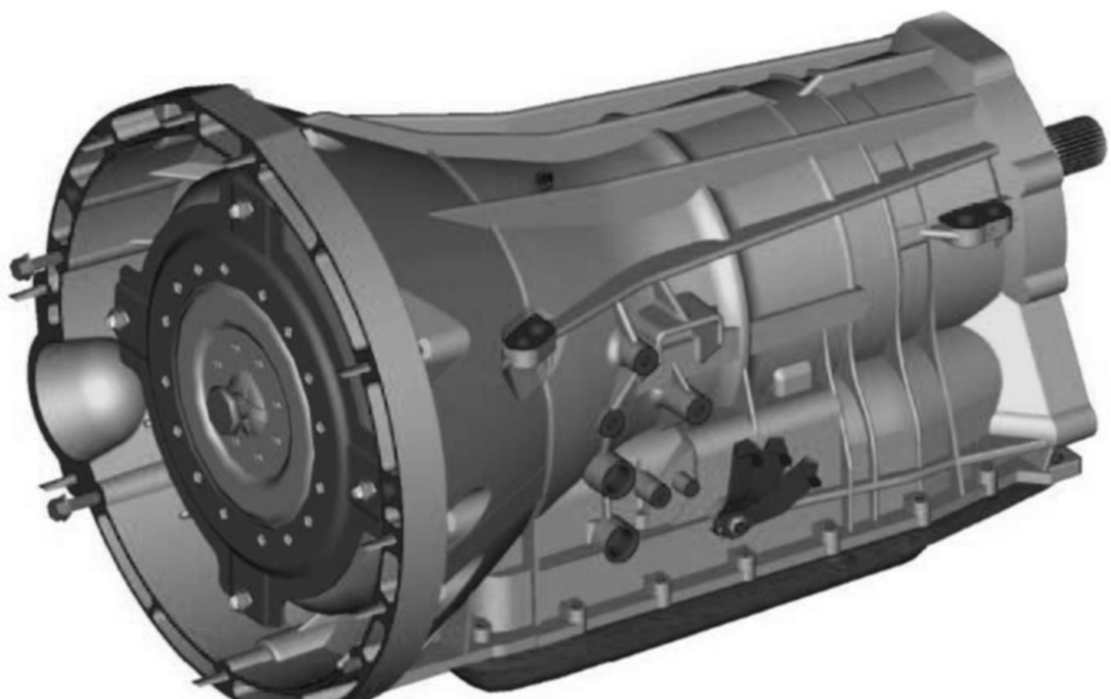
ENGINE DISTRIBUTORS INC.

Ford 6R80

INDUSTRIAL TRANSMISSION SERVICE MANUAL



Powertrain Assemblies & Components Provided By Ford Component Sales

Ford Power Products

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6R80 Automatic Transmission – Index

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HEALTH & SAFETY

WARNING: THE FOLLOWING HEALTH AND SAFETY RECOMMENDATIONS SHOULD BE CAREFULLY OBSERVED

WARNING: CARRYING OUT CERTAIN OPERATIONS AND HANDLING SOME SUBSTANCES CAN BE DANGEROUS OR HARMFUL TO THE OPERATOR IF THE CORRECT SAFETY PRECAUTIONS ARE NOT OBSERVED. SUCH PRECAUTIONS ARE RECOMMENDED AT THE APPROPRIATE POINTS IN THIS BOOK. WARNING: WHILE IT IS IMPORTANT THAT THESE RECOMMENDED SAFETY PRECAUTIONS ARE OBSERVED, CARE NEAR MACHINERY IS ALWAYS NECESSARY, AND NO LIST CAN BE EXHAUSTIVE. ALWAYS BE CAUTIOUS TO AVIOD POTENTIAL SAFETY RISKS.

The following recommendations are for general guidance:

1. Always wear correctly fitting protective clothing which should be laundered regularly. Loose or baggy clothing can be extremely dangerous when working on running engines or machinery. Clothing which becomes impregnated with oil or other substances can constitute a health hazard due to prolonged contact with the skin even through underclothing.

2. So far as practicable, work on or close to engines or machinery only when they are stopped. If this is not practicable, remember to keep tools, test equipment and all parts of the body well away from the moving parts of the engine or equipment—fans, drive belts and pulleys are particularly dangerous. The electric cooling fan used on some installations is actuated automatically when the coolant reaches a specified temperature. For this reason, care should be taken to ensure that the ignition/isolating switch is OFF when working in the vicinity of the fan as an increase in coolant temperature may cause the fan suddenly to operate.

3. Avoid contact with exhaust pipes, exhaust manifolds and silencers when an engine is, or has recently been running; these can be very hot and can cause severe burns.

4. Many liquids used in engines or vehicles are harmful if taken internally or splashed into the eyes. In the event of accidentally swallowing gasoline (petrol), oil, diesel fuel, antifreeze, battery acid etc, do NOT encourage vomiting and OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.

Wear protective goggles when handling liquids which are harmful to the eyes; these include ammonia and battery acid. If any of these substances are splashed in the eyes, wash out thoroughly with clean water and OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY.

WARNING:

WARNING: ENGINE EXHAUST, SOME OF ITS CONSTITUENTS, AND CERTAIN VEHICLE COMPONENTS CONTAIN OR EMIT CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM. IN ADDITION, CERTAIN FLUIDS CONTAINED IN VEHICLES AND CERTAIN PRODUCTS OF COMPONENT WEAR CONTAIN OR EMIT CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

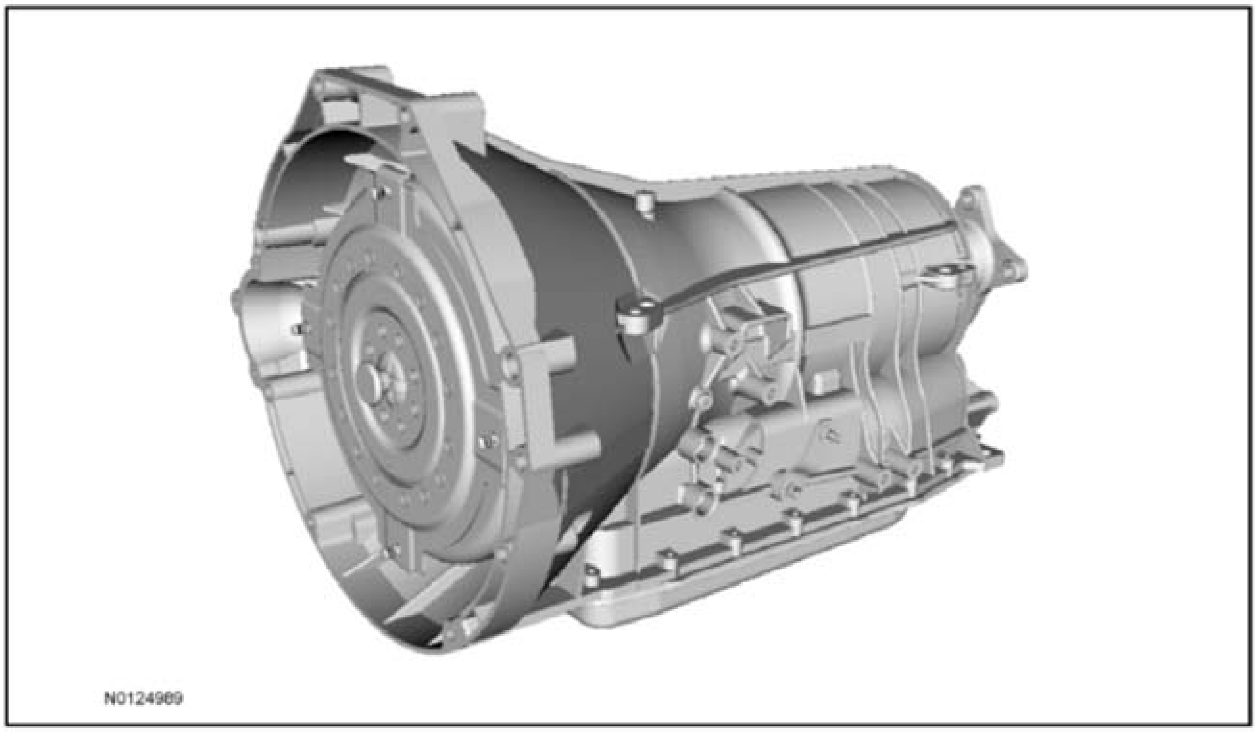
IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all industrial engines as well as the personal safety of the individual doing the work. This Service Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

DESCRIPTION AND OPERATION

Transmission Description

6R80 Transmission



This transmission has the following features:

- Six forward speeds
- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear se
- Double planetary gear se
- Two fixed multi-disc clutches
- Three multi-plate clutches
- One-Way Clutch (OWC)

Hydraulic functions are directed by electronic solenoids to control the following:

- Engagement feel
- Shift feel
- Shift scheduling
- Modulated Torque Converter Clutch (TCC) applications

The 6R80 transmission has a main control assembly which contains:

- Turbine Shaft Speed (TSS) sensor
- Output Shaft Speed (OSS) sensor
- An internal Transmission Range (TR) sensor
- Transmission Fluid Temperature (TFT) sensor
- Line Pressure Control (LPC)
- TCC solenoid
- Five electronically controlled shift solenoids

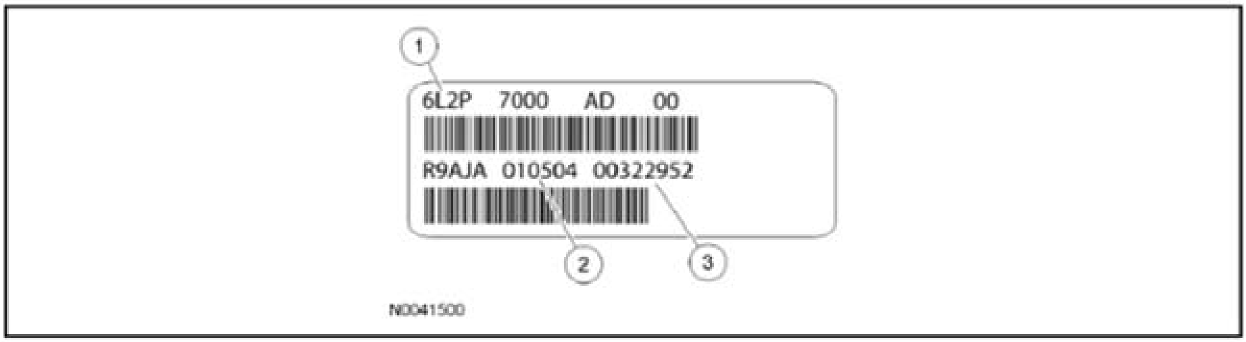
Engine power reaches the transmission by a torque converter with an integral converter clutch. The 6 forward gears and one reverse gear are obtained from 2 planetary gearsets.

This 6-speed electronically controlled automatic transmission is comprised of a PCM, main control valve body assembly, torque converter, 1 solenoid valve and 6 pressure regulators. Gear selection is achieved by controlling transmission fluid to operate various internal clutches. The PCM operates the electrical components and provides for the control of gear selection and shift pressure, which increases refinement and torque converter slip.

In the event of a system fault, the PCM also provides for Failure Mode Effect Management to maintain maximum functional operation of the transmission with a minimum power reduction. In the event of a total loss of control or electrical power, the basic transmission functions park, reverse, neutral and drive are retained. Also 3rd or 5th gear is retained by the transmissions hydraulic system. The default gear retained is dependent upon the gear selected at the time of a failure.

Identification Tags

All vehicles come equipped with a Safety Compliance Certification Label. The location on the label marked TR is reserved for the transmission code. To determine the correct transmission for this vehicle, refer to the Owner's Literature, Transmission Code Designations. All transmissions are equipped with an identification tag located on the transmission case. For transmission part number, serial number and build date, refer to the transmission identification tag located on the transmission case.



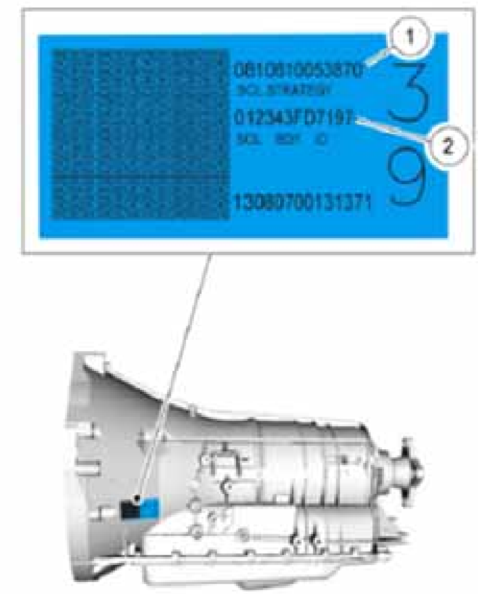
Item	Description
1	Part number
2	Build date
3	Serial number

Solenoid Strategy Identification Tag

NOTE:
Letters are not used in the 13 digit solenoid body strategy. The characters consist of all numbers.

PCM controlled transmissions have a solenoid strategy identification tag located on the left side of the transmission case. Compare the 13 digit number on the tag with the 13 digit number displayed on the scan tool to determine the correct solenoid strategy for the transmission. If the scan tool matches the service tag then the solenoid strategy is correct. If the solenoid strategy retrieved from the scan tool does not match the solenoid strategy identification tag, the transmission fluid pan must be removed to compare what the scan tool displays to the solenoid strategy number etched on the main control. Refer to Fluid Pan, Gasket and Filter in this section. If the solenoid strategy identification etched on the main control matches what the scan tool displays, then the solenoid strategy is correct. If the solenoid strategy identification etched on the main control does not match the scan tool, then a Solenoid Strategy Data Download is required. Refer to Solenoid Body Strategy for the download procedure in this section.

Original Solenoid Body Tag



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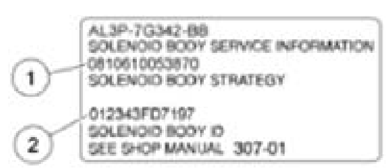
Item	Description
1	13 digit solenoid strategy
2	12 digit solenoid body identification

A replacement solenoid body tag is provided when the main control is serviced. The replacement solenoid body tag is placed over the original solenoid body tag.

Replacement Solenoid Body Tag



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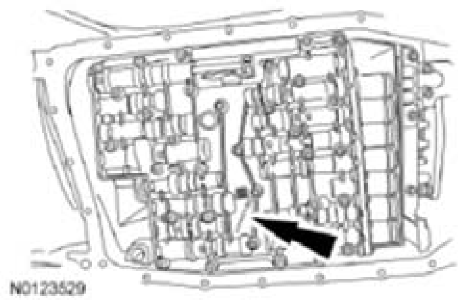
Item	Description
1	13 digit solenoid strategy
2	12 digit solenoid body identification

Main Control Solenoid Body Strategy Identification



If the solenoid body strategy etched on the main control does not match what the scan tool displays, the solenoid body strategy must be downloaded into the PCM or harsh shifts will result.

Major Components

Major Components

This transmission has the following major components:

- Transmission case with integral torque converter housing
- Torque converter
- Fluid pump
- Three drive clutches:
    - Forward clutch (A)
    - Direct clutch (B)
    - Overdrive clutch (E)
- Three brake clutches:
    - Intermediate clutch (C)
    - Low/reverse clutch (D)
    - One-Way Clutch (OWC)
- Two planetary gearsets:
    - Front single planetary gearset (1 sun gear, 1 carrier, 1 ring gear)
    - Rear ravigneaux planetary gearset (2 sun gears, 1 carrier with 2 sets of pinion gears and 1 ring gear)
- Main control:
    - Upper valve body
    - Lower valve body
    - Transmission Range (TR) sensor
    - Turbine Shaft Speed (TSS) sensor
    - Output Shaft Speed (OSS) sensor
    - Transmission Fluid Temperature (TFT) sensor
    - Line Pressure Control (LPC) solenoid
    - Torque Converter Clutch (TCC) solenoid
    - Five electronically controlled shift solenoids

In addition to the torque converter, the other shift elements are:

- Three rotating multi-plate clutches: forward (A), direct (B) and overdrive (E).
- Two fixed multi-disc brakes: intermediate (C) and low/reverse (D).

All gear shifts from 1st to 6th or from 6th to 1st are power-on overlapping shifts. That is, during the shift, one of the clutches must continue to transmit the drive at lower main pressure until the other clutch is able to accept the input torque.

The shift elements, clutches or brakes are engaged hydraulically. The transmission fluid pressure builds up between the cylinder and the piston, pressing the clutches together.

The purpose of these shift elements is to carry out in-load shifts with no interruption to traction.

Multi-plate clutches; forward, direct and overdrive, supply power from the engine to the planetary geartrain. Multi-disc brakes, intermediate and low/reverse, press against the transmission housing in order to achieve a torque reaction effect.

Multi-Plate Clutch

Clutches; overdrive (E), forward (A) and direct (B) are balanced in terms of dynamic pressure. That is, their pistons are exposed to the transmission fluid flow on both sides, in order to prevent pressure buildup in the clutch as speed increases. This equalization process is achieved by a baffle plate and pressurefree transmission fluid supplied by a lubricating passage, through which the space between piston and baffle plate is filled with transmission fluid.

The advantages of this dynamic pressure equalization are:

- reliable clutch engagement and release in all speed ranges.
- improved shift refinement.

Shift Overlap Control

The electro-hydraulic shift action is obtained by means of various valves in the main control valve body, actuated by pressure regulators. They engage or disengage the relevant clutches or brakes at the correct moments.

Hydraulic Systems

Fluid Pump

The torque converter is supported in the fluid pump by a needle roller bearing. The fluid pump is driven directly from the engine by the torque converter shell and supplies transmission fluid to the transmission and the hydraulic control unit.

The fluid pump draws in transmission fluid through a transmission fluid filter and delivers it at high pressure to the main pressure valve in the main control valve body unit. The valve adjusts the pressure and returns excess transmission fluid to the transmission fluid pan.

Fluid Filter

All transmission fluid that is picked up from the transmission fluid pan passes through the transmission fluid filter. The transmission fluid filter and its accompanying seal are part of the transmission fluid path from the pan to the transmission fluid pump.

Single Planetary Gearset

The single planetary gear overdrive carrier is driven by the input shaft. The single planetary gear set consists of the following components:

- One sun gear
- Four planetary gears meshing with the sun gear
- One planetary carrier
- One ring gear

Ravigneaux Planetary Gearset

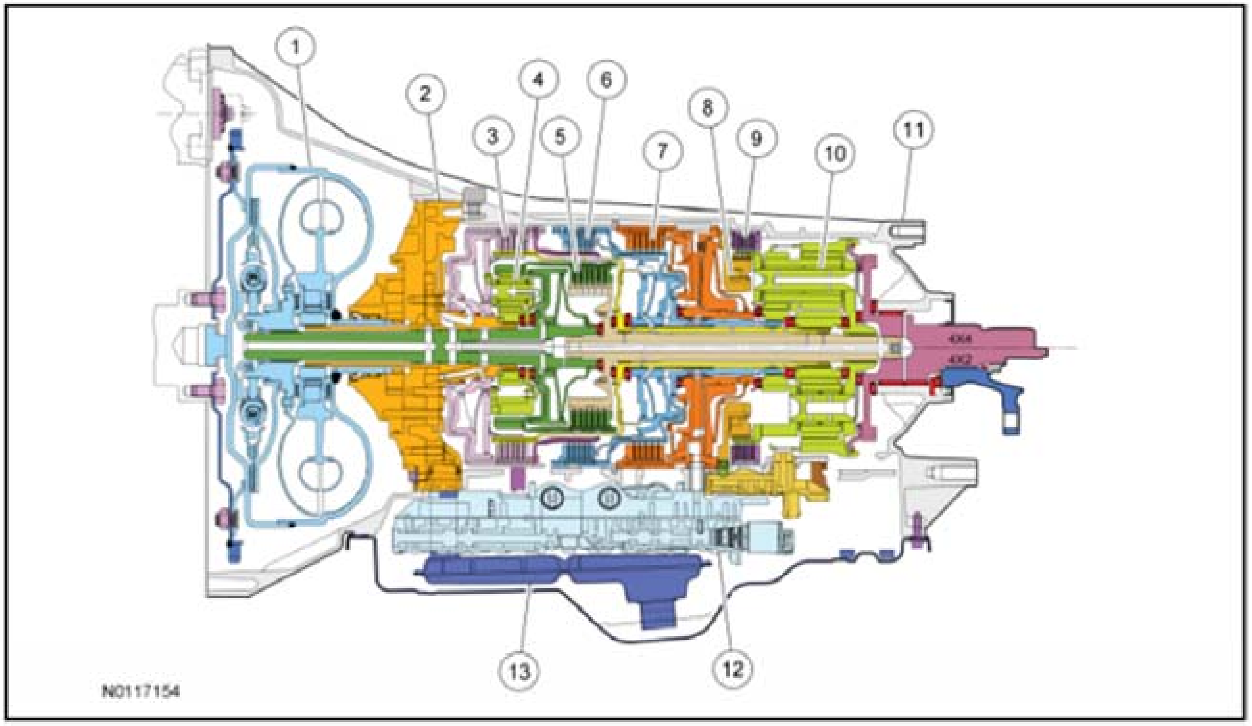
The ravigneaux planetary gearset is splined to the output shaft and consists of the following components:

- Two sun gears of different sizes
- Three long planetary gear pinions meshing with the large sun gear and the ring gear
- Three short planetary gear pinions meshing with the small sun gear and the long pinions
- One planetary carrier
- One ring gear

Output Shaft

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

Major Components Cutaway View



Item	Description
1	Torque converter
2	Front pump assembly
3	Forward clutch (A)
4	Front planetary gearset
5	Overdrive clutch (E)
6	Direct clutch (B)
7	Intermediate clutch (C)
8	One-Way Clutch (OWC)
9	Low/reverse clutch (D)
10	Rear planetary gearset
11	Transmission case
12	Main control assembly
13	Transmission fluid filter

Gear Ratios

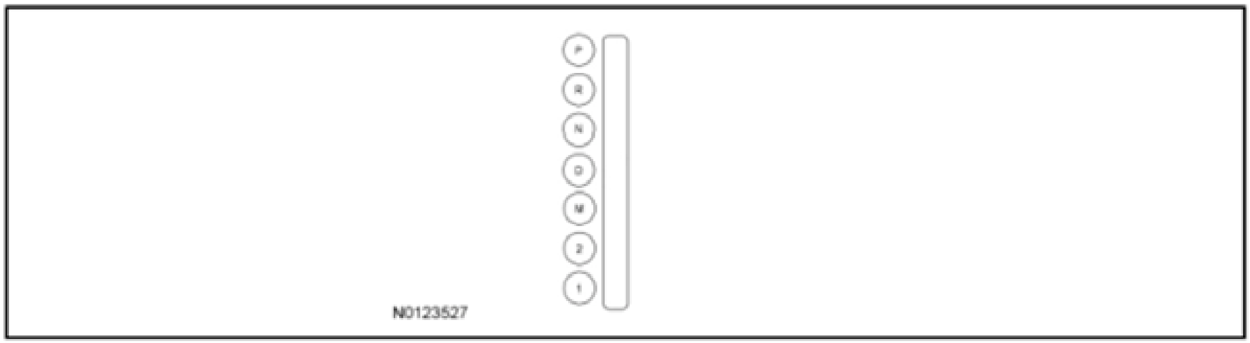
Power is transmitted from the torque converter to the planetary gearsets through the input shaft. Clutches are used to hold and drive certain combinations of
gearsets. This results in 6 forward ratios and one reverse ratio which are transmitted to the rear planetary ring gear (output shaft). The planetary gearsets of
this transmission provide the following ratios:

- Reverse:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.24:1 (reverse direction)
  - Total ratio of 3.40:1 (reverse direction)
- 1st gear:
  - Front planetary gearset ratio of 1.52:1
  - Rear planetary gearset ratio of 2.74:1
  - Total ratio of 4.17:1

- 2nd gear:
    - Front planetary gearset ratio of 1.52:1
    - Rear planetary gearset ratio of 1.54:1
    - Total ratio of 2.34:1
- 3rd gear:
    - Front planetary gearset ratio of 1.52:1
    - Rear planetary gearset ratio of 1:1
    - Total ratio of 1.52:1
- 4th gear:
    - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
    - Rear planetary gearset ratio of 1.14:1
    - Total ratio of 1.14:1
- 5th gear:
    - Front planetary gearset provides ratios of 1:1 and 1.52:1 to different rear planetary gearset members
    - Rear planetary gearset ratio of 0.87:1
    - Total ratio of 0.87:1
- 6th gear:
    - Front planetary gearset ratio of 1:1
    - Rear planetary gearset ratio of 0.69:1
    - Total ratio of 0.69:1

Range Selection

The transmission has 7 range positions: P, R, N, D, M, 2 and 1.



Park

In the PARK position:

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

D Position

The D is the normal position for most forward driving.
The D position provides:

- automatic shifts 1-6 and 6-1.
- apply and release of the torque converter clutch.
- maximum fuel economy during normal operation.
- engine braking in all gears.

Position M — SelectShift™

This position provides:

- manual control of the transmission.
- engine braking.

Position 2 — 2nd Gear

This position provides:

- manual 2nd gear.

Position 1 — 1st Gear

This position provides:

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

Gear Availability

MANUAL LEVER POSITION	TRANSMISSION GEAR OPERATION	DESCRIPTION
P	Park	Forward or reverse gears not available. Output shaft is held to the transmission case.
R	Reverse	Transmission allows reverse only.
N	Neutral	Forward or reverse gears not available. Output shaft moves freely.
D	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6	6 forward gears are available. Gears are dependent on vehicle speed and throttle position with coast braking.
D Tow/Haul	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6	1st through 6th gears are available. The shift scheduling is altered for higher shift speeds for a given throttle position. Transmission provides engine braking.
D Range Select	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6	All gears available. Driver has the option to lockout higher gears by pressing "-" on the selector lever. Driver can also enable higher gears that have been locked out by pressing "+". Transmission automatically shifts through lower gears that have not been locked out.
M SelectShift™	1 ⇆ 2 ⇆ 3 ⇆ 4 ⇆ 5 ⇆ 6	All gears available upon driver request. Driver has the ability to shift the transmission using the "+" "-" switches on the selector lever.
2	1 $\boxed{2}$ ← 3 ← 4 ← 5 ← 6	2nd gear hold, no upshift. Downshift to 2nd gear when 2 position is selected above a calibrated speed.
1	$\boxed{1}$ ← 2 ← 3 ← 4 ← 5 ← 6	1st gear hold with engine braking, no upshift. The transmission downshifts to 1st gear when 1 is selected above a calibrated speed under minimum to moderate accelerator pedal position.

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Torque Converter

The torque converter is a 4-element unit containing a 2-plate clutch. The clutch can be controlled and engaged in any gear, 2nd through 6th. Calibration parameters may be set to allow lockup in a higher gear only. The clutch is applied by removing fluid pressure from one side of the plate. The torque converter transmits and multiplies torque. The torque converter includes the following 4 elements:

- Impeller assembly
- Turbine assembly
- Reactor assembly
- Torque Converter Clutch (TCC)

Rotation of the torque converter housing and impeller set the transmission fluid in motion by driving the impeller blades and pump. The turbine is driven by the transmission fluid from the impeller and transmits power to the input shaft.

The reactor redirects transmission fluid flow returned from the turbine to the impeller so that it rotates in the same direction as the impeller. This action assists in torque multiplication.

The reactor has a One-Way Clutch (OWC) to hold it stationary during torque multiplication and allows it to rotate at higher vehicle speeds.

Torque Converter Clutch (TCC)
The TCC has a cover assembly with a 2-plate clutch and a turbine and damper assembly that connects to the transmission input shaft.

The TCC connects the cover to the turbine when the TCC is applied.

During TCC release, transmission fluid flows through the torque converter in one direction to release the 2-plate clutch.

During TCC apply, transmission fluid flows through the torque converter in the opposite direction to apply the 2-plate clutch.

The TCC operates in 3 stages:
- Full release
- Controlled modulation
- Full apply

The PCM controls TCC operation using the TCC solenoid. TCC solenoid operation provides the modulation of hydraulic pressure to change the position of the bypass clutch control regulator valve. The valve changes the pressure and direction of transmission fluid flow in the torque converter. TCC may be applied in forward gears, 2nd through 6th.

Shift Patterns
Downshifts

Under certain conditions, the transmission will downshift automatically to a lower gear range (without moving the range selector lever). There are 3 categories of automatic downshifts:
- Coastdown
- Torque demand
- Forced or kickdown shifts

Coastdown

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

Torque Demand

The torque demand downshift occurs (automatically) during part throttle acceleration when the demand for torque is greater than the engine can provide at that gear ratio.

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.

Mechanical Components and Functions
Planetary Gearset
This transmission has 2 planetary gearsets (front and rear) to provide operation in reverse and 6 forward speeds.
The front planetary gearset is a single planetary gearset and has the following components:
- Front planetary No. 1 sun gear
- Front planetary carrier
- Front planetary ring gear (part of the input shaft assembly)

The input shaft rotates the front ring gear as a driving member. The front sun gear is connected to the fluid pump and is held stationary. The front ring gear rotates the front planetary carrier assembly with a reduction ratio of 1.52:1.

The front planetary carrier assembly is the only output member of the front planetary gearset in reverse, 1st, 2nd and 3rd gear. The front planetary gearset provides a 1.52:1 gear ratio to the rear planetary gearset.

In 4th and 5th gear, both the front ring gear and front planetary carrier assembly are output members of the front planetary gearset. The front planetary gearset provides both a 1:1 and 1.52:1 gear ratio to different members of the rear planetary gearset.

In 6th gear, the front ring gear is the only output member of the front planetary gearset. The front planetary gearset provides a 1:1 gear ratio to the rear planetary gearset.

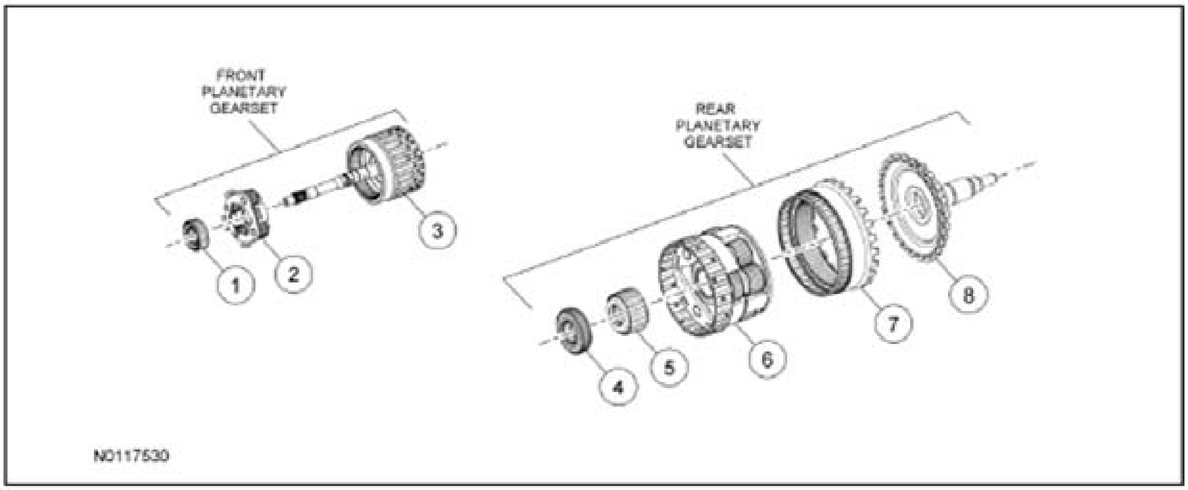
The rear planetary gearset is a ravigenaux planetary gearset and has the following components:

- Rear planetary No. 2 sun gear
- Rear planetary No. 3 sun gear
- Rear planetary carrier assembly (2 sets of pinion gears)
- Rear planetary ring gear assembly

Power flow through the rear planetary gearset is as follows:

- In reverse, rear sun gear No. 2 is driven, the rear planetary carrier is held and the ring gear is the output (2.24:1 with reverse direction)
- In 1st gear, sun gear No. 3 is driven, the rear planetary carrier is held and the ring gear is the output (2.74:1)
- In 2nd gear, sun gear No. 3 is driven, sun gear No. 2 is held and the ring gear is the output (1.54:1)
- In 3rd gear, sun gear No. 3 and sun gear No. 2 are driven and the ring gear is the output (1:1)
- In 4th gear, sun gear No. 3 and the rear planetary carrier are driven and the ring gear is the output (1.14:1)
- In 5th gear, sun gear No. 2 and the rear planetary carrier are driven and the ring gear is the output (0.87:1)
- In 6th gear, the rear planetary carrier is driven, sun gear No. 2 is held and the ring gear is the output (0.69:1)

Planetary Gearset Exploded View



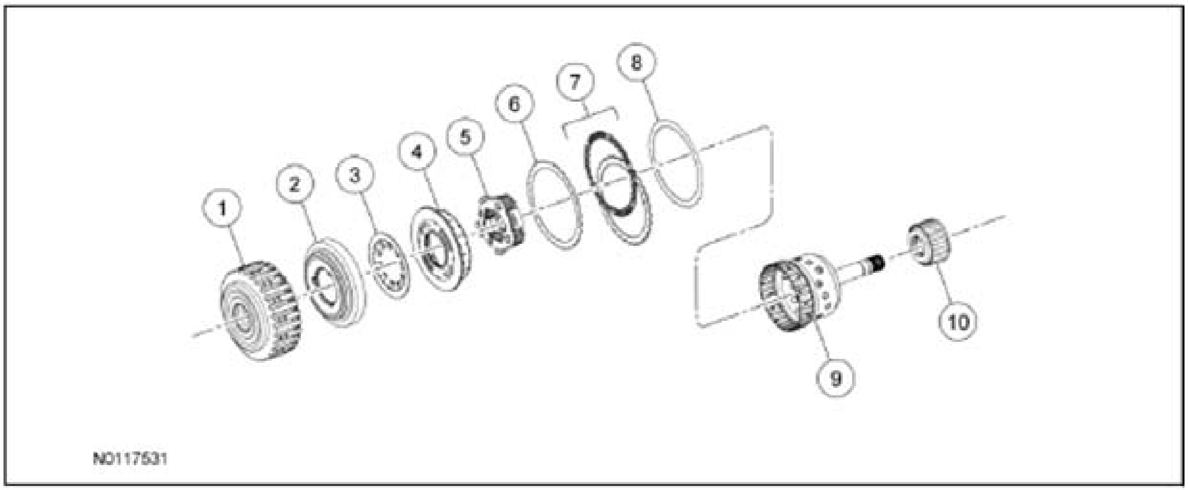
Item	Description
1	Front planetary No. 1 sun gear
2	Front planetary carrier
3	Front planetary ring gear (part of input shaft assembly)
4	Rear planetary No. 2 sun gear
5	Rear planetary No. 3 sun gear
6	Rear planetary carrier
7	Rear planetary ring gear
8	Output shaft

Forward Clutch (A)

The forward clutch (A) connects the front planetary carrier to the rear No. 3 sun gear. This provides a gear reduction ratio of 1.52:1 from the input shaft to rear sun gear No. 3. The forward clutch (A) is applied in 1st, 2nd, 3rd and 4th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the forward clutch (A) piston against the forward clutch (A) pack to apply the clutch. The front planetary carrier and the rear No. 3 sun gear are connected as a result of the clutch being applied.

Forward Clutch (A) Exploded View



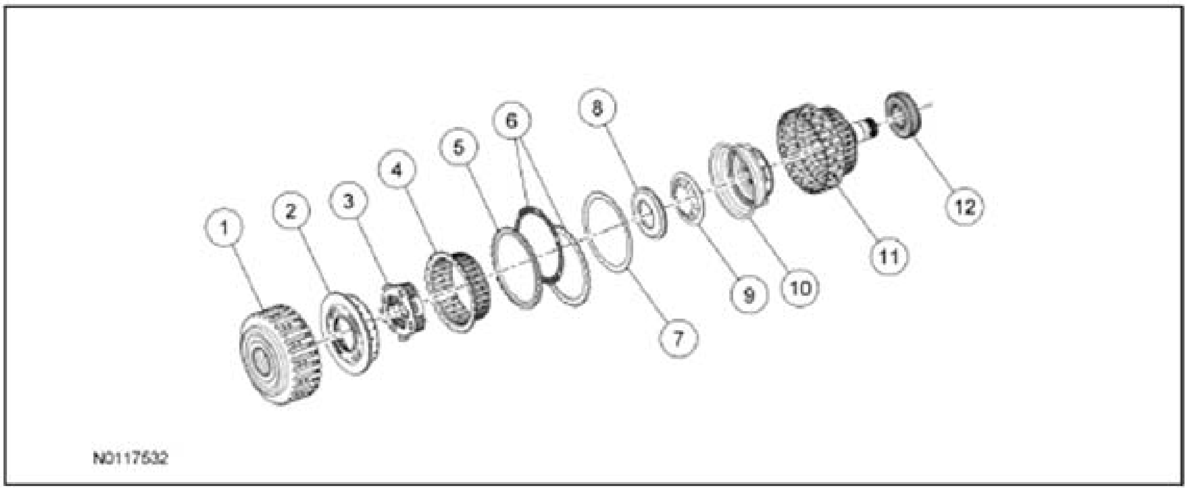
Item	Description
1	Forward clutch cylinder
2	Forward clutch piston
3	Forward clutch piston return spring
4	Forward clutch balance piston
5	Front planetary carrier assembly
6	Forward clutch wave spring
7	Forward clutch friction and steel plates
8	Forward clutch pressure plate
9	Rear planetary No. 3 sun gear hub and shaft assembly
10	Rear planetary No. 3 sun gear

Direct Clutch (B)

The direct clutch (B) connects the front planetary carrier to the rear No. 2 sun gear. This provides a gear reduction ratio of 1.52:1 from the input shaft to rear sun gear No. 2. The direct clutch (B) is applied in reverse, 3rd and 5th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the direct clutch (B) piston against the direct clutch (B) pack to apply the clutch. The front planetary carrier and the rear No. 2 sun gear are connected as a result of the clutch being applied.

Direct Clutch (B) Exploded View



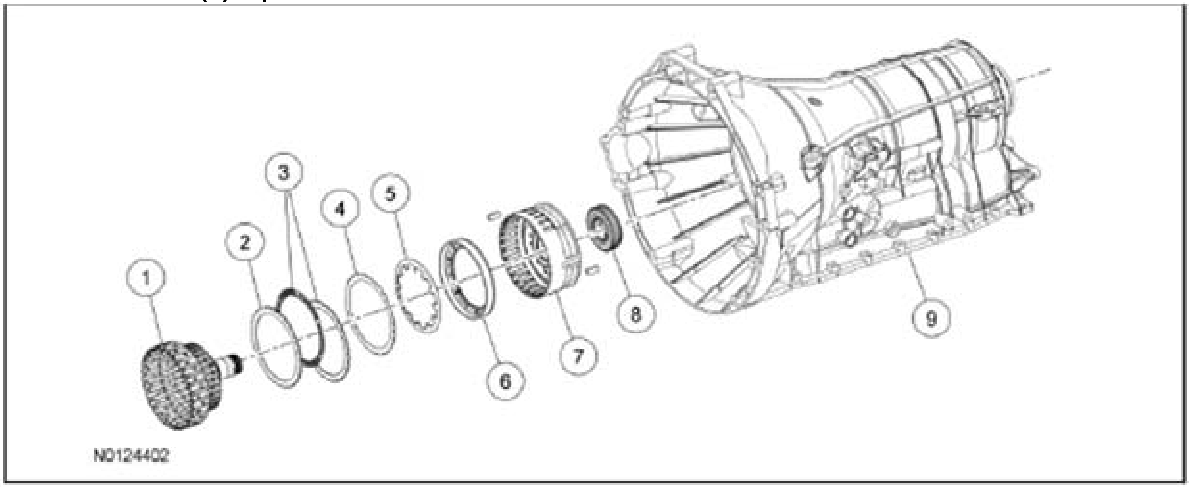
Item	Description
1	Forward clutch cylinder
2	Forward clutch balance piston
3	Front planetary carrier assembly
4	Direct clutch hub
5	Direct clutch pressure plate
6	Direct clutch friction and steel plates
7	Direct clutch wave spring
8	Direct clutch balance piston
9	Direct clutch piston return spring
10	Direct clutch piston
11	Direct clutch cylinder
12	Rear planetary sun gear No. 2

Intermediate Clutch (C)

The intermediate clutch (C) holds the rear planetary No. 2 sun gear stationary to the transmission case. The intermediate clutch (C) is applied in 2nd and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the intermediate clutch (C) piston against the intermediate clutch (C) pack to apply the clutch.

Intermediate Clutch (C) Exploded View



Item	Description
1	Direct clutch cylinder
2	Intermediate clutch pressure plate
3	Intermediate clutch friction and steel plates
4	Intermediate clutch wave spring
5	Intermediate clutch piston return spring
6	Intermediate clutch piston
7	Center support assembly
8	Rear planetary sun gear No. 2
9	Transmission case

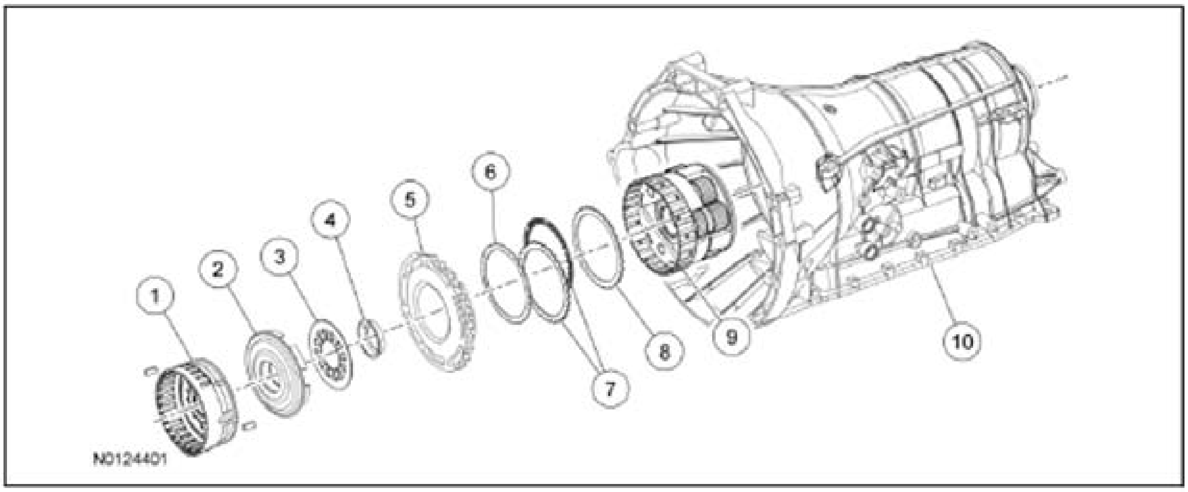
Low/Reverse Clutch (D) and Low/One-Way Clutch (OWC)

The low/reverse clutch (D) holds the rear planetary carrier stationary to the transmission case. The low/reverse clutch (D) is applied in park, reverse, neutral and 1st gear below 5 kph (3 mph).

Regulated hydraulic pressure from the regulator valve in the valve body pushes the low/reverse clutch (D) piston against the low/reverse clutch (D) pack to apply the clutch.

The low/One-Way Clutch (OWC) is a brake clutch that holds the rear planetary carrier in one direction and allows it to freewheel in the opposite direction eliminating engine braking in 1st gear when the transmission is in drive, above 5 kph (3 mph) only.

Low/Reverse Clutch (D) and Low/One-Way Clutch (OWC) Exploded View



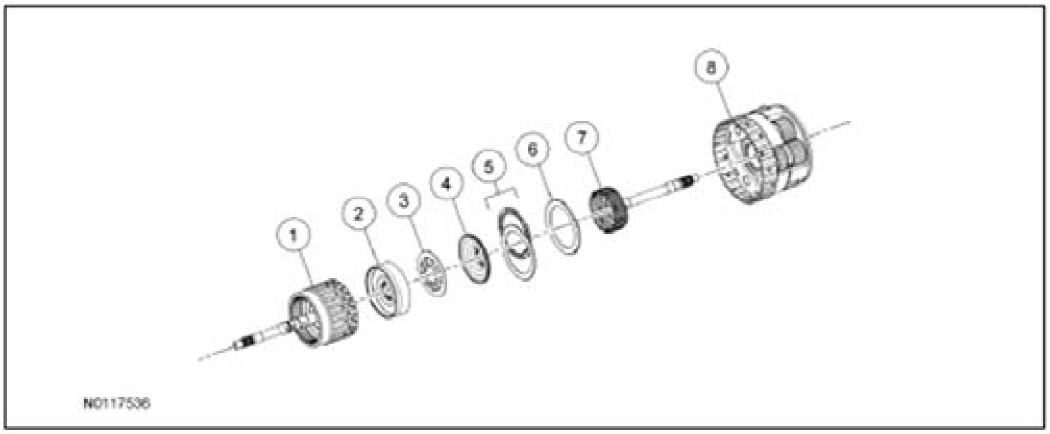
Item	Description
1	Center support assembly
2	Low/reverse clutch piston
3	Low/reverse clutch piston return spring
4	Low/reverse clutch piston retainer
5	Low/One-Way Clutch (OWC)
6	Low/reverse clutch wave spring
7	Low/reverse clutch friction and steel plates
8	Low/reverse clutch pressure plate
9	Rear planetary carrier assembly
10	Transmission case

Overdrive Clutch (E)

The overdrive clutch (E) connects the input shaft with the rear planetary carrier. The overdrive clutch (E) is applied in 4th, 5th and 6th gears.

Regulated hydraulic pressure from the regulator valve in the valve body pushes the overdrive clutch (E) piston against the overdrive clutch (E) pack to apply the clutch.

Overdrive Clutch (E) Exploded View



Item	Description
1	Input shaft assembly
2	Overdrive clutch piston
3	Overdrive clutch piston return spring
4	Overdrive clutch balance piston
5	Overdrive clutch friction and steel plates
6	Overdrive clutch pressure plate
7	Intermediate shaft
8	Rear planetary carrier assembly

External Sealing

The pump assembly has a lip-type seal for the torque converter impeller hub. The pump assembly uses a large O-ring to seal the transmission case. The pump bolts also seal the pump to the transmission case.

The manual control lever shaft has a lip seal for its bore in the transmission case.

The transmission fluid pan uses a reusable gasket.

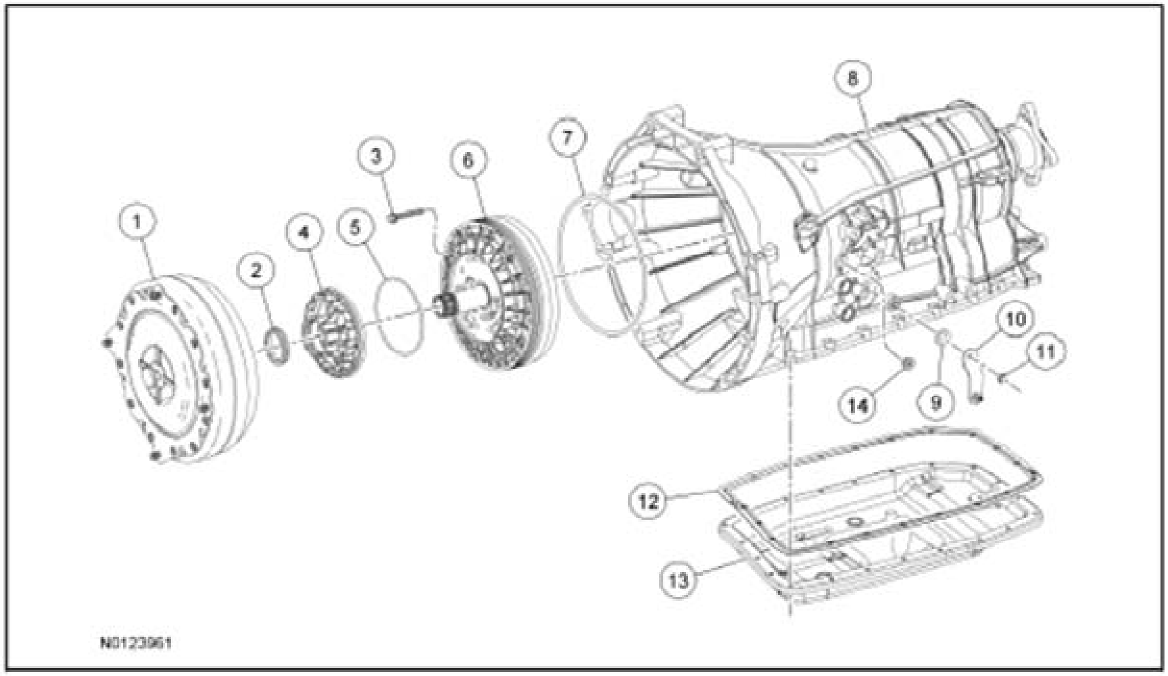
The output shaft flange has a lip-type seal that seals the flange to the transmission case.

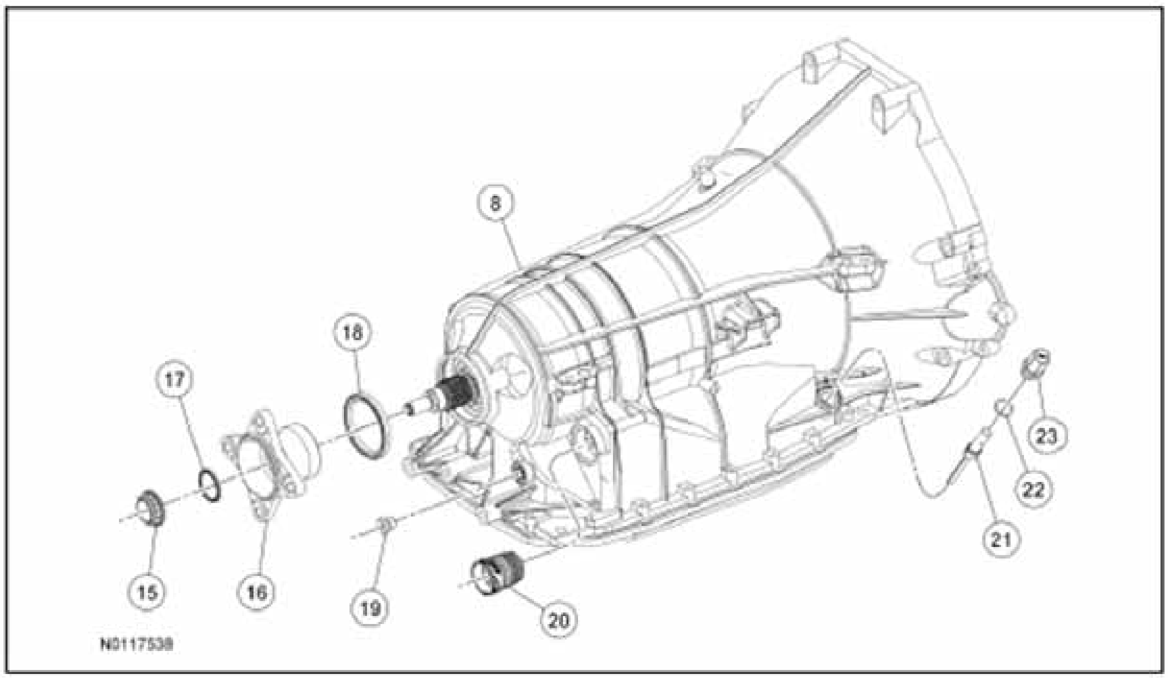
The transmission case plug provides access to the park pawl shaft. The plug has a seal that is serviced as an assembly with the plug.

