

1999 AUTOMATIC TRANSMISSIONS

Ford 4R100 Overhaul

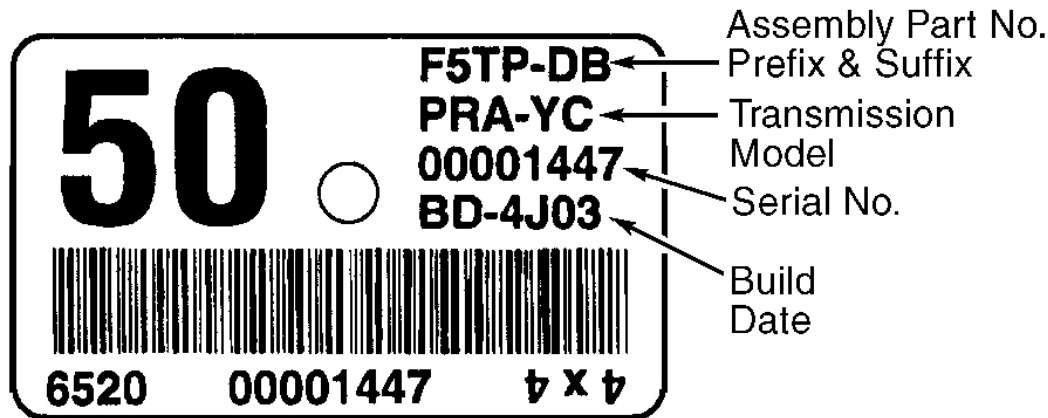
APPLICATION

4R100 TRANSMISSION APPLICATIONS

Vehicle Model	Transmission
Expedition/Navigator	4R100
E150/250/350/450	4R100
F150/250/350/450/550	4R100

IDENTIFICATION

The 4R100 automatic transmission is identified by a tag located on left side of case, to rear of Transmission Range (TR) sensor. Top line of tag shows assembly part number and serial number. Second line on tag shows model number. Last line of tag shows build date. See [Fig. 1](#).



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Fig. 1: 4R100 Identification Tag
Courtesy of FORD MOTOR CO.

GEAR RATIOS

TRANSMISSION GEAR RATIOS

Gear	Ratio
1	2.71:1
2	1.54:1

3	1.00:1
4	.71:1
Reverse	2.18:1

DESCRIPTION

The 4R100 transmission is a fully automatic, electronically controlled, 4-speed automatic overdrive transmission. Transmission consists of torque converter clutch, 6 multiple-disc friction clutches, one band, 2 sprag one-way clutches, a roller one-way clutch and 3 planetary gearsets. See **Fig. 2**.

Shift control solenoids provide gear selection and are controlled by the EEC microprocessor. For additional information on the EEC-V system, refer to SELF-DIAGNOSTICS - EEC-V article in ENGINE PERFORMANCE.

The EEC system has self-diagnostic capabilities. Fault codes for faulty engine and transmission sensors, switches and circuits are stored in the PCM and may be retrieved to aid diagnosis and repair.

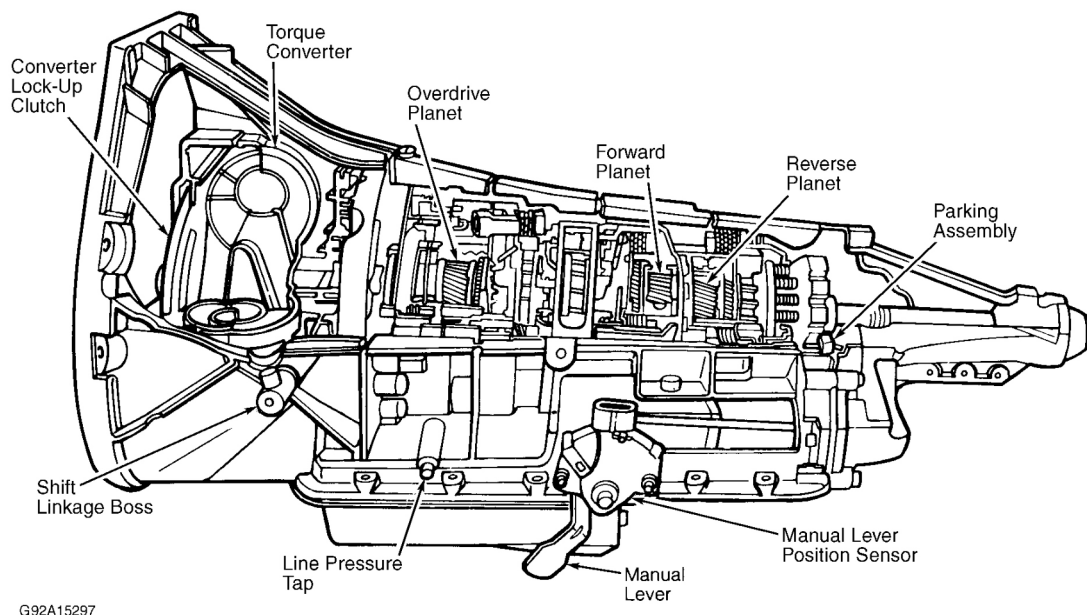


Fig. 2: Cross-Sectional View Of 4R100 Automatic Transmission
Courtesy of FORD MOTOR CO.

LUBRICATION

RECOMMENDED FLUID

Use only MERCON automatic transmission fluid.

FLUID CAPACITIES

TRANSMISSION FLUID CAPACITIES

Application	Dry Refill Qts. (L)
Except 4WD	15.9 (15)
4WD	16.4 (15.5)

ON-VEHICLE SERVICE**TORQUE CONVERTER & OIL COOLER FLUSHING**

Whenever transmission has been disassembled to replace worn or damaged parts, converter and oil cooler **MUST BE** cleaned using a mechanically agitated cleaner. Under **NO** conditions should converter or oil cooler be cleaned by hand agitation using solvent. For torque converter testing, see **TORQUE CONVERTER** under **COMPONENT TESTS**.

The following components can be serviced without removing transmission from vehicle:

- Cooler Bypass Valve
- Extension Housing Gasket
- Extension Housing Seal & Bushing
- Manual Lever Seal
- Parking Mechanism
- Turbine Shaft Speed (TSS) & Output Shaft Speed (OSS) Sensors
- Oil Pan & Filter
- Accumulator Body Assembly
- Valve Body & Intermediate Band Servo
- Solenoid Body Assembly
- Transmission Range (TR) Switch

TROUBLE SHOOTING

NOTE: After verifying driveability complaint, perform trouble shooting and testing procedures in this article. For electronic diagnostics and testing, see **FORD 4R100 ELECTRONIC CONTROLS** article.

NOTE: For engine related DTCs, see **SELF-DIAGNOSTICS - EEC-V** article in **ENGINE PERFORMANCE**. These DTCs pertain to engine performance and must be repaired first, as engine performance and related component signals will affect transmission operation and diagnosis.

SYMPTOM TESTS**ENGAGEMENT FAULTS**

No Forward Gears

Fluid level, shift linkage or cable, low line pressure, pump inlet filter and seal assembly damaged, manual valve (stuck or damaged), valve body leakage (gasket damage), improperly torqued valve body bolts, forward clutch assembly (damaged stator support, damaged check ball, loose feed bolt, damaged center support, worn clutch components), forward/reverse sun gear damaged, front planet assembly damaged, forward ring gear damaged, output shaft splines or low one-way clutch assembly damaged.

No Reverse Gears

Fluid level, shift linkage or cable, low line pressure, pump inlet filter and seal assembly, manual valve (stuck or damaged), valve body leakage (gasket damage), improperly torqued valve body bolts, reinforcing plate bolts improperly torqued or loose, direct clutch assembly (only if 3rd gear is also inoperative), reverse clutch assembly, reverse planet assembly and reverse ring gear.

Harsh Reverse

High line pressure, improperly torqued valve body bolts, valve body gaskets damaged, Electronic Pressure Control (EPC) solenoid stuck, stuck low-reverse modulator valve, main regulator/booster valve stuck or damaged, and damaged pump assembly or pump gaskets.

Harsh Forward

High line pressure, valve body leakage (gasket damage), improperly torqued valve body bolts, Electronic Pressure Control (EPC) solenoid stuck, valve body engagement control valve stuck, pump assembly, main regulator/booster valve stuck or damaged and forward clutch assembly.

Delayed/Soft Reverse

Shift linkage or cable, improperly torqued valve body bolts, valve body components (direct clutch accumulator regulator valve, low reverse modulator valve, springs), check ball (BS1 or BS3) missing or damaged, reinforcing plate improperly installed, coast clutch assembly and reverse clutch assembly damaged.

Delayed/Soft Forward

NOTE: Vehicles equipped with Output Shaft Speed (OSS) sensor, will have new adaptive shift strategies. Whenever battery is disconnected for any reason, strategy parameters that are stored in Keep Alive Memory (KAM) will be lost. Once vehicle battery is reconnected, vehicle must be driven while Powertrain Control Module (PCM) relearns parameters from driving conditions. If a concern is present during downshifts or converter clutch apply, concern is not shift strategy and will require diagnosis as outlined.

Fluid level, shift linkage or cable, low line pressure, pump inlet filter plugged, filter seal damaged, improperly torqued valve body bolts, valve body gaskets damaged, loose or damaged center support assembly bolts and forward clutch assembly.

No Forward & No Reverse

Fluid level, internal or external shift linkage, low line pressure, pump inlet filter or seal assembly damaged, manual valve, valve body leakage (improperly torqued bolts), damaged or stuck solenoids due to contamination, pump assembly (main regulator/booster valve), center support assembly damaged or support bolts loose or damaged, forward/reverse sun gear, forward planet assembly, input shaft splines damaged, center shaft, output shaft, overdrive carrier assembly, overdrive overrunning clutch (shift selector in OD with OD switch in cancel mode) and torque converter damaged.

Harsh Forward & Reverse

High line pressure, valve body bolts improperly torqued, EPC solenoid stuck, valve body components (engagement control valve), incorrect main control valve body or separator plate installed and pump assembly (main regulator/booster valve).

Delayed/Soft Forward & Reverse Engagement

NOTE: **Torque converter drainback can cause delayed or soft engagement on initial engagement only. See TORQUE CONVERTER DRAINBACK TEST under SYSTEM TESTS.**

Shift linkage or cable, fluid level, low line pressure, pump inlet filter and seal assembly, valve body bolts improperly torqued (gasket damage) and torque converter drainback (initial engagement only).

SHIFTING FAULTS

No Shifts

Fluid level, internal or external shift linkage, pump inlet filter/seal assembly damaged and valve body components (accumulator valves stuck, damaged or misassembled).

Early/Late Shift Timing

Incorrect tire size, incorrect speedometer gear or Programmable Speedometer (PSOM) incorrect coding, axle ratio change, poor engine performance and valve body components. If all previous listed items are okay, see **SOFT/SLIPPING 1-2 SHIFT** , **SOFT/SLIPPING 2-3 SHIFT** , **SOFT/SLIPPING 3-4 SHIFT** or **SOFT/SLIPPING DOWNSHIFTS** for diagnosis of affected shift routines.

Erratic Or Hunting Shift Timing

Fluid level, pump inlet filter and seal assembly damaged or plugged, valve body components and Torque Converter Clutch (TCC). See **TORQUE CONVERTER CLUTCH CYCLING/SHUDDER/CHATTER** .

Soft Or Slipping Shift Feel

NOTE: **Vehicles equipped with Output Shaft Speed (OSS) sensor, will have new adaptive shift strategies. Whenever battery is disconnected for any reason, strategy parameters that are stored in Keep Alive Memory (KAM) will be lost. Once vehicle battery is reconnected, vehicle must be driven while Powertrain Control Module (PCM) relearns parameters from driving conditions. If a concern**

is present during downshifts or converter clutch apply, concern is not shift strategy and will require diagnosis as outlined.

Fluid level, low line pressure, valve body bolts improperly torqued (gasket damage, leaks), EPC solenoid, valve body components (line modulator valve, accumulator assembly), pump assembly (main regulator/booster valve damaged or misassembled) and EPC air bleed check valve damaged or missing. If all previous listed items are okay, see **SOFT/SLIPPING 1-2 SHIFT** , **SOFT/SLIPPING 2-3 SHIFT** , **SOFT/SLIPPING 3-4 SHIFT** or **SOFT/SLIPPING DOWNSHIFTS** for diagnosis of affected shift routines.

Harsh Shift Feel

NOTE: Vehicles equipped with Output Shaft Speed (OSS) sensor, will have new adaptive shift strategies. Whenever battery is disconnected for any reason, strategy parameters that are stored in Keep Alive Memory (KAM) will be lost. Once vehicle battery is reconnected, vehicle must be driven while Powertrain Control Module (PCM) relearns parameters from driving conditions. If a concern is present during downshifts or converter clutch apply, concern is not shift strategy and will require diagnosis as outlined.

Fluid level, high line pressure, valve body bolts improperly torqued (gasket damage), EPC solenoid, accumulator assembly, valve body components (line modulator valve) and pump assembly (main regulator/booster valve damaged or misassembled). If all previous listed items are okay, see **HARSH 1-2 SHIFT** , **HARSH 2-3 SHIFT** , **HARSH 3-4 SHIFT** , **HARSH 4-3 SHIFT** , **HARSH 3-2 SHIFT** or **HARSH 2-1 SHIFT** for diagnosis of affected shift routines.

No 1st Gear, Engages In Higher Gear

Internal or external shift linkage, transmission range sensor (misadjusted/damaged), valve body bolts improperly torqued (gasket damage), SS1 and/or SS2 stuck or damaged, valve body components (solenoid regulator valve, 2-3 shift valve, 3-4 shift valve, D2 valve), air bleeds for SS1 or SS2 circuits missing, damaged band servo or clutches, reverse ring gear and low-reverse one-way clutch.

No Low Gear (Manual 1st)

Internal or external shift linkage, valve body bolts improperly torqued (gasket damage), SS1 failure to operate correctly, valve body components (manual control valve, low reverse modulator valve, 1-2 shift valve, 2-3 shift valve, BS1 check ball, 4-3-2 timing valve) and low-reverse one-way clutch assembly.

No 2nd Gear (Manual 2nd)

Internal or external shift linkage, improperly torqued valve body bolts, valve body components (2-3 shift valve, 3-4 shift valve, manual 1-2 transition valve, BS1 or BS6 check ball), and intermediate clutch assembly and intermediate one-way clutch assembly.

No 1-2 Shift

Internal or external shift linkage, transmission range sensor (misadjusted/damaged), improperly torqued valve body bolts, valve body components (D2 valve, 1-2 shift valve, manual 1-2 transition valve, intermediate clutch

accumulator regulator valves, springs), SS2 failure to operate correctly, intermediate clutch assembly and intermediate one-way clutch assembly.

No 2-3 Shift

Improperly torqued valve body bolts, valve body components (2-3 shift valve, direct clutch accumulator regulator valves, springs), SS1 failure to operate correctly, direct clutch assembly and center support assembly.

No 3-4 Shift

Improperly torqued valve body bolts (gasket damage), SS1 and/or SS2 failure to operate correctly, valve body components (overdrive accumulator regulator valve), 3-4 shift valve, overdrive one-way clutch assembly, overdrive clutch assembly and overdrive planet assembly.

No 4-3 Shift

Improperly torqued valve body bolts (gasket damaged), SS2 failure to operate correctly and valve body components (check ball BS2, 3-4 shift valve).

No 3rd To 2nd Shift

Improperly torqued valve body bolts (gasket damaged), SS1 failure to operate correctly and valve body components (3-2 shift valve).

No 2-1 Shift

Improperly torqued valve body bolts (gasket damaged), SS2 failure to operate correctly and valve body components (D2 shift valve).

Soft/Slipping 1-2 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (intermediate clutch accumulator regulator valve or plunger) and intermediate clutch assembly.

Soft/Slipping 2-3 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (direct clutch accumulator regulator valve or plunger), center support assembly and direct clutch assembly.

Soft/Slipping 3-4 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (overdrive accumulator regulator valve and spring, overdrive accumulator plunger and springs) and overdrive clutch assembly.

Soft/Slipping Downshifts

Improperly torqued valve body bolts (gasket damaged) and valve body components (damaged check ball CB7 or valve body separator plate).

Harsh 1-2 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (intermediate clutch accumulator regulator valve or plunger springs) and intermediate clutch assembly.

Harsh 2-3 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (direct clutch accumulator valve or plunger), center support assembly and direct clutch assembly.

Harsh 3-4 Shift

Improperly torqued valve body bolts (gasket damaged), valve body components (overdrive accumulator regulator valve or plunger) and overdrive clutch assembly.

Harsh 4-3 Shift

Improperly torqued valve body bolts (gasket damaged), check ball CB7 missing and separator plate damaged.

Harsh 3-2 Shift

Improperly torqued valve body bolts (gasket damaged), check ball CB6 missing and separator plate damaged.

Harsh 2-1 Shift

Improperly torqued valve body bolts (gasket damaged), check ball CB14 missing and separator plate damaged.

No Torque Converter Clutch Application

Improperly torqued valve body bolts (gasket damaged), torque converter clutch solenoid, transmission oil temperature sensor, pump assembly (converter clutch control valve and regulator valve stuck), stator support and torque converter assembly. See **TORQUE CONVERTER** under COMPONENT TESTS.

Torque Converter Clutch Always Applied (Stalls Vehicle In Drive & Manual 2nd Gear Only)

Low line pressure, improperly torqued valve body bolts (gasket damaged), torque converter clutch solenoid, pump assembly (converter clutch control valve) and torque converter assembly. See **TORQUE CONVERTER** under COMPONENT TESTS.

Torque Converter Clutch Cycling/Shudder/Chatter

Fluid condition, improperly torqued valve body bolts (gasket damaged), torque converter clutch solenoid, pump assembly, stator support and torque converter assembly. See **TORQUE CONVERTER** under COMPONENT TESTS.

MISCELLANEOUS FAULTS**No Park Range**

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Misadjusted internal or external shift linkage, park mechanism components and transfer case and linkages (4WD).

Transmission Overheating

Fluid level and condition, transmission cooling system, poor engine performance and torque converter clutch.

No Engine Braking In Manual 2nd Gear

Improperly torqued valve body bolts (gasket damaged), check balls missing or damaged, valve body separator plate, valve body components (4-3-2 timing valve, D2 valve, 2-3 shift valve, coast clutch shift valve, manual 1-2 transition valve, 3-4 shift valve), coast clutch assembly and intermediate servo/band assembly.

No Engine Braking In Manual 1st Gear

Improperly torqued valve body bolts (gasket damaged), check balls missing or damaged, valve body components (3-4 shift valve, low reverse clutch modulator valve, D2 valve, 4-3-2 timing valve, 2-3 shift valve, coast clutch shift valve), valve body separator plate, coast clutch assembly and low reverse clutch assembly.

No Engine Braking With Overdrive Switch Cancelled (Manual 1st & Manual 2nd Have Engine Braking)

Improperly torqued valve body bolts (gasket damaged) and/or valve body components (coast clutch solenoid, check ball, separator plate, 3-4 shift valve damaged).

Fluid Venting/Foaming

Blocked or damaged vent, overfilled, fluid contamination (coolant or water), overheating, pump inlet filter and seal, and pump to case gasket damage.

CLUTCH & BAND APPLICATIONS

CLUTCH & BAND APPLICATIONS

Selector Lever Position	Elements In Use
"OD" (Overdrive)	
1st Gear	(1) Forward Clutch, Coast Clutch, (2) Overdrive One-Way Clutch & Low/Reverse One-Way Clutch
2nd Gear	(1) Intermediate Clutch, Coast Clutch, Forward Clutch & (2) Overdrive One-Way Clutch
3rd Gear	Forward Clutch, (3) Intermediate Clutch, Direct Clutch & Overdrive One-Way Clutch
3rd Gear (Overdrive Canceled)	Coast Clutch, (3) Intermediate Clutch, Direct Clutch, Forward

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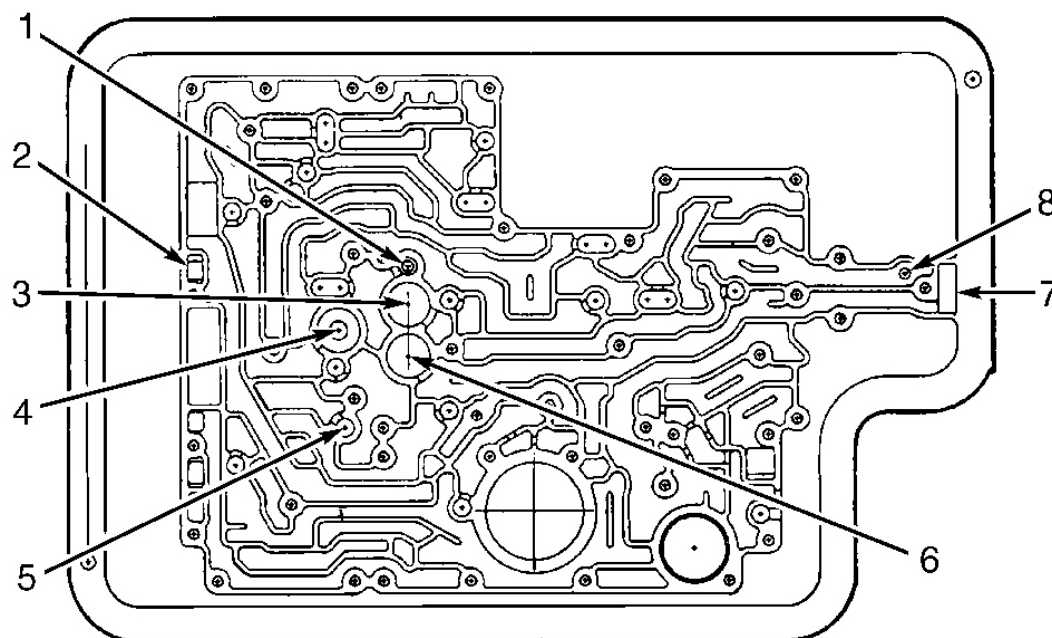
	Clutch & Overdrive One-Way Clutch
4th Gear	Forward Clutch, ⁽³⁾ Intermediate Clutch, Overdrive Clutch & Direct Clutch
"2"	Coast Clutch, Forward Clutch, Intermediate Clutch, Intermediate Band, Intermediate One-Way Clutch & Overdrive One-Way Clutch
"1"	Coast Clutch, Forward Clutch, Low/Reverse Clutch, Overdrive One-Way Clutch & Low Reverse One-Way Clutch
"R"	Coast Clutch, Forward Clutch, Low/Reverse Clutch, Low/Reverse One-Way Clutch & Overdrive One-Way Clutch
(1) Coast clutch is applied with Transmission Control Switch (TCS) in ON position. (2) Overdrive one-way clutch is holding during drive and ineffective with TCS in ON position. (3) Intermediate clutch is applied but ineffective.	

SYSTEM TESTS

Check fluid level and correct if necessary. See appropriate AUTOMATIC TRANSMISSION SERVICING article in TRANSMISSION SERVICING. Use initial road test to verify transmission malfunction. Ensure engine is operating properly.

AIR PRESSURE CHECKS

1. A "No Drive" condition can exist, even with correct transmission fluid pressure, due to inoperative clutches or bands. Inoperative components can be located by substituting air pressure for fluid pressure to determine location of malfunction. To check component, drain transmission fluid. Remove oil pan, filter, seal assembly, solenoid body and valve body.
2. Forward, coast, reverse, overdrive, direct and intermediate clutch operation may be checked as follows: Using shop air, apply air to proper points. See **Fig. 3** . A dull thud can be heard when clutch piston is applied. If no thud is heard, movement of piston can be felt by placing finger tips on input shell. If seals are leaking, a hissing sound will be heard.



1. Direct Clutch Feed
2. Coast Clutch Feed
3. Forward Clutch Feed
4. Overdrive Clutch Feed

5. Intermediate Clutch Feed
6. Intermediate Lube
7. Rear Lube
8. Low-Reverse Clutch Feed

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Fig. 3: Locating Air Pressure Test Points
Courtesy of FORD MOTOR CO.

