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AUTOMATIC TRANSMISSION - 48RE

DESCRIPTION

The 48RE (Fig. 1) is a four-speed fully automatic transmission with an electronic governor. The 48RE is equipped with a lock-up clutch in the torque converter. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that contains an overdrive clutch, direct clutch, planetary gear set, and overrunning clutch.

The transmission contains a front, rear, and direct clutch which function as the input driving components. It also contains the kickdown (front) and the low/reverse (rear) bands which, along with the overrunning clutch and overdrive clutch, serve as the holding components. The driving and holding components combine to select the necessary planetary gear components, in the front, rear, or overdrive planetary gear set, transfer the engine power from the input shaft through to the output shaft.

The valve body is mounted to the lower side of the transmission and contains the valves to control pressure regulation, fluid flow control, and clutch/band application. The oil pump is mounted at the front of the transmission and is driven by the torque converter hub. The pump supplies the oil pressure necessary for clutch/band actuation and transmission lubrication.
IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

OPERATION

The application of each driving or holding component is controlled by the valve body based upon the manual lever position, throttle pressure, and governor pressure. The governor pressure is a variable pressure input to the valve body and is one of the signals that a shift is necessary. First through fourth gear are obtained by selectively applying and releasing the different clutches and bands. Engine power is thereby routed to the various planetary gear assemblies which combine with the overrunning clutch assemblies to generate the different gear ratios. The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear under various conditions, such as when the O/D switch is OFF, when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch can also be engaged in the MANUAL SECOND gear position if high transmission temperatures are sensed by the PCM. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased. The torque converter clutch feature increases fuel economy and reduces the transmission fluid temperature.

Since the overdrive clutch is applied in fourth gear only and the direct clutch is applied in all ranges except fourth gear, the transmission operation for park, neutral, and first through third gear will be described first. Once these powerflows are described, the third to fourth shift sequence will be described.
PARK POWERFLOW

As the engine is running and the crankshaft is rotating, the flexplate and torque converter, which are also bolted to it, are all rotating in a clockwise direction as viewed from the front of the engine. The notched hub of the torque converter is connected to the oil pump’s internal gear, supplying the transmission with oil pressure. As the converter turns, it turns the input shaft in a clockwise direction. As the input shaft is rotating, the front clutch hub-rear clutch retainer and all their associated parts are also rotating, all being directly connected to the input shaft. The power flow from the engine through the front clutch hub and rear clutch retainer stops at the rear clutch retainer. Therefore, no power flow to the output shaft occurs because no clutches are applied. The only mechanism in use at this time is the parking sprag (Fig. 3), which locks the parking gear on the output shaft to the transmission case.

NEUTRAL POWERFLOW

With the gear selector in the NEUTRAL position (Fig. 4), the power flow of the transmission is essentially the same as in the park position. The only operational difference is that the parking sprag has been disengaged, unlocking the output shaft from the transmission case and allowing it to move freely.

---

**Fig. 3 Park Powerflow**

1 - PAWL ENGAGED FOR PARK
2 - PARK SPRAG
3 - OUTPUT SHAFT

**Fig. 4 Neutral Powerflow**

1 - PAWL DISENGAGED FOR NEUTRAL
2 - PARK SPRAG
3 - OUTPUT SHAFT
4 - CAM
5 - PAWL
REVERSE POWERFLOW

When the gear selector is moved into the REVERSE position (Fig. 5), the front clutch and the rear band are applied. With the application of the front clutch, engine torque is applied to the sun gear, turning it in a clockwise direction. The clockwise rotation of the sun gear causes the rear planet pinions to rotate against engine rotation in a counterclockwise direction. The rear band is holding the low reverse drum, which is splined to the rear carrier. Since the rear carrier is being held, the torque from the planet pinions is transferred to the rear annulus gear, which is splined to the output shaft. The output shaft in turn rotates with the annulus gear in a counterclockwise direction giving a reverse gear output. The entire transmission of torque is applied to the rear planetary gearset only. Although there is torque input to the front gearset through the sun gear, no other member of the gearset is being held. During the entire reverse stage of operation, the front planetary gears are in an idling condition.

---

**Fig. 5 Reverse Powerflow**

1 - FRONT CLUTCH ENGAGED
2 - OUTPUT SHAFT
3 - LOW/REVERSE BAND APPLIED
4 - INPUT SHAFT
5 - OUTPUT SHAFT
6 - INPUT SHAFT
7 - FRONT CLUTCH ENGAGED
8 - LOW/REVERSE BAND APPLIED
FIRST GEAR POWERFLOW

When the gearshift lever is moved into the DRIVE position the transmission goes into first gear (Fig. 6). As soon as the transmission is shifted from PARK or NEUTRAL to DRIVE, the rear clutch applies, applying the rear clutch pack to the front annulus gear. Engine torque is now applied to the front annulus gear turning it in a clockwise direction. With the front annulus gear turning in a clockwise direction, it causes the front planets to turn in a clockwise direction. The rotation of the front planets cause the sun to revolve in a counterclockwise direction. The sun gear now transfers its counterclockwise rotation to the rear planets which rotate back in a clockwise direction. With the rear annulus gear stationary, the rear planet rotation on the annulus gear causes the rear planet carrier to revolve in a counterclockwise direction. The rear planet carrier is splined into the low-reverse drum, and the low reverse drum is splined to the inner race of the over-running clutch. With the over-running clutch locked, the planet carrier is held, and the resulting torque provided by the planet pinions is transferred to the rear annulus gear. The rear annulus gear is splined to the output shaft and rotated along with it (clockwise) in an underdrive gear reduction mode.

Fig. 6 First Gear Powerflow

1 - OUTPUT SHAFT 5 - OVER-RUNNING CLUTCH HOLDING
2 - OVER-RUNNING CLUTCH HOLDING 6 - INPUT SHAFT
3 - REAR CLUTCH APPLIED 7 - REAR CLUTCH APPLIED
4 - OUTPUT SHAFT 8 - INPUT SHAFT
SECOND GEAR POWERFLOW

In DRIVE-SECOND (Fig. 7), the same elements are applied as in MANUAL-SECOND. Therefore, the power flow will be the same, and both gears will be discussed as one in the same. In DRIVE-SECOND, the transmission has proceeded from first gear to its shift point, and is shifting from first gear to second. The second gear shift is obtained by keeping the rear clutch applied and applying the front (kickdown) band. The front band holds the front clutch retainer that is locked to the sun gear driving shell. With the rear clutch still applied, the input is still on the front annulus gear turning it clockwise at engine speed.

Now that the front band is holding the sun gear stationary, the annulus rotation causes the front planets to rotate in a clockwise direction. The front carrier is then also made to rotate in a clockwise direction but at a reduced speed. This will transmit the torque to the output shaft, which is directly connected to the front planet carrier. The rear planetary annulus gear will also be turning because it is directly splined to the output shaft. All power flow has occurred in the front planetary gear set during the drive-second stage of operation, and now the over-running clutch, in the rear of the transmission, is disengaged and freewheeling on its hub.

---

Fig. 7 Second Gear Powerflow

1 - KICKDOWN BAND APPLIED
2 - OUTPUT SHAFT
3 - REAR CLUTCH ENGAGED
4 - OUTPUT SHAFT
5 - OVER-RUNNING CLUTCH FREE-WHEELING
6 - INPUT SHAFT
7 - REAR CLUTCH APPLIED
8 - KICKDOWN BAND APPLIED
9 - INPUT SHAFT
DIRECT DRIVE POWERFLOW

The vehicle has accelerated and reached the shift point for the 2-3 upshift into direct drive (Fig. 8). When the shift takes place, the front band is released, and the front clutch is applied. The rear clutch stays applied as it has been in all the forward gears. With the front clutch now applied, engine torque is now on the front clutch retainer, which is locked to the sun gear driving shell. This means that the sun gear is now turning in engine rotation (clockwise) and at engine speed. The rear clutch is still applied so engine torque is also still on the front annulus gear. If two members of the same planetary set are driven, direct drive results. Therefore, when two members are rotating at the same speed and in the same direction, it is the same as being locked up. The rear planetary set is also locked up, given the sun gear is still the input, and the rear annulus gear must turn with the output shaft. Both gears are turning in the same direction and at the same speed. The front and rear planet pinions do not turn at all in direct drive. The only rotation is the input from the engine to the connected parts, which are acting as one common unit, to the output shaft.

FOURTH GEAR POWERFLOW

Fourth gear overdrive range is electronically controlled and hydraulically activated. Various sensor inputs are supplied to the powertrain control module to operate the overdrive solenoid on the valve body. The solenoid contains a check ball that opens and closes a vent port in the 3-4 shift valve feed passage. The overdrive solenoid (and check ball) are not energized in first, second, third, or reverse gear. The vent port remains open, diverting line pressure from the 2-3 shift valve away from the 3-4 shift valve. The Tow/Haul control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position. This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston. Line pressure through the timing
valve moves the overdrive piston into contact with the overdrive clutch. The direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts, and when accelerating in fourth gear. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

**DIAGNOSIS AND TESTING**

**DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION**

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

**DIAGNOSIS AND TESTING - PRELIMINARY**

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

**VEHICLE IS DRIVEABLE**

(1) Check for transmission fault codes using DRB® scan tool.
(2) Check fluid level and condition.
(3) Adjust throttle and gearshift linkage if complaint was based on delayed, erratic, or harsh shifts.
(4) Road test and note how transmission upshifts, downshifts, and engages.
(5) Perform hydraulic pressure test if shift problems were noted during road test.
(6) Perform air-pressure test to check clutch-band operation.

**VEHICLE IS DISABLED**

(1) Check fluid level and condition.
(2) Check for broken or disconnected gearshift or throttle linkage.
(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.
(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:
   (a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.
   (b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump, or input shaft.
   (c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

**DIAGNOSIS AND TESTING - ROAD TESTING**

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul will be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart provides a basis for analyzing road test results.
CLUTCH AND BAND APPLICATION CHART

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<tr>
<td>Manual First</td>
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Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only. Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and over-running clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmission would lose both reverse gear and overrun braking in 2 position (manual second gear).

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help determine the probable cause.

DIAGNOSIS AND TESTING - HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and pressure test gauges are required. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo and overdrive ports where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 9).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.
The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case.

Test One - Transmission In Manual Low

This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

1. Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.
2. Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.
3. Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.
4. Have helper start and run engine at 1000 rpm.
5. Move transmission shift lever fully forward into 1 range.
6. Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

- Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two - Transmission In 2 Range

This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

1. Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port.
2. Have helper start and run engine at 1000 rpm.
3. Move transmission shift lever one detent rearward from full forward position. This is 2 range.
4. Move transmission throttle lever from full forward to full rearward position and read pressure on gauge.
5. Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three - Transmission In D Range Third Gear

This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

1. Turn OD switch off.
2. Leave vehicle on hoist and leave Gauge C-3292 in place at accumulator port.
3. Move Gauge C-3293-SP over to front servo port for this test.
4. Have helper start and run engine at 1600 rpm for this test.
5. Move transmission shift lever two detents rearward from full forward position. This is D range.
6. Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:
   - Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.
   - Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

Test Four - Transmission In Reverse

This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

1. Leave vehicle on hoist and leave gauge C-3292 in place at accumulator port.
2. Move 300 psi Gauge C-3293-SP back to rear servo port.
AUTOMATIC TRANSMISSION - 48RE (Continued)

(3) Have helper start and run engine at 1600 rpm for test.
(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.
(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.
(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five - Governor Pressure

This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.
(2) Move transmission shift lever two detents rearward from full forward position. This is D range.
(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.
(4) Note governor pressure:
   • Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
   • If pressure exceeds 20.6 kPa (3 psi), a fault exists in governor pressure control system.
(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.
(6) Governor pressure rise should be smooth and drop back to no more than 20.6 kPa (3 psi), after engine returns to curb idle and brakes are applied to prevent wheels from rotating.
(7) Compare results of pressure test with analysis chart.

Test Six - Transmission In Overdrive Fourth Gear

This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3293-SP for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer; it is not needed for this test.
(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.
(3) Lower vehicle.
(4) Turn OD switch on.
(5) Secure test gauge so it can be viewed from drivers seat.
(6) Start engine and shift into D range.
(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.
(8) Pressure should be 524-565 kPa (76-82 psi) with closed throttle and increase to 690-896 kPa (100-130 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 965 kPa (140 psi) at full throttle.
(9) Return to shop or move vehicle off chassis dyno.

PRESSURE TEST ANALYSIS CHART

<table>
<thead>
<tr>
<th>TEST CONDITION</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line pressure OK during any one test</td>
<td>Pump and regulator valve OK</td>
</tr>
<tr>
<td>Line pressure OK in R but low in D, 2, 1</td>
<td>Leakage in rear clutch area (seal rings, clutch seals)</td>
</tr>
<tr>
<td>Pressure low in D Fourth Gear Range</td>
<td>Overdrive clutch piston seal, or check ball problem</td>
</tr>
<tr>
<td>Pressure OK in 1, 2 but low in D3 and R</td>
<td>Leakage in front clutch area</td>
</tr>
<tr>
<td>Pressure OK in 2 but low in R and 1</td>
<td>Leakage in rear servo</td>
</tr>
<tr>
<td>Front servo pressure in 2</td>
<td>Leakage in servo; broken servo ring or cracked servo piston</td>
</tr>
<tr>
<td>Pressure low in all positions</td>
<td>Clogged filter, stuck regulator valve, worn or faulty pump, low oil level</td>
</tr>
<tr>
<td>Governor pressure too high at idle speed</td>
<td>Governor pressure solenoid valve system fault. Refer to diagnostic book.</td>
</tr>
<tr>
<td>Governor pressure low at all mph figures</td>
<td>Faulty governor pressure solenoid, transmission control module, or governor pressure sensor</td>
</tr>
<tr>
<td>Lubrication pressure low at all throttle positions</td>
<td>Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.</td>
</tr>
<tr>
<td>Line pressure high</td>
<td>Output shaft plugged, sticky regulator valve</td>
</tr>
<tr>
<td>Line pressure low</td>
<td>Sticky regulator valve, clogged filter, worn pump</td>
</tr>
</tbody>
</table>
Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check, after overhaul.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown (Fig. 10).

**Front Clutch Air Test**  
Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

**Rear Clutch Air Test**  
Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

**Front Servo Air Test**  
Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

**Rear Servo Air Test**  
Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

**DIAGNOSIS AND TESTING - CONVERTER HOUSING FLUID LEAK**

When diagnosing converter housing fluid leaks, two items must be established before repair.

1. Verify that a leak condition actually exists.
2. Determine the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump body leaks follow the same path as a seal leak (Fig. 11). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 11). Pump o-ring or gasket leaks usually travel down the inside of the converter housing. Front band lever pin plug leaks are generally deposited on the housing and not on the converter.
TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:
- Leaks at the weld joint around the outside diameter weld.
- Leaks at the converter hub weld.

CONVERTER HOUSING AREA LEAK CORRECTION

1. Remove converter.
2. Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.
3. Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.
4. Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter.
5. Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal may occur if the band is still tightened to the front clutch retainer.
6. Loosen kickdown lever pin access plug three turns. Apply Loctite™ 592, or Permatex No. 2 to plug threads and tighten plug to 17 N·m (150 in. lbs.) torque.
7. Adjust front band.
8. Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.
9. Install transmission and converter housing dust shield.
10. Lower vehicle.

DIAGNOSIS AND TESTING - DIAGNOSIS CHARTS

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for PARK, NEUTRAL, FIRST, SECOND, THIRD, FOURTH, MANUAL FIRST, MANUAL SECOND, and REVERSE gear ranges. Normal working pressures are also supplied for each of the gear ranges.
### DIAGNOSIS CHARTS

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)</td>
<td>1. Fluid Level Low.</td>
<td>1. Add Fluid</td>
</tr>
<tr>
<td></td>
<td>2. Throttle Linkage Mis-adjusted.</td>
<td>2. Adjust linkage - setting may be too long.</td>
</tr>
<tr>
<td></td>
<td>3. Mount and Driveline Bolts Loose.</td>
<td>3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.</td>
</tr>
<tr>
<td></td>
<td>4. U-Joint Worn/Broken.</td>
<td>4. Remove propeller shaft and replace U-Joint.</td>
</tr>
<tr>
<td></td>
<td>6. Hydraulic Pressure Incorrect.</td>
<td>6. Check pressure. Remove, overhaul or adjust valve body as needed.</td>
</tr>
<tr>
<td></td>
<td>7. Band Mis-adjusted.</td>
<td>7. Adjust rear band.</td>
</tr>
<tr>
<td></td>
<td>8. Valve Body Check Balls Missing.</td>
<td>8. Inspect valve body for proper check ball installation.</td>
</tr>
<tr>
<td></td>
<td>9. Axle Pinion Flange Loose.</td>
<td>9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.</td>
</tr>
<tr>
<td></td>
<td>10. Clutch, band or planetary component damaged.</td>
<td>10. Remove, disassemble and repair transmission as necessary.</td>
</tr>
<tr>
<td></td>
<td>11. Converter Clutch Faulty.</td>
<td>11. Replace converter and flush cooler and line before installing new converter.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
<td>CORRECTION</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)</td>
<td>1. Fluid Level Low.</td>
<td>1. Correct level and check for leaks.</td>
</tr>
<tr>
<td></td>
<td>2. Filter Clogged.</td>
<td>2. Change filter.</td>
</tr>
<tr>
<td></td>
<td>3. Gearshift Linkage Mis-adjusted.</td>
<td>3. Adjust linkage and repair linkage if worn or damaged.</td>
</tr>
<tr>
<td></td>
<td>4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump).</td>
<td>4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.</td>
</tr>
<tr>
<td></td>
<td>5. Rear Band Mis-adjusted.</td>
<td>5. Adjust band.</td>
</tr>
<tr>
<td></td>
<td>6. Valve Body Filter Plugged.</td>
<td>6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.</td>
</tr>
<tr>
<td></td>
<td>7. Oil Pump Gears Worn/Damaged.</td>
<td>7. Remove transmission and replace oil pump.</td>
</tr>
<tr>
<td></td>
<td>8. Governor Circuit and Solenoid Valve Electrical Fault.</td>
<td>8. Test with DRB® scan tool and repair as required.</td>
</tr>
<tr>
<td></td>
<td>10. Reaction Shaft Seal Rings Worn/Broken.</td>
<td>10. Remove transmission, remove oil pump and replace seal rings.</td>
</tr>
<tr>
<td></td>
<td>11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.</td>
<td>11. Remove and disassemble transmission and repair as necessary.</td>
</tr>
<tr>
<td>NO DRIVE RANGE (REVERSE OK)</td>
<td>1. Fluid Level Low.</td>
<td>1. Add fluid and check for leaks if drive is restored.</td>
</tr>
<tr>
<td></td>
<td>2. Gearshift Linkage/Cable Loose/Misadjusted.</td>
<td>2. Repair or replace linkage components.</td>
</tr>
<tr>
<td></td>
<td>3. Rear Clutch Burnt.</td>
<td>3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.</td>
</tr>
<tr>
<td></td>
<td>4. Valve Body Malfunction.</td>
<td>4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.</td>
</tr>
<tr>
<td></td>
<td>5. Transmission Overrunning Clutch Broken.</td>
<td>5. Remove and disassemble transmission. Replace overrunning clutch.</td>
</tr>
<tr>
<td></td>
<td>6. Input Shaft Seal Rings Worn/Damaged.</td>
<td>6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
<td>CORRECTION</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Fluid Level Low.</td>
<td></td>
<td>1. Add fluid and check for leaks if drive is restored.</td>
</tr>
<tr>
<td>2. Gearshift Linkage/Cable Loose/Misadjusted.</td>
<td></td>
<td>2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.</td>
</tr>
<tr>
<td>3. U-Joint/Axle/Transfer Case Broken.</td>
<td></td>
<td>3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.</td>
</tr>
<tr>
<td>4. Filter Plugged.</td>
<td></td>
<td>4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.</td>
</tr>
<tr>
<td>5. Oil Pump Damaged.</td>
<td></td>
<td>5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.</td>
</tr>
<tr>
<td>6. Valve Body Malfunctioned.</td>
<td></td>
<td>6. Check and inspect valve body. Replace valve body (as assembly) if any valve or bore is damaged. Clean and reassemble correctly if all parts are in good condition.</td>
</tr>
<tr>
<td>7. Transmission Internal Component Damaged.</td>
<td></td>
<td>7. Remove and disassemble transmission. Repair or replace failed components as needed.</td>
</tr>
<tr>
<td>9. Torque Converter Damage.</td>
<td></td>
<td>9. Inspect and replace as required.</td>
</tr>
<tr>
<td>SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fluid Filter Clogged.</td>
<td></td>
<td>2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.</td>
</tr>
<tr>
<td>3. Throttle Linkage Mis-adjusted.</td>
<td></td>
<td>3. Adjust linkage as described in service section.</td>
</tr>
<tr>
<td>4. Throttle Linkage Binding.</td>
<td></td>
<td>4. Check cable for binding. Check for return to closed throttle at transmission.</td>
</tr>
<tr>
<td>5. Gearshift Linkage/Cable Mis-adjusted.</td>
<td></td>
<td>5. Adjust linkage/cable as described in service section.</td>
</tr>
<tr>
<td>6. Clutch or Servo Failure.</td>
<td></td>
<td>6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.</td>
</tr>
<tr>
<td>7. Governor Circuit Electrical Fault.</td>
<td></td>
<td>7. Test using DRB® scan tool and repair as required.</td>
</tr>
<tr>
<td>8. Front Band Mis-adjusted.</td>
<td></td>
<td>8. Adjust band.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
<td>CORRECTION</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>NO REVERSE (D RANGES OK)</td>
<td>1. Gearshift Linkage/Cable Mis-adjusted/Damaged.</td>
<td>1. Repair or replace linkage parts as needed.</td>
</tr>
<tr>
<td></td>
<td>2. Park Sprag Sticking.</td>
<td>2. Replace overdrive annulus gear.</td>
</tr>
<tr>
<td></td>
<td>3. Rear Band Mis-adjusted/Worn.</td>
<td>3. Adjust band; replace.</td>
</tr>
<tr>
<td></td>
<td>4. Valve Body Malfunction.</td>
<td>4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.</td>
</tr>
<tr>
<td></td>
<td>5. Rear Servo Malfunction.</td>
<td>5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.</td>
</tr>
<tr>
<td></td>
<td>6. Direct Clutch in Overdrive Worn.</td>
<td>6. Disassemble overdrive. Replace worn or damaged parts.</td>
</tr>
<tr>
<td></td>
<td>7. Front Clutch Burnt.</td>
<td>7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.</td>
</tr>
<tr>
<td>HAS FIRST/REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)</td>
<td>1. Governor Circuit Electrical Fault.</td>
<td>1. Test using DRB® scan tool and repair as required.</td>
</tr>
<tr>
<td></td>
<td>2. Valve Body Malfunction.</td>
<td>2. Repair stuck 1-2 shift valve or governor plug.</td>
</tr>
<tr>
<td>MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW</td>
<td>1. Valve Body Malfunction.</td>
<td>1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.</td>
</tr>
<tr>
<td>NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)</td>
<td>1. Governor Circuit Electrical Fault.</td>
<td>1. Test with DRB® scan tool and repair as required.</td>
</tr>
<tr>
<td></td>
<td>2. Valve Body Malfunction.</td>
<td>2. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.</td>
</tr>
<tr>
<td></td>
<td>3. Front Servo Piston Cocked in Bore.</td>
<td>3. Inspect servo and repair as required.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
<td>CORRECTION</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NO KICKDOWN OR NORMAL DOWNSHIFT</td>
<td>1. Throttle Linkage Mis-adjusted.</td>
<td>1. Adjust linkage.</td>
</tr>
<tr>
<td></td>
<td>2. Accelerator Pedal Travel Restricted.</td>
<td>2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.</td>
</tr>
<tr>
<td></td>
<td>3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.</td>
<td>3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.</td>
</tr>
<tr>
<td></td>
<td>4. Governor Circuit Electrical Fault.</td>
<td>4. Test with DRB® scan tool and repair as required.</td>
</tr>
<tr>
<td></td>
<td>5. Valve Body Malfunction.</td>
<td>5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.</td>
</tr>
<tr>
<td></td>
<td>6. TPS Malfunction.</td>
<td>6. Replace sensor, check with DRB® scan tool.</td>
</tr>
<tr>
<td></td>
<td>7. PCM Malfunction.</td>
<td>7. Check with DRB® scan tool and replace if required.</td>
</tr>
<tr>
<td></td>
<td>8. Valve Body Malfunction.</td>
<td>8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.</td>
</tr>
<tr>
<td>STUCK IN LOW GEAR (WILL NOT UPSHIFT)</td>
<td>1. Throttle Linkage Mis-adjusted/Stuck.</td>
<td>1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.</td>
</tr>
<tr>
<td></td>
<td>2. Gearshift Linkage Mis-adjusted.</td>
<td>2. Adjust linkage and repair linkage if worn or damaged.</td>
</tr>
<tr>
<td></td>
<td>3. Governor Component Electrical Fault.</td>
<td>3. Check operating pressures and test with DRB® scan tool, repair faulty component.</td>
</tr>
<tr>
<td></td>
<td>4. Front Band Out of Adjustment.</td>
<td>4. Adjust Band.</td>
</tr>
<tr>
<td></td>
<td>5. Clutch or Servo Malfunction.</td>
<td>5. Air pressure check operation of clutches and bands. Repair faulty component.</td>
</tr>
<tr>
<td>CREEPS IN NEUTRAL</td>
<td>1. Gearshift Linkage Mis-adjusted.</td>
<td>1. Adjust linkage.</td>
</tr>
<tr>
<td></td>
<td>2. Rear Clutch Dragging/Warped.</td>
<td>2. Disassemble and repair.</td>
</tr>
<tr>
<td></td>
<td>3. Valve Body Malfunction.</td>
<td>3. Perform hydraulic pressure test to determine cause and repair as required.</td>
</tr>
</tbody>
</table>