The main control leadframe connector sleeve has a seal for the transmission case bore. The seal is serviced as an assembly with the bulkhead connector sleeve.

The plug for the fluid level indicator uses an O-ring seal.

External Sealing (Gaskets, O-rings and Seals)





Item	Description
1	Torque converter
2	Front pump oil seal

(Continued)

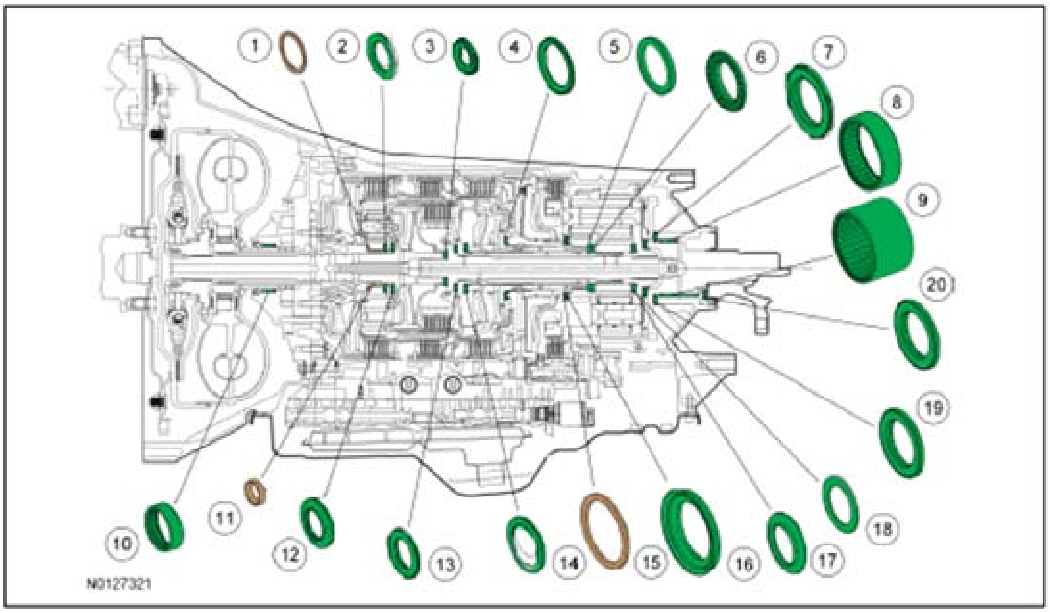
Item	Description
3	Front pump-to-case bolt (13 required)
4	Front pump assembly
5	Pump assembly inner oil seal
6	Front pump assembly
7	Front pump outer oil seal
8	Transmission case
9	Manual control lever shaft seal
10	Manual control lever (Manual control lever installation position is vehicle/model dependent.)
11	Manual control lever nut
12	Transmission fluid pan gasket
13	Transmission fluid pan
14	Line pressure tap plug
15	Output shaft flange retaining nut
16	Output shaft flange
17	Extension housing flange seal
18	Output shaft flange seal
19	Transmission case plug (park pawl shaft access)
20	Transmission bulkhead connector sleeve
21	Transmission fluid level indicator
22	Transmission fluid level indicator plug seal (part of transmission fluid level indicator)
23	Transmission fluid level indicator plug (part of transmission fluid level indicator)

Bushings, Bearings and Thrust Washer Locations

This transmission supports the rotating components of the transmission with bushings, bearings and thrust washers.

The pump assembly support thrust washer controls the amount of end play for components between the pump assembly and the center support (forward/ overdrive clutch assembly, direct clutch cylinder).

The T8 thrust bearing outer race controls the amount of end play for components between the center support and the rear of the transmission case (rear planetary gearset assembly, output shaft assembly).



Item	Description
1	Front pump selective washer
2	Bearing T1
3	Bearing T3
4	Bearing T6
5	Thrust bearing outer race
6	Roller bearing T8
7	Thrust bearing T10
8	Output shaft bearing assembly (Four-Wheel Drive (4WD) vehicles)
9	Output shaft bearing assembly (Rear Wheel Drive (RWD) vehicles)
10	Front oil pump bearing assembly (part of pump assembly)
11	Input shaft bushing (part of pump assembly)
12	Bearing T2
13	Bearing T4
14	Roller bearing T5
15	Rear planetary carrier selective washer
16	Thrust bearing T7
17	Roller bearing T9
18	Outer race bearing T9
19	Bearing T11
20	Thrust bearing T12 (RWD only)

Lubrication

This transmission provides lubrication for rotating mechanical components through one main hydraulic circuit. The general flow of lubrication moves from the front of the transmission, through the input and intermediate shafts, to the rear of the transmission.

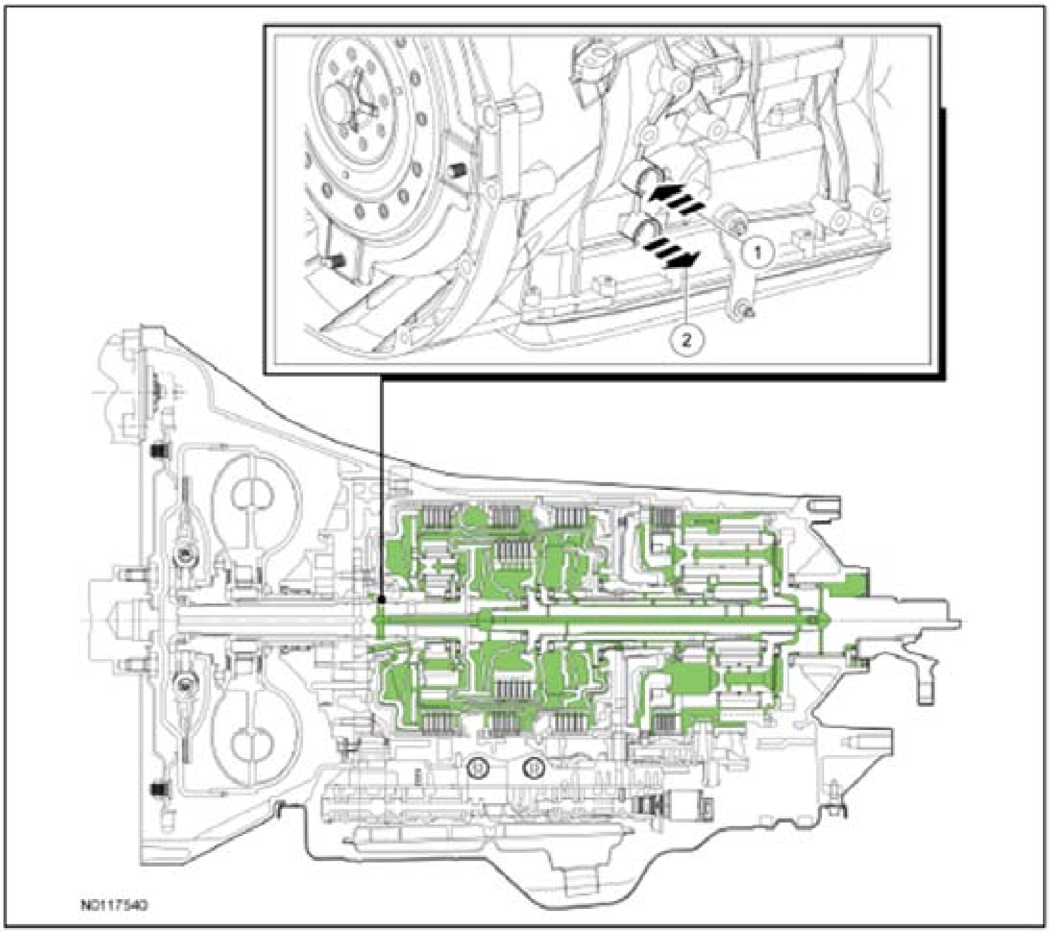
Transmission fluid from the pump assembly and the torque converter exit the transmission case to go to the transmission fluid cooler through the bottom of the transmission fluid cooler tube and returns to the transmission through the top of the transmission fluid cooler tube.

With lower transmission fluid temperatures, the thermal bypass valve in the transmission case bypasses the transmission fluid cooler tubes and redirects the fluid to the lubrication circuit. As transmission fluid temperature increases, the thermal bypass valve directs the fluid to the transmission fluid cooler.

Transmission fluid from the transmission fluid cooler or the thermal bypass valve enters the main lubrication circuit from the top of the transmission fluid cooler tube port.

Transmission fluid in the lubrication circuit flows to each of the balance pistons for the forward (A), direct (B) and overdrive (E) clutches. The balance pistons prevent unwanted clutch application when the clutch cylinder rotates at high speeds and hydraulic controls have released the clutch.

Lubrication Passages



Item	Description
1	Transmission fluid cooler return (inlet from the transmission fluid cooler)
2	Transmission fluid cooler pressure (outlet to the transmission fluid cooler)

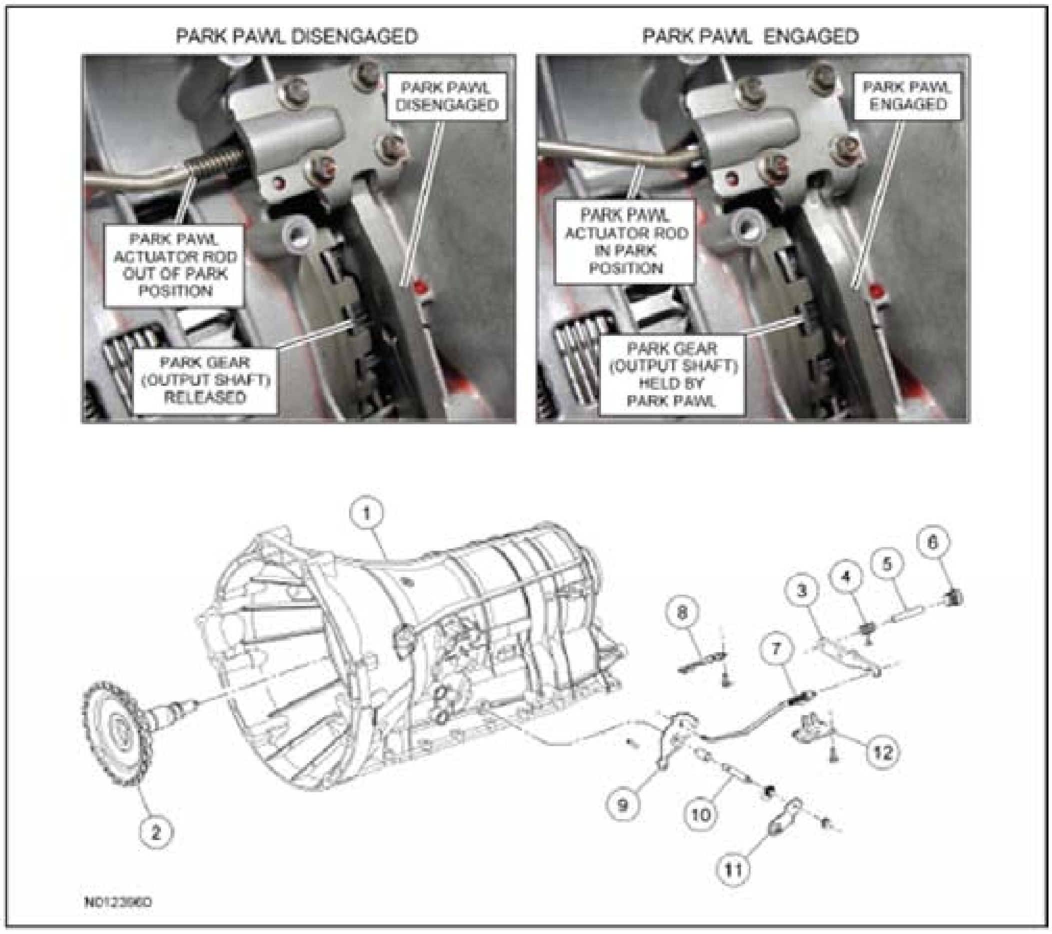
Park

The park gear is part of the output shaft assembly. The park gear has lugs on its overdrive surface that the park pawl engages to lock the output shaft.

The park lock prevents the vehicle wheels from rotating by allowing the transmission case to hold the output shaft stationary through the park pawl. When the park pawl is engaged in the park gear, the output shaft is held stationary.

When the manual control lever is rotated to the PARK position, the park lock works as follows:

- The detent assembly (connected to the manual control shaft) rotates and pushes the park pawl actuator rod into the park pawl. The actuator rod is spring loaded.
- The actuator rod is guided into the park pawl by the park pawl abutment.
- When the park pawl actuator rod is pushed into the park pawl, the park pawl pivots into the park gear and engages with the lugs.
- The park pawl holds the output shaft to the transmission case.



Item	Description
1	Transmission case
2	Output shaft park gear assembly
3	Park pawl
4	Park pawl return spring
5	Park pawl pin

(Continued)

Item	Description
6	Plug — park pawl pin
7	Park pawl actuator rod
8	Manual valve detent spring
9	Manual valve detent lever assembly
10	Manual control lever shaft
11	Manual control lever (Manual control lever installation position is vehicle/model dependent.)
12	Park rod actuating plate

Hydraulic System

Pump Assembly and Transmission Fluid Filter

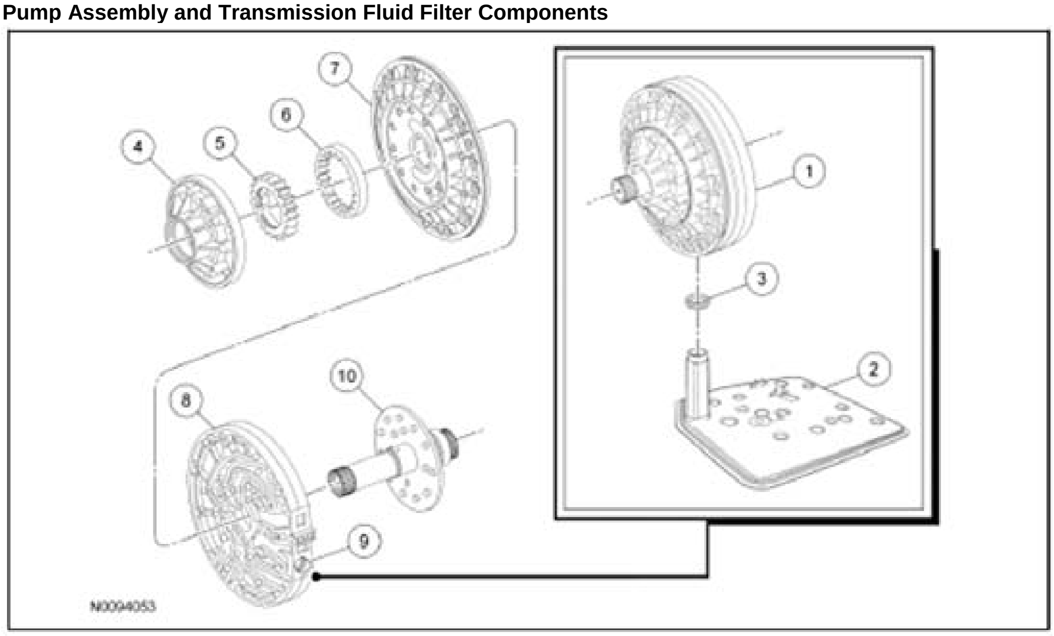
This transmission has a gear type pump that supplies transmission fluid pressure to the hydraulic system. The inner (drive) gear is turned by the torque converter hub.

The transmission fluid pump has the following parts:

- o Pump body, with inner (drive) and outer (driven) gears
- o Centering plate
- o Intermediate plate
- o Stator shaft

The transmission fluid pump draws transmission fluid from the sump area, formed by the transmission fluid pan, through the transmission fluid filter, which is installed into the intermediate plate portion of the pump assembly and sealed by a rubber seal. A magnet attached to the transmission fluid pan collects any metallic material in the transmission fluid.

Pump Assembly and Transmission Fluid Filter Components



Item	Part Number	Description
1	7A103	Transmission fluid pump assembly
2	7A098	Transmission fluid filter

Item	Part Number	Description
3	—	Transmission fluid filter seal (part of 7A098)
4	—	Transmission fluid pump body (part of 7A103)
5	—	Inner (drive) gear (part of 7A103)
6	—	Outer (driven) gear (part of 7A103)
7	—	Centering plate (part of 7A103)
8	—	Intermediate plate (part of 7A103)
9	—	Filter suction port
10	—	Stator shaft (part of 7A103)

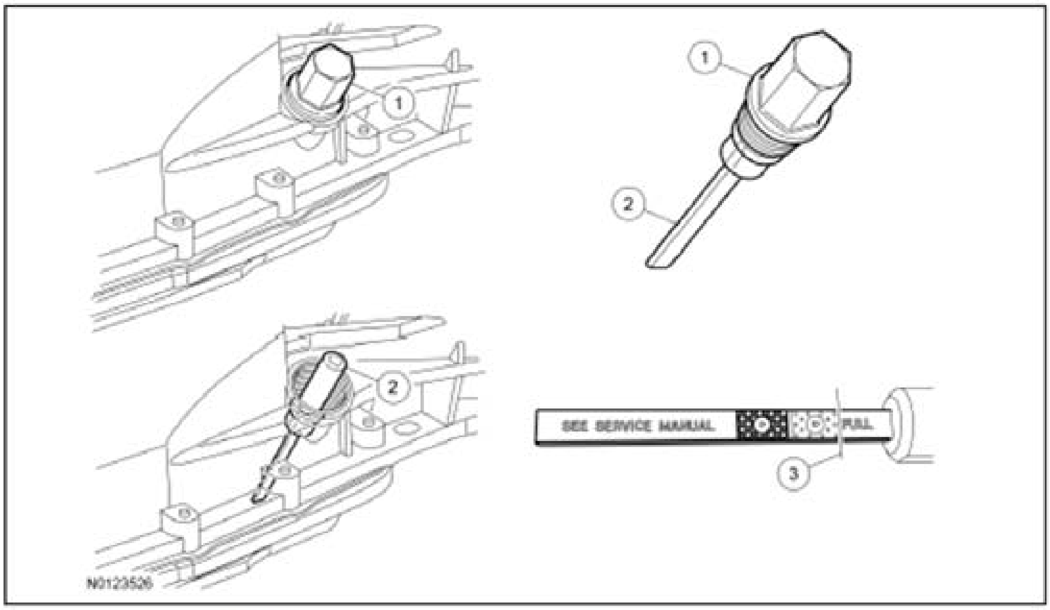
Transmission Fluid Level Indicator

A removable dipstick-type fluid level indicator is located on the right front area of the transmission case. It is held in by an external fluid fill plug. The transmission fluid level indicator is removed with the transmission fluid fill plug. The transmission fluid level indicator is removed from the fill plug to check the transmission fluid level.

The transmission fluid level is correctly checked when the transmission is at normal operating temperature, 89ºC-102ºC (193ºF-215ºF), and the vehicle is on a level surface.

The correct transmission fluid level is at the upper level of the crosshatch marks on the transmission fluid level indicator.

Transmission Fluid Level Indicator



Item	Part Number	Description
1	—	Transmission fluid fill plug
2	7A010	Transmission fluid level indicator
3	—	Transmission fluid level indicator FULL line

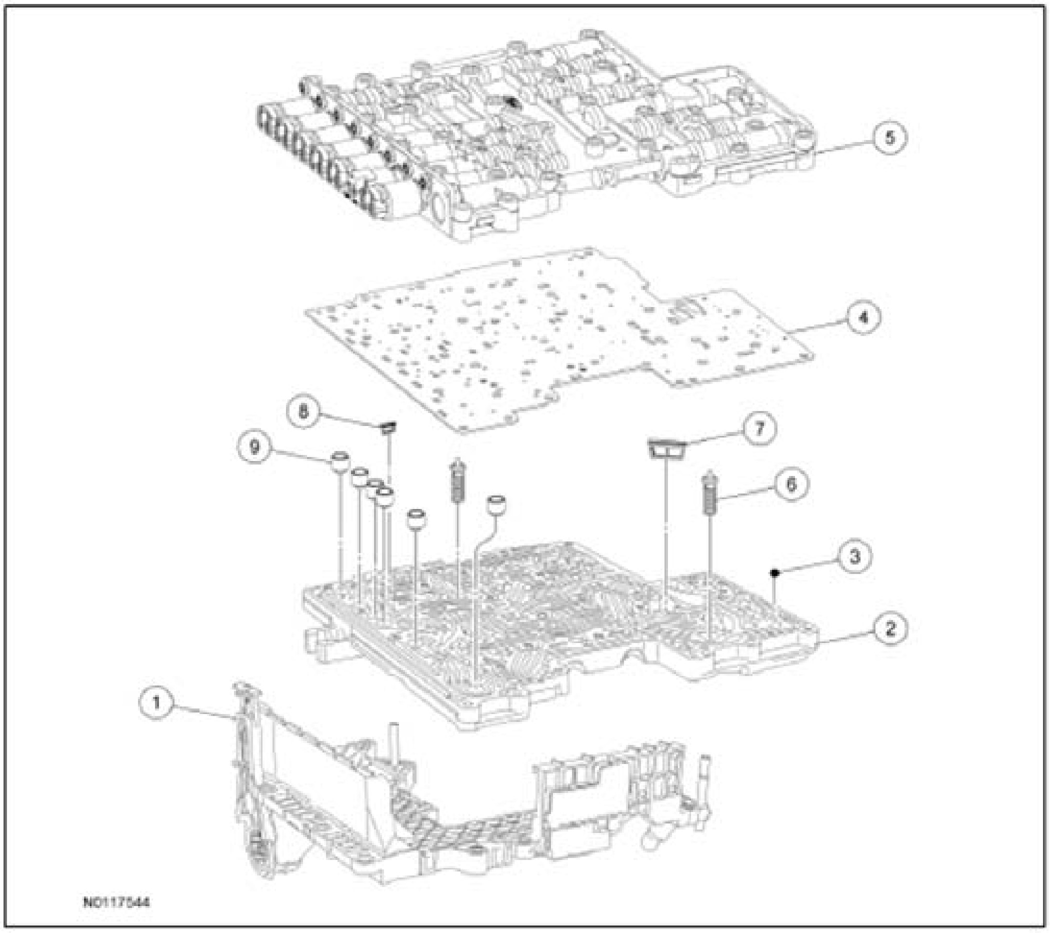
Main Control Assembly

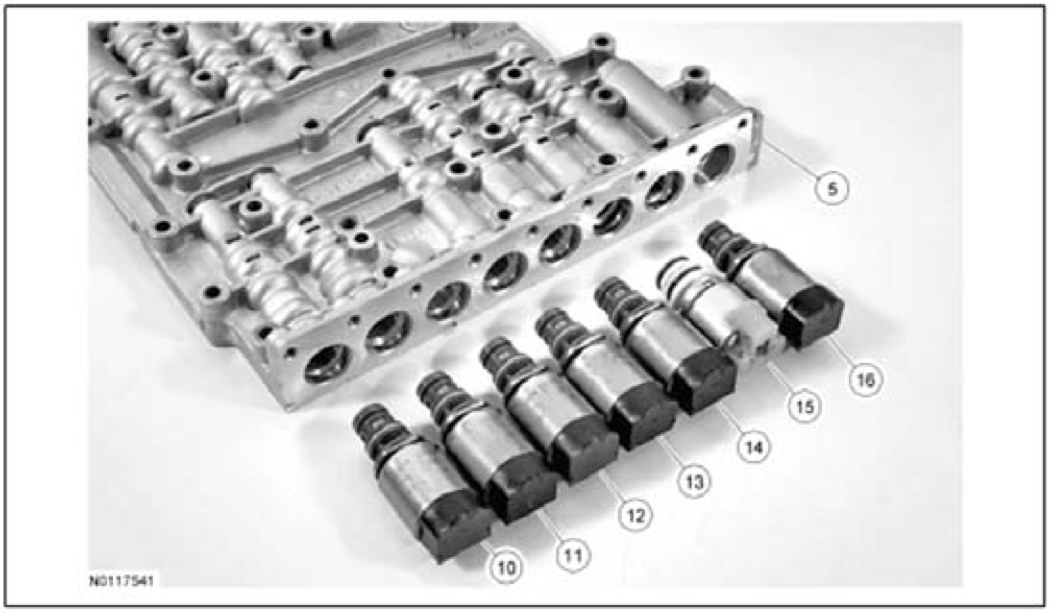
The hydraulic system of this transmission includes the fluid pump, a main control assembly and fluid passages in the transmission case and center support to apply the clutches.

The main control assembly has an upper valve body assembly, a separator plate and a lower valve body assembly. The lower valve body assembly has 7 solenoids to control the valves in the main control.

TheTurbine Shaft Speed (TSS), Output Shaft Speed (OSS), Transmission Range (TR) and Transmission Fluid Temperature (TFT) sensors are all part of the main control assembly leadframe.

Main Control Assembly

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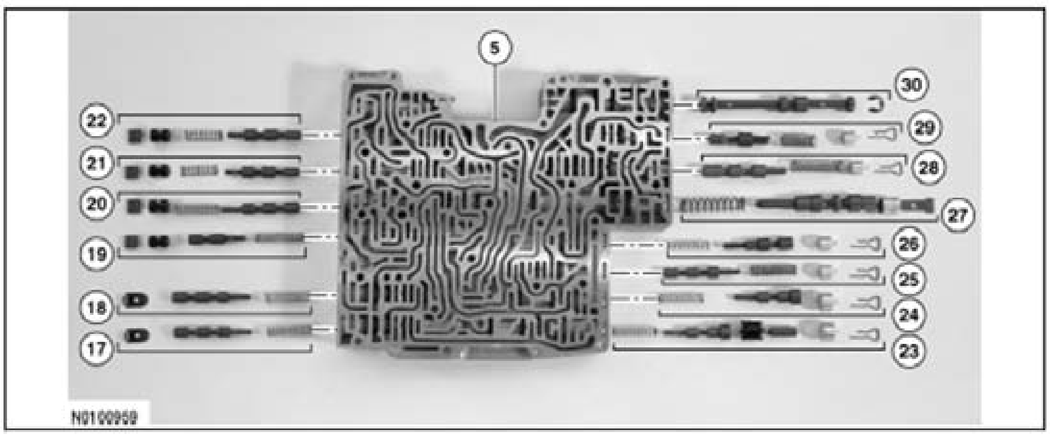
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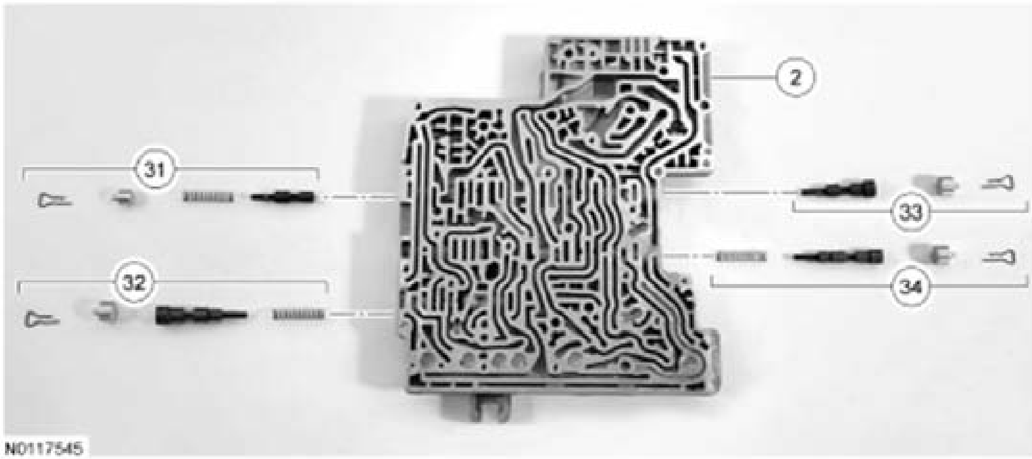
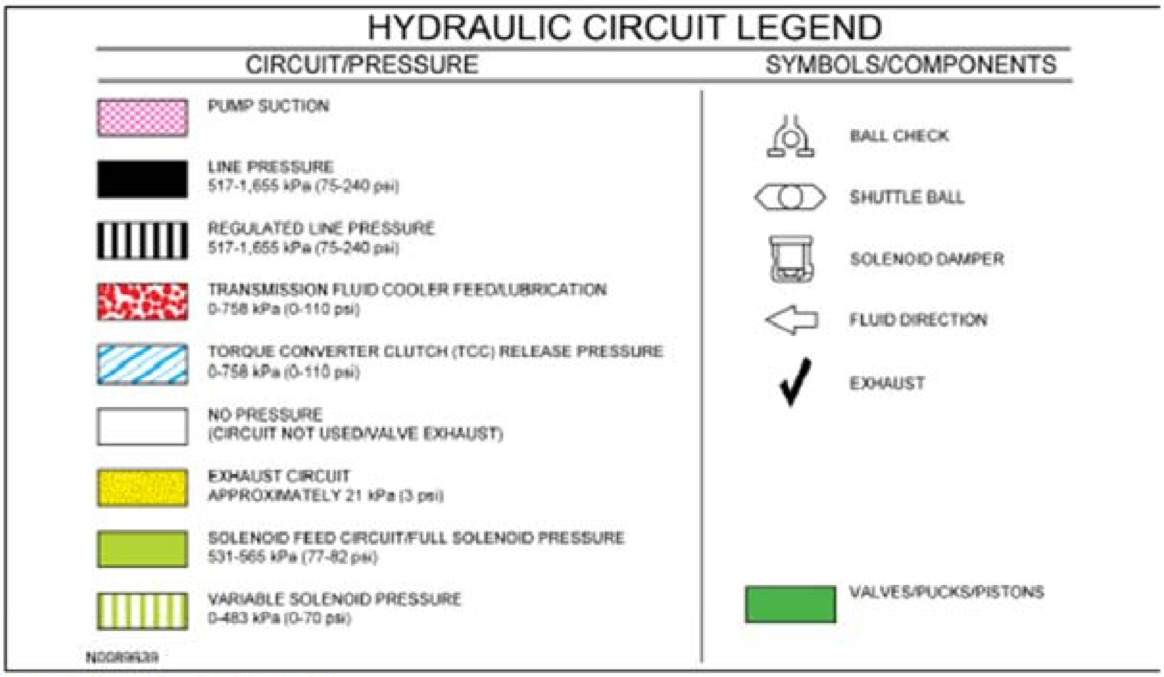


Item	Part Number	Description
1	7A100	Main control
1	7G276	Molded leadframe
2	—	Transmission control valve body (upper)
3	7E195	Transmission control valve check ball (8 required)
4	7Z490	Transmission control valve body separator plate
5	—	Transmission control valve body (lower)
6	—	Transmission control valve assembly
7	7H187	Transmission control filter assembly
8	7B155	Transmission fluid filter
9	—	Transmission solenoid damper valve assembly
10	7G383	Shift Solenoid A (SSA)
11	7G383	Shift Solenoid B (SSB)
12	7G383	Shift Solenoid C (SSC)
13	7G383	Line Pressure Control (LPC) solenoid
14	7G383	Shift Solenoid D (SSD)
15	7G484	Shift Solenoid E (SSE)
16	7G383	Torque Converter Clutch (TCC) solenoid
17	—	Forward (A) clutch latch valve assembly
18	—	Direct (B) clutch latch valve assembly
19	—	Solenoid regulator valve
20	—	Low/reverse (D1) clutch latch valve assembly
21	—	Drive enable valve
22	—	Solenoid multiplex valve
23	—	Forward (A) clutch regulator valve assembly
24	—	Overdrive (E) clutch regulator valve assembly
25	—	Overdrive (E) clutch latch valve assembly
26	—	Bypass clutch control regulator valve assembly
27	—	Main regulator valve assembly
28	—	Converter release regulator valve assembly
29	—	Lubrication control valve assembly
30	—	Manual valve assembly

Item	Part Number	Description
31	—	Low/reverse (D2) clutch latch valve assembly
32	—	Direct (B) clutch regulator valve assembly
33	—	Low/reverse (D1) clutch regulator valve assembly
34	—	Intermediate (C) clutch regulator valve

Hydraulic Circuits

Hydraulic Circuit Identification and Function



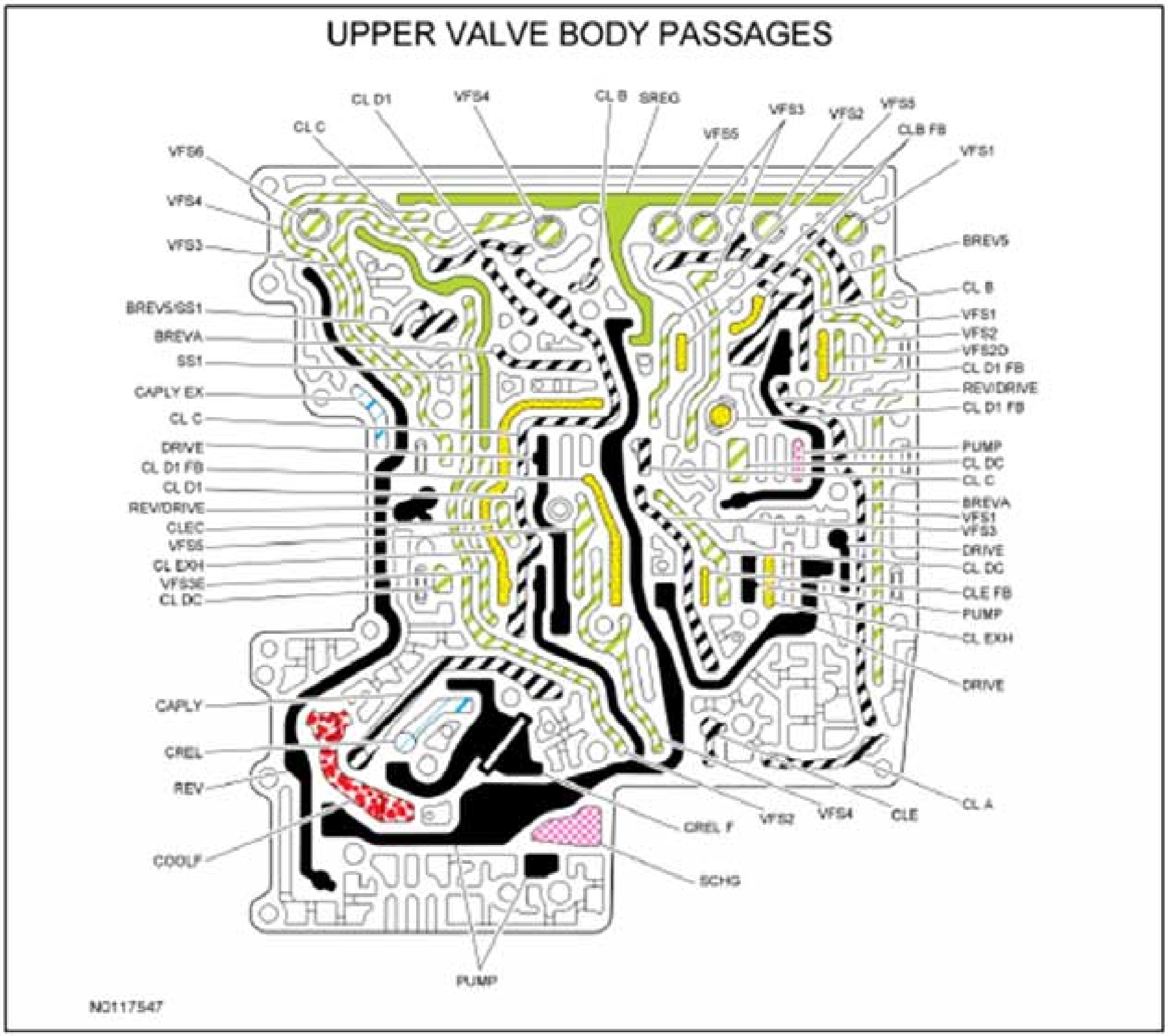
Hydraulic Circuit Identification Chart

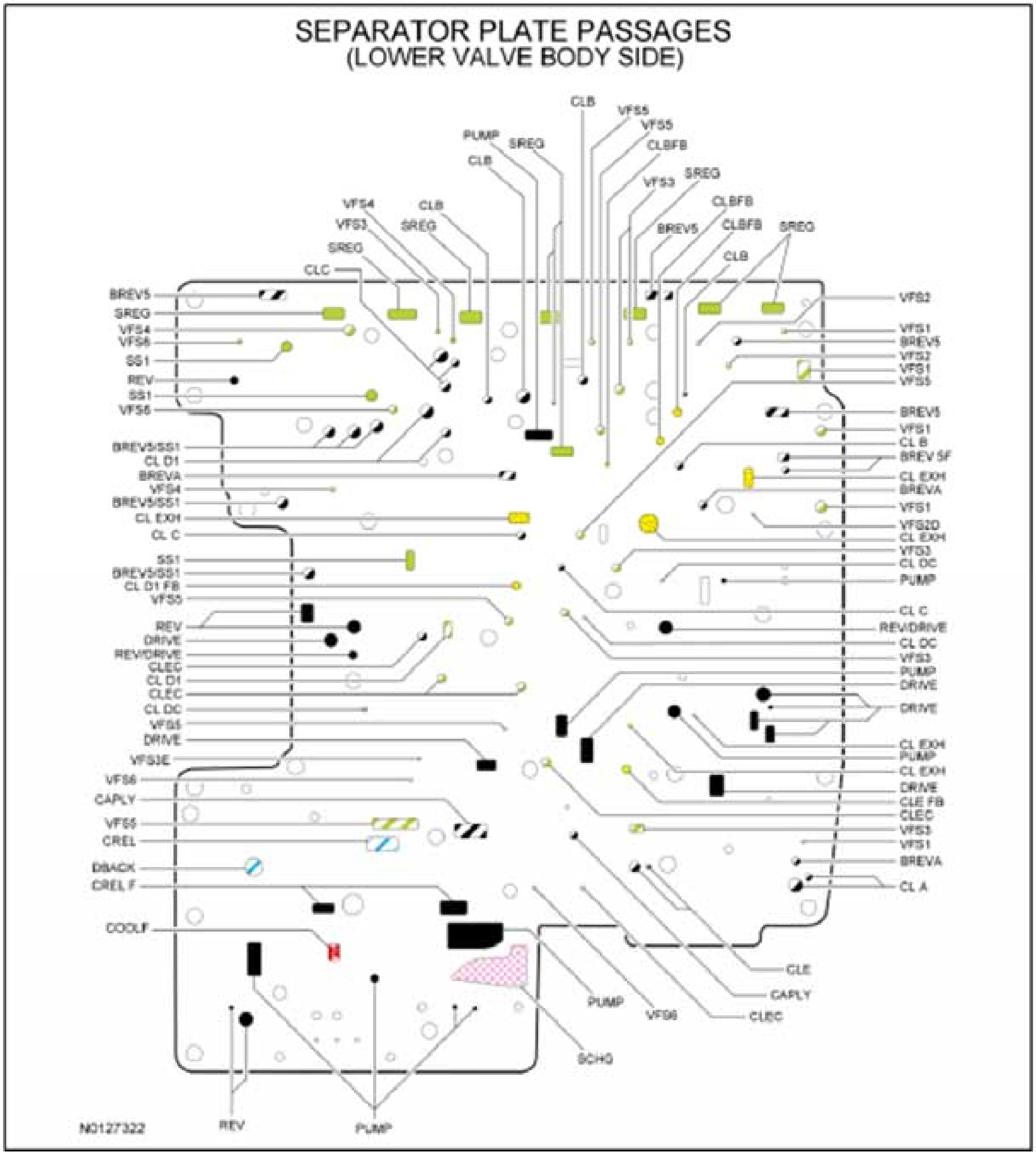
Circuit Name	Description
BREVA	BREV5 pressure from the drive enable valve to the clutch A regulator valve.
BREV5	BREV 5F pressure from the clutch A latch valve to the drive enable valve and the No. 2 shuttle ball.
BREV 5F	Regulated line pressure from the CL B circuit directed to the A clutch latch valve by the B clutch latch valve.
BREV5/SS1	BREV5 or SS1 pressure from the No. 2 shuttle ball to the solenoid multiplex valve.
CAPLY	Apply circuit to the torque converter, also the return circuit during Torque Converter Clutch (TCC) release.
CAPLY EX	TCC release pressure from the bypass clutch control regulator valve to the converter release regulator valve.
CAPLY F	Line pressure from the PUMP circuit directed to the bypass clutch control regulator valve by the main regulator valve.
CL A	Regulated line pressure from the clutch A regulator valve to the clutch A latch valve and the forward (A) clutch to apply the clutch.
CLA FB	Regulated line pressure from the clutch A latch valve that feeds back to the clutch A regulator valve.
CL B	Regulated line pressure from the clutch B regulator valve to the clutch B latch valve and the direct (B) clutch to apply the clutch.
CLB FB	Regulated line pressure from the clutch B latch valve that feeds back to the clutch B regulator valve.
CL C	Regulated line pressure from the clutch C regulator valve to the intermediate (C) clutch to apply the clutch.

Hydraulic Circuit Identification Chart (Continued)

Circuit Name	Description
CL D1	Regulated line pressure from the clutch D1 regulator valve to the clutch D1 latch valve and the low/reverse (D) clutch to apply the clutch.
CL D1 FB	Regulated line pressure from the clutch D1 latch valve that feeds back to the clutch D1 regulator valve.
CL DC	Regulated solenoid output pressure from Shift Solenoid D (SSD) directed by the solenoid multiplex valve to the D1 and D2 regulator and latch valves to apply the low/reverse (D) clutch.
CLE	Regulated line pressure from the clutch E regulator valve to the clutch E latch valve and the overdrive (E) clutch to apply the clutch.
CLEC	Regulated solenoid output pressure from the CLEC F circuit directed by the drive enable valve to the clutch E regulator and latch valves to apply the clutch.
CLEC F	Regulated solenoid output pressure from the VFS4 circuit directed to the drive enable valve by the solenoid multiplex valve to move the clutch E regulator and latch valves to apply the overdrive (E) clutch.
CLE FB	Regulated line pressure from the clutch E latch valve that feeds back to the clutch E regulator valve.
CL EXH	Line pressure regulated to approximately 21 kPa (3 psi) by the D2 latch valve that supplies exhaust pressure to the A, B, C, D1 and E clutch when the clutches are released.
COOLF	Pressure from the lubrication control valve to the oil cooler or the thermal bypass valve that feeds the lubrication circuit.
CREL	Pressure supplied to the torque converter by the converter release regulator valve to release the TCC.
CREL F	Line pressure from the main regulator valve that supplies the converter release regulator valve and the lubrication control valve.
DBACK	CAPLY EX pressure directed to the drain back valve by the converter release regulator valve.
DRIVE	Line pressure directed by the manual valve to the A, C and E clutch regulator valves and the No. 1 shuttle ball.
LUBE	Transmission lubrication circuit supplied by the COOLF circuit after the fluid circulates the transmission fluid cooler or is returned by the cooler bypass valve.
PUMP	Line pressure supplied by the pump to the manual valve, solenoid pressure regulator valve, main regulator valve, clutch D1 regulator valve, clutch D2 regulator valve and clutch D2 latch valve.
REV	Line pressure from the manual valve to the No. 1 shuttle ball and the solenoid multiplex valve.
REV/DRIVE	REV or DRIVE pressure from the No. 1 shuttle ball to the clutch B regulator valve.
SCHG	Line pressure from the main regulator valve to the pump suction port.
SREG	Line pressure from the solenoid regulator valve that supplies pressure to the 7 solenoids Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC), SSD, Shift Solenoid E (SSE), TCC solenoid and Line Pressure Control (LPC) solenoid.
SS1	Solenoid output pressure from SSE to the drive enable valve and to shuttle ball No. 2. to direct SSD output pressure to clutch E regulator and latch valves to apply the overdrive (E) clutch.
VFS1	Solenoid output pressure from SSA to the A clutch regulator and latch valve to apply the forward (A) clutch.
VFS2	Solenoid output pressure from SSB to the B clutch regulator and latch valve to apply the direct (B) clutch and is also routed to the D1 latch valve.
VFS2D	SSB output pressure from the VFS2 circuit directed to the clutch B regulator valve by the D1 latch valve.
VFS3	Solenoid output pressure from SSC to the C clutch regulator valve to apply the intermediate (C) clutch and is also routed to the clutch E latch valve.
VFS3E	SSC output pressure from the VFS3 circuit directed to the clutch C regulator valve by the clutch E latch valve.
VFS4	Solenoid output pressure from SSD to the solenoid multiplex valve to apply either the D or E clutch.
VFS5	Solenoid output pressure from the LPC solenoid to the main regulator valve to control line pressure.
VFS6	Solenoid output pressure from the TCC solenoid to the bypass clutch control regulator valve and the converter release regulator valve to control the TCC.

Main Control Hydraulic Passage Identification




SEPARATOR PLATE PASSAGES
(LOWER VALVE BODY SIDE)
CLB
VFS5
VFS5
PUMP
SREG
CLB
CLBFB
VFS3
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CLB
VFS3
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SREG
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CLBFB
BREV5
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CLB
BREV5
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VFS6
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VFS6
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VFS5
CREL
DBACK
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CL B
BREV 5F
CL EXH
BREVA
VFS1
VFS2D
CL EXH
VFS3
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PUMP
CL C
REV/DRIVE
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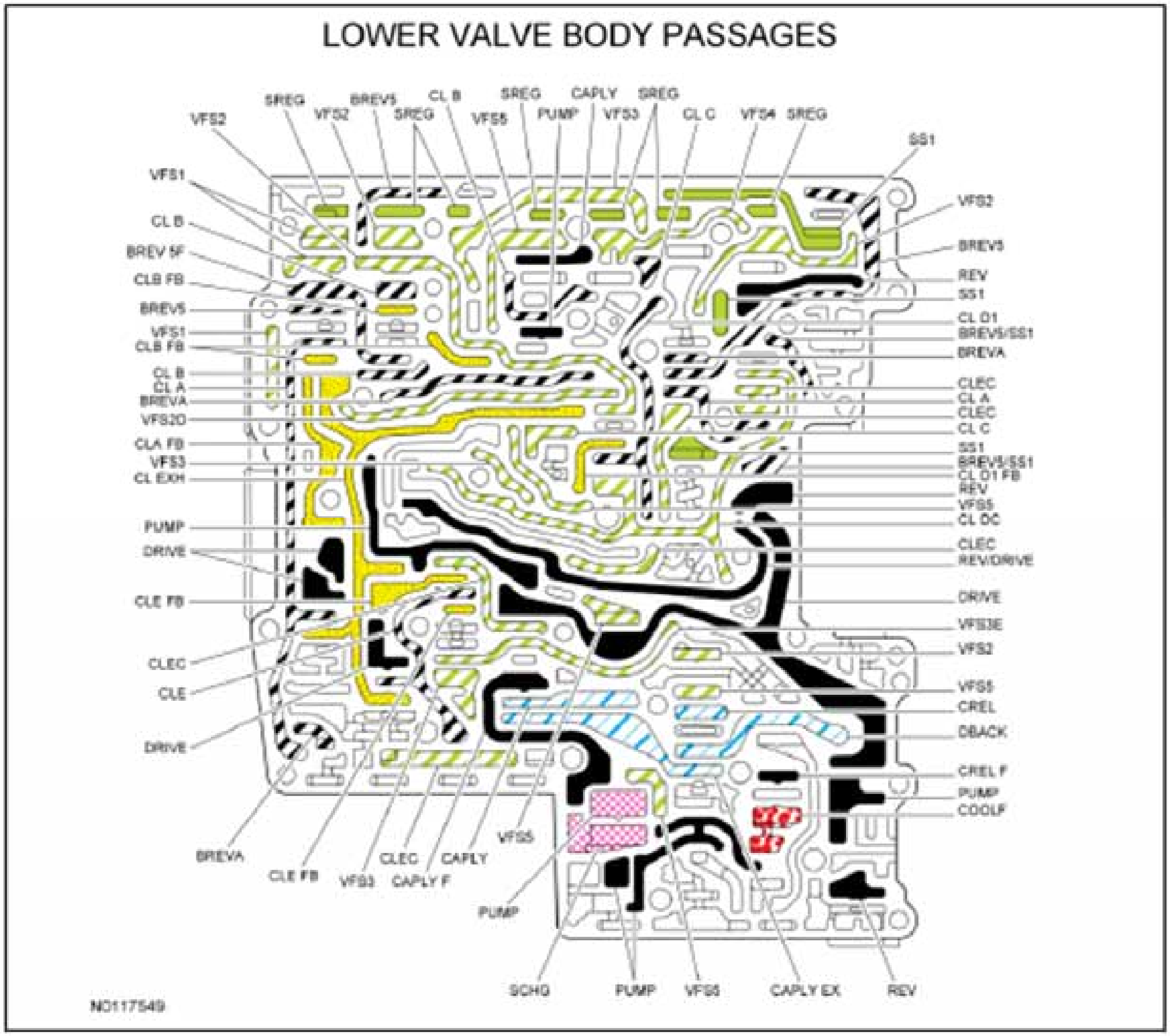

LOWER VALVE BODY PASSAGES
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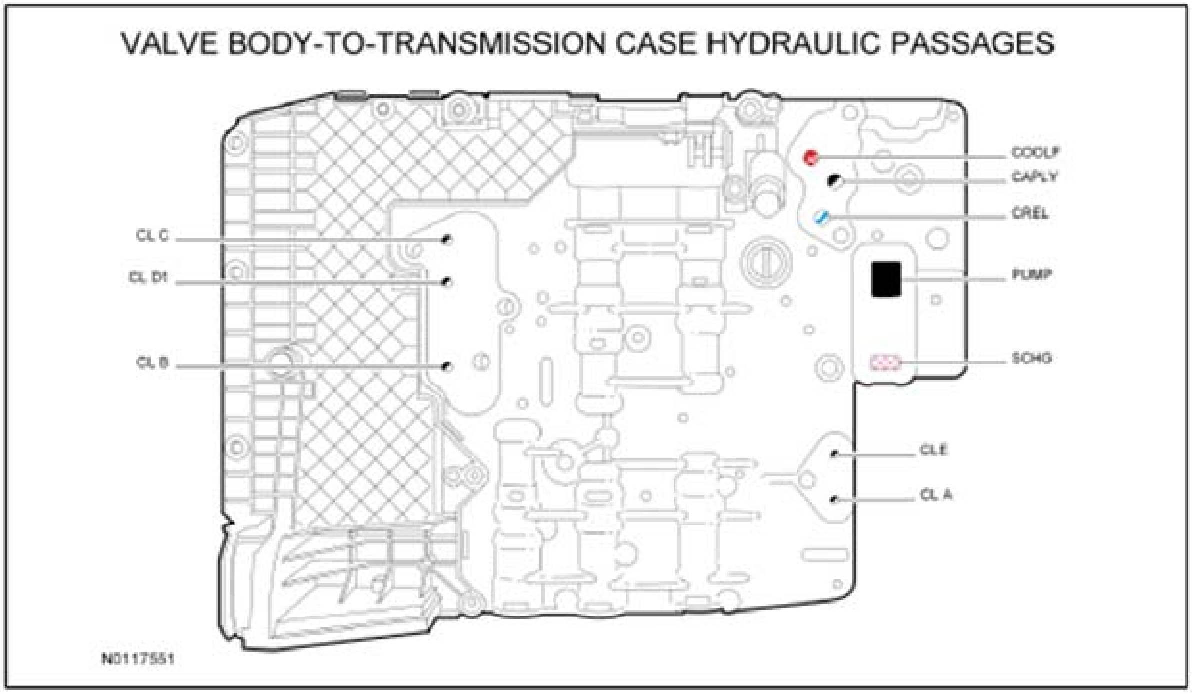
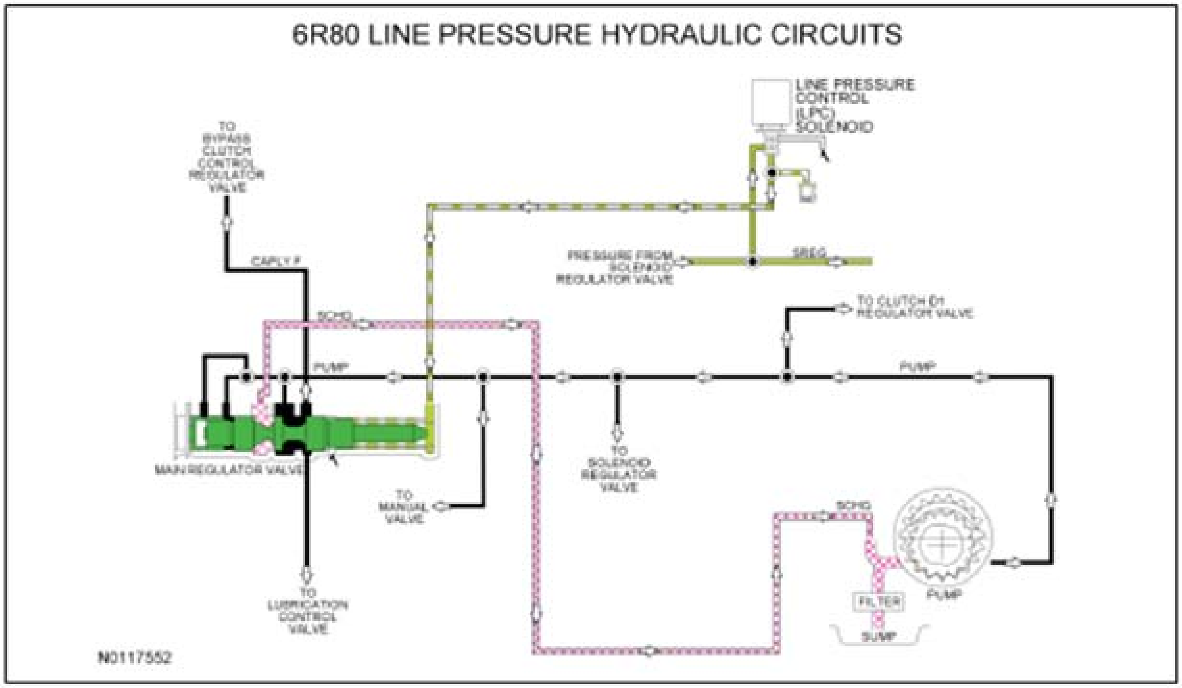


Line Pressure Hydraulic Circuits

The PCM controls line pressure with the Line Pressure Control (LPC) solenoid. Varying pressure from the LPC solenoid effects shift feel while allowing sufficient pressure for clutch application.