LINE PRESSURE TESTS

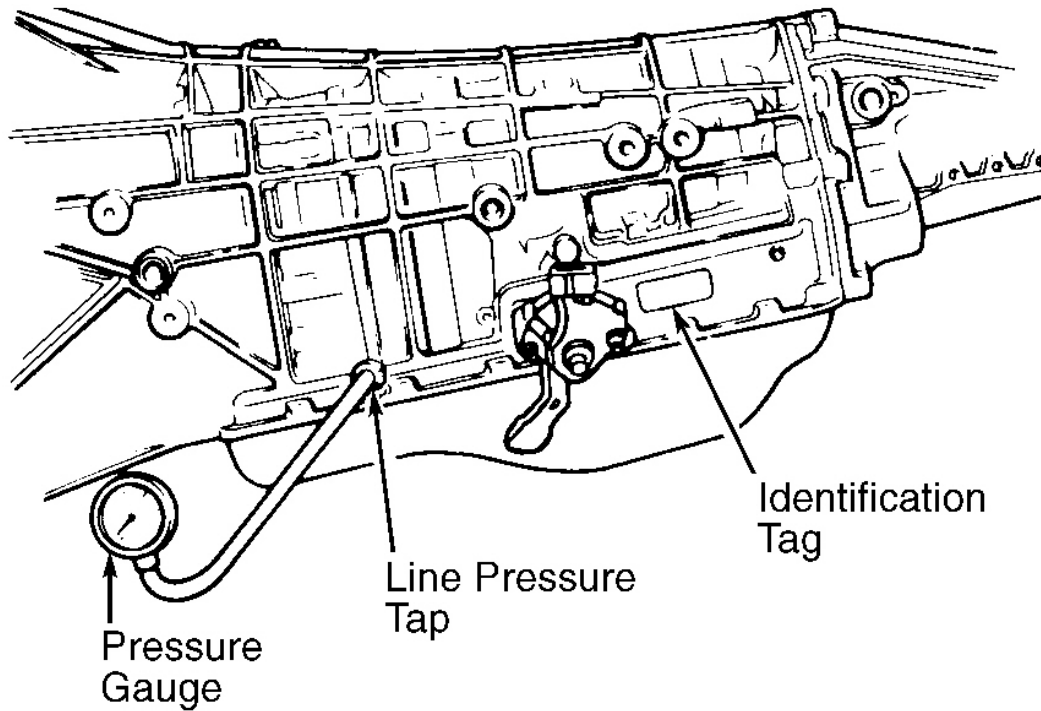
CAUTION: Perform line pressure test before stall speed test. If line pressure is low at stall speed, do not perform stall speed test or transmission damage will occur. Do not maintain Wide Open Throttle (WOT) in any gear for more than 5 seconds. If engine RPM exceeds maximum specified stall speed, release accelerator immediately. Clutch or band slippage is indicated.

1. Connect a 0-300 psi (0-21.1 kg/cm²) pressure gauge to line pressure tap on left side of transmission case just forward of control lever. See **Fig. 4**.
2. With engine at normal operating temperature, apply parking and service brakes. Check line pressure in all ranges. Pressure should be as specified. See **LINE PRESSURE SPECIFICATIONS** table.

LINE PRESSURE SPECIFICATIONS

Selector Lever Position	Idle psi (kg/cm ²)	WOT Stall psi (kg/cm ²)
-------------------------	--------------------------------	-------------------------------------

"P" & "N"	50-65 (3.5-4.6)	(Not Applicable)
"R"	70-100 (4.9-7.0)	213-223 (15.0-15.7)
"OD" & "2"	50-65 (3.5-4.6)	136-156 (9.6-11.0)
"1"	95-120 (6.7-8.4)	165-185 (11.6-13.0)



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Fig. 4: Testing Line Pressure With Pressure Gauge
Courtesy of FORD MOTOR CO.

LINE PRESSURE TEST RESULTS

Compare recorded line pressures with **LINE PRESSURE SPECIFICATIONS** table under LINE PRESSURE TESTS. If line pressures are outside of specified ranges, use following list to determine cause of trouble.

High At Idle In All Ranges

Check main regulator valve, solenoid body and wiring harness.

Low At Idle In All Ranges

Check for low fluid level, restricted inlet filter, loose main control valve body, solenoid body or accumulator body-to-case bolts. Excessive leakage in pump, case control bodies, sticking main regulator valve or damaged

inlet tube seal, gaskets or valve body separator plate.

Low In "P" Or "N"

Check main control valve body.

Low In "OD"

Check forward clutch, and main control valve body and accumulator valve body.

Low In "2"

Check forward clutch, coast clutch, intermediate clutch, band or servo assembly, and main control valve body and accumulator valve body.

Low In "1"

Check forward clutch, low-reverse clutch, coast clutch, and main control valve body and accumulator valve body.

Low In "R"

Check separator reinforcing plate, coast clutch, low-reverse clutch, direct clutch, and main control valve body and accumulator valve body.

ROAD TEST

1. Check minimum throttle upshifts in overdrive. Transmission should start in 1st gear and shift automatically into and through each gear at pre-determined specifications. See **Fig. 5 -Fig. 12** for appropriate shift speeds specifications.
2. With transmission in 4th gear (overdrive), depress overdrive cancel switch. Transmission should downshift to 3rd gear.
3. Depress accelerator pedal to floor (WOT). Transmission should downshift from 3rd to 2nd or 1st gear, depending on vehicle speed. See **Fig. 5 -Fig. 12** for appropriate shift speeds specifications.
4. When traveling above 50 MPH at less than half throttle, move selector lever from Overdrive to 2nd gear and release accelerator pedal. Transmission should immediately downshift into 2nd gear. With selector lever and transmission in 2nd gear, move selector lever to 1st gear and release accelerator pedal. Transmission should downshift to 1st gear at less than 30-35 MPH.

SHIFT SPEEDS SPECIFICATIONS (MPH)

NOTE: Shift speeds are approximate. All shift speeds may vary somewhat due to production tolerances, rear axle ratios or emission control equipment. Ensure all tires are factory recommended sizes.

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Throttle Opening	Drive Range	Shift	Vehicle Speed ^①			
			Axle Ratios			
			3.08 ^②	3.31 ^③	3.55 ^②	3.73 ^③
Light Throttle	Ⓓ or D	1-2	16-19	15.5-18	13.5-17	13.5-16
	Ⓓ or D	2-3	28-32	27.5-30.5	24-29	24-27
	Ⓓ	3-4	48-54.5	47-51.5	42-49.5	42-45.5
	Ⓓ	4-3	42-47.5	41-42.5	36.5-43	36.5-40
	Ⓓ or D	3-2	17.5-21	17.5-20	15.5-19	15.5-17.5
	Ⓓ or D	2-1	9	8.5-10.5	8-10	7.5-9.5
Wide Open Throttle (WOT)	Ⓓ or D	1-2	44-50	43-47	38-45	38-41.5
	Ⓓ or D	2-3	77-86	75-81	66.5-77.5	66.5-72
	Ⓓ	3-4	106-118	103.5-111	92-106.5	92-98.5
	Ⓓ	4-3	97-108.5	95-102	84.5-98	84.5-90.5
	Ⓓ or D	3-2	70.5-79	69-74.5	61-71.5	61-66
	Ⓓ or D	2-1	35-40	35-37.5	30-36	30-33.5

① Nominal shift speed at sea level is shown. Actual shift speed will depend on tire brand and size.

② F-150

③ F-250

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Fig. 5: 5.4L F150/250 Under 8500 GVW
Courtesy of FORD MOTOR CO.

Throttle Opening	Drive Range	Shift	Vehicle Speed ^①	
			Axle Ratios	
			3.55 ^②	3.73 ^③
Light Throttle	Ⓓ or D	1-2	13.5-16.5	13-15.7
	Ⓓ or D	2-3	22-26	21.5-25.5
	Ⓓ	3-4	44.5-51	44-50
	Ⓓ	4-3	34-39	33.5-38
	Ⓓ or D	3-2	17-20	16.5-19.5
	Ⓓ or D	2-1	9-11.5	9-11
Wide Open Throttle	Ⓓ or D	1-2	37-42.5	36.5-41.5
	Ⓓ or D	2-3	66.5-75	65.5-73
	Ⓓ	3-4	94.5-106	93.5-103.5
	Ⓓ	4-3	79.5-89.5	78.5-87
	Ⓓ or D	3-2	62-70	61.5-68.5
	Ⓓ or D	2-1	33-38	32.5-37

① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

② E-350

③ E-250

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Fig. 6: 5.4L E150/250/350 Under 8500 GVW
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Throttle Opening	Drive Range	Shift	Vehicle Speed ^①	
			Axle Ratios	
			3.55	4.10
Light Throttle	Ⓛ or D	1-2	14-16.5	12.5-14
	Ⓛ or D	2-3	23-26.5	20.5-22
	Ⓛ	3-4	46.5-52.5	42-43.5
	Ⓛ	4-3	35.5-40	31.5-33.5
	Ⓛ or D	3-2	17.5-20.5	15.5-17
	Ⓛ or D	2-1	9.5-11.5	8.5-10
Wide Open Throttle	Ⓛ or D	1-2	38.5-43.5	35-36.5
	Ⓛ or D	2-3	69-77	62-64
	Ⓛ	3-4	98-108.5	88.5-90.5
	Ⓛ	4-3	82.5-91.5	74.5-90.5
	Ⓛ or D	3-2	64.5-72	58-60
	Ⓛ or D	2-1	34-39	30.5-32.5

^① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

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Fig. 7: 5.4L E250/350 Over 8500 GVW
Courtesy of FORD MOTOR CO.

Throttle Opening	Drive Range	Shift	Vehicle Speed ^①	
			Axle Ratios	
			3.31	3.73
Light Throttle	Ⓛ or D	1-2	15.5-18	13.5-16.5
	Ⓛ or D	2-3	27-30	24-28
	Ⓛ	3-4	46.5-51	41-47.5
	Ⓛ	4-3	40.5-44.5	35.3-41.5
	Ⓛ or D	3-2	17-19.5	15.3-18.5
	Ⓛ or D	2-1	8.5-10.5	7.5-10
Wide Open Throttle (WOT)	Ⓛ or D	1-2	42.5-46.5	37.5-43.5
	Ⓛ or D	2-3	74-81	65.5-75
	Ⓛ	3-4	102.5-111	90.5-103.5
	Ⓛ	4-3	94-102	83-95
	Ⓛ or D	3-2	68-74	60-69
	Ⓛ or D	2-1	33.5-37.5	30-35

^① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

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Fig. 8: 5.4L Expedition & Navigator
Courtesy of FORD MOTOR CO.

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Throttle Opening	Drive Range	Shift	Vehicle Speed ^①	
			Axle Ratios	
			3.55	4.10
Light Throttle	Ⓓ or D	1-2	13.5-16.5	12.5-15
	Ⓓ or D	2-3	25-29	23-27
	Ⓓ	3-4	42-47.5	40-45.5
	Ⓓ	4-3	34.5-39.5	32.5-37.5
	Ⓓ or D	3-2	15.5-18.5	23-27
	Ⓓ or D	2-1	8-10	7-9
Wide Open Throttle (WOT)	Ⓓ or D	1-2	34-39.5	32.5-37.5
	Ⓓ or D	2-3	62-69.5	59-66.5
	Ⓓ	3-4	85-94.5	79-88.5
	Ⓓ	4-3	79-88.5	74.5-83.5
	Ⓓ or D	3-2	56.5-73.5	51.5-58
	Ⓓ or D	2-1	29-33	26-30

① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

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Fig. 9: 5.4L F250/350 Over 8500 GVW
Courtesy of FORD MOTOR CO.

Throttle Opening	Drive Range	Shift	Vehicle Speed ^①		
			Axle Ratios		
			3.73 ^②	4.10 ^②	4.63 ^③
Light Throttle	Ⓓ or D	1-2	11-12	10-11	8.5-9.5
	Ⓓ or D	2-3	19.5-20.5	17.5-18.5	14.5-15.5
	Ⓓ	3-4	36-37	32.5-33.5	29-30
	Ⓓ	4-3	35-36	31.5-32.5	27.5-28.5
	Ⓓ or D	3-2	17.5-18.5	16.5-17.5	13.5-14.5
	Ⓓ or D	2-1	10-11	9-10	7.5-8.5
Wide Open Throttle (WOT)	Ⓓ or D	1-2	36.5-37.5	36.5-37.5	29.5-31.5
	Ⓓ or D	2-3	65.5-66.5	64.5-65.5	53-54
	Ⓓ	3-4	91.5-92.5	94.5-95.5	76.5-77.5
	Ⓓ	4-3	89.5-90.5	85.5-86.5	71.5-72.5
	Ⓓ or D	3-2	63.5-64.5	60-61	47.5-48.5
	Ⓓ or D	2-1	34.5-35.5	31.5-32.5	25.5-26.5

① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

② E-350

③ E-Series Super Duty

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Fig. 10: 6.8L E350 & "E" - Series Super Duty
Courtesy of FORD MOTOR CO.

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

Throttle Opening	Drive Range	Shift	Vehicle Speed ^①	
			Axle Ratios	
			3.55 ^③	4.10 ^{②③}
Light Throttle	Ⓓ or D	1-2	11.5-14	10-12.5
	Ⓓ or D	2-3	20.5-24	18-21
	Ⓓ	3-4	37.5-42.5	32.5-37
	Ⓓ	4-3	35.5-40	30.5-34.5
	Ⓓ or D	3-2	18.5-21.5	16-19
	Ⓓ or D	2-1	9.5-11.5	8-10.5
Wide Open Throttle (WOT)	Ⓓ or D	1-2	24.5-28.5	21-24.5
	Ⓓ or D	2-3	49-54.5	42-47.5
	Ⓓ	3-4	74.5-83	64.5-72
	Ⓓ	4-3	69-77	59.5-66.5
	Ⓓ or D	3-2	43-48.5	37.5-42
	Ⓓ or D	2-1	18.5-21.5	16-19

① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

② E-Super Duty

③ E-350

G98C01345

Fig. 11: 7.3L Diesel E350 & "E" - Series Super Duty
Courtesy of FORD MOTOR CO.

Throttle Opening	Drive Range	Shift	Vehicle Speed ^①			
			Axle Ratios			
			3.55 ^③	4.10 ^③	4.63 ^②	5.13 ^②
Light Throttle	Ⓓ or D	1-2	12-14.5	10.5-13	9.5-11.5	8.5-10.5
	Ⓓ or D	2-3	21.5-25	18.5-21.5	17-19.5	15.5-17.5
	Ⓓ	3-4	39-44	33.5-38	31-34	28-30.5
	Ⓓ	4-3	36.5-41.5	31.5-36	29-32	26-29
	Ⓓ or D	3-2	19-22.5	16.5-19.5	15-17.5	13.5-15.5
	Ⓓ or D	2-1	9	8.5-10.5	7.5-9.5	7-8.5
Wide Open Throttle (WOT)	Ⓓ or D	1-2	25.5-29.5	22-25.5	20-22.5	18-20.5
	Ⓓ or D	2-3	50.5-57	43.5-49.5	40.5-43.5	36.5-39.5
	Ⓓ	3-4	77-86	66.5-74.5	61.5-66	55.5-60
	Ⓓ	4-3	71.5-80	61.5-69	57-61.5	51.5-55.5
	Ⓓ or D	3-2	44.5-50.5	38.5-44	35.5-39	32-35
	Ⓓ or D	2-1	19-22.5	16.5-19.5	15-17.5	13.5-15.5

① Nominal shift speed at sea level is shown. Actual shift speed will depend on the tire brand and size.

② F Super Duty

③ F-250HD, F-350

G98E01346

Fig. 12: 7.3L Diesel F250/350 "F" - Series Super Duty
Courtesy of FORD MOTOR CO.

STALL SPEED TEST

CAUTION: Do not maintain Wide Open Throttle (WOT) in any gear for more than 5 seconds. If engine RPM exceeds maximum specified stall speed, release accelerator immediately. Clutch or band slippage is indicated.

Testing Precautions

Engine coolant and transmission fluid MUST be at proper level and operating temperature. Hold accelerator down long enough to stabilize tachometer. DO NOT hold at WOT for more than 5 seconds. DO NOT exceed

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

maximum specified RPM for vehicle. After testing each range, run engine in Neutral at 1000 RPM for 15 seconds to cool torque converter. If engine speed exceeds specification, release accelerator immediately, as this indicates clutch or band slippage.

Testing Procedure

Connect tachometer to engine. Apply parking and service brakes firmly. Stall test transmission in each driving range at WOT. Note maximum RPM obtained. Engine speed should be within limits. See **STALL SPEED SPECIFICATIONS** table. If maximum RPM obtained is not within specifications, see **STALL SPEED TEST RESULTS** .

STALL SPEED SPECIFICATIONS

Vehicle Application	Engine Size	Stall Speeds (RPM)
E150/250, Expedition, F150/250, Navigator	5.4L SFI	2248-2631
E250/350 & F250/350 (Over 8550 GVW)	5.4L SFI	2238-2613
E250 & F250 Super Duty	7.3L DI Diesel	1950-2285
E350 & F350 Super Duty	6.8L SFI	1911-2283

STALL SPEED TEST RESULTS

Low In All Ranges

Poor engine performance. Faulty torque converter reactor one-way clutch.

High In All Ranges

General transmission problems are indicated. Perform **LINE PRESSURE TESTS** .

High In "OD" Only

Forward clutch, overdrive one-way clutch or low-reverse one-way clutch faulty.

High In "2" Only

Forward clutch, intermediate clutch, intermediate one-way clutch, band or overdrive one-way clutch and coast clutch faulty.

High In "1" Only

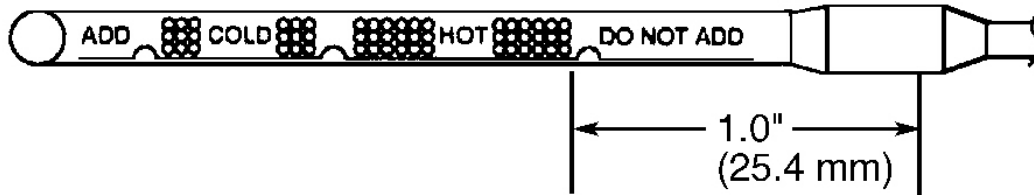
Forward clutch, reverse clutch and low-reverse one-way clutch, or coast clutch and overdrive one-way clutch faulty.

High In "R" Only

Direct clutch, overdrive one-way clutch and coast clutch, or low-reverse clutch faulty.

TORQUE CONVERTER DRAINBACK TEST

1. Drive vehicle for 30-60 minutes to attain normal operating temperature. Check transmission fluid level and add fluid if necessary. Drive vehicle through 8-10 cycles of 1/2 throttle, 1-2 upshifts to raise transmission temperature.
2. Park vehicle on level surface and allow for vehicle to sit for 30-60 minutes. Check and note fluid level on dipstick with engine off and transmission in Park. Then allow vehicle to sit for a minimum of 24 hours, then check and note fluid level.
3. If fluid level on dipstick has risen 1" (25.4 mm) or more above previous reading, excessive converter drainback has occurred. See **Fig. 13** . If excessive torque converter drainback occurs, check the following:
 - Stuck open check ball in rear cooler line case fitting.
 - Missing check ball in rear cooler line case fitting.
 - Incorrect case cooler line case fitting (without check ball) installed.



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Fig. 13: Identifying Excessive Torque Converter Drainback On Dipstick
Courtesy of FORD MOTOR CO.

COMPONENT TESTS

TORQUE CONVERTER

Converter Clutch Test

NOTE: Due to the difficulty of feeling converter clutch shift, a tachometer and/or vacuum gauge **MUST** be connected to engine.

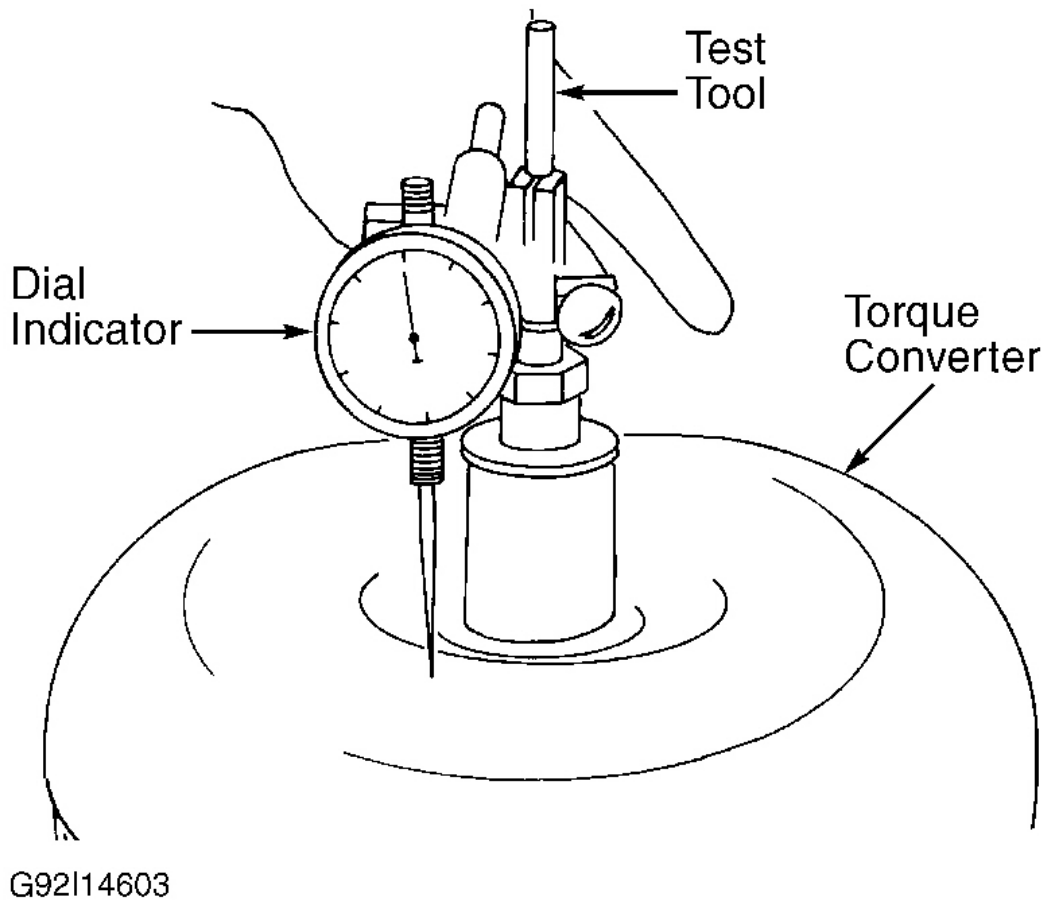
1. To check converter for engagement and disengagement, drive vehicle at about 50 MPH in overdrive and lightly tap brake pedal. Engine RPM and vacuum should increase when clutch disengages. Engine RPM will decrease about 5 seconds after pedal is released. If this does not occur, see FORD 4R100 ELECTRONIC CONTROLS article.
2. Stop vehicle. If engine stalls at idle in overdrive, shift transmission to 1st gear. If vehicle stalls in 1st gear, repair or replace converter control valve in pump. If vehicle does not stall in 1st gear, see FORD 4R100 ELECTRONIC CONTROLS article.

Leak Test

If torque converter welds indicate leakage, attach appropriate torque converter leak detector to converter and follow detector kit instructions.

Turbine & Stator End Play Check

1. Insert End Play Tester (T80L-7902-D) into converter pump drive hub until tester bottoms. Expand sleeve in turbine spline by tightening threaded inner post of tester until tester is securely locked into spline.
2. Attach a dial indicator to tool with indicator button on converter housing. See **Fig. 14** . Zero dial indicator. Lift tool upward as far as possible and note dial indicator reading.
3. Reading is total end play of turbine and stator. Replace torque converter assembly if end play exceeds specification. See **TORQUE CONVERTER END PLAY SPECIFICATIONS** table.



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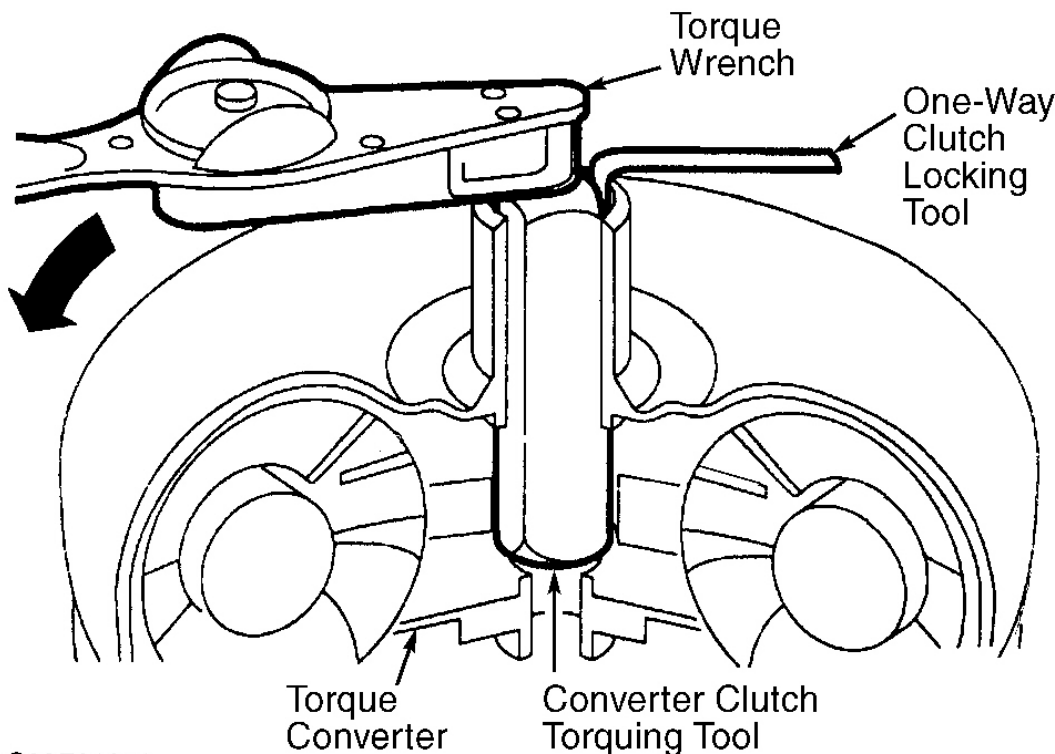
Fig. 14: Checking Torque Converter End Play
Courtesy of FORD MOTOR CO.

