General Specifications

Item	Specification
Lubricant	
Ford Multi-Purpose Grease DOAZ-19584-AA	ESB-M1C93-B

General Specifications

Item	Specification			
Automatic Transmission				
Refill Capacity Liters (Quarts)	13.1 (13.9) Motorcraft MERCON® V (ATF) Transmission Fluid XT-5-QM meeting MERCON® V specification. MERCON V® is not interchangeable at this time with the current MERCON® service fluids. Check the transmission dipstick to determine the correct fluid and refer to the Workshop Information/Owner publication to determine the correct service interval for the specific vehicle.			
Torque Converter				
Stall Speed				
	Engine		Min	Max
	5.0L		2481	2904
End Play				
New or Rebuilt mm (inch)	0.355-1.04 (0.014-0.041)			
Used mm (inch)	0.355-1.87 (0.014-0.074)			
Forward Clutch Pack				
Clearance mm (inch)	1.17-1.63 (0.046-0.068)			
Snap Ring Thickness mm (inch)	1.524-1.625 (0.060-0.064) 1.880-1.981 (0.074-0.078) 2.235-2.337 (0.088-0.092) 2.591-2.692 (0.102-0.106)			
Reverse Clutch Pack				
Clearance mm (inch)	1.27-1.94 (0.050-0.076)			
Snap Ring Thickness mm (inch)	1.524-1.625 (0.060-0.064) 1.880-1.981 (0.074-0.078) 2.235-2.337 (0.088-0.092) 2.591-2.692 (0.102-0.106)			

Direct Clutch Pack	
Clearance mm (inch)	1.5748-2.159 (0.062-0.085)
Snap Ring Thickness mm (inch)	1.270-1.372 (0.050-0.054) 1.625-1.727 (0.064-0.068) 1.981-2.083 (0.078-0.082) 2.337-2.438 (0.092-0.096)
Intermediate Clutch Pack	
Clearance mm (inch)	41.7322-42.5958 (1.643-1.677)
Selective Steel Plate mm (inch)	1.702-1.803 (0.067-0.071) 1.956-2.057 (0.077-0.081) 2.210-2.311 (0.087-0.091) 2.464-2.565 (0.097-0.101)
Selective Thrust Washer - No. 1	
Green Thickness mm (inch)	1.217-1.371 (0.050-0.054)
Yellow Thickness mm (inch)	1.727-1.828 (0.068-0.072)
Natural Thickness mm (inch)	2.159-2.260 (0.085-0.089)
Red Thickness mm (inch)	2.590-2.692 (0.102-0.106)
Blue Thickness mm (inch)	3.022-3.124 (0.119-0.123)

Torque Specifications

Description	Nm	lb-ft	lb-in
Rear Transmission Support Crossmember Bolts	47-63	35-46	—
Transmission Mount Nuts	34-46	25-34	—
Transmission Mount Bolts	68-92	50-68	—
Rear Insulator Bolts	79	58	—
Extension Housing Bolts	25-30	19-22	—
Transmission Fluid Pan Bolts	12-15	9-11	—
Front Pump Bolts	20-26	15-19	—
Front Pump Support Bolts	20-26	15-19	—
Harness Electrical Connector Bolt	4.0-5.6	—	36-49
Inspection Cover Bolts	11	8	—
Main Control Valve Body Bolts	9-11	—	80-97
Main Control Valve Body Cover Plate Bolts	9-11	—	80-97
Main Control Valve Body Separator Plate Bolts	9-11	—	80-97
Manual Lever Shaft Nut	26-37	20-27	—

Manual Lever Shaft Outer Nut	30-35	23-25	—
Fluid Cooler Line Case Fittings	20-26	15-19	—
Pressure Tap Plugs	8-16	—	71-141
Rear Driveshaft Bolts	88-119	65-87	—
Starter Bolts	22-28	17-20	—
TCC Solenoid Bolt	9-11	—	80-97
Torque Converter Drain Plug	28-30	21-22	—
Torque Converter Nuts	27-46	20-33	—
Digital Transmission Range (TR) Sensor Bolts	7-10	—	62-88
Transmission Bolts	40-55	30-40	—
Vehicle Speed Sensor (VSS) Plug Bolt	7-10	—	62-88
Output Shaft Speed (OSS) Sensor Bolt	12	9	—
Starter B+ Cable	9-14	—	80-123
Exhaust Manifold Bolts	34-46	25-33	—
Exhaust Pipe Bolts	34-46	25-33	—
Transmission Vent Tube	8-16	—	71-141
Manual Control Valve Detent Lever Spring Bolt	9-11	—	62-97
Cooler Tube Nut to Case Fitting	18	13	—
Rear Differential Retaining Nuts (Front)	77-103	57-75	—
Rear Differential Retaining Bolts and Nuts (Rear)	60-80	45-59	—
Transmission Linkage	19-26	14-19	—
Shift Cable Bracket	14	10	—

Band and Clutch Application Chart

Gear	Overdrive Band	Intermediate Clutch	Low/ Reverse Band	Reverse Clutch	Forward Clutch	Direct Clutch
PARK						
REVERSE			A [a]	A [a]		
NEUTRAL						
1st GEAR MANUAL LOW			A [a]		A [a]	
2nd GEAR MANUAL LOW	A [a]	A [a]			A [a]	
1st GEAR (D) (Overdrive)					A [a]	
2nd GEAR (D) (Overdrive)		A [a]			A [a]	
3rd GEAR (D) (Overdrive)		A [a]			A [a]	A [a]

4th GEAR (D) (Overdrive)	A [a]	A [a]				A [a]

[a] A = Applied

Band and Clutch Application Chart

Gear	Intermediate One-Way Clutch		Planetary One-Way Clutch		Solenoid States		
	Drive	Coast	Drive	Coast	SSA	SSB	TCC
PARK					ON	OFF	HD [a]
REVERSE			NE [b]		ON	OFF	HD [a]
NEUTRAL					ON	OFF	HD [a]
1st GEAR MANUAL LOW			H [c]		ON	OFF	HD [a]
2nd GEAR MANUAL LOW	H [c]				OFF	OFF	EC [d]
1st GEAR (D) (Overdrive)			H [c]	OR [e]	ON	OFF	HD [a]
2nd GEAR (D) (Overdrive)	H [c]	OR [e]	OR [e]		OFF	OFF	EC [d]
3rd GEAR (D) (Overdrive)	OR [e]	OR [e]			OFF	ON	EC [d]
4th GEAR (D) (Overdrive)	OR [e]	OR [e]	OR [e]		ON	ON	EC [d]

[a] HD = Hydraulically Disabled
[b] NE = No Effect
[c] H = Hold
[d] EC = Electronically Controlled
[e] OR = Overrunning

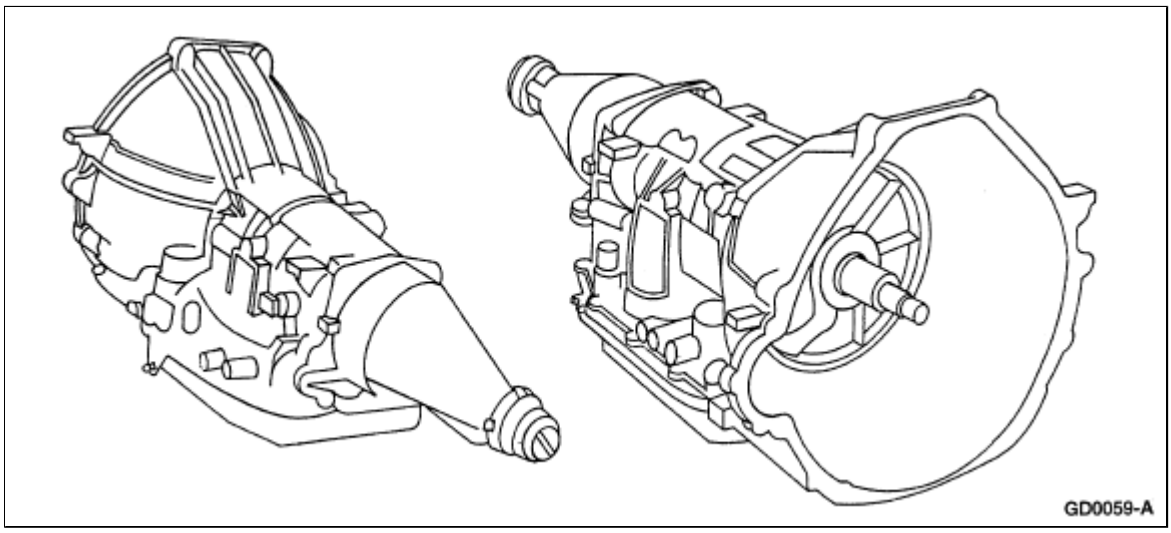
Automatic Transmission

The 4R70W has the following features:

- Wide ratio gears
- Four speeds
- Rear wheel drive
- Automatic
- Electronic shift
- Torque converter clutch control
- Line pressure controls

The transmission uses Ravigneaux-style double-pinion gearset with two bands, one one-way roller clutch, one mechanical diode and four friction clutches to produce four forward gears and Reverse.

4R70W Automatic Transmission

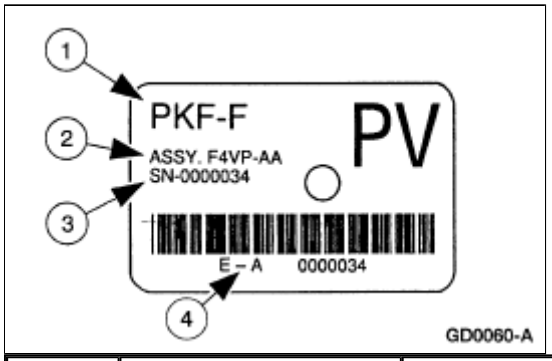


Identification Tags

All vehicles are equipped with a Vehicle Certification Label, located on the driver side door lock post. For correct transmission identification, refer to the code in the space marked TR.

For model, service ID level or build date information, refer to the transmission service ID tag located on the transmission case.

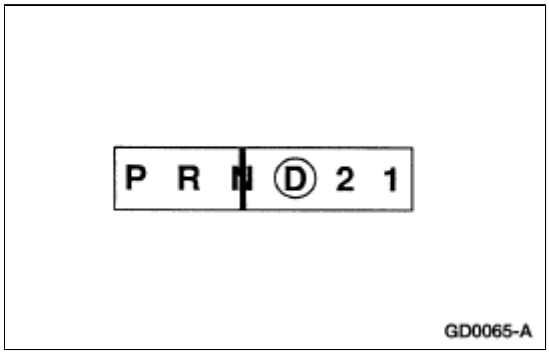
Identification Tag



Item	Part Number	Description
1	—	Model number
2	—	Assembly number
3	—	Serial number
4	—	Model and serial number

Range Selection

The transmission has six range positions: P, R, N, (D), 2 and 1.



Park

In the PARK position:

- there is no powerflow through the transmission.
- the parking pawl locks the output shaft to the case.
- the engine can be started.
- the ignition key can be removed.

Reverse

In the REVERSE position:

- the vehicle can be operated in a rearward direction, at a reduced gear ratio.
- engine braking will occur.

Neutral

In the NEUTRAL position:

- there is no powerflow through the transmission.
- the output shaft is not held and is free to turn.
- the engine can be started.

Overdrive

Overdrive is the normal position for most forward driving.

The OVERDRIVE position provides:

- Automatic shifts.
- Apply and release of the torque converter clutch.

- Maximum fuel economy during normal operation.

Second Position

This position provides:

- Second gear start and hold.
- The torque converter clutch can apply and release.
- Improved traction and engine braking on slippery roads.
- Engine braking for descending steep grades.

First Position

If this position is selected at normal road speeds, the transmission will shift into second gear, then into first when the vehicle reaches a speed below approximately 45 km/h (28 mph).

This position provides:

- First gear operation only.
- Engine braking for descending steep grades.

Shift Patterns

Upshifts

Transmission upshifting is controlled by the powertrain control module (PCM). The PCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and torque converter clutch (TCC) operation.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the gearshift lever). There are three categories of automatic downshifts; Coastdown, Torque Demand and Forced or Kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

Torque Demand

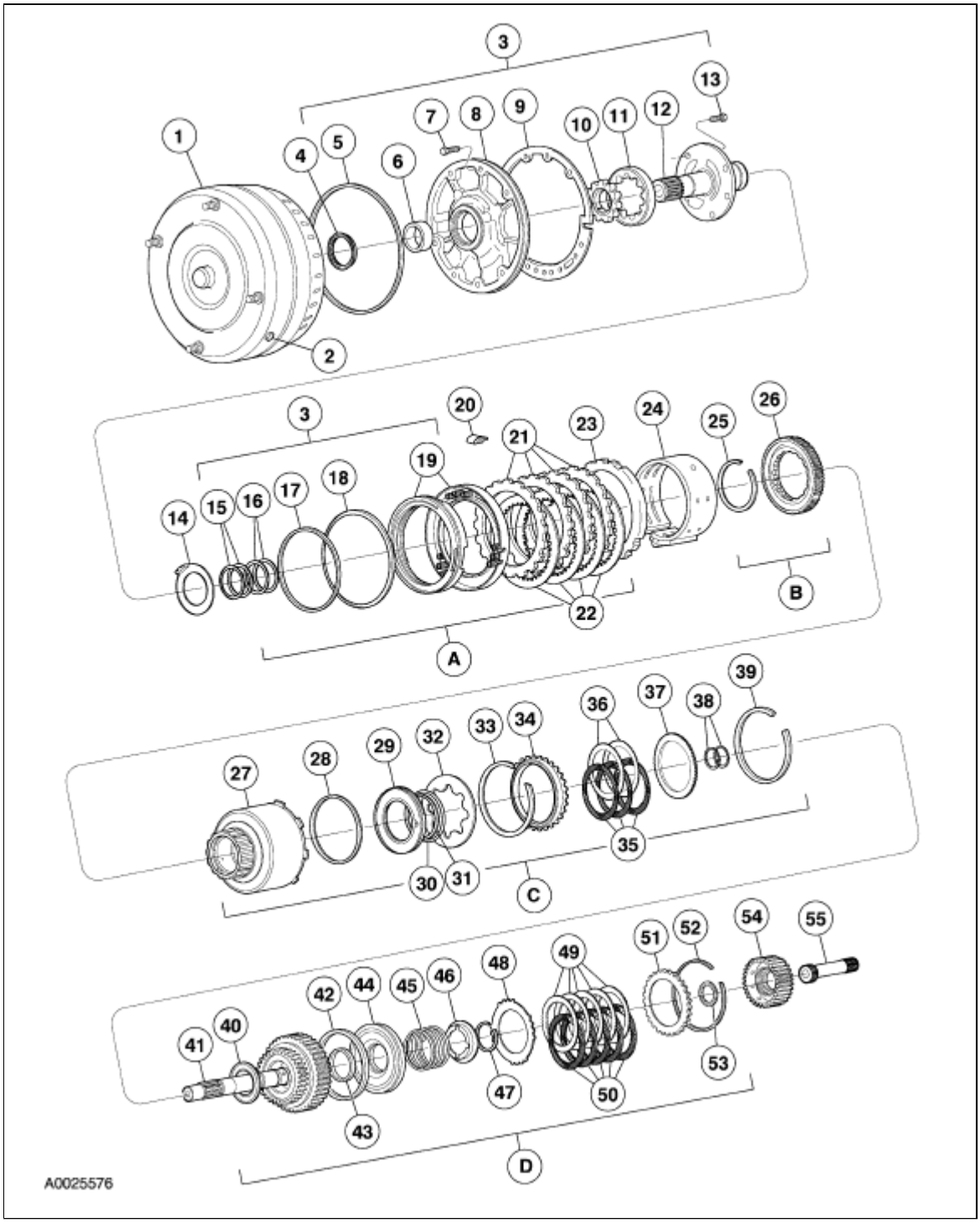
The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

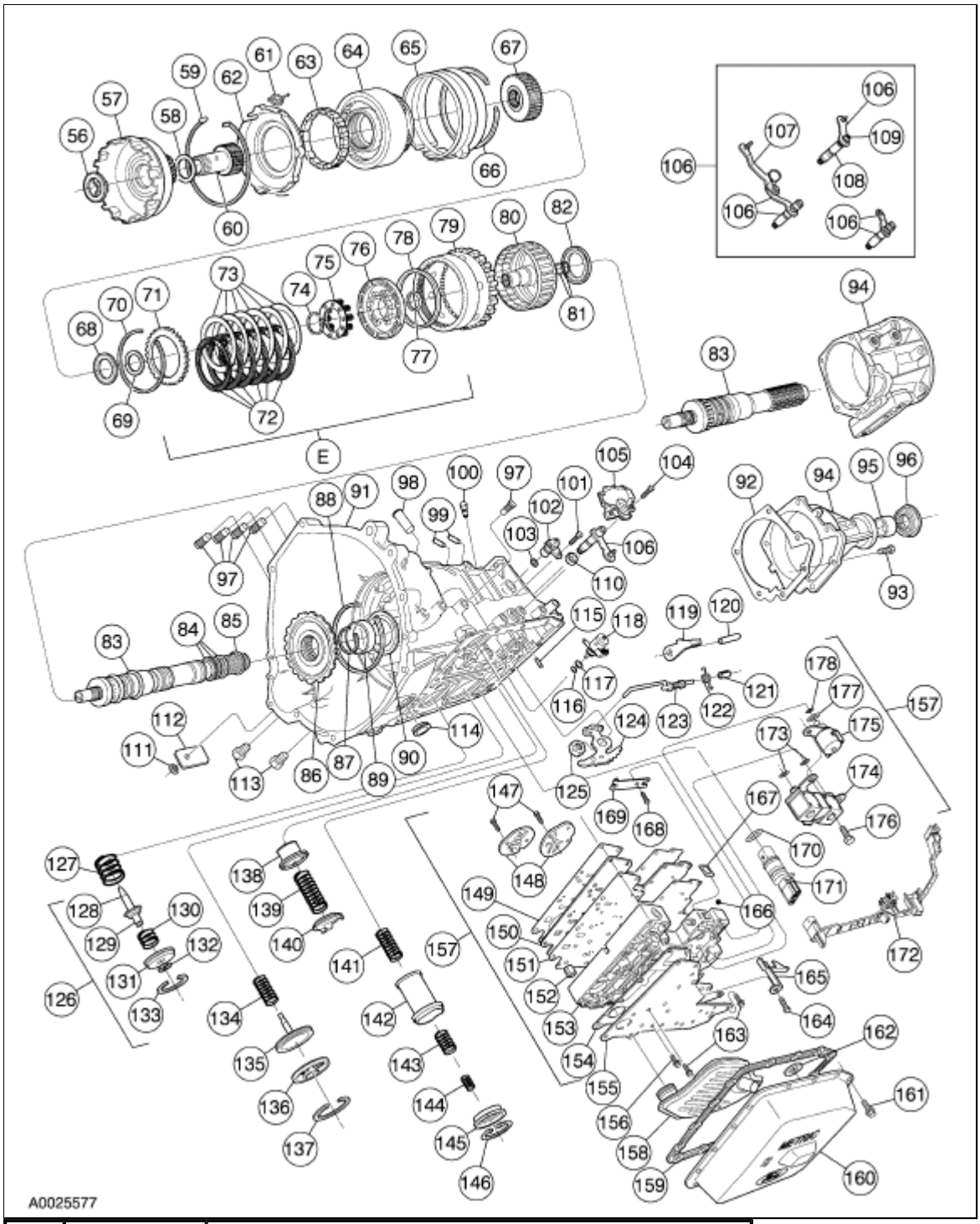
Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Disassembled Views

4R70W Automatic Transmission — Disassembled View





Item	Part Number	Description
1	7902	Converter assembly (model dependent)
2	391855-S100	Plug — converter drain — 1/8-27 Dryseal (model dependent)
3	7A103	Pump assembly — front
4	7A248	Seal assembly — front pump
5	7A248	Seal — front pump

6	7B258	Bushing — front pump
7	N605789-S100	Bolt — M8-1.25 x 35 hex head (7-attaches 7A103 to 7005)
8	7A106	Body assembly — front pump (part of 7A103)
9	7A136	Gasket — front pump
10	7H169	Gear — pump inner gerotor (part of 7A103)
11	7H169	Gear — pump outer gerotor (part of 7A103)
12	7A108	Support assembly — front pump
13	N605787-S	Bolt — M8-1.25 x 25 hex flange head (5-attaches 7A108 to 7A103)
14	7D014	Washer — front pump support thrust — select fit No. 1
15	7D020	Seals — reverse clutch cylinder (2 req'd)
16	7D019	Seals — forward clutch cylinder (2 req'd)
17	7F225	Seal — intermediate clutch piston inner
18	7F224	Seal — intermediate clutch piston outer
19	7E005	Piston kit — intermediate clutch
20	7A609	Intermediate clutch anti-rattle clip (model dependent)
21	7B442	Plate — intermediate clutch external spline (select fit) (steel)
22	7B164	Plate assembly — intermediate clutch internal spline (friction)
23	7B066	Plate — intermediate clutch pressure
24	7F196	Band assembly — overdrive
25	391267-S	Ring —3-21/64 retains type SU external (retains 7F262 to 7F215)
26	7F271	Clutch assembly —intermediate one-way clutch
27	7D044	Drum assembly — reverse clutch
28	7D403	Seal — reverse clutch piston outer
29	7D402	Piston assembly — reverse clutch
30	7D404	Seal reverse clutch piston inner
31	7D256	Ring — reverse clutch piston pressure
32	7B070	Spring — reverse clutch piston return
33	7A577	Spring — reverse clutch piston spring
34	7B066	Plate — reverse clutch front pressure
35	7B164	Plate — reverse clutch internal spline (friction)
36	7B442	Plate — reverse clutch external spline (steel)
37	7B066	Plate — reverse clutch rear pressure
38	7B497	Seals — input shaft (2 req'd)
39	7D483	Retainer — reverse clutch pressure plate — (select fit)

40	7A166	Bearing and race assembly — forward clutch No. 2
41	7F207	Cylinder and input shaft assembly — forward clutch
42	7A548	Seal — forward clutch piston outer
43	7C099	Seal — forward clutch piston inner
44	7A262	Piston — forward clutch
45	7A480	Spring — forward clutch piston return
46	7A527	Retainer return spring — forward clutch
47	388099-S	Snap ring — retaining — 1-59/64 (retains 7A529 in 7F207)
48	7E085	Spring — rear clutch pressure plate (model dependent)
49	7B442	Plate — forward clutch external spline (steel)
50	7B164	Plate — forward clutch internal spline (friction)
51	7B066	Plate — forward clutch pressure
52	7D483	Snap ring — retaining (select fit)
53	7F231	Bearing and race assembly — forward clutch front No. 3
54	7B067	Hub — forward clutch
55	7F351	Shaft — intermediate stub
56	7C096	Bearing and race assembly — forward clutch hub No. 4
57	7A019	Gear assembly — reverse sun
58	7F244	Bearing and race assembly — forward clutch sun gear No. 5
59	388501-S	Retaining ring — center support — 7-7/92
60	7A399	Gear assembly — forward clutch sun
61	7F277	Spring — case to planet support
62	7A130	Support assembly — planetary gear
63	7A089	OWC cage spring and roller assembly — planetary
64	7A398	Planetary assembly (model dependent)
65	7D095	Band assembly — reverse
66	377437-S	Retaining ring — 0.58 thick (locates reverse band during assembly)
67	7F236	Hub — direct clutch
68	7F243	Bearing and race assembly — direct clutch inner No. 7
69	7F237	Support — direct clutch inner bearing
70	7D483	Retaining ring — direct clutch pressure plate (select fit)
71	7B066	Plate — direct clutch pressure
72	7B164	Plate — direct clutch internal spline (friction)

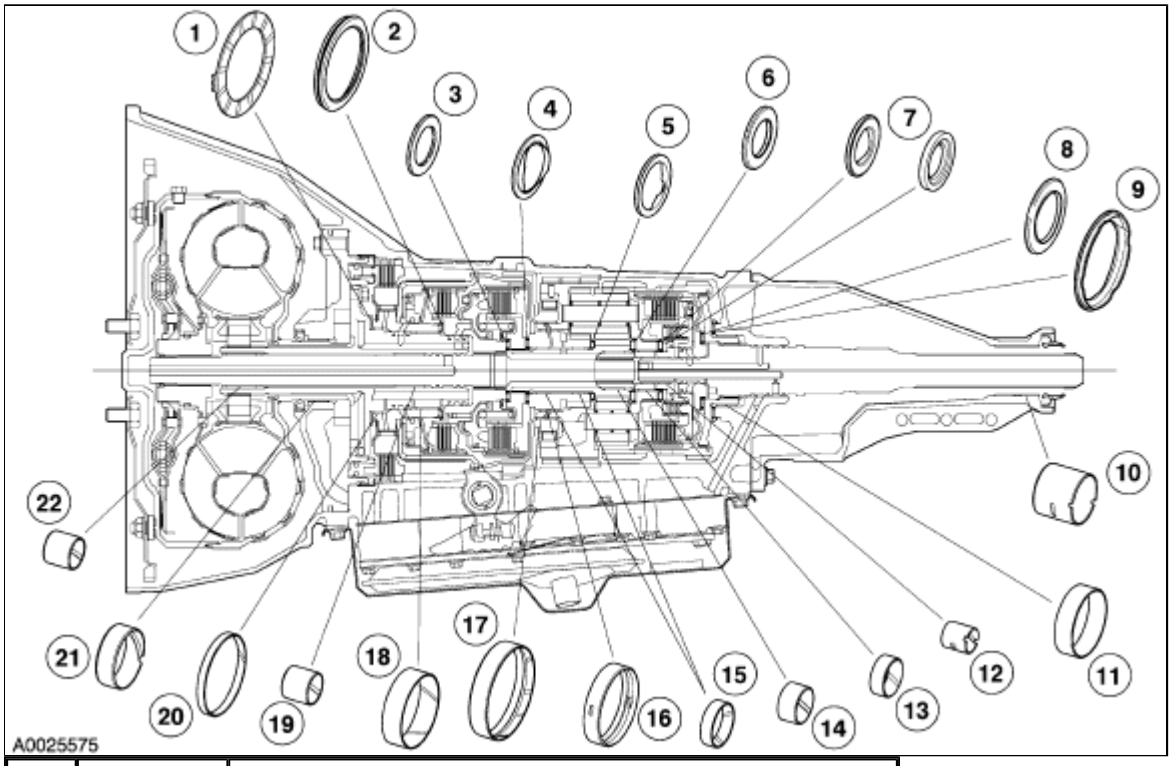
73	7B442	Plate — direct clutch external spline (steel)
74	388104-S	Retainer ring — 1-19/32 (retains 7F235 to 7F283)
75	7F235	Retainer and spring assembly — direct clutch
76	7A262	Piston assembly — direct clutch
77	7C099	Seal — direct clutch piston inner
78	7A233	Seal — direct clutch piston outer
79	7A153	Gear — output shaft ring
80	7F283	Cylinder assembly — direct clutch
81	7F274	Seals — output shaft small — direct clutch (2 req'd)
82	7F240	Bearing and race assembly — direct clutch outer No. 8
83	7060	Shaft assembly — output (model dependent)
84	7F273	Seal — output to case shaft large (3 req'd)
85	87054-S94	Seal — O-ring (piloted output shaft only) (model dependent)
86	7D164	Hub — output shaft
87	97713-S	Snap ring — 1-13/16 retaining (retains 7D164 to 7060)
88	7C122	Snap ring — retaining (retains 7D164 to 7A153)
89	7025	Bushing — rear case
90	7F242	Bearing and race assembly — case rear No. 9
91	7005	Case assembly
92	7086	Gasket — extension (model dependent)
93	N803747-S1101	Bolt — M8-1.25 x 30 (6-attaches 7A039 to 7005) (model dependent)
94	7A039	Extension housing assembly (model dependent)
95	—	Bushing — extension housing (part of 7A039)
96	7052	Seal assembly — extension housing (model dependent)
97	390318-S100	Pipe plug — 1/8-27 Dryseal tapered (5 req'd)
98	7F295	Pin — overdrive band anchor
99	388142-S	Pin — reverse band anchor (part of 7005)
100	7034	Vent assembly — case
101	N605771-S427	Bolt — M6-1.0 x 14 hex head (attaches output shaft speed sensor to case)
102	7H103	Sensor assembly — transmission output shaft speed
103	N811757-S100	Seal — 14.0 x 1.78 O-ring (2 req'd)
104	N806933-S102	Bolt and washer assembly — M6-1.0 x 25 mm (1 in) (2-attaches 7F293 to 7005) (model dependent)
105	7F293	Sensor — transmission range

106	7A256	Lever assembly — manual control (model dependent)
107	7H296	Link assembly — manual control (model dependent)
108	7C493	Shaft — transmission manual control lever (model dependent)
109	N808737-S427	Nut — M10-1.5 (attaches 7A256 to 7C493)
110	7B498	Seal assembly — manual control lever
111	373907-S2	Nut — 1/4 spring (retains identification tag to 7000)
112	7B148	Tag — identification (part of 7005)
113	7D273	Connector assembly — fluid tube (2 req'd)
114	7N171	Plug — converter housing access
115	7B210	Pin — manual lever shaft retainer
116	391131	Seal — 0.426 x 0.070 O-ring
117	N805862-S	Seal — 14.0 x 1.78 O-ring
118	7G383	Solenoid valve — transmission pressure control
119	7A441	Pawl — parking pawl
120	7D071	Shaft — parking pawl
121	7D419	Cup — park rod guide (part of 7A039)
122	7D070	Spring — parking pawl return
123	7A232	Rod assembly — park pawl actuating
124	7A115	Lever assembly — manual valve detent lever
125	N800287-S536	Nut — M14 x 1.5 hex intermediate detent lever (attaches 7A115 to 7A256)
126	7H188	Piston assembly — overdrive servo
127	7F201	Spring — overdrive servo piston
128	7F203	Rod — overdrive servo actuating (part of 7H188)
129	7H179	Washer — backup overdrive servo (part of 7H188)
130	7G277	Spring — overdrive cushion spring (part of 7H188)
131	7F200	Piston assembly — overdrive servo (part of 7H188)
132	97411-S	Ring — retaining (part of 7H188)
133	7384	Ring — 2.85 retaining type TVP "H" internal (retains 7H188 to 7005)
134	7D031	Spring — reverse band servo piston
135	7D189	Piston assembly — reverse band servo
136	7D036	Cover assembly — reverse band servo piston
137	388215-S100	Retaining ring internal — 3-13/16
138	7H292	Piston — 2-3 accumulator (bonded seals)
139	7F285	Spring — 2-3 shift accumulator piston (model dependent)
140	7B264	Retainer — 2-3 shift accumulator spring

141	7F284	Spring — 1-2 shift accumulator (model dependent)
142	7F251	Piston — 1-2 shift accumulator (bonded seals)
143	7F284	Spring — 1-2 shift accumulator
144	7G326	Nested spring — 1-2 (inner spring) (vehicle dependent)
145	7F247	Cover and seal assembly — 1-2 accumulator
146	7384	Ring — 2-1/16 retaining type HU internal (retains 7H300 to 7005)
147	N807178-S1000	Bolt — M6-1.0 x 18 hex head (12-attaches reinforcing plate to valve body)
148	7F282	Plate — valve body reinforcing (part of 7A100)
149	7C155	Gasket — valve body separator upper
150	7A008	Plate — control valve body separator (part of 7A100)
151	7D100	Gasket — valve body separator lower
152	7D174	Valve — converter drainback
153	7A091	Body assembly — main control
154	7H173	Gasket — valve body cover plate
155	7C034	Plate — valve body cover (part of 7A100)
156	N807178-S1000	Bolt — M6-1.0 x 18 hex head (11-attaches 7C034 to 7A100 (part of 7A100)
157	7A100	Control assembly — main (model dependent)
158	7A098	Filter and seal assembly — fluid
159	7A191	Gasket — transmission pan
160	7A194	Pan — transmission
161	N605785-S1036	Bolt — M8-1.25 x 18 hex flange head (14-attaches 7A194 to 7005)
162	7L027	Magnet — ceramic case (part of 7A194)
163	N808947-S1300	Bolt — M8-1.25 x 46 hex shoulder pilot (2-attaches 7C034 to 7A100)
164	N807179-S1000	Bolt — M6-1.0 x 52 hex flange head (12-attaches 7A100 to 7005)
165	7H111	Retainer — solenoid
166	7E195	Ball — 1/4 diameter coast booster valve shuttle (8 req'd)
167	7H187	Screen — solenoid pressure supply
168	N800670-S1000	Bolt — M6-1.0 x 40 hex flange head (13-attaches 7A100 to 7005)
169	7E332	Spring assembly — manual valve detent
170	7Z276	Seal — 0.864 x 0.070 O-ring (2 req'd)
171	7G276	Bulkhead assembly — wiring connector
172	7G276	Bulkhead assembly — connector (molded lead frame)

173	7Z484	Seal — 6.07 x 1.70 O-ring (2 req'd)
174	7G484	Solenoid valve — transmission shift
175	7G136	Solenoid valve — transmission torque converter clutch
176	N807178-S1000	Bolt — M6-1.0 x 16 hex head (retains 7D136 and 7G484 to 7A100)
177	7Z136	Seal — 0.489 x 0.070 O-ring
178	7Z484	Seal — 0.176 x 0.070 O-ring
A	—	Intermediate clutch assembly
B	—	Intermediate one-way clutch
C	—	Reverse clutch assembly
D	—	Forward clutch assembly
E	—	Direct clutch assembly

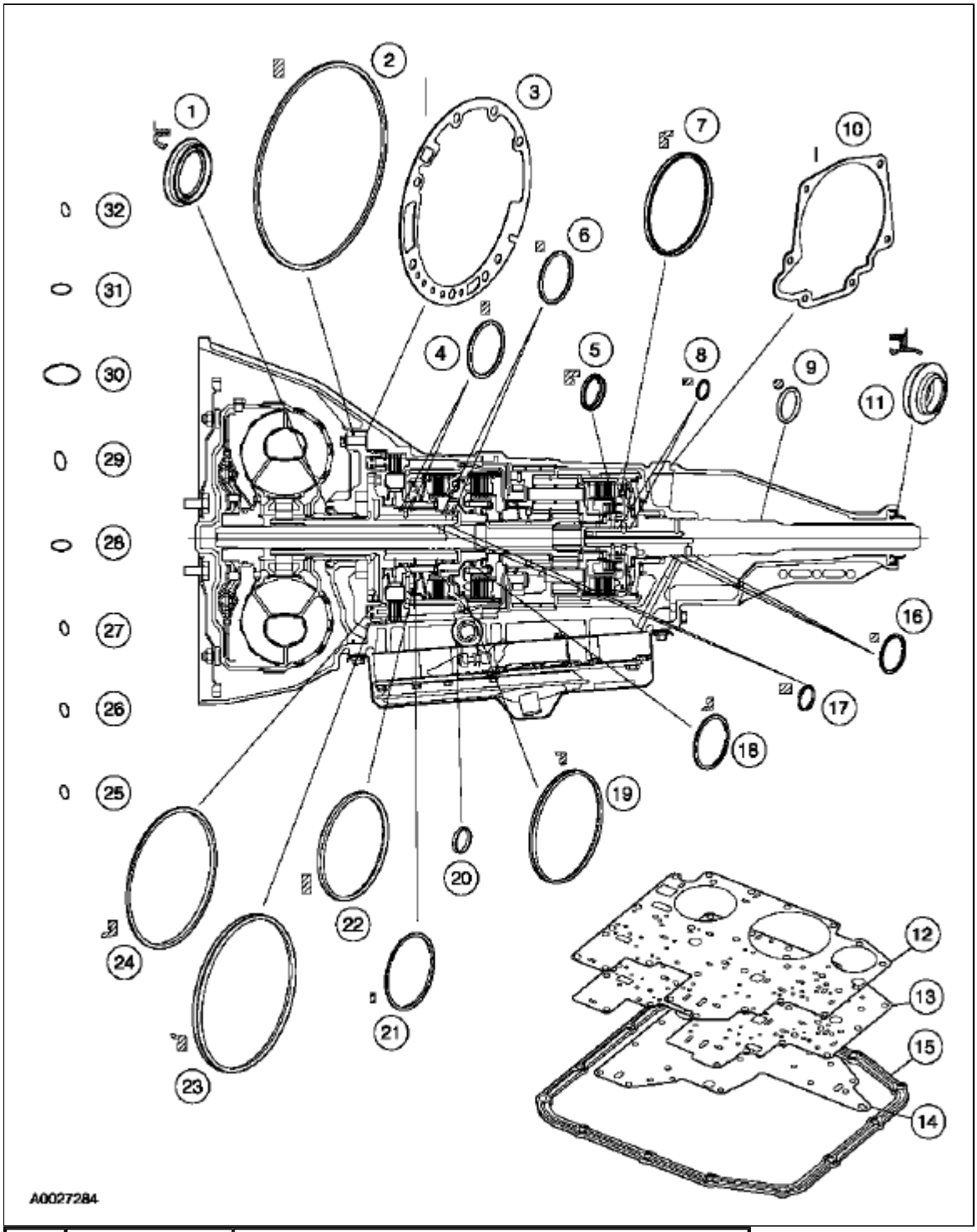
Bushings, Bearing and Thrust Washer Locator



Item	Part Number	Description
1	7D014	Pump No.1 thrust washer (select fit)
2	7A166	Forward clutch No. 2 bearing and race assembly
3	7F231	Forward clutch bearing and race assembly — front No. 3
4	7F244	Forward clutch hub bearing and race assembly No. 4
5	7F244	Forward clutch sun gear bearing and race assembly No. 5
6	7F241	Planet assembly bearing and race No. 6
7	7F243, 7F237	Direct clutch inner bearing, race assembly No. 7 and direct clutch inner bearing support No. 7
8	7F240	Direct clutch outer bearing and race assembly No. 8
9	7F242	Outer bearing and race assembly — rear No. 9
10	—	Extension bushing (part of 7A039)
11	7025	Case bushing
12	7B233	Output shaft bushing
13	7B375	Planet carrier bushing — rear
14	7F209	Forward clutch sun gear bushing

15	7N193	Reverse clutch sun gear bushing
16	7B374	Carrier bushing — front
17	7A132	Planetary support bushing
18	7F218	Reverse clutch drum bushing — rear
19	7B261	Front pump support bushing
20	7F217	Reverse clutch drum bushing — front
21	7B258	Front pump bushing
22	7B261	Front pump support bushing

Seals, Rings and Gasket Locator

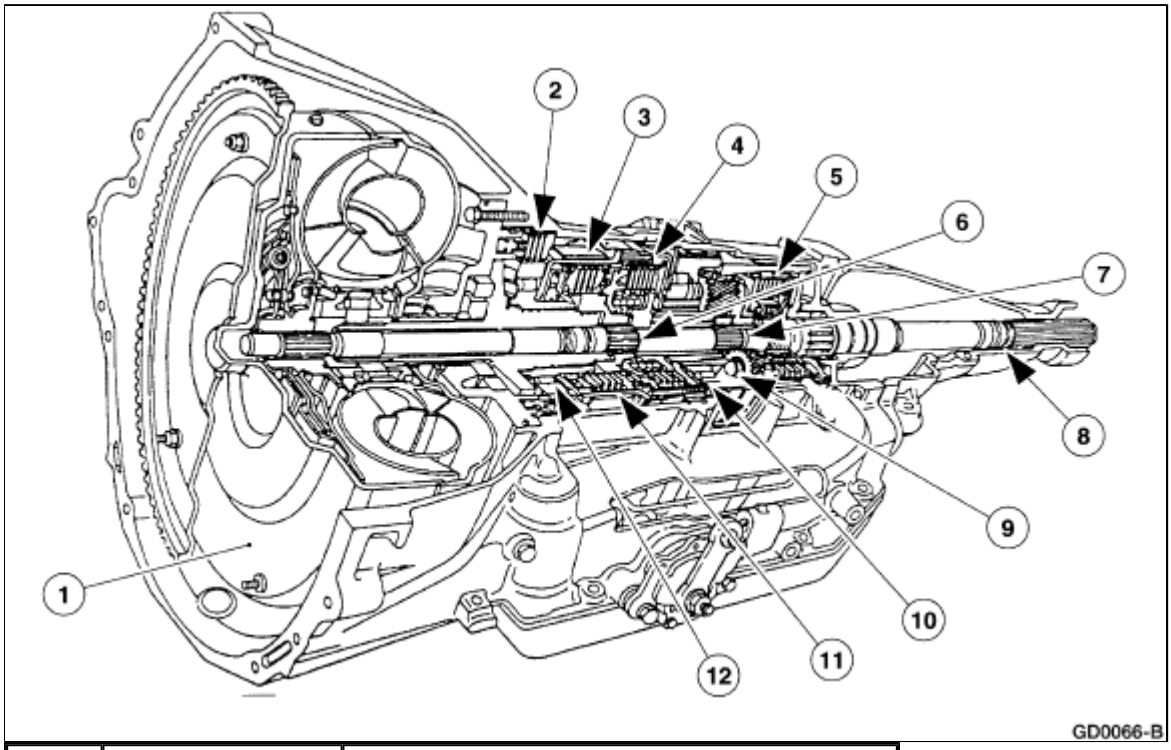


Item	Part Number	Description
1	7A248	Front pump seal assembly

2	7A248	Front pump seal
3	7A136	Front pump gasket
4	7D020	Reverse clutch cylinder seal (2 req'd)
5	7C099	Direct clutch piston inner seal
6	7D019	Forward clutch cylinder
7	7A548	Direct clutch piston outer seal
8	7F274	Output shaft to direct clutch cylinder seal (2 req'd)
9	87054-S94	O-ring seal (piloted) (model dependent)
10	7086	Extension gasket
11	7052	Extension housing seal assembly
12	7C155	Control valve body upper gasket
13	7D100	Valve body separator plate lower gasket
14	7H173	Valve body cover plate gasket
15	7A191	Transmission pan to case gasket
16	7F273	Output shaft to case seal (3 req'd)
17	7B497	Input shaft seal (2 req'd)
18	7C099	Forward clutch piston inner seal
19	7A548	Forward clutch piston outer seal
20	7B498	Manual control lever seal assembly
21	7D403	Reverse clutch piston outer seal
22	7D404	Reverse clutch piston inner seal
23	7F224	Intermediate clutch piston outer seal
24	7F225	Intermediate clutch piston inner seal
25	391308-S	Fill tube level indicator seal
26	7Z484	TCC solenoid seal (large)
27	7Z136	TCC solenoid seal (small)
28	7Z484	Shift solenoid seal (2 req'd)
29	N811757-S100	Output shaft speed sensor seal
30	7Z276	Bulkhead seal (1 req'd)
31	N805862-S	Pressure control solenoid seal (large)
32	391131	Pressure control solenoid seal (small)

Main Components and Functions

Transmission Main Components — Sectional View



Item	Part Number	Description
1	7902	Torque converter
2	7B164	Intermediate clutch (friction)
3	7B164	Reverse clutch (friction)
4	7B164	Forward clutch (friction)
5	7B164	Direct clutch (friction)
6	7F207	Forward clutch cylinder and shaft
7	7F351	Shaft — intermediate stub
8	7060	Output shaft
9	7A089	Planetary one-way clutch
10	7D095	Reverse clutch band
11	7F196	Overdrive band
12	7A089	Intermediate one-way clutch

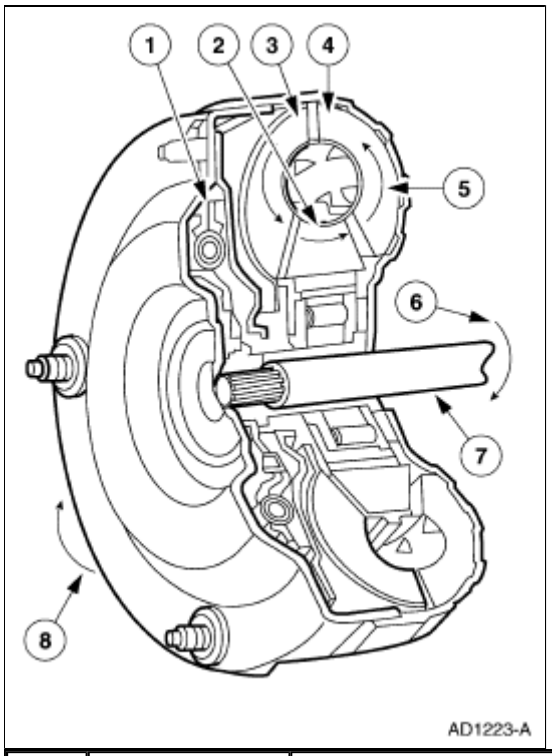
Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a four-element device:

- impeller assembly
- turbine assembly
- reactor assembly
- clutch and damper assembly

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.



Item	Part Number	Description
1	—	Converter clutch and damper (part of 7902)
2	—	Reactor (part of 7902)
3	—	Turbine (part of 7902)

4	—	Impeller (part of 7902)
5	—	Fluid motion
6	—	Transmission input rotation
7	—	Input shaft
8	—	Engine rotation

Geartrain

Power is transmitted from the torque converter to the Ravigneaux geartrain components through the input shaft and forward clutch cylinder.

- The geartrain contains a Ravigneaux planetary set connected by dual pinion gears.
- By holding or driving certain components of the gearset, four forward ratios and one reverse ratio are obtained and transmitted to the output shaft. The ratios are as follows:

Gear Ratio	
1st	2.84 to 1
2nd	1.55 to 1
3rd	1.00 to 1
4th	0.70 to 1
Reverse	2.32 to 1

- Components of the geartrain can be held by bands or clutches and driven by clutches only.

The 4R70W uses:

- two bands.
- two one-way clutches (one roller, one mechanical diode).
- four friction clutches.

Planetary Gearset

The planetary gearset in the transmission is a Ravigneaux-type set consisting of the following components:

- forward clutch sun gear
- reverse clutch sun gear
- a pinion carrier
- long and short pinions
- output ring gear

Components are held or driven to produce forward and reverse gear ratios.

Input Shaft

The forward clutch cylinder and shaft transfers speed and torque from the converter turbine to the geartrain. This shaft is splined to the turbine on one end and to the forward clutch sun gear and stub shaft on the other end.

Stub Shaft

The stub shaft transfers power from the input shaft to the planet carrier (through the direct clutch) during third and fourth gear operation.

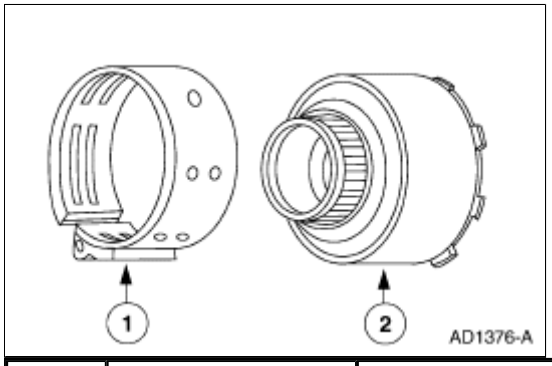
Output Shaft

The output shaft provides torque to the driveshaft and rear axle assembly. It is driven by the ring gear of the planetary gearset.

Apply Components

There are eight apply components used to drive or hold the planetary gearset components.

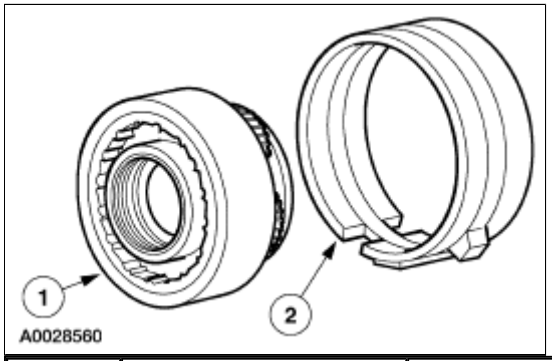
Band—Overdrive



Item	Part Number	Description
1	7F196	Overdrive band assembly
2	7D044	Reverse clutch drum assembly

The overdrive band holds the reverse clutch drum stationary in fourth gear and manual 2. This action causes the reverse sun gear to be held in these ranges.

Band—Low and Reverse

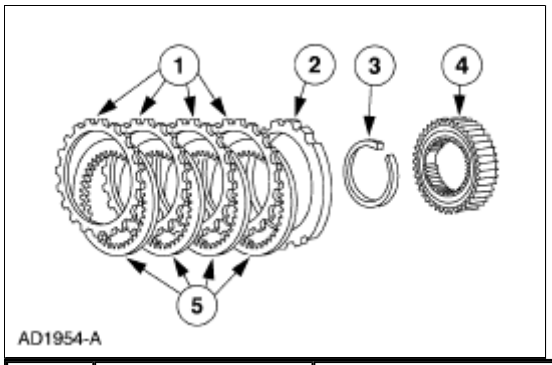


Item	Part Number	Description
1	7A398	Planetary assembly
2	7D095	Reverse band assembly

The low and reverse band holds the pinion carrier in reverse. The reverse band also applies in manual 1 position to provide engine braking.

Clutch—Intermediate

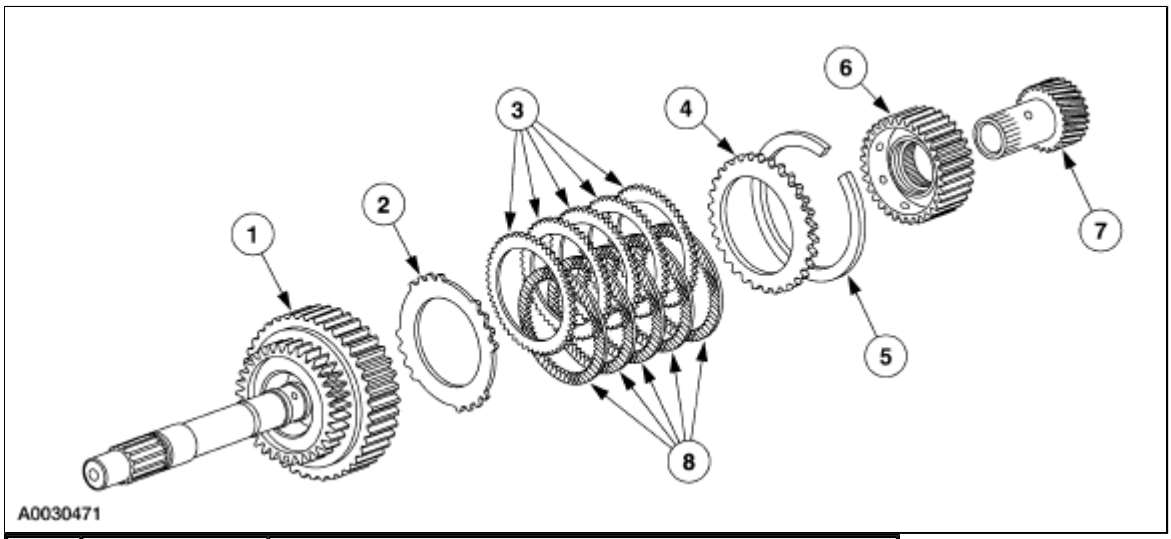
Intermediate Clutch Disassembled View



Item	Part Number	Description
1	7B442	Intermediate clutch plates (steel)
2	7B066	Intermediate clutch pressure plate
3	391267-S	Retaining ring
4	7A089	Intermediate one-way clutch assembly
5	7B164	Intermediate clutch plates (friction)

The intermediate clutch works with the intermediate one-way clutch to hold the reverse sun gear stationary in second gear. The intermediate clutch remains applied in third and fourth gears, but does not transmit power.

Clutch—Forward

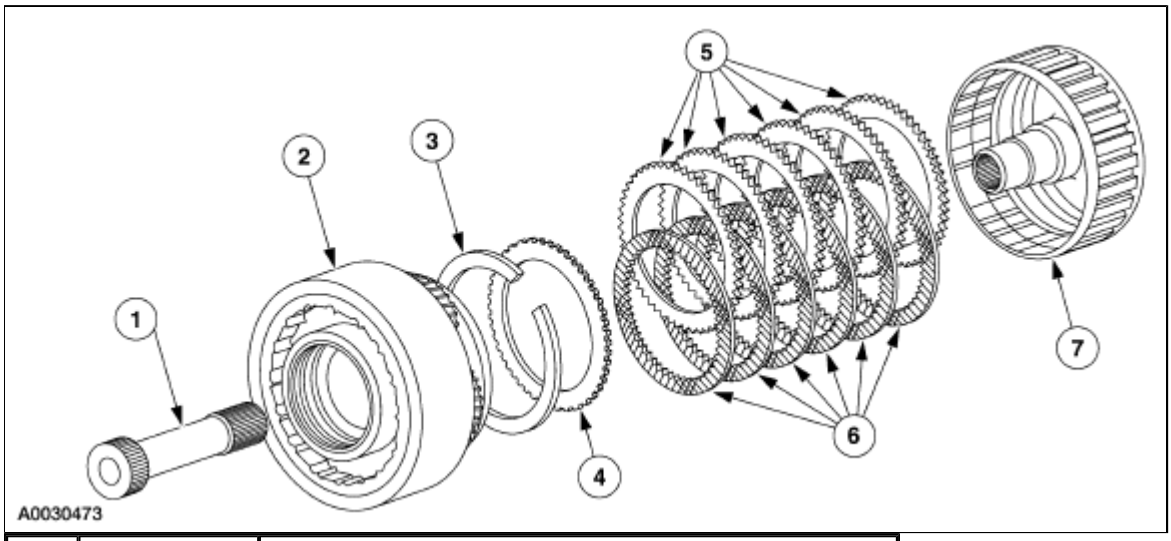


Item	Part Number	Description
1	7F207	Forward clutch cylinder and input shaft assembly
2	7E085	Rear clutch pressure plate spring
3	7B442	Forward clutch plate external spline (steel)
4	7B066	Forward clutch pressure plate
5	7D483	Snap ring — retaining (select fit)
6	7B067	Forward clutch hub
7	7A399	Forward clutch sun gear assembly

8	7B164	Forward clutch plate internal spline (friction)

The forward clutch couples the forward clutch cylinder and input shaft to the forward sun gear in first, second, and third gears. The forward clutch is not applied in fourth gear.

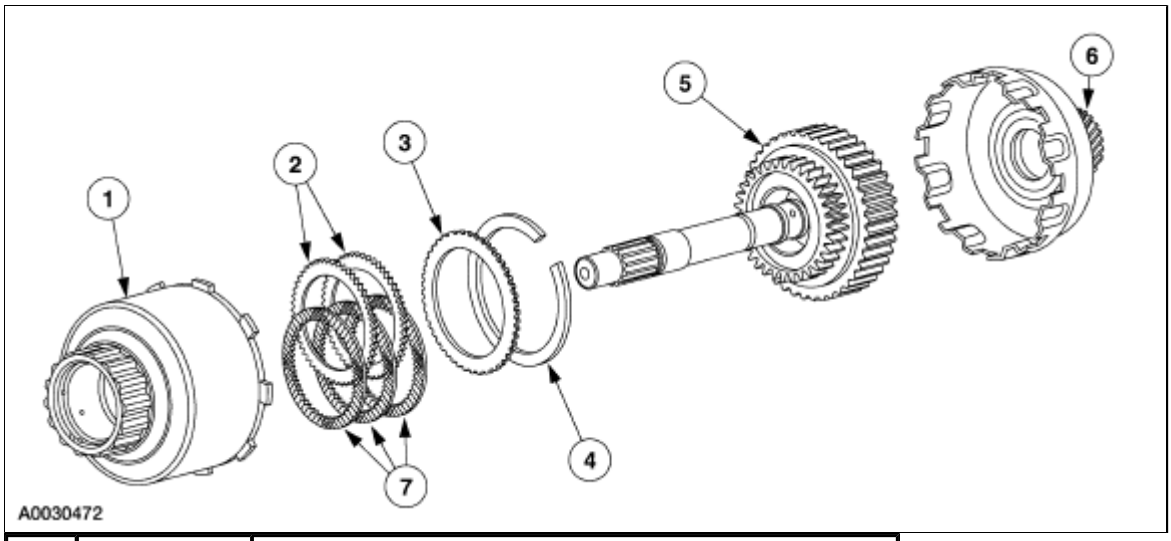
Clutch—Direct



Item	Part Number	Description
1	7F351	Intermediate stub shaft
2	7A398	Planetary assembly
3	7D483	Direct clutch pressure plate retaining ring (select fit)
4	7B066	Direct clutch pressure plate
5	7B442	Direct clutch plates external splined (steel)
6	7B164	Direct clutch plates internal splined (friction)
7	7F283	Direct clutch cylinder assembly

The direct clutch couples the input shaft to the planet carrier through the stub shaft in third and fourth gears.

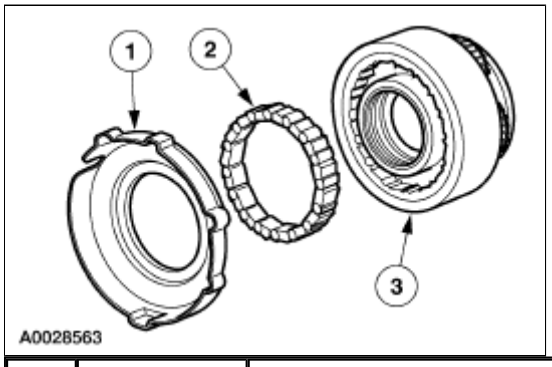
Clutch—Reverse



Item	Part Number	Description
1	7D044	Reverse clutch drum assembly
2	7B442	Reverse clutch plate external splined (steel)
3	7B066	Reverse clutch pressure plate (rear)
4	7D483	Reverse clutch pressure plate retaining ring (select fit)
5	7F207	Forward clutch cylinder and input shaft assembly
6	7A019	Reverse clutch sun gear assembly
7	7B164	Reverse clutch plate internal splined (friction)

The reverse clutch couples the input shaft to the reverse sun gear, applied in reverse range only.

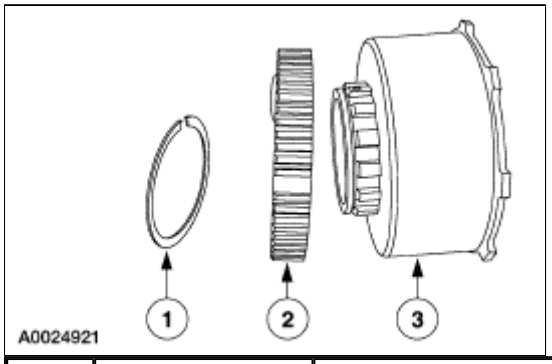
One-Way Clutch—Planetary (Low)



Item	Part Number	Description
1	7A130	Planetary gear support assembly
2	7A089	Planetary one-way clutch cage and spring roller assembly
3	7A398	Planetary assembly

The planetary (low) one-way clutch is a roller clutch that holds the planetary gearset in first gear, (D) and D ranges. During automatic coasting downshifts into first gear ((D) and D ranges), the planetary one-way clutch freewheels so there is no engine braking.

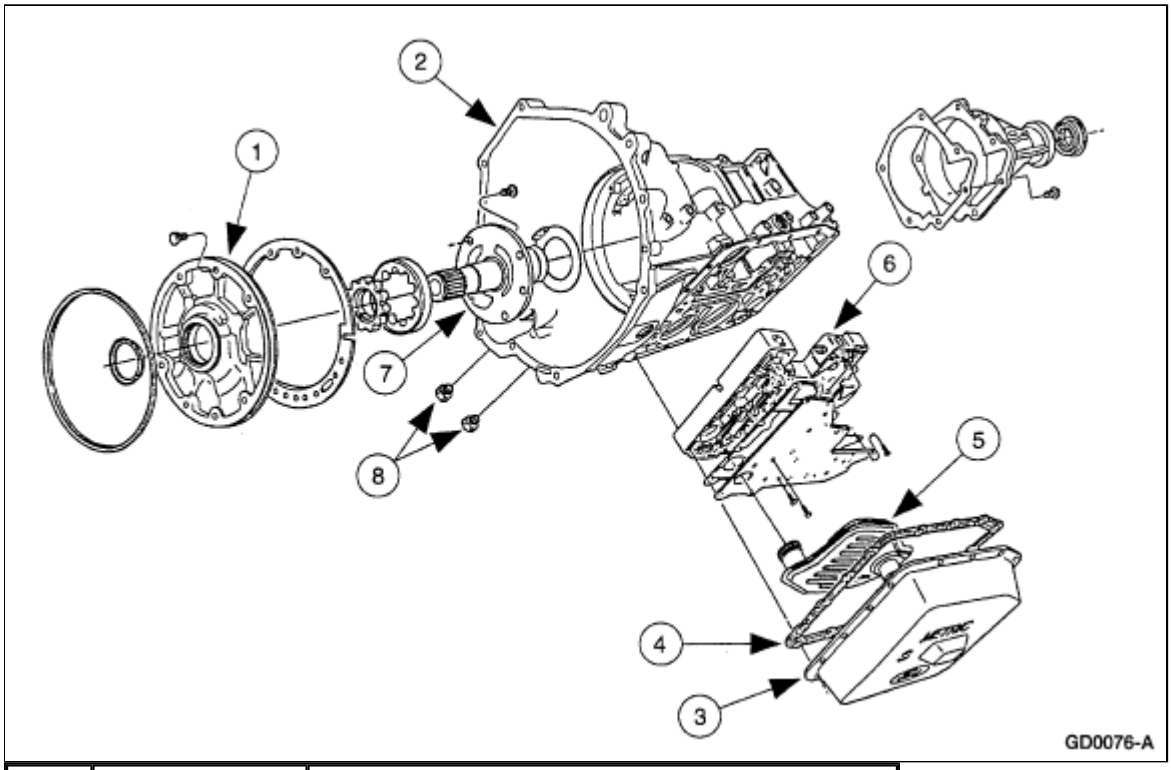
One-Way Clutch—Intermediate



Item	Part Number	Description
1	391267-S	Retaining ring
2	7A089	Intermediate one-way clutch assembly
3	7D044	Reverse clutch drum assembly

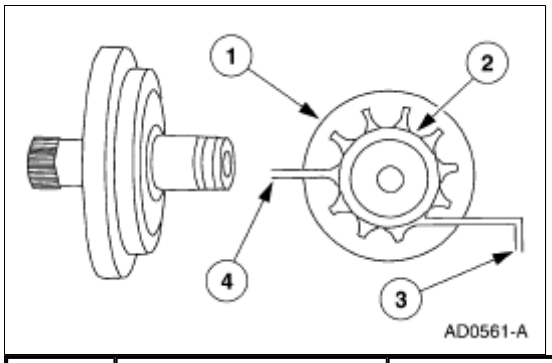
The intermediate one-way clutch works with the intermediate friction clutch to hold the reverse clutch drum and reverse sun gear stationary in second gear during acceleration. The intermediate one-way clutch freewheels in third gear and during coasting in second gear, (D) and D ranges.

Hydraulic System



Item	Part Number	Description
1	7A106	Front pump body assembly
2	7005	Case assembly
3	7A194	Transmission pan
4	7A191	Transmission pan gasket
5	7A098	Fluid filter and seal assembly
6	7A100	Main control assembly
7	7A108	Front pump support assembly
8	7D273	Fluid tube connector assembly (2 req'd)

Fluid Pump



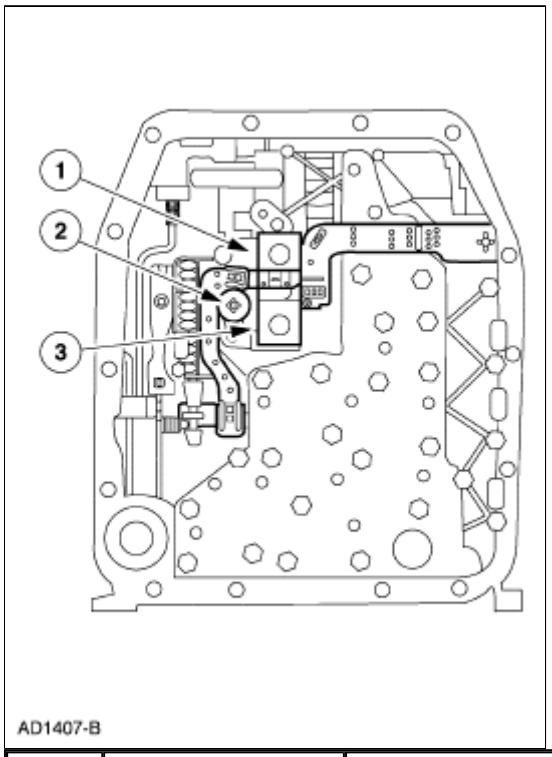
Item	Part Number	Description
1	—	Outer rotor (part of 7A103)
2	—	Inner rotor (part of 7A103)
3	—	Outlet
4	—	Inlet

The transmission uses a gerotor-type design front pump support and gear. The pump provides the volume of fluid needed to charge the torque converter, main control assembly, cooling system and lube system. Pump pressure is regulated by the main regulator valve. The pump has an internal boost circuit which is more efficient at lower engine speeds.

Filter

All fluid drawn from the transmission pan by the pump passes through the filter. The filter and its accompanying seal are part of the fluid path from the sump (pan) to the fluid pump.

Main Control

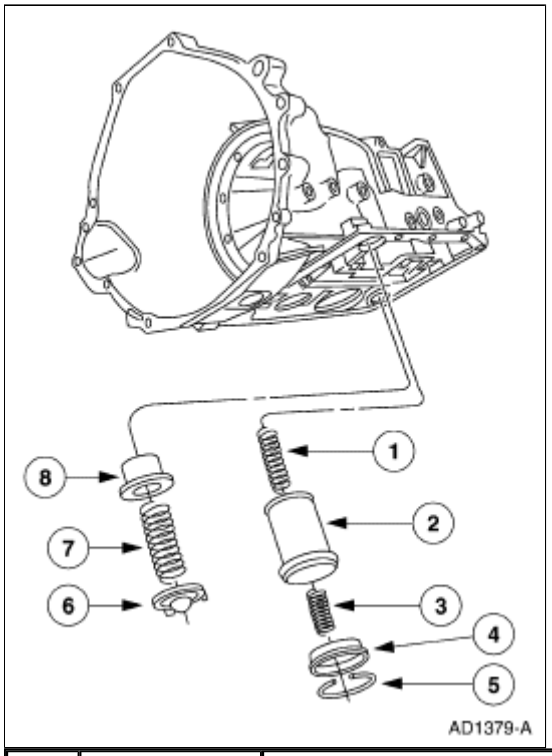


Item	Part Number	Description
1	—	Shift solenoid A (part of 7G484)
2	7G136	Torque converter clutch solenoid
3	—	Shift solenoid B (part of 7G484)

The main control valve body houses three electronic solenoids:

- two shift solenoids
- one torque converter clutch solenoid (TCC solenoid)

Accumulators



Item	Part Number	Description
1	7F284	Spring — 1-2 shift accumulator (model dependent)
2	7F251	Piston — 1-2 shift accumulator
3	7F284	Spring — 1-2 shift accumulator (model dependent)
4	7H300	Cover and seal assembly — 1-2 accumulator
5	7384	Ring — 2-1/16 retaining type HU internal
6	7B264	Retainer — 2-3 shift accumulator piston
7	7F285	Spring — 2-3 shift accumulator piston
8	7H292	Piston — 2-3 shift accumulator

The transmission uses two accumulators:

- 1-2 Accumulator — The 1-2 accumulator is used to soften the 1-2 shift by absorbing some of the

pressure directed to the intermediate clutch. Constant line pressure is applied to the middle section of the 1-2 accumulator piston, opposing the intermediate clutch pressure, until the pressure is high enough to overcome line pressure. The top of the piston is exhausted to the sump.

- 2-3 Accumulator — The 2-3 accumulator is used to soften the 2-3 shift by absorbing some of the direct clutch pressure. Forward clutch pressure is applied to the top side of the 2-3 accumulator piston, holding the piston down until clutch pressure is high enough to overcome it. The middle section of the piston is exhausted to the sump.

Transmission Electronic Control System

Electronic System Description

The powertrain control module (PCM) and its input/output network control the following transmission operations:

- shift timing
- line pressure (shift feel)
- torque converter clutch

The transmission control is separate from the engine control strategy in the PCM, although some of the input signals are shared. When determining the best operating strategy for transmission operation, the PCM uses input information from certain engine-related and driver-demand related sensors and switches.

In addition, the PCM receives input signals from certain transmission-related sensors and switches. The PCM also uses these signals when determining transmission operating strategy.

Using all of these input signals, the PCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the best line pressure needed to optimize shift feel. To accomplish this the PCM uses hydraulic solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Mass Air Flow (MAF) Sensor

The mass air flow sensor (MAF) measures the mass of air flowing into the engine. The MAF sensor output signal is used by the powertrain control module (PCM) to calculate injector pulse width. For transmission strategies the MAF sensor is used to regulate electronic pressure control EPC, shift and torque converter clutch scheduling.

Powertrain Control Module (PCM)

The operation of the transmission is controlled by the powertrain control module (PCM). Many input sensors provide information to the PCM. The PCM then controls actuators which determine transmission operation.

Transmission Control Switch (TCS) and Transmission Control Indicator Lamp (TCIL)

The transmission control switch (TCS) is a momentary contact switch. When the switch is pressed, a signal is sent to the PCM to allow automatic shifts from first through fourth gears or first through third gears only. The PCM energizes the transmission control indicator lamp (TCIL) when the switch is off. The TCIL indicates overdrive cancel mode activated (lamp on) and electronic pressure control (EPC) circuit shorted (lamp flashing) or a monitored sensor failure.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a magnetic pickup, located at the output shaft ring gear, that sends a signal to the powertrain control module to indicate transmission output shaft speed. The OSS is used for torque converter clutch control, shift scheduling and to determine electronic pressure control.

Digital Transmission Range (TR) Sensor

The digital transmission range (TR) sensor is located on the outside of the transmission at the manual lever. The digital TR sensor completes the start circuit in PARK and NEUTRAL, the back-up lamp circuit in REVERSE and the neutral sense circuit (4x4 only) in NEUTRAL. The digital TR sensor also opens and closes a set of four switches that are monitored by the powertrain control module (PCM) to determine the position of the manual lever (P, R, N, D, 2, 1).

Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature (TFT) sensor is located on the lead frame assembly near the shift solenoids on the main control valve body. It is a temperature sensitive device called a thermistor. It sends a voltage signal to the PCM. The voltage signal varies with transmission fluid temperature. The PCM uses this signal to determine whether a cold start shift schedule is necessary. The shift schedule is compensated when the transmission fluid temperature is cold. The PCM also inhibits (TCC) operation at low transmission fluid temperatures and corrects electronic pressure control.

Vehicle Speed Sensor (VSS)

The vehicle speed sensor (VSS) is model dependent. Possible sources of vehicle speed input are, anti-lock brake sensor (ABS), a gear-driven vehicle speed sensor (VSS), or the transmission output shaft speed (OSS) sensor. On 4x4 applications with a manual shift transfer case, the transfer case speed sensor is the source of vehicle speed. The VSS signal is either an AC signal whose frequency changes with vehicle speed, or an SCP data message depending on the source. Some vehicles have both. The vehicle speed signal is an input to various vehicle sub-systems such as the powertrain control module (PCM), instrument cluster (speedometer and odometer), speed control systems, etc. The vehicle speed source must be operational to enter output state control mode for diagnostics.

Electronic Pressure Control (EPC) Solenoid

The electronic pressure control (EPC) solenoid regulates transmission pressure. EPC valve pressure is used to control line pressure.

Shift Solenoid — SSA, SSB

Two on/off shift solenoids provide gear selection of first through fourth gears by controlling the pressure to the three shift valves. One unit containing the two shift solenoids is located in the main control valve body. The shift solenoids are two-way normally open style.

Solenoid Operation Chart

Gear Lever Position	PCM Commanded Gear	Solenoids		
		SSA	SSB	TCC
P/R/N	1	ON	OFF	HD
(D)	1	ON	OFF	HD
(D)	2	OFF	OFF	EC
(D)	3	OFF	ON	EC
(D)	4	ON	ON	EC
w/OD OFF				
1	1	ON	OFF	HD

2	2	OFF	OFF	EC
3	3	OFF	ON	EC
Manual 2	2	OFF	OFF	EC
Manual 1	1	ON	OFF	HD
1 [a]	2	OFF	OFF	EC

[a] When a manual pull-in occurs above a calibrated speed, the transmission will not downshift from the higher gear until the vehicle speed drops below this calibrated speed.

EC = Electronically Controlled.

HD = Hydraulically Disabled.

Torque Converter Clutch (TCC) Solenoid

The torque converter clutch (TCC) solenoid is used to control the apply and release of the TCC.

4x4 Low (4x4L) Switch

The 4x4 low (4x4L) range switch is located on the transfer case cover. It provides an indication of when the 4x4 transfer case gear system is in the low range. The PCM then modifies shift schedule for 4x4L operation.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the powertrain control module (PCM) when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released.

Electronic Ignition (EI) System

The electronic ignition consists of a crankshaft position sensor, two four tower ignition coils and the powertrain control module (PCM). The ignition control module operates by sending crankshaft position information from the crankshaft position sensor to the ignition control module. The ignition control module generates a profile ignition pickup (PIP) signal (engine rpm) and sends it to the PCM. The PCM uses PIP signal in the transmission strategy, wide-open throttle (WOT) shift control, torque converter clutch control and EPC pressure.

Air Conditioning (A/C) Clutch

An electromagnetic clutch is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator/drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft. When the A/C clutch is engaged, electronic pressure control (EPC) is adjusted by the PCM to compensate for additional load on the engine.

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor provides the sequential fuel injection (SFI) system mixture temperature information. The IAT sensor is used both as a density corrector for air flow calculation and to proportion cold enrichment fuel flow. The IAT sensor is installed in the air cleaner outlet tube. The IAT sensor is also used in determining electronic pressure control (EPC) pressures.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects temperature of engine coolant and supplies the information to the powertrain control module (PCM). The ECT sensor is used to control torque converter clutch (TCC) operation. The ECT is installed in the heater outlet fitting or cooling passage on the engine. For engine control applications, the ECT signal is used to modify ignition timing, EGR flow and air-to-fuel ratio as a function of engine coolant temperature.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and sends this information to the powertrain control module (PCM). The TP sensor is used for shift scheduling, electronic pressure control and torque converter clutch (TCC) control.

Diagnostic Strategy

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take any short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To properly diagnose a concern have the following publications available:

- Transmission Reference Manual.
- Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- TSBs and OASIS Messages.
- Wiring Diagram.

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check shift linkages for proper adjustment.
- Check TSBs and OASIS messages regarding the concern.

Diagnostics

- Carry out on-board diagnostic procedures key on engine off (KOEO) and key on engine running (KOER).
- Record all diagnostic trouble codes (DTCs).
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, refer to Diagnosis By Symptom for further information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Diagnostic Flow Chart		
• Know and understand the customer concerns • Check the fluid level and condition • Verify the concern by operating the vehicle • Check for non-factory-installed items and verify correct installation • Check the shift linkage adjustments • Check TSBs and OASIS messages for vehicle concerns • Carry out quick test both KOER and KOEO • Record all codes 1) Did you record any diagnostic trouble codes?	Yes	· REPAIR all hard diagnostic trouble codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first, then this Workshop Manual.
	No	· REFER to Diagnosis By Symptom in this section, then GO to Step 5.
2) Are any continuous test memory codes present?	Yes	· CLEAR codes and CARRY OUT drive cycle test.
	No	· GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	· REPAIR all continuous test memory codes. FOLLOW the pinpoint tests. REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual then the transmission reference manual, then this workshop manual, then GO to Step 4.
	No	· GO to Step 4.
4) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no diagnostic trouble codes are present. CLEAR memory codes.
	No	· REFER to Diagnosis By Symptom in this section.
5) Are there any electrical concerns?	Yes	· INSTALL the scan tool and CARRY OUT the output state control test, then GO to Step 6.
	No	· REFER to the hydraulic and mechanical routine to diagnose and REPAIR the concern, then GO to Step 7.
6) Was the transmission	Yes	· REFER to the Powertrain Control/Emissions Diagnosis (PC/ED)

concern corrected when the scan tool was installed?		manual, intermittent fault diagnosis section and use the scan tool to diagnose cause of concern in the processor, vehicle harness or external inputs (sensors or switches).
	No	· REFER to the hydraulic and mechanical routine to diagnose the concern, then GO to Step 7.
7) Is the concern repaired?	Yes	· CARRY OUT the final quick test to verify that no diagnostic trouble codes are present. CLEAR memory codes.
	No	· Get assistance from technical hotline.

Preliminary Inspection

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to properly diagnose a concern, first understand the customer complaint or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions as to when the concern occurs, for example:

- hot or cold vehicle temperature
- hot or cold ambient temperature
- vehicle driving conditions
- vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to verify the concern.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and performing the appropriate procedures.

The following procedures must be used when verifying customer concerns for the transmission (7003).

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The torque converter clutch not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift
- Downshift
- Coasting
- Engagement
- Noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent, or temperature dependent.

Check Fluid Level and Condition

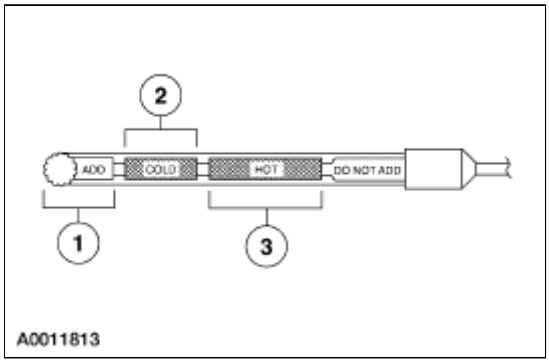
Fluid Level Check

CAUTION: The vehicle should not be driven if the fluid level indicator shows the fluid below the DO NOT DRIVE mark or internal failure could result.

NOTE: If vehicle has been operated for an extended period of time at highway speeds, city traffic, hot weather, or pulling a trailer, the fluid needs to cool down to obtain an accurate reading.

NOTE: The fluid level reading on the indicator will differ from operating and ambient temperatures. The correct reading should be within the normal operating temperature range. Under normal circumstances, the fluid level should be checked during normal maintenance. If the transmission starts to slip, shifts slowly, or has signs of fluid leaking, the fluid level should be checked.

1. With the transmission in (P) PARK, the engine at idle, foot pressed on the brake, move the range selector lever through each gear and allow engagement of each gear. Place the selector lever in the PARK position.
2. Wipe the fluid level indicator cap and remove the indicator.
3. Wipe the indicator with a clean cloth.
4. Install the indicator back in the filler tube until it is fully seated, then remove the indicator. The fluid level should be within the normal operating temperature range.



Item	Description
1	Do Not Drive Mark
2	Fluid Level at Room Temperature 10°C-35°C (50°-95°F)
3	Fluid Level at Operating Temperature 66°C-77°C (150°F-170°F)

High Fluid Level

A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission malfunction and/or damage. If an overfill reading is indicated, refer to Fluid Pan, Gasket and Filter in this section.

Low Fluid Level

A low fluid level could result in poor transmission engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transmission seals or gaskets.

Adding Fluid

CAUTION: The use of any other type of transmission fluid than specified could result in transmission malfunction and/or damage.

If fluid needs to be added, add fluid in 0.25L (1/2 pint) increments through the filler tube. Do not overfill the fluid. For fluid type refer to the General Specifications chart.

Fluid Condition Check

1. Check the fluid level.
2. Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black or have a burnt odor.
3. Hold the fluid level indicator over a white facial tissue and allow the fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transmission. The engine cooling system should also be inspected at this time.
6. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the fluid pan, the transmission must be disassembled and completely cleaned. This includes the torque converter, coolers, and cooler lines.
7. Perform diagnostic checks and adjustments; refer to the Diagnosis by Symptom Index in this section.

Road Testing Vehicle

NOTE: Always drive the vehicle in a safe manner according to the driving conditions and obey all traffic laws.

The shift point road test and torque converter operation tests provide diagnostic information on transmission shift controls and torque converter operation.

Shift Point Road Test

This test verifies that the shift control system is operating correctly.

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

2. Operate vehicle with transmission range selector lever in (D) position.

3. **NOTE:** Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio and application) refer to the Automatic Transmission Specification Issue, available from Ford Customer Service Division.

   Apply minimum throttle and observe speeds at which upshift occurs and torque converter engages; refer to the 4R70W Shift Speeds chart in this section.

4. With the transmission in Overdrive (fourth gear), press the transmission control switch. The transmission should downshift to third gear. Release the accelerator pedal; engine braking should occur.

5. Press accelerator pedal to floor, wide open throttle (WOT). Transmission should shift from third to second gear, or third to first, depending on vehicle speed. Torque converter clutch should disengage and then reapply.

6. With the transmission in (D) position and speed above 80 km/h (50 mph) and less than half throttle, move the transmission range selector lever from (D) position to manual 2 position and remove pressure from the accelerator pedal. Transmission should immediately downshift into second gear. With vehicle remaining in manual 2 position, move the transmission range selector lever into manual 1 position, and release accelerator pedal. Transmission should downshift into first gear at speeds approximately below 45-56 km/h (28-35 mph).

7. If transmission fails to upshift/downshift or torque converter clutch does not apply and release, refer to Diagnosis By Symptom in this section.

4R70W Shift Speeds

Throttle Position	Shift	MPH	Km/H
Light Throttle (TP Voltage 1.25 Volts)	1-2	9-15	14-24
	2-3	17-25	27-40
	3-4	34-45	55-72
Closed Throttle	4-3	25-21	40-33
	3-2	15-12	24-19
	2-1	8-6	13-10
Wide Open Throttle	1-2	35-42	56-68
	2-3	64-72	102-116
	3-2	60-65	97-105
	2-1	31-27	50-43

Torque Converter Diagnosis

Prior to torque converter installation, all diagnostic procedures must be followed. This is to prevent the unnecessary installation of good torque converters (7902). Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary inspection.

2. Know and understand the customer's concern.

3. Verify the condition — carry out the torque converter operation test.

4. Carry out diagnostic procedures.

- Carry out on-board diagnostics; refer to Diagnostics.
  - Repair all non-transmission related DTCs first.
  - Repair all transmission DTCs.
  - Rerun on-board diagnostic to verify repair.
- Carry out Line Pressure Test. For additional information, refer to Special Testing Procedures in this section.
- Carry out Stall Speed Test. For additional information, refer to Special Testing Procedures in this section.
- Carry out Diagnostic Routines. For additional information, refer to Diagnosis By Symptom in this section.
  - Use the Diagnosis by Symptom Index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and repair as required before changing the torque converter.

Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

5. Carry out Quick Test with scan tool. For additional information, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Check for DTCs.

6. Connect a tachometer to the engine.

7. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in (D) position.

8. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h (50 mph) and tap brake pedal with the left foot.

9. Engine rpm should increase when brake pedal is tapped, and decrease about five seconds after pedal is released. If this does not occur, see torque converter operation concerns. For additional

information, refer to Diagnosis By Symptom in this section.

10. If the vehicle stalls in (D) or manual 2 at idle with vehicle at a stop, move the transmission range selector lever to manual 1 position. If the vehicle stalls, see torque converter operation concerns. For additional information, refer to Diagnosis By Symptom in this section. If the vehicle does not stall in (D), refer to Diagnosis By Symptom in this section.

11. If the vehicle exhibits a vibration during the road test, complete the Road Test Evaluation Form. This form will aid the technician in determining the source of the vibration.

NOTE: The following is a list of common vehicle concerns that have been misdiagnosed as torque converter clutch shudder. For diagnosis of the following items, refer to the appropriate sections of the workshop manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

- spark plugs - check for cracks, high resistance or broken insulators
- plug wires
- fuel injector - filter may be plugged
- fuel contamination - poor engine performance
- EGR valve - valve may let in too much exhaust gas and cause engine to run lean
- vacuum leak - engine will not get correct air/fuel mixture
- MAP/MAF sensor - improper air/fuel mixture
- HO2S sensor - too rich/lean air/fuel mixture
- fuel pressure - may be too low
- engine mounts -loose/damaged mounts can cause vibration concerns
- axle joints - check for vibration

Torque Converter Road Evaluation Form

1) Does the Torque Converter Engage/Disengage?	Yes	· GO to Step 2.
	No	· For further diagnosis, REFER to Diagnosis By Symptom — Torque Converter, No Apply Routine 240/340 and Always Applied Routine 241/341 found in this section. Repair as required, verify converter operation and then continue.
2) Does vibration occur during 3-4 or 4-3 shift at: light, medium, or heavy throttle?	Light	· May be torque converter clutch shudder. GO to Step 3.
	Medium	· May be torque converter clutch shudder. GO to Step 3.
	Heavy	· Not torque converter clutch shudder — converter does not engage due to PCM strategy. For further diagnosis, REFER to Section 100-04 and Diagnosis By Symptom — Noise/Vibration Routine 254/354 found in this section.

3) Is the problem vehicle speed dependent (operating at steady speed, i.e., 64 km/h [40 mph] regardless of transmission range)? Verify by manually selecting 2nd, OD cancel, and OD.	Yes	· Not torque converter clutch shudder. For further diagnosis, REFER to Section 100-04 and Diagnosis By Symptom — Noise/Vibration Routine 254/354 found in this section.
	No	· GO to Step 4.
4) Is the problem engine-rpm dependent (occurs at the same engine rpm independent of transmission gear)? Verify by holding same rpm in each transmission gear.	Yes	· Not torque converter clutch shudder. For further diagnosis, REFER to Section 100-04 and Diagnosis By Symptom — Noise/Vibration Routine 254/354 found in this section.
	No	· GO to Step 5.
5) Does the problem occur in coast, steady speed, or reverse range?	Yes	· Not torque converter clutch shudder. For further diagnosis, REFER to Section 100-04 and Diagnosis By Symptom — Noise/Vibration Routine 254/354 found in this section.
	No	· GO to Step 6.
6) Does vibration occur during extended light brake application?	Yes	· Not torque converter clutch shudder. For further diagnosis, REFER to Section 100-04 , Section 206-00 and Diagnosis By Symptom — Noise/Vibration Routine 254/354 found in this section.
	No	· GO to Step 7.
7) If one of the driving modes in Step 2 identifies a vibration which is not present in Steps 3-6, then there is a strong possibility that the vibration is caused by the torque converter clutch function. Carry out the repair procedures as found under Disassembly/Assembly.		

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- electronic add-on items:
  - air conditioning
  - generator (alternator)
  - engine turbo
  - cellular telephone
  - cruise control
  - CB radio
  - linear booster
  - backup alarm signal
  - computer
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module (PCM), or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size, or axle ratio changes.

- Leaks; refer to Leak Inspection.
- Correct linkage adjustments; refer to Section 307-05 .

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those of the manual lever in the transmission. If they match, the misadjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 for shift linkage adjustment.

Check TSBs and OASIS

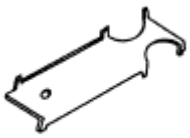
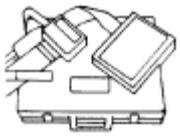
Refer to all technical service bulletins (TSB) and OASIS messages which pertain to the transmission concern and follow the procedure as described.

Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using the scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Diagnostics

Special Tool(s)

 ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
 ST1392-A	Air Test Plate, Transmission 307-246 (T92P-7006-A)
 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST1391-A	Breakout Box, EEC-V Control System 418-049 (T94L-50-EEC-V) or equivalent
 ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool
	Transmission Tester 307-F016 (007-00130) or equivalent

 ST1389-A	
	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
 ST1137-A	73 III Automotive Meter 105-R0057 or equivalent
 ST1300-A	UV Leak Detector Kit 164-R0756 or equivalent

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. One of the most important things to remember is that there is a definite procedure to follow. DO NOT TAKE SHORT CUTS OR ASSUME THAT CRITICAL CHECKS OR ADJUSTMENTS HAVE ALREADY BEEN MADE. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics With Diagnostic Tool

NOTE: For detailed instruction and other diagnostic methods using the scan tool, refer to the scan tool tester manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual. These quick tests should be used to diagnose the powertrain control module (PCM) and should be carried out in order.

- **Quick Test 1.0 - Visual Inspection**
- **Quick Test 2.0 - Set Up**
- **Quick Test 3.0 - Key On, Engine Off (KOEO)**
- **Quick Test 4.0 - Continuous Memory**
- **Quick Test 5.0 - Key On, Engine Running (KOER)**
  - Special Test Mode
  - Wiggle Test
  - Output Test Mode
  - PCM Reset Mode
  - Clearing DTCs
  - OBD II Drive Cycle
- **Other Scan Tool Features**

For further information on other diagnostic testing features using the scan tool, refer to the Powertrain

Control/Emissions Diagnosis (PC/ED) manual. Other diagnostic methods include the following:

- Parameter Identification (PID) Access Mode
- Freeze Frame Data Access Mode
- Oxygen Sensor Monitor Mode

Output State Control (OSC) Mode

Output State Control (OSC) allows the technician to take control of certain parameters to function the transmission. For example, OSC allows the technician to shift the transmission only when he/she commands a gear change. If the technician commands 1st gear in OSC, the transmission will remain in 1st gear until the technician commands the next gear. Another example, the technician can command a shift solenoid to turn on or off when carrying out an electrical circuit check. OSC has two modes of operation for transmission, the BENCH MODE and the DRIVE MODE. Each mode/parameter has a unique set of vehicle operating requirements that the technician is required to meet before being allowed to operate OSC.

NOTE: To operate OSC the digital transmission range (TR) sensor must be operational. No Diagnostic Trouble Codes (DTCs) related to the digital TR sensor can be present.

To operate OSC the vehicle speed source must be operational. No diagnostic codes (DTCs) related to this source can be present. The vehicle speed source can vary depending on vehicle configuration. Technicians should verify which input source is applicable for their vehicle application. The following are potential vehicle speed sources:

- anti-lock braking system (ABS)
- rear anti-lock braking system (RABS)
- output shaft speed (OSS) sensor

For manual 4x4 applications, the vehicle speed source is from the transfer case speed sensor.

- The vehicle requirements MUST BE MET when SENDING the OSC value. Refer to individual test modes for vehicle requirements.
- If the vehicle requirements are NOT MET when SENDING the OSC value, an ERROR MESSAGE will appear. When the ERROR MESSAGE is received, OSC is aborted and must be restarted.
- If AFTER SENDING an OSC value, and the vehicle requirements are no longer met, the PCM will cancel the OSC value and NO ERROR message will appear. Once the vehicle requirements are met again, the PCM will automatically SEND the previous OSC value without any additional actions required by the service technician.
- The OSC value XXX may be sent anytime to cancel OSC.

Output State Control (OSC) Procedures

- Carry out visual inspection and vehicle preparation as required.
- Select "Vehicle and Engine Selection" menu.
- Select appropriate vehicle and engine.
- Select "Diagnostic Data Link."
- Select "Powertrain Control Module."
- Select "Output Test Mode."
- Select "KOEO On-Demand Self Test and KOER On-Demand Self Tests."
- Carry out test and record DTCs.
- Repair all NON-Transmission DTCs.
- Repair all digital TR Sensor DTCs.
- Repair all vehicle speed DTCs.
- Ensure that the vehicle speed sensor and digital TR Sensors are functional.
- Select "Active Command Modes."

- Select "Trans - Bench Mode or Trans - Drive Mode."

OSC — Transmission Bench Modes

The following Transmission Bench Modes may be used or required during diagnostics.

SSA, SSB and TCC in BENCH MODE

The BENCH MODE allows the technician to carry out electrical circuit checks on the following components:

- SSA - Activates SSA OFF or ON.
- SSB - Activates SSB OFF or ON.
- Transmission Converter clutch (TCC) - Activates TCC OFF or ON.

OSC "SSA, SSB, TCC" BENCH MODE Operates ONLY when:

- digital TR sensor is operational and no digital TR sensor DTCs present.
- vehicle speed sensor is operational and no VSS sensor DTCs present.
- transmission range selector lever is in P.
- key is ON.
- engine is OFF.

OSC Command Values

- OFF - turns solenoid OFF.
- ON - turns solenoid ON.
- XXX - cancels OSC value sent.
- SEND - sends the values to PCM.

BENCH MODE Procedure for SSA, SSB and TCC

Follow operating instructions from the scan tool menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - SSA, SSB or TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

EPC in BENCH MODE

The BENCH MODE is also used to test the functionality of the transmission's electronic pressure control. During BENCH MODE, the electronic pressure control (EPC) solenoid can ramp in increments of 103 kPa (15 psi) from zero to 620 kPa (90 psi) and 620 kPa (90 psi) to zero psi.

The OSC functions for the parameter EPC allows the technician to choose the following options:

- EPC - Activates EPC to selected values.
- 00 - sets EPC pressure to 00 kPa (00 psi).
- 15 - sets EPC pressure to 103 kPa (15 psi).
- 30 - sets EPC pressure to 206 kPa (30 psi).
- 45 - sets EPC pressure to 310 kPa (45 psi).
- 60 - sets EPC pressure to 411 kPa (60 psi).
- 75 - sets EPC pressure to 517 kPa (75 psi).
- 90 - sets EPC pressure to 620 kPa (90 psi).

To carry out an EPC BENCH MODE pressure functionality test, install a pressure gauge in the EPC port. The following requirements are required to carry out this test:

- VSS and digital TR sensor operational.
- no VSS and digital TR sensor DTCs.
- transmission range selector lever in P.
- key ON.
- engine ON.
- engine speed at least 1,500 rpm for accurate EPC pressure measurement.

To carry out an EPC BENCH MODE solenoid circuit pinpoint test, the following requirements are required:

- VSS and digital TR sensor operational.
- no VSS and digital TR sensor DTCs.
- key ON.
- engine OFF.

OSC Command Values

- 00 - sets EPC pressure to 00 kPa (00 psi).
- 15 - sets EPC pressure to 103 kPa (15 psi).
- 30 - sets EPC pressure to 206 kPa (30 psi).
- 45 - sets EPC pressure to 310 kPa (45 psi).
- 60 - sets EPC pressure to 411 kPa (60 psi).
- 75 - sets EPC pressure to 517 kPa (75 psi).
- 90 - sets EPC pressure to 620 kPa (90 psi).
- XXX - cancels OSC value sent.
- SEND - sends the values to PCM.

BENCH MODE Procedure for EPC

Following operating instructions from the scan tool menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - EPC."
- Select Value "0-620 kPa (0-90 psi)."

- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

OSC — Transmission DRIVE MODES

The DRIVE MODE allows control of three transmission parameters. Each mode/parameter has a unique set of vehicle operating requirements that the technician is required to meet before being allowed to operate OSC. The recommended procedure, when using the DRIVE MODE, is to control one parameter at a time.

The DRIVE MODE allows the technician to carry out the following functions on the transmission:

- GR_CM - allows upshifts or downshifts.
- TCC - engages or disengages the torque converter clutch.
- EPC - increases/decreases EPC pressure.

GR_CM in DRIVE MODE

This OSC function is used to test the transmission shift functions.

The OSC functions for the GR_CM parameter allows the technician to choose the following options:

- 1 - PCM selects 1st gear.
- 2 - PCM selects 2nd gear.
- 3 - PCM selects 3rd gear.
- 4 - PCM selects 4th gear.

OSC "GR_CM" Mode operates ONLY when:

- digital TR sensor is operational and no digital TR sensor DTCs present.
- vehicle speed sensor is operational and no VSS sensor DTCs present.
- engine is ON.
- TCC is OFF.
- transmission range selector lever is in O/D.
- vehicle speed is greater than 3.2 km/h (2 mph).

OSC Command Values

- 1 - PCM selects 1st gear.
- 2 - PCM selects 2nd gear.
- 3 - PCM selects 3rd gear.
- 4 - PCM selects 4th gear.
- XXX - cancels OSC value sent.
- SEND - sends the values to PCM.

DRIVE MODE Procedure for GR_CM

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans - DRIVE MODE."

- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - GR_CM."
- Select Value "1-4."
- Press "SEND" to send command.
- Re-Select Value "1-4."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

TCC in DRIVE MODE

This OSC function is used to test whether the torque converter clutch is engaging and disengaging correctly.

The OSC functions for the TCC parameter allows the technician to choose the following:

- TCC - activates TCC OFF and ON.
- ON - turns TCC solenoid ON.
- OFF - turns TCC solenoid OFF.

OSC "TCC OFF" DRIVE MODE operates ONLY when:

- digital TR sensor is operational and no digital TR sensor DTCs present.
- vehicle speed sensor is operational and no VSS sensor DTCs present.
- engine is ON.
- transmission range selector lever is in O/D.
- vehicle speed is greater than 3.2 km/h (2 mph).

OSC "TCC ON" DRIVE MODE operates ONLY when:

- digital TR sensor is operational and no digital TR sensor DTCs present.
- vehicle speed sensor is operational and no VSS sensor DTCs present.
- engine is ON.
- transmission range selector lever is in O/D.
- vehicle speed is greater than 3.2 km/h (2 mph).
- transmission is in 2nd gear or higher.
- TFT is between 15 and 135°C (60 and 275°F).
- brake is not applied "OFF" below 32 km/h (20 mph).
- Not an excessive load on engine (engine lugging).

OSC Command Values

- OFF - turns TCC OFF.
- ON - turns TCC ON.
- XXX - cancels OSC value sent.
- SEND - sends the values to PCM.

Drive Mode Procedures for TCC

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

EPC in DRIVE MODE

This OSC function is used to increase the EPC pressure while testing the transmission shift functions. This OSC function can only increase the EPC pressure greater than what the PCM normally commands. If an OSC value, such as (75) or (90) psi is sent, the upshifts and downshifts should exhibit a firmer shift. Firmer shifts would indicate that the EPC pressure control works at higher pressures. The best test for the EPC is to use the BENCH MODE and a hydraulic pressure gauge. Using EPC in the BENCH MODE will confirm that the EPC works at both the higher and lower pressures.

The OSC functions for the parameter EPC allows the technician to choose the following options:

- EPC - Activates EPC to selected
    - 00 - sets EPC pressure to 00 kPa (00 psi).
    - 15 - sets EPC pressure to 103 kPa (15 psi).
    - 30 - sets EPC pressure to 206 kPa (30 psi).
    - 45 - sets EPC pressure to 310 kPa (45 psi).
    - 60 - sets EPC pressure to 411 kPa (60 psi).
    - 75 - sets EPC pressure to 517 kPa (75 psi).
    - 90 - sets EPC pressure to 620 kPa (90 psi).

OSC "EPC" DRIVE MODE operates ONLY when:

- digital TR sensor is operational and no digital TR sensor DTCs present.
- vehicle speed sensor is operational and no VSS sensor DTCs present.
- transmission range selector lever is in O/D.
- pressure gauge is installed.
- key is ON.
- engine is ON.
- vehicle speed is greater than 3.2 km/h (2 mph).
- OSC value for EPC must be greater than what the PCM commands (see EPC PID).

OSC Command Values

- 00 - sets EPC pressure to 00 kPa (00 psi).
- 15 - sets EPC pressure to 103 kPa (15 psi).
- 30 - sets EPC pressure to 206 kPa (30 psi).
- 45 - sets EPC pressure to 310 kPa (45 psi).
- 60 - sets EPC pressure to 411 kPa (60 psi).
- 75 - sets EPC pressure to 517 kPa (75 psi).

- 90 - sets EPC pressure to 620 kPa (90 psi).
- XXX - cancels OSC value sent.
- SEND - sends the values to PCM.

DRIVE MODE Procedure for EPC.

Follow operating instructions from the scan tool menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - EPC."
- Select Value "0-620 kPa (0-90 psi)."
- Press "SEND" to send command.
- Re-Select Value "0-620 kPa (0-90 psi)."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

Using Output State Control and Accessing PIDs

To confirm that the OSC value was sent by the scan tool and the EEC has accepted the OSC substitution, a corresponding PID for each OSC parameter must be monitored. Additional PIDs should be monitored to help the technician adequately diagnose the transmission.

The following is a list of OSC parameters and their corresponding PID:

OSC PARAMETER CHART

OSC Parameter	PID	Additional PIDs
SSA	SSA	SS1F
SSB	SSB	SS2F
TCC	TCC	TCCF, TCCMACT (do not use PID TCCMCMD during OSC)
EPC	EPC	—
GR_CM	GEAR	TRANRAT

To confirm that the OSC substitution occurred, SEND the OSC value and monitor the corresponding PID value. If no ERROR MESSAGE was received and the value of the corresponding PID remains the same as the value sent from OSC, then the OSC substitution was successful.

Transmission Drive Cycle Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur four times consecutively for shift error DTC code to be set, and five times consecutively for continuous TCC code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, refer to the Solenoid Application Chart for correct solenoid operation.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in OVERDRIVE, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into fourth gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in fourth gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stoplamps. Then hold speed and throttle steady for a minimum of five seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat steps 4 through 6 at least five times.
8. Carry out Quick Test and record continuous DTCs.
    - If the DTCs are still present, refer to the Diagnostic Trouble Code Chart. Repair all non transmission DTCs first as they can directly affect the operation of the transmission. Repeat the Quick Test and the Road Test to verify the correction. Erase the DTCs, carry out the Drive Cycle Test and repeat the Quick Test after completing repair on the DTC.
    - If the continuous test passes and a concern is still present, refer to Diagnosis By Symptom in this section, OASIS messages, and TSBs for concerns.

After On-Board Diagnostic

NOTE: The vehicle wiring harness, PCM and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Use the diagnostic trouble code chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the

vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the PCM wiring harness for tight connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis has been carried out, refer to Diagnosis By Symptom in this section.

If DTCs appear while carrying out the on-board diagnostics, refer to the Diagnostic Trouble Code Charts for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs and OASIS messages for transmission concerns.

Diagnostic Trouble Code Charts

Diagnostic Trouble Code Chart

Five Digit DTC	Component	Description	Condition	Symptom	Action
P0102 P0103 P1100 P1101	MAF	MAF concerns	MAF system has a malfunction which may cause a transmission concern.	High or low EPC pressure, incorrect shift schedule. Incorrect torque converter clutch engagement scheduling. Symptoms similar to a throttle position (TP) failure.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0112	IAT	IAT indicates 125°C (257°F) (grounded)	Voltage drop across IAT exceeds scale set for temperature 125°C (257°F).	Incorrect EPC pressure, either high or low, results in harsh or soft shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT	IAT indicates -40°C (-40°F) (open circuit)	Voltage drop across IAT exceeds scale set for temperature -40°C (-40°F).	Incorrect EPC pressure, either high or low, results in harsh or soft shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT	IAT out of on-board diagnostic range	IAT temperature higher or lower than expected during KOEO and KOER.	Rerun on-board diagnostic at normal operating temperature.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	ECT	ECT indicates 125°C (257°F)	Voltage drop across ECT exceeds scale set for temperature 125°C (257°F) (grounded).	Torque converter clutch will always be off, resulting in reduced fuel economy.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0118	ECT	ECT indicates -40°C (-40°F)	Voltage drop across ECT exceeds scale set for temperature -40°C (-40°F) (open circuit).	Torque converter clutch will always be off, resulting in reduced fuel economy.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0122 P0123 P1120	TP	TP concern	PCM has detected an error that may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, torque converter clutch does not engage, torque converter clutch cycling.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

P0300- P0308 P0320 P0340 P1351- P1364	Electronic Ignition (EI)	EI systems concerns	EI system has a malfunction which may cause a transmission concern.	Harsh engagements and shifts, late WOT shifts, no torque converter clutch engagement.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1702	Digital TR	Intermittent DTC codes P0705 or P0708	Refer to DTC codes P0705 or P0708 condition.	Refer to DTC codes P0705 or P0708 symptom.	Go To Pinpoint Test C .
P1704	Digital TR	Digital TR circuit reading in between gear position during KOEO/KOER	Digital TR sensor or shift cable incorrectly adjusted; or digital TR circuit failure.	Wrong commanded EPC pressure. Digital TR reading the wrong gear position.	Go To Pinpoint Test C .
P0705	Digital TR	Digital TR circuit failure	Digital TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground or an open in TR4, TR3A, TR2, and or TR1 circuits. This DTC cannot be set by an incorrectly adjusted digital TR sensor.	Increase in EPC pressure (harsh shifts). Defaults to (D) or D for all gear positions. In (D) position trans, stuck in D or manual 2.	Go To Pinpoint Test C .
P0708	Digital TR	Digital TR sensor circuit TR3A open	Digital TR sensor circuit TR3A reading 2.6v - 5.0v (open circuit). This DTC cannot be set by an incorrectly adjusted digital TR sensor.	Increase in EPC pressure. Defaults to (D)or D for all gear ranges.	Go To Pinpoint Test C .
P1705	Digital TR	Digital TR self test was not carried out in PARK or NEUTRAL	Vehicle not in PARK or NEUTRAL during on-board diagnostic.	Rerun on-board diagnostic in PARK or NEUTRAL.	Go To Pinpoint Test C .
P0720	OSS	Insufficient input from output shaft speed sensor	PCM detected a loss of OSS signal during operation.	Harsh shifts, abnormal shift schedule, no torque converter clutch activation.	Go To Pinpoint Test E .
P0721	OSS	OSS sensor signal noisy	PCM has detected an erratic OSS signal.	Harsh shifts, abnormal shift schedule, no torque converter clutch engagement.	Go To Pinpoint Test E .
P0722	OSS wiring	Insufficient input from OSS	PCM has detected a loss of OSS signal.	Harsh shifts, abnormal shift schedule, no torque	Go To Pinpoint Test E .

				converter clutch engagement.	
P0741 **	TCC, internal components	TCC slippage detected	The PCM picked up an excessive amount of slippage during normal vehicle operation.	TCC slippage/erratic or no torque converter clutch operation. Flashing Transmission Control Indicator Lamp (TCIL).	Refer to Diagnosis By Symptom in this section.
P0743 *	TCC, wiring, PCM	TCC solenoid circuit failure during on-board diagnostic	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Short circuit: engine stalls in second (OD, 2 range) at low idle speeds with brake applied. Open circuit: torque converter clutch never engages.	Go To Pinpoint Test A .
P0750 *	SSA, wiring, PCM	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off Chart.	Go To Pinpoint Test A .
P0751	SSA, wiring, PCM	Shift solenoid A functional failure	Mechanical or hydraulic failure of the shift solenoid.	Incorrect gear selection depending on failure mode manual lever position.	Refer to Solenoid Operation Chart, then Go To Pinpoint Test A .
P0753	SSA, wiring, PCM	SSA electrical failure	SSA circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear depending on condition mode and manual lever position. See Solenoid On/Off Chart. May flash TCIL.	Go To Pinpoint Test A .
P0755 *	SSB, wiring, PCM	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off Chart.	Go To Pinpoint Test A .
P0758 *	SSB, wiring, PCM	SSB electrical circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear depending on condition mode and manual lever position. See Solenoid On/Off Chart. May flash TCIL.	Go To Pinpoint Test A .
P1714	SSA, internal components	SSA malfunction	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition, mode and manual lever position. See Solenoid Operation	Go To Pinpoint Test F .

				Chart.	
P1715	SSB	SSB malfunction	Mechanical failure of the solenoid detected.	Incorrect gear selection depending on condition, mode and manual lever position. See Solenoid Operation Chart.	Go To Pinpoint Test F .
P0756	SSB	SSB functional failure	Mechanical or hydraulic failure of the shift solenoid.	Incorrect gear selection depending on failure mode and manual lever position.	Refer to Solenoid Operation Chart, then Go To Pinpoint Test A .
P0781 **	SSA or internal parts	1-2 shift error	Engine rpm drop not detected when 1-2 shift was commanded by PCM.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to Solenoid Operation Chart, then Go To Pinpoint Test A .
P0782 **	SSA, SSB or internal parts	2-3 shift error	Engine rpm drop not detected when 2-3 shift was commanded by PCM.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to Solenoid Operation Chart, then Go To Pinpoint Test A .
P0783 **	SSA, SSB or internal parts	3-4 shift error	Engine rpm drop not detected when 3-4 shift was commanded by PCM.	Incorrect gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to Solenoid Operation Chart, then Go To Pinpoint Test A .
—	TCIL	TCIL circuit failure	TCIL circuit open or shorted.	Failed on, OD cancel mode on. No flashing TCIL for EPC failure or sensor. Failed off, OD cancel mode never indicated. No flashing TCIL for EPC sensor failure.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1116	ECT	ECT out of on-board	ECT temperature higher or lower than	Rerun on-board diagnostic at normal	Refer to the Powertrain

		diagnostic range	expected during KOEO and KOER.	operating temperature.	Control/Emissions Diagnosis (PC/ED) manual.
P1124	TP	TP voltage high/low for on-board diagnostic	TP was not in the correct position for on-board diagnostic.	Rerun at appropriate throttle position per application.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1460	A/C	A/C clutch cycling pressure switch error	A/C or defrost on condition may result from A/C clutch being on during on-board diagnostic.	DTC set during on-board diagnostic, repeat with A/C off. Failed on, EPC pressure slightly low with A/C off.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1636	PCM	PCM detected internal error	—	—	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP	BPP switch circuit failed	Brake ON/OFF circuit failure.	Failed on or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed off or not connected — torque converter clutch will not disengage when brake is applied.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP	Brake not actuated during on-board diagnostic	Brake not cycled during KOER.	Failed off or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed off or not connected — torque converter clutch will not disengage when brake is applied.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0713	TFT, wiring, PCM	-40°C (-40°F) indicated TFT sensor circuit open	Voltage drop across TFT sensor exceeds scale set for temperature -40°C (-40°F).	Firm shift feel.	Go To Pinpoint Test B .
P1711	TFT	TFT out of on-board diagnostic range	Transmission not at operating temperature during on-board diagnostic.	Warm vehicle to normal operating temperature.	Go To Pinpoint Test B .
P0712	TFT, wiring, PCM	157°C (315°F) indicated TFT sensor circuit grounded	Voltage drop across TFT sensor exceeds scale set for temperature of 157° C (315°F).	Firm shift feel.	Go To Pinpoint Test B .
P1713	TFT wiring	TFT continually	TFT sensor in range	Firm shift feel.	Go To Pinpoint Test

	PCM	reading cold	low failure.	Substitute ECT for TFT	B .
P1783	TFT	Transmission over temperature condition indicated	Transmission fluid temperature exceeded 127°C (270°F).	Increase in EPC pressure.	Go To Pinpoint Test B .
P1718	TFT, wiring, PCM	TFT continually reading hot	TFT sensor in range high failure.	Firm shift feel. Substitute ECT for TFT.	Go To Pinpoint Test B .
P0740	TCC, wiring, PCM	TCC electrical failure	TCC circuit fails to provide voltage drop across solenoid. Circuit open, shorted or PCM driver failure during on-board diagnostics.	Short circuit, engine stalls in SECOND ((D), 2 range) at low speeds with brake applied. Open circuit, torque converter clutch never engages. May flash TCIL.	Go To Pinpoint Test A .
P1740	TCC	TCC malfunction	Mechanical failure of the solenoid detected.	Failed on — Engine stalls in 2nd (O/D, Manual 2 ranges) at low idle speeds with brake applied. Failed off — Torque Converter never applies.	Go To Pinpoint Test F .
P1741 **	TCC, internal components	Excessive torque converter clutch engagement error	Excessive variations in slip (engine speed surge) across the torque converter clutch.	Engine rpm oscillation is present in 3rd gear.	Go To Pinpoint Test A .
P1742	TCC, internal components	TCC solenoid failed on	TCC solenoid has failed on by electric, mechanical or hydraulic concern.	Harsh shifts.	Go To Pinpoint Test A .
P1743	TCC, internal components	TCC solenoid failed on	TCC solenoid has failed on by electric, mechanical or hydraulic concern.	Harsh shifts.	Go To Pinpoint Test A .
P1744	TCC	TCC	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage/erratic or no torque converter clutch operation.	Refer to Diagnosis By Symptom in this section.
P1746 *	EPC, wiring, PCM	EPC solenoid open circuit	Voltage through EPC solenoid is checked. An error will be noted if tolerance is exceeded.	Open circuit causes maximum EPC pressure, harsh engagements and shifts.	Go To Pinpoint Test D .
P1747	EPC, wiring,	EPC solenoid	Voltage through	Short circuit causes	Go To Pinpoint Test

*	PCM	circuit failure, shorted circuit or output driver	EPC solenoid is checked. An error will be noted if tolerance is exceeded.	minimum EPC pressure (minimum capacity) and limits engine torque (alternate firm).	D .
P1760	EPC, wiring, PCM	EPC solenoid circuit failure, shorted circuit or output driver	PCM detected a loss of EPC during operation.	Unexpected reduction in engine torque.	Go To Pinpoint Test D .
P1780	TCS	TCS not changing states	TCS not cycled during self-test. TCS circuit open or shorted.	Rerun on-board diagnostic and cycle switch. No OD cancel when switch is cycled.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1781 [1]	4x4 low switch	4x4 low switch closed	4x4 low switch closed or 4x4 low indicator lamp circuit open.	Failed on — early shift schedules in 4x2 and 4x4 HI range. Failed off — shifts delayed in 4x4 low. [1]	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1729	4x4L	4x4 low switch failure	4x4 low switch failure during normal vehicle operation.	Early shifts, harsh shifts, increase in electronic pressure control valve.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1728	Trans	Transmission slip error	The PCM has detected an excessive amount of slippage during normal operation.	Transmission slippage erratic or no torque converter clutch operation.	Refer to Diagnosis By Symptom in this section.

* Output circuit check, generated only by electrical symptoms.
** May also be generated by some other non-electric transmission hardware system.
[1] If the 4x4 low indicator light fuse is blown, the transmission will shift according to the 4x4 low shift scheduling regardless of the transfer case position.

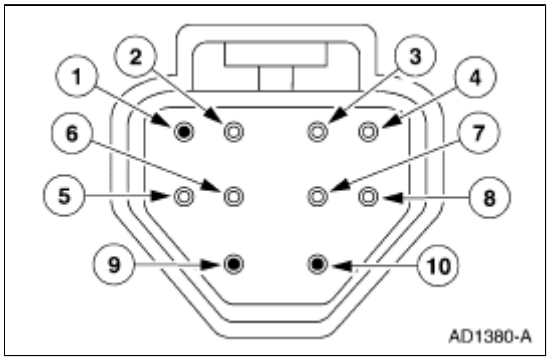
Rotunda Transmission Tester

The Rotunda Transmission Tester is used to diagnose the digital transmission range sensor and is used in conjunction with the pinpoint tests. The tests should be carried out in order. Installing the Rotunda Transmission Tester allows separation of the vehicle electronics from transmission electronics. For additional information, refer to the Rotunda Transmission Tester manual for these tests.

- Digital Transmission Range (TR) Sensor Testing
- Resistance/Continuity Test
- Voltage Test - PARK/NEUTRAL, REVERSE Lamp, and Optional Circuits

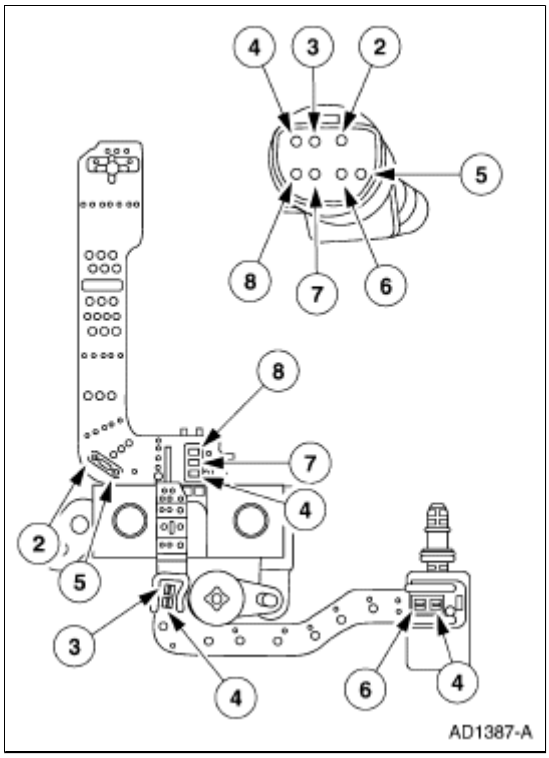
Transmission Connector Layouts

Transmission Vehicle Harness Connector



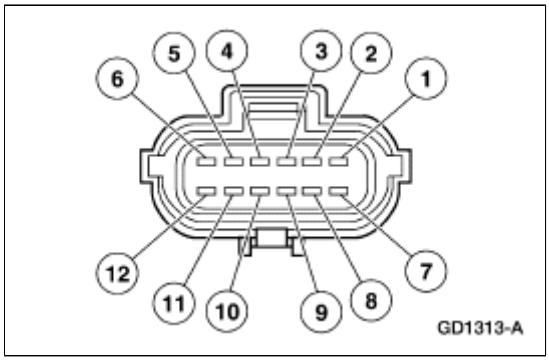
Pin Number	Circuit	Circuit Function
1	—	NOT USED
2	—	Signal Return
3	—	Torque Converter Clutch (TCC) Solenoid
4	—	Vehicle Power
5	—	Transmission Fluid Temperature (TFT) Input
6	—	Electronic Pressure Control (EPC) Solenoid
7	—	SSA
8	—	SSB
9	—	NOT USED
10	—	NOT USED

Transmission Internal Harness Connector



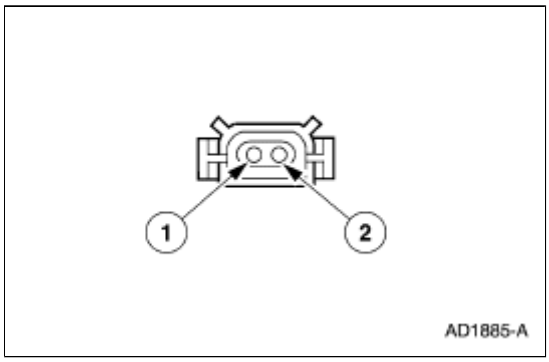
Pin Number	Circuit	Circuit Function
1	—	NOT USED
2	—	Signal Return Transmission Fluid Temperature (TFT)
3	—	Torque Converter Clutch (TCC)
4	—	Vehicle Power Shift Solenoid
5	—	Transmission Fluid Temperature (TFT)
6	—	Electronic Pressure Control
7	—	SSA
8	—	SSB
9	—	NOT USED
10	—	NOT USED

Digital Transmission Range (TR) Sensor Connector



Pin Number	Circuit	Circuit Function
1	—	NOT USED
2	—	Signal Return
3	—	TR3A
4	—	TR1
5	—	TR2
6	—	TR4
7	—	NOT USED
8	—	NOT USED
9	—	Fused Power Feed
10	—	Starter Control
11	—	Reverse
12	—	Starter to Starter Interrupt Relay

Output Shaft Speed (OSS) Sensor Harness Connector



Pin Number	Circuit	Circuit Function
1	—	Output Shaft Speed (OSS) Sensor
2	—	Signal Return

Digital Transmission Range (TR) Sensor Diagnosis Chart

Selector Position	PID: TR	PID: TR_D				PID: TR_V (volts)
		TR4	TR3A	TR2	TR1	TR3A (PCM Pin 64 to sigrtn)
PARK	P/N	0	0	0	0	0.0 Volts
In Between	REV	0	1	0	0	1.3 - 1.8 Volts
REVERSE	REV	1	1	0	0	1.3 - 1.8 Volts
In Between	REV	0	1	0	0	1.3 - 1.8 Volts
NEUTRAL	NTRL	0	1	1	0	1.3 - 1.8 Volts
In Between	O/D [a]	1	1	1	0	1.3 - 1.8 Volts

OVERDRIVE	O/D [a]	1	1	1	1	1.3 - 1.8 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 2	Man 2	1	0	0	1	0.0 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 1	Man 1	0	0	1	1	0.0 Volts

[a] Will read "Drive" if O/D is canceled.

A. TR_V is the voltage at the PCM pin 64 (TR3A Circuit) to signal return.
B. "In Between" reading could be caused by a shift cable or digital TR sensor misaligned or a digital TR sensor circuit failure of TR1, TR2, TR3A, or TR4.
C. TR_D: 1= Open Digital TR switch, 0= Closed Digital TR switch.
D. Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A, TR4 to signal return.
    - **Voltages for TR1, TR2, TR4:**
    - 0 = 0.0 volts.
    - 1 = 9.0 - 14.0 volts.
    - **Voltage for TR3A:**
    - 0 = 0.0 volts.
    - 1 = 1.3 - 1.8 volts.
    - 1.8 - 5.0 volts = Invalid reading (open in wires or bad resistor in digital TR sensor).

Wiggle Test Information For Open/Shorts

- TR4, TR3A, TR2, and TR1 are all closed in PARK. PARK is a good position to check for intermittent open circuits (with scan tool monitoring TR_D).
- TR4, TR3A, TR2, and TR1 are all open in OVERDRIVE, so OVERDRIVE is a good position to check for shorts to ground. To determine the shorted components while observing TR_D, unplug the TR and see if the short goes away. If the short is still present, unplug the transmission harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire from the PCM vehicle harness. If the short is still present, then the PCM has an internal failure. Otherwise the failure is in the vehicle harness.

Pinpoint Tests — OSC Equipped Vehicles

Any time an electrical connector or solenoid body is disconnected, inspect the connector for pin condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoids Pre-Diagnosis

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Gear Lever Position	PCM Commanded Gear	Solenoids		
		SSA	SSB	TCC
P/R/N	1	ON	OFF	HD
(D)	1	ON	OFF	HD
(D)	2	OFF	OFF	EC
(D)	3	OFF	ON	EC
(D)	4	ON	ON	EC
(D)				
w/OD OFF				
1	1	ON	OFF	HD
2	2	OFF	OFF	EC
3	3	OFF	ON	EC
Manual 2	2	OFF	OFF	EC
Manual 1	1	ON	OFF	HD
[a] 1	2	OFF	OFF	EC

[a] When a manual pull-in occurs above a calibrated speed the transmission will downshift from the higher gear until the vehicle speed drops below this calibrated speed.

EC = Electronically controlled.

HD = Hydraulically disabled.

Shift Solenoid Failure Mode Chart "Always Off"

Failed off due to powertrain control module and or vehicle wiring concerns, shift solenoid electrically or hydraulically stuck off.

SSA ALWAYS OFF:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	2	2
2	2	2	2
3	3	2*	2*
4	3	2*	2*

*No engine braking.

SSB ALWAYS OFF:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	2	2	2
3	2	2	2
4	1	1	1

Shift Solenoid Failure Mode Chart "Always On"

Failed on due to powertrain control module and or vehicle wiring concerns, shift solenoid electrically or hydraulically stuck on.

SSA ALWAYS ON:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	1	1	1
3	4	2*	2*
4	4	2*	2*

*No engine braking.

SSB ALWAYS ON:	Gear Lever Position (D)	2	1
PCM Gear	Actual Gear		

Commanded	Obtained		
1	4	2*	2*
2	3	2*	2*
3	3	2*	2*
4	4	2*	2*

*No engine braking.

PINPOINT TEST A: SHIFT AND TORQUE CONVERTER CLUTCH SOLENOIDS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Read and record all DTCs. All digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC). **NOTE:** Refer to the Transmission Internal Harness Illustration preceding these pinpoint tests. **NOTE:** Refer to the Transmission Vehicle Harness Connector Illustration preceding these pinpoint tests.	
A1 ELECTRONIC DIAGNOSTICS	
1  2  4  Scan Tool 5  6  Diagnostic Data Link	3 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does vehicle enter Trans-Bench Mode?**

→ **Yes**
GO to A2 .

→ **No**
REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter Trans-Bench Mode, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

A2 WIGGLE TEST

1 Select PIDs to be monitored.

PID Command	PID Actual
SSA	SS1F
SSB	SS2F
TCC	TCCF

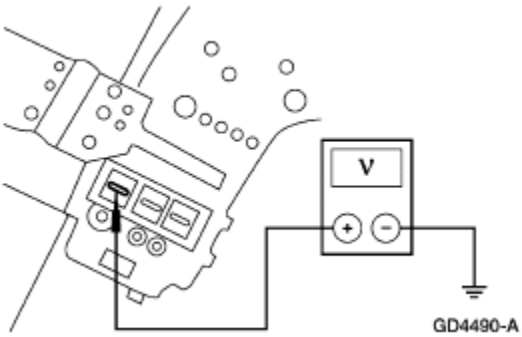
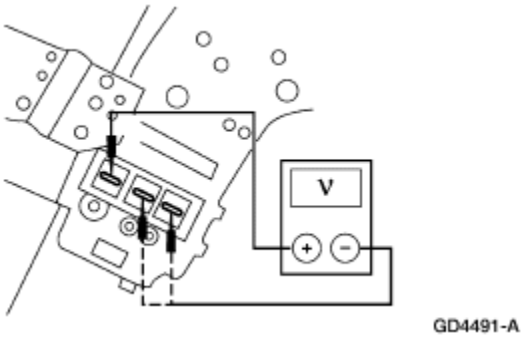
2 Select "ON" to turn suspect solenoid on.

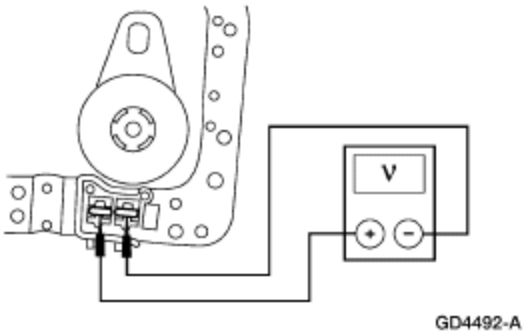
3 Press "SEND".

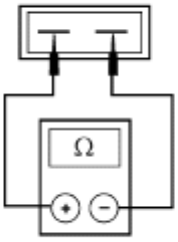
4 Wiggle all wiring and connectors to the transmission. Monitor the Solenoid State for changes.

5 Select "OFF" to turn solenoid off.

	6 Press "SEND". • **Does the suspect solenoid(s) fault state change?** → **Yes** REPAIR open or short in the vehicle harness or connector. → **No** GO to A3 .
A3 SOLENOID FUNCTIONAL CHECK	
	1 Monitor each solenoid state. 2 Turn each solenoid ON and OFF. • **Does the solenoid turn ON and OFF when commanded and can solenoid activation be heard?** → **Yes** GO to A4 . → **No** GO to A5 .
A4 OSC TRANS-DRIVE MODE (GR_CM OR TCC)	
	1 Carry out OSC Trans-Drive Mode. 2 Select GR_CM for Shift Solenoids or follow procedures for GR_CM as listed. 3 Select TCC for Torque Converter Clutch Solenoid. Follow procedures of TCC in Drive Mode as listed. • **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?** → **Yes** CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose shift or torque converter concern. → **No** GO to A5 .
A5 CHECK FOR BATTERY VOLTAGE	
	1 Remove transmission fluid pan.

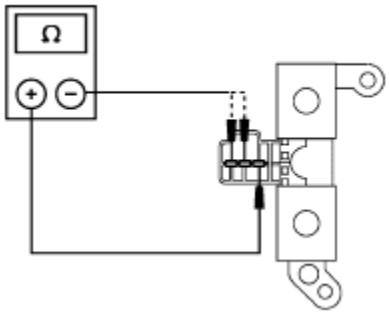
3  4  	2 Visually inspect the lead frame and connectors for damage. 4 Measure the voltage with the positive lead to VPWR solenoid pin and negative lead to a good ground. • **Is the voltage greater than 10 volts?** → **Yes** GO to A6 . → **No** CHECK for open or short circuit in harness, or solenoid.
A6 ELECTRICAL SIGNAL CHECK	
1  2  Trans-Bench Mode	1 Measure the voltage with the positive lead connected to VPWR solenoid pin and the negative lead to the signal pin of the appropriate solenoid. 3 Select Parameter SSA, SSB or TCC. 4 Select "ON". 5 Press "SEND".

	6 Turn the solenoids ON and OFF, while monitoring the voltage, solenoid state on the scan tool (ON and OFF), and listen for the solenoid to activate (click).
7  GD4492-A	7 Measure the voltage with the positive lead to VPWR pin and the negative lead to the TCC pin.
8 	8 Select Parameter TCC.
	9 Select "ON".
	10 Press "SEND".
	11 Turn the solenoid ON and OFF, while monitoring the voltage, solenoid state on the scan tool (ON and OFF), and listen for the solenoid to activate (click).
	12 Select "OFF", press "SEND".
	• **Does the voltage and solenoid state change?**
	→ **Yes** GO to A7 .
	→ **No** CHECK for open or short circuit in harness, solenoid or a PCM concern.
A7 CHECK SOLENOID RESISTANCE AT SOLENOID	
1 	
	2 Disconnect the appropriate solenoid from the lead frame.
3	3 Measure the solenoid resistance between the pins of the solenoid.



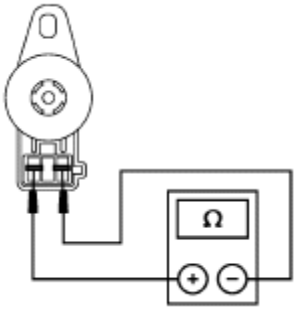
GD3386-A

4



AD1391-A

5



AD1392-A

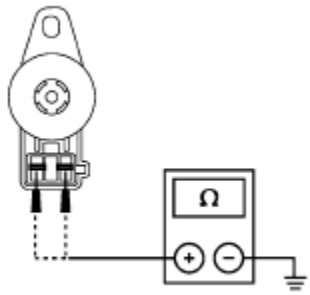
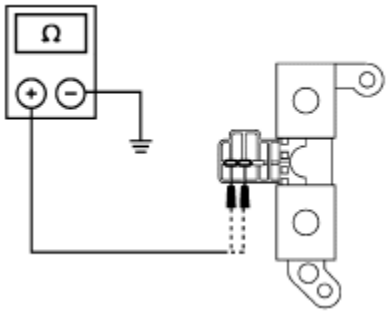
6 Measure the resistance for each solenoid (SSA, SSB or TCC) as follows:

Solenoid	Resistance (ohms)
SSA	20-30
SSB	20-30
TCC	10-16

- **Are the resistances correct?**

→ **Yes**
GO to A8 .

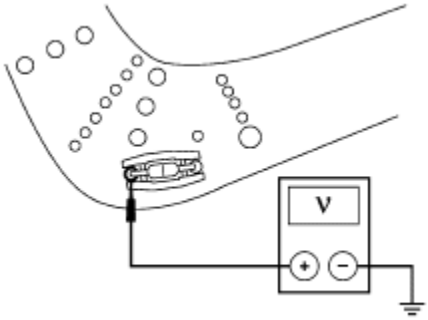
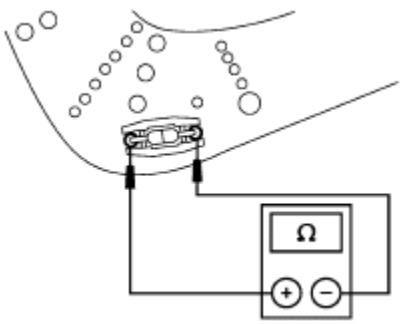
→ **No**
INSTALL a new solenoid.

A8 CHECK SOLENOID FOR SHORT TO GROUND	
1  AD1393-A 2  AD1394-A	1 Check for continuity between engine ground and appropriate solenoid pin with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity). **Solenoid** / **Terminal** SSA / +/- SSB / +/- TCC / +/- • **Is there continuity?** → **Yes** INSTALL a new solenoid. → **No** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns.

PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Connector Layouts preceding these pinpoint tests.	
B1 ELECTRONIC DIAGNOSTICS	
2 	1 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.

Scan Tool 3  7  PIDs; TFT, TFTV	4 Select Diagnostic Data Link. 5 Select PCM. 6 Select PID/Data Monitor and Record. • **Does the vehicle enter PID/Data Monitor and Record?** → **Yes** GO to B2 . → **No** REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
B2 WARM-UP/COOL-DOWN CYCLE	
	1 While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down. • **Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?** → **Yes** If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose transmission overheating. If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector.

	→ **No** GO to B3 .
B3 ELECTRICAL SIGNAL CHECK	
1  4  GD4493-A	2 Remove transmission fluid pan. 3 Visually inspect the lead frame and connectors for damage. 4 Measure the voltage with the positive lead to positive TFT at sensor pin and negative lead to a good ground. • **Is the voltage present?** → **Yes** GO to B4 . → **No** CHECK for open or short circuit in vehicle harness, internal harness or a PCM concern.
B4 CHECK RESISTANCE OF TFT SENSOR	
1  Transmission Harness 2  AD1396-A	2 Measure the resistance between the positive TFT and negative TFT pins at transmission connector, using the following: **Transmission Fluid Temperature** **°C** / **°F** / **Resistance (Ohms)** -40 to -20 / -40 to -4 / 967K - 284K -19 to -1 / -3 - 31 / 284K - 100K 0 - 20 / 32 - 68 / 100K - 37K

21 - 40	69 - 104	37K - 16K
41 - 70	105 - 158	16K - 5K
71 - 90	159 - 194	5K - 2.7K
91 - 110	195 - 230	2.7K - 1.5K
111 - 130	231 - 266	1.5K - 0.8K
131 - 150	267 - 302	0.8K - 0.54K

- **Is the resistance correct?**

→ **Yes**
REFER to Diagnosis By Symptom in this section to diagnose an overheating concern.

→ **No**
INSTALL a new internal harness (sensor is part of harness).

PINPOINT TEST C: DIGITAL TRANSMISSION RANGE (TR) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration preceding these pinpoint tests. **NOTE:** Refer to the Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.	
C1 VERIFY DIAGNOSTIC TROUBLE CODES	
1  2 	3 **NOTE:** DTC codes P0705 and P0708 cannot be set by an incorrectly adjusted digital TR sensor. Carry out on board diagnostic test. • **Are only DTC codes P0705, P0708 present?** → **Yes** GO to C4.

	→ **No** GO to C2 .
C2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT	
3  	1 Check to make sure the digital TR sensor harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding. 2 Apply the parking brake. 4 Disconnect the shift cable/linkage from the manual lever. 5 Verify that the digital TR Sensor Alignment Tool fits in the appropriate slots. • **Is the digital TR sensor adjustment OK?** → **Yes** GO to C3 . → **No** ADJUST the digital TR sensor. PLACE transmission range selector lever in P and CLEAR DTCs. REPEAT OBD Tests.GO to C3 .
C3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT	
2  	1 Place the manual lever in the overdrive position. 3 Re-connect the shift cable/linkage. 4 Verify that the shift cable/linkage is adjusted OK. REFER to Section 307-05 . • **Is the shift cable/linkage adjusted OK?** → **Yes** GO to C4 . → **No** ADJUST the shift cable/linkage. REFER to Section 307-05 .
C4 CHECK ELECTRICAL SIGNAL OPERATION	

1

2

Digital TR Sensor

2 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.**

Press the button and pull out on the digital TR harness connector.

3 Inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.

- **Are the connector, pins and harness OK?**

→ **Yes**
REPAIR as required. CLEAR DTCs and REPEAT OBD Tests.

→ **No**
If diagnosing a DTC, GO to C5 .

If diagnosing a starting concern or a reversing lamp concern, GO to C10 .

C5 CHECK ELECTRICAL SYSTEM OPERATION (DIGITAL TR AND PCM)

1

2

Scan Tool

3

Digital TR Sensor

4

5

TR PIDS TR, TR_D, TR_V

6 Move transmission range selector lever into each gear and stop.

7 Observe any of the following PIDs, TR and TR_D, TR_V (vehicle dependent) while wiggling harness, tapping on sensor, or driving the vehicle. Use PIDs TR, and TR_D for DTCs P0705, P1704, and P1705. Use PIDs TR, and TR_V for DTC P0708.

8 Compare the PIDs to the Digital Transmission Range (TR) Sensor Diagnosis Chart.

- **Do the PIDs TR, TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped, or the vehicle driven?**

→ **Yes**
The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis.

→ **No**
If TR_D changes when wiggling harness, tapping on the sensor, or driving the vehicle, the problem may be intermittent.

GO to C6 .

C6 CHECK DIGITAL TRANSMISSION RANGE SENSOR OPERATION

1

Digital TR Sensor

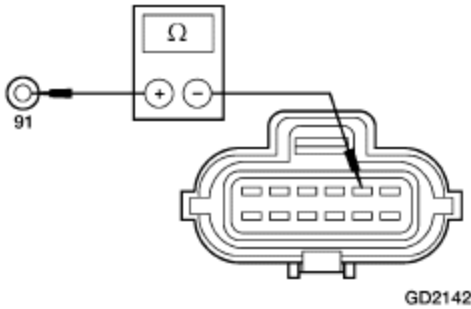
2

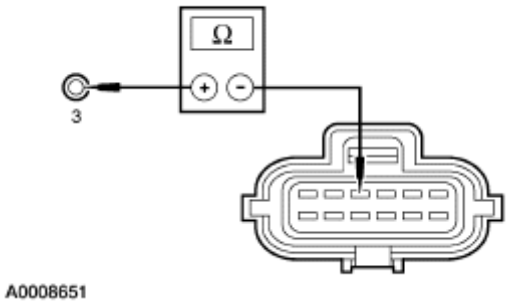
TR-E Cable to Transmission Tester

3

TR-E Cable to Digital TR Sensor

1 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.**

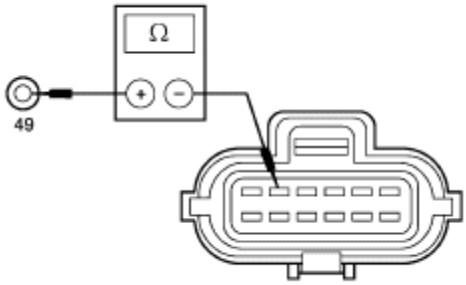
	4 Place the Digital TR Overlay onto Transmission Tester. 5 Carry out Sensor Test as instructed on the Digital TR Overlay. • **Does the status lamp on the tester TRS-E cable match the selected gear positions?** → **Yes** Concern is not in the digital TR sensor, GO to C7 . → **No** INSTALL a new digital TR sensor. CLEAR DTCs and REPEAT OBD Tests.
C7 CHECK PCM HARNESS CIRCUITS FOR OPENS	
1  2  Powertrain Control Module (PCM) 4  Digital TR Sensor 6  GD2142-A 7	3 Inspect for damaged or pushed-out pins, corrosion or loose wires. 4 **CAUTION: Do not pry the connector. This will damage the connector and result in a transmission concern.** Disconnect the digital TR sensor connector. 5 Install the EEC-V 104-Pin Breakout Box. 6 Measure the resistance between the PCM Test Pin 91 at the EEC-V 104-Pin Breakout Box and signal return circuit Pin 2 at digital TR sensor connector harness side. 7 Measure the resistance between the PCM Test Pin 3 at the EEC-V 104-Pin Breakout



A0008651

Box and TR1 circuit Pin 4 at digital TR sensor connector harness side.

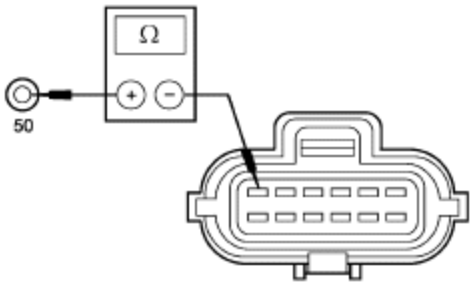
8



GD2144-A

8 Measure the resistance between the PCM Test Pin 49 at the EEC-V 104-Pin Breakout Box and TR2 circuit Pin 5 at digital TR sensor connector harness side.

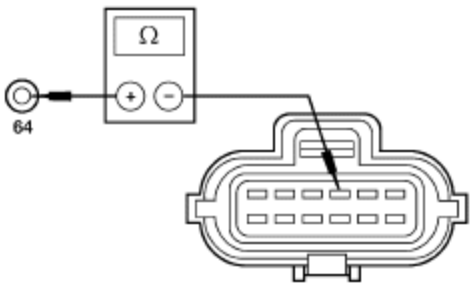
9



GD2145-A

9 Measure the resistance between the PCM Test Pin 50 at the EEC-V 104-Pin Breakout Box and TR4 circuit Pin 6 at digital TR sensor connector harness side.

10

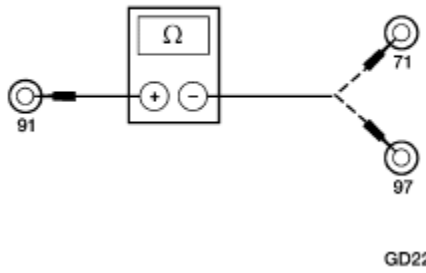
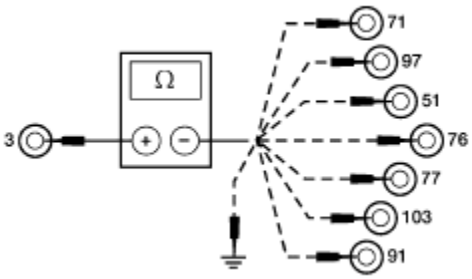
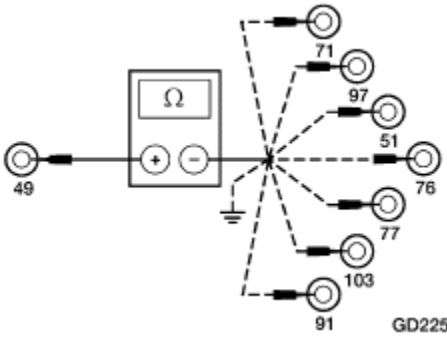
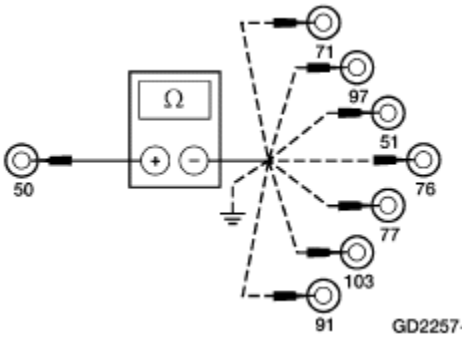


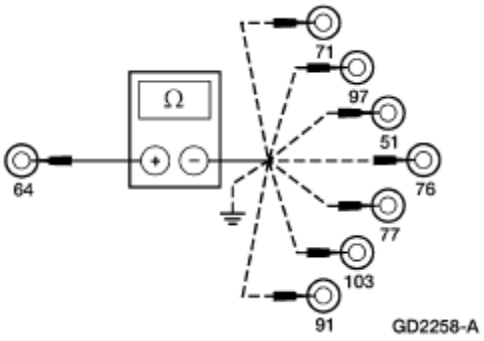
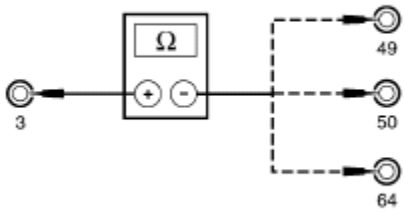
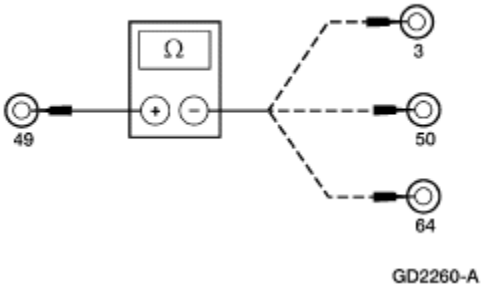
GD2146-A

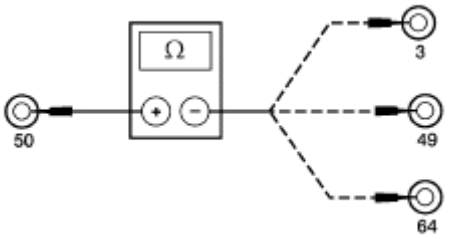
10 Measure the resistance between the PCM Test Pin 64 at the EEC-V 104-Pin Breakout Box and TR3A circuit Pin 3 at digital TR sensor connector harness side.

- **Are all resistances less than 5 ohms?**

→ **Yes**
GO to C8 .

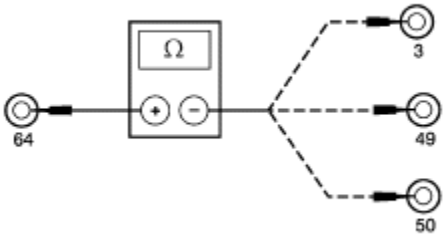
	→ **No** REPAIR open circuit(s). RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.
C8 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND OR POWER	
1  GD2254-A	1 Measure the resistance between PCM Test Pin 91 and Test Pins 71 and 97 at the EEC-V 104-Pin Breakout Box.
2  GD4496-A	2 Measure the resistance between PCM Test Pin 3 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.
3  GD2256-A	3 Measure the resistance between PCM Test Pin 49 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.
4  GD2257-A	4 Measure the resistance between PCM Test Pin 50 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.

5  GD2258-A	5 Measure the resistance between PCM Test Pin 64 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground. • **Are all resistances greater than 10,000 ohms?** → **Yes** GO to C9 . → **No** REPAIR short circuit(s). RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.
C9 CHECK FOR SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS	
1  A0008656	1 Measure the resistance between Test Pin 3 and Pins 49, 50, and 64 at the EEC-V 104-Pin Breakout Box.
2  GD2260-A	2 Measure the resistance between Test Pin 49 and Pins 3, 50, and 64 at the EEC-V 104-Pin Breakout Box.
3	3 Measure the resistance between Test Pin 50 and Pins 3, 49, and 64 at the EEC-V 104-Pin Breakout Box.



GD2261-A

4



GD2262-A

4 Measure the resistance between Test Pin 64 and Pins 3, 49, and 50 at the EEC-V 104-Pin Breakout Box.

- **Are all the resistances greater than 10,000 ohms?**

→ **Yes**
INSTALL a new PCM. REFER to Section 303-14 . RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.

→ **No**
REPAIR shorts on circuits having less than 10,000 ohms between other TR/PCM input signal circuits. RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.

C10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR

1

TRS-E Cable to Transmission

2

TRS-E Cable to Digital TR Sensor

3 Place the Digital TR Overlay onto Transmission Tester.

4 Carry out Switch Test as instructed on the

	Digital TR Overlay. • **Does the status lamp on the tester indicate RED for the correct gear position?** → **Yes** Concern is not in the digital TR sensor. For starting system concerns, REFER to Section 303-06 . For reversing lamp concerns, REFER to Section 417-01 . For optional circuits, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. → **No** INSTALL a new digital TR sensor. Clear DTCs. REPEAT OBD Tests.

PINPOINT TEST D: ELECTRICAL PRESSURE CONTROL (EPC) SOLENOID

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Internal Harness Illustration preceding these pinpoint tests. **NOTE:** Read and record all DTCs. All digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).	
D1 ELECTRONIC DIAGNOSTICS	
1  2  3 4  Scan Tool 5  6	3 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in the connector and in good condition before proceeding.

Diagnostic Data Link

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does the vehicle enter the Trans-Bench Mode?**

→ **Yes**
GO to D2 .

→ **No**
REPEAT procedure to ENTER Trans-Bench Mode. If vehicle did not enter OSC, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

D2 SOLENOID FUNCTIONAL TEST

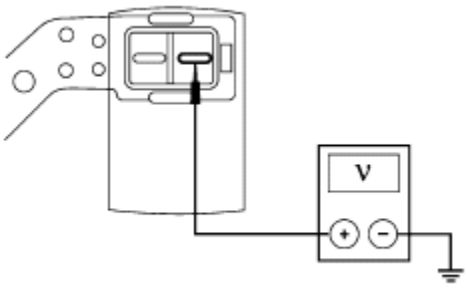
1 Install 2,060 kPa (300 psi) pressure gauge into EPC tap.

2 Monitor pressure gauge.

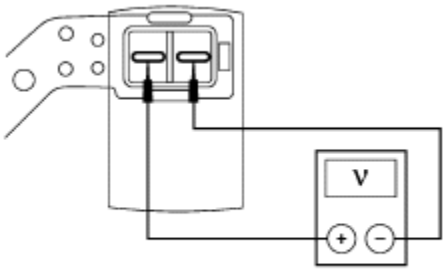
3

Parameter; EPC

4 Select value - 15, 30, 45, 60, 70 or 90 psi.

8  XXX	5 Press "SEND". 6 Select another value "0-90 psi". 7 Press "SEND". 9 Press "SEND". • **Does the pressure reading match the commanded pressure?** → **Yes** CLEAR DTCs. REPEAT OBD Tests. → **No** GO to D3 .
D3 CHECK FOR BATTERY VOLTAGE	
3  4  GD4494-A	1 Remove transmission fluid pan. 2 Visually inspect the lead frame connectors for damage. 4 Measure the voltage with positive lead to VPWR solenoid pin and negative lead to a good ground. • **Is voltage greater than 10 volts?** → **Yes** GO to D4 . → **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the OBD Tests.

D4 ELECTRICAL SIGNAL CHECK

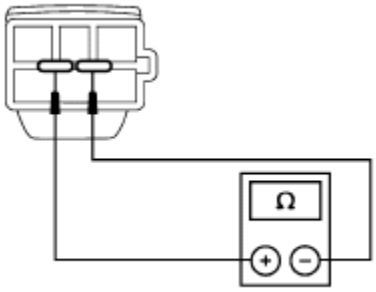
1  GD4495-A	1 Measure the voltage with positive lead connected to VPWR solenoid pin and connect negative lead to the signal pin of the EPC solenoid.
	2 Turn the solenoids ON and OFF, while monitoring the voltage reading, solenoid state on the scan tool (ON and OFF), listen for the solenoid to activate (click).
3  Trans-Bench Mode	
4  Parameter EPC	
	5 Select a value "0-90 psi". 6 Press "SEND". 7 Select another value "0-90 psi". 8 Press "SEND".
9  XXX	
	10 Press "SEND". • **Does the voltage and solenoid state change?** → **Yes** GO to D5 . → **No** CHECK for open or short circuit in harness or PCM.

D5 CHECK SOLENOID RESISTANCE AT SOLENOID

1

Transmission Harness

2



AD1399-A

2 Measure the resistance between the pins of the solenoid.

3 Measure the resistance of the EPC solenoid.

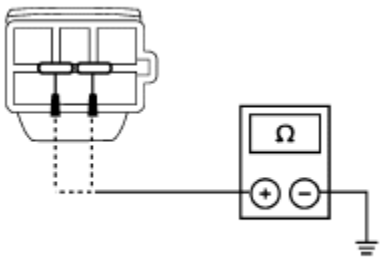
- **Is the resistance between 2.48 and 5.66 ohms?**

→ **Yes**
GO to D6 .

→ **No**
INSTALL a new solenoid. CLEAR the DTCs. REPEAT the OBD Tests.

D6 CHECK SOLENOID FOR SHORT TO GROUND

1



AD1400-A

1 Check for continuity between engine GROUND and the EPC solenoid terminals with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).

- **Is there continuity?**

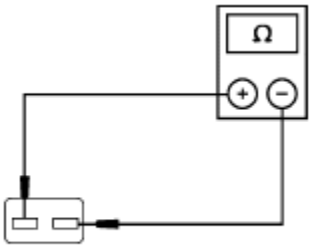
→ **Yes**
INSTALL a new solenoid. CLEAR the DTCs. REPEAT the OBD Tests.

→ **No**
REFER to Diagnosis by Symptom Index in this

	section for diagnosis of pressure concerns.

PINPOINT TEST E: OUTPUT SHAFT SPEED (OSS) SENSORS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Output Shaft Speed (OSS) Sensor Harness Connector illustration preceding these pinpoint tests.	
E1 ELECTRONIC DIAGNOSTICS	
2  Scan Tool 3  4  Diagnostic Data Link 5  PCM	1 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding. 6 Select PID/Data Monitor and Record. 7 Select the PID OSS. • **Does vehicle enter PID/Data Monitor and Record?** → **Yes** GO to E2 . → **No** REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
E2 DRIVE CYCLE TEST	

	1 While monitoring the OSS Speed PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Does the OSS Speed PID increase and decrease with engine and vehicle speed?** → **Yes** CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section. → **No** If the OSS Speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern. If the sensor signal is erratic, INSPECT for intermittent concern in the internal/external harness, sensor, or connector. If the sensor signal is steady, GO to E3.
E3 CHECK RESISTANCE OF OSS SENSOR	
2  AD1084-B	1 Disconnect the vehicle harness connector from the OSS sensor. 2 Measure the resistance between the OSS sensor pins. • **Is the resistance between 334-759 ohms?** → **Yes** REFER to Diagnosis by Symptom Index for concern diagnosis. → **No** INSTALL a new OSS sensor.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1740.	
F1 ELECTRONIC DIAGNOSIS	
1  Scan Tool	2 Carry out KOEO test. • **Are only DTCs P1714, P1715, P1740 present?** → **Yes** REPAIR the other DTCs first. CLEAR DTCs and CARRY OUT Transmission Drive Cycle Test. REPEAT Quick Test. → **No** INSTALL a new solenoid and or body. REFER to the Diagnostic Trouble Code Charts in this section for code description. GO to F2.
F2 TRANSMISSION DRIVE CYCLE TEST	
	1 Carry out transmission drive cycle test. 2 Carry out On-Board Diagnostic Test. • **Does the vehicle upshift and downshift OK?** → **Yes** GO to F3. → **No** REFER to Diagnosis By Symptom in this section to diagnose shift concerns.
F3 RETRIEVE DTCS	
1  Scan Tool	2 Carry out KOEO test until continuous DTCs have been displayed. • **Are DTCs P1714, P1715, P1740 still present?** → **Yes** INSTALL a new PCM. REFER to Section 303-14. ROAD TEST and REPEAT Quick Test.

	→ **No** Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

Pinpoint Tests — OSC Equipped Vehicles

Any time an electrical connector or solenoid body is disconnected, inspect the connector for pin condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install a new connector as required.

Shift Solenoids Pre-Diagnosis

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Operation Chart

Gear Lever Position	PCM Commanded Gear	Solenoids		
		SSA	SSB	TCC
P/R/N	1	ON	OFF	HD
(D)	1	ON	OFF	HD
(D)	2	OFF	OFF	EC
(D)	3	OFF	ON	EC
(D)	4	ON	ON	EC
(D)				
w/OD OFF				
1	1	ON	OFF	HD
2	2	OFF	OFF	EC
3	3	OFF	ON	EC
Manual 2	2	OFF	OFF	EC
Manual 1	1	ON	OFF	HD
[a] 1	2	OFF	OFF	EC

[a] When a manual pull-in occurs above a calibrated speed the transmission will downshift from the higher gear until the vehicle speed drops below this calibrated speed.

EC = Electronically controlled.

HD = Hydraulically disabled.

Shift Solenoid Failure Mode Chart "Always Off"

Failed off due to powertrain control module and or vehicle wiring concerns, shift solenoid electrically or hydraulically stuck off.

SSA ALWAYS OFF:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	2	2	2
2	2	2	2
3	3	2*	2*
4	3	2*	2*

*No engine braking.

SSB ALWAYS OFF:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	2	2	2
3	2	2	2
4	1	1	1

Shift Solenoid Failure Mode Chart "Always On"

Failed on due to powertrain control module and or vehicle wiring concerns, shift solenoid electrically or hydraulically stuck on.

SSA ALWAYS ON:	Gear Lever Position (D)	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	1	1
2	1	1	1
3	4	2*	2*
4	4	2*	2*

*No engine braking.

SSB ALWAYS ON:	Gear Lever Position (D)	2	1
PCM Gear	Actual Gear		

Commanded	Obtained		
1	4	2*	2*
2	3	2*	2*
3	3	2*	2*
4	4	2*	2*

*No engine braking.

PINPOINT TEST A: SHIFT AND TORQUE CONVERTER CLUTCH SOLENOIDS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Read and record all DTCs. All digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC). **NOTE:** Refer to the Transmission Internal Harness Illustration preceding these pinpoint tests. **NOTE:** Refer to the Transmission Vehicle Harness Connector Illustration preceding these pinpoint tests.	
A1 ELECTRONIC DIAGNOSTICS	
1  2  4  Scan Tool 5  6  Diagnostic Data Link	3 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does vehicle enter Trans-Bench Mode?**

→ **Yes**
GO to A2 .

→ **No**
REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter Trans-Bench Mode, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

A2 WIGGLE TEST

1 Select PIDs to be monitored.

PID Command	PID Actual
SSA	SS1F
SSB	SS2F
TCC	TCCF

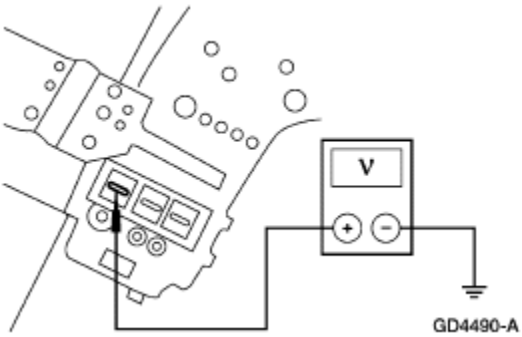
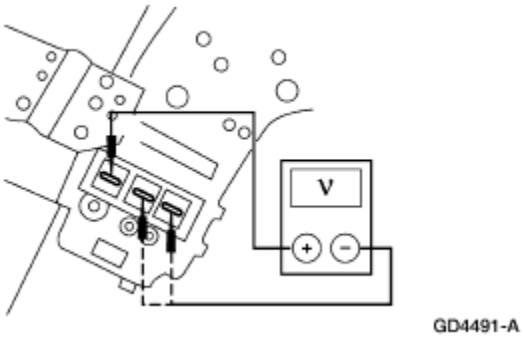
2 Select "ON" to turn suspect solenoid on.

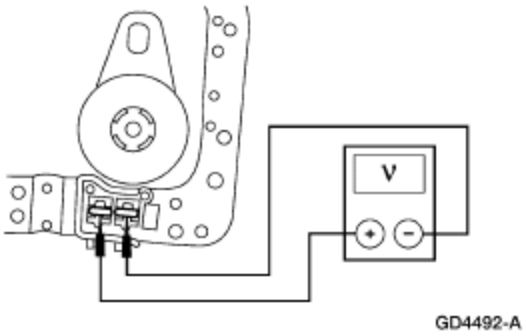
3 Press "SEND".

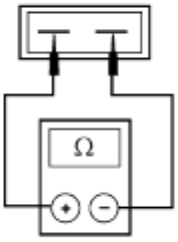
4 Wiggle all wiring and connectors to the transmission. Monitor the Solenoid State for changes.

5 Select "OFF" to turn solenoid off.

	6 Press "SEND". • **Does the suspect solenoid(s) fault state change?** → **Yes** REPAIR open or short in the vehicle harness or connector. → **No** GO to A3 .
A3 SOLENOID FUNCTIONAL CHECK	
	1 Monitor each solenoid state. 2 Turn each solenoid ON and OFF. • **Does the solenoid turn ON and OFF when commanded and can solenoid activation be heard?** → **Yes** GO to A4 . → **No** GO to A5 .
A4 OSC TRANS-DRIVE MODE (GR_CM OR TCC)	
	1 Carry out OSC Trans-Drive Mode. 2 Select GR_CM for Shift Solenoids or follow procedures for GR_CM as listed. 3 Select TCC for Torque Converter Clutch Solenoid. Follow procedures of TCC in Drive Mode as listed. • **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?** → **Yes** CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose shift or torque converter concern. → **No** GO to A5 .
A5 CHECK FOR BATTERY VOLTAGE	
	1 Remove transmission fluid pan.

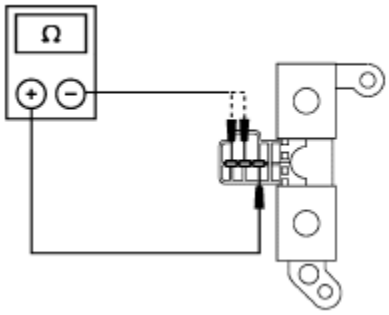
3  4  	2 Visually inspect the lead frame and connectors for damage. 4 Measure the voltage with the positive lead to VPWR solenoid pin and negative lead to a good ground. • **Is the voltage greater than 10 volts?** → **Yes** GO to A6 . → **No** CHECK for open or short circuit in harness, or solenoid.
A6 ELECTRICAL SIGNAL CHECK	
1  2  Trans-Bench Mode	1 Measure the voltage with the positive lead connected to VPWR solenoid pin and the negative lead to the signal pin of the appropriate solenoid. 3 Select Parameter SSA, SSB or TCC. 4 Select "ON". 5 Press "SEND".

	6 Turn the solenoids ON and OFF, while monitoring the voltage, solenoid state on the scan tool (ON and OFF), and listen for the solenoid to activate (click).
7  GD4492-A	7 Measure the voltage with the positive lead to VPWR pin and the negative lead to the TCC pin.
8 	8 Select Parameter TCC.
	9 Select "ON".
	10 Press "SEND".
	11 Turn the solenoid ON and OFF, while monitoring the voltage, solenoid state on the scan tool (ON and OFF), and listen for the solenoid to activate (click).
	12 Select "OFF", press "SEND".
	• **Does the voltage and solenoid state change?**
	→ **Yes** GO to A7 .
	→ **No** CHECK for open or short circuit in harness, solenoid or a PCM concern.
A7 CHECK SOLENOID RESISTANCE AT SOLENOID	
1 	
	2 Disconnect the appropriate solenoid from the lead frame.
3	3 Measure the solenoid resistance between the pins of the solenoid.



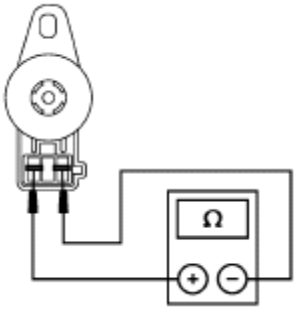
GD3386-A

4



AD1391-A

5



AD1392-A

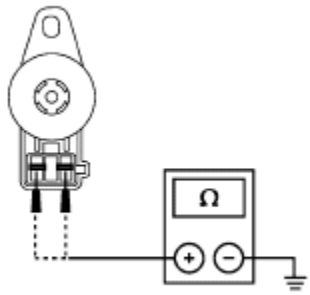
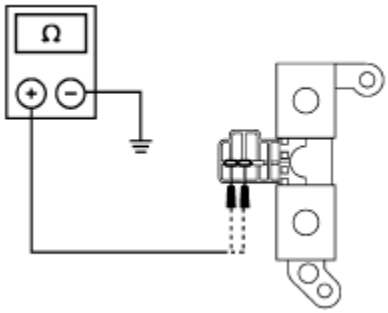
6 Measure the resistance for each solenoid (SSA, SSB or TCC) as follows:

Solenoid	Resistance (ohms)
SSA	20-30
SSB	20-30
TCC	10-16

- **Are the resistances correct?**

→ **Yes**
GO to A8 .

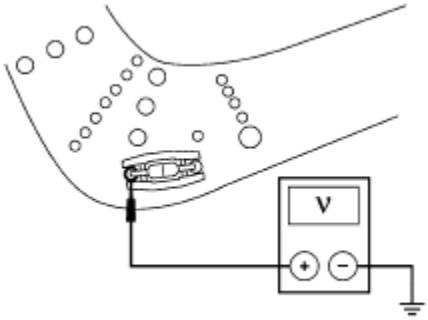
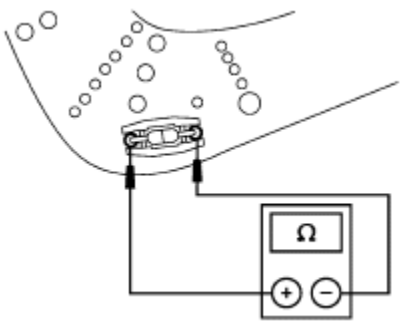
→ **No**
INSTALL a new solenoid.

A8 CHECK SOLENOID FOR SHORT TO GROUND	
1  AD1393-A 2  AD1394-A	1 Check for continuity between engine ground and appropriate solenoid pin with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity). **Solenoid** / **Terminal** SSA / +/- SSB / +/- TCC / +/- • **Is there continuity?** → **Yes** INSTALL a new solenoid. → **No** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns.

PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Connector Layouts preceding these pinpoint tests.	
B1 ELECTRONIC DIAGNOSTICS	
2 	1 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding.

Scan Tool 3  7  PIDs; TFT, TFTV	4 Select Diagnostic Data Link. 5 Select PCM. 6 Select PID/Data Monitor and Record. • **Does the vehicle enter PID/Data Monitor and Record?** → **Yes** GO to B2 . → **No** REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
B2 WARM-UP/COOL-DOWN CYCLE	
	1 While monitoring the TFT PIDs, carry out the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down. • **Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?** → **Yes** If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose transmission overheating. If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector.

	→ **No** GO to B3 .
B3 ELECTRICAL SIGNAL CHECK	
1  4  GD4493-A	2 Remove transmission fluid pan. 3 Visually inspect the lead frame and connectors for damage. 4 Measure the voltage with the positive lead to positive TFT at sensor pin and negative lead to a good ground. • **Is the voltage present?** → **Yes** GO to B4 . → **No** CHECK for open or short circuit in vehicle harness, internal harness or a PCM concern.
B4 CHECK RESISTANCE OF TFT SENSOR	
1  Transmission Harness 2  AD1396-A	2 Measure the resistance between the positive TFT and negative TFT pins at transmission connector, using the following: **Transmission Fluid Temperature** **°C** / **°F** / **Resistance (Ohms)** -40 to -20 / -40 to -4 / 967K - 284K -19 to -1 / -3 - 31 / 284K - 100K 0 - 20 / 32 - 68 / 100K - 37K

21 - 40	69 - 104	37K - 16K
41 - 70	105 - 158	16K - 5K
71 - 90	159 - 194	5K - 2.7K
91 - 110	195 - 230	2.7K - 1.5K
111 - 130	231 - 266	1.5K - 0.8K
131 - 150	267 - 302	0.8K - 0.54K

- **Is the resistance correct?**

→ **Yes**
REFER to Diagnosis By Symptom in this section to diagnose an overheating concern.

→ **No**
INSTALL a new internal harness (sensor is part of harness).

PINPOINT TEST C: DIGITAL TRANSMISSION RANGE (TR) SENSOR

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration preceding these pinpoint tests. **NOTE:** Refer to the Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.	
C1 VERIFY DIAGNOSTIC TROUBLE CODES	
1  2 	3 **NOTE:** DTC codes P0705 and P0708 cannot be set by an incorrectly adjusted digital TR sensor. Carry out on board diagnostic test. • **Are only DTC codes P0705, P0708 present?** → **Yes** GO to C4.

	→ **No** GO to C2 .
C2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT	
3  	1 Check to make sure the digital TR sensor harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding. 2 Apply the parking brake. 4 Disconnect the shift cable/linkage from the manual lever. 5 Verify that the digital TR Sensor Alignment Tool fits in the appropriate slots. • **Is the digital TR sensor adjustment OK?** → **Yes** GO to C3 . → **No** ADJUST the digital TR sensor. PLACE transmission range selector lever in P and CLEAR DTCs. REPEAT OBD Tests.GO to C3 .
C3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT	
2  	1 Place the manual lever in the overdrive position. 3 Re-connect the shift cable/linkage. 4 Verify that the shift cable/linkage is adjusted OK. REFER to Section 307-05 . • **Is the shift cable/linkage adjusted OK?** → **Yes** GO to C4 . → **No** ADJUST the shift cable/linkage. REFER to Section 307-05 .
C4 CHECK ELECTRICAL SIGNAL OPERATION	

1

2

Digital TR Sensor

2 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.**

Press the button and pull out on the digital TR harness connector.

3 Inspect both ends of the connector for damage or pushed-out pins, corrosion, loose wires and missing or damaged seals.

- **Are the connector, pins and harness OK?**

→ **Yes**
REPAIR as required. CLEAR DTCs and REPEAT OBD Tests.

→ **No**
If diagnosing a DTC, GO to C5 .

If diagnosing a starting concern or a reversing lamp concern, GO to C10 .

C5 CHECK ELECTRICAL SYSTEM OPERATION (DIGITAL TR AND PCM)

1

2

Scan Tool

3

Digital TR Sensor

4

5

TR PIDS TR, TR_D, TR_V

6 Move transmission range selector lever into each gear and stop.

7 Observe any of the following PIDs, TR and TR_D, TR_V (vehicle dependent) while wiggling harness, tapping on sensor, or driving the vehicle. Use PIDs TR, and TR_D for DTCs P0705, P1704, and P1705. Use PIDs TR, and TR_V for DTC P0708.

8 Compare the PIDs to the Digital Transmission Range (TR) Sensor Diagnosis Chart.

- **Do the PIDs TR, TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped, or the vehicle driven?**

→ **Yes**
The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis.

→ **No**
If TR_D changes when wiggling harness, tapping on the sensor, or driving the vehicle, the problem may be intermittent.

GO to C6 .

C6 CHECK DIGITAL TRANSMISSION RANGE SENSOR OPERATION

1

Digital TR Sensor

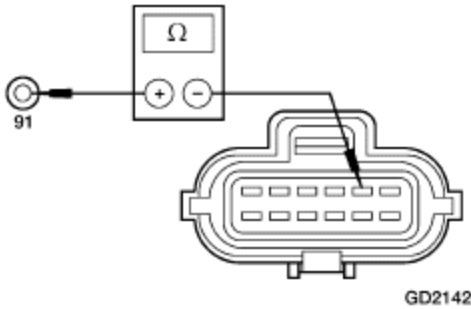
2

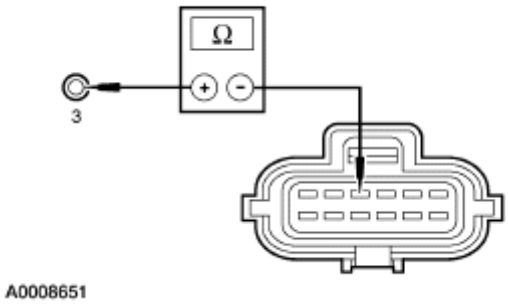
TR-E Cable to Transmission Tester

3

TR-E Cable to Digital TR Sensor

1 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.**

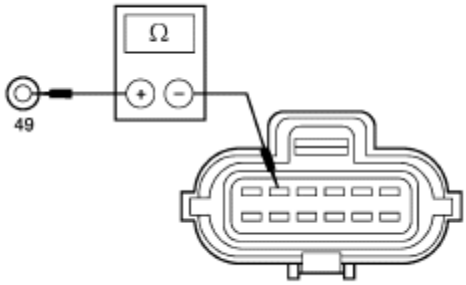
	4 Place the Digital TR Overlay onto Transmission Tester. 5 Carry out Sensor Test as instructed on the Digital TR Overlay. • **Does the status lamp on the tester TRS-E cable match the selected gear positions?** → **Yes** Concern is not in the digital TR sensor, GO to C7 . → **No** INSTALL a new digital TR sensor. CLEAR DTCs and REPEAT OBD Tests.
C7 CHECK PCM HARNESS CIRCUITS FOR OPENS	
1  2  Powertrain Control Module (PCM) 4  Digital TR Sensor 6  GD2142-A 7	3 Inspect for damaged or pushed-out pins, corrosion or loose wires. 4 **CAUTION: Do not pry the connector. This will damage the connector and result in a transmission concern.** Disconnect the digital TR sensor connector. 5 Install the EEC-V 104-Pin Breakout Box. 6 Measure the resistance between the PCM Test Pin 91 at the EEC-V 104-Pin Breakout Box and signal return circuit Pin 2 at digital TR sensor connector harness side. 7 Measure the resistance between the PCM Test Pin 3 at the EEC-V 104-Pin Breakout



A0008651

Box and TR1 circuit Pin 4 at digital TR sensor connector harness side.

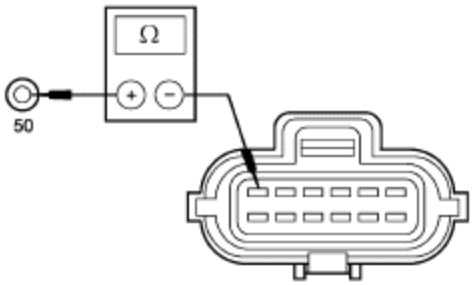
8



GD2144-A

8 Measure the resistance between the PCM Test Pin 49 at the EEC-V 104-Pin Breakout Box and TR2 circuit Pin 5 at digital TR sensor connector harness side.

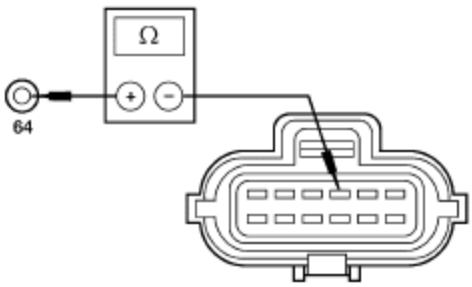
9



GD2145-A

9 Measure the resistance between the PCM Test Pin 50 at the EEC-V 104-Pin Breakout Box and TR4 circuit Pin 6 at digital TR sensor connector harness side.

10

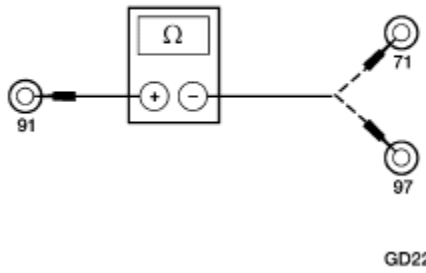
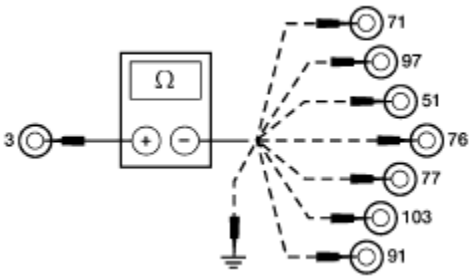
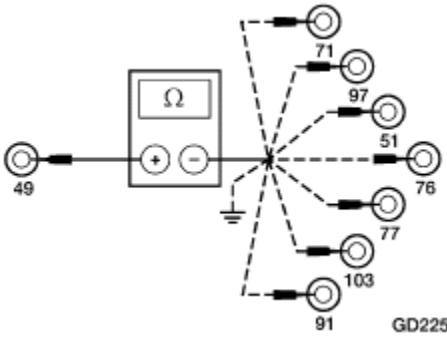
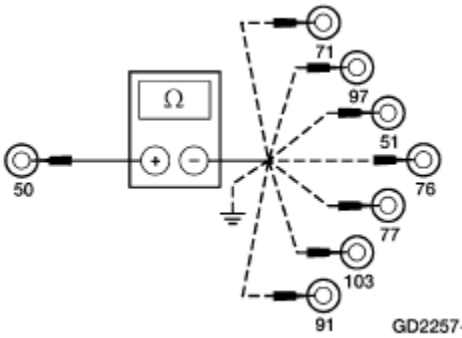


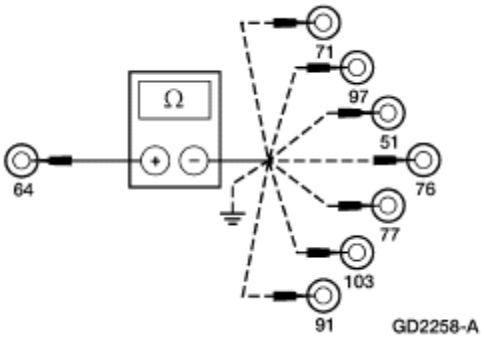
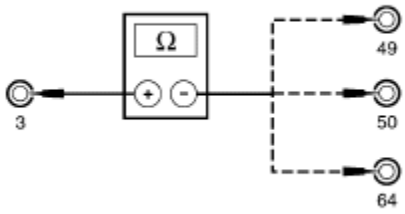
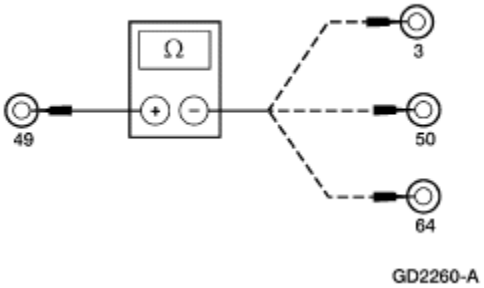
GD2146-A

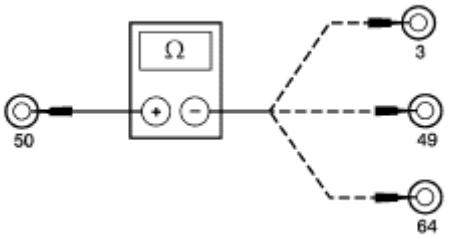
10 Measure the resistance between the PCM Test Pin 64 at the EEC-V 104-Pin Breakout Box and TR3A circuit Pin 3 at digital TR sensor connector harness side.

- **Are all resistances less than 5 ohms?**

→ **Yes**
GO to C8 .

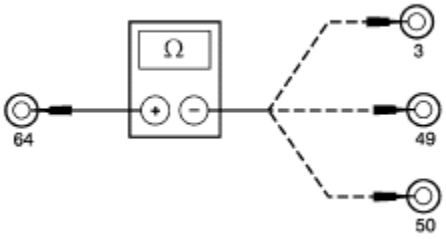
	→ **No** REPAIR open circuit(s). RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.
C8 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND OR POWER	
1  GD2254-A	1 Measure the resistance between PCM Test Pin 91 and Test Pins 71 and 97 at the EEC-V 104-Pin Breakout Box.
2  GD4496-A	2 Measure the resistance between PCM Test Pin 3 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.
3  GD2256-A	3 Measure the resistance between PCM Test Pin 49 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.
4  GD2257-A	4 Measure the resistance between PCM Test Pin 50 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground.

5  GD2258-A	5 Measure the resistance between PCM Test Pin 64 and Test Pins 71, 97, 51, 76, 77, 103, and 91 at the EEC-V 104-Pin Breakout Box and chassis ground. • **Are all resistances greater than 10,000 ohms?** → **Yes** GO to C9 . → **No** REPAIR short circuit(s). RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.
C9 CHECK FOR SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS	
1  A0008656	1 Measure the resistance between Test Pin 3 and Pins 49, 50, and 64 at the EEC-V 104-Pin Breakout Box.
2  GD2260-A	2 Measure the resistance between Test Pin 49 and Pins 3, 50, and 64 at the EEC-V 104-Pin Breakout Box.
3	3 Measure the resistance between Test Pin 50 and Pins 3, 49, and 64 at the EEC-V 104-Pin Breakout Box.



GD2261-A

4



GD2262-A

4 Measure the resistance between Test Pin 64 and Pins 3, 49, and 50 at the EEC-V 104-Pin Breakout Box.

- **Are all the resistances greater than 10,000 ohms?**

→ **Yes**
INSTALL a new PCM. REFER to Section 303-14 . RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.

→ **No**
REPAIR shorts on circuits having less than 10,000 ohms between other TR/PCM input signal circuits. RECONNECT all components. CLEAR DTCs. REPEAT OBD Tests.

C10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR

1

TRS-E Cable to Transmission

2

TRS-E Cable to Digital TR Sensor

3 Place the Digital TR Overlay onto Transmission Tester.

4 Carry out Switch Test as instructed on the

	Digital TR Overlay. • **Does the status lamp on the tester indicate RED for the correct gear position?** → **Yes** Concern is not in the digital TR sensor. For starting system concerns, REFER to Section 303-06 . For reversing lamp concerns, REFER to Section 417-01 . For optional circuits, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. → **No** INSTALL a new digital TR sensor. Clear DTCs. REPEAT OBD Tests.

PINPOINT TEST D: ELECTRICAL PRESSURE CONTROL (EPC) SOLENOID

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Internal Harness Illustration preceding these pinpoint tests. **NOTE:** Read and record all DTCs. All digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).	
D1 ELECTRONIC DIAGNOSTICS	
1  2  3 4  Scan Tool 5  6	3 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in the connector and in good condition before proceeding.

Diagnostic Data Link

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does the vehicle enter the Trans-Bench Mode?**

→ **Yes**
GO to D2 .

→ **No**
REPEAT procedure to ENTER Trans-Bench Mode. If vehicle did not enter OSC, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

D2 SOLENOID FUNCTIONAL TEST

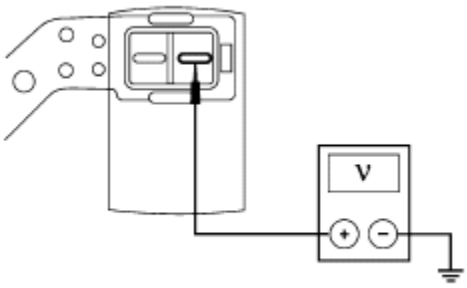
1 Install 2,060 kPa (300 psi) pressure gauge into EPC tap.

2 Monitor pressure gauge.

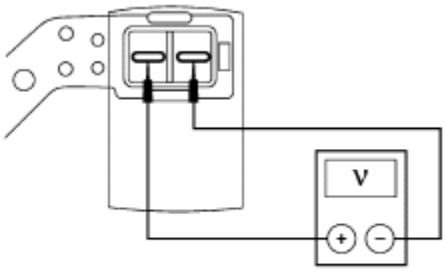
3

Parameter; EPC

4 Select value - 15, 30, 45, 60, 70 or 90 psi.

8  XXX	5 Press "SEND". 6 Select another value "0-90 psi". 7 Press "SEND". 9 Press "SEND". • **Does the pressure reading match the commanded pressure?** → **Yes** CLEAR DTCs. REPEAT OBD Tests. → **No** GO to D3 .
D3 CHECK FOR BATTERY VOLTAGE	
3  4  GD4494-A	1 Remove transmission fluid pan. 2 Visually inspect the lead frame connectors for damage. 4 Measure the voltage with positive lead to VPWR solenoid pin and negative lead to a good ground. • **Is voltage greater than 10 volts?** → **Yes** GO to D4 . → **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the OBD Tests.

D4 ELECTRICAL SIGNAL CHECK

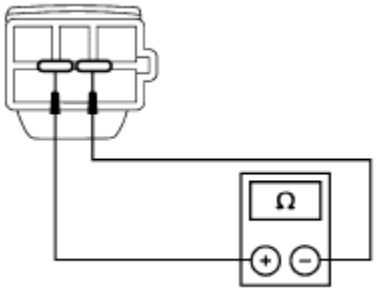
1  GD4495-A	1 Measure the voltage with positive lead connected to VPWR solenoid pin and connect negative lead to the signal pin of the EPC solenoid.
	2 Turn the solenoids ON and OFF, while monitoring the voltage reading, solenoid state on the scan tool (ON and OFF), listen for the solenoid to activate (click).
3  Trans-Bench Mode	
4  Parameter EPC	
	5 Select a value "0-90 psi". 6 Press "SEND". 7 Select another value "0-90 psi". 8 Press "SEND".
9  XXX	
	10 Press "SEND". • **Does the voltage and solenoid state change?** → **Yes** GO to D5 . → **No** CHECK for open or short circuit in harness or PCM.

D5 CHECK SOLENOID RESISTANCE AT SOLENOID

1

Transmission Harness

2



AD1399-A

2 Measure the resistance between the pins of the solenoid.

3 Measure the resistance of the EPC solenoid.

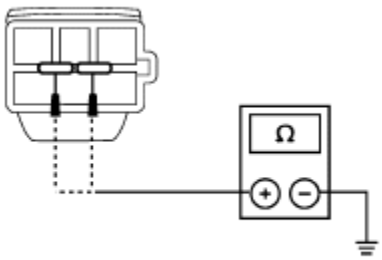
- **Is the resistance between 2.48 and 5.66 ohms?**

→ **Yes**
GO to D6 .

→ **No**
INSTALL a new solenoid. CLEAR the DTCs. REPEAT the OBD Tests.

D6 CHECK SOLENOID FOR SHORT TO GROUND

1



AD1400-A

1 Check for continuity between engine GROUND and the EPC solenoid terminals with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).

- **Is there continuity?**

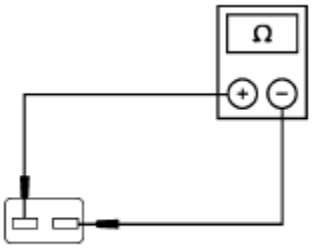
→ **Yes**
INSTALL a new solenoid. CLEAR the DTCs. REPEAT the OBD Tests.

→ **No**
REFER to Diagnosis by Symptom Index in this

	section for diagnosis of pressure concerns.

PINPOINT TEST E: OUTPUT SHAFT SPEED (OSS) SENSORS

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Output Shaft Speed (OSS) Sensor Harness Connector illustration preceding these pinpoint tests.	
E1 ELECTRONIC DIAGNOSTICS	
2  Scan Tool 3  4  Diagnostic Data Link 5  PCM	1 Check to make sure the transmission harness connector is fully seated, pins are fully engaged in connector and in good condition before proceeding. 6 Select PID/Data Monitor and Record. 7 Select the PID OSS. • **Does vehicle enter PID/Data Monitor and Record?** → **Yes** GO to E2 . → **No** REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.
E2 DRIVE CYCLE TEST	

	1 While monitoring the OSS Speed PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Does the OSS Speed PID increase and decrease with engine and vehicle speed?** → **Yes** CLEAR all DTCs. ROAD TEST to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section. → **No** If the OSS Speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern. If the sensor signal is erratic, INSPECT for intermittent concern in the internal/external harness, sensor, or connector. If the sensor signal is steady, GO to E3.
E3 CHECK RESISTANCE OF OSS SENSOR	
2  AD1084-B	1 Disconnect the vehicle harness connector from the OSS sensor. 2 Measure the resistance between the OSS sensor pins. • **Is the resistance between 334-759 ohms?** → **Yes** REFER to Diagnosis by Symptom Index for concern diagnosis. → **No** INSTALL a new OSS sensor.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1740.	
F1 ELECTRONIC DIAGNOSIS	
1  Scan Tool	2 Carry out KOEO test. • **Are only DTCs P1714, P1715, P1740 present?** → **Yes** REPAIR the other DTCs first. CLEAR DTCs and CARRY OUT Transmission Drive Cycle Test. REPEAT Quick Test. → **No** INSTALL a new solenoid and or body. REFER to the Diagnostic Trouble Code Charts in this section for code description. GO to F2.
F2 TRANSMISSION DRIVE CYCLE TEST	
	1 Carry out transmission drive cycle test. 2 Carry out On-Board Diagnostic Test. • **Does the vehicle upshift and downshift OK?** → **Yes** GO to F3. → **No** REFER to Diagnosis By Symptom in this section to diagnose shift concerns.
F3 RETRIEVE DTCS	
1  Scan Tool	2 Carry out KOEO test until continuous DTCs have been displayed. • **Are DTCs P1714, P1715, P1740 still present?** → **Yes** INSTALL a new PCM. REFER to Section 303-14. ROAD TEST and REPEAT Quick Test.

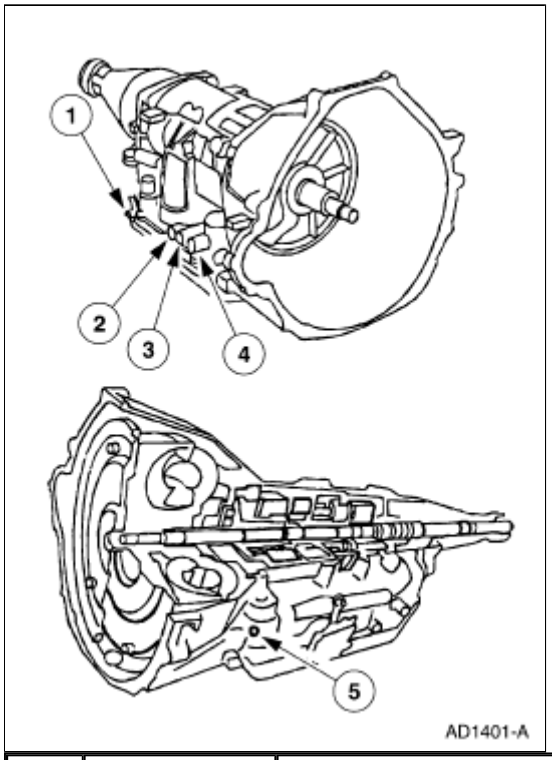
	→ **No** Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

Special Testing Procedures

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portion of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.



Item	Part Number	Description
1	—	Direct clutch pressure tap
2	—	Forward clutch pressure tap
3	—	Electronic pressure control (EPC) pressure tap
4	—	Intermediate clutch pressure tap
5	—	Line pressure tap

Line Pressure Test

CAUTION: Carry out the line pressure test prior to carrying out the stall speed test. If the line pressure is low at stall, do not carry out stall speed test or further transmission damage will occur. Do not maintain WOT in any transmission range for more than five seconds.

This test verifies that the line pressure is within specification.

1. Connect pressure gauge to line pressure tap.

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

Line Pressure Chart

Application	Range	Idle		WOT Stall	
		EPC	Line Pressure	EPC	Line Pressure
	P, N, OD, 2, 1	35-103 kPa (5-15 psi)	310-537 kPa (45-78 psi)	572-641 kPa (83-93 psi)	1103-1448 kPa (160-210 psi)
	R	35-103 kPa (5-15 psi)	441-675 kPa (64-98 psi)	572-675 kPa (83-98 psi)	1427-1875 kPa (207-272 psi)

Clutch Pressure Chart

Transmission Pressures with TP at 1.5 Volts and Vehicle Speed Above 8 Km/h (5 MPH)					
Gear	EPC Tap [1]	Line Pressure Tap	Forward Clutch Tap	Intermediate Clutch Tap	Direct Clutch Tap
M1	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
M2	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	483-620 kPa (70-90 psi)	0-34 kPa (0-5 psi)
1	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	0-34 kPa (0-5 psi)	0-34 kPa (0-5 psi)
2	172-241 kPa (25-35 psi)	517-655 kPa (75-95 psi)	448-586 kPa (65-85 psi)	483-620 kPa (70-90 psi)	0-34 kPa (0-5 psi)
3	310-379 kPa (45-55 psi)	724-862 kPa (105-125 psi)	655-793 kPa (95-115 psi)	689-827 kPa (100-120 psi)	655-793 kPa (95-115 psi)
4	241-310 kPa (35-45 psi)	620-758 kPa (90-110 psi)	0-34 kPa (0-5 psi)	586-724 kPa (85-105 psi)	551-689 kPa (80-100 psi)

[1] EPC readings will vary due to EEC strategy. These values are approximate pressures. Actual clutch apply pressures should be within 69-103 kPa (10-15 psi) of line pressure. For additional information on testing, refer to the Clutch Pressure Test in this section.

3. Place the ignition switch in the OFF position. If line pressure is not within specification, check EPC pressure.

4. Connect pressure gauge to EPC pressure tap.

5. Start engine and check EPC pressure. Use the line pressure chart for specifications.

6. If EPC pressure is not within specification, carry out Pinpoint Test E to diagnose EPC operation. If EPC operation is OK, see the line pressure diagnosis chart for line pressure concern causes.

Line Pressure Diagnosis Chart

Test Results	Possible Source
High at Idle — All Positions	• Wiring Harnesses • Run Quick Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. • EPC Solenoid • Main Regulator Valve
Low at Idle — All Positions	• Low Fluid Level • Control Bodies • Excessive Leakage in Pump • Damaged Gaskets on Separator Valve • Damaged Separator Plate • Restricted Inlet Filter • Case Bolts • Loose Main Body • Case • Sticking Main Regulator Valve • Damaged Inlet Tube Seal on Inlet Filter
Low in Park Only	• Valve Body • Low/Reverse Servo
Low in Reverse Only	• Separator Plate • Low/Reverse Servo or Valve Bodies • Reverse Clutch
Low in Neutral Only	• Valve Body
Low in Overdrive Only	• Forward Clutch • Valve Body
Low in 1st Position	• Forward Clutch • Valve Body • Low/Reverse Servo
Low in 2nd Position	• Intermediate Clutch • Valve Bodies • Forward Clutch

Stall Speed Test

WARNING: Apply the parking brake firmly while carrying out each stall test.

CAUTION: Carry out line pressure test prior to carrying out stall test. If the line pressure is low at stall, do not carry out stall test or further transmission damage will occur.

The stall speed test checks:

- torque converter clutch operation and installation.
- holding ability of the forward clutch.
- reverse clutch (the low-reverse bands).
- planetary one-way clutch.
- engine driveability.

Conduct this test with the engine coolant and transmission fluid at correct levels and at normal operating temperature.

Apply the parking brake firmly for each stall speed test.

1. Find the specified stall rpm for the vehicle; see the stall speed diagnosis chart. Use a grease pencil to mark the rpm on the dial of a tachometer.

Stall Speed Chart

Engine	Stall Speed RPM
5.0L	2481-2904

2. Connect a tachometer to the engine.

3. **NOTE:** If the rpm recorded by the tachometer exceeds the maximum limits, release the accelerator pedal immediately because clutch or band slippage is indicated.

   In each of the following ranges (D), 2, 1, R, press the accelerator pedal to the floor and hold it just long enough to let the engine get to wide open throttle (WOT). While making this test, do not hold the throttle open for more than 5 seconds at a time.

4. Note the results in each range.

5. After each range, move the shift control selector lever to Neutral and run the engine at 1000 rpm for about 15 seconds to cool the torque converter before making the next test.

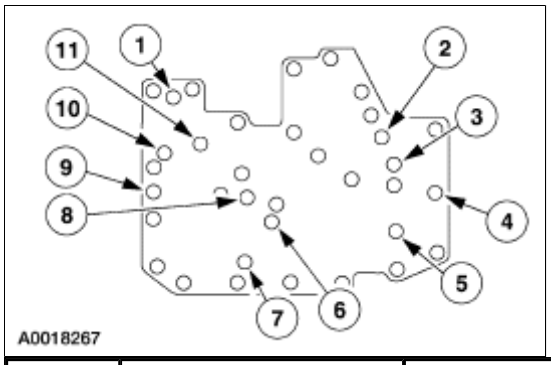
6. Refer to the stall speed diagnosis chart for corrective actions.

Stall Speed Diagnosis Chart

Selector Position	Stall Speeds High	Stall Speeds Low
(D)	Planetary One-Way Clutch	
(D), 2 and 1	Forward Clutch or Intermediate Clutch	
(D), 2, 1 and R	Carry Out Pressure Test	Torque Converter Stator One-Way Clutch or Engine Performance
R	Reverse Clutch or Low Reverse Band or Servo	

Air Pressure Tests

Transmission Air Test Plate



Item	Part Number	Description
1	—	Converter bypass
2	—	Direct clutch
3	—	Forward clutch
4	—	2-3 accumulator, top
5	—	2-3 accumulator, bottom
6	—	Reverse servo
7	—	Overdrive servo, apply
8	—	Overdrive servo, release
9	—	Intermediate clutch
10	—	Reverse clutch
11	—	1-2 accumulator, apply

A no-drive condition can exist even with correct transmission fluid pressure because of inoperative clutches or bands. An erratic shift can be located through a series of checks by substituting air pressure for fluid pressure to determine the location of the malfunction.

Follow the procedure to determine the location of the inoperative clutch or band by introducing air pressure into the various test plate passages.

NOTE: Use only dry, regulated 276 kPa (40 psi) maximum air pressure.

Apply air to the appropriate passage(s). A dull thud should be felt or heard or movement could be observed when the clutch component applies. There should be no hissing sound when the component is applied.

Cover the vent hole in the test plate with a clean, lint-free shop towel to prevent spray when the air is applied. Plugging the vent hole during testing will result in inaccurate results.

1. Drain transmission fluid and remove the transmission fluid pan.

2. Remove the main control valve body.

3. Install transmission test plate and gasket. Tighten bolts to 10 Nm (89 lb/in).

4. **NOTE:** Do not apply air to the test plate vent hole.

   Apply air to the appropriate clutch port (refer to the Transmission Air Test Plate illustration). A dull thud may be heard or movement felt when the component is applied or released. If clutch seals or

check balls are leaking a hissing sound may be heard.

If the servos do not operate, disassemble, clean and inspect them to locate the source of the concern.

If air pressure applied to the clutch passages fails to operate a clutch, or operates clutches simultaneously, inspect the fluid passages in the case.

If air pressure applied to the accumulator fails to operate an accumulator, remove and inspect case passages and piston.

Clutch Pressure Test

The Clutch Pressure Test will diagnose a low-pressure condition or leakage in a clutch circuit. A difference of 103 kPa (15 psi) or more between the clutch pressure and line pressure will prevent a normal shift.

1. **CAUTION: Pressure gauges affect the shift quality of the transmission. Care must be taken not to accelerate or decelerate rapidly. Possible transmission failure can result.**

   Attach 0-2068 kPa (0-300 psi) pressure gauges to the line pressure tap and the appropriate clutch pressure tap according to Band/Clutch Application Chart 601. Gauges must be accurate enough to distinguish a 103 kPa (15 psi) difference. (If this test is done in conjunction with a control pressure test, pressure gauges will be attached to all pressure taps.) Have sufficient flexible hose available to read the gauges in the vehicle.

2. Drive the vehicle. When pressure is applied to the clutch, note the difference between the line pressure gauge and the corresponding clutch pressure gauge.

3. If the difference in pressures is less than 103 kPa (15 psi), the corresponding clutch circuit does not have a pressure loss. The gauges on the line pressure tap and appropriate clutch pressure tap can be switched to confirm that gauge calibration differences are not the cause.

4. If the difference is greater than 103 kPa (15 psi), there is a leak in the corresponding clutch pressure circuit. The gauges on the line pressure tap and clutch pressure tap can be switched to confirm that gauge calibration differences are not the cause. Carry out the appropriate procedure to correct the clutch leak problem.

Leakage Inspection

CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specifications. This may cause damage to the case threads.

Check the fluid filler tube connection at the transmission case. If leakage is found here, install a new grommet.

Check the VSS plug or VSS sensor O-ring (model dependent). If leakage is found install a new O-ring.

Check fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fluid tube nut, install new parts. When fluid is found leaking between the case and cooler line fitting, check for missing or damaged O-ring, then tighten the fitting to maximum specification.

If the leak continues, install a new cooler line fitting and tighten to specification. The same procedure should be followed for fluid leaks between the radiator cooler and the cooler line fittings in this section; refer to Section 307-02 .

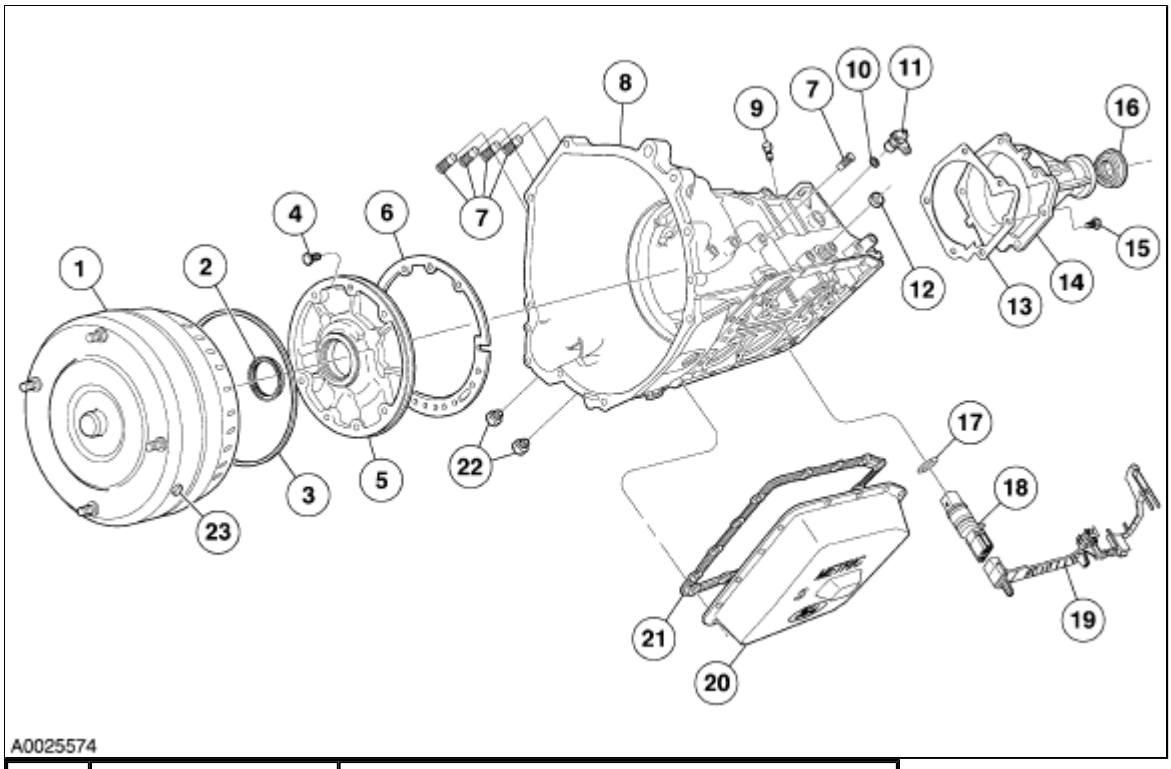
Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines for the cooler fittings and applying no more than 345 kPa (50 psi) air pressure to the fittings. Remove the radiator cap to relieve the pressure buildup at the exterior of the oil cooler tank. If the cooler is leaking and or will not hold pressure, install a new cooler.

If leakage is found at the transmission range selector lever, install a new seal.

If leakage is found at the transmission internal harness connector, install a new O-ring.

4R70W External Sealing

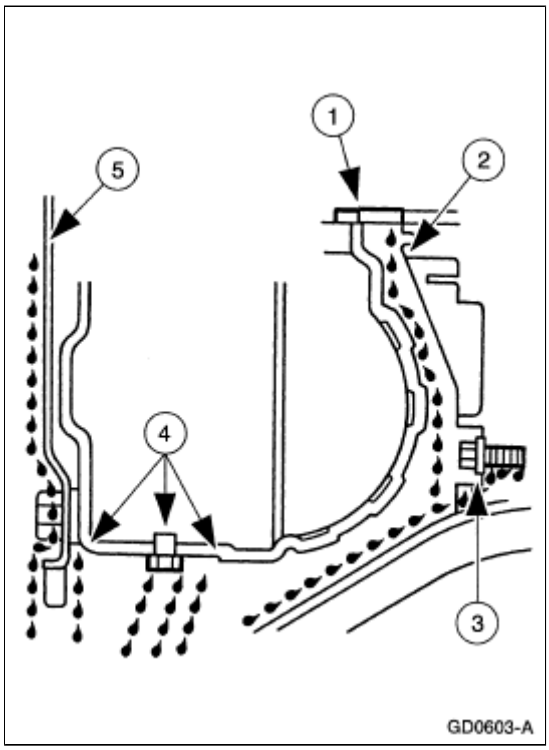


Item	Part Number	Description
1	7902	Torque converter
2	7A248	Front pump seal
3	7A248	Front pump seal
4	N605789-S101	Bolt
5	7A106	Front pump body assembly
6	7A136	Pump gasket
7	390318-S2	Pipe plug — 1/8 — 27 Dryseal tapered
8	7005	Case
9	7034	Vent
10	N811757-S100	Speed sensor seal
11	7H103	Output shaft speed (OSS) sensor
12	7B498	Manual control lever seal assembly
13	7086	Extension housing gasket
14	7A039	Extension housing
15	N803737-S1101	Bolt — M8-1.25 x 30
15	N606047-S101	Bolt — M8-1.25 x 70
15	N803521-S1101	Bolt — M8-1.25 x 1.25 x 0.54
15	N811524-S101	Bolt — M8-1.25 x 42
16	7052	Oil seal
17	7Z276	Seal — bulkhead assembly
18	7G276	Bulkhead assembly wiring connector

19	7G276	Molded lead frame
20	7A194	Transmission fluid pan
21	7A191	Gasket
22	7D273	Fluid tube connector
23	87650-S2	Converter drain plug

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the front pump support and gear and torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transmission, as evidenced by fluid around the torque converter housing, may have several sources. By careful observation it is possible, in many instances, to pinpoint the source of leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The five steps following correspond with the numbers in the illustration.



1. Fluid leaking by the front pump seal lip will tend to move along the impeller hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.

2. Fluid leakage by the outside diameter of the front pump seal and front pump body will follow the same path that leaks by the inside diameter of the front pump seal follow.

3. Fluid that leaks by a front pump to case bolt or pump gasket will be deposited on the inside of the torque converter housing only. Fluid will not be deposited on the back of the torque converter.

4. Fluid leakage from the converter drain plug, (model dependent) converter seal weld or converter to flexplate stud weld will appear at the outside diameter of the torque converter on the back face of the flexplate and in the converter housing only near the flexplate. Fluid leaks from the torque converter

will leave a ring of fluid around the inside of the torque converter housing.

5. **NOTE:** White facial tissue paper may aid in determining the color (red is transmission fluid) and source of the leaking fluid.

   Engine oil leaks are sometimes incorrectly diagnosed as transmission pump gasket leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the concern.

a. Leakage at the engine valve cover gasket may allow oil to flow over the torque converter housing or seep down between the torque converter housing and cylinder block causing oil to be present in or at the bottom of the torque converter housing.
b. Oil galley plug leaks will allow oil to flow down the rear face of the cylinder block to the bottom of the torque converter housing.
c. Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.
d. Leakage at engine oil pressure sensor.

Leak Check Test

1. Remove the fluid level indicator and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of makeup fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak.

2. Remove the torque converter housing cover. Clean off any fluid from the top and bottom of the torque converter housing, front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable nonflammable solvent and blow dry with compressed air.

3. Wash out the torque converter housing, the front of the flexplate and the converter drain plugs. The torque converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.

4. Start and run the engine until the transmission reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist; refer to Section 100-02 and run the engine at fast idle, then at engine idle, occasionally shifting to the Overdrive and Reverse ranges to increase pressure within the transmission. Observe the front of the flexplate, back of the cylinder block (in as far as possible), and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

Leak Check Test With Black Light Used With 12 Volt Master UV Diagnostic Inspection Kit

Oil soluble aniline or fluorescent dyes premixed at the rate of 2.5ml (1/2 teaspoon) of dye powder to 0.235L (1/2 pint) of transmission fluid have proved helpful in locating the source of fluid leakage. Such dyes may be used to determine whether an engine oil or transmission fluid leak is present, or if the fluid in the fluid cooler leaks into the engine cooling system. A black light must be used with the fluorescent dye solution.

Transmission Fluid Cooler

CAUTION: Whenever a transmission has been disassembled to install new parts, the cooler bypass valve (CBV), all transmission fluid coolers (in tank and auxiliary) and transmission fluid cooler lines must be cleaned and backflushed. Use a suitable the torque converter/fluid cooler cleaner.

NOTE: Cleaning and backflushing the transmission fluid cooling system along with following all the normal cleaning and inspection procedures in this section during disassembly and reassembly will keep contamination from reentering the transmission and causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the torque converter and transmission fluid cooler. These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back into use.

Transmission Fluid Cooler Flow Test

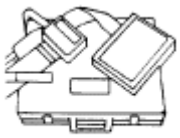
NOTE: The transmission linkage/cable adjustment, fluid level and line pressure must be within specification before carrying out this test. Refer to Section 307-05 for adjustments.

1. Remove fluid level indicator from fluid filler tube.
2. Place funnel in fluid filler tube.
3. Position the vehicle on a hoist. For additional information, refer to Section 100-02 .
4. Remove the cooler return line (top fitting) from the fitting on the transmission case.
5. Connect one end of a hose to the cooler return line and route other end of the hose up to a point where it can be inserted into the funnel at the fluid filler tube.
6. Remove the safety stands and lower the vehicle. Insert end of hose into the funnel.
7. Start the engine and run it at idle with the transmission in NEUTRAL.
8. When fluid flows from the hose in a steady stream, a liberal amount of fluid should be observed. "Liberal" is about 1 liter (1 quart) delivered in 15 seconds. If a liberal flow is observed, the test is complete.
9. If the flow is not liberal, stop the engine. Disconnect the hose from the cooler return line and connect it to the converter outlet fitting (bottom fitting) on the transmission case.
10. Repeat steps 6 and 7. If flow is now approximately 1 liter (1 quart) in 15 seconds, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section. If the flow is still not approximately 1 liter (1 quart) in 15 seconds, repair or install pump and or converter.

