

SERVICE MANUAL

SERVICE MANUAL SECTION

CF 500, CF 600 Transmission

Truck Model: CF 500

Truck Model: CF 600

Unit Code: 13ADK

Unit Code: 13ADL

S13036

10/17/2005

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Follow all warnings, cautions, and notes.

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Safety Information

NOTE: Read the following before starting the service procedure.

The information contained in this International Service Manual Section was current at the time of printing and is subject to change without notice or liability.

You must follow your company safety procedures when you service or repair equipment. Be sure to understand all of the procedures and instructions before you begin work on the unit.

International uses the following types of notations to give warning of possible safety problems and to give information that will prevent damage to the equipment being serviced or repaired.



WARNING: A warning indicates procedures that must be followed exactly. Personal injury or possible death can occur if the procedure is not followed.

CAUTION: A caution indicates procedures that must be followed exactly. If the procedure is not followed, damage to equipment or components can occur.

NOTE: A note indicates an operation, procedure or instruction that is important for correct service.

Some procedures require the use of special tools for safe and correct service. Failure to use these special tools when required can cause injury to service personnel or damage to vehicle components.

This service manual section is intended for use by professional technicians, NOT a "do-it-yourselfer." It is written to inform these technicians of conditions that may occur on some vehicles, or to provide information

that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, DO NOT assume that the service section applies to your vehicle. See your International Truck Dealer for information on whether this service section applies to your vehicle.

Automatic Transaxle/Transmission — 5R110

Specifications

Table 1 General Specifications

Item	Specification
Fluid	
CAUTION: MERCON®, MERCON® V and MERCON® SP are not interchangeable transmission fluids.	
	<ul style="list-style-type: none"> • Use of any fluid other than the recommended fluid may cause transmission damage. • The transmission fluid should be changed every 48,000 km (30,000 miles) regardless of normal or special operating conditions.
ONLY MERCON® SP Automatic Transmission Fluid 2645005R1	MERCON® SP
Fluid Capacity	
	<ul style="list-style-type: none"> • The fluid capacities are approximate dry fill capacities and include the fluid coolers, fluid filter and fluid cooler tubes. • Fluid should be checked with the vehicle on a level surface and at normal operating temperature.
Transmission Fluid	18.0L (19.2 quart)

Table 2 Band, Clutch, Solenoid, Application Chart (A)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
P	P	—	HP/LA ^a	—	—	LP/HA
N	N	—	HP/LA ^a	—	—	LP/HA
R	R	—	HP/LA ^a	—	A	HP/LA
OD with Tow/Haul OFF	1	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	2	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	3	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	4 ^b	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	5	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	6	Yes	HP/LA ^a	A	—	LP/HA

^a ECM Calibration Controlled^b Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(I) = Inversely Proportional

Table 3 Band, Clutch, Solenoid, Application Chart (B)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
P	P	—	LP/LA	—	LP/LA
N	N	—	LP/LA	—	LP/LA
R	R	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	1	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	2	A	HP/HA	—	LP/LA
OD with Tow/Haul OFF	3	—	LP/LA	A	HP/HA
OD with Tow/Haul OFF	4@	A	HP/HA	A	HP/HA
OD with Tow/Haul OFF	5	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	6	A	HP/HA	—	LP/LA
<p>@ Cold Strategy HP = High Pressure LP = Low Pressure HA = High Current LA = Low Current A = Applied (D) = Directly Proportional</p>					

Table 4 Band, Clutch, Solenoid, Application Chart (C)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
P	P	—	LP/HA	A ^{ab}	a
N	N	—	LP/HA	A ^{ab}	a
R	R	A ^c	LP/HA ^c	A ^a	HP/HA ^a
OD with Tow/Haul OFF	1	—	LP/HA	A ^{ad}	a
OD with Tow/Haul OFF	2	—	LP/HA	—	LP/LA
OD with Tow/Haul OFF	3	—	LP/HA	A	LP/LA
OD with Tow/Haul OFF	4 ^c	—	LP/HA	—	LP/LA
OD with Tow/Haul OFF	5	A	HP/LA	—	LP/LA
OD with Tow/Haul OFF	6	A	HP/LA	—	LP/LA

^a ECM Calibration Controlled^b 207 kPa (30 psi) until MPH reaches 5 km/h (3 mph)^c Clutch Applied Through Manual Valve Position^d Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(D) = Directly Proportional

(I) = Inversely Proportional

Table 5 Band, Clutch, Solenoid, Application Chart (D)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
P	P	LP/LA	X	X
N	N	LP/LA	X	X
R	R	LP/LA	X	—
OD with Tow/Haul OFF	1	^a	X	X
OD with Tow/Haul OFF	2	^a	O/R	X
OD with Tow/Haul OFF	3	^a	X	O/R
OD with Tow/Haul OFF	4 ^b	^a	O/R	O/R
OD with Tow/Haul OFF	5	^a	X	O/R
OD with Tow/Haul OFF	6	^a	O/R	O/R

^a ECM Calibration Controlled
^b Cold Strategy
O/R = Overrunning
LP = Low Pressure
LA = Low Current
X = Holding
(D) = Directly Proportional

Table 6 Band, Clutch, Solenoid, Application Chart (E)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
P	P	—	HP/LA ^a	—	—	LP/HA
N	N	—	HP/LA ^a	—	—	LP/HA
R	R	—	HP/LA ^a	—	A	HP/LA
OD with Tow/Haul ON	1	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	2	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul ON	3	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	4 ^b	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul ON	5	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	6	Yes	HP/LA ^a	A	—	LP/HA

^a ECM Calibration Controlled^b Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(I) = Inversely Proportional

Table 7 Band, Clutch, Solenoid, Application Chart (F)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
P	P	—	LP/LA	—	LP/LA
N	N	—	LP/LA	—	LP/LA
R	R	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	1	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	2	A	HP/HA	—	LP/LA
OD with Tow/Haul ON	3	—	LP/LA	A	HP/HA
OD with Tow/Haul ON	4 ^a	A	HP/HA	A	HP/HA
OD with Tow/Haul ON	5	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	6	A	HP/HA	—	LP/LA

^a Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(D) = Directly Proportional

Table 8 Band, Clutch, Solenoid, Application Chart (G)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
P	P	—	LP/HA	A ^{ab}	a
N	N	—	LP/HA	A ^{ab}	a
R	R	A ^c	LP/HA ^c	A ^a	HP/HA ^a
OD with Tow/Haul ON	1	—	LP/HA	A ^a	a
OD with Tow/Haul ON	2	—	LP/HA	A ^a	HP/HA
OD with Tow/Haul ON	3	—	LP/HA	—	LP/LA
OD with Tow/Haul ON	4 ^d	—	LP/HA	—	LP/LA
OD with Tow/Haul ON	5	A	HP/LA	—	LP/LA
OD with Tow/Haul ON	6	A	HP/LA	—	LP/LA

^a ECM Calibration Controlled

^b 207 kPa (30 psi) until MPH reaches 5 km/h (3 mph)

^c Clutch Applied Through Manual Valve Position

^d Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(D) = Directly Proportional

(I) = Inversely Proportional

Table 9 Band, Clutch, Solenoid, Application Chart (H)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
P	P	LP/LA	X	X
N	N	LP/LA	X	X
R	R	LP/LA	X	—
OD with Tow/Haul ON	1	^a	X	X
OD with Tow/Haul ON	2	^a	O/R	X
OD with Tow/Haul ON	3	^a	X	O/R
OD with Tow/Haul ON	4 ^b	^a	O/R	O/R
OD with Tow/Haul ON	5	^a	X	O/R
OD with Tow/Haul ON	6	^a	O/R	O/R

^a ECM Calibration Controlled
^b Cold Strategy
O/R = Overrunning
LP = Low Pressure
LA = Low Current
X = Holding
(D) = Directly Proportional

Table 10 Band, Clutch, Solenoid, Application Chart (I)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
Manual 3rd	3	Yes	HP/LA ^a	A	A	HP/LA
Manual 2nd	2	Yes	HP/LA ^a	A	—	LP/HA
Manual 1st	1	Yes	HP/LA ^a	A	A	HP/LA

^a ECM Calibration Controlled
HP = High Pressure
LP = Low Pressure
HA = High Current
LA = Low Current
A = Applied
(I) = Inversely Proportional

Table 11 Band, Clutch, Solenoid, Application Chart (J)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
Manual 3rd	3	—	LP/LA	A	HP/HA
Manual 2nd	2	A	HP/HA	—	LP/LA
Manual 1st	1	—	LP/LA	—	LP/LA

HP = High Pressure
LP = Low Pressure
HA = High Current
LA = Low Current
A = Applied
(D) = Directly Proportional

Table 12 Band, Clutch, Solenoid, Application Chart (K)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
Manual 3rd	3	—	LP/HA	—	LP/LA
Manual 2nd	2	—	LP/HA	A	HP/HA
Manual 1st	1	—	LP/HA	A	HP/HA

HP = High Pressure
LP = Low Pressure
HA = High Current
LA = Low Current
A = Applied
(D) = Directly Proportional
(I) = Inversely Proportional

Table 13 Band, Clutch, Solenoid, Application Chart (L)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
Manual 3rd	3	^a	X	O/R
Manual 2nd	2	^a	O/R	X
Manual 1st	1	^a	X	X

^a ECM Calibration Controlled
O/R = Overrunning
X = Holding
(D) = Directly Proportional

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 14 Pressure Chart A

Gear	Line Pressure — kPa (psi)		Commanded (a) — PC-A pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	414 (60)	—	248 (36)	—
R	496 (72)	2,068 (300)	310 (45)	1,407 (204)
(D)	538 (78)	1,793 (260)	338 (49)	1,379 (200)
3	538 (78)	1,793 (260)	338 (49)	1,172 (170)
2	551 (80)	1,379 (200)	338 (49)	952 (138)
1	538 (78)	1,793 (260)	338 (49)	1,213 (176)

(a) = commanded pressure as viewed on diagnostic equipment.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 15 Pressure Chart B

Gear	Commanded (a) — SSPC-A pressure kPa (psi)		Commanded (a) — SSPC-B pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	0	—	0	—
R	531 (77)	2,068 (300)	0	0
(D)	0	0	0	0
3	572 (83)	1,820 (264)	0	0
2	0	0	586 (85)	1,434 (208)
1	0	0	0	0

(a) = commanded pressure as viewed on diagnostic equipment.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 16 Pressure Chart C

Gear	Commanded (a) — SSPC-C pressure kPa (psi)		Commanded (a) — SSPC-D pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	0	—	0	—
R	0	0	0 (b)	0 (b)
(D)	0	0	0	0
3	572 (83)	1,820 (264)	0	0
2	0	0	0	0
1	0	0	0	0

(a) = commanded pressure as viewed on diagnostic equipment.

(b) = SSPC-D commanded pressure as viewed on diagnostic equipment will be zero. The manual valve controls pressure to the direct clutch in the R detent position.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 17 Pressure Chart D

Gear	Commanded (a) — SSPC-E pressure kPa (psi)	
	Idle	WOT Stall
P, N	965 (140)	—
R	1,048 (152)	0
(D)	207 (30)	0
3	0	0
2	1,103 (160)	0
1	1,089 (158)	0

(a) = commanded pressure as viewed on diagnostic equipment.

Table 18 Stall Speed Chart

Engine	Min.	Max.
4.5L Diesel	2,091	2,401

NOTE: All shift speeds are for normal mode, not with tow/haul ON.

NOTE: Shift speeds listed, are nominal and will vary with calibration, model, axle ratio and tire size.

Table 19 Shift Speeds

Throttle Position	(D) Position Shift	Speed Tow/Haul OFF MPH	Speed Tow/Haul OFF Km/H	Speed Tow/Haul ON MPH	Speed Tow/Haul ON Km/H
Closed	6–5	21–23	34–37	21–23	34–37
	5–3	13–14	21–23	13–14	13–14
	3–2	—	—	—	—
	3–1	6–7	10–11	6–7	10–11
	2–1	6–7	—	6–7	—
Minimum Throttle APP3 1.25 Volts	1–2	7–9	11–14	8–9	13–14
	2–3	10–12	16–19	12–14	19–22
	3–4 ^a	—	—	—	—
	3–5	15–17	24–27	17–19	27–31
	4–6 ^a	—	—	—	—
	5–6	22–25	35–39	26–29	42–47
Wide Open	1–2	17–19	27–31	17–19	27–31
	2–3	24–27	39–43	24–27	39–43
	3–4 ^a	—	—	—	—
	3–5	34–38	55–61	34–38	55–61
	4–6 ^a	—	—	—	—
	5–6	54–60	87–97	54–60	87–97
^a Cold Strategy					

Table 20 Forward Clutch Pack

				Selective Snap Rings
Clutch	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	4	4	1.65-1.15 (0.065-0.045)	3.22-3.12 (0.127-0.123) 2.92-2.82 (0.115-0.111) 2.61-2.51 (0.103-0.099) 2.30-2.20 (0.091-0.087) 2.00-1.90 (0.079-0.075)

Table 21 Direct Clutch Pack

				Selective Snap Rings
Application	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	4	4	1.2-0.76 (0.05-0.03)	2.44-2.34 (0.096-0.092) 2.21-2.11 (0.087-0.083) 1.98-1.88 (0.078-0.074) 1.75-1.65 (0.069-0.065) 1.52-1.42 (0.060-0.056)

Table 22 Intermediate Clutch Pack

				Selective Snap Rings
Application	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	3	3	1.81-0.88 (0.071-0.035)	—

Table 23 Coast Clutch Pack

				Selective Snap Rings
Application	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	3	3	1.71-0.81 (0.067-0.032)	1.65-1.55 (0.065-0.061)

Table 24 Reverse Clutch Pack

				Selective Snap Rings
Application	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	6	6	3.01-1.81 (0.119-0.071)	1.88-1.98 (0.074-0.078)

Table 25 Overdrive Clutch Pack

				Selective Snap Rings
Application	Steel	Friction	Clearance mm (in)	Thickness mm (in)
All	3	3	1.79-0.78 (0.070-0.031)	2.6-2.5 (0.102-0.098) 2.05-1.95 (0.081-0.077)

Table 26 Gear Ratio

1st	3.114 to 1
2nd	2.218 to 1
3rd	1.545 to 1
4th	1.096 to 1
5th	1 to 1
6th	0.712 to 1
Reverse	2.88 to 1

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 27 Torque Specifications

Description	Nm	lb-ft	lb-in
Center support fluid feed bolts	32	24	—
Front support-to-fluid pump-to-case bolts	27	20	—
Coast clutch hub-to-overdrive carrier bolts	25 ^a	18 ^a	—
Cooler tube fitting-to-case nut	40	30	—
Extension housing-to-case bolts	47	35	—
Parking rod guide plate-to-case bolt	25	18	—
Solenoid body-to-case bolts	13	10	—
Transmission fluid pan drain plug	25	18	—
Transmission fluid pan-to-case bolts	15	11	—
Output shaft retaining nut	200	148	—
Parking pawl abutment-to-case bolts	25	18	—
Pump body-to-case bolts	29	21	—
Power take off plate-to-case bolts	41	30	—
Solenoid body and ditch plate-to-case bolts	13	10	—
Transmission range sensor-to-case bolts	10	—	89
Output shaft speed (OSS) sensor bolt	9	—	80
Solenoid body electrical connector bolt	5	—	44
Turbine shaft speed and intermediate shaft speed (TSS) sensor bolt	9	—	80
Transmission fluid cooler tube nut at case	40	30	—
Transmission fluid filler tube bracket bolt (upper)	31	23	—
Transmission fluid filler tube bracket bolt (lower bellhousing bolt)	47	35	—
Remote filter housing	50	37	—
Torque converter-to-flexplate nut	35	26	—
Output shaft flange bolt	135	100	—
Shift cable bracket bolts	25	18	—
Transmission-to-engine bolts	47	35	—
Transmission rear mount bolts	94	69	—
Transmission support crossmember-to-frame bolts	81	60	—
Transmission control module (TCM) cover	10	—	89
Inner splash shield	31	23	—

^a Plus 90 degrees

Description and Operation

Transmission Description

The transmission features include:

- six speeds.
- a fully automatic transmission.
- direct electronic shift control.
- optional power take-off.



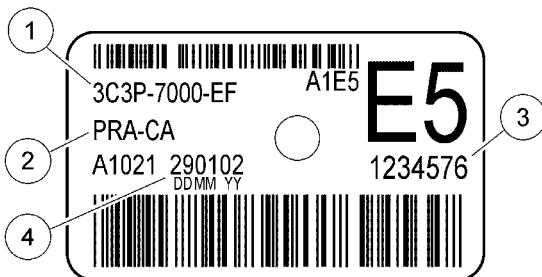
The main operating components include:

- a torque converter clutch.
- six multiple-disc friction clutches.
- two mechanical diode one-way clutches (OWC).
- three planetary gear sets.

A0058385

Identification Tags

An identification tag is located on the left side of the transmission, rearward of the manual control lever.



N0018685

Figure 1

1. Assembly part number prefix and suffix
2. Transmission model
3. Serial number
4. Build date (day, month and year)

Range Selection

The transmission has 7 range positions: P, R, N, (D), 3, 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.

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.

Third Position — 3rd Gear

This position provides:

- third gear start and hold.

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- improved traction and engine braking on slippery roads.

Second Position — 2nd Gear

If this position is selected at higher speeds, the transmission will downshift into a lower gear, and will downshift into 1st gear after the vehicle decelerates to the correct speed. The transmission will not downshift if it will cause an engine over-speed condition.

This position provides:

- second gear start and hold.
- improved traction and engine braking on slippery roads.

First Position — Manual Low Gear

If this position is selected at higher speeds, the transmission will downshift into a lower gear, and will downshift into 1st gear after the vehicle decelerates to the correct speed. The transmission will not downshift if it will cause an engine over-speed condition.

This position provides:

- first gear operation only.
- engine braking for descending steep grades.

Tow/Haul

The tow/haul feature was designed to assist the driver when towing a trailer or a heavy load. All transmission gear ranges, including all 5 forward gears, are available when using the tow/haul feature.

The tow/haul function is activated and deactivated through a switch located on the shift lever knob. The indicator light that is located on the instrument panel will illuminate when the tow/haul is activated and will go off when deactivated.

With the tow/haul activated, the transmission will have the following features:

- Shifts will occur at higher vehicle speeds for a given accelerator pedal position to improve vehicle acceleration, reduce excessive shifting and increase the coast braking capability.
- The torque converter will lock up at lower vehicle speeds than normal with a given accelerator pedal position to improve transmission cooling and efficiency.

- Upshifts are temporarily delayed while decreasing accelerator position during hill cresting to reduce excessive transmission shifting and to prepare for a possible grade braking downshift event.
- Engine braking is provided in all forward gears without the requirement of moving the shift lever.
- Manual 1, 2 or 3 will still be available.
- Grade braking downshift feature provides increased coast braking automatically to assist driver in maintaining desired speed while descending a grade. This reduces duty cycle on the brake system and increases brake pad longevity.
- Grade braking downshifts are automatically commanded when:
 - positive vehicle acceleration is sensed (natural acceleration from grade descent).
 - a near zero accelerator pedal position is obtained.
 - a minimum amount of time has expired since the last grade braking downshift.
- Grade braking downshift mode is immediately exited should the tow haul mode be deactivated or if the accelerator pedal is depressed beyond a minimum threshold.

Shift Patterns

The vehicle is equipped with adaptive shift strategy. Whenever the battery has been disconnected for any type of service or repair, the strategy parameters stored in keep alive memory (KAM) will be lost. The strategy will start or relearn once the battery is reconnected and the vehicle is driven. This is a temporary condition and normal operating mode will be resumed once the transmission control module (TCM) relearns all the parameters from the driving conditions. There is no set time frame for this process.

The customer must be notified that they may experience slightly firm upshifts, delayed or early shifts. This operation is considered normal and will not affect the function or durability of the transmission. As the TCM relearns its adaptive strategy, this temporary condition will be replaced by a normal operating condition.

The transmission upshifts and downshifts are firmer with tow/haul ON than when tow/haul is off.

Upshifts

Transmission upshifting is controlled by the TCM. The TCM 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 transmission range selector lever). There are 4 categories of automatic downshifts; Coastdown, Torque Demand, Forced or Kickdown shifts and grade braking.

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.

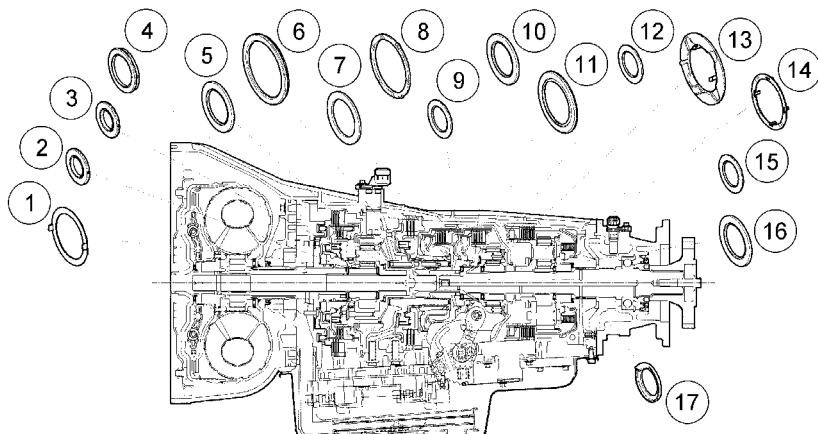
Kickdown

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.

Grade Braking

During tow/haul operation, depending on conditions, automatically scheduled downshifts may occur to increase the level of engine braking, particularly on down grades.

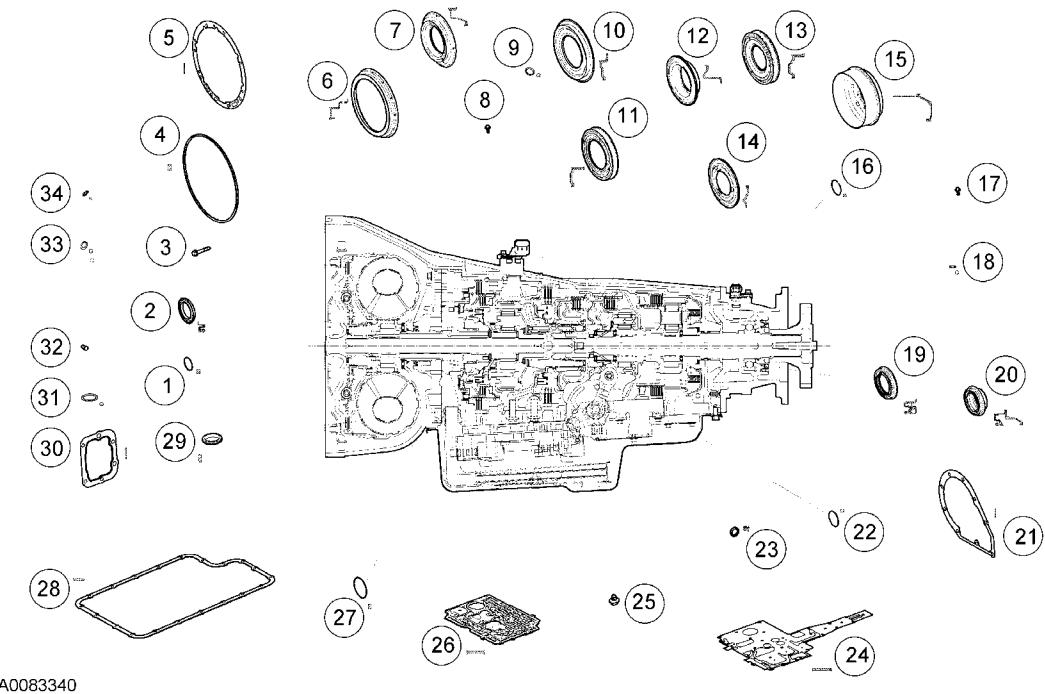
Some of these vehicles may be equipped with a PTO. During stationary operation in PARK or NEUTRAL, the torque converter is locked up when the PTO is on, line pressure is set to 1,034 kPa (150 psi) and the engine operates at 1200 rpm.

Bushings, Bearing and Thrust Washer Locator

N0029354

Figure 3

1. Front pump support washer No. 1T
2. Sun gear thrust bearing and race assembly No. 2B and 3B
3. Part of the overdrive carrier (7E031)
4. Direct clutch bearing and race assembly No. 4B
5. Sun gear thrust bearing and race assembly No 5B
6. Center support thrust washer
7. Intermediate clutch thrust bearing No. 8B
8. Intermediate brake thrust washer
9. Sun gear thrust bearing and race assembly No 10B, 12B, 15B
10. Forward clutch hub thrust washer No. 9T
11. Forward carrier bearing and race assembly No 11B
12. Sun gear thrust bearing and race assembly No 10B, 12B, 15B
13. Forward carrier lube dam
14. Planetary carrier thrust washer
15. Sun gear thrust bearing and race assembly No 10B, 12B, 15B
16. Bearing and race assembly No. 16B
17. Park gear thrust washer (fixed yoke)

Seals, Rings and Gasket Locator**Figure 4**

1. Stator support seal
2. Front pump support seal assembly
3. Pump-to-case bolts
4. Front pump seal-to-case
5. Front pump-to-case gasket
6. Overdrive clutch piston
7. Coast clutch piston
8. Sensor-to-case retaining bolt
9. Turbine shaft speed (TSS) and intermediate shaft speed sensor O-ring
10. Intermediate clutch piston
11. Direct clutch piston
12. Direct clutch balance piston
13. Forward clutch piston
14. Forward clutch balance piston
15. Reverse clutch piston
16. Case seal pack Teflon® seals
17. Sensor-to-case retaining bolt
18. Output shaft speed (OSS) sensor O-ring
19. Fixed yoke extension housing seal
20. Slip yoke extension housing seal
21. Extension housing-to-case gasket
22. Forward clutch piston Teflon® seals
23. Manual lever-to-case
24. Solenoid body-to-case gasket
25. Transmission fluid pan drain plug
26. Manifold-to-ditch plate filter and gasket
27. Coast clutch Teflon® seals
28. Transmission fluid pan-to-case gasket
29. Transmission fluid filter-to-case seal
30. Power take off (PTO) cover gasket (if equipped)
31. Solenoid body bulkhead electrical connector
32. Line pressure pipe plug
33. Cooler tube connector O-ring
34. Fluid fill tube-to-stub seal

Main Components and Functions

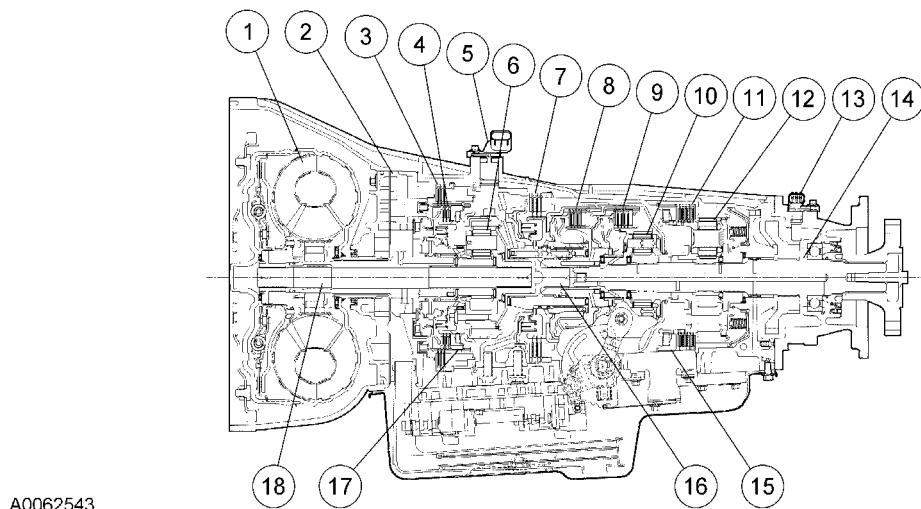


Figure 5 Automatic Transmission — Sectional View

- | | | |
|--|-------------------------------------|---|
| 1. Torque converter | 8. Direct clutch assembly | 15. Low/reverse mechanical diode one-way clutch (OWC) |
| 2. Pump assembly | 9. Forward clutch assembly | 16. Center shaft assembly |
| 3. Overdrive clutch assembly | 10. Forward planet assembly | 17. Coast mechanical diode (OWC) |
| 4. Coast clutch assembly | 11. Reverse clutch assembly | 18. Input shaft |
| 5. Turbine shaft speed (TSS) intermediate shaft speed sensor | 12. Reverse planet assembly | |
| 6. Overdrive planet assembly | 13. Output shaft speed (OSS) sensor | |
| 7. Intermediate clutch assembly | 14. Output shaft assembly | |

Torque Converter

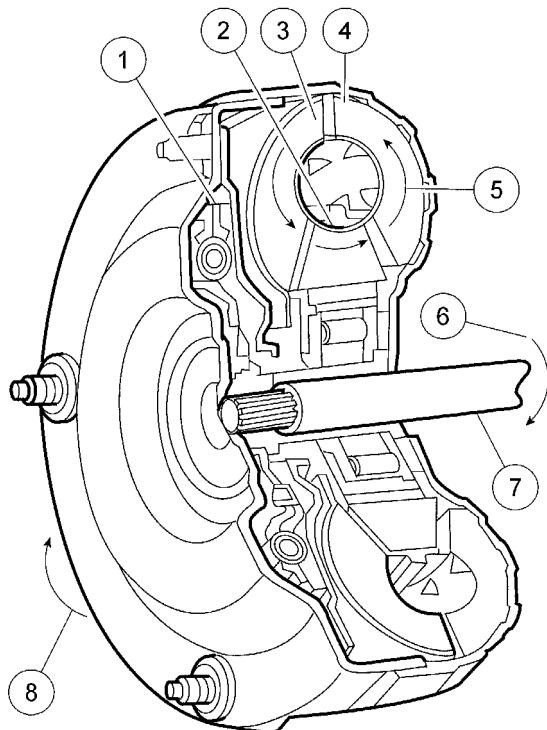
The torque converter transmits and multiplies torque. The torque converter is a device which includes 4 elements:

- The impeller assembly
- The turbine assembly
- The reactor assembly
- The 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, providing 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.



N0018686

Figure 6

1. Converter clutch and damper
2. Reactor
3. Turbine
4. Impeller
5. Fluid motion
6. Transmission input rotation
7. Input shaft
8. Engine rotation

Geartrain

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

- By holding or driving certain members of the gearset, 5 forward ratios and 1 reverse ratio are obtained and transmitted to the output shaft. The ratios are as follows:

Table 28 Gear Ratio

1st	3.114 to 1
2nd	2.218 to 1
3rd	1.545 to 1
4th ^a	1.096 to 1
5th ^a	1 to 1
6th ^a	0.712 to 1
REVERSE	2.88 to 1

^a Special operating strategy is enabled when transmission temperature is less than -15°C (5°F).

Input Shaft

The input shaft is supported by 2 bushings in the stator support. End positioning of the input shaft is controlled by the splines in the converter turbine and the overdrive planet assembly.

Output Shaft

The output shaft is supported by a press fit radial bearing in the extension housing. It is positioned by a bushing in the forward clutch cylinder, which in turn is positioned by the case center support and the center shaft.

Overdrive and Coast Clutch System

The overdrive (OD) and coast clutch system consists of the following:

- OD friction clutch assembly
- Coast clutch cylinder
- Overdrive sun gear
- Coast clutch input hub
- Coast clutch friction clutch assembly
- OD planetary
- OD ring gear
- Center shaft

The OD clutch piston has bonded lip seals. It is installed into the piston bore, cast into the pump and held in place by the return spring. The return spring is attached to the pump with 3 bolts. The OD clutch separator plates and pressure plate are splined to the case. The 3 OD friction plates are splined to the coast clutch cylinder. The OD clutch assembly is positioned between the pump face and a snap ring, and installed

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into the case adjacent to the OD pressure plate. The OD sun gear is pressed into the coast clutch cylinder.

The coast clutch piston is also a bonded lip seal type. The coast clutch piston is installed into the coast clutch cylinder and held to the cylinder along with the clutch return spring by a snap ring. The separator plates are splined to the case.

The coast clutch pressure plate is a mechanical diode one-way clutch (OWC) assembly. The OWC is splined to the coast clutch cylinder and held in with a snap ring. The coast clutch friction plates are internally splined to the coast clutch hub, which is held to the OD carrier by 4 bolts. Absorbing the load between the OD carrier and the OD sun gear is the "captured" thrust bearing, part of the OD planet assembly.

On the opposite side of the OD planet is a thrust bearing positioned between the carrier and the shaft. The OD ring gear is splined to the center shaft and retained by a snap ring. On the opposite side of the center shaft is a thrust bearing that separates it from the center support. The overdrive/coast clutch system is driven clockwise by the input shaft, one end of which is splined to the torque converter cover and the other end is splined to the OD carrier.

Center Support and Intermediate Clutch

The center support is rigidly held to the case by a tapered snap ring. The flat side faces toward the center support and the gap at 6 o'clock. The center support is also retained to the case by 2 hollow feed bolts. Both the forward clutch feed bolt and the intermediate clutch feed bolt are installed through the solenoid body worm trail of the case. The forward feed bolt has an orifice plug installed on top of the bolt head.

The center support acts as the intermediate clutch cylinder piston bore, and also provides the snap ring groove to retain the bonded seal type intermediate clutch piston and the return spring. A black phenolic thrust washer is positioned by its 2 tabs into 2 holes in the center support. A seal pack containing 2 Teflon® seals is pressed onto the center support hub below a pressed-on steel sleeve. The sleeve acts as the journal for the direct clutch cylinder bushings.

The intermediate clutch separator plates and pressure plate are externally splined to the case and the friction plates are internally splined to the direct clutch cylinder. The case and the center support define and limit the stroke of the intermediate clutch.

Forward Drive System

The forward drive system consists of the following:

- Direct clutch assembly
- Forward clutch assembly
- Forward ring gear
- Forward planetary assembly
- Forward/reverse input shell assembly

The direct clutch grooved cylinder contains the following:

- A bonded lip seal piston
- A direct clutch return spring
- A direct clutch bonded lip seal balance piston

These components are held in place by a snap ring to the direct clutch cylinder.

The direct clutch separator plates and pressure plate are splined to the direct clutch cylinder and held by a snap ring. The direct clutch friction internally splined plates mate with the grooved splines on the forward clutch cylinder. The forward clutch has a bonded lip seal piston, a beveled design return spring and a bonded lip seal balance piston, which are held to the cylinder with a snap ring.

The forward clutch cushion wave spring is splined to the cylinder, as are the separator plates and pressure plate, they are held together with a selective snap ring. The forward clutch friction plate is splined to the forward ring gear.

Positioned on the center support hub is a thrust bearing to locate the forward clutch cylinder. There is a thrust bearing positioned between the direct clutch cylinder and the forward clutch cylinder. There is also a thrust bearing positioned between the forward clutch cylinder and the forward ring gear; and between the forward planet and the forward clutch cylinder. There is a thrust washer separating the forward carrier from the forward ring gear hub. The 6 gear forward planet has a black, phenolic lube dam, which snaps onto the rear of the carrier body. Into the center of the input shell is the forward/reverse sun gear positioned by a spacer and held in place by a retaining ring.

Low and Reverse Drive System

The low and reverse drive system consists of the following:

- Reverse side of the forward/reverse sun gear
- Reverse planet assembly
- Reverse ring gear and hub assembly

The reverse ring gear and output shaft hub assemblies are splined to the output shaft. The reverse bonded lip seal piston installs into the case. The return spring is held to the case by a snap ring.

The reverse separator plates are splined to the case and the friction plates are splined to the reverse carrier. The pressure plate is combined with a mechanical diode one-way clutch, which is splined to the case and held in with a snap ring. There is a thrust bearing located between the case and the output shaft hub, and between the output shaft hub and the reverse sun gear. Located on both sides of the reverse carrier are white, phenolic thrust washers (4-tabbed).

Apply Components

The following information describes the operation of the 2 one-way clutches.

Overdrive One-Way Clutch (OWC) Mechanical Diode

The overdrive one-way clutch (OWC) mechanical diode is a one-way clutch, which also acts as the coast clutch pressure plate. It provides direct drive through the overdrive gearset when in power ON mode. It overruns in power OFF mode or when the overdrive clutch is applied.

Engine torque is transmitted in 1st, 3rd and 5th gears while the range selector lever is in the (D) position. The input shaft drives the overdrive carrier clockwise. The overdrive carrier which also turns clockwise, has the coast clutch hub bolted to it. The overdrive sun gear would turn counterclockwise, but is kept from turning by the coast clutch mechanical diode. The input shaft turns the same speed as the center shaft and transmits torque through it.

In 2nd, 4th and 6th gears the overdrive clutch is applied, the mechanical diode overruns and holds

the overdrive sun gear fixed to the case. This causes the overdrive planet to walk around the sun gear and over-drive the overdrive ring gear.

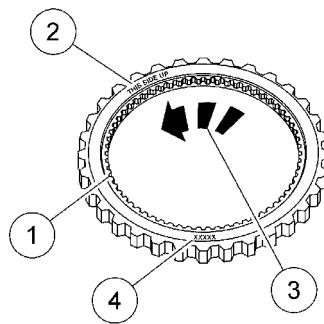


Figure 7 Overdrive One-Way Clutch Mechanical Diode

1. Overdrive one-way clutch inner race (overrunning)
2. Overdrive one-way outer race (stationary)
3. Counterclockwise rotation
4. Julian date

Low/Reverse Mechanical Diode

The low/reverse clutch mechanical diode is a one-way clutch which also functions as the low/reverse clutch pressure plate. The low/reverse mechanical diode has fewer external splines than the coast clutch mechanical diode. The low/reverse mechanical diode external splines mate with the case and the internal splines mate with the reverse ring gear/reverse planet assembly.

In 1st and 2nd, the center shaft drives the forward cylinder clockwise. The forward clutch is applied and holds the forward ring gear, driving it clockwise. The forward planet provides a counterclockwise resisting torque and the forward/reverse sun gear is driven counterclockwise. The low/reverse clutch is released. The low/reverse mechanical diode holds the reverse planet carrier body and allows the forward/reverse sun gear to drive the reverse planet gears, which in turn drive the output shaft ring gear and hub assembly. The forward planet and output shaft hub are both splined to the output shaft.

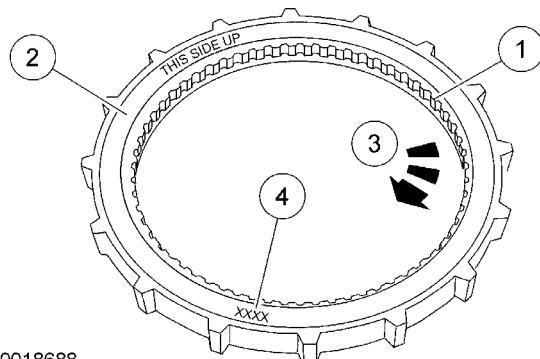


Figure 8 Low/Reverse Mechanical Diode — One-Way Clutch

1. Low/reverse one-way clutch inner race (overrunning)
2. Low/reverse one-way clutch outer race (stationary)
3. Clockwise rotation
4. Julian date

Transmission Electronic Control System

Electronic System Description

Transmission shift scheduling relies on the following:

- Accelerator pedal position
- Engine speed and acceleration
- Vehicle speed and acceleration
- Engine torque
- Converter state as defined by engine speed
- Turbine speed
- Transmission range sensor position
- Brake status
- Speed control status
- Tow/haul switch status
- Transmission fluid temperature
- Engine coolant temperature
- PTO engaged signal

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

- VFS (shift feel)
- Shift timing
- Line pressure (engagement feel)
- Torque converter clutch operation

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

The following components are used to determine engine torque information for the transmission control strategies:

- Crankshaft position (CKP) sensor
- Camshaft position (CMP) sensor
- Barometric pressure (BARO) sensor
- Mass air flow (MAF) sensor
- Manifold absolute pressure (MAP) sensor
- Engine oil temperature (EOT) sensor
- Air conditioning pressure (ACP) switch
- Exhaust gas recirculation (EGR) valve
- Injection pressure regulator (IPR)
- Manifold air temperature (MAT) sensor

Any concerns with the engine sensors must be diagnosed and repaired before proceeding with diagnosis of the transmission components. Refer to EGES-305, Engine Diagnostics Manual for engine component diagnosis.

Using all of these input signals, the TCM 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 TCM uses output solenoids to control transmission operation.

The following provides a brief description of each of the sensors and actuators used by the ECM and the TCM for transmission operation.

Remote Filter

This transmission is equipped with a remote transmission fluid filter. This filter passes 10 percent of the transmission fluid from the transmission through a small orifice into a serviceable filter element. The filtered fluid is then directed back into the rear lube circuit through the large opening in the remote manifold.

Transmission Output Shaft Speed (OSS) Sensor

The transmission output shaft speed (OSS) sensor is located on the extension housing. The OSS is a Hall-effect type sensor. The OSS reads the gear teeth on the park gear, different than the teeth used for PARK function. The OSS input to the TCM is used for shift scheduling, timing and torque converter clutch (TCC) operation vehicle speed. The OSS has bi-directional capability and has a digital output.

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a 2-wire thermistor sensor which changes resistance as temperature changes. The resistance of the sensor increases as engine temperature decreases and the voltage sent to the ECM increases. The TCM uses this information to help determine TCC operation.

Intake Air Temperature Sensor (IAT)

The intake air temperature (IAT) sensor is a thermistor in which resistance changes with temperature. The electrical resistance decreases as the temperature increases. The IAT provides air temperature information to the ECM and TCM which is used to help determine transmission line pressure and shift scheduling.

Accelerator Pedal Position (APP) Sensor

The accelerator pedal position (APP) sensor is mounted on the accelerator pedal on diesel applications. The APP detects the position of the accelerator pedal and inputs this information as a voltage to the ECM. The ECM and TCM uses APP sensor information to aid in determining line pressure, shift scheduling and TCC operation. Failure of this sensor will cause the transmission to operate at higher line pressure to avoid damage to the transmission. This higher line pressure causes harsh upshifts and harsh engagements.

Turbine Shaft Speed (TSS) Sensor and Intermediate Shaft Speed Sensor

The turbine shaft speed (TSS) and intermediate shaft speed sensors are a Hall-effect sensor requiring a 12-volt power and a ground. The other 2 terminals at the sensor are for TSS/intermediate shaft speed sensors output. The sensor detects teeth on the coast clutch input hub TSS and the adjacent overdrive ring gear intermediate shaft speed sensors. Both read 30 teeth per revolution. The TSS and intermediate shaft speed sensors are mounted externally on the transmission case toward the top of the driver's side. The TSS and intermediate shaft speed sensors input to the TCM is digital and used to determine line pressure, shift scheduling, timing and TCC operation.

Brake Pedal Position (BPP) Switch

Brake status comes from brake pedal position (BPP) switch. The BPP sensor supplies battery voltage to the ECM that the brake pedal is applied. The ECM and TCM uses this input to disengage the converter clutch, speed control and auxiliary idle (if equipped).

Transmission Control Module (TCM)

The operation of the transmission is controlled by the TCM. Many input sensors provide information to the TCM. The TCM then controls actuators which determine transmission operation.

Tow Haul Switch

The tow/haul switch is located on the end of the shift lever and is a momentary contact switch. The tow/haul switch provides a signal to the TCM when pressed by the driver, resulting in a change in shift and TCC scheduling. When the tow/haul switch has been pressed, the indicator light that is located on the instrument panel will illuminate "Tow/Haul - ON". When the switch is pressed again, tow/haul will be deactivated and the transmission control indicator lamp (TCIL) will turn OFF.

Transmission Control Indicator Lamp (TCIL)

The Transmission Control Indicator Lamp (TCIL) is used with the TCM to indicate to the driver that a transmission error has been detected. The TCIL is located on the instrument cluster with graphics that read "Check Trans".

The TCM controls the operation of the TCIL. The TCM flashes the TCIL when it detects faults with a transmission solenoid, transmission operation or with monitored shared sensors.

When the TCIL is illuminated, "Check Trans", the TCM may limit transmission operation to default (5th gear only) strategies. Continued operation of the transmission in this mode may cause internal transmission damage, have the transmission serviced immediately.

Transmission Solenoid Body Assembly

The TCM controls the transmission operation through:

- seven variable force solenoids (VFS).
- a transmission fluid temperature (TFT) sensor.
- a manual valve.
- an over-pressurization relief valve.

All of the above components are located on the solenoid body.

There is a solenoid dedicated to the function of each clutch. Line pressure and the torque converter clutch each have their own solenoid. Four solenoids are directly proportional; the pressure output is directly proportional to the applied DC amps. Three solenoids are inversely proportional; the pressure output is inversely proportional to the applied DC current.

Solenoids are keyed to prevent misassembly. The tan wire connectors connect to the solenoids. There are separate connectors for the TFT sensor and for the transmission range (TR-P) sensor. The 24-pin bulkhead connector completes the serviceable harness assembly and has serviceable O-ring seals. The 24-pin connector uses gold-plated pins.

All of the solenoids except the line pressure solenoid can be serviced without removing the solenoid assembly from the transmission case. The solenoid assembly, which holds the solenoids, is aligned to the transmission case with permanent dowel pins. There is a filter-type gasket between the solenoid assembly and the transmission case.

Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature (TFT) sensor twist-locks into the solenoid body. The TFT sensor is a temperature-sensitive device called a thermistor. The resistance value of the TFT sensor varies with temperature change. The TCM monitors the voltage across the TFT sensor to determine fluid temperature.

The TCM uses the TFT sensor signal to determine cold and hot shift and TCC scheduling. If the TCM has detected an over-temp condition a diagnostic trouble

code (DTC) will be set, then the TCM will illuminate the "Trans Temp" lamp on the instrument cluster. The over-temp degree setting is calibrated, with the actual temperature settings being application dependant.

Line Pressure Control Solenoid (PC-A)

The line pressure control (PC-A) solenoid is an inversely proportional 3-port device. The pressure output is inversely proportional to the applied DC current supplied through an electronically controlled driver, which varies the current between 0 and 1 amp from the TCM. The PC-A solenoid controls the line pressure circuits.

Torque Converter Clutch (TCC) Solenoid

The torque converter clutch (TCC) solenoid is a directly proportional VFS. The pressure output of this 3-port device is proportional to the applied DC current supplied through an electronically controlled driver which varies the current between 0 and 1 amp from the TCM.

Shift Solenoid Pressure Control Solenoids (SSPC-A, SSPC-B, SSPC-C, SSPC-D, SSPC-E)

The intermediate (SSPC-C), low/reverse (SSPC-E) and overdrive (SSPC-B) clutches are each controlled by a directly proportional variable force shift (VFS) solenoid. The coast (SSPC-A) and the direct clutch (SSPC-D) are each controlled by an inversely proportional VFS. All shift pressure solenoids are electronically controlled by the TCM which varies the current from 0 to 1 amp (direct proportional) or 1 to 0 amp (indirectly proportional).

Line Pressure Relief Valve

The solenoid body assembly contains an over-pressurization relief valve that will limit the line pressure through the (PC-A) solenoid and feedback to the pump main regulator valve. The LPC relief valve controls line pressure spikes when cold. If this valve fails, you may see concerns with the filter found in the solenoid body assembly.

Transmission Range (TR-P) Sensor Assembly

The transmission range (TR-P) sensor assembly is an internally mounted sensor that includes the detent spring, rooster comb and bracket, located next to the solenoid body. The components of the TR-P sensor are factory-adjusted to each other and the sensor must be installed as a calibrated assembly. The TR-P sensor contains electronic circuitry that provides the

TCM a fixed frequency at a duty cycle for each of the various positions of the manual lever (PARK, REVERSE, NEUTRAL, DRIVE, M3, M2 and M1) to the TCM. The TCM uses the TR-P sensor signal for engine functions (start, reverse lamps) and for line pressure control, shift scheduling and TCC operation.

Retrieving Diagnostic Trouble Codes

The TCM also logs Diagnostic Trouble Codes (DTC) to assist in diagnosing problems in the various systems. These DTC's can be retrieved and cleared using either the EZ-Tech III or manually as flash codes.

The following procedure must be used for retrieving flash codes.

1. Turn the key to ON but do not start the engine.
2. Place the shift selector in the 2 position.
3. Press the Tow/Haul switch 4 times within 4 seconds – this will initiate the code retrieval.

Once initiated, the following sequence will communicate any existing fault codes.

1. The CHECK TRANS, TRANS TEMP and TOW/HAUL indicator lamps all turn on simultaneously to indicate the diagnostic mode has been entered.
2. The CHECK TRANS and TRANS TEMP indicators turn off. The TOW/HAUL indicator will remain on.
3. The CHECK TRANS indicator will then communicate each digit of any fault code by flashing (for example, 1 flash = 1, 3 flashes = 3). There will be a pause between each of the 3 digits of the fault code.

4. If more than one fault code is present, the TRANS TEMP indicator will flash once between each fault code.
5. When all fault codes have been flashed, the TRANS TEMP indicator will flash twice and the TOW/HAUL indicator will turn off.

Once repairs have been made, the stored fault codes can be cleared as follows.

1. Turn the key to ON but do not start the engine.
2. Place the shift selector in the D position and push the Tow/Haul switch once.
3. Place the shift selector in the N position and push the Tow/Haul switch once.
4. Place the shift selector in the R position and push the Tow/Haul switch once.
5. Place the shift selector in the P position and push the Tow/Haul switch once.
6. The CHECK TRANS, TRANS TEMP and TOW/HAUL indicators will then flash three times to indicate that all codes have been cleared.

Diagnostic Trouble Code Index

NOTE: Some of the following DTC code symptoms may experience multiple DTC code symptoms. The loss of one or more gears could be experienced depending on transmission condition.

Table 29 Diagnostic Trouble Code Chart

Flash Code	DTC	Compon-ent	Descrip-tion	Condition	Symptom	Action
111	—	—	No codes found	—	—	—
113	P0706	TR-P Sensor	TR-P sensor frequency fault detected.	TR-P sensor signal frequency is out of normal range.	Only REVERSE, NEUTRAL and 5th gear detected. Engine may not crank.	GO to Pinpoint Test C.
114	P0707	TR-P Sensor	TR-P sensor circuit duty cycle low input.	TR-P sensor signal duty cycle is below threshold, sensor/circuit electrical malfunction.	Only REVERSE, NEUTRAL and 5th gear detected. Engine may not crank.	GO to Pinpoint Test C.
115	P0708	TR-P Sensor	TR-P sensor circuit duty cycle high input.	TR-P sensor signal duty cycle is above threshold, sensor/circuit electrical malfunction.	Only REVERSE, NEUTRAL and 5th gear detected. Engine may not crank.	GO to Pinpoint Test C.
412	P1702	TR-P Sensor	TR-P error.	TR-P sensor error detected.	Only REVERSE, NEUTRAL and 5th gear detected. Engine may not crank.	GO to Pinpoint Test C.
413	P1705	TR-P Sensor	TR-P sensor not in P or N positions during KOEO or KOER.	KOEO or KOER not run in P or N positions, or TR-P sensor circuit failure.	DTC is set.	RERUN KOEO and KOER in P or N position. GO to Pinpoint Test C.
122	P0711	TFT Sensor	No change if TFT during operation.	TCM has detected no TFT change during operation. TFT value stuck at some normal reading.	No 5th or 6th gears.	GO to Pinpoint Test B.
123, 121	P0712, P0710	TFT Sensor	157°C (315°F) indicated, TFT sensor circuit grounded.	Voltage drop across TFT sensor exceeds scale set for temperature of 157°C (315°F).	No 5th or 6th gears.	GO to Pinpoint Test B.
124, 121	P0713, P0710	TFT Sensor	-40°C (-40°F) indicated, TFT sensor circuit open.	Voltage drop across TFT sensor exceeds scale set for temperature of -40°C (-40°F).	No 5th or 6th gears.	GO to Pinpoint Test B.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compo- nent	Descrip- tion	Condition	Symptom	Action
414	P1711	TFT Sensor	TFT out of range during on-board diagnostics.	Transmission not operating at temperature during on-board diagnostics.	DTC set: engine cold or overheated.	Warm or cool engine to normal operating temperature. GO to Pinpoint Test B.
423	P1783	TFT Sensor	Transmission overtemp condition indicated.	Transmission fluid temperature exceeded 127°C (270°F).	Torque converter engages earlier than expected.	GO to Pinpoint Test B.
125	P0715	TSS Sensor	Insuff- icient input from TSS.	TCM detected a loss of TSS signal during operation.	Harsh shifts and engagements, engine rpm higher or lower than expected. No 1st, 3rd or 5th gear.	GO to Pinpoint Test D.
131	P0717	TSS Sensor	No TSS signal.	TCM has not detected a TSS signal.	Harsh shifts and engagements, engine rpm higher or lower than expected. No 1st, 3rd or 5th gear.	GO to Pinpoint Test D.
132	P0718	TSS Sensor	TSS signal noisy.	TCM has detected a noisy TSS signal.	—	GO to Pinpoint Test D.
133	P0720	OSS Sensor	Insuff- icient input from OSS.	TCM detected a loss of OSS signal during operation.	No 1st, 2nd, 3rd, 4th or 6th gear.	GO to Pinpoint Test D.
134	P0721	OSS Sensor	OSS signal noisy.	TCM has detected a noisy OSS signal.	—	GO to Pinpoint Test D.
135	P0722	OSS Sensor	No OSS signal.	TCM has detected no OSS signal.	No 1st, 2nd, 3rd, 4th or 6th gear.	GO to Pinpoint Test D.
435	U0100	TCM CAN	TCM communi-cation link error.	CAN link error detected by TCM. Loss of communication with the ECM.	Only reverse, neutral and 5th gears are available.	Refer to the Powertrain Control/ Emissions Diagnosis (PC/ED) manual.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Component	Descrip- tion	Condition	Symptom	Action
141	P0730	Clutch Control Solenoid or Internal Parts	Gear ratio error.	TCM has detected a gear ratio error. OWC clutch or clutches may have failed.	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). Engine rpm could be higher or lower than expected. May flash TCIL.	REFER to PID P0730_Status Chart, found immediately after Output State Control (OSC) Mode in this section, for a specific failure. REFER to the Solenoid Application charts located at the beginning of Pinpoint Tests — OSC Equipped Vehicles. If other solenoid DTCs are present, GO to Pinpoint Test A. If only P0730 is present, INSTALL the appropriate clutch solenoid. CLEAR DTCs, road test. If the concern is still present, REPAIR/INSTALL new internal transmission components.
142	P0740 (Output circuit check, generated only by electronic symptoms.)	TCC Solenoid	TCC solenoid open circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open.	Open circuit: TCC never engages.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compo- nent	Descrip- tion	Condition	Symptom	Action
143	P0741	TCC Solenoid	TCC solenoid circuit performance error.	Torque converter slippage detected during engagement command indicating a concern with mechanical or hydraulic operation of the converter clutch.	No TCC engagement.	Refer to Diagnosis By Symptom.
144	P0742	TCC Solenoid	TCC solenoid circuit shorted to ground.	TCC solenoid circuit fails to provide voltage drop across solenoid. Shorted to ground.	Short circuit: Only 5th gear at low vehicle speeds.	GO to Pinpoint Test A.
145	P0743	TCC Solenoid	TCC solenoid circuit failure.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit open, shorted or TCM driver failure during on-board diagnostics.	Open circuit: TCC never engages. Short circuit: Only 5th gear at lower speeds.	GO to Pinpoint Test A.
151	P0744	TCC Solenoid	TCC solenoid circuit shorted to power.	TCC solenoid circuit fails to provide voltage drop across solenoid. Circuit shorted to power.	No torque converter engagement.	GO to Pinpoint Test A.
421	P1744	TCC Solenoid	TCC solenoid circuit performance error.	Torque converter slippage detected during engagement command indicating a concern with mechanical or hydraulic operation of the converter clutch.	No TCC engagement.	Refer to Diagnosis By Symptom.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compon-ent	Descrip- tion	Condition	Symptom	Action
152	P0748 ^b	PC-A Line Pressure Control Solenoid	PC-A solenoid circuit failure.	Voltage through PC-A solenoid is checked. An error will be noted if tolerance is exceeded.	Open circuit: maximum PC-A pressure, harsh engagements and shifts. Engine rpm higher than expected. Only 5th gear present. Short circuit: Maximum PC-A pressure, harsh engagements and shifts. Engine rpm higher than expected.	GO to Pinpoint Test E.
314	P0960 ^b	PC-A Line Pressure Control Solenoid	PC-A solenoid circuit open failure.	Voltage through PC-A solenoid is checked. An error will be noted if tolerance is exceeded.	Open circuit: maximum PC-A pressure, harsh engagements and shifts. Engine rpm higher than expected.	GO to Pinpoint Test E.
315	P0962 ^b	PC-A Line Pressure Control Solenoid	PC-A solenoid short to ground circuit failure.	Voltage through PC-A solenoid is checked. An error will be noted if tolerance is exceeded.	Short circuit: Only 5th gear present.	GO to Pinpoint Test E.
321	P0963	PC-A Line Pressure Control Solenoid	PC-A solenoid short to power circuit failure.	Voltage through PC-A solenoid is checked. An error will be noted if tolerance is exceeded.	Maximum PC-A pressure, harsh engagements and shifts. Engine rpm higher than expected.	GO to Pinpoint Test E.
153	P0750 ^a	SSPC-A Coast Clutch	SSPC-A solenoid circuit open.	SSPC-A circuit failed to provide voltage drop across solenoid. Circuit open or TCM driver failure during on-board diagnostics.	No 2nd, 4th or 6th gear.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compo- nent	Descrip- tion	Condition	Symptom	Action
154	P0751	SSPC-A Coast Clutch	SSPC-A circuit, clutch or solenoid failure — OFF.	SSPC-A circuit, clutch or solenoid failed in the OFF position during operation resulting in HIGH pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• No 1st, 3rd or 5th gears available. Tow/Haul ON: <ul style="list-style-type: none">• No 1st, 3rd or 5th gears available.	GO to Pinpoint Test A.
155	P0752	SSPC-A Coast Clutch	SSPC-A circuit, clutch or solenoid failure — ON.	SSPC-A circuit, clutch or solenoid failed in the ON position during operation resulting in LOW pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• No 1st, 2nd, 3rd or 5th gears available. Tow/Haul ON: <ul style="list-style-type: none">• No 2nd, 4th or 6th gears available.	GO to Pinpoint Test A.
211	P0753*	SSPC-A Coast Clutch	SSPC-A solenoid circuit failure.	SSPC-A circuit failed to provide voltage drop across solenoid. Circuit failure or TCM driver failure.	Tow/Haul OFF: <ul style="list-style-type: none">• No 2nd, 4th, 5th or 6th gears available.• No gears available. Tow/Haul ON: <ul style="list-style-type: none">• No 1st, 2nd, 3rd, 4th or 6th gears available.	GO to Pinpoint Test A.
323	P0973	SSPC-A Coast Clutch	SSPC-A solenoid or circuit shorted to ground.	Voltage through SSPC-A solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• No 2nd, 4th, 5th or 6th gears available. Tow/Haul ON: <ul style="list-style-type: none">• No 1st, 2nd, 3rd, 4th or 6th gears available.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compon- ent	Descrip- tion	Condition	Symptom	Action
324	P0974	SSPC-A Coast Clutch	SSPC-A solenoid or circuit shorted to power.	Voltage through SSPC-A solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• No gears available. Tow/Haul ON: <ul style="list-style-type: none">• No 2nd, 4th or 6th gears available.	GO to Pinpoint Test A.
212	P0755 ^a	SSPC-B Overdrive Clutch	SSPC-B solenoid circuit open.	SSPC-B circuit, clutch or solenoid failed to provide voltage drop across solenoid. Circuit open or TCM driver failure during on-board diagnostics.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st or 3rd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
213	P0756	SSPC-B Overdrive Clutch	SSPC-B circuit, clutch or solenoid — OFF.	SSPC-B circuit, clutch or solenoid failed in the OFF position during operation resulting in LOW pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• No 2nd gear available. Tow/Haul ON: <ul style="list-style-type: none">• No 2nd, 4th or 6th gears available.	GO to Pinpoint Test A.
214	P0757	SSPC-B Overdrive Clutch	SSPC-B circuit, clutch or solenoid failure — ON.	SSPC-B circuit, clutch or solenoid failed in the ON position during operation resulting in HIGH pressure in the hydraulic circuit.	No 1st, 3rd or 5th gears available.	GO to Pinpoint Test A.
215	P0758 ^a	SSPC-B Overdrive Clutch	SSPC-B solenoid circuit failure.	SSPC-B circuit failed to provide voltage drop across solenoid. Circuit failure or TCM driver failure.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st or 3rd gears available.• No 2nd gear available. Tow/Haul ON: <ul style="list-style-type: none">• No 5th gear available.• Only 4th, 5th and 6th gears available.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compo-nent	Descrip-tion	Condition	Symptom	Action
331	P0976	SSPC-B Overdrive Clutch	SSPC-B solenoid or circuit shorted to ground.	Voltage through SSPC-B solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• No 2nd gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 4th and 6th gears available.	GO to Pinpoint Test A.
332	P0977 ^b	SSPC-B Overdrive Clutch	SSPC-B solenoid or circuit shorted to power.	Voltage through SSPC-B solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 3rd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
221	P0760 ^a	SSPC-C Intermediate Clutch	SSPC-C solenoid circuit open.	SSPC-C circuit failed to provide voltage drop across solenoid. Circuit open or TCM drive failure during on-board diagnostics.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
222	P0761	SSPC-C Intermediate Clutch	SSPC-C circuit, clutch or solenoid failure — OFF.	SSPC-C circuit, clutch or solenoid failed in the OFF position during operation resulting in LOW pressure in the hydraulic circuit.	No 3rd and 4th gear available.	GO to Pinpoint Test A.
223	P0762	SSPC-C Intermediate Clutch	SSPC-C circuit, clutch or solenoid failure — ON.	SSPC-C circuit, clutch or solenoid failed in the ON position during operation resulting in HIGH pressure in the hydraulic circuit.	Only 3rd and 4th gear available.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compon-ent	Descrip-tion	Condition	Symptom	Action
224	P0763 ^a	SSPC-C Intermediate Clutch	SSPC-C solenoid circuit failure.	SSPC-C circuit failed to provide voltage drop across solenoid. Circuit failure or TCM driver failure.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st, 2nd and 3rd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 4th and 5th gear available.	GO to Pinpoint Test A.
334	P0979	SSPC-C Intermediate Clutch	SSPC-C solenoid or circuit shorted to ground.	Voltage through SSPC-C solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 3rd gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 4th gear available.	GO to Pinpoint Test A.
335	P0980 ^b	SSPC-C Intermediate Clutch	SSPC-C solenoid or circuit shorted to power.	Voltage through SSPC-C solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
225	P0765	SSPC-D Direct Clutch	SSPC-D solenoid circuit open.	SSPC-D circuit failed to provide voltage drop across solenoid. Circuit open or TCM driver failure during on-board diagnostics.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 5th gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 6th gear available.	GO to Pinpoint Test A.
231	P0766	SSPC-D Direct Clutch	SSPC-D circuit, clutch or solenoid failure — OFF.	SSPC-D circuit, clutch or solenoid failed in the OFF position during operation resulting in HIGH pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• No 5th gear available. Tow/Haul ON: <ul style="list-style-type: none">• No 5th or 6th gears available.	GO to Pinpoint Test A.

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compo- nent	Descrip- tion	Condition	Symptom	Action
232	P0767	SSPC-D Direct Clutch	SSPC-D circuit, clutch or solenoid failure — ON.	SSPC-D circuit, clutch or solenoid failed in the ON position during operation resulting in LOW pressure in the hydraulic circuit.	No 1st, 2nd, 3rd or 4th gears available.	GO to Pinpoint Test A.
233	P0768	SSPC-D Direct Clutch	SSPC-D solenoid circuit failure.	SSPC-D circuit failed to provide voltage drop across solenoid. Circuit failure or TCM driver failure.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st, 2nd and 5th gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th and 6th gear available.	GO to Pinpoint Test A.
342	P0982 ^b	SSPC-D Direct Clutch	SSPC-D solenoid or circuit shorted to ground.	Voltage through SSPC-D solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
343	P0983 ^b	SSPC-D Direct Clutch	SSPC-D solenoid or circuit shorted to power.	Voltage through SSPC-D solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 5th gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 6th gear available.	GO to Pinpoint Test A.
234	P0770	SSPC-E Low/ Reverse Clutch	SSPC-E solenoid circuit open.	SSPC-E circuit failed to provide voltage drop across solenoid. Circuit open or TCM drive failure during on-board diagnostics.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Compon- ent	Descrip- tion	Condition	Symptom	Action
235	P0771	SSPC-E Low/ Reverse Clutch	SSPC-E circuit, clutch or solenoid failure — OFF.	SSPC-E circuit, clutch or solenoid failed in the ON position during operation resulting in LOW pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• No 1st gear available. Tow/Haul ON: <ul style="list-style-type: none">• No 1st or 2nd gears available.	GO to Pinpoint Test A.
241	P0772	SSPC-E Low/ Reverse Clutch	SSPC-E circuit, clutch or solenoid failure — ON.	SSPC-E circuit, clutch or solenoid failed in the OFF position during operation resulting in HIGH pressure in the hydraulic circuit.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st gear available. Tow/Haul ON: <ul style="list-style-type: none">• Only 1st or 2nd gears available.	GO to Pinpoint Test A.
242	P0773	SSPC-E Low/ Reverse Clutch	SSPC-E solenoid circuit failure.	SSPC-E circuit failed to provide voltage drop across solenoid. Circuit failure or TCM driver failure.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
345	P0985 ^b	SSPC-E Low/ Reverse Clutch	SSPC-E solenoid or circuit shorted to ground.	Voltage through SSPC-E solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to ground failure detected.	Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
351	P0986 ^b	SSPC-E Low/ Reverse Clutch	SSPC-E solenoid or circuit shorted to power.	Voltage through SSPC-E solenoid circuit is checked. An error will be noted if tolerance is exceeded. Short to power failure detected.	Tow/Haul OFF: <ul style="list-style-type: none">• Only 1st and 2nd gears available. Tow/Haul ON: <ul style="list-style-type: none">• Only 5th gear available.	GO to Pinpoint Test A.
243	P0791	Intermed- iate Shaft Speed Sensor	Insuff- icient input from intermed- iate shaft speed sensor.	TCM detected an insufficient signal from the intermediate shaft speed sensor during operation.	Harsh shifts or engagements, engine rpm higher or lower than expected. No 1st, 3rd or 5th gears.	GO to Pinpoint Test D.

Table 29 Diagnostic Trouble Code Chart (cont.)

Flash Code	DTC	Component	Description	Condition	Symptom	Action
244	P0793	Intermediate Shaft Speed Sensor	No input from intermediate shaft speed sensor.	TCM detected a loss of intermediate shaft speed sensor signal during operation.	Harsh shifts or engagements, engine rpm higher or lower than expected. No 1st, 3rd or 5th gears.	GO to Pinpoint Test D.
245	P0794	Intermediate Shaft Speed Sensor	Intermediate shaft speed sensor signal intermittent.	TCM has detected an intermittent intermediate shaft speed sensor signal.	—	GO to Pinpoint Test D.
422	P1780	TCS Switch	TCS switch input incorrect per selected position.	TCS switch voltage incorrect.	No Tow/Haul feature when TCS switch is pressed during self-test.	RERUN on-board diagnostics and cycle switch. If concern is still present, REFER to Automatic Transaxle/Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).

^a Output circuit check, generated only by electrical symptoms.
^b May also generate by some other non-electrical transmission hardware system.

Diagnosis and Testing

Preliminary Inspection

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

Know/Understand the Concern

In order to diagnose a concern correctly, you must first understand the customer complaint or condition. Customer contact may be required in order for the technician to begin to verify the concern. You must also understand the conditions when the concern occurs, for example:

- hot or cold vehicle temperature.
- hot or cold ambient temperature.
- vehicle driving conditions.

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

Verify the 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 transmission:

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 temperature
- 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.
- Vehicles equipped with power take-off (PTO), the PTO must be turned OFF. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

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

NOTE: The fluid level reading on the indicator will differ depending on 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 shows signs of leaking, the fluid level should be checked.

1. With the transmission in (P) PARK, the engine at idle and foot pressed on the brake, move the range selector lever through each gear and allow engagement of each gear. Place the range 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.

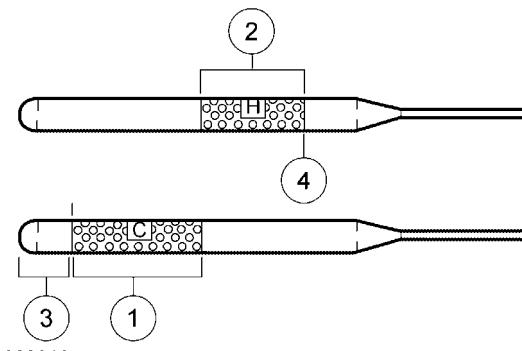


Figure 9

1. Cold Temperature Range
2. Normal Operating Temperature Range
3. DO NOT DRIVE IF BELOW THIS LEVEL AND OUTSIDE TEMPERATURE IS ABOVE 10°C (50°F) (Underfill). Recheck fluid level at normal operating temperature and adjust as required.
4. DO NOT DRIVE LEVEL (Overfill). Remove excess fluid. Recheck fluid level at normal operating temperature and adjust as required.

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 or damage. If an overfill reading is indicated, refer to Transmission Fluid Drain and Refill — Without Torque Converter Drain Plug and With Fluid Pan Drain Plug 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 0.25-L (1/2-pint) increments through the filler tube. Do not overfill the fluid. For fluid type, refer to the Fluid Type specification 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 drop 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, cooler tubes and remote filter.
7. Carry out diagnostic checks and adjustments. Refer to Diagnosis By Symptom in this section.

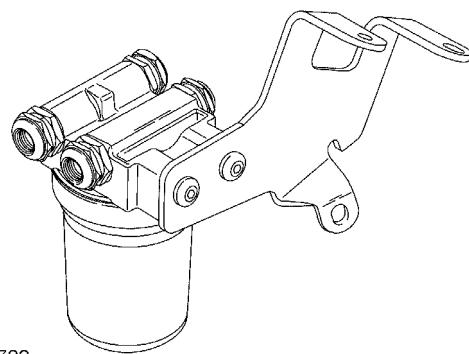


Figure 10 Remote Fluid Filter

The 5R110 transmission is equipped with a remote transmission fluid filter which is located on the driver side rear of the transmission. Most of the transmission fluid which leaves the front fluid cooler tube connector passes through the remote filter and is directed into the cooling circuit. The remote filter takes 10 percent of the incoming hot fluid and directs it through a small orifice and into a serviceable filter element. The filtered transmission fluid is then directed back into the rear lubrication circuit through the larger opening in the remote filter manifold. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning or Transaxle/Transmission Cooling(Transaxle / Transmission Cooling, page 299).

Road Testing Vehicle

The following 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

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

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

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

1. Bring engine and transmission up to normal operating temperature.
2. Operate the vehicle with the transmission range selector lever in (D) range.
3. Apply minimum throttle and observe the speeds at which the upshift occurs and the torque converter engages. (Refer to the shift speed chart.)
4. Press the accelerator pedal to the floor (wide-open throttle). The transmission should shift from 6th to 5th gear or 5th to 3rd, depending on vehicle speed. Torque converter clutch should disengage and then reapply.

5. With the vehicle speed above 48 km/h (30 mph), move the transmission range selector lever to manual 3. The transmission should immediately obtain 3rd gear. When the vehicle speed drops to 32 km/h (20 mph), a 3 to 1 shift should occur.
6. If transmission fails to upshift/downshift or if the torque converter clutch does not apply and release, refer to Diagnosis By Symptom in this section for concern diagnosis.

NOTE: Shift speeds listed, are nominal and will vary with calibration, model, axle ratio and tire size.

NOTE: All shift speeds are for normal mode, not with tow/haul ON.

Table 30 Shift Speeds

Throttle Position	(D) Position Shift	Speed Tow/Haul OFF MPH	Speed Tow/Haul OFF Km/H	Speed Tow/Haul ON MPH	Speed Tow/Haul ON Km/H
Closed	6–5	21–23	34–37	21–23	34–37
	5–3	13–14	21–23	13–14	13–14
	3–2	—	—	—	—
	3–1	6–7	10–11	6–7	10–11
	2–1	6–7	10–11	6–7	10–11
Minimum Throttle APP3 1.25 Volts	1–2	7–9	11–14	8–9	13–14
	2–3	10–12	16–19	12–14	19–22
	3–4 ^a	—	—	—	—
	3–5	15–17	24–27	17–19	27–31
	4–6 ^a	—	—	—	—
	5–6	22–25	35–39	26–29	42–47
Wide Open	1–2	17–19	27–31	17–19	27–31
	2–3	24–27	39–43	24–27	39–43
	3–4 ^a	—	—	—	—
	3–5	34–38	55–61	34–38	55–61
	4–6 ^a	—	—	—	—
	5–6	54–60	87–97	54–60	87–97

^a Cold Strategy

Torque Converter Diagnosis

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

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

During PTO operation, the on-board diagnostics will be disabled. However, the circuit checks made by the

diagnostic system and the FMEM will continue. The PTO must be turned off to do on-board diagnostics.

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 in this section.

4. Carry out Diagnostic Procedures.
 - Run on-board diagnostics. Refer to On-Board Diagnostics with diagnostic tool in this section.
 - Repair all non-transmission-related DTCs first.
 - Repair all transmission DTCs.
 - Rerun on-board diagnostics to verify repair.
 - Carry out Line Pressure Test in this section.
 - Carry out Stall Speed Test in this section.
 - Carry out Diagnostic Routines 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 repairing the torque converter.
5. Engine rpm should increase when brake pedal is tapped and decrease about 5 seconds after pedal is released. If this does not occur, refer to Diagnosis By Symptom — Torque Converter Clutch Operation Concerns in this section.

Visual Inspection

This inspection will identify modifications or additions to the vehicle operating system that may affect diagnosis.

Inspect vehicle for non-approved add-on devices such as:

- Electronic add-on items:
 - air conditioning
 - generators (alternators)
 - engine turbos
 - cellular telephones
 - cruise controls
 - turbo engine brake
 - CB radios
 - linear amplifiers
 - backup alarm signals
 - electronic brakes for trailer towing
 - computers
- Vehicle modifications.

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

Leaks; refer to Leakage Inspection in this section.

Shift Linkage Check

Check for a misadjustment in shift linkage by matching the detents in the transmission range selector lever with those 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.

For additional information, refer to Automatic Transaxle/Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307) for shift linkage adjustment.

Check TSIs and ISIS

Refer to all TSIs and ISIS messages that pertain to the transmission concerns, and follow the procedure outlined.

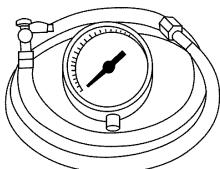
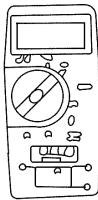
Carry out On-Board Diagnostics

NOTE: If equipped, turn the power take-off (PTO) unit off to make sure test results are correct. For a description of PTO operation, refer to Transmission Electronic Control System in this section. On-Board Diagnostic is not accessible when the PTO is in operation.

After a road test, with the vehicle warm and before disconnecting any connectors, carry out the Quick Test using the diagnostic tool. Refer to EGES-305, Engine Diagnostics Manual for diagnosis and testing of the engine control system.

Diagnostics

Table 31 Special Tools

 ST1300-A	UV Leak Detector Kit ZTSE4618
 ST1565-A	Transmission Fluid Pressure Gauge ZTSE9103
 ST1137-A	Automotive Meter ZTSE4357
 EZ-Tech III	

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 diagnostic tool, refer to the diagnostic tool manual.

These quick tests should be used to diagnose the transmission control module (TCM) 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
- Clearing DTCs

Transmission Drive Cycle Test

NOTE: If equipped, turn the power take-off (PTO) unit off for correct test results. For a description of PTO operation, refer to Transmission Electronic Control System in this section.

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 4 times consecutively for the shift error DTC to be set. Torque converter clutch (TCC) failures must occur 5 times consecutively for a continuous TCC DTC code to be set.

NOTE: When carrying out the Transmission Drive Cycle Test, refer to the Solenoid Operation 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 the Quick Test codes.
2. Warm the engine to normal operating temperature.

3. Make sure the transmission fluid level is correct.
4. With the transmission range selector lever in (D), moderately accelerate from stop to 80 km/h (50 mph). This allows the transmission to shift into 5th gear. Hold the vehicle speed and throttle position steady for a minimum of 15 seconds.
5. With the transmission in 5th gear and a steady vehicle speed and throttle position, lightly apply and release the brake pedal enough to operate the stop lamps. Hold the vehicle speed and throttle position steady for a minimum of 15 seconds.
6. Brake to a stop and remain stopped for a minimum of 20 seconds.
7. Repeat Steps 4 through 6 at least 5 times.
8. Carry out Quick Test and record continuous codes.

After On-Board Diagnostics

NOTE: The vehicle wiring harness, transmission control module (TCM) and non-transmission sensors can affect transmission operations. Repair these concerns first.

After the On-Board Diagnostics procedures are completed, repair all DTCs.

Always repair all non-transmission-related DTCs first, then repair any transmission-related DTCs. Refer to the Diagnostic Trouble Code Charts in this section for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and to aid in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing electrical concerns of the transmission. Make sure the vehicle wiring harness and the TCM are diagnosed as well. The Engine Diagnostics Manual will aid in diagnosing non-transmission-related electronic components.

Before Pinpoint Tests

NOTE: Prior to entering pinpoint tests, check the transmission control module (TCM) wiring harness for correct connections, bent or broken pins, corrosion, loose wires, correct routing, correct seals and their condition. Check the TCM, sensors and actuators for damage.

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 in this section for the appropriate procedure. Prior to entering pinpoint tests, refer to any TSIs and ISIS messages for transmission concerns.

Output State Control (OSC) Mode

Description

Output state control (OSC) on a service diagnostic tool allows the technician to control the main functions of the transmission such as gear shifts, torque converter clutch or the shift solenoids quickly and easily. For example, the OSC allows the technician to command the torque converter clutch to engage while monitoring the actual converter slip, or disengage the torque converter clutch while testing the transmission upshifts or downshifts. The technician may command a shift solenoid to turn ON or OFF while carrying out the electrical tests, while measuring voltage or current with an inductive pickup.

Procedure to access and use the OSC

1. Using the service diagnostic tool:

- select Tool Box.
- select Data Logger.
- select Modules.
- select TCM.

2. Using the OSC:

- highlight a signal with a pound (#) sign so a black bar appears around the selected signal.
 - select the (#) icon of the right side of the screen where 3 new icons will appear below it.
 - select the activate icon (finger on button icon). The (#) symbol by the signal will change to an (=) sign indicating control of the item.
 - use the (+) or (-) buttons to increase or decrease the values to control icon. The increments will be 10% of the scaled value. Example of TCC case shown will be in changes of 10%.
3. To stop OSC, select the activate icon which will change the (=) sign back to (#) sign next to the signal name.

If an (!) symbol is shown instead of an (=) sign then an OSC error has occurred. This could be because of a condition not correct.

The OSC has 2 modes of operation for the transmission:

- Service bay mode
- Drive mode

In order to operate the OSC in the DRIVE mode, no diagnostic trouble codes (DTCs) related to the transmission range (TR) sensor, turbine shaft speed (TSS) sensor, output shaft speed (OSS) sensor or the SSPC-A (coast clutch), SSPC-B (overdrive clutch), SSPC-C (intermediate clutch), SSPC-D (direct clutch), SSPC-E (low/reverse) and PC-A (line pressure) solenoids may be present. Carry out the KOEO on-demand self test and retrieve continuous codes to identify any codes that are present.

OSC For Transmission — Service Bay Mode

The SERVICE BAY mode is used to test various transmission components and functions when the vehicle is in the service bay. The service bay mode is used when carrying out electrical pinpoint tests and hydraulic pressure tests. Each OSC function has a unique set of vehicle operating requirements or vehicle states that the technician is required to meet before the transmission control module (TCM) will

allow the OSC to operate. The SERVICE BAY mode is used in the following 3 vehicle states:

Vehicle State No. 1

The Vehicle State No.1 requirements for sending an OSC value are as follows:

- Key on
- Engine not running
- Gear selector in PARK or NEUTRAL

Vehicle State No. 1 is used when carrying out electrical pinpoint tests. The following transmission components may be controlled using the OSC in Vehicle State No. 1:

- SSE_AMP — Controls the current to the SSPC-E (low/reverse clutch) solenoid.
- SSD_AMP — Controls the current to the SSPC-D (direct clutch) solenoid.
- SSC_AMP — Controls the current to the SSPC-C (intermediate clutch) solenoid.
- SSB_AMP — Controls the current to the SSPC-B (overdrive clutch) solenoid.
- SSA_AMP — Controls the current to the SSPD-A (coast clutch) solenoid.
- TCC_AMP — Controls the current to the torque converter (TCC) clutch solenoid.
- LINEDSD — Controls the commanded pressure, which in turn controls the current to the PC-A (line pressure control) solenoid.

The vehicle requirements must be met when sending the OSC value for SSPC-E, SSPC-D, SSPC-C, SSPC-B, SSPC-A, TCC and PC-A solenoids. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After sending the OSC value, if the vehicle requirements are no longer met, the (!) symbol will not appear but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel the OSC.

Vehicle State No. 2

The Vehicle State No. 2 requirements for sending an OSC value are as follows:

- Engine running

- Exception: Engine running greater than 1,000 rpm to control LINEDSD
- Gear selector in PARK or NEUTRAL

Vehicle State No. 2 is used when carrying out electrical pinpoint tests. The following transmission components may be controlled using the OSC in Vehicle State No. 2:

- SSE_AMP — Controls the current to the SSPC-E (low/reverse clutch) VFS solenoid.
- SSB_AMP — Controls the current to the SSPC-B (overdrive clutch) solenoid.
- SSA_AMP — Controls the current to the SSPC-A (coast clutch) solenoid.
- TCC_AMP — Controls the current to the torque converter (TCC) clutch solenoid.
- LINEDSD — Controls the commanded pressure, which in turn controls the current to the PC-A (line pressure control) solenoid.

The vehicle requirements must be met when sending the OSC value for SSPC-E, SSPC-B, SSPC-A, TCC and PC-A solenoids. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After sending the OSC value, if the vehicle requirements are no longer met, the (!) symbol will not appear but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel OSC.

Vehicle State No. 3

The Vehicle State No. 3 requirements for sending an OSC value are as follows:

- Engine running
- Gear selector in overdrive
- Vehicle not moving

Vehicle State No. 3 is used when carrying out electronic pressure control tests and electrical pinpoint tests. The following transmission components may be controlled using the OSC in Vehicle State No. 3:

- SSD_AMP — Controls the current to the SSPC-D (direct clutch) solenoid.

- **SSC_AMP** — Controls the current to the SSPC-C (intermediate clutch) solenoid.

The vehicle requirements must be met when sending the OSC value for SSPC-D and SSPC-C solenoids. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After sending the OSC value, if the vehicle requirements are no longer met, the (!) symbol will appear, but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel OSC.

The OSC options to control SSA_AMP, SSB_AMP, SSC_AMP, SSD_AMP, SSE_AMP, TCC_AMP for solenoids in SERVICE BAY mode are as follows:

- (+) icon — Commands the TCM to increase the control current.
- (-) icon — Commands the TCM to decrease the control current.
- Activate icon — Cancels OSC and allows the TCM normal control of the VFS solenoids.

Controlling the solenoids allows the technicians to measure the circuit current using an inductive pickup or to measure the circuit voltage when carrying out electrical tests.

- (+) icon — Commands the TCM to increase the control current.
- (-) icon — Commands the TCM to decrease the control current.
- Activate icon — Cancels OSC and allows the TCM normal control of the line pressure.

The OSC allows the technician to control the commanded line pressure instead of the PC-A current. The TCM will command a specific current to the PC-A solenoid when requesting a particular OSC line pressure. Using OSC to control the line pressure allows the technician to accurately test the electronic pressure control system by comparing the OSC command line pressure to the actual line pressure indicated on the gauge. This will aid in testing for pump capacity and the ability of the TCM to electronically control the pressure. The technician may also measure the circuit current using an inductive pickup or to measure the circuit voltage when carrying out an electrical test on the line pressure (PC-A) solenoid.

OSC For Transmission — Drive Mode

The DRIVE MODE allows control of 3 transmission functions. Each function has a unique set of vehicle operating requirements that the technician is required to meet before the TCM will allow OSC to operate. The drive mode allows the technician to carry out the following functions:

- **TCC#** — Commands the TCM to engage or disengage the torque converter clutch.
- **GEAR_OSC** — Commands the TCM to upshift or downshift.
- **HRSH_SFT** — Commands a higher pressure value during an upshift.

The OSC options to control TCC# to engage or disengage the torque converter clutch in drive mode are as follows:

- (+) icon — Commands the TCM to engage the torque converter clutch.
- (-) icon — Commands the TCM to keep the torque converter clutch from engaging.
- Activate icon — Cancels OSC and allows the TCM normal control of the torque converter clutch.

Controlling the torque converter clutch will assist the technician in testing the torque converter for engagements and disengagements. Also, the technician is better able to evaluate upshifts and downshifts by using the OSC to keep the torque converter clutch from engaging.

The vehicle requirements must be met when sending the OSC value for TCC#. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After the OSC value for TCC# is sent, if the vehicle requirements are no longer met, the (!) symbol will not appear but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel OSC.

The vehicle requirements for sending the TCC# value OFF are as follows:

- Engine running
- Gear selector in overdrive
- Vehicle speed greater than 5 km/h (3 mph)

The vehicle requirements for sending the TCC# value ON are as follows:

- Engine running
- Gear selector in overdrive
- Vehicle speed greater than 5 km/h (3 mph)
- Transmission fluid temperature (TFT) between 17°C and 135°C (60°F and 275°F)
- Brake is off when vehicle speed is below 32 km/h (20 mph)
- Not an excessive load on the engine
- Engine speed greater than 1,300 rpm

The OSC options to control GEAR_OSC to shift the transmission in DRIVE MODE are as follows:

- (+) icon — Commands the TCM to shift to the next higher gear automatically.
- (-) icon — Commands the TCM to shift to the next lower gear automatically.
- Activate icon — Cancels OSC and allows the TCM normal control of upshifts and downshifts.