TORQUE CONVERTER END PLAY SPECIFICATIONS

Application	In. (mm)
Diesel	
New Or Rebuilt Converter	.024-.048 (.60-1.21)
Used Converter	.079 (2.00) Maximum
Gasoline	
New Or Rebuilt Converter	.014-.038 (.35-.96)
Used Converter	.071 (1.80) Maximum

Converter One-Way Clutch Check

1. Insert One-Way Clutch Locking Tool (T77L-7902-R) in one of stator thrust washer grooves. Insert Converter Clutch Torquing Tool (T76L-7902-C) with torque wrench in converter pump drive hub to engage one-way clutch inner race. See **Fig. 15**.
2. Hold locking tool stationary. Turn torque wrench counterclockwise. Converter one-way clutch should lock up and hold force of 10 ft. lbs. (13 N.m). One-way clutch should turn freely clockwise. Repeat procedure with locking tool in at least 5 locations. Replace torque converter as necessary.



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Fig. 15: Checking Stator One-Way Clutch
Courtesy of FORD MOTOR CO.

Stator-To-Impeller Interference Check (Gasoline Engine Only)

NOTE: Stator support may remain in pump assembly during check.

1. Position stator support on bench with spline end of stator shaft pointing up. Mount torque converter on stator support so splines of one-way clutch inner race engage splines of stator support.
2. While holding pump stationary, rotate torque converter counterclockwise. Torque converter should rotate freely without interference or scraping within assembly. Should interference or a scraping condition within torque converter exist or torque converter does not rotate freely, replace torque converter unit.

Stator-To-Turbine Interference Check (Gasoline Engine Only)

1. Place torque converter on bench, front side down. Install stator support to engage mating splines of stator support shaft.
2. Install input shaft, engaging splines with turbine hub. While holding stator shaft stationary, rotate turbine with input shaft.
3. Turbine should rotate freely in both directions without interference or noise. If interference or noise exists, stator front thrust washer may be worn and torque converter should be replaced.

REMOVAL & INSTALLATION**COOLER BYPASS VALVE (CBV)**

NOTE: DO NOT lose rubber coated sealing washers when removing CBV cooler line case fittings

1. Raise and support vehicle. Remove front cooler line from front (CBV) fitting. See **Fig. 16** . Remove rear cooler line from rear CBV fitting. Remove front and rear CBV bolt cooler line case fittings. Clean and flush CBV. See **COOLER BYPASS VALVE** under COMPONENT DISASSEMBLY & REASSEMBLY.

CAUTION: Ensure Cooler Bypass Valve is properly backflushed. Use dry compressed air to remove excess solvent. If an overhaul is being performed, replace Oil-To-Air (OTA) cooler.

2. To install, reverse removal procedure. Check rubber coated sealing washers for damage. Replace as needed. Use sealant or threadlock meeting Ford specification WSK-M2G351-A5 and coat line case fitting threads. Install CBV with check ball at rear fitting. This allows fluid to flow in one direction only. Ensure that check ball moves freely.

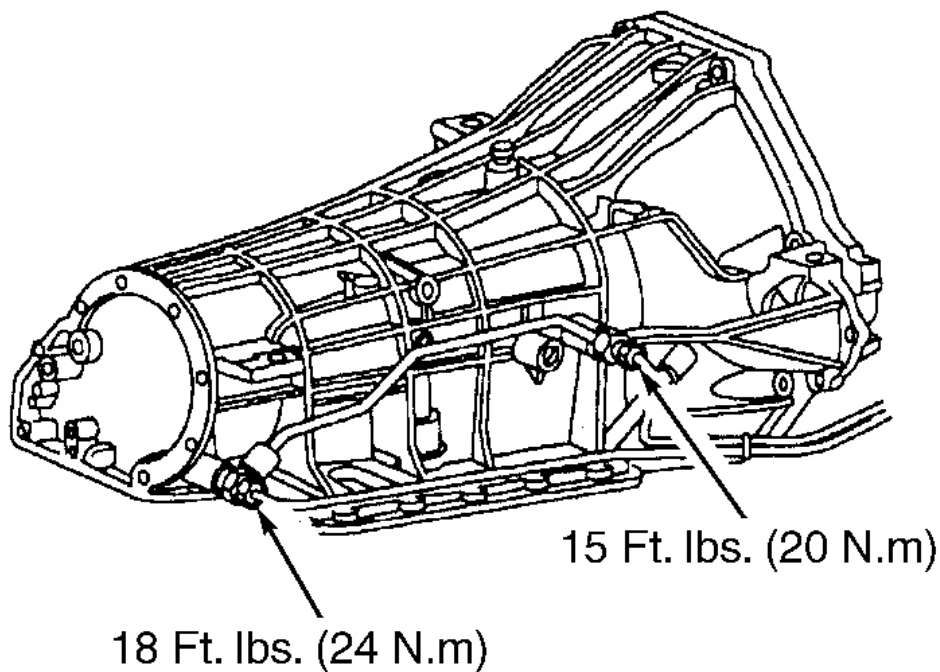
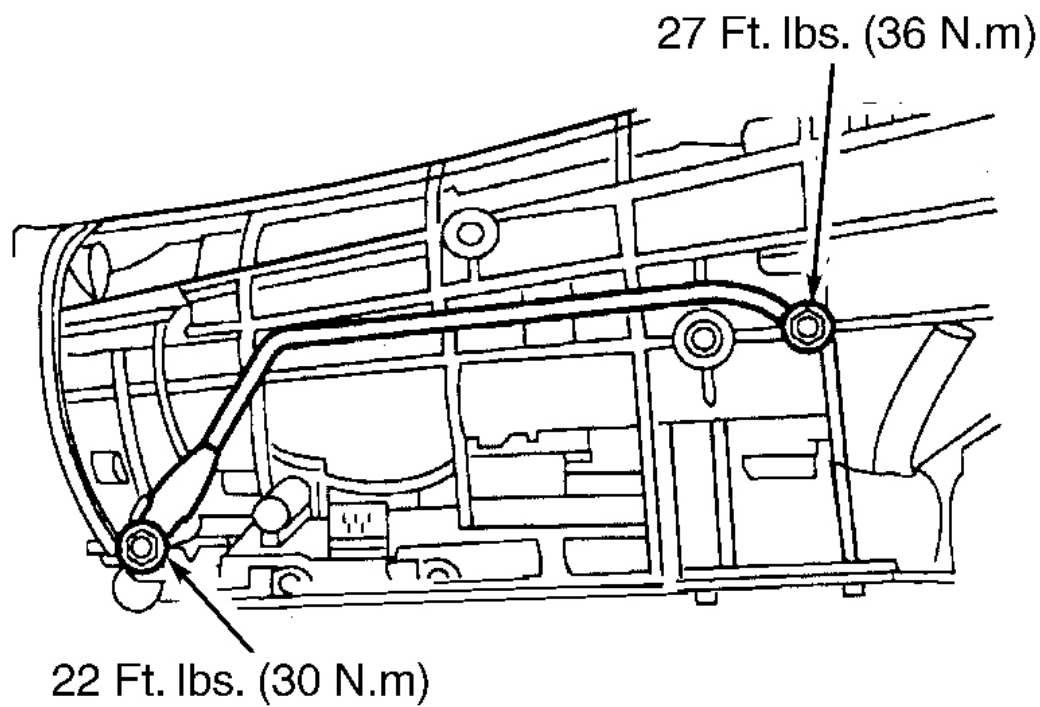
CAUTION: If cooler line case fitting is over-tightened, rubber coated sealing washers and/or cooler line case fittings can be damaged, causing a transmission fluid leak.

3. Install CBV fitting and tighten cooler line nuts to specifications. See **Fig. 16** . See **TORQUE**

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

SPECIFICATIONS . Lower vehicle and add transmission fluid. Start vehicle, apply both foot brakes and move selector lever through each gear position. Check fluid level of transmission and add if necessary.



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Fig. 16: Identifying Cooler Bypass Valve & Case Fitting Bolts

Courtesy of FORD MOTOR CO.

EXTENSION HOUSING GASKET

Removal

NOTE: **DO NOT raise transmission so that case contacts underbody. Raising transmission too high, so that it contacts underbody of vehicle, may cause damage to TSS or OSS sensors.**

Raise and support vehicle. Index and remove drive shaft(s) for reassembly reference. Remove parking brake assembly. On 4WD vehicles, remove transfer case. See appropriate TRANSFER CASE article in AXLE SHAFTS & TRANSFER CASES. On all models, remove transmission mount-to-transmission retaining bolts. Position transmission jack under transmission, and remove transmission mount-to-crossmember bolts. Remove 9 extension housing bolts. Remove extension housing and discard gasket.

Installation

Install NEW extension housing gasket and position extension housing on case. Ensure parking pawl spring is properly seated in case. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

EXTENSION HOUSING SEAL & BUSHING

Removal

Raise and support vehicle. Index and remove rear drive shaft for reassembly reference. Remove extension seal, using appropriate seal remover. Using appropriate bushing remover, remove extension housing bushing. Ensure extension housing is not scored.

Installation

1. Inspect extension housing bushing bore for burrs and remove burrs with an oil stone, as necessary. Install extension housing bushing, aligning lubrication slots to 2 and 7 o'clock positions.
2. Install extension housing seal, aligning drain hole to 6 o'clock position. Ensure seal is seated against extension housing. Install drive shaft, aligning index marks. Check fluid level of transmission and add if necessary.

MANUAL LEVER SEAL

Removal

1. Remove digital Transmission Range (TR) sensor connector. Using a large screwdriver, remove shift cable from transmission manual lever. DO NOT damage cable or fitting. Pry control cable and fitting from lever ball and stud. Remove 2 bolts retaining digital Transmission Range (TR) sensor and remove sensor.
2. Loosen oil pan bolts and drain transmission fluid. Remove oil pan, filter and "O" ring. Discard filter and "O" ring. DO NOT scratch or damage aluminum pump bore. Using Lock Nut Pin Remover (T78P-3504-

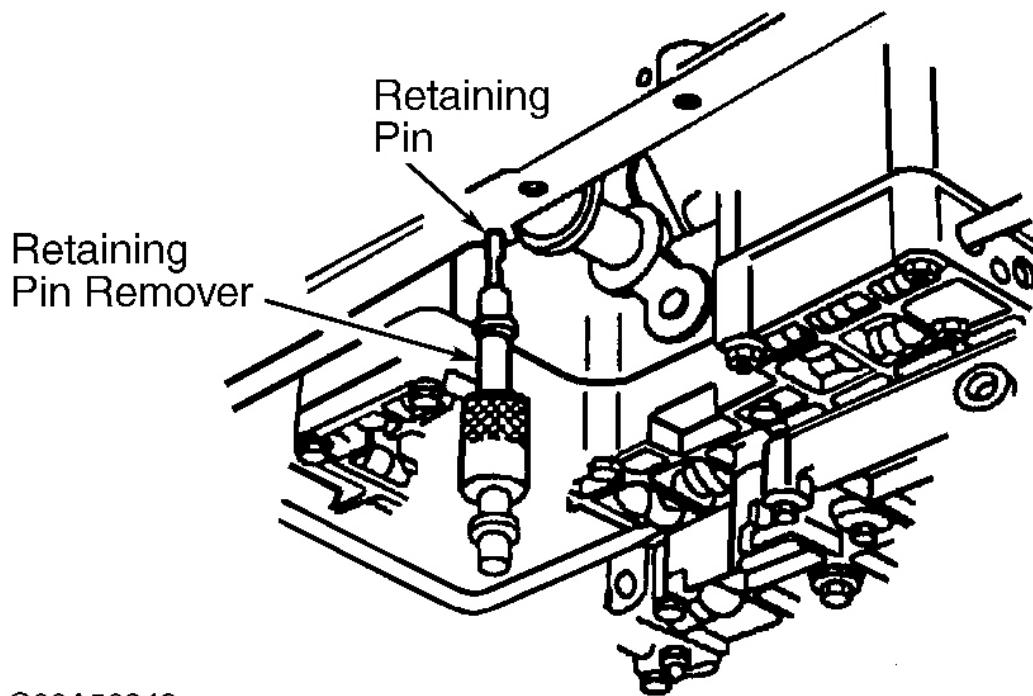
N), remove manual lever retaining pin. See **Fig. 17** . A No. 53 drill bit (1/16") can be used instead of lock nut pin remover.

NOTE: **Outer manual control lever and manual control lever shaft are one piece.**

3. Using a 21-mm box wrench, remove inner detent lever nut. Hold lever with crescent wrench on outer flats of manual control lever shaft. Remove inner detent lever and park actuating rod assembly from manual control lever shaft. Remove manual control lever shaft and seal.

Installation

1. Clean seal bore opening with solvent. Using appropriate seal driver, install seal. Install manual control lever shaft, inner detent lever, park actuating rod assembly and nut. Ensure inner detent lever is seated on flats of shaft, and rod assembly is through guide plate. Inner lever pin **MUST BE** aligned with manual valve.
2. Tighten inner detent lever nut to specification. See **TORQUE SPECIFICATIONS** . Ensure manual valve detent spring is on inner detent lever and aligned with inner detent.
3. Install manual lever shaft retaining pin. Install manual lever position sensor finger tight. Use Gear Position Sensor Adjustor (T92P-70010-AH) to align manual lever position sensor for Neutral gear position. Tighten bolts to specification.
4. Install manual lever position sensor connector. Install shaft linkage and adjust. See appropriate AUTOMATIC TRANSMISSION SERVICING article in TRANSMISSION SERVICING. Install NEW filter and "O" ring assembly. Install oil pan and NEW gasket. Check condition and placement of pan magnet. Tighten oil pan retaining bolts to specifications. See **TORQUE SPECIFICATIONS** .



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Fig. 17: Removing Manual Lever Shaft Retaining Pin
Courtesy of FORD MOTOR CO.

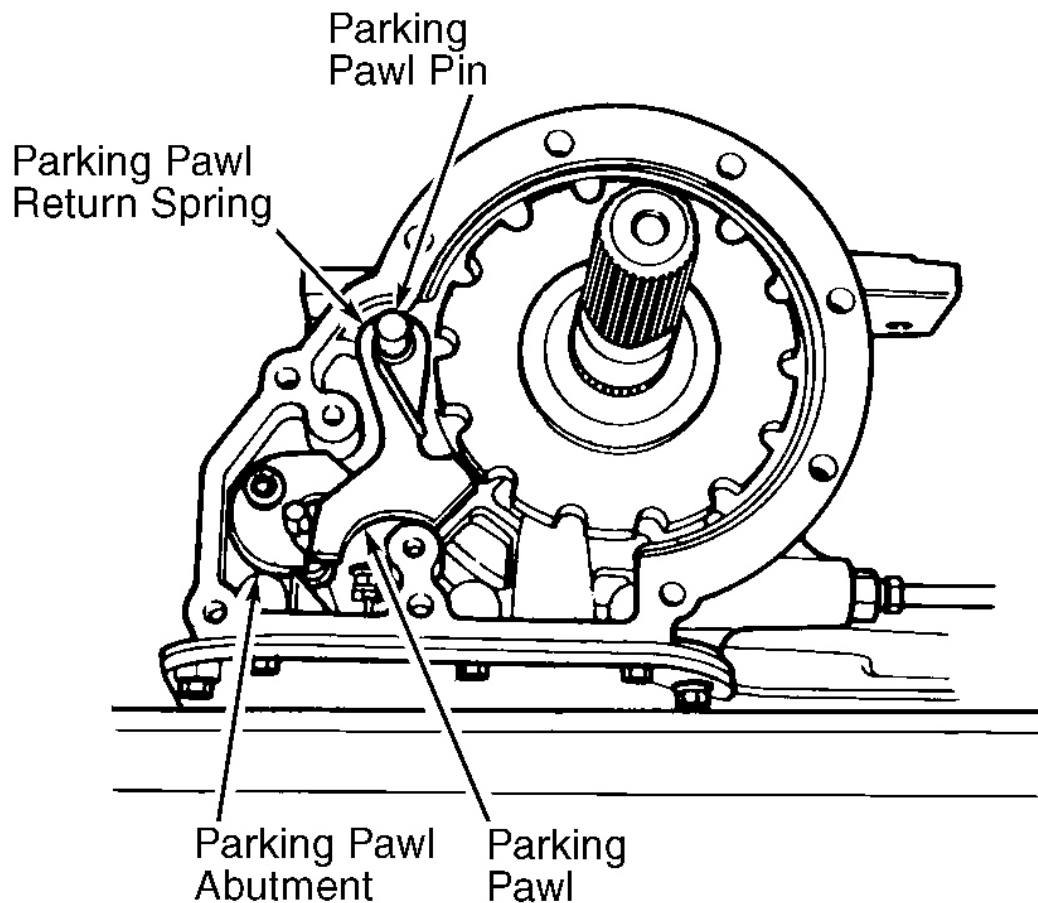
PARKING MECHANISM

Removal

Remove extension housing. See [EXTENSION HOUSING GASKET](#) . Remove parking rod guide plate retaining bolts. Remove parking pawl return spring, parking pawl and parking pawl shaft from case. Remove and discard Torx head bolt) and parking pawl abutment (if required). See [Fig. 18](#) .

Installation

To install, reverse removal procedure. Ensure return spring end rests on inside surface of case, and parking rod guide plate dimple is facing inward. Install NEW Torx bolt (if removed). Tighten bolts to specification. See [TORQUE SPECIFICATIONS](#) .



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Fig. 18: Removing Parking Mechanism
Courtesy of FORD MOTOR CO.

TRANSMISSION ASSEMBLY

NOTE: See appropriate AUTOMATIC TRANSMISSION REMOVAL article in TRANSMISSION SERVICING.

TURBINE SHAFT SPEED SENSOR (TSS) & OUTPUT SHAFT SPEED (OSS) SENSOR

Removal & Installation

NOTE: DO NOT raise transmission so that case contacts underbody. Raising transmission too high, so that it contacts underbody of vehicle, may cause damage to TSS or OSS sensors.

1. Index and remove rear drive shaft for reassembly reference. See FORD MOTOR CO. LIGHT TRUCKS & VANS article in AUTOMATIC TRANSMISSION REMOVAL. Remove 2 rear transmission mount-to-crossmember nuts. Raise and support transmission up off rear crossmember support and remove 2 mount-to-extension housing bolts and remove rear transmission mount.
2. Lower transmission slightly to gain access to TSS and OSS sensors. Remove TSS retaining bolt and remove TSS sensor. Remove OSS retaining bolt and remove OSS sensor. To install, reverse removal procedures. Tighten TSS, OSS retaining bolts and rear mount bolts to specifications. See **TORQUE SPECIFICATIONS**.

VALVE BODY & INTERMEDIATE BAND SERVO

NOTE: If valve body is disassembled, place individual parts in correct order and relation to valve body for reassembly reference. Tag all springs as they are removed.

Removal

1. Remove solenoid body connector heat shield. Remove solenoid body connector by pushing on center tab and pulling on wire harness. DO NOT attempt to pry tab with pry bar or screwdriver. Check electrical connector condition.

NOTE: If separator plate is not going to be removed, prevent front of separator plate from sagging and displacing check balls. Thread one separator plate reinforcement plate bolt into any case threaded bolt hole on front of separator plate.

2. Loosen oil pan bolts and drain fluid. Remove oil pan, filter and "O" ring. DO NOT scratch or damage aluminum pump bore when removing "O" ring. Remove accumulator body. Remove main control valve body retaining bolts and nuts. Do not remove center 2 bolts. See **Fig. 19**. This keeps upper and lower valve body together during disassembly. Remove main control valve body.
3. Remove solenoid body Torx retaining bolts and one nut. Push on solenoid body connector (on outside of case), push through case and remove solenoid body. To remove solenoid screen from separator plate, rotate solenoid screen to align tabs on screen with notches in separator plate and pull outward. See **Fig. 20**. To remove separator plate, remove 3 reinforcing plate bolts and reinforcing plate. Carefully lower separator plate and gasket so check balls, EPC ball and spring are retained.

CAUTION: Use caution when removing intermediate band servo. Spring pressure behind servo will cause outward force on servo and injury could occur.

4. Using plastic or rubber-headed hammer, tap on intermediate servo piston. This forces servo to pop out of case bore. Remove servo retainer, piston and servo spring.

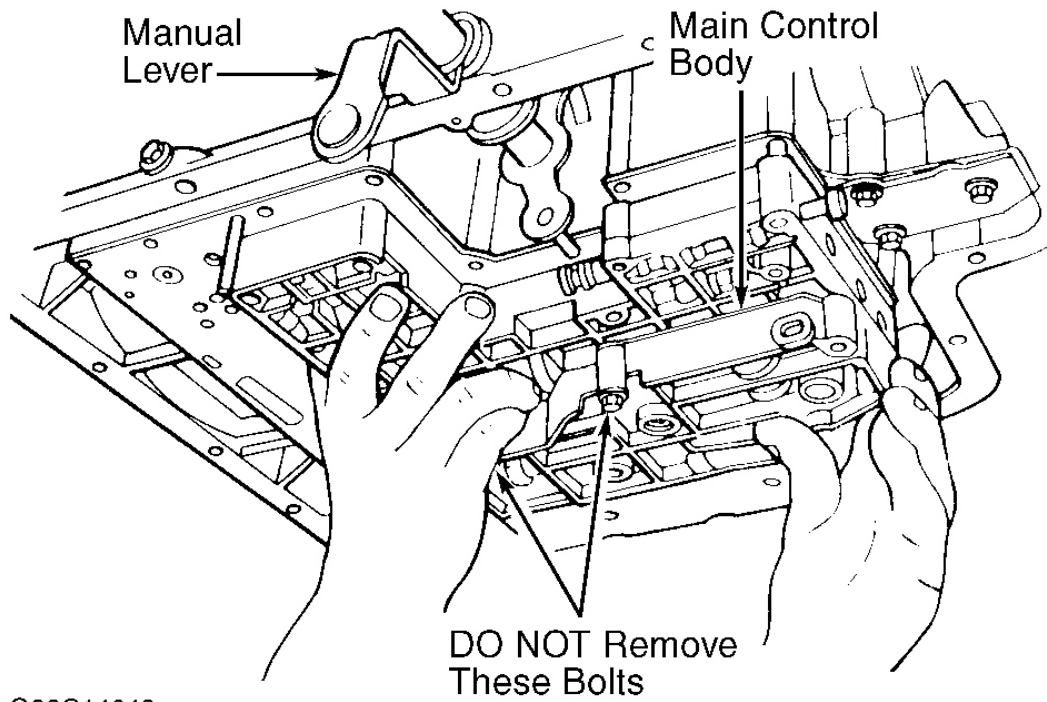


Fig. 19: Removing Main Control Valve Body
Courtesy of FORD MOTOR CO.

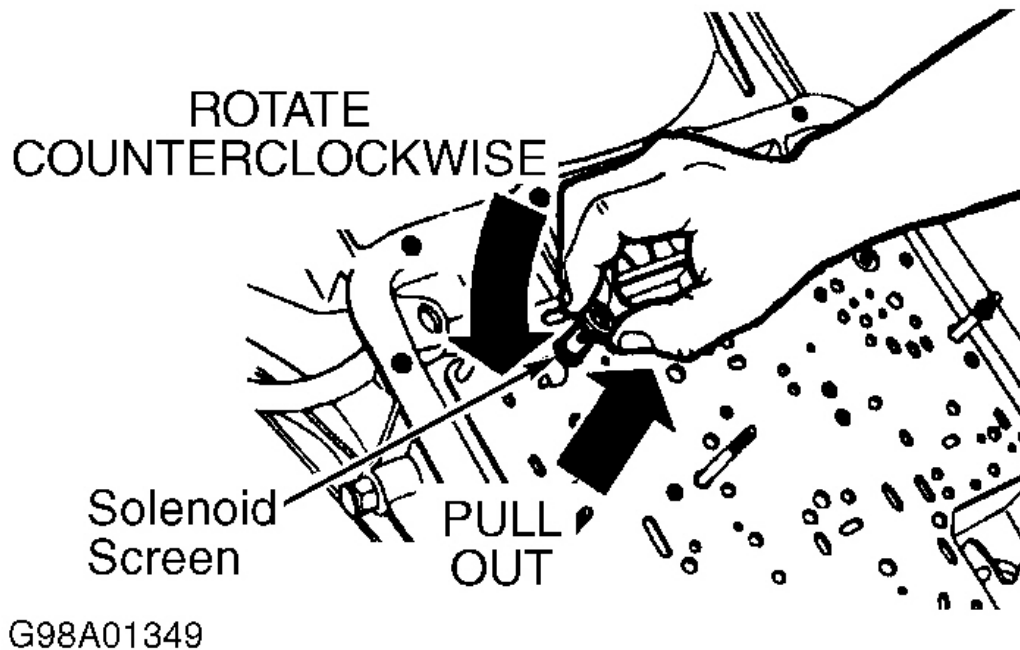


Fig. 20: Removing Solenoid Screen
Courtesy of FORD MOTOR CO.