For the installation of new transmission fluid cooler or tubes, refer to Section 307-02 .

Diagnosis By Symptom

Special Tool(s)

 ST1565-A	Pressure Gauge 307-004 (T57L-77820-A)
 ST1392-A	AOD-E Transmission Test Plate 307-246 (T92P-7006-A)
 ST1391-A	EEC-V 104-Pin Breakout Box 418-049 (014-00950) or equivalent
 ST1632-A	TRS-E Cable 418-F107 (007-00111) or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418–F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool
 ST1389-A	Transmission Tester 007-00130 or equivalent
	Digital TRS Sensor Overlay 007-00131 or equivalent

	
 ST1137-A	73 Digital Multimeter 105-R0051 or equivalent
 ST1300-A	12 Volt Master UV Diagnostic Inspection Kit 164-R0756 or equivalent

The Diagnosis by Symptom charts give the technician diagnostic information, direction, and suggest possible components, using a symptom as a starting point.

The Diagnosis by Symptom charts are divided into two categories: Electrical Routines, indicated by 200 series numbers, and Hydraulic/Mechanical Routines, indicated by 300 series numbers. The Electrical Routines list the possible electrical components that could cause or contribute to the symptom described. The Hydraulic/Mechanical Routines list the possible hydraulic or mechanical components that could cause or contribute to the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom Index, select the Concern/Symptom that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:

a. preliminary inspections.
b. verifications of condition.
c. checking the fluid levels.
d. carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

   Begin with the Electrical Routine, if indicated. Follow the reference or action required statements. Always carry out the on-board diagnostic tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.

5. The Hydraulic/Mechanical Routines list possible hydraulic or mechanical components that could cause the concern. These components are listed in the removal sequence and by most probable

cause. All components listed must be inspected to ensure correct repair.

Diagnosis by Symptom Index

Title	Routines	
	Electrical [1]	Hydraulic/Mechanical
Engagement Concerns		
No Forward	201	301
No Reverse	202	302
Harsh Reverse	203	303
Harsh Forward	204	304
Delayed/Soft Reverse	205	305
Delayed/Soft Forward	206	306
Shift Concerns		
Some/All Shifts Missing	210	310
Timing Concerns		
—Early/Late	211	311
—Erratic/Hunting	212	312
Feel		
—Soft/Slipping	213	313
—Harsh	214	314
No 1st Gear, Engages in Higher Gear	215	315
No Manual 1st Gear	216	316
No Manual 2nd Gear	217	317
Torque Converter Operation Concerns		
No Apply	240	340
Always Applied/Stalls Vehicle	241	341
Cycling/Shudder/Chatter	242	342
Other Concerns		
No Engine Braking in 2nd Gear, Manual 2nd or Manual 1st Position	250	350
Gearshift Lever Efforts High	251	351
External Leaks	252	352
Poor Vehicle Performance	253	353
Noise/Vibration in Forward or Reverse	254	354
Engine Will Not Crank	255	355
No Park (P) Range	256	356
Overheating	257	357

[1] Carry out electrical routine first.

Diagnostic Routines

Engagement Concern: No Forward

Possible Component	Reference/Action
201 — ELECTRICAL ROUTINE	
· No Electrical Concerns	
301 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect as under Fluid Condition Check; refer to Verification of Condition.
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low forward clutch pressure, low line pressure	· Check pressure at line and forward clutch tap. Refer to Line Pressure Chart for specification. If pressures are low, check the following components: oil filter and seal assembly, main controls, pump assembly, forward clutch assembly.
Fluid Filter and Seal Assembly	
· Plugged, damaged	· Install a new filter and seal assembly.
· Filter seal damaged	
Main Controls	
· 3-4 shift valve, main regulator valve, manual valve — stuck, damaged	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect gaskets for damage and install a new gasket.
· 2-3 accumulator and seals damaged	· Inspect piston, seals and bore for damage. Repair as required.
· Pressure regulator valve	· Inspect the diameter for wear.
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Porosity/cross leaks/ball missing or leaking, plugged hole	· Inspect for porosity and leaks. Repair as required.
· No. 3 and No. 4 seal rings damaged	· Inspect seals for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect seals for damage. Repair as required.

· Check balls damaged, missing, mislocated, not seating correctly	· Inspect for mislocation, poor seating, damage. Install a new cylinder as required.
· Friction elements damaged or worn	· Check for abnormal wear, damage. Repair as required.
One-Way Clutch Assembly (Planetary)	
· Worn, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
Output Shaft	
· Damaged	· Inspect for damage. Repair as required.

Engagement Concern: No Reverse

Possible Component	Reference/Action
202 — ELECTRICAL ROUTINE	
· No Electrical Concerns	
302 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low reverse clutch pressure, low reverse band pressure, low line pressure	· Check pressure at line pressure tap; refer to Line Pressure Chart for specifications. If pressures are low, check the following components: oil filter and seal assembly, main controls, reverse servo, pump assembly, reverse clutch assembly.
Fluid Filter and Seal Assembly	
· Plugged, damaged	· Install a new filter and seal assembly.
Main Controls	
· No. 6 shuttle ball, manual valve, main regulator valve, 1-2 accumulator seals stuck or damaged	· Inspect for damage. Repair as required.
· Loose bolts	· Tighten bolts to specifications.
· Gasket damaged	· Inspect for damage and install a new gasket.
Low/Reverse Servo	
· Seals (piston and cover) damaged	· Inspect for damage. Repair as required.
· Servo cover retaining ring	

damaged	
· Anchor pins (case) damaged	
Pump Assembly	
· Loose bolts	· Tighten bolts to specifications.
· Porosity/cross leaks/ball missing or leaking, plugged hole	· Inspect pump assembly. Install new as required.
· Gasket damaged	· Inspect for damage and install a new gasket.
· No. 1 and 2 seal rings damaged	· Inspect for damage. Repair as required.
Reverse Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as required.
· Check ball missing or damaged	
· Friction elements damaged or worn	
Low/Reverse Band	
· Band, servo, anchor pins damaged or worn	· Inspect for damage. Repair as required.

Engagement Concern: Harsh Reverse

Possible Component	Reference/Action
203 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, transmission fluid temperature (TFT) sensor, electronic pressure control (EPC) solenoid	· Carry out Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out engagement test, EPC test and Pinpoint Tests B and D. Repair as required. Clear DTCs, road test and repeat Self-Test.
303 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· High line pressure, high EPC pressure	· Check pressure at line and EPC pressure taps; refer to Line Pressure Chart for specifications. If high, check the following components: main controls, oil filter and seal assembly.
Fluid Filter and Seal Assembly	

· Plugged or damaged	· Install a new filter and seal assembly.
· Filter seal damaged	
Main Controls	
· No. 6 shuttle ball, No. 5 check ball, manual valve, main regulator valve stuck, damaged or missing	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gasket damaged	· Inspect for damage and install a new gasket.
· EPC solenoid stuck or damaged	· Inspect for damage, contamination. Carry out EPC test in Routine No. 203. Repair as required.
Low Reverse Servo	
· Seals (piston and cover) damaged	· Inspect for damage. Repair as required.
· Servo cover retaining ring assembled incorrectly	
· Anchor pins (case) damaged	
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Porosity/cross leaks	· Inspect pump assembly. Install new as required.
· Gasket damaged	· Inspect for damage and install a new gasket.
· No. 1 and No. 2 seal rings damaged	· Inspect for damage. Repair as required.
Reverse Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as required.
· Check ball missing or damaged	
· Friction elements damaged, worn	
· Return spring piston damaged, worn	
Low Reverse Band	
· Band, servo, anchor pin damaged or worn	· Inspect for damage. Repair as required.

Engagement Concern: Harsh Forward

Possible Component	Reference/Action
204 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, TFT sensor, EPC solenoid	· Carry out Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out engagement test, EPC test and Pinpoint Tests B and D. Repair as required. Clear DTCs, road test and repeat Self-Test.
304 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.

· Condition	· Inspect condition of fluid.
Incorrect Pressures	
· High forward clutch pressure, high line pressure, high EPC pressure	· Check pressure at line, EPC and forward pressure taps. Refer to Line Pressure Chart for specifications. If pressures are high, check the following possible components: main controls, pump assembly.
Main Controls	
· Main regulator valve, 2-3 accumulator seal/retainer stuck, damaged	· Inspect and repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· EPC solenoid stuck or damaged	· Inspect for damage or contamination. Carry out EPC test in Routine 204. Repair as required.
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Porosity/cross leaks	· Inspect for porosity/leaks. Install a new pump as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Forward Clutch Assembly	
· Check balls missing or damaged	· Inspect for mislocation, poor seating, damage. Install a new forward clutch cylinder.
· Friction element damaged or worn	· Inspect for damage. Repair as required.
· Forward clutch wave spring damaged	· Inspect for damage. Repair as required.
· Forward clutch return spring damaged	· Inspect for damage. Repair as required.

Engagement Concern: Delayed/Soft Reverse

Possible Component	Reference/Action
205 — ELECTRICAL ROUTINE	
	· No Electrical Concerns
305 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as

	necessary.
Incorrect Pressures	
· Low reverse clutch pressure, low reverse band pressure, low line pressure	· Check pressure at line tap; refer to Line Pressure Chart for specifications. If pressures are low, check the following components: main controls, pump assembly, reverse clutch assembly, reverse servo.
Fluid Filter and Seal Assembly	
· Plugged, damaged	· Install a new filter and seal assembly.
	· Filter seal damaged
Main Controls	
· No. 6 shuttle ball, 1-2 accumulator seals, manual valve, main regulator valve stuck or damaged	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Low Reverse Servo	
· Seals (piston and cover) damaged	· Inspect for damage. Repair as required.
· Servo cover retaining ring assembled incorrectly	
Pump Assembly	
· Bolts not tightened to specification	· Tighten bolts to specification.
· Porosity/cross leaks/ball missing or leaking	· Inspect pump assembly. Install new as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· No. 1 and No. 2 seal rings damaged	· Inspect for damage. Repair as required.
Reverse Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Install new components as required.
· Check ball missing or damaged	
· Friction elements damaged, worn	
· Return spring and piston damaged, worn	
Low Reverse Band	
· Damaged, worn	· Inspect for damage. Repair as required.

Engagement Concern: Delayed/Soft Forward

Possible Component	Reference/Action

206 — ELECTRICAL ROUTINE	
	· No Electrical Concerns
306 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low forward clutch pressure, low line pressure, low EPC pressure	· Check pressure at line, forward clutch and EPC taps; refer to Line Pressure Chart for specifications. If pressures are low, check the following components: oil filter and seal assembly, main controls and pump assembly.
Fluid Filter and Seal Assembly	
· Plugged, damaged	· Install a new filter and seal assembly.
· Filter seal damaged	
Main Controls	
· 3-4 shift valve, main regulator valve stuck or damaged	· Inspect and repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect for damage and repair as required.
· 2-3 or 1-2 accumulator, bore damaged or stuck	· Inspect for damage. Repair as required.
Pump Assembly	
· Bolts not tightened to specification	· Tighten bolts to specifications.
· Porosity/cross leaks	· Inspect pump assembly. Repair as required.
· Gaskets damaged	· Inspect for damage. Repair as required.
· No. 3 and No. 4 seal rings damaged	· Inspect for damage. Repair as required.
Forward Clutch Assembly	
· Seals, piston damaged	· Inspect for damage. Repair as required.
· Check balls missing, damaged	· Inspect for mislocation, poor seating, damage. Install a new cylinder as required.
· Friction elements damaged, worn	· Check for damage. Repair as required.

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, output shaft speed (OSS) sensor, digital TR sensor	· Carry out Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A, C, and E. Repair as required. Clear DTCs, road test and repeat Self-Test.
310 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
	· Refer to the following shift routine(s) for further diagnosis: ■ Shift 1-2, Routine 220/320 ■ Shift 2-3, Routine 221/321 ■ Shift 3-4, Routine 222/322 ■ Shift 4-3, Routine 223/323 ■ Shift 3-2, Routine 224/324 ■ Shift 2-1, Routine 225/325

Shift Concerns: Timing Concerns — Early/Late

Possible Component	Reference/Action
211 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, EPC solenoid, TFT sensor, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A, B, D, and E. Repair as required. Clear DTCs, road test and repeat Self-Test.
311 — HYDRAULIC/MECHANICAL ROUTINE	
Other	
· Tire size change, axle ratio change	· Verify vehicle has original equipment. Refer to Certification Label and Safety Standard Certification Label. Changes in tire size or axle ratio will affect shift timing.
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Incorrect Pressures	

· Line pressure, EPC pressure	· Check pressure at line and EPC taps; refer to Line Pressure Chart for specifications. If not OK, check the main controls. If OK, refer to the shift routine(s) for further diagnosis: ■ Shift 1-2, Routine 320 ■ Shift 2-3, Routine 321 ■ Shift 3-4, Routine 322 ■ Shift 4-3, Routine 323 ■ Shift 3-2, Routine 324 ■ Shift 2-1, Routine 325
Main Controls	
· EPC solenoid, stuck or damaged hydraulically or mechanically	· Inspect for damage, contamination. Carry out EPC tests in Routine No. 211. Repair as required.
· Valves, accumulators, seals stuck or damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· Solenoid screen (in valve body) blocked or damaged	· Clean or install a new screen.

Shift Concerns: Timing Concerns — Erratic/Hunting

Possible Component	Reference/Action
212 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, torque converter clutch (TCC) solenoid, digital TR sensor, output shaft speed (OSS)	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out Pinpoint Tests A, C, and E . Repair as required. Clear DTCs, road test and repeat Self-Test.
312 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Main Controls	
· Valves, accumulators, seals, assembled wrong, stuck or damaged	· Inspect for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· Solenoid screen (in valve body) blocked or damaged	· Clean or install a new screen.
Torque Converter Clutch	
· Torque converter	· Refer to Torque Converter Operation Concerns: Cycling/Shudder/Chatter Hydraulic/Mechanical Routine 342.
Specific Shifts	
	· Refer to the following shift routine(s) for further diagnosis:

	■ Shift 1-2, Routine 320 ■ Shift 2-3, Routine 321 ■ Shift 3-4, Routine 322 ■ Shift 4-3, Routine 323 ■ Shift 3-2, Routine 324 ■ Shift 2-1, Routine 325

Shift Concerns: Feel — Soft/Slipping

Possible Component	Reference/Action
213 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, EPC solenoid, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests D and E. Repair as required. Clear DTCs, road test and repeat Self-Test.
313 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Incorrect Pressures	
· Low line pressure, low EPC pressure	· Check pressures at line and EPC taps; refer to Line Pressure Chart for specifications. If pressures are low or all shifts are soft/slipping, go to main controls. If pressures are OK and a specific shift is soft/slipping, refer to the following routine(s) for further diagnosis: ■ Shift 1-2, Routine 320 ■ Shift 2-3, Routine 321 ■ Shift 3-4, Routine 322 ■ Shift 4-3, Routine 323 ■ Shift 3-2, Routine 324 ■ Shift 2-1, Routine 325
Main Controls	
· 1-2 accumulator, main regulator valve, overdrive servo regulator valve stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· EPC solenoid stuck or damaged	· Inspect for damage and contamination. Carry out EPC tests in Routine 213. Repair as required.

Shift Concerns: Feel — Harsh

Possible Component	Reference/Action
214 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle	· Carry out Self-Test. Refer to the Powertrain Control/Emissions

wiring harnesses, PCM, EPC solenoid, OSS	Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests D and E. Repair as required. Clear DTCs, road test and repeat Self-Test.
314 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Incorrect Pressures	
· High line pressure, high EPC pressure	· Check pressures at line and EPC taps. See the to Line Pressure Chart for specifications. If pressures are high or all shifts are harsh, go to Main Controls. If pressures are OK and a specific shift is harsh, refer to the following shift routine(s) for further diagnosis: ■ Shift 1-2, Routine 320 ■ Shift 2-3, Routine 321 ■ Shift 3-4, Routine 322 ■ Shift 4-3, Routine 323 ■ Shift 3-2, Routine 324 ■ Shift 2-1, Routine 325
Main Controls	
· 1-2 accumulator, main regulator valve, overdrive servo regulator valve stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· EPC solenoid stuck or damaged	· Inspect for damage or contamination. Carry out EPC tests in Routine 214. Repair as required.

Shift Concerns: No 1st Gear, Engages In Higher Gear

Possible Component	Reference/Action
215 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, digital transmission range TR sensor	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and C. Repair as required. Clear DTCs, road test and repeat Self-Test.
315 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment. Refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low reverse clutch pressure, low reverse band pressure, low line pressure	· Check for which pressures are on and refer to Band/Clutch Application Chart 601 and corresponding routines.

• Forward Off, Intermediate Off, Direct X • Forward Off, Intermediate X, Direct Off • Forward Off, Intermediate X, Direct X • Forward X, Intermediate Off, Direct X • Forward X, Intermediate X, Direct Off • Forward X, Intermediate X, Direct X • Forward X, Intermediate Off, Direct Off	■ 324, 301 ■ 325, 301 ■ 323, 324, 325, 301 ■ 324 ■ 325 ■ 323, 324, 325 ■ Refer to appropriate mechanical diagnosis.
Mechanical	
· Bands, clutches or seals damaged or worn	· Refer to Transmission Disassembly and Assembly.

X = pressure applied

Shift Concerns: No Manual 1st Gear

Possible Component	Reference/Action
216 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, digital TR sensor	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and C. Repair as required. Clear DTCs, road test and repeat Self-Test.
316 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Cable, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low reverse clutch pressure, low reverse band pressure, low line pressure, low EPC pressure	· Check pressure at line and EPC pressure taps; refer to Line Pressure Chart for specifications. If pressures are low, check the following components: oil filter and seal assembly, main controls, reverse clutch assembly and reverse servo assembly.
Fluid Filter and Seal Assembly	
· Plugged or damaged	· Install a new filter and seal assembly.
Main Controls	
· No. 6 shuttle ball, manual valve, main regulator valve, low servo modulator valve stuck, damaged	· Inspect for damage. Repair as required.

or assembled incorrectly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Low Reverse Servo	
· Seals (piston and cover) damaged	· Inspect for damage. Repair as required.
	· Servo cover retaining ring assembled incorrectly
	· Anchor pins (case) damaged

Shift Concerns: No Manual 2nd Gear

Possible Component	Reference/Action
217 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, digital TR sensor	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and C. Repair as required. Clear DTCs, road test and repeat Self-Test.
317 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Cable, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Main Controls	
· 3-4 shift valve, 1-2 and 2-3 shift valve, 3-4 capacity modulator valve stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Gaskets damaged	· Inspect for damage and install a new gasket.

Shift Concerns: 1-2 Shift (Automatic)

Possible Component	Reference/Action
220 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and E. Repair as required. Clear DTCs, road test and repeat Self-Test.

320 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Intermediate clutch pressure, line pressure	· Check pressure at line and intermediate clutch taps; see the line pressure chart for specifications. If not OK, check the main controls.
Main Controls	
· 1-2 shift valve, 1-2 accumulator valve stuck or damaged	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specification.
· Shift solenoid SSA malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gasket damaged	· Inspect for damage and install a new gasket.
· No. 8 ball not seating	· Inspect for damage. Repair as required.
Pump	
· Porosity/cross leaks, balls missing, damaged or leaking	· Inspect for porosity/leaks, balls missing. Install a new pump as required.
· Gasket damaged	· Inspect for damage and install a new gasket.
Intermediate Clutch Assembly	
· Seals damaged	· Inspect for damage. Repair as required.
· Piston damaged	· Inspect for damage. Repair as required.
· Friction elements damaged or worn	· Inspect for damage. Repair as required.
Intermediate One-Way Clutch Assembly	
· Not holding or damaged	· Inspect for damage. Repair as required.
Planetary One-Way Clutch Assembly	
· Not overrunning or damaged	· Inspect for damage. Repair as required.

Shift Concerns: 2-3 Shift (Automatic)

Possible Component	Reference/Action
221 — ELECTRICAL ROUTINE	

Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and E . Repair as required. Clear DTCs, road test and repeat Self-Test.
321 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment. Refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Direct clutch pressure	· Check pressure at direct clutch tap; refer to Line Pressure Chart for specifications. If not OK, check the main controls.
Main Controls	
· 2-3 shift valve, check ball No. 9 or No. 3, solenoid pressure regulator valve, 2-3 modulator valve, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Shift solenoid SSB malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· Output shaft seals damaged or cup plug leaking or missing	· Inspect for damage and repair as required.
· 2-3 accumulator damaged or stuck	· Inspect piston seal and bore for damage. Repair as required.
· Solenoid screen (in main control) blocked or damaged	· Clean or install a new screen.
Intermediate One-Way Clutch Assembly	
· Not overrunning or damaged	· Inspect for damage. Repair as required.
Output Shaft	
· Seal rings damaged	· Inspect for damage. Repair as required.
· Cup plug damaged or missing	
Direct Clutch Assembly	
· Seals or piston damaged	· Inspect for damage. Repair as required.
· Friction elements worn or damaged	· Inspect for damage. Repair as required.
· Check ball not seating	· Inspect for damage. Repair as required.
· Return spring assembly damaged	· Inspect for damage. Repair as required.
Case	
· Output shaft rear seals leaking or damaged	· Inspect for damage. Repair as required. Inspect case for damaged seal area. If damaged, install a new case.

Shift Concerns: 3-4 Shift (Automatic)

Possible Component	Reference/Action
222 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, OSS, transmission control switch (TCS)	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A and E. Repair as required. Clear DTCs, road test and repeat Self-Test.
322 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Forward clutch pressure, direct clutch pressure, line pressure	· Check line, direct and forward clutch pressures at appropriate taps; refer to Line Pressure Chart for specifications. If pressures are out of specification, check main controls.
Main Controls	
· 3-4 shift valve, solenoid pressure regulator valve, OD servo regulator, 3-4 capacity modulator valve, 1-2 and 2-3 shift valves stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· SSA or SSB malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· OD servo rod and piston cushion spring or seals damaged	· Inspect for damage. Repair as required.
· No. 2, No. 4, No. 7 and No. 9 check balls damaged or missing	· Inspect for damage. Repair as required.
· Solenoid screen (in main control) blocked or damaged	· Clean or install a new screen.
Pump	
· Porosity/cross leaks, balls missing, damaged or leaking	· Inspect for porosity/leaks, balls missing. Install a new pump as required.
· Gaskets damaged	· Inspect for damage. Install new gaskets as required.
OD Band	
· OD band and reverse clutch drum	· Inspect for damage. Repair as required.

assembly damaged, worn or assembled incorrectly	
· Intermediate one-way clutch assembly damaged	· Inspect for damage. Repair as required.
Forward Clutch Assembly	
· Seals or piston damaged	· Inspect for damage. Repair as required.
· Friction elements worn or damaged	· Inspect for damage. Repair as required.
· Check ball stuck, damaged or not seating correctly	· Inspect for damage. Repair as required.
Input Shaft	
· Seals damaged	· Inspect for damage. Repair as required.

Shift Concerns: 4-3 Shift (Automatic)

Possible Component	Reference/Action
223 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids, transmission control switch (TCS)	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Test A . Repair as required. Clear DTCs, road test and repeat Self-Test.
323 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Forward clutch pressure, line pressure	· Check line and forward clutch at pressure taps; refer to Line Pressure Chart for specifications. If out of specification, check the main controls.
Main Controls	
· 3-4 shift valve, solenoid pressure regulator valve, OD servo regulator, 3-4 capacity modulator, 1-2 and 2-3 shift valves stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Check balls No. 2, No. 7, No. 9 damaged, missing or not seating correctly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specification.
· SSA malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
· OD servo, seal, rod damaged	· Inspect for damage. Repair as required.
· Solenoid screen (in main control) blocked or damaged	· Clean or install a new screen.
Pump	

· Porosity/cross leaks, balls missing, damaged or leaking	· Inspect for porosity/leaks, balls missing. Install a new pump as required.
· Seal rings damaged	· Inspect for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Overdrive Band	
· OD band and reverse clutch assembly damaged, worn or assembled incorrectly	· Inspect for damage. Repair as required.
· Intermediate one-way clutch assembly damaged	· Inspect for damage. Repair as required.
Forward Clutch Assembly	
· Seals or piston damaged	· Inspect for damage. Repair as required.
· Friction elements damaged, worn	· Inspect for damage. Repair as required.
· Check ball stuck, damaged or not seating correctly	· Inspect for damage. Repair as required.
· Forward clutch piston and return spring damaged	· Inspect for damage. Repair as required.
Input Shaft	
· Seals damaged	· Inspect for damage. Repair as required.

Shift Concerns: 3-2 Shift (Automatic)

Possible Component	Reference/Action
224 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Test A . Repair as required. Clear DTCs, road test and repeat Self-Test.
324 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Direct clutch	· Check pressure at direct clutch tap; refer to Line Pressure Chart for specifications. If not within specification, check the main controls.
Main Controls	
· 2-3 shift valve stuck or damaged	· Inspect for damage. Repair as required.
· Check balls damaged or missing	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· SSB malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.

Intermediate One-Way Clutch	
· Not holding or damaged	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Seals or piston damaged	· Inspect for damage. Repair as required.
· Friction element damaged, worn	· Inspect for damage. Repair as required.
· Check ball stuck, damaged or not seating correctly	· Inspect for damage. Repair as required.

Shift Concerns: 2-1 Shift (Automatic)

Possible Component	Reference/Action
225 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, shift solenoids	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Test A . Repair as required. Clear DTCs, road test and repeat Self-Test.
325 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Intermediate clutch	· Check pressure at intermediate clutch tap; refer to Line Pressure Chart for specifications. If not within specifications, check main controls and pump.
Main Controls	
· 1-2 shift valve, 1-2 accumulator solenoid pressure regulator valve stuck, damaged or assembled wrong	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· SSA malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage; repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Pump	
· Gaskets damaged	· Inspect for damage and install a new gasket.
· Porosity/cross leaks	· Inspect for leak/porosity. Install a new pump as required.
Intermediate Clutch Assembly	
· Piston damaged	· Inspect for damage. Repair as required.
· Friction elements damaged, worn	· Inspect for damage. Repair as required.
· End clearance incorrect	· Inspect and correct; refer to Transmission Assembly.
Intermediate One-Way Clutch	

· Damaged	· Inspect for damage. Repair as required.
Planetary One-Way Clutch	
· Not holding or damaged	· Inspect for damage. Repair as required.

Torque Converter Operation Concerns: No Apply

Possible Component	Reference/Action
240 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, torque converter clutch (TCC) solenoid, TFT sensor, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests B and E. Repair as required. Clear codes, road test and repeat Self-Test.
340 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Low line pressure, low EPC pressure	· Check pressure at line and EPC taps; refer to Line Pressure Chart for specifications. If pressure is low, check EPC and main regulator valve. If within specifications, check the main controls.
Main Controls	
· Solenoid pressure regulator valve, manual valve, bypass clutch control valve and plunger, converter pressure limit valve, drain back valve stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Solenoid screen (in valve body) blocked or damaged	· Clean or install a new screen.
· TCC solenoid malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Porosity/cross leaks, balls leaking	· Inspect for porosity/leaks, ball missing. Install a new pump as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Input Shaft	

· Seals damaged	· Inspect for damage. Repair as necessary.
Torque Converter Assembly	
· Leakage, friction material damaged, internal seals damaged	· Inspect torque converter. Repair or install a new or remanufactured torque converter as required.

Torque Converter Operation Concerns: Always Applied/Stalls Vehicle

Possible Component	Reference/Action
241 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, torque converter clutch (TCC) solenoid, TFT sensor	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests B and A. Repair as required. Clear DTCs, road test and repeat Self-Test.
341 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control	
· Drain back valve, torque converter clutch (TCC) and plunger stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· TCC solenoid malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· No. 7 ball incorrect seating	· Inspect for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Ball missing, leaking, porosity/cross leaks	· Inspect for porosity/leaks, balls missing. Install a new pump as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Input Shaft	
· Seals damaged	· Inspect for damage. Repair as required.
Torque Converter Assembly	
· No end clearance	· Inspect converter and install a new or remanufactured torque converter as required.
· Piston plate damaged or stuck to cover	· If cover is heat-stained, install a new converter.

Torque Converter Operation Concerns: Cycling/Shudder/Chatter

Possible Component	Reference/Action

242 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, PCM, torque converter clutch (TCC) solenoid, OSS	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Test E . Repair as required. Clear DTCs, road test and repeat Self-Test.
342 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid Condition	
	· Inspect fluid condition. If burnt, drain fluid and converter. Install a new fluid and filter assembly. Bring vehicle to normal operating temperature. Carry out Transmission Drive Cycle Test. Carry out Transmission Self-Test. If condition still exists, continue diagnostics.
Main Controls	
· Solenoid pressure regulator valve, No. 7 check ball, bypass clutch control valve and plunger, converter pressure limit valve stuck, damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Solenoid screen (in valve body) blocked or damaged	· Clean or install a new screen.
· TCC solenoid malfunction	· Activate solenoid using scan tool. If solenoid operation cannot be felt when placing hand on solenoid, install a new solenoid. Inspect O-rings for damage. Repair as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Pump Assembly	
· Bolts not tightened to specification	· Tighten bolts to specification.
· Porosity/cross leaks, missing balls or leaking	· Inspect for porosity/leaks or missing balls. Install a new pump as required.
· Gaskets damaged	· Inspect for damage and install a new gasket.
Input Shaft	
· Seals damaged	· Inspect for damage. Repair as required.
Torque Converter	
· Excessive end clearance	· Inspect converter. Install a new or re-manufactured torque converter as required.

Other Concerns: No Engine Braking In 2nd Gear, Manual 2nd Or Manual 1st Position

Possible Component	Reference/Action
250 — ELECTRICAL ROUTINE	
	· No Electrical Concerns
350 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	

· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Main Controls	
· 3-4 shift valve, 1-2 and 2-3 shift valve, gaskets, 3-4 capacity modulator valve, stuck or damaged or assembled incorrectly	· Inspect for damage. Repair as required.
· OD servo assembly damaged or stuck	· Inspect cover, piston and seal for damage. Repair as required.
Overdrive	
· Reverse band, manual 1st (only) damaged	· Inspect for damage. Repair as required.
· OD band, reverse clutch drum assembly worn or damaged	· Inspect for damage. Repair as required.
· Intermediate one-way assembly damaged	· Inspect for damage. Repair as required.
Reverse Band (Manual 1st Only)	
· Damaged or incorrectly adjusted	· Inspect for damage. Repair as required.

Other Concerns: Shift Lever Efforts High

Possible Component	Reference/Action
251 — ELECTRICAL ROUTINE	
	· No Electrical Concerns
351 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Manual Lever	
· Retaining pin damaged, nut loose, detent spring bent or damaged or Park mechanism damaged	· Inspect for damage. Repair as required.
Main Controls	
· Manual valve stuck or damaged	· Inspect for damage. Repair as required.
· Bolts not tightened to specifications	· Tighten bolts to specifications.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, sensor seals leaking (digital TR, OSS, vehicle speed sensor (VSS) or transmission connector)	· Inspect for leakage and repair as required.
352 — HYDRAULIC/MECHANICAL ROUTINE	
Seals, Gaskets	
· Converter, pump, pan, extension housing gasket/seal, manual lever, fluid level indicator tube	· Locate source of leak. Repair as required.
Other	
· Cooler fitting, pressure taps, converter drain plug, band anchor pins, cooler lines, case porosity, case cracked	· Locate source of leak. Repair as required.
· Vent blocked or damaged	· Check vent for damage or blockage. Repair as required.

Other Concerns: Poor Vehicle Performance

Possible Component	Reference/Action
253 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, shift solenoids, digital TR sensor, torque converter clutch (TCC) solenoid, transmission fluid temperature (TFT) sensor	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Tests A, B and C. Repair as required. Clear codes, road test and repeat Self-Test. Also refer to Routines 241/341 Torque Converter Operation Concern: Always Applied.
353 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	
· Damaged or incorrectly adjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Verify Proper Shift Scheduling and Engagements	
· See Reference/Action	· Go to the appropriate diagnostic routines.
Torque Converter Clutch Always Applied	
· See Reference/Action	· Go to Hydraulic/Mechanical Routine 241/341.
Torque Converter Clutch	
· Damaged	· Inspect torque converter. Install a new converter as outlined.

Other Concerns: Noise/Vibration — Forward Or Reverse

Possible Component	Reference/Action
254 — ELECTRICAL ROUTINE	
	· No Electrical Concerns
354 — HYDRAULIC/MECHANICAL ROUTINE	
For Noises/Vibrations That Change With Engine Speed	
· Converter components	· Locate source of disturbance. Repair as required.
· Fluid level (low) pump cavitation	
· Pump assembly	
· Engine drive accessories	
· Cooler lines grounding out	
· Flexplate	
For Noises/Vibrations That Change With Vehicle Speed	
· Engine mounts loose or damaged	· Locate source of disturbance and repair as required.
· Driveline concerns: ■ U-joints ■ Rear axle ■ Suspension ■ Modifications 1st Gear: ■ Low one-way clutch ■ Gearset ■ Friction elements	· Refer to the following shift routine(s) for further diagnosis:Shift 1-2, Routine 320 Shift 2-3, Routine 321 Shift 3-4, Routine 322 Shift 4-3, Routine 323 Shift 3-2, Routine 324 Shift 2-1, Routine 325 Torque Converter Cycling 242/342
· 2nd Gear: ■ Intermediate one-way clutch ■ Intermediate clutch piston bleed hole out of 12 o'clock position ■ Friction elements	
· 3rd Gear: ■ Torque converter ■ Case to planet support spring ■ Friction elements	
· 4th Gear:	

■ Gear set ■ Friction elements ■ Torque converter	
· Reverse: ■ Gear set ■ Friction elements	
· Output shaft splines worn or damaged	
Other Noises/Vibrations	
· Main controls, valve resonance	· Locate source of disturbance and repair as required.
· Shift cable: ■ Vibration ■ Grounding ■ Cooler lines ■ Grounding	

Other Concerns: Engine Will Not Crank

Possible Component	Reference/Action
255 — ELECTRICAL ROUTINE	
Powertrain Control System	· Carry out Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out Pinpoint Test C . Repair and adjust as required.
· Electrical inputs/outputs, vehicle wiring harnesses, engine starting system hardware, digital TR sensor	
355 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
· Damaged or incorrectly adjusted	

Other Concerns: No Park (P) Range

Possible Component	Reference/Action
256 — ELECTRICAL ROUTINE	
· No Electrical Concerns	
356 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage, Digital TR Sensor	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing
· Damaged or incorrectly adjusted	

	transmission shift cable, verify that the digital TR sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Park Mechanism	
· Output shaft ring, parking brake pawl, parking pawl return spring, park rod guide cup, parking pawl shaft, parking pawl actuating rod, manual lever detent spring damaged or assembled incorrectly	· Inspect for damage or incorrect assembly and repair as required.

Other Concerns: Overheating

Possible Component	Reference/Action
257 — ELECTRICAL ROUTINE	
Refer to Routine 240/340, Torque Converter Operation Concern: No Apply	
357 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect condition of fluid.
Cooler Lines	
· Damaged, blocked or reversed	· Inspect for damage and correct installation. Repair as required.
Vehicle Concerns Causing Engine Overheating	
	· Refer to Section 303-03 .
Main Controls	
· Drain back valve, torque clutch control valve, converter limit valve stuck, damaged or assembled incorrectly	· Inspect for damage and repair as required.
Torque Converter	
· No apply	· Refer to Routine 240/340.

Transmission Fluid Cooler — Backflushing and Cleaning

1. **CAUTION: Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products could cause internal transmission components to fail; this will effect the operation of the transmission.**

   Conduct backflushing with a suitable torque converter/fluid cooler cleaner. Test your equipment to make sure that a vigorous fluid flow is present before proceeding. Install a new filter in the flush equipment if flow is weak or contaminated.

2. To aid in attaching the cleaner to the transmission steel cooler lines, connect two additional rubber hoses to the transmission end of the steel transmission cooler lines as described below.
   - Connect the cleaner tank pressure line to the steel transmission cooler return line (longest line).
   - Connect a tank return hose to the steel transmission cooler pressure line (shorter line). Place the outlet end of this hose in the solvent tank reservoir.

3. Turn on solvent pump and allow the solvent to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants in cooler system).

4. Switch off the solvent pump and disconnect the solvent pressure hose from the transmission cooler return line.

5. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all solvent is removed.

6. Remove the rubber return hose from the remaining steel cooler line.

Fluid Pan, Gasket and Filter

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

1. Normal maintenance requires periodic automatic transmission fluid changes. If a major repair, such as a clutch, band, bearing, etc., is required, the automatic transmission will also have to be removed for repair. At this time, the torque converter, transmission cooler and tubes must be thoroughly flushed to remove any dirt. The transmission fluid needs to be changed if evidence of fluid contamination is found. When used under continuous or severe conditions, the transmission and torque converter should be drained and refilled with fluid as specified.

2. **CAUTION: Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products could cause internal transmission components to fail; this will effect the operation of the transmission.**

   CAUTION: Use of a fluid other than specified could result in transmission failure.

   Refer to the vehicle certification label affixed to the LH front door lock face panel or door pillar for the transmission code.

3. When filling a dry transmission and torque converter, refer to General Specifications chart in this section for capacity. Check the fluid level.

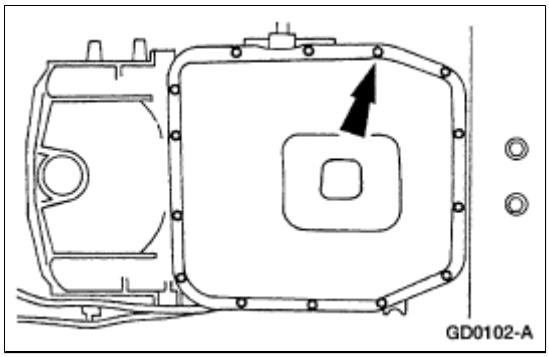
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .

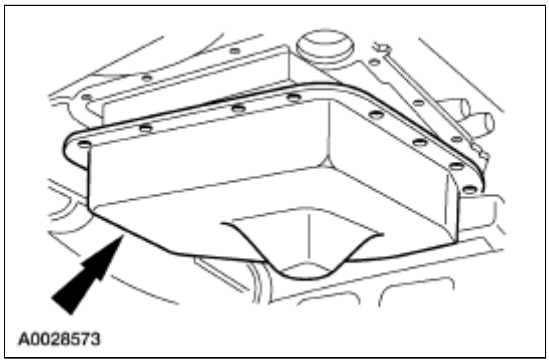
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .

3. Place a drain pan under the transmission fluid pan.

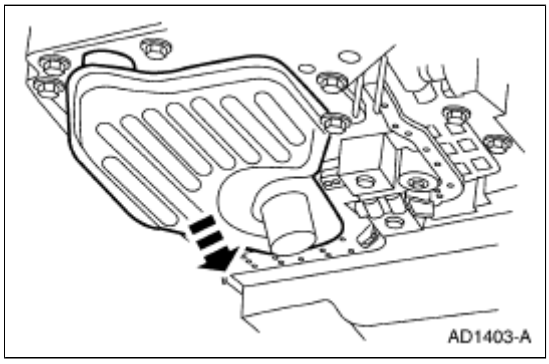
4. Drain transmission fluid.
   - Loosen the transmission fluid pan bolts and allow fluid to drain. After fluid is drained remove the bolts.



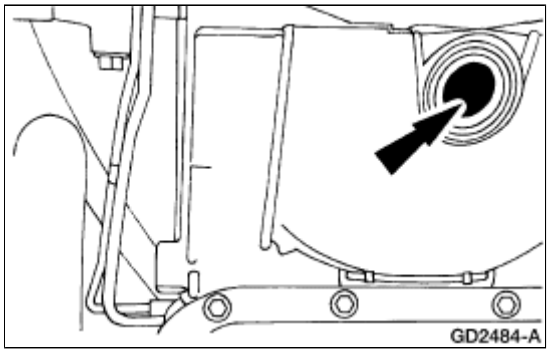
5. Remove the transmission fluid pan and transmission fluid pan gasket.



6. Pull down evenly and remove the transmission fluid filter and seal.

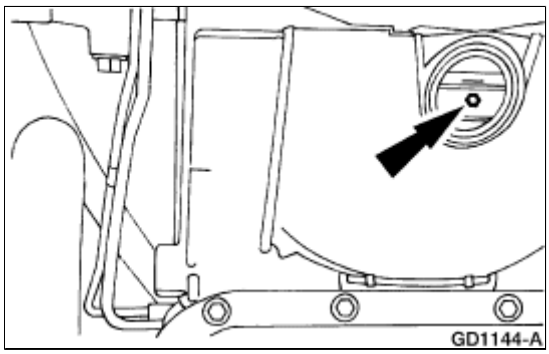


7. Remove torque converter housing plug.

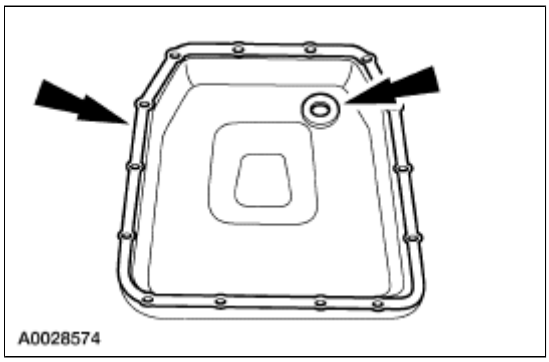


8. Remove the torque converter drain plug and drain the torque converter.

- Rotate the crankshaft to access the drain plug.



9. Clean and inspect the transmission fluid pan, gasket and magnet.

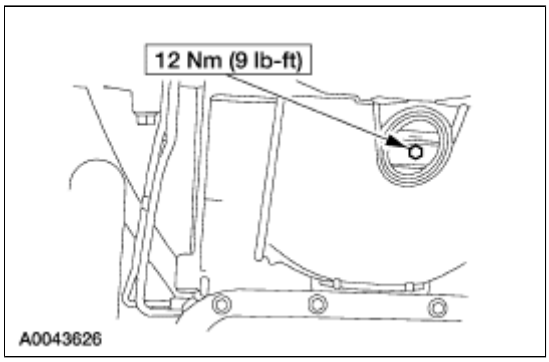


10. Flush the fluid cooler tubes. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

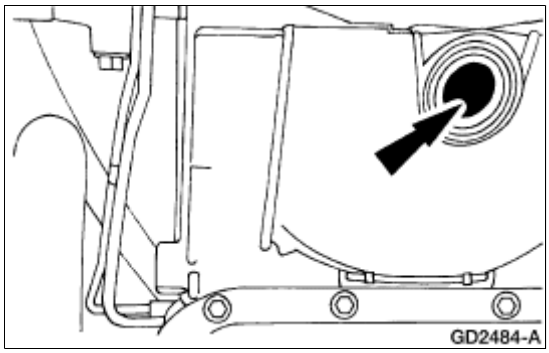
Installation

1. **NOTE:** A new torque converter drain plug must be used.

   Install the torque converter drain plug.



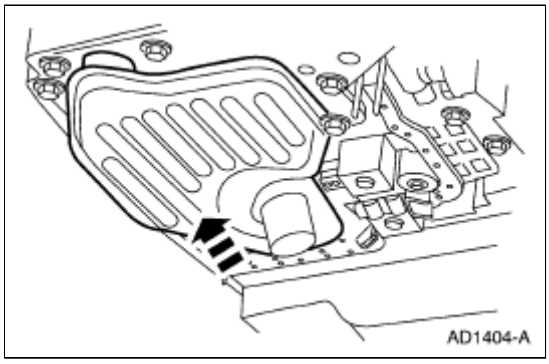
2. Install the torque converter housing plug.



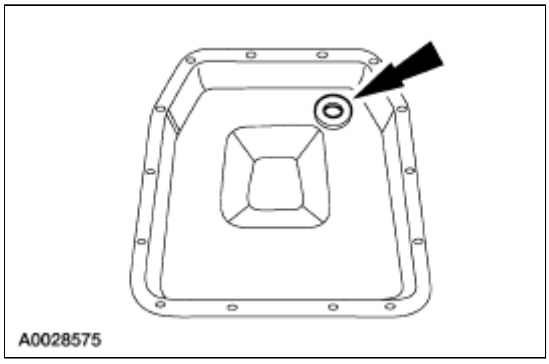
3. **CAUTION: If installing a new filter, and the seal remains in the main control bore, carefully use a small screwdriver to remove the seal. Use care not to damage the main control bore.**

   NOTE: If transmission is being repaired for a contamination-related failure, use a new filter and seal. The filter may be reused if no excessive contamination is present.

   Install a new fluid filter and seal as required.

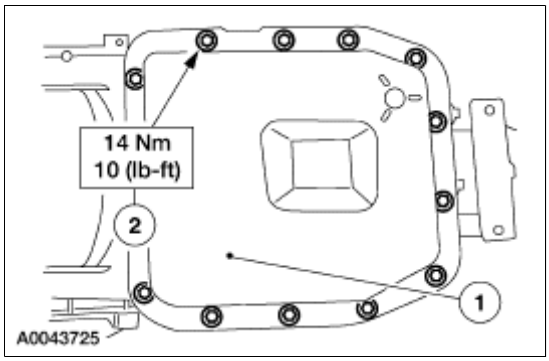


4. Position the pan magnet into the transmission fluid pan.



5. **NOTE:** The transmission fluid pan gasket is reusable. Clean and inspect for damage; if not damaged, the gasket should be reused.

   Install the transmission fluid pan and gasket.
   1. Position the transmission fluid pan and gasket.
   2. Install the transmission fluid pan bolts.



6. Lower the vehicle.

7. **NOTE:** When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

   Connect the battery ground cable. For additional information, refer to Section 414-01 .

8. **NOTE:** When filling a dry transmission and converter, start with a minimum of 4.7 liters (5 quarts).

   Fill the transmission to the correct level with clean automatic transmission fluid.

Main Control Valve Body

Special Tool(s)

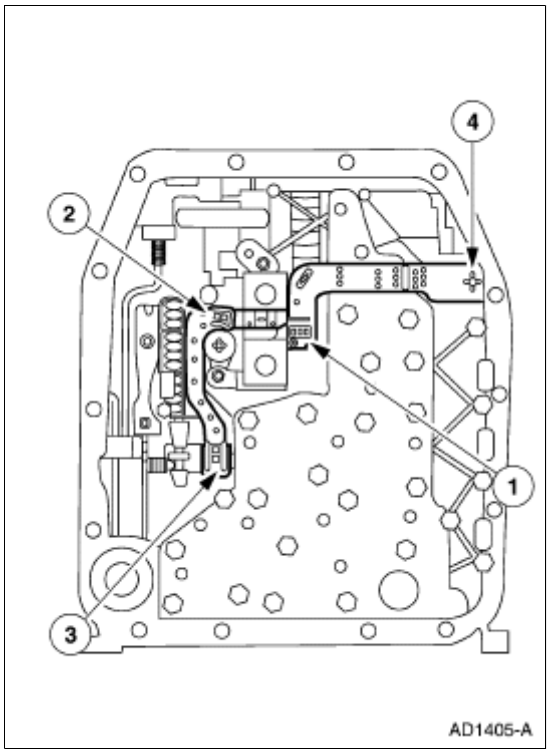
 ST2545-A	Gauge, Transmission Solenoid Connectors 307-426

Removal

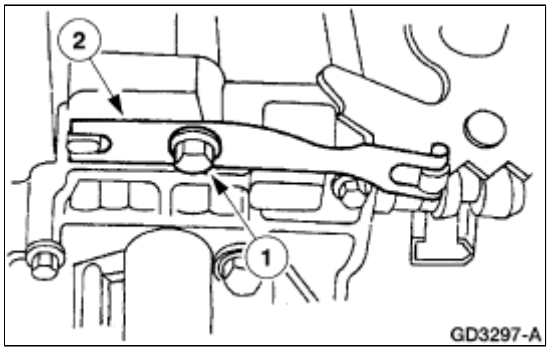
1. Drain transmission fluid and remove the transmission fluid pan and filter. For additional information, refer to Fluid Pan, Gasket and Filter .

2. **CAUTION: Do not pull on the molded lead frame. This may cause damage to the connector ends. Carefully pry up on the locking tabs to disconnect the solenoids. Disconnect the molded lead frame from the solenoids.**

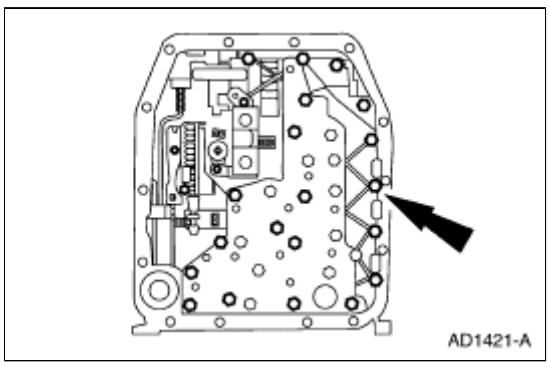
   Disconnect the molded lead frame from the solenoids.
   1. Disconnect the shift solenoid SSA and SSB.
   2. Disconnect the torque converter clutch (TCC).
   3. Disconnect the electronic pressure control (EPC) solenoid.
   4. Disconnect the bulkhead inter-connector.



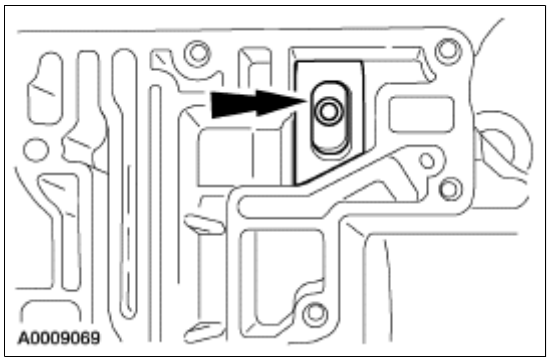
3. Remove the manual control valve detent lever spring.
    1. Remove the bolt.
    2. Remove the manual control valve detent lever spring.



4. Remove the 24 valve body to case bolts.



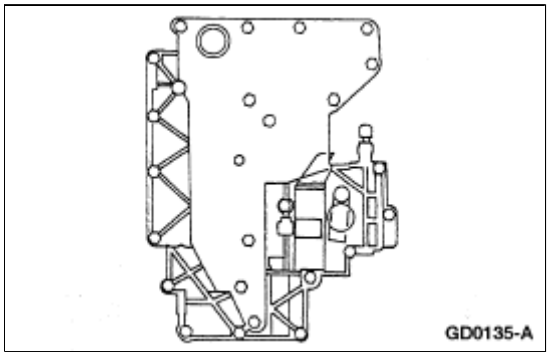
5. Remove the main control valve body and discard the pump outlet screen.



Installation

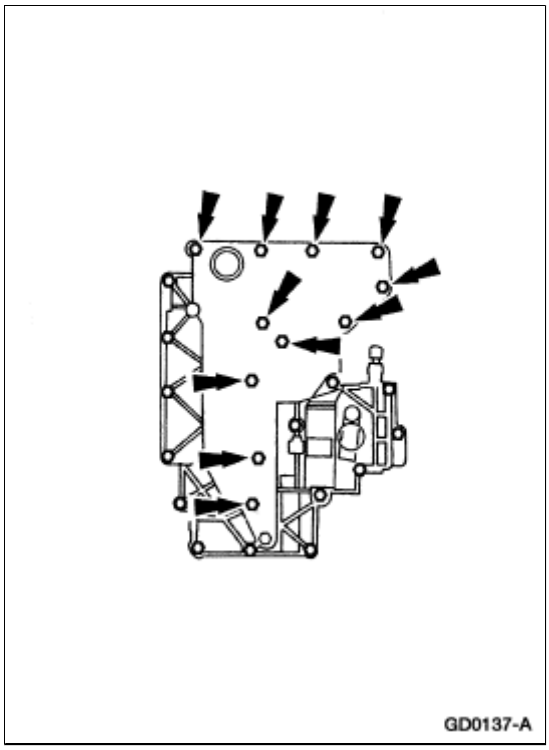
1. **NOTE:** Make sure that the drive pin of the manual valve detent lever assembly engages the manual valve in the correct location prior to installing the bolts.

   Position the main control valve body gasket and main control valve body using the two alignment bolts as a guide.



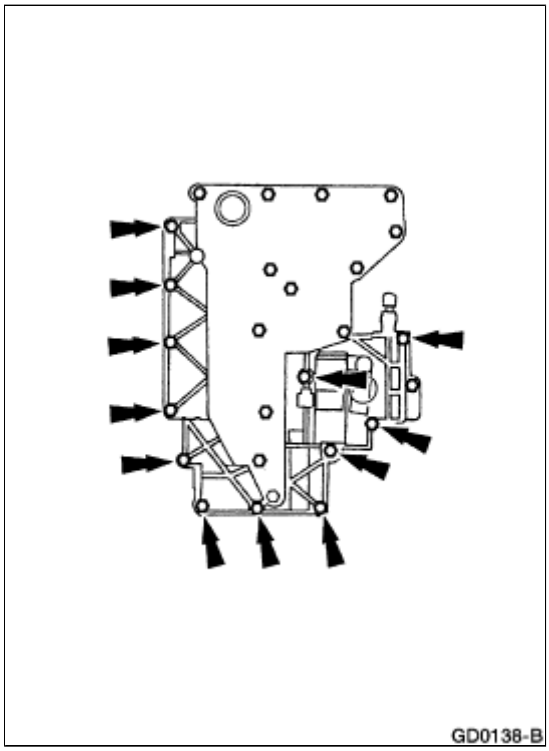
2. **NOTE:** The main control valve body bolts will be tightened in later steps.

   Loosely install the bolts.

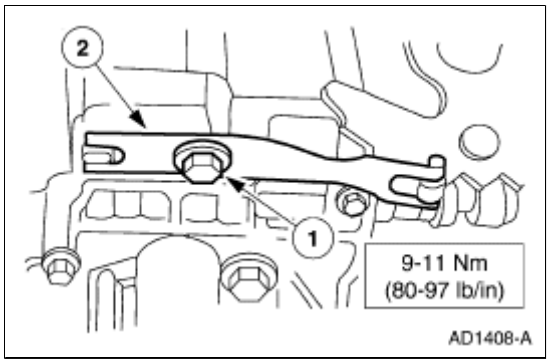


3. **NOTE:** The main control valve body bolts will be tightened in later steps.

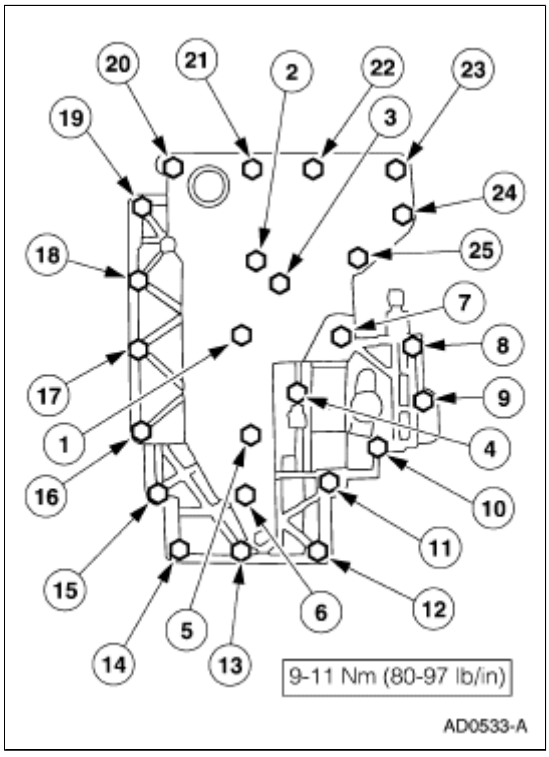
   Loosely install the bolts.



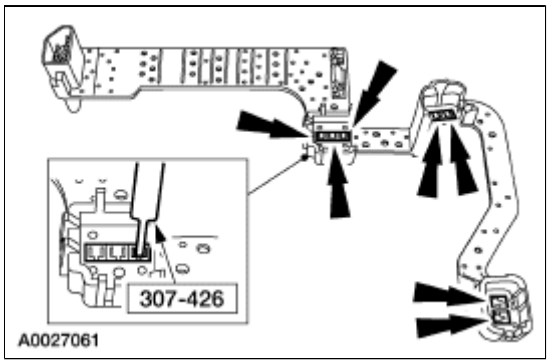
4. Install the manual control valve detent lever spring.
   1. Position the manual control valve detent lever spring.
   2. Install the bolt.



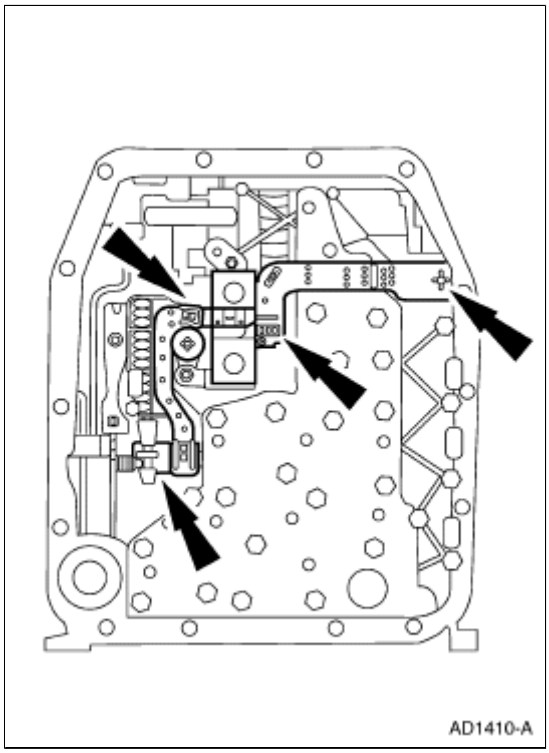
5. Tighten the main control valve body bolts in the sequence shown.



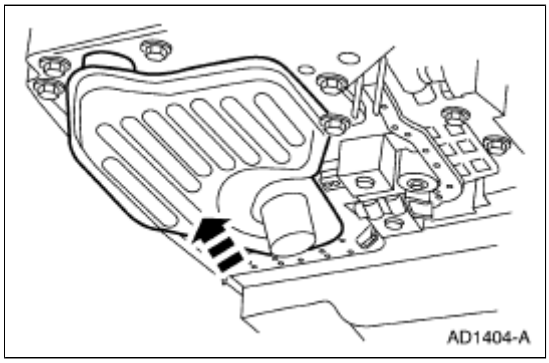
6. Inspect the lead frame for damage.
   - Using the special tool, check all lead frame solenoid connections.
   - If the special tool passes through any lead frame connector pins, install a new lead frame.



7. Connect the molded lead frame to the solenoids.
    - Connect the bulkhead inter-connector.
    - Connect the EPC solenoid.
    - Connect the TCC.
    - Connect the shift solenoid SSA and SSB.

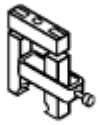


8. Install the transmission filter and pan. For additional information, refer to Fluid Pan, Gasket and Filter in this section.



Extension Housing Seal and Gasket

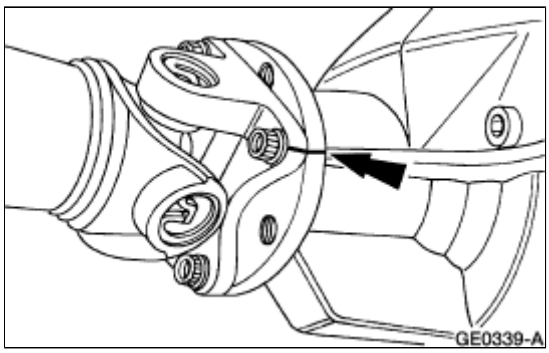
Special Tool(s)

 ST1188-A	Installer, Transmission Extension Housing Fluid Seal 308-002 (T61L-7657-A)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1192-A	Remover, Transmission Fluid Seal 307-048 (T74P-77248-A)

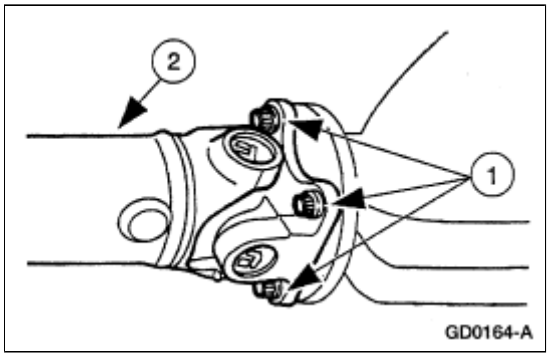
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Drain the transmission fluid. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
4. **NOTE:** To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they may be installed in their original positions.

   Mark the driveshaft flange and the rear companion flange for correct alignment during assembly.

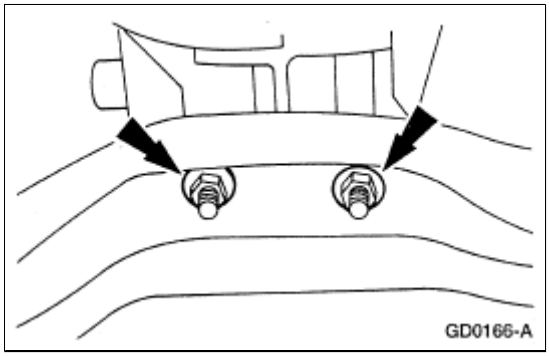


5. Remove the rear driveshaft.
    1. Remove the four bolts.
    2. Remove the rear driveshaft.

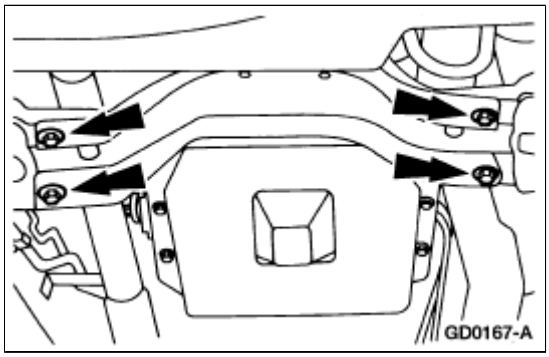


6. Use high-lift jack to support the transmission.

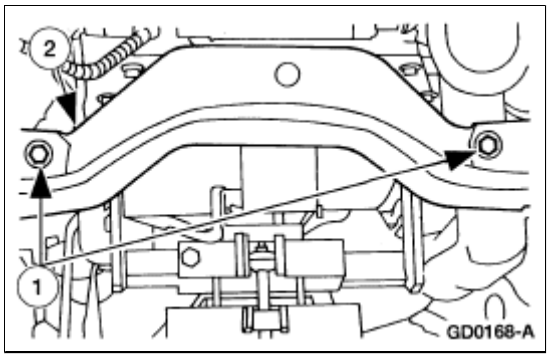
7. Remove the nuts.



8. Remove the bolts.

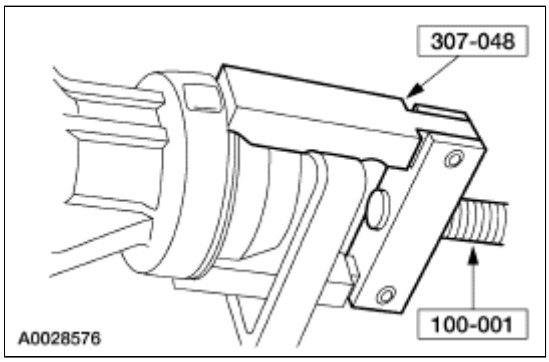


9. Remove the transmission crossmember.
    1. Remove the bolts.
    2. Remove the transmission crossmember.

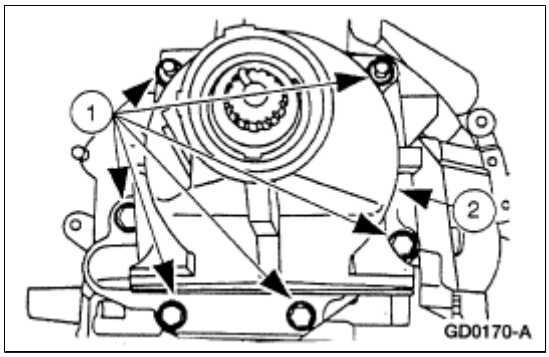


10. Lower the transmission to access the extension housing bolts.

11. Using the special tool remove the extension housing seal.

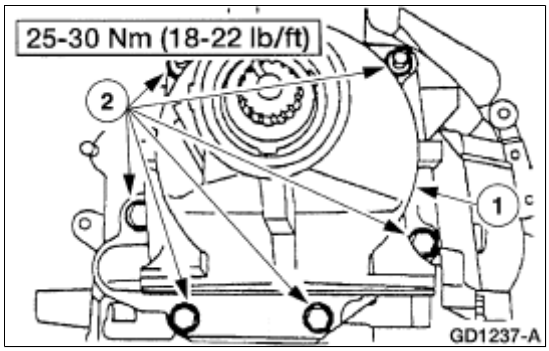


12. Remove the extension housing and gasket.
    1. Remove the bolts and nuts.
    2. Remove the extension housing and gasket.

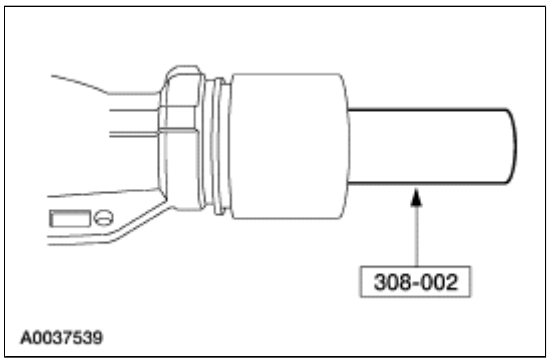


Installation

1. Install the extension housing and gasket.
    1. Position the extension housing gasket and the extension housing.
    2. Install the bolts and nuts.

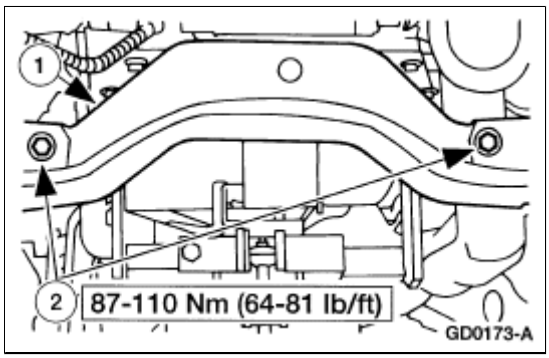


2. Using the special tool, install the new extension housing seal.

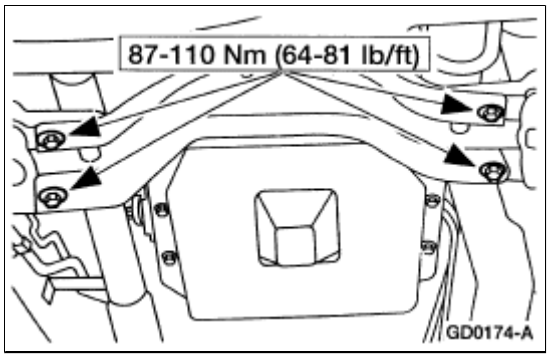


3. Raise and position the transmission.

4. Install the transmission crossmember.
    1. Position the transmission crossmember.
    2. Install the bolts.

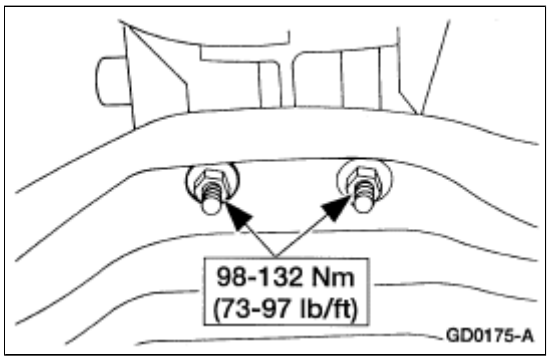


5. Install the transmission crossmember bolts.



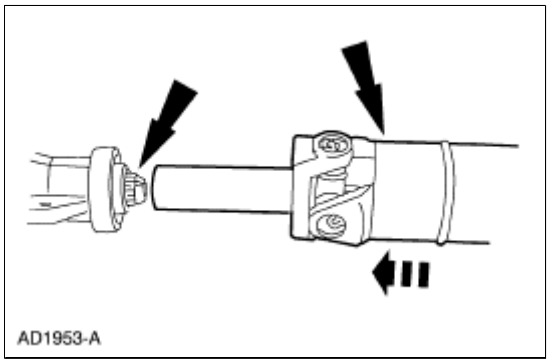
6. Remove the high-lift transmission jack.

7. Install the nuts.

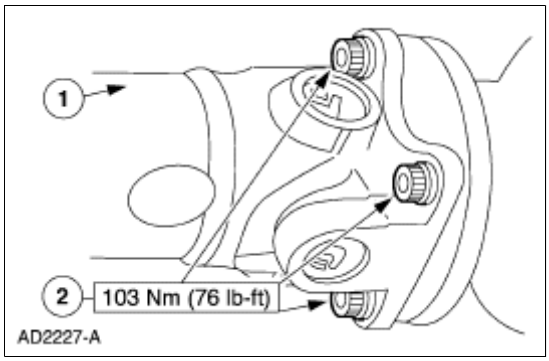


8. **NOTE:** The output shaft and the driveshaft are a balanced assembly.

   Install the drive shaft.
   - Align the yellow dots and position the driveshaft on the transmission.



9. Install the rear driveshaft.
   1. Position the driveshaft.
   2. Install the four bolt.



10. Lower the vehicle.

11. Connect the battery ground cable.

12. Fill the transmission with clean automatic transmission fluid and inspect for correct operation. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

Electronic Pressure Control (EPC) Solenoid

Special Tool(s)

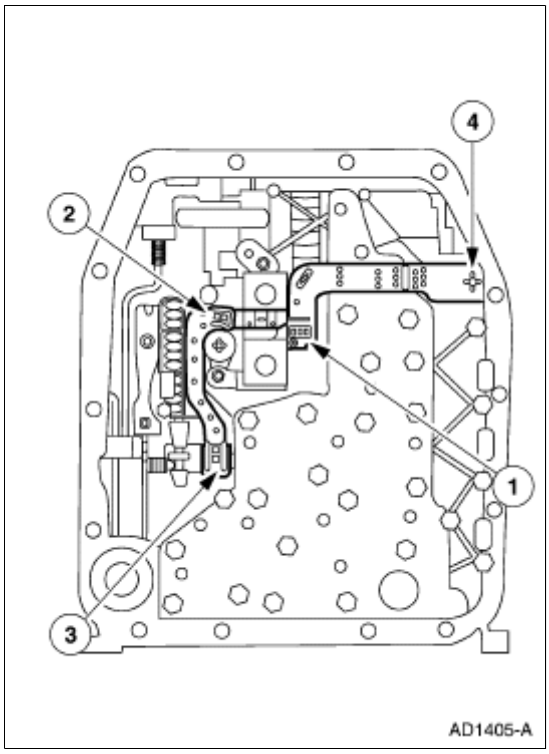
 ST2545-A	Gauge, Transmission Solenoid Connectors 307-426

Removal

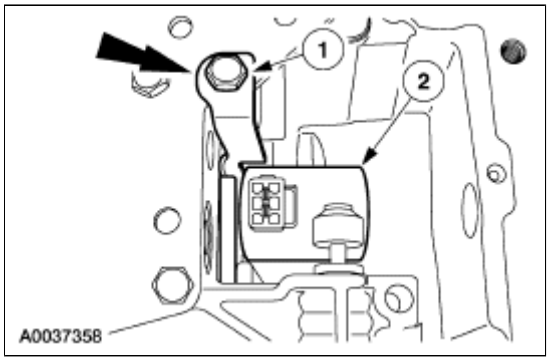
1. Remove the manual control lever. For additional information, refer to Manual Control Lever Shaft and Seal in this section.

2. **CAUTION: Do not pull on the molded lead frame. This may cause damage to the connector ends. Carefully pry up on the locking tabs to disconnect the solenoids. Disconnect the molded lead frame from the solenoids.**

   Disconnect the molded lead frame from the solenoids.
   1. Disconnect the shift solenoid SSA and SSB.
   2. Disconnect the torque converter clutch (TCC).
   3. Disconnect the electronic pressure control (EPC) solenoid.
   4. Disconnect the bulkhead inter-connector.

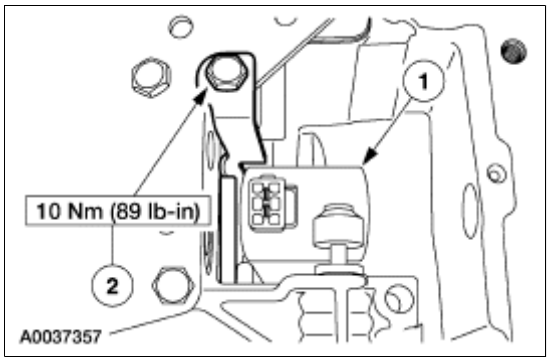


3. Remove the EPC solenoid.
    1. Remove the bolt and EPC solenoid bracket.
    2. Remove the EPC solenoid.

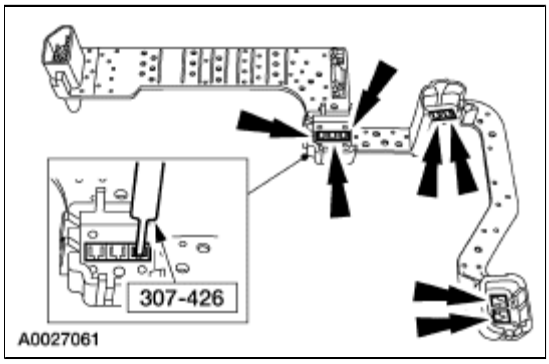


Installation

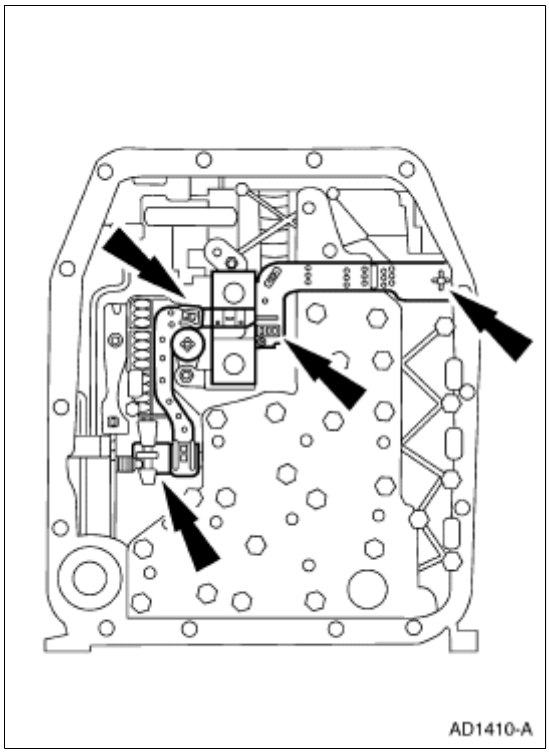
1. Install the EPC solenoid.
    1. Install the EPC solenoid.
    2. Install the EPC solenoid bracket and bolt.



2. Inspect the lead frame for damage.
    - Using the special tool, check all lead frame solenoid connections. The gauge should fit tightly and not fall out after being inserted.
    - If the special tool passes through any lead frame connector pins or does not feel like it makes a good contact, install a new lead frame.



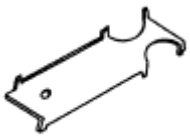
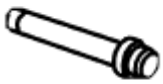
3. Connect the molded lead frame to the solenoids.
    - Connect the bulkhead inter-connector by pressing it in place by hand and fully seating the connector in place.
    - Connect the EPC solenoid by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.
    - Connect the TCC by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.
    - Connect the shift solenoid SSA and SSB by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.



4. Install the manual control lever. For additional information, refer to Manual Control Lever Shaft and Seal in this section.

Manual Control Lever Shaft and Seal

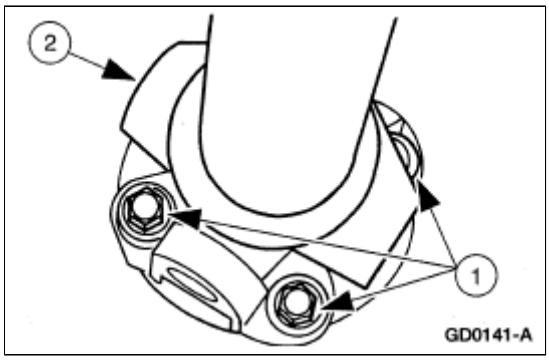
Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST1199-A	Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)

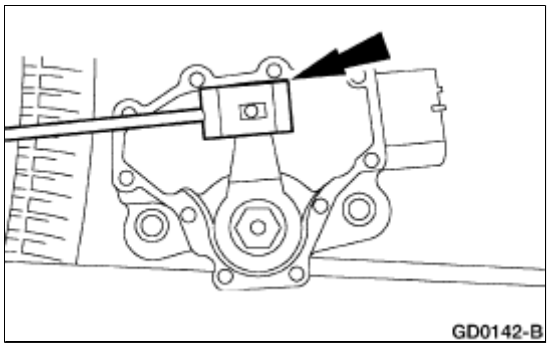
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. **NOTE:** Mark the driveshaft flange and rear axle pinion flange for correct alignment during installation.

   On 4x4 vehicles, remove the front driveshaft.
   1. Remove the eight front driveshaft bolts (four each end).
   2. Remove the front driveshaft.

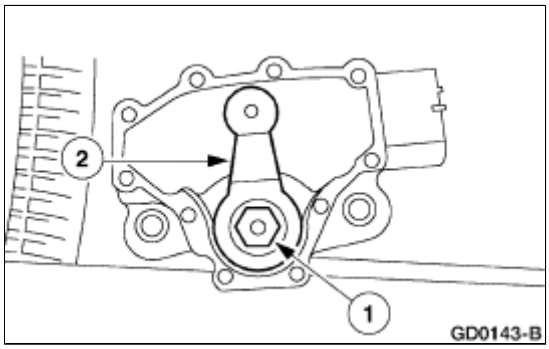


4. Drain the transmission fluid and remove the fluid pan and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
5. Disconnect digital TR sensor electrical connector.
6. Disconnect the transmission shift linkage.

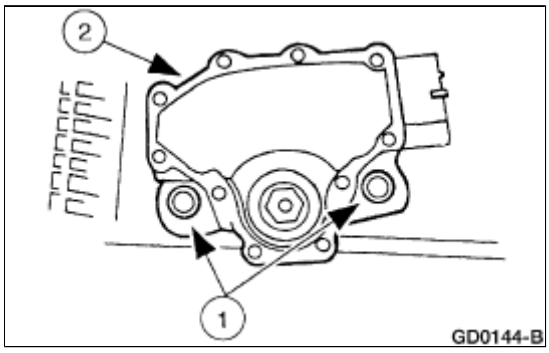


7. **CAUTION: Discard outer manual control lever shaft nut. Do not reuse. The old nut will not retain torque specification.**

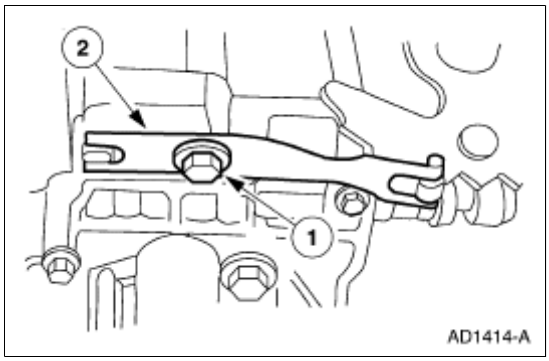
   Remove the manual control lever.
   1. Remove the outer manual control lever shaft nut.
   2. Remove the manual control lever.



8. Remove the digital transmission range TR sensor.
   1. Remove the two bolts.
   2. Remove the digital TR sensor.

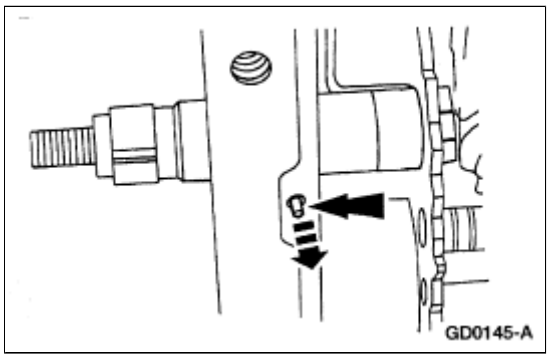


9. Remove the manual control valve detent lever spring.
   1. Remove the bolt.
   2. Remove the manual control valve detent lever spring.

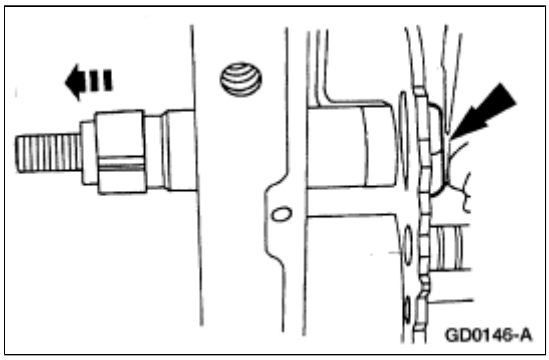


10. **NOTE:** Use a shop cloth to protect the transmission case surface.

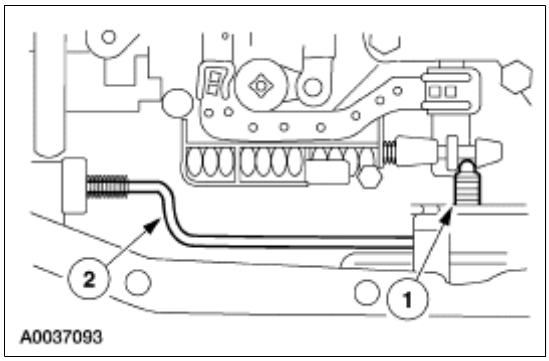
    Remove the manual lever shaft retaining pin.



11. Remove the inner manual control lever shaft nut and slide the manual control lever shaft out of the case.

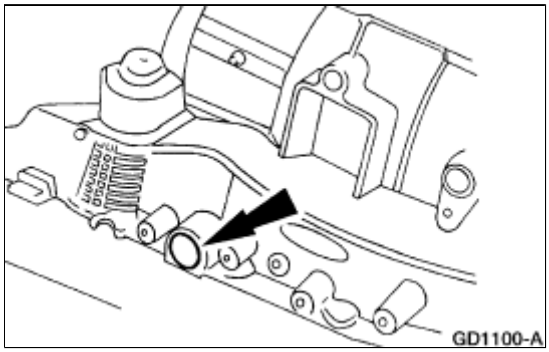


12. Remove the parking lever actuating rod.
    1. Remove the manual valve detent lever.
    2. Remove the parking lever actuating rod.



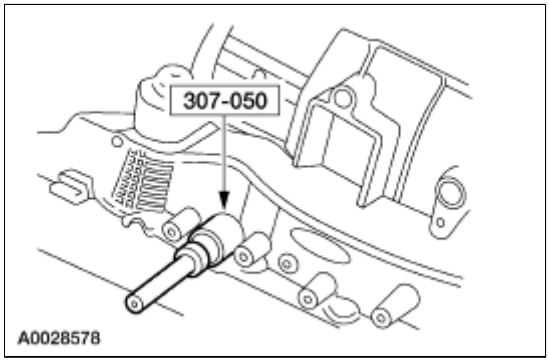
13. **CAUTION: Use care not to damage the manual control lever shaft bore. The new seal can leak.**

    Remove the manual control lever shaft seal.

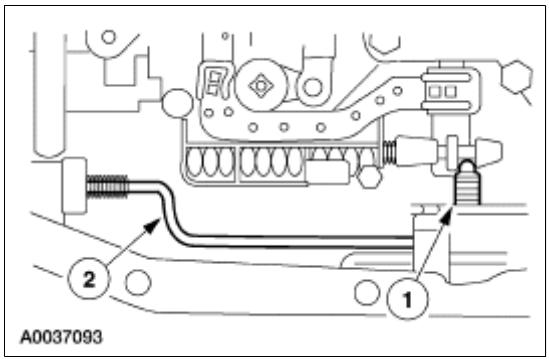


Installation

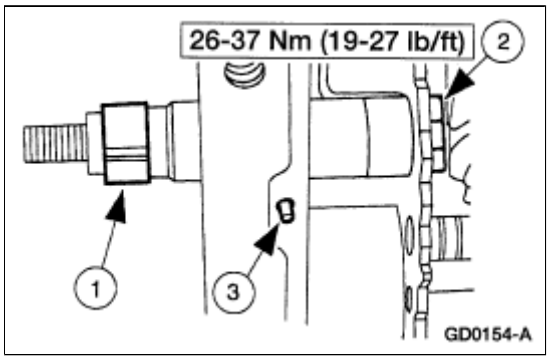
1. Using the special tool, install the manual control lever seal.



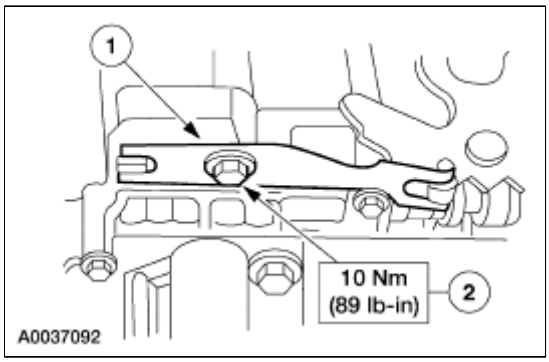
2. Install the parking lever actuating rod.
    1. Install the manual valve detent lever.
    2. Install the parking lever actuating rod.



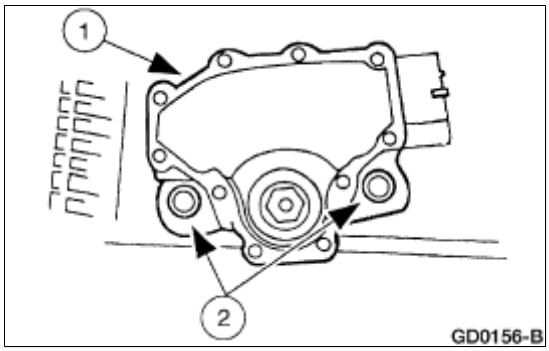
3. Install the manual control lever shaft.
    1. Install the manual control lever shaft.
    2. Install the inner manual control lever shaft nut.
    3. Install the manual lever shaft retaining pin.



4. Install the manual valve detent lever spring.
    1. Position the manual valve detent lever spring.
    2. Install the manual valve detent lever spring bolt.

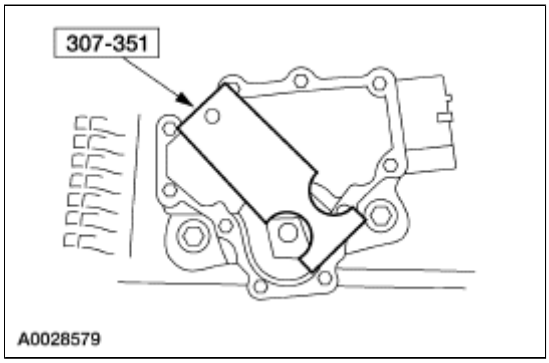


5. Install the digital TR sensor.
    1. Install the digital TR sensor.
    2. Loosely install the bolts.

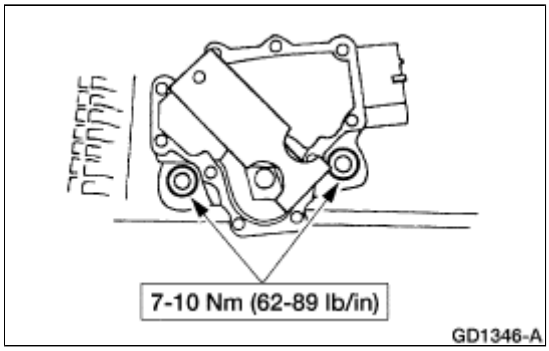


6. **NOTE:** Manual shift lever must be in the neutral position.

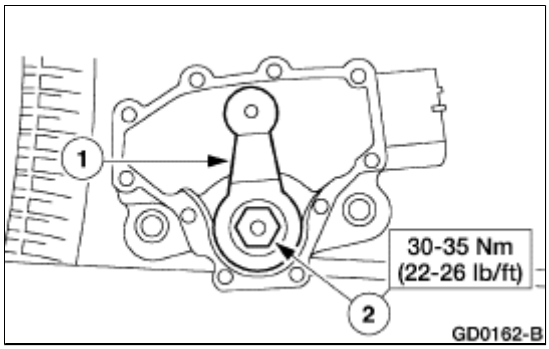
   Using the special tool, align the digital TR sensor slots. The tool is designed to fit snug.



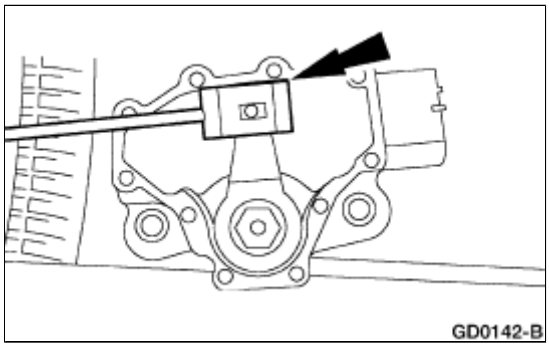
7. Tighten the bolts.



8. Install the manual control lever.
   1. Position the manual control lever.
   2. Install a new manual lever shaft outer nut.



9. With manual lever in overdrive, connect the shift control cable.

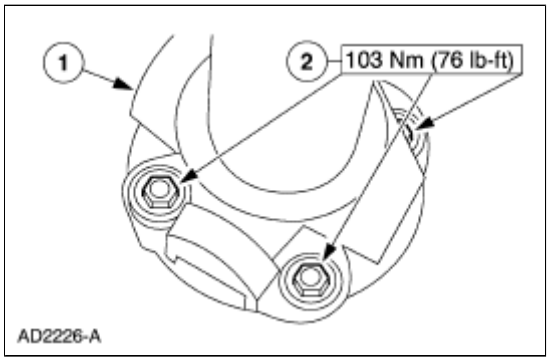


10. Install digital TR sensor electrical connector.

11. Install the filter and transmission fluid pan.

12. **NOTE:** To maintain initial driveshaft balance, align the index marks made during removal.

    On 4x4 vehicles, install the front driveshaft.
    1. Position the front driveshaft.
    2. Install the eight front driveshaft bolts (four each end).



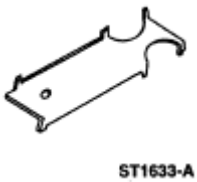
13. Lower the vehicle.

14. Connect the battery ground cable.

15. Fill the transmission with clean automatic transmission fluid and inspect for correct operation. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

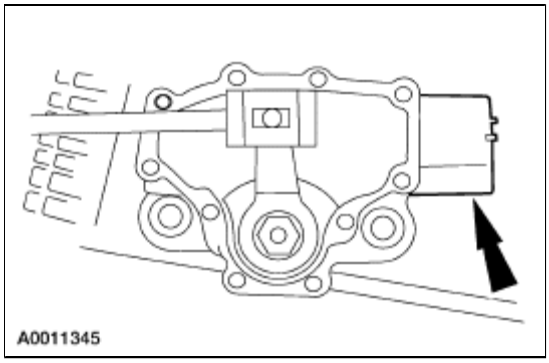
Digital Transmission Range (TR) Sensor

Special Tool(s)

 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)

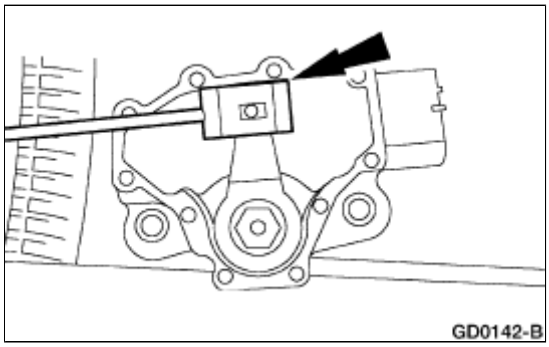
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Disconnect the digital TR electrical connector.



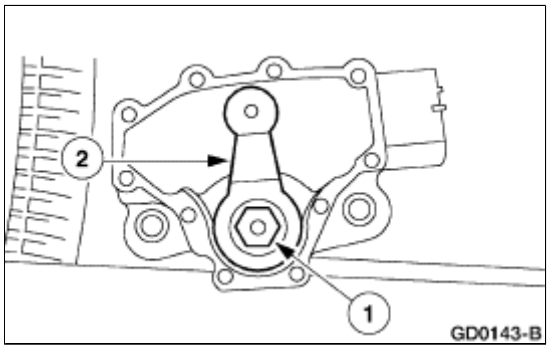
4. **CAUTION: Do not pry on the swivel tube to disconnect the transmission shift linkage.**

   Disconnect the manual lever shift control cable.

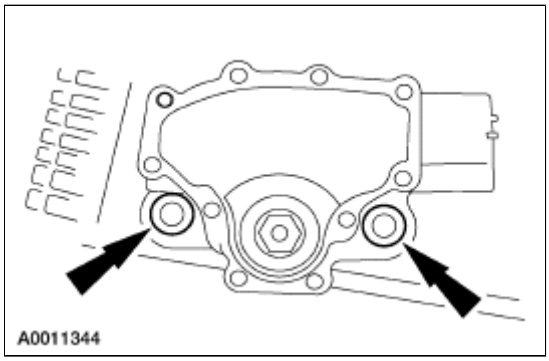


5. **CAUTION: Discard outer manual control lever shaft nut. Do not reuse. The old nut will not retain torque specification.**

   Remove the manual control lever.
   1. Remove the nut.
   2. Remove the lever.

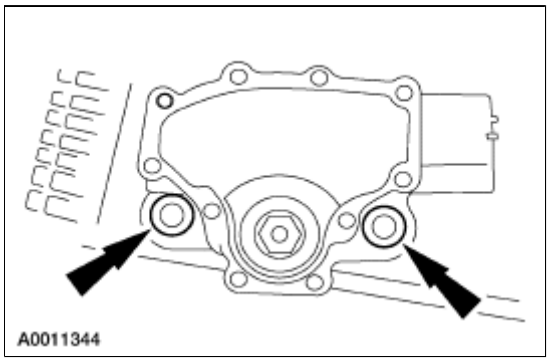


6. Remove the digital TR sensor bolts and the TR sensor.



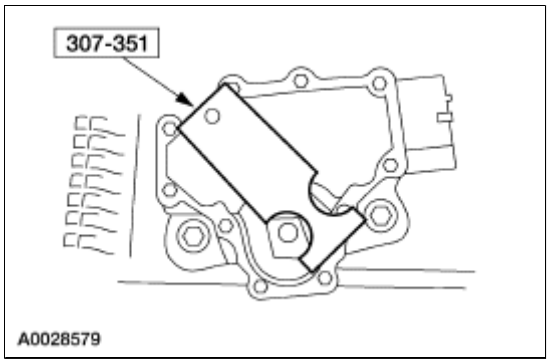
Installation

1. Install the digital TR sensor and loosely install the bolts.

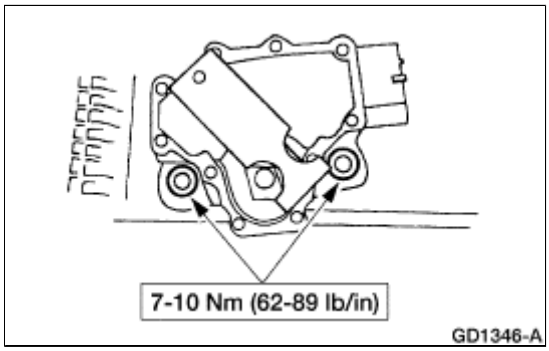


2. **NOTE:** Manual shift lever must be in the neutral position.

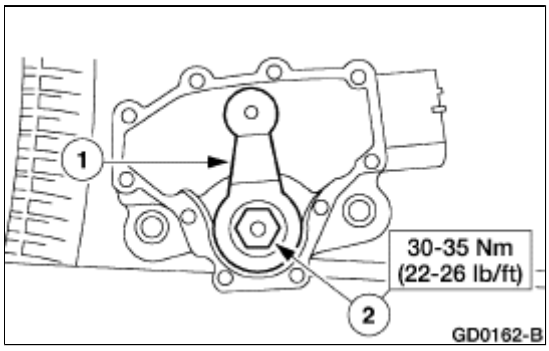
   Using the special tool, align the digital TR sensor slots. The tool is designed to fit snug.



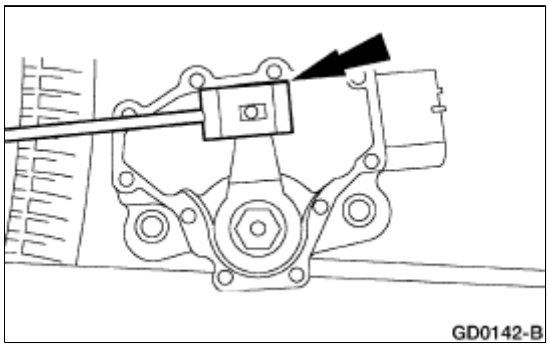
3. Tighten the bolts.



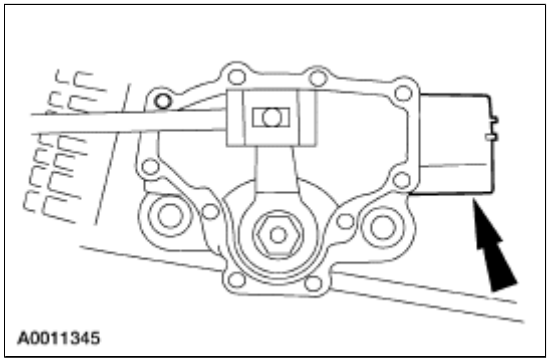
4. Install the manual control lever.
    1. Position the manual control lever.
    2. Install a new manual lever shaft outer nut.



5. With the manual lever in overdrive connect the shift lever control cable.



6. Install the digital TR sensor electrical connector.



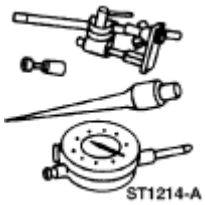
7. Lower the vehicle.

8. **NOTE:** When the battery is disconnect and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

   Connect the battery ground cable. For additional information, refer to Section 414-01 .

Reverse Servo Assembly

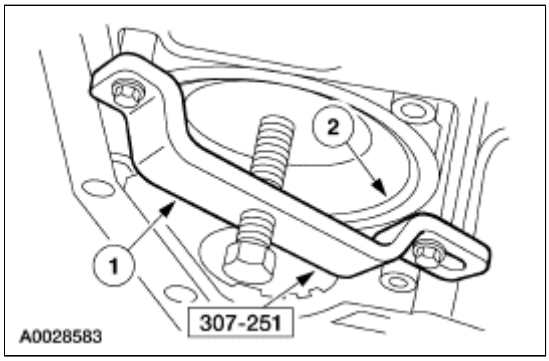
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1210-A	Remover/Installer, Servo Piston 307-251 (T92P-70023-A)
 ST1202-A	Installer, Servo Piston 307-073 (T80L-77030-A)

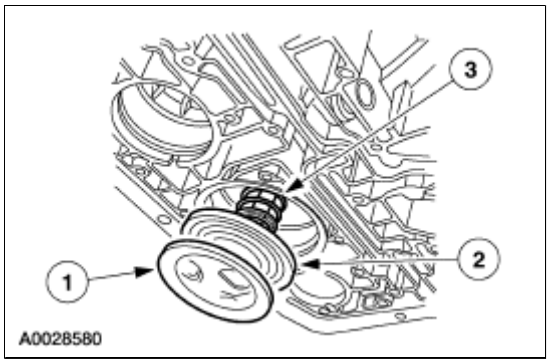
Removal

1. Remove the main control valve body. For additional information, refer to Main Control Valve Body in this section.

2. Using the special tool, remove the reverse band servo retaining ring.
    1. Compress the servo spring.
    2. Remove the reverse band servo retaining ring.



3. Remove the reverse servo assembly.
    1. Remove the reverse band servo cover.
    2. Remove the reverse band servo piston and rod.
    3. Remove the reverse band servo spring.

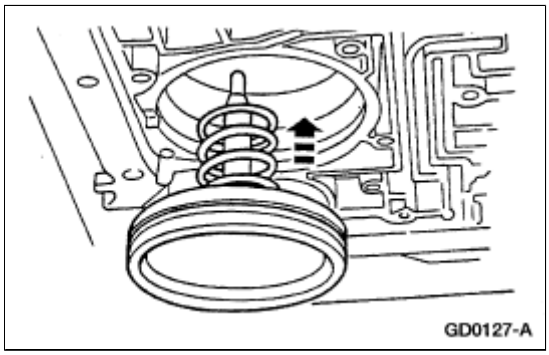


Installation

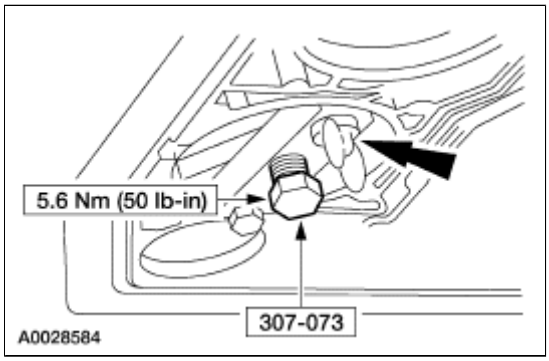
NOTE: This is not an ordinary installation procedure and does not compensate for band wear.

1. **NOTE:** Lubricate the reverse piston seal to facilitate assembly and prevent damage to the seal.

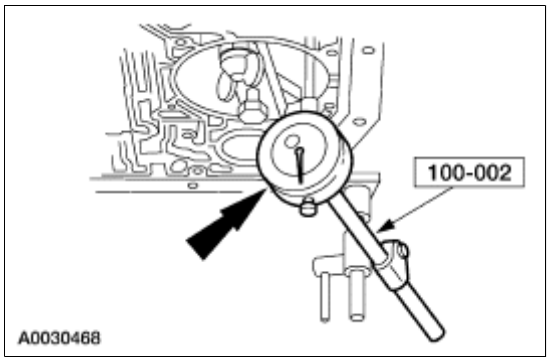
   Install the reverse servo return spring and piston.
   - Do not install the piston cover.



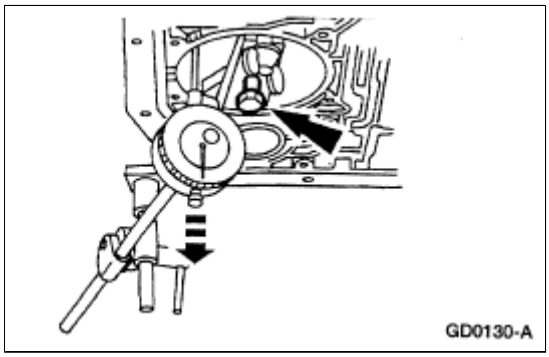
2. Install the special tool and tighten the band apply bolt.



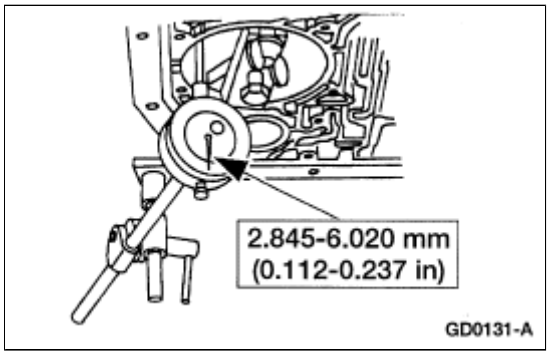
3. Attach the special tool to the transmission.
   - Position the indicator stem on the flat portion of the reverse servo piston and zero the dial indicator.



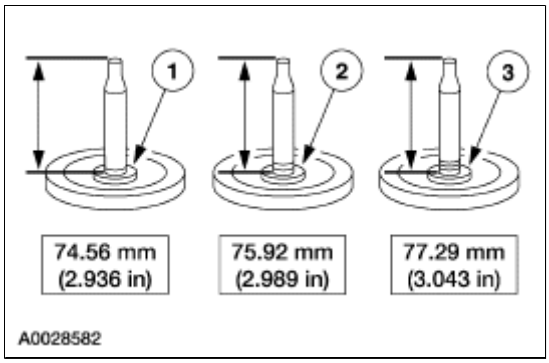
4. Loosen the bolt until the piston stops against the tool.



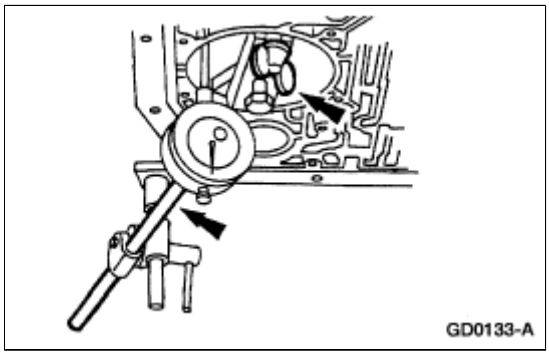
5. Verify that the amount of piston travel on the dial indicator is within specification.



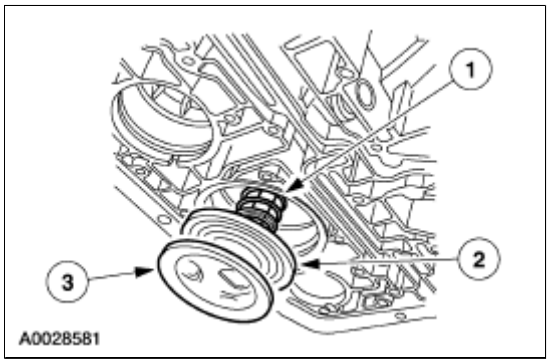
6. If piston travel is not within specification, select and install the correct servo piston assembly to bring the servo piston travel within specification.
    1. One groove
    2. Two groove
    3. Three groove



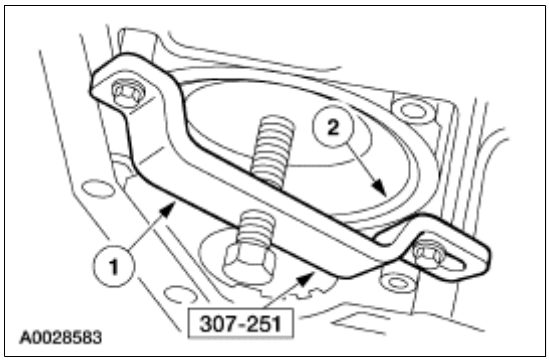
7. Remove the dial indicator and servo selection tool.



8. Install the correct reverse servo assembly.
    1. Install the reverse band servo spring.
    2. Install the reverse band servo piston and rod.
    3. Install the reverse band servo cover.



9. Using the special tool, install the reverse servo retaining ring.
    1. Compress the servo spring.
    2. Install the reverse band servo retaining ring.



10. Install the main control valve body. For additional information, refer to Main Control Valve Body in this section.

Overdrive Servo

Special Tool(s)

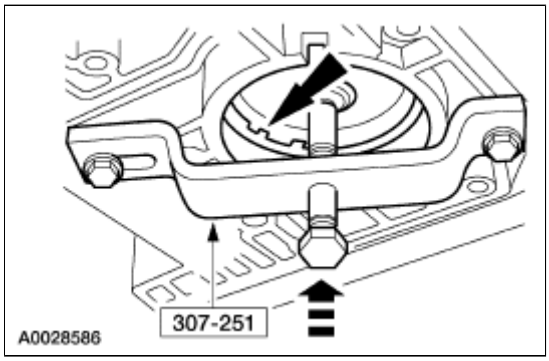
 ST1210-A	Remover/Installer, Servo Piston 307-251 (T92P-70023-A)

Removal

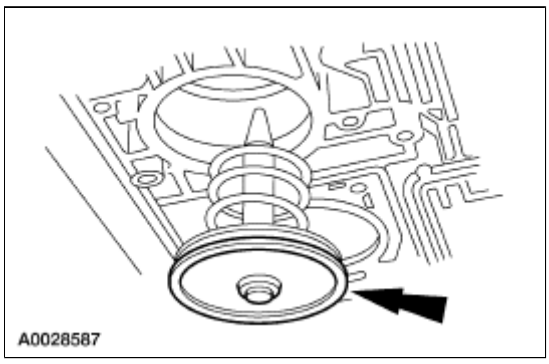
1. Remove the main control valve body. For additional information, refer to Main Control Valve Body in this section.

2. **NOTE:** If the tool is not available, extreme care must be taken. Spring pressure will force overdrive servo piston assembly out of case. Case bore damage may result from trying to pry on overdrive servo internal retaining ring.

   Using the special tool, compress the servo spring to remove the overdrive servo retaining ring.

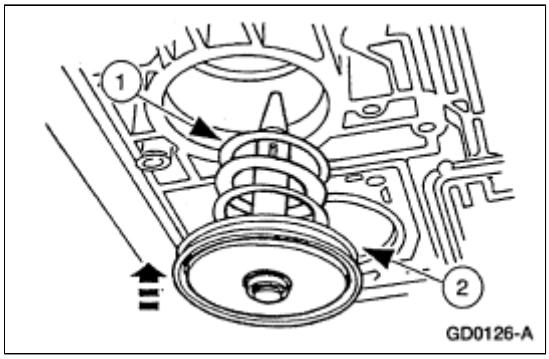


3. Remove the overdrive servo piston and return spring.

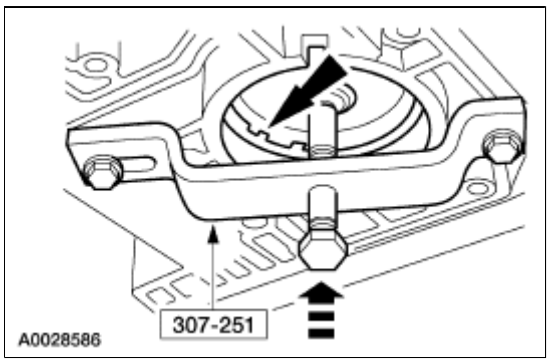


Installation

1. Install the overdrive servo piston assembly.
    1. Install the overdrive servo piston return spring.
    2. Install the overdrive servo piston assembly.



2. Use the special tool to install the overdrive servo piston retaining ring.

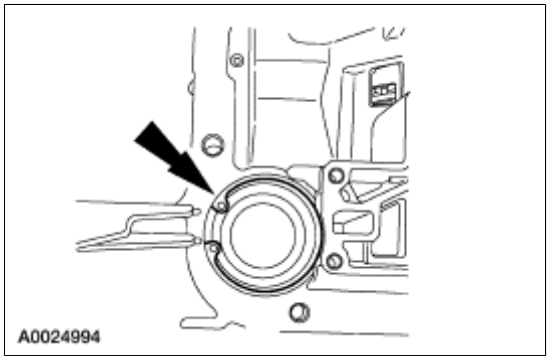


3. Install the main control valve body. For additional information, refer to Main Control Valve Body in this section.

1-2 Accumulator

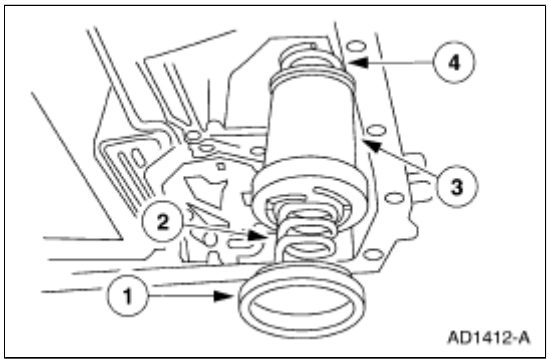
Removal

1. Compress the 1-2 accumulator cover and remove the accumulator piston retaining ring.



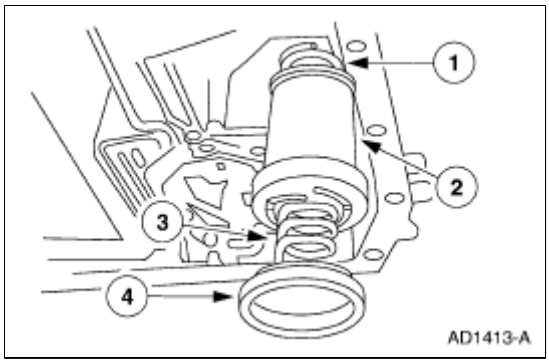
2. **NOTE:** Note the location of the 1-2 accumulator springs for reference during assembly.

   Remove the 1-2 accumulator.
   1. Remove the 1-2 accumulator cover.
   2. Remove the lower 1-2 accumulator spring.
   3. Remove the accumulator piston.
   4. Remove the upper 1-2 accumulator spring.

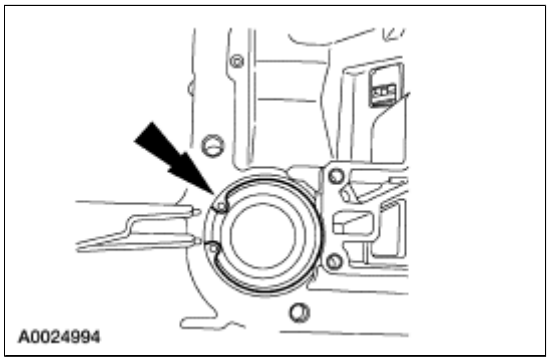


Installation

1. Install the 1-2 accumulator.
   1. Install the 1-2 accumulator upper spring.
   2. Install the accumulator piston.
   3. Install the 1-2 accumulator lower spring.
   4. Install the cover and seal assembly.



2. Compress the accumulator and install the accumulator piston retaining ring.

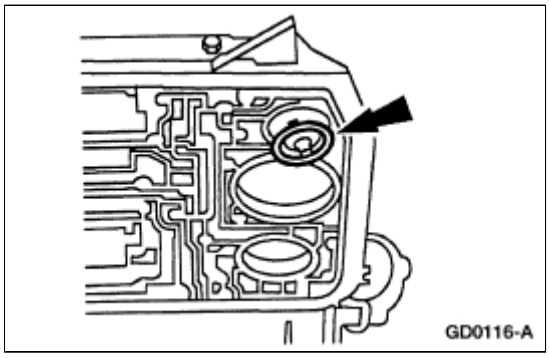


2-3 Accumulator

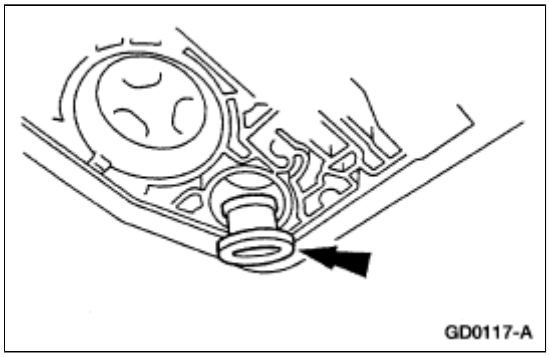
Removal

1. Remove the main control valve body. For additional information, refer to Main Control Valve Body in this section.

2. Remove the 2-3 accumulator piston retainer.

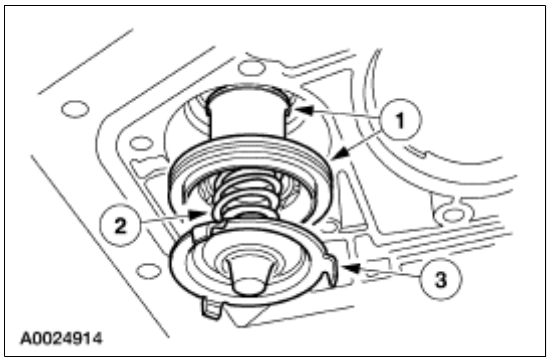


3. Remove the accumulator piston and spring.



Installation

1. Install the 2-3 accumulator assembly.
    1. Install the accumulator piston.
    2. Install the accumulator piston spring.
    3. Install the accumulator spring retainer.

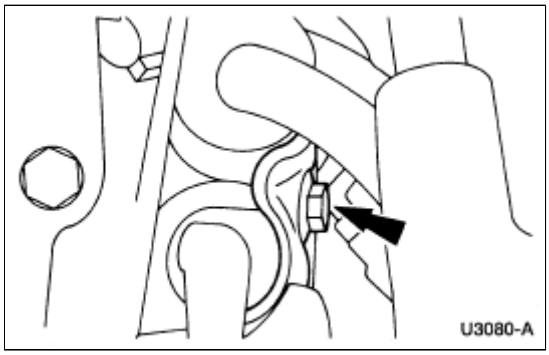


2. Install the main control valve body. For additional information, refer to Main Control Valve Body in this section.

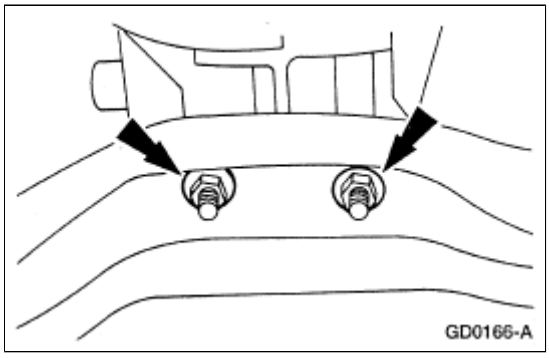
Transmission Insulator and Retainer

Removal

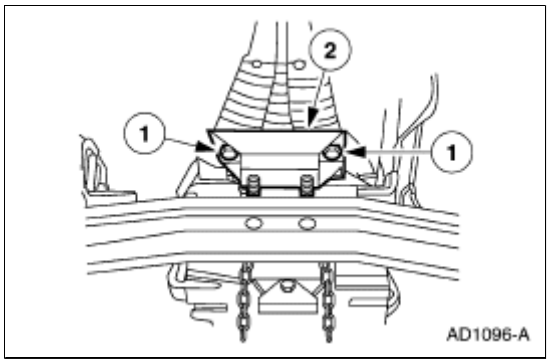
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise the vehicle on a hoist. For additional information, refer to Section 100-02 .
3. Remove the support insulator bracket bolt.



4. Use High-Lift Transmission Jack to support the transmission and remove the nuts.

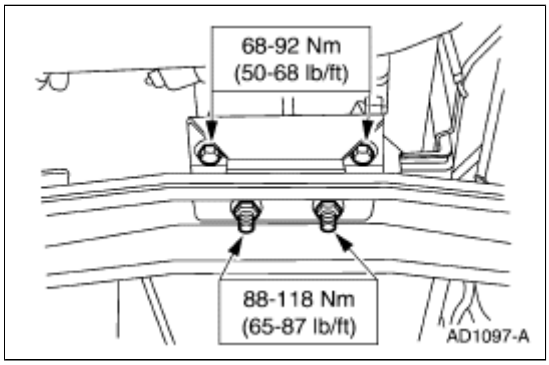


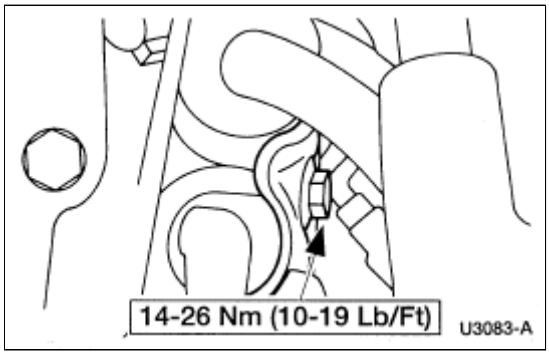
5. Raise the transmission enough for studs to clear the crossmember.
    1. Remove the bolts.
    2. Remove the transmission insulator.



Installation

1. To install, reverse the removal procedure.

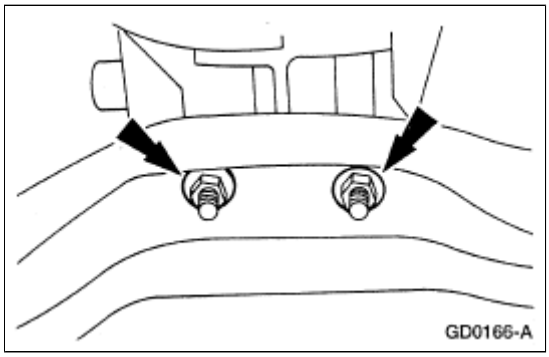




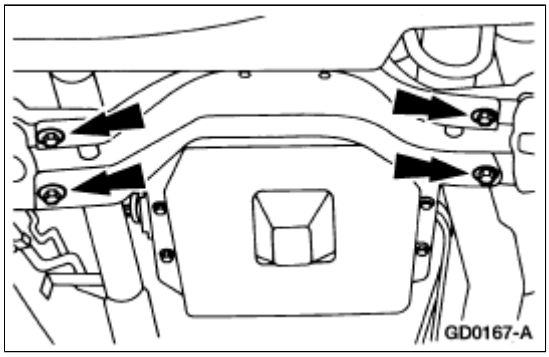
Transmission Support Crossmember

Removal

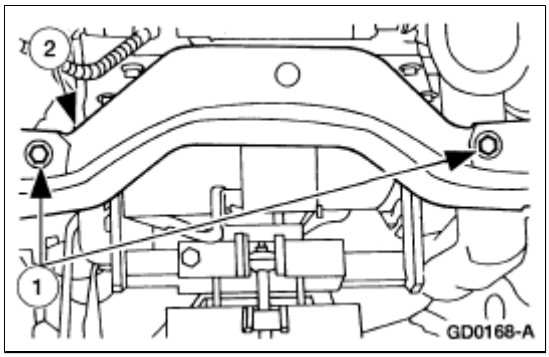
1. Raise and support the vehicle; refer to Section 100-02 .
2. Use High Lift Transmission Jack to support the transmission.
3. Remove the nuts from the transmission support insulator.



4. Remove the bolts.

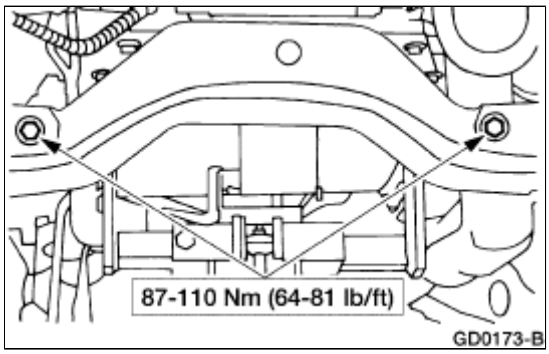


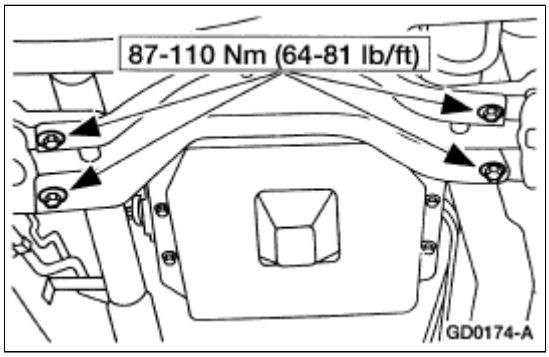
5. Remove the transmission crossmember.
    1. Remove the bolts and nuts.
    2. Remove the crossmember.

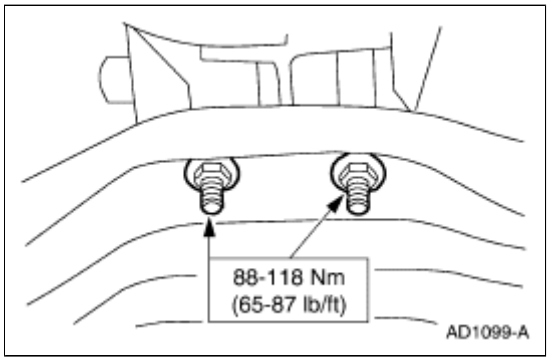


Installation

1. Follow the removal procedure in reverse order.







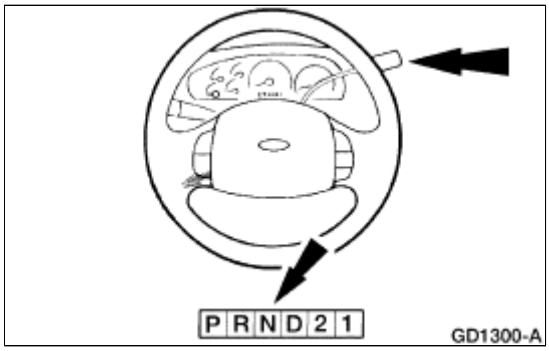
Transmission

Special Tool(s)

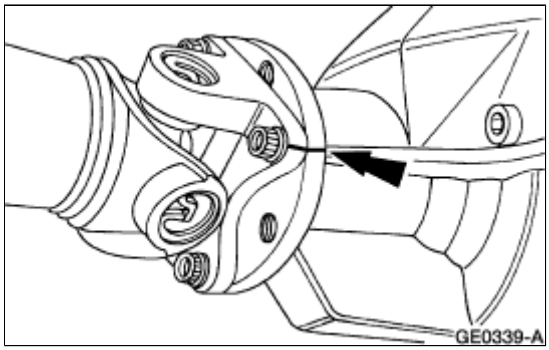
 ST1636-A	Torque Converter Holding Tool 307-346 (T97T-7902-A)

Removal

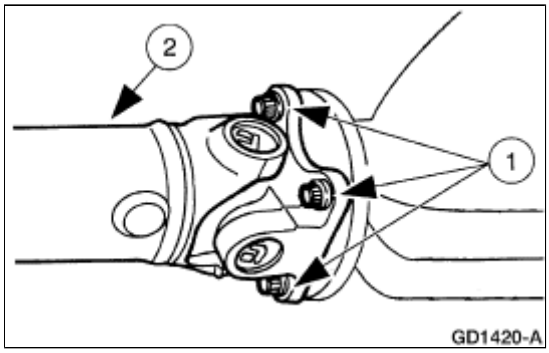
1. Place the selector lever in the NEUTRAL position.



2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
3. Raise the vehicle on a hoist. For additional information, refer to Section 100-02 .
4. If transmission disassembly is required, drain the transmission fluid. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
5. On 4WD vehicles remove the transfer case. For additional information, refer to Section 308-07B .
6. Mark the driveshaft flange and rear axle companion flange for correct alignment during installation.

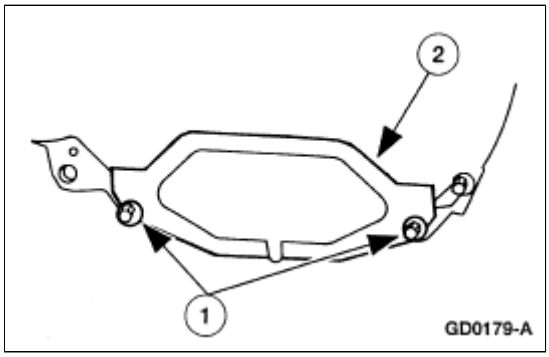


7. Remove the rear driveshaft.
    1. Remove the four bolts.
    2. Remove the driveshaft.

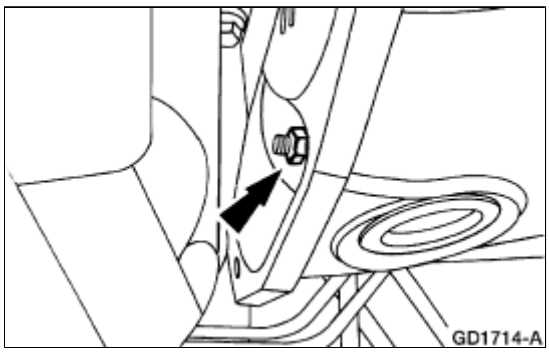


8. Remove the starter motor. For additional information, refer to Section 303-06 .

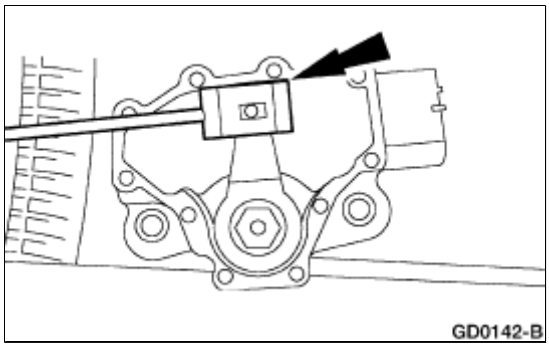
9. Remove the transmission inspection cover.
    1. Remove the two bolts.
    2. Remove the transmission inspection cover.



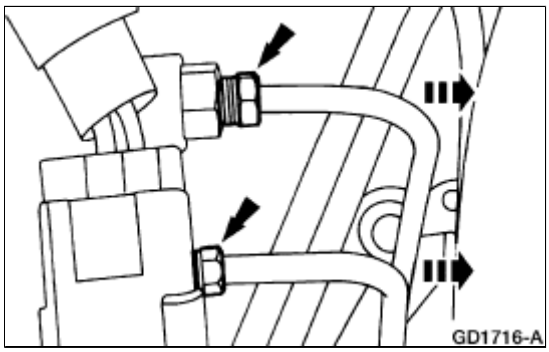
10. Remove the nuts from the torque converter.
    - Rotate the crankshaft/flexplate assembly to access all the nuts.



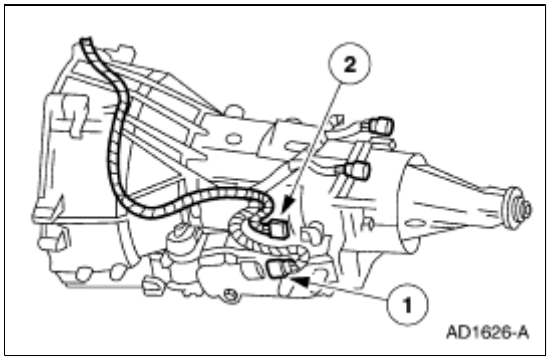
11. Disconnect the transmission shift linkage.



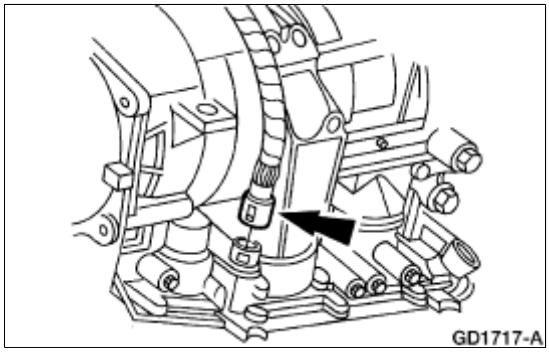
12. Disconnect the transmission cooler lines.



13. Disconnect the transmission electrical connectors.
    1. Disconnect the digital transmission range (TR) sensor.
    2. Disconnect the output shaft speed (OSS) sensor.

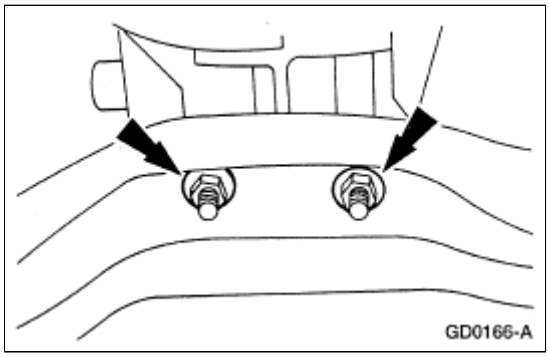


14. Disconnect the solenoid body assembly electrical connector.

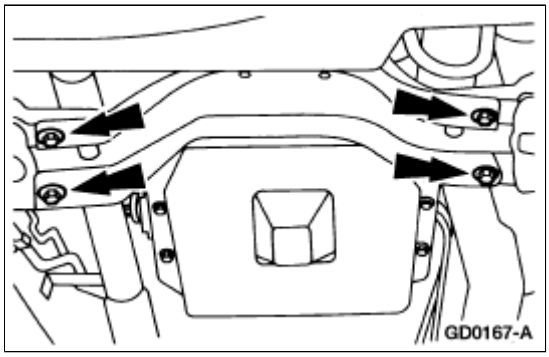


15. Position the High-Lift Transmission Jack under the transmission.

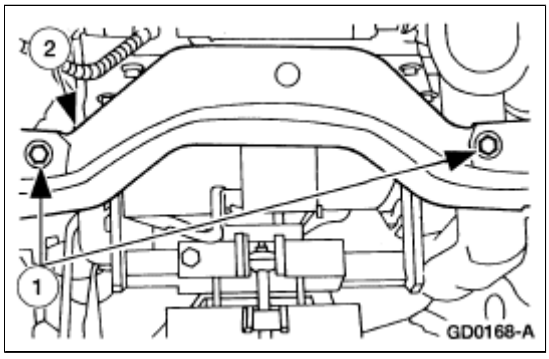
16. Remove the nuts.



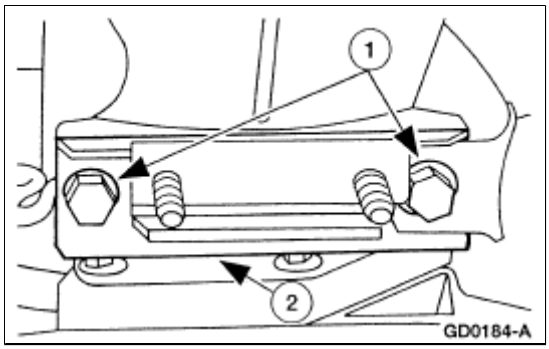
17. Remove the bolts.



18. Remove the transmission crossmember.
    1. Remove the bolts.
    2. Remove the transmission crossmember.

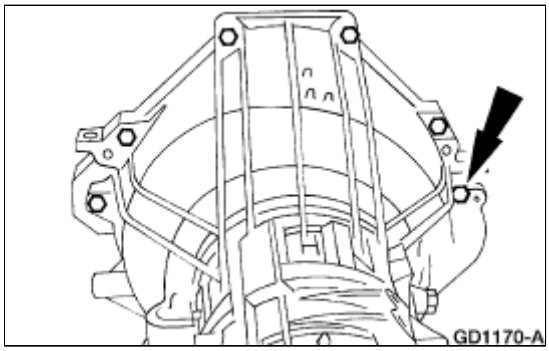


19. Remove the transmission mount.
    1. Remove the bolts.
    2. Remove the transmission mount.

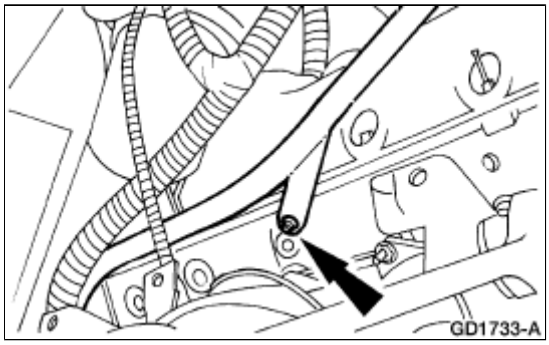


20. Remove the exhaust. For additional information, refer to Section 309-00 .

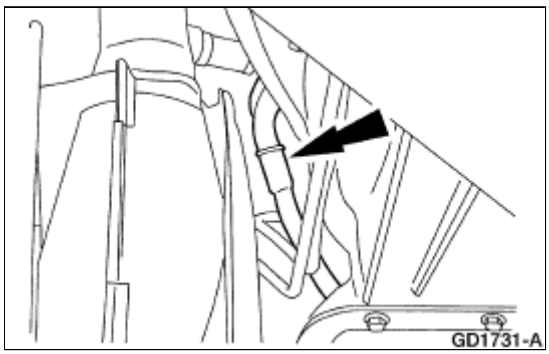
21. Remove the bolts.



22. Remove the transmission fill tube bolt from the back of the (RH) cylinder head.

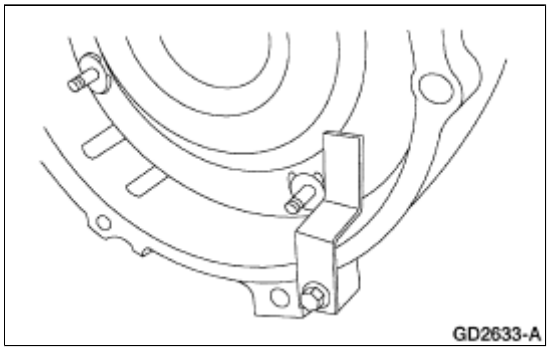


23. Remove the transmission fluid fill tube.



24. **WARNING: The torque converter is heavy and may result in injury if it falls out of the transmission. Secure the torque converter in the transmission.**

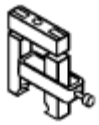
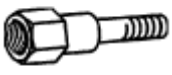
    Install the Torque Converter Holding Tool.

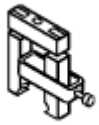


25. Lower the transmission from the vehicle. Carry out the transmission fluid cooler backflushing and cleaning procedure. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

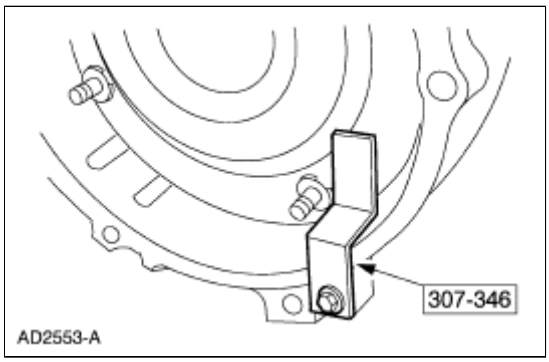
Transmission

Special Tool(s)

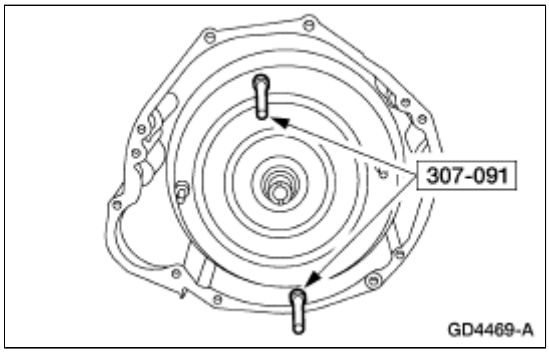
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1187-A	Slide Hammer 307-005 (T59L-100-B)
 ST1192-A	Remover, Transmission Fluid Seal 307-048 (T74P-77248-A)
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST1208-A	Remover, Transmission Fluid Pump 307-221 (T89T-70010-A)
 ST1210-A	Remover/Installer, Servo Piston 307-251 (T92P-70023-A)

 ST1192-A	Remover, Torque Converter Fluid Seal 307-309 (T94P-77001-BH)
 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)
 ST1200-A	Remover, Bearing Cup 308-047 (T77F-1102-A)

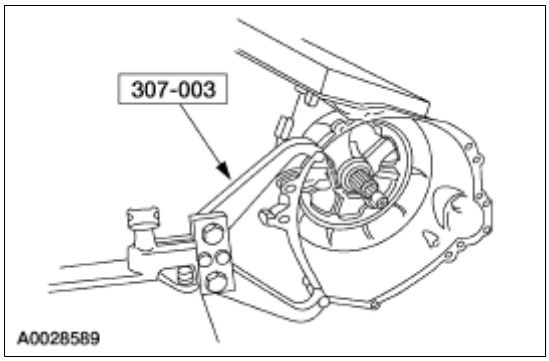
1. Remove the special tool.



2. Using the special tools, remove torque converter.

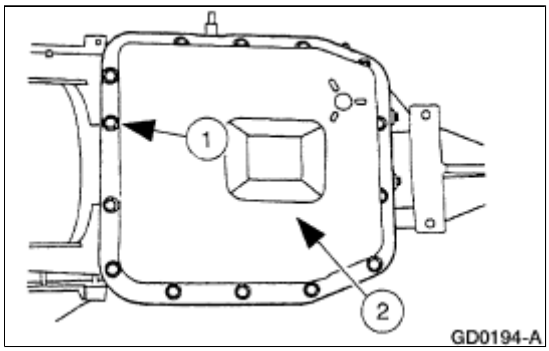


3. Using the special tool, mount the transmission to the bench.

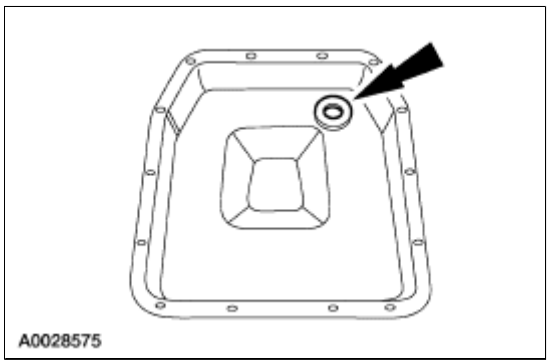


4. **NOTE:** If the transmission fluid pan gasket is not damaged, it may be reused.

   Remove the transmission fluid pan and transmission fluid pan gasket.
   1. Remove the bolts.
   2. Remove the transmission fluid pan and transmission fluid pan to case gasket.



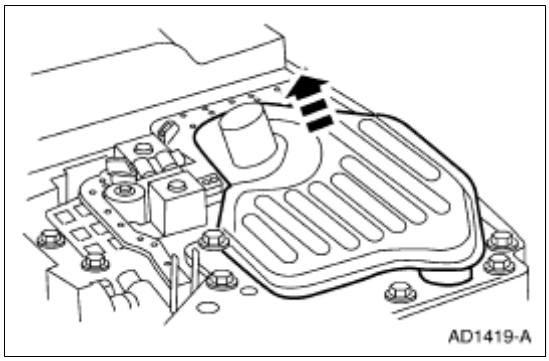
5. Clean the transmission fluid pan and pan magnet.



6. **CAUTION: If installing a new filter, and grommet remains in the main control bore, carefully use a small screwdriver to remove the grommet. Use care not to damage the main control bore.**

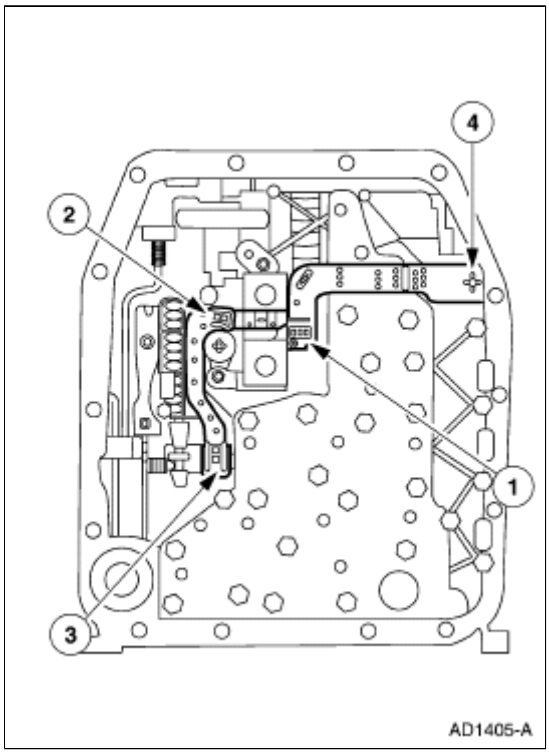
   NOTE: If transmission is being repaired for a contamination-related failure, use a new filter and seal. The filter may be reused if no excessive contamination is present.

   Remove the fluid filter and grommet.

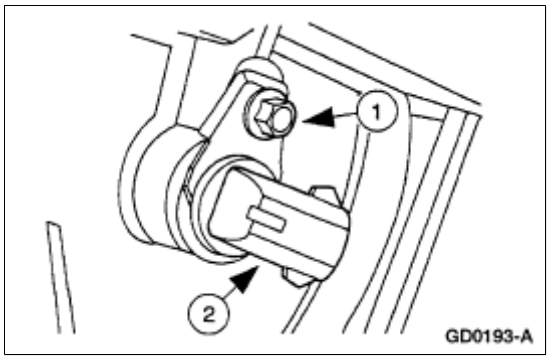


7. **CAUTION: Do not pull on the molded lead frame. This may cause damage to the connector ends. Carefully pry up on the locking tabs to disconnect the solenoids. Disconnect the molded lead frame from the solenoids.**

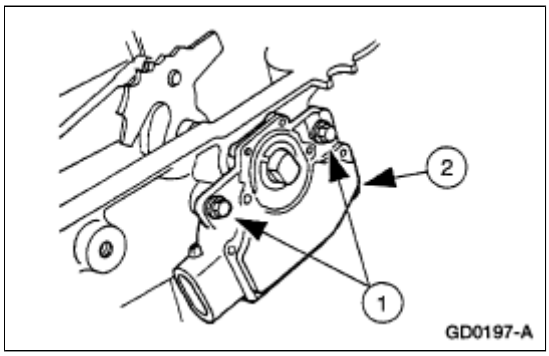
   Disconnect the molded lead frame from the solenoids.
   1. Disconnect the shift solenoid SSA and SSB.
   2. Disconnect the torque converter clutch (TCC).
   3. Disconnect the electronic pressure control (EPC) solenoid.
   4. Disconnect the bulkhead inter-connector.



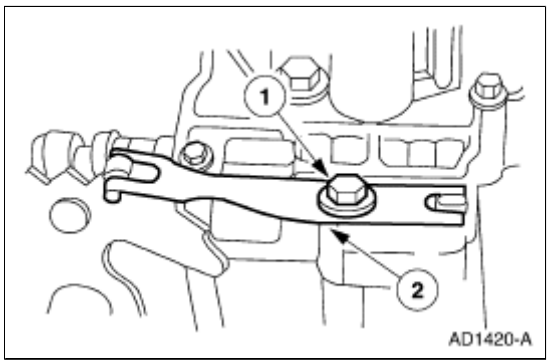
8. Remove the output shaft speed (OSS) sensor.
   1. Remove the bolt.
   2. Remove the OSS sensor.



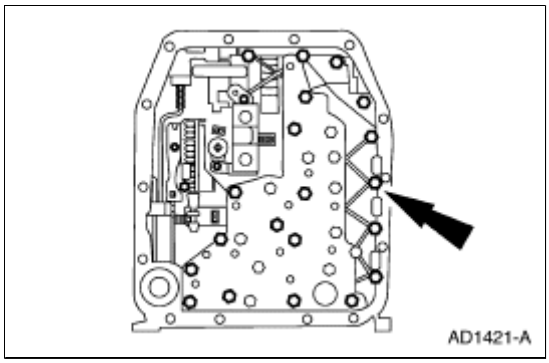
9. Remove the digital transmission range (TR) sensor.
    1. Remove the bolts.
    2. Remove the digital TR sensor.



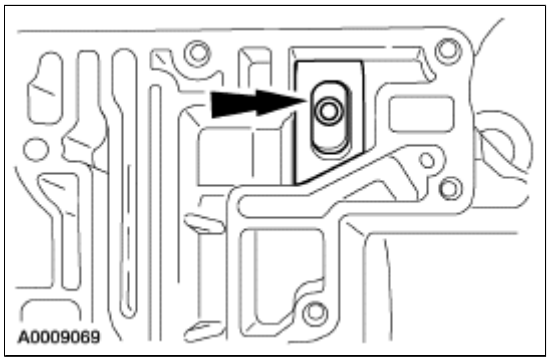
10. Remove the manual control valve detent lever spring.
    1. Remove the bolt.
    2. Remove the manual control valve detent lever spring.



11. Remove the 24 main control valve body bolts and the main control valve body.

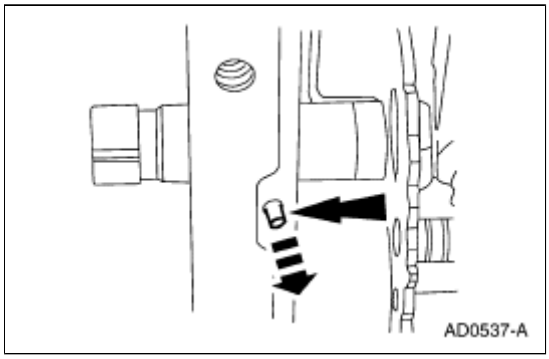


12. Remove and discard the pump outlet screen.

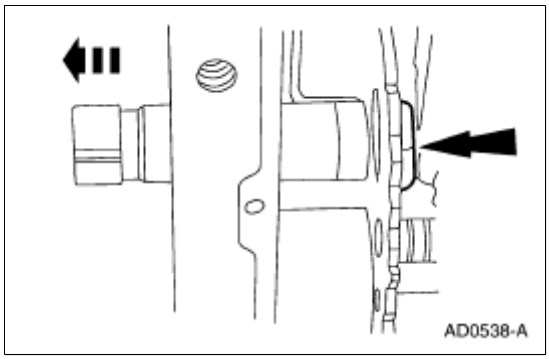


13. **NOTE:** Use a shop cloth to protect the transmission case surface.

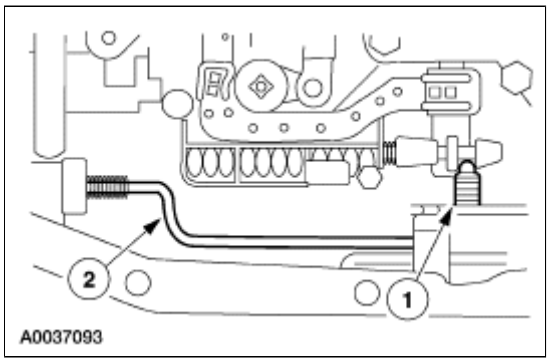
    Remove the manual lever shaft retaining pin.



14. Remove the manual lever shaft inner nut.
    - Slide the manual control lever shaft out of the case while removing the inner nut.

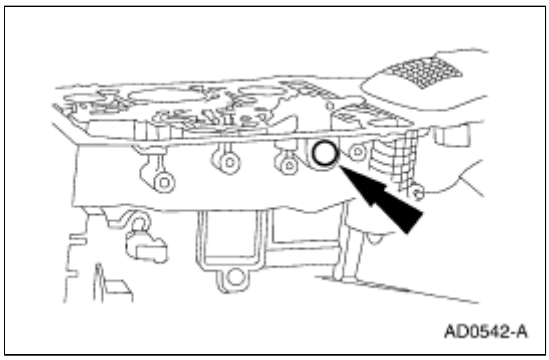


15. Remove the parking lever actuating rod.
    1. Remove the manual valve detent.
    2. Remove the parking lever actuating rod.

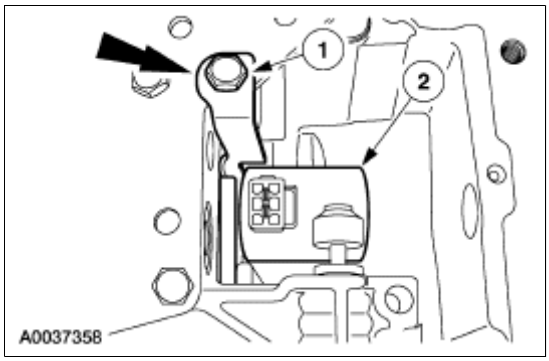


16. **CAUTION: Use care not to damage the manual control lever shaft bore. If the bore is damaged the new seal may leak.**

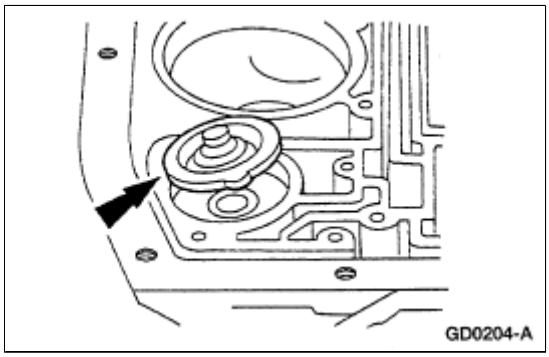
    Remove the manual control lever shaft seal.



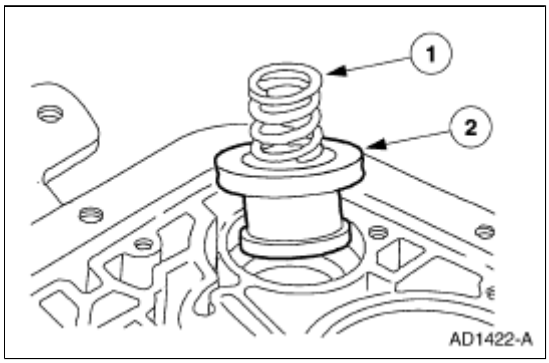
17. Remove the EPC solenoid.
    1. Remove the bolt and EPC solenoid bracket.
    2. Remove the EPC solenoid.



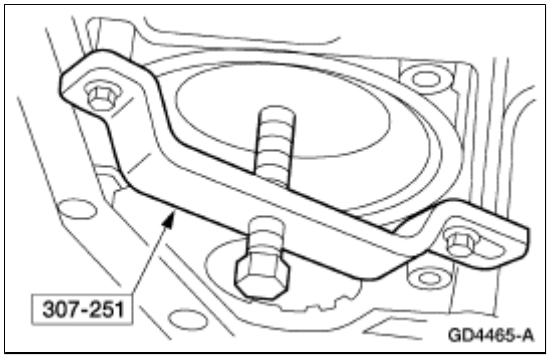
18. Remove the 2-3 accumulator spring retainer.



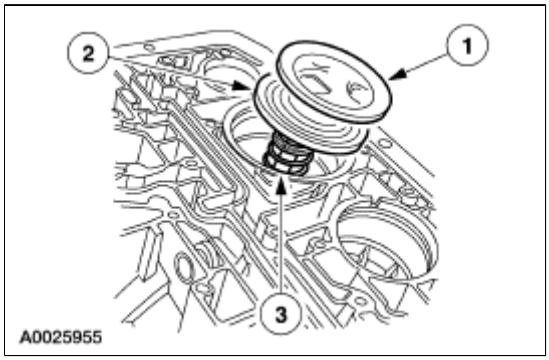
19. Remove the 2-3 accumulator piston.
    1. Remove the 2-3 accumulator spring.
    2. Remove the 2-3 accumulator piston.



20. Using the special tool, remove the reverse band servo retaining ring.

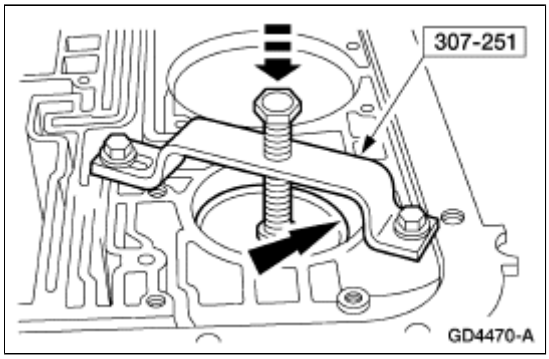


21. Remove the reverse servo assembly.
    1. Remove the reverse band servo cover.
    2. Remove the reverse band servo piston and rod.
    3. Remove the reverse band servo spring.

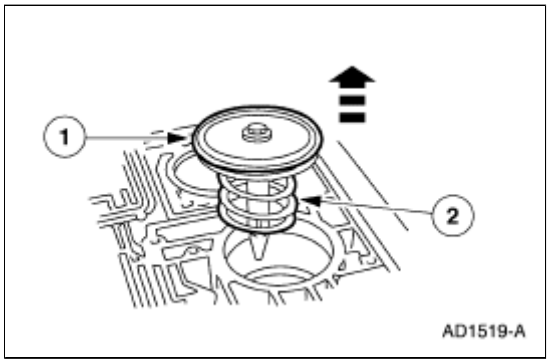


22. **NOTE:** If tool is not available, extreme care must be taken. Spring pressure will force overdrive servo piston assembly out of case. Case bore damage may result from trying to pry on internal retaining ring.

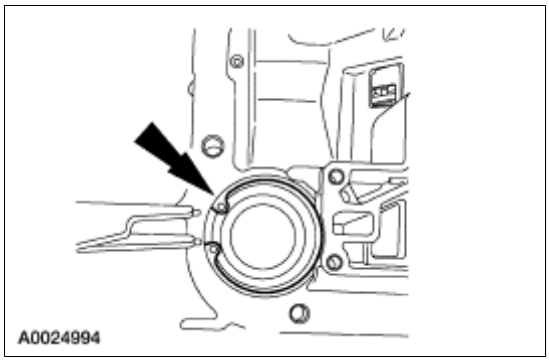
    Using the special tool, compress the piston spring, then remove the overdrive servo piston retainer.



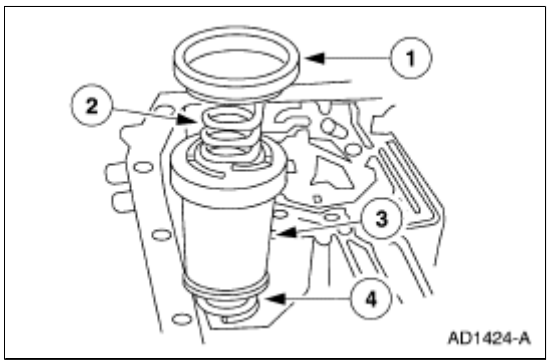
23. Remove the overdrive servo piston.
    1. Remove the overdrive servo piston.
    2. Remove the overdrive servo piston return spring.



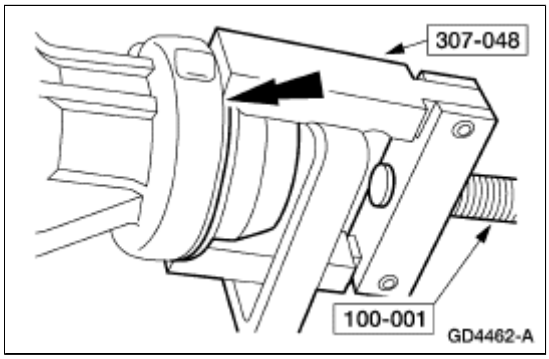
24. Compress the 1-2 accumulator cover and remove the retaining ring.



25. Remove the 1-2 accumulator upper spring.
    1. Remove the 1-2 accumulator spring cover.
    2. Remove the 1-2 accumulator lower spring.
    3. Remove the 1-2 accumulator.
    4. Remove the 1-2 accumulator upper spring.

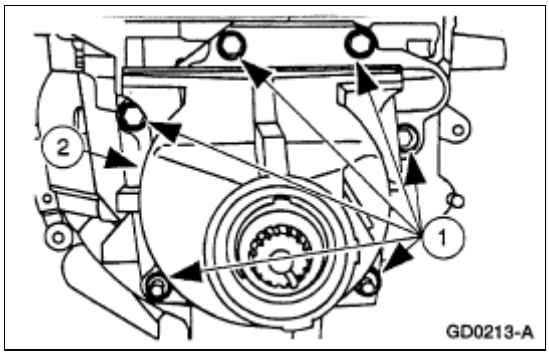


26. Using the special tools, remove the extension housing seal.

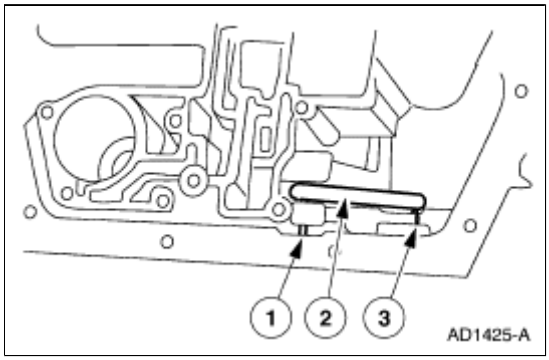


27. **NOTE:** These bolts have been coated with a sealant. High break torque may be required to remove these bolts.

    Remove the extension housing.
    1. Remove the four bolts and two nuts.
    2. Remove the extension housing and the extension housing gasket.



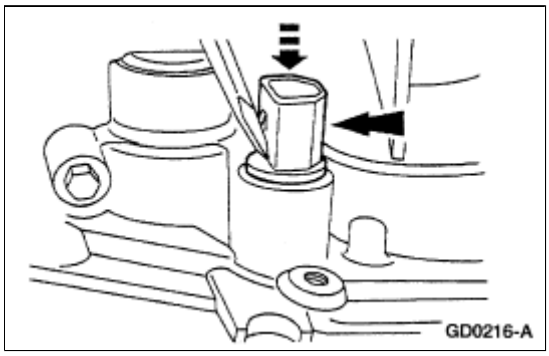
28. Remove the parking pawl.
    1. Remove the parking pawl shaft.
    2. Remove the parking pawl return spring.
    3. Remove the parking pawl.



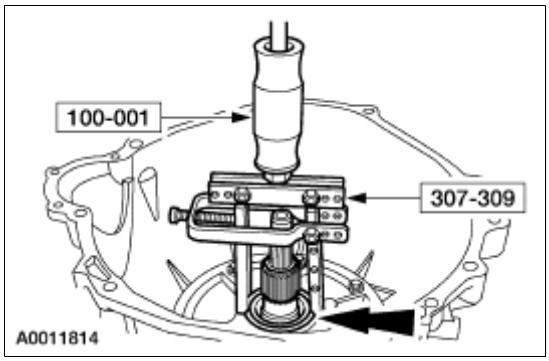
29. Rotate the transmission to the vertical position with the output shaft towards the floor.

30. **CAUTION: Extreme care must be taken during transmission connector removal. Do not use a hammer on the connector body.**

    Place a screwdriver on the flat portion of the connector and push the connector out through the bottom of the case.

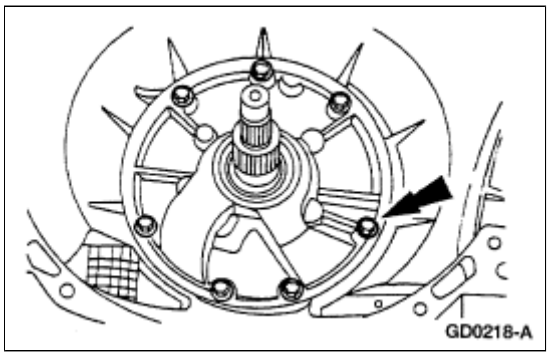


31. Using the special tools, remove the front pump seal.

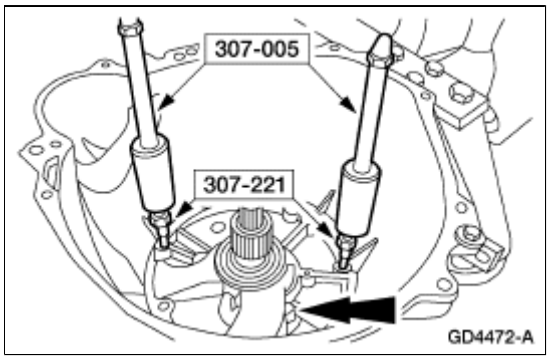


32. **NOTE:** These bolts have been coated with sealant. High break torque may be required to remove the bolts.

    Remove the bolts.

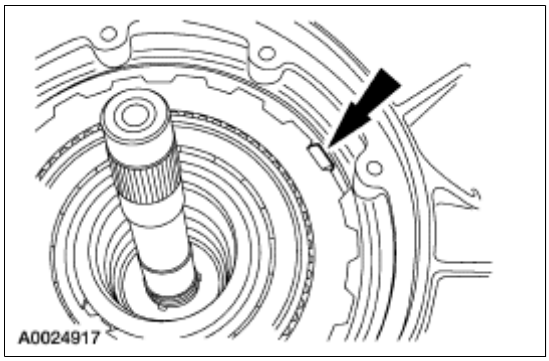


33. Using the special tools, remove the front pump support.



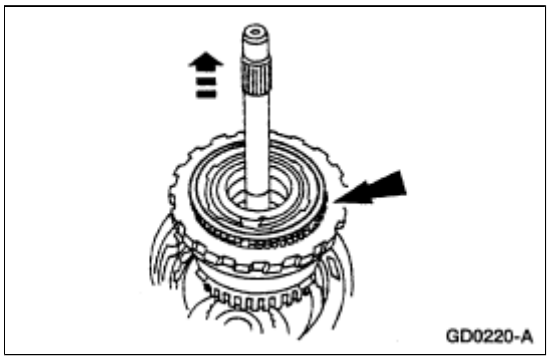
34. Remove and discard the pump gasket.

35. Remove the intermediate anti-rattle clip, if equipped.

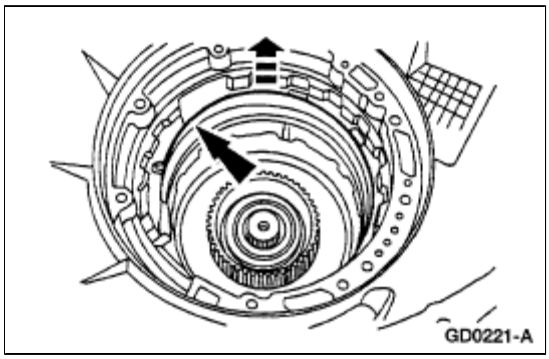


36. **CAUTION: Remove the assembly carefully to prevent damage to the overdrive band friction material by the reverse clutch drive lugs.**

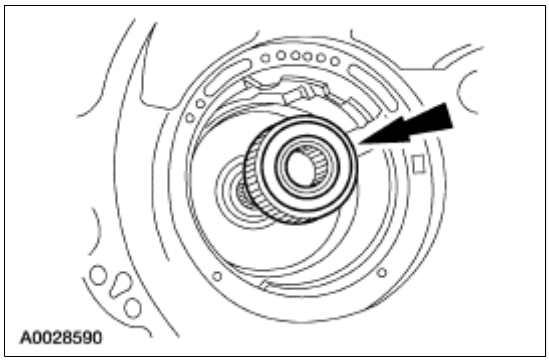
    Remove the following components as an assembly:
    - Intermediate clutch pack.
    - Intermediate one-way clutch.
    - Reverse clutch.
    - Forward clutch assembly.



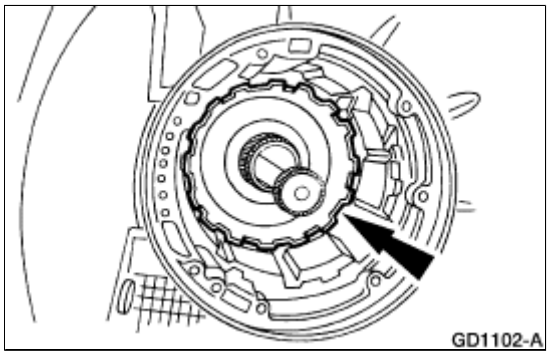
37. Disengage and remove the overdrive band.



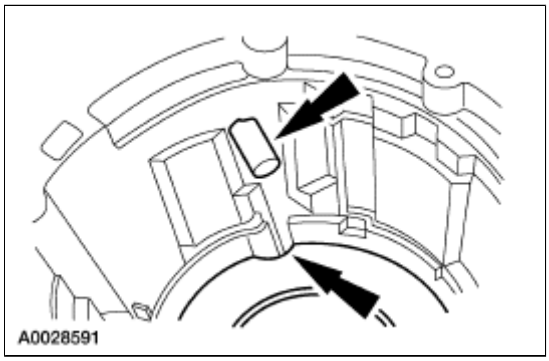
38. Remove the forward clutch hub and the No. 3 forward clutch hub front bearing.



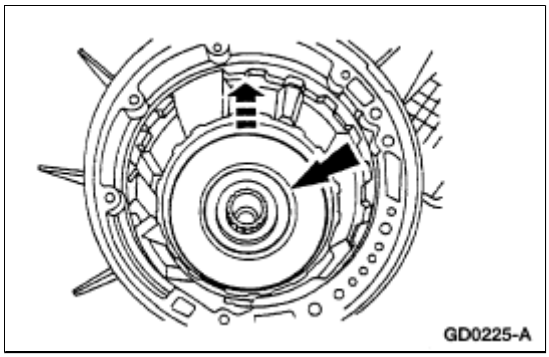
39. Remove the intermediate stub shaft.



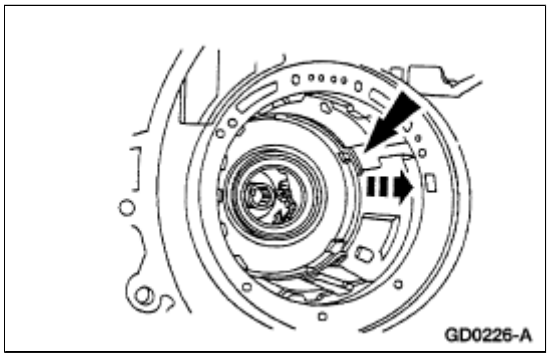
40. Align the reverse sun shell with the overdrive band anchor pin for removal.



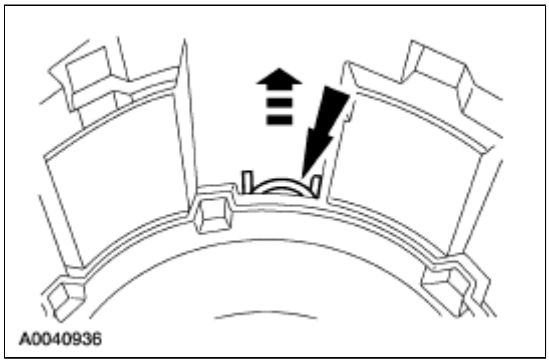
41. Remove the following components as an assembly:
    - Forward clutch sun gear.
    - No. 5 forward clutch sun gear bearing.
    - Reverse clutch sun gear.
    - No. 4 forward clutch hub bearing.



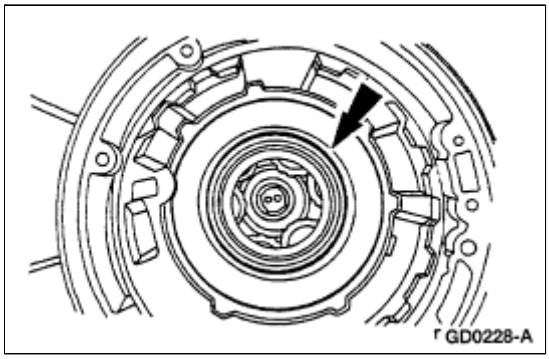
42. Remove the center support retaining ring and note location for assembly.



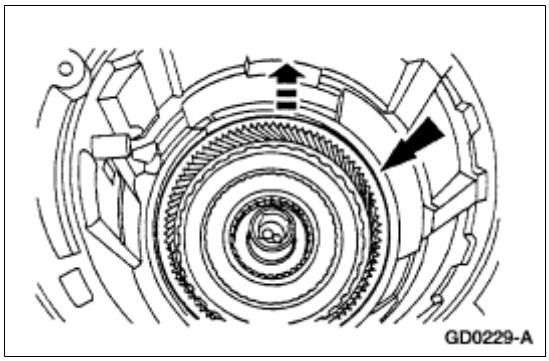
43. Remove the case to planet support spring.



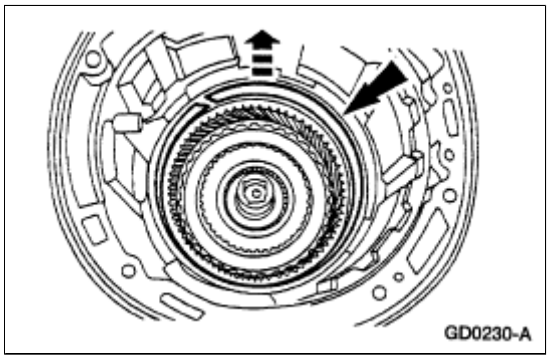
44. Remove the planetary gear support and planetary as an assembly.



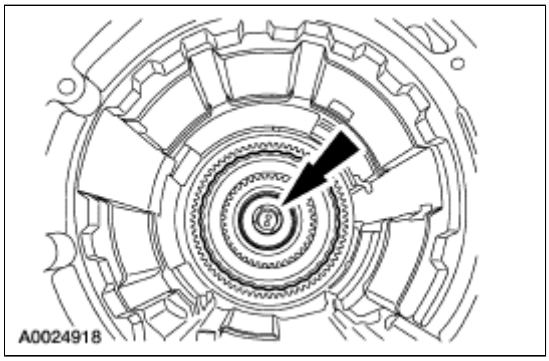
45. Remove the reverse clutch band.



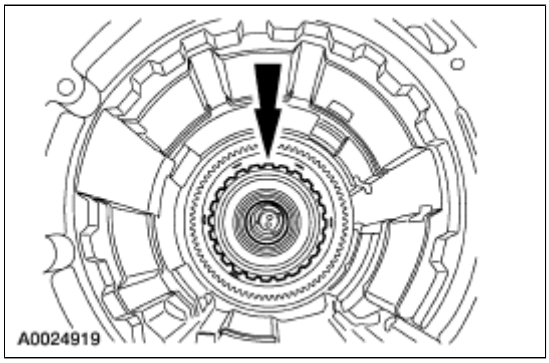
46. Remove the retaining ring.



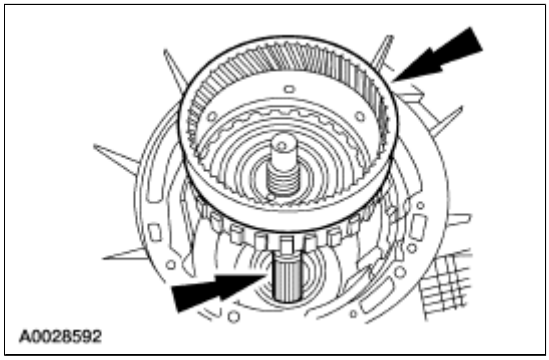
47. Remove the direct clutch pack.



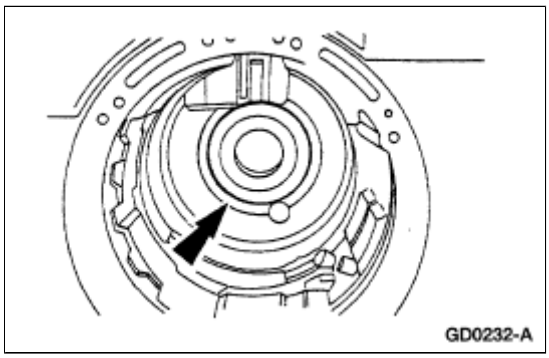
48. Remove the No. 8 bearing.



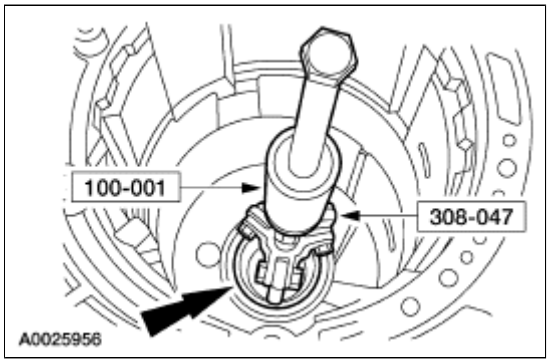
49. Remove the output shaft, output shaft ring gear assembly and direct clutch.



50. Remove the No. 9 case rear bearing.



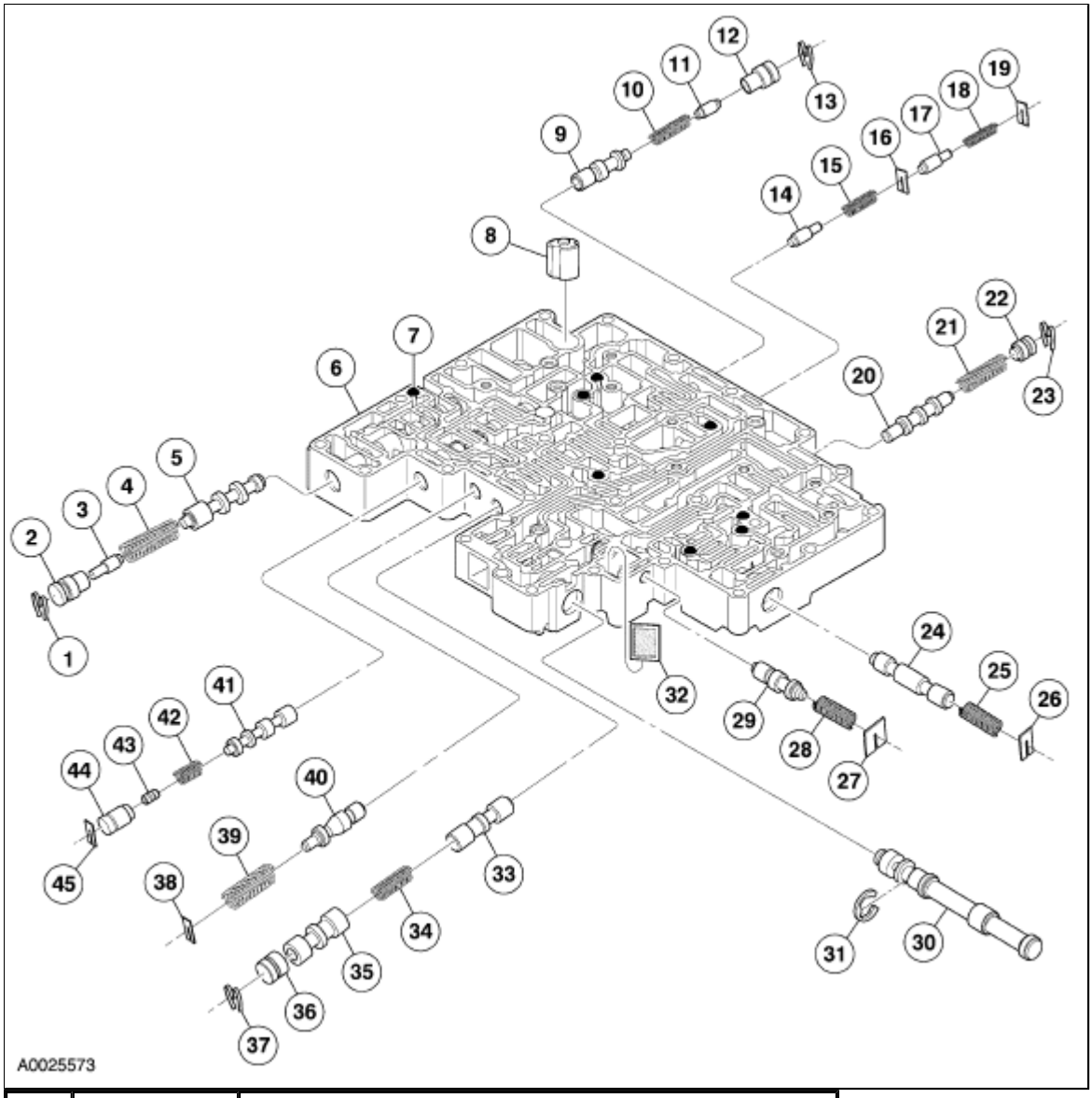
51. Inspect and if necessary, use the special tools to remove the rear case bushing.



Main Control Valve Body

Disassembly

Main Control Valve Body — Disassembled View

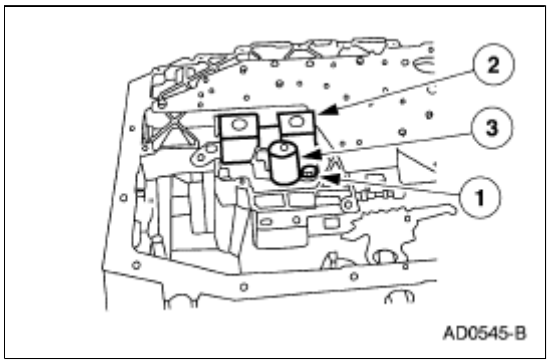


Item	Part Number	Description
1	—	Valve plug retainer (part of 7A100)
2	—	Main pressure booster valve sleeve (part of 7A100)
3	—	Main pressure booster valve (part of 7A100)
4	—	Main pressure regulator valve spring (part of 7A100)
5	—	Main regulator valve (part of 7A100)

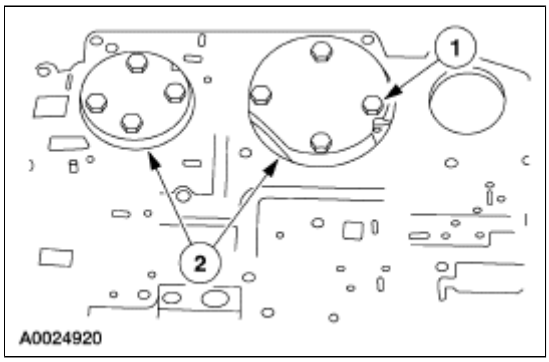
6	7A100	Main control valve body assembly
7	7E195	Check ball (8 req'd)
8	7H171	Converter drain back valve
9	—	Pressure regulator valve (part of 7A100)
10	—	Pressure regulator valve spring (part of 7A100)
11	—	Regulator boost plunger (part of 7A100)
12	—	Regulator boost sleeve (part of 7A100)
13	—	Valve retainer (part of 7A100)
14	—	Capacity modulator valve (part of 7A100)
15	—	Capacity modulator valve spring (part of 7A100)
16	—	Spring retaining plate (part of 7A100)
17	—	Capacity modulator valve (part of 7A100)
18	—	Capacity modulator valve spring (part of 7A100)
19	—	Spring retaining plate (part of 7A100)
20	—	3-4 shift valve (part of 7A100)
21	—	3-4 shift valve spring (part of 7A100)
22	—	Valve retainer plug (part of 7A100)
23	—	Valve plug retainer (part of 7A100)
24	—	2-3 backout valve (part of 7A100)
25	—	2-3 backout valve spring (part of 7A100)
26	—	Spring retaining plate (part of 7A100)
27	—	Spring retaining plate (part of 7A100)
28	—	Pressure regulator valve spring (part of 7A100)
29	—	Pressure regulator valve (part of 7A100)
30	—	Control manual valve (part of 7A100)
31	—	Retaining ring (part of 7A100)
32	—	Solenoid screen
33	—	1-2 shift valve (part of 7A100)
34	—	2-3 shift valve spring (part of 7A100)
35	—	2-3 valve (part of 7A100)
36	—	Valve retaining plug (part of 7A100)
37	—	Valve plug retainer (part of 7A100)
38	—	Spring retaining plate (part of 7A100)
39	—	Pressure regulator valve spring (part of 7A100)
40	—	Pressure regulator valve (part of 7A100)
41	—	Bypass clutch control valve (part of 7A100)
42	—	Bypass clutch control valve spring (part of 7A100)
43	—	Bypass clutch control valve plunger (part of 7A100)
44	—	Bypass clutch control plunger sleeve (part of 7A100)

45	—	Control valve plate (part of 7A100)

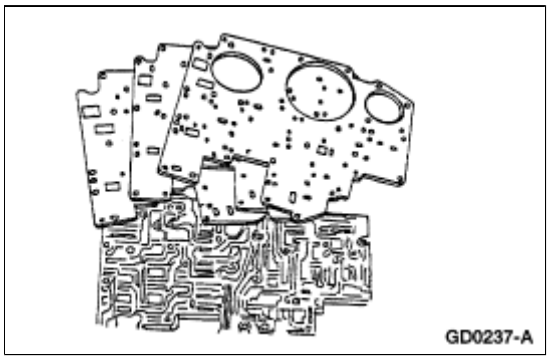
1. Remove the torque converter clutch (TCC) solenoid and the shift solenoid.
    1. Remove the bolt.
    2. Remove the shift solenoid.
    3. Remove the TCC solenoid.



2. Remove the two reinforcement plates.
    1. Remove the bolts.
    2. Remove the plates.

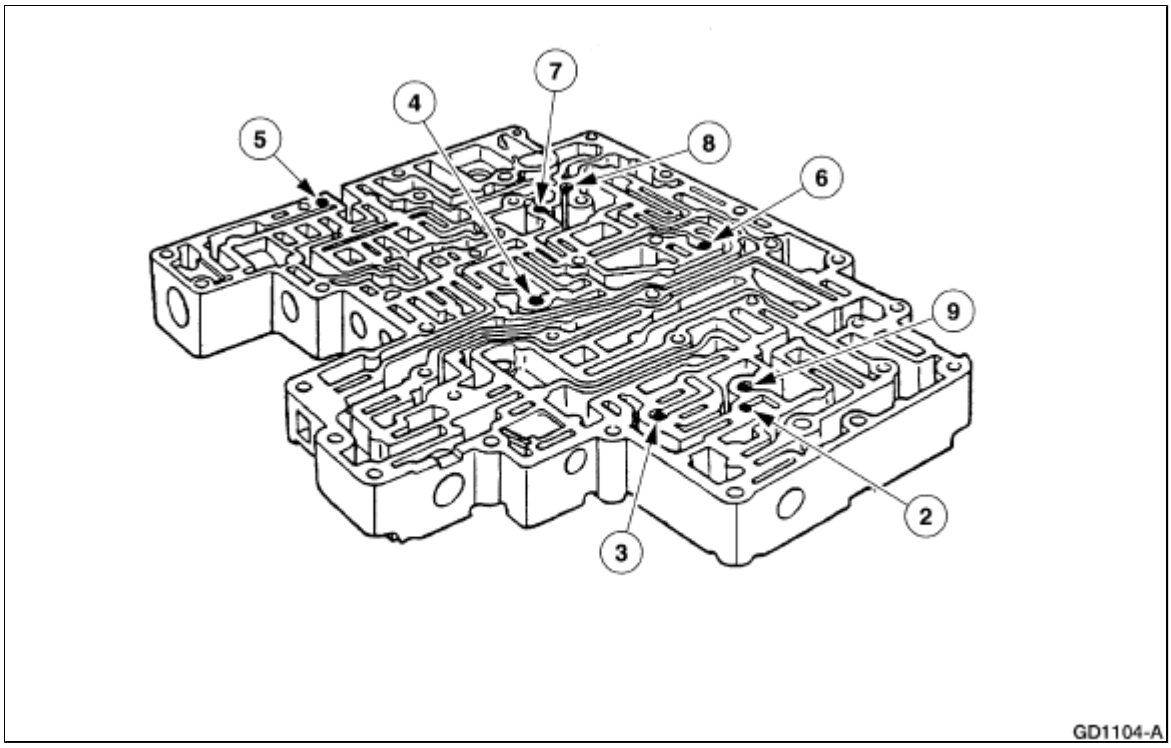


3. Remove the separator plate and discard the gaskets.

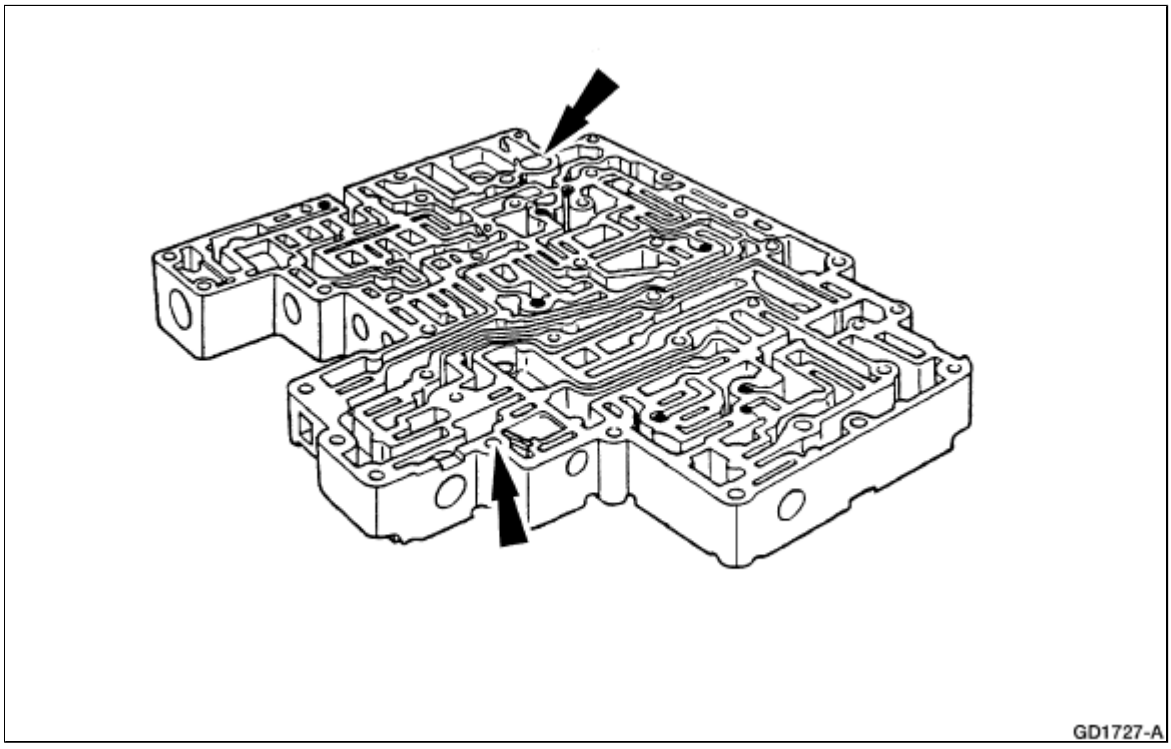


4. **NOTE:** Note the location of the eight coasting booster valve shuttle balls for assembly.

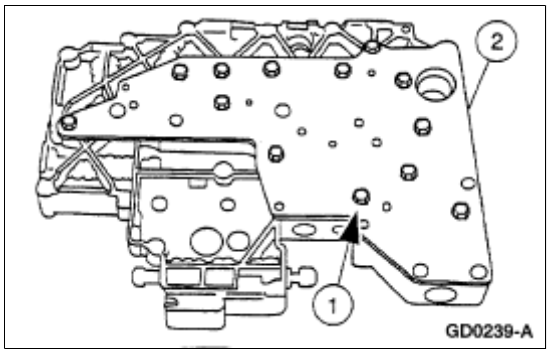
   Remove the eight coasting booster valve shuttle balls.



5. Remove the converter drain back valve and solenoid pressure supply screen.



6. Remove the main control valve body cover plate.
    1. Remove the 13 bolts.
    2. Remove the valve body cover plate and gasket.



Assembly

1. **CAUTION: Before beginning assembly, carry out and inspect the following:**

   When building up subassemblies and assembling the transmission, ALWAYS use new gaskets and seals.

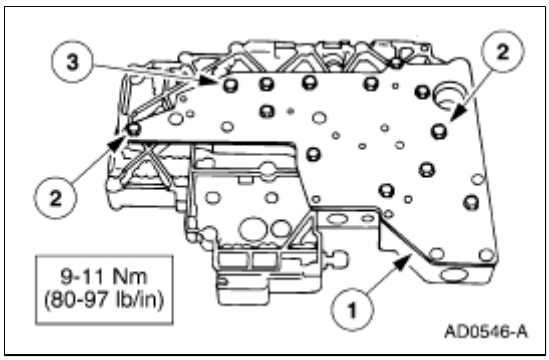
   All fasteners must be tightened to the torque specification indicated. In addition to appearing in the section, the necessary torques can be found in the General Specifications Chart.

   When building up subassemblies, each component part should be lubricated with clean transmission fluid. It is also good practice to lubricate the subassemblies as they are installed in the case.

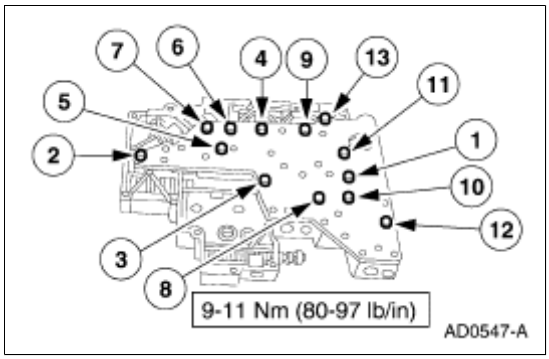
   Needle bearings, thrust washers and seals should be lightly coated with petroleum jelly during subassembly buildup or transmission assembly.

   Many components and surfaces in the transmission are precision machined. Careful handling during disassembly, cleaning, inspection and assembly can prevent unnecessary damage to machined surfaces.

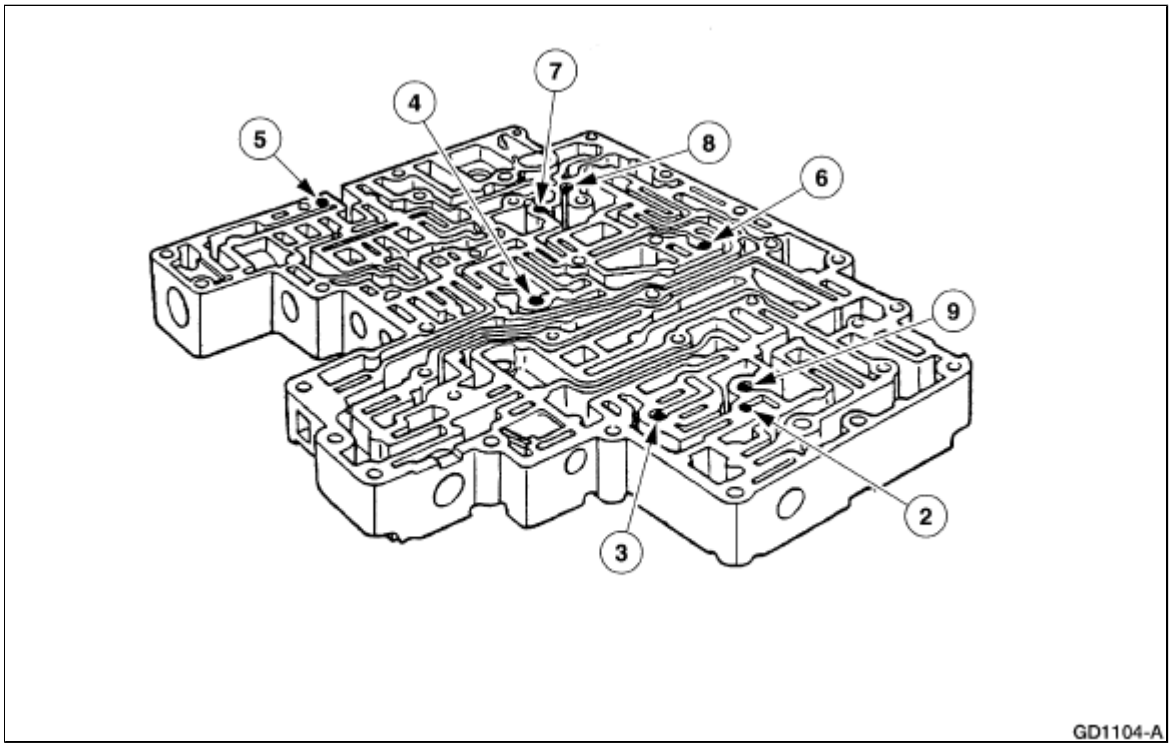
   Install the valve body cover plate.
   1. Position the valve body cover plate gasket and cover plate.
   2. Install the two guide pin bolts.
   3. Install the bolts.



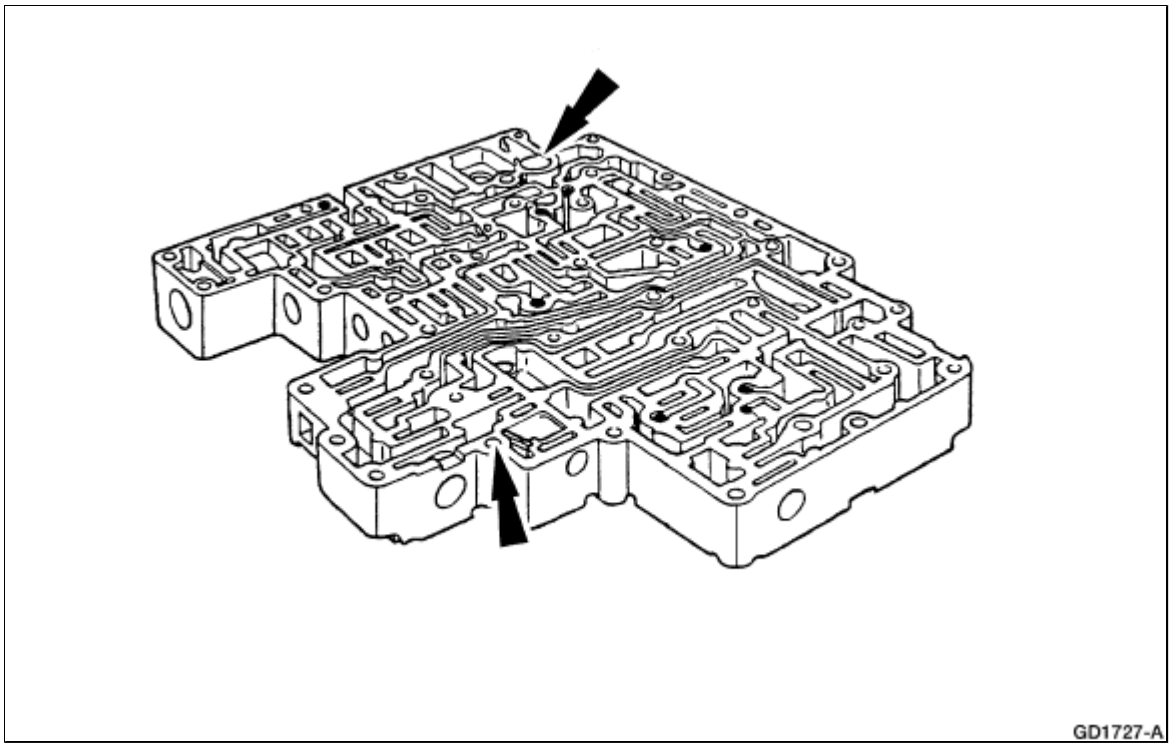
2. Tighten the bolts in the sequence shown.



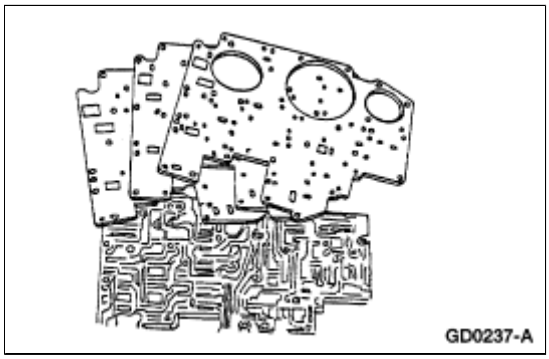
3. Install the eight coasting booster valve shuttle balls.



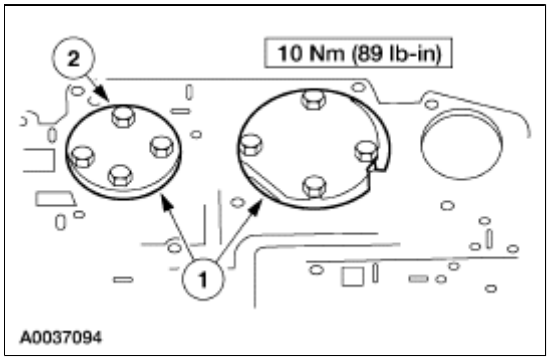
4. Install the converter drain back valve and solenoid pressure supply screen.



5. Install the separator plate and gaskets.



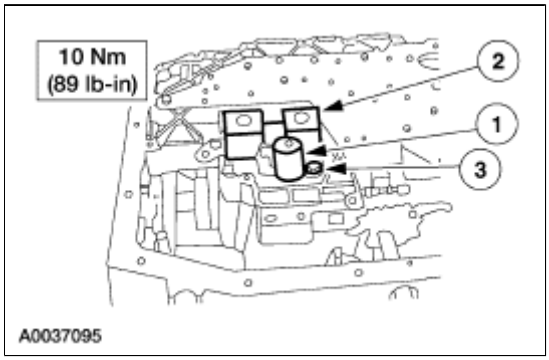
6. Install the two reinforcement plates.
    1. Position the plates.
    2. Install the bolts.



7. **NOTE:** Inspect the shift solenoid O-rings and TCC solenoid O-rings for damage.

Install the shift solenoid.

1. Position the TCC solenoid.
2. Position the shift solenoid.
3. Install the bolt.

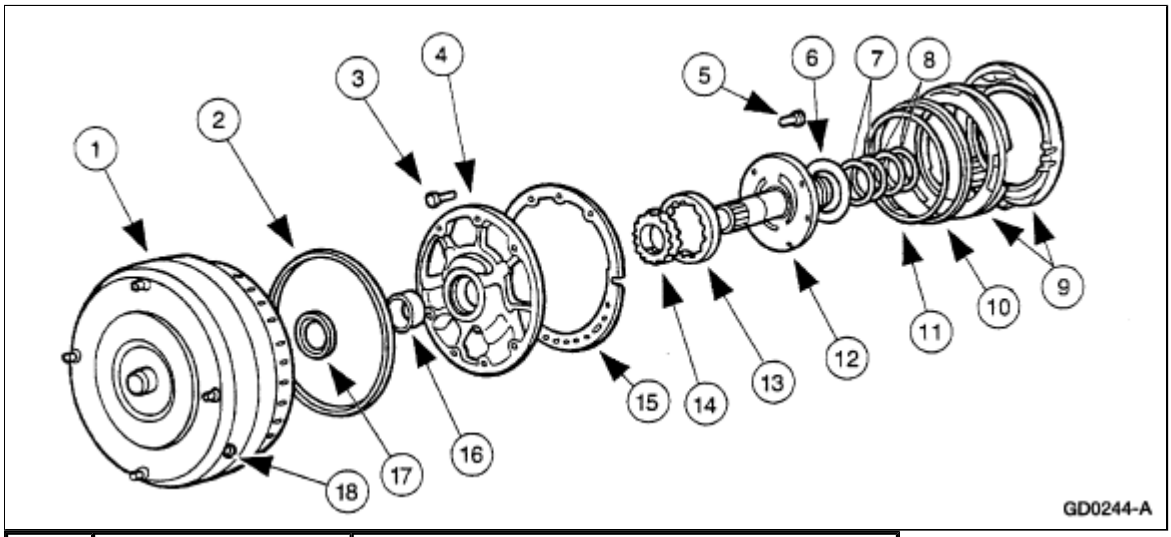


Pump and Intermediate Clutch Piston

Special Tool(s)

 ST1189-A	Installer, Front Pump Fluid Seal 307-014 (T63L-77837-A)
 ST1914-A	Protector, Piston Seal 307-339 (T95L-77005-A)

Pump and Intermediate Clutch Piston — Disassembled View

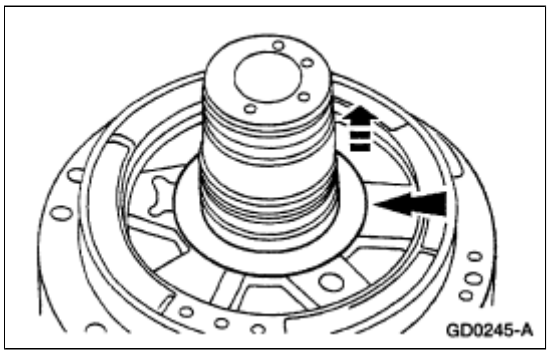


Item	Part Number	Description
1	7902	Torque converter
2	7A248	Front pump O-ring
3	N605789-S101	Bolt
4	—	Pump body assembly
5	N605787-S1000	Front pump support bolt
6	7D014	No. 1 pump support thrust washer
7	7D020	Reverse clutch cylinder seal
8	7D019	Forward clutch cylinder seal

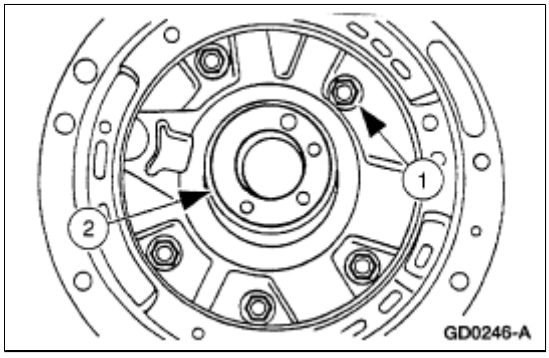
9	7E005	Intermediate clutch piston
10	7F224	Intermediate clutch piston outer seal
11	7F225	Intermediate clutch piston inner seal
12	7A108	Pump support
13	—	Pump outer gerotor gear
14	—	Pump inner gerotor gear
15	7A136	Pump gasket
16	—	Pump bushing
17	7A248	Pump inner seal
18	391855-S100	Converter drain plug

Disassembly

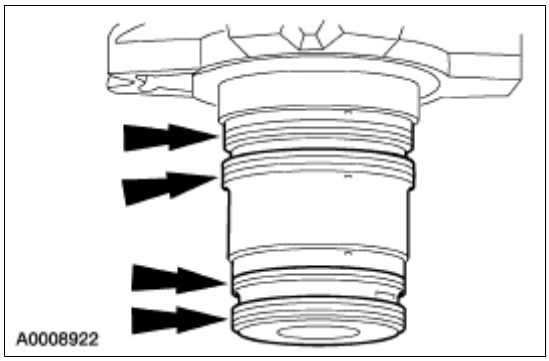
1. Remove the No. 1 selective pump support thrust washer.



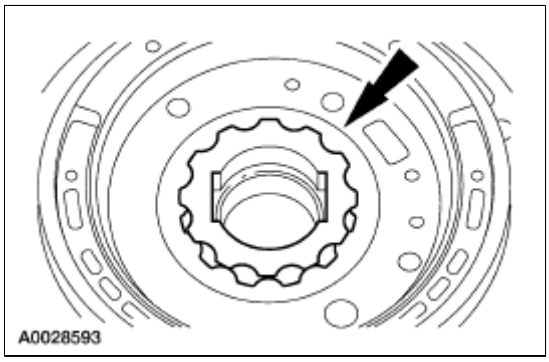
2. Remove the front pump support.
    1. Remove the bolts.
    2. Remove the front pump support.



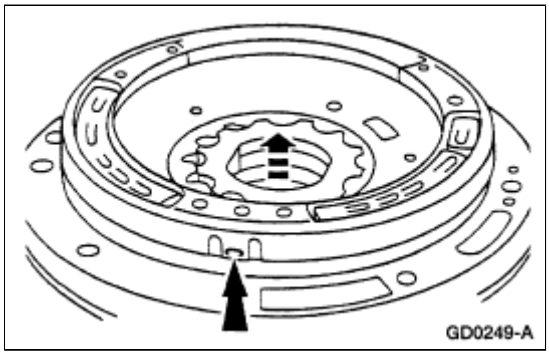
3. Remove the seal rings.



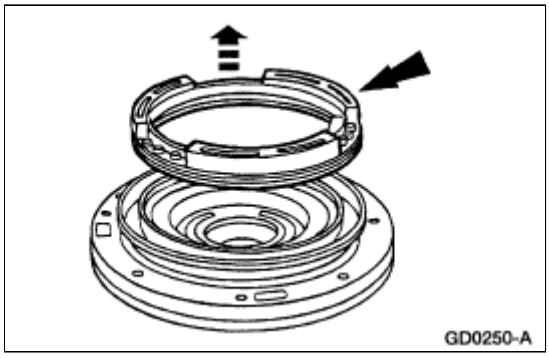
4. Remove the inner and outer pump gerotor gears.