Controlling the gear changes will assist the technician in testing the various clutches and bands and determine whether the transmission is slipping in any particular gear. The OSC will command the TCM to upshift or downshift depending on the gear the technician selects. The transmission will remain in the OSC gear selected until another OSC gear is selected or until OSC is cancelled.

NOTE: Fourth gear is not allowed to be commanded when using OSC.

The vehicle requirements must be met when sending the OSC value for GEAR_OSC. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After the OSC value for GEAR_OSC is sent, if the vehicle requirements are no longer met, the (!) symbol will not appear but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel OSC.

It is recommended to use TCC# to first turn off the torque converter clutch before testing the transmission gear changes. This will allow the

technician to evaluate only the gear changes. If the torque converter clutch is NOT turned OFF, the TCM will command the torque converter clutch to engage. This could make it difficult for the technician to determine whether an abnormal shift is the result of the torque converter clutch or the actual gear change.

The vehicle requirements for sending a GEAR_OSC value are as follows:

- Engine running
- Gear selector in overdrive
- Vehicle speed greater than 5 km/h (3 mph)

The OSC options to control HRSH_SFT to moderately increase line pressure to test for firmer engagements and shifts in drive mode are as follows:

- (+) icon — Commands the TCM to moderately increase hydraulic pressure.
- (-) icon — Commands the TCM to use normal pressure and not to increase hydraulic pressure.
- Activate icon — Cancels OSC.

Setting HRSH_SFT allows the technician to moderately increase the pressure when carrying out engagements such as PARK-to-REVERSE, NEUTRAL-to-REVERSE and when carrying out automatic upshifts. This will provide additional diagnostic information to help the technician determine whether the electronic pressure control system is providing at least limited control (a normal shift would become firmer) and/or whether a hydraulic circuit that may have abnormally low pressure (due to such things as low fluid level or leaky clutch) resulting in a soft shift, becomes normal when increasing the pressure.

The vehicle requirements must be met when sending the OSC value for HRSH_SFT. If the vehicle requirements are not met when sending the OSC value, an (!) symbol may appear. When the (!) symbol is received, the OSC is aborted and must be restarted. After the OSC value for HRSH_SFT is sent, if the vehicle requirements are no longer met, the (!) symbol will not appear but the OSC value will be canceled by the TCM (monitor corresponding PID). The control item activate icon may be pressed anytime to cancel OSC.

Using Output State Control (OSC) and Monitoring PIDs

Additional PIDs should be monitored to help the technician accurately diagnose the transmission. The following is a list of PIDs to monitor while using OSC.

Table 32 PID Chart

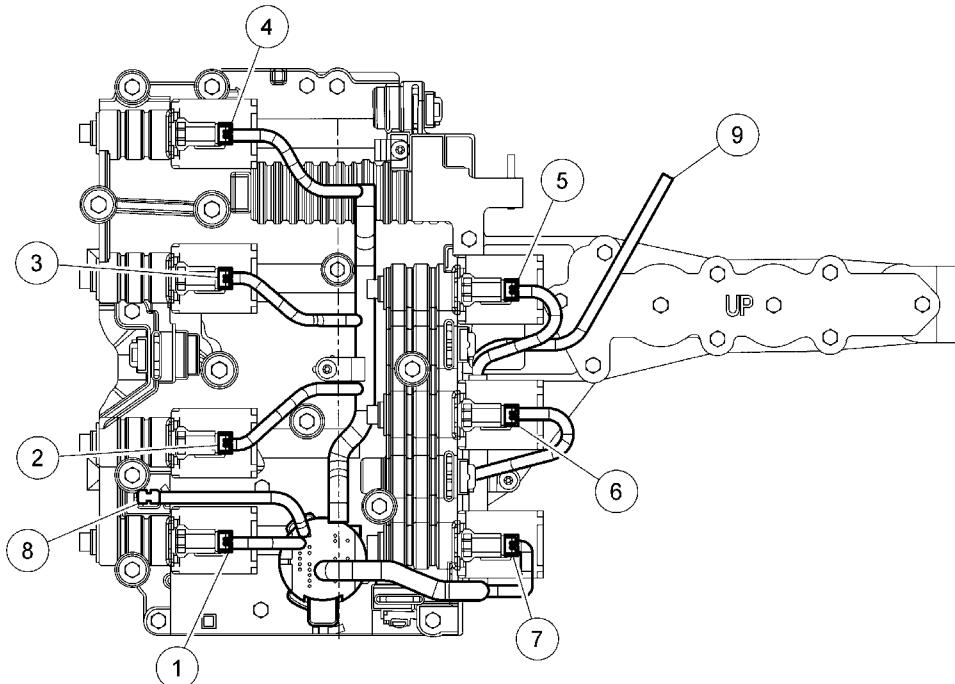
PID Name	PID Description	Value	Range
TCCPC	Commanded pressure for the TCC solenoid	PSI	0-2,069 kPa (0-300 psi).
TCC AMP#	Commanded current for the TCC solenoid	Amps	0-1.0 Amp.
TCCPC_F	Fault status for the TCC solenoid	—	Open or short to power or ground.
GEAR #	Commanded transmission gear	Gear	1-6.
LINEDSD	Commanded line pressure	PSI	0-2,069 kPa (0-300 psi).
PCA	Commanded pressure for the PC-A solenoid	PSI	0-2,069 kPa (0-300 psi).
PCA AMP	Commanded current for the PC-A solenoid	Amps	0-1.0 Amp.
PCA_F	Fault status for the PC-A solenoid	—	Open or short to power or ground.
SSPCA	Commanded pressure for the SSPC-A solenoid	PSI	0-2,069 kPa (0-300 psi).
SSA AMP#	Commanded current for the SSPC-A solenoid	Amps	0-1.0 Amp.
SSPCA_F	Fault status for the SSPC-A solenoid	—	Open or short to power or ground.
SSPCB	Commanded pressure for the SSPC-B solenoid	PSI	0-2,069 kPa (0-300 psi).
SSB_AMP#	Commanded current for the SSPC-B solenoid	Amps	0-1.0 Amp.
SSPCB_F	Fault status for the SSPC-B solenoid	—	Open or short to power or ground.
SSPCC	Commanded pressure for the SSPC-C solenoid	PSI	0-2,069 kPa (0-300 psi).
SSC_AMP#	Commanded current for the SSPC-C solenoid	Amps	0-1.0 Amp.
SSPCC_F	Fault status for the SSPC-C solenoid	—	Open or short to power or ground.
SSPCD	Commanded pressure for the SSPC-D solenoid	PSI	0-2,069 kPa (0-300 psi).
SSD_AMP#	Commanded current for the SSPC-D solenoid	Amps	0-1.0 Amp.
SSPCD_F	Fault status for the SSPC-D solenoid	—	Open or short to power or ground.
SSPCE	Commanded pressure for the SSPC-E solenoid	PSI	0-2,069 kPa (0-300 psi).
SSE_AMP#	Commanded current for the SSPC-E solenoid	Amps	0-1.0 Amp.

Table 32 PID Chart (cont.)

PID Name	PID Description	Value	Range
SSPCE_F	Fault status for the SSPC-E solenoid	—	Open or short to power or ground.
TCC_RAT	Actual speed ratio of torque converter (1.0 = fully engaged)	Ratio	Ratio.
TC_SLIPACT	Actual difference between engine speed and turbine speed	RPM	RPM
TRAN_RAT	Actual transmission gear ratio	Ratio	Ratio.
ISS_SRC	Actual speed of the intermediate shaft speed sensor	RPM	RPM.
TSS_SRC	Actual speed of the turbine shaft speed sensor	RPM	RPM.
OSS_SRC	Actual speed of the output shaft speed sensor	RPM	RPM.
TR	Transmission range (TR) sensor position	Detents	P, R, N, D, 3, 2, 1.
TR_FREQ	TR sensor carrier frequency	Frequency (Hz)	Frequency (Hz).
TR_DC	TR sensor duty cycle	Frequency (Hz)	Frequency (Hz).
TFT	Transmission fluid temperature sensor	°F	°F.
TCS	Transmission control switch	Not Depressed, Depressed	Not Depressed, Depressed.
Tow_Haul	Tow haul state: Off = normal; On = tow haul activated	Off/On	Off/On.
RLC_F	Reverse lamp control fault	—	Open or short to power or ground.
SHFT_TYP	Type of shift	Auto/ Manual	Auto/ Manual.
HRSH_SFT	HRSH_SFT Output state control for firm shifts	See OSC	—
TSPC	TSPC_Flag = Fault Flag	1 = On 0 = Off	1 or 0.
TCC#	Output state control for torque converter	See OSC	—
GEAR_OSC	Output state control for upshift/downshifts	1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6.

Table 33 P0730_Status

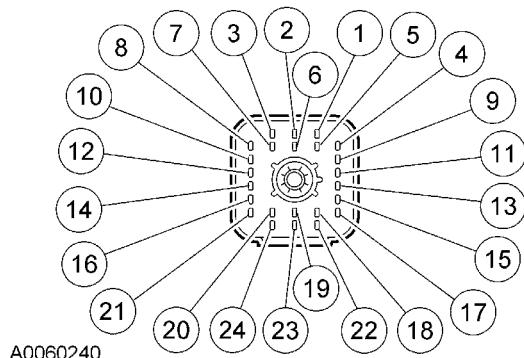
PID Acronym	PID Description
P730_00	P0730 Overdrive one-way clutch system failed OFF
P730_01	P0730 Coast clutch system failed OFF
P730_02	P0730 Coast clutch failed ON
P730_03	P0730 Overdrive clutch system failed OFF
P730_04	P0730 Overdrive clutch system failed ON
P730_09	P0730 Low/reverse one-way clutch system failed OFF
P730_10	P0730 Low/reverse clutch system failed OFF
P730_11	P0730 Low/reverse clutch system failed ON
P730_12	P0730 Intermediate clutch system failed OFF
P730_13	P0730 Intermediate clutch system failed ON
P730_14	P0730 Direct clutch system failed OFF
P730_15	P0730 Direct clutch system failed ON

Transmission Connector Layouts

N0018689

Figure 11 Internal Transmission Harness Connector/Component Locator

- | | |
|----------------------------------|--|
| 1. PC-A (line pressure control) | 7. SSPC-C (intermediate clutch) |
| 2. TCC (torque converter clutch) | 8. TFT (transmission fluid temperature) |
| 3. SSPC-B (overdrive clutch) | 9. TR position (transmission range sensor) |
| 4. SSPC-A (coast clutch) | |
| 5. SSPC-E (low/reverse clutch) | |
| 6. SSPC-D (direct clutch) | |

**Figure 12 Transmission Vehicle Harness Connector**

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 34

Pin Number	Description	TCM Connector
1	SSPC-E	90
2	Not used	—
3	SSPC-B	70
4	SSPC-D	48
5	SSPC-C	91
6	Not used	—
7	Solenoid VPWR	6
8	TCC	49
9	Not used	—
10	PC-A	89
11	Not used	—
12	SSPC-A	92
13	Not used	—
14	Not used	—
15	TR-P Signal	37
16	Not used	—
17	TR-P Ground	36
18	TFT Signal	14
19	Not used	—
20	Solenoid VPWR	6
21	VPWR for TR-P Sensor only	30
22	SGNRTN	14
23	Not used	—
24	Solenoid VPWR	73

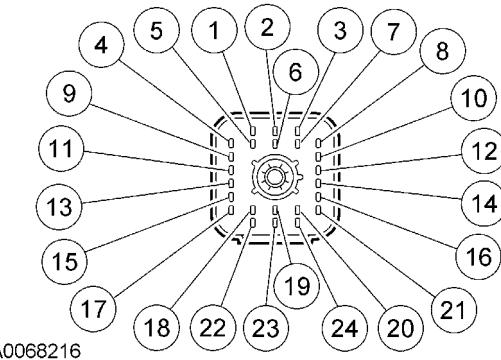
**Figure 13 Transmission Internal Harness Connector**

Table 35

Pin Number	Description	TCM Connector	Int. Wire Color Pin No. 1	Int. Wire Color Pin No. 2	Int. Wire Color Pin No. 3
1	SSPC-E	90	Light Green	Gray	—
2	Not used	—	—	—	—
3	SSPC-B	70	Red	Light Green	—
4	SSPC-D	48	Brown	Pink	—
5	SSPC-C	91	Yellow	Purple	—
6	Not used	—	—	—	—
7	Solenoid VPWR ^a	6	—	—	—
8	TCC	49	Dark Blue	Orange	—
9	Not used	—	—	—	—
10	PC-A	89	Light Blue	White	—
11	Not used	—	—	—	—
12	SSPC-A	92	Purple	Yellow	—
13	Not used	—	—	—	—
14	Not used	—	—	—	—
15	TR-P Signal	37	—	Light Blue	—
16	Not used	—	—	—	—
17	TR-P Ground	36	—	—	Tan
18	TFT Signal	14	Tan	Gray	—
19	Not used	—	—	—	—
20	Solenoid VPWR ^a	6	—	—	—
21	VPWR for TR-P Sensor only	30	Orange	—	—
22	SGNRTN ^a	14	—	—	—
23	Not used	—	—	—	—
24	Solenoid VPWR ^a	73	—	—	—

^a See negative pins for SSPC-x.

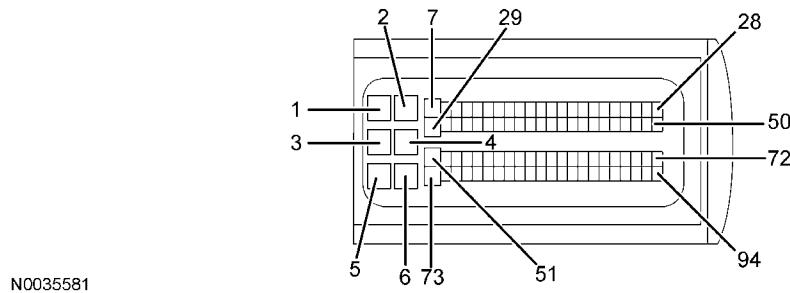


Figure 14 Transmission Control Module (TCM) Connector

Table 36

Transmission Connector Pin Number	Description	TCM Connector Pin Number
1	SSPC-E	90
3	SSPC-B	70
4	SSPC-D	48
5	SSPC-D	91
7	Solenoid VPWR	6
8	TCC	49
10	PC-A	89
12	SSPC-A	92
15	TR-P Signal	37
17	TR-P Ground	36
18	TFT Signal	14
20	Solenoid VPWR	6
21	VPWR for TR-P Sensor only	30
22	SGNRTN	14
24	Solenoid VPWR	73

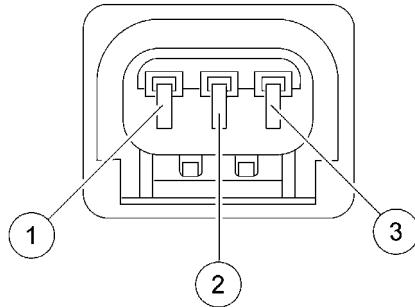


Figure 15 Internal Harness TR-P Sensor Connector — Tan (3 Pin)

Table 37

Pin Number	Circuit Function
1	Power
2	Sensor Signal
3	Ground

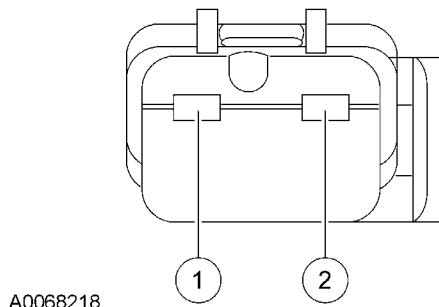


Figure 16 Internal Harness SSPC-x Solenoid Connector — Tan (2 Pin)

Table 38

Pin Number	Circuit Function
1	Common
2	Solenoid Signal

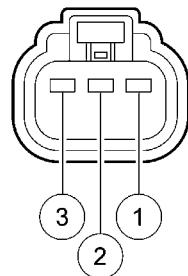


Figure 17 Output Shaft Speed (OSS) Sensor Harness Connector

Table 39

Pin Number	TCM Pin	Circuit Function
1	30	Vehicle Power
2	87	Output Shaft Speed (OSS) Sensor Signal
3	14	Signal Return

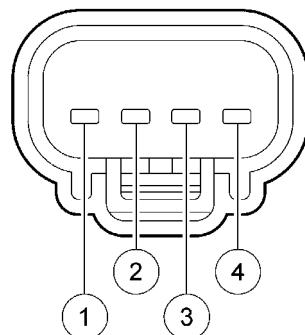
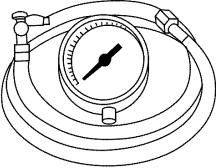
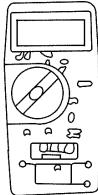


Figure 18 Intermediate Shaft Speed and Turbine Shaft Speed (TSS) Sensor Harness Connector

Table 40

Pin Number	TCM Pin	Circuit Function
1	30	Vehicle Power
2	14	Signal Return
3	63	Turbine Shaft Speed (TSS) Sensor Signal
4	61	Intermediate Shaft Speed Sensor Signal

Pinpoint Tests — OSC Equipped Vehicles**Table 41 Special Tools**

 ST1565-A	Transmission Fluid Pressure Gauge ZTSE9103
 ST1137-A	Automotive Meter ZTSE4357
	EZ-Tech III

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 42 Band, Clutch, Solenoid, Application Chart (A)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
P	P	—	HP/LA ^a	—	—	LP/HA
N	N	—	HP/LA ^a	—	—	LP/HA
R	R	—	HP/LA ^a	—	A	HP/LA
OD with Tow/Haul OFF	1	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	2	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	3	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	4 ^b	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	5	—	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul OFF	6	Yes	HP/LA ^a	A	—	LP/HA

^a ECM Calibration Controlled^b Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(I) = Inversely Proportional

Table 43 Band, Clutch, Solenoid, Application Chart (B)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
P	P	—	LP/LA	—	LP/LA
N	N	—	LP/LA	—	LP/LA
R	R	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	1	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	2	A	HP/HA	—	LP/LA
OD with Tow/Haul OFF	3	—	LP/LA	A	HP/HA
OD with Tow/Haul OFF	4 ^a	A	HP/HA	A	HP/HA
OD with Tow/Haul OFF	5	—	LP/LA	—	LP/LA
OD with Tow/Haul OFF	6	A	HP/HA	—	LP/LA

^a Cold Strategy
 HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional

Table 44 Band, Clutch, Solenoid, Application Chart (C)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
P	P	—	LP/HA	A ^{ab}	a
N	N	—	LP/HA	A ^{ab}	a
R	R	A ^c	LP/HA ^c	A ^a	HP/HA ^a
OD with Tow/Haul OFF	1	—	LP/HA	A ^{ad}	a
OD with Tow/Haul OFF	2	—	LP/HA	—	LP/LA
OD with Tow/Haul OFF	3	—	LP/HA	—	LP/LA
OD with Tow/Haul OFF	4 ^c	—	LP/HA	—	LP/LA
OD with Tow/Haul OFF	5	A	HP/LA	—	LP/LA
OD with Tow/Haul OFF	6	A	HP/LA	—	LP/LA

^a TCM Calibration Controlled
^b 207 kPa (30 psi) until MPH reaches 5 km/h (3 mph)
^c Clutch Applied Through Manual Valve Position
^d Cold Strategy
 HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional
 (I) = Inversely Proportional

Table 45 Band, Clutch, Solenoid, Application Chart (D)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
P	P	LP/LA	X	X
N	N	LP/LA	X	X
R	R	LP/LA	X	—
OD with Tow/Haul OFF	1	^a	X	X
OD with Tow/Haul OFF	2	^a	O/R	X
OD with Tow/Haul OFF	3	^a	X	O/R
OD with Tow/Haul OFF	4 ^b	^a	O/R	O/R
OD with Tow/Haul OFF	5	^a	X	O/R
OD with Tow/Haul OFF	6	^a	O/R	O/R

^a TCM Calibration Controlled
^b Cold Strategy
O/R = Overrunning
LP = Low Pressure
LA = Low Current
X = Holding
(D) = Directly Proportional

Table 46 Band, Clutch, Solenoid, Application Chart (E)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
P	P	—	HP/LA ^a	—	—	LP/HA
N	N	—	HP/LA ^a	—	—	LP/HA
R	R	—	HP/LA ^a	—	A	HP/LA
OD with Tow/Haul ON	1	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	2	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul ON	3	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	4 ^b	Yes	HP/LA ^a	A	—	LP/HA
OD with Tow/Haul ON	5	Yes	HP/LA ^a	A	A	HP/LA
OD with Tow/Haul ON	6	Yes	HP/LA ^a	A	—	LP/HA

^a TCM Calibration Controlled^b Cold Strategy

HP = High Pressure

LP = Low Pressure

HA = High Current

LA = Low Current

A = Applied

(I) = Inversely Proportional

Table 47 Band, Clutch, Solenoid, Application Chart (F)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
P	P	—	LP/LA	—	LP/LA
N	N	—	LP/LA	—	LP/LA
R	R	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	1	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	2	A	HP/HA	—	LP/LA
OD with Tow/Haul ON	3	—	LP/LA	A	HP/HA
OD with Tow/Haul ON	4 ^a	A	HP/HA	A	HP/HA
OD with Tow/Haul ON	5	—	LP/LA	—	LP/LA
OD with Tow/Haul ON	6	A	HP/HA	—	LP/LA

^a Cold Strategy
 HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional

Table 48 Band, Clutch, Solenoid, Application Chart (G)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
P	P	—	LP/HA	A ^{ab}	a
N	N	—	LP/HA	A ^{ab}	a
R	R	A ^c	LP/HA ^c	A ^a	HP/HA ^a
OD with Tow/Haul ON	1	—	LP/HA	A ^a	a
OD with Tow/Haul ON	2	—	LP/HA	A ^a	HP/HA
OD with Tow/Haul ON	3	—	LP/HA	—	LP/LA
OD with Tow/Haul ON	4 ^d	—	LP/HA	—	LP/LA
OD with Tow/Haul ON	5	A	HP/LA	—	LP/LA
OD with Tow/Haul ON	6	A	HP/LA	—	LP/LA

^a TCM Calibration Controlled
^b 207 kPa (30 psi) until MPH reaches 5 km/h (3 mph)
^c Clutch Applied Through Manual Valve Position
^d Cold Strategy
 HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional
 (I) = Inversely Proportional

Table 49 Band, Clutch, Solenoid, Application Chart (H)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
P	P	LP/LA	X	X
N	N	LP/LA	X	X
R	R	LP/LA	X	—
OD with Tow/Haul ON	1	^a	X	X
OD with Tow/Haul ON	2	^a	O/R	X
OD with Tow/Haul ON	3	^a	X	O/R
OD with Tow/Haul ON	4 ^b	^a	O/R	O/R
OD with Tow/Haul ON	5	^a	X	O/R
OD with Tow/Haul ON	6	^a	O/R	O/R

^a TCM Calibration Controlled
^b Cold Strategy
O/R = Overrunning
LP = Low Pressure
LA = Low Current
X = Holding
(D) = Directly Proportional

Table 50 Band, Clutch, Solenoid, Application Chart (I)

Range Selector Lever Position	Gear	Engine Braking	Line Pressure PC-A (I)	Forward Clutch	Coast Clutch	SSPC-A Coast Clutch (I)
Manual 3rd	3	Yes	HP/LA ^a	A	A	HP/LA
Manual 2nd	2	Yes	HP/LA ^a	A	—	LP/HA
Manual 1st	1	Yes	HP/LA ^a	A	A	HP/LA

^a TCM Calibration Controlled
HP = High Pressure
LP = Low Pressure
HA = High Current
LA = Low Current
A = Applied
(I) = Inversely Proportional

Table 51 Band, Clutch, Solenoid, Application Chart (J)

Range Selector Lever Position	Gear	OD Clutch	SSPC-B OD Clutch (D)	Int. Clutch	SSPC-C Int. Clutch (D)
Manual 3rd	3	—	LP/LA	A	HP/HA
Manual 2nd	2	A	HP/HA	—	LP/LA
Manual 1st	1	—	LP/LA	—	LP/LA

HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional

Table 52 Band, Clutch, Solenoid, Application Chart (K)

Range Selector Lever Position	Gear	Direct Clutch	SSPC-D Direct Clutch (I)	Low Reverse Clutch	SSPC-E Low Reverse Clutch (D)
Manual 3rd	3	—	LP/HA	—	LP/LA
Manual 2nd	2	—	LP/HA	A	HP/HA
Manual 1st	1	—	LP/HA	A	HP/HA

HP = High Pressure
 LP = Low Pressure
 HA = High Current
 LA = Low Current
 A = Applied
 (D) = Directly Proportional
 (I) = Inversely Proportional

Table 53 Band, Clutch, Solenoid, Application Chart (L)

Range Selector Lever Position	Gear	TCC Torque Converter (D)	OD OWC	L/R OWC
Manual 3rd	3	a	X	O/R
Manual 2nd	2	a	O/R	X
Manual 1st	1	a	X	X

^a TCM Calibration Controlled
O/R = Overrunning
X = Holding
(D) = Directly Proportional

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Connector illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs. All TR-P Sensor, PCA (line pressure solenoid) and VSS DTCs must be repaired before entering Output State Control (OSC) — Service Bay Mode.

NOTE: Use the PID Chart for available diagnostic PIDs. Refer to Output State Control (OSC) Mode in this section.

Table 54 PINPOINT TEST A: CONTROL SOLENOIDS

Test Step	Result / Action to Take
A1 ELECTRONIC DIAGNOSTICS <ul style="list-style-type: none"> • Key in OFF position. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the diagnostic tool. • Engine idling. • Enter the following diagnostic mode on the diagnostic tool: Tool Box. • Enter the following diagnostic mode on the diagnostic tool: Data Logger. • Enter the following diagnostic mode on the diagnostic tool: Module. • Enter the following diagnostic mode on the diagnostic tool: TCM. • Monitor the appropriate PID for the solenoid SSPC-x (#) or TCC (#) being tested, refer to the PID chart in Output State Control (OSC) Mode. 	Yes REMAIN in TCM Mode. GO to A2. No REPEAT procedure to enter TCM. If the vehicle did not enter TCM, INSTALL a new transmission control module (TCM).
Can the PIDs be monitored or solenoids be commanded?	
A2 SOLENOID FUNCTIONAL TEST <ul style="list-style-type: none"> • Monitor the appropriate commanded current and pressure PID(s) for the solenoid being tested. • Select the appropriate active solenoid that is to be tested, SSx (#) or TCC (#). • Select activate icon. • Select (+) or (-) to increase or decrease the solenoid signal. • Select another value by using the (+) or (-) to increase or decrease the solenoid signal. • To cancel and return to normal operation press the activate icon. 	Yes CLEAR DTCs. Road test. If symptom persists, REFER to Diagnosis By Symptom in this section. No GO to A3.
Do the monitored pressure and current readings change and match the command?	

Table 54 PINPOINT TEST A: CONTROL SOLENOIDS (cont.)

Test Step	Result / Action to Take
A3 CHECK FOR BATTERY VOLTAGE <ul style="list-style-type: none"> • Disconnect the transmission vehicle harness connector from the transmission bulkhead connector. • Inspect the harness connector for damaged pins. • Key in ON position • Measure the voltage between the appropriate power pins on the harness side. Is the voltage greater than 10 volts?	Yes GO to A4. No REPAIR the circuit. TEST for normal operation.
A4 ELECTRICAL SIGNAL CHECK <ul style="list-style-type: none"> • Disconnect vehicle wire harness connector from TCM. • Carry out a continuity check between the appropriate transmission connector signal pin and TCM connector signal pin on vehicle harness side. • Check the appropriate signal wire for shorts to ground. Is there shorts or opens in the vehicle wire harness signal lead?	Yes REPAIR open or short in the harness. No GO to A5.
A5 CHECK THE INTERNAL HARNESS <ul style="list-style-type: none"> • Drain the transmission fluid. • Remove the transmission fluid pan. • Disconnect: Affected Solenoid • Measure the resistance between pins 1, 3, 4, 5, 8, 10 and 12 transmission bulkhead side and pin 2 at each associated solenoid connector. • Measure the resistance between pins 7, 20 and 24 transmission bulkhead side and pin 1 at each associated solenoid connector. Are the resistances less than 0.5 ohms?	Yes GO to A6. No INSTALL a new harness. GO to A7.
A6 CHECK FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Measure the resistance between pins 1, 3, 4, 5, 8, 10 and 12 harness side and ground. Is the resistance greater than 10,000 ohms?	Yes INSTALL a new harness. No GO to A7.

Table 54 PINPOINT TEST A: CONTROL SOLENOIDS (cont.)

Test Step	Result / Action to Take
A7 CHECK THE SOLENOID RESISTANCE AT THE SOLENOID <ul style="list-style-type: none"> • Measure the resistance between pins 1 and 2 at each solenoid. Is the resistance between 4.1-4.7 ohms?	Yes GO to A8. No INSTALL a new solenoid if not within specification. CLEAR the DTCs. TEST the system for normal operation.
A8 CHECK THE SOLENOID FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Measure the resistance between pins 1 and 2 at each solenoid and ground. Is the resistance less than 10,000 ohms?	Yes INSTALL a new solenoid. No INSTALL a new TCM. If the condition persists, REFER to Diagnosis By Symptom in this section for diagnosis of pressure concerns. CLEAR the DTCs. TEST the system for normal operation.

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Connector illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs.

NOTE: Use the PID Chart for available diagnostic PIDs. Refer to Output State Control (OSC) Mode in this section.

Table 55 PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR

Test Step	Result / Action to Take
B1 ELECTRONIC DIAGNOSTICS <ul style="list-style-type: none"> • Key in OFF position. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Tool Box. • Enter the following diagnostic mode on the diagnostic tool: Data Logger. • Enter the following diagnostic mode on the diagnostic tool: Module. • Enter the following diagnostic mode on the diagnostic tool: TCM. • Monitor the appropriate PID for the TFT sensor. <p>Can the PIDs be monitored?</p>	Yes REMAIN in TCM. GO to B2. No REPEAT procedure to enter PID. If the vehicle did not enter PID, INSTALL a new transmission control module (TCM).
B2 WARM-UP/COOL-DOWN CYCLE <ul style="list-style-type: none"> • While monitoring the TFT PIDs, carry out the following test: If transmission is cold, operate to warm it up. If transmission is warm, allow transmission to cool down. <p>Do the TFT PIDs increase as the transmission is warmed up or decrease as the transmission is cooled or does the TFT drop in and out of range?</p>	Yes If the TFT PIDs increase as the transmission is warmed or decrease as the transmission is cooled, CLEAR all DTCs. CARRY OUT the 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. No GO to B3.
B3 ELECTRICAL SIGNAL CHECK <ul style="list-style-type: none"> • Disconnect: Transmission Harness Connector • Visually inspect all wires and connectors for damage. • Measure the voltage between pin 18 harness side and ground. <p>Is the voltage between 4.5 and 5.5 volts?</p>	Yes GO to B4. No REPAIR an open or short in the harness. TEST the system for normal operation. If normal operation does not return, INSTALL a new TCM.

Table 55 PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR (cont.)

Test Step	Result / Action to Take																														
B4 CHECK THE RESISTANCE OF THE TFT SENSOR <ul style="list-style-type: none"> • Measure the resistance between pins 18 and 22 at the transmission bulkhead body connector. • Record the resistance. • Resistance should be approximately in the following ranges: Transmission Fluid Temperature <table border="1"> <thead> <tr> <th>°C</th><th>°F</th><th>Resistance (Ohms)</th></tr> </thead> <tbody> <tr><td>-40 to -20</td><td>-40 to -4</td><td>967K - 284K</td></tr> <tr><td>-19 to -1</td><td>-3 to 31</td><td>284K - 100K</td></tr> <tr><td>0 to 20</td><td>32 to 68</td><td>100K - 37K</td></tr> <tr><td>21 to 40</td><td>69 to 104</td><td>37K - 16K</td></tr> <tr><td>41 to 70</td><td>105 to 158</td><td>16K - 5K</td></tr> <tr><td>71 to 90</td><td>159 to 194</td><td>5K - 2.7K</td></tr> <tr><td>91 to 110</td><td>195 to 230</td><td>2.7K - 1.5K</td></tr> <tr><td>111 to 130</td><td>231 to 266</td><td>1.5K - 0.8K</td></tr> <tr><td>131 to 150</td><td>267 to 302</td><td>0.8K - 0.54K</td></tr> </tbody> </table> 	°C	°F	Resistance (Ohms)	-40 to -20	-40 to -4	967K - 284K	-19 to -1	-3 to 31	284K - 100K	0 to 20	32 to 68	100K - 37K	21 to 40	69 to 104	37K - 16K	41 to 70	105 to 158	16K - 5K	71 to 90	159 to 194	5K - 2.7K	91 to 110	195 to 230	2.7K - 1.5K	111 to 130	231 to 266	1.5K - 0.8K	131 to 150	267 to 302	0.8K - 0.54K	Yes REFER to Diagnosis By Symptom in this section to diagnose an overheating concern. No GO to B5.
°C	°F	Resistance (Ohms)																													
-40 to -20	-40 to -4	967K - 284K																													
-19 to -1	-3 to 31	284K - 100K																													
0 to 20	32 to 68	100K - 37K																													
21 to 40	69 to 104	37K - 16K																													
41 to 70	105 to 158	16K - 5K																													
71 to 90	159 to 194	5K - 2.7K																													
91 to 110	195 to 230	2.7K - 1.5K																													
111 to 130	231 to 266	1.5K - 0.8K																													
131 to 150	267 to 302	0.8K - 0.54K																													
Is the resistance in range?	Yes GO to B6. No INSTALL a new internal harness. GO to B7.																														
Are the resistances less than 0.5 ohms?																															
B6 CHECK THE INTERNAL HARNESS FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Measure the resistance between TFT sensor connector pins 18 and 22, and ground. 	Yes INSTALL a new internal harness. No GO to B7.																														
Is the resistance greater than 10,000 ohms?																															

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 55 PINPOINT TEST B: TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR (cont.)

Test Step	Result / Action to Take																														
B7 CHECK THE RESISTANCE AT THE SENSOR <ul style="list-style-type: none"> Measure the resistance between pins 1 and 2 at the TFT sensor. <p>Transmission Fluid Temperature</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">°C</th> <th style="text-align: center;">°F</th> <th style="text-align: center;">Resistance (Ohms)</th> </tr> </thead> <tbody> <tr><td>-40 to -20</td><td>-40 to -4</td><td>967K - 284K</td></tr> <tr><td>-19 to -1</td><td>-3 to 31</td><td>284K - 100K</td></tr> <tr><td>0 to 20</td><td>32 to 68</td><td>100K - 37K</td></tr> <tr><td>21 to 40</td><td>69 to 104</td><td>37K - 16K</td></tr> <tr><td>41 to 70</td><td>105 to 158</td><td>16K - 5K</td></tr> <tr><td>71 to 90</td><td>159 to 194</td><td>5K - 2.7K</td></tr> <tr><td>91 to 110</td><td>195 to 230</td><td>2.7K - 1.5K</td></tr> <tr><td>111 to 130</td><td>231 to 266</td><td>1.5K - 0.8K</td></tr> <tr><td>131 to 150</td><td>267 to 302</td><td>0.8K - 0.54K</td></tr> </tbody> </table> <p>Is the resistance within specification?</p>	°C	°F	Resistance (Ohms)	-40 to -20	-40 to -4	967K - 284K	-19 to -1	-3 to 31	284K - 100K	0 to 20	32 to 68	100K - 37K	21 to 40	69 to 104	37K - 16K	41 to 70	105 to 158	16K - 5K	71 to 90	159 to 194	5K - 2.7K	91 to 110	195 to 230	2.7K - 1.5K	111 to 130	231 to 266	1.5K - 0.8K	131 to 150	267 to 302	0.8K - 0.54K	Yes GO to B8. No INSTALL a new TFT sensor. CLEAR the DTCs. TEST the system for normal operation.
°C	°F	Resistance (Ohms)																													
-40 to -20	-40 to -4	967K - 284K																													
-19 to -1	-3 to 31	284K - 100K																													
0 to 20	32 to 68	100K - 37K																													
21 to 40	69 to 104	37K - 16K																													
41 to 70	105 to 158	16K - 5K																													
71 to 90	159 to 194	5K - 2.7K																													
91 to 110	195 to 230	2.7K - 1.5K																													
111 to 130	231 to 266	1.5K - 0.8K																													
131 to 150	267 to 302	0.8K - 0.54K																													
B8 CHECK THE SENSOR FOR A SHORT TO GROUND <ul style="list-style-type: none"> Measure the resistance between pins 1 and 2 at the TFT sensor connector and ground. <p>Is the resistance less than 10,000 ohms?</p>	Yes INSTALL a new TFT sensor. No INSTALL a new TCM. CLEAR the DTCs. If the DTCs return, an overtemp condition may exist. REFER to Diagnosis By Symptom in this section.																														

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Connector illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs.

NOTE: Use the PID Chart for available diagnostic PIDs. Refer to Output State Control (OSC) Mode in this section.

Table 56 PINPOINT TEST C: TRANSMISSION RANGE (TR-P) SENSOR

Test Step	Result / Action to Take
C1 VERIFY THE DIAGNOSTIC TROUBLE CODES <ul style="list-style-type: none"> • Key in OFF position. • Select PARK. • Carry out On-Board Diagnostic Test. Are only TR-P DTC codes present?	Yes GO to C3. No GO to C2.
C2 VERIFY THE SHIFT CABLE/LINKAGE ADJUSTMENT <ul style="list-style-type: none"> • Select DRIVE. • Connect the shift cable/linkage. • Verify that the shift cable/linkage is correctly adjusted. REFER to Automatic Transaxle/ Transmission External Controls.(Automatic Transaxle/Transmission External Controls, page 307) Is the shift cable/linkage correctly adjusted?	Yes GO to C3. No ADJUST the shift cable/linkage. REFER to Automatic Transaxle/ Transmission External Controls.(Automatic Transaxle/Transmission External Controls, page 307) GO to C3.
C3 CHECK THE ELECTRICAL SYSTEM OPERATION (START AND REVERSE) <ul style="list-style-type: none"> • Select PARK. • Key in START position. • Key in OFF position. • Select NEUTRAL. • Key in START position. • Select PARK. • Key in OFF position. • Select REVERSE. • Key in ON position. • Check the reverse lamp illumination. Does the engine crank in PARK and NEUTRAL? Do the reverse lamps illuminate?	Yes The problem is not in the TR-P. REFER to the Engine Operation and Maintenance Manual for further diagnosis of the starting system and reverse lamps. No GO to C4.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 56 PINPOINT TEST C: TRANSMISSION RANGE (TR-P) SENSOR (cont.)

Test Step	Result / Action to Take																								
C4 CHECK THE ELECTRICAL SYSTEM OPERATION (TR-P AND TCM) <ul style="list-style-type: none"> • Key in OFF position. • Select PARK. • Check to make sure the transmission harness connector is fully seated, terminals are fully engaged in connector and in good condition before proceeding. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Tool Box. • Enter the following diagnostic mode on the diagnostic tool: Data Logger. • Enter the following diagnostic mode on the diagnostic tool: Module. • Enter the following diagnostic mode on the diagnostic tool: TCM. • Enter the following diagnostic mode on the diagnostic tool: TR_DC and TR_FREQ. • Move transmission range selector lever into each gear and stop. • Observe the PIDs: TR_DC, and TR_FREQ. • Monitor PID: TR_FREQ. • Compare the PID: TR_DC to the TR-P Duty Cycle Chart. <p>TR_DC Duty Cycle Chart</p> <table border="1"> <thead> <tr> <th>Position</th><th>Min % Duty Cycle</th><th>Max % Duty Cycle</th></tr> </thead> <tbody> <tr> <td>P</td><td>7.13</td><td>23.76</td></tr> <tr> <td>R</td><td>23.77</td><td>38.48</td></tr> <tr> <td>N</td><td>38.49</td><td>48.55</td></tr> <tr> <td>D</td><td>48.56</td><td>58.82</td></tr> <tr> <td>3</td><td>58.83</td><td>68.08</td></tr> <tr> <td>2</td><td>68.09</td><td>77.96</td></tr> <tr> <td>1</td><td>77.97</td><td>90.34</td></tr> </tbody> </table> <p>Is the PID: TR_FREQ in the range of 100 to 150 Hz? Is the PID: TR_DC in the TR-P Duty Cycle range? Does PID: TR_DC remain steady when the harness is wiggled, the sensor is tapped, or the vehicle is driven?</p>	Position	Min % Duty Cycle	Max % Duty Cycle	P	7.13	23.76	R	23.77	38.48	N	38.49	48.55	D	48.56	58.82	3	58.83	68.08	2	68.09	77.96	1	77.97	90.34	<p>Yes The problem is not in the digital TR sensor system. REFER to Diagnosis By Symptom for additional diagnosis.</p> <p>No If TR_DC changes when wiggling the harness, tapping on the sensor or driving the vehicle, the problem may be intermittent. GO to C5.</p>
Position	Min % Duty Cycle	Max % Duty Cycle																							
P	7.13	23.76																							
R	23.77	38.48																							
N	38.49	48.55																							
D	48.56	58.82																							
3	58.83	68.08																							
2	68.09	77.96																							
1	77.97	90.34																							

Table 56 PINPOINT TEST C: TRANSMISSION RANGE (TR-P) SENSOR (cont.)

Test Step	Result / Action to Take
C5 CHECK THE TCM HARNESS CIRCUITS FOR OPENS <ul style="list-style-type: none"> • Key in OFF position. • Disconnect: Transmission TCM Connector • Disconnect: Transmission Bulkhead Connector • Measure the resistance between pin 15 of the transmission bulkhead connector harness side and the appropriate TR-P signal pin at the transmission TCM connector, harness side. • Measure the resistance between pin 17 of the transmission bulkhead connector harness side and the appropriate TR-P ground pin at the transmission TCM connector, harness side. • Measure the resistance between pin 21 of the transmission bulkhead connector harness side and the appropriate TR-P power pin at the transmission TCM connector, harness side. 	Yes GO to C6. No REPAIR the circuits. CLEAR DTCs and REPEAT Quick Tests.
Are the resistances less than 5 ohms?	
C6 CHECK THE TCM HARNESS CIRCUIT FOR A SHORT TO GROUND OR POWER <ul style="list-style-type: none"> • Measure the resistance between pin 15 of the transmission bulkhead connector harness side and the appropriate pin at the TCM connector, harness side. • Measure the resistance between pin 17 of the transmission bulkhead connector harness side and the appropriate pin at the TCM connector, harness side. • Measure the resistance between pin 15 of the transmission bulkhead connector harness side and the appropriate pin at the TCM connector, harness side. • Measure the resistance between pin 1 of the transmission bulkhead connector harness side and the appropriate pin at the TCM connector, harness side. 	Yes GO to C7. No REPAIR the circuits. TEST the system for normal operation.
Are the resistances greater than 10,000 ohms?	

Table 56 PINPOINT TEST C: TRANSMISSION RANGE (TR-P) SENSOR (cont.)

Test Step	Result / Action to Take
C7 CHECK THE INTERNAL HARNESS FOR AN OPEN <ul style="list-style-type: none"> • Drain the transmission fluid. • Remove the transmission fluid pan. • Remove the transmission fluid filter. • Connect the diagnostic tool. • Measure the resistance between pin 21 transmission bulkhead connector and pin 1 on the sensor. • Measure the resistance between pin 15 transmission bulkhead connector and pin 2 on the sensor. • Measure the resistance between pin 17 transmission bulkhead connector and pin 3 on the sensor and ground. 	Yes INSTALL a new internal harness. No GO to C8.
Are the resistances greater than 0.5 ohms?	
C8 CHECK THE NON-TCM INTERNAL CIRCUITS OF THE SENSOR <ul style="list-style-type: none"> • Measure the resistance between pins 1, 22 and 25 and ground. Are the resistances greater than 10,000 ohms?	Yes INSTALL a new internal harness. No INSTALL a new TR-P sensor assembly. REFER to Digital Transmission Range (TR) Sensor in this section. CLEAR DTCs and RERUN the OBD Tests.

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Connector illustration preceding these pinpoint tests.

NOTE: Read and record all DTCs.

NOTE: Use the PID Chart for available diagnostic PIDs. Refer to Output State Control (OSC) Mode in this section.

Table 57 PINPOINT TEST D: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED, AND OUTPUT SHAFT SPEED (OSS) SENSORS

Test Step	Result / Action to Take												
D1 ELECTRONIC DIAGNOSTICS <ul style="list-style-type: none"> • Key in OFF position. • Select PARK. • Check to make sure the transmission harness connectors are fully seated, terminals are fully engaged in the connector and in good condition before proceeding. • Connect the diagnostic tool. • Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: Tool Box. • Enter the following diagnostic mode on the diagnostic tool: Data Logger. • Enter the following diagnostic mode on the diagnostic tool: Module. • Enter the following diagnostic mode on the diagnostic tool: TCM. • Select and monitor the appropriate PID for the suspected sensor(s): turbine shaft speed (TSS), intermediate shaft speed sensor or output shaft speed (OSS) sensor. <table border="1"> <thead> <tr> <th>PID</th> <th>Description</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>ISS_SRC</td> <td>Raw ISS signal</td> <td>RPM</td> </tr> <tr> <td>OSS_SRC</td> <td>Raw OSS signal</td> <td>RPM</td> </tr> <tr> <td>TSS_SRC</td> <td>Raw TSS signal</td> <td>RPM</td> </tr> </tbody> </table>	PID	Description	Value	ISS_SRC	Raw ISS signal	RPM	OSS_SRC	Raw OSS signal	RPM	TSS_SRC	Raw TSS signal	RPM	Yes Continue to monitor the suspect sensor(s). GO to D2. No REPEAT procedure to ENTER PID. If you cannot monitor the sensor(s) using the diagnostic equipment, INSTALL a new transmission control module (TCM).
PID	Description	Value											
ISS_SRC	Raw ISS signal	RPM											
OSS_SRC	Raw OSS signal	RPM											
TSS_SRC	Raw TSS signal	RPM											
Can you select and monitor the appropriate sensor(s)?													
D2 DRIVE CYCLE TEST <ul style="list-style-type: none"> • While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. Does the TSS, intermediate shaft speed sensor, or OSS PID increase and decrease with engine and vehicle speed?	Yes GO to D3. No If the TSS, intermediate shaft speed sensor, or OSS PID does not increase and decrease with engine and vehicle speed, the issue may be found with the vehicle harness, TCM, sensor or internal hardware. GO to D4.												

Table 57 PINPOINT TEST D: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED, AND OUTPUT SHAFT SPEED (OSS) SENSORS (cont.)

Test Step	Result / Action to Take
D3 DRIVE CYCLE TEST ERRATIC <ul style="list-style-type: none"> While monitoring the appropriate sensor PID, drive the vehicle so that the transmission upshifts and downshifts through all gears. Is the TSS, intermediate shaft speed sensor, or OSS speed PID signal erratic (drop to zero or near zero and return to normal operation)?	Yes If the sensor signal is erratic, there may be an intermittent concern in the vehicle harness sensor or connector. GO to D4. No CLEAR all DTCs. RERUN the OBD Tests.
D4 CHECK FOR SENSOR BATTERY VOLTAGE <ul style="list-style-type: none"> Key in OFF position. Disconnect: Appropriate Speed Sensor Inspect for damaged or pushed out pins, corrosion or loose wires. Key in ON position. For OSS, measure the voltage between sensor connector pin 3 and ground. For TSS/intermediate shaft speed sensor, measure the voltage between sensor connector pin 1 and ground. Are the voltages greater than 10 volts?	Yes GO to D5. No Repair the circuit. TEST the system for normal operation. CLEAR all DTCs. RERUN the OBD Tests.

Table 57 PINPOINT TEST D: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED, AND OUTPUT SHAFT SPEED (OSS) SENSORS (cont.)

Test Step	Result / Action to Take
D5 CHECK THE TCM HARNESS CIRCUITS FOR AN OPEN <ul style="list-style-type: none"> • Disconnect: Transmission TCM Connector From the TCM • For intermediate shaft speed sensor, measure the resistance between the appropriate pin at the transmission TCM connector, harness side and the sensor connector pin 4, harness side. • For TSS, measure the resistance between the appropriate pin at the transmission TCM connector, harness side and the sensor connector pin 3, harness side. • For intermediate shaft speed sensor/TSS, measure the resistance between the appropriate pin at the TCM connector, harness side and the sensor connector pin 1, harness side. • For intermediate shaft speed sensor/TSS, measure the resistance between the appropriate pin at the TCM connector, harness side and the sensor connector pin 22, harness side. • For OSS, measure the resistance between the appropriate pin at the TCM connector, harness side and the sensor connector pin 1, harness side. • For OSS, measure the resistance between the appropriate pin at the TCM connector, harness side and the sensor connector pin 3, harness side. • For OSS, measure the resistance between the appropriate pin at the TCM connector, harness side and sensor connector pin 2, harness side and ground. 	Yes GO to D6. No REPAIR the open circuits. TEST the system for normal operation. CLEAR all DTCs. RERUN the OBD Tests.
Are the resistances less than 5 ohms?	
D6 CHECK THE TCM HARNESS CIRCUITS FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Disconnect: Transmission TCM Connector From TCM • Measure the resistance between TSS/intermediate shaft speed sensor connector pins 1, 2, 3 and 4 and ground. • Measure the resistance between OSS sensor connector pins 1, 2 and 3 and ground. 	Yes GO to D7. No REPAIR the short circuits. TEST the system for normal operation. CLEAR all DTCs. RERUN the OBD Tests.
Are the resistances greater than 10,000 ohms?	

Table 57 PINPOINT TEST D: TURBINE SHAFT SPEED (TSS), INTERMEDIATE SHAFT SPEED, AND OUTPUT SHAFT SPEED (OSS) SENSORS (cont.)

Test Step	Result / Action to Take								
D7 CHECK THE RESISTANCE OF THE TSS, INTERMEDIATE SHAFT SPEED SENSOR OR OSS SENSOR	<p>Yes GO to D8.</p> <p>No INSTALL a new sensor. TEST the system for normal operation.</p>								
<ul style="list-style-type: none"> Disconnect the appropriate vehicle harness connector from the TSS, intermediate shaft speed sensor or OSS sensor. Measure the resistance between pins 3 and 2 for the OSS sensor. Measure the resistance between pins 2 and 4 for the intermediate shaft speed sensor. Measure the resistance between pins 2 and 3 for the TSS sensor. Record the resistance. Resistance should be as follows: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Resistance (ohms)</th> <th style="text-align: center;">Temperature °C (°F)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">266-390</td> <td style="text-align: center;">-20 (-4)</td> </tr> <tr> <td style="text-align: center;">325-485</td> <td style="text-align: center;">21 (70)</td> </tr> <tr> <td style="text-align: center;">492-738</td> <td style="text-align: center;">150 (302)</td> </tr> </tbody> </table>	Resistance (ohms)	Temperature °C (°F)	266-390	-20 (-4)	325-485	21 (70)	492-738	150 (302)	
Resistance (ohms)	Temperature °C (°F)								
266-390	-20 (-4)								
325-485	21 (70)								
492-738	150 (302)								
Is the resistance within specification for the appropriate sensor?									
D8 CHECK THE SENSORS FOR A SHORT TO GROUND	<p>Yes INSTALL a new sensor. TEST the system for normal operation.</p> <p>No INSTALL a new TCM.</p>								
Is the resistance less than 10,000 ohms?									

CAUTION: This test should only be used if DTCs P0748, P0960, P0962 or P0963 are present.

NOTE: Refer to the Transmission Vehicle Harness Connector illustration preceding these pinpoint tests.

NOTE: Refer to the Internal Harness Connector illustration preceding these pinpoint tests.

Table 58 PINPOINT TEST E: PC-A (LINE PRESSURE) SOLENOID

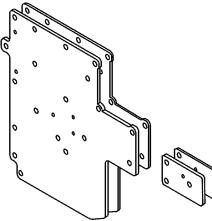
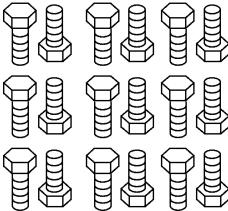
Test Step	Result / Action to Take
E1 CHECK VEHICLE HARNESS FOR CONTINUITY <ul style="list-style-type: none"> • Key in OFF position. • Disconnect transmission control module (TCM) connector. • Inspect for damage or pushed out pins, corrosion or loose wires. • Disconnect vehicle harness from transmission, inspect for damage or pushed out pins, corrosion or loose wires. • Measure resistance between the appropriate pin at the transmission TCM connector, harness side and the signal pin 10 at transmission harness connector. • Measure resistance between the appropriate pin at the transmission TCM connector, harness side and the power pins 7, 20, and 24 at the transmission harness connector. 	Yes GO to E2. No REPAIR an open. RECONNECT all components. REPEAT Quick Test.
Is each resistance less than 5.0 ohms?	
E2 CHECK VEHICLE HARNESS FOR SHORTS TO POWER AND GROUND <ul style="list-style-type: none"> • Measure resistance between the appropriate pin at the transmission TCM connector, harness side and the power pins 7, 20, and 24. • Measure resistance between the appropriate pin at the transmission TCM connector, harness side and chassis ground. 	Yes GO to E3. No SERVICE short circuit. RECONNECT all components. REPEAT Quick Test.
Is each resistance greater than 10,000 ohms?	
E3 CHECK FOR TRANSMISSION INTERNAL HARNESS <ul style="list-style-type: none"> • Drain the transmission fluid. • Remove the transmission fluid pan. • Disconnect: Affected Solenoid • Measure the resistance between pin 10 transmission bulkhead side and pin 2 at the solenoid connector. • Measure the resistance between pins 7, 20 and 24 transmission bulkhead side and pin 1 at each associated solenoid connector. 	Yes GO to E4. No INSTALL a new harness. RECONNECT all components. REPEAT Quick Test.
Are the resistances less than 0.5 ohms?	

Table 58 PINPOINT TEST E: PC-A (LINE PRESSURE) SOLENOID (cont.)

Test Step	Result / Action to Take
E4 CHECK FOR A SHORT TO GROUND <ul style="list-style-type: none"> Measure the resistance between pins 10 harness side and ground. Is the resistance greater than 10,000 ohms?	Yes GO to E5. No INSTALL a new harness. RECONNECT all components. REPEAT Quick Test.
E5 CHECK THE SOLENOID RESISTANCE AT THE SOLENOID <ul style="list-style-type: none"> Measure the resistance between pins 1 and 2 at each solenoid. Is the resistance for PC-A solenoid between 5.08-5.80 ohms?	Yes GO to E6. No INSTALL a new solenoid if not within specifications. CLEAR the DTCs. TEST the system for normal operation.
E6 CHECK THE SOLENOID FOR A SHORT TO GROUND <ul style="list-style-type: none"> Measure the resistance between pins 1 and 2 at each solenoid and ground. Is the resistance greater than 10,000 ohms?	Yes INSTALL a new TCM. If the condition persists. REFER to in this section for diagnosis of pressure concerns. CLEAR the DTCs. TEST the system for normal operation. No INSTALL a new solenoid. CLEAR the DTCs. TEST the system for normal operation.

Special Testing Procedures

Table 59 Special Tools

	Air Test Plate ZTSE9114
	Test Plate Screw Set, Transmission ZTSE9107

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

Engine Idle Speed Check

Refer to the Engine Diagnostics Manual for diagnosis and testing of the engine idle speed.

Line Pressure Test

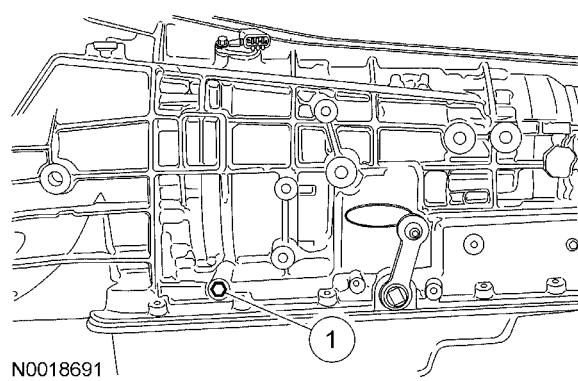


Figure 19

1. Line pressure tap

CAUTION: Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the Stall Speed Test or additional transmission damage will occur. Do not maintain wide-open throttle (WOT) in any transmission range for more than 5 seconds or transmission damage may occur.

CAUTION: Apply the parking brake and block drive wheels during the line pressure test. Vehicle movement during the test may cause personal injury or damage to the vehicle and equipment.

NOTE: Certain sensor failures may cause high control pressure and failure mode effect management (FMEM) actions. Make sure that on-board diagnostic and electrical repairs have been carried out, or test results may be incorrect.

This test verifies the line pressure is within specifications.

1. Connect the Pressure Gauge to the line pressure tap.
2. Start the engine and check the line pressures at idle speeds with the transmission in each gear range. Refer to the Line Pressure Chart to determine if the line pressure is within specification.

CAUTION: Do not immediately press the throttle to the floor or allow the throttle to immediately close, or internal damage to the engine or transmission will occur.

3. Check line pressure at wide open throttle (WOT) stall speed with the range selector lever in all gear ranges. Slowly press the throttle to WOT record the pressure reading. After recording the pressure reading slowly release the throttle until closed throttle is obtained (idle). Refer to the Line Pressure Chart to determine if the line pressure is within specification.

4. If pressure is not within specification, refer to the Line Pressure Chart for further diagnosis.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 60 Pressure Chart A

Gear	Line Pressure — kPa (psi)		Commanded (a) — PC-A pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	414 (60)	—	248 (36)	—
R	496 (72)	2,068 (300)	310 (45)	1,407 (204)
(D)	538 (78)	1,793 (260)	338 (49)	1,379 (200)
3	538 (78)	1,793 (260)	338 (49)	1,172 (170)
2	551 (80)	1,379 (200)	338 (49)	952 (138)
1	538 (78)	1,793 (260)	338 (49)	1,213 (176)

(a) = commanded pressure as viewed on diagnostic equipment.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 61 Pressure Chart B

Gear	Commanded (a) — SSPC-A pressure kPa (psi)		Commanded (a) — SSPC-B pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	0	—	0	—
R	531 (77)	2,068 (300)	0	0
(D)	0	0	0	0
3	572 (83)	1,820 (264)	0	0
2	0	0	586 (85)	1,434 (208)
1	0	0	0	0

(a) = commanded pressure as viewed on diagnostic equipment.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 62 Pressure Chart C

Gear	Commanded (a) — SSPC-C pressure kPa (psi)		Commanded (a) — SSPC-D pressure kPa (psi)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	0	—	0	—
R	0	0	0 (b)	0 (b)
(D)	0	0	0	0
3	572 (83)	1,820 (264)	0	0
2	0	0	0	0
1	0	0	0	0

(a) = commanded pressure as viewed on diagnostic equipment.
(b) = SSPC-D commanded pressure as viewed on diagnostic equipment will be zero. The manual valve controls pressure to the direct clutch in the R detent position.

NOTE: Actual and commanded pressures will vary based on calibration and transmission adaptive strategies. All pressures listed are approximate.

Table 63 Pressure Chart D

Gear	Commanded (a) — SSPC-E pressure kPa (psi)	
	Idle	WOT Stall
P, N	965 (140)	—
R	1,048 (152)	0
(D)	207 (30)	0
3	0	0
2	1,103 (160)	0
1	1,089 (158)	0

(a) = commanded pressure as viewed on diagnostic equipment.

Table 64 Line Pressure Diagnostic Chart

Test Results	Possible Source
High line pressure at idle — all ranges	<ul style="list-style-type: none"> • Wiring harness (external or internal). • PC-A solenoid. • Main regulator valve in pump stuck.
Low line pressure at idle — all ranges	<ul style="list-style-type: none"> • PC-A solenoid concerns. • Low fluid level. • Blown out solenoid gasket filter (7H200). • Line pressure blow off valve stuck open (on solenoid body assembly). • Cross leaks due to loose bolts on the solenoid body. • Line pressure skill valve in pump stuck open. • Restricted or damage sump filter. • Sticking pump regulator valve.
Low coast clutch pressure	<ul style="list-style-type: none"> • Wiring harness (external or internal). • SSPC-A solenoid. • Coast clutch assembly.
Low overdrive clutch pressure	<ul style="list-style-type: none"> • Wiring harness (external or internal). • SSPC-B solenoid. • Overdrive clutch assembly.
Low intermediate clutch pressure	<ul style="list-style-type: none"> • Wiring harness (external or internal). • SSPC-C solenoid. • Intermediate clutch assembly.
Low direct clutch pressure	<ul style="list-style-type: none"> • Wiring harness (external or internal). • SSPC-D solenoid. • Direct clutch assembly.
Low low/reverse clutch pressure	<ul style="list-style-type: none"> • Wiring harness (external or internal). • SSPC-E solenoid. • Low/reverse clutch assembly.

Stall Speed Test

WARNING: Apply the service and parking brakes firmly while carrying out each stall test.

CAUTION: Carry out the Line Pressure Test prior to carrying out the Stall Speed Test. If line pressure is low at stall, do not carry out the stall test or additional transmission damage will occur. Do not maintain wide open throttle (WOT) in any gear range for more than 5 seconds.

CAUTION: After testing each of the ranges, move the range selector into the NEUTRAL position and run the engine at 1,000 rpm for about 15 seconds to allow the torque converter to cool off before continuing onto the next range.

CAUTION: If the engine speed recorded by the tachometer exceeds maximum specified rpm, release the throttle immediately. Clutch or band slippage is indicated.

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

NOTE: Prolonged use of this procedure may set DTCs P0712 or P1783. After carrying out the stall speed test, run on-board diagnostics and clear the DTCs.

The stall test checks the operation of the following items:

- Torque converter clutch (TCC)
- Forward clutch
- Low one-way clutch
- Overdrive one-way clutch
- Engine driveability concerns
 1. Connect a tachometer to the engine.
 2. Press the accelerator pedal to floor (WOT) in each range. Record the rpm reached in each range. Stall speeds should be in the appropriate range.

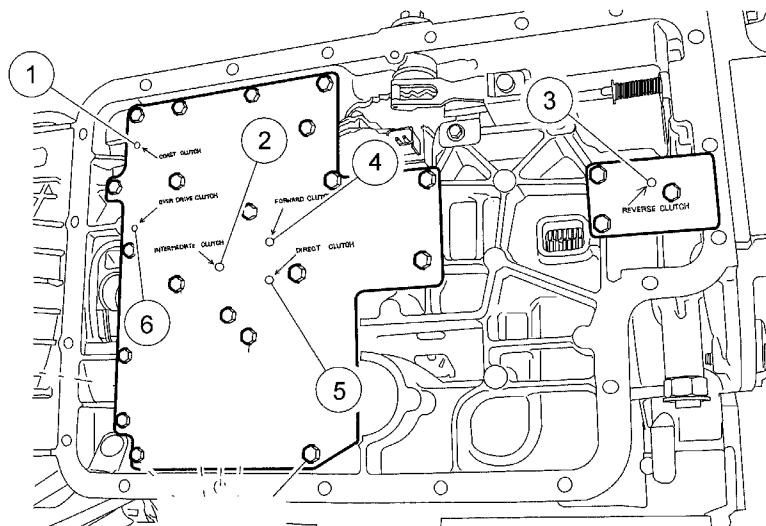
Table 65 Stall Speed Chart

Engine	Min.	Max.
4.5L Diesel	2,091	2,401

Table 66 Stall Speed Diagnostic Chart

Test Results	Possible Source
Stall speed high — R only	<ul style="list-style-type: none"> • General line pressure concerns • Overdrive one-way clutch • Direct clutch • Reverse clutch
Stall speed high — (D)	<ul style="list-style-type: none"> • General line pressure concerns. • Overdrive one-way clutch. • Forward clutch. • Low/reverse one-way clutch.
Stall speed high — Manual 3 only	<ul style="list-style-type: none"> • Overdrive one-way clutch. • Coast clutch. • Forward clutch. • Intermediate clutch.
Stall speed high — Manual 2 only	<ul style="list-style-type: none"> • Overdrive one-way clutch. • Forward clutch. • Low/reverse one-way clutch. • Reverse clutch.
Stall speed high — Manual 1 only	<ul style="list-style-type: none"> • Coast clutch. • Overdrive one-way clutch. • Forward clutch. • Low/reverse one-way clutch. • Reverse clutch.
Stall speed low — D, 3, 2, 1, and R	<ul style="list-style-type: none"> • Torque converter clutch (TCC). • Engine driveability concerns.

Air Pressure Tests



N0018692

Figure 20 Air Pressure Test Port Locations

- | | | |
|-----------------------------|------------------------|--------------------------|
| 1. Coast clutch feed | 3. Reverse clutch feed | 5. Direct clutch feed |
| 2. Intermediate clutch feed | 4. Forward clutch feed | 6. Overdrive clutch feed |

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

Example: When the transmission range selector lever is in a forward gear range (D, 3, 2, 1), a no-drive condition may be caused by an inoperative forward clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.
2. Remove the filter and seal assembly, the solenoid body, the control assemblies and separator plate, upper/lower gaskets.
3. The inoperative clutches can be located by applying air pressure into the appropriate clutch port. See the Air Pressure Test Port Locations illustration for clutch port locations.

4. Apply air pressure to the appropriate clutch port (see the Air Pressure Test Port Locations illustration). A dull thud may be heard or movement felt when a clutch piston is applied. If the clutch seals or check ball are leaking, a hissing may be heard.
5. If the clutches fail to operate during the air check:
 - inspect the fluid passages in the case.
 - the piston seals are not seated, not installed or are damaged.
 - plugged feed holes for clutch apply in the case and/or clutch cylinder.
 - damaged piston and/or clutch cylinder.
6. Repair as required and recheck.

Leakage Inspection

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

- Gaskets
- Lip-type seals
- O-ring seals

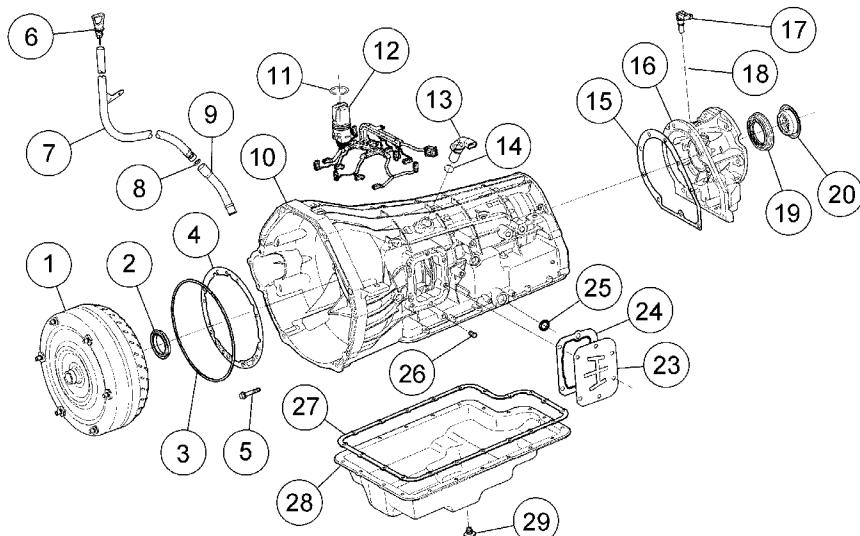
S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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- Seal rings
- Seal grommets
- Thread sealant
- Sealing washers



N0029363

Figure 21 External Sealing

- | | | |
|------------------------------------|--|--|
| 1. Torque converter assembly | 12. Bulkhead connector and harness | 20. Transmission output shaft retainer |
| 2. Front pump seal | 13. Turbine shaft speed (TSS) sensor (model-dependent) | 21. PTO — case cover (if equipped) |
| 3. Front pump seal | 14. O-ring seal | 22. PTO — cover gasket (if equipped) |
| 4. Pump gasket | 15. Extension housing gasket | 23. Manual control lever seal |
| 5. Front pump sealing bolt | 16. Extension assembly | 24. Plug — test port — 1/8-27 hex head |
| 6. Fluid level indicator | 17. Output shaft speed sensor | 25. Transmission fluid pan gasket |
| 7. Fluid filler tube assembly | 18. O-ring seal | 26. Transmission fluid pan |
| 8. Filler tube O-ring | 19. Extension housing seal | 27. Fluid pan drain plug |
| 9. Short fluid inlet tube assembly | | |
| 10. Case | | |
| 11. Bulkhead connector O-ring seal | | |

Leakage at the transmission pan-to-case gasket often can be stopped by tightening the retaining bolts to specification. Refer to Torque Specifications in this section. If necessary, install a new pan-to-case gasket only if gasket is damaged.

If leakage is found by the solenoid body connector, refer to Solenoid Body Assembly in this section.

When fluid is found to be leaking between the case and the cooler tube fitting, tighten the fitting to maximum specification. Refer to Transaxle/Transmission Cooling(Transaxle / Transmission Cooling, page 299).

If the vehicle is equipped with power take-off (PTO), check the sealing gasket at the PTO unit for leaks.

CAUTION: Do not try to stop the fluid leak by increasing the torque beyond specification. This can cause damage to the case threads and/or case fittings.

If the leak continues, install new cooler tube fitting and tighten to specification. The same procedure should

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Follow all warnings, cautions, and notes.

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be followed for fluid leaks between the oil-to-air cooler transmission remote filter, and the cooler tube fittings.

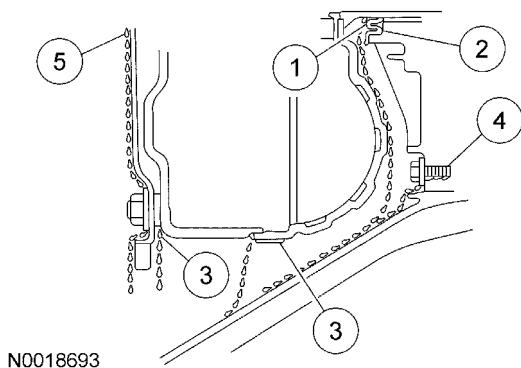
If leakage is found at the manual control lever shaft, install a new seal.

Check for fluid leaking from the end of the extension housing. Leakage can result from a damaged seal, missing garter spring, worn extension bushing, damaged speed sensor plug or the output shaft retainer (vehicles equipped with a fixed yoke). Install a new seal assembly, bushing or both, as necessary.

Inspect the line pressure plug for leakage. Make sure it is tightened to specification. Refer to Torque Specifications in this section. If tightening the plug does not stop the leak, the case threads and/or plug could be damaged. Remove the plug and inspect the plug and case thread for damage. Repair as necessary.

Fluid Leakage in Torque Converter Area

In diagnosing and correcting fluid leaks in the front pump assembly and torque converter area, use the following procedures to locate the exact cause of the leakage. Leakage at the front of the 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 the 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 following 5 steps correspond with the numbers in the illustration.



- 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.

- Fluid leakage by the outside diameter of the front pump seal and front pump body will follow the same path as leaks by the inside diameter.
- Fluid leakage from the 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.
- 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.

NOTE: White facial tissue may aid in determining the color (transmission fluid is red) 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.

- 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.
- 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.
- Leakage at the crankshaft rear oil seal will work back to the flexplate, and then into the torque converter housing.

Leak Check Test with Black Light

NOTE: An ultraviolet light must be used to detect the fluorescent dye solution.

- Add UV Fluorescent Tracer dye for automatic transmission fluid. Use 1 ounce of dye solution for every 4 quarts of ATF capacity. Add any transmission fluid, designated for the transaxle/transmission, to bring the unit to its correct fluid level.

2. Start and run the engine. Shift the transmission through all the gears several times to make sure the fluorescent dye has had enough time to circulate. Observe the back of the engine cylinder block and the top of the converter housing part of the case for evidence of leakage. Turn off the engine.
3. Position the vehicle on a hoist. For additional information, refer to Jacking and Lifting in S10019.
4. **NOTE: The leak source will probably be above and/or forward of the actual leak indications due to airflow and/or gravity.**

Using an ultraviolet light, observe the transmission. Follow the leak back to its source point. Repair as required.

Table 67 External Fluid Leaks

Leak Path	Possible Source
Leaks at the fluid pan-to-case	<ul style="list-style-type: none"> • Pan bolts not tightened to specification. • Case pan rail damaged. • Pan gasket damaged.
Fluid cooler lines or fittings leaking	<ul style="list-style-type: none"> • Cooler line(s), cooler line fitting(s) damaged. • Cooler line fittings-to-case union damaged. • Case damage at case fitting. • Fittings not tightened to specifications.
Fluid cooler line nut-to-case fittings leaking	<ul style="list-style-type: none"> • Damaged or missing O-ring seals. • Fittings not tightened to specifications.
Leaks at the fluid cooler	<ul style="list-style-type: none"> • Fluid cooler damage. • Fitting(s) damaged or not tightened to specifications.
Leaks at the external sensors	<ul style="list-style-type: none"> • Damaged or missing O-ring seals. • Screw not tightened to specifications.
Leaks at the manual control lever seal	<ul style="list-style-type: none"> • Damaged or missing lever seal.
Leaks at the solenoid body harness connector	<ul style="list-style-type: none"> • Install a new solenoid body harness connector O-ring seal. Either on the harness end or the solenoid body.
Fluid leakage in the torque converter area	<ul style="list-style-type: none"> • For possible sources refer to Fluid Leakage In Torque Converter Area Chart.

Transmission Fluid Cooler

Table 68 Special Tool

	EZ-Tech III
---	-------------

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

When internal wear or damage has occurred in the transmission, metal particles or clutch plate 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 Fluid Level Check under Verification of Condition in this section. Refer to Line Pressure Test under Special Testing Procedures in this section. For shift linkage/cable adjustment procedures, refer to Automatic Transaxle/Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).

1. Install EZ-Tech and monitor the transmission fluid temperature (TFT) sensor.
2. Remove the fluid level indicator from the fluid filler tube.
3. Place a funnel in the fluid filler tube.
4. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Jacking and Lifting in S10019.

5. Disconnect the cooler return tube (rear fitting) from the transmission case.
6. Connect one end of a hose to the cooler return tube and route the other end of the hose up to a point where it can be inserted into the funnel at the fluid filler tube.
7. Insert the end of a hose into the funnel.
8. Start the engine and run at idle with the transmission in the NEUTRAL range.
9. 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.

Table 69

Temperature	Flow
44°C (112°F)	236.6 ml (8 oz) 15 sec
78°C (172°F)	473.2 ml (16 oz) 15 sec
82°C (180°F) and up	1893 ml (64 oz) 15 sec

There is a temperature valve in the pump. Cooler flow rates will vary according to automatic transmission fluid temperature. The use of a diagnostic tool will determine the actual fluid temperature. If adequate flow is observed into the container, the test is now complete.

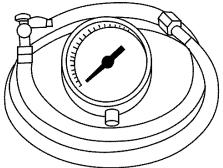
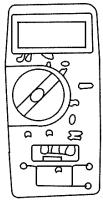
10. If adequate flow is not observed, turn off the engine. Disconnect the hose from the cooler return line (transmission inlet).
11. Disconnect the fluid cooler tube from the front case fitting and connect the hose to the case fitting (converter out) and repeat Steps 7, 8 and 9.
12. If adequate flow is not observed from the transmission, look for a plugged or crushed cooler tube, plugged remote filter manifold orifice, and/or fluid cooler. Refer to Transaxle/Transmission Cooling(Transaxle / Transmission Cooling, page 299) for diagnosis of the transmission fluid cooler.
13. If adequate flow is still not observed, repair or installation of a new pump and/or torque converter may be required.

For the installation of new transmission fluid cooler tubes, refer to Transaxle/Transmission

Cooling(Transaxle / Transmission Cooling, page 299).

Diagnosis By Symptom

Table 70 Special Tools

	UV Leak Detector Kit ZTSE4618 ST1300-A
	Transmission Fluid Pressure Gauge ZTSE9103 ST1565-A
	Automotive Meter ZTSE4357 ST1137-A
	EZ-Tech III

The Diagnosis By Symptom Index gives the technician diagnostic information and direction. It suggests possible components, using a symptom as a starting point. All routines start out with any potential electrical

components that can cause or contribute to the symptom described. The routines then list all possible hydraulic or mechanical components that can cause or contribute to the symptom described.

Diagnosis By Symptom Index Directions

1. Use the Symptom Index to 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. verification of conditions.
 - c. checking 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 components listed.**

NOTE: When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The Transmission Control Module (TCM) 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 TCM.

Follow the reference or action statements. Always carry out the on-board diagnostic tests as necessary. Never skip steps. Repair as necessary. If the concern is still present after the electrical components have been diagnosed, proceed to the hydraulic/mechanical components listed.

5. The list contains only possible hydraulic or mechanical components that may cause or contribute to the concern. These components are listed in the removal sequence and by most probable cause. All components listed must be inspected to make sure repair is correct.

Table 71 Diagnosis by Symptom Index

Concerns and Symptoms	Routines
Engagement Concerns	
No Forward ONLY	201
No Reverse ONLY	202
Harsh Reverse ONLY	203
Harsh Forward ONLY	204
Delayed/Soft Reverse ONLY	205
Delayed/Soft Forward ONLY	206
No Forward and No Reverse	207
Harsh Forward and Harsh Reverse	208
Delayed Forward and Delayed Reverse	209
Shift Concerns	
Some/All Shifts Missing	210
Timing Concern — Early/Late (Some/All)	211
Timing Concern — Erratic/Hunting (Some/All)	212
Feel Concern — Soft/Slipping (Some/All)	213
Feel Concern — Harsh (Some/All)	214
No 1st Gear in Drive, Engages in a Higher Gear	215
No 1st Gear in Manual 1st	216
No Manual 2nd Gear in Manual 2nd	217
No Manual 3rd Gear in Manual 3rd	218
Harsh 6-5 Coast Downshift in Tow Haul	246
Harsh 5-3 Coast Downshift in Tow Haul or to Manual 3rd	247
Harsh 3-2 Coast Downshift in Tow Haul or to Manual 2nd	248
Harsh 2-1 Coast Downshift in Tow Haul or to Manual 1st	249

Table 71 Diagnosis by Symptom Index (cont.)

Concerns and Symptoms	Routines
Torque Converter Clutch Operation Concerns	
Does Not Apply	250
Always Applied/Stalls Vehicle	251
Cycling/Shudder/Chatter	252
Erratic Scheduling	253
Other Concerns	
Shift Lever Efforts High	254
External Leaks	255
Vehicle Driveability Concerns	256
Noise/Vibration — Forward or Reverse	257
Engine Will Not Crank	258
No Park Range	259
Transmission Overheating	260
Fluid Venting or Foaming	261
Unexpected Elevated Idle Speed	262
No Tow Haul Mode	263
Reverse Lamps Do Not Illuminate	264
FMEM	265
PTO Concerns	266
Engagement Schedule Update	267
— Dead battery	
— Battery disconnected	
— Calibration updated	

Table 72 No Forward Only

Possible Component	Reference/Action
201 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness, line pressure control (PC-A) solenoid	Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again. GO to Pinpoint Test E.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressure Low pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged, blown out, leaking C. Contamination D. PC-A solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new PC-A solenoid or solenoid body assembly. If misassembled, reassemble correctly.
OD OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install new if damaged or fails inspection.
Center Support A. Feed bolt not tightened to specification B. FWD clutch seal rings damaged C. Support damaged or leaking	A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Forward Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install new if damaged or fails inspection.

Table 73 No Reverse Only

Possible Component	Reference/Action
202 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness, line pressure control (PC-A) solenoid	Repair as required. Clear DTCs, road test and carry out on-board diagnostic test. GO to Pinpoint Test E.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressure Low pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged, blown out, leaking C. Contamination D. PC-A solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new PC-A solenoid or solenoid body assembly. If misassembled, reassemble correctly.
Center Support <ul style="list-style-type: none"> A. Feed bolt not tightened to specification B. Direct clutch seal rings or bearing damaged C. Support damaged or leaking 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 74 Harsh Reverse Only

Possible Component	Reference/Action
203 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness, line pressure solenoid (PC-A), low/reverse solenoid SSPC-E	Repair as required. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test A and Pinpoint Test F.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
PTO Input to TCM	
Incorrect Pressure High pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A, SSPC-E Solenoid damaged, stuck or bore damaged. Manual valve or solenoid damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new PC-A solenoid or solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs or seal damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. Repair as necessary. If damaged, install a new gasket. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. If damaged, install a new pump. E. Inspect for damage. Repair as necessary. If damaged, install a new seal or pump assembly.
Center Support A. Feed bolt not tightened to specification B. FWD clutch seal rings damaged C. Center support damaged or leaking	A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.

Table 74 Harsh Reverse Only (cont.)

Possible Component	Reference/Action
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged
Low/Reverse Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged

Table 75 Harsh Forward Only

Possible Component	Reference/Action
204 — ROUTINE	
Powertrain Control System	Carry out on-board diagnostic tests.
TCM, external vehicle wiring harnesses, transmission internal harness	Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
External Shift Cable	Inspect and repair as necessary.
Incorrect Pressure	<p>Check pressure at line tap.</p> <p>Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.</p>
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoids damaged, stuck or bore damaged. Manual valve or solenoid damaged, stuck or bore damaged
	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 75 Harsh Forward Only (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	
A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs or seal damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. Repair as necessary. If damaged, install a new gasket. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. If damaged, install a new pump. E. Inspect for damage. Repair as necessary. If damaged, install a new seal or pump assembly.
Forward Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 76 Delayed or Soft Reverse Only

Possible Component	Reference/Action
205 — ROUTINE	
Powertrain Control System	
TCM, external vehicle wiring harnesses, transmission internal harness, line pressure solenoid (PC-A), low/reverse solenoid SSPC-E	GO to Pinpoint Test A and Pinpoint Test E. Repair as required. Clear DTCs, road test and carry out on-board diagnostic test again.
External Shift Cable	
Cable system damaged, misaligned	Inspect and repair as necessary.

Table 76 Delayed or Soft Reverse Only (cont.)

Possible Component	Reference/Action
Incorrect Pressure	
Low pressure	<p>Check pressure at line tap.</p> <p>Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.</p>
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A, SSPC-E Solenoid damaged, stuck or bore damaged. Manual valve or solenoid damaged, stuck or bore damaged <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid or solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs or seal damaged, stuck or not assembled correctly <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. Repair as necessary. If damaged, install a new gasket. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. If damaged, install a new pump. E. Inspect for damage. Repair as necessary. If damaged, install a new seal or pump assembly.
Center Support	<ul style="list-style-type: none"> A. Feed bolt not tightened to specification B. FWD clutch seal rings damaged C. Support damaged or leaking <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 76 Delayed or Soft Reverse Only (cont.)

Possible Component	Reference/Action
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 77 Delayed or Soft Forward Only

Possible Component	Reference/Action
206 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness, line pressure solenoid (PC-A)	Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test E.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A, Solenoid damaged, stuck or bore damaged. Manual valve or solenoid damaged, stuck or bore damaged <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new PC-A solenoid or solenoid body assembly. If misassembled, reassemble correctly.

Table 77 Delayed or Soft Forward Only (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	
A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs or seal damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. Repair as necessary. If damaged, install a new gasket. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. If damaged, install a new pump. E. Inspect for damage. Repair as necessary. If damaged, install a new seal or pump assembly.
OD OWC	
Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.
Forward Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse OWC	
Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.
Low/Reverse Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 78 No Forward and No Reverse

Possible Component	Reference/Action
207 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness, line pressure solenoid (PC-A)	Repair as required. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test E.

Table 78 No Forward and No Reverse (cont.)

Possible Component	Reference/Action
Fluid Incorrect level	Adjust to the correct level. Refer to Preliminary Inspection in this section.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressure Low pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged. Line pressure blowoff valve damaged.	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new PC-A solenoid or solenoid body assembly. If misassembled, reassemble correctly.
Input Shaft Shaft damaged	Inspect for damage. Repair as necessary.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly, skill orifice plugged, LPC air bleed plugged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. Repair as necessary. D. Inspect for damage. If damaged, install a new pump. E. Inspect for damage. If damaged, install a new seal or pump assembly.
Center Shaft Assembly A. Shaft damaged B. Overdrive one-way clutch damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary.

Table 78 No Forward and No Reverse (cont.)

Possible Component	Reference/Action
Center Support	
A. Feedbolt not tightened to specification B. FWD clutch seal rings damaged C. Support damaged or leaking	A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Output Shaft	
Shaft damaged	Inspect for damage. Repair as necessary.
Torque Converter	
Flexplate, adapter plate, turbine hub or impeller hub damaged	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 79 Harsh Forward and Harsh Reverse

Possible Component	Reference/Action	
208 — ROUTINE		
Powertrain Control System	If the battery has been disconnected or the TCM has been reflashed, carry out the engagement schedule update. NOTE: The battery being disconnected or a TCM reflash will cause firm engagements. TCM, external vehicle wiring harnesses, transmission internal harness, line pressure solenoid PC-A, torque converter clutch solenoid TCC, TSS/intermediate shaft speed sensor and TR-P sensors, PTO input	GO to Pinpoint Test A, B, C, D and E. Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.
Fluid		
Incorrect level Condition	Adjust to the correct level. Refer to Preliminary Inspection in this section. Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.	

Table 79 Harsh Forward and Harsh Reverse (cont.)

Possible Component	Reference/Action
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A, TCC solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged. Blowoff valve damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly, blowoff valve damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Low/Reverse Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 80 Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ROUTINE	
Powertrain Control System TCM, external vehicle wiring harnesses, transmission internal harness and line pressure solenoid PC-A	GO to Pinpoint Test E. Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.
Fluid Incorrect level Condition	Adjust to the correct level. Refer to Preliminary Inspection in this section. Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 80 Delayed Forward and Delayed Reverse (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Low/Reverse Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 81 Some/All Shifts Missing

Possible Component	Reference/Action
210 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids SSPC-A, SSPC-B, SSPC-C, SSPC-D, SSPC-E, torque converter clutch (TCC) solenoid, line pressure control solenoids PC-A, TSS/intermediate shaft speed sensor, output shaft speed (OSS) sensor, transmission range (TR-P) sensor and, transmission fluid temperature (TFT) sensor	Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test A, B, C, D, and E.
Some Shifts Missing Only	If only some shifts are missing, determine which shift(s) do not occur. Use the Band, Clutch, Solenoid, Switch Application Chart and monitor the appropriate PIDs. Refer to Special Testing Procedures in this section.
Fluid Incorrect level	Adjust to the correct level. Refer to Preliminary Inspection in this section.

