutch plates. This condition must be corrected before the pump is pulled fully into place.

22. If necessary, install a new front seal, coat the outside diameter with a good sealer and using Tool J-21359, drive the seal in place. See Figure 76-259.

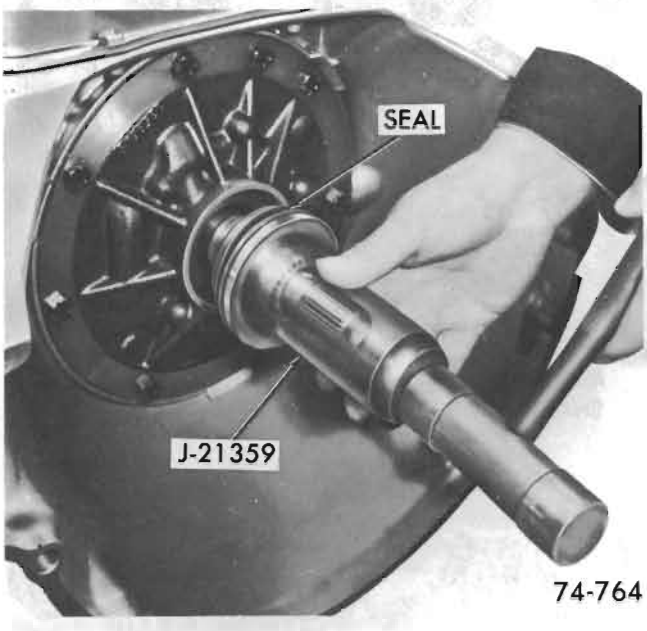


Figure 76-259

23. Check front unit end play as follows: See Figure 76-260.

a. Remove one front pump attaching bolt, and bolt seal.

b. Install J-7004, Slide Hammer into bolt hole.

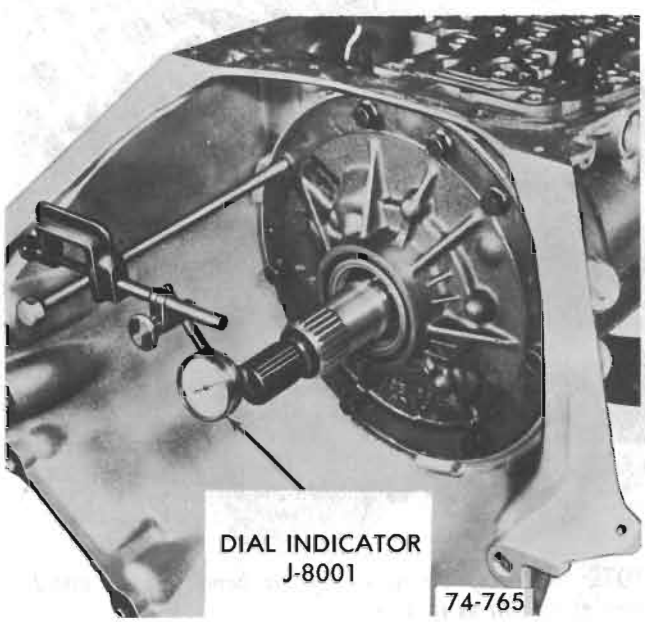


Figure 76-260

c. Mount the dial indicator on the rod and index indicator to register with end of turbine shaft.

d. Push turbine shaft rearward.

e. Push output shaft forward.

f. Set dial indicator to zero.

g. Pull turbine shaft forward.

Read the resulting travel or end play which should be .003" - .024".

The selective washer controlling this end play is the washer located between the pump cover and the forward clutch housing. If more or less washer thickness is required to bring end play within specifications, select the proper washer from the chart below.

Thickness	Color
.060-.064	Yellow
.071-.075	Blue
.082-.086	Red
.093-.097	Brown
.104-.108	Green
.115-.119	Black
.126-.130	Purple

76-48

NOTE: *An oil soaked washer may tend to discolor so that it will be necessary to measure the washer for its actual thickness.*

24. Install the remaining front pump attaching bolt and new seal. Torque bolts to 15-20 lb. ft.

76-34 REAR EXTENSION HOUSING

1. Install the extension housing to case gasket on the extension housing.

2. Attach the extension housing to the case using attaching bolts. Torque bolts to 20-25 lb. ft.

3. If necessary, install a new rear seal, coat the outside diameter with a good sealer and using Tool J-21464 on "BT" and Tool J-21359 on other models, drive the seal in place. See Figure 76-261.

Figure 76-261

76-35 INSTALLATION MANUAL LINKAGE

1. If necessary, install a new manual shaft to case lip seal using a 3/4" diameter rod to seat seal in case.

2. If removed, insert the actuator rod into manual detent lever from side opposite pin.

3. Install the actuator rod plunger under the parking bracket and over the parking pawl.

4. Install the manual shaft through the case and detent lever. See Figure 76-262.

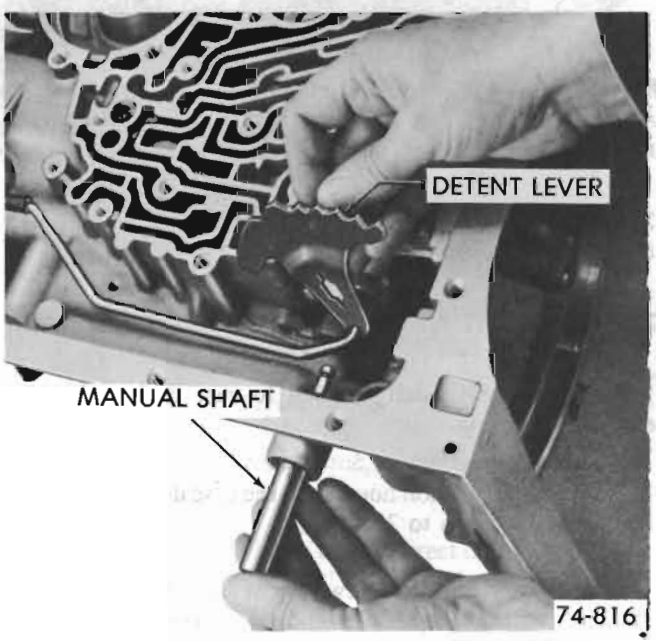


Figure 76-262

5. Install retaining hex-lock nut on manual shaft. See Figure 76-263.

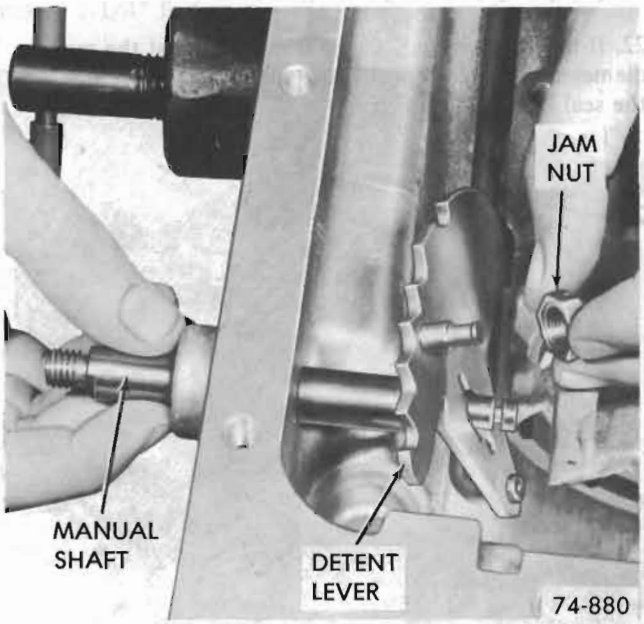


Figure 76-263

6. Install manual shaft retaining pin indexing with groove in manual shaft. See Figure 76-264.

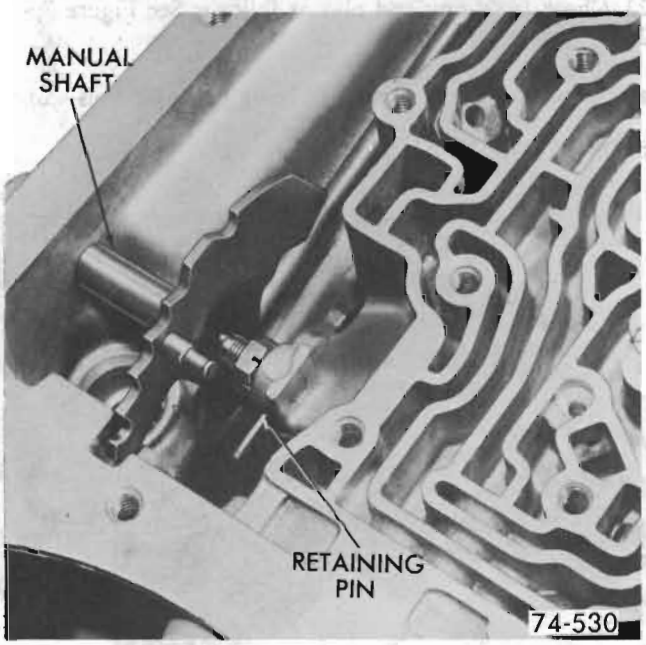


Figure 76-264

NOTE: *It may be necessary to bend pin to install. Straighten pin as it is installed.*