21 - 150 AUTOMATIC TRANSMISSION - 48RE (Continued)
<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUZZING NOISE</td>
<td>1. Fluid Level Low</td>
<td>1. Add fluid and check for leaks.</td>
</tr>
<tr>
<td></td>
<td>2. Shift Cable Mis-assembled.</td>
<td>2. Route cable away from engine and bell housing.</td>
</tr>
<tr>
<td></td>
<td>3. Valve Body Mis-assembled.</td>
<td>3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.</td>
</tr>
<tr>
<td>SLIPS IN REVERSE ONLY</td>
<td>1. Fluid Level Low.</td>
<td>1. Add fluid and check for leaks.</td>
</tr>
<tr>
<td></td>
<td>2. Gearshift Linkage Mis-adjusted.</td>
<td>2. Adjust linkage.</td>
</tr>
<tr>
<td></td>
<td>3. Rear Band Mis-adjusted.</td>
<td>3. Adjust band.</td>
</tr>
<tr>
<td></td>
<td>4. Rear Band Worn.</td>
<td>4. Replace as required.</td>
</tr>
<tr>
<td></td>
<td>5. Overdrive Direct Clutch Worn.</td>
<td>5. Disassemble overdrive. Repair as needed.</td>
</tr>
<tr>
<td></td>
<td>6. Hydraulic Pressure Too Low.</td>
<td>6. Perform hydraulic pressure tests to determine cause.</td>
</tr>
<tr>
<td></td>
<td>7. Rear Servo Leaking.</td>
<td>7. Air pressure check clutch-servo operation and repair as required.</td>
</tr>
<tr>
<td></td>
<td>8. Band Linkage Binding.</td>
<td>8. Inspect and repair as required.</td>
</tr>
<tr>
<td>SLIPS IN FORWARD DRIVE RANGES</td>
<td>1. Fluid Level Low.</td>
<td>1. Add fluid and check for leaks.</td>
</tr>
<tr>
<td></td>
<td>2. Fluid Foaming.</td>
<td>2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.</td>
</tr>
<tr>
<td></td>
<td>3. Throttle Linkage Mis-adjusted.</td>
<td>3. Adjust linkage.</td>
</tr>
<tr>
<td></td>
<td>4. Gearshift Linkage Mis-adjusted.</td>
<td>4. Adjust linkage.</td>
</tr>
<tr>
<td></td>
<td>5. Rear Clutch Worn.</td>
<td>5. Inspect and replace as needed.</td>
</tr>
<tr>
<td></td>
<td>6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines.</td>
<td>6. Perform hydraulic and air pressure tests to determine cause.</td>
</tr>
<tr>
<td></td>
<td>7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.</td>
<td>7. Air pressure check clutch-servo operation and repair as required.</td>
</tr>
<tr>
<td>SLIPS IN LOW GEAR &quot;D&quot; ONLY, BUT NOT IN MANUAL 1 POSITION</td>
<td>Overrunning Clutch Faulty.</td>
<td>Replace overrunning clutch.</td>
</tr>
</tbody>
</table>
### CONDITION: GROWLING, GRATING OR SCRAPING NOISES

<table>
<thead>
<tr>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Drive Plate Broken.</td>
<td>1. Replace.</td>
</tr>
<tr>
<td>2. Torque Converter Bolts Hitting Dust Shield</td>
<td>2. Dust shield bent. Replace or repair.</td>
</tr>
<tr>
<td>3. Planetary Gear Set Broken/Seized</td>
<td>3. Check for debris in oil pan and repair as required.</td>
</tr>
<tr>
<td>4. Overrunning Clutch Worn/Broken.</td>
<td>4. Inspect and check for debris in oil pan. Repair as required.</td>
</tr>
<tr>
<td>5. Oil Pump Components Scored/Binding</td>
<td>5. Remove, inspect and repair as required.</td>
</tr>
<tr>
<td>6. Output Shaft Bearing or Bushing Damaged.</td>
<td>6. Remove, inspect and repair as required.</td>
</tr>
<tr>
<td>7. Clutch Operation Faulty.</td>
<td>7. Perform air pressure check and repair as required.</td>
</tr>
</tbody>
</table>

### CONDITION: DRAGS OR LOCKS UP

<table>
<thead>
<tr>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fluid Level Low.</td>
<td>1. Check and adjust level.</td>
</tr>
<tr>
<td>2. Clutch Dragging/Failed</td>
<td>2. Air pressure check clutch operation and repair as required.</td>
</tr>
<tr>
<td>3. Front or Rear Band Mis-adjusted.</td>
<td>3. Adjust bands.</td>
</tr>
<tr>
<td>4. Case Leaks Internally.</td>
<td>4. Check for leakage between passages in case.</td>
</tr>
<tr>
<td>5. Servo Band or Linkage Malfunction.</td>
<td>5. Air pressure check servo operation and repair as required.</td>
</tr>
<tr>
<td>7. Planetary Gears Broken.</td>
<td>7. Remove, inspect and repair as required (look for debris in oil pan).</td>
</tr>
</tbody>
</table>

### CONDITION: NO 4-3 DOWNSHIFT

<table>
<thead>
<tr>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Circuit Wiring and/or Connectors Shorted.</td>
<td>1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.</td>
</tr>
<tr>
<td>2. PCM Malfunction.</td>
<td>2. Check PCM operation with DRB® scan tool. Replace PCM only if faulty.</td>
</tr>
<tr>
<td>3. TPS Malfunction</td>
<td>3. Check TPS with DRB® scan tool at PCM.</td>
</tr>
<tr>
<td>4. Lockup Solenoid Not Venting.</td>
<td>4. Remove valve body and replace solenoid assembly if plugged or shorted.</td>
</tr>
<tr>
<td>5. Overdrive Solenoid Not Venting.</td>
<td>5. Remove valve body and replace solenoid if plugged or shorted.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF</strong></td>
<td>1. Control Switch Open/Shorted.</td>
</tr>
<tr>
<td></td>
<td>2. Overdrive Solenoid Connector Shorted.</td>
</tr>
<tr>
<td></td>
<td>3. PCM Malfunction.</td>
</tr>
<tr>
<td></td>
<td>4. Valve Body Stuck Valves.</td>
</tr>
<tr>
<td><strong>CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT</strong></td>
<td>1. Transmission Fluid Low.</td>
</tr>
<tr>
<td></td>
<td>2. Throttle Cable Mis-adjusted.</td>
</tr>
<tr>
<td></td>
<td>3. Overdrive Clutch Select Spacer Wrong Spacer.</td>
</tr>
<tr>
<td><strong>3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT</strong></td>
<td>1. Overdrive Solenoid Connector or Wiring Shorted.</td>
</tr>
<tr>
<td></td>
<td>2. TPS Malfunction.</td>
</tr>
<tr>
<td></td>
<td>3. PCM Malfunction.</td>
</tr>
<tr>
<td></td>
<td>4. Overdrive Solenoid Malfunction.</td>
</tr>
<tr>
<td></td>
<td>5. Valve Body Malfunction.</td>
</tr>
<tr>
<td><strong>WHINE/NOISE RELATED TO ENGINE SPEED</strong></td>
<td>1. Fluid Level Low.</td>
</tr>
<tr>
<td></td>
<td>2. Shift Cable Incorrect Routing.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>NO 3-4 UPSHIFT</td>
<td>1. O/D Switch In OFF Position.</td>
</tr>
<tr>
<td></td>
<td>2. Overdrive Circuit Fuse Blown.</td>
</tr>
<tr>
<td></td>
<td>3. O/D Switch Wire Shorted/Open Cut.</td>
</tr>
<tr>
<td></td>
<td>4. Distance or Coolant Sensor Malfunction.</td>
</tr>
<tr>
<td></td>
<td>5. TPS Malfunction.</td>
</tr>
<tr>
<td></td>
<td>6. Neutral Sense to PCM Wire Shorted/Cut.</td>
</tr>
<tr>
<td></td>
<td>7. PCM Malfunction.</td>
</tr>
<tr>
<td></td>
<td>8. Overdrive Solenoid Shorted/Open.</td>
</tr>
<tr>
<td></td>
<td>10. Overdrive Clutch Failed.</td>
</tr>
<tr>
<td></td>
<td>11. Hydraulic Pressure Low.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td>SLIPS IN OVERDRIVE FOURTH GEAR</td>
<td>1. Fluid Level Low.</td>
</tr>
<tr>
<td></td>
<td>2. Overdrive Clutch Pack Worn.</td>
</tr>
<tr>
<td></td>
<td>4. Overdrive Piston or Seal Malfunction.</td>
</tr>
<tr>
<td></td>
<td>5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.</td>
</tr>
<tr>
<td></td>
<td>6. Overdrive Unit Thrust Bearing Failure.</td>
</tr>
<tr>
<td></td>
<td>7. O/D Check Valve/Bleed Orifice Failure.</td>
</tr>
<tr>
<td>DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)</td>
<td>1. Fluid Level Low.</td>
</tr>
<tr>
<td></td>
<td>2. Throttle Valve Cable Mis-adjusted.</td>
</tr>
<tr>
<td></td>
<td>4. TPS Faulty.</td>
</tr>
<tr>
<td></td>
<td>5. Overdrive Clutch Bleed Orifice Plugged.</td>
</tr>
<tr>
<td></td>
<td>6. Overdrive Solenoid or Wiring Shorted/Open.</td>
</tr>
<tr>
<td></td>
<td>7. Overdrive Excess Clearance.</td>
</tr>
<tr>
<td></td>
<td>8. O/D Check Valve Missing or Stuck.</td>
</tr>
<tr>
<td>TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR</td>
<td>Lockup Solenoid, Relay or Wiring Shorted/Open.</td>
</tr>
<tr>
<td>HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS</td>
<td>Lockup Solenoid Malfunction.</td>
</tr>
<tr>
<td>CONDITION</td>
<td>POSSIBLE CAUSES</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
</tr>
<tr>
<td>NO START IN PARK OR NEUTRAL</td>
<td>1. Gearshift Linkage/Cable Mis-adjusted.</td>
</tr>
<tr>
<td></td>
<td>2. Neutral Sense Wire Open/Cut.</td>
</tr>
<tr>
<td></td>
<td>3. Park/Neutral Switch, or Transmission Range Sensor Faulty.</td>
</tr>
<tr>
<td></td>
<td>5. Valve Body Manual Lever Assembly Bent/Worn/Broken.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO REVERSE (OR SLIPS IN REVERSE)</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Rear Band Mis-adjusted.</td>
<td>2. Adjust band.</td>
<td></td>
</tr>
<tr>
<td>3. Front Clutch Malfunctioned/ Burned.</td>
<td>3. Air-pressure test clutch operation. Remove and rebuild if necessary.</td>
<td></td>
</tr>
<tr>
<td>4. Overdrive Thrust Bearing Failure.</td>
<td>4. Disassemble geartrain and replace bearings.</td>
<td></td>
</tr>
<tr>
<td>5. Direct Clutch Spring Collapsed/ Broken.</td>
<td>5. Remove and disassemble unit. Check clutch position and replace spring.</td>
<td></td>
</tr>
</tbody>
</table>
## AUTOMATIC TRANSMISSION - 48RE (Continued)

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OIL LEAKS.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Fluid Lines and Fittings Loose/Leaks/Damaged.</td>
<td>1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.</td>
<td></td>
</tr>
<tr>
<td>3. Pressure Port Plug Loose Loose/Damaged.</td>
<td>3. Tighten to correct torque. Replace plug or reseal if leak persists.</td>
<td></td>
</tr>
<tr>
<td>4. Pan Gasket Leaks.</td>
<td>4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.</td>
<td></td>
</tr>
<tr>
<td>7. Gasket Damaged or Bolts are Loose.</td>
<td>7. Replace bolts or gasket or tighten both.</td>
<td></td>
</tr>
<tr>
<td>10. Converter Housing Area Leaks.</td>
<td>10. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing or hole plugged. Check for leaks past O-ring seal on pump or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.</td>
<td></td>
</tr>
</tbody>
</table>

**NOISY OPERATION IN FOURTH GEAR ONLY**

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.</td>
<td>1. Remove unit and rebuild clutch pack.</td>
<td></td>
</tr>
<tr>
<td>2. Overdrive Piston or Planetary Thrust Bearing Damaged.</td>
<td>2. Remove and disassemble unit. Replace either thrust bearing if damaged.</td>
<td></td>
</tr>
<tr>
<td>3. Output Shaft Bearings Scored/Damaged.</td>
<td>3. Remove and disassemble unit. Replace either bearing if damaged.</td>
<td></td>
</tr>
<tr>
<td>4. Planetary Gears Worn/Chipped.</td>
<td>4. Remove and overhaul overdrive unit.</td>
<td></td>
</tr>
<tr>
<td>5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.</td>
<td>5. Remove and overhaul overdrive unit.</td>
<td></td>
</tr>
</tbody>
</table>
STANDARD PROCEDURE - ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils™, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil™ tap, or equivalent, and installing a Heli-Coil™ insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil™, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL

NOTE: The overdrive unit can be removed and serviced separately. It is not necessary to remove the entire transmission assembly to perform overdrive unit repairs.

1. Disconnect battery negative cable.
2. Raise vehicle.
3. Remove the transfer case skid plate (Fig. 12), if equipped.
4. Disconnect and lower or remove necessary exhaust components.
5. Remove engine-to-transmission struts.
6. Remove starter motor. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL)
7. Disconnect and remove the crankshaft position sensor. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/CRANKSHAFT POSITION SENSOR - REMOVAL) Retain the sensor attaching bolts.
8. If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan.
9. Remove torque converter access cover.
10. Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on damper bolt.
11. Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shaft. On 4 x 4 models, remove both propeller shafts. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
12. Disconnect wires from the transmission range sensor and transmission solenoid connector.
13. Disconnect gearshift cable (Fig. 13) from the transmission.

Fig. 12 Transfer Case Skid Plate
1 - FRAME RAIL
2 - SKID PLATE
3 - BOLTS (6)

Fig. 13 Gearshift Cable At Transmission
1 - GEARSHIFT CABLE
2 - TRANSMISSION MANUAL LEVER
3 - CABLE SUPPORT BRACKET
(14) Disconnect throttle valve cable from transmission bracket and throttle valve lever.
(15) On 4X4 models, disconnect shift rod from transfer case shift lever.
(16) Support rear of engine with safety stand or jack.
(17) Raise transmission slightly with service jack to relieve load on crossmember and supports.
(18) Remove bolts securing rear support and cushion (Fig. 14) and (Fig. 15) to transmission and crossmember and remove rear support.

(19) Remove bolts attaching crossmember to frame and remove crossmember.
(20) On 4X4 models, remove transfer case with transmission jack or aid of helper.
(21) Disconnect fluid cooler lines at transmission.
(22) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. On 4X4 models, it will also be necessary to remove bolt attaching transfer case vent tube to converter housing (Fig. 16).
(23) Remove all converter housing bolts.
(24) Carefully work transmission and torque converter assembly rearward off engine block dowels.
(25) Lower transmission and remove assembly from under the vehicle.
(26) To remove torque converter, remove C-clamp from edge of bell housing and carefully slide torque converter out of the transmission.
DISASSEMBLY
(1) Clean exterior of transmission with suitable solvent or pressure washer.
(2) Place transmission in vertical position.
(3) Measure the input shaft end play as follows (Fig. 17).
   (a) Attach Adapter 8266-5 to Handle 8266-8.
   (b) Attach dial indicator C-3339 to Handle 8266-8.
   (c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-5 to secure it to the input shaft.
   (d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.
   (e) Move input shaft in and out and record reading. Record the maximum travel for assembly reference.
(4) Remove the overdrive unit from the main transmission case. If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.
(5) Remove throttle and shift levers from valve body manual shaft and throttle lever shaft.
(6) Remove transmission oil pan and gasket.
(7) Remove filter from valve body (Fig. 18). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.
(8) Remove the transmission range sensor.
(9) Remove hex head bolts attaching valve body to transmission case (Fig. 19). A total of 10 bolts are used. Note different bolt lengths for assembly reference.
(10) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 20).

Fig. 20 Valve Body Removal
1 - GOVERNOR PRESSURE SENSOR
2 - VALVE BODY
3 - PARK ROD
4 - ACCUMULATOR PISTON
5 - GOVERNOR PRESSURE SOLENOID

(11) Remove accumulator outer spring, piston and inner spring (Fig. 21). Note position of piston and springs for assembly reference. Remove and discard piston seals if worn or cut.

(12) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

(13) Remove front band lever pin access plug (Fig. 22). Use square end of 1/4 in. drive extension to remove plug as shown.

Fig. 21 Accumulator Component Removal
1 - ACCUMULATOR PISTON
2 - OUTER SPRING
3 - INNER SPRING

(14) Remove oil pump and reaction shaft support assembly as follows:
(a) Tighten front band adjusting screw until band is tight around front clutch retainer (Fig. 23). This will prevent retainer from coming out with pump and possibly damaging clutch or pump components.

Fig. 23 Tightening Front Band To Hold Front Clutch In Place
1 - LOCK-NUT
2 - FRONT BAND ADJUSTER

Fig. 22 Front Band Lever Pin Access Plug
1 - FRONT BAND REACTION PIN ACCESS PLUG
2 - 1/4 DRIVE EXTENSION AND RATCHET
(b) Remove oil pump bolts.
(c) Thread Slide Hammer Tools C-3752 into threaded holes in flange of oil pump housing (Fig. 24).
(d) Remove oil pump and reaction shaft support by bumping slide hammers outward alternately to pull pump from case (Fig. 25).
(15) Remove oil pump gasket (Fig. 26). Note gasket position in case for assembly reference.

(16) Loosen front band adjusting screw until band is completely loose.
(17) Remove front band strut and anchor (Fig. 27).
(18) Squeeze front band together slightly and slide band over front clutch retainer and out of case (Fig. 28).

(19) Remove front and rear clutch assemblies as a unit (Fig. 29).

(20) Remove front band reaction pin and lever. Start pin through lever and out of case bore with drift or punch. Then use pencil magnet to withdraw pin completely (Fig. 30).

(21) Remove intermediate shaft thrust washer. Triangular shaped washer will either be on shaft pilot hub or in rear clutch retainer (Fig. 31).
(22) Remove thrust plate from intermediate shaft hub (Fig. 32).
(23) Remove intermediate shaft-planetary geartrain assembly (Fig. 33).
(24) Loosen rear band locknut and loosen adjusting screw 3-4 turns.
(25) Remove snap-ring that retains low-reverse drum on overdrive piston retainer hub (Fig. 34).

(26) Slide low-reverse drum and thrust washer off piston retainer hub and out of rear band (Fig. 35).
AUTOMATIC TRANSMISSION - 48RE (Continued)

(27) Note that overrunning clutch race will remain on splines of low-reverse drum after removal (Fig. 36). The race is a permanent press fit on the hub splines. Do not attempt to remove the race.

(28) Remove overrunning clutch assembly (Fig. 37). Assembly can be removed without displacing rollers and springs if care is exercised. Note position of rollers and springs for assembly reference.

(29) Remove rear band adjusting lever and reaction pin.

(30) Remove rear band.

(31) Compress front servo rod guide with large C-clamp and Tool C-4470, or Compressor Tool C-3422-B (Fig. 38). Compress guide only enough to permit snap-ring removal (about 1/8 in.).