Table 81 Some/All Shifts Missing (cont.)

Possible Component	Reference/Action
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section. Follow the pressure diagnosis test as required.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Coast Clutch Assembly A. Seals, piston damaged B. Check ball damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary.
OD OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only, mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.

Table 81 Some/All Shifts Missing (cont.)

Possible Component	Reference/Action
Overdrive Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
A. Seals, piston damaged B. Cup plug missing, plugged or damaged C. Friction elements damaged or worn D. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary.
Forward Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Low/Reverse OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only, mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.

Table 81 Some/All Shifts Missing (cont.)

Possible Component	Reference/Action
Low/Reverse Clutch Assembly	<p>A. Seals, piston damaged</p> <p>B. Filtered orifice damaged, missing, not seating, off location</p> <p>C. Friction elements damaged or worn</p> <p>D. Return springs damaged</p> <p>E. Snap ring for OWC and/or return spring not seated or damaged</p>
Torque Converter Internal failure	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 82 Timing Concerns — Early/Late

Possible Component	Reference/Action
211 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness or tow/haul switch	Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.
Some Shifts Early/Late Only	<p>If only some shifts are early/late, determine which shift(s) is missing.</p> <p>Refer to the following routine(s) for further Soft/Slipping Shift concerns:</p> <ul style="list-style-type: none"> — Soft/Slipping 1-2 Shift, Routine 226 — Soft/Slipping 2-3 Shift, Routine 227 — Soft/Slipping 3-5 Shift, Routine 228 — Soft/Slipping 4-6 Shift, Routine 229 — Soft/Slipping 5-6 Shift, Routine 230 — Soft/Slipping 6-5 Shift, Routine 231 — Soft/Slipping 6-4 Shift, Routine 232 — Soft/Slipping 5-3 Shift, Routine 233 — Soft/Slipping 3-2 Shift, Routine 234 — Soft/Slipping 2-1 Shift, Routine 235

Table 82 Timing Concerns — Early/Late (cont.)

Possible Component	Reference/Action
Fluid Incorrect level	Adjust to the correct level. Refer to Preliminary Inspection in this section. Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump assembly. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 82 Timing Concerns — Early/Late (cont.)

Possible Component	Reference/Action
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support assembly if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new transmission case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 83 Timing Concerns — Erratic/Hunting (Some/All)

Possible Component	Reference/Action
212 — ROUTINE	
Powertrain Control System	<p>GO to Pinpoint Test A, B, C, D and E.</p> <p>Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.</p>
TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids SSPC-A, SSPC-B, SSPC-C, SSPC-D, SSPC-E, line pressure control solenoids PC-A, TSS/intermediate shaft speed sensor, output shaft speed (OSS) sensor, transmission range (TR-P) sensor, transmission fluid temperature (TFT) sensor and tow/haul switch	
FMEM enabled, refer to routine 265	
Fluid	
Incorrect level	<p>Adjust to the correct level. Refer to Preliminary Inspection in this section.</p> <p>Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.</p>

Table 83 Timing Concerns — Erratic/Hunting (Some/All) (cont.)

Possible Component	Reference/Action
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Further Diagnosis For further diagnosis for timing issues, refer to Reference/Actions	Refer to the following routine(s) for specific diagnosis: — Soft/Slipping 1-2 Shift, Routine 226 — Soft/Slipping 2-3 Shift, Routine 227 — Soft/Slipping 3-5 Shift, Routine 228 — Soft/Slipping 4-6 Shift, Routine 229 — Soft/Slipping 5-6 Shift, Routine 230 — Soft/Slipping 6-5 Shift, Routine 231 — Soft/Slipping 6-4 Shift, Routine 232 — Soft/Slipping 5-3 Shift, Routine 233 — Soft/Slipping 3-2 Shift, Routine 234 — Soft/Slipping 2-1 Shift, Routine 235 — Harsh 1-2 Shift, Routine 236 — Harsh 2-3 Shift, Routine 237 — Harsh 3-5 Shift, Routine 238 — Harsh 4-6 Shift, Routine 239 — Harsh 5-6 Shift, Routine 240 — Harsh 6-5 Shift, Routine 241 — Harsh 6-4 Shift, Routine 242 — Harsh 5-3 Shift, Routine 243 — Harsh 3-2 Shift, Routine 244 — Harsh 2-1 Shift, Routine 245

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Follow all warnings, cautions, and notes.

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Table 83 Timing Concerns — Erratic/Hunting (Some/All) (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump assembly. E. Inspect for damage. Install a new seal or pump assembly.
Coast Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Check ball damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump assembly if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Forward Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.

Table 83 Timing Concerns — Erratic/Hunting (Some/All) (cont.)

Possible Component	Reference/Action
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support assembly if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Low/Reverse Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new transmission case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 84 Feel — Soft/Slipping (Some/All)

Possible Component	Reference/Action
213 — ROUTINE	
Powertrain Control System	<p>Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test.</p> <p>GO to Pinpoint A, D, and E.</p>

Table 84 Feel — Soft/Slipping (Some/All) (cont.)

Possible Component	Reference/Action
Some Shifts Soft/Slipping Only	<p>If only some of the shifts are soft/slipping, determine which shift(s) is missing.</p> <p>Refer to the following routine(s) for further Soft/Slipping Shift concerns:</p> <ul style="list-style-type: none"> — Soft/Slipping 1-2 Shift, Routine 226 — Soft/Slipping 2-3 Shift, Routine 227 — Soft/Slipping 3-5 Shift, Routine 228 — Soft/Slipping 4-6 Shift, Routine 229 — Soft/Slipping 5-6 Shift, Routine 230 — Soft/Slipping 6-5 Shift, Routine 231 — Soft/Slipping 6-4 Shift, Routine 232 — Soft/Slipping 5-3 Shift, Routine 233 — Soft/Slipping 3-2 Shift, Routine 234 — Soft/Slipping 2-1 Shift, Routine 235
Fluid Incorrect level Condition	<p>Adjust to the correct level. Refer to Preliminary Inspection in this section.</p> <p>Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.</p>
Incorrect Pressures High/Low pressures	<p>Check pressure at line tap.</p> <p>Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.</p>

Table 84 Feel — Soft/Slipping (Some/All) (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump assembly. E. Inspect for damage. Install a new seal or pump assembly.

Table 85 Feel — Harsh (Some/All)

Possible Component	Reference/Action
214 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids SSPC-B, TSS/intermediate shaft speed sensor, output shaft speed (OSS) sensor, transmission fluid temperature (TFT) sensor	Repair as necessary. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint A, B, and E.

Table 85 Feel — Harsh (Some/All) (cont.)

Possible Component	Reference/Action
Some Shifts Harsh Only	<p>If only some of the shifts are harsh, determine which shift(s) is missing.</p> <p>Refer to the following routine(s) for further Harsh Shift concerns:</p> <ul style="list-style-type: none"> — Harsh 1-2 Shift, Routine 236 — Harsh 2-3 Shift, Routine 237 — Harsh 3-5 Shift, Routine 238 — Harsh 4-6 Shift, Routine 239 — Harsh 5-6 Shift, Routine 240 — Harsh 6-5 Shift, Routine 241 — Harsh 6-4 Shift, Routine 242 — Harsh 5-3 Shift, Routine 243 — Harsh 3-2 Shift, Routine 244 — Harsh 2-1 Shift, Routine 245
Fluid	
Incorrect level	Adjust to the correct level. Refer to Preliminary Inspection in this section.
Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	
High/Low pressures	<p>Check pressure at line tap.</p> <p>Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.</p>
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 85 Feel — Harsh (Some/All) (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Torque Converter Internal failure	<p>Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.</p> <p>Refer to Routine 251: TCC always applied/stalls vehicle.</p>

Table 86 No 1st Gear in Drive, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids SSPC-B, line pressure solenoid PC-A (shorted to ground) and TCC solenoid (shorted to ground)	<p>Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.</p> <p>GO to Pinpoint Test A, D and E.</p>
Incorrect Pressures High/Low pressures	<p>Check pressure at line tap.</p> <p>Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.</p>
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 86 No 1st Gear in Drive, Engages in a Higher Gear (cont.)

Possible Component	Reference/Action
Overdrive Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
OD OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.
Direct Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Low/Reverse OWC Mechanical diode engaged in both directions, struts missing, OWC damaged	Inspect for rotation in one direction only. Mechanical diode should overrun in the opposite direction. Install a new OWC if damaged or fails inspection.
Reverse Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Torque Converter FMEM default mode applying the torque converter clutch	Refer to FMEM routine 265.

Table 87 No 1st Gear in Manual 1 Position

Possible Component	Reference/Action
216 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 87 No 1st Gear in Manual 1 Position (cont.)

Possible Component	Reference/Action
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive OWC Assembly Worn, damaged or not assembled correctly	Inspect for damage. Repair as necessary.
Reverse Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 88 No 2nd Gear in Manual 2 Position

Possible Component	Reference/Action
217 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Input Shaft Shaft damaged	Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly (failed OFF) <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 89 No 3rd Gear in Manual 3 Position

Possible Component	Reference/Action
218 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test.
External Shift Cable Cable system damaged, misaligned	Inspect and repair as necessary.
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly A. Seals, piston damaged B. Check ball damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum assembly. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new cylinder. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 90 Soft/Slipping 1-2 Shift

Possible Component	Reference/Action
226 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-B (overdrive clutch control solenoid), TSS/intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Incorrect level Condition	Adjust to the correct level. Refer to Preliminary Inspection in this section. Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 90 Soft/Slipping 1-2 Shift (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 91 Soft/Slipping 2-3 Shift

Possible Component	Reference/Action
227 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-B, SSPC-C, TSS/intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Table 91 Soft/Slipping 2-3 Shift (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, SSPC-C solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump assembly if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary.

Table 92 Soft/Slipping 3-5 Shift

Possible Component	Reference/Action
228 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-C, SSPC-D, TSS/intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Center Support A. Feedbolt not tightened to specification B. FWD clutch seal rings damaged C. Support damaged or leaking	A. Tighten to specification. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.

Table 92 Soft/Slipping 3-5 Shift (cont.)

Possible Component	Reference/Action
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new cylinder. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 93 Soft/Slipping 4-6 Shift

Possible Component	Reference/Action
229 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoids, SSPC-C, SSPC-D, TSS/intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 93 Soft/Slipping 4-6 Shift (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	
A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Direct Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 94 Soft/Slipping 5-6 Shift

Possible Component	Reference/Action
230 — ROUTINE	

Table 94 Soft/Slipping 5-6 Shift (cont.)

Possible Component	Reference/Action
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A.
Fluid Incorrect level Condition	Adjust to the correct level. Refer to Preliminary Inspection in this section. Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

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Table 94 Soft/Slipping 5-6 Shift (cont.)

Possible Component	Reference/Action	
Fluid Pump Assembly	<p>A. Bolts not tightened to specification</p> <p>B. Gasket damaged</p> <p>C. Porosity, cross leaks, cup plug missing, plugged hole</p> <p>D. Pump gears and/or gear pocket damaged</p> <p>E. Control valves, springs, or seals damaged, stuck or not assembled correctly</p>	<p>A. Tighten to specification.</p> <p>B. Inspect for damage. If damaged, install a new gasket.</p> <p>C. Inspect for damage. If damaged, repair as necessary.</p> <p>D. Inspect for damage. Install a new pump.</p> <p>E. Inspect for damage. Install a new seal or pump assembly.</p>
Overdrive Clutch Assembly	<p>A. Seals, piston damaged</p> <p>B. Filtered orifice damaged, missing, not seating, off location</p> <p>C. Friction elements damaged or worn</p> <p>D. Return springs damaged</p> <p>E. Snap ring for OWC and/or return spring not seated or damaged</p>	<p>A. Inspect for damage. Repair as necessary.</p> <p>B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged.</p> <p>C. Inspect for damage. Repair as necessary.</p> <p>D. Inspect for damage. Repair as necessary.</p> <p>E. Inspect for damage. Repair as necessary.</p>

Table 95 Soft/Slipping 6-5 Shift

Possible Component	Reference/Action
231 — ROUTINE	
Powertrain Control System	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Table 95 Soft/Slipping 6-5 Shift (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 96 Soft/Slipping 6-4 Shift

Possible Component	Reference/Action
232 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-C, SSPC-D, TSS intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.

Table 96 Soft/Slipping 6-4 Shift (cont.)

Possible Component	Reference/Action
Incorrect Pressures High/Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 96 Soft/Slipping 6-4 Shift (cont.)

Possible Component	Reference/Action
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 97 Soft/Slipping 5-3 Shift

Possible Component	Reference/Action
233 — ROUTINE	
Powertrain Control System	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 97 Soft/Slipping 5-3 Shift (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly <ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Direct Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 98 Soft/Slipping 3-2 Shift

Possible Component	Reference/Action
234 — ROUTINE	
Powertrain Control System	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Table 98 Soft/Slipping 3-2 Shift (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, SSPC-C, solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged
Fluid Pump Assembly	<ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly
Overdrive Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged

Table 99 Soft/Slipping 2-1 Shift

Possible Component	Reference/Action
235 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B, TSS/intermediate shaft speed sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 99 Soft/Slipping 2-1 Shift (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, springs, or seals damaged, stuck or not assembled correctly 	<ul style="list-style-type: none"> A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Overdrive Clutch Assembly <ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged 	<ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump assembly if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 100 Harsh 1-2 Shift

Possible Component	Reference/Action
236 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B, TSS/intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Intermediate Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 101 Harsh 2-3 Shift

Possible Component	Reference/Action
237 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B, SSPC-C, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.

Table 101 Harsh 2-3 Shift (cont.)

Possible Component	Reference/Action	
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.	
Incorrect Pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.	
Solenoid Body Assembly	A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, SSPC-C, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Overdrive Clutch Assembly	A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new drum. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 102 Harsh 3-5 Shift

Possible Component	Reference/Action
238 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-C, SSPC-D, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Direct Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 103 Harsh 4-6 Shift

Possible Component	Reference/Action
239 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-C, SSPC-D, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Direct Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 104 Harsh 5-6 Shift

Possible Component	Reference/Action
240 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 105 Harsh 6-5 Shift

Possible Component	Reference/Action
241 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-B, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 106 Harsh 6-4 Shift

Possible Component	Reference/Action
242 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoids, SSPC-C, SSPC-D, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Direct Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 107 Harsh 5-3 Shift

Possible Component	Reference/Action
243 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, pressure control solenoid SSPC-C, SSPC-D, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-C, SSPC-D, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Direct Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 108 Harsh 3-2 Shift

Possible Component	Reference/Action
244 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-B, SSPC-C, TCC solenoid, TSS/ intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, SSPC-D, TCC solenoids damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.

Table 108 Harsh 3-2 Shift (cont.)

Possible Component	Reference/Action
Overdrive Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 109 Harsh 2-1 Shift

Possible Component	Reference/Action
245 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-B, TSS/intermediate shaft speed sensor, OSS sensor, TFT sensor	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B solenoid damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 110 Harsh 6-5 Coast Downshift in Tow Haul Mode

Possible Component	Reference/Action
246 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-A, SSPC-B, TCC solenoid	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-A, SSPC-B, TCC solenoid(s) damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 111 Harsh 5-3 Coast Downshift in Tow Haul Mode or to Manual 3rd

Possible Component	Reference/Action
247 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-A, SSPC-C, SSPC-D, TCC solenoid(s), TSS/ intermediate shaft speed sensors, TFT sensor, PTO input	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B, and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-A, SSPC-C, SSPC-D, TCC solenoid(s) damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Direct Clutch Assembly A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.

Table 111 Harsh 5-3 Coast Downshift in Tow Haul Mode or to Manual 3rd (cont.)

Possible Component	Reference/Action
Intermediate Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Torque Converter Internal failure	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 112 Harsh 3-2 Coast Downshift in Tow Haul Mode or to Manual 2nd

Possible Component	Reference/Action
248 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-B, SSPC-C, SSPC-E, TCC solenoid(s), TSS/ intermediate shaft speed sensors, TFT sensor, PTO input	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B, and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Table 112 Harsh 3-2 Coast Downshift in Tow Haul Mode or to Manual 2nd (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly	
A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-B, SSPC-C, SSPC-E, TSS solenoid(s) damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Intermediate Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 112 Harsh 3-2 Coast Downshift in Tow Haul Mode or to Manual 2nd (cont.)

Possible Component	Reference/Action
Reverse Clutch Assembly	<ul style="list-style-type: none"> A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged <ul style="list-style-type: none"> A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new center support if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Torque Converter Internal failure	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 113 Harsh 2-1 Coast Downshift in Tow Haul Mode or to Manual 1st

Possible Component	Reference/Action
249 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, shift pressure control solenoids, SSPC-A, SSPC-B, TCC solenoid, TSS/ intermediate shaft speed sensors, TFT sensor, PTO input	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B, and D.
Fluid Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Incorrect Pressures High pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.

Table 113 Harsh 2-1 Coast Downshift in Tow Haul Mode or to Manual 1st (cont.)

Possible Component	Reference/Action
Solenoid Body Assembly	
A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-A, SSPC-B, TSS solenoid(s) damaged, stuck or bore damaged, manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Coast Clutch Assembly	
A. Seals, piston damaged B. Friction elements damaged or worn C. Return springs damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary. C. Inspect for damage. Repair as necessary.
Overdrive Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new pump if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.
Reverse Clutch Assembly	
A. Seals, piston damaged B. Filtered orifice damaged, missing, not seating, off location C. Friction elements damaged or worn D. Return springs damaged E. Snap ring for OWC and/or return spring not seated or damaged	A. Inspect for damage. Repair as necessary. B. Inspect for mislocation, poor seating, damage. Install a new case if damaged. C. Inspect for damage. Repair as necessary. D. Inspect for damage. Repair as necessary. E. Inspect for damage. Repair as necessary.

Table 114 TCC Does Not Apply

Possible Component	Reference/Action
250 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal wiring harness, transmission line pressure solenoid PC-A, TCC, TFT, transmission range (TR-P) sensor, OSS	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A, B, C, D, and E.
Incorrect Pressures Low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. SSPC-A, SSPC-B, TCC solenoid(s) damaged, misassembled, missing, stuck or bore damaged. Manual valve damaged, misassembled, missing, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, converter charge limit valve, converter pressure regulator valve springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Torque Converter Internal failure preventing TCC to apply	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 115 TCC Always Apply/Stalls Vehicle

Possible Component	Reference/Action
251 — ROUTINE	
Powertrain Control System Torque Converter Clutch (TCC) Solenoid	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A.
Incorrect Pressures High TCC pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. TCC solenoid damaged, misassembled, missing, stuck or bore damaged. Manual valve damaged, misassembled, missing, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, converter charge limit valve, converter pressure regulator valve springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Torque Converter Internal failure preventing TCC from releasing	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 116 TCC Cycling, Shudder, Chatter

Possible Component	Reference/Action
252 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal wiring harness, line pressure control solenoid PC-A, TCC and tow haul switch	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and E.
Incorrect Pressures High/low TCC pressure	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. PC-A, TCC solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole D. Pump gears and/or gear pocket damaged E. Control valves, converter charge limit valve, converter pressure regulator valve springs, or seals damaged, stuck or not assembled correctly	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. Inspect for damage. Install a new pump. E. Inspect for damage. Install a new seal or pump assembly.
Torque Converter Internal components failure	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 117 Erratic TCC Scheduling

Possible Component	Reference/Action
253 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal wiring harness, TCC solenoid, OSS sensor, transmission range (TR-P) sensor, tow haul switch and TFT sensor, PTO input FMEM enabled causing the TCC to engage, disengage then engage. DTC P0471 present	Repair as necessary. Clear DTCs, road test and re-run on-board diagnostic test. GO to Pinpoint Test A and B.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. TCC solenoid damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Torque Converter Internal component failure	Remove the transmission. Inspect for damage. Refer to Torque Converter in the General Procedures portion of this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 118 Shift Lever Effort High

Possible Component	Reference/Action
254 — ROUTINE	
External Shift Cable System Cable system damaged, misaligned	Inspect and repair as necessary. Refer to Automatic Transaxle/ Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).
Transmission Range (TR-P) Sensor Assembly TR-P sensor assembly damaged, manual valve inner lever pin bent or inner lever damaged	Inspect and repair as necessary. Refer to Digital Transmission Range (TR) Sensor in this section.
Solenoid Body Assembly <ul style="list-style-type: none"> A. Bolts not tightened to specification B. Contamination C. Manual valve damaged, misassembled, stuck or bore damaged 	<ul style="list-style-type: none"> A. Tighten to specification. B. Disassemble and clean. C. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Transmission Case <ul style="list-style-type: none"> A. Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged B. Manual lever assembly pin incorrectly installed C. Parking pawl incorrectly installed 	<ul style="list-style-type: none"> A. Inspect parts for damage. Install new parts if damaged. B. Inspect parts. If parts are found to be installed incorrectly, refer to Transmission in this section. C. Inspect parts. If parts are found to be installed incorrectly, refer to Transmission in this section.

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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Table 119 External Leaks

Possible Component	Reference/Action
255 — ROUTINE	
Powertrain Control System TSS/ intermediate shaft speed sensor, OSS sensor, transmission bulkhead connector	Inspect for leakage. If areas around sensor or bulkhead connector show signs of leakage, install a new sensor O-ring seal.
Fluid Incorrect level	Adjust fluid to the correct level. Refer to Preliminary Inspection in this section.
Transmission External Remote Filter	Inspect for leakage. If damaged, repair as necessary.
Incorrect Pressures High/low pressures	Check pressure at line tap. Carry out Line Pressure Test. Refer to Special Testing Procedures in this section.
Solenoid Body Assembly A. Bolts not tightened to specification B. Filter gasket damaged C. Contamination D. Solenoid(s) damaged, stuck or bore damaged. Manual valve stuck or bore damaged	A. Tighten to specification. B. Inspect for damage. If damaged, install a new filter gasket. C. Disassemble and clean. D. If damaged or parts are missing, install a new solenoid body assembly. If misassembled, reassemble correctly.
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. O-ring damaged D. Porosity	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, install a new O-ring. D. Inspect for damage. If damaged, repair as necessary.
Transmission Case Assembly Case vent damaged, case porosity	Inspect for damage. If damaged, repair as necessary.
Seals/Gaskets Leakage at gaskets, seals	Refer to Leakage Inspection in this section. Remove all traces of lubricant on exposed surface of the transmission. Repair as necessary.

Table 120 Driveability Concerns

Possible Component	Reference/Action
256 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, transmission pressure control solenoids SSPCx, TCC solenoid, OSS, TFT sensors, transmission control tow/haul switch, APP, IAT, ECT sensors	Repair as necessary. Clear DTCs, road test and re-run onboard diagnostic test. GO to Pinpoint Test A, B, D, and E.
Torque Converter A. Torque internal components damaged B. Incorrect torque converter used in overhaul	A. Remove the transmission. Inspect for damage. Refer to Torque Converter in this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter. B. Inspect for correct torque converter assembly. If not correct, install a new or remanufactured torque converter.

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Follow all warnings, cautions, and notes.

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Table 121 Noise/Vibration Forward or Reverse

Possible Component	Reference/Action
257 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, PTO input	Repair as required. Clear DTCs, road test and re-run onboard diagnostic test.
Fluid Incorrect level	Adjust fluid to the correct level. Refer to Preliminary Inspection in this section.
External Shift Cable System Cable system damaged, misaligned, grounding out	Inspect and repair as necessary. Refer to Automatic Transaxle/ Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).
Fluid Pump Assembly A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole gears cracked or seized	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary.
One-Way Clutches Worn, damaged or assembled incorrectly	Inspect for damage. If damaged, repair as necessary.
Other Transmission fluid cooling lines, fill tube grounding, driveshaft damaged	Relocate cooling line or fill tube correctly. Inspect for damage. Repair as necessary.
Gears Gear noise	Inspect for damage. Repair as necessary.
Torque Converter Assembly Flexplate, converter assembly damaged	Remove the transmission. Inspect for damage. Refer to Torque Converter in this section. If the torque converter fails to pass the criteria for replacement or is damaged, install a new or remanufactured torque converter.

Table 122 Engine Will Not Crank

Possible Component	Reference/Action
258 — ROUTINE	
Powertrain Control System NOTE: If the battery has been disconnected or is dead, the transmission shifts and engagements will feel firm. Carry out Routine 267. TCM, vehicle wiring harnesses, vehicle starter transmission internal harness, transmission range (TR-P) sensor	Repair as required. Clear DTCs, road test and re-run onboard diagnostic test. GO to Pinpoint Test C. Check PIDs for TR-P, PARK and NEUTRAL.
Engine Components Sensors, solenoids, fan clutch damages, shorted to power or ground.	Refer to EGES-305, Engine Diagnostics Manual, for engine concerns. Refer to the Wiring Diagrams.
Vehicle Starter Starter damaged	Inspect and repair as necessary. Refer to the Engine Operation and Maintenance Manual.
External Shift Cable System Cable system damaged, misaligned	Inspect and repair as necessary. Refer to Automatic Transaxle/ Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).
TR-P Sensor Assembly TR-P assembly damaged	Inspect and repair as necessary.
Fluid Pump Assembly Internal parts seized	Inspect for damage and repair as necessary.
Torque Converter Flexplate damaged	Inspect for damage and repair as necessary.

Table 123 No Park Range

Possible Component	Reference/Action
259 — ROUTINE	
Shift Cable System	
Cable system damaged, misaligned	Inspect and repair as necessary. Refer to Automatic Transaxle/ Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).
TR-P Assembly	
TR-P assembly damaged	Inspect and repair as necessary.
Transmission Case	
A. Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged B. Manual valve lever shaft retaining pin damaged	A. Inspect for damage. If damaged, install new components. B. Inspect for damage. If damaged, repair as necessary.
Park System	
A. Park gear, parking pawl, parking pawl return spring, park or guide plate, parking actuating rod, parking pawl shaft, manual lever, manual lever detent spring damaged or misassembled B. External linkages/brackets damaged	A. Inspect for damage. Repair as necessary. B. Inspect for damage. Repair as necessary.

Table 124 Transmission Overheating

Possible Component	Reference/Action
260 — ROUTINE	
Powertrain Control System	
NOTE: FMEM may be enabled, refer to routine 266. TCM, vehicle wiring harnesses, line pressure control solenoid PC-A, TCC solenoid	Repair as required. Clear DTCs, road test and re-run onboard diagnostic test. GO to Pinpoint Test A and E.
Fluid	
Incorrect level	Adjust fluid to the correct level. Refer to Preliminary Inspection in this section.
Transmission External Remote Filter	
	Inspect for leakage. If damaged, repair as necessary.

Table 124 Transmission Overheating (cont.)

Possible Component	Reference/Action
Fluid Pump Assembly	
A. Bolts not tightened to specification B. Gasket damaged C. Porosity, cross leaks, cup plug missing, plugged hole gears cracked or seized D. Control valves and springs or seal damaged, misassembled or stuck	A. Tighten to specification. B. Inspect for damage. If damaged, install a new gasket. C. Inspect for damage. If damaged, repair as necessary. D. If damaged or parts are missing, install a new seal or pump assembly. If misassembled, reassemble correctly.
Transmission Case	
Case vent damaged	Inspect for damage. If damaged, repair as necessary.
Torque Converter	
A. Torque converter one-way clutch seized B. Excessive torque converter slip detected	A. Remove the transmission. Inspect for damage. Refer to Torque Converter in this section. If the torque converter fails to pass the criteria for installing a new component or is damaged, install a new or remanufactured torque converter. B. Remove the transmission. Inspect for damage. Refer to Torque Converter in this section. If the torque converter fails to pass the criteria for installing a new component or is damaged, install a new or remanufactured torque converter.
Other	
A. Restriction in transmission cooling system B. Excessive trailer tow load C. Engine driveability concerns D. Vehicle heat shields missing or damaged E. Vehicle air flow restricted	A. Check transmission cooling system efficiency. Refer to Transaxle/ Transmission Cooling(Transaxle / Transmission Cooling, page 299). B. Refer to the towing manual. C. Check engine driveability concerns. Refer to the Engine Operation and Maintenance Manual. D. Inspect for damage. If damaged, repair as necessary. E. Inspect for damage. If damaged, repair as necessary.

Table 125 Fluid Venting or Foaming

Possible Component	Reference/Action
261 — ROUTINE	
Fluid	
Incorrect level	Adjust fluid to the correct level. Refer to Preliminary Inspection in this section.
Condition	Carry out Fluid Condition Check. Refer to Preliminary Inspection in this section.
Transmission Case Assembly	
Case vent damaged	Inspect for damage. Repair as necessary.
Other	
Transmission overheating	Refer to Routine 260.

Table 126 Unexpected Elevated Idle Speed

Possible Component	Reference/Action
262 — ROUTINE	
Powertrain Control System	
A. TCM, vehicle wiring harnesses, internal transmission wiring harness, line pressure control solenoid SSPC-A, TSPC driver circuit, TCC solenoid OSS, TFT, TR-P sensors, PTO input	A. Repair as required. Clear DTCs, road test and re-run onboard diagnostic test.
B. FMEM has been enabled. Refer to Routine 266.	B. GO to Pinpoint Test A, B, C, and D.

Table 127 No Tow/Haul Mode

Possible Component	Reference/Action
263 — ROUTINE	
Powertrain Control System	
TCM, vehicle wiring harnesses, internal transmission wiring harness, transmission control tow/haul switch, transmission control indicator lamp (TCIL) tow/haul	Refer to Automatic Transaxle/ Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307). Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.

Table 128 Reverse Lamps Do Not Illuminate

Possible Component	Reference/Action
264 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, internal transmission wiring harness, TR-P sensor, reverse lamps	GO to Pinpoint Test C. Repair as required. Clear DTCs, road test and rerun on-board diagnostic test.

Table 129 Transmission Failure Mode Effects Management (FMEM), Shift Concerns: Erratic/Hunting or Erratic Scheduling

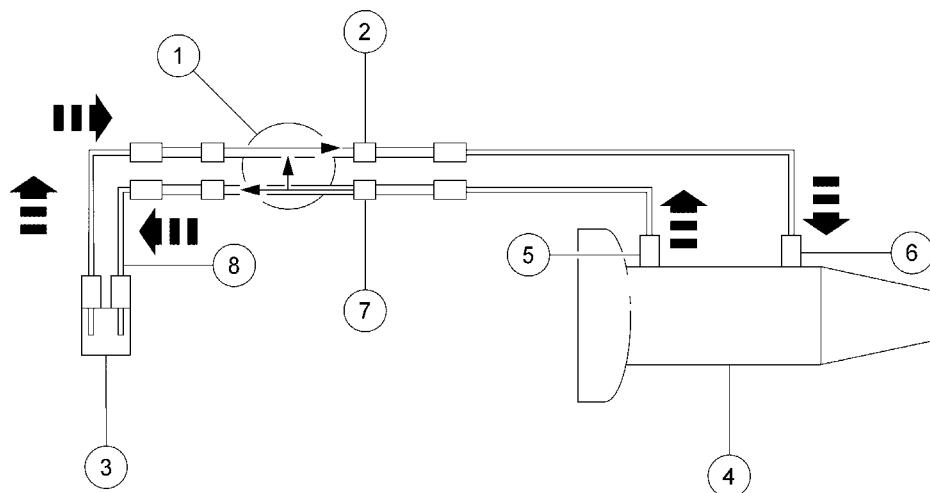
Possible Component	Reference/Action
265 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, TSS/intermediate shaft speed sensor, OSS sensor, TR-P sensor, TFT sensor, TCIL, tow/haul switch, TSPC driver circuit.	Repair as required. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test B, C, D, and E. Refer to Routine 212.
The transmission FMEM serves 3 purposes: <ul style="list-style-type: none">• Prevents invalid combinations of applied clutches that cause tie-ups• Isolates a potential fault down to a specific, solenoid, or clutch• Limits gears of operation based on the failure after the fault had been isolated	When failures occur the customer may complain of erratic shifting or transmission hanging in gear. This is normal for the FMEM strategy. Determine which gears are being commanded, and which gears are being avoided, and this will in turn point to a specific pressure switch, solenoid, or clutch fault.

Table 130 PTO Concerns

Possible Component	Reference/Action
266 — ROUTINE	
Powertrain Control System TCM, vehicle wiring harnesses, transmission internal harness, parking brake switch, BPP, TFT, TSS sensors required for correct elevated idle and TCC engagements in PARK and NEUTRAL and for correct line pressure PTO switch, PTO input	Repair as required. Clear DTCs, road test and rerun on-board diagnostic test. GO to Pinpoint Test B and D.

Table 131 Engagement Schedule Update (Dead Battery, Disconnected Battery, Calibration Updated)

Possible Component	Reference/Action
267 — ROUTINE	
Powertrain Control System Any time the vehicle battery has been disconnected, a new TCM has been installed or the vehicle calibration has been reflashed the adaptive strategy for the "Engagement Schedule" will need to be updated. This will prevent the customer from returning with firm engagements.	<p>NOTE: All of the following engagements must be carried out in order for engagement pressures to correctly adapt with the new calibration.</p> <p>Once the vehicle's battery has been reconnected or the reprogramming is complete, the adaptive strategy for pressure control on engagements must be updated.</p> <ul style="list-style-type: none"> a. Install the diagnostic equipment and monitor TFT. b. Warm the transmission fluid to 54°C (130°F) as indicated by the TFT. c. Carry out 5 engagements from PARK to REVERSE. Each engagement must be 5 seconds apart. d. Carry out 5 engagements from DRIVE to REVERSE. Each engagement must be 5 seconds apart. e. Carry out 5 engagements from REVERSE to DRIVE. Each engagement must be 5 seconds apart. f. Carry out 5 engagements from NEUTRAL to DRIVE. Each engagement must be 5 seconds apart.

General Procedures**Transmission Fluid Cooler — Backflushing and Cleaning**

N0035930

Figure 23 Typical Cooler Line and Remote Filter Fluid Flow

1. Remote filter adapter assembly
2. Transmission fluid cooler fitting (fluid flowing from remote filter back into transmission)
3. Radiator in-tank cooler
4. Transmission
5. Transmission fluid cooler fitting (fluid flowing out)
6. Transmission fluid cooler fitting (fluid flowing in)
7. Transmission fluid cooler fitting (fluid flowing into remote filter)
8. Transmission fluid cooler tube (fluid flowing into radiator in-tank cooler)

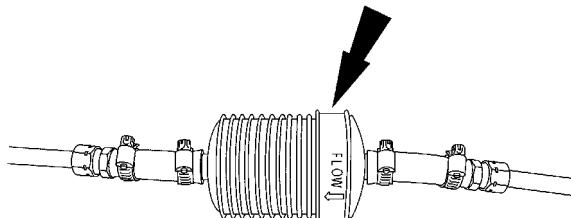
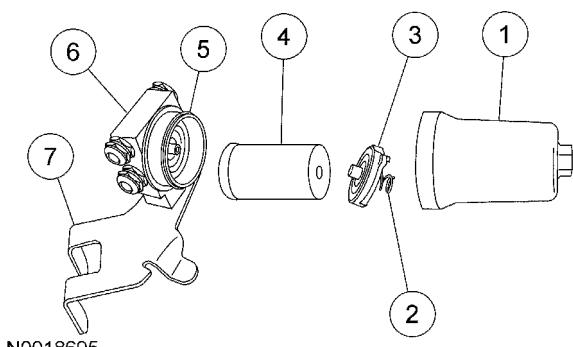


Figure 24 Remote Fluid Filter

1. Housing
2. Spring
3. Pressure plate/ magnet
4. Filter element
5. O-ring
6. Manifold
7. Bracket

CAUTION: Whenever the transmission has been serviced or a remanufactured transmission has been installed, the transmission fluid cooler tubes and the remote filter manifold must be cleaned and backflushed to remove any contaminants or transmission failure will occur.

NOTE: This transmission is equipped with a remote transmission fluid filter which is located on the driver side rear of the transmission. When carrying out an overhaul or installing a remanufactured transmission a new filter element must be installed.

1. Using a suitable torque converter/fluid cooler cleaner, flush the transmission fluid cooler and tubes.
2. If equipped, remove and discard the transmission fluid in-line filter.

3. Remove the remote filter element.

CAUTION: The transmission cooler tubes must be disconnected prior to flushing out the cooler tubes.

4. Disconnect the 4 transmission fluid cooler tubes at the remote filter housing. For additional information, refer to Transaxle/ Transmission Cooling(Transaxle / Transmission Cooling, page 299).
5. Leave the transmission fluid cooler tubes disconnected from the transmission case.
6. Disconnect both transmission fluid cooler tubes from the radiator in-tank cooler.
7. Flush each transmission fluid cooler tube independently.
8. Connect the cleaner pressure and return lines correctly.
 - a. Connect the pressure line-to-fluid cooler inlet tube.
 - b. Connect the return line-to-fluid cooler outlet tube.
 - c. Place the outlet end of the return line in the fluid tank reservoir.

NOTE: Cycling the solvent pump on and off will help dislodge contaminants in the cooler system.

9. Switch the pumps ON. Allow the fluid to circulate a minimum of 5 minutes.
10. Switch the pump OFF.

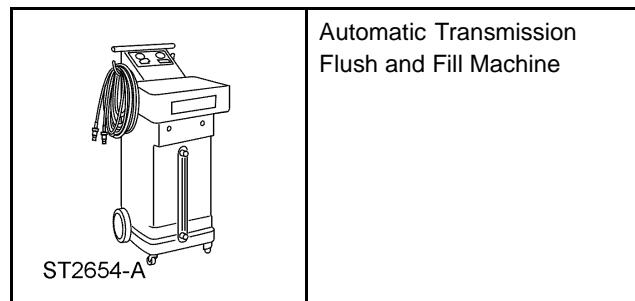
11. Disconnect the cleaner pressure line at the fluid cooler tube.
12. Using compressed air, blow through the fluid cooler inlet tube until all fluid is removed.
13. Remove the rubber hoses from fluid cooler tubes.
14. Connect the cleaner pressure and return lines correctly.
 - a. Connect the pressure line to the radiator in-tank fluid cooler.
 - b. Connect the return line to the other side of the radiator in-tank fluid cooler.
 - c. Place the outlet end of the return line in the fluid tank reservoir.

NOTE: Cycling the pump on and off will help dislodge contaminants in the cooler system.

15. Switch the pumps ON. Allow the fluid to circulate a minimum of 5 minutes.
16. Switch the pump OFF.
17. Disconnect the cleaner pressure line at the fluid cooler tube.
18. Using compressed air, blow through the fluid cooler inlet tube until all fluid is removed.
19. Remove the rubber hoses from fluid cooler tubes.
20. Flush the remote filter manifold and make sure that the small bypass orifice is free of foreign material.
21. Flush the remote filter housing and clean the magnet.
22. Backflush and then flush the radiator in-tank cooler.
23. Install a new remote filter element.
24. Carry out the transmission fluid cooler flow test. For additional information, refer to Transmission Fluid Cooler in this section.

Transmission Fluid Drain and Refill — Automated Equipment (if available)

Table 132 Special Tool



Draining

CAUTION: Always refer to the instructions supplied with the flush and fill machine.

1. Raise and support the vehicle with the transmission in PARK. For additional information, refer to Jacking and Lifting in S10019.
2. Use a suitable flush and fill machine to change the fluid, and follow the manufacturer's instructions.
3. When connecting the flush and fill machine, connect the machine to the fluid cooler tube after the fluid cooler on the cooler return line. This will help remove any foreign material trapped in the fluid coolers.

Refill

1. Once the fluid exchange has been completed, disconnect the flush and fill machine. Reconnect any disconnected fluid cooler tubes.

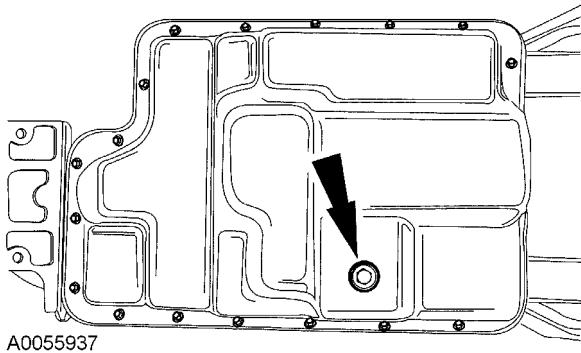
CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

2. With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks.

If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Transmission Fluid Drain and Refill — Without Torque Converter Drain Plug and With Fluid Pan Drain Plug

Draining

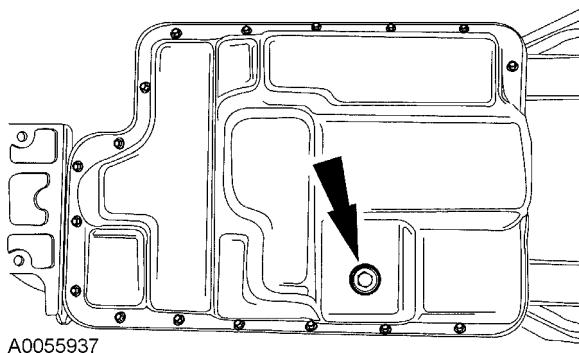


NOTE: The radiator in-tank transmission fluid cooler will need to be flushed.

1. Raise and support the vehicle with the transmission in PARK. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the transmission fluid pan drain plug and allow the fluid to drain.
3. Only flush the cooler tubes and fluid coolers if carrying out a transmission overhaul. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

Refill

1. Install the transmission fluid drain plug.
 - Tighten to 25 Nm (18 lb-ft).



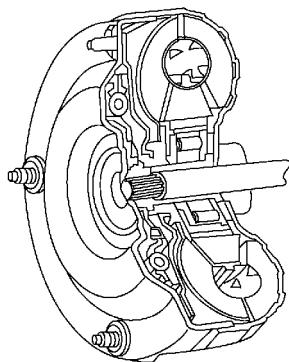
CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

2. Fill the transmission.
 - Add 7.1 liters (7.5 qts) of clean automatic transmission fluid to the transmission through the fluid filler tube.
3. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.
4. With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Torque Converter

1. A new or remanufactured torque converter must be installed if one or more of the following statements are true:
 - A torque converter malfunction has been determined based on the complete diagnostic procedures.
 - Converter stud(s), impeller hub or bushing is damaged.
 - Discoloration of the torque converter (due to overheating).

- 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.



AD2358-A

Torque Converter Contamination Inspection

CAUTION: Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur. Use only clean automatic transmission fluid designated for the transmission and converter being serviced.

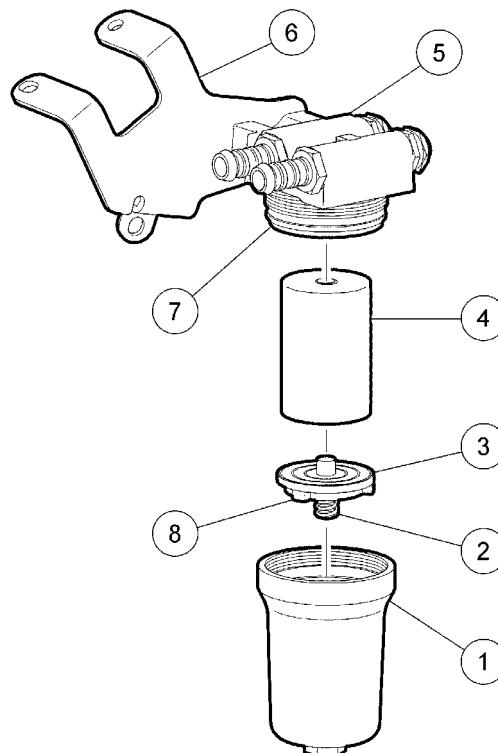
1. If a new or remanufactured torque converter is not being installed, the following steps must be completed.
2. With the torque converter on a bench, pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter and examine the fluid.
3. Observe the color and odor of the fluid. The fluid should be red, not brown or black. Odor may indicate an overheating condition such as clutch disc or band failure.
4. Examine the stain on the tissue for evidence of particles (spec of any kind). Examine the fluid level indicator for signs of antifreeze (gum or varnish). If particles are present in the fluid or

there is evidence of engine coolant or water, a new torque converter must be installed.

5. If there are no particles or contamination present, drain the remainder of the transmission fluid from the torque converter.
6. Add 1.9 liter (2 qt.) of clean automatic transmission fluid into the converter and agitate by hand.
7. Thoroughly drain the fluid.

Transmission Fluid Remote Filter

Remote Fluid Filter Removal



N0024721

Figure 29 Remote Fluid Filter

1. Housing
2. Spring
3. Pressure plate
4. Filter element
5. Manifold
6. Bracket
7. O-ring
8. Magnet

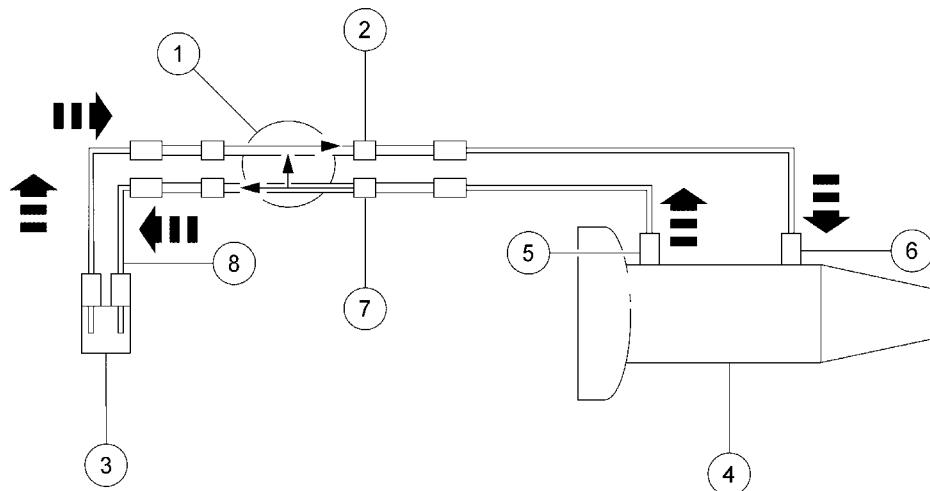
NOTE: The remote filter for this vehicle is located on the LH side of the transmission.

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the remote filter housing by unscrewing it.
3. Remove the spring/retainer and magnet assembly.
4. Remove and discard the remote filter element.

Installation

1. Inspect the O-ring for damage (nicks or cuts). Install a new O-ring if damage is indicated.
2. Install a new remote filter element.
3. Clean the spring/retainer and magnet assembly and install it into the remote filter element.
4. Clean the remote filter housing and install.
 - Tighten to 50 Nm (37 lb-ft).
5. Fill with clean automatic transmission fluid.

Transmission Fluid In-Line Filter



N0035930

Figure 30 Typical Cooler Line and Remote Filter Fluid Flow

- | | | |
|--|--|--|
| 1. Remote filter adapter assembly | 4. Transmission | 7. Transmission fluid cooler fitting (fluid flowing into remote filter) |
| 2. Transmission fluid cooler fitting (fluid flowing from remote filter back into transmission) | 5. Transmission fluid cooler fitting (fluid flowing out) | 8. Transmission fluid cooler tube (fluid flowing into radiator in-tank cooler) |
| 3. Radiator in-tank cooler | 6. Transmission fluid cooler fitting (fluid flowing in) | |

NOTE: Use the following guidelines for installing the transmission fluid in-line filter.

- If the transmission was overhauled and the vehicle was equipped with an in-line fluid filter, install a new in-line fluid filter.
- If the transmission was overhauled and the vehicle was not equipped with an in-line fluid filter, install a new in-line fluid filter kit.
- If the transmission is being installed for a non-internal repair, do not install an in-line fluid filter or kit.

- If installing a new or remanufactured transmission, install the transmission fluid filter that is supplied.
- 1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
- 2. Remove a section of rubber hose as close to the radiator as possible.
 - Section of hose 76.2 mm (3 inch)

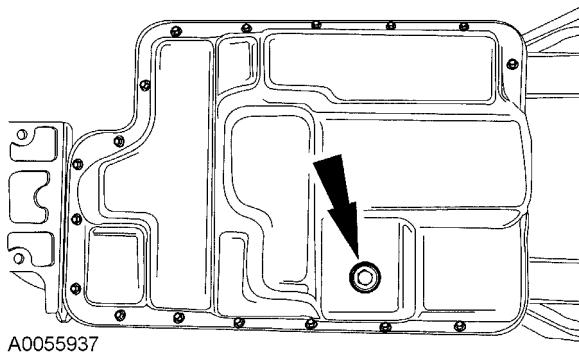
S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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CAUTION: The filter has a bypass valve in it. The red arrow on the filter indicates the direction of fluid flow through the filter. The filter must be installed in the cooler return line with the red on the filter pointing away from the radiator in-tank cooler and toward the transmission (the return line has fluid coming out of the cooler going to the transmission). If the fluid filter is not installed correctly, it will cause internal damage.



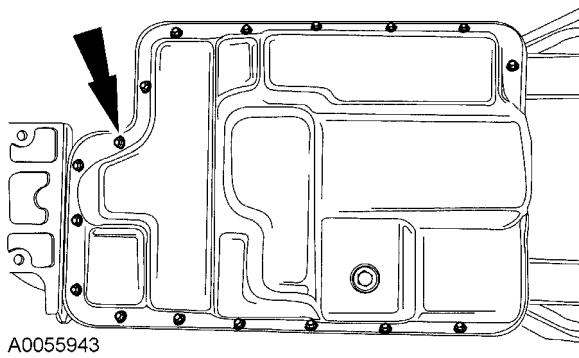
CAUTION: Do not install any rubber hoses or steel tubing with a bend entering the filter greater than 60 degrees.

3. Install the in-line fluid filter.
4. Clean a section of the transmission fluid pan and install the sticker.

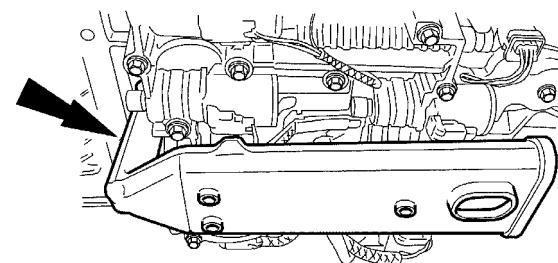
CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

5. Fill with clean automatic transmission fluid.
 - With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

3. Remove the transmission fluid pan and gasket.



4. Remove the transmission fluid filter.



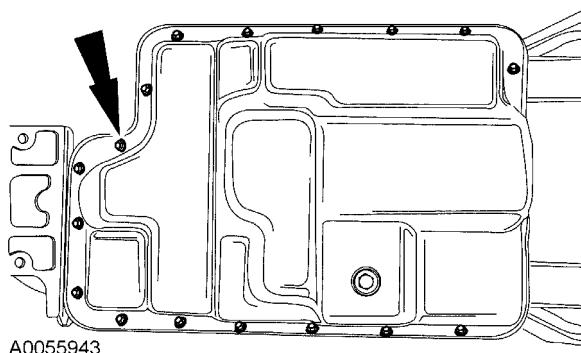
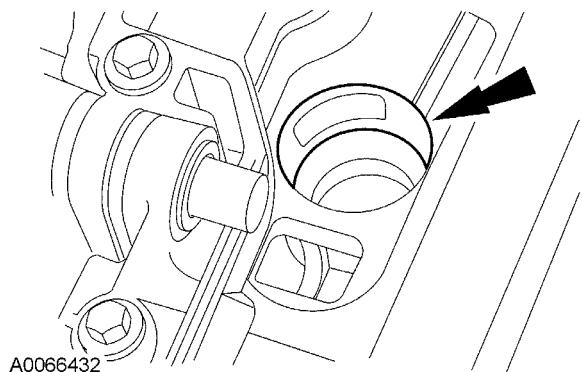
In-Vehicle Repair

Fluid Pan, Gasket and Filter Removal

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the transmission fluid drain plug and allow the fluid to drain.

CAUTION: Carefully remove the transmission fluid filter seal. Damage to the seal bore will cause transmission failure.

- Inspect the transmission fluid bore for the transmission fluid seal. If the seal is in the bore, carefully remove the seal.

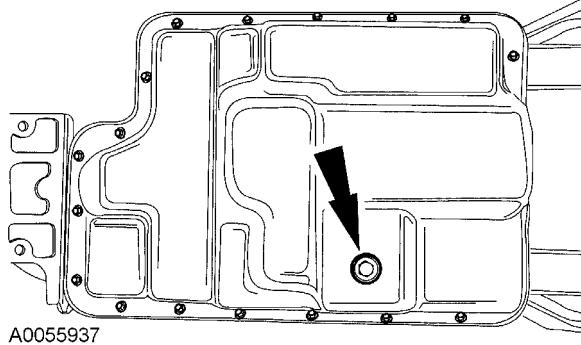
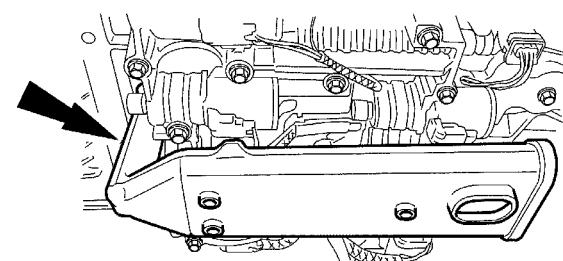


- Install the transmission fluid drain plug.
- Tighten to 25 Nm (18 lb-ft).

Fluid Pan, Gasket and Filter Installation

NOTE: Prior to installing the transmission filter, make sure that the old fluid filter seal has been removed.

- Install a new fluid filter and seal assembly.



CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

NOTE: Tighten all the transmission fluid pan bolts in a crisscross pattern.

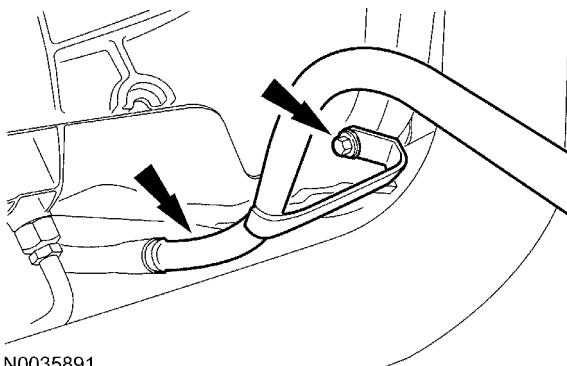
- Install the fluid pan gasket and fluid pan.
- Tighten to 15 Nm (11 lb-ft).

- Fill the transmission.
 - Add 7.0 liters (7.5 qts) of clean automatic transmission fluid to the transmission through the fluid filler tube.
- Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.
- With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24

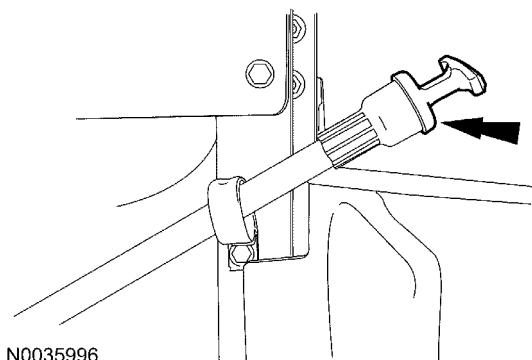
liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Transmission Filler Tube Removal

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the fluid level indicator.

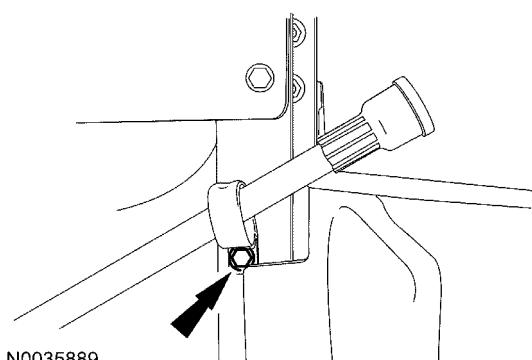


N0035891



N0035996

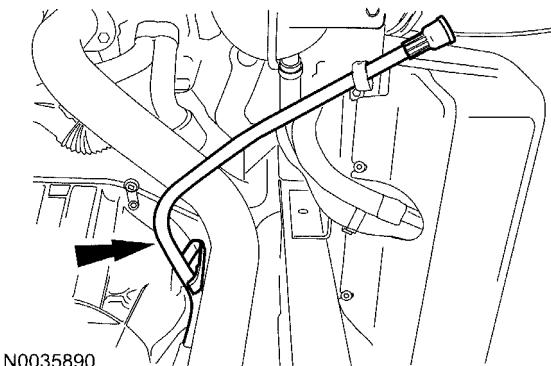
3. Remove the transmission fluid fill tube nut.



N0035889

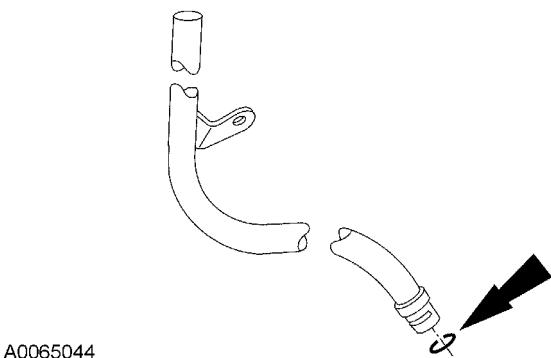
4. Remove the transmission fluid fill tube bracket bellhousing bolt.

5. Remove the transmission filler tube from the vehicle.



N0035890

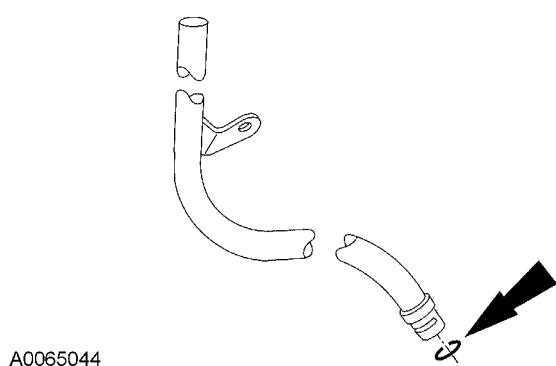
6. Inspect the O-ring seal for damage. Discard the O-ring if damaged.



A0065044

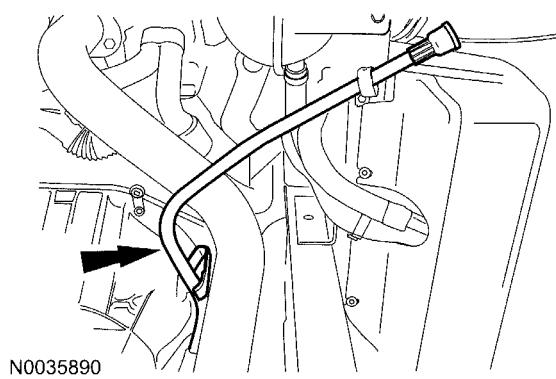
Transmission Filler Tube Installation

1. Install a new O-ring if damaged.



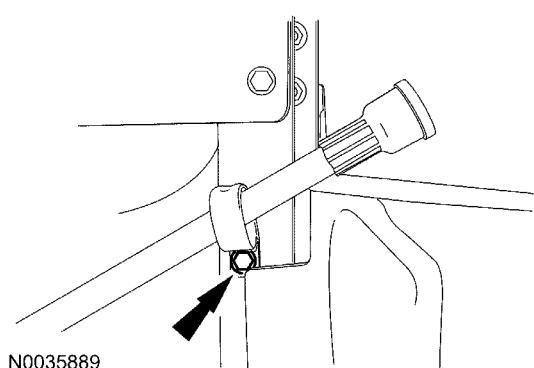
NOTE: Coat the O-ring at the bottom of the transmission fluid filler tube with transmission fluid.

2. Install the transmission fluid filler tube.



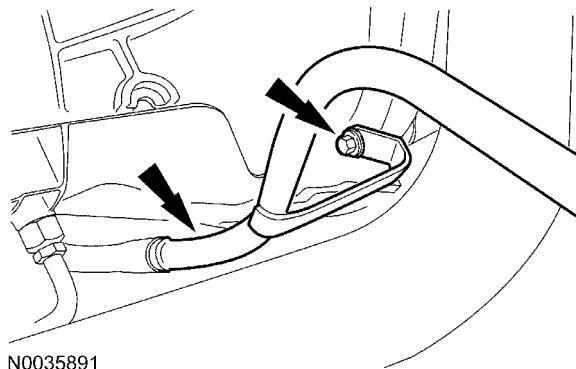
3. Install the transmission fluid filler tube bellhousing bolt.

- Tighten to 47 Nm (35 lb-ft).

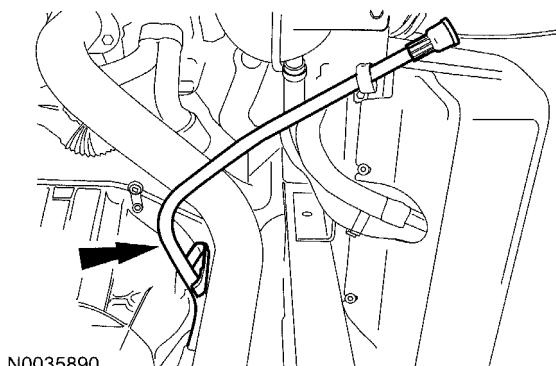


4. Install the transmission fluid filler tube bolt.

- Tighten to 31 Nm (23 lb-ft).

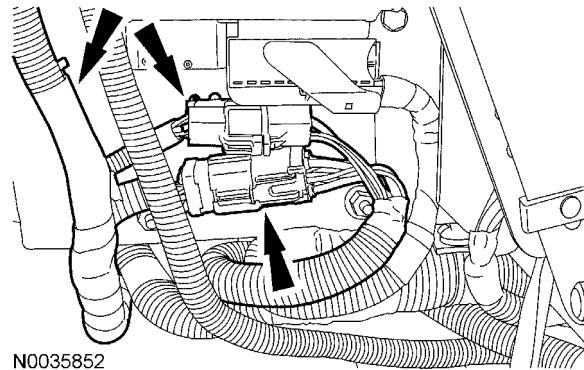
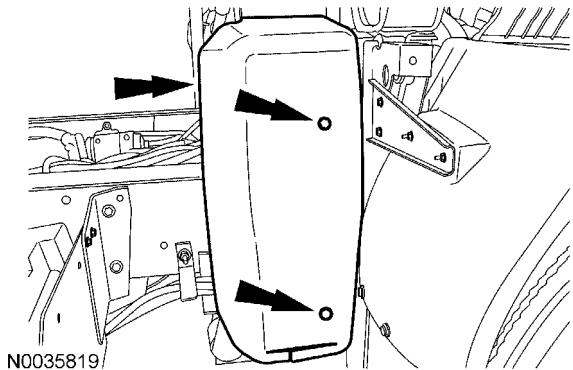


5. Install the fluid level indicator.

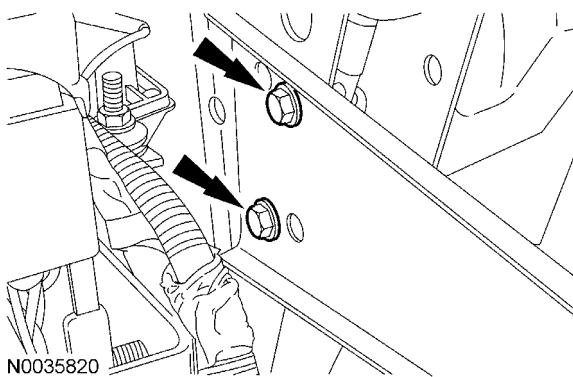


Transmission Control Module (TCM) Removal

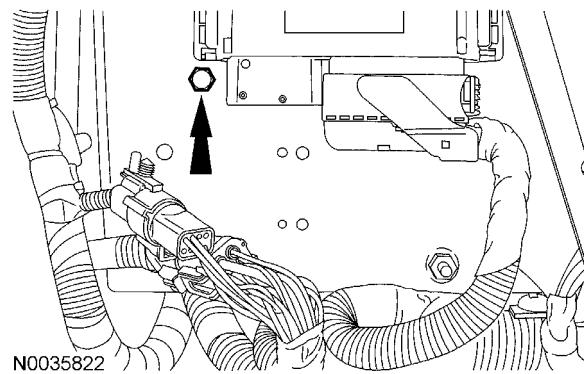
1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Disconnect the battery ground cable. For additional information, refer to Battery, Mounting and Cables in S08307.
3. Tilt the cab forward to gain access to the transmission control module (TCM).
4. Remove the 2 bolts and remove the cover.



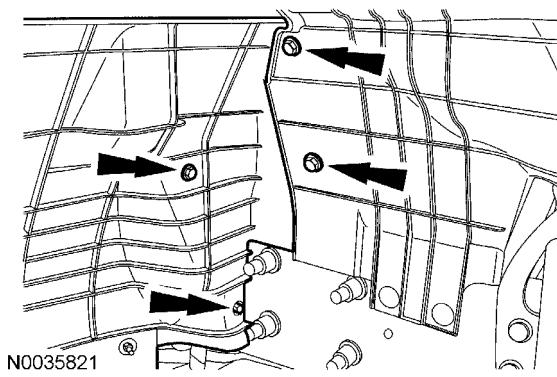
- Remove the 2 bolts for the inner splash shield.



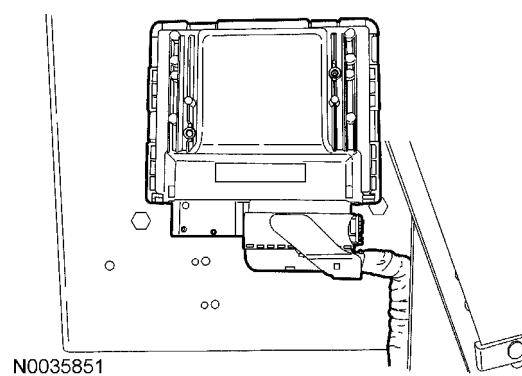
- Remove the bolt from the bracket in order to allow the TCM to slide down.



- Remove the 4 bolts and remove the inner splash shield from the vehicle.

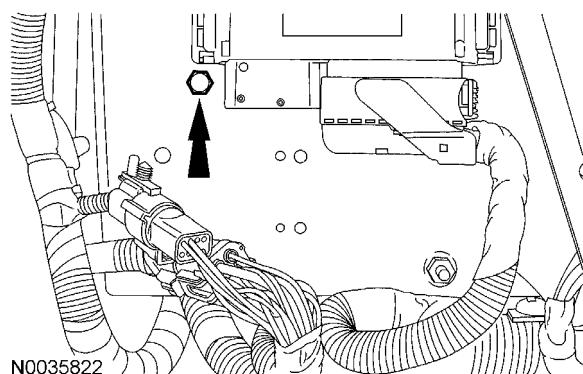
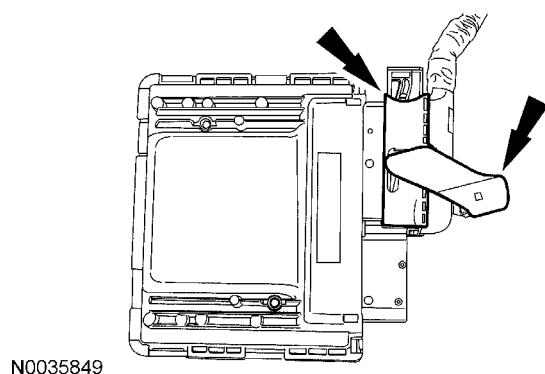


- Slide the TCM down to remove it from the bracket.



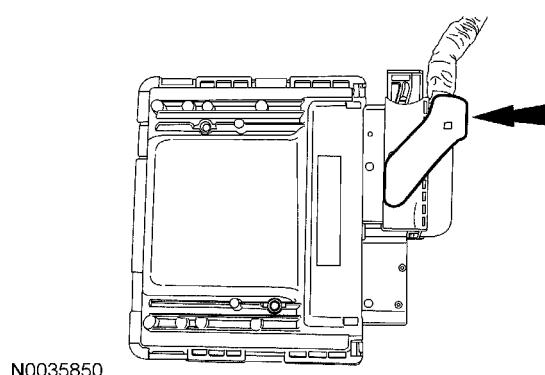
- Remove the wire harnesses from the bracket.

- Move the lever on the TCM electrical connector in order to disconnect the harness from the TCM.

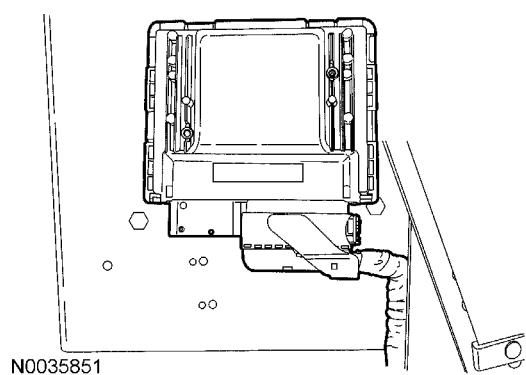


Transmission Control Module (TCM) Installation

1. Connect the harness to the TCM and move the lever to lock the connector lever in place.



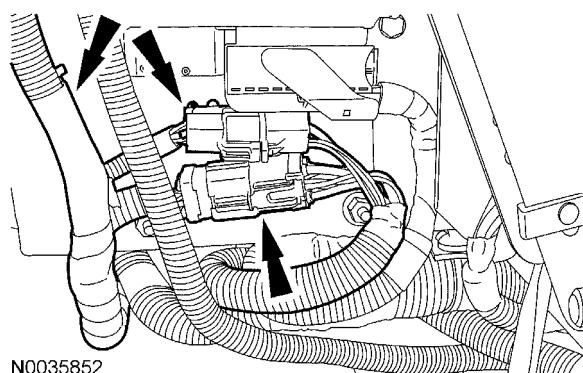
2. Slide the TCM back up into the bracket.



3. Install the bolt back into the bracket.

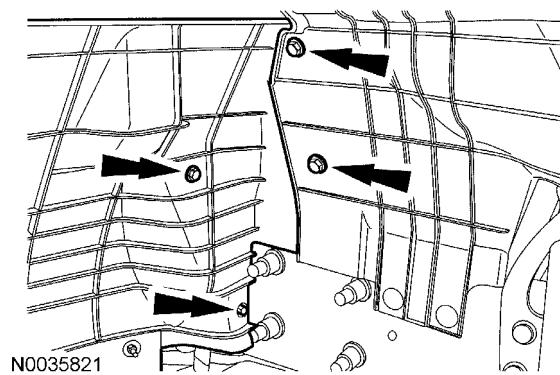
- Tighten to 31 Nm (23 lb-ft).

4. Connect the wire harnesses onto the bracket.



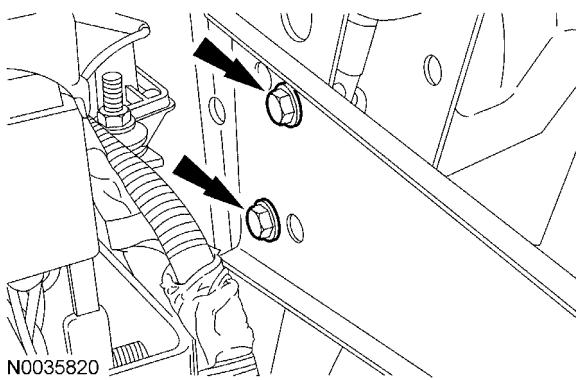
5. Position the inner splash shield in place and install the 4 bolts.

- Tighten to 31 Nm (23 lb-ft).

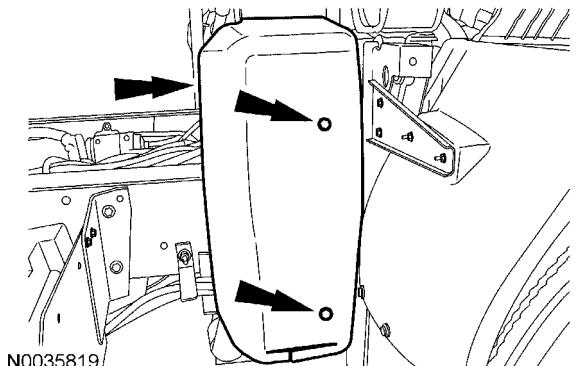


6. Install the 2 bolts for the inner splash shield.

- Tighten to 31 Nm (23 lb-ft).



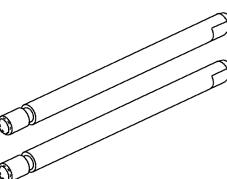
7. Install the cover and the 2 bolts.
- Tighten to 10 Nm (89 lb-in).



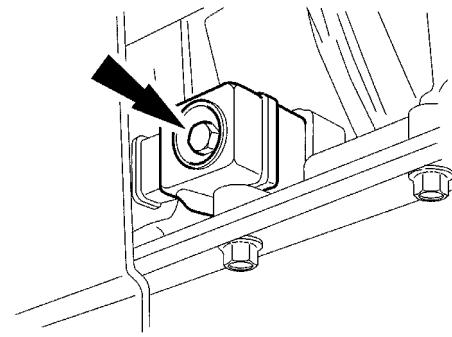
8. Tilt the cab back down.
9. Connect the battery ground cable. For additional information, refer to Battery, Mounting and Cables in S08307.

Solenoid Body Assembly Removal

Table 133 Special Tool

	Aligner, Valve Body ZTSE9113
ST2717-A	

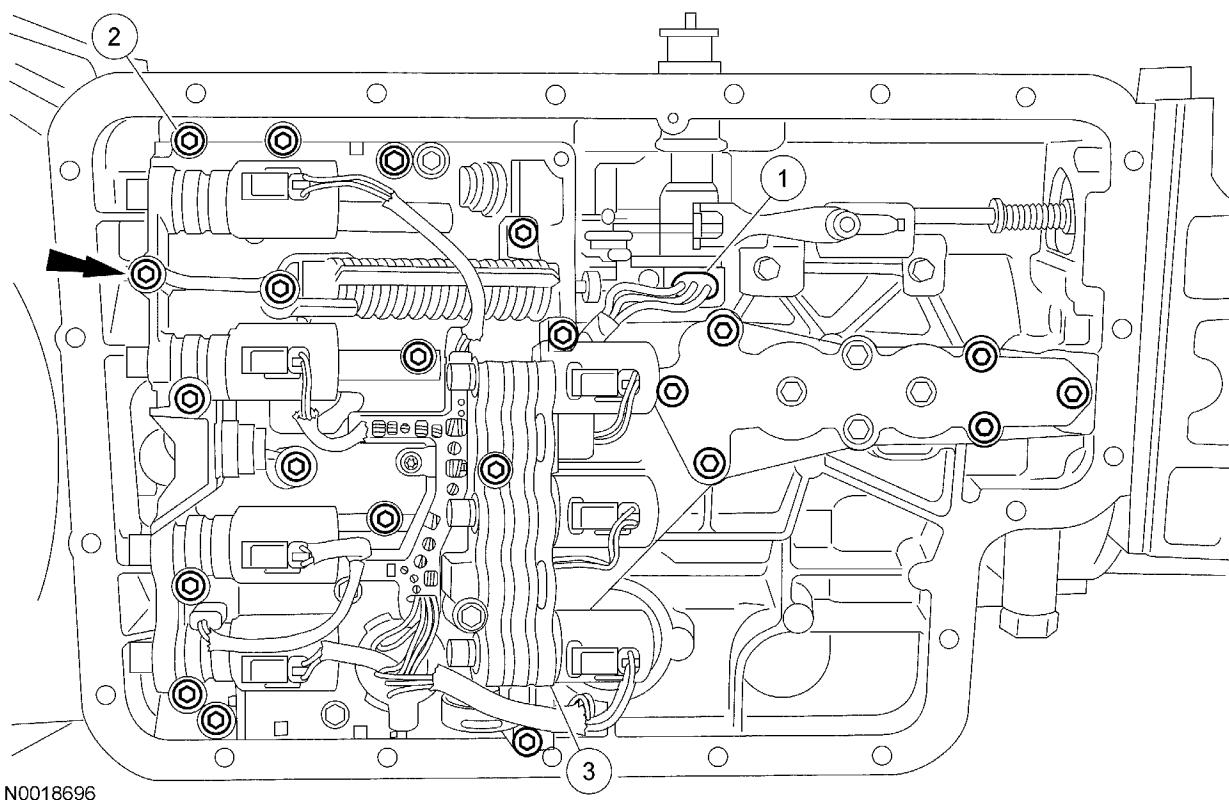
1. Remove the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
2. Disconnect the solenoid body electrical connector.



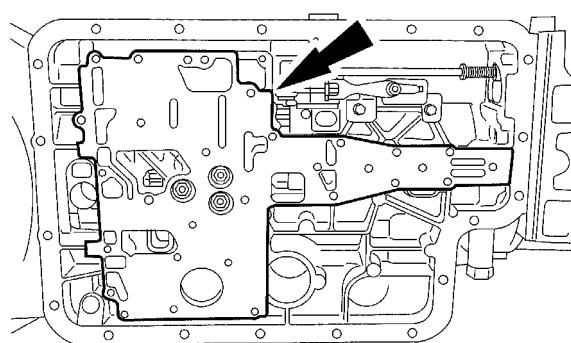
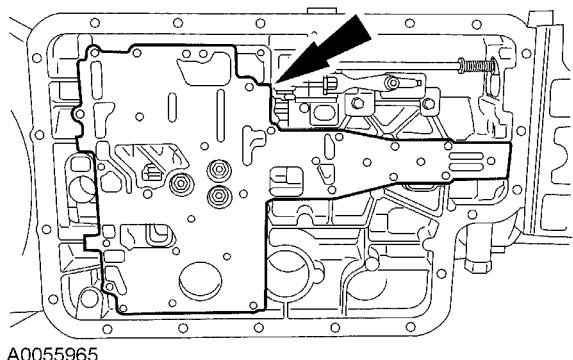
NOTE: While lowering the solenoid body, the manual valve may fall out of the solenoid body.

NOTE: While lowering the solenoid body, the forward clutch orifice may fall out of the transmission case.

3. Remove the solenoid body.

**Figure 63**

1. Disconnect the transmission range sensor electrical connector.
2. Remove the solenoid body bolts.
3. Remove the solenoid body.
4. Remove the solenoid body gasket.



2. Using the special tools, install the solenoid body and loosely install the bolts.
 - While installing the solenoid body, align the manual valve.

Solenoid Body Assembly Installation

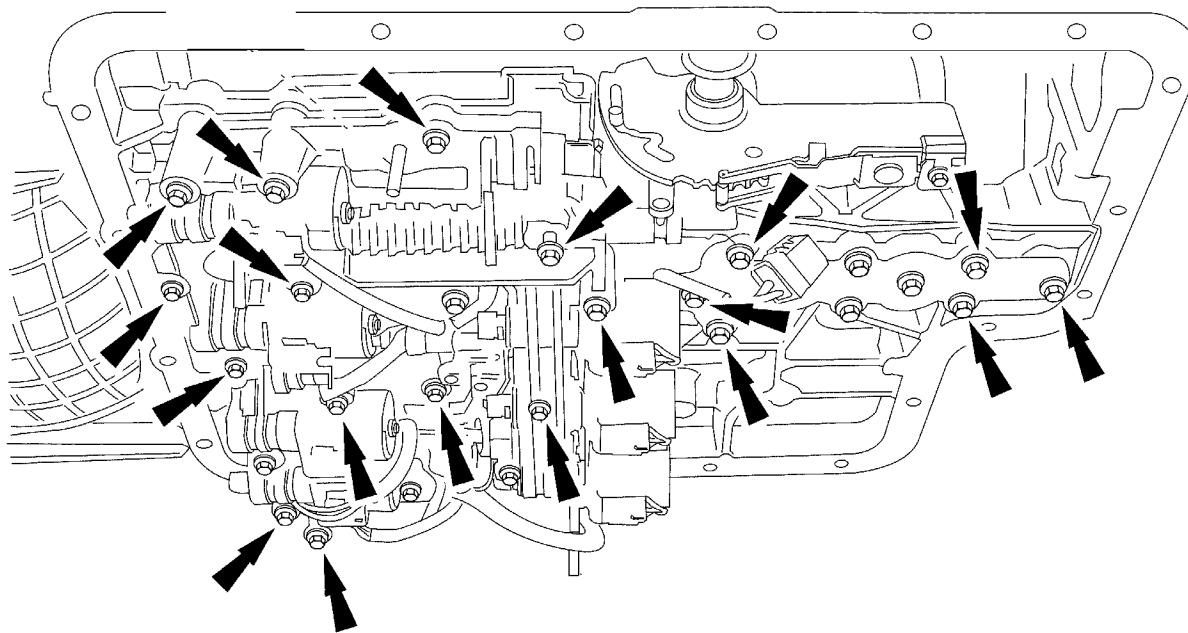
1. Install a new solenoid body gasket.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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N0018697

3. Tighten bolts in the sequence shown.

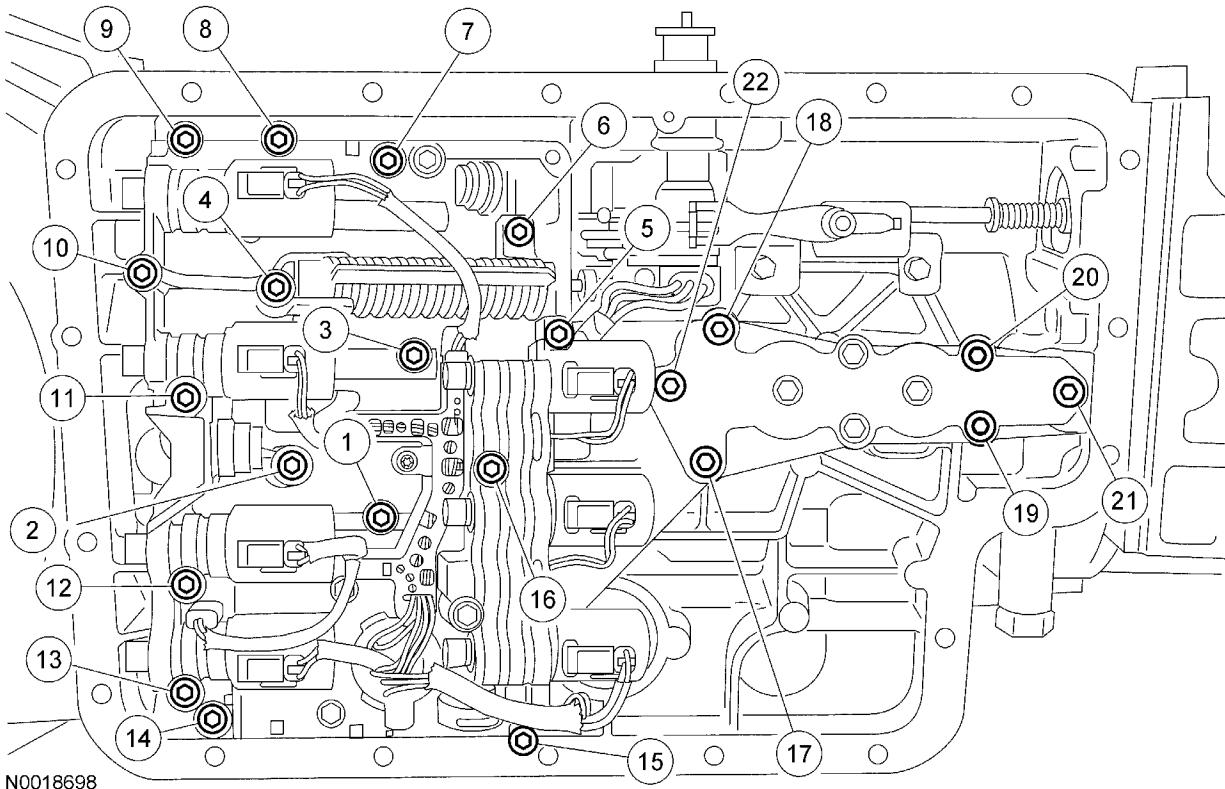
- Tighten to 13 Nm (10 lb-ft).

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

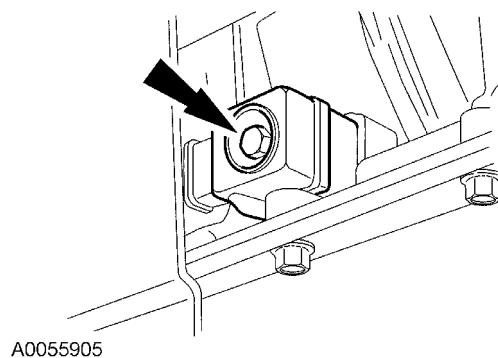
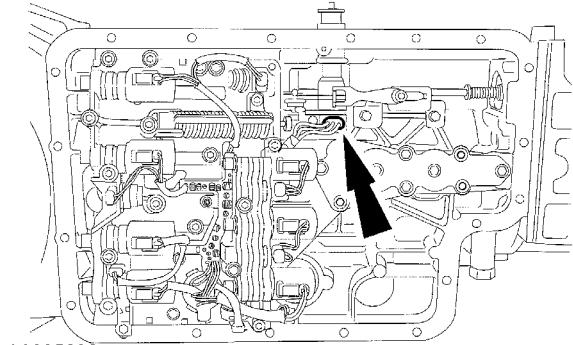
Follow all warnings, cautions, and notes.

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4. Connect the transmission range sensor connector.
6. Connect the solenoid body electrical connector.

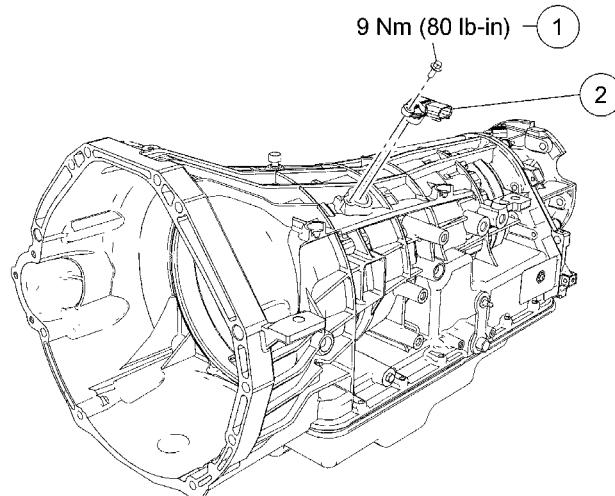
- Tighten to 5 Nm (44 lb-in).