Installation

1. Clean and inspect valve body thoroughly. DO NOT clean non-metallic check balls with solvent. Ensure servo spring, servo piston and rod assembly are installed correctly. If separator plate was not removed, go to step 3 . Apply petroleum jelly on valve body separator plate where check balls are to be placed. Lightly coat 8 rubber check balls and EPC steel check ball with petroleum jelly and place in position on separator plate. See **Fig. 21** .
2. Apply petroleum jelly to EPC check ball and spring and install into case. Case must be dry and free of ATF, or petroleum jelly will not hold spring and check ball in place while installing separator plate. Install separator plate, gaskets and reinforcing plate. Tighten separator plate retaining bolts to specifications. See **TORQUE SPECIFICATIONS** . The word UP on reinforcing plate MUST be visible.

NOTE: Ensure manual valve is aligned with manual lever prior to tightening main valve body.

3. Install solenoid screen and lock in place. Install main valve body over studs and align manual valve with manual lever. Install and tighten retaining bolts to specification. Install accumulator body retaining bolts. Tighten to specification. See **TORQUE SPECIFICATIONS** .
4. Coat case connector bore with petroleum jelly and install solenoid body retaining bolts and nut. Tighten to specification. Install NEW filter and seal assembly. Install oil pan and NEW gasket. Check condition

and placement of pan magnet. Tighten pan bolts to specification. See **TORQUE SPECIFICATIONS** .

5. Install solenoid body harness connector into case connector. Audible click indicates full connection. Install solenoid body connector heat shield with offset bending inward. Add transmission fluid and start engine. Fill transmission to proper level. Test transmission for proper operation and ensure no leakage is present.

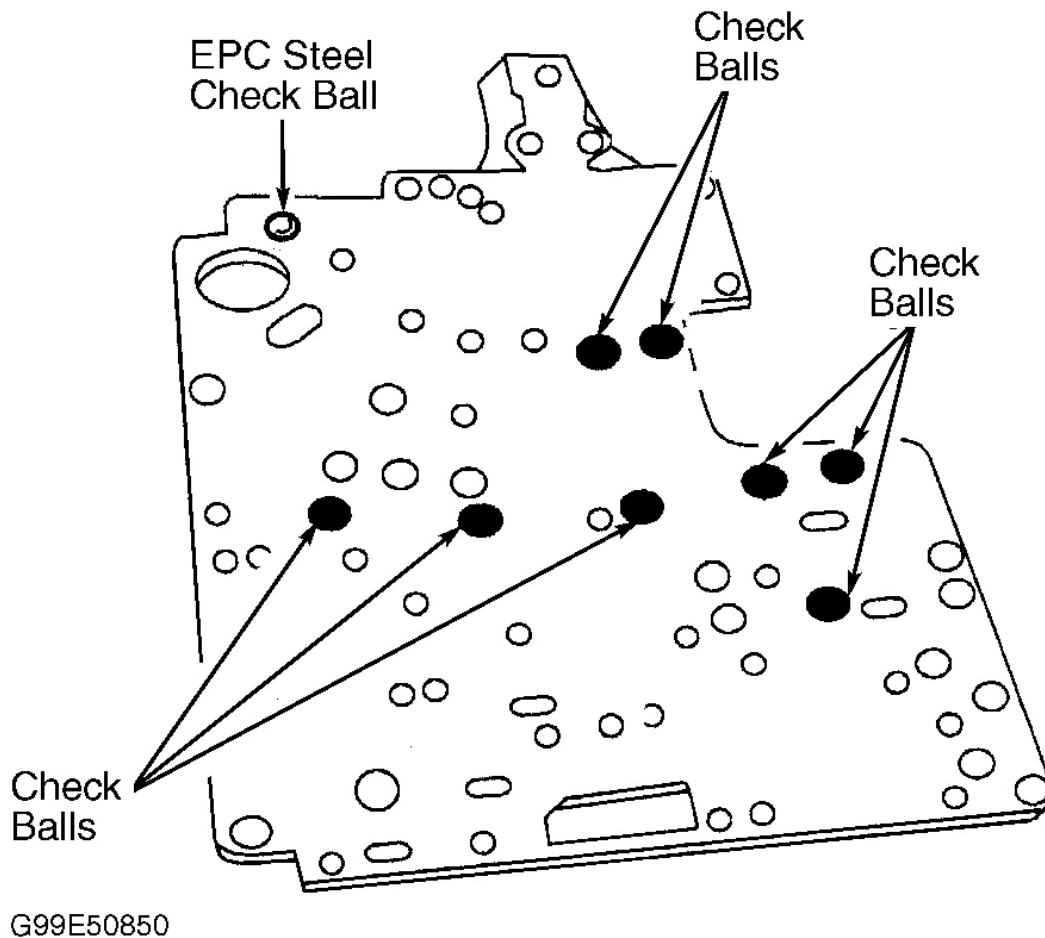


Fig. 21: Locating Case Check Balls On Separator Plate
 Courtesy of FORD MOTOR CO.

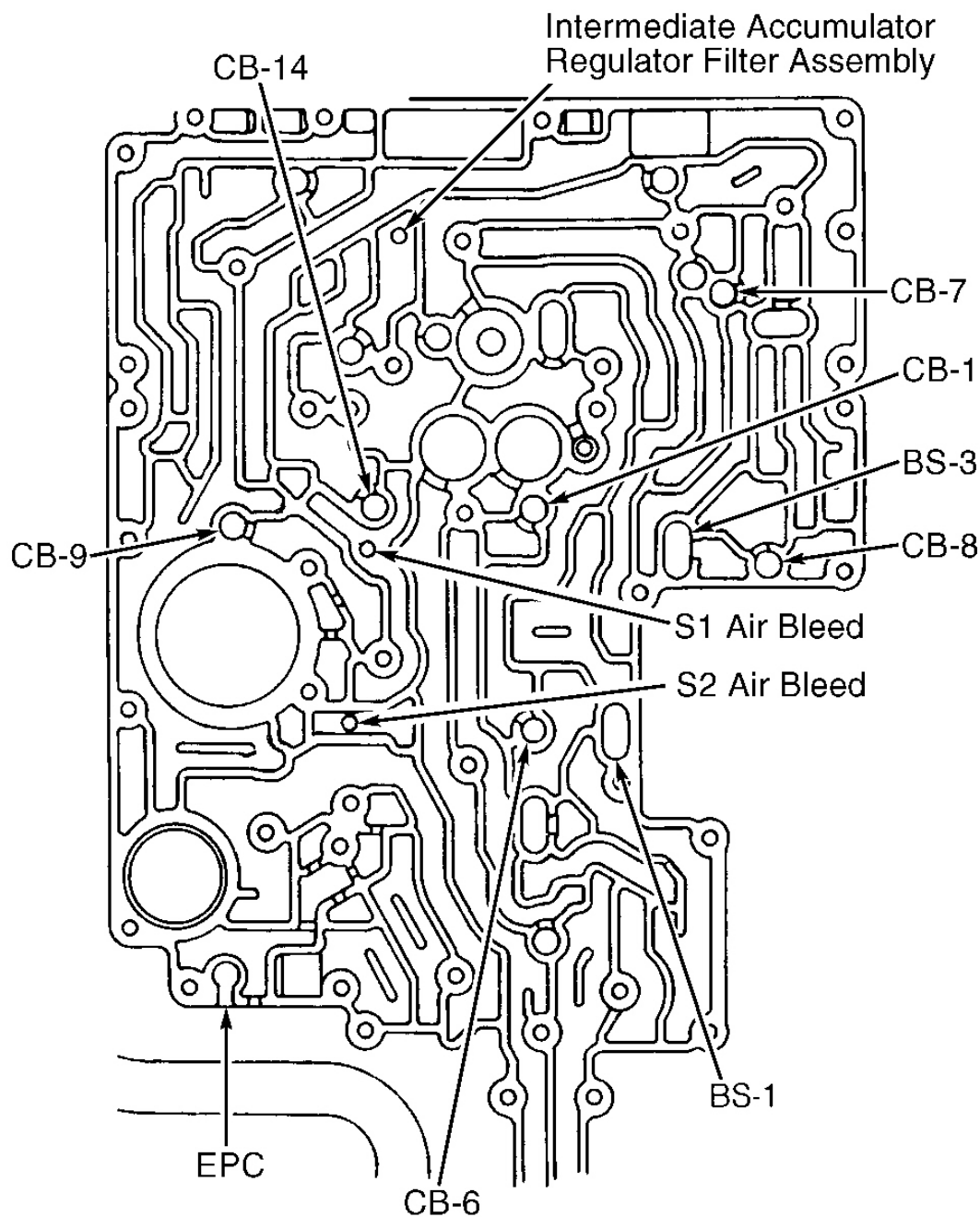
TRANSMISSION DISASSEMBLY

NOTE: For exploded views of internal parts, thrust washer and thrust bearing locations, see **Fig. 46 -Fig. 48** .

1. Remove torque converter. Remove transfer case (if equipped). Remove Turbine Shaft Speed (TSS) and Output Shaft Speed (OSS) sensors. Mount transmission in appropriate holding fixture. Remove input

shaft. Thoroughly clean solenoid body connector area to avoid contamination. Remove oil pan and gasket. Remove filter and "O" ring assembly. DO NOT damage bore in aluminum pump.

2. Remove accumulator body and valve body retaining bolts and 4 nuts. Note bolt locations for reassembly. Do not remove center 2 bolts that secure upper and lower valve bodies together during disassembly. See **Fig. 19** . Remove solenoid body Torx retaining bolts and one nut.
3. Push up on solenoid body connector while removing solenoid body. To remove solenoid screen from separator plate, rotate solenoid screen to align tabs on screen with notches in separator plate and pull outward. See **Fig. 20** . Remove separator reinforcing plate. EPC check ball is spring loaded under separator plate. Remove separator plate and 2 gaskets. Remove EPC check ball and spring. Discard gasket.
4. Remove 8 rubber check balls. DO NOT damage rubber check balls. See **Fig. 22** . Using a plastic or rubber-headed hammer, tap gently on intermediate servo assembly piston. Downward force will cause servo to be released from case bore. Remove 3 feed bolts and discard.



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Fig. 22: Locating Valve Body Check Balls In Case
Courtesy of FORD MOTOR CO.

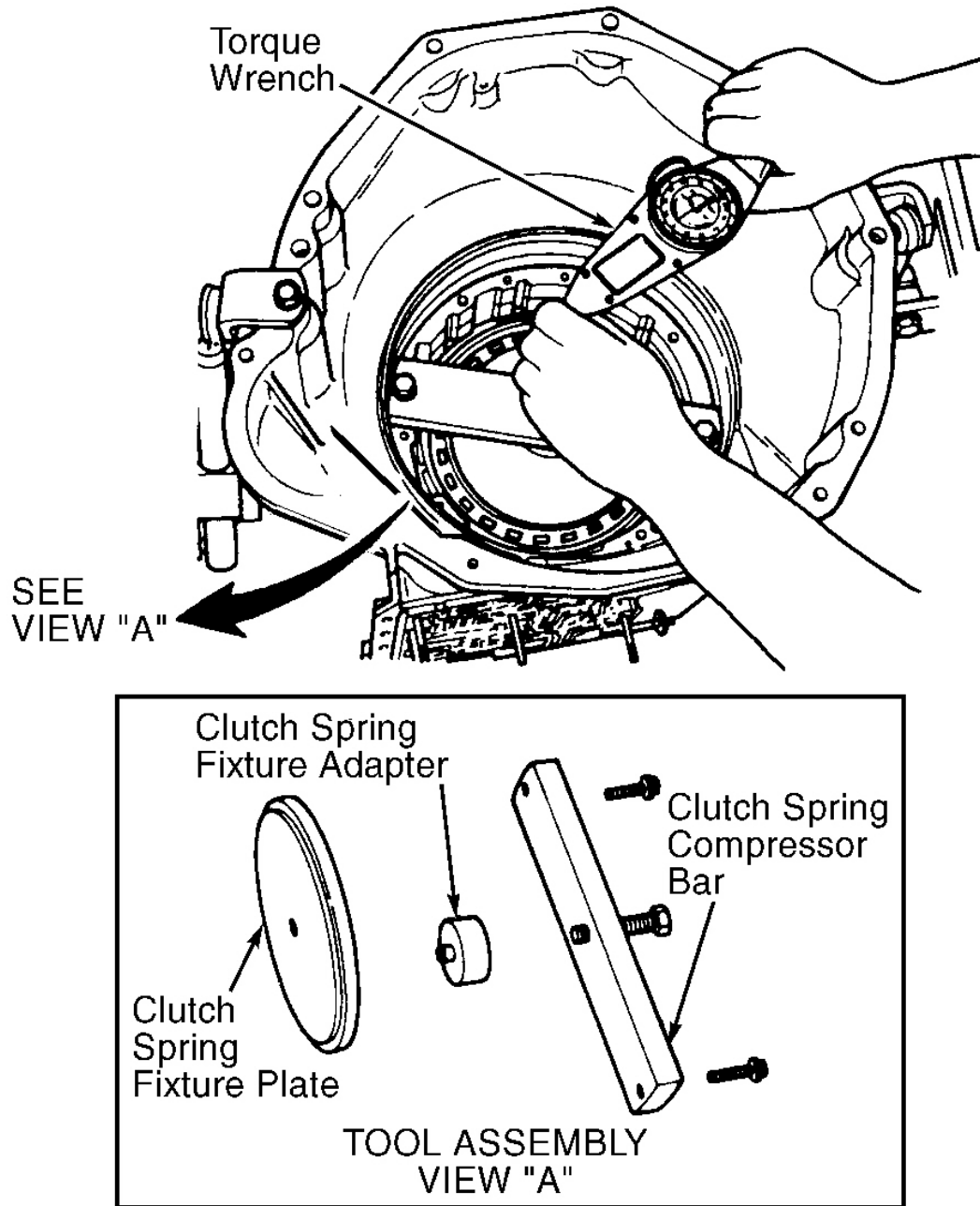
CAUTION: DO NOT use a screwdriver to pry out oil pump. This may cause severe damage to transmission case. When removing coast

clutch/center shaft assembly, special tool (307-S383) must be used or damage to overdrive one-way clutch may occur

5. Rotate transmission so bellhousing is facing upward. Remove 9 pump retaining bolts. Discard washers. Using 2 slide hammers, remove pump, gasket and pump support thrust washer. Remove thrust bearing assembly between front pump and sun gear. Using Coast Clutch Installation Tool (307-S383), lift out coast clutch, overdrive ring gear and center shaft assembly.

NOTE: Ensure No. 5 thrust bearing is not remaining on center shaft or center support.

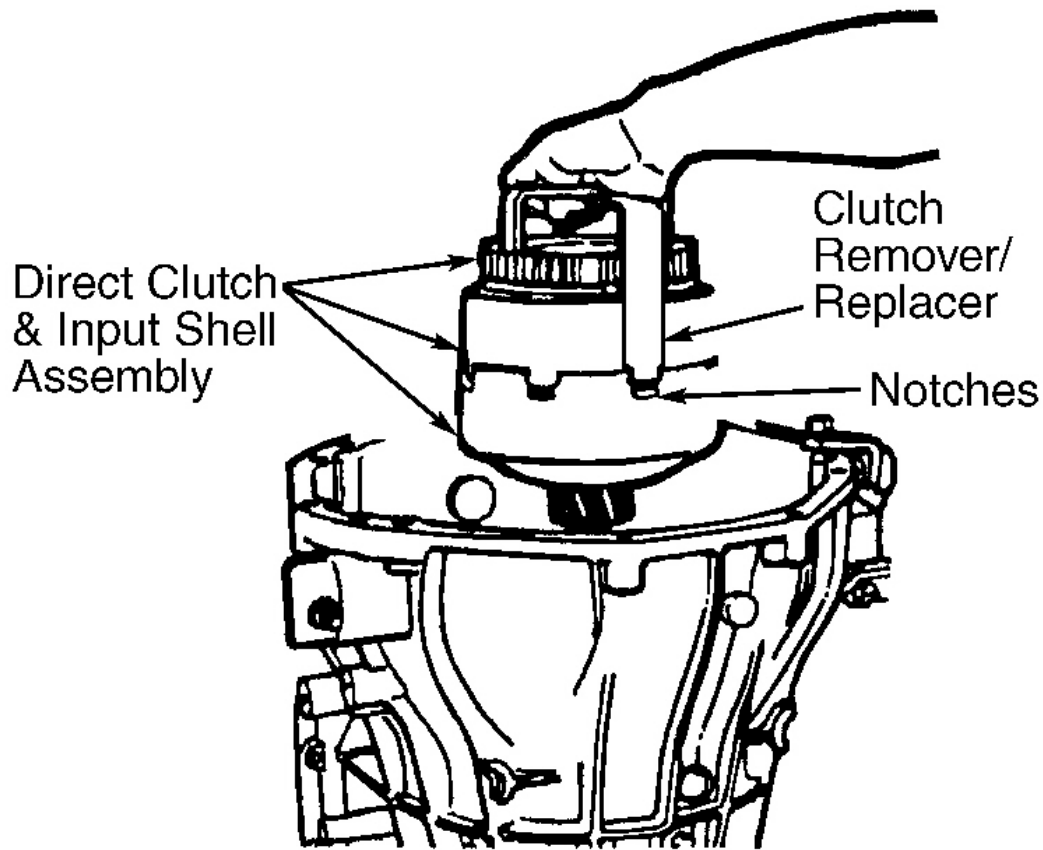
6. Remove No. 5 thrust bearing. Remove overdrive clutch pressure plate retaining ring. Remove overdrive pressure plate and clutch pack. Tag clutch plates for reassembly. Install Clutch Spring Compressor (T89T-70010-C) into case. See **Fig. 23**.
7. Tighten center bolt to 65 INCH lbs. (7 N.m). Remove large retaining ring. Remove spring compressor. Remove intermediate/overdrive cylinder assembly. Remove intermediate return spring, center support and center support thrust washer.



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Fig. 23: Compressing Intermediate/Overdrive Cylinder Assembly
Courtesy of FORD MOTOR CO.

8. Remove intermediate pressure plate and clutch plates. Tag clutch plates for reassembly. Remove intermediate band. Using Clutch Remover/Replacer (T89T-70010-E), remove direct clutch, forward clutch and input shell. Hooks on crossbar **MUST** be rotated into notches on input shell. See **Fig. 24**.



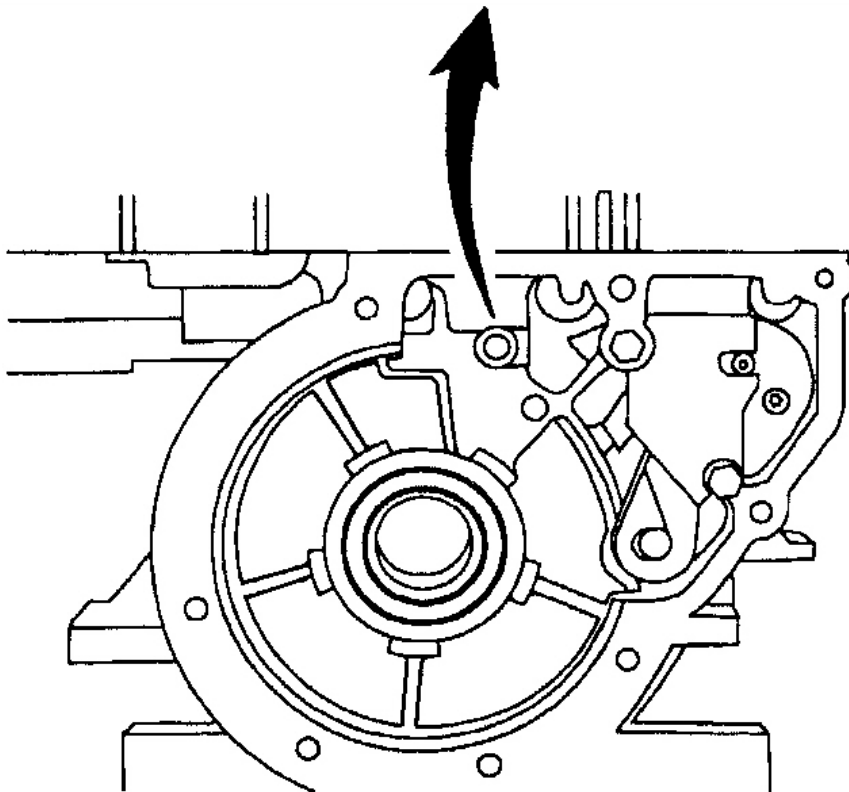
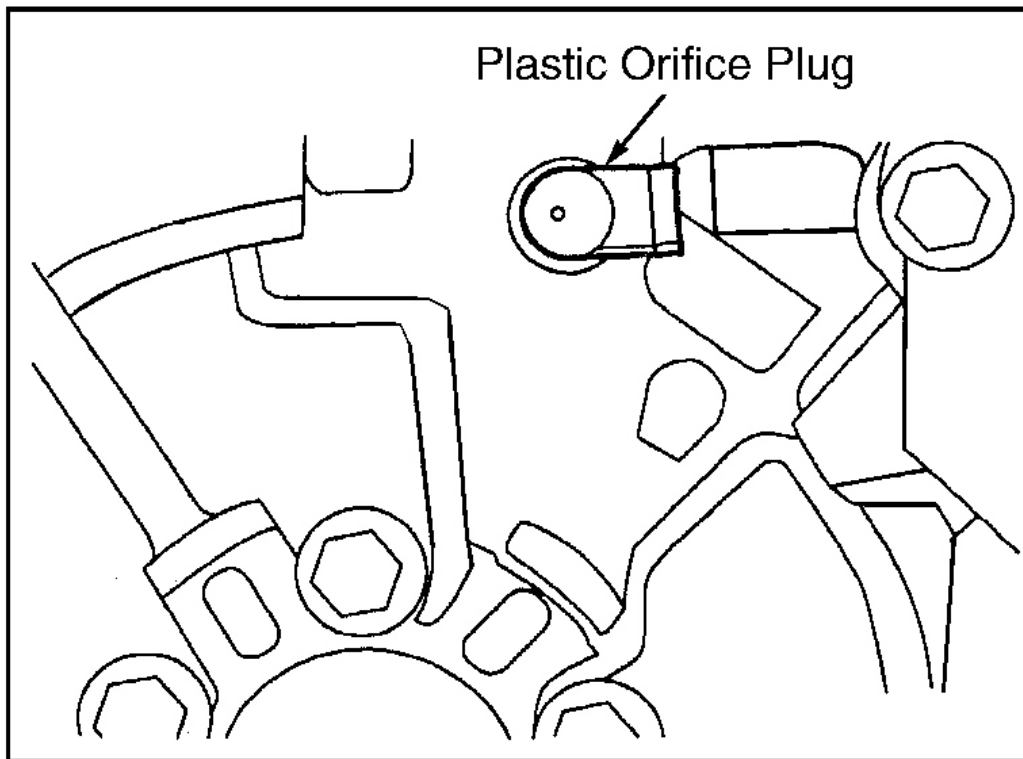
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Fig. 24: Removing Direct Clutch & Input Shell Assembly
Courtesy of FORD MOTOR CO.

CAUTION: Use caution when removing output shaft retaining ring. Output shaft can drop out of case when retaining ring is removed.

9. Using large screwdriver, remove reverse planet assembly retaining ring. Remove reverse planet assembly and 2 planet carrier thrust washers. Remove and discard output shaft retaining ring.
10. Remove rear ring gear and hub assembly and thrust bearing No. 12. Remove reverse clutch hub and one-way clutch assembly. Using large screwdriver, remove reverse clutch retaining ring. Remove reverse pressure plate and clutch pack. Tag clutch plates for reassembly.
11. Rotate transmission so pan surface faces up. Remove 8 extension housing bolts. Remove extension housing and gasket and discard gasket.
12. Remove output shaft, park gear and output shaft thrust bearing No. 13. Remove plastic orifice plug from rear of case and discard. See **Fig. 25** . Remove 5 retaining bolts from low-reverse one way clutch inner

race. Remove reverse clutch return spring assembly and low-reverse one-way clutch inner race.



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Fig. 25: Location Of Rear Orifice Lube Plug
Courtesy of FORD MOTOR CO.