(32) Remove servo piston snap-ring (Fig. 38). Unseat one end of ring. Then carefully work removal tool around back of ring until free of ring groove. Exercise caution when removing snap-ring. Servo bore can be scratched or nicked if care is not exercised.
(33) Remove tools and remove servo piston and spring.

(34) Compress rear servo piston with C-clamp and Tool C-4470, or Valve Spring Compressor C-3422-B (Fig. 39). Compress servo spring retainer only enough to permit snap-ring removal.

(35) Remove servo piston snap-ring (Fig. 39). Start one end of ring out of bore. Then carefully work removal tool around back of snap-ring until free of ring groove. Exercise caution when removing snap-ring. Servo bore can be scratched or nicked if care is not exercised.

(36) Remove tools and remove rear servo retainer, spring and piston assembly.

Fig. 39 Rear Servo Retaining Snap-Ring

1 - TOOL C-4470
2 - C-CLAMP
3 - REAR SERVO SPRING RETAINER
4 - RETAINER SNAP-RING

CLEANING

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Lubricate transmission parts with Mopar® ATF +4, Automatic Transmission fluid, during overhaul and assembly. Use petroleum jelly to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

INSPECTION

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

Lubricate the front band adjusting screw threads with petroleum jelly and thread the screw part-way into the case. Be sure the screw turns freely.

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. However, do not replace bushings as a matter of course. Replace bushings only when they are actually worn, or scored.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

ASSEMBLY

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for reassembly operations are equally clean.

Shop towels used for wiping off tools and your hands must be made from lint free materials. Lint will stick to transmission parts and could interfere with valve operation or even restrict fluid passages.

Lubricate transmission clutch and gear components with Mopar® ATF +4 during reassembly. Soak clutch discs in transmission fluid before installation.

Use petroleum jelly on piston seals and O-rings to ease installation. Petroleum jelly can also be used to lubricate and hold thrust washers and plates in position during assembly.

Do not use chassis grease, bearing grease, white grease, or similar lubricants on any part. These types of lubricants can eventually block or restrict fluid passages and valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and sub-assemblies are easily installed by hand when properly aligned. If a part seems difficult to install, it is either misaligned or incorrectly
assembled. Verify that thrust washers, thrust plates and seal rings are correctly positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright. Either tilt the case upward with wood blocks, or cut a hole in the bench large enough for the intermediate shaft and rear support. Then lower the shaft and support into the hole and support the rear of the case directly on the bench.

FRONT/REAR SERVO

(1) Lubricate rear servo piston seal with ATF +4. Lubricate servo bore in case with ATF +4.
(2) Install rear servo piston in case. Position piston at slight angle to bore and insert piston with twisting motion (Fig. 40).
(3) Install rear servo spring and retainer in case bore (Fig. 41). Be sure spring is seated on piston.
(4) Compress rear servo piston with C-clamp or Valve Spring Compressor C-3422-B and install servo piston snap-ring (Fig. 42).
(5) Lubricate front servo piston components and servo bore in case with transmission fluid.
(6) Install front servo piston in bore. Carefully “run” small, suitable tool around piston ring to press it back into groove and ease installation (Fig. 43). Rotate piston into bore at same time. Rock piston slightly to ease piston ring past snap-ring groove and into bore.
(7) Bottom front servo piston in bore and install servo spring.

(8) Install front servo piston rod guide as follows:
   (a) Place Tool SP-5560 (or similar size tool) on guide and position C-clamp on tool and case (Fig. 44).
   (b) Slowly compress rod guide while simultaneously easing seal ring into bore with suitable tool.

(9) Install rod guide snap-ring (Fig. 44).

OVERRUNNING CLUTCH, REAR BAND, AND LOW-REVERSE DRUM

(1) Install overrunning clutch components if not yet installed.

(2) Position rear band reaction pin and band in case. Be sure that the twin lugs on the band are seated against the reaction pin.

(3) Install low-reverse drum. Slide drum through rear band, onto piston retainer hub and into engagement with overrunning clutch and race.

(4) Install thrust washer in low-reverse drum spot-face (Fig. 45). Use petroleum jelly to hold washer in place.

(5) Install snap-ring that secures low-reverse drum to piston retainer hub (Fig. 45).

(6) Insert the rear band pivot pin part way into the case.
PLANETARY GEARTRAIN, FRONT/REAR CLUTCH, AND FRONT BAND

(1) Remove Alignment Shaft 6227-2, if installed previously.
(2) Install assembled intermediate shaft and planetary geartrain (Fig. 46). Support shaft carefully during installation. Do not allow shaft bearing/bushing surfaces to become nicked or scratched.
(3) Lubricate intermediate shaft thrust plate with petroleum jelly and install plate on shaft pilot hub (Fig. 47).
(4) Check input shaft front seal rings, fiber thrust washer and rear seal ring (Fig. 48). Be sure the ends of rear seal ring are hooked together and diagonal cut ends of front seal rings are firmly seated against each other as shown. Lubricate seal rings with petroleum jelly after checking them.
(5) Assemble front and rear clutches (Fig. 49). Align lugs on front clutch discs. Mount front clutch on rear clutch. Turn front clutch retainer back and forth until front clutch discs are fully seated on rear clutch splined hub.

Fig. 46 Intermediate Shaft And Planetary Geartrain
1 - INTERMEDIATE SHAFT AND PLANETARY GEAR TRAIN ASSEMBLY

Fig. 47 Intermediate Shaft Thrust Plate
1 - SHAFT THRUST PLATE
2 - INTERMEDIATE SHAFT PILOT HUB

Fig. 48 Input Shaft Seal Ring And Thrust Washer
1 - TORLON® FRONT SEAL RINGS
2 - INPUT SHAFT
3 - REAR SEAL RING
4 - THRUST WASHER
(6) Install intermediate shaft thrust washer in hub of rear clutch retainer (Fig. 50). Use petroleum jelly to hold washer in place. Position washer so grooves are facing outward. **Washer only fits one way in clutch retainer hub.**

(7) Place transmission case in upright position, or place blocks under front end of transmission repair stand to tilt case rearward. This makes it easier to install front/rear clutch assembly.

(8) Align discs in rear clutch. Then install and engage assembly in front planetary and driving shell (Fig. 51). Turn clutch retainers back and forth until both clutches are seated.

(9) Position front band lever in case and over servo rod guide. Then install front band lever pin in case and slide it through lever.

(10) Coat threads of front band pin access plug with sealer and install it in case. Tighten plug to 17 N·m (13 ft. lbs.) torque.
AUTOMATIC TRANSMISSION - 48RE (Continued)

(11) Slide front band over front clutch retainer and install front band strut and anchor (Fig. 52).
(12) Tighten front band adjusting screw until band is tight on clutch retainer. This will hold clutches in place while oil pump is being installed. **Verify that front/rear clutch assembly is still properly seated before tightening band.**

(2) Install new oil pump gasket on pilot studs and seat it in case. Be sure gasket is properly aligned with fluid passages in case (Fig. 53).
(3) Coat the reaction shaft thrust washer with petroleum jelly to hold it in place. Then install washer over reaction shaft hub and seat it on pump (Fig. 54).

**CAUTION:** The thrust washer bore (I.D.), is chamfered on one side. Make sure the chamfered side is installed so it faces the pump.

---

**Fig. 52 Front Band And Linkage**

1. LEVER
2. STRUT
3. ANCHOR
4. FRONT BAND

---

**Fig. 53 Oil Pump Gasket And Pilot Studs**

1. OIL PUMP GASKET
2. PILOT STUDS C-3288-B

---

**Fig. 54 Front Clutch Thrust Washer Installation**

1. THRUST WASHER
2. CHAMFERED SIDE OF WASHER BORE GOES TOWARD PUMP

---

**Fig. 55 Reaction Shaft Seal Ring And Thrust Washer**

1. SEAL RINGS
2. REACTION SHAFT SUPPORT
3. THRUST WASHER (FIBER)
(4) Check seal rings on reaction shaft support. Be sure rings are hooked together correctly. Also be sure fiber thrust washer is in position (Fig. 55). Use extra petroleum jelly to hold washer in place if necessary.

(5) Check the torque converter hub seal ring on the reaction shaft for damage. Also check that the seal ring rotates freely in the reaction shaft groove. Replace the seal if necessary.

(6) Lubricate oil pump seals with petroleum Mopar® ATF +4.

(7) Mount oil pump on pilot studs and slide pump into case opening (Fig. 56). Work pump into case by hand. Do not use a mallet or similar tools to seat pump.

(8) Remove pilot studs and install oil pump bolts. Tighten pump bolts alternately and evenly to fully seat pump in case. Then final-tighten pump bolts to 20 N·m (15 ft. lbs.) torque.

(9) Verify correct installation. Rotate input and intermediate shafts and check for bind. If bind exists, components are either mis-assembled, or not seated. Disassemble and correct as necessary before proceeding.

NOTE: If end play is incorrect, transmission is incorrectly assembled, or reaction shaft thrust washer is incorrect. The reaction shaft thrust washer is selective.

(a) Attach Adapter 8266-5 to Handle 8266-8.

(b) Attach dial indicator C-3339 to Handle 8266-8.

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-5 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move input shaft in and out and record reading. End play should be 0.86 - 2.13 mm (0.034 - 0.084 in.). Adjust as necessary.

INPUT SHAFT END PLAY CHECK

NOTE: Overdrive unit must be installed in order to correctly measure the input shaft end-play.

(1) Measure input shaft end play (Fig. 57).

ACCUMULATOR, VALVE BODY, OIL PAN, AND TORQUE CONVERTER

(1) Install accumulator inner spring, piston and outer spring (Fig. 58).

(2) Verify that the transmission range sensor has not been installed in case. Valve body can not be installed if sensor is in position.

(3) Install new valve body manual shaft seal in case (Fig. 59). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

(4) Install valve body as follows:
AUTOMATIC TRANSMISSION - 48RE (Continued)

(a) Start park rod into park pawl. If rod will not slide past park pawl, pawl is engaged in park gear. Rotate overdrive output shaft with suitable size 12 point socket; this will free pawl and allow rod to engage.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are fully seated in case.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.

(5) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(6) Move the transmission manual shaft lever to the manual LOW position.

(7) Install the TRS mounting bracket into the transmission case. Using Adapter 8581 (Fig. 60), tighten the mounting bracket to 34 N·m (300 in.lbs.).

(8) Install the TRS (Fig. 61) into the mounting bracket with the wiring connector facing the front of the transmission.

CAUTION: If the condition of the transmission before the overhaul procedure caused excessive metallic or fiber contamination in the fluid, replace the torque converter and reverse flush the cooler(s) and cooler lines. Fluid contamination and transmission failure can result if not done.
(9) Install the two screws to hold the TRS to the mounting bracket. Tighten the screws to 5 N·m (45 in.lbs.).

(10) Verify proper sensor operation (Fig. 62).

![Fig. 62 Transmission Range Sensor Operation](image)

1 - NEUTRAL CONTACT
2 - MANUAL LEVER AND SENSOR PLUNGER IN REVERSE POSITION
3 - PARK CONTACT
4 - TRANSMISSION RANGE SENSOR

(11) Move the transmission manual shaft lever to the PARK position.

(12) Install torque converter. Use C-clamp or metal strap to hold converter in place for installation.

**BAND ADJUSTMENT AND FINAL**

1 Adjust front and rear bands as follows:
   a. Loosen locknut on each band adjusting screw 4-5 turns.
   b. Tighten both adjusting screws to 8 N·m (72 in. lbs.).
   d. Back off rear band adjusting screw 3 turns.
   e. Hold each adjusting screw in position and tighten locknut to 34 N·m (25 ft. lbs.) torque.

2 Lubricate pocket in the rear oil pump seal lip with transmission fluid.

3 Lubricate converter pilot hub of the crankshaft with a light coating of Mopar® High Temp Grease.

4 Align and install converter in oil pump.

5 Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

6 Check converter seating with steel scale and straightedge (Fig. 63). Surface of converter lugs should be 19mm (0.75 in.) to rear of straightedge when converter is fully seated.

7 Temporarily secure converter with C-clamp.

![Fig. 63 Checking Converter Seating - Typical](image)

1 - SCALE
2 - STRAIGHTEDGE

8 Position transmission on jack and secure it with chains.

9 Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

10 Raise transmission and align converter with drive plate and converter housing with engine block.

11 Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

12 Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.
(13) Install bolts attaching converter housing to engine.
(14) Install rear support.
(15) Install the rear transmission crossmember.
(16) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember.
(17) Remove engine support fixture.
(18) Install the transfer case, if equipped.
(19) Install crankshaft position sensor. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/CRANKSHAFT POSITION SENSOR - INSTALLATION)
(20) Connect gearshift cable (Fig. 64) and throttle cable to transmission.

(21) Connect wires to the transmission range sensor and transmission solenoid connector. Be sure the transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(22) Install torque converter-to-driveplate bolts.
(23) Install converter housing access cover.
(24) Install starter motor and cooler line bracket. (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION)
(25) Connect cooler lines (Fig. 65) to transmission.

(26) Install transmission fill tube. Install new seal on tube before installation.
(27) Install any exhaust components previously removed.
(28) Align and connect propeller shaft. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
(29) Adjust gearshift cable and throttle valve cable, if necessary.
(30) Install the transfer case skid plate, if equipped.
(31) Lower vehicle.
(32) Fill transmission with Mopar® ATF +4, Automatic Transmission fluid.
HYDRAULIC FLOW IN DRIVE SECOND GEAR (CONVERTER CLUTCH APPLIED)
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH APPLIED)
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)
HYDRAULIC FLOW IN MANUAL SECOND (2)
HYDRAULIC FLOW DURING FULL THROTTLE 3-2 DOWNSHIFT (PASSING GEAR)
### TRANSMISSION

#### GENERAL

<table>
<thead>
<tr>
<th>Component</th>
<th>Metric</th>
<th>Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planetary end play</td>
<td>0.150-1.22</td>
<td>0.006-0.048</td>
</tr>
<tr>
<td>Input shaft end play</td>
<td>0.86-2.13</td>
<td>0.034-0.084</td>
</tr>
<tr>
<td>Clutch pack clearance/ Front.</td>
<td>2.5-4.09</td>
<td>0.098-0.161</td>
</tr>
<tr>
<td>Clutch pack clearance/ Rear.</td>
<td>0.635-0.914</td>
<td>0.025-0.036</td>
</tr>
<tr>
<td>Front clutch</td>
<td>5 discs</td>
<td></td>
</tr>
<tr>
<td>Rear clutch</td>
<td>4 discs</td>
<td></td>
</tr>
<tr>
<td>Overdrive clutch</td>
<td>5(STD) OR 6(Diesel HO) discs</td>
<td></td>
</tr>
<tr>
<td>Direct clutch</td>
<td>23 Single Sided discs</td>
<td></td>
</tr>
<tr>
<td>Band adjustment from 72 in. lbs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front band</td>
<td>Back off 1 3/4 turns</td>
<td></td>
</tr>
<tr>
<td>Rear band</td>
<td>Back off 3 turns</td>
<td></td>
</tr>
<tr>
<td>Recommended fluid</td>
<td>Mopar® ATF +4</td>
<td></td>
</tr>
</tbody>
</table>

#### GEAR RATIOS

<table>
<thead>
<tr>
<th>Gear</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST GEAR</td>
<td>2.45:1</td>
</tr>
<tr>
<td>2ND GEAR</td>
<td>1.45:1</td>
</tr>
<tr>
<td>3RD GEAR</td>
<td>1.0:1</td>
</tr>
<tr>
<td>4TH GEAR</td>
<td>0.69:1</td>
</tr>
<tr>
<td>REVERSE</td>
<td>2.20:1</td>
</tr>
</tbody>
</table>

#### THRUST WASHER/SPACER/SNAP-RING DIMENSIONS

<table>
<thead>
<tr>
<th>Component</th>
<th>Metric</th>
<th>Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front clutch thrust washer (reaction shaft support hub)</td>
<td>1.55 mm</td>
<td>0.061 in.</td>
</tr>
<tr>
<td></td>
<td>2.15 mm</td>
<td>0.084 in.</td>
</tr>
<tr>
<td></td>
<td>2.59 mm</td>
<td>0.102 in.</td>
</tr>
<tr>
<td>Rear clutch thrust washer (clutch retainer)</td>
<td>1.55 mm</td>
<td>0.061 in.</td>
</tr>
<tr>
<td>Intermediate shaft thrust plate (shaft hub pilot)</td>
<td>1.5-1.6 mm</td>
<td>0.060-0.063 in.</td>
</tr>
<tr>
<td>Output shaft thrust washer (rear clutch hub)</td>
<td>1.3-1.4 mm</td>
<td>0.052-0.054 in.</td>
</tr>
<tr>
<td></td>
<td>1.75-1.8 mm</td>
<td>0.068-0.070 in.</td>
</tr>
<tr>
<td></td>
<td>2.1-2.2 mm</td>
<td>0.083-0.085 in.</td>
</tr>
<tr>
<td>Rear clutch pack snap-ring</td>
<td>1.5-1.6 mm</td>
<td>0.060-0.062 in.</td>
</tr>
<tr>
<td></td>
<td>1.9-1.95 mm</td>
<td>0.074-0.076 in.</td>
</tr>
<tr>
<td>Planetary geartrain snap-ring (at front of output shaft)</td>
<td>1.4-1.5 mm</td>
<td>0.055-0.059 in.</td>
</tr>
<tr>
<td></td>
<td>1.6-1.7 mm</td>
<td>0.062-0.066 in.</td>
</tr>
<tr>
<td>Overdrive piston thrust plate</td>
<td>Thrust plate and spacer are select fit. Refer to size charts and selection procedures in Overdrive Unit D&amp;A procedures</td>
<td></td>
</tr>
<tr>
<td>Intermediate shaft spacer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Pressure Test

<table>
<thead>
<tr>
<th>Component</th>
<th>Gear or Range</th>
<th>Condition</th>
<th>Pressure/Test Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overdrive clutch</td>
<td>Fourth gear only</td>
<td></td>
<td>Pressure should be 524-565 kPa (76-82 psi) with closed throttle and increase to 965 kPa (140 psi) at 1/2 to 3/4 throttle.</td>
</tr>
<tr>
<td>Line pressure</td>
<td>Closed throttle</td>
<td></td>
<td>372-414 kPa (54-60 psi).</td>
</tr>
<tr>
<td>Front servo</td>
<td>Third or Fourth gear only</td>
<td>No more than 21 kPa (3 psi) lower than line pressure.</td>
<td></td>
</tr>
<tr>
<td>Rear servo</td>
<td>1 range</td>
<td></td>
<td>No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.</td>
</tr>
<tr>
<td>Rear servo</td>
<td>R range</td>
<td></td>
<td>1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.</td>
</tr>
<tr>
<td>Governor</td>
<td>D range closed throttle</td>
<td>Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.</td>
<td></td>
</tr>
</tbody>
</table>

## Torque Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>N·m</th>
<th>Ft. Lbs.</th>
<th>In. Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitting, cooler line at trans</td>
<td>18</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, torque convertor</td>
<td>47</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, clevis bracket to crossmember</td>
<td>47</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, clevis bracket to rear support</td>
<td>68</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, driveplate to crankshaft</td>
<td>75</td>
<td>55</td>
<td>-</td>
</tr>
<tr>
<td>Plug, front band reaction</td>
<td>17</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Locknut, front band adj.</td>
<td>34</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, fluid pan</td>
<td>13</td>
<td>10</td>
<td>120</td>
</tr>
<tr>
<td>Screws, fluid filter</td>
<td>4</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Bolt, oil pump</td>
<td>20</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, overrunning clutch cam</td>
<td>17</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, O/D to trans</td>
<td>34</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, O/D piston retainer</td>
<td>17</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Plug, pressure test port</td>
<td>14</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, reaction shaft support</td>
<td>20</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Locknut, rear band</td>
<td>41</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Bolt, valve body to case</td>
<td>12</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Sensor, trans speed</td>
<td>27</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Screw, solenoid wiring connector</td>
<td>4</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Screw, solenoid to transfer plate</td>
<td>4</td>
<td>-</td>
<td>35</td>
</tr>
<tr>
<td>Bracket, transmission range sensor mounting</td>
<td>34</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Screw, transmission range sensor to mounting bracket</td>
<td>5</td>
<td>-</td>
<td>45</td>
</tr>
</tbody>
</table>
AUTOMATIC TRANSMISSION - 48RE (Continued)

SPECIAL TOOLS

RE TRANSMISSION

Pilot Studs C-3288-B

Oil Pressure Gauge - C-3292

Pressure Gauge - C-3293SP

Dial Indicator C-3339

Valve Spring Compressor C-3422-B

Adapter, Band Adjuster - C-3705

Puller/Slide Hammer, C-3752

Gauge, Throttle Setting - C-3763

Installer C-3860-A

Spring Compressor - C-3863-A
Handle C-4171

Dial Caliper - C-4962

Spring Compressor and Alignment Shaft - 6227

Gauge Bar - 6311

Gauge - 6312

Retainer - 6583

Installer - 8114

Socket, TRS Mounting Bracket - 8581

Installer, Seal - 9037
**ACCUMULATOR**

**DESCRIPTION**

The accumulator (Fig. 66) is a hydraulic device that has the sole purpose of cushioning the application of a band or clutch. The accumulator consists of a dual-land piston and a spring located in a bore in the transmission case. The 3-4 accumulator is located in a housing attached to the side of the valve body (Fig. 67).

**OPERATION**

Both the accumulator and the 3-4 accumulator function the same. Line pressure is directed to the small end of the piston when the transmission is placed into a DRIVE position (Fig. 68), bottoming it against the accumulator plate. When the 1-2 upshift occurs (Fig. 69), line pressure is directed to the large end of the piston and then to the kickdown servo. As the line pressure reaches the accumulator, the combination of spring pressure and line pressure forces the piston away from the accumulator plate. This causes a balanced pressure situation, which results in a cushioned band application. After the kickdown servo has become immovable, line pressure will finish pushing the accumulator up into its bore. When the large end of the accumulator piston is seated in its bore, the band or clutch is fully applied.

**NOTE:** The accumulator is shown in the inverted position for illustrative purposes.
INSPECTION
Inspect the accumulator piston and seal rings. Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.
Check condition of the accumulator inner and outer springs. Replace the springs if the coils are cracked, distorted or collapsed.

BANDS
DESCRIPTION
KICKDOWN (FRONT) BAND
The kickdown, or "front", band (Fig. 70) holds the common sun gear of the planetary gear sets. The front (kickdown) band is made of steel, and faced on its inner circumference with a friction-type lining. One end of the band is anchored to the transmission case, and the other is acted on with a pushing force by a servo piston. The front band is a single-wrap design (the band does not completely encompass/wrap the drum that it holds).

