

Figure 4

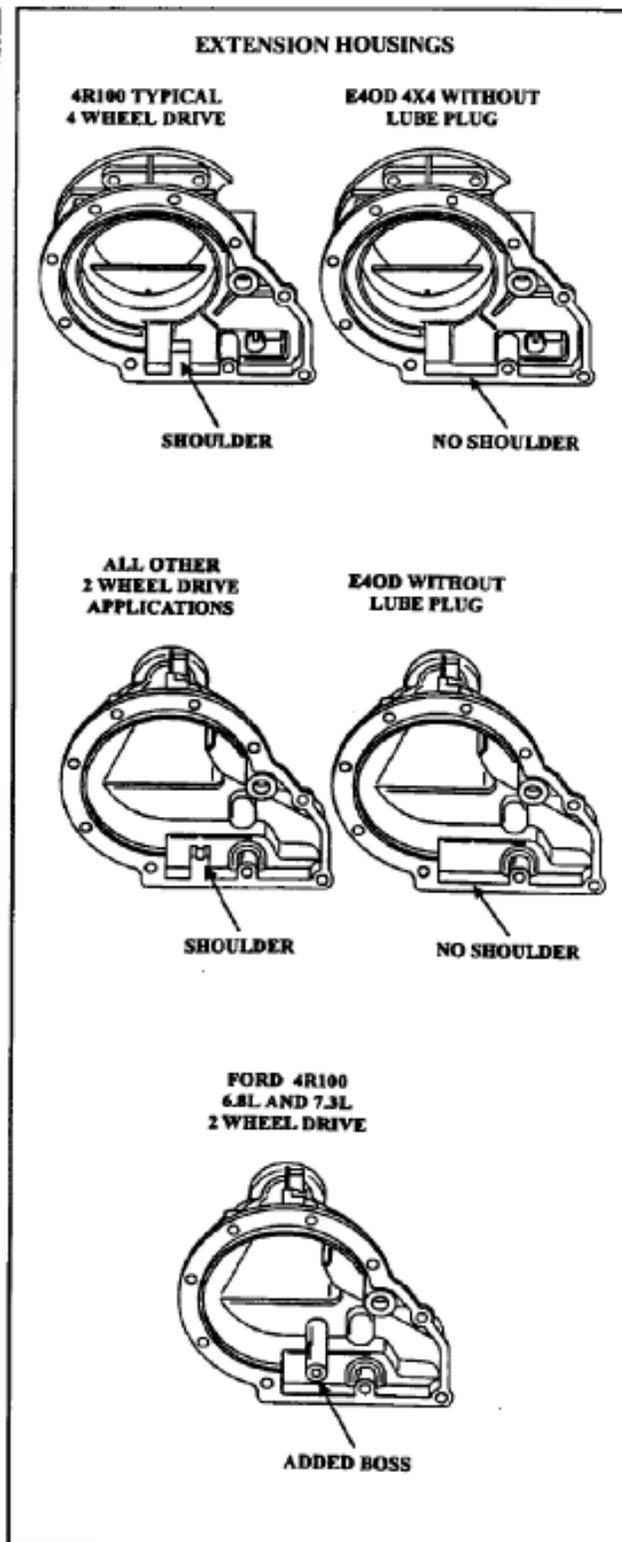


Figure 5



## POWER TAKE-OFF

Beginning at the start of production for 1999 models, Ford Motor Company introduced a new 4R100 transmission in some F250, F350, F450 and F550 Super Duty Trucks, equipped with the 5.4L, 6.8L and 7.3L engines. Basically the new 4R100 is a revised version of the previous E4OD transmission with a Power-Take-Off (PTO) window on the left side of the transmission case, right behind the front pump. Refer to Figure 1. The revisions that have occurred have created many major engineering changes that have affected many internal and external parts that will create service concerns and diagnostic concerns.