7. Tighten lock nut on manual shaft.

76-36 INSTALLATION OF CHECK BALLS, CONTROL VALVE SPACER PLATE AND GASKET, DETENT SOLENOID, FRONT SERVO ASSEMBLY, AND ELECTRICAL CONNECTOR

1. Install two control valve assembly attaching bolts with heads cut off as guide pins, as shown in Figure 76-265.

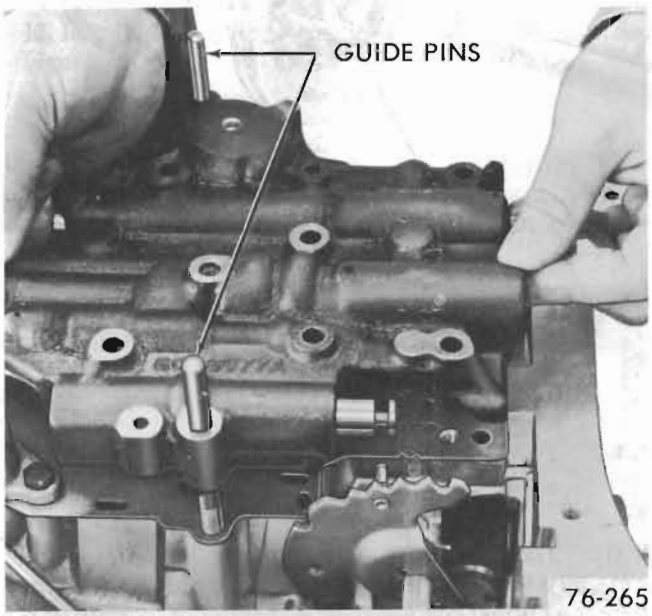


Figure 76-265

2. Install six check balls into ball seat pockets in transmission case. See Figure 76-266.

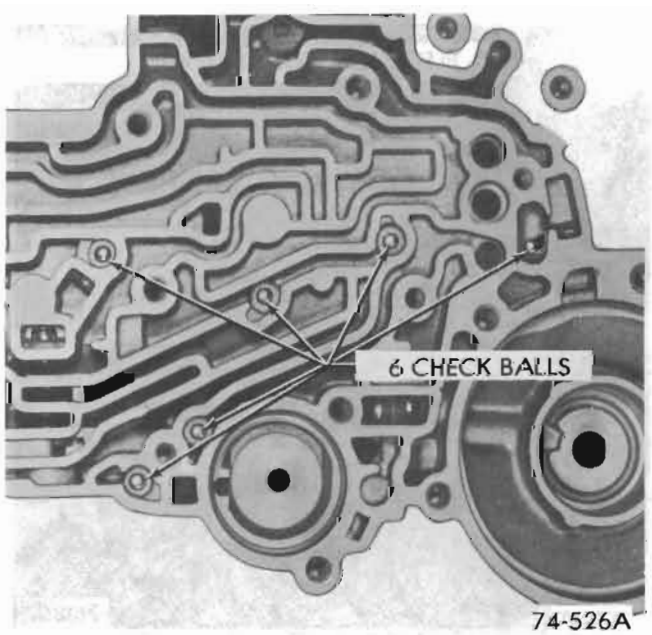


Figure 76-266

NOTE: *If transmission is in car, install check balls into ball seat pockets on spacer plate. See Figure 76-266A.*