LOW/REVERSE (REAR) BAND
The low/reverse band, or "rear", band (Fig. 71) is similar in appearance and operation to the front band. The rear band is slightly different in that it does not use a link bar, but is acted directly on by the apply lever. This is referred to as a double-wrap band design (the drum is completely encompassed/wrapped by the band). The double-wrap band provides a greater holding power in comparison to the single-wrap design.

OPERATION
KICKDOWN (FRONT) BAND
The kickdown band holds the common sun gear of the planetary gear sets by applying and holding the front clutch retainer, which is splined to the sun gear driving shell, and in turn splined directly to the sun gear. The application of the band by the servo is typically done by an apply lever and link bar.
BANDS (Continued)

LOW/REVERSE (REAR) BAND
The rear band holds the rear planet carrier stationary by being mounted around and applied to the low/reverse drum.

ADJUSTMENTS

ADJUSTMENT - BANDS

FRONT BAND
The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

1) Raise vehicle.
2) Loosen band adjusting screw locknut (Fig. 72). Then back locknut off 3-5 turns. Be sure adjusting screw turns freely in case. Apply lubricant to screw threads if necessary.
3) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with an appropriate Torx™ socket.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw, tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

4) Back off front band adjusting screw 1-3/4 turns.
5) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.
6) Lower vehicle.

REAR BAND
The transmission oil pan must be removed for access to the rear band adjusting screw.

1) Raise vehicle.
2) Remove transmission oil pan and drain fluid.
3) Loosen band adjusting screw locknut 5-6 turns. Be sure adjusting screw turns freely in lever.
4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque (Fig. 73).
5) Back off adjusting screw 3 turns.
6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.
7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.
8) Lower vehicle and refill transmission with Mopar® ATF +4, Automatic Transmission fluid.

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![Fig. 72 Front Band Adjustment Screw Location](image1)

![Fig. 73 Rear Band Adjustment Screw Location](image2)

---
BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM

DESCRIPTION
The Brake Transmission Shifter Interlock (BTSI) (Fig. 74), is a solenoid operated system. It consists of a solenoid permanently mounted on the gearshift cable.

OPERATION
The system locks the shifter into the PARK position. The interlock system is engaged whenever the ignition switch is in the LOCK or ACCESSORY position. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed approximately one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING - BRAKE TRANSMISSION SHIFT INTERLOCK
(1) Verify that the key can only be removed in the PARK position.
(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.
(3) Shifting out of PARK should not be possible when the ignition key cylinder is in the OFF position.
(4) Shifting out of PARK should not be possible while applying normal pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).
(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.
(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions.

ADJUSTMENTS - BRAKE TRANSMISSION SHIFT INTERLOCK
Correct cable adjustment is important to proper interlock operation. The gearshift cable must be correctly adjusted in order to shift out of PARK.

ADJUSTMENT PROCEDURE
(1) Remove the steering column trim as necessary for access to the brake transmission shift interlock.
(2) Shift the transmission into the PARK position.
(3) Pull upward on both the BTSI lock tab and the gearshift cable lock tab (Fig. 75).
(4) Verify that the shift lever is in the PARK position.
(5) Verify positive engagement of the transmission park lock by attempting to rotate the propeller shaft. The shaft will not rotate when the park lock is engaged.
(6) Turn ignition switch to LOCK position. Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.
(7) Ensure that the cable is free to self-adjust by pushing cable rearward and releasing.
(8) Push the gearshift cable lock tab down until it snaps in place.
(9) Locate the BTSI alignment hole in the bottom of the BTSI mechanism between the BTSI lock tab and the BTSI connector.
(10) Move the BTSI assembly up or down on the gearshift cable until an appropriate size drill bit can be inserted into the alignment hole and through the assembly.
(11) Push the BTSI lock tab down until it snaps into place and remove the drill bit.
(12) Install any steering column trim previously removed.
BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM (Continued)

BTSI FUNCTION CHECK
(1) Verify removal of ignition key allowed in PARK position only.

(2) When the shift lever is in PARK, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of PARK should not be possible while applying normal force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gear and NEUTRAL, or PARK, may be done without depressing foot brake with ignition switch in run or start positions.

(7) Engine starts must be possible with shifter lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any position other than PARK or NEUTRAL.

(8) With shifter lever in the:
  • PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
  • NEUTRAL position - Normal position. Engine starts must be possible.
  • NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

ELECTRONIC GOVERNOR

DESCRIPTION
Governor pressure is controlled electronically. Components used for governor pressure control include:

• Governor body
• Valve body transfer plate
• Governor pressure solenoid valve
• Governor pressure sensor
• Fluid temperature thermistor
• Throttle position sensor (TPS)
• Transmission speed sensor
• Powertrain control module (PCM)

GOVERNOR PRESSURE SOLENOID VALVE
The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device located in the governor body on the valve body transfer plate (Fig. 76).
GOVERNOR PRESSURE SENSOR

The governor pressure sensor measures output pressure of the governor pressure solenoid valve (Fig. 77).

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate is designed to supply transmission line pressure to the governor pressure solenoid valve and to return governor pressure.

The governor pressure solenoid valve is mounted in the governor body. The body is bolted to the lower side of the transfer plate (Fig. 77).

GOVERNOR PRESSURE CURVES

There are four governor pressure curves programmed into the transmission control module. The different curves allow the control module to adjust governor pressure for varying conditions. One curve is used for operation when fluid temperature is at, or below, –1°C (30°F). A second curve is used when fluid temperature is at, or above, 10°C (50°F) during normal city or highway driving. A third curve is used during wide-open throttle operation. The fourth curve is used when driving with the transfer case in low range.

OPERATION

Compensation is required for performance variations of two of the input devices. Though the slope of the transfer functions is tightly controlled, offset may vary due to various environmental factors or manufacturing tolerances.

The pressure transducer is affected by barometric pressure as well as temperature. Calibration of the zero pressure offset is required to compensate for shifting output due to these factors.

Normal calibration will be performed when sump temperature is above 50 degrees F, or in the absence of sump temperature data, after the first 10 minutes of vehicle operation. Calibration of the pressure transducer offset occurs each time the output shaft speed falls below 200 RPM. Calibration shall be repeated each 3 seconds the output shaft speed is below 200 RPM. A 0.5 second pulse of 95% duty cycle is applied to the governor pressure solenoid valve and the transducer output is read during this pulse. Averaging of the transducer signal is necessary to reject electrical noise.

Under cold conditions (below 50 degrees F sump), the governor pressure solenoid valve response may be too slow to guarantee 0 psi during the 0.5 second calibration pulse. Calibration pulses are continued during this period, however the transducer output valves are discarded. Transducer offset must be read at key-on, under conditions which promote a stable reading. This value is retained and becomes the offset during the "cold" period of operation.

GOVERNOR PRESSURE SOLENOID VALVE

The inlet side of the solenoid valve is exposed to normal transmission line pressure. The outlet side of the valve leads to the valve body governor circuit.

The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid controls governor pressure. One amp current produces zero kPa/psi governor pressure. Zero amps sets the maximum governor pressure.

The powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

GOVERNOR PRESSURE SENSOR

The sensor output signal provides the necessary feedback to the PCM. This feedback is needed to adequately control governor pressure.

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate channels line pressure to the solenoid valve through the governor body. It also channels governor pressure from the solenoid valve to the governor circuit. It is the solenoid valve that develops the necessary governor pressure.

GOVERNOR PRESSURE CURVES

LOW TRANSMISSION FLUID TEMPERATURE

When the transmission fluid is cold the conventional governor can delay shifts, resulting in higher than normal shift speeds and harsh shifts. The electronically controlled low temperature governor pres-
sure curve is higher than normal to make the
transmission shift at normal speeds and sooner. The
PCM uses a temperature sensor in the transmission
oil sump to determine when low temperature govern-
or pressure is needed.

NORMAL OPERATION

Normal operation is refined through the increased
computing power of the PCM and through access to
data on engine operating conditions provided by the
PCM that were not available with the previous
stand-alone electronic module. This facilitated the
development of a load adaptive shift strategy - the
ability to alter the shift schedule in response to vehi-
cle load condition. One manifestation of this capabil-
ity is grade "hunting" prevention - the ability of the
transmission logic to delay an upshift on a grade if
the engine does not have sufficient power to main-
tain speed in the higher gear. The 3-2 downshift and
the potential for hunting between gears occurs with a
heavily loaded vehicle or on steep grades. When
hunting occurs, it is very objectionable because shifts
are frequent and accompanied by large changes in
noise and acceleration.

WIDE OPEN THROTTLE OPERATION

In wide-open throttle (WOT) mode, adaptive mem-
ory in the PCM assures that up-shifts occur at the
preprogrammed optimum speed. WOT operation is
determined from the throttle position sensor, which
is also a part of the emission control system. The ini-
tial setting for the WOT upshift is below the opti-
mum engine speed. As WOT shifts are repeated, the
PCM learns the time required to complete the shifts
by comparing the engine speed when the shifts occur
to the optimum speed. After each shift, the PCM
adjusts the shift point until the optimum speed is
reached. The PCM also considers vehicle loading,
grade and engine performance changes due to high
altitude in determining when to make WOT shifts. It
does this by measuring vehicle and engine accelera-
tion and then factoring in the shift time.

TRANSFER CASE LOW RANGE OPERATION

On four-wheel drive vehicles operating in low
range, the engine can accelerate to its peak more
rapidly than in Normal range, resulting in delayed
shifts and undesirable engine "flare." The low range
governor pressure curve is also higher than normal
to initiate upshifts sooner. The PCM compares elec-
tronic vehicle speed signal used by the speedometer
to the transmission output shaft speed signal to
determine when the transfer case is in low range.

REMOVAL

(1) Hoist and support vehicle on safety stands.
(2) Remove transmission fluid pan and filter.
(3) Disengage wire connectors from pressure sen-
sor and solenoid (Fig. 78).

![Fig. 78 Governor Solenoid And Pressure Sensor](image1)

1 - PRESSURE SENSOR
2 - PRESSURE SOLENOID
3 - GOVERNOR

(4) Remove screws holding pressure solenoid
retainer to governor body.
(5) Separate solenoid retainer from governor (Fig.
79).

![Fig. 79 Pressure Solenoid Retainer](image2)

1 - PRESSURE SOLENOID RETAINER
2 - GOVERNOR
ELECTRONIC GOVERNOR (Continued)

(6) Pull solenoid from governor body (Fig. 80).
(7) Pull pressure sensor from governor body.
(8) Remove bolts holding governor body to valve body.

(9) Separate governor body from valve body (Fig. 81).
(10) Remove governor body gasket.

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace o-ring seals, clean the gasket surfaces and replace gasket.

(1) Place gasket in position on back of governor body (Fig. 82).
ELECTRONIC GOVERNOR (Continued)

(10) Place solenoid retainer in position on governor (Fig. 84).

(11) Install screws to hold pressure solenoid retainer to governor body.

(12) Engage wire connectors into pressure sensor and solenoid (Fig. 85).

(13) Install transmission fluid pan and (new) filter.

(14) Lower vehicle and road test to verify repair.

(4) Remove old seal with a screw mounted in a slide hammer.

INSTALLATION

(1) Place seal in position on overdrive housing.

(2) Drive seal into overdrive housing with Seal Installer 9037 (Fig. 86).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

EXTENSION HOUSING SEAL

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle yoke for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Remove old seal with a screw mounted in a slide hammer.

INSTALLATION

(1) Place seal in position on overdrive housing.

(2) Drive seal into overdrive housing with Seal Installer 9037 (Fig. 86).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

Fig. 84 Pressure Solenoid Retainer
1 - PRESSURE SOLENOID RETAINER
2 - GOVERNOR

Fig. 85 Governor Solenoid And Pressure Sensor
1 - PRESSURE SENSOR
2 - PRESSURE SOLENOID
3 - GOVERNOR

Fig. 86 Installing Overdrive Housing Yoke Seal
1 - SPECIAL TOOL 9037
2 - SPECIAL TOOL C-4171

FLUID AND FILTER

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve and clutch operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.
FLUID AND FILTER (Continued)

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

DIAGNOSIS AND TESTING - FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:
- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to replace contaminated converter after repair

The use of non-recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission, an overhaul is necessary.

The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

STANDARD PROCEDURE - FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmission has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

Fluid level is checked with the engine running at curb idle speed, the transmission in NEUTRAL and the transmission fluid at normal operating temperature. The engine should be running at idle speed for at least one minute, with the vehicle on level ground.

The transmission fluid level can be checked two ways.

PROCEDURE ONE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).
(2) Position vehicle on level surface.
(3) Start and run engine at curb idle speed.
(4) Apply parking brakes.
(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to NEUTRAL.
(6) Clean top of filler tube and dipstick to keep dirt from entering tube.
(7) Remove dipstick (Fig. 87) and check fluid level as follows:
   (a) Correct acceptable level is in crosshatch area.
   (b) Correct maximum level is to MAX arrow mark.
   (c) Incorrect level is at or below MIN line.
   (d) If fluid is low, add only enough Mopar® ATF +4 to restore correct level. Do not overfill.

Fig. 87 Dipstick Fluid Level Marks - Typical

1 - DIPSTICK
2 - MAXIMUM CORRECT FLUID LEVEL
3 - ACCEPTABLE FLUID LEVEL
PROCEDURE TWO
(1) Start engine and apply parking brake.
(2) Shift the transmission into DRIVE for approximately 2 seconds.
(3) Shift the transmission into REVERSE for approximately 2 seconds.
(4) Shift the transmission into PARK.
(5) Hook up DRB® scan tool and select engine.
(6) Select sensors.
(7) Read the transmission temperature value.
(8) Compare the fluid temperature value with the chart.
(9) Adjust transmission fluid level shown on the dipstick according to the chart (Fig. 88).

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

(10) Check transmission for leaks.

STANDARD PROCEDURE - FLUID AND FILTER REPLACEMENT
For proper service intervals (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION). The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).
FLUID AND FILTER (Continued)

(5) Slowly separate front of pan and reusable gasket away from transmission allowing the fluid to drain into drain pan.
(6) Hold up pan and remove remaining bolt holding pan to transmission.
(7) While holding pan level, lower pan and gasket away from transmission.
(8) Pour remaining fluid in pan into drain pan.
(9) Remove screws holding filter to valve body (Fig. 90).
(10) Separate filter from valve body and pour fluid in filter into drain pan.
(11) Dispose of used trans fluid and filter properly.

INSTALLATION

(1) Position a new transmission oil filter onto the valve body.
(2) Install the screws to hold the filter to the valve body. Tighten the screws to 4 N·m (35 in.lbs.).
(3) Clean the gasket surfaces of the transmission oil pan and transmission pan rail.

NOTE: The transmission pan oil gasket is reusable. Inspect the sealing surfaces of the gasket. If the sealing ribs on both surfaces appear to be in good condition, clean the gasket of any foreign material and reinstall.

(4) Position the oil pan gasket onto the oil pan.
(5) Position the oil pan and gasket onto the transmission and install several bolts to hold the pan and gasket to the transmission.
(6) Install the remainder of the oil pan bolts. Tighten the bolts to 13.6 N·m (125 in.lbs.).
(7) Lower vehicle and fill transmission. (Refer to 21 - TRANSMISSION/AUTOMATIC/FLUID - STANDARD PROCEDURE)

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.
(2) Add following initial quantity of Mopar® ATF +4 to transmission:
   (a) If only fluid and filter were changed, add 3 pints (1-1/2 quarts) of ATF +4 to transmission.
   (b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add 12 pints (6 quarts) of ATF +4 to transmission.
(3) Apply parking brakes.
(4) Start and run engine at normal curb idle speed.
(5) Apply service brakes, shift transmission through all gear ranges back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.
(6) Remove funnel, insert dipstick and check fluid level. If level is low, add fluid to bring level to MIN mark on dipstick. Check to see if the oil level is equal on both sides of the dipstick. If one side is noticeably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.
(7) Drive vehicle until transmission fluid is at normal operating temperature.
(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.
FRONT CLUTCH

DESCRIPTION
The front clutch assembly (Fig. 91) is composed of the front clutch retainer, pressure plate, clutch plates, driving discs, piston, piston return spring, return spring retainer, and snap-rings. The front clutch is the forward-most component in the transmission geartrain and is directly behind the oil pump and is considered a driving component.

OPERATION
To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap-ring is used to cushion the application of the clutch pack.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one-way ball-check-valve located in the clutch retainer. The check-valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

DISASSEMBLY
(1) Remove the waved snap-ring, reaction plate, clutch plates, and clutch discs.
FRONT CLUTCH (Continued)

(2) Compress clutch piston retainer and piston springs with Compressor Tool C-3863-A (Fig. 92).

(3) Remove retainer snap-ring and remove compressor tool.

(4) Remove clutch piston springs (Fig. 93). Note position and number of piston springs for assembly reference.

(5) Remove clutch piston from retainer with a twisting motion.

(6) Remove and discard clutch piston inner and outer seals.

INSPECTION

Inspect the front clutch components. Replace the clutch discs if warped, worn, scored, burned or charred, the lugs are damaged, or if the facing is flaking off. Replace the steel plates and reaction plate if heavily scored, warped, or broken. Be sure the driving lugs on the discs and plate are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston springs and spring retainer if either are distorted, warped or broken.

Check the lug grooves in the clutch piston retainer. The steel plates should slide freely in the slots. Replace the piston retainer if the grooves are worn or damaged. Also check action of the check ball in the piston retainer. The ball must move freely and not stick.
FRONT CLUTCH (Continued)

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check the clutch piston check ball. The ball should be securely in place. Replace the piston if the ball is missing, or seized in place.

ASSEMBLY

NOTE: The 48RE transmission uses five plates and discs for the front clutch.

(1) Soak clutch discs in transmission fluid.
(2) Install new inner piston seal onto the outer diameter of the clutch retainer inner hub.
(3) Install new outer seal onto the clutch piston. Be sure seal lips of both seals face the interior of the retainer.
(4) Lubricate new inner and outer piston seals with petroleum jelly.
(5) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.015 - 0.020 in. thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(6) Install and position nine clutch piston springs (Fig. 94).
(7) Install spring retainer on top of piston springs.
(8) Compress spring retainer and piston springs with Tool C-3863-A.
(9) Install spring retainer snap-ring and remove compressor tool.
(10) Install clutch plates and discs (Fig. 95). Five clutch discs, five steel plates and one reaction plate are required.

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**Fig. 94 Front Clutch Spring Position**

1 - 9 SPRING CLUTCH

- Install and position nine clutch piston springs.
- Install spring retainer on top of piston springs.
- Compress spring retainer and piston springs.
- Install spring retainer snap-ring and remove compressor tool.

**Fig. 95 48RE Front Clutch Components**

1 - INNER PISTON SEAL
2 - CLUTCH PISTON
3 - CLUTCH PISTON SPRING RETAINER
4 - CLUTCH PLATES
5 - CLUTCH PACK SNAP-RING (WAVED)
6 - REACTION PLATE
7 - CLUTCH DISCS
8 - RETAINER SNAP-RING
9 - CLUTCH PISTON SPRINGS
10 - OUTER PISTON SEAL
11 - FRONT CLUTCH RETAINER
FRONT CLUTCH (Continued)

(11) Install reaction plate followed by waved snap-ring.

(12) Check clutch pack clearance with feeler gauge (Fig. 96). Clearance between waved spring and pressure plate should 2.5-4.09 mm (0.098-0.161 in.). If clearance is incorrect, clutch plates, clutch discs, snap-ring, or pressure plate may have to be changed.

FRONT SERVO

DESCRIPTION

The kickdown servo (Fig. 97) consists of a two-land piston with an inner piston, a piston rod and guide, and a return spring. The dual-land piston uses seal rings on its outer diameters and an O-ring for the inner piston.

Fig. 96 Typical Method Of Measuring Front Clutch Pack Clearance

1 - FEELER GAUGE
2 - WAV ED SNAP-RING
3 - FEELER GAUGE

Fig. 97 Front Servo

1 - VENT
2 - INNER PISTON
3 - PISTON
4 - SPRING
5 - RELEASE PRESSURE
6 - APPLY PRESSURE
7 - PISTON ROD

OPERATION

The application of the piston is accomplished by applying pressure between the two lands of the piston. The pressure acts against the larger lower land to push the piston downward, allowing the piston rod to extend though its guide against the apply lever. Release of the servo at the 2-3 upshift is accomplished by a combination of spring and line pressure, acting on the bottom of the larger land of the piston. The small piston is used to cushion the application of the band by bleeding oil through a small orifice in the larger piston. The release timing of the kickdown servo is very important to obtain a smooth but firm shift. The release has to be very quick, just as the front clutch application is taking place. Otherwise, engine runaway or a shift hesitation will occur. To accomplish this, the band retains its holding capacity until the front clutch is applied, giving a small amount of overlap between them.
FRONT SERVO (Continued)

DISASSEMBLY
(1) Remove seal ring from rod guide (Fig. 98).
(2) Remove small snap-ring from servo piston rod. Then remove piston rod, spring and washer from piston.
(3) Remove and discard servo component O-ring and seal rings.

CLEANING
Clean the servo piston components (Fig. 99) with solvent and dry them with compressed air.

INSPECTION
Inspect the servo components (Fig. 100). Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap-ring if distorted or warped.
Check the servo piston bore for wear. If the bore is severely scored, or damaged, it will be necessary to replace the case.
Replace any servo component if doubt exists about condition. Do not reuse suspect parts.

ASSEMBLY
Clean and inspect front servo components.
(1) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.
FRONT SERVO (Continued)

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap-ring (Fig. 101).

(3) Disengage cable eyelet at transmission shift lever and pull cable adjuster out of mounting bracket (Fig. 102) or (Fig. 103).

**Fig. 101 Front Servo**

1 - PISTON RINGS
2 - SERVO PISTON
3 - O-RING
4 - SNAP-RING
5 - PISTON ROD GUIDE
6 - SEAL RING
7 - SNAP-RING
8 - SERVO SPRING
9 - WASHER
10 - SPRING
11 - PISTON ROD

**GEARSHIFT CABLE**

**DIAGNOSIS AND TESTING - GEARSHIFT CABLE**

(1) Engine starts must be possible with shift lever in PARK or NEUTRAL positions only. Engine starts must not be possible in any other gear position.

(2) With the shift lever in the:
   (a) PARK position - Apply upward force on the shift arm and remove pressure. Engine starts must be possible.
   (b) PARK position - Apply downward force on the shift arm and remove pressure. Engine starts must be possible.
   (c) NEUTRAL position - Normal position. Engine starts must be possible.
   (d) NEUTRAL position - Engine running and brakes applied, apply upward force on the shift arm. Transmission shall not be able to shift from neutral to reverse.