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

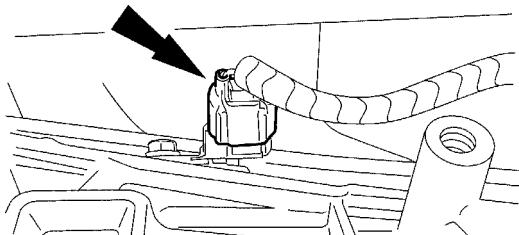
Turbine Shaft Speed (TSS) Sensor and Intermediate Shaft Speed Sensor Removal

N0019990

**Figure 70**

1. Turbine shaft speed (TSS) sensor and intermediate shaft speed sensor retaining bolt
2. TSS sensor and intermediate shaft speed sensor

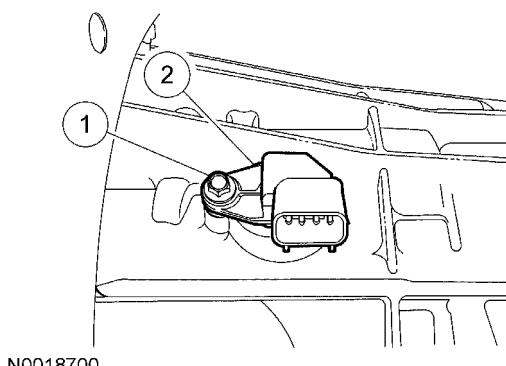
1. Raise and support the vehicle with transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Using the cab tilt release lever located on the driver's side of the vehicle, tilt the vehicle cab forward.
3. Disconnect the intermediate shaft and turbine shaft combination speed sensor electrical connector.



A0055906

NOTE: Prior to removing the speed sensor, make sure that the area around the sensor is free of foreign material to prevent contamination of the transmission.

4. Remove the intermediate shaft and turbine shaft combination speed sensor.

**Figure 72**

1. Remove the bolt.
2. Remove the intermediate shaft and turbine shaft combination speed sensor.

S13036

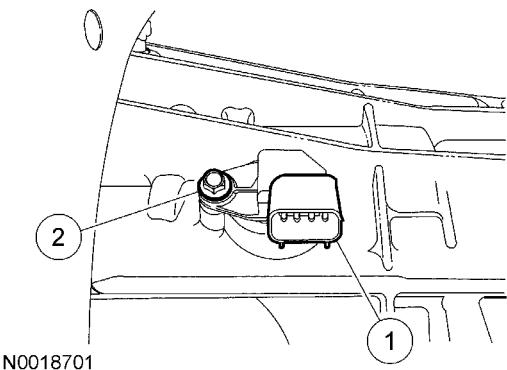
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

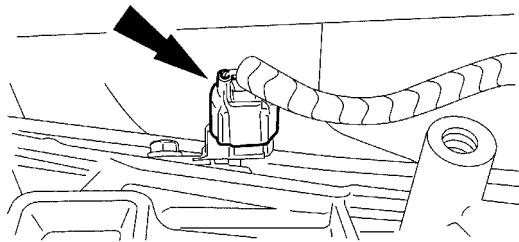
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Turbine Shaft Speed (TSS) Sensor and Intermediate Shaft Speed Sensor Installation

1. Install the intermediate shaft and turbine shaft combination speed sensor.



2. Connect the intermediate shaft and turbine shaft combination speed sensor electrical connector.



3. Tilt the cab back down into the lowered position.

Figure 73

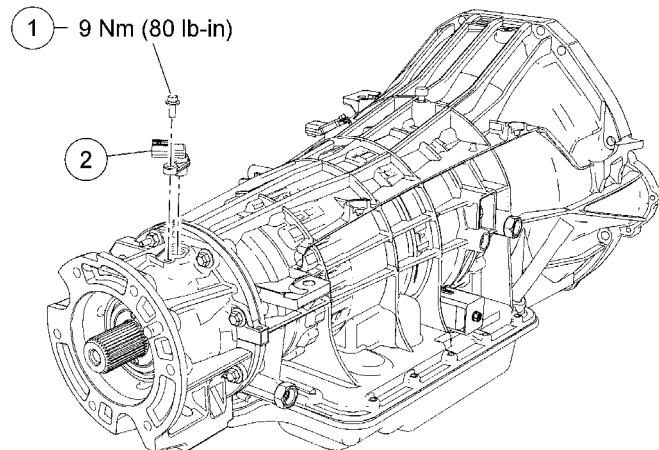
1. Lubricate the O-ring with clean automatic transmission fluid and install the intermediate shaft and turbine shaft combination speed sensor.
2. Install the bolt.
 - a. Tighten to 9 Nm (80 lb-in).

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

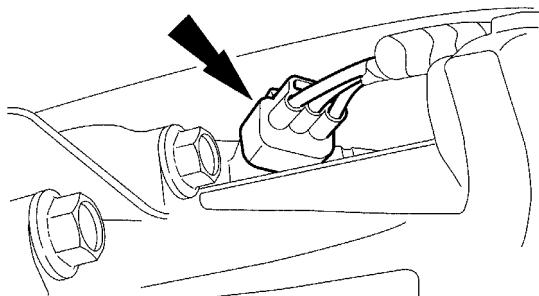
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Output Shaft Speed (OSS) Sensor Removal

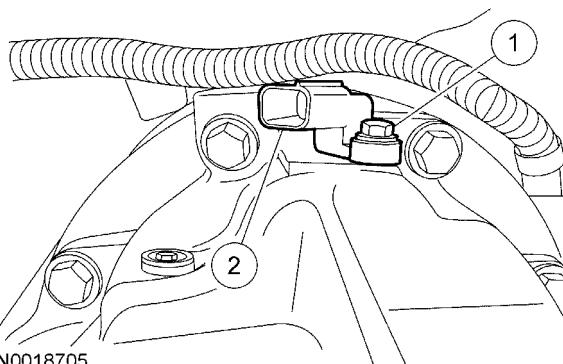
N0019991

Figure 75

1. Output shaft speed (OSS) sensor retaining bolt
 2. OSS sensor
-
1. Raise and support the vehicle with transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
 2. Disconnect the output shaft speed (OSS) sensor.
 3. Remove the OSS sensor.



A0055907

**Figure 77**

1. Remove the bolt.
2. Remove the OSS sensor.

NOTE: Prior to removing the speed sensor, make sure that the area around the sensor is free of foreign material to prevent contamination of the transmission.

Output Shaft Speed (OSS) Sensor Installation

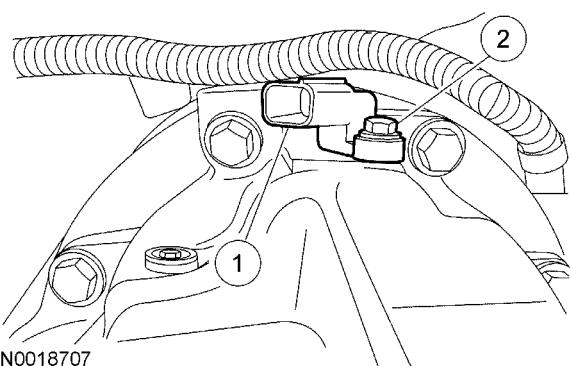
1. Install the OSS sensor.

S13036

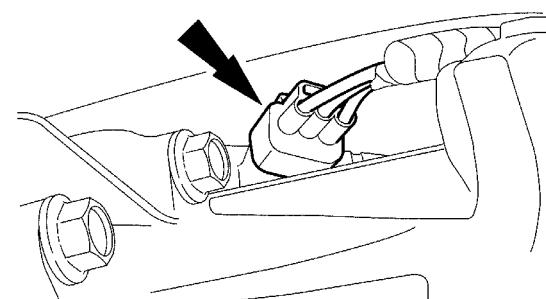
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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**Figure 78**

1. Lubricate the O-ring with clean automatic transmission fluid and install the OSS sensor.
2. Install the bolt.
 - a. Tighten to 9 Nm (80 lb-in).
2. Connect the OSS sensor electrical connector.



Extension Housing Seal Removal

Table 134 Special Tools

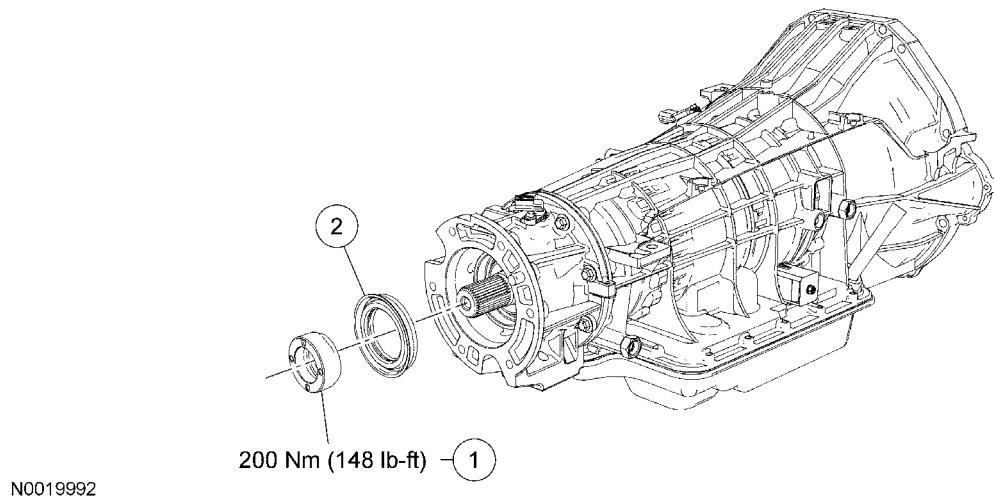
ST1185-A	Slide Hammer
ST2692-A	Installer, Transmission Extension Housing Fluid Seal ZTSE9143
ST1758-A	Remover, Transmission Fluid Seal ZTSE9108
ST2731-A	Legs (used with ZTSE9108)
ST2720-A	Nut Driver, Output Shaft ZTSE9141

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

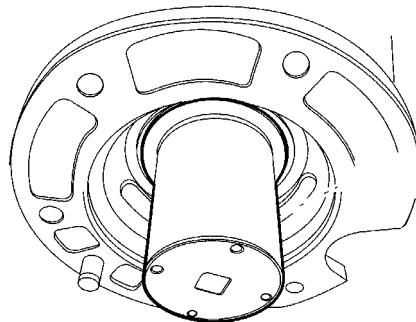
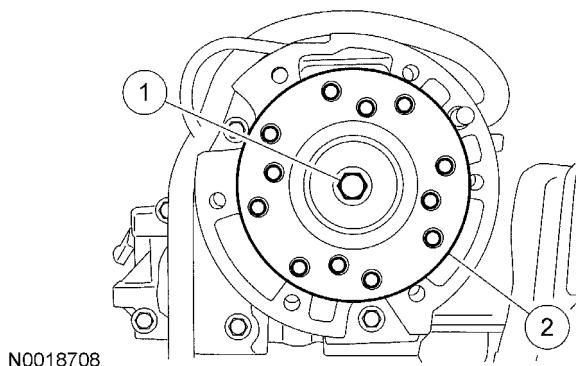
Follow all warnings, cautions, and notes.

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**Figure 80**

1. Transmission output shaft retainer
2. Transmission output shaft seal

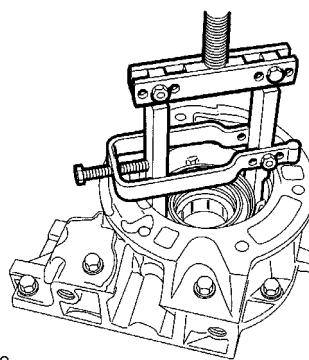
1. Remove the driveshaft. For additional information, refer to Driveshaft in S06002.
2. Remove the output shaft flange.

**Figure 81**

1. Remove and discard the output shaft flange bolt.
2. Remove the output shaft flange.

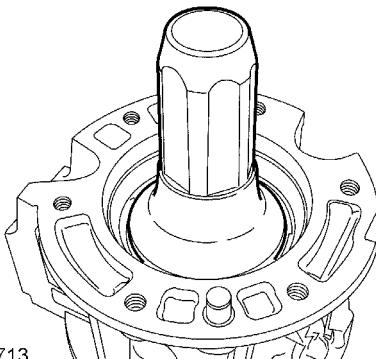
3. Using the special tool, remove the output shaft nut.

4. Using the special tools, remove the output shaft seal.

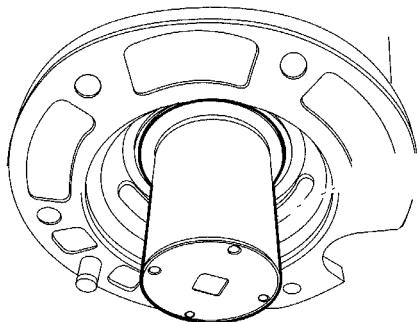


Extension Housing Seal Installation

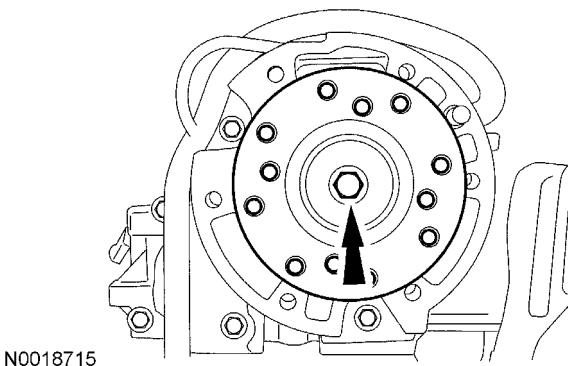
- Using the special tool, install the output shaft seal.



- Using the special tool, install the output shaft nut.
- Tighten to 200 Nm (148 lb-ft).



- Install the output shaft flange and a new bolt.
- Tighten to 135 Nm (100 lb-ft).



- Install the driveshaft. For additional information, refer to Driveshaft in S06002.
- Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.
- With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Extension Housing Gasket Removal

Table 135 Special Tool

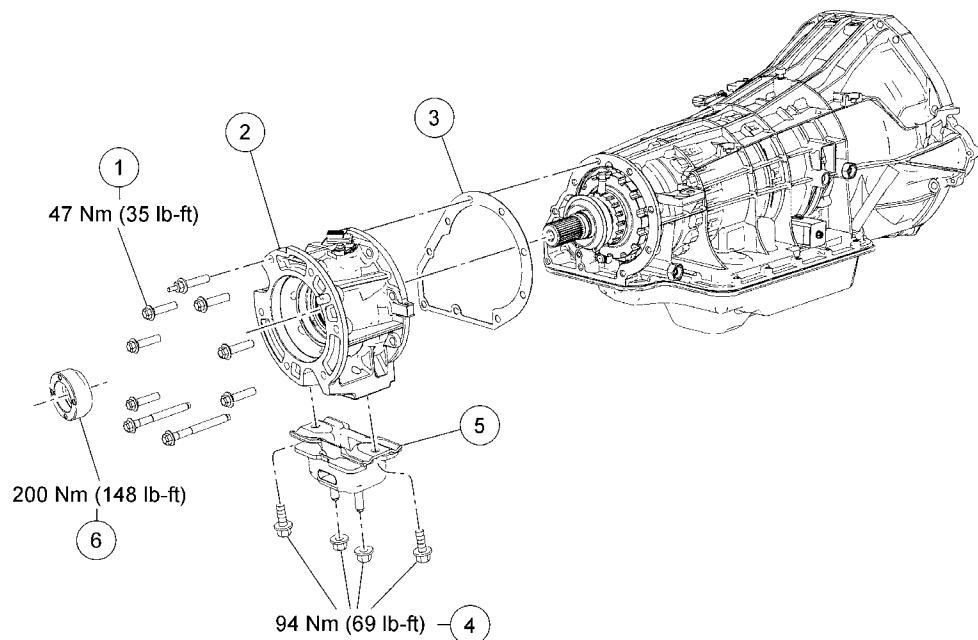
	Nut Driver, Output Shaft ZTSE9141
--	--------------------------------------

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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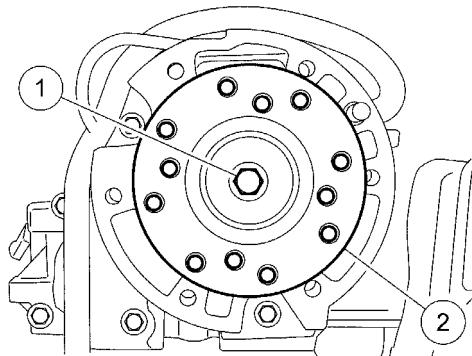


N0019993

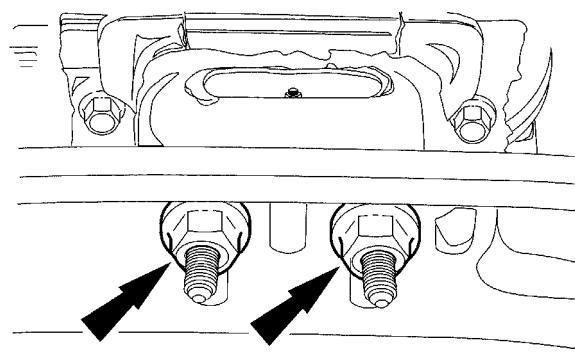
Figure 87

- | | | |
|-----------------------------|---|--|
| 1. Extension housing bolts | 4. Rear transmission insulator
retainers | 6. Transmission output shaft
retainer |
| 2. Extension housing | 5. Rear transmission insulator | |
| 3. Extension housing gasket | | |

1. Remove the driveshaft. For additional information, refer to Driveshaft in S06002.
2. Remove the output shaft flange.
3. Remove the transmission rear crossmember support insulator nuts.



N0018708



A0056172

Figure 88

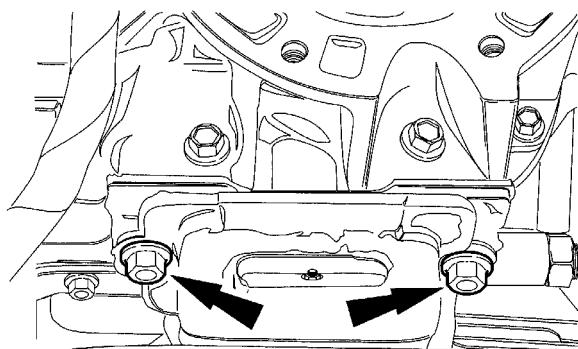
1. Remove and discard the bolt.
2. Remove the output shaft flange.
4. Install a suitable transmission jack.
5. Remove the transmission rear crossmember support insulator bolts.

S13036

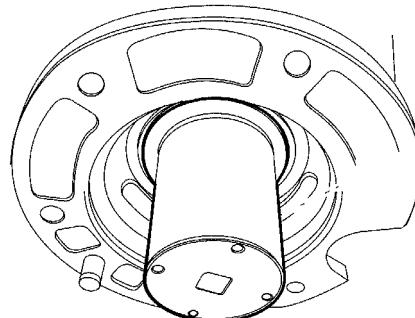
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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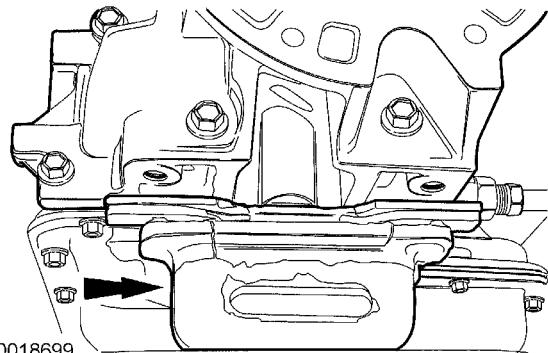


A0056168



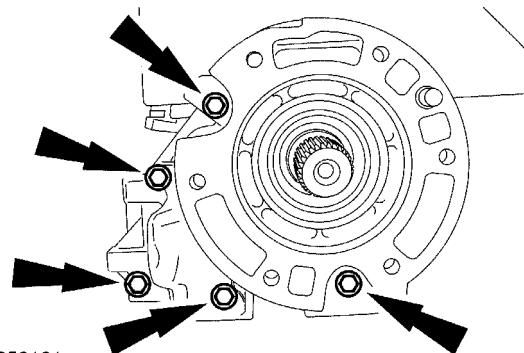
N0018709

6. Raise the transmission upward, off the rear transmission mount and remove the mount.



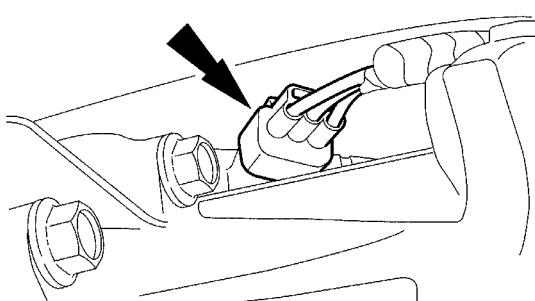
N0018699

9. Remove the bolts and the transmission extension housing.



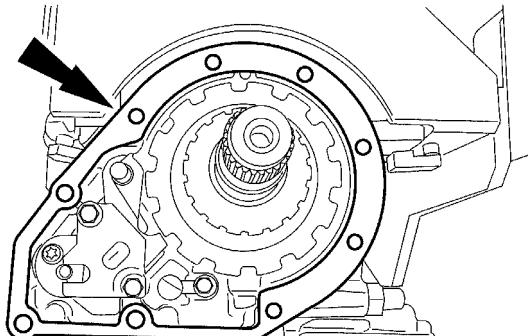
A0056161

7. Disconnect the output shaft speed (OSS) sensor electrical connector.



A0055907

10. Remove and discard the extension housing gasket.



A0056155

8. Using the special tool, remove and discard the output shaft retaining nut.

Extension Housing Gasket Installation

NOTE: Lightly lubricate the gasket with petroleum jelly to hold it in place during assembly.

S13036

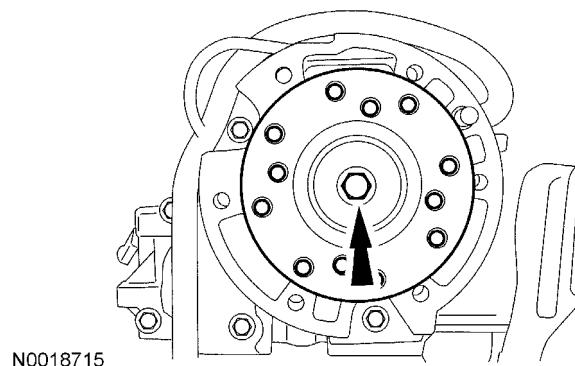
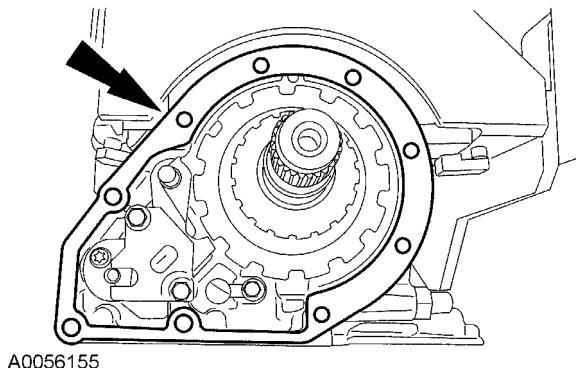
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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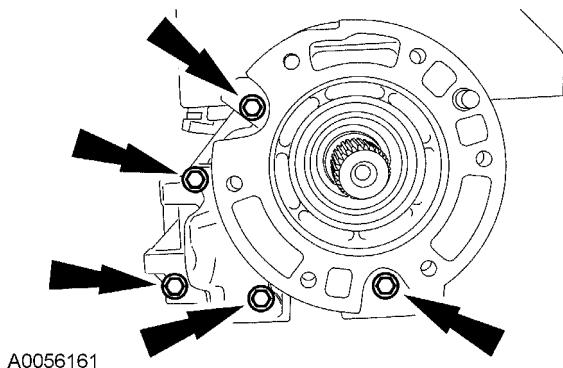
1. Install the new extension housing gasket.

- Tighten to 135 Nm (100 lb-ft).

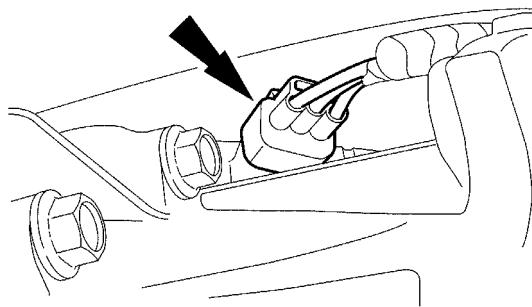


2. Install the extension housing bolts.

- Tighten to 47 Nm (35 lb-ft).

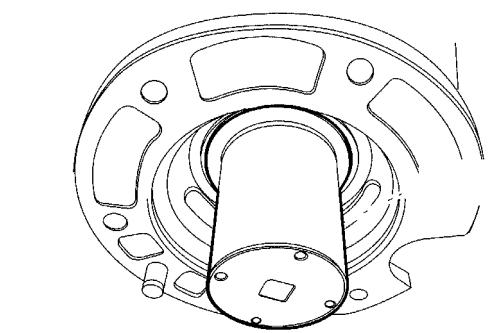


5. Connect the OSS sensor.

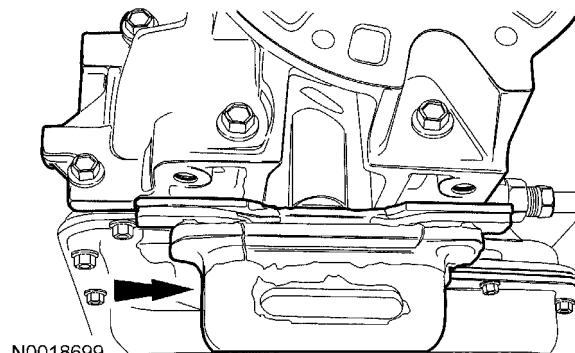


3. Using the special tool, install the output shaft nut.

- Tighten to 200 Nm (148 lb-ft).



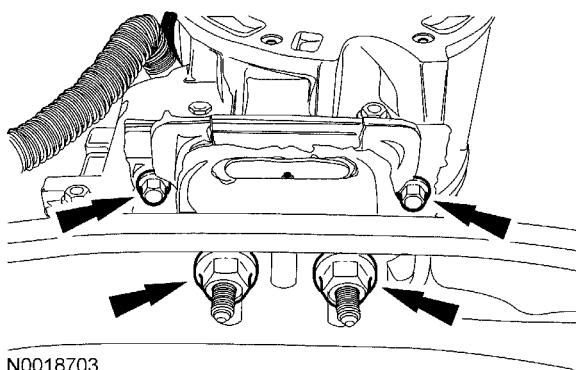
6. Install the rear transmission mount and lower the transmission onto the crossmember.



4. Install the output shaft flange and a new bolt.

7. Install the rear transmission bolts and nuts.

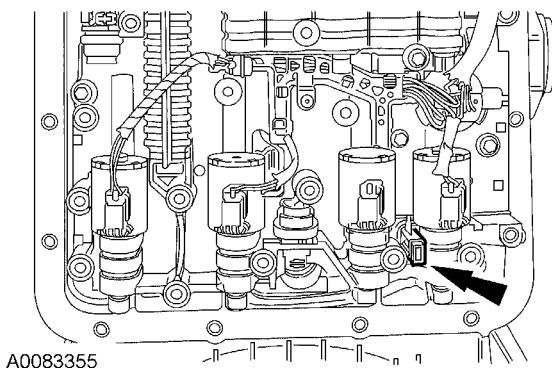
- Tighten to 94 Nm (69 lb-ft).



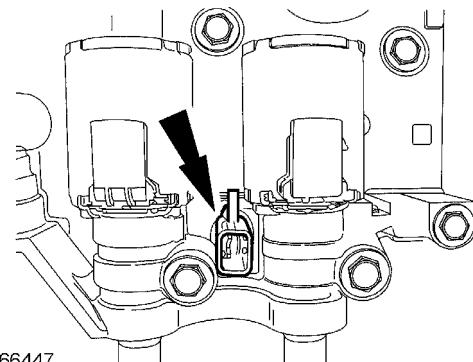
8. Install the driveshaft. For additional information, refer to Driveshaft in S06002.
9. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.
10. With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Transmission Fluid Temperature (TFT) Sensor Removal

1. Remove the transmission fluid pan gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
2. Disconnect the transmission fluid temperature (TFT) sensor electrical connector.



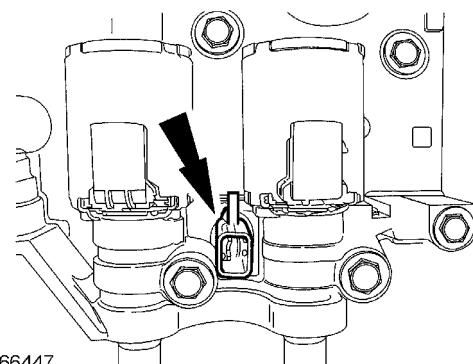
3. Press the tab, rotate the sensor counterclockwise and pull out.



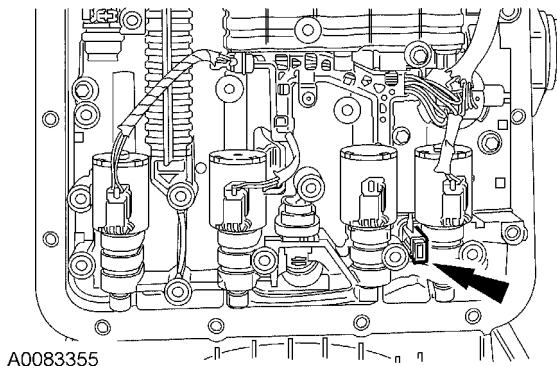
4. Inspect the O-ring. If the O-ring is damaged, install a new O-ring.

Transmission Fluid Temperature (TFT) Sensor Installation

1. Lubricate the O-ring with clean automatic transmission fluid and install a new TFT sensor. Make sure to slightly rotate the sensor to lock it in place.



2. Connect the TFT sensor electrical connector.



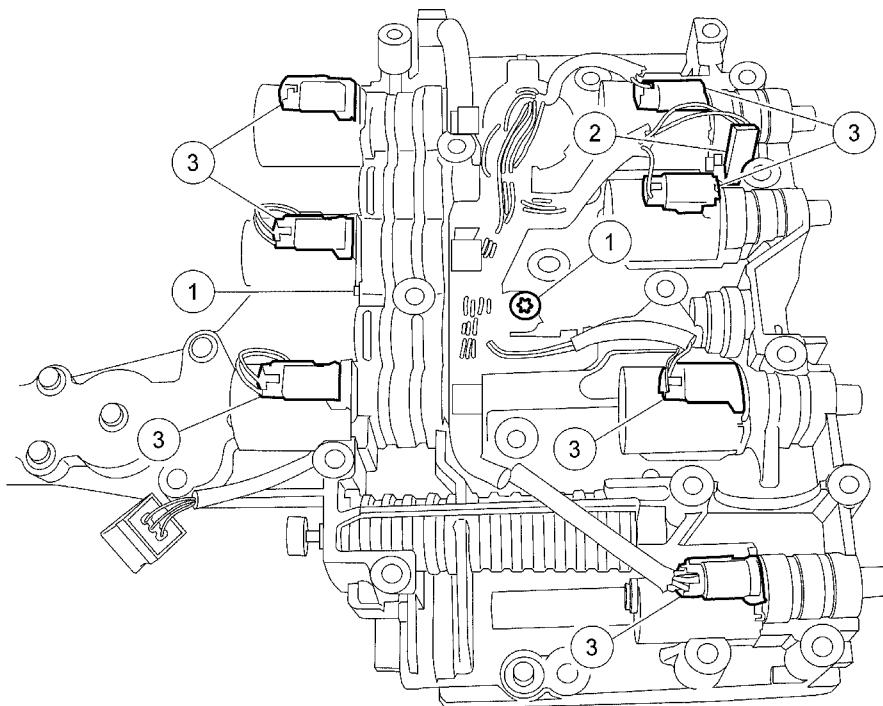
3. Install the transmission fluid filter, pan gasket and pan. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

4. Fill the transmission.
 - Add 7.0 liters (7.5 quarts) of clean automatic transmission fluid to the transmission through the fluid filler tube.
5. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.
6. With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature 66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Internal Harness Service Removal

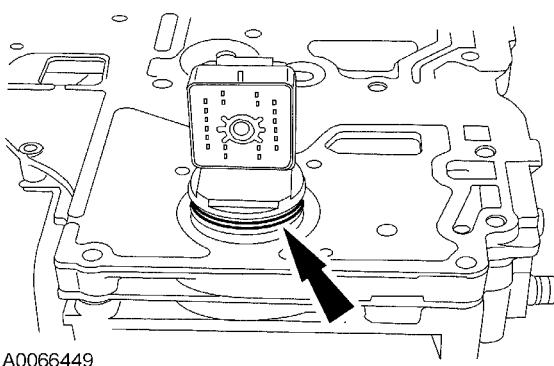
1. Remove the main control solenoid body. For additional information, refer to Solenoid Body Assembly in this section.
2. Disconnect the internal wiring harness.



N0018702

Figure 107

1. Remove the 2 screws.
2. Disconnect the transmission fluid temperature sensor electrical connector.
3. Remove the bulkhead connector O-ring.
3. Disconnect the solenoid electrical connectors.
4. Lift the tab twisting the bulkhead connector, push it through the solenoid body and remove the wire harness.



A0066449

Internal Harness Service Installation

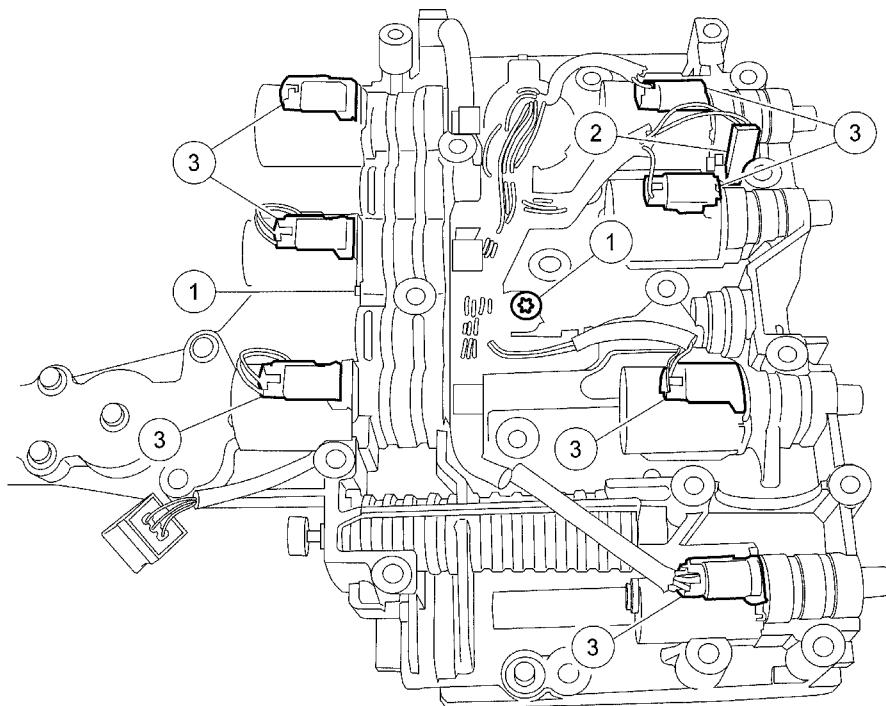
1. Push the bulkhead connector through the transmission solenoid body, twist it to lock it in place.
2. Connect the internal wiring harness.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

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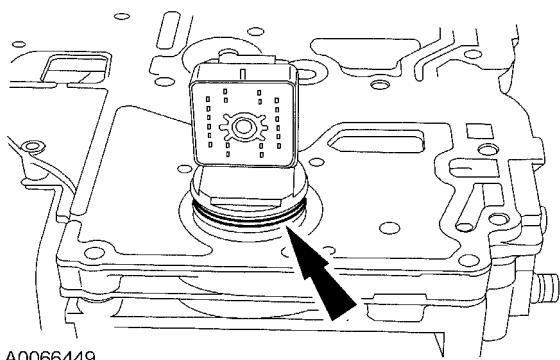
N0018702

Figure 109

1. Install the 2 screws.
2. Connect the transmission fluid temperature sensor electrical connector.
3. Connect the solenoid electrical connectors.

NOTE: The O-ring must be installed in the top slot.

3. Install a new solenoid body bulkhead connector O-ring.



A0066449

4. Install the solenoid body.

Shift Solenoids (SS) Removal and Installation

NOTE: Some solenoid body bolts and wire loom bolts will need to be removed in order to remove affected solenoids.

NOTE: The line pressure solenoid is not serviced in the vehicle. The solenoid body will need to be removed to remove line pressure solenoid. For additional information, refer to Solenoid Body Assembly in this section.

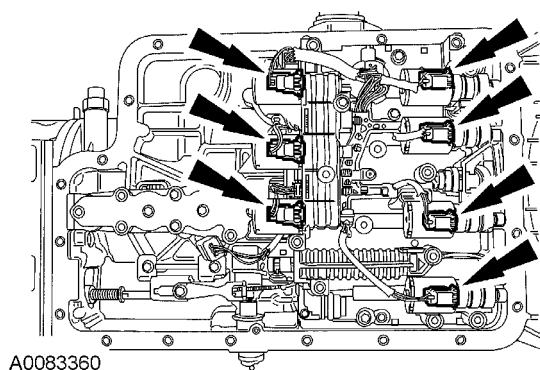
1. Remove the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
2. Disconnect the affected shift solenoid electrical connector.

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- Remove the affected shift solenoid.

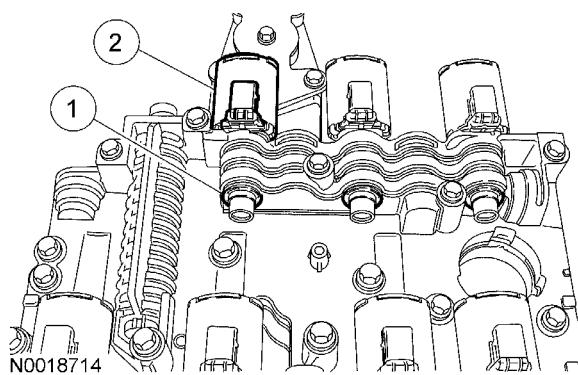


Figure 112

- Remove the retaining "E" clip.
- Remove the affected shift solenoid.

- To install, reverse the removal procedure.

Manual Control Lever Shaft and Seal Removal

Table 136 Special Tools

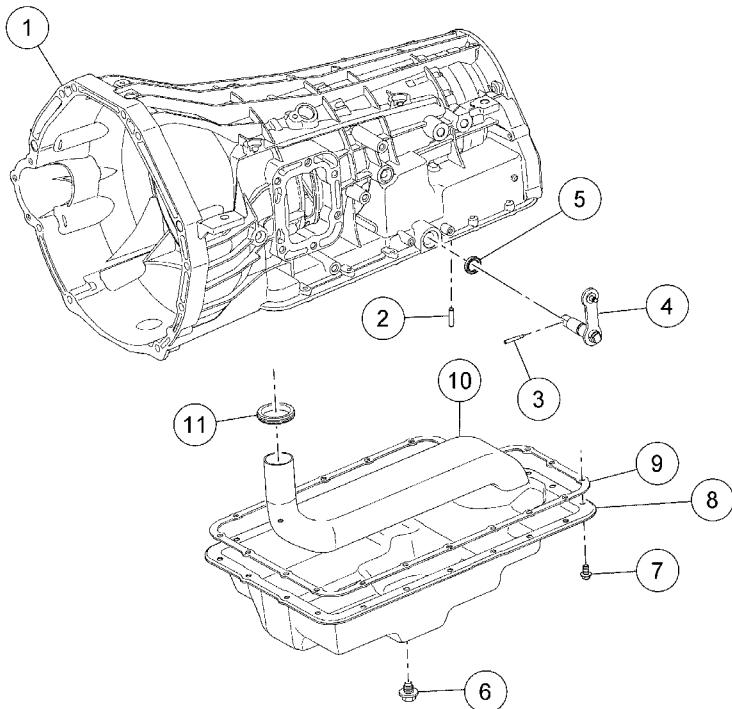
	Roll Pin Set ZTSE9101 ST1634-A
	Installer, Shift Shaft Fluid Seal ZTSE9102 ST1199-A
	Remover, Pilot Bearing ZTSE9134 ST1282-A

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

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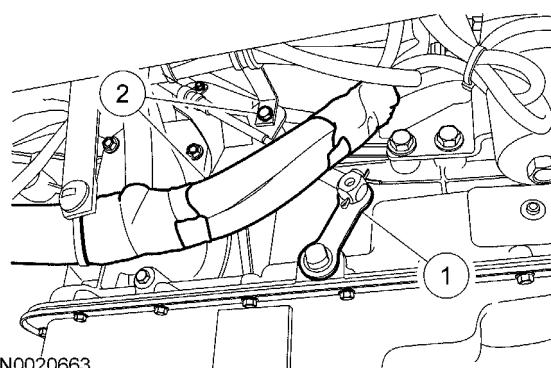


N0020084

Figure 113

- | | | |
|--|---------------------------------------|---|
| 1. Case | 5. Manual control lever seal | 10. Transmission oil filter and seal assembly |
| 2. Manual control lever-to-case roll pin | 6. Oil pan drain plug | 11. Transmission oil filter seal |
| 3. Shift retaining pin | 7. Oil pan-to-case bolt (20 required) | |
| 4. Manual control lever assembly | 8. Transmission oil pan assembly | |
| | 9. Transmission oil pan gasket | |

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Disconnect the shift cable.

**Figure 114**

1. Remove the cotter pin from the shift cable end.
2. Remove the 2 bolts from the shift cable bracket and position it aside.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

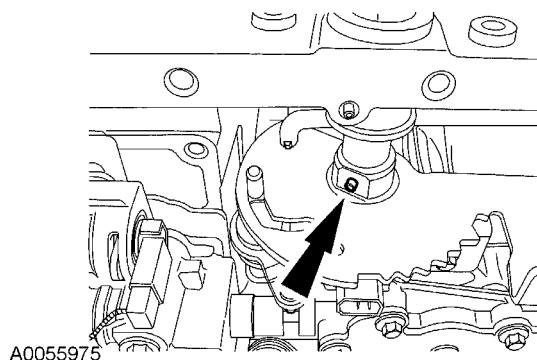
Follow all warnings, cautions, and notes.

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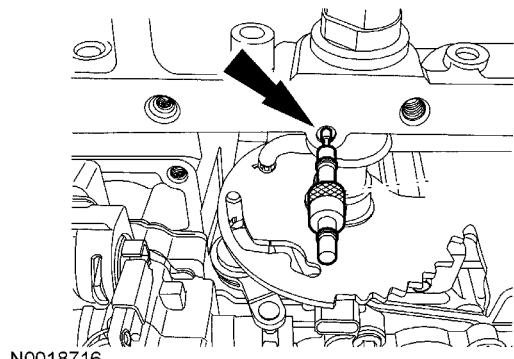
- Remove the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.

NOTE: The pin should be driven up through the manual lever.

- Remove and discard the manual valve detent lever shaft retaining pin.

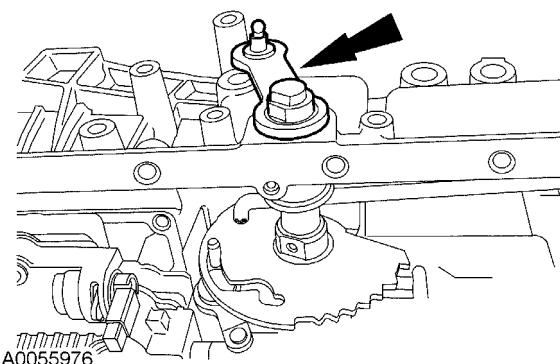


- Using the special tool, remove the manual valve detent lever shaft retaining pin.

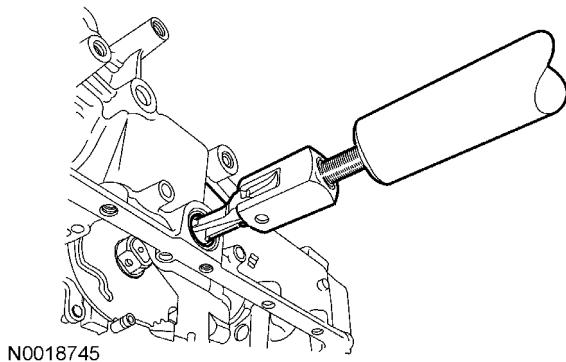


CAUTION: Be careful not to damage the manual control lever bore.

- Remove the manual control lever shaft assembly.



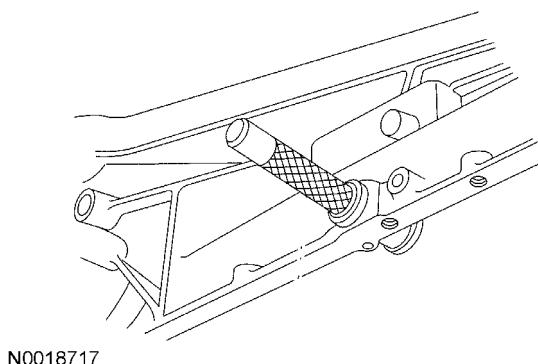
- Using a suitable tool, remove the manual control lever seal and discard.



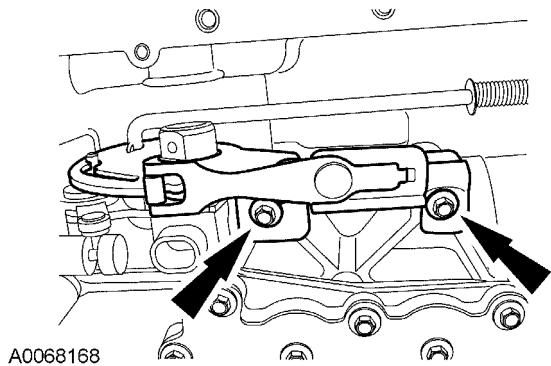
Manual Control Lever Shaft and Seal Installation

NOTE: Prior to installing the manual control lever seal, clean the bore opening with mineral spirits.

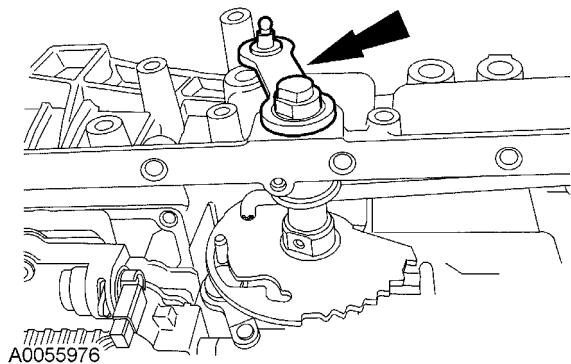
- Using the special tool, install the manual control lever seal.



- Loosen the 2 bolts on the transmission range sensor.

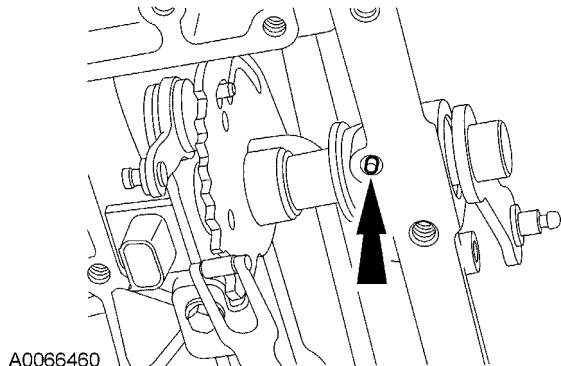


- Install the manual control lever shaft.



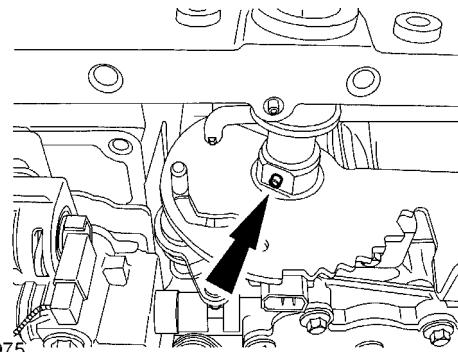
NOTE: Leave a small portion of the pin exposed.

- Install the manual valve detent lever shaft retaining pin into the case.

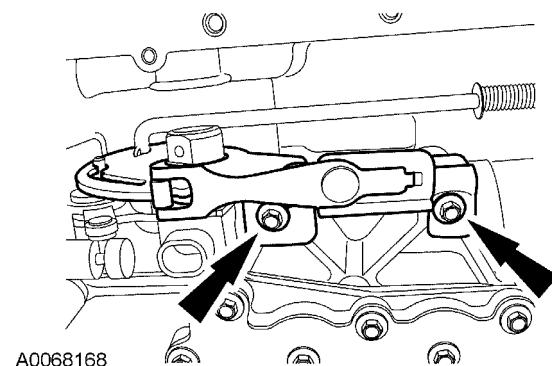


NOTE: When the retaining pin is installed correctly, 2 mm (0.08 in) of the pin will be exposed.

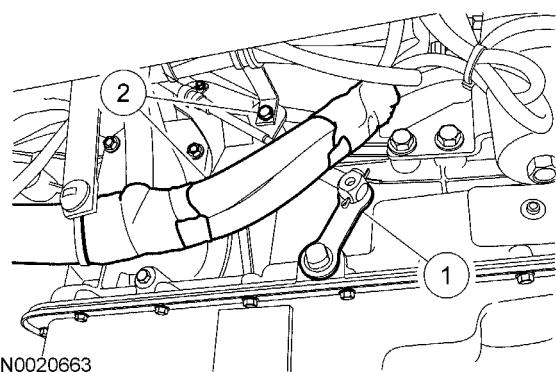
- Install a new manual valve detent lever shaft retaining pin.



- Tighten the 2 transmission range sensor bolts to 10 Nm (89 lb-in).



- Install the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter.
- Connect the shift cable.

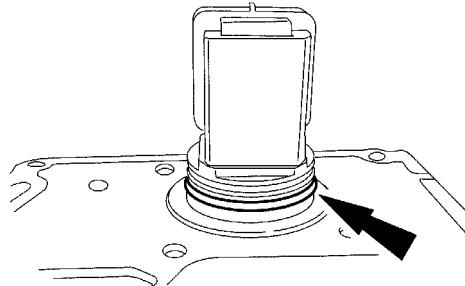
**Figure 125**

1. Install the shift cable end to the manual lever and install the cotter pin.
2. Install the shift cable bracket and install the 2 bolts.
 - a. Tighten to 25 Nm (18 lb-ft).

9. Adjust the shift linkage. Verify that the vehicle starts in PARK and NEUTRAL and the reverse lamps illuminate in REVERSE. For additional information, refer to Automatic Transaxle/Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).

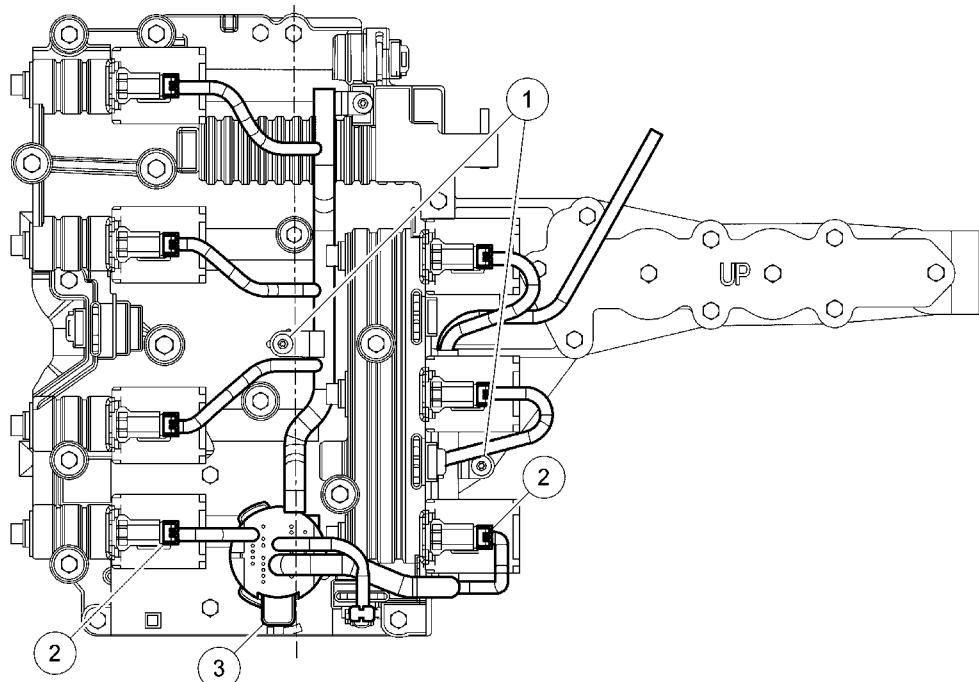
Line Pressure Control Solenoid — PC-A Removal

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the transmission main control valve body. For additional information, refer to Solenoid Body Assembly in this section.
3. Remove the solenoid body electrical connector O-ring seal.



A0057628

4. Partially remove the solenoid body electrical wire harness.



N0018781

Figure 127

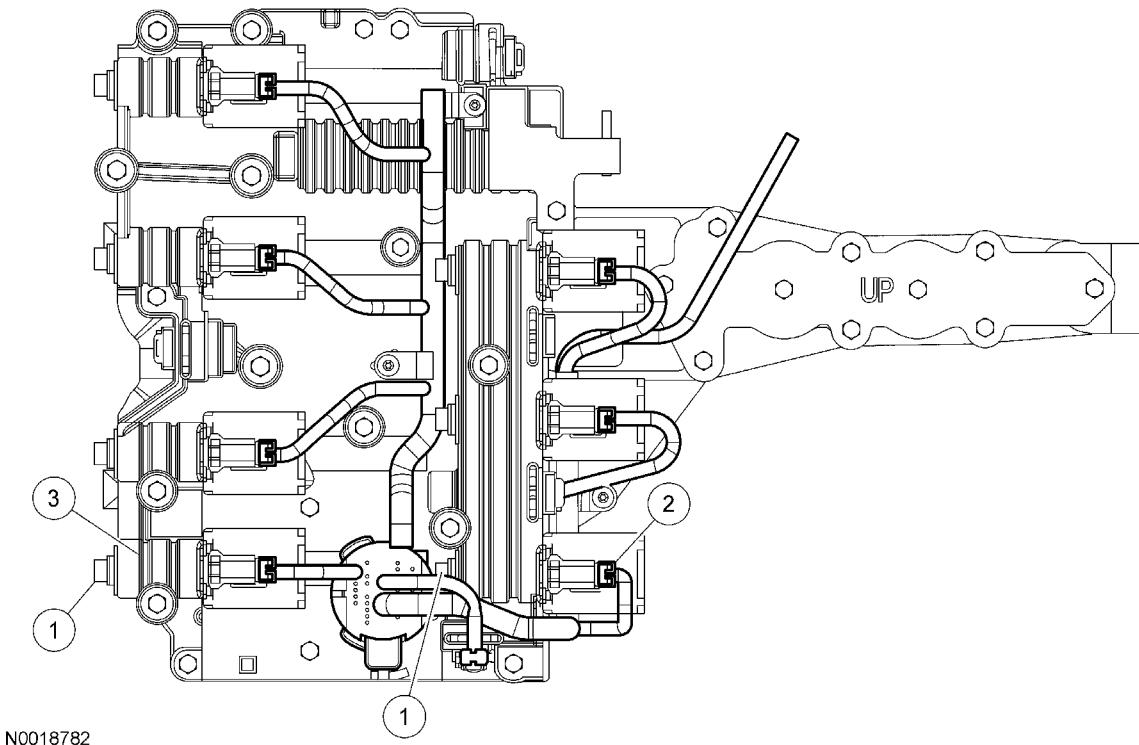
1. Remove the wire harness to solenoid body bolts.
2. Disconnect the electrical connector from the pressure control solenoid (PC-A) and the shift solenoid (SSPC-C).
3. Lift the tab on the bulkhead connector, twist and push the bulkhead connector through the solenoid body.
5. Remove the pressure control solenoid (PC-A).

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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**Figure 128**

1. Remove the (E) retaining clips from the pressure control solenoid (PC-A) and the shift solenoid (SSPC-C).
2. Partially slide the shift solenoid (SSPC-C) back enough to gain clearance to remove the pressure control solenoid (PC-A).
3. Remove the pressure control solenoid (PC-A).

Line Pressure Control Solenoid — PC-A Installation

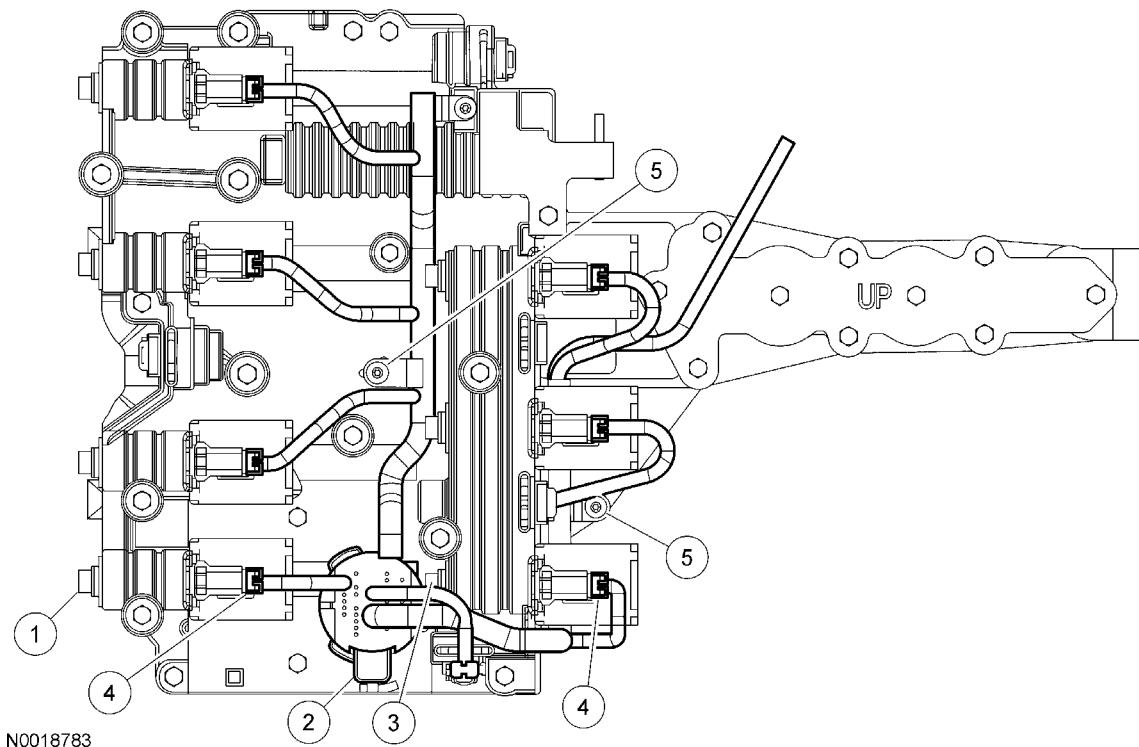
1. Assemble the main control valve body.

S13036

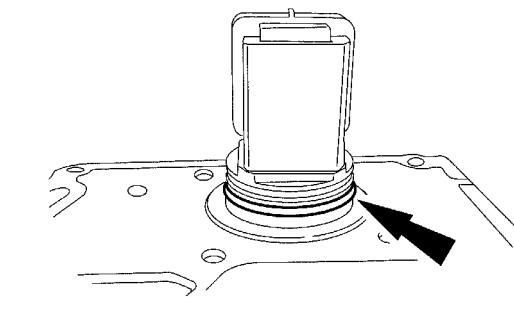
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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**Figure 129**

1. Install the pressure control solenoid (PC-A) and install the (E) retaining clip.
2. Push the bulkhead connector through the solenoid body and twist the bulkhead connector locking it into place.
2. Remove the solenoid body electrical connector O-ring seal.
3. Install the shift solenoid (SSPC-C) back into place and install the (E) retaining clip.
4. Connect the electrical connectors to the pressure control solenoid (PC-A) and the shift solenoid (SSPC-C).
3. Install the transmission main control valve body. For additional information, refer to Solenoid Body Assembly in this section.
5. Install the wire harness to solenoid body and tighten the bolts.



A0057628

Digital Transmission Range (TR) Sensor Removal**Table 137 Special Tool**

	Roll Pin Set ZTSE9101
	ST1634-A

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Disconnect the shift cable.

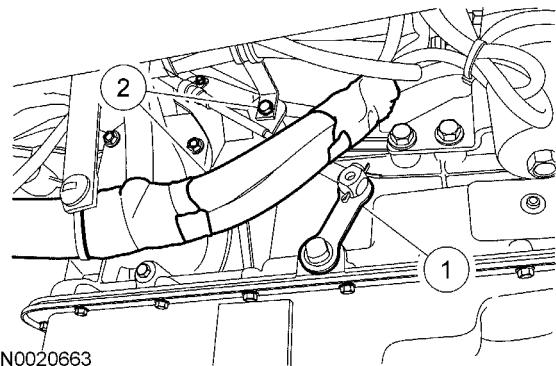
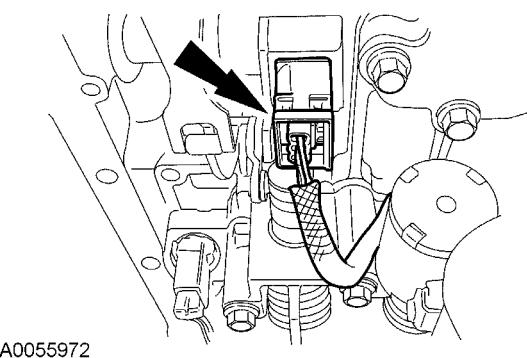


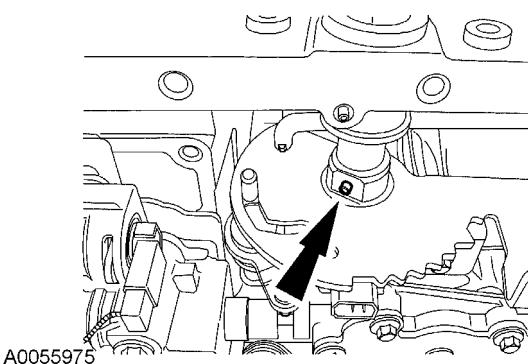
Figure 131

1. Remove the cotter pin from the shift cable end.
2. Remove the 2 bolts from the shift cable bracket and position it aside.
3. Remove the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
4. Disconnect the transmission range (TR) sensor electrical connector.

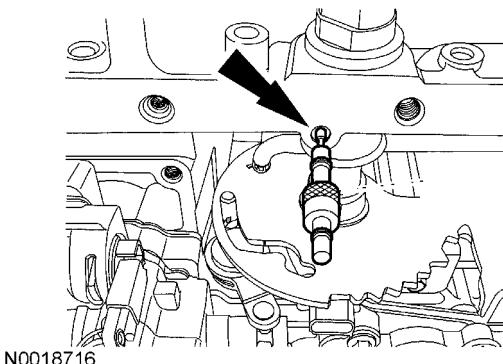


NOTE: The pin should be driven up through the manual valve.

5. Remove and discard the manual valve detent lever shaft retaining pin.

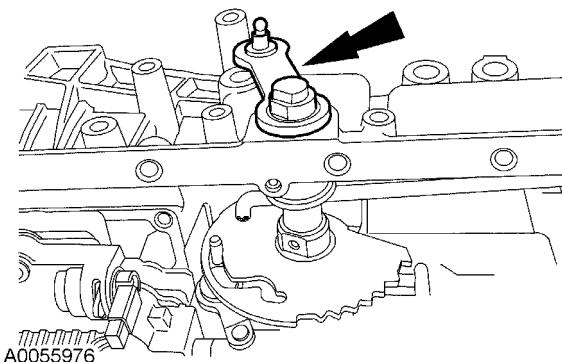


6. Using the special tool, remove the manual valve detent lever shaft retaining pin.



CAUTION: Be careful not to damage the manual control lever bore.

7. Remove the manual control lever shaft assembly.



8. Remove the TR sensor and detent lever assembly.

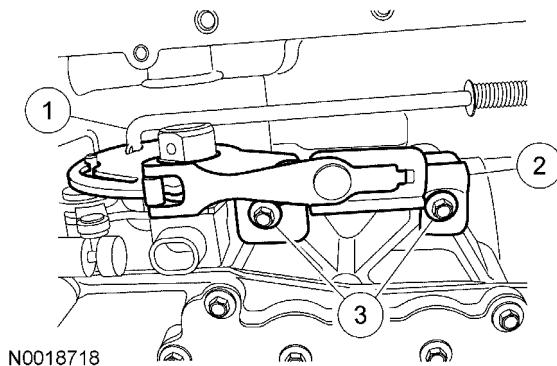


Figure 136

1. Remove the bolts.
2. Remove the TR sensor and detent lever assembly.
3. Disconnect the park rod from the detent lever assembly.

Digital Transmission Range (TR) Sensor Installation

1. Install the TR sensor and detent lever assembly.

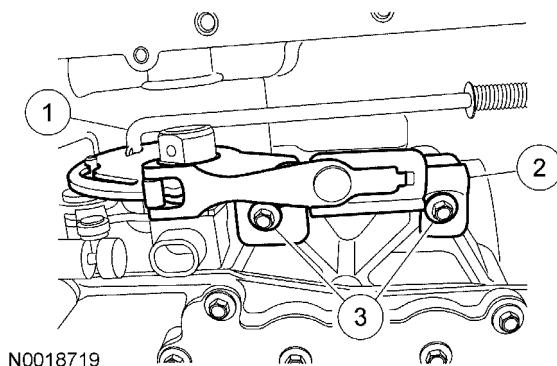
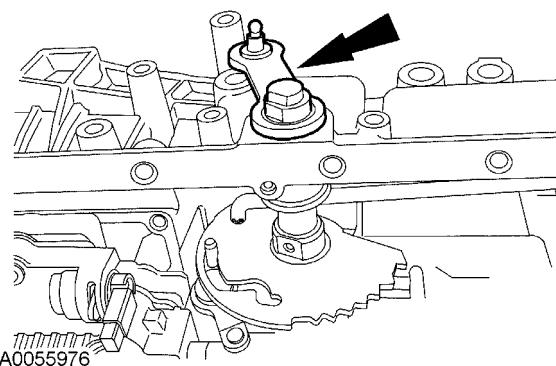


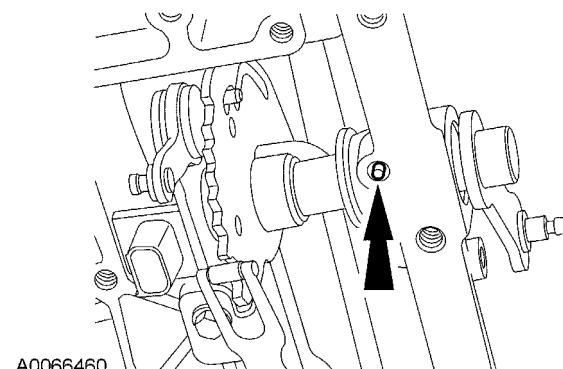
Figure 137

1. Connect the park rod to the detent lever assembly.
 2. Install the TR sensor and the detent lever assembly.
 3. Loosely install the bolts.
2. Install the manual control lever shaft.



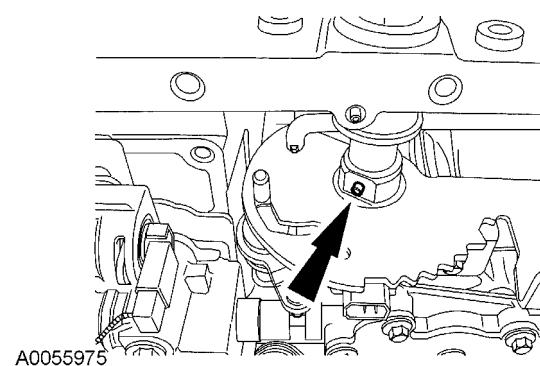
NOTE: Leave a small portion of the pin exposed.

3. Install the manual valve detent lever shaft retaining pin into the case.

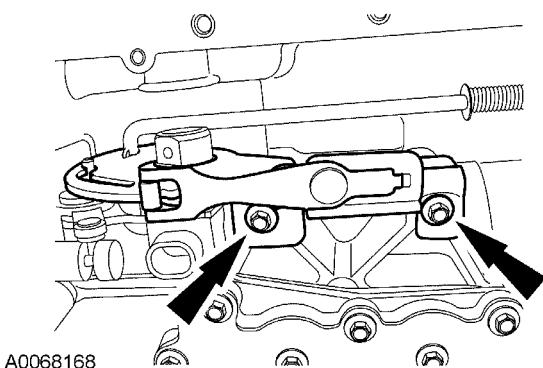


NOTE: When the retaining pin is installed correctly, 2 mm (0.08 in) of the pin will be exposed.

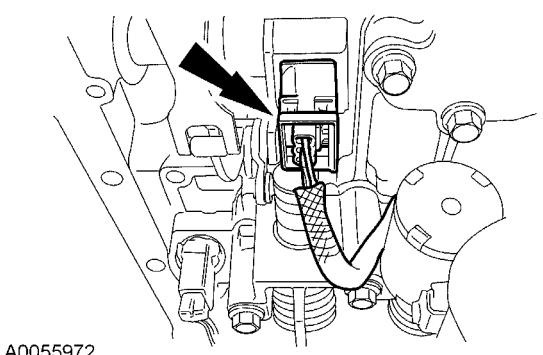
4. Install a new manual valve detent lever shaft retaining pin.



5. Tighten the bolts to 10 Nm (89 lb-in).



6. Connect the TR sensor electrical connector.



7. Connect the shift cable.

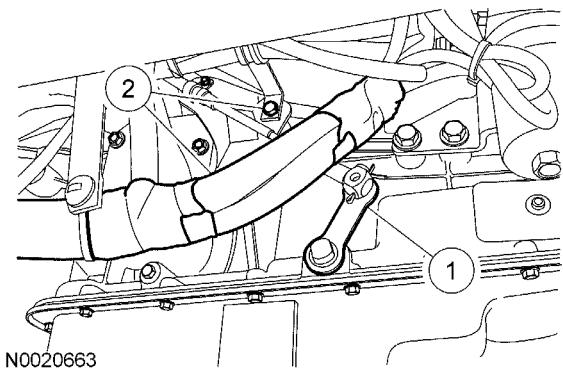


Figure 143

1. Install the shift cable end to the manual lever and install the cotter pin.
2. Install the shift cable bracket and install the 2 bolts.
 - a. Tighten to 25 Nm (18 lb-ft).

8. Install the transmission fluid pan, gasket and filter. For additional information, refer to Fluid Pan, Gasket and Filter in this section.
9. Adjust the shift linkage. Verify that the vehicle starts in PARK and NEUTRAL and the reverse lamps illuminate in REVERSE. For additional information, refer to Automatic Transaxle/Transmission External Controls(Automatic Transaxle/Transmission External Controls, page 307).

Park System Removal

Table 138 Special Tool

 ST2720-A	Nut Driver, Output Shaft ZTSE9141
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1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the rear driveshaft. For additional information, refer to Driveshaft in S06002.
3. Remove the output shaft flange.

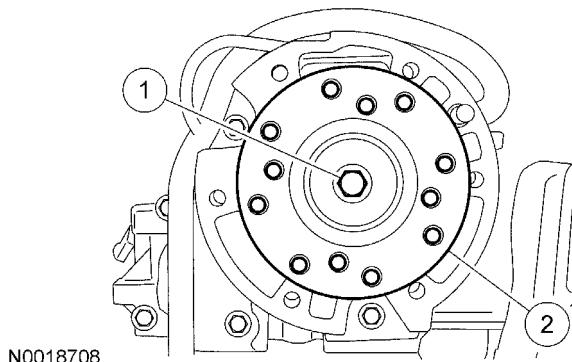
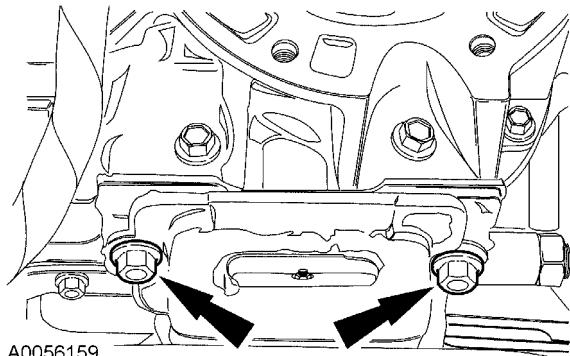


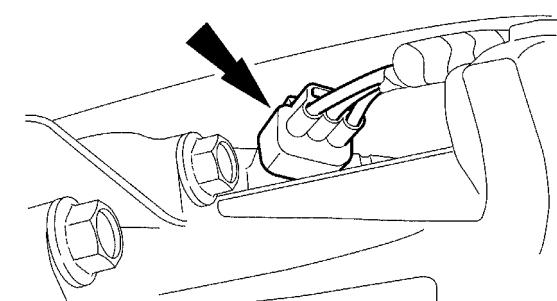
Figure 144

1. Remove and discard the output shaft flange bolt.
2. Remove the output shaft flange.

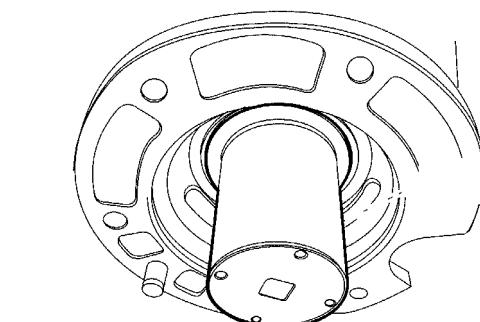
4. Using a suitable transmission jack, support the transmission.
5. Remove the bolts and raise the transmission upward, from the rear mount.



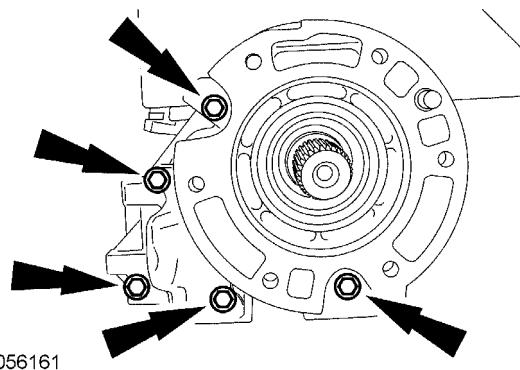
6. Disconnect the output shaft speed (OSS) sensor electrical connector.



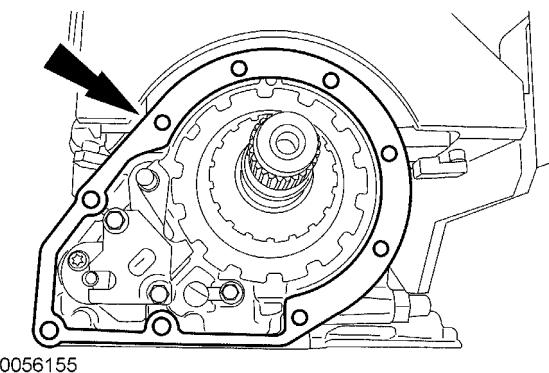
7. Using the special tool, remove the output shaft retaining nut.



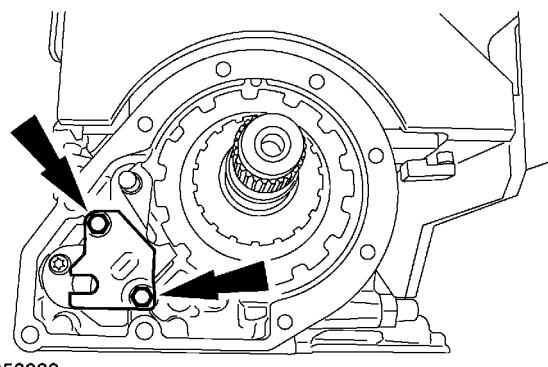
8. Remove the 9 bolts and the extension housing.



9. Remove and discard the extension housing gasket.



10. Remove the parking rod guide plate bolts and the plate.



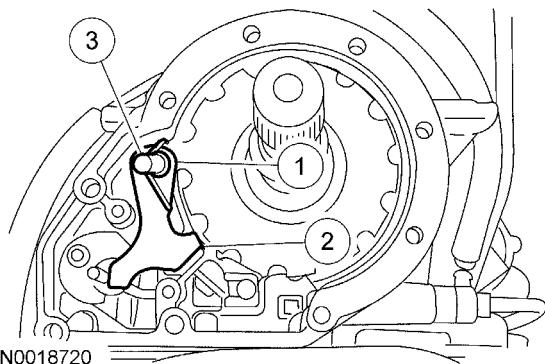
11. Remove the park pawl components.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

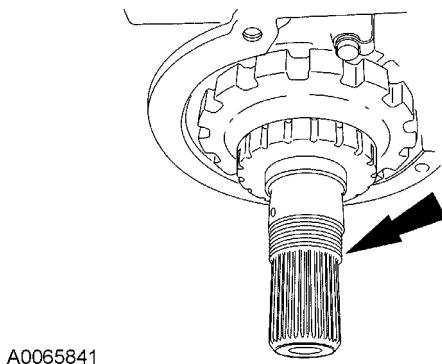
Follow all warnings, cautions, and notes.

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**Figure 151**

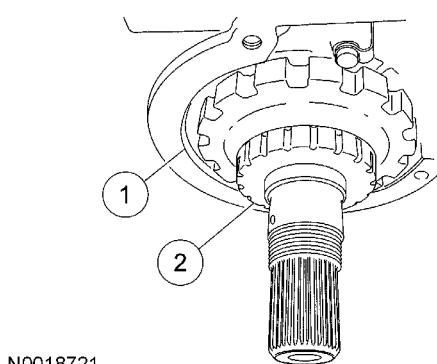
1. Remove the park pawl return spring.
2. Remove the park pawl.
3. Remove the park pawl shaft.

12. Inspect the output shaft and park gear for damage.



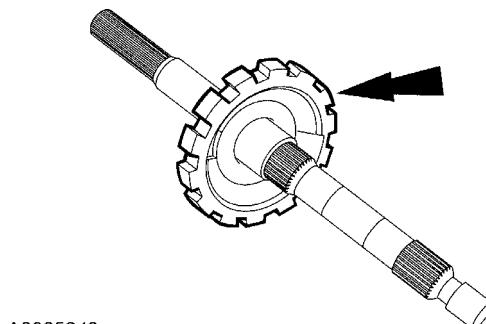
NOTE: The park gear and OSS gear may be pressed on the output shaft.

14. Remove the park and OSS gear from the output shaft.

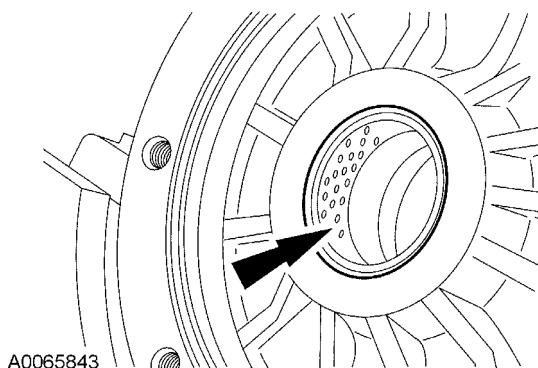
**Figure 152**

1. Inspect the park gear for damage.
2. Inspect the OSS gear for damage.

13. If damage is found to either the OSS or park gears, remove the park gear and output shaft as an assembly.



15. Inspect the Teflon® seals in the rear of the case. If the seals are worn or damaged, install new scarf cut seals.



Park System Installation

- Using clean automatic transmission fluid to hold the bearing or bushing in place, install the output shaft bearing for slip yoke models and the bushing for fixed yoke models.

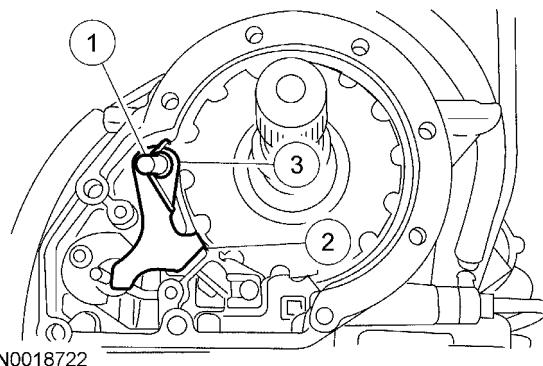
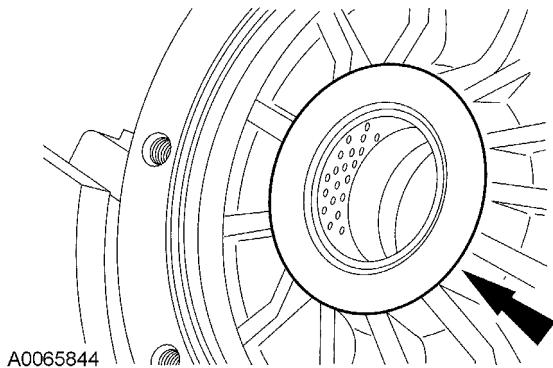
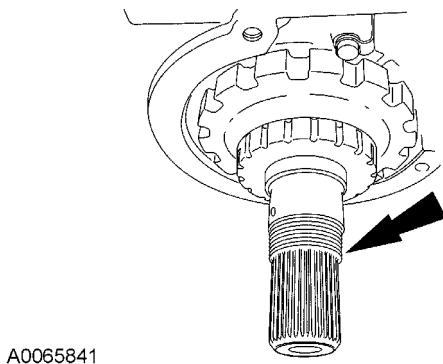


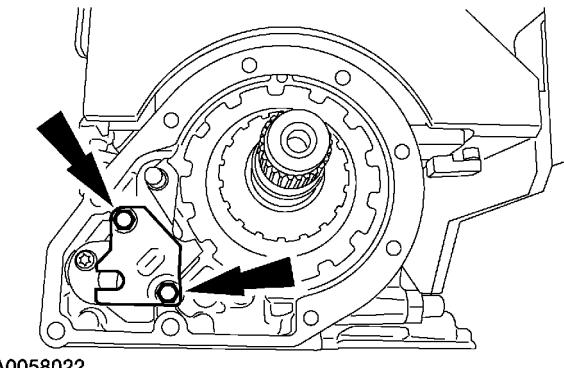
Figure 158

- Install the park pawl shaft.
- Install the park pawl.
- Install the park pawl return spring.

- If the output shaft was removed, install the output shaft and park gear assembly.

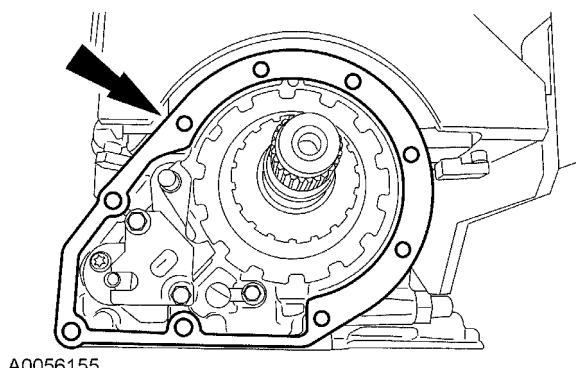


- Install the parking rod guide plate and bolts.
- Tighten to 25 Nm (18 lb-ft).

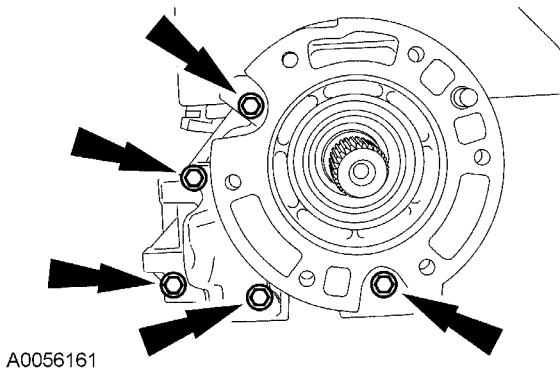


- Install the park pawl shaft.

- Install a new extension housing gasket.

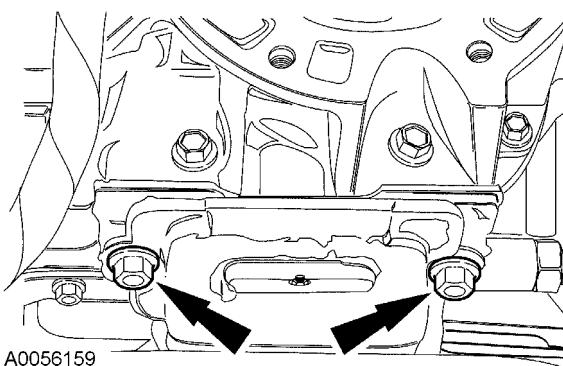


6. Install the extension housing and the 9 bolts.
 • Tighten to 47 Nm (35 lb-ft).



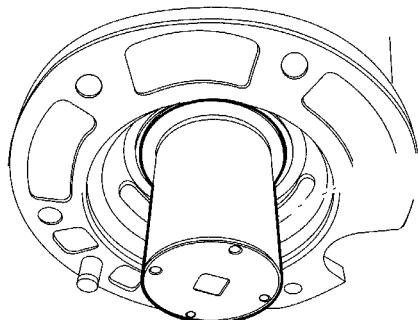
A0056161

9. Lower the transmission onto the rear mount and install the bolts.
 • Tighten to 94 Nm (69 lb-ft).



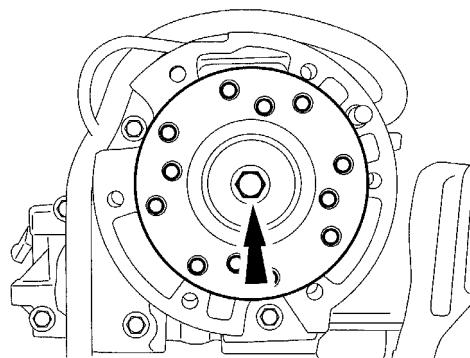
A0056159

7. Using the special tool, install the output shaft nut.
 • Tighten to 200 Nm (148 lb-ft).



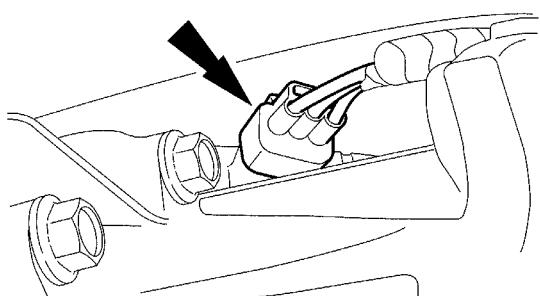
N0018709

10. Install the output shaft flange and a new bolt.
 • Tighten to 135 Nm (100 lb-ft).



N0018715

8. Connect the OSS sensor electrical connector.



A0055907

11. Install the rear driveshaft. For additional information, refer to Driveshaft in S06002.
 12. Start the engine. Move the transmission range selector lever through all the gear ranges, checking for engagements.