When the engine is running, the pump supplies pressure to the main regulator valve through the PUMP circuit. The position of the main regulator valve controls line pressure (in the PUMP circuit). Pressure from the LPC through the VFS5 circuit controls the position of the main regulator valve.

The main regulator valve varies pressure in the SCHG circuit. The higher the pressure in the SCHG circuit, the lower the line pressure (PUMP circuit) is. As SCHG pressure decreases, line pressure (PUMP circuit) increases.

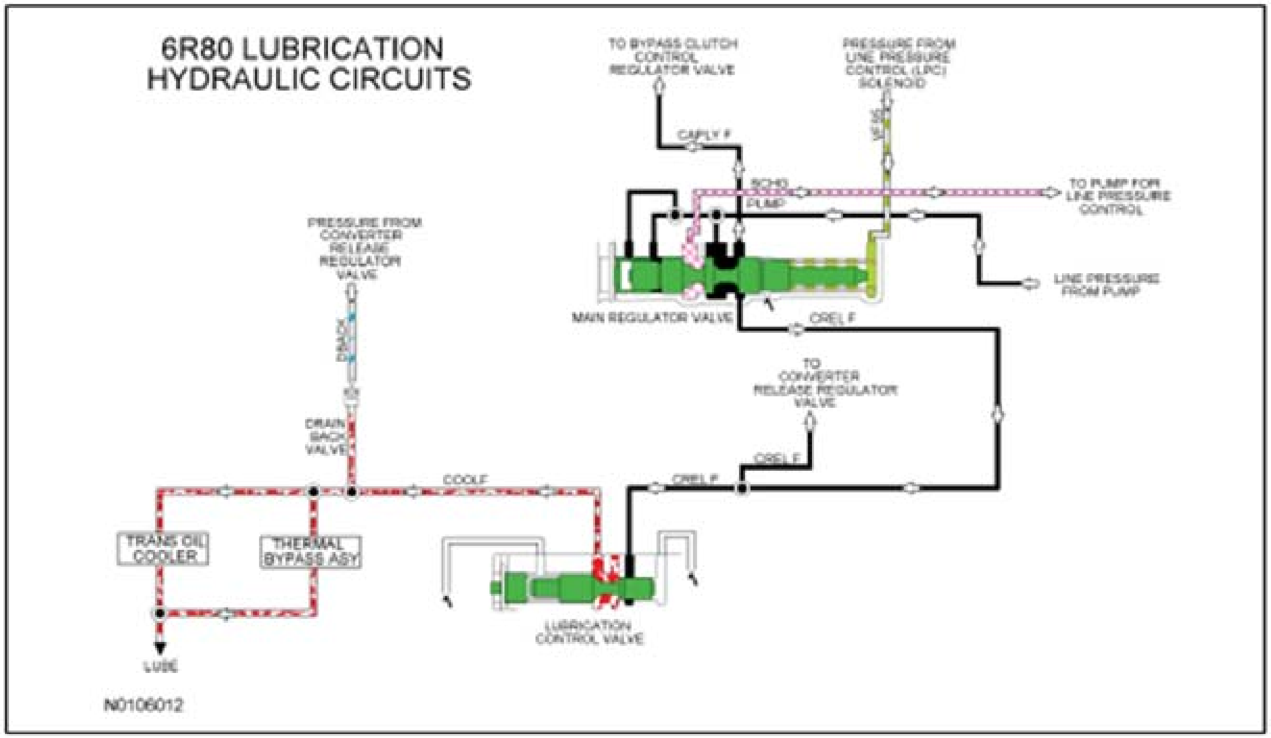


Lubrication Hydraulic Circuits

The main regulator valve supplies pressure to the lubrication control valve through the CREL F circuit. When the Torque Converter Clutch (TCC) is applied, the lubrication control valve supplies the transmission lubrication through the COOLF circuit to the LUBE circuit.

When the TCC is released, return fluid from the torque converter is supplied to the LUBE circuit through the CAPLY, CAPLY EX and DBACK circuits.

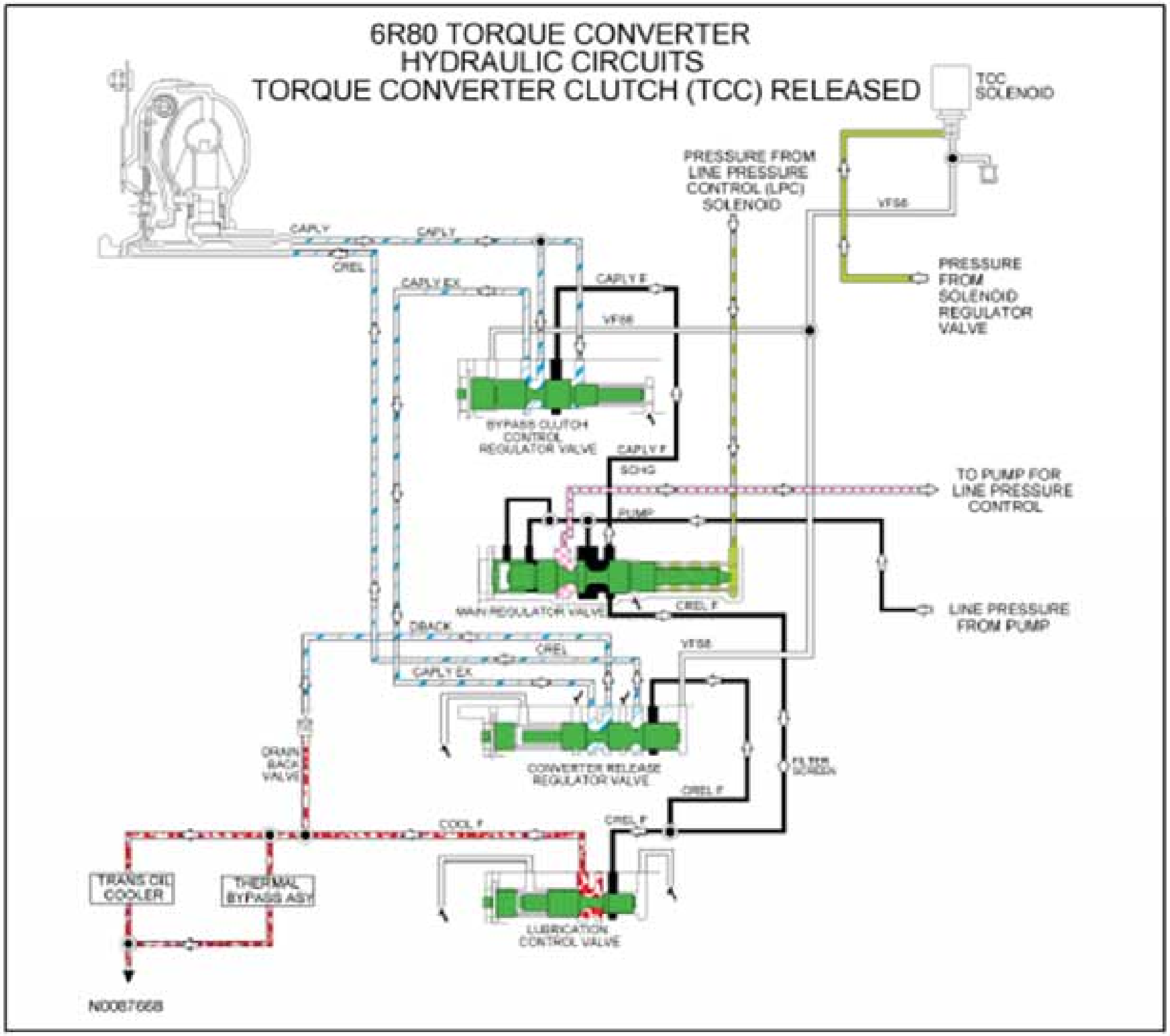
Pressure in the LUBE circuit either circulates through the thermal bypass valve when Transmission Fluid Temperature (TFT) is below operating temperature or through the transmission fluid cooler when the transmission fluid is at or above operating temperature. Return fluid from the thermal bypass valve or the transmission fluid cooler enters the input shaft through the pump assembly and flows through passages in the input shaft, intermediate shaft and output shaft to provide lubrication for the transmission.



Torque Converter Hydraulic Circuits

When the TCC is released, line pressure is supplied to the converter release regulator valve from the lubrication control valve through the CREL F circuit. The converter release regulator valve supplies pressure to the torque converter through the CREL circuit to release the torque converter.

CREL pressure exits the torque converter through the CAPLY circuit and goes to the bypass clutch control regulator valve. The bypass clutch control regulator valve directs the fluid back to the converter release regulator valve through the CAPLY EX circuit. The converter release regulator valve direct the fluid to the DBACK circuit where it supplies lubrication in the LUBE circuit.

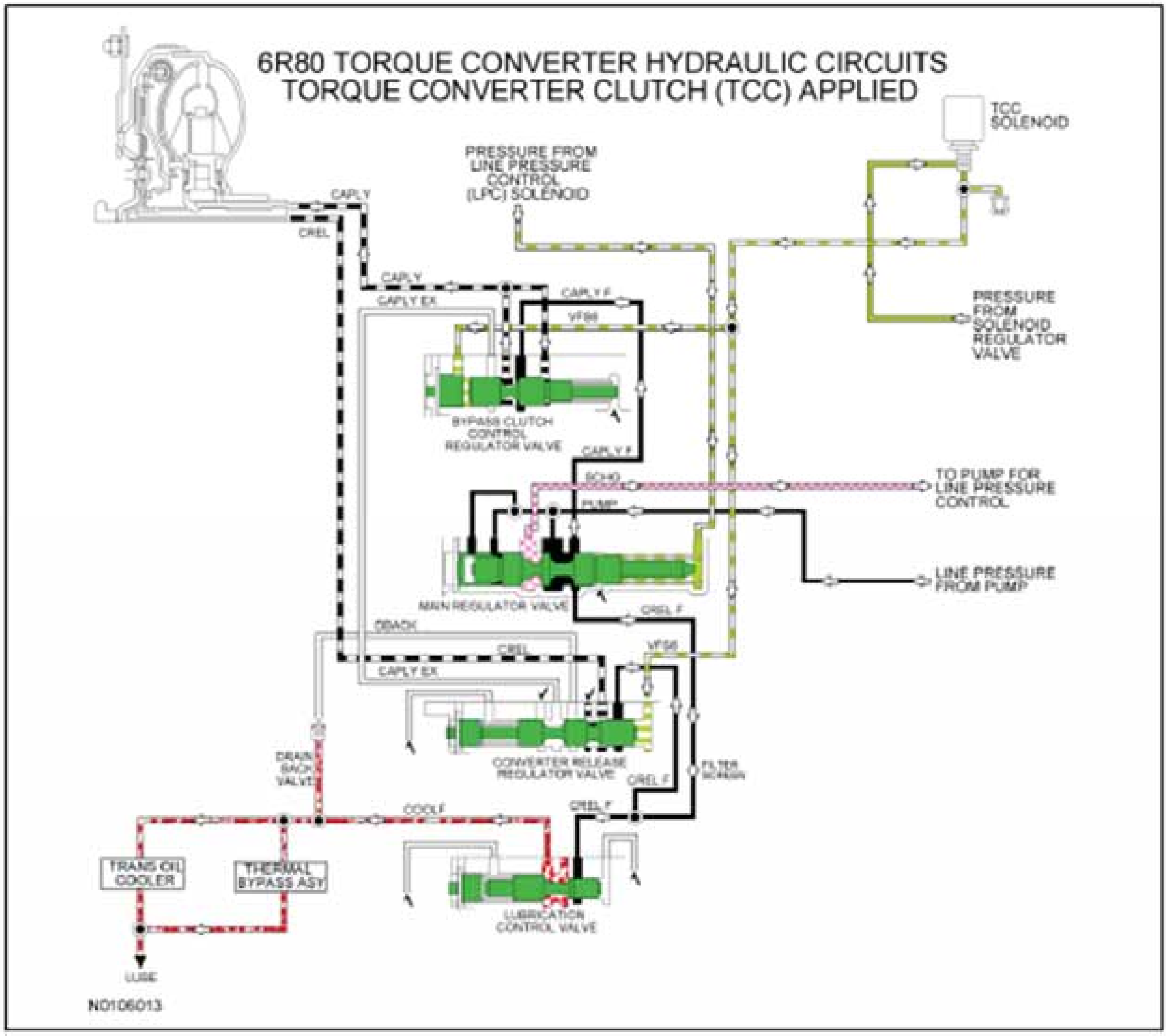


When the TCC is applied, the TCC solenoid applies hydraulic pressure to the bypass clutch control regulator valve and the converter release regulator valve through the VFS6 circuit to position the valves to apply the TCC.

Line pressure is supplied to the bypass clutch control regulator valve from the main regulator valve. The bypass clutch control regulator valve directs regulated line pressure to the TCC through the CAPLY circuit to apply the TCC.

CAPLY pressure exits the torque converter through the CREL circuit and goes to the converter release regulator valve.

For torque converter description and function, refer to Torque Converter in this section.



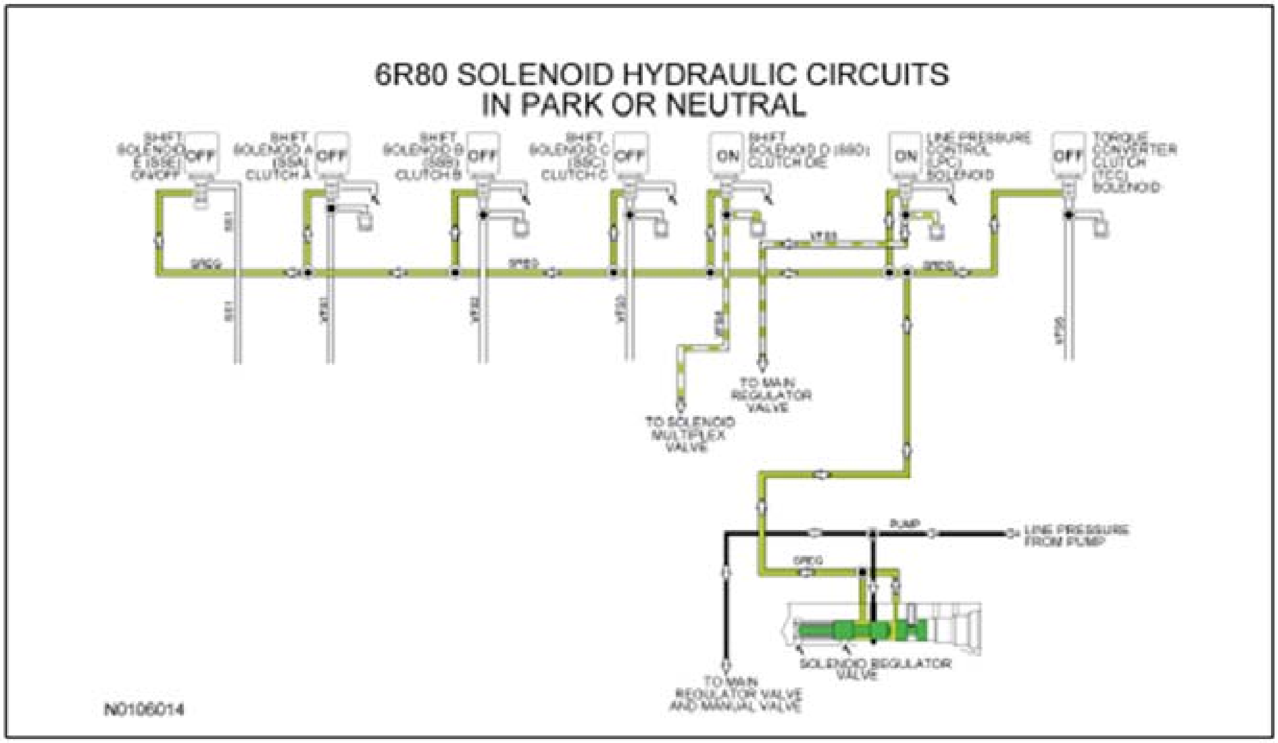
Solenoid Hydraulic Circuits

LINE pressure from the pump is directed to the individual shift, TCC solenoid and LPC solenoid by the solenoid regulator valve through the SREG circuit.

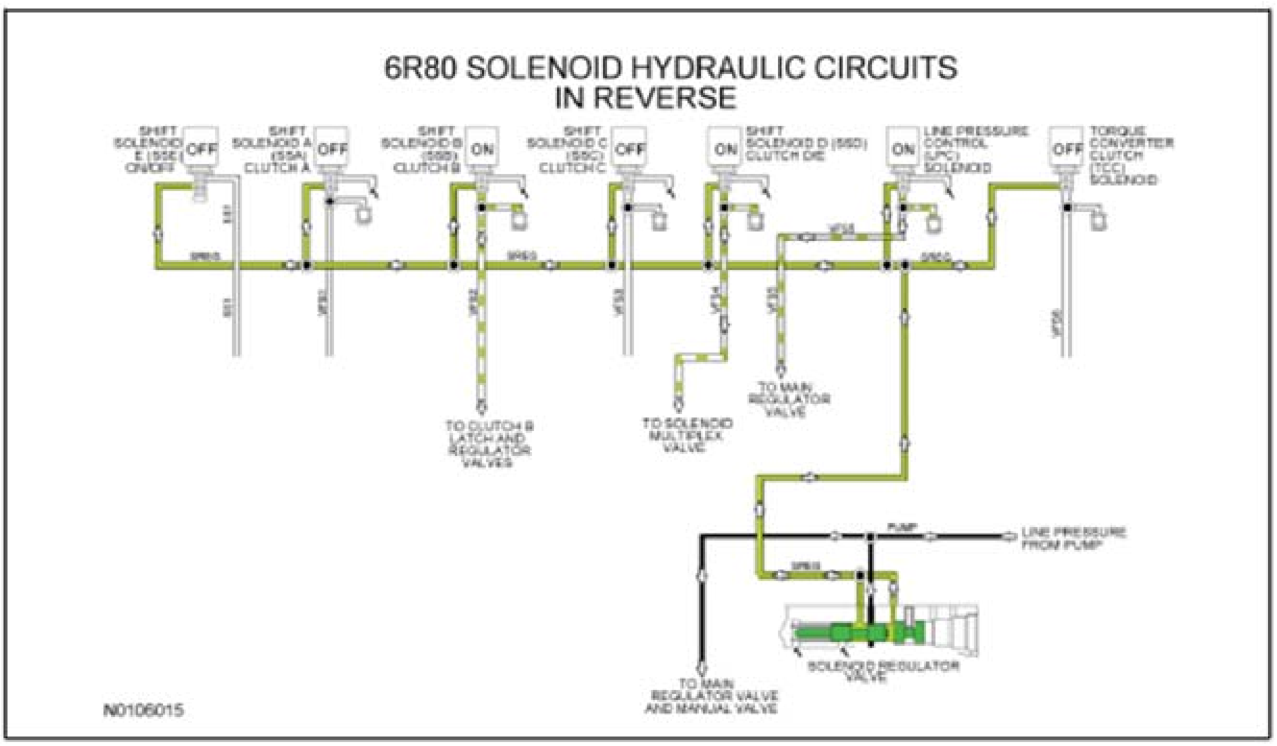
The PCM controlled solenoids, direct full or regulated SREG pressure to the valves that they control.
For electrical operation of the solenoids, refer to Transmission Electronic Control System in this section.

The LPC solenoid sends varying pressure to the main regulator valve to control line pressure.

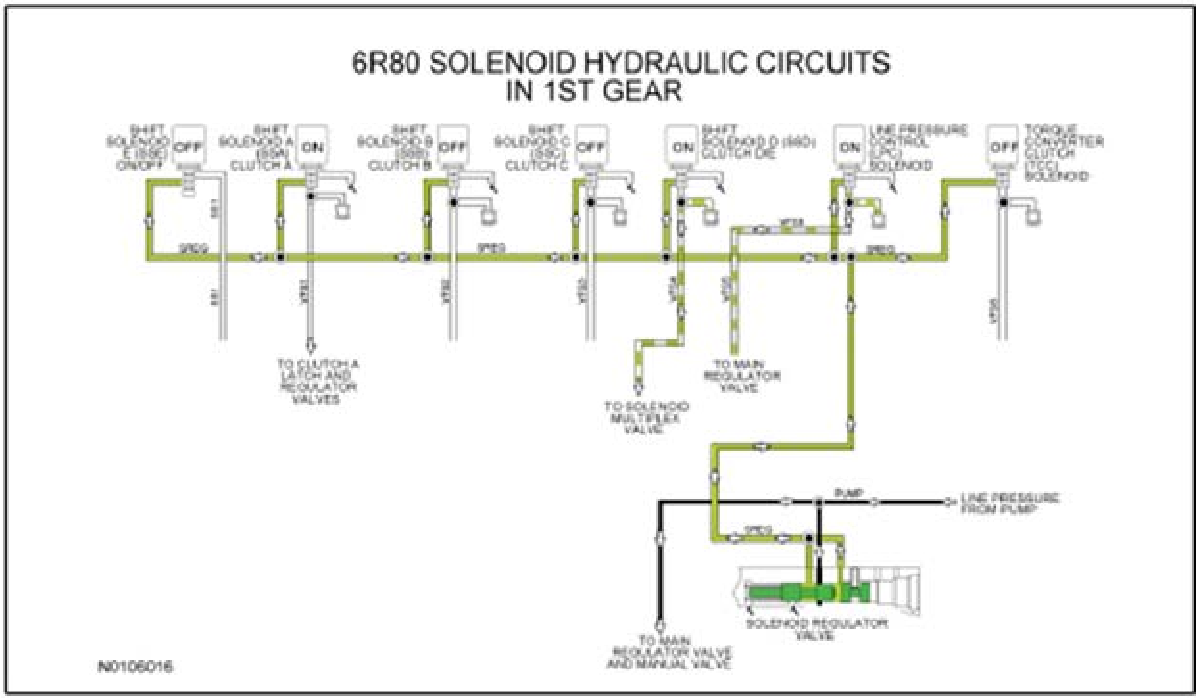
In the PARK and NEUTRAL position, the PCM supplies low current to Shift Solenoid D (SSD) to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 regulator and latch valves to apply the low/reverse clutch (D).



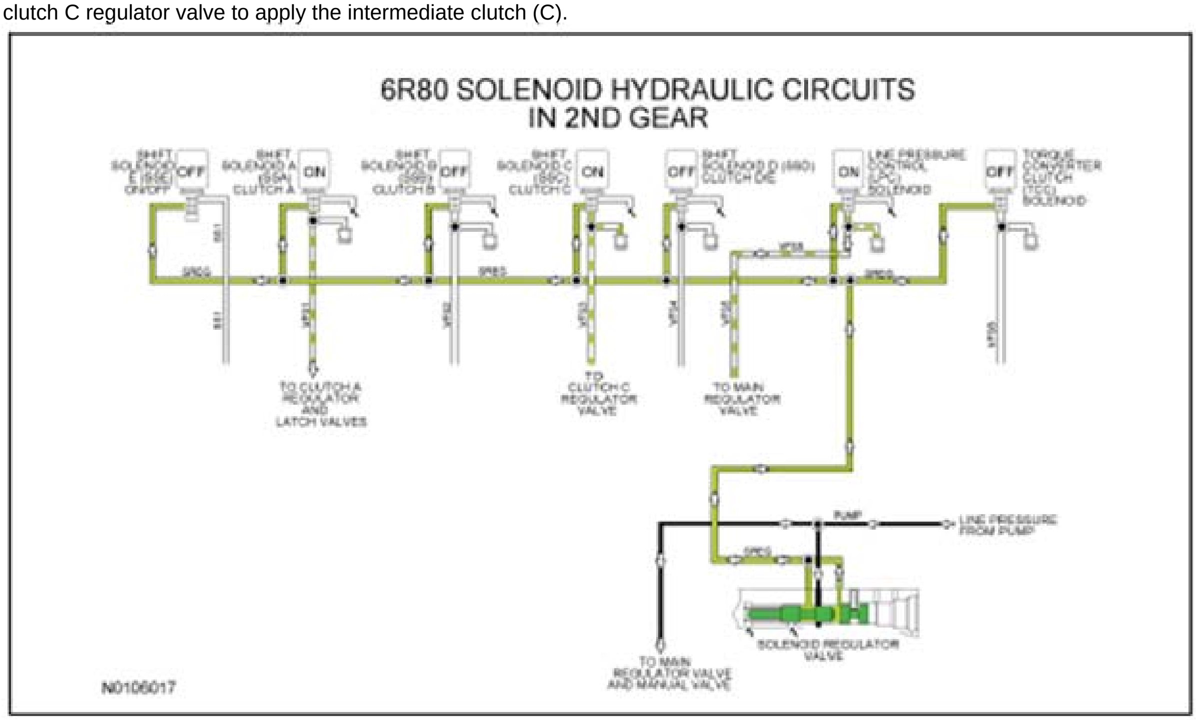
In the REVERSE position, the PCM supplies low current to Shift Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The PCM also supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 regulator and latch valves to apply the low/reverse clutch (D).



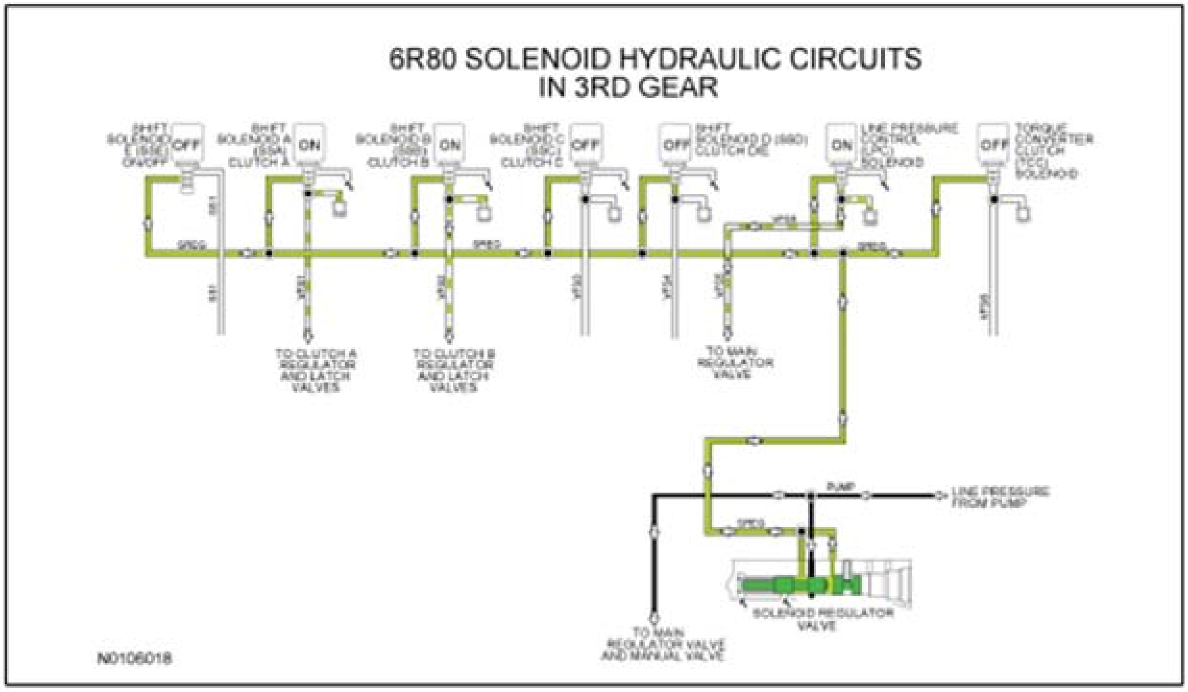
In 1st gear, the PCM supplies high current to Shift Solenoid A (SSA) to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The PCM also supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the D1 regulator and latch valves to apply the low/reverse clutch (D).



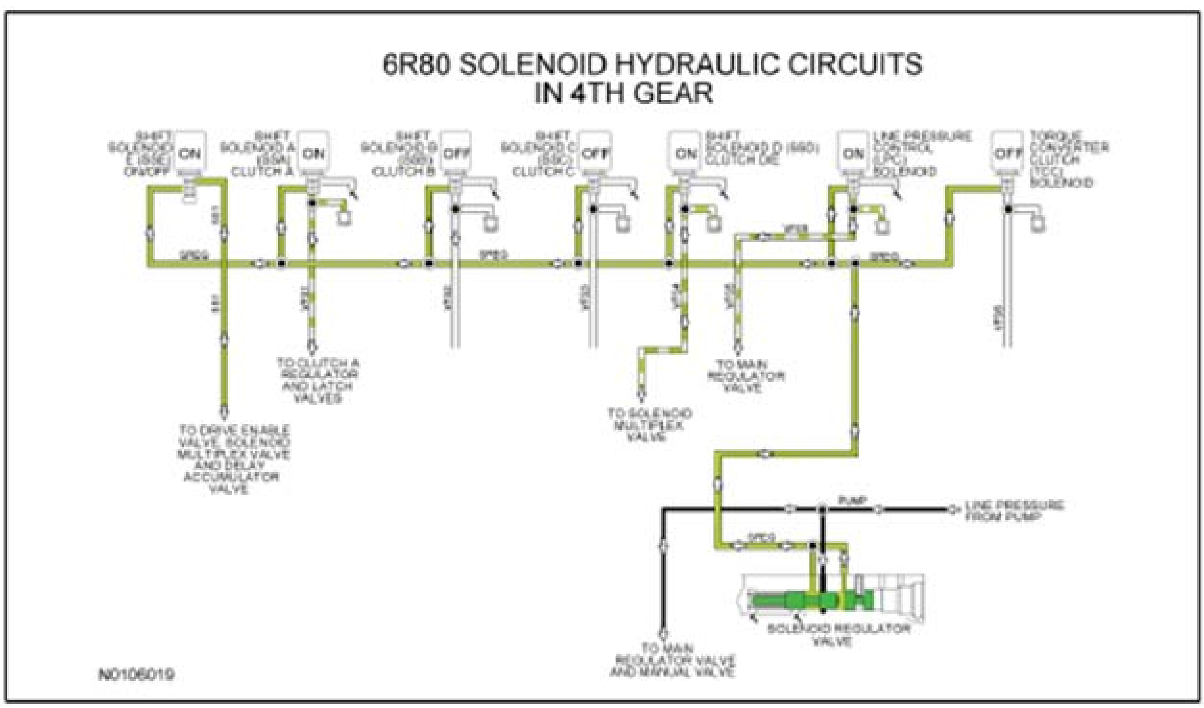
In 2nd gear, the PCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The PCM also supplies high current to Shift Solenoid C (SSC) to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C).



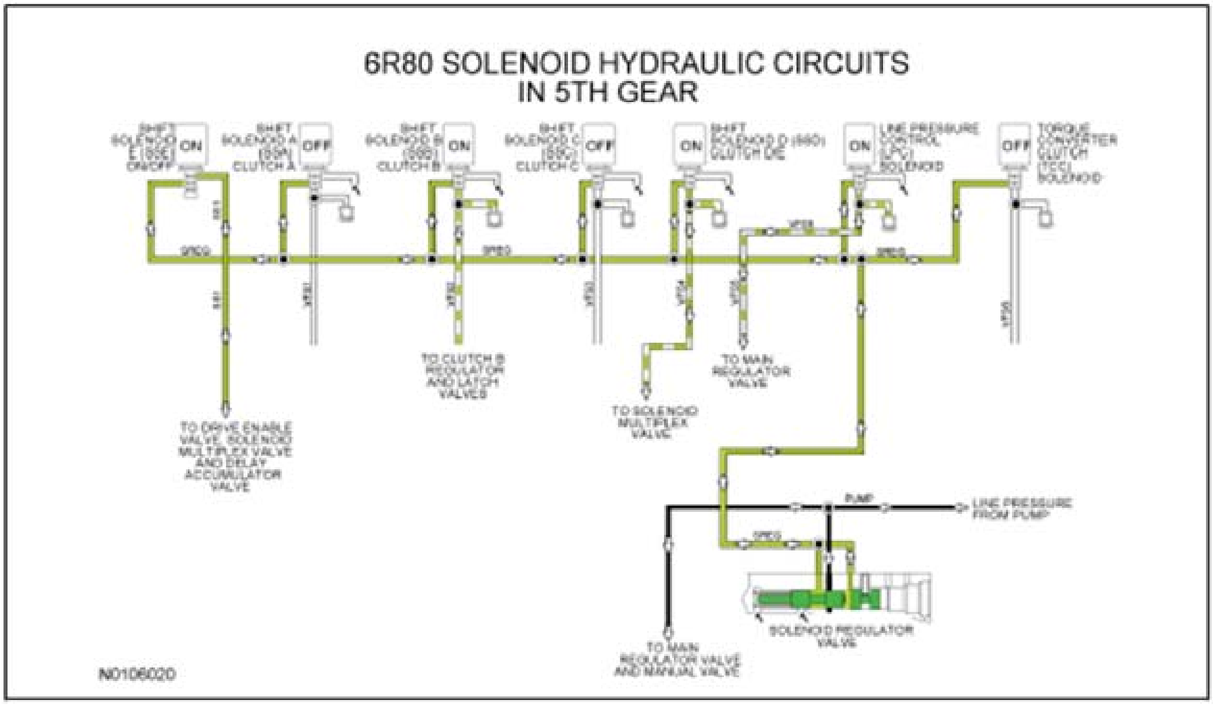
In 3rd gear, the PCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The PCM also supplies low current to Shift Solenoid B (SSB) to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



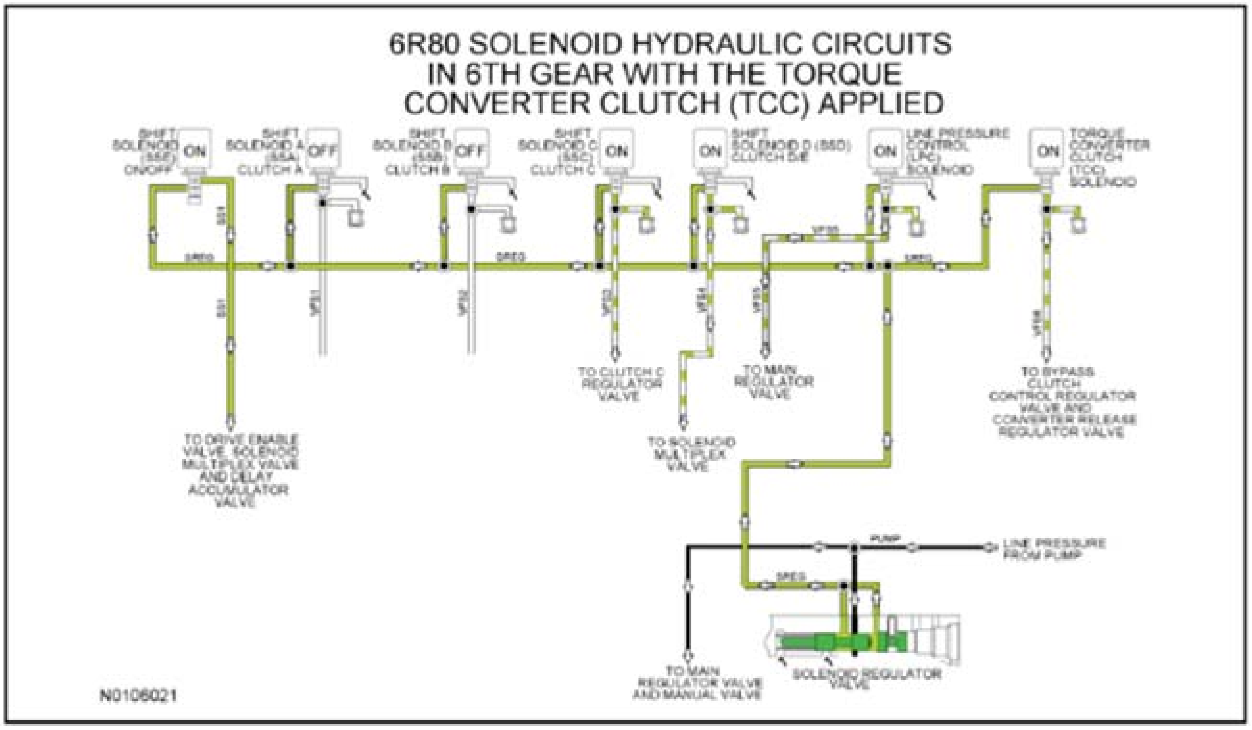
In 4th gear, the PCM supplies high current to SSA to apply high-regulated pressure to the clutch A regulator and latch valves to apply the forward clutch (A). The PCM also supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The PCM turns on Shift Solenoid E (SSE) to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves.



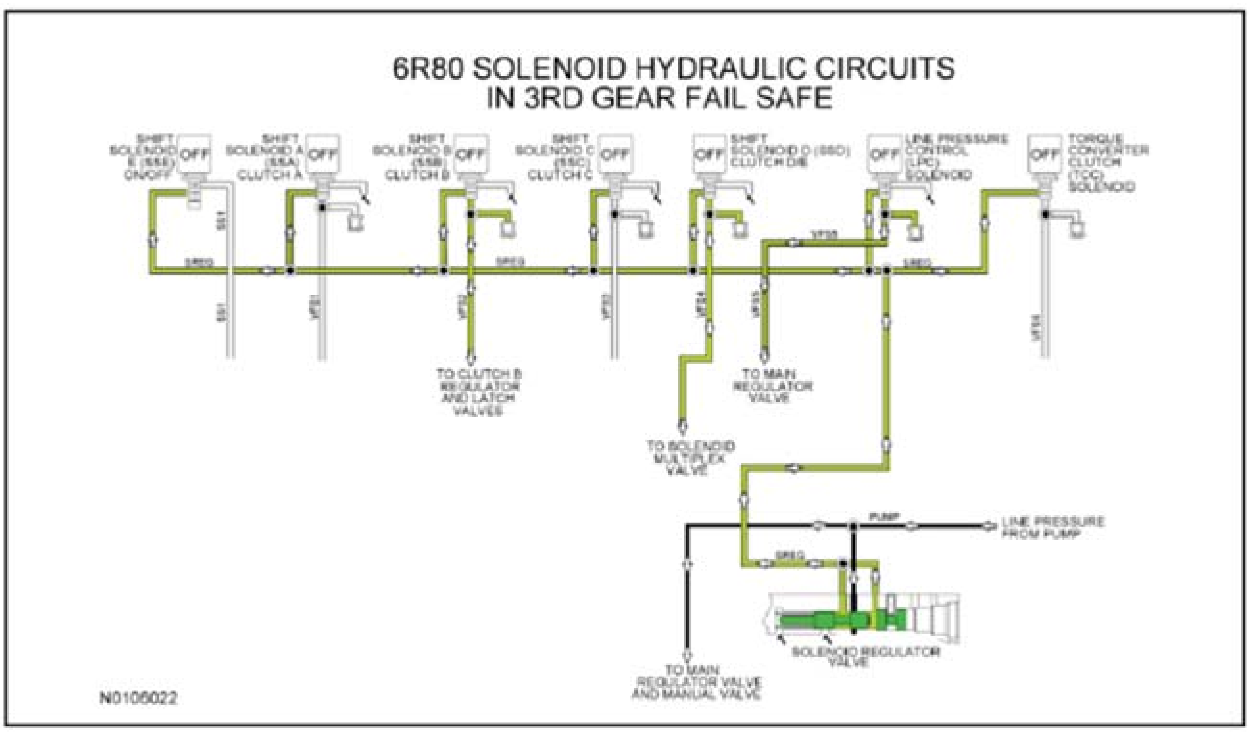
In 5th gear, the PCM supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The PCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The PCM also supplies low current to SSB to apply high-regulated pressure to the clutch B regulator and latch valves to apply the direct clutch (B).



In 6th gear, the PCM supplies low current to SSD to apply high-regulated pressure to the solenoid multiplex valve which directs the pressure to the clutch E regulator and latch valves to apply the overdrive clutch (E). The PCM turns on SSE to apply pressure to the solenoid multiplex valve and the drive enable valve to direct SSD pressure to the clutch E regulator and latch valves. The PCM also supplies high current to SSC to apply high-regulated pressure to the clutch C regulator valve to apply the intermediate clutch (C). To apply the TCC, the PCM supplies high current to the TCC solenoid to apply high-regulated pressure to the converter release regulator valve and the bypass clutch control regulator valve to apply the TCC.



In 3rd gear fail safe, all solenoids are off. SSB, in the off position, applies high pressure to the clutch B regulator and latch valves to apply the direct clutch (B). The forward clutch (A) is hydraulically applied in 3rd gear fail safe. PCA provides maximum solenoid pressure to the main regulator valve for maximum line pressure. Also, SSD is on which applies high pressure to the solenoid multiplex valve which is directed to the drive enable valve where it is blocked.

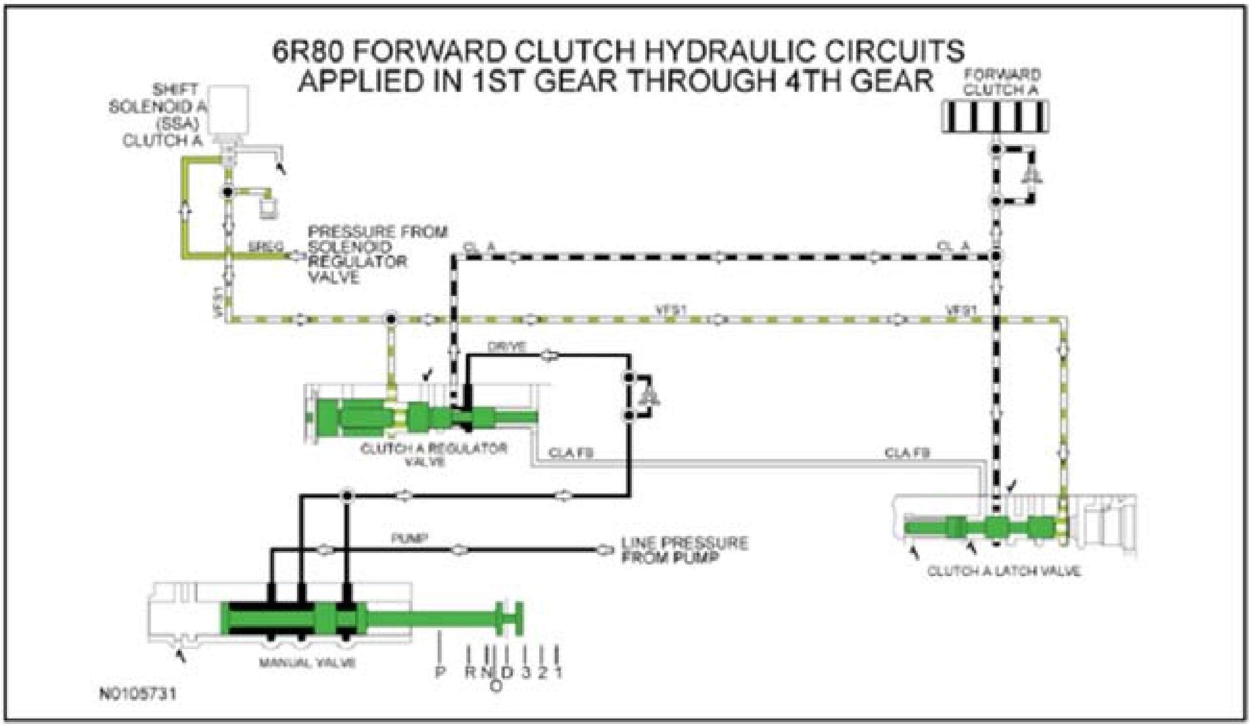


Forward Clutch (A) Hydraulic Circuits

To apply the forward clutch (A), the manual valve must be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch A regulator valve through the DRIVE circuit.

For the forward clutch (A) to apply, SSA provides regulated solenoid pressure from the SREG circuit to the clutch A regulator and latch valves through the VFS1 circuit to position the valves to apply the forward clutch (A). As the forward clutch is applied, SSA increases pressure to the clutch A regulator and
latch valves.

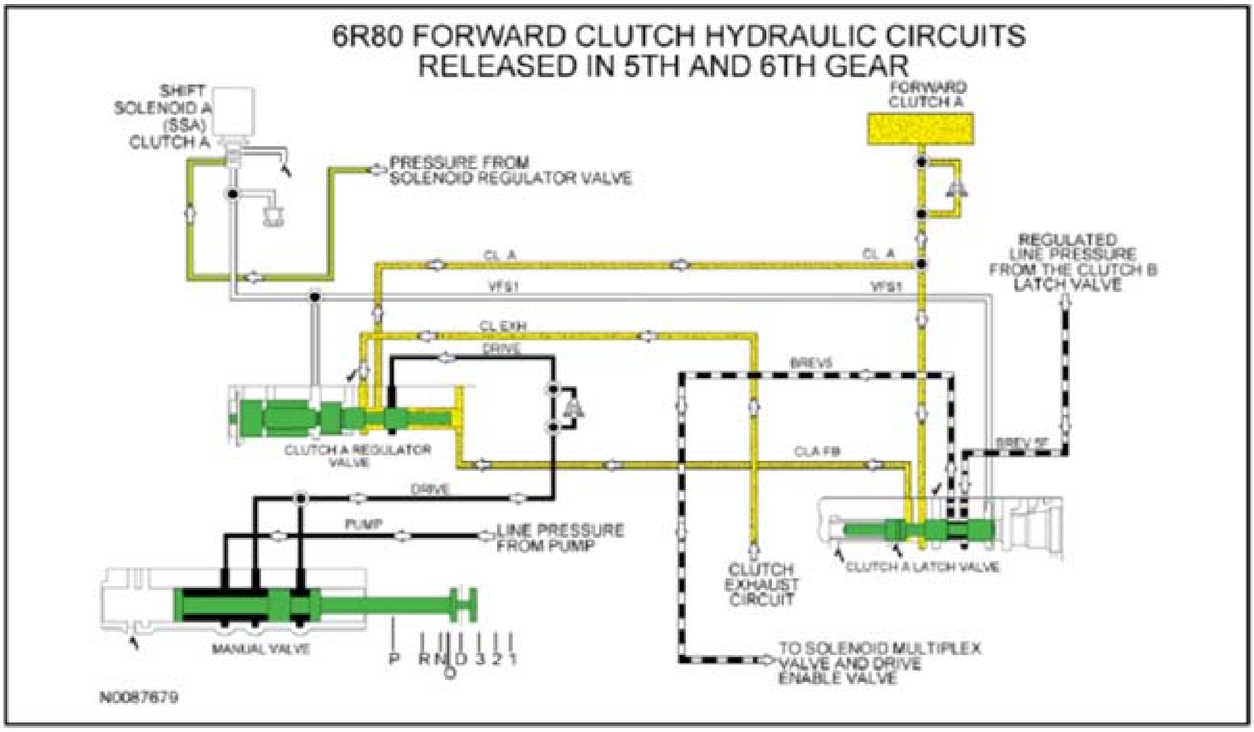
The clutch A regulator valve provides regulated line pressure to the CL A circuit to apply the forward clutch (A).



The forward clutch (A) is released when the manual valve is in the NEUTRAL, REVERSE or PARK position or the when the manual valve is in the DRIVE position with the transmission in 5th or 6th gear.

SSA lowers pressure to the clutch A regulator and latch valve to position the valves to lower the regulated line pressure in the CL A circuit to release the clutch.

When the forward clutch (A) is released, the clutch A regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL A circuit to fill the circuit and the forward clutch (A) with fluid at low pressure, approximately 21 kPa (3 psi).