### **PTO REQUIREMENTS:**

- (1) Obviously the case must be PTO capable with the cast-in window in the transmission where the PTO unit mounts to the transmission, as shown in Figure 1.
- (2) Designed for use during Mobile (Some Models) or Stationary conditions.
- (3) PTO is available as an option *only* on 8500 GVW or above, Super Duty F-Series trucks with 6.8L Gasoline and 7.3L Diesel engines. Ford 4R100 transmissions on other models *are not* PTO capable.
- (4) Battery voltage *must* be supplied to the Electronic Engine Control (EEC) input pin 4 on gasoline models, or pin 66 on diesel models, *when PTO is engaged*. The processor uses this information to raise EPC pressure to approximately 55 PSI so that you do not smoke the coast clutch. *This voltage must be provided by the PTO installer.*

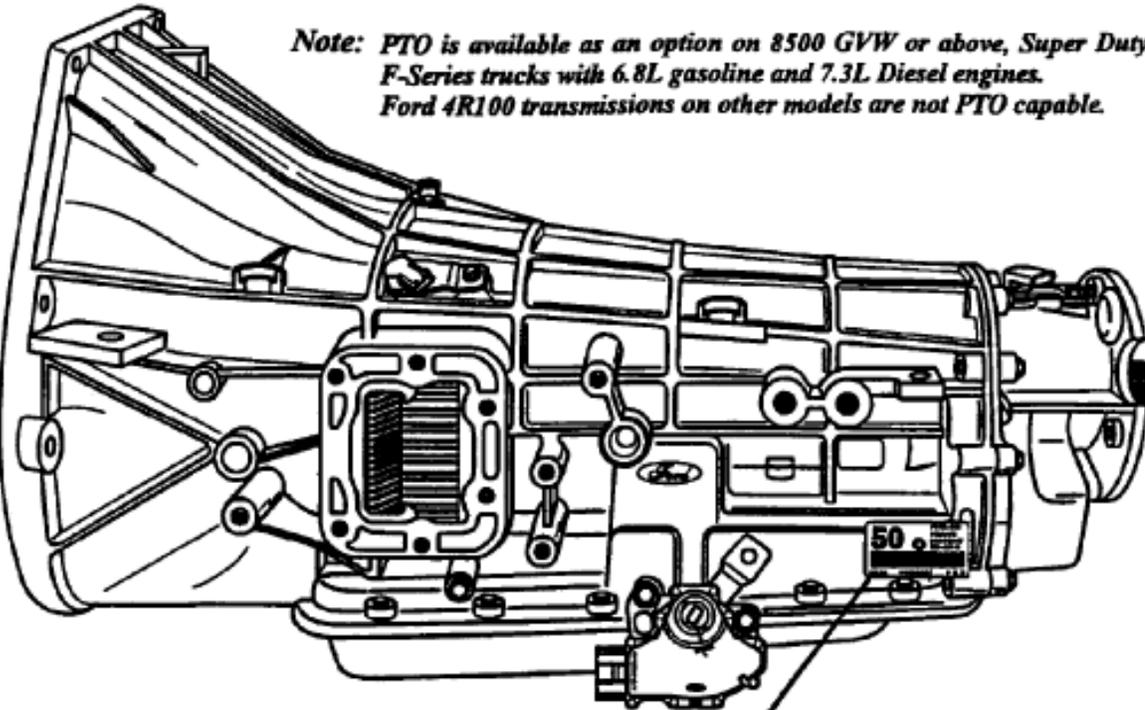
### **CONDITIONS FOR PTO OPERATION (General):**

- (1) The vehicle is not in the crank or start mode.
- (2) The transmission range selector *Must* be in P,R, O.D, 2 or 1 position. The PTO will not operate when the selector is in the neutral position.
- (3) PTO operation is inhibited when in granking mode or 4th gear.
- (4) Transmission only operates 1st through 3rd gears. Computer strategy does not allow 4th gear to engage, even if selected.
- (5) Transmission Fluid Temperature Sensor reading is up to operating temperature.