**REMOVAL**

(1) Shift transmission into PARK.
(2) Raise vehicle.

**Fig. 102 Gearshift Cable at Transmission - RFE**

1 - GEARSHIFT CABLE
2 - RFE TRANSMISSION
3 - MANUAL LEVER

**Fig. 103 Gearshift Cable at Transmission - RE**

1 - GEARSHIFT CABLE
2 - RE TRANSMISSION
3 - MANUAL LEVER
GEARSHIFT CABLE (Continued)

(4) Lower the vehicle.
(5) Remove the dash panel insulation pad as necessary to access the gearshift cable grommet (Fig. 104).
(6) Remove grommet from the dash panel.
(7) Remove any steering column trim necessary to access the gearshift cable and BTSI mechanism.
(8) Disconnect the BTSI wiring connector.
(9) Disconnect cable at lower column bracket and shift lever pin and pull the cable through the dash panel opening into the vehicle (Fig. 105).

INSTALLATION

(1) Route the transmission end of the gearshift cable through the opening in the dash panel (Fig. 106).
(2) Seat the cable grommet into the dash panel opening.
(3) Snap the cable into the steering column bracket so the retaining ears (Fig. 107) are engaged and snap the cable eyelet onto the shift lever ball stud.

(10) Remove gearshift cable from vehicle.

(4) Raise the vehicle.
(5) Place the transmission manual shift lever in the "PARK" detent (rearmost) position and rotate prop shaft to ensure transmission is in PARK.
GEARSHIFT CABLE (Continued)

(6) Route the gearshift cable through the transmission mounting bracket and secure the cable by snapping the cable retaining ears into the transmission bracket and snapping the cable eyelet on the manual shift lever ball stud.

(7) Lower vehicle.

(8) Lock the shift cable adjustment by pressing the cable adjuster lock tab downward until it snaps into place.

(9) Check for proper operation of the transmission range sensor.

(10) Adjust the gearshift cable (Refer to 21 - TRANSMISSION/AUTOMATIC/GEAR SHIFT CABLE - ADJUSTMENTS) and BTSI mechanism (Refer to 21 - TRANSMISSION/AUTOMATIC/ BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM - ADJUSTMENTS) as necessary.

ADJUSTMENTS

GEARSHIFT CABLE

Check adjustment by starting the engine in PARK and NEUTRAL. Adjustment is CORRECT if the engine starts only in these positions. Adjustment is INCORRECT if the engine starts in one but not both positions. If the engine starts in any position other than PARK or NEUTRAL, or if the engine will not start at all, the transmission range sensor may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into PARK.

(2) Release cable adjuster lock tab (underneath the steering column) (Fig. 108) to unlock cable.

(3) Raise vehicle.

(4) Disengage the cable eyelet from the transmission manual shift lever.

(5) Verify transmission shift lever is in PARK detent by moving lever fully rearward. Last rearward detent is PARK position.

(6) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Snap the cable eyelet onto the transmission manual shift lever.

(8) Lower vehicle.

(9) Lock shift cable by pressing cable adjuster lock tab downward until it snaps into place.

(10) Check engine starting. Engine should start only in PARK and NEUTRAL.

Fig. 108 Gearshift Cable at Steering Column

1 - STEERING COLUMN
2 - GEARSHIFT CABLE
3 - GEARSHIFT CABLE LOCK TAB
4 - BTSI SOLENOID LOCK TAB
5 - BTSI CONNECTOR
OIL PUMP

DESCRIPTION
The oil pump (Fig. 109) is located in the pump housing inside the bell housing of the transmission case. The oil pump consists of an inner and outer gear, a housing, and a reaction shaft support.

OPERATION
As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

Fig. 109 Oil Pump Assembly

1 - OIL SEAL
2 - VENT BAFFLE
3 - OIL PUMP BODY
4 - GASKET
5 - REACTION SHAFT SUPPORT
6 - SEAL RINGS
7 - BOLTS (6)
8 - #1 THRUST WASHER (SELECTIVE)
9 - INNER GEAR
10 - OUTER GEAR
11 - “O” RING
12 - TORQUE CONVERTER SEAL RING
DISASSEMBLY

1. Mark position of support in oil pump body for assembly alignment reference. Use scriber or paint to make alignment marks.
2. Place pump body on two wood blocks.
3. Remove reaction shaft support bolts and separate support from pump body (Fig. 110).
4. Remove pump inner and outer gears (Fig. 111).
5. Remove o-ring seal from pump body (Fig. 112). Discard seal after removal.

CLEANING

Clean pump and support components with solvent and dry them with compressed air.

INSPECTION

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump bushing. Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by installing the gears in the pump body and measure pump component clearances as follows:

1. Position an appropriate piece of Plastigage™ across both gears.
2. Align the plastigage to a flat area on the reaction shaft housing.
3. Install the reaction shaft to the pump housing. Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

Clearance between inner gear tooth and outer gear should be 0.051 to 0.19 mm (0.002 to 0.0075 in.). Measure clearance with an appropriate feeler gauge (Fig. 113).

Clearance between outer gear and pump housing should be 0.10 to 0.229 mm (0.004 to 0.009 in.). Measure clearance with an appropriate feeler gauge.

ASSEMBLY

1. Lubricate pump gears with transmission fluid and install them in pump body.
2. Install thrust washer on reaction shaft support hub. Lubricate washer with petroleum jelly or transmission fluid before installation.
3. If reaction shaft seal rings are being replaced, install new seal rings on support hub. Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.
CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.
OIL PUMP (Continued)

(4) Align and install reaction shaft support on pump body.
(5) Install bolts attaching reaction shaft support to pump. Tighten bolts to 20 N·m (175 in. lbs.) torque.
(6) Install new pump seal with Installer Tool C-3860-A (Fig. 114). Use hammer or mallet to tap seal into place.
(7) Install new o-ring on pump body. Lubricate oil seal and o-ring with petroleum jelly.
(8) Cover pump assembly to prevent dust entry and set aside for assembly installation.

OUTPUT SHAFT FRONT BEARING

REMOVAL
(1) Remove overdrive unit from the vehicle.
(2) Remove overdrive geartrain from housing.
(3) Remove snap-ring holding output shaft front bearing to overdrive geartrain. (Fig. 115).
(4) Pull bearing from output shaft.

INSTALLATION
(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.
(2) Push bearing onto shaft until the snap-ring groove is visible.
(3) Install snap-ring to hold bearing onto output shaft.
(4) Install overdrive geartrain into housing.
(5) Install overdrive unit in vehicle.

OUTPUT SHAFT REAR BEARING

REMOVAL
(1) Remove overdrive unit from the vehicle. (Refer to 21 - TRANSMISSION/AUTOMATIC/OVERDRIVE - REMOVAL)
(2) Remove overdrive geartrain from housing.
(3) Remove snap-ring holding output shaft rear bearing into overdrive housing (Fig. 116).
(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.
OUTPUT SHAFT REAR BEARING (Continued)

INSTALLATION
(1) Place replacement bearing in position in housing.
(2) Using a suitable driver, drive bearing into housing until the snap-ring groove is visible.
(3) Install snap-ring to hold bearing into housing (Fig. 116).
(4) Install overdrive geartrain into housing.
(5) Install overdrive unit in vehicle.

OVERDRIVE CLUTCH

DESCRIPTION
The overdrive clutch (Fig. 117) is composed of the pressure plate, clutch plates, holding discs, overdrive piston retainer, piston, piston spacer, and snap-rings. The overdrive clutch is the forwardmost component in the transmission overdrive unit and is considered a holding component. The overdrive piston retainer, piston, and piston spacer are located on the rear of the main transmission case.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION
To apply the clutch, pressure is applied between the piston retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through passages at the lower rear portion of the valve body area. With pressure applied between the piston retainer and piston, the piston moves away from the piston retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the intermediate shaft into the overdrive planetary gear set. The overdrive clutch discs are attached to the overdrive clutch hub while the overdrive clutch plates, reaction plate, and pressure plate are lugged to the overdrive housing. This allows the intermediate shaft to transfer the engine torque to the planetary gear and overrunning clutch. This drives the planetary gear inside the annulus, which is attached to the overdrive clutch drum and output shaft, creating the desired gear ratio. The waved snap-ring is used to cushion the application of the clutch pack for the 5 disc version of the overdrive clutch. The 6 disc overdrive clutch does not use a waved snap-ring.

Fig. 117 Overdrive Clutch

1 - REACTION PLATE
2 - PRESSURE PLATE
OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into PARK.
(2) Raise vehicle.
(3) Remove transfer case, if equipped.
(4) Mark propeller shaft universal joint(s) and axle pinion yoke, or the companion flange and flange yoke, for alignment reference at installation, if necessary.
(5) Disconnect and remove the rear propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL)
(6) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.
(7) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.
(8) Support transmission with transmission jack.
(9) Remove bolts attaching overdrive unit to transmission (Fig. 118).

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

(10) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(11) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.
(12) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.
(13) Position drain pan on workbench.
(14) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.
(15) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.
(16) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

DISASSEMBLY

(1) Remove transmission speed sensor and o-ring seal from overdrive case (Fig. 119).
(2) Remove overdrive piston thrust bearing (Fig. 120).
OVERDRIVE UNIT (Continued)

OVERDRIVE PISTON

(1) Remove overdrive piston thrust plate (Fig. 121). Retain thrust plate. It is a select fit part and may possibly be reused.

(2) Remove intermediate shaft spacer (Fig. 122). Retain spacer. It is a select fit part and may possibly be reused.

(3) Remove overdrive piston from retainer (Fig. 123).
OVERDRIVE UNIT (Continued)

OVERDRIVE CLUTCH PACK
(1) Remove overdrive clutch pack wire retaining ring (Fig. 124).
(2) Remove overdrive clutch pack (Fig. 125).
(3) Note position of clutch pack components for assembly reference (Fig. 126).

OVERDRIVE GEARTRAIN
(1) Remove overdrive clutch wave spring (Fig. 127), 5 disc clutch only.
(2) Remove overdrive clutch reaction snap-ring (Fig. 128). Note that snap-ring is located in same groove as wave spring.
(3) Remove Torx™ head screws that attach access cover and gasket to overdrive case (Fig. 129).
(4) Remove access cover and gasket (Fig. 130).

(5) Expand output shaft bearing snap-ring with expanding-type snap-ring pliers. Then push output shaft forward to release shaft bearing from locating ring (Fig. 131).

(6) Lift gear case up and off geartrain assembly (Fig. 132).

(7) Remove snap-ring that retains rear bearing on output shaft.
(8) Remove rear bearing from output shaft (Fig. 133).
WARNING: THE NEXT STEP IN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

1) Mount geartrain assembly in shop press (Fig. 134).
2) Position Compressor Tool 6227-1 on clutch hub (Fig. 134). Support output shaft flange with steel press plates as shown and center assembly under press ram.
3) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap-ring (Fig. 134).

4) Remove direct clutch pack snap-ring (Fig. 135).
5) Remove direct clutch hub retaining ring (Fig. 136).
OVERDRIVE UNIT (Continued)

(6) Release press load slowly and completely (Fig. 137).
(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 137). Note the orientation of the clutch discs. The clutch pack consists of 23 single-sided discs and they must be installed in the same orientation as they were removed.

GEARTRAIN
(1) Remove direct clutch hub and spring (Fig. 138).
(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 139).
OVERDRIVE UNIT (Continued)

(3) Remove overrunning clutch assembly with expanding type snap-ring pliers (Fig. 140). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

(4) Remove thrust bearing from overrunning clutch hub.

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 141). Use small center punch or scribe to make alignment marks.

(7) Remove direct clutch drum rear retaining ring (Fig. 142).

(8) Remove direct clutch drum outer retaining ring (Fig. 143).
OVERDRIVE UNIT (Continued)

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 144). Use punch or scribe to mark gear and shaft.

(10) Remove snap-ring that secures annulus gear on output shaft (Fig. 145). Use two screwdrivers to unseat and work snap-ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 146). Use rawhide or plastic mallet to tap gear off shaft.

GEAR CASE AND PARK LOCK

(1) Remove locating ring from gear case.
(2) Remove park pawl shaft retaining bolt and remove shaft, pawl and spring.
(3) Remove reaction plug snap-ring and remove reaction plug.
(4) Remove output shaft seal.

CLEANING

Clean the geartrain and case components with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap-rings if distorted or damaged.

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

INSPECTION

Check condition of the park lock components and the overdrive case.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.

Examine the overdrive and direct clutch discs and plates. Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked.
OVERDRIVE UNIT (Continued)

Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring. Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked.

Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate. Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinnelled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings. If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Replace the shaft pilot bushing and inner bushing if damaged. Replace either shaft bearing if rough or noisy. Replace the bearing snap-rings if distorted or cracked.

Check the machined surfaces on the output shaft. These surfaces should clean and smooth. Very minor nicks or scratches can be smoothed with crocus cloth. Replace the shaft if worn, scored or damaged in any way.

Inspect the output shaft bushings. The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn.

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF +4, Automatic Transmission fluid. Allow discs to soak for 10-20 minutes.

(2) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap-ring (Fig. 147).

(3) Align and install clutch drum on annulus gear (Fig. 148). Be sure drum is engaged in annulus gear lugs.

(4) Install clutch drum outer retaining ring (Fig. 148).
OVERDRIVE UNIT (Continued)

(5) Slide clutch drum forward and install inner retaining ring (Fig. 149).

(6) Install rear bearing and snap-ring on output shaft (Fig. 150). Be sure locating ring groove in bearing is toward rear.

(7) Install overrunning clutch on hub (Fig. 151). Note that clutch only fits one way. Shoulder on clutch should seat in small recess at edge of hub.

(8) Install thrust bearing on overrunning clutch hub. Use generous amount of petroleum jelly to hold bearing in place for installation. Bearing fits one way only. Be sure bearing is seated squarely against hub. Reinstall bearing if it does not seat squarely.

(9) Install overrunning clutch in output shaft (Fig. 152). Insert snap-ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.
(10) Install planetary gear in annulus gear (Fig. 153). Be sure planetary pinions are fully seated in annulus gear before proceeding.

(11) Coat planetary thrust bearing and bearing contact surface of spring plate with generous amount of petroleum jelly. This will help hold bearing in place during installation.

(12) Install planetary thrust bearing on sun gear (Fig. 154). Slide bearing onto gear and seat it against spring plate as shown. Bearing fits one way only. If it does not seat squarely against spring plate, remove and reposition bearing.

(13) Install assembled sun gear, spring plate and thrust bearing (Fig. 155). Be sure sun gear and thrust bearing are fully seated before proceeding.

(14) Mount assembled output shaft, annulus gear, and clutch drum in shop press. Direct clutch spring, hub and clutch pack are easier to install with assembly mounted in press.

(15) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 156). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.
OVERDRIVE UNIT (Continued)

(16) Install direct clutch spring (Fig. 157). Be sure spring is properly seated on spring plate.

![Diagram of direct clutch spring installation]

NOTE: The direct clutch in a 48RE transmission uses 23 single-sided clutch discs.

(17) Assemble and install direct clutch pack on hub as follows:

(a) Install direct clutch reaction plate on clutch hub first. Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly. Counterbore in plate fits over raised splines. Plate should be flush with this end of hub (Fig. 158).

![Diagram of correct position of direct clutch reaction plate]

(b) Install first clutch disc with internal splines friction side up, followed by a disc with external lugs friction side up. Continue alternating internal and external discs until all discs have been installed.
OVERDRIVE UNIT (Continued)

(c) Install pressure plate. This is last clutch pack item to be installed. Be sure plate is installed with shoulder side facing upward (Fig. 159).

(18) Install clutch hub and clutch pack on direct clutch spring (Fig. 160). Be sure hub is started on sun gear splines before proceeding.

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSION THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(19) Position Compressor Tool 6227-1 on clutch hub.

(20) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(21) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap-ring and clutch hub retaining ring.

(22) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(23) Install direct clutch pack snap-ring (Fig. 161). Be very sure snap-ring is fully seated in clutch drum ring groove.
OVERDRIVE UNIT (Continued)

(24) Install clutch hub retaining ring (Fig. 162). Be very sure retaining ring is fully seated in sun gear ring groove.
(25) Slowly release press ram, remove compressor tools and remove geartrain assembly.

GEAR CASE

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.
(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.
(3) Install park lock reaction plug. Note that plug has locating pin at rear (Fig. 163). Be sure pin is seated in hole in case before installing snap-ring.
(4) Install reaction plug snap-ring (Fig. 164). Compress snap-ring only enough for installation; do not distort it.
(5) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 165).
(6) Support geartrain on Tool 6227-1 (Fig. 166). Be sure tool is securely seated in clutch hub.
OVERDRIVE UNIT (Continued)

(7) Install overdrive gear case on geartrain (Fig. 166).

(8) Expand front bearing locating ring with snap-ring pliers (Fig. 167). Then slide case downward until locating ring locks in bearing groove and release snap-ring.

(9) Install locating ring access cover and gasket in overdrive unit case (Fig. 168).

OVERDRIVE CLUTCH

NOTE: The overdrive clutch in a 48RE transmission uses 5 or 6 clutch discs depending on the application.

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 169).

(2) For 5 disc overdrive clutch versions, install wave spring on top of reaction ring (Fig. 170). Reaction ring and wave ring both fit in same ring groove. Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

(3) Assemble overdrive clutch pack.

(4) Install overdrive clutch reaction plate first.
OVERDRIVE UNIT (Continued)

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 171).

INTERMEDIATE SHAFT SPACER SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness intermediate shaft spacer as follows:

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 172). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place. Remove dial caliper tool and note distance measured (Fig. 172).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 173).

(e) Remove Gauge Alignment Tool 6312.

INTERMEDIATE SHAFT END PLAY SPACER SELECTION

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<tr>
<th>End Play Measurement (Inches)</th>
<th>Spacer Thickness (Inches)</th>
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Fig. 171 Overdrive Clutch Pack Retaining Ring Installation

1 - OVERDRIVE CLUTCH PACK RETAINING RING

Fig. 172 Shaft End Play Measurement

1 - SPECIAL TOOL 6312
2 - SPECIAL TOOL 6311
3 - SPECIAL TOOL C-4962

Fig. 173 Intermediate Shaft End Play Spacer Selection

J9121-341
OD THRUST PLATE SELECTION

1. Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

2. Determine correct thickness overdrive piston thrust plate as follows:
   (a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 174).
   (b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.
   (c) Select and install required thrust plate from information in thrust plate chart (Fig. 175).

3. Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

4. Transmission speed sensor can be installed at this time if desired. However, it is recommended that sensor not be installed until after overdrive unit is secured to transmission.

OVERDRIVE PISTON

1. Install new seals on overdrive piston.
2. Stand transmission case upright on bellhousing.
5. Install overdrive piston in overdrive piston retainer by:
   (a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.
   (b) Lubricate overdrive piston seals with Mopar® ATF+4.
   (c) Install piston over Seal Guide 8114-3 and inside Guide Ring 8114-1.
   (d) Push overdrive piston into position in retainer.
   (e) Verify that the locating lugs entered the lug bores in the retainer.
6. Install intermediate shaft spacer on intermediate shaft.
7. Install overdrive piston thrust plate on overdrive piston.
8. Install overdrive piston thrust bearing on overdrive piston.
9. Install transmission speed sensor and o-ring seal in overdrive case.

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<th>Spacer Thickness (Inches)</th>
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Fig. 174 Overdrive Piston Thrust Plate Measurement

1 - SPECIAL TOOL 6311
2 - DIRECT CLUTCH HUB THRUST BEARING SEAT
3 - SPECIAL TOOL C-4962

Fig. 175 Overdrive Piston Thrust Plate Selection
OVERDRIVE UNIT (Continued)

INSTALLATION
(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.
(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.
(3) Cut out old case gasket around piston retainer with razor knife (Fig. 176).
(4) Use old gasket as template and trim new gasket to fit.
(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. Do not use any type of sealer to secure gasket. Use petroleum jelly only.
(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 177).
(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.
CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out of alignment, unit will have to be disassembled to realign splines.
(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.
(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.
(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.
(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft-lbs).
(13) Connect the transmission speed sensor and overdrive wiring connectors.
(14) Install the transfer case, if equipped.
(15) Align and install rear propeller shaft, if necessary. (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION)
OVERRUNNING CLUTCH
CAM/OVERDRIVE PISTON RETAINER

DESCRIPTION
The overrunning clutch (Fig. 178) consists of an inner race, an outer race (or cam), rollers and springs, and the spring retainer. The number of rollers and springs depends on what transmission and which overrunning clutch is being dealt with.

OPERATION
As the inner race is rotated in a clockwise direction (as viewed from the front of the transmission), the race causes the rollers to roll toward the springs, causing them to compress against their retainer. The compression of the springs increases the clearance between the rollers and cam. This increased clearance between the rollers and cam results in a free-wheeling condition. When the inner race attempts to rotate counterclockwise, the action causes the rollers to roll in the same direction as the race, aided by the pushing of the springs. As the rollers try to move in the same direction as the inner race, they are wedged between the inner and outer races due to the design of the cam. In this condition, the clutch is locked and acts as one unit.

DISASSEMBLY
(1) Remove the overdrive piston (Fig. 179).
(2) Remove the overdrive piston retainer bolts.
(3) Remove overdrive piston retainer.
(4) Remove case gasket.
(5) Tap old cam out of case with pin punch. Insert punch through bolt holes at rear of case (Fig. 180). Alternate position of punch to avoid cocking cam during removal.
(6) Clean clutch cam bore and case. Be sure to remove all chips/shavings generated during cam removal.

CLEANING
Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.
INSPECTION
Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.
Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is damaged.**
Examine the overdrive piston retainer carefully for wear, cracks, scoring or other damage. Be sure the retainer hub is a snug fit in the case and drum. Replace the retainer if worn or damaged.

ASSEMBLY
(1) Temporarily install overdrive piston retainer in case. Use 3-4 bolts to secure retainer.
(2) Align and start new clutch cam in the transmission case. Be sure serrations on cam and in case are aligned (Fig. 181). Then tap cam into case just enough to hold it in place.
(3) Verify that cam is correctly positioned before proceeding any further. Narrow ends of cam ramps should be to left when cam is viewed from front end of case (Fig. 181).
(4) Insert Adapter Tool SP-5124 from Installer/Remover C-3863-A into piston retainer (Fig. 182).
(5) Assemble Puller Bolt SP-3701 and Press Plate SP-3583-A (Fig. 183).
(6) Install assembled puller plate and bolt (Fig. 184). Insert bolt through cam, case and adapter tool. Be sure plate is seated squarely on cam.