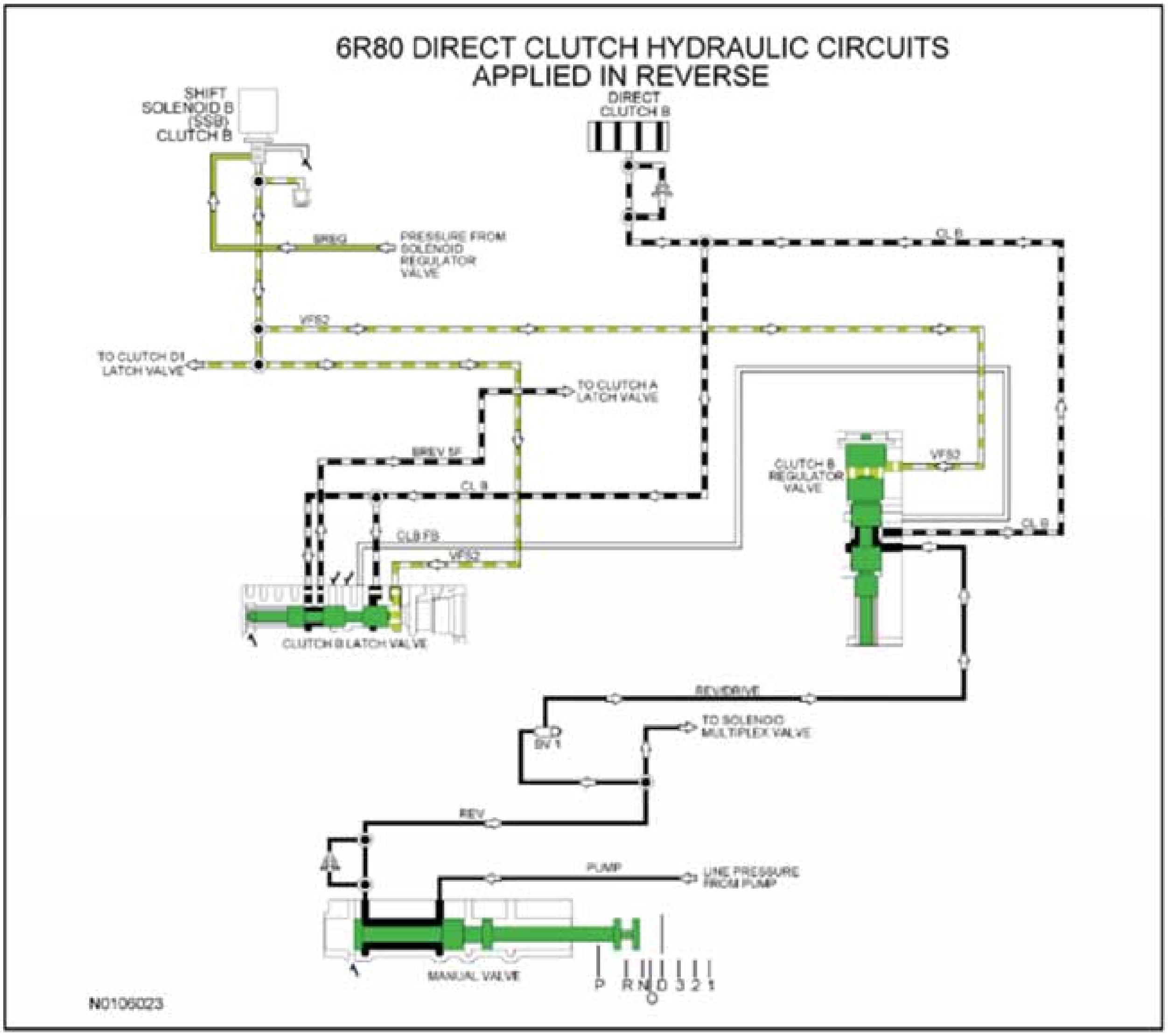


Direct Clutch (B) Hydraulic Circuits

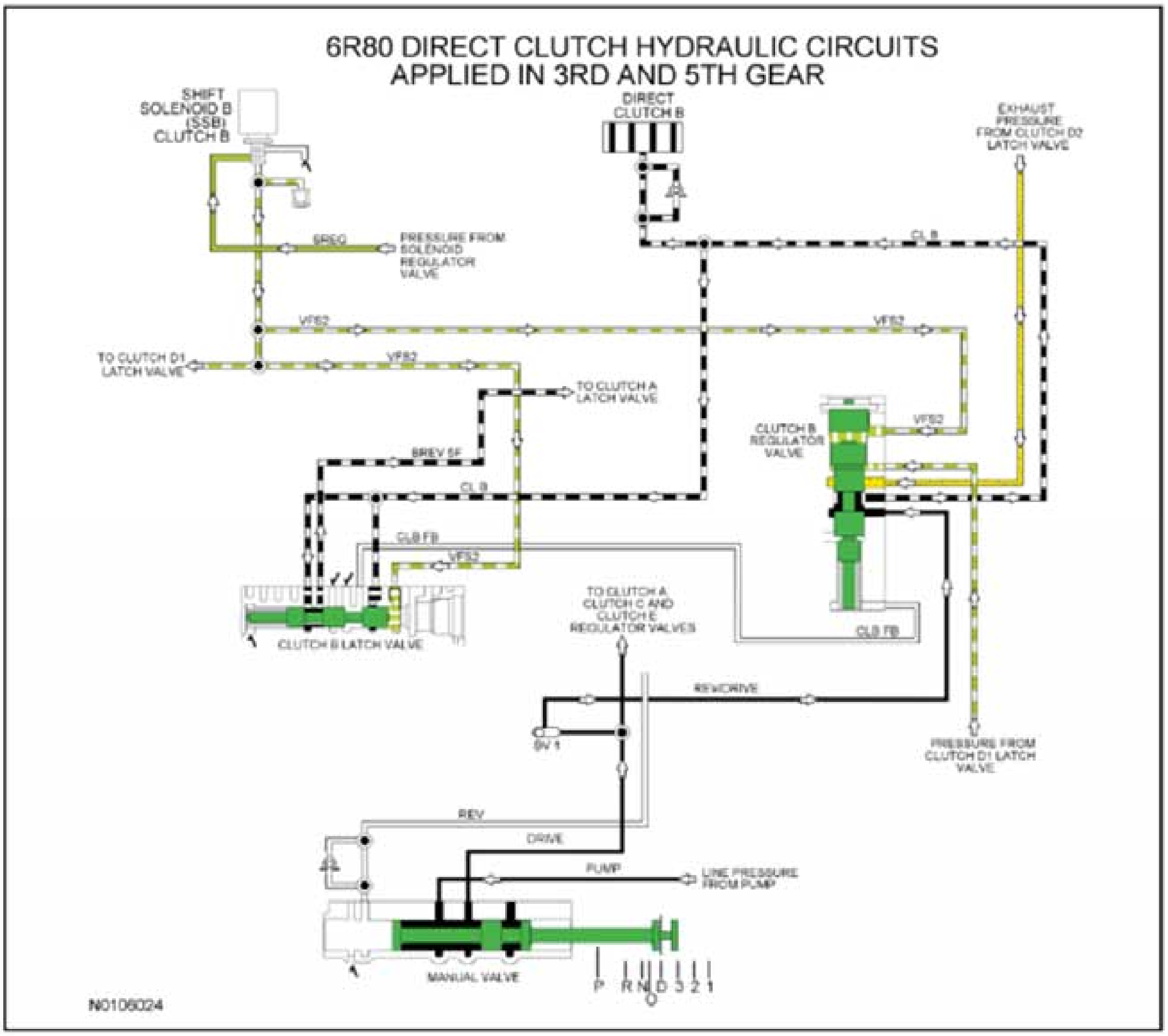
To apply the direct clutch (B), the manual valve can be in the REVERSE, DRIVE, 3, 2 or 1 position to provide line pressure to the clutch B regulator valve through the REV/DRIVE circuit.

For the direct clutch (B) to apply in reverse, SSB provides regulated solenoid pressure from the SREG circuit to the clutch B regulator and latch valves through the VFS2 circuit to position the valves to apply the direct clutch (B). As the direct clutch is applied, SSB increases pressure to the clutch B regulator and latch valves.

The clutch B regulator valve provides regulated line pressure to the CL B circuit to apply the direct clutch (B).

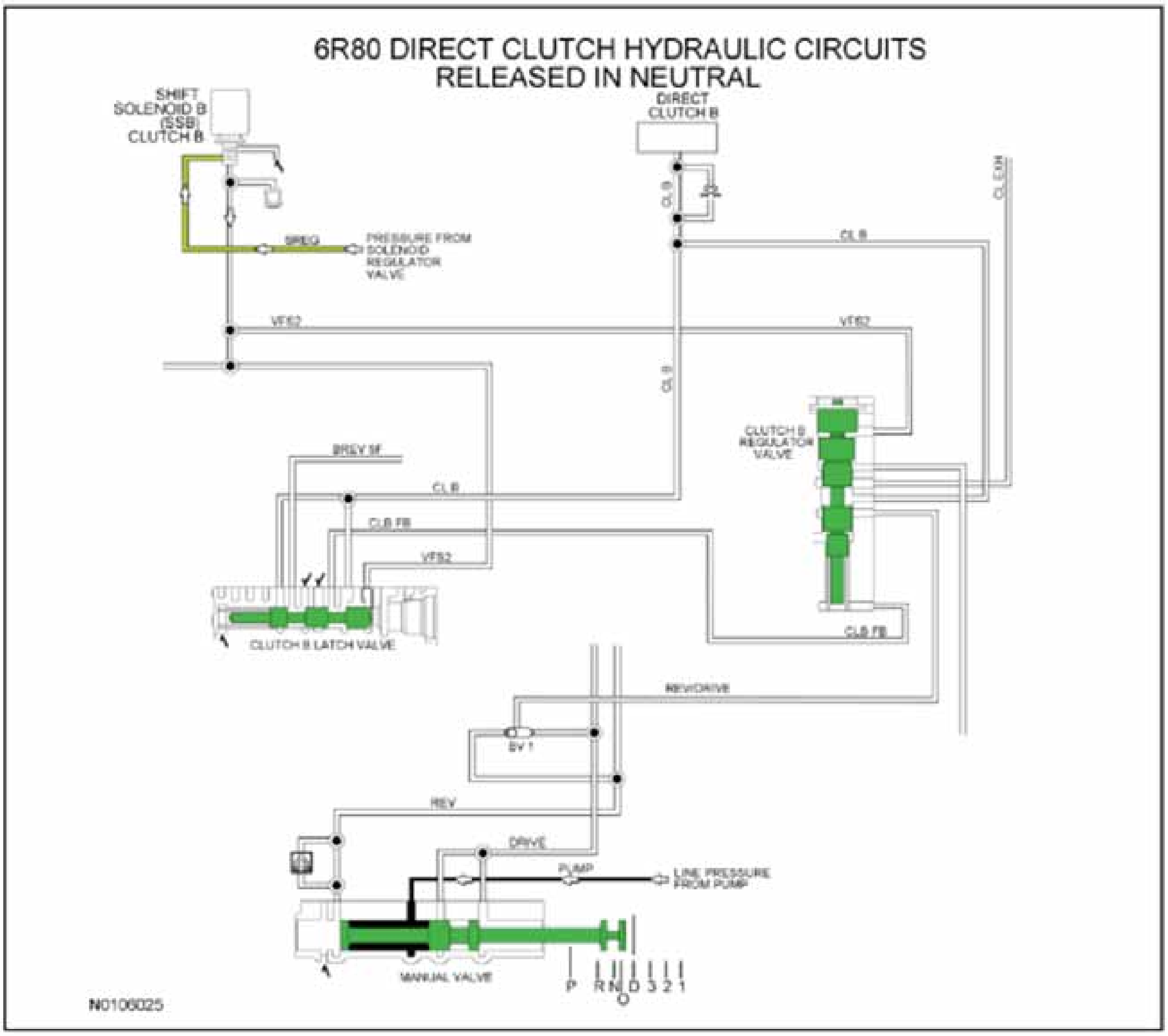


When the direct clutch (B) is applied in 3rd and 5th gear, regulated solenoid pressure from the D1 latch valve is supplied to the clutch B regulator valve through the VFS2D circuit and opposes pressure from the VFS2 circuit for clutch B valve positioning.



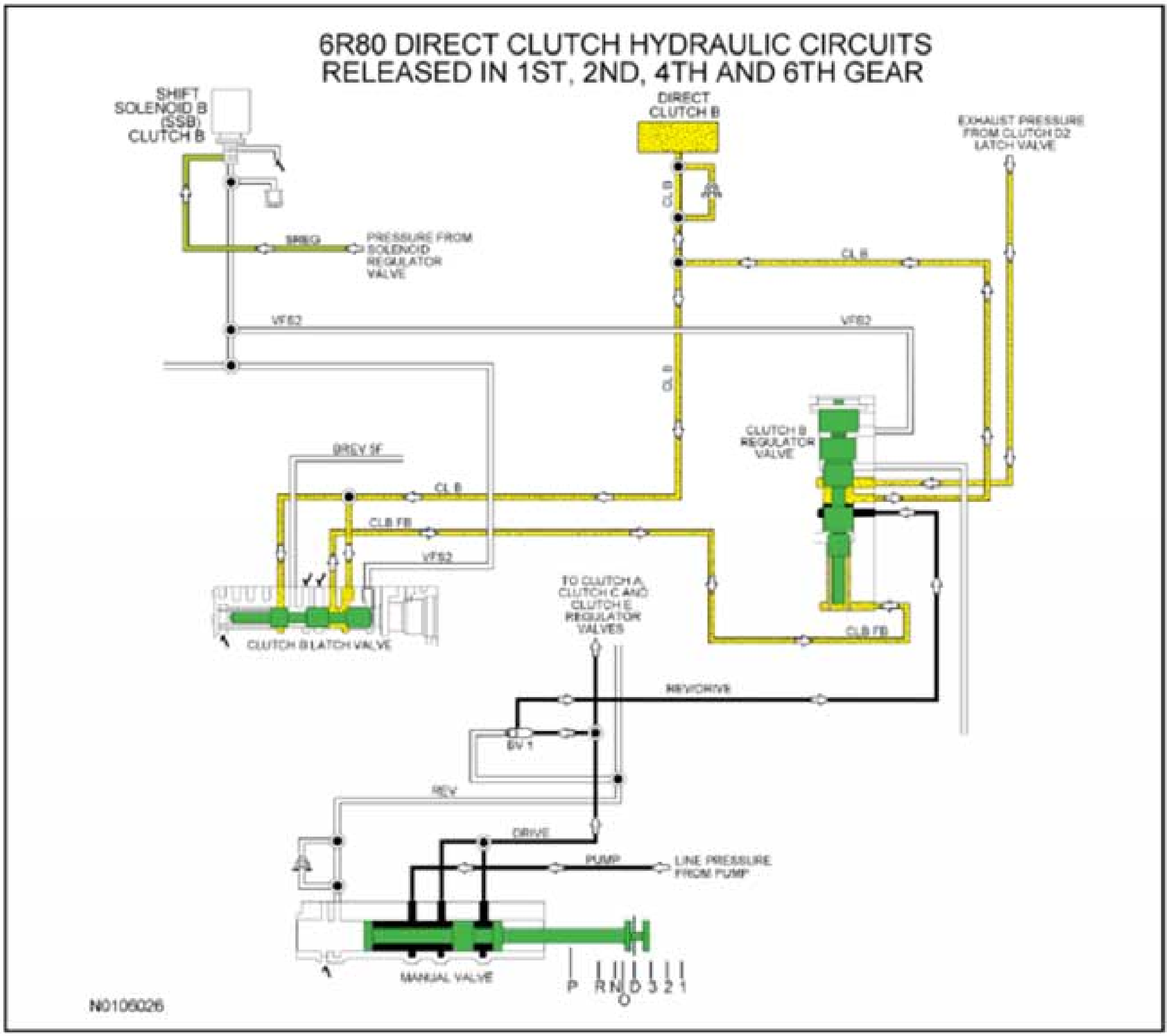
The direct clutch (B) is released when the manual valve is in the PARK or NEUTRAL position or when the manual valve is in the DRIVE position with the transmission in 1st, 2nd, 4th or 6th gear.

In NEUTRAL or PARK, the manual valve does not supply line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.



In 1st, 2nd, 4th or 6th gear, the manual valve supplies line pressure to the clutch B regulator valve. SSB lowers pressure to the clutch B regulator and latch valve to position the valves to lower the regulated line pressure in the CL B circuit to release the clutch.

When the direct clutch (B) is released in 1st, 2nd, 4th or 6th gear, the clutch (B) regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL B circuit to fill the circuit and the direct clutch (B) with fluid at low pressure, approximately 21 kPa (3 psi).



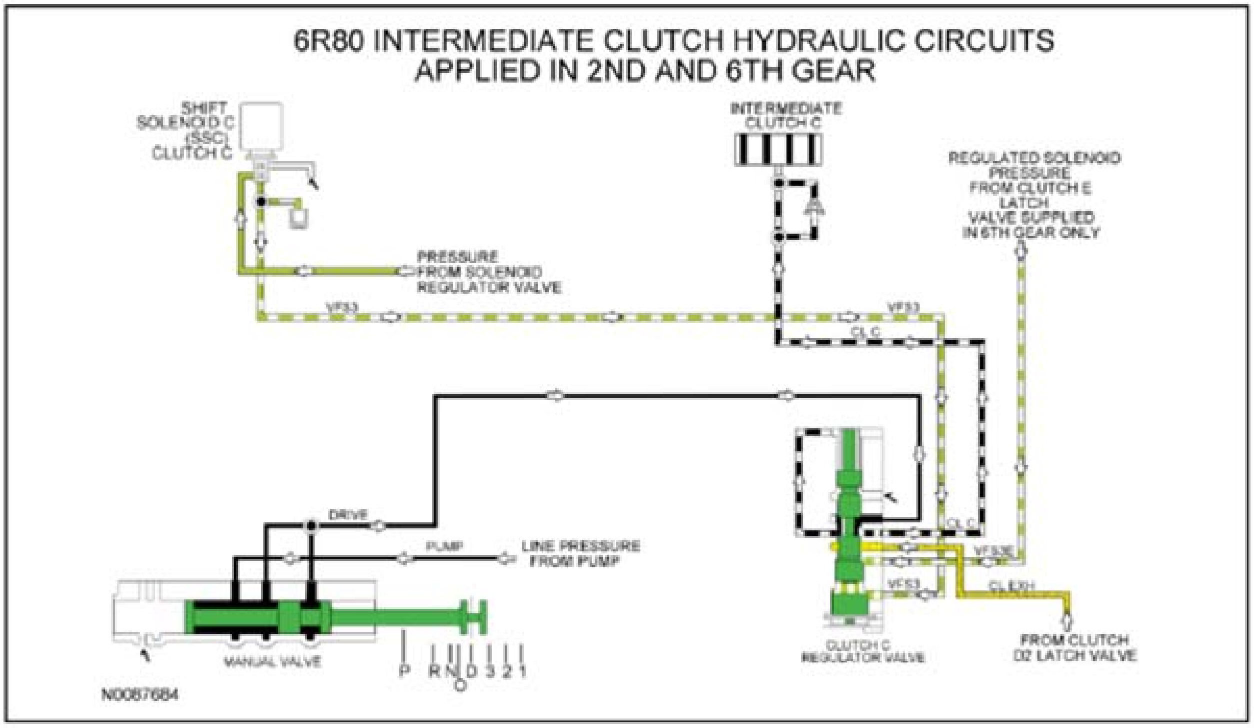
Intermediate Clutch (C) Hydraulic Circuits

To apply the intermediate clutch (C), the manual valve can be in the DRIVE, 3, 2 or 1 position to provide line pressure to the clutch C regulator valve through the DRIVE circuit.

SSC provides regulated solenoid pressure from the SREG circuit to the clutch C regulator valve through the VFS3 circuit to position the valve to apply the intermediate clutch (C). As the intermediate clutch (C) is applied, SSC increases pressure to the clutch C regulator valve.

The clutch C regulator valve provides regulated line pressure to the CL C circuit to apply the intermediate clutch (C).

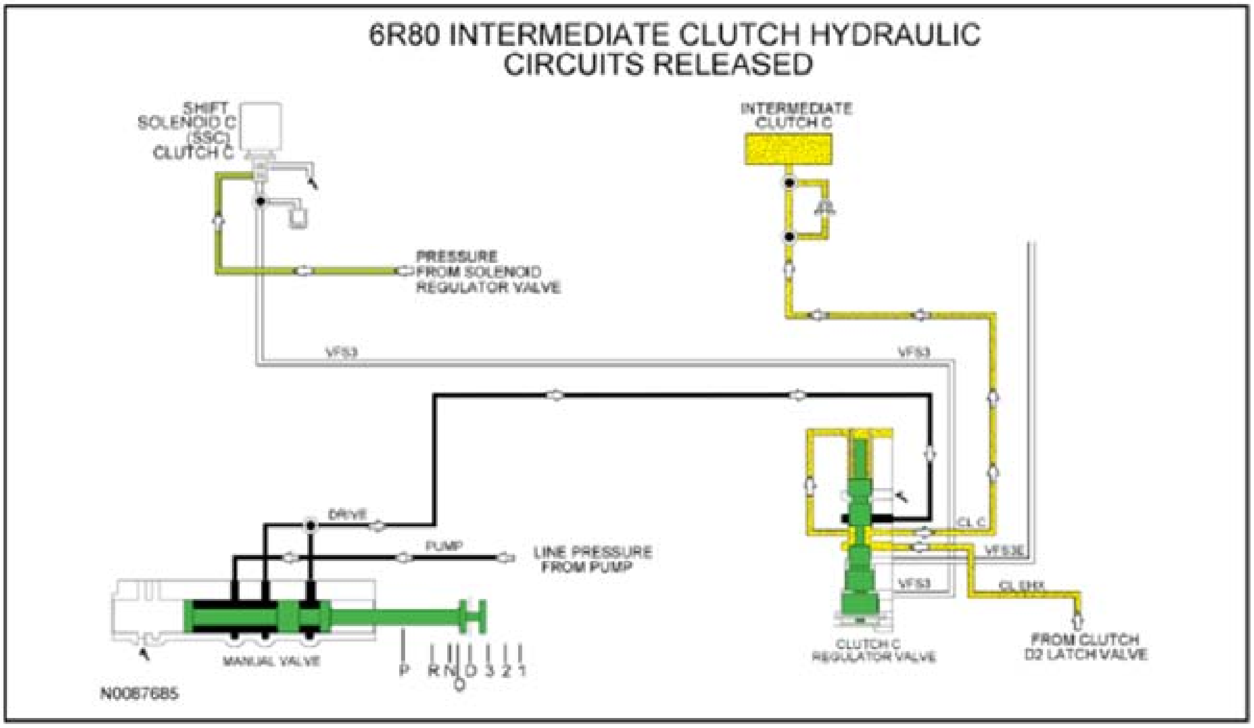
Regulated solenoid pressure from the clutch E latch valve is supplied to the clutch C regulator valve through the VFS3E circuit and opposes VFS3 pressure for clutch C regulator valve positioning in 6th gear only.



To release the intermediate clutch (C) when the manual valve is in the DRIVE, 3, 2 or 1 position SSC lowers pressure to the clutch C regulator valve to position the valve to lower the regulated line pressure in the CL C circuit to release the clutch.

When the intermediate clutch (C) is released, the clutch C regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL C circuit to fill the CL C circuit and the intermediate clutch (C) with fluid at low pressure, approximately 21 kPa (3 psi).

In PARK, REVERSE or NEUTRAL, the manual valve does not supply line pressure to the clutch C regulator valve.

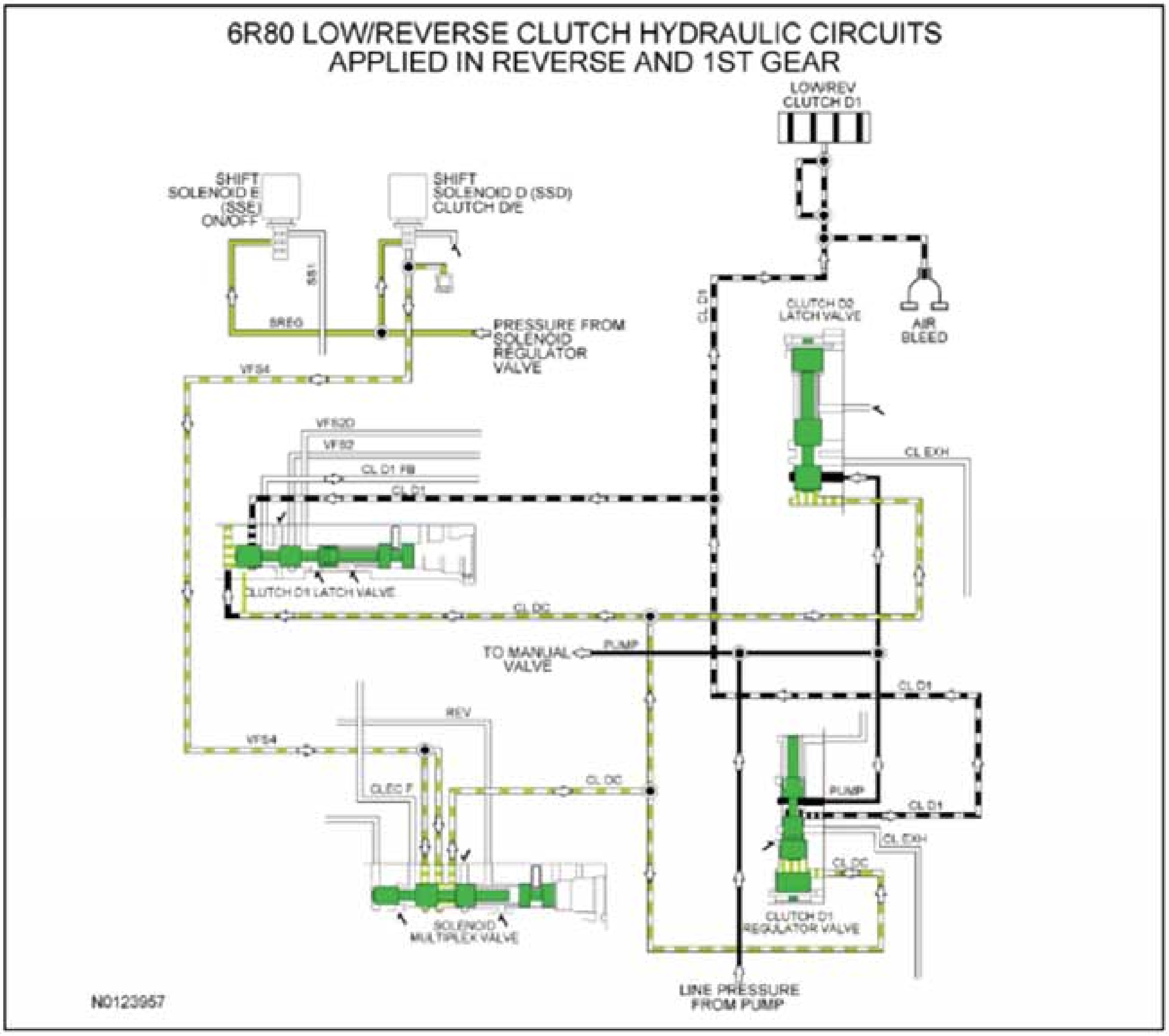


Low/Reverse Clutch (D) Hydraulic Circuits

To apply the low/reverse clutch (D), the manual valve can be in any position. Line pressure is supplied to the D1 regulator and latch valves by the pump through the PUMP circuit.

SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit where it is directed to the D1 regulator and latch valves through the CL DC circuit to position the valves to apply the low/reverse clutch (D). As the low/reverse clutch (D) is applied, SSD increases pressure to the D1 clutch regulator and latch valves.

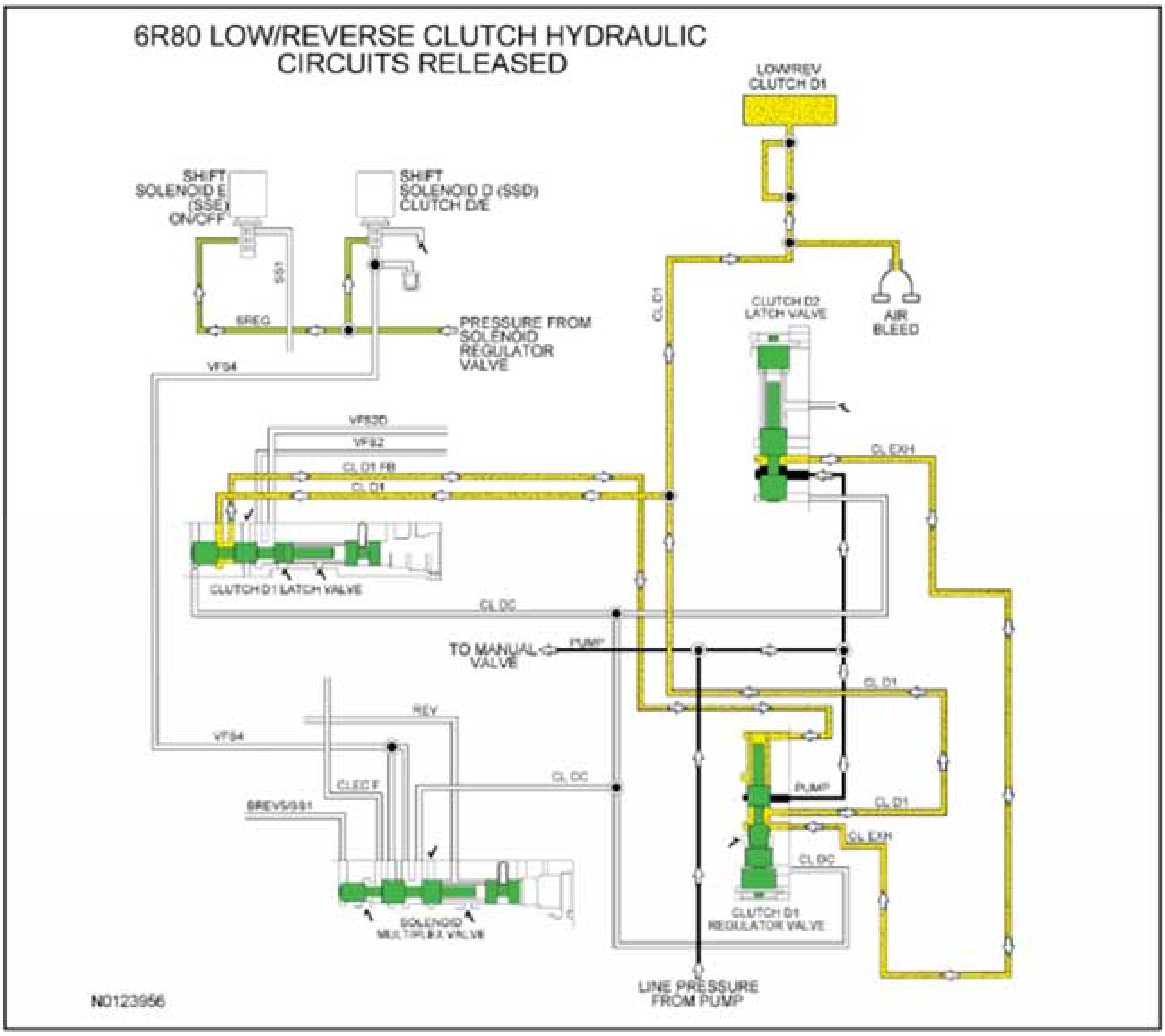
The clutch D1 regulator valve provides regulated line pressure from the PUMP circuit to the CL D1 circuit to apply the low/reverse clutch (D).



To release the low/reverse clutch (D), the manual valve can be in the DRIVE, 3 or 2 position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CL DC circuit to position the D clutch regulator and latch valves to lower pressure in the CL D1 circuit and release the low/reverse clutch (D).

When the low/reverse clutch (D) is released, the clutch D2 latch valve directs line pressure regulated to approximately 21 kPa (3 psi) to the CL EXH circuit which fills the volume of the unused clutches and circuits.

When the low/reverse clutch (D) is released, the CL EXH circuit supplies the D1 regulator valve which fills the CL D1 circuit and the low/reverse (D) clutch.

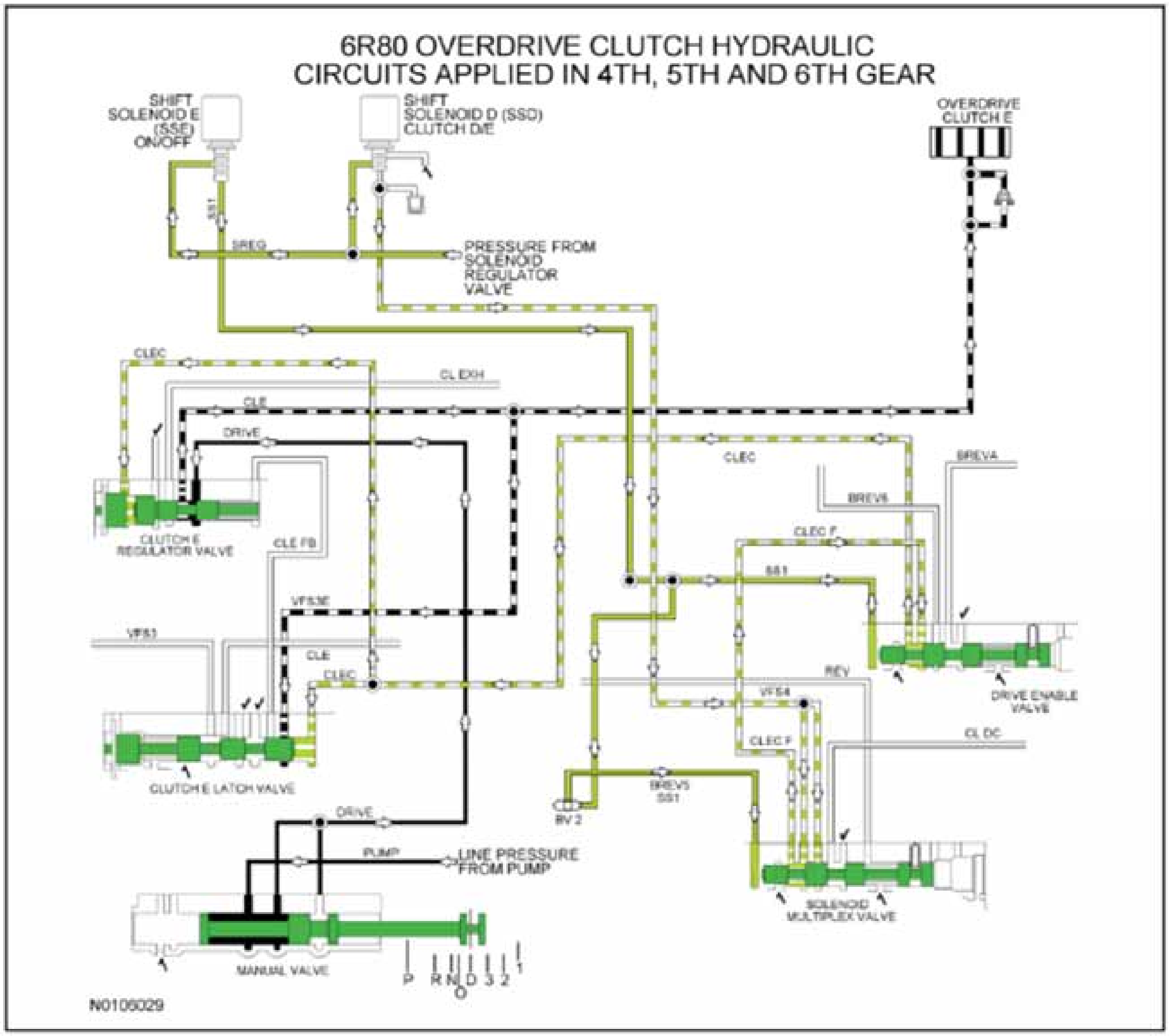


Overdrive Clutch (E) Hydraulic Circuits

To apply the overdrive clutch (E), the manual valve must be in the DRIVE position. Line pressure is supplied to the clutch E regulator valve.

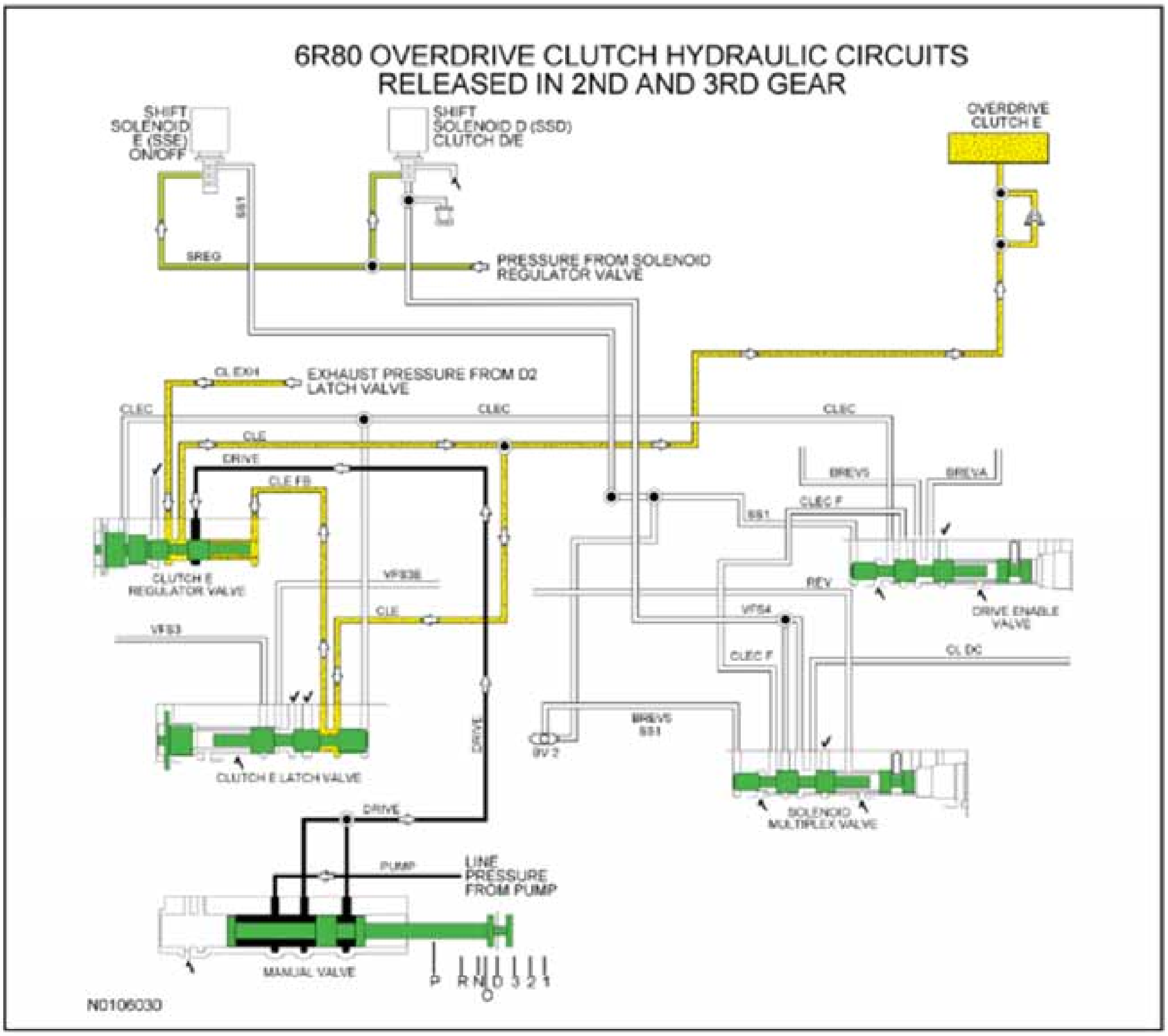
SSD provides regulated solenoid pressure from the SREG circuit to the solenoid multiplex valve through the VFS4 circuit. SSE supplies pressure to the solenoid multiplex valve and the drive enable valve to position the valves to direct pressure from the VFS4 circuit to the CLEC F and CLEC circuits to position the clutch E regulator and latch valves to apply the overdrive clutch (E). As the overdrive clutch (E) is applied, SSD increases pressure to the clutch E regulator and latch valve.

The clutch E regulator valve provides regulated line pressure from the DRIVE circuit to the CLE circuit to apply the overdrive clutch (E).



To release the overdrive clutch (E), the manual valve can be in any position. SSD lowers pressure to the VFS4 circuit which lowers pressure in the CLEC and CLEC F circuits and releases the overdrive clutch (E). SSE blocks SREG pressure to the solenoid multiplex valve and the drive enable valve to allow SSD to control low/reverse clutch (D) operation.

When the overdrive clutch (E) is released, the clutch E regulator valve directs exhaust circuit pressure from the CL EXH circuit to the CL E circuit to fill the circuit and the clutch with fluid at low pressure, approximately 21 kPa (3 psi).



Transmission Electronic Control System

Powertrain Control System

The TCU controls the electronic functions of this transmission. A plastic molded leadframe is bolted to the main control assembly. The leadframe contains the Turbine Shaft Speed (TSS), Output Shaft Speed (OSS), Transmission Fluid Temperature (TFT) and Transmission Range (TR) sensors.

The TCU receives input signals from engine and transmission sensors and uses these inputs to control line pressure, shift time, Torque Converter Clutch (TCC), and shift solenoids.

The following is a list of direct engine and driver inputs to the TCU along with module information from the vehicle Controller Area Network (CAN):

- Engine speed
- Engine torque
- Engine coolant temperature
- Throttle position

The TCU also:

- monitors inputs and outputs for the presence of faults.
- stores DTCs related to detected faults.
- provides outputs on the CAN for transmission range, output shaft speed, turbine shaft speed, transmission fluid temperature, and current gear.
- provides On-Board Diagnostic (OBD) information using the CAN to illuminate the Malfunction Indicator Lamp (MIL) or Transmission Control Indicator Lamp (TCIL)
- provides diagnostic information to a laptop scan tool through the Data Link Connector (DLC).

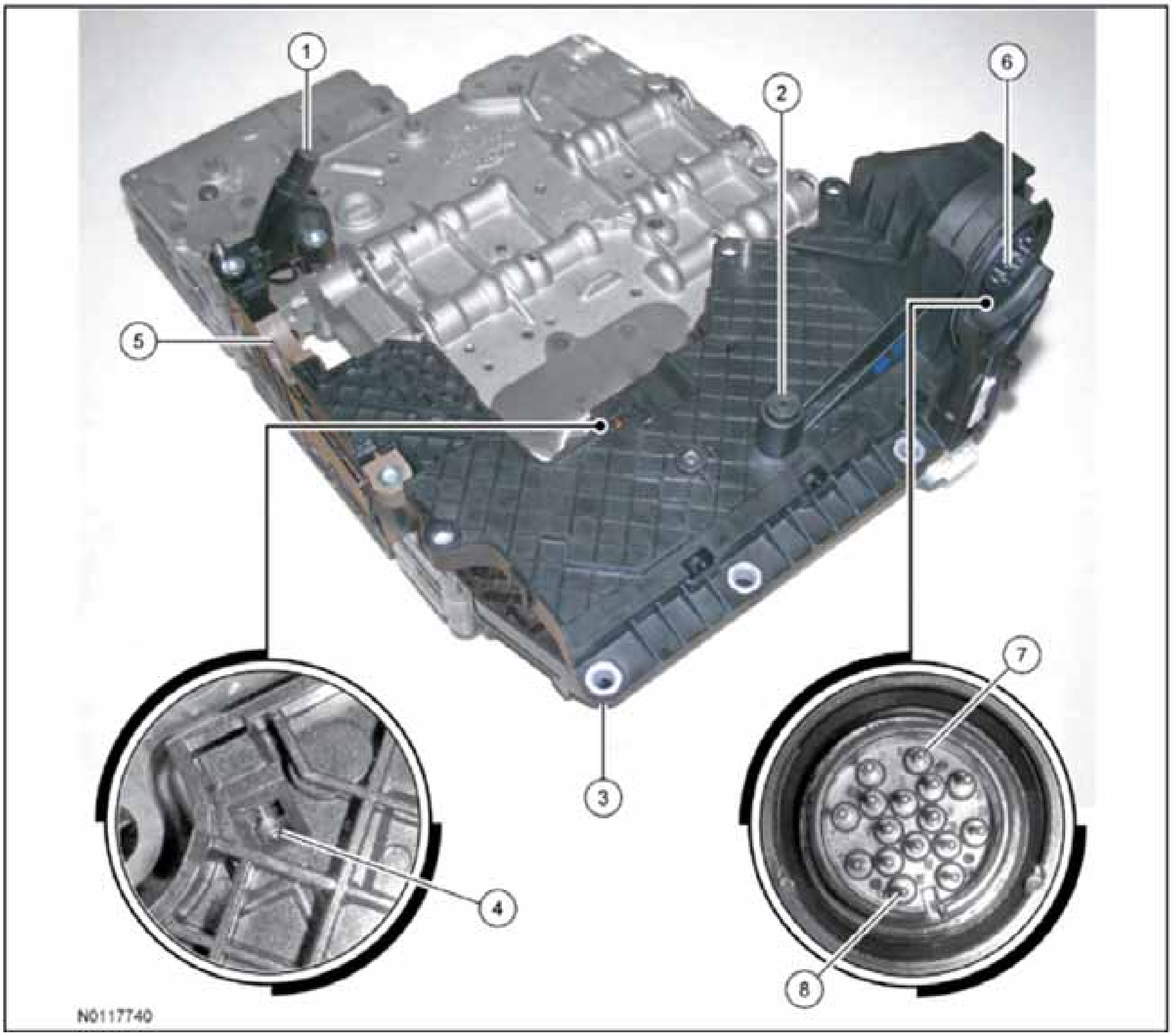
If the TCU detects a system or component fault, it substitutes a default value or signal using Failure Mode and Effect Management strategies.

The TCU also uses Failure Mode and Effect Management strategies to compensate for electrical or mechanical shift solenoid and apply component faults that result in alternate shift patterns.

If the transmission loses complete electronic control, it operates in a fail-safe mode with:

- Maximum line pressure in all transmission ranges
- Functional PARK, REVERSE and NEUTRAL position
- Operation in 3rd or 5th gear (depending on the failure conditions) when the selector lever is in the DRIVE, 3, 2 or 1 position
- TCC is released in all transmission ranges and gears

Molded Lead Frame



Item	Part Number	Description
1	—	Turbine Shaft Speed (TSS) sensor
2	—	Output Shaft Speed (OSS) sensor
3	7G276	Molded leadframe
4	—	Transmission Fluid Temperature (TFT) sensor
5	—	Transmission Range (TR) sensor
6	—	Leadframe connector
7	—	Terminal 1
8	—	Terminal 16

Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	Off	On	Off	Off	Off	Off
R	R	Off	Off	Off	Off	Off	Off
N	N	Off	On	Off	Off [a]	Off	Off
D	1	On	On	Off	Off [b]	Off	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	On	On/Off
	4	On	On	Off	Off	On	On/Off
	5	Off	Off	Off	Off	On	On/Off
	6	Off	On	On	Off	On	On/Off

a Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.
b Solenoid is On when vehicle is above 3 mph.

CB = Clutch brake
NC = Normally closed
NH = Normally high
NL = Normally low

The following are brief descriptions of the sensors and actuators used to control transmission operation.

Line Pressure Control (LPC) Solenoid

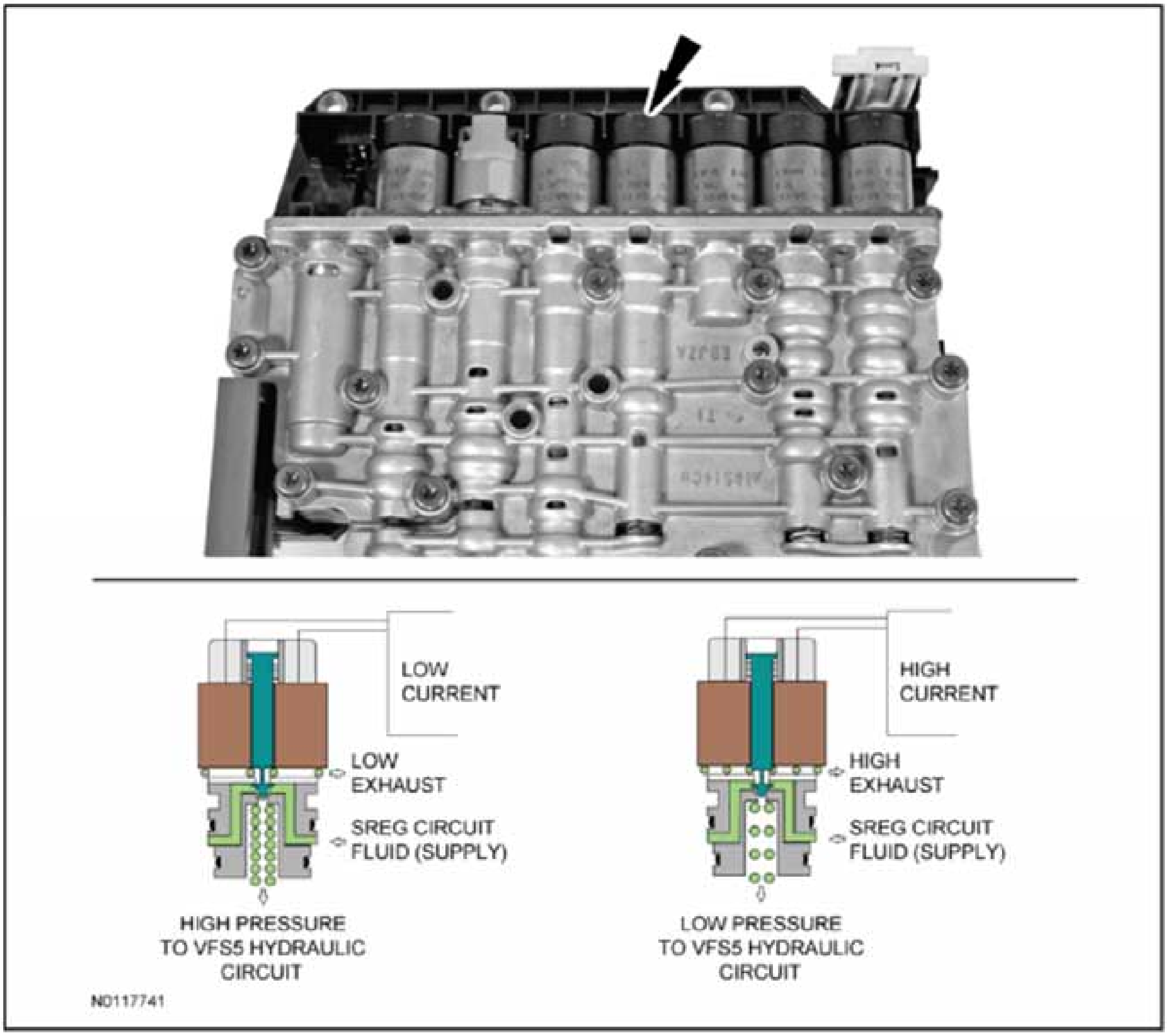
The Line Pressure Control (LPC) solenoid is a Variable Force Solenoid (VFS) that varies hydraulic pressure by actuating a hydraulic valve.

The TCU applies variable current to the LPC solenoid which varies pressure in the VFS5 hydraulic circuit to the main regulator valve. Refer to Hydraulic Circuits in this section.

The LPC solenoid uses inversely proportional operation. As the current from the PCM decreases, the pressure from the solenoid increases. As the current from the PCM increases, the pressure from the solenoid decreases. The LPC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the LPC solenoid fully opens the hydraulic valve which applies the maximum amount of hydraulic pressure to the main regulator valve through the VFS5 hydraulic circuit and applies maximum line pressure in the PUMP hydraulic circuit. With maximum current to the solenoid, the hydraulic valve fully closes the outlet port for minimum pressure to the VFS5 hydraulic circuit, lowering the line pressure in the PUMP hydraulic circuit.