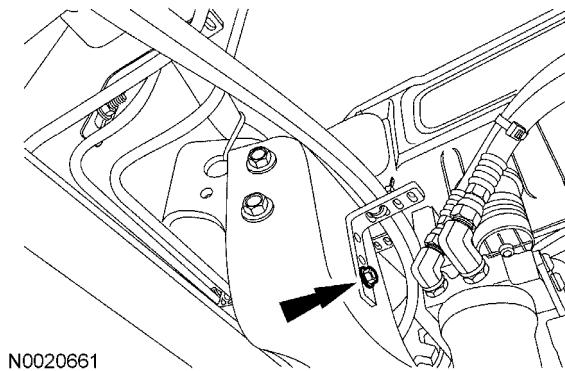
CAUTION: The use of any other transmission fluid than specified can result in the transmission failing to operate in a normal manner or transmission failure.

13. With the vehicle in NEUTRAL, engine running and the transmission at normal operating temperature

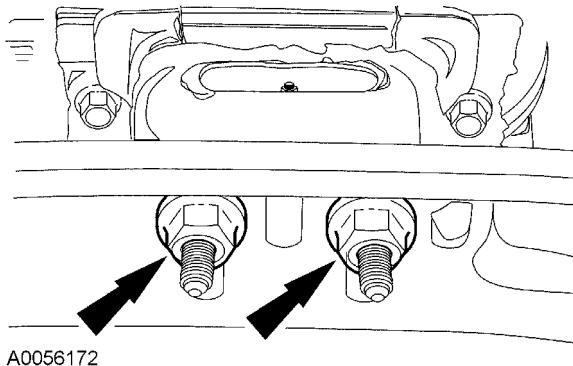
66-77°C (150-170°F), check and adjust the transmission fluid level and check for any leaks. If fluid is needed, add fluid in increments of 0.24 liter (0.5 pint) until the correct level is achieved (fluid should be in the cross-hatched area of the fluid level indicator).

Transmission Support Crossmember Removal

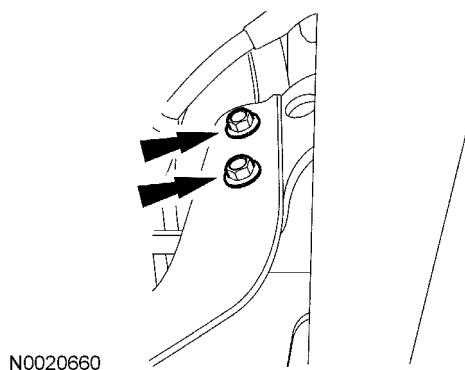
1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Install a suitable high-lift transmission jack.
3. Remove the bolt and the fuel line bracket from the LH side of the crossmember.



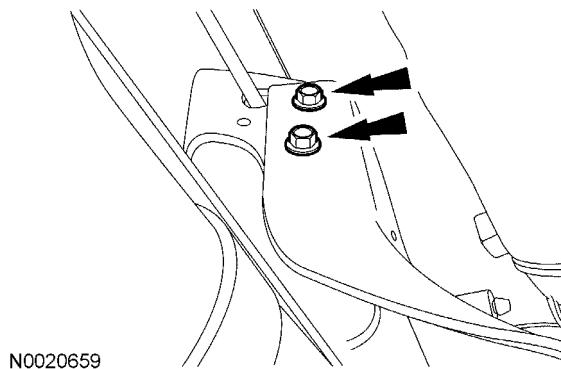
4. Remove the rear transmission mount nuts.



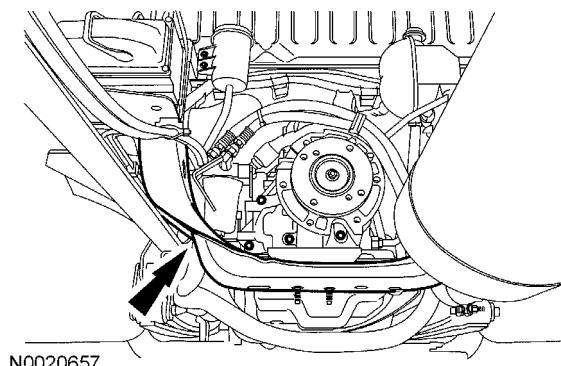
5. Remove the LH crossmember bolts and nuts.



6. Remove the RH crossmember bolts and nuts.

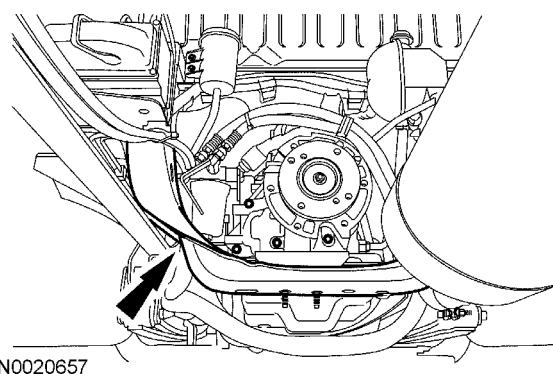


7. Remove the crossmember.



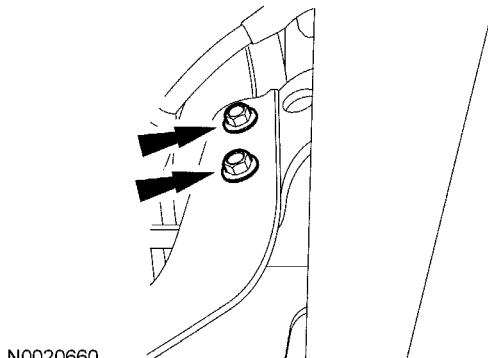
Transmission Support Crossmember Installation

1. Position the crossmember in place.



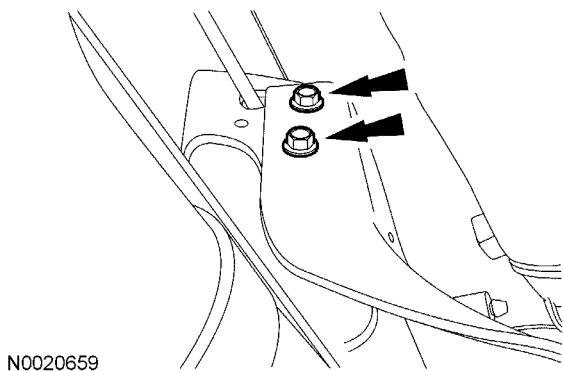
2. Install the LH crossmember bolts.

- Tighten to 81 Nm (60 lb-ft).



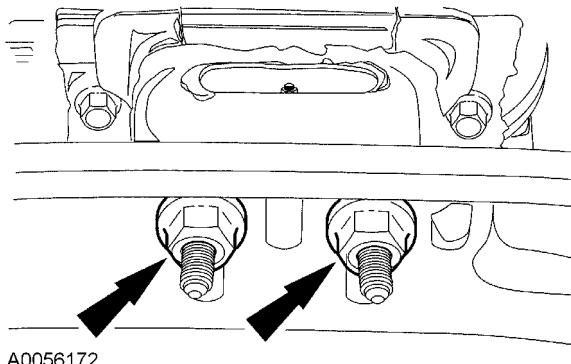
3. Install the RH crossmember bolts and nuts.

- Tighten to 81 Nm (60 lb-ft).



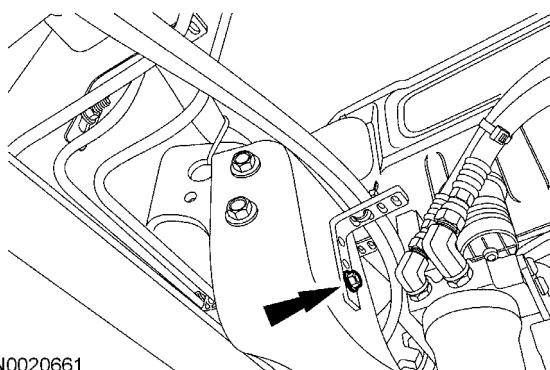
4. Install the rear insulator nuts.

- Tighten to 94 Nm (69 lb-ft).



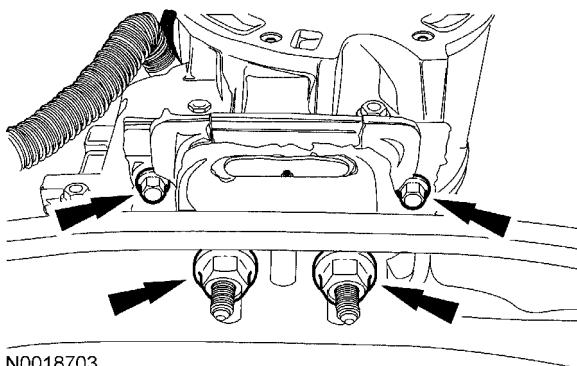
5. Install the fuel line bracket to the LH side of the crossmember and install the bolt.

- Tighten to 25 Nm (18 lb-ft).



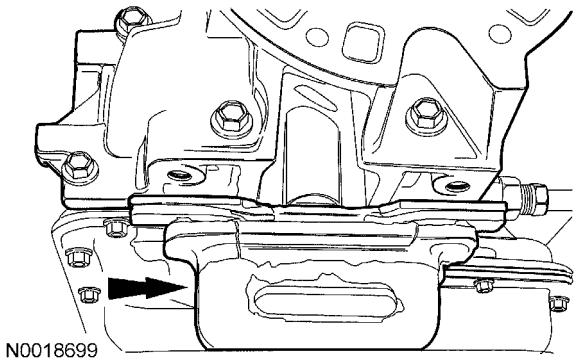
Transmission Insulator and Retainer Removal

1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the rear transmission support insulator bolts and nuts.



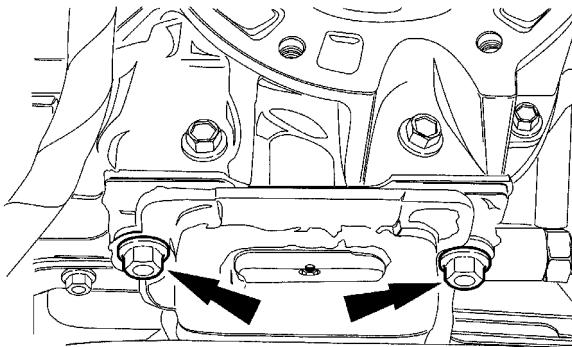
N0018703

3. Raise the transmission upward, off the rear transmission mount and remove the mount.



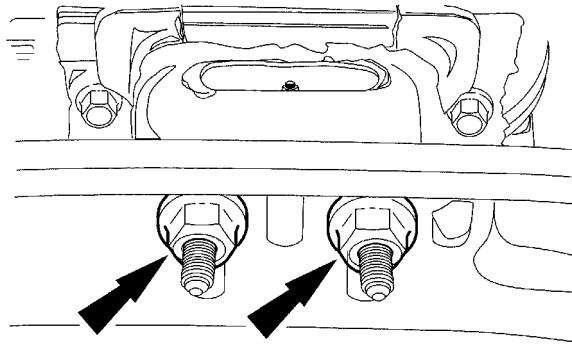
N0018699

2. Loosely install the transmission support insulator bolts.



A0056168

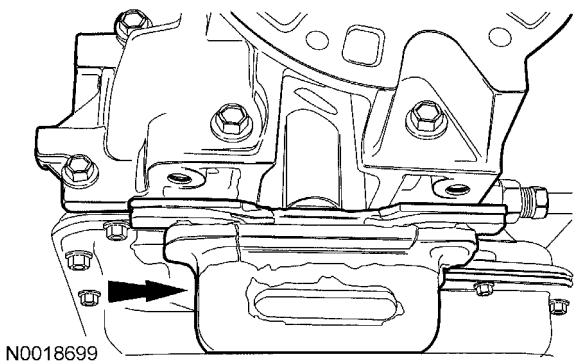
3. Loosely install the transmission support insulator nuts.



A0056172

Transmission Insulator and Retainer Installation

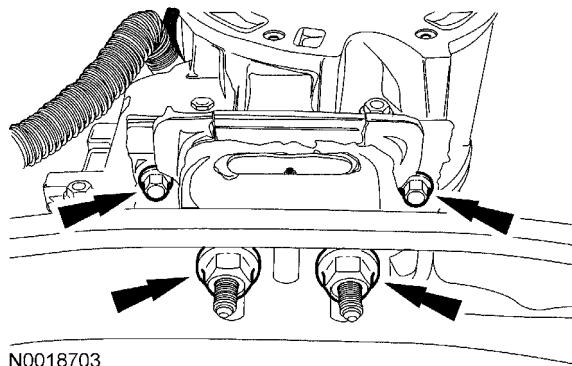
1. Install the rear transmission mount and lower the transmission onto the crossmember.



N0018699

4. Install the rear transmission bolts and nuts.

- Tighten to 94 Nm (69 lb-ft).



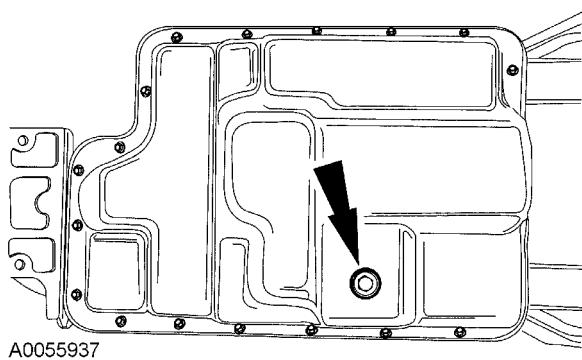
N0018703

NOTE: It may be necessary to raise the back of the transmission slightly in order to install the bolts.

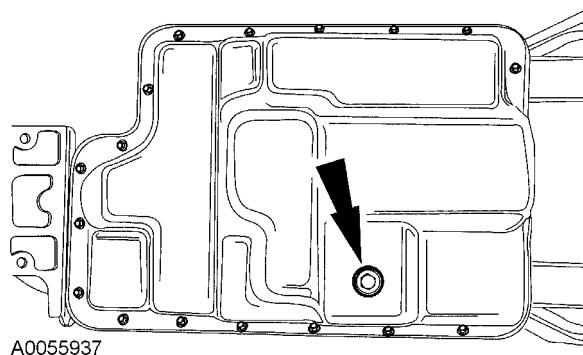
Removal**Transmission****Table 139 Special Tool**

	Retainer, Torque Converter ZTSE9109
ST1636-A	

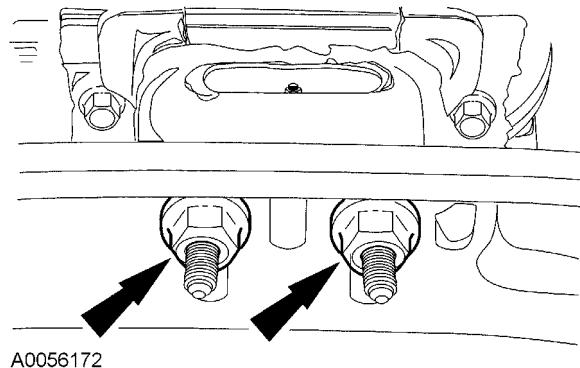
1. Raise and support the vehicle with the transmission in NEUTRAL. For additional information, refer to Jacking and Lifting in S10019.
2. Remove the rear driveshaft. For additional information, refer to Driveshaft in S06002.
3. If transmission disassembly is required, drain the transmission fluid. Remove the drain plug and allow the fluid to drain.



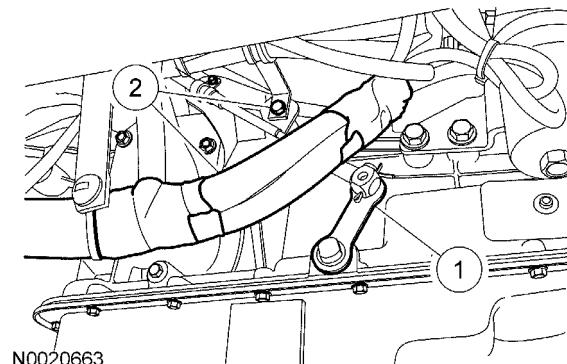
4. Install the drain plug.
 - Tighten to 25 Nm (18 lb-ft).



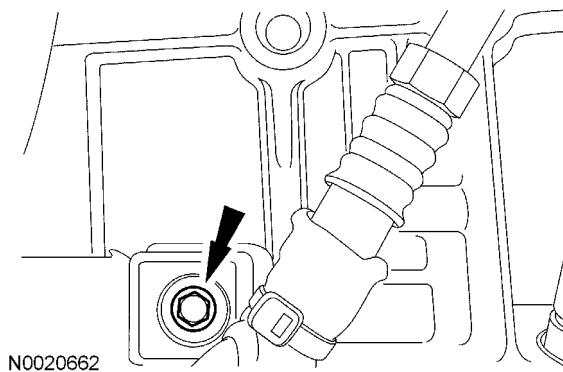
5. Remove the rear transmission mount nuts.



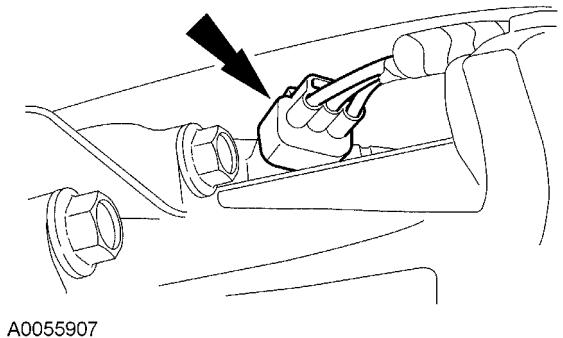
6. Disconnect the shift cable.

**Figure 185**

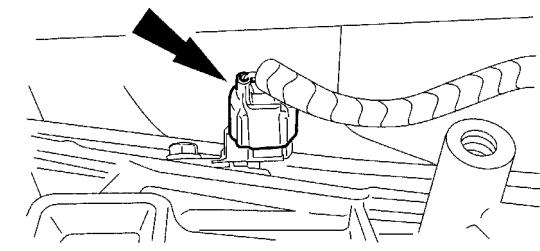
1. Remove the cotter pin from the shift cable end.
 2. Remove the 2 bolts from the shift cable bracket and position it aside.
7. Loosen the bolt and disconnect the solenoid body electrical connector.



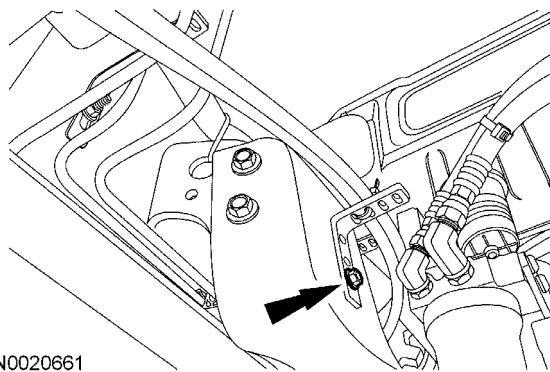
- Disconnect the output shaft speed (OSS) sensor electrical connector.



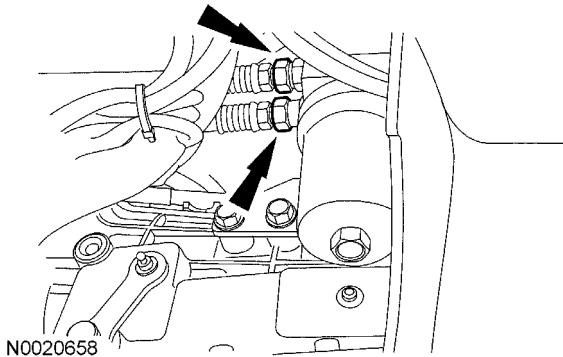
- Disconnect the turbine shaft speed (TSS) and the intermediate shaft speed combination sensor electrical connector.



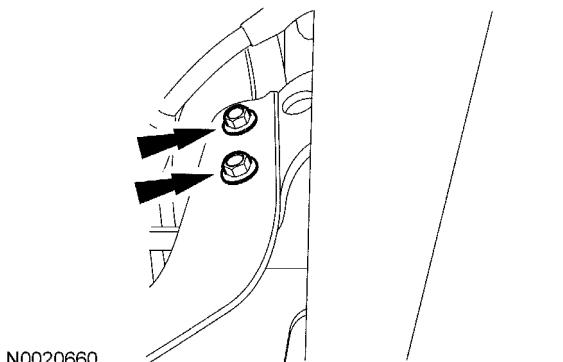
- Remove the bolt and the fuel line bracket from the LH side of the crossmember.



- Disconnect the 2 transmission fluid cooler lines from the fluid filter.



- Remove the 4 LH crossmember bolts and nuts.



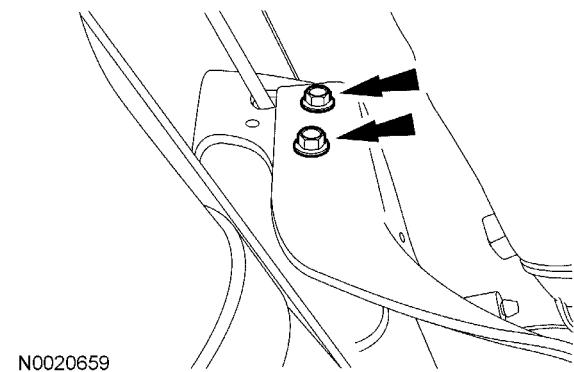
- Remove the 4 RH crossmember bolts and nuts.

S13036

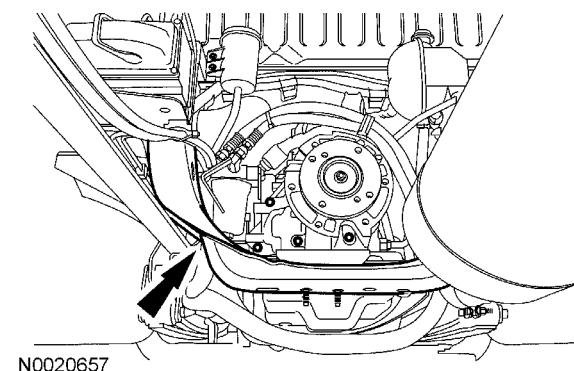
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

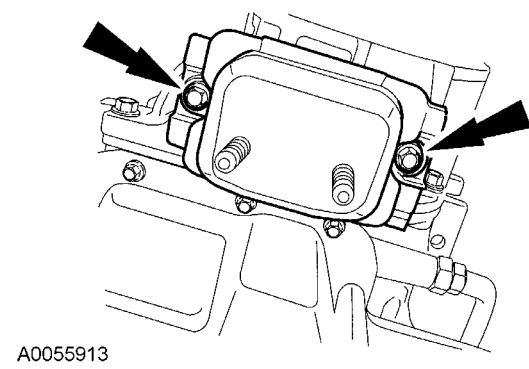
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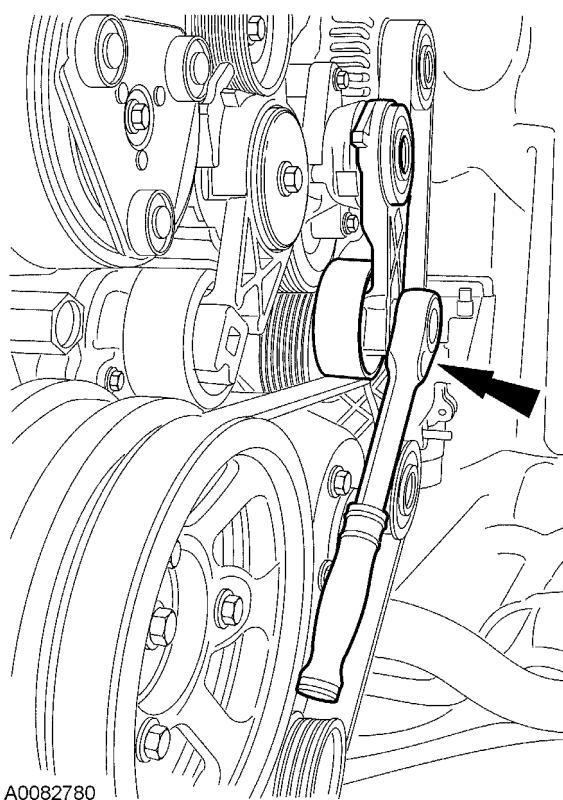
14. Remove the crossmember .



15. Remove the rear transmission mount from the extension housing.

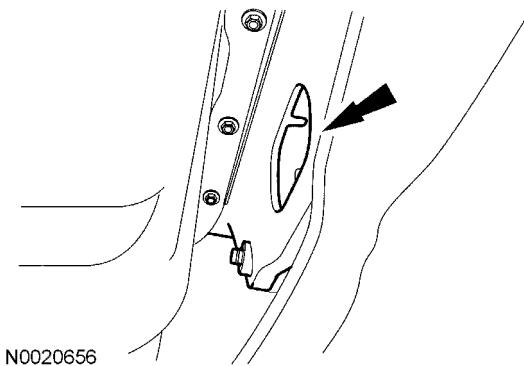


16. If equipped with dual generators, rotate the tensioner and remove the outer accessory drive belt from the crankshaft pulley.

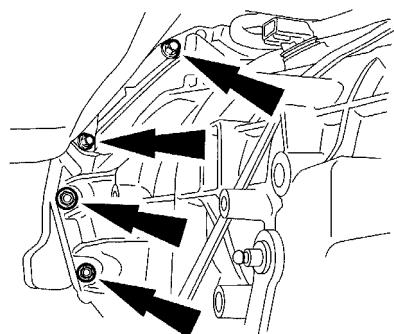


NOTE: Using a suitable strap wrench, rotate the crankshaft pulley to gain access to the torque converter nuts.

17. Locate the opening in the cover to gain access to the torque converter nuts. Remove and discard the 6 torque converter nuts.

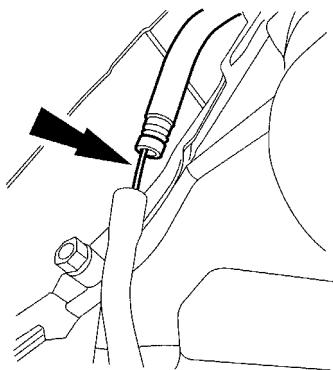


18. Remove the 9 transmission-to-engine mounting bolts.



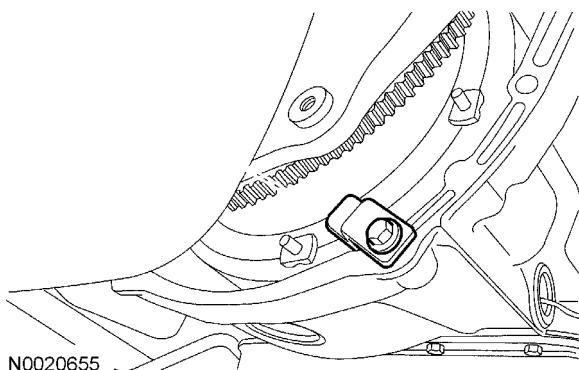
A0055920

19. Remove the transmission fluid filler tube from the stub tube.



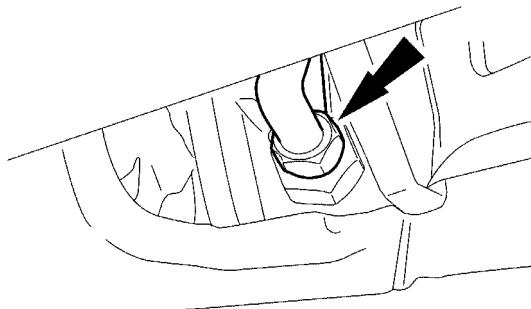
A0057721

20. Slide the transmission back and install the special tool.



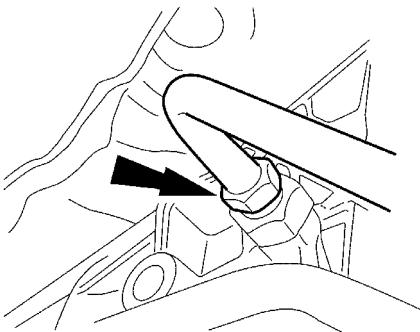
21. Carefully lower the transmission assembly.

22. While holding the case fitting, disconnect the rear fluid cooler tube.



A0055917

23. While holding the case fitting, disconnect the front fluid cooler tube.



A0055918

24. Remove the 2 bolts from the bracket and remove the filter housing.

25. If the transmission is to be overhauled or if installing a new transmission, carry out transmission backflushing and cleaning. For additional information, refer to Transmission Fluid Cooler — Backflushing and Cleaning in this section.

26. For vehicles equipped with a power takeoff (PTO) assembly, prior to installing the transmission, the PTO assembly must be flushed and cleaned to remove any foreign material. Failure to remove foreign material from the PTO assembly may result in subsequent transmission concerns.

Disassembly
Transmission

Table 140 Special Tools

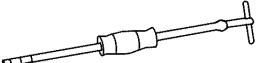
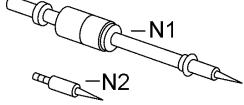
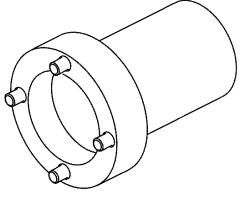
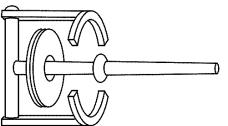
	Slide Hammer ST1185-A
	Roll Pin Set ZTSE9101 ST1738-A
	Nut Driver, Output Shaft ZTSE9141 ST2720-A
	Compressor, Clutch Spring ZTSE9121 ST1190-A

Table 140 Special Tools (cont.)

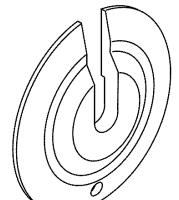
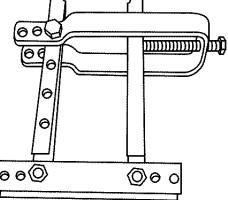
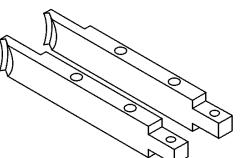
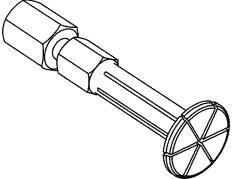
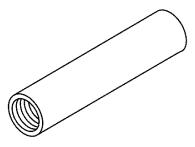
	Alignment Cone ZTSE9144 ST2719-A
	Torque Converter Fluid Seal Remover ZTSE9108 ST1758-A
	Legs (used with ZTSE9108) ST2731-A
	Remover, Seal Pack ZTSE9116 ST2721-A
	Fixture Handle, Coast Clutch Part of ZTSE9133 Kit 307-384

Table 140 Special Tools (cont.)

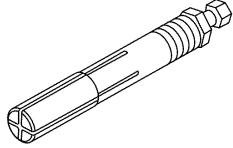
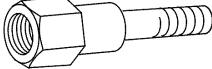
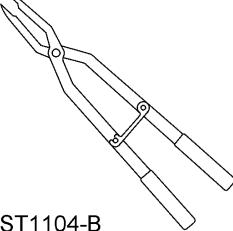
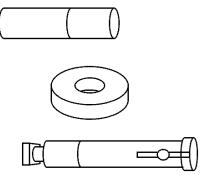
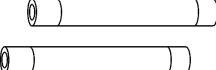
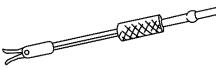
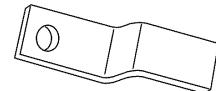
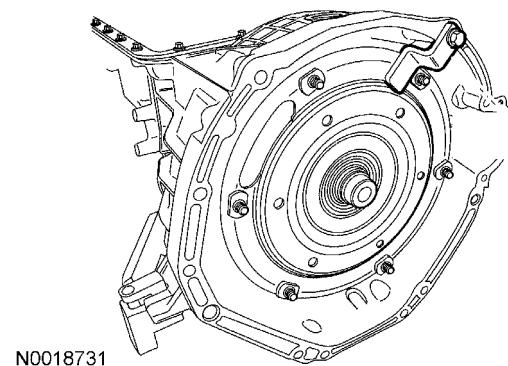
	Fixture Body, Coast Clutch Part of ZTSE9133 Kit 307-385
	Remover, Transmission Fluid Pump ZTSE9123
	Handle ZTSE2365A ST1255-A
	Retaining Ring Pliers ZTSE9125
	Loading Fixture, Clutch Part of ZTSE9133 Kit ST2159-A

Table 140 Special Tools (cont.)

	Handle, Torque Converter ZTSE9122 ST1631-A
	Remover, Pilot Bearing ZTSE9134 ST1282-A
	Retainer, Torque Converter ZTSE9109 ST1636-A

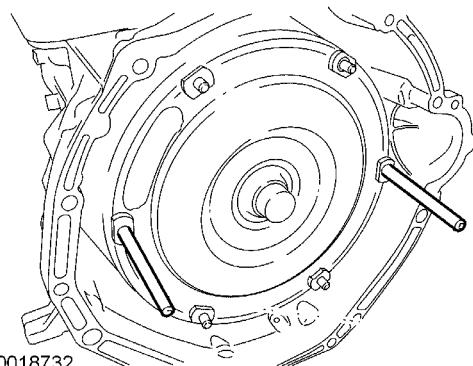
1. Remove the special tool.



WARNING: Use the special tools when removing the torque converter because it is very heavy. Failure to follow may result in personal injury.

NOTE: Fluid loss will occur when removing the torque converter.

2. Using the special tools, remove the torque converter.



3. Remove the turbine shaft speed (TSS) and intermediate shaft speed combination sensor.

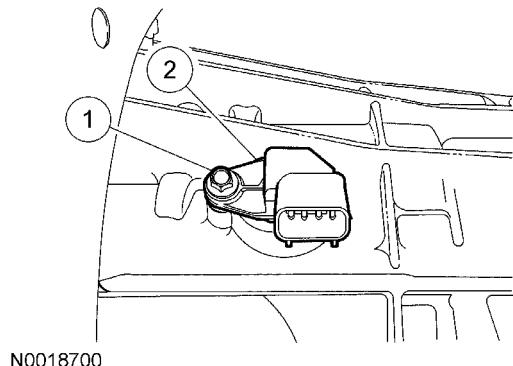


Figure 204

1. Remove the bolt.
2. Remove the sensor.

4. Remove the output shaft speed (OSS) sensor.

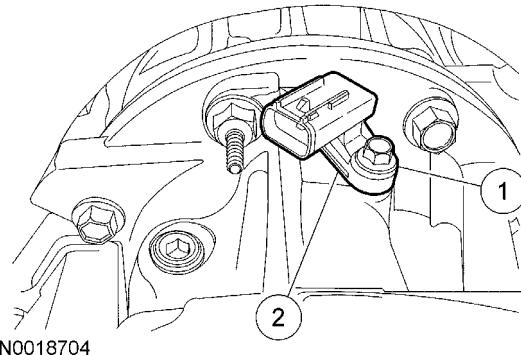
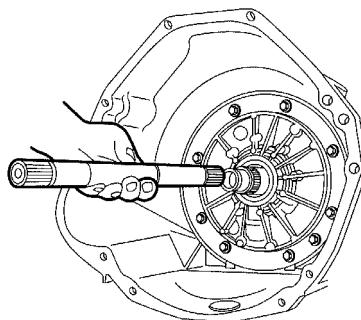


Figure 205

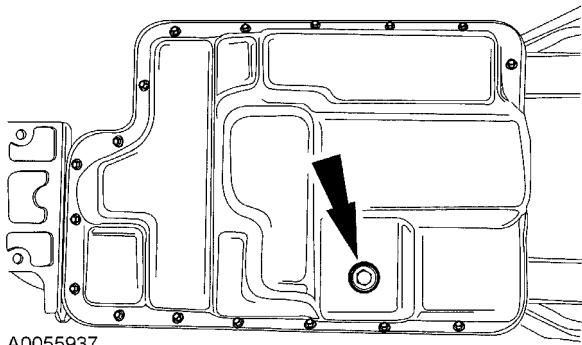
1. Remove the bolt.
2. Remove the OSS.

5. Mount the transmission onto a suitable stand.
6. Remove the input shaft and discard the stator support seal.



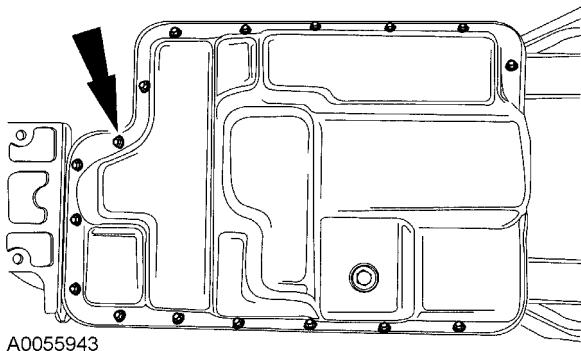
DD0260-A

7. Install a new drain plug and seal assembly if there is evidence of leaking.



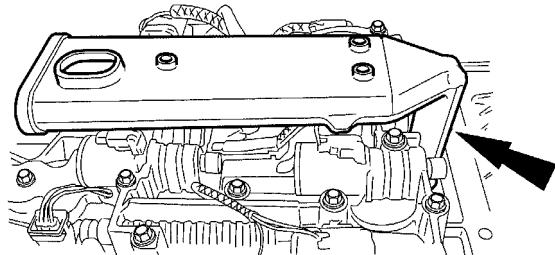
NOTE: Do not discard the gasket unless damaged.
This is a reusable gasket.

8. Remove the transmission fluid pan and the gasket. Check and clean the magnet if foreign material is evident.



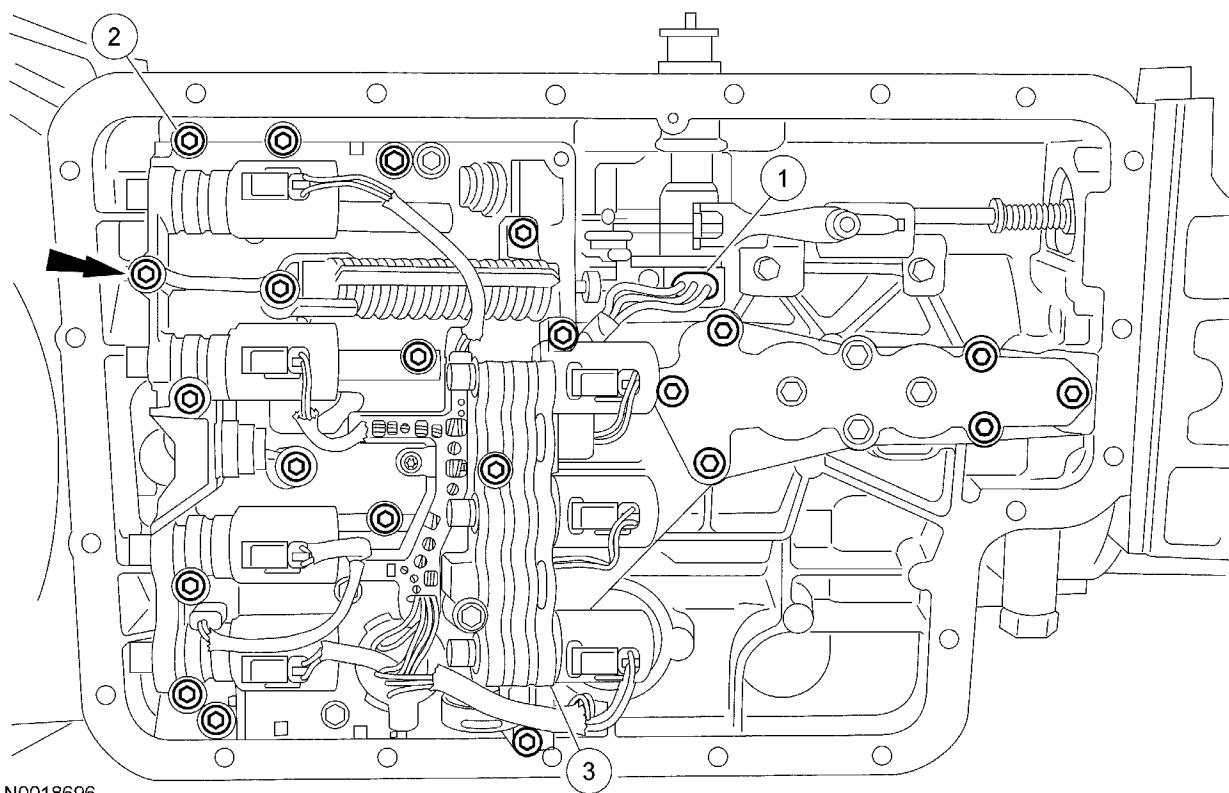
NOTE: After removal, discard the filter and seal assembly.

9. Remove the filter and seal assembly by carefully pulling and rotating the filter as necessary.



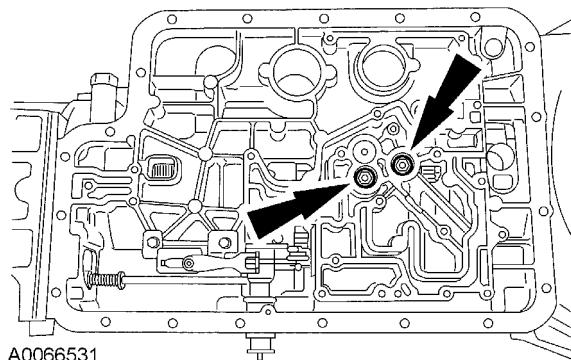
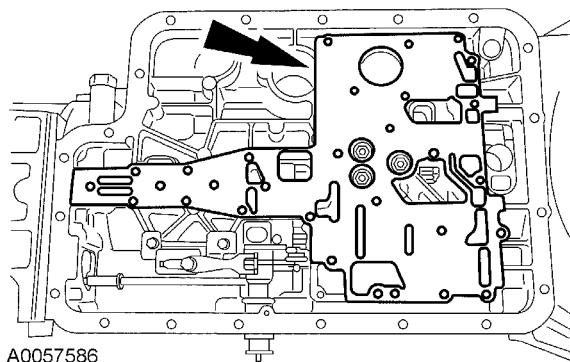
CAUTION: There is no retainer on the manual valve. Hold the manual valve in place while removing the solenoid assembly from the transmission to avoid dropping the valve.

10. Remove the solenoid body.

**Figure 210**

1. Disconnect the transmission range (TR) sensor.
2. Remove the solenoid body bolts.
3. Remove the solenoid body.

11. Remove and discard the solenoid body gasket.



13. Remove and discard the front pump bolts.

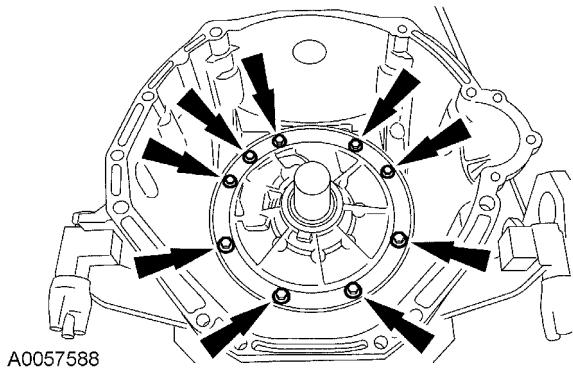
12. Remove the feedbolts.

S13036

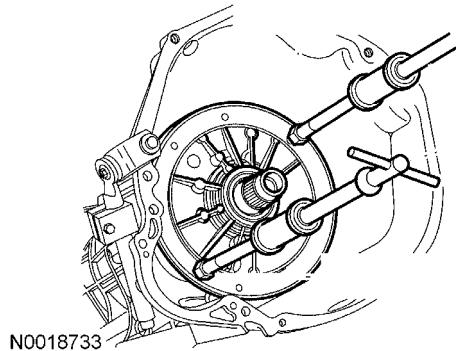
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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14. Using the special tools, remove the front pump.



NOTE: The No. 1 pump thrust washer and the No. 2A overdrive sun gear thrust bearing may stay with the pump.

15. Remove the No. 1 pump thrust washer.

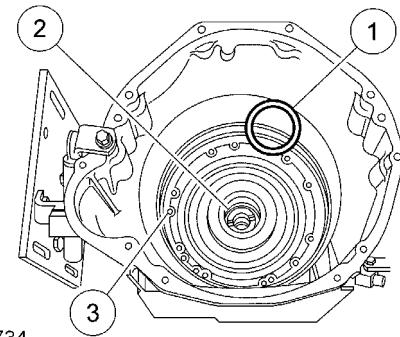
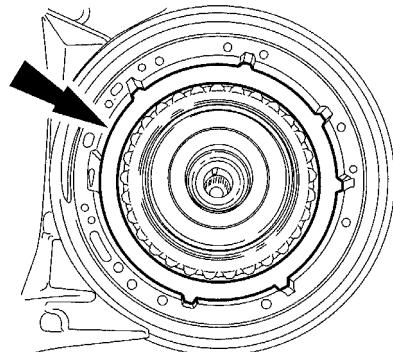


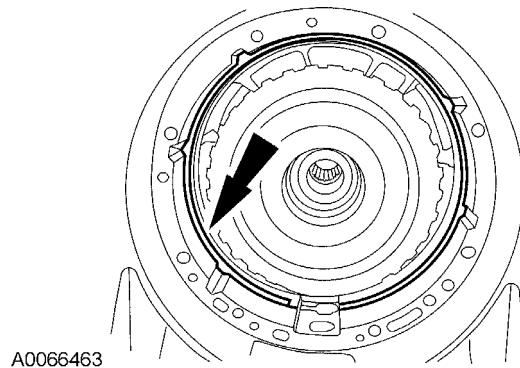
Figure 215

1. Remove the No. 1 pump thrust washer.
2. Remove the No. 2A overdrive sun gear thrust bearing.
3. Remove the pump gasket and discard.

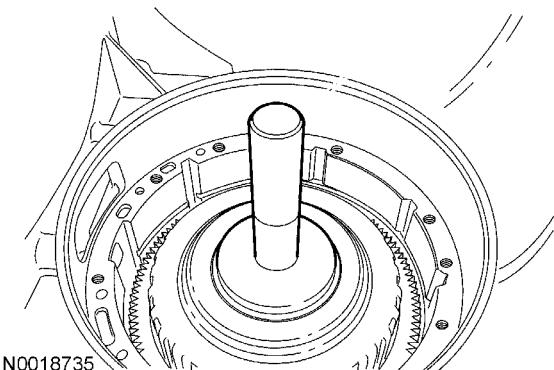
16. Remove the overdrive separator plates, clutch plates and overdrive pressure plate.



17. Remove the overdrive clutch retaining ring.

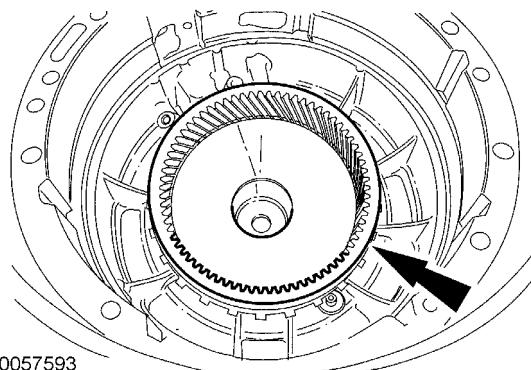


18. Install the special tool.



N0018735

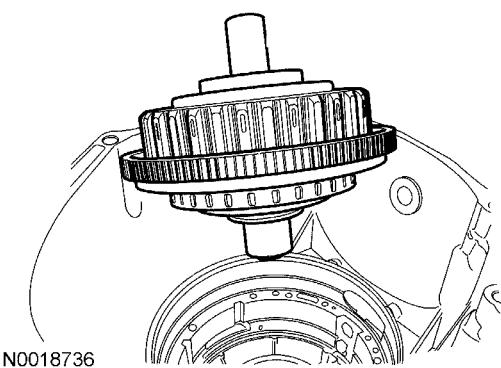
21. Remove the overdrive ring gear and center shaft.



A0057593

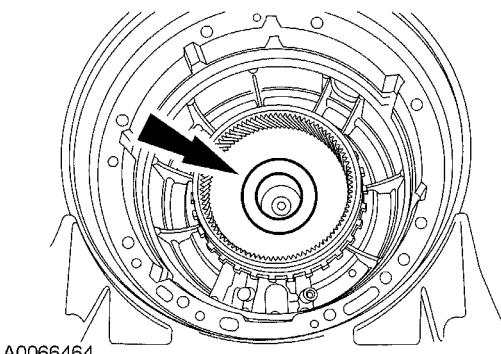
NOTE: The No. 3 overdrive carrier thrust bearing and race assembly may come out with the coast clutch cylinder assembly or it may stay in the transmission.

19. Using the special tool, remove the coast clutch cylinder assembly.



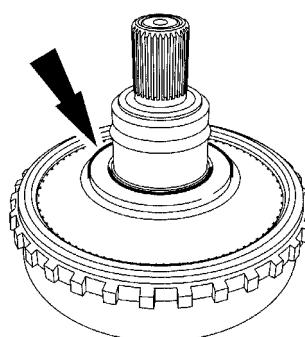
N0018736

20. Remove the No. 4 thrust bearing.



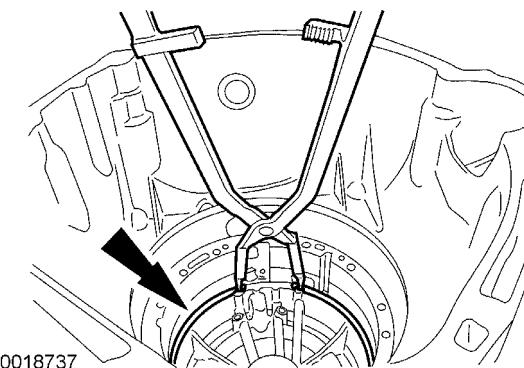
A0066464

22. Remove the No. 5 sun gear thrust bearing.



A0057594

23. Using the special tool, remove the center support retaining ring.



N0018737

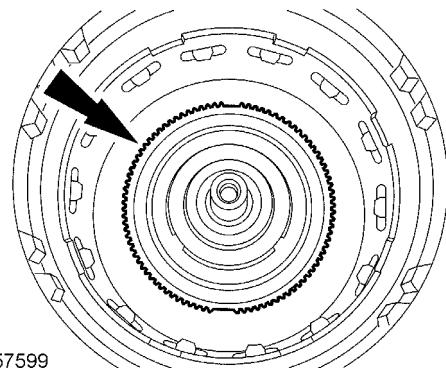
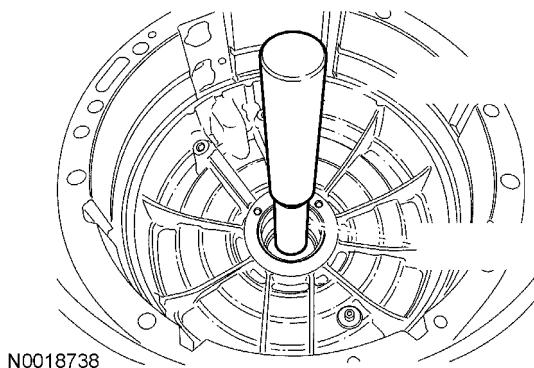
24. Install the special tools into the center support assembly.

S13036

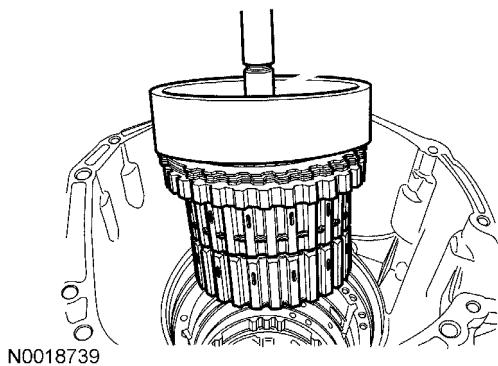
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

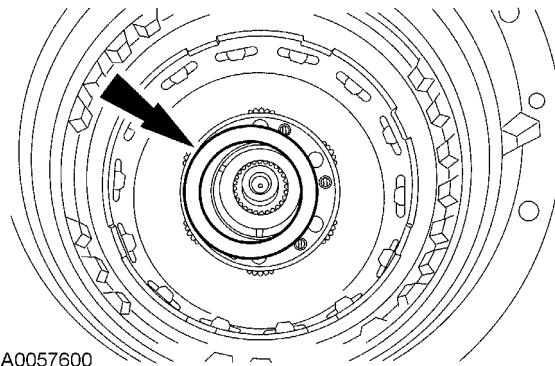
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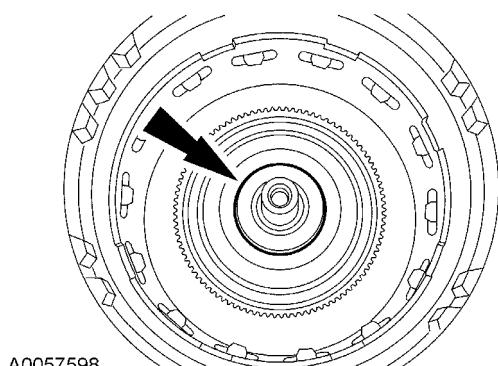
25. Using the special tools, remove the center support, direct clutch and forward clutch cylinder assembly.



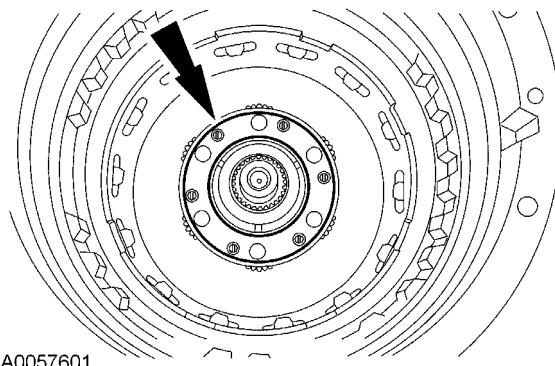
28. Remove the forward carrier race and the No. 11 bearing assembly.



26. Remove the forward clutch hub and the No. 9 thrust washer.

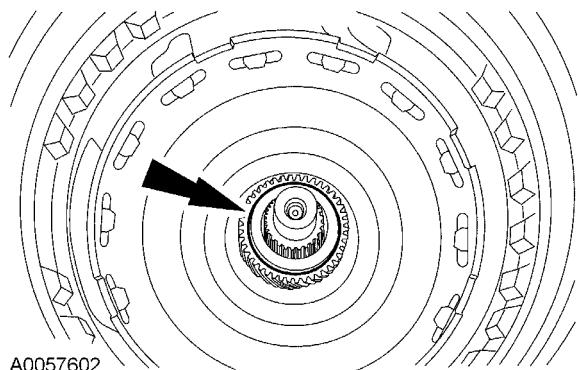


29. Remove the forward carrier.

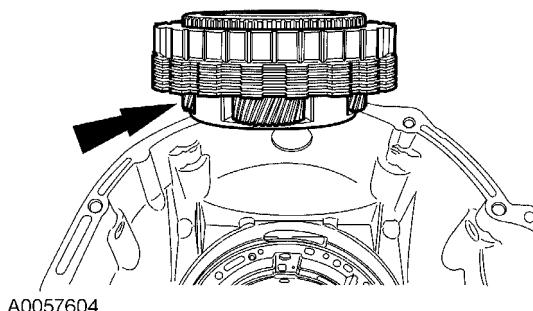


27. Remove the forward ring gear and hub assembly.

30. Remove the sun gear and the No. 12 thrust bearing.

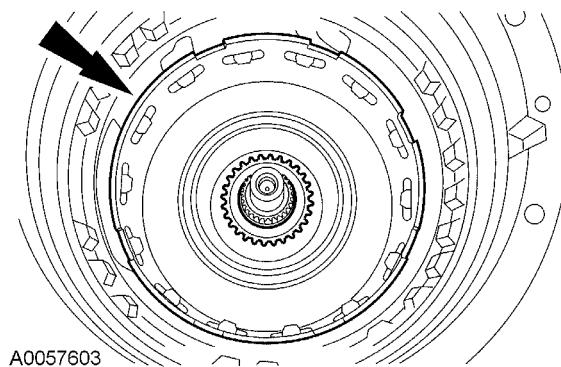


A0057602



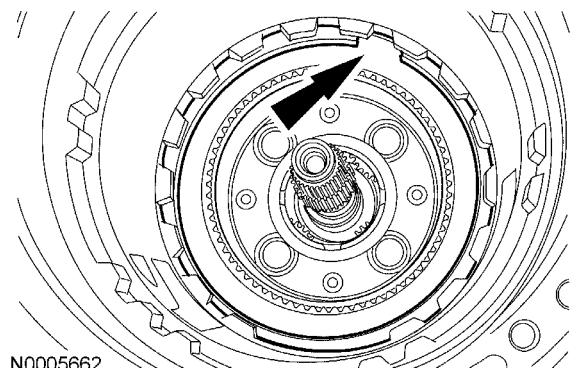
A0057604

31. Remove the low/reverse sun gear and shell assembly.



A0057603

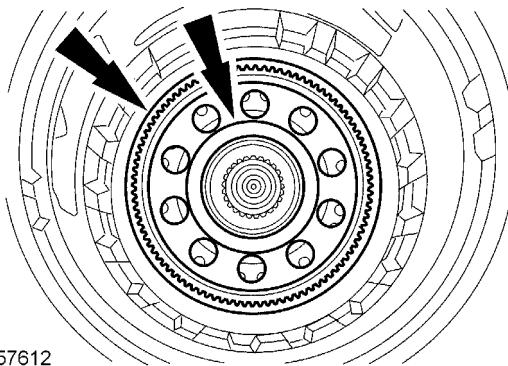
32. Remove and discard the low/reverse clutch wavy retaining ring.



N0005662

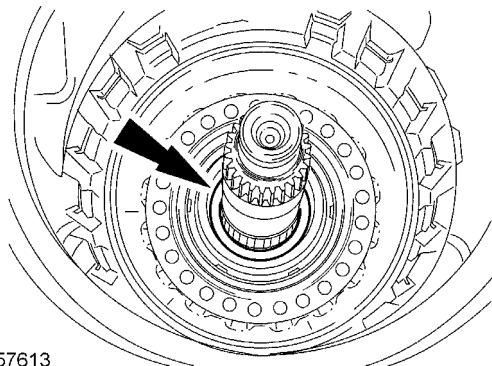
33. Remove the low/reverse one-way clutch and the clutch pack, carrier and hub assembly.

34. Remove the No. 15 thrust bearing and hub.



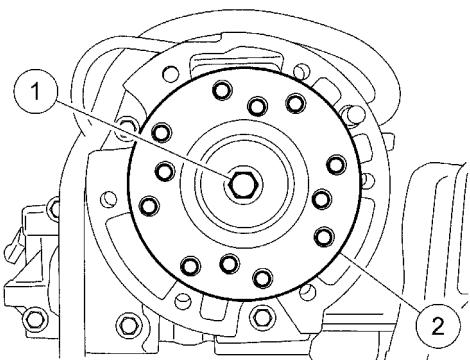
A0057612

35. Place the transmission manual lever in PARK to lock the output shaft from rotating.
 36. Remove the output hub and ring gear.
 37. Remove the low/reverse No. 16 thrust bearing.

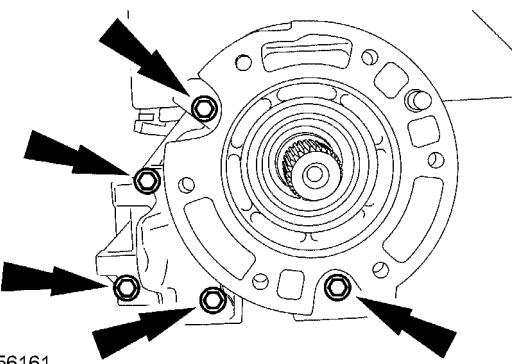


A0057613

38. Remove the output shaft flange.



N0018708

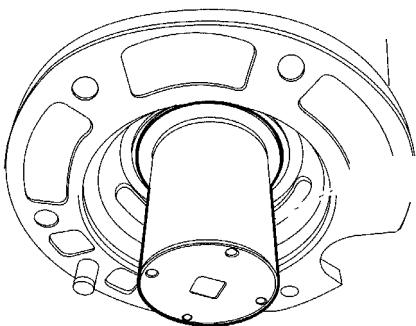


A0056161

Figure 236

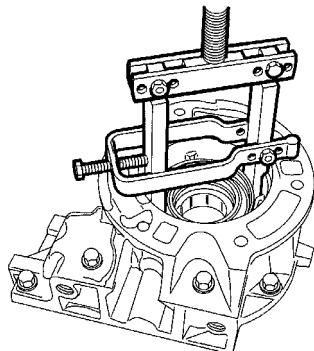
1. Remove and discard the bolt.
2. Remove the output shaft flange.

39. Use the special tool to remove the output shaft retaining nut.



N0018709

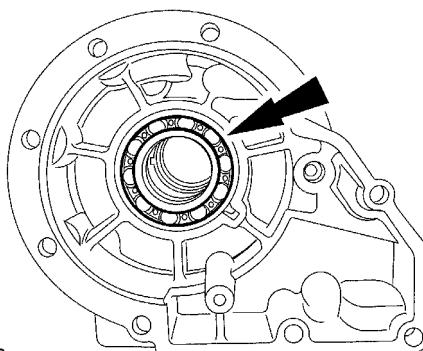
40. Use the special tools to remove the output shaft seal.



N0018710

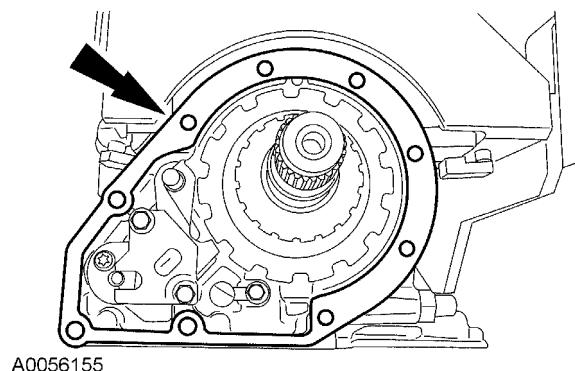
41. Remove the 9 bolts and the extension housing.

42. Inspect the extension housing ball bearing. If any damage is evident, install a new extension housing. Check the output shaft journal.



A0066466

43. Remove and discard the extension housing gasket.



A0056155

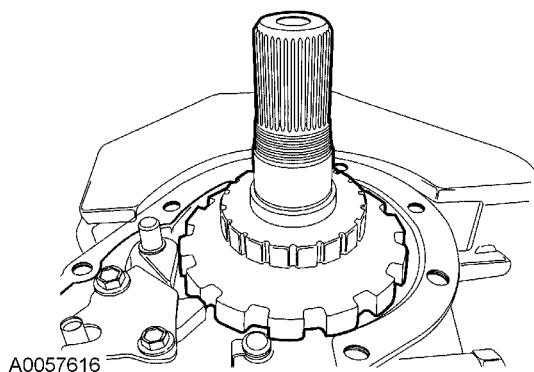
44. Remove the output shaft.

S13036

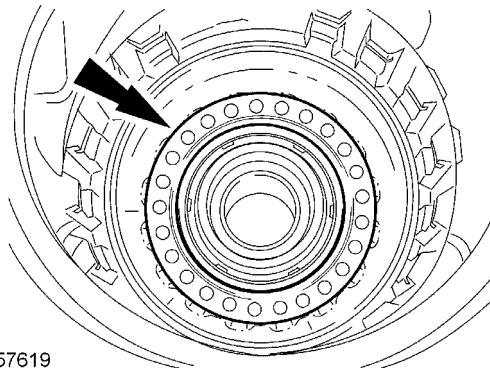
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

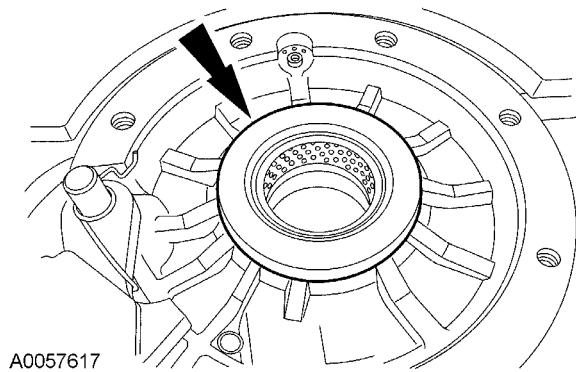
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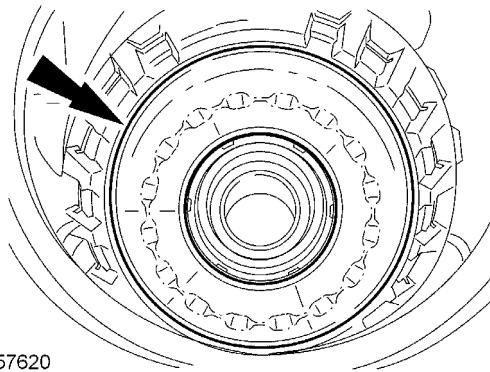
47. Remove the return spring.



45. Remove the No. 17 park gear thrust washer.

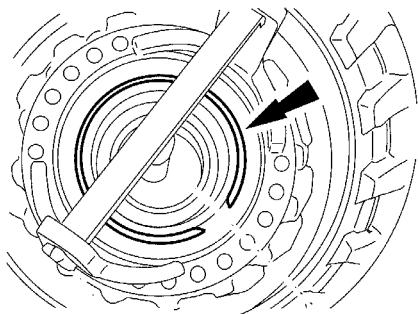


48. While applying air to the extension housing side of the case, remove and discard the reverse piston.

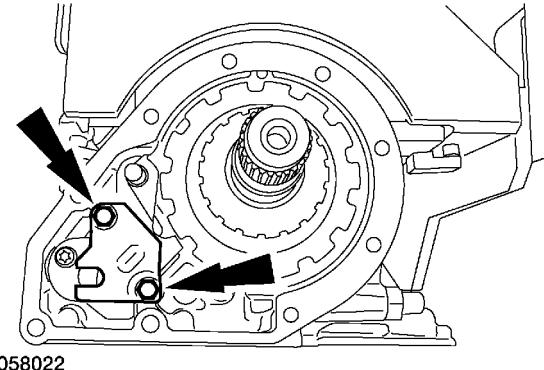


CAUTION: Do not fully compress the return spring or damage to the spring may occur.

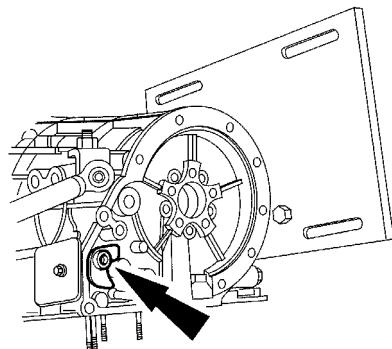
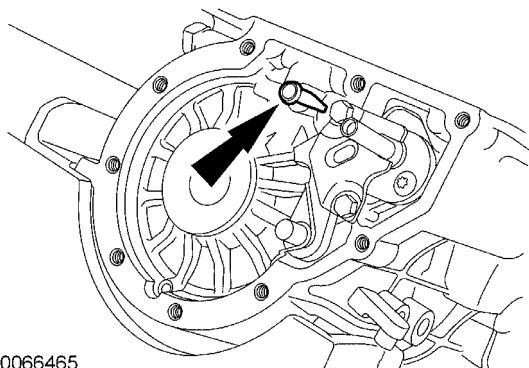
46. Using the special tools, remove and discard the reverse clutch return spring retaining ring.



49. Remove the parking rod guide plate bolts and plate.



50. Remove the plastic orifice lube plug from the rear of the case and discard.



51. Remove the parking pawl.

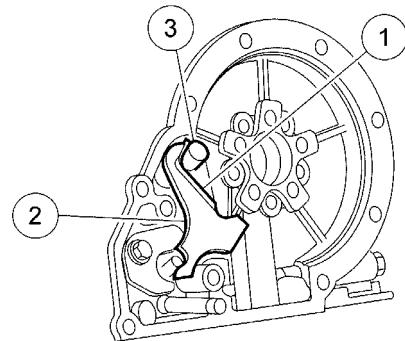


Figure 249

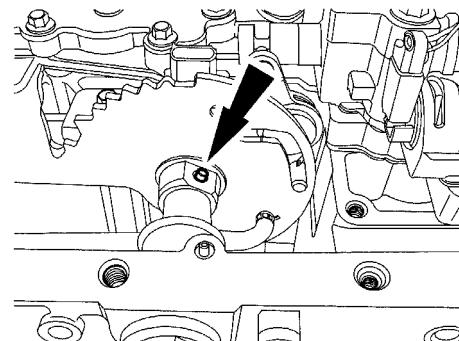
1. Remove the parking pawl return spring.
2. Remove the parking pawl.
3. Remove the parking pawl shaft.

CAUTION: The Torx® head screw has a threadlocking compound and should be removed only if a new case is being installed. If the bolt is removed, it must be discarded and a new bolt installed.

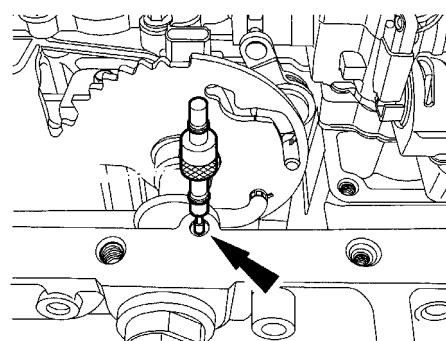
52. Remove the parking pawl abutment.

NOTE: The pin should be driven down into the case.

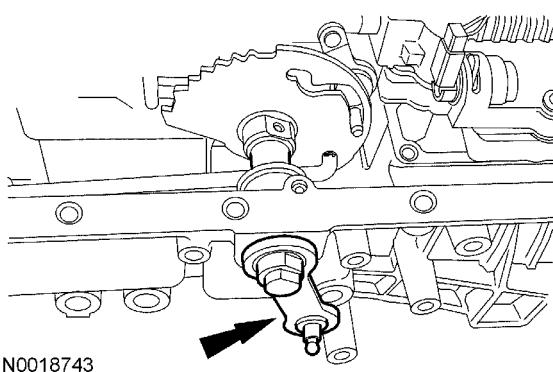
53. Using a suitable tool, remove and discard the manual lever shaft retaining pin.



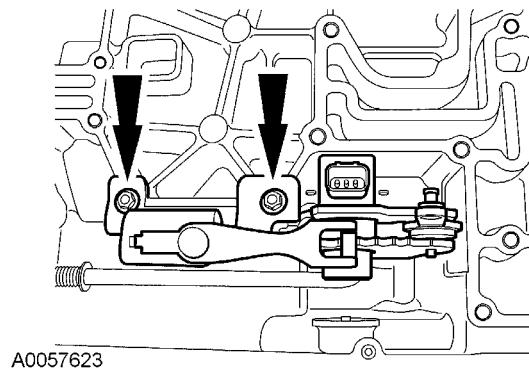
54. Using the special tool, remove the manual lever shaft retaining pin.



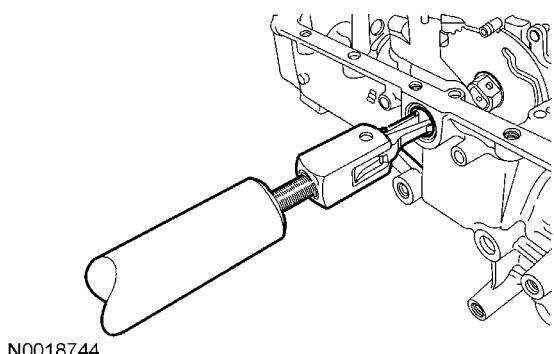
55. Remove the manual control lever shaft.



56. Remove the TR sensor, manual control lever and park rod as an assembly.

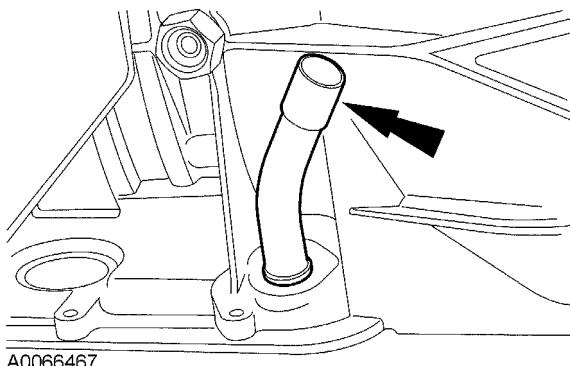


57. Using the special tool, remove and discard the manual control lever seal.



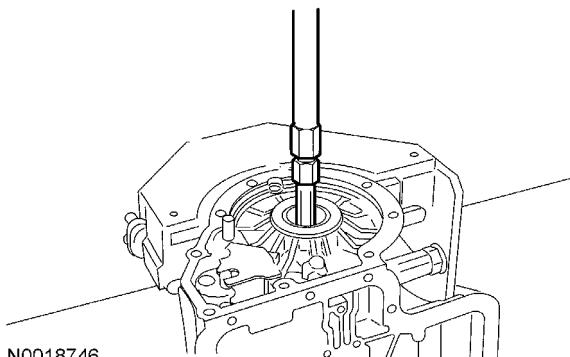
NOTE: The short fluid inlet tube should be removed only if it is loose or damaged.

58. If required, remove the short fluid inlet tube.



NOTE: The top portion seal groove will work the best when removing the seal pack.

59. Inspect the rear case Teflon® seal retainer for damage. If damage is evident, use the special tool to remove the seal retainer.



60. Inspect the case assembly for cracks and stripped threads. Inspect the gasket surfaces and mating surfaces for burrs. Check the case vent assembly and all fluid passages for obstructions.

61. Inspect the rear case snubber bushing. If damage is found, install a new transmission case.

62. Check all parking linkage parts for wear or damage.

63. Inspect the reverse clutch case vent for blockage. The vent is located in the case at the 12 o'clock position. If evidence of blockage is found, use low air pressure to clear out the blockage. Apply air pressure to the extension housing side of the vent.

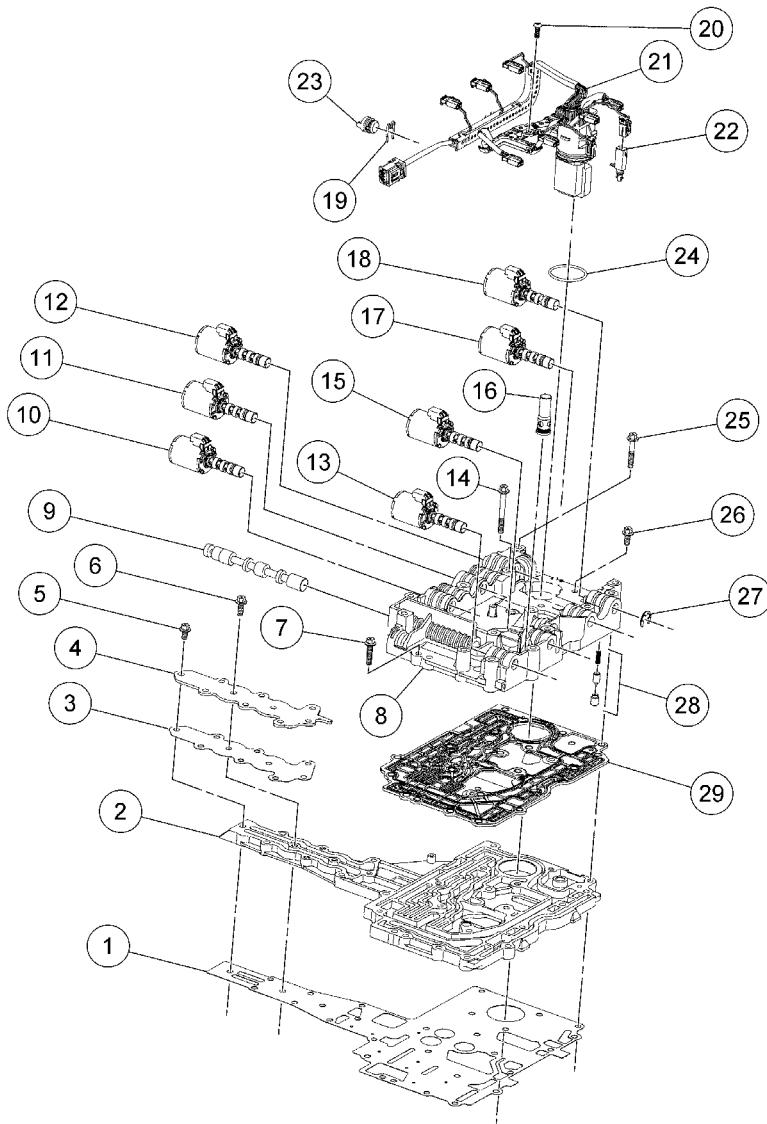
Disassembly and Assembly of Subassemblies**Solenoid Body Disassembly**

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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A0087324

Figure 258 Upper, Lower, Accumulator and Solenoid Body, Disassembled View

- | | |
|---|---|
| 1. Solenoid body-to-case gasket | 12. Intermediate clutch solenoid
SSPC-C |
| 2. Ditch plate | 13. Coast clutch solenoid SSPC-A |
| 3. Backing plate gasket | 14. Solenoid-to-case bolt |
| 4. Backing plate | 15. Overdrive clutch solenoid
SSPC-B |
| 5. Backing plate-to-manifold bolts | 16. Line pressure relief valve |
| 6. Backing plate-to-case bolts | 17. Torque converter clutch solenoid
TCC |
| 7. Solenoid-to-case bolts | 18. Line pressure control solenoid
PC-A |
| 8. Manifold body | |
| 9. Manual valve | |
| 10. Low reverse clutch solenoid
SSPC-E | |
| 11. Direct clutch solenoid SSPC-D | |

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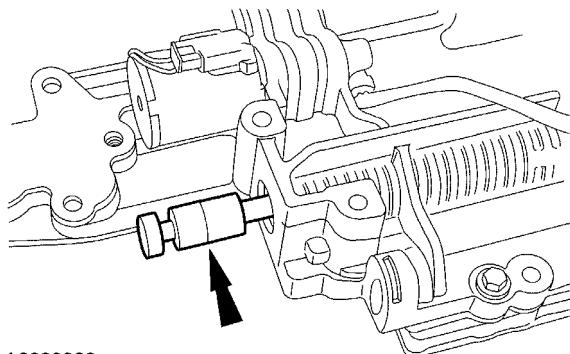
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

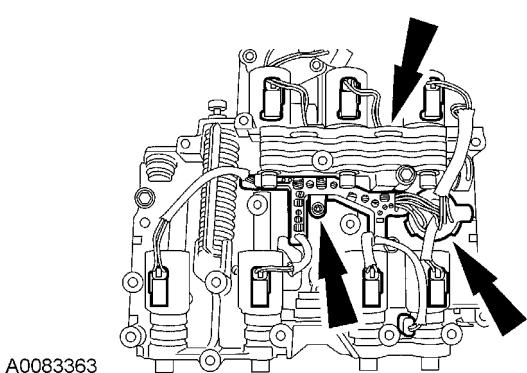
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- | | | |
|---|---------------------------------------|-------------------------|
| 19. Pressure switch retaining clip (W) | 23. Direct clutch bore plug | 29. Filter plate gasket |
| 20. Wiring harness retaining bolt | 24. Bulkhead connector O-ring | |
| 21. Wiring harness | 25. Manifold-to-ditch plate bolt | |
| 22. Transmission fluid temperature (TFT) sensor | 26. Manifold-to-ditch plate bolt | |
| | 27. Shift solenoid retaining clip (E) | |
| | 28. Cold pressure relief valve | |

1. Remove the manual valve.
- Remove the solenoid body electrical harness.

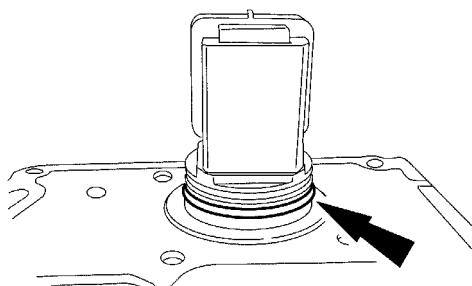


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A0083363

2. Remove and discard the solenoid body electrical connector O-ring seal.



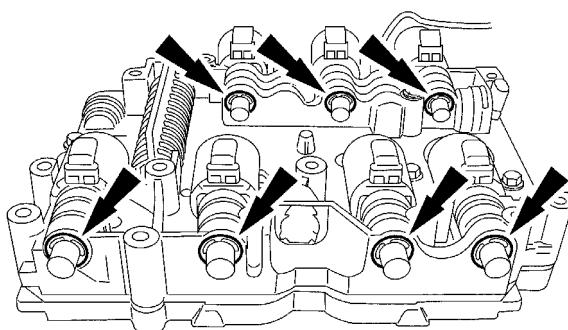
A0057628

3. Remove the main control valve body electrical harness.

- Remove the 2 bolts.
- Disconnect the electrical connectors.
- Twist and push the bulkhead connector through the solenoid body.

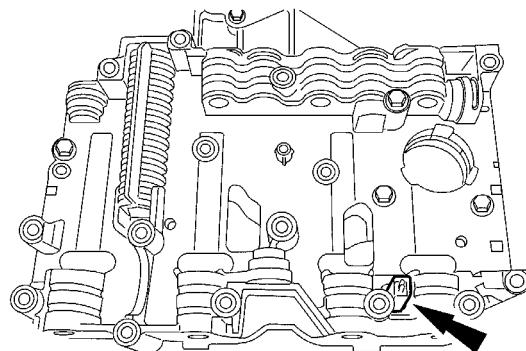
NOTE: Mark the location of each solenoid for correct installation.

4. Remove the retaining clips and remove the solenoids.

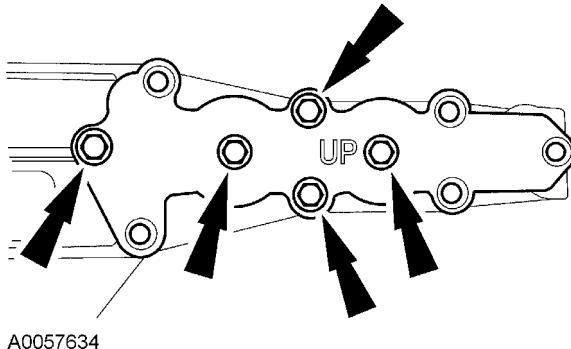


A0083364

5. Remove the transmission fluid temperature (TFT) sensor.

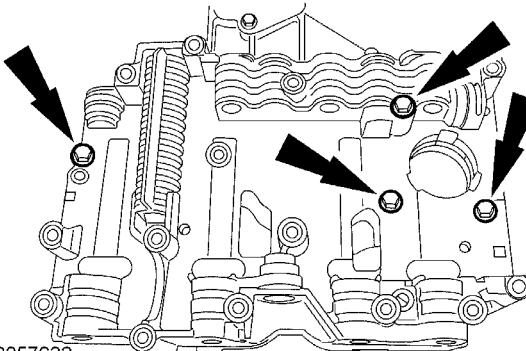


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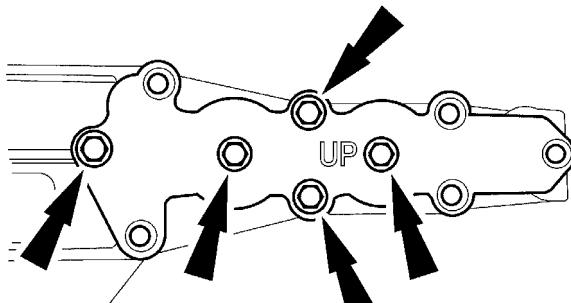
6. Note the location and length of each bolt. Remove the 4 bolts and remove the top half of the main control valve body.



A0057632

Solenoid Body Assembly

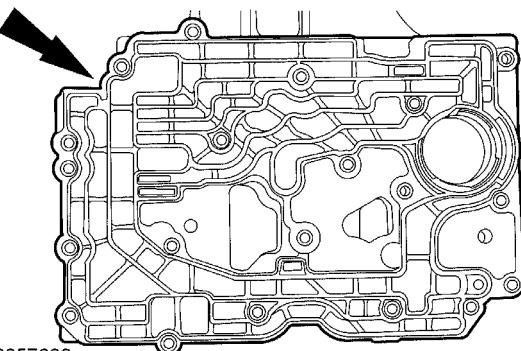
1. Install a new gasket and the backing plate.
 - Tighten to 13 Nm (10 lb-ft).



A0057634

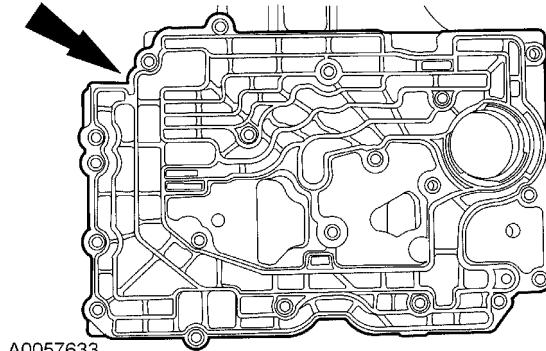
NOTE: The gasket should not be cleaned or reused.