5. Carefully pry spring retainer tabs and remove the spring retainer assembly.

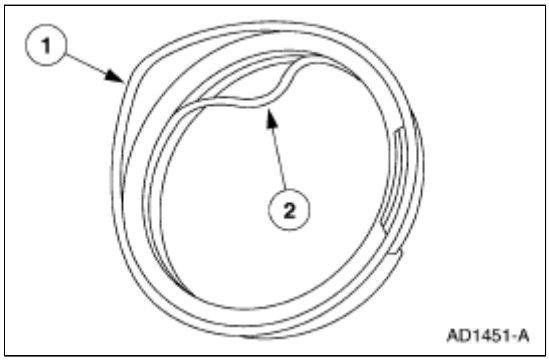


6. Remove the intermediate clutch piston.

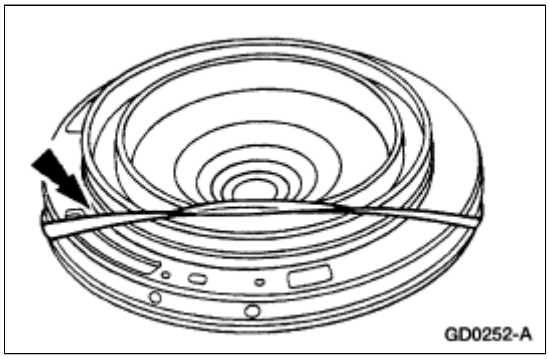


7. Remove the clutch piston seals.

1. Remove the intermediate clutch piston outer seal.
2. Remove the intermediate clutch piston inner seal.

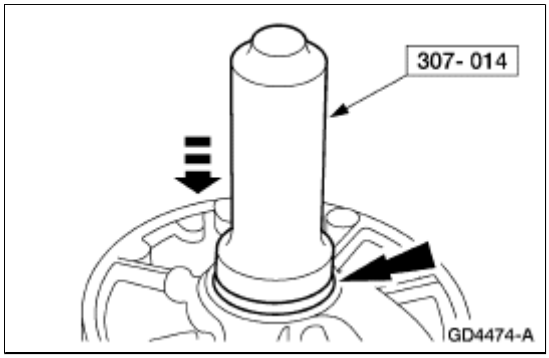


8. Remove and discard the front pump seal.

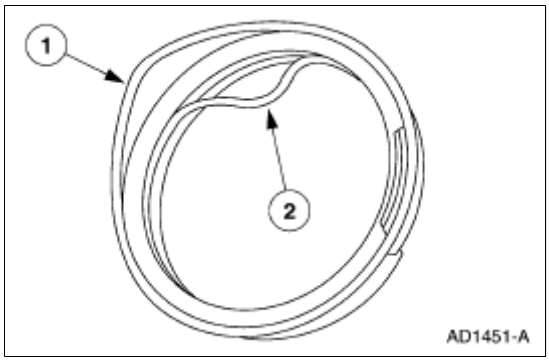


Assembly

1. Using the special tool, install the front pump seal assembly.

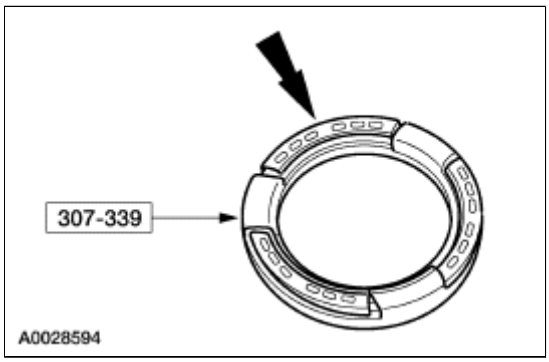


2. Install the clutch piston seals.
    1. Install the intermediate clutch piston outer seal.
    2. Install the intermediate clutch piston inner seal.

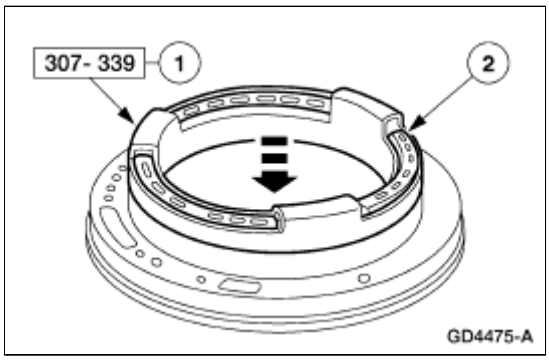


3. **NOTE:** Coat the intermediate clutch piston outer seal, inner seal and pump body with petroleum jelly.

   Install the intermediate clutch piston into the special tool.



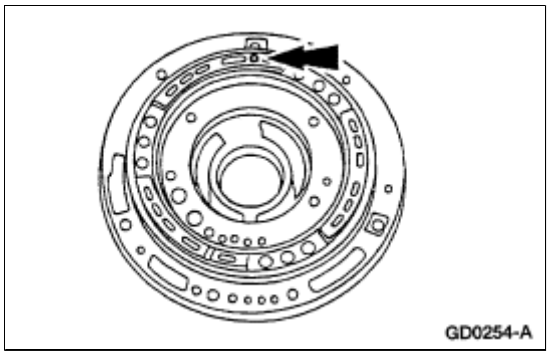
4. Using the special tool, install the intermediate clutch piston.
   1. Position the intermediate clutch piston and the special tool onto the pump body.
   2. Push the intermediate clutch piston to the bottom of the pump body bore, exerting even pressure and remove the special tool.



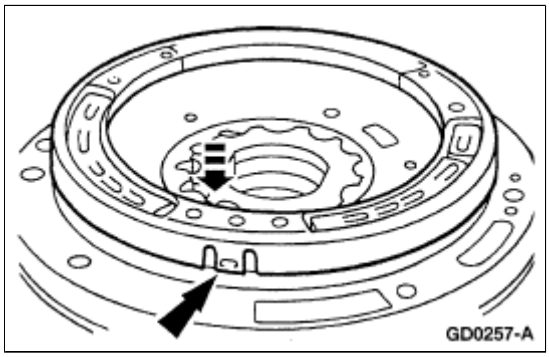
5. **CAUTION: The piston bleed hole must be located at 12 o'clock position (towards the top of the transmission). Shift problems may occur if installed incorrectly.**

   NOTE: The piston bleed hole is the only round hole in the pump body.

   Locate the piston bleed hole.

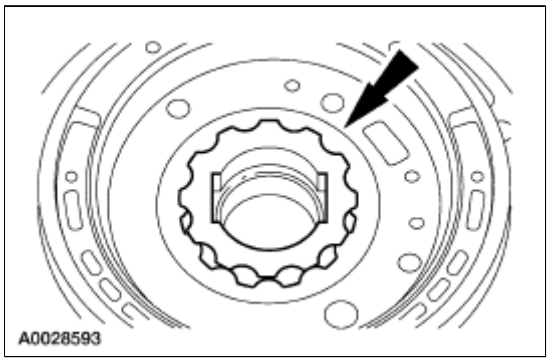


6. Install by snapping the spring retainer assembly on pump body.



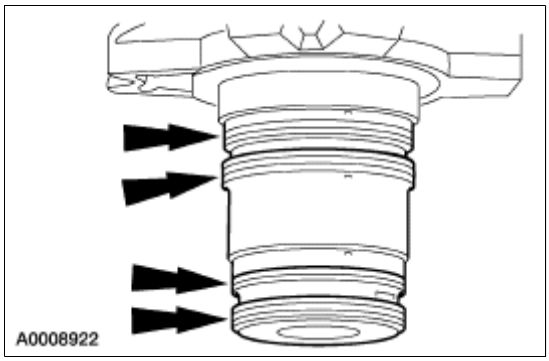
7. **NOTE:** The flats on the inner fluid pump gear have steps that must face the pump body or damage will result.

   Install the inner and outer fluid pump gerotor gears.

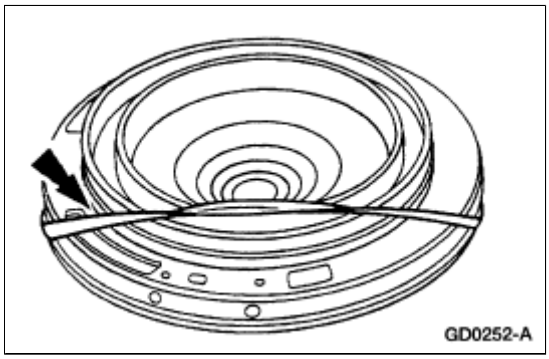


8. **NOTE:** The reverse clutch cylinder seal rings are larger than the forward clutch cylinder seals.

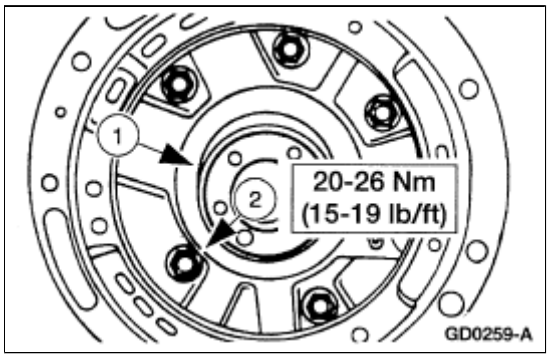
   Install the seal rings.



9. Install a new front pump seal.

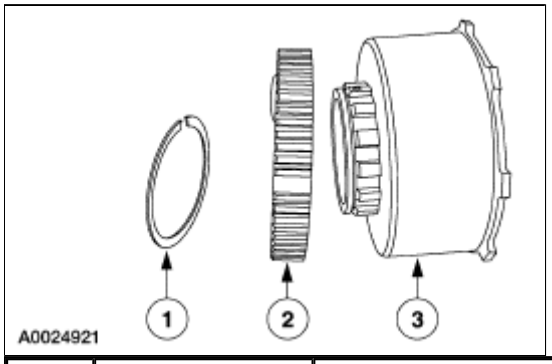


10. Assemble the front pump.
    1. Position the pump support to the pump body assembly.
    2. Install the bolts.



Intermediate One-Way Clutch

Intermediate Clutch Cylinder Disassembled View

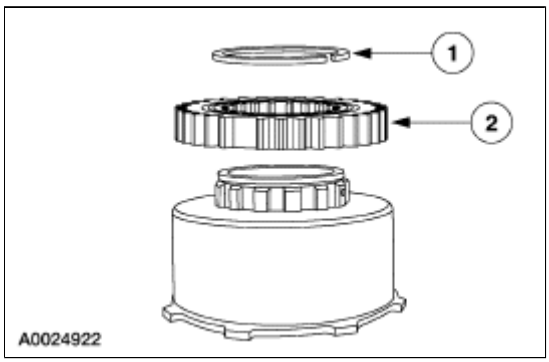


Item	Part Number	Description
1	391267-S	Retaining ring
2	7A089	Intermediate one-way clutch assembly
3	7D044	Reverse clutch drum

Disassembly

1. **NOTE:** One tab that locks the reverse clutch drum into the reverse sun shell may be removed. This is done for balancing purposes.

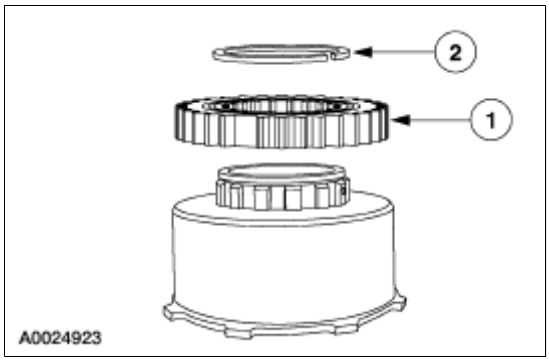
   Remove the intermediate one-way clutch.
   1. Remove the snap ring.
   2. Remove the intermediate one-way clutch.



Assembly

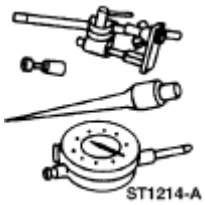
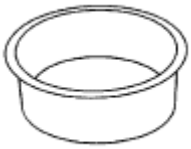
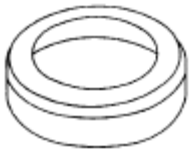
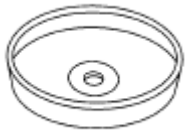
1. **NOTE:** The intermediate one-way clutch must rotate counterclockwise when installed on the reverse clutch drum and will make a ratchet sound.

   Install the intermediate one-way clutch.
   1. Install the intermediate one-way clutch.
   2. Install the snap ring.


2
1
A0024923

Reverse Clutch

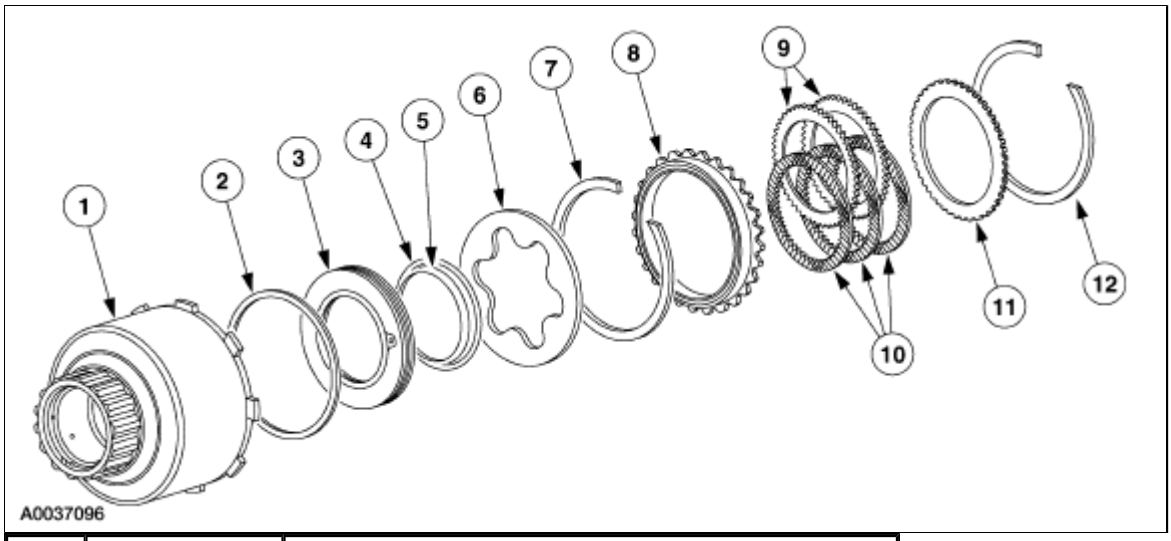
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST1206-A	Protector, Transmission Reverse Clutch Outer Fluid Seal 307-424
 ST1207-A	Protector, Transmission Reverse Clutch Inner Fluid Seal 307-425
 ST1198-B	Compressor, Clutch Spring 307-086 (T80L-77405-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Reverse Clutch Disassembled View



Item	Part Number	Description
1	7D044	Reverse clutch drum
2	7D403	Reverse clutch piston outer seal
3	7D402	Reverse clutch piston
4	7D404	Reverse clutch piston inner seal
5	7D256	Reverse clutch piston spring pressure ring
6	7B070	Reverse clutch piston spring
7	7A577	Reverse clutch piston spring ring
8	7B066	Reverse clutch front pressure plate
9	7B442	Reverse clutch external spline plates (steel)
10	7B164	Reverse clutch internal spline plates (friction)
11	7B066	Reverse clutch rear pressure plate
12	7D483	Reverse clutch retaining ring (select fit)

Disassembly

1. Inspect the clutch cylinder thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with a crocus cloth. Install a new clutch cylinder if badly scored or damaged.

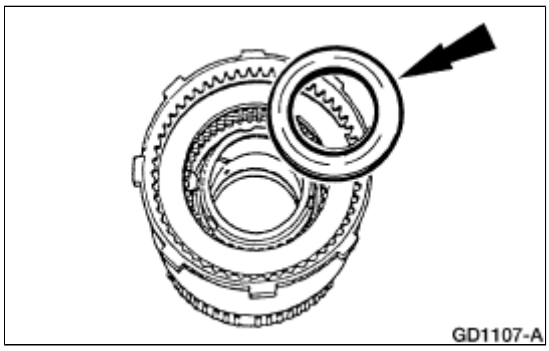
2. Check fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and install new if necessary. Inspect check balls for freedom of movement and correct seating.

3. Check clutch release spring for distortion and cracks. Install a new spring (including the wave spring) if distorted or cracked.

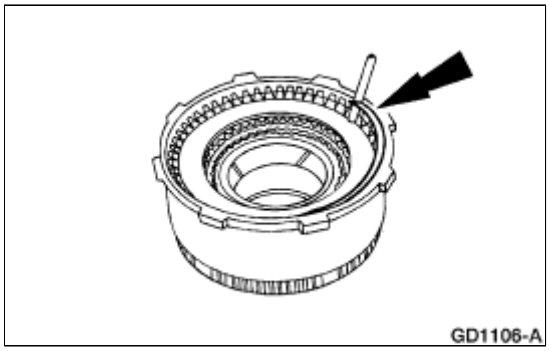
4. Inspect the composition clutch plates, steel clutch plates and clutch pressure plate for worn or scored bearing surfaces. Install new parts if they are deeply scored or burred.

5. Check the clutch plates for flatness and fit on clutch hub serrations. Discard any plate that does not slide freely on serrations or that is not flat.

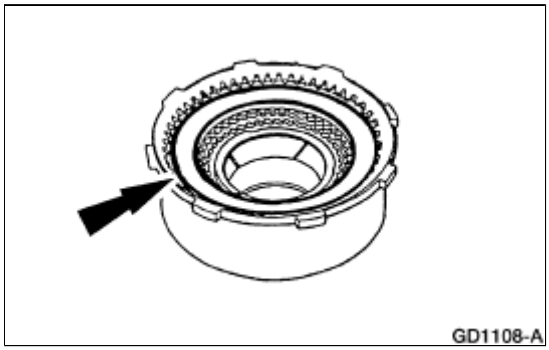
6. Check clutch hub thrust surfaces for scores and clutch hub splines for wear.
7. Remove the No. 2 forward clutch bearing.



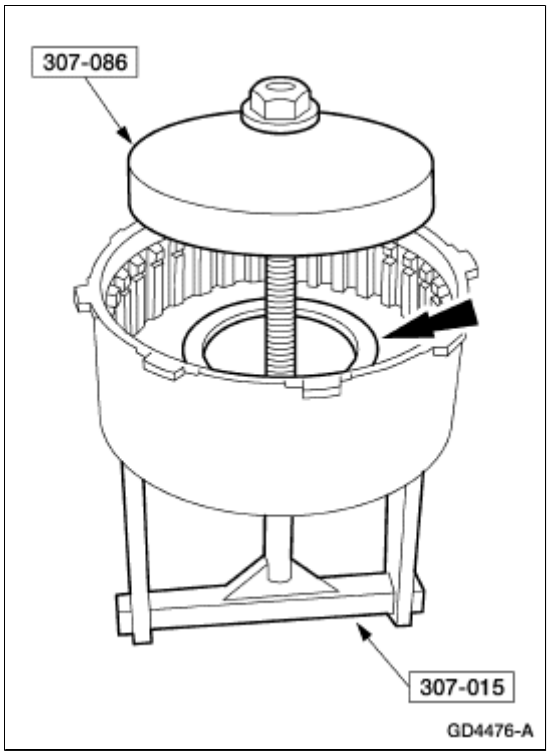
8. Remove the reverse clutch selective retaining ring.



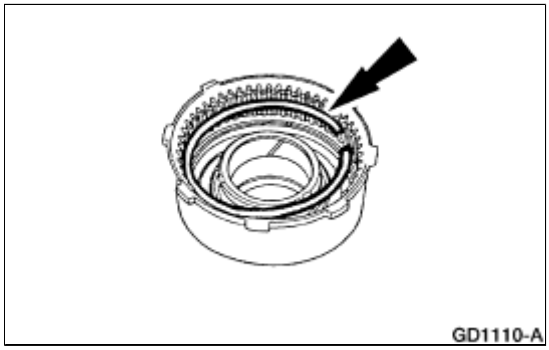
9. Remove the reverse clutch pack.



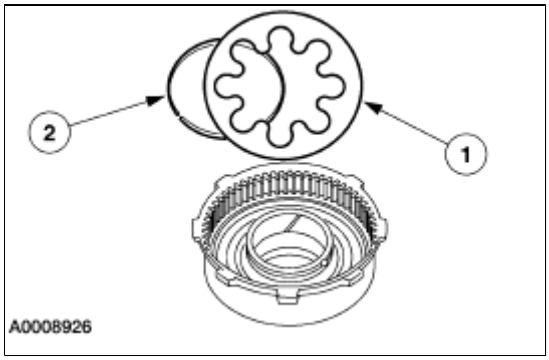
10. Using the special tools, compress the reverse clutch piston spring.



11. Remove the reverse clutch piston spring retaining ring.



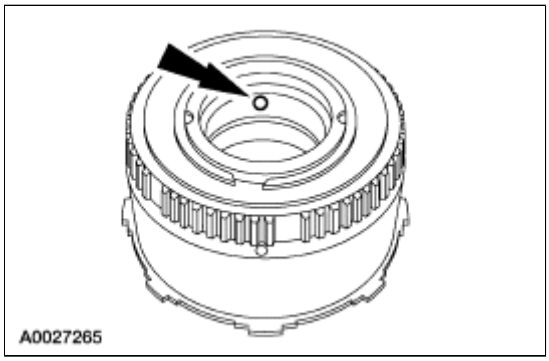
12. Remove the reverse clutch piston spring pressure ring.
    1. Remove the reverse clutch piston spring.
    2. Remove the reverse clutch piston spring pressure ring.



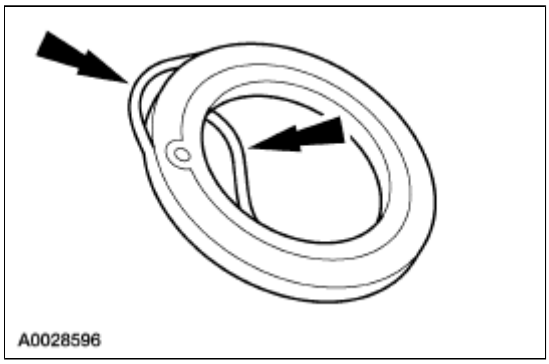
13. **NOTE:** To ease reverse clutch piston removal, it may be necessary to apply air pressure to the

reverse clutch drum. Block the opposite hole.

Remove the reverse clutch piston.



14. Remove the reverse clutch piston inner and outer seals.



Assembly

1. **NOTE:** One tab that locks the reverse clutch drum into the reverse sun shell may be removed. This is done for balancing purposes.

   Inspect the clutch cylinder thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Install a new clutch cylinder if badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect clutch piston for scores and install new if necessary. Inspect the check balls for freedom of movement and correct seating.

3. Check the clutch release spring for distortion and cracks. Install a new spring (including wave spring) if distorted or cracked.

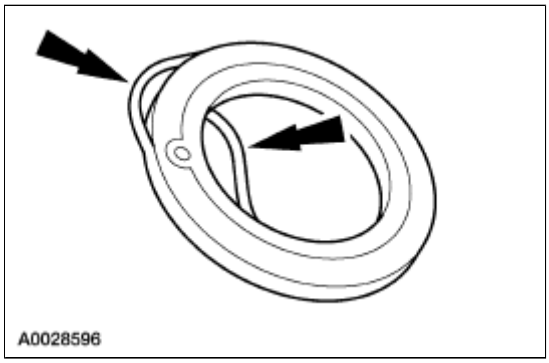
4. Inspect the composition clutch plates, steel clutch plates and clutch pressure plate for worn or scored bearing surfaces. Install new parts if they are deeply scored or burred.

5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on serrations or that is not flat.

6. Check the clutch hub thrust surfaces for scores and clutch hub splines for wear.

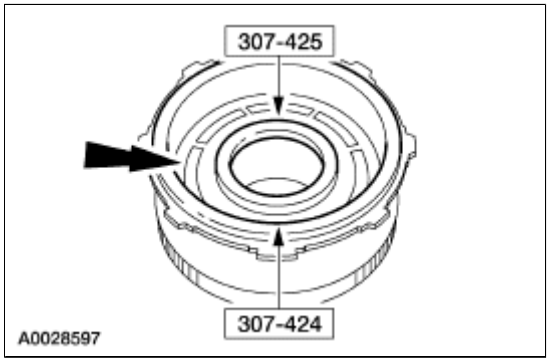
7. **NOTE:** The piston check ball must be present and moving freely.

   Install a new reverse clutch piston inner and outer seals.



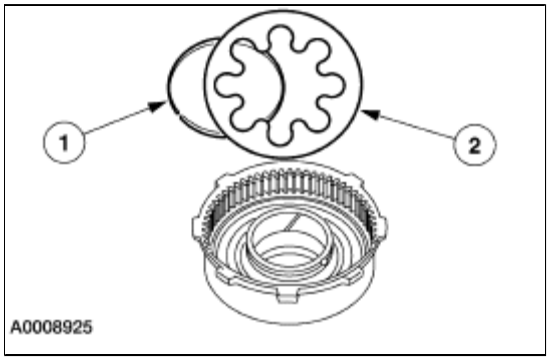
8. **NOTE:** Coat the reverse clutch piston inner seal, outer seal, drum sealing area and special tools with petroleum jelly.

   Using the special tools, install the reverse clutch piston using even pressure to push it to the bottom of the reverse clutch drum.

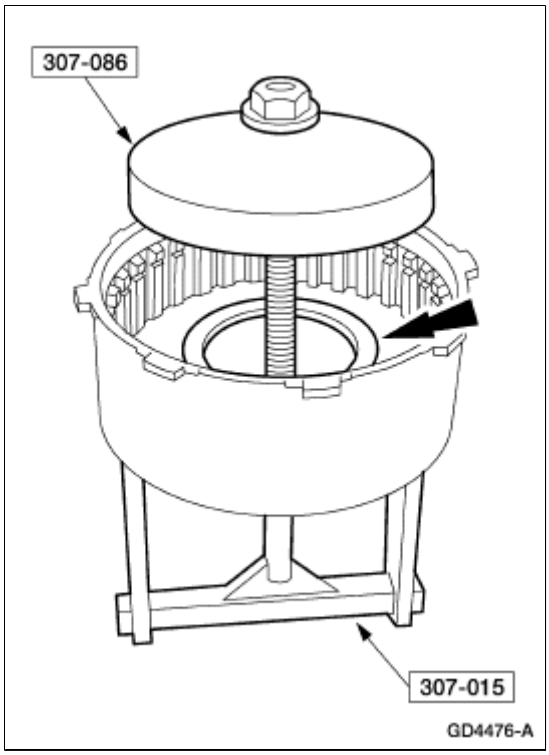


9. **NOTE:** The dished side of the reverse clutch piston spring must face the reverse clutch piston.

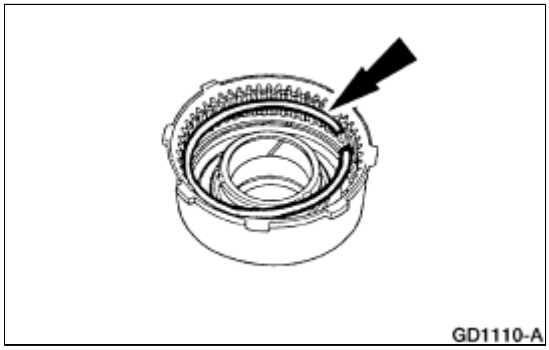
   Install the reverse clutch piston spring.
   1. Install the reverse clutch piston spring pressure ring.
   2. Install the reverse clutch piston spring.



10. Using the special tools, compress the reverse clutch piston spring.



11. Install the reverse clutch piston spring retaining ring.

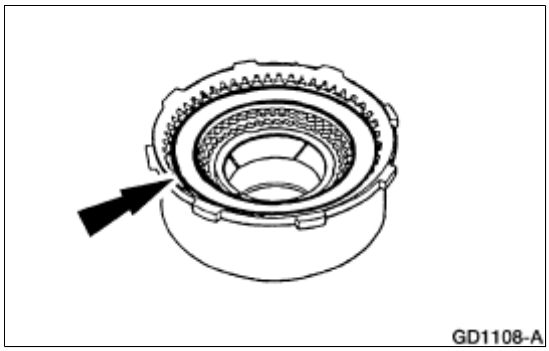


12. Remove the special tool.

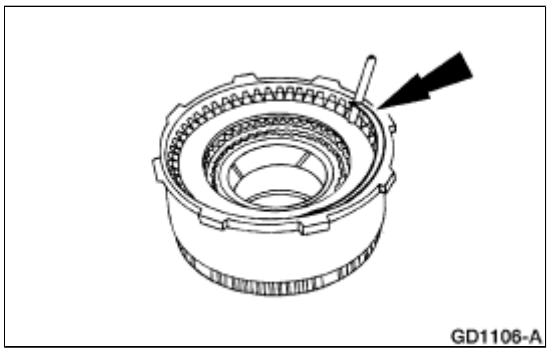
13. **CAUTION: Install the pressure plates with the flat sides facing the clutch pack.**

    NOTE: Before assembly, soak the new clutch discs in clean automatic transmission fluid for 15 minutes.

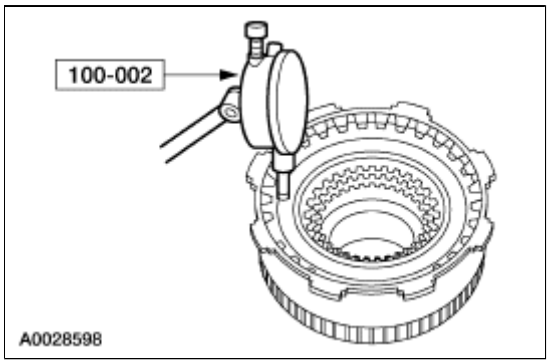
    Install the reverse clutch front pressure plate, clutch pack and reverse clutch rear pressure plate.



14. Install the reverse clutch pressure plate retainer snap ring.



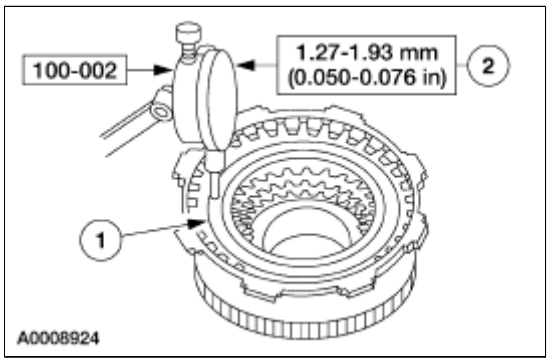
15. Install the special tool on the reverse clutch pack.
    - Push downward on the clutch pack.
    - Release pressure and zero the dial indicator.



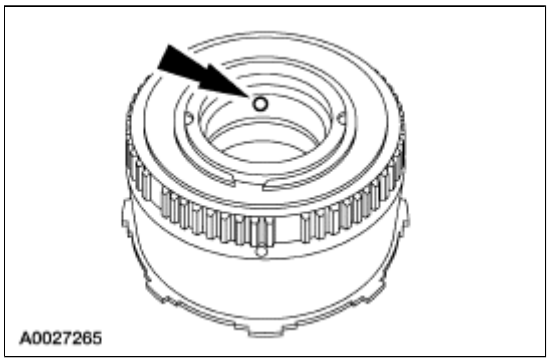
16. Using the special tool check the reverse clutch pack clearance.
    1. Lift up on the clutch pack until it fully seats against the reverse clutch pressure plate retainer.
    2. Read the dial indicator.
        - If clearance is not within specifications, install the correct size retaining ring.

Selective Retaining Rings

Specification
1.52-1.62 mm (0.060-0.064 inch)
1.87-1.98 mm (0.074-0.078 inch)
2.23-2.33 mm (0.088-0.092 inch)
2.59-2.69 mm (0.102-0.106 inch)

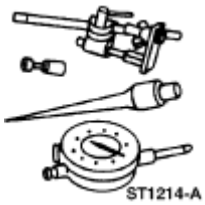


17. Check the clutch for correct operation.
    - Apply air pressure to the reverse clutch drum. The clutch should be heard and felt to work without leakage.



Forward Clutch Cylinder

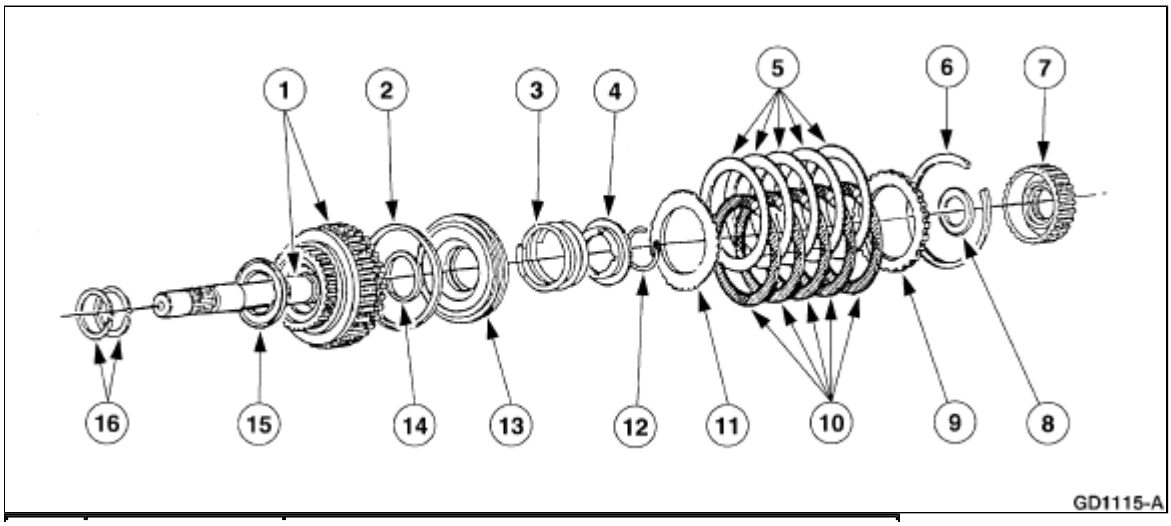
Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST1191-A	Protector, Transmission Forward Clutch Outer Fluid Seal 307-423
 ST1209-A	Compressor, Clutch Spring 307-096 (T81P-70235-A)

Material

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Forward Clutch — Disassembled View



Item	Part Number	Description
1	7F207	Forward clutch cylinder and shaft
2	7A548	Forward clutch piston outer seal
3	7A480	Forward clutch piston return spring
4	7A527	Forward clutch retainer return spring
5	7B442	Forward clutch external spline plate (steel)
6	7D483	Retaining snap ring
7	7B067	Forward clutch hub
8	7F231	No. 3 forward clutch hub front bearing
9	7B066	Forward clutch pressure plate
10	7B164	Forward clutch internal spline plates (friction)
11	7E085	Forward clutch pressure spring
12	388099-S	Retaining snap ring
13	7A262	Forward clutch piston
14	7C099	Forward clutch piston inner seal
15	7A166	No. 2 forward clutch bearing
16	7B497	Input shaft seal

Disassembly

1. Inspect the clutch cylinder thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all the fluid passages. Inspect the clutch piston for scores and replace if necessary. Inspect check balls for freedom of movement and correct seating.

3. Check the clutch release spring for distortion and cracks. Replace the spring (including wave spring) if distorted or cracked.

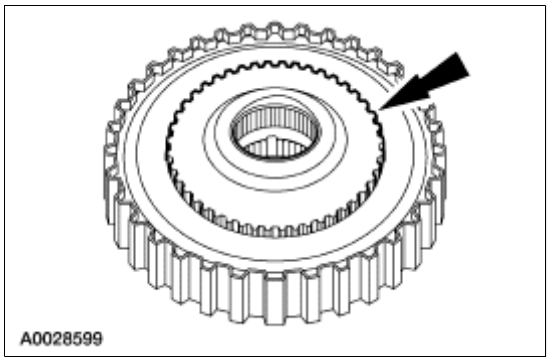
4. Inspect the composition clutch plates, steel clutch plates and clutch pressure plate for worn or scored bearing surfaces. Replace all parts that are deeply scored or burred.

5. Check the clutch plates for flatness and fit on clutch hub serrations. Discard any plate that does not slide freely on serrations or that is not flat.

6. Check the clutch hub thrust surfaces for scores and clutch hub splines for wear.

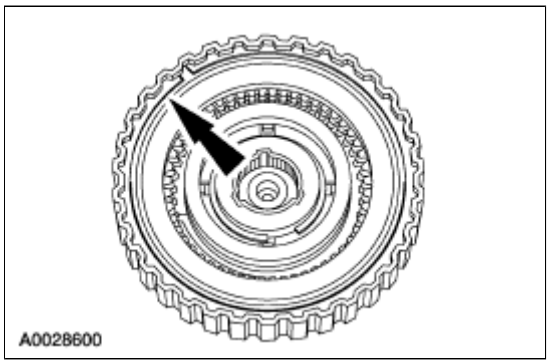
7. **NOTE:** The forward clutch hub may remain in the shell during disassembly.

   Remove the forward clutch hub and the No. 3 forward clutch hub front bearing.

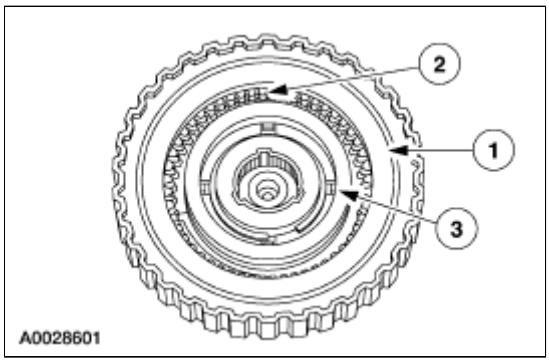


8. **NOTE:** To aid handling, the forward clutch assembly may be set in the extension housing or a hole in the work bench.

   Remove the clutch pack selective retaining ring.

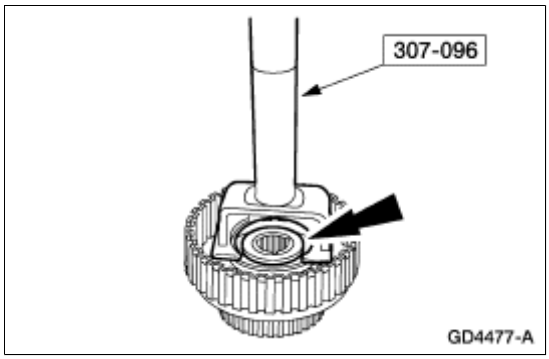


9. Remove the following components.
   1. Remove the pressure plate.
   2. Remove the clutch pack.
   3. Remove the pressure spring.



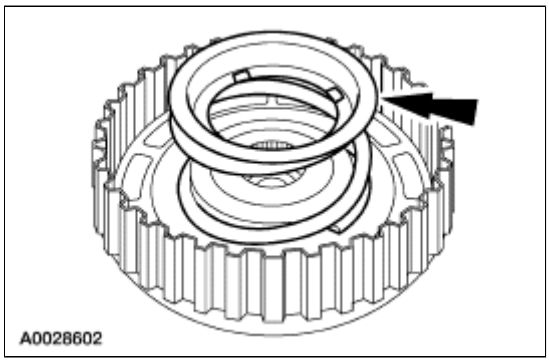
10. **CAUTION: Apply only enough pressure to release pressure on the retaining ring. If too much pressure is applied, the spring may break.**

    Using the special tool, remove the forward clutch retaining ring.



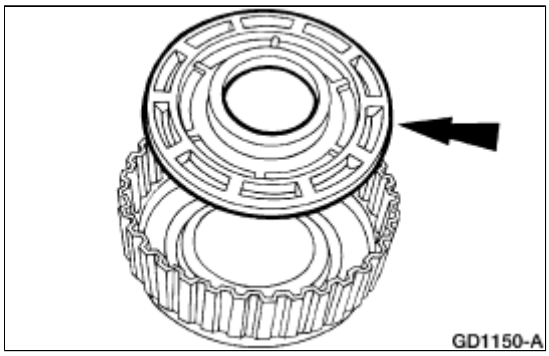
11. Slowly release the press and remove the forward clutch from the press.

12. Remove the forward clutch retainer and the return spring.

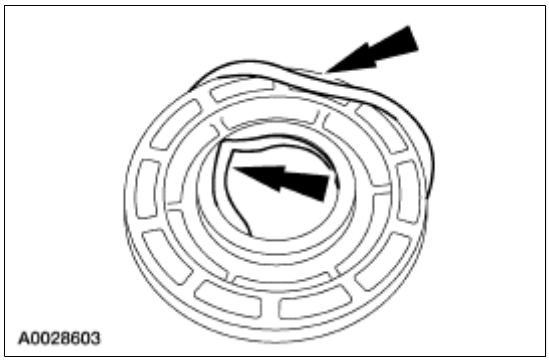


13. **NOTE:** Air pressure may be required to remove the forward clutch piston.

    Remove the forward clutch piston.

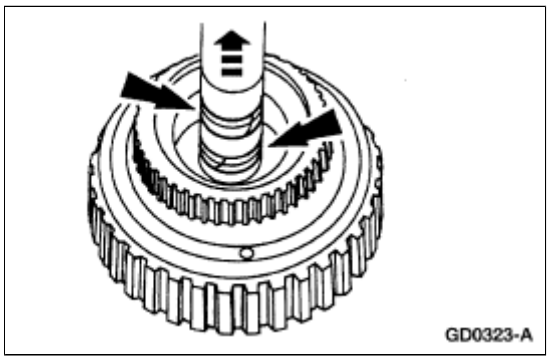


14. Remove the inner and outer forward clutch piston seals.

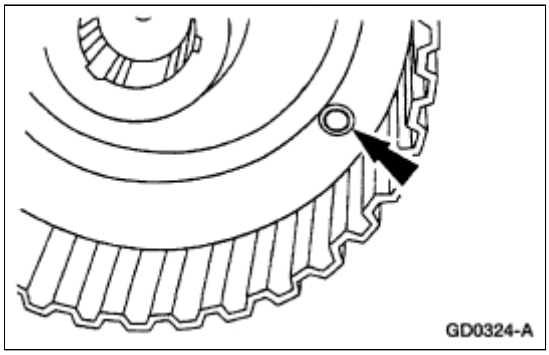


15. **NOTE:** The seals are solid seals but will be replaced with scarf cut seals.

    Remove the forward clutch input shaft seals.



16. Make sure the check ball in the clutch cylinder is free and clean. Check for proper seating.



Assembly

1. Inspect the clutch cylinder thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with crocus cloth. Replace the clutch cylinder if badly scored or damaged.

2. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and replace if necessary. Inspect check balls for freedom of movement and correct seating.

3. Check the clutch release spring for distortion and cracks. Replace the spring (including the wave spring) if distorted or cracked.

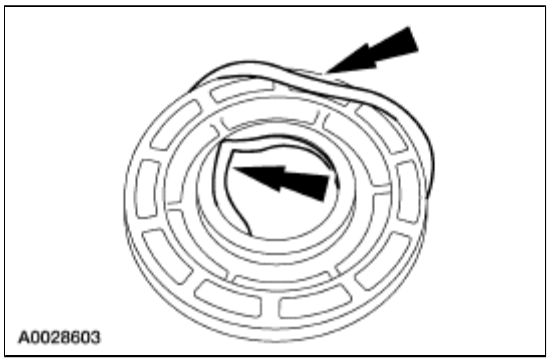
4. Inspect composition clutch plates, steel clutch plates and clutch pressure plate for worn or scored bearing surfaces. Replace all parts that are deeply scored or burred.

5. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on serrations or that is not flat.

6. Check the clutch hub thrust surfaces for scores and the clutch hub splines for wear.

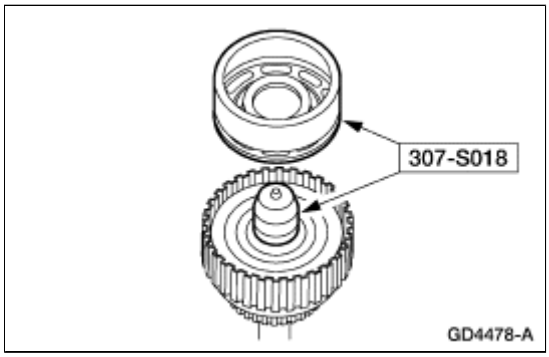
7. **NOTE:** To aid handling, the forward clutch assembly may be set in the extension housing or a hole in the work bench.

   Install the inner and outer forward clutch piston seals. Note the direction of the sealing rings before installation.

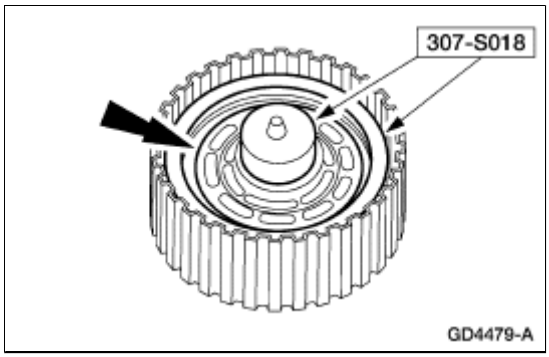


8. **NOTE:** Coat the piston seals and clutch drum sealing area with petroleum jelly.

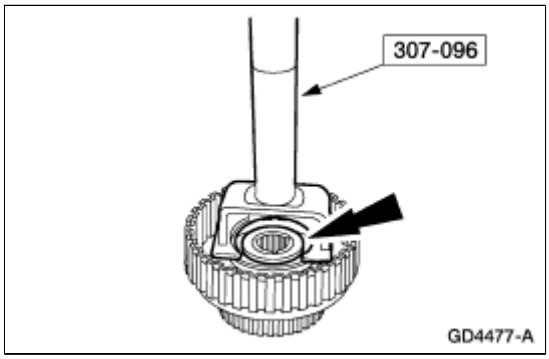
   Position the special tools on the clutch piston.



9. Using the special tools, install the forward clutch piston into the clutch drum.
   - Push the piston to the bottom of the drum using even pressure.



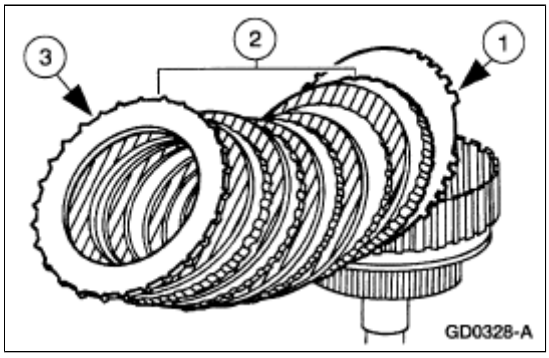
10. Using the special tool, compress the piston return spring and install the retaining ring.



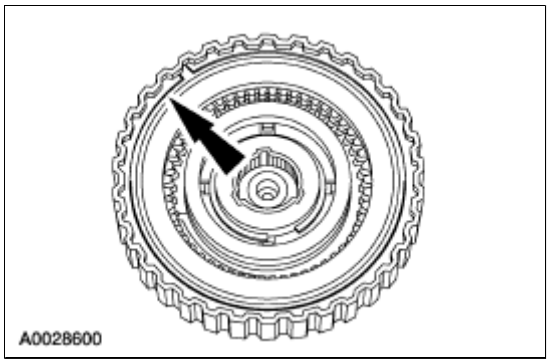
11. Slowly release the press pressure and remove the forward clutch.

12. **NOTE:** Before assembly, soak the new clutch discs in clean automatic transmission fluid for 15 minutes.

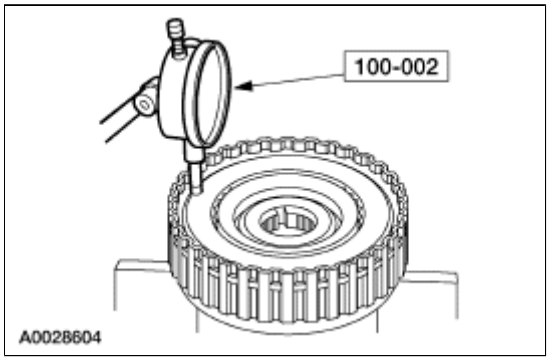
    Install the clutch pack assembly.
    1. Install the pressure ring.
    2. Install the clutch pack.
    3. Install the pressure plate.



13. Install the clutch pack retaining ring.



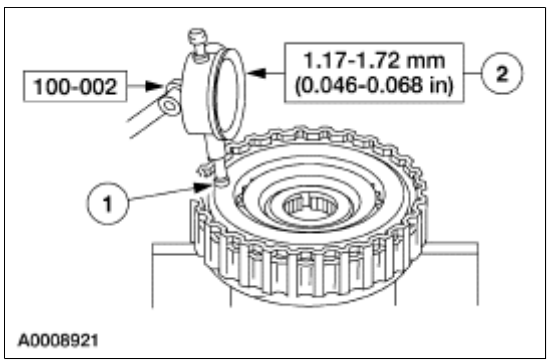
14. Install the special tool on the forward clutch pack.
    - Push downward on the clutch pack.
    - Release pressure and zero the dial indicator.



15. Check the clutch pack clearance.
    1. Lift up on the clutch pack until it fully seats against the clutch pressure plate retainer.
    2. Read the dial indicator.
        - If the clearance is not within specifications, install the correct size retaining ring.

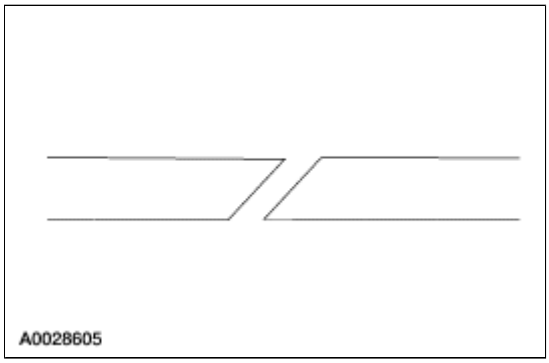
Selective Retaining Ring

Specification
1.52-1.62 mm (0.060-0.064 inch)
1.87-1.98 mm (0.074-0.078 inch)
2.23-2.69 mm (0.086-0.106 inch)
2.59-2.69 mm (0.102-0.106 inch)

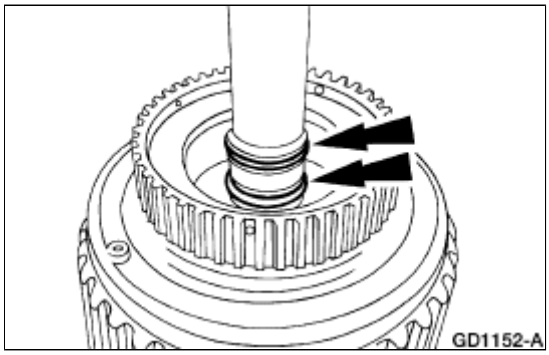


16. **NOTE:** Make sure the scarf-cut seals are mated correctly.

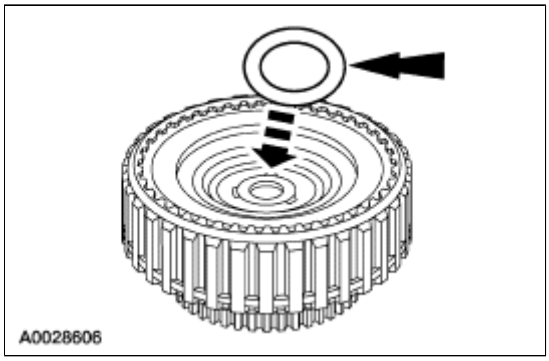
    Slide the two scarf-cut seals on the input shaft.



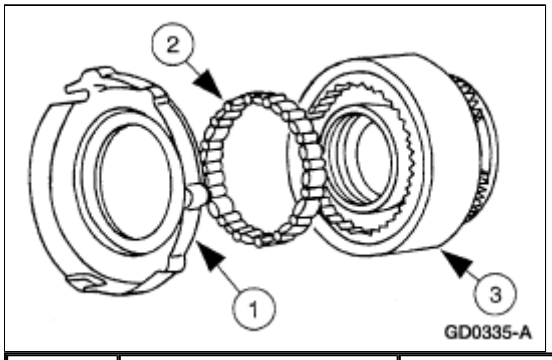
17. Install the two scarf-cut seals on input shaft.



18. Install the No. 3 forward clutch hub front bearing and the forward clutch hub.



Planetary Gear Support Assembly and Planetary One-Way Clutch

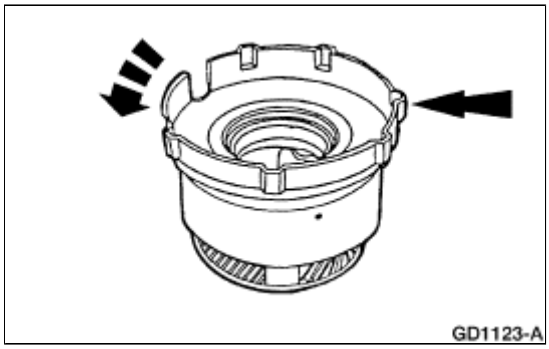


Item	Part Number	Description
1	7A130	Planetary gear support
2	7A089	Planetary one-way clutch
3	7A398	Planetary assembly

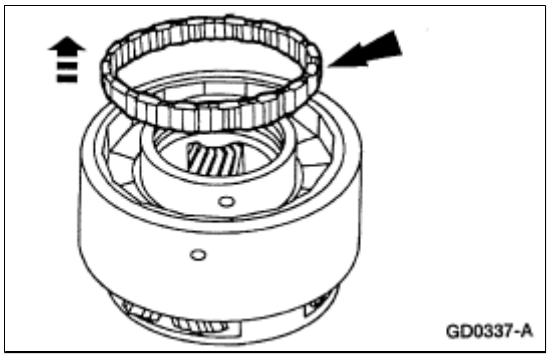
Disassembly and Assembly

1. **NOTE:** Inspect the outer and inner races for scores or damaged surface areas where rollers contact the races. Inspect the rollers and springs for excessive wear or damage. Inspect the spring and cage for bent or damaged spring retainers.

   Rotate the center support counterclockwise and lift to remove the planetary gear support.



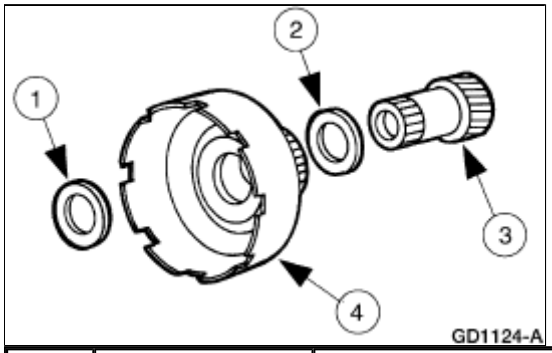
2. Remove the planetary one-way clutch.



3. To assemble, reverse the disassembly procedure.

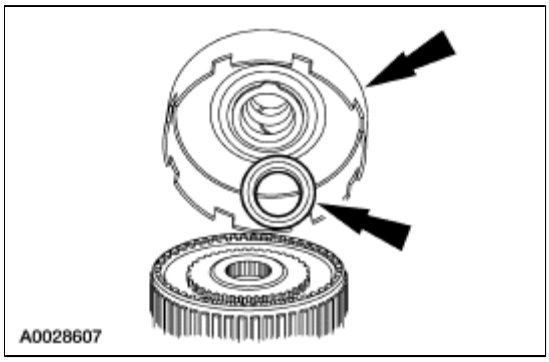
Reverse Sun Gear

Disassembly

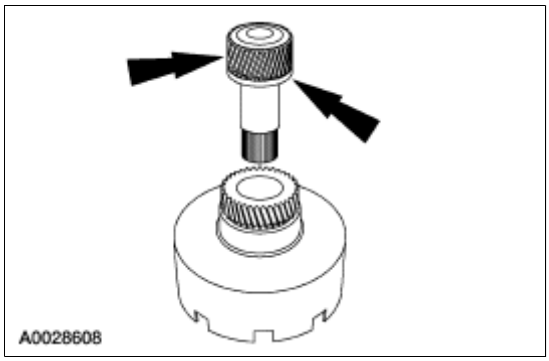


Item	Part Number	Description
1	7C096	Forward clutch hub bearing No. 4
2	7F244	Forward clutch sun gear bearing No. 5
3	7A399	Forward clutch sun gear
4	7A019	Reverse sun gear assembly

1. Remove the reverse clutch sun gear assembly and the No. 4 forward clutch hub bearing and race.



2. Remove the forward clutch sun gear assembly and the No. 5 forward clutch sun gear bearing and race.

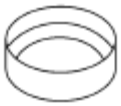


Assembly

1. The forward clutch sun gear and reverse sun gear assembly are assembled as part of the transmission assembly procedure.

Output Shaft and Direct Clutch Cylinder

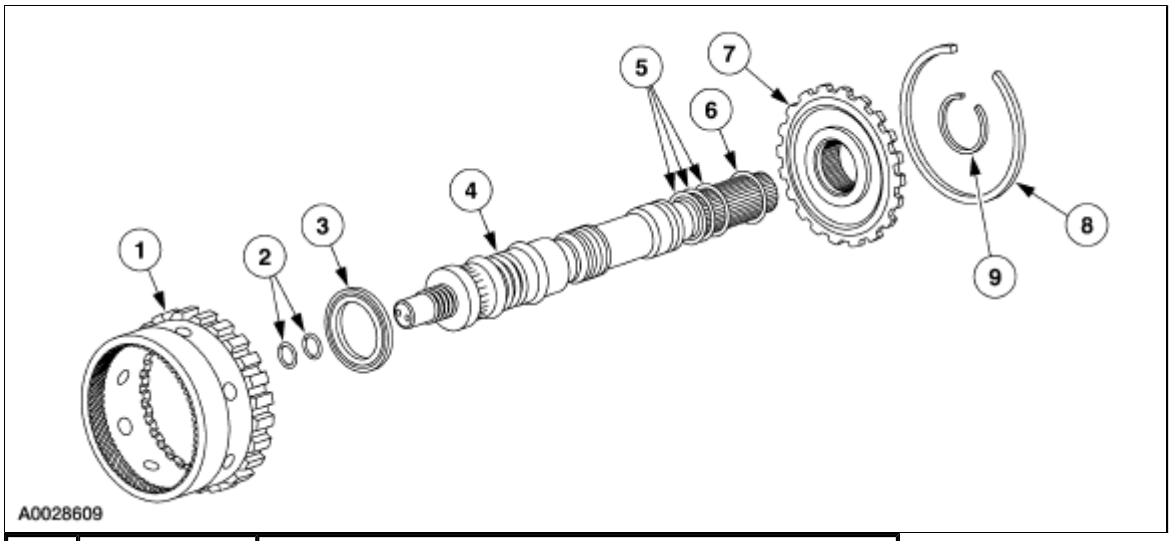
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST1204-A	Protector, Piston Seal 307-080 (T80L-77234-A)
 ST1901-A	Protector, Transmission Direct Clutch Outer Fluid Seal 307-422

Material

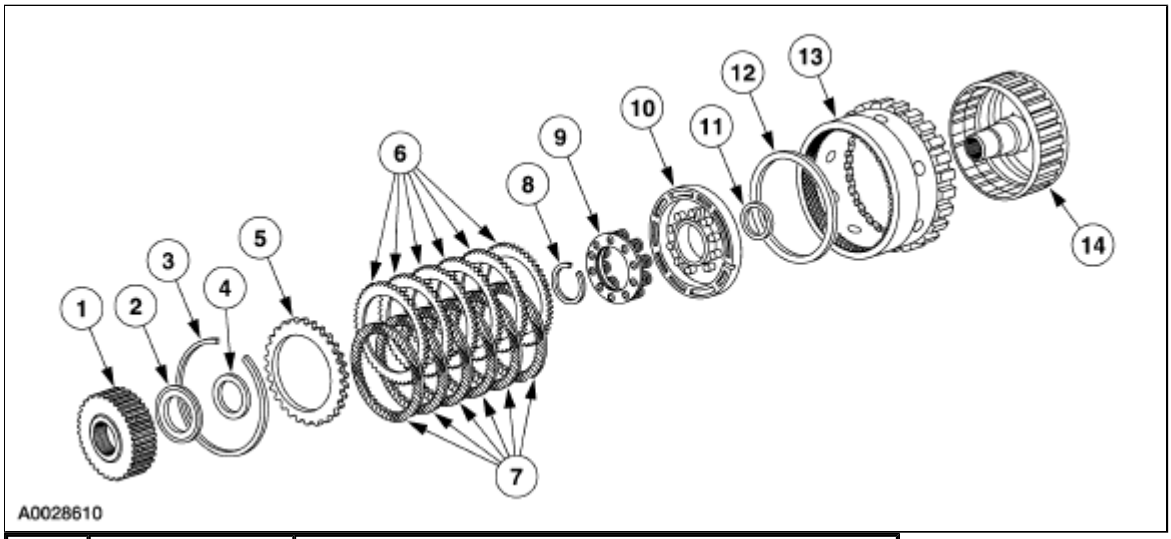
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

Output Shaft, Direct Clutch Cylinder and Ring Gear Disassembled View



Item	Part Number	Description
1	7A233	Output shaft ring gear assembly
2	7F274	Output shaft to direct clutch cylinder seal (2 req'd)
3	7F240	Direct clutch outer bearing and race assembly No. 8
4	7060	Output shaft
5	7F273	Output shaft to case seal (3 req'd)
6	87054-S94	O-ring seal
7	7D164	Output shaft hub
8	97713-S	Retaining snap ring
9	7C122	Snap ring

Direct Clutch Disassembled View



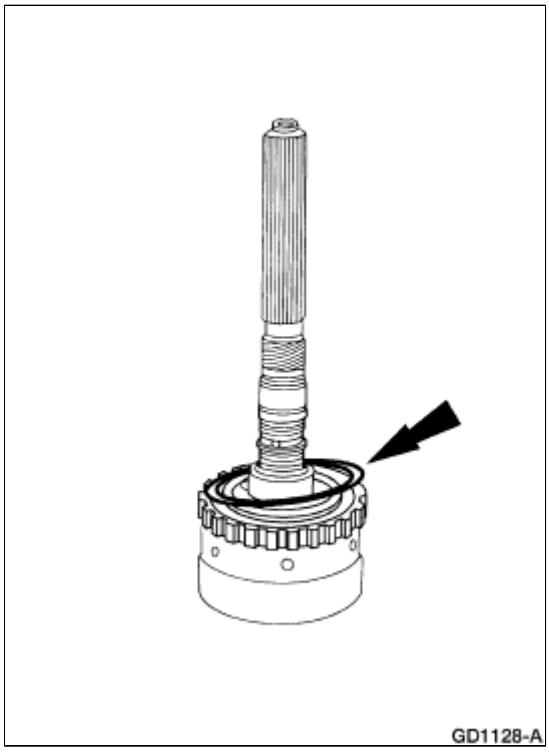
Item	Part Number	Description
1	7F236	Direct clutch hub
2	7F243	No. 7 direct clutch bearing

3	7D483	Direct clutch pressure plate retaining ring
4	7F237	Direct clutch inner bearing support
5	7B066	Direct clutch pressure plate
6	7B442	Direct clutch external spline plates (steel)
7	7B164	Direct clutch internal spline plates (friction)
8	388104-S2	Retaining ring
9	7F235	Direct clutch retainer and spring assembly
10	7A262	Direct clutch piston
11	7C099	Direct clutch piston inner seal
12	7A548	Direct clutch piston outer seal
13	7A233	Output shaft ring gear
14	7F283	Direct clutch cylinder

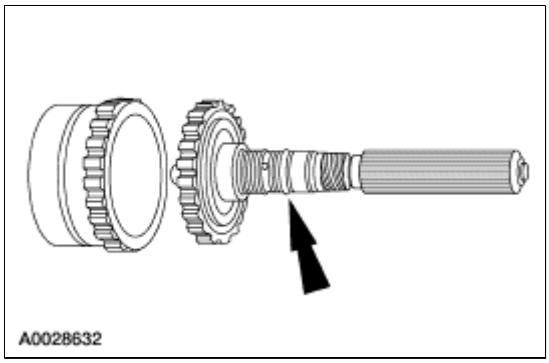
Disassembly

1. **NOTE:** The index mark on the output shaft must be aligned with the index mark on the output shaft ring gear during the assembly procedure.

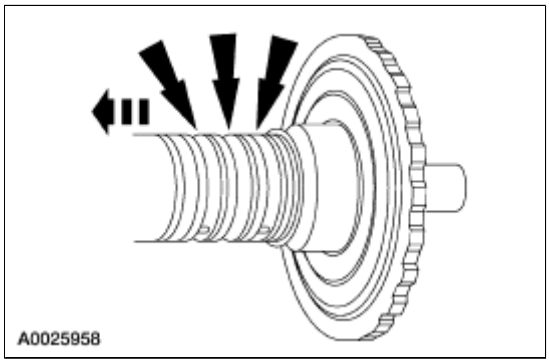
   Remove the ring gear snap ring.



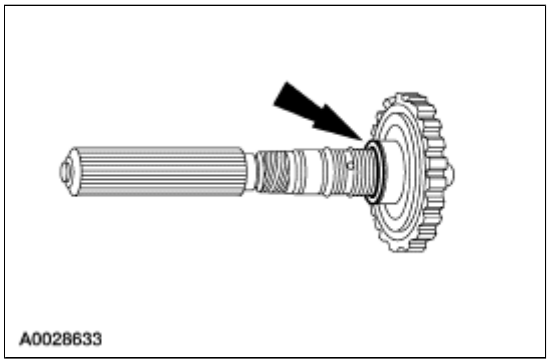
2. Separate the ring gear and output shaft.



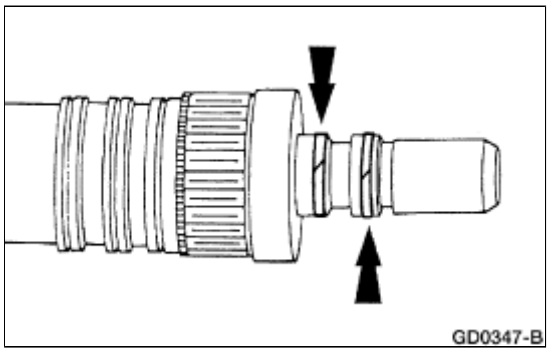
3. Remove the three output shaft seal rings.



4. Remove the output shaft hub snap ring and the output shaft hub.

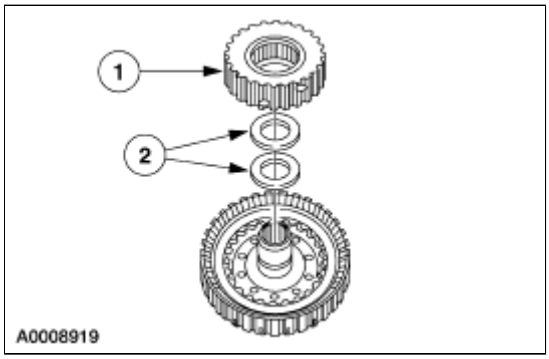


5. Remove the two direct clutch seal rings.



6. Remove the No. 7 direct clutch inner bearing support.

1. Remove the direct clutch hub.
2. Remove the No. 7 direct clutch inner bearing support.



7. Inspect the clutch cylinder thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Minor scores or burrs may be removed with a crocus cloth. Install a new clutch cylinder if badly scored or damaged.

8. Check the fluid passage in the clutch cylinder for obstructions. Clean out all fluid passages. Inspect the clutch piston for scores and install new if necessary. Inspect the check balls for freedom of movement and correct seating.

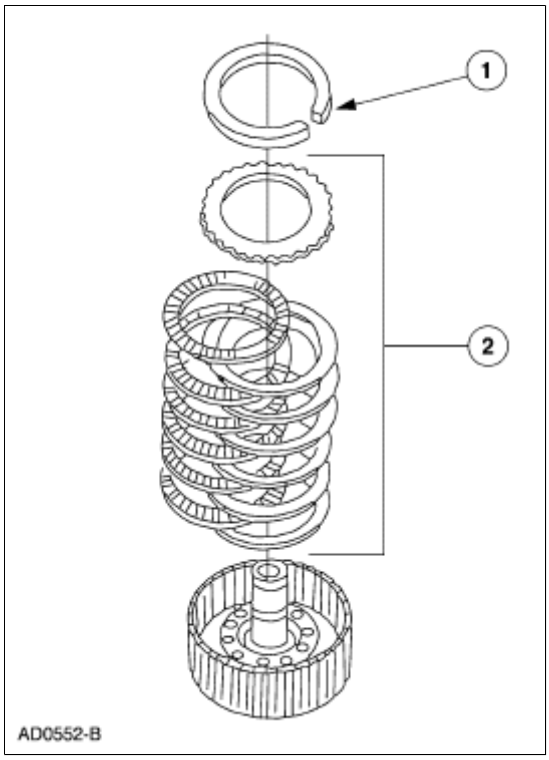
9. Check clutch release spring for distortion and cracks. Install a new spring (including wave spring) if distorted or cracked.

10. Inspect composition clutch plates, steel clutch plates and clutch pressure plate for worn or scored bearing surfaces. Install new parts if they are deeply scored or burred.

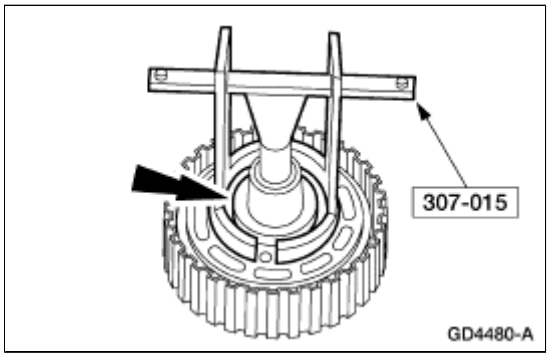
11. Check the clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat.

12. Check the clutch hub thrust surfaces for scores and clutch hub splines for wear.

13. Remove the direct clutch pack.
    1. Remove the selective retaining ring.
    2. Remove the direct clutch pack.



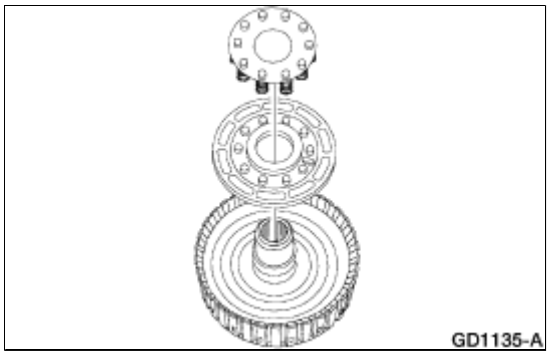
14. Using the special tool, compress the piston return spring and remove the snap ring.



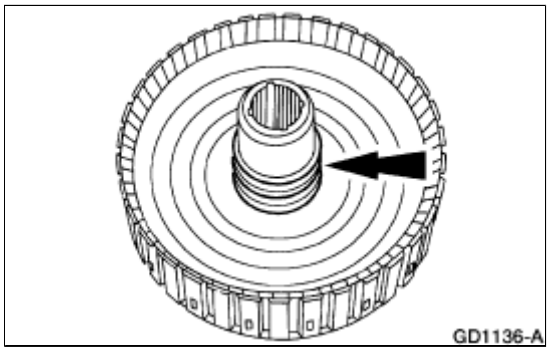
15. **WARNING: Wear safety glasses when using compressed air.**

NOTE: If necessary, use regulated compressed air 207 kPa (30 psi) max pressure to remove the clutch piston.

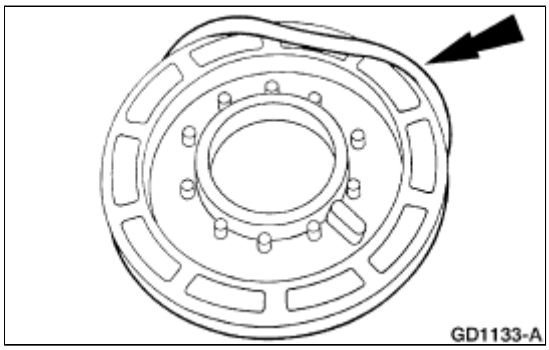
Remove the support and spring assembly and piston.



16. Remove the inner piston seal.



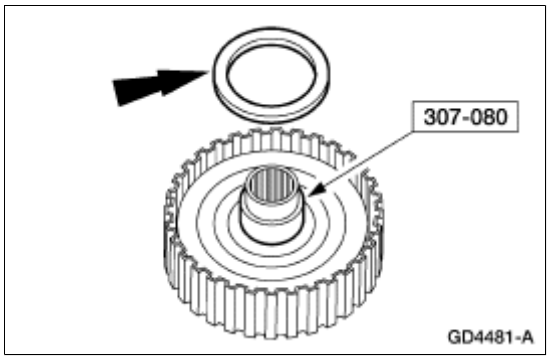
17. Remove the outer piston seal.



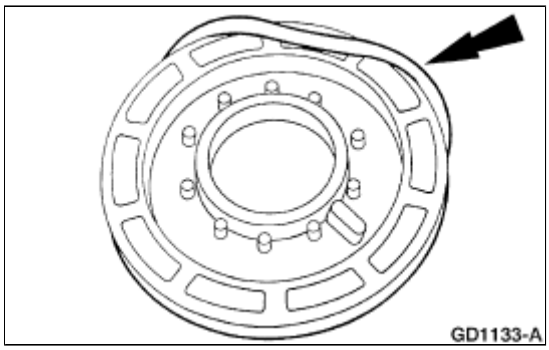
Assembly

1. **NOTE:** Lubricate direct clutch piston inner seal and seal protector with petroleum jelly.

   Using the special tool, install the inner piston seal.
   - Install the seal with sealing lip facing down.

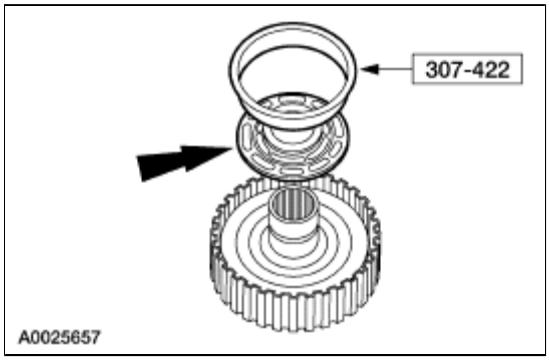


2. Install the clutch piston outer seal so that when the piston is installed the sealing lip points toward the bottom of the cylinder.



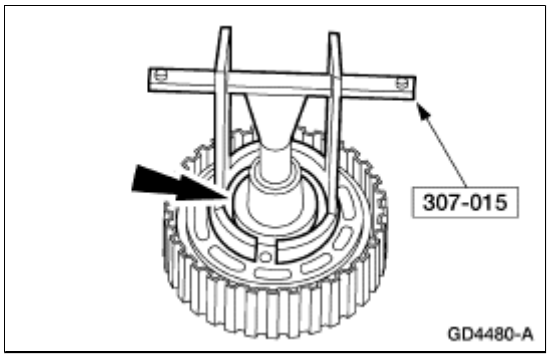
3. **NOTE:** Coat the inner and outer direct clutch piston seals, clutch cylinder sealing area and piston inner sealing area with petroleum jelly.

   Using the special tool, install the direct clutch piston.



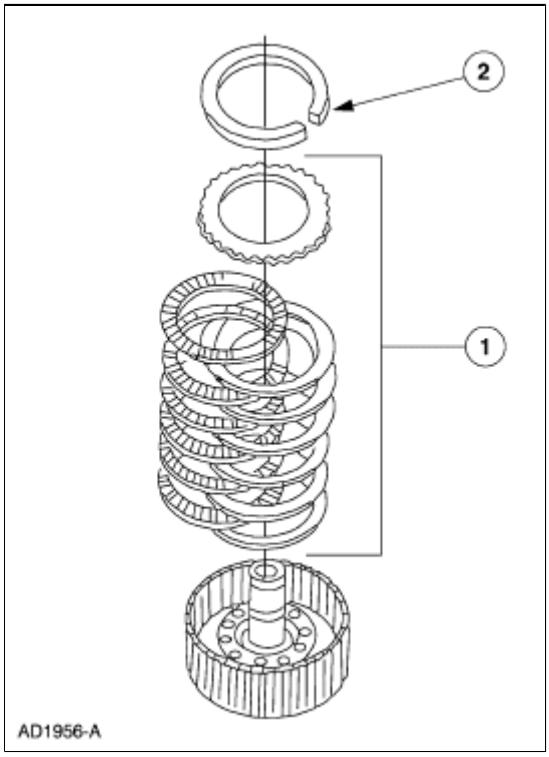
4. Install the piston return spring and retainer assembly.

5. Using the special tool, compress the piston return spring and install the retaining ring.



6. **NOTE:** Before assembly, soak new clutch discs in clean automatic transmission fluid for 15 minutes.

   Install the clutch pack retaining ring.
   1. Alternate external spline (steel) plates and internal spline (friction) plates, starting with a steel plate and ending with the friction plate.
   2. Install the clutch pack retaining ring.

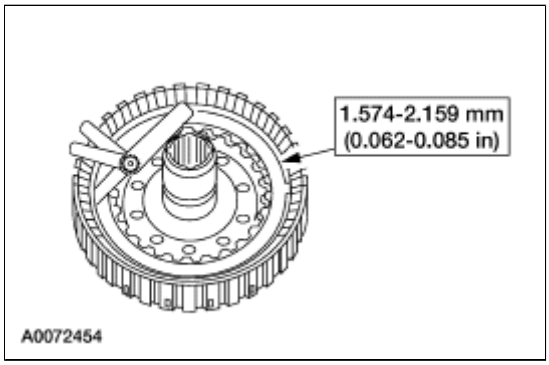


7. Use a feeler gauge to check the clearance between the clutch pack selective retaining ring and the pressure plate.
   - If the clearance is not within specifications, install the correct size retaining ring and recheck the clearance.

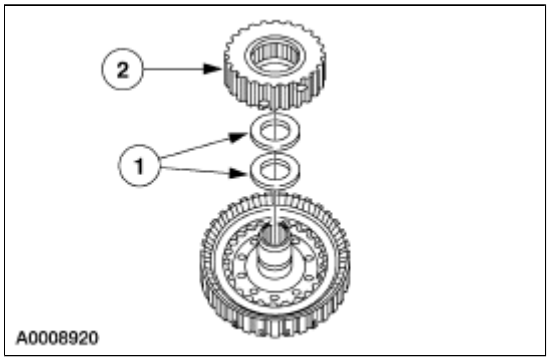
Selective Retaining Ring

Specification
1.52-1.62 mm (0.060-0.064 inch)
1.87-1.98 mm (0.074-0.078 inch)
2.24-2.34 mm (0.088-0.092 in)

2.59-2.69 mm (0.102-0.106 inch)



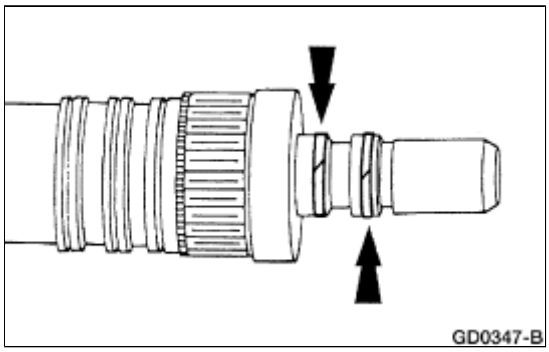
8. Install the direct clutch hub.
    1. Install the No.7 direct clutch inner bearing support.
    2. Install the direct clutch hub.



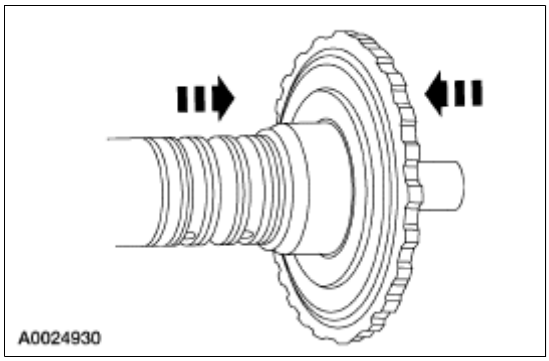
NOTE: Inspect the output shaft bearing surfaces for scores. Inspect the output shaft splines for wear. Inspect all bushings.

9. **CAUTION: Make sure the seals are lapped correctly. Internal damage may occur.**

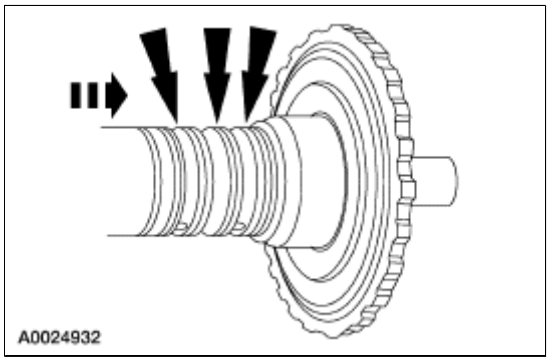
    Install the two direct clutch seal rings.



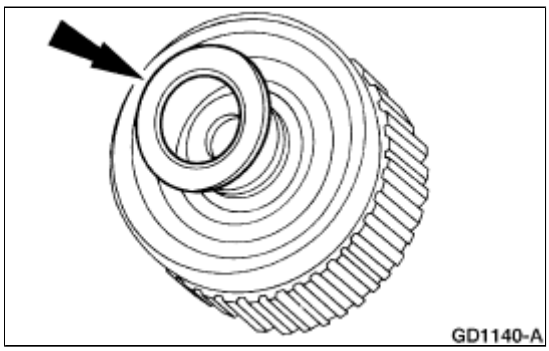
10. Install the output shaft hub.
    - Position the output shaft hub.
    - Install the retaining ring.



11. Install the three output shaft seal rings.

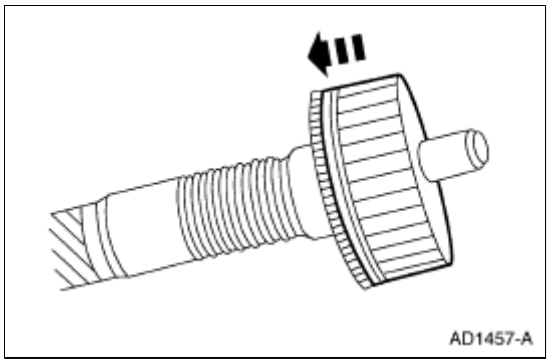


12. Install the No. 8 needle bearing on the direct clutch cylinder.



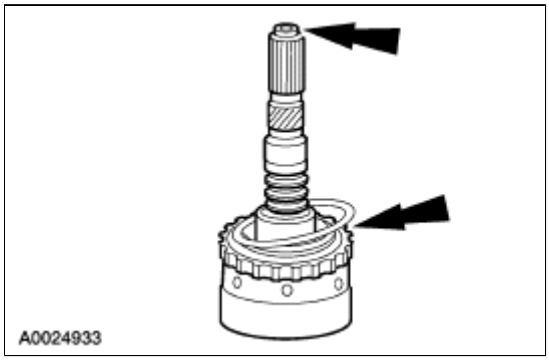
13. **NOTE:** Direct clutch cylinder may be installed after the output shaft ring gear is installed to the output shaft hub.

    Assemble the direct clutch on the output shaft.



14. **CAUTION: The index mark on the output shaft must be aligned with the index mark on the output shaft ring gear.**

Align the index marks on output shaft and the output shaft ring gear and install the ring gear on the output shaft.



Torque Converter

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - Converter stud or studs, impeller hub or bushing are damaged.
    - Discoloration (due to overheating).
    - The torque converter is found to be out of specification when carrying out one of the following torque converter checks:
        - One-Way Clutch Check
        - End Play Check
        - Stator to Turbine Interference Check
        - Stator to Impeller Interference Check
        - Torque Converter Leak Check
    - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
        - Major metallic failure.
        - Multiple clutches or clutch plate failures.
        - Sufficient component wear which results in metallic contamination.

Torque Converter Cleaning And Inspection

1. If the torque converter (7902) is being replaced, continue with Substep 2 of Step 2.

2. If the torque converter is not being replaced, the following procedures must be performed:
    1. The torque converter must be thoroughly cleaned.
        - Torque converters with drain plugs can be cleaned by using Torque Converter/Oil Cooler Cleaner.
        - Torque converters without drain plugs can be cleaned by hand. Partially fill the torque converter using only recommended transmission fluid for the applicable transmission. Hand agitate the torque converter and then thoroughly drain the fluid. Refill the torque converter with new fluid specified for transmission, and reinstall.
    2. All in-tank and auxiliary coolers must be thoroughly cleaned by forward and backward flushing; refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.
    3. All cooler lines must be thoroughly cleaned by backward and forward flushing; refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.
    4. All Cooler Bypass Valves (CBV), if equipped, must be thoroughly cleaned.
    5. Carry out the Transmission Fluid Cooler Flow Test.
    6. If the transmission cooling system fails the Transmission Fluid Cooler Flow Test, the fluid cooler, cooler bypass valve, and/or cooler lines must be replaced; refer to Section 307-02 .
    7. If the coolers are to be replaced, use only factory approved service parts; refer to Section 303-03 .

Torque Converter Flushing

Material

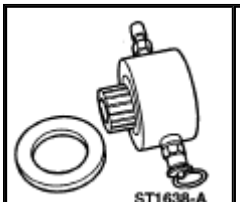
Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

NOTE: When the transmission has been repaired for internal damage the torque converter must be cleaned using a mechanically agitated cleaner.

1. Using a suitable torque converter/fluid cooler cleaner, clean and flush the torque converter.
2. After flushing, drain the remainder of the solvent.
3. Add 1.9 liter (2 qt.) of clean transmission fluid to the converter and agitate by hand.
4. Thoroughly drain the solution.

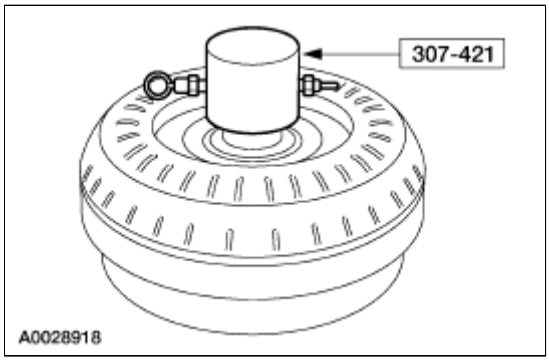
Torque Converter Leak Check

Special Tool(s)

	Leak Tester, Torque Converter 307-421

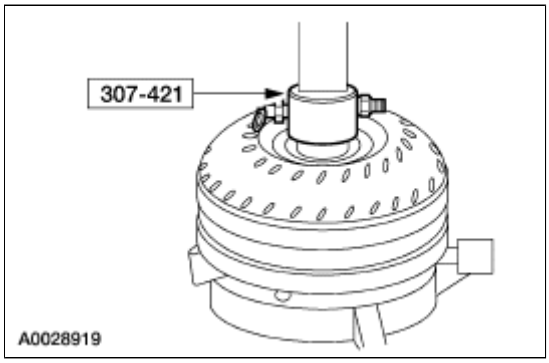
1. Clean the outside surface of the torque converter.

2. Install the special tool into the converter hub.



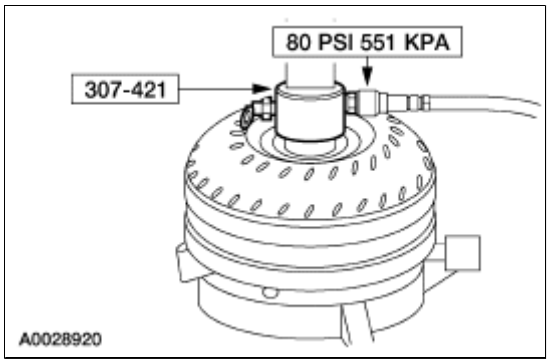
3. **WARNING: Always follow correct safety procedures while using press. Failure to follow these instructions may result in personal injury.**

   Install the torque converter with the installed special tool into the arbor press.
   Secure the press, apply enough force to seal the tool into the torque converter.

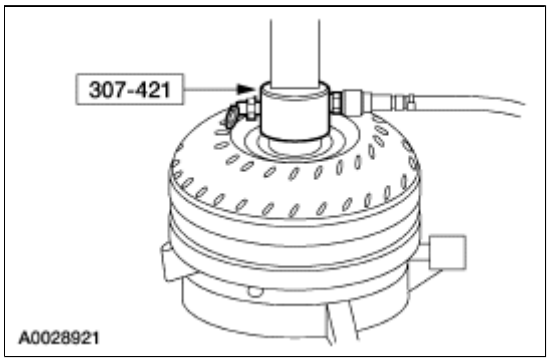


4. **NOTE:** Use clean dry shop air.

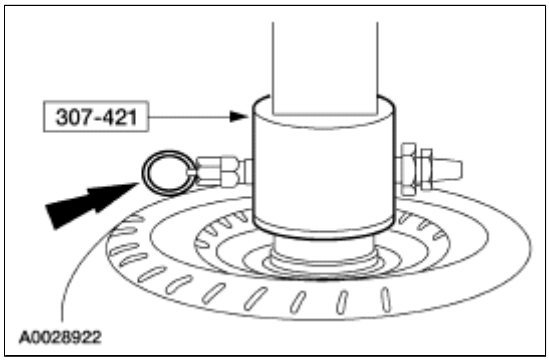
   Apply air pressure to the valve on the special tool.



5. With air pressure applied to the valve, inspect for leaks at the converter hub, seams, drain plug and studs. A soap bubble solution may be applied around these areas to aid in diagnosis. If a leak is found around the drain plug, install a new drain plug and recheck the torque converter. If any other leaks are present, install a new or remanufactured torque converter.



6. Remove the air hose. Release pressure and then slowly release the press. Remove the torque converter. Remove the special tool.

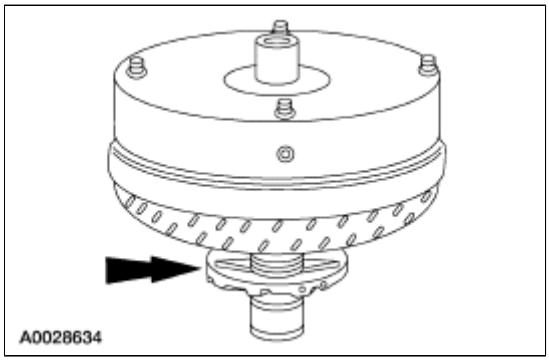


Torque Converter Impeller to Pump Stator Interference Check

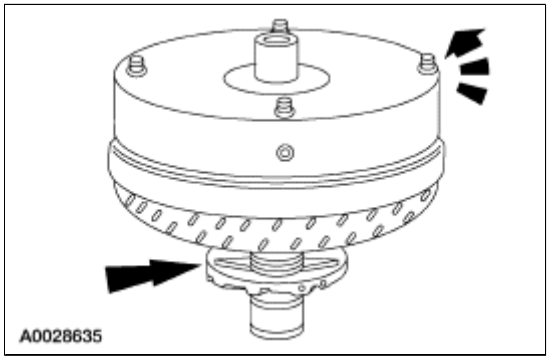
1. **NOTE:** Front pump support may remain in front pump support and gear during this test.

   Position the front pump support with the splines up.

2. Mount the torque converter on the front pump support with the splines on the one-way clutch inner race, engaging the mating splines of the front pump support.

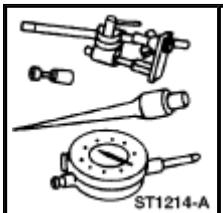


3. Hold the front pump support stationary and rotate the torque converter counterclockwise.
   - The torque converter should rotate freely with no signs of scraping.
   - If there are signs of scraping, install a new or remanufactured torque converter.

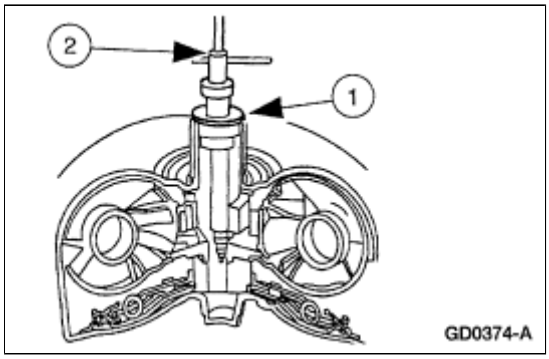


End Play Check

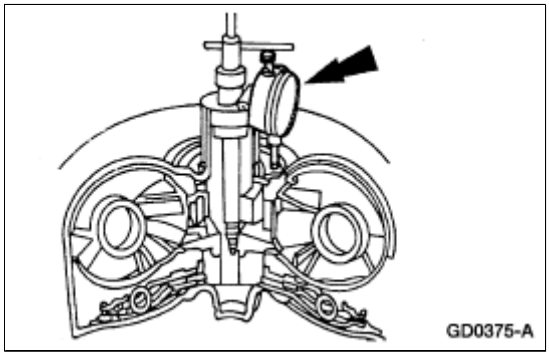
Special Tool(s)

 ST1214-A	Dial Indicator With Bracketry 100-002 (TOOL-4201-C) or equivalent
 ST1196-A	End Play Checking Tool 307-071 (T80L-7902-A) or equivalent

1. Insert End Play Checking Tool into the torque converter pump drive.
    1. Position End Play Checking Tool.
    2. Tighten the inner post until the tool is securely locked.



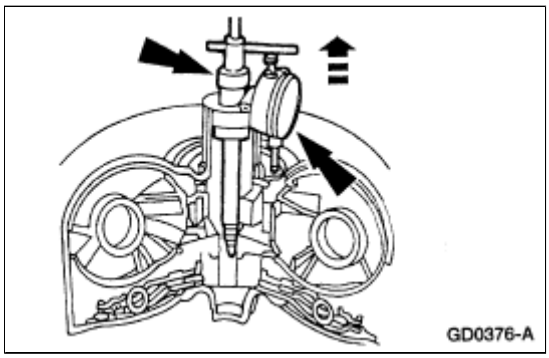
2. Attach Dial Indicator With Bracketry to End Play Checking Tool.
    - Position the dial indicator bottom on the converter pump drive hub and zero the dial.



3. Lift up on End Play Checking Tool and note the dial indicator reading.
   - If the reading exceeds end play limits, replace the torque converter (7902).

Torque Converter End Play

New or Rebuilt Torque Converter	Used Torque Converter
0.355-1.04 mm (0.014-0.041 inch) Max.	0.355-1.87 mm (0.014-0.074 inch) Max.



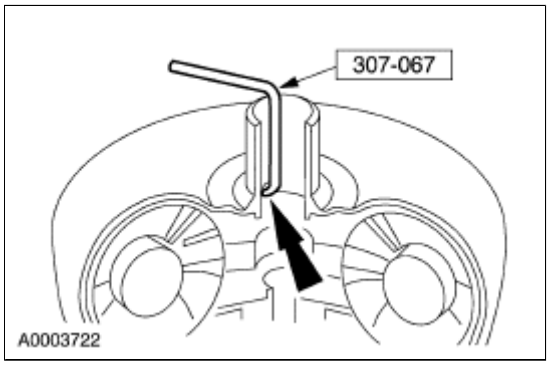
4. Remove the dial indicator and tool.

Torque Converter One-Way Clutch Check

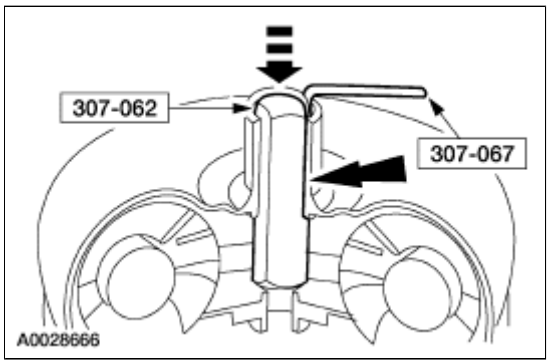
Special Tool(s)

 ST1193-A	Holding Tool, One-Way Clutch 307-062 (T76L-7902-C) or equivalent
 ST1195-A	Holding Tool, Torque Converter Clutch 307-067 (T77L-7902-R) or equivalent

1. Install the special tool in one of the grooves in the stator thrust washer.

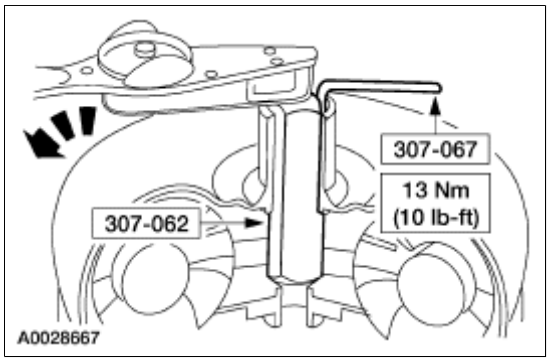


2. Install the special tool in the converter pump drive.



3. Use a torque wrench to turn the special tool counterclockwise while holding the special tool stationary.
   - The converter should lock up and hold torque.

- The torque converter one-way clutch should rotate freely in the clockwise direction.
- Try the clutch for lockup and hold in at least five positions.
- If the torque converter fails the lockup test torque, install a new or remanufactured torque converter.

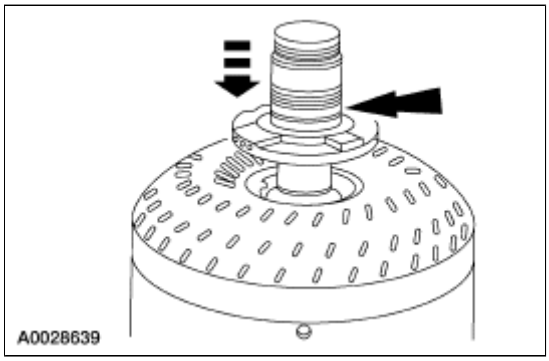


Torque Converter Turbine to Pump Stator Interference Check

1. **NOTE:** Front pump support may remain in front pump support and gear during this test.

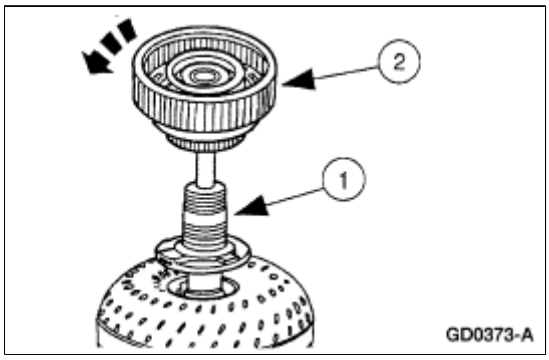
   Position the torque converter with the pump drive up.

2. Install the front pump support to engage the mating splines of the front pump support shaft on the torque converter.



3. Install the forward clutch cylinder and shaft, engaging the splines with the rear clutch hub.

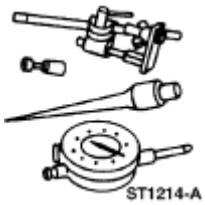
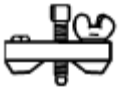
4. Check for stator to turbine interference.
   1. Hold the front pump support stationary.
   2. Attempt to rotate the forward clutch cylinder and shaft.
      - The turbine and torque converter clutch assemblies should rotate in both directions, not exceeding maximum torque of 9.5 Nm (7 lb-ft), without any signs of metallic interference or scraping noise.

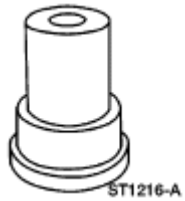
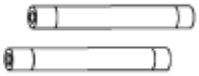


5. If interference exists, the stator front thrust washer may be worn, allowing the stator to hit the turbine. In such cases, a new or remanufactured torque converter must be installed.
   - The converter crankshaft pilot should be checked for nicks or damaged surfaces that could cause interference when installing the torque converter into the crankshaft. Check the converter front impeller hub for nicks or sharp edges that would damage the pump seal.

Transmission

Special Tool(s)

 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST2467-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST1633-A	Alignment Gauge, TR Sensor 307-351 (T97L-70010-A)
 ST1185-A	Slide Hammer 100-001 (T50T-100-A)
 ST1199-A	Installer, Shift Shaft Fluid Seal 307-050 (T74P-77498-A)
 ST1197-A	Shim Selection Gauge 307-072 (T80L-77003-A)
 ST1202-A	Installer, Servo Piston 307-073 (T80L-77030-A)

 ST1216-A	Remover/Installer, Transmission Extension Housing 307-077 (T80L-77110-A)
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST1940-A	Test Plate Screw Set, Transmission 307-126 (T82P-7006-C)
 ST1392-A	Air Test Plate, Transmission 307-246 (T92P-7006-A)
 ST1210-A	Remover/Installer, Servo Piston 307-251 (T92P-70023-A)
 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)
 ST1188-A	Installer, Transmission Extension Housing Oil Seal 308-002 (T61L-7657-A)
 ST2545-A	Gauge, Transmission Solenoid Connectors 307-426

Material

Item	Specification
Multi-Purpose Grease D0AZ-19584-AA	ESB-M1C93-B
MERCON® V Automatic Transmission Fluid XT-5-QM, XT-5-DM	MERCON® V

CAUTION: Before beginning assembly, carry out and inspect the following:

When building up subassemblies and assembling the transmission, ALWAYS use new gaskets and seals.

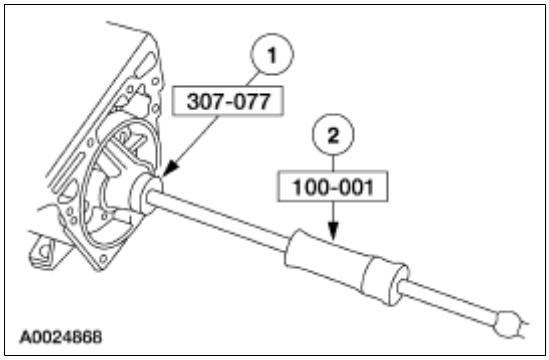
All fasteners must be tightened to the torque specification indicated. In addition to appearing in the section, the necessary torques can be found in the General Specifications Chart.

When building up subassemblies, each component part should be lubricated with clean transmission fluid. It is also good practice to lubricate the subassemblies as they are installed in the case.

Needle bearings, thrust washers and seals should be lightly coated with petroleum jelly during subassembly buildup or transmission assembly.

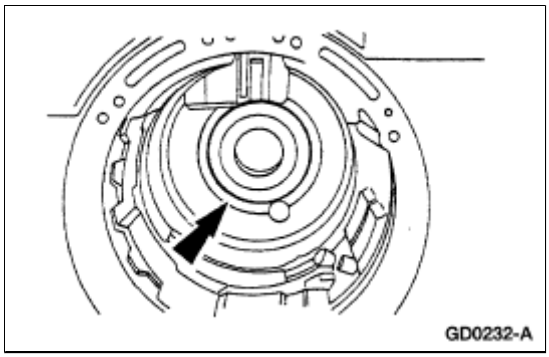
Many components and surfaces in the transmission are precision machined. Careful handling during disassembly, cleaning, inspection and assembly can prevent unnecessary damage to machined surfaces.

1. Use the special tools to install the rear case bushing if removed.
    1. Position the rear case bushing and the special tool inside the case.
    2. Assemble the special tools through the back of the case.



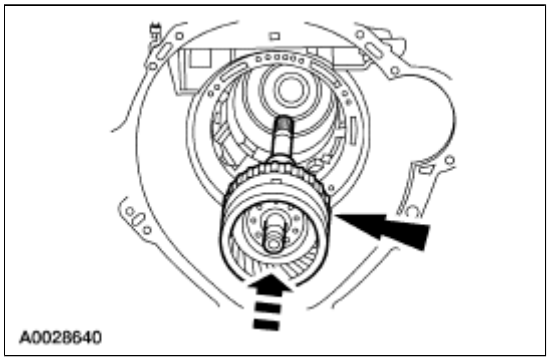
2. Place the transmission in the vertical position.

3. Coat the No. 9 case rear bearing with petroleum jelly and install on the case boss.

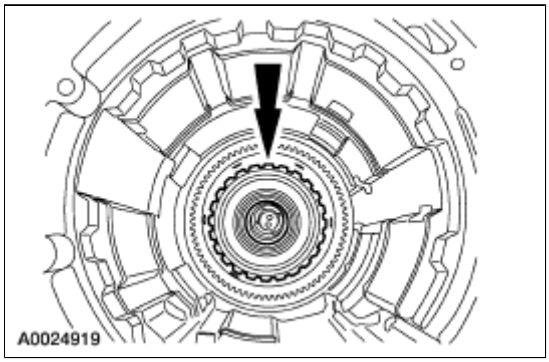


4. **CAUTION: Be sure the No. 7 needle bearing and direct clutch hub are installed as shown in the Subassembly section. Internal damage and shift problems may occur.**

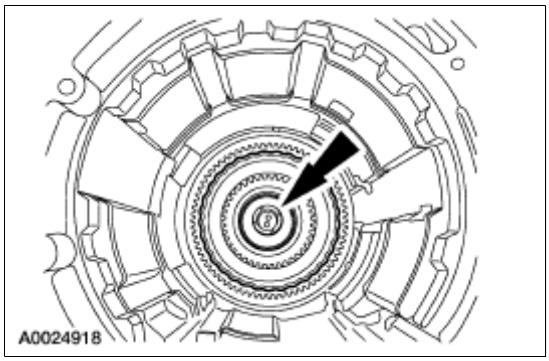
   Install the output shaft and output shaft ring gear.



5. Install the No. 8 bearing.

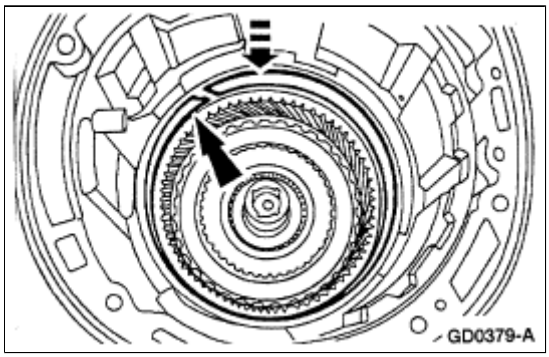


6. Install the direct clutch.



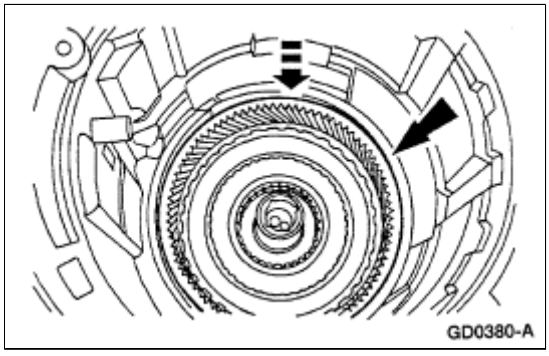
7. **NOTE:** The reverse band support retaining ring is used for assembly purposes during production. The reverse band support retaining ring is not required during assembly and it will not affect the operation of the transmission.

   Install the reverse band support retaining ring.



8. **NOTE:** Make sure the band is seated on the anchor pins.

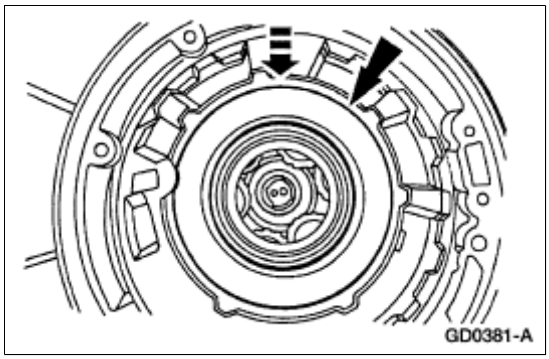
   Install the reverse band.



9. **NOTE:** The planetary assembly and planetary gear support cannot be installed unless the notch cut in the planetary gear support is aligned with the overdrive band anchor pin.

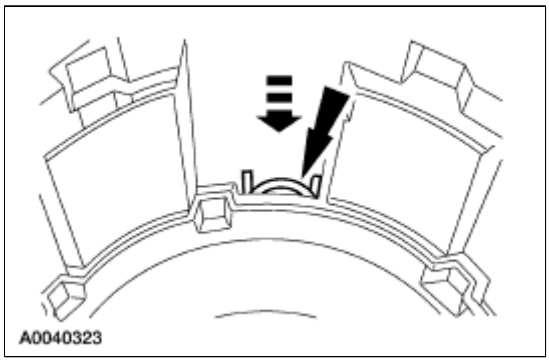
   NOTE: The top of the planetary gear support must be below the snap ring groove.

   Install the planetary assembly and planetary gear support as a unit.
   - Rotate the output shaft to fully seat the planetary assembly.

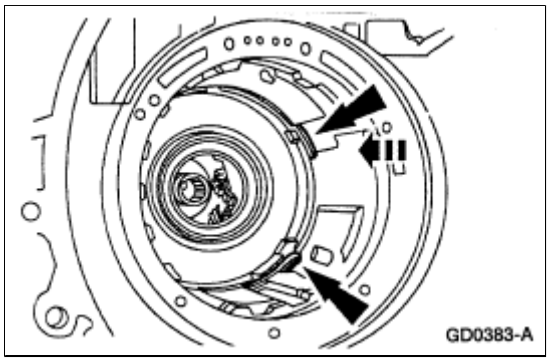


10. **NOTE:** The planet support spring must be compressed and installed below the snap ring groove. When the planet support spring is installed correctly both ends of the spring will be visible.

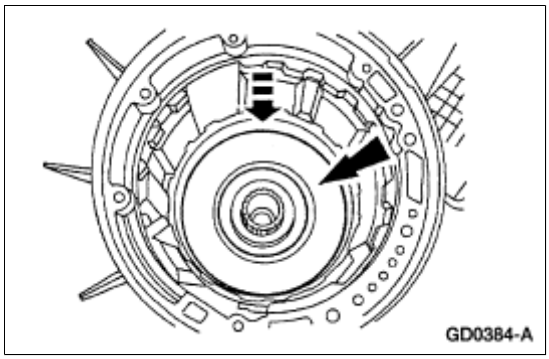
    Install the case to the planet support spring located at the 1 o'clock position.



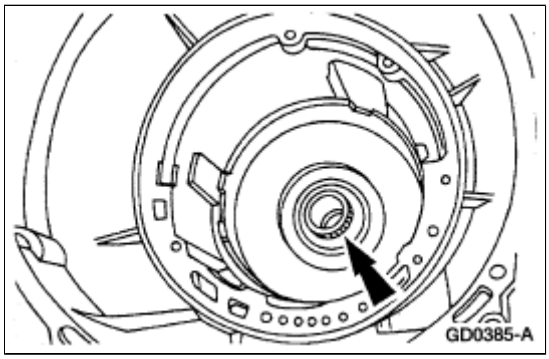
11. Install the center support retaining ring.
    - Reference the retaining ring tabs to the band anchor pin location.



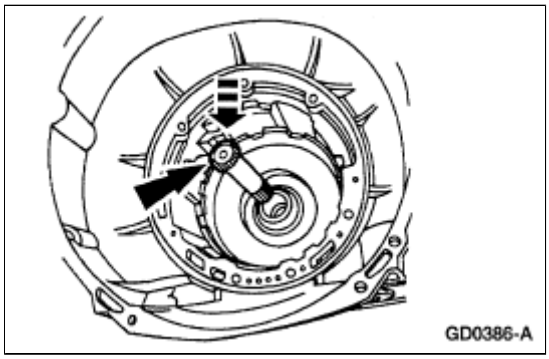
12. Install the forward clutch sun gear, the No. 5 forward clutch sun gear bearing and the reverse sun gear.



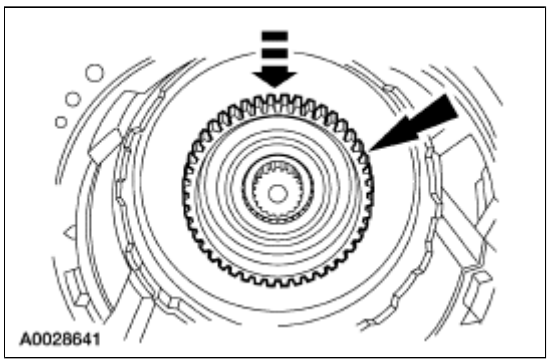
13. Install the No. 4 forward clutch hub bearing.



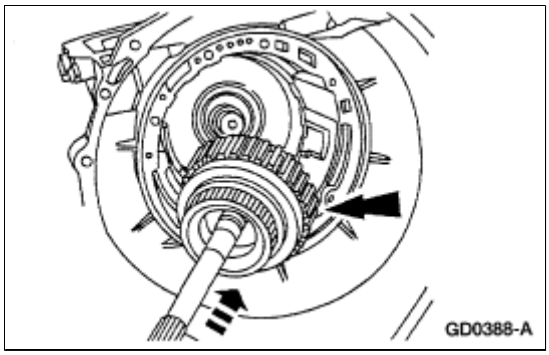
14. Install the intermediate stub shaft.



15. Install the forward clutch hub and the No. 3 forward clutch hub front bearing.

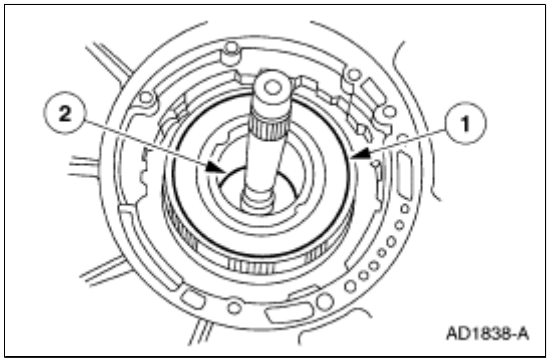


16. Install the forward clutch assembly.

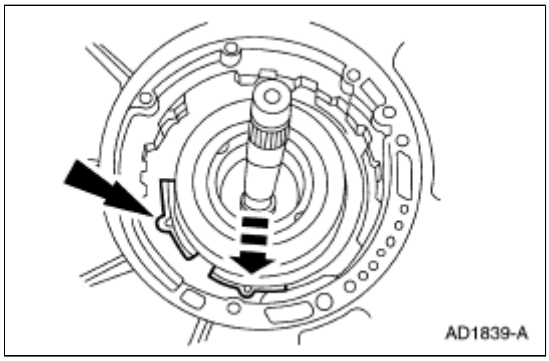


17. **NOTE:** Make sure the reverse clutch cylinder lugs are completely seated in the notches of the reverse sun gear.

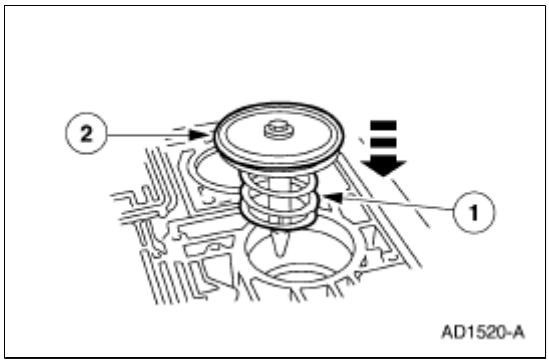
    Install the reverse clutch cylinder assembly.
    1. Install the reverse clutch cylinder.
    2. Install the No. 2 forward clutch bearing.



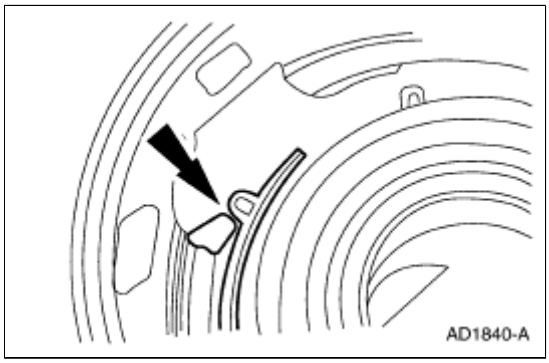
18. Install the overdrive band.
    - Position the overdrive band pocket onto the anchor pin.



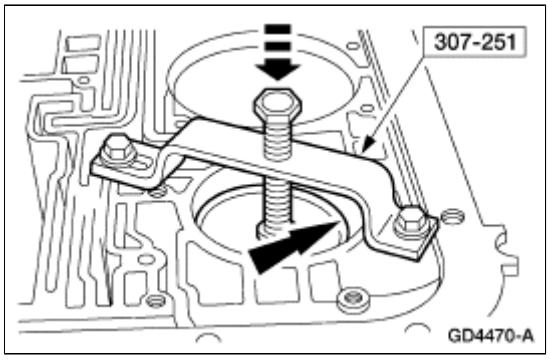
19. Install the overdrive servo spring.
    1. Install the overdrive servo piston return spring.
    2. Install the overdrive servo piston.



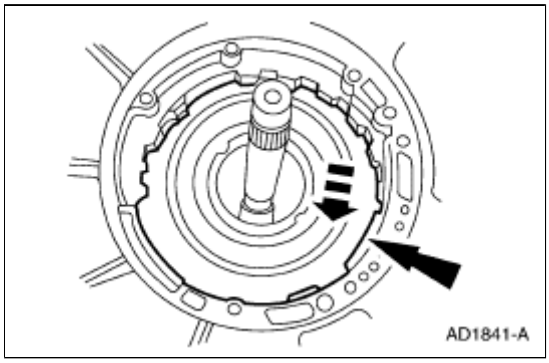
20. Verify the tip of the piston assembly engages the pocket of the overdrive band.



21. Using the special tool, compress the overdrive servo assembly and install the overdrive servo retaining ring.

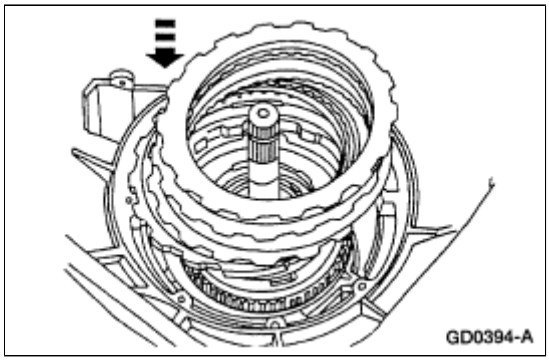


22. Install the intermediate clutch pressure plate.



23. **NOTE:** Before assembly, soak the new clutch discs in clean automatic transmission fluid for 15 minutes.

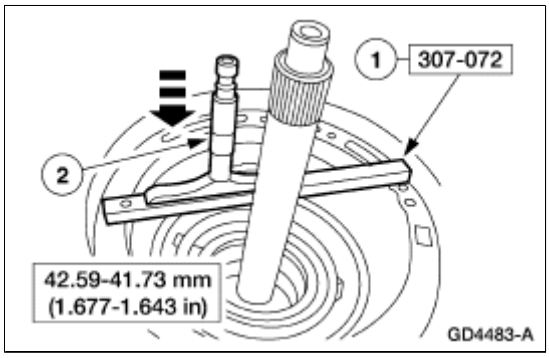
    Install the intermediate clutch pack and selective steel plate.



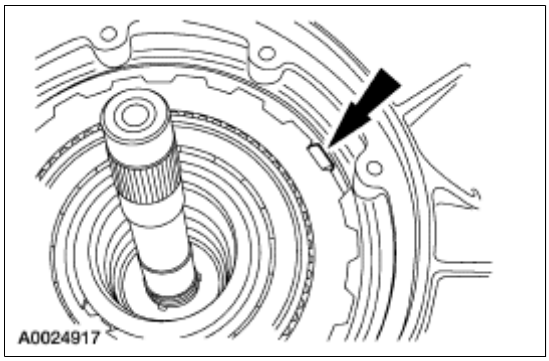
24. Using the special tool, check the intermediate clutch clearance.
    1. Position the special tool on the pump case mounting surface.
    2. Maintaining downward pressure, use a depth micrometer to measure and verify intermediate clutch clearance is within specification.
       If the intermediate clutch is not within specification, install a correct selective plate.

Selective Steel Plates

Specification
1.80-1.70 mm (0.071-0.067 inch)
2.05-1.95 mm (0.081-0.077 inch)
2.31-2.20 mm (0.091-0.087 inch)
2.56-2.46 mm (0.101-0.097 inch)



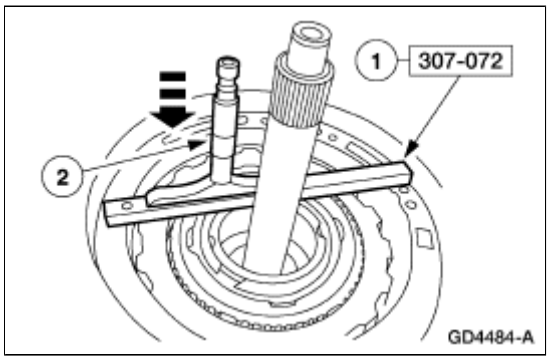
25. Install the intermediate anti-rattle clip, if equipped.



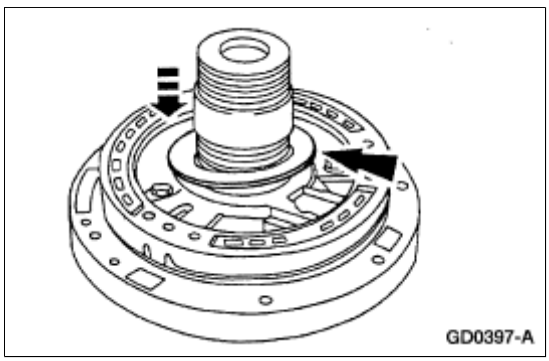
26. Using the special tool, measure end clearance for the No.1 front pump thrust washer.
    1. Position the special tool on the pump case mounting surface.
    2. Maintaining downward pressure, use a depth micrometer to measure end play clearance. Use the No.1 thrust washer chart to select the correct washer.

No.1 Thrust Washer Chart

Depth	Thickness	Color Code
37.706-38.184 mm (1.485-1.503 inch)	1.270-1.372 mm (0.050-0.054 inch)	Green
38.185-38.641 mm (1.504-1.521 inch)	1.727-1.829 mm (0.068-0.072 inch)	Yellow
38.642-39.073 mm (1.522-1.538 inch)	2.159-2.261 mm (0.085-0.089 inch)	Natural
39.074-39.505 mm (1.539-1.555 inch)	2.591-2.692 mm (0.102-0.106 inch)	Red
39.506-40.165 mm (1.556-1.581 inch)	3.023-3.124 mm (0.119-0.123 inch)	Blue

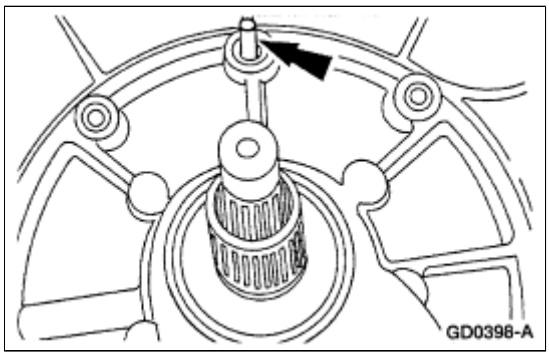


27. Install the No.1 front pump support thrust washer.
    - Use petroleum jelly to hold the washer in place.



28. **NOTE:** The alignment pin is a fabricated M8 x 1.25 mm (0.05 in) bolt with the head removed.

    Install an alignment pin at the top of the case.

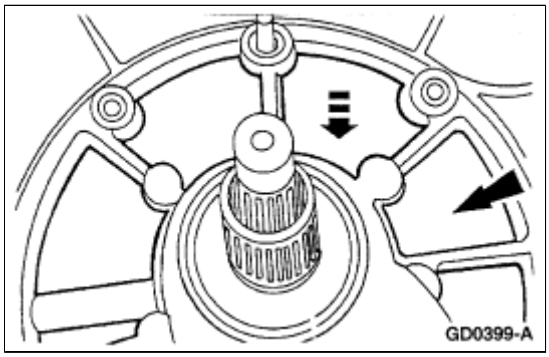


29. **NOTE:** Make sure the gasket is positioned correctly and the case passages are not covered.

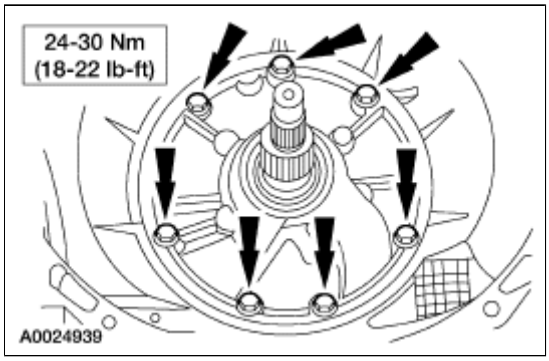
    Install the pump gasket.

30. **NOTE:** To aid assembly, shake the input shaft while pushing down on the pump.

    Install the pump assembly.



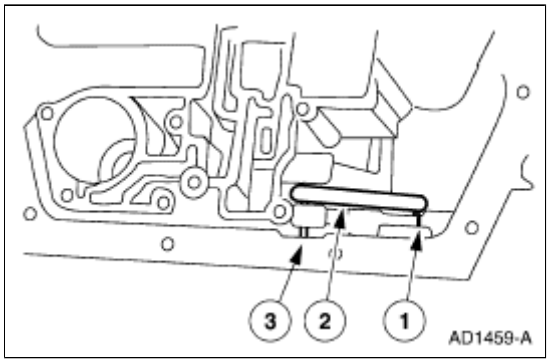
31. Remove the alignment pin and install the front pump bolts.
    - Alternate bolt tightening to set the pump.



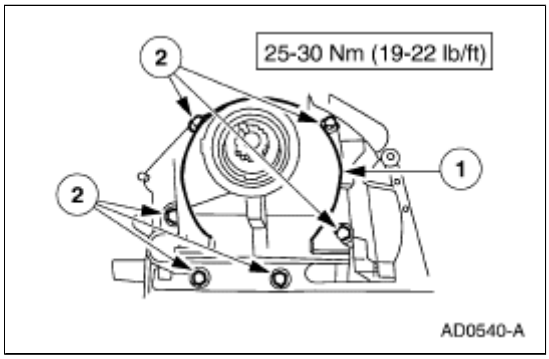
32. Rotate the transmission to the horizontal position.

33. Install the parking pawl.

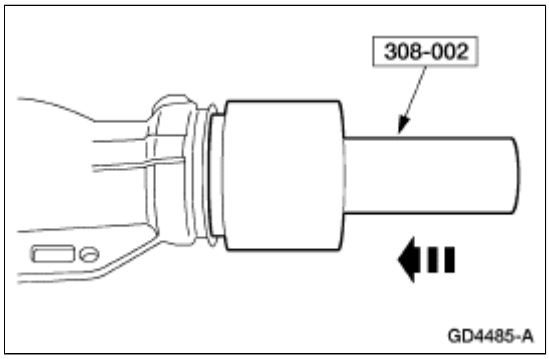
1. Position the parking pawl return spring.
2. Position the parking pawl.
3. Install the parking pawl shaft.



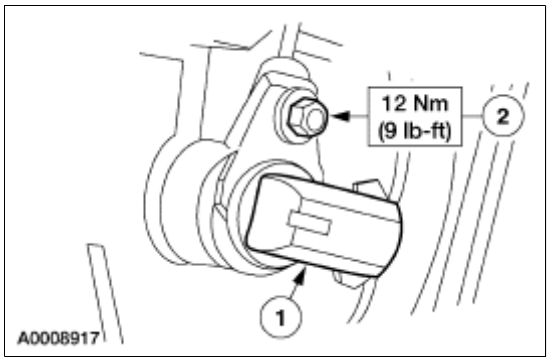
34. Install a new extension housing gasket and the extension housing.
    1. Position the extension housing.
    2. Install the four bolts and two nuts.



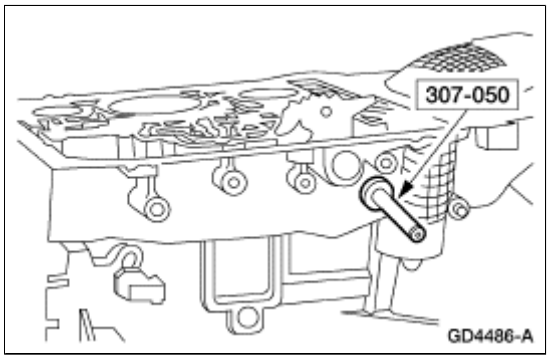
35. Using the special tool, install a new extension housing seal.



36. Install the output shaft speed (OSS) sensor.
    1. Position the OSS sensor.
    2. Install the bolt.

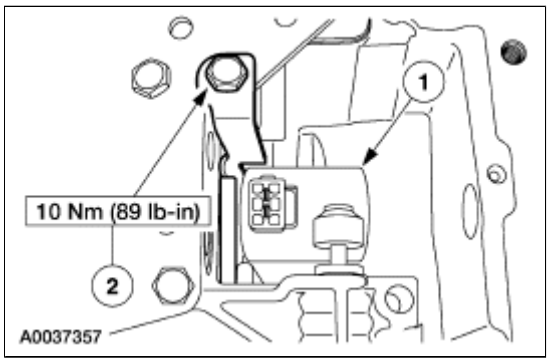


37. Using the special tool, install the manual control lever seal.

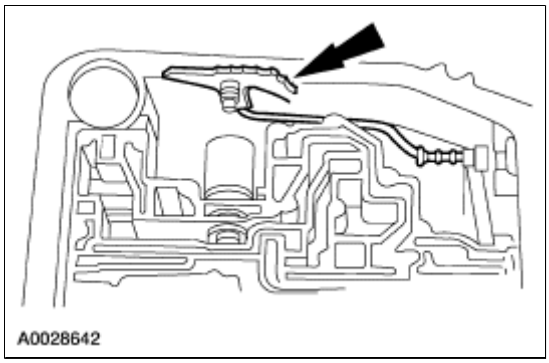


38. **NOTE:** Lubricate the electronic pressure control (EPC) solenoid O-rings with clean automatic transmission fluid.

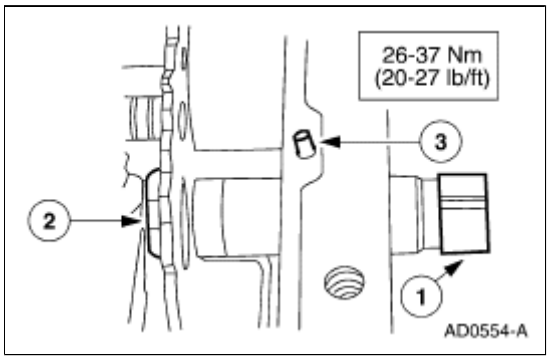
    Install the EPC solenoid.
    1. Install the EPC solenoid.
    2. Install the EPC solenoid bracket and bolt.



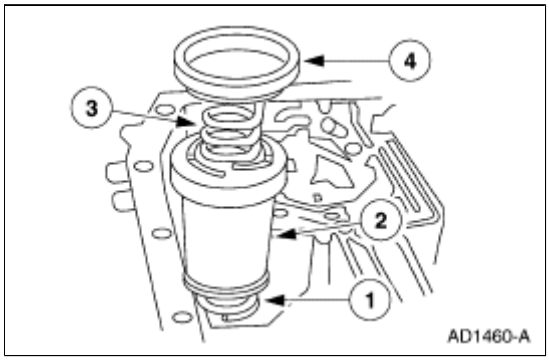
39. Install the manual valve detent lever and parking lever actuating rod.



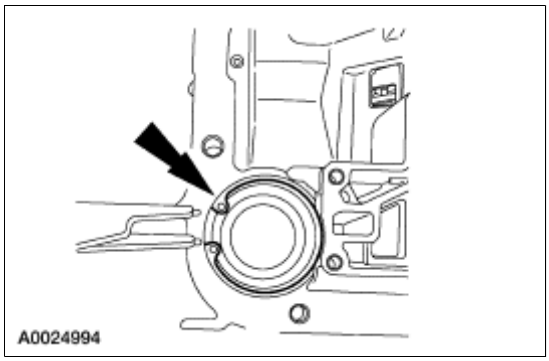
40. Install the manual control lever shaft.
    1. Slide the manual control shaft into the case.
    2. Install the manual lever shaft inner nut.
    3. Install the manual lever shaft retaining pin.



41. Install the 1-2 accumulator piston assembly.
    1. Install the 1-2 accumulator upper spring.
    2. Install the 1-2 accumulator.
    3. Install the 1-2 accumulator lower spring.
    4. Install the 1-2 accumulator cover and seal.



42. Install the 1-2 accumulator retaining ring.

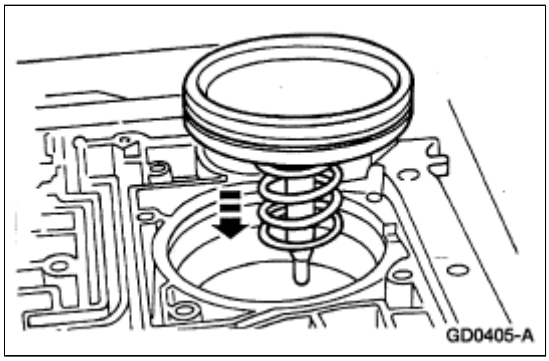


43. **NOTE:** This is not an ordinary installation procedure and does not compensate for band wear. When new piston and rod assembly installation becomes necessary, or when a new reverse band has been installed, the reverse piston and rod length must be adjusted.

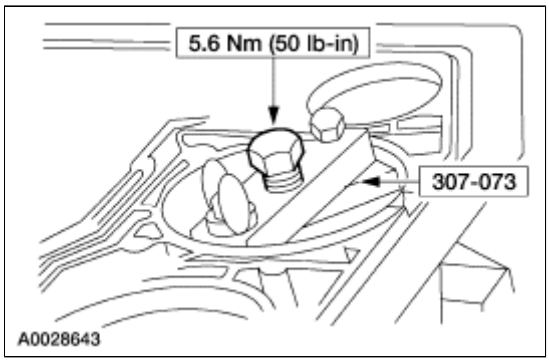
    NOTE: Lubricate the reverse piston seal to facilitate assembly and prevent damage to the seal.

    NOTE: Do not install the reverse servo piston cover and seal at this time.

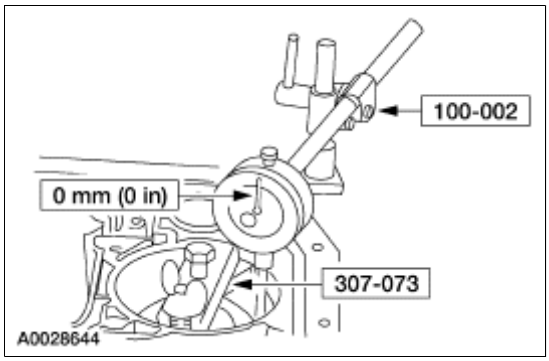
    Install the reverse servo piston and rod assembly.



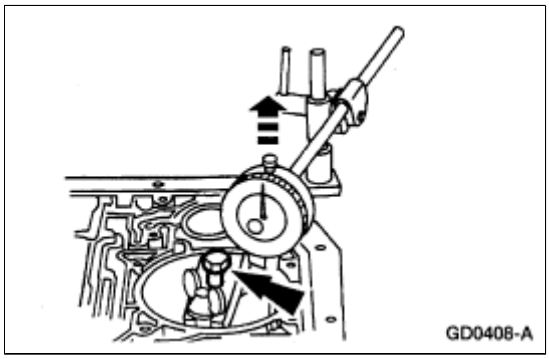
44. Install the special tool.
    - Tighten the bolt.



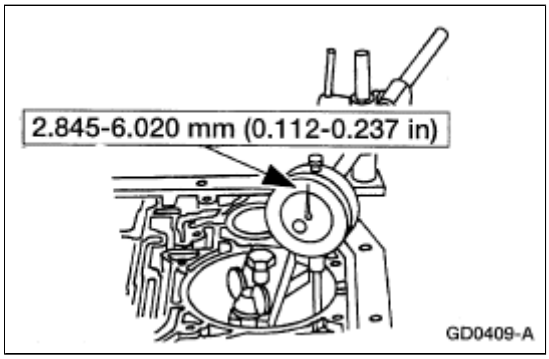
45. Install the special tool.
    - Position the indicator stem on the flat portion of the reverse servo piston and zero the dial indicator.



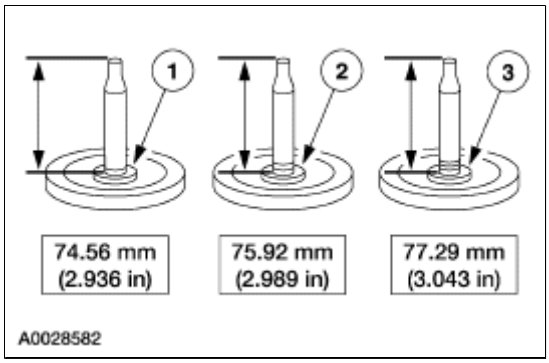
46. Loosen the bolt until the piston stops against the tool.



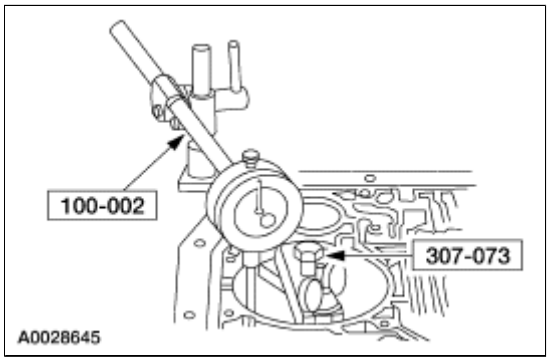
47. Verify that the amount of piston travel on the dial indicator is within specification.



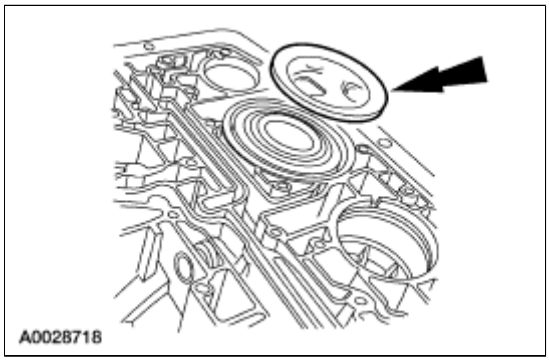
48. If piston travel is not within specification, select and install the correct servo assembly to bring the servo piston travel within specification.
    1. One groove
    2. Two grooves
    3. Three grooves



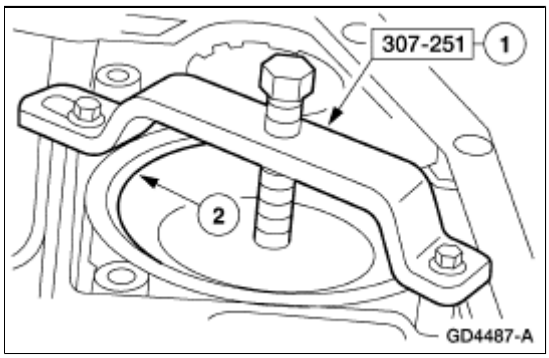
49. Remove the special tools.



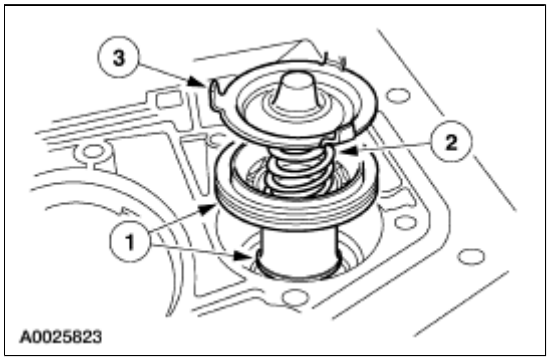
50. Install the reverse servo piston cover and seal assembly.



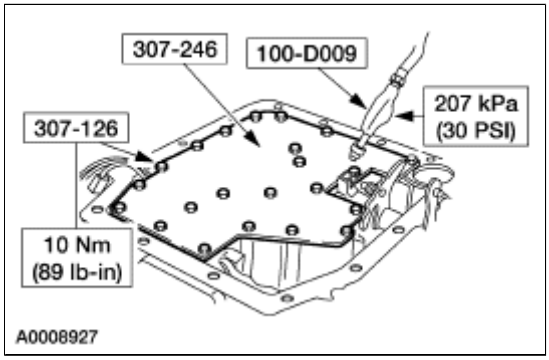
51. Using the special tool, install the reverse servo retaining ring.
    1. Compress the reverse band servo.
    2. Install the reverse band servo retaining ring.



52. Install the 2-3 accumulator assembly.
    1. Install the accumulator piston.
    2. Install the accumulator piston spring.
    3. Install the accumulator spring retainer.

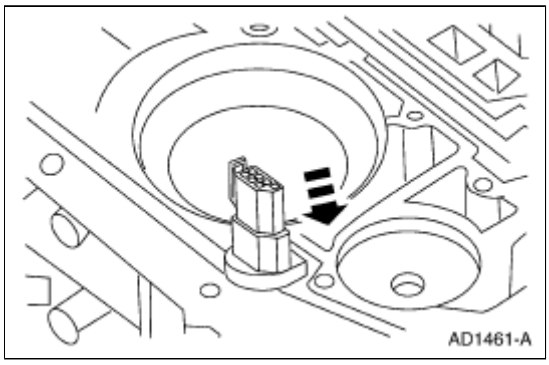


53. Using the special tools apply regulated air pressure to the test ports. Verify that the components are applied and released.



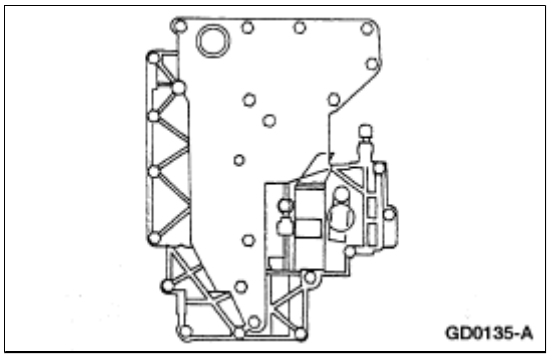
54. **NOTE:** The tab on the electrical connector is secured by main control valve body.

    Install the electrical connector into the case.



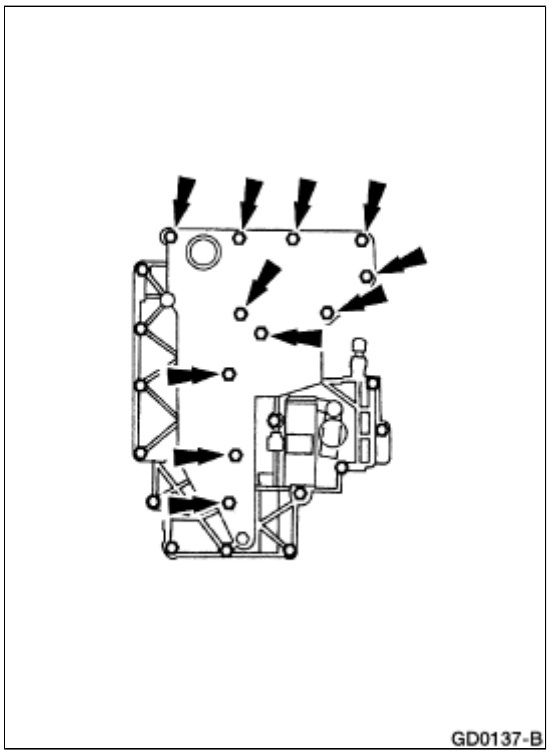
55. **NOTE:** The alignment bolts are valve body assembly bolts and are in the valve body.

    Align the main control valve body alignment bolts and position the main control valve body.



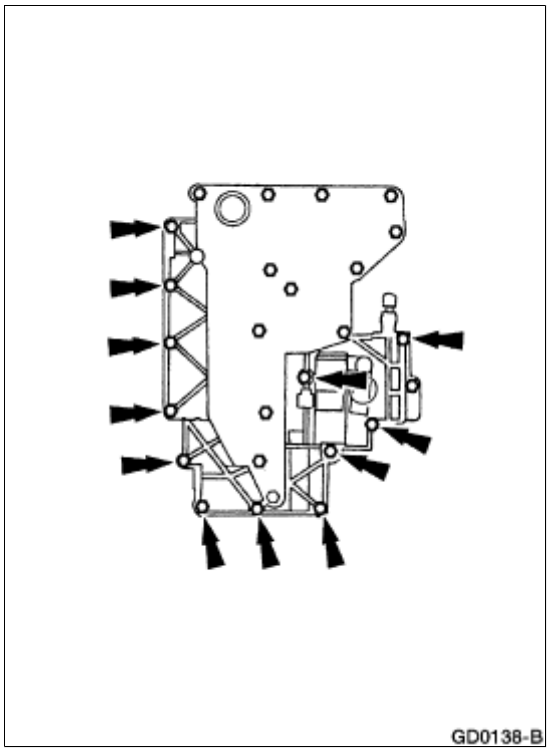
56. **NOTE:** The main control valve body bolts will be tightened in later steps.

    Loosely install the 11 long main control valve body bolts.

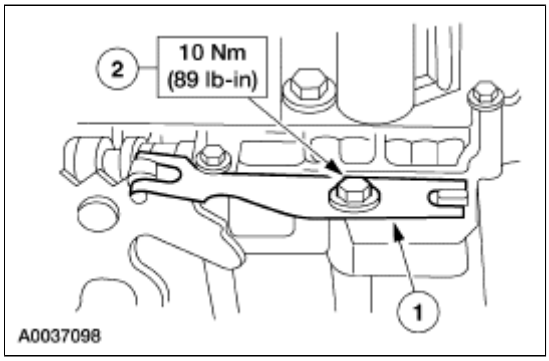


57. **NOTE:** The main control valve body bolts will be tightened in later steps.

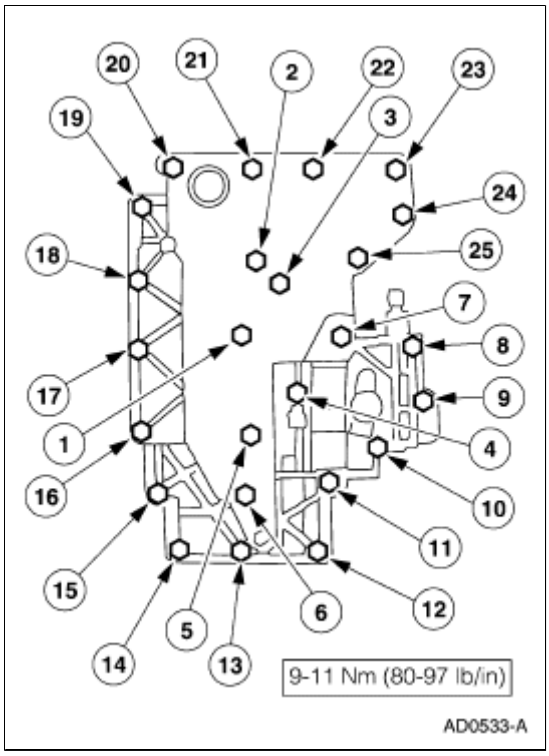
    Loosely install the 12 short main control valve body bolts.



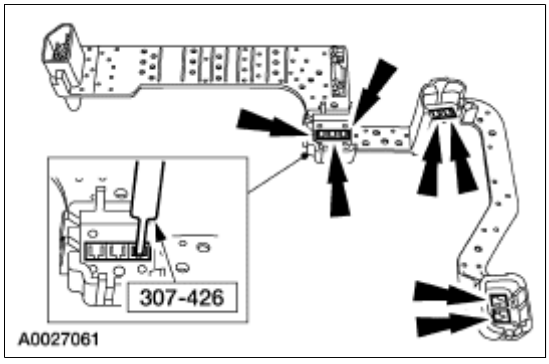
58. Install the manual control valve detent lever spring.
    1. Position the manual control valve detent lever spring.
    2. Install the bolt.



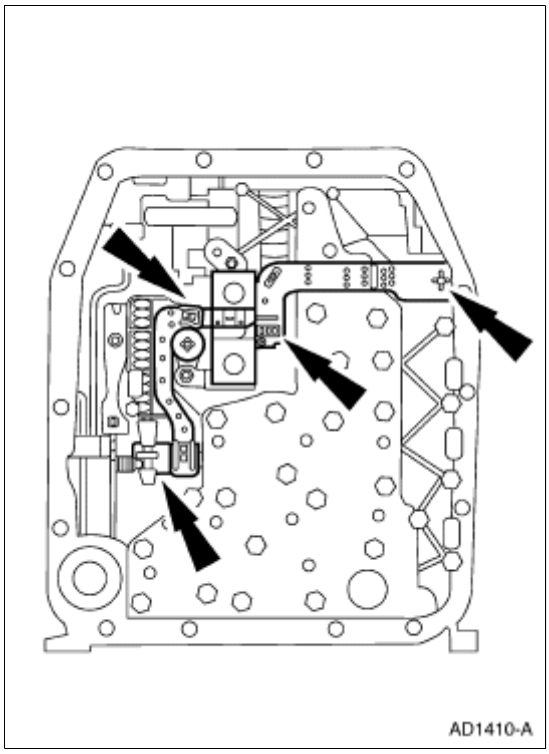
59. Tighten the bolts in the sequence shown.



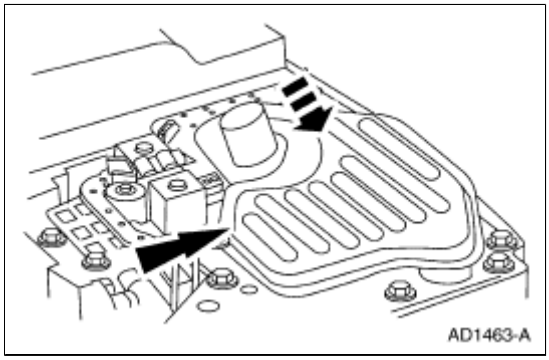
60. Inspect the lead frame for damage.
    - Using the special tool, check all the lead frame solenoid connections. The gauge should fit tightly and not fall out after being inserted.
    - If the special tool passes through any lead frame connector pins or does not feel like it makes a good contact, install a new lead frame.



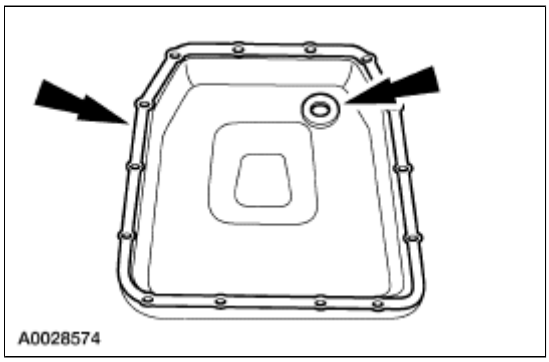
61. Connect the molded lead frame to the solenoids.
    - Connect the bulkhead inter-connector by pressing it in place by hand and fully seating the connector in place.
    - Connect the EPC solenoid by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.
    - Connect the TCC by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.
    - Connect the shift solenoid SSA and SSB by pressing it in place by hand and fully seating the connector in place. Make sure that the terminals pass fully through the connector slots.



62. Install the fluid filter and seal assembly.



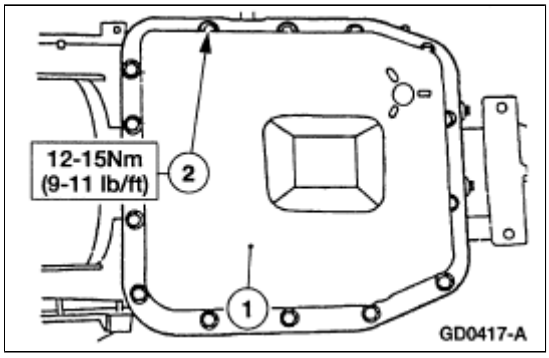
63. Position the pan magnet onto the fluid pan.



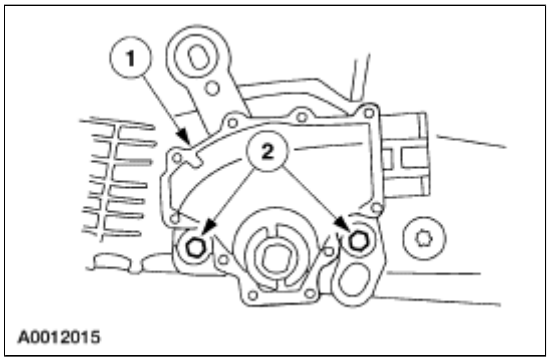
64. **NOTE:** The pan gasket is reusable; clean and inspect for damage. If not damaged, the gasket should be reused.

Install the fluid pan.

1. Position the transmission fluid pan.
2. Install the 14 transmission fluid pan bolts.



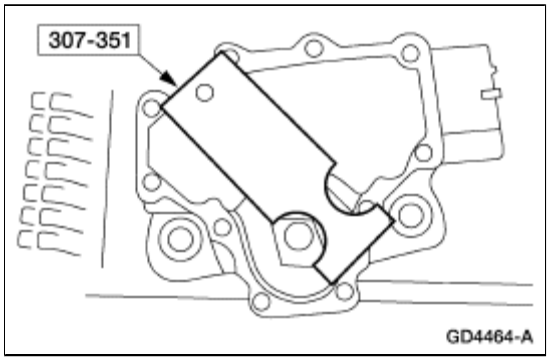
65. Install the digital transmission range (TR) sensor.
    1. Install the digital TR sensor.
    2. Loosely install the digital TR bolts.



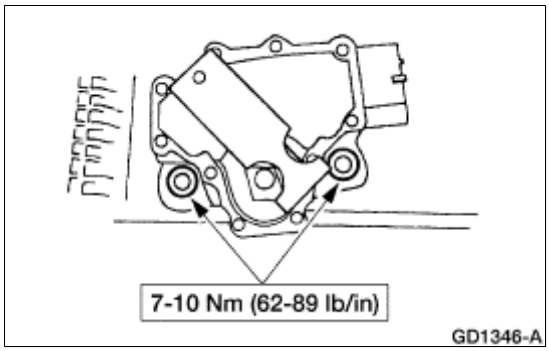
66. **NOTE:** The tool is designed to fit snugly.

    NOTE: Manual shift lever must be in the neutral position.

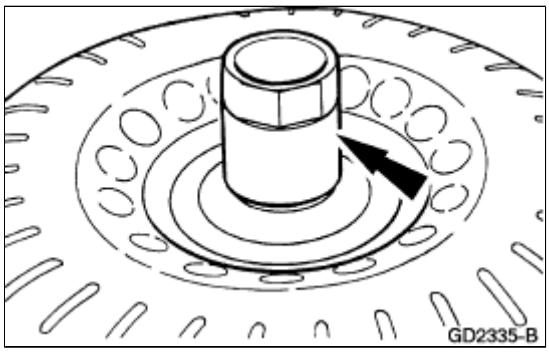
    Using the special tool, align the digital TR sensor slots.



67. Tighten the bolts.



68. Lightly lubricate the converter hub with clean automatic transmission fluid.

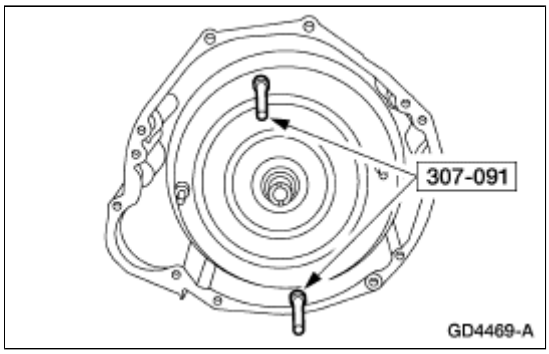


69. **WARNING: The torque converter can fall out if the transmission is tipped.**

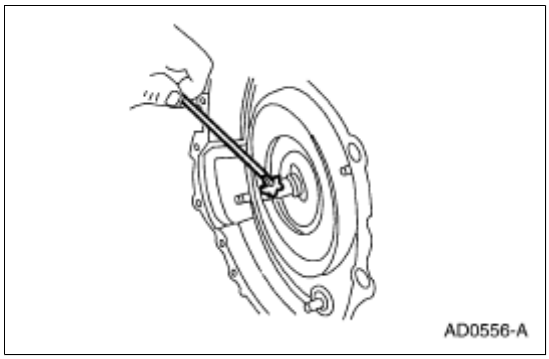
CAUTION: Make sure the converter hub is fully engaged in the front pump support and gear and rotates freely. Do not damage the hub seal.

CAUTION: If the torque converter slides out, the hub seal may be damaged.

Using the special tools, install the torque converter.



70. Lubricate the torque converter pilot hub with multi-purpose grease.


AD0556-A

Transmission

Special Tool(s)

 ST1636-A	Torque Converter Holding Tool 307-346 (T97T-7902-A)

Installation

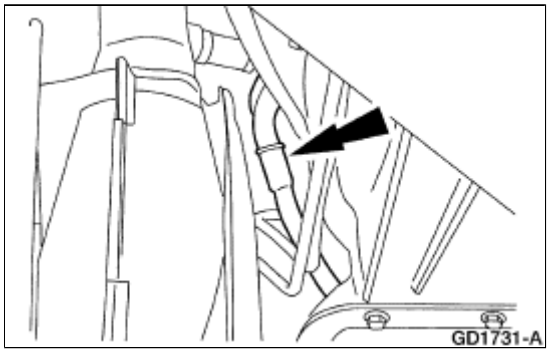
1. **CAUTION: During this move, to avoid damage, do not allow the transmission to get into a nose-down position as this will cause the torque converter to move forward and disengage from the pump gear. The converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates that the converter pilot is not binding in the engine.**

   Position and secure the transmission on High-Lift Transmission Jack.
   - Raise and position the transmission into the vehicle.

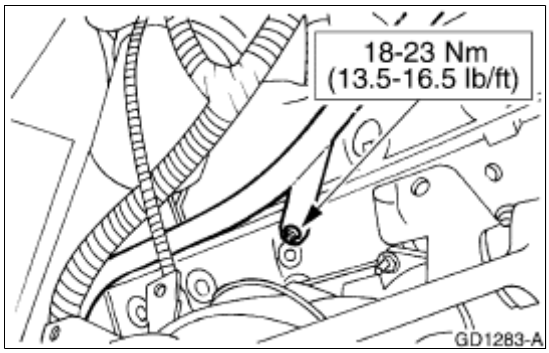
2. **NOTE:** Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

   Align the orange balancing marks between the torque converter studs and the flexplate bolt holes.

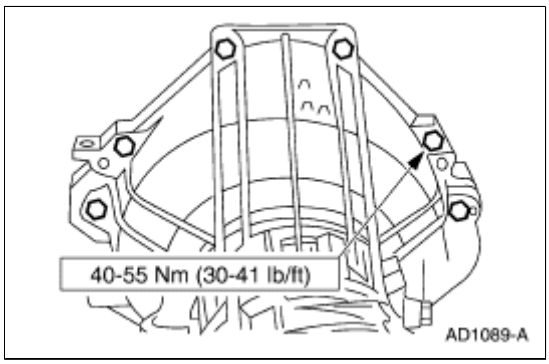
3. Install the transmission fluid fill tube.


GD1731-A

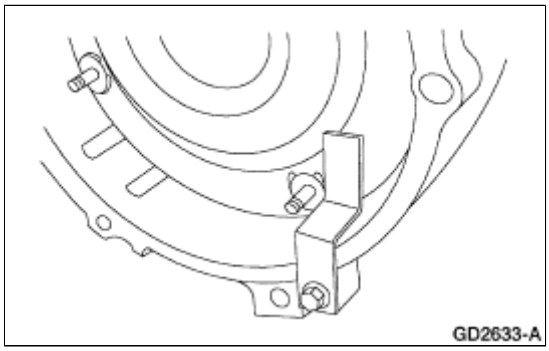
4. Install the bolt on the (RH) side of the cylinder head.



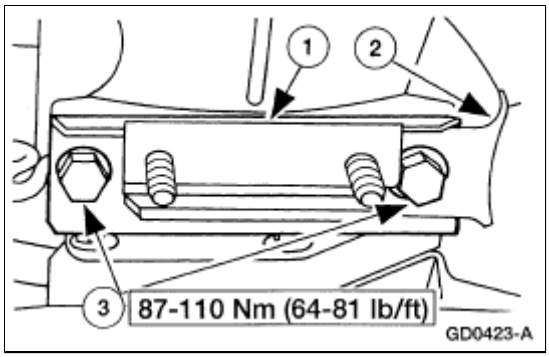
5. Install the six transmission to engine bolts.



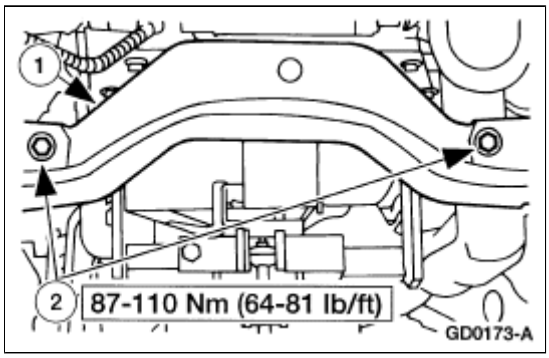
6. Remove the Torque Converter Holding Tool.



7. Install the transmission mount.
    1. Position the transmission mount.
    2. Position the exhaust pipe bracket.
    3. Install the bolts.

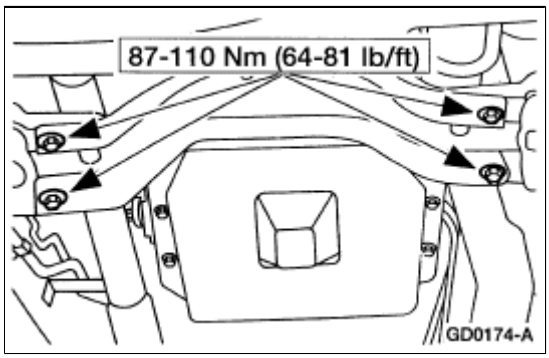


8. Install the rear crossmember.
    1. Position the crossmember.
    2. Install the bolts.

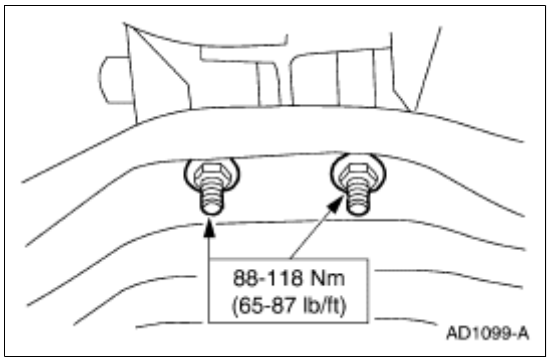


9. Install the exhaust. For additional information, refer to Section 309-00 .

10. Install the bolts.

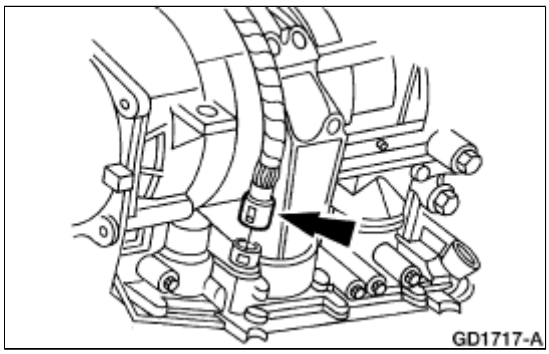


11. Install the two transmission mount nuts.

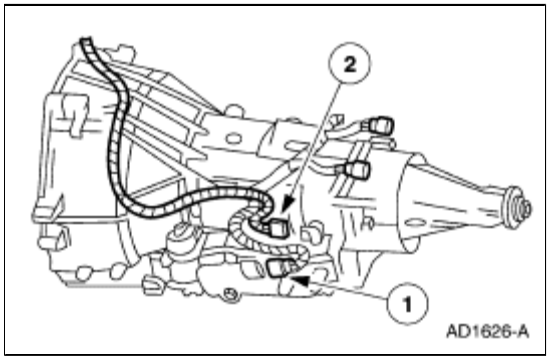


12. Remove the High Lift Transmission Jack.

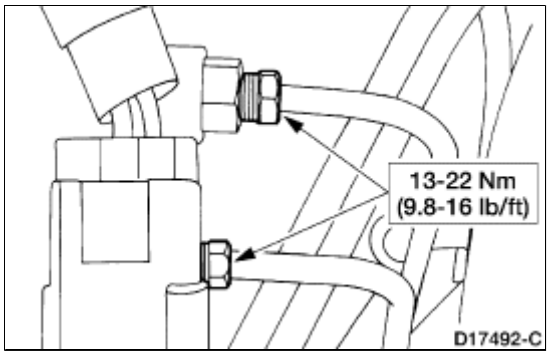
13. Connect the solenoid body assembly electrical connector.



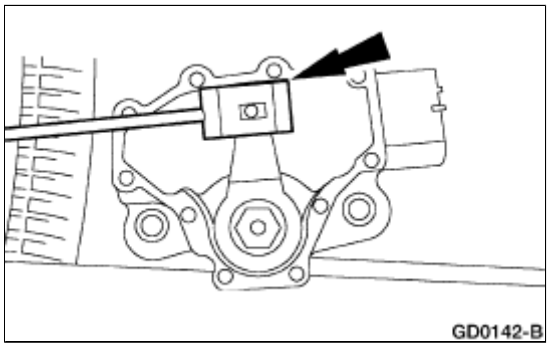
14. Connect the electrical connectors.
    1. Connect the digital transmission range (TR) sensor.
    2. Connect the output shaft speed (OSS) sensor.



15. Connect the transmission coolant lines.

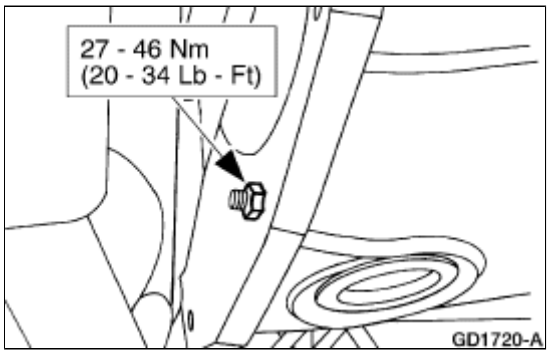


16. Connect the transmission shift linkage.

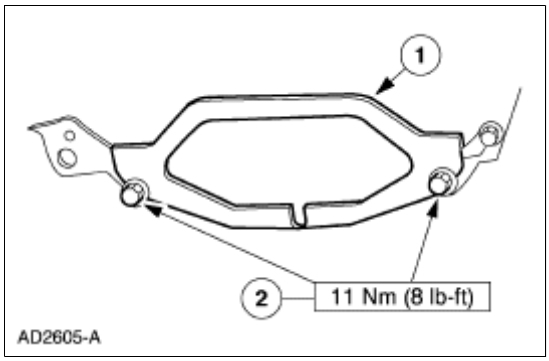


17. Install the starter motor. For additional information, refer to Section 303-06 .

18. Install the four nuts.



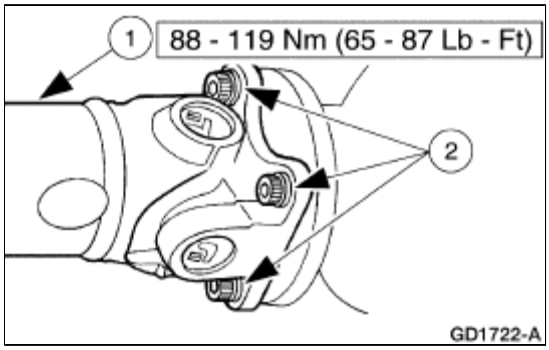
19. Install the transmission inspection cover.
    1. Position the transmission inspection cover.
    2. Install the bolts.



20. On 4WD vehicles install the transfer case. For additional information, refer to Section 308-07B .

21. **NOTE:** To maintain initial driveshaft balance, align the index marks made during removal.

    Install the rear driveshaft.
    1. Position the driveshaft.
    2. Install the four bolts.



22. Lower the vehicle.

23. Connect the battery ground cable.

24. Fill the transmission with fluid and inspect for proper operation.
    - Use MERCON® V (ATF) Transmission Fluid XT-5-QM or equivalent meeting MERCON® V specification.

Fluid Maintenance

CAUTION:Use only MERCON ® V Automatic Transmission Fluid XT-5-QM meeting Ford MERCON ® V specification. Use of any other fluids may result in a transmission malfunction or failure.

Intervals	
Normal Maintenance	Not required. Filled for life.
Special Operating Conditions	Change the fluid at 48,000 km (30,000 miles) intervals. Use MERCON ® V; Automatic Transmission Fluid XT-5-QM meeting Ford MERCON ® V specification. • Sustained high speed driving during hot weather 32°C (90°F) • Towing a trailer for long distances over 1600 km (1000 miles) • Accumulating 8000 km (5000 miles) or more in one month. • Continuous running service.

General Specifications

Vehicle	Engine	Approximate Liters	Refill Capacity [a] U.S. Quarts	Fluid Type
Explorer, Mountaineer— 5R55E (4x2)	4.0L SOHC	9.5	10.0	MERCON ® V XT-5-QM
Explorer — 5R55E (4x2)	4.0L OHV	9.3	9.8	
Explorer — 5R55E (4x4)	4.0L OHV	9.5	10.0	
Explorer, Mountaineer — 5R55E (4x4)	4.0L SOHC	9.8	10.3	MERCON ® V XT-5-QM
Mountaineer — 5R55E (4x2)	4.0L OHV	9.3	9.8	
Mountaineer — 5R55E (4x4)	4.0L OHV	9.5	10.0	

[a] Approximate dry capacity, includes cooler and lines. Fluid level indicator should be used to determine actual fluid requirements and fluid specification. Check the level at normal operating temperature. DO NOT OVERFILL. If it is necessary to add or replace fluid, use only fluid which has been certified by the supplier as meeting the Ford Motor Company specification shown.

General Specifications

Item	Specification
MERCON ® V Automatic Transmission Fluid XT-5-QM	MERCON ® V
Lubricant	
Ford Multi-Purpose Grease D0AZ-19584AA	ESA-M1C45-A

Band/Clutch Application Chart No. 601

Gear	Front Band	Intermediate Band	Low/ Rev- erse Band	Forward Clutch	Direct Clutch	Coast Clutch	Front One-Way Clutch		Rear One-Way Clutch		Engine Braking	TCIL
							Drive	Coast	Drive	Coast		
P											NE	NE
R			A		A		H	OR			NE	NE
N											NE	NE
1st				A			H	OR	H	OR	NO	OFF
1st [a]				A			H	OR	H	OR	NO	ON
2nd [b]	A			A			OR	OR	H	OR	NO	OFF
2nd [a] [b]	A			A			OR	OR	H	OR	NO	ON
3rd		A		A			H	OR	OR	OR	NO	OFF
3rd [a]		A		A			H	OR	OR	OR	NO	ON
4th				A	A		H	OR	OR	OR	NO	OFF
4th [a]				A	A	A	H	OR	OR	OR	YES	ON
5th	A			A	A		OR	OR	OR	OR	NO	OFF
Man 1st			A	A		A	H	OR	H	OR	YES	NE
Man 2nd (3rd gear)		A		A		A	H	OR	OR	OR	YES	NE

[a] Overdrive Cancelled CANCELLED
[b] PCM Controlled

A = Applied

H = Hold

OR = Overrunning

NE = No Effect

Selective Snap Rings

Coast and Reverse Clutch Drum					Forward Clutch Cylinder				
	Thickness		Diameter			Thickness		Diameter	
Part Number	mm	inch	mm	inch	Part Number	mm	inch	mm	inch
E860126-S	1.37	0.0539	130.1	5.122	E860115-S	1.37	0.0539	125.1	4.925

E860127-S	1.73	0.0681	130.1	5.122	E860116-S	1.73	0.0681	125.1	4.495
E860128-S	2.08	0.0819	130.1	5.122	E860117-S	2.08	0.0819	125.1	4.925
E860129-S	2.44	0.0961	130.1	5.122	E860118-S	2.44	0.0961	125.1	4.925

Service Identification Model Chart

Vehicle Application			
7000 Prefix and Suffix	**C=Column F=Floor**	**Engine Displacement**	**Vehicle Application**
XL2P-EA	C	4.0L EI	Explorer (4x2)
XL2P-FA	C	4.0L EI	Explorer (4x4)
XL2P-CA	C	4.0L (SOHC)	Explorer, Mountaineer (4x2)
XL2P-DA	C	4.0L (SOHC)	Explorer, Mountaineer (4x4)

Reference: Line Pressure Chart

			Idle 1000 RPM		WOT Stall	
Trans.	**Transmission Model/Application**	**Range**	**EPC**	**Line**	**EPC**	**Line**
5R55E	4.0L EI	R	55-65	175-215	112-134	282-350
	Explorer/Mountaineer	N	20-40	75-120		
	4x2, 4x4	(D) 2, 1	25-35	80-110	112-134	228-263
5R55E	4.0L SOHC	R	55-65	175-215	112-134	282-350
	Explorer/Mountaineer 4x2/4x4	N	20-40	75-120		
		(D), 2, 1	40-50	100-135	112-134	228-263

Clutch Plate Usage And Clearance Specifications

				Selective Snap Rings	
Clutch	**Steel**	**Friction**	**Clearance**	**Part Number**	**Thickness**
Forward Clutch (4.0L)	6	6	1.397-2.108 mm (0.055-0.083 in)	E860115-S	1.37 mm (0.0539 in)
				E860116-S	1.73 mm (0.0681 in)
Forward Clutch (2.5L, 3.0L)	5	5		E860117-S	2.08 mm (0.0819 in)
				E860118-S	2.44 mm (0.0961 in)
Direct Clutch			1.295-2.006 mm (0.051-0.079 in)	E860126-S	1.37 mm (0.0539 in)
4.0L SOHC use 1.71 mm (0.06 in)	5	5		E860127-S	1.73 mm (0.0681 in)
EI and all others use 2.14	4	4		E860128-S	2.08 mm (0.0819

mm (0.08 in)					in)
				E860129-S	2.44 mm (0.0961 in)
Coast Clutch	2	2	1.295-2.006 mm (0.051-0.079 in)	E860126-S	1.37 mm (0.0539 in)
				E860127-S	1.73 mm (0.0681 in)
				E860128-S	2.08 mm (0.0819 in)
				E860129-S	2.44 mm (0.0961 in)

Stall Speed

Vehicle	Engine	Rpm
Explorer	4.0 EI	2610-2983
Explorer, Mountaineer	4.0 SOHC	2632-3114

Shift Speeds — KM/H (MPH)

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio and application) refer to the Automatic Transmission Specification booklet.

Throttle Position	Range	Shift	MPH	KM/H
Closed Throttle	(D)	3-2	11-19	18-31
	(D)	2-1	6-16	10-26
Minimum Throttle (TP Voltage 1.25 Volts)	(D)	1-3	36-79 [a]	58-127
	(D)	1-2	11-13	18-21
	(D)	2-3	15-38	24-61
	(D)	3-4	16-47	26-76
	(D)	4-5	39-71	63-114
	(D)	5-4	39-49	63-79
	(D)	4-3	17-30	27-48
	(D)	3-2	10-22	16-35
	(D)	2-1	6-12	10-19
Wide Open Throttle	(D)	1-2	18-80	29-129
	(D)	2-3	55-94	88-151
	(D)	3-4	72-108	116-174
	(D)	4-5	100-134	161-216
	(D)	5-4	88-119	142-192
	(D)	4-3	66-96	106-154

	(D)	3-2	33-67	53-108
	(D)	2-1	25-40	25-64

[a] The 5R55E 4.0L EI will shift 1-3 at minimum throttle. At medium throttle the transmission will resume a normal shift pattern 1-2, 2-3, 3-4, 4-5.

Band Adjustment And Torque Chart

Description	Number of Turns To Back Off	Locknut		Adjusting Screw	
		Nm	Lb-Ft	Nm	Lb-Ft
Intermediate Band	2.0	47-61	35-45	14	10
Front Band	2.0	47-61	35-45	14	10

End Play Specifications

Transmission Front End Play Dimension "C"	Select Thrust Washer (No. 1 Nylon)		Identification: Color
	Part Number	Thickness	
Front No. 0.4 in (10 mm) (0.007-0.028 in) Without Gasket	F7TZ-7D014-VA F7TZ-7D014-TA F7TZ-7D014-MA F7TZ-7D014-NA F7TZ-7D014-PA F7TZ-7D014-RA F7TZ-7D014-SA	1.35-1.40 mm (0.053-0.055 in) 1.55-1.60 mm (0.061-0.063 in) 1.75-1.80 mm (0.069-0.071 in) 1.85-1.90 mm (0.073-0.075 in) 1.95-2.00 mm (0.077-0.079 in) 2.05-2.10 mm (0.081-0.083 in) 2.15-2.20 mm (0.085-0.087 in)	Blue White Green Red Beige Black Yellow

End Play Specifications

Rear (No. 4) Dimension "H"	Selective Needle Bearings (No. 4)		Identification: Notches
	Part Number	Thickness	
3.01-3.15 mm (0.119-0.124 in)	XW4Z-7D014-CA	2.65-2.80 mm (0.104-0.110 in)	0
3.17-3.34 mm (0.125-0.132 in)	XW4Z-7D014-DA	2.80-2.95 mm (0.110-0.116 in)	1
3.36-3.54 mm (0.133-0.140 in)	XW4Z-7D014-EA	3.00-3.15 mm (0.118-0.124 in)	2
3.57-3.71 mm (0.141-0.147 in)	XW4Z-7D014-FA	3.20-3.35 mm (0.126-0.132 in)	3
Rear No. 4 Reference End Play 0.20-0.54 mm (0.008-0.021 in)			

Torque Converter End Play

Transmission Model	Converter End Play			
	New or Rebuilt Converter		Used Converter	
	mm	inch	mm	inch
5R55E	0.58 max.	0.023 max.	1.27 max.	0.050 max.

Solenoid Application Chart

Gearshift Selector Position	Powertrain Control Module (PCM) Commanded Gear	5R55E Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
(D)	2 [2]	On	Off	On	Off	No
(D)	3	On	On	Off	Off	No
(D)	4	Off	Off	Off	Off	No
(D)	5	Off	Off	On	Off	No
Drive	1	On	Off	Off	Off	No
	2 [2]	On	Off	On	Off	No
	3	On	On	Off	On [2]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

[2] PCM Controlled
[2] On time calibration dependent

Torque Specifications

Description	Nm	lb-ft	lb-in
Catalytic converter-to-exhaust pipe nuts and bolts	34-46	25-34	—
Catalytic converter-to-crossover pipe nuts	34-46	25-34	—
Center support capscrew	9-13	—	80-115
Converter housing screws	36-52	27-39	—
Converter housing-to-engine screws	40-55	30-41	—
Crossmember screws	85-118	63-87	—
Crossmember nuts	88-115	65-85	—
Digital transmission range (TR) sensor screws	8-11	—	71-97
Extension housing screws and studs	36-52	27-39	—
Fluid pump screws	22-28	16-21	—

Front band locknut	47-61	35-45	—
Intermediate band locknut	47-61	35-45	—
Low/reverse servo cover screws	12-14	—	106-124
Main control valve body screws	8-11	—	71-97
Manual control outer lever nut	41-54	30-40	—
Manual valve detent spring screw	8-11	—	71-97
Manual valve inner lever nut	41-54	30-40	—
Output shaft speed sensor (OSS) sensor screw	8-11	—	71-97
Pressure plug to case (line and EPC)	8-12	—	71-106
Rear driveshaft screws	95-129	70-95	—
Separator plate screws	6-8	—	53-71
Solenoid clamp screws	6-8	—	53-71
Torque converter-to-flexplate nuts	30-40	22-30	—
Transmission cooler lines to case connectors	35-43	26-32	—
Transmission cooler line nut	24-31	18-23	—
Transmission fluid filter screws	8-11	—	71-97
Transmission fluid pan screws	13-15	—	115-132
Transmission servo heat shield nut	8-11	—	71-97
Transmission servo heat shield stud	12-16	—	106-142
Transmission mount nuts to crossmember	87-110	64-81	—
Transmission mount-to-extension housing screws	87-110	64-81	—
Turbine shaft speed (TSS) sensor screw	8-11	—	71-97
Transmission servo heat shield stud	12-16	—	106-142

Transmission Description

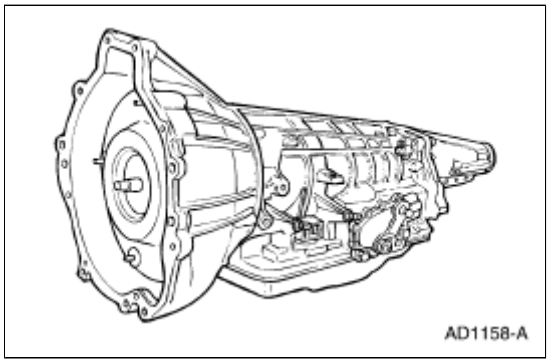
The 5R55E has the following features:

- Five forward speeds.
- Electronic shift, pressure, and torque converter clutch controls.
- Three compound planetary gearsets.
- Three bands.
- Three multi-plate clutches.
- Two one-way clutches.

All hydraulic functions are directed by electronic solenoids to control:

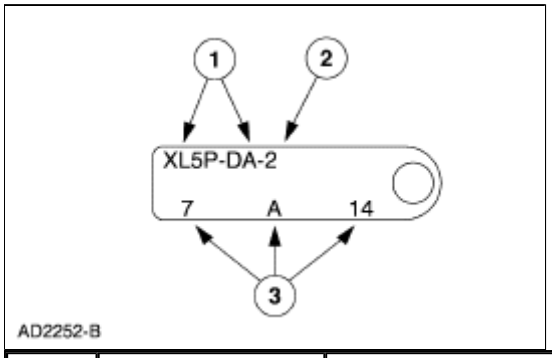
- Engagement feel.
- Shift feel.
- Shift scheduling.
- Modulated torque converter clutch (TCC) applications.
- Timing of the 3-2 torque demand and kickdown shifts.
- Engine braking (with O/D canceled) utilizing the coast clutch.
- Manual 1st timing.

Transmission View



Identification Tags

I. D. Tag Located on Transmission Case

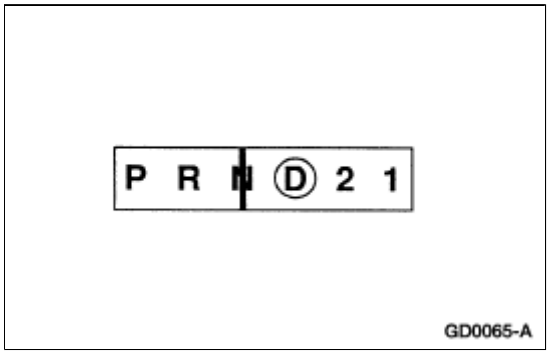


Item	Part Number	Description
1	—	Assembly Part No. Prefix and Suffix
2	—	Line Shift Code
3	—	Build Date Code (Year, Month, Day)

All vehicles are equipped with a Vehicle Certification Label, located on the driver side door lock post. Refer to the code in the space marked TR. For service ID level or build date information, refer to the transmission service ID tag located on the transmission case.

Range Selection

The transmission has six range positions: P, R, N, (D), 2 and 1.



Park

In the PARK position:

- There is no power flow through the transmission.
- The parking pawl locks the output shaft to the case.
- The engine may be started.
- The ignition key may be removed.

Reverse

In the REVERSE position:

- The vehicle may be operated in a rearward direction, at a reduced gear ratio.

Neutral

In the NEUTRAL position:

- There is no Power flow through the transmission.
- The output shaft is not held and is free to turn.
- The engine may be started.

Overdrive

Overdrive is the normal position for most forward driving.

The OVERDRIVE position provides:

- Automatic shifts.
- Apply and release of the torque converter clutch.
- Maximum fuel economy during normal operation.

- Automatic shift 1-4 with O/D canceled.
- Engine braking with coast clutch applied in 1, 3 and 4.

2nd Position—3rd Gear

The 2nd position provides:

- Third gear start and hold.
- The torque converter clutch may apply and release.
- Improved traction on slippery roads.
- Engine braking.

Manual Low Position

If this position is selected at normal road speeds, the transmission will shift into third gear, then into first when the vehicle reaches a speed below approximately 48 km/h (30 mph).

This position provides:

- First gear operation only.
- Engine braking for descending steep grades.

Shift Patterns

Upshifts

Transmission upshifting is controlled by the powertrain control module (PCM) (12A650). The PCM receives inputs from various engine or vehicle sensors and driver demands to control shift scheduling, shift feel and torque converter clutch (TCC) operation.

Downshifts

Under certain conditions the transmission will downshift automatically to a lower gear range (without moving the gearshift lever (7210)). There are three categories of automatic downshifts; Coastdown, Torque Demand and Forced or Kickdown shifts.

Coastdown

The coastdown downshift occurs when the vehicle is coasting down to a stop.

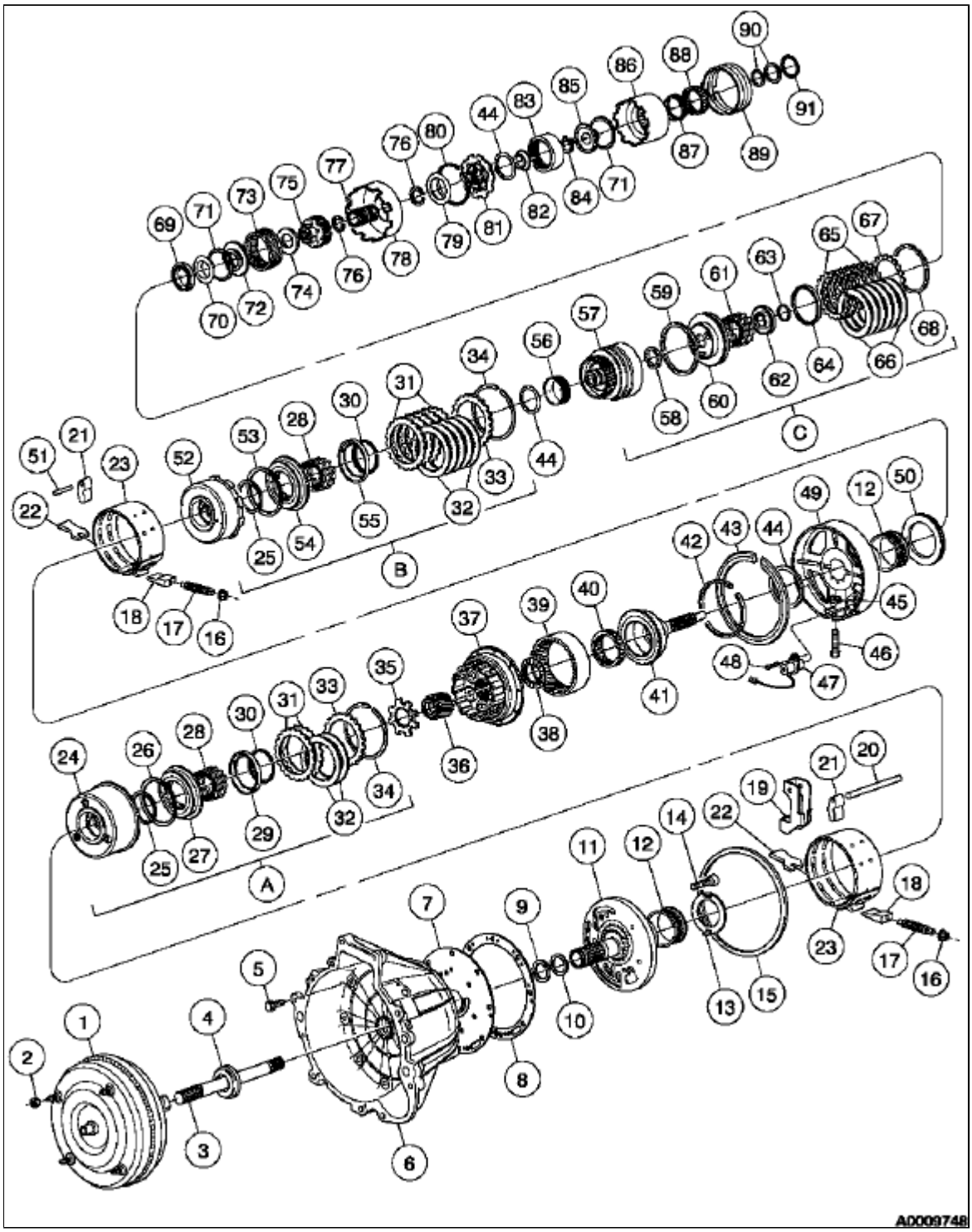
Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio. If applied, the transmission will disengage the TCC to provide added acceleration.

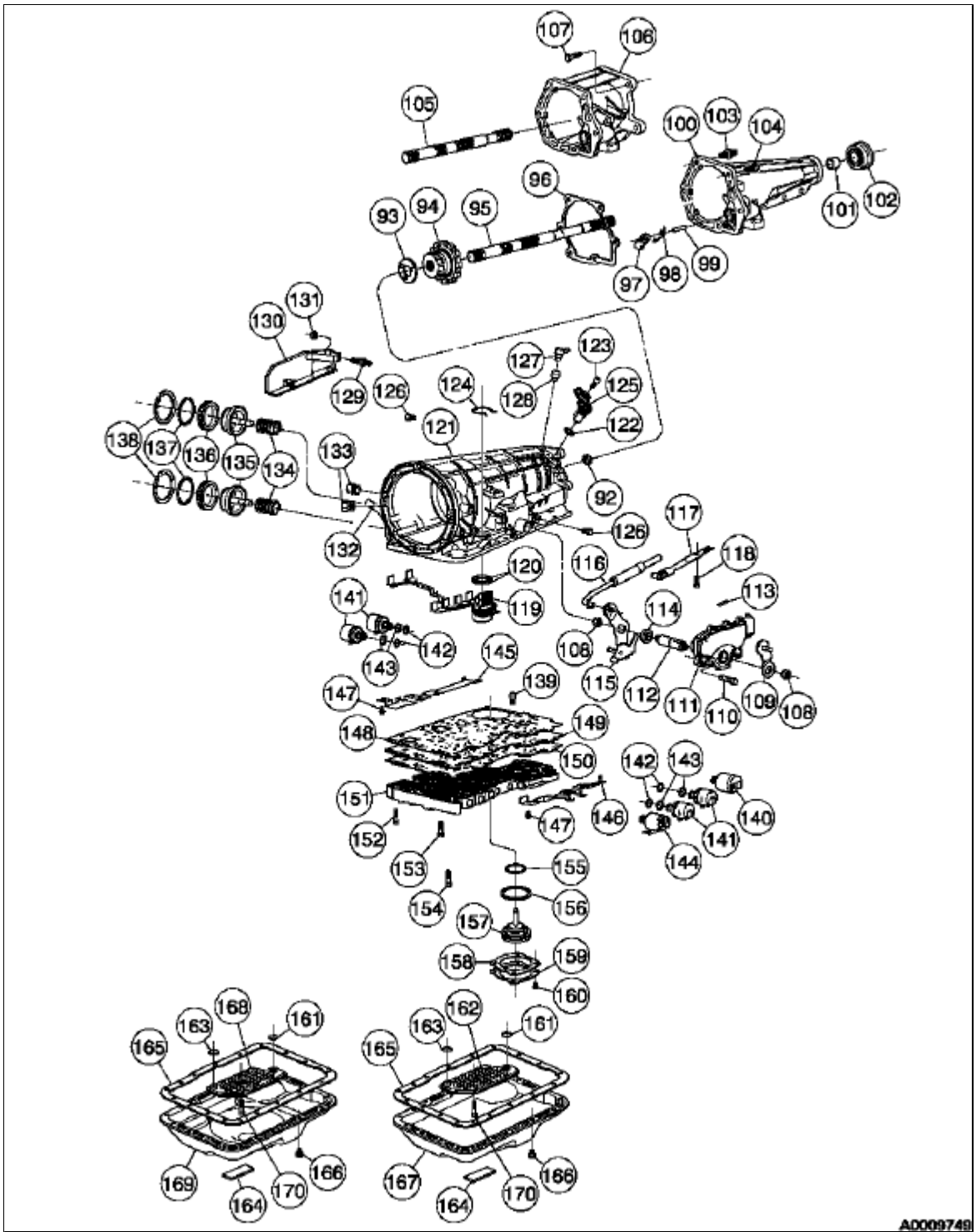
Kickdown

For maximum acceleration, the driver can force a downshift by pressing the accelerator pedal to the floor. A forced downshift into a lower gear is possible below calibrated speeds. Specifications for downshift speeds are subject to variations due to tire size, engine and transmission calibration requirements.

Disassembled Views



Disassembled Views



Item	Part Number	Description
1	7902	Converter assembly — (contains piston type clutch)
2	379299-S2	Nut — (attaches converter assembly to flexplate) (4 req'd)
3	7017	Shaft — input
4	7A248	Seal assembly — converter hub to converter

		housing (also in converter housing assembly)
5	E804595	Screw and seal assembly — M10 x 33 (attaches converter housing to case) (8 req'd)
6	7976	Converter housing
7	7B472	Plate — fluid pump adapter
8	7A136	Converter housing-to-case gasket
9	7L323	Seal ring — fluid pump support
10	W701431-S300	O-ring — fluid pump shaft to inner gear (also in pump assembly)
11	7M205	Fluid pump assembly
12	7M155	Bearing assembly
13	7D014	Washer — fluid pump input thrust (select fit) No. 1
14	W701429-S309M	Screw, fluid pump-to-converter housing (6 req'd)
15	7A248	Seal ring — fluid pump
16	E825100-S100	Nut and seal assembly — hex intermediate and front band adjustment/lock (2 req'd)
17	7C492	Screw — intermediate and front band adjuster/lock (2 req'd)
18	7D430	Strut — intermediate and front band anchor (2 req'd)
19	7A653	Bracket — front band lever to case
20	7D433	Shaft — front band actuating lever
21	7330	Lever — intermediate and front band servo (2 req'd)
22	7D029	Strut — intermediate and front band apply (2 req'd)
23	7D034	Band assembly — intermediate and front (2 req'd)
24	7L669	Drum assembly — front brake and coast clutch
25	7D404	Seal ring — coast clutch and direct clutch piston — inner (2 req'd)
26	7A548	Seal ring — coast clutch piston — outer
27	7A262	Piston — coast clutch
28	7A480	Spring — coast and direct clutch piston (40 req'd)
29	7A527	Retainer — coast and direct clutch piston springs
30	E860125-S	Retaining ring, 63 mm — coast and direct clutch piston
31	7B442	Plate — coast (2 req'd) and direct (4 or 5 req'd) clutch external steel
32	7B164	Plate — coast (2 req'd) and direct (4 or 5 req'd) clutch internal friction

33	7B066	Plate — coast and direct clutch pressure (2 req'd)
34	E860126S/129S	Retaining ring — coast and direct clutch plates (select fit) (2 req'd)
35	7660	Adapter — coast clutch to front carrier
36	7D063	Gear — sun overdrive
37	7B446	Carrier — planetary gear front (with trigger wheel)
38	7L495	Bearing — front planet thrust No. 2
39	7A153	Gear — overdrive ring
40	7C109	Shaft — overdrive center
41	7A658	Shaft — center overdrive ring (includes front overrunning clutch 7C109)
42	W702037-S300	Retaining ring — center shaft in front ring gear
43	W702465-S300	Retaining ring — center support in case
44	7M153	Bearing — center shaft thrust No. 3, 5, and 9 (3 req'd)
45	E826160-S76	Nut and cage assembly — (attaches center support to case)
46	E804373-S	Screw cap (attaches center support to case)
47	7M101	Sensor — turbine shaft speed (TSS)
48	W702297-S300	Screw — turbine shaft speed sensor
49	7A130	Support — center
50	7D014	Bearing — intermediate brake drum thrust (select fit) No. 4
51	7D433	Shaft — intermediate band actuating lever
52	7D044	Drum — intermediate brake and direct clutch (not available separately)
53	7A548	Seal ring — direct clutch piston outer
54	7A262	Piston — direct clutch
55	7A527	Retainer — direct clutch piston spring
56	7M154	Bearing assembly
57	7A360	Cylinder — forward clutch
58	7A548	Seal ring — forward clutch piston inner
59	7A548	Seal ring — forward clutch piston outer
60	7A262	Piston — forward clutch
61	7A480	Spring — forward clutch piston (15 req'd)
62	7A527	Retainer — forward clutch piston spring
63	E860109-S	Retaining ring — forward clutch piston and spring in forward clutch cylinder
64	7B070	Spring — forward clutch cushion
65	7B442	Plate — forward clutch external steel (6 req'd)
66	7B164	Plate — forward clutch internal friction (6 req'd)

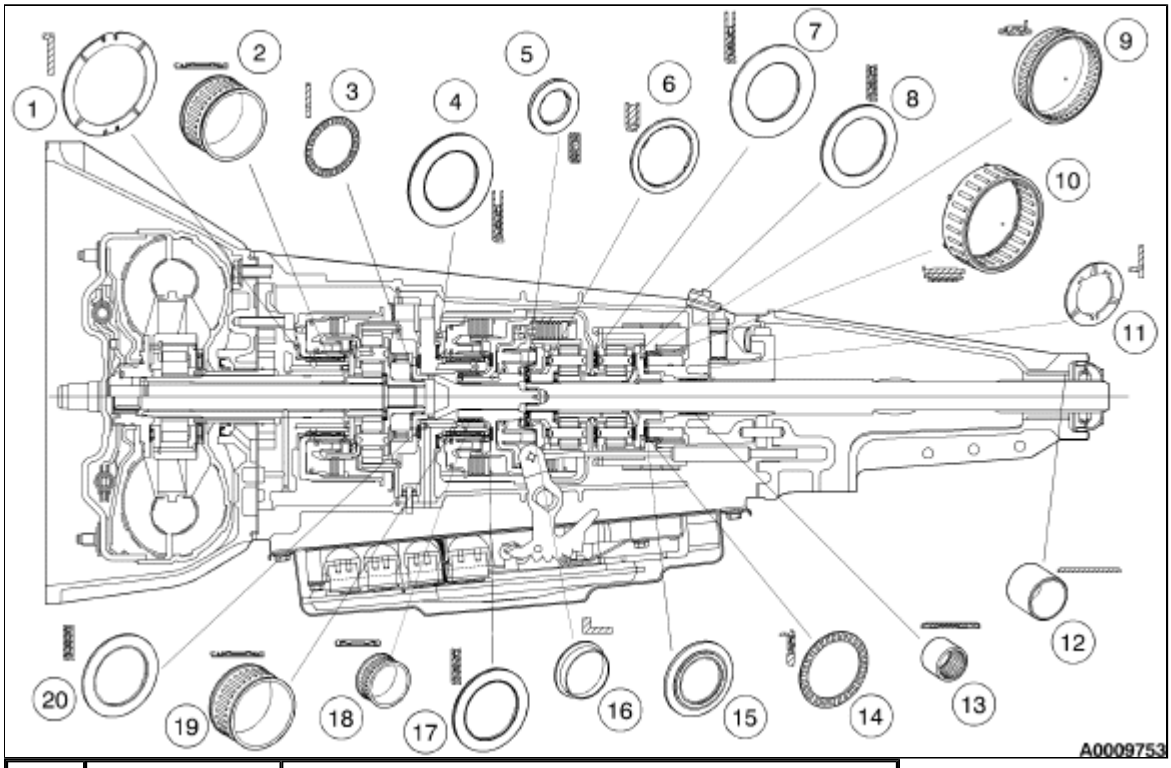
67	7B066	Plate — forward clutch pressure
68	E860115S/118S	Retaining ring — forward clutch plates in forward clutch cylinder (select fit)
69	7D234	Bearing — forward ring gear hub thrust No. 6A
70	7D090	Washer — forward clutch thrust No. 6B
71	E860122-S	Retaining ring — forward and output shaft ring gears to hubs (2 req'd)
72	7B067	Hub — forward ring gear
73	7D392	Gear — forward ring (72 external teeth and 57 internal teeth)
74	7F374	Bearing — forward planet thrust No. 7
75	7A398	Planetary — forward (6 pinion)
76	E860121-S	Retaining ring 39 mm (1.56 in) — input shell to sun gear assembly (2 req'd)
77	7D063	Gear — sun (forward)
78	7D064	Shell — input
79	7M151	Bearing — low/reverse planet carrier thrust No. 8
80	W702037-S300	Retaining ring — low/rev planet to low/rev brake drum
81	7D006	Planet — low/reverse (6 pinion)
82	7B176	Sleeve — output
83	7A153	Gear — output shaft ring
84	E860527-S	Retaining ring 25 x 2 mm — output shaft in case
85	7D164	Hub — output shaft
86	7C498	Drum — low/reverse brake (includes overrunning clutch)
87	7D001	Bearing — part of reverse drum
88	7C109	Clutch assembly — part of reverse drum
89	7D095	Band — low/reverse
90	7M150	Bearing race (2 pieces) — output shaft hub thrust No. 10A
91	7M150	Bearing — output shaft hub thrust No. 10B
92	7R205	Bearing — output shaft to case (part of case assembly)
93	7B368	Washer — output shaft thrust No. 11
94	7M167	Gear — transmission parking
95	7060	Shaft — output (4x2)
96	7086	Gasket — extension housing
97	7A441	Pawl — parking
98	7D070	Spring — parking pawl return
99	7D071	Shaft — parking pawl

100	7A039	Extension housing (4x2)
101	7A034	Bushing — extension housing (4x2)
102	7052	Seal — extension housing to slip yoke (4x2)
103	E804137-S72	Stud — extension housing (1 or 2 req'd)
104	E800152-S72	Screw — extension housing (5 or 6 req'd)
105	7060	Shaft — output (4x4)
106	7A039	Extension housing (4x4)
107	N605804-S100	Screw — extension housing to transfer case (5 req'd)
108	W701271-S309	Nut — attaches outer and inner manual valves to shaft (2 req'd)
109	7A256	Lever — manual control outer
110	N806933-S100	Screw — digital transmission range (TR) sensor (2 req'd)
111	7F293	Sensor — digital transmission range (TR)
112	7A308	Shaft — manual valve outer to inner lever
113	E840125-S	Pin — spring (retains outer manual lever to case)
114	7B498	Seal — main control lever
115	7A115	Lever — manual valve inner
116	7A232	Rod — parking pawl actuating
117	7E332	Spring assembly — manual valve detent
118	E800185-S	Screw detent spring
119	7Z409	Connector — transmission case (16-pin with wire harness to 6 solenoids)
120	W703015-S300	O-ring — transmission case (16-pin) connector
121	7005	Case assembly (model dependent)
122	W702981-S300	O-ring — speed sensor
123	W702297-S300	Screw — OSS sensor
124	W703165-S300	Spring — transmission case (16-pin) connector
125	7H103	Sensor — output shaft speed (OSS)
126	390318-S2	Plug — pipe line and EPC pressure (part of case assembly) (2 req'd)
127	7034	Vent — (4x4)
128	7034	Vent — (4x2)
129	E804533-S201	Stud — attaches heat shield to case
130	7F013	Shield — transmission heat
131	N620040-S36	Nut — transmission heat shield
132	7A160	Tube — lube fluid inlet — short
133	7D273	Connector — fluid tube (2 req'd)
134	7D028	Spring — intermediate servo and front piston

135	7D021	Piston and rod — intermediate and front servo
136	7D027	Cover and seal — intermediate and front servo
137	7D040	O-ring — intermediate and front servo
138	E860343-S	Retaining ring — 67 x 1.5 mm intermediate and front servo
139	E804357-S76	Screw — attaches separating plate to main control (3 req'd)
140	7G383	Solenoid — electronic pressure control (EPC)
141	7G484	Solenoid — transmission shift (SS) (4 req'd)
142	W702949-S300	O-ring — shift solenoid small (13x1.5) (4 req'd)
143	W702951-S300	O-ring — shift solenoid large (15x1.5) (4 req'd)
144	7G136	Solenoid — torque converter clutch (TCC)
145	7L491	Clamp — (SSA and SSC) solenoids
146	7L491	Clamp — TCC/SSD/SSB and EPC solenoids
147	E800155-S	Screw — clamp (2 req'd)
148	7C155	Gasket — control valve body-to-case
149	7A008	Plate — valve body separating (not available separately)
150	7D100	Gasket — control valve body separating
151	7A100	Control valve body — main (model dependent)
152	E800154-S	Screw — M6x45 main control valve body (4 req'd)
153	E800153-S	Screw — main control valve body (16 req'd)
154	E800163-S	Screw — main control valve body (3 req'd)
155	7423	Seal ring — low/reverse servo piston small
156	7423	Seal ring — low/reverse servo piston large
157	7D189	Piston — low/reverse band servo (select fit)
158	7L173	Gasket — low/reverse servo cover
159	7D036	Cover — low/reverse servo
160	E800156-S	Screw — low/reverse servo cover (4 req'd)
161	E853163-S	O-ring — fluid filter small
162	7A098	Filter — fluid pan (4x2)
163	E853164-S	O-ring — fluid filter large
164	7E290	Magnet
165	7A191	Gasket — fluid pan
166	W701203-S309M	Screw — transmission fluid pan (18 req'd)
167	7A194	Pan — transmission fluid (4x2)
168	7A098	Filter — transmission fluid pan (4x4)
169	7A194	Pan — transmission fluid (4x4)

170	E800154-S	Screw — fluid filter
A	—	Coast clutch assembly
B	—	Direct clutch assembly
C	—	Forward clutch assembly

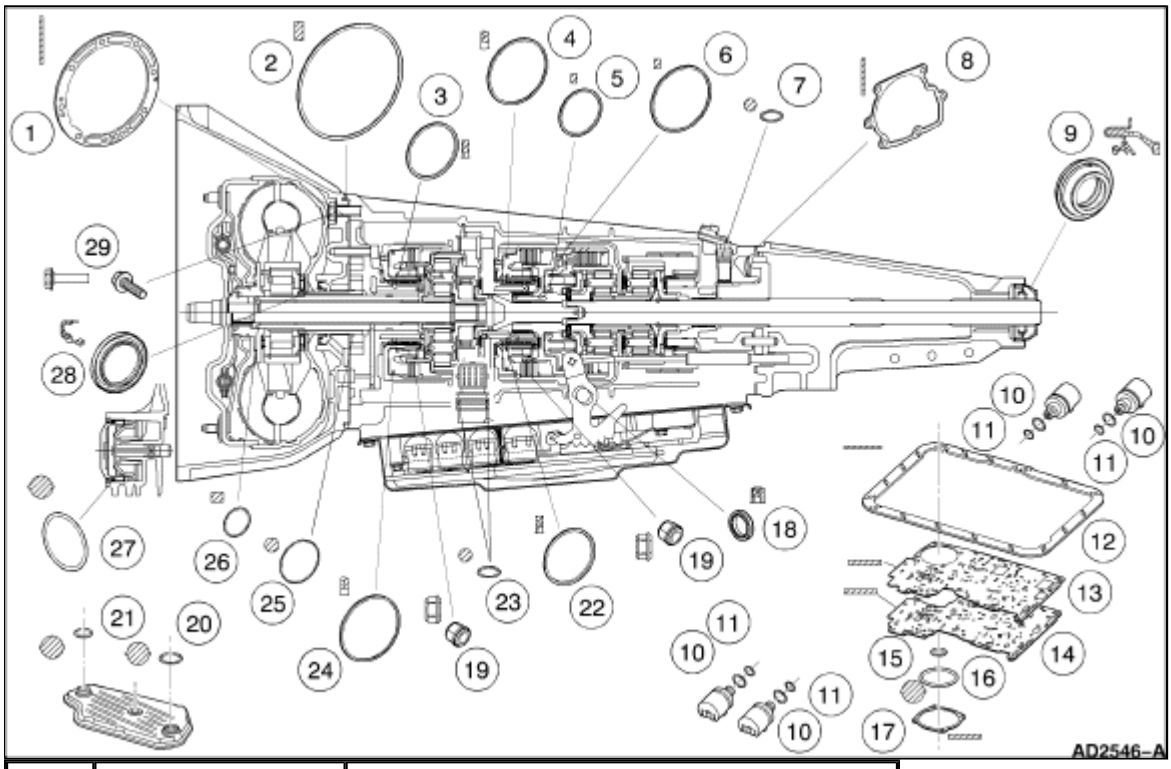
Bushings, Bearing and Thrust Washer Locator



Item	Part Number	Description
1	7D014	No. 1 selective washer
2	7M155	Bearing and seal assembly
3	7L495	No. 2 needle bearing
4	7F014	No. 4 selective needle bearing
5	7D234	No. 6A needle bearing
6	7F374	No. 7 needle bearing
7	7M151	No. 8 needle bearing
8	7M153	No. 9 needle bearing
9	7D001	Bearing — part of reverse drum
10	7C109	Clutch assembly — part of reverse drum
11	7B368	No. 11 washer
12	7A034	Bushing (part of 7A039) (serviced separately)
13	7R205	Needle bearing
14	7M150	No. 10B needle bearing assembly
15	7M150	No. 10B needle bearing assembly (2 pieces)
16	7D090	No. 6B bushing
17	7M153	No. 5 needle bearing

18	7M154	Bearing and seal assembly
19	7M155	Bearing and seal assembly
20	7M153	No. 3 needle bearing

Seals, Rings and Gaskets Locator



Item	Part Number	Description
1	7A136	Gasket (fluid pump)
2	7A248	Seal ring (fluid pump)
3	7D404	Seal ring
4	7A548	Seal ring
5	7A548	Seal ring
6	7A548	Seal ring
7	W702981-S300	O-ring
8	7086	Gasket (transmission extension)
9	7052	Seal (extension housing)
10	W702949-S300	O-ring (large) (4 req'd)
11	W702951-S300	O-ring (small) (4 req'd)
12	7A191	Gasket (fluid pan)
13	7C155	Gasket (main control, upper)
14	7D100	Gasket (main control, lower)
15	7423	O-ring (reverse servo piston) (small)
16	7423	O-ring (reverse servo piston) (large)
17	7L173	Gasket (reverse servo plate cover)

18	7B498	Seal assembly (manual cover lever)
19	E825100-S100	Nut and seal
20	7A469	O-ring (large) (fluid filter)
21	7A469	O-ring (small) (fluid filter)
22	7D404	Seal ring
23	W703015-S300	O-ring
24	7A548	Seal ring
25	W703015-S300	O-ring
26	7L323	Seal ring
27	7D040	O-ring (intermediate/front servos)
28	7A248	Seal assembly (converter hub)
29	E804595-S200	Screw and seal assembly

Main Components and Functions

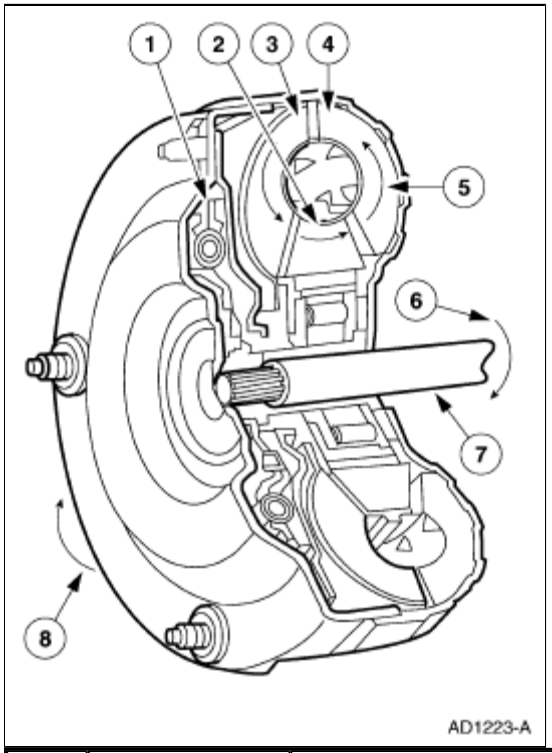
Torque Converter

The torque converter transmits and multiplies torque. The torque converter is a four-element device:

- Impeller assembly
- Turbine assembly
- Reactor assembly
- Clutch and damper assembly

The standard torque converter components operate as follows:

- Rotation of the converter housing and impeller set the fluid in motion.
- The turbine reacts to the fluid motion from the impeller, transferring rotation to the geartrain through the input shaft.
- The reactor redirects fluid going back into the impeller, allowing for torque multiplication.
- The clutch and damper assembly dampens powertrain torsional vibration and provides a direct mechanical connection for improved efficiency.
- Power is transmitted from the torque converter to the planetary gearsets and other components through the input shaft.