NOTE: Reinstall reverse clutch pressure plate and selective retaining ring to restrain reverse clutch piston during removal.

13. Using compressed air in low-reverse clutch feed port, blow out low-reverse clutch piston against pressure plate. See **Fig. 3** . Remove selective retaining ring, low-reverse clutch pressure plate and low-reverse clutch piston from case.

NOTE: If Torx head bolt retaining parking pawl abutment is removed, it must be discarded and replaced with NEW bolt.

14. Rotate transmission so pan surface faces downward. Remove parking pawl return spring, pin and parking pawl from case. Remove parking rod guide plate. Remove Torx head bolt and parking pawl abutment (if necessary).
15. Using side cutters or remover tool, remove manual lever shaft retaining pin from case. Remove inner detent lever nut, while holding lever with crescent wrench. Remove inner detent lever and parking pawl actuating rod assembly from manual lever.
16. Remove Transmission Range (TR) sensor and manual lever. Remove manual valve detent spring. Using slide hammer, remove manual lever seal. Remove short lube inlet tube, if required using channel lock pliers.

COMPONENT DISASSEMBLY & REASSEMBLY

COAST CLUTCH ASSEMBLY

NOTE: All models use 2 steel and 2 friction plates on coast clutch cylinder assembly.

Disassembly

1. Remove selective pressure plate retaining ring. Remove pressure and clutch plates, and tag plates for reassembly. Remove overdrive one-way clutch. Using appropriate spring compressor, remove return spring retainer. Remove spring compressor.
2. Remove coast clutch cylinder piston return spring, piston and seal assembly. See **Fig. 26** . Inspect outer and inner seals of piston. Replace piston as a complete assembly if seals are damaged.

Inspection

Inspect all parts for wear, damage and effects of overheating. Inspect coast clutch cylinder and overdrive one-way clutch for damage and wear. Replace as necessary.

Reassembly

1. Apply transmission fluid to piston seals before installing. Soak all friction plates in ATF for 15 minutes before installing. Install inner and outer seals with lips facing down in cylinder and piston respectively.

2. Install sun gear (if removed). Install piston, piston apply plate and piston return spring. Use spring compressor and compress springs. Install return spring retaining ring. Carefully remove spring compressor.
3. Install overdrive one-way clutch and turn counterclockwise to lock into place. See **Fig. 26** . Alternately install a steel plate and then a friction plate. Install pressure plate and secure pack with selective retaining ring.
4. Using a feeler gauge, check clearance between selective retaining ring and pressure plate. Ensure clearance is .030-.050" (.76-1.27 mm). If clearance is not within specifications, install correct selective retaining ring. Selective retaining rings are available in thicknesses of .053-.057" (1.35-1.45 mm), .069-.073" (1.75-1.85 mm) and .085-.089" (2.15-2.25 mm). Install correct size retaining ring and recheck clearance.

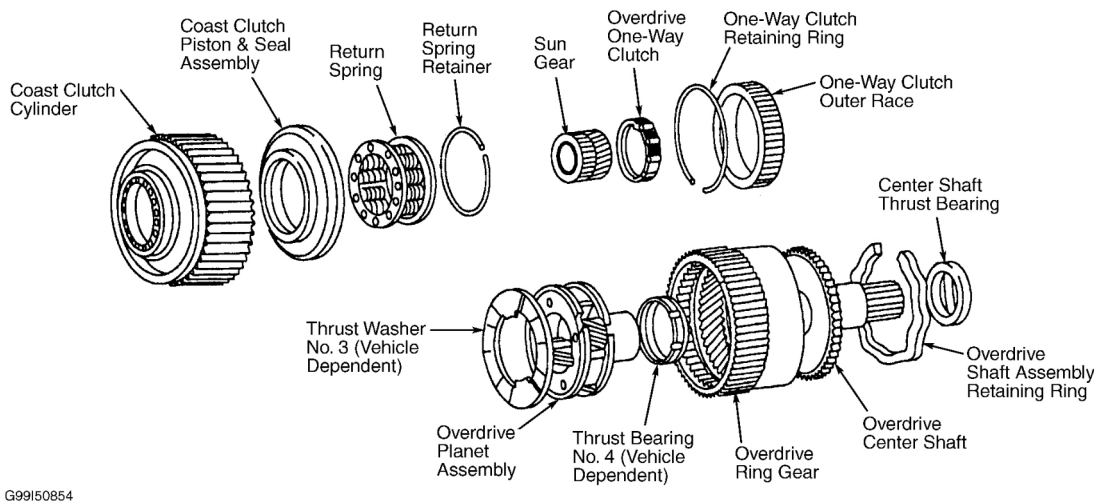


Fig. 26: Exploded View Of Coast Clutch/Overdrive One-Way Clutch Assembly
Courtesy of FORD MOTOR CO.

COOLER BYPASS VALVE (CBV)

NOTE: Cooler Bypass Valve (CBV) must be thoroughly cleaned and flushed out at this time.

1. Remove and inspect cooler line case fittings. See **Fig. 16** . If cooler line case fittings are damaged, replace with NEW fittings. Remove rubber-coated sealing washers. Replace washers if damaged, or fluid will leak at CBV.
2. Inspect all sealing areas for burrs or scratches. If CBV is damaged, replace with NEW CBV. When installing, ensure rubber-coated sealing washers are correctly installed. Install cooler line case fittings and install assembly on transmission.

DIRECT CLUTCH ASSEMBLY

Disassembly

1. Remove intermediate one-way clutch outer race and intermediate one-way clutch. Remove thrust washer No. 7 from between one-way clutch and rear face of intermediate brake drum. Remove thrust washer No. 8A from front face of intermediate brake drum. See **Fig. 27**.
2. Using a screwdriver, remove pressure plate retaining ring. Remove pressure plate and clutch pack. Tag clutch plates for reassembly. Install appropriate spring compressor. Remove return spring retaining ring and return spring assembly. Remove piston from intermediate brake drum. Remove inner and outer seals from drum.

Reassembly

1. Install inner and outer seals in intermediate brake drum with seal lips facing down into drum. Ensure piston check ball moves freely. Install piston into drum. Ensure piston rotates freely in intermediate brake drum.
2. Install return spring assembly with protrusions properly engaged with lugs on clutch piston. Use spring compressor and compress springs. Install retaining ring. Install clutch plates, first using a steel plate and then a friction plate. Install pressure plate and secure pack with selective retaining ring.
3. Using a feeler gauge, check clearance between selective retaining ring and pressure plate. Ensure clearance is .045-.081" (1.15-2.06 mm). If clearance is not within specification, install correct selective retaining ring. Selective retaining rings are available in thicknesses of .056-.060" (1.42-1.53 mm), .065-.069" (1.65-1.75 mm), .074-.078" (1.88-1.98 mm) and .083-.087" (2.11-2.21 mm).
4. Install correct selective retaining ring and recheck clearance. Apply a coat of petroleum jelly to No. 7 thrust washer and install onto intermediate brake drum. See **Fig. 27**. Ensure tabs of thrust washer No. 7 are aligned with notches in intermediate brake drum.
5. Install intermediate one-way clutch end cap, one-way clutch assembly, and bottom end cap into outer race. Lip on one-way clutch faces upward. Install outer race and one-way clutch assembly onto inner race to ensure race turns counterclockwise. Apply a coat of petroleum jelly to thrust washer No. 8A and install onto intermediate brake drum face. See **Fig. 27**. Ensure tabs on thrust washer No. 8A align with notches in drum.

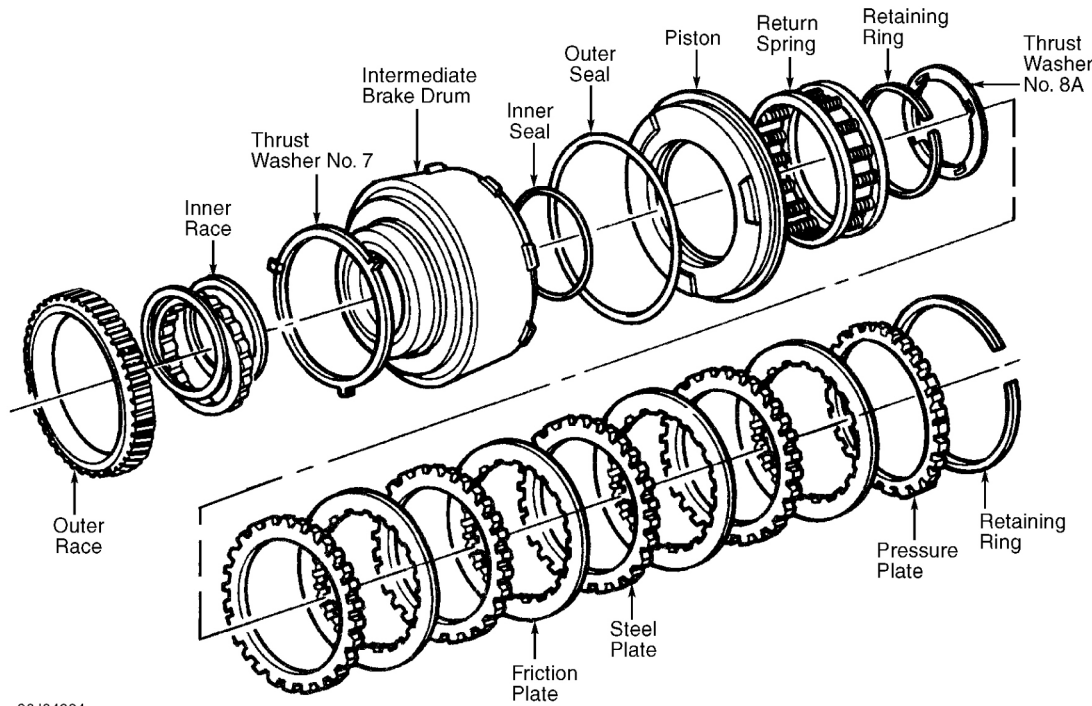


Fig. 27: Exploded View Of Direct Clutch Assembly
Courtesy of FORD MOTOR CO.

FORWARD CLUTCH ASSEMBLY

Disassembly

1. Remove both thrust bearings and both outer seal rings from forward clutch cylinder. Remove retaining ring and forward pressure plate. Remove clutch plates, cushion spring and rear pressure plate. Tag clutch plates for reassembly.
2. Remove spring retainer and piston return spring. Remove piston apply ring from piston groove. Remove cylinder piston with compressed air. Remove outer seal from forward clutch cylinder piston and inner seal from clutch cylinder.

Reassembly

1. Install inner seal in cylinder and outer seal on cylinder piston with seal lip facing toward back side of piston. Ensure forward clutch cylinder piston check ball moves freely. Using appropriate lip seal protector, install piston into cylinder. Install piston apply ring into groove on piston. See **Fig. 28** . Install piston return spring with fingers against piston and steel ring. Ensure both ends of piston apply ring are visible between fingers of piston return spring. See **Fig. 29** . Install spring retainer.
2. Install rear pressure plate and cushion spring. Install 4 steel plates, and 4 friction plates. Alternately install a steel plate and then a friction plate. See **Fig. 28** . Install forward pressure plate and secure pack with selective retaining ring.
3. Using a feeler gauge, check clearance between selective retaining ring and pressure plate. Ensure

clearance is .030-.055" (.76-1.40 mm). If clearance is not within specifications, install correct selective retaining ring. Selective retaining rings are available in thicknesses of .056-.060" (1.42-1.52 mm), .074-.078" (1.88-1.98 mm), .092-.096" (2.34-2.44 mm), .110-.114" (2.79-2.90 mm) and .128-.132" (3.25-3.35 mm). Install correct selective retaining ring and recheck clearance.

NOTE: Forward clutch cylinder seal rings will be Teflon from factory and should be replaced with cast iron rings for longevity.

4. Install 2 cast iron seal rings, ensuring ring ends are placed 180 degrees apart. Install thrust bearing No. 8A over outer seal hub. See **Fig. 28** . Apply a light coat of petroleum jelly to thrust bearing No. 9A. Install thrust bearing No. 9A on inner face of forward clutch cylinder with rounded corner facing clutch cylinder. See **Fig. 30** .

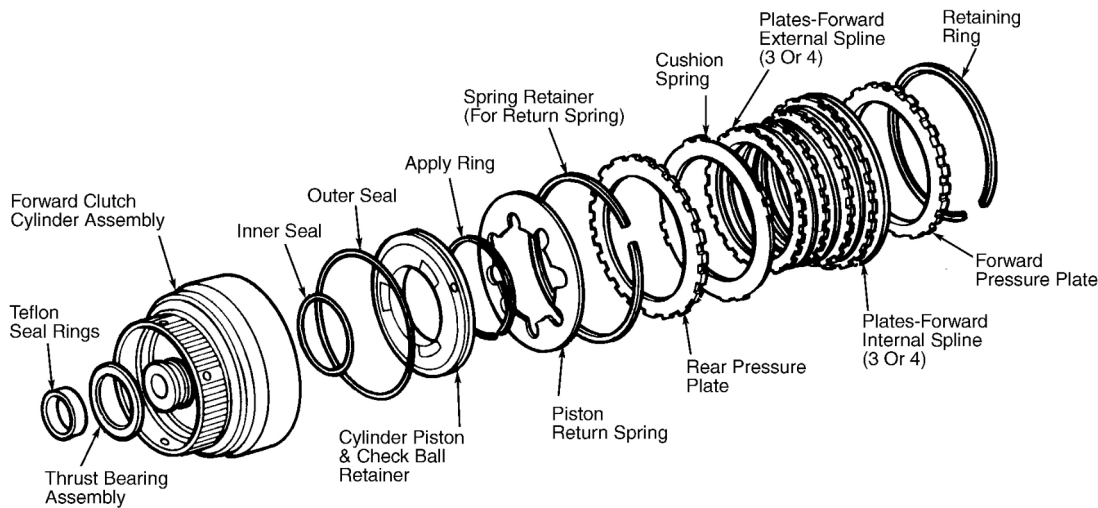
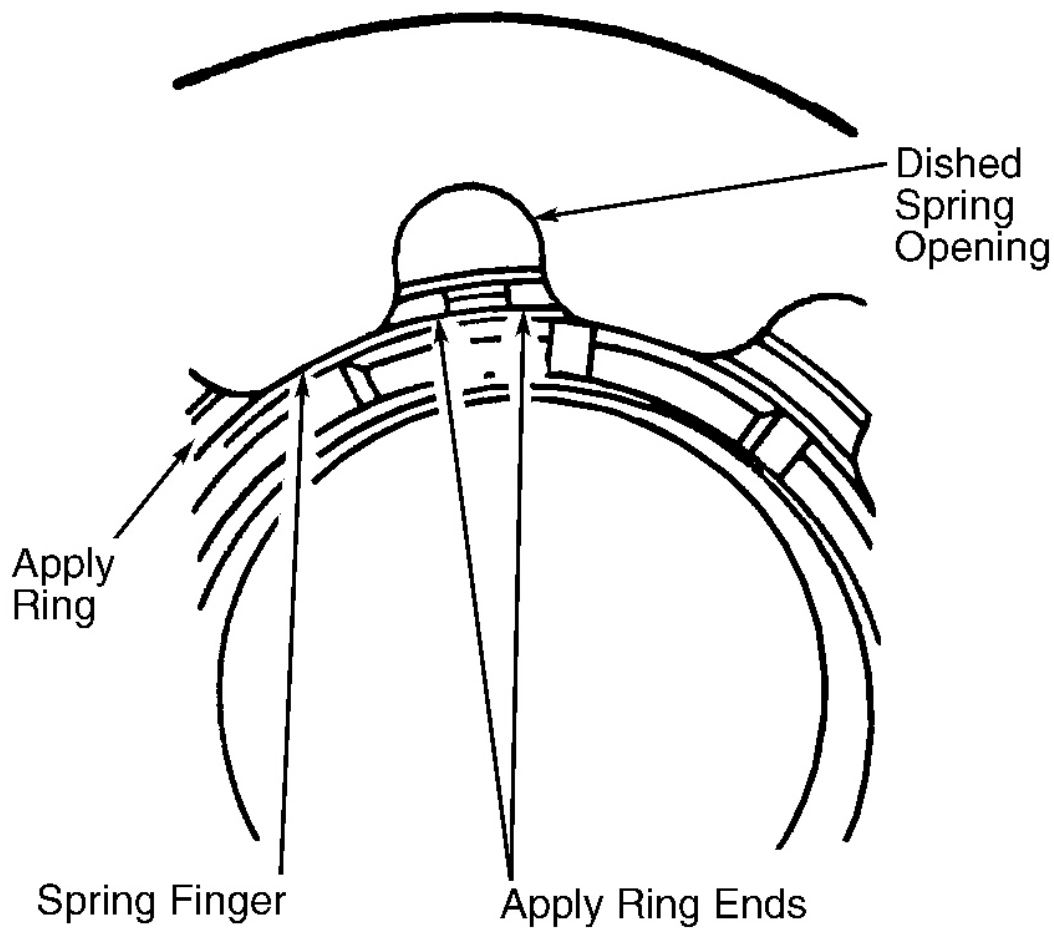
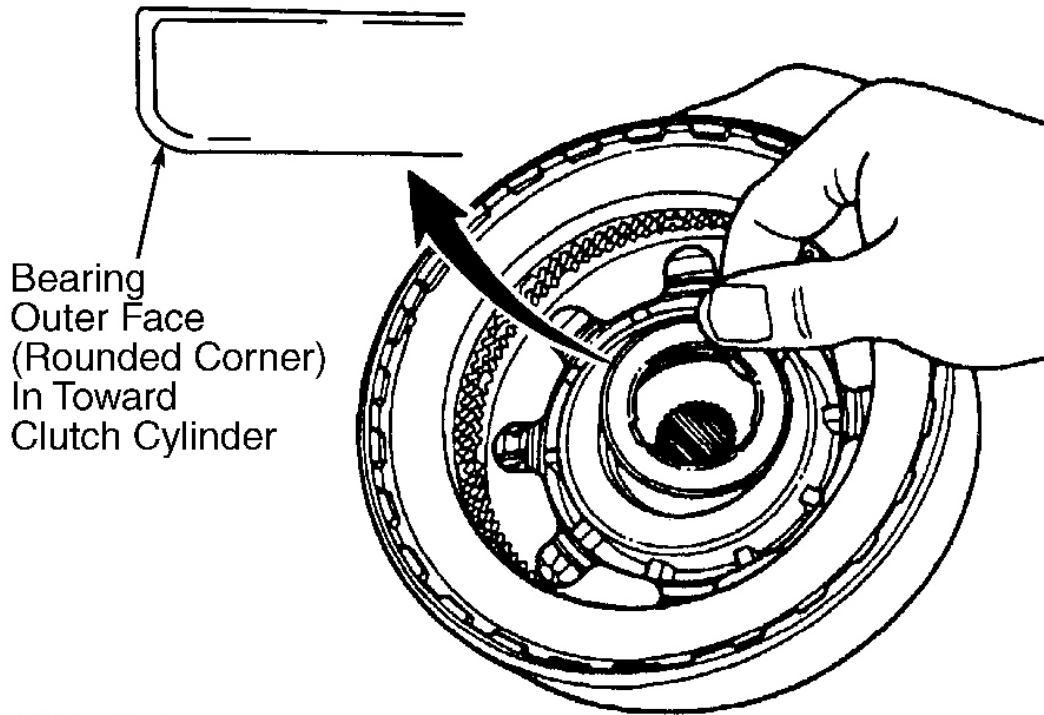


Fig. 28: Exploded View Of Forward Clutch
Courtesy of FORD MOTOR CO.



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Fig. 29: Installation Of Piston Apply Ring
Courtesy of FORD MOTOR CO.



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Fig. 30: Installation Of Forward Clutch Cylinder Thrust Bearing No. 9A
Courtesy of FORD MOTOR CO.

INPUT SHELL

Disassembly & Reassembly

Remove and discard forward/reverse sun gear retaining ring. Remove input shell thrust washer. Remove forward/reverse sun gear from input shell. See [Fig. 47](#) and [Fig. 48](#) . To reassemble, reverse disassembly procedure. Ensure lube hole in sun gear is between standoff pads on input shell.

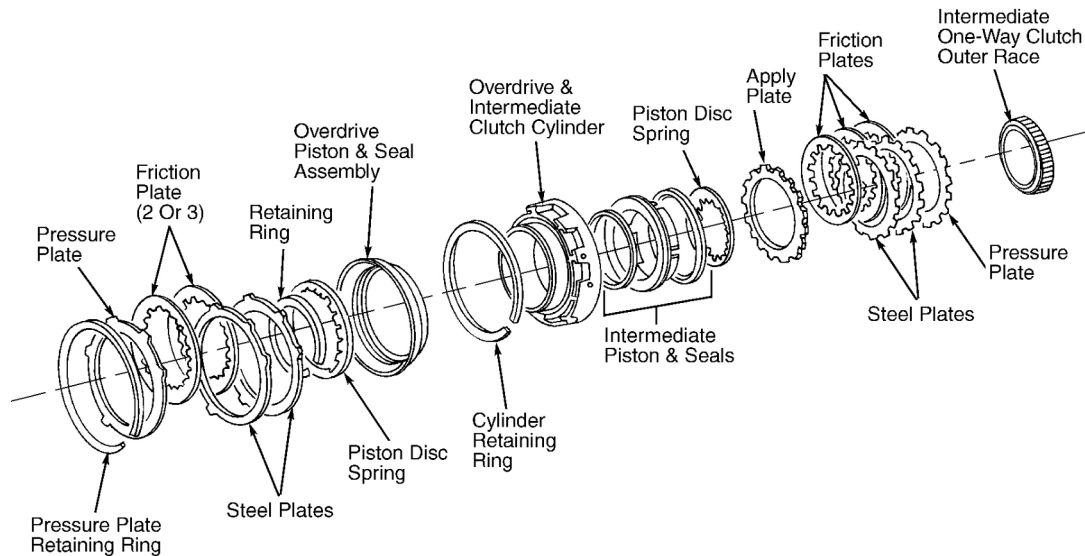
INTERMEDIATE/OVERDRIVE CLUTCH CYLINDER ASSEMBLY

Disassembly

1. Using appropriate spring compressor, compress overdrive disc spring. Remove retaining ring. Remove spring compressor. Remove overdrive disc spring.
2. Remove overdrive piston and seal assembly. Outer and inner seals are bonded to overdrive piston. See [Fig. 31](#) . Remove intermediate piston from cylinder bore. Remove inner and outer seals from intermediate piston. Remove 2 cast iron outer seal rings and thrust washer No. 6 from center support assembly. See [Fig. 47](#) and [Fig. 48](#) .

Reassembly

To reassemble, reverse disassembly procedure. Outer and inner seals are installed with lips facing down toward cylinder. Overdrive disc spring fingers face up. Ensure piston rotates freely in cylinder.



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Fig. 31: Exploded View Of Intermediate & Overdrive Clutches
Courtesy of FORD MOTOR CO.

LOW-REVERSE ONE-WAY CLUTCH

Disassembly

Remove output shaft ring gear and thrust washer No. 12 from reverse clutch hub. See **Fig. 32** . Rotate low-reverse one-way clutch counterclockwise and remove from reverse clutch hub at rear of case by lifting upward.

Reassembly

To reassemble, reverse disassembly procedure. Install one-way clutch into reverse clutch hub and rotate clockwise to seat one-way clutch. Ensure locking tabs are against hub.

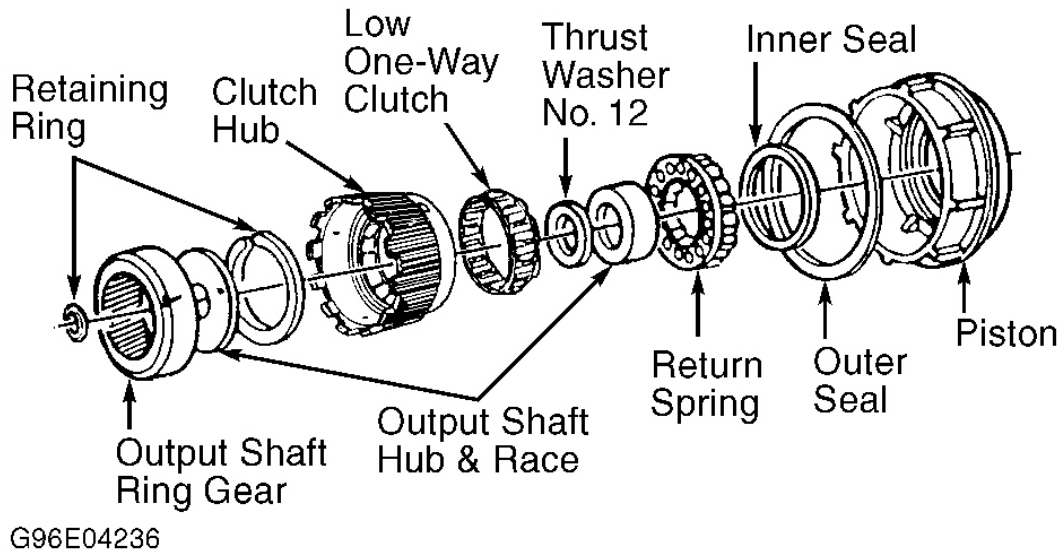


Fig. 32: Exploded View Of Low-Reverse One-Way Clutch
Courtesy of FORD MOTOR CO.