7. Remove and discard the gasket.



A0057633

2. Install a new filter screen gasket.

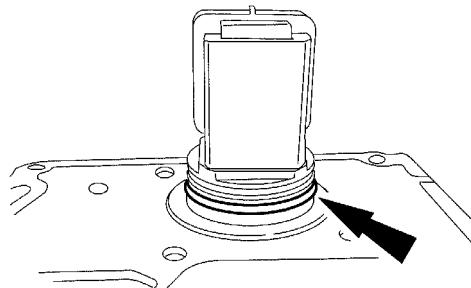
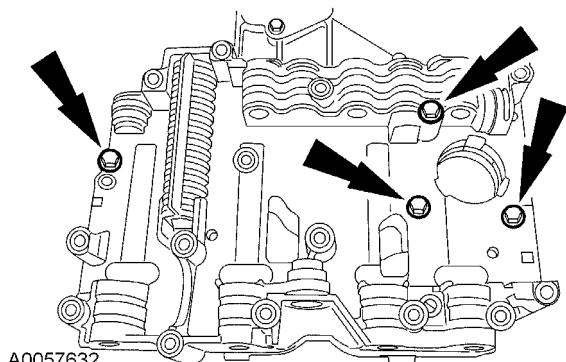


A0057633

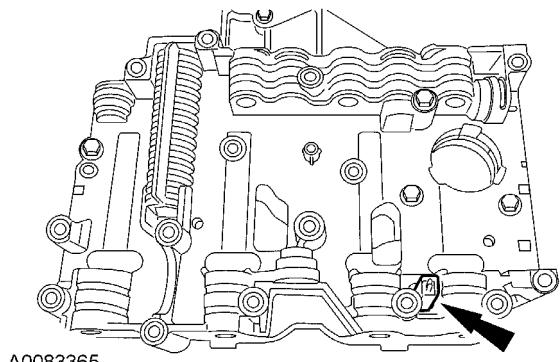
8. Remove the bolts, backing plate and discard the gasket. Clean and inspect the components.

NOTE: Tighten the bolts in a crisscross pattern to prevent the gasket from becoming distorted.

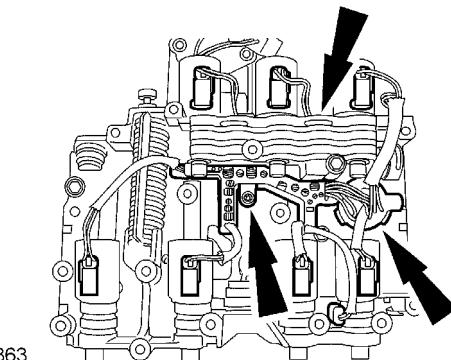
3. Assemble the top and bottom halves of the solenoid body.
 - Tighten to 13 Nm (10 lb-ft).
6. Install a new O-ring on the solenoid body electrical connector in the uppermost groove.



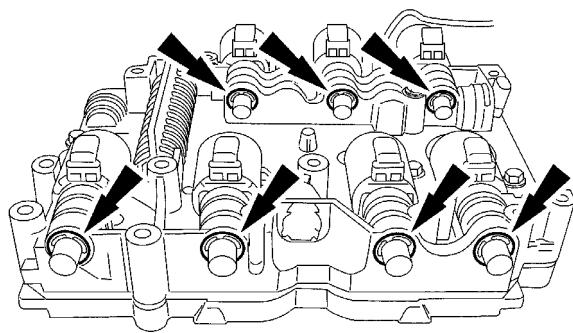
4. Install the TFT sensor.



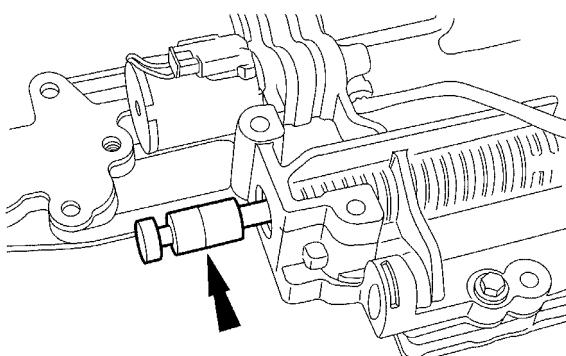
7. Install the solenoid body harness and connect the connectors.



5. Install the shift solenoids with the E-clips.



8. Install the manual valve.



Pump Assembly — Disassembly**Table 141 Special Tools**

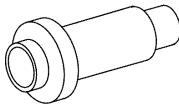
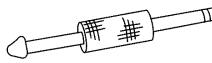
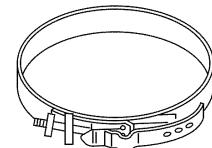
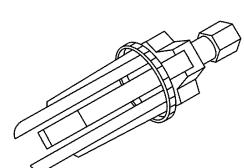
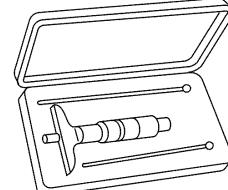
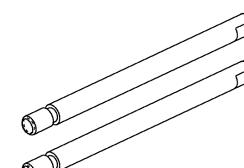
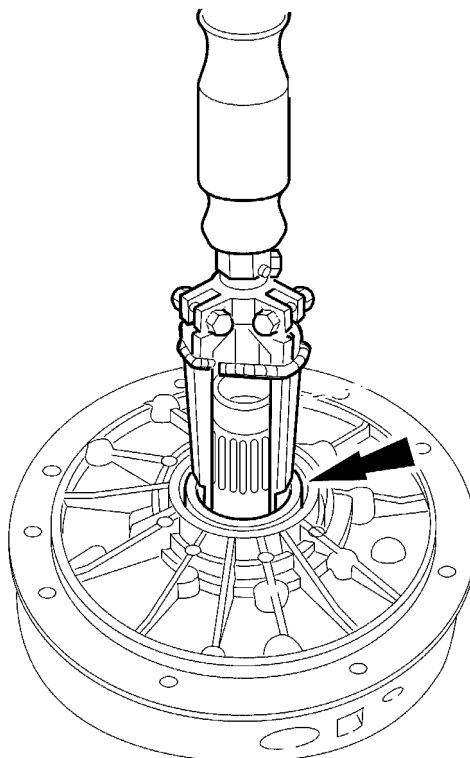
	Installer, Front Pump Fluid Seal ZTSE9104
	Slide Hammer ZTSE43981
	Banding Tool, Transmission Pump ZTSE9138
	Remover, Bushing ZTSE9140

Table 141 Special Tools (cont.)

	Depth Micrometer ST1274-A
	Alignment Pins, Pump ZTSE9132 ST2717-A

1. Using the special tools, remove and discard the front pump seal.



N0018747

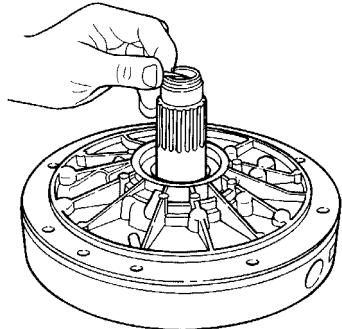
S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

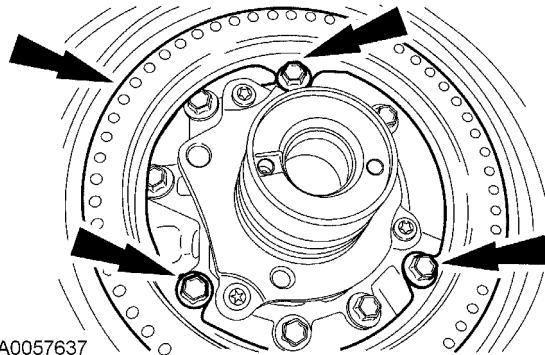
Follow all warnings, cautions, and notes.

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- Remove and discard the front pump stator support seal.



N0006626

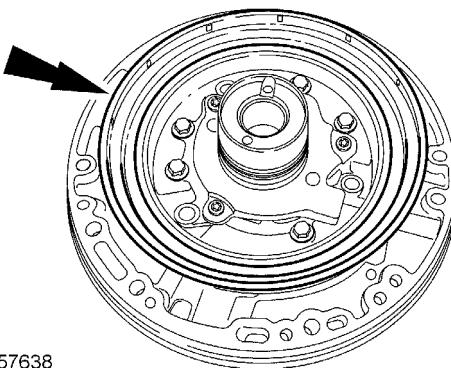


A0057637

- Remove and discard the 2 seals.

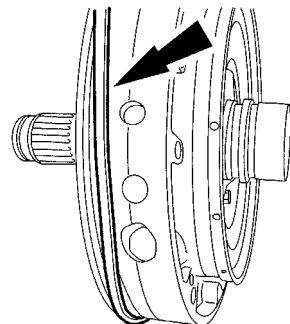


A0057627



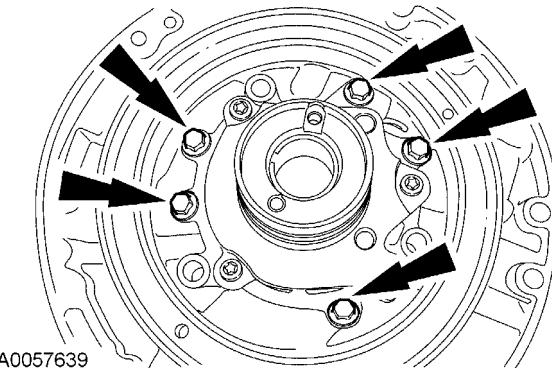
A0057638

- Remove and discard the pump outer diameter square-cut front pump seal.



A0057636

- Remove bolts and separate the pump control body from the pump body.



A0057639

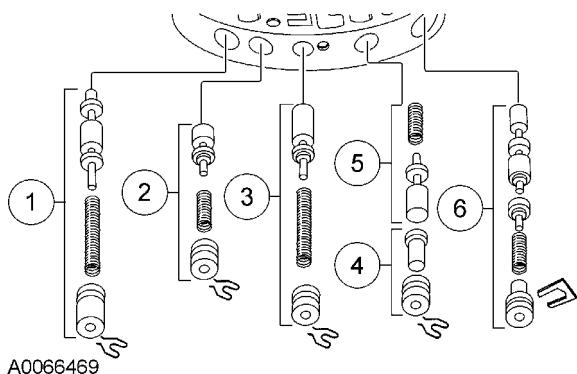
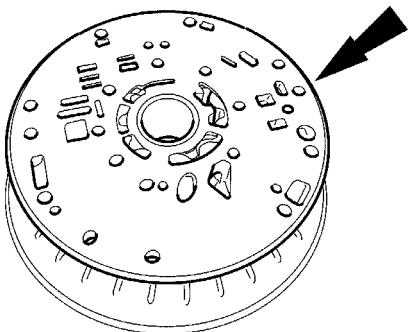
NOTE: Note the location of the bolts for assembly.

- Remove the overdrive piston return spring.

NOTE: If the pump gears or plate show any signs of wear or scoring, a new pump assembly must be installed.

- Remove and inspect the plate.

A0057640

**Figure 283**

CAUTION: Do not remove any of the cup plugs unless directed to do so in other steps. Do not remove the stator support from the control body. This can distort the surface of the control body.

9. Remove the converter clutch control valve, cooler bypass valve and thermostat valve, converter pressure limit valve, converter anti-drain back valve and the main regulator valve.

1. Remove the retainer clip with a small screwdriver, then remove the main regulator plug, spring and valve.
2. Remove the retainer clip with a small screwdriver, then remove the converter anti-drain back plug, spring and valve.
3. Remove the retainer clip with a small screwdriver, then remove the converter pressure limit plug, spring and valve.
4. Remove the retainer clip with a small screwdriver, then remove thermostat plug, spring and valve.
5. Remove the cooler bypass valve.
6. Remove the retainer clip with a small magnet or pliers, then remove the converter clutch control plug with shuttle valve, spring retainer and valve.

CAUTION: To avoid part damage and loss of function, do not clean the pump thermostat with mineral spirits or solvent.

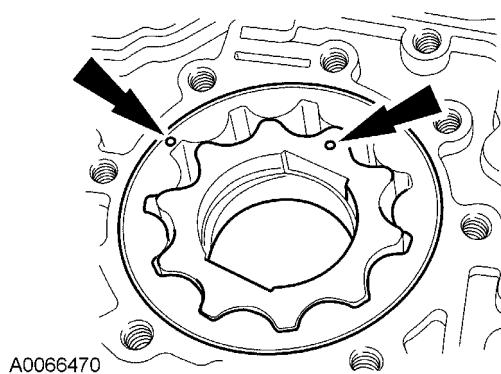
10. Remove and inspect the inner and the outer gearotor gears.
 - Clean all pump parts except the thermostat, in solvent.
 - Dry the parts with compressed air.
 - Inspect the pump gears, faces, gear teeth, pump housing and mating surfaces for damage or scoring.
 - If any parts are damaged or worn, install a new pump.

S13036

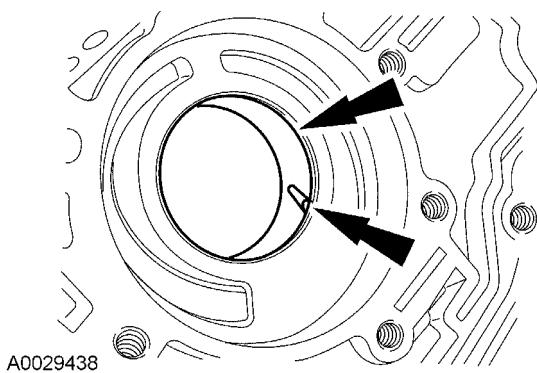
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

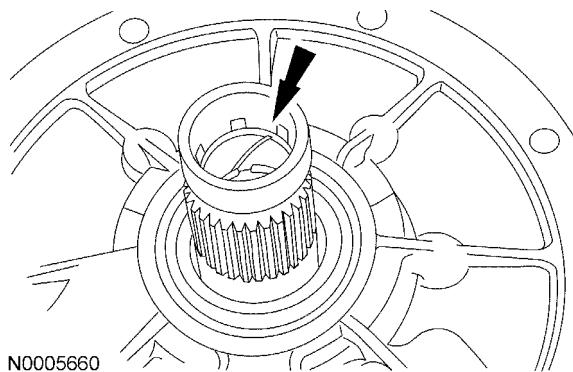
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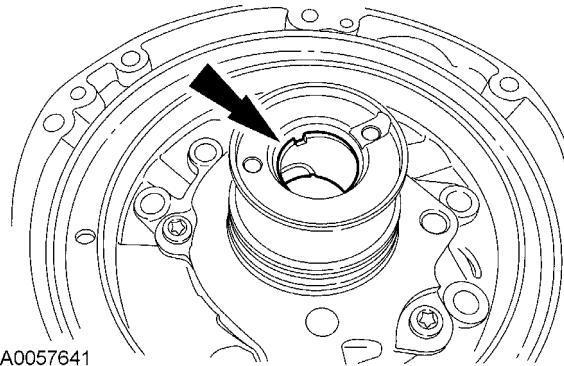
11. Inspect the converter hub bushing. If scored or excessively worn, install a new pump. Note the orientation of the notch in the bushing. It must face up.



12. Inspect the front input shaft bushing. If the bushing is worn or scored, install a new pump.



13. Inspect the rear input shaft bushing for wear. If scored or worn, install a new pump.



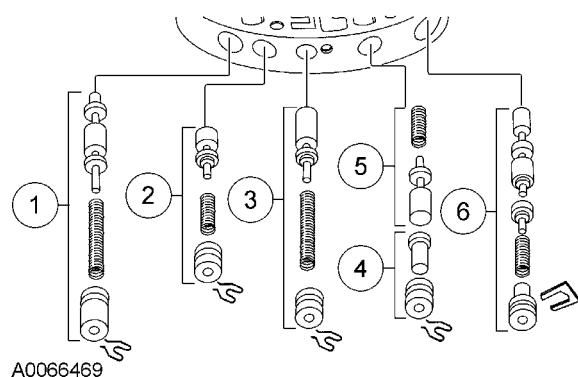
14. Inspect the following:

- All valve and plug bores for scoring or damage.
- All passages for obstructions.
- Mating surfaces for burrs and scoring.
- All springs for distortion.
- When dry, check all valves and plugs for free movement in their respective bores.

Pump Assembly — Assembly

NOTE: All the valves must drop into their bores freely without hanging up.

1. Install the converter clutch control valve, cooler bypass valve and thermostat valve, converter pressure limit valve, converter anti-drain back valve and the main regulator valve.



0.04-0.06 mm (0.0015-0.0023 inch)

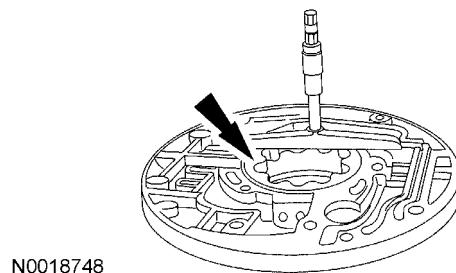
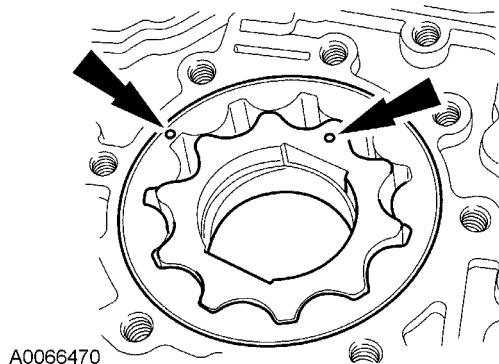


Figure 288

1. Install the main regulator boost valve spring, plug and install the retainer clip.
2. Install the converter anti-drain back valve, spring, plug and install the retainer clip.
3. Install the converter pressure limit valve, spring, plug and install the retainer clip.
4. Install the thermostat spring and valve.
5. Install the cooler bypass valve, plug and clip.
6. Install the converter clutch control valve, spring, plug and install the retainer clip.

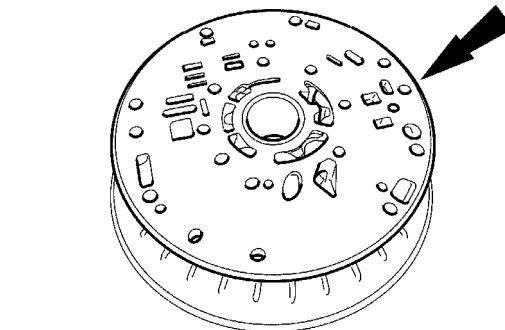
NOTE: Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.

2. Install the gearotor gearset with both dots facing up.



3. Using the special tool, measure the pump gear to pump body clearance.

4. Install the separator plate.



CAUTION: Prior to pump assembly, make sure all cup plugs are installed.

CAUTION: Inspect mating surfaces of the pump body and the control body to make sure they are clean and free of nicks and burrs.

NOTE: Note the location of the alignment pins. The pins should be installed at 1 o'clock and 7 o'clock with the pump filter inlet sump at 6 o'clock. The alignment pins should move freely when installing the band strap.

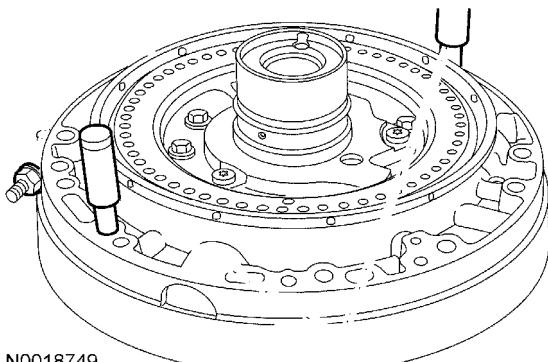
5. Using the special tools, assemble the control body and stator assembly onto the pump body.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

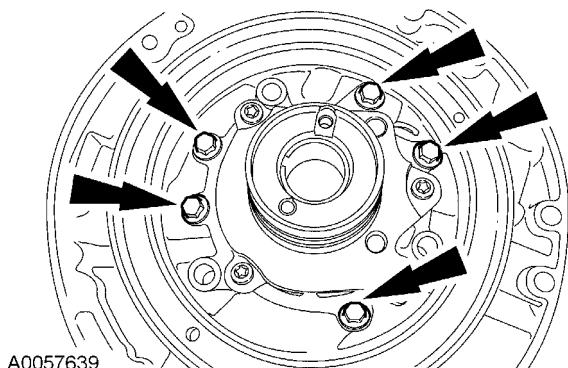
Follow all warnings, cautions, and notes.

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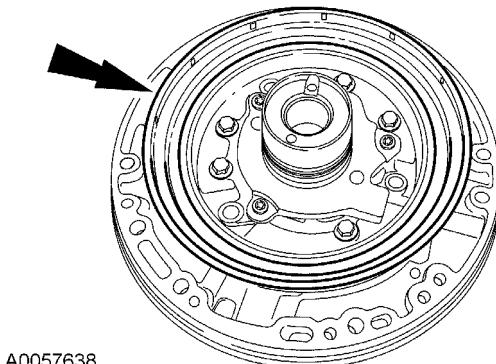


NOTE: Make sure that the outer edges of the pump body and the outer bolt holes are aligned during assembly.

- Assemble the pump and loosely install the bolts. Check that the outer edges of the pump body and the bolt holes are aligned.
- Tighten to 29 Nm (21 lb-ft).

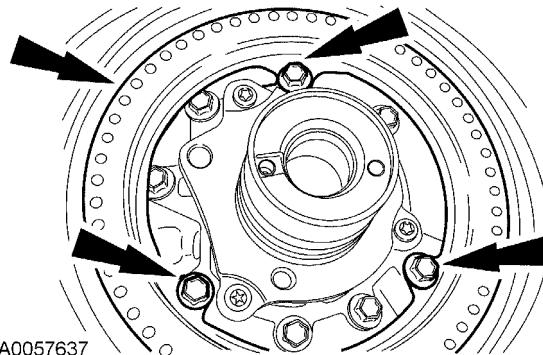


- Lubricate and install a new overdrive piston.

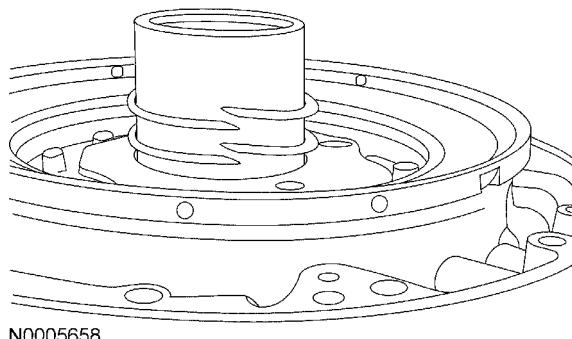


- Install the overdrive piston return spring and the bolts.

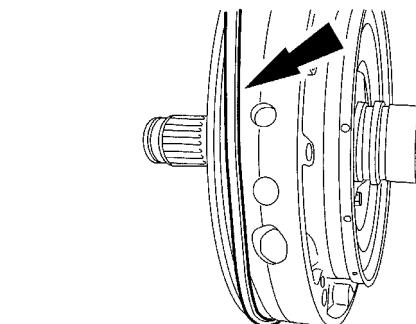
- Tighten to 29 Nm (21 lb-ft).



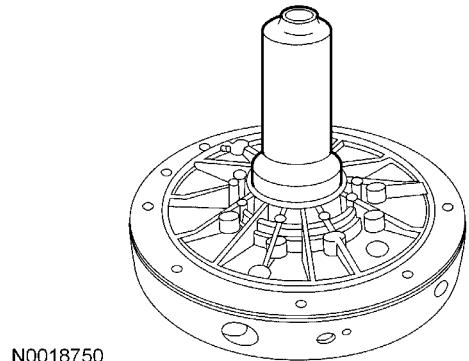
- Install new pump seals.



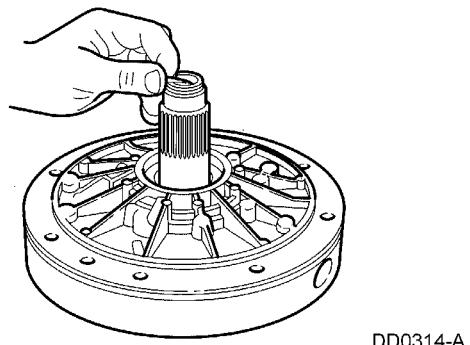
- Coat the seal with automatic transmission fluid and install the pump outer diameter square-cut front pump seal with the white stripe facing out.



11. Install a new front pump seal, using the special tool.

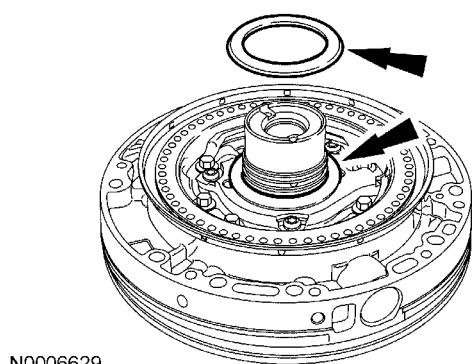


12. Install a new front pump stator support seal.



NOTE: Lightly lubricate the thrust washer and the bearing with petroleum jelly to hold them in place during assembly.

13. Install the No. 1 pump thrust washer and the No. 2A overdrive sun gear thrust bearing.

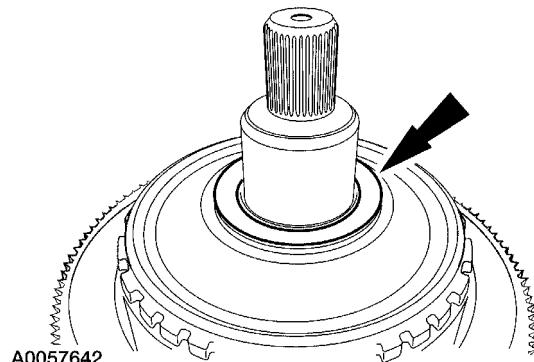


Coast Clutch Assembly — Disassembly

Table 142 Special Tools

	Compressor, Clutch Spring ZTSE9121
	Protector, Clutch Piston Seal ZTSE9128
	Alignment Cone ZTSE9144

1. Remove the No. 5 thrust bearing.



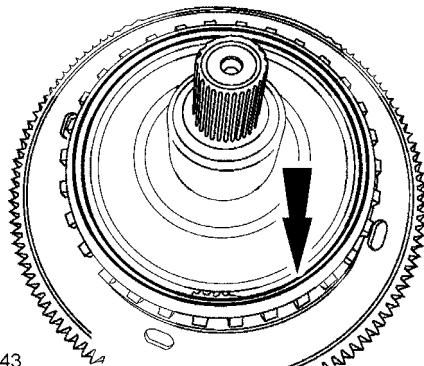
2. Remove the retaining ring and remove the center shaft.

S13036

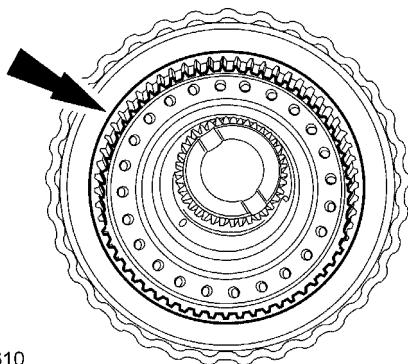
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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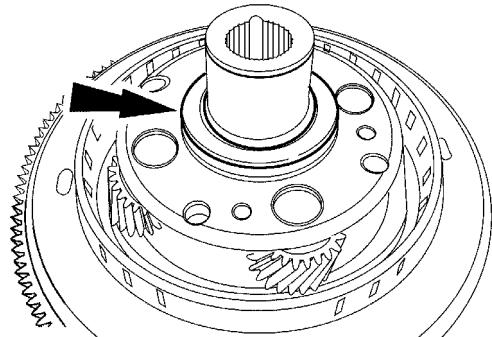


A0057643

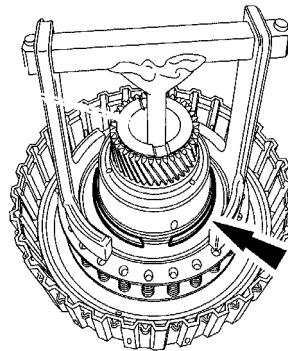


A0057610

3. Remove the overdrive planetary No. 4 thrust bearing.
6. Using the special tool, remove the coast clutch return spring retaining ring.

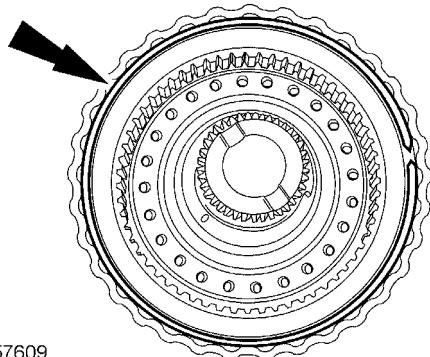


A0057644

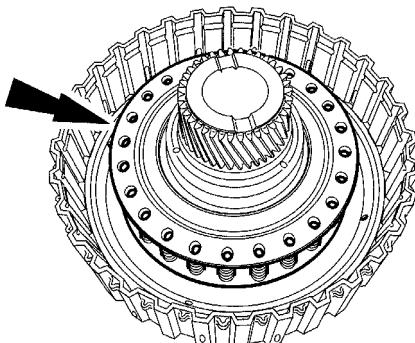


N0018751

4. Remove the retaining ring.
7. Remove the coast clutch return spring.

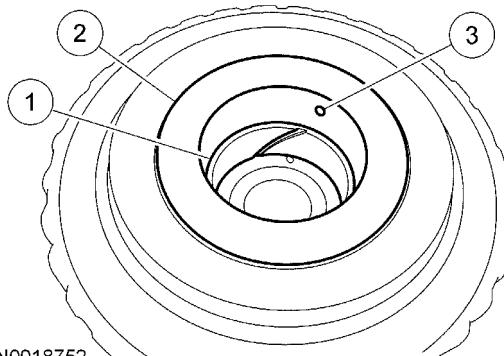
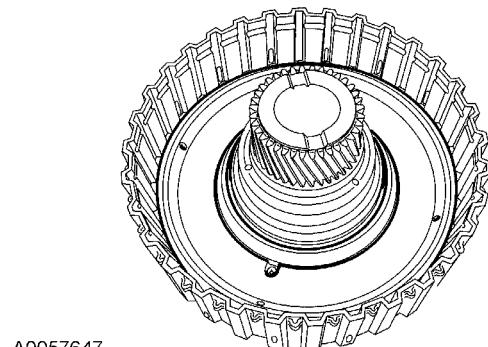


A0057609



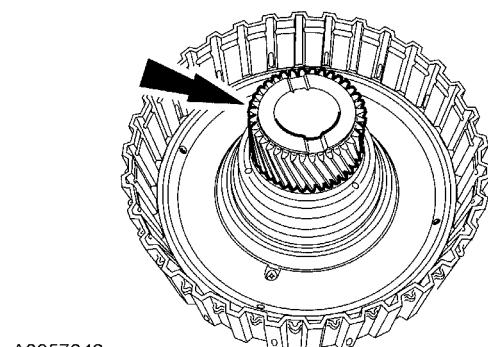
A0057646

5. Remove the coast clutch pressure plate one-way clutch (OWC) (mechanical diode) assembly and the clutch plates.
8. Remove and discard the coast clutch piston and seal assembly.

**Figure 310**

NOTE: If the teeth and/or bushing are damaged, a new sun gear will need to be installed.

9. If required, use an arbor press to remove the sun gear.

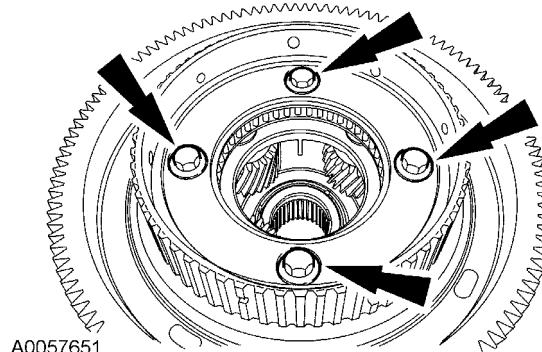


NOTE: If the coast clutch cylinder assembly shows any signs of damage, install a new coast clutch cylinder.

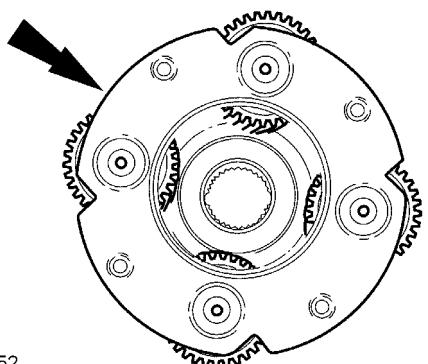
10. Inspect the coast clutch cylinder assembly.

NOTE: If the coast clutch hub shows any signs of damage, install a new coast clutch hub.

11. Inspect the one-way clutch inner race.
12. Remove and discard the retaining bolts for the coast clutch hub. Separate the 2 halves.

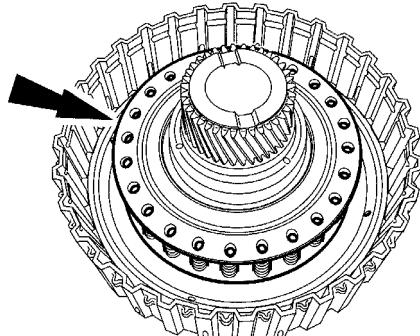


13. Inspect the planet gears for damage. If any damage is found, install a new overdrive planet.



A0057652

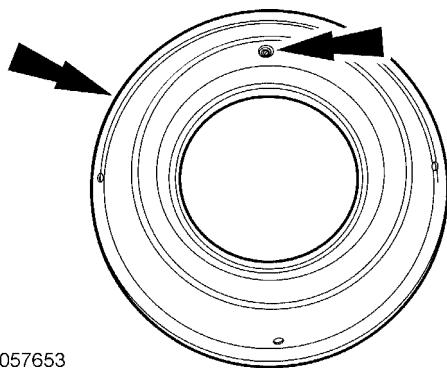
3. Install the coast clutch return spring.



A0057646

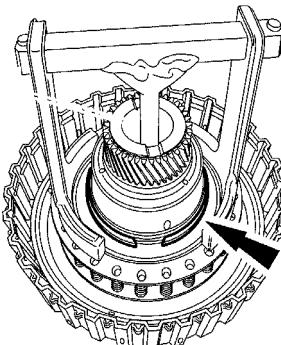
Coast Clutch Assembly — Assembly

1. Inspect the new coast clutch piston and seal assembly for damage and the check ball for free movement.



N0018751

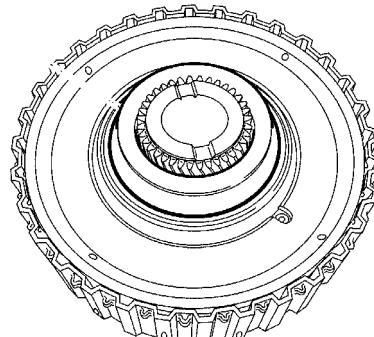
4. Using the special tool, install the coast clutch return spring retaining ring.



N0018753

2. Using the special tool, install the coast clutch piston.

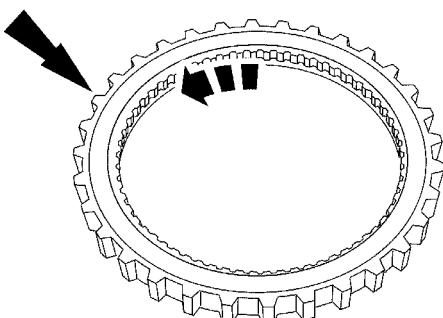
NOTE: The OWC mechanical diode is also the coast clutch pressure plate.



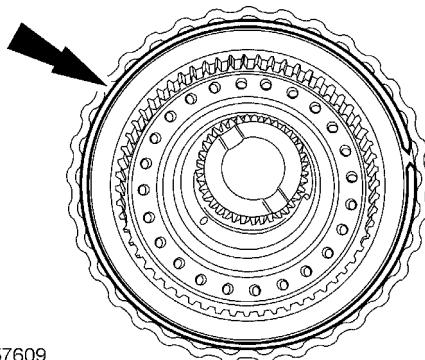
N0018753

NOTE: Gas applications use a unique mechanical diode from diesel applications.

5. Inspect the OWC for cracks and damaged splines. When installed correctly the internal splined portion of the OWC should rotate counterclockwise and lock when rotated clockwise. If any damage is found or if it does not rotate in the correct direction, install a new OWC.



A0066475

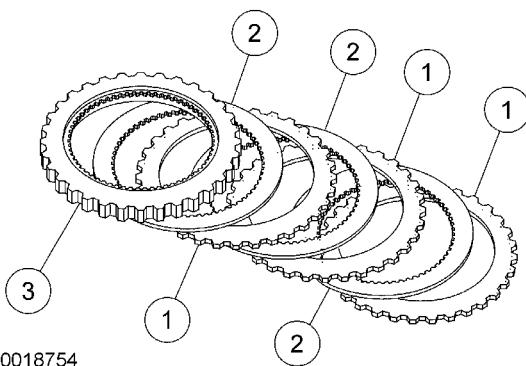


A0057609

NOTE: Inspect all separator and friction plates for damage. If any damage is found to any of the plates install new friction and separator plates.

NOTE: When installing the one-way clutch (OWC) (mechanical diode) the words "this side up" should be visible.

6. Install the coast clutch pressure plate one-way clutch (OWC) (mechanical diode) assembly and the clutch plates starting with the separator plate.



N0018754

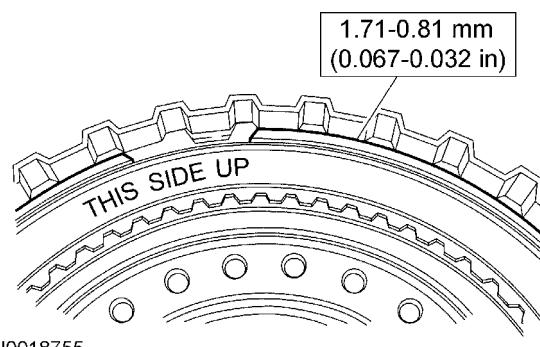
Figure 318

1. Steel clutch plates (externally splined)
2. Friction clutch plates (internally splined)
3. Mechanical diode (one-way clutch)

7. Install the retaining ring.

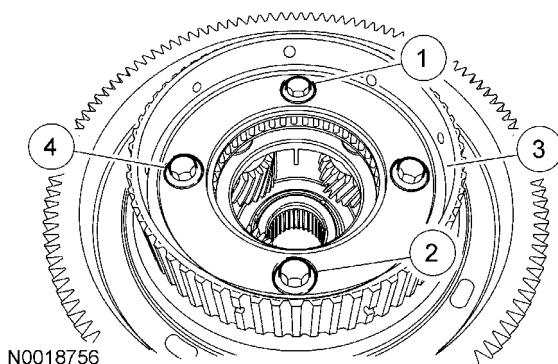
8. Check the stack-up clearance.

- Using a feeler gauge, measure the stack-up clearance in 3 places, 120 degrees apart, between the snap ring and the coast clutch pressure plate.
- If the clearance is not within specification, install the correct coast clutch pressure plate retainer snap ring and recheck the clearance.

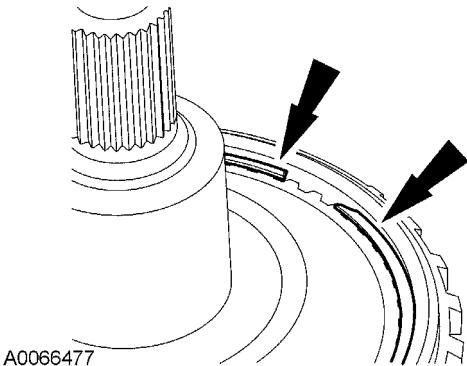


N0018755

9. Assemble the overdrive planet to the coast clutch hub. Tighten bolts in the sequence shown in 2 stages.
 - Stage 1: Tighten to 25 Nm (18 lb-ft).
 - Stage 2: Tighten an additional 90 degrees.

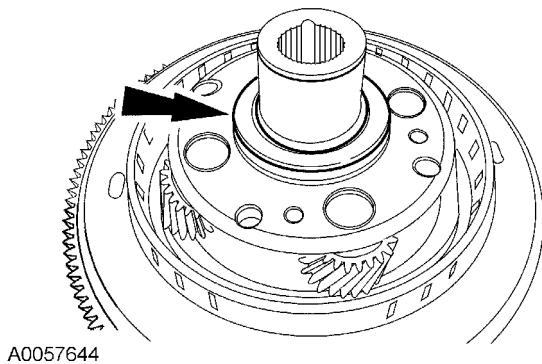


12. Install the overdrive ring gear to the center shaft and install the retaining ring.

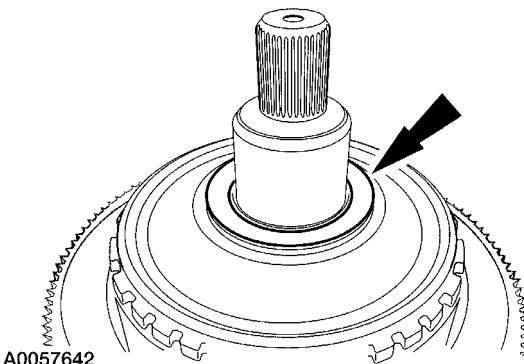


10. Install the coast clutch hub assembly into the coast clutch cylinder assembly.

11. Install the No. 4 thrust bearing and washer.



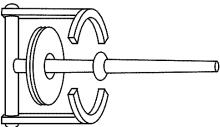
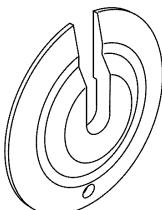
13. Install the No. 5 thrust bearing.



NOTE: When installing the retaining ring, make sure that it is completely seated in the groove with the tips down against the hub.

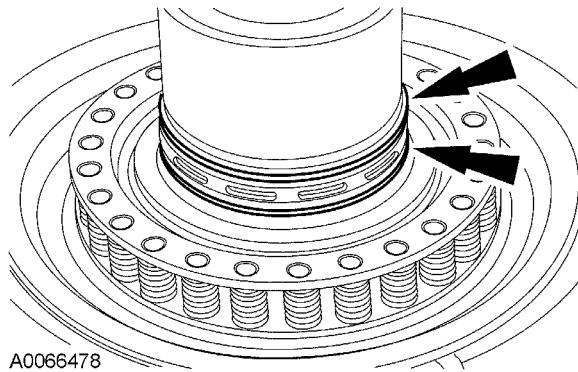
Center Support Disassembly

Table 143 Special Tools

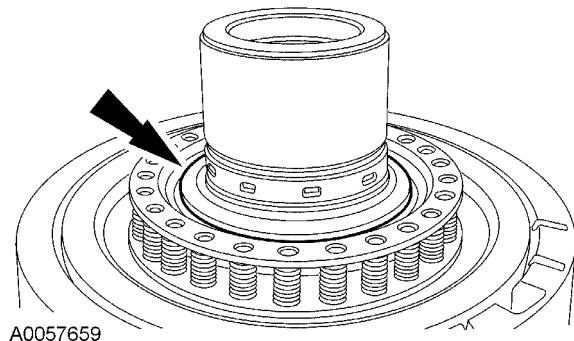
	Compressor, Clutch Spring ZTSE9121
	Alignment Cone ZTSE9144

NOTE: Note the location of the seal ring ends and how they overlap for correct assembly.

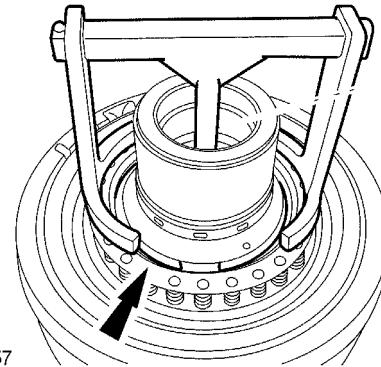
1. Remove and discard the direct clutch seal rings.



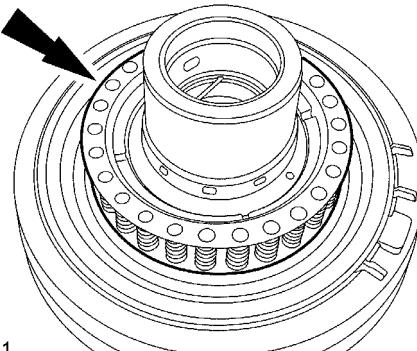
2. Remove the No. 6 thrust washer.



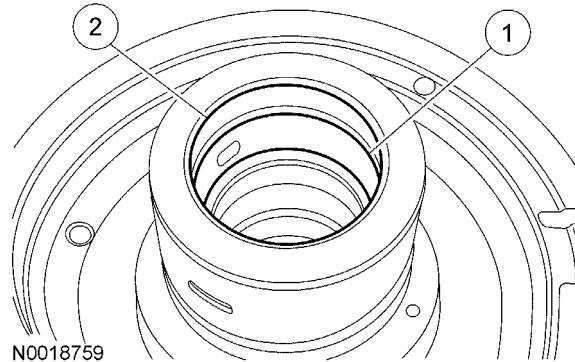
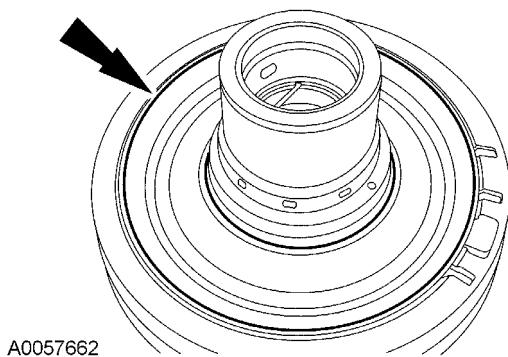
3. Using the special tool, remove the intermediate piston return spring snap ring.



4. Remove the intermediate piston return spring.



5. Remove and discard the intermediate piston.



6. Inspect the new intermediate piston.

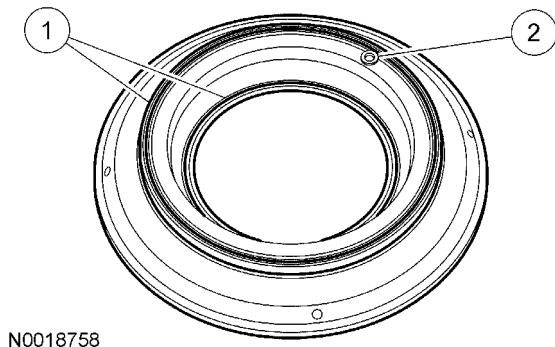


Figure 330

1. Inspect the intermediate piston inner and outer seals.
2. Inspect the check ball for free movement.

NOTE: If the sealing surface or the bushing show signs of damage or wear, a new center support must be installed.

7. Inspect the center support for damage or wear.

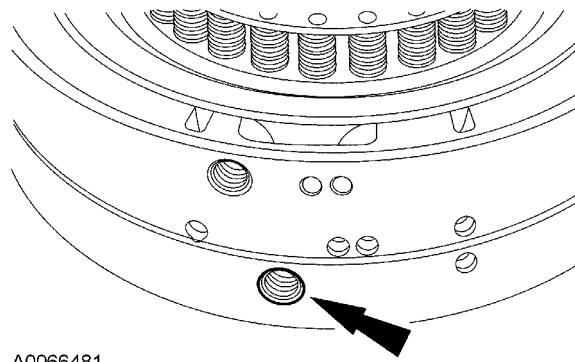
Figure 331

1. Inspect the center support bushing.
2. Inspect the center support sealing surface.

- Verify that the air bleed orifice located on the center support is in the 12:00 o'clock position and is not clogged. Apply 138 kPa (20 psi) air pressure from the piston side of the center support to verify that the bleed orifice is clear.

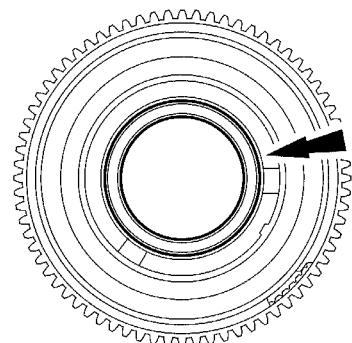
Center Support Assembly

1. To assemble, reverse the disassembly procedure.
 - Lightly lubricate the thrust washer with clean transmission fluid to hold it in place during assembly.
 - Install new seals.
2. After the center support is completely assembled, apply air to the port and verify the function of the piston.



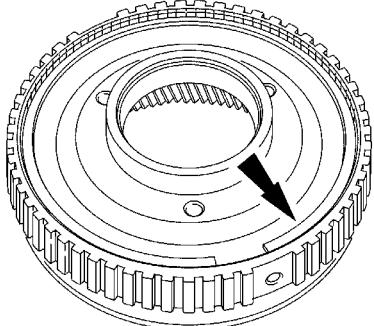
Forward Hub and Ring Gear Disassembly

1. Remove the No. 10 forward clutch hub thrust washer.



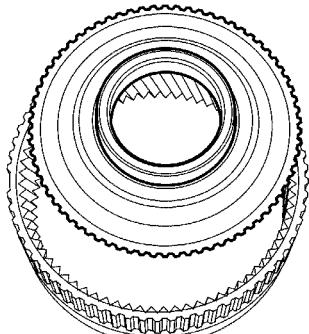
N0005657

2. Remove the forward hub retaining ring.



A0005656

3. Remove the forward hub.

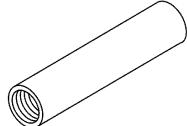
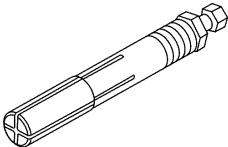


N0005655

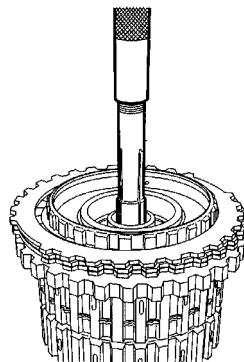
Forward Hub and Ring Gear Assembly

1. To assemble, reverse the disassembly procedure.
- Lightly lubricate the thrust washer with clean transmission fluid to hold it in place during assembly.
 - When installed, make sure the retaining ring is fully seated in the forward ring gear ring groove. The tips must face downward against the hub.

Forward Geartrain Assembly — Disassembly**Table 144 Special Tools**

	Fixture Handle, Coast Clutch Part of ZTSE9133 Kit
	Fixture Body, Coast Clutch Part of ZTSE9133 Kit

1. Remove the special tools.



N0017345

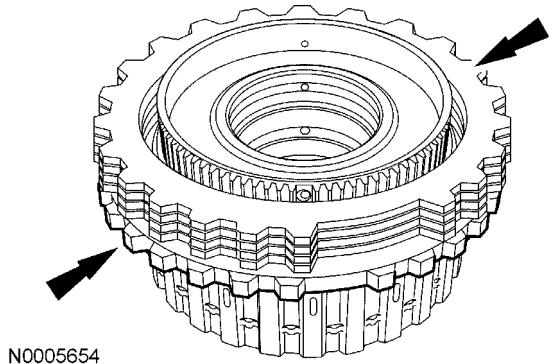
S13036

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Follow all warnings, cautions, and notes.

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2. Remove the intermediate clutch plates and pressure plate.



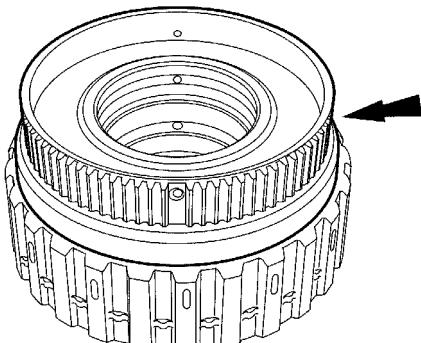
N0005654

Forward Clutch Assembly — Disassembly

Table 145 Special Tools

	Compressor, Clutch Spring ZTSE9121
	Alignment Cone ZTSE9144

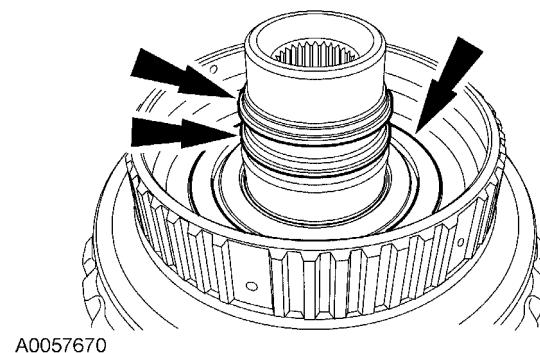
3. Remove the direct clutch assembly.



N0005653

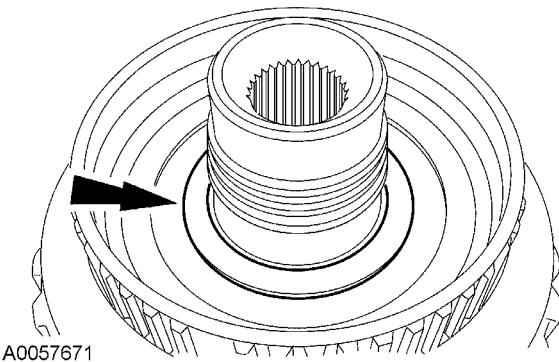
NOTE: Soak all friction clutch plates in clean automatic transmission fluid.

1. Remove and discard the 2 seals and remove the No. 7 thrust washer.

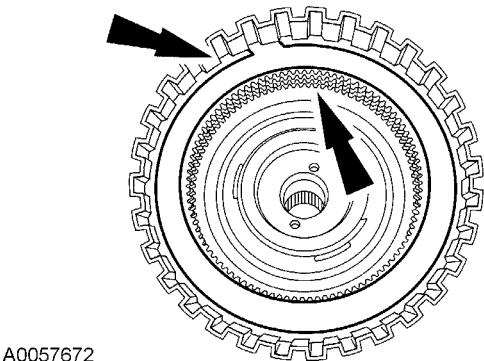


A0057670

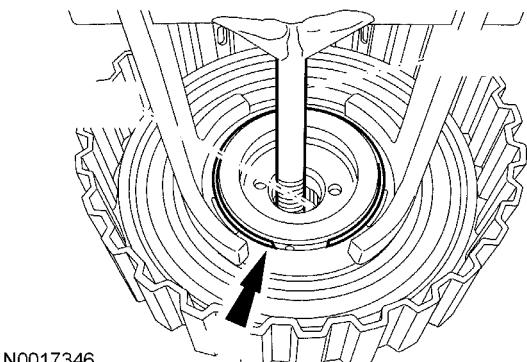
2. Remove the No. 8 forward clutch thrust bearing.



3. Remove the snap ring and the forward clutch plates.

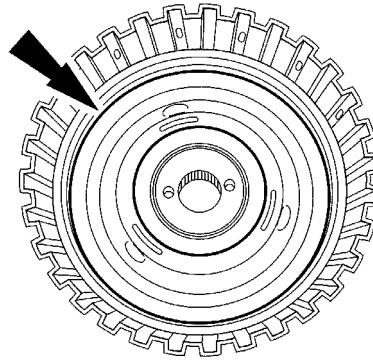


4. Using the special tools, remove the snap ring.

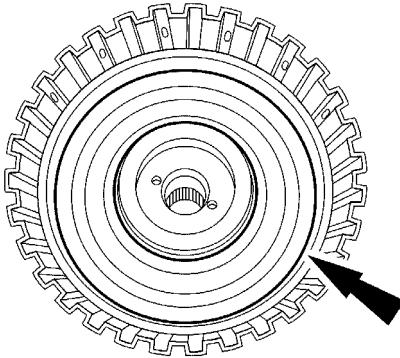


NOTE: Note the orientation of the return spring.

5. Remove the forward clutch balance piston and the return spring. Discard the forward clutch balance piston.



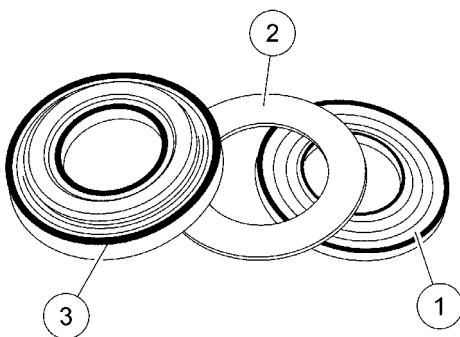
6. Remove and discard the forward clutch piston.



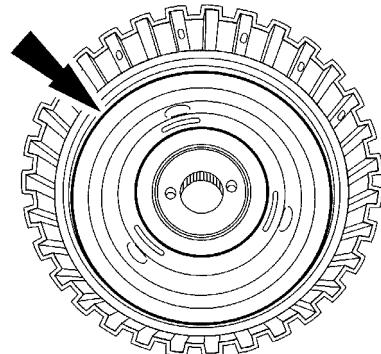
7. Clean and inspect all components for damage.

Forward Clutch Assembly — Assembly

1. Lightly lubricate the new pistons and seals with clean automatic transmission fluid.



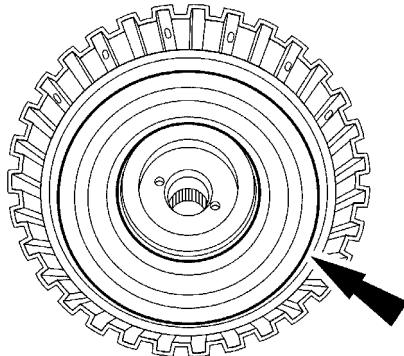
N0017347



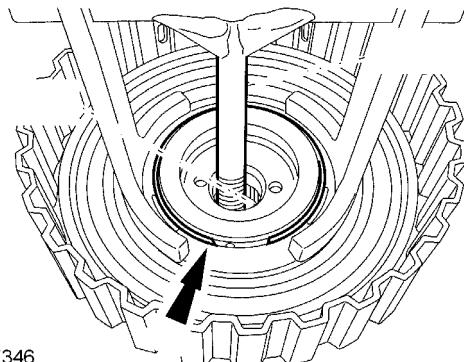
A0057674

Figure 345

1. Forward clutch balance piston.
 2. Forward clutch balance piston return spring.
 3. Forward clutch piston.
2. Install the forward clutch piston.
4. Using the special tools, install the snap ring.

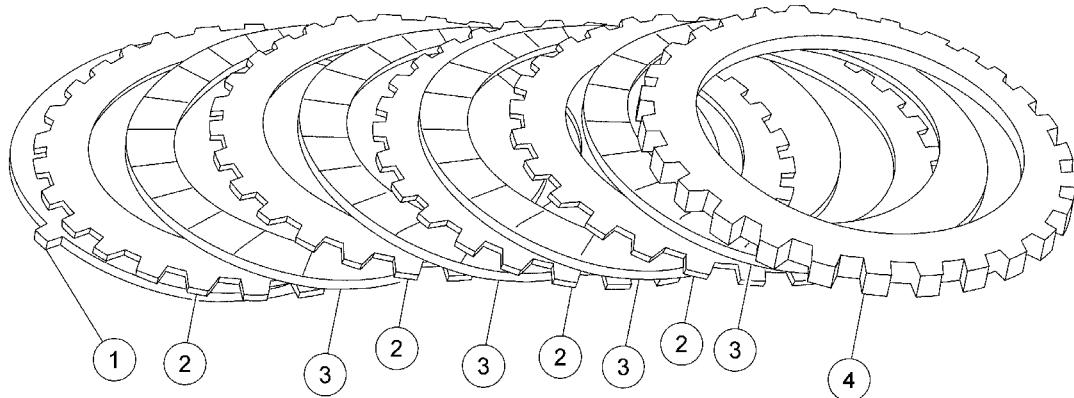


A0057675



N0017346

- NOTE:** Inspect the forward clutch plates for damage. If any damage is found, install new plates.
5. Install the forward clutch pack.
3. Install the forward clutch balance piston return spring and balance piston.

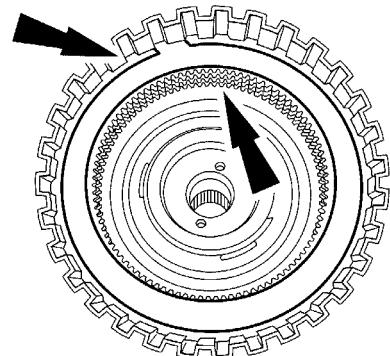


N0017348

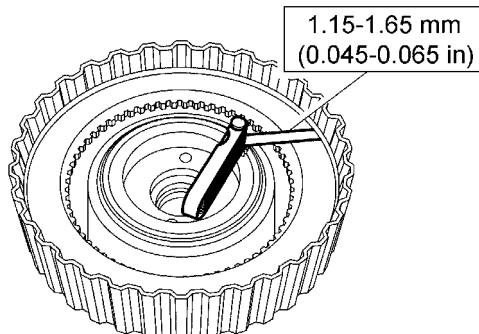
Figure 349

- 1. Cushion spring.
- 2. Externally splined steel plates.
- 3. Internally splined friction plates.
- 4. Forward clutch pressure plate.

6. Install the forward clutch snap ring.

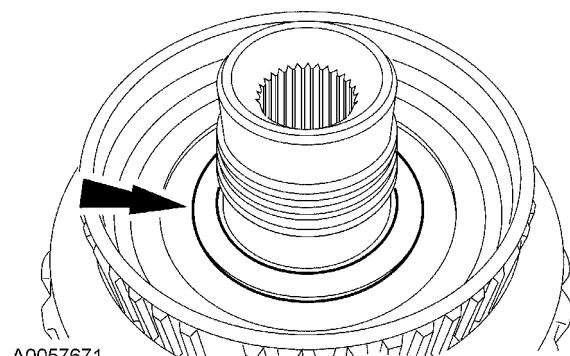


A0057672



N0017349

8. Install the No. 8 forward clutch thrust bearing, blue side up.



A0057671

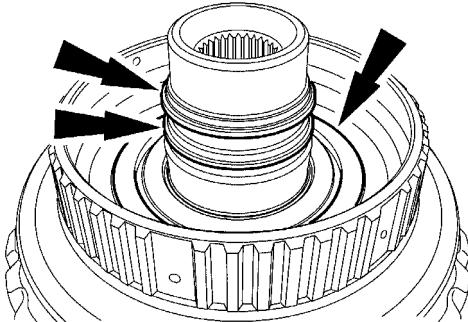
S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

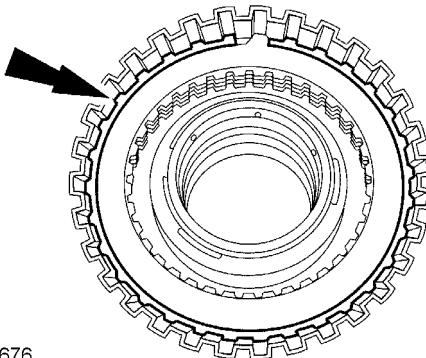
Follow all warnings, cautions, and notes.

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9. Install the No. 7 thrust washer and 2 new seals.



A0057670



A0057676

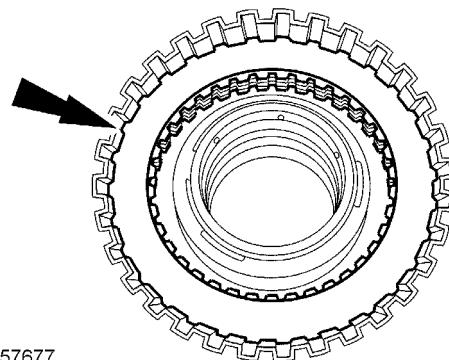
Direct Clutch Assembly — Disassembly

Table 146 Special Tools

	Compressor, Clutch Spring ZTSE9122
	Alignment Cone ZTSE9144

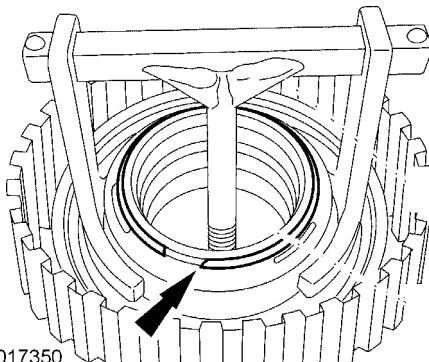
NOTE: Soak all friction clutch plates in clean automatic transmission fluid.

1. Remove the snap ring.



A0057677

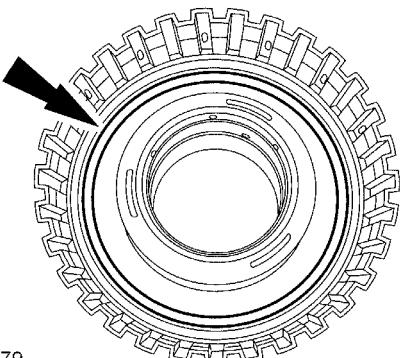
2. Remove the direct clutch plates.



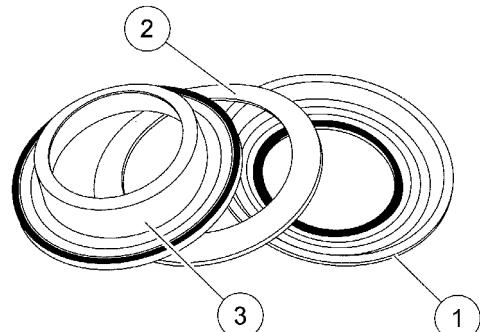
N0017350

NOTE: Note the orientation of the return spring.

3. Using the special tools, remove the snap ring.
4. Remove the direct clutch balance piston and return spring. Discard the direct clutch balance piston.

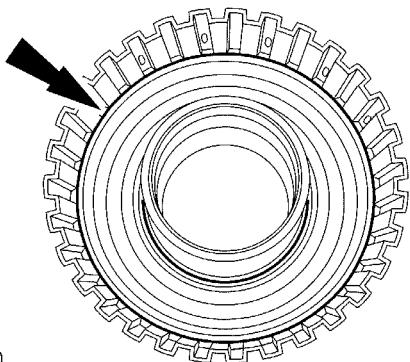


A0057679



N0017351

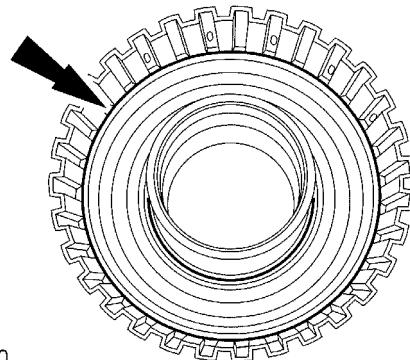
- Remove and discard the direct clutch piston.



A0057680

- Clean and inspect all components for damage.

- Install a new direct clutch piston.

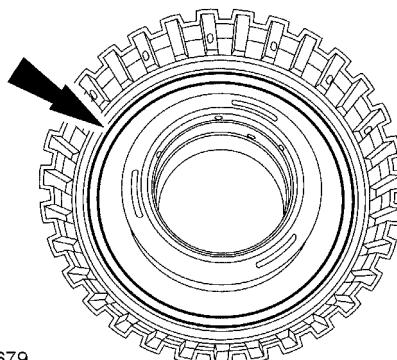


A0057680

Direct Clutch Assembly — Assembly

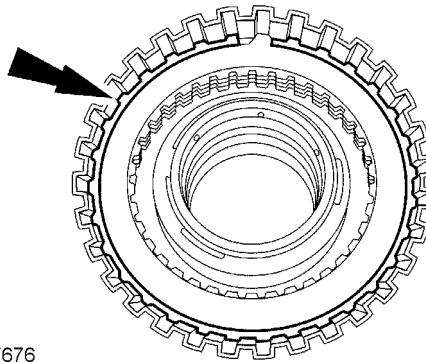
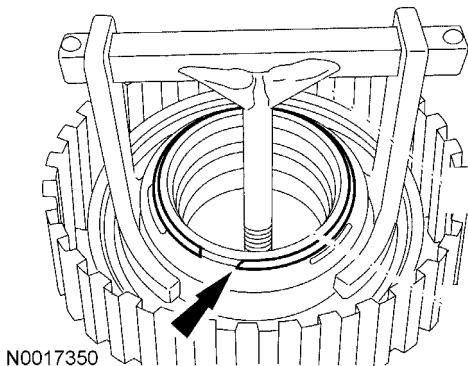
- Lightly lubricate the new pistons with clean automatic transmission fluid.

- Install the direct clutch return spring and a new balance piston.



A0057679

- Using the special tools, install the snap ring.



NOTE: The direct clutch plates are installed in an alternating sequence, starting with an externally splined steel plate, then an internally splined friction plate, with the pressure plate on the top just under the snap ring.

- Install the plates.

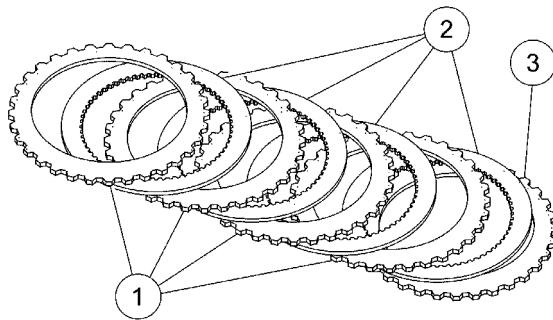
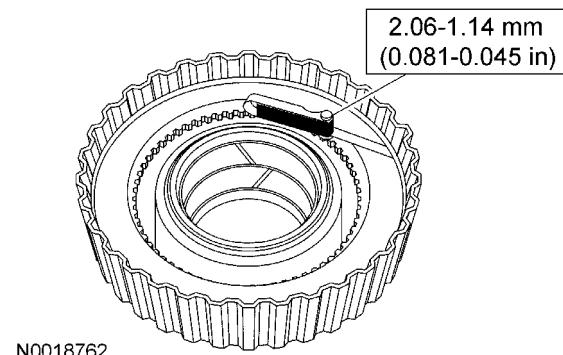


Figure 363

- Externally splined steel plates.
- Internally splined friction plates.
- Pressure plate.

- Install the snap ring.

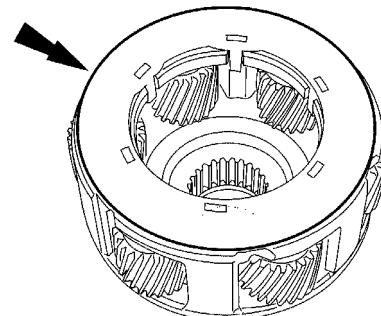
- Using a feeler gauge, measure the clearance between the snap ring and the pressure plate.



Forward Planet Assembly — Disassembly and Assembly

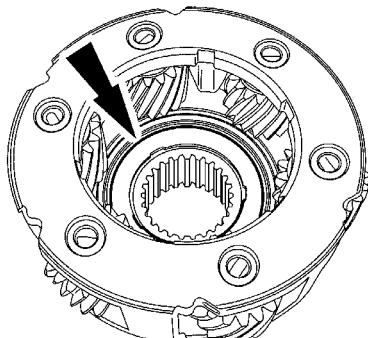
NOTE: Individual parts of the planet assemblies are not repairable.

- Remove the lube slinger.

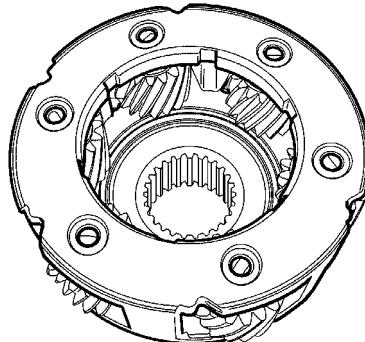


2. Remove the No. 12 forward clutch thrust bearing.

A0057682

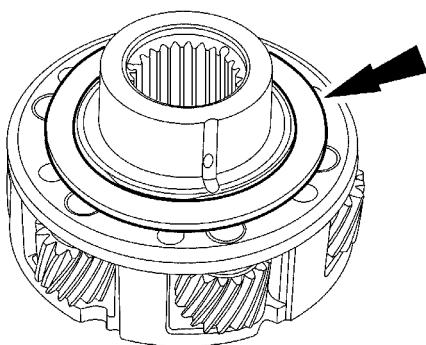


A0057683



3. Remove the No. 11 thrust bearing.

A0066488



4. Inspect the forward planet assembly.

- The pins and shafts in the plant assemblies should be checked for loose fit or damage. Use a new planet assembly if either condition exists.
- Inspect the pinion gears for damaged or excessively worn teeth.
- Check for free rotation of the pinion gears.

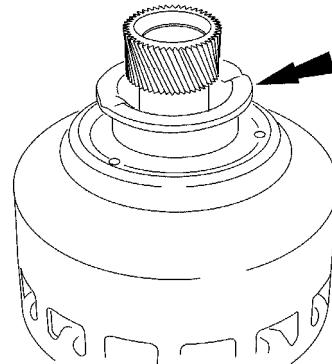
5. To assemble, reverse the disassembly procedure.

- Lightly lubricate the thrust bearings with clean automatic transmission fluid to hold them in place during assembly.
- The No. 12 thrust bearing must be installed with the notched inner race facing outward.

Input Shell Assembly — Check

1. Clean and inspect the forward/reverse sun gear and input shell assembly. Check the sun gear teeth, lug teeth and thrust surface for damage. If any evidence of damage is found, a new input shell assembly must be installed.

N0005651



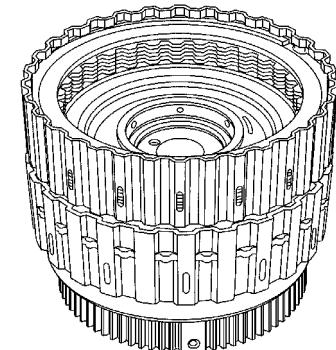
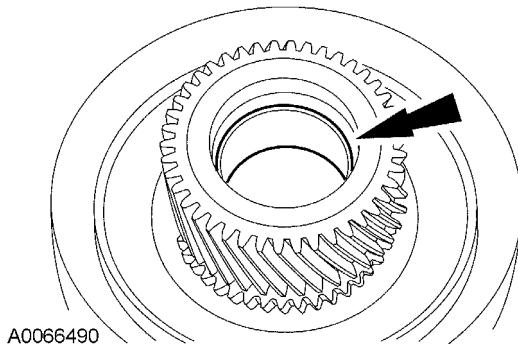
2. Inspect the front bushing for damage. If any damage is found, a new input shell assembly must be installed.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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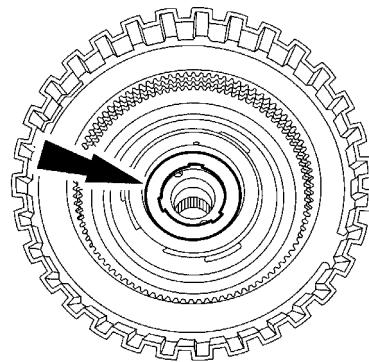
Forward Geartrain Assembly — Assembly

- Install the No. 9 forward clutch bearing.

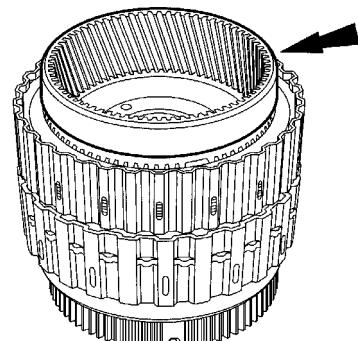
Table 147 Special Tools

	Installer, Transmission Forward Clutch Assembly ZTSE9129
	Bridge Adapter ZTSE9129

- Install the forward clutch assembly into the direct clutch assembly.



- Install the forward hub and ring gear assembly.



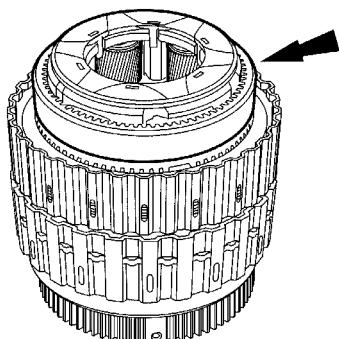
- Install the planet carrier and bearing assembly.

S13036

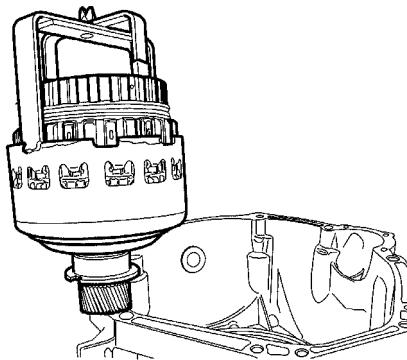
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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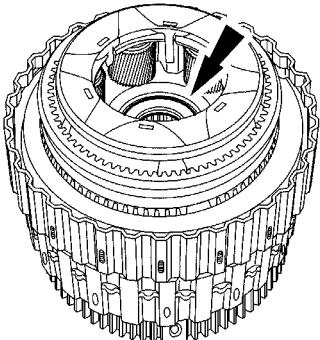


N0005648



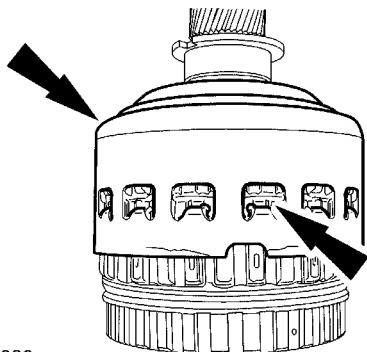
N0018763

5. Install the No. 12 thrust bearing onto the forward carrier assembly.



N0005647

6. Install the input shell assembly.
 - Make sure the tab is engaged in the forward clutch assembly.

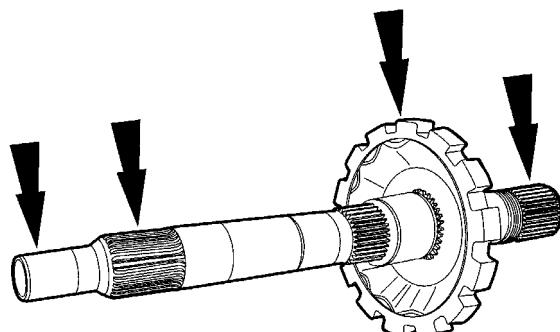


A0057689

7. Install the special tools. Position aside to use during transmission assembly.

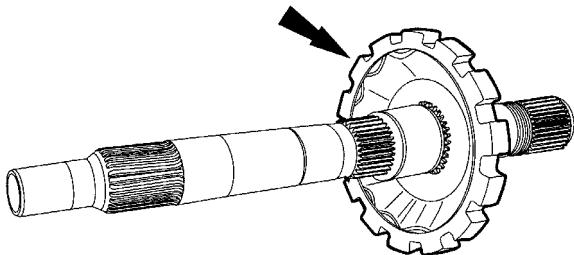
CAUTION: Buildup of contamination can block the flow of lubricant behind the cup plug and cause transmission assembly damage.

1. Inspect the output shaft for damage. If damage is found, install a new shaft.
- Inspect the output shaft.
- Inspect the park and output shaft speed (OSS) sensor gear.
- Inspect the bearing surfaces of the output shaft for wear or scores. If excessive wear or scoring is found, install a new output shaft and inspect the mating components.
- Check the splines on the output shaft for wear. Install a new output shaft if the splines are excessively worn. Inspect all the bushing journals for wear. Install new if scored or damaged.



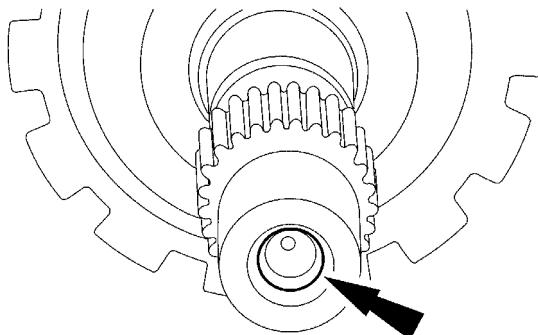
A0057699

2. Remove the park gear.



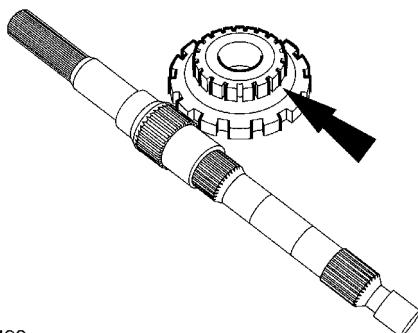
A0057700

is found, remove the orifice plug, flush out the foreign material and install a new orifice plug.



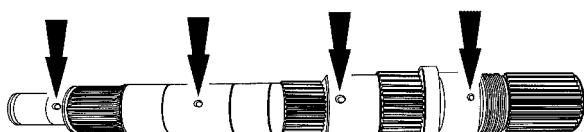
A0068173

3. Inspect the park and OSS sensor gear.



A0066493

4. Inspect the output shaft. Make sure the lube passages through the output shaft are clean and free of foreign material. Install new as required.

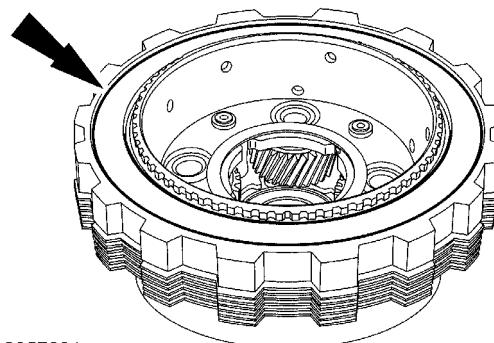


A0057701

5. Inspect the orifice cup plug on the end of the output shaft for foreign material, if foreign material

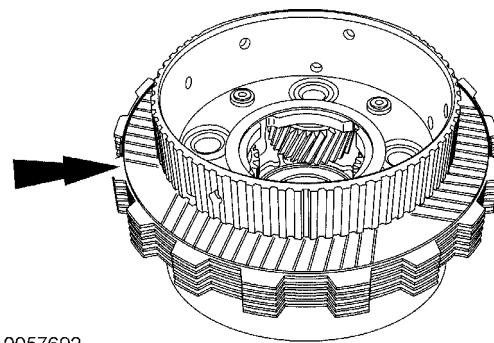
Reverse Planet Assembly — Disassembly and Assembly

1. Remove the one-way clutch pressure plate assembly.



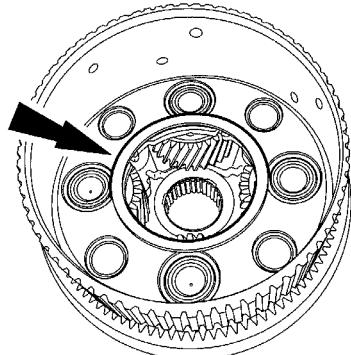
A0057691

2. Remove the reverse clutch plates.



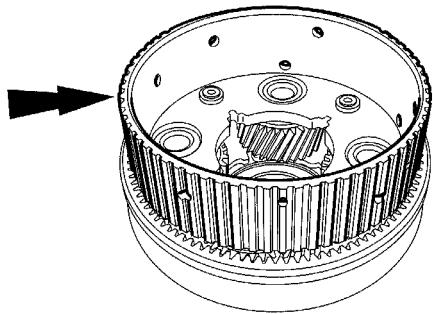
A0057692

3. Remove the No. 13 rear reverse planet thrust washer.



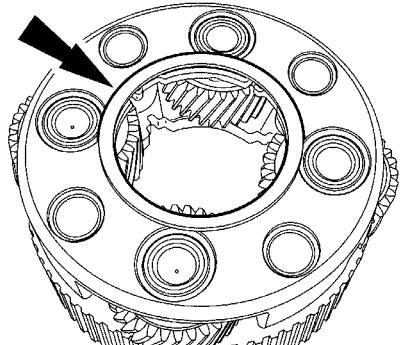
A0057693

4. Remove the reverse clutch ring gear subassembly.



A0057694

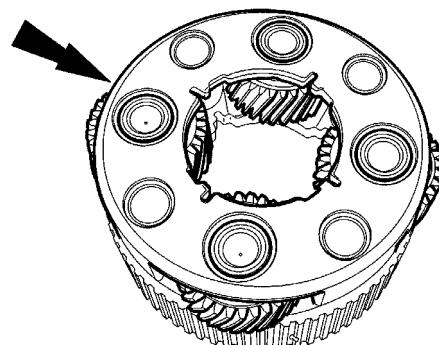
5. Remove the No. 14 front reverse planet thrust washer.



A0057695

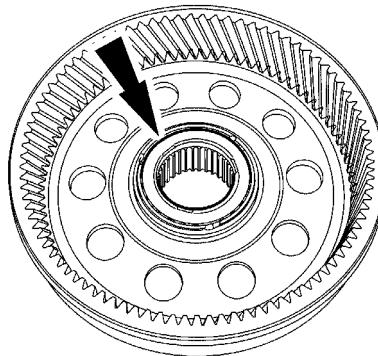
6. Inspect the reverse planet assembly.

- The pins and shafts in the planet assemblies should be checked for loose fit or damage. Use a new planet assembly if either condition exists.
- Inspect the pinion gears for damaged or excessively worn teeth.
- Check for free rotation of the pinion gears.
- Check for damage in the overdrive planet assembly.



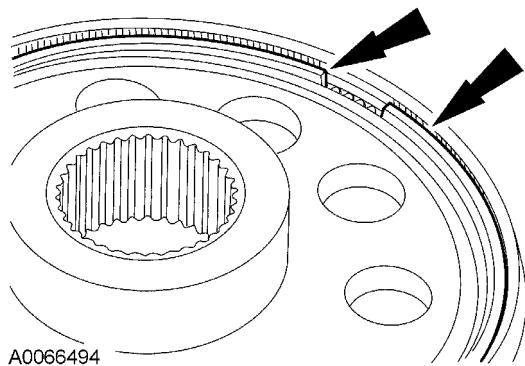
A0057696

7. Remove the No. 15 sun gear thrust bearing.



A0057697

8. Remove the snap ring. Disassemble the reverse ring gear and hub assembly. Inspect the components for damage. If damaged, install new components.



9. To assemble, reverse the disassembly procedure.
- Lightly lubricate the thrust bearings with clean automatic transmission fluid to hold them in place during assembly.
- The tabs on the thrust washers must engage the slots on the reverse planet assembly when installed.
- The snap ring tips must be facing down toward the output shaft hub and fully engaged in the groove.

Assembly

Transmission

Table 148 Special Tools

	Installer, Transmission Extension Housing Fluid Seal ZTSE9143
	Compressor, Clutch Spring ZTSE9121

Table 148 Special Tools (cont.)

	Installer, Shift Shaft Fluid Seal ZTSE9102
	Handle, Torque Converter ZTSE9122
	Aligner, Transmission Fluid Pump ZTSE9124
	Installer, Fluid Filler Tube ZTSE9110
	Installer, Transmission Forward Clutch Assembly ZTSE9129

Table 148 Special Tools (cont.)