Item	Part Number	Description
1	—	Converter clutch and damper (part of 7902)
2	—	Reactor (part of 7902)

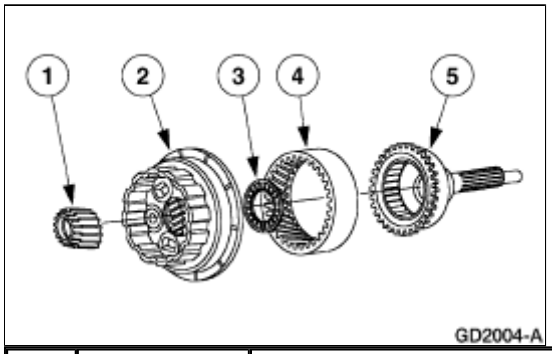
3	—	Turbine (part of 7902)
4	—	Impeller (part of 7902)
5	—	Fluid motion
6	—	Transmission input rotation
7	—	Input shaft
8	—	Engine rotation

Geartrain

Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Bands and clutches are used to hold and drive certain combinations of gearsets. This results in five forward ratios and one reverse ratio, which are transmitted to the output shaft and differential.

Gear Ratio	
1st	2.47 to 1
2nd	1.87 to 1
3rd	1.47 to 1
4th	1.00 to 1
5th	0.75 to 1
Reverse	2.10 to 1

Planetary Gearset — Front

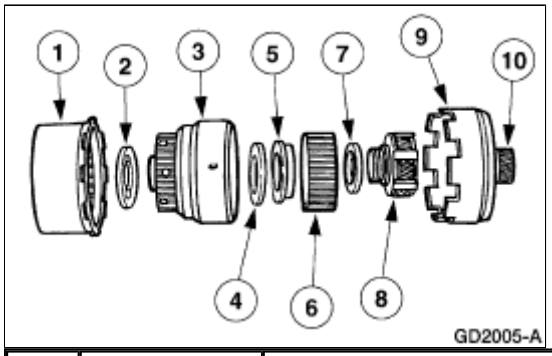


Item	Part Number	Description
1	7D063	Front sun gear
2	7B446	Front planetary gear carrier
3	7L495	Front planetary thrust bearing (No. 2)
4	7653	Front ring gear
5	—	Center ring and shaft (includes front overrunning clutch)

The planetary gear front carrier is driven by the input shaft.

- The front planetary gearset carrier drives the center shaft via the overdrive one-way clutch in 1st, 3rd and 4th gears.
- In 2nd, the front sun gear is held causing the pinion gears to rotate around the front sun gear.
- The pinion gears in turn drive the front ring gear and, with the intermediate band applied results in a 2nd gear ratio of 1.87 to 1.
- In 5th, the front sun gear is held causing the pinion gears to rotate around the front sun gear.
- The pinion gears in turn drive the front ring gear and, with the intermediate band applied results in a 5th (overdrive) gear ratio of 0.75 to 1.
- The front planetary gearset is internally splined to the coast clutch for engine braking.

Planetary Gearset — Forward

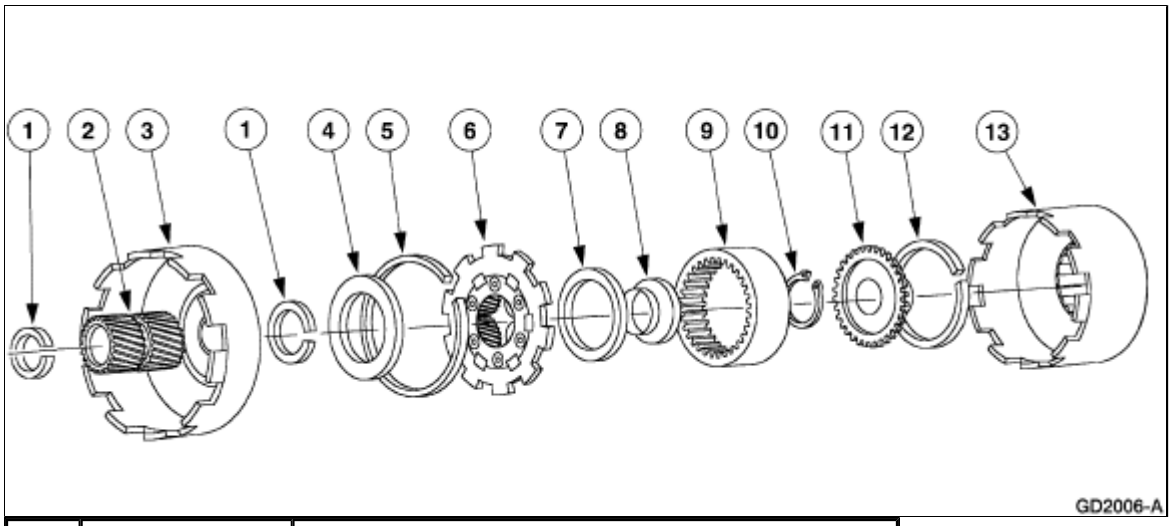


Item	Part Number	Description
1	7D044	Intermediate brake and direct clutch drum
2	7M153	Forward clutch thrust bearing (No. 5)
3	7A360	Forward clutch cylinder
4	7D234	Forward ring gear thrust bearing (No. 6a)
5	7D090	Forward clutch thrust washer (No. 6b)
6	7D392	Forward ring gear
7	7F374	Forward planetary thrust bearing assembly (No. 7)
8	7A398	Forward planetary
9	7D064	Input shell
10	7D063	Forward sun gear

The forward planetary gearset is splined to the output shaft.

- The forward planetary gearset is driven by the forward ring gear when the forward clutch is applied.
- The forward planetary gearset pinions drive the forward sun gear.
- The forward sun gear is splined to the input shell.

Planetary Gearset — Low/Reverse



Item	Part Number	Description
1	E860121-S	Retaining ring (2 req'd)
2	7D063	Forward sun gear
3	7D064	Input shell
4	7M151	Reverse planetary carrier thrust bearing (No. 8)
5	W702037-S300	Retaining ring
6	7D006	Low/reverse planetary gearset
7	7M153	Reverse planetary carrier thrust bearing (No. 9)
8	7B176	Output shaft sleeve
9	7A153	Output shaft ring gear
10	E860527-S	Retaining ring
11	7D164	Output shaft hub
12	E860122-S	Retaining ring
13	7C498	Low/reverse brake drum

The low/reverse planetary gearset is connected to the reverse brake drum by lugs from the low/reverse brake drum to the lugs of the low/reverse planetary gearset.

- The low/reverse planetary gearset is driven by the forward sun gear which is splined to the input shell.
- The splines of the forward sun gear drive the pinions in the low/reverse planetary gearset.
- The pinions of the low/reverse planetary gearset drive the output shaft ring gear and output shaft hub which is splined to the output shaft.
- The low/reverse planetary gearset is held via the low one-way clutch in the low/reverse brake drum, when the low/reverse band is applied.

Input Shaft

The input shaft is supported by two bushings in the stator support.

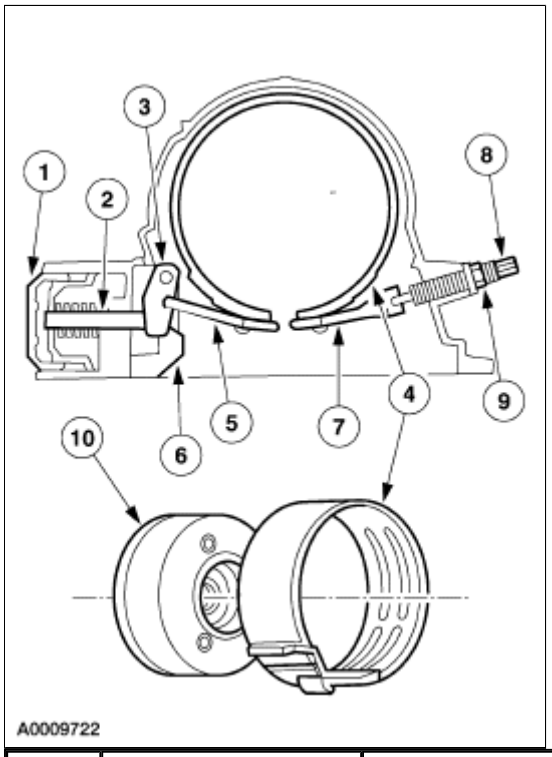
- End positioning of the input shaft is controlled by the splines in the converter turbine and the front planetary carrier.

Output Shaft

The output shaft is supported by a bearing in the case and by the slip yoke bushing in the extension housing. End positioning is controlled by the parking pawl gear and snap ring shoulder and by the reverse ring gear hub and snap ring.

Apply Components

Band — Front



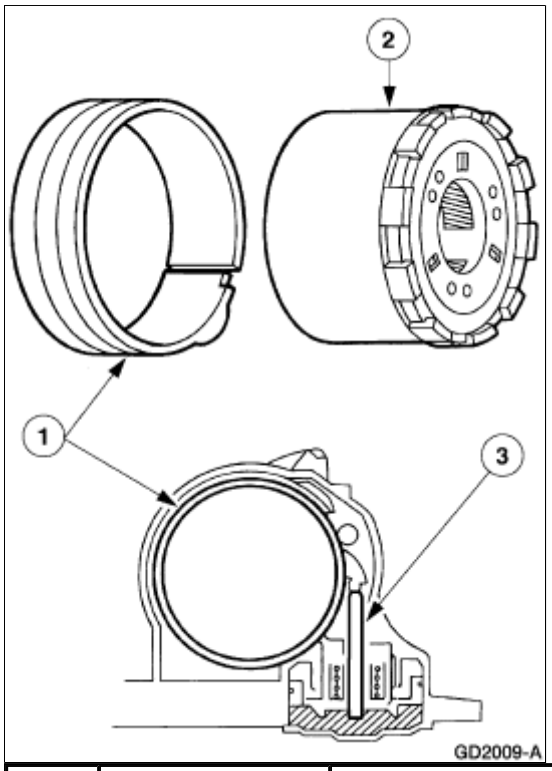
Item	Part Number	Description
1	7L493	Front servo cover assembly
2	7D021	Front servo piston and rod
3	7330	Front band servo lever
4	7D034	Front band
5	7D029	Front band apply strut
6	7A653	Front band lever to case bracket
7	7D430	Front band anchor strut
8	7C492	Front band adjuster/lock screw
9	E825100-S100	Front band lock nut
10	7L669	Front brake and coast clutch

Hydraulic pressure is applied to the front side of the front servo.

- This pressure causes the servo to stroke and apply force to the band.
- This action causes the front brake and coast clutch drum to be held.

- The front band holds the front brake and coast clutch drum to the case in 2nd and 5th gears.
- This causes the front sun gear to be held stationary through the coast clutch adapter and the front brake and coast clutch drum.

Band — Low/Reverse

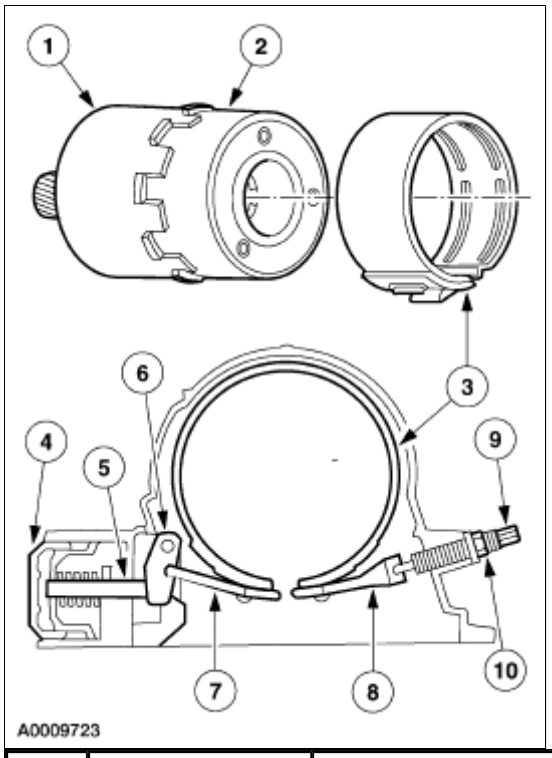


Item	Part Number	Description
1	7D095	Low/reverse band
2	7C498	Low/reverse brake drum
3	7D189	Low/reverse servo piston assembly

Hydraulic pressure is applied to the front side of the low/reverse servo.

- This pressure causes the servo to stroke and apply force to the low/reverse band.
- This action causes the low/reverse brake drum to be held.
- The low/reverse band holds the low/reverse brake to the case in 1st position and reverse gears.
- This causes the low/reverse planetary assembly to be held stationary.

Band — Intermediate

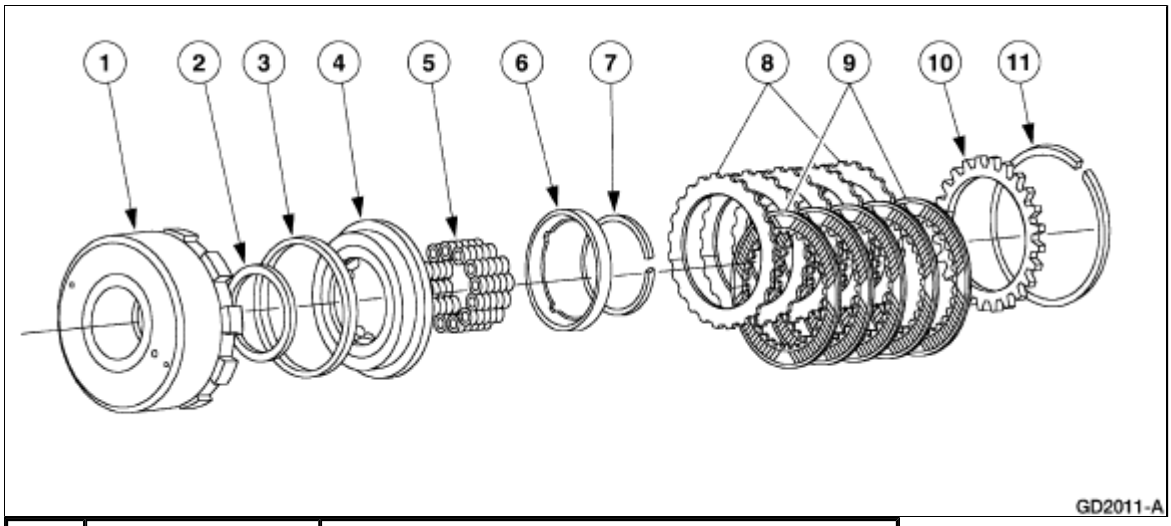


Item	Part Number	Description
1	7D064	Input shell
2	7D044	Intermediate brake and coast clutch drum
3	7D034	Intermediate band
4	7L493	Intermediate servo cover
5	7D021	Intermediate servo piston and rod
6	7330	Intermediate band servo lever
7	7D029	Intermediate band apply strut
8	7D430	Intermediate band anchor strut
9	7C492	Intermediate band adjuster/lock screw
10	E825100-S100	Front band lock nut

Hydraulic pressure is applied to the front side of the intermediate servo.

- This pressure causes the servo to stroke and apply force to the intermediate band.
- This action causes the intermediate brake and direct clutch drum to be held.
- The intermediate band holds the intermediate brake and direct clutch drum to the case in 3rd gear.
- This causes the input shell and forward sun gear to be held stationary.

Clutch — Direct

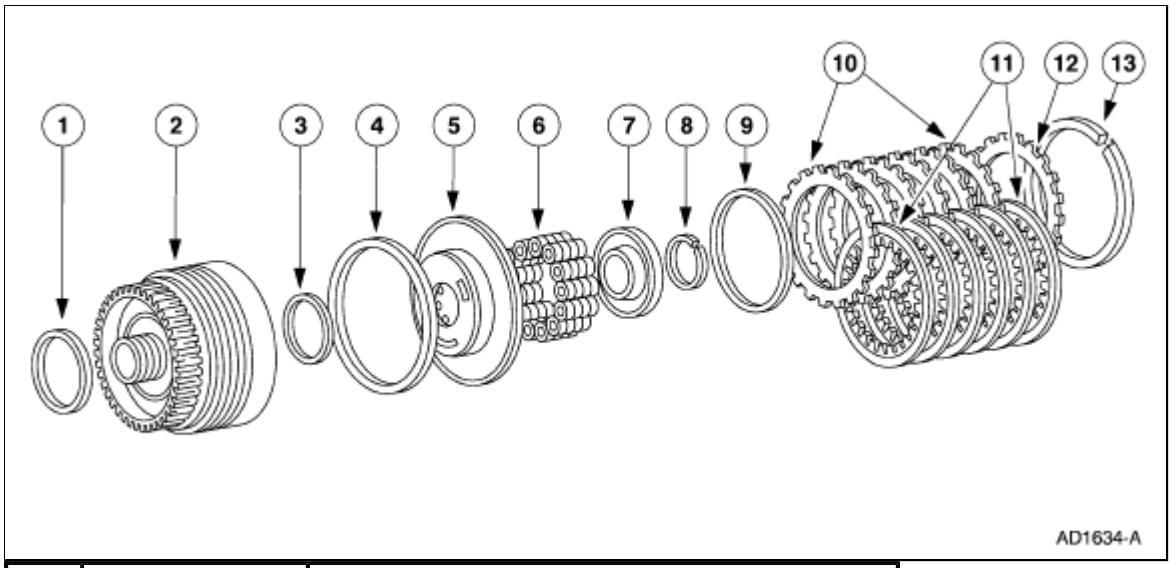


Item	Part Number	Description
1	7D044	Intermediate brake and direct clutch drum
2	7D404	Direct clutch piston inner seal ring
3	7A548	Direct clutch piston outer seal ring
4	7A258	Direct clutch piston
5	7A480	Direct clutch piston spring (20 req'd)
6	7A527	Direct clutch piston spring retainer (8 tabs)
7	E860125-S	Retaining ring
8	7B442	Direct clutch external plate — steel
9	7B164	Direct clutch internal plate — friction
10	7B066	Direct clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

The direct clutch is a multi-disc clutch made up of steel and friction plates.

- The direct clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- It is housed in the intermediate brake and direct clutch drum.
- In drive, the direct clutch is applied and coupled to the forward clutch. This drives the input shell and forward sun gear in 4th and 5th gears.
- In reverse, the direct clutch is applied and coupled to the input shell and forward sun gear.
- This action causes the forward sun gear to drive the pinions of the low/reverse planetary carrier.
- Since the low/reverse planetary carrier is held stationary by the low/reverse band, the pinions drive the output shaft ring gear in reverse.

Clutch — Forward

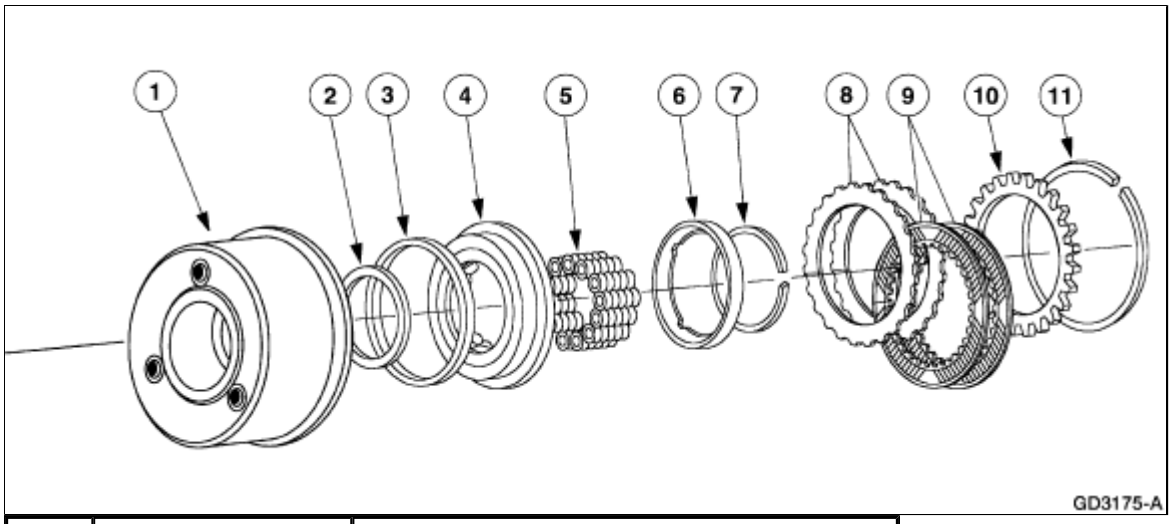


Item	Part Number	Description
1	7M153	Forward clutch cylinder thrust bearing (No. 5)
2	7A360	Forward clutch cylinder
3	7D548	Forward clutch piston inner seal
4	7A548	Forward clutch piston outer seal
5	7A262	Forward clutch piston
6	7A480	Forward clutch piston spring (15 req'd)
7	7A527	Forward clutch piston spring retainer
8	E860109-S	Retaining ring
9	7B070	Forward clutch cushion spring
10	7B442	Forward clutch external plate — steel
11	7B164	Forward clutch internal plate — friction
12	7B066	Forward clutch pressure plate
13	E860115S/118S	Retaining ring (select fit)

The forward clutch is a multi-disc clutch made up of steel and friction plates.

- The forward clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The forward clutch is applied in all forward gears.
- When applied, the forward clutch provides a direct mechanical coupling between the input shaft and the forward ring gear and hub.

Clutch — Coast

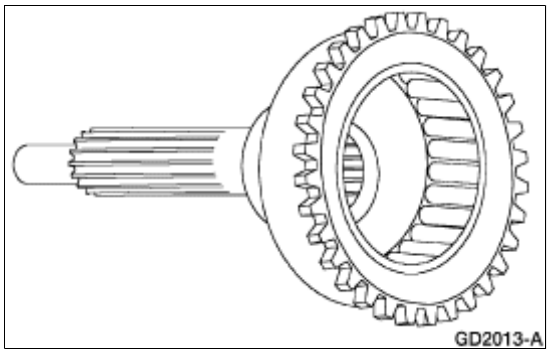


Item	Part Number	Description
1	7L669	Front brake and coast clutch drum
2	7D404	Coast clutch piston inner seal ring
3	7A548	Coast clutch piston outer seal ring
4	7A258	Coast clutch piston
5	7A480	Coast clutch piston spring (20 req'd)
6	7A527	Coast clutch piston spring retainer
7	E860125-S	Retaining ring
8	7B442	Coast clutch external plate — steel
9	7B164	Coast clutch internal plate — friction
10	7B066	Coast clutch pressure plate
11	E860126S/129S	Retaining ring (select fit)

The coast clutch is a multi-disc clutch made up of steel and friction plates.

- The coast clutch is applied with hydraulic pressure and disengaged by return springs and the exhaust of the hydraulic pressure.
- The coast clutch is housed in the front brake and coast clutch drum.
- The coast clutch is applied when the TCS switch is on, energizing SSD, and 5th gear operation is inhibited (4th gear only).
- The coast clutch is hydraulically applied when the transmission is in 2nd and 1st position.
- When applied, the coast clutch locks the input shaft to the front planetary carrier, thus preventing the one-way clutch from overrunning when the vehicle is coasting.
- This allows the use of engine compression to help slow the vehicle and provide engine braking.

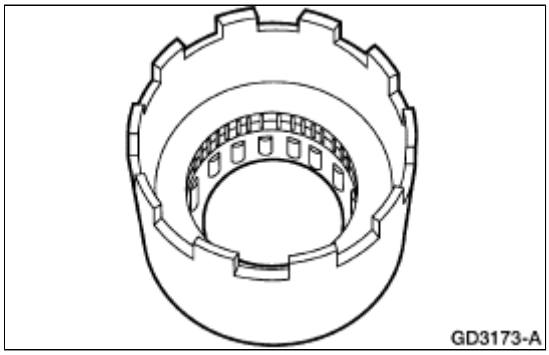
One-Way Clutch — Front



The front one-way clutch is a sprag-type one-way clutch that is pressed into the center shaft.

- The front one-way clutch is driven by the ring gear of the front planetary carrier.
- The front one-way clutch holds and drives the outer splines of the center shaft in 1st, 3rd, and 4th gears.
- The front one-way clutch overruns during all coast operations and at all times in 2nd and 5th gear.

One-Way Clutch — Low/Reverse

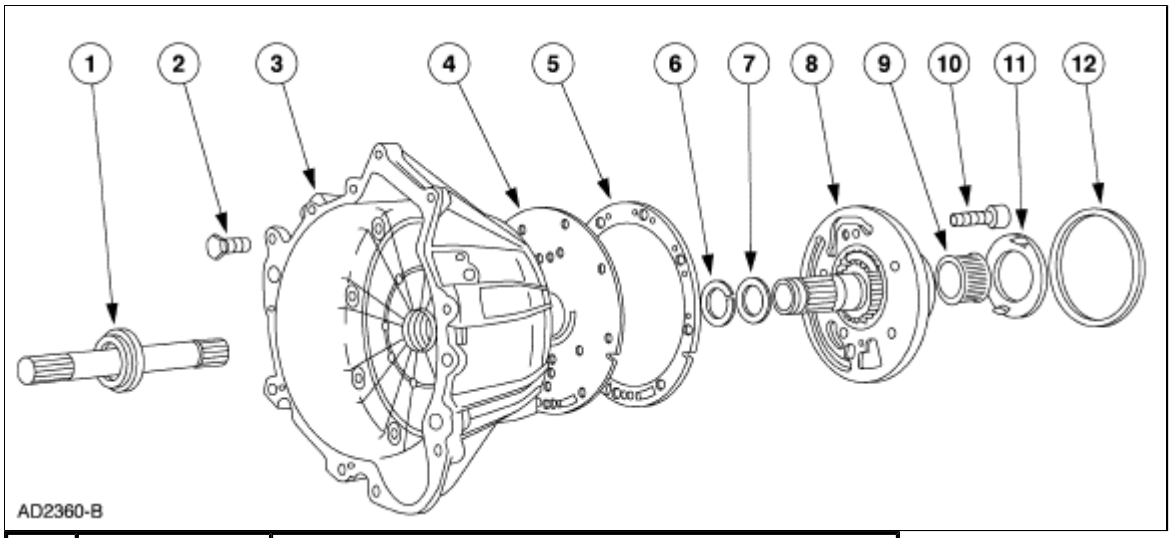


The low/reverse one-way clutch is a sprag-type one-way clutch.

- The low/reverse one-way clutch holds the low/reverse brake drum and low/reverse planetary assembly to the case in 1st gear only.
- In all other gears the low/reverse one-way clutch overruns.

Hydraulic System

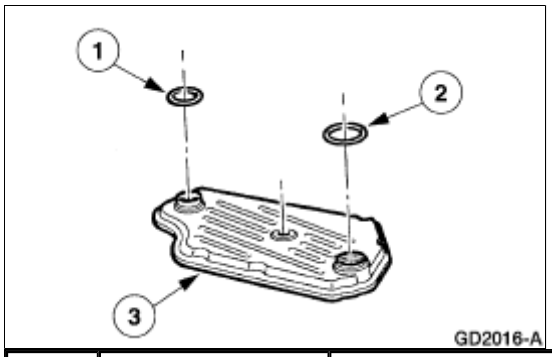
Fluid Pump



Item	Part Number	Description
1	7A248	Converter hub-to-converter housing seal
2	E804595-S2000	Converter housing-to-transmission case bolt and seal assembly (8 req'd)
3	7976	Converter housing
4	7B472	Fluid pump adapter plate
5	7A136	Fluid pump gasket
6	7L323	Fluid pump support seal ring
7	W701431-S300	Fluid pump shaft-to-inner gear O-ring
8	7A103	Fluid pump
9	7M155	Bearing assembly
10	W701429-S309M	Fluid pump-to-converter housing bolts (6 req'd)
11	7D014	Nylon fluid pump input thrust washer (No. 1) (selective)
12	7A248	Seal and ring fluid pump

- The fluid pump provides the fluid pressure required to charge the torque converter, main control assembly, transmission cooling system, lubrication system and apply devices.
- The fluid pump is a positive displacement, gear and crescent-type pump.
  - The fluid pump is driven by the torque converter cover hub.

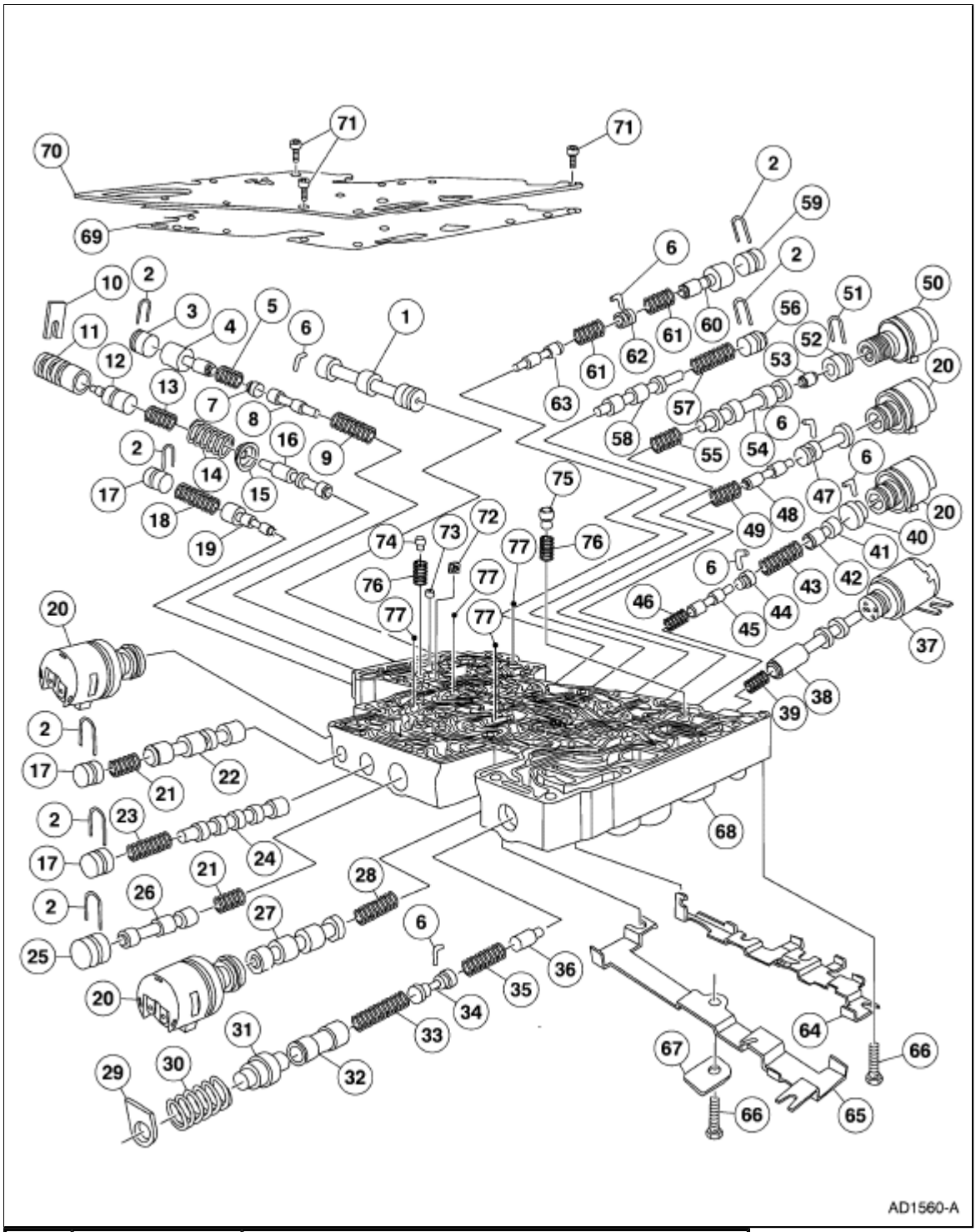
Filter



Item	Part Number	Description
1	7A469	Transmission fluid filter small o-ring
2	7A469	Transmission fluid filter large o-ring
3	7A098	Transmission fluid filter

- All fluid drawn from the transmission fluid pan by the fluid pump passes through the fluid filter.
- The transmission fluid filter and its accompanying seals are part of the fluid path from the sump (pan) to the fluid pump.
  - The transmission fluid filter has a bypass section which allows fluid vented at the main regulator valve to be recirculated to the fluid pump, without passing through the transmission fluid filter.

Main Control



Item	Part Number	Description
1	—	Valve — manual
2	7E335	Retainer — valve plug (7 req'd)
3	—	Plug — valve retainer
4	—	Valve — forward modulator
5	—	Spring — forward modulator

6	7E335	Retainer — valve plug (6 req'd)
7	—	Plug — valve retainer
8	—	Valve — EPC boost
9	—	Spring — EPC boost
10	7E336	Retainer — valve plug
11	—	Sleeve — pressure boost
12	—	Valve — pressure boost
13	—	Spring — pressure boost
14	—	Spring — oil pressure regulator
15	—	Retainer — main regulator spring
16	—	Valve — pressure regulator
17	—	Plug — valve retainer (3 req'd)
18	—	Spring — forward engagement
19	—	Valve — forward engagement control
20	7G484	Solenoid — shift (4 req'd)
21	—	Spring — 4-3 (K.D./T.D.) (2 req'd)
22	—	Valve — 4-3 (K.D.)
23	—	Spring — manual low (1)
24	—	Valve — manual low (1)
25	—	Plug — valve retainer
26	—	Valve — 4-3 (T.D.)
27	—	Valve — 1-2 and 4-5 shift
28	—	Spring — 1-2 and 4-5 shift
29	7E366	Retainer — valve plug
30	—	Spring — thermostat bypass
31	—	Valve — thermostat bypass
32	—	Valve — thermostat bypass
33	—	Spring — thermostat bypass
34	—	Plug — valve retainer
35	—	Spring — cooler limit
36	—	Valve — cooler limit
37	7G136	Solenoid — torque converter clutch (TCC)
38	—	Valve — converter clutch
39	—	Spring — converter clutch
40	—	Plug — valve retainer
41	—	Valve — converter clutch
42	—	Spring — converter clutch
43	—	Spring — converter clutch (3.0 L/4.0 L only)
44	—	Plug — valve retainer

45	—	Valve — coast clutch
46	—	Spring — coast clutch
47	—	Plug — valve retainer
48	—	Valve — 4-3 downshifts
49	—	Spring — 4-3 downshifts
50	7G383	Solenoid — EPC
51	7E335	Retainer — valve plug
52	—	Plug — valve retainer
53	—	Valve — 2-3 shift
54	—	Valve — 2-3 shift
55	—	Spring — 2-3 shift
56	—	Plug — valve retainer
57	—	Spring — 3-4 shift
58	—	Valve — 3-4 shift
59	—	Plug — valve retainer
60	—	Valve — reverse modulation
61	—	Spring — reverse modulation (2 req'd)
62	—	Plug — valve retainer
63	—	Valve — reverse modulation
64	7L491	Clamp — SSA/SSB
65	7L491	Clamp — SSC/SSD/EPC/TCC
66	E800155-S72	Screw — retain solenoid clamps (2 req'd)
67	7D132	I.D. Plate
68	—	Body — valve
69	7D100	Gasket — separator plate
70	7A008	Plate — separator
71	E804357-S76	Screw — retain separator plate (3 req'd)
72	7N113	Screen — EPC limit circuit
73	7D376	Extension housing lube orifice
74	7E368	Valve — EPC limit (metal)
75	7E368	Valve — converter relief (plastic)
76	7E340	Spring — EPC limit/converter relief (2 req'd)
77	7E195	Ball (4 req'd)

- The main control valve body and related components are part of the pressure side of the hydraulic system.
- The main control valve body consists of the solenoids, the valve body assembly and the separator plate.
- These components combine to convert electrical signals into hydraulic actions.
    - All valves in the main control assembly are anodized aluminum and cannot be sanded, filed, or dressed in any other way. Any damage to the valves that prevents or restricts their movement,

requires replacement of the entire main control valve body.

Transmission Electronic Control System

Electronic System Description

The powertrain control module (PCM) (12A650) and its input/output network control the following transmission operations:

- Shift timing.
- Line pressure (shift feel).
- Torque converter clutch.

The transmission control is separate from the engine control strategy in the PCM, although some of the input signals are shared. When determining the best operating strategy for transmission operation, the PCM uses input information from certain engine-related and driver-demand related sensors and switches.

In addition, the PCM receives input signals from certain transmission-related sensors and switches. The PCM also uses these signals when determining transmission operating strategy.

Using all of these inputs signals, the PCM can determine when the time and conditions are right for a shift, or when to apply or release the torque converter clutch. It will also determine the best line pressure needed to optimize shift feel. To accomplish this the PCM uses six output solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used to control transmission operation.

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor provides the sequential fuel injection (SFI) system mixture temperature information. The IAT sensor is used both as a density corrector for air flow calculation and to proportion cold enrichment fuel flow. The IAT sensor is installed in the air cleaner outlet tube. The IAT sensor is also used in determining electronic pressure control (EPC) pressures.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer mounted on the throttle body. The TP sensor detects the position of the throttle plate and sends this information to the powertrain control module. The TP sensor is used for shift scheduling, electronic pressure control and torque converter clutch (TCC) control.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor detects temperature of engine coolant and supplies the information to the powertrain control module (PCM). The ECT sensor is used to control torque converter clutch (TCC) operation.

Anti-Lock Brake Speed Sensor

The programmable speedometer/odometer module (PSOM) receives input from the rear brake anti-lock sensor. After processing the signal, the PSOM relays it to the powertrain control module and the speed control module. Information from the PSOM is used to help determine shift scheduling, torque converter

clutch operation and electronic pressure control (EPC).

Mass Air Flow (MAF) Sensor

The mass air flow sensor measures the mass of air flowing into the engine. The MAF sensor output signal is used by the powertrain control module (PCM) to calculate injector pulse width. For transmission strategies the MAF sensor is used to regulate electronic pressure control, shift and torque converter clutch scheduling.

Air Conditioning (A/C) Clutch

An electromagnetic clutch is energized when the clutch cycling pressure switch closes. The switch is located on the suction accumulator/drier. The closing of the switch completes the circuit to the clutch and draws it into engagement with the compressor driveshaft. When the A/C is engaged, electronic pressure control (EPC) pressure is adjusted to compensate for additional load on the engine.

Electronic Ignition (EI) System

The electronic ignition consists of a crankshaft position sensor, two four tower ignition coils and the powertrain control module. The ignition control module operates by sending crankshaft position information from the crankshaft position sensor to the ignition control module. The ignition control module generates a profile ignition pickup (PIP) signal (engine rpm) and sends it to the PCM. The PCM uses PIP signal in the transmission strategy, wide-open throttle (WOT) shift control, torque converter clutch control and EPC pressure.

Brake Pedal Position (BPP) Switch

The brake pedal position (BPP) switch tells the powertrain control module when the brakes are applied. The torque converter clutch disengages when the brakes are applied. The BPP switch closes when the brakes are applied and opens when they are released.

Transmission Control Switch (TCS)

The transmission control switch (TCS) is a momentary contact switch that allows the driver to cancel operation of 5th (overdrive) gear.

The TCS is located on the end of the selector lever.

When the driver initially presses the TCS a signal is sent to the powertrain control module.

The PCM uses the shift solenoids to disengage/disable 5th gear operation and activate the coast clutch.

At the same time the PCM illuminates the transmission control indicator lamp (TCIL), to notify the driver that 5th gear is canceled.

When the TCS is pressed again, 5th gear operation is enabled, the coast clutch is released and the TCIL is turned off.

Whenever the ignition is cycled (vehicle shut off then started again) the TCS is turned off and 5th gear will be enabled, even if the TCS had been on when the ignition was shut off.

Transmission Control Indicator Lamp (TCIL)

The transmission control indicator lamp (TCIL) is located in the instrument panel and is labled O/D OFF. It is illuminated in conjunction with the transmission switch (TCS).

Turbine Shaft Speed (TSS) Sensor

The turbine shaft speed (TSS) sensor is a magnetic pickup that sends the powertrain control module torque converter turbine speed information.

The TSS sensor is mounted internally on the center support.

The PCM uses TSS information to help determine electronic pressure control (EPC) and torque converter clutch (TCC) operation.

4x4 Low (4x4L) Switch

The 4x4 low (4x4L) range switch is located on the transfer case cover. It provides an indication of when the 4x4 transfer case gear system is in the low range. The PCM then modifies the shift schedule for 4x4L transfer case gear ratio.

Output Shaft Speed (OSS) Sensor

The output shaft speed (OSS) sensor is a magnetic pickup, located at the output shaft ring gear, that sends a signal to the powertrain control module to indicate transmission output shaft speed. The OSS is used for torque converter clutch control, speed scheduling and to determine electronic pressure control.

Digital Transmission Range (TR) Sensor

The digital transmission range (TR) sensor is located on the outside of the transmission at the manual lever. The digital TR sensor completes the start circuit in Park and Neutral, the back-up lamp circuit in Reverse and the neutral sense circuit (4x4 only) in Neutral. The digital TR sensor also opens and closes a set of four switches that are monitored by the powertrain control module to determine the position of the manual lever (P, R, N, D, 2, 1).

Transmission Fluid Temperature (TFT) Sensor

- The transmission fluid temperature (TFT) sensor is a thermistor-type sensor that varies a reference voltage signal. The resistance in the TFT varies with temperature. The powertrain control module (PCM) monitors the voltage signal across the TFT, and uses this information to determine the transmission fluid temperature.
- The TFT is located on the main control body wiring harness assembly.
- The PCM uses the TFT signal to help determine shift scheduling, torque converter clutch operation and electronic pressure control (EPC).

Electronic Pressure Control (EPC) Solenoid

The electronic pressure control (EPC) solenoid is a variable force style (VFS) solenoid. The VFS type solenoid is an electro-hydraulic actuator combining a solenoid and a regulating valve.

The powertrain control module varies the current to the EPC solenoid.

This action causes the solenoid to regulate transmission line pressure and line modulator pressure. This is done by producing resisting forces to the main regulator and line modulator circuits. These two solenoids control clutch application pressures.

Shift Solenoids — A, B, C, and D

Four On/Off shift solenoids allow the powertrain control module to control shift scheduling.

- The solenoids are two-way, normally open style.
- The shift solenoids (SSA, SSB, SSC, and SSD) provide gear selection by controlling the pressures of the shift valves.
- SSD is also used to apply and release the coast clutch.

Torque Converter Clutch (TCC) Solenoid

The torque converter clutch (TCC) solenoid is used to control the apply and release of the TCC.

Powertrain Control Module (PCM)

The operation of the transmission is controlled by the powertrain control module. Many input sensors provide information to the PCM. The PCM then controls actuators which determine transmission operation.

Diagnostic Strategy

Troubleshooting an electronically controlled automatic transmission is simplified by using the proven method of diagnosis. One of the most important things to remember is that there is a definite procedure to follow.

NOTE: Do not take any short cuts or assume that critical checks or adjustments have already been made.

Follow the procedures as written to avoid missing critical components or steps.

To correctly diagnose a concern have the following publications available:

- Transmission Reference Manual.
- Powertrain Control/Emissions Diagnosis (PC/ED) manual.
- TSBs and OASIS Messages.
- Wiring Diagram.

These publications provide the information required when diagnosing transmission concerns.

Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer's concern.
- Verify the concern by operating the vehicle.
- Check the fluid levels and condition.
- Check for non-factory add-on items.
- Check shift linkages for correct adjustment.
- Check TSBs and OASIS messages regarding the concern.

Diagnostics

- Perform on-board diagnostic procedures key on engine off (KOEO) and key on engine running (KOER).
- Record all diagnostic trouble codes (DTCs).
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Erase all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only pass codes are obtained, refer to Diagnosis By Symptom for further information and diagnosis.

Follow the diagnostic sequence to diagnose and repair the concern the first time.

Diagnostic Flow Chart

Diagnostic Flow Chart		
• Know and understand the customer concerns • Check the fluid level and condition • Verify the concern by operating the vehicle • Check for non-factory-installed items and verify correct installation • Check the shift linkage adjustments • Check TSBs and OASIS messages for vehicle concerns • Carry out quick test both KOER and KOEO • Record all codes 1) Did you record any Diagnostic Trouble Codes?	Yes	· Repair all hard Diagnostic Trouble Codes. Follow the pinpoint tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual first, then this Workshop Manual.
	No	· Refer to Diagnosis By Symptom in this section, then GO to Step 5.
2) Are any continuous test memory codes present?	Yes	· Clear codes and carry out drive cycle test.
	No	· GO to Step 4.
3) Did the continuous test memory codes reappear?	Yes	· Repair all continuous test memory codes. Follow the pinpoint tests. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual then the transmission reference manual, then this workshop manual, then GO to Step 4.
	No	· GO to Step 4.
4) Is the concern repaired?	Yes	· Carry out the final quick test to verify that no Diagnostic Trouble Codes are present. Clear memory codes.
	No	· Refer to Diagnosis By Symptom in this section.
5) Are there any electrical concerns?	Yes	· Install the scan tool and carry out output state control test, then GO to Step 6.
	No	· Refer to the hydraulic and mechanical routine to diagnose and repair the concern, then GO to Step 7.
6) Was the transmission	Yes	· Refer to the Powertrain Control/Emissions Diagnosis (PC/ED)

concern corrected when the scan tool was installed?		manual, intermittent fault diagnosis section and use the scan tool or WDS to diagnose cause of concern in the processor, vehicle harness or external inputs (sensors or switches).
	No	· Refer to the hydraulic and mechanical routine to diagnose the concern, then GO to Step 7.
7) Is the concern repaired?	Yes	· Carry out the final quick test to verify that no diagnostic trouble codes are present. Clear memory codes.
	No	· Get assistance from Technical Hotline.

Preliminary Inspection

The following items must be checked prior to beginning the diagnostic procedures:

Know and Understand the Concern

In order to correctly diagnose a concern, first understand the customer complaint or condition. Customer contact may be required in order to begin to verify the concern. Understand the conditions as to when the concern occurs, for example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

After understanding when and how the concern occurs, proceed to verify the concern.

Verification of Condition

This section provides information that must be used in both determining the actual cause of customer concerns and carrying out the appropriate procedures.

The following procedures must be used when verifying customer concerns for the engine.

Determine Customer Concern

NOTE: Some transmission conditions can cause engine concerns. An electronic pressure control short circuit can cause engine misfiring. The torque converter clutch not disengaging will stall the engine.

Determine customer concerns relative to vehicle use and dependent driving conditions, paying attention to the following items:

- Hot or cold vehicle operating temperature
- Hot or cold ambient temperatures
- Type of terrain
- Vehicle loaded/unloaded
- City/highway driving
- Upshift
- Downshift
- Coasting
- Engagement
- Noise/vibration — check for dependencies, either rpm dependent, vehicle speed dependent, shift dependent, gear dependent, range dependent, or temperature dependent.

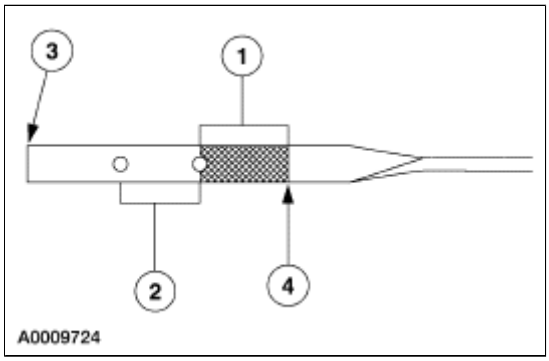
Check Fluid Level and Condition

CAUTION: The vehicle should not be driven if the fluid level indicator shows the fluid below the Do Not Drive mark or internal failure could result.

NOTE: Automatic transmission fluid expands when warmed. To obtain an accurate fluid level check, drive the vehicle until warmed, approximately 30 km (18.75 miles). If the vehicle has been operated for an extended period at high speeds, in city traffic, during hot weather or while pulling a trailer, the vehicle should be turned off for about 30 minutes to allow the fluid to cool before checking.

NOTE: The transmission fluid level should be checked at normal operating temperatures, 66°C-77°C (150° F-170°F), on a level surface. The normal operating temperature can be reached after approximately 32 km (20 miles) of driving. However, you can check the fluid level without driving if the outside temperature is above 10°C (50°F). When the vehicle has not been driven, and the outside is above 10°C (50°F), the fluid level should be between the holes on the indicator. If the transmission fluid is to be checked when the fluid is at room temperature, the fluid level indicator could indicate that fluid should be added if the indicator is misread. If fluid is added at this time, an overfill condition could result when the vehicle reaches operating temperature of 66°C-77°C (150°F-170°F).

1. Drive the vehicle 30 km (18.75 miles) or until the vehicle reaches normal operating temperatures.
2. Park the vehicle on a level surface and apply the parking brake.
3. With the parking brake applied and your foot on the brake pedal, start the engine and move the range selector lever through all the gear ranges. Allow sufficient time for each gear to engage.
4. Place the range selector lever in (P) park and leave the engine running.
5. Remove the fluid level indicator and wipe it clean with a lint free cloth.
6. Install the fluid level indicator until it is fully seated into the filler tube.
7. Remove the fluid level indicator and inspect the fluid level. The fluid level should be in the designated area for normal and room temperature.



Item	Description
1	Fluid level at operating temperature 66°C-77°C (150°F-170°F)
2	Fluid level at room temperature 10°C-35°C (50°-95°F)
3	Do not drive if below this area and outside temperatures are above 10°C (50°)
4	Do not add if above the crosshatched area

High Fluid Level

Fluid levels above the safe range may result in transmission failure. An overfill condition of transmission fluid may cause shift or engagement concerns and possible damage. High fluid levels can be caused by an overheating condition. A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission malfunction and/or damage. If an overfill reading is indicated drain and refill the transmission.

Low Fluid Level

DO NOT DRIVE the vehicle if the fluid level is below the hole at the bottom of the fluid level indicator or not on the fluid level indicator, and the outside temperatures are above 10°C (50°F). A low fluid level could result in poor transmission engagement, slipping, malfunction and/or damage. This could also indicate a leak in one of the transmission seals or gaskets.

Adding Fluid

CAUTION: The use of any other type of transmission fluid than specified could result in transmission malfunction and/or damage. An overfill condition of transmission fluid may cause shift or engagement concerns and possible damage.

Before adding fluid be sure that the correct type is being used. The type of fluid used is found on the fluid level indicator, on the handle, in the owner manual, and in the specification section in this section.

If fluid needs to be added, add fluid in 0.25L (1/2 pint) increments through the filler tube. Do not overfill the fluid.

Fluid Condition Check

1. Check the fluid level.
2. Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black.
3. Hold the fluid level indicator over a white facial tissue and allow the fluid to drip onto the facial tissue and examine the stain.
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transmission. The engine cooling system should also be inspected at this time.
6. If fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, the transmission must be disassembled and completely cleaned. This includes the torque converter and cooler lines.
7. Carry out diagnostic checks and adjustments. Refer to Diagnosis By Symptom in this section.

Road Testing Vehicle

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

The Shift Point Road Test and Torque Converter Clutch Operation Test provide diagnostic information on transmission shift controls and torque converter operation.

Shift Point Road Test

This test verifies that the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with selector lever in (D) range.
3. Apply minimum throttle and observe speeds at which upshift occurs and torque converter engages. Refer to the following Shift Speeds Chart. Also refer to the Automatic Transmission Specifications.
4. Stop the vehicle. Depress transmission control switch (TCS) to activate D range. Repeat Step 3. Transmission will make all upshifts except 4-5 and torque converter clutch apply should occur above 46 km/h (29 mph).
5. Press accelerator pedal to floor, wide open throttle (WOT). Transmission should shift from fourth to third, third to second, or third to first, depending on vehicle speed, and torque converter clutch should release.
6. With vehicle speed above 48 km/h (30 mph), move transmission range selector lever from (D) range to 1 range (LOW) and release accelerator pedal. Transmission should immediately downshift to third gear. When vehicle speed drops below 32 km/h (20 mph), transmission should downshift into first gear.
7. If transmission fails to upshift/downshift or torque converter clutch does not apply/release, refer to Diagnosis By Symptom for possible causes.

Shift Speeds — KM/H (MPH)

NOTE: Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio and application), refer to the Automatic Transmission Specification booklet.

Throttle Position	Range	Shift	MPH	KM/H
Closed Throttle	(D)	3-2	11-19	18-31
	(D)	2-1	6-16	10-26
Minimum Throttle (TP Voltage 1.25 Volts)	(D)	1-3	36-79 [a]	58-127
	(D)	1-2	11-13	18-21
	(D)	2-3	15-38	24-61
	(D)	3-4	16-47	26-76
	(D)	4-5	39-71	63-114
	(D)	5-4	39-49	63-79
	(D)	4-3	17-30	27-48
	(D)	3-2	10-22	16-35
	(D)	2-1	6-12	10-19
Wide Open Throttle	(D)	1-2	18-80	29-129
	(D)	2-3	55-94	88-151

	(D)	3-4	72-108	116-174
	(D)	4-5	100-134	161-216
	(D)	5-4	88-119	142-192
	(D)	4-3	66-96	106-154
	(D)	3-2	33-67	53-108
	(D)	2-1	25-40	25-64

[a] The 5R55E 4.0L EI will shift 1-3 at minimum throttle. At medium throttle the transmission will resume a normal shift pattern 1-2, 2-3, 3-4, 4-5.

Torque Converter Diagnosis

Prior to torque converter replacement, all diagnostic procedures must be followed. This is to prevent the unnecessary replacement of good torque converters. Only after a complete diagnostic evaluation can the decision be made to replace the torque converter.

Begin with the normal diagnostic procedures as follows:

1. Preliminary Inspection.

2. Know and Understand the Customer's Concern.

3. Verify the Concern — Carry out the Torque Converter Clutch Operation Test. Refer to the Torque Converter Operation Test in this section.

4. Carry out Diagnostic Procedures.

- Run on-board diagnostics. Refer to the On-Board Diagnostics With Diagnostic Tool in this section.
  - Repair all non-transmission related DTCs first.
  - Repair all transmission DTCs.
  - Rerun on-board diagnostic to verify repair.
- Carry out Line Pressure Test. Refer to the Line Pressure Test in this section.
- Carry out Stall Speed Test. Refer to the Stall Speed Test in this section.
- Carry out Diagnosis by Symptom Index. Refer to Diagnosis By Symptom in this section.
  - Use the index to locate the appropriate routine that best describes the symptom(s). The routine will list all possible components that may cause or contribute to the symptom. Check each component listed; diagnose and service as required before servicing the torque converter.

Torque Converter Operation Test

This test verifies that the torque converter clutch control system and the torque converter are operating correctly.

1. Carry out Quick Test. Refer to the On-Board Diagnostics With Diagnostic Tool in this section. Check for DTCs. Refer to the Diagnostic Trouble Code Chart.

2. Connect a tachometer to the engine.

3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds for approximately 15 minutes in (D) position.

4. After normal operating temperature is reached, maintain a constant vehicle speed of about 80 km/h

(50 mph) and tap brake pedal with the left foot.

5. Engine rpm should increase when brake pedal is tapped, and decrease about five seconds after pedal is released. If this does not occur, refer to the Torque Converter Operation Concerns in Diagnosis By Symptom .

6. If the vehicle stalls in(D) or manual 2 at idle with vehicle at a stop, move the transmission range selector lever to manual 1 position. If the vehicle stalls, refer to the Torque Converter Operation Concerns in Diagnosis By Symptom in this section. Repair as required. If the vehicle does not stall in (D), refer to Diagnosis By Symptom in this section.

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis. Inspect the vehicle for non-Ford factory add-on devices such as:

- Electronic add-on items:
  - Air conditioning
  - Generator (alternator)
  - Engine turbo
  - Cellular telephone
  - Cruise control
  - CB radio
  - Linear booster
  - Backup alarm signal
  - Computer
- Vehicle modification:

These items, if not installed correctly, will affect the powertrain control module (PCM), or transmission function. Pay particular attention to add-on wiring splices in the PCM harness or transmission wiring harness, abnormal tire size, or axle ratio changes.

- Leaks, refer to the Leakage Inspection in this section.
- Correct linkage adjustments, refer to Section 307-05 .

Shift Linkage Check

Check for a incorrectly adjusted shift linkage by matching the detents in the transmission range selector lever with those in the transmission. If they match, the incorrect adjustment is in the indicator. Do not adjust the shift linkage.

Hydraulic leakage at the manual control valve can cause delay in engagements and/or slipping while operating if the linkage is not correctly adjusted. Refer to Section 307-05 for shift linkage adjustment.

Check TSBs and OASIS

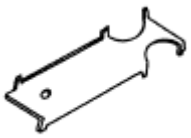
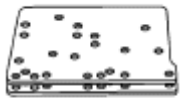
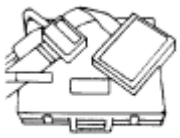
Refer to the technical service bulletins and OASIS messages which pertain to the transmission concern and follow the procedure as outlined.

Carry Out On-Board Diagnostics (KOEO, KOER)

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using scan tool. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the powertrain control system.

Diagnostics

Special Tool(s)

 ST1633-A	TRS Alignment Tool 307-351 (T97L-70010-A)
 ST1637-B	Transmission Test Plate 307-342 (T95L-77000-AH)
 ST1137-A	73 Digital Multimeter 105-R0051 or equivalent
	Digital TR Sensor Overlay 007-00131 or equivalent
 ST1391-A	EEC-V 104-Pin Breakout Box 418-049 (014-00950) or equivalent
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent
	MLP-TR Cable 418-F107 (007-00111) or equivalent

 ST1632-A	
 ST1389-A	Transmission Tester 307-F016 (007-00130) or equivalent
 ST1300-A	12 Volt Master UV Diagnostic Inspection Kit 164-R0756 or equivalent
 ST1565-A	Pressure Gauge 307-004 (T57L-77820-A)

Diagnosing electronically controlled automatic transmissions is simplified using the following procedures. It is important to remember that there is a definite procedure to follow. Do not take short cuts or assume that critical checks or adjustments have already been made. Follow the procedures as written to avoid missing critical components or steps. By following the diagnostic sequence, the technician will be able to diagnose and repair the concern the first time.

On-Board Diagnostics With Scan Tool

NOTE: For detailed instructions and other diagnostic methods using the scan tool, refer to the scan tool tester manual and the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

These quick tests should be used to diagnose the Powertrain Control Module (PCM) and should be carried out in order.

- Quick Test 1.0 — Visual Inspection
- Quick Test 2.0 — Set Up
- Quick Test 3.0 — Key On, Engine Off
- Quick Test 4.0 — Continuous Memory
- Quick Test 5.0 — Key On, Engine Running
- Special Test Mode
    - Wiggle Test Mode
    - Output Test Mode
- PCM Reset Mode
- Clearing DTCs

- OBD II Drive Cycle
- Other NGS Features

For further information on other diagnostic testing features using the scan tool, refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Other diagnostic methods include the following:

- Parameter Identification (PID) Access Mode
- Freeze Frame Data Access Mode
- Oxygen Sensor Monitor Mode

Output State Control (OSC) Mode

Output state control (OSC) mode allows the technician to take control of certain parameters to function the transmission. For example, OSC allows the technician to shift the transmission only when commanding a gear change. If the technician commands 1st gear in OSC, the transmission will remain in 1st gear until the technician commands the next gear. For another example, the technician can command a shift solenoid to turn on or off when carrying out an electrical circuit check. OSC has two modes of operation for transmission, the BENCH MODE and the DRIVE MODE. Each mode/parameter has a unique set of vehicle operating requirements that the technician is required to meet before being allowed to operate OSC.

NOTE: To operate OSC the Digital Transmission Range (TR) Sensor and the Vehicle Speed Sensor (VSS) must be operational. No Diagnostic Trouble Codes (DTCs) related to the digital TR sensor or the VSS sensor can be present.

- The vehicle requirements MUST BE MET when SENDING the OSC value. Refer to Vehicle Requirements for each individual test.
- If the vehicle requirements are NOT MET when SENDING the OSC value, an ERROR MESSAGE will appear. When the ERROR MESSAGE is received, OSC is aborted and must be restarted.
- If AFTER SENDING an OSC value, and the vehicle requirements are no longer met, the PCM will cancel the OSC value and NO ERROR message will appear.
- The OSC value [XXX] may be sent anytime to cancel OSC.

Output State Control (OSC) Procedures:

- Carry out visual inspection and vehicle preparation as required.
- Select "Vehicle and Engine Selection" menu.
- Select appropriate vehicle and engine.
- Select "Diagnostic Data Link."
- Select "Powertrain Control Module."
- Select "Diagnostic Test Mode."
- Select "KOEO On-Demand Self Test and KOER On-Demand Self Tests."
- Carry out test and record DTCs.
- Repair all NON-Transmission DTCs.
- Repair all VSS and digital TR sensor DTCs.
- Make sure that VSS/digital TR sensors are functional.
- Select "Active Command Modes."
- Select "Trans - Bench Mode or Trans - Drive Mode."

OSC — Transmission Bench Modes

The following Transmission Bench Modes may be used or required during diagnostics.

SSA, SSB, SSC, SSD and TCC in BENCH MODE:

The BENCH MODE allows the technician to carry out electrical circuit checks on the following components:

- SSA - Activates SS#1 OFF or ON.
- SSB - Activates SS#2 OFF or ON.
- SSC - Activates SS#3 OFF or ON.
- SSD - Activates SS#4 OFF or ON.
- TCC - Activates TCC OFF or ON.

OSC "SSA, SSB, SSC, SSD, TCC" BENCH MODE Operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in P.
- Key ON.
- Engine OFF.

OSC Command Values

- [OFF] - turns solenoid OFF.
- [ON] - turns solenoid ON.
- [XXX] - cancels OSC value sent.
- [SEND] - sends the values to PCM.

BENCH MODE Procedure for SSA, SSB, SSC, SSD, and TCC

Follow operating instructions from the NGS menu screen:

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - SSA, SSB, SSC, SSD, or TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

EPC in BENCH MODE:

The BENCH MODE is also used to test the functionality of the transmission's electronic pressure control. During BENCH MODE, the EPC solenoid can ramp in increments of 15 psi from zero to 90 psi and 90 to zero psi.

The OSC functions for the parameter EPC allows the technician to choose the following options:

- EPC - Activates EPC to selected values.
- [00] - sets EPC pressure to 00 psi.
- [15] - sets EPC pressure to 15 psi.
- [30] - sets EPC pressure to 30 psi.
- [45] - sets EPC pressure to 45 psi.
- [60] - sets EPC pressure to 60 psi.
- [75] - sets EPC pressure to 75 psi.
- [90] - sets EPC pressure to 90 psi.

OSC "EPC" — BENCH MODE should ONLY be operated to check PRESSURE FUNCTIONALITY using an installed pressure gauge (300 psi) when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in P.
- Pressure gauge installed.
- Key ON.
- Engine ON.
- Engine rpm at 1500.

OSC "EPC" BENCH MODE should ONLY be operated to complete EPC SOLENOID CIRCUIT PINPOINT TESTS when:

- VSS and Digital TR Sensor are operational.
- No VSS and Digital TR Sensor DTCs are present.
- Transmission range selector lever is in "P" or "N".
- Key "ON".
- Engine "OFF".

OSC Command Values

- [00] - sets EPC pressure to 00 psi.
- [15] - sets EPC pressure to 15 psi.
- [30] - sets EPC pressure to 30 psi.
- [45] - sets EPC pressure to 45 psi.
- [60] - sets EPC pressure to 60 psi.
- [75] - sets EPC pressure to 75 psi.
- [90] - sets EPC pressure to 90 psi.
- [OFF] - turns solenoid OFF.
- [ON] - turns solenoid ON.
- [XXX] - cancels OSC value sent.
- [SEND] - sends the values to PCM.

BENCH MODE Procedure for EPC

Following operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans - Bench Mode."
- Select "PIDs" to be monitored.

- Monitor all selected PIDs during test.
- Select "Parameters - EPC."
- Select Value "0 - 90 psi."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

OSC — Transmission DRIVE MODES

The DRIVE MODE allows control of three transmission parameters. Each mode/parameter has a unique set of vehicle operating requirements that the technician is required to meet before being allowed to operate OSC. The recommended procedure, when using the DRIVE MODE, is to control one parameter at a time.

The DRIVE MODE allows the technician to carry out the following functions on the transmission:

- GR_CM - allows upshifts or downshifts.
- TCC - engages or disengages the torque converter clutch.
- EPC - increases/decreases EPC pressure.

GR_CM in DRIVE MODE

This OSC function is used to test the transmission shift functions.

The OSC functions for the GR_CM parameter allows the technician to choose the following options:

- [1] - PCM selects 1st gear.
- [2] - PCM selects 2nd gear.
- [3] - PCM selects 3rd gear.
- [4] - PCM selects 4th gear.
- [5] - PCM selects 5th gear.

OSC "GR_CM" Mode Operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Engine ON.
- TCC "OFF.
- Transmission range selector lever on O/D.
- Vehicle speed is greater than 2 mph.

OSC Command Values

- [1] - PCM selects 1st gear.
- [2] - PCM selects 2nd gear.
- [3] - PCM selects 3rd gear.
- [4] - PCM selects 4th gear.
- [5] - PCM selects 5th gear.
- [OFF] - turns solenoid OFF.
- [ON] - turns solenoid ON.
- [XXX] - cancels OSC value sent.
- [SEND] - sends the values to PCM.

DRIVE MODE Procedure for GR_CM

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans - DRIVE MODE."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - GR_CM."
- Select Value "1-5."
- Press "SEND" to send command.
- Re-Select Value "1-5."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

TCC in DRIVE MODE:

This OSC function is used to test whether the torque converter clutch is engaging and disengaging correctly.

The OSC functions for the TCC parameter allows the technician to choose the following:

- TCC - activates TCC OFF and ON.
- [ON] - turns TCC solenoid ON.
- [OFF] - turns TCC solenoid OFF.

OSC "TCC OFF" DRIVE MODE Operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine ON.
- Transmission range selector lever in O/D.
- Vehicle speed is greater than 2 mph.

OSC "TCC ON" DRIVE MODE Operates ONLY when:

- VSS and digital TR sensors are operational.
- No VSS and digital TR sensor DTCs present.
- Engine on.
- Transmission range selector lever in O/D.
- Vehicle speed is greater than 2 mph.
- Transmission in 2nd gear or higher.
- TFT is between 60 and 275 degrees F.
- Brake not applied "OFF" below 20 mph.
- (Not an excessive load on engine (engine lugging).

OSC Command Values

- [OFF] - turns TCC OFF.
- [ON] - turns TCC ON.

- [XXX] - cancels OSC value sent.
- [SEND] - sends the values to PCM.

Drive Mode Procedures for TCC

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - TCC."
- Select "ON" to turn solenoid ON.
- Press "SEND" to send command ON.
- Select "OFF" to turn solenoid OFF.
- Press "SEND" to send command OFF.
- Select "XXX" to cancel at any time.
- Press "SEND."

EPC in DRIVE MODE

This OSC functions is used to increase the EPC pressure while testing the transmission shift functions. This OSC functions can only increase the EPC pressure greater than what the PCM normally commands. If an OSC value, such as [75] or [90] psi is sent, the upshifts and downshifts should exhibit a harsher shift. Harsher shifts would indicate that the EPC pressure control works at higher pressures. The best test for the EPC is to use the BENCH MODE and a hydraulic pressure gauge. Using EPC in the BENCH MODE will confirm that the EPC works at both the higher and lower pressures.

The OSC functions for the parameter EPC allows the technician to choose the following options:

- EPC - Activates EPC to selected
  - [00] - sets EPC pressure to 00 psi.
  - [15] - sets EPC pressure to 15 psi.
  - [30] - sets EPC pressure to 30 psi.
  - [45] - sets EPC pressure to 45 psi.
  - [60] - sets EPC pressure to 60 psi.
  - [75] - sets EPC pressure to 75 psi.
  - [90] - sets EPC pressure to 90 psi.

OSC "EPC" DRIVE MODE Operates ONLY when:

- VSS and digital TR sensor are operational.
- No VSS and digital TR sensor DTCs.
- Transmission range selector lever in O/D.
- Pressure gauge installed.
- Key ON.
- Engine ON.
- Vehicle speed greater than 2 mph.
- OSC value for EPC must be greater than what the PCM commands (see EPC PID).

OSC Command Values

- [00] - sets EPC pressure to 00 psi.
- [15] - sets EPC pressure to 15 psi.
- [30] - sets EPC pressure to 30 psi.
- [45] - sets EPC pressure to 45 psi.
- [60] - sets EPC pressure to 60 psi.
- [75] - sets EPC pressure to 75 psi.
- [90] - sets EPC pressure to 90 psi.
- [OFF] -" turns solenoid OFF.
- [ON] - turns solenoid ON.
- [XXX] - cancels OSC value sent.
- [SEND] - sends the values to PCM.

DRIVE MODE Procedure for EPC.

Follow operating instructions from the NGS menu screen.

- Select "Output State Control."
- Select "Trans - Drive Mode."
- Select "PIDs" to be monitored.
- Monitor all selected PIDs during test.
- Select "Parameters - EPC."
- Select Value "0-90 psi."
- Press "SEND" to send command.
- Re-Select Value "0-90 psi."
- Press "SEND" to send command.
- Select "XXX" to cancel at any time.
- Press "SEND."

Using Output State Control (OSC) and Accessing PIDs

To confirm that the OSC value was sent by the NGS and the EEC has accepted the OSC substitution, a corresponding PID for each OSC parameter must be monitored. Additional PIDs should be monitored to help the technician adequately diagnose the transmission.

The following is a list of OSC parameters and their corresponding PID:

OSC Parameter	Corresponding PID	Additional PIDs
SSA	SSA	SSA (1)F
SSB	SSB	SSB (2)F
SSC	SSC	SSC (3)F
SSD	SSD/CCSF	—
TCC	TCC	TCCF, TCCMACT (do not use PID TCCMCMD during OSC)
EPC	EPC	—
GR_CM	GEAR	TRANRAT

To confirm that the OSC substitution occurred, SEND the OSC value and monitor the corresponding PID

value. If no ERROR MESSAGE was received and the value of the corresponding PID remains the same as the value sent from OSC, then the OSC substitution was successful.

Transmission Drive Cycle Test

NOTE: Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE: The Transmission Drive Cycle Test must be followed exactly. Malfunctions must occur four times consecutively for shift error DTC code to be set, and five times consecutively for continuous torque converter clutch code to set.

NOTE: When carrying out the Transmission Drive Cycle Test, refer to the Solenoid Application Chart for correct solenoid operation.

After carrying out the Quick Test, use the Transmission Drive Cycle Test for checking continuous codes.

1. Record and then erase Quick Test codes.
2. Warm engine to normal operating temperature.
3. Make sure transmission fluid level is correct.
4. With transmission in Overdrive, moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into fifth gear. Hold speed and throttle open steady for a minimum of 15 seconds.
5. With transmission in fifth gear and maintaining steady speed and throttle opening, lightly apply and release brake to operate stoplamps. Then hold speed and throttle steady for a minimum of five seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat steps 4 through 6 at least five times.
8. Carry out Quick Test and record continuous DTCs.
    - If the DTCs are still present, refer to the Diagnostic Trouble Chart. Repair all non-transmission DTCs first as they can directly affect the operation of the transmission. Repeat the Quick Test and the Road Test to verify the correction. Erase the DTCs, carry out the Drive Cycle Test and repeat the Quick Test after completing repair on the DTC.
    - If the continuous test passes and a concern is still present, refer to Diagnosis By Symptom in this section, OASIS messages, and TSBs for concerns.

After On-Board Diagnostic

NOTE: The vehicle wiring harness, and non-transmission sensors may affect transmission operations. Repair these concerns first.

After the on-board diagnostic procedures are completed, repair all DTCs.

Begin with non-transmission related DTCs, then repair any transmission related DTCs. Refer to the On-Board Diagnostic Trouble Code Chart for information on condition and symptoms. This chart will be helpful

in referring to the proper manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Make sure that the vehicle wiring harness and the PCM are diagnosed as well. The Powertrain Control/Emissions Diagnosis (PC/ED) manual will aid in diagnosing non-transmission electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the powertrain control module (PCM) wiring harness for proper connections, bent or broken pins, corrosion, loose wires, proper routing, proper seals and their condition. Check the PCM, sensors and actuators for damage. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE: If a concern still exists after electrical diagnosis has been carried out, refer to Diagnosis by Symptom in this section.

If DTCs appear while carrying out the on-board diagnostics, refer to the Diagnostic Trouble Code Chart for the appropriate repair procedure. Prior to entering pinpoint tests, refer to any TSBs and OASIS messages for transmission concerns.

Diagnostic Trouble Code Chart

Diagnostic Trouble Code Chart

****May also be generated by some other non-electric transmission hardware system.**					
***Output circuit check, generated only by electrical symptoms.**					
Five Digit DTC	**Component**	**Description**	**Condition**	**Symptom**	**Action**
P0112	IAT	IAT indicates 125°C (254°F) (grounded).	Voltage drop across IAT exceeds scale set for temperature 125°C (254°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0113	IAT	IAT indicates -40°C (-40°F) (open circuit).	Voltage drop across IAT exceeds scale set for temperature -40°C (-40°F).	Incorrect EPC pressure. Either high or low which will result in harsh or soft shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0114	IAT	IAT out of on-board diagnostic range.	IAT temperature higher or lower than expected during KOEO and KOER.	Rerun on-board diagnostic at normal operating temperature.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1116	ECT	ECT out of on-board diagnostic range.	ECT temperature higher or lower than expected during KOEO and KOER.	Rerun on-board diagnostic at normal operating temperature.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0117	ECT	ECT indicates 125°C (254°F).	Voltage drop across ECT exceeds scale set for temperature	Torque converter clutch will always be off, resulting in reduced fuel	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED)

			125°C (254°F) (grounded).	economy.	manual.
P0118	ECT	ECT indicates -40°C (-40°F).	Voltage drop across ECT exceeds scale set for temperature -40°C (-40°F) (open circuit).	Torque converter clutch will always be off, resulting in reduced fuel economy.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1124	TP	TP voltage high/low for on-board diagnostic.	TP was not in the correct position for on-board diagnostic.	Rerun at appropriate throttle position per application.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0121, P0122, P0123, P1120, P1121, P1125, P1124	TP	TP concern.	PCM has detected an error. This error may cause a transmission concern.	Harsh engagements, firm shift feel, abnormal shift schedule, torque converter clutch does not engage. Torque converter clutch cycling.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0102, P0103, P1100, P1101	MAF	MAF concerns.	MAF system has a malfunction which may cause a transmission concern.	High/low EPC pressure, incorrect shift schedule. Incorrect torque converter clutch engagement scheduling. Symptoms similar to a TP failure.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0300-P0308, P0320, P0340, P1351-P1364	EI	EI concerns.	EI system has a malfunction which may cause a transmission concern.	Harsh engagements and shifts, late WOT shifts, no torque converter clutch engagement.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0503, P0500, P1501	VSS	Insufficient VSS input.	PCM detected a loss of vehicle speed signal during operation.	Torque converter clutch engages, shift engagement/ disengagement (hunting) on grades.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1704	Digital TR.	Digital TR circuits reading in-between gear positions during KOEO/KOER.	Digital TR sensor or shift cable improperly adjusted or digital TR circuit failure.	Wrong commanded EPC pressure. Digital TR reading the wrong gear position. (i.e., in overdrive position, transmission stuck in manual 2).	Refer to Pinpoint Test C .
P1705	Digital TR.	Digital TR not in PARK or NEUTRAL during KOEO/KOER.	KOEO/KOER not run in PARK or NEUTRAL; or Digital TR circuit failure.	Rerun KOEO/KOER in PARK or NEUTRAL.	Refer to Pinpoint Test C .

P1703	BPP	Brake not actuated during on-board diagnostic KOER.	Brake not cycled during KOER.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1703	BPP	BPP switch circuit failed.	Brake ON circuit failure during KOEO.	Failed ON or not connected — torque converter clutch will not engage at less than 1/3 throttle. Failed OFF or not connected — torque converter clutch will not disengage when brake is applied.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1460	A/C	A/C clutch cycling pressure switch error.	A/C or defrost ON condition may result from A/C clutch being ON during on-board diagnostic.	DTC set during on-board diagnostic — rerun with A/C OFF. Failed ON — EPC pressure slightly low with A/C OFF.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0731**	SSA, SSB, SSC or internal parts.	1st gear error	No 1st gear.	Improper gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to the Solenoid On/Off Charts. Refer to Pinpoint Test A .
P0732**	SSA, SSB, SSC or internal parts.	2nd gear error.	No 2nd gear.	Improper gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to the Solenoid On/Off Charts. Refer to Pinpoint Test A .
P0733**	SSA, SSB, SSC or internal parts.	3rd gear error.	No 3rd gear.	Improper gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission	Refer to the Solenoid On/Off Charts. Refer to Pinpoint Test A .

				concerns (stuck valves, damaged friction material).	
P0734**	SSA, SSB, SSC or internal parts.	4th gear error.	No 4th gear.	Improper gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material).	Refer to the Solenoid On/Off Charts. Refer to Pinpoint Test A .
P0750*	SSA	SSA solenoid circuit failure.	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Improper gear selection depending on condition mode and manual lever position. See Solenoid On/Off Charts. Will flash MIL.	Refer to Pinpoint Test A .
P0753*	SSA	SSA solenoid circuit failure	SSA circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. Refer to Solenoid On/Off Charts. Will flash TCIL.	Refer to Pinpoint Test A .
P0755*	SSB	SSB solenoid circuit failure.	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Improper gear selection depending on condition mode and manual lever position. See Solenoid On/Off Charts. Will flash MIL.	Refer to Pinpoint Test A .
P0758*	SSB	SSB solenoid circuit failure	SSB circuit fails to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off Charts. Will flash TCIL.	Refer to Pinpoint Test A .
—	TCIL	TCIL circuit failure.	TCIL circuit open or shorted.	Failed ON — overdrive cancel mode always ON. NO flashing TCIL for EPC failure or sensor. Failed OFF — overdrive cancel mode never indicated. NO flashing TCIL for	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.

				EPC sensor failure.	
P1747**	EPC	EPC solenoid circuit failure, shorted circuit.	Voltage through EPC solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit — causes minimum EPC pressure (minimum capacity) and limits engine torque (alt. firing). With zero EPC — no engagements. If engagements occur and then EPC goes to zero, then no, 2nd, 3rd, and 5th gears. Slips in 1st and 4th with high input torque.	Refer to Pinpoint Test D .
P0741**	TCC	TCC slippage detected.	The PCM picked up an excessive amount of TCC slippage during normal vehicle operation.	TCC slippage/erratic or no torque converter clutch operation. Flash TCIL.	Refer to Diagnosis By Symptom in this section.
P1780	TCS	TCS not changing states.	TCS not cycled during self test. TCS circuit open or shorted.	No (D) cancel when switch is cycled during KOER.	Rerun on-board diagnostic and cycle switch. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1711	TFT	TFT out of on-board diagnostic range.	Transmission not at operating temperature during on-board diagnostic.	DTC set — vehicle cold or overheated.	Warm or cool vehicle to normal operating temperature. Refer to Pinpoint Test B .
P0713	TFT	-40°C (-40°F) indicated TFT sensor circuit open.	Voltage drop across TFT sensor exceeds scale set for temperature -40° C (-40°F).	Firm shift feel.	Refer to Pinpoint Test B .
P0712	TFT	157°C (315°F) indicated TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	Firm shift feel.	Refer to Pinpoint Test B .
P0715	TSS	Insufficient input from turbine shaft speed sensor.	PCM detected a loss of TSS signal during operation.	Harsh shifts, abnormal shift schedule, no torque converter clutch activation.	Refer to Pinpoint Test E .
P0743*	TCC	TCC solenoid circuit failure during on-board	TCC solenoid circuit fails to provide voltage drop across	Short circuit — engine stalls in second (OD, 2 range) at low idle	Refer to Pinpoint Test A .

		diagnostic.	solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostics.	speeds with brake applied. Open circuit — torque converter clutch never engages.	
P1783	TFT	Transmission overtemp condition indicated.	Transmission fluid temperature exceeded 127°C (270°F).	Increase in EPC pressure.	Refer to Pinpoint Test B .
P0705	Digital TR sensor.	Digital TR circuit failure.	Digital TR circuits, indicating an invalid pattern in TR_D. Condition caused by a short to ground or an open in TR4, TR3A, TR2, and or TR1 circuits. This DTC cannot be set by an improperly adjusted digital TR sensor.	Increase in EPC pressure (harsh shifts). Defaults to (D) or D for all gear positions. In (D) position transmission is stuck in D or manual 2.	Refer to Pinpoint Test C .
P0708	Digital TR sensor.	Digital TR sensor circuit TR3A open.	Digital TR sensor circuit TR3A reading 2.6v - 5.0v (open circuit). This DTC cannot be set by an improperly adjusted digital TR sensor.	Increase in EPC pressure. Defaults to (D)or D for all gear ranges.	Refer to Pinpoint Test C .
P1781	4x4L	4x4 low switch failure.	Switch closed or shorted during KOEO.	Early or delayed shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P1729	4x4L	4x4 low switch failure.	Circuit open/shorted.	Early or delayed shifts.	Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
P0760*	SSC	SSC solenoid circuit failure.	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or PCM driver failure during on-board diagnostic.	Improper gear selection depending on condition mode and manual lever position. See Solenoid On/Off Chart. Will flash MIL.	Refer to Pinpoint Test A .
P0763*	SSC	SSC solenoid circuit failure	SSC circuit failed to provide voltage drop across solenoid. Circuit open or shorted or	Incorrect gear selection depending on condition mode and manual lever position. See	Go To Pinpoint Test A .

			PCM driver failure during on-board diagnostic.	Solenoid On/Off chart. Will flash TCIL.	
P1701	Transmission.	Reverse engagement error.	Voltage through EPC solenoid is checked. Error noted if tolerance is exceeded.	EPC pressure low, SSA is off, engine lacks power.	Refer to Diagnosis By Symptom in this section.
P1746**	EPC	EPC solenoid circuit open.	Voltage through EPC solenoid is checked. Error is noted if tolerance is exceeded.	Open circuit — causes maximum EPC pressure, harsh engagements and shifts.	Refer to Pinpoint Test D .
P1714	SSA	SSA malfunction.	Mechanical failure of the solenoid detected.	Improper gear selection depending on condition, mode and manual lever position. See Solenoid Operation Chart.	Refer to Pinpoint Test F .
P1715	SSB	SSB malfunction.	Mechanical failure of the solenoid detected.	Improper gear selection depending on condition, mode and manual lever position. See Solenoid Operation Chart.	Refer to Pinpoint Test F .
P1716	SSC	SSC malfunction.	Mechanical failure of the solenoid detected.	Improper gear selection depending on condition, mode and manual lever position. See Solenoid Operation Chart.	Refer to Pinpoint Test F .
P1717	SSD	SSD malfunction.	Mechanical failure of the solenoid detected.	Improper gear selection depending on condition, mode and manual lever position. See Solenoid Operation Chart.	Refer to Pinpoint Test F .
P0735	SSA, SSB, SSC, SSD or internal parts.	5th gear error.	No 5th gear.	Improper gear selection depending on failure or mode and manual lever position. Shift errors may also be due to other internal transmission concerns (stuck valves, damaged friction material etc.).	Refer to the Solenoid On/Off Charts. Refer to Pinpoint Test A .
P0720	Output Shaft Speed sensor.	Insufficient input from OSS sensor.	PCM detected a loss of OSS signal during operation.	Harsh shifts, abnormal shift schedule, no torque	Refer to Pinpoint Test E .

				converter clutch engagement.	
P0765	SSD	SSD solenoid circuit failure.	SSD circuit failed to provide voltage drop across solenoid. Circuit open, shorted or PCM driver circuit failure during on-board diagnostics.	Improper gear selection depending on condition, mode and manual lever position. See the Solenoid On/Off Charts. Will flash MIL.	Refer to Pinpoint Test A .
P0768	SSD	SSD solenoid circuit failure	SSD circuit failed to provide voltage drop across solenoid. Circuit open, shorted or PCM driver circuit failure during on-board diagnostics.	Incorrect gear selection depending on condition mode and manual lever position. See Solenoid On/Off Charts. Will flash TCIL.	Refer to Pinpoint Test A .
P1740	TCC	TCC malfunction.	Mechanical failure of the solenoid detected.	Failed ON — engine stalls in 2nd (O/D, Manual 2 ranges) at low idle speeds with brake applied. Failed OFF — torque converter never applies.	Refer to Pinpoint Test F .
P0721	OSS	Output shaft speed sensor signal noisy.	PCM has detected an erratic OSS signal.	Harsh shifts, abnormal shift schedule, no torque converter clutch engagement.	Refer to Pinpoint Test E .
P1900	OSS	OSS signal intermittent.	PCM has detected an intermittent OSS signal.	Harsh shifts, abnormal shift schedule, no torque converter clutch engagement.	Refer to Pinpoint Test E .
P1713	TFT	No change in TFT - low range.	PCM has detected no TFT change at low range during operation.	Increase EPC, improper TCC engagement schedule, harsh engagement, harsh shifts.	Refer to Pinpoint Test B .
P1718	TFT	No change in TFT - high range.	PCM has detected no TFT change at high range during operation.	Increase EPC, improper TCC engagement schedule, harsh engagement, harsh shifts.	Refer to Pinpoint Test B .
P1702	Digital TR.	Digital TR signal intermittent, code P0705, P0708 are set.	See P0705, P0708 conditions.	See P0705, P0708 Symptoms.	Refer to Pinpoint Test C .

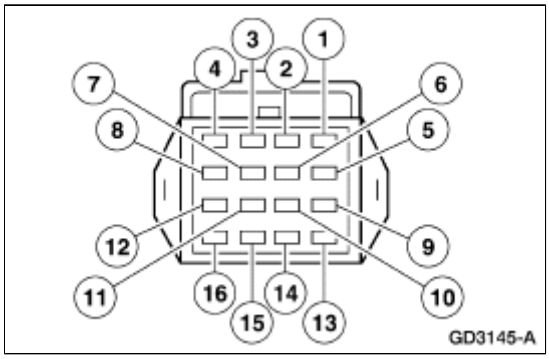
Rotunda Transmission Tester

The Rotunda Transmission Tester is used to diagnosis electronically controlled transmissions and is used in conjunction with the pinpoint tests. The tests should be carried out in order. Installing the Rotunda Transmission Tester allows separation of the vehicle electronics from transmission electronics; refer to the Rotunda Transmission Tester manual for these tests.

- Digital Transmission Range (TR) Sensor Testing
- Resistance/Continuity Test
- Switch Test - Park/Neutral, Backup Lamp, and Optional Circuits

Transmission Connector Layout

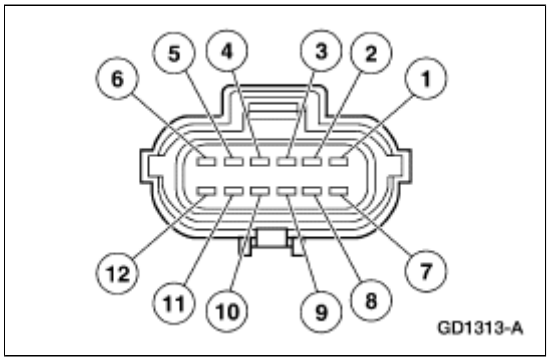
Transmission Vehicle Harness Connector



Pin Number	Circuit	Circuit Function
1	361 (RD)	TCC Power
2	970 (GN/WH)	Turbine Shaft Speed Sensor Signal
3	359 (GY/RD)	Sensor Signal Return (TSS)
4	923 (OG/BK)	Transmission Fluid Temperature Sensor
5	480 (PK/YE)	Torque Clutch Solenoid
6	—	NOT USED
7	971 (PK/BK)	Shift Solenoid SSC
8	359 (GR/RD)	Sensor Signal Return (TFT)
9	924 (BR/OG)	Shift Solenoid SSD
10	361 (RD)	Shift Solenoid Power
11	361 (RD)	EPC Power
12	925 (WH/YE)	Electronic Pressure Control Solenoid
13	—	NOT USED
14	315 (PK/OG)	Shift Solenoid SSB
15	—	NOT USED

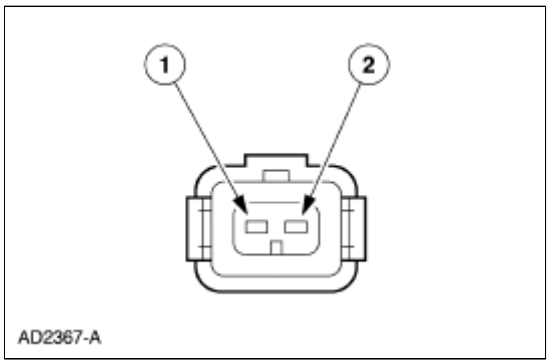
16	237 (OG/YE)	Shift Solenoid SSA

Digital Transmission Range (TR) Sensor Harness Connector



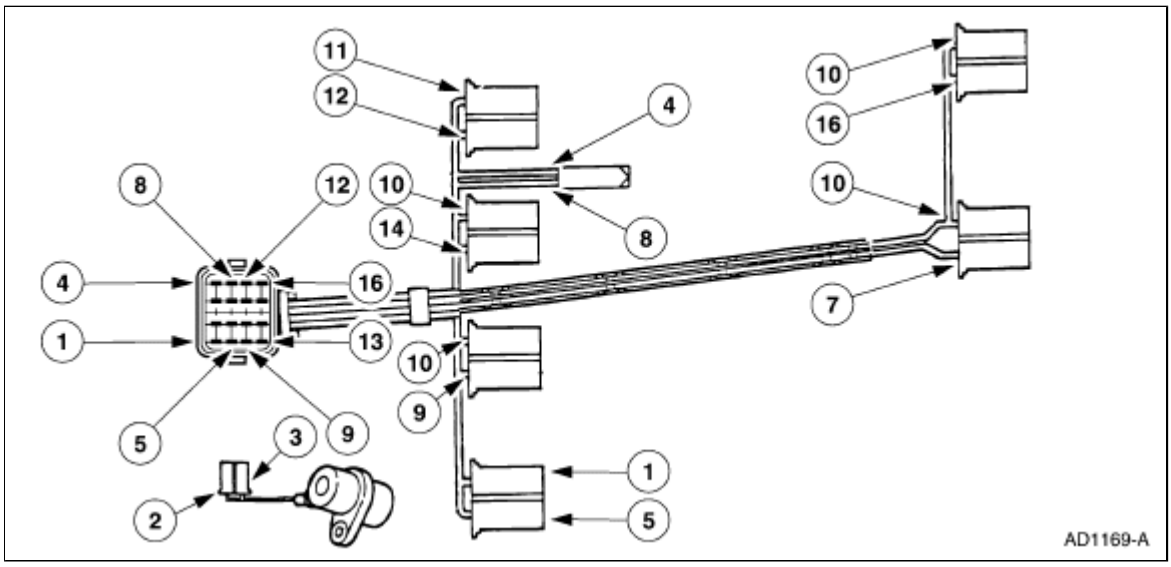
Pin Number	Circuit	EEC-V Pin Number	Circuit Function
1	—	—	NOT USED
2	359 (GY/RD)	91	Signal Return
3	199 (LB/YE)	64	TR3A
4	1144 (YE/BK)	3	TR1
5	1145 (LB/BK)	49	TR2
6	1143 (WH/BK)	50	TR4
7	57 (BK)	—	Ground
8	463 (RD/WH)	—	Neutral Sense
9	298 (PK/OG)	—	Fused Power Feed
10	32 (RD/LB)	—	Starter Control
11	140 (BK/PK)	—	Back Up
12	329 (PK)	—	Starter to Starter Interrupt Relay

Output Shaft Speed (OSS) Sensor Connector



Pin Number	Circuit	Circuit Function
1	—	Output Shaft Speed Sensor (OSS)
2	—	Signal Return

Internal Harness Diagram



Pin Number	Circuit	Circuit Function
1	Black	TCC Power
2	Red	Turbine Shaft Speed Sensor Signal
3	White	Sensor Signal Return (TSS)
4	Red	Transmission Fluid Temperature Sensor
5	Purple	Torque Converter Clutch Solenoid
6	—	NOT USED
7	Yellow	Shift Solenoid SSC
8	Red	Sensor Signal Return (TFT-)
9	Orange	Shift Solenoid SSD
10	White	Shift Solenoid Power
11	Green	EPC Power
12	Blue	Electronic Pressure Control Solenoid
13	—	NOT USED
14	Brown	Shift Solenoid SSB
15	—	NOT USED
16	Gray	Shift Solenoid SSA

Digital Transmission Range (TR) Sensor Diagnosis Chart

		PID: TR_D				PID: TR_V (volts)
Selector Position	PID: TR	TR4	TR3A	TR2	TR1	TR3A (PCM pin 64 to sigrtn)
PARK	P/N	0	0	0	0	0.0 Volts

In Between	REV	0	1	0	0	1.3 - 1.8 Volts
REVERSE	REV	1	1	0	0	1.3 - 1.8 Volts
In Between	REV	0	1	0	0	1.3 - 1.8 Volts
NEUTRAL	NTRL	0	1	1	0	1.3 - 1.8 Volts
In Between	O/D [a]	1	1	1	0	1.3 - 1.8 Volts
OVERDRIVE	O/D [a]	1	1	1	1	1.3 - 1.8 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 2	Man 2	1	0	0	1	0.0 Volts
In Between	Man 2	1	0	1	1	0.0 Volts
Manual 1	Man 1	0	0	1	1	0.0 Volts

[a] Will read "Drive" if O/D is canceled

A. TR_V is the voltage at the PCM pin 64 (TR3A Circuit) to signal return.
B. "In Between" reading could be caused by a shift cable or digital TR sensor misaligned or a digital TR sensor circuit failure of TR1, TR2, TR3A, or TR4.
C. TR_D: 1= Open digital TR switch, 0= Closed digital TR switch.
D. Breakout Box Readings: Taken from PCM signal pins for TR1, TR2, TR3A, TR4 to signal return.
   - **Voltages for TR1, TR2, TR4:**
   - 0 = 0.0 volts (circuit shorted to ground)
   - 1 = 9.0 - 14.0 volts (open circuit).
   - **Voltage for TR3A:**
   - 0 = 0.0 volts (circuit shorted to ground).
   - 1 = 1.3 - 1.8 volts (open circuit).
   - 1.8 - 5.0 volts = Invalid Reading (open in wires or bad resistor in digital TR sensor).

Wiggle Test Information for Open/Shorts

A. TR4, TR3A, TR2, and TR1 are all closed in Park (shorted to signal return), so Park is a good position to check for intermittent open circuits (with scan tool monitoring TR_D).
B. TR4, TR3A, TR2, and TR1 are all open in OVERDRIVE, so OVERDRIVE is a good position to check for shorts to ground. To determine the shorted components while observing TR_D, unplug the TR and see if the short goes away. If the short is still present unplug the transaxle harness and see if the short goes away. If the short is still present, then the short is in the PCM or vehicle harness. Remove the suspect circuit(s) wire terminal from the PCM connector. If the short is still present, then the PCM has an internal failure, otherwise the failure is in the vehicle harness.

Pinpoint Tests

Any time an electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or replace as required.

Shift Solenoids Pre-Diagnosis

Use the following shift solenoid operation information when carrying out Pinpoint Test A.

Solenoid Application Chart — 5R55E

Selector Lever Position	Powertrain Control Module (PCM) Commanded Gear	5R55E Solenoid States				
		SSA	SSB	SSC	SSD	Engine Braking
P/N	P/N	On	Off	Off	Off	No
R	R	On	Off	Off	Off	No
(D) (Overdrive)	1	On	Off	Off	Off	No
(D)	2 [1]	On	Off	On	Off	No
(D)	3	On	On	Off	Off	No
(D)	4	Off	Off	Off	Off	No
(D)	5	Off	Off	On	Off	No
(D) Off	1	On	Off	Off	Off	No
	2 [1]	On	Off	On	Off	No
	3	On	On	Off	On [2]	No
	4	Off	Off	Off	On	Yes
2	3	On	On	Off	On	Yes
1	1	On	Off	Off	On	Yes

[1] PCM controlled.
[2] On time calibration dependent

Shift Solenoid Failure Mode Chart "Always On"

Failed OFF due to powertrain control module and/or vehicle wiring concerns, solenoid electrically, mechanically or hydraulically stuck ON.

	Transmission Range Selector Lever Position		
SSA ALWAYS "ON":	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	1	3	1
5	2	Ratio 1.1	2

	Transmission Range Selector Lever Position		
SSB ALWAYS "ON":	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		

1	3	3	3
2	Ratio 1.1	Ratio 1.1	Ratio 1.1
3	3	3	3
4	3	3	3
5	Ratio 1.1	Ratio 1.1	Ratio 1.1

	Transmission Range Selector Lever Position		
SSC ALWAYS "ON":	**OD**	**2**	**1**
PCM Gear Commanded	**Actual Gear Obtained**		
1	2	3	1
2	2	Ratio 1.1	2
3	Ratio 1.1	3	3
4	5	3	3
5	5	Ratio 1.1	Ratio 1.1

	Transmission Range Selector Lever Position		
SSD ALWAYS "ON":	**OD**	**2**	**1**
PCM Gear Commanded	**Actual Gear Obtained**		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

Shift Solenoid Failure Mode Chart "Always Off"

Failed ON due to powertrain control module and/or vehicle wiring concerns, solenoid electrically or hydraulically stuck OFF.

	Transmission Range Selector Lever Position		
SSA ALWAYS "OFF":	**OD**	**2**	**1**
PCM Gear Commanded	**Actual Gear Obtained**		
1	4	3	3
2	5	Ratio 1.1	Radio 1.1
3	3	3	3
4	4	3	3

5	5	Ratio 1.1	Ratio 1.1

SSB ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	3
2	2	Ratio 1.1	2
3	1 [a b])	3	1
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

[a] During Downshift Only
[b] During Upshift Only

SSC ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	1	3	1
3	3	3	3
4	4	3	3
5	4	3	3

SSD ALWAYS "OFF":	Transmission Range Selector Lever Position		
	OD	2	1
PCM Gear Commanded	Actual Gear Obtained		
1	1	3	1
2	2	Ratio 1.1	2
3	3	3	3
4	4	3	3
5	5	Ratio 1.1	Ratio 1.1

PINPOINT TEST A: SHIFT SOLENOIDS (SSA, SSB, SSC, SSD) AND TORQUE CONVERTER CLUTCH (TCC) SOLENOID

CONDITIONS	DETAILS/RESULTS/ACTIONS

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Diagram illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs. All Digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).

A1 ELECTRONIC DIAGNOSTICS

1

2

3 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.

4

Scan Tool

5

6

Diagnostic Data Link

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does vehicle enter Trans-Bench Mode?**

→ **Yes**
REMAIN in Trans-Bench Mode. GO to A2 .

→ **No**
REPEAT procedure to enter Trans-Bench Mode. If vehicle did not enter Trans-Bench Mode, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

A2 WIGGLE TEST

1 Remain on Trans-Bench Mode.

2 Select PIDs to be monitored;

PID Command	PID Actual
SSA	SS1F
SSB	SS2F
SSC	SS3F
SSD	CCSF
TCC	TCCF

3 Select "ON" to turn suspect solenoid on.

4 Press "SEND".

5 Wiggle all wiring and connectors to the transmission. Monitor the Solenoid State for changes.

6 Select "OFF" to turn solenoid off.

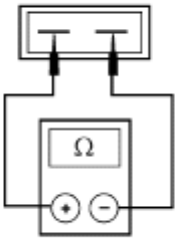
7 Press "SEND".

- **Does the suspect solenoid(s) fault state change?**

→ **Yes**
REPAIR open or short in the vehicle harness or connector.

	→ **No** GO to A3 .
A3 SOLENOID FUNCTIONAL CHECK	
	1 Monitor each solenoid state. 2 Turn each solenoid ON and OFF. • **Does the solenoid turn ON and OFF when commanded and can solenoid activation be heard?** → **Yes** GO to A4 . → **No** GO to A5 .
A4 OSC TRANS-DRIVE MODE (GR_CM OR TCC)	
	1 Carry out OSC Trans-Drive Mode. 2 Select GR_CM for Shift Solenoids or follow procedures for GR_CM; refer to Output State Control (OSC) Procedures in this section. 3 Select TCC for Torque Converter Clutch Solenoid. Follow procedures of TCC in Drive Mode Output State Control (OSC) Procedures in this section. • **Does the transmission upshift and downshift or torque converter engage/disengage when commanded?** → **Yes** CLEAR all DTCs. Road test to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose shift or torque converter concerns. → **No** GO to A5 .
A5 CHECK FOR BATTERY VOLTAGE	
3 	1 Remove transmission fluid pan. 2 Visually inspect all wires and connectors for damage.

	4 Connect DVOM positive lead to VPWR solenoid terminal and negative lead to a good ground. • **Is the battery voltage present?** → **Yes** GO to A6 . → **No** CHECK for open or short circuit in harness, or solenoid.
A6 ELECTRICAL SIGNAL CHECK	
2  Trans-Bench Mode	1 Leave positive lead connected to VPWR solenoid terminal and connect negative lead to the signal terminal of the appropriate solenoid. 3 Select Parameter SSA, SSB, SSC, SSD or TCC. 4 Select "ON". 5 Press "SEND". 6 Turn the solenoids ON and OFF, while monitoring the voltage reading on the DVOM, solenoid state on the scan tool (ON and OFF), listen for the solenoid to activate (click). 7 Select "OFF", press "SEND". • **Does the voltage and solenoid state change?** → **Yes** GO to A7 . → **No** CHECK for open or short circuit in harness, solenoid or a PCM concern.
A7 CHECK SOLENOID RESISTANCE AT SOLENOID	
2	1 Disconnect the appropriate solenoid connector at the solenoid. 2 Check solenoid resistance by connecting an ohmmeter at the terminals of the solenoid.



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3 Measure and record the resistance for each solenoid (SSA, SSB, SSC, SSD or TCC).

Solenoid	Resistance (ohms)
SSA	22-48
SSB	22-48
SSC	22-48
SSD	22-48
TCC	8.9-16

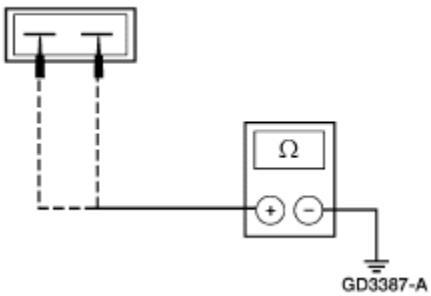
- **Is the resistance within specification?**

→ **Yes**
GO to A8 .

→ **No**
INSTALL a new solenoid.

A8 CHECK SOLENOID FOR SHORT TO GROUND

1



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1 Check for continuity between engine ground and appropriate shift solenoid terminal with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).

Solenoid	Terminal
SSA	+/-
SSB	+/-
SSC	+/-
SSD	+/-
TCC	+/-

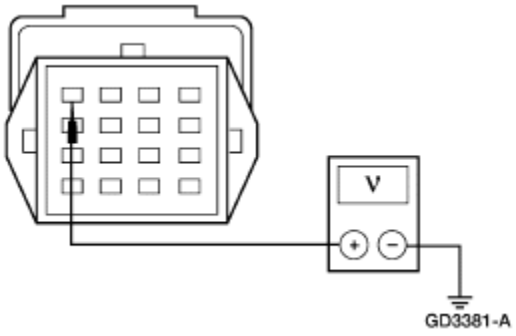
- **Is there continuity?**

→ **Yes**
INSTALL a new solenoid.

	→ **No** REFER to Diagnosis By Symptom in this section for diagnosis of shift or torque converter concerns.

PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

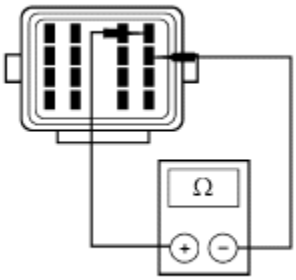
CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests. **NOTE:** Refer to the Internal Harness Diagram illustration preceding these pinpoint tests.	
B1 ELECTRONIC DIAGNOSTICS	
	1 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.
2  Scan Tool	
3 	
	4 Select Diagnostic Data Link. 5 Select PCM. 6 Select PID/Data Monitor and Record.
7  PIDs; TFT, TFTV	
	• **Does the vehicle enter PID/Data Monitor and Record?** → **Yes** REMAIN in PID/Data Control. GO to B2. → **No** REPEAT procedure to enter PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

B2 WARM-UP/COOL-DOWN CYCLE	
	1 While monitoring the TFT PIDs, perform the following test: If transmission is cold, run transmission to warm it up. If transmission is warm, allow transmission to cool down. • **Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT or TFTV drop in and out of range?** → **Yes** If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. Road test to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section to diagnose transmission overheating. If the TFT or TFTV drop in and out of range, INSPECT for intermittent concern in the internal/external harness, sensor or connector. → **No** GO to B3.
B3 ELECTRICAL SIGNAL CHECK	
2  	1 Visually inspect all wires and connectors for damage. 2 Connect DVOM positive lead to +TFT at sensor terminal and negative lead to a good ground. • **Is the voltage present?** → **Yes** GO to B4. → **No** CHECK for open or short circuit in vehicle harness, internal harness or a PCM concern.
B4 CHECK RESISTANCE OF TFT SENSOR	

1

Transmission Harness

2



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2 Connect DVOM across +TFT and -TFT terminals at transmission connector.

3 Record the resistance.

4 Resistance should be approximately in the following ranges:

Transmission Fluid Temperature

°C	°F	Resistance (Ohms)
-40 to -20	-40 to -4	967K - 284K
-19 to -1	-3 - 31	284K - 100K
0 - 20	32 - 68	100K - 37K
21 - 40	69 - 104	37K - 16K
41 - 70	105 - 158	16K - 5K
71 - 90	159 - 194	5K - 2.7K
91 - 110	195 - 230	2.7K - 1.5K
111 - 130	231 - 266	1.5K - 0.8K
131 - 150	267 - 302	0.8K - 0.54K

- **Is the resistance in the range?**

→ **Yes**
REFER to Diagnosis By Symptom in this section to diagnose an overheating concern.

→ **No**
INSTALL a new internal harness (sensor is part of harness).

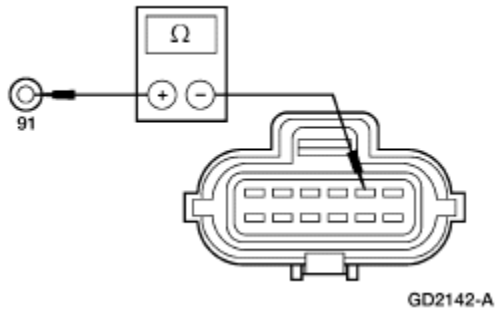
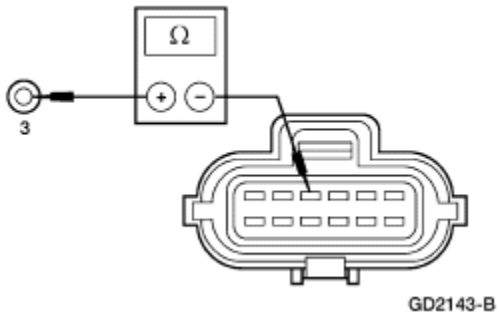
PINPOINT TEST C: DIGITAL TRANSMISSION RANGE (TR) SENSOR

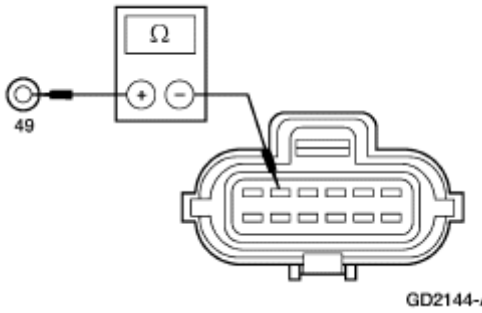
CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Digital Transmission Range (TR) Sensor Connector illustration preceding these pinpoint tests. **NOTE:** Refer to the Digital Transmission Range (TR) Sensor Diagnosis Chart preceding these pinpoint tests.	
C1 VERIFY DIAGNOSTIC TROUBLE CODES	
1  2 	3 Carry out the on-board diagnostic test. DTC codes P0705 and P0708 cannot be set by an improperly adjusted digital TR sensor. • **Are only DTC codes P0705, P0708 present?** → **Yes** GO to C4 . → **No** GO to C2 .
C2 VERIFY DIGITAL TRANSMISSION RANGE SENSOR ALIGNMENT	
1  2  5 	3 Check to make sure the digital TR sensor harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. 4 Apply the parking brake. 6 Disconnect the shift cable/linkage from the manual lever.

	7 Verify that the Digital TR Sensor Alignment Tool fits in the appropriate slots. • **Is the digital TR sensor properly adjusted?** → **Yes** GO to C3 . → **No** ADJUST the digital TR sensor. PLACE the transmission range selector lever into PARK and CLEAR the DTCs. RERUN OBD Tests.GO to C3 .
C3 VERIFY SHIFT CABLE/LINKAGE ADJUSTMENT	
2  	1 Place the manual lever in the overdrive position. 3 Re-connect the shift cable/linkage. 4 Verify that the shift cable/linkage is properly adjusted. Refer to Section 307-05 . • **Is the shift cable/linkage properly adjusted?** → **Yes** GO to C4 . → **No** ADJUST the shift cable/linkage. REFER to the Section 307-05 . GO to C4 .
C4 CHECK ELECTRICAL SIGNAL OPERATION	
1  2  Digital TR Sensor	2 **CAUTION: Do not pry on connector. This will damage the connector and result in a transmission concern.** Press the button and pull out on the digital TR harness connector. 3 Inspect both ends of the connector for damage or pushed-out pins, corrosion, loose

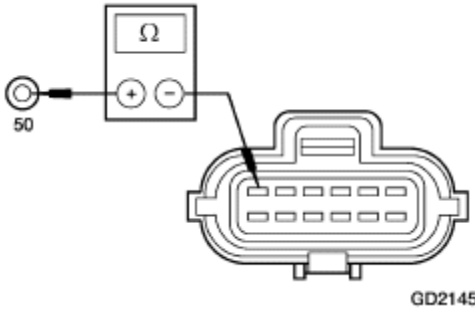
	wires and missing or damaged seals. • **Is there damage to the connector, pins or harness?** → **Yes** REPAIR as required. CLEAR DTCs and RERUN OBD Tests. → **No** If diagnosing a DTC, GO to C5 . If diagnosing a starting concern, 4x4 low engagement concern, or a backup lamp concern,GO to C10 .
C5 CHECK ELECTRICAL SYSTEM OPERATION (DIGITAL TR AND PCM)	
1  2  Scan Tool 3  Digital TR Sensor 4  5  TR PIDS TR, TR_D, TR_V	6 Move transmission range selector lever into each gear and stop. 7 Observe any of the following PIDs, (vehicle dependent) TR and TR_D, TR_V while wiggling harness, tapping on sensor, and/or driving the vehicle. Use PIDs TR, and TR_D for DTCs P0705, P1704, and P1705. Use PIDs TR, and TR_V for DTC P0708. 8 Compare the PIDs to the Digital Transmission

	Range (TR) Sensor Diagnosis Chart. • **Do the PIDs TR, TR_D and TR_V match the Digital Transmission Range (TR) Sensor Diagnosis Chart, and does the TR_D PID remain steady when the harness is wiggled, the sensor is tapped, or the vehicle is driven?** → **Yes** The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis. → **No** If TR_D changes when wiggling harness, tapping on the sensor, or driving the vehicle, the problem may be intermittent. GO to C6.
C6 CHECK DIGITAL TRANSMISSION RANGE SENSOR OPERATION	
1  Digital TR Sensor 2  TR-E Cable to Transmission Tester 3  TR-E Cable to Digital TR Sensor	4 Place the DIGITAL TR Overlay onto Transmission Tester. 5 Carry out SENSOR Test as instructed on the Digital TR Overlay. • **Does the status lamp on the tester TR-E cable match the selected gear positions?** → **Yes** Concern is not in the digital TR sensor, GO to C7. → **No**

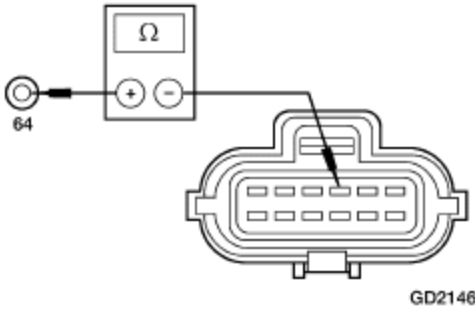
	INSTALL a new digital TR sensor and ADJUST. CLEAR DTCs and RERUN OBD Tests.
C7 CHECK PCM HARNESS CIRCUITS FOR OPENS	
1 	
2  Powertrain Control Module (PCM)	2 Inspect for damaged or pushed out pins, corrosion or loose wires.
3  Digital TR Sensor	3 **CAUTION: Do not pry on the connector. This will damage the connector and result in a transmission concern.** Disconnect digital TR sensor connector.
	4 Install the 104-Pin Breakout Box
5  GD2142-A	5 Measure the resistance between the PCM test pin 91 at the 104-Pin Breakout Box and signal return circuit pin at vehicle harness connector pin 2.
6  GD2143-B	6 Measure the resistance between the PCM test pin 3 at the 104-Pin Breakout Box and TR1 circuit pin at vehicle harness connector pin 4.
7	7 Measure the resistance between the PCM test pin 49 at the 104-Pin Breakout Box and TR2 circuit pin at vehicle harness connector pin 5.



8



9



8 Measure the resistance between the PCM test pin 50 at the 104-Pin Breakout Box and TR4 circuit pin at vehicle harness connector pin 6.

9 Measure the resistance between the PCM test pin 64 at the 104-Pin Breakout Box and TR3A circuit pin at vehicle harness connector pin 3.

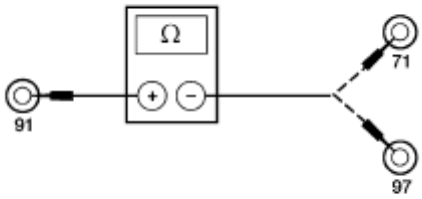
- **Are all resistances less than 5 ohms?**

→ **Yes**
GO to C8 .

→ **No**
REPAIR open circuit(s). RECONNECT all components. CLEAR DTCs. RERUN OBD Tests.

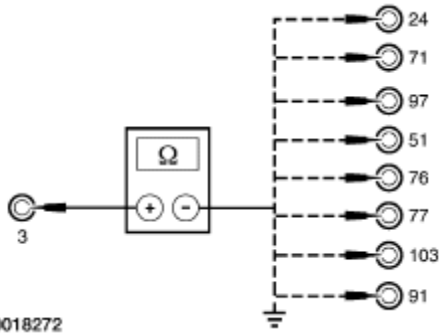
C8 CHECK PCM HARNESS CIRCUITS FOR SHORT TO GROUND OR POWER

1 Measure the resistance between PCM test pin 91 and test pins 71 and 97 at the 104-Pin Breakout Box.



GD2254-A

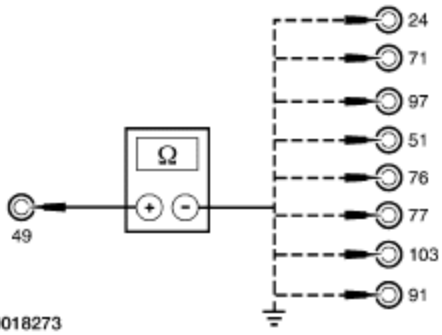
2



A0018272

2 Measure the resistance between PCM test pin 3 and test pins 24, 71, 97, 51, 76, 77, 103, and 91 at the 104-Pin Breakout Box and ground.

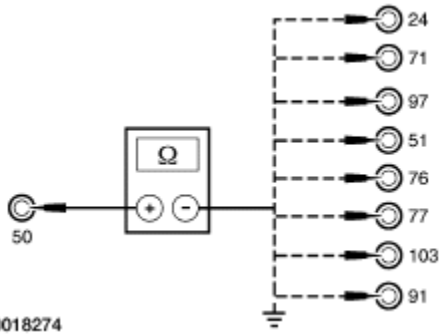
3



A0018273

3 Measure the resistance between PCM test pin 49 and test pins 24, 71, 97, 51, 76, 77, 103, and 91 at the 104-Pin Breakout Box and ground.

4

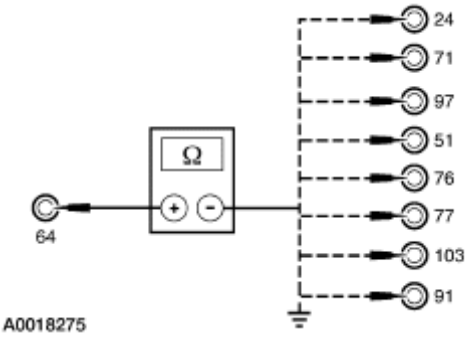


A0018274

4 Measure the resistance between PCM test pin 50 and test pins 24, 71, 97, 51, 76, 77, 103, and 91 at the 104-Pin Breakout Box and ground.

5

5 Measure the resistance between PCM test pin 64 and test pins 24, 71, 97, 51, 76, 77, 103, and 91 at the 104-Pin Breakout Box and ground.



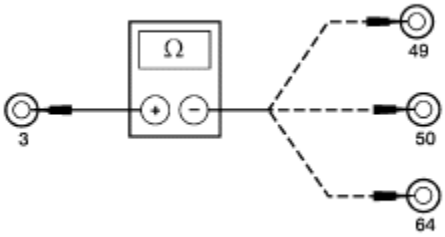
- **Are all resistances greater than 10,000 ohms?**

→ **Yes**
GO to C9 .

→ **No**
REPAIR short circuit(s). RECONNECT all components. CLEAR DTCs. RERUN OBD Tests.

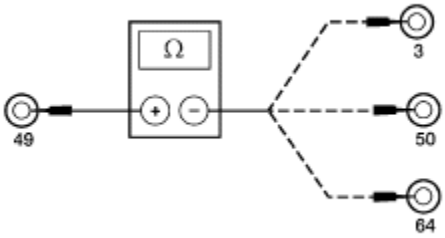
C9 CHECK FOR SHORT BETWEEN TR/PCM INPUT SIGNAL CIRCUITS

1



1 Measure the resistance between test pin 3 and pins 49, 50, and 64 at the 104-Pin Breakout Box.

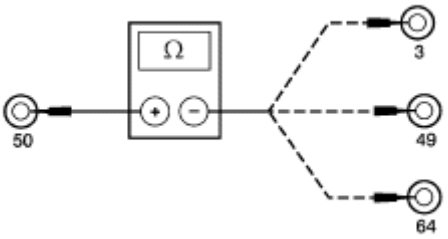
2



2 Measure the resistance between test pin 49 and pins 3, 50, and 64 at the 104-Pin Breakout Box.

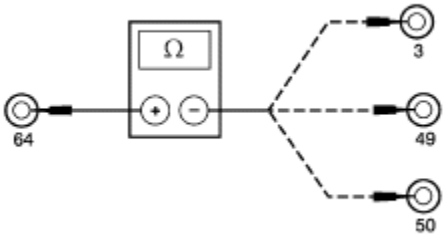
3

3 Measure the resistance between test pin 50 and pins 3, 49, and 64 at the 104-Pin Breakout Box.



GD2261-A

4



GD2262-A

4 Measure the resistance between test pin 64 and pins 3, 49, and 50 at the 104-Pin Breakout Box.

- **Are all the resistances greater than 10,000 ohms?**

→ **Yes**
INSTALL a new PCM. RECONNECT all components. CLEAR DTCs and RERUN OBD Tests.

→ **No**
REPAIR shorts on circuits having less than 10,000 ohms between other TR/PCM input signal circuits. RECONNECT all components. CLEAR DTCs and RERUN OBD Tests.

C10 CHECK THE NON-PCM INTERNAL CIRCUITS OF SENSOR

1

TR-E Cable to Transmission

2

TR-E Cable to Digital TR Sensor

3 Place the DIGITAL TR Overlay onto Transmission Tester.

4 Carry out SWITCH Test as instructed on the

	Digital TR Overlay. • **Does the status lamp on the tester indicate RED for the correct gear position?** → **Yes** Concern is not in the digital TR sensor. For Start System concerns, refer to Section 303-06 . For Backup Lamp concerns, GO to Section 417-01 . For Optional Circuits: 4x4 Low Neutral Sense; REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual and workshop manual Section 308-07A for diagnosis. → **No** INSTALL a new digital TR sensor. Clear DTCs and RERUN OBD Tests.

PINPOINT TEST D: ELECTRONIC PRESSURE CONTROL (EPC) SOLENOID

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests. **NOTE:** Refer to the Transmission Internal Harness Connector illustration preceding these pinpoint tests. **NOTE:** Read and record all DTCs. All Digital TR Sensor and VSS DTCs must be repaired before entering Output State Control (OSC).	
D1 ELECTRONIC DIAGNOSTICS	
1  2  4  Scan Tool 5	3 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in the connector and in good condition before proceeding.

6

Diagnostic Data Link

7

PCM

8

Active Command Modes

9

Output State Control (OSC)

10

Trans-Bench Mode

- **Does the vehicle enter the Trans-Bench Mode?**

→ **Yes**
REMAIN in Trans-Bench Mode. GO to D2 .

→ **No**
REPEAT procedure to ENTER Trans-Bench Mode. If vehicle did not enter OSC, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

D2 SOLENOID FUNCTIONAL TEST

3

1 Install 300 psi pressure gauge into EPC tap.

2 Monitor pressure gauge.

Parameter; EPC

4 Select value - 15, 30, 45, 60, 70 or 90 psi.

5 Press "SEND".

6 Select another value "0-90 psi".

7 Press "SEND".

8

XXX

9 Press "SEND".

- **Does the pressure reading match the commanded pressure?**

→ **Yes**
CLEAR DTCs.

→ **No**
GO to D3 .

D3 CHECK FOR BATTERY VOLTAGE

1 Remove the transmission fluid pan, refer to Fluid Pan, Gasket and Filter in this section.

2 Visually inspect all wires and connectors for damage.

3

4 Connect DVOM positive lead to VPWR solenoid terminal and negative lead to a good ground.

- **Is the battery voltage present?**

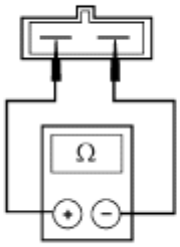
→ **Yes**
GO to D4 .

→ **No**
CHECK for open or short circuit in harness.

D4 ELECTRICAL SIGNAL CHECK

1 Leave positive lead connected to VPWR

	solenoid terminal and connect negative lead to the signal terminal of the EPC solenoid. 2 Turn the solenoids ON and OFF, while monitoring the voltage reading on the DVOM, solenoid state on the scan tool (ON and OFF), listen for the solenoid to activate (click).
3  Trans-Bench Mode 4  Parameter; EPC	5 Select a value "0-90 psi". 6 Press "SEND". 7 Select another value "0-90 psi". 8 Press "SEND".
9  XXX	10 Press "SEND". • **Does the voltage and solenoid state change?** → **Yes** GO to D5 . → **No** CHECK for open or short circuit in harness or PCM.
D5 CHECK SOLENOID RESISTANCE AT SOLENOID	
1  Transmission Harness 2	2 Check solenoid resistance by connecting an ohmmeter at the terminals of the solenoid.



GD3388-A

3 Measure and record the resistance of the EPC solenoid. Resistance should be between 3.10-5.7 ohms.

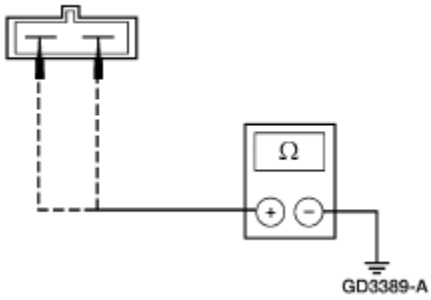
- **Is the resistance within specifications?**

→ **Yes**
GO to D6 .

→ **No**
INSTALL a new solenoid.

D6 CHECK SOLENOID FOR SHORT TO GROUND

1



GD3389-A

1 Check for continuity between engine GROUND and the EPC solenoid terminals with ohmmeter or other low current tester (less than 200 milliamps). Connection should show infinite resistance (no continuity).

Solenoid	Terminal
EPC	+/-

- **Is there continuity?**

→ **Yes**
INSTALL a new solenoid.

→ **No**
REFER to Diagnosis By Symptom in this section for pressure concerns.

PINPOINT TEST E: TURBINE SHAFT SPEED (TSS), OUTPUT SHAFT SPEED (OSS) SENSORS

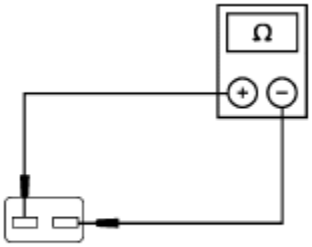
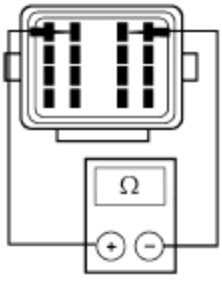
CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Refer to the Output Shaft Speed (OSS) Sensor Connector illustration preceding these pinpoint tests.	

E1 ELECTRONIC DIAGNOSTICS

	1 Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding.
2  Scan Tool	
3 	
4  Diagnostic Data Link	
5  PCM	
	6 Select PID/Data Monitor and Record. 7 Select the following PIDs: TSS, OSS. • **Does vehicle enter PID/Data Monitor and Record?** → **Yes** REMAIN in PID/Data. GO to E2 . → **No** REPEAT procedure to ENTER PID. If vehicle did not enter PID, REFER to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis of PCM.

E2 DRIVE CYCLE TEST

	1 While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. • **Does the TSS or OSS Speed PID increase and decrease with engine and vehicle speed or is the sensor signal erratic (drop to zero or near zero and**

	return to normal operation)? → **Yes** If the TSS or OSS Speed PID increase and decrease with engine and vehicle speed, CLEAR all DTCs. Road test to verify if concern is still present. If concern is still present, REFER to Diagnosis By Symptom in this section for diagnosis. If the sensor signal is erratic, INSPECT for intermittent concern in the internal/external harness, sensor, or connector. → **No** If the TSS or OSS Speed PID does not increase and decrease with engine and vehicle speed, INSPECT for open or short in vehicle harness, sensor, a PCM concern, or internal hardware concern. If the sensor signal is steady, GO to E3.
E3 CHECK RESISTANCE OF TSS OR OSS SENSOR	
2  AD1084-B	1 Disconnect the appropriate vehicle harness connector from the OSS sensor. For the TSS sensor, disconnect the vehicle harness connector from the transmission. 2 For OSS: Connect ohmmeter negative lead to one pin of the sensor and the positive lead to the other pin on the sensor.
3  GD3385-A	3 For TSS: Connect ohmmeter negative lead to the signal return pin and the positive lead to the TSS signal at the transmission connector. 4 Record the resistance. Resistance should be as follows:

Sensor	Resistance (ohms)
TSS	64-126
OSS	305-735

- **Is the resistance within specification for the appropriate sensor?**

→ **Yes**
REFER to Diagnosis By Symptom in this section for concern diagnosis.

→ **No**
REPLACE OSS and TSS sensor.

PINPOINT TEST F: SOLENOID MECHANICAL FAILURE

CONDITIONS	DETAILS/RESULTS/ACTIONS
NOTE: Repair all other DTCs before repairing the following DTCs: P1714, P1715, P1716, P1717, P1740.	
F1 ELECTRONIC DIAGNOSIS	
1  Scan Tool 2  3 	4 Carry out KOEO Test until continuous DTCs have been displayed. 5 If any of the following DTCs are present, continue with this test: P1714, P1715, P1716, P1717, P1740. • **Are other DTCs present for TFT or shift solenoids?** → **Yes** REPAIR the DTCs for TFT or shift solenoids first. CLEAR DTCs and CARRY OUT transmission Drive Cycle test. RERUN Quick Test. → **No** INSTALL a new solenoid and or body. REFER to the Diagnostic Trouble Code

	Chart for code description. GO to F2 .
F2 TRANSMISSION DRIVE CYCLE TEST	
	1 Carry out transmission drive cycle test; refer to the Transmission Drive Cycle Test in this section. • **Does the vehicle upshift and downshift OK?** → **Yes** GO to F3 . → **No** REFER to Diagnosis By Symptom in this section for concern diagnosis.
F3 RETRIEVE DTCS	
1  Scan Tool 2  3 	4 Carry out KOEO Test until continuous DTCs have been displayed. • **Are DTCs P1714, P1715, P1716, P1717, P1740 still present?** → **Yes** REPLACE PCM. Road test and RERUN Quick Test. → **No** Testing completed. If a concern still exists, REFER to Diagnosis By Symptom in this section for concern diagnosis.

Special Testing Procedures

The special tests are designed to aid the technician in diagnosing the hydraulic and mechanical portion of the transmission.

Engine Idle Speed Check

Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the engine idle speed.

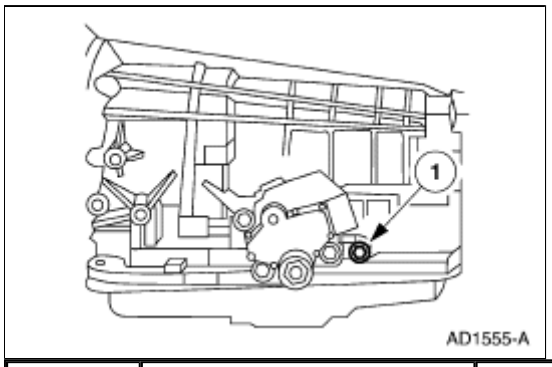
Line Pressure Test

CAUTION: Carry out Line Pressure Test prior to carrying out Stall Speed Test. If line pressure is low at stall, do not carry out Stall Speed Test or further transmission damage will occur. Do not maintain wide open throttle in any gear range for more than five seconds.

NOTE: Certain sensor failures may cause high EPC, FMEM (Failure Mode Effect Management) actions. Be sure that self test and electrical repairs have been carried out, or test results may be incorrect.

This test verifies that the line pressure is within specifications.

1. Connect pressure gauge to the line pressure tap.



Item	Part Number	Description
1	—	Line pressure tap

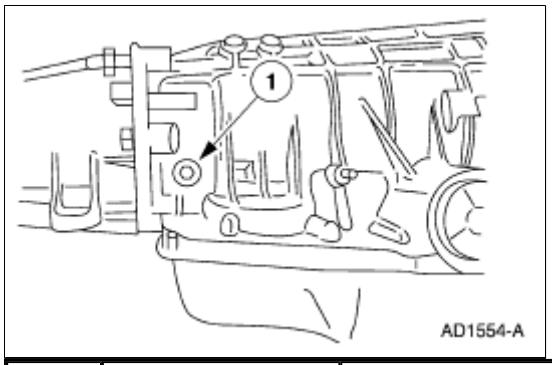
2. Start engine and check line pressures. Refer to the following Line Pressure chart to determine if line pressure is within specifications.

Reference: Line Pressure Chart

Trans.	Transmission Model/Application	Range	Idle 1000 RPM		WOT Stall	
			EPC	Line	EPC	Line
5R55E	4.0L EI	R	55-65	175-215	112-134	282-350
		N	20-40	75-120		
		(D) 2, 1	25-35	80-110	112-134	228-263
5R55E	4.0L SOHC	R	55-65	175-215	112-134	282-350
		N	20-40	75-120		
		(D), 2, 1	40-50	100-135	112-134	228-263

3. If line pressure is not within specifications, check EPC pressure.

4. Connect Pressure Gauge to EPC pressure tap.



Item	Part Number	Description
1	—	Electronic pressure control (EPC)

5. Restart engine and check EPC pressure. Refer to reference Line Pressure Chart for specification.

6. If EPC pressure is not within specification, carry out Pinpoint Test E to diagnose EPC operation. If EPC operation is OK refer to Line Pressure Diagnosis Chart for line pressure concern causes.

Line Pressure Diagnosis Chart

Test Results	Possible Source
High at Idle — All Ranges	• Wiring Harnesses • EPC Boost Valve • EPC Solenoid • Main Regulator Valve
Low at Idle — All Ranges	• Low Fluid Level • Fluid Inlet Filter/Seal • Main Control Body • Cross Leaks • Gaskets • Pump • Separator Plate
Low — All Forward Ranges	• Forward Clutch • Main Control • Front Servo
Low in Park Only	• Valve Body
Low in Reverse Only	• Separator Plate • Rear Servo Piston, Cover Seal • Reverse Clutch • Front Servo • Valve Body • Forward Clutch
Low in Neutral Only	• Valve Body • Front Servo
Low in Overdrive Only	• Forward Clutch • Front Servo • Valve Body
Low in Drive Only (O/D Cancelled)	• Forward Clutch • Front Servo • Valve Body
Low in 1st Position	• Forward Clutch

	• Valve Body
Low in 2nd Position	• Intermediate Servo • Front Servo • Forward Clutch

Stall Speed Test

This test checks operation of the following items:

- Torque converter clutch
- Forward clutch
- Low one-way clutch (OWC) assembly
- Engine driveability concerns

WARNING: Apply the parking brake firmly while carrying out each Stall Speed Test.

CAUTION: Always carry out Line Pressure Test procedures prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out Stall Speed Test or further transmission damage will occur.

NOTE: The Stall Speed Test should be carried out with the engine and transmission at normal operating temperatures.

1. Connect tachometer to the engine.

2. **CAUTION: After testing each of the following ranges (D), 2, 1, and R, move the transmission range selector lever to N (NEUTRAL) and run engine at 1000 rpm for about 15 seconds to allow the torque converter to cool before testing the next range.**

   CAUTION: Do not maintain wide open throttle in any range for more than five (5) seconds.

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

   NOTE: Prolonged use of this procedure may set Diagnostic Trouble Code P0712, P1783. After carrying out Stall Speed Test run OBD Test and clear DTCs from memory.

   Press accelerator pedal to floor (WOT) in each range. Record rpm reached in each range. Stall speeds should be a follows:

Vehicle	Engine	Rpm
Explorer	4.0 EI	2610-2983
Explorer/ Mountaineer	4.0 SOHC	2632-3114

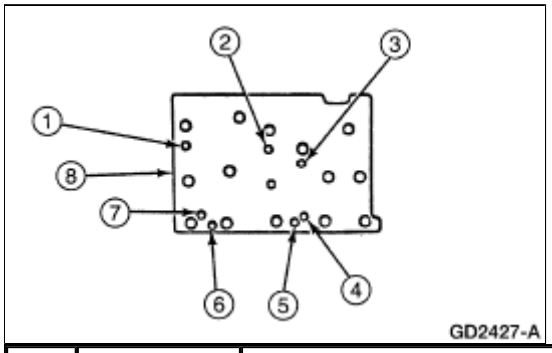
   If stall speeds were too high, refer to the following Stall Speed Diagnosis Chart. If stall speeds were too low, first check the engine idle speed. If engine idle is OK, remove torque converter and check the

torque converter clutch for slippage.

Stall Speed Diagnosis Chart

Transmission Range Selector Lever Position	Stall Speeds High	Stall Speeds Low
(D)Overdrive, D, and 1	Front One-Way Clutch, Rear One-Way Clutch	—
D, 2 and 1	Forward Clutch, Front One-Way Clutch	—
(D)Overdrive	Forward Clutch, Front One-Way Clutch	—
(D)Overdrive, D, 2, 1 and R	General Pressure Concerns, Forward Clutch, Front One-Way Clutch	Converter One-Way Clutch or Engine Driveability Concerns
R Only	Reverse Band, Direct Clutch, Low/Reverse Servo	—
2 Only	Intermediate Band/Servo	—
1 Only	Low/Reverse Band/Servo	—

Air Pressure Tests



Item	Part Number	Description
1	—	Coast clutch apply
2	—	Direct clutch apply
3	—	Forward clutch apply
4	—	Intermediate servo release
5	—	Intermediate servo apply
6	—	Front servo release
7	—	Front servo apply
8	307-342	4R44E/5R55E transmission test plate (T95L-77000-AH)
—	—	4R44E/5R55E transmission test plate gasket (T95L-77000-AH1)

A no-drive condition can exist even with correct transmission fluid pressure because of inoperative clutches or bands. An erratic shift can be located through a series of checks by substituting air pressure for fluid

pressure to determine the location of the malfunction.

Follow the procedure to determine the location of the inoperative clutch or band by introducing air pressure into the various test plate passages.

NOTE: Use only dry, regulated (276 kPa [40 psi] maximum) air pressure.

Apply air to the appropriate passage(s). A dull thud should be felt or heard or movement could be observed when the component applies. There should be no hissing sound when the component is fully applied.

NOTE: Cover the vent hole in the test plate with a clean, lint-free shop towel to prevent spray when the air is applied. Plugging the vent hole during testing will result in inaccurate results.

3. Drain transmission fluid and remove the transmission fluid pan.

4. Remove the main control valve body.

5. Install transmission test plate and gasket. Tighten bolts to 11 Nm (8 lb-ft).

6. Apply air to the appropriate clutch port (refer to diagram). A dull thud may be heard or movement felt when the component is applied or released. If clutch seals or check balls are leaking a hissing sound may be heard.

If test results find that the servos do not operate, disassemble, clean and inspect them to locate the source of the concern.

If air pressure applied to the clutch passages fails to operate a clutch, or operates another clutch simultaneously, disassemble and use air pressure to check the fluid passages in the center support and clutches to detect obstructions.

Leakage Inspection

CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specifications. This may cause damage to the case threads.

Leakage at the transmission fluid pan to case gasket often can be stopped by tightening the attaching bolts to 14 Nm (10 lb-ft). If necessary, replace the oil pan case gasket.

Check the fluid filler tube connection at the transmission case. If leakage is found here, install a new grommet.

Check fluid lines and fittings between the transmission and the cooler in the radiator tank for looseness, wear, or damage. If leakage cannot be stopped by tightening a fluid tube nut, replace the damaged parts. When fluid is found leaking between the case and cooler line fitting, check for missing or damaged O-ring, then tighten the fitting to maximum specification.

If the leak continues, replace cooler line fitting and tighten to specification. The same procedure should be followed for fluid leaks between the radiator cooler and the cooler line fittings in this section. Refer to Section 307-02 .

Check the engine coolant in the radiator. If transmission fluid is present in the coolant, the cooler in the radiator is probably leaking.

The cooler can be further checked for leaks by disconnecting the lines for the cooler fittings and applying no more than 345 kPa (50 psi) air pressure to the fittings. Remove the radiator cap to relieve the pressure buildup at the exterior of the oil cooler tank. If the cooler is leaking and or will not hold pressure, replace the cooler.

If leakage is found at the transmission range selector lever, replace the seal.

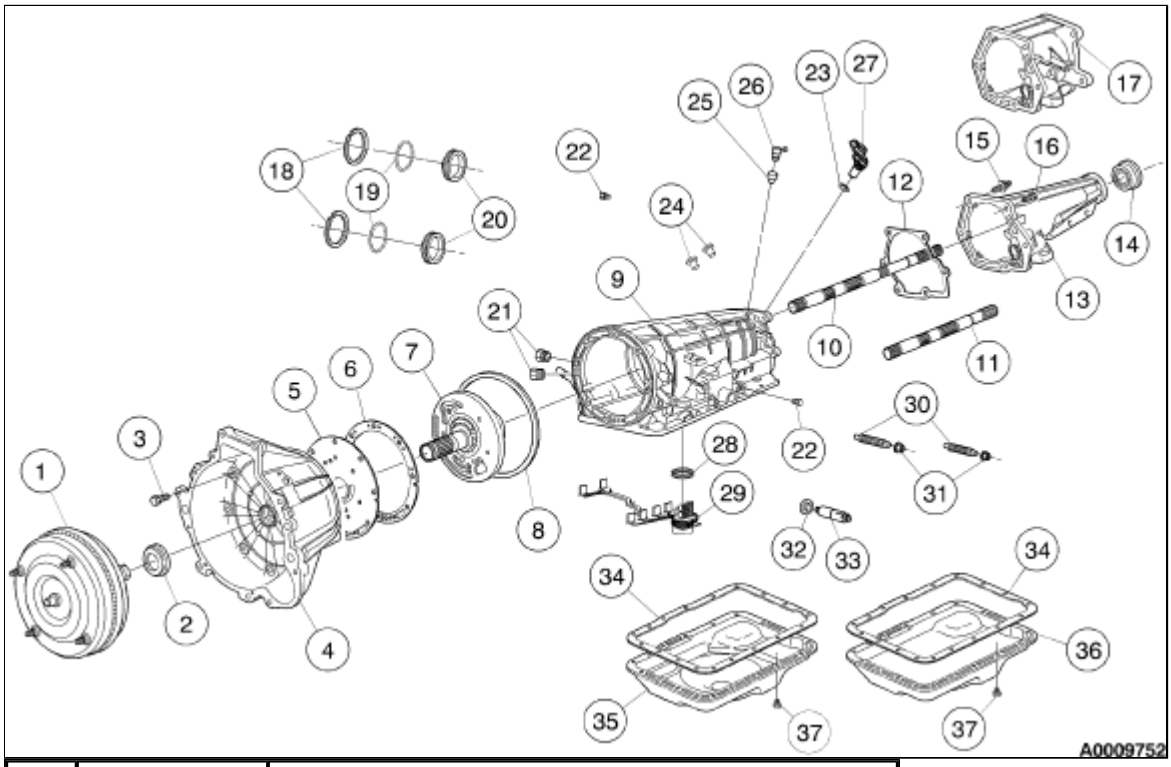
If leakage is found at the transmission internal harness connector, replace O-ring.

External Sealing

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

- Gaskets.
- Lip-type seals.
- O-ring seals.
- Seal rings.
- Seal grommets.
- Thread sealant.

External Sealing



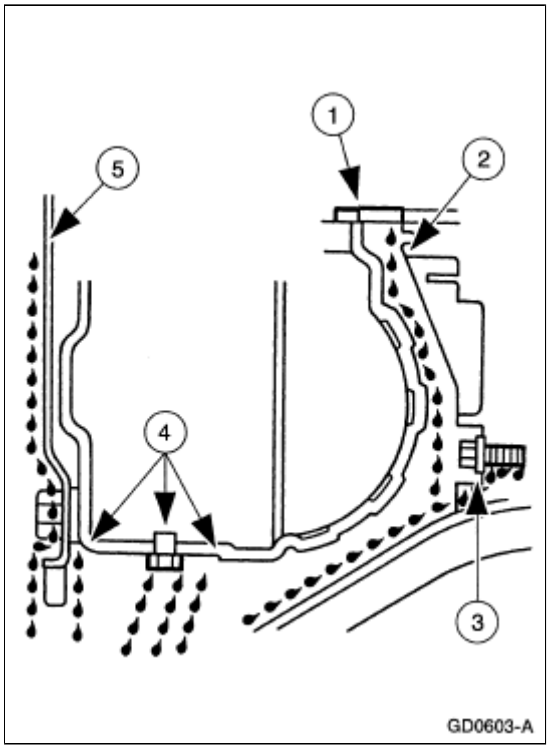
Item	Part Number	Description
1	7902	Torque converter assembly
2	7A248	Seal assembly — converter hub
3	E804595	Screw and seal assy
4	7976	Housing assembly — converter
5	7B472	Plate — fluid pump adaptor

6	7A136	Gasket — converter housing to case
7	7A103	Support and gear assembly — fluid pump
8	7L323	Seal ring — fluid pump
9	7005	Case assembly
10	7060	Shaft assembly — output (4x2)
11	7060	Shaft assembly — output (4x4)
12	7086	Gasket — extension housing
13	7A039	Housing assembly — extension (4x2)
14	7052	Seal assembly — extension housing
15	E804137-S72	Stud — extension housing to case
16	E800152-S72	Screw — extension housing to case (5 required)
17	7A039	Housing assembly — extension (4x4)
18	E860343-S	Retaining ring (servos)
19	7D040	O-ring — servo cover to case
20	7D027	Cover and seal assembly (servo)
21	7D273	Connector assembly — fluid tube
22	E450102-S80	Plug — pipe line and EPC pressure
23	W702981-S300	O-ring — speed sensor
24	E840171-S2	Pin (reverse band anchor)
25	7034	Vent assembly (4x2)
26	7034	Vent assembly (4x4)
27	7H103	Sensor assembly — trans output shaft speed (OSS) model dependent
28	84400120	O-ring — 16 pin connector assembly to case
29	7Z409	Connector assembly
30	7C492	Screw — intermediate and front band adjuster/lock
31	E825100-S100	Nut and seal assembly — hex intermediate and front band adjustment/lock
32	7B498	Seal assembly — main control lever
33	7A308	Shaft — manual valve outer to inner lever
34	7A191	Gasket — fluid pan
35	7A194	Pan — fluid (4x4)
36	7A194	Pan — fluid (4x2)
37	W701203-S309M	Screw — fluid pan-to-case

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the front pump support and gear (7A103) and torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of transmission, as evidenced by fluid around the torque converter housing, may have several sources. By

careful observation it is possible, in many instances, to pinpoint the source of leak before removing the transmission from the vehicle. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The five steps following correspond with the numbers in the illustration.



1. Fluid leaking by the front pump seal lip will tend to move along the impeller hub and onto the back of the impeller housing. Except in the case of a total seal failure, fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing.

2. Fluid leakage by the outside diameter of the front pump seal and front pump body will follow the same path that leaks by the inside diameter of the front pump seal follow.

3. Fluid that leaks by a front pump to case screw or pump gasket will be deposited on the inside of the torque converter housing only. Fluid will not be deposited on the back of the torque converter.

4. Fluid leakage from the converter drain plug (vehicle-dependent), converter seal weld or converter to flexplate stud weld will appear at the outside diameter of the torque converter, on the back face of the flexplate, and in the converter housing only near the flexplate. Fluid leaks from the torque converter will leave a ring of fluid around the inside of the torque converter housing.

5. **NOTE:** White facial tissue paper may aid in determining the color (red is transmission fluid) and source of the leaking fluid.

   Engine oil leaks are sometimes improperly diagnosed as transmission pump gasket leaks. The following areas of possible leakage should also be checked to determine if engine oil leakage is causing the concern.

a. Leakage at the valve cover gasket may allow oil to flow over the torque converter housing or seep down between the torque converter housing and cylinder block causing oil to be present in or at the bottom of the torque converter housing.
b. Oil galley plug leaks will allow oil to flow down the rear face of the cylinder block to the bottom of the

torque converter housing.
c. Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.
d. Leakage at oil pressure sensor.

Leak Check Test

1. Remove the fluid level indicator and note the color of the fluid. Original factory fill fluid is dyed red to aid in determining if leakage is from the engine or transmission. Unless a considerable amount of makeup fluid has been added or the fluid has been changed, the red color should assist in pinpointing the leak.

2. Remove the torque converter housing cover. Clean off any fluid from the top and bottom of the torque converter housing, front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a suitable nonflammable solvent and blow dry with compressed air.

3. Wash out the torque converter housing, the front of the flexplate and the converter drain plugs. The torque converter housing may be washed out using cleaning solvent and a squirt-type oil can. Blow all washed areas dry with compressed air.

4. Start and run the engine until the transmission reaches its normal operating temperature. Observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Raise the vehicle on a hoist, refer to Section 100-02 . Run the engine at fast idle, then at engine idle, occasionally shifting to the Overdrive and Reverse ranges to increase pressure within the transmission. Observe the front of the flexplate, back of the cylinder block (in as far as possible), and inside the torque converter housing and front of the case. Run the engine until fluid leakage is evident and the probable source of leakage can be determined.

Leak Check Test With Black Light

Fluid soluble aniline or fluorescent dyes premixed at the rate of 2.5 ml (1/2 teaspoon) of dye powder to 0.24L (1/2 pint) of automatic transmission fluid have proven helpful in locating the source of fluid leakage. Such dyes may be used to determine whether an engine fluid or transmission fluid leak is present, or if the fluid in the transmission fluid cooler hose leaks into the engine coolant system. An ultraviolet light must be used to detect the fluorescent dye solution.

Transmission Fluid Cooler

CAUTION: Whenever a transmission has been disassembled to replace worn or damaged parts, all transmission fluid coolers (in tank and auxiliary) and transmission fluid cooler lines must be cleaned and backflushed. Use the torque converter/oil cooler cleaner.

NOTE: Cleaning and backflushing the transmission fluid cooling system along with following all the normal cleaning and inspection procedures as outlined in this section during disassembly and reassembly will keep contamination from reentering the transmission and causing a repeat repair.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the torque converter and transmission fluid cooler (7A095). These contaminants are a major cause of recurring transmission troubles and must be removed from the system before the transmission is put back in use.

Transmission Fluid Cooler Flow Test

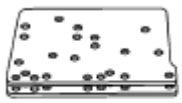
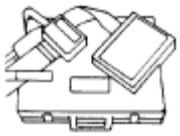
NOTE: The transmission linkage/cable adjustment, fluid level and line pressure must be within specification before carrying out this test, refer to Section 307-05 for adjustments.

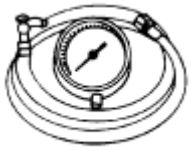
1. Remove fluid level indicator from fluid filler tube.
2. Place funnel in fluid filler tube.
3. Raise the vehicle on a hoist, refer to Section 100-02 and place suitable safety stands under the vehicle.
4. Remove the cooler return line (rear fitting) from the fitting on the transmission case.
5. Connect one end of a hose to the cooler return line and route other end of the hose up to a point where it can be inserted into the funnel at the fluid filler tube.
6. Remove the safety stands and lower the vehicle. Insert end of hose into the funnel.
7. Start the engine and run it at idle with the transmission in NEUTRAL position.
8. Once a steady flow of fluid (without air bubbles) is observed, remove the hose from the funnel and place the hose in a measuring container for 15 seconds. After 15 seconds place the hose back into the funnel and turn the engine off. Measure the amount of fluid in the container. If adequate flow was observed, approximately 237 ml (8 oz) will be in the measuring container; the test is now complete.
9. If the flow is not liberal, stop the engine. Disconnect the hose from the cooler return line and connect it to the converter outline fitting (front fitting) on the transmission case.
10. Repeat Steps 7 and 8. If flow is now approximately 1 liter (1 quart) in 30 seconds, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section. Refer to Section 307-02 for fluid cooler diagnosis. If the flow is still not approximately 1 liter (1 quart) in 30 seconds, service the pump, main control and or converter.

For installation of new cooler tubes, refer to Section 307-02 .

Diagnosis By Symptom

Special Tool(s)

 ST1637-B	Air Test Plate, Transmission 307-342 (T95L-77000-AH)
 ST1137-A	73 III Digital Multimeter 105-R0057 or equivalent
	Trans Tester TR/MLP Overlay and Manual 007-00131 or equivalent
 ST1391-A	Breakout Box, EEC-V Control System 418-049 (014-00950) or equivalent (T94L-50-EEC-V)
 ST2332-A	Worldwide Diagnostic System (WDS) 418-F224 New Generation STAR (NGS) Tester 418-F052 or equivalent scan tool
 ST1632-A	MLP-TR Cable 418-F107 (007-00111) or equivalent
	Transmission Tester 307-F016 (007-00130) or equivalent

 ST1389-A	
 ST1565-A	Transmission Fluid Pressure Gauge 307-004 (T57L-77820-A)
 ST1300-A	UV Leak Detector Kit 164-R0756 or equivalent

The Diagnosis by Symptom Index gives the technician diagnostic information, direction, and suggests possible components, using a symptom as a starting point.

The Diagnosis by Symptom Index is divided into two categories: Electrical Routines, indicated by 200 series numbers, and Hydraulic/Mechanical Routines, indicated by 300 series numbers. The Electrical Routines list the possible electrical components that could cause or contribute to the symptom described. The Hydraulic/Mechanical Routines list the possible hydraulic or mechanical components that could cause or contribute to the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Symptom Index, select the Concern/Symptom that best describes the condition.

2. Refer to the routine indicated in the Diagnosis by Symptom Index.

3. Always begin diagnosis of a symptom with:

a. Preliminary inspections.
b. Verifications of condition.
c. Checking the fluid levels.
d. Carrying out other test procedures as directed.

4. **NOTE:** Not all concerns and conditions with electrical components will set a diagnostic trouble code (DTC). Be aware that the components listed may still be the cause. Verify correct function of these components prior to proceeding to the Hydraulic/Mechanical Routine listed.

   NOTE: The powertrain control module (PCM) has an adaptive learn strategy to electronically control the transmission which will automatically adjust the shift feel. When the battery has been disconnected, or a new battery installed, certain transmission operating parameters may be lost. The PCM must relearn these parameters. During this learning process you may experience slightly firm shifts, delayed, or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

   Begin with the Electrical Routine, if indicated. Follow the reference or action required statements.

Always carry out the on-board diagnostic tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, then proceed to the Hydraulic/Mechanical Routine listed.

5. The Hydraulic/Mechanical Routines list possible hydraulic or mechanical components that could cause the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to ensure correct repair.

Diagnosis by Symptom Index

Concerns	Routines	
	Electrical [a]	Hydraulic/ Mechanical
· **Engagement Concerns:**		
· No Forward Only	201	301
· No Reverse Only	202	302
· Harsh Reverse Only	203	303
· Harsh Forward Only	204	304
· Delayed/Soft Reverse Only	205	305
· Delayed/Soft Forward Only	206	306
· No Forward and No Reverse	207A	307A
· No Forward in (D) Position and No Reverse	207B	307B
· Harsh Forward and Harsh Reverse	208	308
· Delayed Forward and Delayed Reverse	209	309
· **Shift Concerns:**		
· Some/All Shifts Missing	210	310
· Timing Concern		
· Early/Late (Some/All)	211	311
· Erratic/Hunting (Some/All)	212	312
· Feel Concerns		
· Soft/Slipping (Some/All)	213	313
· Harsh (Some/All)	214	314
· No First Gear in Drive, Engages in a Higher Gear	215	315
· No First Gear in Manual 1st Position	216	316
· No Manual Third Gear in 2nd Position	217	317
· **Torque Converter Clutch Operation Concerns:**		
· Does Not Apply	240	340
· Always Applied/Stalls Vehicle	241	341
· Cycling/Shudder/Chatter	242	342
· **Other Concerns:**		
· Shift Lever Efforts High	251	351
· External Leaks	252	352
· Driveability Concerns	253A	353A
· Engine Runs Poor — Wrong Gear Ratio in (D), 2 or 1 Positions	253B	353B

· Noise/Vibration — Forward or Reverse	254	354
· Engine Will Not Crank	255	355
· No Park Range	256	356
· Overheating	257	357
· No Engine Braking in 2nd Position	258	358
· No Engine Braking in 1st Position	259	359
· No Engine Braking with (D) Cancelled (3rd and 4th Gears)	260	360
· Fluid Venting or Foaming	261	361
· Slips/Chatters in 1st Position	263	363
· Slips/Chatters in 2nd Position	264	364
· FMEM — Harsh Engagements and Shifts	265	365

[a] Carry out electrical routines first.

Diagnostic Routines

Engagement Concern: No Forward

Possible Component	Reference/Action
201 — ELECTRICAL ROUTINE	
· No Electrical Concerns	
301 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band/clutch application pressure, low line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are low, check the following components: oil filter and seal assembly, main controls, pump assembly.
Fluid Filter and Seal Assembly	
· Filter, plugged, damaged	· Install new filter and seal assembly.
· Filter seal damaged, missing	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Forward modulator valve/EPC boost valve (207), forward engagement control valve (209), spring, damaged, missing, misassembled,	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may

stuck bore damaged	result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Screws out of torque specifications	· Tighten screws to specifications.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Center Support Assembly	
· Forward clutch support seal rings leaking	· Carry out air pressure check. If OK, go to forward clutch assembly. Repair as required.
Forward Clutch Assembly	
· Burnt, damaged, leaking check ball and cylinder; leaking piston seal rings	· Carry out air pressure check. Repair as required.
Rear One-Way Clutch Assembly	
· Rear one-way clutch damaged, worn	· Install a new case.

Engagement Concern: No Reverse

Possible Component	Reference/Action
202 — ELECTRICAL ROUTINE	
· No Electrical Concerns	
302 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band/clutch application pressure, low line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are low, check the following component: reverse clutch.
Fluid Filter and Seal Assembly	
· Filter, plugged, damaged	· Install new filter and seal assembly.
· Filter seal damaged, missing	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.

· 2-3 shift valve (203), 3-4 shift valve (204), reverse modulator valve (205), spring, damaged, missing, misassembled, stuck bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Bolts not tightened to specifications	· Tighten bolts to specifications.
· Pump damaged, leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Reverse Band	
· Burnt, damaged	· Inspect for damage. Repair as required.
· Servo piston, seals, gasket or cover damaged	· Inspect and install new piston, seals or gasket as required.
Reverse Drum	
· One way clutch damaged	· Inspect for damage. Repair as required.
· Bearing damaged	· Inspect for damage. Repair as required.
· Drum damaged	· Inspect for damage. Repair as required.

Engagement Concern: Harsh Reverse

Possible Component	Reference/Action
203 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, TP, VSS, RPM, SSA (off), electronic pressure control (EPC) solenoid	· Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
303 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressure, high line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are high, check the following component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
	· Inspect for damage. Carry out pinpoint test. Repair as

· EPC, SSA solenoid stuck, damaged, O-ring damaged or out bore	required.
· Reverse modulator valve (205), pressure boost valve/main regulator valve (208), check ball B, spring, damaged, missing, misassembled, stuck bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Reverse Band	
· Burnt, damaged	· Inspect for damage. Repair as required.
· Servo piston, seals, gasket or cover damaged	· Inspect and install new piston, seals or gasket as required.
Reverse Drum	
· One way clutch damaged	· Inspect for damage. Repair as required.
· Bearing damaged	· Inspect for damage. Repair as required.
· Drum damaged	· Inspect for damage. Repair as required.

Engagement Concern: Harsh Forward

Possible Component	Reference/Action
204 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, VSS, TP, RPM, EPC solenoid	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
304 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressure, high line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are high, check the following component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC solenoid stuck, damaged, O-ring damaged or out bore	· Inspect for damage. Carry out pinpoint test. Repair as required.
· Reverse modulator valve (205), forward modulator valve/EPC boost valve (207),	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main

forward engagement control valve (209), spring, damaged, missing, misassembled, stuck bore damaged	control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Forward Clutch Assembly	
· Assembly	· Air check assembly.
· Check balls missing or damaged	· Inspect for mislocation, poor seating, damage. Install a new forward clutch cylinder.
· Friction element damaged or worn	· Inspect for damage. Repair as required.
· Hub damaged	· Inspect for damage. Repair as required.

Engagement Concern: Delayed/Soft Reverse

Possible Component	Reference/Action
205 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, VSS, TP, RPM, EPC solenoid	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
305 — HYDRAULIC/MECHANICAL ROUTINE	
Engine Driveline	
· Inspect the driveshaft, U-joints, engine mounts	· Inspect for damage. Repair as required.
· Restriction in cooling system	· Carry out transmission fluid cooler flow test.
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Inspect fluid condition. Repair as required.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band/clutch application pressure, low line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are low, check the following component: main control.
Fluid Filter and Seal Assembly	
· Filter, plugged, damaged	· Install new filter and seal assembly.
· Filter seal damaged, missing	
Main Control Assembly	

· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC solenoid stuck, damaged, O-ring damaged or out bore	· Inspect for damage. Carry out pinpoint test. Repair as required.
· Reverse modulator valve (205), forward modulator valve/EPC boost valve (207), forward engagement control valve (209), spring, damaged, missing, misassembled, stuck bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front One-way Clutch Assembly	
· One-way clutch damaged	· Inspect for damage. Repair as required.
Center Support Assembly	· Inspect for damage. Repair as required.
· Direct/reverse clutch center support seal rings, ring grooves, worn or damaged	
Reverse Band	
· Burnt, damaged	· Inspect for damage. Repair as required.
· Servo piston, seals, gasket or cover damaged	· Inspect and install new piston, seals or gasket as required.
Reverse Drum	
· One way clutch damaged	· Inspect for damage. Repair as required.
· Bearing damaged	· Inspect for damage. Repair as required.
· Drum damaged	· Inspect for damage. Repair as required.

Engagement Concern: Delayed/Soft Forward

Possible Component	Reference/Action
206 — ELECTRICAL ROUTINE	
Powertrain Control System	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, VSS, TP, RPM, EPC solenoid	
306 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	· Adjust fluid to correct level.
· Incorrect level	
Shift Linkage	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
· Cable and bracket damaged, misadjusted, TR misadjusted	

Incorrect Pressures	
· Incorrect band/clutch application pressure, low line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are low, check the following component: main control.
Fluid Filter and Seal Assembly	
· Filter, plugged, damaged	· Install new filter and seal assembly.
· Filter seal damaged, missing	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC solenoid stuck, damaged, O-ring damaged or out bore	· Inspect for damage. Carry out pinpoint test. Repair as required.
· Forward modulator valve/EPC boost valve (207), forward engagement control valve (209), spring, damaged, missing, misassembled, stuck bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Extension housing lube orifice plug, missing	· Inspect for damage. Repair as required.
· Wrong component used in rebuild	· Verify that correct components were used.
Front One-way Clutch Assembly	
· One-way clutch damaged	· Inspect for damage. Repair as required.
Forward Clutch Assembly	
· Leaking check ball, not seating	· Install a new piston.
· Seals, piston damaged	· Inspect for damage. Repair as required.
· Forward hub seal rings damaged	· Inspect for damage. Repair as required.
Rear One-Way Clutch Assembly	
· Rear one-way clutch damaged, worn	· Install a new case.

Engagement Concerns: No Forward and No Reverse

Possible Component	Reference/Action
207A — ELECTRICAL ROUTINE	
No Electrical Concerns	
307A — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specifications. If pressure is

pressure low, EPC pressure low	high/low, check the following possible component: main control.
Filter and Seal Assembly	
· Filter damaged, plugged; seal damaged, cut or missing	· Inspect for damage and install new parts.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· EPC blow-off valve, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front Pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Front One-Way Clutch Assembly	
· Overdrive one-way clutch damaged	· Inspect for damage. Repair as required.

Engagement Concerns: No Forward in (D) Position and No Reverse

Possible Component	Reference/Action
207B — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, TP, RPM, VSS, EPC	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
307B — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	

· Incorrect level	· Adjust to correct level.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low, EPC pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specifications. If pressure is high/low, check the following possible components: main control, pump assembly.
Filter and Seal Assembly	
· Filter damaged, plugged; seal damaged, cut or missing	· Inspect for damage and install new parts.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Forward modulator valve/EPC boost valve (207), pressure boost valve (208), EPC blow off valve, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Front One-Way Clutch Assembly	
· Front one-way clutch damaged	· Determine cause of condition. Repair as required.
Mechanical	
· Mechanical damage	· Check splines on turbine input shaft and overdrive carrier, overdrive one-way clutch, center shaft, forward clutch, forward carrier and output shaft.

Engagement Concerns: Harsh Forward and Reverse

Possible Component	Reference/Action
208 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harness, internal transmission wiring harness, PCM, EPC, TSS, TFT, VSS, Digital TR, TCC, TP and MAF*	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear DTCs, road test and rerun Self-Test.
	· *Refer to the FMEM — Routine 265 for additional information.

308 — HYDRAULIC/MECHANICAL ROUTINE	
Engine/Driveline	
· Looseness in the driveshaft, U-joints or engine mounts	· Repair as required.
· Engine idle speed too high	· Check engine idle speed. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Fluid	
· Incorrect level	· Adjust to correct level.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator or valve (208), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.

Engagement Concerns: Delayed/Soft Forward and Reverse

Possible Component	Reference/Action
209 — ELECTRICAL ROUTINE	
No Electrical Concerns	
309 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level.
· Fluid contaminated	· Inspect fluid for contamination. If contaminated, locate source of contamination. If burnt, inspect mechanical band, clutches. Repair as required.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specifications. If pressure is low, check the following possible components: main control, pump assembly.
Filter and Seal Assembly	
· Filter damaged, plugged; seal damaged, cut or missing	· Inspect for damage and install new parts.

Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), EPC blow-off valve, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harness, internal transmission wiring harness, PCM, EPC, TSS, OSS, Digital TR, TCS, TP, SSA, SSB, SSC, SSD, and RPM	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear DTCs, road test and rerun Self-Test.
310 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Contaminated	· Inspect fluid for contamination. If contaminated, locate the source of contamination. If burnt, inspect the mechanical band and clutches.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band and clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. See pressure chart for specifications. If pressure is low check main control, pump, and EPC solenoid.
Filter and Seal Assembly	

· Filter damaged, plugged; seal damage, cut, or missing	· Inspect for damage and install new.
Main Control Assembly	
· Screws out of torque specification	· Adjust screws to specification.
· Gasket damaged or off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in the electrical routine. Repair as required.
· Forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), extension housing lube orifice, check ball C damaged, spring damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged install a new main control. If parts are missing install new parts or main control. If misassembled, reassemble correctly. Do not stone, file, or sand valves. This will remove the anodized finish and may result in further main control or transmission failure.
· Wrong components used during assembly	· Verify that the correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
	· Refer to the following shift routine(s) for further diagnosis: ■ Shift 1-2, Routine 220/320 ■ Shift 2-3, Routine 221/321 ■ Shift 3-4, Routine 222/322 ■ Shift 4-5, Routine 270/370 ■ Shift 5-4, Routine 271/371

Shift Concerns: Timing Concerns — Early/Late

Possible Component	Reference/Action

211 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, TP, TFT, EPC, OSS, RPM, and shift solenoids	· Carry out shift point road test. Run Self-Test. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing of the Powertrain Control System. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
Other Electrical Concerns	
· No power to the PCM. Keep alive memory erased from the PCM	· Inspect EEC power relay. Repair as required.
	· Restore memory by carrying out drive cycle test.
311 — HYDRAULIC/MECHANICAL ROUTINE	
Engine Driveability Concerns	
· Vehicle runs poor	· See routines 253A, 253B, 353A, and 353B.
Other	
· Tire size change, axle ratio change, or speedometer gear change	· Verify vehicle has original equipment. See the Certification Label and Safety Standard Certification Label. Changes in tire size or axle ratio will affect shift timing.
Incorrect Pressures	
· Incorrect band, or clutch application pressure, line pressure low (late shift)	· Check line pressure at tap. Carry out line pressure and stall speed tests. See pressure chart for specifications. If the line pressure is low check the following possible component: main control.
Main Control Assembly	
· Screws out of torque specification.	· Adjust screws to specification.
· Gasket damaged or off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in the electrical routine. Repair as required.
· Wrong components used during assembly	· Verify that the correct components were used.
	· Refer to the following shift routine(s) for further diagnosis: ■ Soft/Slipping Shift 1-2, Routine 226/326 ■ Soft/Slipping Shift 2-3, Routine 227/327 ■ Soft/Slipping Shift 3-4, Routine 228/328 ■ Soft/Slipping Shift 4-5, Routine 272/372 ■ Soft/Slipping Shift 5-4, Routine 273/373 ■ Soft/Slipping Shift 4-3, Routine 229/329

Shift Concerns: Timing Concerns — Erratic/Hunting

Possible Component	Reference/Action
212 — ELECTRICAL ROUTINE	
Powertrain Control System	

· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, TP, RPM, EPC, TFT, shift solenoids, Digital TR sensor, TCC, output shaft speed (OSS)	· Carry out shift point road test. Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
312 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Carry out the fluid condition check.
Filter and Seal Assembly	
· Filter damaged, plugged; seal damaged, cut, or missing	· Inspect for damage and install new.
Main Control Assembly	
· Screws out of torque specification.	· Adjust screws to specification.
· Gasket damaged or off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in the electrical routine. Repair as required.
· Wrong components used during assembly	· Verify that the correct components were used.
Torque Converter Clutch	
· Torque converter	· See the Torque Converter Operation Concerns: Cycling/Shudder/Chatter Hydraulic/Mechanical Routine 342.
Specific Shifts	
	· Refer to the following shift routine(s) for further diagnosis: ● No 1-2 shift, Routine 220/330 ● No 2-3 shift, Routine 221/331 ● No 3-4 shift, Routine 222/332 ● No 4-5 shift, Routine 270/370 ● No 5-4 shift, Routine 271/371 ● Soft/Slip 1-2 shift, Routine 226/326 ● Soft/Slip 2-3 shift, Routine 227/327 ● Soft/Slip 3-4 shift, Routine 228/328 ● Soft/Slip 4-5 shift, Routine 272/372 ● Soft/Slip 5-4 shift, Routine 273/373 ● Soft/Slip 4-3 shift, Routine 229/329 ● Harsh 1-2 shift, Routine 232/332 ● Harsh 2-3 shift, Routine 233/333 ● Harsh 3-4 shift, Routine 224/334 ● Harsh 4-5 shift, Routine 274/374 ● Harsh 4-3 shift, Routine 235/335 ● Harsh 3-2 shift, Routine 236/336

Shift Concerns: Feel — Soft/Slipping

Possible Component	Reference/Action
213 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, TP, EPC solenoid, TFT, RPM, and MAF	· Carry out shift point road test. Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
313 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
· Condition	· Carry out the fluid condition check.
Incorrect Pressures	
· Low line pressure	· Check pressures at line tap. See the Line Pressure Chart for specifications. If pressures are low check the following components: main controls, filter/seal, pump.
Filter and Seal Assembly	
· Filter damaged, plugged; seal damaged, cut, or missing	· Inspect for damage and install new.
Main Control Assembly	
· Screws out of torque specification	· Adjust screws to specification.
· Gasket damaged or off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in the electrical routine. Repair as required.
· Pressure boost valve/main regulator valve (208), EPC blow off valve, extension housing lube orifice, check ball C damaged, spring damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged install a new main control. If parts are missing install new parts or main control. If misassembled, reassemble correctly. Do not stone, file, or sand valves. This will remove the anodized finish and may result in further main control or transmission failure.
· Wrong components used during assembly	· Verify that the correct components were used.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.

· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
	· Refer to the following shift routine(s) for further diagnosis: ■ Soft/Slipping Shift 1-2, Routine 226/326 ■ Soft/Slipping Shift 2-3, Routine 227/327 ■ Soft/Slipping Shift 3-4, Routine 228/328 ■ Soft/Slipping Shift 4-5, Routine 272/372 ■ Soft/Slipping Shift 5-4, Routine 273/373 ■ Soft/Slipping Shift 4-3, Routine 229/329

Shift Concerns: Feel — Harsh

Possible Component	Reference/Action
214 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harness, internal transmission wiring harness, PCM, EPC, OSS, TFT, RPM, Digital TR, TP and MAF*	· Run Self-Test; refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear DTCs, road test and rerun Self-Test.
	· * Refer to the FMEM — Routine 265 for additional information.
314 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust fluid to correct level.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.

· Forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator or valve (208), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
	· Refer to the following shift routine(s) for further diagnosis: ■ Harsh Shift 1-2, Routine 232/332 ■ Harsh Shift 2-3, Routine 233/333 ■ Harsh Shift 3-4, Routine 234/334 ■ Harsh Shift 4-5, Routine 274/374 ■ Harsh Shift 4-3, Routine 235/335 ■ Harsh Shift 3-2, Routine 236/336

Shift Concerns: No 1st Gear, Engages In Higher Gear

Possible Component	Reference/Action
215 — ELECTRICAL ROUTINE	
Powertrain Control System	· Carry out shift point road test. Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, EPC, shift solenoids, Digital TR sensor	
315 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	· Inspect and repair as required. Verify transmission shift cable
· Cable and bracket damaged,	

misadjusted, TR misadjusted	adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Main Control Assembly	
· Screws out of torque specification	· Adjust screws to specification.
· Gasket damaged or off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in the electrical routine. Repair as required.
· Wrong components used during assembly	· Verify that the correct components were used.
Mechanical	
· Clutches damaged	· See the disassembly and assembly procedures.
· For diagnosis related to a specific gear use diagnostic tool to determine gear	· Refer to the following shift routine(s) for further diagnosis: ■ Shift 1-2, Routine 220/320 ■ Shift 2-3, Routine 221/321 ■ Shift 3-4, Routine 222/322 ■ Shift 4-5, Routine 270/370

Shift Concerns: No First Gear in Manual First Position

Possible Component	Reference/Action
216 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harness, PCM, SSA, and SSB	· Carry out shift point road test. Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
316 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures (no engine braking), line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, and SSB solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Check ball A damaged	· Inspect for damage. Repair as required.

Reverse Band	
· Burnt, damaged	· Inspect for damage. Repair as required.
· Servo piston, seals, gasket or cover damaged	· Inspect and install new piston, seals or gasket as required.
Reverse Drum	
· One way clutch damaged	· Inspect for damage. Repair as required.
· Bearing damaged	· Inspect for damage. Repair as required.
· Drum damaged	· Inspect for damage. Repair as required.
Low/Reverse One-Way Clutch Assembly	
· Rear one-way clutch damaged	· Inspect for damage. Repair as required.

SHIFT CONCERNS: NO MANUAL 2ND GEAR

Possible Component	Reference/Action
217 — ELECTRICAL ROUTINE	
No Electrical Concerns	
317 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressure, high or low line pressure	· Check line pressure at tap. Carry out line pressure and stall speed tests. See the line pressure chart for specification. If pressures are high or low, check the following component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Check ball A damaged	· Inspect for damage. Repair as required.
· Wrong component used in rebuild	· Verify that correct components were used.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: No 1-2 Shift (Automatic)

Possible Component	Reference/Action
220 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, OSS, EPC, SSA, SSB, SSC, SSD, Digital TR	· Carry out shift point test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
320 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is low check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 1-2 shift valve (215), forward modulator valve/EPC boost valve (207), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: No 2-3 Shift (Automatic)

Possible Component	Reference/Action
221 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, OSS, SSA, SSB, EPC, SSC, SSD, Digital TR	· Carry out shift point test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
321 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 1-2 shift valve (203), forward modulator valve/EPC boost valve (207), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file, or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: No 3-4 Shift (Automatic)

Possible Component	Reference/Action
222 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle	· Carry out shift point test. Run on-board diagnostics. Refer to the

wiring harnesses, internal transmission wiring harnesses, PCM, TP, OSS, SSA, SSB, SSC, and SSD	Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
322 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 1-2 shift valve (203), 3-4 shift valve (204), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage, If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong components used in rebuild	· Verify that correct components were used.
Center Support Assembly	
· Screws not tightened to specification	· Inspect, install new and retighten to specification.
· Seal rings and bearings damaged	· Inspect for damage. Repair as required.
· Outside diameter of case bore or center support damaged or leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.

Shift Concerns: No 4-5 Shift (Automatic)

Possible Component	Reference/Action
270 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, OSS, EPC, SSC, SSD, and TCS	· Carry out shift point test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
370 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: main control.

Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSC, SSD, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), SSC solenoid, 4-5 shift valve (215), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong components used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Front Planetary Assembly	
· Damaged	· Inspect for damage. Repair as required.

Shift Concerns: No 5-4 Shift (Manual)

Possible Component	Reference/Action
271 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, OSS, and TCS	· Carry out shift point test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
371 — HYDRAULIC/MECHANICAL ROUTINE	
No hydraulic/mechanical components	

Shift Concerns: Soft/Slipping 1-2 Only (Automatic)

Possible Component	Reference/Action
226 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring	· Carry out shift point test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions

harnesses, PCM, TP, MAF, EPC	Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
326 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· EPC solenoid, 1-2 shift valve (215), 2-3 shift valve (203), forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), EPC blow-off valve, extension housing lube orifice, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: Soft/Slipping 2-3 Only (Automatic)

Possible Component	Reference/Action
227 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, MAF, EPC, SSD	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required, clear codes, road test and rerun on-board diagnostics.
327 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.

· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 1-2 shift valve (203), forward modulator valve/EPC boost valve (207), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: Soft/Slipping 3-4 Only (Automatic)

Possible Component	Reference/Action
228 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, EPC, TP	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
328 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 3-4 shift valve (204), forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), extension housing tube orifice, EPC blow-off valve, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.

Center Support Assembly	
· Screw not tightened to specification	· Inspect, retighten to specification.
· Seal rings and bearings, groove damaged	· Inspect for damage. Repair as required.
· Outside diameter or case bore, center support, damaged or leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: Soft/Slipping 4-5 Only (Automatic)

Possible Component	Reference/Action
272 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TP, EPC, MAF	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required, clear codes, road test and rerun on-board diagnostics.
372 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Forward modulator valve/EPC boost valve (207) pressure boost valve/main regulator valve (208), 4-5 shift valve (215), extension housing lube orifice, EPC blow-off valve, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.

· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: Soft/Slipping 4-3 Downshifts (Automatic)

Possible Component	Reference/Action
229 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, EPC, TP, SSB, SSC	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
329 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged, openings No. 100, 170 blocked	· Inspect for damage. Repair as required.
· SSB, SSC, EPC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 3-4 shift valve (204), forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), 4-3 kickdown valve (211), manual low valve (212), 4-3 torque demand valve (213), extension housing lube orifice, EPC blow-off valve, spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Center Support Assembly	
· Screw not tightened to specification	· Inspect, retighten to specification.
· Seal rings and bearings, groove damaged	· Inspect for damage. Repair as required.
· Outside diameter or case bore, center support, damaged or leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.

· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Shift Concerns: Harsh 1-2 Only (Automatic)

Possible Component	Reference/Action
232 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Repair as required. Clear codes, road test and rerun on-board diagnostics.
332 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· 1-2 shift valve (215), spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.

Shift Concerns: Harsh 2-3

Possible Component	Reference/Action
233 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, SSD	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required. Clear codes, road test and rerun on-board diagnostics.
333 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· 1-2 shift valve (203), spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.

Shift Concerns: Harsh 3-4 Shift Only (Automatic)

Possible Component	Reference/Action
234 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC, TP	· Carry out TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the

	diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
334 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 3-4 shift valve (204) torque converter clutch (200), forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), thermostat bypass valve/cooler limit valve (216), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Center Support Assembly	
· Seal rings and bearings damaged	· Inspect for damage. Repair as required.
· Outside diameter or case bore damaged or leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Torque Converter Clutch Assembly	
	· Refer to routines 241/341.

Shift Concerns: Harsh 4-5 Only (Automatic)

Possible Component	Reference/Action

274 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC, TP	· Carry out TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
374 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, O-ring, solenoid struck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Torque converter clutch (200), 4-5 shift valve (215) forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), thermostat bypass valve/cooler limit valve (216), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Front Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Torque Converter Clutch Assembly	
	· Refer to routines 241/341.

Shift Concerns: Harsh 4-3 Only (Automatic)

Possible Component	Reference/Action
235 — ELECTRICAL ROUTINE	
Powertrain Control System	
	· Carry out shift point and TCC tests. Run on-

· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC, EPC, SSC	board diagnostics. Refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
335 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, EPC, SSC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Torque converter clutch (200), forward modulator valve/EPC boost valve (207), pressure boost valve/main regulator valve (208), 4-3 kickdown valve (211), manual low valve (212), 4-3 torque demand valve (213), thermostat bypass valve/cooler limit valve (216), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Torque Converter Clutch Assembly	
	· Refer to routines 241/341.

Shift Concerns: Harsh 3-2

Possible Component	Reference/Action
236 — ELECTRICAL ROUTINE	
No Electrical Concerns	
336 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.

· 1-2 shift valve (203), sprint, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.
Direct Clutch Assembly	
· Clutch assembly burnt, worn, check ball leaking in clutch piston, piston seal rings damaged, friction or steel plates damaged	· Carry out air pressure test. Inspect for damage. Repair as required.

Torque Converter Clutch Operation Concerns: No Clutch Apply

Possible Component	Reference/Action
240 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, ECT, TSS, TCC*	· Carry out TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
	· * Also refer to Routine No. 265.
340 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Converter clutch control valve (201), thermostat bypass valve/cooler limit valve (216), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· TCC solenoid and valve (200), stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.

· Wrong component used in rebuild	· Verify that correct components were used.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Torque Converter Clutch Assembly	
· Torque converter internal malfunction preventing lockup, piston application	· Remove transmission. Inspect for damage. Install a new or remanufactured torque converter if required.

Torque Converter Operation Concerns: Clutch Always Applied/Stalls Vehicle

Possible Component	Reference/Action
241 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Low engine idle	· Verify engine idle speed is within specification.
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC	· Carry out TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Use scan tool to carry out Pinpoint Test. Repair as required, clear codes, road test and rerun on-board diagnostics.
341 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· TCC solenoid and valve (200), TCC control valve (201), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control, If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and result in further main control or transmission damage.
· Wrong components used in rebuild	· Verify that correct components were used.
Torque Converter Clutch Assembly	
· Torque converter internal malfunction preventing lockup piston application	· Remove transmission. Inspect for damage. Install a new or remanufactured torque converter if required.

Torque Converter Clutch Concerns: Cycling/Shudder/Chatter

Possible Component	Reference/Action

242 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC, BBP, TP, RPM, TSS, OSS	· Carry out TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required. Clear codes, road test and rerun on-board diagnostics.
· Speed control equipped vehicles	· Evaluate with speed control off.
342 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Fluid contaminated	· Inspect fluid for contamination. If contaminated, locate source of contamination. If burnt, inspect mechanical band, clutches. Repair as required.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· TCC solenoid and valve (200), converter clutch control valve (201), thermostat bypass valve/cooler limit valve (216), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front pump seal damage	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Torque Converter Clutch Assembly	
· End clearance (excessive), internal leakage, clutch material damage	· Carry out end play check. Inspect and repair as required.

Other Concerns: Shift Lever Efforts High

Possible Component	Reference/Action
251 — ELECTRICAL ROUTINE	
No Electrical Concerns	
351 — HYDRAULIC/MECHANICAL ROUTINE	
Brake Shift Interlock	
· System, solenoid damaged	· Refer to the Section 206-00 or Section 211-00 .
Shift Linkage	
· Cable and bracket damaged,	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift

misadjusted, TR misadjusted	cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Case	
· Manual control outer lever damaged. Manual valve inner lever pin bent, damaged. Manual valve inner lever, spring rod damaged	· Manual valve lever shaft retaining pin damaged.
	· Adjust linkage and install manual valve lever shaft retaining pin.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ELECTRICAL ROUTINE	
No Electrical Concerns	
352 — HYDRAULIC/MECHANICAL ROUTINE	
Case	
· Case vent	· Check the vent for free breathing. Repair as required.
Seals/Gaskets	
· Leakage at gaskets, seals, etc. Refer to the leakage diagram for potential leak locations	· Remove all traces of lubricant on exposed surfaces of transmission. Check the vent for free breathing. Operate transmission at normal temperatures and carry out fluid leakage check. Repair as required.

Other Concerns: Driveability Concerns

Possible Component	Reference/Action
253A — ELECTRICAL ROUTINE	
Powertrain Control System	
· Engine runs poor	· Check engine tune-up. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis and testing.
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TCC	· Carry out shift point tests in O/D with the TCS off. Refer to the shift point specification if out of specifications. Run on-board diagnostic and check for shift error codes. Carry out shift point and TCC tests. Re-run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
353A — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.

· TCC solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· 3-4 shift valve (215), spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Torque Converter Clutch Assembly	
· Torque converter one-way clutch slipping	· Inspect one-way clutch. Install a new or remanufactured torque converter.
· Incorrect TCC used in rebuild	· Inspect for correct TCC assembly. Install a new TCC as required.

Other Concerns: Driveability Concerns, Wrong Gear Ratio in D, 2nd and 1st Positions

Possible Component	Reference/Action
253B — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, SSA, SSB, SSC, SSD	· Carry out shift point and TCC tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required. Clear codes, road test and rerun on-board diagnostics.
353B — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· SSA, SSB, SSC, SSD, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· SSC solenoid and valve (215), spring, damaged, missing, misassembled, stuck, bore damaged (210, 202, 201)	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.

Other Concerns: Noise/Vibration — Forward or Reverse

Possible Component	Reference/Action
254 — ELECTRICAL ROUTINE	

No Electrical Concerns	
354 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: pump assembly.
Pump Assembly	
· Screws out of torque specification	· Tighten screws to specification.
· Cross leaks	· Inspect for damage. Repair as required.
· Front Pump seal worn or damaged	· Inspect for damage. Repair as required.
· Seal on inner pump gear damaged	· Inspect for damage. Repair as required.
Front One-Way Clutch Assembly	
· One-way clutch damaged, worn, misassembled	· Repair one-way clutch.
Rear One-Way Clutch Assembly	
· One-way clutch damaged, worn, misassembled	· Repair one-way clutch.
Other	
· Transmission oil cooler lines, fill tube grounding	· Relocate transmission oil cooler lines or fill tube correctly.
Gear	
· Gear noise	· Repair planetary gear assemblies.
Torque Converter Clutch Assembly	
	· Refer to routines 242/342.

Other Concerns: Engine Will Not Crank

Possible Component	Reference/Action
255 — ELECTRICAL ROUTINE	
Powertrain Control System	

· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, Digital TR sensor	· Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Use scan tool to carry out Pinpoint Test. Repair as required. Clear codes, road test and rerun on-board diagnostics.
355 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Pump Assembly	
· Seized	· See the disassembly procedure. Repair as required.
Flexplate	
· Damaged	· Inspect for damage. Repair as required.

Other Concerns: No Park Range

Possible Component	Reference/Action
256 — ELECTRICAL ROUTINE	
No Electrical Concerns	
356 — HYDRAULIC/MECHANICAL ROUTINE	
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Park Mechanism	
· Park gear, parking pawl, parking pawl return spring, park or guide plate, parking pawl shaft, parking pawl actuating rod, manual lever, manual lever detent spring damaged, misassembled	· Inspect for damage. Repair as required.
· Transfer case and linkages damaged	· For transfer case and linkage diagnosis; refer to Section 308-07B .
4x4 Applications	
· Transfer case and linkage damaged	· For transfer case and linkage diagnosis; refer to Section 308-07B .

Other Concerns: Transmission Overheating

Possible Component	Reference/Action

257 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, TFT, TCC	· Carry out shift point and TCC test. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics.
357 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level.
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible components: main control, TCC.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· TCC, solenoid stuck, damaged, O-ring damaged or out of bore	· Inspect for damage. Carry out solenoid function test as listed in electrical routine. Repair as required.
· Thermostat bypass valve/cooler limit valve (216), spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Torque Converter Clutch Assembly	
· Seized torque converter one-way clutch	· Refer to routines 240/340.
	· Inspect torque converter one-way clutch.
· Excessive slip detected	· Install a new or remanufactured torque converter as required. Run on-board diagnostics.
Other	
· Restriction in transmission oil cooler or tubes	· Repair transmission oil cooler or tubes.

Other Concerns: No Engine Braking in 2nd Position

Possible Component	Reference/Action
258 — ELECTRICAL ROUTINE	
No Electrical Concerns	
358 — HYDRAULIC/MECHANICAL ROUTINE	

Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible components: main control, coast clutch assembly.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Extension housing lube orifice, check ball A and C not seating or damaged, spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong part used in rebuild	· Repair as required.
Coast Clutch Assembly	
· Coast clutch damaged	· Install a new coast clutch as required.
· Seal ring damaged	· Inspect for damage. Repair as required.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Other Concerns: No Engine Braking in 1st Position

Possible Component	Reference/Action
259 — ELECTRICAL ROUTINE	
No Electrical Concerns	
359 — HYDRAULIC/MECHANICAL ROUTINE	
Fluid	
· Incorrect level	· Adjust to correct level.
Shift Linkage	
· Cable and bracket damaged, misadjusted, TR misadjusted	· Inspect and repair as required. Verify transmission shift cable adjustment; refer to Section 307-05 . Adjust transmission shift cable as necessary. After repairing transmission shift cable, verify the digital transmission range (TR) sensor is correctly adjusted. Adjust the digital TR sensor as necessary.
Incorrect Pressures	

· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Manual low valve (212), check ball E not seating correctly, spring, damaged, missing, misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong part used in rebuild	· Inspect for correct part. Repair as required.
Coast Clutch Assembly	
· Wrong part used in rebuild	· Inspect parts. Repair as required.
· Overdrive clutch damaged	· Install a new overdrive clutch as required.
· Seal rings damaged	
Reverse Band	
· Burnt, damaged	· Inspect for damage. Repair as required.
· Servo piston, seals, gasket or cover damaged	· Inspect and install new piston, seals or gasket as required.
Reverse Drum	
· One way clutch damaged	· Inspect for damage. Repair as required.
· Bearing damaged	· Inspect for damage. Repair as required.
· Drum damaged	· Inspect for damage. Repair as required.
Rear One-Way Clutch Assembly	
· Rear one-way clutch damaged	· Install new components as required.

Other Concerns: No Engine Braking With Overdrive Canceled (in 3rd and 4th)

Possible Component	Reference/Action
260 — ELECTRICAL ROUTINE	
Powertrain Control System	
· Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, SSD	· Carry out shift point tests. Run on-board diagnostics. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual. Carry out pinpoint tests using the diagnostic tool. Clear codes, road test and rerun on-board diagnostics. Also check for engine braking in 1 and 2* positions.
	· * No engine braking in O/D position with the TCS off, 1st gear is a normal function.
360 — HYDRAULIC/MECHANICAL ROUTINE	
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.

· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Coast clutch solenoid and valve/converter clutch control valve (201), SSC solenoid, 3-4 shift solenoid (215), spring, damaged, missing misassembled, stuck, bore damaged	· Inspect for damage. If damaged, install a new main control. If parts are missing, install new parts or main control. If misassembled, reassemble correctly. Do not stone, file or sand valves. This will remove the anodized finish and may result in further main control or transmission damage.
· Wrong component used in rebuild	· Verify that correct components were used.
Coast Clutch Assembly	
· Wrong part used in rebuild	· Verify that correct components were used.
· Overdrive clutch damaged	· Install new components as required.
· Seal rings damaged	· Inspect for damage. Repair as required.

Other Concerns: Fluid Venting/Foaming

Possible Component	Reference/Action
261 — ELECTRICAL ROUTINE	
No Electrical Concerns	
361 — HYDRAULIC/MECHANICAL ROUTINE	
· Vent blocked or damaged	· Check vent for damage or blockage. Repair as required.
· Overfilled transmission	· Check level and adjust as required.
· Fluid contaminated (antifreeze, water)	· Check for contamination, locate source of contamination. Repair as required.
· Overheating	· Refer to routines 257/357.
· Filter and seal assembly damaged or misassembled	· Inspect filter and seal assembly for damage. Repair as required.

Other Concerns: Slips/Chatters in 1st Position

Possible Component	Reference/Action
263 — ELECTRICAL ROUTINE	
No Electrical Concerns	
363 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.

· Separator plate damaged	· Inspect for damage. Repair as required.
· Wrong components used in rebuild	· Verify that correct components were used.
· Dirty or sticking main control valve body	· Clean, repair or install a new main control valve body.
Rear One-Way Clutch Assembly	
· Low/reverse one-way clutch damaged	· Install a new rear one-way clutch and case.

Other Concerns: Slips/Chatters in 2nd Position

Possible Component	Reference/Action
264 — ELECTRICAL ROUTINE	
No Electrical Concerns	
364 — HYDRAULIC/MECHANICAL ROUTINE	
Incorrect Pressures	
· Incorrect band/clutch application pressures, line pressure high/low	· Check line pressure at tap. Carry out line pressure and stall speed tests. Refer to the line pressure chart for specifications. If pressure is high/low, check the following possible component: main control.
Main Control Assembly	
· Screw out of torque specification	· Tighten to specification.
· Gasket damaged, off location	· Inspect and install a new gasket.
· Separator plate damaged	· Inspect for damage. Repair as required.
· Wrong components used in rebuild	· Verify that correct components were used.
· Dirty or sticking main control valve body	· Clean, repair or install a new main control valve body.
Intermediate Band and Servo Assemblies	
· Band adjustment incorrect	· Readjust to correct specification.
· Seal or piston, strut, lever, damaged	· Inspect for damage. Repair as required.
· Friction elements worn damaged misassembled	· Inspect for damage. Repair as required.
· Return spring wrong, damaged	· Inspect for damage. Repair as required.
· Piston rod lever incorrect	· Inspect for damage. Repair as required.
· Case bore damaged, leaking	· Inspect for damage. Repair as required.

Other Concerns: FMEM — Harsh Engagements and Shifts

Possible Component	Reference/Action
265 — ELECTRICAL ROUTINE	
Powertrain Control System	· Run on-board diagnostic. Refer to the Powertrain Control/Emissions Diagnosis (PC/ED) manual for diagnosis. Carry out pinpoint tests using the diagnostic tool. Repair as required. Clear DTCs, road test and rerun Self-Test.
· Operating in FMEM strategy. Electrical inputs/outputs, vehicle wiring harnesses, internal transmission wiring harnesses, PCM, EPC, OSS, Digital TR, TCC, TFT, TP and MAF, shift error detected (shift solenoid, TSS, OSS and internal hardware)	
365 — HYDRAULIC/MECHANICAL ROUTINE	
No Hydraulic/Mechanical Concerns	

Transmission Fluid Cooler — Backflushing and Cleaning

CAUTION: Whenever a transmission has been disassembled to replace worn or damaged parts or because the valve body sticks from foreign material, the transmission fluid cooler must be cleaned using a suitable torque converter/fluid cooler cleaner. Under no circumstances should torque converters be cleaned by hand agitation with solvent.

When internal wear or damage has occurred in the transmission, metal particles, clutch plate material, or band material may have been carried into the transmission cooler. These contaminants are a major cause of recurring transmission concerns and must be removed from the system before the transmission is put back into service.

1. Conduct backflushing with a suitable torque converter/transmission fluid cooler cleaner. Test the equipment to make sure that a vigorous fluid flow is present before proceeding. Replace the system filter if flow is weak or contaminated.

2. To aid in attaching the cleaner to the transmission steel cooler lines, connect two additional rubber hoses to the transmission end of the steel transmission cooler lines as described.
   - Connect the cleaner tank pressure line to the steel transmission cooler return line (longest line).
   - Connect a tank return hose to the steel transmission cooler pressure line (shorter line). Place the outlet end of this hose in the solvent tank reservoir.

3. Turn on solvent pump and allow the solvent to circulate a minimum of 5 minutes (cycling switch on and off will help dislodge contaminants in cooler system).

4. Switch off the solvent pump and disconnect the solvent pressure hose from the transmission cooler return line.

5. Use compressed air to blow out the cooler(s) and lines (blow air into the transmission cooler return line) until all solvent is removed.

6. Remove the rubber return hose from the remaining steel cooler line.

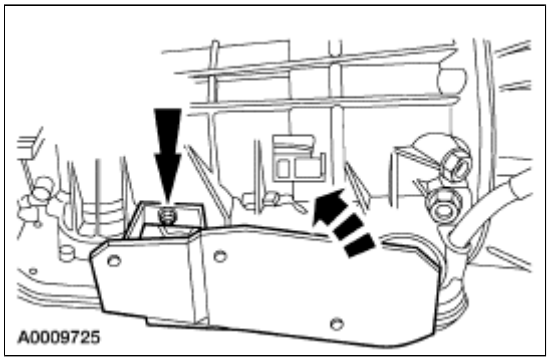
Fluid Pan, Gasket and Filter

Removal

1. Raise and support the vehicle. For additional information, refer to Section 100-02 .

2. **NOTE:** Transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned out of the way for fluid pan removal.

   Loosen the nut and position the heat shield out of the way.

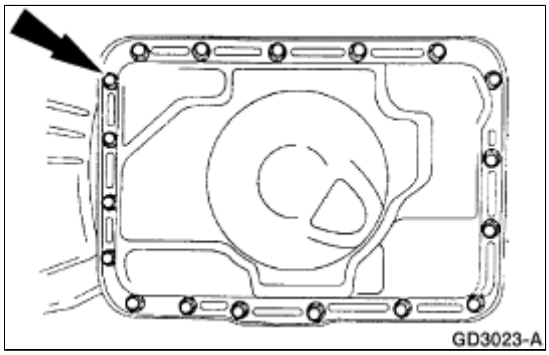


3. Place a drain pan under the transmission fluid pan.

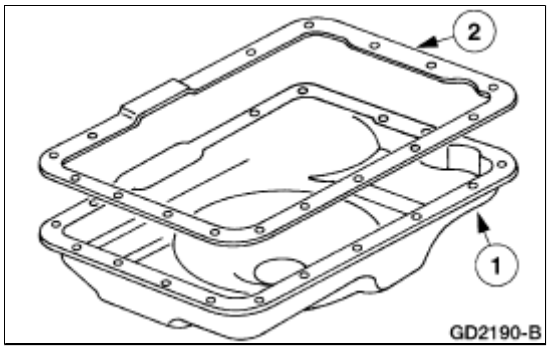
4. Disconnect the LH three-way catalytic converter heated oxygen sensor connectors.

5. Remove the three-way catalytic converter. For additional information, refer to Section 309-00 .

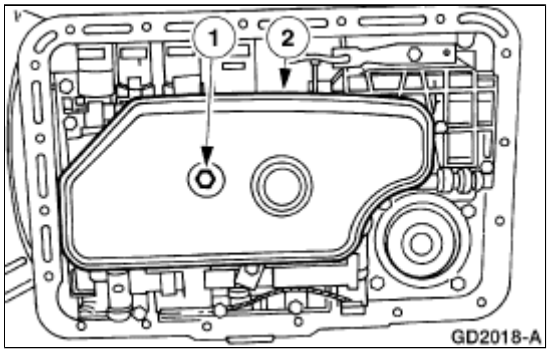
6. Drain transmission fluid.
   - Remove all the transmission fluid pan bolts except for two in the front. Loosen the two front transmission fluid pan bolts. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained remove the front two transmission fluid pan bolts.



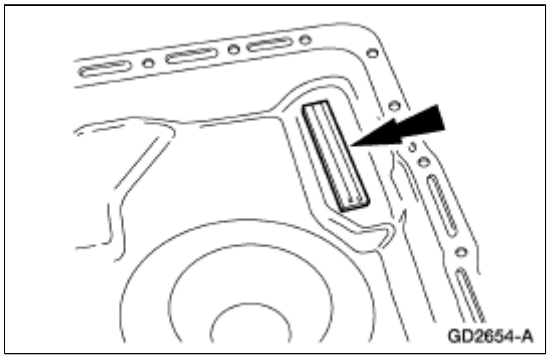
7. Remove the transmission fluid pan.
   1. Remove the transmission fluid pan.
   2. Remove and discard the transmission fluid pan gasket.



8. Remove and discard the transmission fluid filter.
    1. Remove the transmission fluid filter screw.
    2. Remove the transmission fluid filter.



9. Clean and inspect the transmission fluid pan and magnet. Clean all mating surfaces.

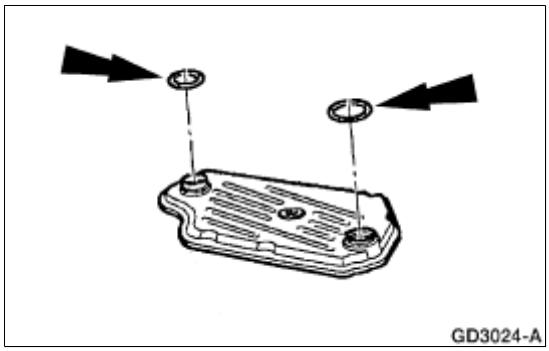


10. Flush the transmission fluid cooler and transmission fluid cooler lines. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Installation

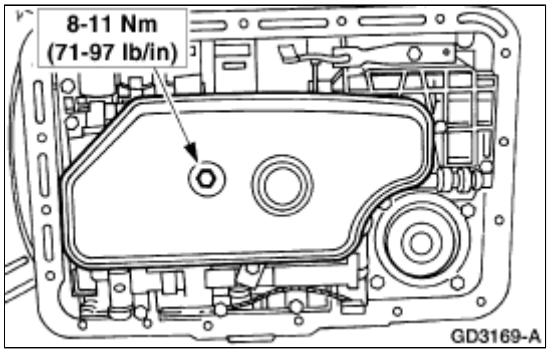
1. **CAUTION: Lubricate fluid filter O-rings with MERCON ® V; Automatic Transmission Fluid XT-5-QM meeting Ford specification MERCON ® V or they may be damaged.**

    Lube and install new O-rings onto the transmission fluid filter. Install a new transmission fluid filter.
    - Position transmission fluid filter on the main control valve body.

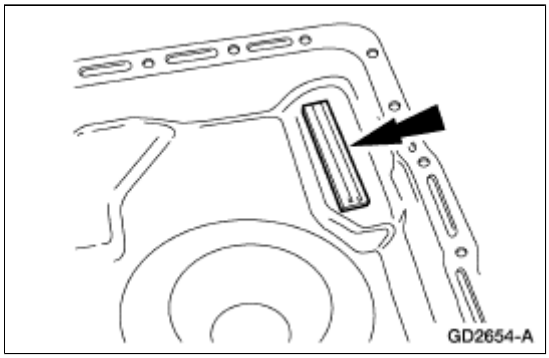


2. **CAUTION: Make sure wire harness is not pinched under filter.**

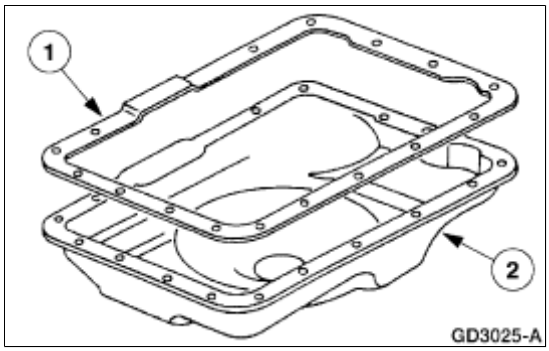
   Install transmission fluid filter screw.



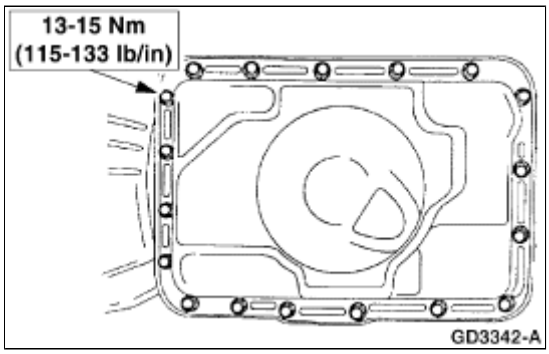
3. Position the oil pan magnet in the transmission fluid pan.



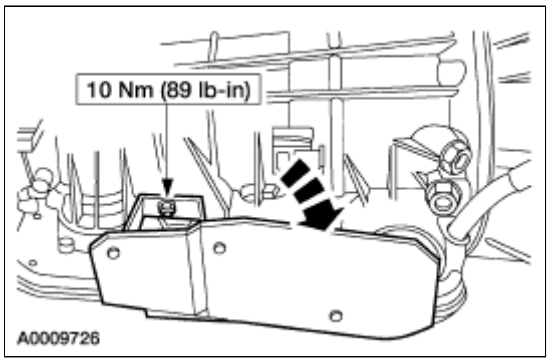
4. Install the transmission fluid pan.
   1. Position a new transmission fluid pan gasket on the transmission fluid pan.
   2. Install and align the transmission fluid pan.
      - Loosely install the transmission fluid pan screws.



5. Tighten the transmission fluid pan screws.
   - Use a crisscross sequence to tighten the transmission fluid pan screws.



6. Position the servo heat shield over the servos and clip it to the pan rail.



7. Install the three-way catalytic converter. For additional information, refer to Section 309-00 .
8. Connect the heated oxygen sensor connectors.
9. Lower the vehicle.
10. **NOTE:** When filling a dry transmission and converter start with a minimum of 3.7 liters (4 quarts).

    Fill transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM meeting Ford specification MERCON ® V.

Main Control Valve Body

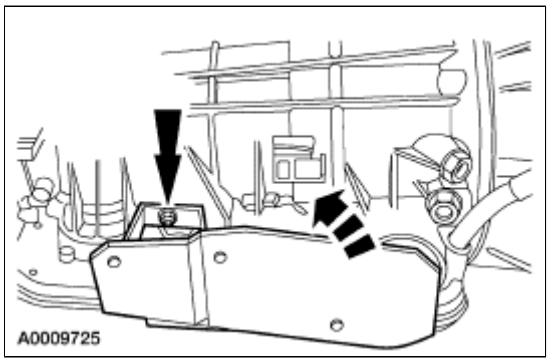
Special Tool(s)

 ST1639-A	Valve Body Aligner (.235) 307-333 (T95L-70010-B)
 ST1639-A	Valve Body Aligner (.248) 307-334 (T95L-70010-C)

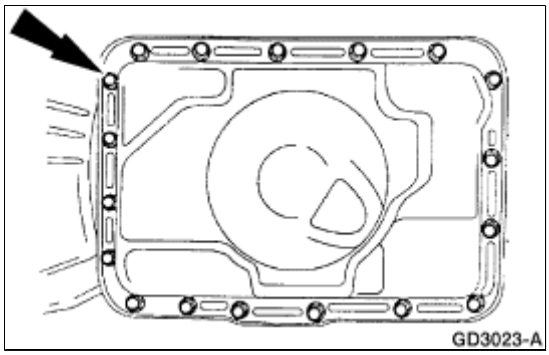
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Place a drain pan under the transmission fluid pan.
4. **NOTE:** Transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned out of the way for fluid pan removal.