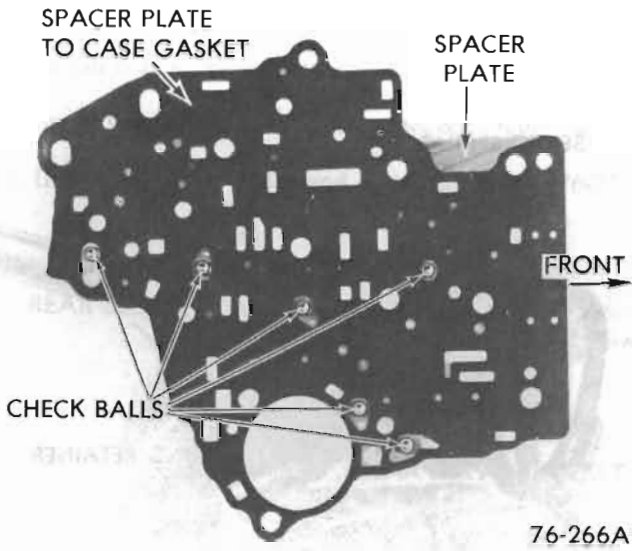


Figure 76-266A

3. Install control valve spacer plate-to-case gasket (gasket with extension for detent solenoid).

4. Install control valve spacer plate.

5. Install detent solenoid gasket. See Figure 76- 267.

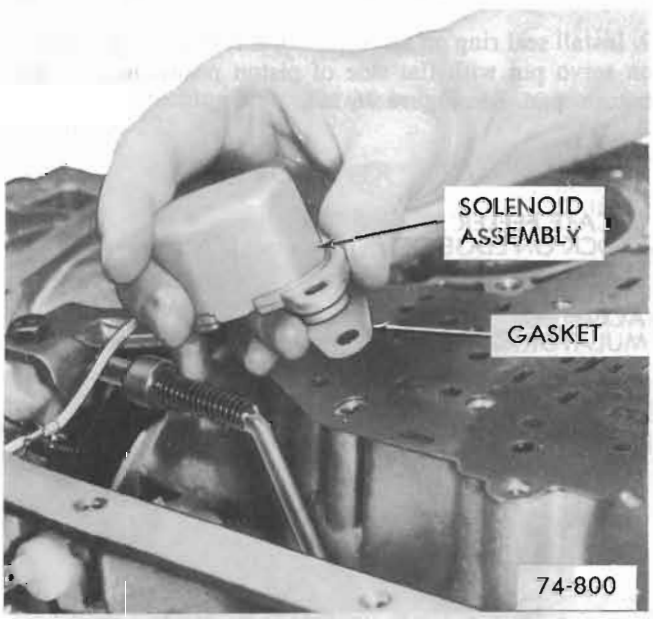


Figure 76-267

6. Install detent solenoid assembly with connector facing outer edge of case. Do not tighten bolts at this time.

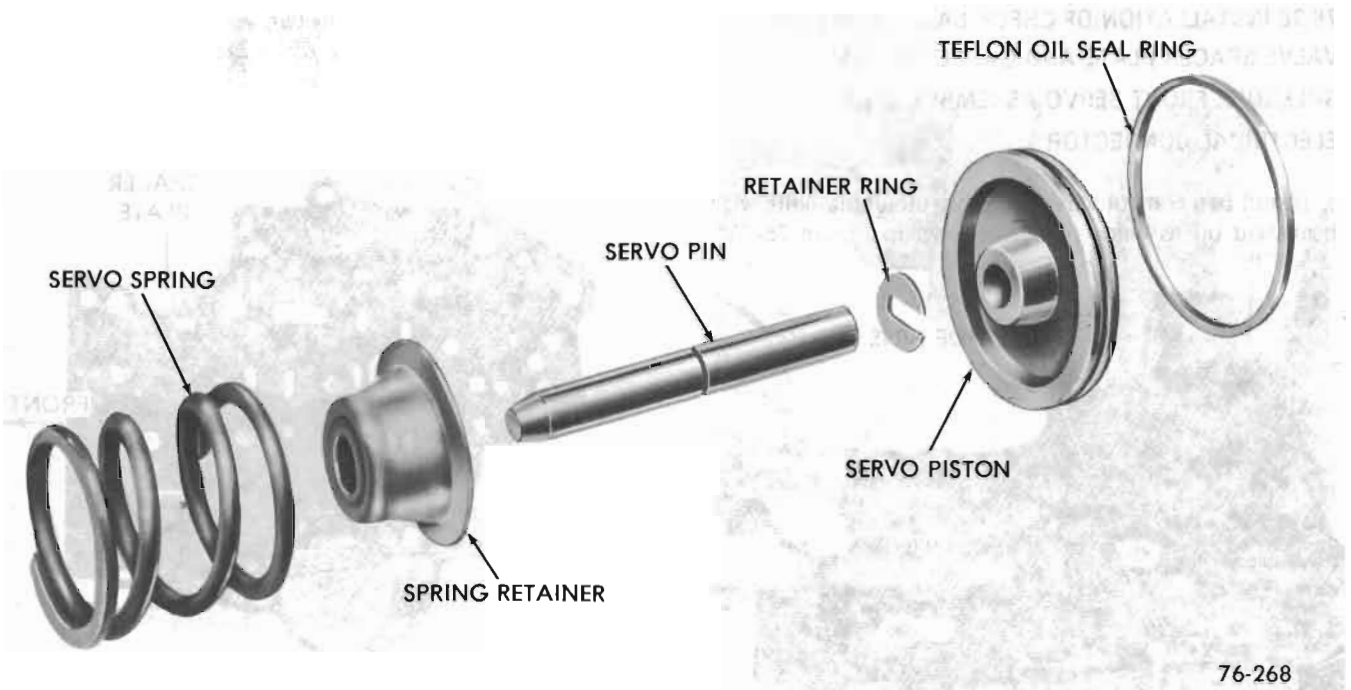


Figure 76-268

7. Install front servo spring and spring retainer into transmission case. See Figure 76-268.

8. Install retainer ring in front servo pin groove and install pin into case so that tapered end contacts band. Make certain retainer ring is installed in servo pin groove.

9. Install seal ring on servo piston, if removed, and install on servo pin with flat side of piston positioned toward bottom pan. See Figure 76-268.

NOTE: *The teflon ring allows the front servo piston to slide very freely in the case. The free fit of the ring in the bore is a normal characteristic and does not indicate leakage during operation. The teflon ring should only be replaced if it shows damage or if evidence of leakage during operation exists.*

NOTE: *If transmission is in car, assemble front servo group, as shown in Figure 76-268, and install this group of parts into front servo bore in case and hold. Slip a*

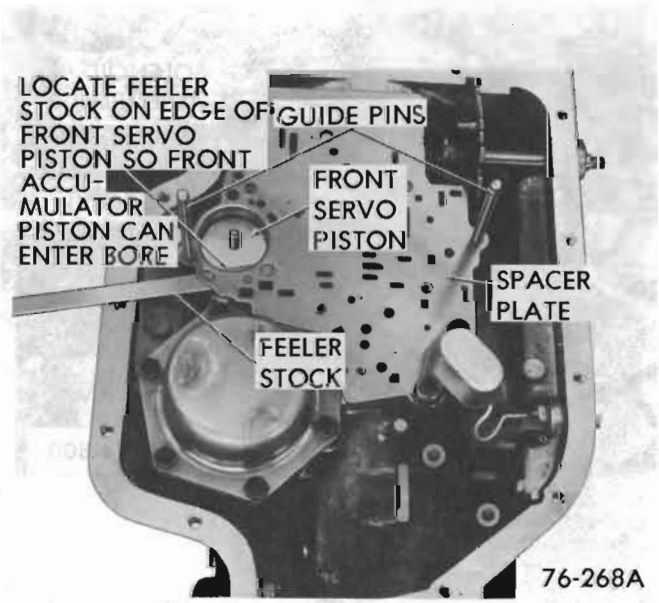


Figure 76-268A

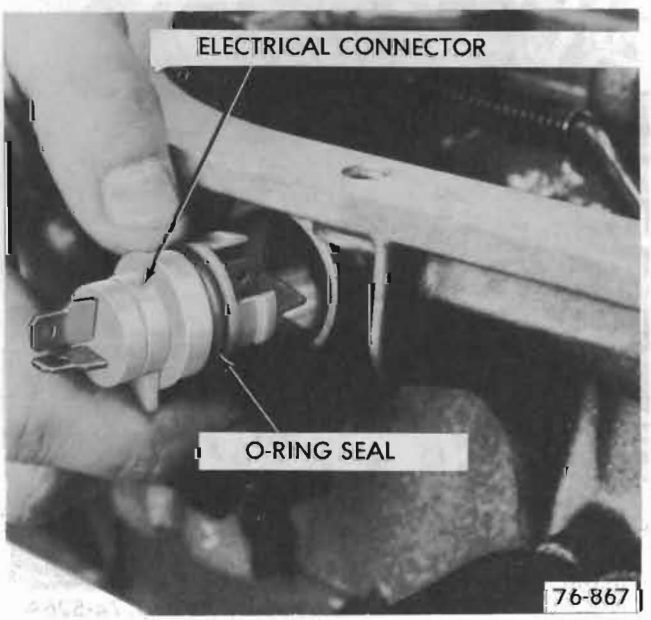


Figure 76-269

length of straight, clean feeler gauge or shim stock (about .020") between spacer plate and front servo piston to temporarily retain front servo group. See Figure 76-268A.

10. Install "O" ring seal on the solenoid connector.

11. Install connector with lock tabs facing into case, positioning locator tab in notch on side of case. See Figure 76-269.

12. Install detent wire and lead wire to case connector. See Figure 76-270.

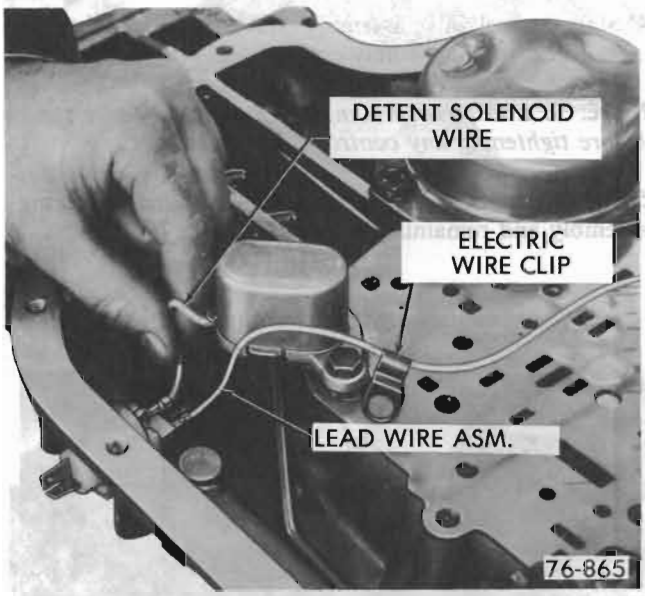


Figure 76-270

Figure 76-271

NOTE: *Check by pulling on detent connector wire. If detent connector wire can be removed, turn wire connector over and reinstall into connector. See Figure 76-270.*