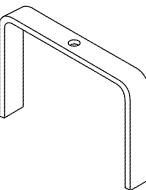
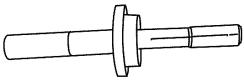
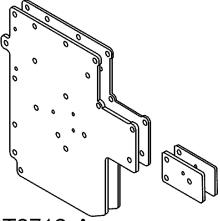
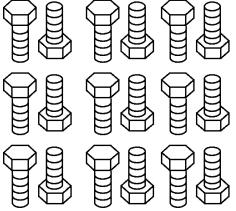
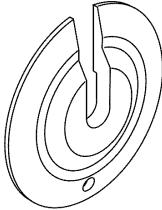
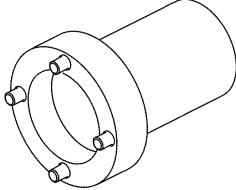
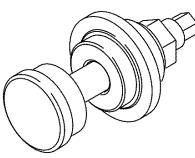
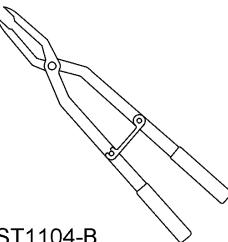
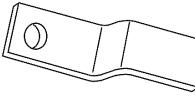
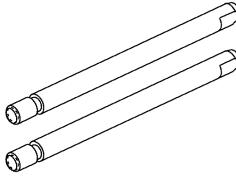
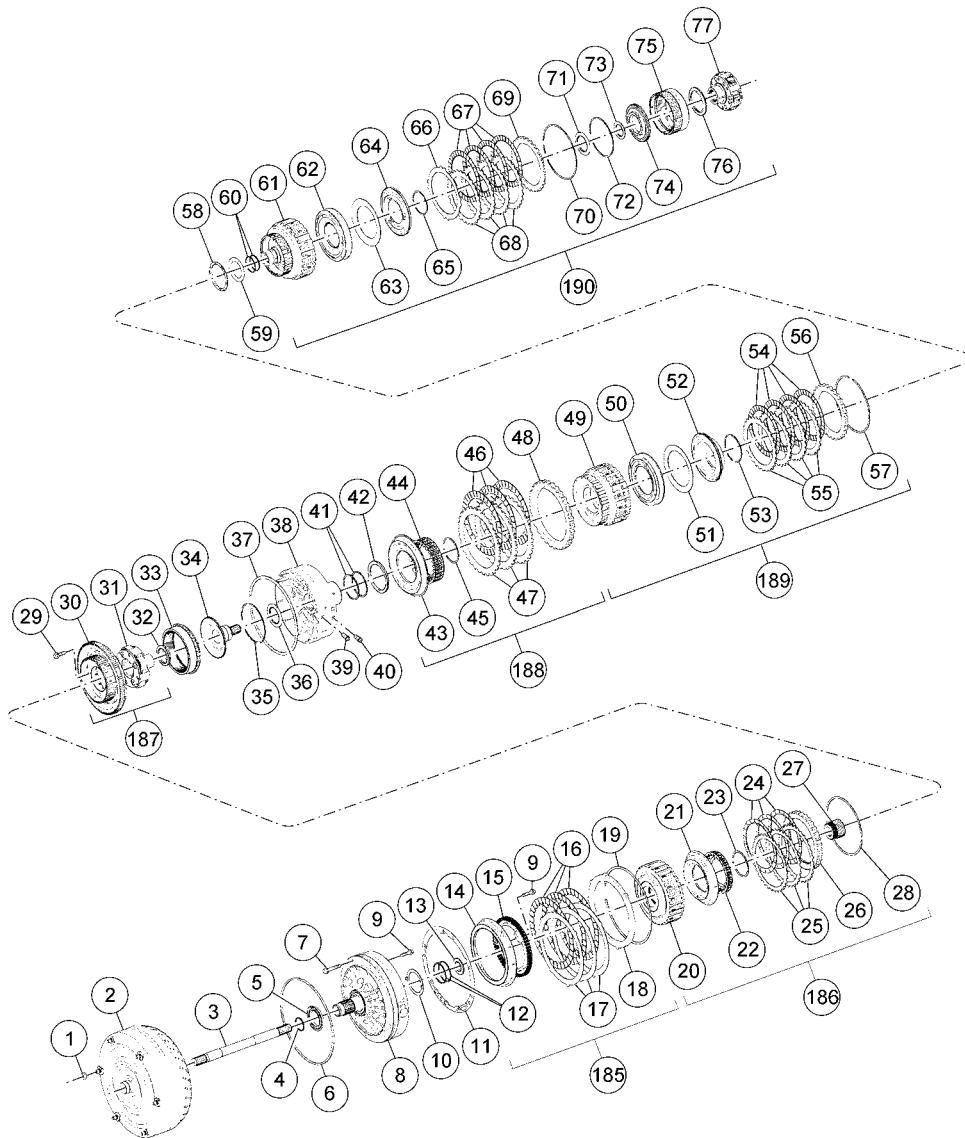
	Bridge Adapter (use with ZTSE9129) ST2723-A
	Loading Fixture, Clutch ZTSE9133 ST2159-B
	Air Test Plate ZTSE9114 ST2718-A
	Test Plate Screw Set, Transmission ZTSE9107 ST1940-A
	Alignment Cone ZTSE9144 ST2719-A

Table 148 Special Tools (cont.)

	Nut Driver, Output Shaft ZTSE9141 ST2720-A
	Installer, Seal Pack ZTSE9111 ST2722-A
	Retaining Ring Pliers ZTSE9125 ST1104-B
	Retainer, Torque Converter ZTSE9109 ST1636-A
	Aligner, Valve Body ZTSE9113 ST2717-A



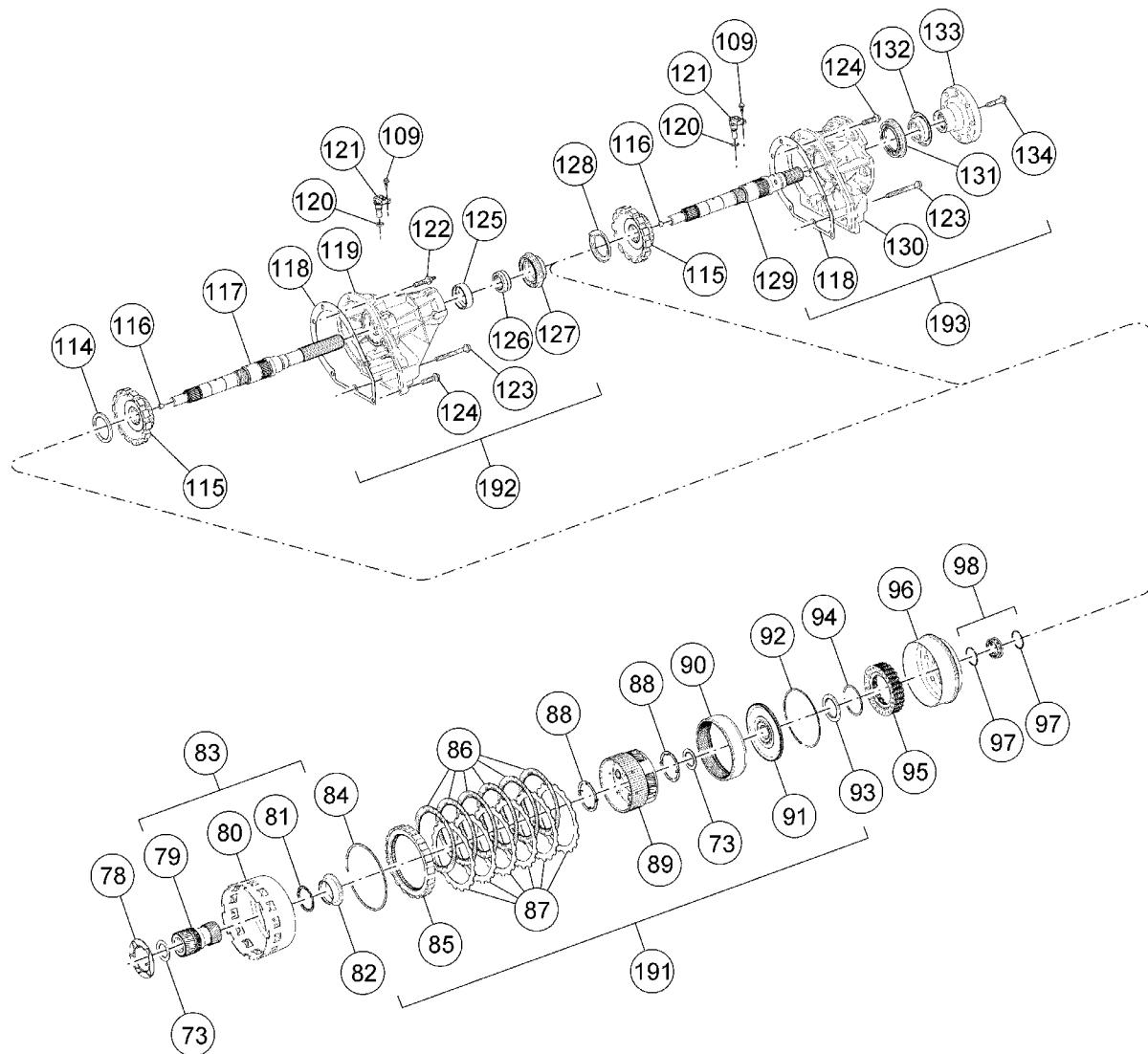
N0024934

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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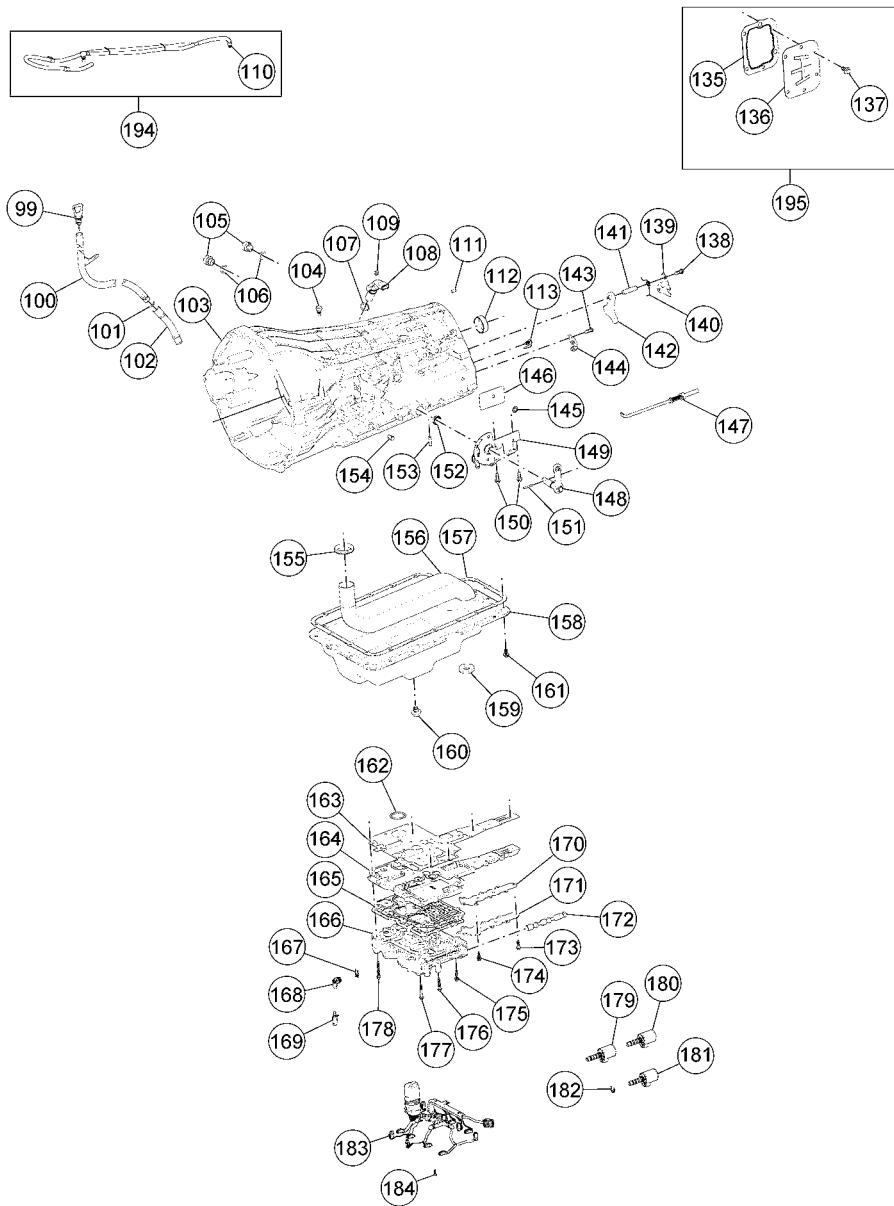
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S13036

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N0024936

Figure 394

1. Flexplate-to-torque converter nut
2. Torque converter assembly (model dependent)
3. Shaft — input
4. Seal — stator support
5. Seal — front pump support
6. Seal — front pump
7. Bolt — M8 x 70 hex flange head
8. Pump assembly — front
9. Bolts — M8 x 1.25 x 45 — front pump
10. Washer — front pump support No. 1T
11. Gasket — front pump
12. Seal — coast clutch (2 required)
13. Race and bearing assembly — sun gear thrust No. 2B and 3B
14. Piston — overdrive clutch

S13036

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Follow all warnings, cautions, and notes.

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15. Spring — overdrive clutch piston return
16. Plates — overdrive clutch internal spline — friction
17. Plates — overdrive clutch external spline — steel
18. Plate — overdrive clutch pressure
19. Ring — overdrive clutch press plate retaining
20. Cylinder and bushing assembly — coast clutch
21. Piston — coast clutch
22. Spring — coast clutch return
23. Ring — coast clutch spring retaining
24. Plates — coast clutch internal spline — friction (model dependent)
25. Plates — coast clutch external spline — steel (model dependent)
26. Clutch assembly — coast one-way
27. Gear — overdrive sun
28. Ring — 172.5 retainer internal style No. 2
29. Bolt — coast clutch hub (4 required)
30. Hub assembly — input coast clutch
31. Gear assembly — overdrive planetary
32. Bearing and race assembly — direct clutch No. 4B
33. Gear — overdrive ring
34. Shaft — overdrive center
35. Ring — center support retaining
36. Bearing and race assembly — sun gear thrust No. 5B
37. Ring — overdrive ring gear retaining
38. Support assembly — center
39. Bolt — M12 x 1.75 x 31 hex flange head (intermediate clutch feed)
40. Bolt — M12 x 1.75 x 31 Torx® head (forward clutch feed)
41. Seals — Teflon® (2 required)
42. Washer — center support thrust No. 6T
43. Piston — intermediate clutch
44. Support and spring assembly — intermediate clutch
45. Ring — intermediate clutch spring
46. Plates — intermediate clutch internal spline (friction)
47. Plates — intermediate clutch external spline (steel)
48. Plate — intermediate clutch pressure
49. Cylinder and hub assembly — direct clutch
50. Piston assembly — direct clutch
51. Spring — direct clutch piston return
52. Piston — direct clutch balance
53. Ring — direct clutch balance piston retaining
54. Plates — direct clutch internal spline — friction
55. Plates — direct clutch external spline — steel
56. Plate — direct clutch pressure
57. Ring — direct clutch plate retaining (selective fit)
58. Washer — intermediate brake thrust No. 7T
59. Bearing assembly — intermediate clutch No. 8B
60. Seals — forward clutch cylinder (2 required)
61. Cylinder assembly — forward clutch
62. Piston assembly — forward clutch
63. Spring — forward clutch piston return
64. Piston assembly — forward clutch balance
65. Ring — forward clutch balance piston retaining
66. Spring — forward clutch cushion
67. Plates — forward clutch internal spline — friction
68. Plates — forward clutch external spline — steel
69. Forward clutch pressure plate

- 70. Ring — forward clutch plate retaining (selective fit)
- 71. Washer — forward clutch hub thrust No. 9T
- 72. Ring — retaining (forward ring gear)
- 73. Bearing and race assembly — sun gear thrust No. 10B, 12B, 15B
- 74. Hub and bushing assembly — forward ring gear
- 75. Gear — forward ring
- 76. Bearing and race assembly — forward carrier No. 11B
- 77. Planet assembly — forward
- 78. Lube dam — forward carrier
- 79. Gear assembly — forward/reverse sun
- 80. Shell — input
- 81. Ring — forward/reverse sun shell retaining
- 82. Spacer — sun gear shell
- 83. Shell and sun gear assembly
- 84. Ring — reverse clutch pressure plate — retaining
- 85. Clutch assembly — low one way
- 86. Plates — reverse clutch internal spline — friction
- 87. Plates — reverse clutch external spline — steel
- 88. Washers — planet carrier thrust No. 13T/14T
- 89. Planet assembly — reverse
- 90. Gear — output shaft ring
- 91. Hub — output shaft ring gear
- 92. Ring — retaining (reverse ring gear)
- 93. Bearing and race assembly No. 16B
- 94. Ring — reverse clutch spring retaining
- 95. Retainer and spring assembly — reverse clutch
- 96. Piston — reverse clutch
- 97. Seals — Teflon®
- 98. Seal assembly — intermediate brake drum
- 99. Indicator — fluid level
- 100. Tube assembly — fluid fill
- 101. O-ring
- 102. Tube — fluid inlet short
- 103. Case assembly
- 104. Vent assembly — case
- 105. Cooler line — case fittings
- 106. O-ring — cooler connectors
- 107. O-ring — sensor
- 108. Sensor — turbine shaft speed (TSS)
- 109. Bolts — M6 x 1 x 15.2
- 110. Case vent assembly (PTO only)
- 111. Valve — air bleed check
- 112. Snubber — output shaft
- 113. Plug — case oil filler
- 114. Bearing assembly — parking gear needle thrust (slip yoke) No. 17B
- 115. Gears — output shaft parking
- 116. Plug cups
- 117. Shafts — output (slip yoke)
- 118. Gaskets — extension housing
- 119. Extension assembly — slip yoke
- 120. O-rings — output shaft speed sensor
- 121. Sensors — output shaft
- 122. Stud — M6 x 1 1-M10 x 1.563 extension housing
- 123. Bolts — M10 x 1.5 x 93.5 extension housing
- 124. Bolts — M10 x 1.5 x 40 extension housing
- 125. Extension housing bushing
- 126. Seal — output shaft spline
- 127. Seal assembly — extension housing (4x2)
- 128. Washer — parking gear thrust fixed yoke No. 17 T
- 129. Shaft — output fixed yoke
- 130. Extension assembly — fixed yoke
- 131. Seal assembly — extension housing (4x4)
- 132. Retainer assembly — transmission output shaft
- 133. Flange — drive shaft (4x4)
- 134. Bolt — M12 x 55 overdrive flange
- 135. PTO — cover gasket
- 136. PTO — case cover
- 137. Bolt — M10 1.5 x 24 hex flange head
- 138. Screw and washer — M8 x 1.25 x 23.5 hex (2 required)

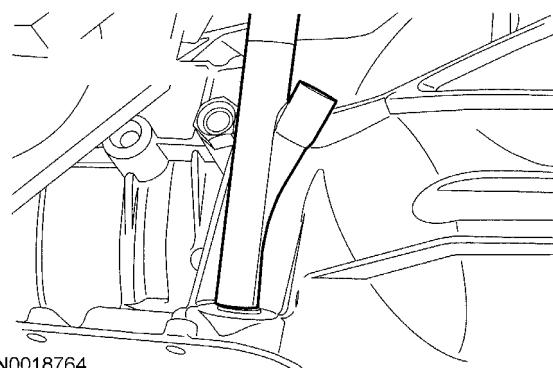
139. Plate — parking rod guide	159. Ceramic magnet — fluid pan	178. Bolt — M6 x 68 hex flange (13 required)
140. Spring — parking pawl return	160. Plug — fluid pan drain	179. Solenoid — line pressure (VFS)
141. Pin — 0.5 x 1.91 dowel ground hardened	161. Bolt — fluid pan	180. Solenoid — directly proportional (VFS) (4 required)
142. Pawl — parking	162. O-ring — bulkhead connector	181. Solenoid — inversely proportional (VFS) (2 required)
143. Screw — M8 x 1.25 x 25 pan head	163. Gasket — control valve body	182. E-clip — VFS (7 required)
144. Abutment — parking pawl	164. Ditch plate	183. Wiring harness
145. Spring nut	165. Gasket — filter plate	184. Bolt — T25 holds wire harness to manifold (2 required)
146. Tag — transmission service identification	166. Manifold body	185. Overdrive clutch assembly
147. Rod assembly — parking pawl actuating	167. W-clip — pressure switch plug	186. Coast clutch assembly
148. Lever assembly — manual control (model dependent)	168. Switch — pressure (if equipped)	187. PTO only
149. Transmission range detent assembly	169. Sensor — transmission fluid temperature (TFT)	188. Intermediate clutch assembly
150. Bolts — M6 x 1.0 x 15.2 hex flange head transmission range	170. Gasket — backing plate	189. Direct clutch assembly
151. Pin — shaft retaining	171. Backing plate	190. Forward clutch and planetary assembly
152. Seal — manual lever	172. Valve — manual	191. Reverse clutch and planetary assembly
153. Roll pin — manual control lever to case	173. Bolt — M6 x 1 x 30 hex head (5 required)	192. Extension housing 4x2 (slip yoke)
154. Plug — line pressure	174. Bolt — M6 x 15.2 solenoid backing plate-to-ditch plate (5 required)	193. Extension housing 4x4 (fixed yoke)
155. Seal — filter	175. Bolt — M6 x 27.5 solenoid manifold-to-ditch plate (3 required)	194. PTO model only
156. Filter and seal assembly	176. Bolt — M6 x 1.0 x 42.5 hex flange head (3 required)	195. PTO model only
157. Gasket — fluid pan	177. Bolt — M6 x 55 solenoid manifold-to-ditch plate (1 required)	
158. Fluid pan		

NOTE: Soak all friction clutch plates in clean automatic transmission fluid.

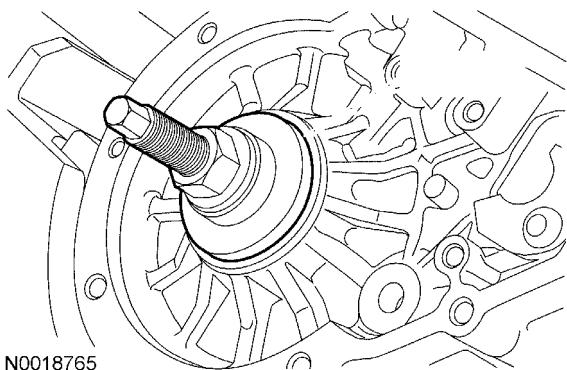
NOTE: Prior to installation, lightly lubricate all O-ring seals with clean automatic transmission fluid.

NOTE: Lightly lubricate all thrust washers with clean automatic transmission fluid to hold them in place during assembly.

1. Mount the transmission case into a suitable stand.
2. If removed, use the special tool to install the short fluid inlet tube.

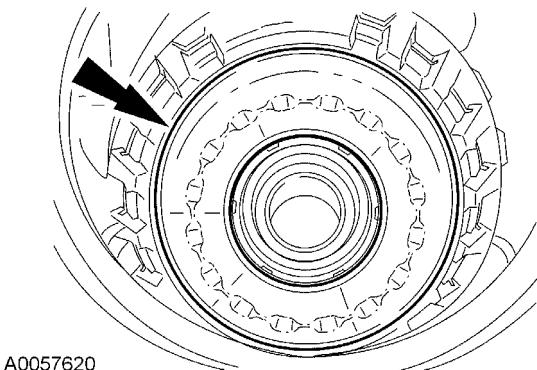


3. If removed, use the special tool to install a new Teflon® seal retainer.
 - Install 2 new Teflon® seals.

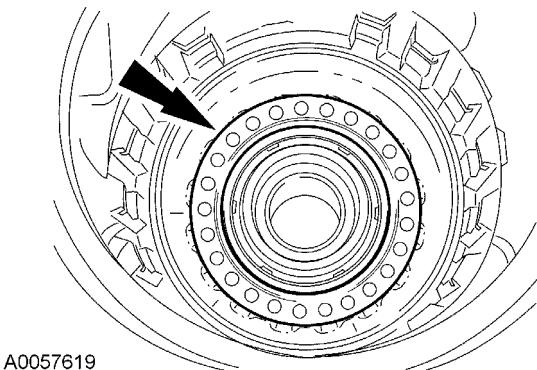


NOTE: Coat the reverse clutch piston seals with clean automatic transmission fluid.

4. Install the reverse clutch piston in the case until it is fully seated in the case.

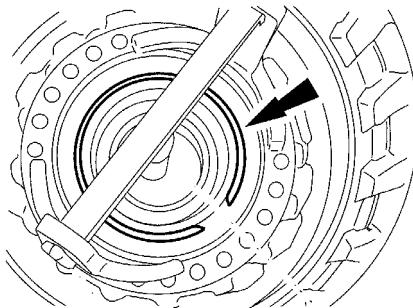


5. Install the reverse clutch return spring assembly.



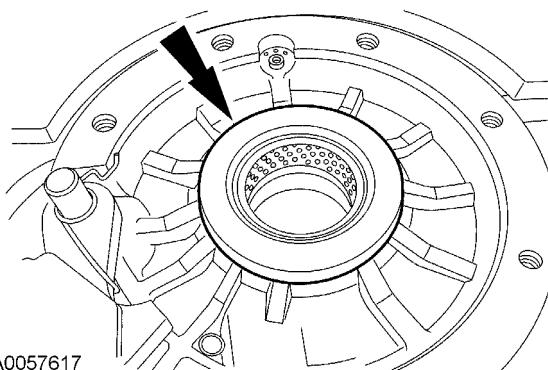
WARNING: Do not over compress the return spring or damage to the spring will occur.

6. Using the special tools, install the reverse clutch return spring snap ring.



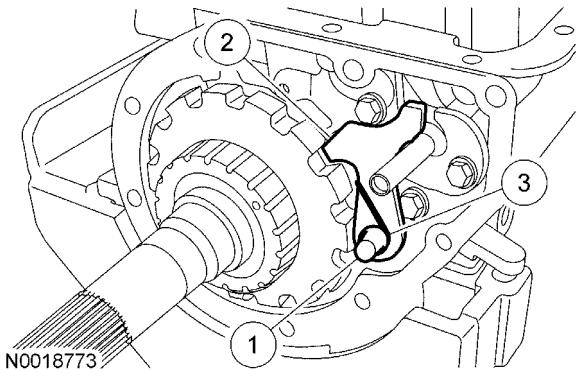
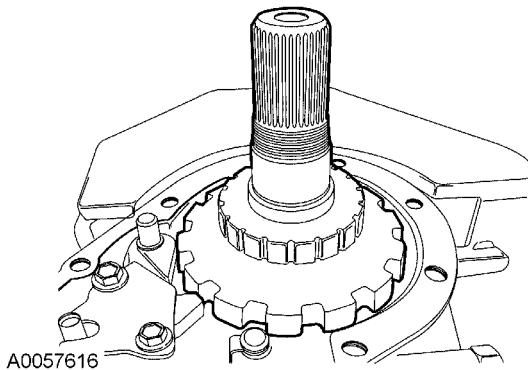
NOTE: Use clean automatic transmission fluid to hold the No. 17 thrust bearing or washer in place during assembly.

7. Install the No. 17 park gear thrust bearing.



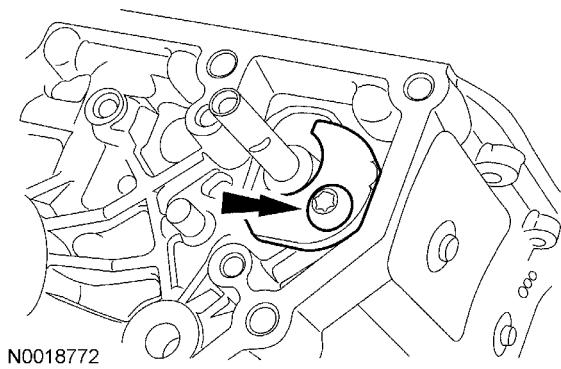
WARNING: Be careful when installing the output shaft not to damage the seals or a transmission leak could occur.

8. Install the output shaft.



CAUTION: The Torx® screw has a threadlocking compound. If the screw is removed, it must be discarded and a new screw installed.

9. If removed, install the parking pawl abutment with a new Torx® screw.
 - Tighten to 24 Nm (18 lb-ft).



10. Install the parking pawl.

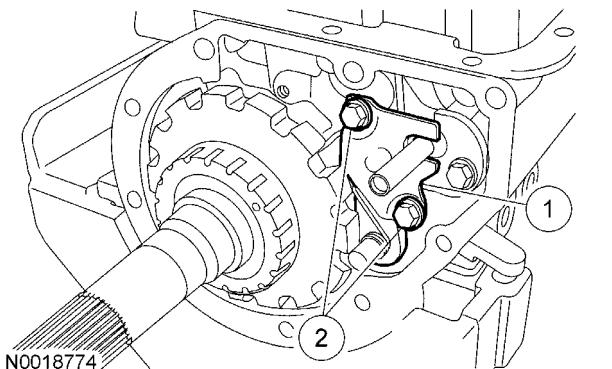
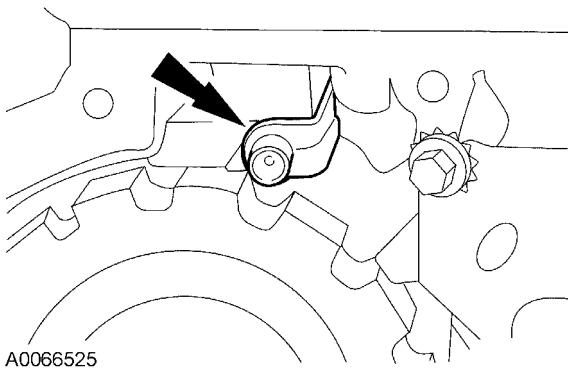
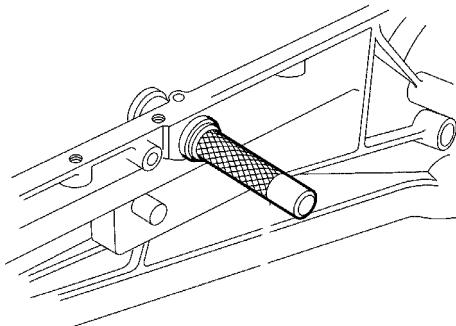


Figure 404

1. Install the parking rod guide plate.
2. Install the bolts.
 - Tighten to 24 Nm (18 lb-ft).
12. Install a new orifice lube plug in the rear of the case. Using a 12 mm (0.47 inch) socket, tap the orifice lube plug into the back of the transmission. Check to make sure that the orifice lube plug is fully seated into the back of the transmission.

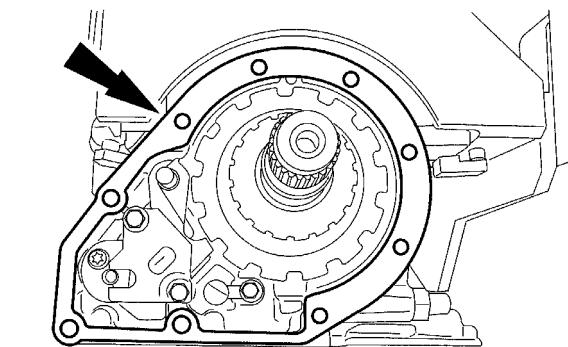


A0066525



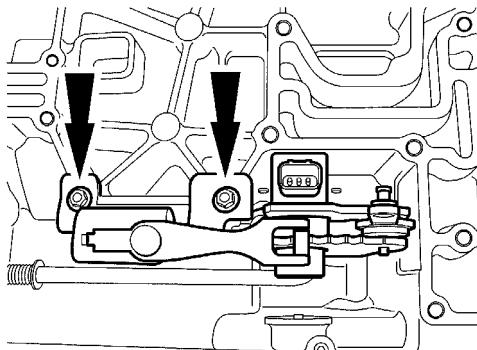
N0018775

13. Install a new extension housing gasket.



A0056155

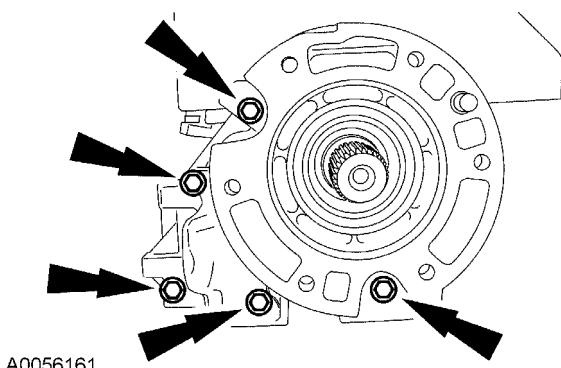
16. Install the transmission range sensor, park rod assembly and loosely install the bolts.



A0057623

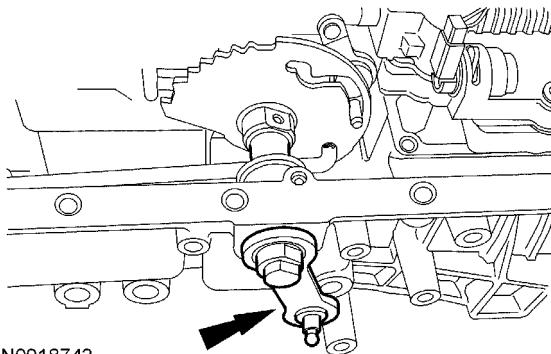
14. Install the extension housing.

- Tighten to 47 Nm (35 lb-ft).



A0056161

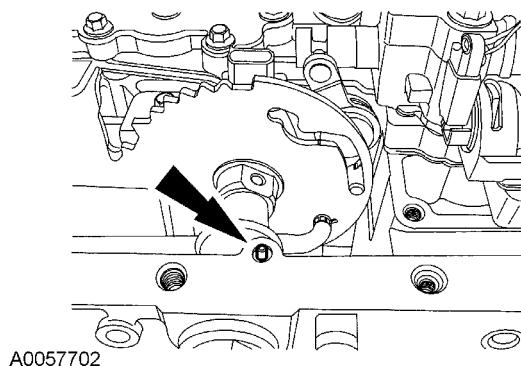
17. Install the manual control lever.



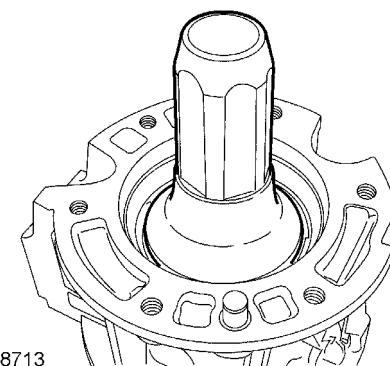
N0018743

15. Using the special tool, install a new manual control lever seal.

18. Install the roll pin into the case.

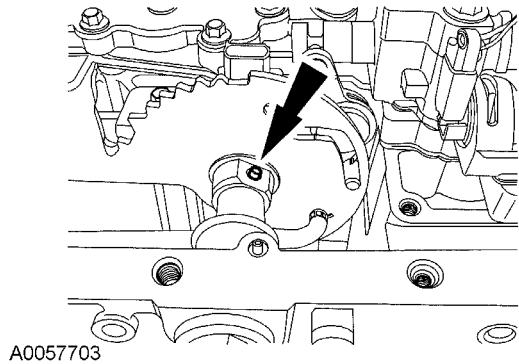


A0057702



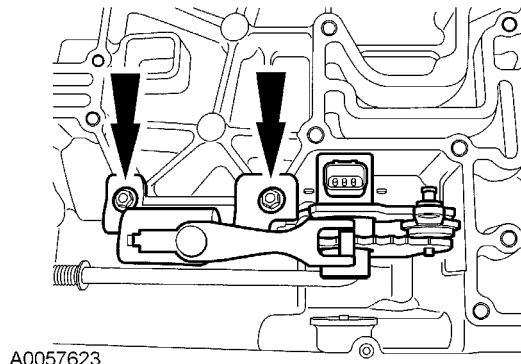
N0018713

19. Install a new roll pin. Leave 2 mm (0.08 in) of the pin exposed.



A0057703

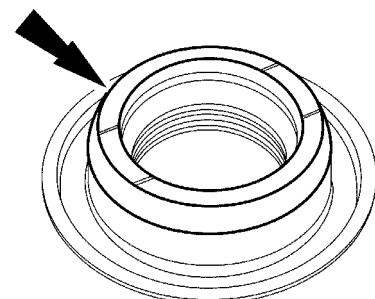
20. Tighten the TR sensor bolts.
• Tighten to 10 Nm (89 lb-in).



A0057623

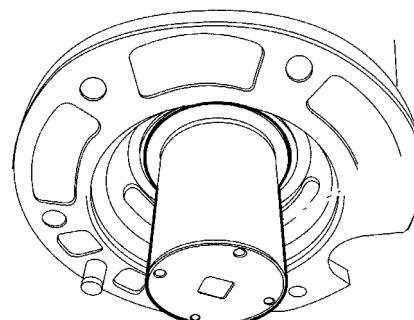
21. Using the special tool, install a new extension housing seal.

22. Inspect the new output shaft nut O-ring for cuts. A new nut must be installed.



A0066526

23. Using the special tool, install the output shaft nut.
• Tighten to 200 Nm (148 lb-ft).



N0018709

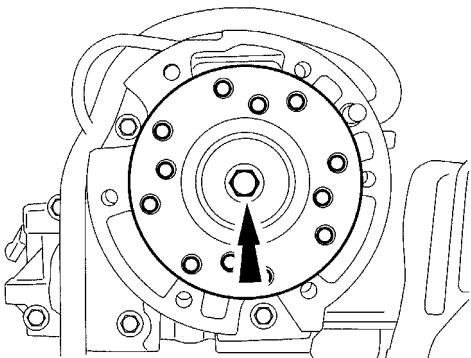
24. Install the output shaft flange and a new bolt.
• Tighten to 135 Nm (100 lb-ft).

S13036

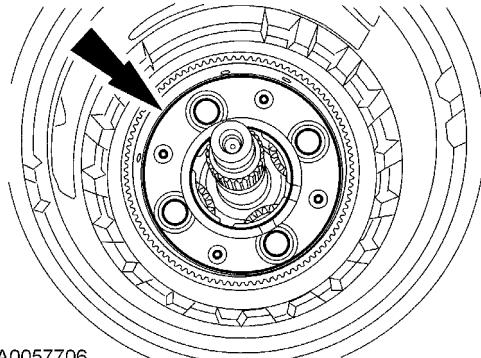
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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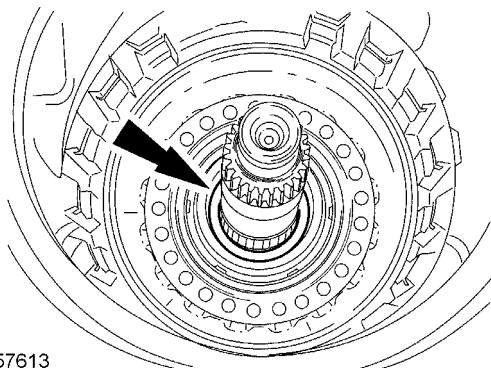


N0018715



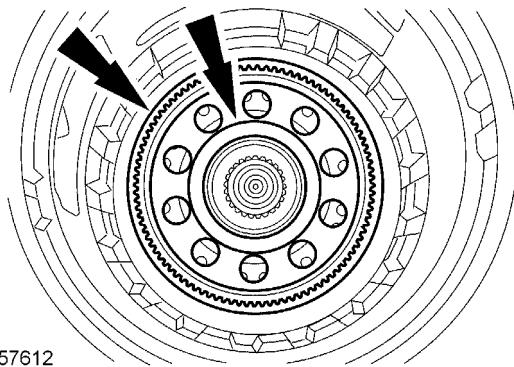
A0057706

25. Install the No. 16 bearing and race.



A0057613

26. Install the ring gear, hub and the No. 15 hub bearing.

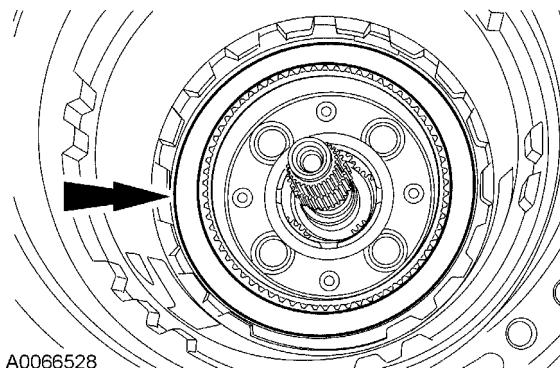


A0057612

27. Install the reverse carrier and hub assembly.

28. Install the low/reverse clutch plates.

- Start with a steel plate on the bottom, followed by a friction plate.
- Alternately stack the remaining steel and friction plates.
- Add the pressure plate (low/reverse one-way clutch) on the last friction plate, with "THIS SIDE UP" facing upward.

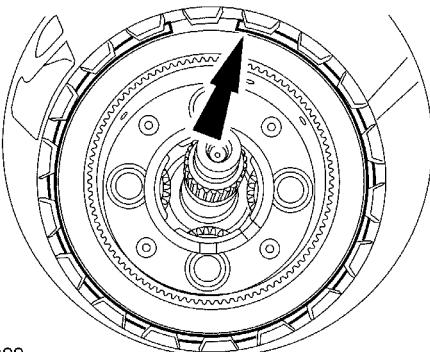


A0066528

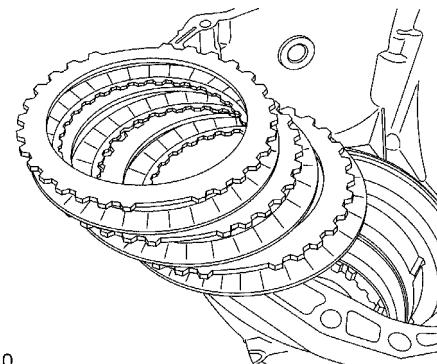
CAUTION: Do not apply air pressure to move the low/reverse piston without first installing the friction plates and the snap ring, or damage to the snap ring will occur.

29. Install the new snap ring. Make sure the snap ring opening is in the 1 o'clock position between 2 teeth on the case.

- Check the function of the reverse clutch by applying air to the correct passage (through the case valve body worm trail) for the reverse clutch.

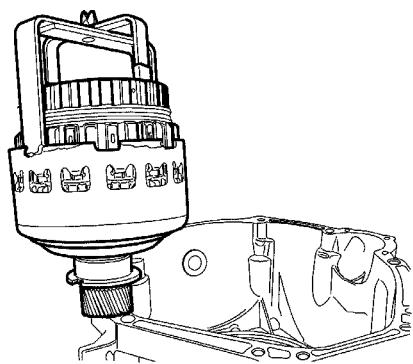


N0033300



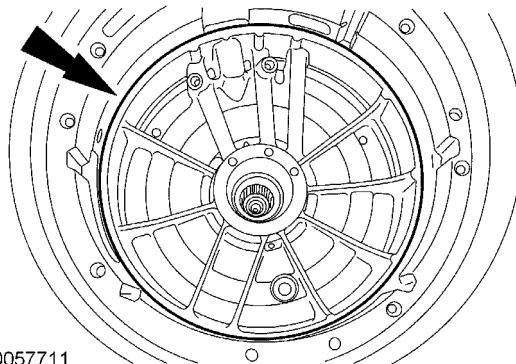
A0057710

30. Using the special tools, install the forward geartrain as an assembly.



N0018763

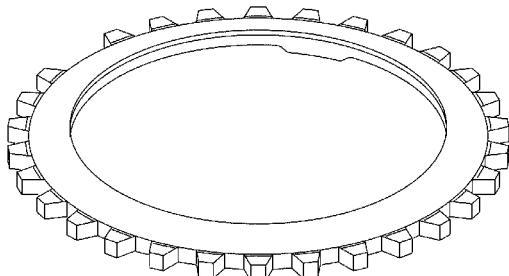
33. Install the center support.



A0057711

31. Install the intermediate clutch pressure plate.

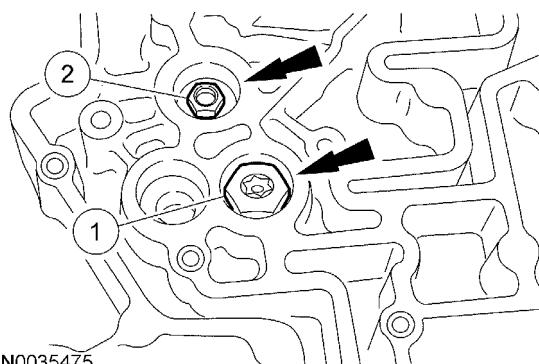
- Position the intermediate clutch pressure plate in the case with the 3 tabs facing downward.



N0005646

32. Install the intermediate clutch plates, starting with a friction plate.

34. Loosely install the feed bolts.



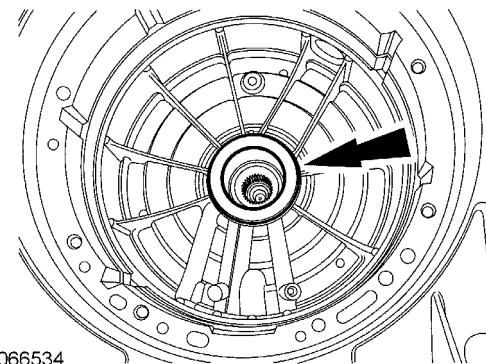
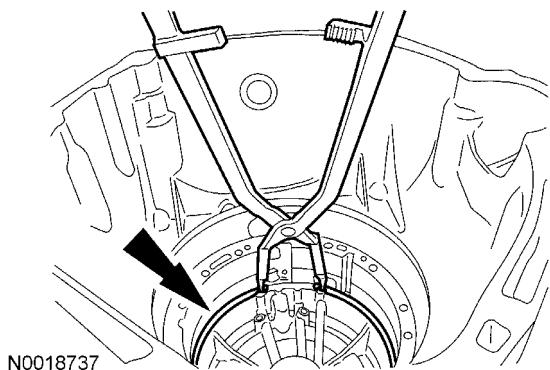
N0035475

Figure 427

1. Loosely install the Torx® head forward clutch feed bolt into the case toward the rear of the case.
2. Loosely install the hex head intermediate clutch feed bolt into the case toward the front of the case.

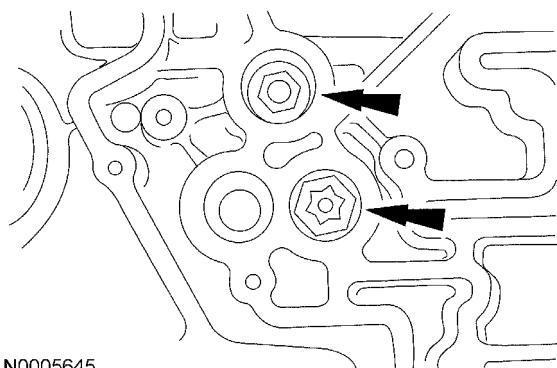
35. Using the special tool, install the center support snap ring.

- The snap ring should be installed with the flat edge facing downward. The gap in the snap ring should be facing in the 6 o'clock position. Tap the snap ring securely into the case.

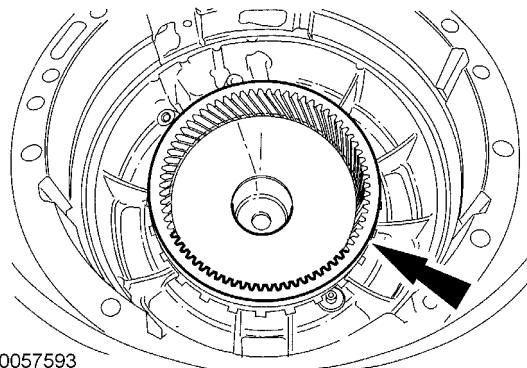


36. Tighten the feed bolts.

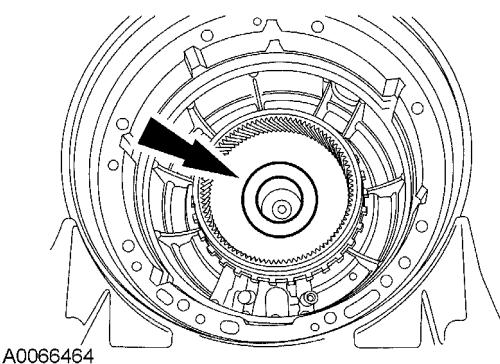
- Tighten to 32 Nm (24 lb-ft).



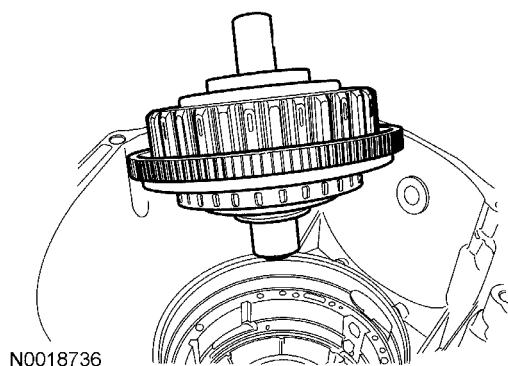
38. Install the center shaft and ring gear.



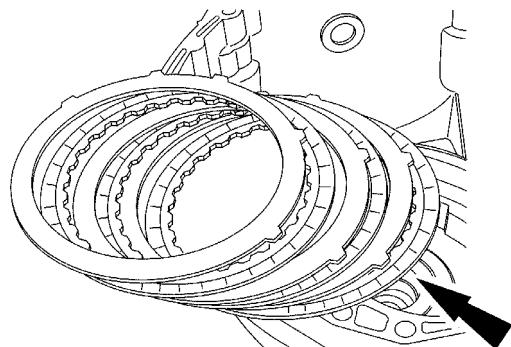
37. Install the No. 5 thrust bearing onto the center support.



40. Using the special tool, install the coast clutch assembly and overdrive carrier.

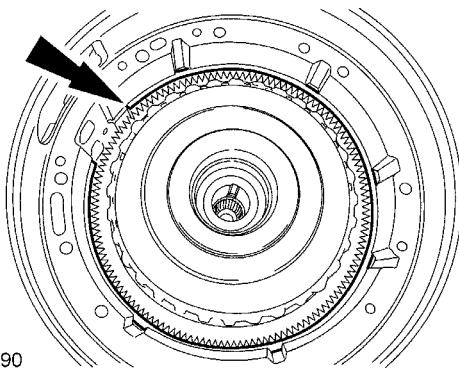


N0018736



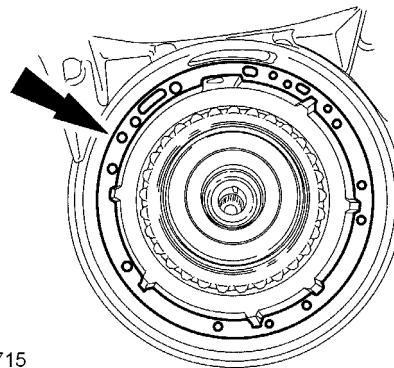
A0057714

41. Install the overdrive clutch assembly snap ring with the gap in the 6 o'clock position.



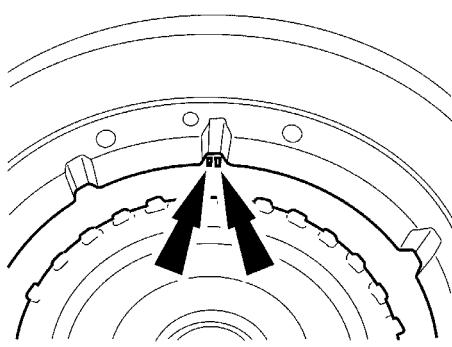
A0057590

44. Install a new pump gasket.



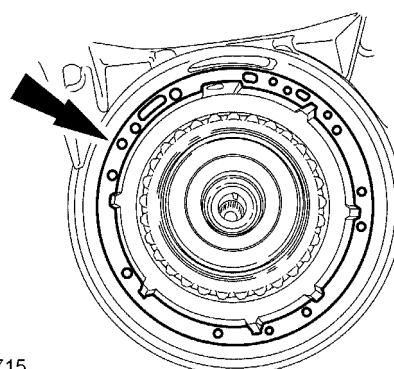
A0057715

42. Install the overdrive pressure plate with the notches facing up.



A0057713

45. Install the No. 2 thrust bearing.



A0057715

46. Install the input shaft into the case.

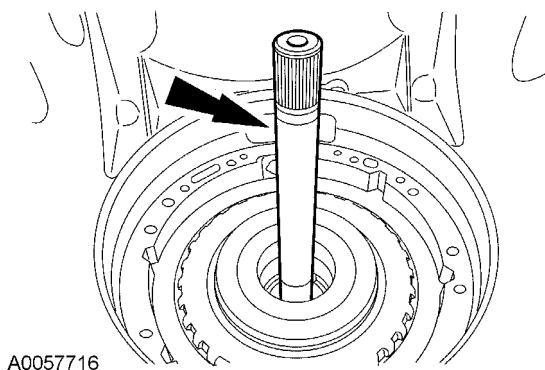
43. Install the overdrive clutch.

S13036

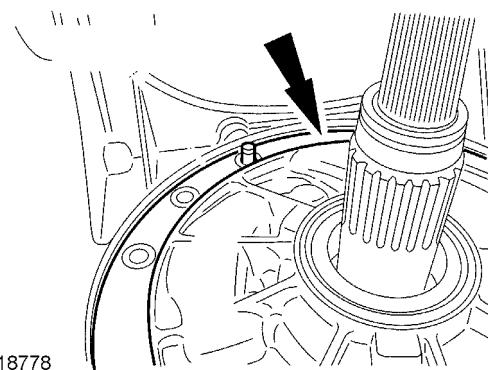
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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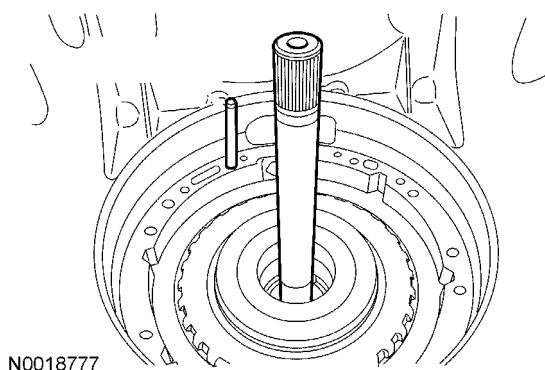
A0057716



N0018778

NOTE: Alignment pins are used in case holes located at the 5 o'clock and 11 o'clock positions.

47. Install the special tools into the case in order to install the pump.



N0018777

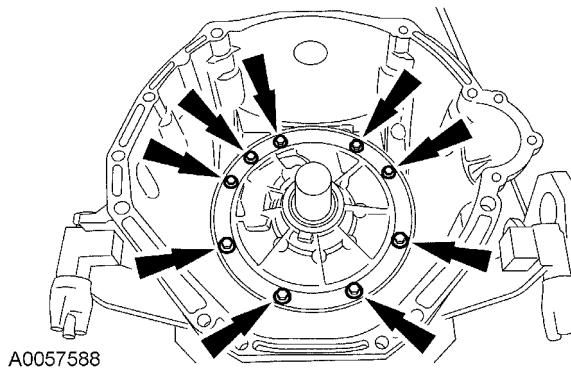
48. Check to make sure that the No. 1 thrust washer is installed on the pump stator.

NOTE: Pump-to-case alignment pins are used in case holes located at the 11 o'clock and 5 o'clock positions.

49. Using the special tools, install the pump assembly.

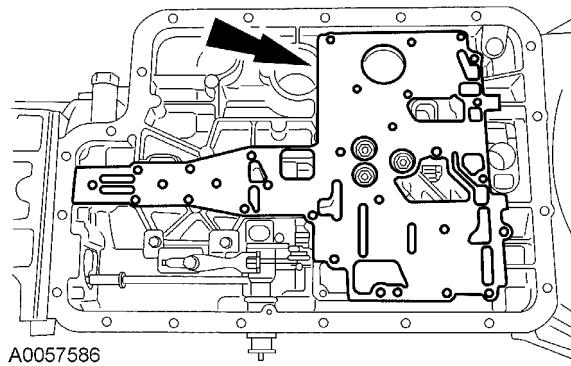
50. Install new retaining bolts.

- Tighten to 27 Nm (20 lb-ft).



A0057588

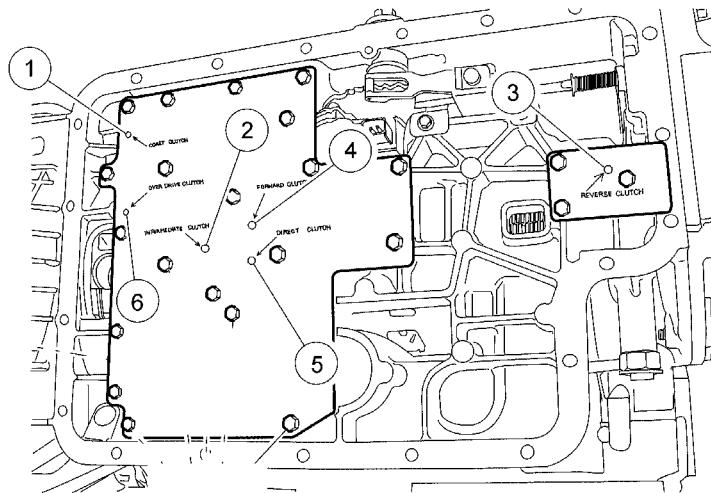
51. Install a new main control body gasket.



A0057586

52. Using the special tools, check the function of each clutch. Apply 20 psi (137.9 kPa) of air to each port.

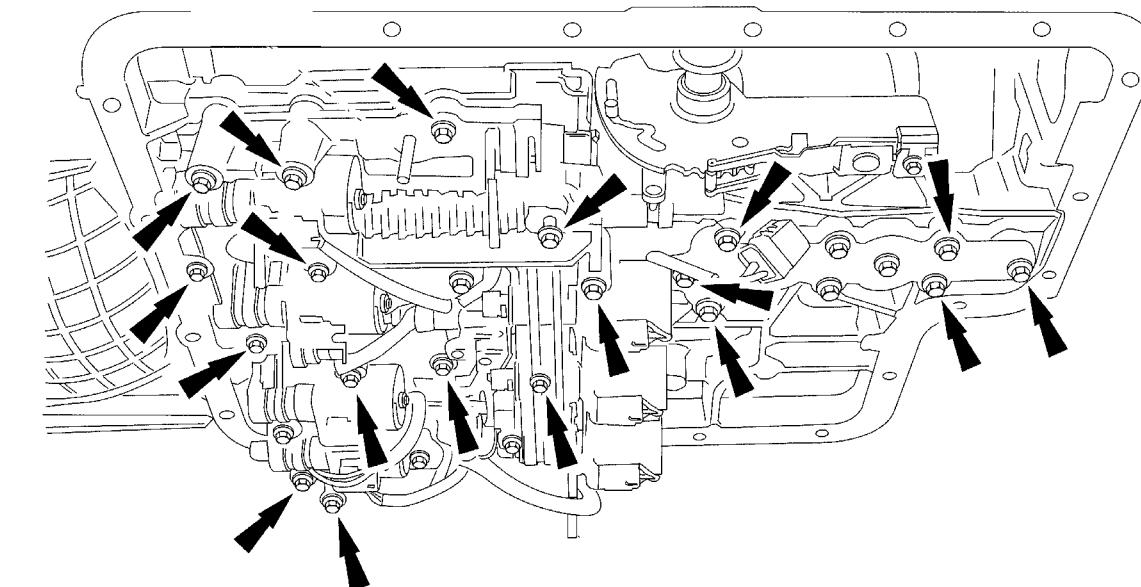
N0018692

**Figure 444**

- | | | |
|------------------------|-------------------|---------------------|
| 1. Coast clutch | 3. Reverse clutch | 5. Direct clutch |
| 2. Intermediate clutch | 4. Forward clutch | 6. Overdrive clutch |

53. Using the special tools, install the solenoid body and loosely install the bolts.

- While installing the solenoid body, align the manual valve.



N0018697

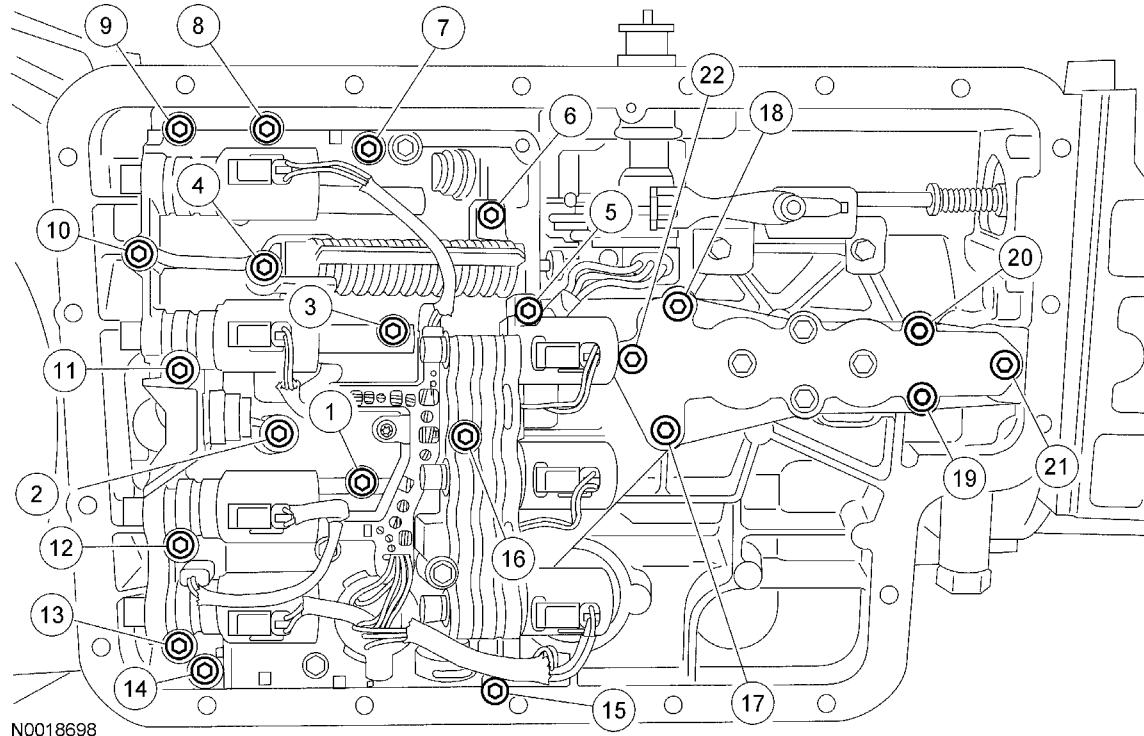
S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.
Follow all warnings, cautions, and notes.

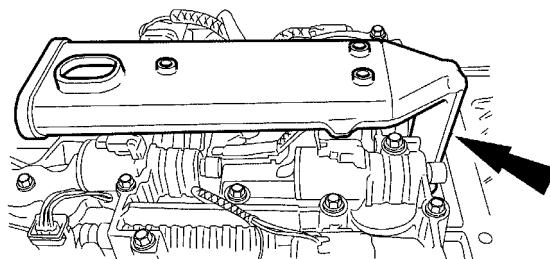
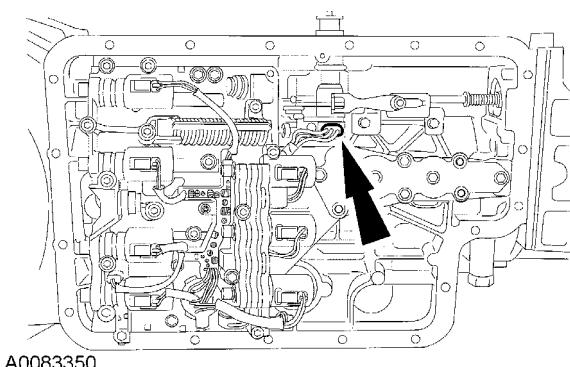
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54. Tighten all the bolts in the sequence shown.

- Tighten to 13 Nm (10 lb-ft).



55. Connect the TR sensor connector.



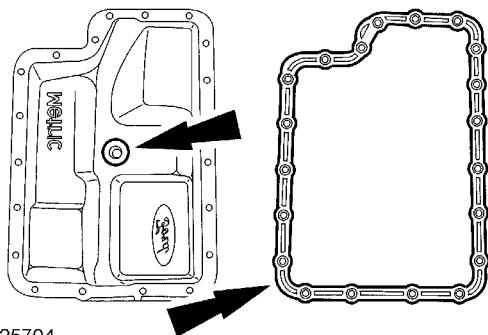
A0055969

NOTE: Prior to installing the fluid filter, make sure that the old seal is not stuck in the case.

56. Install a new transmission fluid filter.

NOTE: Reuse the fluid pan gasket unless it is damaged.

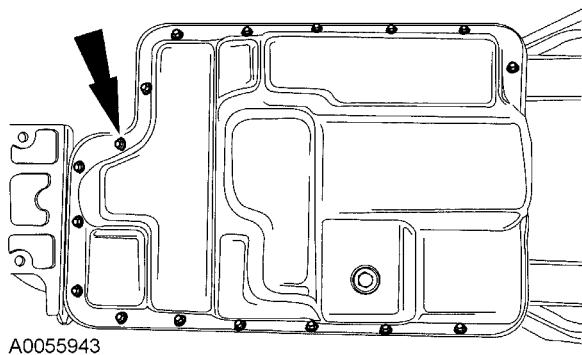
57. Install the transmission fluid pan gasket to the fluid pan. Make sure the magnet is positioned over the dimple in the fluid pan.



NOTE: Tighten all the transmission fluid pan bolts in a crisscross pattern.

58. Install the fluid pan gasket and fluid pan.

- Tighten to 15 Nm (11 lb-ft).



59. Install the intermediate shaft and turbine shaft combination speed sensor.

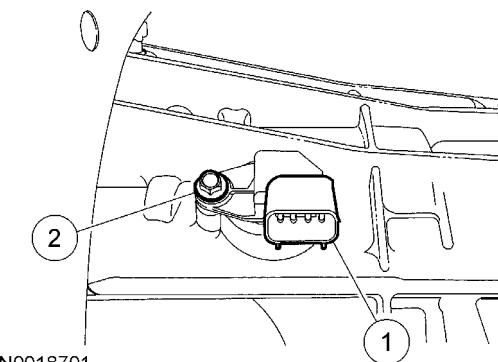


Figure 451

1. Lubricate the O-ring seal with clean automatic transmission fluid and install the intermediate shaft and turbine shaft combination speed sensor.
2. Install the bolt.
 - a. Tighten to 9 Nm (80 lb-in).

60. Install the output shaft speed (OSS) sensor.

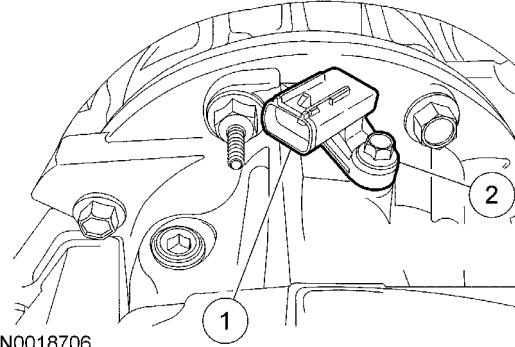


Figure 452

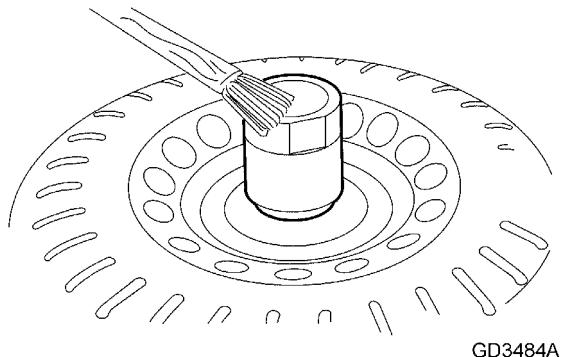
1. Lubricate the O-ring seal with clean automatic transmission fluid and install the OSS sensor.
2. Install the bolt.
 - a. Tighten to 9 Nm (80 lb-in).

CAUTION: Do not damage the fluid pump gear O-ring when installing the 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.

61. Lubricate the converter hub with clean automatic transmission fluid.

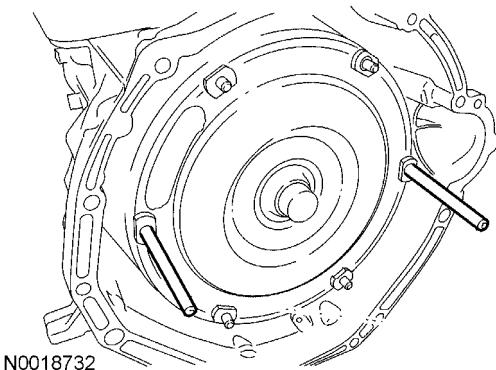


GD3484A

CAUTION: Use care when installing the torque converter to avoid damage to the front pump stator support seal.

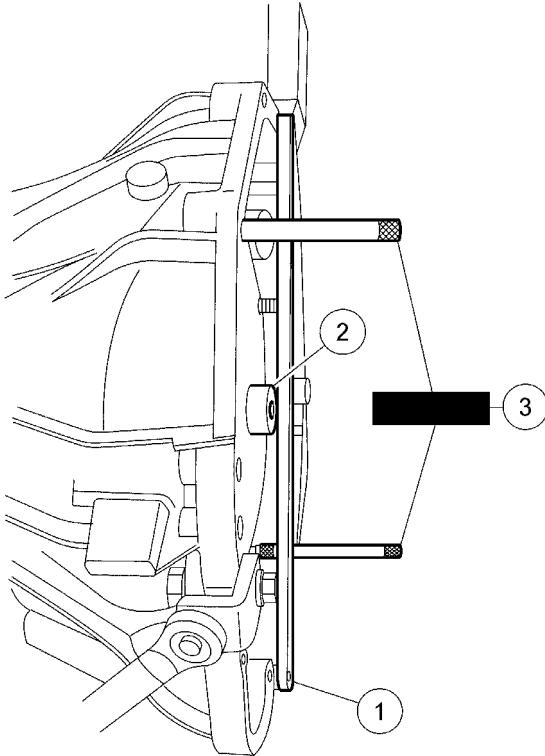
NOTE: Check the converter crankshaft pilot for nicks or damaged surfaces that can cause interference when installing the transmission to the engine. Check the converter impeller hub for nicks or sharp edges that can damage the pump seal.

62. Using the special tools, install the torque converter. Push and rotate the converter onto the front pump assembly until it bottoms out.



N0018732

63. Check the seating of the torque converter.

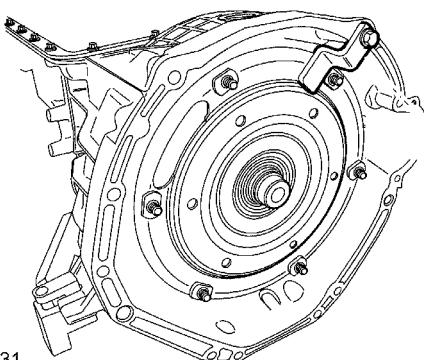


N0018779

Figure 455

1. Place the straightedge across the converter housing.
2. Make sure there is a gap between the converter pilot face and the straightedge.
3. Remove the special tools.

64. Use the special tool to hold the torque converter in place when installing the transmission.

**Installation****Transmission****Table 149 Special Tools**

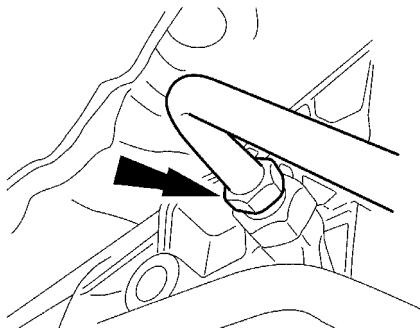
	Retainer, Torque Converter ZTSE9109
ST1636-A	

CAUTION: Prior to installation of a new or overhauled transmission, the fluid cooler tubes must be cleaned, otherwise transmission failure can occur.

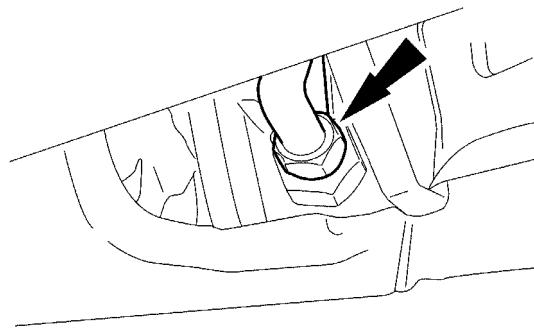
NOTE: Prior to installation of a new or overhauled transmission, install a new remote filter element. For additional information, refer to Transaxle/Transmission Cooling(Transaxle / Transmission Cooling, page 299).

1. Position the transmission fluid remote filter on the transmission and install the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

2. While holding the case fitting, connect the front fluid cooler tube.
 - Tighten to 40 Nm (30 lb-ft).

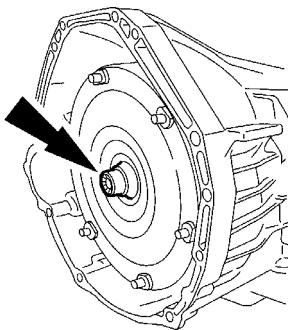


3. While holding the case fitting, disconnect the rear fluid cooler tube.
 - Tighten to 40 Nm (30 lb-ft).



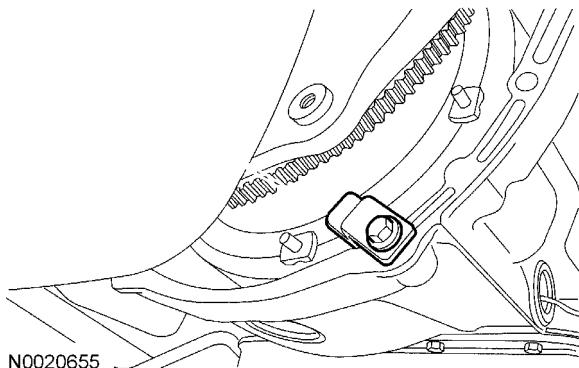
CAUTION: Prior to installing the transmission, the torque converter pilot hub must be lubricated or damage to the torque converter or engine crankshaft can occur.

4. Lubricate the torque converter pilot hub with multi-purpose grease.



A0055970

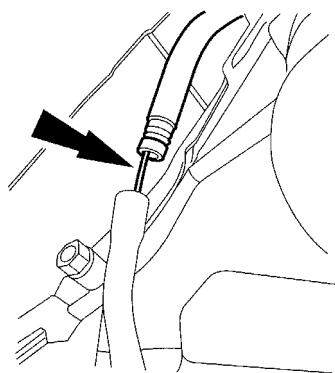
5. Install the special tool if not done during the assembly process.



N0020655

6. Position the transmission in place. While raising the transmission up into the engine compartment, align the fluid filler tube with the stub tube using the fluid level indicator as a guide.

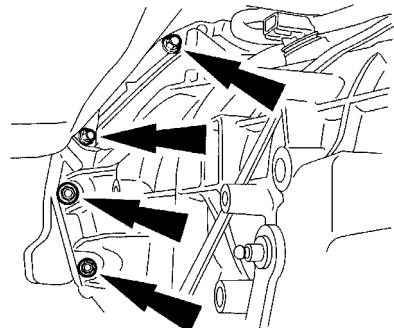
While installing the transmission to the engine, align the torque converter studs with the mounting holes in the flexplate.



A0057721

7. Install the 9 transmission-to-engine retaining bolts.

- Tighten to 47 Nm (35 lb-ft).

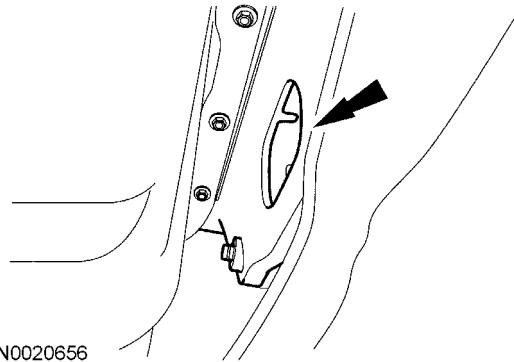


A0055920

NOTE: Using a suitable strap wrench, rotate the crankshaft pulley to gain access to the torque converter nuts.

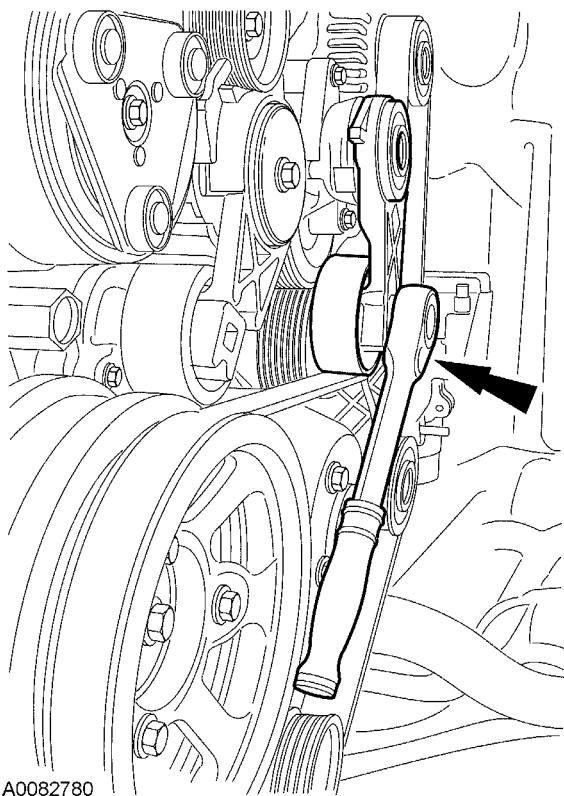
8. Install the 6 torque converter nuts.

- Tighten to 35 Nm (26 lb-ft).



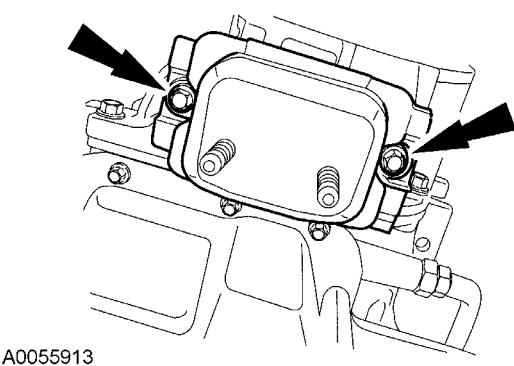
N0020656

9. If equipped with dual generators, rotate the tensioner and install the outer accessory drive belt onto the crankshaft pulley.

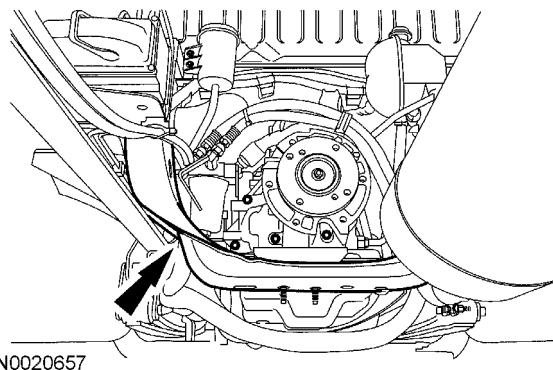


10. Install the rear transmission support.

- Tighten to 94 Nm (69 lb-ft).

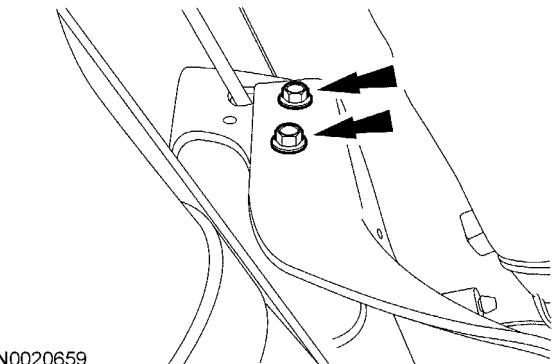


11. Position the crossmember in place.



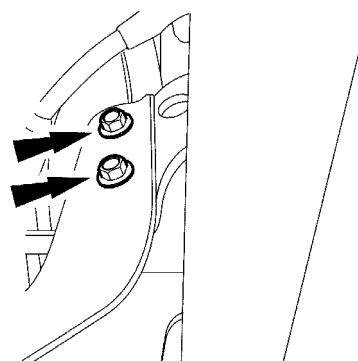
12. Install the 4 RH crossmember bolts and nuts.

- Tighten to 81 Nm (60 lb-ft).



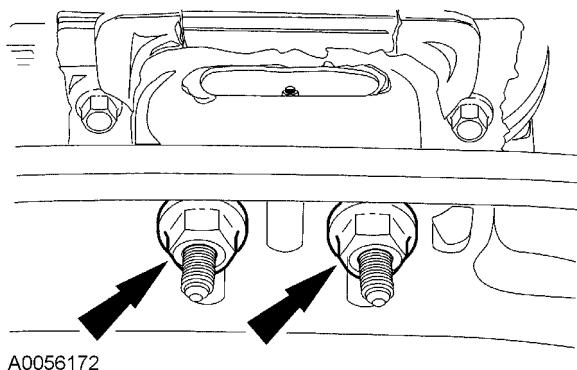
13. Install the 4 LH crossmember bolts and nuts.

- Tighten to 81 Nm (60 lb-ft).



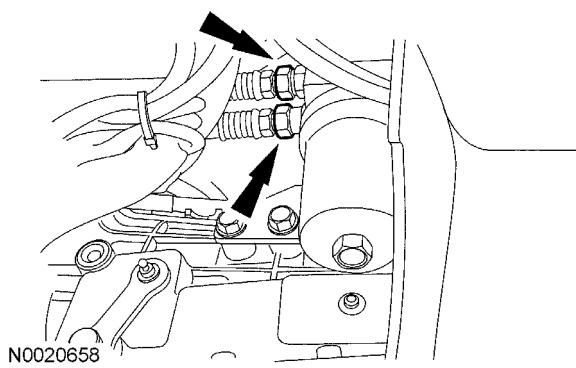
14. Install the 2 crossmember nuts.

- Tighten to 94 Nm (69 lb-ft).



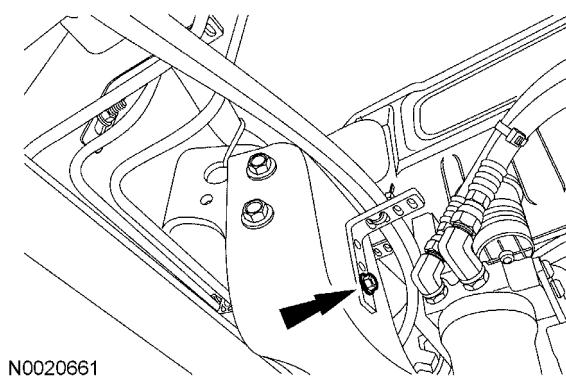
15. Connect the 2 transmission fluid cooler lines to the fluid filter.

- Tighten to 40 Nm (30 lb-ft).

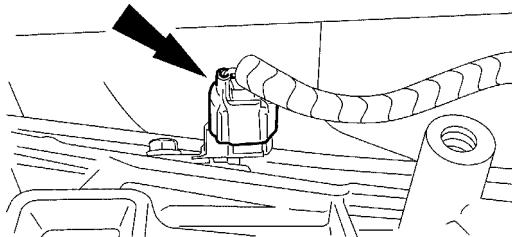


16. Install the fuel line bracket to the LH side of the crossmember and install the bolt.

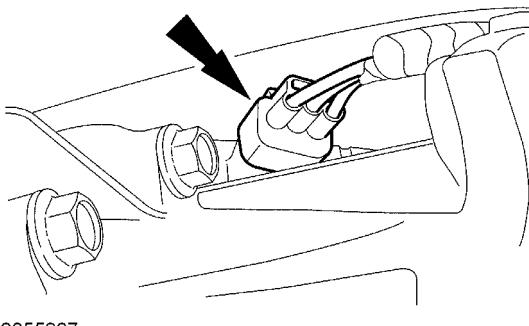
- Tighten to 25 Nm (18 lb-ft).



17. Connect the turbine shaft speed (TSS) and intermediate shaft speed combination sensor electrical connector.

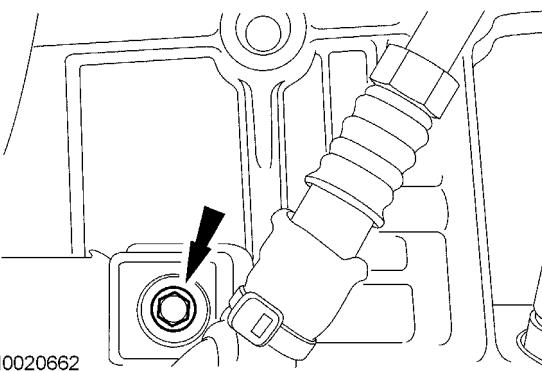


18. Connect the output shaft speed (OSS) sensor electrical connector.



19. Connect the solenoid body electrical connector.

- Tighten to 5 Nm (44 lb-in).



20. Connect the shift cable.

- Tighten to 5 Nm (44 lb-in).

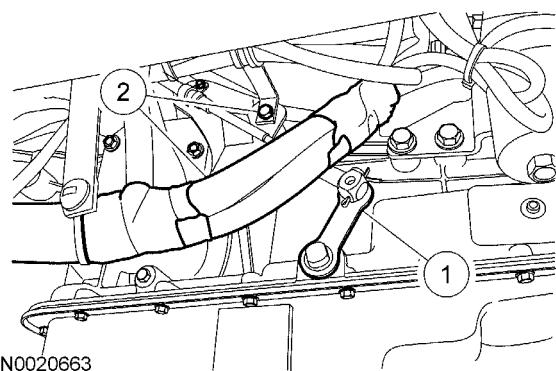


Figure 475

- Install the shift cable end to the manual lever and install the cotter pin.
- Install the shift cable bracket and install the 2 bolts.
 - Tighten to 25 Nm (18 lb-ft).