   Loosen the nut and position the heat shield out of the way.

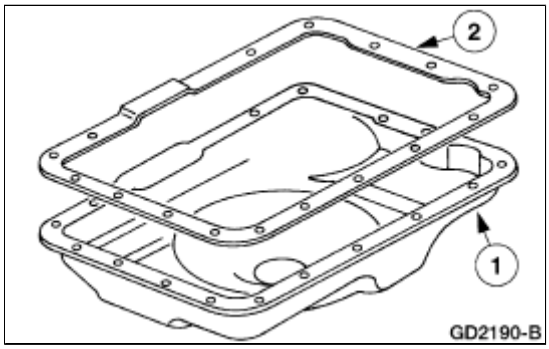


5. Drain transmission fluid.
   - Remove all the transmission fluid pan bolts except for two in the front. Loosen the two front transmission fluid pan bolts. Pry the rear of the transmission fluid pan down and allow fluid to drain. After fluid is drained remove the front two transmission fluid pan bolts.

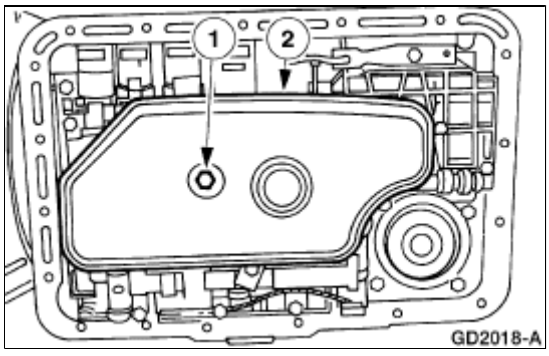


6. **NOTE:** If a transmission has been disassembled to replace worn or damaged parts and the valves in the main control valve body stick repeatedly from foreign material, the torque converter must be removed and cleaned by using a suitable torque converter/fluid cooler cleaner.

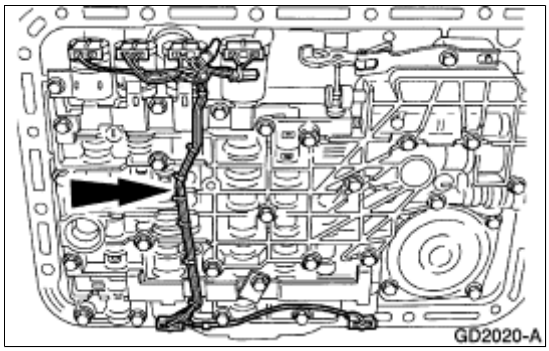
   Remove the transmission fluid pan.
   1. Remove the transmission fluid pan.
   2. Remove and discard the transmission fluid pan gasket.



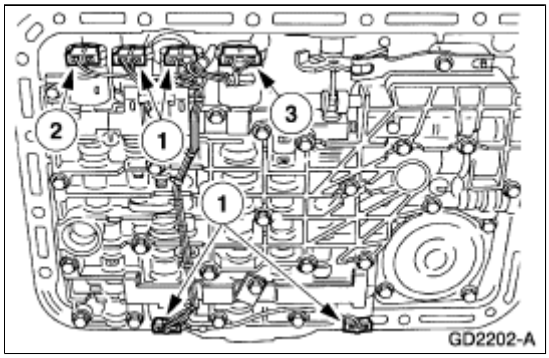
7. Remove and discard the transmission fluid filter.
   1. Remove the transmission fluid filter screw.
   2. Remove the transmission fluid filter.



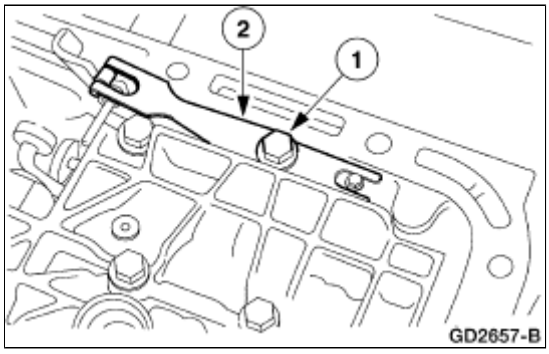
8. Unclip main control valve body wire harness.
   - Lift up on wire harness guide and protector and disengage the retaining pins from the solenoid clamps.



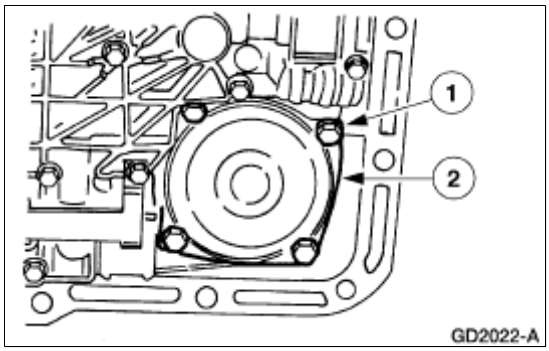
9. Disconnect the six solenoid electrical connectors.
    1. Disconnect the SSA, SSB, SSC and SSD electrical connectors.
    2. Disconnect the torque converter clutch (TCC) solenoid electrical connector.
    3. Disconnect the electronic pressure control (EPC) solenoid electrical connector.



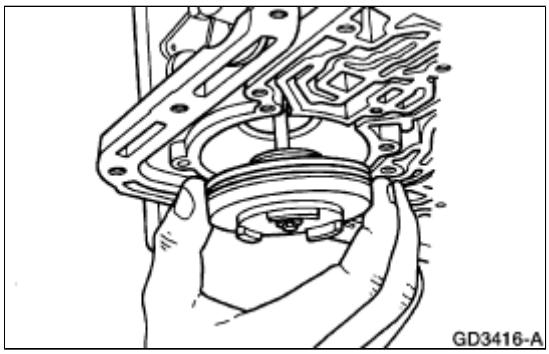
10. Remove the manual control valve detent lever spring.
    1. Remove the manual control valve detent lever spring screw.
    2. Remove the manual control valve detent lever spring.



11. Remove the low/reverse servo.
    1. Remove the low/reverse servo cover screws.
    2. Remove the low/reverse band servo cover and gasket. Discard the low/reverse servo separator plate cover gasket.

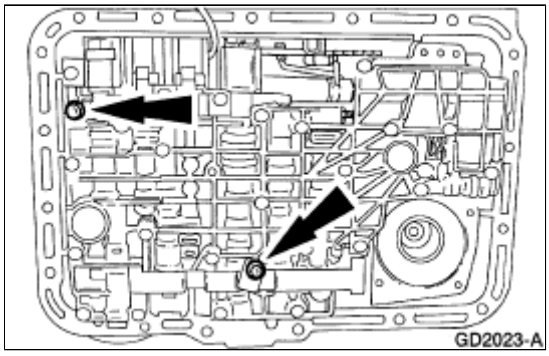


12. Remove the low/reverse band servo piston and rod.



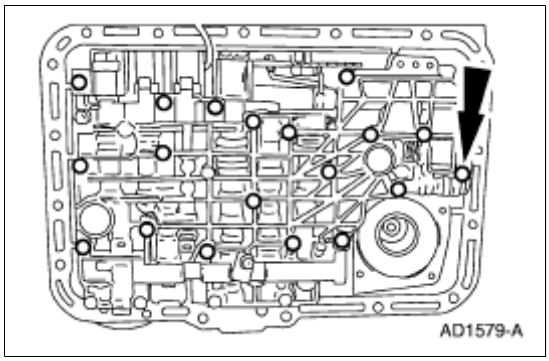
13. **CAUTION: Support the main control valve body.**

Do not remove the two (gold) screws specified.



14. **CAUTION: Support the main control valve body.**

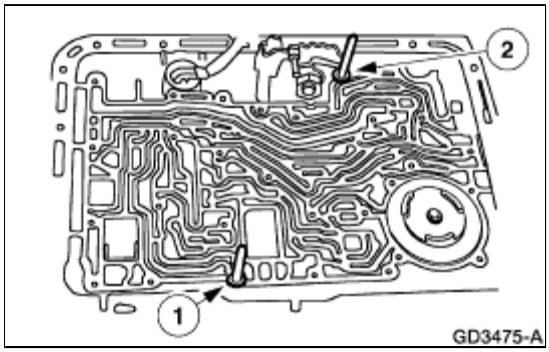
Remove the screws.



15. Remove the main control valve body.

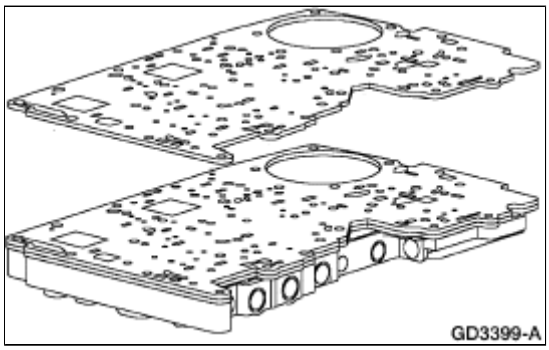
Installation

1. Install the Valve Body Aligner into the transmission case.
    1. Install the Valve Body Aligner (.248).
    2. Install the Valve Body Aligner (.235).

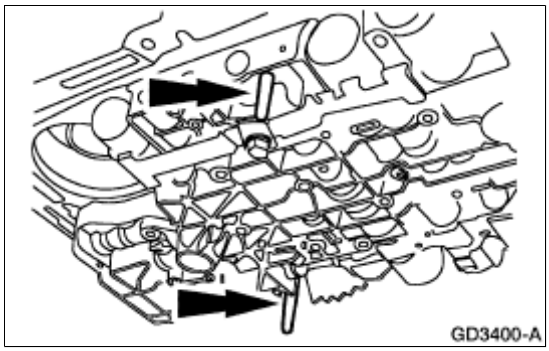


2. **NOTE:** Make sure main control to case gasket is properly aligned.

    Install new main control to case gasket.

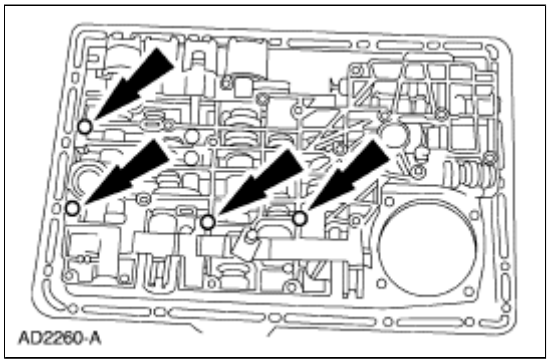


3. Position the main control valve body with the two Valve Body Aligners as a guide.



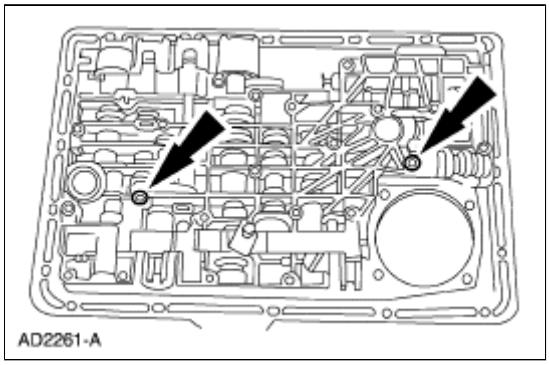
4. **NOTE:** The main control valve body screws will be tightened in later steps.

   Loosely install four M6 x 45 mm (1.8 in) screws.



5. **NOTE:** The main control valve body screws will be tightened in later steps.

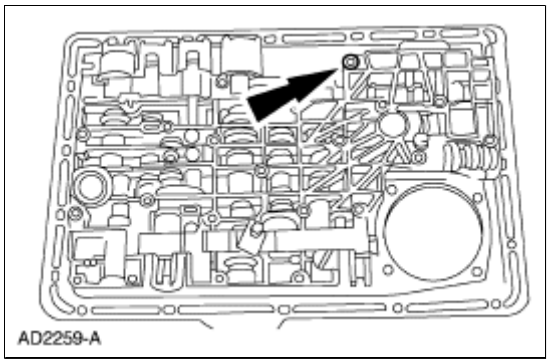
   Loosely install two M6 x 35 mm (1.4 in) screws.



6. Remove the Valve Body Aligners.

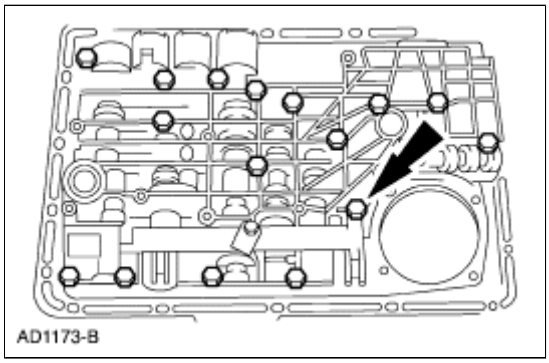
7. **NOTE:** The main control valve body screws will be tightened in later steps.

   Loosely install the M6 x 30 mm (1.2 in) screw.

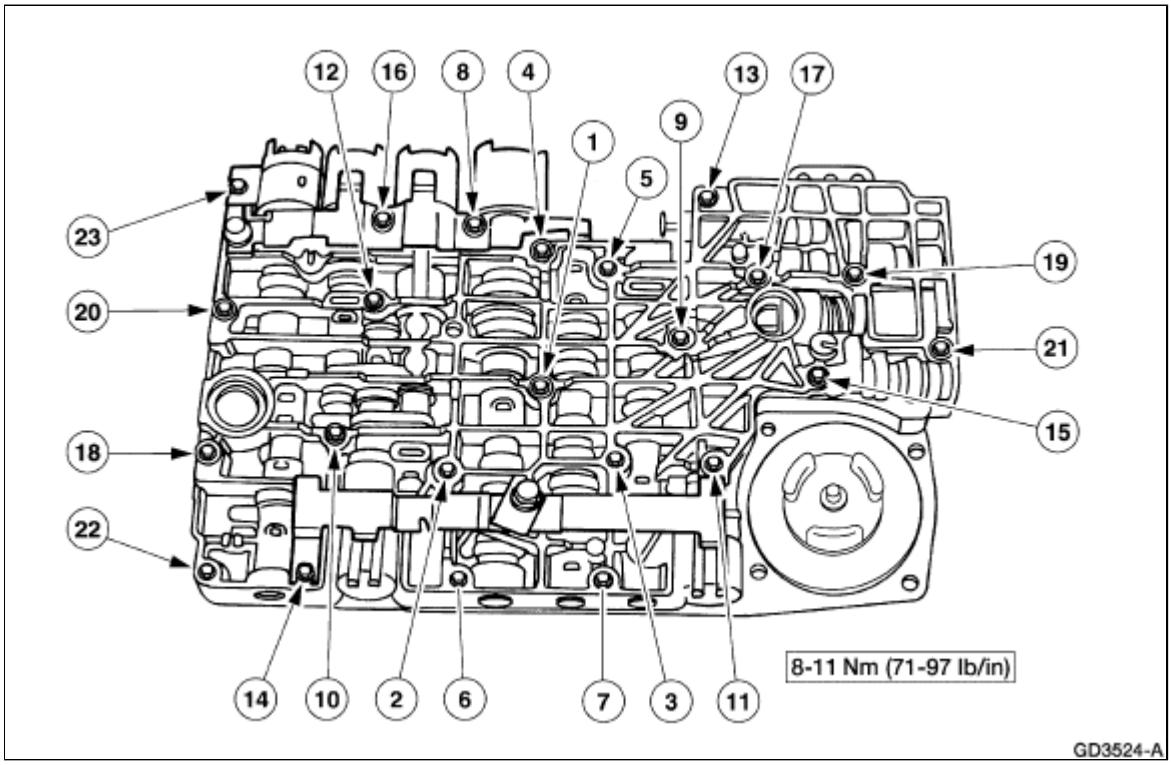


8. **NOTE:** The main control valve body screws will be tightened in later steps.

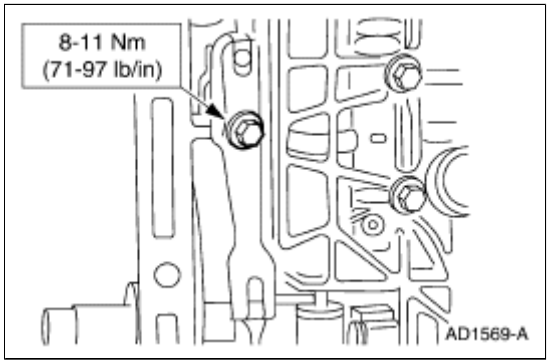
   Loosely install the sixteen M6 x 40 mm (1.6 in) main control valve body screws.



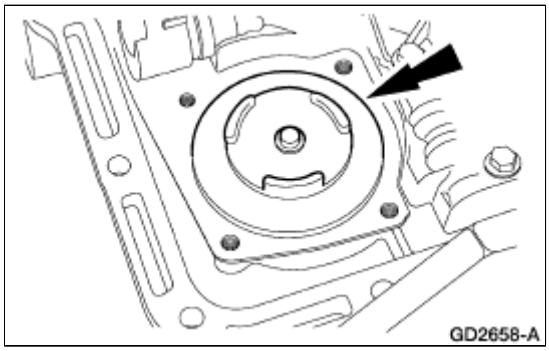
9. Tighten the main control valve body screws in the sequence shown.



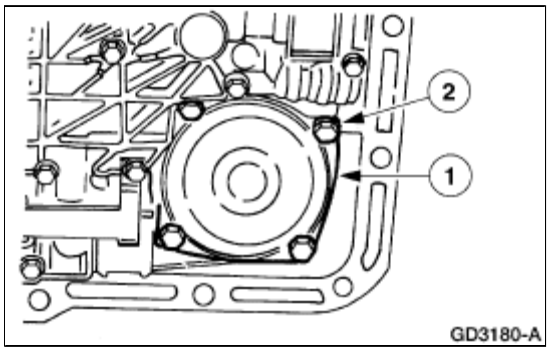
10. Install the manual control valve detent lever spring.



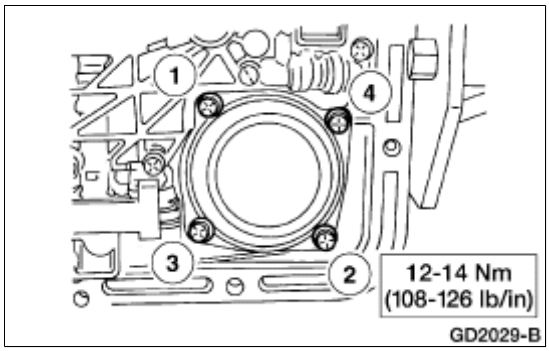
11. Install the low/reverse band servo piston and rod.



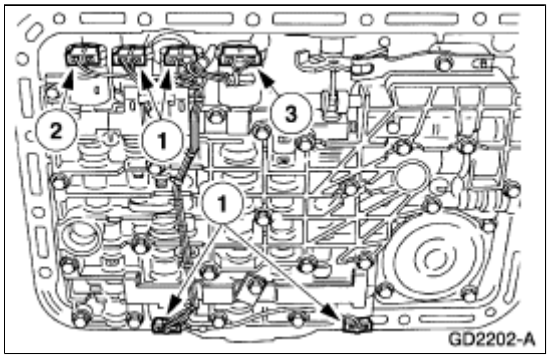
12. Install the low/reverse band servo cover.
    1. Install the low/reverse band servo cover and gasket.
    2. Loosely install the low/reverse servo piston cover screws.



13. Tighten the servo cover screws in the sequence shown.

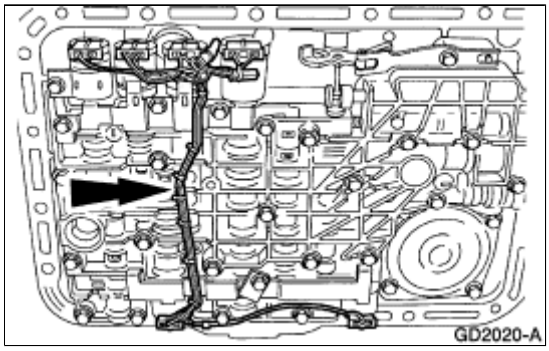


14. Connect the six solenoid electrical connectors.
    1. Connect SSA, SSB, SSC, and SSD electrical connectors.
    2. Connect the torque converter clutch (TCC) solenoid electrical connector.
    3. Connect the electronic pressure control (EPC) solenoid electrical connector.

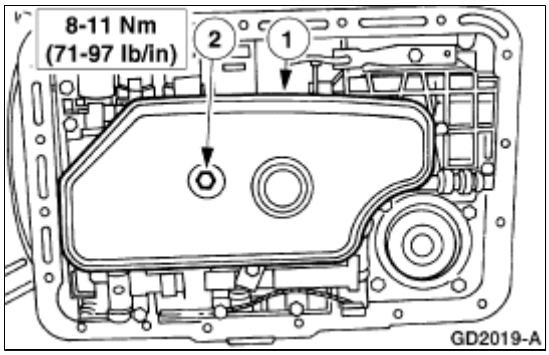


15. **CAUTION: Excessive pressure may break the locating pins.**

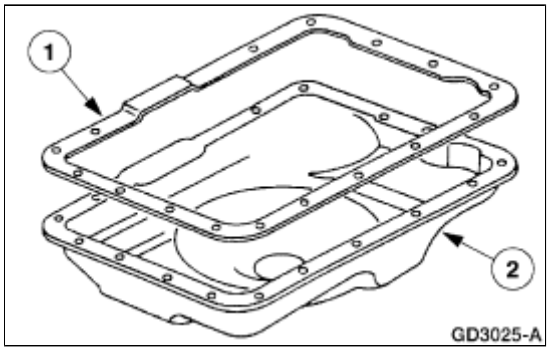
    Install the main control valve body wire harness.
    - Align the retaining pins to the holes in the solenoid clamps and press in the main control valve body wire harness guide and protector.



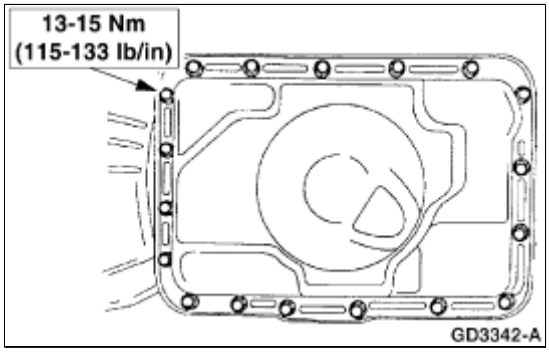
16. Install the transmission fluid filter.
    1. Install the transmission fluid filter.
    2. Install the transmission fluid filter screw.



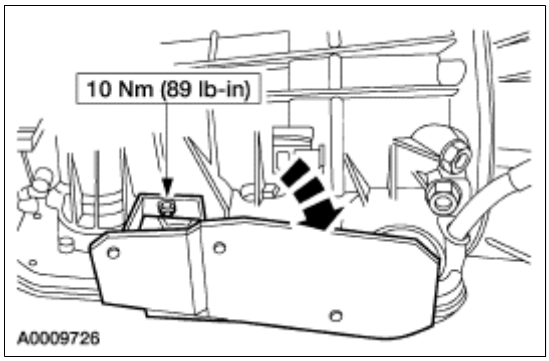
17. Install the transmission fluid pan.
    1. Position a new transmission fluid pan gasket on the transmission fluid pan.
    2. Install and align the transmission fluid pan.



18. Tighten the transmission fluid pan screws.
    - Use a crisscross sequence to tighten the transmission fluid pan screws.



19. Position the servo heat shield over the servos and clip it to the pan rail.



20. Lower the vehicle.

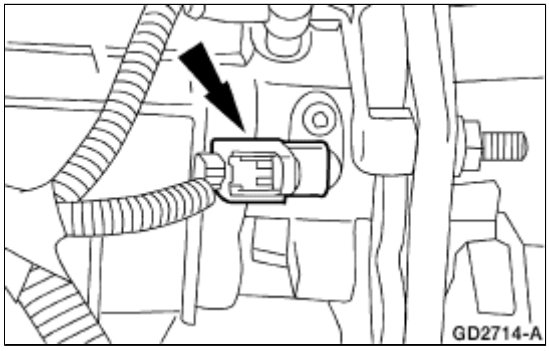
21. Connect the battery ground cable.

22. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

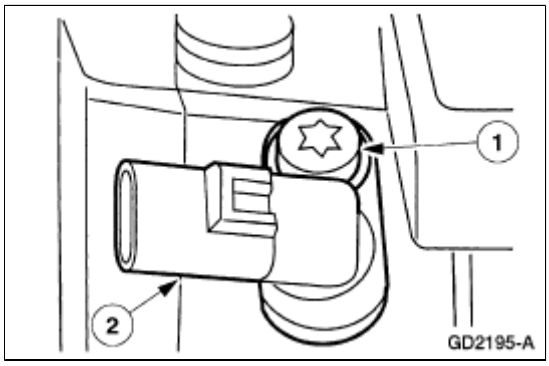
Output Shaft Speed (OSS) Sensor

Removal

1. Raise and support the vehicle. For additional information, refer to the Section 100-02 .
2. Disconnect output shaft speed (OSS) sensor electrical connector.

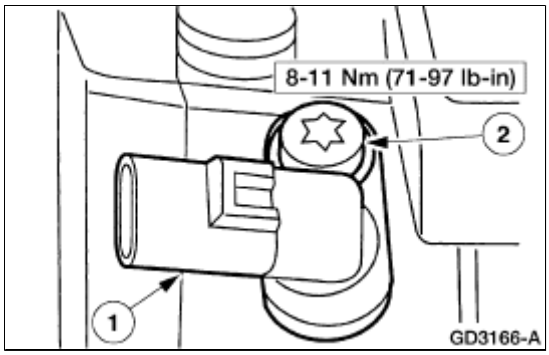


3. Remove OSS sensor.
    1. Remove the OSS sensor screw.
    2. Remove the OSS sensor from the transmission.
        - Inspect the OSS sensor O-ring for damage. If damaged, replace the O-ring.

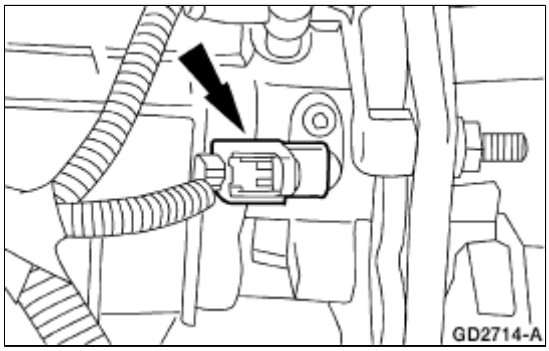


Installation

1. Inspect and lubricate O-ring with petroleum jelly.
    1. Install the OSS sensor into the transmission.
    2. Tighten OSS sensor screw.



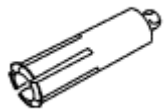
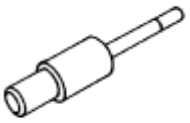
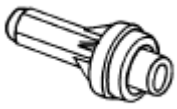
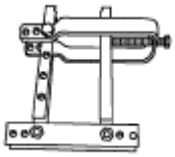
2. Connect OSS sensor electrical connector.



3. Lower the vehicle.

Extension Housing Seal and Bushing

Special Tool(s)

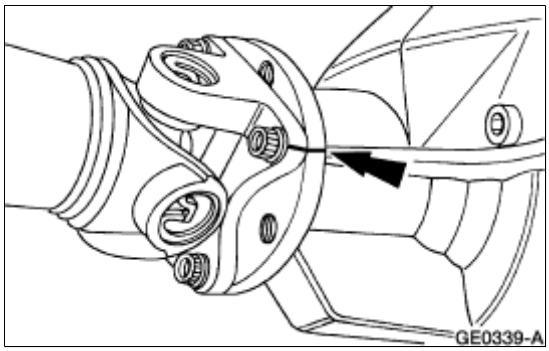
	Housing Bushing Remover 308-070 (T77L-7697-E)
 ST1790-A	Housing Bushing Replacer 307-065 (T77L-7697-F)
 ST1791-A	Extension Housing Seal Replacer 307-038 (T74P-77052-A)
 ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Converter Oil Seal Remover 307-309 (T94P-77001-BH)

Removal

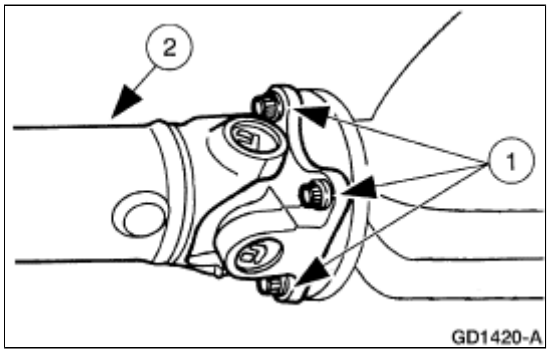
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .

2. **NOTE:** To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they may be installed in their original alignment.

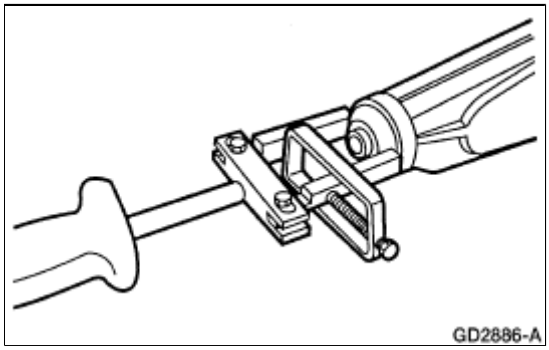
   Mark the rear driveshaft.



3. Remove the rear driveshaft.
    1. Remove the rear driveshaft bolts.
    2. Remove the rear driveshaft.

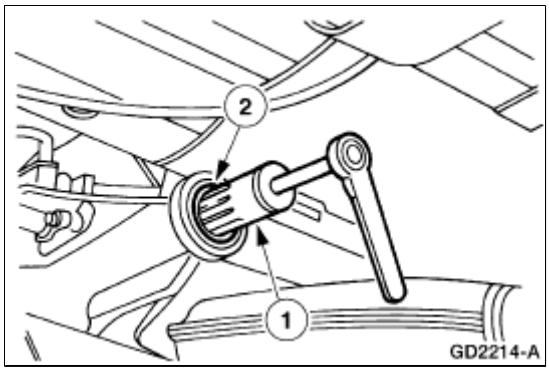


4. Using the Converter Oil Seal Remover and Impact Slide Hammer, remove the extension housing seal.



5. **CAUTION: Use the extension housing bushing remover carefully so that the seal area is not damaged.**

    Remove extension housing bushing.
    1. Install Housing Bushing Remover.
    2. Remove extension housing bushing.

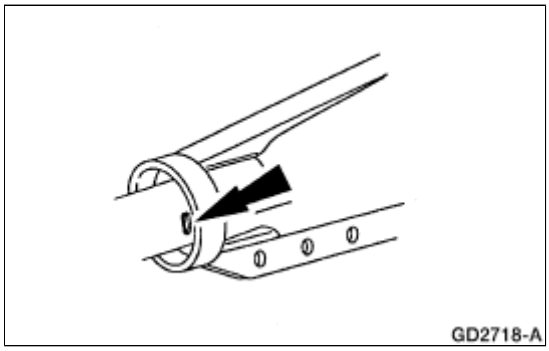


Installation

1. **CAUTION: The lube hole in the extension housing bushing must be aligned with the lube groove in the extension housing. This groove is located at the 3 o'clock position when viewed from the rear.**

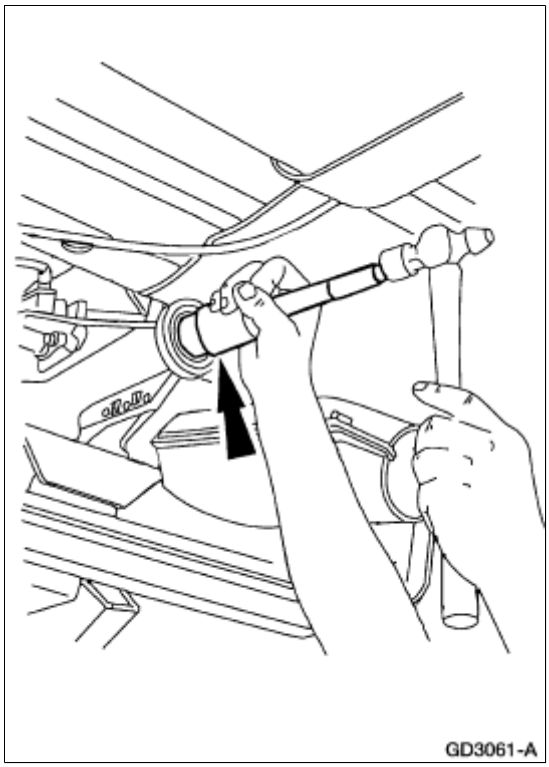
   NOTE: Inspect the counterbore of the extension housing for burrs. Remove any burrs from the extension housing counterbore with an oil stone.

   Position the extension housing bushing into the extension housing.

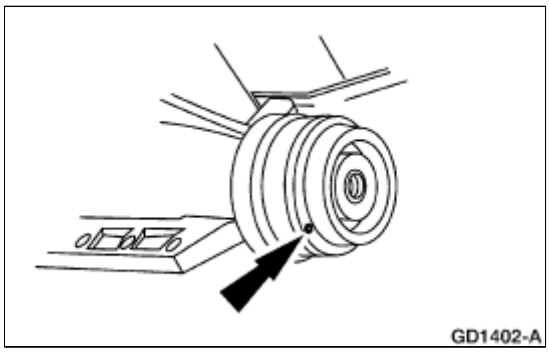


2. **CAUTION: The tool will bottom when bushing is in the proper position.**

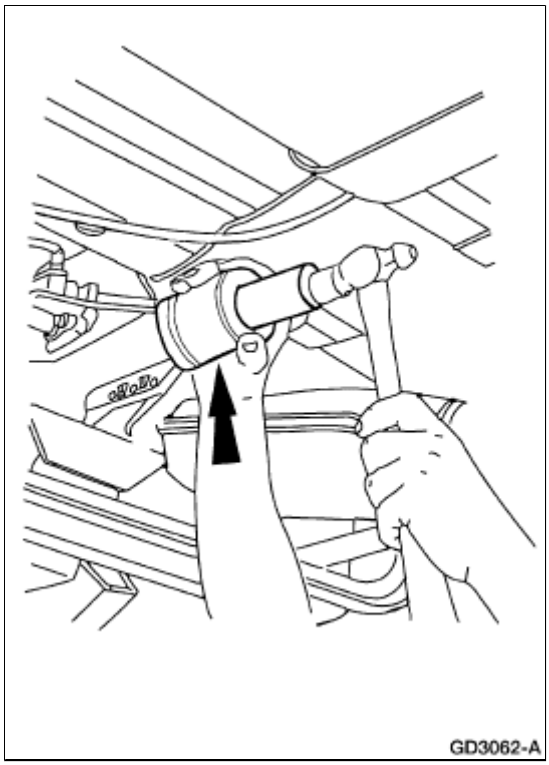
   Use the Housing Bushing Replacer to install the extension housing bushing.



3. Position new extension housing seal with drain hole in the 6 o'clock position.

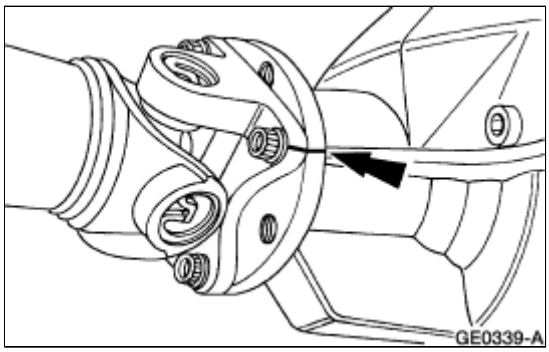


4. Use the Extension Housing Seal Replacer to install the extension housing seal.

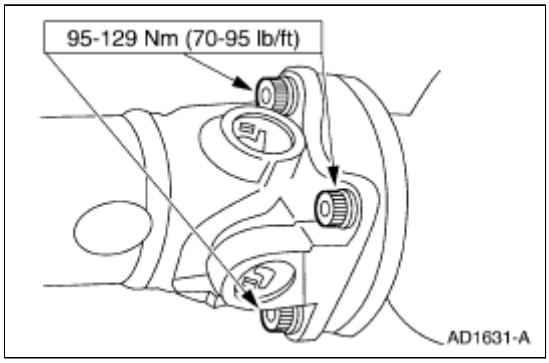


5. **NOTE:** Inspect the driveshaft slip-yoke for wear and damage. Replace if required.

   Align the drive shaft with the marks made during removal to ensure correct balance.



6. Install the rear driveshaft bolts.



7. Lower the vehicle.

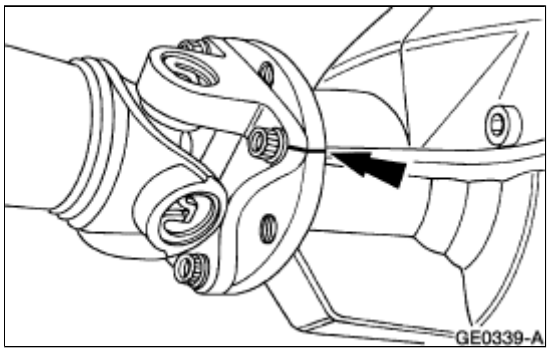
8. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

Extension Housing Gasket —4x2

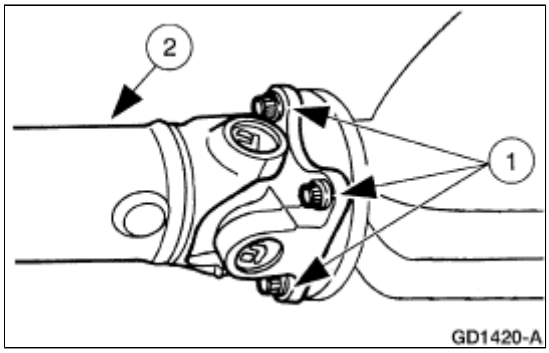
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to the Section 100-02 .
3. **NOTE:** To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they may be installed in their original alignment.

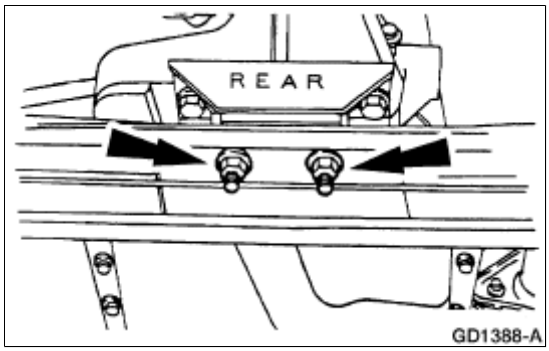
   Mark the rear driveshaft.



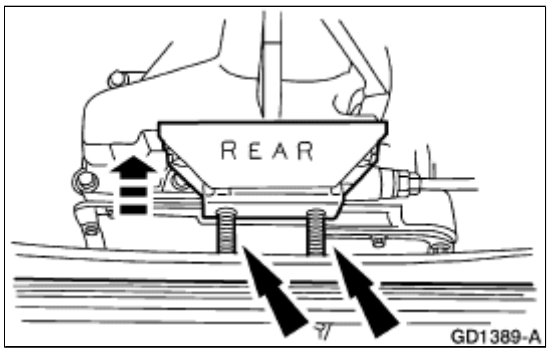
4. Remove the rear driveshaft.
   1. Remove the bolts.
   2. Remove the rear driveshaft.



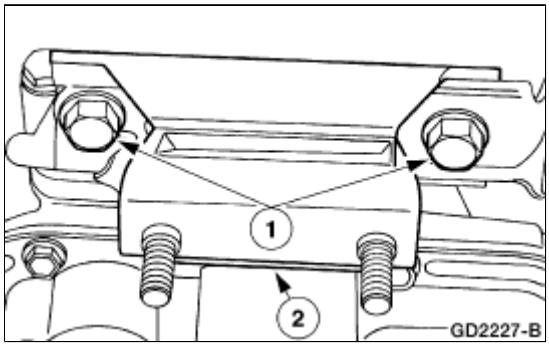
5. Remove the nuts.



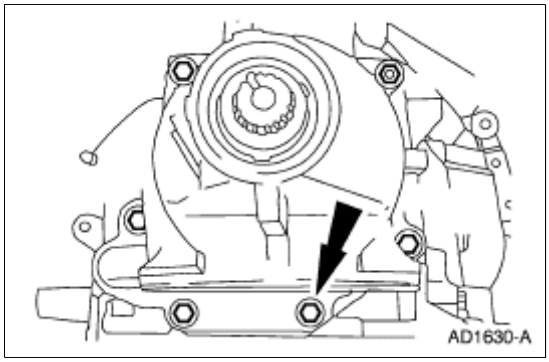
6. Raise and support the transmission.



7. Remove the transmission mount.
    1. Remove the screws.
    2. Remove the transmission mount.

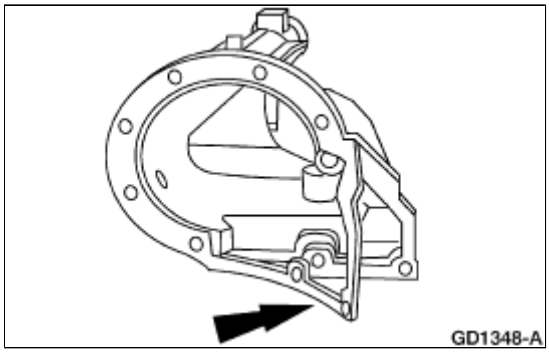


8. Remove the extension housing screws and studs.



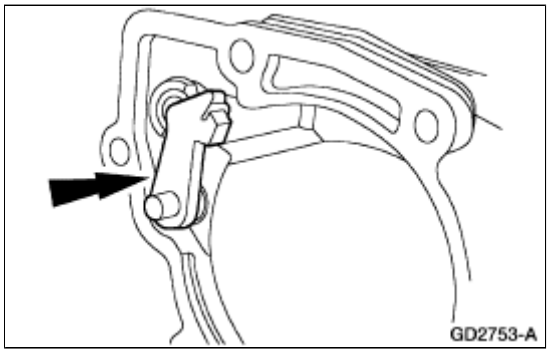
9. **CAUTION: The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.**

   Remove the extension housing (7A039). Discard the extension housing gasket (7086).



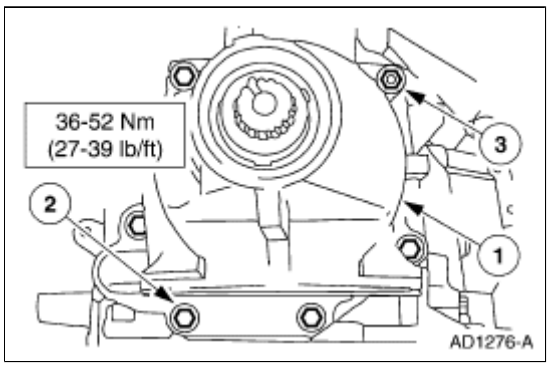
Installation

1. Clean the extension housing and install new extension housing gasket. Make sure that the parking pawl, spring, and shaft are correctly installed.

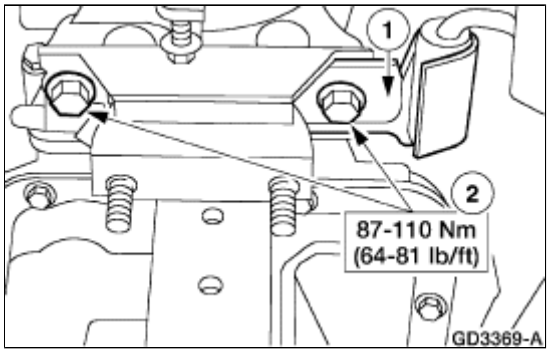


2. **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.**

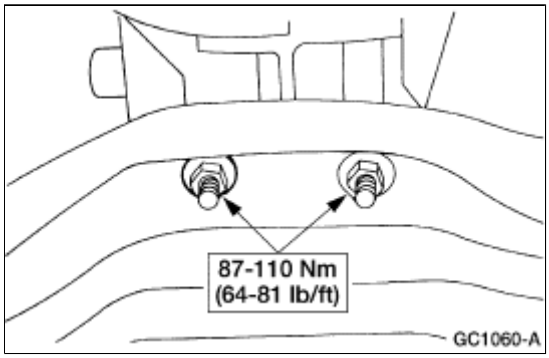
   Install the extension housing.
   1. Position the extension housing.
   2. Install the extension housing screws.
   3. Install the extension housing studs.



3. Install the transmission mount.
    1. Position the transmission mount on the extension housing.
    2. Install the transmission mount-to-extension housing screws.

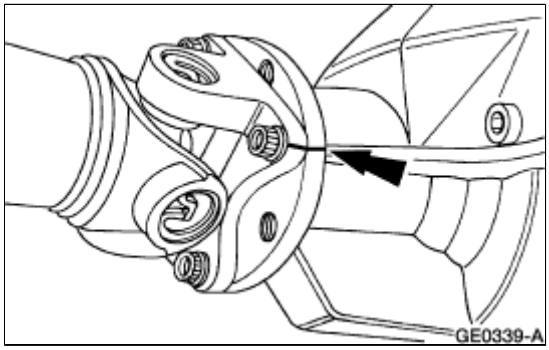


4. Install the transmission mount into the crossmember and tighten the transmission mount nuts.

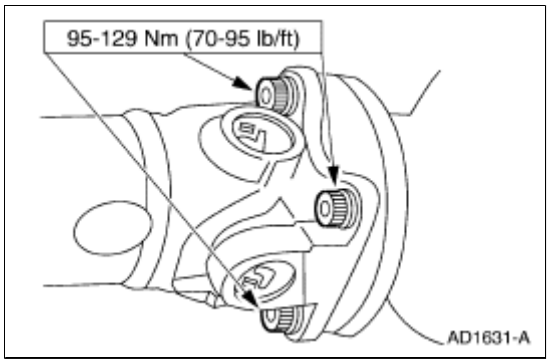


5. **NOTE:** Align the driveshaft with the marks made during removal to ensure correct balance.

    Align and install the rear driveshaft.



6. Install the bolts.



7. Lower the vehicle.

8. Connect the battery ground cable.

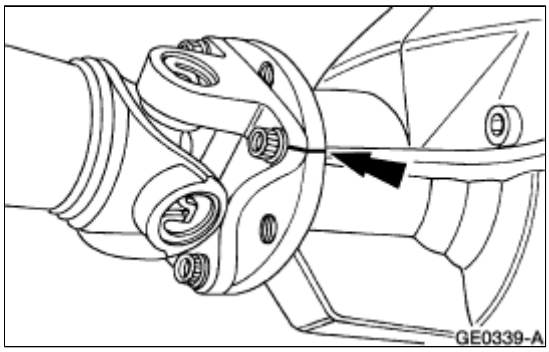
9. Fill the transmission to the correct fluid level and check for correct transmission operation.
   - Use MERCON® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON® V specification.

Extension Housing Gasket —4x4

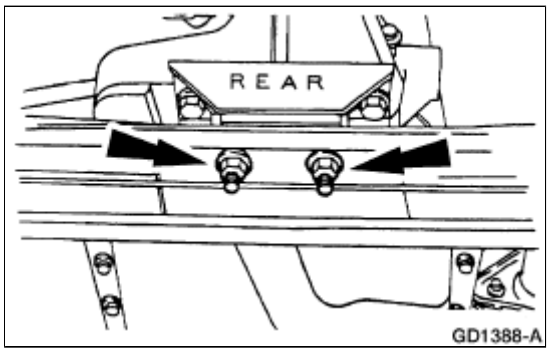
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. **NOTE:** To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they may be installed in their original alignment.

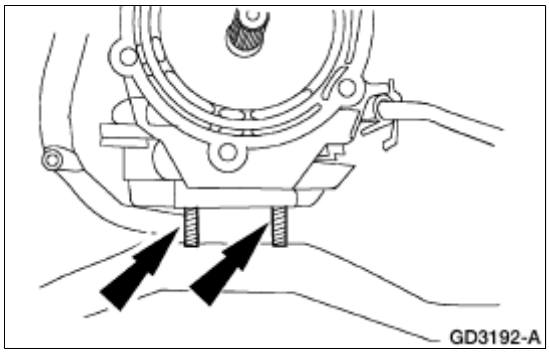
   Mark the rear driveshaft.



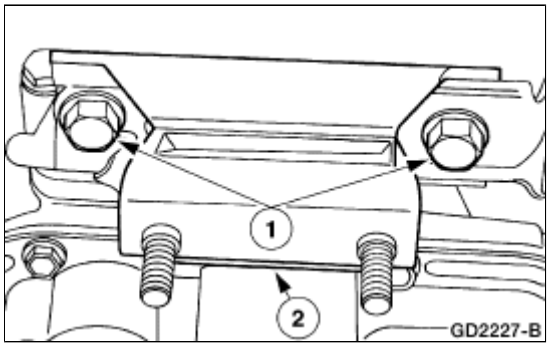
4. Remove the transfer case. For additional information, refer to Section 308-07B .
5. Remove the wire harness locators from the extension housing wire bracket.
6. Remove the transmission mount nuts.



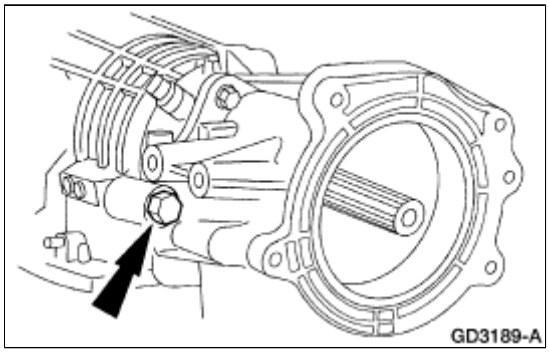
7. Raise and support the transmission.



8. Remove the transmission mount.
    1. Remove the transmission mount-to-extension housing screws.
    2. Remove the transmission mount.

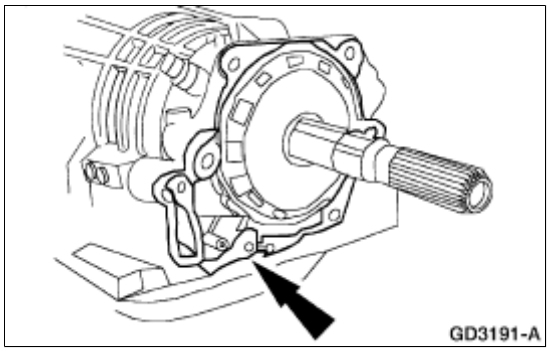


9. Remove the six extension housing screws and studs.



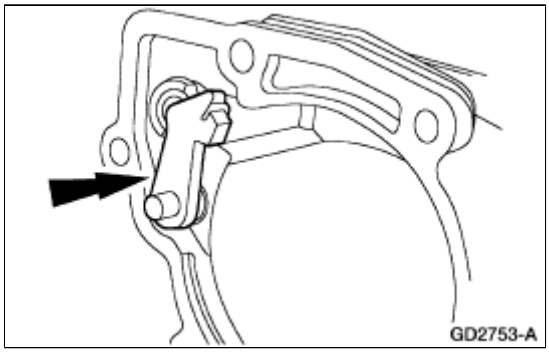
10. **NOTE:** The parking pawl (7A441), parking pawl return spring (7D070) and parking pawl shaft (7D071) may fall out during removal of the extension housing (7A039).

    Remove the extension housing. Discard the extension housing gasket (7086).



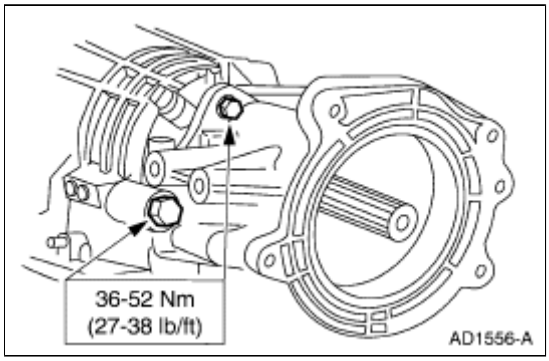
Installation

1. Clean the extension housing and install a new extension housing gasket. Make sure that the parking pawl, spring, and shaft are correctly installed.

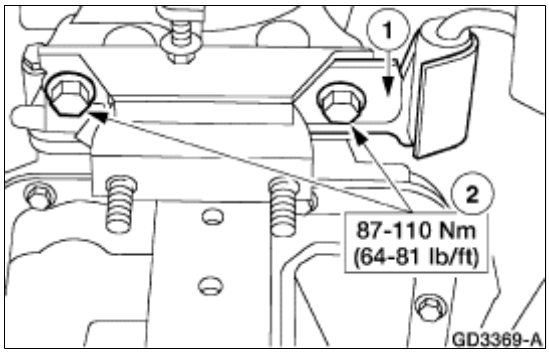


2. **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.**

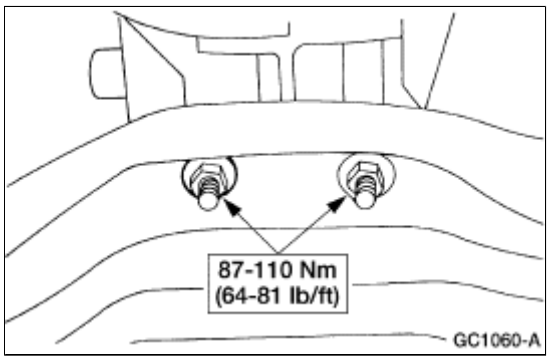
   Install the extension housing.
   - Position the extension housing and install the six extension housing screws and studs.



3. Install the transmission mount.
   1. Position the transmission mount on the extension housing.
   2. Install the screws.

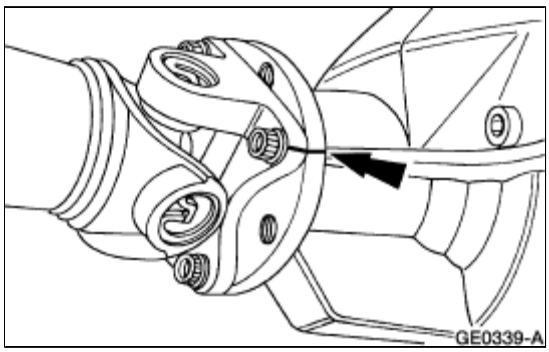


4. Install the transmission mount into the crossmember and tighten the nuts.

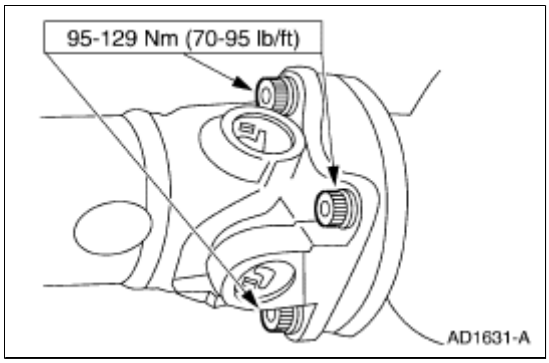


5. Install the wire harness locators from the extension housing wire bracket.
6. Install the transfer case.
7. **NOTE:** Align the driveshaft with the marks made during removal to ensure correct balance.

   Align and install the rear driveshaft.



8. Install the bolts.



9. Connect the battery ground cable.

10. Fill the transmission to correct fluid level and check for correct transmission operation.
    - Use MERCON® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON® V specification.

Solenoids —Shift, Torque Converter Clutch, Electronic Pressure Control

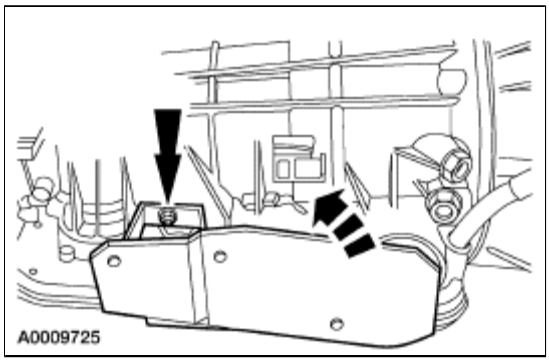
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .

2. Raise and support the vehicle. For additional information, refer to Section 100-02 .

3. **NOTE:** Transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned out of the way for fluid pan removal.

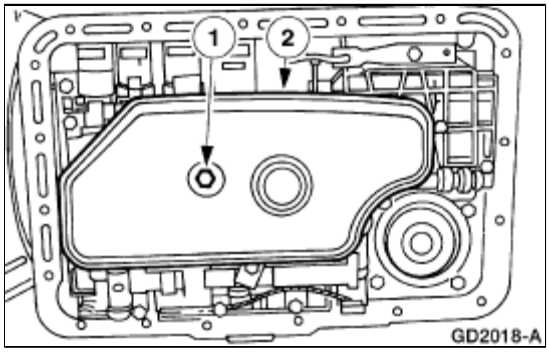
   Loosen the nut and position the heat shield out of the way.



4. Place a drain pan under the transmission fluid pan.

5. Drain the transmission fluid. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

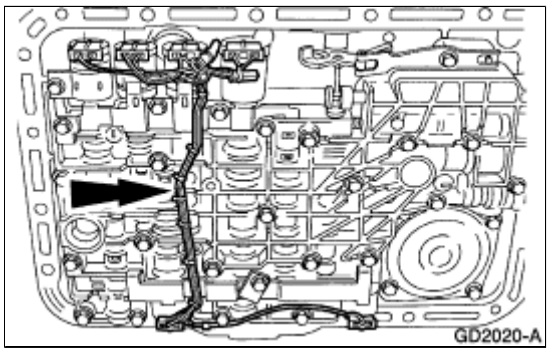
6. Remove the transmission fluid filter.
   1. Remove the transmission fluid filter screw.
   2. Remove the transmission fluid filter.



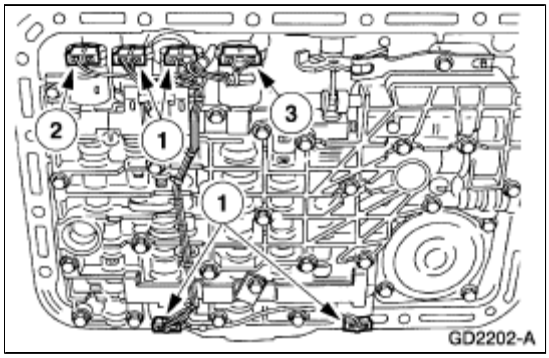
7. **NOTE:** Main control assembly does not need to be removed for solenoid service.

   Remove wire loom guide and protector.
   - Carefully lift up on wire loom guide and protector and disengage the retaining pins from the

solenoid clamps.



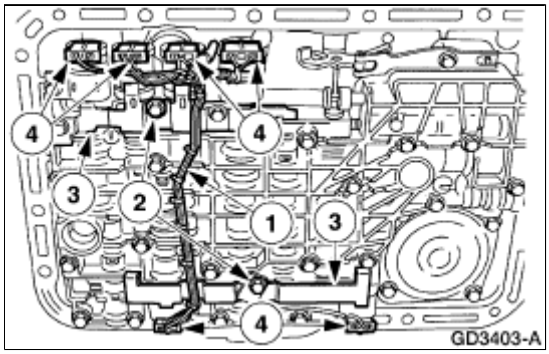
8. Disconnect the appropriate solenoid electrical connector.
    1. Disconnect shift solenoids electrical connectors.
    2. Disconnect the torque converter clutch (TCC) solenoid electrical connector.
    3. Disconnect the electronic pressure control (EPC) solenoid electrical connector.



9. **CAUTION: The TCC solenoid and converter modulator valve may pop out of its bore. This may damage the solenoid or converter modulator valve.**

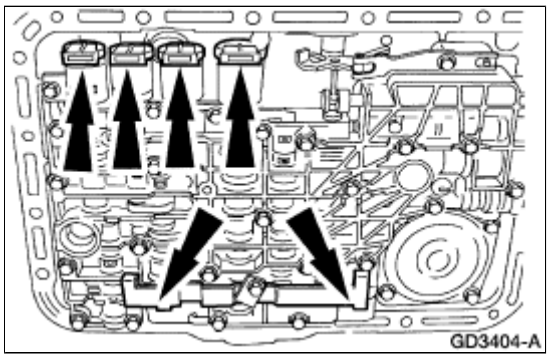
CAUTION: Shift solenoid (SSC) may pop out of its bore. This may damage the solenoid.

Remove the shift solenoids.
    1. Remove the wire harness.
    2. Remove the solenoid clamp screws.
    3. Remove the solenoid clamp.
    4. Remove the appropriate solenoid(s).



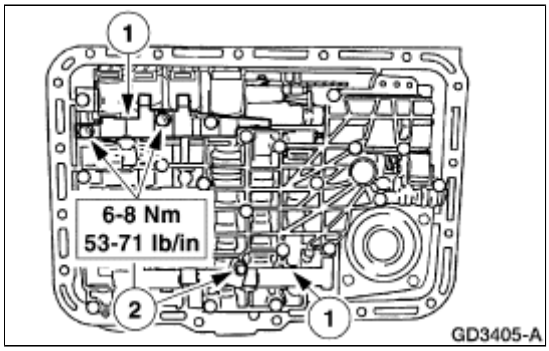
Installation

1. Install the new solenoid(s).

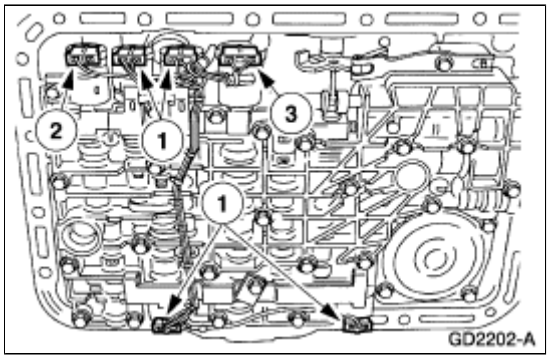


2. **CAUTION: The solenoid clamp must be installed in the TCC and EPC solenoid grooves, shift solenoid pockets and the No. 204 plug.**

   Install the solenoid clamp.
   1. Position the solenoid clamp on the main control valve body.
   2. Install the solenoid clamp screws.



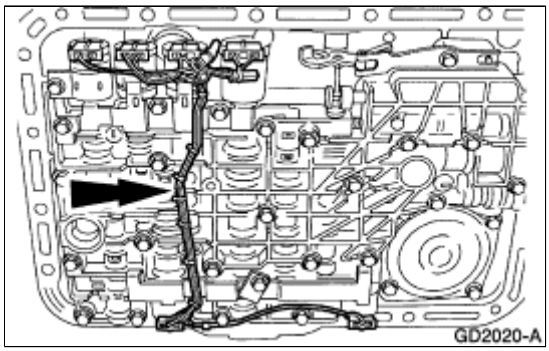
3. Connect the six solenoid electrical connectors.
   1. Connect shift solenoid SSA, SSB, SSC, SSD electrical connectors.
   2. Connect the torque converter clutch (TCC) solenoid electrical connector.
   3. Connect the electrical pressure control (EPC) solenoid electrical connector.



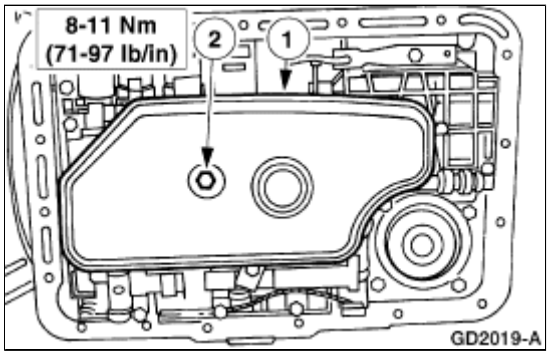
4. **CAUTION: Excessive pressure may break the retaining pins.**

Install the main control valve body wire loom.

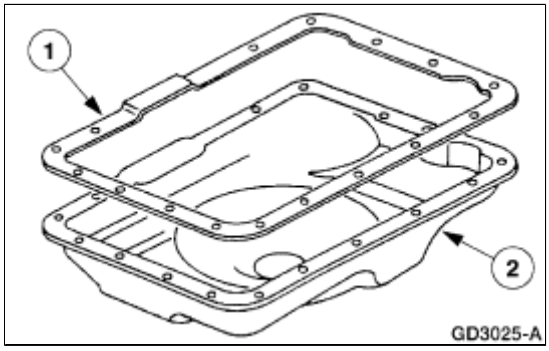
- Align the retaining pins to the holes in the solenoid clamps and gently press in the main control valve body wire loom guide and protector.



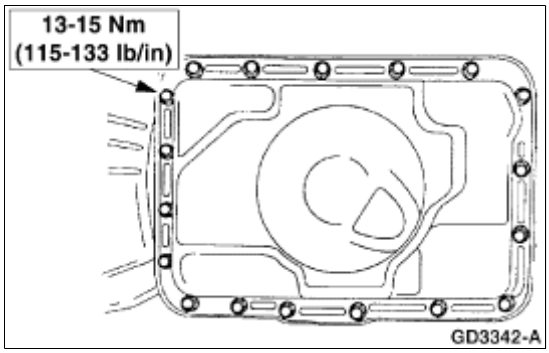
5. Install the transmission fluid filter.
    1. Install the transmission fluid filter.
    2. Install the transmission fluid filter screw.



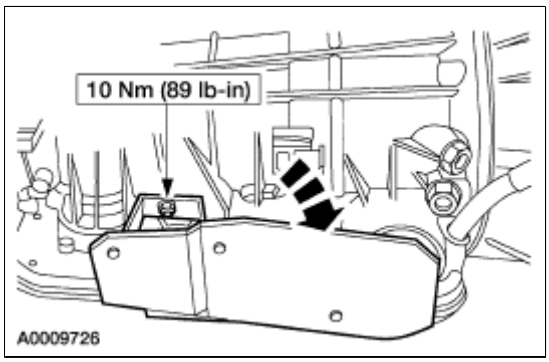
6. Install the transmission fluid pan.
    1. Position a new transmission fluid pan gasket on the transmission fluid pan.
    2. Align and install the transmission fluid pan.
        - Loosely install the transmission fluid pan screws.



7. Tighten the transmission fluid pan screws.



8. Position the servo heat shield over the servos and clip it to the pan rail.



9. Lower the vehicle.

10. Connect the battery ground cable.

11. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

Manual Control Lever Shaft and Seal

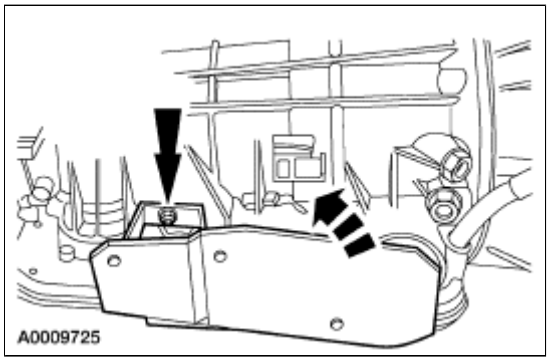
Special Tool(s)

 ST1199-A	Oil Seal Replacer 307-050 (T74P-77498-A)

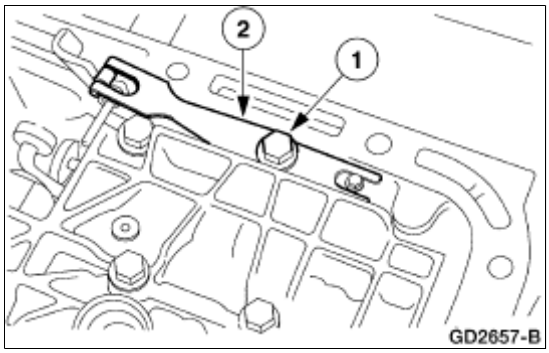
Removal

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support vehicle. For additional information, refer to Section 100-02 .
3. **NOTE:** Transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned out of the way for fluid pan removal.

   Loosen the nut and position the heat shield out of the way.

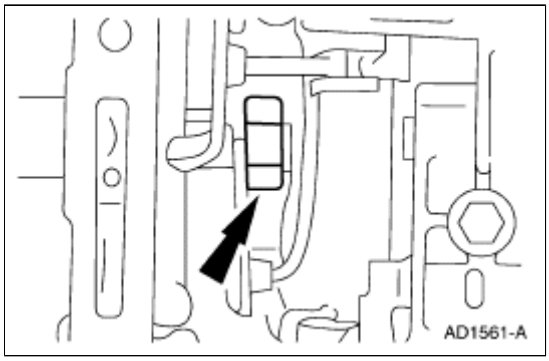
   
   A0009725
4. **NOTE:** It is not necessary to remove the transmission fluid filter to perform this procedure.

   Remove the transmission fluid pan. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
5. Remove the digital transmission range (TR) sensor. For additional Information, refer to Digital Transmission Range (TR) Sensor in this section.
6. Remove the manual control valve detent lever spring.
   1. Remove the manual control valve detent lever spring screw.
   2. Remove the manual control valve detent lever spring.

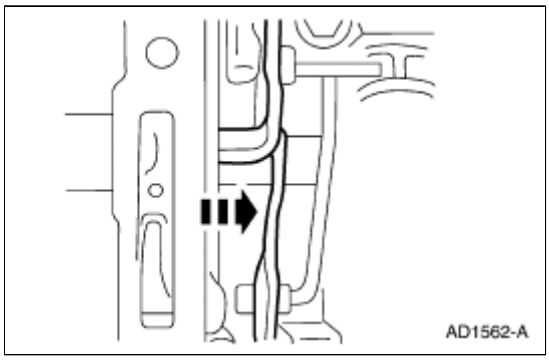


7. **CAUTION: Do not damage the valve inner lever pin.**

   Remove the manual valve inner lever nut.

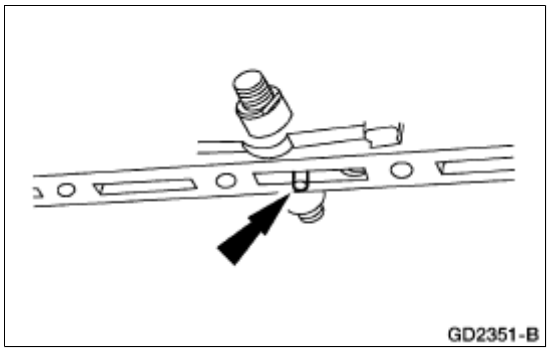


8. Separate the manual valve inner lever and the parking lever actuating rod.

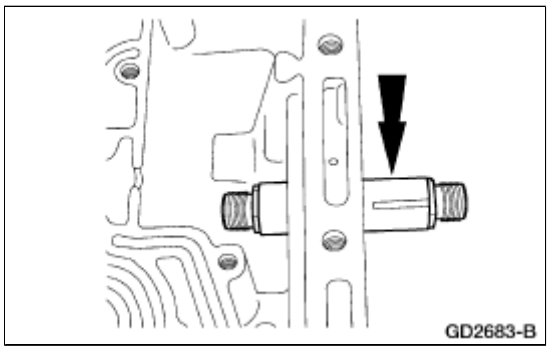


9. **CAUTION: Do not damage the case fluid pan rail.**

   Remove the manual control lever shaft spring pin.
   - Tap lightly on each side of the manual control lever shaft spring pin with a drift punch.
   - Pry the spring pin out of its bore.

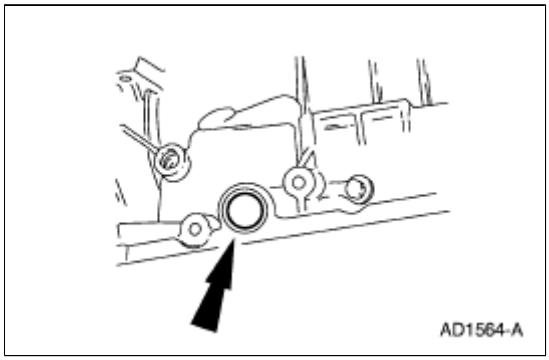


10. Remove the manual control lever shaft.



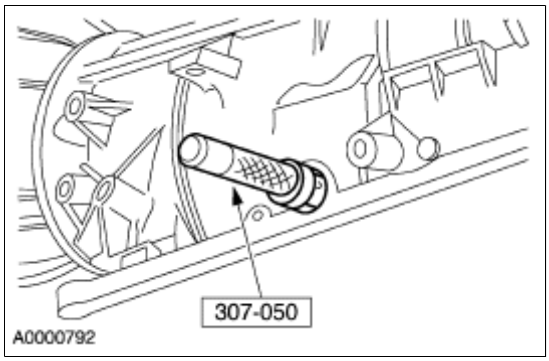
11. **CAUTION: Do not damage the bore.**

    Remove the manual control lever shaft seal.

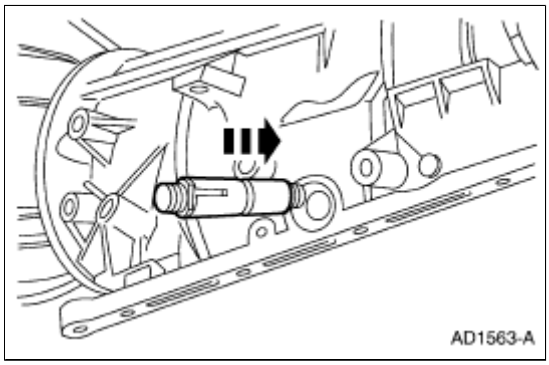


Installation

1. Using the special tool, install the manual control lever shaft seal.
   - Lubricate the manual control lever shaft seal with petroleum jelly.

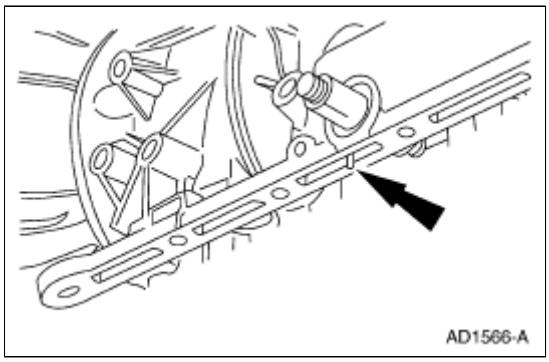


2. Install the manual control lever shaft.

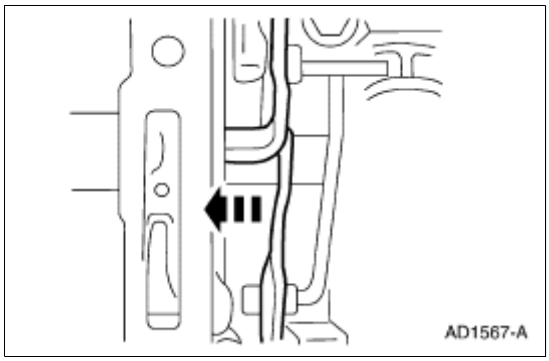


3. **CAUTION: Use care not to damage the fluid pan rail surface when installing the retaining pin.**

   Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.
   - Tap the manual control lever shaft spring pin into the transmission case.

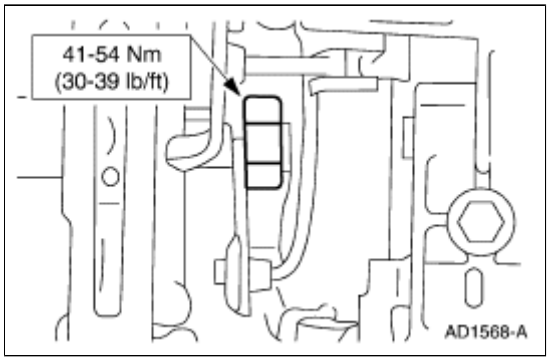


4. Align flats of the manual valve inner lever with flats on the manual control lever shaft. Install the manual valve inner lever and parking lever actuating rod onto the manual control lever shaft.



5. **CAUTION: Do not bend the manual valve inner lever pin.**

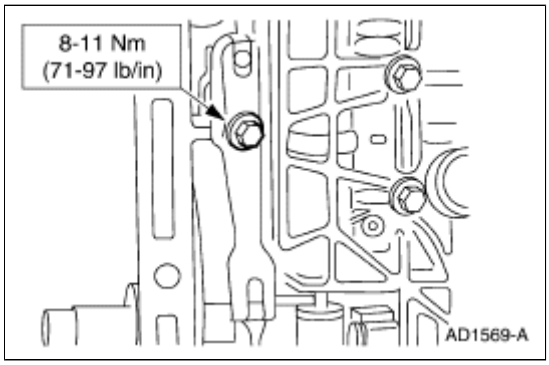
   Install the manual valve inner lever nut.



6. **CAUTION: Park pawl actuating rod must be properly installed into parking pawl and guide cup located in extension housing. Verify park linkage function.**

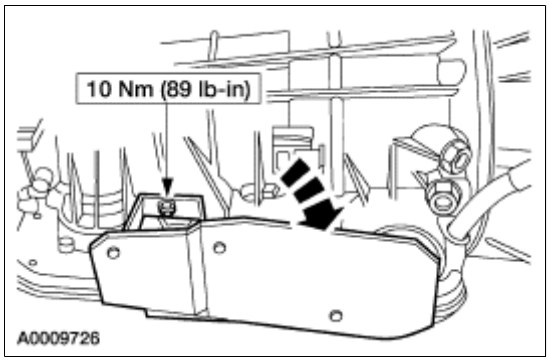
   Verify that the output shaft is locked in the PARK position.

7. Install the manual valve detent spring.



8. Install the transmission fluid pan with new pan gasket.

9. Position the servo heat shield over the servos and clip it to the pan rail.



10. Install the digital transmission range (TR) sensor.

11. Lower the vehicle.

12. Connect the battery ground cable.

13. Fill the transmission to proper level and check for proper transmission operation.
    - Use MERCON V® Automatic Transmission Fluid XT-5-QM meeting Ford specification MERCON V®.

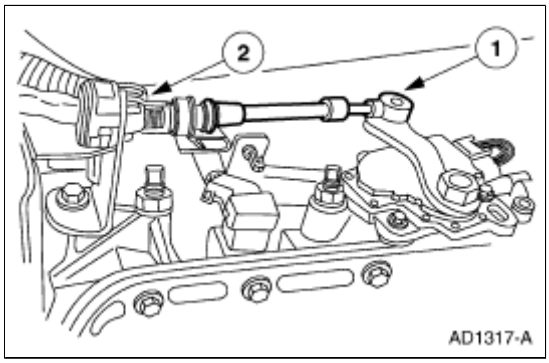
Digital Transmission Range (TR) Sensor

Special Tool(s)

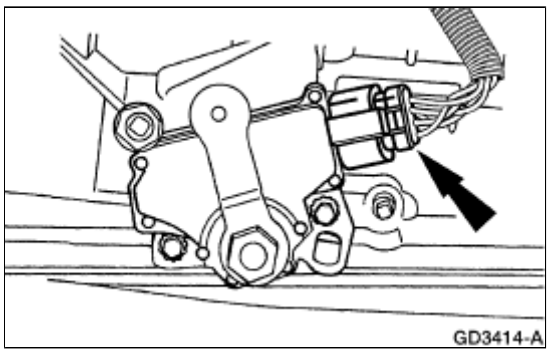
 ST1633-A	TRS Alignment Gauge 307-351 (T97L-70010-A)

Removal

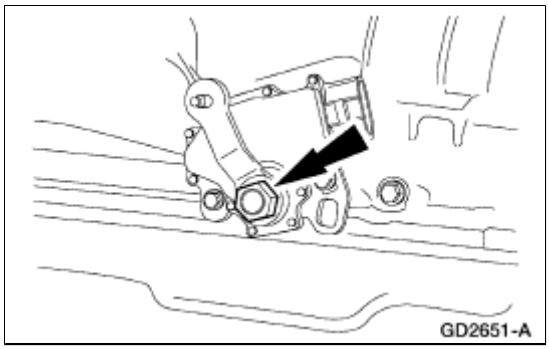
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Disconnect the shift cable.
   1. Disconnect the shift cable from the manual control lever.
   2. Disconnect the shift cable from the bracket.



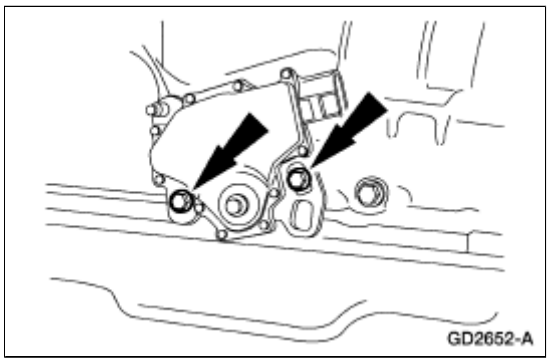
4. Disconnect the digital transmission range (TR) sensor electrical connector.



5. Remove the manual control outer lever nut and manual control outer lever.

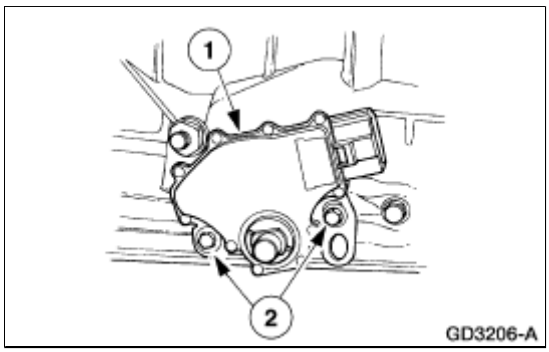


6. Remove the screws and the digital TR sensor.



Installation

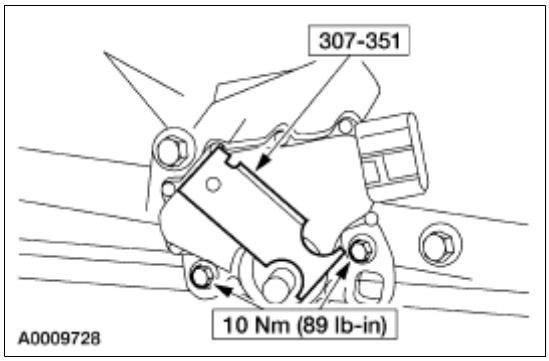
1. Install the digital TR sensor.
    1. Position the digital TR sensor.
    2. Loosely install the screws.



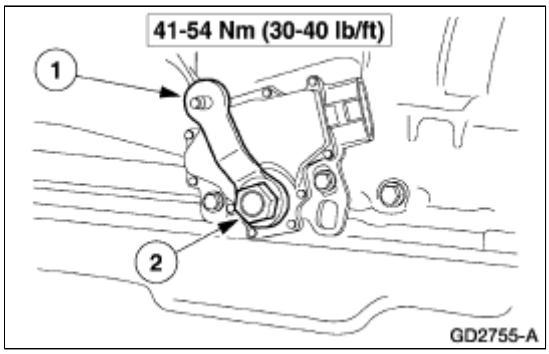
2. **CAUTION: Tightening one screw before tightening the other can cause the sensor to bind or become damaged.**

    NOTE: The manual lever must be in the neutral position.

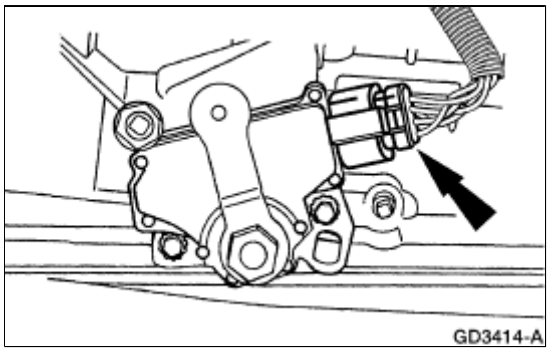
    Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence.



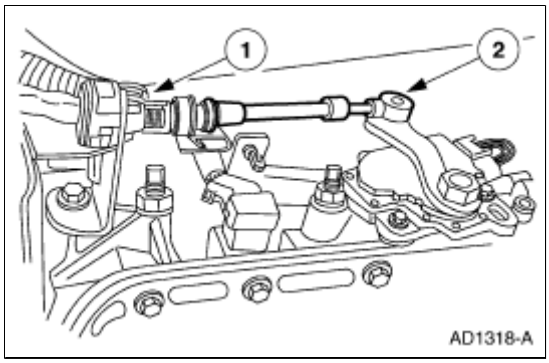
3. Install the manual control outer lever.
    1. Install the manual control outer lever.
    2. Install the manual control outer lever nut.



4. Connect the digital transmission range (TR) sensor electrical connector.



5. Connect the shift cable.
    1. Connect the shift cable to the bracket.
    2. Connect the shift cable to the manual control lever.



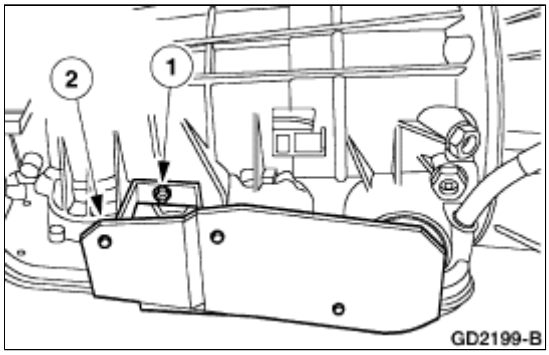
6. Verify that the shift cable is adjusted. For additional information, refer to Section 307-05 .
7. Lower the vehicle.
8. Connect the battery ground cable.

Heat Shield

Removal

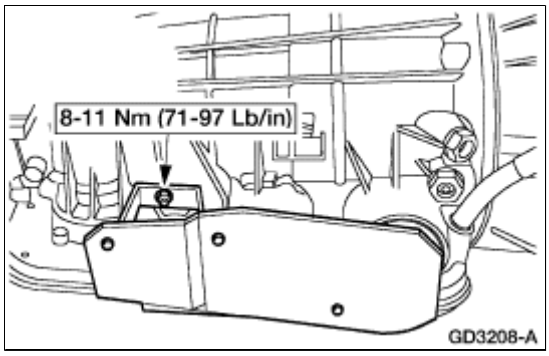
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .

2. Remove the transmission servo heat shield.
    1. Remove the transmission servo heat shield nut.
    2. Remove the transmission servo heat shield.



Installation

1. Follow the removal procedure in reverse order.

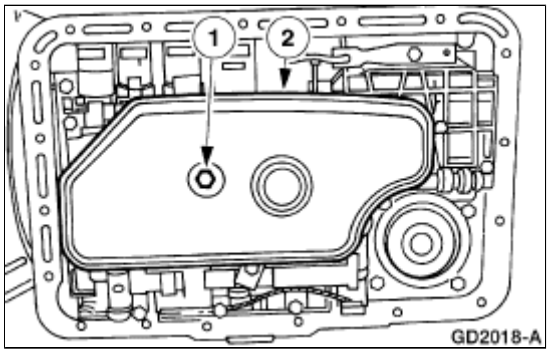


Internal Harness Service

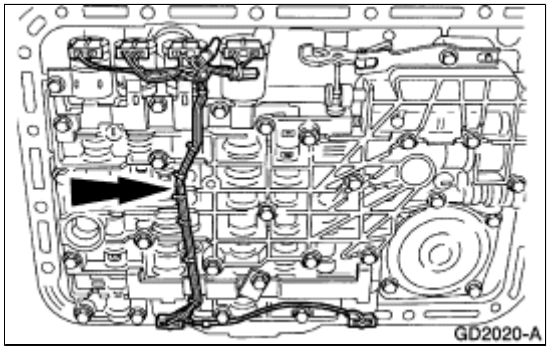
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support the vehicle. for additional information, refer to Section 100-02 .
3. Disconnect vehicle harness from transmission case (16 pin) connector.
4. Drain the transmission fluid; Refer to Fluid Pan, Gasket and Filter in this section.
5. **NOTE:** The main control assembly does not need to be removed.

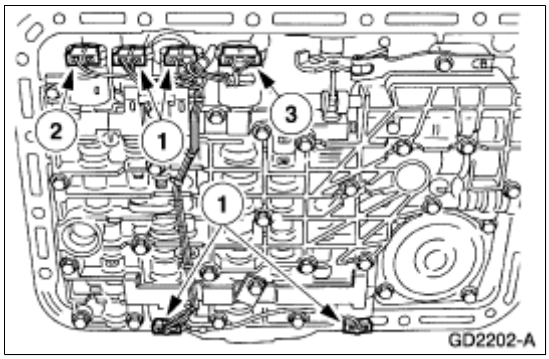
   Remove the transmission fluid filter.
   1. Remove the transmission fluid filter screw.
   2. Remove the transmission fluid filter.



6. Remove main control valve body wire loom.
   - Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.



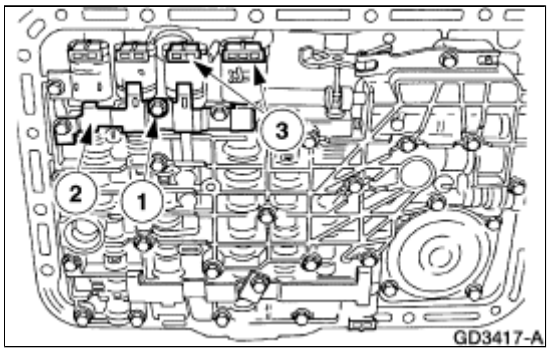
7. Disconnect the solenoid electrical connectors.
   1. Disconnect the SSA, SSB, SSC, and the SSD electrical connectors.
   2. Disconnect the torque converter clutch (TCC) solenoid electrical connector.
   3. Disconnect the electronic pressure control (EPC) solenoid electrical connector.



8. **CAUTION: The TCC solenoid and converter modulator valve may pop out of its bore. This may damage the solenoid or converter modulator valve.**

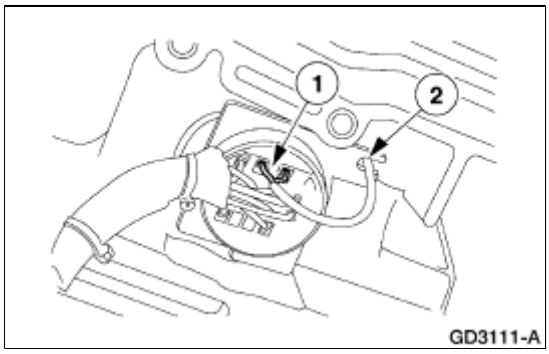
   CAUTION: Shift solenoids may pop out of their bore. This may damage the solenoids.

   Remove the EPC and SSB solenoids.
   1. Remove the solenoid clamp bolts.
   2. Remove the solenoid clamp.
   3. Remove the EPC and SSB solenoids.



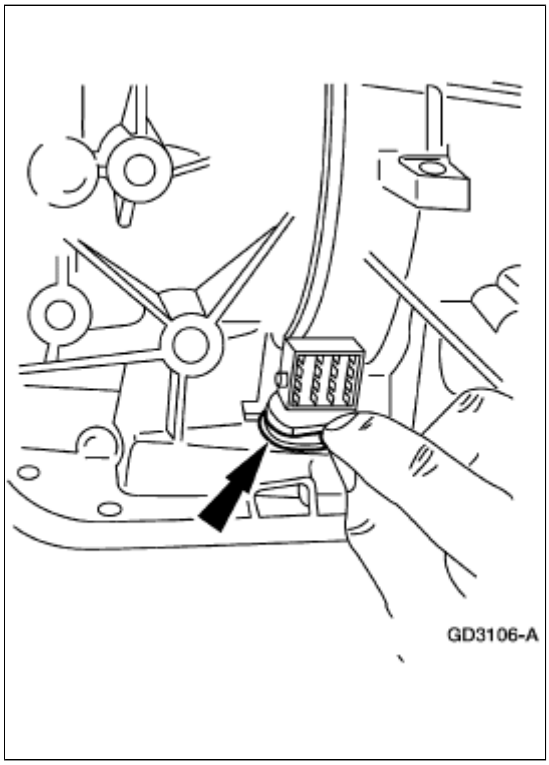
9. **CAUTION: Do not pry on the other wires or damage the connector case surface.**

   Disconnect the turbine shaft speed (TSS) sensor electrical connector from the transmission case (16 pin) electrical connector.
   1. Disconnect the TSS sensor electrical connector.
   2. Remove from the TSS sensor wire locator.



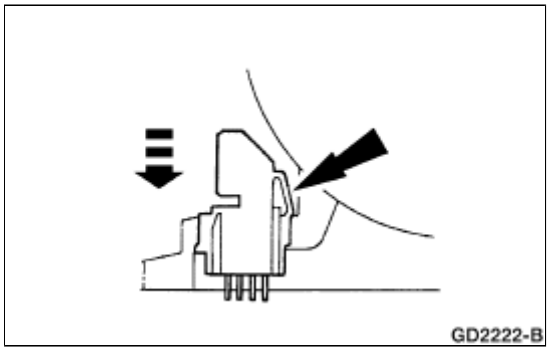
10. **CAUTION: Do not overstretch the retaining spring.**

    Remove the transmission case (16 pin) electrical connector retaining spring.



11. **CAUTION: Do not damage the connector or harness.**

    Remove the transmission case (16 pin) electrical connector.
    - Compress the tabs on the transmission case (16 pin) electrical connector.
    - Push the transmission case (16 pin) electrical connector out of transmission case.



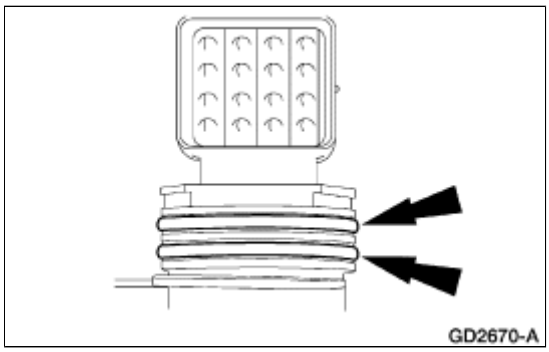
Installation

1. **NOTE:** Make sure the tab is in the lock position.

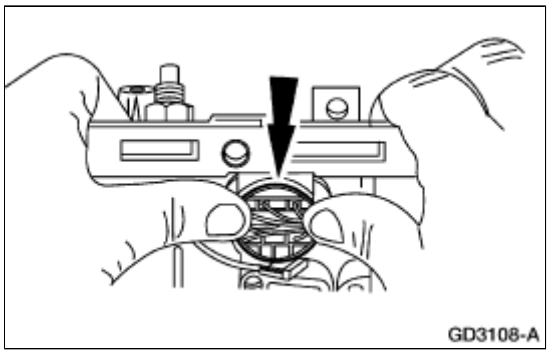
   NOTE: Install new O-rings on the transmission case (16 pin) electrical connector.

Install the transmission case (16 pin) electrical connector.

- Lubricate the transmission case (16 pin) electrical connector O-rings with petroleum jelly.



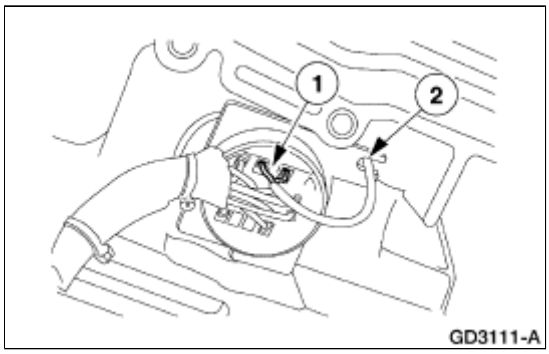
2. Press the transmission case (16 pin) electrical connector through the case until a click is heard.



3. **CAUTION: Align the slot on the TSS sensor electrical connector with the slot in the 16 pin case connector.**

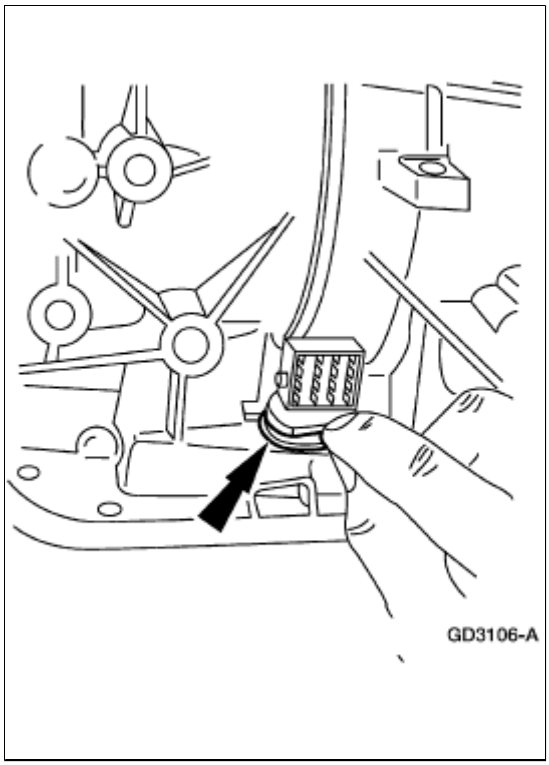
Install the TSS sensor wire.

1. Install TSS sensor wire into (16 pin) case connector.
2. Install TSS sensor wire into the locator.

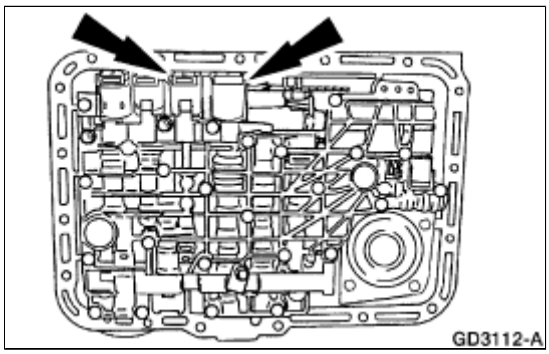


4. **CAUTION: Do not overstretch the retaining spring.**

Install the transmission case (16 pin) electrical connector retaining spring.

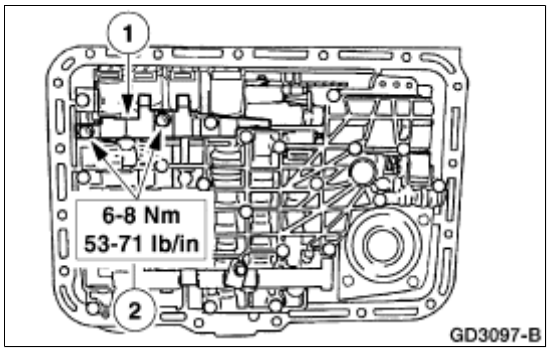


5. Install the EPC and SSB solenoids.

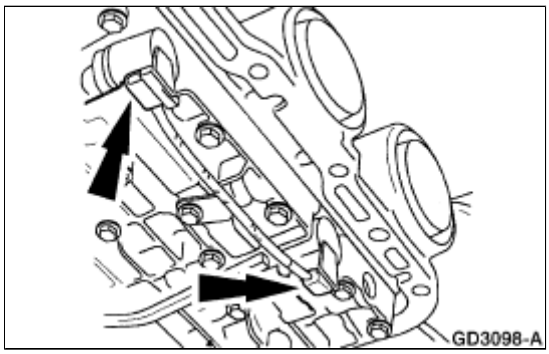


6. **CAUTION: The solenoid clamp must be installed in the TCC and EPC solenoid grooves, shift solenoid pockets and the No. 204 plug.**

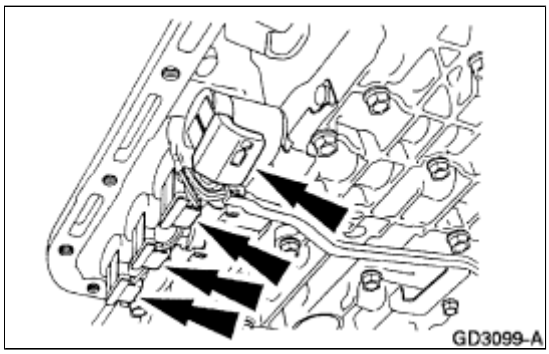
   Install the solenoid clamp.
   1. Position the solenoid clamp on the main control valve body (7A100).
   2. Install the solenoid clamp screws.



7. Connect the SSA and SSC shift (SS) solenoid electrical connectors.



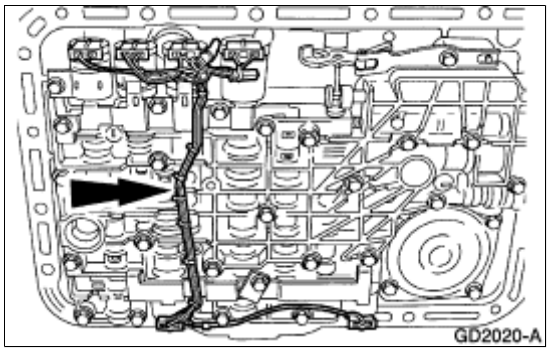
8. Connect the TCC, SSD, SSB, and EPC solenoid electrical connectors.



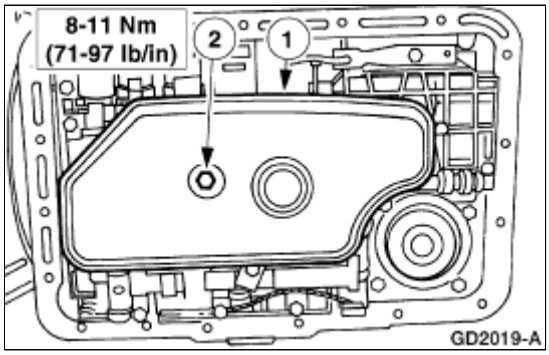
9. **CAUTION: Excessive pressure may break the retaining pins.**

Install the wire harness guide and protector.

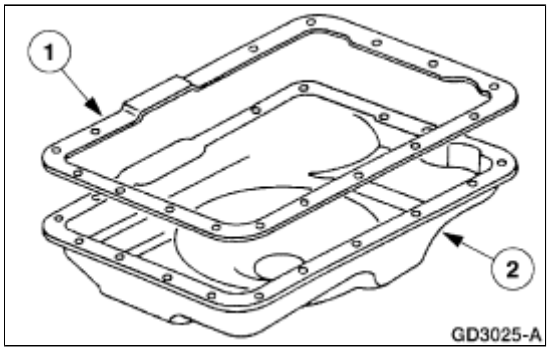
- Align the retaining pins to the holes in the solenoid clamps and gently press in the wire harness guide and protector.



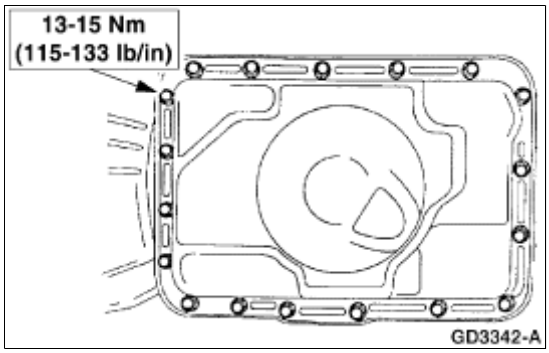
10. Install the transmission fluid filter.
    1. Install the transmission fluid filter.
    2. Install the transmission fluid filter screw.



11. Install the transmission fluid pan (7A194).
    1. Position a new transmission fluid pan gasket on the transmission fluid pan.
    2. Align and install the transmission fluid pan.
       - Loosely install the transmission fluid pan screws.



12. Tighten the transmission fluid pan screws.



13. Connect vehicle harness to transmission (16 pin) connector. Make sure lock is fully engaged.

14. Lower the vehicle.

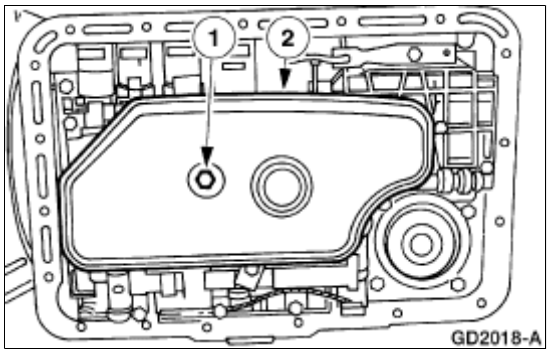
15. Connect the battery ground cable.

16. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

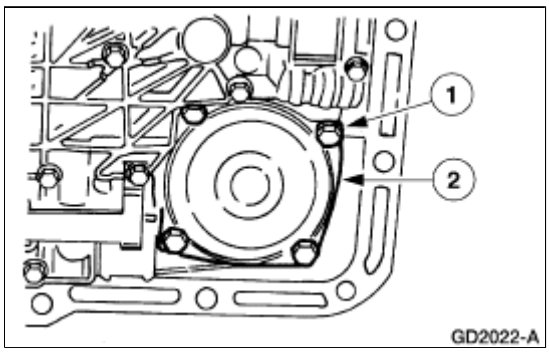
Low/Reverse Servo Assembly

Removal

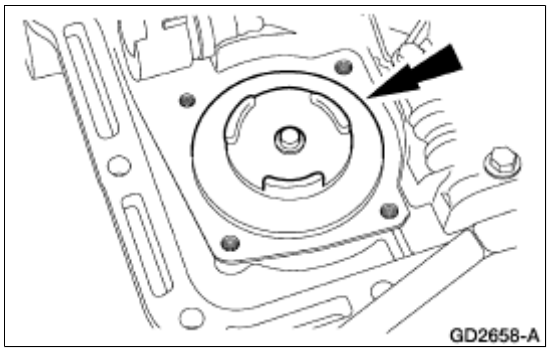
1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support the vehicle; Refer to Section 100-02 .
3. Remove the transmission pan; Refer to Fluid Pan, Gasket and Filter in this section.
4. Remove the transmission fluid filter.
    1. Remove the transmission fluid filter screw.
    2. Remove the transmission fluid filter.



5. Remove the low/ reverse band servo cover (7D036).
    1. Remove the low/reverse band servo cover screws.
    2. Remove the low/ reverse band servo cover and gasket. Discard the low/ reverse servo separator plate cover gasket (7L173).



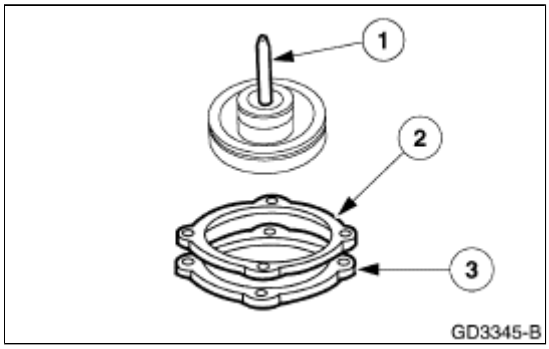
6. Remove the low/ reverse band servo piston and rod assembly.



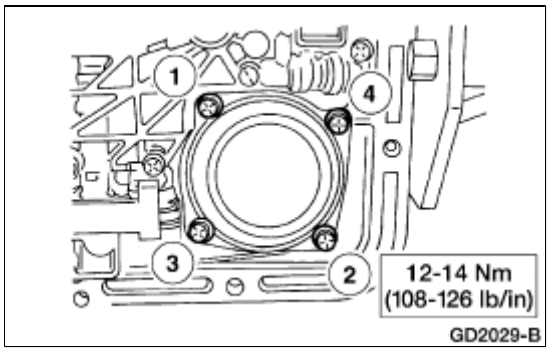
Installation

1. Clean and inspect the low/reverse band servo piston bore and the low/ reverse band servo piston and rod.

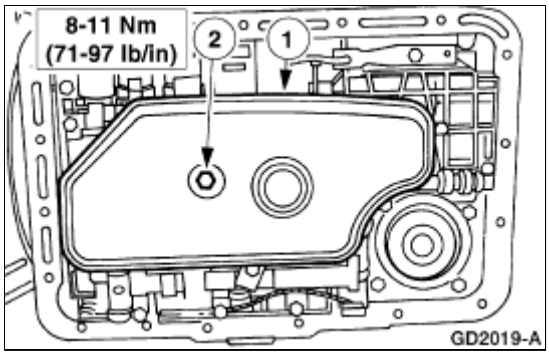
2. Install the low/ reverse band servo piston and rod.
    1. Install the low/ reverse band servo piston and rod assembly.
    2. Install a new low/ reverse band servo separator plate cover gasket.
    3. Install the low/ reverse band servo cover.
        - Loosely install the low/reverse band servo piston cover screws.



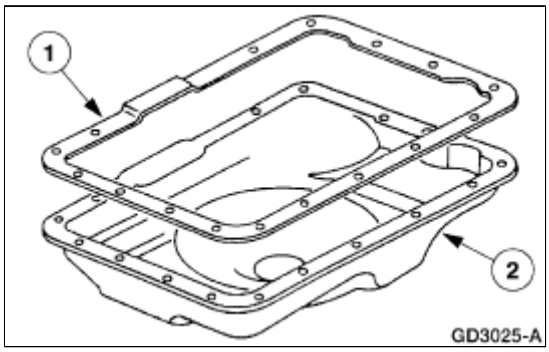
3. Tighten the servo cover screws in the sequence shown.



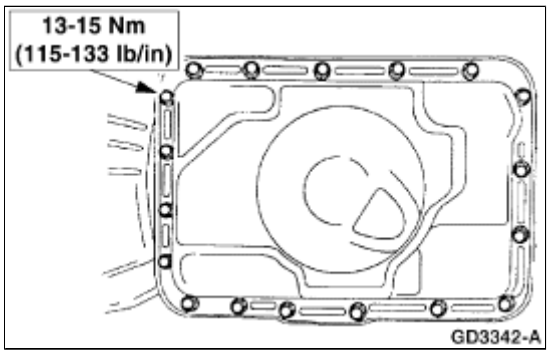
4. Install the transmission fluid filter.
    1. Install the transmission fluid filter.
    2. Install the transmission fluid filter screw.



5. Install the transmission fluid pan (7A194).
    1. Position a new transmission fluid pan gasket on the transmission fluid pan.
    2. Install and align the transmission fluid pan.
        - Loosely install the transmission fluid pan screws.



6. Tighten the transmission fluid pan bolts.
    - Use a crisscross sequence to tighten the transmission fluid pan screws.



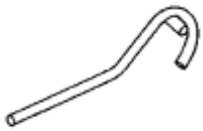
7. Lower the vehicle.

8. Connect the battery ground cable.

9. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V; Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

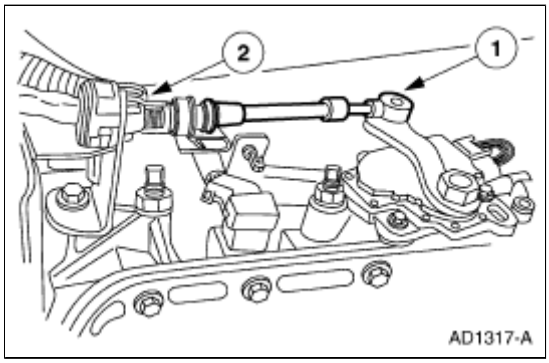
Front Servo

Special Tool(s)

 ST1806-A	Servo Cover Compressor 307-340 (T95L-77028-A)
 ST1770-B	Servo Removal Tool 307-347 (T97T-7D021-A)

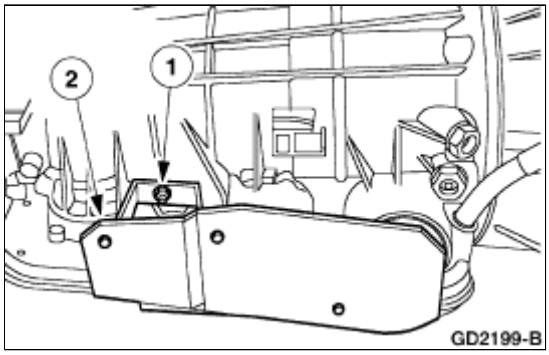
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support vehicle. For additional information, refer to Section 100-02 .
3. Remove the shift cable.
   1. Disconnect the shift cable from the manual control lever (7A256).
   2. Remove the shift cable from the bracket.

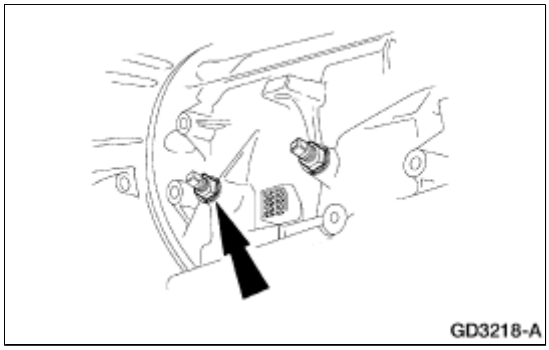


4. Remove the digital transmission range (TR) sensor. For additional information, refer to Digital Transmission Range (TR) Sensor in this section.
5. Remove the main control valve body (7A100). For additional information, refer to the Main Control Valve Body in this section.
6. Remove the three way catalytic converter (TWC) (5E212). For additional information, refer to Section 309-00 .

7. Remove the transmission servo heat shield (7F013).
    1. Remove the transmission servo heat shield nut.
    2. Remove the transmission servo heat shield.

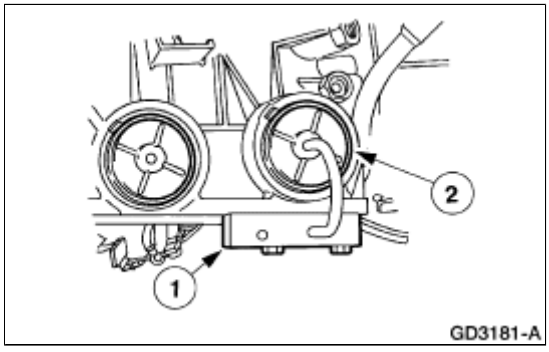


8. Remove the front band locknut and unscrew the front band adjusting screw.
    - Discard the front band locknut after removal.



9. **CAUTION: Servo cover is under spring pressure.**

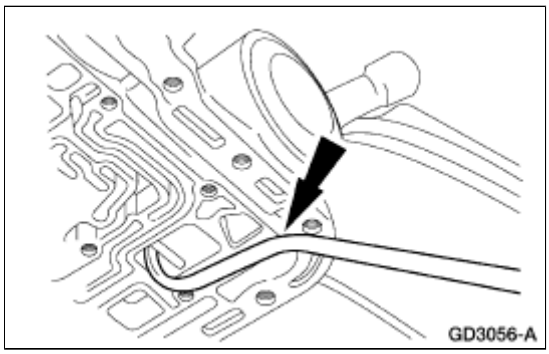
Using Servo Cover Compressor, remove the front band servo cover retaining ring.
1. Install the Servo Cover Compressor and compress the front band servo cover.
2. Remove the front servo cover retaining ring.
    - Slowly remove tension on the J-hook nut and remove the servo cover compressor.



10. **CAUTION: Servo removal tool should be used to prevent damage to servo and bore.**

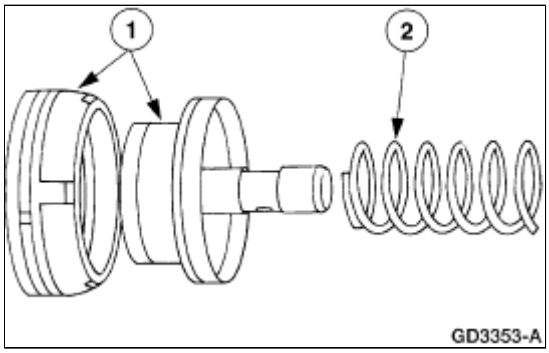
Use Servo Removal Tool to remove the front band servo cover, servo piston and servo piston spring (7D028).

- Insert Servo Removal Tool into the transmission case, locate on servo rod, and remove front band servo cover, servo piston and servo piston spring.



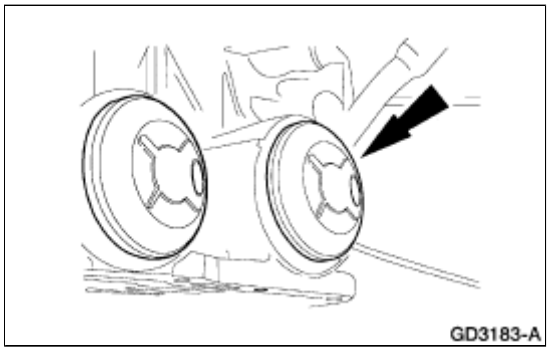
Installation

1. Assemble the front band servo cover, front band servo piston, and the servo piston spring.
    1. Install the front band servo piston into the front band servo cover.
    2. Install the servo piston spring on the front band servo piston.

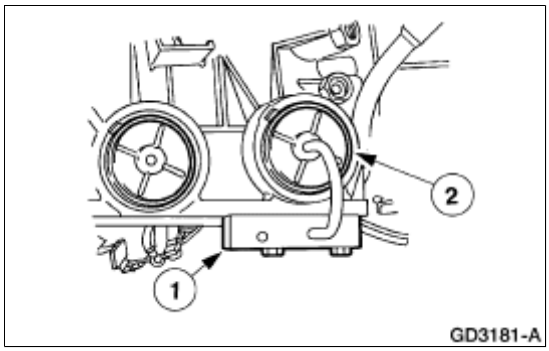


2. **CAUTION: Do not damage O-ring during installation. Do not press servo cover and O-ring past relief hole in case, or O-ring damage may occur.**

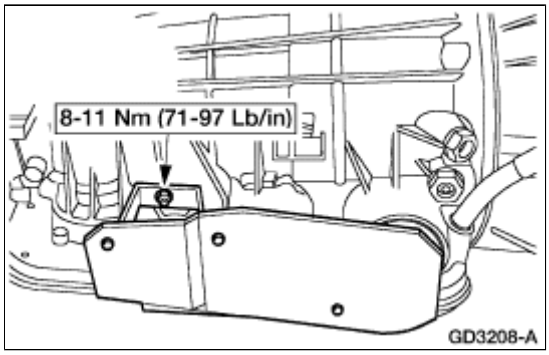
    Install the front band servo assembly into the transmission case (7005).
    - Lubricate the front band servo cover O-ring with petroleum jelly.



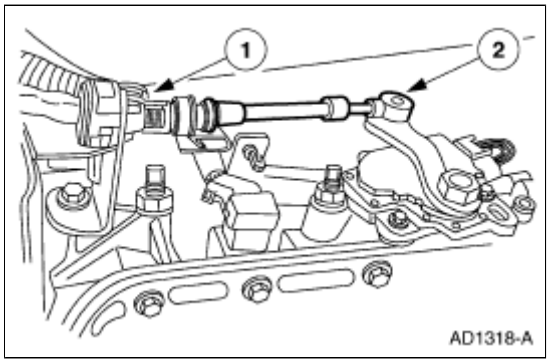
3. Use Servo Cover Compressor to install the front band servo cover retaining ring.
    1. Install the Servo Cover Compressor and compress the front band servo cover.
    2. Install the front servo cover retaining ring.



4. Install the main control valve body.
5. Adjust the front band. For additional information, refer to Front Band Adjustment in this section.
6. Position the transmission servo heat shield on the transmission and install the nut.



7. Install the three way catalytic converter. For additional information, refer to Section 309-00 .
8. Install the shift cable.
    1. Install the shift cable.
    2. Install the shift cable to the manual control lever.



9. Install the digital transmission range (TR) sensor.
10. Lower the vehicle.
11. Connect the battery ground cable.
12. Fill the transmission to the proper fluid level and check for proper transmission operation.

- Use MERCON ® V; Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

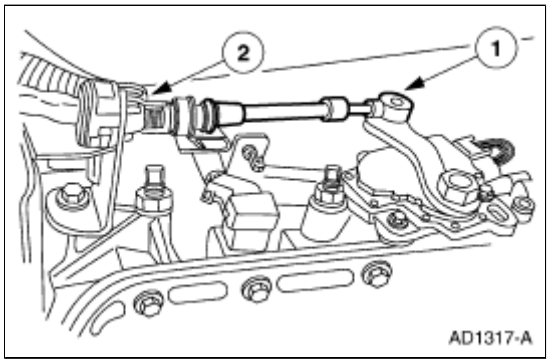
Intermediate Servo

Special Tool(s)

 ST1806-A	Servo Cover Compressor 307-340 (T95L-77028-A)
 ST1770-B	Servo Removal Tool 307-347 (T97T-7D021-A)

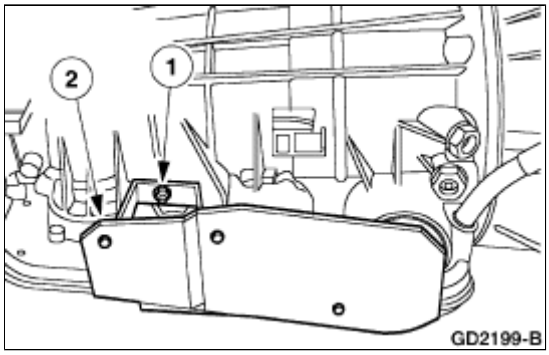
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Remove the shift cable.
   1. Disconnect the shift cable from the manual control lever (7A256).
   2. Remove the shift cable from the bracket.

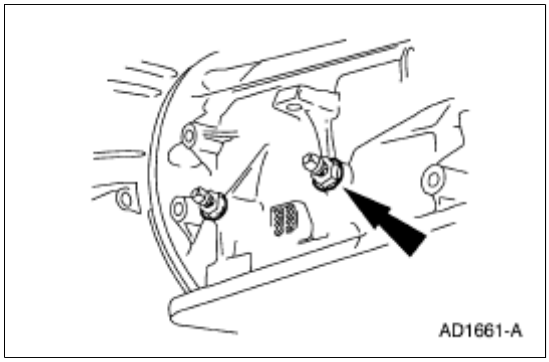


4. Remove the digital transmission range (TR) sensor. For additional information, refer to the Digital Transmission Range (TR) Sensor in this section.
5. Remove the three way catalytic converter (TWC) (5E212). For additional information, refer to Section 309-00 .
6. Remove the main control valve body (7A100). For additional information, refer to the Main Control Valve Body in this section.

7. Remove the transmission servo heat shield (7F013).
    1. Remove the transmission servo heat shield nut.
    2. Remove the transmission servo heat shield.

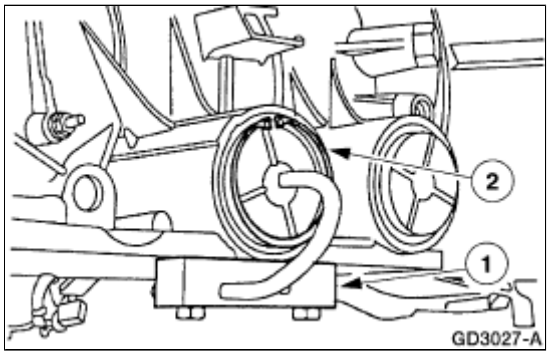


8. Remove the intermediate band locknut and unscrew the screw.
    - Discard the intermediate band locknut after removal.



9. **CAUTION: Servo cover is under spring tension. Use caution when removing.**

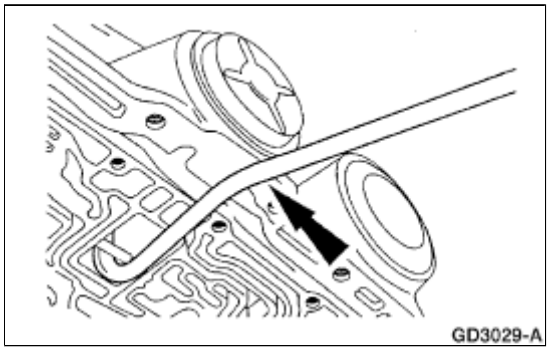
    Using Servo Cover Compressor, remove the intermediate band servo cover retaining ring.
    1. Install the Servo Cover Compressor and compress the intermediate band servo cover.
    2. Remove the intermediate servo cover retaining ring.
        - Slowly remove tension on the J hook nut and remove the servo cover compressor.



10. **CAUTION: Servo removal tool should be used to prevent damage to the servo, servo cover, and bore.**

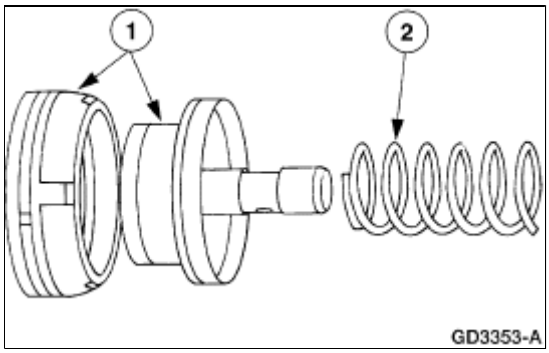
Use Servo Removal Tool to remove the intermediate band servo cover, intermediate band servo piston (7D021) and servo piston spring (7D028).

- Insert Servo Removal Tool into the transmission case, and remove servo cover, intermediate band servo piston and servo piston spring.



Installation

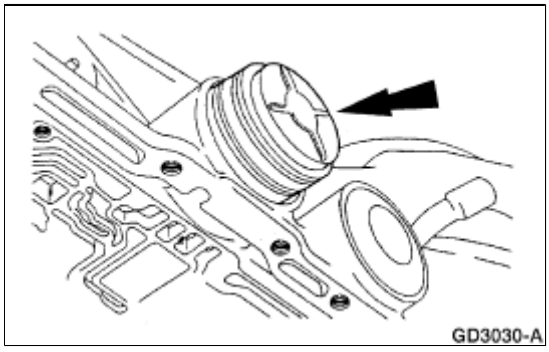
1. Assemble the intermediate band servo cover, intermediate band servo piston, and the servo piston spring.
    1. Install the intermediate band servo piston into the intermediate band servo cover.
    2. Install the servo piston spring on the intermediate band servo piston.



2. **CAUTION: Do not damage O-ring during installation. Do not press servo cover and O-ring past relief hole in case, or O-ring damage may occur.**

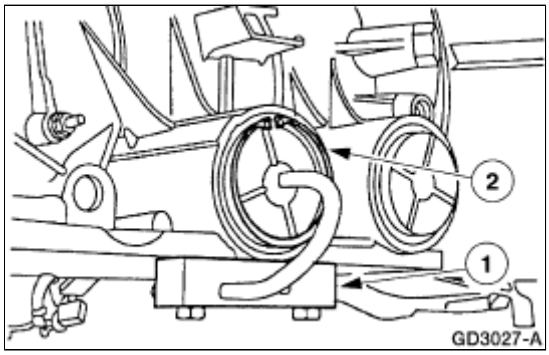
    Install the intermediate band servo piston assembly into the transmission case (7005).

    - Lubricate intermediate band servo cover O-ring with petroleum jelly.



3. Using Servo Cover Compressor, install the intermediate band servo cover retaining ring.

1. Install the Servo Cover Compressor and compress the intermediate band servo cover.
2. Install the intermediate servo cover retaining ring.

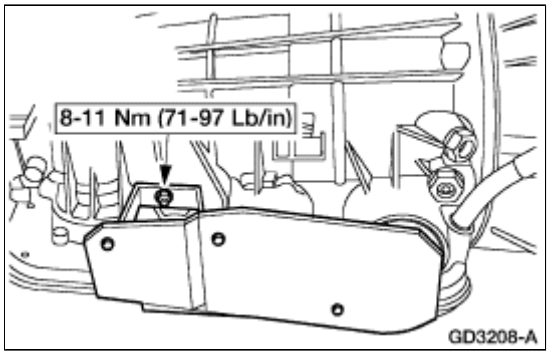


4. Adjust the intermediate band. For additional information, refer to Intermediate Band Adjustment in this section.

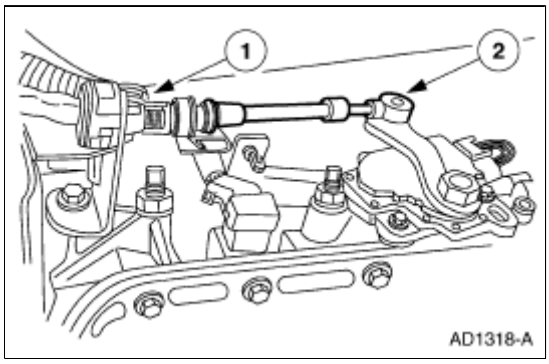
5. Install the main control valve body.

6. Install the digital transmission range (TR) sensor.

7. Position the transmission servo heat shield on the transmission and install the nut.



8. Install the shift cable.
   1. Install the shift cable.
   2. Install the shift cable to the manual control lever.



9. Install the three way catalytic converter.

10. Lower the vehicle.

11. Connect the battery ground cable.

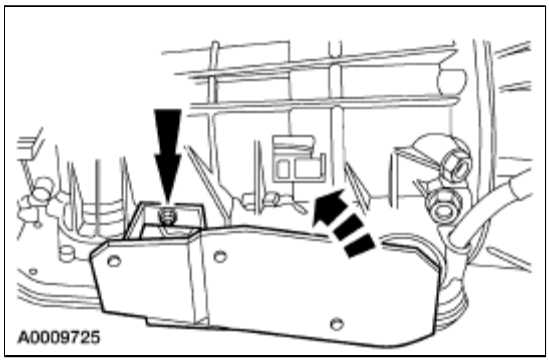
12. Fill the transmission to the proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

Park System

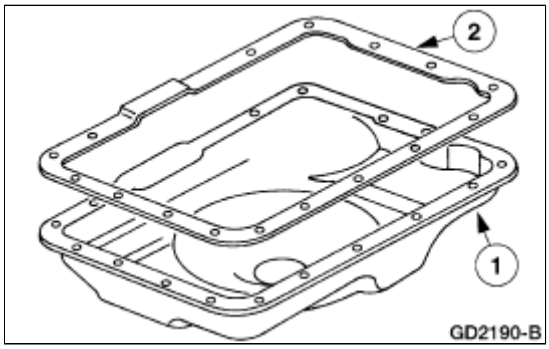
Removal

1. Disconnect the battery ground cable. For additional information; refer to Section 414-01 .
2. Raise and support the vehicle. For additional information; refer to Section 100-02 .
3. **NOTE:** Transmission servo heat shield needs to be unclipped from the fluid pan rail and positioned out of the way for fluid pan removal.

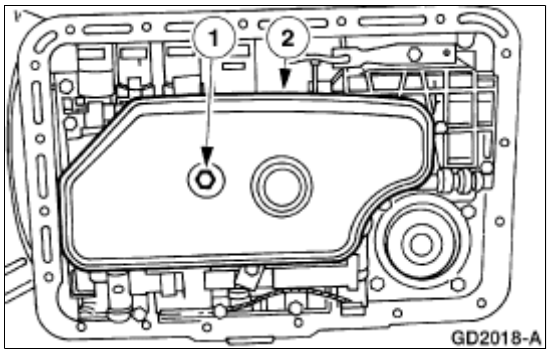
   Loosen the nut and position the heat shield out of the way.



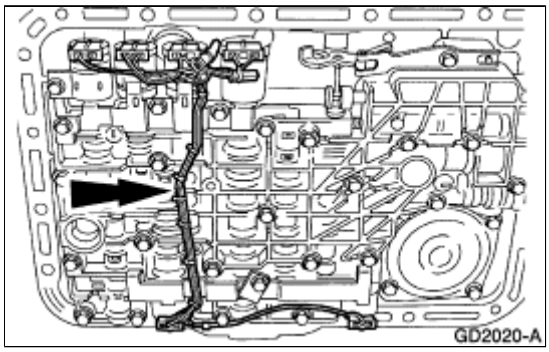
4. Remove the transmission fluid pan.
   1. Remove the transmission fluid pan.
   2. Remove and discard the transmission fluid pan gasket.



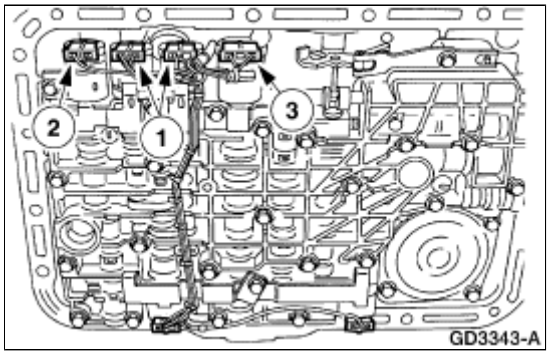
5. Remove the transmission fluid filter.
   1. Remove the transmission fluid filter screw.
   2. Remove the transmission fluid filter.



6. Remove wire loom guide and protector.
    - Carefully lift up on wire loom guide and protector and disengage the retaining pins from the solenoid clamps.

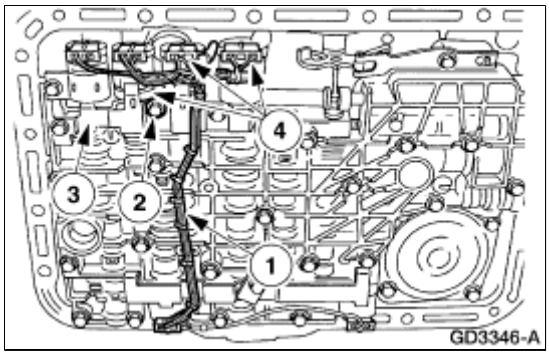


7. Disconnect the solenoid electrical connectors.
    1. Disconnect shift solenoids SSB and SSD electrical connectors.
    2. Disconnect the torque converter clutch (TCC) solenoid electrical connector.
    3. Disconnect the electronic pressure control (EPC) solenoid electrical connector.



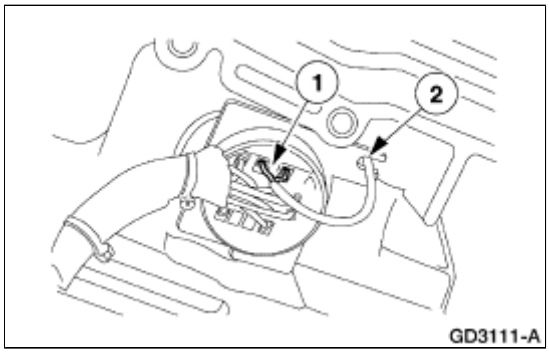
8. **CAUTION: The TCC solenoid and converter modulator valve may pop out of its bore. This may damage the solenoid or converter modulator valve.**

    Remove the EPC, SSB, and SSD solenoids.
    1. Remove the wire harness.
    2. Remove the solenoid clamp screws.
    3. Remove the solenoid clamp.
    4. Remove the EPC, SSB, and SSD solenoids.



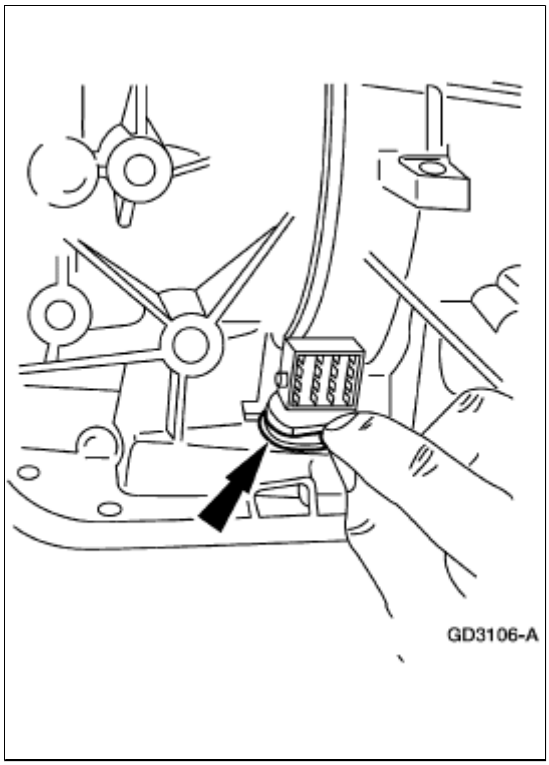
9. **CAUTION: Do not pry on the other wires or damage to the connector case surface may result.**

   Disconnect the turbine shaft speed (TSS) sensor electrical connector from the transmission case (16 pin) electrical connector.
   1. Disconnect the TSS sensor electrical connector.
   2. Remove the TSS sensor wire locator.



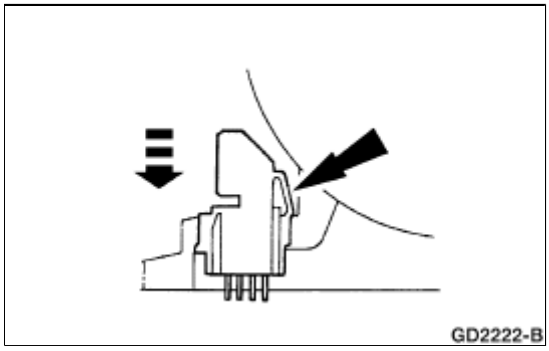
10. **CAUTION: Do not overstretch the retaining spring.**

    Remove the transmission case (16 pin) electrical connector retaining spring.

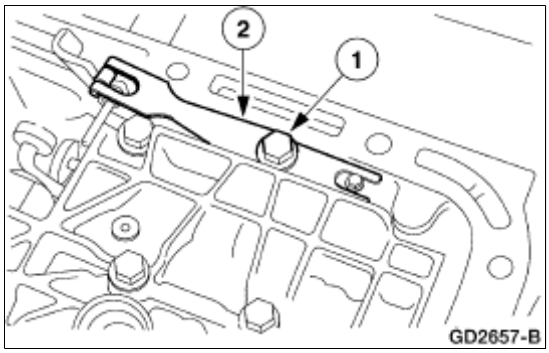


11. **CAUTION: Do not damage the connector or harness.**

    Remove the transmission case (16 pin) electrical connector.
    - Compress the tabs on the connector.
    - Push the connector out of the transmission case.

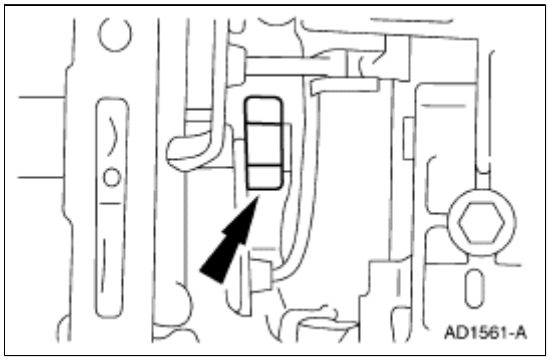


12. Remove the manual control valve detent lever spring.
    1. Remove the screw.
    2. Remove the spring.

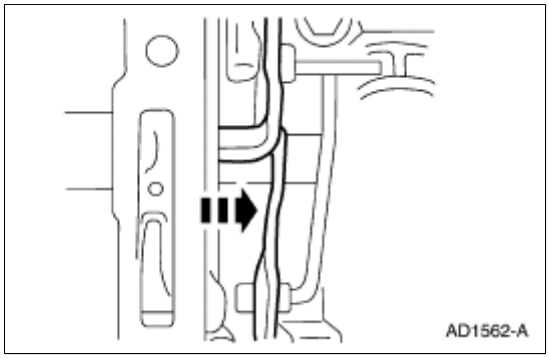


13. **CAUTION: To avoid damage, make sure the wrench does not strike the manual valve inner lever pin.**

    Remove the manual valve inner lever nut.

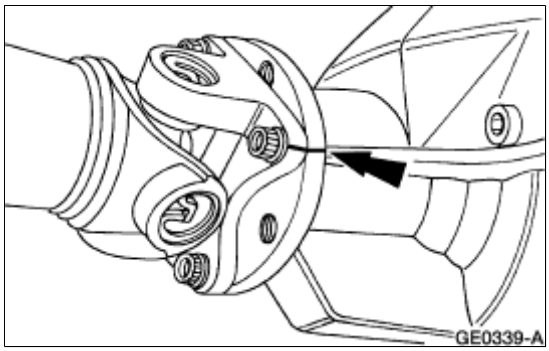


14. Remove the manual valve inner lever and parking lever actuating rod.

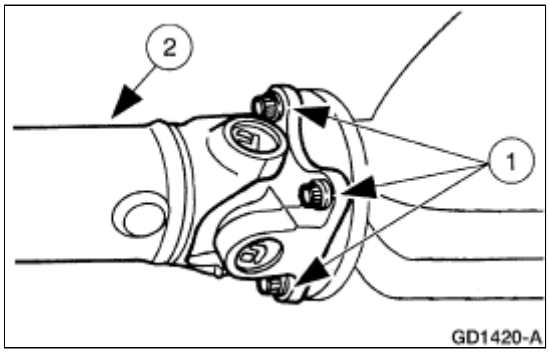


15. **NOTE:** To maintain initial driveshaft balance, mark the rear driveshaft yoke and axle flange so they may be installed in their original alignment.

    Mark the rear driveshaft.



16. Remove the rear driveshaft.
    1. Remove the bolts.
    2. Remove the rear driveshaft.

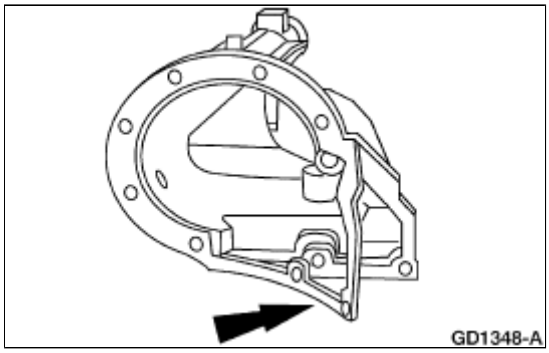


17. If equipped, remove the transfer case. For additional information, refer to Section 308-07B .

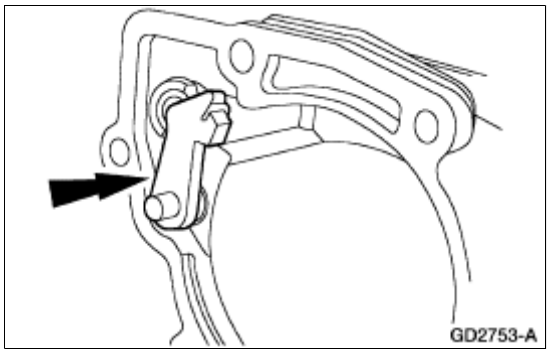
18. **NOTE:** If damage is found to the parking gear, the transmission must be removed and disassembled.

    NOTE: The parking pawl, parking pawl return spring and parking pawl shaft may fall out during removal of the extension housing.

    Remove the extension housing and discard the extension housing gasket.



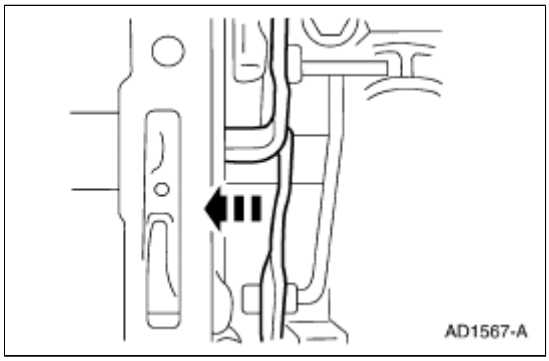
19. Inspect the parking pawl, parking pawl return spring and the parking pawl shaft.
    - Replace if required.



Installation

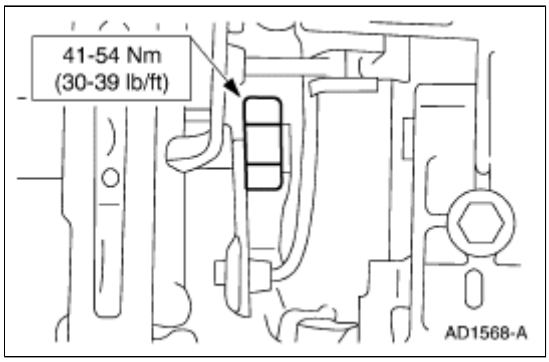
1. **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup. Verify that the output shaft is locked in the PARK position.**

   Align the flats of the manual valve inner lever with the flats on the manual control lever shaft. Install the manual valve inner lever and parking lever actuating rod onto the manual control lever shaft.

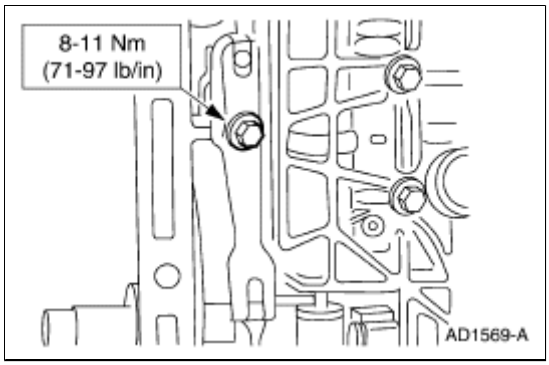


2. **CAUTION: Do not bend the manual valve inner lever pin.**

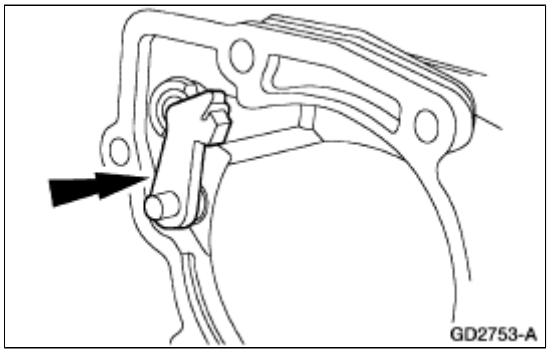
   Install the manual valve inner lever nut.



3. Install the manual valve detent spring.

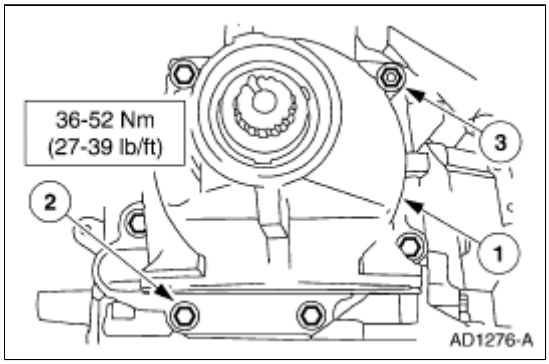


4. Clean the extension housing and install a new extension housing gasket. Make sure that the parking pawl, spring, and shaft is correctly installed.



5. **CAUTION: Make sure the parking lever actuating rod is correctly seated into the case parking rod guide cup.**

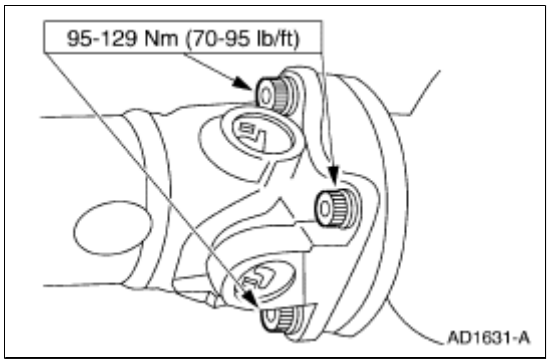
   Install the extension housing.
   1. Position the extension housing.
   2. Install the extension housing screws.
   3. Install the extension housing stud.



6. If equipped, install the transfer case.

7. **NOTE:** Align the drive shaft with the marks made during removal to ensure correct balance.

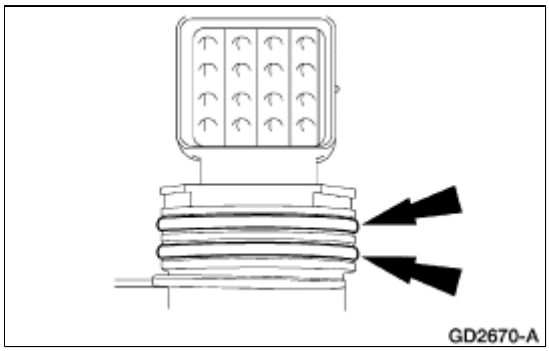
   Install the rear driveshaft bolts.



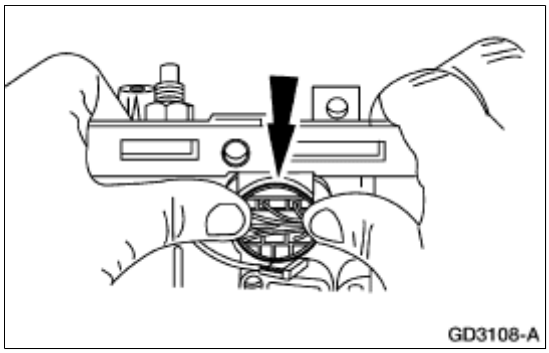
8. **NOTE:** Make sure the tab is in the lock position.

   NOTE: Install new O-rings on the transmission case (16 pin) electrical connector.

   Install the transmission case (16 pin) electrical connector.
   - Lubricate the transmission case (16 pin) electrical connector O-rings with petroleum jelly.

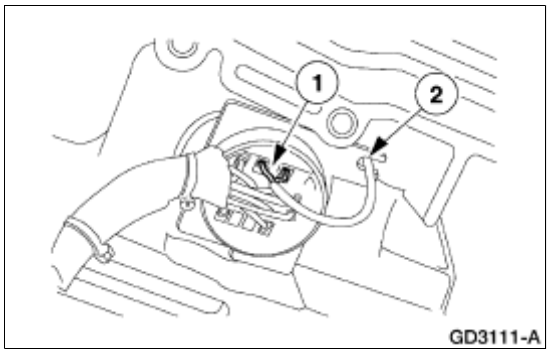


9. Press the transmission case (16 pin) electrical connector through the case until a click is heard.



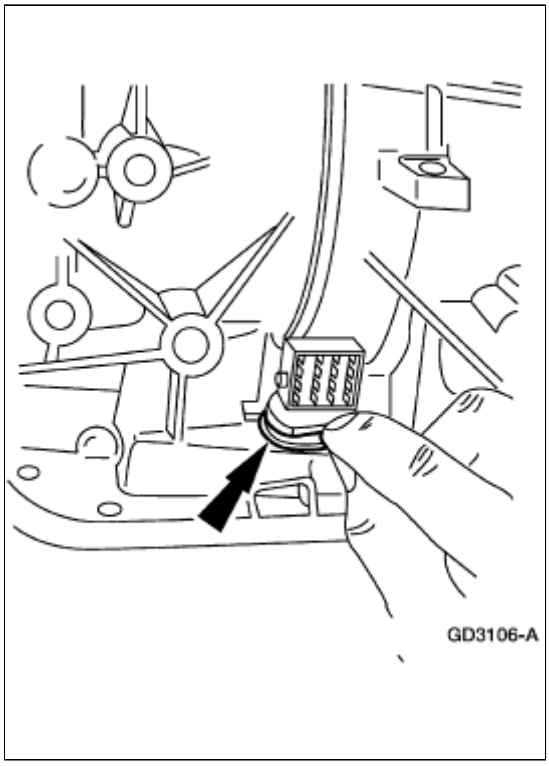
10. **CAUTION: Align the slot on the TSS sensor electrical connector with the slot in the 16 pin case connector.**

    Install the TSS sensor wire.
    1. Install the TSS sensor wire into (16 pin) electrical connector.
    2. Install the TSS sensor wire into locator.

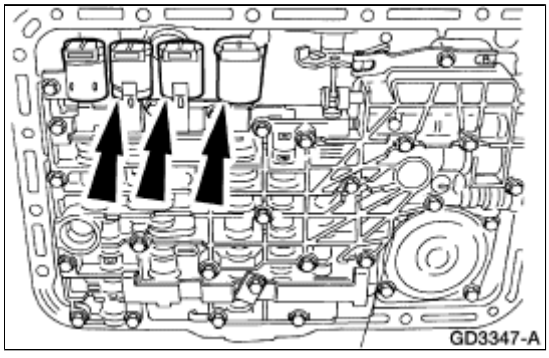


11. **CAUTION: Do not overstretch the retaining spring.**

    Install the transmission case (16 pin) electrical connector retaining spring.

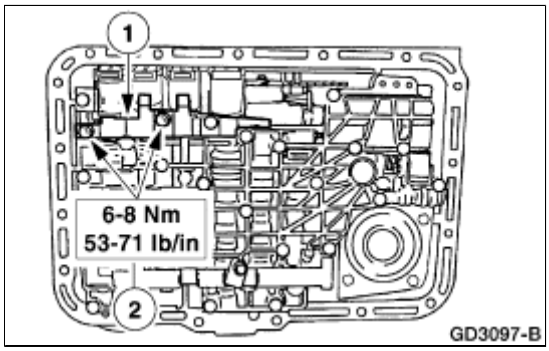


12. Install the EPC, SSD, and SSB solenoids.

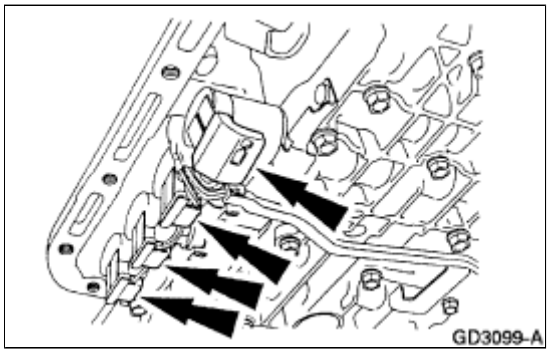


13. **CAUTION: The solenoid clamp must be installed in the TCC and EPC solenoid grooves, shift solenoid pockets and the No. 204 plug.**

    Install the solenoid clamp.
    1. Position the solenoid clamp on the main control valve body.
    2. Install the solenoid clamp screws.

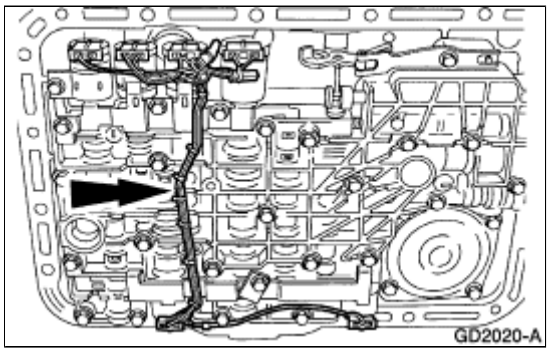


14. Connect the TCC, SSD, SSB, and EPC solenoid electrical connectors.



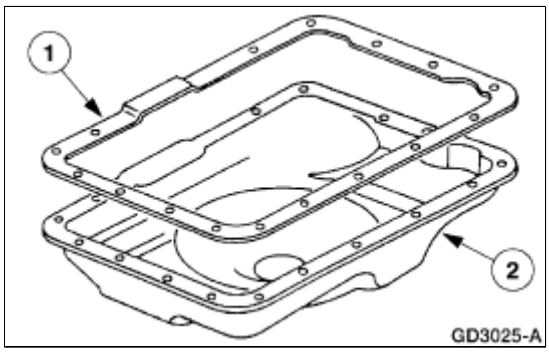
15. **CAUTION: Excessive pressure may break the retaining pins.**

    Install the wire loom guide and protector.
    - Align the retaining pins to the holes in the solenoid clamps and gently press in the wire loom guide and protector.

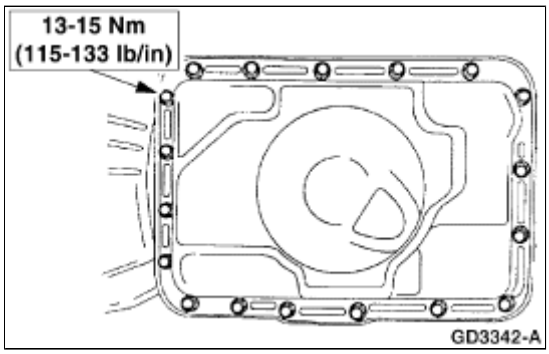


16. Install the transmission fluid pan.
    1. Install a new transmission fluid pan gasket on the transmission fluid pan.
    2. Install and align the transmission fluid pan.

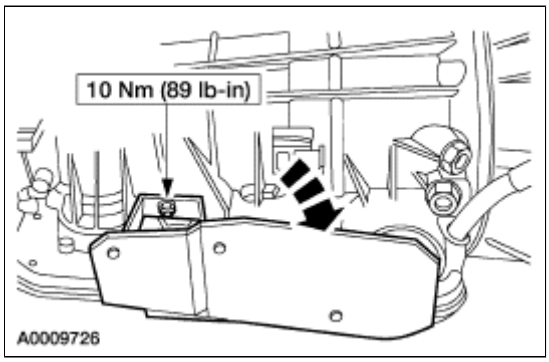
- Loosely install the transmission fluid pan screws.



17. Using a crisscross sequence, tighten the transmission fluid pan screws.



18. Position the servo heat shield over the servos and clip it to the pan rail.



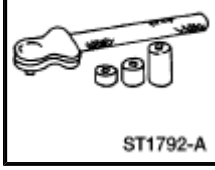
19. Lower the vehicle.

20. Connect the battery ground cable.

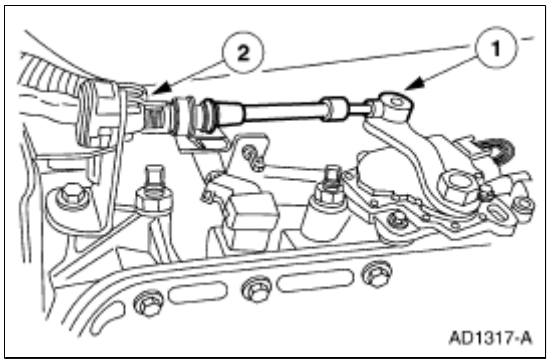
21. Fill transmission to proper fluid level and check for proper transmission operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

Front Band Adjustment

Special Tool(s)

 ST1792-A	Band Adjuster Wrench Kit 307-S022 (T71P-77370-A)

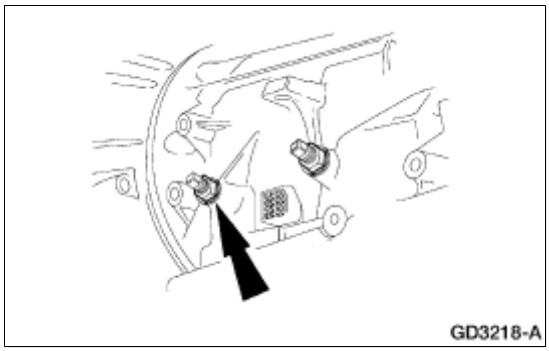
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise the vehicle on a hoist. For additional information, refer to Section 100-02 .
3. Disconnect the shift cable.
   1. Disconnect the shift cable from the manual control lever.
   2. Disconnect the shift cable from the bracket.



4. **CAUTION: Do not allow front band adjustment screw to back out. Band strut could fall out of position.**

   CAUTION: Throw the locknut away. The locknut is not reusable for assembly.

   Remove and discard the locknut.

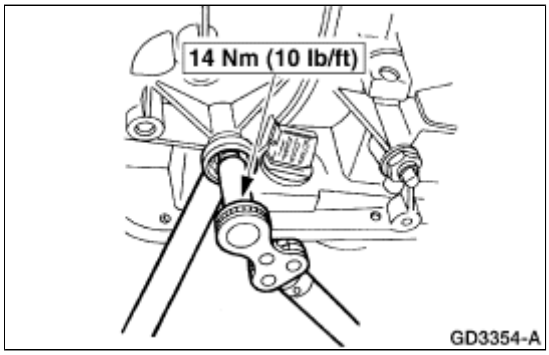


5. **CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.**

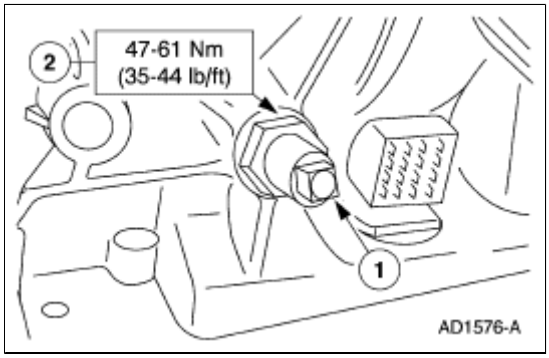
   CAUTION: The servo must be installed prior to band adjustment.

   NOTE: The wrench will click at the specified torque. Install new locknut, do not tighten at this time.

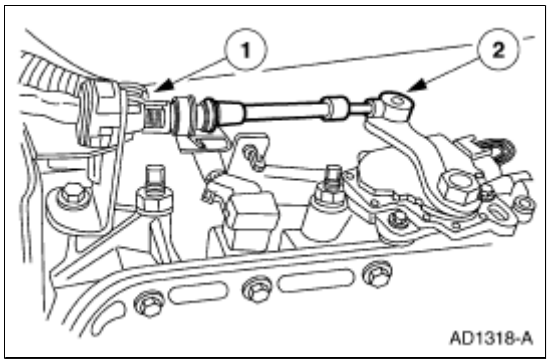
   Tighten front band adjustment screw using the Band Adjuster Wrench Kit and back off front band adjustment screw exactly two (2) turns and hold that position.



6. Tighten the front band locknut.
   1. Hold the front band adjustment screw stationary.
   2. Tighten the front band locknut.



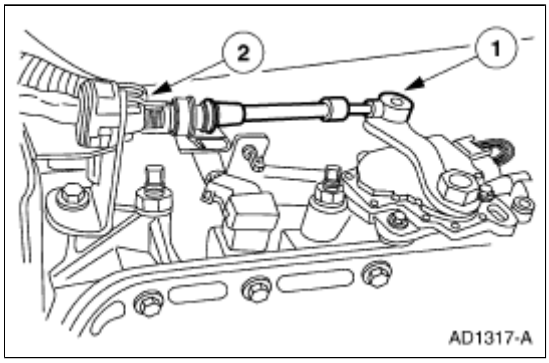
7. Install the shift cable.
   1. Install the shift cable.
   2. Install the shift cable to the manual control lever.



8. Lower the vehicle.

Intermediate Band Adjustment

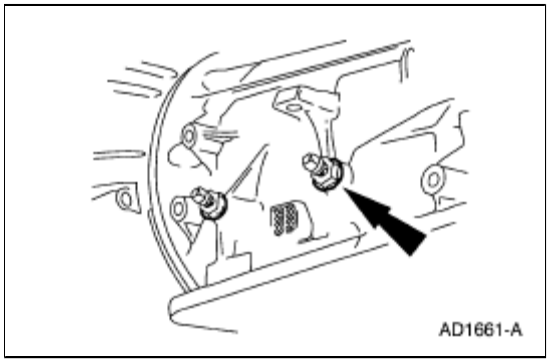
1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Remove the shift cable.
   1. Disconnect the shift cable from the manual control lever.
   2. Remove the shift cable from the bracket.



4. Remove the digital transmission range (TR) sensor. For additional information, refer to the Digital Transmission Range (TR) Sensor in this section.
5. **CAUTION: Do not allow the screw to back out. Band strut could fall out of position.**

   CAUTION: Throw the locknut away. The locknut is not reusable for assembly.

   Remove and discard the locknut.

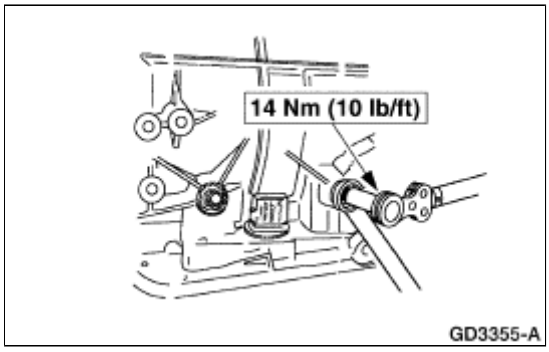


6. **CAUTION: Install, but do not tighten, a new locknut on the screw. Apply petroleum jelly to the locknut seal.**

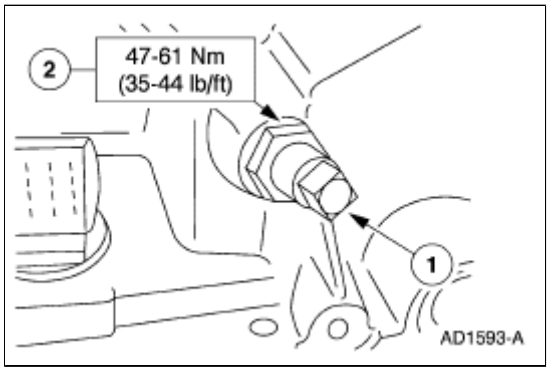
   CAUTION: The intermediate servo must be installed prior to band adjustment.

NOTE: The wrench will click at the specified torque. Install new locknut, do not tighten at this time.

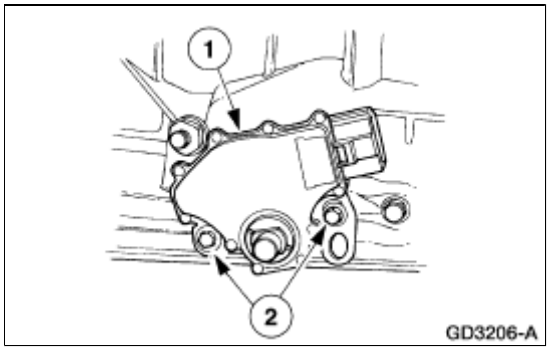
Tighten the screw using the Band Adjuster Wrench Kit and back off the screw exactly two (2) turns and hold that position.



7. Tighten the intermediate band locknut.
    1. Hold the screw stationary.
    2. Tighten the intermediate band locknut.



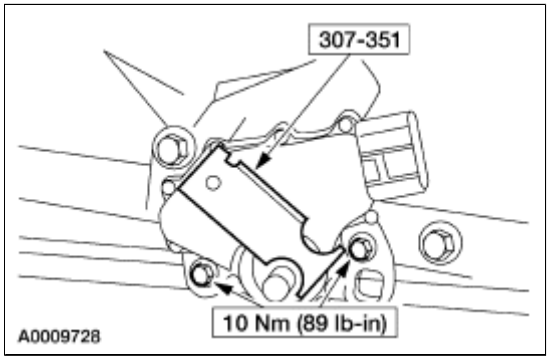
8. Install the digital TR sensor.
    1. Position the digital TR sensor.
    2. Loosely install the screws.



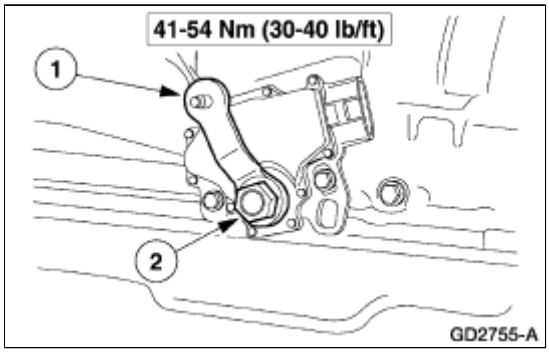
9. **CAUTION: Tightening one screw before tightening the other can cause the sensor to bind or become damaged.**

NOTE: The manual lever must be in the neutral position.

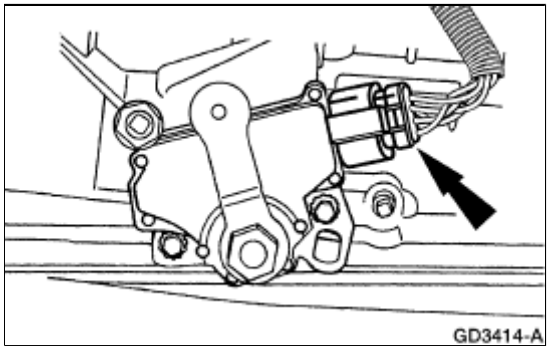
Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence.



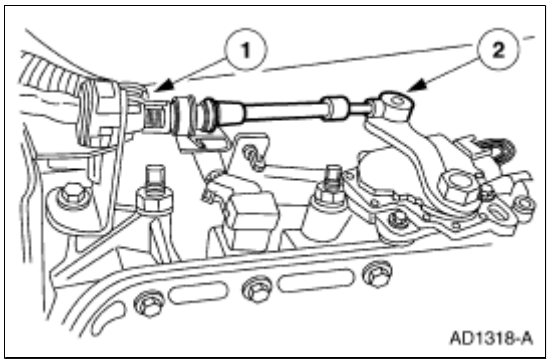
10. Install the manual control outer lever.
    1. Install the manual control outer lever.
    2. Install the manual control outer lever nut.



11. Connect the digital transmission range (TR) sensor electrical connector.



12. Connect the shift cable.
    1. Connect the shift cable to the bracket.
    2. Connect the shift cable to the manual control lever.

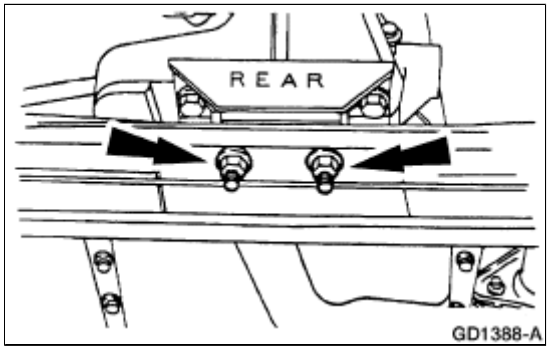


13. Verify that the shift cable is adjusted. For additional information, refer to Section 307-05 .
14. Lower the vehicle.
15. Connect the battery ground cable.

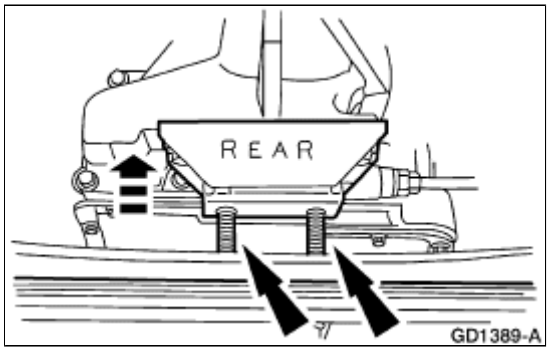
Transmission Insulator and Retainer

Removal

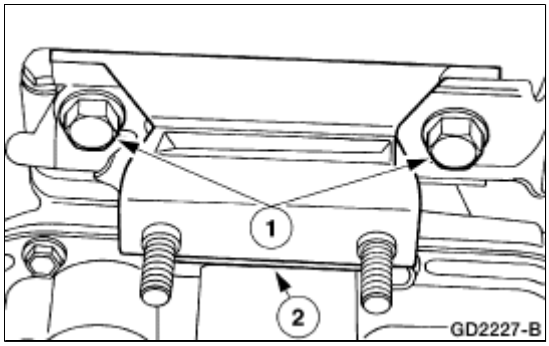
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .
2. Remove the transmission mount nuts.



3. Raise and support the transmission.

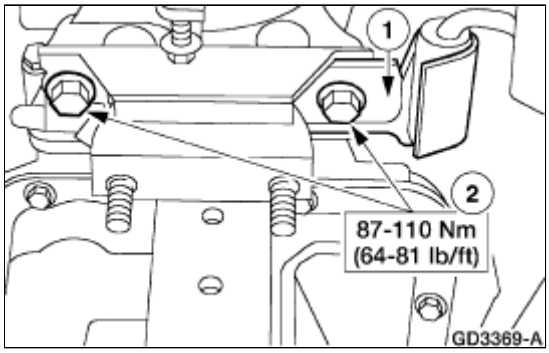


4. Remove the transmission mount.
    1. Remove the screws.
    2. Remove the transmission mount.

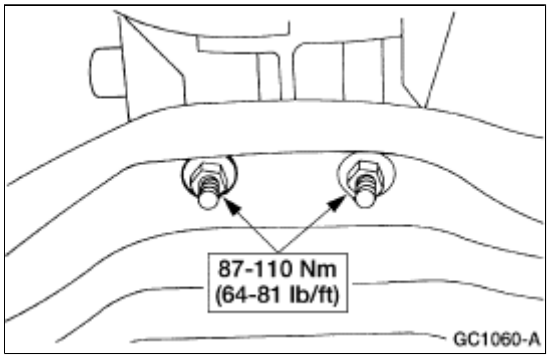


Installation

1. Install the transmission mount.
    1. Position the transmission mount on the extension housing.
    2. Install the transmission mount-to-extension housing screws.



2. Install the transmission mount into the crossmember and tighten the nuts.



3. Lower the vehicle.

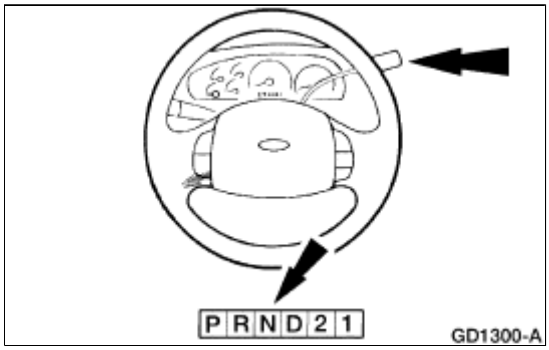
Transmission

Special Tool(s)

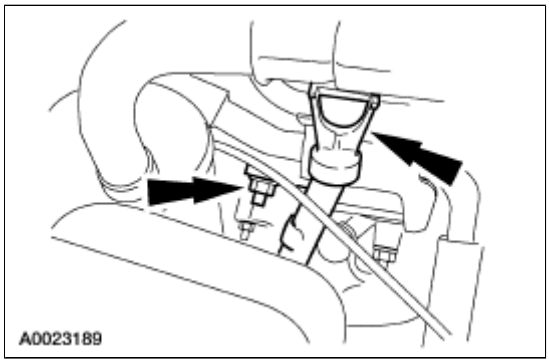
 ST1636-A	Torque Converter Holding Tool 307-346 (T97T-7902-A)

NOTE: If the transmission is to be removed for a period of time, support the engine with a safety stand and a wood block.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 .
2. Place the selector lever in NEUTRAL position.



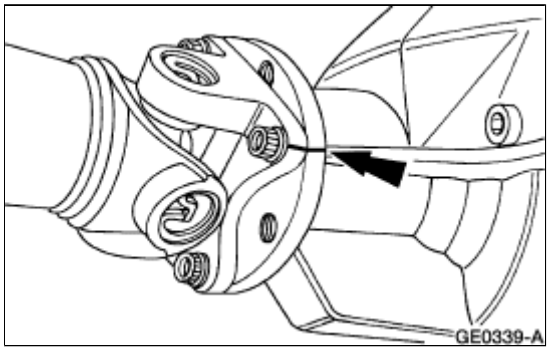
3. For vehicles equipped with a 4.0L SOHC engine, remove the nut and the transmission fill tube and indicator as an assembly.



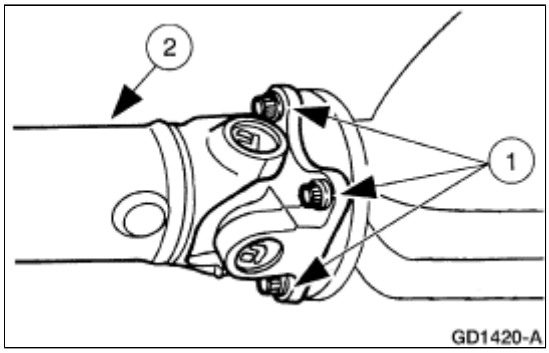
4. Raise and support the vehicle. For additional information, refer to Section 100-02 .
5. If transmission disassembly is required; drain the transmission fluid. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

6. Vehicles equipped with 4WD, remove the transfer case. For additional information, refer to Section 308-07B .

7. To maintain initial driveshaft balance, mark the driveshaft yoke and axle flange, so they can be installed in their original positions.



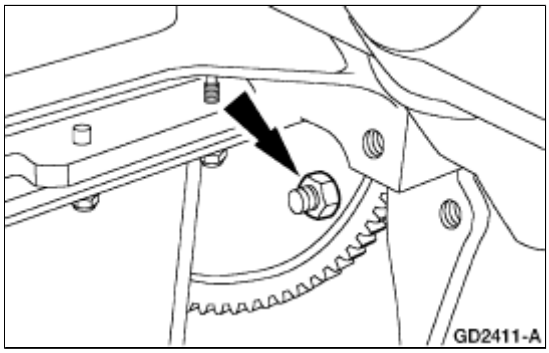
8. Remove the rear driveshaft.
    1. Remove the four bolts.
    2. Remove the driveshaft.



9. Remove the starter motor. For additional information, refer to Section 303-06 .

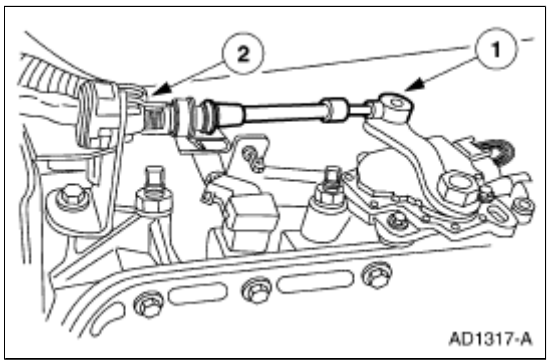
10. **NOTE:** Mark the torque converter and the flexplate for correct alignment at reinstallation.

    Remove the four nuts.
    - Rotate the crankshaft for access to the flexplate nuts.

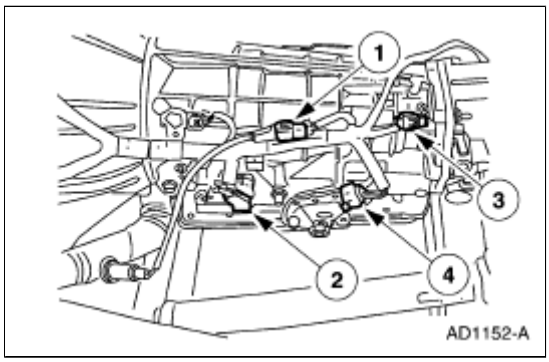


11. Disconnect the shift cable.
    1. Disconnect the shift cable from the manual control lever.

2. Disconnect the shift cable from the bracket.



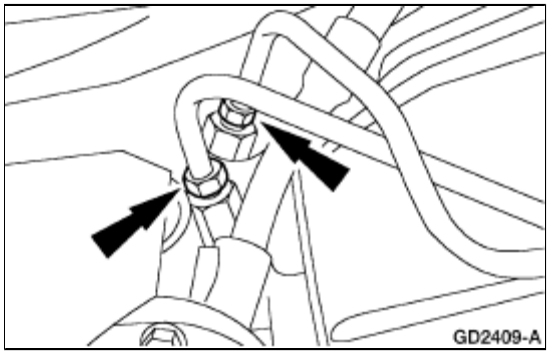
12. Remove the transmission wiring harness.
    1. Disconnect the heated oxygen sensor (HO2S) connector.
    2. Disconnect the transmission connector.
    3. Disconnect the output shaft speed (OSS) sensor connector.
    4. Disconnect the digital transmission range (TR) sensor connector.



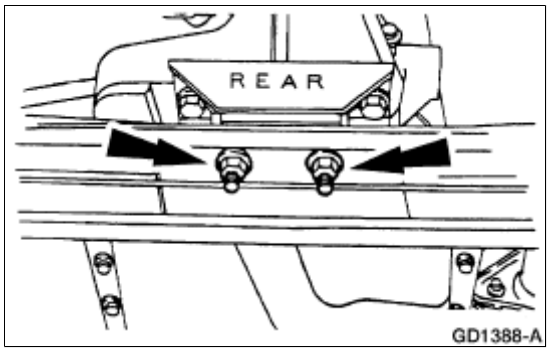
13. Remove the LH three-way catalytic converter. For additional information, refer to Section 309-00 .

14. **CAUTION: Care should be taken not to damage the cooler lines.**

    Hold the case fitting and remove the transmission cooler lines.

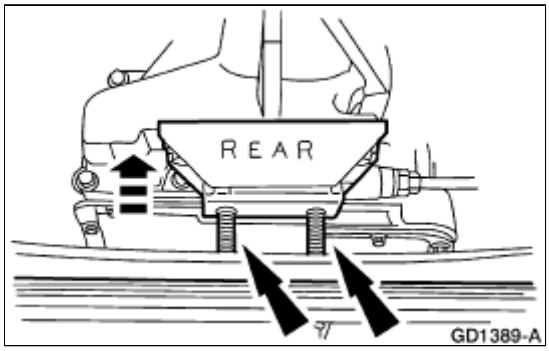


15. Remove the nuts.

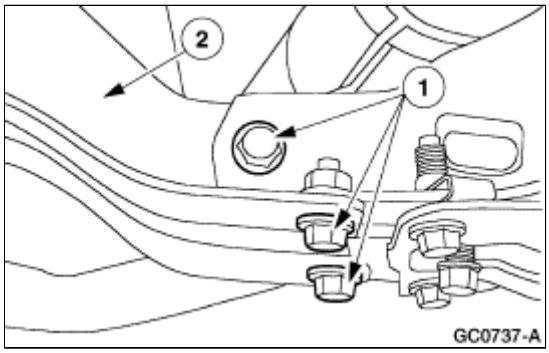


16. **CAUTION: Do not allow the transmission to hang freely.**

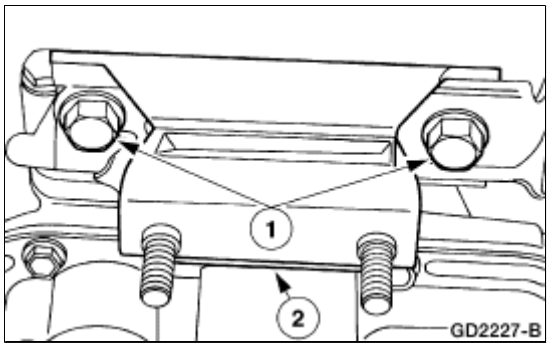
    Position the High-Lift Transmission Jack under the transmission.
    Raise and support the transmission.



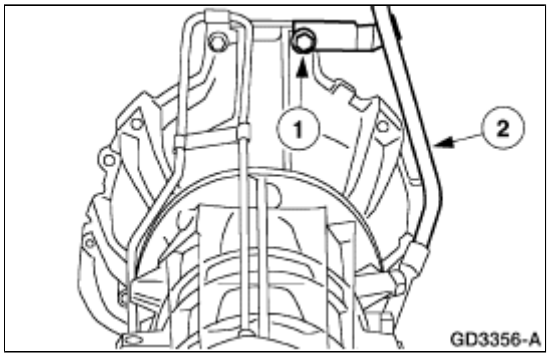
17. Remove the crossmember.
    1. Remove the six bolts (three each side).
    2. Remove the crossmember.



18. Remove the transmission mount.
    1. Remove the screws.
    2. Remove the transmission mount.

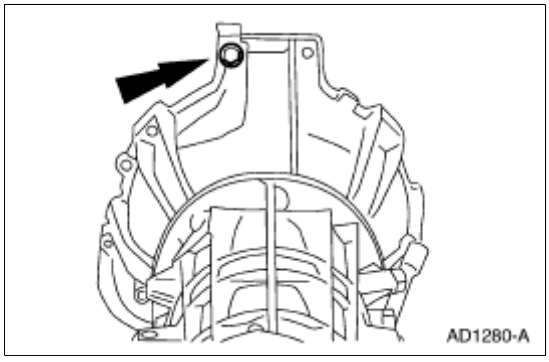


19. For vehicles equipped with a 4.0L EI engine, remove the upper filler tube.
    1. Remove the screw.
    2. Remove the upper filler tube.

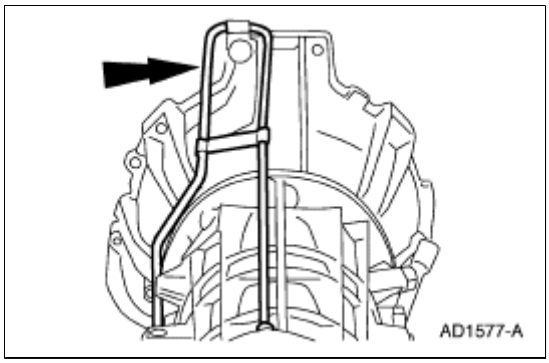


20. **NOTE:** Lower the High-Lift Jack to gain access to the screws.

    Remove the transmission-to-engine screws.

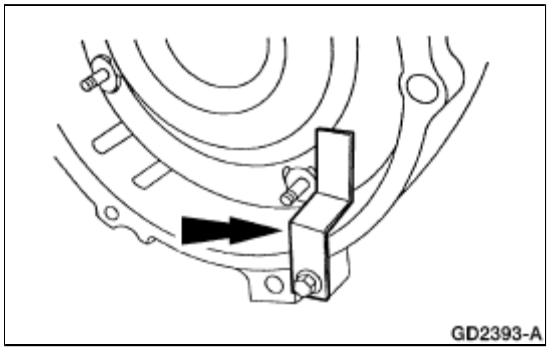


21. On 4x4 models remove the vent tube.



22. **WARNING: The torque converter is heavy and may result in injury if it falls out of the transmission. Secure the torque converter in the transmission. Failure to follow these instructions may result in personal injury.**

    Install the Torque Converter Holding Tool before lowering the transmission from the vehicle.



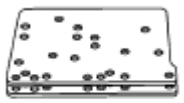
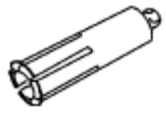
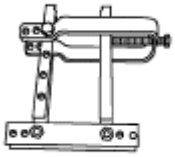
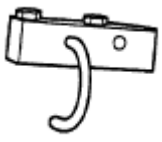
23. **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

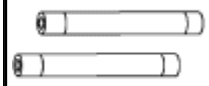
    Lower the transmission.

24. Carry out the Transmission Fluid Cooler Back Flushing/Cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Transmission

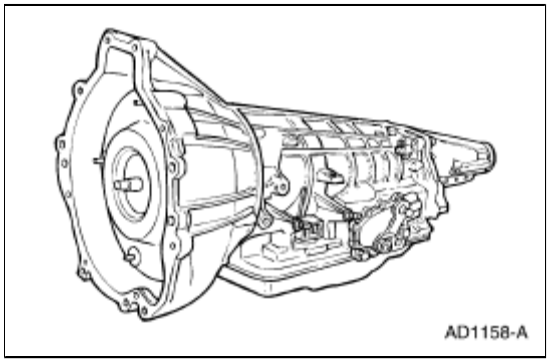
Special Tool(s)

 ST1637-B	Transmission Test Plate 307-342 (T95L-77000-AH)
 ST1759-A	A4LD Holding Fixture Adapter 307-262 (T93T-77002-AH)
 ST1186-A	Holding Fixture 307-003 (T57L-500-B)
	Housing Bushing Remover 308-070 (T77L-7697-E)
 ST1185-A	Impact Slide Hammer 100-001 (T50T-100-A)
 ST1758-A	Seal Remover 307-309 (T94P-77001-BH)
 ST1760-A	Servo Cover Compressor 307-340 (T95L-77028-A)

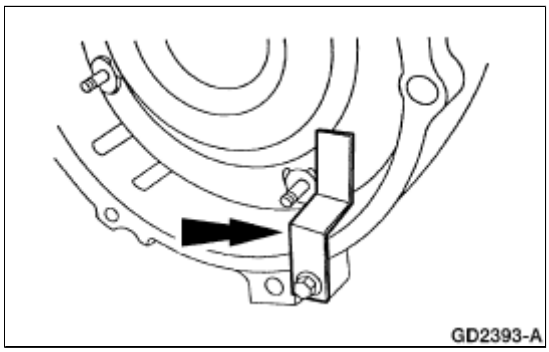
 ST1770-B	Servo Removal Tool 307-347 (T97T-7D021-A)
 ST1631-A	Torque Converter Handles 307-091 (T81P-7902-C)
 ST1636-A	Torque Converter Holding Tool 307-346 (T97T-7902-A)

1. **WARNING: Do not remove the torque converter or the transfer case from the transmission while still on the jack, doing so could cause the transmission to fall. Failure to follow these instructions may result in personal injury.**

   Place the transmission on a workbench.

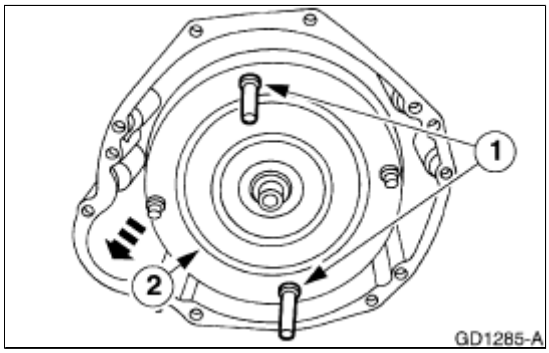


2. Remove the Torque Converter Holding Tool.



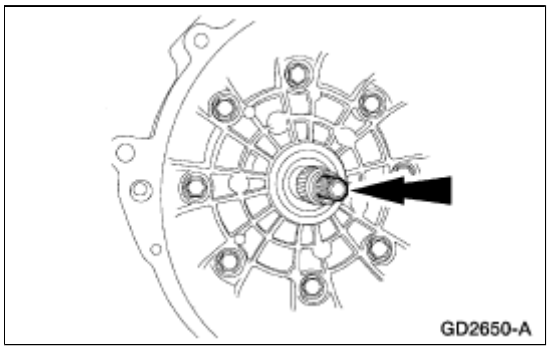
3. **WARNING: The torque converter is heavy, especially when full of fluid. Failure to follow these instructions may result in personal injury.**

   Using Torque Converter Handles, remove the torque converter.
   1. Install the Torque Converter Handles.
   2. Remove the torque converter.

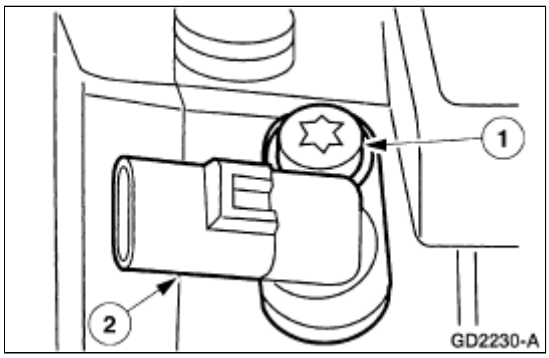


4. **NOTE:** The splines on the input shaft are not the same on both ends. The end with the shorter spline goes into the assembly.

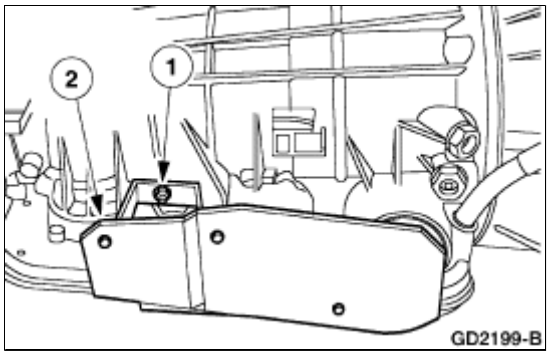
   Remove the input shaft.



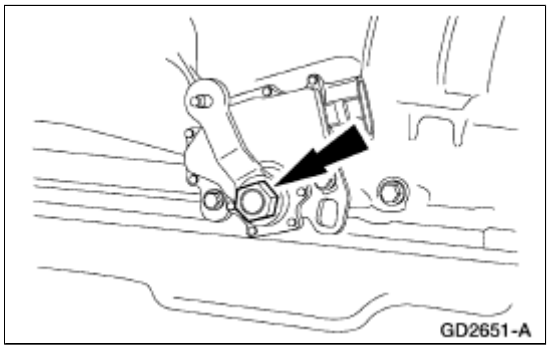
5. Remove output shaft speed (OSS) sensor.
   1. Remove the OSS screw.
   2. Remove OSS sensor.



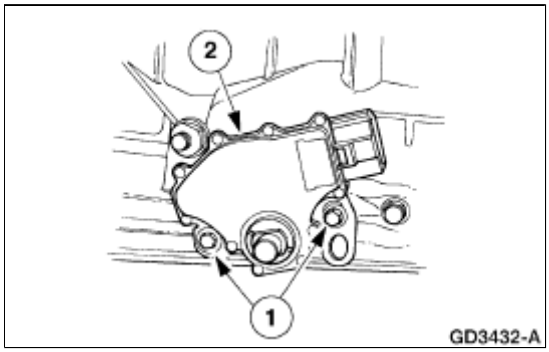
6. Remove transmission servo heat shield.
   1. Remove the nut.
   2. Remove the transmission servo heat shield.



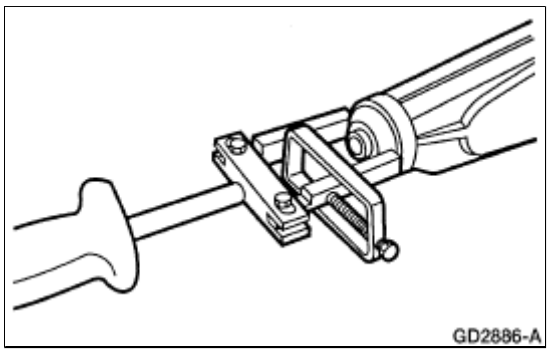
7. Remove manual control outer lever nut and manual control outer lever.



8. Remove the digital transmission range (TR) sensor.
    1. Remove the screws.
    2. Remove the digital TR sensor.

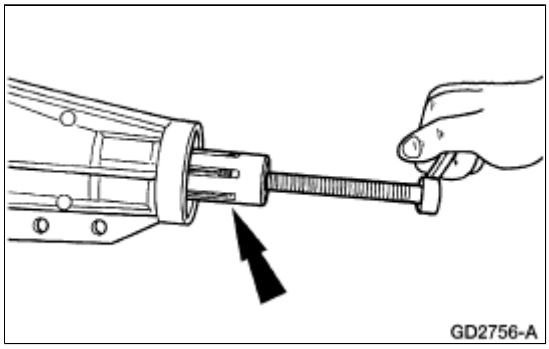


9. Use Seal Remover and Impact Slide Hammer and remove extension housing seal.



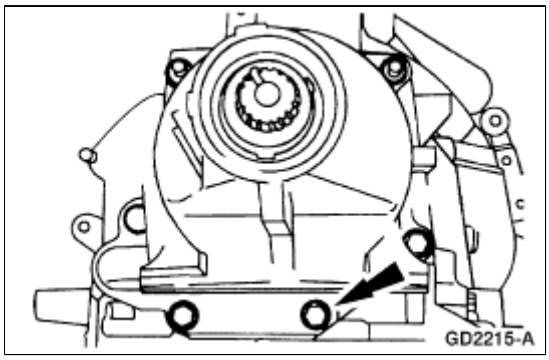
10. **NOTE:** Remove the extension housing bushing only if service is required.

    Use the Housing Bushing Remover to remove the extension housing bushing.
    - Inspect the extension housing bushing and driveshaft slip-yoke for nicks, gauges, scoring, and wear.

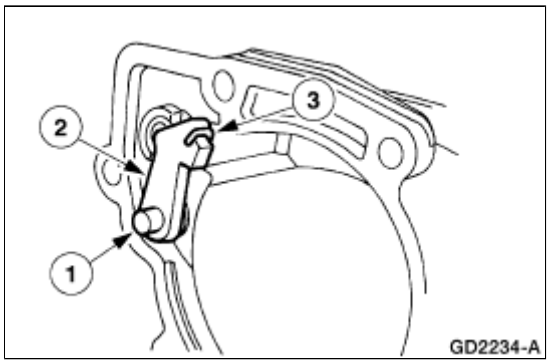


11. **CAUTION: The parking pawl, parking pawl return spring and parking pawl shaft could fall out during removal of the extension housing.**

    Remove the screws, studs, and the extension housing.
    - Discard the extension housing gasket.



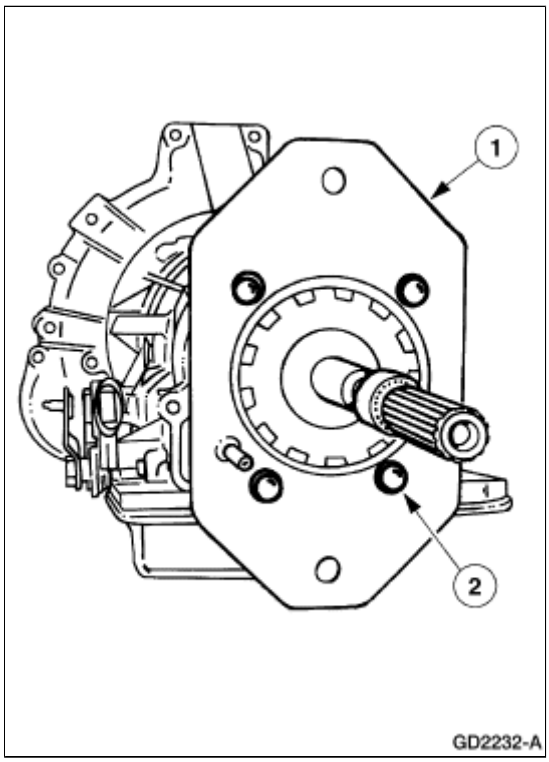
12. Remove the parking pawl assembly.
    1. Remove the parking pawl shaft.
    2. Remove the parking pawl.
    3. Remove the parking pawl return spring.



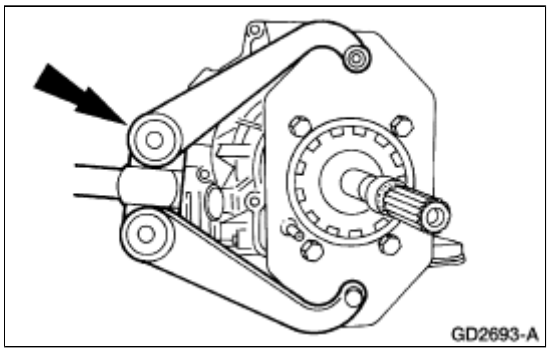
13. **CAUTION: The parking pawl actuating rod must slip freely into the clearance hole in the adapter plate.**

    NOTE: See the special service tool chart for a drawing of this optional adapter plate.

    Install the A4LD Holding Fixture Adapter.
    1. Position the A4LD Holding Fixture Adapter on the rear of the transmission case.
    2. Install the screws.

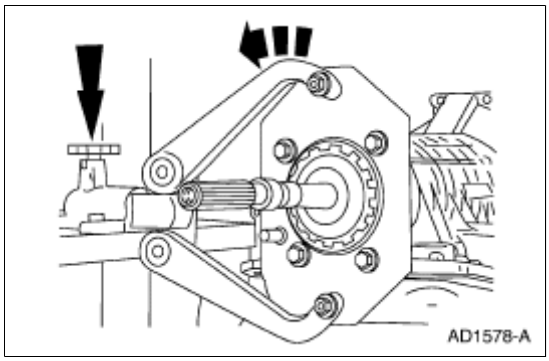


14. Attach the fixture arm of Holding Fixture to the A4LD Holding Fixture Adapter.



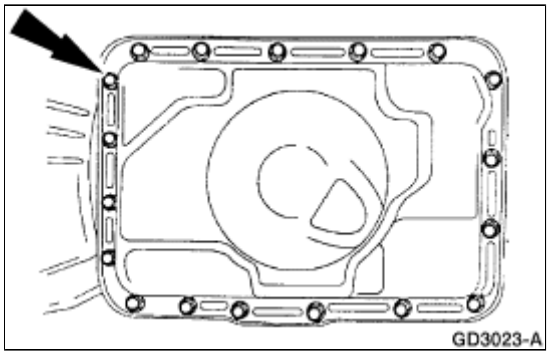
15. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

    Install the transmission into the Holding Fixture. Rotate transmission so fluid pan is facing up.

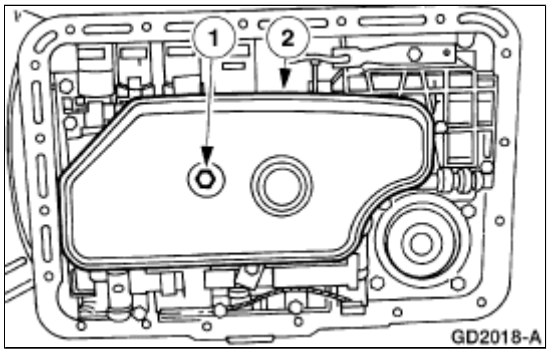


16. **CAUTION: Do not reuse the fluid pan gasket.**

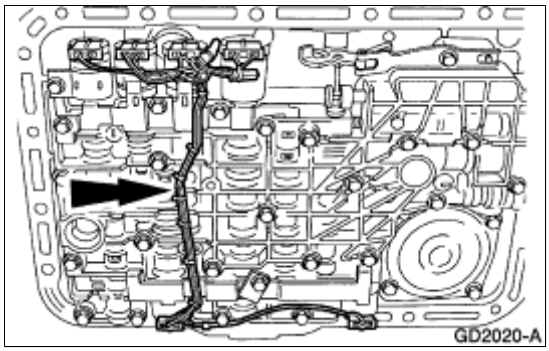
    Remove the transmission fluid pan and transmission pan gasket and then discard gasket.



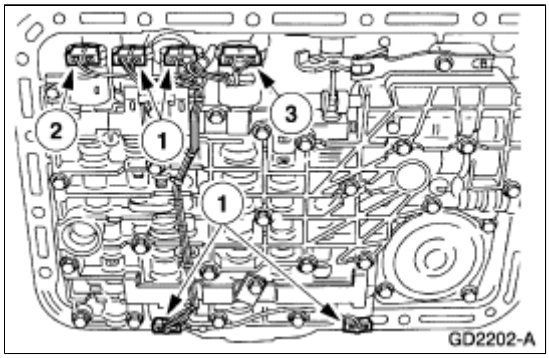
17. Remove the transmission fluid filter and discard.
    1. Remove the screw.
    2. Remove the transmission fluid filter.



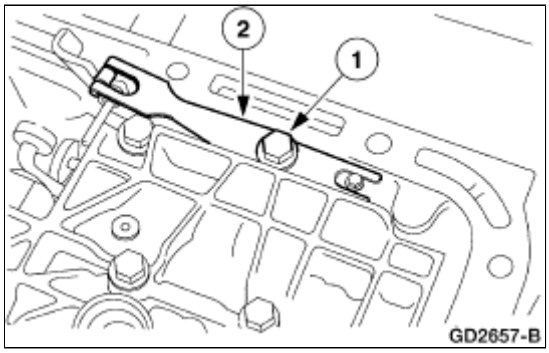
18. Carefully lift up on the wire loom guide and protector. Disengage the retaining pins from the solenoid clamps.



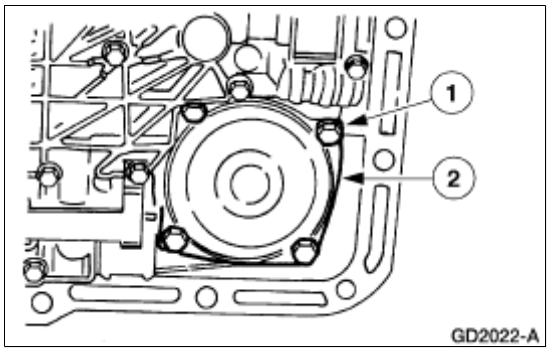
19. Disconnect the solenoid electrical connectors.
    1. Disconnect the SSA, SSB, SSC, and the SSD electrical connectors.
    2. Disconnect the torque converter clutch (TCC) solenoid electrical connector.
    3. Disconnect the electronic pressure control (EPC) solenoid electrical connector.



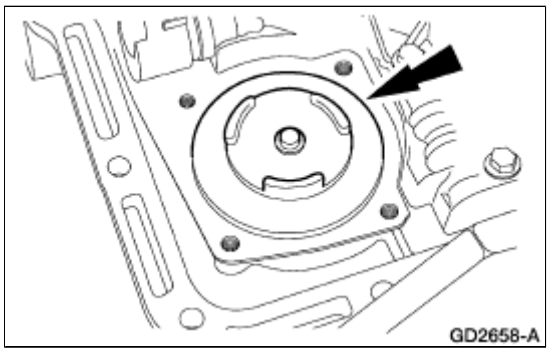
20. Remove the manual control valve detent lever spring.
    1. Remove the screw.
    2. Remove the manual control valve detent lever spring.



21. Remove the low/ reverse band servo cover.
    1. Remove the screws.
    2. Remove the low/reverse band servo cover and the low/ reverse servo separator plate cover gasket.
       - Discard the low/reverse servo separator plate cover gasket.

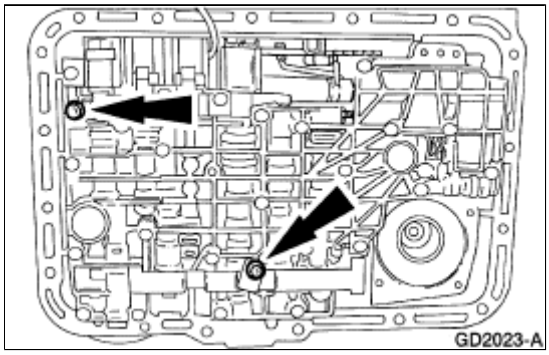


22. Remove the low/reverse band servo piston and rod assembly.

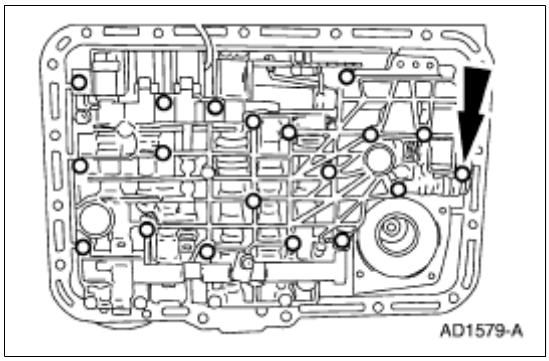


23. **CAUTION: To prevent solenoid valves from falling out, do not remove the two screws shown below.**

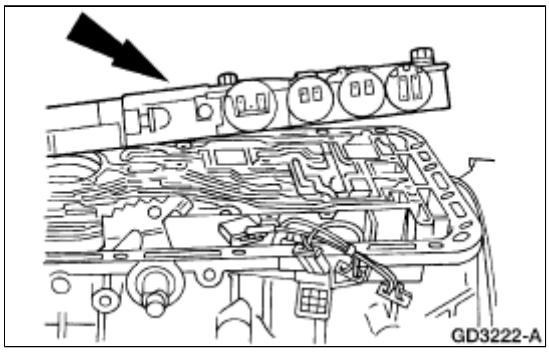
    Do not remove the two (gold colored) screws specified.



24. Remove the twenty-three body screws.

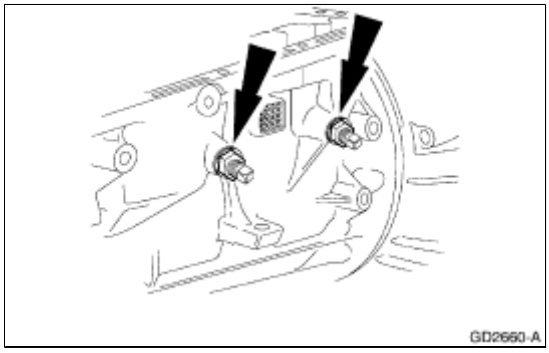


25. Remove the main control valve body, valve body separator plate and main control to separator plate gasket.
    - Discard gaskets.



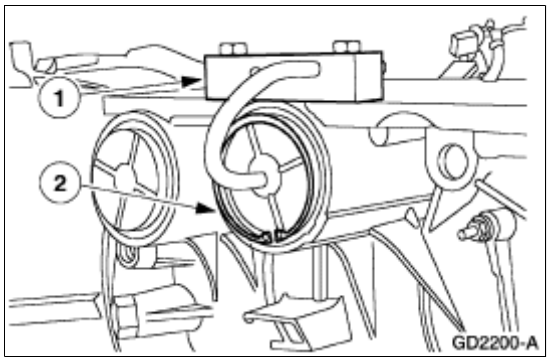
26. **CAUTION: Throw the locknuts away. The locknuts are not reusable for assembly.**

    Remove the locknuts. Back off the screws.