76-37 INSTALLATION OF REAR SERVO ASSEMBLY

1. Install rear servo accumulator spring into case.

2. Install rear servo assembly into case. See Figure 76-271.

3. Install rear servo gasket and cover. See Figure 76-272.

Figure 76-272

4. Install attaching bolts. Torque bolts to 15- 20 lb. ft. See Figure 76-273.

Figure 76-273

76-38 INSTALLATION OF CONTROL VALVE ASSEMBLY, GOVERNOR PIPES, AND GOVERNOR SCREEN ASSEMBLY

1. Install governor pipes on control valve assembly. Governor pipes are interchangeable. See Figure 76-274.

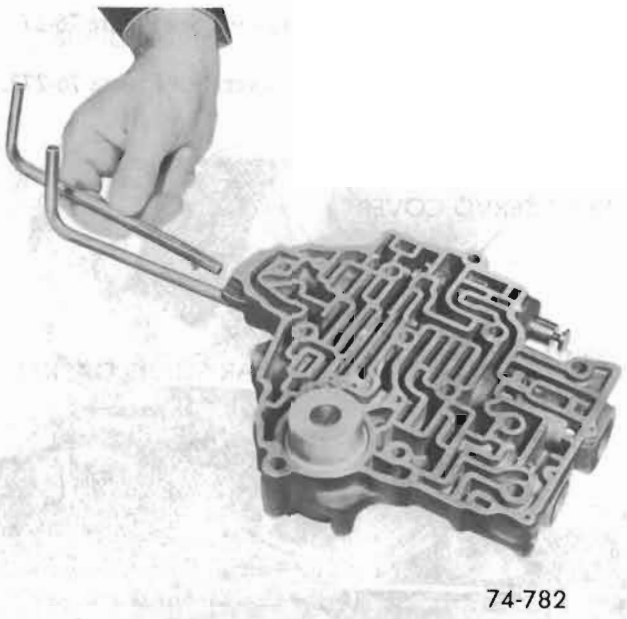


Figure 76-274

2. Install governor screen assembly, *open end first,* into governor feed pipe hole in case (hole nearest the center of transmission). See Figure 76- 275.

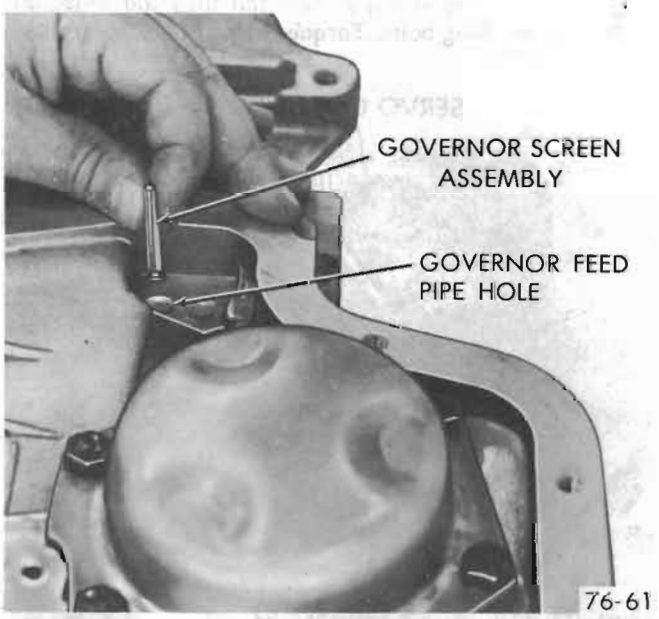


Figure 76-275

NOTE: *If transmission is in vehicle, before installing the control valve assembly and governor pipes, as outlined in Step 3 below, insert governor screen, closed end first, into governor feed pipe. (This pipe locates in the governor feed pipe hole in the case nearest the center of the transmission). See Figure 76-265.*

3. Install control valve assembly and governor pipes on transmission, while carefully aligning the governor feed pipe over the governor screen. See Figure 76- 265. Make certain gasket and spacer do not become mispositioned.

NOTE: *Check manual valve to make sure it is indexed properly with pin on detent lever and governor pipes to make certain they are properly seated in case holes.*

4. Start control valve assembly attaching bolts and make certain lead wire assembly clip is installed.

NOTE: *If transmission is in vehicle, remove feeler stock before tightening any control valve bolts.*

5. Remove guide pins and install detent roller and spring assembly and remaining bolts. See Figure 76- 276.

Figure 76-276

6. Tighten solenoid and valve body attaching bolts. Torque bolts to 6-10 lb. ft.

7. If removed, install the pressure switch assembly.

8. Connect lead wire assembly to pressure switch assembly.

76-39 INSTALLATION OF SPEEDOMETER DRIVEN GEAR ASSEMBLY AND CONVERTER ASSEMBLY

1. Install the speedometer driven gear assembly. See Figure 76-277.

Figure 76-277

2. Install the speedometer driven gear retainer and attaching bolt. See Figure 76-278.

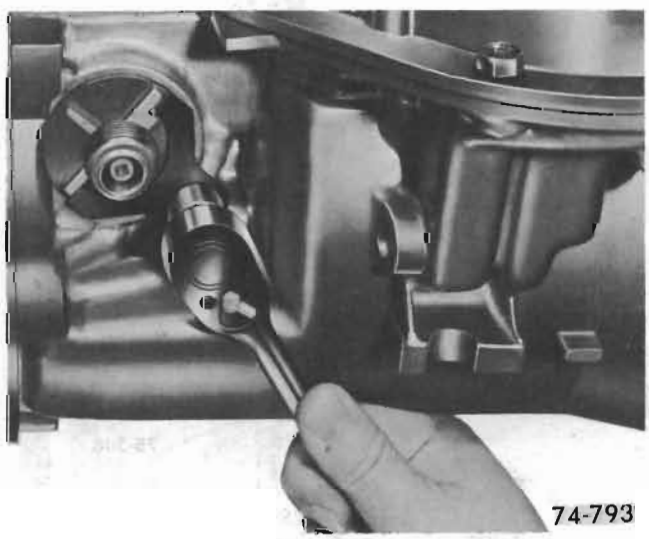


Figure 76-278

3. Install converter assembly into oil pump. Extreme care must be taken not to damage seal.

NOTE: *Make certain converter hub drive tangs are fully engaged with pump drive gear tang.*

4. Install Converter Holding Tool J-21366 to retain converter until ready to install in car.

76-40 INSTALLATION OF GOVERNOR BUSHING

1. Remove transmission from car.

2. Remove the output shaft, valve body, support plate, and governor from the case.

3. Assemble transmission case in fixture J-8763 and mount in a vise. See Figure 76-279.

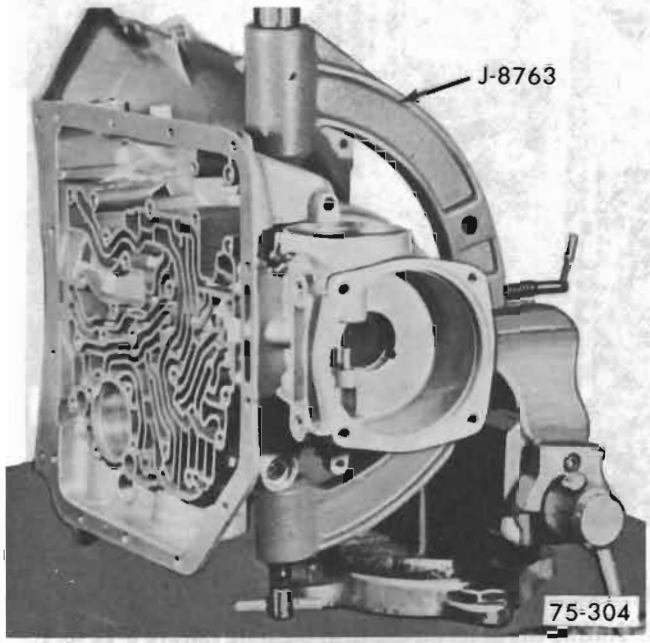


Figure 76-279

4. Clean off excess stock from the governor o- ring seal to case mating surface. See Figure 76-280.

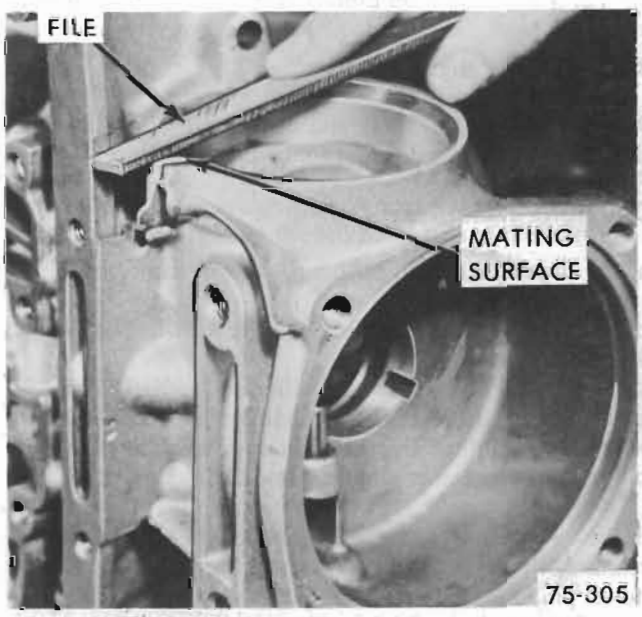


Figure 76-280

5. *Loosely* bolt the drill bushing fixture J-22976-1 to the case.