OIL PUMP ASSEMBLY

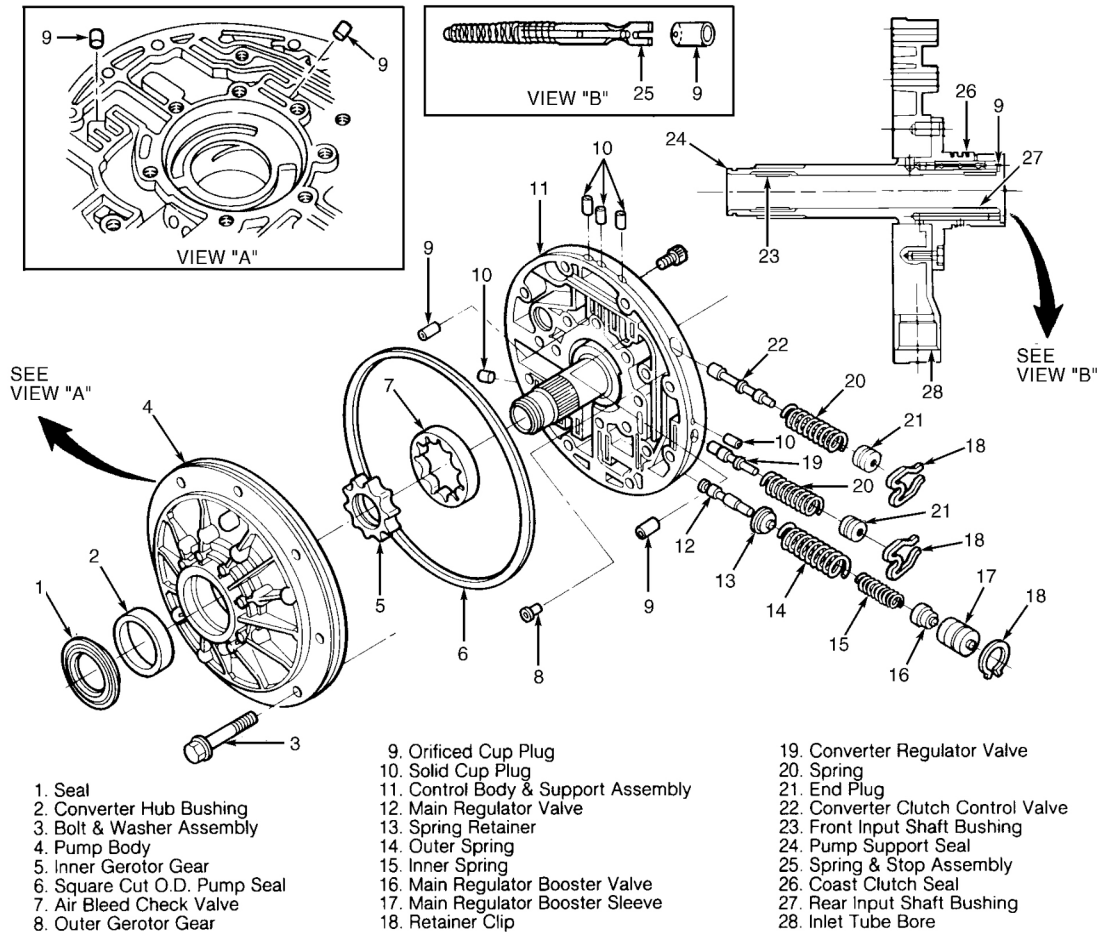
Disassembly

CAUTION: Failure to replace orifice cup plug may lead to repeat repairs. Ensure OLD rubber stop is removed from orifice bore. See VIEW "B" in Fig. 33 . DO NOT remove any other orifice cup plugs, unless directed to do so.

1. Remove coast clutch seals from stator support. Remove large square cut seal from outside diameter of pump housing. Using internal puller, remove converter hub seal from pump body. Remove and discard orifice cup plug, spring and stop assembly.

NOTE: To prevent distortion of control body surface, DO NOT remove stator support from control body.

2. Remove 11 pump control-to-pump body bolts. Separate pump control body from pump body. Using a small screwdriver or similar tool, apply pressure to main regulator booster sleeve. Remove internal retainer clip. Remove main regulator booster sleeve, booster valve, springs and all other components in main regulator bore. See Fig. 33 .
3. Remove converter regulator valve and converter clutch control valve assemblies by applying pressure to end plug and removing retainer clip with small screwdriver or tweezers. DO NOT remove any cup plugs unless damaged or leaking. See Fig. 33 . Remove gerotor gear set from pump body.



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Fig. 33: Exploded View Of Oil Pump Assembly
Courtesy of FORD MOTOR CO.

Inspection

Thoroughly clean and inspect all components for damage, wear or scoring. Carefully check all teeth on gears. Replace pump assembly if any part is damaged or worn. Inspect converter hub bushing. Replace if defective. Stake bushing at notches. Inspect stator input shaft bushings. Replace control body assembly if bushings are worn. If necessary, use crocus cloth to polish components. Use caution to avoid rounding sharp edges of valves and plugs. Replace defective parts.

Reassembly

1. Install main regulator booster valve. Apply pressure to booster sleeve and install internal retainer ring. Install converter clutch control and regulator valves. Lightly coat gerotor gears with transmission fluid and install in pump body. Dot on inner gerotor gear faces control body assembly.
2. Using depth micrometer, measure clearance between each gear and pump body. Clearance should be .0010-.0020" (.025-.051 mm). Replace parts as needed. Lower control body assembly into pump body. Align 28-mm round holes in control body assembly and pump body.

3. Loosely install 11 pump body bolts. Install alignment bolt. See **Fig. 34** . Using Banding Tool (307-D004), ensure outer bolt holes of pump body and control body assembly are aligned. Tighten retaining bolts to specification. See **TORQUE SPECIFICATIONS** . Remove banding tool. Ensure outer edges of control body and pump body are completely aligned.
4. Install coast clutch seals. Ensure seals are fully seated in grooves with gaps 180 degrees apart. Install pump square cut outer diameter seal. Lubricate seal with transmission fluid before installing pump into case.
5. Install NEW spring and stop assembly, place end with rubber stop into bore first. Install NEW cup plug. Ensure cup plug edges are below stator support surface. Install converter hub seal. Apply petroleum jelly to oil pump thrust washer No. 1 and thrust bearing No. 2A and install onto stator support.

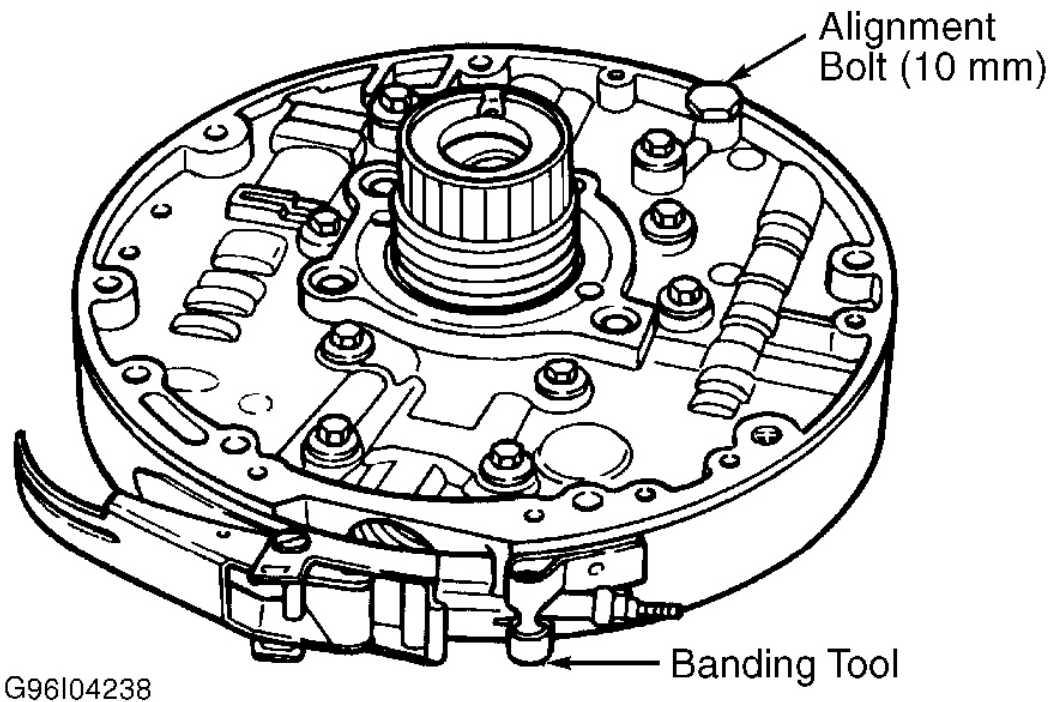


Fig. 34: Aligning Pump Body & Support Assembly
 Courtesy of FORD MOTOR CO.

OUTPUT SHAFT

CAUTION: Build-up of contamination can block flow of lubricant behind cup plug and cause transmission assembly damage.

NOTE: Output shaft can not be disassembled and **MUST** be replaced if damaged.

1. Inspect output shaft for signs of wear or overheating on bushing surface areas. If signs of wear or overheating are found, also inspect mating components for damage. Inspect all splines on output shaft for wear or scores. Inspect all bushings for wear. Replace if worn, scored or damaged.
2. Inspect parking gear and output shaft tone wheel for damage. If either is damaged, replacement is required. Use an arbor press to remove gear or tone wheel. If either require replacement, DO NOT damage when installing NEW parts with press.

OVERDRIVE RING GEAR & CENTER SHAFT ASSEMBLY

Disassembly

1. Remove outer race-to-ring gear retaining ring. Remove overdrive one-way clutch outer race. Remove thrust washer No. 3 from overdrive planet assembly. See **Fig. 26** . Remove overdrive planet assembly from ring gear assembly.
2. Remove thrust bearing No. 4 from front of overdrive planet assembly. Ensure thrust bearing No. 4 does not stay in ring gear/center shaft assembly. Remove thrust bearing No. 5 from bottom of overdrive center shaft. Remove center shaft-to-ring gear retaining ring and center shaft from ring gear.

Reassembly

To reassemble, reverse disassembly procedure. Ensure thrust washers and thrust bearings are installed in their original locations and are pre-lubed with ATF. Install overdrive one-way clutch outer race with beveled edge facing up into ring gear. Install retaining ring and ensure it is completely seated. Install Coast Clutch Installation Tool (307-S383) for assembly installation during reassembly of transmission.

MAIN CONTROL VALVE BODY & ACCUMULATOR VALVE BODY

Disassembly

Disassemble valve body. See **VALVE BODY & INTERMEDIATE BAND SERVO** under ON-VEHICLE SERVICE. Remove all valves, plungers, plugs, check balls and springs from main control valve body and accumulator valve body. See **Fig. 35** and **Fig. 36** .

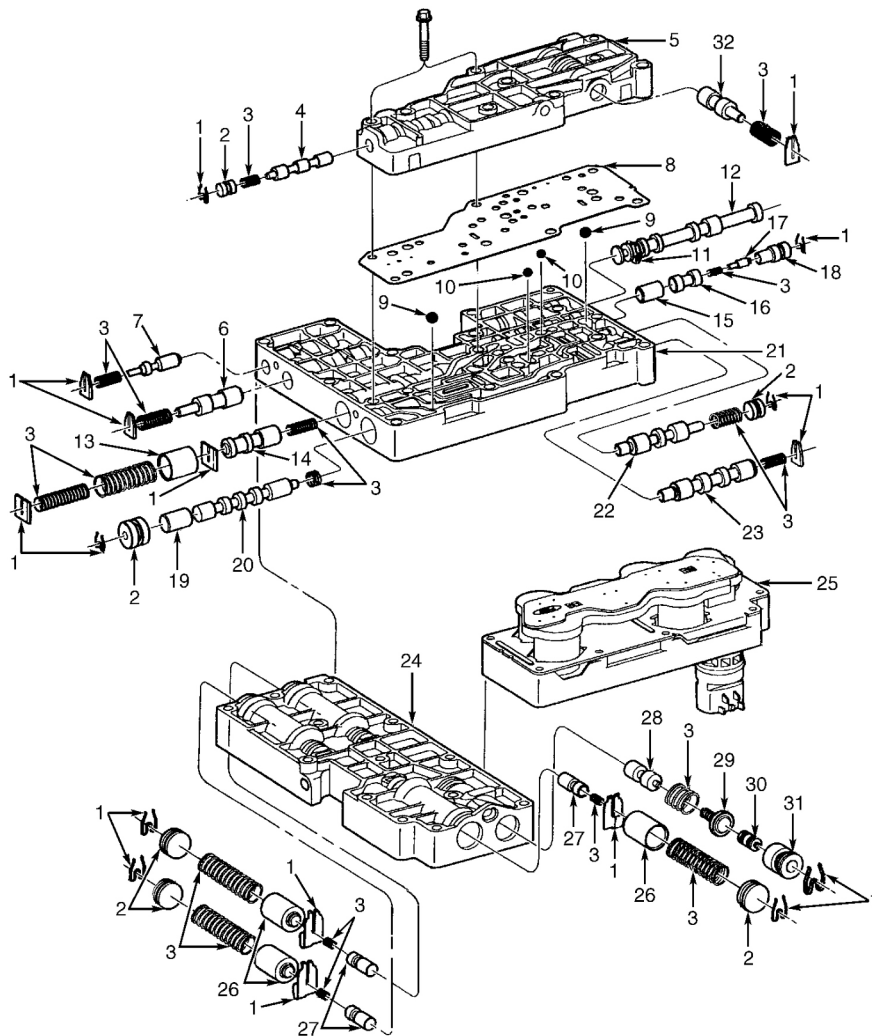
Inspection

1. Clean all parts, except non-metallic check balls, in clean solvent. Blow dry with compressed air.
2. Inspect all valve and plunger bores for scores. Check all fluid passages for obstructions. Inspect all mating surfaces for burrs and scores. If necessary, use crocus cloth to polish valves and plungers. Avoid rounding sharp edges of valves and plungers with crocus cloth.
3. Inspect all springs for distortion. Check all valves and plungers for free movement in their respective bores. Valves and plungers, when dry, should fall by their own weight into their respective bores. Roll manual valve on a flat surface to check for bending.

Reassembly

Install all valves, plungers, plugs, check balls and springs into main control valve body and accumulator valve body. See **Fig. 35** and **Fig. 36** . To complete reassembly, reverse disassembly procedure. See **VALVE BODY**

& INTERMEDIATE BAND SERVO under ON-VEHICLE SERVICE.



- | | | |
|-----------------------------|---|-------------------------------------|
| 1. Retainer | 12. Manual Control Valve | 23. 2-3 Shift Valve |
| 2. Plug | 13. Control Valve Shift Timing Plunger | 24. Accumulator Control Valve Body |
| 3. Spring | 14. 4-3-2 Manual Timing Valve | 25. Solenoid Body Assembly |
| 4. Engagement Control Valve | 15. Low/Reverse Modulator Valve | 26. Accumulator Regulator Plunger |
| 5. Lower Control Valve Body | 16. Low Servo Modulator Valve | 27. Accumulator Regulator Valve |
| 6. Coast Clutch Shift Valve | 17. Low/Reverse Modulator Valve Plunger | 28. Line Pressure Modulator Valve |
| 7. Solenoid Regulator Valve | 18. Low/Reverse Modulator Valve Sleeve | 29. Spring & Retainer Assembly |
| 8. Separator Plate | 19. 1-2 Shift Valve | 30. Line Pressure Modulator Plunger |
| 9. Check Ball (.3125") | 20. D2 Shift Valve | 31. Line Pressure Modulator Sleeve |
| 10. Check Ball (.250") | 21. Upper Control Valve Body | 32. Manual 1-2 Transition Valve |
| 11. Retaining Ring | 22. 3-4 Shift Valve | |

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Fig. 35: Exploded View Of Main Control Valve Body, Accumulator & Solenoid Valve Bodies
Courtesy of FORD MOTOR CO.

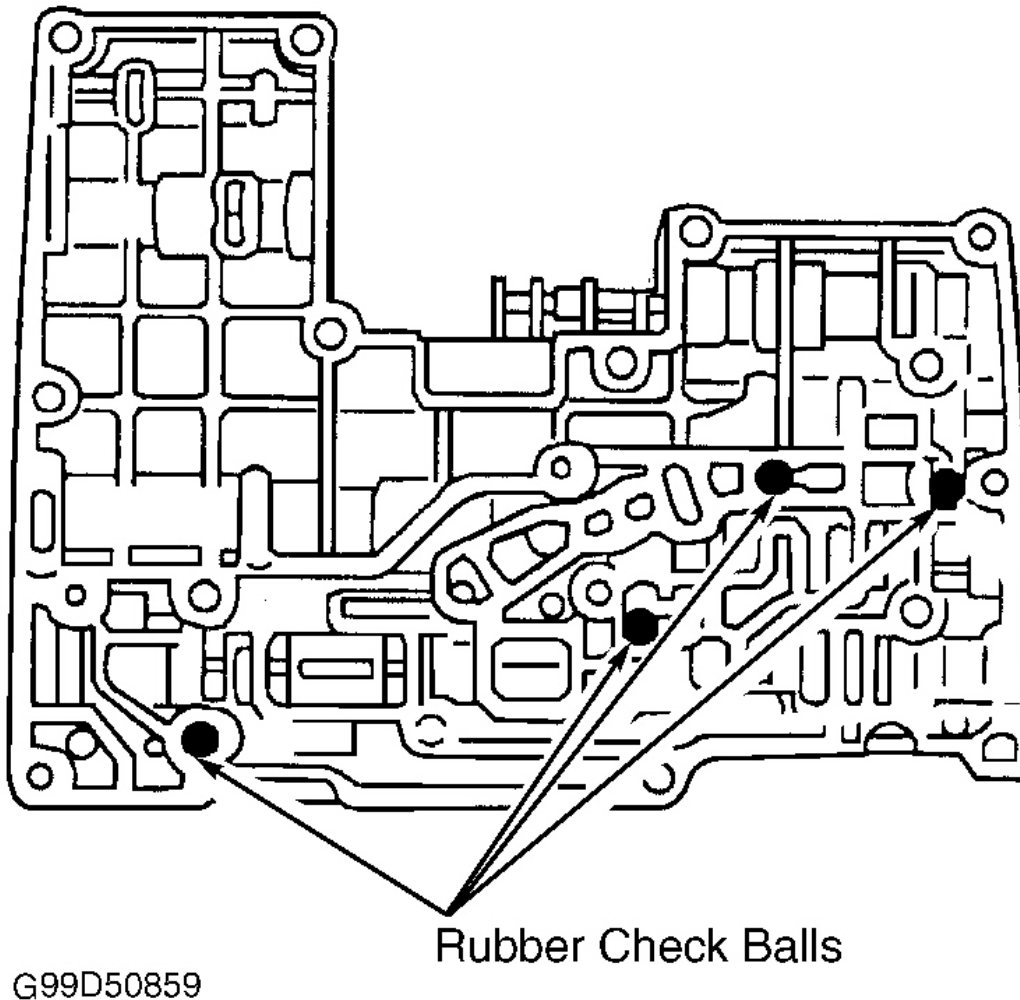


Fig. 36: Location Of Main Control Valve Body Check Balls
Courtesy of FORD MOTOR CO.

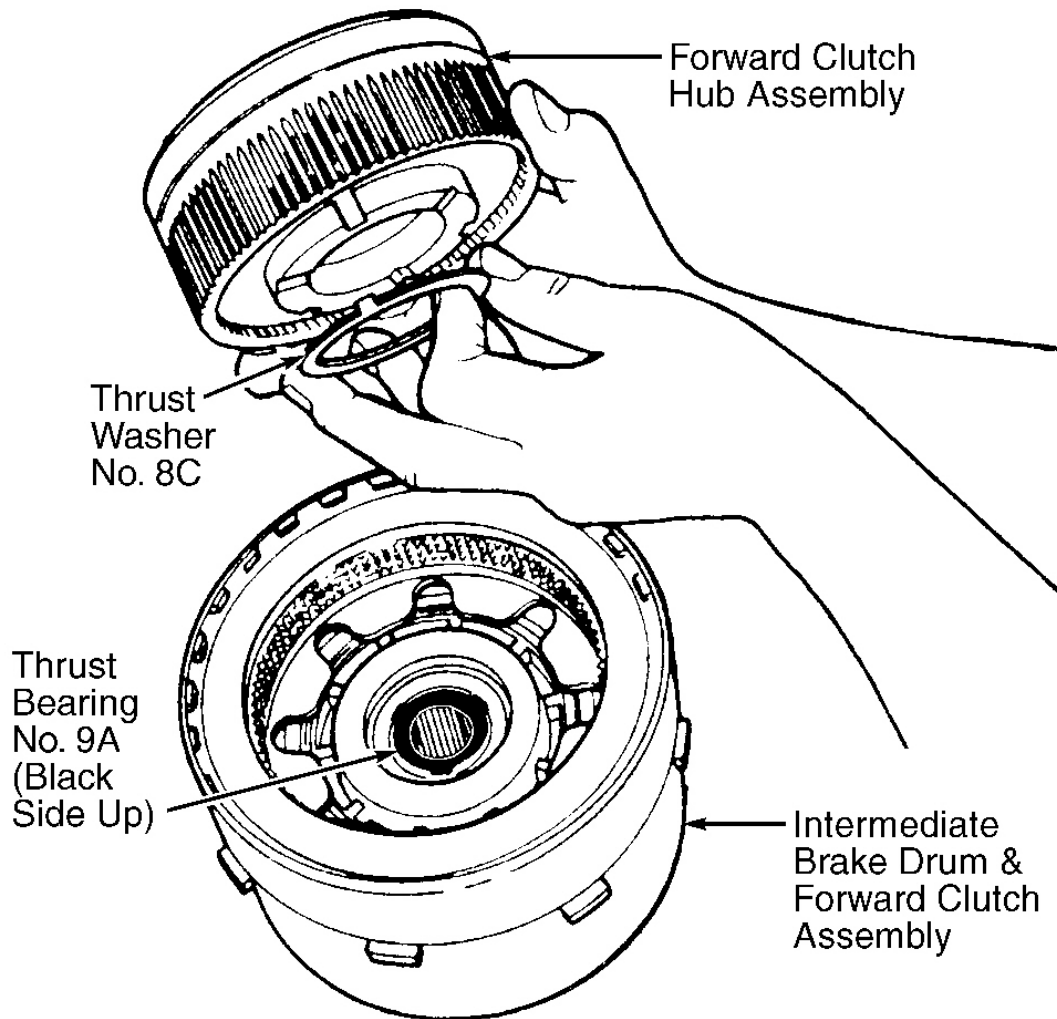
CLUTCH & DRUM SUBASSEMBLIES

NOTE: Forward and direct clutches, and input shell need to be final assembled before proceeding with these procedures.

Reassembly

1. Ensure thrust bearing No. 8B is installed onto forward clutch drum over outer seal hub with petroleum jelly. See **Fig. 28** . Insert forward clutch cylinder assembly into intermediate brake drum and rotate until all direct clutch friction plates are fully engaged.

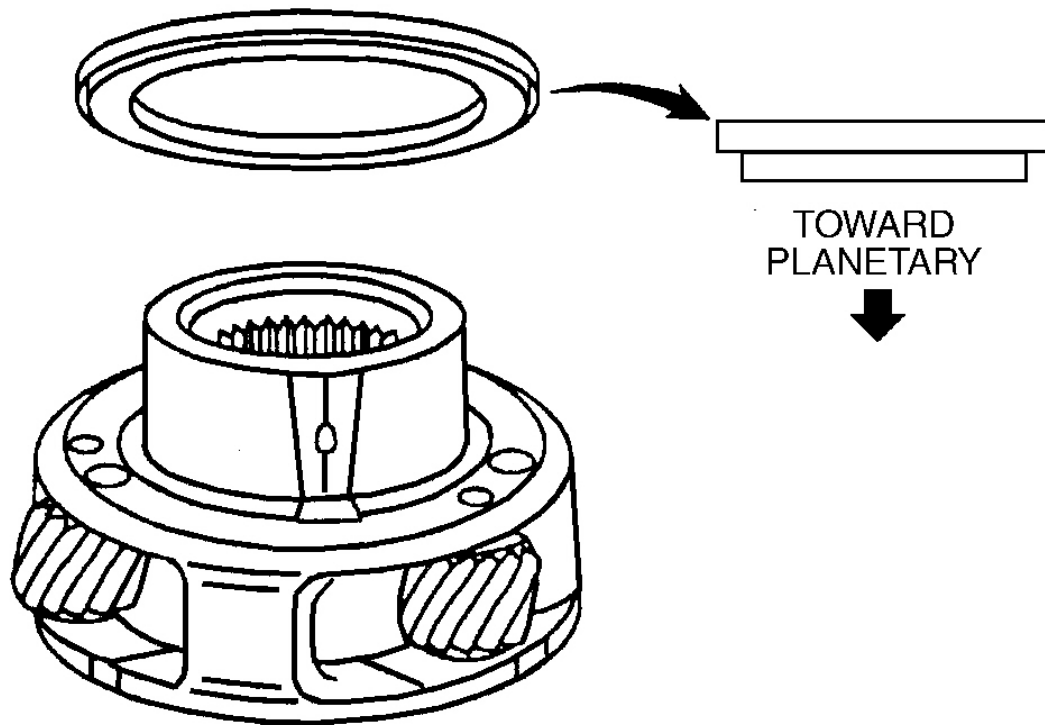
2. Ensure thrust bearing No. 9A is installed into forward clutch cylinder with petroleum jelly. Ensure Black side of thrust bearing is facing up. See **Fig. 37** . Install thrust washer No. 8C on forward clutch hub. Insert forward clutch hub and ring gear assembly into forward clutch drum.