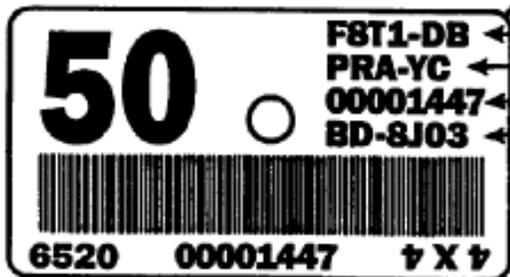
DESCRIPTION and OPERATION

FORD 4R100  
WITH POWER TAKE OFF OPTION

*Note: PTO is available as an option on 8500 GVW or above, Super Duty F-Series trucks with 6.8L gasoline and 7.3L Diesel engines. Ford 4R100 transmissions on other models are not PTO capable.*



- F4 = 1994
- F5 = 1995
- F6 = 1996
- F7 = 1997
- F8 = 1998
- F9 = 1999



- ← Assembly Part Number (Prefix and Suffix)
- ← Transmission Model
- ← Serial Number
- ← Build Date - (Year, Month, Day)

- |         |         |
|---------|---------|
| A = JAN | G = JUL |
| B = FEB | H = AUG |
| C = MAR | J = SEP |
| D = APR | K = OCT |
| E = MAY | L = NOV |
| F = JUN | M = DEC |