27. **CAUTION: Servo cover is under spring tension.**

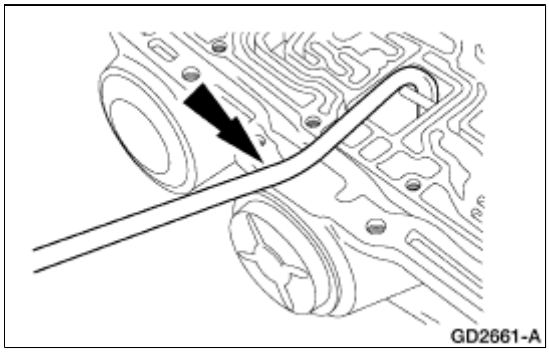
    Remove the intermediate servo cover retaining ring.
    1. Install Servo Cover Compressor and compress the intermediate servo cover.
    2. Remove the intermediate servo cover retaining ring.
    - Remove Servo Cover Compressor.



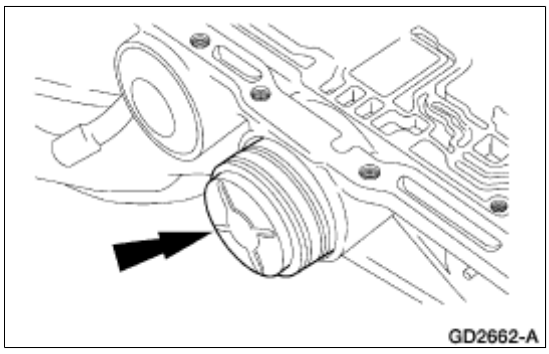
28. **NOTE:** Tag the servo cover, piston and spring. Label accordingly for assembly. The covers have letters cast on the outer surface for identification.

    NOTE: Use Servo Removal Tool to prevent damage to the servo, cover and bore.

    Use Servo Removal Tool to release the intermediate band servo piston.

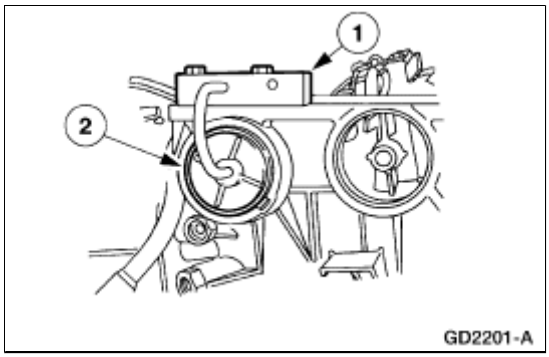


29. Remove the intermediate band servo cover, piston and spring.



30. **CAUTION: Servo cover is under spring tension.**

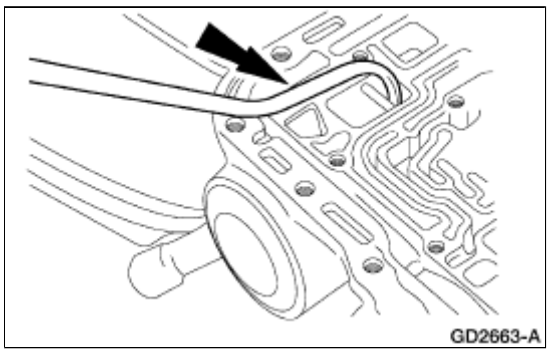
    Remove the overdrive servo cover.
    1. Install Servo Cover Compressor and compress the overdrive servo cover.
    2. Remove the overdrive servo cover retaining ring.
       - Remove Servo Cover Compressor.



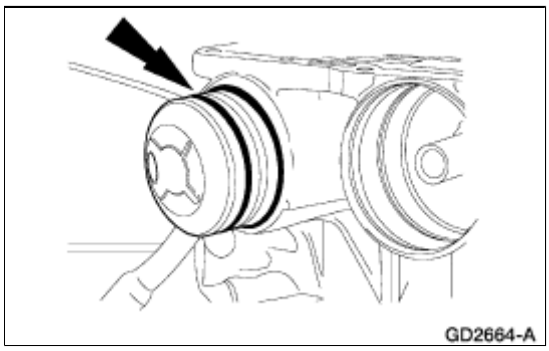
31. **NOTE:** Tag the servo cover, piston and servo piston spring. Label accordingly for assembly. The covers have letters cast on the outer surface for identification.

    NOTE: Use the Servo Removal Tool to prevent damage to the servo piston and bore.

    Use Servo Removal Tool to release the overdrive band servo piston.



32. Remove the overdrive band servo cover, piston and spring.

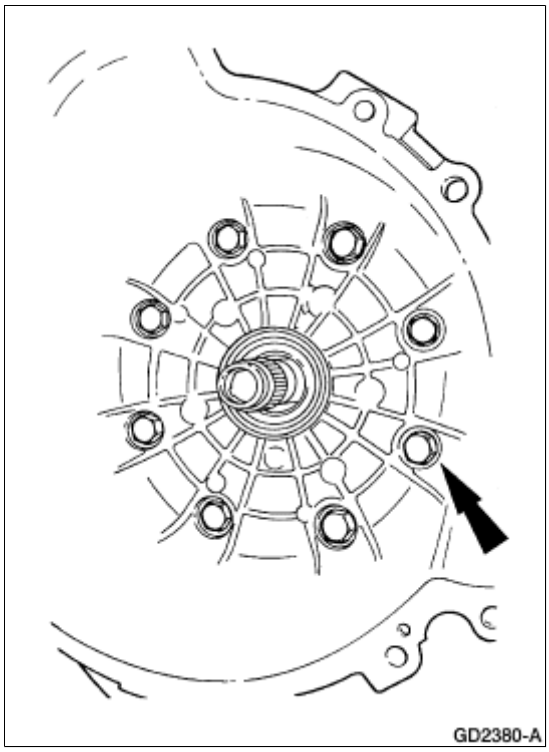


33. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

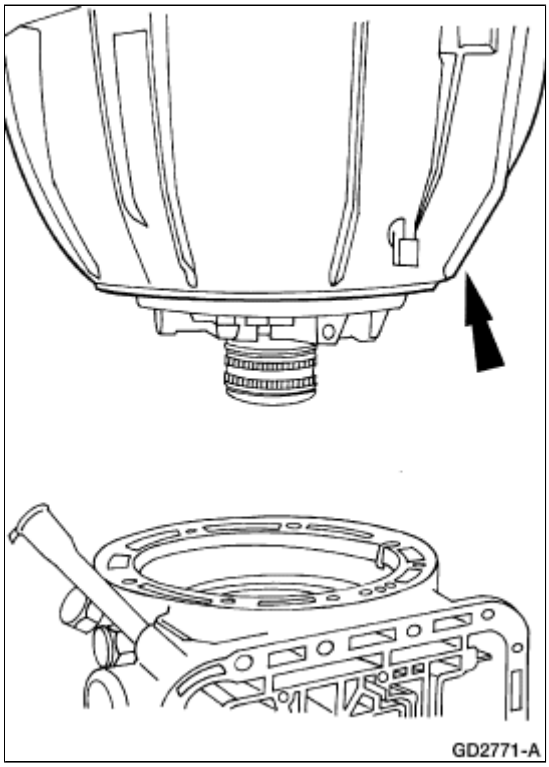
    Rotate the transmission so the converter housing faces up.

34. **CAUTION: Discard the screws. The screws are not reusable for assembly.**

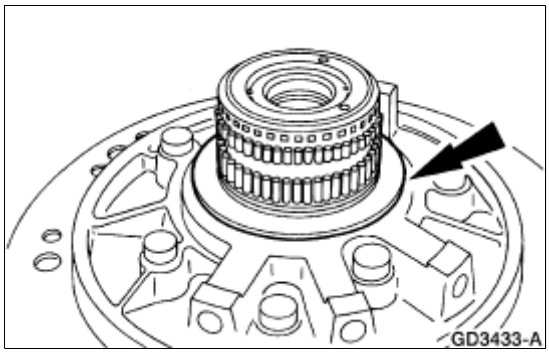
    Remove and discard the screws.



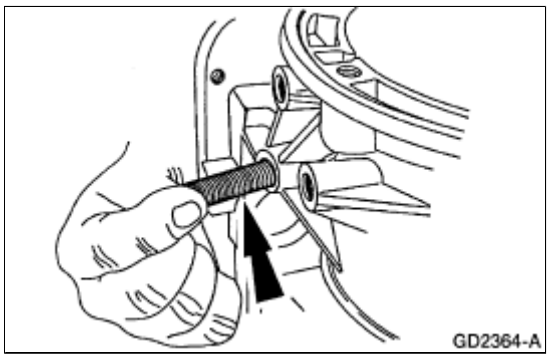
35. Remove the converter housing and fluid pump support.
    - Turn and lift the converter housing and fluid pump support from the case.



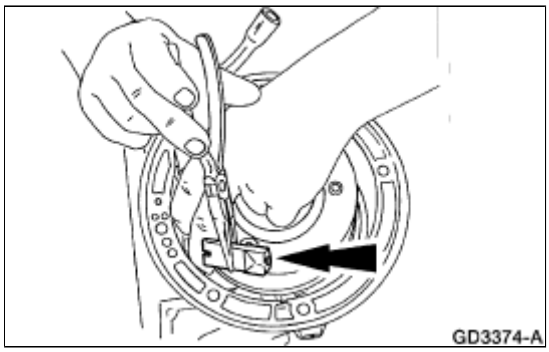
36. Remove the fluid pump input thrust washer (No. 1).
    - Tag and identify the thrust washer.



37. Remove the front band adjusting screw.

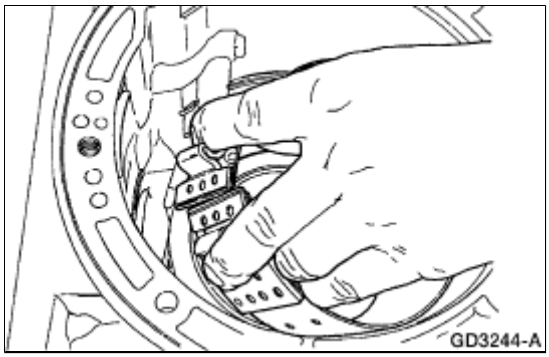


38. Compress the front band around the front brake and coast clutch drum and remove the front band anchor strut.

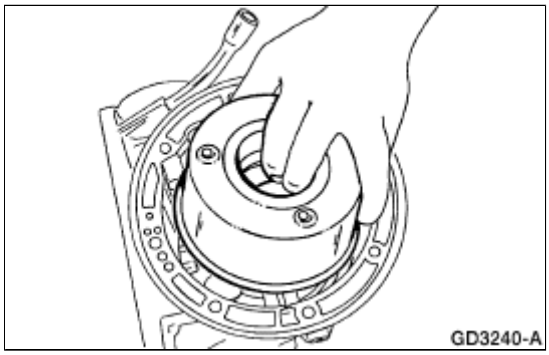


39. **CAUTION: Identify the anchor and apply ends of the front band.**

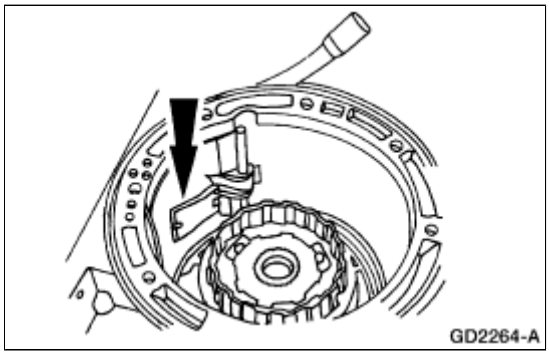
Remove the front band.



40. Remove the front brake and coast clutch drum.

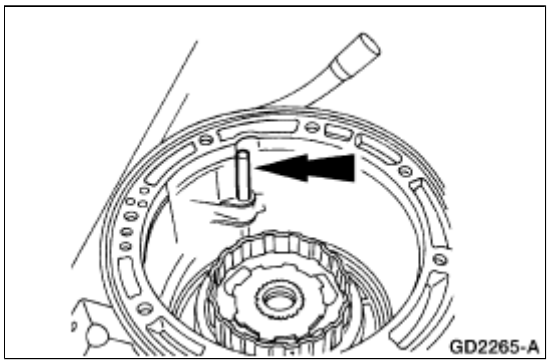


41. Remove the front band apply strut.



42. **NOTE:** The front band lever shaft is longer than the intermediate band lever shaft.

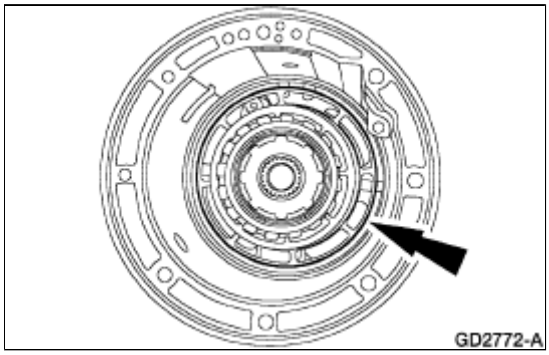
    Remove the front band actuating lever shaft.



43. **CAUTION: Do not bend trigger wheel.**

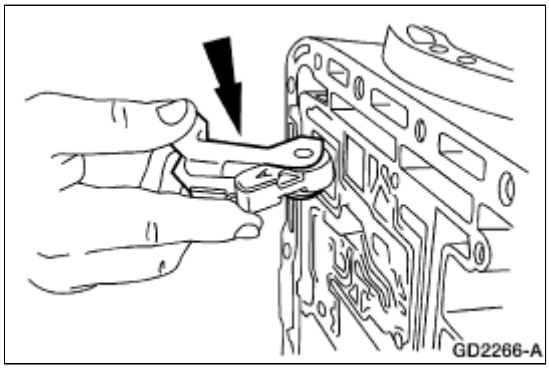
    NOTE: The No. 2 thrust bearing is in this assembly.

    Remove the planetary gear front carrier.

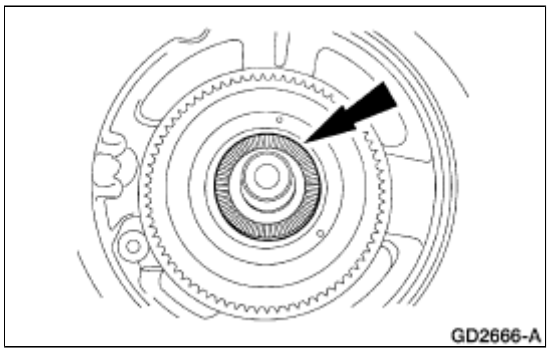


44. **NOTE:** Tag and identify the front band servo lever. The front band servo lever has a letter stamped on the side.

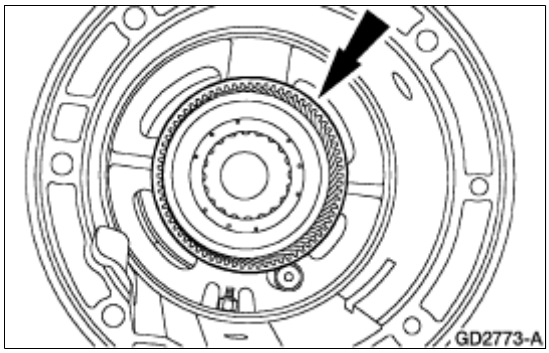
    Remove the front band servo lever and front band lever to case bracket.



45. Remove the front planet thrust bearing (No. 2).

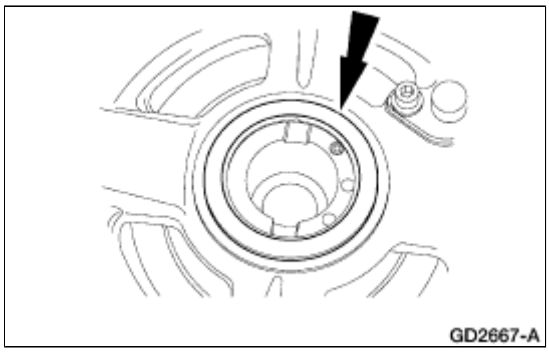


46. Remove the front ring gear, front one-way clutch assembly, and center shaft as an assembly.



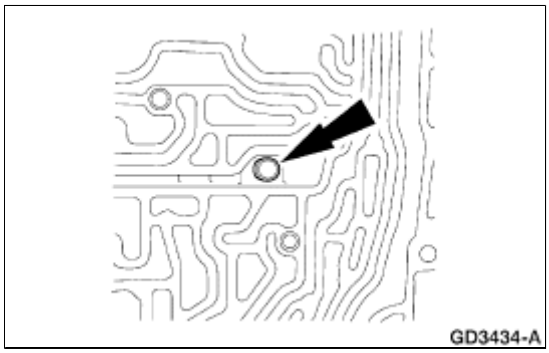
47. **NOTE:** Tag and identify the center shaft thrust bearing (No. 3) for assembly.

    Remove the No. 3 center shaft thrust bearing.

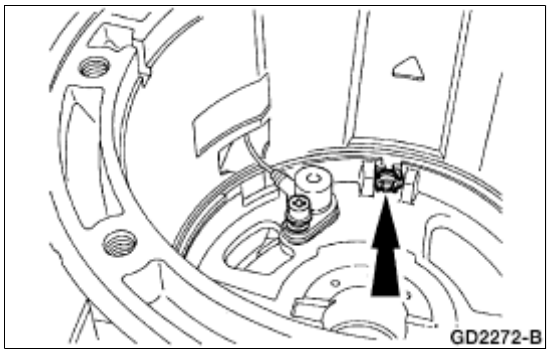


48. **CAUTION: The center support locknut could fall into the remaining assembly if not removed.**

    Remove the center support cap screw.



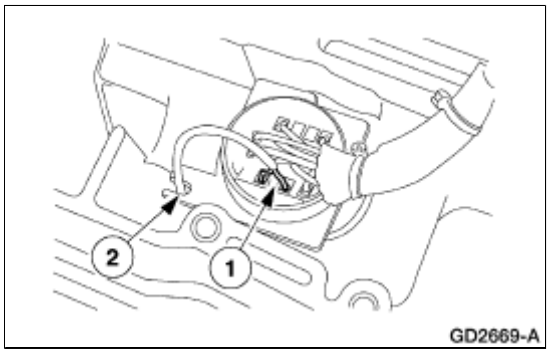
49. Remove the locknut and cage.



50. **CAUTION: Do not pry on other wires or damage the connector or case surface.**

Disconnect the turbine shaft speed (TSS) sensor electrical connector.

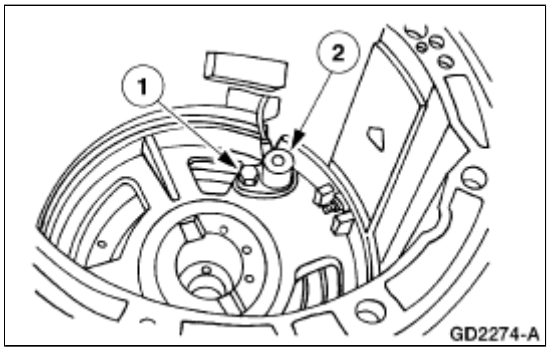
1. Remove the TSS sensor electrical connector from the transmission case (16 pin) electrical connector.
2. Remove the TSS sensor connector wires from wire locator.



51. **CAUTION: Carefully route the TSS connector and wiring into the transmission through the opening in the case.**

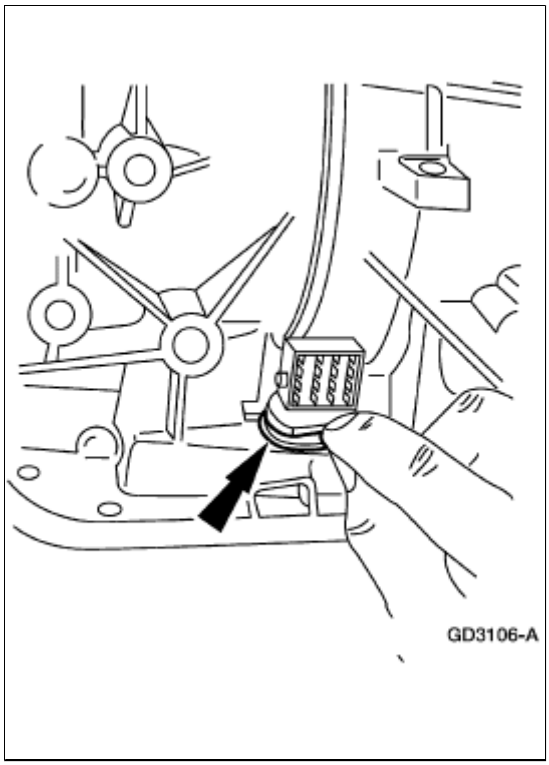
Remove the TSS sensor.

1. Remove the screw.
2. Remove the TSS sensor.



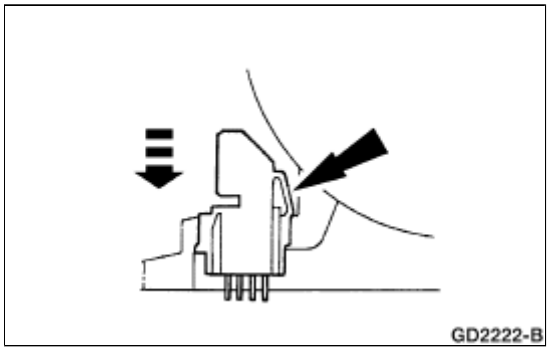
52. **CAUTION: Do not overstretch the retaining spring.**

Remove the transmission case (16 pin) electrical connector retaining spring.

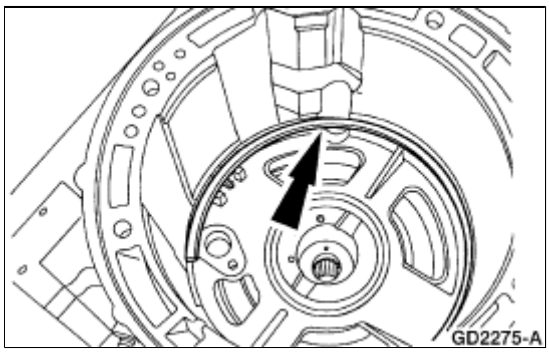


53. **CAUTION: Do not damage the connector or harness.**

Compress the tabs on the transmission case (16 pin) electrical connector.
Push the transmission case (16 pin) electrical connector out of transmission case.

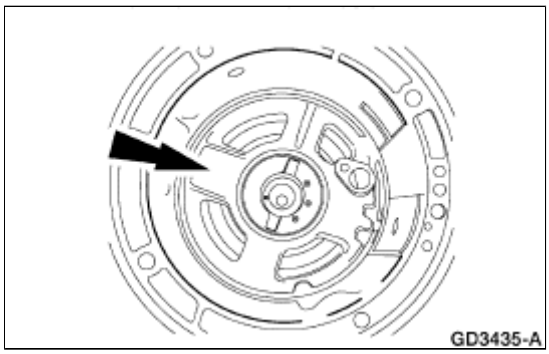


54. Remove the center support retaining ring.



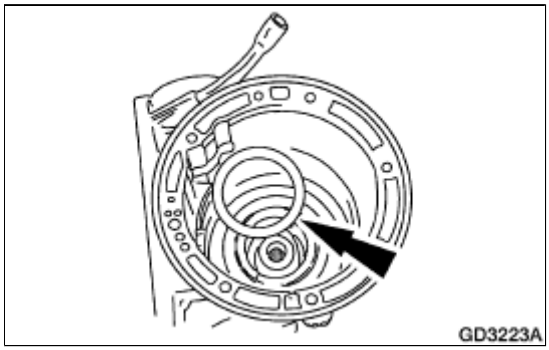
55. **NOTE:** When removing the center support, pull evenly around the center support web.

    Remove the center support.

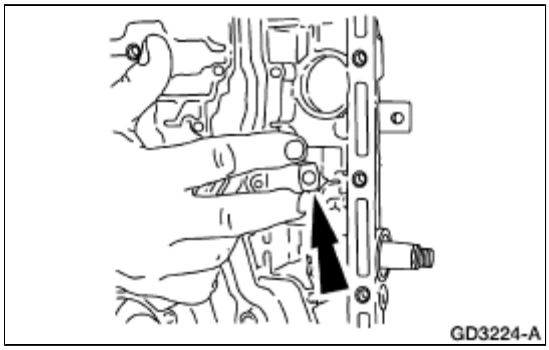


56. **NOTE:** Tag and identify the No. 4 intermediate brake drum thrust bearing.

    Remove the intermediate brake drum thrust bearing (No. 4).

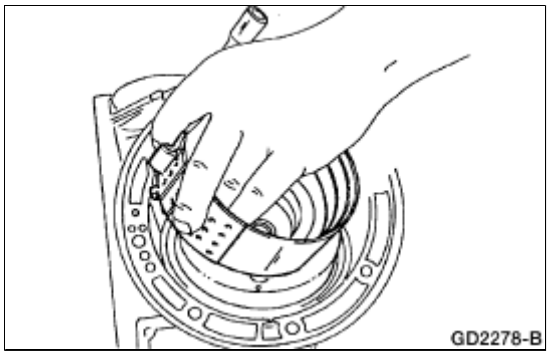


57. Remove the intermediate band anchor strut and adjusting screw.

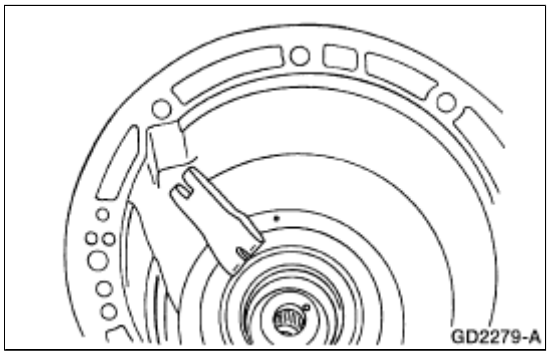


58. **CAUTION: Identify the anchor and apply ends of the intermediate band.**

    Remove the intermediate band.

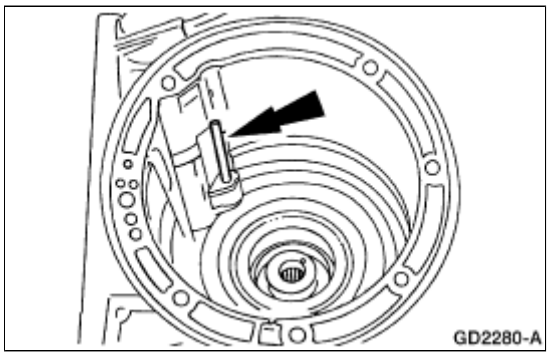


59. Remove the intermediate band apply strut.



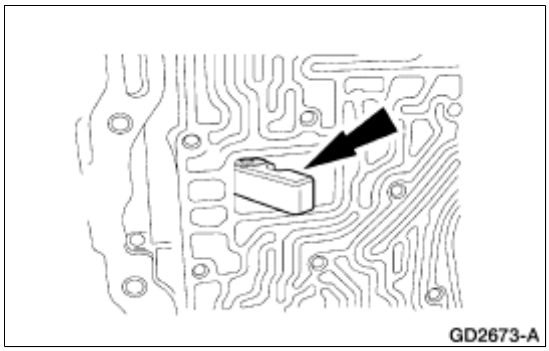
60. **NOTE:** The intermediate band lever shaft is shorter than the front band lever shaft.

    Remove the intermediate band actuating lever shaft.



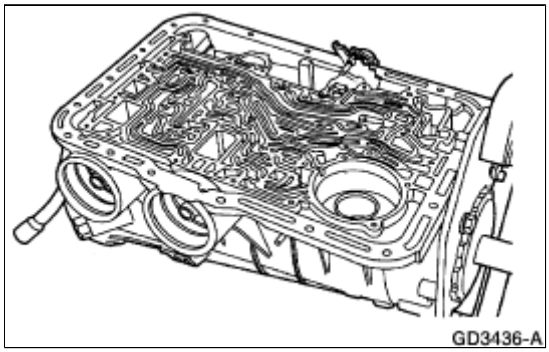
61. **NOTE:** Tag and identify the intermediate servo band lever. The intermediate servo band lever has a letter stamped into its side.

    Remove the intermediate servo actuating lever.



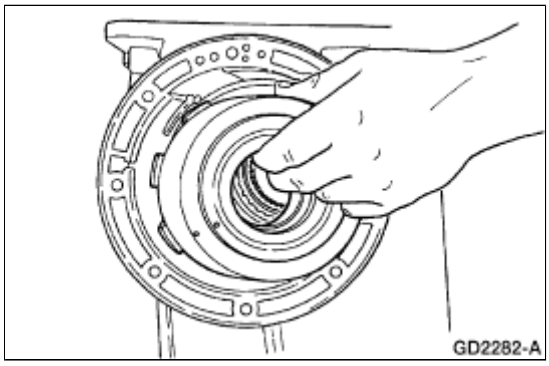
62. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

Rotate the transmission so the transmission fluid pan surface is facing up.

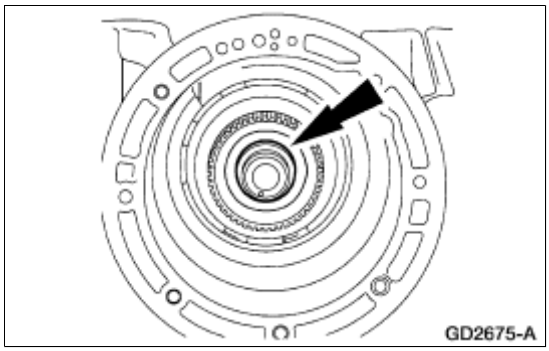


63. **NOTE:** The forward clutch cylinder thrust bearing (No. 5) may come out with the intermediate brake and direct clutch drum.

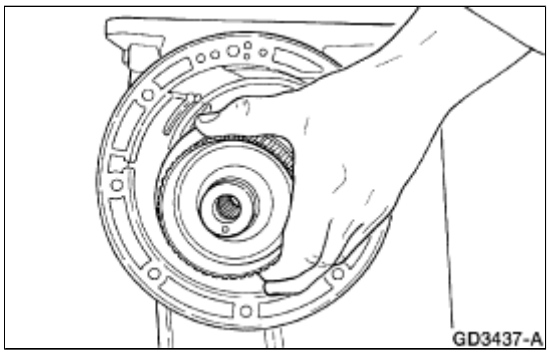
Remove the intermediate brake and direct clutch drum.



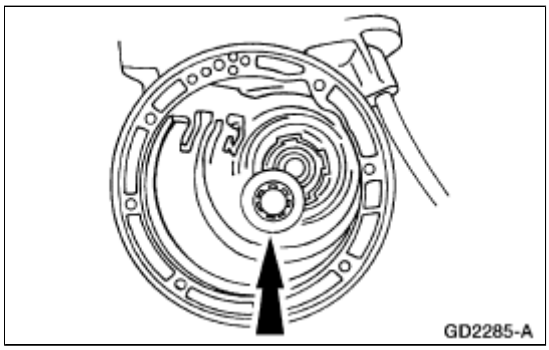
64. Remove the forward clutch cylinder thrust bearing (No. 5); tag and identify.



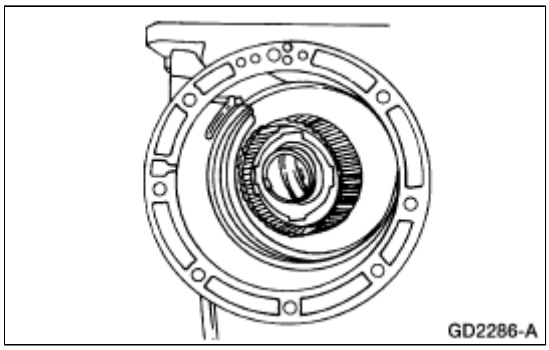
65. Remove the forward clutch cylinder.



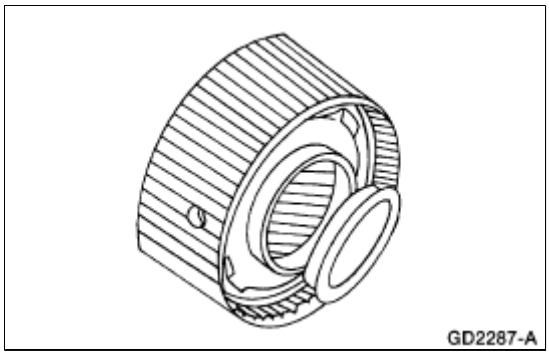
66. Remove the forward ring gear hub thrust bearing (No. 6A).



67. Remove the forward ring gear and forward ring gear hub as an assembly.

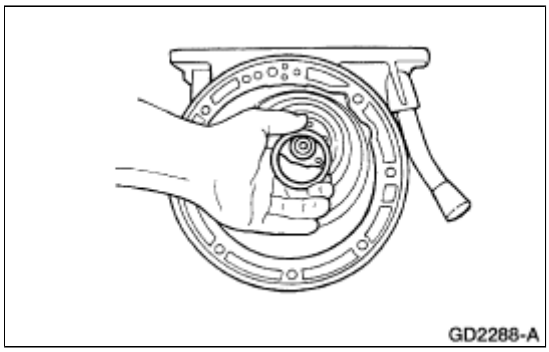


68. Remove forward clutch thrust washer (No. 6B) from the forward ring gear hub.

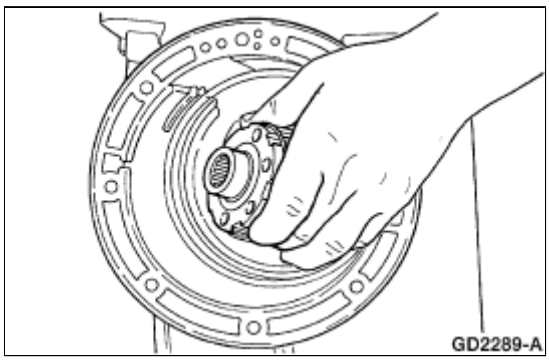


69. **NOTE:** Check black oxidized side during removal to ensure correct placement during reassembly. Black oxidized side must be toward planetary assembly. The uncoated side must face up.

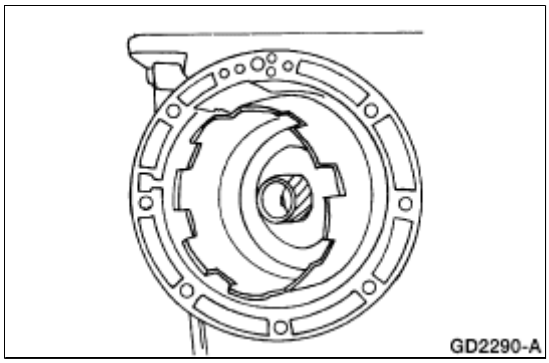
    Remove the forward planet thrust bearing (No. 7).



70. Remove the forward planetary assembly.

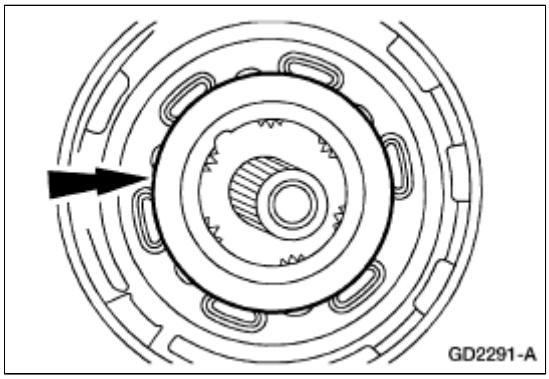


71. Remove input shell with the forward sun gear.

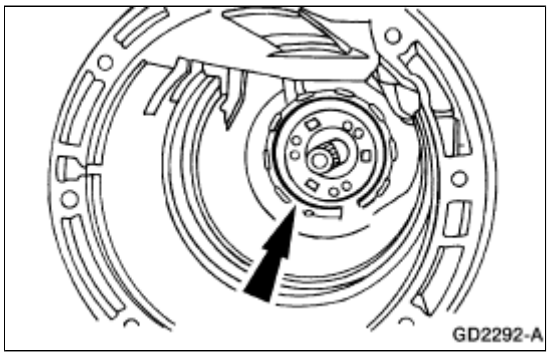


72. **NOTE:** Tag and identify the low/reverse planetary carrier thrust bearing (No. 8).

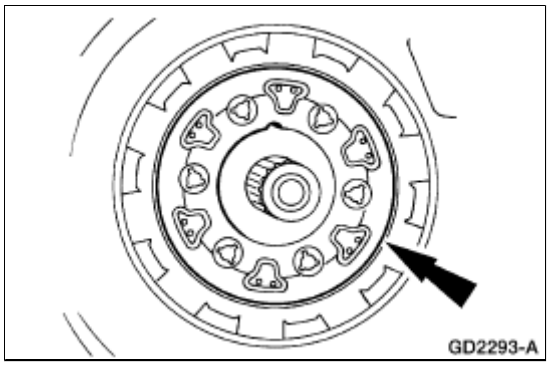
    Remove the low/reverse planetary carrier thrust bearing (No. 8).



73. Remove the low/reverse planetary retaining ring.

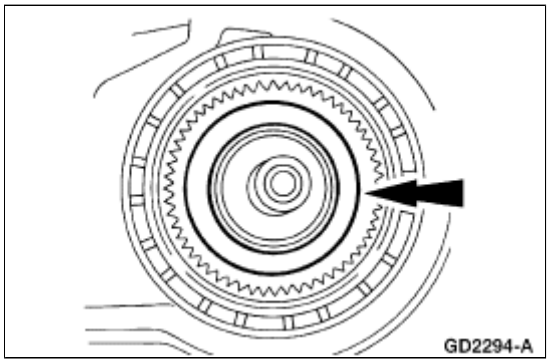


74. Remove low/reverse planetary assembly.

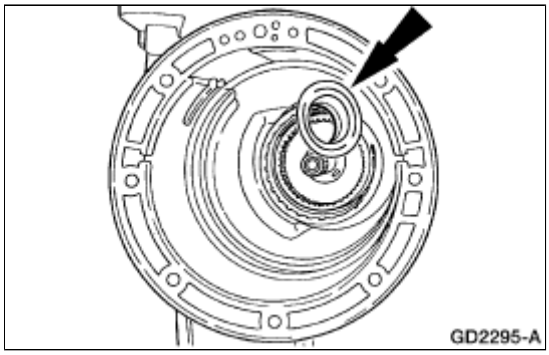


75. **NOTE:** Tag and identify the low/reverse planetary carrier thrust bearing (No. 9).

    Remove the low/reverse planetary carrier thrust bearing (No. 9).

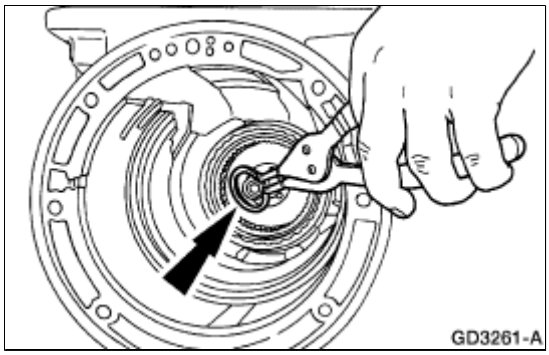


76. Remove the output shaft sleeve.

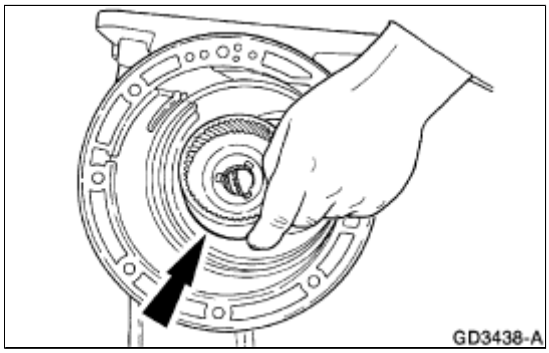


77. **CAUTION: Discard the output shaft retaining ring. A new retaining ring must be used for assembly.**

    Remove and discard the output shaft retaining ring.

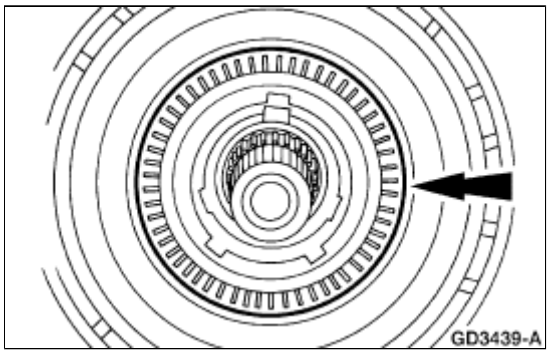


78. Remove the output shaft ring gear and the output shaft hub.



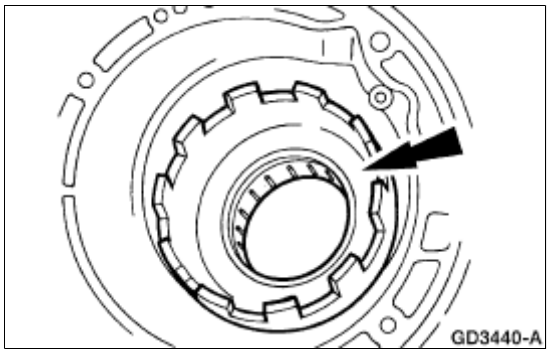
79. **NOTE:** Tag and identify the output shaft hub thrust bearing (No. 10).

    Remove the output shaft thrust bearing (No. 10).

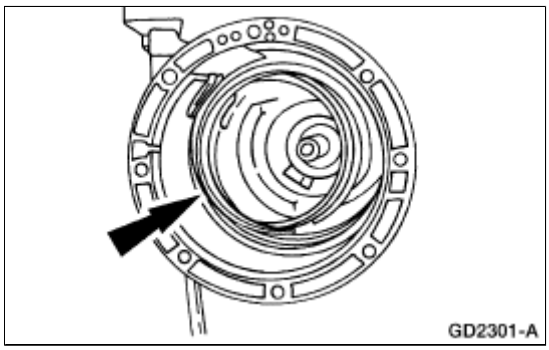


80. **NOTE:** The inner race of the rear one-way clutch is not removable. It is serviced in the case.

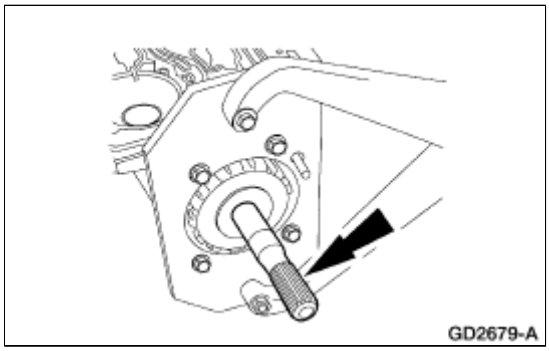
    Remove the low/ reverse brake drum and one-way clutch assembly.



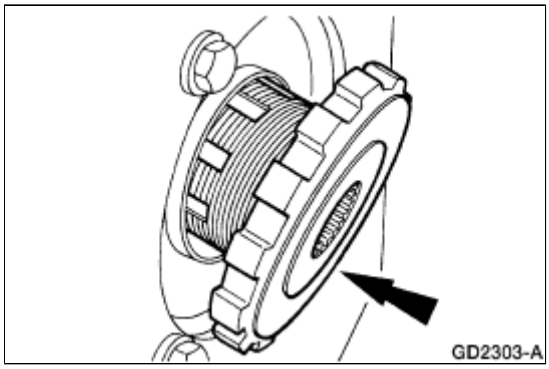
81. Remove the reverse band.



82. Remove the output shaft.

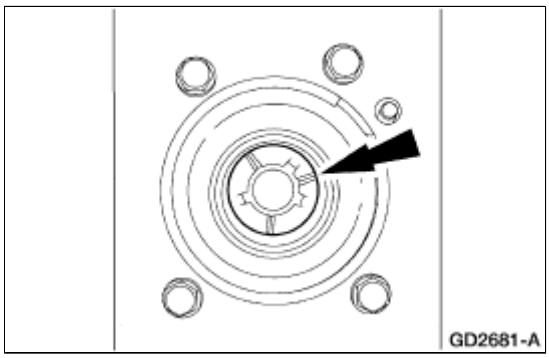


83. Remove the park gear.



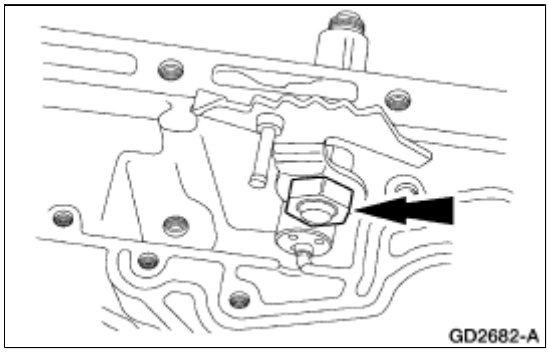
84. **NOTE:** Tag and identify the output shaft thrust washer (No. 11).

Remove the output shaft thrust washer (No. 11).

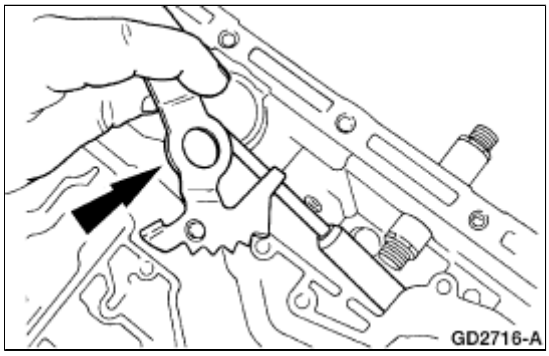


85. **CAUTION: To avoid damage, make sure wrench does not strike the manual valve inner lever pin.**

Remove the manual control valve inner lever nut.



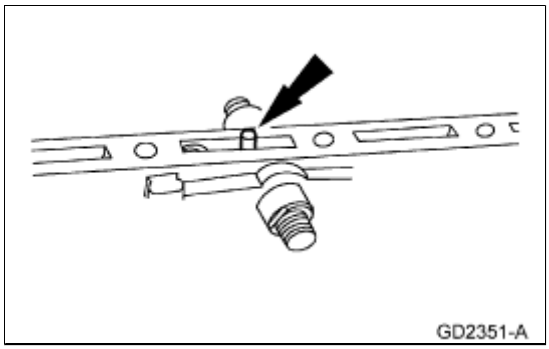
86. Remove the manual control valve inner lever and the parking lever actuating rod.



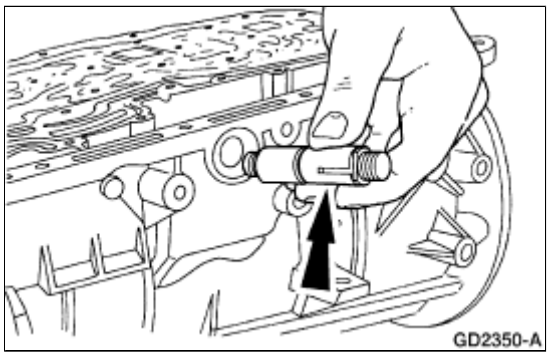
87. **CAUTION: Do not damage the case fluid pan rail.**

Remove the manual control lever shaft spring pin.

- Tap lightly on each side of the manual control lever shaft spring pin with a drift punch.
- Pry the spring pin out of its bore.

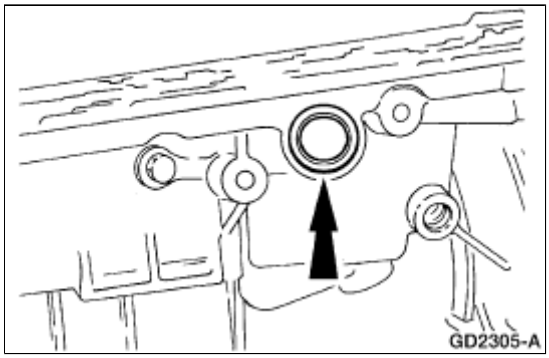


88. Remove the manual control lever shaft.



89. **CAUTION: Do not damage the bore.**

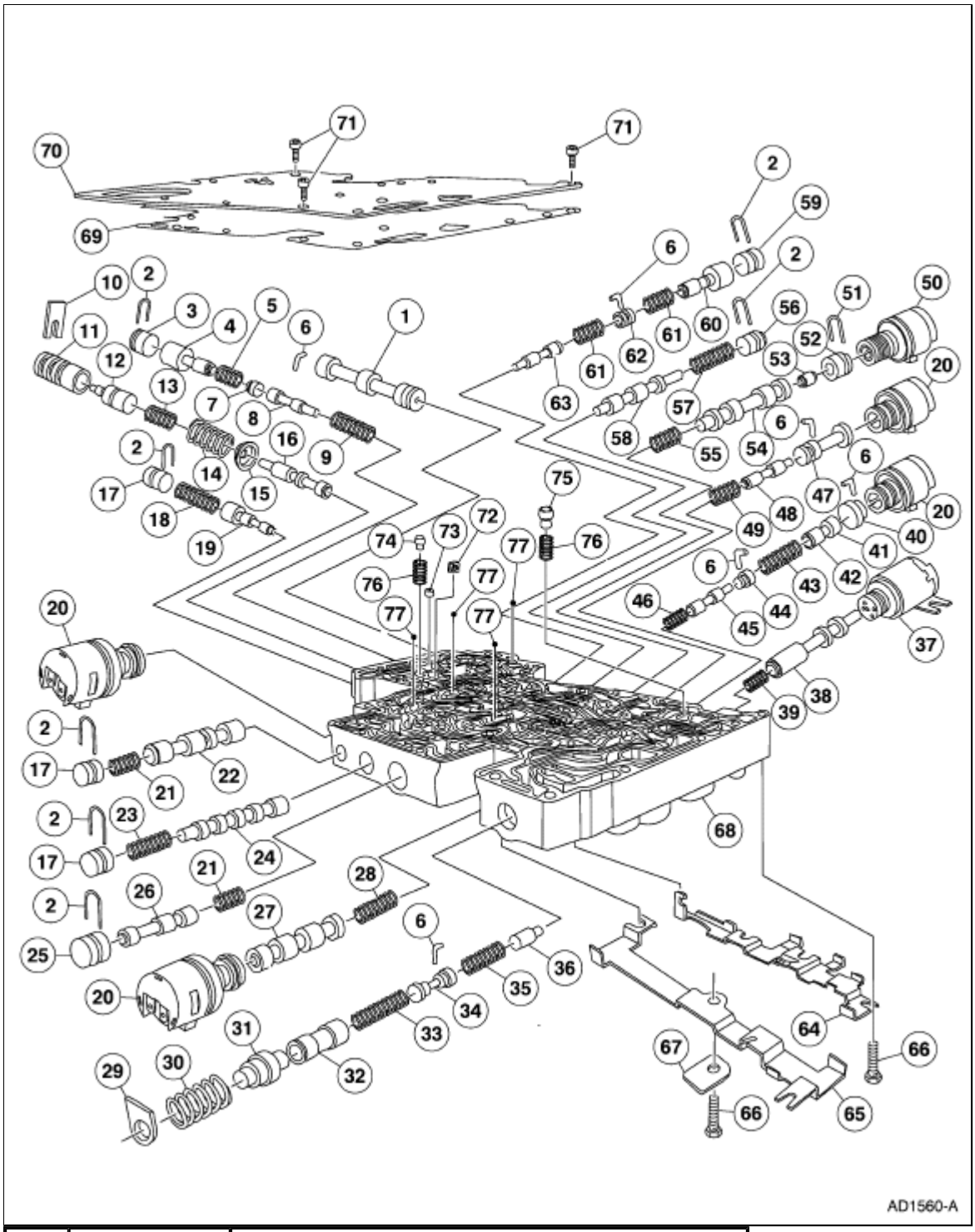
Remove the manual control lever seal.



Main Control Valve Body

Special Tool(s)

 ST1639-A	Valve Body Aligner (.235) 307-333 (T95L-70010-B)
 ST1639-A	Valve Body Aligner (.248) 307-334 (T95L-70010-C)



Item	Part Number	Description
1	—	Valve — manual
2	7E335	Retainer — valve plug (7 required)
3	—	Plug — valve retainer
4	—	Valve — forward modulator
5	—	Spring — forward modulator

6	7E335	Retainer — valve plug (6 required)
7	—	Plug — valve retainer
8	—	Valve — EPC boost
9	—	Spring — EPC boost
10	7E336	Retainer — valve plug
11	—	Sleeve — pressure boost
12	—	Valve — pressure boost
13	—	Spring — pressure boost
14	—	Spring — oil pressure regulator
15	—	Retainer — main regulator spring
16	—	Valve — pressure regulator
17	—	Plug — valve retainer (3 required)
18	—	Spring — forward engagement
19	—	Valve — forward engagement control
20	7G484	Solenoid — shift (4 required)
21	—	Spring — 4-3 (K.D./T.D.) (2 required)
22	—	Valve — 4-3 (K.D.)
23	—	Spring — manual low (1)
24	—	Valve — manual low (1)
25	—	Plug — valve retainer
26	—	Valve — 4-3 (T.D.)
27	—	Valve — 1-2 and 4-5 shift
28	—	Spring — 1-2 and 4-5 shift
29	7E366	Retainer — valve plug
30	—	Spring — thermostat bypass
31	—	Valve — thermostatic bypass
32	—	Valve — thermostat bypass
33	—	Spring — thermostat bypass
34	—	Plug — valve retainer
35	—	Spring — cooler limit
36	—	Valve — cooler limit
37	7G136	Solenoid — converter clutch (PWM)
38	—	Valve — converter clutch
39	—	Spring — converter clutch
40	—	Plug — valve retainer
41	—	Valve — converter clutch
42	—	Spring — converter clutch
43	—	Spring — converter clutch (3.0L and 4.0L only)
44	—	Plug — valve retainer

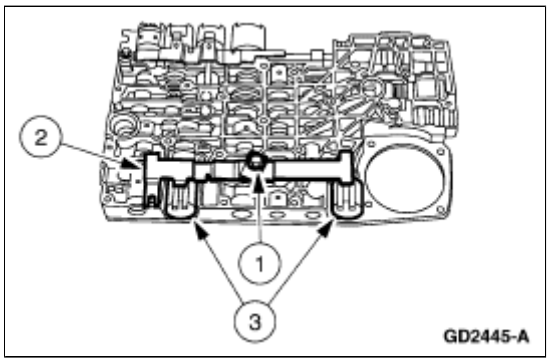
45	—	Valve — coast clutch
46	—	Spring — coast clutch
47	—	Plug — valve retainer
48	—	Valve — 4-3 downshifts
49	—	Spring — 4-3 downshifts
50	7G383	Solenoid — EPC (VFS)
51	7E335	Retainer — valve plug
52	—	Plug — valve retainer
53	—	Valve — 2-3 shift
54	—	Valve — 2-3 shift
55	—	Spring — 2-3 shift
56	—	Plug — valve retainer
57	—	Spring — 3-4 shift
58	—	Valve — 3-4 shift
59	—	Plug — valve retainer
60	—	Valve — reverse modulation
61	—	Spring — reverse modulation (2 required)
62	—	Plug — valve retainer
63	—	Valve — reverse modulation
64	7L491	Clamp — SSA/SSC
65	7L491	Clamp — SSB/SSD/EPC/TCC
66	E800155-S72	Screw — retain solenoid clamps (2 required)
67	7D132	ID plate
68	—	Body — valve
69	7D100	Gasket — separator plate
70	7A008	Plate — separator
71	E804357-S	Screw — retain separator plate (3 required)
72	7N113	Screen — EPC limit circuit
73	7D376	Extension housing lube orifice
74	7D376	Valve — EPC limit (metal)
75	7E368	Valve — converter relief (plastic)
76	7E340	Spring — EPC limit/converter relief (2 required)
77	7E195	Ball (4 required)

Disassembly

1. **CAUTION: The SSC solenoid may pop out of its bore. This may damage the solenoid.**

   Remove the SSA and the SSC clamp and SSA and SSC solenoid.
   1. Remove the solenoid clamp screw.

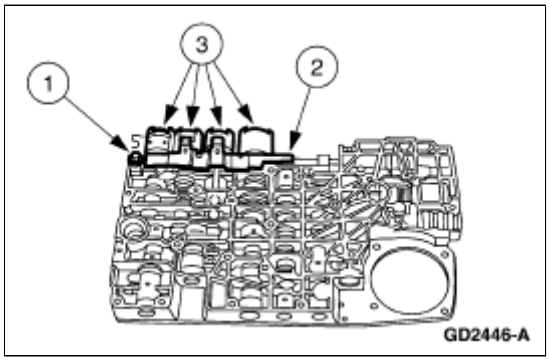
2. Remove the solenoid clamp.
3. Remove the SSA and SSC solenoids.



2. **CAUTION: The torque converter clutch solenoid (TCC) solenoid may pop out of its bore. This may damage the solenoid.**

CAUTION: The converter modulator valve may come out after the TCC solenoid. This may cause damage to the valve.

Remove the SSB, SSD, torque converter clutch solenoid, and the EPC solenoid.
1. Remove the solenoid clamp screw.
2. Remove the solenoid clamp.
3. Remove the SSB, SSD, torque converter clutch solenoid and the EPC solenoids.



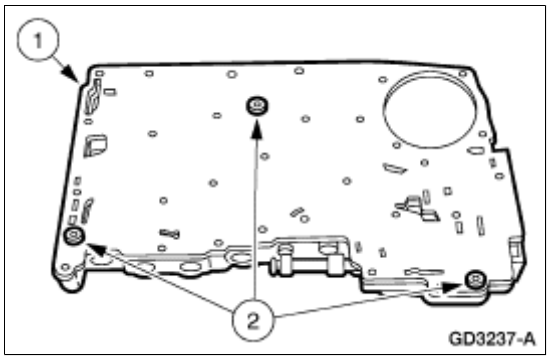
3. Rotate the main control valve body so that the main control to case gasket is facing up.

4. **CAUTION: Valves may come out when rotating the main control valve body.**

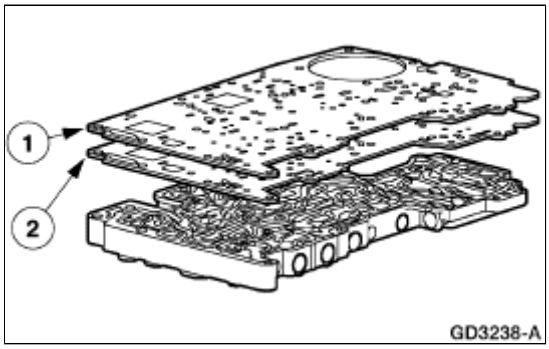
CAUTION: The extension housing lube orifice and relief valves may stick to the separator plate.

NOTE: Discard the main control to case gasket.

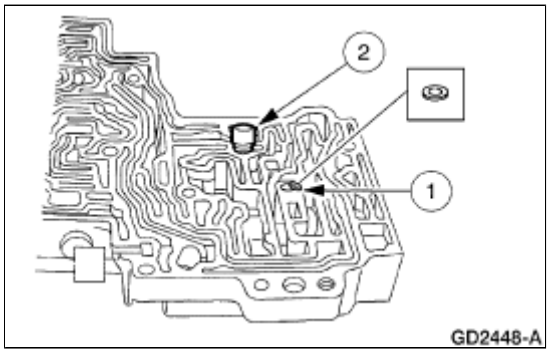
Remove the valve body separator plate screws.
1. Remove the main control to case gasket and discard.
2. Remove the valve body separator plate screws.



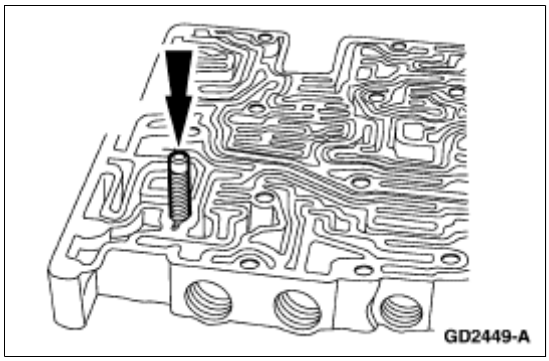
5. Remove valve body separator plate and main control to separating plate gasket.
    1. Remove valve body separator plate.
    2. Remove main control to separator plate gasket and discard.



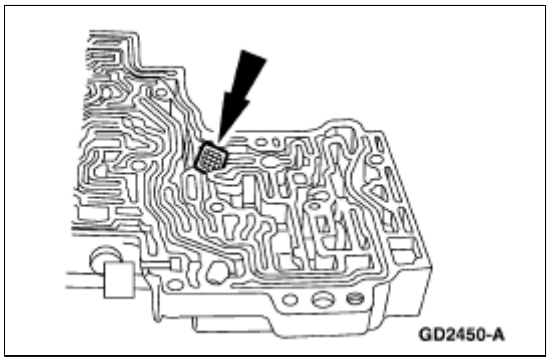
6. Remove the extension housing lube orifice and the metal silver electronic pressure control (EPC) limit relief valve and spring.
    1. Remove the extension housing lube orifice.
    2. Remove the silver metal EPC limit relief valve and spring.



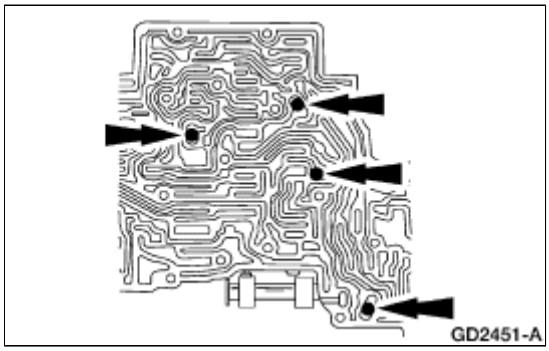
7. Remove the black plastic converter relief valve and spring.



8. Remove the electronic pressure control (EPC) limit circuit screen.



9. Remove the four main control valve body check balls.



Assembly

1. **CAUTION: Do not lose parts when cleaning or servicing.**

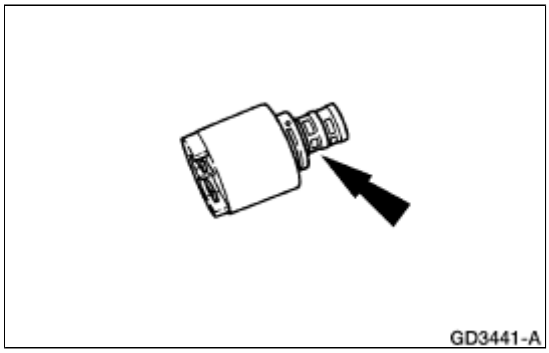
   Thoroughly clean all parts in solvent and blow dry with moisture free compressed air.

2. **CAUTION: Do not stone, file, or sand the valves. This will remove the anodized finish and may result in further main control or transmission damage.**

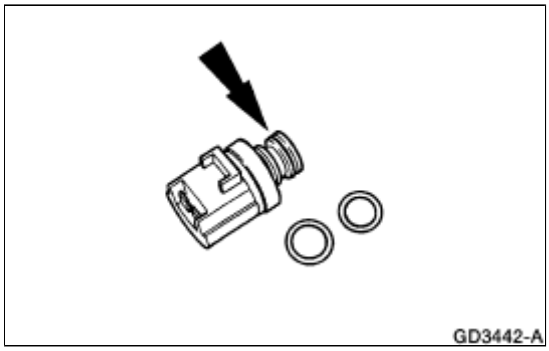
   After cleaning the main control valve body, carry out the following:
   - Inspect all valve and plug bores for scoring or burrs.
   - Check all fluid passages for obstructions.
   - Inspect all valves and plugs for burrs.

- Inspect all mating surfaces for burrs or distortion.
- Inspect all springs for distortion.
- Check all valves and plugs for free movement in their respective bores.
  - Valves and plugs, when dry, must fall from their own weight into their respective bores.
- Roll the manual valve on a flat surface to check for a bent condition.

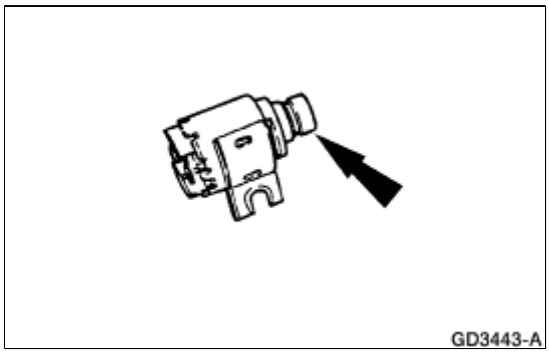
3. Clean and inspect the EPC solenoid screens.



4. Remove and replace all shift solenoid O-rings.

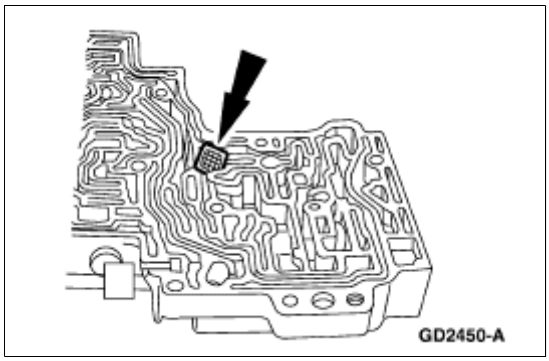


5. Clean and inspect the torque converter clutch solenoid.

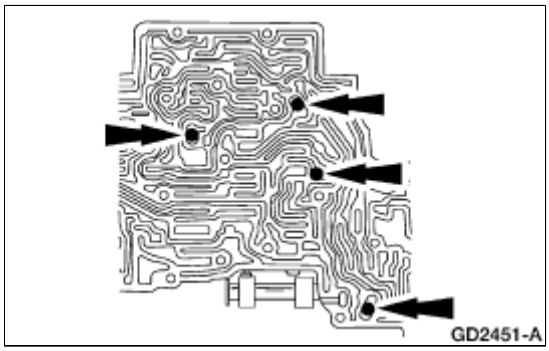


6. **CAUTION: Make sure that the screen is properly located.**

Clean and inspect the electronic pressure control (EPC) limit circuit screen. Install the EPC limit circuit screen.

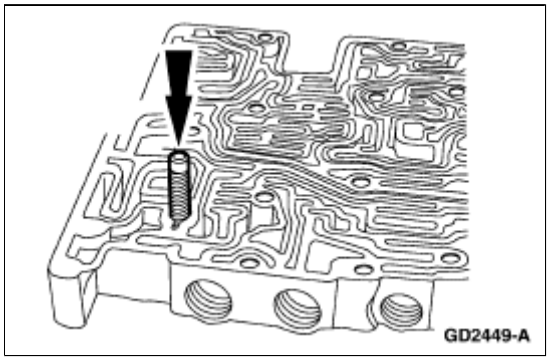


7. Install the four main control valve body check balls.



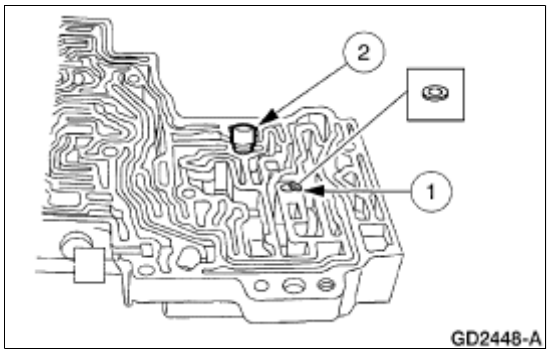
8. **CAUTION: The springs and valves are not interchangeable. Damage to transmission may occur.**

   Install the dark color plastic converter relief valve and spring.



9. **NOTE:** The springs and valves are not interchangeable.

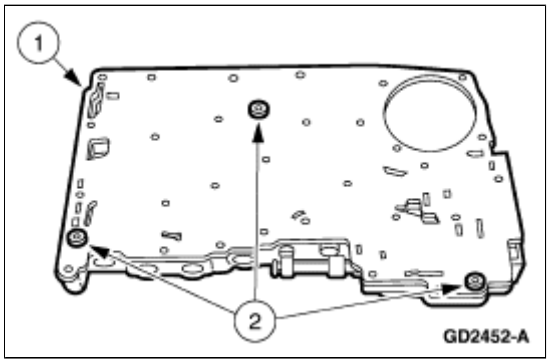
   Install the extension housing lube orifice and the metal silver electronic pressure control (EPC) limit relief valve and spring.
   1. Install the extension housing lube orifice.
   2. Install the silver metal EPC limit relief valve and spring.



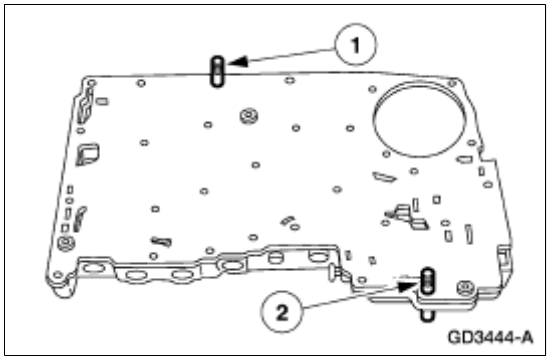
10. **NOTE:** Apply petroleum jelly on the valve body separator plate to hold the main control to separator plate gasket in place.

    NOTE: Use new separator plate main control to separator plate gasket on installation.

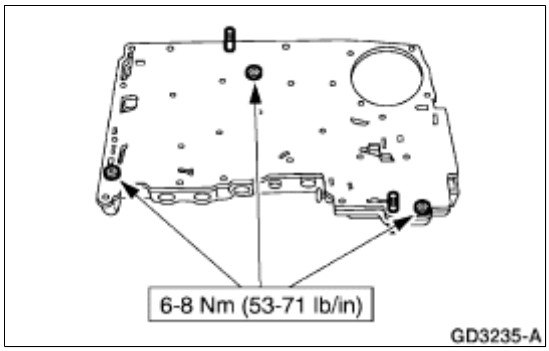
    Install the main control valve body separator plate and gasket to the main control.
    1. Position the main control valve body separator plate to the main control gasket and install separator plate to main control valve body.
    2. Install, do not tighten, the three screws.



11. Install the Valve Body Aligner into the main control valve body.
    1. Install the Valve Body Aligner (.248).
    2. Install the Valve Body Aligner (.235).



12. Tighten the screws.

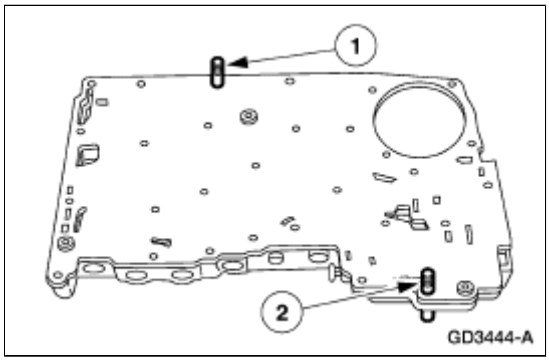


13. **NOTE:** Apply petroleum jelly on the separator plate surface to hold the gasket in place.

    NOTE: Use new separator plate gasket on installation.

    Install new main control to case gasket.

14. Remove the Valve Body Aligner from the main control valve body.
    1. Remove the Valve Body Aligner (.248).
    2. Remove the Valve Body Aligner (.235).



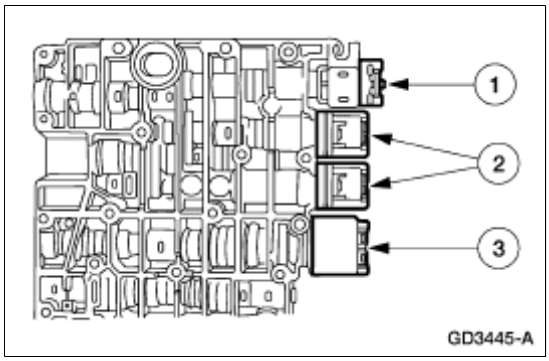
15. Rotate the main control valve body so the valve body separator plate is facing down.

16. **CAUTION: All solenoid electrical connectors must face upward on installation.**

    NOTE: All shift solenoids are interchangeable.

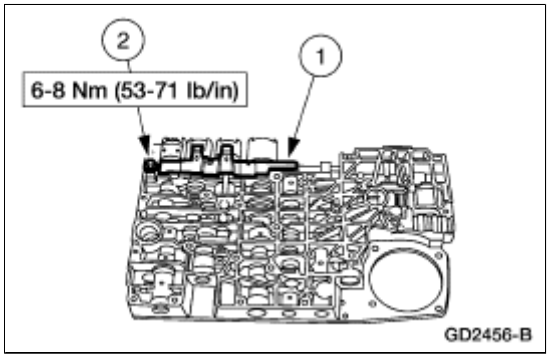
    NOTE: If the TCC valve came out during disassembly, use caution when installing the torque converter clutch solenoid.

    Install the SSB, SSD, TCC and EPC solenoids.
    1. Install the TCC solenoid.
    2. Install the SSB and SSD solenoids.
    3. Install the EPC solenoid.



17. **CAUTION: The solenoid clamp must be installed in the TCC and EPC solenoid grooves, shift solenoid pockets and the No. 204 plug.**

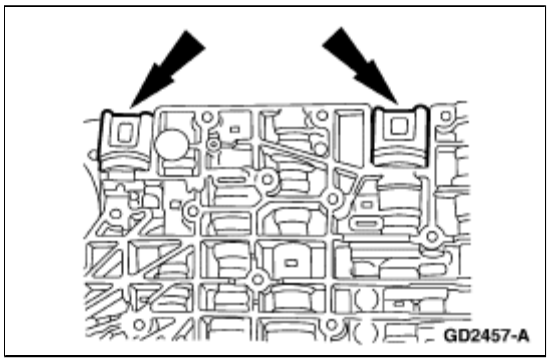
Install the solenoid clamp and the screw.
1. Position the solenoid clamp on the main control valve body.
2. Install the screw.



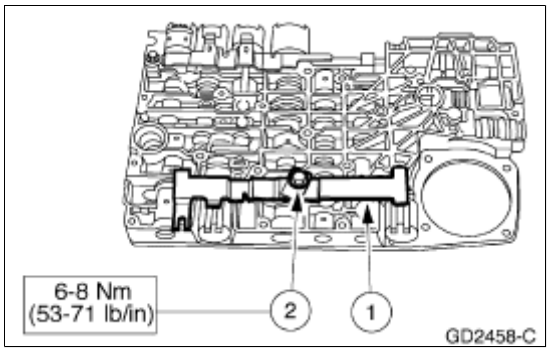
18. **CAUTION: The shift solenoid electrical terminals must face up on installation.**

NOTE: The shift solenoids are interchangeable.

Install the SSA and the SSC shift solenoids.

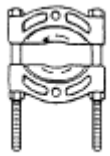
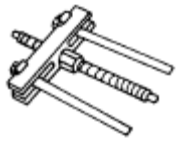
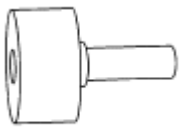
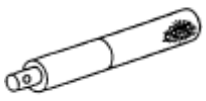
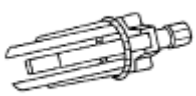


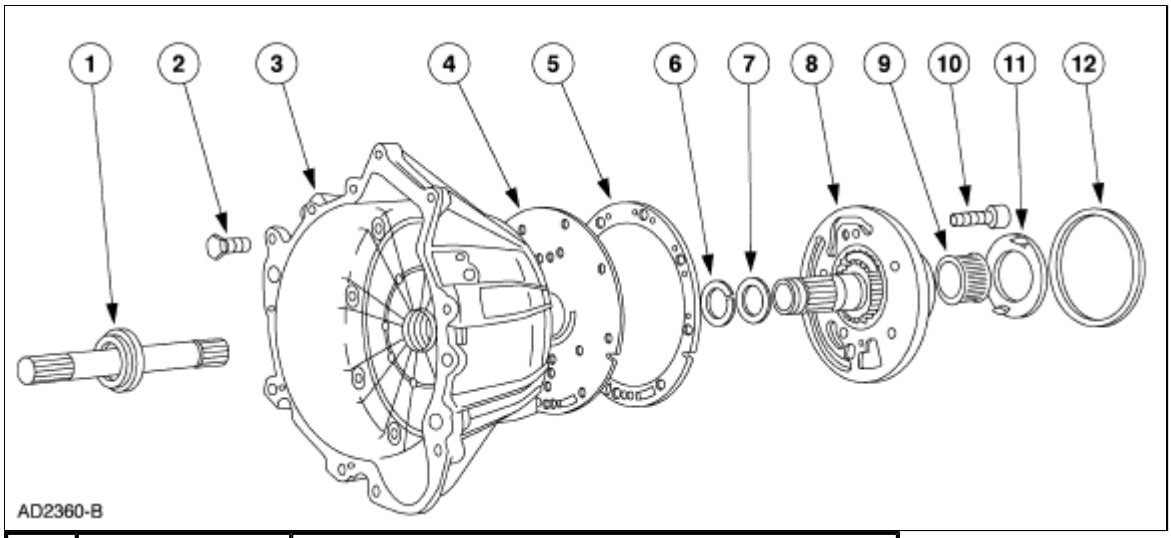
19. Install the solenoid clamp and the screw.
1. Position the solenoid clamp on the main control valve body.
2. Install the screw.


6-8 Nm
(53-71 lb/in)
2
1
GD2458-C

Converter Housing and Fluid Pump

Special Tool(s)

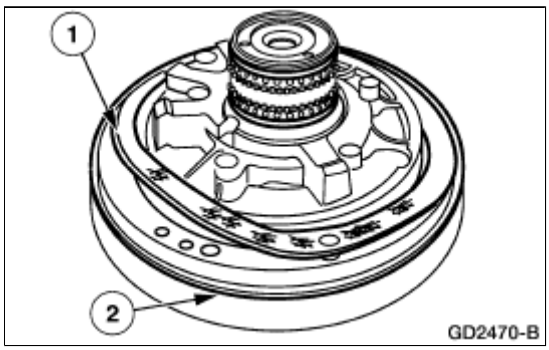
 ST1833-A	Converter Seal Replacer 307-349 (T97T-77000-A)
 ST1543-A	Step Plate 205-D018 (D80L-630-7)
 ST1368-A	Pinion Bearing Cone Remover 205-D002 (D79L-4621-A)
 ST1516-A	Front Hub Tool 204-069 (T81P-1104-C)
 ST2187-A	Bearing Replacer 307-373
 ST1326-A	Handle 205-153 (T80T-4000-W)
 ST1213-A	Puller 307-001 (TOOL-1175-AC)



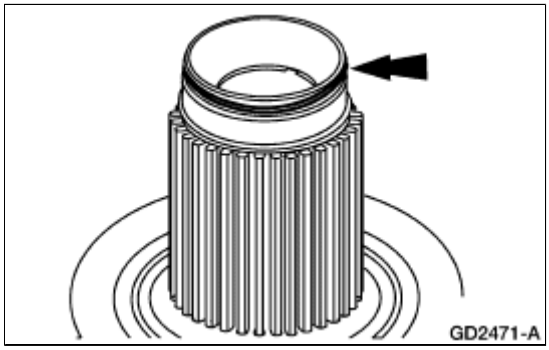
Item	Part Number	Description
1	7A248	Converter hub-to-converter housing seal
2	E804595-S200	Converter housing-to-case screw and seal (8 required)
3	7976	Converter housing
4	7B472	Fluid pump adapter plate
5	7A136	Fluid pump gasket
6	7L323	Fluid pump support seal ring
7	W701431-S300	Fluid pump shaft-to-inner gear O-ring
8	7A103	Fluid pump assembly
9	7M155	Bearing assembly
10	W701429-S309M	Fluid pump-to-converter housing screws (6 required)
11	7D014	No. 1 fluid pump input thrust washer (selective)
12	7A248	Seal ring — fluid pump.

Disassembly

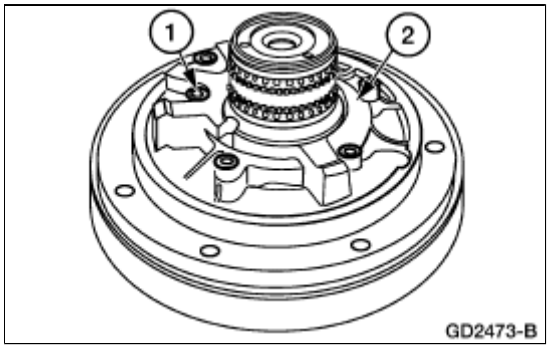
1. Remove the fluid pump gasket and fluid pump seal rings.
    1. Remove and discard the fluid pump gasket.
    2. Remove and discard the fluid pump seal ring (square cut).



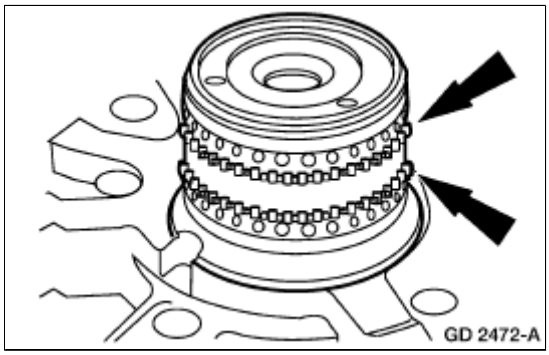
2. Remove the fluid pump support seal ring.



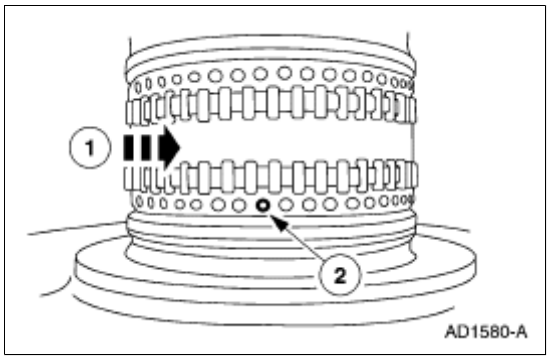
3. Remove the fluid pump housing.
    1. Remove the six fluid pump screws.
    2. Remove the fluid pump support and gear and the fluid pump adapter plate.



4. Inspect the fluid pump support needle bearings and cage for scored or missing rollers and alignment of lube holes.

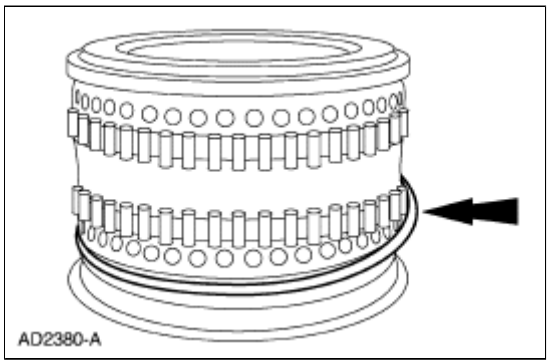


5. Inspect the coast clutch feed hole for blockage or damage.
    1. Rotate the pump bearing and locate the coast clutch feed hole.
    2. Inspect the coast clutch feed hole for blockage or damage.



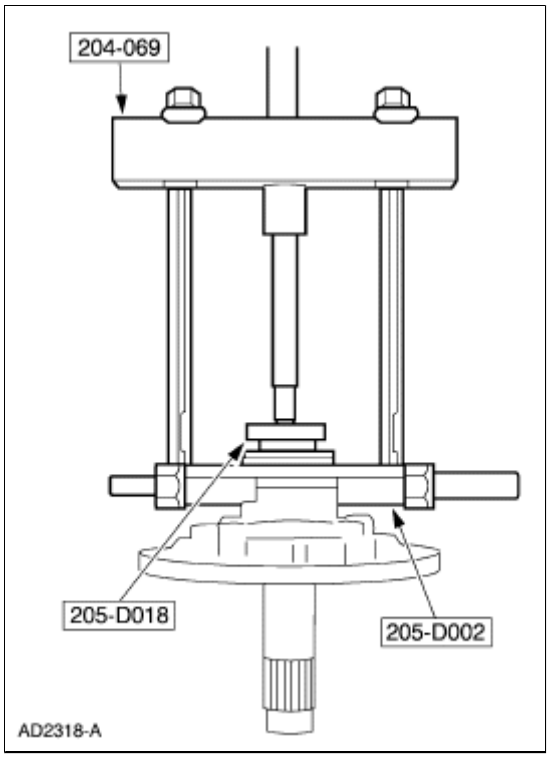
6. **NOTE:** Inspect the needle bearing for damage and install new if necessary.

   Remove the lower seal.



7. **NOTE:** This step only needs to be carried out if there is damage to the bearing.

   Assemble the special tools onto the front pump assembly.

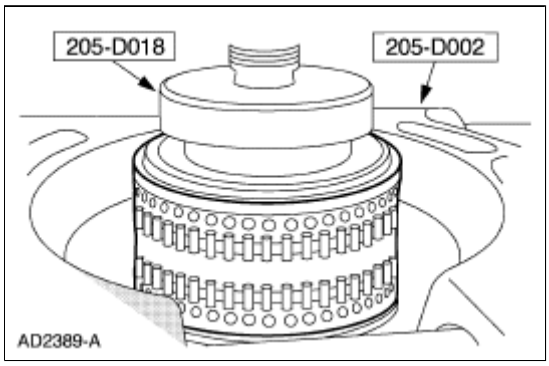


8. **CAUTION: Do not over tighten the tool or damage to the bearing may occur.**

   NOTE: This step only needs to be carried out if there is damage to the bearing.

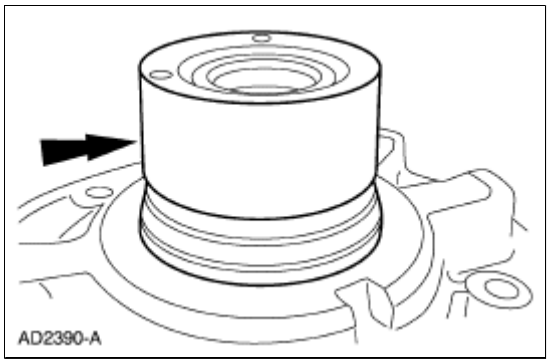
   NOTE: The Pinion Bearing Cone Remover Tool must fit into the lower seal groove.

   Using the special tools, remove the needle bearing.



9. **NOTE:** This step only needs to be carried out if there is damage to the bearing.

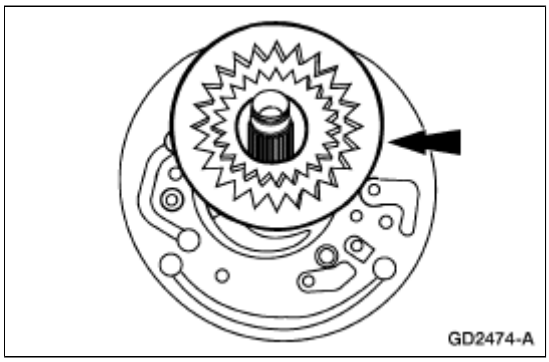
   Inspect the front pump outer race for scoring or nicks, if any damage is found the pump assembly will need to be replaced.



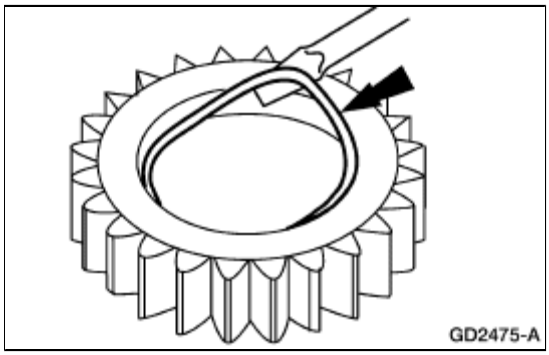
10. **NOTE:** A rough casting on the pump surface crescent is not a flaw.

    NOTE: The fluid pump gears are part of the pump assembly and are not serviced separately.

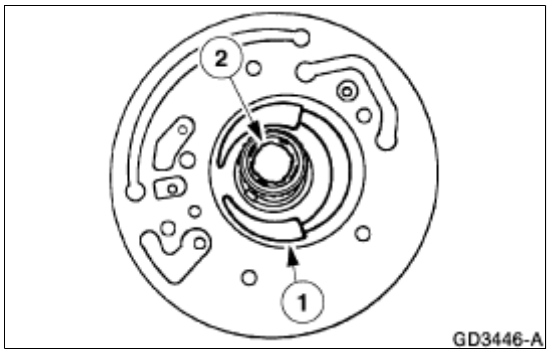
    Remove the fluid pump gears and front pump adapter plate.



11. Remove the drive gear O-ring and discard. Inspect the fluid pump gears for cracks and scoring. Replace front pump support and gear assembly if damaged.



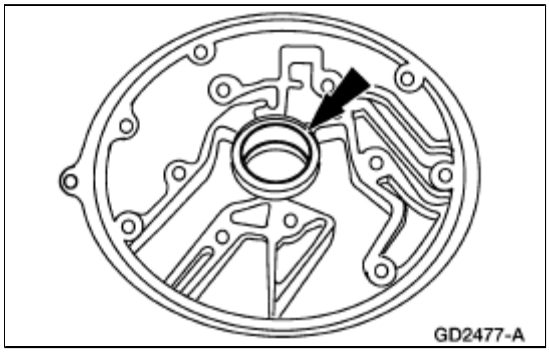
12. Inspect front pump.
    1. Inspect the front pump support gear pockets for scoring and wear.
    2. Clean and inspect the front and rear input shaft bushings.



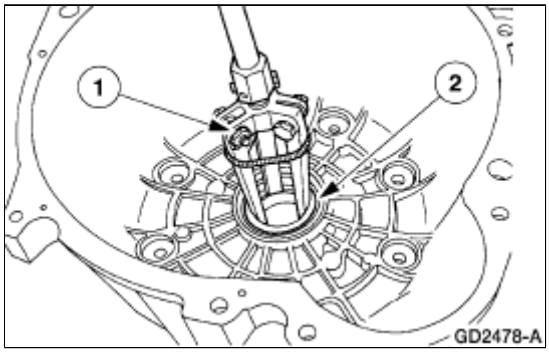
13. Inspect the fluid pump adapter plate for scoring and wear.

14. **NOTE:** The fluid pump-to-converter housing bushing is not serviced separately. If service is required, the converter housing must be replaced.

    Inspect the fluid pump-to-converter housing bushing and converter hub-to-converter housing seal. Replace converter housing assembly if necessary.



15. Remove the converter hub-to-converter housing seal.
    1. Install the Seal Remover into the converter hub-to-converter housing seal.
    2. Remove the converter hub-to-converter housing seal.



Assembly

1. Thoroughly clean all parts and blow dry with moisture free compressed air.

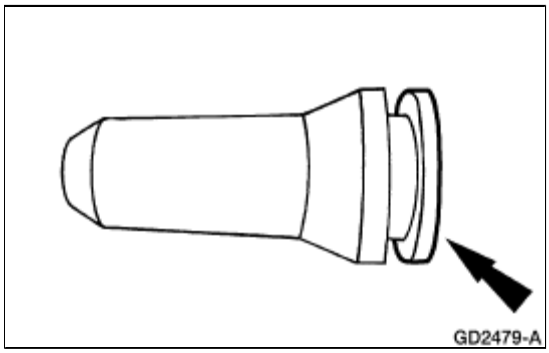
2. **NOTE:** Minor burrs and scoring may be removed with crocus cloth. If damage is found, the pump must be replaced as an assembly.

Inspect the converter housing and fluid pump components for the following:

- Cracks and scoring of the pump gears.
- Front and rear input shaft bushings for scoring and wear.
- Fluid pump support needle bearing and cage for scored or missing rollers.
- Pump gear pockets for scoring and wear.
- Fluid pump adapter plate for scoring and wear.
- Fluid pump to converter housing bushing for scoring and wear.
- Pump body and case for burrs.
- Fluid passages for obstructions.
- Converter housing for cracks.

3. **NOTE:** Check and make sure that the garter spring in the seal has not popped off of the converter hub-to-converter housing seal.

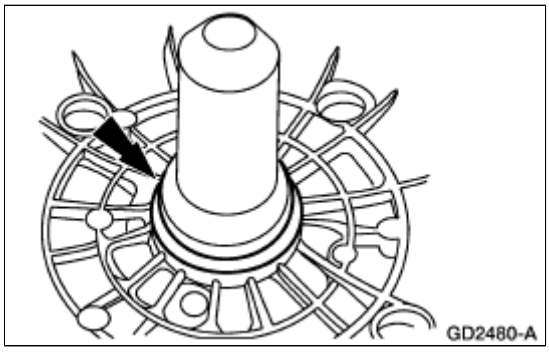
   Install a new converter hub to housing seal onto the Converter Seal Replacer.



4. **CAUTION: Place the converter housing on a block of wood or equivalent to protect the converter hydraulic passages on the backside.**

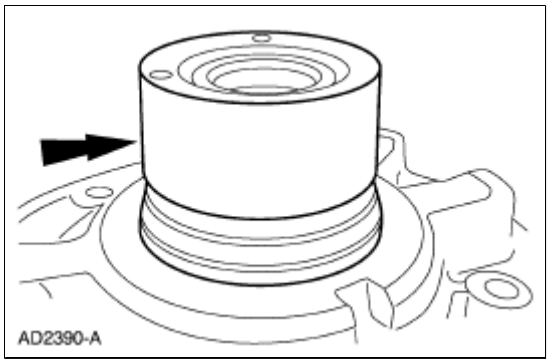
   NOTE: Do not finish converter housing and fluid pump reassembly at this time. Assembly is completed during transmission assembly to correctly set front end clearance.

   Use the Converter Seal Replacer and install the new converter hub-to-converter housing seal into the converter housing, until it bottoms in the housing.



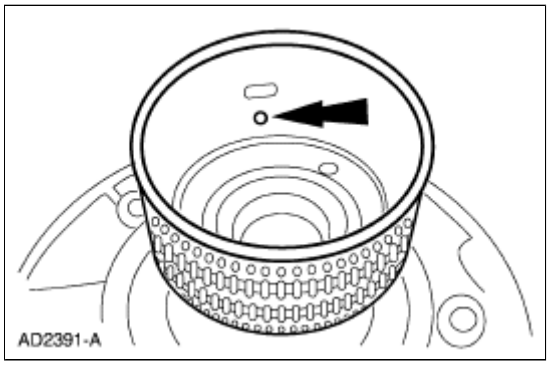
5. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Clean and lubricate the outer surface with petroleum jelly.



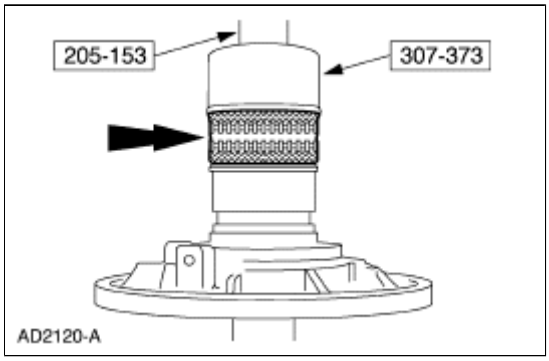
6. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Place the bearing over the pump assembly making sure that the lube feed hole is facing down.



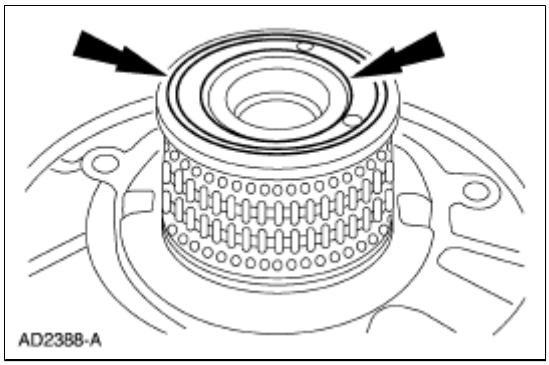
7. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Using the special tool, install the bearing.



8. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Inspect that the bearing is properly seated on the pump. Inspect the top portion of the pump that it was not damaged, and the bearing rotates freely.

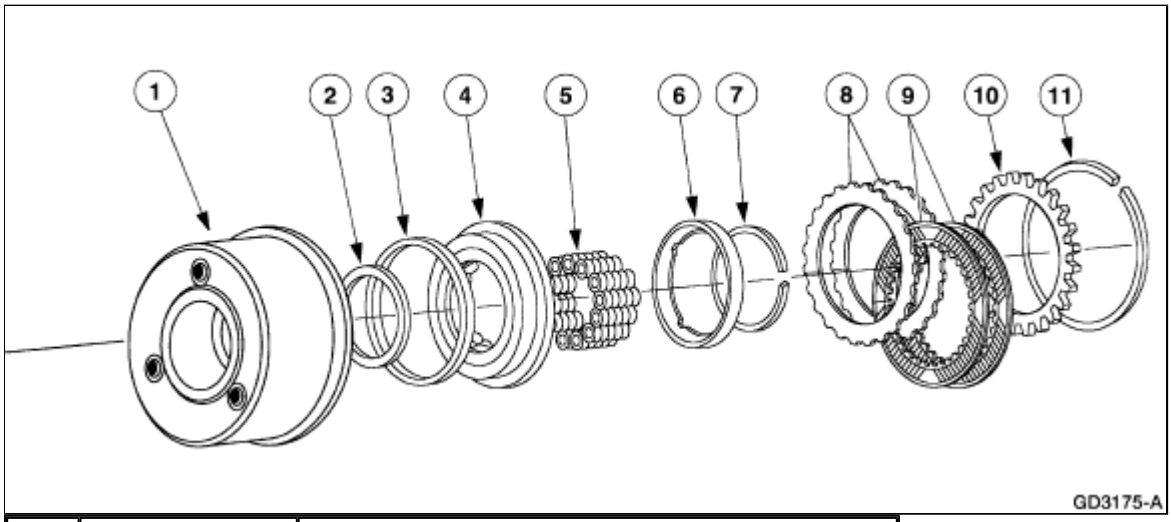

AD2388-A

Front Brake and Coast Clutch Drum Assembly

Special Tool(s)

 ST1190-A	Clutch Spring Compressor 307-015 (T65L-77515-A)
 ST2127-A	Coast Clutch Outer Seal Sizing Tool 307-353

Front Brake and Coast Clutch Drum Assembly



Item	Part Number	Description
1	7L669	Front Brake and Coast Clutch Drum
2	7D404	Coast Clutch Piston Inner Seal Ring
3	7A548	Coast Clutch Piston Outer Seal Ring
4	7A258	Coast Clutch Piston
5	7A480	Coast Clutch Piston Spring (20 Req'd)
6	7A527	Coast Clutch Piston Spring Retainer
7	E860125-S	Retaining Ring
8	7B442	Coast Clutch External Plate — Steel (2 Req'd)

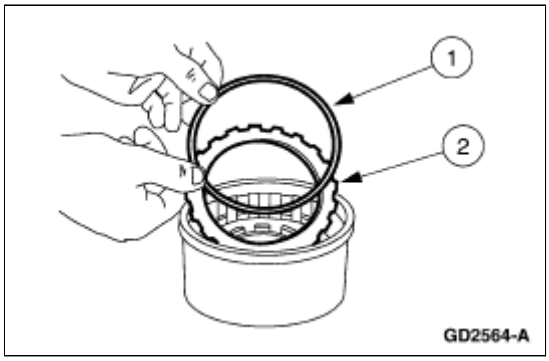
9	7B164	Coast Clutch Internal Plate — Friction (2 Req'd)
10	7B066	Coast Clutch Pressure Plate
11	E860126S/129S	Retaining Ring (Select Fit)

Disassembly

1. **CAUTION: If new plates are being used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.**

   CAUTION: This is a select fit ring. See assembly procedure if the ring or clutch plate is replaced.

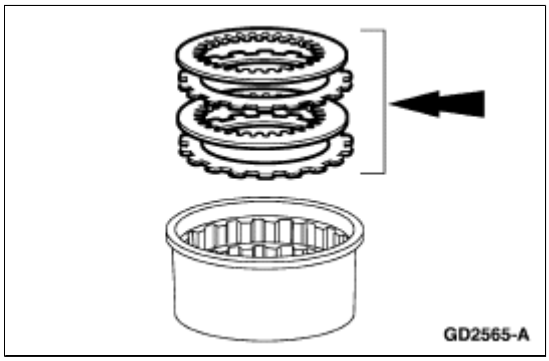
   Remove the coast clutch pressure plate.
   1. Remove the coast clutch retaining ring.
   2. Remove the coast clutch pressure plate.



2. **CAUTION: If new clutch plates are being used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.**

   CAUTION: Coast clutch friction plates are directional. Note direction of grooves for installation.

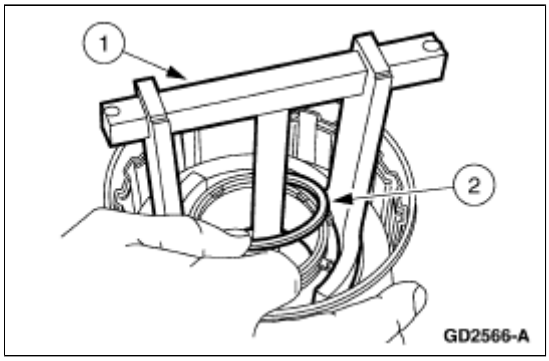
   Remove the coast clutch disc pack.
   - Inspect for wear, replace as necessary.



3. **WARNING: Use caution when releasing tool pressure on the rear clutch piston spring. Failure to follow these instructions may result in personal injury.**

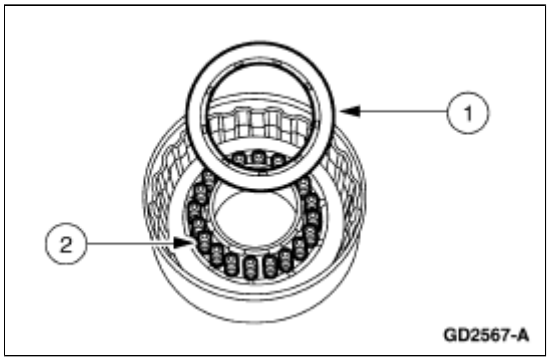
   CAUTION: Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.

   Remove the coast clutch piston retaining ring.
   1. Use Clutch Spring Compressor to compress the coast clutch piston springs.
   2. Remove the coast clutch piston retaining ring.



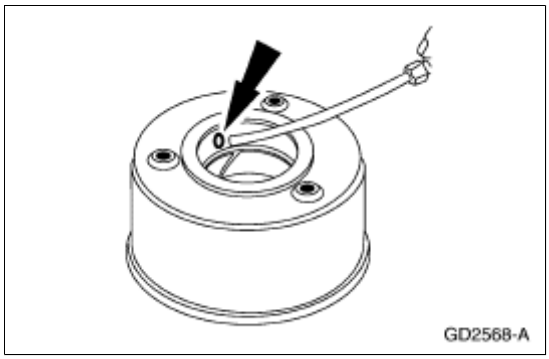
4. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

5. Remove the coast clutch piston springs.
   1. Remove the coast clutch piston spring retainer.
   2. Remove the (20) clutch piston springs.

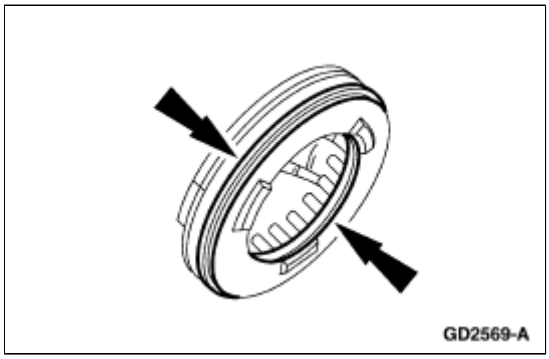


6. **WARNING: Air pressure must not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air, and make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

   Remove the coast clutch piston.
   - Apply air pressure to the hole in the drum to remove coast clutch piston while blocking other hole with finger.



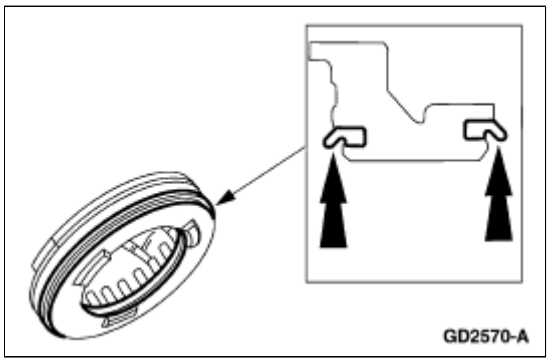
7. Remove the coast clutch piston inner seal and the coast clutch piston outer seal.
   - Clean and replace as necessary.



Assembly

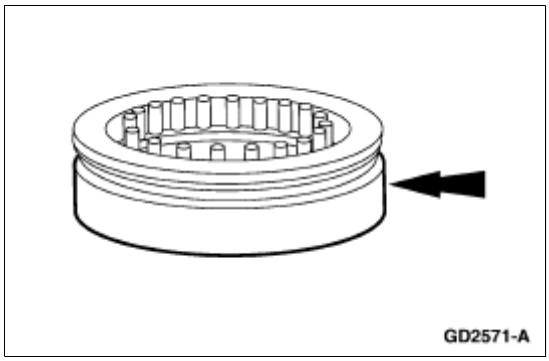
1. **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent roll over of the lip seal.**

   Install the new coast clutch piston inner and outer seal.



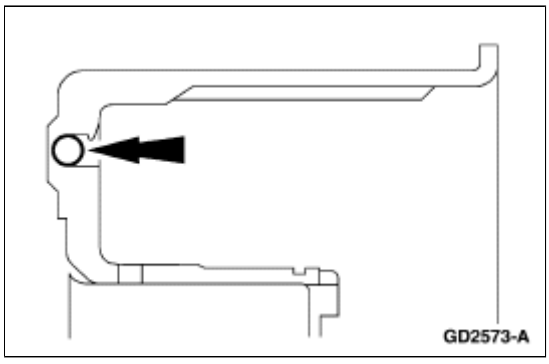
2. **CAUTION: Lubricate the coast clutch piston inner and outer seal.**

   Install the coast clutch piston into Coast Clutch Outer Seal Sizing Tool.

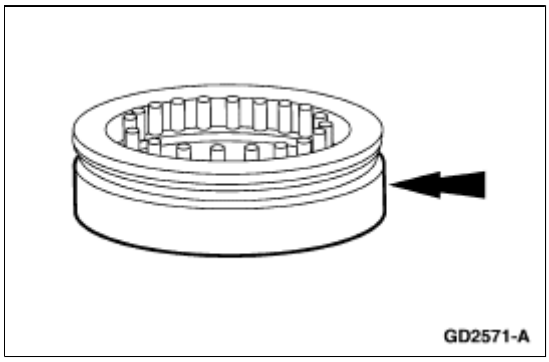


3. Inspect the coast clutch components for damage or wear. Replace as necessary.
   - Inspect the drum band surface, bushing, and thrust surfaces for scores. Minor scores may be removed with a crocus cloth. Badly scored parts must be replaced.
   - Inspect the clutch piston bore and the clutch piston and the piston inner and outer bearing surfaces for scores.
   - Check the fluid passages for obstructions. All fluid passages must be clean and free of obstructions.
   - Inspect the clutch plates for wear, scoring and fit on the clutch hub serrations. Replace all plates that are badly scored, worn or do not fit freely in the hub serrations.
   - Inspect the clutch pressure plate for scores on the clutch plate surface. Check the clutch release spring(s) for distortion.

4. Verify the check ball in the front band brake and coast clutch drum is free to move and clear of debris.

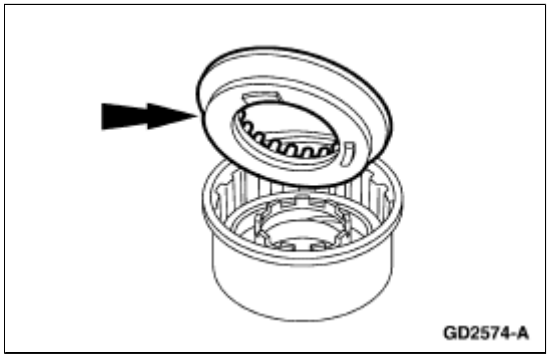


5. Carefully remove the coast clutch piston from the Coast Clutch Outer Seal Sizing Tool.

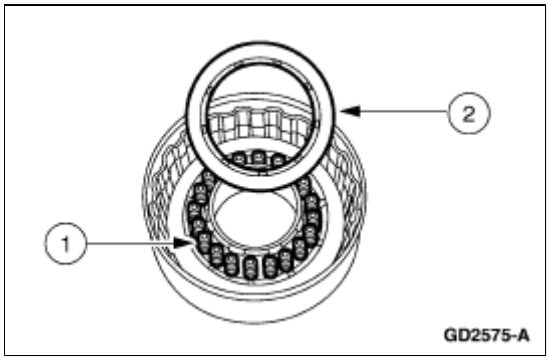


6. **CAUTION: Care must be taken to prevent damage to the seals during installation.**

Install the coast clutch piston into the front band brake and coast clutch drum.

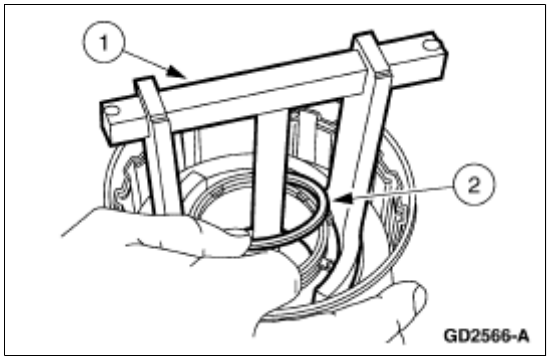


7. Install the coast clutch piston springs.
    1. Install the twenty (20) coast clutch piston springs.
    2. Position the coast clutch piston spring retainer on the coast clutch piston springs.



8. **CAUTION: Do not fully compress the Clutch Spring Compressor or damage to the coast clutch piston spring retainer may occur.**

    Install the coast clutch piston spring retainer ring.
    1. Use Clutch Spring Compressor to compress the coast clutch piston springs.
    2. Install the coast clutch piston retaining ring.

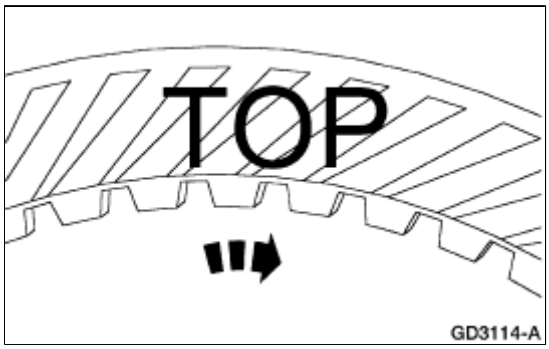


9. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

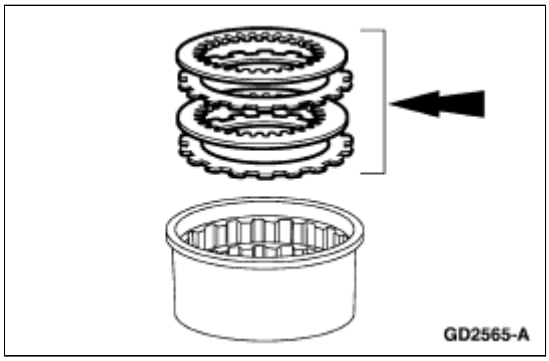
10. **CAUTION: Coast clutch friction plates are directional and must be installed with grooves clockwise (I.D. to O.D.). The word "TOP" should face up.**

CAUTION: If new clutch plates are being used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.

When installing friction plates, the word "TOP" should face up. If reusing plates, grooves must be installed clockwise. Install the coast clutch disc pack.



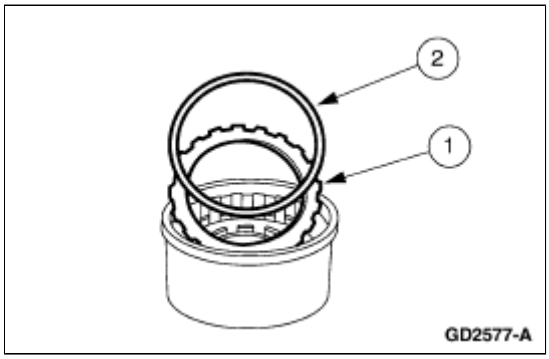
11. Install the two steel clutch plates and two friction clutch plates in alternating order starting with a steel clutch plate.



12. **CAUTION: The retaining ring is select fit.**

Install the coast clutch pressure plate.

1. Install the clutch pressure plate.
2. Install the original coast clutch retaining ring.



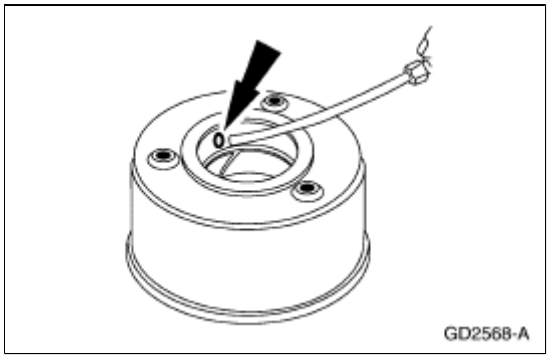
13. **WARNING: Air pressure must not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air. Make sure drum is facing down as shown. Failure to follow these**

instructions may result in personal injury.

NOTE: The coast clutch piston is applied with air pressure and released when the air is removed.

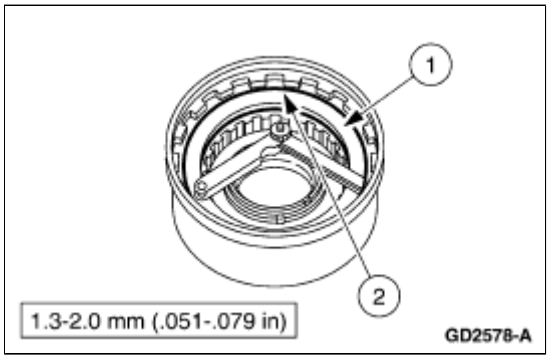
Air check the assembly.

- Apply air pressure to the hole in the drum while blocking the other hole with a finger.



14. Check the coast clutch disc pack free play.
    1. Push down on the coast clutch pressure plate.
    2. Check clearance between the coast clutch retaining ring and coast clutch pressure plate. Clearance should be 1.3-2.0 mm (.051-.079 in). If clearance is not within the specification, replace with the proper coast clutch retaining ring that will correct free play adjustment.

	Thickness		Diameter	
Part Number	mm	In	mm	In
E860126-S	1.37	.0539	130.1	5.122
E860127-S	1.73	.0681	130.1	5.122
E860128-S	2.08	.0819	130.1	5.122
E860129-S	2.44	.0961	130.1	5.122

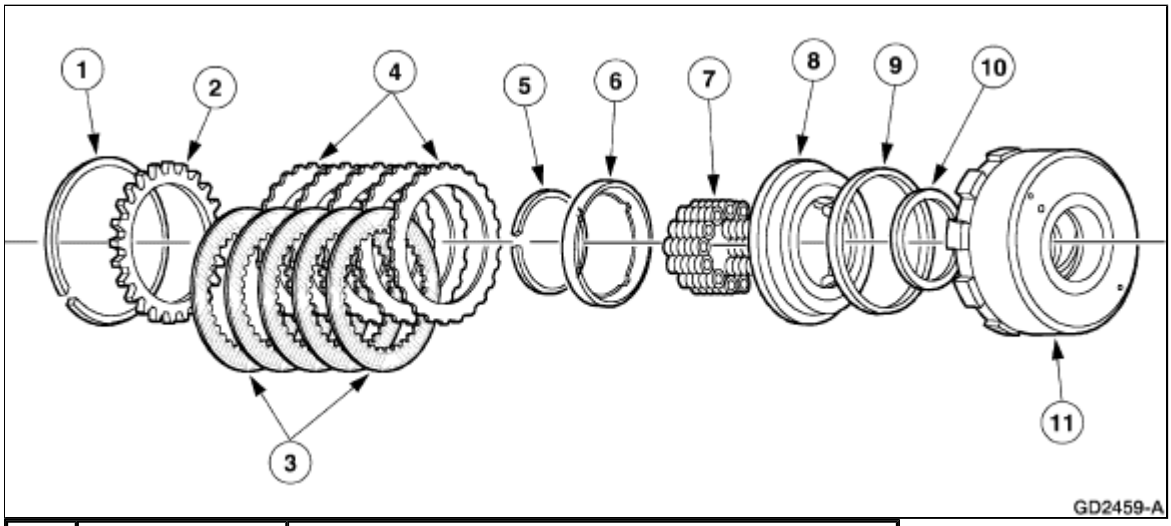


Intermediate Brake and Direct Clutch Drum Assembly

Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST1756-A	Sizer, Piston Seal 307-336 (T95L-70010-E)
 ST1756-A	Sizer, Piston Seal 307-335 (T95L-70010-D)

Intermediate Brake and Direct Clutch Drum Assembly



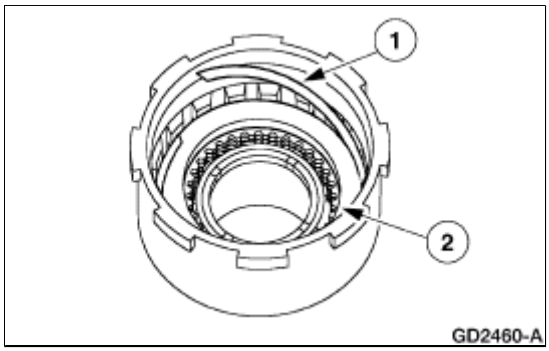
Item	Part Number	Description
1	E860126S/129S	Retaining ring (select fit)
2	7B066	Direct clutch pressure plate
3	7B164	Direct clutch internal plate — friction
4	7B442	Direct clutch internal plate — steel

5	E860125-S	Direct clutch retaining ring
6	7A527	Direct clutch piston spring retainer
7	7A480	Direct clutch piston springs (20 required)
8	7A258	Direct clutch piston
9	7A548	Direct clutch piston outer seal ring
10	7D404	Direct clutch piston inner seal ring
11	7D044	Intermediate brake and direct clutch drum assembly

Disassembly

1. **CAUTION: The retaining ring is a select fit. See assembly procedure if the ring or clutch pack is replaced.**

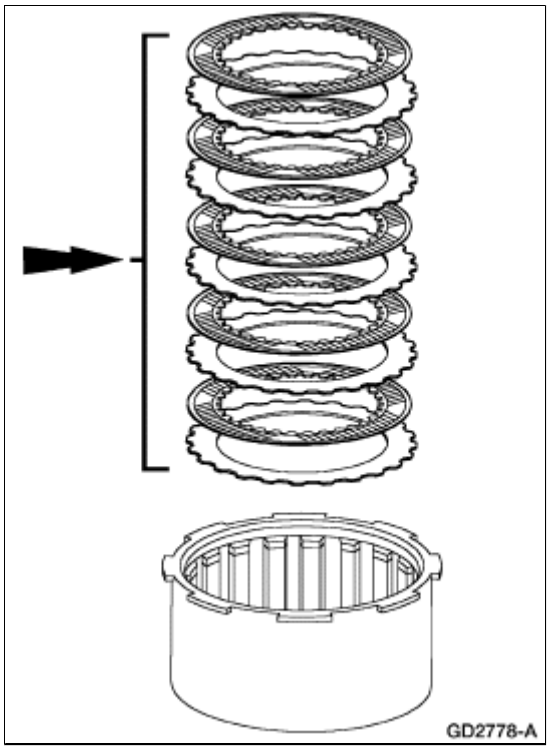
   Remove the direct clutch retaining ring and the direct clutch pressure plate.
   1. Remove the direct clutch retaining ring.
   2. Remove the direct clutch pressure plate.



2. **CAUTION: Clutch plates are directional. Note the direction of the grooves for installation.**

   CAUTION: If new clutch plates are being used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.

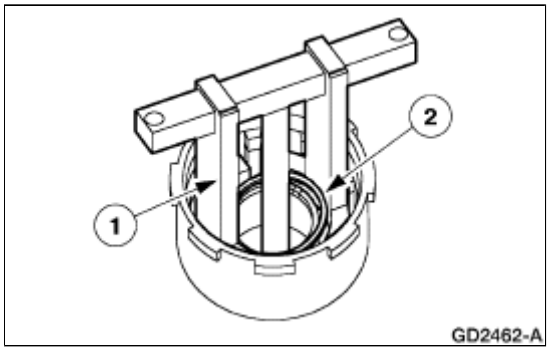
   Remove the direct clutch disc pack.
   - Inspect and replace the steel and friction plates if worn, damaged, or overheated.
   - Measure and record the thickness of the steel plates for assembly.



3. **WARNING: After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.**

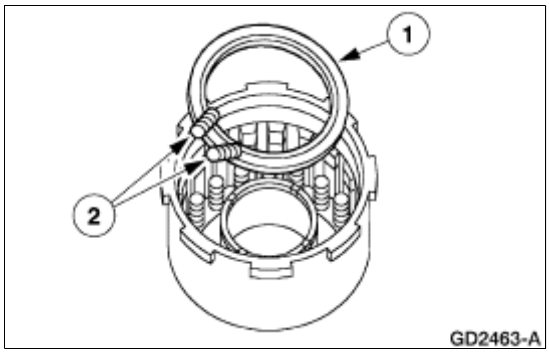
   CAUTION: Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.

   Use a Clutch Spring Compressor to remove the direct clutch piston retaining ring.
   1. Install the Clutch Spring Compressor and compress the direct clutch piston springs.
   2. Remove the direct clutch piston retaining ring.



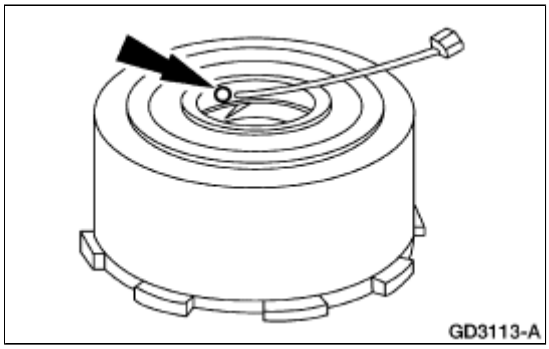
4. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

5. Remove the direct clutch piston spring retainer and the twenty (20) direct clutch piston springs.
   1. Lift the direct clutch piston spring retainer off the direct clutch piston springs.
   2. Remove the direct clutch piston springs.

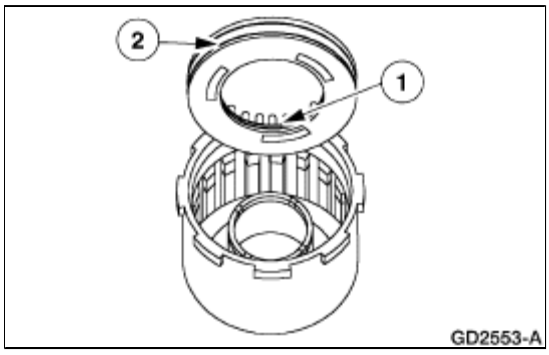


6. **WARNING: Do not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air. Make sure drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

   Using compressed air, remove the direct clutch piston from the intermediate brake and direct clutch drum.
   - Apply air pressure to the hole in the drum while blocking the other with a finger.



7. Remove the direct clutch piston inner and outer seal.
   1. Remove the direct clutch piston inner seal.
   2. Remove the direct clutch piston outer seal.

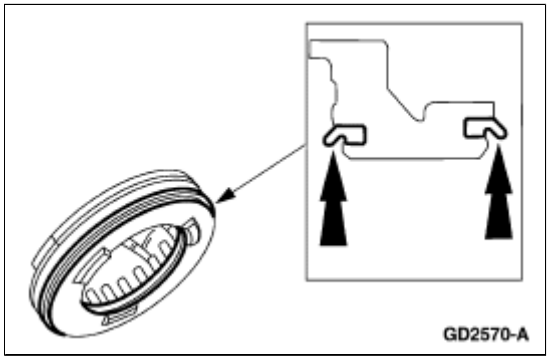


Assembly

1. **CAUTION: The lip seals must be positioned as shown. Care must be taken to prevent rollover of the lip seal.**

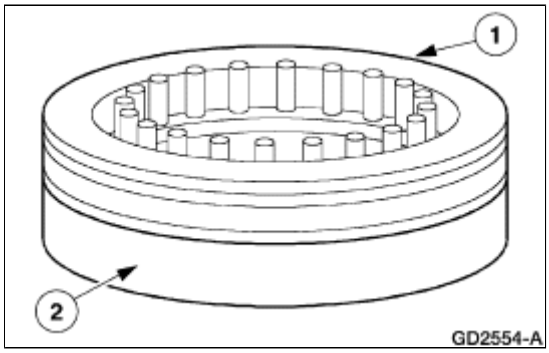
   NOTE: Use new seals to help prevent seal failures.

Install the new direct clutch piston inner seal and the direct clutch piston outer seal.



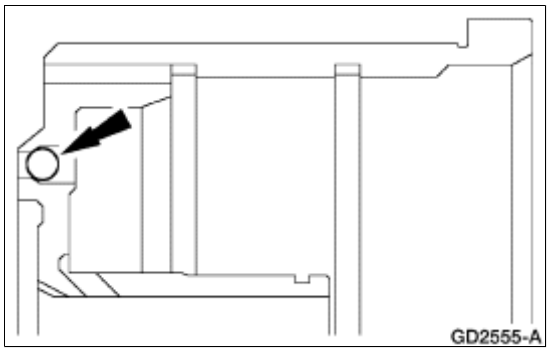
2. **CAUTION: Lubricate the direct clutch piston inner and outer seals with MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.**

   Install the direct clutch piston into the Direct Clutch Outer Seal Sizing Tool.
   1. Press together until seated.
   2. Install the direct clutch piston into the Direct Clutch Outer Seal Sizing Tool.

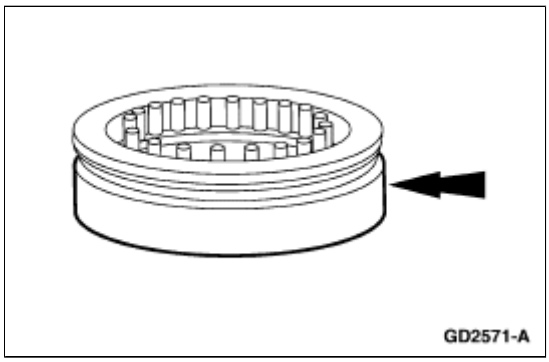


3. Inspect the intermediate brake and direct clutch drum and components for the following:
   - Intermediate brake and direct clutch band surface for scoring.
   - Clutch piston bore and the piston inner and outer bearing surfaces for scoring.
   - The fluid passages for obstructions. All fluid passages must be clean and free of debris.
   - Inspect the clutch plates for wear, scoring and fit on the clutch hub serrations. Replace all plates that are badly scored, worn or do not fit freely in the hub serrations.
   - Inspect the direct clutch pressure plate for scores on the clutch plate bearing surface. Check the clutch release springs for distortion.

4. Verify that the intermediate brake and direct clutch drum check ball is clean and free of debris.

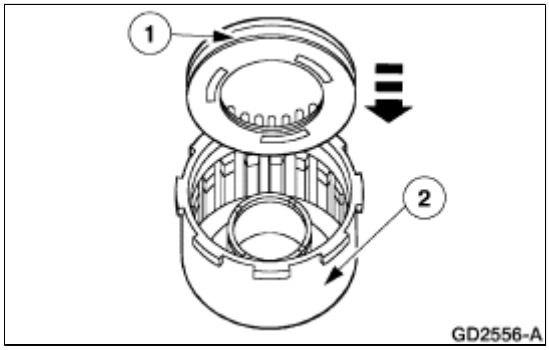


5. Carefully remove the direct clutch piston from the Direct Clutch Outer Seal Sizing Tool.

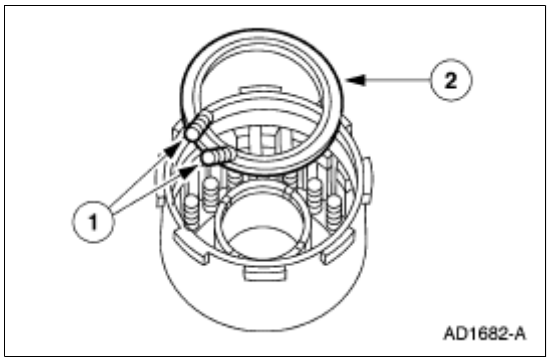


6. **CAUTION: Care must be taken to prevent damage to the seals during installation.**

   Install the direct clutch piston.
   1. Position the direct clutch piston in the intermediate brake and direct clutch drum.
   2. Push down evenly around the piston circumference.



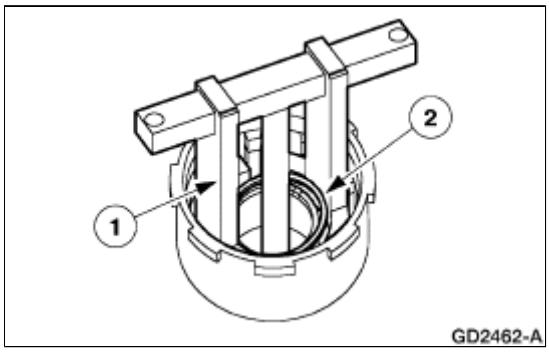
7. Install the direct clutch piston spring retainer and the twenty (20) direct clutch piston springs.
   1. Install the direct clutch piston springs.
   2. Place the direct clutch piston spring retainer on the direct clutch piston springs.



8. **WARNING: After removing the retaining ring, use care when releasing the pressure on the springs. Failure to follow these instructions may result in personal injury.**

   CAUTION: Do not fully compress the Clutch Spring Compressor or damage to the spring retainer may occur.

   Use a Clutch Spring Compressor to install the direct clutch piston retaining ring.
   1. Install the Clutch Spring Compressor and compress the direct clutch piston springs.
   2. Install the direct clutch piston retaining ring.

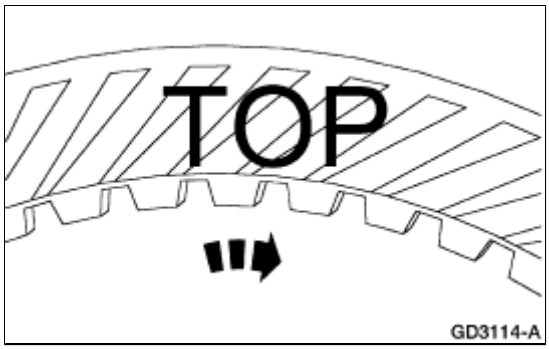


9. Relieve the direct clutch spring tension and remove the Clutch Spring Compressor.

10. **CAUTION: The direct clutch friction plates are directional and must be installed with grooves pointing clockwise (I.D. to O.D.) and the word (TOP) facing up.**

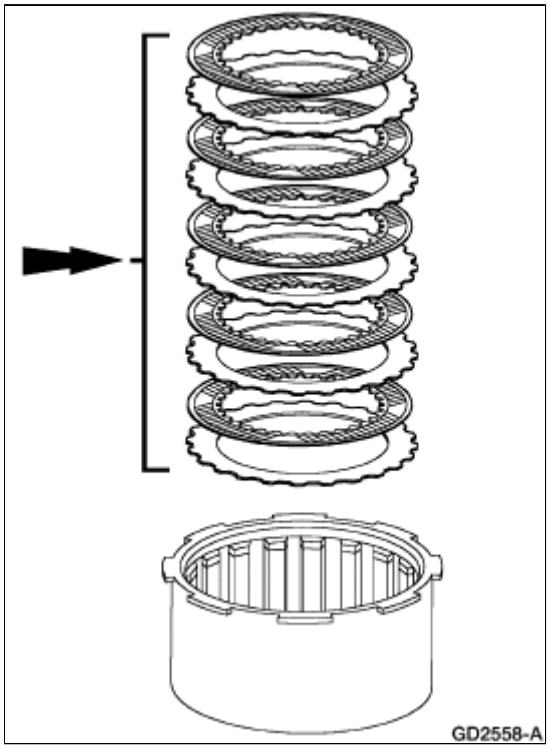
    CAUTION: If new plates are used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.

    When installing friction plates, the word (TOP) should face up. If reusing plates, grooves must be installed clockwise. Install the direct clutch disc pack.



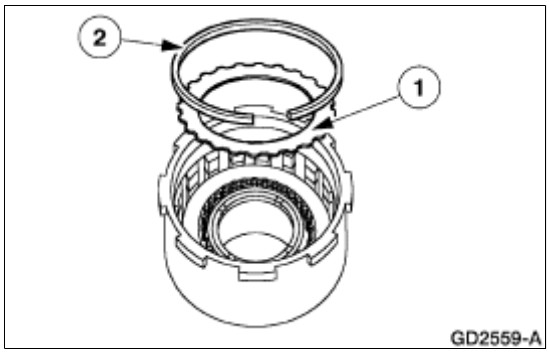
11. **NOTE:** If the steel plates are being replaced, make sure to use the correct steel plates. For SOHC use 1.71 mm (0.06 in) steel plates. For EI use 2.14 mm (0.08 in) steel plates.

    Install the steel clutch plates and friction clutch plates in alternating order starting with a steel clutch plate.



12. **CAUTION: The retaining ring is a select fit.**

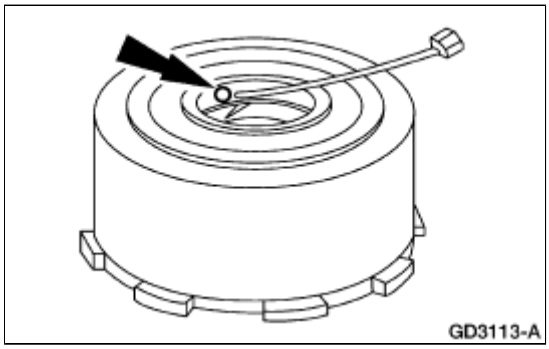
    Install the direct clutch pressure plate.
    1. Install the direct clutch pressure plate.
    2. Install the original direct clutch retaining ring on the direct clutch disc pack.



13. **WARNING: Air pressure must not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air. Make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

    NOTE: The direct clutch piston must apply with air pressure and release when the air is removed.

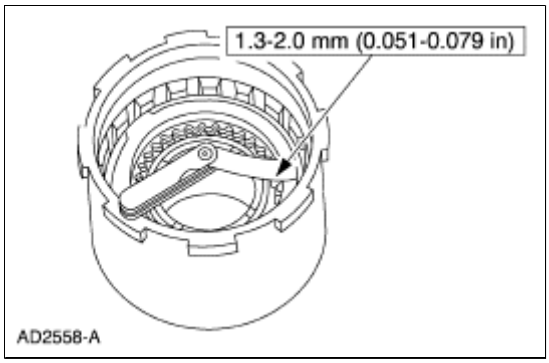
    Check the operation using compressed air.
    - Apply air pressure to the hole in the drum while blocking the other hole with a finger.



14. Push down on direct clutch disc pack and check gap between the direct clutch retaining ring and the direct clutch pressure plate with a feeler gauge.
    - If specifications do not match use a select fit direct clutch retaining ring to match specifications and verify with a feeler gauge.

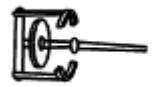
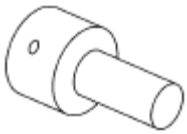
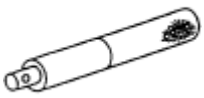
Direct Clutch

	Thickness		Diameter	
Part Number	mm	In	mm	In
E860126-S	1.37	0.0539	130.1	5.122
E860127-S	1.73	0.0681	130.1	5.122
E860128-S	2.08	0.0819	130.1	5.122
E860129-S	2.44	0.0961	130.1	5.122

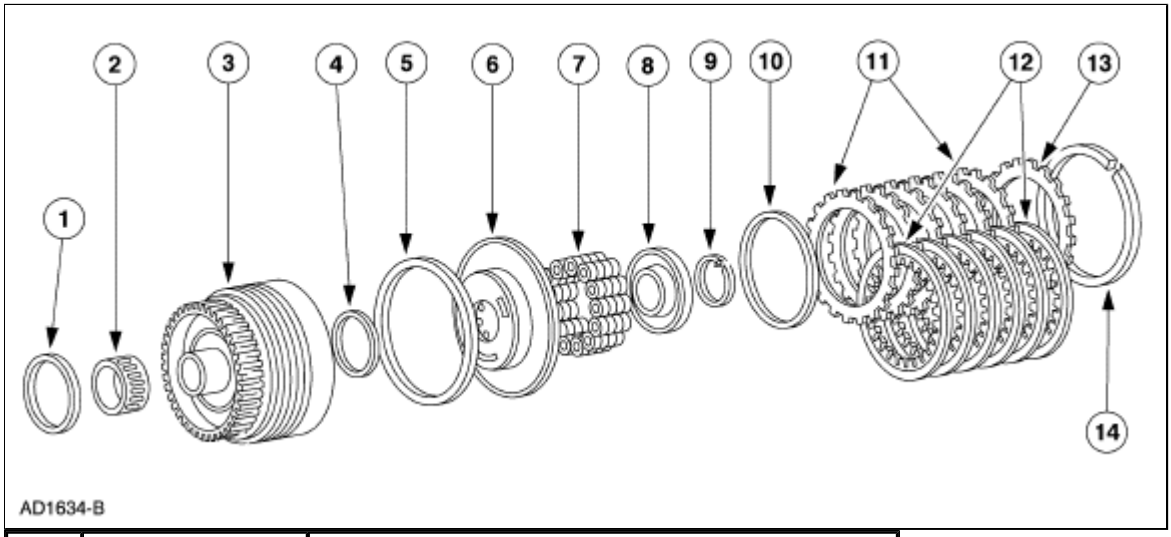

1.3-2.0 mm (0.051-0.079 in)
AD2558-A

Forward Clutch

Special Tool(s)

 ST1190-A	Clutch Spring Compressor 307-015 (T65L-77515-A)
 ST1813-A	Inner Seal Protector 307-051 (T74P-77548-A)
 ST1812-A	Outer Seal Protector 307-052 (T74P-77548-B)
 ST2185-A	Bearing Replacer 307-375
 ST1326-A	Handle 205-153 (T80T-4000-W)
 ST1543-A	Step Plate 205-D012 (D80L-630-1)
 ST2382-A	3 Jaw Puller 303-D120

Forward Clutch Assembly

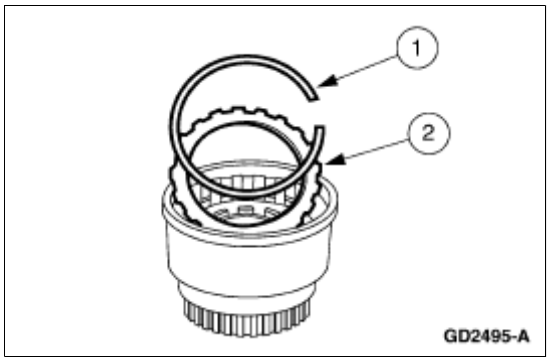


Item	Part Number	Description
1	7M153	Forward clutch cylinder thrust bearing (No. 5)
2	7M154	Forward clutch cylinder needle bearing
3	7A360	Forward clutch cylinder assembly
4	7A548	Forward clutch piston inner seal ring
5	7A548	Forward clutch piston outer seal ring
6	7A262	Forward clutch piston
7	7A480	Forward clutch piston spring (15 required)
8	7A527	Forward clutch piston spring retainer
9	E860109-S	Forward clutch retaining ring
10	7B070	Forward clutch cushion spring
11	7B442	Forward clutch external plate — steel
12	7B164	Forward clutch internal plate — friction
13	7B066	Forward clutch pressure plate
14	E860115S/118S	Forward clutch retaining ring (select fit)

Disassembly

1. **CAUTION: The retaining ring is a select fit. See assembly procedure if the ring or clutch plate pack is replaced.**

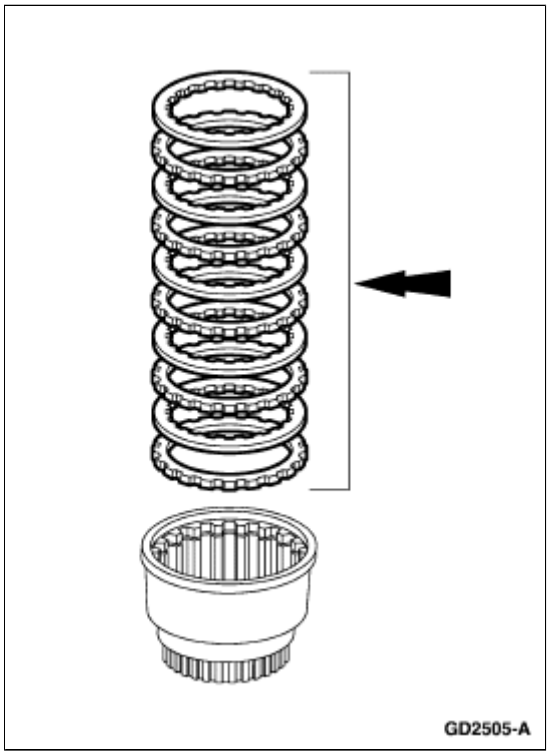
   Remove the forward clutch pressure plate.
   1. Remove the forward clutch retaining ring.
   2. Remove the forward clutch pressure plate.



2. **CAUTION: If new plates are being used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.**

   CAUTION: Clutch discs are directional. Note direction of grooves for installation.

   Remove the forward clutch disc pack.
   - Inspect the forward clutch plates for wear, damage or overheating.

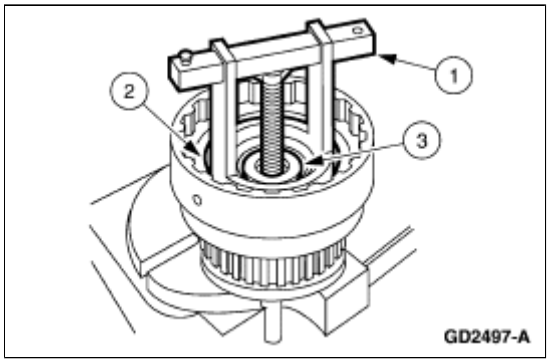


3. **WARNING: Use caution when releasing tool pressure on the clutch piston springs. Failure to follow these instructions may result in personal injury.**

   CAUTION: Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.

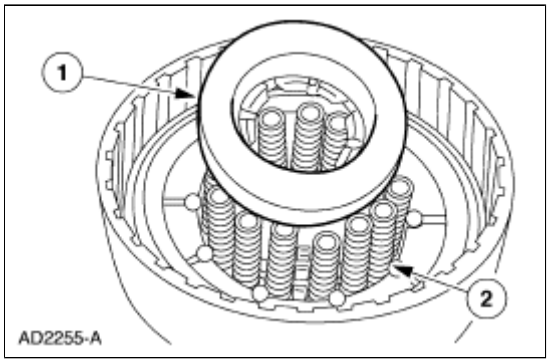
   Use Clutch Spring Compressor to remove the forward clutch piston retaining ring.

1. Install the Clutch Spring Compressor.
2. Compress the forward clutch piston springs.
3. Remove the forward clutch piston spring retaining ring.



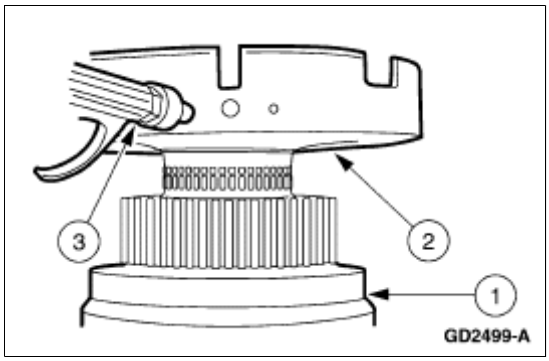
4. Relieve the forward clutch spring tension and remove the Clutch Spring Compressor.

5. Remove the forward clutch piston spring retainer and 15 forward clutch piston springs.
   1. Remove the forward clutch piston spring retainer.
   2. Remove the 15 forward clutch piston springs.
      - Inspect the forward clutch piston springs for distortion.

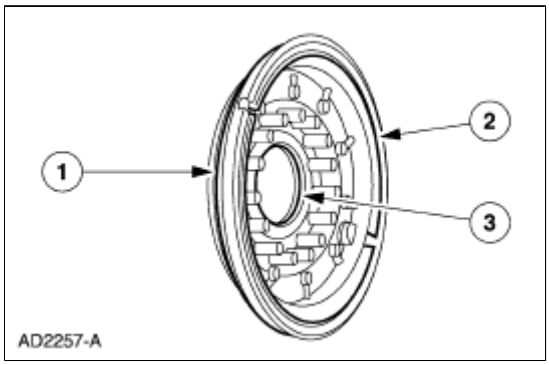


6. **WARNING: Air pressure must not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air. Make sure the cylinder is facing down as shown. Failure to follow these instructions may result in personal injury.**

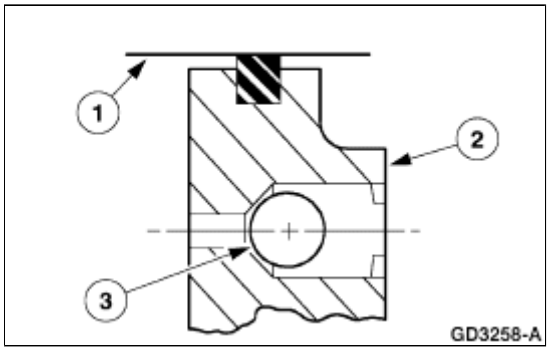
   Remove the forward clutch piston.
   1. Place the forward clutch cylinder with forward clutch piston facing down.
   2. Install the center support on the forward clutch cylinder.
   3. Apply air pressure to the left port of the center support.



7. Remove and discard the forward clutch piston seals.
    1. Remove the forward clutch piston outer seal and inspect the forward clutch piston for cracks.
    2. Remove forward clutch cushion spring.
    3. Remove the forward clutch piston inner seal.



8. Inspect the remaining forward clutch drum components for damage or wear, replace components as necessary:
    1. Inspect the forward clutch cylinder surfaces for scores or burrs. Minor scores or burrs may be removed with a crocus cloth. Replace the forward clutch cylinder if it is badly scored or damaged.
    2. Inspect forward clutch piston for scores or burrs. Minor scores or burrs may be removed with a crocus cloth. Replace forward clutch cylinder if it is badly scored or damaged.
    3. Make sure the check ball is free and clear of debris, has freedom of movement, and is properly seated.

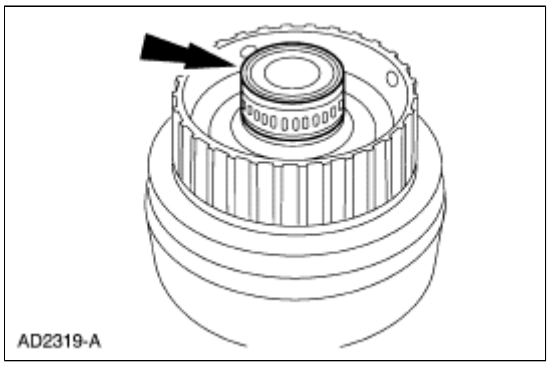


9. Inspect the forward clutch drum components.
    - Inspect clutch plate serration for scores or burrs.
    - Inspect fluid passages for obstructions. Clean out all passages.
    - Inspect the friction clutch plates, steel clutch plates and clutch pressure plate for worn or

scored bearing surface. Replace all parts that are deeply scored.
- Check clutch plates for flatness and fit on the clutch hub serrations. Discard any plate that does not slide freely on the serrations or that is not flat.
- Check clutch hub thrust surfaces for scores and clutch hub splines for wear.
- Inspect for damage or wear to the clutch disc grooves and retaining ring grooves.

10. **NOTE:** Inspect the needle bearing for damage and install new if necessary.

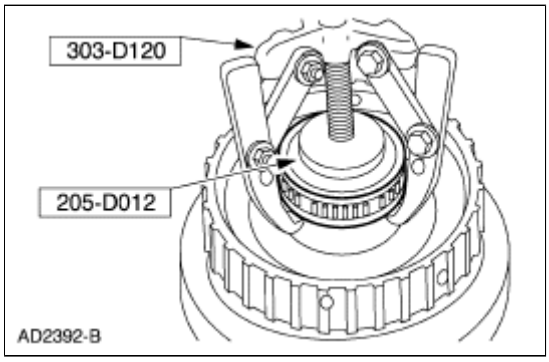
    Inspect the needle bearing for damage.



11. **CAUTION: Do not overtighten the tool or damage to the forward clutch bearing may occur**

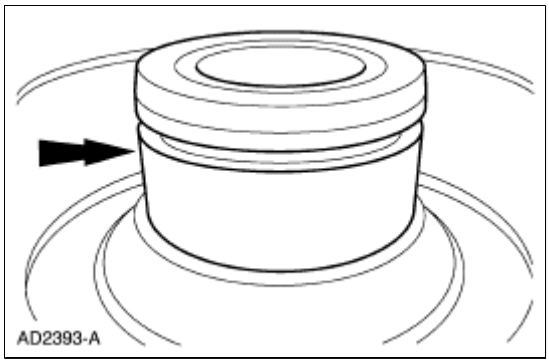
    NOTE: This step only needs to be carried out if there is damage to the bearing.

    Using the special tools, remove the forward clutch bearing.



12. **NOTE:** This step only needs to be carried out if there is damage to the bearing.

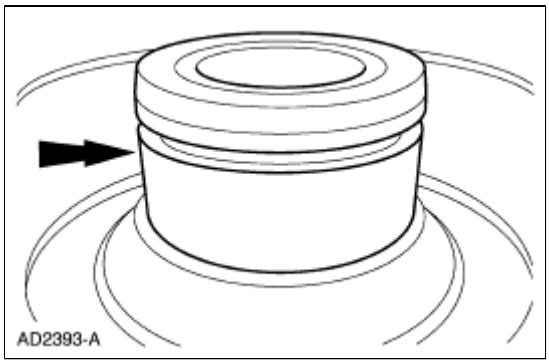
    Inspect the forward clutch outer race for scoring or nicks, if any damage is found the forward clutch drum will need to be replaced.



Assembly

1. Thoroughly clean all parts in solvent and blow dry with moisture free compressed air.
2. **NOTE:** This step only needs to be carried out if the bearing was removed.

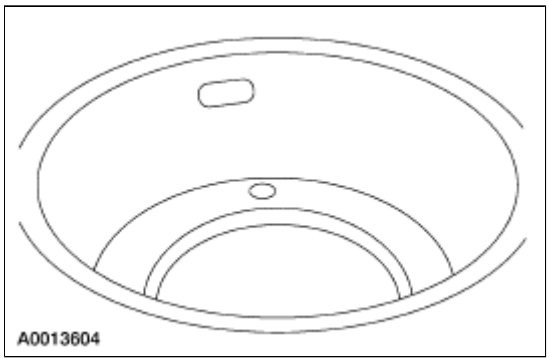
   Clean and lubricate the outer surface with clean transmission fluid.



3. **NOTE:** This step only needs to be carried out if the bearing was removed.

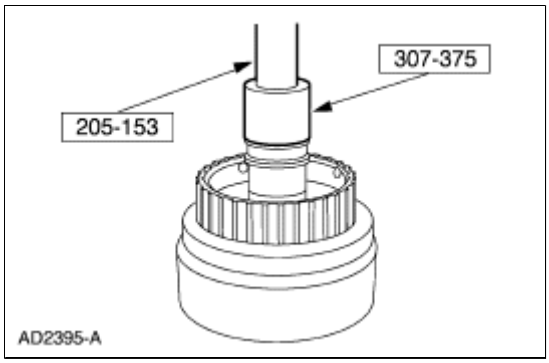
   NOTE: The rectangular hole in the inside of the forward clutch bearing must face up (away from the forward clutch drum)

   Install the forward clutch bearing with the rectangular hole facing up.



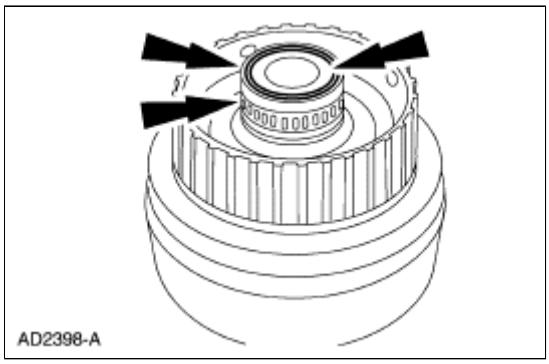
4. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Using the special tools, install the forward clutch bearing.



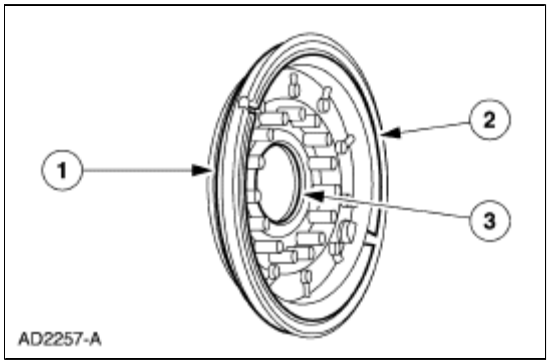
5. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Inspect that the bearing is properly seated on the drum. Inspect the top portion of the drum that it was not damaged, and the bearing rotates freely.



6. **CAUTION: If there is evidence of clutch plate burning, replace the forward clutch cushion spring.**

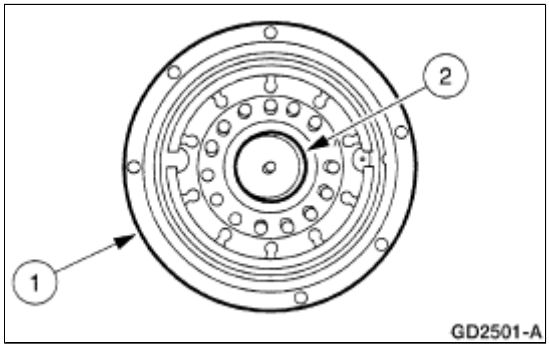
   Install new forward clutch piston seals.
   1. Install the forward clutch piston outer seal.
   2. Install forward clutch cushion spring.
   3. Install the forward clutch piston inner seal.



7. **NOTE:** Lubricate the forward clutch piston inner and outer seal with clean MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification.

   Install lip seal protector tools on the forward clutch piston.
   1. Install the Outer Seal Protector to the forward clutch piston outer seal.

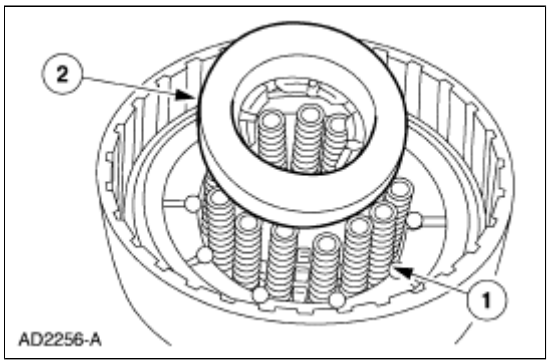
2. Install the Inner Seal Protector to the forward clutch piston inner seal.



8. **CAUTION: Care must be taken to prevent damage to the seals.**

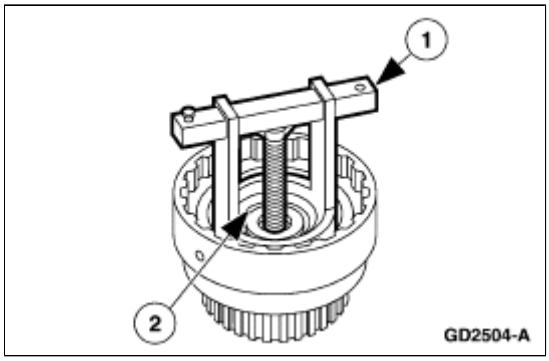
   As you install the forward clutch piston into the forward clutch cylinder, remove the Inner and Outer Seal Protectors.

9. Install the 15 forward clutch piston springs and the forward clutch piston spring retainer.
   1. Install the 15 forward clutch piston springs.
   2. Install the forward clutch piston spring retainer.



10. **CAUTION: Do not fully depress the Clutch Spring Compressor or damage to the spring retainer may occur.**

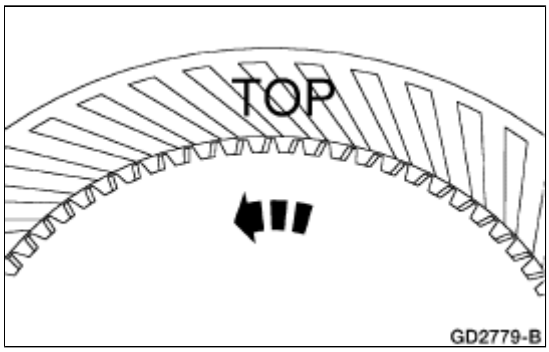
    Use the Clutch Spring Compressor to install the forward clutch piston spring retaining ring.
    1. Install the Clutch Spring Compressor and compress the forward clutch springs.
    2. Install the forward clutch piston spring retaining ring.



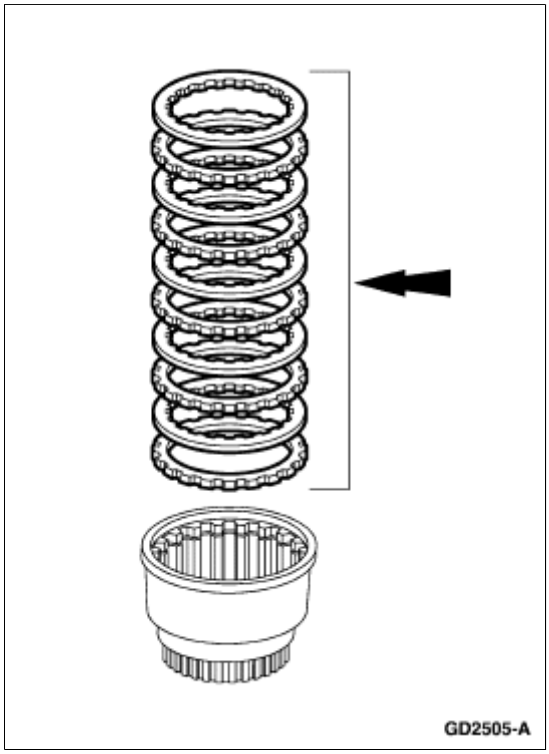
11. **CAUTION: The forward clutch friction plates are directional and must be installed with grooves pointing counterclockwise (I.D. to O.D.) and the word "TOP" facing up.**

    CAUTION: If new plates are used, they should be soaked in clean transmission fluid for at least 30 minutes before assembly.

    When installing friction plates, the word "TOP" should face up. If reusing plates, grooves must be installed counterclockwise. Install the direct clutch disc pack.

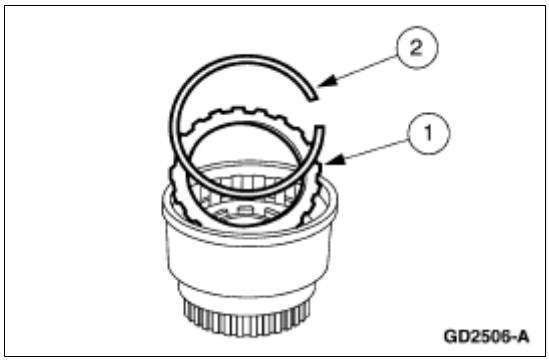


12. Install the steel clutch plates and friction clutch plates (quantity model dependent) in alternating order starting with a steel clutch plate.



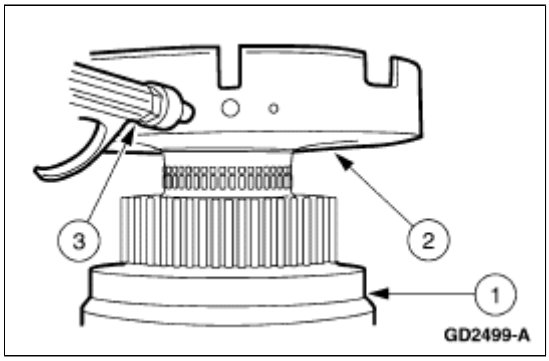
13. **CAUTION: The retaining ring is a select fit.**

    Install the forward clutch pressure plate and the original selective retaining ring.
    1. Install the forward clutch pressure plate.
    2. Install the forward clutch retaining ring.



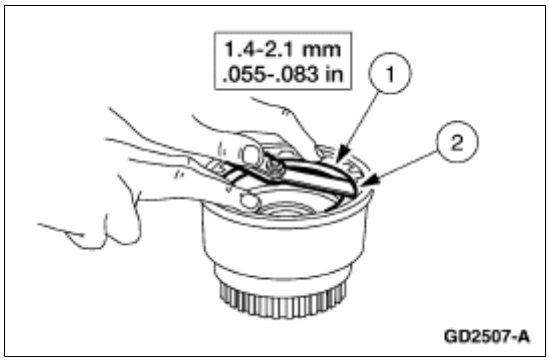
14. **WARNING: Air pressure must not exceed 138 kpa (20 psi). Wear safety glasses when using compressed air. Make sure the drum is facing down as shown. Failure to follow these instructions may result in personal injury.**

    Air check the forward clutch piston.
    1. Place the forward clutch cylinder with forward clutch piston facing down.
    2. Install the transmission center support on the forward clutch cylinder.
    3. Apply air pressure to the left port of the center support.



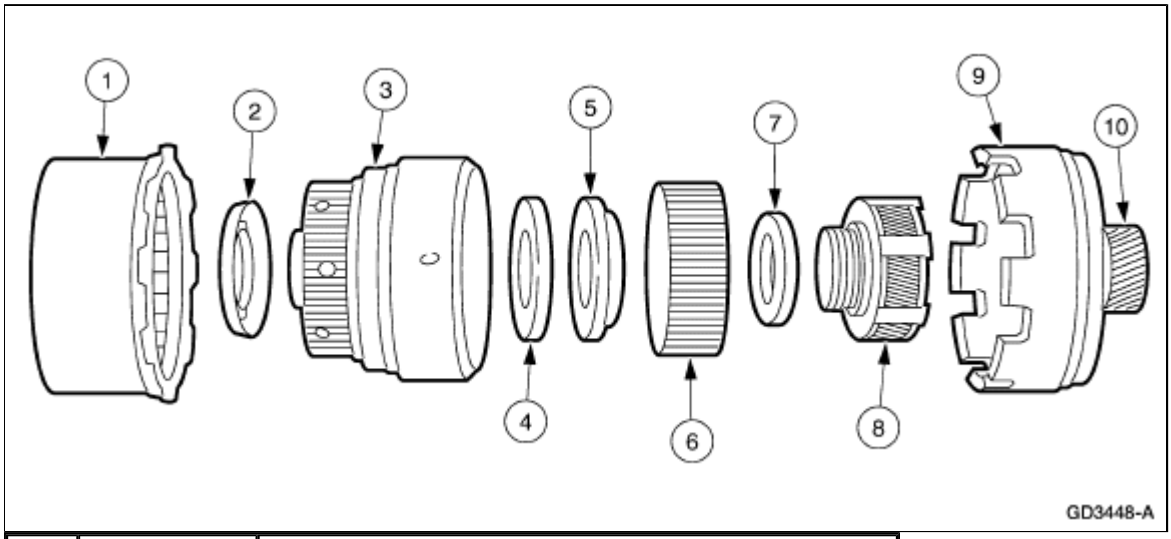
15. Check forward clutch disc pack free play.
    1. Press down on forward clutch disc pack.
    2. Using a feeler gauge, check the gap between the forward clutch retaining ring and the forward clutch pressure plate.
    - If the clearance is not within specifications, install the correct size retaining ring.

	Thickness		Diameter	
Part Number	mm	In	mm	In
E860115-S	1.37	.0539	125.1	4.925
E860116-S	1.73	.0681	125.1	4.925
E860117-S	2.08	.0819	125.1	4.925
E860118-S	2.44	.0961	125.1	4.925


1.4-2.1 mm
.055-.083 in
1
2
GD2507-A

Forward Geartrain

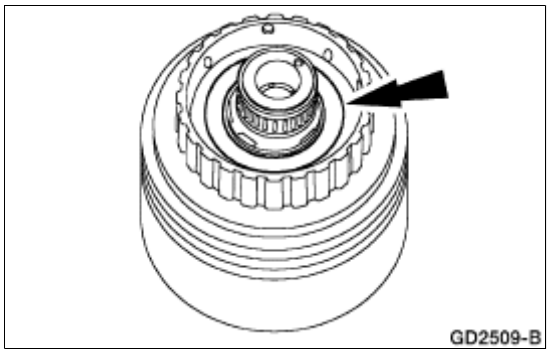
Forward Geartrain Assembly



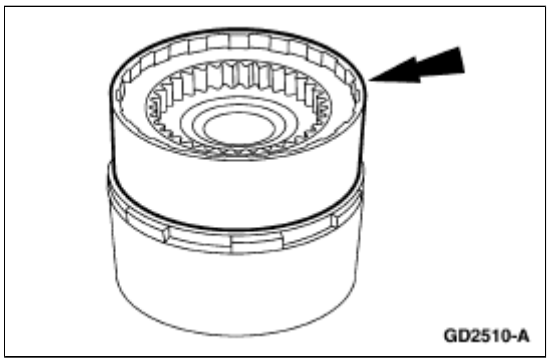
Item	Part Number	Description
1	—	Intermediate brake and direct clutch drum assembly
2	7M153	No. 5 forward clutch cylinder thrust bearing
3	—	Forward clutch cylinder assembly
4	7D234	No. 6A forward ring gear hub thrust bearing
5	7D090	No. 6B forward clutch thrust washer
6	7D392	Forward ring gear
7	7F374	No. 7 forward planetary thrust bearing
8	7A398	Forward planetary
9	7D064	Input shell
10	7D063	Forward sun gear

Assembly

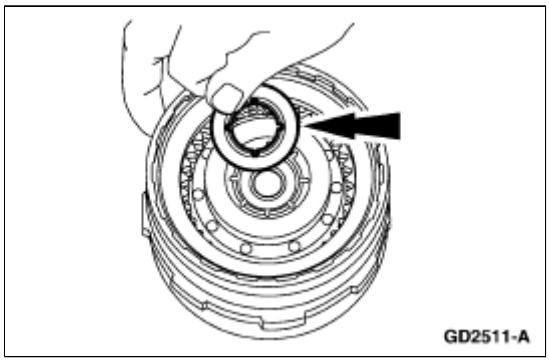
1. Install the forward clutch cylinder thrust bearing (No. 5) on the forward clutch cylinder assembly.
    - Use petroleum jelly to hold the forward clutch cylinder thrust bearing (No. 5) in place.



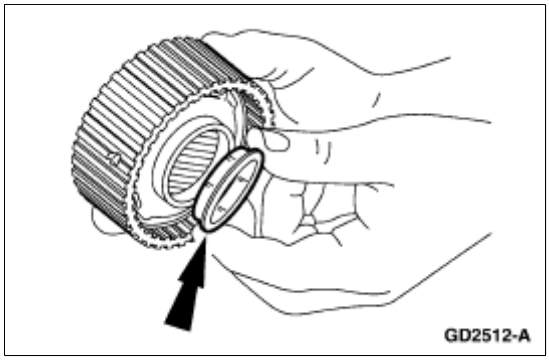
2. Install the forward clutch cylinder assembly into the intermediate brake and direct clutch drum assembly.



3. Install the forward ring gear hub thrust bearing (No. 6A) with the tabs facing up.

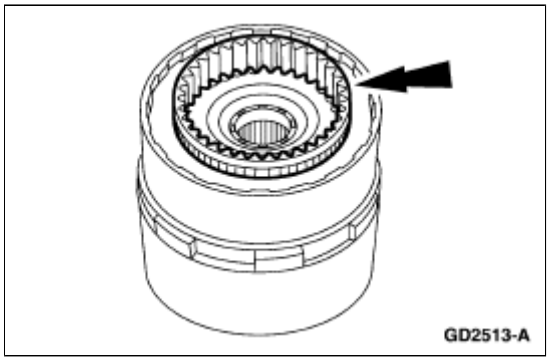


4. Install the forward clutch thrust washer (No. 6B) into the forward ring gear hub.
    - Use petroleum jelly to hold the forward clutch thrust washer (No. 6B) in place.



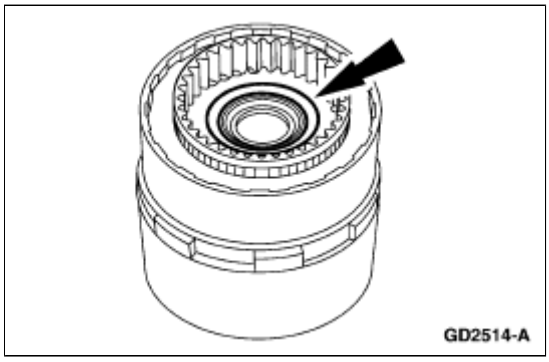
5. **NOTE:** Make sure the forward ring gear hub thrust bearing (No. 6A) and forward clutch thrust washer (No. 6B) are inside the forward ring gear.

   Install the forward ring gear (7D392) into the forward clutch cylinder.



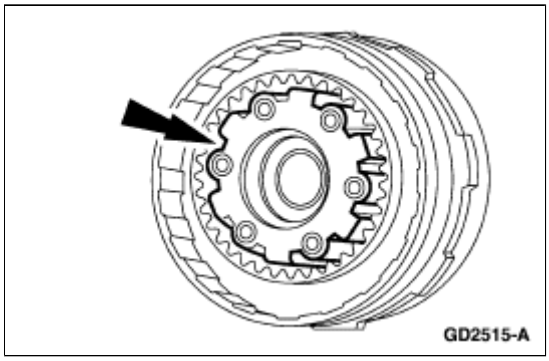
6. **CAUTION: Black oxidized color of thrust bearing must face up towards the planetary assembly.**

   Install the forward planetary thrust bearing (No. 7) into the forward ring gear.



7. **NOTE:** The forward planetary assembly is serviced with a 6 pinion assembly in all applications.

   Install the forward planetary assembly into the forward ring gear.

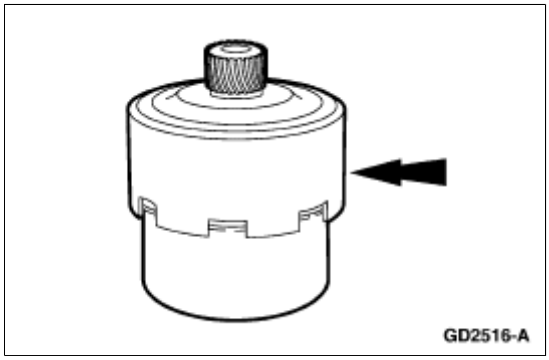


8. **NOTE:** There is not a bushing inside the forward sun gear or washer on the back of the input shell.

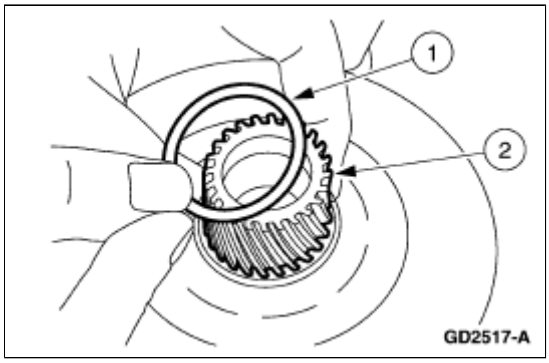
   NOTE: If the sun gear or input shell is damaged perform the following steps, if not, install the input shell and forward sun gear assembly into planetary gearset.

NOTE: Ensure the forward sun gear aligns with the forward planetary assembly. Ensure the input shell aligns with the intermediate brake and direct clutch.

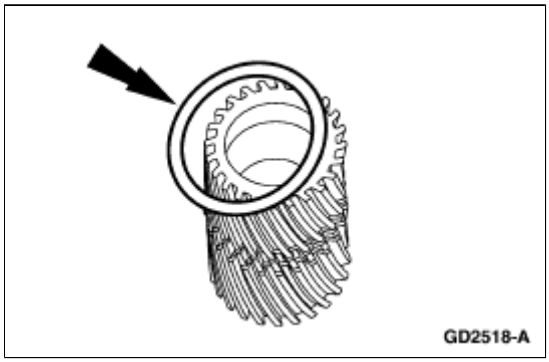
Inspect sun gear and input shell for damage or wear. If sun gear or input shell are damaged, repair/install new as necessary. Install the input shell and forward sun gear assembly into planetary gearset.



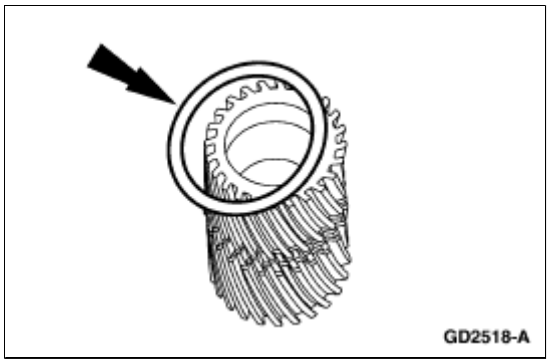
9. Remove the rear retaining ring, sun gear, and the retaining ring from the sun gear.
    1. Remove the rear retaining ring.
    2. Remove the sun gear.



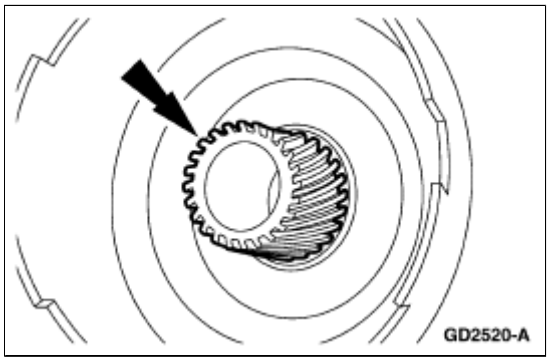
10. Remove the front retaining ring from the sun gear.



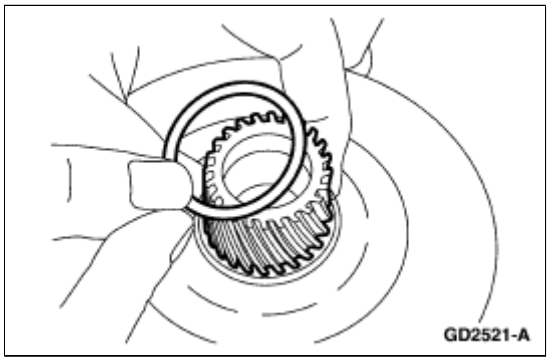
11. Install a new retaining ring onto the sun gear.



12. Install the sun gear into the input shell.



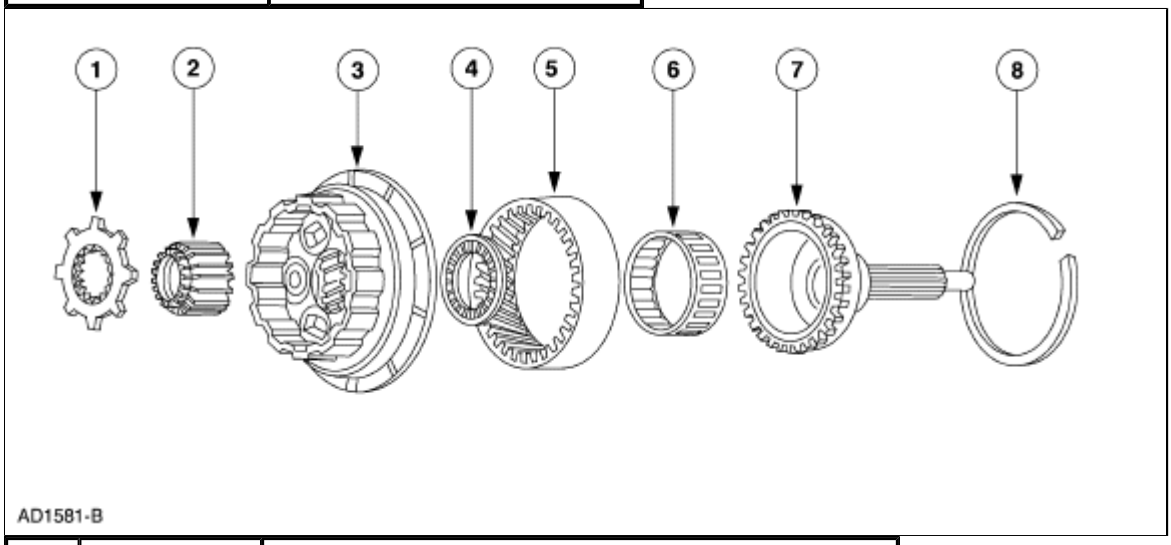
13. Install a new rear retaining ring.



Front Planetary and One-Way Clutch Assembly

Special Tool(s)

 ST2189-A	One-Way Clutch Sleeve 307-391
 ST2190-A	One-Way Clutch Pusher 307-392

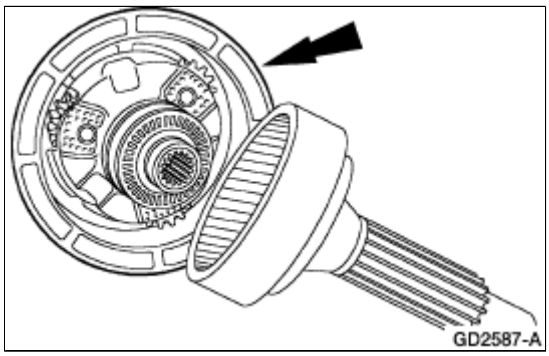


AD1581-B

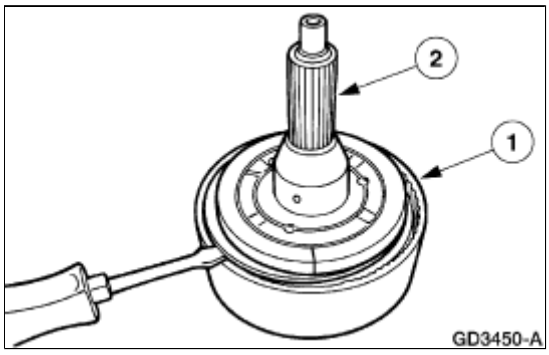
Item	Part Number	Description
1	7660	Coast Clutch Adapter
2	7D063	Front Sun Gear
3	7B446	Front Planetary Gear Carrier Assembly
4	7L495	No. 2 Front Planetary Thrust Bearing
5	7653	Front Ring Gear
6	7C109	Front One-Way Clutch Bearing
7	7A658	Center Shaft and Front One-Way Clutch Assembly
8	E860119-S	Retaining Ring

Disassembly

1. Inspect the one-way clutch.
    - Temporarily insert the front planetary gear carrier assembly into the center shaft and one-way clutch assembly for verification of the one-way clutch.
    - The planetary gear must rotate counterclockwise and hold when rotated clockwise.
    - Remove the planetary gear carrier assembly.

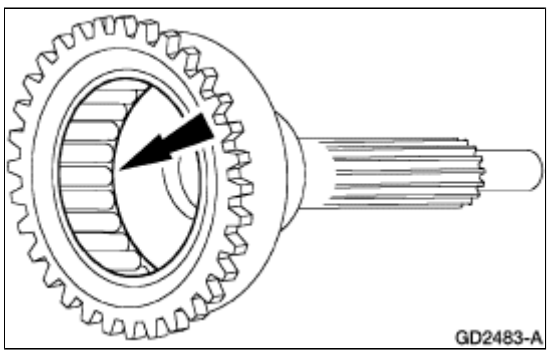


2. Remove the overdrive center shaft from the front ring gear.
    1. Remove the front center shaft retaining ring.
    2. Remove the center shaft from the ring gear.



3. **NOTE:** If the inner race of the front planetary gear is damaged, the front one-way clutch can be replaced. If the center shaft is damaged the complete front one-way clutch must be replaced as an assembly.

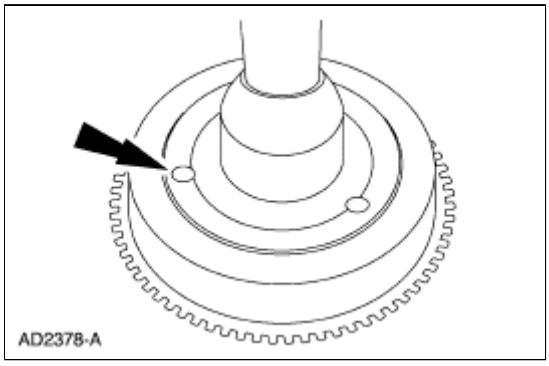
    Clean and inspect the front one-way clutch and center shaft.
    - Inspect the roller cage for cracks.
    - Inspect the roller clutch for wear.
    - Inspect the press fit of the one-way clutch to the center shaft.
    - Inspect the spring and roller cage for bent or damaged spring retainers.



4. **CAUTION: Do not score the center shaft bore.**

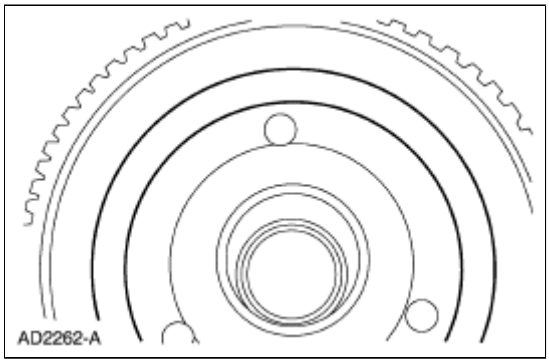
   NOTE: This step only needs to be carried out if there is damage to the bearing.

   Insert a screwdriver through the holes, remove the front one-way clutch from the center shaft.



5. **NOTE:** This step only needs to be carried out if there is damage to the bearing.

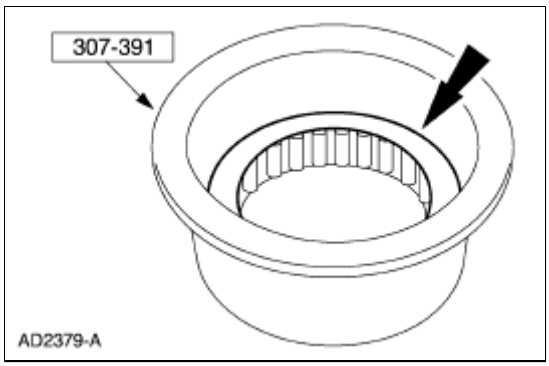
   Inspect the center shaft bore for damage. If the outer race of the center shaft bore is damaged, the front one-way clutch and center shaft must be replaced



Assembly

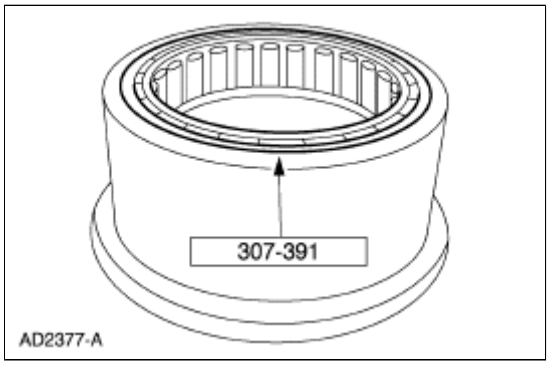
1. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Install the front one-way clutch into the special tool with the brass end cap facing up.



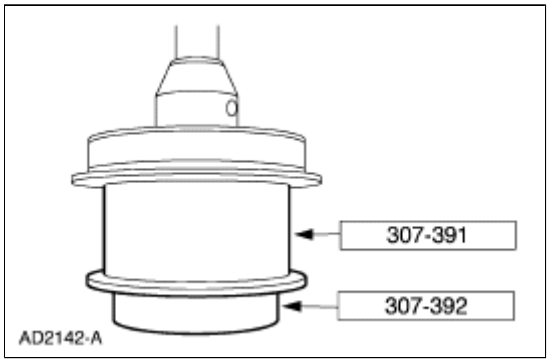
2. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Inspect that the front one-way clutch is flush with the special tool.



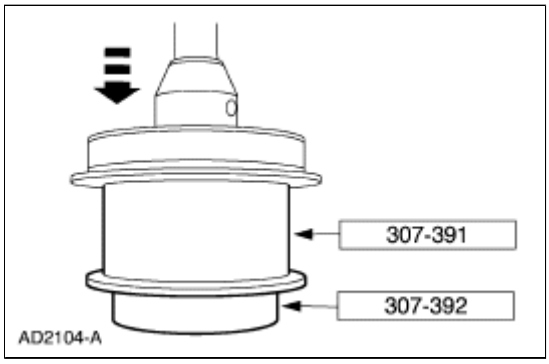
3. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Assemble the special tools with the front one-way clutch onto the center shaft.



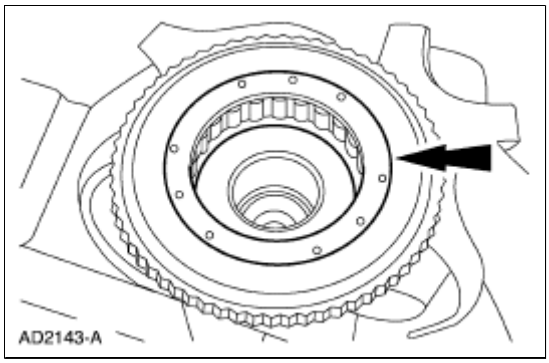
4. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Push down on the center shaft to seat the front one-way clutch into the center shaft.

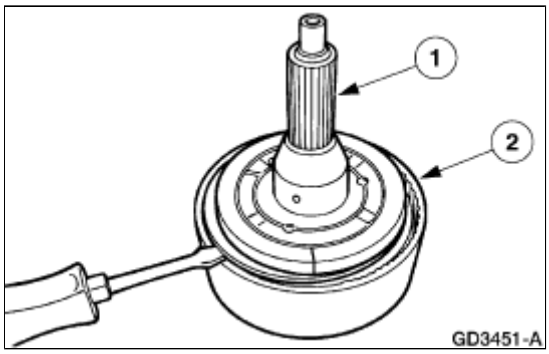


5. **NOTE:** This step only needs to be carried out if the bearing was removed.

   Inspect the front one-way clutch for proper installation and function. The front one-way clutch tabs should be flush with the center shaft.



6. Install the center shaft and one-way clutch onto the front ring gear.
    1. Install the center shaft and one-way clutch.
    2. Install the center shaft retaining ring.



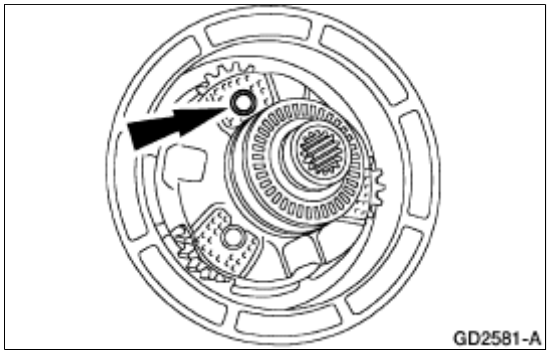
Front Planetary Gears

Disassembly

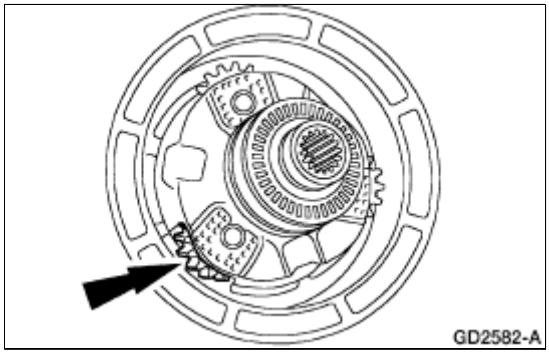
1. **CAUTION: Planetary gears must be replaced. Do not restake them.**

   NOTE: Individual parts of the planetary carriers are not serviceable.

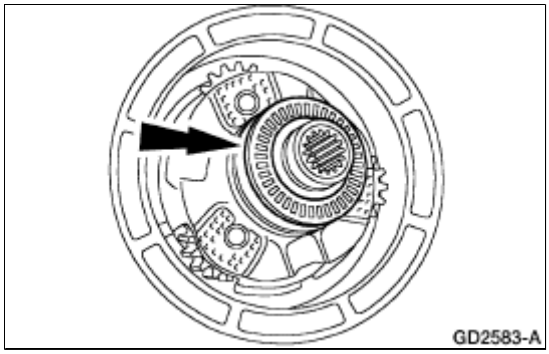
   Before installing a planetary assembly, the shaft retaining pins should be checked for adequate staking. Use a new planetary assembly if either of the following conditions exist. Check the pins and shafts in the planetary assemblies for loose fit and or complete disengagement.



2. Inspect the pinion gears for damaged or excessively worn teeth, and for free rotation.

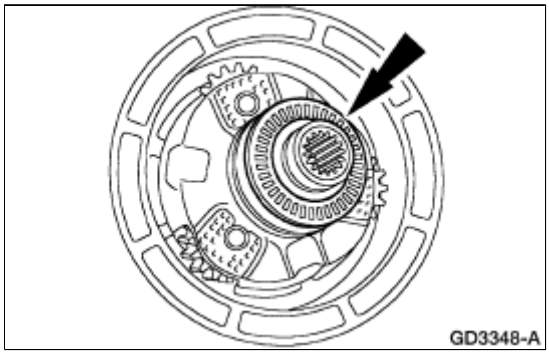


3. Inspect the front one-way clutch inner race for scoring. If the front one-way clutch inner race is scored or damaged the front planetary gear, center shaft, and one-way will need to be replaced.



4. Inspect the inner and outer races for scored or damaged surface areas where the rollers contact the races.

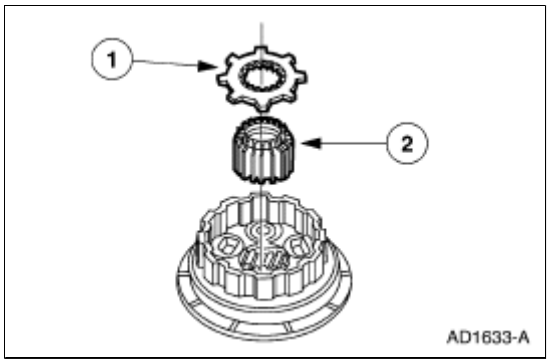
5. Remove and inspect the No. 2 front planetary thrust bearing on the nose of the front planetary gear carrier assembly.



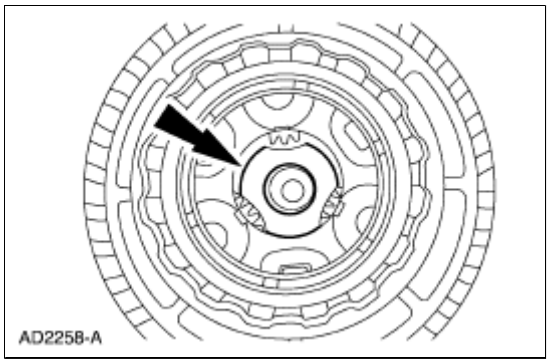
6. **NOTE:** Note the location of the part number stamped on the coast clutch adapter (7660) for assembly.

   NOTE: Inspect the sun gear for damaged or worn teeth.

   Remove the front sun gear.
   1. Remove the coast clutch to front carrier adapter.
   2. Remove the front sun gear.



7. Inspect the No. 12 bearing for damage.

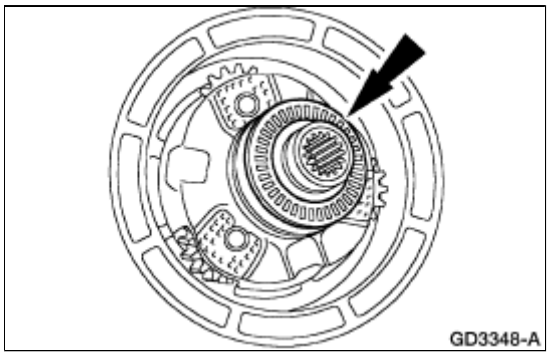


Assembly

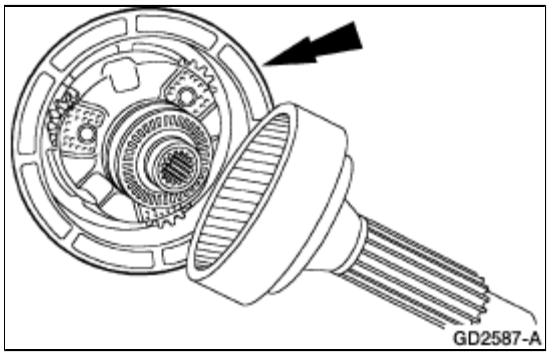
1. **NOTE:** Thoroughly clean all parts and blow dry with moisture free compressed air.

   NOTE: Use petroleum jelly to hold the front planetary thrust bearing (No. 2) in place.

   Install the No. 2 front planetary thrust bearing.

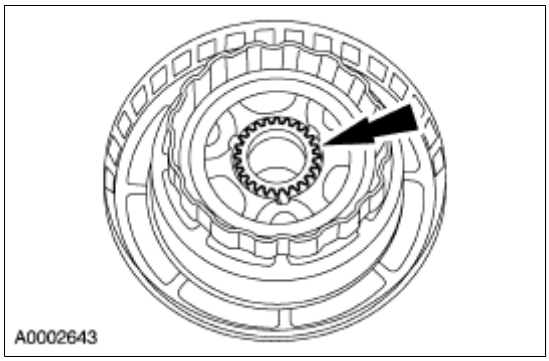


2. Install the front planetary gear carrier into the center shaft and front ring gear (7A153).



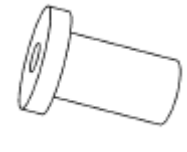
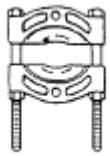
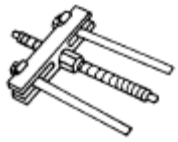
3. **CAUTION: Make sure that the No. 12 bearing is in place in the overdrive planetary prior to installing the overdrive sun gear.**

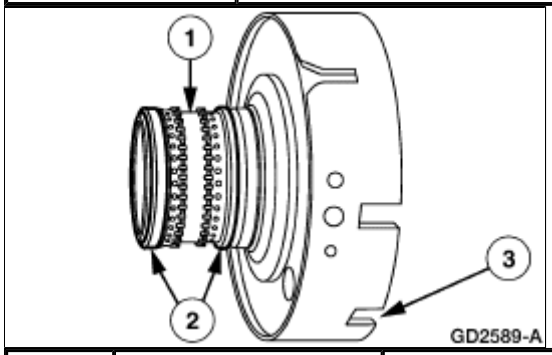
   Install the front sun gear with the recessed gear teeth facing toward the adapter.


A0002643

Center Support

Special Tool(s)

 ST2186-A	Bearing Replacer 307-374
 ST1543-A	Step Plate 205-D018 (D80L-630-7)
 ST1368-A	Pinion Bearing Cone Remover 205-D002 (D79L-4621-A)
 ST1516-A	Front Hub Tool 204-069 (T81P-1104-C)
 ST1326-A	Handle 205-153 (T80T-4000-W)



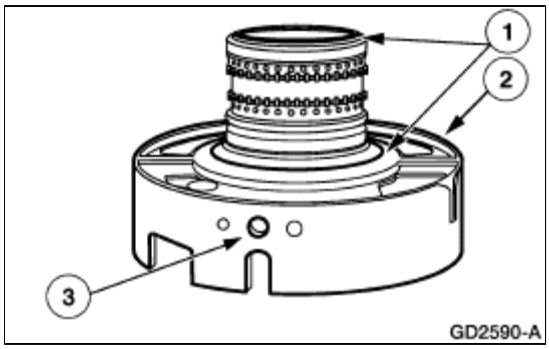
Item	Part Number	Description

1	7M155	Bearing
2	—	Seal Rings (Part of 7M155)
3	7A130	Center Support

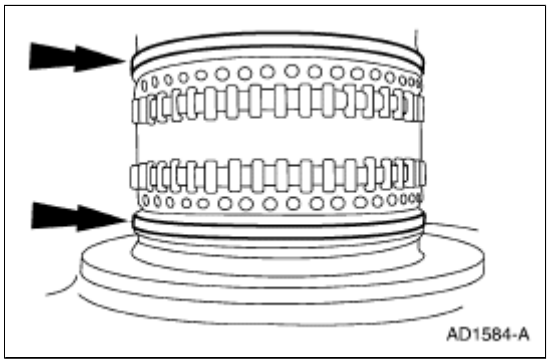
NOTE: Thoroughly clean center support assembly and blow dry with compressed air.

NOTE: The center support is serviced as an assembly. Any damage requires replacement of entire component.

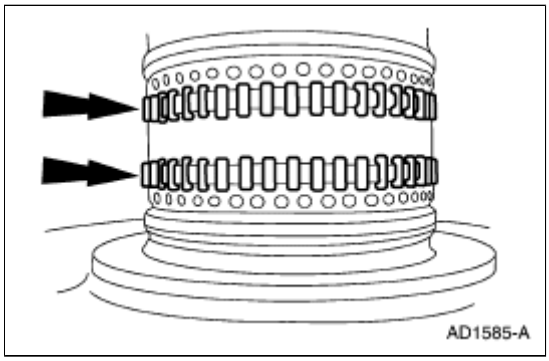
1. Inspect the center support assembly for wear or damage.
    1. Inspect the thrust surfaces for wear, scoring or damage.
    2. Inspect the center support sealing surface.
    3. Inspect the fluid passage for blockage or damage.



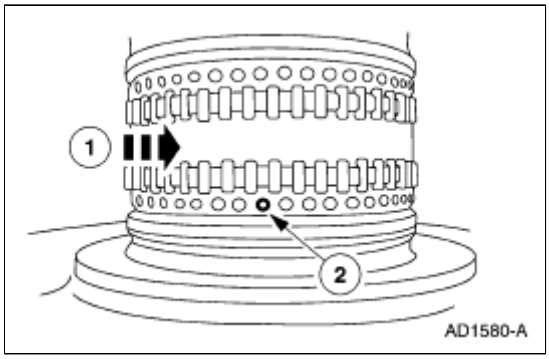
2. Inspect the seal rings for damage.



3. Inspect the bearing for missing rollers or damage.



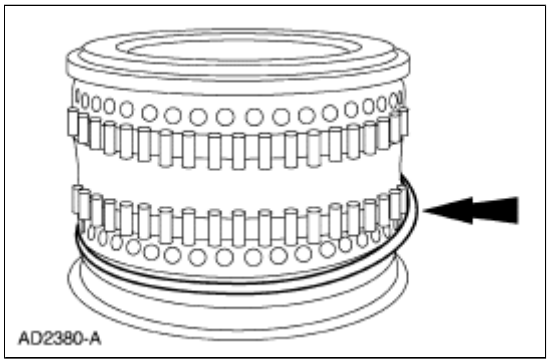
4. Inspect the direct clutch feed hole for blockage or damage.
    1. Rotate center support bearing to locate the direct clutch feed hole.
    2. Inspect the direct clutch feed hole for blockage or damage.



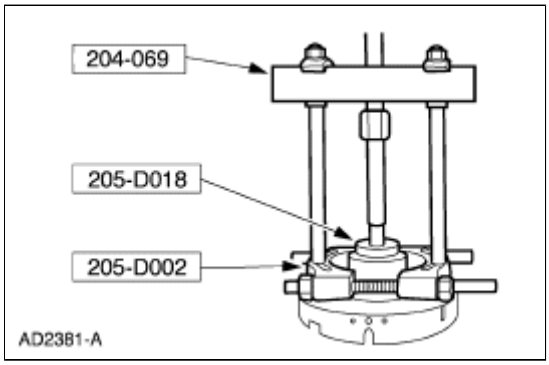
5. **NOTE:** Carry out the rest of the procedure only if there is damage to the bearing.

   NOTE: Inspect the needle bearing for damage and install new if necessary.

   Remove the lower seal.



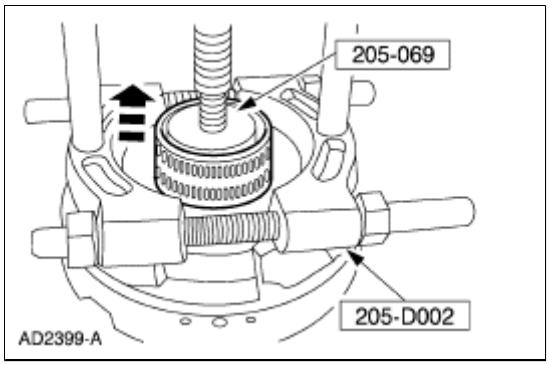
6. Assemble the special tools onto the center support.



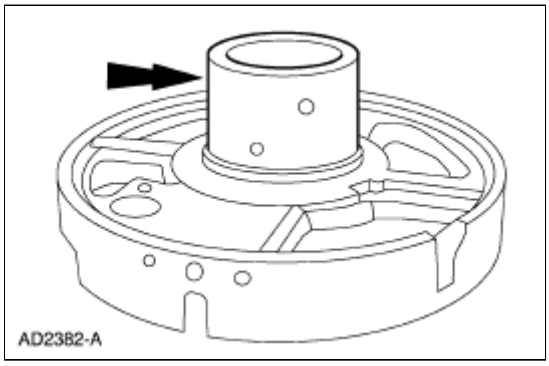
7. **CAUTION: Do not overtighten the tool or damage to the bearing may occur.**

   NOTE: The Pinion Bearing Cone Remover Tool must fit into the lower seal groove.

   Using the special tools, remove the needle bearing.

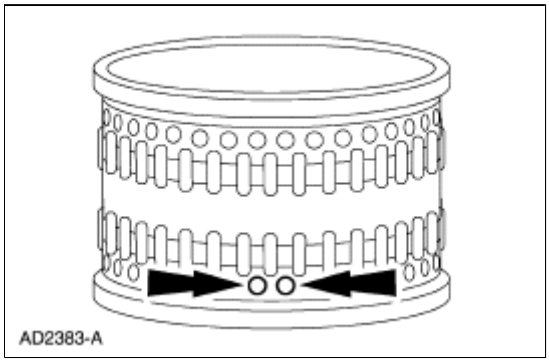


8. Inspect the front pump outer race for scoring or nicks, if any damage is found the pump assembly will need to be replaced.

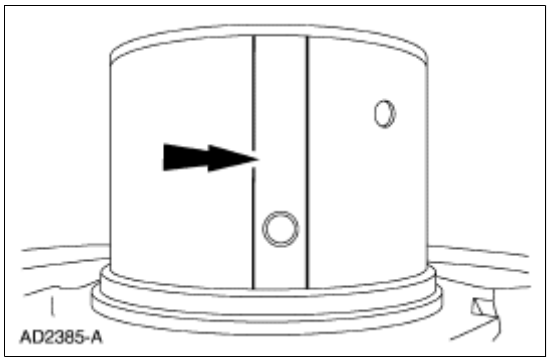


Assembly

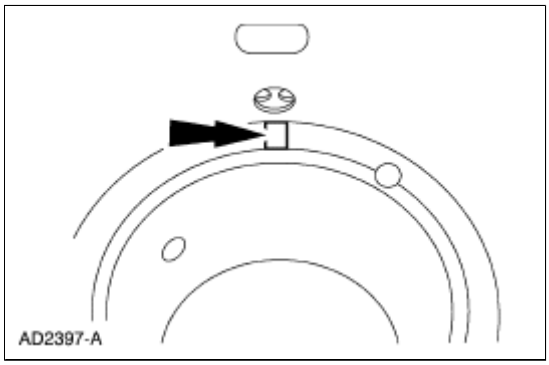
1. Align two of the center lower bearing holes with the lube hole in the bottom of the bearing.



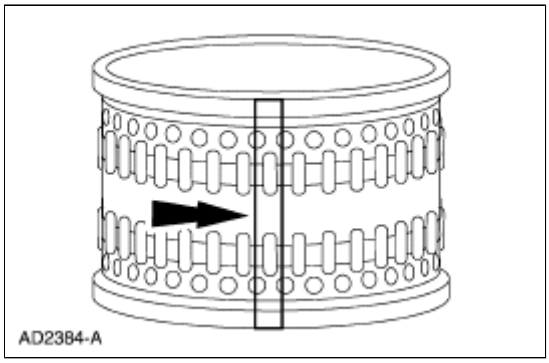
2. Using a black felt tip marker draw a line from the top of the center support snout to the hole at the bottom of the center support. This will be used as an alignment when installing the bearing.



3. Make an alignment mark on the top of the center support



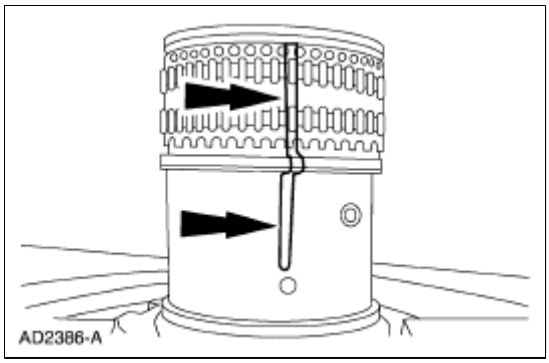
4. Using a black felt tip marker draw a line from the bottom lower holes to the top of the bearing. This will be used as an alignment when installing the bearing.



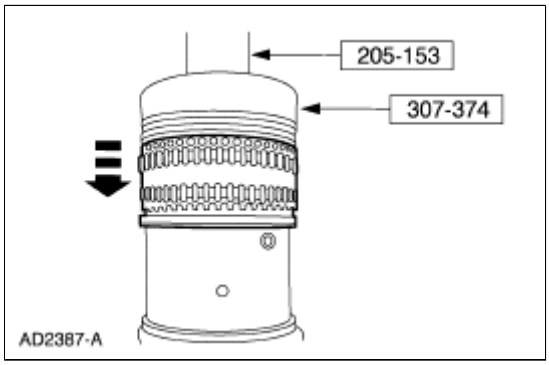
5. **CAUTION: The alignment marks on the bearing and the support must be aligned or a transmission failure could occur.**

   NOTE: The small hole on the inside of the bearing must be in the down position. (toward the center support)

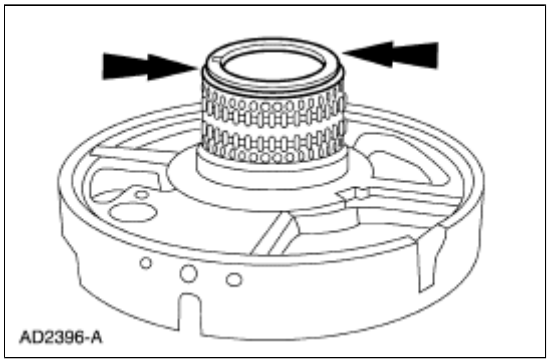
   Install the bearing onto the center support.



6. Using the special tools, install the center support bearing.



7. After the center support bearing has been installed inspect the top of the bearing and center support for any damage.

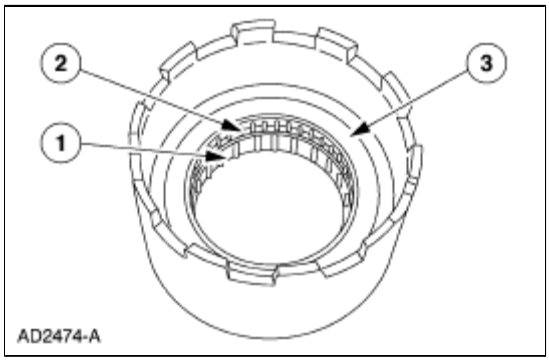


Reverse Brake Drum

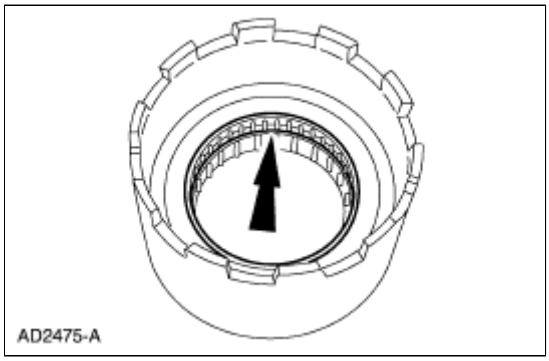
Disassembly

1. **NOTE:** New low reverse one-way clutch and rollers can now be installed. The following procedure only needs to be carried out if there is damage to the low reverse one-way clutch and roller bearing.