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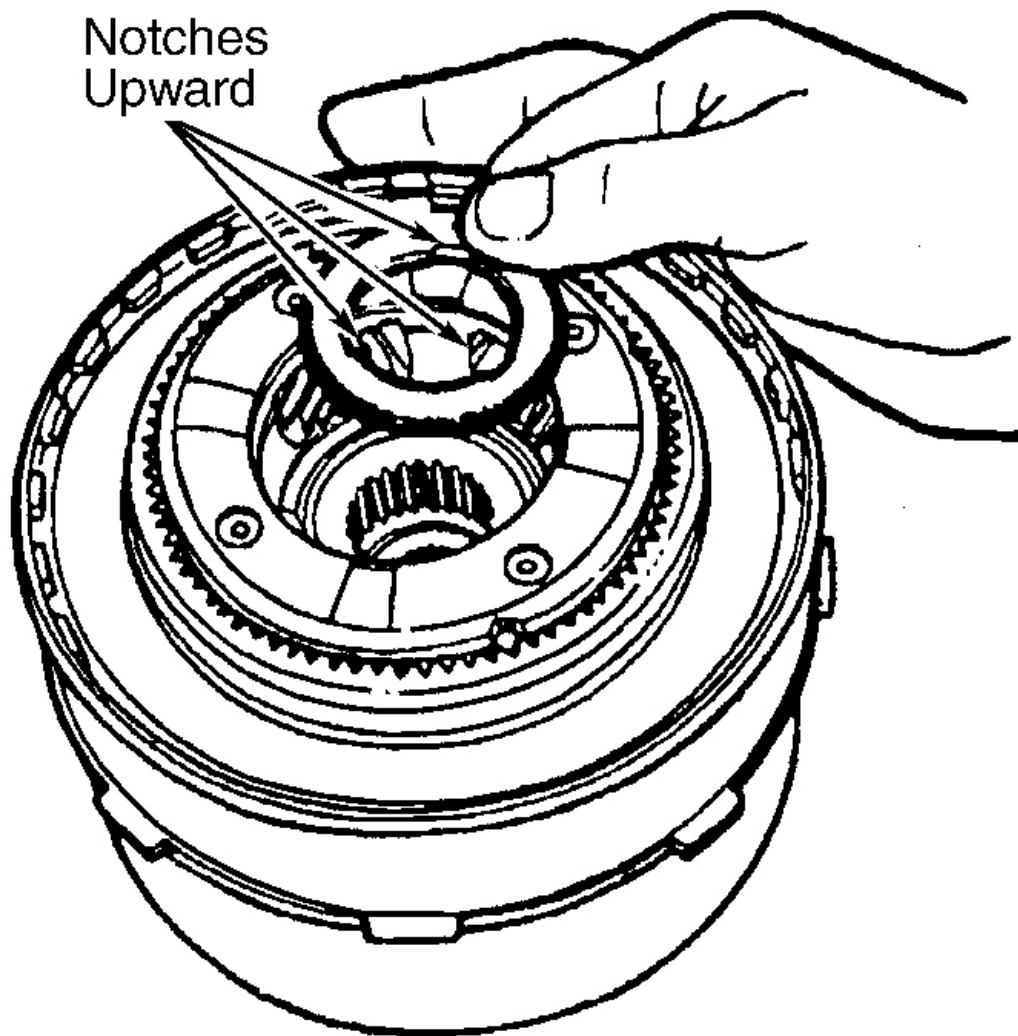
Fig. 37: Installing Thrust Bearing No. 9A & Thrust Washer No. 8C
Courtesy of FORD MOTOR CO.

3. Coat thrust bearing No. 10A with petroleum jelly and place onto forward planet assembly. See **Fig. 38** . Insert planet assembly into forward hub and ring gear assembly. Install thrust bearing No. 9B into forward planet assembly. Ensure Black side of thrust bearing is facing up. See **Fig. 39** .



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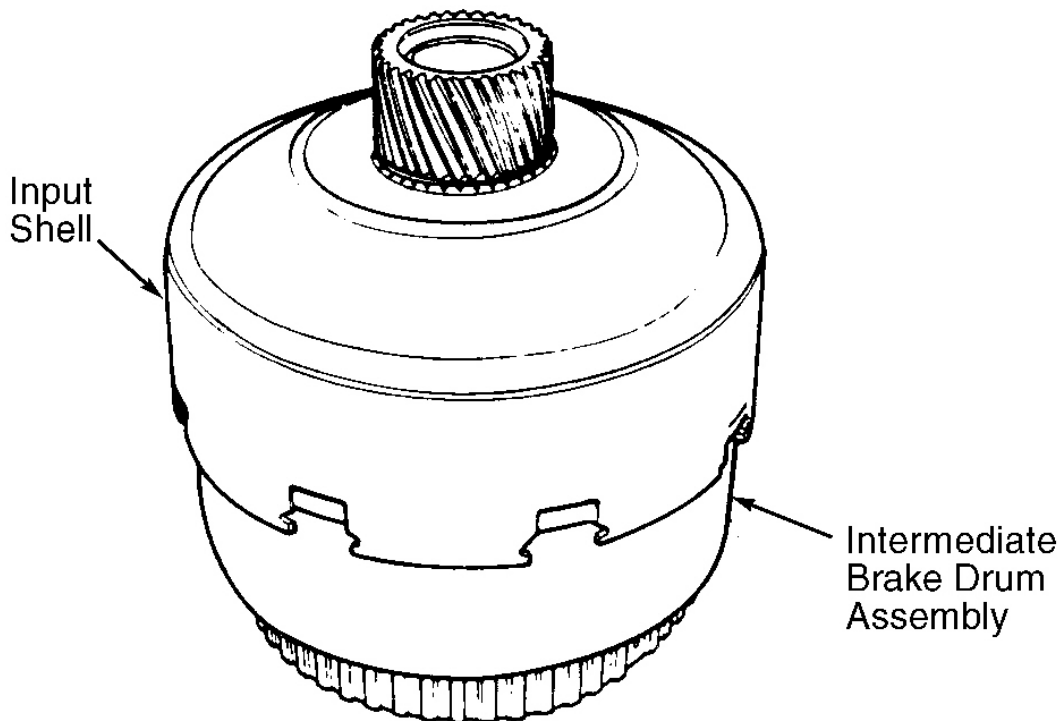
Fig. 38: Installation Of Thrust Bearing No. 10A
Courtesy of FORD MOTOR CO.



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Fig. 39: Installation Of Thrust Bearing No. 9B
Courtesy of FORD MOTOR CO.

4. Install input shell on forward and direct clutch assembly and rotate until sun gear and input shell notches are seated fully. See **Fig. 40** . Ensure thrust bearing No. 8B is installed onto front end of forward clutch assembly. Install Remover/Installer (T89T-70010-E) onto intermediate brake drum, forward clutch and input shell. See **Fig. 43** .



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Fig. 40: Assembling Direct Clutch, Forward Clutch & Input Shell
Courtesy of FORD MOTOR CO.

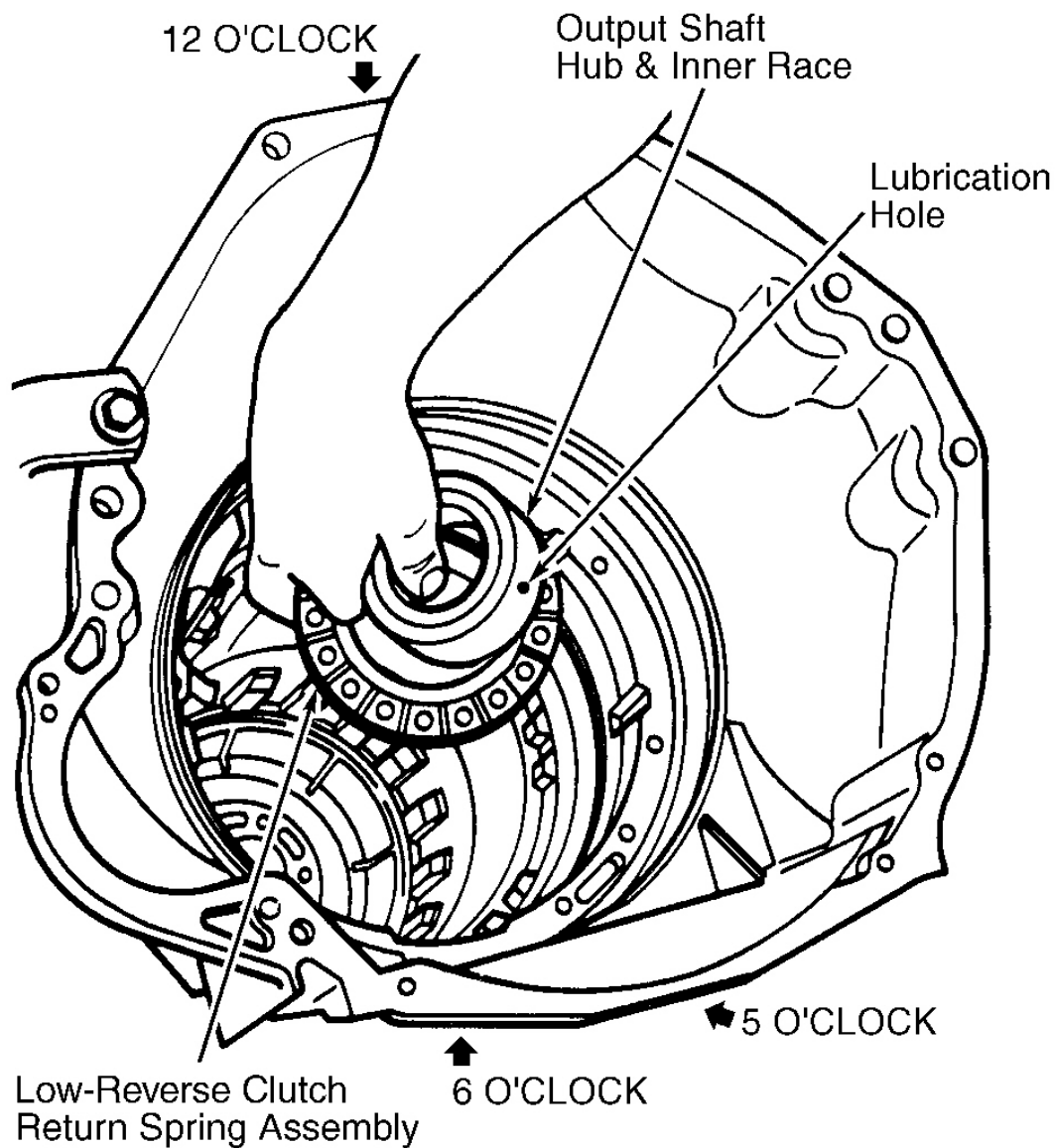
TRANSMISSION REASSEMBLY

NOTE: Exploded views of internal parts, thrust washer and thrust bearing locations can be found in **Fig. 46 -Fig. 48** . Lubricate all parts with transmission fluid during reassembly. Thrust washers, thrust bearings and gaskets should be held in place with petroleum jelly.

1. With transmission mounted in fixture, rotate bellhousing to face upward. Install inner and outer seals on low-reverse clutch piston. Using appropriate spring compressor, install low-reverse clutch piston. Remove spring compressor.
2. Install low-reverse clutch piston return spring assembly, output shaft hub and inner race. Ensure lubrication hole of inner race is in 5 o'clock position. See **Fig. 41** . Using 2 5/16-24, 3" long bolts with nuts, compress low-reverse piston return spring. See **Fig. 42** . Install 3 bolts in remaining one-way clutch inner race bolt holes and remove 2 compression bolts. Install remaining 2 bolts and tighten to specification. See **TORQUE SPECIFICATIONS** .
3. Install reverse clutch hub and low-reverse one-way clutch. Rotate transmission to horizontal position. Apply petroleum jelly to parking gear thrust bearing No. 13, and place on rear of case. Slide parking gear onto output shaft with thrust surface forward. Install output shaft. Apply coat of petroleum jelly to thrust

bearing No. 12 and install onto rear surface of output shaft hub. Install output shaft hub and ring gear. See **Fig. 32** . Install NEW retaining ring on output shaft.

4. Rotate transmission with bellhousing facing upward. Install cushion spring into reverse clutch case bore. Install reverse clutch pack (5 or 6 plate assembly depending on model) starting with an external spline steel plate. Alternate external spline steel plates with internal spline friction plates. Install reverse clutch pressure plate and retaining ring. Ensure retaining ring is installed with opening between 12 and 3 o'clock. Clearance measurement is not required.
5. Install reverse planet assembly into hub with No. 11 and No. 10B thrust washers. See **Fig. 46** . Install reverse planet retaining ring into low-reverse hub. Ensure retaining ring is securely seated in groove.
6. Using Clutch Remover-Installer (T89T-70010-E), install intermediate brake drum, forward clutch and input shell assembly into case as a unit. See **Fig. 43** . It may be necessary to rotate output shaft to seat reverse sun gear. Remove installer.



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Fig. 41: Locating Inner Race Lubrication Hole
Courtesy of FORD MOTOR CO.

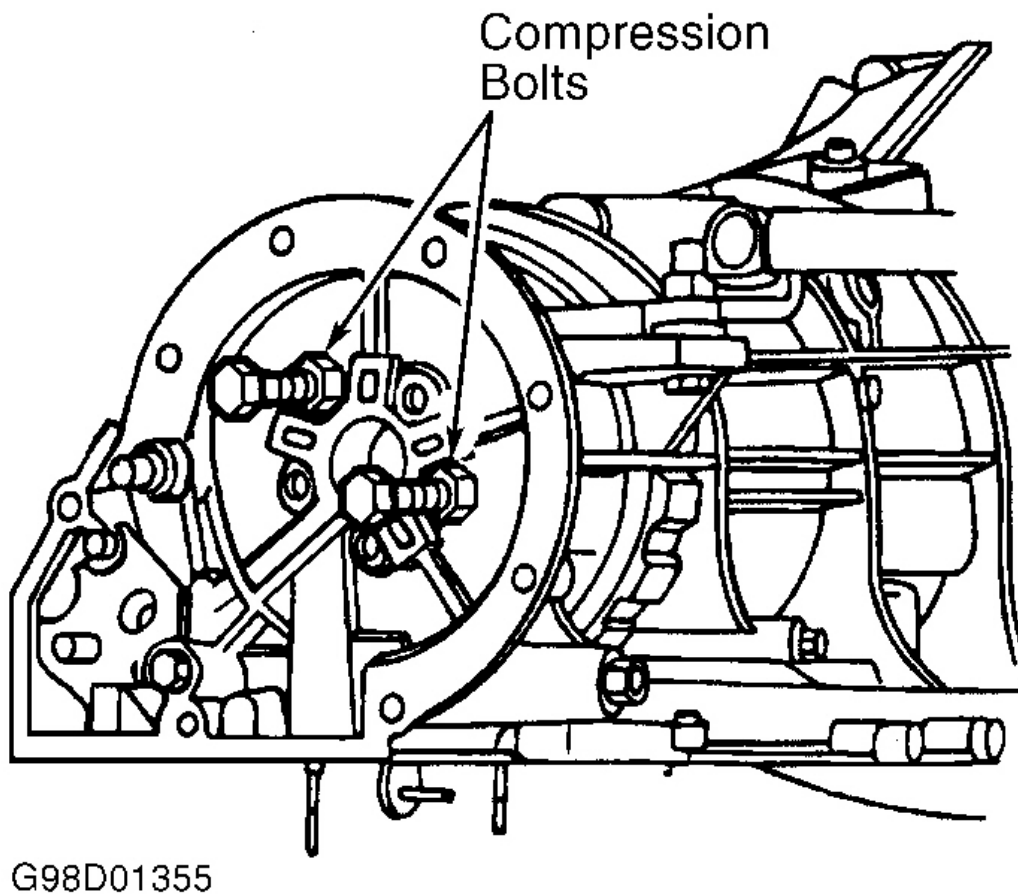
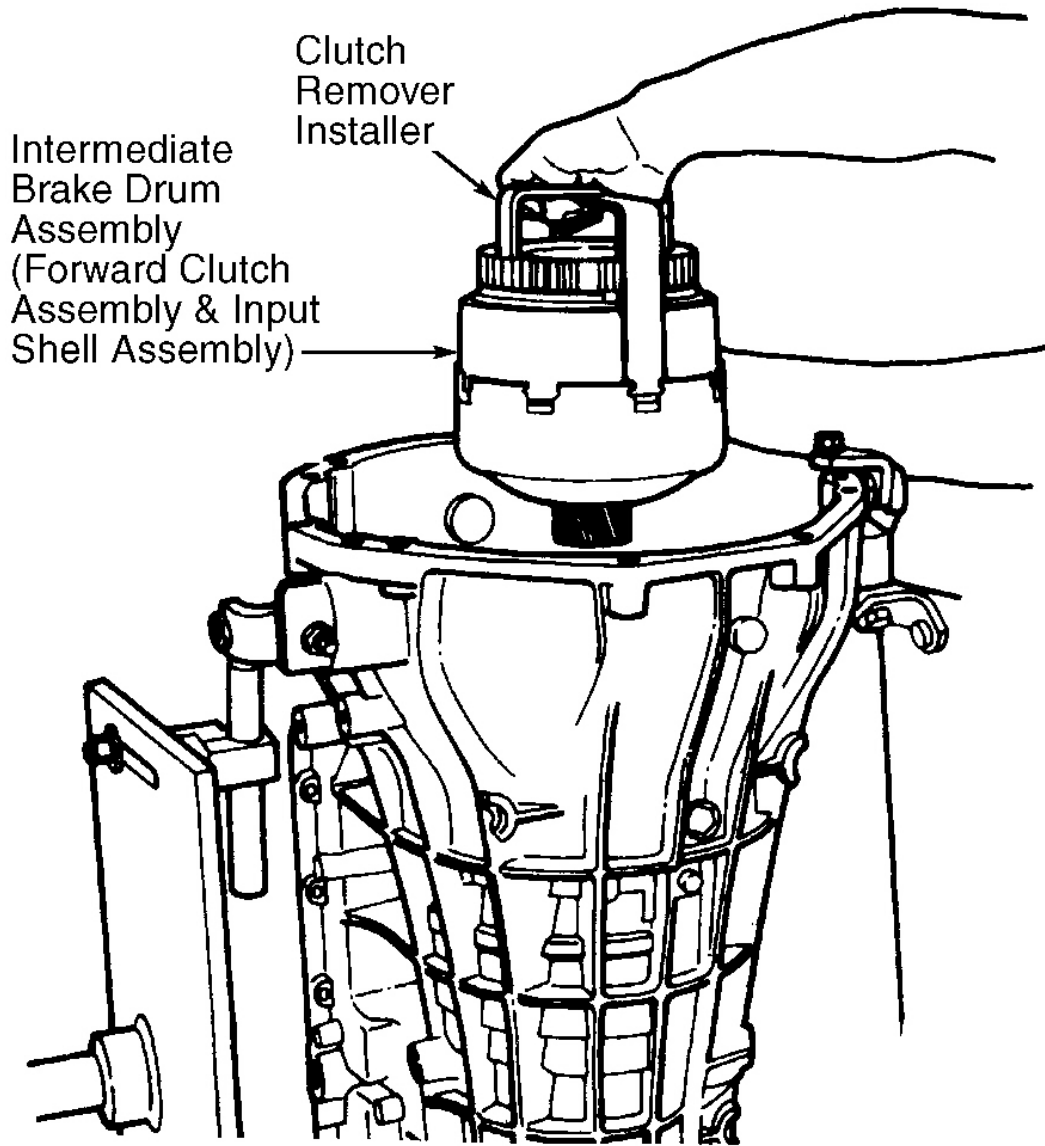


Fig. 42: Compressing Low-Reverse Piston Return Spring
Courtesy of FORD MOTOR CO.



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Fig. 43: Removing & Installing Input Shell
Courtesy of FORD MOTOR CO.

NOTE: When installing intermediate servo piston, ensure that intermediate servo rod is making contact in correct position and location on band assembly. If intermediate band and servo rod fall out of position during transmission reassembly, a possible fault with manual 2nd may occur.

7. Install intermediate band with one ear on anchor pin. Install servo spring, piston and rod assembly and

retaining plate. Install intermediate clutch pressure plate (thickest plate). Install intermediate clutch pack starting with internal spline plate. Install intermediate pressure apply plate with blank area (no teeth) in 6 and 12 o'clock positions.

NOTE: Remove cast iron seals from center support to allow easy insertion into intermediate brake drum.

8. Install center support without thrust washer into intermediate brake drum. Measure clearance between center support and intermediate brake drum. Note reading as measurement "A". See **Fig. 44**.
9. To determine center support thickness (measurement "B"), hold thrust washer against center support. Place depth micrometer over drilled hole. Extend depth micrometer probe until flush with thrust washer surface and note reading. See **Fig. 45**. Use the following equation: "A" - "B" = "C".
10. Ensure measurement "C" is .032-.081" (.81-2.06 mm). This verifies components are correctly installed. If thrust washer clearance is not within specification, this indicates improper assembly, missing parts or parts out of specification. Correct before continuing reassembly. If clearance is within specifications, remove center support and reinstall cast iron seal rings onto center support.

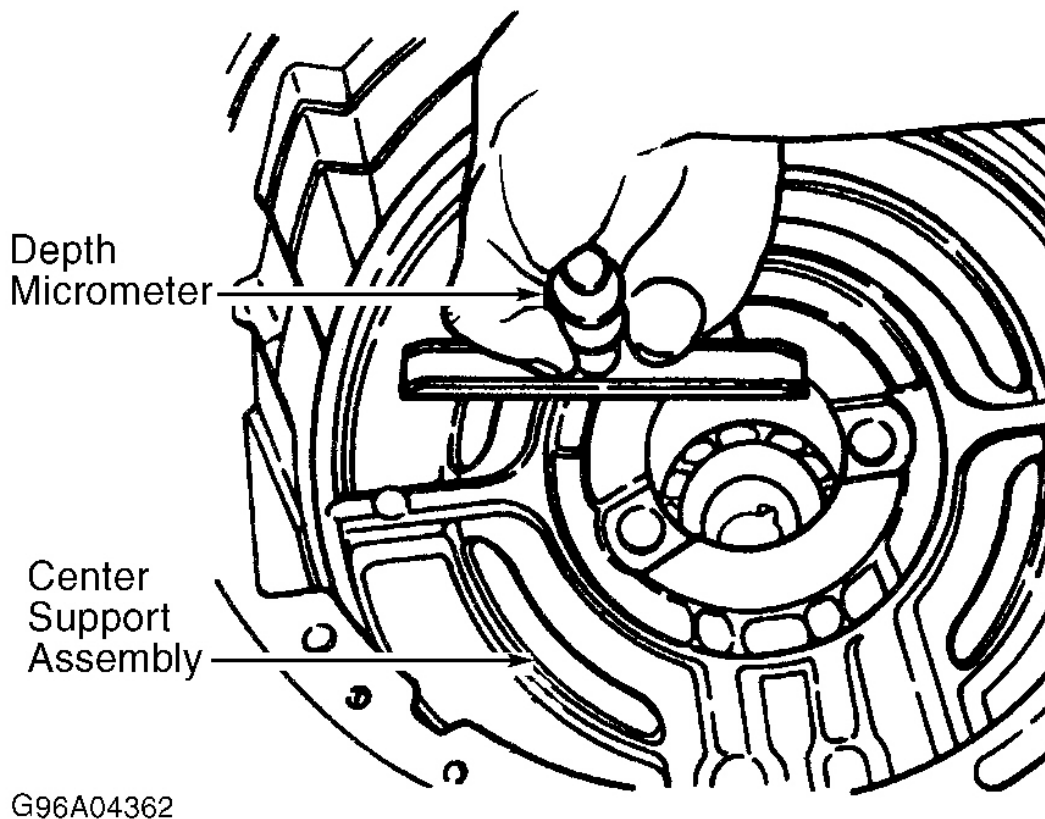


Fig. 44: Measuring Thrust Washer Clearance
Courtesy of FORD MOTOR CO.