LPC Inversely Proportional VFS



Torque Converter Clutch (TCC) Solenoid

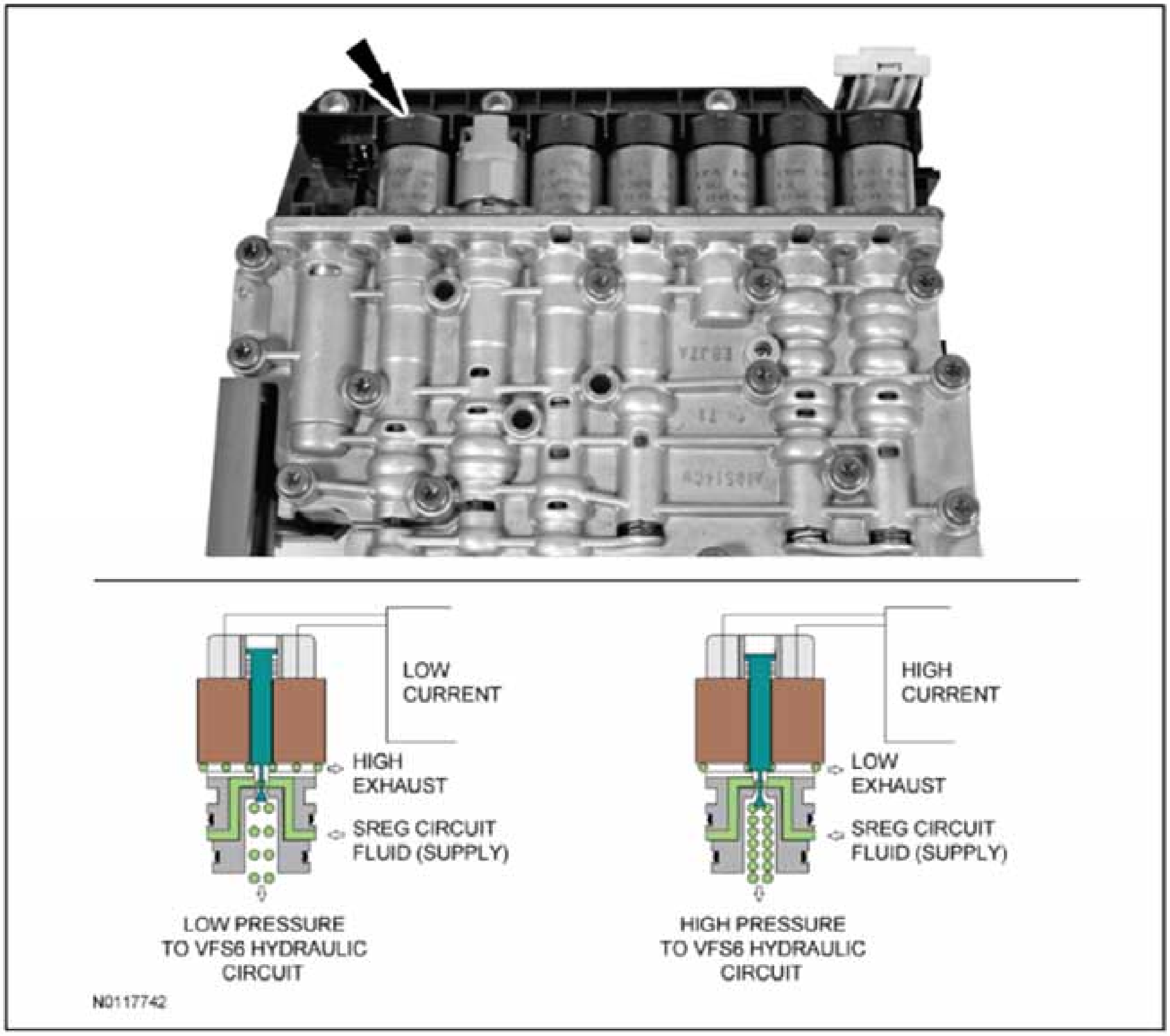
The TCC solenoid is a VFS that varies hydraulic pressure by actuating a hydraulic valve.

The TCU applies variable current to the TCC solenoid which varies pressure in the VFS6 hydraulic circuit to the converter release regulator valve and the bypass clutch control regulator valve. Refer to Hydraulic Circuits in this section.

The TCC solenoid uses proportional operation. As the current from the PCM decreases, the pressure from the solenoid decreases. As the current from the PCM increases, the pressure from the solenoid increases. The TCC solenoid is supplied hydraulic pressure from the SREG circuit.

With zero current, the TCC solenoid fully closes the hydraulic valve which applies the minimum amount of hydraulic pressure to the converter release regulator valve and the bypass clutch control regulator valve through the VFS6 hydraulic circuit and releases the TCC. With maximum current to the solenoid, the hydraulic valve fully opens the outlet port for maximum pressure to the VFS6 hydraulic circuit to apply the TCC.

Torque Converter Clutch (TCC) Proportional VFS



Shift Solenoid A (SSA), Shift Solenoid B (SSB), Shift Solenoid C (SSC) and Shift Solenoid D (SSD)

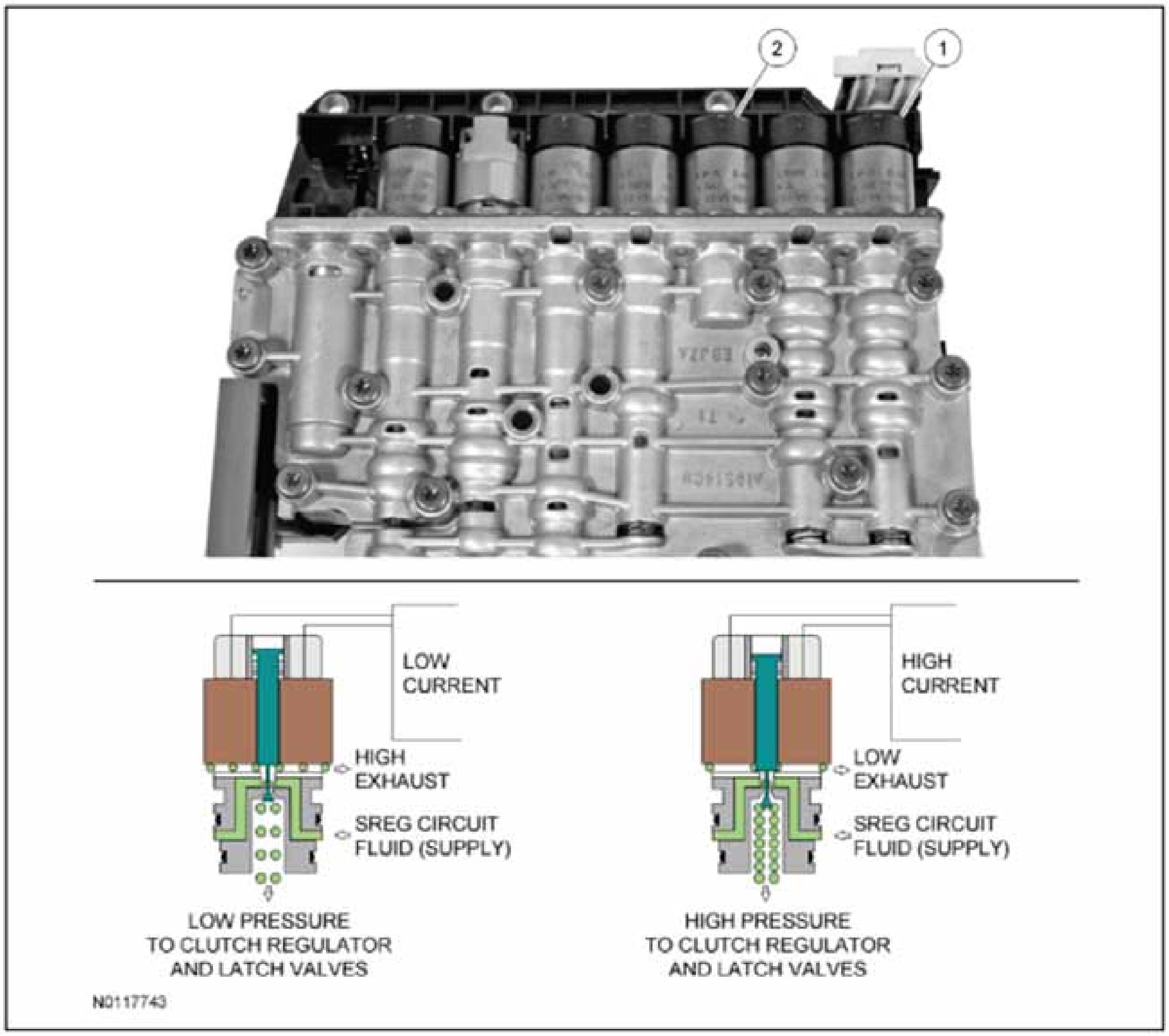
Shift solenoids A through D are VFS that vary hydraulic pressure by actuating a hydraulic valve.

The TCU applies variable current to the shift solenoids which varies pressure in the hydraulic circuit to the regulator and latch valves of the clutch that it controls. Refer to Hydraulic Circuits in this section.

SSA and SSC use proportional operation. As the current from the TCU decreases, the pressure from the solenoid decreases. As the current from the TCU increases, the pressure from the solenoid increases. SSA and SSC are supplied hydraulic pressure from the SREG circuit.

With zero current, SSA and SSC fully close the hydraulic valves which applies zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch. With maximum current to the solenoids, the hydraulic valves fully open for maximum pressure to the regulator and latch valves to apply the clutch.

Shift Solenoid A (SSA) and Shift Solenoid C (SSC) Proportional VFS

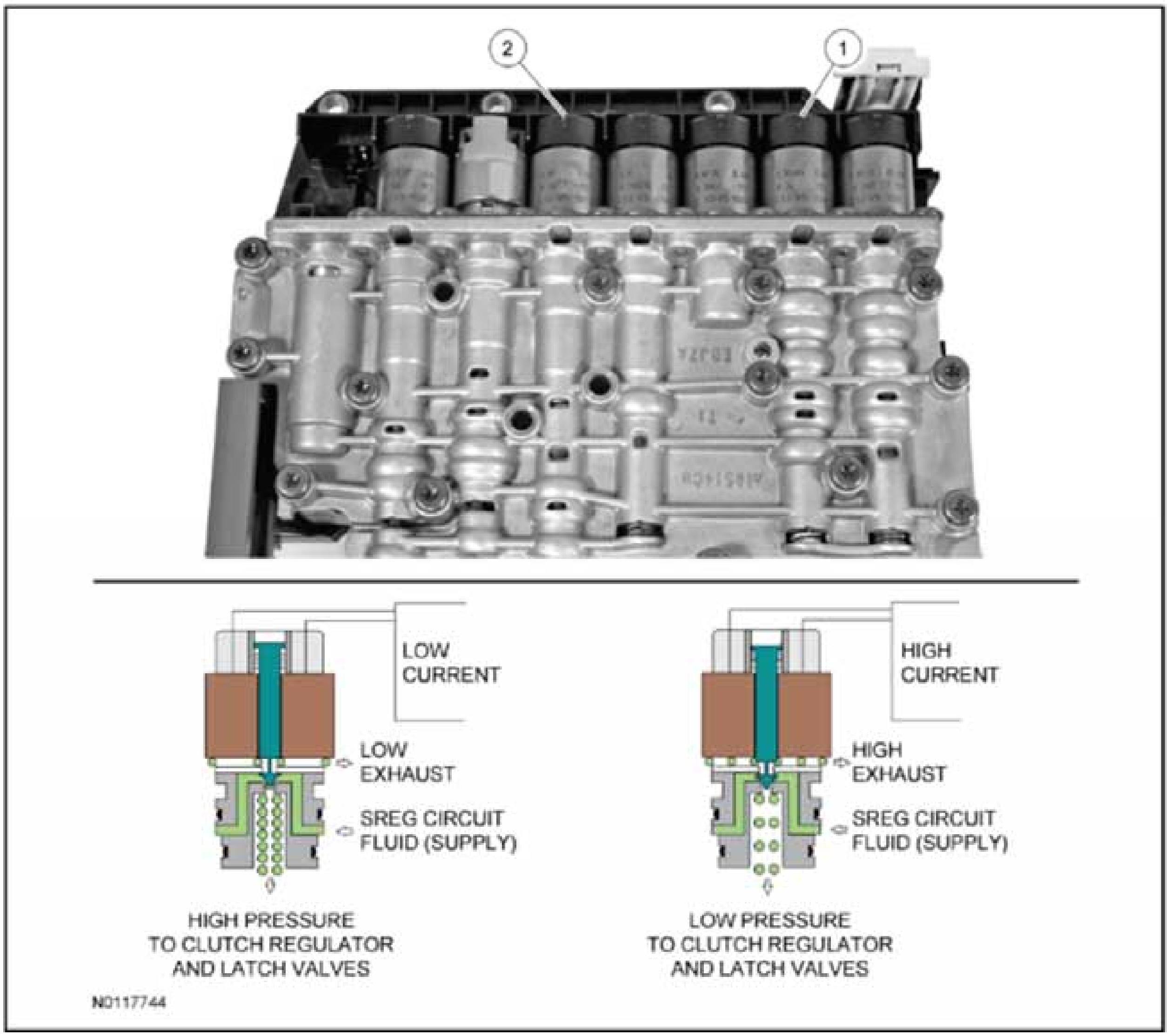


Item	Description
1	Shift Solenoid A (SSA) Variable Force Solenoid (VFS)
2	Shift Solenoid C (SSC) VFS

SSB and SSD use inverse proportional operation. As the current from the TCU decreases, the pressure from the solenoid increases. As the current from the TCU increases, the pressure from the solenoid decreases. SSB and SSD are supplied hydraulic pressure from the SREG circuit.

With zero current, SSB and SSD fully open the hydraulic valves which applies maximum hydraulic pressure to the regulator and latch valves to apply the clutch that it controls. With maximum current to the solenoids, the hydraulic valve fully closes to apply zero amount of hydraulic pressure to the regulator and latch valves of the clutch that it controls and releases the clutch.

Shift Solenoid B (SSB) and Shift Solenoid D (SSD) Inverse Proportional VFS



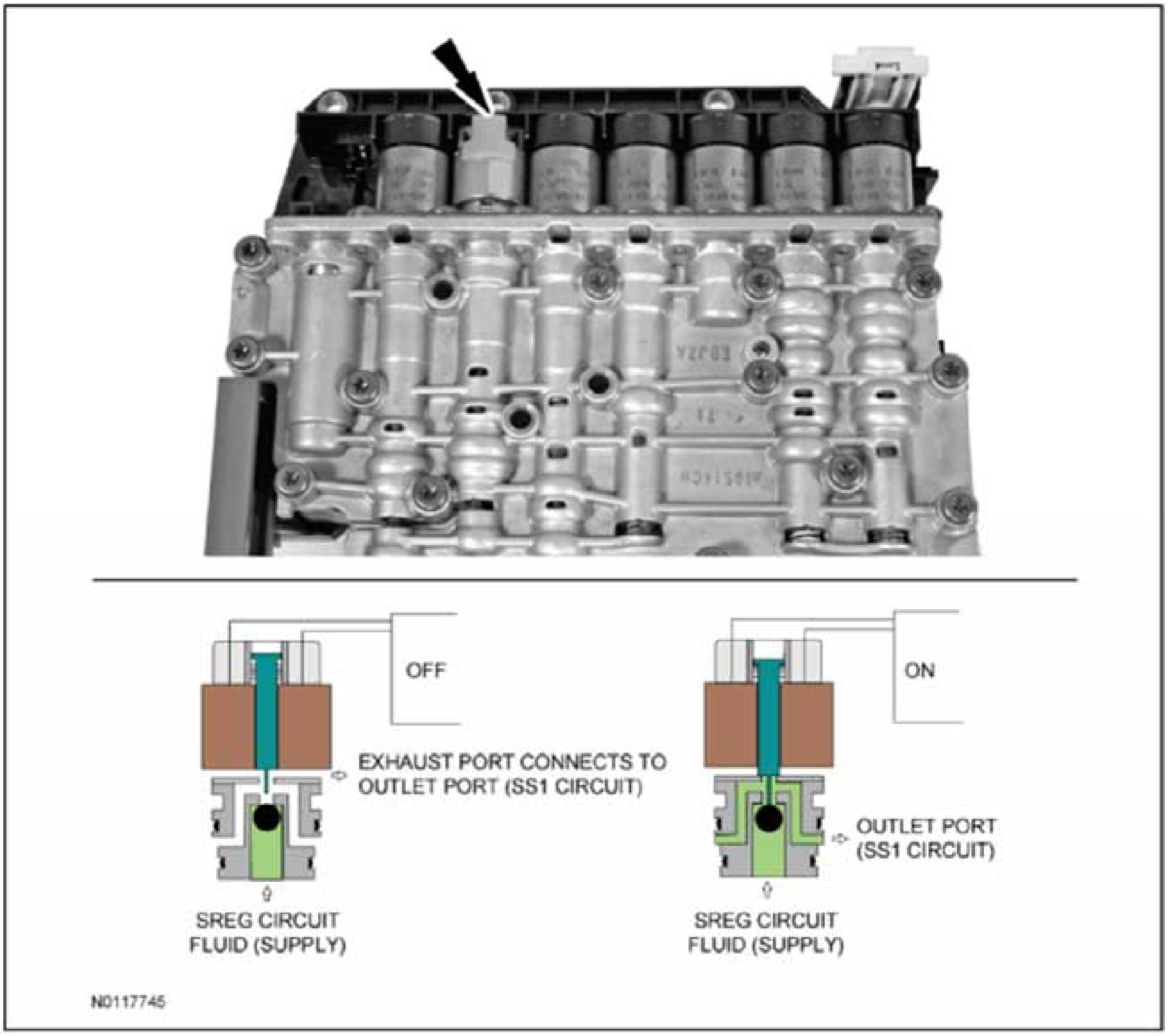
Item	Description
1	Shift Solenoid B (SSB) Variable Force Solenoid (VFS)
2	Shift Solenoid D (SSD) VFS

Shift Solenoid E (SSE)

SSE is an ON/OFF solenoid. When SSE is in the OFF position, SSD controls the regulator and latch valves to apply the low/reverse clutch. When SSE is in the ON position, SSD controls the regulator and latch valves to apply the overdrive (456) clutch. Refer to Hydraulic Circuits in this section.

SSE is supplied hydraulic pressure from the SREG circuit. When SSE is OFF, the solenoid supply is blocked and the outlet port (SS1 circuit) is connected to the exhaust port. When SSE is ON, the exhaust port is blocked and the solenoid supply is connected to the outlet port (SS1 circuit).

Shift Solenoid E (SSE) ON/OFF Solenoid



Turbine Shaft Speed (TSS) Sensor

The TSS sensor is a Hall-effect type sensor that provides a signal to the TCU that changes in frequency as the rotating speed of the forward (1,2,3,4) clutch cylinder varies.

The TCU compares the TSS sensor signal with the engine speed information to determine the amount of slip occurring in the torque converter.

The TCU also compares the TSS sensor signal with the OSS sensor signal to determine the gear ratio provided by the rear planetary gearset.

The TCU uses the TSS sensor signal as an input for its strategies for shifts and TCC operation. The TCU also uses the TSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TSS sensor.

Output Shaft Speed (OSS) Sensor

The OSS sensor is a Hall-effect type sensor that provides a signal to the TCU that changes in frequency as the rotating speed of the output shaft ring gear varies.

The TCU also compares the OSS sensor signal with the TSS sensor signal to determine the gear ratio provided by the rear planetary gearset.
The TCU uses the OSS sensor signal as an input for its strategies for shifts and TCC operation. The TCU also uses the OSS sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the OSS sensor.

Transmission Fluid Temperature (TFT) Sensor

The TFT sensor is a temperature dependent resistor that is in contact with transmission fluid in the transmission sump area.

The TCU monitors the voltage across the TFT sensor, which changes as transmission fluid temperature varies.

The TCU uses the TFT sensor signal as an input for its strategy for shifting and TCC operation. The TCU also uses the TFT sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TFT sensor.

Transmission Range (TR) Sensor

The TR sensor has a set of Hall-effect sensors that have a pattern of ON/OFF states which are dependant on the PARK, REVERSE, NEUTRAL, DRIVE, 3, 2 or 1 position of the manual valve.

The TR sensor also provides signals for the starting system and the reverse lights.

The TCU uses the TR sensor signal as an input for its strategy for shifting and TCC operation. The TCU also uses the TR sensor signal for transmission fault detection and diagnostics.

Refer to the component illustration at the beginning of this procedure for the location of the TR sensor.

Transmission Operation

Transmission Operation Overview

Transmission operation is controlled by the TCU.

Torque Converter

This transmission uses a torque converter with the following elements:

- Impeller
- Turbine
- Reactor
- Torque Converter Clutch (TCC)

For component information, refer to Torque Converter in this section.

Planetary Gearsets

Operation of this transmission involves the use of 2 planetary gearsets that have the following components:

- Front (single planetary gearset)
    - One sun gear
    - One planetary carrier with 4 gears
    - One ring gear
- Rear (ravigneaux planetary gearset)
    - Two sun gears of different sizes
    - Three short planetary gear pinions meshing with the sun gears
    - Three long planetary gear pinions meshing with the sun gears
    - One planetary carrier
    - One ring gear

Apply Clutches

This transmission uses the following clutches to operate the 2 planetary gearsets:

- Forward clutch (A)
- Direct clutch (B)
- Intermediate clutch (C)
- Low/reverse clutch (D)

- Overdrive clutch (E)
- Low One-Way Clutch (OWC)

For information about planetary gearsets or the apply clutches, refer to Mechanical Components and Functions in this section.

Hydraulic System
The hydraulic operation of this transmission includes the following components:

- Main control assembly
- Pump assembly with filter
- Torque converter
- Apply components (clutches)

For component information, refer to Hydraulic System in this section.

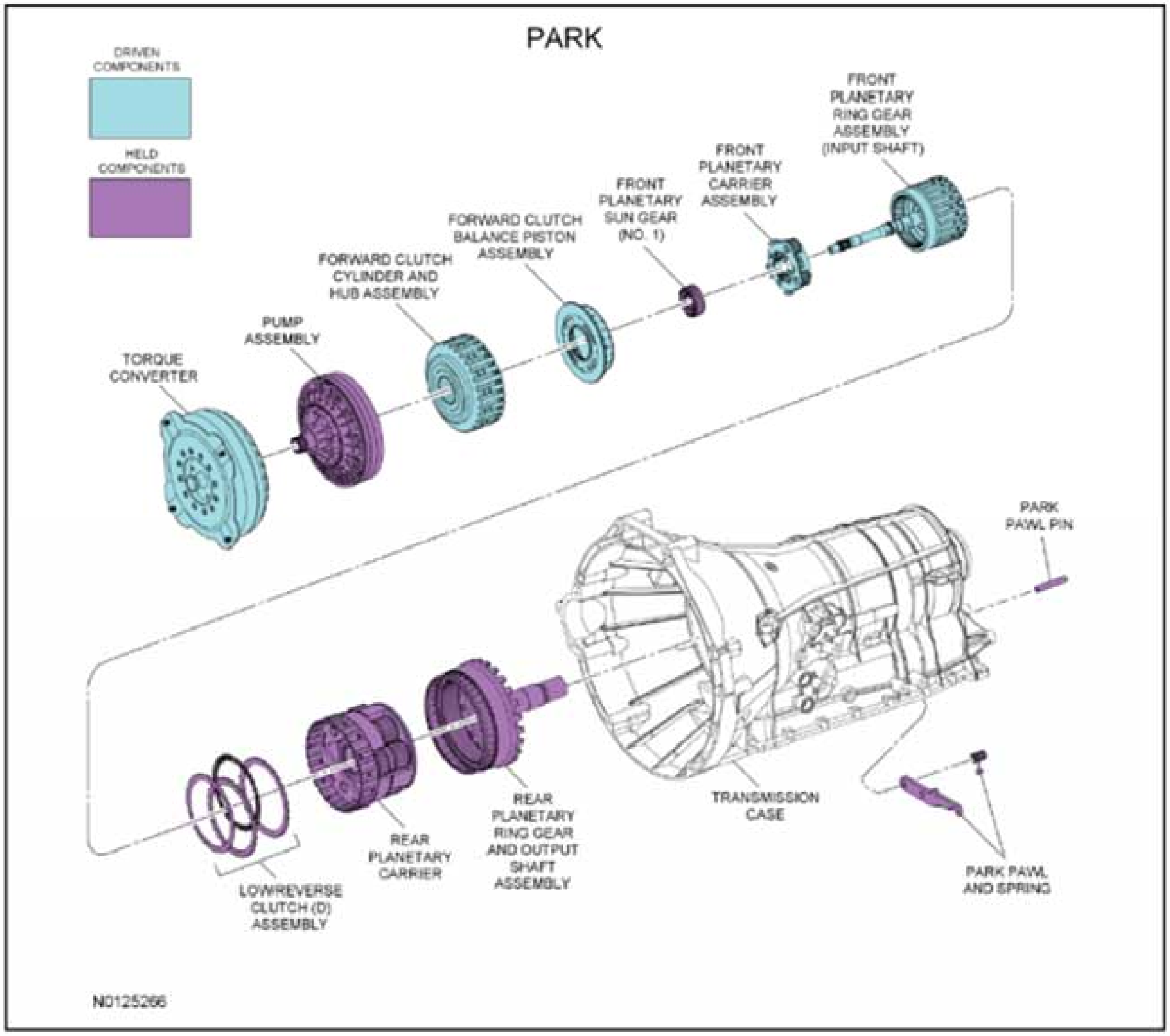
Electronic Operation

The PCM controls the operation of this transmission with the following solenoids:

- Line Pressure Control (LPC) solenoid
- Shift Solenoid A (SSA)
- Shift Solenoid B (SSB)
- Shift Solenoid C (SSC)
- Shift Solenoid D (SSD)
- Shift Solenoid E (SSE)
- TCC solenoid

For solenoid information, refer to Transmission Electronic Control System in this section.

Park Position



Mechanical Operation

Apply components:
- Park pawl engaged holding the park gear (output shaft) stationary
- Low/reverse clutch (D) applied

Planetary Gearset Operation

Front planetary gearset driving components:
- Ring gear (input shaft)

Front planetary gearset driven components:
- Planetary carrier

Front planetary gearset held components:
- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- None

Rear planetary gearset driven components:
- None

Rear planetary gearset held components:
- Planetary carrier
- Ring gear (output shaft)

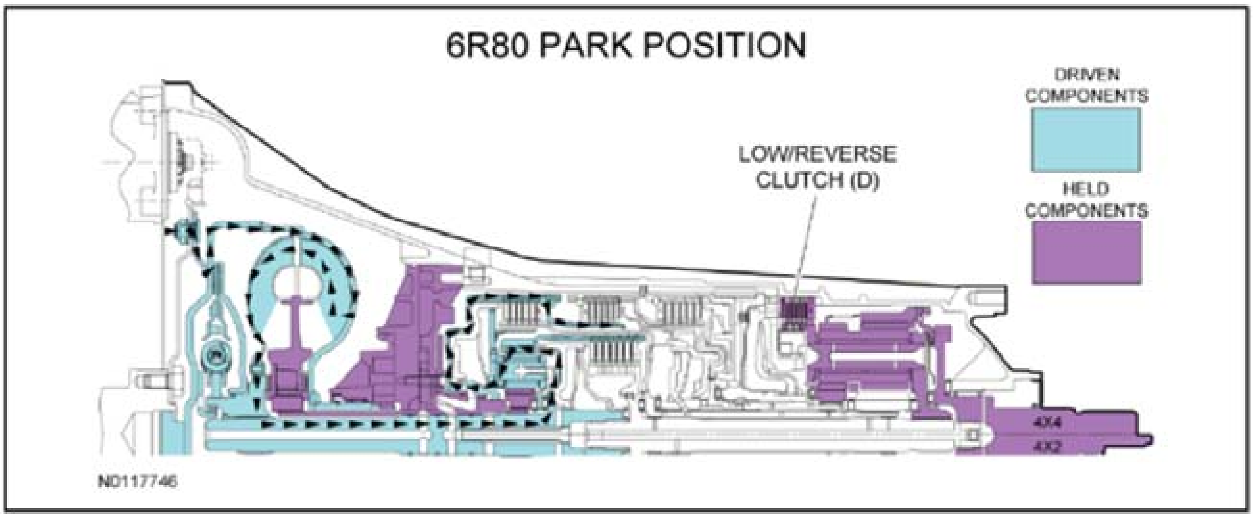
Park Position Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
Park				H		
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section.

Park Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CL DC circuit to position the valves for low/reverse clutch (D) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

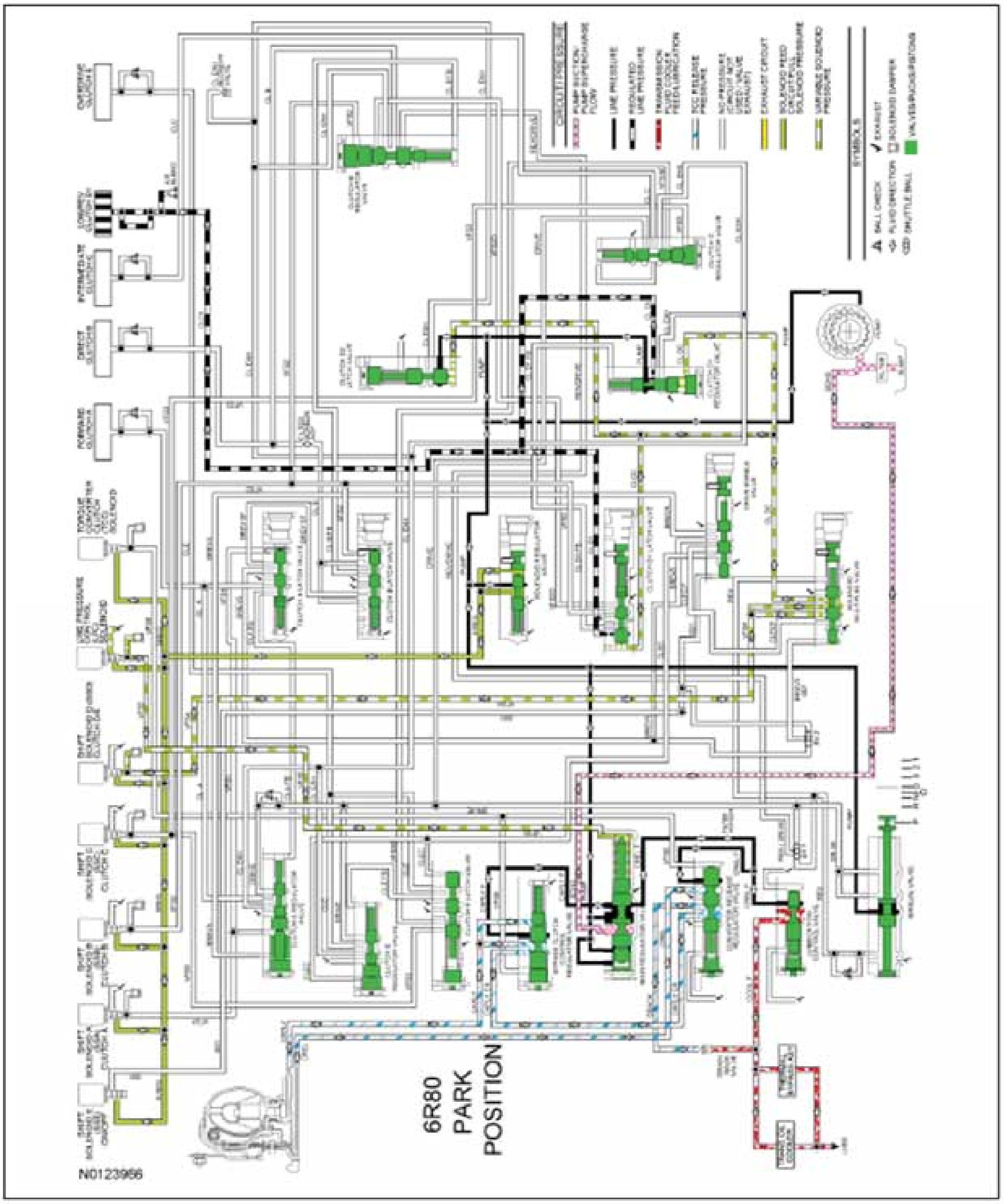
Solenoid operation:

Park Position Solenoid Operation Chart

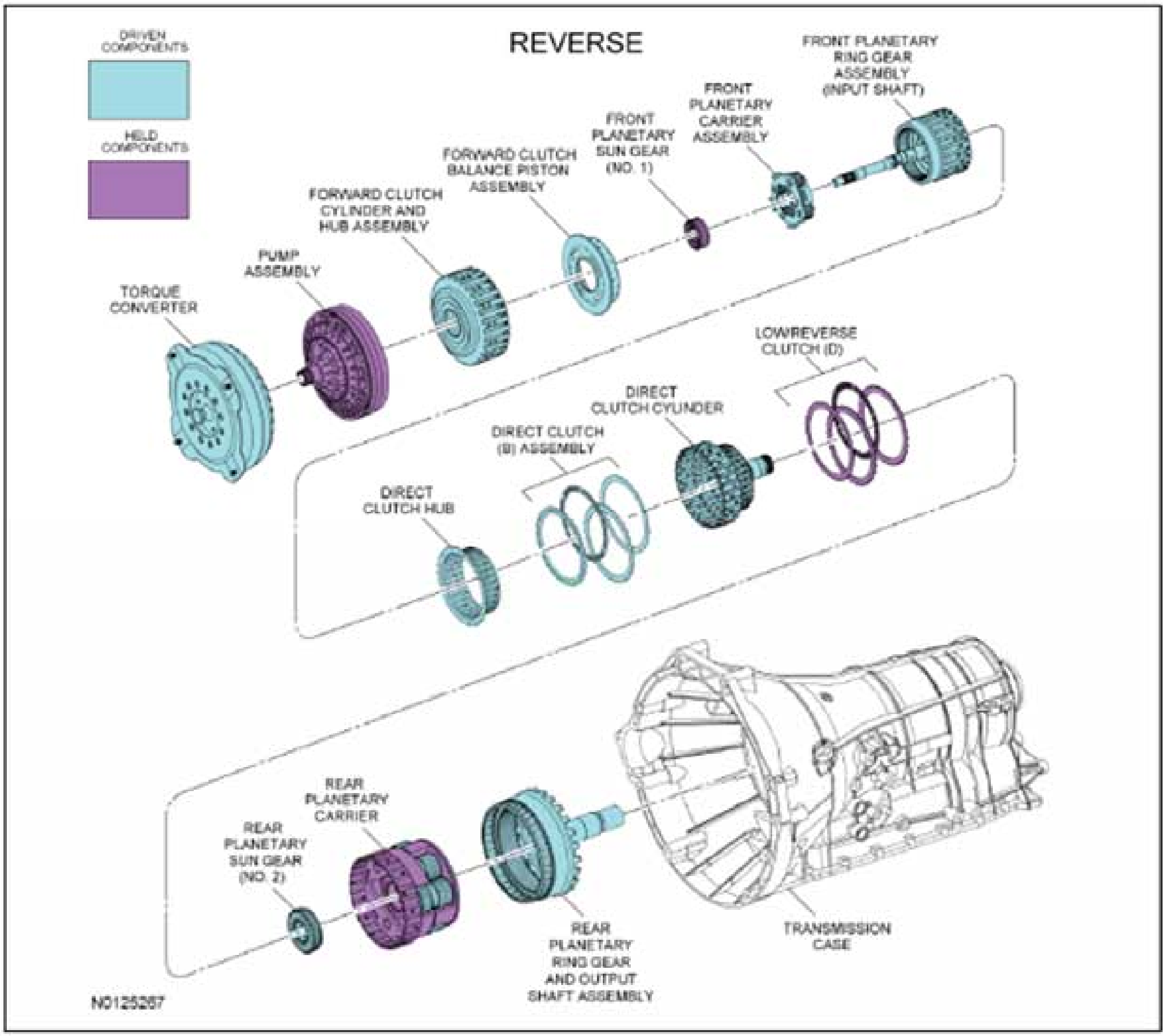
Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
P	P	Off	On	Off	On	On	Off

CB = Clutch brake
NC = Normally closed
NH = Normally high
NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
PARK
POSITION
N0123966

Reverse Position



Mechanical Operation

Apply components:
- Low/reverse clutch (D) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:
- Ring gear (input shaft)

Front planetary gearset driven components:
- Planetary carrier

Front planetary gearset held components:
- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- Sun gear No. 2

Rear planetary gearset driven components:
- Ring gear (output shaft)

Rear planetary gearset held components:
- Planetary carrier

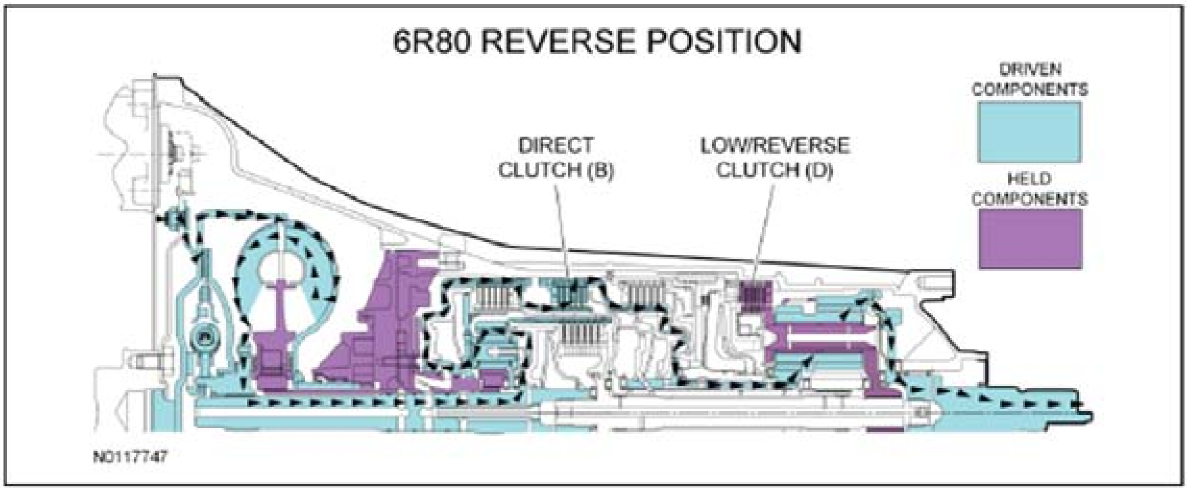
Reverse Position Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
Reverse		D		H		
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section.

Reverse Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In reverse, the manual valve directs line pressure to the No. 1 shuttle valve and the solenoid multiplex valve through the REV circuit.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 and D2 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSB supplies pressure to the clutch B regulator and latch valves to position the valves for direct clutch (B) application.

Clutch hydraulic circuits:

- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch.
- Line pressure is supplied by the manual valve to the clutch B latch and regulator valves.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

Reverse Position Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
R	R	Off	Off	Off	Off	On	Off

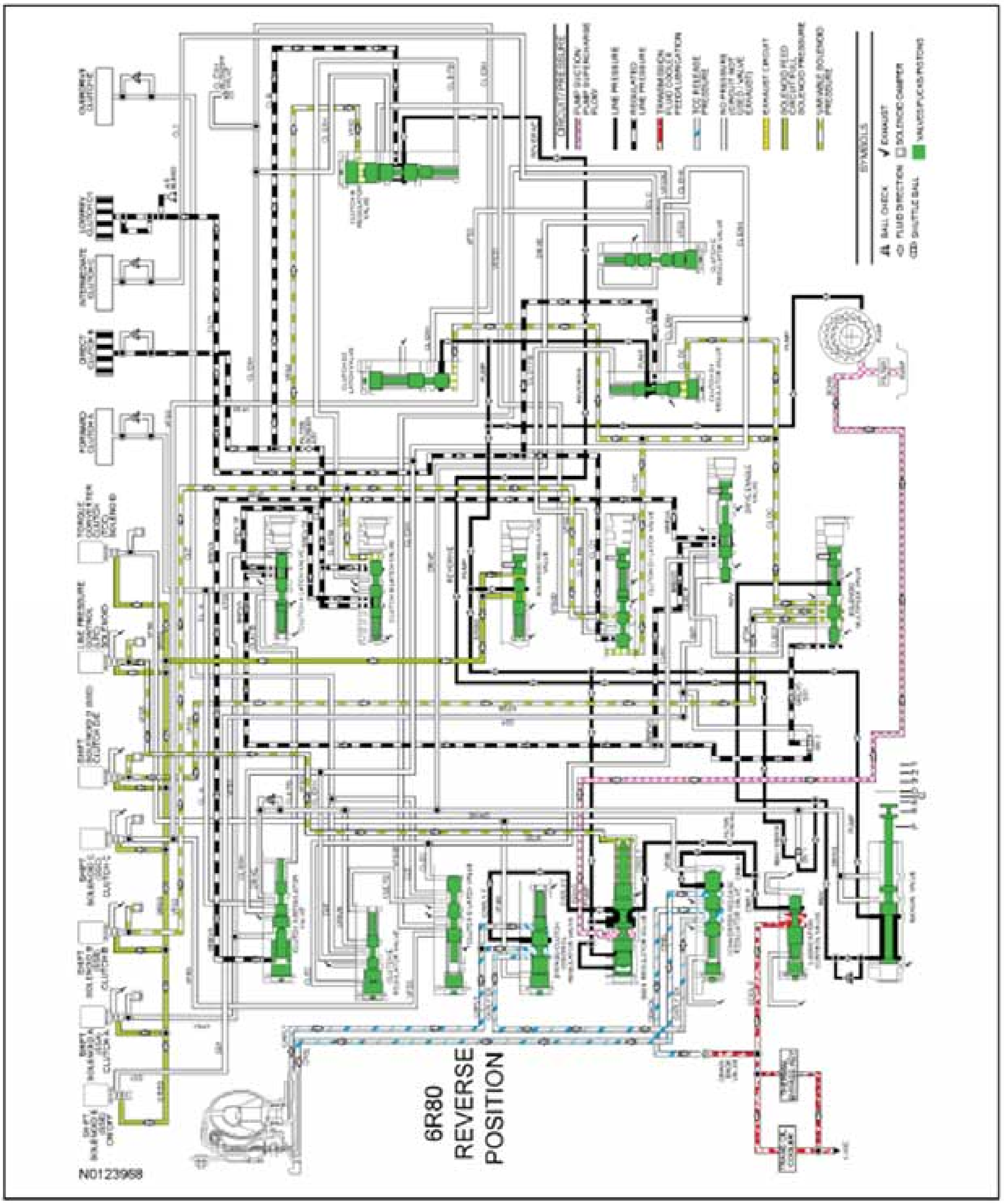
CB = Clutch brake

NC = Normally closed

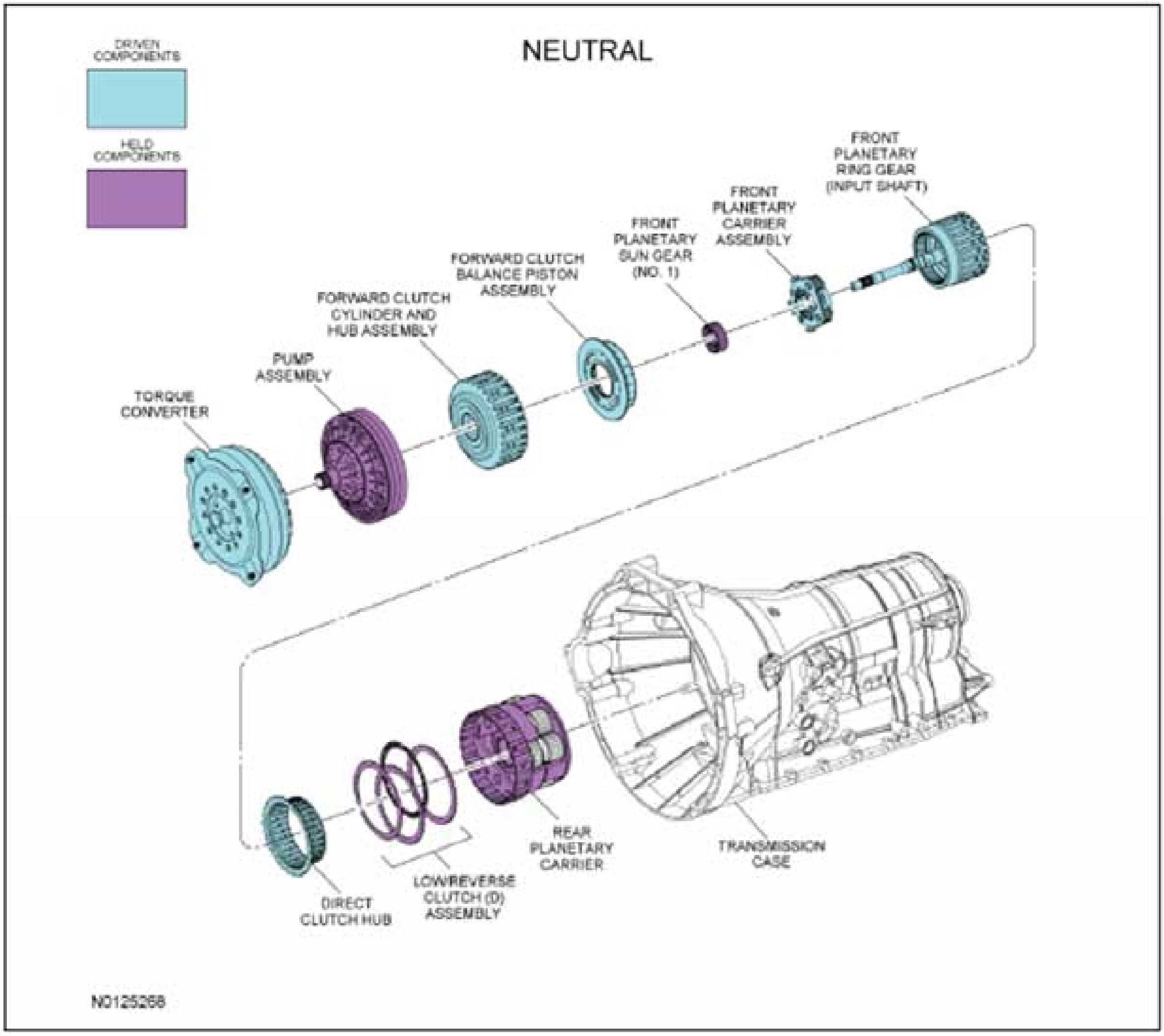
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
REVERSE
POSITION
N0123968

Neutral Position



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- None

Rear planetary gearset driven components:
- None

Rear planetary gearset held components:
- Planetary carrier

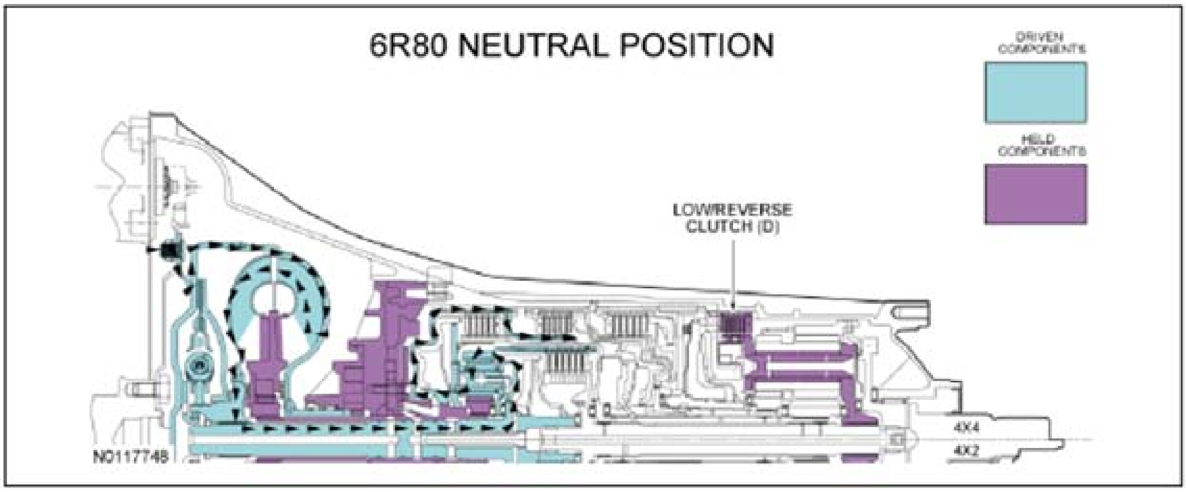
Neutral Position Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
Neutral				H		
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- H = Hold Clutch

For component information, refer to Mechanical Components and Functions in this section.

Neutral Position Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.

Torque converter circuits:
- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.

- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:
- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:
- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 latch and regulator valves through the CL DC circuit to position the valves for low/reverse clutch (D) application.

Clutch hydraulic circuits:
- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

Neutral Position Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
N	N	Off	On	Off	On [a]	On[a]	Off

a Solenoid state changes if vehicle is moving forward with the selector lever in the NEUTRAL position.