(7) Hold puller plate and bolt in place and install puller nut SP-3701 on puller bolt (Fig. 185).

(8) Tighten puller nut to press clutch cam into case (Fig. 185). Be sure cam is pressed into case evenly and does not become cocked.

(9) Remove clutch cam installer tools.

(10) Stake case in 14 places around clutch cam to help secure cam in case. Use blunt punch or chisel to stake case.

(11) Remove piston retainer from case. Cover retainer with plastic sheeting, or paper to keep it dust free.

(12) Clean case and cam thoroughly. Be sure any chips/shavings generated during cam installation are removed from case.

(13) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. Be sure to align governor feed holes in gasket with feed passages in case (Fig. 186). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.
(14) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 187). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

(15) Install new seals on overdrive piston.

(16) Stand transmission case upright on bellhousing.

(17) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(18) Position Seal Guide 8114-3 on inner edge of overdrive piston retainer.

(19) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114-3 and inside Guide Ring 8114-1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches, while others are used to apply bands. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 188) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in. or 1 pound per square inch, or PSI as it is commonly referred to.

\[
\text{Pressure} = \frac{\text{Force}}{\text{Area}} = \frac{100 \text{ lbs.}}{100 \text{ sq. in.}} = 1 \text{ PSI}
\]

FORCE ON LARGE PISTON = 1000 LBS.
PRESSURE ON A CONFINED FLUID
Pressure is exerted on a confined fluid (Fig. 189) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply “leak” past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O-rings, D-rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal’s Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

FORCE MULTIPLICATION
Using the 10 PSI example used in the illustration (Fig. 190), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 190), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept “pressure is the same everywhere” means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

Fig. 189 Pressure on a Confined Fluid

Fig. 190 Force Multiplication
PISTONS (Continued)

PISTON TRAVEL
The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it’s a weight-to-distance output rather than a pressure-to-area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 191) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

PLANETARY GEARTRAIN/OUTPUT SHAFT

DESCRIPTION
The planetary gearsets (Fig. 192) are designated as the front, rear, and overdrive planetary gear assemblies and located in such order. A simple planetary gearset consists of three main members:

- The sun gear which is at the center of the system.
- The planet carrier with planet pinion gears which are free to rotate on their own shafts and are in mesh with the sun gear.
- The annulus gear, which rotates around and is in mesh with the planet pinion gears.

NOTE: The number of pinion gears does not affect the gear ratio, only the duty rating.

OPERATION
With any given planetary gearset, several conditions must be met for power to be able to flow:
- One member must be held.
- Another member must be driven or used as an input.
- The third member may be used as an output for power flow.
- For direct drive to occur, two gear members in the front planetary gearset must be driven.

NOTE: Gear ratios are dependent on the number of teeth on the annulus and sun gears.
DISASSEMBLY

(1) Remove planetary snap-ring from intermediate shaft (Fig. 193). Discard snap-ring as it is not reusable.

(2) Remove front planetary gear and front annulus gear as assembly (Fig. 194).

(3) Remove front planetary gear and thrust washer from front annulus gear (Fig. 195). Note thrust washer position for assembly reference.

(4) Remove tabbed thrust washer from driving shell (Fig. 196). Note washer position for assembly reference.

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Fig. 193 Removing Planetary Snap-Ring
1 - PLANETARY SNAP-RING

Fig. 194 Removing Front Planetary And Annulus Gears
1 - DRIVING SHELL
2 - FRONT ANNULUS GEAR
3 - FRONT PLANETARY GEAR

Fig. 195 Disassembling Front Planetary And Annulus Gears
1 - FRONT PLANETARY GEAR
2 - TABBED THRUST WASHER
3 - FRONT ANNULUS GEAR
4 - TORLON BUSHING

Fig. 196 Driving Shell Thrust Washer Removal
1 - DRIVING SHELL
2 - TABBED THRUST WASHER
3 - SUN GEAR
(5) Remove sun gear and driving shell as assembly (Fig. 197).

(6) Remove tabbed thrust washer from rear planetary gear (Fig. 198). Note washer position on gear for assembly reference.

(7) Remove rear planetary gear and rear annulus gear from intermediate shaft (Fig. 199).

(8) Remove thrust washer from rear planetary gear (Fig. 200).

**Fig. 197 Sun Gear And Driving Shell Removal**

1 - INTERMEDIATE SHAFT  
2 - DRIVING SHELL  
3 - SUN GEAR

**Fig. 198 Rear Planetary Thrust Washer Removal**

1 - SUN GEAR  
2 - REAR PLANETARY THRUST WASHER  
3 - DRIVING SHELL

**INSPECTION**

Inspect the planetary gear sets and annulus gears. The planetary pinions, shafts, washers, and retaining pins are serviceable. However, if a pinion carrier is damaged, the entire planetary gear set must be replaced as an assembly.

Replace the annulus gears if the teeth are chipped, broken, or worn, or the gear is cracked. Replace the planetary thrust plates and the tabbed thrust washers if cracked, scored or worn.

Inspect the machined surfaces of the intermediate shaft. Be sure the oil passages are open and clear. Replace the shaft if scored, pitted, or damaged.

Inspect the sun gear and driving shell. If either component is worn or damaged, remove the sun gear rear retaining ring and separate the sun gear and thrust plate from the driving shell. Then replace the necessary component.

Replace the sun gear as an assembly if the gear teeth are chipped or worn. Also replace the gear as an assembly if the bushings are scored or worn. The sun gear bushings are not serviceable. Replace the
thrust plate if worn, or severely scored. Replace the driving shell if distorted, cracked, or damaged in any way.

Replace all snap-rings during geartrain assembly. Reusing snap-rings is not recommended.

ASSEMBLY

(1) Lubricate sun gear and planetary gears with transmission fluid during assembly. Use petroleum jelly to lubricate intermediate shaft bushing surfaces, thrust washers and thrust plates and to hold these parts in place during assembly.

(2) Install front snap-ring on sun gear and install gear in driving shell. Then install thrust plate over sun gear and against rear side of driving shell (Fig. 201). Install rear snap-ring to secure sun gear and thrust plate in driving shell. Note that the large ID chamfer on the sun gear goes forward.

(3) Install rear annulus gear on intermediate shaft (Fig. 202).

(4) Install thrust washer to rear planetary gear (Fig. 203) using petroleum jelly. Be sure washer is seated against corner with the tabs completely in the locating holes.

(5) Install rear planetary gear in rear annulus gear (Fig. 204). Be sure planetary carrier is seated against annulus gear.
(6) Install tabbed thrust washer on front face of rear planetary gear (Fig. 205). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

(7) Lubricate sun gear bushings with petroleum jelly or transmission fluid.

(8) Install sun gear and driving shell on intermediate shaft (Fig. 206). Seat shell against rear planetary gear. Verify that thrust washer on planetary gear was not displaced during installation.

(9) Install tabbed thrust washer in driving shell (Fig. 207), be sure washer tabs are seated in tab slots of driving shell. Use extra petroleum jelly to hold washer in place if desired.

(10) Install tabbed thrust washer on front planetary gear (Fig. 208). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

(11) Install the torlon bushing onto the front planetary carrier hub.
(12) Install front annulus gear over and onto front planetary gear (Fig. 209). Be sure gears are fully meshed and seated.

(13) Install front planetary and annulus gear assembly (Fig. 210). Hold gears together and slide them onto shaft. Be sure planetary pinions are seated on sun gear and that planetary carrier is seated on intermediate shaft.

(14) Place geartrain in upright position. Rotate gears to be sure all components are seated and properly assembled. Snap-ring groove at forward end of intermediate shaft will be completely exposed when components are assembled correctly.

(15) Install new planetary snap-ring in groove at end of intermediate shaft (Fig. 211).

(16) Turn planetary geartrain over. Position wood block under front end of intermediate shaft and support geartrain on shaft. Be sure all geartrain parts have moved forward against planetary snap-ring. This is important for accurate end play check.
(17) Check planetary geartrain end play with feeler gauge (Fig. 212). Insert gauge between rear annulus gear and shoulder on intermediate shaft as shown. End play should be 0.15 to 1.22 mm (0.006 to 0.048 in.).

(18) If end play is incorrect, install thinner/thicker planetary snap-ring as needed.

REAR CLUTCH
DESCRIPTION

The rear clutch assembly (Fig. 213) is composed of the rear clutch retainer, pressure plate, clutch plates, driving discs, piston, Belleville spring, and snap-rings. The Belleville spring acts as a lever to multiply the force applied on to it by the apply piston. The increased apply force on the rear clutch pack, in comparison to the front clutch pack, is needed to hold against the greater torque load imposed onto the rear pack. The rear clutch is directly behind the front clutch and is considered a driving component.

Fig. 212 Checking Planetary Geartrain End Play
1 - OUTPUT SHAFT
2 - REAR ANNULUS GEAR
3 - FEELER GAUGE

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

Fig. 213 Rear Clutch Components
1 - REAR CLUTCH RETAINER
2 - TORLON™ SEAL RINGS
3 - INPUT SHAFT
4 - PISTON RETAINER
5 - OUTPUT SHAFT THRUST WASHER
6 - INNER PISTON SEAL
7 - PISTON SPRING
8 - PRESSURE PLATE
9 - CLUTCH DISCS
10 - SNAP-RING (SELECTIVE)
11 - REACTION PLATE
12 - CLUTCH PLATES
13 - WAVE SPRING
14 - SPACER RING
15 - PISTON
16 - OUTER PISTON SEAL
17 - REAR SEAL RING
18 - FIBER THRUST WASHER
19 - RETAINING RING
OPERATION
To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are luged to the clutch retainer. The waved spring is used to cushion the application of the clutch pack. The snap-ring is selective and used to adjust clutch pack clearance.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one-way ball-check-valve located in the piston. The check-valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

DISASSEMBLY
(1) Remove fiber thrust washer from forward side of clutch retainer.
(2) Remove input shaft front and rear seal rings.
(3) Remove selective clutch pack snap-ring (Fig. 214).
(4) Remove the reaction plate, clutch discs, steel plates, pressure plate, wave spring, spacer ring, and piston spring (Fig. 214).
(5) Remove clutch piston with rotating motion.
(6) Remove and discard piston seals.
(7) Remove input shaft retaining ring. It may be necessary to press the input shaft in slightly to relieve tension on the retaining ring.
(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

CLEANING
Clean the clutch components with solvent and dry them with compressed air. Do not use rags or shop towels to dry any of the clutch parts. Lint from such materials will adhere to component surfaces and could restrict or block fluid passages after assembly.

INSPECTION
Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off. Replace the top and bottom pressure plates if scored, warped, or cracked. Be sure the driving lugs on the pressure and clutch plates are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The clutch and pressure plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the check balls in the retainer and piston. Each check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists about bushing condition.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check condition of the fiber thrust washer and metal output shaft thrust washer. Replace either washer if worn or damaged.

Check condition of the seal rings on the input shaft and clutch retainer hub. Replace the seal rings only if worn, distorted, or damaged. The input shaft front seal ring is teflon with chamfered ends. The rear ring is metal with interlocking ends.

Check the input shaft for wear, or damage. Replace the shaft if worn, scored or damaged in any way.
ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft if necessary.
   (a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then partially press input shaft into retainer (Fig. 215). Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft retaining ring.

(5) Press the input shaft the remainder of the way into the clutch retainer.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.020" thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(9) Install piston spring in retainer and on top of piston. Concave side of spring faces downward (toward piston).
(10) Install the spacer ring and wave spring into the retainer. Be sure spring is completely seated in retainer groove.

(11) Install pressure plate (Fig. 214). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) Install first clutch disc in retainer on top of pressure plate. Then install a clutch plate followed by a clutch disc until entire clutch pack is installed (4 discs and 3 plates are required) (Fig. 214).

(13) Install the reaction plate.

(14) Install selective snap-ring. Be sure snap-ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 216).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 216).

(b) Using two small screw drivers, lift the pressure plate and release it.

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading. Clearance should be 0.635 - 0.914 mm (0.025 - 0.036 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

The selective snap ring thicknesses are:

- 0.107 - 0.109 in.
- 0.098 - 0.100 in.
- 0.095 - 0.097 in.
- 0.083 - 0.085 in.
- 0.076 - 0.078 in.
- 0.071 - 0.073 in.
- 0.060 - 0.062 in.

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 217). Use enough petroleum jelly to hold washer in place.

(17) Set rear clutch aside for installation during final assembly.
REAR SERVO

DESCRIPTION
The rear (low/reverse) servo consists of a single stage or diameter piston and a spring loaded plug. The spring is used to cushion the application of the rear (low/reverse) band.

OPERATION
While in the de-energized state (no pressure applied), the piston is held up in its bore by the piston spring. The plug is held down in its bore, in the piston, by the plug spring. When pressure is applied to the top of the piston, the plug is forced down in its bore, taking up any clearance. As the piston moves, it causes the plug spring to compress, and the piston moves down over the plug. The piston continues to move down until it hits the shoulder of the plug and fully applies the band. The period of time from the initial application, until the piston is against the shoulder of the plug, represents a reduced shocking of the band that cushions the shift.

DISASSEMBLY
(1) Remove small snap-ring and remove plug and spring from servo piston (Fig. 218).
(2) Remove and discard servo piston seal ring.

Figs. 218 Rear Servo Components
1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON

CLEANING
Remove and discard the servo piston seal ring (Fig. 219). Then clean the servo components with solvent and dry with compressed air. Replace either spring if collapsed, distorted or broken. Replace the plug and piston if cracked, bent, or worn. Discard the servo snap-rings and use new ones at assembly.

ASSEMBLY
(1) Lubricate piston and guide seals (Fig. 220) with petroleum jelly. Lubricate other servo parts with Mopar® ATF +4, Automatic Transmission fluid.
(2) Install new seal ring on servo piston.
(3) Assemble piston, plug, spring and new snap-ring.
(4) Lubricate piston seal lip with petroleum jelly.

Figs. 219 Rear Servo Components
1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON

Figs. 220 Rear Servo Components
1 - SNAP-RING
2 - PISTON SEAL
3 - PISTON PLUG
4 - SPRING RETAINER
5 - SNAP-RING
6 - PISTON SPRING
7 - CUSHION SPRING
8 - PISTON
SHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- PARK (P)
- REVERSE (R)
- NEUTRAL (N)
- DRIVE (D)
- Manual SECOND (2)
- Manual LOW (1)

OPERATION

Manual LOW (1) range provides first gear only. Overrun braking is also provided in this range. Manual SECOND (2) range provides first and second gear only.

DRIVE range provides first, second, third, and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The fourth gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to fourth gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to third is not yet complete.
- Vehicle speed is too low for the 3-4 shift to occur.
- Battery temperature is below -5° C (23° F).

SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as normally open or normally closed. The normally open solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The normally closed solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil.
2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage across the solenoid to allow either full flow or no flow through the solenoid's valve.

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.
SPEED SENSOR

DESCRIPTION
The speed sensor (Fig. 221) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed.

OPERATION
Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. Input signals from the sensor are sent to the transmission control module for processing. Signals from this sensor are shared with the powertrain control module.

THROTTLE VALVE CABLE

DESCRIPTION
Transmission throttle valve cable (Fig. 222) adjustment is extremely important to proper operation. This adjustment positions the throttle valve, which controls shift speed, quality, and part-throttle downshift sensitivity.

If cable setting is too loose, early shifts and slippage between shifts may occur. If the setting is too tight, shifts may be delayed and part throttle downshifts may be very sensitive.

The transmission throttle valve is operated by a cam on the throttle lever. The throttle lever is operated by an adjustable cable (Fig. 223). The cable is attached to an arm mounted on the throttle lever shaft. A retaining clip at the engine-end of the cable is removed to provide for cable adjustment. The retaining clip is then installed back onto the throttle valve cable to lock in the adjustment.
THROTTLE VALVE CABLE (Continued)

ADJUSTMENTS - THROTTLE VALVE CABLE

A correctly adjusted throttle valve cable will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment will allow simultaneous movement without causing the transmission throttle lever to either move ahead of, or lag behind the lever on the throttle body.

ADJUSTMENT VERIFICATION

1. Turn ignition key to OFF position.
2. Remove air cleaner.
3. Verify that lever on throttle body is at curb idle position (Fig. 224). Then verify that the transmission throttle lever (Fig. 225) is also at idle (fully forward) position.
4. Slide cable off attachment stud on throttle body lever.
5. Compare position of cable end to attachment stud on throttle body lever:
   - Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction (Fig. 226).
   - If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in Throttle Valve Cable Adjustment procedure.

Fig. 224 Throttle Valve Cable Attachment - At Engine

1. THROTTLE VALVE CABLE
2. CABLE BRACKET
3. THROTTLE BODY LEVER
4. ACCELERATOR CABLE
5. SPEED CONTROL CABLE

Fig. 225 Throttle Valve Cable at Transmission

1. TRANSMISSION SHIFTER CABLE
2. THROTTLE VALVE CABLE
3. TRANSFER CASE SHIFTER CABLE
4. TRANSFER CASE SHIFTER CABLE BRACKET RETAINING BOLT (1 OR 2)
5. THROTTLE VALVE CABLE BRACKET RETAINING BOLT
6. ELECTRICAL CONNECTORS
7. TRANSMISSION FLUID LINES

Fig. 226 Throttle Valve Cable at Throttle Linkage

1. THROTTLE LINKAGE
2. THROTTLE VALVE CABLE LOCKING CLIP
3. THROTTLE VALVE CABLE
THROTTLE VALVE CABLE (Continued)

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.
- If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.
- If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position.
(2) Remove air cleaner if necessary.
(3) Disconnect cable end from attachment stud. Carefully slide cable off stud. Do not pry or pull cable off.
(4) Verify that transmission throttle lever is in fully closed position. Then be sure lever on throttle body is at curb idle position.
(5) Pry the T.V. cable lock (A) into the UP position (Fig. 226). This will unlock the cable and allow for readjustment.
(6) Apply just enough tension on the T.V. cable (B) to remove any slack in the cable. Pulling too tight will cause the T.V. lever on the transmission to move out of its idle position, which will result in an incorrect T.V. cable adjustment. Slide the sheath of the T.V. cable (D) back and forth until the centerlines of the T.V. cable end (B) and the throttle bell crank lever (C) are aligned within one millimeter (1mm) (Fig. 226).
(7) While holding the T.V. cable in the set position push the T.V. cable lock (A) into the down position (Fig. 226). This will lock the present T.V. cable adjustment.

NOTE: Be sure that as the cable is pulled forward and centered on the throttle lever stud, the cable housing moves smoothly with the cable. Due to the angle at which the cable housing enters the spring housing, the cable housing may bind slightly and create an incorrect adjustment.

(8) Reconnect the T.V. cable (B) to the throttle bellcrank lever (C).
(9) Check cable adjustment. Verify transmission throttle lever and lever on throttle body move simultaneously.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 227) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the all transmission fluid cooler(s) and lines.

Fig. 227 Torque Converter Assembly

1 - TURBINE
2 - IMPELLER
3 - HUB
4 - STATOR
5 - FRONT COVER
6 - CONVERTER CLUTCH DISC
7 - DRIVE PLATE
IMPELLER

The impeller (Fig. 228) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.

Fig. 228 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

IMPELLER VANE CONSTRUCTION AND CURVATURE
TORQUE CONVERTER (Continued)

TURBINE
The turbine (Fig. 229) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

Fig. 229 Turbine
1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

BLADE CONSTRUCTION
TORQUE CONVERTER (Continued)

STATOR
The stator assembly (Fig. 230) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 231). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

TORQUE CONVERTER CLUTCH (TCC)
The TCC (Fig. 232) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.
OPERATION
The converter impeller (Fig. 233) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE
As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine’s blades it continues in a “hindering” direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in a direction that would tend to slow it down.
TORQUE CONVERTER (Continued)

STATOR
Torque multiplication is achieved by locking the stator’s over-running clutch to its shaft (Fig. 234). Under stall conditions the turbine is stationary and the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a “helping” direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 1.75:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such a way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

TORQUE CONVERTER CLUTCH (TCC)
The torque converter clutch is hydraulically applied or released when fluid is feed or vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in FOURTH gear, and in THIRD gear under various conditions, such as when the O/D switch is OFF, or when the vehicle is cruising on a level surface after the vehicle has warmed up. The torque converter clutch can also be engaged in the MANUAL SECOND gear position if high transmission temperatures are sensed by the PCM. The torque converter clutch may disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased.

REMOVAL
(1) Remove transmission and torque converter from vehicle.
(2) Place a suitable drain pan under the converter housing end of the transmission.
CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition. The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.
(3) Pull the torque converter forward until the center hub clears the oil pump seal.
(4) Separate the torque converter from the transmission.

INSTALLATION
Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.
(1) Lubricate oil pump seal lip with transmission fluid.
(2) Place torque converter in position on transmission.
CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.
(3) Align torque converter to oil pump seal opening.
(4) Insert torque converter hub into oil pump.
(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

Fig. 234 Stator Operation
1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 - FRONT OF ENGINE
3 - INCREASED ANGLE AS OIL STRIKES VANES
4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

FLOW IS MORE NEARLY STRAIGHT THROUGH (ANGLE IS LESS)
(6) Check converter seating with a scale and straightedge (Fig. 235). Surface of converter lugs should be 19mm (0.75 in.) to the rear of the straight-edge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

**STANDARD PROCEDURE - TORQUE CONVERTER DRAINBACK VALVE**

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates significant amounts of sludge and/or clutch particles and metal shavings, the valve must be replaced.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheating condition and possible transmission failure.

**CAUTION:** The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

**TOW/HAUL OVERDRIVE SWITCH**

**DESCRIPTION**

The tow/haul overdrive OFF (control) switch is located in the shift lever arm (Fig. 236). The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function.
TOW/HAUL OVERDRIVE SWITCH (Continued)

OPERATION
At key-on, overdrive operation is allowed. Pressing the switch once causes the tow/haul overdrive OFF mode to be entered and the Tow/Haul lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the tow/haul lamp to be turned off. The tow/haul overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the tow/haul overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

DIAGNOSIS AND TESTING - OVERDRIVE ELECTRICAL CONTROLS
The tow/haul overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

REMOVAL
(1) Using a plastic trim tool, remove the tow/haul overdrive off switch retainer from the shift lever (Fig. 237).

(2) Pull the switch outwards to release it from the connector in the lever (Fig. 238)

Fig. 238 Remove the Tow/Haul Overdrive Off Switch

INSTALLATION
NOTE: There is enough slack in the wire to pull out the connector from the lever.

(1) Pull the connector out of the lever just enough to grasp it.

CAUTION: Be careful not to bend the pins on the tow/haul overdrive off switch. Use care when installing the switch, as it is not indexed, and can be accidentally installed incorrectly.