21. Install the rear driveshaft. For additional information, refer to Driveshaft in S06002.

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

23. For vehicles equipped with a power takeoff (PTO) assembly, prior to installing the transmission, the PTO assembly must be flushed and cleaned to remove any foreign material. Failure to remove foreign material from the PTO assembly may result in subsequent transmission concerns.

Transaxle / Transmission Cooling

Specifications

NOTE: Use only MERCON® SP Transmission Fluid in the transmission. Mixing MERCON® or MERCON® V in a transmission may cause internal transmission damage. Use of any fluid other than the recommended fluid can cause internal transmission damage.

Table 150 Torque Specifications

Description	Nm	Ibf-ft	lb-in
Fluid cooler inlet tube-to-case	40	30	—
Fluid cooler outlet tube-to-case nut	40	30	—
Fluid cooler tubes-to-remote filter inlet nut	40	30	—
Fluid cooler tubes-to-remote filter outlet nut	40	30	—
Cooler tube bracket nuts-to- engine studs	27	20	—
Transmission fluid cooler hose bracket nuts	10	—	89
Transmission fluid cooler fitting	60	44	—
Transmission to-bellhousing bolt	47	35	—

Description and Operation

Transmission Cooling

The automatic transmission fluid cooling system consists of:

- an in-tank fluid cooler inlet tube.
- a non-repairable radiator in-tank transmission fluid cooler.
- an in-tank fluid cooler outlet tube.
- separate fluid cooler hoses.
- a fluid cooler return tube.
- hose clamps.
- a remote mount fluid filter and bracket.

The transmission fluid flows from the transmission front fitting, to the transmission remote filter, to the in-tank transmission fluid cooler, back to the remote filter and then returns to the transmission rear fitting.

For fluid cooler flow testing and backflushing and cleaning procedures, refer to Automatic

Transaxle/ Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1)

Diagnosis and Testing

Transmission Cooling Inspection and Verification

CAUTION: When internal wear or damage occurs in the transmission, component material can travel into the fluid cooler tubes and the in-tank transmission fluid cooler. Remove these contaminants from the cooling system before placing the transmission back into use. Refer to Automatic Transaxle/ Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1)

NOTE: When internal wear or damage occurs in the transmission, metal particles, clutch plate material and band material can travel into the torque converter, the fluid cooler tubes and the in-tank transmission fluid cooler. These contaminants are a major cause of recurring transmission concerns. To prevent future concerns, remove these contaminants from the cooling system before placing the transmission back into use.

1. Clean the contaminants from the transmission fluid cooling system. Carry out the following:

- Transmission fluid cooler-backflushing and cleaning.
- Torque converter flushing.
- Torque converter cleaning and inspection.

Also carry out the transmission fluid cooler flow test. Refer to Automatic Transaxle/ Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1)

2. Visually inspect for obvious signs of mechanical damage, incorrect component installation and system leaks. Repair as necessary.

- Install a new or remanufactured radiator when fluid is found leaking from the in-tank transmission fluid cooler. Refer to the Engine Operation and Maintenance Manual.

If the fault is not visually evident, GO to Symptom Chart.

Symptom Chart**Table 151 Symptom Chart**

Condition	Possible Sources	Action
Transmission overheating	<ul style="list-style-type: none"> A. Excessive vehicle or towing loads, severe vehicle use. B. Incorrect fluid level. C. Fluid condition. D. Incorrect fluid type. E. Transmission cooling system damaged, blocked, restricted or installed incorrectly. F. System leaks. G. Engine overheating. H. Engine control system electrical inputs/outputs, vehicle wiring harnesses, engine control module (ECM), torque converter clutch (TCC) solenoid. I. Internal transmission concerns. 	<ul style="list-style-type: none"> A. REFER to the vehicle specification manual for load and GVW/GCW information. REFER to the Owner's Guide. B. CHECK and, if necessary, ADJUST the fluid to the correct level. REFER to Automatic Transaxle/Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1) C. Check fluid condition. REFER to Automatic Transaxle/Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1) D. REFER to Specifications in this section. E. CARRY OUT the transmission fluid cooler flow test. REFER to Automatic Transaxle/Transmission — 5R110.(Automatic Transaxle/Transmission — 5R110, page 1) F. REFER to Automatic Transaxle/Transmission — 5R110 (Automatic Transaxle/Transmission — 5R110, page 1) for leakage inspection procedures. G. REFER to the Engine Operation and Maintenance manual. H. CARRY OUT on-board diagnostics. REFER to the engine manual EGES-305 and Automatic Transaxle/ Transmission — 5R110 (Automatic Transaxle/Transmission — 5R110, page 1) I. REFER to Automatic Transaxle/Transmission — 5R110 (Automatic Transaxle/Transmission — 5R110, page 1)
Fluid leak at transmission in-tank cooler	Transmission fluid cooler to fluid cooler fitting.	REFER to component test in this section.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Component Test

Transmission Fluid Cooler Leaks at Radiator

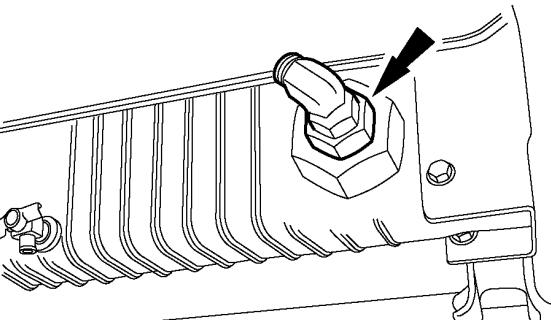
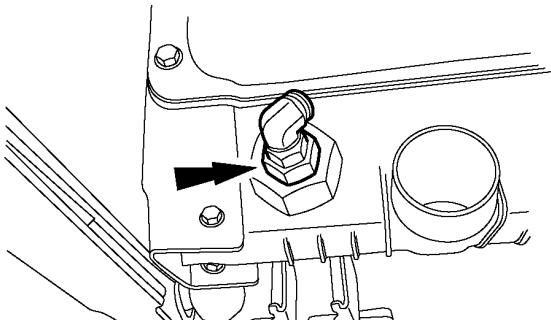
Transmission fluid may leak between the radiator transmission fluid cooler and the transmission fluid cooler fitting (not the cooler tube into the fitting), which may result in a residue of transmission fluid on the radiator tank around the fluid cooler fitting. Insufficient thread sealer on the transmission fluid cooler fitting may cause this.

1. Clean the area around the transmission fluid cooler fittings.

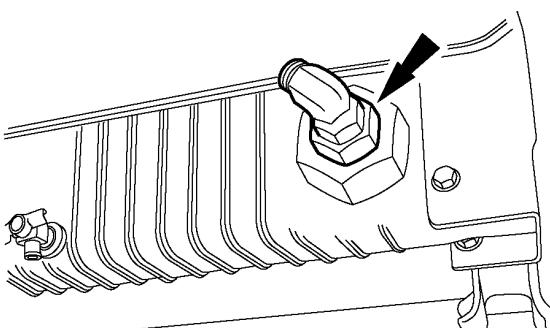
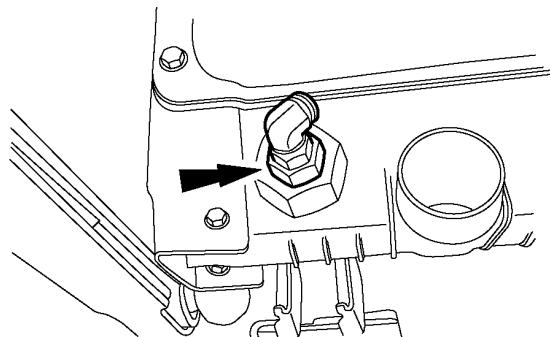
refer to the Engine Operation and Maintenance manual.

CAUTION: Oil-based solvents and cleaners should not be used when cleaning the radiator. Oil-based solvents and cleaners can damage the radiator end tank seals and cause leaks.

4. Clean the area around the transmission fluid cooler fittings so that contaminants do not enter the transmission fluid cooler when the transmission fluid cooler fittings are removed.



N0024560



N0024560

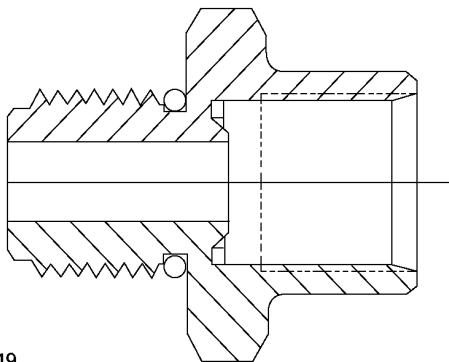
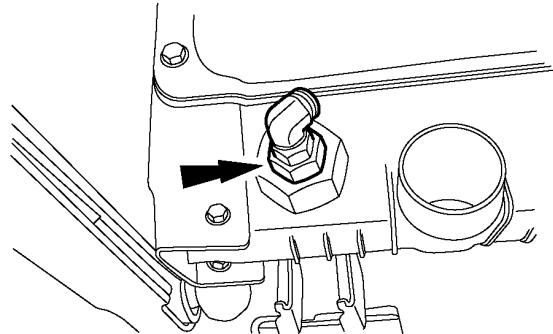
2. Verify that transmission fluid is leaking between the transmission fluid cooler and the transmission fluid cooler fitting (not the transmission fluid cooler tube fitting into the transmission fluid cooler fitting).
3. Remove the radiator from the vehicle and place it on a flat surface with the transmission fluid cooler fittings facing upward. For additional information,

NOTE: Remove only one transmission fluid cooler fitting at a time, otherwise the cooler may drop into the radiator.

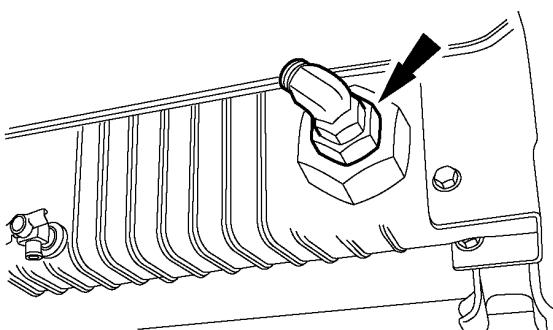
5. Remove the upper transmission fluid cooler fitting.
6. Once the fitting is removed from the transmission fluid cooler, verify that there is a gasket between

the transmission fluid cooler and the inside of the radiator tank.

- If there is no gasket, install a new radiator.
 - If there is a gasket, proceed to the next step.
7. Inspect the transmission fluid cooler fitting threads for damage.
- If the threads are damaged, install a new radiator.
 - If the threads show no sign of damage, proceed to the next step.



A0082149



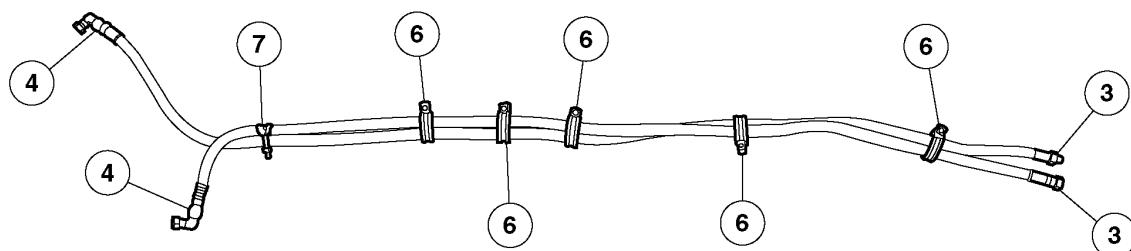
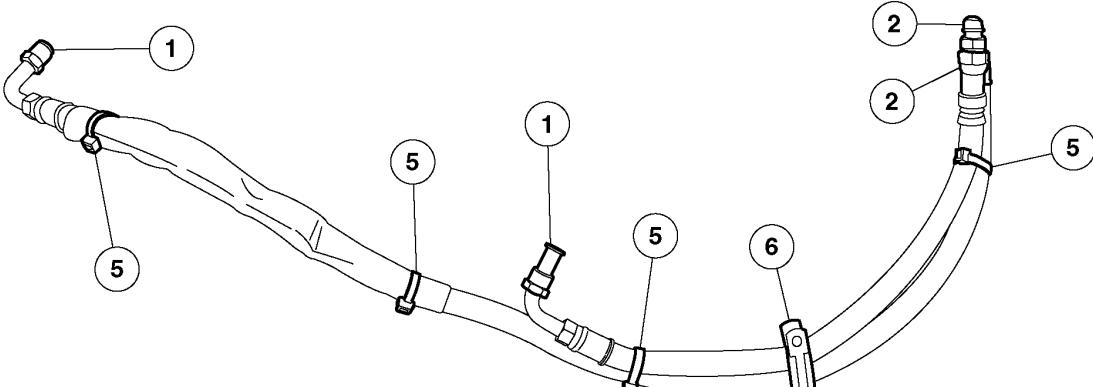
N0024560

CAUTION: Thread sealant or tape should never be used on the threads of the transmission fluid cooler fittings. The use of such materials will create a leak path.

8. Install a new O-ring on the transmission fluid cooler fitting.

NOTE: Do not use air tools to tighten the transmission fluid cooler fitting. Use a hand-operated torque wrench only.

9. Making sure that the gasket between the transmission fluid cooler and the inside of the radiator tank is still in place, install the transmission fluid cooler fitting.
 - Tighten to 60 Nm (44 lb-ft).
10. Follow the procedure to install a new O-ring on the other transmission fluid cooler fitting.
11. Make sure that no radiator coolant has entered the transmission fluid cooler. Install the radiator in the vehicle.
12. Verify that both the transmission and the engine cooling system are at the correct fluid levels.

Removal and Installation**Transmission Fluid Cooler Hoses**

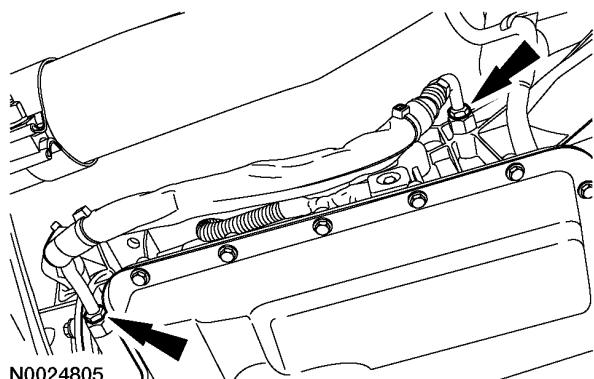
N0024814

Figure 480

- | | | |
|--|--|--------------------------|
| 1. 1. Transmission fluid cooler hose fittings | 3. 3. Front transmission fluid remote filter fittings | 5. 5. Plastic cable ties |
| 2. 2. Rear transmission fluid remote filter fittings | 4. 4. Transmission fluid cooler hose radiator fittings | 6. 6. Retaining clamps |
| | | 7. 7. Plastic retainer |

Transmission fluid cooler hoses between the remote filter and transmission

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Jacking and Lifting in S10019.
 2. While holding the case fitting, disconnect both fluid cooler tubes at the transmission.
- To install, tighten to 40 Nm (30 lb-ft).



3. Remove the nut from the cooler hose bracket at the extension housing.

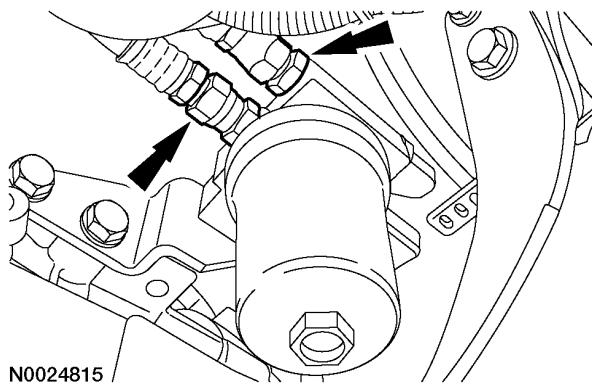
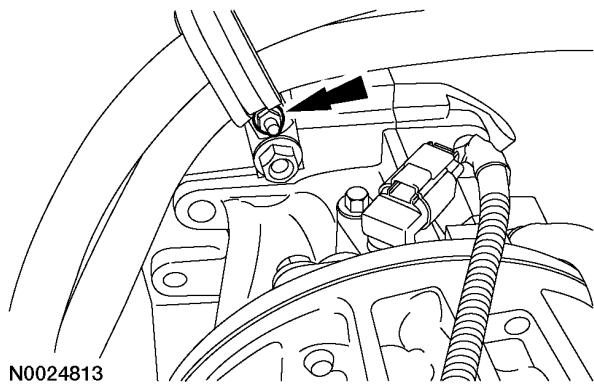
S13036

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Follow all warnings, cautions, and notes.

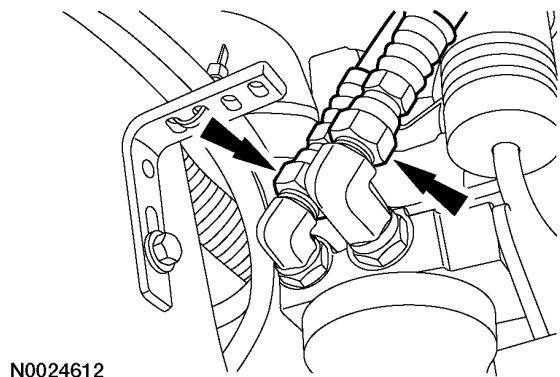
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- To install, tighten to 10 Nm (89 lb-in).



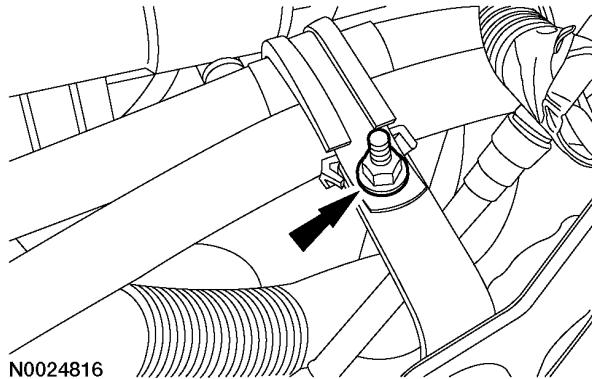
4. Disconnect the 2 transmission fluid cooler hoses from the rear of the remote filter.

 - To install, tighten to 40 Nm (30 lb-ft).



7. Remove the nut from the cooler hose bracket on the LH side of the transmission.

 - To install, tighten to 10 Nm (89 lb-in).



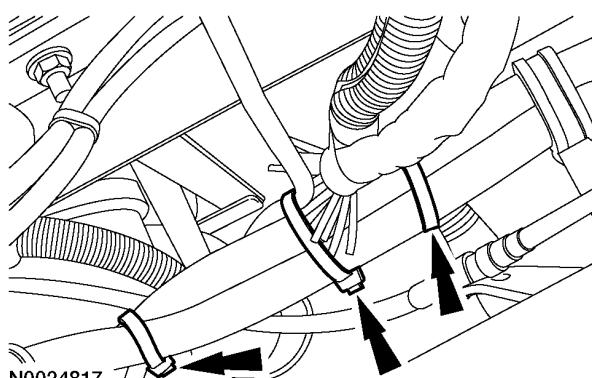
5. Remove the transmission fluid cooler hoses from the vehicle. Transfer the retaining clamps and the plastic cable ties to the new hoses.

Transmission fluid cooler hoses between the remote filter and radiator

6. Disconnect the 2 transmission fluid cooler hoses from the front of the remote filter.

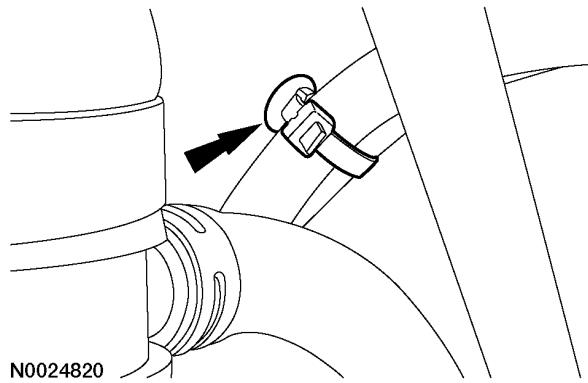
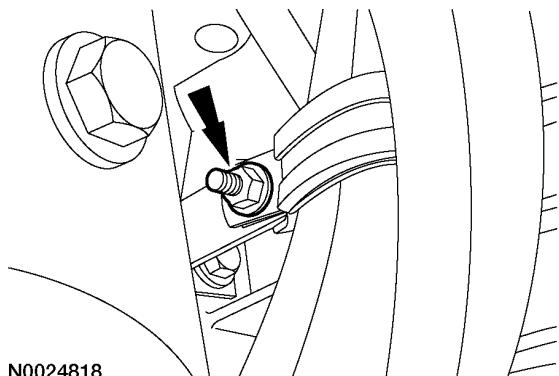
 - To install, tighten to 40 Nm (30 lb-ft).

8. Remove the 3 tie straps and position the block heater and wiring harness aside.



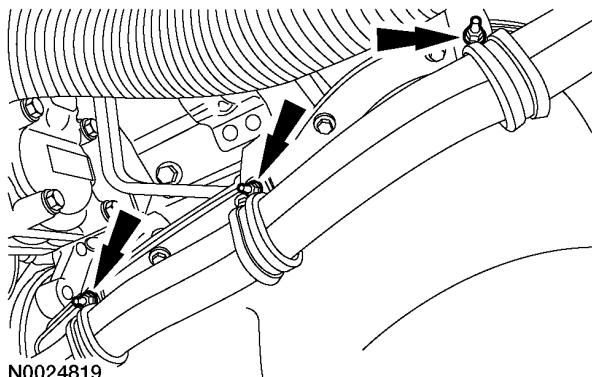
9. Remove the nut from the cooler hose bracket at the bellhousing.

- To install, tighten to 10 Nm (89 lb-in).



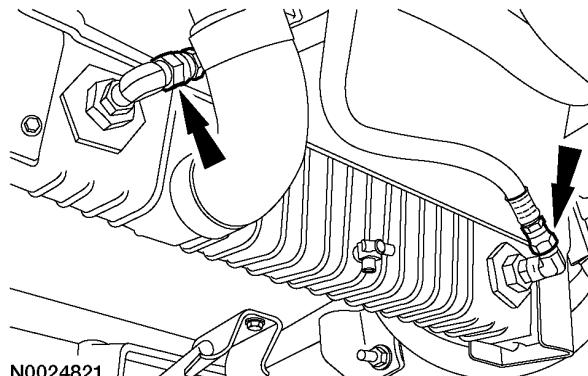
10. Remove the 3 cooler hose bracket nuts from the LH side of the engine.

- To install, tighten to 10 Nm (89 lb-in).



12. Disconnect the cooler hoses from the radiator.

- To install, tighten to 40 Nm (30 lb-ft).



11. Disconnect the cooler hose retainer from the fan shroud.

13. Remove the transmission fluid cooler hoses from the vehicle and remove all of the band clamps. Transfer the retaining clamps and the plastic cable ties to the new hoses.

All vehicles

CAUTION: Use only MERCON® SP Transmission Fluid to service transmissions. Mixing MERCON® or MERCON® V in a transmission may cause transmission damage. The use of any fluid other than the recommended fluid can cause transmission damage.

14. Fill the transmission with clean automatic transmission fluid.

15. Check for leaks.

16. To install, reverse the removal procedure.

actuator is continually on unless the brake pedal is depressed.

Tow/Haul

The Tow/Haul switch is a momentary contact switch that is located on the transmission control selector lever.

Pushing the Tow/Haul button will either disengage or engage the TOW/HAUL function of the transmission. If TOW/HAUL is engaged, the word Tow/Haul will illuminate on the dash panel.

Automatic Transaxle/Transmission External Controls

Specifications

Table 152 Torque Specifications

Description	Nm	lb-ft.	lb-in.
Selector lever cable bracket-to-shifter bolt	10	—	89
Center seat cushion	22	16	—
Selector lever cable brackets	10	—	89
Selector lever bolts	22	16	—
Park brake cable bracket bolt	10	—	89
Selector lever trim cover bolts	10	—	89
Selector lever cable lock nut	10	—	89

Description and Operation

External Controls

The transmission shift cable transfers the transmission operating mode from the gearshift lever to the automatic transmission. The indicated position of the transmission control selector lever is transferred to the transmission through the steering column shift selector tube, then to the cable and down to the manual control lever on the transmission.

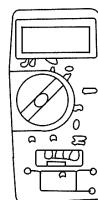
Shift Interlock System

The shift interlock system prevents the shifting from PARK unless the brake pedal is depressed. The shift interlock system consists of a shift lock actuator mounted at the base of the steering column tube. If the ignition switch is in the ON position, the shift lock

Diagnosis and Testing

Refer to the Wiring Diagrams for schematic and connector information.

Table 153 Special Tool

 ST1137-A	Digital Multimeter ZTSE4357
	EZ-Tech III

External Controls — Inspection and Verification

1. Verify the customer concern by operating the transmission external control.
2. Visually inspect for obvious signs of mechanical or electrical damage. Refer to the following chart.

Table 154 Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">• Damaged brake shift interlock actuator• Damaged transmission control switch (TCS)	<ul style="list-style-type: none">• Failed fuse(s):<ul style="list-style-type: none">— 10 (20A)— 35 (20A)• Damaged wiring harness• Loose or corroded connections

3. If the fault is not visually evident, determine the symptom. GO to Symptom Chart.

S13036

Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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Symptom Chart**Table 155 Symptom Chart**

Condition	Possible Sources	Action
The shift interlock system does not release/lock correctly	A. Circuitry. B. Fuse(s). C. Shift lock actuator. D. Brake pedal position switch.	GO to Pinpoint Test A.
The shift control is out of correct gear relationship	Transmission shift cable.	GO to Pinpoint Test B.
The transmission range indicator does not correspond to the gear	A. Transmission shift cable. B. Transmission shift cable loose from the transmission bracket. C. Shift cable adjustment incorrect.	A. INSTALL a new transmission shift cable. B. VERIFY the shift cable is seated in the transmission shift cable bracket. C. VERIFY the transmission shift cable adjustment. REFER to Selector Lever Cable Adjustment in this section.
The transmission range indicator lamp does not illuminate	A. Bulb. B. Circuitry.	REFER to Instrument Cluster and Panel Illumination in S08307.
The tow/haul switch/indicator lamp not operating correctly	A. Fuse. B. Tow/haul button. C. Transmission control module. D. Circuitry.	GO to Pinpoint Test C.
Rattle, noise, buzz or other noise	Shift control selector lever.	TIGHTEN the housing bolts.
Water enters inside the vehicle	A. Cable assembly grommet. B. Torn cable assembly grommet.	A. SECURE the grommet to dash panel. B. INSTALL new transmission shift cable.
Excessive shift effort	Transmission shift cable.	INSTALL a new transmission shift cable.
The transmission range selector lever will not shift from range	A. Transmission shift cable disconnected. B. Broken transmission shift cable.	A. REINSTALL the transmission shift cable. B. INSTALL a new transmission shift cable.

Pinpoint Tests

Table 156 PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY

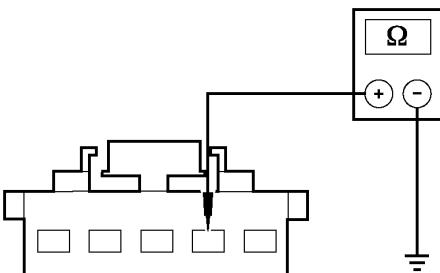
Test Step	Result / Action to Take
A1 TEST THE BRAKE LIGHTS <ul style="list-style-type: none">• Apply the brake pedal and view the brake lights. Do the brake lights illuminate?	Yes GO to A7. No GO to A2.
A2 TEST FUSE 10 (20A) <ul style="list-style-type: none">• Key in OFF position.• Check fuse: Fuse 10 (20A) Is the resistance 5 ohms or less?	Yes GO to A4. No GO to A3.
A3 TEST CIRCUIT 10 (LG/RD) FOR A SHORT TO GROUND <ul style="list-style-type: none">• Measure the resistance of circuit 10 (LG/RD) at C278 pin 4.  N0024954	Yes SERVICE circuit 10 (LG/RD) for short to ground. TEST the system for normal operation. No GO to A4.
Is the resistance 10,000 ohms or less?	

Table 156 PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY (cont.)

Test Step	Result / Action to Take
A4 TEST CIRCUIT 10 (LG/RD) FOR AN OPEN <ul style="list-style-type: none"> Measure the resistance between the output side of fuse 10 (20A) and brake pedal position switch C278 pin 4, circuit 10 (LG/RD). <p>N0024937</p> <p>Is the resistance 5 ohms or less?</p>	<p>Yes GO to A5.</p> <p>No SERVICE circuit 10 (LG/RD) for open. TEST the system for normal operation.</p>

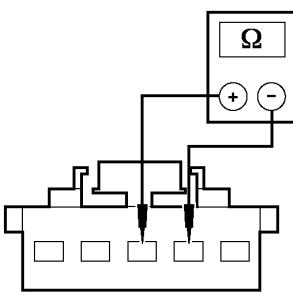
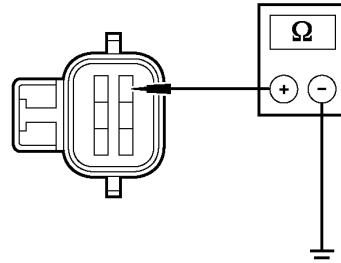
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Follow all warnings, cautions, and notes.

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Table 156 PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY (cont.)

Test Step	Result / Action to Take
A5 TEST THE BRAKE PEDAL POSITION SWITCH <ul style="list-style-type: none"> Measure the resistance of the brake pedal position switch while open (OFF) and closed (ON).  N0024951	Yes GO to A6. No INSTALL a new brake pedal position switch. TEST the system for normal operation.
Is the resistance of switch greater than 10,000 ohms while OFF and 5 ohms or less while ON?	
A6 TEST CIRCUIT 511 (LG) FOR SHORT TO GROUND <ul style="list-style-type: none"> Disconnect: Brake Pedal Position Switch C278. Measure the resistance of circuit 511 (LG), C3245 pin A.  N0024948	Yes SERVICE circuit 511 (LG) for short to ground. TEST the system for normal operation. No GO to A7.
Is the resistance 10,000 ohms or less?	

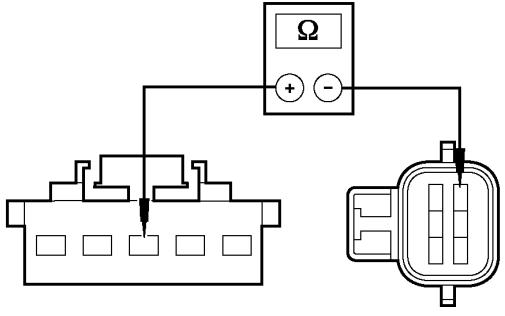
S13036

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Table 156 PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY (cont.)

Test Step	Result / Action to Take
A7 TEST CIRCUIT 511 (LG) FOR OPEN <ul style="list-style-type: none"> Measure the resistance of circuit 511 (LG) between shift lock actuator C3245 pin A and brake pedal position switch C278 pin 3.  <p>N0025081</p> <p>Is the resistance 5 ohms or less?</p>	<p>Yes GO to A8.</p> <p>No SERVICE circuit 511 (LG) for open. TEST the system for normal operation.</p>

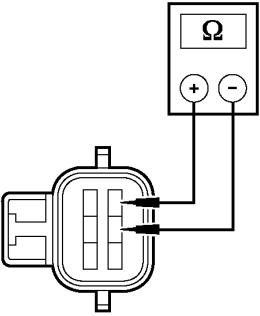
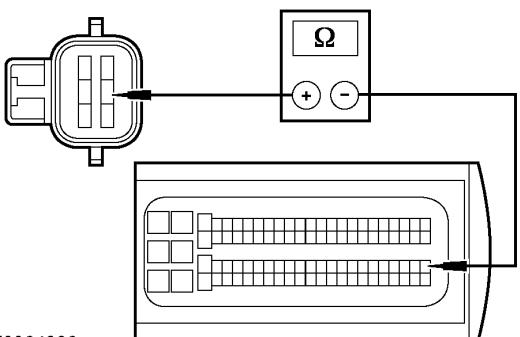
S13036

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Table 156 PINPOINT TEST A: THE SHIFT INTERLOCK SYSTEM DOES NOT RELEASE/LOCK CORRECTLY (cont.)

Test Step	Result / Action to Take
A8 TEST THE SHIFT LOCK ACTUATOR <ul style="list-style-type: none"> Measure the resistance of shift lock actuator between C3245 pin A and pin B.  N0024961	Yes GO to A9. No INSTALL a new shift lock actuator. REFER to Brake Shift Interlock Actuator in this section. TEST the system for normal operation.
Is continuity present and the resistance greater than 0 ohms?	
A9 TEST CIRCUIT 22 (LB/BK) FOR AN OPEN <ul style="list-style-type: none"> Disconnect: TCM C168. Disconnect: Selector Lever C3245 Measure the resistance of circuit 22 (LB/BK) between selector lever C3245 pin B and TCM C168 pin 72.  N0024962	Yes INSTALL a new TCM. TEST the system for normal operation. No SERVICE circuit 22 (LB/BK) for an open. TEST the system for normal operation.
Is the resistance less than 5 ohms?	

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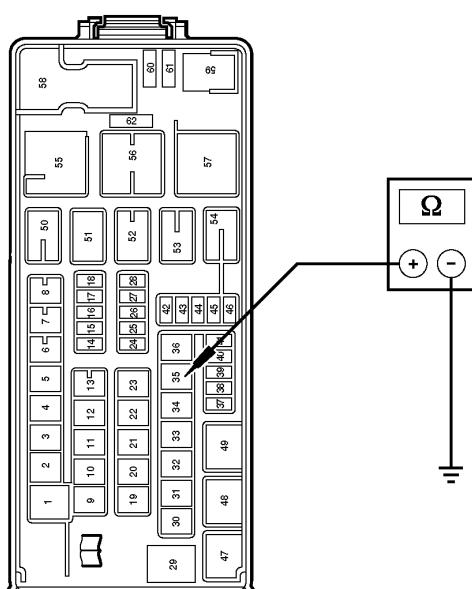
Table 157 PINPOINT TEST B: PINPOINT TEST B: THE SHIFT CONTROL IS OUT OF CORRECT GEAR RELATIONSHIP

Test Step	Result / Action to Take
B1 CHECK THE SHIFT CONTROL LINKAGE <ul style="list-style-type: none"> • Key in ON position. • Apply the brake pedal. • Gain access to the shift control linkage. • Actuate the transmission range selector lever in all ranges. • Observe all linkages during operation. Is the linkage damaged?	Yes INSTALL new shift control linkage. TEST the system for normal operation. No GO to B2.
B2 CHECK THE TRANSMISSION SHIFT CABLE <ul style="list-style-type: none"> • Check transmission shift cable and bracket installation and tightness. Is the transmission shift cable correctly installed and adjusted?	Yes VERIFY the transmission shift cable adjustment. REFER to Selector Lever Cable Adjustment in this section. ADJUST the transmission shift cable if necessary. No REPAIR as necessary. TEST the system for normal operation.

Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY

Test Step	Result / Action to Take
C1 TEST FUSE F35 (20A) <ul style="list-style-type: none"> • Key in OFF position. • Check the power distribution center fuse F35 (20A). Is the resistance less than 5 ohms?	Yes REINSTALL the fuse. GO to C3. No INSTALL a new fuse. TEST the system for normal operation. If the fuse fails again, GO to C2.

Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY (cont.)

Test Step	Result / Action to Take
C2 TEST CIRCUIT 3049 (BK/LG) FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Key in OFF position. • Measure the resistance of circuit 3049 (BK/LG) at the output side of power distribution box fuse F35 (20A).  N0024984 <p>Is the resistance greater than 10,000 ohms?</p>	<p>Yes GO to C3.</p> <p>No SERVICE circuit 3049 (BK/LG) for short to ground. TEST the system for normal operation.</p>

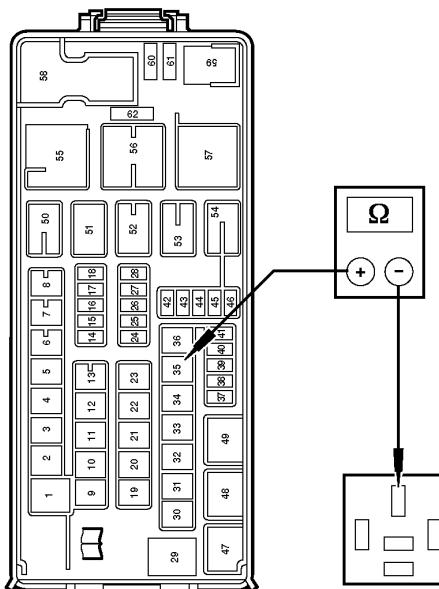
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Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY (cont.)

Test Step	Result / Action to Take
C3 TEST CIRCUIT 3049 (BK/LG) FOR AN OPEN <ul style="list-style-type: none"> Measure the resistance between output side of power distribution box fuse F35 (20A) and ignition relay pin 30 circuit 3049 (BK/LG).  <p>N0024985</p> <p>Is the resistance less than 5 ohms?</p>	Yes TEST the ignition relay. REFER to the Wiring Diagrams for component testing. GO to C4. No SERVICE circuit 3049 (BK/LG) for an open. TEST the system for normal operation.

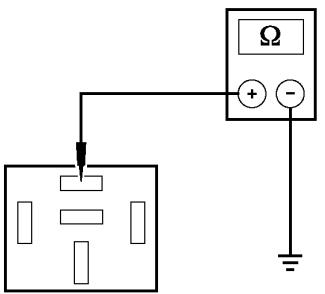
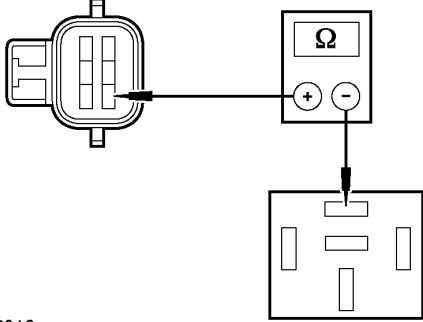
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Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY (cont.)

Test Step	Result / Action to Take
C4 TEST CIRCUIT 489 (PK/BK) FOR A SHORT TO GROUND <ul style="list-style-type: none"> • Disconnect: Ignition Relay • Disconnect: Selector Lever C3245 • Measure the resistance of circuit 489 (PK/BK) at the ignition relay pin 87.  N0024987	Yes GO to C5. No SERVICE circuit 489 (PK/BK) for a short to ground. TEST the system for normal operation.
C5 TEST CIRCUIT 489 (PK/BK) FOR AN OPEN <ul style="list-style-type: none"> • Disconnect: Ignition Relay • Disconnect: Selector Lever C3245 • Measure the resistance of circuit 489 (PK/BK) between C3245 pin C and ignition relay pin 87.  N0025019	Yes GO to C6. No SERVICE circuit 489 (PK/BK) for an open. TEST the system for normal operation.

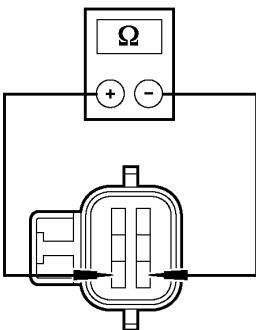
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Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY (cont.)

Test Step	Result / Action to Take
C6 TEST THE TOW/HAUL SWITCH <ul style="list-style-type: none"> • Disconnect: Selector Lever C3245 • Measure the resistance between C3245 pin C and pin D while opened and closed.  N0024989 <p>Is the resistance of the switch greater than 10,000 ohms while opened and 5 ohms or less while closed?</p>	Yes GO to C7. No INSTALL a new selector lever. TEST the system for normal operation.

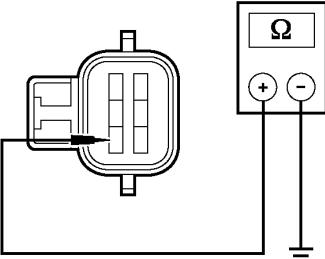
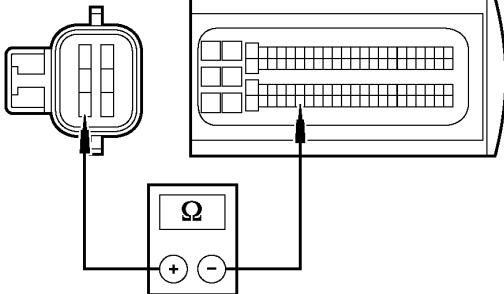
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Table 158 PINPOINT TEST C: PINPOINT TEST C: THE TOW/HAUL SWITCH/INDICATOR LAMP NOT OPERATING CORRECTLY (cont.)

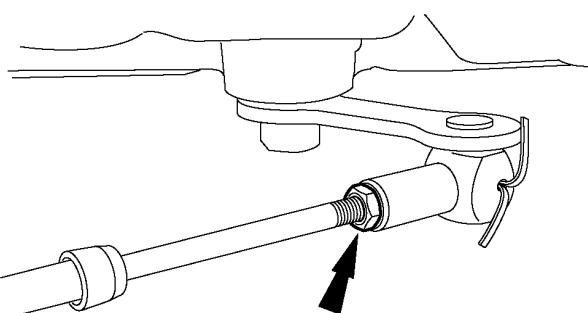
Test Step	Result / Action to Take
C7 TEST CIRCUIT 224 (TN/WH) FOR A SHORT TO GROUND <ul style="list-style-type: none"> Disconnect: Shifter Lever C3245 Disconnect: TCM C168. Measure the resistance of circuit 224 (TN/WH) at C3245 pin D.  N0024990	Yes GO to C8. No SERVICE circuit 224 (TN/WH) for a short to ground. TEST the system for normal operation.
Is the resistance greater than 10,000 ohms?	
C8 TEST CIRCUIT 224 (TN/WH) FOR AN OPEN <ul style="list-style-type: none"> Disconnect: Shifter Lever C3245 Disconnect: TCM C168. Measure the resistance of circuit 224 (TN/WH) between shifter lever C3245 pin D and TCM C168 pin 78.  N0024991	Yes INSTALL a new TCM. TEST the system for normal operation. No SERVICE circuit 224 (TN/WH) for an open. TEST the system for normal operation.
Is the resistance less than 5 ohms?	

General Procedures

Selector Lever Cable Adjustment

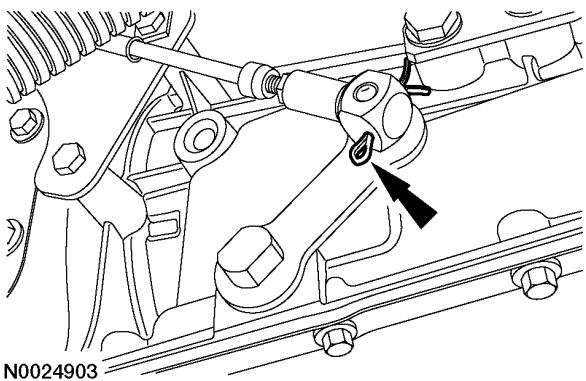
- Place the selector lever in the (D) position.
 - Place a 3-lb weight on the selector lever.

- Position the vehicle on a hoist. For additional information, refer to Jacking and Lifting in S10019.
- Loosen the lock nut on the selector lever cable.

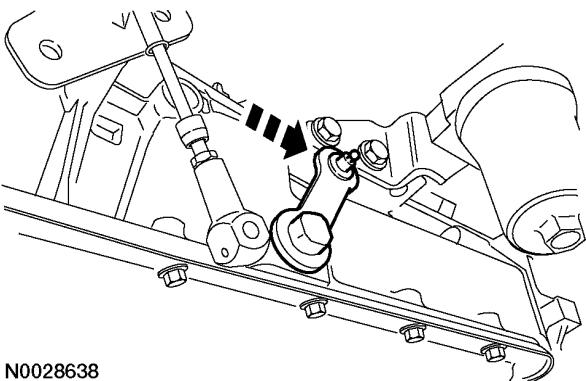


N0025063

- Remove the cotter pin and disconnect the selector lever cable from the manual lever.

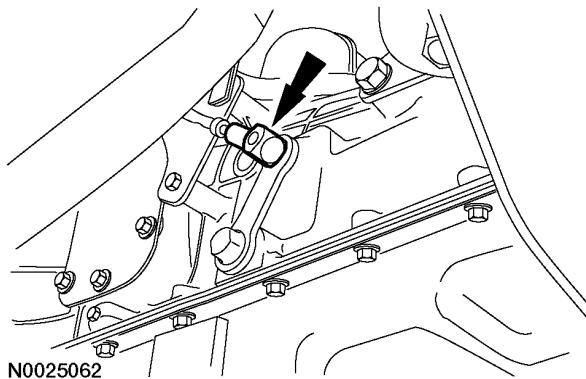


- Place the manual control lever in the (D) position.
 - Place the manual control lever in the 1st gear position.
 - Move the manual control lever 3 detents to the (D) position.



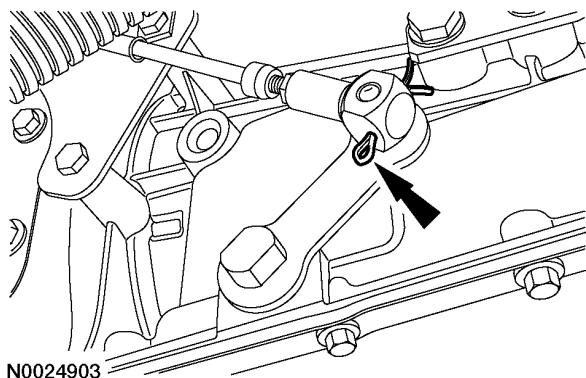
N0028638

- Adjust the selector lever cable to fit on the manual control lever by turning the cable adjuster on the cable.
 - Install the cable on the lever.



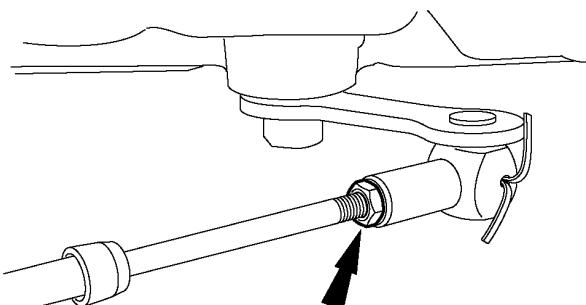
N0025062

- Install the cotter pin.



N0024903

- Tighten the lock nut to 10 Nm (89 lb-in).



N0025063

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9. Remove the 3-lb weight.
10. Carefully move the gearshift lever from detent to detent and compare with transmission settings. Verify that the vehicle will start in PARK or NEUTRAL and backup lamps illuminate in REVERSE. If not, Steps 1 through 5 must be repeated and include digital TR or TR sensor adjustment in NEUTRAL. Readjust if necessary.

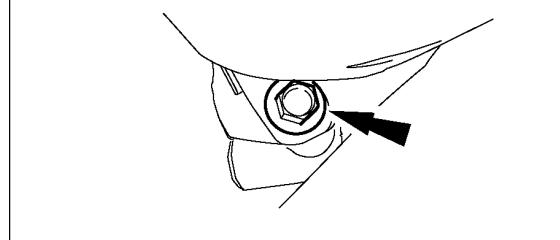
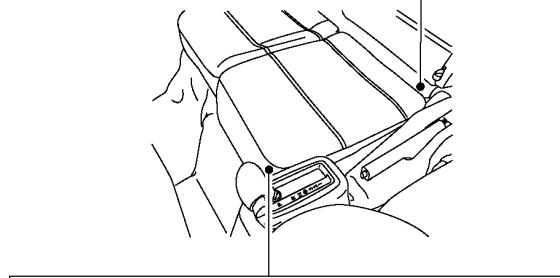
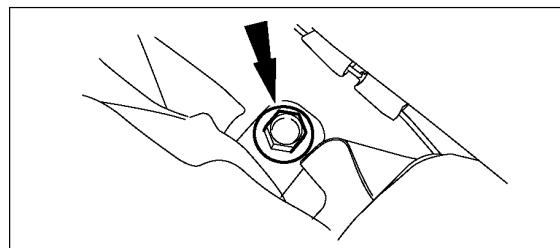
Brake Shift Interlock Override

NOTE: If it is necessary to use the override procedure to move the gearshift lever out of the PARK position, it is possible that a fuse has blown and the brake lights are not operational. Before driving the vehicle, verify that the brake lights are working.

The Low Cab Forward is equipped with a brake-shift interlock feature that prevents the gearshift lever from being moved out of PARK when the ignition is in the ON position unless the brake pedal is depressed.

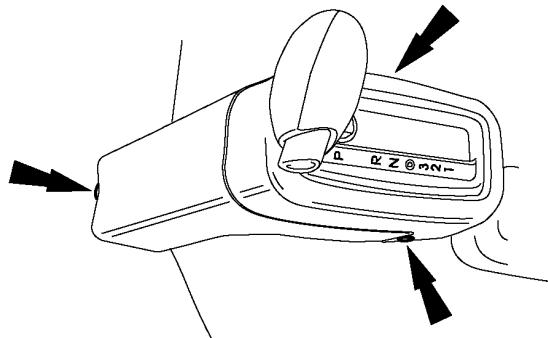
If the gearshift lever cannot be moved out of the PARK position when the ignition is in the ON position and the brake pedal is depressed:

1. Apply the parking brake and remove the ignition key.
2. Remove the 2 bolts and pull up on the front of the center seat cushion and position it aside.



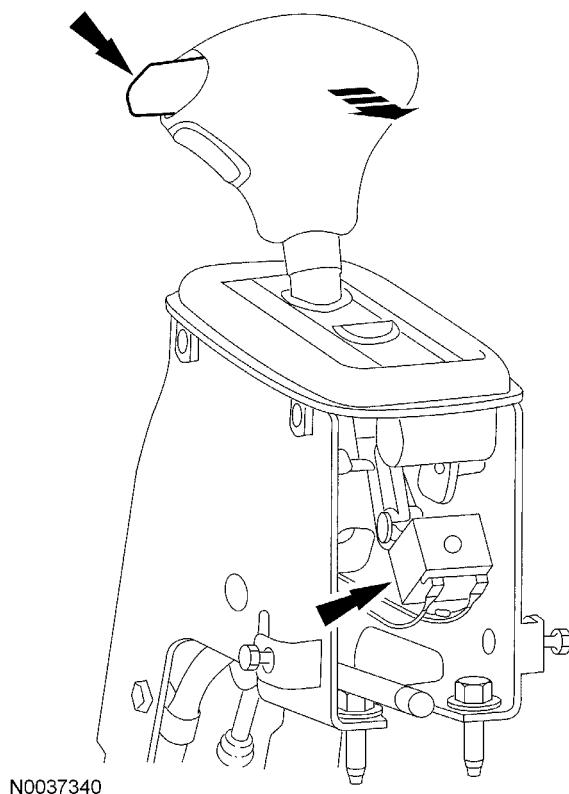
N0024907

3. Remove the 2 screws at the top of the trim cover, loosen the screw at the bottom of the trim cover and remove the selector lever trim cover.



N0024908

4. Pull back on the interlock actuator solenoid plunger, apply the brake pedal, depress the button on the shift lever and shift into NEUTRAL.

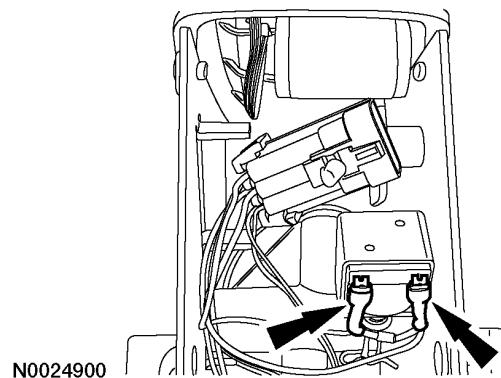


5. Start the vehicle.
6. To install, reverse the removal procedure.

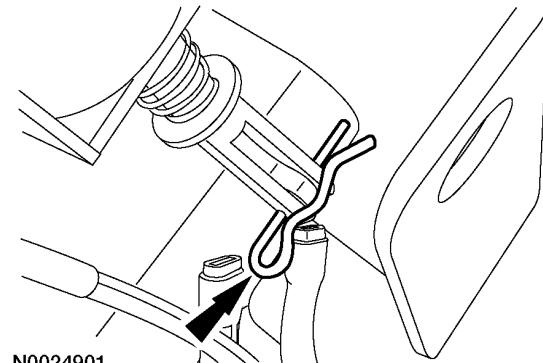
Removal and Installation

Brake Shift Interlock Actuator

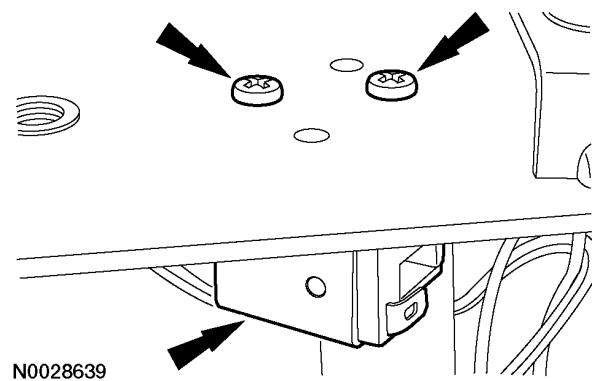
1. Remove the selector lever. For additional information, refer to Transmission Selector Lever in this section.
2. Disconnect the brake shift interlock actuator electrical connectors.



3. Remove the cotter pin.



4. Remove the 2 screws and the brake shift interlock actuator.



5. To install, reverse the removal procedure.

S13036

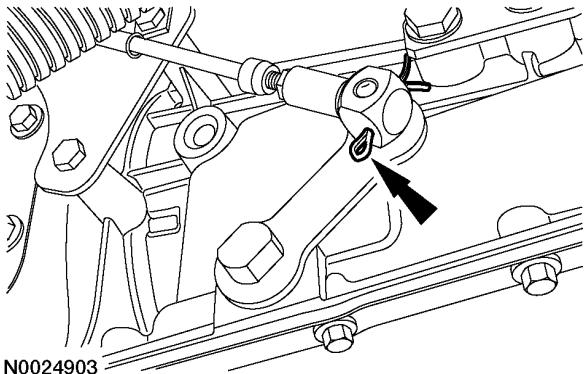
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

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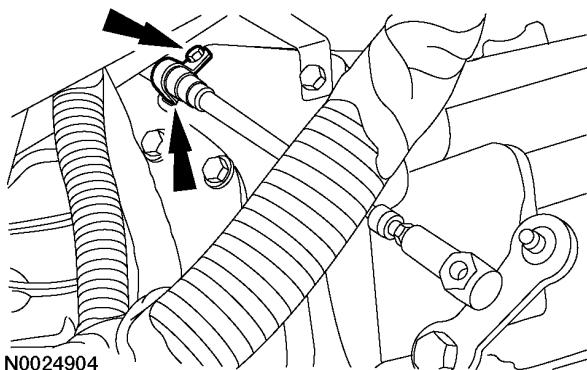
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Selector Lever Cable Removal

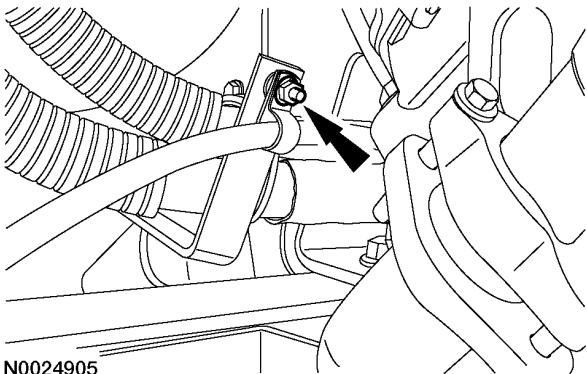
1. Remove the cotter pin from the selector lever cable at the transmission.



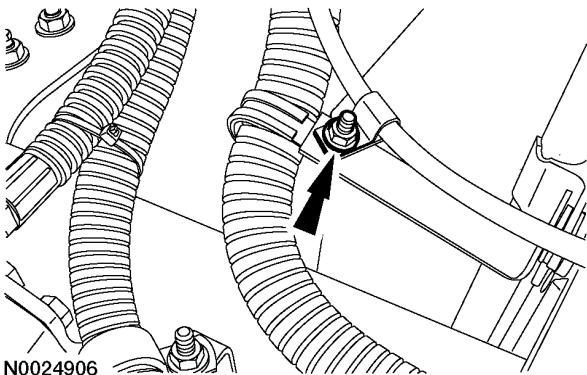
2. Remove the bolt for the selector lever cable bracket and remove the retaining bracket.



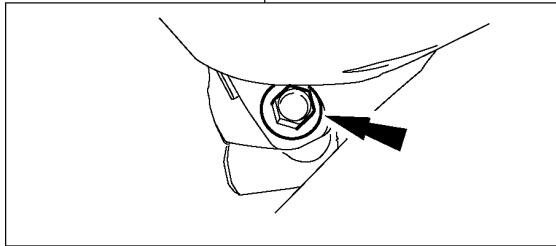
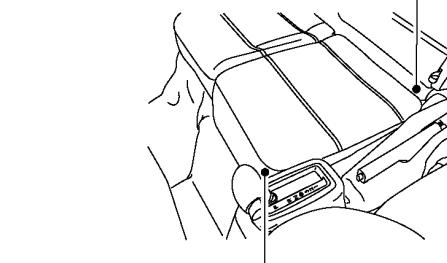
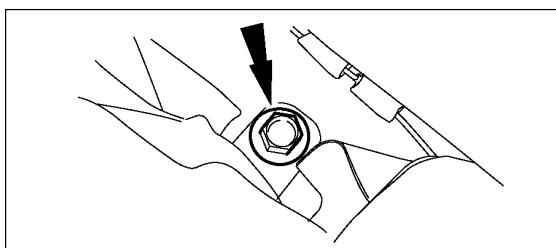
3. Remove the nut and the selector lever cable bracket.



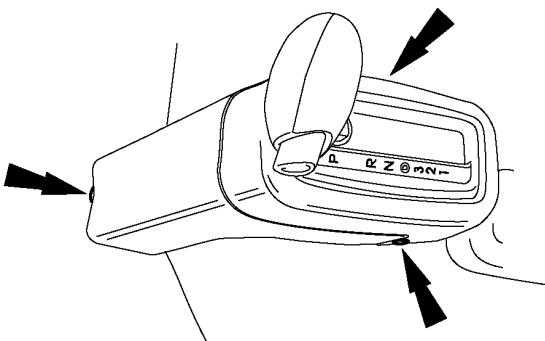
4. Remove the nut and the selector lever cable bracket.



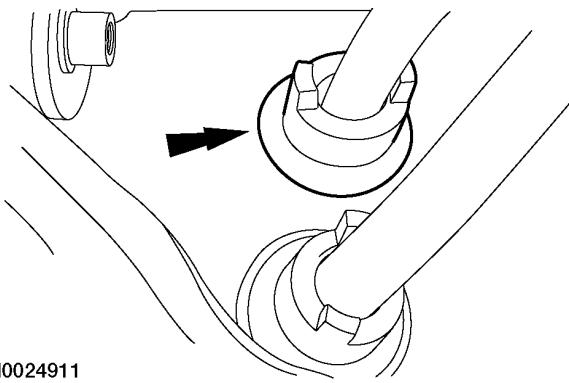
5. Remove the 2 bolts and pull up on the front of the center seat cushion. Position the cushion aside.



6. Remove the 2 screws at the top, loosen the screw at the bottom and remove the selector lever trim cover.

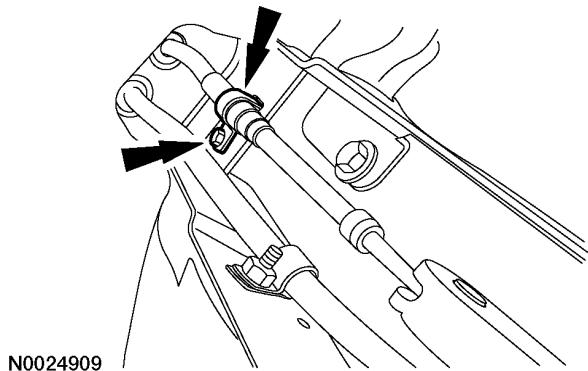


N0024908

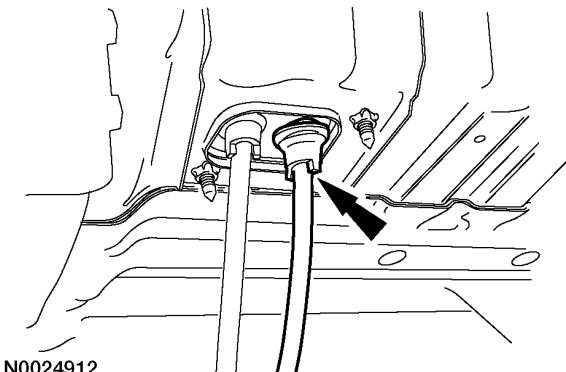


N0024911

7. Remove the selector lever cable bracket bolt and the bracket.

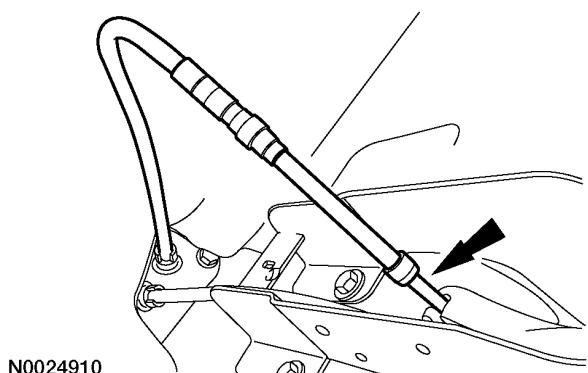


8. Pull the selector lever cable up through the floor and disconnect it from the selector lever.

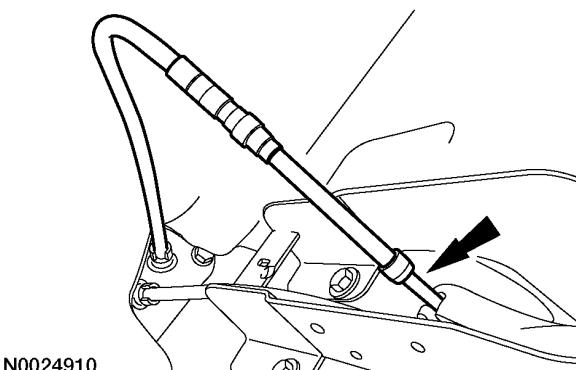


N0024912

3. Install the selector lever cable in the selector lever.



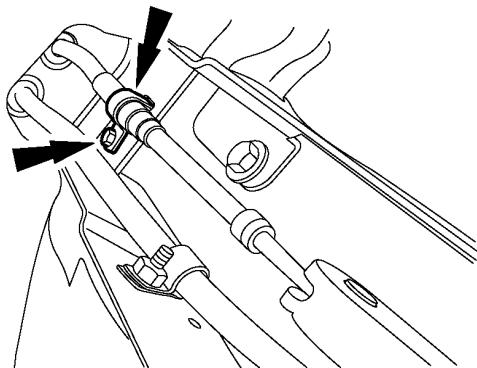
9. Push the selector lever cable and grommet through the floor and remove the selector lever cable.



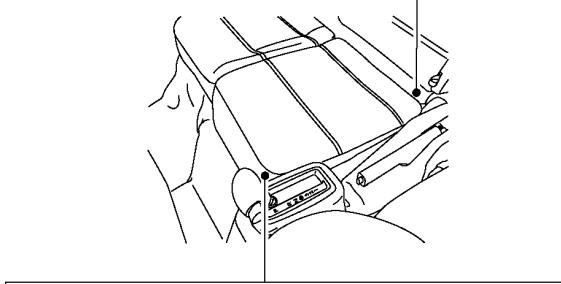
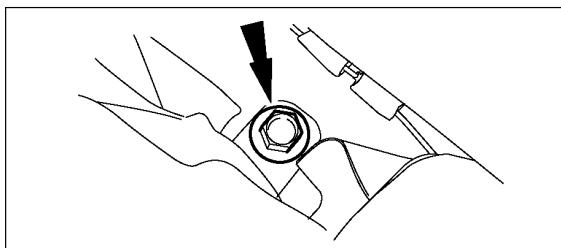
N0024910

4. Install the selector lever cable bracket and the bolt.

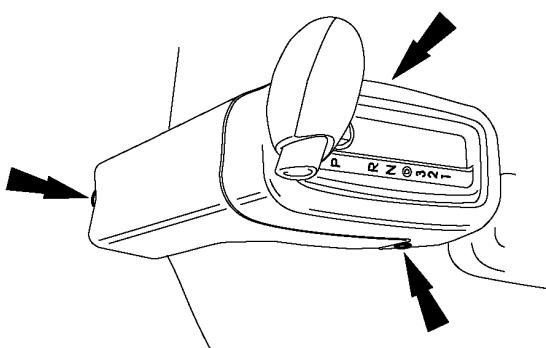
- Tighten to 10 Nm (89 lb-in).



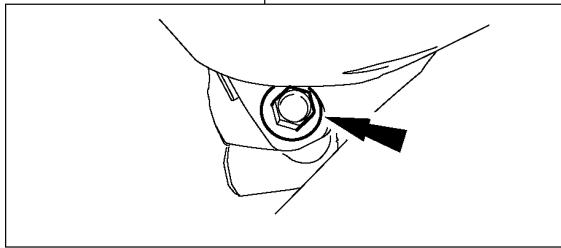
N0024909



5. Install the selector lever trim cover, install the 2 screws at the top and tighten the screw at the bottom.



N0024908



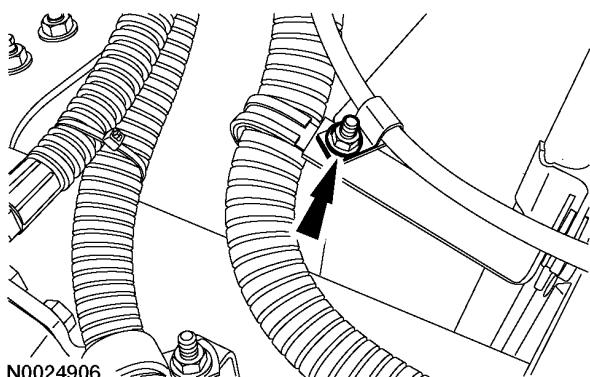
N0024907

6. Position the center seat cushion in place. Push down on the front of the cushion to clip the fastener in place and install the 2 bolts.

- Tighten to 22 Nm (16 lb-ft).

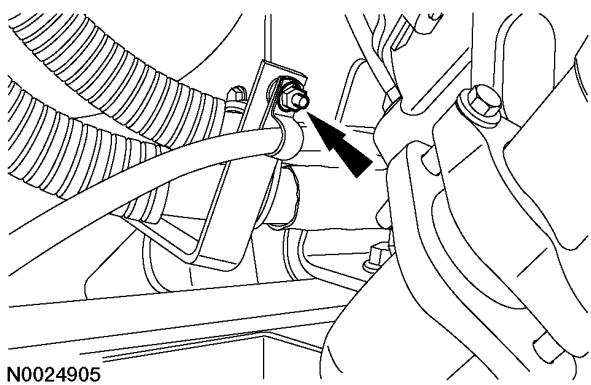
7. Install the selector lever cable bracket and the nut.

- Tighten to 10 Nm (89 lb-in).



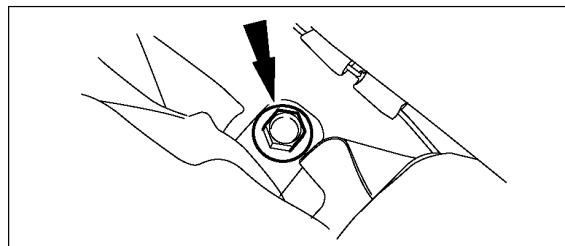
8. Install the selector lever cable bracket and the nut.

- Tighten to 10 Nm (89 lb-in).

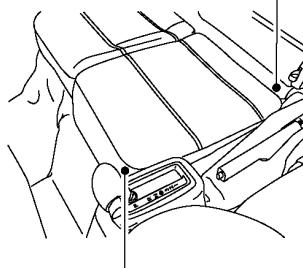
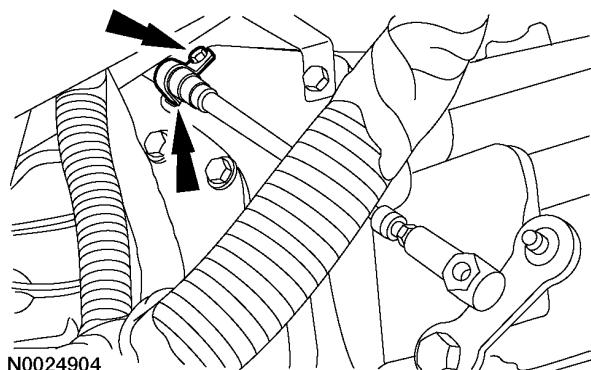


Transmission Selector Lever Removal

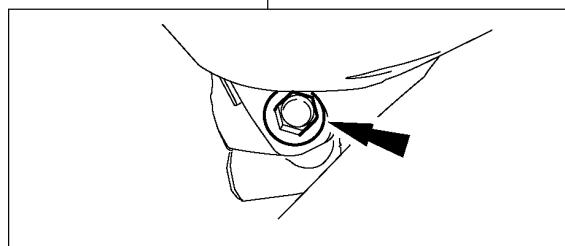
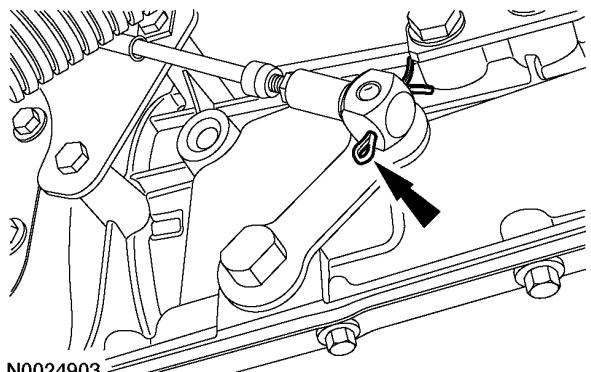
1. Remove the 2 bolts and pull up on the front of the center seat cushion and position it aside.



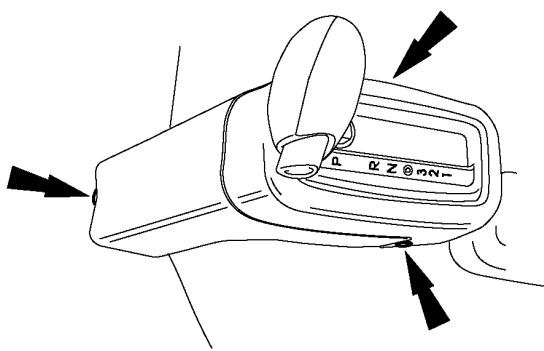
9. Install the selector lever cable retaining bracket and the bolt on the side of the transmission.
- Tighten to 10 Nm (89 lb-in).



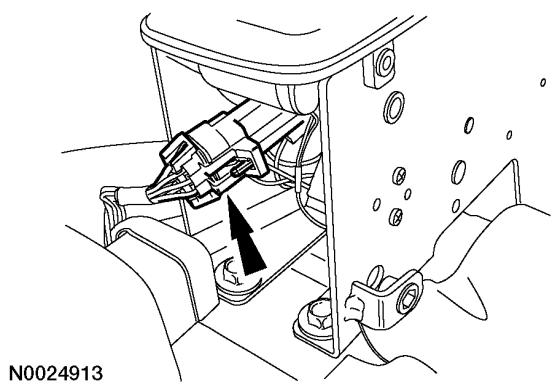
10. Position the selector lever cable on the shift lever at the transmission and install the cotter pin. Adjust the selector lever cable. For additional information, refer to Selector Lever Cable Adjustment in this section.



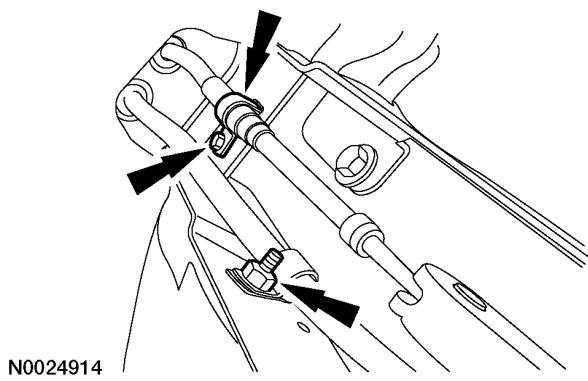
2. Remove the 2 screws at the top of the trim cover, loosen the screw at the bottom of the trim cover and remove the selector lever trim cover.



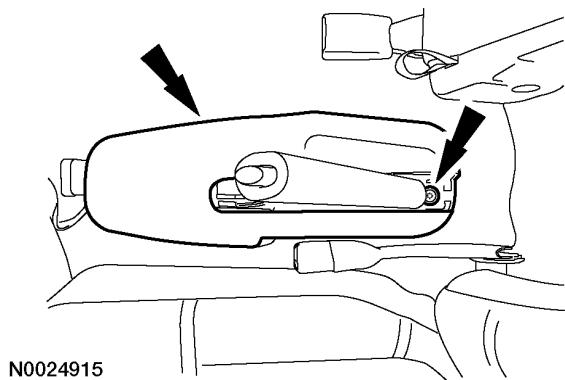
3. Disconnect the electrical connector.



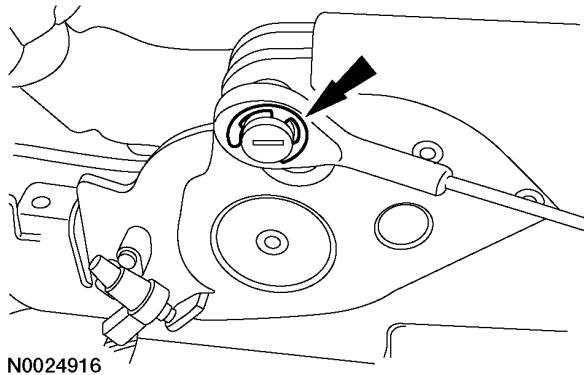
4. Remove the selector lever cable bracket bolt and bracket, and the park brake cable bracket nut and bolt.



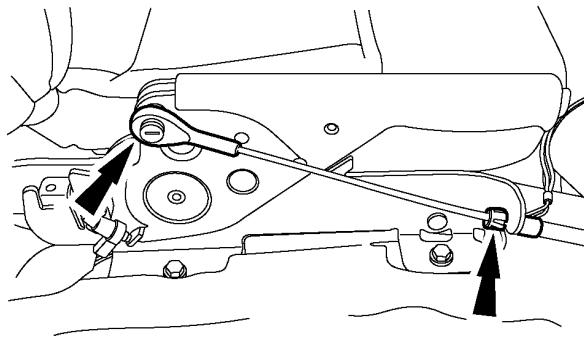
5. Pull back on the park brake, remove the park brake trim panel screw and the trim panel and release the park brake.



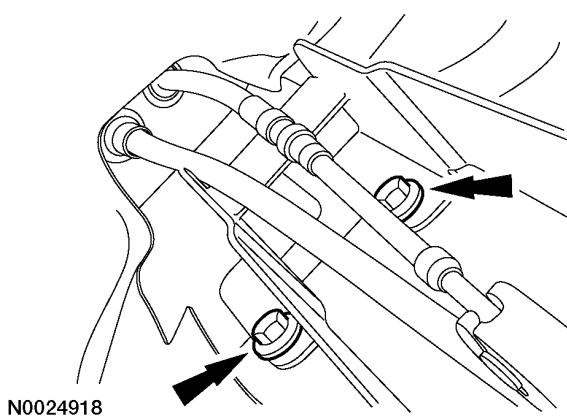
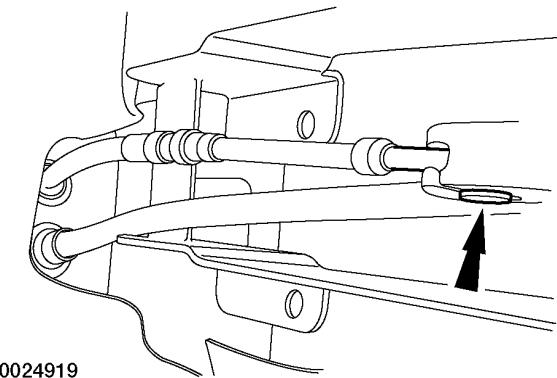
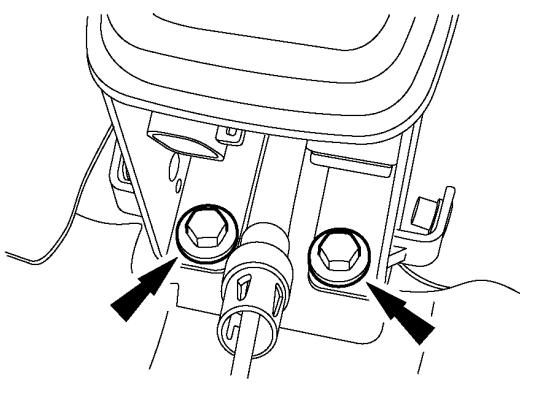
6. Remove the park brake cable E-clip.



7. Remove the park brake cable from the park brake lever and bracket.



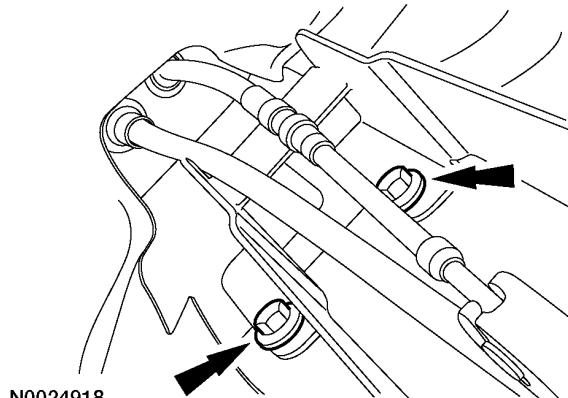
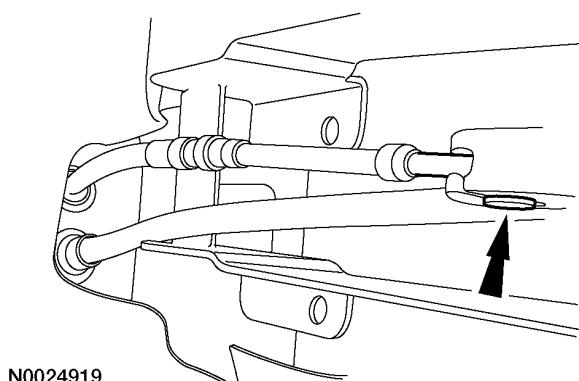
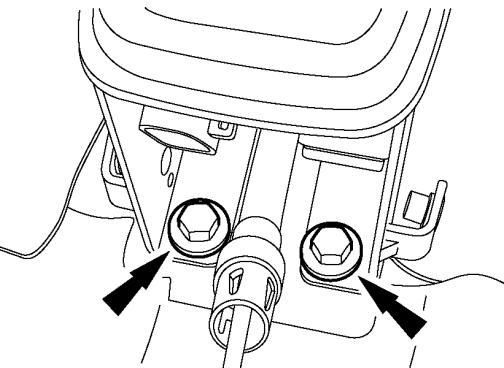
8. Remove the 4 transmission selector lever bolts.



9. Disconnect the selector lever cable from the selector lever and remove the selector lever.

2. Install the shift selector lever bolts.

- Tighten to 22 Nm (16 lb-ft).



Transmission Selector Lever Installation

1. Route the park brake cable through the shift selector lever. Connect the shift cable end onto the shift selector lever and position the shift selector lever in place.

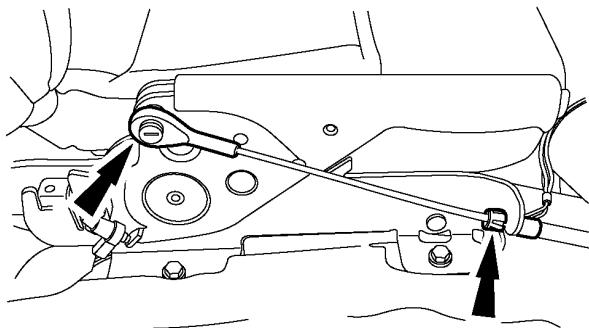
3. Install the park brake cable into the bracket and connect the cable end to the park brake lever.

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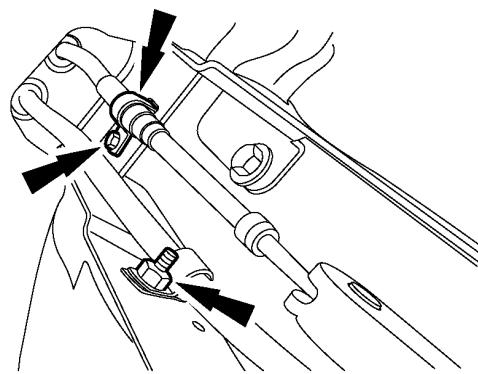
Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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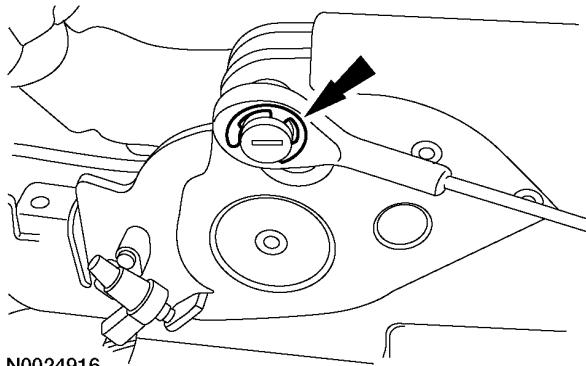


N0024917



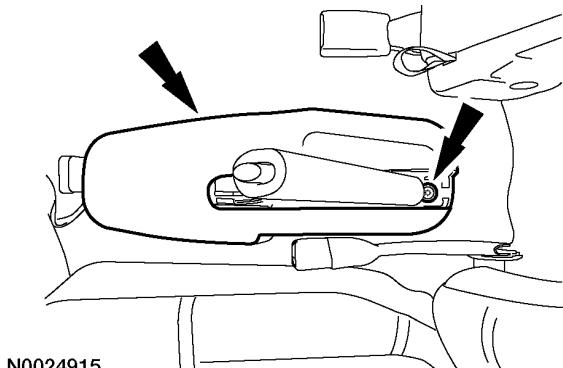
N0024914

4. Install the E-clip.



N0024916

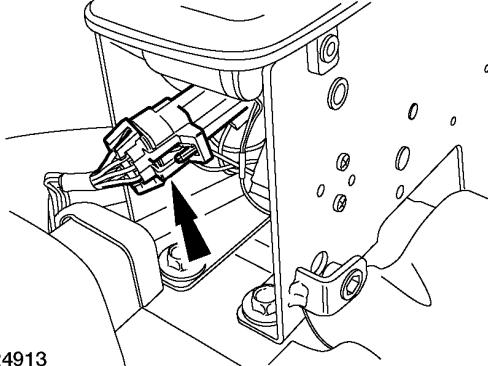
5. Install the park brake lever trim panel by pulling back on the lever. Install the trim panel and the screw.



N0024915

6. Install the park brake cable nut and bolt and the selector lever cable bracket and bolt.

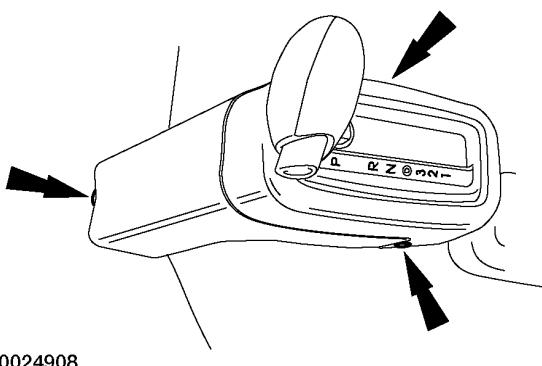
- Tighten to 10 Nm (89 lb-in).



N0024913

7. Connect the electrical connector.
8. Install the selector lever trim cover. Install the bottom screw and the 2 top screws.

- Tighten to 10 Nm (89 lb-in).

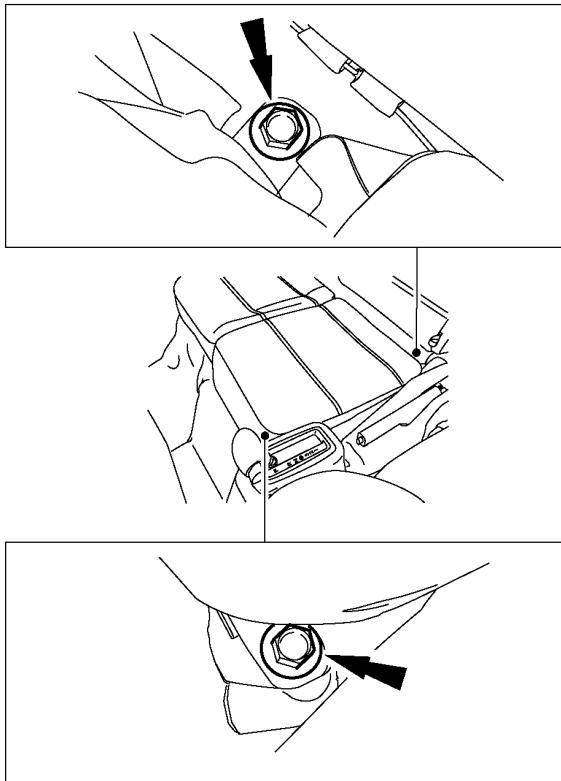


N0024908

9. Install the center seat cushion. Push down on the front of the cushion to clip the fastener in place and install the 2 bolts.

- Tighten to 22 Nm (16 lb-ft).

10. Adjust the selector lever cable. For additional information, refer to Selector Lever Cable Adjustment in this section.



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Read all safety instructions in the "Safety Information" section of this manual before doing any procedures.

Follow all warnings, cautions, and notes.

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