IDENTIFICATION TAG LOCATION AND INFORMATION

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Figure 1



## Technical Service Information Ford 4R100

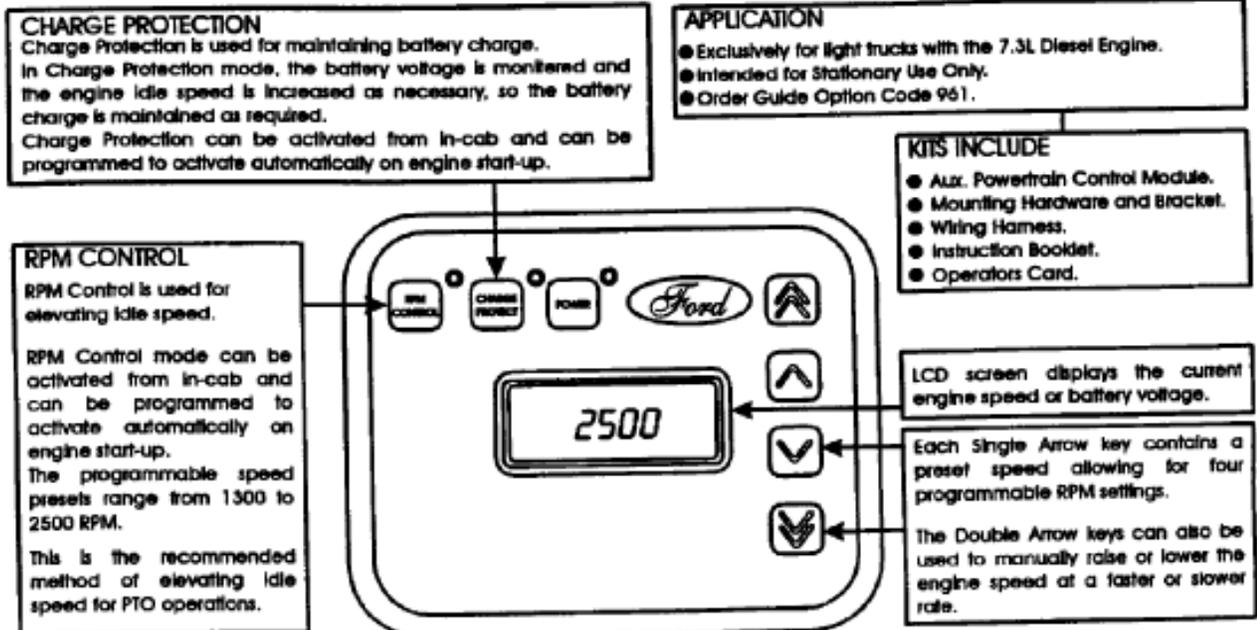
### DESCRIPTION and OPERATION

#### DIESEL ENGINE PTO OPERATION:

#### "AUXILIARY" POWERTRAIN CONTROL MODULE 7.3L DIESEL ENGINE (ONLY)

- The Auxiliary Powertrain Control Module (APCM) commands the Electronic Engine Control (EEC) module to increase the idle speed during PTO operation. The APCM controls engine speed from 1200 to 2500 RPM.
- The Auxiliary Powertrain Control Module is a separate option, *it does not come standard* with a PTO capable transmission, and is for 7.3L diesel applications only.
- Intended for stationary use only, and in stationary operation the PTO requires an engine idle speed of 1200 RPM. During stationary PTO operation on the 7.3L diesel, the EEC increases the idle to 1200 RPM automatically.
- During stationary PTO operation, the Torque Converter Clutch (TCC) engages once the RPM reaches 1200-1300 RPM.
- The following conditions *must* be met before the idle speed is increased:
  1. Parking brake must be engaged for all applications.
  2. No hydraulic brake actuation.
  3. Accelerator pedal must be in the idle position.
  4. Vehicle speed must be zero MPH.
  5. Brake lights must be functional.

#### AUXILIARY POWERTRAIN CONTROL MODULE



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## Technical Service Information Ford 4R100

### DESCRIPTION and OPERATION

#### ***GASOLINE ENGINE PTO OPERATION:***

- (1) PTO installer must obtain a "High Idle Throttle Control" from an aftermarket source.
- (2) Auxiliary Powertrain Control Module seen on the previous page ***does not*** work on the gasoline engine models. APCM module works ***only*** on the 7.3L diesel engine.
- (3) For stationary PTO operation an engine idle speed of 1300 RPM is required.
- (4) The Torque Converter Clutch (TCC) engages once the engine reaches 1300 RPM.

#### ***TRANSMISSION FUNCTIONS DURING PTO OPERATION:***

- (1) Shift Solenoid "B" (2) is turned on, the coast clutch activates and does not allow 4th gear operation during PTO operation.
- (2) The Electronic Pressure Control (EPC) pressure is raised to approximately 55 PSI. This is why the coast clutch will be smoked in a short period of time if the battery voltage wire is not applied to EEC input pin 4 (gasoline) or pin 66 (diesel) when the PTO is engaged.
- (3) The Transmission Control Indicator Lamp (TCIL) illuminates.
- (4) When the PTO is turned ON, the transmission operates only in 1st through 3rd gears. Overdrive 4th gear is not allowed by the strategy.
- (5) The transmission shift schedule is ***early*** and shift feel is ***very firm***.

#### ***DIAGNOSIS CONCERNS WITH PTO EQUIPPED VEHICLES:***

- (1) ***Always*** ensure that PTO is turned OFF, before any diagnosis procedures begin.
- (2) ***Never*** perform any transmission special tests (i.e. pressure test, stall test etc.) when the PTO is turned ON.
- (3) If a transmission concern or symptom goes away with the PTO turned OFF, it is most likely ***not a transmission concern***.
- (4) On Board Diagnostics operate normally during PTO operation with the exception of the engine misfire monitor. The circuit checks made by the PCM and Failure Mode Effect Management (FMEM) capability will continue. The PTO ***must*** be turned OFF to access Diagnostic Trouble Codes (DTC's) and perform OBD tests.
- (5) ***No testing with the PTO turned ON.***



# Technical Service Information Ford 4R100

## DIAGNOSIS and TESTING

### Line Pressure Test

**CAUTION:** Perform the line pressure test prior to performing the stall speed test. If line pressure is low at stall, do not perform the stall speed test or further transmission damage will occur. Do not maintain wide-open throttle in any transmission range for more than 5 seconds or transmission damage may occur.