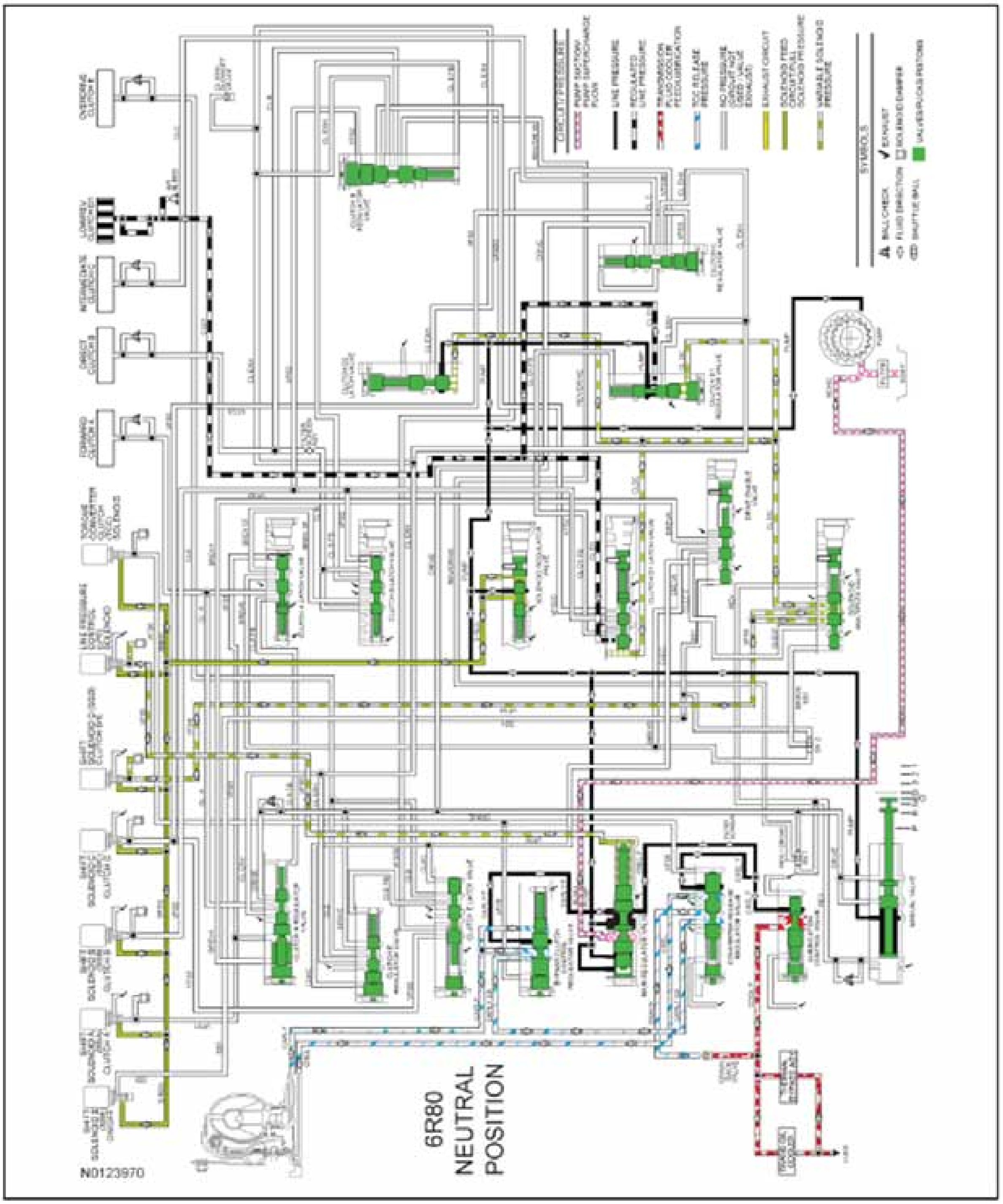
CB = Clutch brake

NC = Normally closed

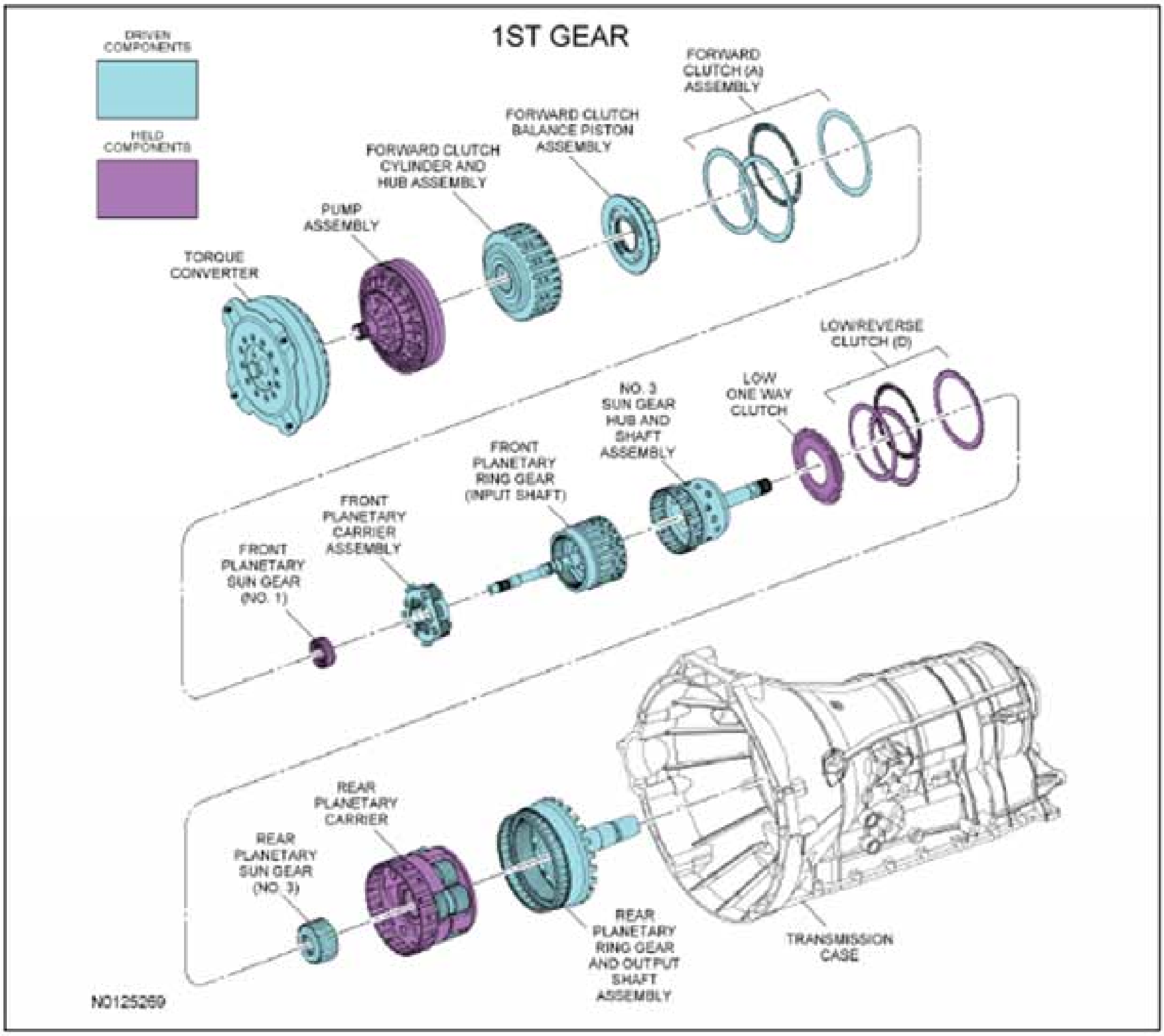
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
NEUTRAL
POSITION
N0123970

1st Gear



Mechanical Operation

Apply components:

- Low/reverse clutch (D) applied Below 5 kph (3 mph) only
- Low/One-Way Clutch (OWC)
- Forward clutch (A) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- No. 3 sun gear

Rear planetary gearset driven components:
- Ring gear (output shaft)

Rear planetary gearset held components:
- Planetary carrier

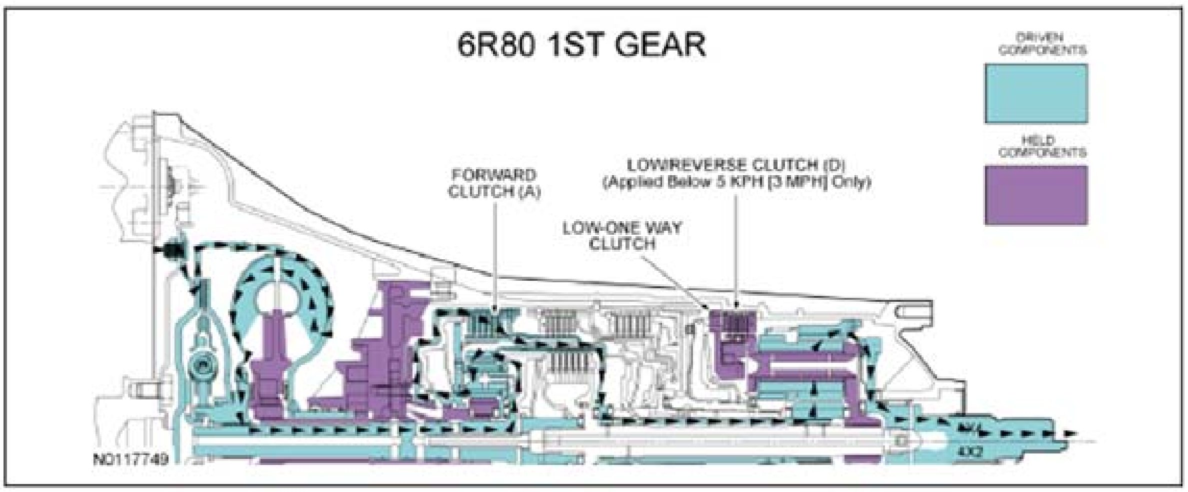
1st Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
1st Gear D	D			H [a]		H
1st Gear Manual	D			H		H
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

a Clutch released when vehicle speed is above 3 mph.
- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.

- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:
- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:
- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:
- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by
- controlling the position of the main regulator valve.
- Below 5 kph (3 mph), SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit. Above 5 kph (3 mph), amperage to SSD is increased to decrease pressure to the solenoid multiplex valve and clutch D1 regulator valve to release the low/reverse clutch (D).
- The position of the solenoid multiplex valve allows pressure from the VFS4 circuit to be directed to the D1 latch and regulator valves through the CLDC circuit to position the valves for low/reverse clutch (D) application.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.

Clutch hydraulic circuits:
- Line pressure is supplied by the pump to the D1 latch and regulator valves.
- Below 5 kph (3 mph), regulated line pressure from the D1 regulator valve is supplied to the low/reverse clutch (D) to apply the clutch. Above 5 kph (3mph) the D1 regulator valve exhausts to release the low/reverse clutch and the Low/OWC continues to hold the rear planetary carrier with no engine braking.
- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:
1st Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	1	On	On	Off	Off [b]	On	Off
1	1	On	On	Off	Off	On	Off

b Solenoid is On when vehicle is above 3 mph.

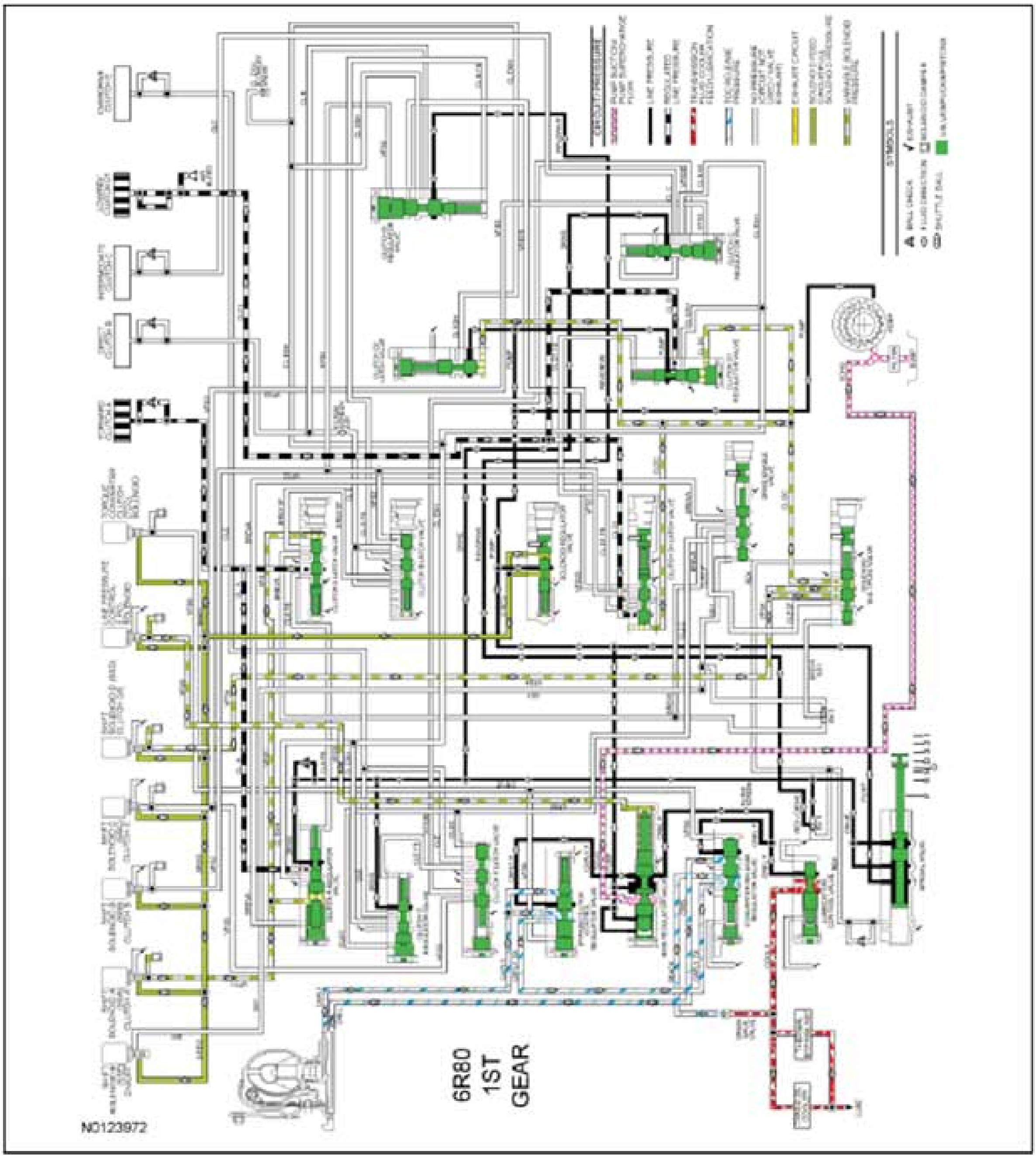
CB = Clutch brake

NC = Normally closed

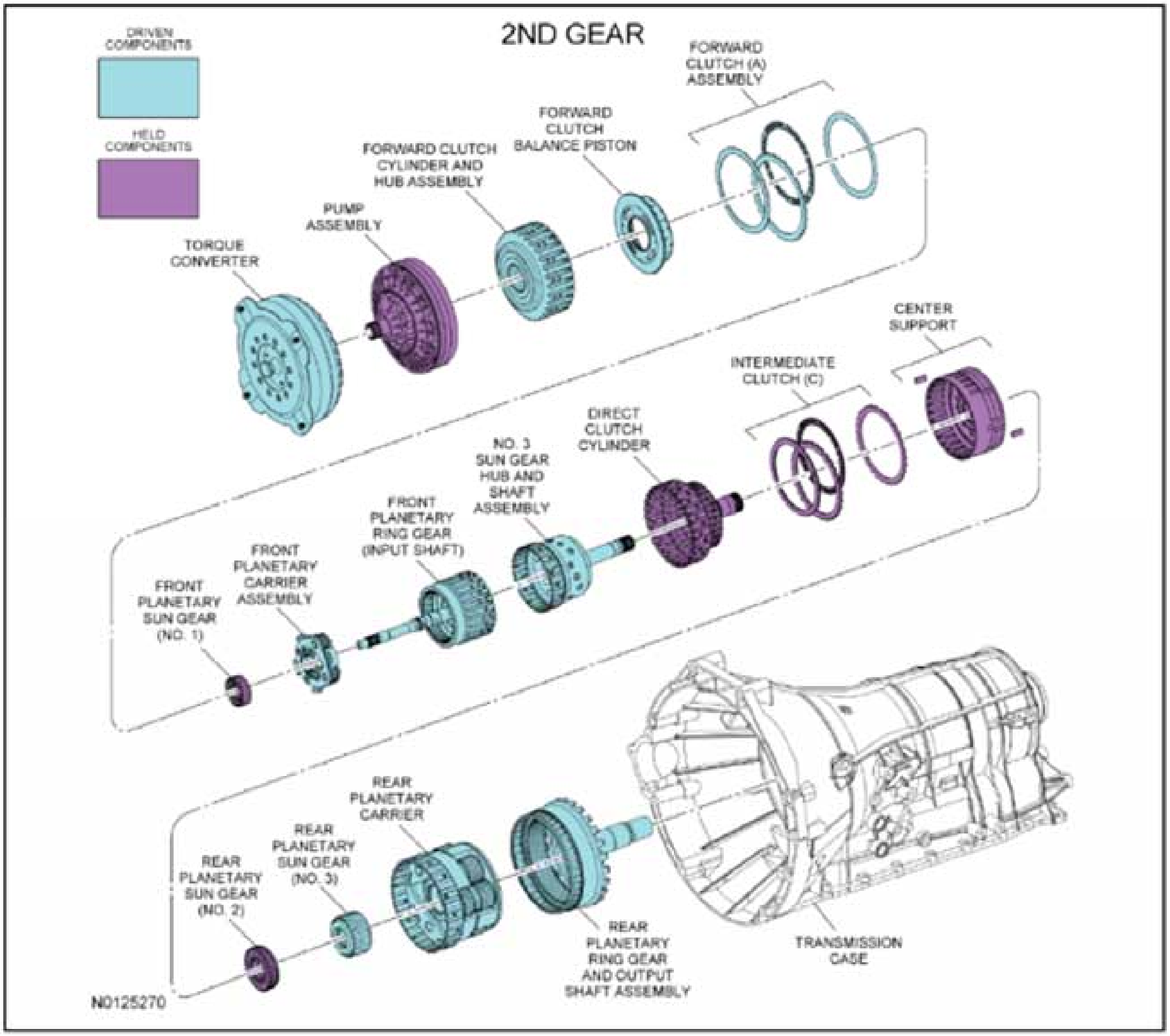
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
1ST
GEAR
N0123972

2nd Gear



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Intermediate clutch (C) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- No. 3 sun gear

Rear planetary gearset driven components:
- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:
- No. 2 sun gear

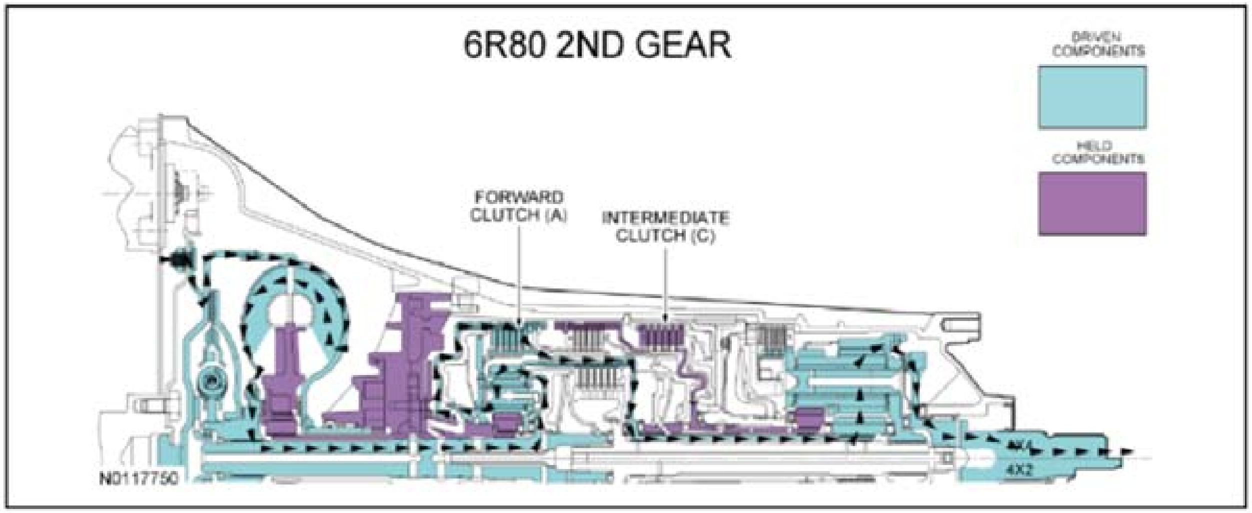
2nd Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
2nd Gear D and Manual 2	D		H			O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

2nd Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D and 2	2	On	On	On	On	Off	Off

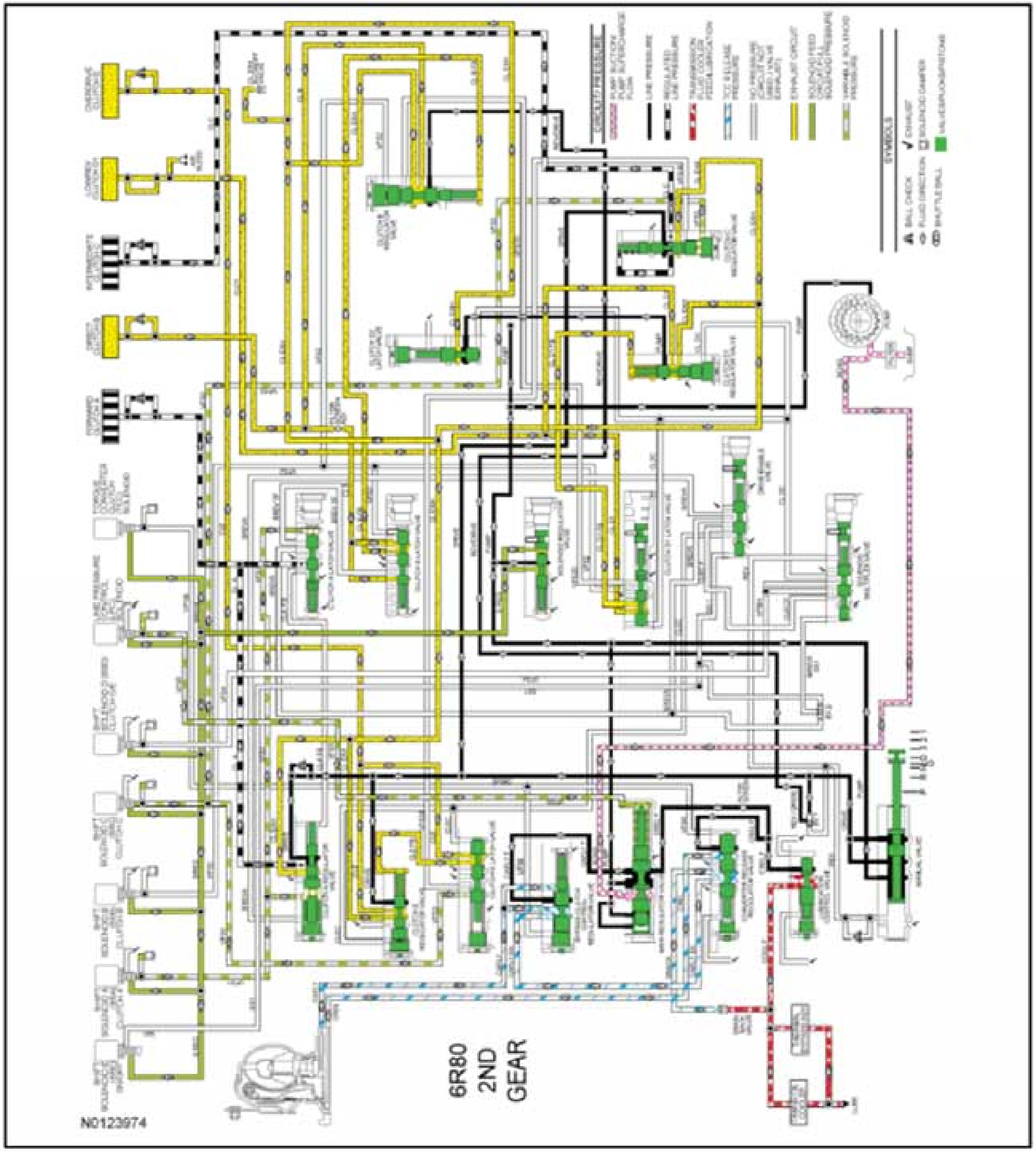
CB = Clutch brake

NC = Normally closed

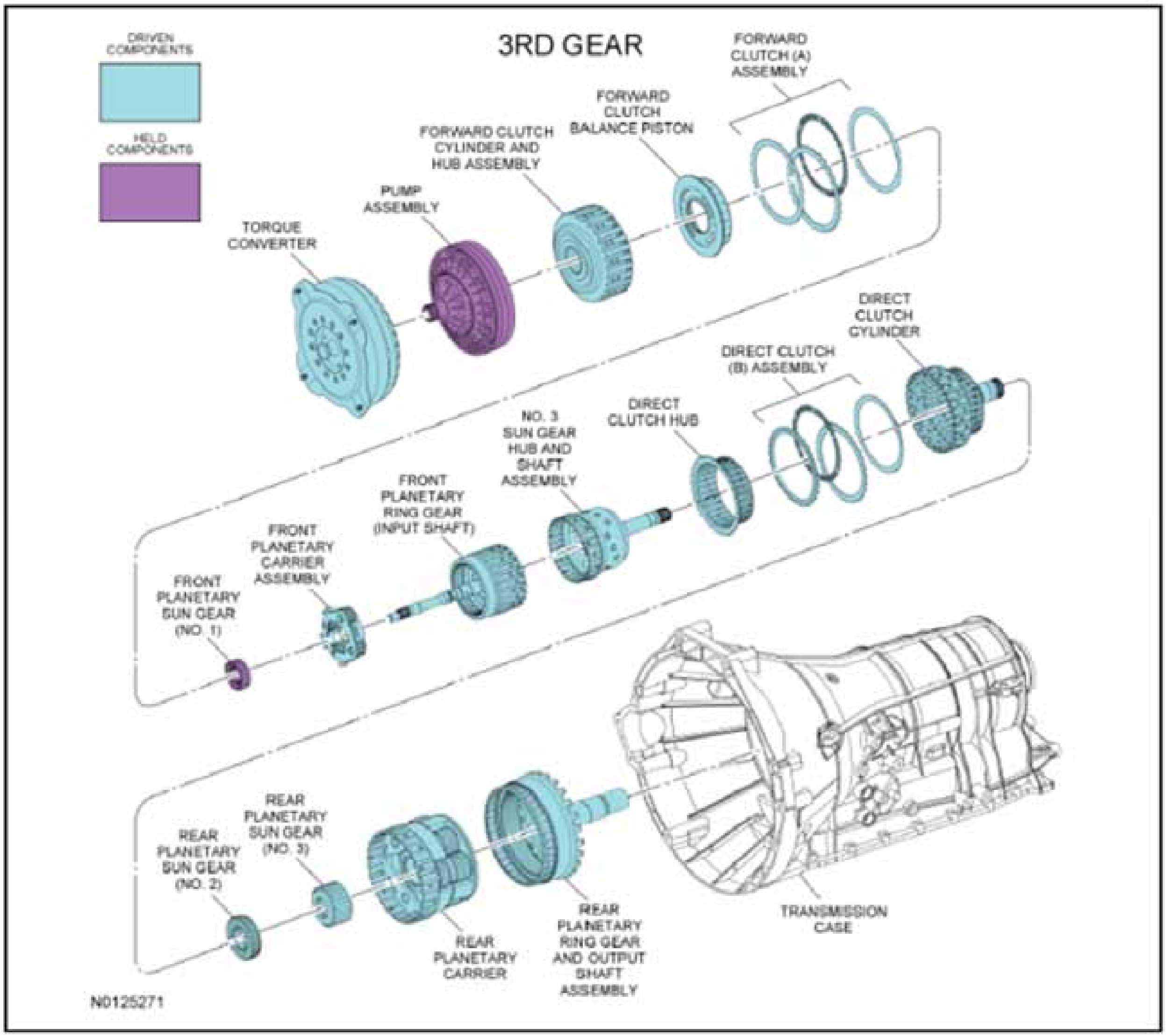
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
2ND
GEAR
N0123974

3rd Gear



Mechanical Operation

Apply components:
- Forward clutch (A) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:
- Ring gear (input shaft)

Front planetary gearset driven components:
- Planetary carrier

Front planetary gearset held components:
- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:
- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:
- None

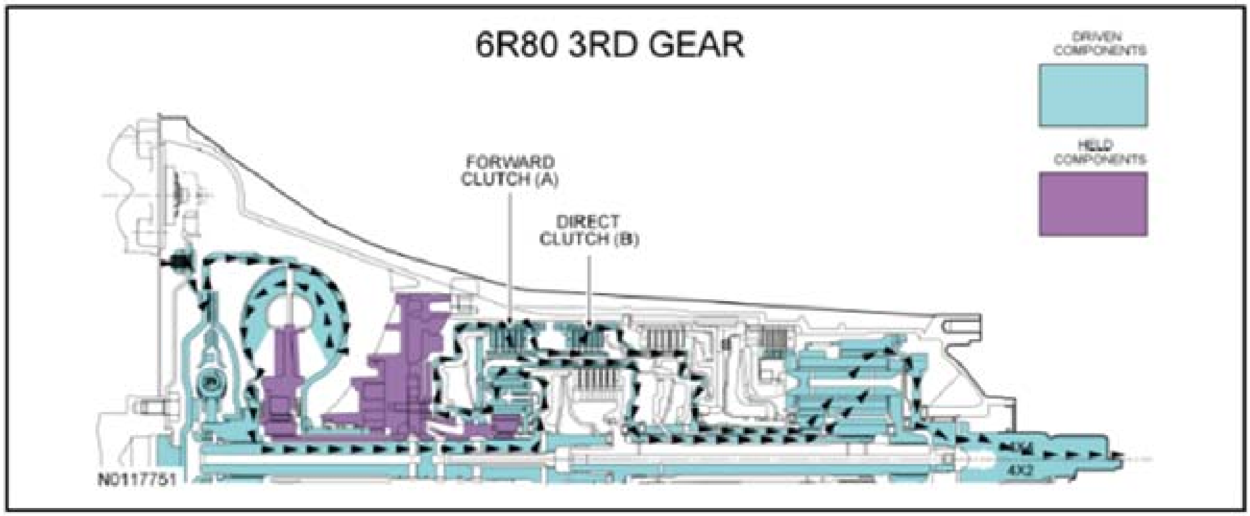
3rd Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
3rd Gear D and Manual 3	D	D				O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:

- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

3rd Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D and 3	3	On	Off	Off	On	Off	Off

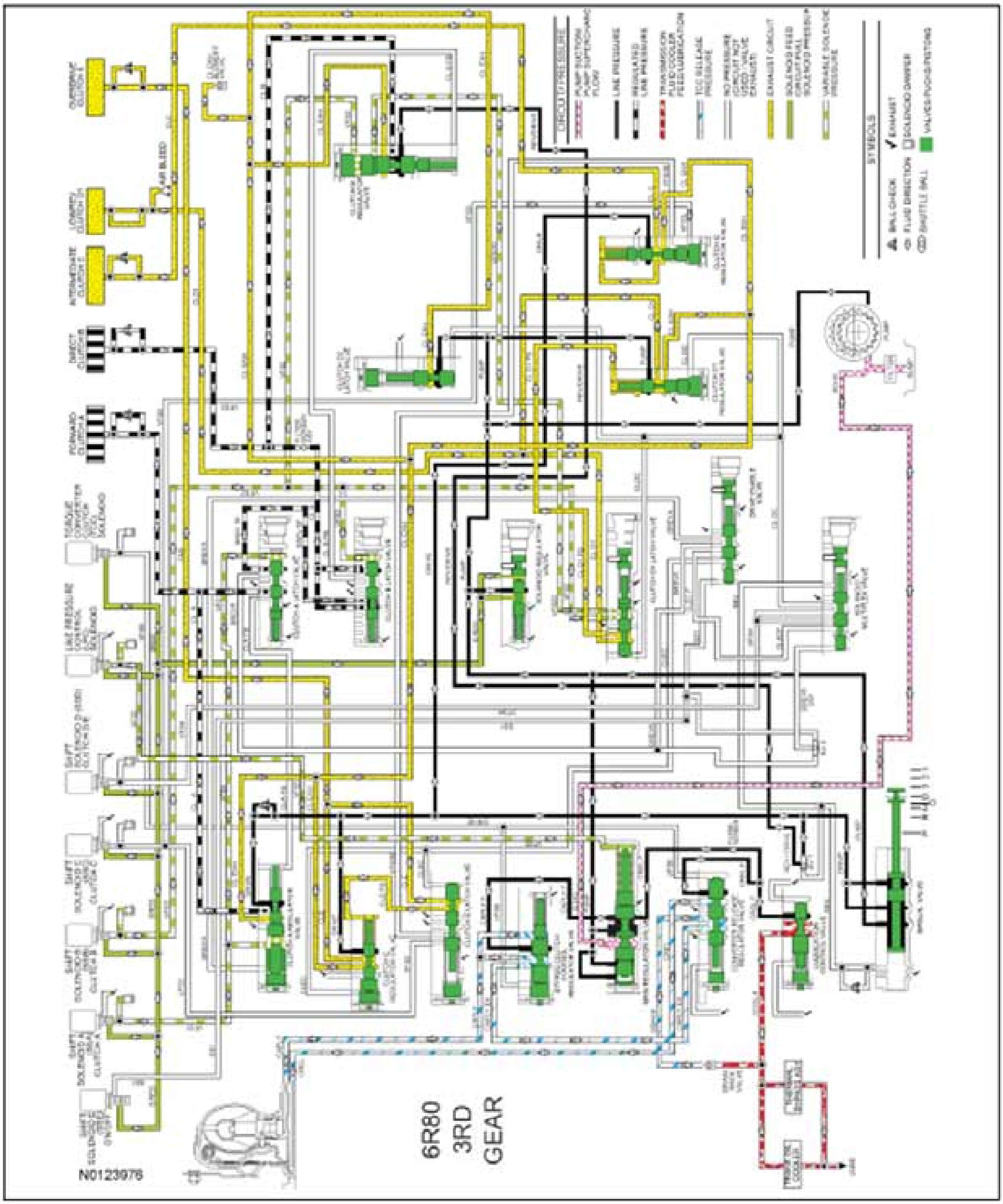
CB = Clutch brake

NC = Normally closed

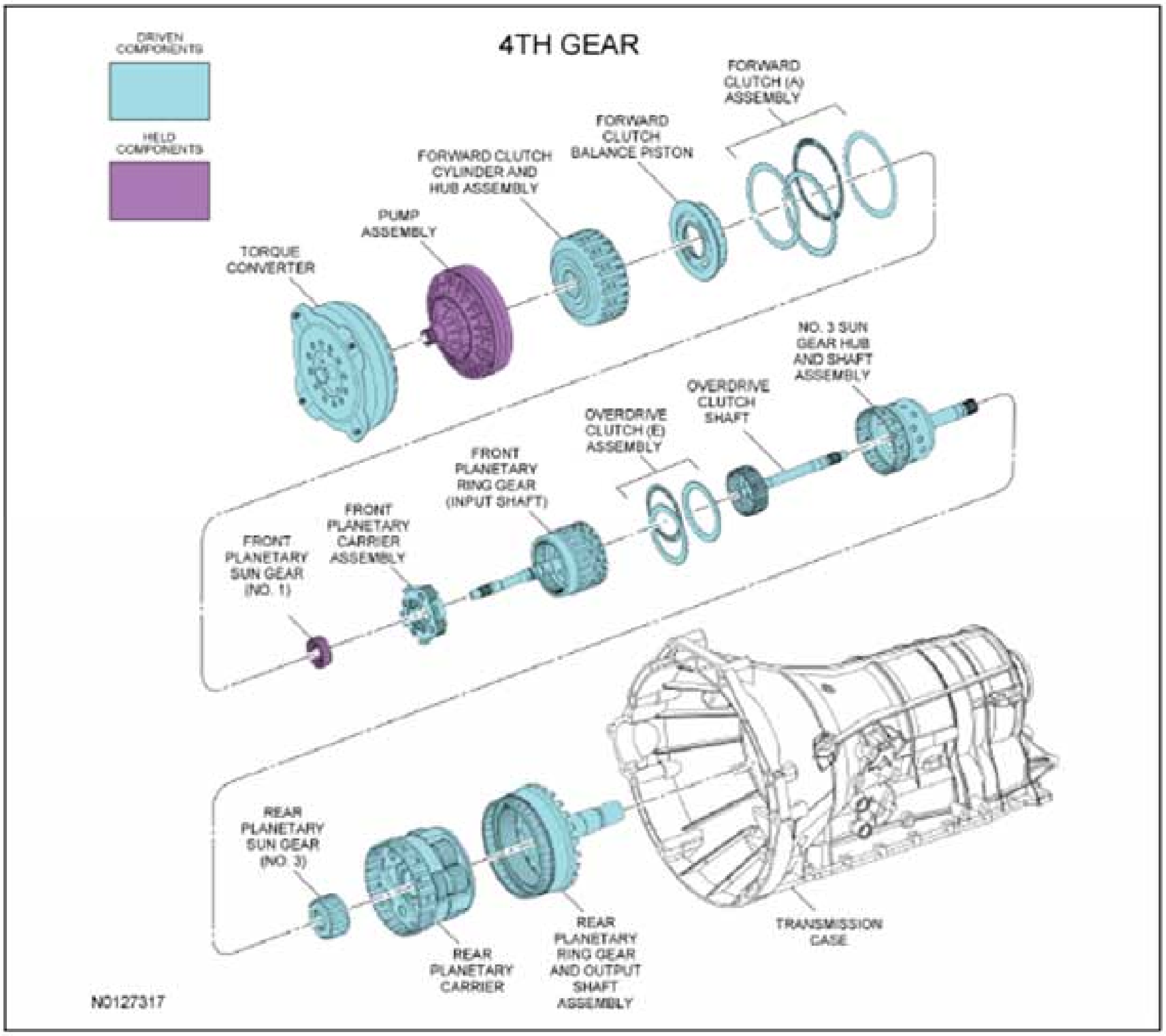
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
3RD
GEAR
N0123976

4th Gear



Mechanical Operation
Apply components:
- Forward clutch (A) applied
- Overdrive clutch (E) applied

Planetary Gearset Operation

Front planetary gearset driving components:
- Ring gear (input shaft)

Front planetary gearset driven components:
- Planetary carrier

Front planetary gearset held components:
- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- No. 3 sun gear
- Planetary carrier

Rear planetary gearset driven components:
- Ring gear (output shaft)

Rear planetary gearset held components:
- None

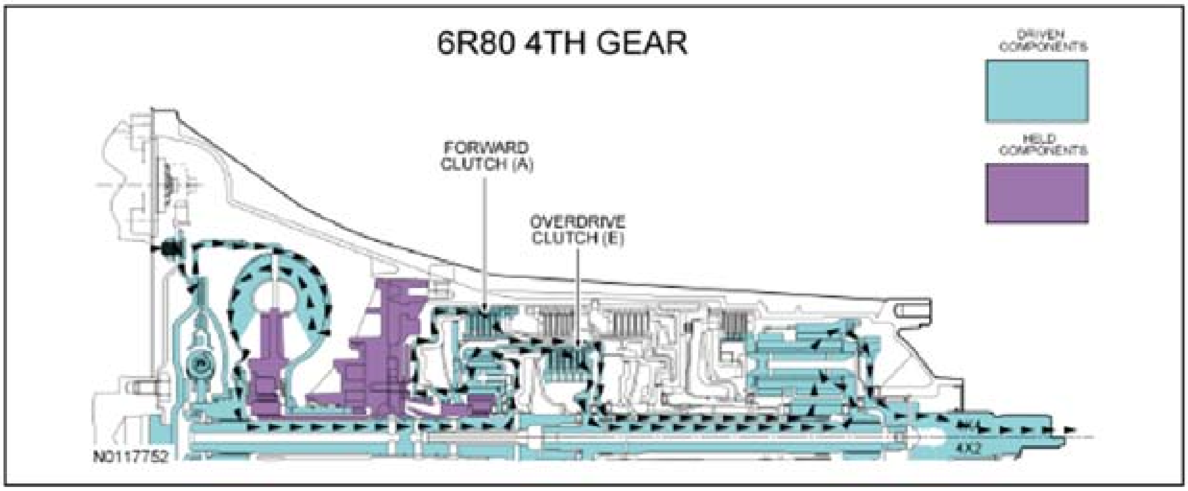
4th Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
4th Gear D	D				D	O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - o manual valve.
  - o lubrication control valve.
  - o converter release regulator valve.
  - o bypass clutch control regulator valve.
  - o solenoid pressure regulator valve.
  - o D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:
- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:

- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:

- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSA supplies pressure to the clutch A regulator and latch valves to position the valves for forward clutch (A) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:

- Regulated line pressure from the clutch A regulator valve is supplied to the forward clutch (A) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

4th Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	4	On	On	Off	Off	Off	On/Off

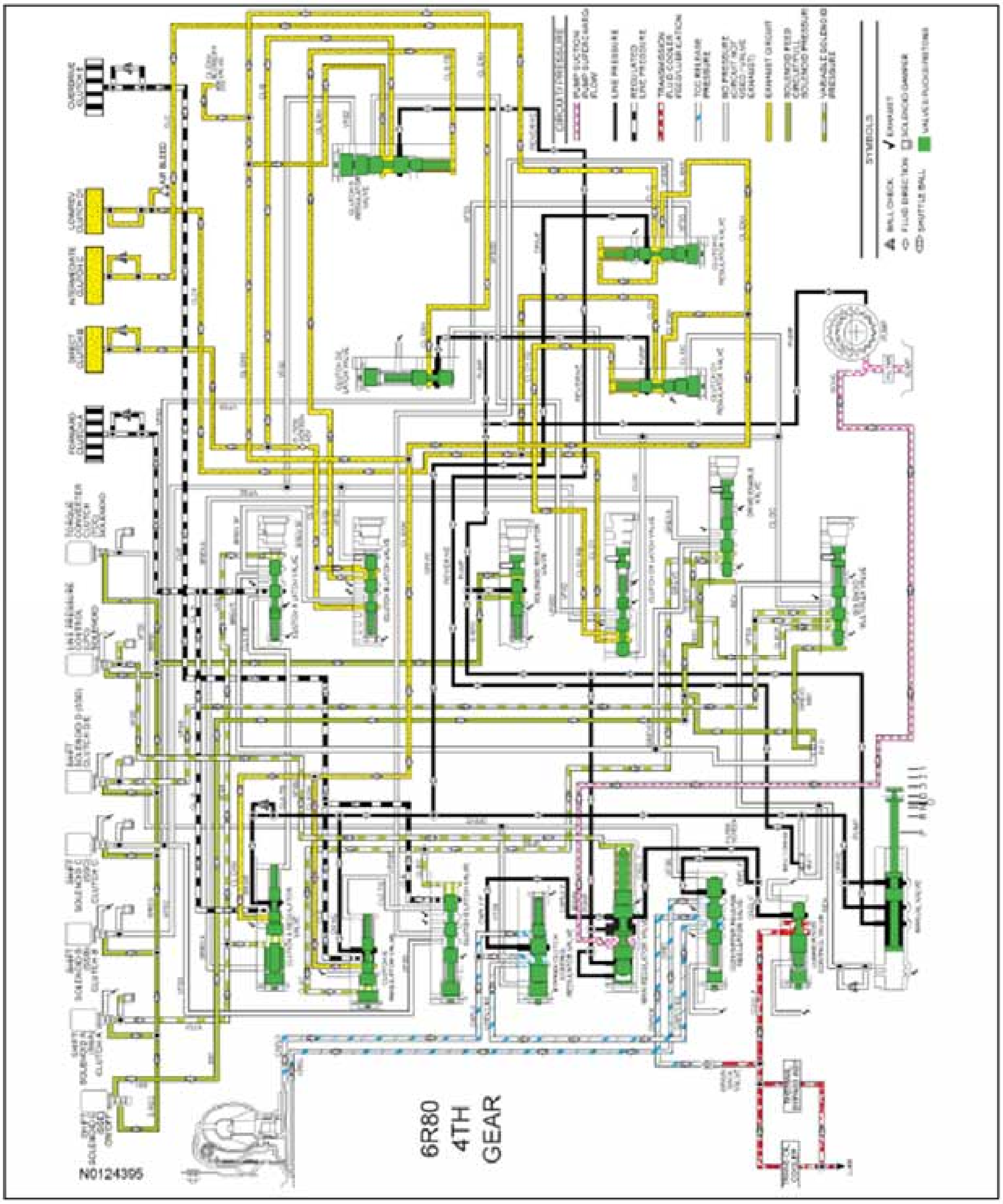
CB = Clutch brake

NC = Normally closed

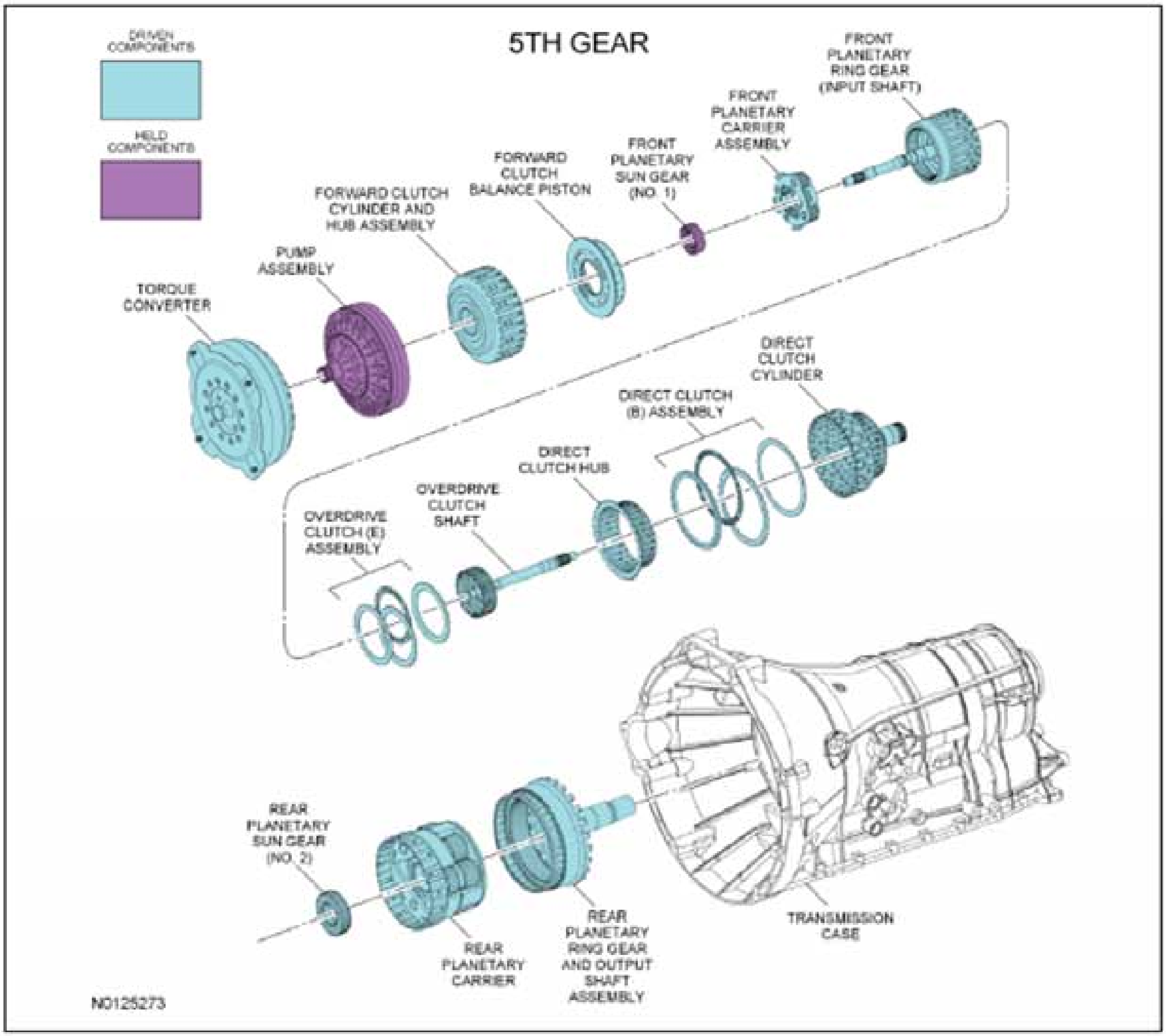
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
4TH
GEAR
N0124395

5th Gear



Mechanical Operation

Apply components:

- Overdrive clutch (E) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- No. 2 sun gear
- Planetary carrier

Rear planetary gearset driven components:
- Ring gear (output shaft)

Rear planetary gearset held components:
- None

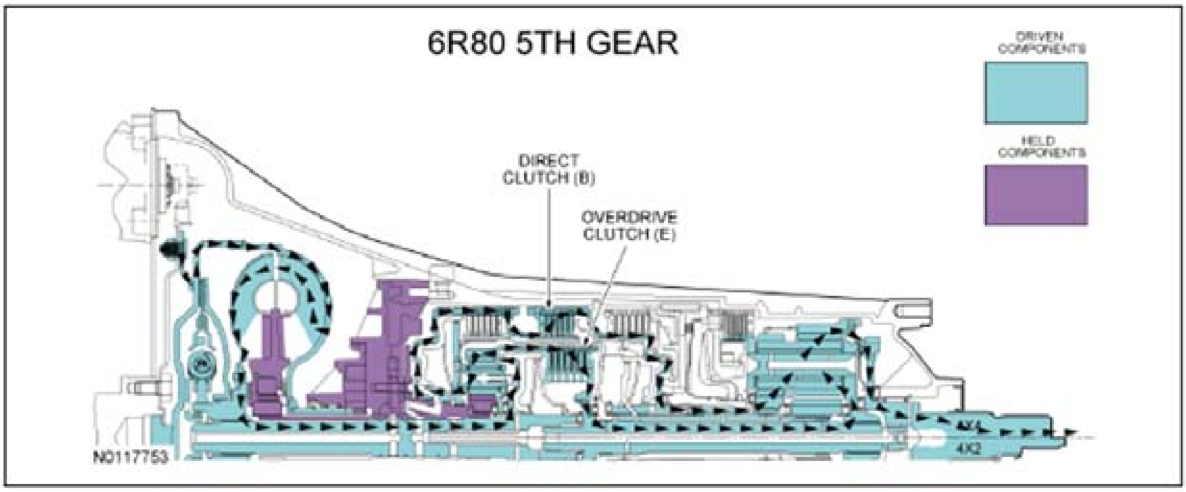
5th Gear Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
5th Gear D		D			D	O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.

- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:
- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:
- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:
- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The PCA applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- SSB supplies pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation
Solenoid operation:

5th Gear Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
D	5	Off	Off	Off	Off	Off	On/Off

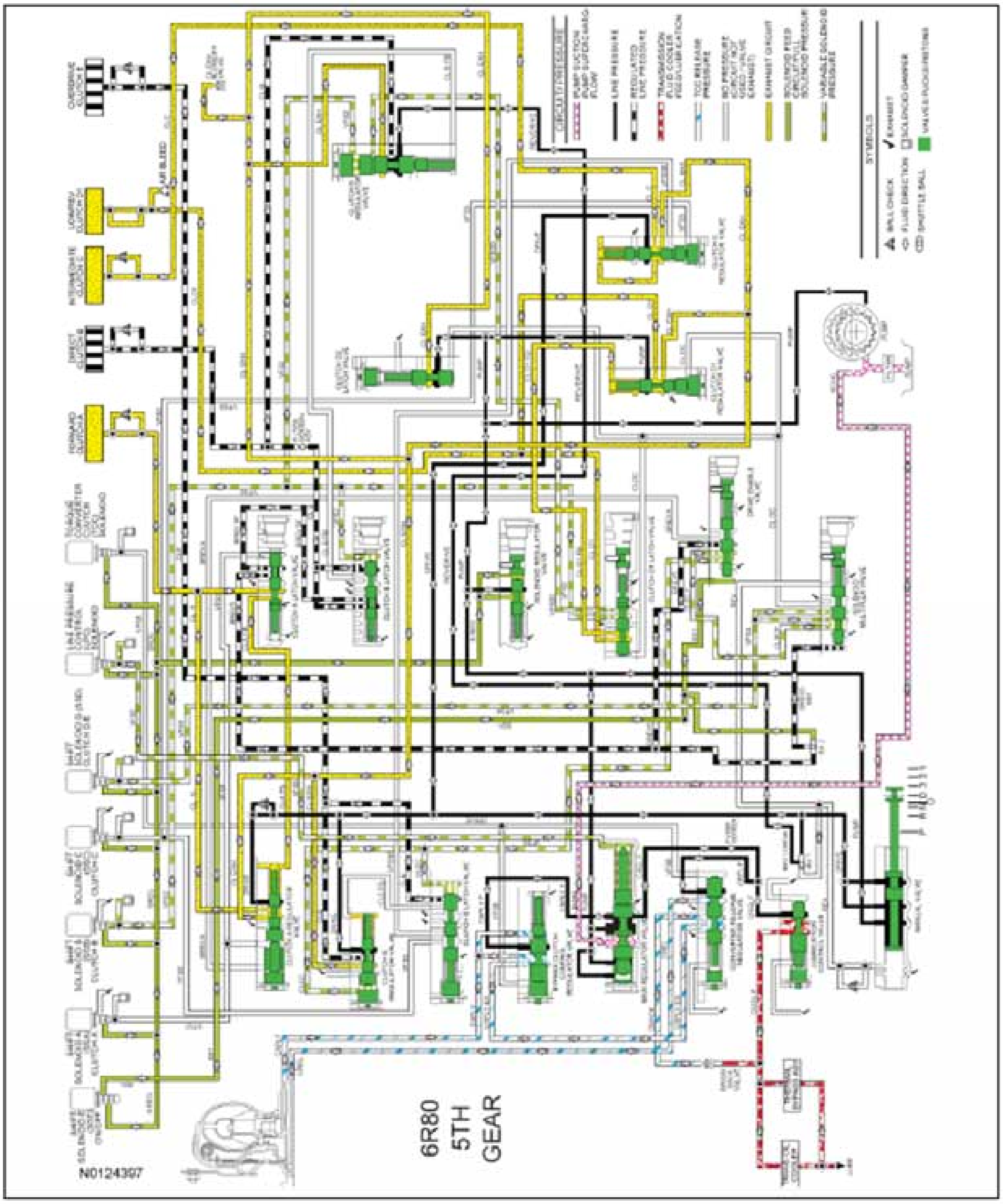
CB = Clutch brake

NC = Normally closed

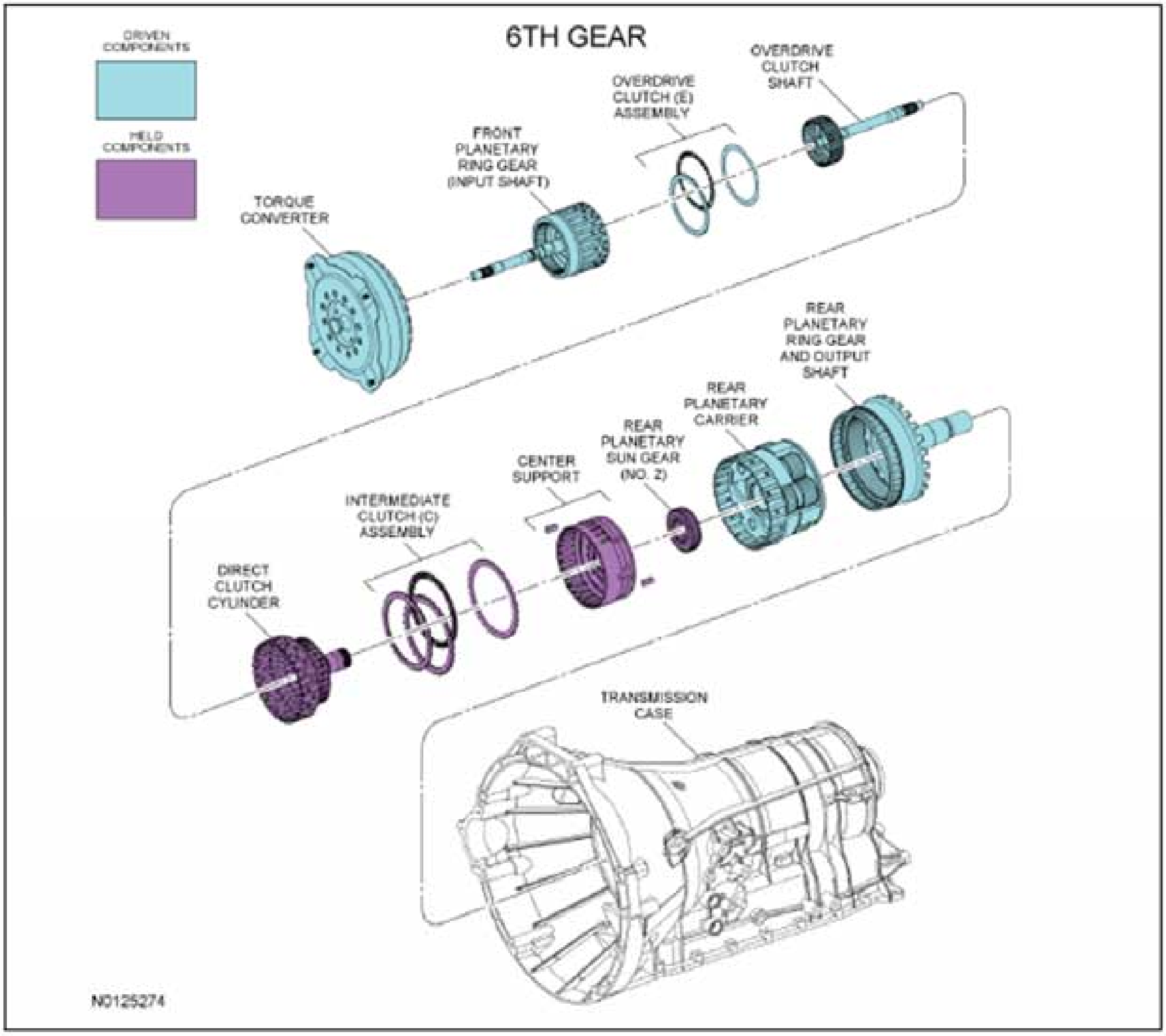
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
5TH
GEAR
N0124397

6th Gear Torque Converter Clutch (TCC) Applied



Mechanical Operation

Apply components:

- Overdrive clutch (E) applied
- Intermediate clutch (C) applied

Planetary Gearset Operation

Front planetary gearset driving components:
- Ring gear (input shaft)

Front planetary gearset driven components:
- Planetary carrier (does not contribute to power flow)

Front planetary gearset held components:
- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:
- Planetary carrier

Rear planetary gearset driven components:
- Ring gear (output shaft)

Rear planetary gearset held components:
- No. 2 sun gear

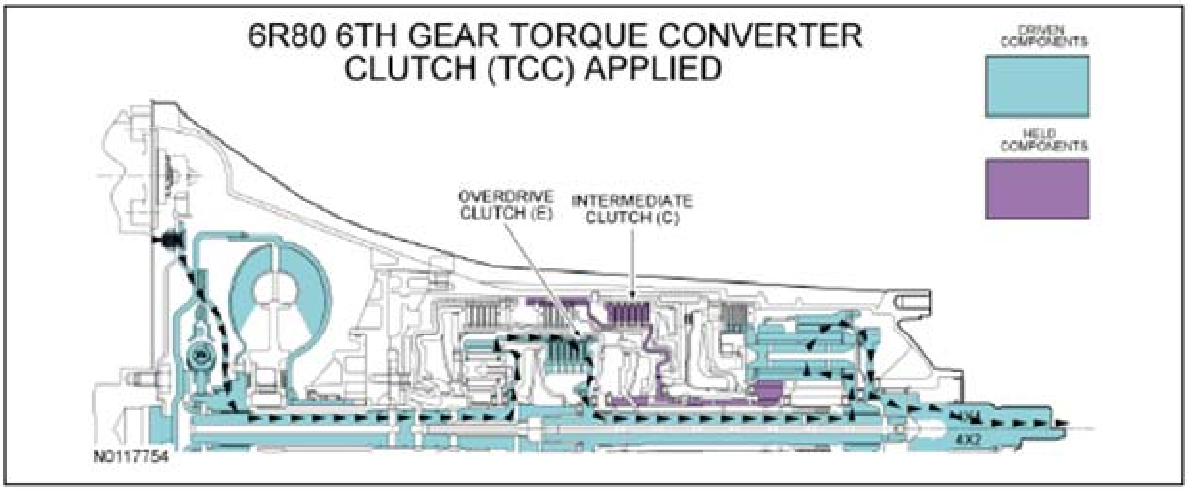
6th Gear Torque Converter Clutch (TCC) Applied Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
6th Gear D			H		D	O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:
- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.
- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.

- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:
- When the TCC is applied, the bypass clutch control regulator valve applies pressure to the torque converter through the CAPLY circuit to apply the TCC.
- CAPLY pressure exits the torque converter through the CREL circuit to the converter release regulator valve.

Cooler and lubrication hydraulic circuits:
- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:
- The solenoid pressure regulator valve supplies regulated line pressure to the shift, LPC and TCC solenoids through the SREG hydraulic circuit.
- The LPC solenoid applies varying pressure to the main regulator valve through the VFS5 hydraulic circuit. The LPC solenoid regulates line pressure by controlling the position of the main regulator valve.
- The TCC solenoid supplies pressure to the converter release regulator valve and the bypass clutch control regulator valve to move the position of the valves for TCC application.
- SSC supplies pressure to the clutch C regulator valve to position the valve for intermediate clutch (C) application.
- SSD supplies pressure to the solenoid multiplex valve through the VFS4 circuit.
- SSE supplies pressure to the solenoid multiplex valve and the drive enable valve through the SS1 circuit to move the valves.
- The position of the solenoid multiplex valve and the drive enable valve allows pressure from the VFS4 circuit to be directed to the clutch E latch and regulator valves through the CLEC circuit to position the valves for overdrive clutch (E) application.

Clutch hydraulic circuits:
- Regulated line pressure from the clutch C regulator valve is supplied to the intermediate clutch (C) to apply the clutch.
- Regulated line pressure from the clutch E regulator valve is supplied to the overdrive clutch (E) to apply the clutch.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation:

6th Gear Torque Converter Clutch (TCC) Applied Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	
	6	Off	On	On	Off	Off	On/Off

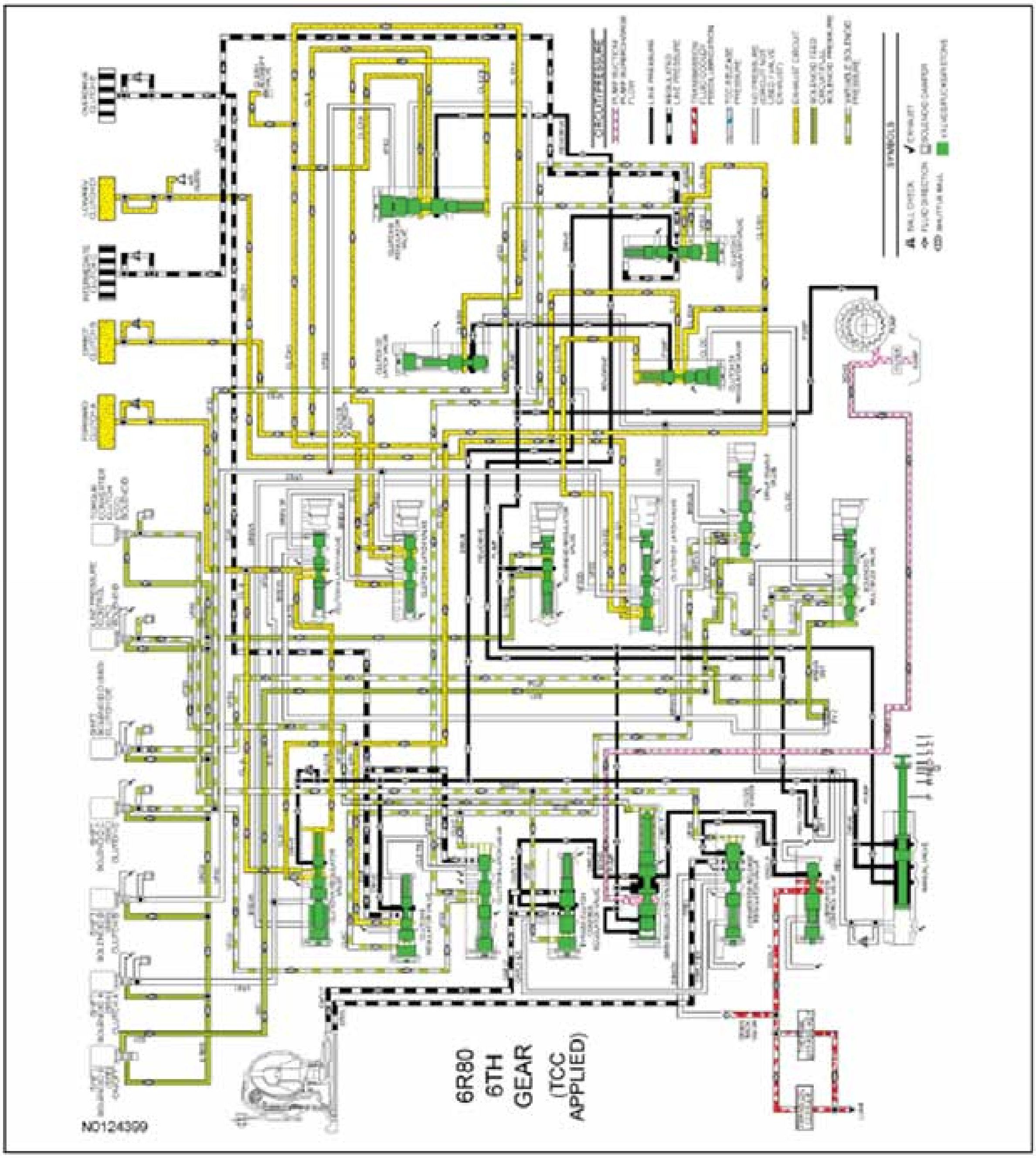
CB = Clutch brake

NC = Normally closed

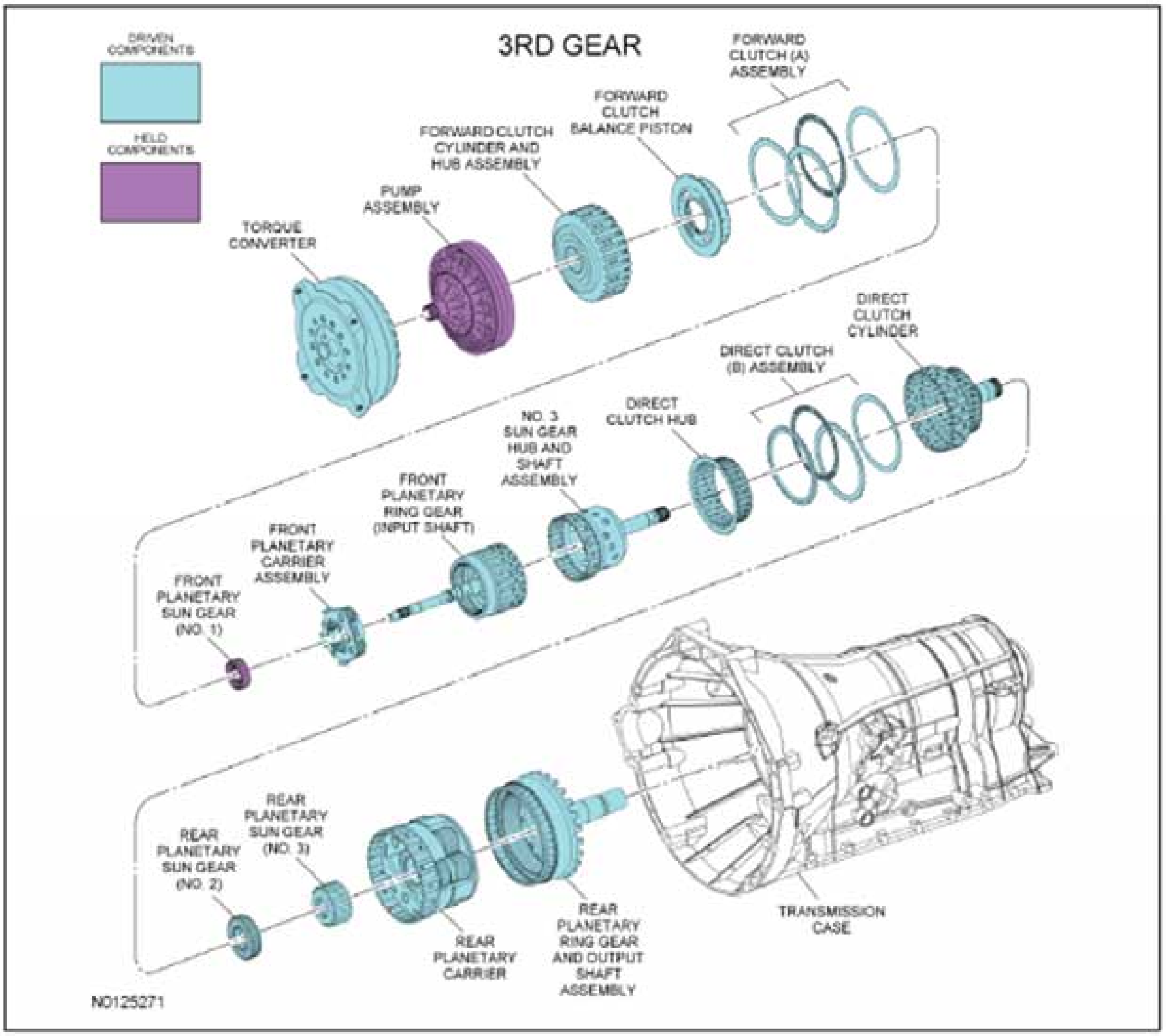
NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
6TH
GEAR
(TCC
APPLIED)
N0124399

3rd Gear Fail Safe



Mechanical Operation

Apply components:

- Forward clutch (A) applied
- Direct clutch (B) applied

Planetary Gearset Operation

Front planetary gearset driving components:

- Ring gear (input shaft)

Front planetary gearset driven components:

- Planetary carrier

Front planetary gearset held components:

- Sun gear (splined to pump assembly)

Rear planetary gearset driving components:

- No. 3 sun gear
- No. 2 sun gear

Rear planetary gearset driven components:

- Planetary carrier
- Ring gear (output shaft)

Rear planetary gearset held components:

- None

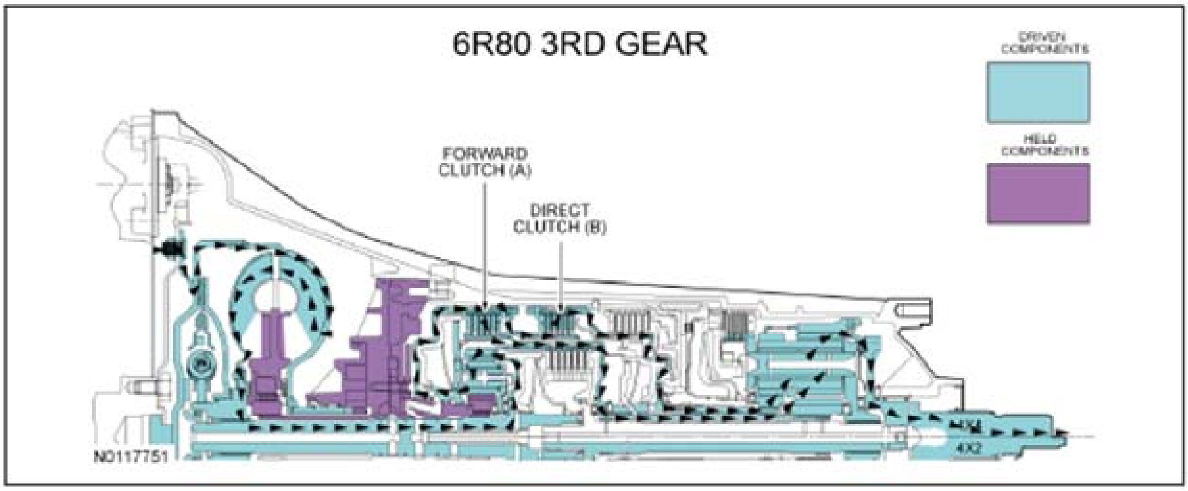
3rd Gear Fail Safe Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
3rd Gear D and Manual 3	D	D				O/R
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

- D = Drive Clutch
- O/R = Overrunning

For component information, refer to Mechanical Components and Functions in this section.

Power Flow



Hydraulic Operation

Line pressure hydraulic circuits:

- The position of the main regulator valve controls line pressure. The position of the main regulator valve is dependent on the pressure applied to it by the LPC solenoid through the VFS5 circuit.
- The main regulator valve varies pressure in the PUMP circuit by controlling hydraulic flow from the SCHG circuit into the pump suction circuit.
- Line pressure is supplied to the:
  - manual valve.
  - lubrication control valve.
  - converter release regulator valve.
  - bypass clutch control regulator valve.
  - solenoid pressure regulator valve.
  - D1 latch and regulator valves.

- In drive, the manual valve directs line pressure to the No. 1 shuttle valve and clutch A, C and E regulator valves.
- The No. 1 shuttle ball directs line pressure to the clutch B regulator valve.

Torque converter circuits:
- When the TCC is released, the converter release regulator valve applies pressure to the torque converter through the CREL circuit to release the TCC.
- CREL pressure exits the torque converter through the CAPLY circuit to the bypass clutch control regulator valve.
- The bypass clutch control regulator valve directs the pressure from the CAPLY circuit back to the converter release regulator valve through the CAPLY EX circuit.
- The converter release regulator valve directs the pressure from the CAPLY EX circuit to the drain back valve through the DBACK circuit.

Cooler and lubrication hydraulic circuits:
- The lubrication control valve directs line pressure to the transmission fluid cooler or the thermal bypass valve through the COOLF circuit.
- When the transmission fluid exits the transmission fluid cooler or thermal bypass valve, it provides lubrication to the transmission through the LUBE circuit. For information about transmission lubrication, refer to Mechanical Components and Functions in this section.

Solenoid hydraulic circuits:
- The solenoid pressure regulator valve supplies line pressure to the shift, LPC and TCC solenoid through the SREG hydraulic circuit.
- The LPC solenoid applies full solenoid output pressure to the main regulator valve through the VFS5 hydraulic circuit. With full solenoid output pressure, the main regulator valve provides maximum line pressure during fail safe.
- SSB supplies maximum solenoid output pressure to the clutch B regulator valve to position the valve for direct clutch (B) application.

Clutch hydraulic circuits:
- Regulated line pressure from the clutch B regulator valve is supplied to the direct clutch (B) to, apply the clutch. Regulated line pressure from the clutch B regulator valve is also supplied to the clutch A latch valve from the clutch B latch valve through the BREV 5F circuit.
- The clutch A latch valve directs the regulated line pressure to the drive enable valve through the BREV5 circuit.
- The drive enable valve directs the BREV5 pressure to the BREVA circuit which supplies the clutch A regulator valve to position the valve to apply the forward clutch (A) with 81% of line pressure.

For hydraulic circuit information, refer to Hydraulic Circuits in this section.

Electrical Operation

Solenoid operation: In failsafe, voltage is removed from all solenoids and the solenoids default to their normal position. If a solenoid is a normally low (NL) solenoid, the solenoid will not supply pressure to the regulator valve, releasing the clutch that it controls. If a solenoid is a normally high (NH) solenoid, the solenoid will provide high pressure to the regulator valve, applying the clutch that it controls.

3rd Gear Fail Safe Solenoid Operation Chart

Gear	SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L/R 4,5,6)	SSE NC	LPC NH	TCC NL
3rd Gear	—	—	—	—	—	—	—

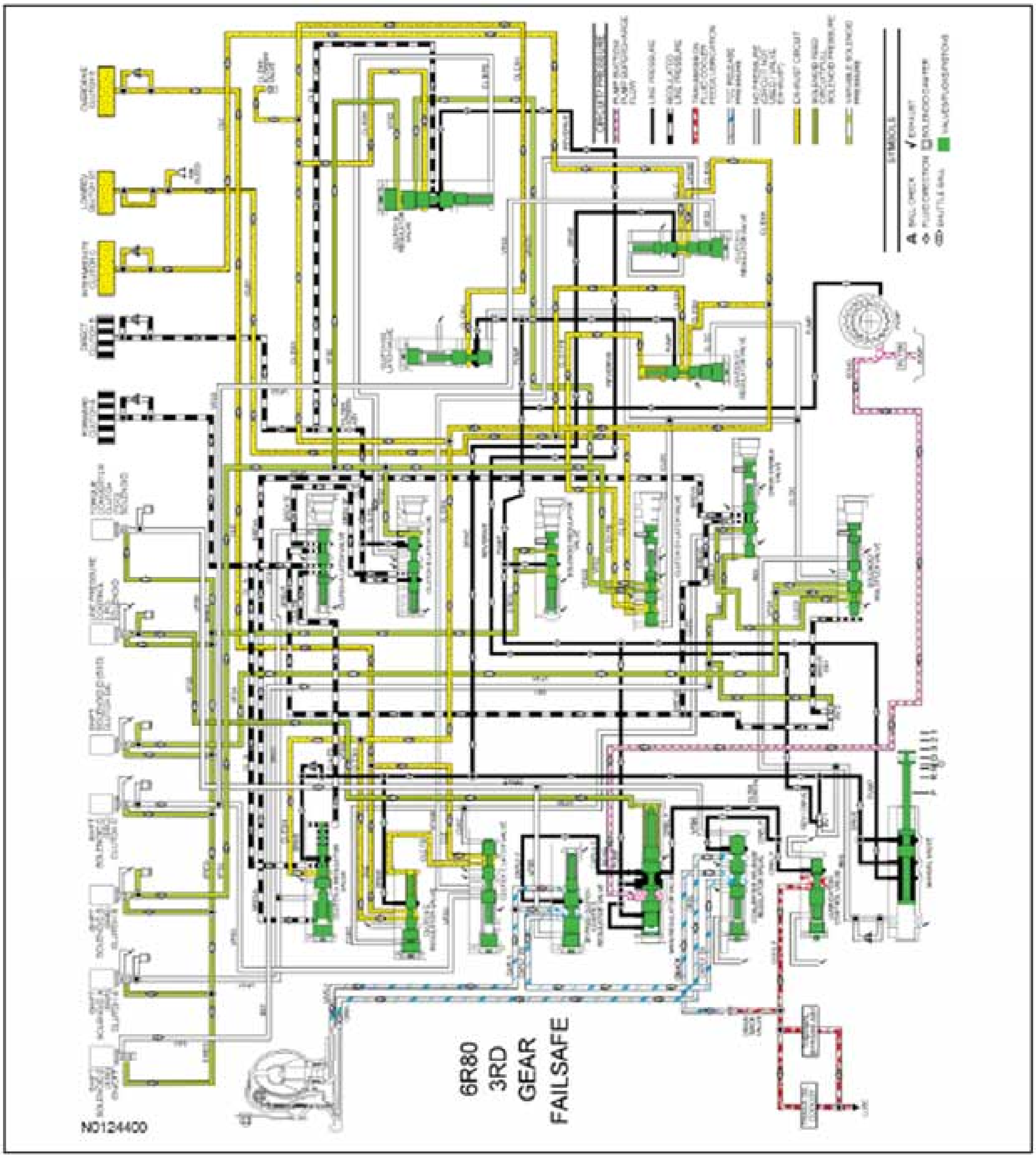
CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

For solenoid information, refer to Transmission Electronic Control System in this section.


6R80
3RD
GEAR
FAILSAFE
N0124400

SPECIFICATIONS

Material

Item	Specification	Fill Capacity
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—	—
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV	12.30L (13.0 qt)
Motorcraft® Multi-Purpose Grease XL-5	ESB-M1C93-B	—

General Specifications

Item	Specification
Fluid	
NOTICE: Transmission fluids are not interchangeable. The use of any other fluid or cleaning agents will cause internal transmission damage.	
• Normal maintenance: — Transmission fluid change not necessary, filled for life. • Severe duty maintenance: — Change the transmission fluid at 240,000 km (150,000 mi) intervals.	
Fluid Filter	
Internal to the transmission	—

Assembly Weight

Description	Specification
Transmission	84.24 kg (215 lb)

Clutch Application Chart

Gear	Forward A (1,2,3,4)	Direct B (3,5,R)	Inter-mediate C (2,6)	Low/ Reverse D (1,R)	Overdrive E (4,5,6)	Low-OWC
Park				H		
Reverse		D		H		
Neutral				H		
1st Gear D	D			H *		H
2nd Gear D	D		H			O/R
3rd Gear D	D	D				O/R
4th Gear D	D				D	O/R
5th Gear D		D			D	O/R
6th Gear D			H		D	O/R
3rd Gear Manual	D	D				O/R
2nd Gear Manual	D		H			O/R
1st Gear Manual	D			H		H
Planetary Components	Front planetary carrier-to-No. 3 sun gear	Front carrier-to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft-to-rear planetary carrier	Rear planetary carrier

Clutch released when vehicle speed is above 3 mph.

- D = Drive Clutch
- H = Hold Clutch
- O/R = Overrunning

Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	Off	On	Off	Off	Off	Off
R	R	Off	Off	Off	Off	Off	Off
N	N	Off	On	Off	Off [a]	Off	Off
D	1	On	On	Off	Off [b]	Off	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	On	On/Off
	4	On	On	Off	Off	On	On/Off
	5	Off	Off	Off	Off	On	On/Off
	6	Off	On	On	Off	On	On/Off
M [c]	—	—	—	—	—	—	—
2	2	On	On	On	On	Off	Off
1	1	On	On	Off	Off	On	Off

a Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.
b Solenoid is On when vehicle is above 3 mph.
c All gears available upon driver request.

CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

Gear Ratio	
1st	4.17 to 1
2nd	2.34 to 1
3rd	1.52 to 1
4th	1.14 to 1
5th	0.87 to 1
6th	0.69 to 1
Reverse	3.40 to 1

Stall Speed

Engine	Min	Max
3.7L	2300	2580
5.0L	2400	2700
3.5L GTDI	2300	2580
6.2L	2,000	2,250

NOTE:
All friction and steel plates use a wave design plate.

End Play

Item	Specifications
Forward Clutch (A)	0.71-1.10 mm (0.027-0.043 in)
Direct Clutch (B)	0.50-1.30 mm (0.019-0.051 in)
Intermediate Clutch (C)	0.71-1.10 mm (0.028-0.043 in)
Low/Reverse Clutch (D)	1.0-1.6 mm (0.039-0.063 in)
Overdrive (O/D) Clutch (E)	0.50-0.90 mm (0.019-0.035 in)

Clutch Plate Quantity 3.5L GTDI, 5.0L and 6.2L Engines

Component	Number of Frictions	Number of Separator Plates	Separator Plate Thickness	Number of Pressure Plates	Pressure Plate Thickness
Forward Clutch (A)	5	5	3.0 mm (0.118 in)	1	3.0 mm (0.118 in)
Direct Clutch (B)	5	5	1.75 mm (0.068 in)	1	3.9 mm (0.153 in)
Intermediate Clutch (C)	5	5	3.0 mm (0.118 in)	1	3.9 mm (0.153 in)
Low/Reverse (D)	5	5	1.75 mm (0.068 in)	Select	5.4 mm (0.212 in)
				Select	5.7 mm (0.224 in)
			1.75 mm (0.068 in)	Select	6.0 mm (0.236 in)
Overdrive (O/D) Clutch (E)	6	6	3.0 mm (0.118 in)	1	6.15 mm (0.242 in)

Clutch Plate Quantity 3.7L Engine

Component	Number of Frictions	Number of Separator Plates	Separator Plate Thickness	Number of Pressure Plates	Pressure Plate Thickness
Forward Clutch (A)	4	4	3.0 mm (0.118 in)	1	3.0 mm (0.118 in)
Direct Clutch (B)	4	4	1.75 mm (0.068 in)	1	3.9 mm (0.153 in)
Intermediate Clutch (C)	4	4	3.0 mm (0.118 in)	1	3.9 mm (0.153 in)
Low/Reverse (D)	5	5	1.75 mm (0.068 in)	Select	5.4 mm (0.212 in)
				Select	5.7 mm (0.224 in)
			1.75 mm (0.068 in)	Select	6.0 mm (0.236 in)
Overdrive (O/D) Clutch (E)	6	6	3.0 mm (0.118 in)	1	6.15 mm (0.242 in)

Torque Specifications

Description	Nm	lb-ft	lb-in
Detent spring bolts	12	—	106
Evaporative Emission (EVAP) canister bolt	20	—	177
Exhaust heat shield bolts	15	—	133
Flexplate inspection cover bolts	48	35	—
Flexplate-to-torque converter nuts	40	30	—
Front pump bolts [a]	—	—	—
Fuel line bracket bolt	25	18	—
Isolator cap bolt	35	26	—
Main control bolts[a]	—	—	—
Manual control lever nut	15	—	133
Molded leadframe bolts[a]	—	—	—
Output shaft flange nut [a]	—	—	—
Park pawl pin bolt	23	17	—
Park rod actuating plate	12	—	106
Pump plate assembly-to-pump body bolts	15	—	133
Selector lever cable bracket bolts	48	35	—
Skid plate bolts	40	30	—
Solenoid bracket bolts	6	—	53
Transmission fluid cooler tube-to-transmission bolt [a]	—	—	—
Transmission fluid cooler tube bracket nut	12	—	106
Transmission fluid fill plug	35	26	—
Transmission fluid pan bolts[a]	—	—	—
Transmission insulator and retainer bolts	90	66	—
Transmission insulator and retainer nuts	103	76	—
Transmission-to-engine bolts	48	35	—

Refer to the procedure in this section.

GENERAL PROCEDURES

Transmission Fluid Cooler Backflushing and Cleaning

Special Tool(s)

 ST2971-A	Transmission Heated Cooler Line Flusher 222-00007, 222-00004 or equivalent

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

NOTE:
Transmission fluid cooler backflushing and cleaning will be performed using the Transmission Heated Cooler Line Flusher or equivalent. Follow the manufacturer's instructions included with the machine. Test the equipment to make sure that a vigorous fluid flow is present before proceeding.

NOTE:
If the Transmission Heated Cooler Line Flusher or equivalent is not available, install a new transmission fluid cooler and/or an auxiliary transmission fluid cooler.

1. Check and top off the fluid level of the cooler line flusher with transmission fluid.
2. Allow the transmission fluid in the cooler line flusher 15-30 minutes to heat up to 60°C (140°F) before using.
3. Install the line adapters into the transmission fluid cooler tubes
4. Attach the cooler line flusher red line to the transmission fluid cooler pressure tube quick connect fitting.
5. Attach the cooler line flusher blue line to the transmission fluid cooler return tube quick connect fitting.
6. Follow the equipment instructions to purge the transmission fluid cooler tubes and cooler prior to starting the flushing procedure.
7. Allow the transmission fluid cooling system to backflush for 10-15 minutes, then flush the transmission fluid cooler in a normal flow direction for an additional 10-15 minutes.

Transmission Fluid Drain and Refill

Special Tool(s)

 ST2407-A	Rubber Tip Air Nozzle 100-D009 (D93L-7000-A)
 ST2933-A	Transmission Fluid Fill Tube 307-570

 ST2715-A	Transporter Fluid Evacuator/Injector 307-D465 or equivalent
 ST1269-A	Vacuum Pump Kit 416-D002 (D95L-7559-A) or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

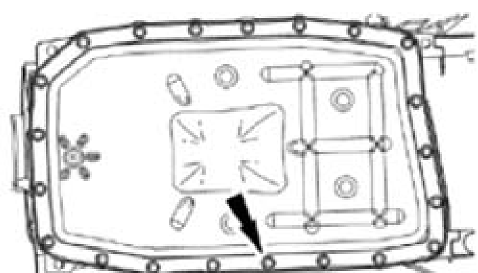
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Drain

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.

2. Remove the transmission fluid pan and allow the transmission fluid to drain.



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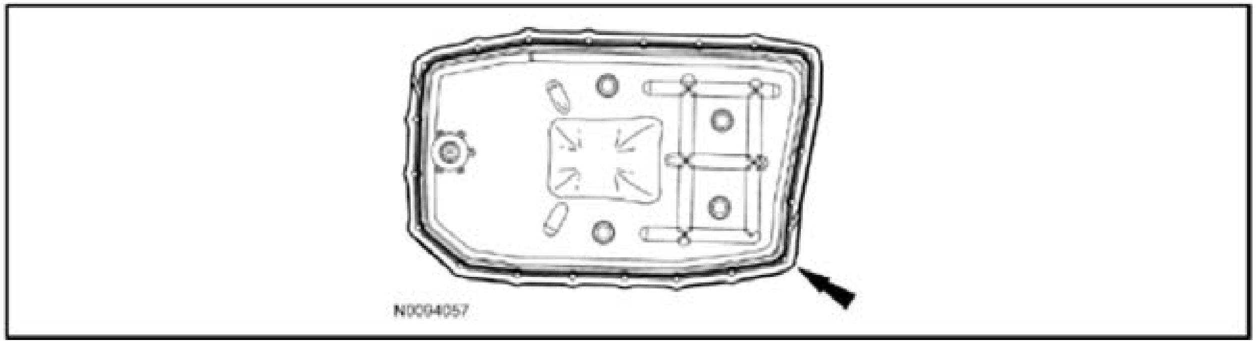
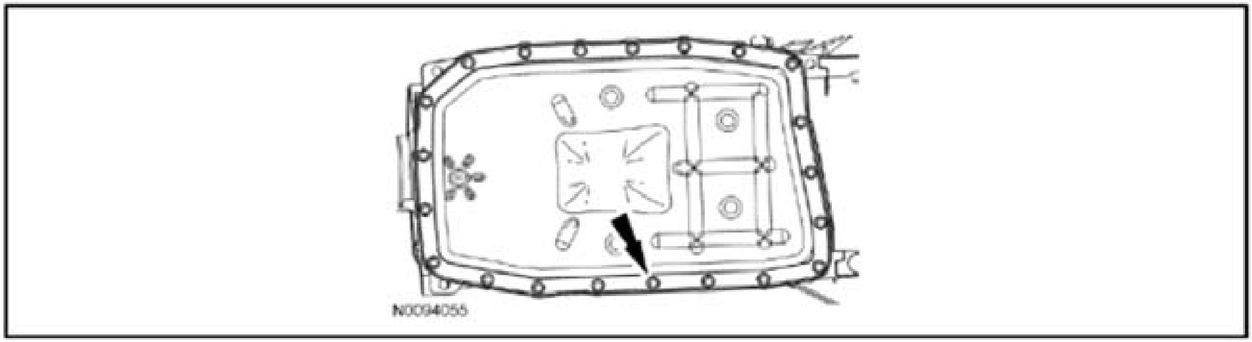
3. **NOTE:**
   The transmission fluid pan gasket can be reused if not damaged.

   Install a new transmission fluid pan gasket, if required.



4. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   - Tighten to 12 Nm (106 lb-in).



Refill

NOTICE:

This procedure contains the air purge steps required to purge air from the transmission fluid cooling system. This procedure is NOT intended for use with the Transmission Fluid Level Check.

NOTICE:
The vehicle should not be driven if the transmission fluid level is low as internal failure could result.

NOTICE:
The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTICE:
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:
If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

NOTE:
Here is an overview of the Transmission Fluid Drain and Refill procedure.

- Adding 3.3L (3.5 qt) of transmission fluid to the transmission is an initial fill enabling the engine to be started.
- The cold level range shown in the procedure allows the vehicle to be driven.
- The vehicle should be driven to allow the Transmission Fluid Temperature (TFT) to reach 91ºC-102ºC (195ºF-215ºF) in order to purge the air from the transmission fluid cooling system.
- Fill the transmission fluid to the fill range on the transmission fluid level indicator at the normal operating range 91ºC-102ºC (195ºF-215ºF).

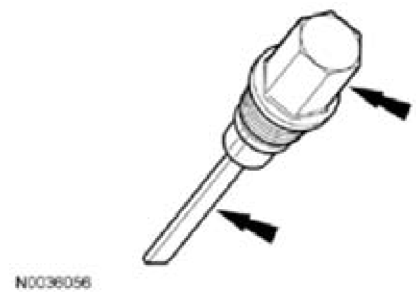
1. **NOTE:**
   The transmission will need 3.3L (3.5 qt) of transmission fluid added to the transmission as an initial fill if:
   - a new mechatronic assembly has been installed.
   - the transmission fluid pan or transmission fluid filter have been removed.

NOTE:

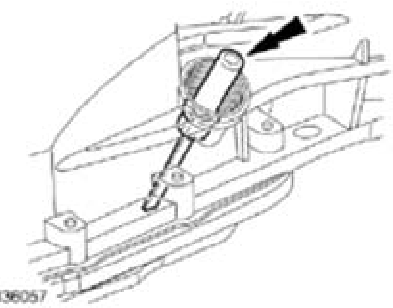
The transmission will need 11.35L (12 qt) of transmission fluid added to the transmission as an initial fill if the transmission has been overhauled.

Using the Transmission Fluid Fill Tube, add the transmission fluid to the transmission through the transmission fluid fill hole. For additional information, refer to Adding Additional Transmission Fluid in this procedure.

2. Check the transmission fluid level cold.
    - The vehicle is safe to drive if the transmission fluid is in the cold level range 32°C-43°C (90°F-110°F).
    - Using the scan tool and with the engine running, place the selector lever in each gear position and hold approximately 5 seconds. Place the selector lever in PARK, with the engine at idle (600-750 rpm).
3. Separate the transmission fluid level indicator from the transmission fluid fill plug.

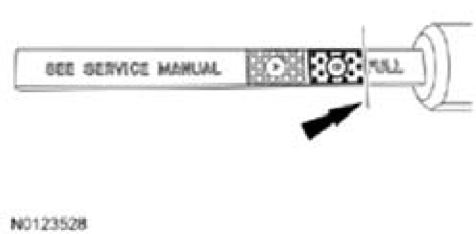


4. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.

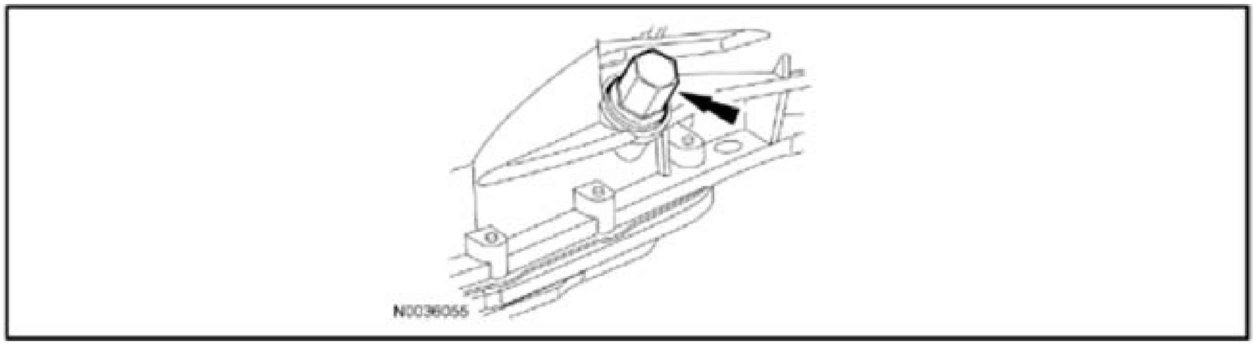


5. **NOTE:**
    The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted area to check the transmission fluid level.

    Using the scan tool, verify that the Transmission Fluid Temperature (TFT) is between 91ºC-102ºC (195ºF-215ºF). Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted (B) marked area on the transmission fluid level indicator.

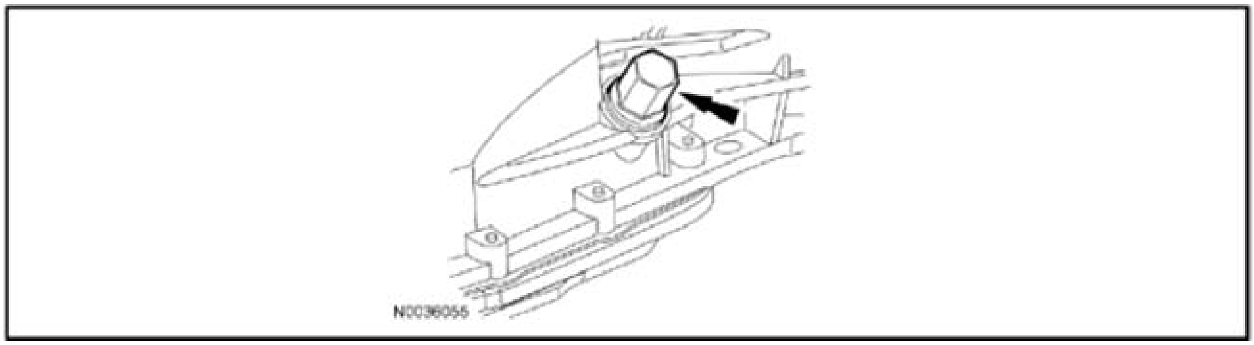


6. Install the transmission fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).

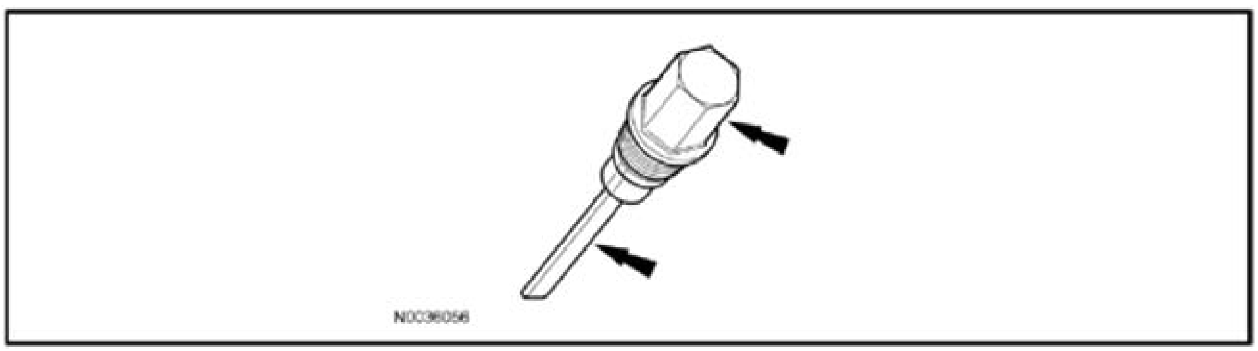


7. While driving the vehicle, use the scan tool to verify that the TFT has reached a temperature of 91°C (195°F). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.
   - With the engine idling (600-750 rpm) in PARK, verify that the TFT is between 91ºC-102ºC (195ºF-215ºF).

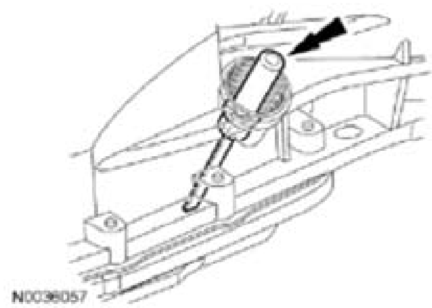
8. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case.



9. Separate the transmission fluid level indicator from the transmission fluid fill plug.

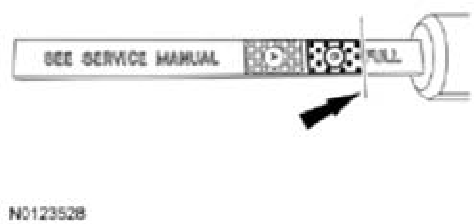


10. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



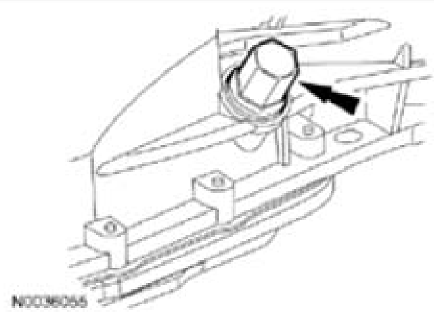
11. **NOTE:**
    The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the dotted marks on the transmission fluid level indicator.

    Using the scan tool verify that the TFT is between 91ºC-102ºC (195ºF-215ºF). The transmission fluid level must be at the upper level of the dotted (B) mark.



12. **NOTE:**
    If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid in this procedure.

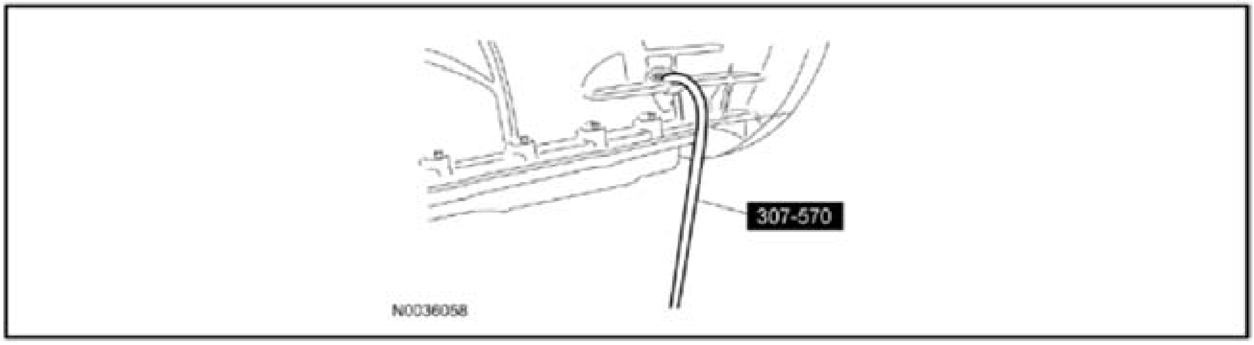
    Install the transmission fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



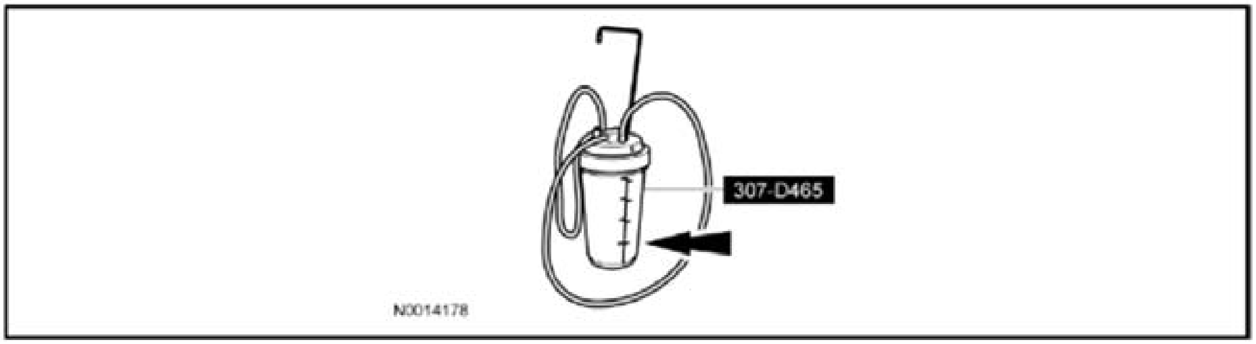
Adding Additional Transmission Fluid

NOTE:
To get an accurate transmission fluid level reading the engine should be idling (600-750 rpm) in PARK.

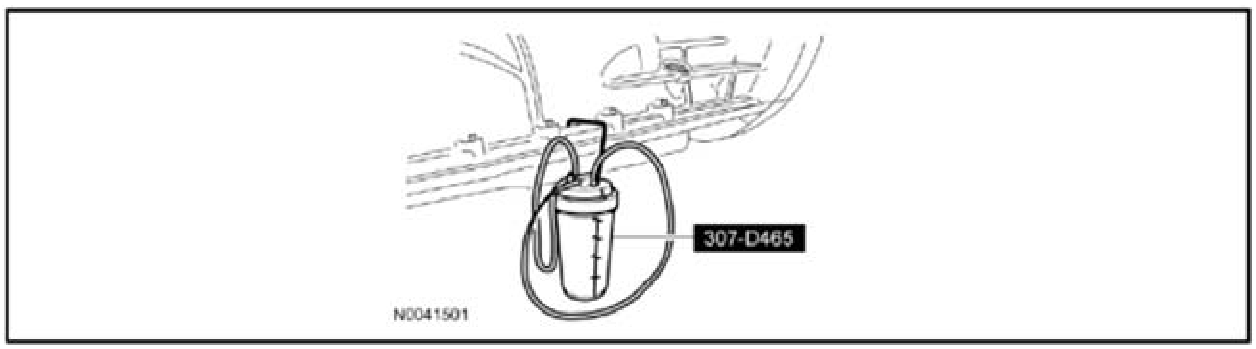
1. Install the Transmission Fluid Fill Tube into the transmission fluid fill hole.