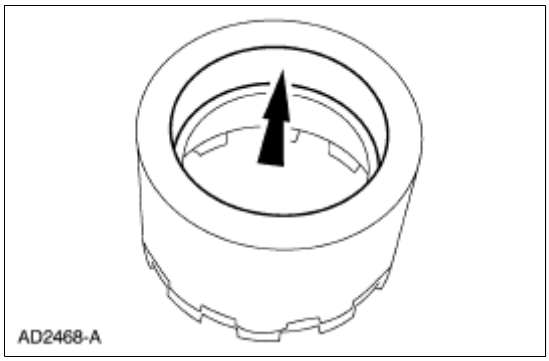
   Inspect the reverse brake drum for damage.
   1. Inspect the low reverse one-way clutch.
   2. Inspect the roller bearing.
   3. Inspect the reverse brake drum.



2. With the reverse clutch drum supported use a flat drift punch to tap the one-way clutch and the roller bearing out of the drum.

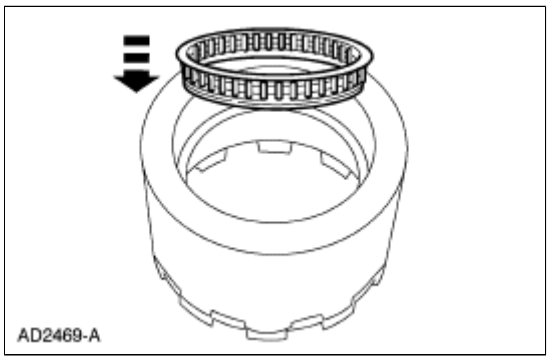


3. Inspect the low reverse one-way clutch inner race and roller bearing inner race for scoring, and nicks. If damage is indicated a new reverse clutch drum will need to be installed as an assembly.

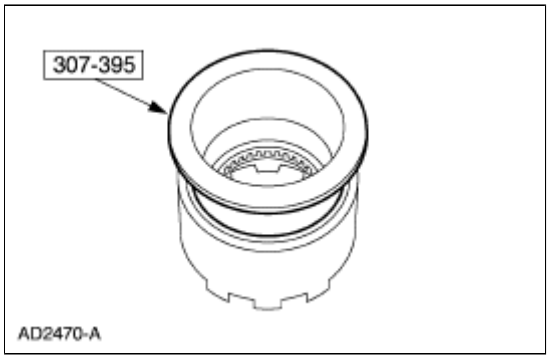


Assembly

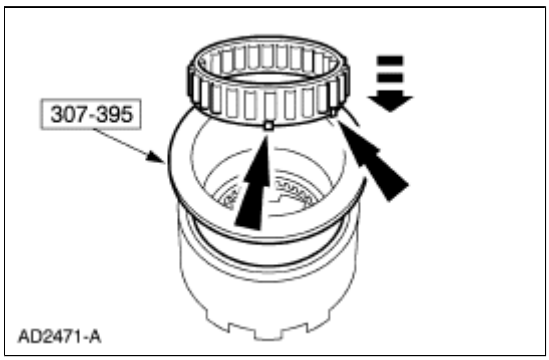
1. Install the roller bearing with the lip facing up toward the low reverse one-way clutch.



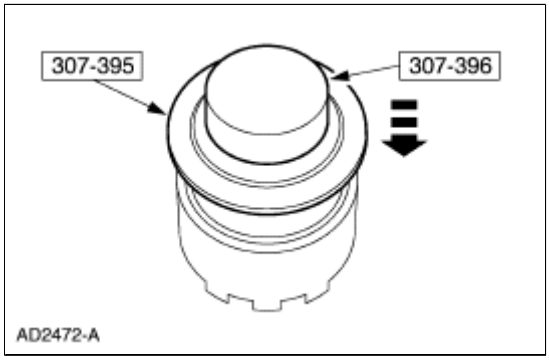
2. Install the special tool.



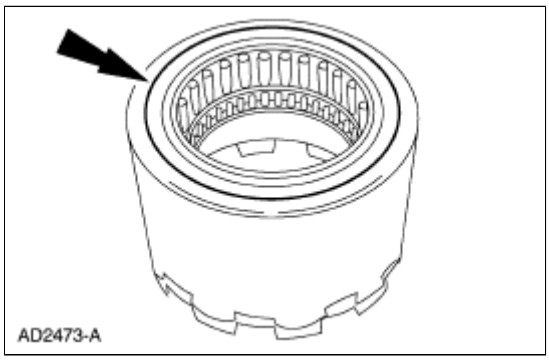
3. Install the low reverse one-way clutch with the tabs facing down toward the roller bearing.



4. Using the special tools, install the one-way clutch by pressing down on the tool to seat the bearing

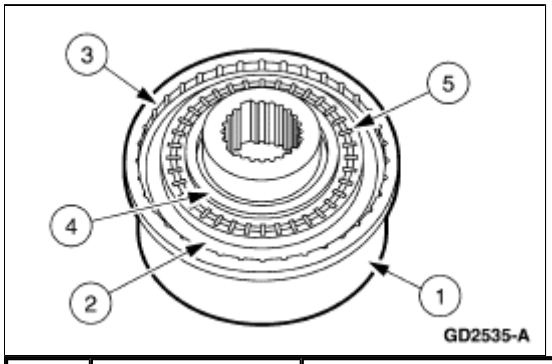


5. Inspect the reverse clutch drum to see if the low reverse one-way clutch is seated correctly.



Output Shaft Ring Gear and Hub Shaft Assembly

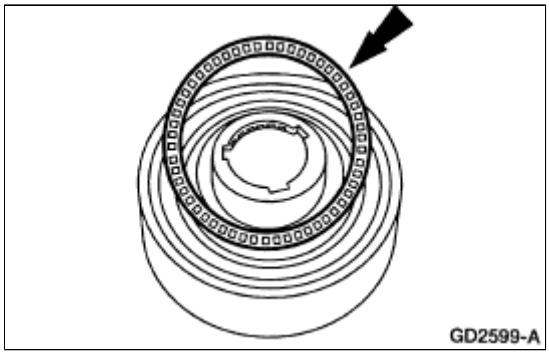
Disassembly



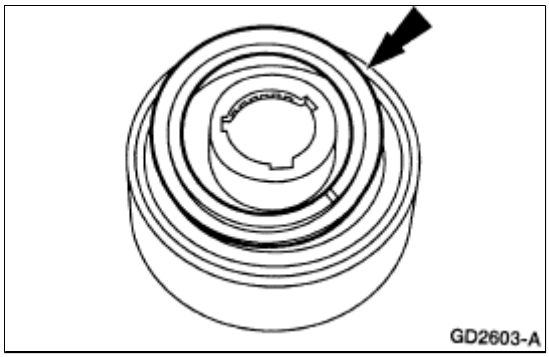
Item	Part Number	Description
1	7A153	Shaft ring gear
2	7D164	Output shaft hub
3	E860122-S	Retaining ring
4	7M150	Needle bearing race assembly (No. 10A)
5	7M150	Needle bearing (No. 10B)

1. Inspect the output shaft ring gear, output shaft hub, needle bearing (10B), and needle bearing race (10A) assembly for damage. If service is required use the following procedure.

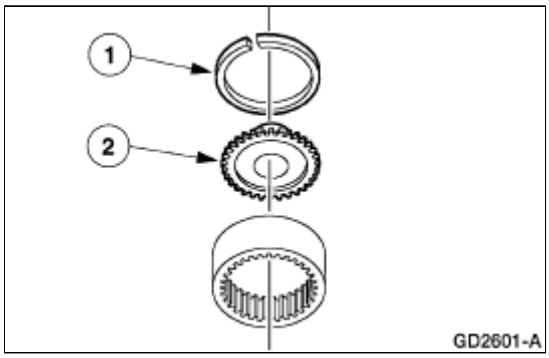
2. Remove the No. 10B needle bearing.



3. Remove the No. 10A needle bearing race assembly.

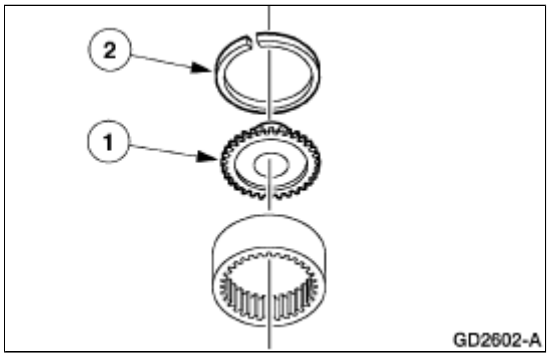


4. Remove the output shaft hub from the output shaft ring gear.
    1. Remove the retaining ring.
    2. Remove the output shaft hub.

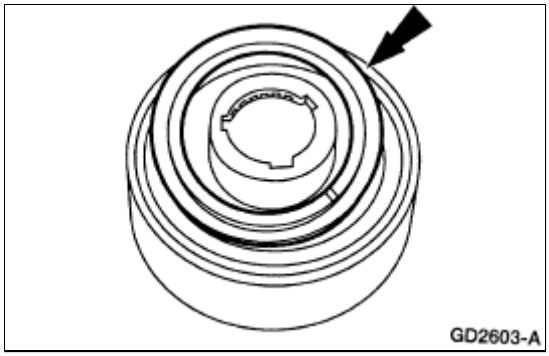


Assembly

1. Install the output shaft hub onto the output shaft ring gear.
    1. Install the output shaft hub.
    2. Install the retaining ring.

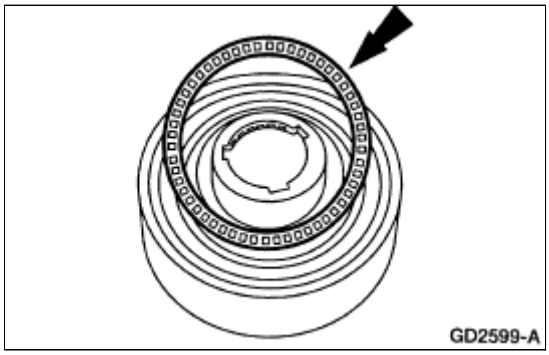


2. Install the No. 10A needle bearing race assembly.
    - Snap the needle bearing race assembly onto the output shaft hub.



3. **NOTE:** Use petroleum jelly to hold needle bearing to.

   Install the No. 10B needle bearing onto output shaft ring gear and output shaft hub.



Torque Converter

1. A new torque converter (7902) must be installed if one or more of the following statements are true:
    - A torque converter malfunction has been determined based on complete diagnostic procedures.
    - Converter stud(s), impeller hub or bushing are damaged.
    - Discoloration of the torque converter (due to overheating).
    - The torque converter is found to be out of specification when performing one of the following torque converter checks:
        - One-way clutch check
        - End play check
        - Stator to turbine interference check
        - Stator to impeller interference check
        - Torque converter leak check
    - Evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes:
        - Major metallic failure
        - Multiple clutches or clutch plate failures
        - Sufficient component wear which results in metallic contamination

Torque Converter Cleaning And Inspection

1. If the torque converter is being replaced, continue with Substep 2 of Step 2.

2. If the torque converter is not being replaced, the following procedures must be carried out:
    1. The torque converter must be thoroughly cleaned.
        - Torque converters with drain plugs can be cleaned by using a suitable torque converter fluid cooler cleaner.
        - Torque converters without drain plugs can be cleaned by hand. Partially fill the torque converter using only recommended transmission fluid for the applicable transmission. Hand agitate the torque converter and then thoroughly drain the fluid. Refill the torque converter with new fluid specified for transmission, and reinstall.
    2. All in-tank and auxiliary coolers must be thoroughly cleaned by forward and backward flushing. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.
    3. All cooler lines must be thoroughly cleaned by backward and forward flushing. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.
    4. All cooler bypass valves (CBV), if equipped, must be thoroughly cleaned.
    5. Carry out Transmission Fluid Cooler Flow Test. For additional information, refer to the Transmission Fluid Cooler Flow Test in Diagnostics in this section.
    6. If the transmission cooling system fails the Transmission Fluid Cooler Flow Test, the fluid cooler, cooler bypass valve, and or cooler lines must be replaced. For additional information, refer to Section 307-02 .
    7. If the coolers are to be replaced, refer to Section 303-03 . Use only factory approved service parts.

Torque Converter Flushing

1. **CAUTION: Mineral spirits used to clean the torque converter must be fresh, non-chlorinated and non-halogenated.**

   Following the instructions included with any suitable torque converter fluid cooler cleaner, flush the torque converter.

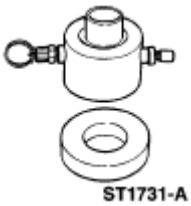
2. After flushing, drain the remainder of the solvent.

3. Add 1.9 liter (2 qt.) of clean MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting MERCON ® V specification into the converter fluid filler tube and agitate by hand.

4. Thoroughly drain the solution.

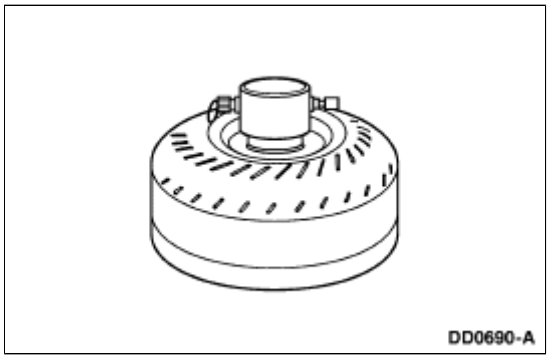
Torque Converter Leak Check

Special Tool(s)

 ST1731-A	Torque Converter Leak Tester 307-F015 (014-R1075) or equivalent

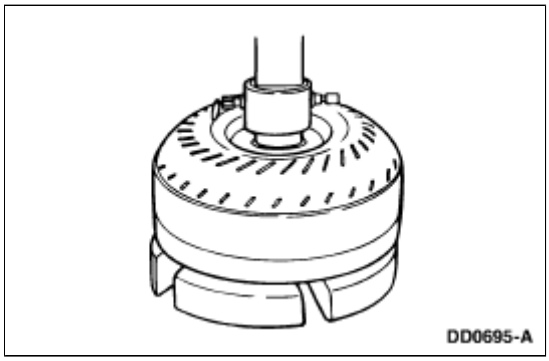
1. Clean the outside surface of the torque converter (7902).

2. Install the Torque Converter Leak Tester into the converter hub.


DD0690-A

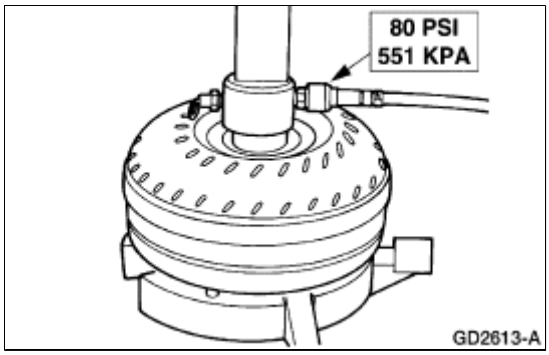
3. **WARNING: Always follow correct safety procedures while using the press. Failure to follow these instructions can result in personal injury.**

   Install the torque converter with installed leak check tool into the Arbor press.
   Secure the press. Apply enough force from the press to seal the tool into the torque converter.

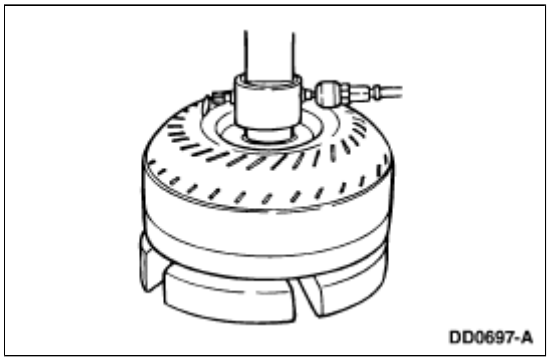

DD0695-A

4. **NOTE:** Use clean, dry shop air.

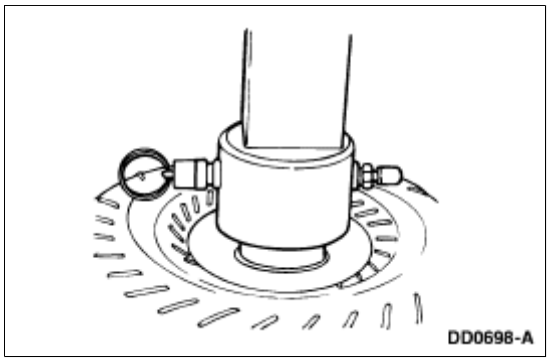
   Apply air pressure to valve on leak check tool.



5. With air pressure applied to the valve, inspect for leaks at the converter hub, the seams and the studs. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new converter.

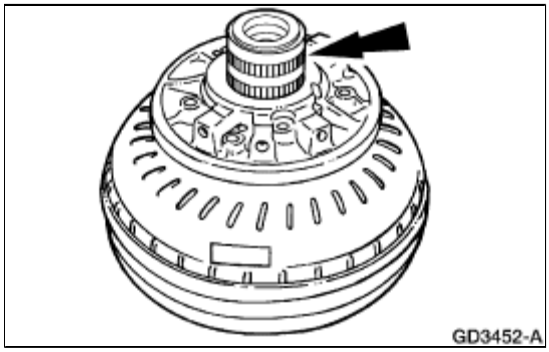


6. Remove the air hose. Release the pressure, and then slowly release the press. Remove the converter. Remove the tool.

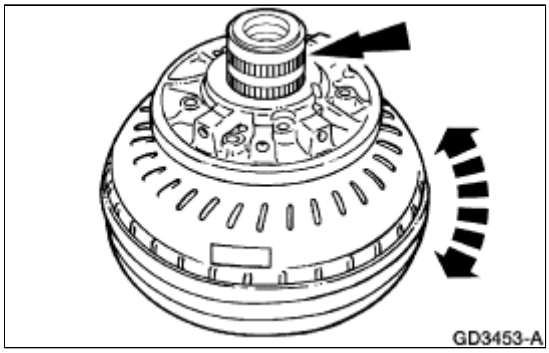


Torque Converter Impeller to Pump Stator Interference Check

1. Install the fluid pump support into the torque converter (7902). Engage the splines of the one-way clutch inner race with the mating splines of the front pump support.

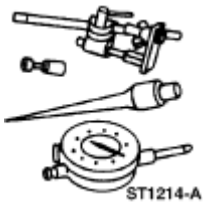
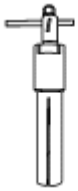


2. While holding the fluid pump support stationary, rotate the torque converter clockwise and counterclockwise. The torque converter should rotate freely with no signs of scraping. If there are signs of scraping, install a new torque converter.

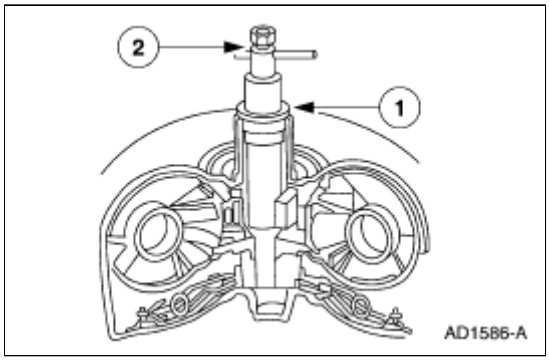


End Play Check

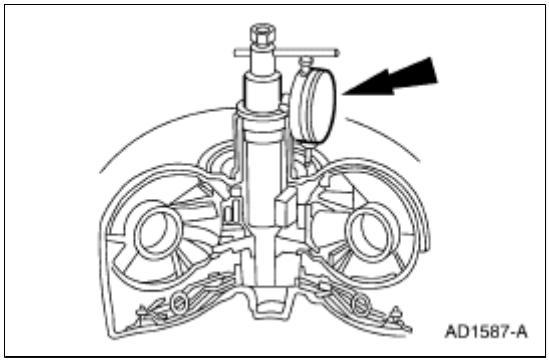
Special Tool(s)

 ST1214-A	Dial Indicator with Bracketry 100-002 (TOOL-4201-C)
 ST2128-A	End Play Checking Tool 307-360

1. Install the End-Play Checking Tool into the torque converter (7902).
    1. Insert the End-Play Checking Tool into the torque converter until it bottoms.
    2. Tighten the inner post until the tool is securely locked.



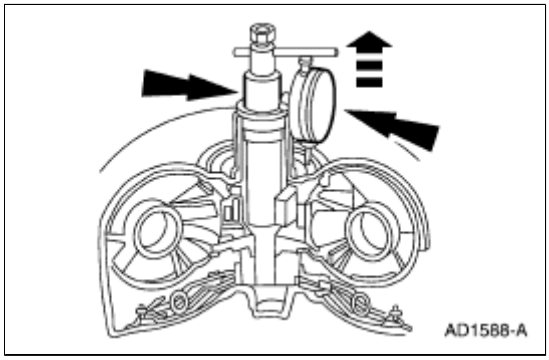
2. Attach the Dial Indicator with Bracketry to the End Play Checking Tool. Position the dial indicator bottom on the converter impeller housing and zero the dial.



3. Lift up on the end play checking tool and note the dial indicator reading. If the reading exceeds end play limits, install a new torque converter.

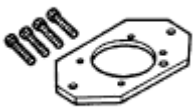
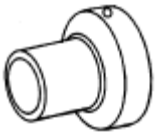
Torque Converter End Play

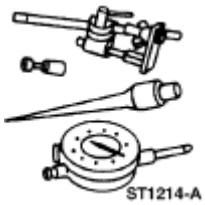
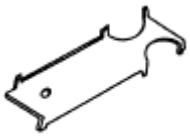
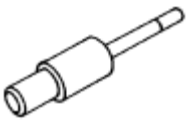
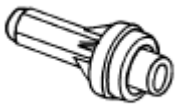
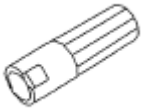
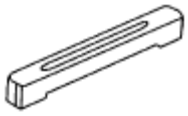
New or Rebuilt Torque Converter	Used Torque Converter
0.58 mm Max. (0.023 in.)	1.27 mm Max. (0.050 in.)

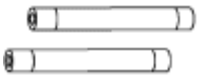


Transmission

Special Tool(s)

 ST1759-A	A4LD Holding Fixture 307-262 (T93T-77002-AH)
 ST1792-A	Band Adjuster Wrench Kit 307-S022 (T71P-77370-A)
 ST1200-A	Bearing Cup Remover 308-047 (T77F-1102-A)
 ST1635-A	Output Shaft Bearing Replacer 307-348 (T97T-77110-A)
 ST1186-A	Holding Fixture 307-003 (T57L-500-B)
 ST1815-A	Converter Guide Pins 307-331 (T95L-7902-A)
 ST1274-A	Depth Micrometer 303-D026 (D80P-4201-A) or equivalent

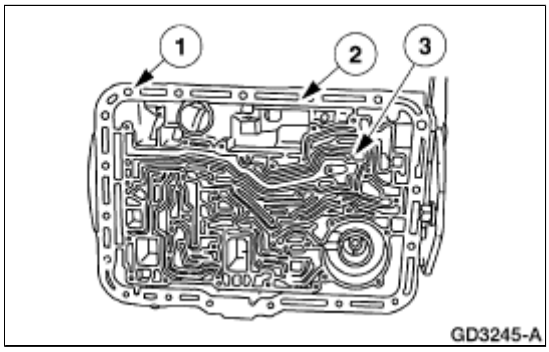
 ST1214-A	Dial Indicator With Bracketry 100-002 (TOOL-4201-C) or equivalent
 ST1633-A	TRS Alignment Tool 307-351 (T97L-70010-A)
 ST1255-A	Handle 205-153 (T80T-4000-W)
 ST1790-A	Housing Bushing Replacer 307-065 (T77L-7697-F)
 ST1791-A	Extension Housing Seal Replacer 307-038 (T74P-77052-A)
 ST1817-A	Oil Pump Aligning Gauge 307-S039 (T74P-77103-X)
 ST1826-A	Front Pump Seal Sizer 307-338 (T95L-70010-G)
 ST1816-A	Gauge Bar 307-263 (T93T-77003-AH)
	Impact Slide Hammer 100-001 (T50T-100-A)

 ST1185-A	
 ST1760-A	Servo Cover Compressor 307-340 (T95L-77028-A)
 ST1199-A	Oil Seal Replacer 307-050 (T74P-77498-A)
 ST1631-A	Converter Handles 307-091 (T81P-7902-C)
 ST1814-A	TSS Gauge 307-337 (T95L-70010-F)
 ST1639-A	Valve Body Alignment Pin (.235) 307-333 (T95L-70010-B)
 ST1639-A	Valve Body Alignment Pin (.248) 307-334 (T95L-70010-C)
 ST1636-A	Torque Converter Holding Tool 307-346 (T97T-7902A)

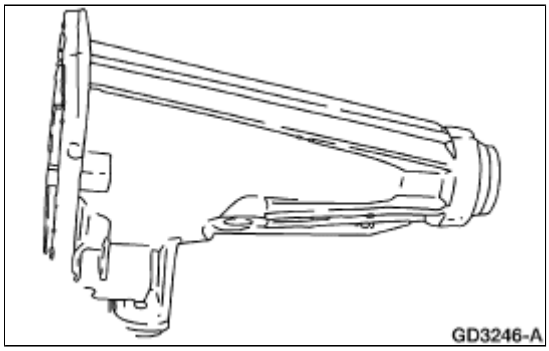
1. Thoroughly clean the transmission case and extension housing in solvent and blow dry with

compressed air.

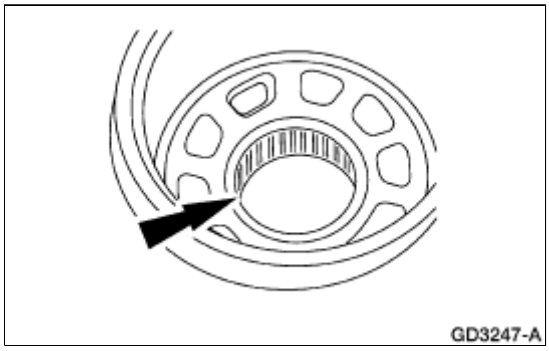
2. Inspect the transmission case for the following:
    1. Stripped bolt hole threads.
    2. Gasket and mating surfaces for burrs or nicks.
    3. Obstructions to vent and fluid passages.
    - Cracks or warpage.



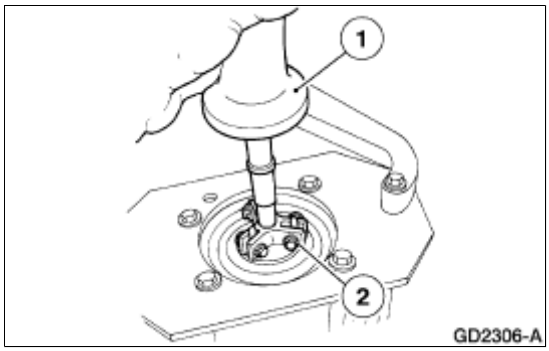
3. Inspect the extension housing for cracks, burrs or warpage.



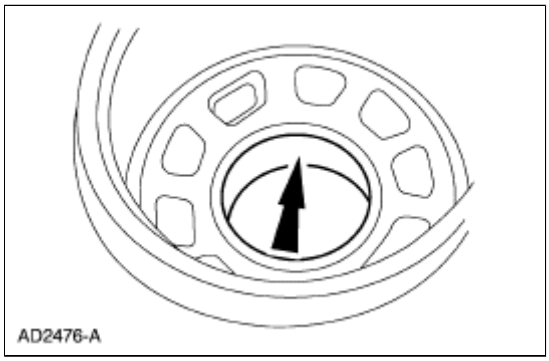
4. Inspect case bearing for damage. Replace as needed. Follow Steps 6-8 if replacing the case bearing. If not replacing the case bearing, proceed to Step 8.



5. Remove the case bearing.
    1. Install the Bearing Cup Remover with Slide Hammer into case bearing.
    2. Remove the case bearing.
    - Use an oil stone to remove any nicks or burrs in the bearing case bore.

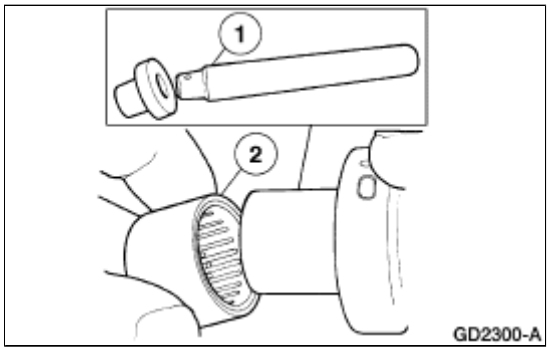


6. Inspect the rear case inner race for burrs, nicks, and scoring. If any damage has been found the case will need to be replaced.

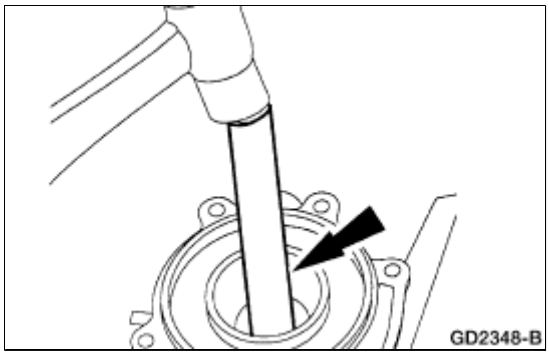


7. **CAUTION: Make sure bearing seal ring is facing drive handle.**

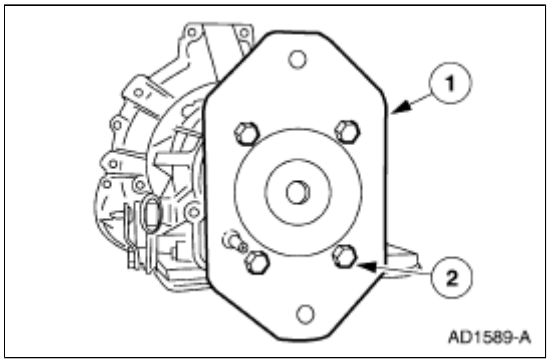
   Install a new case bearing.
   1. Assemble and install the Handle and Bearing Installer.
   2. Position new case bearing onto bearing installer tool.



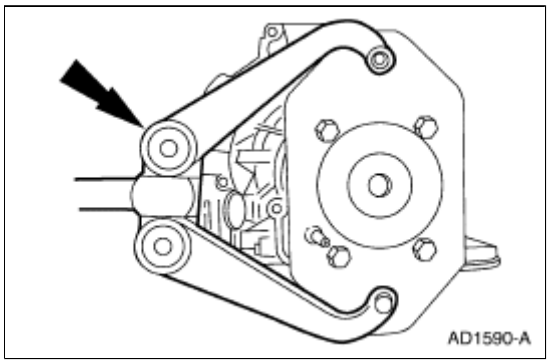
8. Tap case bearing into case bearing bore.



9. Install the A4LD Holding Fixture.
    1. Position the A4LD Holding Fixture on the rear of the transmission case.
    2. Install the A4LD Holding Fixture bolts.

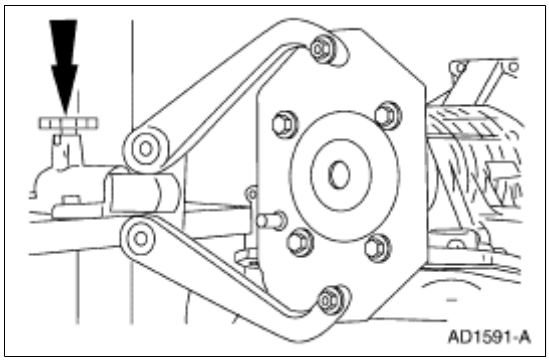


10. Attach the fixture arm of the Bench Mounted Holding Fixture to the A4LD Holding Fixture Adapter.

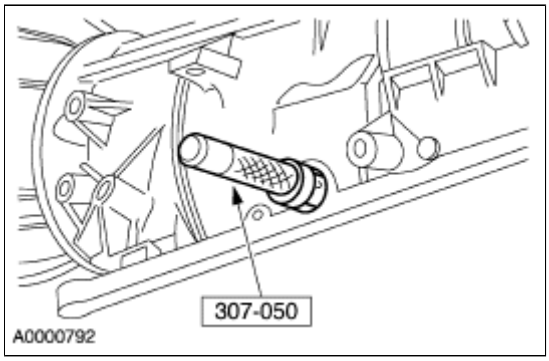


11. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

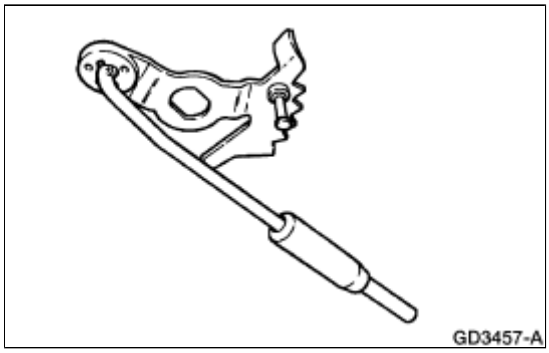
    Install transmission into the Holding Fixture.
    - Rotate the transmission so that the fluid pan rail is facing up.



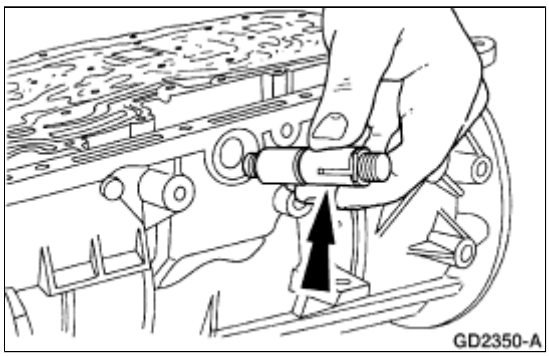
12. Using the special tool, install the manual control lever shaft seal.
    - Lubricate the manual control lever shaft seal with petroleum jelly.



13. Assemble the manual valve inner lever and parking lever actuating rod as shown.



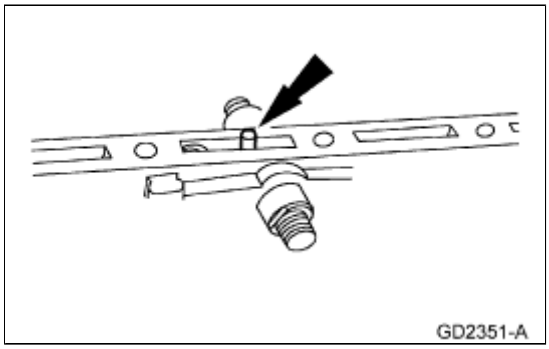
14. Install the manual control lever shaft.



15. **CAUTION: Use care not to damage the fluid pan rail surface when installing the retaining pin.**

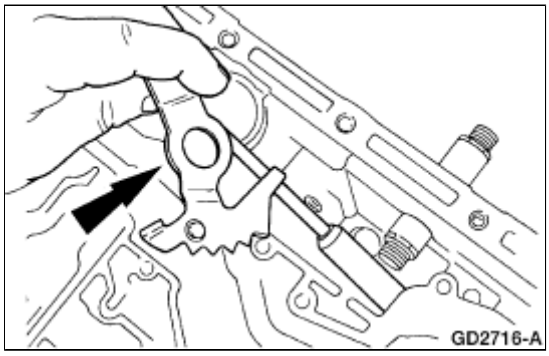
    NOTE: Align the manual control lever shaft alignment groove with the manual control lever shaft spring pin bore in the transmission case.

    Install the manual control lever shaft spring pin.
    - Tap the manual control lever shaft spring pin into the transmission case.



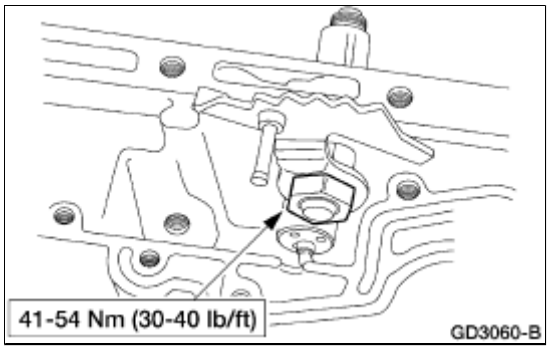
16. **CAUTION: Align the flats on the manual valve inner lever with the flats on the manual control lever shaft.**

    Install the manual valve inner lever and parking lever actuating rod on to the manual control lever shaft.



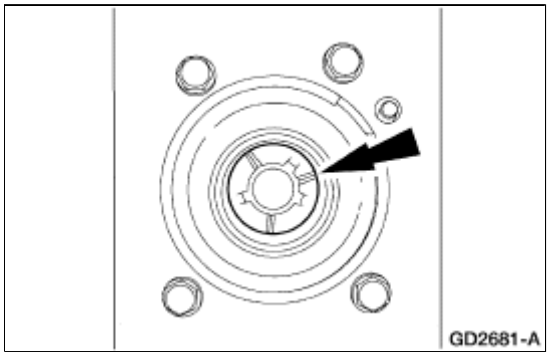
17. **CAUTION: To avoid damage, do not allow the wrench to strike the manual valve inner lever pin.**

    Install the manual valve inner lever nut on the manual control lever shaft and tighten.

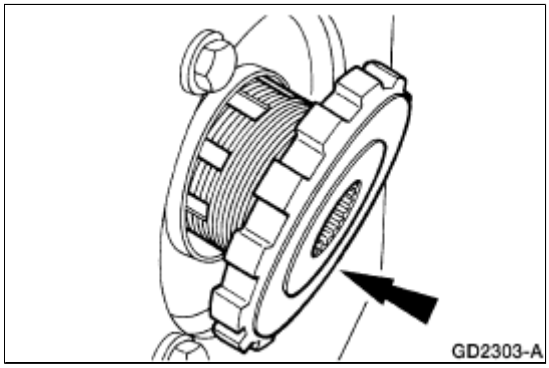


18. **CAUTION: The tabs on the output shaft thrust washer (No. 11) point into the case. Make sure the thrust washer is properly seated.**

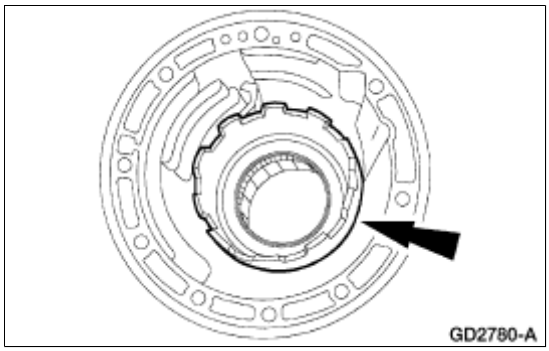
    Install the output shaft thrust washer (No. 11).
    - Coat the output shaft thrust washer with petroleum jelly.



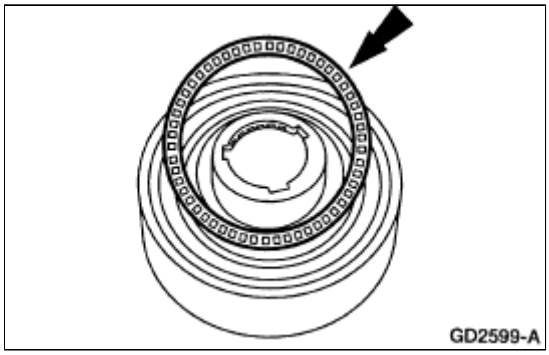
19. Install the park gear.



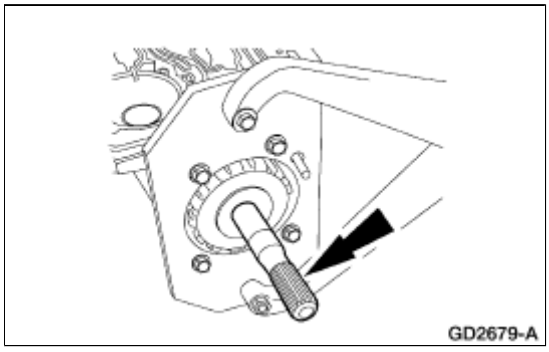
20. Install the low/ reverse brake drum.
    - Rotate the low/ reverse brake drum clockwise to install.



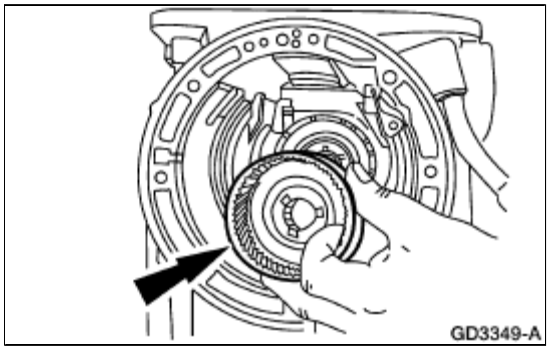
21. If not already installed during subassembly, install the No. 10B needle bearing onto the output shaft ring gear and hub assembly.
    - Coat the needle bearing with petroleum jelly.



22. Install the output shaft through the output shaft park gear.

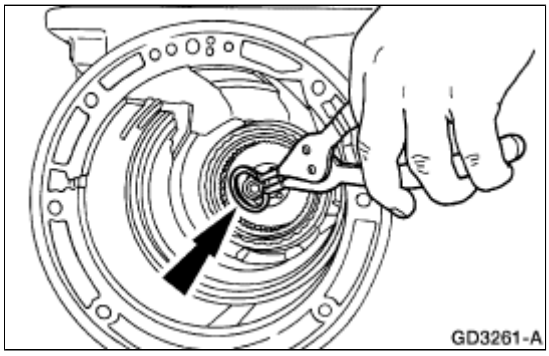


23. Install the output shaft ring gear and output shaft hub.



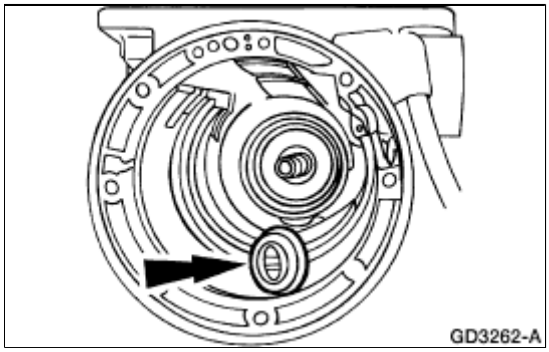
24. **CAUTION: Always install a new output shaft retaining ring.**

    Install a new output shaft retaining ring.

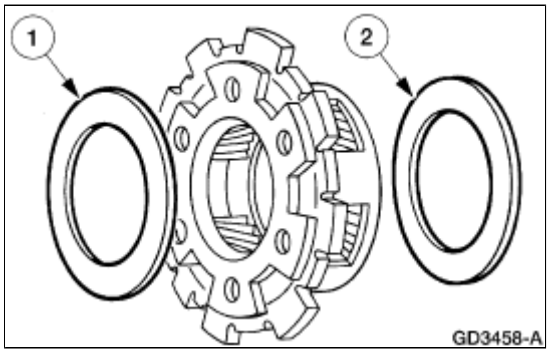


25. **NOTE:** Install the output shaft sleeve with the cone facing up.

    Install the output shaft sleeve.

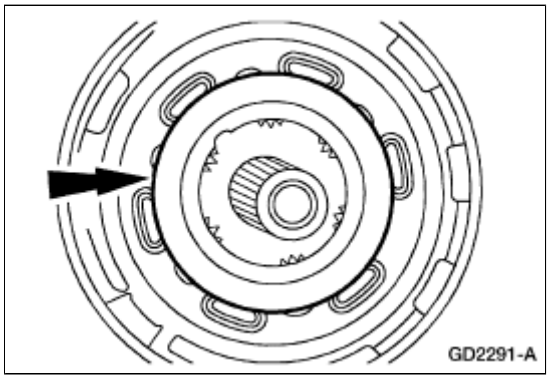


26. Install low/reverse planetary carrier needle bearings.
    1. Install low/reverse planetary carrier needle bearing (No. 8) on the front face of the low/reverse planetary.
    2. Install low/reverse planetary carrier needle bearing (No. 9) on the rear face of the low/reverse planetary.
    - Coat the low/reverse planet carrier needle bearing (No. 8) and low/reverse planetary carrier needle bearing (No. 9) with petroleum jelly.



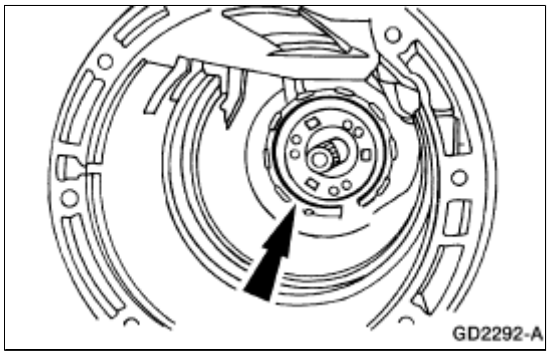
27. **CAUTION: Make sure needle bearings stay in place.**

Install the low/reverse planetary assembly with No. 8 and No. 9 low/reverse planetary carrier needle bearings into the output shaft ring gear.



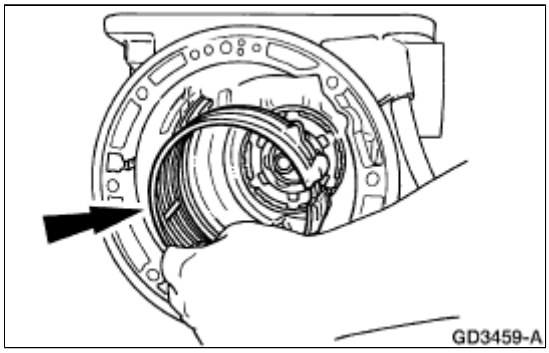
28. **CAUTION: The low/reverse brake drum must be pulled forward to install the low/reverse planet retaining ring.**

Install the low/reverse retaining ring into the low/reverse brake drum groove.

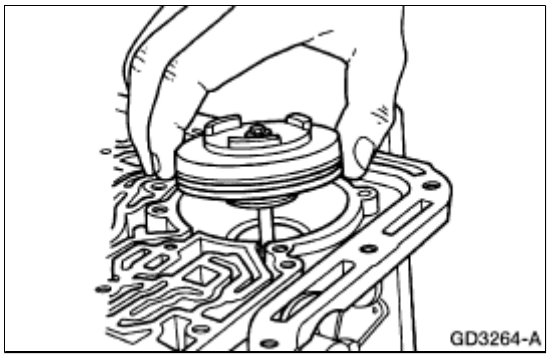


29. **CAUTION: Make sure band is resting on the two anchor pins in the case.**

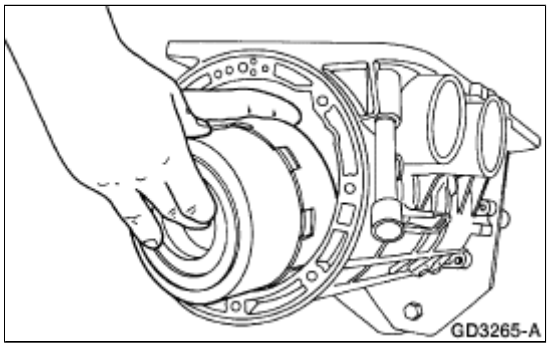
Install the low/reverse band over the low/ reverse brake drum.



30. Temporarily install the low/ reverse band servo piston and rod to hold the low/reverse band in position.



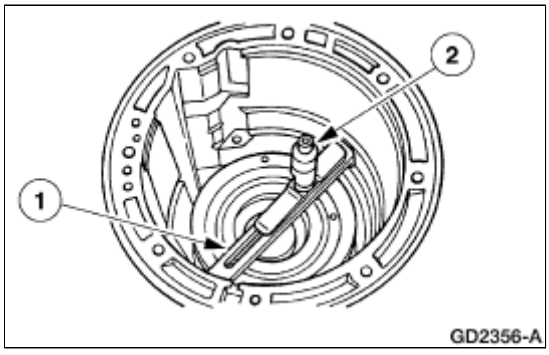
31. Install the previously assembled forward geartrain assembly.



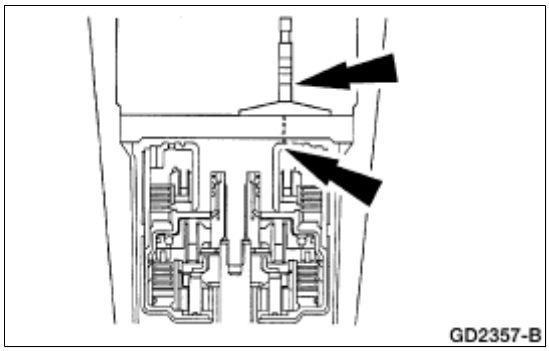
32. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

    Rotate transmission assembly so that the converter housing surface is facing up.

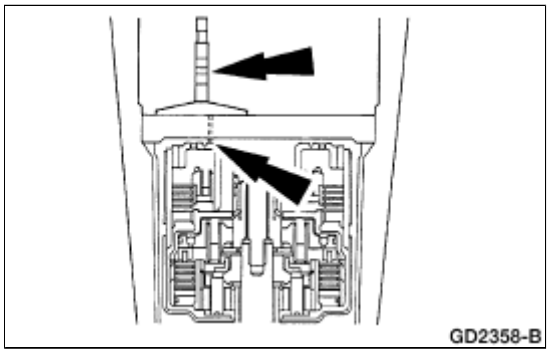
33. Select the intermediate brake drum thrust bearing (No. 4) as follows:
    1. Install the Gauge Bar on case assembly shoulder.
    2. Set the depth micrometer on top of the Gauge Bar.



34. Calculate the thrust bearing thickness.
    - Extend the micrometer probe until it contacts the intermediate brake drum thrust bearing surface. Record the reading. This is dimension A.

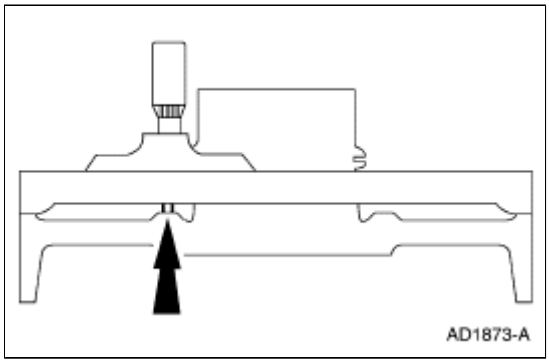


35. Place the micrometer on the opposite side of the Gauge Bar and repeat measurement. This is dimension B.

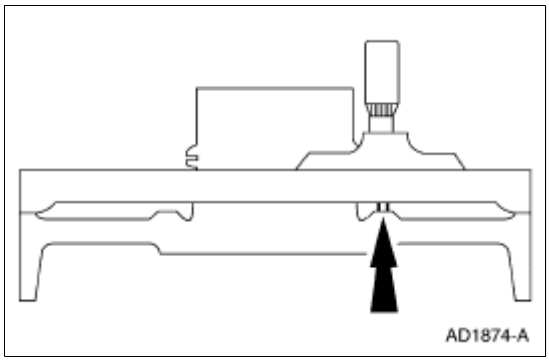


36. Add dimension A and B, divide the total of A and B by 2. Then subtract the gauge bar thickness 17.78 mm (0.700 in). Record this reading as dimension C.

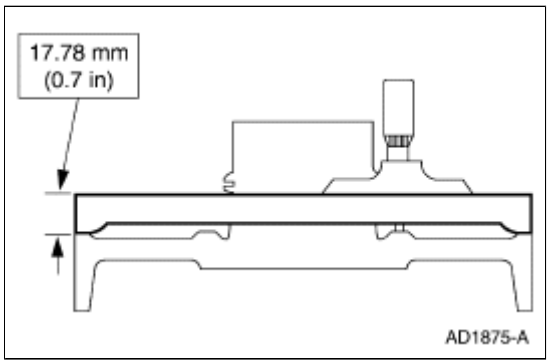
37. Place the Gauge Bar across the center support. Place the micrometer on the top of the Gauge Bar.
    1. Extend the micrometer probe until it makes contact with the center support thrust bearing surface. Record this reading as dimension D.



38. Place the micrometer on the opposite side of the center support.
    1. Extend the micrometer probe until it makes contact with the center support thrust bearing surface. Record this reading as dimension F.



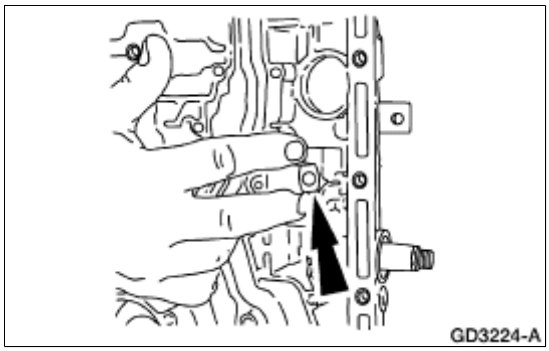
39. Add dimensions D and F; divide the total of D and F by two. Subtract the Gauge Bar thickness 17.78 mm (0.700 in) dimension E. The result is dimension G.



40. Add dimensions C and G. This total is dimension H. Use the following chart to select the proper #4 thrust bearing. Reference end play is 0.20-0.54 mm (0.008-0.021 in).

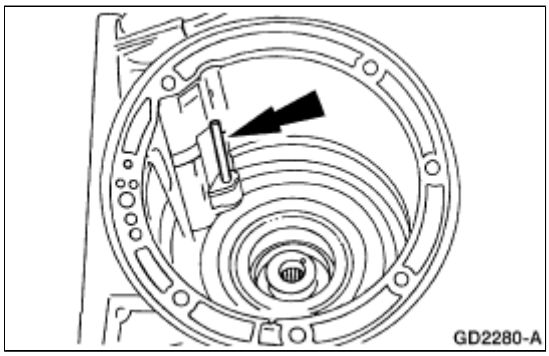
Dimension H	Service Part Number	Bearing Thickness	Identification (Notches)
3.01-3.15 mm (0.119-0.124 in)	XW4Z-7D014-CA	2.65-2.80 mm (0.104-0.110 in)	None
3.17-3.34 mm (0.125-0.132 in)	XW4Z-7D014-DA	2.80-2.95 mm (0.110-0.116 in)	One
3.36-3.54 mm (0.133-0.140 in)	XW4Z-7D014-EA	3.00-3.15 mm (0.118-0.124 in)	Two
3.57-3.71 mm(0.141-0.147 in)	XW4Z-7D014-FA	3.20-3.35 mm (0.126-0.132 in)	Three

41. Install the intermediate servo actuating lever.

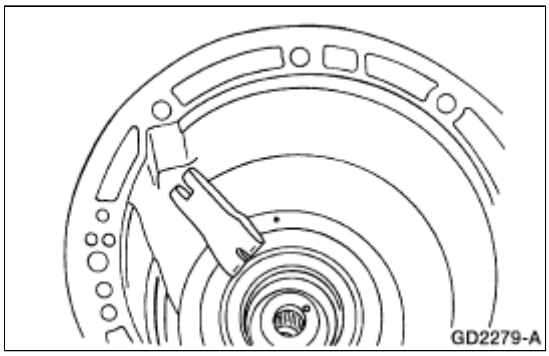


42. **NOTE:** The intermediate band lever shaft is shorter than the front band lever shaft.

    Install the intermediate band actuating lever shaft through the intermediate servo actuating lever.

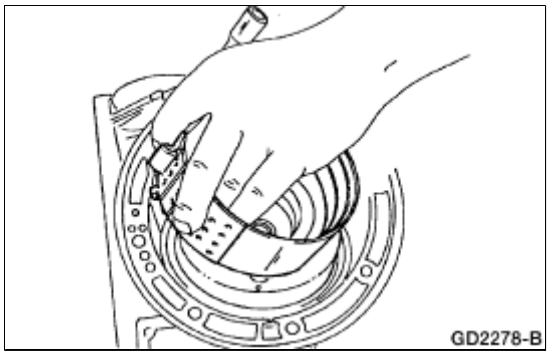


43. Install the intermediate band apply strut on the intermediate servo actuating lever.



44. **NOTE:** Make sure that the intermediate apply strut is aligned with the band notch.

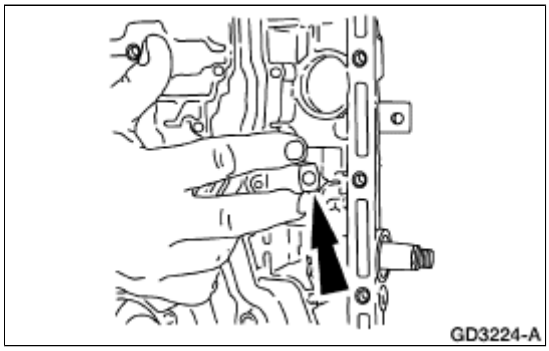
    Install the intermediate band.



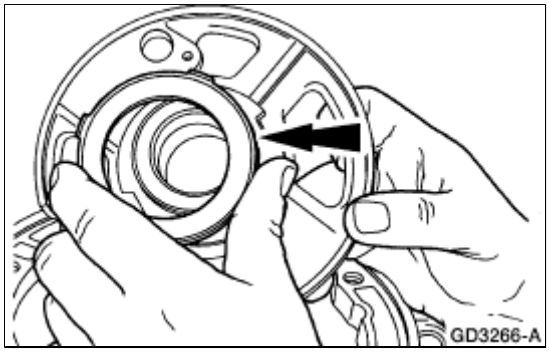
45. **NOTE:** Use the intermediate band adjusting screw as a temporary alignment guide.

    NOTE: The intermediate and front band anchor struts and band adjustment screws are the same.

    Install the intermediate band anchor strut and the intermediate band adjustment screw.



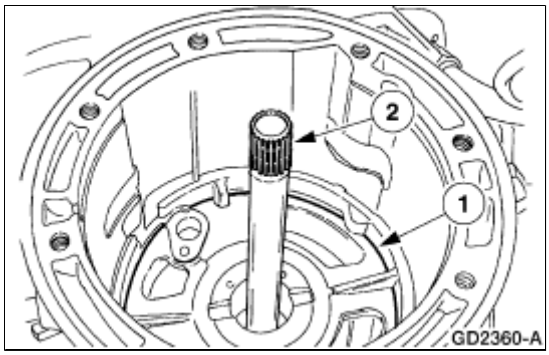
46. Install the selected intermediate brake drum thrust washer (No. 4) on the center support.
    - Coat the intermediate brake drum thrust washer with petroleum jelly.



47. **CAUTION: Do not apply pressure to the center support while installing. Damage to sealing rings could result. Make sure the rear planetary support is seated.**

    NOTE: Align the center support screw hole with correct case hole.

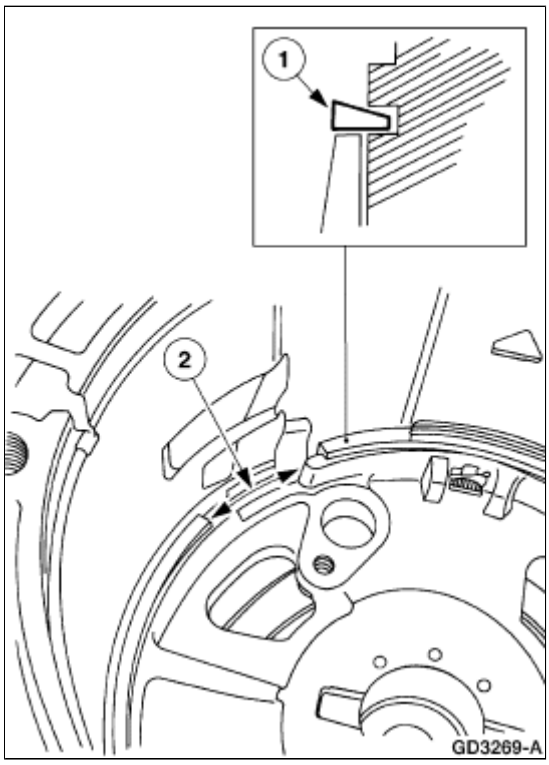
    Install the center support.
    1. Position the center support into the intermediate brake and direct clutch drum.
    2. Temporarily insert input shaft and gently wiggle it until the center support is seated against the case shoulder, then remove the input shaft.



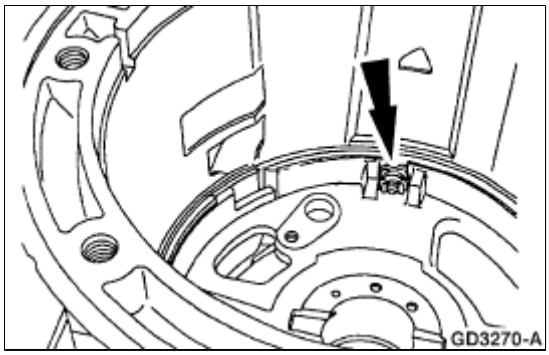
48. **CAUTION: Install the center support retaining ring with the tapered side facing up.**

CAUTION: Make sure the notch opening is not obstructed by the center support retaining ring.

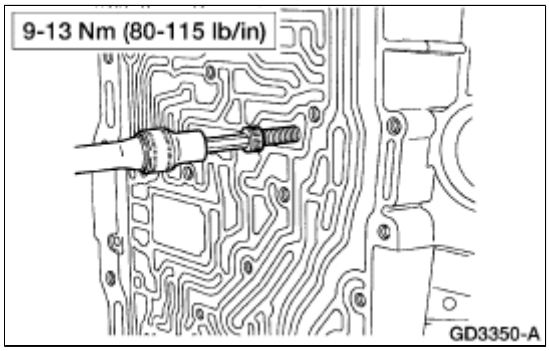
Install the center support retaining ring.
1. Position center support retaining ring with the tapered side facing up.
2. Install the center support retaining ring so that the notch opening is not obstructed.



49. Install the center support locknut and cage.



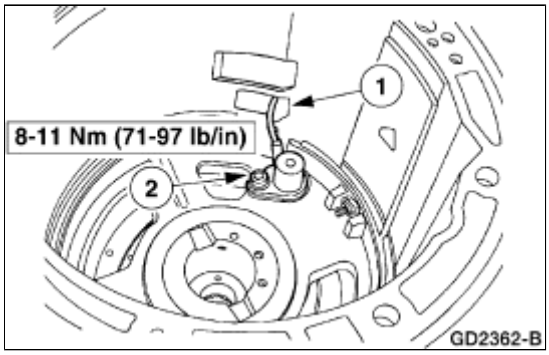
50. Install the center support-to-case cap screw.



51. **CAUTION: Carefully route the turbine shaft speed (TSS) sensor connector and wiring harness through the opening in the case. Do not damage the wiring.**

NOTE: Route TSS sensor electrical connector and wiring through transmission case opening.

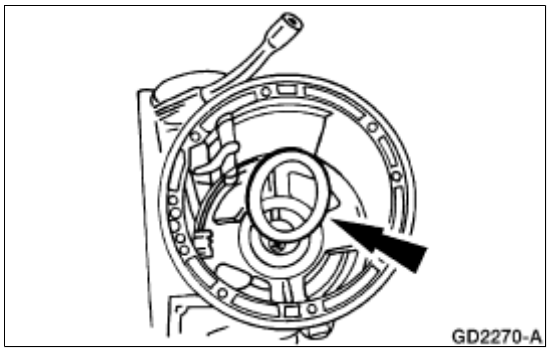
Install the Turbine Shaft Speed (TSS) sensor.
1. Install the TSS sensor.
2. Install TSS sensor screw.



52. **CAUTION: Use only the center shaft thrust bearing (No. 3).**

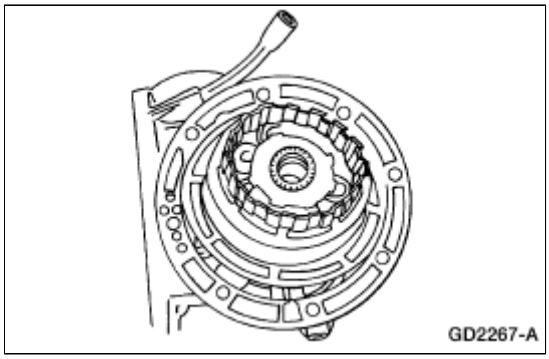
NOTE: The center shaft thrust bearing (No. 3) has no notches on the outer race.

Install the center shaft thrust bearing (No. 3).



53. **CAUTION: Do not bend the trigger wheel.**

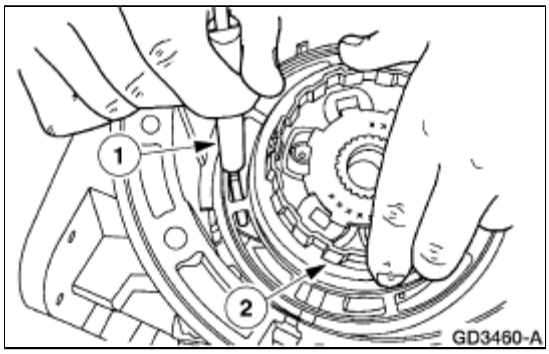
Install the front planetary and the one-way clutch assembly.



54. **CAUTION: The trigger wheel triggering window should pass over the thin blade of the Turbine Shaft Speed (TSS) sensor Gauge. If it does not, the front planetary carrier and trigger wheel must be replaced.**

Using the Turbine Shaft Speed (TSS) sensor Gauge, check TSS sensor air gap.

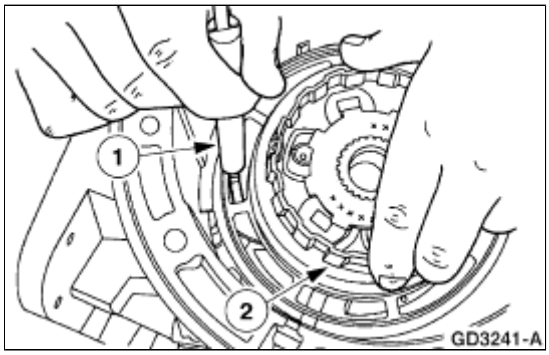
1. Place the thin blade of the Turbine Shaft Speed (TSS) sensor Gauge over the TSS sensor.
2. Rotate the trigger wheel and repeat checks for all windows.



55. **CAUTION: The trigger wheel triggering window should not pass over the thick blade of the Turbine Shaft Speed (TSS) sensor Gauge. If it does, the front planetary carrier and trigger wheel must be replaced.**

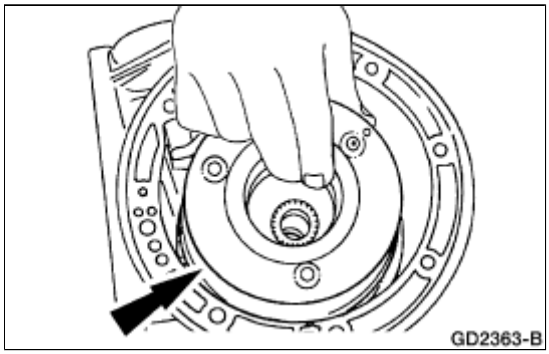
Use the Turbine Shaft Speed (TSS) sensor Gauge to check TSS sensor air gap.

1. Place the thick blade of the Turbine Shaft Speed (TSS) sensor Gauge over the TSS sensor.
2. Rotate the trigger wheel and repeat checks for all windows.

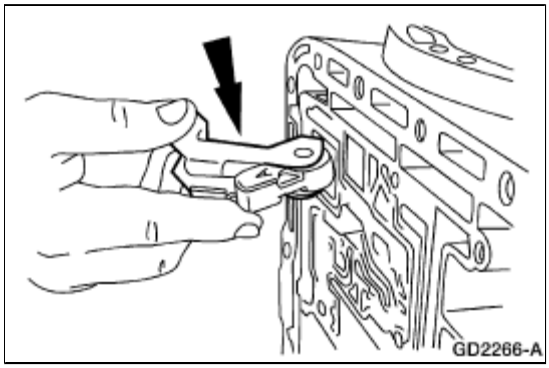


56. **NOTE:** Align the clutch plates and front adapter gear.

    Install the front brake drum and coast clutch drum assembly.

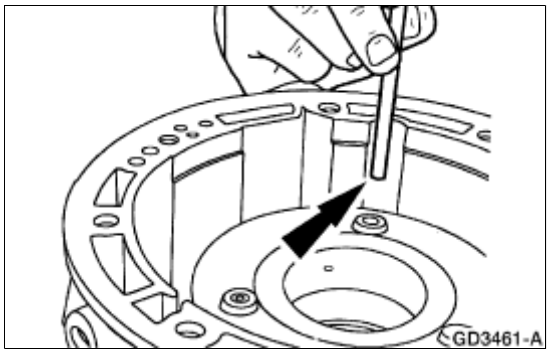


57. Install the front servo band lever and front band lever-to-case bracket into the transmission case.

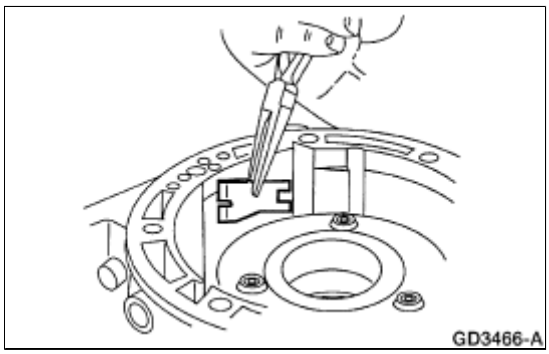


58. **NOTE:** The front band lever shaft is longer than the intermediate band actuating lever shaft.

    Install the front band actuating lever shaft through the front servo band lever.

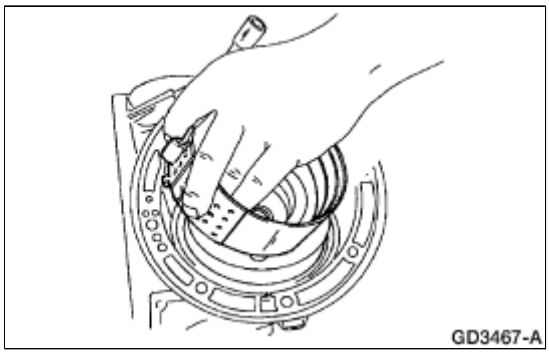


59. Install the front band apply strut.



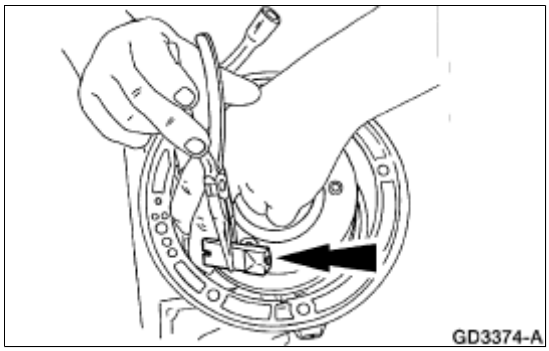
60. **NOTE:** If the front band is reused, it must be installed in the same position as when removed.

    Install the front band over the front brake and coast clutch drum.

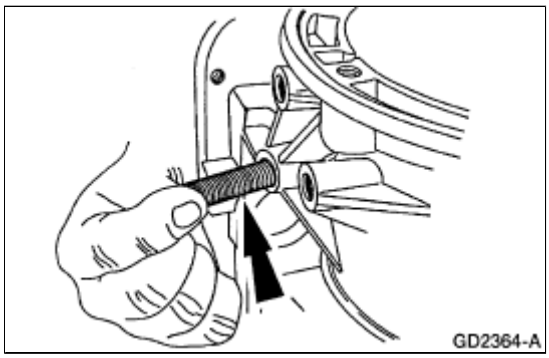


61. **NOTE:** Use the band adjustment screw as a temporary alignment guide.

    Install the front band anchor strut.



62. Install the front band adjusting screw.

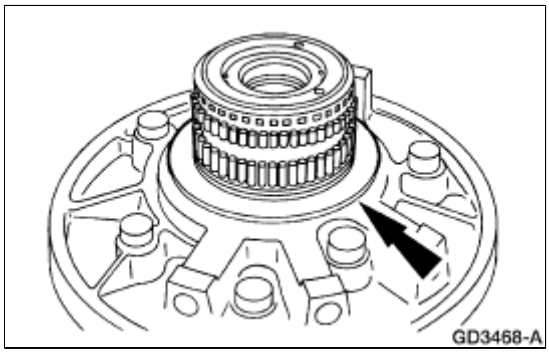


63. **CAUTION: Make sure that the pump body is seated against the thrust washer and the front brake and coast clutch drum. The pump body must be below the level of the case gasket surface.**

CAUTION: The tabs on the washer go into the pump face.

Perform front end play check procedure as follows:

- Coat the fluid pump inlet thrust washer (No. 1) with petroleum jelly.
- Install the fluid pump inlet thrust washer (No. 1) on the rear of the fluid pump and place pump into position in case.

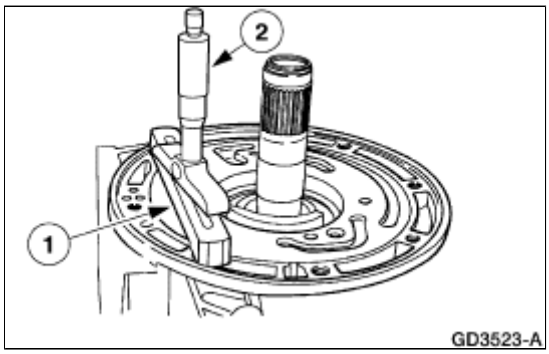


64. **CAUTION: The gauge bar must rest on the gasket surface.**

Measure the front end play clearance.

1. Place Gauge Bar across the case.

2. Place depth micrometer on Gauge Bar and extend micrometer probe until it contacts the fluid pump face.
   - Read the measurement and subtract Gauge Bar thickness 17.78 mm (0.700 inch). This is dimension A.
   - Repeat the measurement at the opposite side of the transmission case. This is dimension B.
   - Add dimensions A and B together and divide by two. This is front end clearance dimension C.



65. **CAUTION: If the average front end clearance is below the specification, choose a thinner washer. If the average is above the specification, choose a thicker washer.**

NOTE: The front end play specification is 0.18-0.70 mm (0.007-0.028 in).

Use dimension C and the chart below to select the correct thickness fluid pump inlet thrust washer (No. 1).

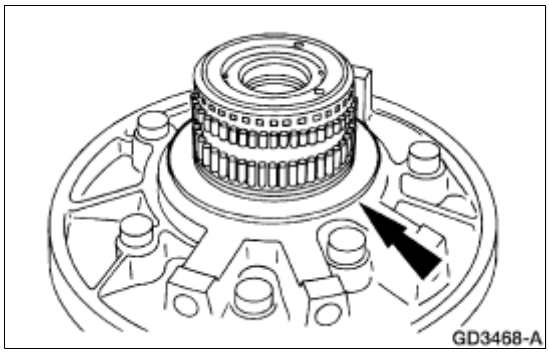
Front End Play Selective Thrust Washer No. 1

Front End Play "C" 0.18 - 0.70 mm (0.007 - 0.028 in) Without Gasket		
Selective Pump Support Thrust Washer		
Part Number	**Thickness**	**Color**
F77Z-7D014-VA	1.35 - 1.40 mm (0.035 - 0.055 inch)	Blue
F77Z-7D014-TA	1.55 - 1.60 mm (0.061 - 0.063 inch)	White
F77Z-7D014-MA	1.75 - 1.80 mm (0.069 - 0.071 inch)	Green
F77Z-7D014-NA	1.85 - 1.90 mm (0.073 - 0.075 inch)	Red
F77Z-7D014-PA	1.95 - 2.00 mm (0.077 - 0.079 inch)	Beige
F77Z-7D014-RA	2.05 - 2.10 mm (0.081 - 0.083 inch)	Black
F77Z-7D014-SA	2.15 - 2.20 mm (0.085 - 0.087 inch)	Yellow

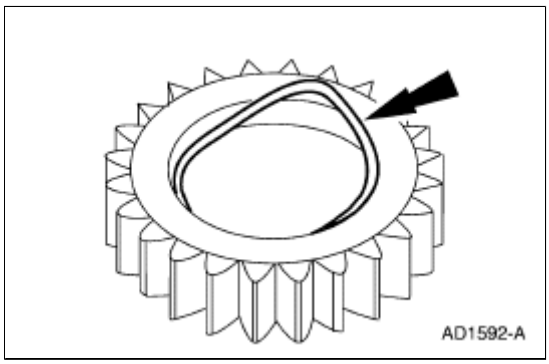
66. **CAUTION: Make sure that the pump body is seated against the thrust washer and the front brake and coast clutch drum. The pump body must be below the level of the case gasket surface.**

CAUTION: The tabs on the washer go into the pump face.

Remove pump and install No. 1 thrust washer onto pump. After installing selected front pump thrust washer No. 1, repeat front end play check. Make sure correct end play, then remove pump for assembly.

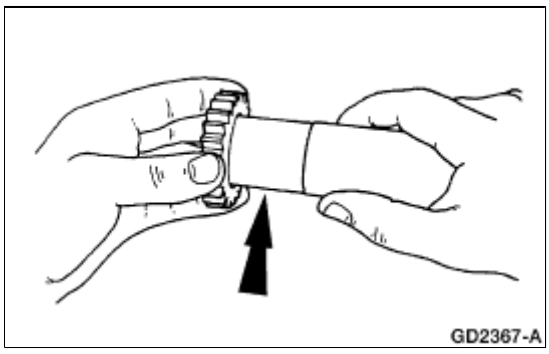


67. Install a new O-ring in fluid pump drive gear.



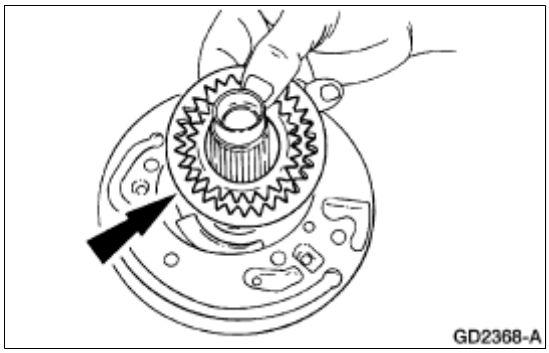
68. **CAUTION: Lubricate the Front Pump Seal Seating Tool with Ford Multi-Purpose Grease D0AZ-19584-A meeting Ford specification ESA-M1C45-A.**

Install the fluid pump drive gear on Fluid Pump Seal Seating Tool to seat O-ring. Remove the tool.



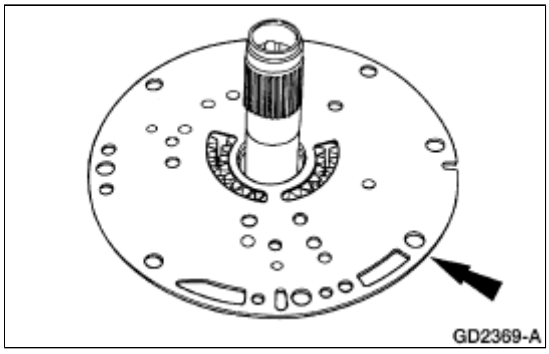
69. **CAUTION: The chamfer on the inside edge of the small gear must be up when in the pump housing gear pocket. The dimple on the larger gear must be down when in the pump housing gear pocket.**

Install the pump gears into the fluid pump housing. Apply Ford Multi-Purpose Grease D0AZ-19584-A meeting Ford specification ESA-MC193-B to pump gear to prevent scoring at start up.



70. **CAUTION: Make sure the holes in the plate line up with the holes in the pump.**

Install the fluid pump adapter plate.

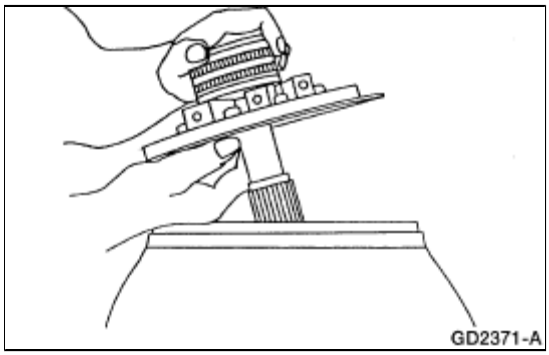


71. **CAUTION: Do not allow the pump gears to come out of the pump housing pocket.**

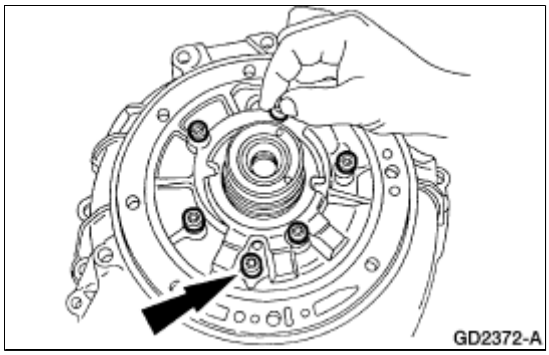
NOTE: The notch on the outside of the adapter plate will be at the 9 o'clock position relative to the converter housing.

Install the fluid pump on the converter housing.

- Hold the fluid pump adapter plate against the pump housing. Turn the pump and adapter plate over and place on the converter housing.

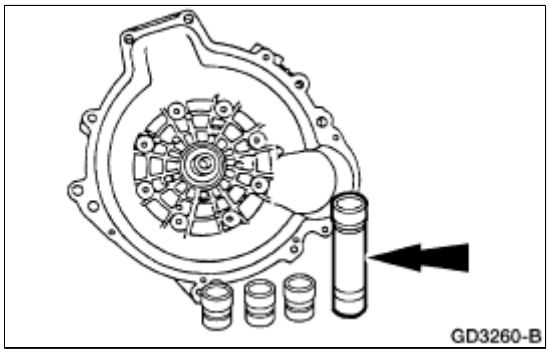


72. Loosely install the fluid pump screws.

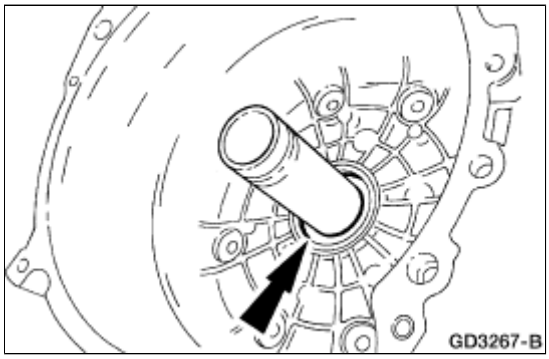


73. **CAUTION: Fluid Pump Alignment Set must be used to properly align the fluid pump to the fluid adapter plate. This will prevent seal leakage, gear noise, broken gears and bushing failure.**

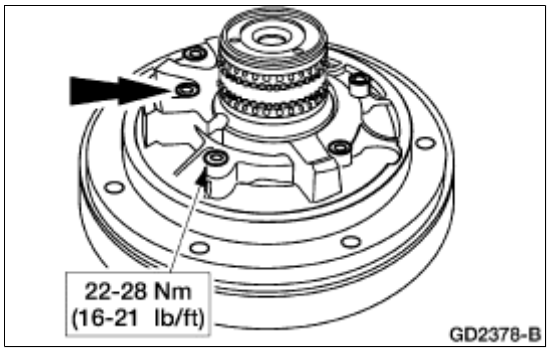
    Align the fluid pump to the fluid pump adapter plate and select the gauge from the Fluid Pump Alignment Set that is the snuggest fit when placed over the fluid pump.



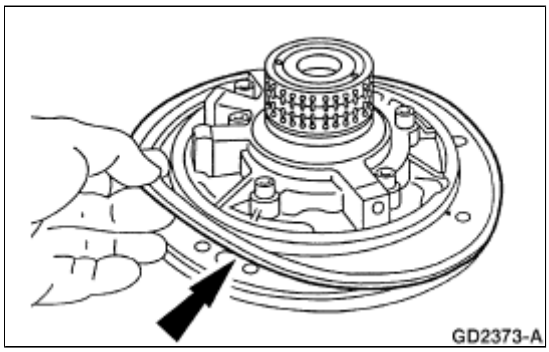
74. Thread the gauge into Pump Alignment Handle and slide the tool over the fluid pump until it bottoms out in the fluid pump gear pocket.



75. Tighten the fluid pump bolts in a star pattern and remove the pump alignment handle.

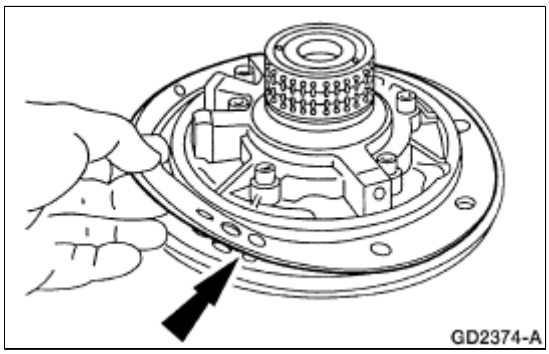


76. Install a new fluid pump seal ring.
    - Coat the fluid pump seal ring with petroleum jelly.



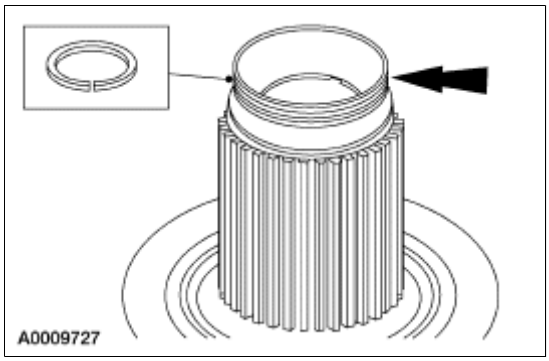
77. **NOTE:** Make sure the fluid pump seal ring is installed on the housing and pump assembly.

    Install a new fluid pump gasket.
    - Hold the fluid pump gasket in place with petroleum jelly.

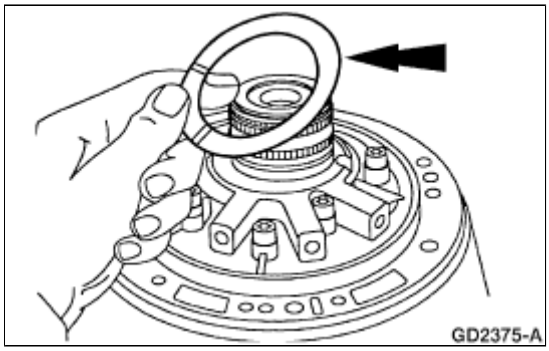


78. **CAUTION: Verify correct seal installation. Make sure seal grooves are clean and free of burrs.**

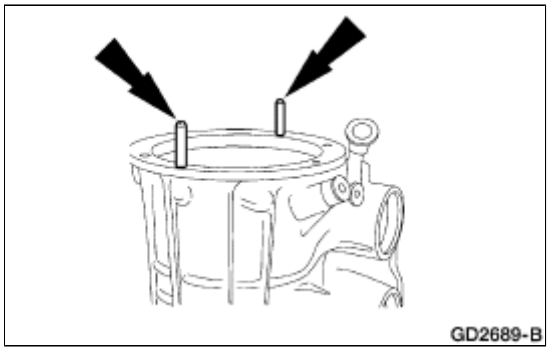
    Install the front pump support seal.



79. Install the selected No. 1 fluid pump thrust washer.
    - Coat the fluid pump thrust washer with petroleum jelly.

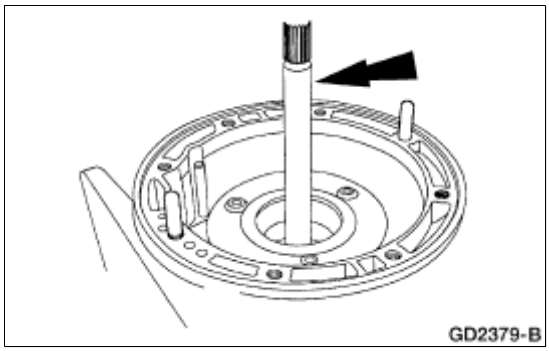


80. Install Converter Guide Pins into the transmission case.



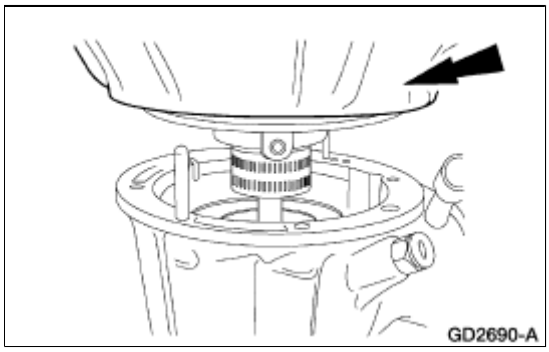
81. **CAUTION: The splines on the ends of the input shaft are not the same length. The shorter splines go into the assembly.**

    Install the input shaft.



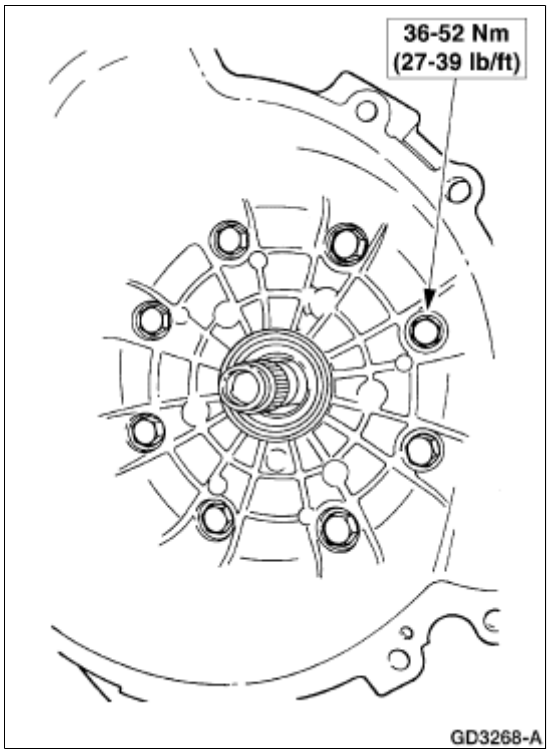
82. **CAUTION: Make sure that the fluid pump inlet thrust washer (No. 1) selective thrust washer, fluid pump gasket, and the fluid pump-to-case O-ring remain in the correct position throughout this step.**

    Install the fluid pump and converter housing onto the case.

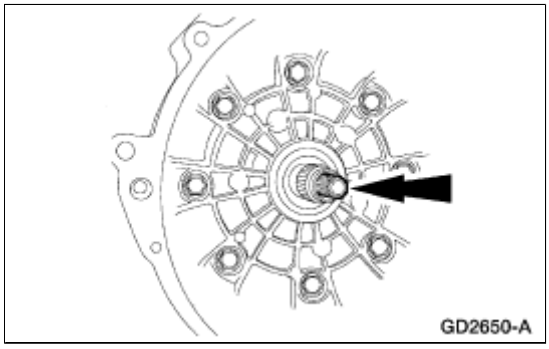


83. **NOTE:** Lubricate O-rings on converter housing screws.

    Remove Converter Guide Pins. Install the new converter housing-to-case screws. Tighten the screws in a star pattern.



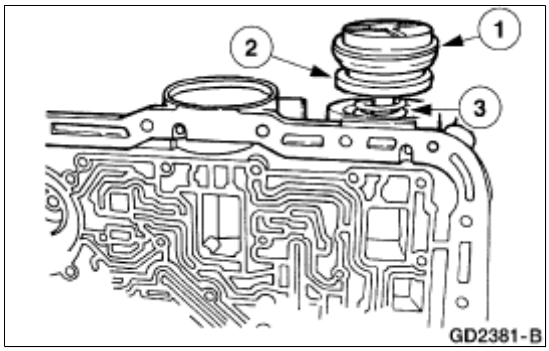
84. Remove the input shaft.



85. **WARNING: Make sure the lock pin on the Holding Fixture is secure. Failure to follow these instructions may result in personal injury.**

Rotate transmission assembly so the fluid pan rails are facing up.

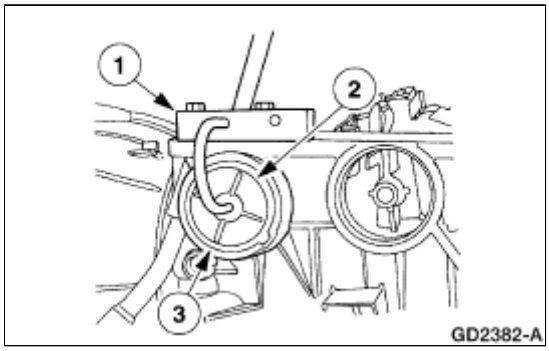
86. Assemble the front servo assembly.
    1. Install the front servo cover O-ring on front servo cover. Coat the front servo cover O-ring with petroleum jelly.
    2. Install front servo piston into the front servo cover.
    3. Install the front servo piston spring (7D028) on the front servo piston.



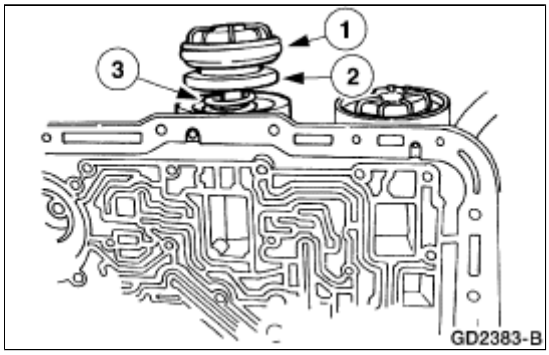
87. **CAUTION: Do not damage the front servo to case O-ring during installation.**

CAUTION: Do not press the front servo cover and O-ring past the relief hole in the case or O-ring damage may occur.

Using the Servo Cover Compressor, install the front servo assembly into the case.
1. Install Servo Cover Compressor.
2. Insert the front servo assembly into front servo bore in the transmission case.
3. Compress front servo cover and install the front servo cover retaining ring.



88. Assemble the intermediate servo assembly.
1. Install the intermediate servo cover O-ring on intermediate servo cover. Coat the intermediate servo cover O-ring with petroleum jelly.
2. Install intermediate servo piston into the intermediate servo cover.
3. Install the intermediate servo piston spring on the intermediate servo piston.

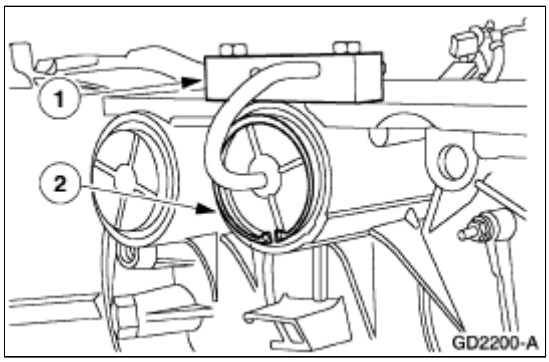


89. **CAUTION: Do not damage servo cover to case O-ring during installation.**

CAUTION: Do not press the intermediate servo cover and O-ring past the relief hole in the case or O-ring damage may occur.

Install the intermediate servo assembly into the case.

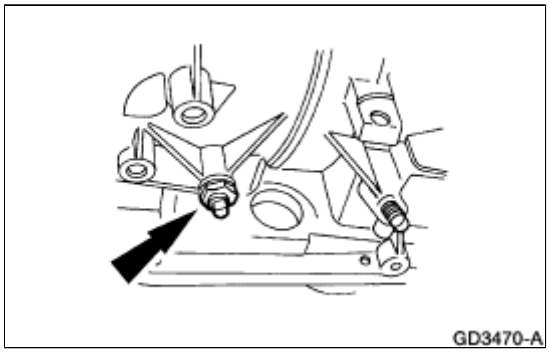
1. Install Servo Cover Compressor.
2. Insert the intermediate servo assembly into intermediate servo bore in the transmission case. Compress servo cover and install the intermediate servo cover retaining ring.



90. **CAUTION: Do not allow front band adjustment screw to back out. Band strut could fall out of position.**

CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

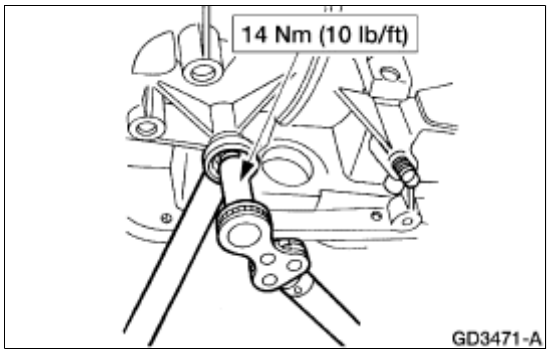
Install new locknut on the band adjustment screw.



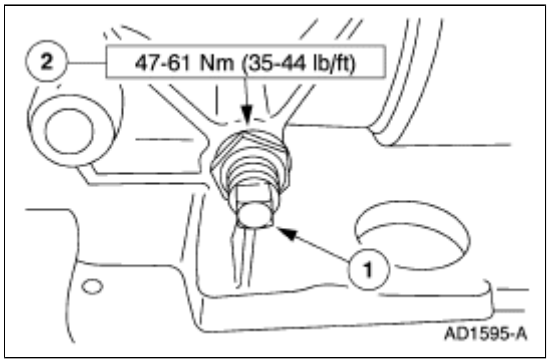
91. **CAUTION: The front servo must be installed prior to band adjustment.**

NOTE: The wrench will click at the specified torque.

Tighten front band adjustment screw using the Band Adjuster Wrench Kit and back off front band adjustment screw exactly two (2) turns and hold that position.



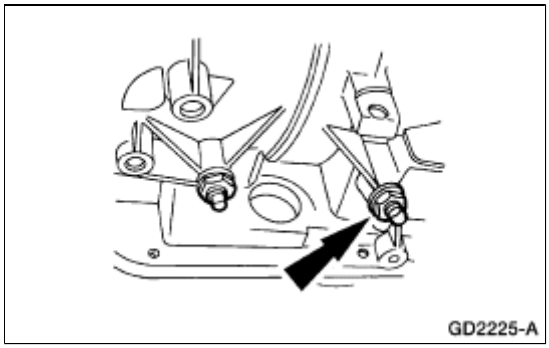
92. Tighten the front band locknut.
    1. Hold the front band adjustment screw stationary.
    2. Tighten the front band locknut.



93. **CAUTION: Do not allow intermediate band adjusting screw to back out. Band strut could fall out of position.**

    CAUTION: Install, but do not tighten, a new locknut on the band adjustment screw. Apply petroleum jelly to the locknut seal.

    Install new nut on the band adjustment screw.

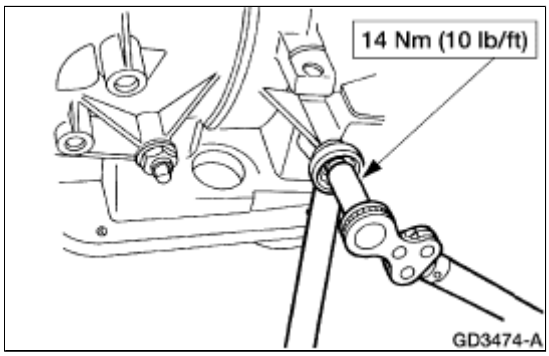


94. **CAUTION: The intermediate servo must be installed prior to band adjustment.**

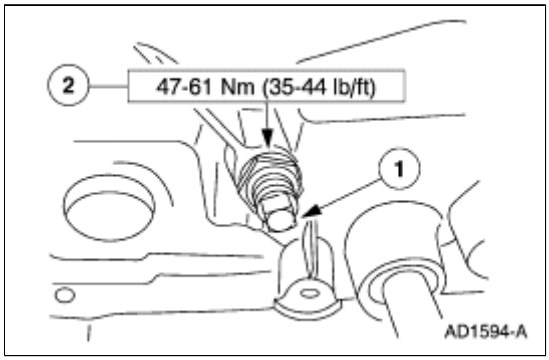
    NOTE: The wrench will click at the specified torque.

    Tighten intermediate band adjusting screw using the Band Adjuster Wrench Kit and back off

intermediate band adjusting screw exactly two (2) turns and hold that position.



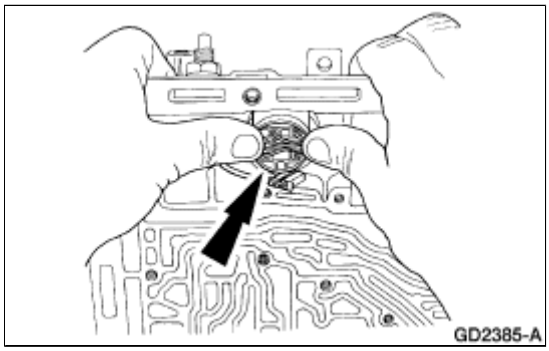
95. Tighten the intermediate band locknut.
    1. Hold the intermediate band adjustment screw stationary.
    2. Tighten the intermediate band locknut.



96. **CAUTION: Install new O-rings on the 16-pin electrical connector. Coat the O-rings with petroleum jelly.**

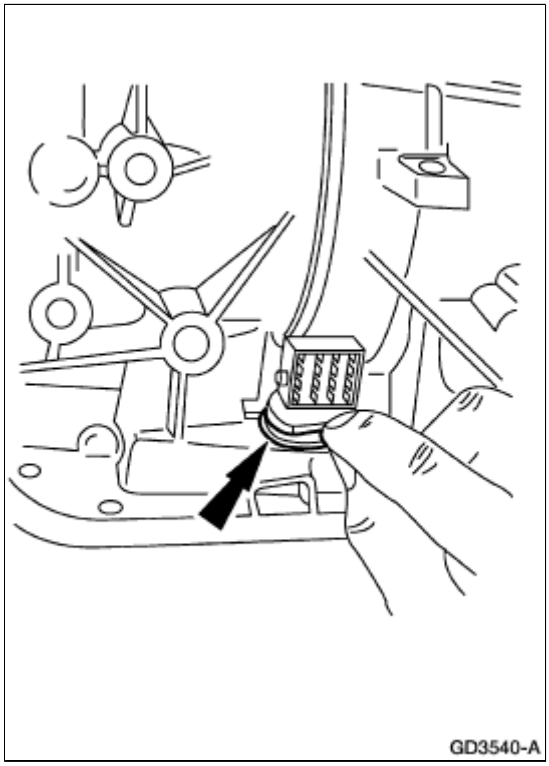
    NOTE: Make sure that the tab is in the lock position.

    Position the transmission case (16-pin) electrical connector into the case bore.
    - Press the transmission case (16-pin) electrical connector through the case until a click is heard.



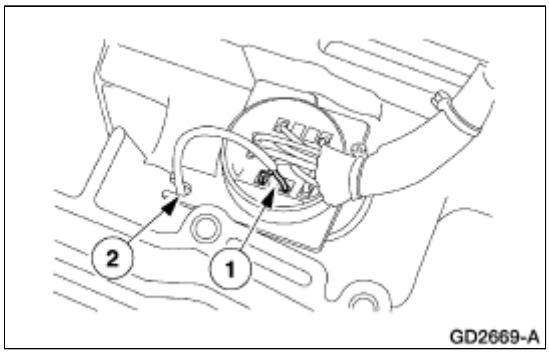
97. **CAUTION: Do not overstretch the retaining spring.**

Install the 16-pin electrical connector retaining spring.

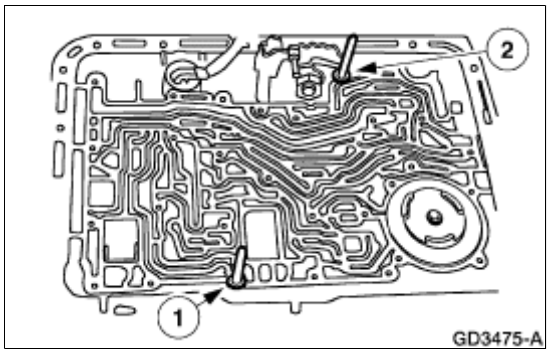


98. **CAUTION: Align the slot on the turbine shaft speed (TSS) sensor electrical connector with the slot in the 16-pin electrical connector.**

Install the TSS sensor electrical connector into the transmission case (16-pin) electrical connector.
1. Connect the TSS sensor electrical connector.
2. Insert the TSS sensor electrical connector wires into the retaining slot in the 16-pin electrical connector.



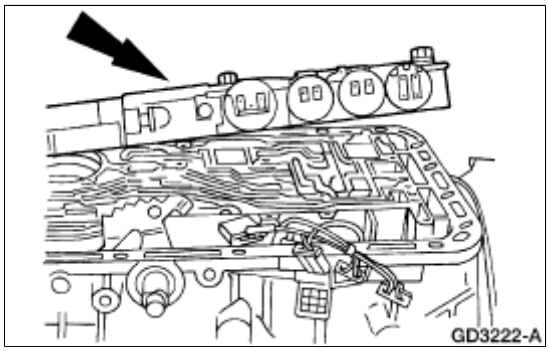
99. Install the Valve Body Guide Pins into the transmission case.
1. Install the large Valve Body Guide Pin (.248).
2. Install the small Valve Body Guide Pin (.235).



100. **CAUTION: Make sure main control valve body gasket is aligned.**

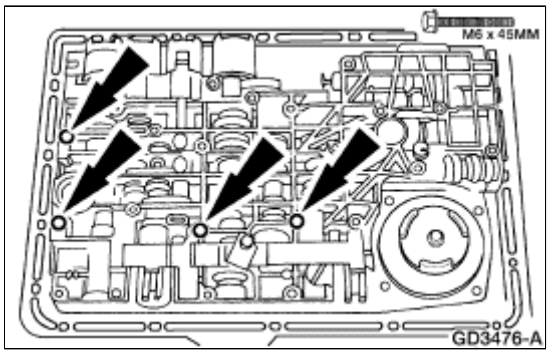
CAUTION: Make sure that the manual valve is correctly aligned with the manual valve inner pin when the main control valve body is installed.

Position the main control valve body into the transmission case.



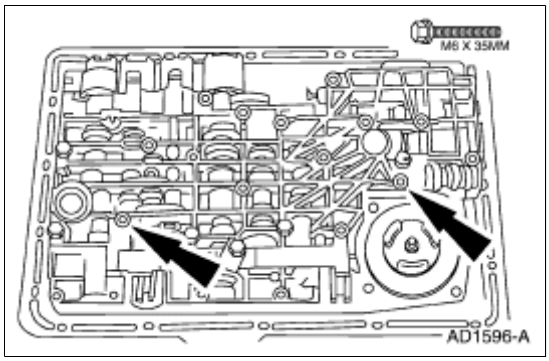
101. **NOTE:** The screws will be tightened in later steps.

Loosely install the four M6 x 45 mm screws.



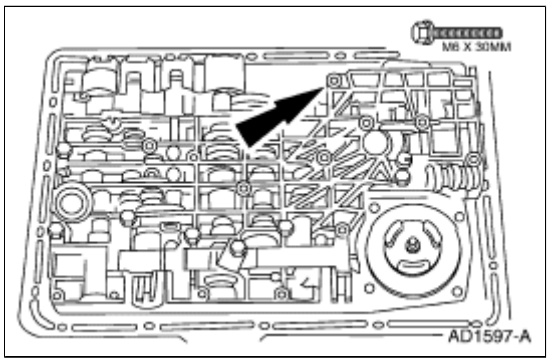
102. **NOTE:** The main control valve body screws will be tightened in later steps.

Loosely install the two M6 x 35 mm screws.

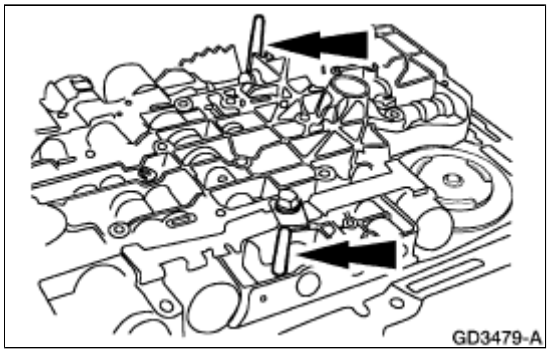


103. **NOTE:** The main control valve body screw will be tightened in later steps.

Loosely install M6 x 30 mm screw.

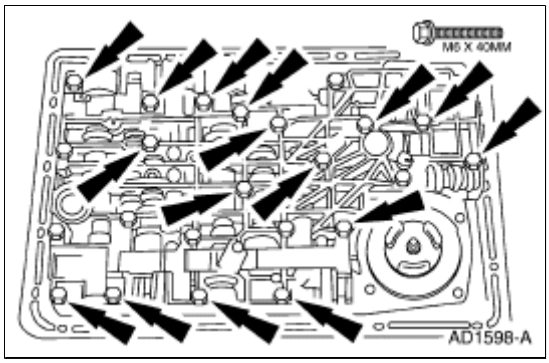


104. Remove the valve body guide pins.

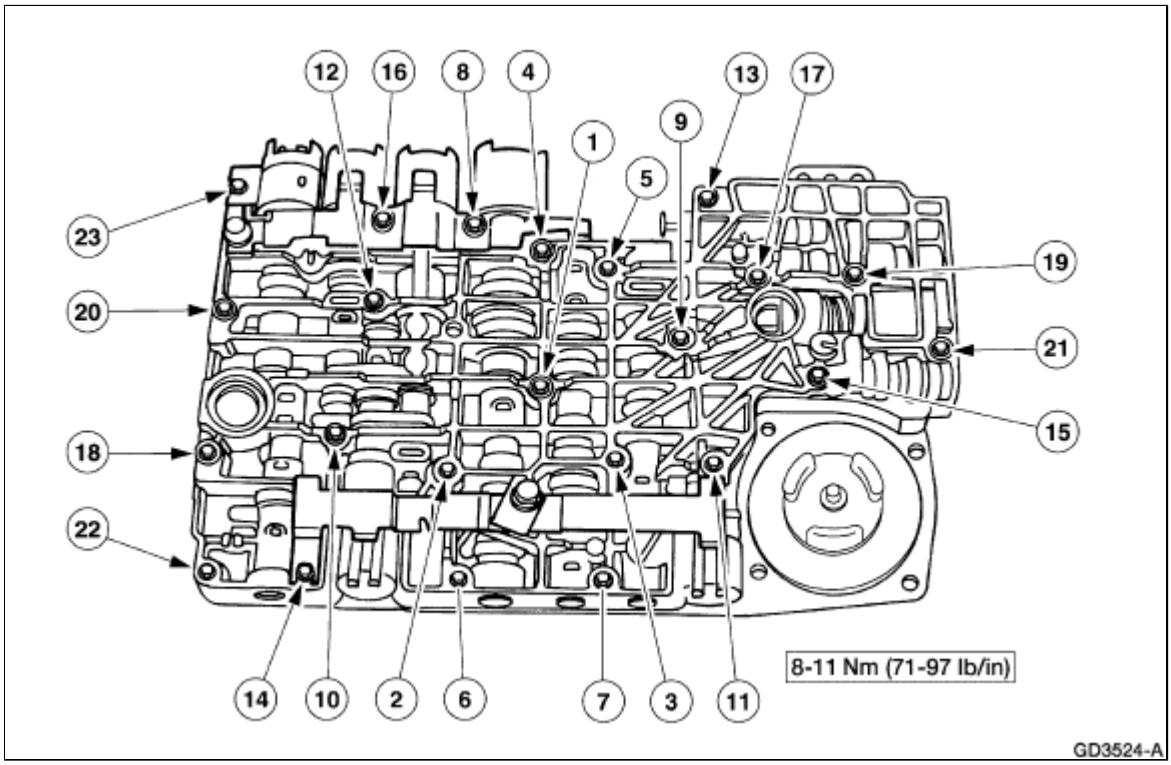


105. **NOTE:** The main control valve body screws will be tightened in later steps.

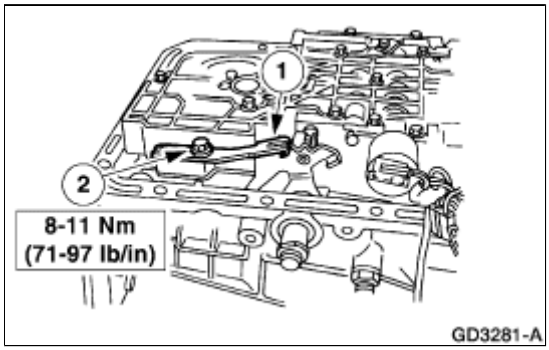
Loosely install the sixteen M6 x 40 mm screws.



106. Tighten the screws in the sequence shown.

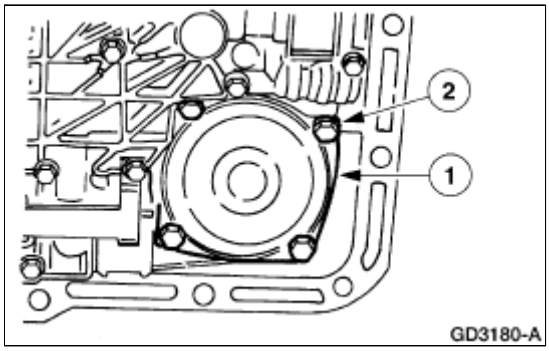


107. Install the manual control valve detent lever spring.
    1. Position the manual control valve detent lever spring on the main control valve body.
    2. Install the screw.

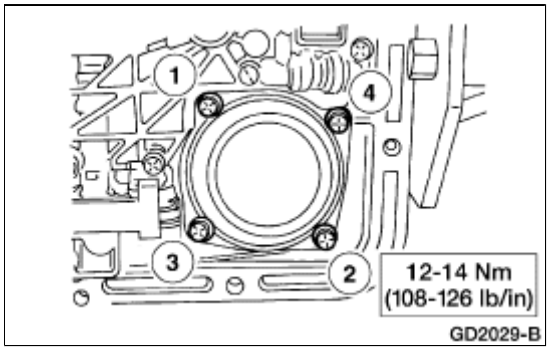


108. Install the low/ reverse band servo cover and reverse servo separator plate cover gasket.

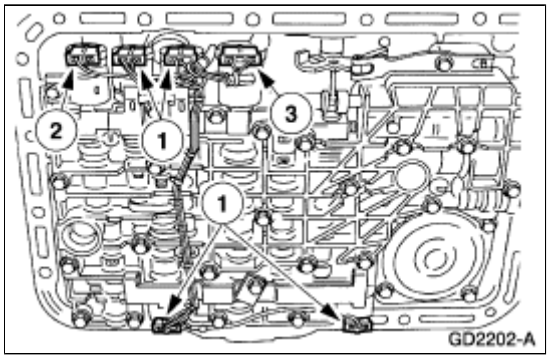
1. Position the low/ reverse band servo cover and low/ reverse servo separator plate cover gasket on the transmission case.
2. Loosely install the screws.



109. Tighten the screws in the sequence shown.



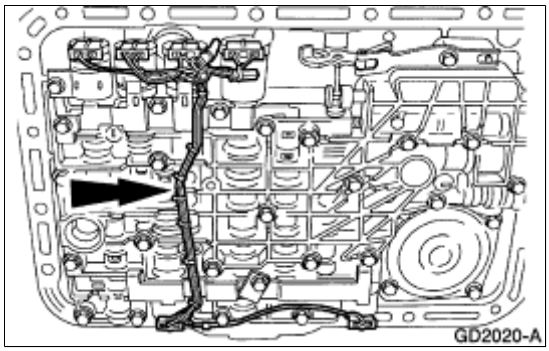
110. Connect the solenoid electrical connectors.
    1. Connect shift solenoids SSA, SSB, SSC and SSD electrical connectors.
    2. Connect the torque converter clutch (TCC) solenoid electrical connector.
    3. Connect the electronic pressure control (EPC) solenoid electrical connector.



111. **CAUTION: Excessive pressure may break the locating pins.**

Install wiring loom protector and guide.

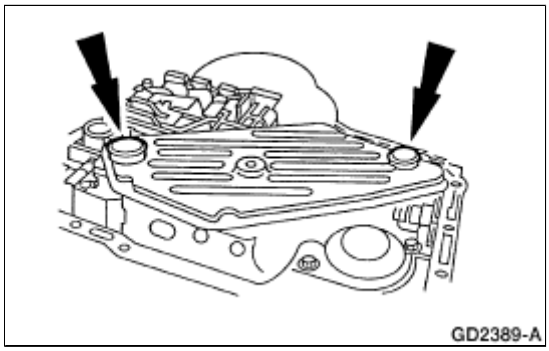
- Align the pins in the holes of the solenoid clamps and gently push down.



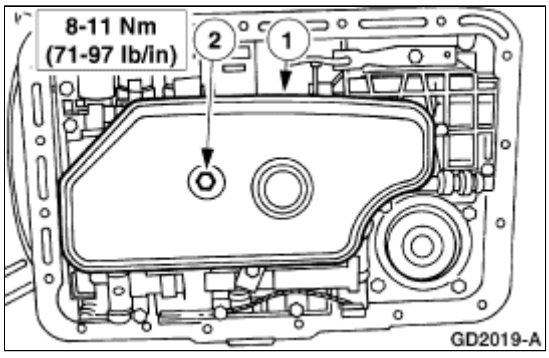
112. **CAUTION: Make sure that both fluid pan filter O-rings are properly installed on the fluid pan filter prior to installation.**

Install the fluid pan filter O-rings.

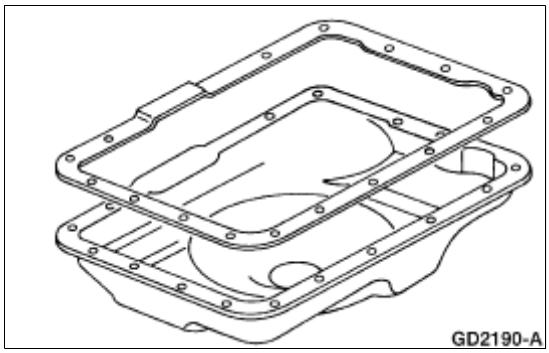
- Coat the fluid pan filter O-rings with MERCON ® V; Automatic Transmission fluid XT-5-QM meeting Ford specification MERCON ® V.



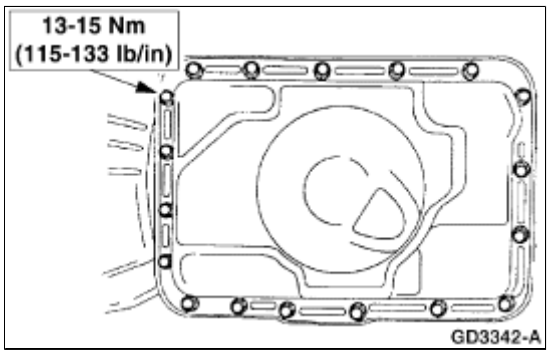
113. Install the fluid pan filter.
    1. Position fluid pan filter on the main control valve body.
    2. Install the screw.



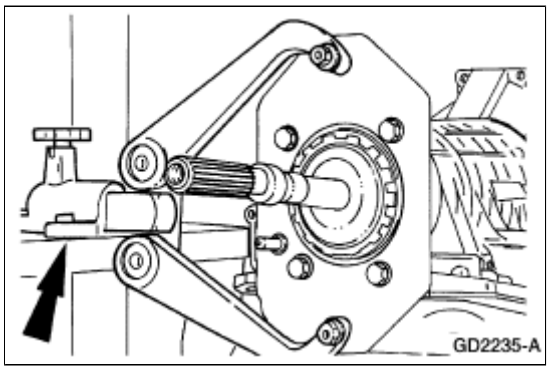
114. Install the transmission fluid pan and transmission fluid pan gasket.
    - Loosely install the screws.



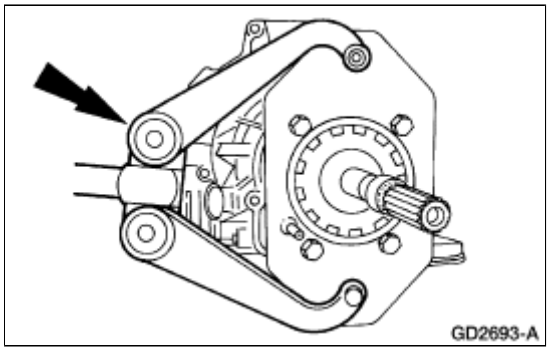
115. Tighten the screws.



116. Remove the transmission from the Holding Fixture and place on a flat surface.

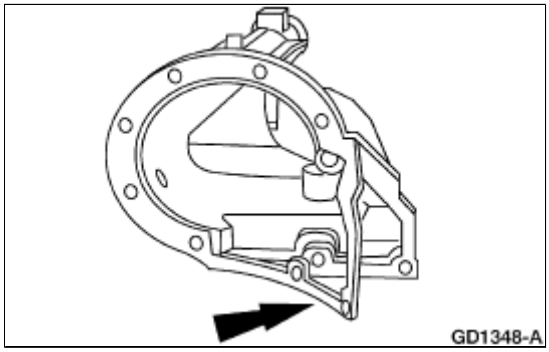


117. Remove the fixture arm of the Holding Fixture from the A4LD Holding Fixture Adapter.



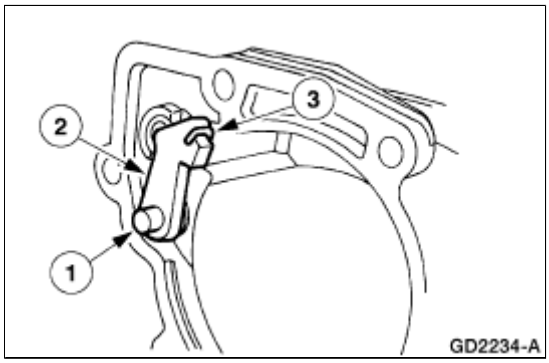
118. **NOTE:** Use petroleum jelly to hold the gasket in place.

Install a new extension housing gasket.



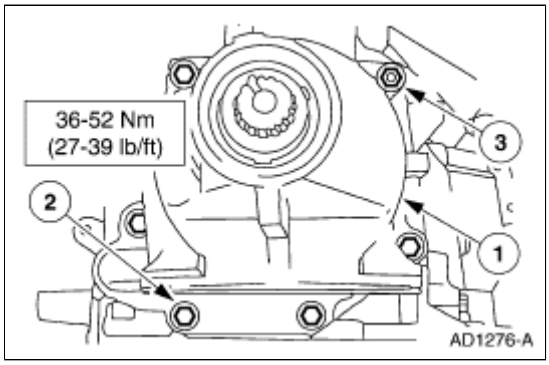
119. **NOTE:** The guide cup is press-fit into the extension housing and is not serviced separately.

Install the parking pawl assembly.
1. Install the parking pawl shaft into the extension housing.
2. Install the parking pawl.
3. Install the parking pawl return spring.



120. **CAUTION: Make sure the parking lever actuating rod is correctly seated into the transmission case parking rod guide cup.**

Install the extension housing.
1. Install the extension housing and gasket.
2. Install the screws.
3. Install the stud(s).

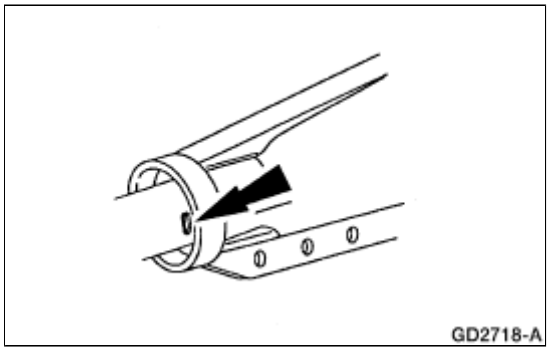


121. **CAUTION: The lube hole in the bushing must be aligned with the lube groove in the extension housing.**

NOTE: Install the extension housing bushing (7A034) only if removed in disassembly.

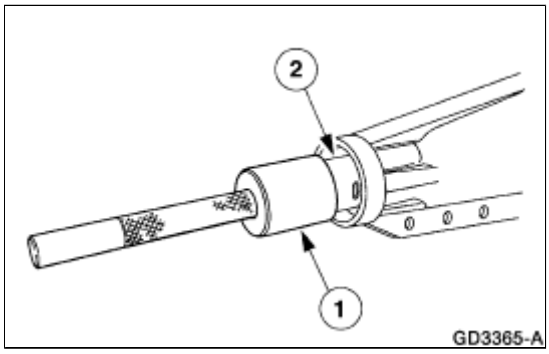
NOTE: Remove any burrs from the extension housing counterbore.

Align lube hole with the lube groove in extension housing. This groove is located at the 3 o'clock position when viewed from the rear.

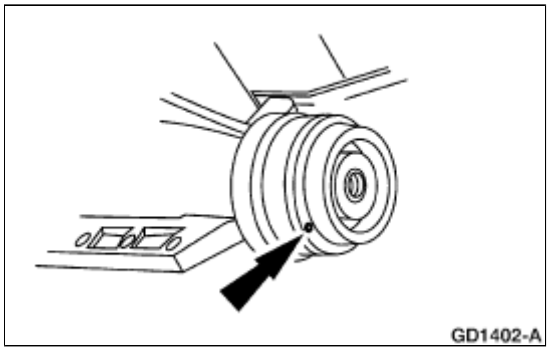


122. **CAUTION: Tool will bottom when bushing is in the proper position.**

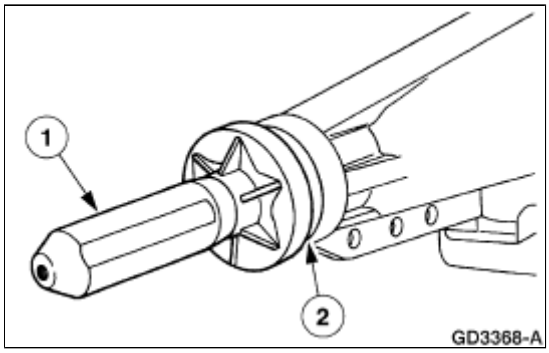
Using the Housing Bushing Replacer, install the extension housing bushing.
1. Position the Housing Bushing Replacer.
2. Install extension housing bushing.



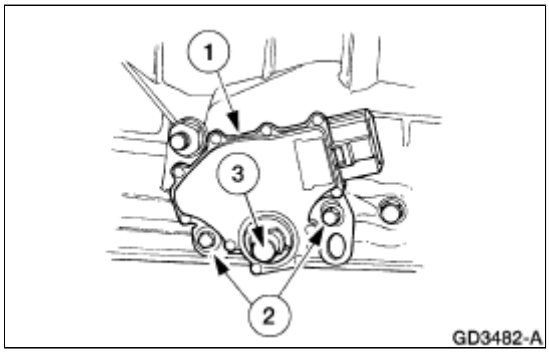
123. Position new extension housing seal with drain hole in the 6 o'clock position.



124. Using Align Extension Housing Seal Replacer, install a new extension housing seal.
    1. Align Extension Housing Seal Replacer.
    2. Install the extension housing seal.



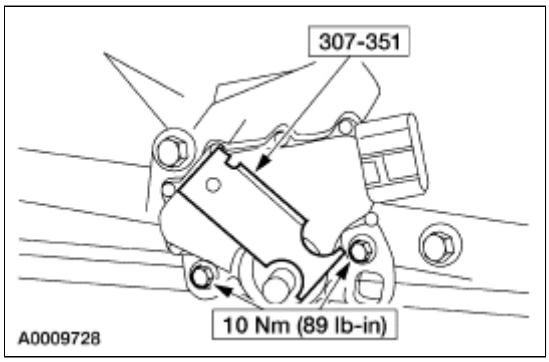
125. Install the digital transmission range (TR) sensor.
    1. Position the digital TR sensor on the transmission.
    2. Loosely install the screws.
    3. Rotate manual lever to neutral position (two detents rearward).



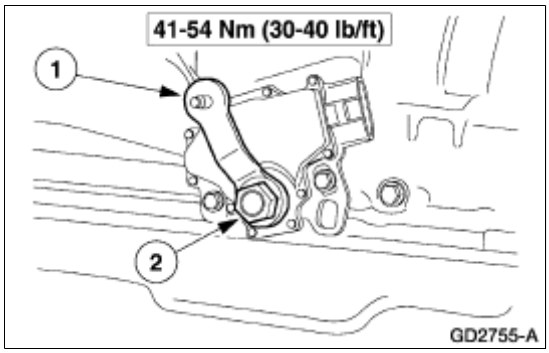
126. **CAUTION: Tightening one screw before tightening the other may cause the sensor to bind or become damaged.**

    NOTE: The manual lever must be in the neutral position.

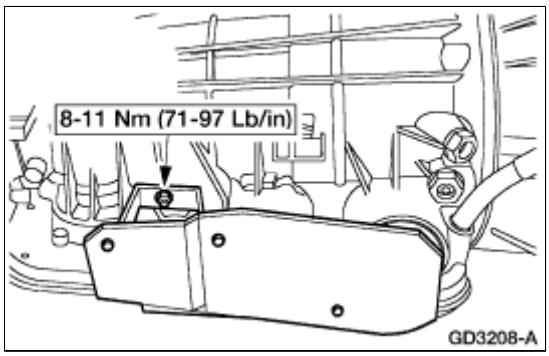
    Using the special tool, align the digital TR sensor and tighten screws in an alternating sequence.



127. Install the manual control lever.
    1. Install the lever.
    2. Install the nut.

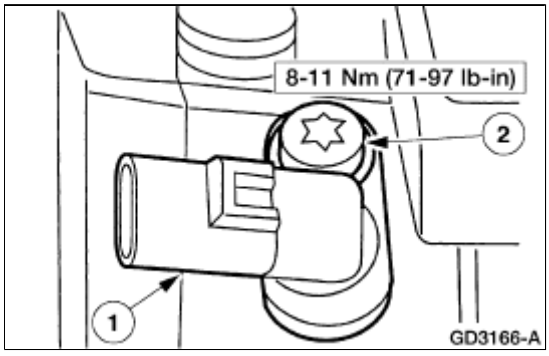


128. Install transmission servo heat shield and nut.



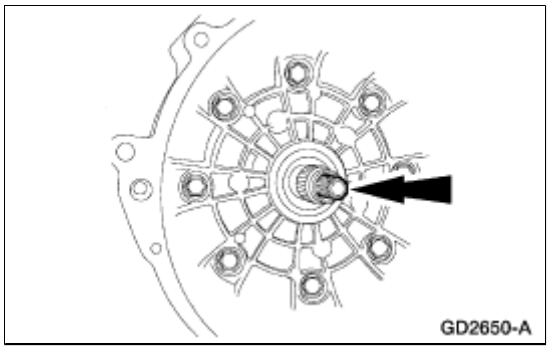
129. **NOTE:** Inspect O-ring for damage. Replace if damaged.

Install the output shaft speed (OSS) sensor.
1. Install the sensor.
2. Install the screw.

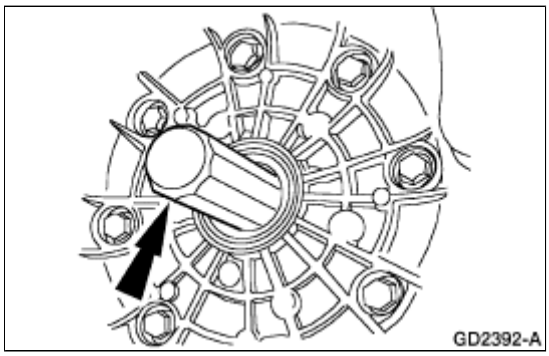


130. **CAUTION: The splines of the input shaft are not the same length on both ends. The shaft end with the shorter splines goes into the fluid pump.**

Install the input shaft.



131. Check that the fluid pump gear seal ring is seated.
    - Insert the Front Pump Seal Sizing Tool into the fluid pump drive gear.

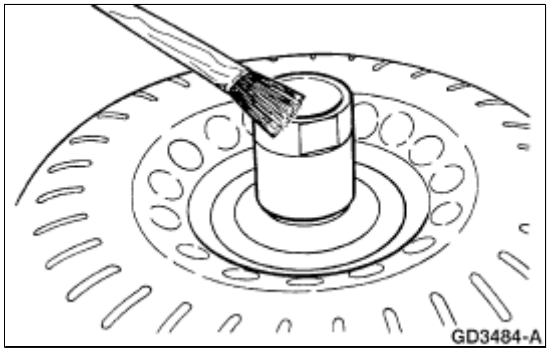


132. **CAUTION: Do not damage the fluid pump gear O-ring when installing torque converter.**

CAUTION: Make sure the converter hub is fully engaged in the front pump support and gear, and rotates freely. Do not damage the hub seal.

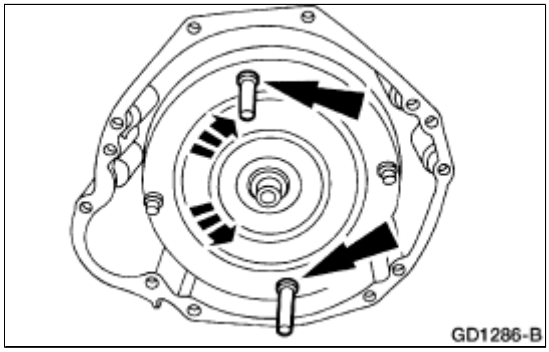
CAUTION: If the torque converter slides out, the hub seal may be damaged.

Lubricate the converter hub with MERCON ® V; Automatic Transmission Fluid XT-5-QM or equivalent Meeting Ford MERCON ® V specification.



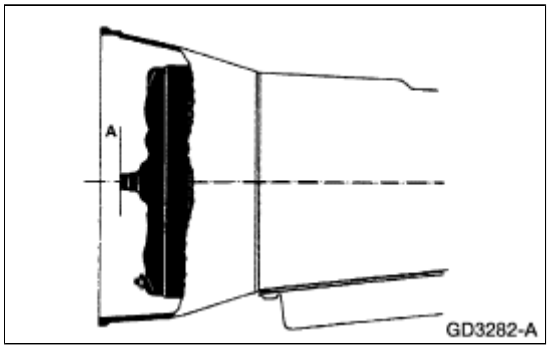
133. **WARNING: The torque converter can fall out if the transmission is tipped. Failure to follow these instructions may result in personal injury.**

Use the Torque Converter Handles to install the torque converter by pushing and rotating.

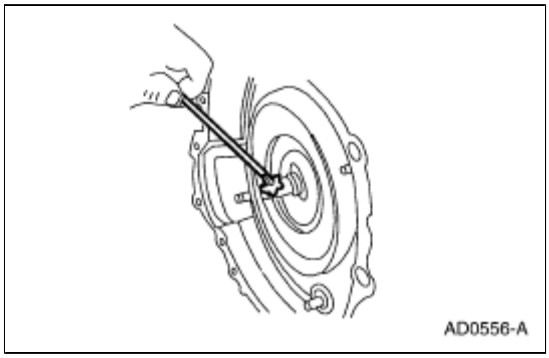


134. **NOTE:** Dimension "A" should be 10.23-14.43 mm (0.43-0.56 in).

Make sure the torque converter is installed to specification.

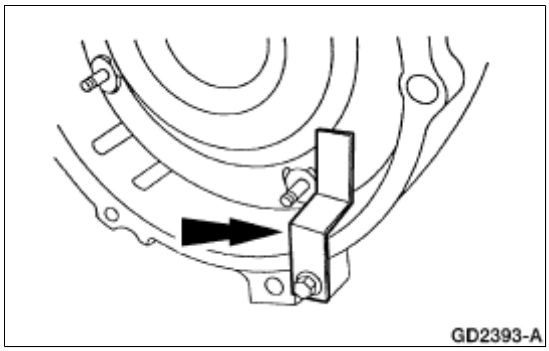


135. Lubricate the torque converter pilot hub with Multi-Purpose Grease D0AZ-19584-A meeting Ford specification ESB-M1C93-B.



136. Before installing transmission, make sure that the transmission cooling system (line and cooler [s]) have been thoroughly flushed. If contamination cannot be removed or proper flow cannot be obtained, replace cooler(s) and/or lines. For additional information, refer to Section 307-02 .

137. Install the Torque Converter Holding Tool on case.


GD2393-A

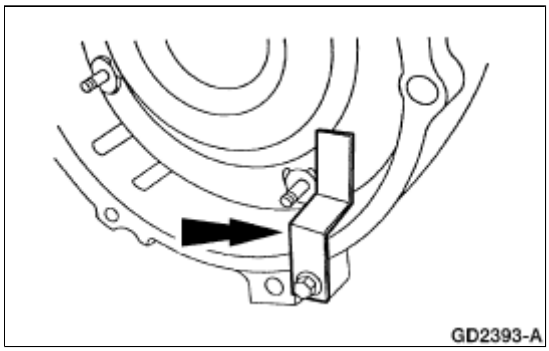
Transmission

1. On 4x4 models install the vent tube assembly.

2. **WARNING: Secure the transmission to the transmission jack with a safety chain. Failure to follow these instructions may result in personal injury.**

   Raise and position the transmission.

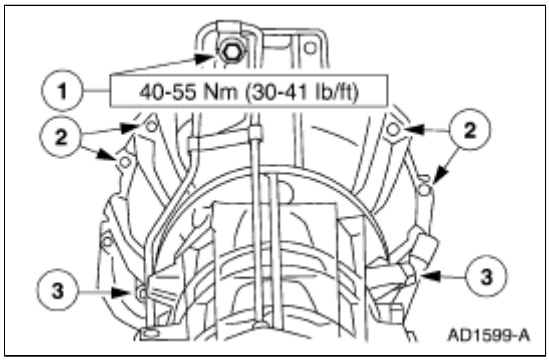
3. Remove the Torque Converter Holding Tool.



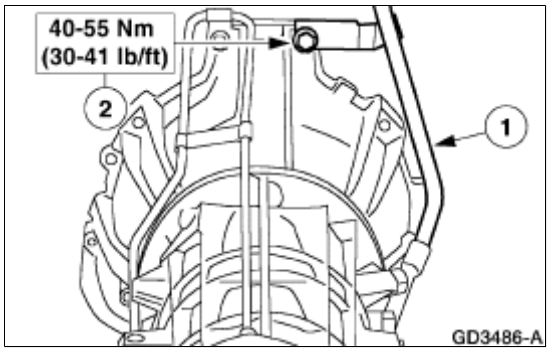
4. **NOTE:** Align the flexplate to converter marks made at removal.

   NOTE: For vehicles equipped with 4.0L SOHC engines, install all eight transmission-to-engine screws. For vehicles equipped with 4.0L EI engines, only install seven transmission-to-engine screws.

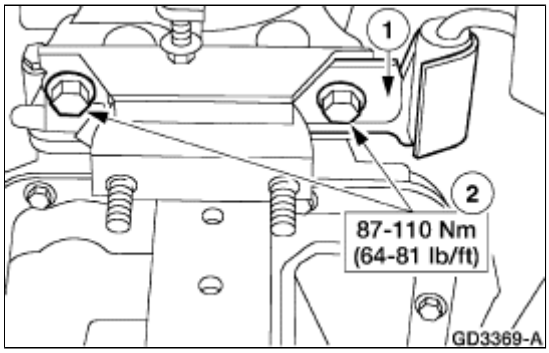
   Install the transmission-to-engine screws.
   1. Install 2 M10 x 40 mm (1.6 in) screws.
   2. Install 4 M10 x 50 mm (2 in) screws.
   3. Install 2 M10 x 75 mm (3 in) screws.



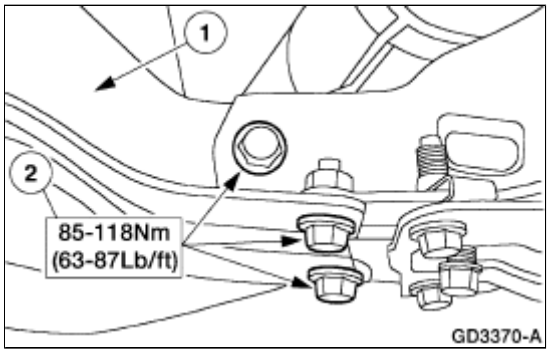
5. For vehicles equipped with a 4.0L EI engine, install the upper filler tube.
   1. Install the upper filler tube.
   2. Install the screw.



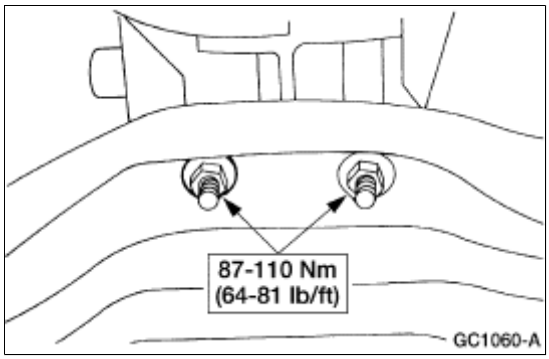
6. Install the transmission mount screws.
    1. Install the exhaust bracket.
    2. Install the screws.



7. Install the crossmember.
    1. Position the crossmember.
    2. Install the six crossmember bolts (three each side).



8. Install the transmission mount into the crossmember and tighten the nuts.

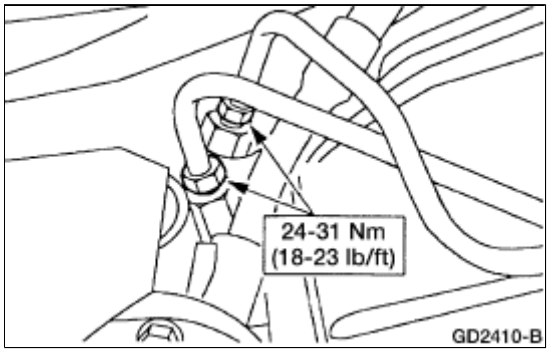


9. Remove the High-Lift Transmission Jack.

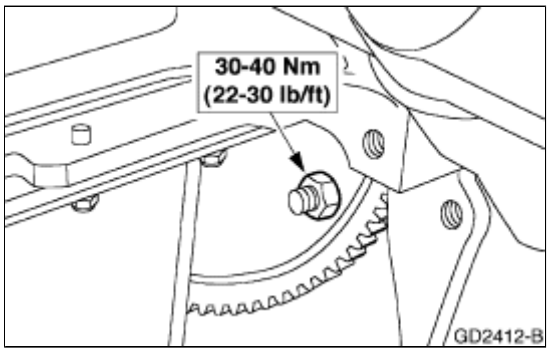
10. If equipped, install the transfer case. For additional information, refer to Section 308-07B .

11. **CAUTION: Use care not to bend or otherwise damage the cooler lines.**

    Hold the case fitting and install the transmission cooler lines.



12. Install the four torque converter-to-flexplate nuts.
    - Rotate the crankshaft as needed to gain access to all the nuts.

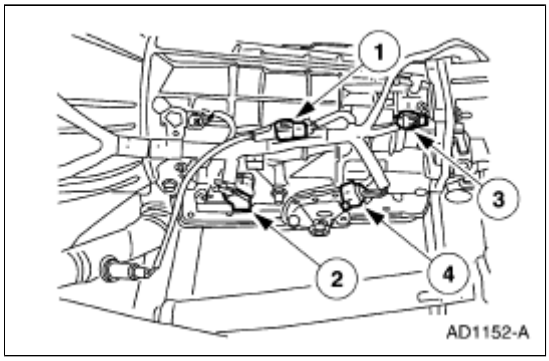


13. Install the starter motor. For additional information, refer to Section 303-06 .

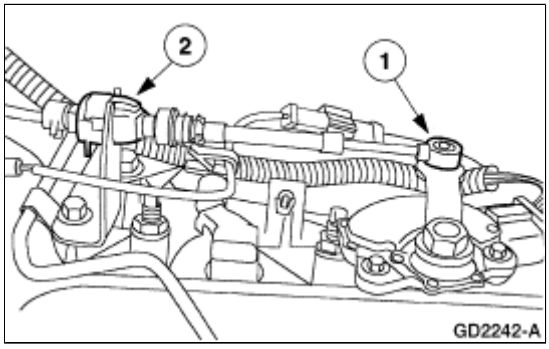
14. Install the catalytic converter assembly and crossover pipe nuts. For additional information, refer to Section 309-00 .

15. Install the transmission wiring harnesses.
    1. Connect the heated oxygen sensor (HO2S) connector.

2. Connect the transmission connector.
3. Connect the output shaft speed (OSS) sensor connector.
4. Connect the digital transmission range (TR) sensor connector.

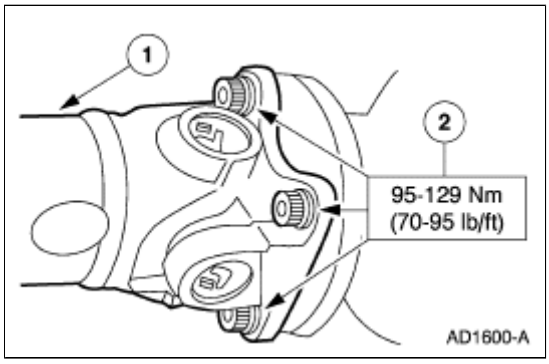


16. Install the shift cable.
    1. Connect the shift cable to the manual control lever.
    2. Connect the shift cable to the bracket.



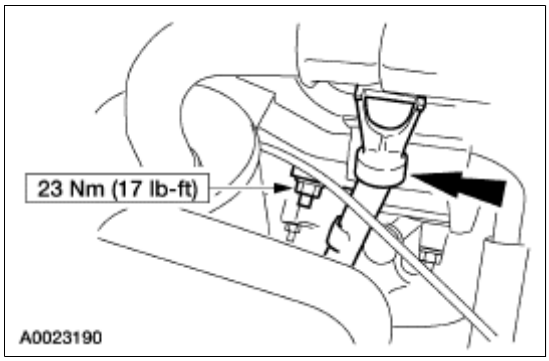
17. **NOTE:** Align the driveshaft yoke and the axle shaft marks made at removal to maintain driveline balance.

    Install the rear driveshaft.
    1. Position the driveshaft.
    2. Install the four driveshaft bolts.



18. Lower the vehicle.

19. For vehicles equipped with a 4.0L SOHC engine, install the transmission fill tube and indicator as an assembly.



20. Connect the battery ground cable.

21. Fill the transmission with fluid and inspect for correct operation.
    - Use MERCON ® V Automatic Transmission Fluid XT-5-QM or equivalent meeting Ford MERCON ® V specification.

22. Verify that the shift cable is correctly adjusted. For additional information, refer to Section 307-05 .

General Specifications

Item	Specification
MERCON® V Automatic Transmission Fluid XT-5-QM—Transmission (4R70W and 5R55E)	MERCON® V or equivalent

Torque Specifications

Description	Nm	lb-ft	lb-in
Transmission Auxiliary Fluid Cooler Bolts	5-7	—	45-62
Transmission Auxiliary Fluid Cooler Hose Clamps	3-4	—	27-35
Radiator Air Deflector Bolts	12-17	—	106-150
Transmission Fluid Cooler Tube Fitting To Radiator	13-22	10-16	—
Transmission Fluid Cooler Tube Fittings At Case(4R70W)	29-35	21-25	—
Transmission Fluid Cooler Tube to Case Fitting (5R55E)	24-31	18-23	—
Transmission Cooler Lines Bracket Bolts	3.1-4.3	—	28-38
Radiator to Radiator Support Bolts	6-8	—	53-71

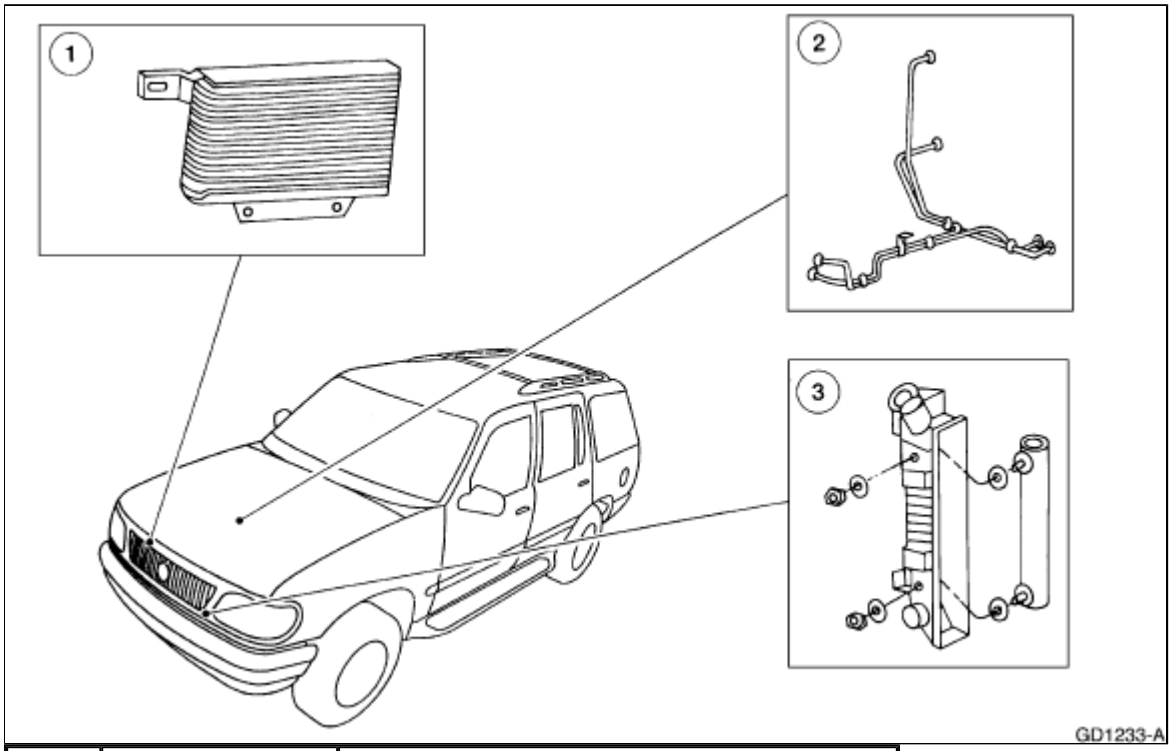
Transmission Cooling

All vehicles with automatic transmissions are equipped with integral transmission fluid coolers (7A095). The integral transmission fluid cooler is contained inside of the radiator outlet tank (8054) and cannot be repaired separately. All (AWD) vehicles are equipped with the transmission auxiliary fluid cooler (7K177) which is mounted in front of the radiator (8005). In operation, transmission fluid travels from the transmission to the integral transmission fluid cooler to the transmission auxiliary fluid cooler then back to the transmission. The integral transmission fluid cooler transfers heat from the transmission fluid to the engine coolant. The transmission auxiliary fluid cooler transfers heat from the transmission fluid to the outside air.

For transmission fluid cooler flow test, refer to Section 307-01A and Section 307-01B .

For transmission fluid cooler backflushing and cleaning, refer to Section 307-01A and Section 307-01B .

Transmission Cooling Components (Mountaineer Shown, Explorer Similar)



Item	Part Number	Description
1	7K177	Transmission auxiliary fluid cooler
2	7C140	Transmission fluid cooler tube
3	7A095	Transmission fluid coolers

Transmission Cooling

Inspection and Verification

WARNING: Never remove the radiator cap under any conditions while the engine is operating. Failure to follow these instructions could result in personal injury and/or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the radiator, use extreme care when removing the radiator cap from a hot radiator. Wait until the engine has cooled, then wrap a thick cloth around the radiator cap and turn it slowly to the first stop. Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, press down on the radiator cap (with a cloth), turn and remove.

Check for fluid leakage. If fluid leakage is found at any of the transmission fluid cooling components, the component must be replaced.

Symptom Chart

SYMPTOM CHART

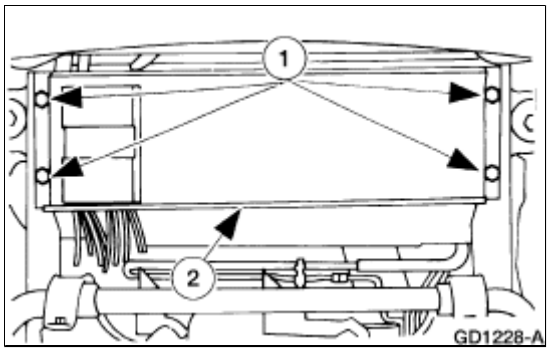
Condition	Possible Sources	Action
• Transmission Overheating	• Damaged radiator.	• REPAIR or install a new radiator. For additional information, REFER to Section 303-03 .
	• System leaks.	• INSPECT for leaks. REPAIR as required.
	• System leaks.	• INSPECT transmission fluid cooler and tubes for leaks. REPAIR as required.
	• Incorrect fluid level.	• ADJUST to proper level.
	• Fluid condition.	• INSPECT according to instructions under Fluid Condition Check. For additional information, REFER to Section 303-03 .
	• Damaged, blocked, reversed, leaking or restricted cooler lines or cooler tubes.	• INSPECT cooler lines and tubes. REPAIR or flush as necessary.
	• Engine concerns causing transmission to overheat.	• INSPECT engine cooling system. For additional information, REFER to Section 303-03 .
	• Excessive towing loads.	• CHECK gross vehicle weight.
	• Incorrect idle or performance.	• REFER to Powertrain Control/Emissions Diagnosis

		(PC/ED) manual.

Auxiliary Transmission Fluid Cooler

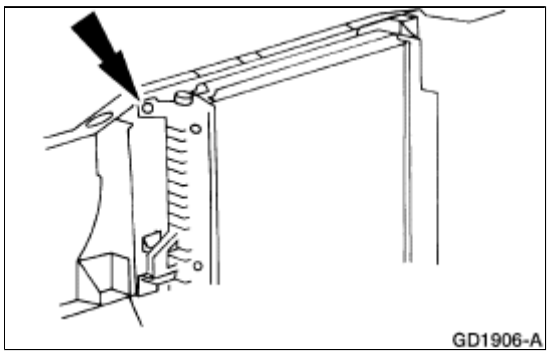
Removal

1. Shut off the air suspension if equipped.
2. Disconnect the battery cables.
3. Raise and support the vehicle. For additional information, refer to Section 100-02 .
4. Remove the radiator air deflector (8327).
   1. Remove the bolts.
   2. Remove the radiator air deflector.

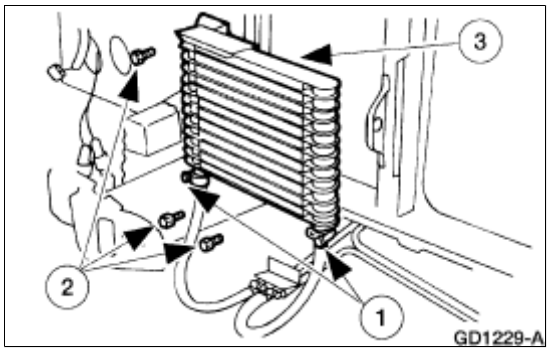


5. Place a drain pan under the transmission auxiliary fluid cooler (7K177).
6. **NOTE:** On 5.0L, the radiator (8005) must be loosened to provide access for removing the upper transmission fluid cooler screw.

   Loosen the two upper radiator hold down screws.

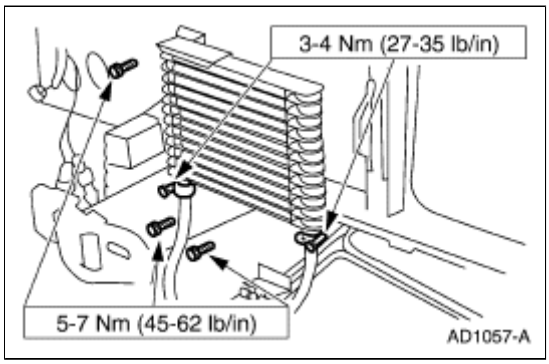


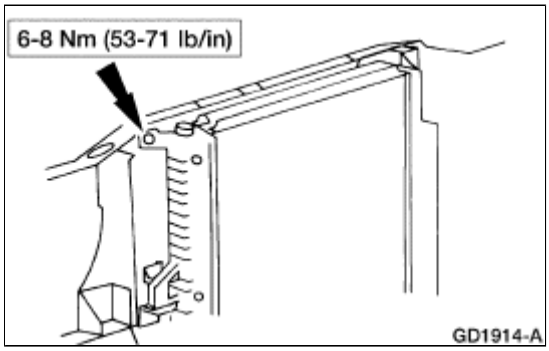
7. Remove the transmission auxiliary fluid cooler.
   1. Disconnect the hoses.
   2. Remove the bolts.
   3. Remove the transmission auxiliary fluid cooler.

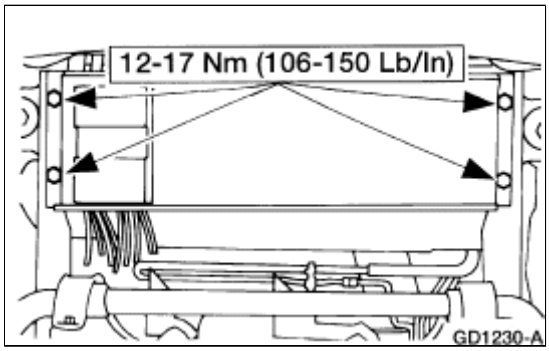


Installation

1. Follow the removal procedure in reverse order.







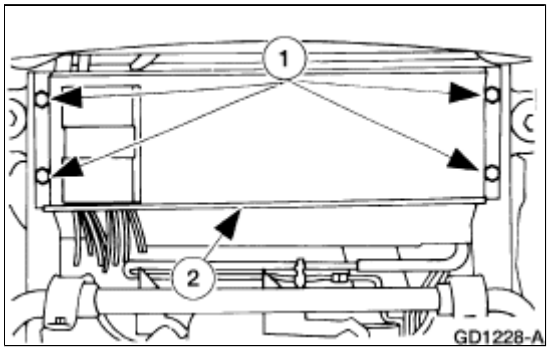
Transmission Fluid Cooler Tubes —4R70W Transmission

Removal

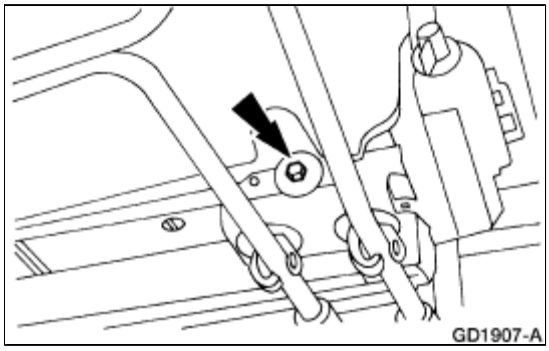
1. **WARNING: The electrical power supply to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the rear jack storage area. Failure to do so may result in unexpected inflation or deflation of the air springs which may result in shifting of the vehicle during these operations.**

   Raise and support the vehicle. Refer to Section 100-02 .

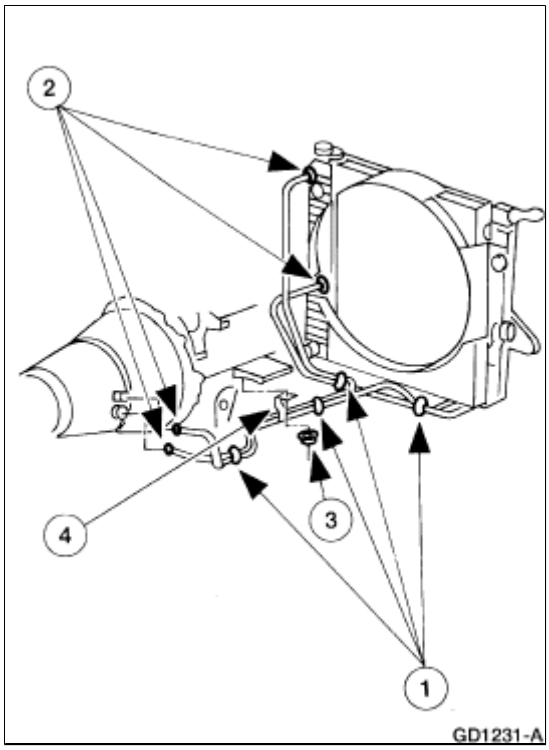
2. Remove the radiator air deflector (8327).
   1. Remove the bolts.
   2. Remove the radiator air deflector.



3. Remove the nut, bolt, and transmission cooler line bracket.



4. Remove the transmission fluid cooler tubes (7C140).
   1. Remove the clips.
   2. Disconnect the fittings.
      - Use a backup wrench to hold the case fitting secure.
   3. Remove the nut.
   4. Remove the transmission fluid cooler tubes.



Installation

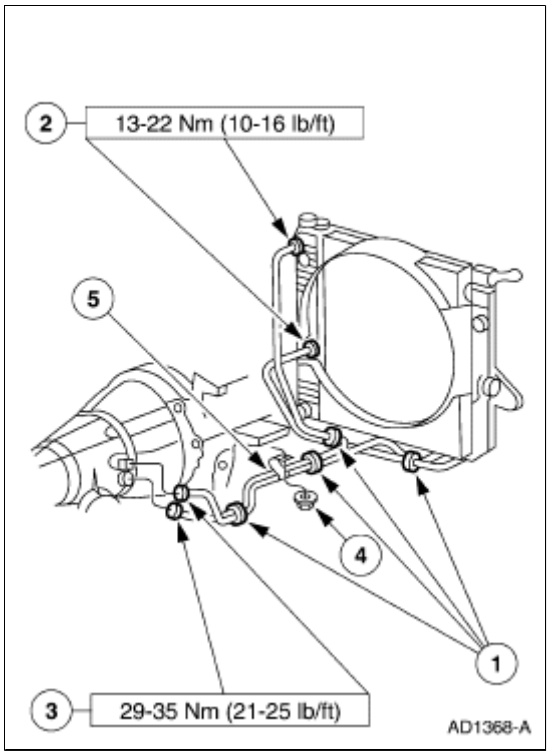
1. **NOTE:** When a transmission fluid cooler tube is replaced, each replacement tube must be fabricated from the same size tube as the original.

   Shape a new transmission fluid cooler tube.
   - Use the prior tube as a guide.
   - Install the appropriate fittings.
   - Use a double flare on the ends of the tubes.

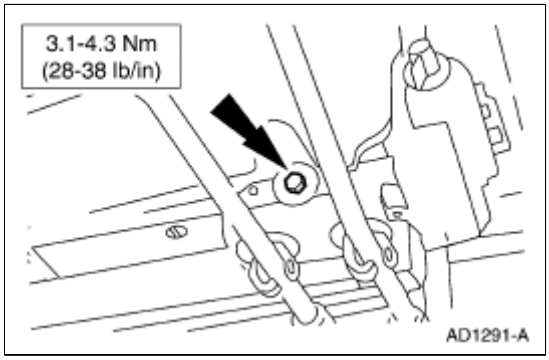
CAUTION: To prevent damage, make sure all plugs are removed from port openings before installing tubes.

CAUTION: To prevent cross threading, all tube nuts must be hand started before being torqued to specification.

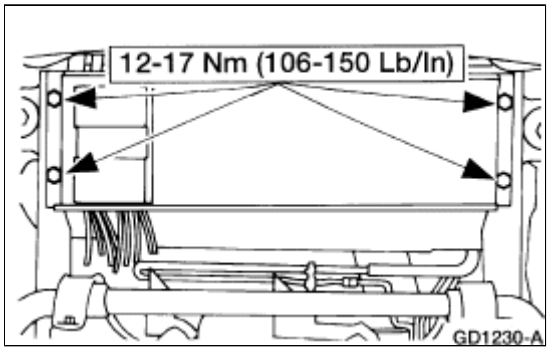
2. Install the transmission fluid cooler tubes.
   1. Install the clips.
   2. Connect the tube fittings to the radiator.
   3. Connect the tube fitting to the transmission.
      - Use a backup wrench to hold the case fitting secure.
   4. Install the tube bracket nut.
   5. Install the transmission fluid cooler tubes.



3. Install the transmission cooler line bracket and nut and bolt.



4. Install the radiator air deflector.
    - Install the bolts.



5. **NOTE:** If equipped with air suspension, reactivate the system by turning on the air suspension switch.

Lower the vehicle.

6. Fill transmission fluid to the proper level using the correct fluid and inspect for leaks.

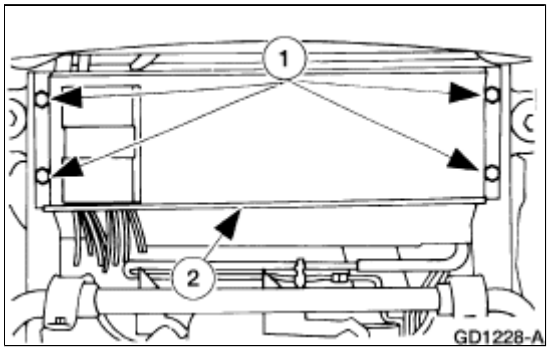
Transmission Fluid Cooler Tubes —5R55E Transmission

Removal

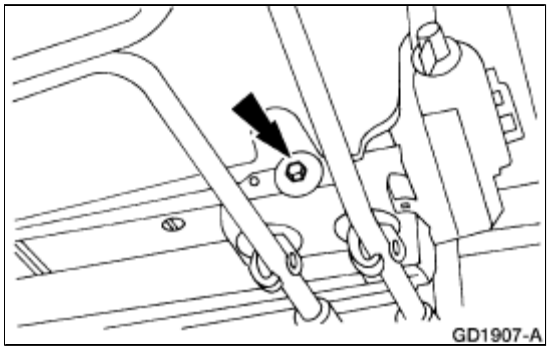
1. **WARNING: The electrical power supply to the air suspension system must be shut off prior to hoisting, jacking or towing an air suspension vehicle. This can be accomplished by turning off the air suspension switch located in the rear jack storage area. Failure to do so may result in unexpected inflation or deflation of the air springs which may result in shifting of the vehicle during these operations.**

   Raise and support the vehicle; refer to Section 100-02 .

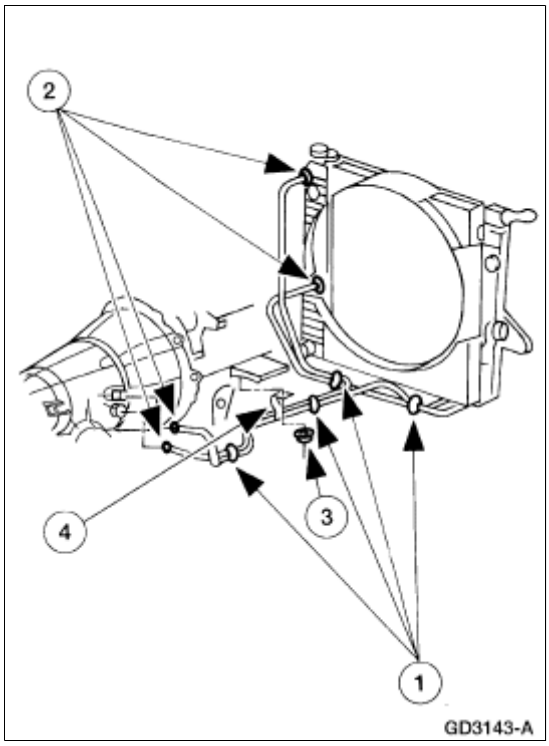
2. Remove the radiator air deflector (8327).
   1. Remove the bolts.
   2. Remove the radiator air deflector.



3. Remove the nut, bolt and transmission cooler line bracket.



4. Remove the transmission fluid cooler tubes (7C140).
   1. Remove the clips.
   2. Disconnect the fittings.
      - Use a backup wrench to hold the case fitting secure.
   3. Remove the nut.
   4. Remove the transmission fluid cooler tubes.



Installation

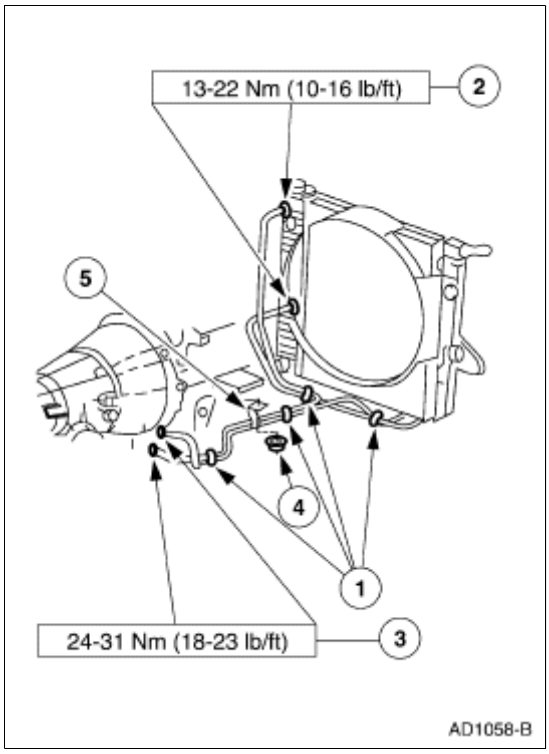
1. **NOTE:** When a transmission fluid cooler tube is replaced, each replacement tube must be fabricated from the same size tube as the original.

   Shape a new transmission fluid cooler tube.
   - Use the prior tube as a guide.
   - Install the appropriate fittings.

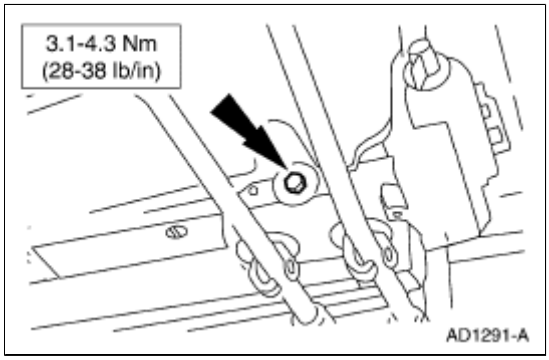
2. **CAUTION: To prevent damage, make sure all plugs are removed from port openings before installing tubes.**

   CAUTION: To prevent cross threading, all tube nuts must be hand started before being torqued to specification.

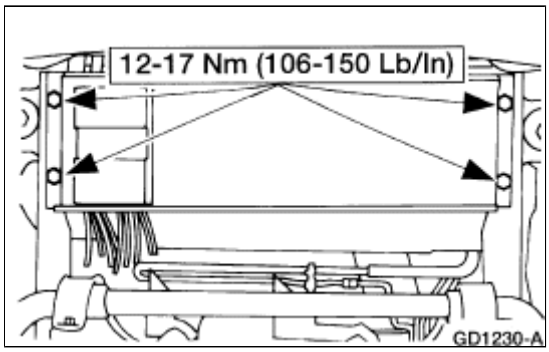
   Install the transmission fluid cooler tubes.
   1. Install the clips.
   2. Connect the tube fittings to the radiator.
   3. Connect the tube fittings to the transmission.
      - Use a backup wrench to hold the case fitting secure.
   4. Install the tube bracket nut.
   5. Install the transmission fluid cooler tubes.



3. Install the nut, bolt, and transmission cooler line bracket.



4. Install the radiator air deflector.
    - Install the bolts.



5. **NOTE:** If equipped with air suspension, reactivate the system by turning on the air suspension switch.

Lower the vehicle.

6. Fill transmission fluid to the proper level using the correct fluid and inspect for leaks.

Torque Specifications

Description	Nm	lb-ft	lb-in
Transmission shift cable bracket bolts	34-46	25-34	—
Floor shifter base to floor cover	12-16	8-12	—

External Controls

The transmission shift cable transfers the transmission operating mode from the shift control selector lever to the transmission. The indicated position of the shift control selector lever is transferred to the transmission through the transmission column shift selector tube (7212), then to the shift cable and bracket (7E395), and down to the manual control lever (7A256) on the transmission.

Shift Interlock System

The shift interlock system prevents the shifting from PARK unless the brake pedal (2455) is depressed. The shift interlock system consists of a shift lock actuator (3Z719) mounted at the base of the steering column tube (3514). If the ignition switch (11572) is in the RUN position, the shift lock actuator is continually on unless the brake pedal is depressed.

Transmission Control Switch (TCS)

The transmission control switch (TCS) is a momentary contact switch located on the end of the shift control selector lever. Pushing the transmission control switch (TCS) will either disengage or engage the overdrive function of the transmission. If the overdrive ((D)) is disengaged, the message O/D OFF will illuminate on the instrument panel.

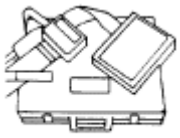
External Controls

Refer to Wiring Diagrams Cell 37 , Shift Lock for schematic and connector information.

Refer to Wiring Diagrams Cell 30 , Transmission Controls for schematic and connector information.

Refer to Wiring Diagrams Cell 29 , Transmission Controls for schematic and connector information.

Special Tool(s)

 ST1137-A	73 Digital Multimeter 105-R0051 or equivalent
 ST1391-A	104-Pin Breakout Box 418-049 (014-00950) or equivalent

Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical and electrical damage, incorrect component installation, and component misalignment. Verify that all circuit-related systems are functioning correctly. Refer to the following chart:

Visual Inspection Chart

Mechanical	Electrical
• Damaged shift lock actuator • Damaged brake pedal position switch • Damaged steering column • Damaged transmission control switch • Damaged instrument cluster • Damaged shift cable and bracket	• Failed fuse(s) • Damaged wiring harness • Loose or corroded connections

3. If the fault is not visually evident, proceed to the Symptom Chart.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• Shift Interlock System Does Not Release/Lock Properly	• Circuit(s). • Fuse(s). • Shift lock actuator. • Brake pedal position (BPP) switch.	• GO to Pinpoint Test A .
• Shift Control Out of Proper Gear Relationship	• Transmission shift cable and bracket. • Retainer bracket. • Shift control linkage.	• GO to Pinpoint Test B .
• Transmission Range Indicator Does Not Correspond to the Gear	• Transmission shift cable bracket.	• TIGHTEN bolts holding transmission shift cable bracket.
	• Transmission control indicator linkage.	• ADJUST PRNDL at steering housing.
	• Transmission shift cable loose from the transmission retainer bracket.	• TIGHTEN transmission shift cable bolts.
	• Shift linkage.	• VERIFY transmission shift cable adjustment. REFER to Adjustments in this section. ADJUST transmission shift cable if necessary. VERIFY digital transmission range (DTR) sensor or transmission range (TR) sensor for proper adjustment. REFER to Section 307-01A (5R55E) or Section 307-01B (4R70W).
	• Clip securing the transmission shift cable to the shift control selector lever.	• INSTALL clip properly.
	• Internal transmission concern.	• REFER to Section 307-01A (5R55E) or Section 307-01B (4R70W).
• Transmission Range Indicator Lamp Does Not Illuminate	• Bulb. • Circuit(s).	• REFER to Section 413-00 .
• Transmission Control Switch (TCS) Is Not Operating Properly	• Fuse. • TCS not cycled during self test. • Powertrain control module.	• GO to Pinpoint Test C .

	• Circuit(s).	
• Transmission Control Indicator Lamp (TCIL) Does Not Illuminate	• Bulb. • Circuit(s). • Powertrain control module.	• GO to Pinpoint Test D .
• Transmission Control Indicator Lamp (TCIL) Stays Illuminated	• Circuit(s). • Powertrain control module.	• GO to Pinpoint Test E .
• Rattle, Noise, Buzz, or Other Noise	• Selector lever knob. • Shift control selector lever. • Shift interlock spring.	• REPLACE selector lever knob. • TIGHTEN housing bolts. • ATTACH shift interlock spring properly.
• Water Enters Inside the Vehicle	• Cable assembly grommet. • Torn cable assembly grommet.	• SECURE grommet to dash panel. • INSTALL new transmission shift cable.
• Excessive Shift Effort	• Transmission shift cable. • Cable bracket.	• REPLACE transmission shift cable. • ADJUST cable. TIGHTEN cable bracket screws.
• Transmission Range Selector Lever Will Not Shift From Range	• Transmission shift cable. • Lock tab. • Broken transmission shift cable.	• REINSTALL transmission shift cable. • REPAIR/REPLACE lock tab. • REPLACE transmission shift cable.

Pinpoint Tests

PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 TEST FUSE 10 (7.5A)	
1	

2

Fuse 10 (7.5A)

2 Measure the resistance of fuse 10.

- **Is the resistance 5 ohms or less?**

→ **Yes**
GO to A2 .

→ **No**
GO to A3 .

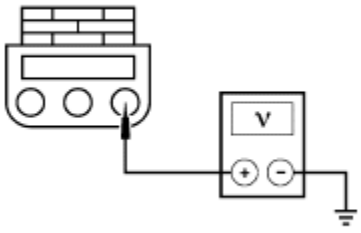
A2 CHECK THE POWER SUPPLY TO THE SHIFT LOCK ACTUATOR—CIRCUIT 1003 (GY/YE)

1

2

Shift Lock Actuator C289

3



A0037583

3 Measure the voltage between the shift lock actuator C289 pin 3, circuit 1003 (GY/YE), harness side and ground.

- **Is the voltage greater than 10 volts?**

→ **Yes**
GO to A5 .

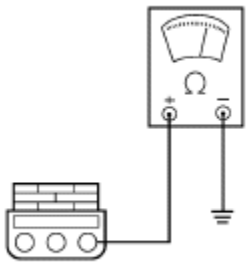
→ **No**
GO to A4 .

A3 TEST CIRCUIT 1003 (GY/YE) FOR SHORT TO GROUND

1

Shift Lock Actuator C289

2



AD1006-A

2 Measure the resistance at C289 pin 3, circuit 1003 (GY/YE).

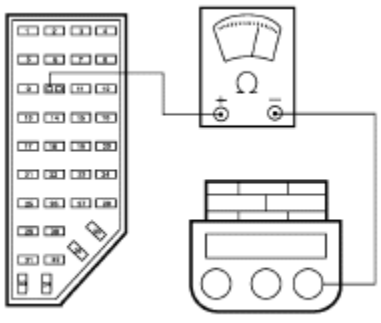
- **Is the resistance 10 K ohms or less?**

→ **Yes**
REPAIR circuit 1003 (GY/YE) for short to ground. TEST the system for normal operation.

→ **No**
INSTALL a new shift lock actuator. TEST the system for normal operation.

A4 TEST CIRCUIT 1003 (GY/YE) FOR OPEN

1



AD1081-A

1 Measure the resistance of circuit 1003 (GY/YE) between the output side of fuse 10 (7.5A) and the shift lock actuator C289 pin 3.

- **Is the resistance 5 ohms or less?**

→ **Yes**
GO to A5 .

→ **No**
REPAIR circuit 1003 (GY/YE) for open. TEST the system for normal operation.

A5 CHECK FUSE 9 (7.5A)

1

2

Fuse 9 (7.5A)

2 Measure the resistance of fuse 9 (7.5A).

- **Is the resistance 5 ohms or less?**

→ **Yes**
GO to A8 .

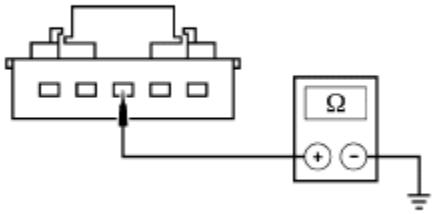
→ **No**
GO to A6 .

A6 TEST CIRCUIT 276 (BN) FOR SHORT TO GROUND.

1

Brake Pedal Position (BPP) Switch C224

2



A0037586

2 Measure the resistance of circuit 276 (BN) between C224 pin 3 and ground.

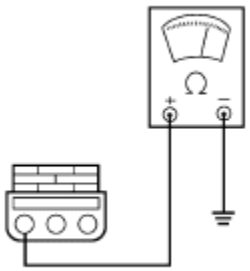
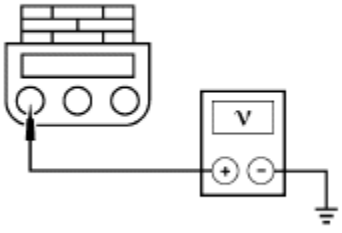
- **Is the resistance 10 K ohms or less?**

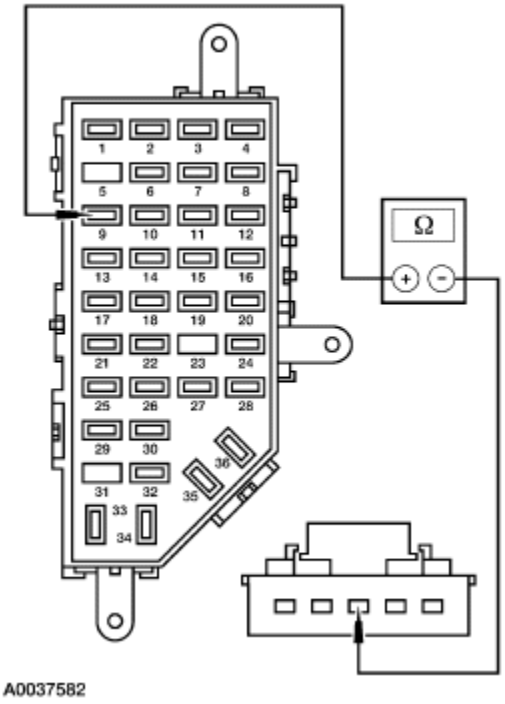
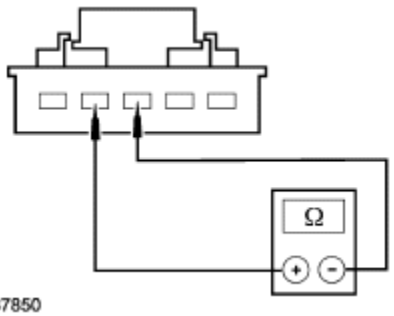
→ **Yes**
REPAIR circuit 276 (BN) for short to ground.
TEST the system for normal operation.

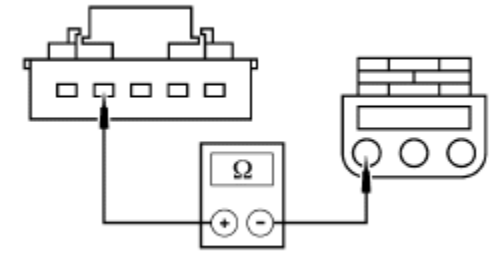
→ **No**
GO to A7 .

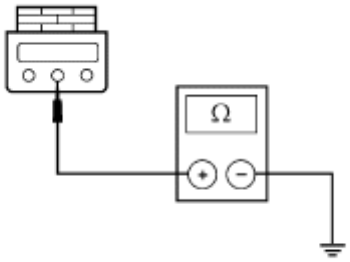
A7 TEST CIRCUIT 810 (RD/LG) FOR SHORT TO GROUND

1

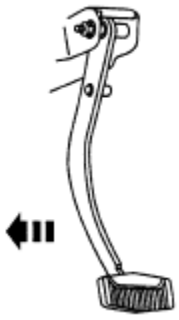
Shift Lock Actuator C289 2  AD1004-A	2 Depress the brake pedal and measure the resistance between C289 pin 1 and ground. • **Is the resistance 10 K ohms or less?** → **Yes** REPAIR circuit 810 (RD/LG) for short to ground. TEST the system for normal operation. → **No** INSTALL a new shift lock actuator. TEST the system for normal operation.
A8 CHECK FOR B+ ON CIRCUIT 810 (RD/LG)	
1  Shift Lock Actuator C289 2  A0037584	2 Depress the brake pedal and measure voltage at C289 pin 1. • **Is the voltage 10 volts or greater?** → **Yes** GO to A12 . → **No** GO to A9 .
A9 TEST CIRCUIT 276 (BN) FOR OPEN	

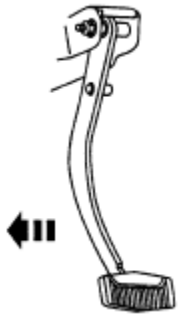
1  Brake Pedal Position (BPP) Switch C224 2  A0037582	2 Measure the resistance between the output side of fuse 9 (7.5A) and the brake pedal position switch pin 3, circuit 276 (BN). • **Is the resistance 5 ohms or less?** → **Yes** GO to A10 . → **No** REPAIR circuit 276 (BN) for open. TEST the system for normal operation.
A10 TEST BRAKE PEDAL POSITION SWITCH	
1  A0037850	1 Measure the resistance of the brake pedal position switch, while open (OFF) and closed (ON), between pin 2 and pin 3 of C224.

	• **Is the resistance of the switch greater than 10 K ohms while OFF and 5 ohms or less while ON?** → **Yes** GO to A11 . → **No** INSTALL a new switch. TEST the system for normal operation.
A11 TEST CIRCUIT 810 (RD/LG) FOR OPEN	
1  Brake Pedal Position (BPP) Switch C224 2  Shift Lock Actuator C289 3  A0037587	3 Measure the resistance between C224 pin 2 and C289 pin 1. • **Is the resistance 5 ohms or less?** → **Yes** INSTALL a new shift lock actuator. TEST the system for normal operation → **No** REPAIR circuit 810 (RD/LG) for open. TEST the system for normal operation.
A12 CHECK CIRCUIT 57 (BK) FOR AN OPEN	
1	1 Measure the resistance between the shift lock actuator C289 pin 2, circuit 57 (BK), harness side and ground.

 GD2181-A	• **Is the resistance less than 5 ohms?** → **Yes** INSTALL a new shift lock actuator. REFER to Brake Shift Interlock Actuator in this section. TEST the system for normal operation. → **No** REPAIR circuit 57 (BK). RECONNECT all components. TEST the system for normal operation.

PINPOINT TEST B: SHIFT CONTROL IS OUT OF PROPER GEAR RELATIONSHIP

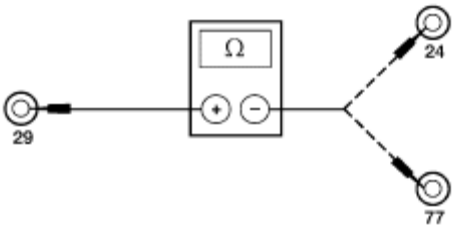
CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK SHIFT CONTROL LINKAGE	
1  2  L10513-A	2 Apply the brake pedal (2455). 3 Gain access to the shift control linkage. 4 Actuate the transmission range selector lever in all ranges. 5 Observe all linkages during operation.

	• **Is the linkage damaged?** → **Yes** REPLACE the shift control linkage. TEST the system for normal operation. → **No** GO to B2 .
B2 CHECK TRANSMISSION SHIFT CABLE	
	1 Check transmission shift cable and bracket installation and tightness. • **Is the transmission shift cable properly installed and adjusted?** → **Yes** VERIFY the transmission shift cable adjustment. REFER to Adjustments in this section. ADJUST the transmission shift cable if necessary. VERIFY the digital transmission range (DTR) sensor for proper adjustment. REFER to Section 307-01A (5R55E) or Section 307-01B (4R70W). ADJUST DTR sensor if necessary. GO to B3 . → **No** REPAIR as necessary. TEST the system for normal operation.
B3 CHECK LINKAGE/CABLE FOR PROPER GEAR RELATIONSHIP	
1  L10513-A	1 Apply the brake pedal. 2 Actuate the transmission range selector lever in all ranges. • **Does the indicator match the gear selection?** → **Yes** System OK. TEST the system for normal operation.

	→ **No** REFER to Shift Indicator Cable Adjustment in this section. TEST the system for normal operation.

PINPOINT TEST C: TRANSMISSION CONTROL SWITCH (TCS) IS NOT OPERATING PROPERLY

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK I/P FUSE 26	
1  2  I/P Fuse 26 (10A)	• **Is the resistance less than 5 ohms?** → **Yes** REINSTALL the fuse. GO to C3 . → **No** REPLACE the failed fuse. TEST the system for normal operation. If the fuse fails again, GO to C2 .
C2 CHECK CIRCUIT 224 (T/W) FOR SHORT TO GROUND	
1  Powertrain Control Module (PCM) 2  104-Pin Breakout Box 3	1 Inspect for damaged or pushed out pins, corrosion, loose wires, etc. Repair as necessary. 2 Leave PCM disconnected. 3 Measure the resistance between test pin 29 and test pins 24 and 77 at the 104-Pin Breakout Box.



D17786-A

- **Is the resistance greater than 10,000 ohms?**

→ **Yes**
CHECK circuit 298 (P/O) and related components for short to ground. TEST the system for normal operation.

→ **No**
REPAIR circuit 224 (T/W). TEST the system for normal operation.

C3 CHECK TRANSMISSION CONTROL SWITCH (TCS) CIRCUIT FOR VOLTAGE

1

Powertrain Control Module (PCM)

1 Inspect for damaged or pushed out pins, corrosion, loose wires, etc. Repair as necessary.

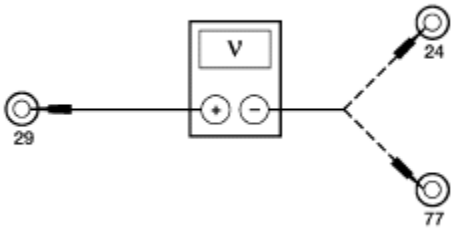
2

104-Pin Breakout Box

2 Leave PCM disconnected.

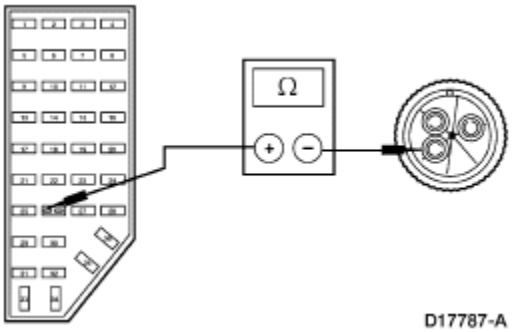
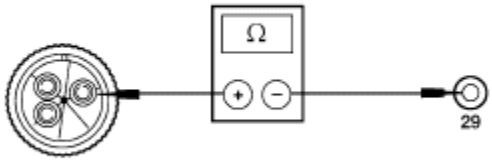
3

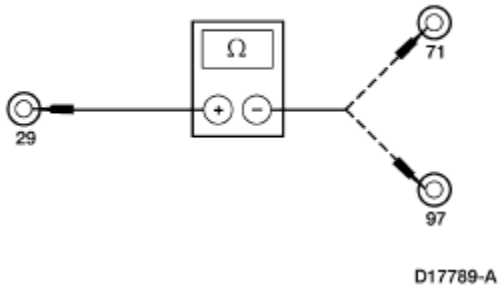
4



D17791-A

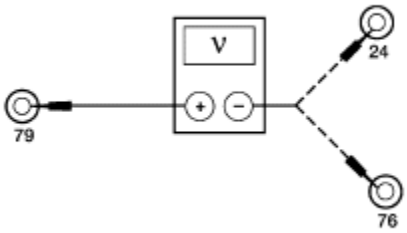
4 Measure the voltage between test pin 29 and test pins 24 and 77 at the 104-Pin Breakout Box while cycling the TCS several times.

	• **Does the voltage cycle?** → **Yes** REPLACE the powertrain control module (PCM) (12A650). REMOVE the 104-Pin Breakout Box. TEST the system for normal operation. → **No** GO to C4 .
C4 CHECK CIRCUIT 298 (P/O) AND CIRCUIT 224 (T/W) FOR OPEN	
1 	
2  I/P Fuse 26 (10A)	
3  Transmission Control Switch (TCS)	3 Inspect both ends for damaged or pushed out pins, moisture, corrosion, loose wires, etc. Repair as necessary.
4  D17787-A	4 Measure the resistance between the I/P fuse 26 (10A) connector pin 1 and the power side of the TCS vehicle harness connector circuit 298 (P/O).
5  29 D17788-A	5 Measure the resistance between test pin 29 at the 104-Pin Breakout Box and signal side of the transmission control switch vehicle harness connector circuit 224 (T/W).

	• **Is the resistance less than 5 ohms for both circuits?** → **Yes** GO to C5 . → **No** REPAIR open circuit. REMOVE 104-Pin Breakout Box. RECONNECT all components. TEST the system for normal operation.
C5 CHECK CIRCUIT 224 (T/W) FOR SHORT TO POWER	
1  D17789-A	1 Measure the resistance between test pin 29 and test pins 71 and 97 at the 104-Pin Breakout Box. • **Is the resistance greater than 10,000 ohms?** → **Yes** REPLACE the transmission control switch. REMOVE the 104-Pin Breakout Box. RECONNECT all components. TEST the system for normal operation. → **No** REPAIR circuit 224 (T/W). REMOVE the 104-Pin Breakout Box. RECONNECT all components. TEST the system for normal operation.

PINPOINT TEST D: TRANSMISSION CONTROL INDICATOR LAMP (TCIL) DOES NOT ILLUMINATE

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK TRANSMISSION CONTROL INDICATOR LAMP (TCIL) CIRCUIT FOR VOLTAGE	
1  2	2 Inspect for damaged or pushed out pins, corrosion, loose wires, etc. Repair as

 Powertrain Control Module (PCM) 3  104-Pin Breakout Box 4  5  GD2604-A	necessary. 3 Leave the powertrain control module disconnected. 5 Measure the voltage between test pin 79 and test pins 24 and 76 at 104-Pin Breakout Box. • **Is the voltage reading greater than 2 volts?** → **Yes** REPLACE the PCM. REMOVE the 104-Pin Breakout Box. CYCLE the transmission control switch (TCS) to check the operation of the TCIL. TEST the system for normal operation. → **No** CHECK the indicator bulb and the fuse. If OK, REPAIR wiring between the ignition switch and test pin 79 at the PCM harness connector. TEST the system for normal operation.

PINPOINT TEST E: TRANSMISSION CONTROL INDICATOR LAMP (TCIL) STAYS ILLUMINATED

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CYCLE TRANSMISSION CONTROL SWITCH (TCS)	
1	

2 Cycle the transmission control switch (TCS).

- **Does the transmission control indicator lamp (TCIL) illuminate and then go off?**

→ **Yes**
OK at this time. Concern may be intermittent.

→ **No**
GO to E2 .

E2 CHECK CIRCUIT 911 (W/LG) FOR SHORT TO GROUND

1

2

Powertrain Control Module (PCM)

3

2 Inspect both ends for damage or pushed out pins, moisture, corrosion, loose wires, etc. Repair as necessary.

- **Does the TCIL remain on?**

→ **Yes**
REPAIR circuit 911 (W/LG). REMOVE 104-Pin Breakout Box. RECONNECT all components. TEST the system for normal operation.

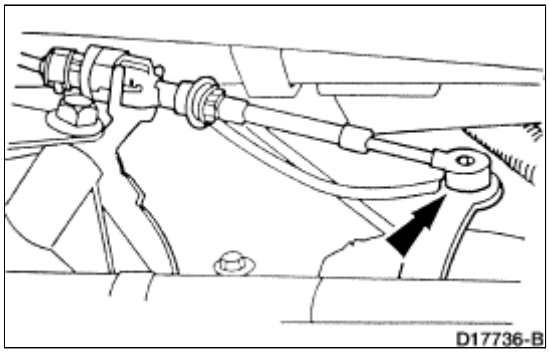
→ **No**
REPLACE the PCM. TEST the system for normal operation.

Cable/Bracket Adjustment

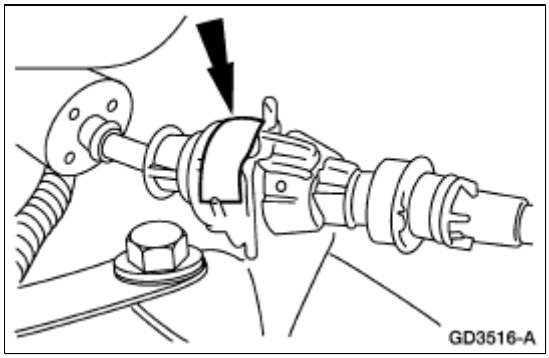
1. Place the gearshift lever (7210) in the (D) position and hang a 3.6 kg (8 lb) weight on the gearshift lever.

2. Raise and support the vehicle; refer to Section 100-02 .

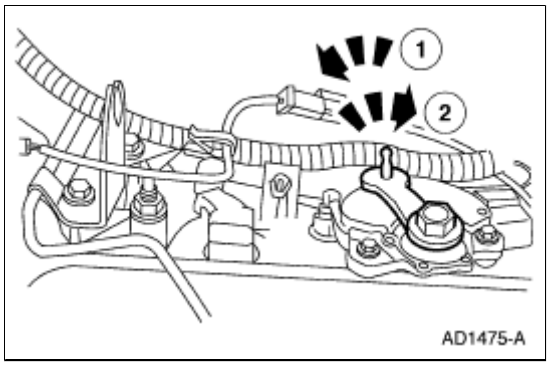
3. Disconnect the transmission shift cable from the manual control lever (7A256).



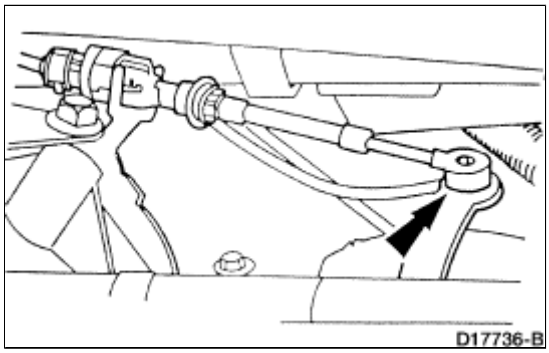
4. Pull out the transmission shift cable adjustment lock tab on the shift cable body.



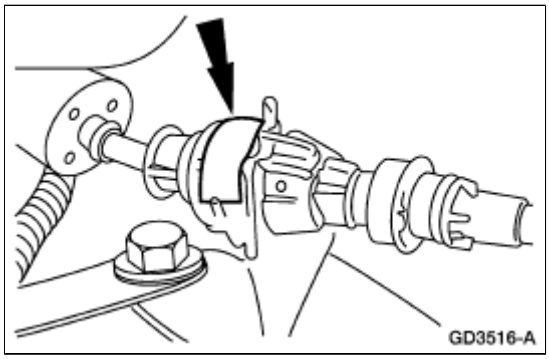
5. Place the manual control lever in the (D) position.
    1. Place the manual control lever in the first gear position. Rotate the manual control lever forward until travel stops.
    2. Move the manual control lever back two detents to the (D) position.



6. Connect the transmission shift cable to the manual control lever.



7. Push in the transmission shift cable adjustment lock tab on the shift cable body.



8. **NOTE:** If equipped with air suspension, reactivate the system by turning on the air suspension switch.

   Lower the vehicle.

9. Remove the 3.6 kg (8 lb) weight.

10. **CAUTION: Do not adjust the transmission shift cable in any position other than (D).**

    Verify that the vehicle will start in P or N and that backup lamps illuminate in R. If not, repeat Steps 1 through 7 and perform a digital transmission range sensor alignment. Refer to Section 307-01A (5R55E) or Section 307-01B (4R70W).

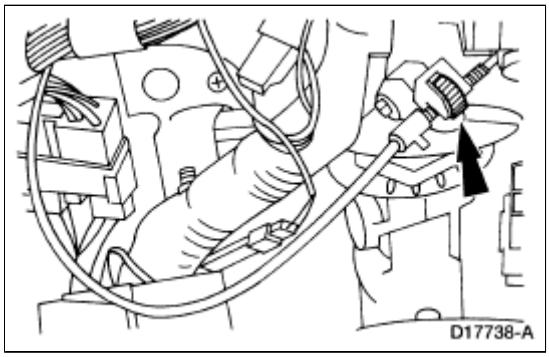
Cable Adjustment —Shift Indicator

1. Remove the upper instrument panel steering column cover (04459); refer to Section 501-12 .

2. Place the gearshift lever in the (D) position.
   - Rotate the gearshift lever clockwise until it bottoms out (first gear), then rotate two detents counterclockwise ((D) position).

3. Hang a 3.6 kg (8 lb) weight on the gearshift lever.

4. Center the pointer in the middle of the (D) position.
   - Rotate the thumbwheel located on the bottom of the steering column to adjust the pointer.



5. Remove the 3.6 kg (8 lb) weight.

6. Carefully move the gearshift lever from detent to detent and compare with the transmission settings.
   - Readjust if necessary.

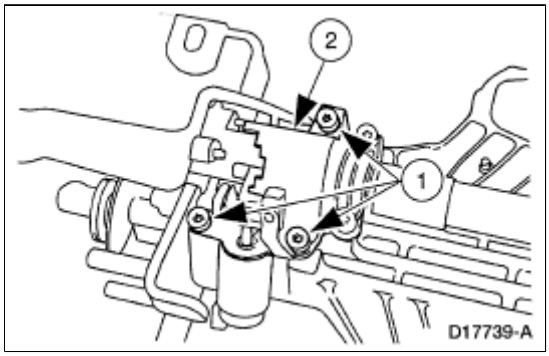
7. Install the upper instrument panel steering column cover; refer to Section 501-12 .

Brake Shift Interlock Actuator

Removal

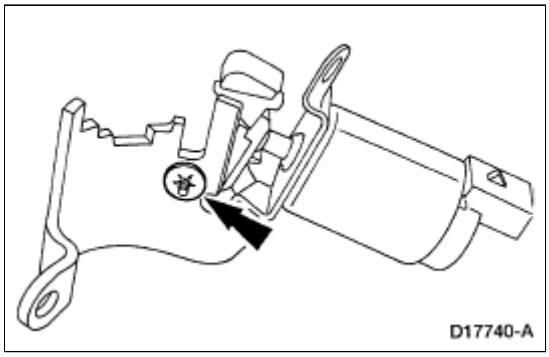
1. Remove the steering column assembly. For additional information, refer to Section 211-04 .

2. Remove the insert plate and shift lock actuator (3Z719).
    1. Remove the bolts.
    2. Remove the insert plate and shift lock actuator.



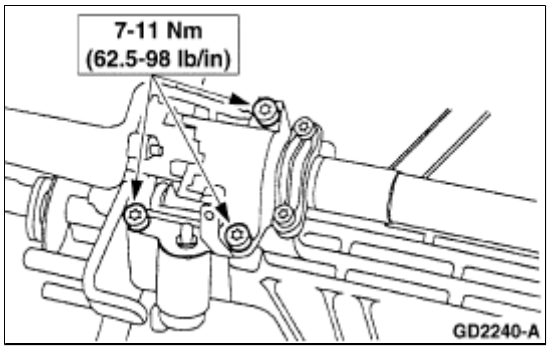
3. **NOTE:** The shift lock actuator clip is an assembly aid for the assembly plant and does not need to be replaced.

    Remove the insert plate from the shift lock actuator.
    - Remove and discard the shift lock actuator clip.



Installation

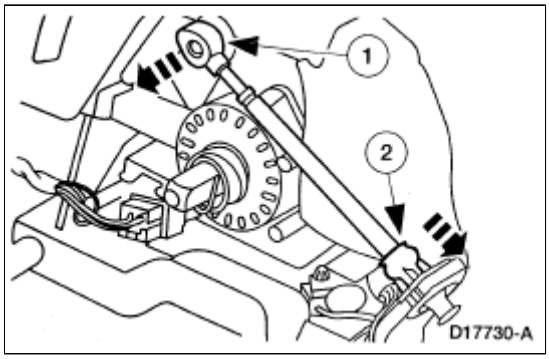
1. Follow the removal procedure in reverse order.


7-11 Nm
(62.5-98 lb/in)
GD2240-A

Cable/Bracket —4.0L

Removal

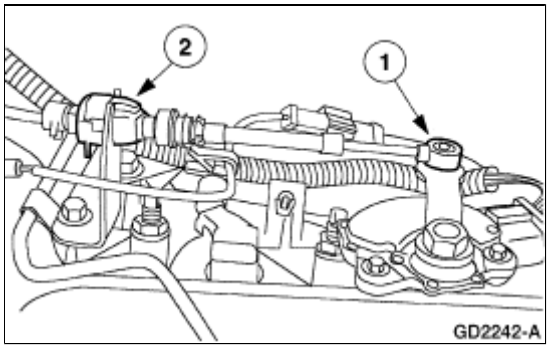
1. Disconnect the transmission shift cable from the steering column.
    1. Disconnect the shift cable from the transmission column shift selector tube (7212).
    2. Disconnect the shift cable from the steering column bracket.



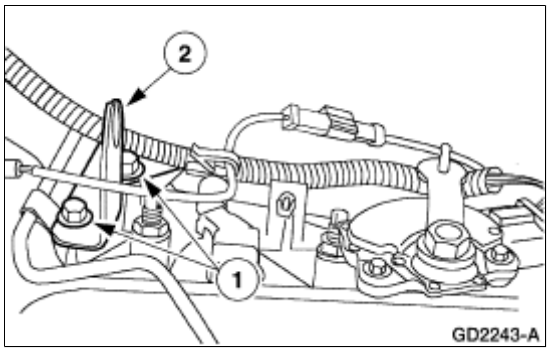
2. Push the rubber grommet and transmission shift cable through the bulkhead.

3. Raise and support the vehicle. For additional information, refer to Section 100-02 .

4. Remove the transmission shift cable from the automatic transmission.
    1. Disconnect the shift cable from the manual control lever (7A256).
    2. Depress lock tabs to release shift cable and disconnect the shift cable from the shift cable bracket.



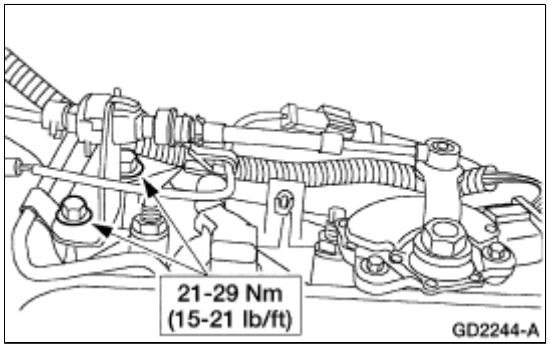
5. Remove the transmission shift cable bracket from the automatic transmission.
    1. Remove the bolt.
    2. Remove the transmission shift cable bracket.



Installation

1. **NOTE:** The manual lever must be in the O/D position.

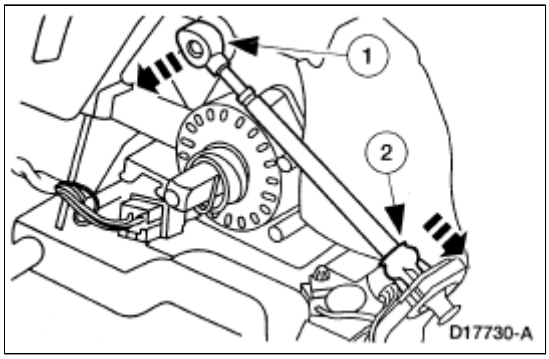
   Follow the removal procedure in reverse order.
   - Adjust the transmission shift cable. For additional information, refer to Cable/Bracket Adjustment in this section.



Cable/Bracket —5.0L

Removal

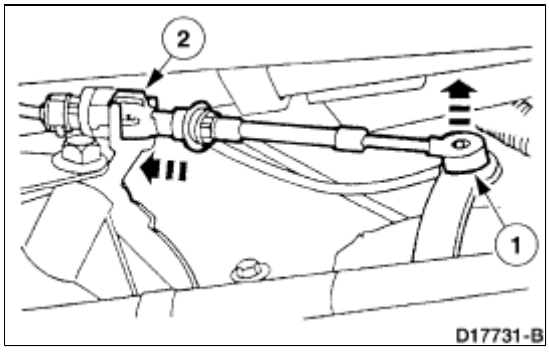
1. Disconnect the transmission shift cable from the steering column.
    1. Disconnect the shift cable from the transmission column shift selector tube (7212).
    2. Disconnect the shift cable from the steering column bracket.



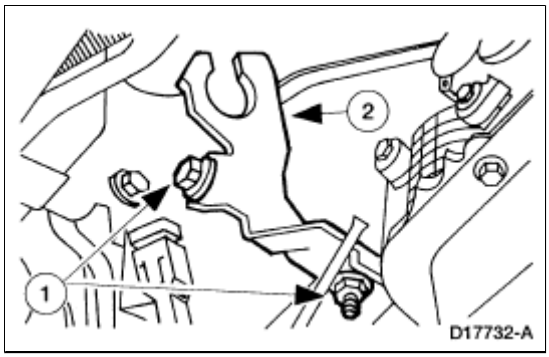
2. Push the rubber grommet and shift cable through the bulkhead.