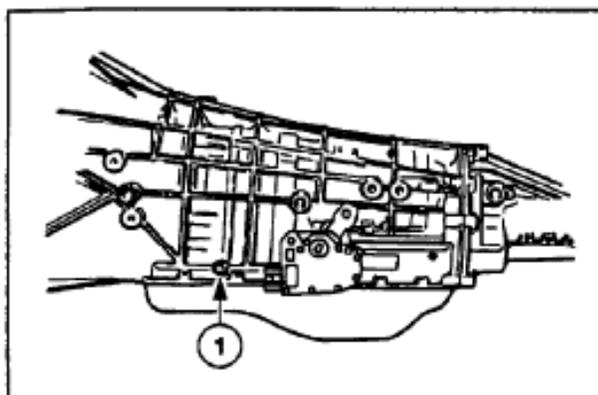
**NOTE:** If the transmission tester is installed it must be removed prior to performing the test.

**NOTE:** If equipped, turn the power take-off unit off for proper test results.

**NOTE:** Perform shift linkage check prior to performing this test; refer to Section 307-05.

This test verifies the line pressure is within specifications.

1. Connect the Pressure Gauge to the line pressure tap.
2. Start the engine and check the line pressures. Refer to the Line Pressure Chart to determine if the line pressure is within specification.



Item	Part Number	Description
1	—	Line Pressure Tap

3. If the line pressure is not within specifications, perform On-Board Diagnostics and Pinpoint Test E, air pressure check, and clean, inspect and replace the main control system or pump as required.

### Line Pressure Chart<sup>1</sup>

Gear	Line Pressure — Idle		Line Pressure — Stall	
	kPa	psi	kPa	psi
P,N	345-448	50-65	—	—
R	483-690	70-100	1689-2000	213-223
⊙, 2	345-448	50-65	1138-1276	136-156
1	483-690	70-100	1207-1448	136-156

<sup>1</sup> Power take-off must be turned off prior to performing test.

### Line Pressure Diagnosis Chart

Low at Idle in All Ranges			High at Idle in All Ranges		
Check for low fluid level, restricted inlet filter, loose main body, solenoid body or accumulator body-to-case bolts, excessive leakage in pump, case, control bodies, sticking main regulator valve, damaged filter assembly and seal, damaged gaskets or valve body separating plate.			Check the main regulator valve, solenoid body and wiring harness. Run the Quick Test referred to in the Diagnostics portion of this section.		
Low Only in					
P	R	N	⊙	2	1
Check valve bodies 7A100	Check separator reinforcing plate, coast clutch, low/reverse clutch or direct clutch. Valve bodies 7A100, 7G422	Check valve bodies 7A100	Check forward clutch. Valve bodies 7A100	Check forward clutch, coast clutch or intermediate clutch, band, servo assy. Valve bodies 7A100, 7G422	Check forward clutch, low/reverse clutch or coast clutch. Valve bodies 7A100

## DIAGNOSIS and TESTING

### Stall Speed Test

**⚠ WARNING:** Apply the service and parking brakes firmly while performing each stall test.

**⚠ CAUTION:** Perform the line pressure test prior to performing the stall test. If line pressure is low at stall, do not perform the stall test or further transmission damage will occur.

**NOTE:** If the transmission tester is installed it must be removed prior to performing the test.

**NOTE:** If equipped, turn the power take-off unit off for proper test results.

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

The stall test checks the operation of the following items:

- Torque converter one-way clutch.
- Forward clutch.
- Low one-way clutch.
- Reverse clutch.