6. Place the alignment arbor J-22976-3 into the drill bush-

ing fixture and down into the governor bore until it bottoms on the dowel pin. See Figure 76-281.

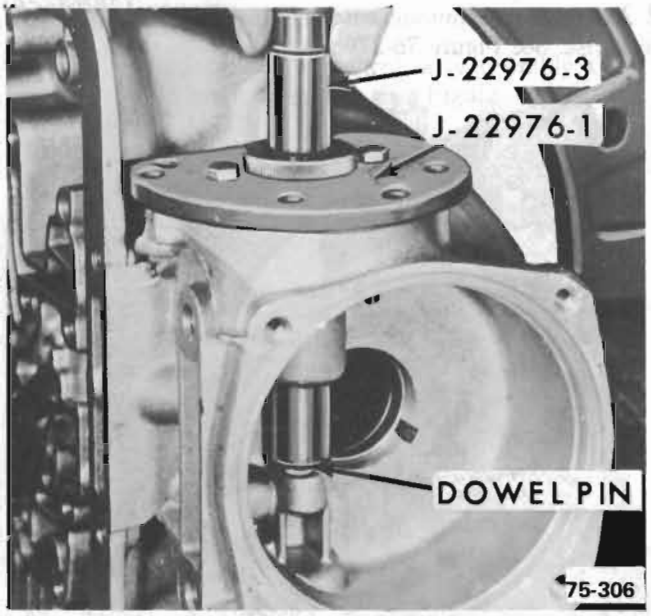


Figure 76-281

7. Torque the bolts on the drill bushing fixture 8-12 lb. ft. *Do not over torque and strip the threads.*

NOTE: *The alignment arbor should be able to rotate freely after the bolts are properly torqued. If the alignment arbor cannot be rotated by hand, recheck the work performed in step 4.*

8. Remove the alignment arbor.

9. Using reamer J-22976-9 and drive rachet, *hand* ream the governor bore using the following procedure:

CAUTION: *Hand Ream Only*

a. Oil the reamer, drill bushing, and governor bore.

b. Use 5-10 lbs. of feeding force on the reamer. See Figure 76-282.

c. *After each 10 revolutions* remove the reamer and dip it into a cup full of transmission oil. This will clean the chips from the reamer and lubricate it. See Figure 76-283.

d. When the reamer reaches the end of the bore, continue reaming the bore until the reamer bottoms out on the dowel pin in the case. *At this point, rotate the reamer 10 complete revolutions.*

e. Remove the reamer using a clockwise rotation and 5-10 lbs. force upward.

IMPORTANT: *Pulling the reamer out without rotating it may score the bore causing a leak between the case and the bushing.*

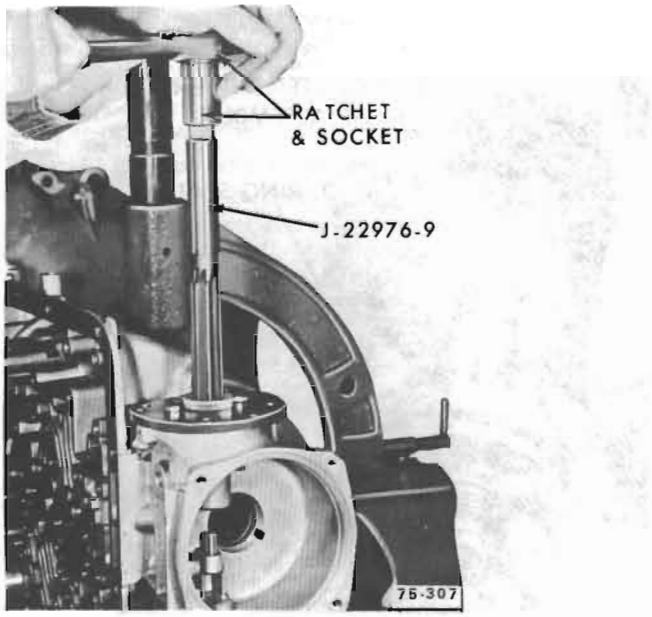


Figure 76-282

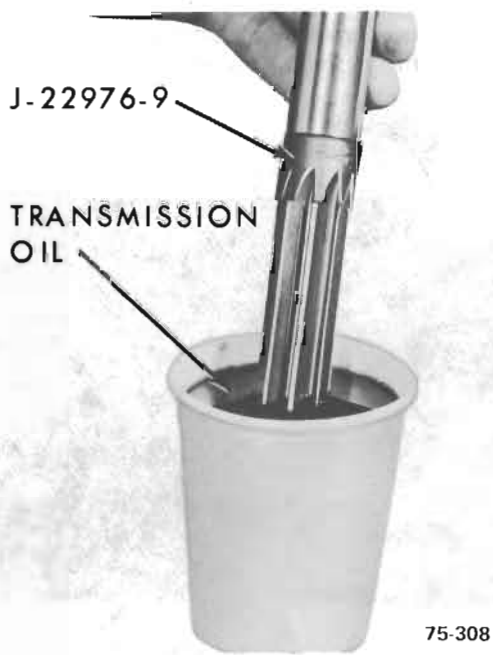


Figure 76-283

10. Remove the drill bushing fixture from the case.

11. Thoroughly clean the chips from the case, visually check the governor feed holes to insure that they are free from chips.

12. Install the bushing using the following procedure:

a. Note the two (2) notches at one end of the bushing.

b. Position the notches so that one notch is toward the front of the case and the other is toward the bottom of the case. See Figure 76-284.

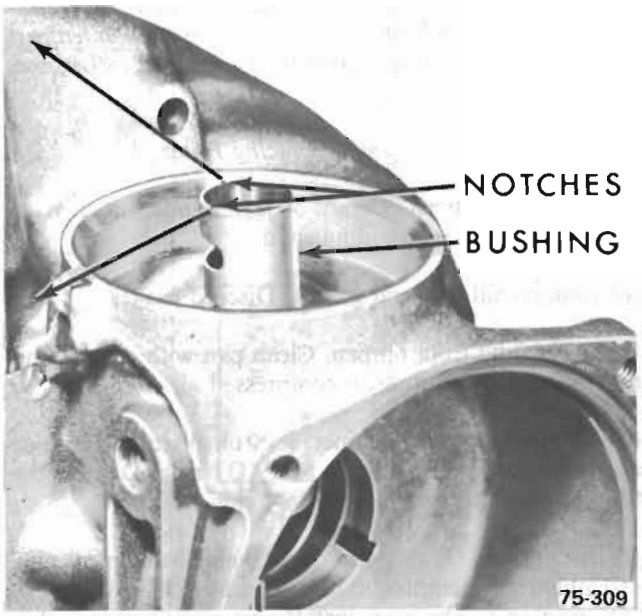


Figure 76-284

c. Use J-22976-3 alignment arbor and bushing installer to drive the bushing into the case. See Figure 76-285.