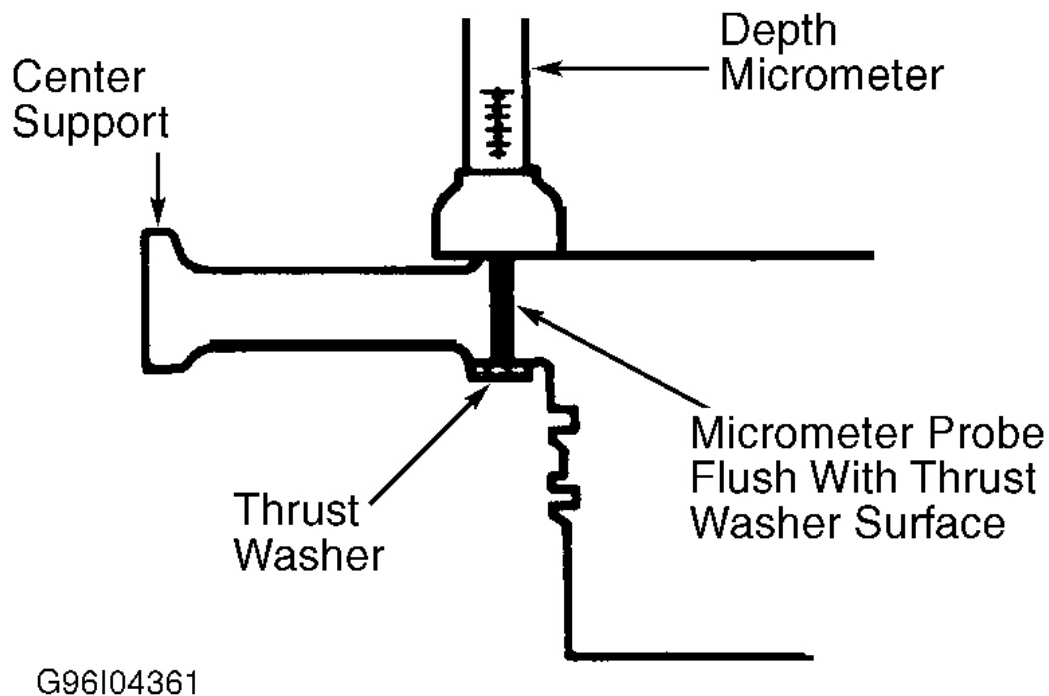


Fig. 45: Measuring Center Support Thickness
Courtesy of FORD MOTOR CO.

11. Align fluid feed holes in center support with holes in case for fluid feed bolts, and install center support. Install intermediate clutch return spring with dished surface inward. Ensure one spring locator leg is located at 6 o'clock position and properly located in center support circular rib.

NOTE: Intermediate-overdrive clutch cylinder and retaining ring will not be fully seated until intermediate clutch return spring is compressed fully. DO NOT attempt to force cylinder or ring into position before completing this step.

12. Install intermediate-overdrive clutch cylinder. DO NOT angle clutch cylinder when installing. Align cylinder threaded feed hole with hole in case. Install large retaining ring over intermediate-overdrive clutch cylinder with ring opening at bottom of case for proper oil drainback. Large retaining ring will not be able to seat into case ring groove until intermediate-overdrive clutch cylinder is fully seated into case. See **Fig. 23**.
13. Install Spring Compressor Plate (T89T-70010-F) and Spring Fixture (T89T-70010-C) onto intermediate-overdrive clutch cylinder. Tighten center bolt on clutch spring compressor bar to 62 INCH lbs. (7 N.m). See **Fig. 23**. When intermediate-overdrive clutch cylinder is fully seated into case, finger tighten 3 NEW fluid feed bolts into intermediate-overdrive clutch cylinder. DO NOT fully tighten fluid feed bolts at this time.

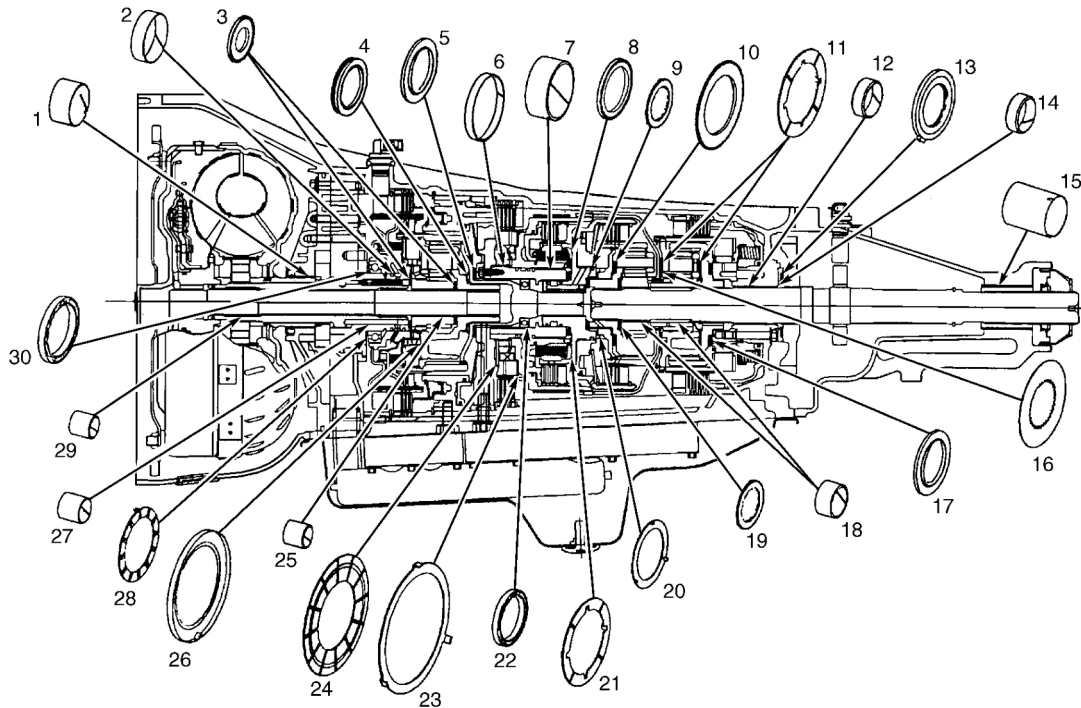
NOTE: Coast clutch cylinder Tool Installer (307-S383) must be used to install coast clutch cylinder/center shaft assembly, or damage may occur.

14. Install intermediate-overdrive cylinder retaining ring into case ring groove. Remove spring compressor. No clearance measurement is required. Coat thrust bearing No. 5 with petroleum jelly and install on rear face of coast clutch cylinder/center shaft assembly. Install coast clutch cylinder/center shaft assembly.
15. Install overdrive clutch pack, starting with a steel plate. Install pressure plate with dot facing outward and toward top of case. Install selective retaining ring with opening at bottom of case. Using a feeler gauge, measure clutch pack clearance. Ensure clearance is .027-.052" (.68-1.32 mm) on 2-plate clutch. On 3-plate clutch, clearance should be .032-.058" (.81-1.47 mm).
16. If clearance is not within specification, install correct selective retaining ring. Selective retaining rings are available in thicknesses of .077-.081" (1.95-2.05 mm), .098-.102" (2.50-2.60 mm), .118-.122" (3.00-3.10 mm) and .138-.142" (3.50-3.60 mm).
17. Lightly coat oil pump gasket with petroleum jelly to hold it in place and install pump gasket into case. Install input shaft long splined end first into case. Apply petroleum jelly to thrust washer No. 1 and thrust bearing No. 2A and install onto pump. See **Fig. 46** . Install appropriate alignment pin into transmission case to aid pump installation. Lubricate outer pump o-ring and install pump. Ensure filter inlet tube bore is in 6 o'clock position.
18. Fully seat pump into case using hand pressure only. DO NOT use bolts to draw pump into case. Remove alignment pin. Install pump bolts and NEW seal washers. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Remove input shaft.
19. Using appropriate seal driver, install manual lever seal. Install manual lever shaft and retaining pin, with pin just below case surface. Install TR sensor with 2 bolts and washer. DO NOT tighten bolts at this time. Install manual lever detent spring. Tighten bolt to specification.
20. Install manual detent lever, park lever actuating rod and nut. Tighten nut to specification. Ensure manual valve detent spring is positioned correctly on inner detent lever. Using appropriate TR sensor adjuster, align TR sensor to Neutral gear position. Tighten bolts to specification.
21. Install parking pawl, parking pawl shaft and parking pawl return spring on rear face. Ensure parking pawl return spring end rests on inside surface of case. If removed, install parking pawl actuator abutment with NEW Torx bolt and tighten to specification. Attach parking rod guide plate with 2 bolts and washers. Tighten bolts to specification.
22. Ensure parking rod guide plate dimple is facing inward and parking rod is in guide plate slot. Install gasket on extension housing. Install extension housing and wiring harness bracket on rear of case. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . On 4WD vehicles, the 2 bottom extension housing bolts are longer.

CAUTION: Intermediate-overdrive clutch cylinder feed bolt torque is lower than 2 center support feed bolts. Ensure proper torque specification is used. See **TORQUE SPECIFICATIONS** .

23. Rotate transmission with pan surface facing upward. Intermediate-overdrive clutch cylinder feed bolt should be tightened to 71-124 INCH lbs. (8-14 N.m) and 2 center support feed bolts to 97-144 INCH lbs. (11-16 N.m). Install 8 rubber check balls, and steel EPC check ball and spring into case pockets. See **Fig. 22** .
24. Install case-to-separator plate gasket. Ensure correct placement of EPC check ball and spring. Install

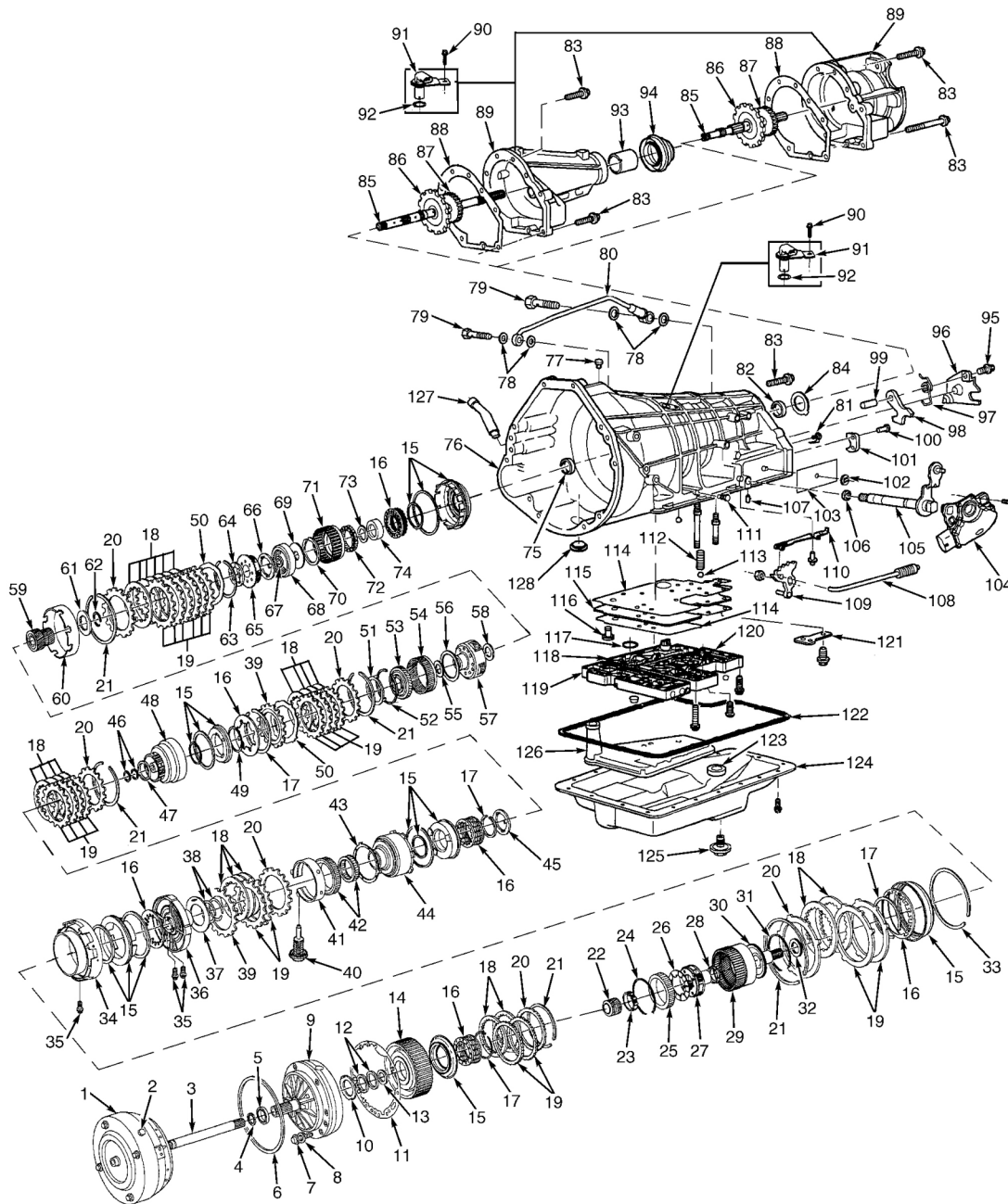
- separator plate. Attach reinforcing plate with 3 bolts. Ensure the word UP on reinforcing plate faces up. Tighten bolts to specification. Install NEW separator-to-main control valve body gasket.
25. Install solenoid valve screen into separator plate. Turn and lock solenoid screen. Install accumulator control body over studs. Install 2 nuts and 11 bolts finger tight. Lower main control valve body over studs. Align manual valve with manual lever. Install 2 nuts and 14 bolts finger tight.
 26. Ensure case connector bore is coated with petroleum jelly prior to installing solenoid valve body. Install solenoid valve body over stud. Install 9 Torx bolts and one nut finger tight. Tighten all accumulator control body, upper and lower main control valve body and solenoid valve body nuts and bolts to specification.
 27. Install NEW filter and seal assembly. Lubricate seal with ATF. Press filter into place. Install pan magnet on dimple in bottom of pan. Install NEW pan gasket on pan. Install oil pan and tighten bolts to specification. See [TORQUE SPECIFICATIONS](#) .
 28. If removed, install short fluid inlet tube into case. Use stripe or rib on side of tube for alignment. Stripe should be farthest outboard when installed. Rib should face toward front. Reinstall input shaft, long splined end first. Install torque converter. Using straightedge, ensure converter crankshaft pilot is inset from converter housing.



- | | | |
|--|--------------------------------------|---|
| 1. Front Pump Bushing | 12. Front Case Bushing | 24. Thrust Washer No. 6 |
| 2. Coast Clutch Bushing | 13. Thrust Washer No. 13 | 25. Overdrive Sun Gear Bushing |
| 3. Thrust Bearing Nos. 2A & 2B | 14. Rear Case Bushing | 26. Overdrive Carrier Thrust Washer (Vehicle Dependent) |
| 4. Thrust Bearing No. 4 | 15. Extension Housing Bushing | 27. Front Pump Bushing (Vehicle Dependent) |
| 5. Thrust Bearing No. 5 | 16. Thrust Washer No. 14 | 28. Thrust Washer No. 1 (Vehicle Dependent) |
| 6. Intermediate Brake Drum Front Bushing | 17. Thrust Bearing No. 12 | 29. Front Pump Support Ball Bearing Front Bushing |
| 7. Intermediate Brake Drum Rear Bushing | 18. Forward/Reverse Sun Gear Bushing | 30. Grob Coast Clutch Ball Bearing (Vehicle Dependent) |
| 8. Thrust Bearing No. 8A | 19. Thrust Bearing No. 9B | |
| 9. Thrust Bearing No. 9A | 20. Thrust Washer No. 8C | |
| 10. Thrust Bearing No. 10A | 21. Thrust Washer No. 8A | |
| 11. Thrust Washer Nos. 10B & 11 | 22. Center Shaft Ball Bearing | |
| | 23. Thrust Washer No. 7 | |

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Fig. 46: Locating Thrust Washers & Bearings
 Courtesy of FORD MOTOR CO.



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Fig. 47: Exploded View Of 4R100 Automatic Transmission (1 Of 2)
 Courtesy of FORD MOTOR CO.

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

- | | | |
|---|---|--|
| 1. Torque Converter Assembly | 43. Thrust Washer No. 7 | 86. Parking Gear |
| 2. Converter Drain Plug | 44. Intermediate Brake Drum Assembly | 87. Tone Wheel |
| 3. Input Shaft | 45. Thrust Washer No. 8A | 88. Extension Housing Gasket |
| 4. Front Pump Support Seal | 46. Cast Iron Seal Rings | 89. Extension Housing |
| 5. Front Pump Seal | 47. Thrust Bearing No. 8B | 90. Output Speed Sensor Bolt |
| 6. Front Pump Outer "O" Ring | 48. Forward Clutch Cylinder | 91. Output Speed Sensor |
| 7. Front Pump Bolt | 49. Piston Apply Ring | 92. "O" Ring |
| 8. Seal Washer | 50. Waved Clutch Spring | 93. Extension Housing Bushing |
| 9. Front Pump Assembly | 51. Thrust Washer No. 8C | 94. Extension Housing Seal |
| 10. Thrust Washer No. 1 | 52. Hub Retaining Ring | 95. Screw & Washer |
| 11. Front Pump Gasket | 53. Ring Gear Hub | 96. Parking Rod Guide Plate |
| 12. Coast Clutch Seal Rings | 54. Forward Ring Gear | 97. Parking Pawl Return Spring |
| 13. Thrust Bearing No. 2A | 55. Thrust Bearing No. 9A | 98. Parking Pawl |
| 14. Coast Clutch Cylinder | 56. Thrust Bearing No. 10A | 99. Parking Pawl Shaft |
| 15. Low-Reverse Piston & Seal Assembly | 57. Forward Planet Assembly | 100. Torx Bolt |
| 16. Piston Return Spring | 58. Thrust Bearing No. 9B | 101. Parking Pawl Actuator Abutment |
| 17. Return Spring Retainer Ring | 59. Forward-Reverse Sun Gear | 102. Spring Nut |
| 18. Internal Spline Plate (Friction) | 60. Input Shell | 103. Transmission Identification Tag |
| 19. External Spline Plate (Steel) | 61. Thrust Washer No. 14 | 104. Transmission Range (TR) Sensor |
| 20. Pressure Plate | 62. Sun Gear Retaining Ring | 105. Manual Control Lever |
| 21. Pressure Plate Retaining Ring | 63. Reverse Planet Retaining Ring | 106. Manual Control Lever Seal |
| 22. Overdrive Sun Gear | 64. Thrust Washer No. 10B | 107. Manual Lever Retaining Pin |
| 23. Overdrive One-Way Roller Assembly | 65. Reverse Planet Assembly | 108. Parking Pawl Actuator Rod |
| 24. Overdrive One-Way Retainer Ring | 66. Thrust Washer No. 11 | 109. Manual Control Valve Detent Lever |
| 25. Overdrive One-Way Outer Race | 67. Output Shaft Retaining Ring | 110. Manual Valve Detent Spring |
| 26. Overdrive Carrier Plastic Thrust Washer (Vehicle Dependent) | 68. Output Shaft Ring Gear | 111. Line Pressure Test Port Plug |
| 27. Overdrive Planet Assembly | 69. Output Shaft Hub | 112. EPC Blow-Off Spring |
| 28. Thrust Bearing No. 4 | 70. Output Shaft Hub Retaining Ring | 113. EPC Blow-Off Check Ball |
| 29. Overdrive Ring Gear | 71. Reverse Clutch Hub | 114. Separator Plate Gasket |
| 30. Overdrive Center Shaft | 72. Low-Reverse One-Way Clutch | 115. Separator Plate |
| 31. Waved Retaining Ring | 73. Thrust Bearing No. 12 | 116. Solenoid Valve Screen |
| 32. Thrust Bearing No. 5 | 74. Low-Reverse One-Way Clutch Inner Race | 117. Solenoid Body-To-Case "O" Ring |
| 33. Large Retaining Ring | 75. Front Case Bushing (3 Lube Grooves) | 118. Solenoid Valve Body |
| 34. Intermediate-Overdrive Clutch Cylinder | 76. Transmission Case | 119. Accumulator Control Body |
| 35. Fluid Feed Bolt(s) | 77. Case Vent Assembly | 120. Main Control Valve Body |
| 36. Center Support Assembly | 78. Case Outlet Sealing Washers | 121. Valve Body Reinforcing Plate |
| 37. Thrust Washer No. 6 | 79. Cooler By-Pass Valve Fitting | 122. Pan Gasket |
| 38. Cast Iron Seal Rings | 80. Cooler By-Pass Valve | 123. Pan Magnet |
| 39. Apply Plate | 81. Case Fluid Filler Plug | 124. Transmission Pan |
| 40. Intermediate Servo Piston & Spring | 82. Rear Case Bushing (1 Lube Groove) | 125. Fluid Drain Plug |
| 41. Intermediate Band Assembly | 83. Bolt | 126. Filter & Seal |
| 42. Intermediate One-Way Clutch | 84. Thrust Bearing No. 13 | 127. Fluid Inlet Tube |
| | 85. Output Shaft | 128. Converter Drain Access Plug |

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Fig. 48: Legend For Exploded View Of 4R100 Transmission (2 Of 2)

Courtesy of FORD MOTOR CO.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Connector-To-Case Cooler Line Nut	18-23 (24-31)
Front Cooler Line	15 (20)
Rear Cooler Line	18 (24)
Control Assembly-To-Pump Body Bolts	18-23 (24-31)
Converter Drain Plug	21-23 (29-31)
Cooler Bypass Valve Case Bolts	
Case Outlet Bolt (Front)	22 (30)
Case Inlet Bolt (Rear)	27 (36)
Extension Housing-To-Case Bolts	
2WD	20-29 (27-39)
4WD	24-40 (33-54)
Inner One-Way Clutch Race-To-Case Bolts	18-25 (24-34)
Manual Lever Nut	

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

Inner	30-40 (41-54)
Outer	20-29 (27-39)
Oil Pan-To-Case Bolts	10-12 (14-16)
Oil Pump Body-To-Case Bolts	18-23 (24-31)
Parking Pawl Abutment-To-Case Bolts	16-20 (22-27)
Parking Rod Guide Plate-To-Case Bolts	16-20 (22-27)
Rear Mount-To-Transmission Bolts	60-80 (81-108)
Rear Mount-To-Crossmember Nuts	60-80 (81-108)
INCH Lbs. (N.m)	
Detent Spring-To-Case Bolt	80-97 (9-11)
Fluid Feed Bolt	
Intermediate-Overdrive Clutch Cylinder	71-124 (8-14)
Center Support	97-144 (11-16)
Line Pressure Case Plug	71-144 (8-16)
Lower Body-To-Main Body Bolts	80-97 (9-11)
Main Accumulator & Solenoid Body-To-Case Bolts	80-97 (9-11)
Main & Lower Body-To-Case Bolts	80-97 (9-11)
MLP Sensor-To-Case Bolts	53-71 (6-8)
Output Shaft Speed (OSS) Sensor Bolt	71-89 (8-10)
Reinforcing Plate-To-Case Bolts	80-97 (9-11)
Solenoid Body-To-Case Bolts	80-97 (9-11)
Stator Support-To-Pump Body Bolts	80-97 (9-11)
Turbine Shaft Speed (TSS) Sensor Bolt	71-89 (8-10)
Valve Body-To-Case Long Stud	80-97 (9-11)
Valve Body-To-Case Nut	80-97 (9-11)
Valve Body-To-Case Short Stud	80-97 (9-11)

TRANSMISSION SPECIFICATIONS**TRANSMISSION SPECIFICATIONS**

Application	In. (mm)
Coast Clutch Pack Clearance	.030-.050 (.76-1.27)
Direct Clutch Pack Clearance	.045-.081 (1.15-2.06)
Forward Clutch Pack Clearance	.030-.055 (.76-1.40)
Gear-To-Housing Clearance ⁽¹⁾	.0010-.0020 (.025-.051)
Overdrive Clutch Pack Clearance	
2-Disc Clutch	.027-.052 (.68-1.32)
3-Disc Clutch	.032-.058 (.81-1.47)
Torque Converter End Play	
Diesel	
New Or Rebuilt	.024-.048 (.60-1.21)

1999 Ford Cab & Chassis F350 Super Duty

1999 AUTOMATIC TRANSMISSIONS Ford 4R100 Overhaul

Used	.079 (2.00)
Gasoline	
New Or Rebuilt	.014-.038 (.35-96)
Used	.071 (1.80)
(1) Oil pump inner/outer gerotor gear.	