#### Stall Speed Chart

Series	Engine	Min.	Max.
F-250	5.4L	2248	2631
F-250 HD	5.4L	2238	2613
F-350	5.4L	2238	2613
F-350	6.8L	1911	2283
F-Super Duty	6.8L	1911	2283
F-250	7.3L DI Diesel	1950	2285
F-Super Duty	7.3L DI Diesel	1950	2285

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

- Overdrive one-way clutch.
  - Direct clutch.
  - Engine performance.
1. Connect a tachometer to the engine.
  2. After testing each of the following ranges,  $\odot$ , 2, 1 and R, move the transmission range selector lever to N (NEUTRAL) and run the engine for about 15 seconds to allow the torque converter (7902) to cool before testing the next range.

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

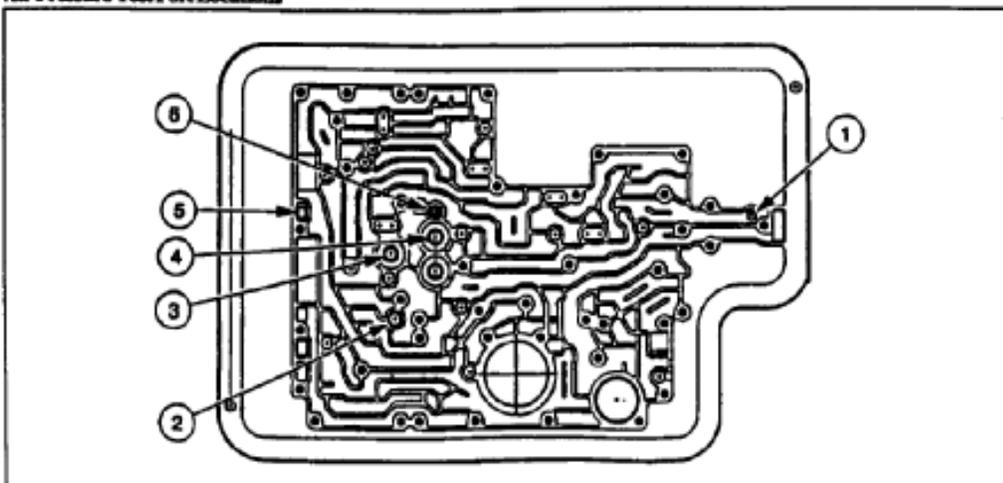
**⚠ CAUTION:** Do not maintain wide-open throttle (WOT) in any gear range for more than 5 seconds or transmission damage may occur.

Press the accelerator pedal to floor (WOT) in each range. Record the rpm reached in each range. Stall speeds should be in the appropriate range.

#### Stall Speed Diagnosis Chart

Range	Possible Source
$\odot$	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Overdrive One-Way Clutch</li> <li>• Low One-Way Clutch</li> </ul>
R	<ul style="list-style-type: none"> <li>• Direct Clutch</li> <li>• Overdrive One-Way Clutch and Coast Clutch</li> <li>• Reverse Clutch</li> </ul>
2	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Overdrive One-Way Clutch and Coast Clutch</li> </ul>
1	<ul style="list-style-type: none"> <li>• Forward Clutch</li> <li>• Reverse Clutch and Low One-Way Clutch</li> <li>• Coast Clutch and Overdrive One-Way Clutch</li> </ul>

#### Air Pressure Test Port Locations



## DIAGNOSIS and TESTING

Item	Part Number	Description
1	—	Reverse Clutch Feed
2	—	Intermediate Clutch Feed
3	—	Overdrive Clutch Feed

A no-drive condition can exist, even with correct transmission fluid pressure, because of inoperative clutches or bands. Refer to the Band/Clutch Application Chart No. 601 to determine the appropriate elements. A clutch concern can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the concern.