CAUTION: *A brass hammer should be used to strike the hardened steel bushing installer tool.*

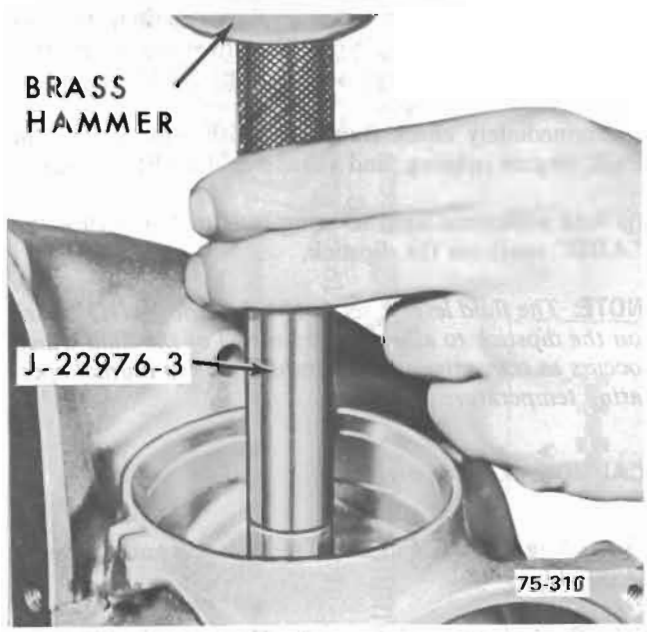


Figure 76-285

d. Drive the bushing until it is flush with the top of the bore. See Figure 76-286.

13. Oil a new governor and insert it into the installed bushing. The governor should spin freely. If slight honing on the bushing is necessary, use crocus or fine emery cloth and move in the annular direction only.

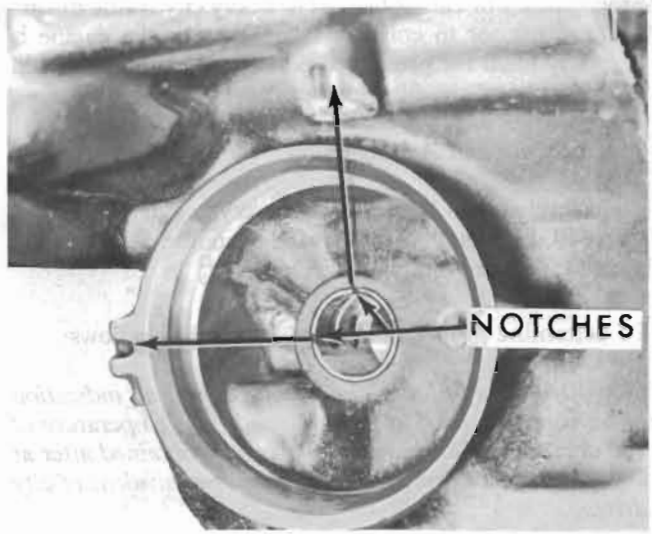


Figure 76-286

B. Transmission Identification Number

A production identification number is stamped on a metal tag, located in the lower right side of the transmission case.

The production code number is located along the top of the tag. Since the production code number furnishes the key to construction and interchangeability of parts in each transmission, the number should be used when selecting replacement parts as listed in the master parts list. The number should always be furnished on product reports, *AFA forms, and all correspondence with the factory* concerning a particular transmission.

On all 1971 Turbo Hydra-Matic 400 transmissions, the car serial number is stamped on a pad located just above the bottom pan face on the left hand side of the transmission.

C. Turbo Hydra-Matic 400 Fluid Recommendations

Use DEXRON Automatic Transmission Fluid *only* in all 1971 model Turbo Hydra-Matic 400 automatic transmissions (GM Part No. 1050568-69-70 or other fluid having DEXRON identifications).

DEXRON is an especially formulated automatic transmission fluid designed to improve transmission operation.

NOTE: *Use DEXRON or type "A" automatic transmission fluid identified by the mark "AQ-ATF" followed by a number and the suffix letter "A" (AQ- ATF-XXXX-A) in all automatic transmissions prior to the 1968 models.*

The oil pan should be drained and the filter replaced every 24,000 miles and fresh fluid added to obtain the proper level on the dipstick. See sub-paragraph 2 for proper refill

procedures. For cars subjected to heavy city traffic during hot weather, or in commercial use, when the engine is regularly idled for prolonged periods, the oil pan should be drained and the filter replaced every 12,000 miles.

1. *Checking and Adding Fluid*

Fluid level should be checked at every engine oil change. The "FULL" and "ADD" marks on the transmission dipstick indicate one pint difference.

To determine proper fluid level, proceed as follows:

CAUTION: *The full mark on the dipstick is an indication of transmission fluid at normal operating temperature of 180 degrees F. This temperature is only obtained after at least 15 miles of expressway driving or equivalent of city driving.*

1. With manual control lever in Park position start engine. DO NOT RACE ENGINE. Move manual control lever through each range.

2. Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be at the "FULL" mark.

3. If additional fluid is required, add fluid to the "FULL" mark on the dipstick.

If vehicle can not be driven 15 expressway miles or equivalent, and it becomes necessary to check fluid level, the transmission fluid must be at room temperature (70 degrees F).

With fluid at room temperature (70 degrees F) follow steps 1, 2, and 3 below.

1. With manual control lever in Park position start engine. DO NOT RACE ENGINE. Move manual control lever through each range.

2. Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

At this point, when a reading is made, fluid level on the dipstick should be 1/4" below the "ADD" mark.

3. If additional fluid is required add fluid to bring level to 1/4" below the "ADD" mark on the dipstick.

CAUTION: *Do not Overfill, as foaming and loss of fluid through the vent pipe might occur as fluid heats up. If fluid is too low, especially when cold, complete loss of drive may result which can cause transmission failure.*

NOTE: *If transmission fluid level is correctly established at 70 degrees F it will appear at the "FULL" mark on the dipstick when the transmissions reaches normal operating temperature (180 degrees F). The fluid level is set 1/4" below the "ADD" mark on the dipstick to allow for expansion of the fluid which occurs as transmission temperatures rise to normal operating temperature of 180 degrees F.*

2. *Draining Oil Pan and Replacing Filter*

(a) Raise car on hoist or place on jack stands, and provide container to collect draining fluid.

(b) Remove oil pan and gasket. Discard gasket.

(c) Drain fluid from oil pan. Clean pan with solvent and dry thoroughly with clean compressed air.

(d) Remove oil filter retainer bolt, oil filter, intake pipe assembly and intake pipe to case "O" ring. Discard the filter and intake pipe to case "O" ring.

(e) Install new "O" ring seal on intake pipe and place pipe assembly into grommet on new filter assembly. With new "O" ring on intake pipe, install pipe and filter assembly into case, attaching filter to valve body assembly with retainer bolt. Torque to 10 lb.ft.

(f) Install new gasket on oil pan and install pan. Tighten attaching bolts to 12 lb.ft.

(g) Lower car and add 5 pints of transmission fluid through filler tube.

(h) With manual control lever in Park position, start engine. DO NO RACE ENGINE. Move manual control lever through each range.

(i) Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

(j) Add additional fluid to bring level to 1/4" below the "ADD" mark on the dipstick.

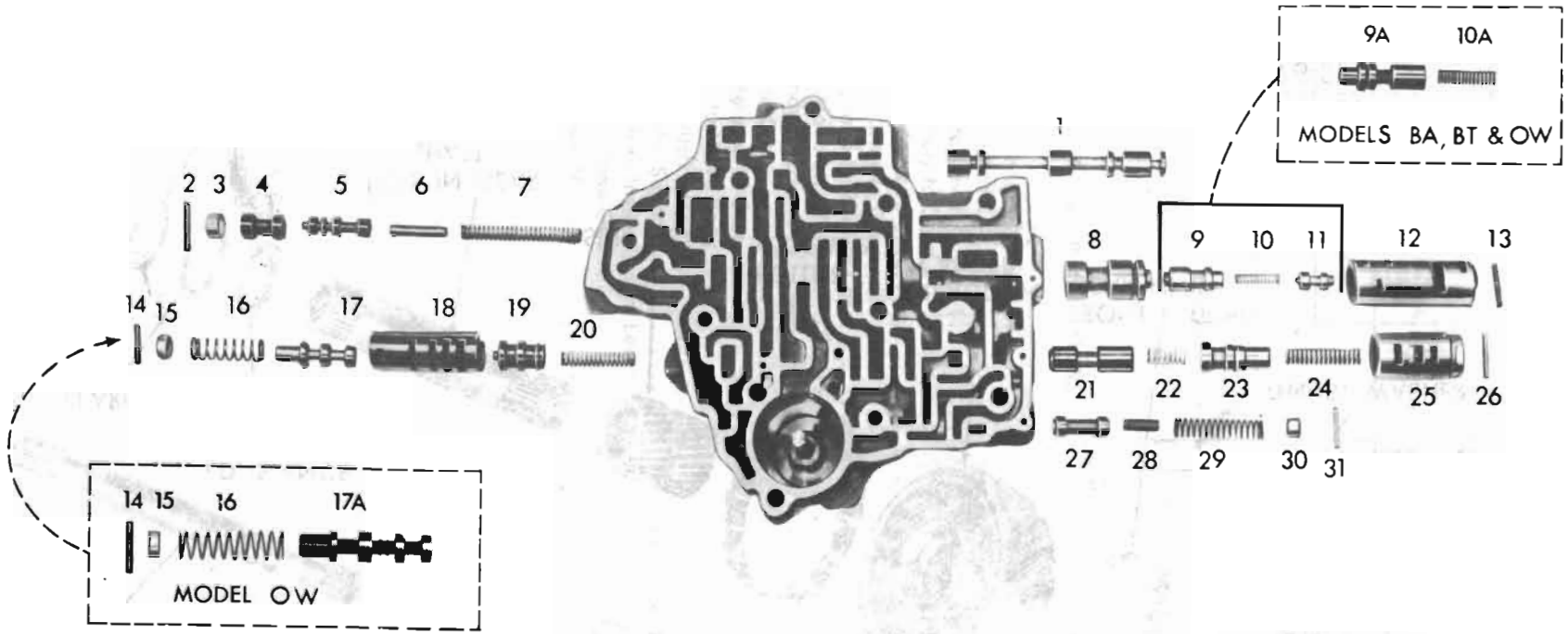
NOTE: *The fluid level is set 1/4" below the "ADD" mark on the dipstick to allow for expansion of the fluid which occurs as transmission temperatures rise to normal operating temperature.*