(2) Install the tow/haul overdrive off switch into the connector (Fig. 239)

(3) Push the tow/haul overdrive off switch and wiring into the shift lever.

(4) Install the tow/haul overdrive off switch retainer onto the shift lever.

Fig. 237 Tow/Haul Overdrive Off Switch Retainer

Fig. 239 Install the Tow/Haul Overdrive Off Switch
TRANSMISSION RANGE SENSOR

DESCRIPTION
The Transmission Range Sensor (TRS) (Fig. 240) has 3 primary functions:
- Provide a PARK/NEUTRAL start signal to the engine controller and the starter relay.
- Turn the Back-up lamps on when the transmission is in REVERSE and the engine (ignition) is on.
- Provide a transmission range signal to the instrument cluster.

The sensor is mounted in the transmission housing near the valve body, just above the pan rail. It’s in the same position as the Park/Neutral switch on other transmissions. The TRS contacts a cammed surface on the manual valve lever. The cammed surface translates the rotational motion of the manual lever into the linear motion of the sensor. The cammed surface on the manual lever is comprised of two parts controlling the TRS signal: The insulator portion contacts the switch poppet when the manual lever is not in PARK or NEUTRAL. The manual lever itself contacts the poppet when the lever is in PARK or NEUTRAL; providing a ground for the signal from the starter relay and the JTEC engine controller.

OPERATION
As the switch moves through its linear motion (Fig. 241) contacts slide across a circuit board which changes the resistance between the range sensing pins of the switch. A power supply on the instrument cluster provides a regulated voltage signal to the switch. The return signal is decoded by the cluster, which then controls the PRNDL display to correspond with the correct transmission range. A bus message of transmission range is also sent by the cluster. In REVERSE range a second contact set closes the circuit providing power to the reverse lamps.
<table>
<thead>
<tr>
<th>Indicated Gear Position</th>
<th>Mechanical State</th>
<th>Electronic Display (Ignition Unlocked)</th>
<th>Electronic Display (Ignition On)</th>
<th>Transmission Status</th>
<th>Column Shifter Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Vehicle is in PARK with the pawl engaged.</td>
<td>In the PARK gate.</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
<td>The PARK pawl is disengaged and the vehicle is free to roll, but REVERSE is not engaged.</td>
<td>Between the PARK and REVERSE gates.</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>R</td>
<td>R</td>
<td>The transmission is hydraulically in REVERSE.</td>
<td>In the REVERSE gate.</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
<td>The transmission is transitioning between REVERSE and NEUTRAL.</td>
<td>Between the REVERSE and NEUTRAL gates.</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
<td>The vehicle is in NEUTRAL.</td>
<td>In the NEUTRAL gate.</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
<td>The transmission is transitioning between NEUTRAL and DRIVE, but is not in DRIVE.</td>
<td>Between the NEUTRAL and DRIVE gates.</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>D</td>
<td>The transmission is hydraulically in DRIVE.</td>
<td>In the DRIVE gate.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>The transmission is hydraulically in Manual SECOND.</td>
<td>In the SECOND gate.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>The transmission is hydraulically in Manual FIRST.</td>
<td>In the FIRST gate.</td>
<td></td>
</tr>
</tbody>
</table>

**DIAGNOSIS AND TESTING - TRANSMISSION RANGE SENSOR (TRS)**

**NOTE:** For all circuit identification in the following steps, Refer to the appropriate Wiring Information.

1. Raise vehicle on suitable hoist.
2. Disconnect the vehicle’s shift cable from the manual lever.
3. With the manual lever in the PARK position (the PARK position is with the manual lever moved to the full rearward position), measure the resistance between the Park/Neutral Position Sense pin of the TRS and the transmission case. The resistance should be less than 5 ohms.
4. With the manual lever in the NEUTRAL position (the NEUTRAL position is with the manual lever moved two detents forward of the full rearward position), measure the resistance between the Park/Neutral Position Sense pin of the TRS and the transmission case. The resistance should be less than 5 ohms.
5. If the resistance is greater than 5 ohms in either of the previous steps, check for a dirty contact between the tip of the TRS rod and the valve body manual lever. If the contact is OK, replace the TRS.
6. With the manual lever in the REVERSE position (the REVERSE position is with the manual lever moved one detent forward of the full rearward position), measure the resistance between the Fused Ignition Switch Output and the Back-up Lamp feed pins of the TRS. The resistance should be less than 5 ohms. If the resistance is greater than 5 ohms, replace the TRS.
TRANSMISSION RANGE SENSOR (Continued)

(7) With the manual lever in the PARK position (the PARK position is with the manual lever moved to the full rearward position), measure the resistance between the Transmission Range Sensor MUX and the Transmission Range Sensor 5V Supply pins of the TRS. The resistance should be 522.2 ohms. If the resistance is not correct, replace the TRS.

(8) With the manual lever in the REVERSE position (the REVERSE position is with the manual lever moved one detent forward of the full rearward position), measure the resistance between the Transmission Range Sensor MUX and the Transmission Range Sensor 5V Supply pins of the TRS. The resistance should be 206.2 ohms. If the resistance is not correct, replace the TRS.

(9) With the manual lever in the NEUTRAL position (the NEUTRAL position is with the manual lever moved two detents forward of the full rearward position), measure the resistance between the Transmission Range Sensor MUX and the Transmission Range Sensor 5V Supply pins of the TRS. The resistance should be 108.6 ohms. If the resistance is not correct, replace the TRS.

(10) With the manual lever in the DRIVE position (the DRIVE position is with the manual lever moved three detents forward of the full rearward position), measure the resistance between the Transmission Range Sensor MUX and the Transmission Range Sensor 5V Supply pins of the TRS. The resistance should be 59.9 ohms. If the resistance is not correct, replace the TRS.

(11) With the manual lever in the SECOND position (the SECOND position is with the manual lever moved one detent rearward of the full forward position), measure the resistance between the Transmission Range Sensor MUX and the Back-up Lamp feed pins of the TRS. The resistance should be 31.9 ohms. If the resistance is not correct, replace the TRS.

(12) With the manual lever in the LOW position (the LOW position is with the manual lever moved to the full forward position), measure the resistance between the Transmission Range Sensor MUX and the Back-up Lamp feed pins of the TRS. The resistance should be 13.7 ohms. If the resistance is not correct, replace the TRS.

REMOVAL

(1) Raise vehicle and position drain pan under the transmission range sensor (TRS).

(2) Move the transmission manual lever to the manual LOW position. The manual LOW position is with the manual lever in the forward-most detent.

(3) Disengage the wiring connector from the TRS.

(4) Remove the two screws holding the TRS to the TRS mounting bracket.

(5) Remove the TRS (Fig. 242) from the TRS mounting bracket by pulling it straight out of the bracket.

(6) Loosen the TRS mounting bracket in the transmission case using Adapter 8581 (Fig. 243).
(7) Remove the TRS mounting bracket (Fig. 244) from the transmission case.

INSTALLATION

(1) Move the transmission manual shaft lever to the manual LOW position.

(2) Install the TRS mounting bracket into the transmission case. Using Adapter 8581 (Fig. 245), tighten the mounting bracket to 34 N·m (300 in.lbs.).

(3) Install the TRS (Fig. 246) into the mounting bracket with the wiring connector facing the front of the transmission.

(4) Install the two screws to hold the TRS to the mounting bracket. Tighten the screws to 5 N·m (45 in.lbs.).

(5) Verify proper sensor operation (Fig. 247).

(6) Move the transmission manual shaft lever to the PARK position.

(7) Connect TRS wiring connector to the TRS and lower vehicle.

(8) Refill the transmission fluid to the correct level.
TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION
Transmission fluid temperature readings are supplied to the transmission control module by the thermistor (Fig. 248). The temperature readings are used to control engagement of the fourth gear overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermistor at room temperature is approximately 2000 ohms.

The thermistor is part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

OPERATION
The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The Tow/Haul lamp in the instrument panel illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 110°C (230°F).

VALVE BODY

DESCRIPTION
The valve body consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 249), (Fig. 250), (Fig. 251), and (Fig. 252):

- Regulator valve
- Regulator valve throttle pressure plug
- Line pressure sleeve
- Kickdown valve
- Kickdown limit valve
- 1-2 shift valve
- 1-2 control valve
- 2-3 shift valve
- 2-3 governor plug
- 3-4 shift valve
- 3-4 timing valve
- 3-4 quick fill valve
- 3-4 accumulator
- Throttle valve
- Throttle pressure plug
- Switch valve
- Manual valve
- Converter clutch lock-up valve
- Converter clutch lock-up timing Valve
- Shuttle valve
- Shuttle valve throttle plug
- Boost Valve
- 9 check balls

By adjusting the spring pressure acting on the regulator valve, transmission line pressure can be adjusted.
Fig. 249 Upper Housing Control Valve Locations

1 - UPPER HOUSING
2 - REGULATOR VALVE
3 - SWITCH VALVE
4 - REGULATOR VALVE SPRING
5 - KICKDOWN VALVE
6 - KICKDOWN DETENT
7 - THROTTLE VALVE AND SPRING
8 - MANUAL VALVE
9 - 1-2 GOVERNOR PLUG
10 - GOVERNOR PLUG COVER
11 - THROTTLE PLUG
12 - 2-3 GOVERNOR PLUG
13 - SHUTTLE VALVE PRIMARY SPRING
Fig. 250 Shuttle and Boost Valve Locations

1 - SPRING  
2 - RETAINER  
3 - BOOST VALVE  
4 - BOOST VALVE PLUG  
5 - SPRING GUIDES  
6 - E-CLIP  
7 - SHUTTLE VALVE SECONDARY SPRING  
8 - SHUTTLE VALVE COVER  
9 - SHUTTLE VALVE  
10 - SHUTTLE VALVE PRIMARY SPRING  
11 - GOVERNOR PLUG COVER  
12 - THROTTLE PLUG  
13 - UPPER HOUSING  
14 - BOOST VALVE COVER
**Fig. 251 Upper Housing Shift Valve and Pressure Plug Locations**

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - PLUG SLEEVE
12 - THROTTLE PRESSURE SPRING AND PLUG
Fig. 252 Lower Housing Shift Valves and Springs

1 - 3-4 ACCUMULATOR HOUSING
2 - 3-4 SHIFT VALVE AND SPRING
3 - PLUG
4 - SPRING RETAINER
5 - CONVERTER CLUTCH VALVE AND SPRING
6 - CONVERTER CLUTCH TIMING VALVE AND SPRING
7 - OVERDRIVE SEPARATOR PLATE
8 - CASE CONNECTOR
9 - CONVERTER CLUTCH SOLENOID
10 - OVERDRIVE SOLENOID
11 - TIMING VALVE COVER
12 - PLUG
13 - 3-4 TIMING VALVE AND SPRING
14 - LOWER HOUSING
15 - ACCUMULATOR END PLATE
16 - 3-4 ACCUMULATOR PISTON AND SPRING
17 - E-CLIP
18 - 3-4 QUICK FILL SPRING AND VALVE
19 - SOLENOID GASKET
20 - HARNESS
OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

CHECK BALLS

<table>
<thead>
<tr>
<th>CHECK BALL NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Allows either the manual valve to put line pressure on the 1-2 governor plug or the KD Valve to put WOT line pressure on the 1-2 governor plug.</td>
</tr>
<tr>
<td>3</td>
<td>Allows either the Reverse circuit or the 3rd gear circuit to pressurize the front clutch.</td>
</tr>
<tr>
<td>4</td>
<td>Allows either the Manual Low circuit from the Manual Valve or the Reverse from the Manual Valve circuit to pressurize the rear servo.</td>
</tr>
<tr>
<td>5</td>
<td>Directs line pressure to the spring end of the 2-3 shift valve in either Manual Low or Manual 2nd, forcing the downshift to 2nd gear regardless of governor pressure.</td>
</tr>
<tr>
<td>6</td>
<td>Provides a by-pass around the front servo orifice so that the servo can release quickly.</td>
</tr>
<tr>
<td>7</td>
<td>Provides a by-pass around the rear clutch orifice so that the clutch can release quickly.</td>
</tr>
<tr>
<td>8</td>
<td>Directs reverse line pressure through an orifice to the throttle valve eliminating the extra leakage and insuring that Reverse line pressure pressure will be sufficient.</td>
</tr>
<tr>
<td>9</td>
<td>Provides a by-pass around the rear servo orifice so that the servo can release quickly.</td>
</tr>
<tr>
<td>10</td>
<td>Allows the lockup clutch to used at WOT in 3rd gear by putting line pressure from the 3-4 Timing Valve on the interlock area of the 2-3 shift valve, thereby preventing a 3rd gear Lock-up to 2nd gear kickdown.</td>
</tr>
</tbody>
</table>
REGULATOR VALVE

The pressure regulator valve is needed to control the hydraulic pressure within the system and reduce the amount of heat produced in the fluid. The pressure regulator valve is located in the valve body near the manual valve. The pressure regulator valve train controls the maximum pressure in the lines by metering the dumping of fluid back into the sump. Regulated pressure is referred to as "line pressure."

The regulator valve (Fig. 253) has a spring on one end that pushes the valve to the left. This closes a dump (vent) that is used to lower pressure. The closing of the dump will cause the oil pressure to increase. Oil pressure on the opposite end of the valve pushes the valve to the right, opening the dump and lowering oil pressure. The result is spring pressure working against oil pressure to maintain the oil at specific pressures. With the engine running, fluid flows from the pump to the pressure regulator valve, manual valve, and the interconnected circuits. As fluid is sent through passages to the regulator valve, the pressure pushes the valve to the right against the large spring. It is also sent to the reaction areas on the left side of the throttle pressure plug and the line pressure plug. With the gear selector in the PARK position, fluid recirculates through the regulator and manual valves back to the sump.

Fig. 253 Regulator Valve in Park Position
Meanwhile, the torque converter is filled slowly. In all other gear positions (Fig. 254), fluid flows between two right side lands to the switch valve and torque converter. At low pump speeds, the flow is controlled by the pressure valve groove to reduce pressure to the torque converter. After the torque converter and switch valve fill with fluid, the switch valve becomes the controlling metering device for torque converter pressure. The regulator valve then begins to control the line pressure for the other transmission circuits. The balance of the fluid pressure pushing the valve to the right and the spring pressure pushing to the left determines the size of the metering passage at land #2 (land #1 being at the far right of the valve in the diagram). As fluid leaks past the land, it moves into a groove connected to the filter or sump. As the land meters the fluid to the sump, it causes the pressure to reduce and the spring decreases the size of the metering passage. When the size of the metering passage is reduced, the pressure rises again and the size of the land is increased again. Pressure is regulated by this constant balance of hydraulic and spring pressure.

The metering at land #2 establishes the line pressure throughout the transmission. It is varied according to changes in throttle position and the transmission’s internal condition within a range of 57-94 psi (except in REVERSE) (Fig. 255). The regulated line pressure in REVERSE (Fig. 256) is held at much higher pressures than in the other gear positions: 145-280 psi. The higher pressure for REVERSE is achieved by the manual valve blocking the supply of line pressure to the reaction area left of land #4. With this pressure blocked, there is less area for pressure to act on to balance the force of the spring on the right. This allows line pressure to push the valve train to the right, reducing the amount of fluid returned to the pump's inlet, increasing line pressure.

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**Fig. 254 Regulator Valve in Neutral Position**
Fig. 255 Regulator Valve in Drive Position

Fig. 256 Regulator Valve in Reverse Position
KICKDOWN VALVE

When the throttle valve is as far over to the left as it can go, the maximum line pressure possible will enter the throttle pressure circuit. In this case, throttle pressure will equal line pressure. With the kickdown valve (Fig. 257) pushed into the bore as far as it will go, fluid initially flows through the annular groove of the 2-3 shift valve (which will be in the direct drive position to the right).

After passing the annular groove, the fluid is routed to the spring end of the 2-3 shift valve. Fluid pressure reacting on the area of land #1 overcomes governor pressure, downshifting the 2-3 shift valve into the kickdown, or second gear stage of operation. The valve is held in the kickdown position by throttle pressure routed from a seated check ball (#2). Again, if vehicle speed is low enough, throttle pressure will also push the 1-2 shift valve left to seat its governor plug, and downshift to drive breakaway.
**KICKDOWN LIMIT VALVE**

The purpose of the limit valve is to prevent a 3-2 downshift at higher speeds when a part-throttle downshift is not desirable. At these higher speeds only a full throttle 3-2 downshift will occur. At low road speeds (Fig. 258) the limit valve does not come into play and does not affect the downshifts. As the vehicle's speed increases (Fig. 259), the governor pressure also increases. The increased governor pressure acts on the reaction area of the bottom land of the limit valve overcoming the spring force trying to push the valve toward the bottom of its bore. This pushes the valve upward against the spring and bottoms the valve against the top of the housing. With the valve bottomed against the housing, the throttle pressure supplied to the valve will be closed off by the bottom land of the limit valve. When the supply of throttle pressure has been shut off, the 3-2 part throttle downshift plug becomes inoperative, because no pressure is acting on its reaction area.

*Fig. 258 Kickdown Limit Valve - Low Speeds*

*Fig. 259 Kickdown Limit Valve - High Speeds*
1-2 SHIFT VALVE

The 1-2 shift valve assembly (Fig. 260), or mechanism, consists of: the 1-2 shift valve, governor plug, and a spring on the end of the valve. After the manual valve has been placed into a forward gear range, line pressure is directed to the 1-2 shift valve. As the throttle is depressed, throttle pressure is applied to the right side of the 1-2 shift valve assembly. With throttle pressure applied to the right side of the valve, there is now both spring pressure and throttle pressure acting on the valve, holding it against the governor plug. As the vehicle begins to move and build speed, governor pressure is created and is applied to the left of the valve at the governor plug.

When governor pressure builds to a point where it can overcome the combined force of the spring and throttle pressure on the other side of the valve, the valve will begin to move over to the right. As the valve moves to the right, the middle land of the valve will close off the circuit supplying the throttle pressure to the right side of the valve. When the throttle pressure is closed off, the valve will move even farther to the right, allowing line pressure to enter another circuit and energize the front servo, applying the front band (Fig. 261).

The governor plug serves a dual purpose:
- It allows the shift valves to move either left or right, allowing both upshifts and downshifts.
- When in a manual selection position, it will be hydraulically “blocked” into position so no upshift can occur.

The physical blocking of the upshift while in the manual “1” position is accomplished by the directing of line pressure between both lands of the governor plug. The line pressure reacts against the larger land of the plug, pushing the plug back against the end plate overcoming governor pressure. With the combination of the line pressure and spring pressure, the valve cannot move, preventing any upshift.

Fig. 260 1-2 Shift Valve - Before Shift

Fig. 261 1-2 Shift Valve - After Shift
1-2 SHIFT CONTROL VALVE

It contains a valve with four lands and a spring. It is used as both a “relay” and “balanced” valve.

The valve has two specific operations (Fig. 262):
- Aid in quality of the 1-2 upshift.
- Aid in the quality and timing of the 3-2 kickdown ranges.

When the manual valve is set to the DRIVE position and the transmission is in the first or second gear range, 1-2 shift control or “modulated throttle pressure” is supplied to the middle of the accumulator piston by the 1-2 shift control valve. During the 1-2 upshift, this pressure is used to control the kickdown servo apply pressure that is needed to apply the kickdown and accumulator pistons. Thus, the 1-2 shift point is “cushioned” and the quality is improved. During a WOT kickdown, kickdown pressure is applied between the kickdown valve and the 1-2 shift control valve. This additional pressure is directed to the 1-2 shift control’s spring cavity, adding to the spring load on the valve. The result of this increased “modulated” throttle pressure is a firmer WOT upshift.

Fig. 262 1-2 Shift Control Valve
2-3 SHIFT VALVE

The 2-3 shift valve mechanism (Fig. 263) consists of the 2-3 shift valve, governor plug and spring, and a throttle plug. After the 1-2 shift valve has completed its operation and applied the front band, line pressure is directed to the 2-3 shift valve through the connecting passages from the 1-2 shift valve. The line pressure will then dead-end at land #2 until the 2-3 valve is ready to make its shift. Now that the vehicle is in motion and under acceleration, there is throttle pressure being applied to the spring side of the valve and between lands #3 and #4.

As vehicle speed increases, governor pressure increases proportionately, until it becomes great enough to overcome the combined throttle and spring pressure on the right side of the valve. Since the throttle pressure end of the 2-3 shift valve is larger in diameter than the 1-2 shift valve, the 2-3 shift will always happen at a greater speed than the 1-2 shift. When this happens, the governor plug is forced against the shift valve moving it to the right. The shift valve causes land #4 to close the passage supplying throttle pressure to the 2-3 shift valve. Without throttle pressure present in the circuit now, the governor plug will push the valve over far enough to bottom the valve in its bore. This allows land #2 to direct line pressure to the front clutch.

After the shift (Fig. 264), line pressure is directed to the release side of the kickdown servo. This releases the front band and applies the front clutch, shifting into third gear or direct drive. The rear duct remains applied, as it has been in the other gears. During a manual “1” or manual “2” gear selection, line pressure is sent between the two lands of the 2-3 governor plug. This line pressure at the governor plug locks the shift valve into the second gear position, preventing an upshift into direct drive. The theory for the blocking of the valve is the same as that of the 1-2 shift valve.

If the manual “2” or manual “1” gear position is selected from the drive position, the PCM will control the timing of the downshift by targeting for a high governor pressure. When a safe vehicle speed is reached, the PCM will switch to its normal control governor curve and the downshift will occur.

3-4 SHIFT VALVE

The PCM energizes the overdrive solenoid during the 3-4 upshift (Fig. 265). This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position (Fig. 266). This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston.
Fig. 264 2-3 Shift Valve - After Shift

Fig. 265 3-4 Shift Valve Before Shift

Fig. 266 3-4 Shift Valve After Shift
3-4 TIMING VALVE

The 3-4 timing valve is moved by line pressure coming through the 3-4 shift valve (Fig. 266) or the converter clutch valve. After the shift, the timing valve holds the 2-3 shift valve in an upshift position. The purpose is to prevent the 2-3 valve from downshifting while either the overdrive clutch or converter clutch is applied (Fig. 265).

3-4 QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift (Fig. 265). This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence. The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass (Fig. 266). Clutch fill is then completed through the regular feed orifice.