**Example:** When the transmission range selector lever is in a forward gear range (Ⓜ, 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

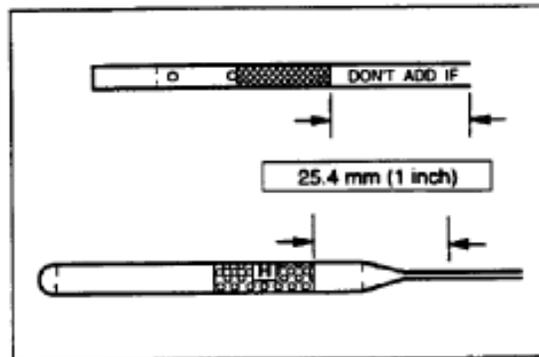
1. Drain the transmission fluid. Remove the transmission fluid pan.
2. Remove the filter and seal assembly, the solenoid body, the control assemblies and separator plate, upper/lower gaskets.
3. The inoperative clutches can be located by applying air pressure into the appropriate clutch port. See the Air Pressure Test Port Locations illustration for clutch port locations.
4. Apply air pressure to the appropriate clutch port (see the Air Pressure Test Port Locations illustration). A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing may be heard.
5. If the clutches fail to operate during the air check:
  - inspect the fluid passages in the case.
  - the piston seals are not seated, damaged, not installed.
  - plugged feed holes for clutch apply in the case and/or clutch cylinder.
  - damaged piston and/or clutch cylinder.
6. Repair as required and re-check.

### Torque Converter Drainback Test

1. Drive the vehicle for 30-60 minutes to attain normal operating temperature.
2. Check the transmission fluid level. Add fluid only if required.
3. Drive the vehicle through 8 to 10 cycles of 1/2 throttle, 1-2 upshifts to elevate the transmission temperature. Then proceed as follows:
  - Park the vehicle on level ground.

Item	Part Number	Description
4	—	Forward Clutch Feed
5	—	Coast Clutch Feed
6	—	Direct Clutch Feed

- Allow the vehicle to sit for 30-60 minutes.
- Check and note the fluid level on the fluid level indicator (7A020) with the engine off, in PARK. The following example shows the fluid level after 45 minutes.



4. Allow the vehicle to sit for a minimum of 24 hours. Check and note the fluid level.
5. If the fluid has risen 25.4 mm (1 in) or more above the level in the first check, excessive converter drainback has occurred.
6. If excessive drainback has occurred:
  - stuck open check ball in rear cooler line case fitting.
  - no check ball in rear cooler line case fitting.
  - incorrect case cooler line case fitting (without check ball) installed.
7. Repair as required and recheck.

### Leakage Inspection

The transmission has the following parts to prevent external fluid leakage:

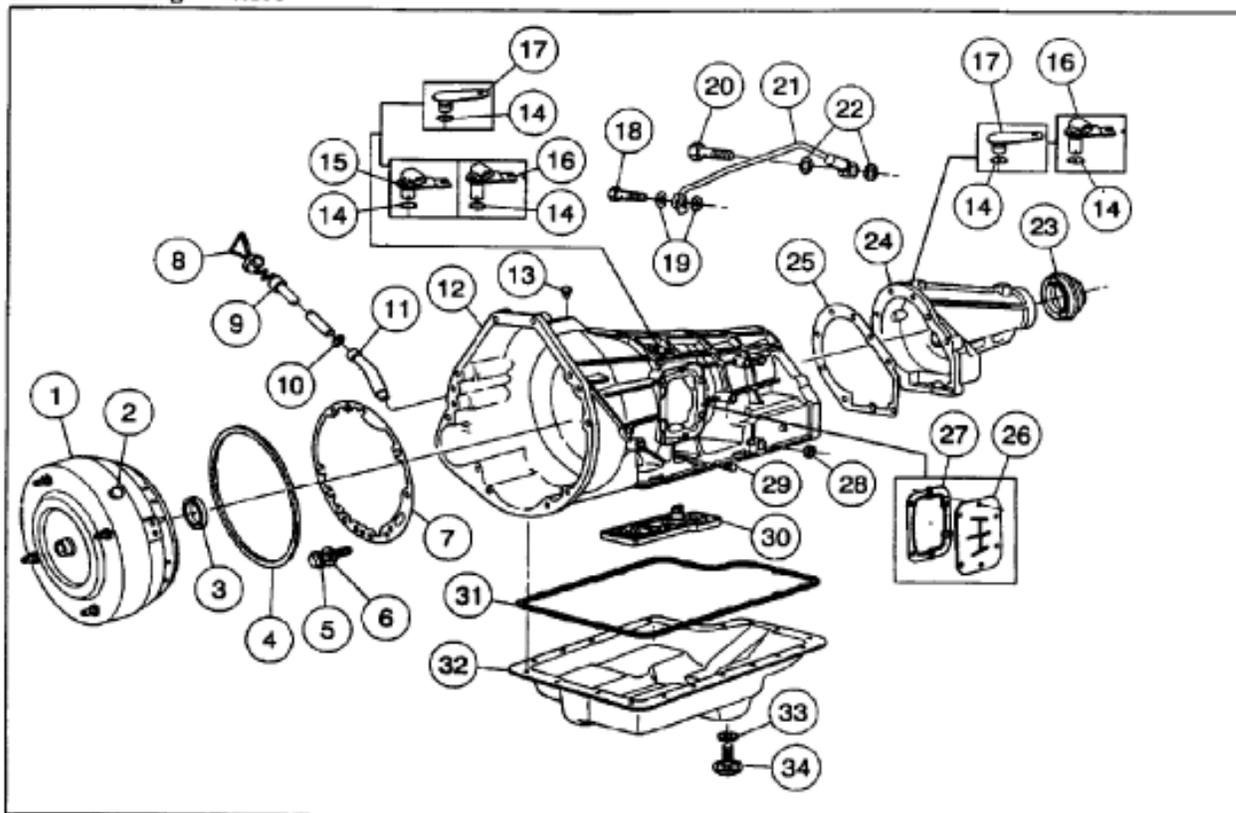
- gaskets
- lip-type seals
- O-ring seals
- seal rings
- seal grommets
- thread sealant
- cooler bypass valve (CBV) sealing washers



# Technical Service Information Ford 4R100

## DIAGNOSIS and TESTING

### External Sealing — 4R100



Item	Part Number	Description
1	7902	Torque Converter Assy
2	87650-S2	Torque Converter Drain Plug
3	7A248	Front Pump Seal
4	7A248	Front Pump Seal Square-Cut O.D. Seal
5	N805260-S	Bolt and Washer Assy
6	7G379	Washer
7	7A136	Pump Gasket
8	7A020	Fluid Level Indicator
9	7A228	Fluid Filler Tube Assy
10	391308-S	Filler Tube O-Ring
11	7A160	Short Fluid Inlet Tube Assy
12	7005	Case
13	7034	Case Vent Assy
14	N118757-S100	Sensor O-Rint (Part of 7H183 and 7M101) (Model Dependent)
15	7M101	Turbine Shaft Speed (TSS) Sensor (Model Dependent)

(Continued)

Item	Part Number	Description
16	7M101	Turbine/Output Shaft Speed (TSS/OSS) Sensor (Model Dependent)
17	7H183	Plug Assembly — Case (Model Dependent)
18	7Z152	Cooler Line - Case Fitting (Part of 7H332 CBV Assy)
19	391933-S100	Sealing Washers
20	7G118	Cooler Line - Case Fitting (Part of 7H332 CBV Assy)
21	7H322	Transmission Cooler Bypass Valve Assy
22	391932-S100	Sealing Washers
23	7052	Extension Housing Seal
24	7A039	Extension Housing
25	7086	Extension Housing Gasket
26	7222	PTO — Case Cover
27	7223	PTO — Cover Gasket
28	7B498	Manual Control Lever Seal

(Continued)