CAUTION: *Do not overfill.*

3. Adding Fluid to Fill Dry Transmission and Converter Assembly

The fluid capacity of the Turbo Hydra-matic 400 transmission and converter assembly is approximately 23 pints, but correct level is determined by the mark on the dipstick rather than by amount added. In cases of transmission overhaul, when a complete fill is required, including a new converter proceed as follows:

NOTE: *The converter should be replaced only if the converter itself fails. On any major failure, such as a clutch or gearset, the filter must be replaced.*



1. MANUAL VALVE
2. RETAINING PIN
3. BORE PLUG
4. DETENT VALVE
5. DETENT REGULATOR VALVE
6. SPACER PIN
7. DETENT REGULATOR SPRING
8. 1-2 SHIFT VALVE
9. 1-2 DETENT VALVE

9A. 1-2 MODULATOR VALVE

10. 1-2 REGULATOR SPRING

10A. 1-2 MODULATOR VALVE SPRING

11. 1-2 REGULATOR VALVE
12. 1-2 MODULATOR BUSHING
13. RETAINING PIN
14. GROOVED RETAINING PIN
15. BORE PLUG
16. 1-2 ACCUMULATOR SECONDARY SPRING (NOT USED IN "BB" MODEL)
17. 1-2 ACCUMULATOR VALVE
18. 1-2 ACCUMULATOR BUSHING
19. 1-2 PRIMARY ACCUMULATOR VALVE
20. 1-2 ACCUMULATOR PRIMARY SPRING
21. 2-3 SHIFT VALVE
22. 3-2 INTERMEDIATE SPRING
23. 2-3 MODULATOR VALVE
24. 2-3 VALVE SPRING
25. 2-3 MODULATOR BUSHING
26. RETAINING PIN
27. 3-2 VALVE
28. SPACER PIN
29. 3-2 VALVE SPRING
30. BORE PLUG
31. RETAINING PIN

Figure 76-287

76-287

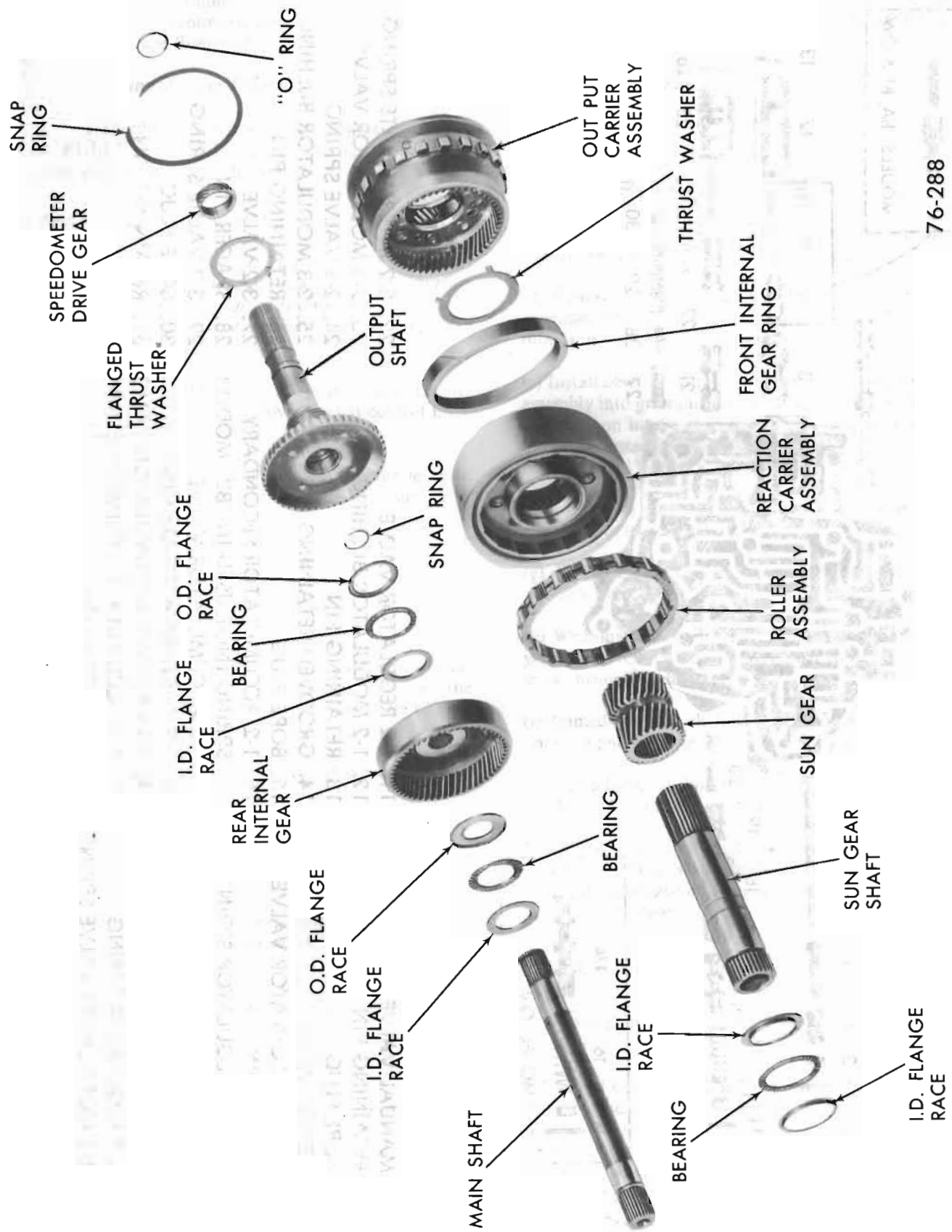


Figure 76-288 Exploded View of Gear Unit Assemt

DIVISION VI SPECIFICATIONS

76-41 GENERAL SPECIFICATIONS

A MODEL DESIGNATIONS

TRANS. CODE	ENG	MODEL USE	CONVERTER IDENTIFICATION NUMBER	SPEEDOMETER DRIVE GEAR	FORWARD CLUTCH				DIRECT CLUTCH			INTERMEDIATE CLUTCH		
					FLAT STEEL PLATES		NO. OF WAVED STEEL PLATES	NO. OF COMPOSITION PLATES	NO. OF FLAT STEEL PLATES	NO. OF WAVED STEEL PLATES	NO. OF COMPOSITION PLATES	NO. OF FLAT STEEL PLATES	NO. OF WAVED STEEL PLATES	NO. OF COMPOSITION PLATES
					NO.	THICKNESS								
BA	455	GS 455	5	16 Tooth	4	.0775"	1	5	5	1	6	2	1	3
BC	455	Le Sabre, Centurion, Electra & Estate Wagon	5	18 Tooth	4	.0775"	1	5	4	1	5	2	1	3
BT	455	Riviera	5	18 Tooth	4	.0775"	1	5	4	1	5	2	1	3
BB & OW	455	GS 455 Stage 1	5	16 Tooth	4	.0775"	1	5	6	0	6	3	0	3