THROTTLE VALVE

In all gear positions the throttle valve (Fig. 267) is being supplied with line pressure. The throttle valve meters and reduces the line pressure that now becomes throttle pressure. The throttle valve is moved by a spring and the kickdown valve, which is mechanically connected to the throttle. The larger the throttle opening, the higher the throttle pressure (to a maximum of line pressure). The smaller the throttle opening, the lower the throttle pressure (to a minimum of zero at idle). As engine speed increases, the increase in pump speed increases pump output. The increase in pressure and volume must be regulated to maintain the balance within the transmission. To do this, throttle pressure is routed to the reaction area on the right side of the throttle pressure plug (in the regulator valve).

The higher engine speed and line pressure would open the vent too far and reduce line pressure too much. Throttle pressure, which increases with engine speed (throttle opening), is used to oppose the movement of the pressure valve to help control the metering passage at the vent. The throttle pressure is combined with spring pressure to reduce the force of the throttle pressure plug on the pressure valve. The larger spring at the right closes the regulator valve passage and maintains or increases line pressure. The increased line pressure works against the reaction area of the line pressure plug and the reaction area left of land #8 simultaneously moves the regulator valve train to the right and controls the metering passage.

The kickdown valve, along with the throttle valve, serve to delay upshifts until the correct vehicle speed has been reached. It also controls downshifts upon driver demand, or increased engine load. If these valves were not in place, the shift points would be at the same speed for all throttle positions. The kickdown valve is actuated by a cam connected to the throttle. This is accomplished through either a linkage or a cable. The cam forces the kickdown valve toward the throttle valve compressing the spring between them and moving the throttle valve. As the throttle valve land starts to uncover its port, line

![Fig. 267 Throttle Valve](image-url)
pressure is “metered” out into the circuits and viewed as throttle pressure. This increased throttle pressure is metered out into the circuits it is applied to: the 1-2 and 2-3 shift valves. When the throttle pressure is high enough, a 3-2 downshift will occur. If the vehicle speed is low enough, a 2-1 downshift will occur.

SWITCH VALVE
When the transmission is in Drive Second before the TCC application occurs (Fig. 268), the pressure regulator valve is supplying torque converter pressure to the switch valve. The switch valve directs this pressure through the transmission input shaft, into the converter, through the converter, back out between the input shaft and the reaction shaft, and back up to the switch valve. From the switch valve, the fluid pressure is directed to the transmission cooler, and lubrication pressure returns from the cooler to lubricate different portions of the transmission.

Fig. 268 Switch Valve - Torque Converter Unlocked
Once the TCC control valve has moved to the right (Fig. 269), line pressure is directed to the tip of the switch valve, forcing the valve to the right. The switch valve now vents oil from the front of the piston in the torque converter, and supplies line pressure to the (rear) apply side of the torque converter piston. This pressure differential causes the piston to apply against the friction material, cutting off any further flow of line pressure oil. After the switch valve is shuttled right allowing line pressure to engage the TCC, torque converter pressure is directed past the switch valve into the transmission cooler and lubrication circuits.
MANUAL VALVE
The manual valve (Fig. 270) is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the side of the valve body. The valve is connected mechanically by either a cable or linkage to the gear-shift mechanism. The valve is held in each of its positions by a spring-loaded roller or ball that engages the “roostercomb” of the manual valve lever.

CONVERTER CLUTCH LOCK-UP VALVE
The torque converter clutch (TCC) lock-up valve controls the back (ON) side of the torque converter clutch. When the PCM energizes the TCC solenoid to engage the converter clutch piston, pressure is applied to the TCC lock-up valve which moves to the right and applies pressure to the torque converter clutch.

CONVERTER CLUTCH LOCK-UP TIMING VALVE
The torque converter clutch (TCC) lock-up timing valve is there to block any 4-3 downshift until the TCC is completely unlocked and the clutch is disengaged.

SHUTTLE VALVE
The assembly is contained in a bore in the valve body above the shift valves. When the manual valve is positioned in the Drive range, throttle pressure acts on the throttle plug of the shuttle valve (Fig. 262) to move it against a spring, increasing the spring force on the shuttle valve. During a part or full throttle 1-2 upshift, the throttle plug is bottomed by throttle pressure, holding the shuttle valve to the right against governor pressure, and opening a by-pass circuit. The shuttle valve controls the quality of the kickdown shift by restricting the rate of fluid discharge from the front clutch and servo release circuits. During a 3-2 kickdown, fluid discharges through the shuttle by-pass circuit. When the shuttle valve closes the by-pass circuit, fluid discharge is restricted and controlled for the application of the front band. During a 2-3 “lift foot” upshift, the shuttle valve by-passes the restriction to allow full fluid flow through the by-pass groove for a faster release of the band.

Fig. 270 Manual Valve
BOOST VALVE
The boost valve (Fig. 271) provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts (Fig. 272), and when accelerating in fourth gear. The boost valve also serves to increase line pressure during torque converter lock-up.

REMOVAL
The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components.

The only replaceable valve body components are:
- Manual lever.
- Manual lever washer, seal, E-clip, and shaft seal.
- Manual lever detent ball.
- Throttle lever.
- Fluid filter.
- Pressure adjusting screw bracket.
- Governor pressure solenoid.
- Governor pressure sensor (includes transmission temperature thermistor).
- Converter clutch/overdrive solenoid assembly and harness.
- Governor housing gasket.
- Solenoid case connector O-rings.

1. Shift transmission into NEUTRAL.
2. Raise vehicle.
3. Remove gearshift and throttle levers from shaft of valve body manual lever.
4. Disconnect wires at solenoid case connector (Fig. 273).
5. Remove the transmission range sensor (Refer to 21 - TRANSMISSION/AUTOMATIC/TRANSMISSION RANGE SENSOR - REMOVAL).
6. Position drain pan under transmission oil pan.
7. Remove transmission oil pan and gasket.
8. Remove fluid filter from valve body.
9. Remove bolts attaching valve body to transmission case.
10. Lower valve body enough to remove accumulator piston and springs.
VALVE BODY (Continued)

(11) Work manual lever shaft and electrical connector out of transmission case.
(12) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 274).

(4) Remove governor pressure sensor from governor body.
(5) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.
(6) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 275). Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.
(7) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 276).

DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly and installation. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Disconnect wires from governor pressure sensor and solenoid.
(2) Remove screws attaching governor body and retainer plate to transfer plate.
(3) Remove retainer plate, governor body and gasket from transfer plate.
VALVE BODY (Continued)

(8) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 277).

(9) Remove solenoid and harness assembly from valve body (Fig. 278).

(10) Remove boost valve cover (Fig. 279).

(11) Remove boost valve retainer, valve spring and boost valve (Fig. 280).

**Fig. 277 Solenoid Assembly Screws**
1 - OVERDRIVE/CONVERTER CLUTCH SOLENOID ASSEMBLY
2 - HARNESS

**Fig. 278 Solenoid Assembly**
1 - GOVERNOR SOLENOID WIRES
2 - CONVERTER CLUTCH SOLENOID
3 - SOLENOID SCREWS
4 - GOVERNOR SENSOR WIRES
5 - OVERDRIVE SOLENOID
6 - HARNESS
7 - CASE CONNECTOR

**Fig. 279 Boost Valve Cover Location**
1 - BOOST VALVE HOUSING AND COVER
2 - BOOST VALVE TUBE

**Fig. 280 Boost Valve Components**
1 - SPRING AND VALVE RETAINER
2 - COVER SCREWS
3 - BOOST VALVE COVER
4 - BOOST VALVE PLUG
5 - BOOST VALVE
6 - BOOST VALVE SPRING
VALVE BODY (Continued)

(12) Secure detent ball and spring with Retainer Tool 6583 (Fig. 281).
(13) Remove park rod E-clip and separate rod from manual lever (Fig. 282).
(14) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 283).
(15) Remove manual lever and throttle lever (Fig. 284). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.
(16) Position pencil magnet next to detent housing to catch detent ball and spring. Then carefully remove Retainer Tool 6583 and remove detent ball and spring (Fig. 285).
VALVE BODY (Continued)

(17) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 286). Hold bracket firmly against spring tension while removing last screw.

(18) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 287). Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.

(19) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 288).

(20) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 288).

(21) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 289).

(22) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter dutch valve plug and spring (Fig. 290).
**Fig. 288 Upper Housing Control Valve Locations**

1 - UPPER HOUSING  
2 - REGULATOR VALVE  
3 - SWITCH VALVE  
4 - REGULATOR VALVE SPRING  
5 - KICKDOWN VALVE  
6 - KICKDOWN DETENT  
7 - THROTTLE VALVE AND SPRING  
8 - MANUAL VALVE  
9 - 1-2 GOVERNOR PLUG  
10 - GOVERNOR PLUG COVER  
11 - THROTTLE PLUG  
12 - 2-3 GOVERNOR PLUG  
13 - SHUTTLE VALVE PRIMARY SPRING

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**Fig. 289 Accumulator Housing Screw Locations**

1 - LOOSEN THIS SCREW  
2 - REMOVE THESE SCREWS  
3 - 3-4 ACCUMULATOR HOUSING

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**Fig. 290 3-4 Shift And Converter Clutch Valve Springs and Plug**

1 - ACCUMULATOR HOUSING  
2 - CONVERTER CLUTCH VALVE SPRING  
3 - CLUTCH VALVE PLUG  
4 - 3-4 SHIFT VALVE SPRING
VALVE BODY (Continued)

(23) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 291).
(24) Bend back tabs on boost valve tube brace (Fig. 292).

(25) Remove boost valve connecting tube (Fig. 293). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

(26) Turn valve body over so lower housing is facing upward (Fig. 294). In this position, the two check balls in upper housing will remain in place and not fall out when lower housing and separator plate are removed.

(27) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 294). Note position of boost valve tube brace for assembly reference.
(28) Remove lower housing and overdrive separator plate from transfer plate (Fig. 294).
VALVE BODY (Continued)

(29) Remove the Number 10 check ball from the transfer plate (Fig. 295). The check ball is approximately 4.8 mm (3/16 in.) in diameter.

(30) Remove transfer plate from upper housing (Fig. 296).

(31) Turn transfer plate over so upper housing separator plate is facing upward.

(32) Remove upper housing separator plate from transfer plate (Fig. 297). Note position of filter in separator plate for assembly reference.

(33) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 298).
VALVE BODY (Continued)

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 299). Then remove the one large diameter and the five smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 301).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 300).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 301).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 288).

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 302).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 302).

(9) Remove 1-2 shift control valve and spring (Fig. 302).

(10) Remove 1-2 shift valve and spring (Fig. 302).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 302).

(12) Remove pressure plug cover (Fig. 302).

(13) Remove line pressure sleeve, throttle pressure plug and spring (Fig. 302).

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Fig. 299 Check Ball Locations In Upper Housing
1 - SMALL DIAMETER CHECK BALLS (5)
2 - LARGE DIAMETER CHECK BALL (1)

Fig. 300 Shuttle Valve E-Clip And Secondary Spring
1 - E-CLIP
2 - SECONDARY SPRING AND GUIDES
3 - SHUTTLE VALVE
Fig. 301 Shuttle and Boost Valve Location

1 - SPRING
2 - RETAINER
3 - BOOST VALVE
4 - BOOST VALVE PLUG
5 - SPRING GUIDES
6 - E-CLIP
7 - SHUTTLE VALVE SECONDARY SPRING
8 - SHUTTLE VALVE COVER
9 - SHUTTLE VALVE
10 - SHUTTLE VALVE PRIMARY SPRING
11 - GOVERNOR PLUG COVER
12 - THROTTLE PLUG
13 - UPPER HOUSING
14 - BOOST VALVE COVER
Fig. 302 Upper Housing Shift Valve and Pressure Plug Locations

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - PLUG SLEEVE
12 - THROTTLE PRESSURE SPRING AND PLUG
VALVE BODY LOWER HOUSING

(1) Remove timing valve cover.
(2) Remove 3-4 timing valve and spring.
(3) Remove 3-4 quick fill valve, spring and plug.
(4) Remove 3-4 shift valve and spring.
(5) Remove converter clutch valve, spring and plug (Fig. 303).
(6) Remove converter clutch timing valve, retainer and valve spring.

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Fig. 303 Lower Housing Shift Valves and Springs

1 - 3-4 ACCUMULATOR HOUSING
2 - 3-4 SHIFT VALVE AND SPRING
3 - PLUG
4 - SPRING RETAINER
5 - CONVERTER CLUTCH VALVE AND SPRING
6 - CONVERTER CLUTCH TIMING VALVE AND SPRING
7 - OVERDRIVE SEPARATOR PLATE
8 - CASE CONNECTOR
9 - CONVERTER CLUTCH SOLENOID
10 - OVERDRIVE SOLENOID
11 - TIMING VALVE COVER
12 - PLUG
13 - 3-4 TIMING VALVE AND SPRING
14 - LOWER HOUSING
15 - ACCUMULATOR END PLATE
16 - 3-4 ACCUMULATOR PISTON AND SPRING
17 - E-CLIP
18 - 3-4 QUICK FILL SPRING AND VALVE
19 - SOLENOID GASKET
20 - HARNESS
VALVE BODY (Continued)

3-4 ACCUMULATOR HOUSING
(1) Remove end plate from housing.
(2) Remove piston spring.
(3) Remove piston. Remove and discard piston seals (Fig. 304).

CLEANING
Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the governor solenoid and sensor and the dual solenoid and harness assembly by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.

Wipe the governor pressure sensor and solenoid valve with dry, lint free shop towels only. The O-rings on the sensor and solenoid valve are the only serviceable components. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB scan tool diagnosis indicates this is necessary. Or, if either part has sustained physical damage (dented, deformed, broken, etc.).

CAUTION: Do not turn the small screw at the end of the solenoid valve for any reason. Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the valve housing.

INSPECTION
Inspect the throttle and manual valve levers and shafts. Do not attempt to straighten a bent shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straight-edge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs under any circumstances. This practice could damage the special coating causing the valves/plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but do not round off the edges of the valve or plug lands. Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.
VALVE BODY (Continued)

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

The only serviceable valve body components are listed below. The remaining valve body components are serviced only as part of a complete valve body assembly. Serviceable parts are:

- dual solenoid and harness assembly
- solenoid gasket
- solenoid case connector O-rings and shoulder bolt
- switch valve and spring
- pressure adjusting screw and bracket assembly
- throttle lever
- manual lever and shaft seal
- throttle lever shaft seal, washer, and E-clip
- fluid filter and screws
- detent ball and spring
- valve body screws
- governor pressure solenoid
- governor pressure sensor and retaining clip
- park lock rod and E-clip

ASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Overtightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

LOWER HOUSING

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 305).
(2) Install 3-4 timing valve spring and valve in lower housing.
(3) Install 3-4 quick fill valve in lower housing.
(4) Install 3-4 quick fill valve spring and plug in housing.
(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.
Fig. 305 Lower Housing Shift Valves and Springs

1 - 3-4 ACCUMULATOR HOUSING
2 - 3-4 SHIFT VALVE AND SPRING
3 - PLUG
4 - SPRING RETAINER
5 - CONVERTER CLUTCH VALVE AND SPRING
6 - CONVERTER CLUTCH TIMING VALVE AND SPRING
7 - OVERDRIVE SEPARATOR PLATE
8 - CASE CONNECTOR
9 - CONVERTER CLUTCH SOLENOID
10 - OVERDRIVE SOLENOID

11 - TIMING VALVE COVER
12 - PLUG
13 - 3-4 TIMING VALVE AND SPRING
14 - LOWER HOUSING
15 - ACCUMULATOR END PLATE
16 - 3-4 ACCUMULATOR PISTON AND SPRING
17 - E-CLIP
18 - 3-4 QUICK FILL SPRING AND VALVE
19 - SOLENOID GASKET
20 - HARNESS
VALVE BODY (Continued)

3-4 ACCUMULATOR
(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 306).
(2) Install new seal rings on accumulator piston.
(3) Install piston and spring in housing.
(4) Install end plate on housing.

TRANSFER PLATE
(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 307).
(2) Install filter screen in upper housing separator plate (Fig. 308).
(3) Align and position upper housing separator plate on transfer plate (Fig. 309).
(4) Install brace plate (Fig. 309). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.
(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.
UPPER AND LOWER HOUSING

1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 310). Seven check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 5 check balls are approximately 6.3 mm (1/4 in.) in diameter.

2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 311). Be sure filter screen is seated in proper housing recess.

3) Install the Number 10 check ball into the transfer plate (Fig. 312). The check ball is approximately 4.8 mm (3/16 in.) in diameter.

4) Position lower housing separator plate on transfer plate (Fig. 313).

Fig. 310 Check Ball Locations In Upper Housing
1 - SMALL DIAMETER CHECK BALLS (5)
2 - LARGE DIAMETER CHECK BALL (1)

Fig. 311 Installing Transfer Plate On Upper Housing
1 - FILTER SCREEN
2 - TRANSFER PLATE/SEPARATOR PLATE ASSEMBLY
3 - UPPER HOUSING

Fig. 312 Number 10 Check Ball
1 - NUMBER 10 CHECK BALL (3/16")

Fig. 313 Lower Housing Separator Plate
1 - BE SURE TO ALIGN BORES
2 - TRANSFER PLATE
3 - LOWER HOUSING (OVERDRIVE) SEPARATOR PLATE
VALVE BODY (Continued)

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 314).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 314).

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 315), (Fig. 316) and (Fig. 317) to perform the following steps.

(1) Lubricate valves, plugs, springs with clean transmission fluid.

(2) Assemble regulator valve line pressure sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(3) Install 1-2 and 2-3 shift valves and springs.

(4) Install 1-2 shift control valve and spring.

Fig. 314 Installing Lower Housing On Transfer Plate And Upper Housing

Fig. 315 Shuttle and Boost Valve Locations

1 - SPRING
2 - RETAINER
3 - BOOST VALVE
4 - BOOST VALVE PLUG
5 - SPRING GUIDES
6 - E-CLIP
7 - SHUTTLE VALVE SECONDARY SPRING
8 - SHUTTLE VALVE COVER
9 - SHUTTLE VALVE
10 - SHUTTLE VALVE PRIMARY SPRING
11 - GOVERNOR PLUG COVER
12 - THROTTLE PLUG
13 - UPPER HOUSING
14 - BOOST VALVE COVER
VALVE BODY (Continued)

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.
(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).
(7) Install shuttle valve as follows:
   (a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.
   (b) Install shuttle valve into housing.
   (c) Hold shuttle valve in place.
   (d) Compress secondary spring and install E-clip in groove at end of shuttle valve.
   (e) Verify that spring and E-clip are properly seated before proceeding.
(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.
(9) Install 1-2 and 2-3 valve governor plugs in valve body.
(10) Install shuttle valve primary spring and throttle plug.
(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

Fig. 316 Upper Housing Control Valve Locations

1 - UPPER HOUSING  8 - MANUAL VALVE
2 - REGULATOR VALVE  9 - 1-2 GOVERNOR PLUG
3 - SWITCH VALVE  10 - GOVERNOR PLUG COVER
4 - REGULATOR VALVE SPRING  11 - THROTTLE PLUG
5 - KICKDOWN VALVE  12 - 2-3 GOVERNOR PLUG
6 - KICKDOWN DETENT  13 - SHUTTLE VALVE PRIMARY SPRING
7 - THROTTLE VALVE AND SPRING
Fig. 317 Upper Housing Shift Valve and Pressure Plug Locations

1 - UPPER HOUSING
2 - 1-2 SHIFT VALVE AND SPRING
3 - 2-3 SHIFT VALVE AND SPRING
4 - 2-3 THROTTLE PLUG
5 - LIMIT VALVE HOUSING
6 - LIMIT VALVE COVER
7 - LIMIT VALVE AND SPRING
8 - RETAINER
9 - 1-2 SHIFT CONTROL VALVE AND SPRING
10 - PRESSURE PLUG COVER
11 - PLUG SLEEVE
12 - THROTTLE PRESSURE SPRING AND PLUG
BOOST VALVE TUBE AND BRACE

1. Position valve body assembly so lower housing is facing upward (Fig. 318).
2. Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.
3. Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 318).
4. Insert and seat each end of tube in housings.
5. Slide tube brace under tube and into alignment with valve body screw holes (Fig. 319).
6. Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 319).
7. Bend tube brace tabs up and against tube to hold it in position (Fig. 320).
8. Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.
VALVE BODY (Continued)

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 321).

(2) Loosely attach accumulator housing with right-side screw (Fig. 321). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 322). Tighten screws to 4 N·m (35 in. lbs.).

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 323).

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.


(6) Then install manual lever seal, washer and E-clip.
VALVE BODY (Continued)

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 324).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install pressure regulator valve.

(15) Install switch valve.

(16) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(17) Perform Line Pressure and Throttle Pressure adjustments. (Refer to 21 - TRANSMISSION/TRANS-AXLE/AUTOMATIC/VALVE BODY - ADJUSTMENTS)

(18) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(19) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 325). Seat tang in dimple before tightening connector screw.

(20) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(21) Verify that solenoid wire harness is properly routed (Fig. 326). Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.
GOVERNOR BODY, SENSOR AND SOLENOID

1. Turn valve body assembly over so accumulator side of transfer plate is facing down.
2. Install new O-rings on governor pressure solenoid and sensor.
3. Lubricate solenoid and sensor O-rings with clean transmission fluid.
4. Install governor pressure sensor in governor body.
5. Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.
6. Position governor body gasket on transfer plate.
7. Install retainer plate on governor body and around solenoid. Be sure solenoid connector is positioned in retainer cutout.
8. Align screw holes in governor body and transfer plate. Then install and tighten governor body screws to 4 N·m (35 in. lbs.) torque.
9. Connect harness wires to governor pressure solenoid and governor pressure sensor.
10. Install fluid filter and pan.
11. Lower vehicle.
12. Fill transmission with recommended fluid and road test vehicle to verify repair.

INSTALLATION

1. Check condition of O-ring seals on valve body harness connector (Fig. 327). Replace seals on connector body if cut or worn.
2. Check condition of manual lever shaft seal in transmission case. Replace seal if lip is cut or worn. Install new seal with 15/16 deep well socket (Fig. 328).
3. Check condition of seals on accumulator piston. Install new piston seals, if necessary.
4. Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.
5. Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.
6. Lubricate seal rings on valve body harness connector with petroleum jelly.
7. Position valve body in case and work end of park lock rod into and through pawl sprag. Turn propeller shaft to align sprag and park lock teeth if necessary. The rod will click as it enters pawl. Move rod to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity.
ADJUSTMENTS - VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body:
- Line Pressure
- Throttle Pressure

Line and throttle pressures are interdependent because each affects shift quality and timing. As a result, both adjustments must be performed properly and in the correct sequence. Adjust line pressure first and throttle pressure last.

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 329).

Distance should be 33.4 mm (1-5/16 in.).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

NOTE: The 33.4 mm (1-5/16 in.) setting is an approximate setting. Manufacturing tolerances may make it necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa).

Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 330).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.