3. Raise and support the vehicle; refer to Section 100-02 .

4. Remove the transmission shift cable from the transmission.
    1. Disconnect the shift cable from the manual control lever (7A256).
    2. Depress the lock tabs to release the shift cable and disconnect the shift cable from the shift cable bracket.

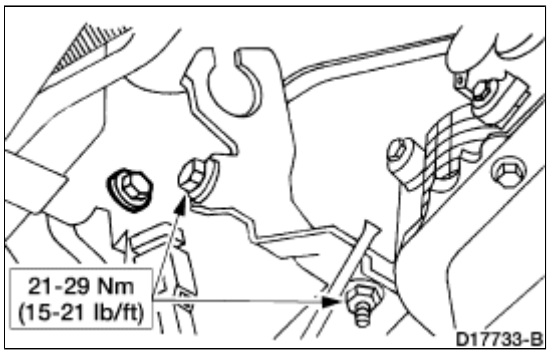


5. Remove the transmission shift cable bracket from the automatic transmission.
    1. Remove the bolts.
    2. Remove the transmission shift cable bracket.



Installation

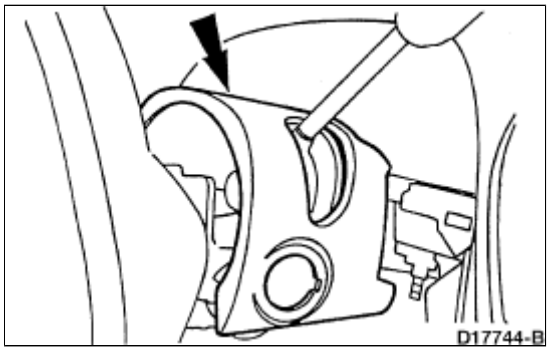
1. Follow the removal procedure in reverse order.
    - Adjust the transmission shift cable; refer to Shift Indicator Cable Adjustment in this section.



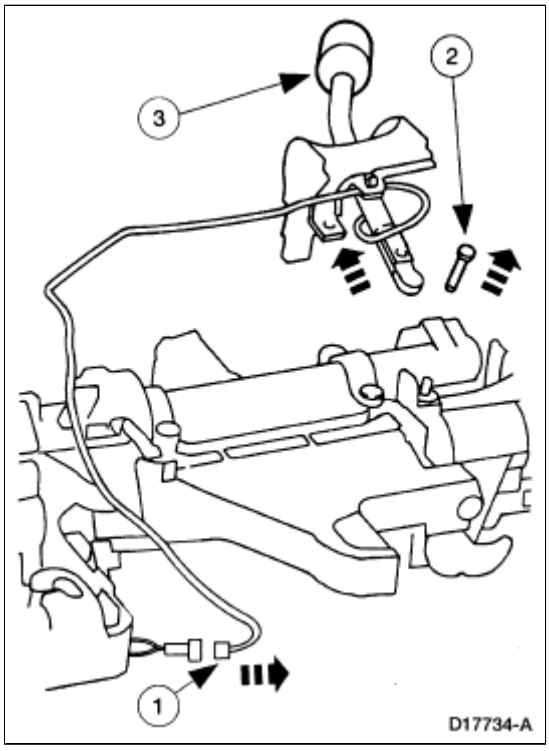
Selector Lever

Removal

1. Remove the ignition switch lock cylinder. For additional information, refer to Section 211-04 .
2. Remove the upper steering column shroud (3530).



3. Remove the gearshift lever (7210).
    1. Disconnect the shift control selector lever harness connector.
    2. Remove and discard the gearshift lever pin (7G357).
    3. Remove the gearshift lever.



Installation

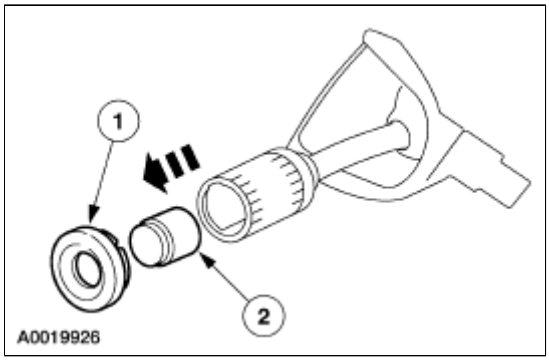
1. **NOTE:** The gearshift lever pin must be replaced whenever removed.

   Follow the removal procedure in reverse order.

Transmission Control (TC) Switch

Removal

1. Remove the transmission control switch (TCS).
    1. Remove the TCS cover.
    2. Remove the TCS.



Installation

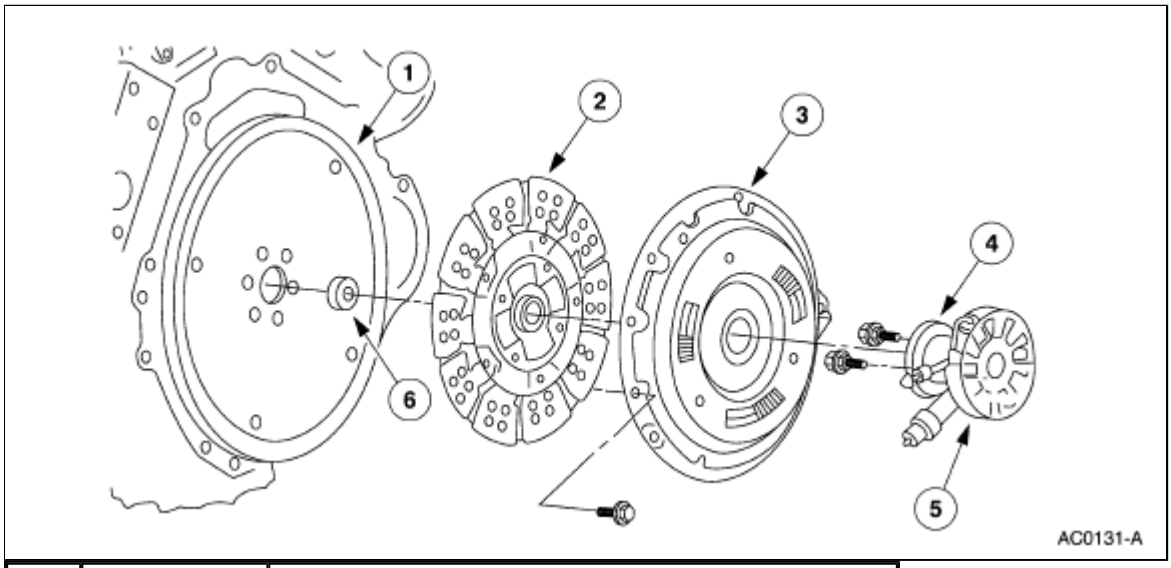
1. Follow the removal procedure in reverse order.

General Specifications

Item	Specification
Diaphragm Spring	Belleville
Total Plate Pressure Kg (lbs)	1020 (2248) 143 (315)
Clutch Disc	
O.S. Diameter (approx) mm (in)	258 (10.2)
I.S. Diameter (approx) mm (in)	185 (7.3)
Facing Area Sq. cm (sq. in)	508 (787)
Compressed Thickness mm (in)	7.8 (0.307)
Lining Material	Woven non-asbestos
Flywheel Runout mm (in)	0.13 (0.005)
No. Torsion Springs	4

Manual Transmission and Clutch

The primary function of the clutch system is to couple and decouple engine power to the transmission upon driver command. For additional information, refer to Section 308-01 .



Item	Part Number	Description
1	6375	Flywheel
2	7550	Clutch Disc
3	7563	Clutch Pressure Plate
4	—	Clutch Release Hub and Bearing (Part of 7A508)
5	7A508	Clutch Slave Cylinder
6	7118	Transmission Input Shaft Pilot Bearing

- The clutch is a single-plate, dry friction clutch disc (7550) with a self-adjusting, diaphram-style spring clutch plate. The clutch disc has a splined hub which attaches the clutch disc to the input shaft (7017).
- The clutch operating mechanism consists of a clutch slave cylinder (7A508) with an integral release bearing.
- A input shaft which supports the end of the bearing (7120). The bearing does not require lubrication unless the clutch system is repaired.
- The clutch system engages and disengages the manual transmission from the engine. The clutch system is disengaged when the clutch pedal (7519) is depressed and engaged when the clutch pedal is released. When the clutch pedal is depressed, it pushes the clutch master cylinder plunger, which hydraulically actuates the clutch slave cylinder. The clutch slave cylinder actuates the clutch pressure plate diaphragm spring, releasing pressure on the clutch disc. This release eliminates the engagement between the transmission and the engine.

Manual Transmission and Clutch

Inspection and Verification

The vehicle should be road tested, if possible, to verify the customer concern. Some clutch conditions may be attributed to a misadjusted clutch pedal height, linkage, or shift mechanism. These should be checked and corrected prior to attempting major disassembly procedures. Check to see that the transaxle is filled to the proper level with the specified lubricant; refer to Section 308-03 for the procedure.

Symptom Chart

SYMPTOM CHART

Condition	Possible Sources	Action
• Clutch Slippage	• Clutch pedal (7519) sticking. • Clutch pressure plate diaphragm spring damaged or weakened. • Clutch pressure plate (7563) damaged. • Clutch disc facing damaged or worn excessively. • Clutch disc facing surface hardened or oil coated. • Clutch release hub and bearing binding. • Flywheel glazed or damaged. • Clutch slave cylinder (7A508) damaged or leaking. • Clutch master cylinder damaged or leaking. • Clutch hydraulic reservoir leaking or damaged or low hydraulic fluid.	• GO to Pinpoint Test A .
• Clutch Chatter or Shudder	• Loose or worn engine mount. • Oil on clutch disc facing. • Clutch pressure plate damaged or excessive runout. • Clutch disc facing surface hardened or damaged. • Flywheel surface glazed or damaged. • Input shaft (7017) eccentric not perpendicular. • Transmission not square with engine mounting surface.	• GO to Pinpoint Test B .
• Clutch Drag	• Insufficient clutch system fluid. • Leakage of clutch system fluid. • Excessive runout or damaged clutch disc (7550). • Clutch disc splines rusted or worn.	• GO to Pinpoint Test C .

• Clutch Pedal Pulsation	• Clutch disc damaged or worn. • Excessive flywheel runout.	• GO to Pinpoint Test D .
• Clutch Related Vibrations	• Engine component grounding against frame. • Engine mounts loose or damaged. • Loose flywheel bolts. • Excessive flywheel runout. • Imbalanced clutch pressure plate. • Accessory drive belt loose or damaged.	• GO to Pinpoint Test E .
• Hard Shifting	• Insufficient clutch system fluid. • Damaged or worn gear shifter fork. • Damaged clutch slave cylinder. • Transmission concern.	• GO to Pinpoint Test F .
• Excessive Noise	• Clutch slave cylinder worn or damaged. • Pilot bearing worn or damaged. • Excessive crankshaft end play.	• GO to Pinpoint Test G .

Pinpoint Tests

PINPOINT TEST A: CLUTCH SLIPPAGE

CONDITIONS	DETAILS/RESULTS/ACTIONS
A1 CLUTCH PEDAL RELEASE TEST	
2 	1 Block the wheels and apply the parking brake. 3 Depress and slowly release clutch pedal. • **Does clutch pedal release without binding?** → **Yes** GO to A2 . → **No** INSPECT clutch pedal ; REFER to Section 308-02 .
A2 PERFORM STALL TEST	
2 	1 Block the wheels and apply the parking brake. 3 Place transmission in fourth gear.

	4 Increase engine to 2000 rpm and slowly release the clutch pedal fully. • **Does the engine stall within five seconds?** → **Yes** The clutch is not slipping. VERIFY customer concern. → **No** VERIFY customer concern. RETURN to the Symptom Chart if necessary.

PINPOINT TEST B: CLUTCH CHATTER OR SHUDDER

CONDITIONS	DETAILS/RESULTS/ACTIONS
B1 CHECK ENGINE OR TRANSMISSION MOUNTS	
	1 Inspect all engine and transmission mounts for looseness or damage. Refer to Section 303-01A , Section 303-01B , Section 303-01C and Section 308-03 if necessary. • **Are any of the engine or transmission mounts loose or damaged?** → **Yes** TIGHTEN or REPLACE the engine or transmission mounts. TEST the system for normal operation. → **No** GO to B2 .
B2 INSPECT CLUTCH PRESSURE PLATE	
	1 Remove the clutch pressure plate ; refer to Section 308-01 . 2 Inspect the clutch pressure plate for damage and runout. • **Are any signs of damage present on the clutch pressure plate ?** → **Yes** REPLACE the clutch pressure plate ; refer to Section 308-01 . TEST the system for normal operation. → **No** GO to B3 .
B3 CHECK CLUTCH DISC	
	1 Perform the clutch disc inspection; refer to Disc Check in this section. • **Is the clutch disc OK?** → **Yes** GO to B4 .

	→ **No** REPLACE the clutch disc ; refer to Section 308-01 . TEST the system for normal operation.
B4 INSPECT FLYWHEEL	
	1 Inspect the flywheel (6375) for damage and runout. • **Is the flywheel OK?** → **Yes** GO to B5 . → **No** TIGHTEN, RESURFACE or REPLACE the flywheel as necessary; refer Section 308-01 . TEST the system for normal operation.
B5 INSPECT INPUT SHAFT	
	1 Inspect the input shaft (7015) for signs of wear or damage. • **Are any signs of wear or damage present on the input shaft ?** → **Yes** REPLACE input shaft ; refer to Section 308-03 . → **No** VERIFY customer concern. RETURN to the Symptom Chart if necessary.

PINPOINT TEST C: CLUTCH DRAG

CONDITIONS	DETAILS/RESULTS/ACTIONS
C1 CHECK FLUID LEVEL	
1 	2 Inspect the fluid level in the clutch master cylinder reservoir. • **Is the fluid level within the MAX and MIN level marks?** → **Yes** GO to C2 . → **No** ADD brake fluid and CHECK for leaks.
C2 CHECK CLUTCH PRESSURE PLATE	
	1 Remove the clutch pressure plate ; refer to Section 308-01 . 2 Inspect the clutch pressure plate for wear or runout.

	• **Are there any signs of excessive wear or runout to the clutch pressure plate ?** → **Yes** REPLACE the clutch pressure plate ; REFER to Section 308-01 . → **No** GO to C3 .
C3 CHECK CLUTCH DISC	
	1 Perform the clutch disc inspection procedure in this section. • **Is the clutch disc OK?** → **Yes** VERIFY customer concern. RETURN to the Symptom Chart if necessary. → **No** REPLACE the clutch disc ; REFER to Section 308-01 .

PINPOINT TEST D: CLUTCH PEDAL PULSATION

CONDITIONS	DETAILS/RESULTS/ACTIONS
D1 CHECK CLUTCH PEDAL PULSATION	
1 	2 With the transmission in NEUTRAL, slowly press the clutch pedal. • **Does the clutch pedal pulsate while being pressed?** → **Yes** GO to D2 . → **No** VERIFY customer concern. RETURN to Symptom Chart if necessary.
D2 INSPECT CLUTCH PRESSURE PLATE	
	1 Remove the clutch pressure plate ; REFER to Section 308-01 . 2 Inspect the clutch pressure plate for damage. • **Are there any signs of damage on the clutch pressure plate ?** → **Yes** REPLACE the clutch pressure plate ; REFER to Section 308-01 .

	→ **No** GO to D3 .
D3 INSPECT CLUTCH DISC	
	1 Perform the clutch disc inspection; refer to Disc Check in this section. • **Is the clutch disc OK?** → **Yes** GO to D4 . → **No** REPLACE the clutch disc ; REFER to Section 308-01 .
D4 INSPECT FLYWHEEL	
	1 Inspect the flywheel for damage and runout. • **Is the flywheel OK?** → **Yes** VERIFY customer concern. RETURN to the Symptom Chart if necessary. → **No** TIGHTEN, RESURFACE or REPLACE the flywheel as necessary; REFER to Section 308-01 . TEST the system for normal operation.

PINPOINT TEST E: CLUTCH RELATED VIBRATIONS

CONDITIONS	DETAILS/RESULTS/ACTIONS
E1 CHECK FOR ENGINE COMPONENT GROUNDING	
	1 Raise the vehicle on a hoist; refer to Section 100-02 . 2 Check the engine and transmission mounts for grounding. 3 Check for exhaust manifolds or other engine components grounding on the body or frame. • **Is there evidence of grounding on the body or frame?** → **Yes** REPAIR components as necessary. TEST the system for normal operation. → **No** GO to E2 .
E2 CHECK FOR ACCESSORY DRIVE VIBRATIONS	
2	1 Remove the accessory drive belt.

- **Does the vibration stop when the accessory drive belt is removed from the engine?**

→ **Yes**
REFER to Section 303-05 to diagnose the accessory drive belt components.

→ **No**
STOP the engine and REINSTALL the drive belt. GO to E3 .

E3 CHECK FOR RELEASE BEARING NOISE

1

2 Depress and hold the clutch pedal.

- **Is a whirring, grating, or grinding noise present only when pedal is pushed?**

→ **Yes**
REPLACE the clutch release hub and bearing; REFER to Section 308-02 .

→ **No**
GO to E4 .

E4 INSPECT FLYWHEEL

1

1 Remove the transmission; refer to Section 308-03 .

2 Inspect the flywheel ; REFER to Flywheel Check in this section.

- **Is the flywheel OK?**

→ **Yes**
GO to E5 .

→ **No**
TIGHTEN, RESURFACE, or REPLACE the flywheel ; REFER to Section 308-01 .
TEST the system for normal operation.

E5 CHECK FOR PRESSURE PLATE IMBALANCE

1 **CAUTION: Failure to support the engine properly could result in damage to the vehicle.**

	Support the engine securely. 2 Operate the engine with the transmission removed. • **Is the vibration still present?** → **Yes** REFER to Section 303-00 to diagnose the engine vibration concern. → **No** REPLACE the clutch pressure plate and clutch disc ; REFER to Section 308-01 . TEST the system for normal operation.

PINPOINT TEST F: HARD SHIFTING

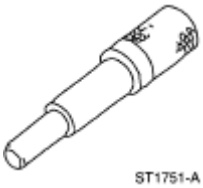
CONDITIONS	DETAILS/RESULTS/ACTIONS
F1 CHECK FLUID LEVEL	
1 	2 Inspect the fluid level in the clutch master cylinder reservoir. • **Is the fluid level within the MAX and MIN level marks?** → **Yes** GO to F2 . → **No** ADD brake fluid and CHECK for leaks.
F2 CHECK TRANSMISSION SHIFTING	
1 	2 Shift the transmission. • **Does transmission shift smoothly?** → **Yes** VERIFY the customer concern. RETURN to the Symptom Chart if necessary. → **No** REFER to Section 308-03 to diagnose hard shifting concern.

PINPOINT TEST G: EXCESSIVE NOISE

CONDITIONS	DETAILS/RESULTS/ACTIONS
G1 TRANSMISSION NEUTRAL GEAR ROLLOVER TEST	
	1 Start the engine and let idle with transmission in neutral and clutch engaged (pedal up). If noise is excessive, depress the clutch pedal to stop the transmission input shaft from rotating. • **Does the noise stop when the clutch pedal is depressed?** → **Yes** REFER to Section 308-03 to diagnose the transmission noise concern. → **No** GO to G2.
G2 CHECK CLUTCH SLAVE CYLINDER	
	1 Remove the transmission; refer to Section 308-03. 2 Inspect the clutch slave cylinder for wear or loss of lubrication; refer to Section 308-02. • **Are there signs of wear or loss of lubrication?** → **Yes** REPLACE the clutch slave cylinder and bearing; REFER to Section 308-02. → **No** GO to G3.
G3 CHECK PILOT BEARING	
	1 Inspect the transmission input shaft pilot bearing (7118) for damage. • **Is the transmission input shaft pilot bearing OK?** → **Yes** GO to G4. → **No** REPLACE the pilot bearing.
G4 CHECK TORSION SPRINGS	
	1 Inspect the torsion springs for fatigue or breakage. • **Are there any signs of fatigue or breakage?** → **Yes** REPLACE the clutch disc. TEST the system for normal operation. → **No** INSPECT the crankshaft end play.

Disc Check

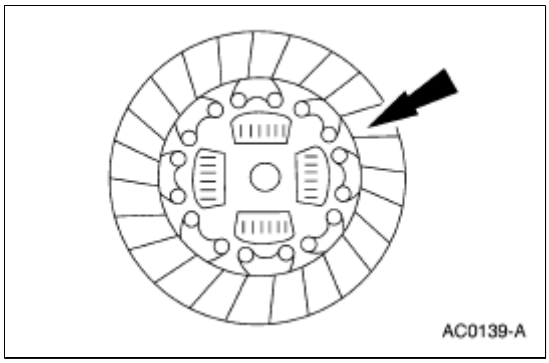
Special Tool(s)

 ST1266-A	Dial Indicator/Magnetic Base 100-D002 (D78P-4201-B) or equivalent
 ST1751-A	Clutch Aligner T71P-7137-H
 ST1470-A	Pilot Bearing Replacer T85T-7137-A
 ST1282-A	Puller T58L-101-B

1. Remove the clutch assembly; refer to Section 308-01 .

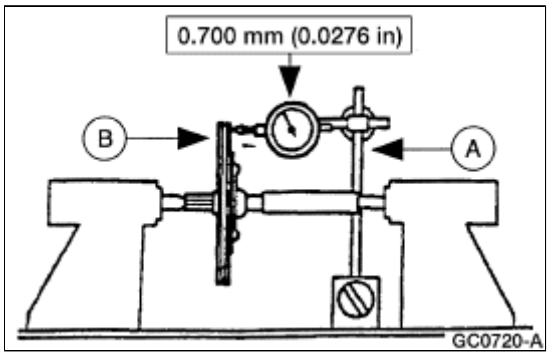
2. **NOTE:** Use emery cloth to remove minor imperfections in the clutch disc lining surface.

   Inspect the clutch disc (7550) for:
   - oil or grease saturation.
   - worn or loose facings.
   - warpage.
   - broken springs.
   - wear or rust on the splines.
   - replace the clutch disc if any of these conditions are present.



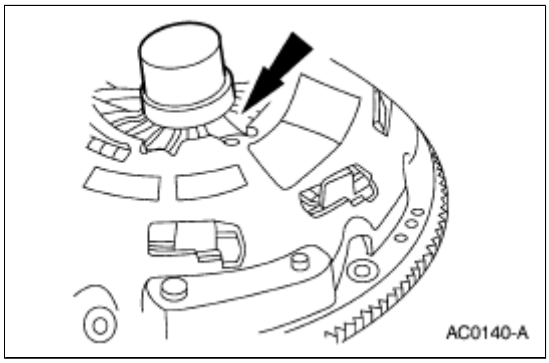
3. **NOTE:** The clutch disc and pressure plate should always be replaced as an assembly.

   Use (A) Dial Indicator/Magnetic Base to inspect the (B) clutch disc runout.
   - Replace the clutch disc if not within specification.



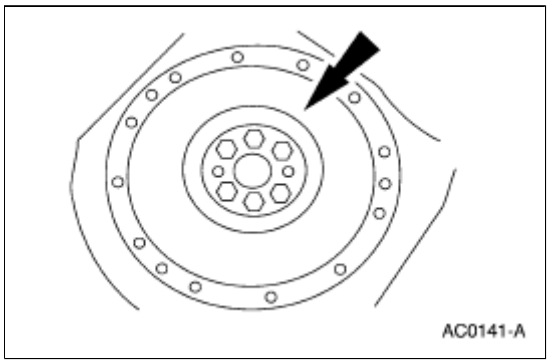
Pressure Plate Check

1. Inspect the clutch pressure plate diaphragm fingers for wear.
    - Replace the clutch pressure plate (7563), if necessary.



Flywheel Check

1. Inspect the flywheel (6375) for:
   - cracks.
   - heat checks or other damage.
   - machine friction surface of flywheel if scored or worn.

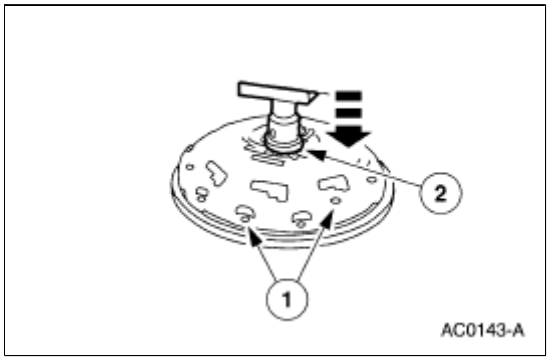


2. After machining
   - Surface runout must not exceed 0.13 mm (0.005 inch) TIR, surface finish must be in the range of 4.0/1.3 micrometer (160/52 microinch).
   - Major diameter of dowel pin (press fit diameter) must not extend above the new surface.
   - The clutch pressure plate retaining bolts must screw into the flywheel under hand torque to within 1.50 mm (0.06) of new surface.
   - Flywheel with dimensions less than the charted dimensions must not be used; install new service flywheel.

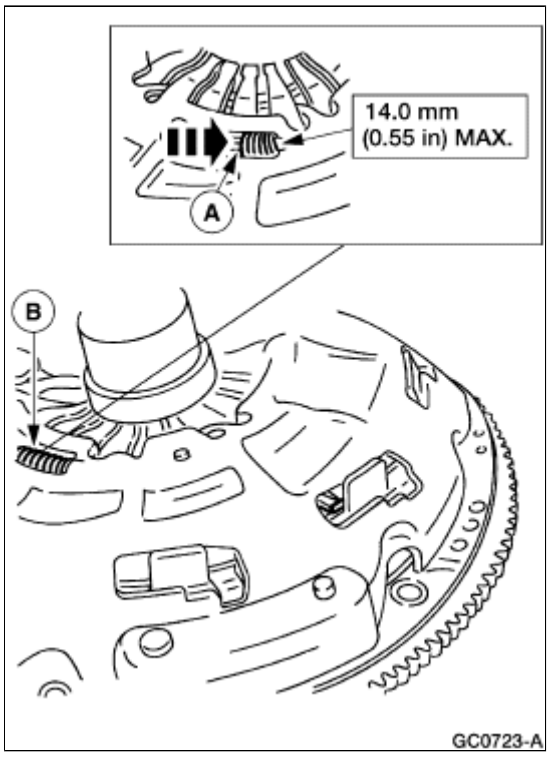
Pressure Plate Adjustment

1. **NOTE:** Self-adjusting clutch pressure plate must be adjusted before installation.

   Compress the clutch diaphragm fingers.
   1. Place the flywheel and the clutch pressure plate in a press.
   2. Use a suitable adapter and a press to depress the clutch diaphragm fingers until the adjusting ring moves freely.



2. Adjust the clutch pressure plate.
   - Rotate the (A) adjusting ring counterclockwise until the (B) tension springs are compressed.
   - Hold the (A) adjusting ring while releasing the pressure on the clutch fingers.

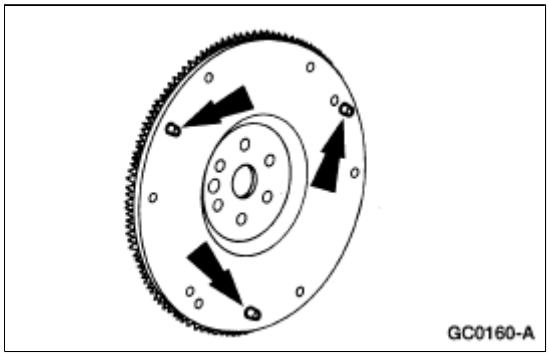


Dowels —Flywheel

Removal

1. **NOTE:** Take care not to damage the flywheel dowel holes or surface areas around the flywheel dowel during removal.

   Remove the flywheel dowels by using a drift pin where the flywheel dowel is installed in an open hole, and locking pliers where the flywheel dowel is installed in a blind hole.



Installation

1. **NOTE:** Care should be taken to drive the flywheel dowel squarely into place until fully seated and to not damage surrounding surface areas.

   Install all flywheel dowels by driving them into place using a brass or plastic mallet.

Dowels —Flywheel Housing to Block

Removal

1. **NOTE:** Take care not to damage the flywheel housing-to-block dowel holes or surface areas around the flywheel housing-to-block dowel hole during removal.

   Remove the flywheel housing-to-block dowels (6397) using a drift pin where the flywhere housing-to-block dowel is installed in an open hole, and locking pliers where the flywheel housing-to-block dowel is installed in a blind hole.

General Specifications

Item	Specification
Lubricants	
Threadlock and Sealer E0AZ-19554-AA	WSK-M2G351-A5 (Type II)
High-Temperature 4x4 Front Axle and Wheel Bearing Grease E8TZ-19590-A	ESA-M1C198-A

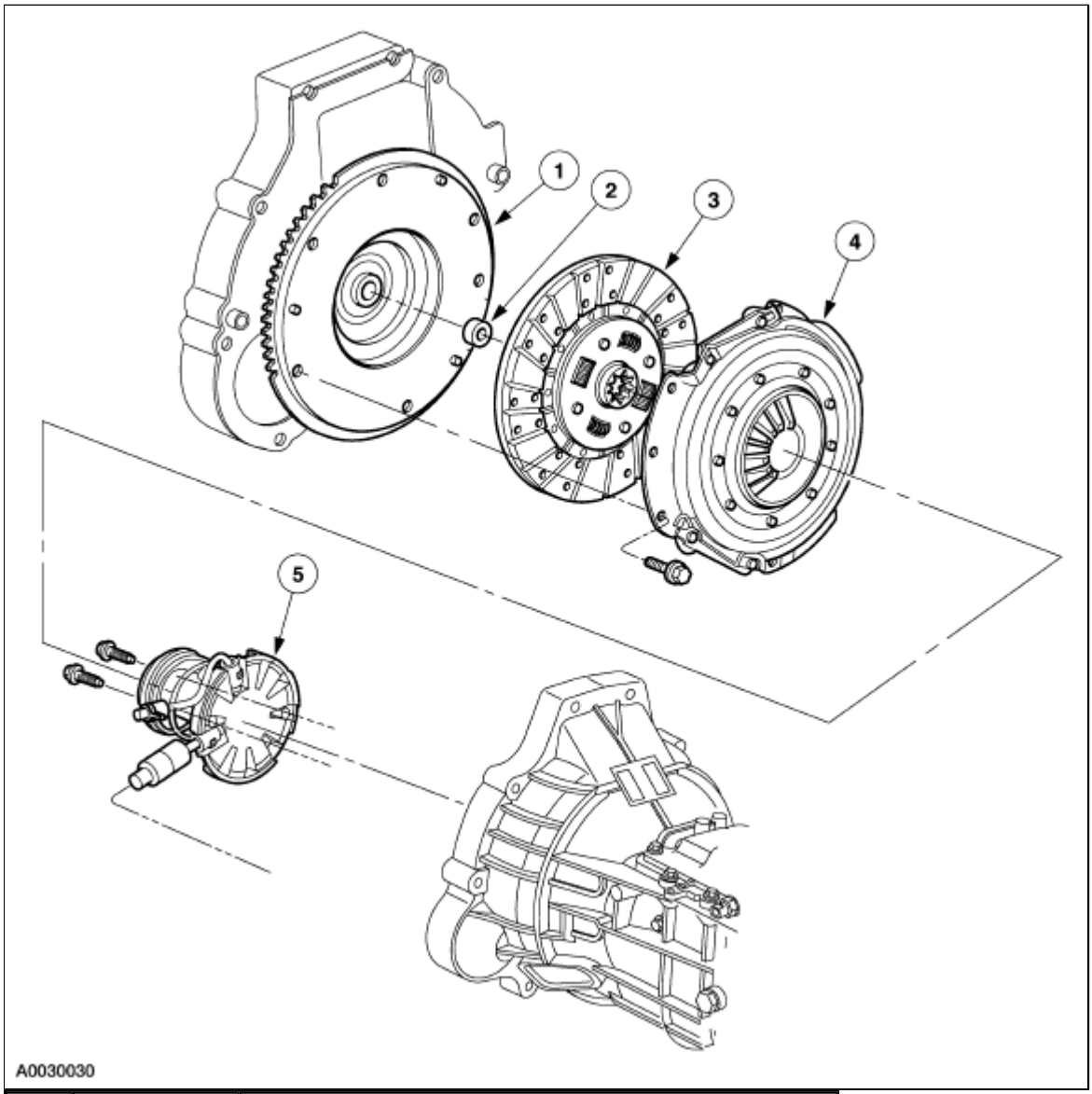
Torque Specifications

Description	Nm	lb-ft
Clutch pressure plate bolts	32	24
Flywheel bolts	102-115	75-85
Clutch slave cylinder bolts	20	15

Clutch

The primary function of the clutch system is to connect and disconnect engine power to the transmission upon driver command.

Clutch System Components



Item	Part Number	Description
1	6375	Flywheel
2	7600	Transmission input shaft pilot bearing
3	7550	Clutch disc
4	7563	Clutch pressure plate

5	7A508	Clutch slave cylinder/clutch release hub and bearing

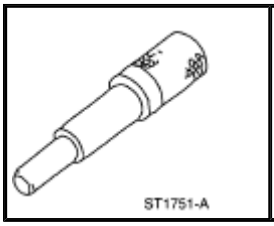
- The clutch is a single-plate, dry friction clutch disc with a self-adjusting, diaphragm-style spring clutch pressure plate.
- The clutch operating mechanism consists of a clutch slave cylinder with an integral release bearing.
- A pilot bearing supports the end of the input shaft. The bearing does not require lubrication unless the clutch system is serviced.

Clutch

Refer to Section 308-00 .

Disc and Pressure Plate

Special Tool(s)

 ST1751-A	Aligner, Clutch Disc 308-006 (T71P-7137-H)

Material

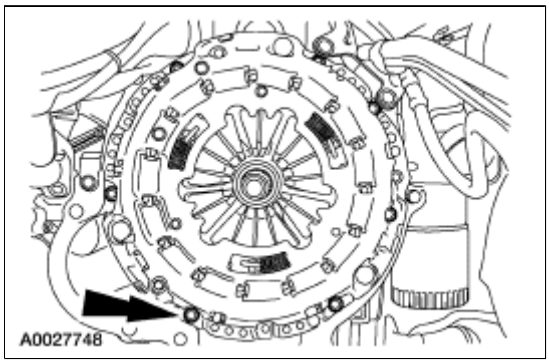
Item	Specification
High-Temperature 4X4 Front Axle Grease E8TZ-19590-A	ESA-M1C198-A

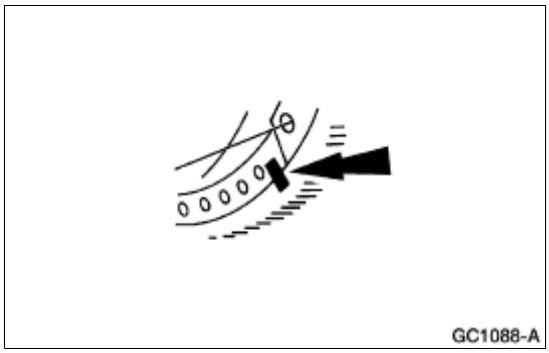
Removal

1. Remove the transmission. For additional information, refer to Section 308-03 .

2. **CAUTION: If the clutch disc and pressure plate are to be reinstalled, bolts must be removed evenly or permanent damage to the diaphragm spring will occur resulting in complete clutch release.**

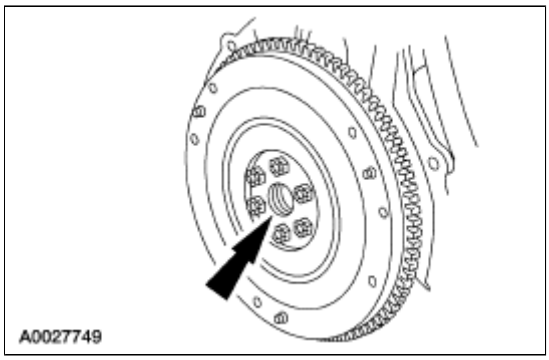
   Remove the bolts, clutch pressure plate and the clutch disc.
   - If the parts are to be reused, index-mark the clutch pressure plate to the flywheel.



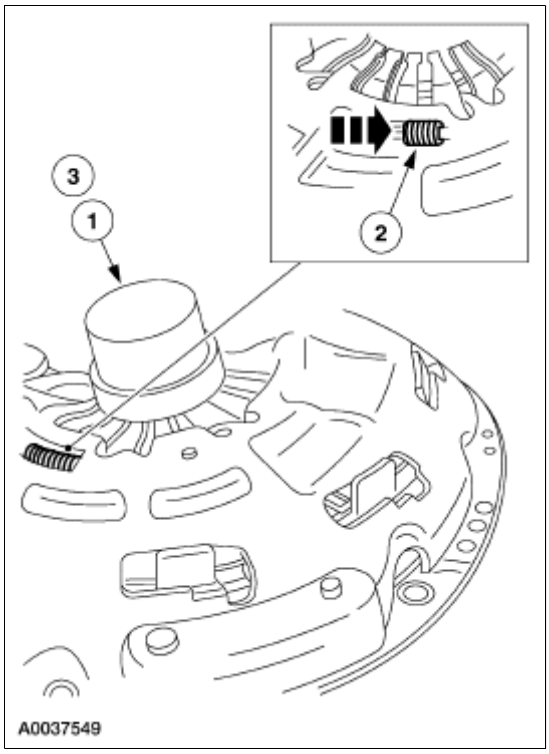


Installation

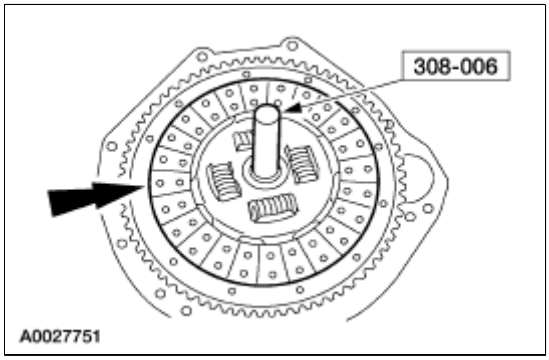
1. Lubricate the transmission input shaft pilot bearing with grease.



2. Adjust the clutch pressure plate.
    1. Using a suitable press, press downward on the fingers until the adjusting ring moves freely.
    2. Rotate the adjusting ring counterclockwise to compress the tension springs. Hold the adjusting ring in this position.
    3. Release the pressure on the fingers. The adjusting ring will stay in the reset position.

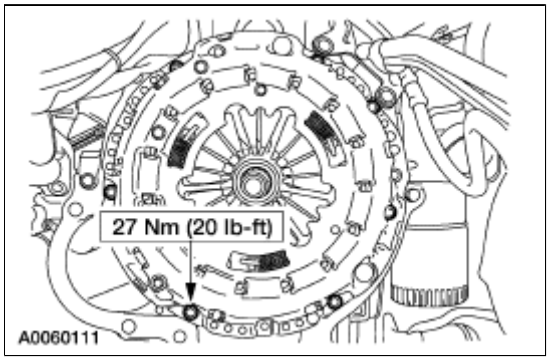


3. Using the special tool, position the clutch disc on the flywheel.



4. **NOTE:** If reusing the clutch pressure plate and flywheel, align the marks made during removal.

   Using the special tool, align the clutch disc and the clutch pressure plate. Install the bolts and tighten in a star pattern sequence.



5. **NOTE:** Before securing the transmission to the engine, connect the hydraulic line to the clutch slave cylinder.

   Install the transmission.
   - For additional information, refer to Section 308-03 .

Flywheel

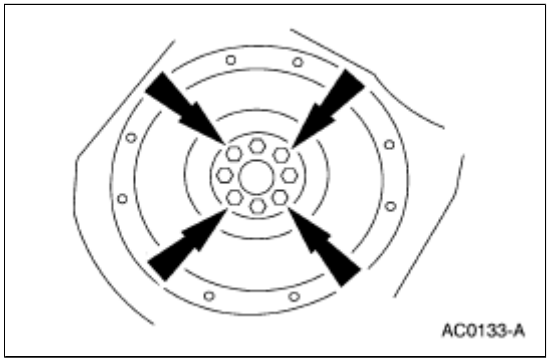
Material

Item	Specification
Threadlock and Sealer E0AZ-19554-AA	WSK-M2G351-A5 (type II)

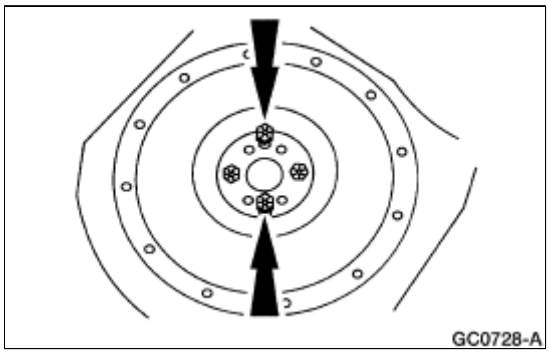
Removal

1. Remove the transmission. For additional information, refer to Section 308-03 .
2. Remove the clutch disc and pressure plate. For additional information, refer to Disc and Pressure Plate in this section.
3. **CAUTION: Two bolts should be loosened but left in to prevent the flywheel (6375) from falling.**

   Remove six of the eight bolts. Loosen the two remaining bolts but leave in place.



4. Press the flywheel off the crankshaft.
   - Install two bolts in the threaded holes in the flywheel and remove flywheel.

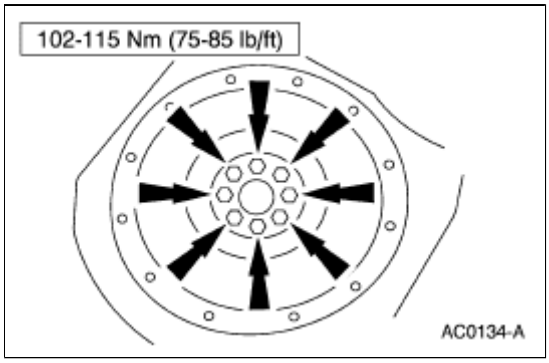


5. Remove the bolts remaining in the crankshaft.

6. Remove the flywheel.

Installation

1. Position the flywheel onto the crankshaft and install the flywheel-to-crankshaft bolts (6379).
   - Apply threadlock and sealer to bolt threads.



2. Install the disc and pressure plate. For additional information, refer to Disc and Pressure Plate in this section.

3. Install the transmission. For additional information, refer to Section 308-03 .

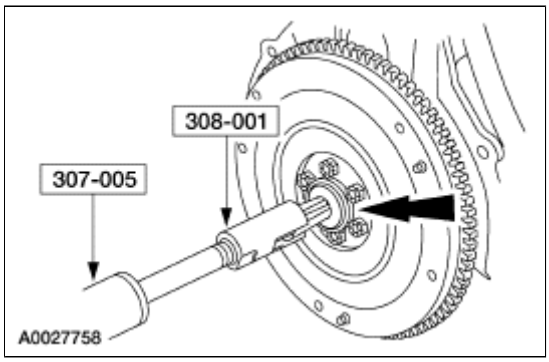
Bearing

Special Tool(s)

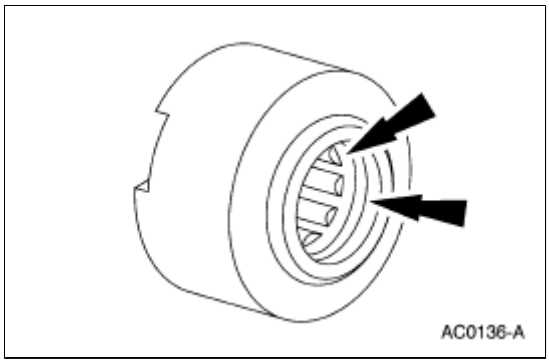
 ST1187-A	Slide Hammer 307-005 (T59L-100-B)
 ST1470-A	Installer, Pilot Bearing 308-105 (T85T-7137-A)
 ST1282-A	Remover, Pilot Bearing 308-001 (T58L-101-B)

Removal

1. Using the special tool, remove the transmission input shaft pilot bearing.



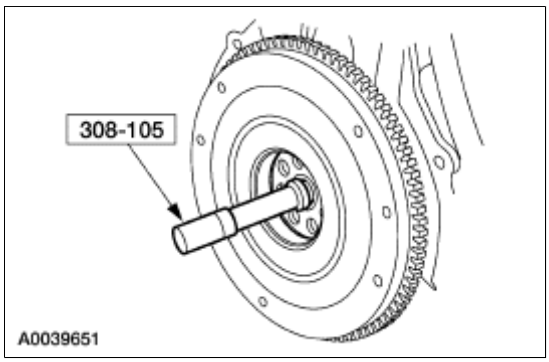
2. Inspect the transmission input shaft pilot bearing for:
   - misalignment and looseness in the flywheel.
   - needle rollers for scoring, worn or broken needle rollers, inadequate grease or discoloration.
   - seal leakage.



Installation

1. **NOTE:** The transmission input shaft pilot bearing can only be installed with the seal facing the transmission. The transmission input shaft pilot bearing is pregreased and does not require additional lubrication. A new transmission input shaft pilot bearing must be installed whenever it is removed.

   Using a soft-face hammer and the special tool, install the transmission input shaft pilot bearing.



Ring Gear

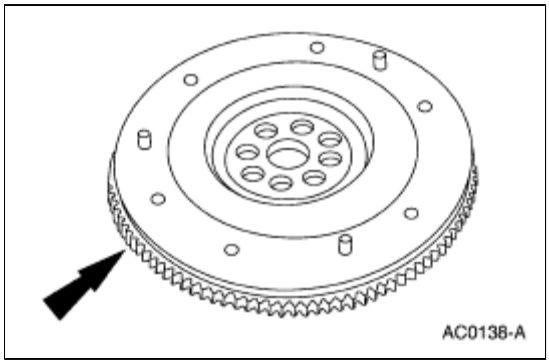
Removal

WARNING: This procedure should be performed only by a properly equipped and experienced acetylene torch operator. To avoid personal injury, use tongs or wear welding gloves and safety goggles when handling the heated flywheel ring gear.

1. Remove the transmission. For additional information, refer to Section 308-03 .
2. Remove the clutch pressure plate and clutch disc. For additional information, refer to Disc and Pressure Plate in this section.
3. Remove the flywheel (6375). For additional information, refer to Flywheel in this section.
4. **CAUTION: Do not heat the flywheel ring gear (6384) beyond 278°C (500°F). Use heat indicating crayons to prevent over heating.**

   CAUTION: Tap the flywheel ring gear evenly to prevent binding.

   Remove the flywheel ring gear from the flywheel.
   - Evenly heat the flywheel ring gear and use a brass drift to drive the flywheel ring gear off the flywheel.



Installation

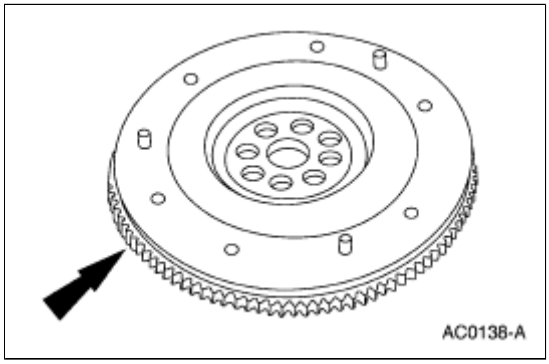
WARNING: This procedure should be performed only by a properly equipped and experienced acetylene torch operator. To avoid personal injury, use tongs or wear welding gloves and safety goggles when handling the heated flywheel ring gear.

1. **CAUTION: Do not heat the flywheel ring gear beyond 278°C (500°F). Use heat indicating crayons to prevent over heating.**

CAUTION: Keep the torch moving to prevent hot spots.

Evenly heat the flywheel ring gear.

2. Install the flywheel ring gear.
   - The bevel on the flywheel ring gear must face the rear of the flywheel.
   - Use a brass drift.



3. Install the flywheel. For additional information, refer to Flywheel in this section.
4. Install the clutch pressure plate and clutch disc.
5. Install the transmission.

General Specifications

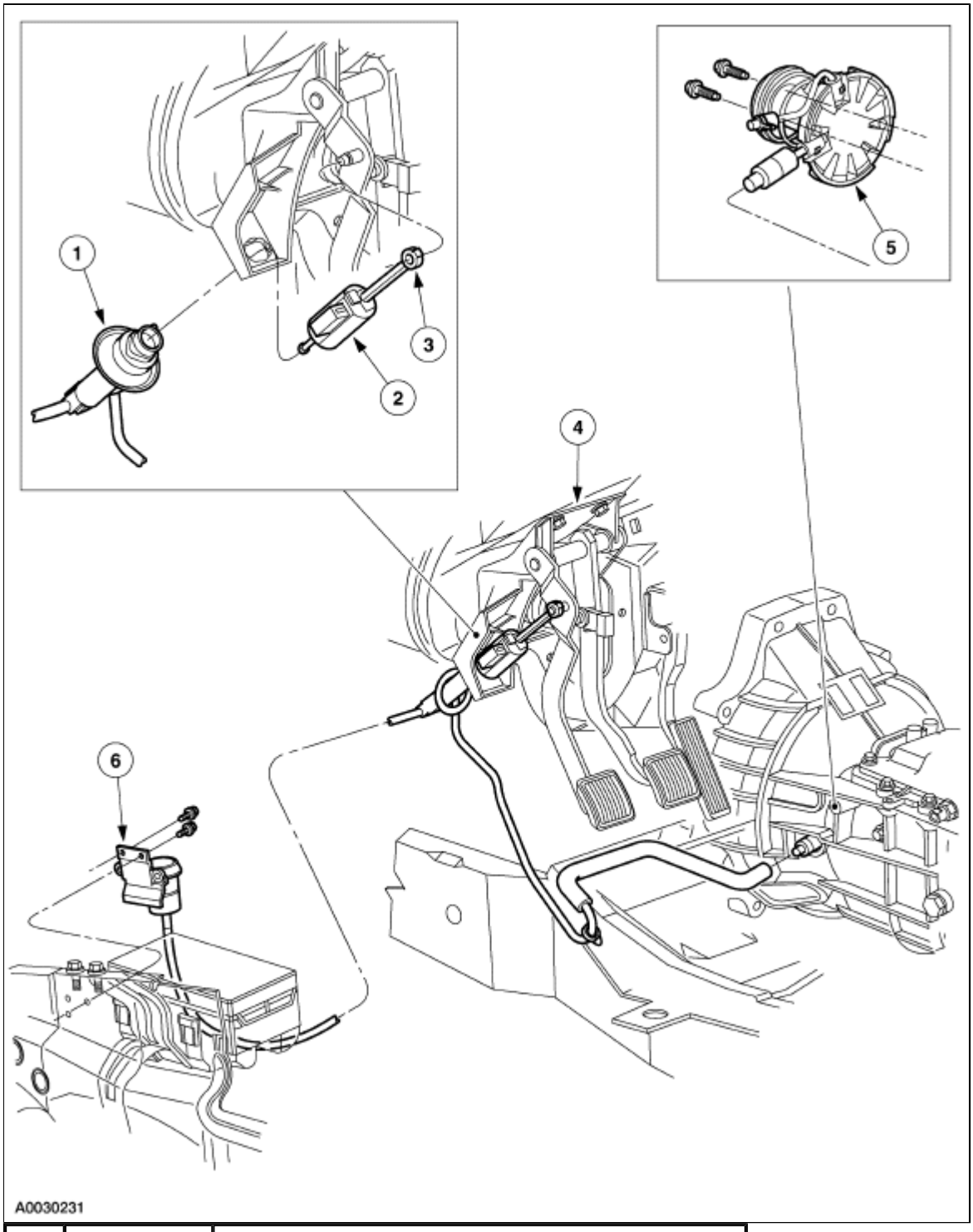
Item	Specification
Clutch System	
Clutch control	Hydraulic
System adjustment	Automatic
Clutch pedal type	Suspended
Fluid and Lubricant	
Ford High Performance DOT 3 Motor Vehicle Brake Fluid C6AZ-19542-AB	ESA-M6C25-A
Premium Long-Life Grease XG-1-C, XG-1-K	ESA-M1C75-B

Torque Specifications

Description	Nm	lb-ft	lb-in
Clutch slave cylinder bolts	20	15	—
Clutch master cylinder reservoir bolts	2.2	—	18

Clutch Controls

Component Location



Item	Part Number	Description
1	7A543	Clutch master cylinder
2	11A152	Clutch pedal position (CPP) switch
3	7A581	Clutch master cylinder push rod bushing
4	2450	Brake and clutch pedal support bracket
5	7A508	Clutch slave cylinder/clutch release hub and bearing
6	7K500	Clutch master cylinder reservoir and tubing

The clutch control system actuates the clutch system. When the clutch pedal is depressed it pushes the clutch master cylinder plunger which transmits hydraulic pressure to the clutch slave cylinder. The clutch slave cylinder engages and compresses the clutch pressure plate diaphragm spring, releasing the pressure on the clutch disc which in turn disengages the transmission from the engine.

- The hydraulic clutch system adjusts automatically to compensate for clutch disc wear.
- The clutch pedal position (CPP) switch is attached to the clutch pedal via the push rod assembly. Depressing the clutch pedal manually closes the switch and allows engine cranking. The switch also deactivates the speed control system and signals the EEC module when the clutch pedal is depressed.

Clutch Controls

Refer to Section 308-00 .

Clutch Pedal

Removal and Installation

NOTE: The clutch pedal is serviced with the brake pedal as an assembly only.

For additional information, refer to Section 206-06 .

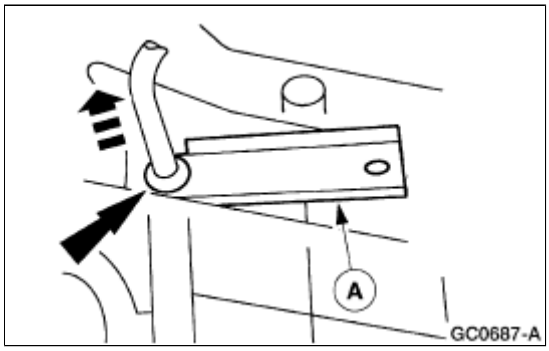
Clutch Master Cylinder/Reservoir

Special Tool(s)

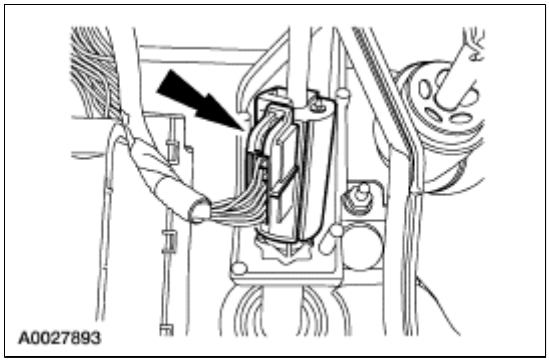
 ST1318-A	Remover, Hydraulic Line Connector 308-182 (T88T-70522-A)

Removal and Installation

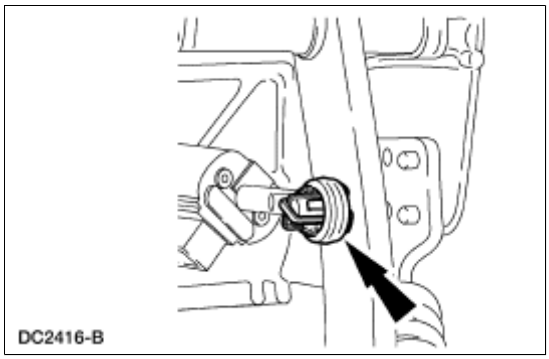
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .
2. Using the special tool, disconnect the hydraulic line from the clutch slave cylinder.



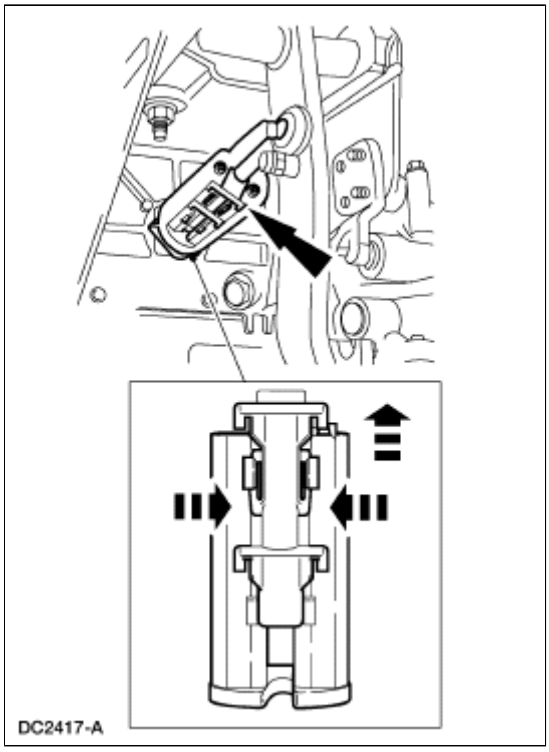
3. Lower the vehicle.
4. Disconnect the clutch pedal position (CPP) switch electrical connector.



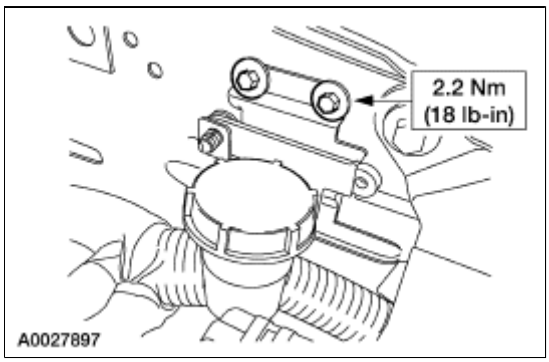
5. Disconnect the clutch master cylinder rod from the clutch pedal arm.
   - Remove and discard the clutch master cylinder push rod bushing.



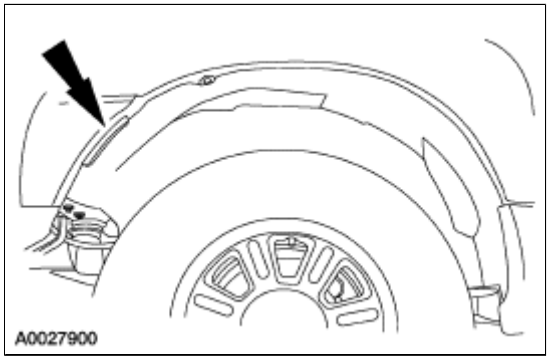
6. Remove the CPP switch.
    - Pinch the lock tabs and pull the clip forward.
    - Rotate and snap the CPP switch from the clutch master cylinder rod.



7. Remove the reservoir.



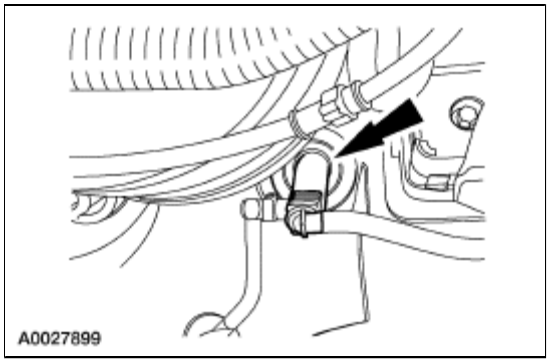
8. Remove the three pushpins, four bolts, four screws and the inner fender splash shield.



9. Unclip the hydraulic line-to-frame retainer.

10. **CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, wash the surface with water immediately.**

    Unlock and remove the clutch master cylinder assembly.
    - Twist the clutch master cylinder clockwise 45 degrees to unlock it from the support bracket.
    - Remove the reservoir, the hydraulic line and the clutch master cylinder as an assembly.
    - Install a new clutch master cylinder push rod bushing.



11. **CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, wash the surface with water immediately.**

    To install, reverse the removal procedure.
    - Bleed the clutch hydraulic system. For additional information, refer to Section 308-00 .
    - Rotate the clutch master cylinder 45 degrees counterclockwise.

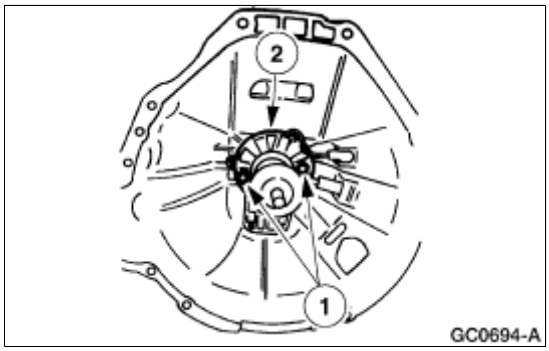
Slave Cylinder

Removal

1. Remove the transmission. For additional information, refer to Section 308-03 .

2. **NOTE:** Inspect the clutch housing for traces of fluid. If brake fluid is visible, install a new clutch slave cylinder.

   Remove the clutch slave cylinder.
   1. Remove the bolts.
   2. Remove the clutch slave cylinder.

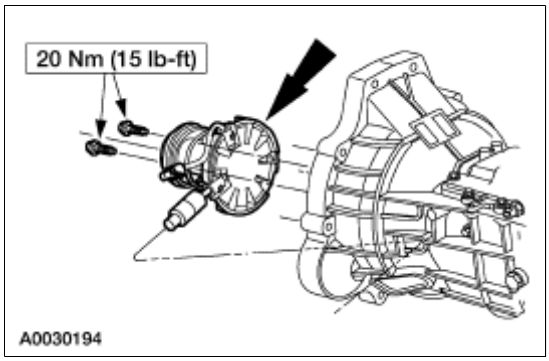


3. Inspect the clutch slave cylinder for the following:
   - Worn or damaged boot.
   - Leaking fluid.
   - Worn or damaged bearing.

4. Inspect the clutch release bearing as follows:
   - Rotate the outer race while applying pressure. If the bearing rotation is rough, install a new clutch slave cylinder.
   - Inspect for wear or damage.

Installation

1. To install, reverse the removal procedure.
   - Position the clutch slave cylinder to the transmission and install the bolts.



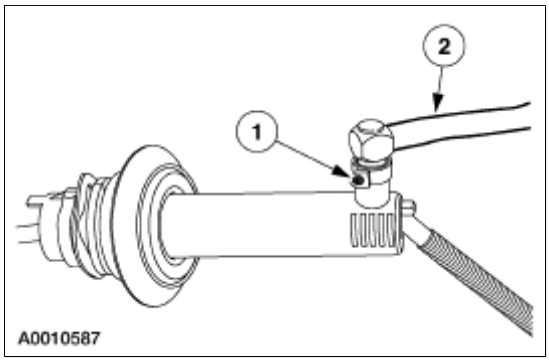
2. Install the transmission. For additional information, refer to Section 308-03 .
3. Depress and release the clutch pedal five full strokes.

Hydraulic Tubes

Removal

1. Remove the clutch master cylinder and the hydraulic line assembly. For additional information, refer to Clutch Master Cylinder/Reservoir in this section.

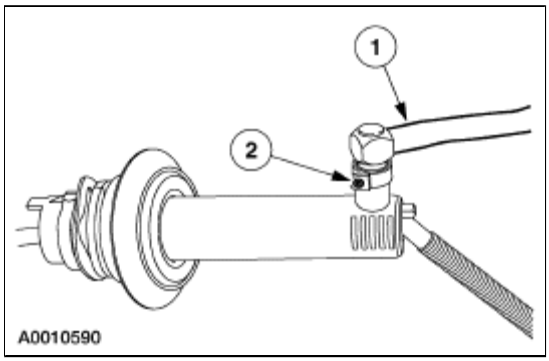
2. Disconnect the hydraulic line from the clutch master cylinder.
    1. Using a 3/32-inch punch and hammer, drive out the roll pin and discard it.
    2. Disconnect the hydraulic line.



Installation

1. **NOTE:** Make sure the O-ring is in the outlet port or on the tube connector.

   Connect and secure the hydraulic tube to the clutch master cylinder.
    1. Install the tube to the clutch master cylinder.
    2. Install a new roll pin.



2. Bleed the clutch hydraulic system. For additional information, refer to Section 308-00 .

General Specifications

Item	Specification
Output shaft maximum runout	0.05 mm (0.002 in)
Shift fork to synchronizer sleeve	0.8 mm (0.031 in)
Synchronizer blocking ring to gear	1.5 mm (0.059 in)
Third/fourth clutch hub end play	0.00-0.05 mm (0.00-0.0019 in)
Reverse idler gear end play	0.1-0.2 mm (0.0039-0.0078 in)
Fifth/reverse hub end play	0.00-0.05 mm (0.00-0.0019 in)
Countershaft reverse gear end play	0.25-0.35 mm (0.0098-0.0138 in)
Lubricant	
MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX or -DDX	MERCON®
Silicone Rubber D6AZ-19562-AA	ESB-M4G92-A

Torque Specifications

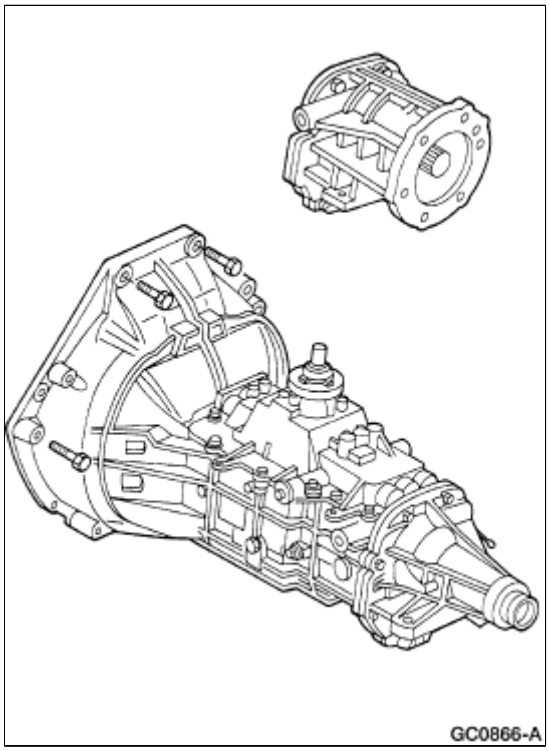
Description	Nm	lb-ft	lb-in
Backup lamp switch	25-35	18-26	—
Case cover bolts	16-22	12-16	—
Case plug	40-58	30-43	—
Counter lever shaft bolt	8-10	6-8	—
Countershaft locknut	128-196	94-144	—
Crossmember bolts	53-72	39-53	—
Crossmember nuts	53-72	39-53	—
Drain plug	40-58	30-43	—
Dust cover bolts	8-11	—	53-70
Extension housing bolts	32-46	24-33	—
Fifth/reverse shift rail bolt	20-30	15-22	—
Fifth/reverse lock plate bolt	8-10	6-8	—
Fill plug	40-58	30-43	—
Fluid passage bolt	8-10	—	72-89
Front bearing retainer bolts	16-22	12-16	—
Gearshift lever bolt	27-40	20-29	—
Gear selector interlock bolts	8-10	—	72-89

Ground wire nut	25-34	18-25	—
Inner gearshift lever boot bolts	10-14	—	89-123
Outer gearshift lever boot screws	5-9	—	45-79
Output shaft locknut	216-274	160-202	—
Rear bearing retainer bolts	18-26	14-19	—
Rear driveshaft bolts	88-119	65-87	—
Reverse idler shaft bolt	79-117	58-86	—
Shift plate bolts	8-10	6-8	—
Transmission bolts	50-68	—	—
Transmission mount bolts	87-110	64-81	—
Transmission mount nuts	87-110	64-81	—
Vehicle speed sensor bolt	11-13	—	98-115

Manual Transmission

The M5OD is a top-shifted, fully synchronized, five speed manual transmission, equipped with an overdrive fifth gear ratio. All gear changes are accomplished with synchronizer sleeves.

M5OD Manual Transmission

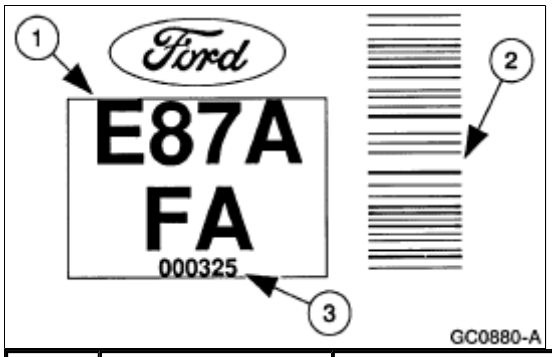


The case (7005), case cover (7222), and extension housing (7A039) are constructed of aluminum alloy. Steel bearing race inserts provide durability in appropriate areas. The extension housing contains a bronze alloy bushing that cannot be replaced. The extension housing must be replaced if the bushing is damaged.

Transmission Identification

The Vehicle Safety Compliance Label (located on the driver door lock pillar) lists applicable transmission identification codes. For additional information on codes, refer to Section 100-01 .

Tag, Service Identification



Item	Part Number	Description
1	—	Ford Motor Company Part Number
2	—	Bar Code
3	—	Serial Number

Manual transmissions are also equipped with service identification tags. The M5OD tag is located on the driver side of the transmission.

Powerflow

Powerflow is accomplished with a series of gears and synchronizers.

In NEUTRAL, there is no powerflow through the transmission.

In first gear, the first/second synchronizer sleeve locks the first gear to the output shaft. The input shaft (7015) drives the countershaft. First gear on the countershaft turns first gear on the output shaft which is driven in reduction at a 3.90:1 ratio.

In second gear, the first/second synchronizer sleeve locks the second gear (2GR) (7102) to the output shaft. The input shaft drives the countershaft. Second gear on the countershaft drives second gear on the output shaft. The output shaft is driven in reduction at a 2.25:1 ratio.

In third gear, the third/fourth synchronizer sleeve locks the third gear (3GR) to the output shaft. The input shaft drives the countershaft. Third gear on the countershaft drives third gear on the output shaft. The output and fifth gear drive shaft (7061) is driven in reduction at a 1.49:1 ratio.

In fourth gear, the third/fourth synchronizer sleeve locks the input shaft to the output and fifth gear drive shaft. The input shaft and output shaft turn at the same speed (1:1 ratio).

In fifth gear, the fifth/reverse synchronizer sleeve locks the fifth gear (5GR) to the countershaft. The input shaft drives the countershaft. Fifth gear on the countershaft drives fifth gear on the output shaft. The output shaft is overdriven at a ratio of 0.80:1.

In REVERSE gear, the fifth/reverse synchronizer sleeve locks the REVERSE gear to the countershaft. The input gear drives the countershaft. The countershaft reverse gear drives the reverse idler gear. The reverse idler gear drives the reverse gear on the output shaft. The output shaft is driven in the opposite direction of the input shaft at a ratio of 3.91:1.

Manual Transmission

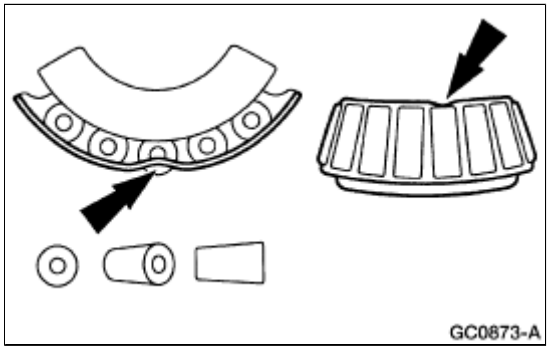
Refer to Section 308-00 .

Bearings

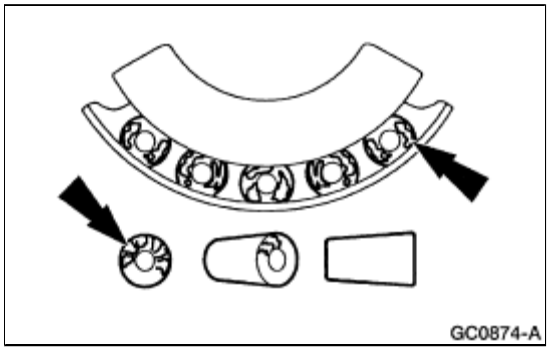
Inspect

1. **NOTE:** If any of the following conditions exist, replace the bearing.

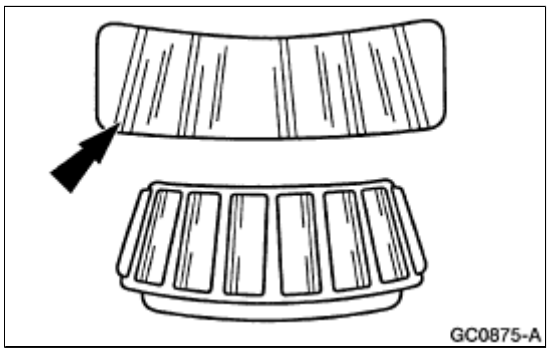
   Inspect the bearing for bent cage.



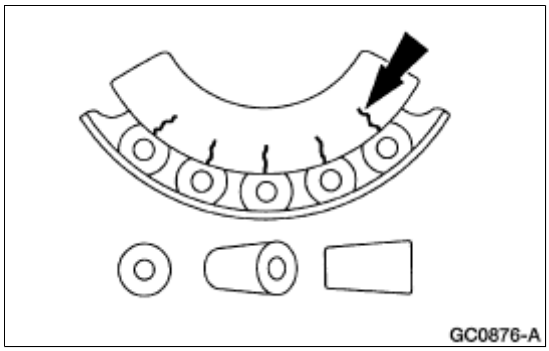
2. Inspect the bearings for galling (metal smears on the roller ends).
   - Galling is caused by overheating, poor lubrication or overload.
   - If galling is found, replace the bearing and inspect the seals.



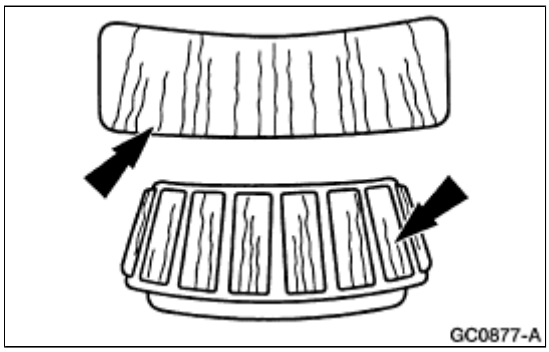
3. Inspect the bearing for brinelling (surface indentations in the raceway).



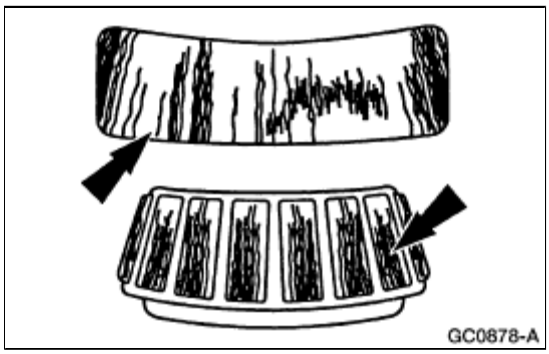
4. Inspect the bearing for cracked inner race.



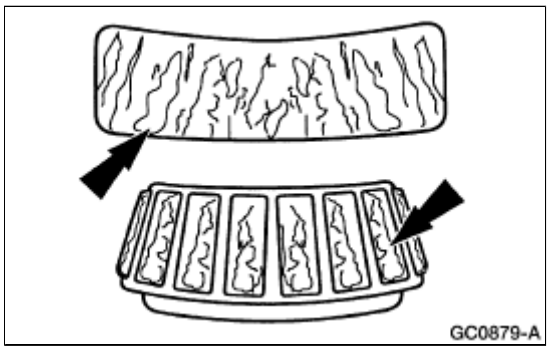
5. Inspect the bearing and raceway for etching.
    - If etching is present, inspect the seals.



6. Inspect the bearing for heat discoloration (dark blue).
    - If heat discoloration is evident, check the bearing and race for loss of temper. Draw a file across the component. If the file cuts the metal, there is a loss of temper.

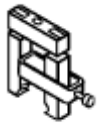


7. Inspect the bearing for fatigue spalling (metal flaking).



Extension Housing

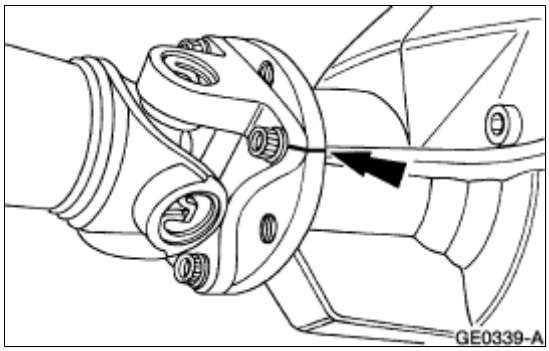
Special Tool(s)

 ST1188-A	Extension Housing Seal Replacer 308-002 (T61L-7657-A)
 ST1192-A	Seal Remover 307-048 (T74P-77248-A)
 ST1927-A	High Lift Transmission Jack 164-R3508 or equivalent

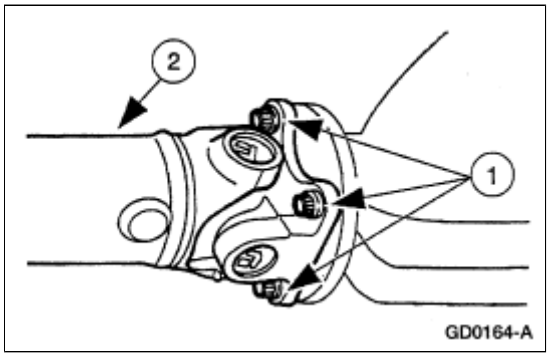
Removal

1. If equipped, turn the air suspension switch off.
2. Disconnect the battery ground cable (14301).
3. Raise and support the vehicle; refer to Section 100-02 .
4. On 4WD vehicles, remove the transfer case; refer to Section 308-07B .
5. Drain the transmission fluid.
6. **NOTE:** To maintain initial driveshaft balance, mark the driveshaft centering socket yoke (4782) and rear axle universal joint flange (4851) so they may be installed in their original positions.

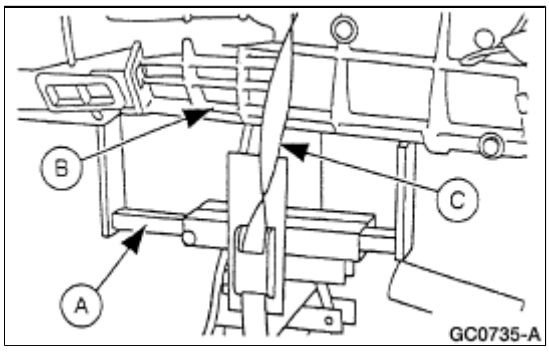
   Mark the driveshaft centering socket yoke and rear axle universal joint flange.



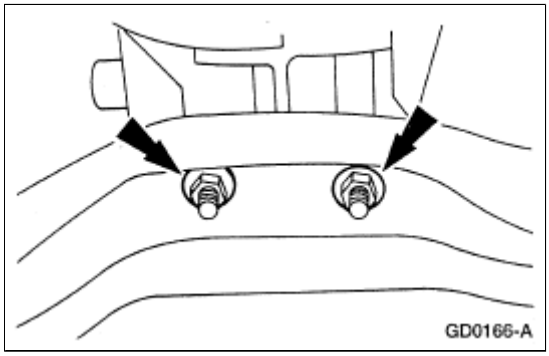
7. Remove and support the rear driveshaft (4A376).
    1. Remove the bolts.
    2. Remove the rear driveshaft.



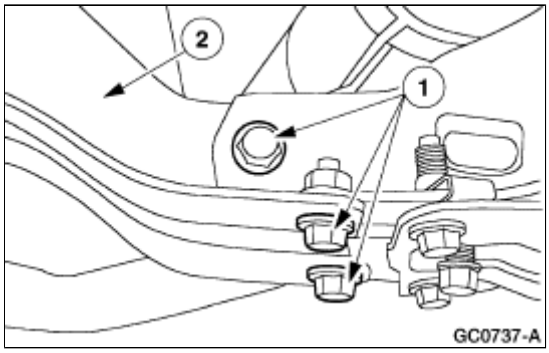
8. Use the (A) Hi-Lift Jack to support the (B) transmission.
    - Secure the (B) transmission with the (C) strap.



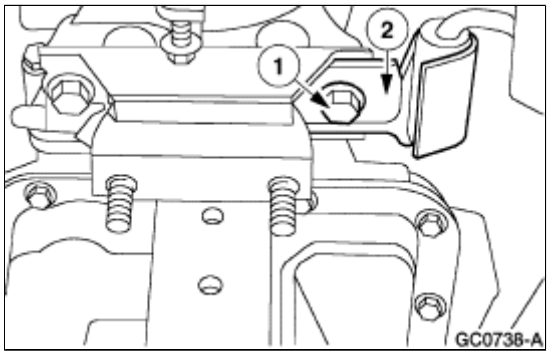
9. Remove the nuts.



10. Remove the crossmember.
    1. Remove the six bolts (three each side).
    2. Remove the crossmember.

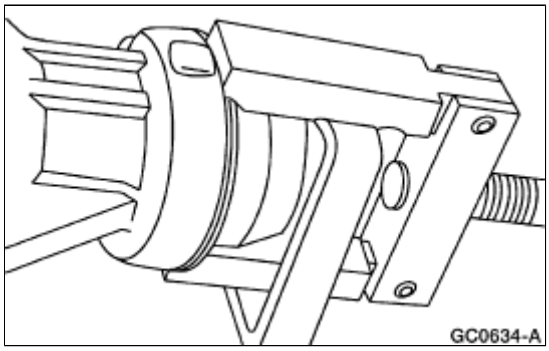


11. Remove the (RH) transmission mount bolt.
    1. Remove the bolt.
    2. Reposition the exhaust mounting bracket.

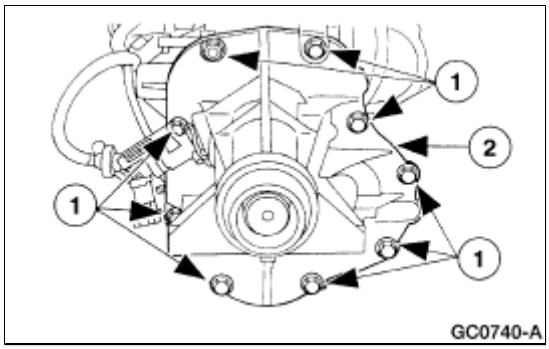


12. Lower the transmission to access extension housing bolts.

13. Use the Seal Remover to remove the extension housing seal.



14. Remove the extension housing (7A039).
    1. Remove the bolts.
    2. Remove the extension housing.

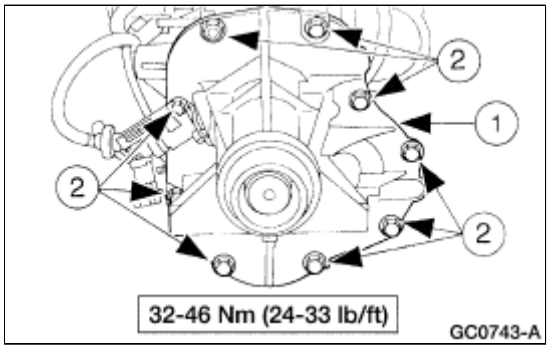


Installation

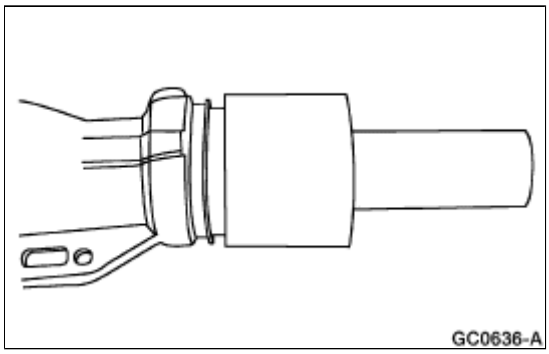
1. **NOTE:** The extension housing must be installed within four minutes after applying silicone.

   Apply a small bead of Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specification ESB-M4G92-A to the surface of the case (7005).

2. Install the extension housing.
   1. Position the extension housing.
   2. Install the bolts.

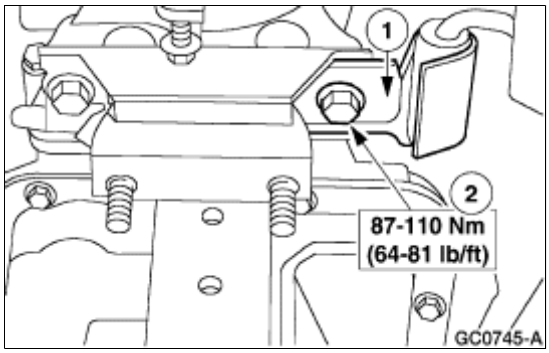


3. Use Extension Housing Seal Replacer to install the extension housing seal.

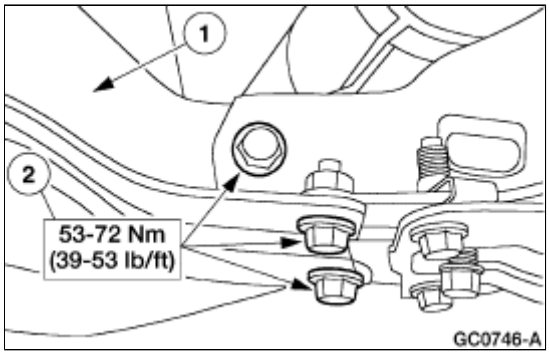


4. Raise and position the transmission.

5. Install the (RH) transmission mount bolt.
   1. Position the exhaust bracket.
   2. Install the bolt.

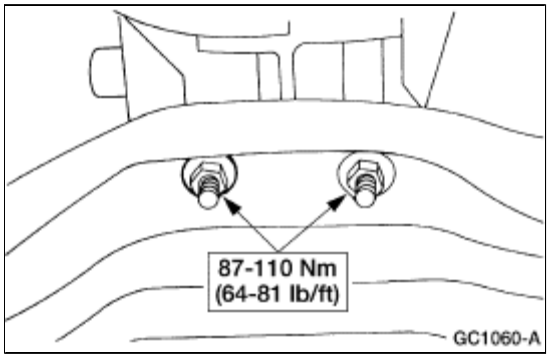


6. Install the crossmember.
    1. Position the crossmember.
    2. Install the six bolts and nuts (three each side).

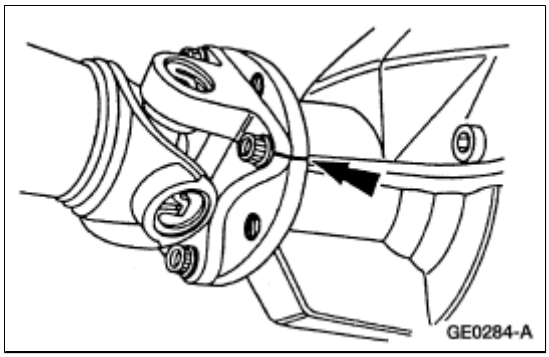


7. Remove the Hi-Lift Jack.

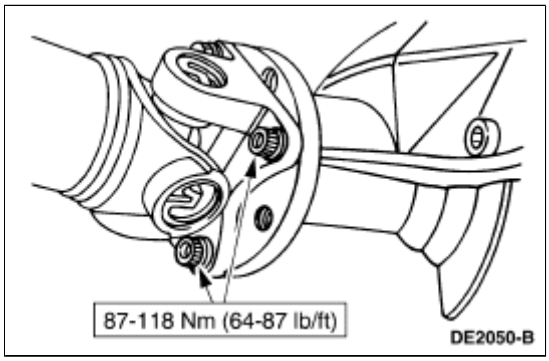
8. Install the nuts.



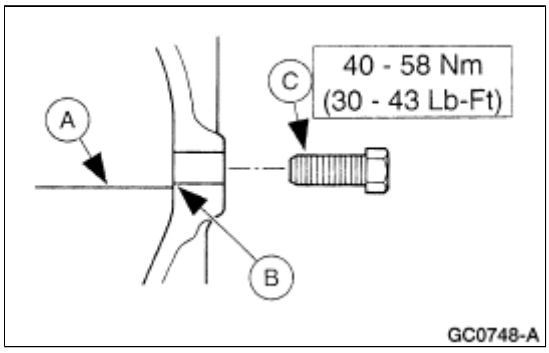
9. Align the marks on the rear driveshaft yoke and on the rear axle pinion flange made during removal. Loosely install the bolts.



10. Tighten the four bolts to specifications.



11. Fill the (A) transmission with MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX or DDX or equivalent meeting Ford MERCON® specification until it reaches the bottom of the (B) fill port and install the (C) case plug (7A010).



12. Lower the vehicle.

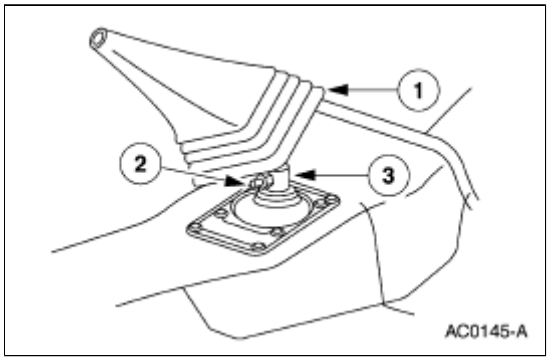
13. Connect the battery ground cable.

14. If equipped with air suspension, reactivate the system by turning on the air suspension switch.

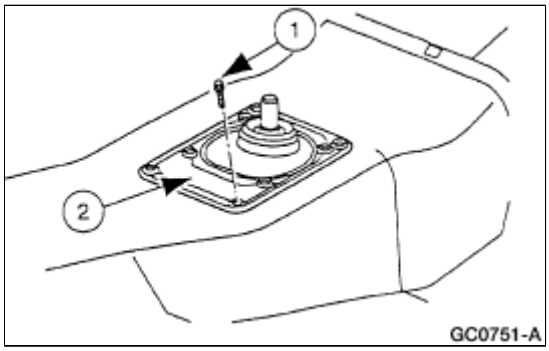
Shift Lever and Boot

Removal

1. Remove the gearshift lever (7210).
    1. Lift the outer gearshift lever boot (7277).
    2. Remove the bolt.
    3. Remove the gearshift lever.

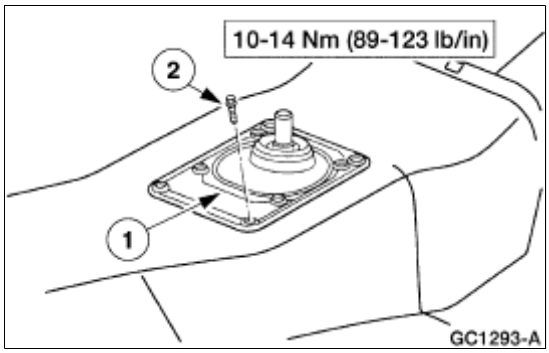


2. Remove the inner gearshift lever boot.
    1. Remove the four screws.
    2. Remove the inner gearshift lever boot.

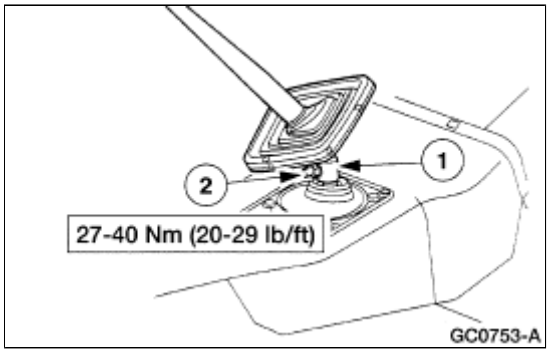


Installation

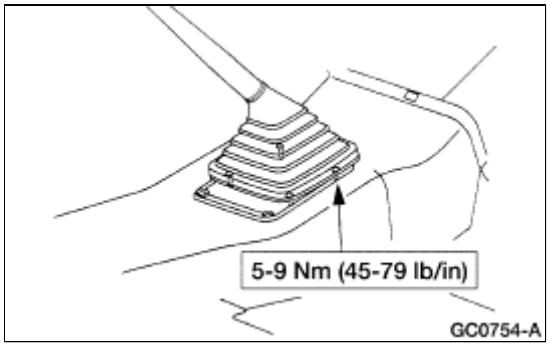
1. Install the inner gearshift lever boot.
    1. Position the inner gearshift lever boot.
    2. Install the screws.



2. Install the gearshift lever.
    1. Position the gearshift lever.
    2. Install the bolt.



3. Install the screws.

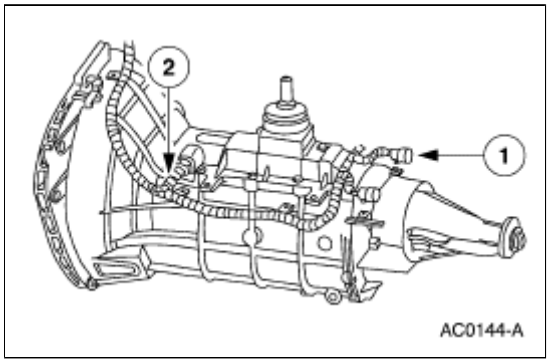


Transmission

Special Tool(s)

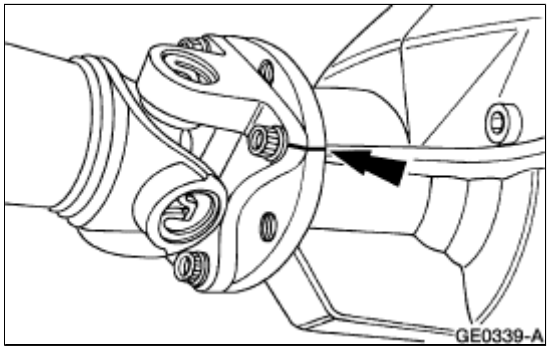
 ST1318-A	Clutch Coupling Tool 308-182 (T88T-70522-A)
 ST1927-A	Hi-Lift Transmission Jack 164-R3508 or equivalent

1. If equipped, turn the air suspension switch off.
2. Disconnect the battery ground cable (14301).
3. Place the transmission in the NEUTRAL position.
4. Remove the outer gearshift lever boot (7277), gearshift lever (7210) and inner gearshift lever boot; refer to Shift Lever and Boot in this section.
5. Disconnect the transmission wiring harness.
    1. Disconnect the heated oxygen sensor connector.
    2. Disconnect the backup lamp switch connector.

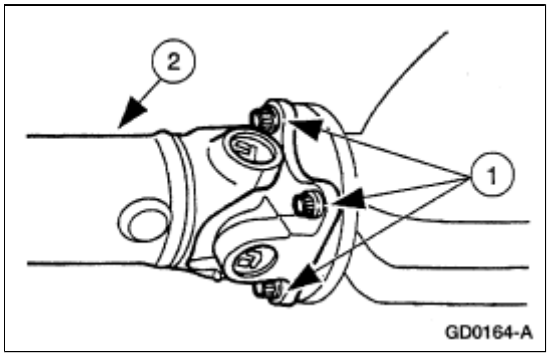


6. Raise and support the vehicle; refer to Section 100-02 .
7. If transmission disassembly is required, drain the transmission fluid.
8. **NOTE:** To maintain initial driveshaft balance, mark the driveshaft centering socket yoke (4782) and rear axle universal joint flange (4851) so they may be installed in their original positions.

Mark the driveshaft centering socket yoke and rear axle universal joint flange.

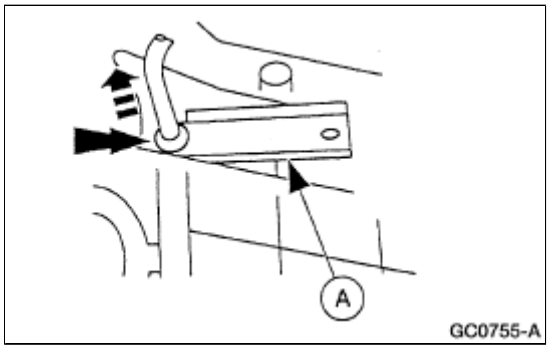


9. Remove the rear driveshaft (4A376).
    1. Remove the four bolts.
    2. Remove the rear driveshaft.



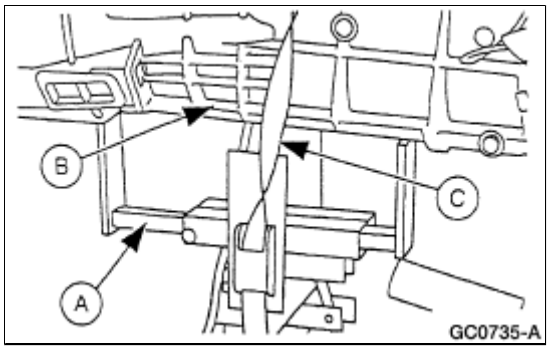
10. On 4-wheel drive vehicles, remove the transfer case; refer to Section 308-07B .

11. Use (A) Clutch Coupling Tool to disconnect the clutch hydraulic line.

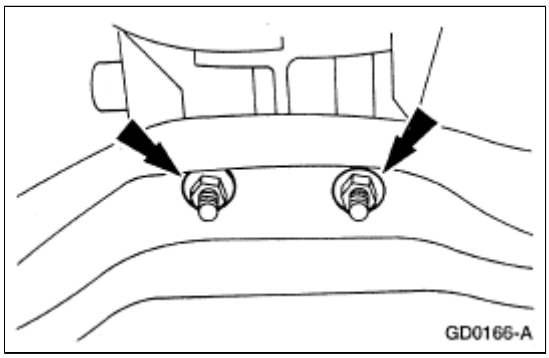


12. Remove the starter motor (11001); refer to Section 303-06 .

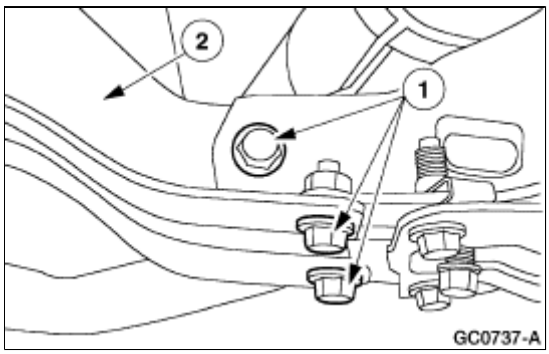
13. Position the (A) Hi-Lift Jack under the transmission (B).
    - Secure with the (C) strap.



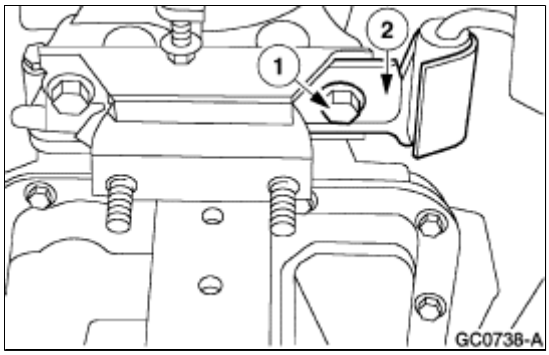
14. Remove the nuts.



15. Remove the rear crossmember.
    1. Remove the six bolts (three each side).
    2. Remove the crossmember.



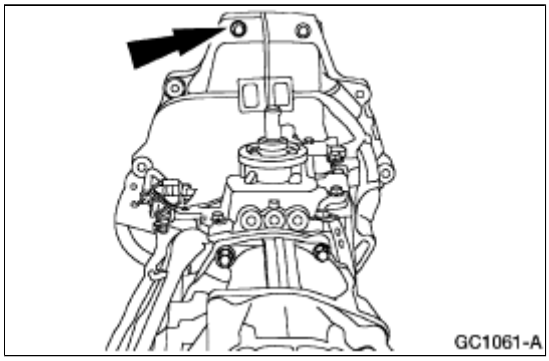
16. Remove the (RH) transmission bolt.
    1. Remove the bolt.
    2. Reposition the exhaust bracket.



17. Remove the exhaust inlet cross-over pipe; refer to Section 309-00 .

18. **NOTE:** Lower the transmission enough to gain access to the bolts. Use a long extension to remove the bolts.

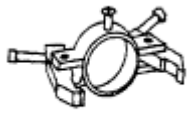
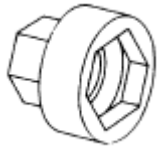
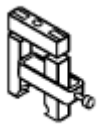
    Remove the nine bolts.



19. Lower the transmission.

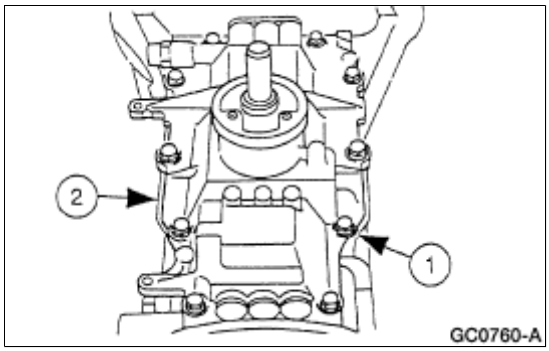
Transmission

Special Tool(s)

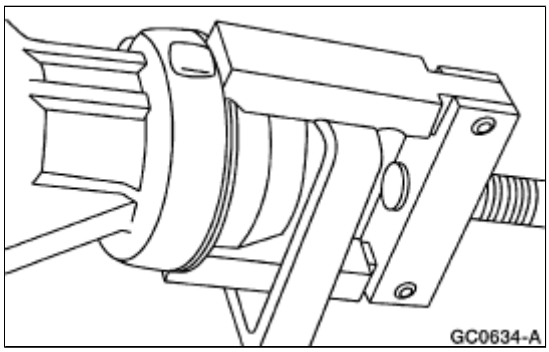
 ST1305-A	Bearing Puller 308-058 (T77J-7025-H)
 ST1618-A	Front Cover Removing Bolt Set 308-171 (T88T-7025-D)
 ST1583-A	Mainshaft Locknut Wrench 308-168 (T88T-7025-AR)
 ST1303-A	Remover/Replacer Tube 308-024 (T75L-7025-B)
 ST1192-A	Seal Remover 307-048 (T74P-77248-A)
 ST1304-A	TOD Forcing Screw 308-092 (T84T-7025-B)

1. Set the transmission on a work bench.

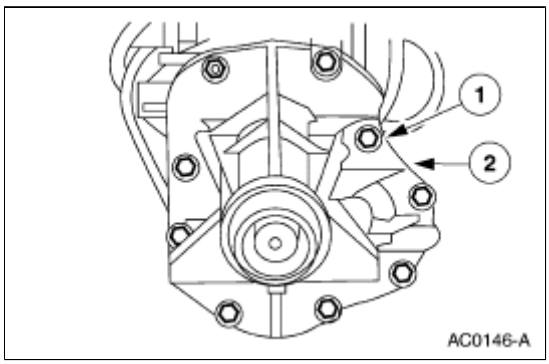
2. Remove the case cover (7222).
    1. Remove the case cover bolts.
    2. Remove the case cover.



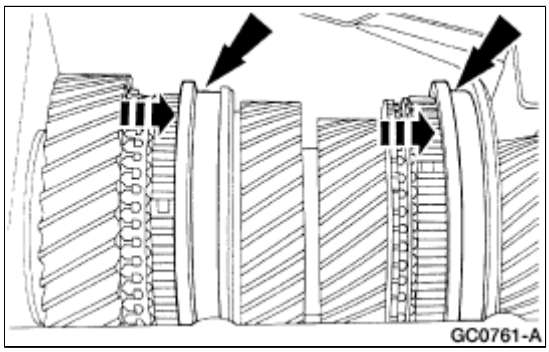
3. Use Seal Remover to remove the extension housing seal.



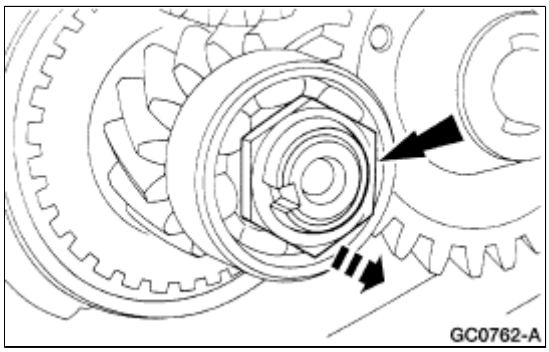
4. Remove the extension housing (7A039).
    1. Remove the bolts.
    2. Remove the extension housing.



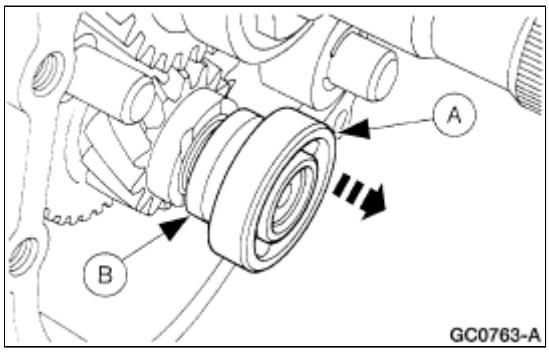
5. Slide the first/second and third/fourth synchronizer sleeves forward to lock the transmission into first and third gears.



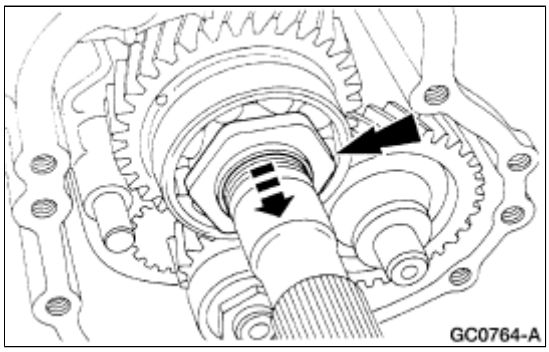
6. Remove and discard the countershaft locknut.



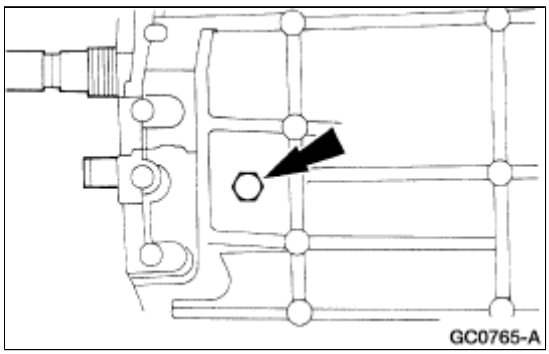
7. Remove the (A) countershaft rear bearing and (B) countershaft rear bearing thrust washer (7L324).



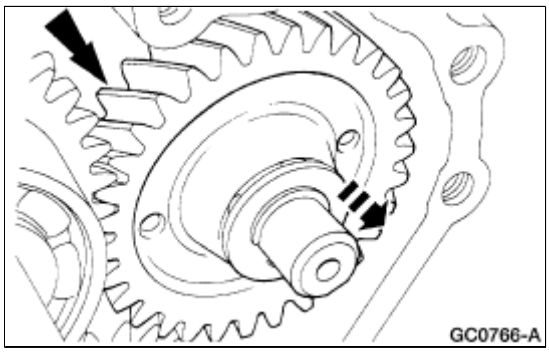
8. Use Mainshaft Locknut Wrench to remove and discard the output shaft rear bearing lock nut (7B364).



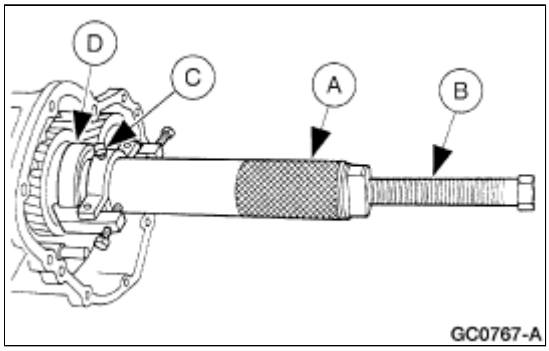
9. Remove the bolt.



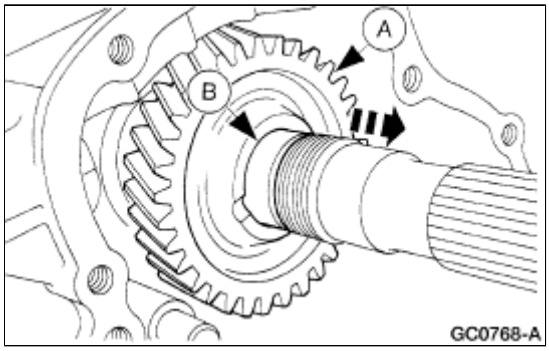
10. Remove the reverse idler gear and bushing (7141).



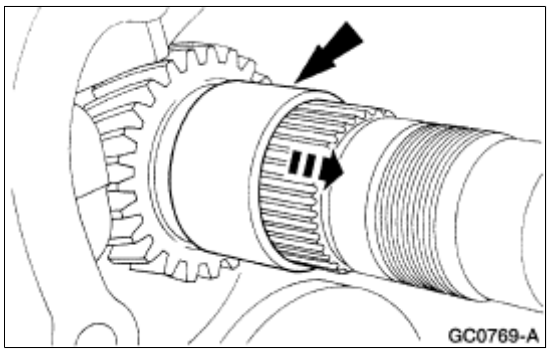
11. Use (A) Remover/Replacer Tube, (B) TOD Forcing Screw and (C) Bearing Puller to remove the (D) output shaft rear bearing (7R205).



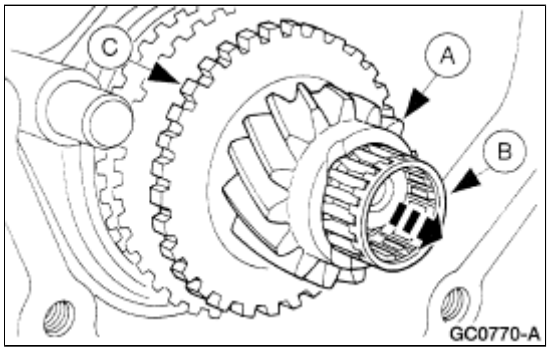
12. Remove the output shaft (7060) (A) reverse gear (7K013) and (B) bushing.



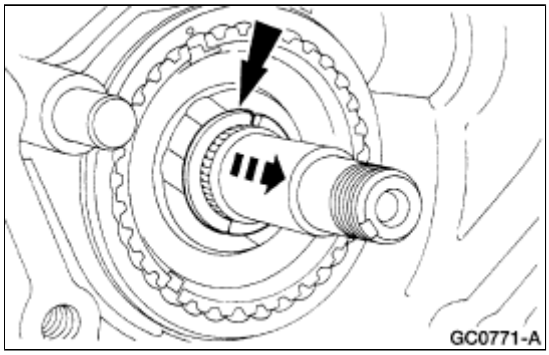
13. Remove the spacer or sleeve (7072).



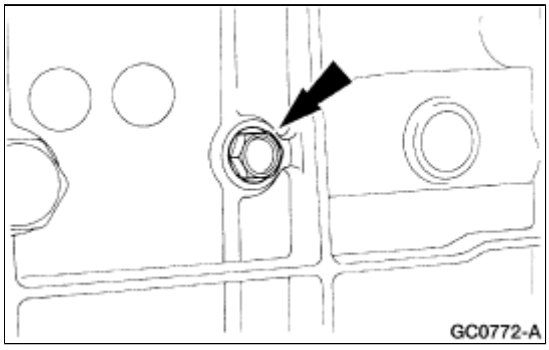
14. Remove the (A) countershaft reverse gear (7N040), the (B) two countershaft reverse gear bearings (7N270), and the (C) reverse synchronizer blocking ring (7107).



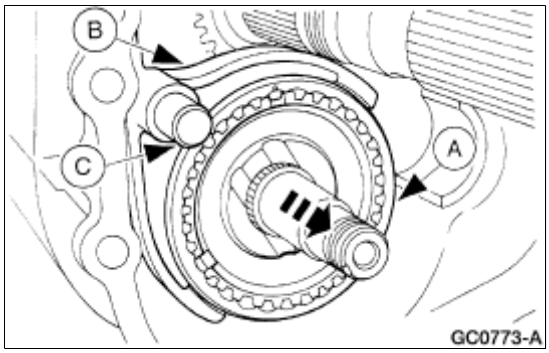
15. Remove the countershaft split washer.



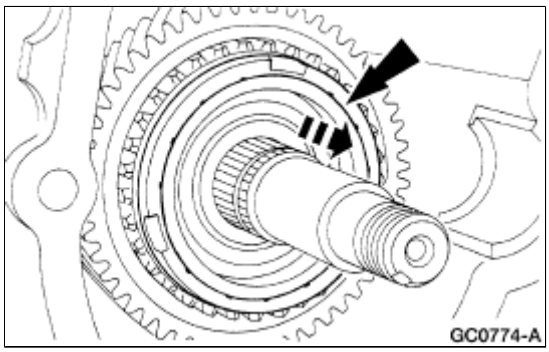
16. Remove the fifth/reverse shift rail bolt.



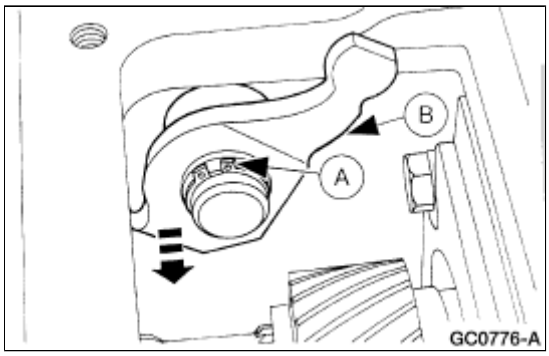
17. Remove the fifth/reverse (A) synchronizer (7124), (B) gear shifter fork (7230), and (C) reverse gear shift rail (7240) as an assembly.



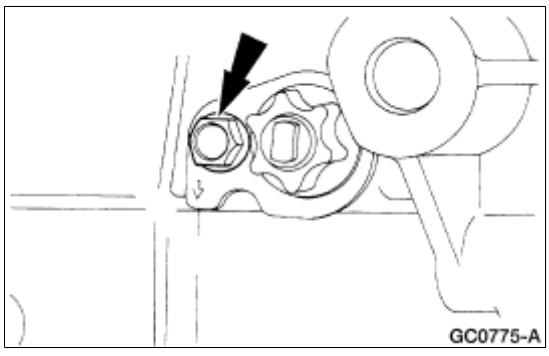
18. Remove the countershaft fifth gear synchronizer blocking ring.



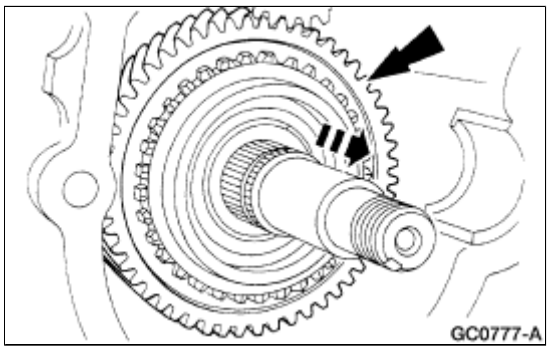
19. Remove the (A) fifth and reverse shift lever retaining ring and the (B) fifth and reverse shift lever (7243).



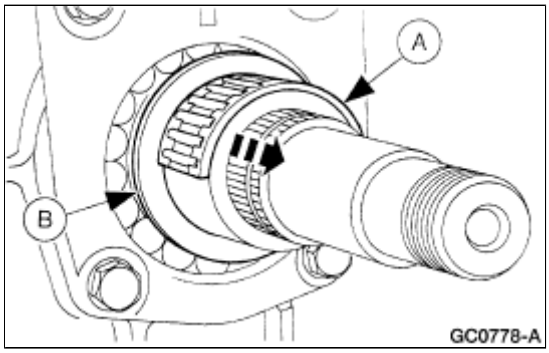
20. Remove the bolt.
Slide shaft out of case.



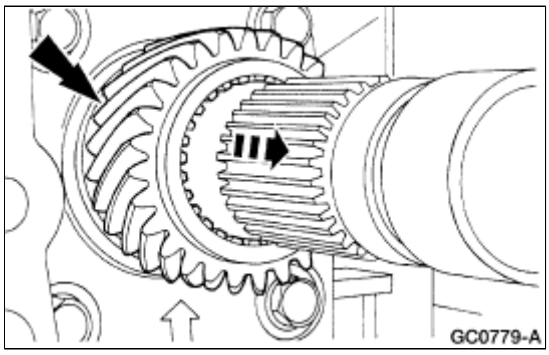
21. Remove the countershaft fifth speed gear.



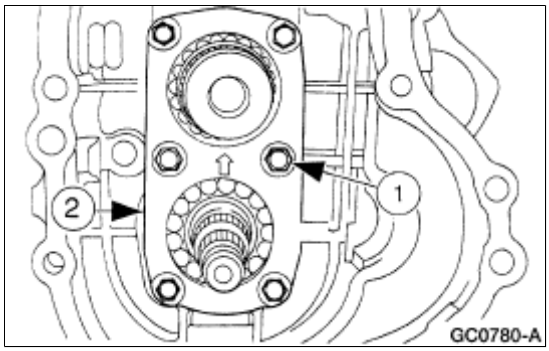
22. Remove the (A) countershaft fifth speed gear split bearing and (B) race.



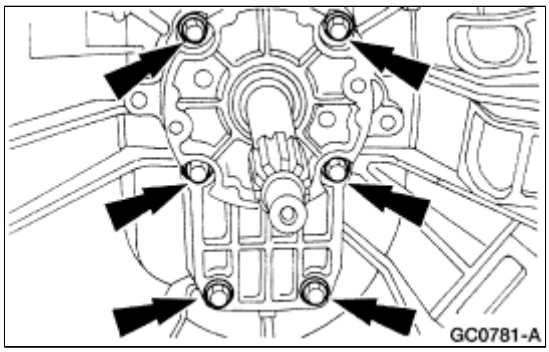
23. Remove the output shaft fifth speed gear.



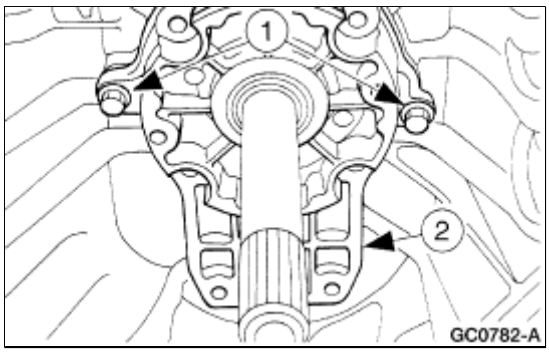
24. Remove the rear bearing retainer.
    1. Remove the retainer bolts.
    2. Remove the bearing retainer (7085).



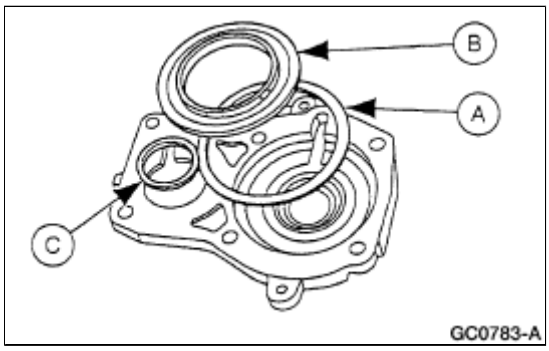
25. Remove the bolts.



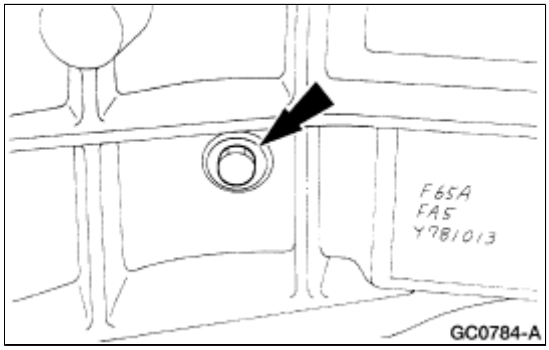
26. Remove the main drive gear bearing retainer (7050).
    1. Install Front Cover Removing Bolt Set into the slave cylinder bolt locations.
    2. Remove the main drive gear bearing retainer.
    - Alternately tighten the bolts until the bearing retainer can be removed by hand.



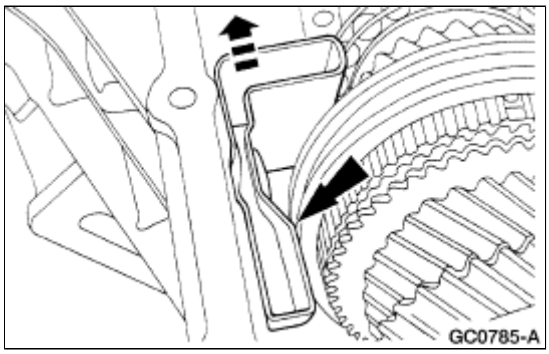
27. Remove the (B) fluid baffle, the (A) input bearing shim, and the (C) countershaft bearing shim.



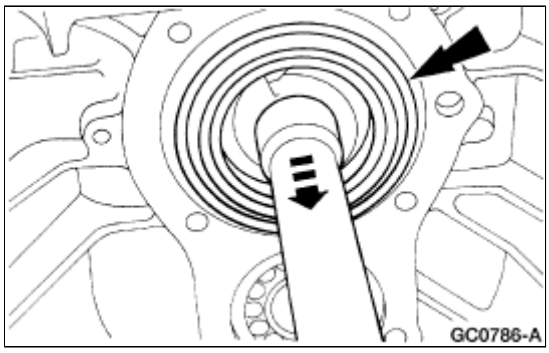
28. Remove the fluid passage bolt.



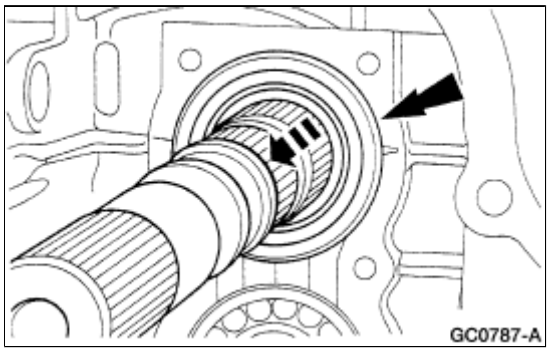
29. Remove the fluid passage.



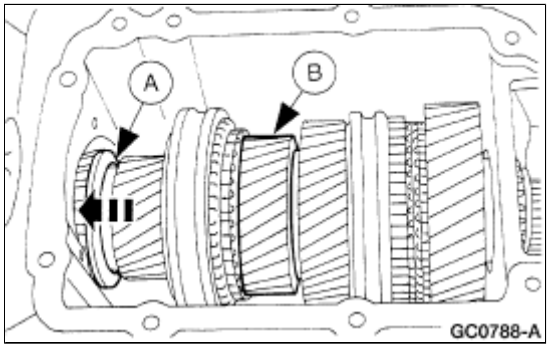
30. Remove the input shaft front bearing race.



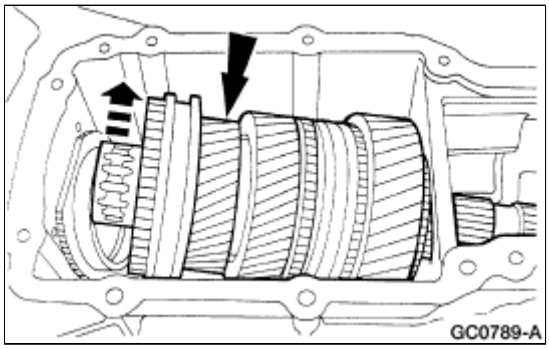
31. Remove the output shaft center bearing race.



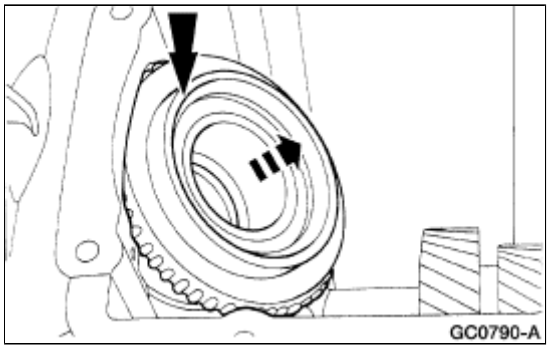
32. Separate the (A) input shaft (7015) and the (B) output shaft.



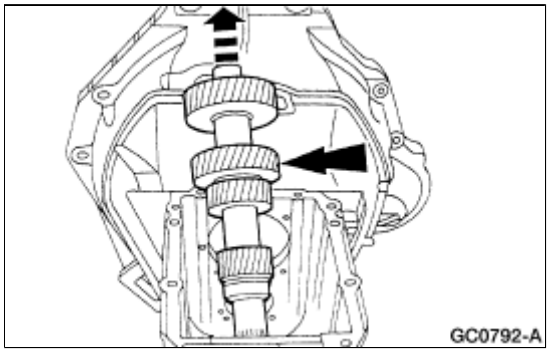
33. Remove the output shaft.



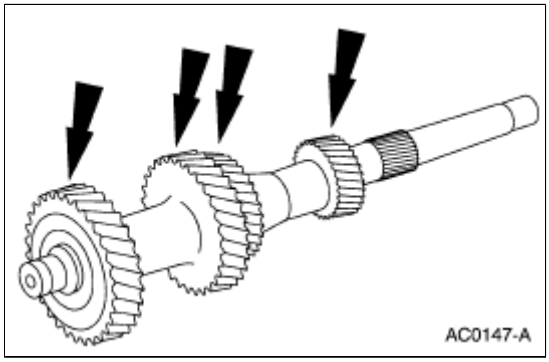
34. Remove the input shaft (7017).



35. Remove the countershaft cluster gear (7113).

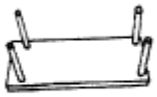


36. Inspect the countershaft cluster gear for damage.



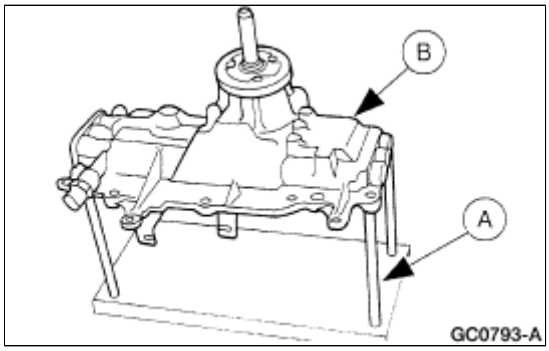
Shift Control Housing

Special Tool(s)

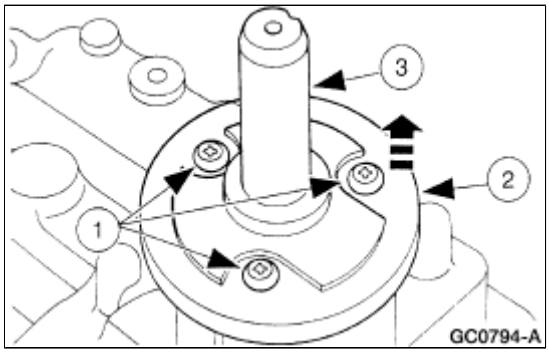
 ST1311-A	Top Cover Holding Fixture 308-170 (T88T-7025-C)

Disassembly

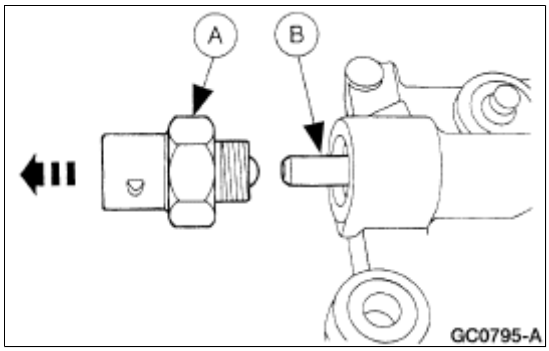
1. Position the (B) case cover (7222) onto (A) Top Cover Holding Fixture.



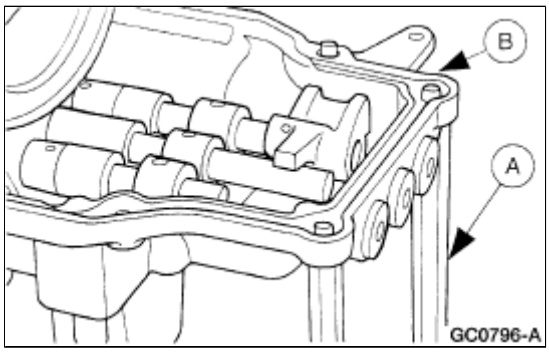
2. Remove the lower gearshift lever (7210).
    1. Remove the screws.
    2. Remove the dust cover.
    3. Remove the lower gearshift lever.



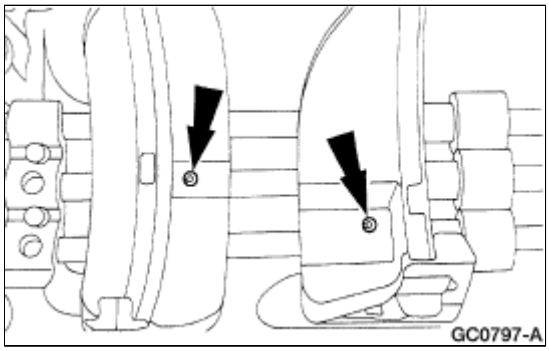
3. Remove the (A) backup lamp switch (15520) and the (B) pin.



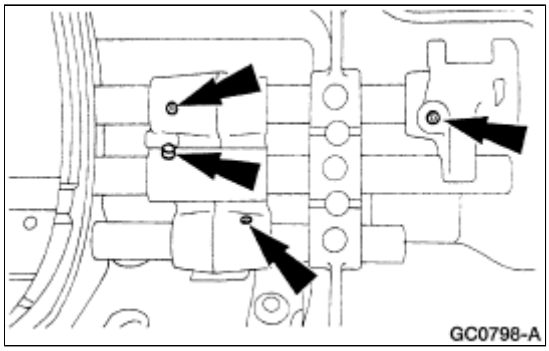
4. Invert the (B) case cover on (A) Top Cover Holding Fixture.



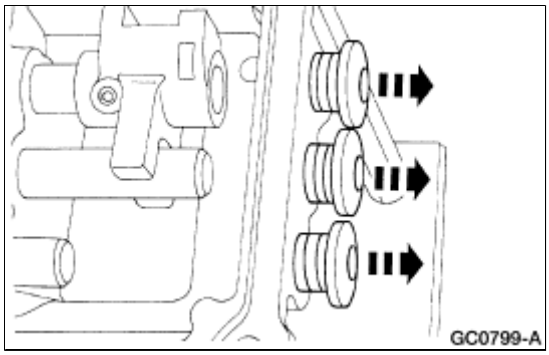
5. Remove and discard the two shift fork spring pins.



6. Remove and discard the four shift gate spring pins.



7. Remove the three rubber service bore plugs.

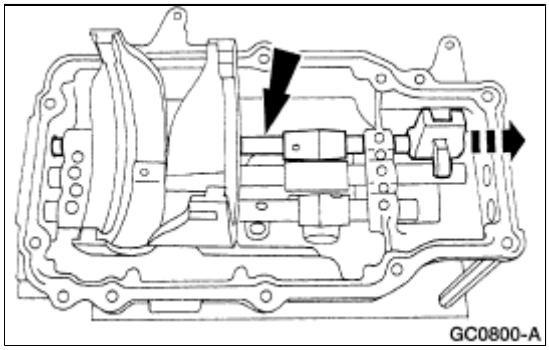


8. **WARNING: Wear safety glasses while performing shift rail removal procedure.**

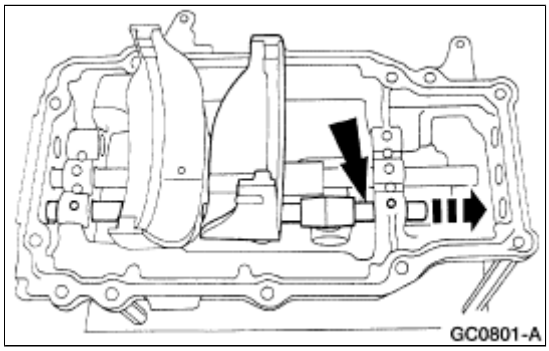
   CAUTION: Perform the following shift rail removal procedure with great care. Cover the lockball and friction device bores and spring seats with a clean cloth held firmly into place during shift rail removal. Failure to cover bores can result in component loss when the ball/friction device and spring forcefully leave their installed positions.

   NOTE: When removing the shift rails, collect and separate the interlock pins to ensure installation into their original locations.

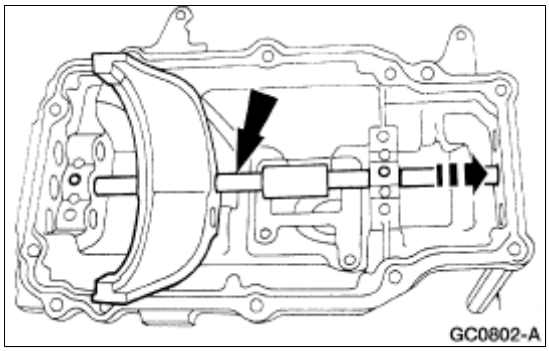
   Use the spring pin bore to remove the fifth/reverse shift rail.



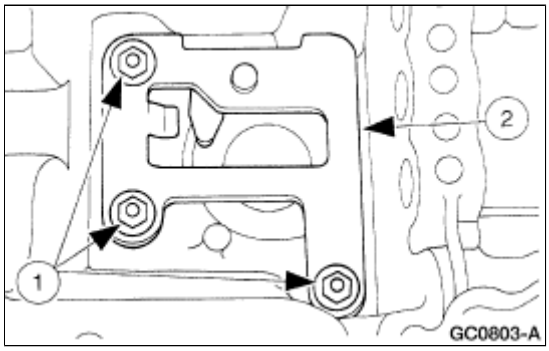
9. Remove the first/second shift rail.
   - Use a suitable punch in the spring pin bore to aid removal.



10. Use the spring pin bore to remove the third/fourth shift rail.

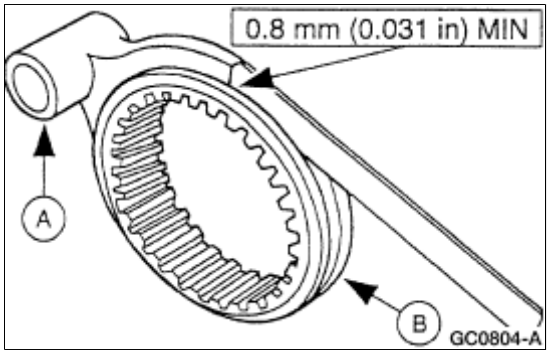


11. Remove the gear selector interlock sleeve (7K201).
    1. Remove the bolts.
    2. Remove the gear selector interlock sleeve.

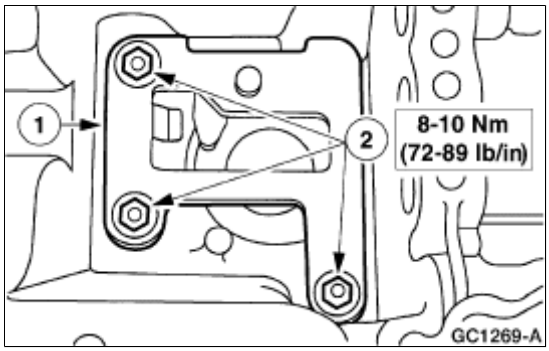


Assembly

1. Check the contact surface of the (A) shift fork and (B) synchronizer sleeve for wear or damage.

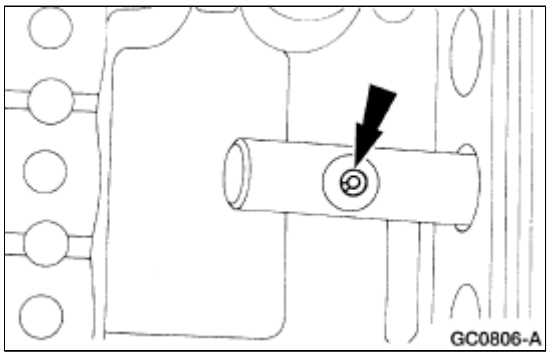


2. Install the gear selector interlock sleeve.
    1. Position the gear selector interlock sleeve.
    2. Install the bolts.

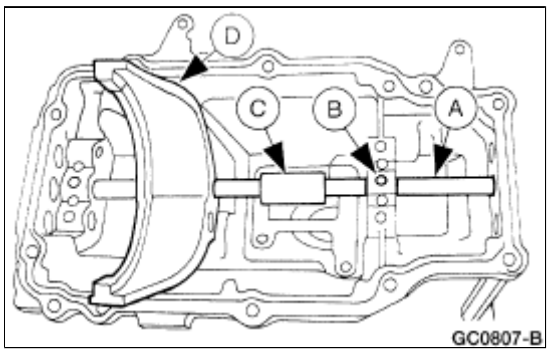


3. **NOTE:** Improper installation of the interlock pins will prevent activation of the backup lamp switch.

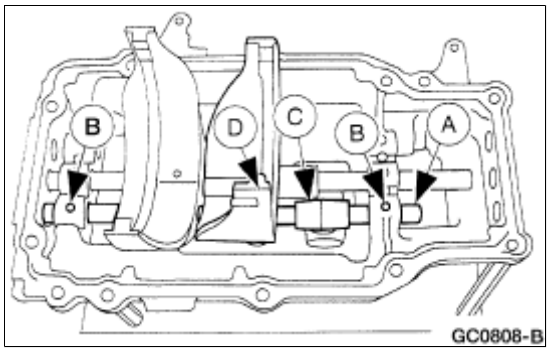
   Install the interlock pins into their original shift rails.



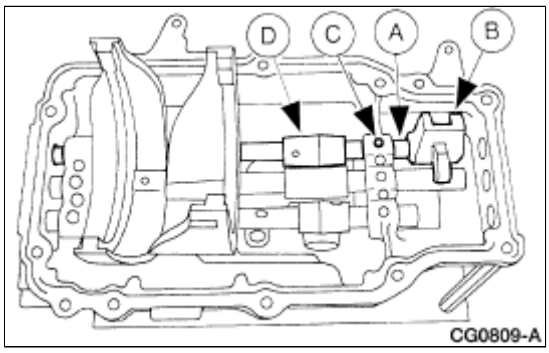
4. Position the (B) detent ball and spring, the (C) shift gate, the (D) shift fork and spring and install the (A) third/fourth shift rail.



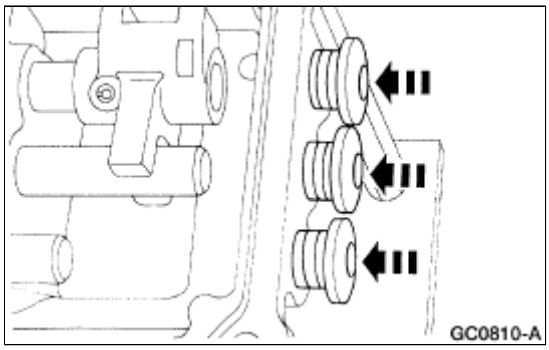
5. Position the (B) detent ball and spring, the (C) shift gate, the (D) shift fork and spring and install the (A) first/second shift rail.



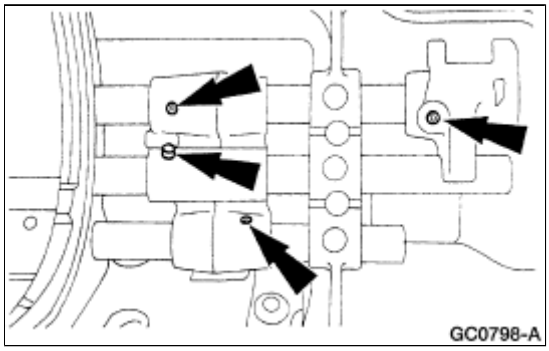
6. Position the (B) fifth/reverse shift control, the (C) detent ball and spring and the (D) shift gate and install the (A) fifth/reverse shift rail.



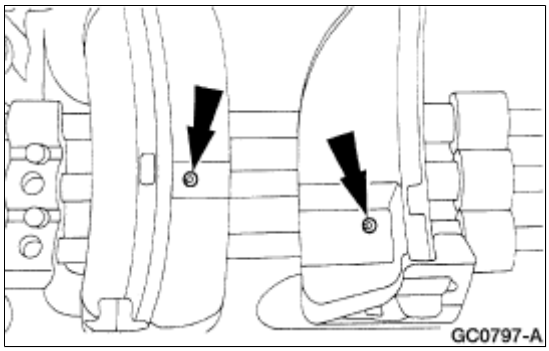
7. Install the three rubber service bore plugs.



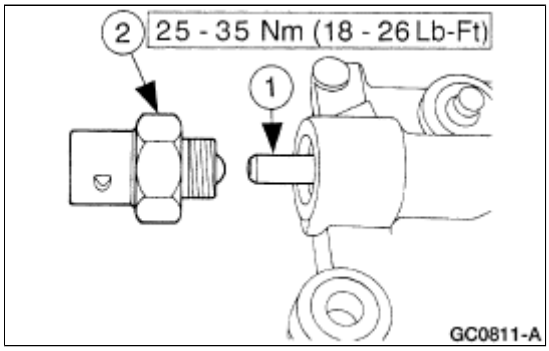
8. Install the pins.



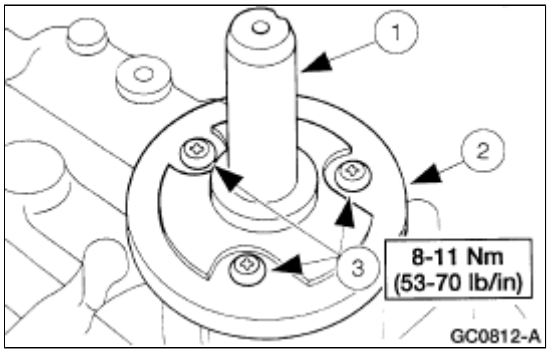
9. Install the two new shift fork spring pins.



10. Install the backup lamp switch.
    1. Install the backup lamp switch pin.
    2. Install the backup lamp switch.



11. Install the lower gearshift lever.
    1. Position the gearshift lever.
    2. Position the dust cover.
    3. Install the bolts.



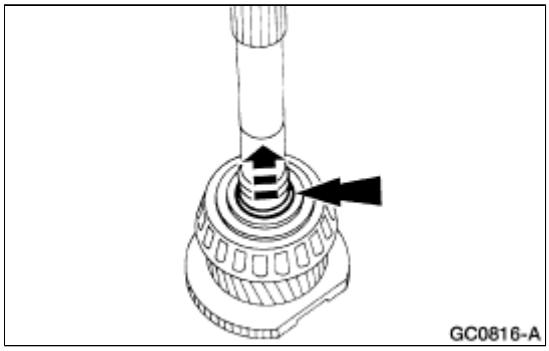
Input Shaft and Bearing

Special Tool(s)

 ST1310-A	Pinion Bearing Cone Remover 205-055 (T71P-4621-B)
 ST1752-A	1988 Ford Tool Set 308-S167 (T88T-7025-S)

Disassembly

1. Inspect the input shaft bearing.
2. Remove and discard the front bearing oil scoop ring (7046).

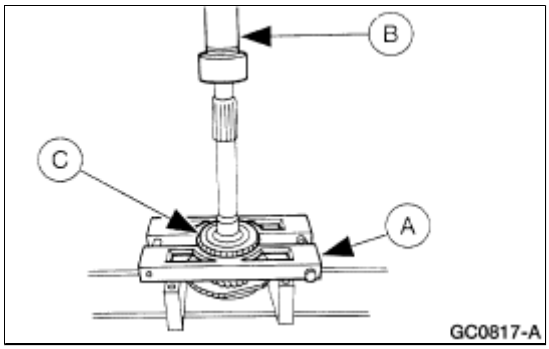

GC0816-A

3. **CAUTION: Use of essential tools may cause damage to the bearings being removed.**

   CAUTION: Hold the input shaft (7015) so it does not fall.

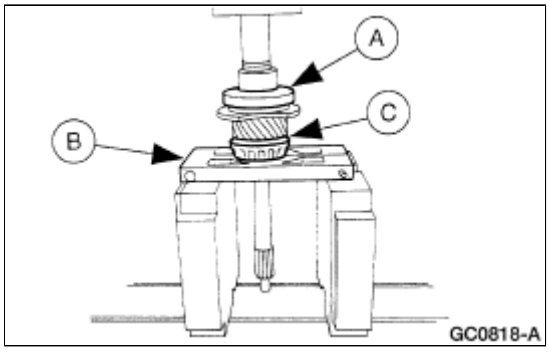
   NOTE: Only remove the bearing if replacement is necessary.

   Use (A) Bearing Cone Remover and an (B) arbor press to remove the (C) bearing.

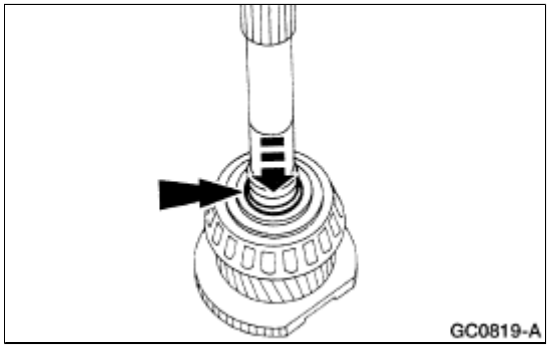


Assembly

1. Use (A) Bearing Cone Replacer, (B) Bearing Cone Remover, and an arbor press to install the (C) bearing.

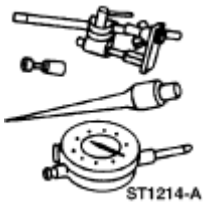


2. Install the front bearing oil scoop ring.
    - A click should be felt as the scoop ring notches align with the input shaft oil holes.



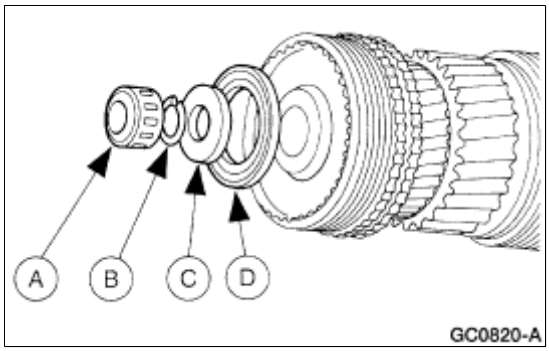
Output Shaft

Special Tool(s)

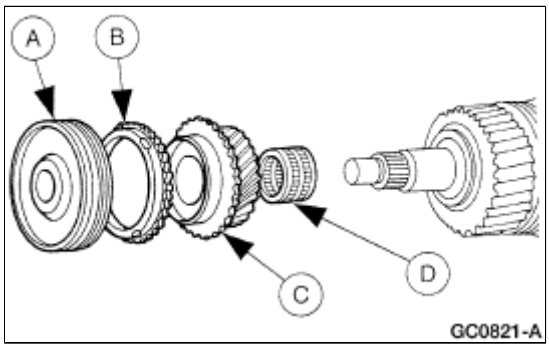
 ST1254-A	Axle Bearing/Seal Plate 205-090 (T75L-1165-B)
	Bearing Cone Replacer 308-169 (T88T-7025-B)
 ST1308-A	Pinion Bearing Replacer 205-004 (T53T-4621-B)
 ST1214-A	Dial Indicator with Bracketry 100-002 (TOOL-4201-C) or equivalent
 ST1303-A	Remover/Replacer Tube 308-024 (T75L-7025-B)

Disassembly

1. Remove the (A) transmission input shaft pilot bearing (7118), the (B) bearing outer snap ring (7030), the (C) third and fourth synchronizer spacer (7N112) and the (D) thrust bearing (7C096).

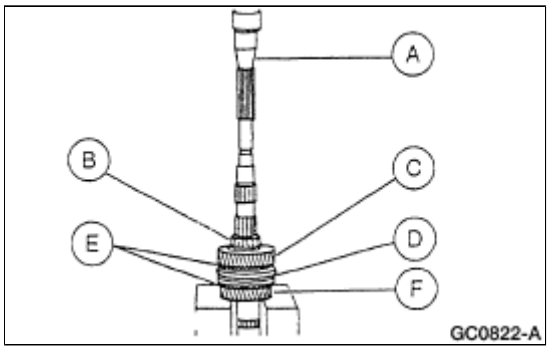


2. Remove the (A) third/fourth synchronizer (7124), the (B) third gear synchronizer blocking ring (7107), the (C) third gear and the (D) gear bearing (7127).



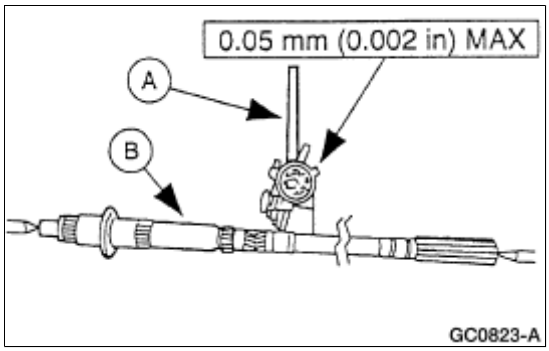
3. **CAUTION: Make sure that the output shaft flange does not contact or ride up onto the press cradle. Improper positioning can result in component damage.**

   Use an (A) arbor press to remove the (B) output shaft center bearing (3C123), the (C) first gear, the (D) first/second synchronizer, the (E) first/second synchronizer blocking rings, and the (F) second gear.

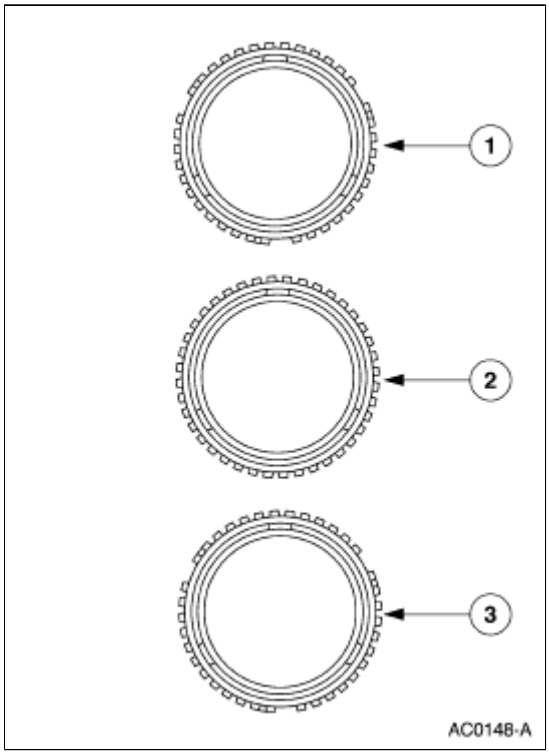


Assembly

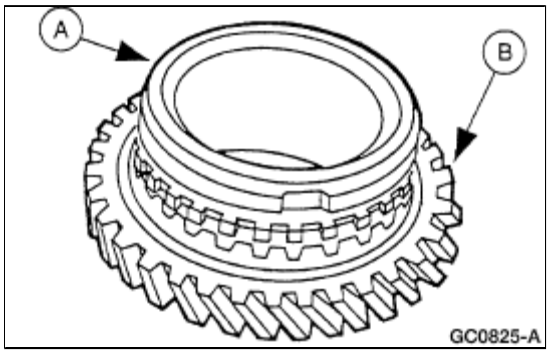
1. Use (A) Dial Indicator with Bracketry to check the (B) output shaft runout.
   - Check runout in several places along the output shaft. If runout exceeds specification, replace the shaft.



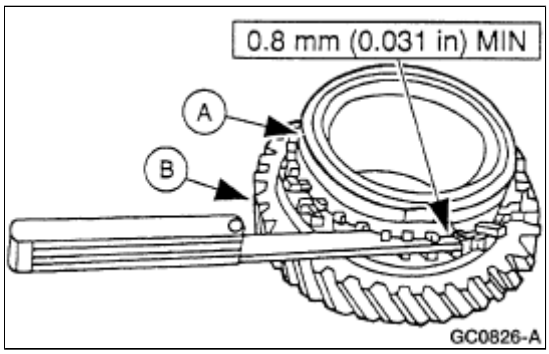
2. Identify the synchronizer blocking ring.
    1. Brass - third gear synchronizer blocking ring.
    2. Brass - first and fourth gear synchronizer blocking ring.
    3. Carbon - second gear synchronizer blocking ring.



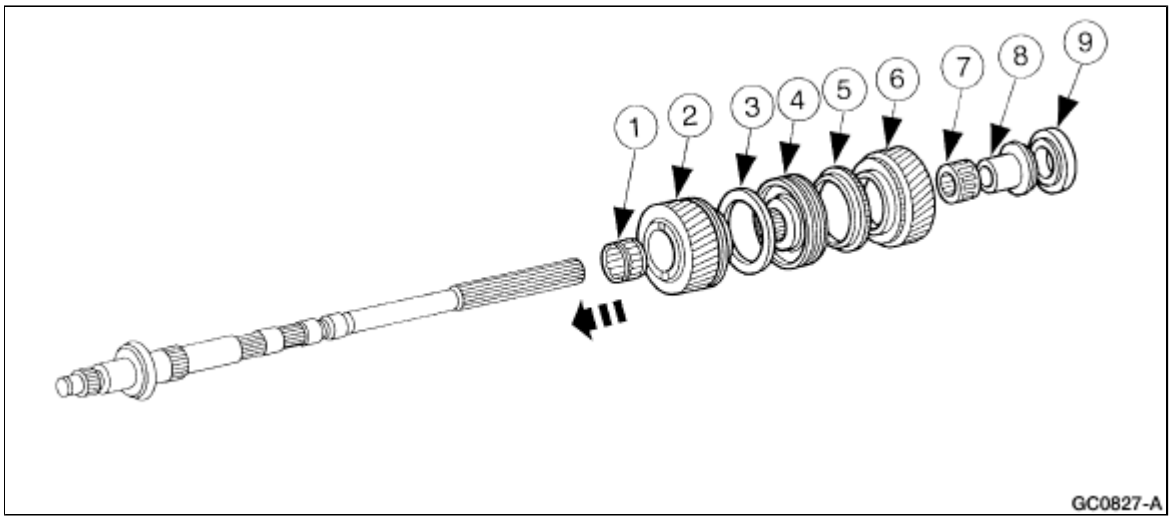
3. Inspect the (A) synchronizer blocking rings for proper contact with the (B) cone surface of the gears.



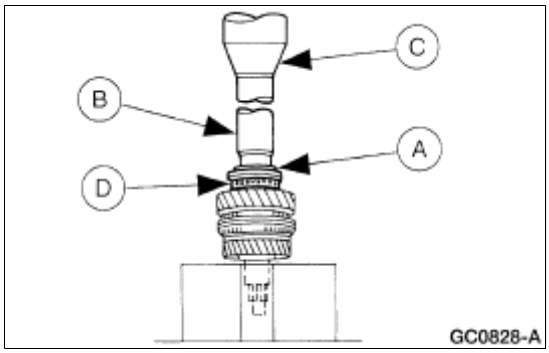
4. Inspect the (A) synchronizer blocking rings for wear on the (B) gear.
    - If clearance is less than specification, replace the ring or gear.



5. Assemble the first and second gear assembly.
    1. Install the second gear needle bearing.
    2. Install the second gear (2GR) (7102).
    3. Install the second synchronizer blocking ring.
    4. Install the first/second synchronizer with the identification hole in the sleeve facing first gear.
    5. Install the first gear synchronizer blocking ring.
    6. Install the first gear (1GR) (7100).
    7. Install the first gear needle bearing.
    8. Install the input bearing spacer.
    9. Position the output shaft center bearing.

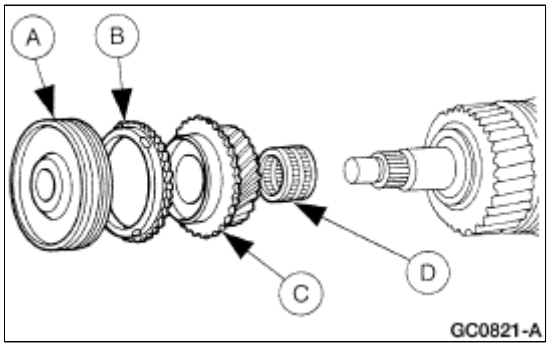


6. Use (A) Bearing Replacer, (B) Remover/Replacer Tube, and an (C) arbor press to press the (D) center bearing into place.

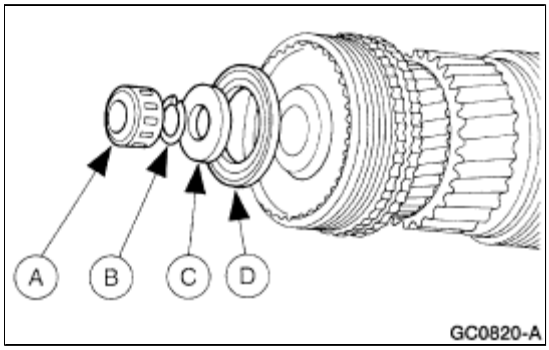


7. **NOTE:** Install the third/fourth synchronizer with the chamfer on the sleeve facing fourth gear.

   Install the (D) third gear bearing, the (C) third gear (3GR) (7B340), the (B) third gear synchronizer blocking ring, and the (A) third/fourth synchronizer.



8. Install the (D) thrust bearing, the (C) third and fourth synchronizer spacer, the (B) bearing outer snap ring, and the (A) transmission input shaft pilot bearing.

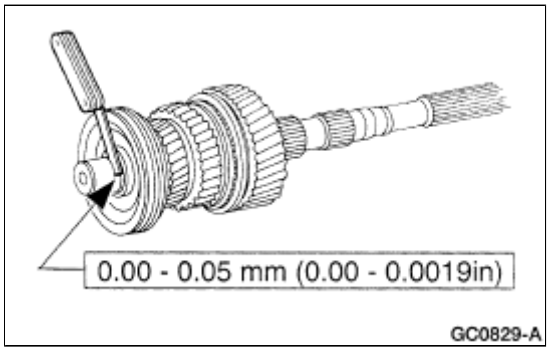


9. Check the third/fourth clutch hub end play.
   - If clearance is not within specification, select the proper bearing outer snap ring.

Bearing Outer Snap Ring Select Chart

Part Number	Thickness
E8TZ-7030-A	1.50 mm (0.0590 in)
E8TZ-7030-B	1.55 mm (0.0610 in)
E8TZ-7030-C	1.60 mm (0.0629 in)

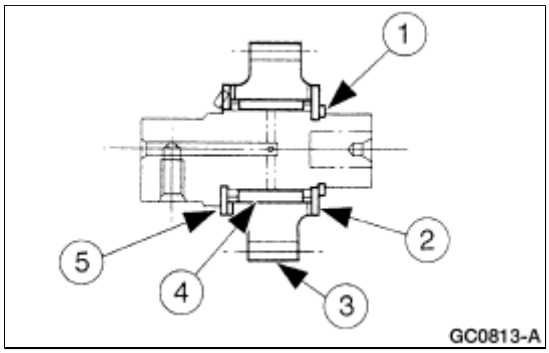
E8TZ-7030-D	1.65 mm (0.0649 in)
E8TZ-7030-E	1.70 mm (0.0669 in)
E8TZ-7030-F	1.75 mm (0.0688 in)
E8TZ-7030-G	1.80 mm (0.0708 in)
E8TZ-7030-H	1.85 mm (0.0728 in)
E8TZ-7030-J	1.90 mm (0.0748 in)
E8TZ-7030-K	1.95 mm (0.0767 in)



Reverse Idler Gear

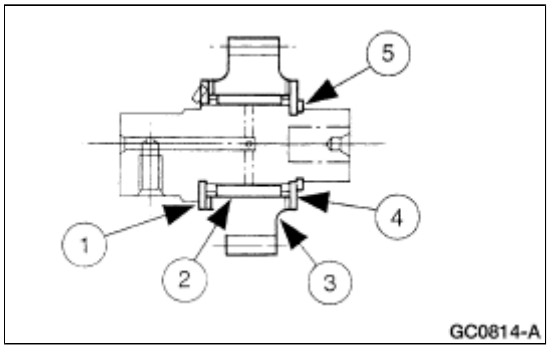
Disassembly

1. Disassemble the reverse idler gear.
    1. Remove the reverse idler gear retaining ring (7156).
    2. Remove the spacer.
    3. Remove the reverse idler gear and bushing (7141).
    4. Remove the reverse idler gear bearing (7E139).
    5. Remove the reverse idler gear thrust washer (7N037).



Assembly

1. Assemble the reverse idler gear.
    1. Install the reverse idler gear thrust washer.
    2. Install the reverse idler gear bearing.
    3. Install the reverse idler gear and bushing.
    4. Install the spacer.
    5. Install the drive belt (8620).



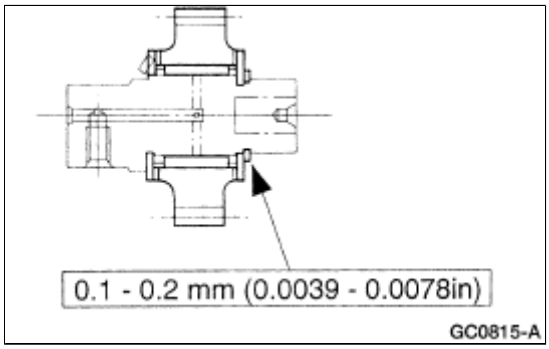
2. Measure the reverse idler gear end play.

Reverse Idler Gear Retaining Rings

Part Number	Thickness
E8TZ-7156-A	1.5 mm (0.0590 in)

E8TZ-7156-G	1.6 mm (0.0629 in)
E8TZ-7156-H	1.7 mm (0.0669 in)
E8TZ-7156-J	1.8 mm (0.0708 in)
E8TZ-7156-K	1.9 mm (0.0748 in)

- If end play is not within specification, install a retaining ring of proper thickness.

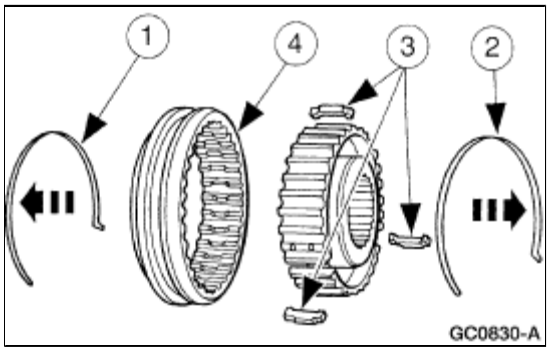


Synchronizers

Disassembly

1. **NOTE:** Mark parts for assembly.

   Disassemble the synchronizer.
   1. Remove one retaining spring.
   2. Flip the synchronizer over and remove the opposite retaining spring.
   3. Remove the three insert keys.
   4. Remove the sleeve.

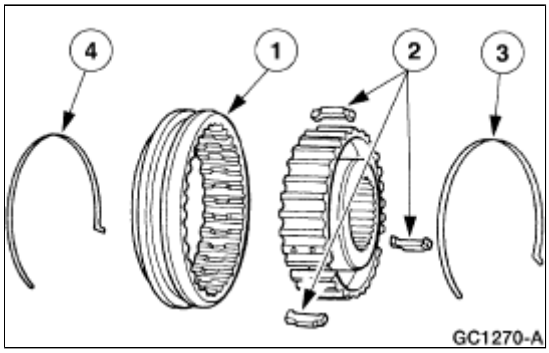


2. Inspect all the synchronizer components for wear and damage.

Assembly

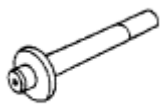
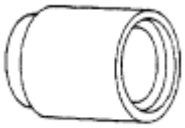
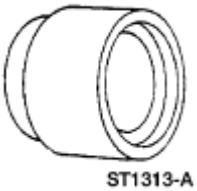
1. **NOTE:** Match the marked parts for assembly.

   Assemble the synchronizer.
   1. Install the sleeve.
   2. Install the insert keys.
   3. Install the retaining spring.
   4. Flip the synchronizer over and install the opposite retaining spring.



Transmission

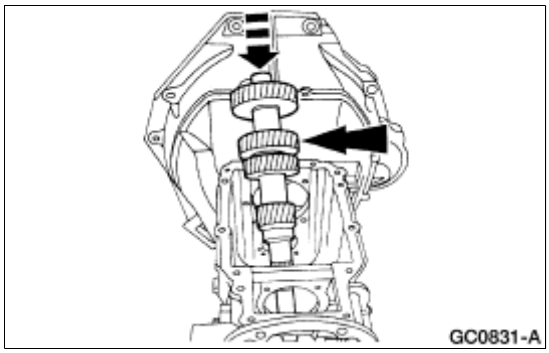
Special Tool(s)

 ST1316-A	Bell Housing Seal Replacer 308-057 (T77J-7025-G)
 ST1302-A	Countershaft Locknut Staking Tool 308-056 (T77J-7025-F)
 ST1274-A	Depth Micrometer 303-D026 (D80P-4201-A) or equivalent
 ST1188-A	Extension Housing Seal Replacer 308-002 (T61L-7657-A)
 ST1312-A	Gear Replacing Spacer 308-173 (T88T-7025-F)
 ST1313-A	Gear Replacing Spacer 308-174 (T88T-7025-G)
 ST1583-A	Mainshaft Locknut Wrench 308-168 (T88T-7025-AR)

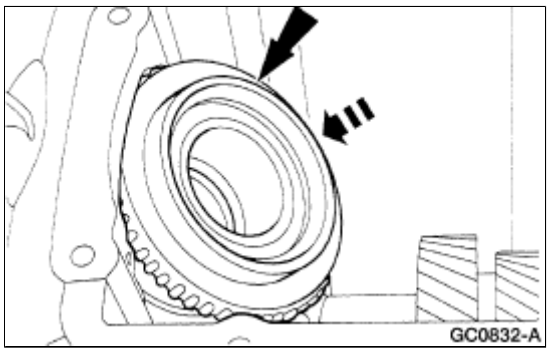
 ST1752-A	Mount Transmission Ford Tool Set 308-S167 (T88T-7025-S)
 ST1303-A	Remover/Replacer Tube 308-024 (T75L-7025-B)
 ST1307-A	Remover/Replacer Tube 308-098 (T85T-7025-A)
 ST1317-A	Shaft Adapter - Replacing 308-032 (T75L-7025-L)
 ST1314-A	Shaft Collar 308-035 (T75L-7025-P)
 ST1314-A	Shaft Collar (4x4 Only) 308-033 (T75L-7025-M)
 ST1315-A	Shaft Sleeve Replacer 308-031 (T75L-7025-K)

Assembly

1. Install the countershaft cluster gear (7113).

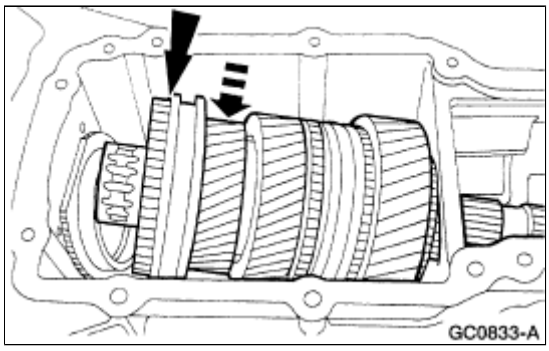


2. Position the input shaft (7015).



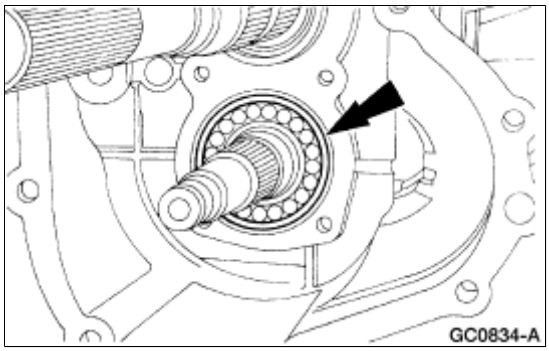
3. **NOTE:** Make sure the fourth gear synchronizer blocking ring is in place.

   Install the output shaft (7060).

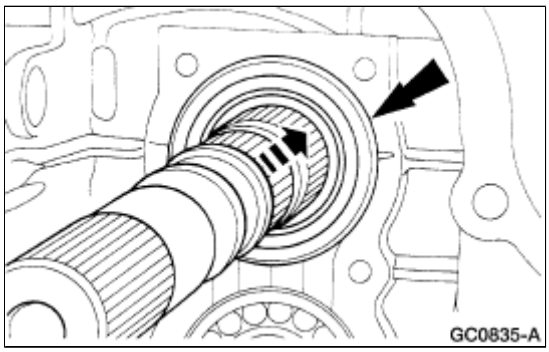


4. Mate the input shaft and output shaft together.

5. Install the countershaft pilot bearing (7121).

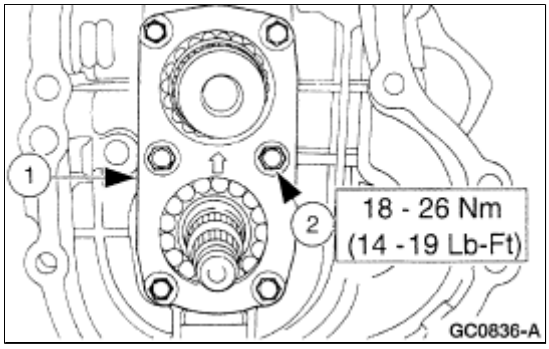


6. Install the output shaft rear bearing (7R205).



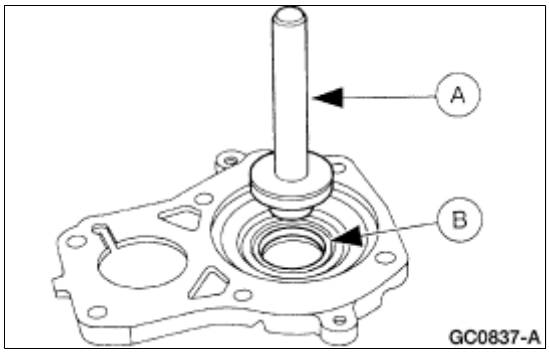
7. **NOTE:** Install the rear bearing retainer (3C610) with the arrow pointing to the top of the case (7005) .

   Install the rear bearing retainer.
   1. Position the rear bearing retainer.
   2. Install the bolts.



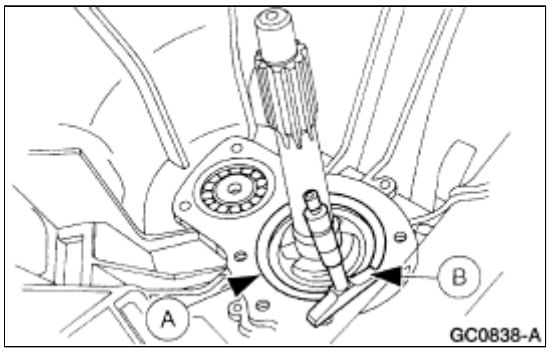
8. **NOTE:** If any related parts (such as the output shaft and bearings) have been replaced, perform the shim thickness selective procedure.

   Use (A) Bell Housing Seal Replacer to install the (B) front cover oil baffle.

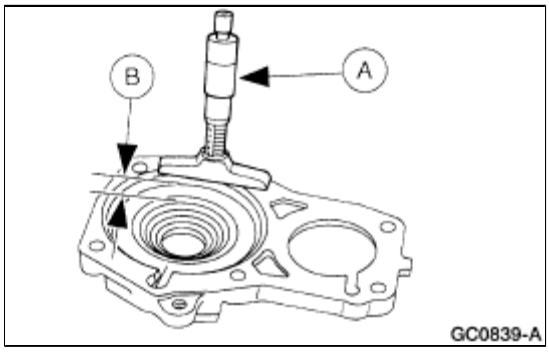


9. Position the transmission with the bell housing facing up.

10. Use (B) Depth Micrometer to measure dimension (A) input shaft bearing race depth.
    - Record dimension (A) on line 2 of the selective shim equation chart.



11. Use (A) Depth Micrometer to measure dimension (B) front bearing retainer depth.
    - Record dimension (B) on line 1 of the selective shim equation chart.



12. Select the proper output shaft shim.

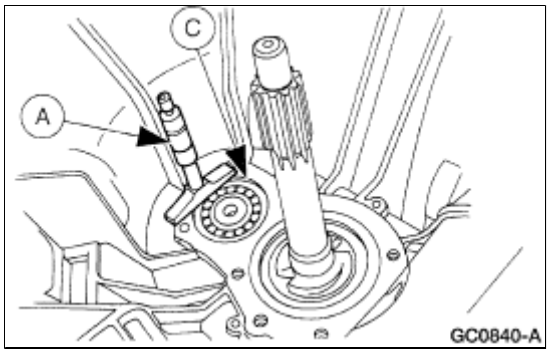
Selective Shim Equation Chart

Step	Measurement mm (in)
Line 1 (Dimension B)	
Line 2 (Dimension A)	
Line 3 (Subtract line 2 from line 1)	

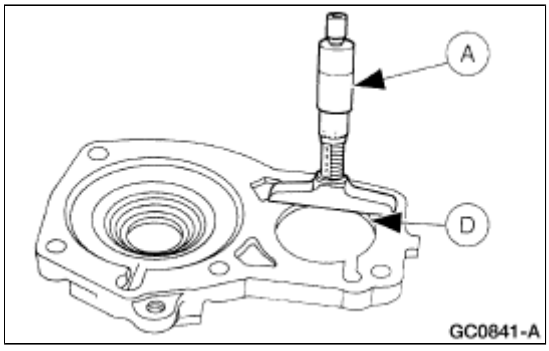
Output Shaft Shim Selective Chart

Total From Line 3 mm (in)	Part Number	Thickness mm (in)
2.75-2.85 (0.108-0.112)	E8TZ-7029-C	2.7 (0.106)
2.85-2.95 (0.112-0.116)	E8TZ-7029-D	2.8 (0.110)
2.95-3.05 (0.116-0.120)	E8TZ-7029-E	2.9 (0.114)
3.05-3.15 (0.120-0.124)	E8TZ-7029-F	3.0 (0.118)
3.15-3.25 (0.124-0.127)	E8TZ-7029-G	3.1 (0.122)
3.25-3.35 (0.127-0.131)	E8TZ-7029-H	3.2 (0.125)
3.35-3.45 (0.131-0.135)	E8TZ-7029-J	3.3 (0.129)
3.45-3.55 (0.135-0.139)	E8TZ-7029-K	3.4 (0.133)
3.55-3.65 (0.139-0.143)	E8TZ-7029-L	3.5 (0.137)
3.65-3.75 (0.143-0.147)	E8TZ-7029-M	3.6 (0.141)
3.75-3.85 (0.147-0.151)	E8TZ-7029-N	3.7 (0.145)
3.85-3.95 (0.151-0.155)	E8TZ-7029-P	3.8 (0.149)
3.95-4.05 (0.155-0.159)	E8TZ-7029-R	3.9 (0.153)
4.05-4.15 (0.159-0.163)	E8TZ-7029-A	4.0 (0.157)
4.15-4.25 (0.163-0.167)	E8TZ-7029-B	4.1 (0.161)

13. Use (A) Depth Micrometer to measure dimension (C) countershaft bearing.
    - Record dimension (C) on line 1 of the countershaft spacer equation chart.



14. Use (A) Depth Micrometer to measure dimension (D) countershaft bearing retainer depth.
    - Record dimension (D) on line 2 of the countershaft spacer equation chart.



15. Select the proper countershaft spacer.

Countershaft Spacer Equation Chart

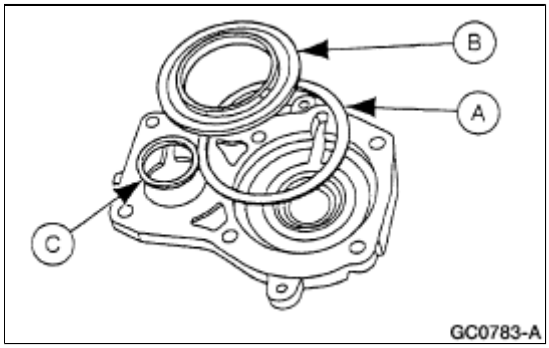
Step	Measurement mm (in)
Line 1 (Dimension C)	
Line 2 (Dimension D)	
Line 3 (subtract line 2 from line 1)	

Countershaft Spacer Selective Chart

Total From Line 3 mm (in)	Part Number	Thickness mm (in)
2.45-2.55 (0.096-0.100)	E8TZ-7C434-A	2.3 (0.090)
2.55-2.65 (0.100-0.104)	E8TZ-7C434-B	2.4 (0.094)
2.65-2.75 (0.104-0.108)	E8TZ-7C434-C	2.5 (0.098)
2.75-2.85 (0.108-0.112)	E8TZ-7C434-D	2.6 (0.102)
2.85-2.95 (0.112-0.116)	E8TZ-7C434-E	2.7 (0.106)
2.95-3.05 (0.116-0.120)	E8TZ-7C434-F	2.8 (0.110)
3.05-3.15 (0.120-0.124)	E8TZ-7C434-G	2.9 (0.114)
3.15-3.25 (0.124-0.128)	E8TZ-7C434-H	3.0 (0.118)
3.25-3.35 (0.127-0.131)	E8TZ-7C434-J	3.1 (0.122)

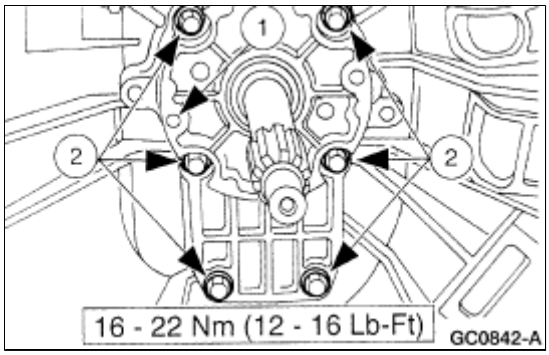
16. **NOTE:** If necessary, apply a light coat of grease to the countershaft spacer, shim and fluid baffle.

Position the (A) bearing shim, the (B) fluid baffle, and the (C) countershaft spacer onto the front bearing retainer.

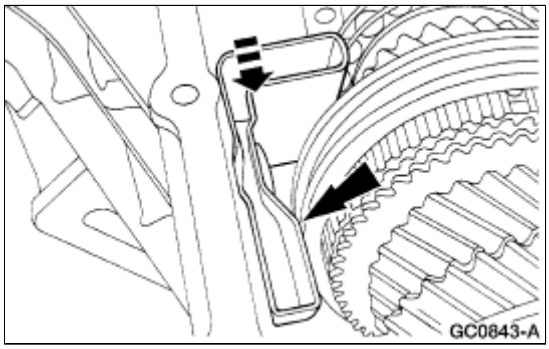


17. **NOTE:** To prevent damage to the fluid seal lip during assembly, tape the input shaft splines.

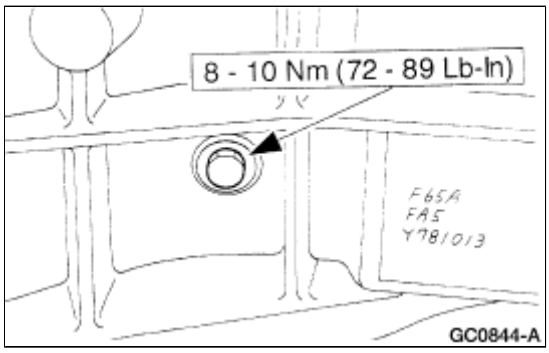
Install the front bearing retainer.
1. Position the front bearing retainer.
2. Install the bolts.



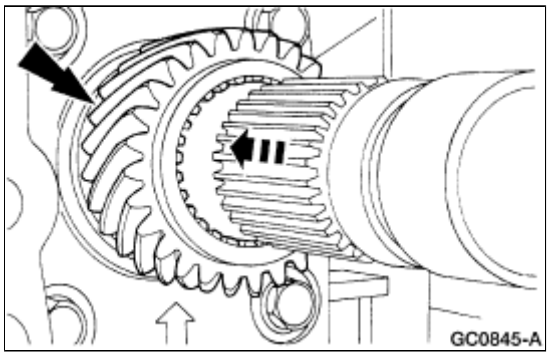
18. Position the fluid passage.



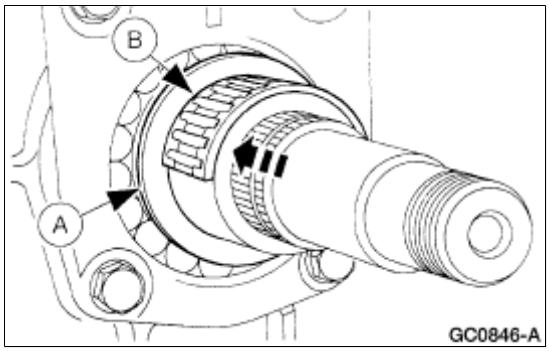
19. Install the fluid passage bolt.



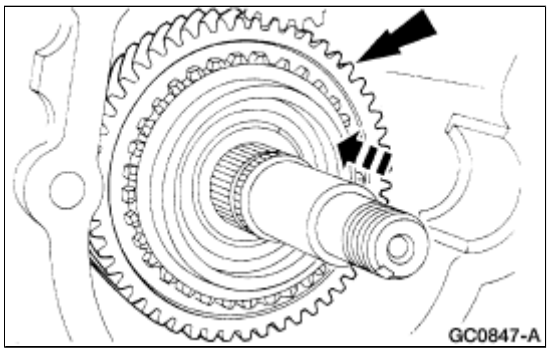
20. Install the output shaft fourth gear (4GR) (7112).



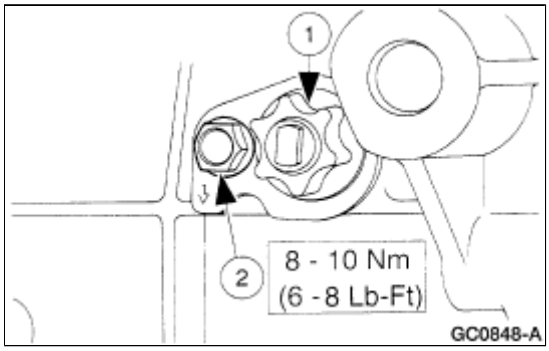
21. Install the (A) race and the (B) fifth speed gear split bearing on the countershaft.



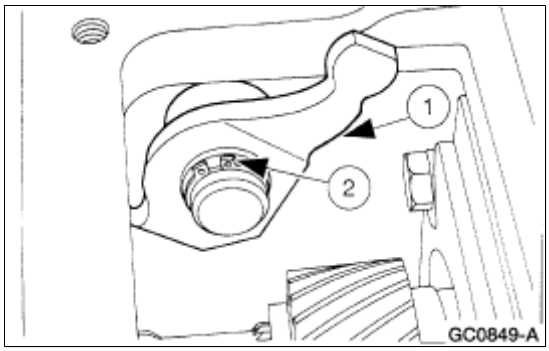
22. Install the countershaft fifth speed gear (7K316).



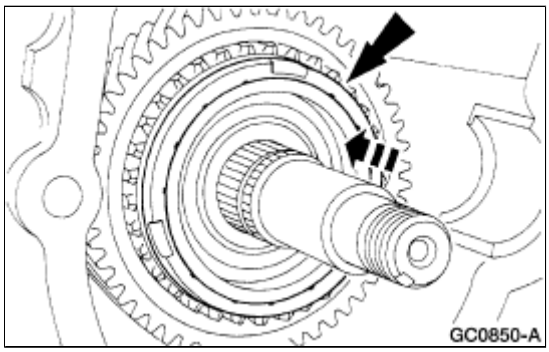
23. Install the counter lever shaft assembly.
    1. Position the counter lever shaft and plate.
    2. Install the counter lever shaft bolt.



24. Install the 5th reverse shift lever.
    1. Position the 5th reverse shift lever.
    2. Install the 5th reverse shift retaining ring.

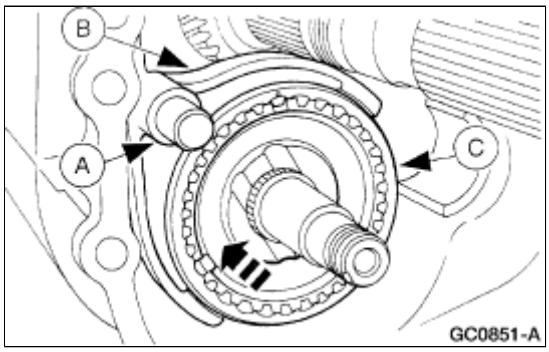


25. Install the countershaft fifth gear synchronizer blocking ring (7107).

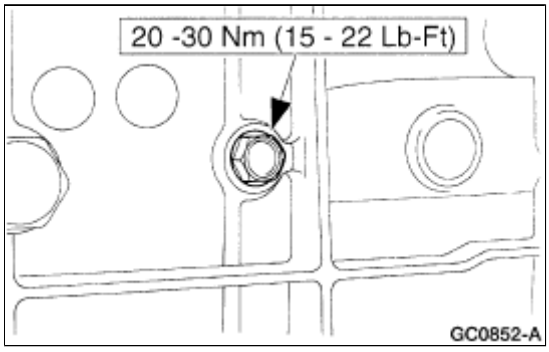


26. **NOTE:** The reference mark on the synchronizer sleeve must face toward the reverse gear.

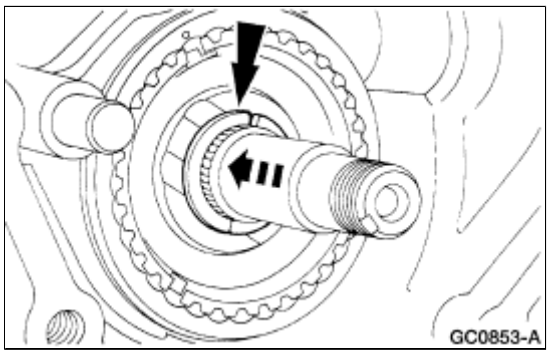
    Install the (A) fifth/reverse shift rail, the (B) shift fork, and the (C) synchronizer.



27. Install the fifth/reverse shift rail bolt.



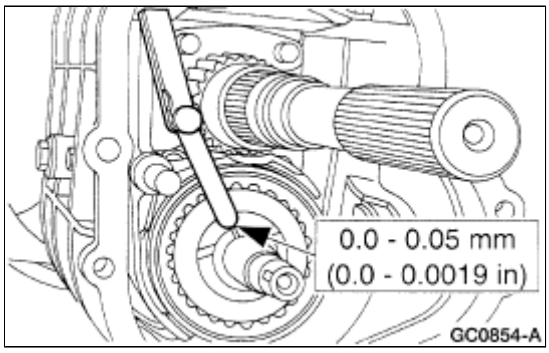
28. Install the synchronizer split washer (7R482).



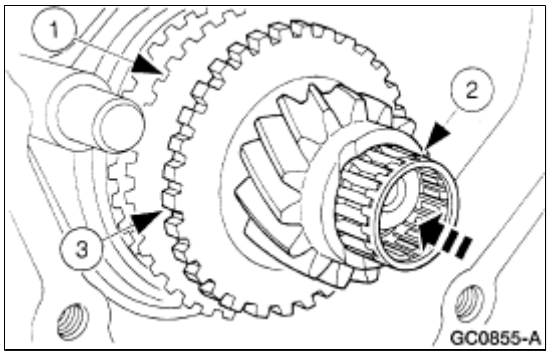
29. Check clutch hub end play.
    - If clutch hub end play is not within specification, select and install the correct split washer.

Spilt Washer Select Chart

Part Number	Thickness mm (in)
E8TZ-7R482-A	3.0 (0.118)
E8TZ-7R482-B	3.1 (0.122)
E8TZ-7R482-C	3.2 (0.125)
E8TZ-7R482-D	3.3 (0.129)
E8TZ-7R482-E	3.4 (0.133)
E8TZ-7R482-F	3.05 (0.120)
E8TZ-7R482-G	3.15 (0.124)
E8TZ-7R482-H	3.25 (0.127)
E8TZ-7R482-J	3.35 (0.131)
E8TZ-7R482-K	3.45 (0.135)
E8TZ-7R482-L	3.50 (0.137)



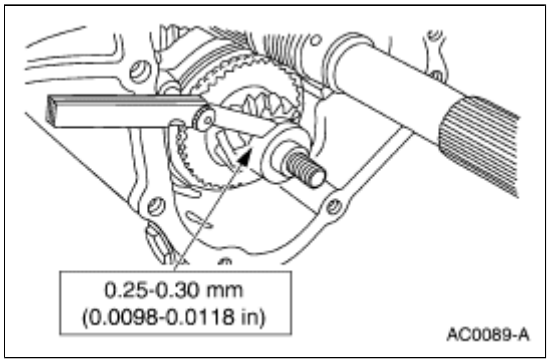
30. Install the countershaft reverse gear (7N040).
    1. Install the countershaft reverse gear.
    2. Install the two countershaft reverse gear bearings (7N270).
    3. Install the reverse synchronizer blocking ring.



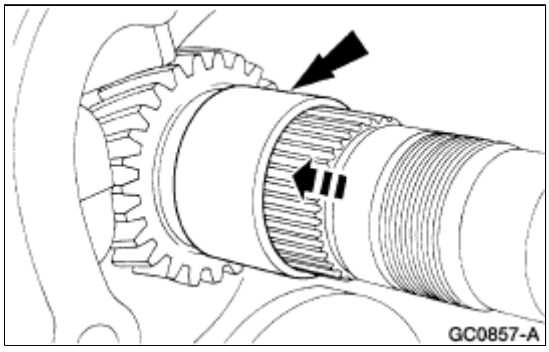
31. Measure the countershaft reverse gear end play.
    - Install the thrust washer and hold it against the shoulder on the countershaft while checking the end play.
    - Determine the correct thrust washer to obtain the correct end play.

Thrust Washer Select Chart

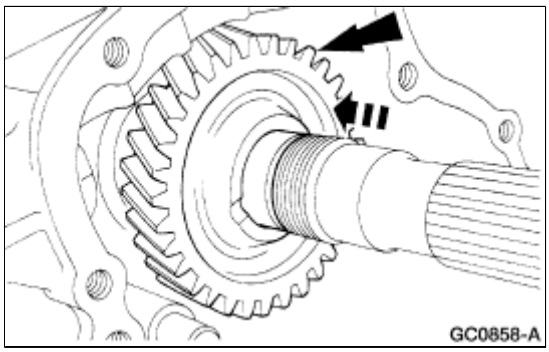
Part Number	Thickness mm (in)
E8TZ-7C340-A	7.45 (0.293)
E8TZ-7C340-B	7.65 (0.301)
E8TZ-7C340-C	7.85 (0.309)
E8TZ-7C340-D	7.35 (0.289)
E8TZ-7C340-E	7.55 (0.297)
E8TZ-7C340-F	7.75 (0.305)



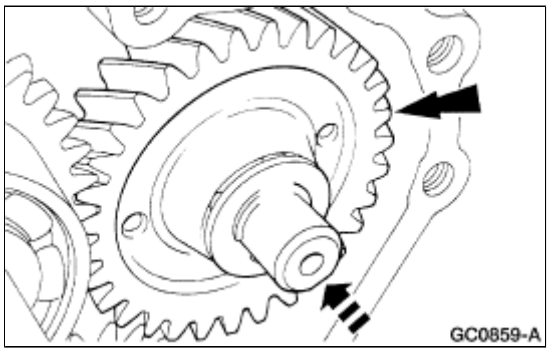
32. Install the output shaft spacer.



33. Install the output shaft reverse gear.

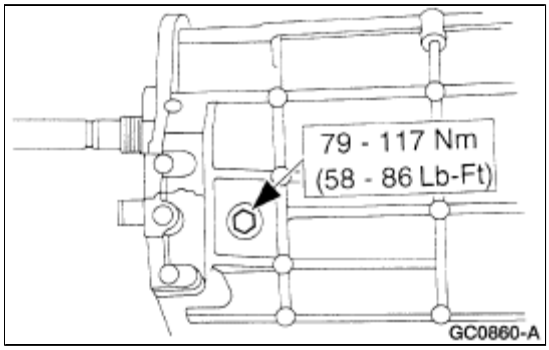


34. Install the reverse idler gear and bushing (7141).

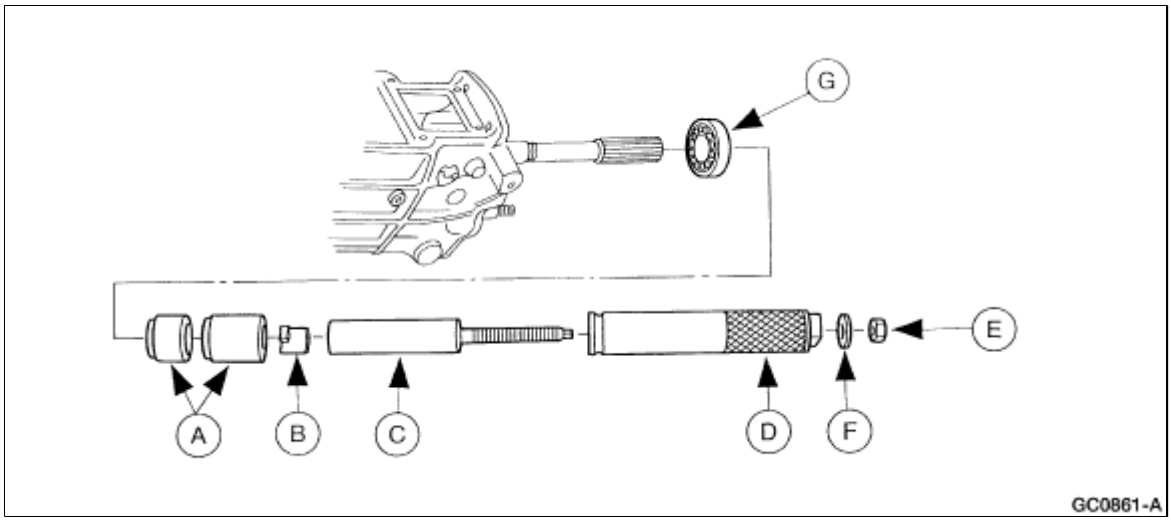


35. **NOTE:** Reverse idler shaft bolt must be installed within four minutes after applying silicone.

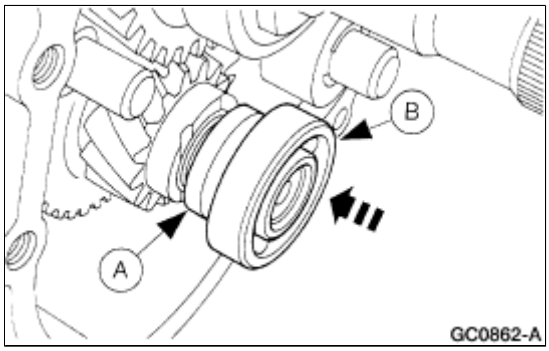
    Apply Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specification ESB-M4G92-A to reverse idler shaft bolt threads and install the reverse idler shaft bolt.



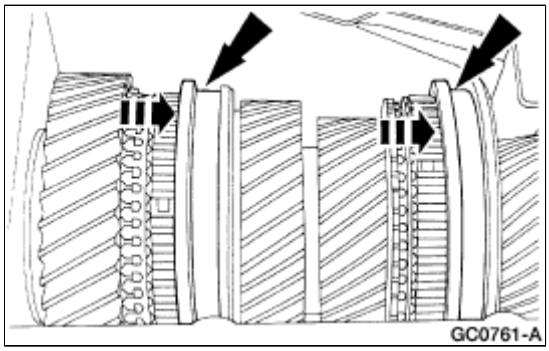
36. Use (A) Gear Replacing Spacer, (B) Shaft Collar, (C) Shaft Sleeve Replacer, (D) Remover/Replacer Tube, (E) nut and (F) washer to install the (G) output shaft rear bearing.



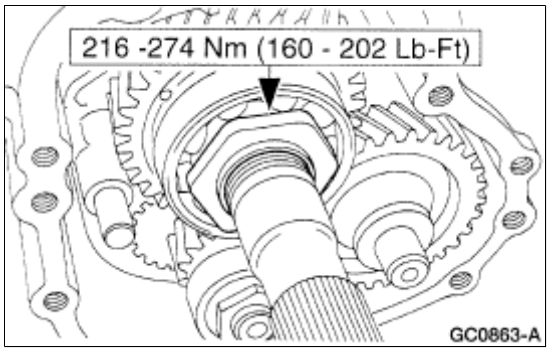
37. Install the (A) thrust washer and (B) countershaft rear bearing (7D283).



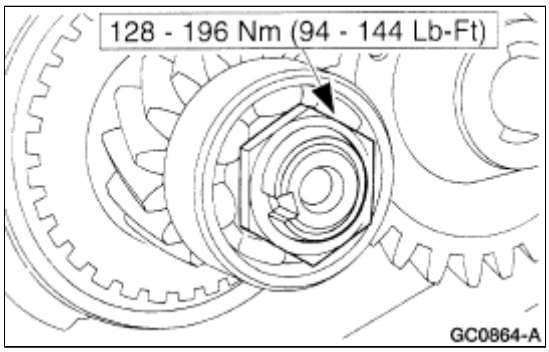
38. Lock the transmission into first and third gear.



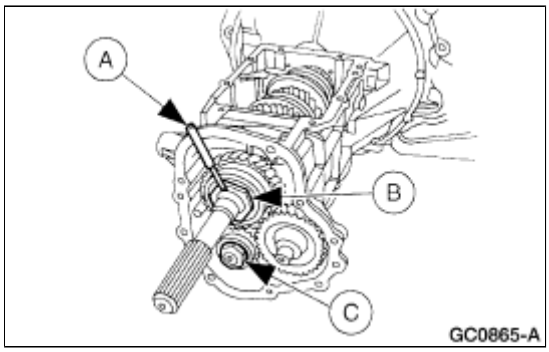
39. Use Mainshaft Locknut Wrench to install a new output shaft rear bearing lock nut (7B364).



40. Install a new countershaft locknut.



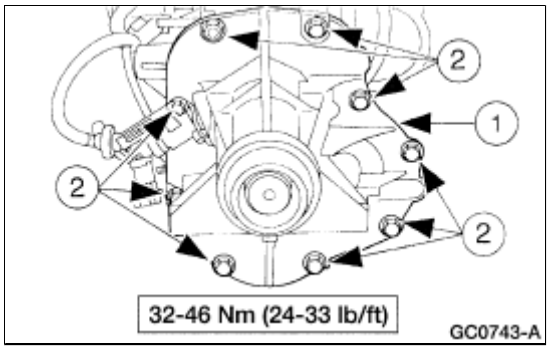
41. Use (A) Countershaft Locknut Staking Tool to stake the (B) output shaft rear bearing lock nut and the (C) countershaft locknut.



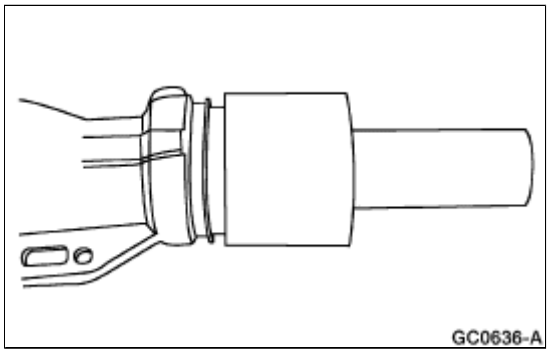
42. **NOTE:** Extension housing must be installed within four minutes after applying silicone.

    Apply a small bead of Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specification ESB-M4G92-A to the extension housing mating surface.

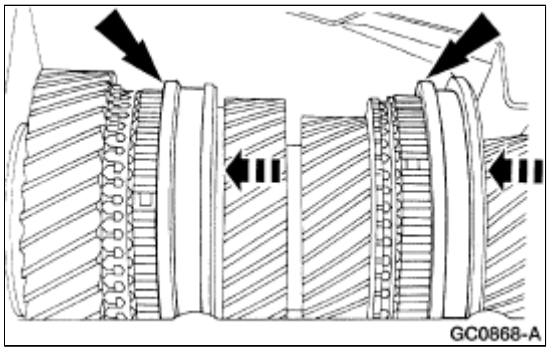
43. Install the extension housing (7A039).
    1. Position the extension housing.
    2. Install the bolts.



44. Use Extension Housing Seal Replacer to install the extension housing seal.



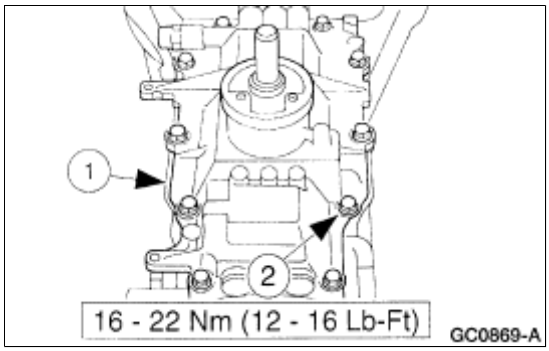
45. Place the synchronizer sleeves in neutral.



46. **NOTE:** Case cover must be installed within four minutes after applying silicone.

    Apply a small bead of Silicone Rubber D6AZ-19562-AA or equivalent meeting Ford specification ESB-M4G92-A to the case cover mating surface.

47. Install the case cover (7222).
    1. Position the case cover.
    2. Install the bolts.

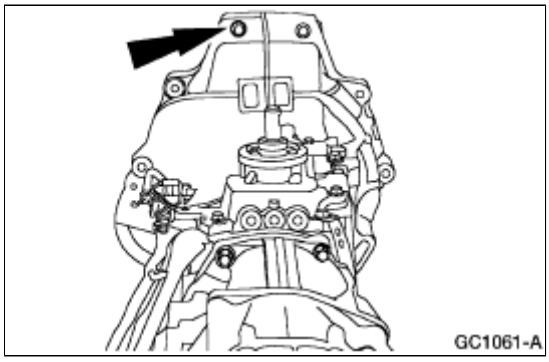

1
2
16 - 22 Nm (12 - 16 Lb-Ft)
GC0869-A

Transmission

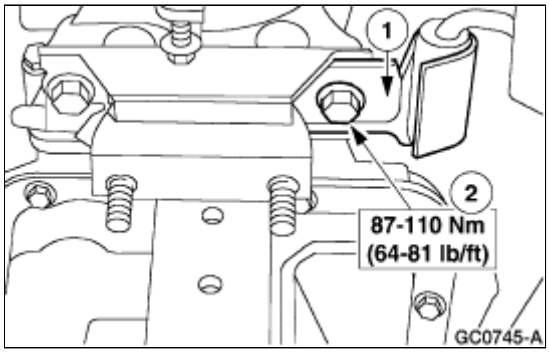
Special Tool(s)

 ST1927-A	Hi-Lift Transmission Jack 164-R3508 or equivalent

1. Position the transmission onto a Hi-Lift Jack.
2. Raise and position the transmission.
3. Install the nine transmission to engine bolts.

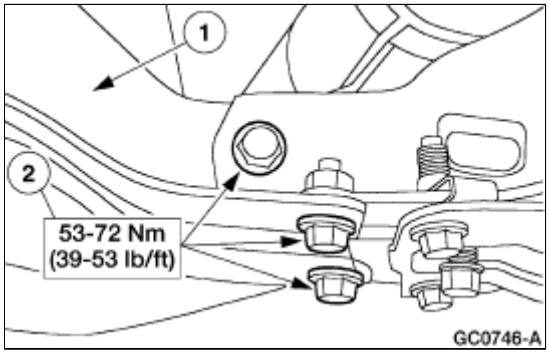


4. Install the exhaust inlet crossover pipe; refer to Section 309-00 .
5. Install the (RH) transmission mount bolt.
    1. Position the exhaust bracket.
    2. Install the bolt.

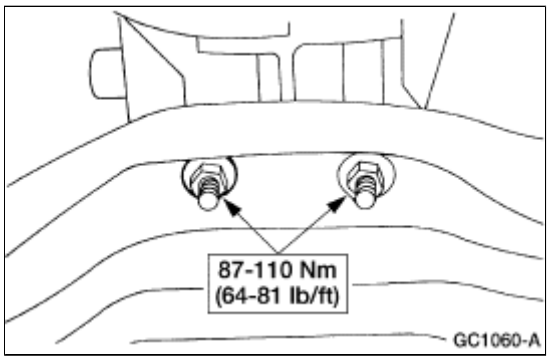


6. Install the rear crossmember.
    1. Position the crossmember.

2. Install the six bolts (three each side).



7. Install the nuts.



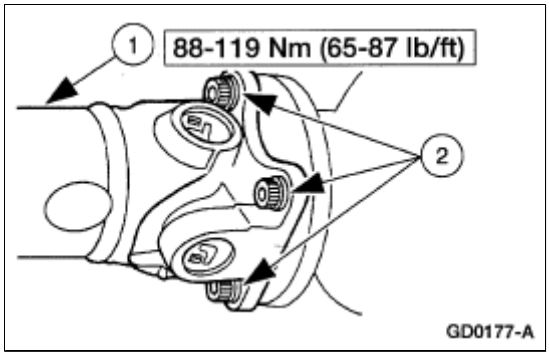
8. Remove the Hi-Lift Jack.

9. Install the starter motor (11001); refer to Section 303-06 .

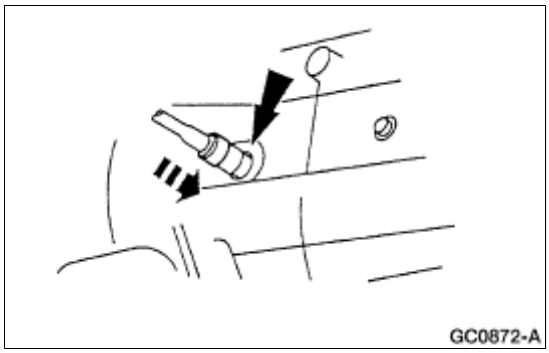
10. On 4-wheel drive vehicles, install the transfer case; refer to Section 308-07B .

11. **NOTE:** To maintain initial driveshaft balance, align marks on the rear driveshaft yoke and axle flange made during removal.

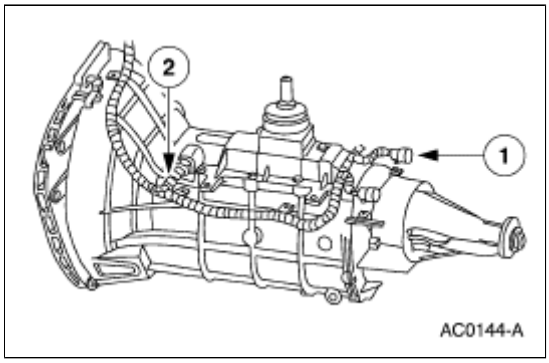
    Install the rear driveshaft.
    1. Position the rear driveshaft.
    2. Install the four bolts.



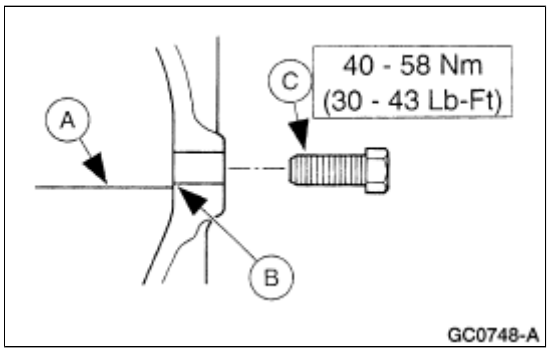
12. Connect the hydraulic clutch line.



13. Reconnect the transmission wiring harness.
    1. Connect the heated oxygen sensor (HO2S) connector.
    2. Connect the backup lamp switch connector.



14. Fill the transmission with (A) transmission fluid until it reaches the bottom of the (B) fill port and install the (C) case plug (7A010).
    - Use MERCON® Multi-Purpose Automatic Transmission Fluid XT-2-QDX or DDX or equivalent MERCON® automatic transmission fluid.



15. **NOTE:** If equipped with air suspension, reactivate the system by turning on the air suspension switch.

    Lower the vehicle.

16. Install the gear shift lever; refer to Shift Lever and Boot in this section.

17. Connect the battery ground cable (14301).