Forward & Direct Clutch
Waved steel plate thickness – All models – .0615"
Direct clutch flat steel plate thickness – All models – .0915"

76-42 BOLT TORQUE SPECIFICATIONS

Location	Thread Size	Torque Lbs. Ft.
Solenoid Assembly to Case	1/4-20	8
Valve Body to Case	1/4-20	8
Pump Body to Cover	5/16-18	18
Pump Assembly to Case	5/16-18	18
Rear Servo Cover to Case	5/16-18	18
Governor Cover to Case	5/16-18	18
Parking Brake Bracket to Case	5/16-18	18
Vacuum Modulator Retainer to Case	5/16-18	18
Valve Body to Case	5/16-18	8
Oil Pan to Case	5/16-18	12
Case Extension to Case	3/8-16	23
Oil Filter to Valve Body	1/4-20	10
Pressure Switch Assembly	1/8-27	6-10
Case to Center Support	3/8-16	20-25
Manual Shaft to Inside Detent Lever	3/8-24	15-20
Line Pressure Take-Off	1/8-27	10-15
Cooler Connector	1/4-18	23-30

(a) Add 10 pints of transmission fluid through filler tube.

NOTE: *If installation of a new converter is not required add only 6 pints of transmission fluid.*

(b) With manual control lever in Park position start engine and place fast idle screw on middle of fast idle cam. DO NOT RACE ENGINE. Move manual control lever through each range.

(c) Immediately check fluid level with selector lever in Park, engine running, and vehicle on LEVEL surface.

(d) Add additional fluid to bring level to 1/4" below the "ADD" mark on the dipstick.

NOTE: *Fluid level is set at 1/4" below the "ADD" mark on the dipstick to allow for expansion as fluid heats up.*

CAUTION: *Do not overfill.*

D. Turbo Hydra-matic 400 Towing Instructions

If a Buick equipped with Turbo Hydra-matic 400 transmission must be towed, the following precautions must be observed: The car may be towed safely on its rear wheels with the shift lever in neutral position at speeds of 35 miles per hour or less under most conditions.

However, the drive shaft must be disconnected or the car towed on its front wheels if:

Tow speeds in excess of 35 mph are necessary,

Car must be towed for extended distances (over 50 miles) or,

Transmission is not operating properly.

If car is towed on its front wheels, the steering wheel should be secured to keep the front wheels in a straight-ahead position.

E. Rocking Car

If it becomes necessary to rock the car to free it from sand, mud or snow, move the selector lever from "D" to "R" in a repeat pattern while simultaneously applying moderate pressure to the accelerator. Do not race engine. Avoid spinning wheels when trying to free the car.

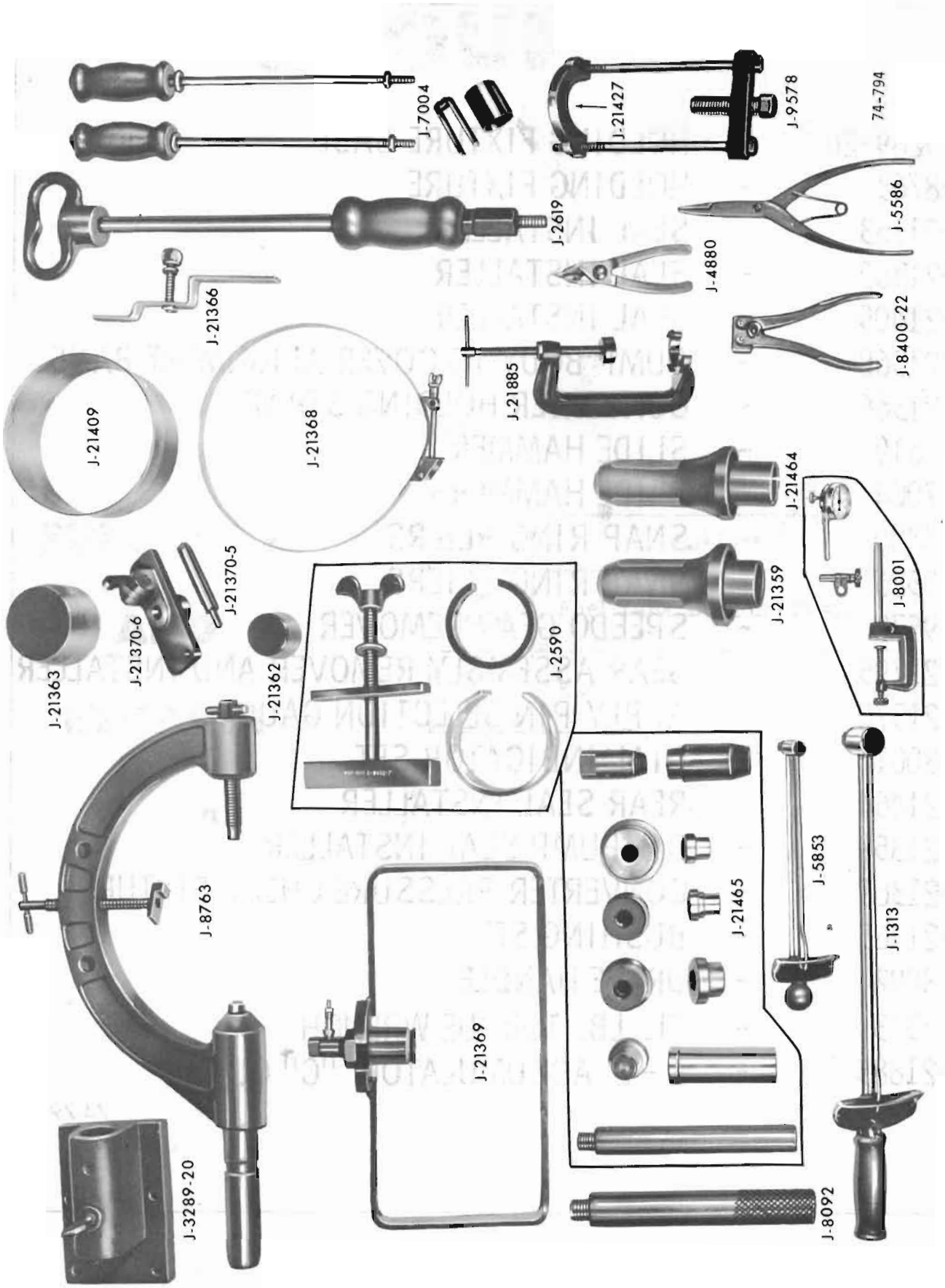


Figure 76-300 - Tool Picture

J-3289-20	-	HOLDING FIXTURE BASE
J-8763	-	HOLDING FIXTURE
J-21363	-	SEAL INSTALLER
J-21362	-	SEAL INSTALLER
J-21409	-	SEAL INSTALLER
J-21368	-	PUMP BODY TO COVER ALIGNMENT BAND
J-21366	-	CONVERTER HOLDING STRAP
J-2619	-	SLIDE HAMMER
J-7004	-	SLIDE HAMMERS
J-4880	-	SNAP RING PLIERS
J-5586	-	SNAP RING PLIERS
J-9578	-	SPEEDO GEAR REMOVER
J-21795	-	GEAR ASSEMBLY REMOVER AND INSTALLER
J-21370	-	APPLY PIN SELECTION GAUGE
J-8001	-	DIAL INDICATOR SET
J-21464	-	REAR SEAL INSTALLER
J-21359	-	OIL PUMP SEAL INSTALLER
J-21369	-	CONVERTER PRESSURE CHECK FIXTURE
J-21465	-	BUSHING SET
J-8092	-	DRIVE HANDLE
J-1313	-	FT. LB. TORQUE WRENCH
J-21885	-	1 - 2 ACCUMULATOR "C" CLAMP

74-795

Figure 76-301 - Tool Picture Identification