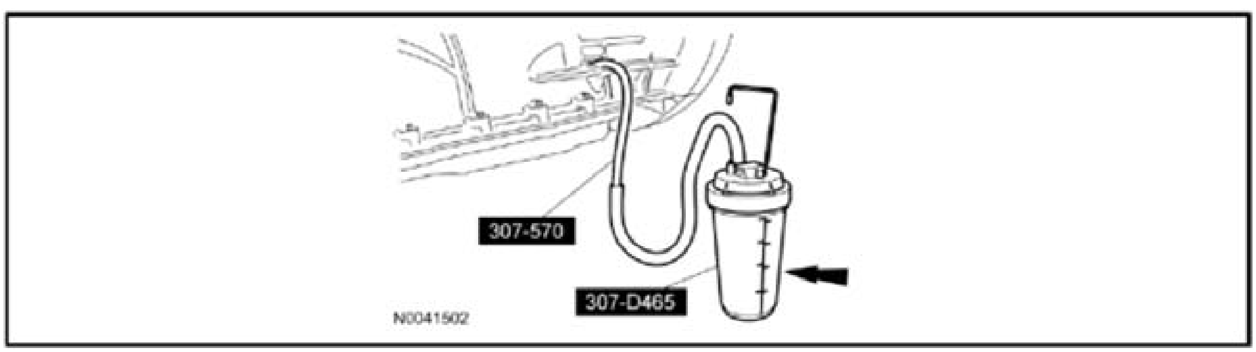
2. Fill the Transporter Fluid Evacuator/Injector with approximately 0.47L (1 pt) of transmission fluid.



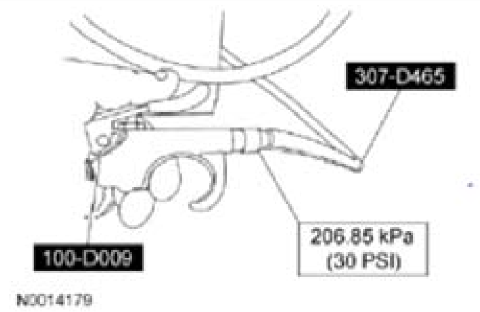
3. Hang the Transporter Fluid Evacuator/Injector under the vehicle, upright and close to the transmission.



4. Connect the Transporter Fluid Evacuator/Injector and Transmission Fluid Fill Tube.
   - Connect the open end of the fluid hose from the Transporter Fluid Evacuator/Injector onto the Transmission Fluid Fill Tube from the transmission case.

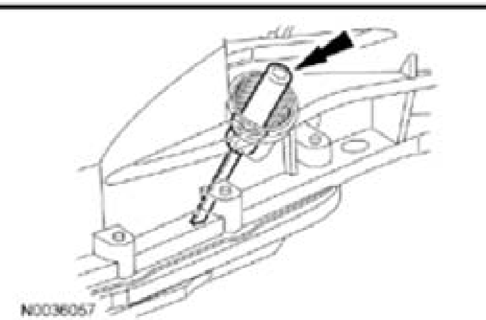


5. Use a Rubber Tip Air Nozzle to apply a maximum of 206.85 kPa (30 psi) to the open end of the vacuum/pressure hose from the Transporter Fluid Evacuator/Injector. Transmission fluid will immediately start flowing out of the Transporter Fluid Evacuator/Injector into the transmission.



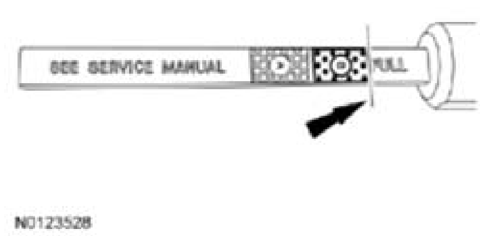
6. **NOTE:**
   Do not overfill the transmission. The transmission fluid level must be at the upper level of the dotted mark.

   Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



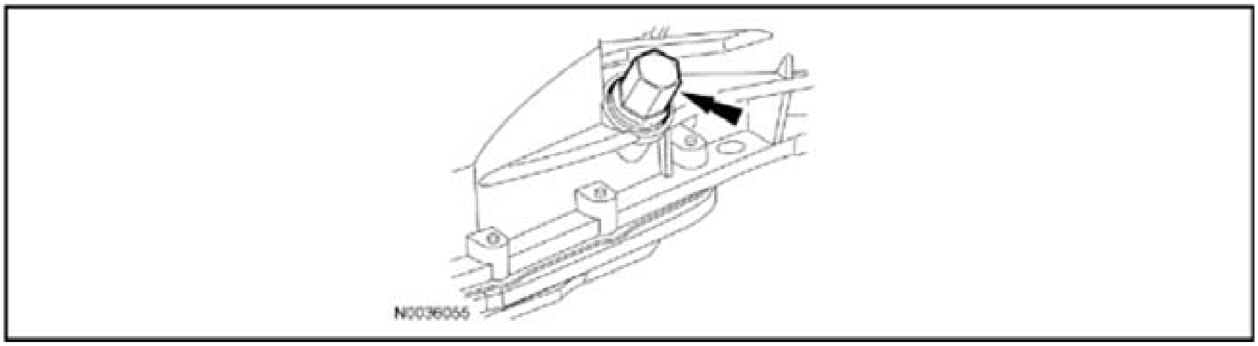
7. **NOTE:**
   The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the dotted marks on the transmission fluid level indicator.

   Using the scan tool, verify that the TFT is between 91ºC-102ºC (195ºF-215ºF). The transmission fluid level must be at the upper level of the dotted (B) mark.



8. **NOTE:**
   If the transmission fluid is over full, follow the steps for Removing Transmission Fluid in this procedure.

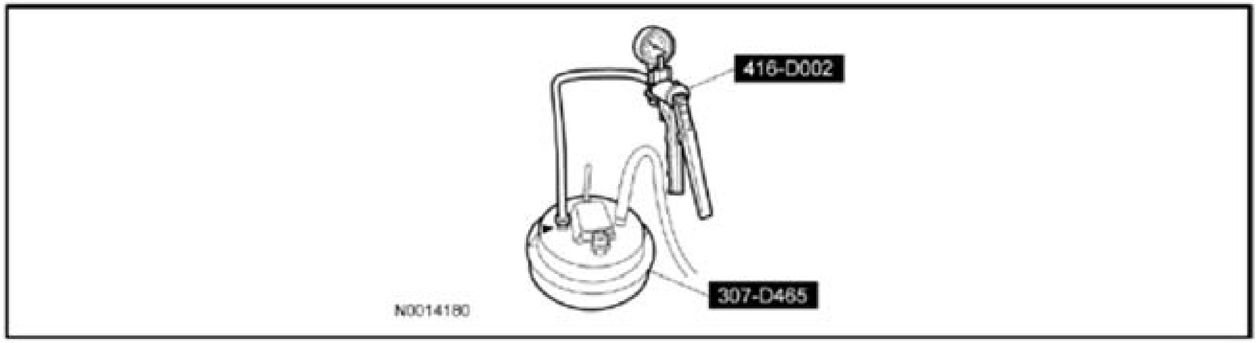
   Install the transmission fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).



Removing Transmission Fluid

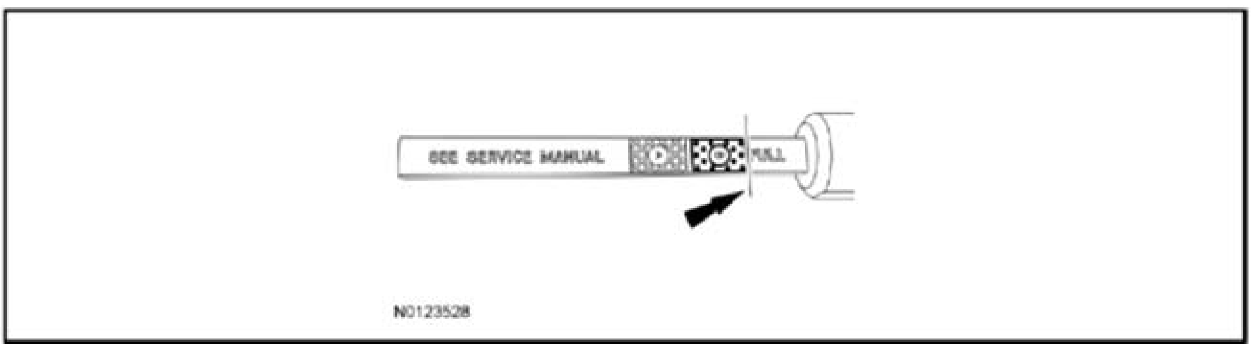
NOTE:
To get an accurate transmission fluid level reading the engine should be idling (600-750 rpm) in PARK.

1. If the transmission is overfilled, transmission fluid must be removed to the correct level. Use the Transporter Fluid Evacuator/Injector and the Vacuum Pump Kit to extract any excessive transmission fluid.

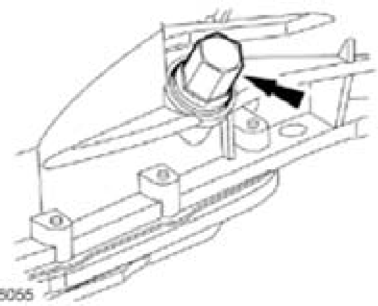


2. **NOTE:**
   The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the dotted marks on the transmission fluid level indicator.

   Using the scan tool, verify that the TFT is between 91ºC-102ºC (195ºF-215ºF). The transmission fluid level must be at the upper level of the dotted (B) mark.



3. Install the transmission fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).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Transmission Fluid Exchange

Special Tool(s)

 ST3088-A	ATF Fluid Exchanger W/Power Steering Fluid Exchanger 199-00059 or equivalent
 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

NOTICE:
Use transmission fluid specific for this transmission. Do not use any supplemental transmission fluid additives or cleaning agents. The use of these products can cause internal transmission components to fail, which will affect the operation of the transmission.

NOTE:
For best results, perform the transmission cooler backflush and cleaning procedure before exchanging the fluid.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.

2. Connect the ATF Fluid Exchanger W/Power Steering Fluid Exchanger to the transmission fluid cooler tube after the transmission fluid cooler on the return tube. This will help remove any foreign material trapped in the transmission fluid coolers.

3. Perform the transmission fluid exchange using the ATF Fluid Exchanger W/Power Steering Fluid Exchanger. Follow the manufacturer's instructions included with the machine.

4. Once the transmission fluid exchange is completed, disconnect the ATF Fluid Exchanger W/Power Steering Fluid Exchanger. Reconnect any disconnected transmission fluid cooler tubes.

5. Using the scan tool with the engine running, check and make sure that the transmission is at normal operating temperature 91ºC-102ºC (195ºF-215ºF). Check and adjust the transmission fluid level and check for any leaks. If transmission fluid is needed, add transmission fluid in increments of 0.24L (0.5 pt) until the correct level is achieved.

Transmission Fluid Level Check

Special Tool(s)

Diagnostic USB harness and software CD: Part # TCM4120

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

NOTICE:
The vehicle should not be driven if the transmission fluid level is low as internal failure could result.

NOTICE:
The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTE:
If the vehicle has been operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the transmission fluid must cool down to obtain an accurate reading.

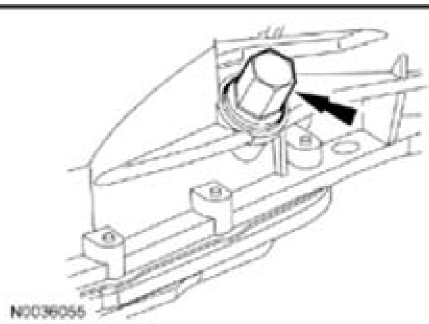
NOTE:
If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

NOTE:
Do not overfill the transmission. The transmission fluid level must be at the upper level of the crosshatch mark.

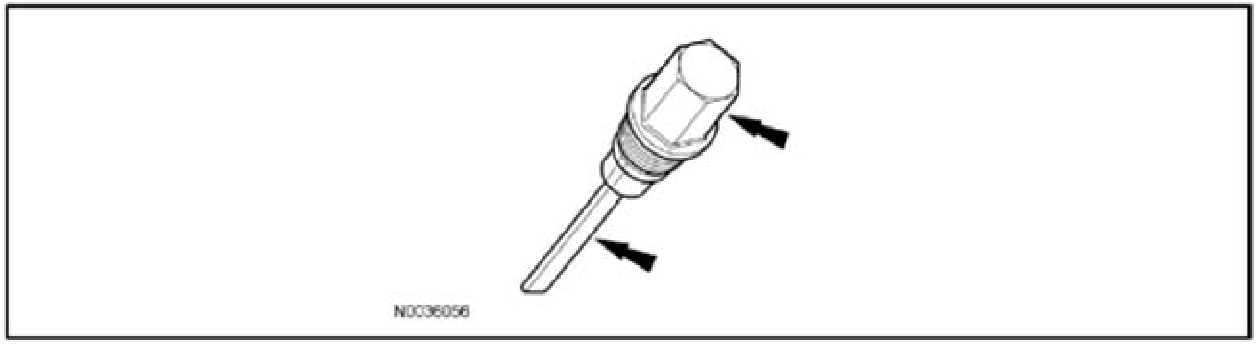
NOTE:

If the installation of a new transmission fluid cooler or transmission fluid cooler tubes has been carried out, the vehicle must be driven to get the transmission fluid to a temperature of 89°C (193°F) in order to purge the air from the transmission fluid cooling system.

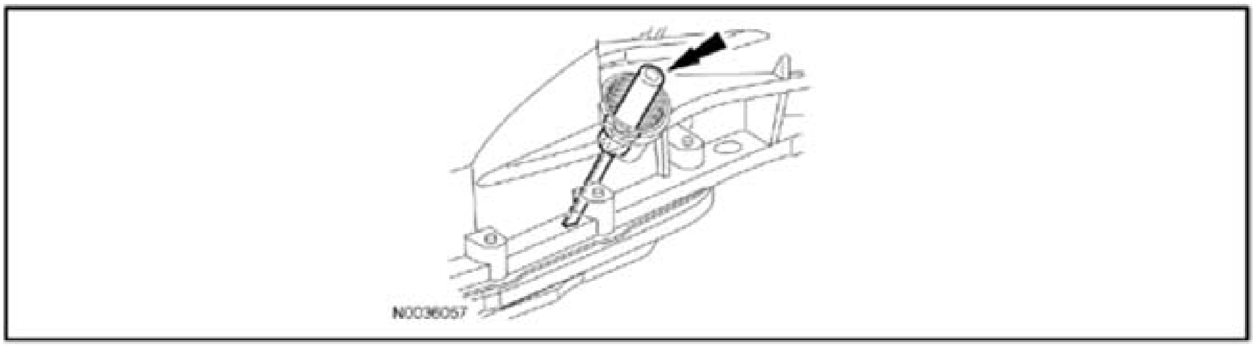
1. With the engine running, place the transmission selector lever in each gear position and hold approximately 5 seconds. Place the transmission selector lever in PARK.
2. With the engine idling (600-750 rpm) in PARK, position it on a hoist. For additional information, refer to Section 100-02.
3. Remove the transmission fluid fill plug transmission fluid level indicator assembly, located on the passenger side front portion of the transmission case.



4. Separate the transmission fluid level indicator from the transmission fluid fill plug.

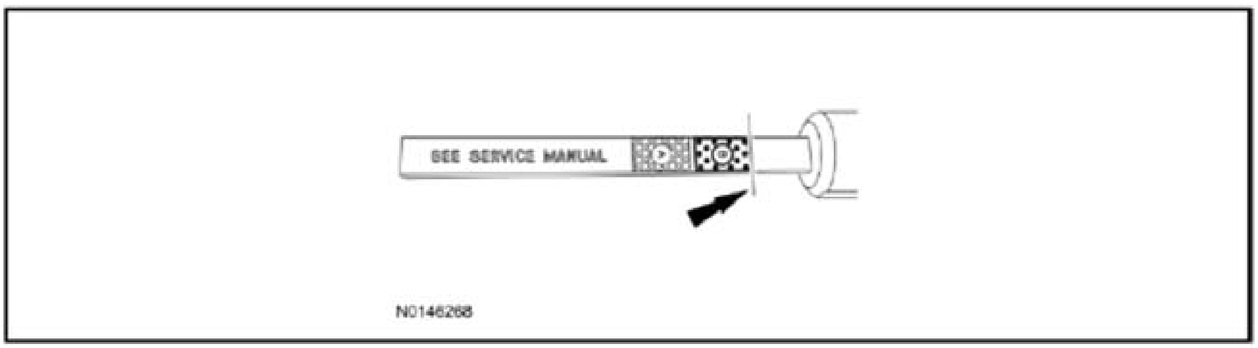


5. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level.



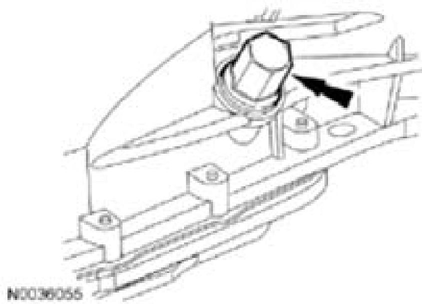
6. **NOTE:**
   The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched (labeled A) area and a dotted (labeled B) area. Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the dotted marks on the transmission fluid level indicator.

   Using the scan tool verify that the TFT is between 89ºC-102ºC (193ºF-215ºF). The transmission fluid level must be at the upper level of the dotted (B) mark.



7. **NOTE:**
   If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

   Install the transmission fluid fill plug.
   - Tighten to 35 Nm (26 lb-ft).



Torque Converter Contamination Inspection

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

1. A new or remanufactured torque converter must be installed if one or more of the following statements is true:
   - A torque converter malfunction has been determined based on complete diagnostic procedures.
   - The torque converter stud or studs, impeller hub or bushing are damaged.
   - The torque converter exhibits external discoloration (due to overheating).
   - There is evidence of transmission assembly or fluid contamination due to the following transmission or converter failure modes.
   - Major metallic failure
   - Multiple clutch plates or band failures
   - Sufficient component wear which results in metallic contamination
   - Water or antifreeze contamination

2. If none of the above conditions are present, continue with the following fluid inspection.

3. Pour a small amount of transmission fluid from the torque converter onto an absorbent white tissue or through a paper filter.

4. Examine the fluid for contaminants. The fluid must be free of metallic contaminants.

5. ***NOTICE:***
   Do not use water-based cleaners or mineral spirits to clean or flush the torque converter or transmission damage will occur.

   If the fluid passed inspection:
   - Drain the remaining fluid from the torque converter.
   - Using only the recommended transmission fluid, add 1.9L (2 qt) of clean fluid into the converter and agitate by hand.
   - Thoroughly drain the fluid.

DIAGNOSIS AND TESTING
Diagnostic Strategy

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

NOTE:
Do not take short cuts or assume that critical checks or adjustments have already been made.
Follow the procedures as written to avoid missing critical components or steps.
To correctly diagnose a concern, have the following publications available:

- Powertrain Control/Emissions Diagnosis (PC/ED) manual
- Transmission diagnostic cable and software
- TSBs
- Wiring Diagrams

These publications provide the information required when diagnosing transmission concerns.
Use the Diagnostic Flow Chart as a guide and follow the steps as indicated.

Preliminary Inspection

- Know and understand the customer concern.
- Verify the concern by operating the vehicle.
- Check the transmission fluid level and condition.
- Check for non-factory add-on items.
- Check selector lever cable for correct adjustment.
- Check TSBs regarding the concern.

Diagnostics

- Carry out On-Board Diagnostic (OBD) procedures, Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER).
- Record all DTCs.
- Repair all non-transmission codes first.
- Repair all transmission codes second.
- Clear all continuous codes and attempt to repeat them.
- Repair all continuous codes.
- If only codes that have passed are obtained, refer to Diagnosis by Symptom in this section for additional information and diagnosis.

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

Preliminary Inspection
Special Tool(s)

TCM4210 – Laptop software and USB cable

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Check the following items prior to beginning the diagnostic procedures:

Know and Understand the Concern

To correctly diagnose a concern, first understand the customer concern or condition. Customer contact may be required to understand the conditions, including when the concern occurs. For example:

- Hot or cold vehicle temperature
- Hot or cold ambient temperature
- Vehicle driving conditions
- Vehicle loaded/unloaded

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

Verification of Condition

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

Use the following procedures when verifying customer concerns for the transmission.

Determine Customer Concern
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
- Upshifting
- Downshifting
- Coasting
- Engagement
- Noise/vibration — check for engine rpm, vehicle speed, shift, gear, range or temperature dependencies.

Check Transmission Fluid Level and Condition

Transmission Fluid Level Check

NOTICE:
The vehicle should not be driven if the transmission fluid level is low as internal transmission failure could result.

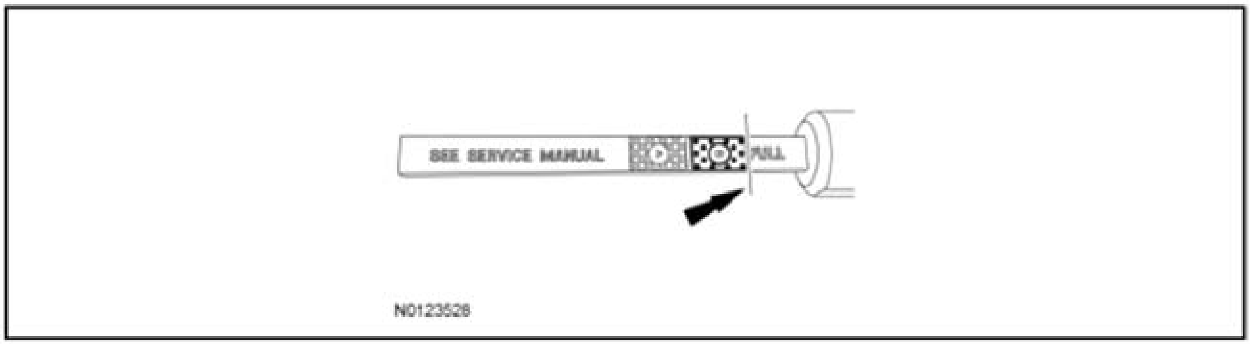
NOTICE:
The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTE:
If the vehicle is operated for an extended period at high highway speeds, in city traffic, during hot weather or while pulling a trailer, the transmission fluid must cool down to obtain an accurate reading.

NOTE:
If the transmission starts to slip, shifts slowly or shows signs of transmission fluid leaking, the transmission fluid level should be checked.

This transmission is equipped with an internal thermal bypass located in the case. This internal thermal bypass valve will shut off transmission fluid flowing to the transmission fluid cooler if the transmission fluid temperature falls below normal operating temperature. Refer to Transmission Fluid Level Check in this section.

The transmission fluid level indicator has 2 areas for the fluid level, a crosshatched area (labeled A) and a dotted area (labeled B). Use the dotted (labeled B) area when checking the transmission fluid level. The correct transmission fluid level is at the upper level of the dotted marks on the transmission fluid level indicator.



High Transmission Fluid Level

NOTICE:
Transmission fluid level that is too high can cause the transmission fluid to become aerated due to the churning action of the rotating internal parts.

This may cause erratic control pressure, foaming, loss of transmission fluid through the vent tube and possible transmission failure.

If an overfill reading is indicated on the transmission fluid level indicator, remove the excessive transmission fluid. Refer to Transmission Fluid Level Check in this section.

Low Transmission Fluid Level
Low transmission fluid level can result in poor transmission engagement, slipping or failure. This may also indicate a leak in one of the transmission seals or gaskets.

Adding Transmission Fluid

NOTICE:
The use of any type of transmission fluid other than specified can result in transmission failure.

NOTICE:
The transmission fluid fill plug is located near the exhaust system. The exhaust will be extremely hot during this procedure.

NOTICE:
The vehicle should not be driven if the transmission fluid level is low as internal failure could result.
Add transmission fluid using the refill procedure. Refer to Transmission Fluid Drain and Refill in this section.

Transmission Fluid Condition Check
1. Check the transmission fluid level.
2. Remove the transmission fluid fill plug and transmission fluid level indicator allowing the transmission fluid to drip onto a facial tissue and examine the stain.
3. Observe the color and the odor.
4. If evidence of solid material is found, remove the transmission fluid pan for further inspection.
5. If the stain is a foamy pink color, this may indicate coolant in the transmission. Inspect the engine cooling system at this time.
6. If transmission fluid contamination or transmission failure is confirmed by the sediment in the bottom of the transmission fluid pan, disassemble and completely clean the transmission. This includes the torque converter and transmission fluid cooler tubes. Install a new auxiliary transmission fluid cooler.

Water in Transmission Fluid
To correctly repair an automatic transmission that had water or coolant introduced into the system, completely disassemble, clean and replace the following parts:
- All internal and external seals
- All friction material
- Torque converter
- All parts with bonded seals
- All solenoids
- All transmission fluid filters

Prior to installing the transmission, the transmission fluid cooler(s), transmission fluid cooler tubes and hoses need to be flushed and cleaned. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

Shift Point Road Test

Special Tool(s)

TCM4210 – Laptop software and USB cable

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

This test verifies the shift control system is operating correctly.

1. Bring engine and transmission up to normal operating temperature.
2. Operate vehicle with the selector lever in the D position.
3. Apply minimum throttle and observe speeds when an upshift occurs. Refer to the Shift Speeds chart in this section.
4. With the selector lever in the D position and speed above 80 km/h (50 mph) and less than half throttle, move the selector lever from the D position to manual 2 position and release the accelerator pedal. The transmission should downshift into 2nd gear. With the transmission remaining in the manual 2 position, move the selector lever into the manual 1 position and release the accelerator pedal. The transmission should downshift into 1st gear at speeds below approximately 45-56 km/h (28-35 mph).
5. If the transmission fails to upshift/downshift, refer to Diagnosis By Symptom in this section.

   NOTE:
   Shift speed ranges are approximate for all applications. For specific applications (engine, axle ratio, tire size and application), refer to the Automatic Transmission Specification booklet. Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

Throttle Position	Shift	Km/H	MPH
Light Throttle	1-2	13-21	8-13

Shift Speeds (Continued)

Throttle Position	Shift	Km/H	MPH
Throttle Position (TP) Sensor Voltage @ 1.25 Volts	2-3	26-34	16-21
	3-4	35-43	22-27
	4-5	56-64	35-40
	5-6	71-79	44-49
Closed Throttle	6-5	56-64	35-40
	5-4	40-48	25-30
	4-3	13-21	8-13
	3-2	3-11	2-7
	2-1	2-6	1-4
Wide Open Throttle (WOT)	1-2	45-53	28-33
	2-3	87-95	54-59
	3-4	140-148	87-92

Road Test — Adaptive Drive Cycle

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

1. Connect the scan tool to the Data Link Connector (DLC).
2. **NOTE:**
   Disconnecting the battery will not clear the Keep Alive Memory (KAM).

   NOTE:
   Do not clear the PCM KAM.

   Using the scan tool, clear the adaptive table before conducting an adaptive drive cycle test.
3. Verify the transmission fluid is at normal operating temperature, between 91°-102°C (195°-215°F). If the transmission fluid is not at operating temperature, drive the vehicle until the operating temperature is reached.
4. **NOTE:**
   The transmission fluid must be at operating temperature before proceeding to this step.

   Drive the vehicle on a level road surface performing the adaptive drive cycle.
   1. Accelerate from a stop with light throttle to 24 km/h (15 mph) then release the accelerator pedal
   2. Gently brake and bring the vehicle to a stop and hold the brake for 6 seconds.
   3. Repeat substeps 1 and 2 an additional 5 times.
   4. Accelerate from a stop with light throttle so the 1-2, 2-3 and 3-4 shifts occur with engine rpm between 1,700-2,000.
   5. Continue accelerating until the vehicle speed reaches 80 km/h (50 mph) or the 5-6 upshift is reached.
   6. Gently brake and bring the vehicle to a stop and hold the brake for 10 seconds.
   7. Repeat substeps 4, 5 and 6 an additional 3 times.

Torque Converter Diagnosis

Special Tool(s)

TCM4210 – Laptop software and USB cable

NOTE:
If the torque converter is replaced, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.

Perform all diagnostic procedures prior to torque converter installation. This prevents the unnecessary installation of new or remanufactured torque converters. Only after a complete diagnostic evaluation can the decision be made to install a new torque converter.

Torque Converter Operation Test

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

The Torque Converter Operation Test verifies the Torque Converter Clutch (TCC) control system and the torque converter are operating correctly.

1. Connect a scan tool to the vehicle.
2. Perform a self-test and check for DTCs.
3. Bring the engine to normal operating temperature by driving the vehicle at highway speeds in the D position.
4. After normal operating temperature is reached, maintain a constant speed of about 56 km/h (35 mph) in 5th gear for 10 seconds.
5. Release the accelerator pedal and monitor the scan tool TP1 PID voltage to approximately 1.25 volts or 25% throttle.
6. Monitor the TCC_OSC# and RPM# PID. The torque converter should release and engine rpm should increase before the 5-4 shift occurs.

Visual Inspection

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

- Electronic add-on items
- Vehicle modification

PCM or transmission function is affected if add on devices, wiring splices, abnormal tire size or axle ratio changes are made.

- If leaks are present; refer to Leakage Inspection in this section.
- Correct selector lever adjustments; refer to Section 307-05.

Selector Lever Check

Check for misadjustment in the selector lever by matching the detents in the selector lever with those of the manual control lever in the transmission. Refer to Section 307-05 for selector lever cable adjustment.

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

Carry Out On-Board Diagnostic (OBD) Key ON Engine OFF (KOEO), Key ON Engine Running (KOER)

After a road test, with the engine and transmission warm and before disconnecting any connectors, use the scan tool and perform a self-test.

Diagnostics

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent

TCM4210 – Laptop software and USB cable

Diagnosing an electronically controlled automatic transmission is simplified by using the following procedures. The most important things to remember is there is a definite procedure to follow. Do not take shortcuts 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 Diagnostic Laptop Software

These self-tests should be used to diagnose the TCU and should be carried out in order.

NOTE:
Make sure the latest software version is loaded on the scan tool.

1. If the cause is not visually evident, connect the scan tool to the Data Link Connector (DLC).

NOTE:
The Transmission Control Unit (TCU) LED prove-out confirms power and ground from the DLC to the TCU.

2. If the laptop tool does not communicate with the TCU:
   - check the TCU connection to the vehicle.
   - check the scan tool connection to the VCM..
3. If the scan tool does not communicate with the vehicle:
   - verify the ignition is in the RUN position.
   - verify scan tool operation with a known good vehicle.
4. Clear the continuous DTCs and carry out the PCM self-test.
5. If DTCs retrieved are related to the concern, GO to the DTC Chart.
6. If no DTCs related to the concern are retrieved, REFER to Diagnosis By Symptom in this section.

Output State Control (OSC) Mode

On-Board Diagnostic (OBD)

Output state control allows the technician to take control of certain parameters to function the transmission.

Output state control allows the technician to shift the transmission when commanding a gear change.

Another example of the output state control features is, the technician can command the torque converter ON or OFF to check operation.

This transmission output state control has one mode of operation; DRIVE. This mode has a unique set of operating requirements that the technician must meet before allowed to operate the torque converter or select gears.

Diagnostic Parameters Identification (PID) Chart

The following is a list of output state control parameters and their corresponding PIDs:

Diagnostic PID Chart

PID Name	PID Description	Units
AXLE	Axle Ratio	Ratio
BOO1	Brake ON/OFF Switch	On/Off
BOO2	Brake ON/OFF Switch	On/Off
CHT	Cylinder Head Temperature	Temperature
DTCCNT	Continuous Codes	Number
GEAR	Gear Commanded by Module	Mode
GEAR_OSC#	Gear Commanded by Output State Control	Mode
GEAR_RAT	Gear Ratio Commanded	Ratio
HRSH_SHFT#	Firm Shift	On/Off
IN_GEAR	In Gear-Transmission is Applying a Load to Engine	In Gear
ISS_F	Input Shaft Speed Sensor Fault	No Fault/Yes Fault
ISS_SRC	Input Shaft Speed Sensor	rpm
LINEDSD#	Line Pressure Control Desired	Pressure
LOAD	Engine Load	Percentage
OSS_F	Output Shaft Speed Reliable	No Fault/Yes Fault
OSS_SRC	Unfiltered Output Shaft Speed	rpm
PARK_BRK	Park Brake Switch	On/Off
LPC	Line Pressure Control (LPC) solenoid	Pressure
LPC_AMP#	LPC solenoid current	Current
LPC_F	LPC solenoid fault status	No Fault/Yes Fault
RLC_F	Reverse Control Lamp Status	No Fault/Yes Fault
RPM#	Engine Revolutions Per Minute	rpm
SHIFT_DROP	Shift rpm Drop in Input Shaft Speed Below Expected	rpm
SHIFT_FLRE	Shift rpm Rise in Input Shaft Speed Above Expected	rpm
SHIFT_ID	Shift Identification of Shift PIDs Lag, Time, Flair and Drop	rpm
SHIFT_LAG	Shift Time Elapsed From 1% to 9% Complete	Time
SHIFT_TIME	Shift Time From Commanded to 10% Complete	Time
SHIFT_TYPE	Shift Type	Type
SSA_AMP#	Shift Solenoid Pressure Control A (SSPCA)	Current
SSB_AMP#	Shift Solenoid Pressure Control B (SSPCB)	Current
SSC_AMP#	Shift Solenoid Pressure Control C (SSPCC)	Current
SSD_AMP#	Shift Solenoid Pressure Control D (SSPCD)	Current
SSE_AMP#	Shift Solenoid Pressure Control E (SSPCE)	Current
SSPCA	SSPCA	Pressure
SSPCA_F	SSPCA Status	No Fault/Yes Fault
SSPCB	SSPCB	Pressure
SSPCB_F	SSPCB Status	No Fault/Yes Fault
SSPCC	SSPCC	Pressure
SSPCC_F	SSPCC Status	No Fault/Yes Fault
SSPCD	SSPCD	Pressure
SSPCD_F	SSPCD Status	No Fault/Yes Fault
SSPCE_F	SSPCE Status	No Fault/Yes Fault

Diagnostic PID Chart (Continued)

PID Name	PID Description	Units
TCC	Torque Converter Clutch (TCC) Solenoid	Pressure
TCC AMP#	Converter Pressure Control	Current
TCC_F	TCC Fault	No Fault/Yes Fault
TCC_OSC#	Output State Control of Torque Converter	Locked/Unlocked
TCC_RAT	Transmission Slip Ratio	Ratio
TCIL	Transmission Control Indicator Lamp (TCIL)	On/Off
TCS_DEPRES	Transmission Control Switch (TCS) Pressed	Yes/No
TCS_STATE	TCS Requested State	On/Off
TC_SLIPACT	Torque Converter Slip Actual	rpm
TC_SLIPDSD	Torque Converter Slip Desired	rpm
TFT	Transmission Fluid Temperature (TFT)	Temperature
TFTV	TFT Volts	Volts
TFT_F	TFT Status	No Fault/Yes Fault
TIRESIZE	Tire Size	Rev Per Mile
TP	Throttle Position (TP) Sensor	Percentage
TP1	TP Sensor 1	Volts
TP2	TP Sensor 2	Volts
TR	Transmission Range (TR)	Mode
TRANS_VOLT_A	Transmission Supply Voltage Control State	On/Off
TRAN_RAT	Transmission Gear ratio	Ratio
TRN_N_F	Neutral Output Status	On/Off
TRN_P_F	Park Output Status	On/Off
TR_CRANK	TR Input Allowing Input Start	Yes/No
TR_DC	TR Duty Cycle	Percentage
TR_F	TR Status	No Fault/Yes Fault
TR_FREQ	TR Frequency	Frequency
TSS_F	Turbine Shaft Speed (TSS) Reliable	No Fault/Yes Fault
TSS_SRC	Unfiltered Turbine Shaft Speed	rpm
VPWR	Module Supply Voltage	Volts
VREF	Reference Voltage	Volts
VSOUT_F	Vehicle Speed Output Status	No Fault/Yes Fault
VSS	Vehicle Speed Sensor (VSS)	Speed

Transmission Drive Cycle Test
Special Tool(s)

TCM4210 – Laptop software and USB cable

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

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 a shift error DTC to set, and 5 times consecutively for continuous Torque Converter Clutch (TCC) DTCs to set.

NOTE:
Refer to the Solenoid Application Chart for solenoid operation while performing the Transmission Drive Cycle Test.
After performing the self-test, follow the transmission drive cycle test for checking codes.

1. Record then clear the DTCs.
2. Warm the engine to normal operating temperature.
3. Make sure the transmission fluid level is correct.
4. With the selector lever in Overdrive (O/D), moderately accelerate from stop to 80 km/h (50 mph) allowing the transmission to shift into 6th gear.
   Keep vehicle speed and throttle steady for a minimum of 15 seconds.
5. With the transmission in 6th gear and maintaining steady speed and throttle, lightly apply and release the brake pedal to operate the stop lamps. Then, hold vehicle speed and throttle steady for a minimum of 5 seconds.
   Brake to a stop and remain stopped for a minimum of 20 seconds.
6. Repeat steps 4 through 6 at least 5 times.
7. Perform a self-test and record DTCs.
   - If DTCs are present, refer to the DTC Chart. Repair all non-transmission DTCs first as they can directly affect the operation of the transmission. Repeat the self-test and the road test to verify the correction. Clear the DTCs. Perform the transmission drive cycle test and repeat the self-test after completing the repair.
   - If the tests pass and a concern is present, refer to Diagnosis By Symptom in this section, OASIS messages and TSBs for concerns.

After On-Board Diagnostic (OBD)

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

Repair all DTCs after the On-Board Diagnostic (OBD) test procedures are completed.

Begin with non-transmission related DTCs, then repair transmission related DTCs. Use the DTC Chart for information on condition and symptoms. This chart will be helpful in referring to the correct manual(s) and aids in diagnosing internal transmission concerns and external non-transmission inputs. The pinpoint tests are used in diagnosing transmission electrical concerns. Diagnosis the vehicle wiring harness and the PCM as well. The Powertrain Control/ Emissions Diagnosis (PC/ED) manual aids in diagnosing non-transmission electronic components.

Diagnostic Trouble Code (DTC) Charts

Special Tool(s)

TCM4210 – Laptop software and USB cable

Using a scan tool to retrieve DTCs, begin with and repair all non-transmission related DTCs. Start with the U-DTCs (communication link codes) then repair transmission related DTCs.

The PCM will command a default gear to protect the engine and transmission when certain faults occur. Default or (limp-home mode) depends on the actual gear the vehicle was in when the fault occurred.

- For gears 1-3, the default will be 3rd gear.
- For gears 4-6, the default will be 5th gear.

The default gear is held until the vehicle is placed in reverse, park or the vehicle is restarted. After these action(s) the vehicle will default to 3rd gear.

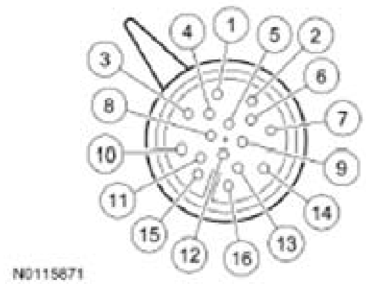
DTC Charts

Delphi / GM ALDL 2 Digit DTC#	OBD2 3 Digit DTC#	J1939 SPN	DESCRIPTION	Fail Conditions	TCM Actions Taken	Reasons For Action Taken	Clear Condition
21			Throttle Position High	Throttle Position High Throttle position voltage has been above 4.9 Volts for more than 1 second.	Maximum line pressure. Shift points fixed at 35% throttle.	Assumes fixed shift points. Goes to maximum pressure because engine load is unknown.	Throttle Position below 4.9 Volts for more than 1 second
22			Throttle Position Low	TPS voltage is less than 0.20 volts for more than 1 second.	Maximum line pressure. Shift points fixed at 35% throttle.	Assumes fixed shift points. Goes to maximum pressure because engine load is unknown.	Throttle Position Above 0.20 volts for more than 1 second
24	P0722	522741	Output Speed Sensor	No Code 21,22,U0001. Sets When not in Park or Neutral, Engine RPM greater than 3000, Input shaft speed greater than 2800, Throttle position greater than 10%, Output Speed Less than 200. All condition met for 3 seconds.	Calculate Output shaft speed from input shaft speed and commanded gear. Maximum line pressure	Calculates output shaft speed to determine shift points. Assumes maximum pressure because transmission slippage cannot be measured.	Key Cycle
28	P1810	522751	Range Pressure Switch / Lever Position Error	Sets when TCM sees one of two illegal combinations from pressure switch manifold for 2 Seconds.	Maximum pressure. Assume Overdrive 4 is selected. Inhibit 4th and TCC.	Assumes D4 so that performance of the vehicle is not limited. Inhibits 4th and TCC because actual selector position is unknown.	Key Cycle
37	P0719	522740	Brake Switch Stuck Off	Sets when Brake is not pressed, Vehicle speed is below 5 mph for greater than 6 seconds, then Vehicle speed is greater than 20 mph for greater than 6 seconds, for a total of 7 times.	Inhibit TCC.	Inhibits TCC to prevent engine stalling in panic brake situtation.	Key Cycle or When Brake Pedal is pressed
38	P0724	522743	Brake Switch Stuck On	Sets when Brake is pressed. Vehicle speed is below 5 mph for greater than 6 seconds, then Vehicle speed is greater than 20 mph for greater than 6 seconds, for a total of 7 times.	Inhibit TCC.	Inhibits TCC to prevent engine stalling in panic brake situtation.	Key Cycle or When Brake Pedal is released
39	P0741	522744	TCC Stuck OFF	TCC slip is greater than 65 RPM for 3 seconds when TCC is commanded on in 2nd or 3rd	Inhibit TCC and 4th gear	Inhibits TCC and 4th gear because code could be tripped by slipping 4th clutch.	Key Cycle
51	P0601	522736	Transmission Control Module	Sets when Internal memory writes/reads fail, COP stops operating or processor executes an Illegal Opcode.	2nd Gear, Maximum line pressure, Inhibit TCC		Key Cycle
52	P0560	522733	System Voltage High Long	Sets when system voltage is greater than 16 volts for 30 minutes.	2nd Gear, Maximum line pressure, Inhibit TCC	Turns off all solenoids to protect them from overheating/overcurrent	Key Cycle or when system voltage drops below 15V
53	P0561	522734	System Voltage High	Sets when system voltage is greater than 19.5 volts for 5 seconds.	2nd Gear, Maximum line pressure, Inhibit TCC	Turns off all solenoids to protect them from overheating/overcurrent	Key Cycle or when system voltage drops below 18V
58	P0712	522737	Trans Temp High or TFT circuit low	Sets When Transmission Temperature Is above 151 Deg. C (304 Deg. F) for 1 second.	Inhibit 4th and TCC	Transmission Temperature is unknown	When Transmission Temperature drops below 148 Deg C for 5 second
59	P0713	522738	Trans Temp Low or TFT Circuit High	Transmission Temperature Is Below -37 Deg. C (-34 Deg. F) for 1 second.	Inhibit 4th and TCC	Transmission Temperature is unknown	When Transmission Temperature goes above -35 Deg C for 5 second
63			Reserved. Only Flashes through diagnostic light on Military Humvee	None	None	Is Barometric Pressure code on older Delphi Modules.	
68	P1870	522753	Component Slipping / TCC or 4th Clutch Slipping	No 28,71,74,U0001. Throttle Position is Greater Than 25%, Engine speed is 200 rpm or more than input speed for 6 seconds when in 4th gear and TCC engaged.	Maximum line pressure. Inhibit 4th.	Inhibits 4th because either TCC or 4th clutch could be slipping. Goes to maximum pressure to attempt to stop the slippage. If TCC slippage continues in 3rd code 39 will activate	Key Cycle
69	P0742	522745	TCC Stuck On	No DTC 21,22,71,74,U0001 Sets when TCC slip is between -25 and 25 rpm, TCC solenoid is commanded off, TPS is greater than 25% for 4 seconds	TCC Commanded on, Maximum Line Pressue	Commands TCC on in case of partial TCC pressure being applied.	Key Cycle
71			Engine Speed Circuit Low	Sets when Engine speed is less than 50 rpm, transmission range is R,D4,D3,D1 for 2 seconds	Inhibit 4th and TCC	Inhibits 4th and TCC because slippage of either clutch cannot be measured.	When Engine RPM goes above 300 RPM

72	P0723	522742	Intermittent Output Shaft Speed	No DTC 21,22,28,71,74,U0001. Sets when Engine RPM is greater than 300, range is D4,D3,D2, or D1, Throttle position is greater than 25% and Output shaft speed changes more than 500 rpm in one measurement period.	Maximum line pressure. Calculate TOSS from TISS and commanded Gear.	Calculates output shaft speed to determine shift points. Assumes maximum pressure because transmission slippage cannot be measured.Inhibits TCC to prevent inadverent stalling at low speeds.	Key Cycle
73	P0748	522746	Pressure Control Circuit	Force motor current is more than 0.16 Amps different than commanded current for 2 seconds.	Maximum line pressure.	Commands maximum pressure because pressure cont	Key Cycle
74	P0717	522739	Input Speed Sensor Circuit	No DTC 28. Sets when Range is not park or neutral, engine speed greater than 300rpm, Output speed greater than 200rpm, Input speed less than 50 rpm, for 2 seconds.	Maximum line pressure. Inhibit 4th and TCC.	Commands Maximum pressure because Transmission slippage cannot be measured. Inhibits 4th and TCC because TCC slippage cannot be measured	When Input Speed goes above 75rpm for 2 seconds
75	P0562	522735	System Voltage Low	Sets when the ignition is on, voltage is less than the following conditions: -40F (-40C) = 7.3 volts 194F (90C) = 10.3 volts 302F (150C) = 11.7 volts Engine Speed is greater than 300 rpm for 4 seconds.	2nd Gear with Maximum pressure. Inhibit TCC	Turns off all solenoids because the TCM cannot properly control them	Clears when system voltage is greater than the following conditions for 4 seconds: -40F (-40C) = 7.3 volts 194F (90C) = 10.3 volts 302F (150C) = 11.7 volts
79	P0218	522732	Transmission Fluid Overtemp	No DTC 58 Sets when transmission fluid temperature is greater than 270F (132C), for 5 minutes	None		When Temperature falls below 266F (130C) for 5 seconds
81	P0758	522750	2-3 Shift Solenoid Circuit Fault - Shift Solenoid B Electrical	Battery Voltage above 10volts TCM detects an open circuit, short to battery, short to ground, or over-current condition on the shift solenoid "B" circuit for 2 seconds	2nd or 3rd gears only. Maximum Line Pressure.	Turns off all solenoids. Depending on the Fault 2nd or 3rd gear is possible	When Fault condtion removed for 2 seconds
82	P0753	522748	1-2 Shift Solenoid Circuit Fault - Shift Solenoid A Electrical	Battery Voltage above 10volts TCM detects an open circuit, short to battery, short to ground, or over-current condition on the shift solenoid "A" circuit for 2 seconds	2nd and 3rd gears only or 1st and 4th gear only. Maximum Line Pressure	Turns off all solenoids. Depending on the Fault 2nd and 3rd gear or 1st and 4th is possible.	When Fault condtion removed for 2 seconds
83	P1860	522752	TCC Solenoid Circuit Fault	Battery Voltage above 10 Volts. TCM detects an open circuit, short to battery, short to ground, or over-current condition on the TCC solenoid circuit.	Inhibit TCC. Inhibit 4th when in Hot mode	Turns off the TCC output to prevent damage to the driver	When Fault condtion removed for 2 seconds
85	P1871	522754	Undefined Ratio Error	No DTC 21,22,24,28,71,72,U0001 Sets when TPS is greater than 25%, Engine speed is greater than 300 rpm, Vehicle speed is greater than 7mph. Ratio falls out of following table for 6 seconds. Gear Low Limit High Limit 1 2.38 2.63 2 1.43 1.58 3 .95 1.05 REV 1.97 2.17	2nd Gear with Maximum line pressure. Inhibit TCC	Turns off all solenoinds in an attempt to protect the transmission.	Key Cycle
86	P0756	522749	Low ratio error (Shift Solenoid B Stuck On)	No DTC 21,22,24,28,71,72,74,85,U0001 Sets when RPM is greater than 300rpm, TPS is greater than 25%, VSS is greater than 7mph, Transmission ratio matches 4th when 1st is commanded or 3rd gear when 2nd gear is commanded, for 6 seconds.	2nd Gear with Maximum line pressure Inhibit TCC.	Turns off all solenoinds in an attempt to protect the transmission.	Key Cycle
87	P0751	522747	High ratio error (Shift Solenoid B Stuck off)	No DTC 21,22,24,28,71,72,74,85,U0001 Sets When RPM is Greater than 300rpm, TPS is greater than 25%, VSS is greater than 7mph, Transmission ratio matches 1st gear when 4th is commanded or 2nd gear when 3rd gear is commanded, for 6 seconds.	2nd Gear with Maximum line pressure Inhibit TCC.	Turns off all solenoinds in an attempt to protect the transmission.	Key Cycle
	U0001	522731	Can Communications Lost	No Can communications for greater than 5 seconds.	Maximum line pressure. Shift points fixed at 35% throttle. Inhibit 4th and TCC	Assumes fixed shift points. Goes to maximum pressure because engine load is unknown.	

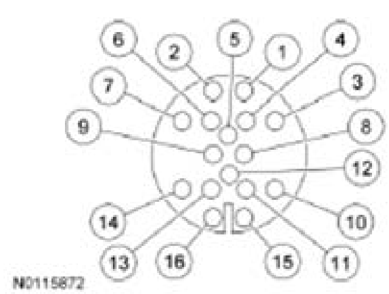
Transmission Connector Layouts

Transmission Vehicle Harness



Item	Description
1	Turbine Shaft Speed (TSS) sensor
2	NOT USED
3	TCC control
4	Transmission Range (TR) sensor
5	Signal return
6	Transmission Fluid Temperature (TFT) sensor power
7	Ignition voltage
8	Shift Solenoid E (SSE) control
9	Shift Solenoid A (SSA) control
10	Shift Solenoid D (SSD) control
11	TR sensor signal return
12	Battery voltage
13	Shift Solenoid C (SSC) control
14	Shift Solenoid B (SSB) control
15	Output Shaft Speed (OSS) sensor
16	LPC solenoid control

Transmission Leadframe Connector



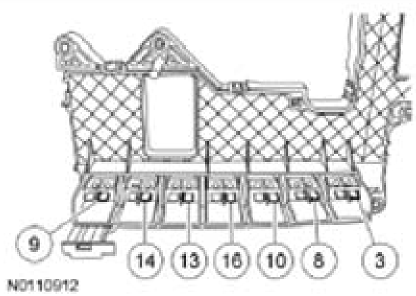
Item	Description
1	Turbine Shaft Speed (TSS) sensor
2	NOT USED

(Continued)

Item	Description
3	TCC control
4	Transmission Range (TR) sensor
5	Signal return
6	Transmission Fluid Temperature (TFT) sensor power
7	Ignition voltage
8	Shift Solenoid E (SSE) control
9	Shift Solenoid A (SSA) control
10	Shift Solenoid D (SSD) control
11	TR sensor signal return
12	Battery voltage
13	Shift Solenoid C (SSC) control
14	Shift Solenoid B (SSB) control
15	Output Shaft Speed (OSS) sensor
16	LPC solenoid control

Molded Leadframe

NOTE:
Terminal 7 of the transmission leadframe connector is the common power feed to the solenoids listed in the following chart.



Item	Description
3	Torque Converter Clutch (TCC) control
8	Shift Solenoid E (SSE) control
10	Shift Solenoid D (SSD) control
16	LPC solenoid control
13	Shift Solenoid C (SSC) control
14	Shift Solenoid B (SSB) control
9	Shift Solenoid A (SSA) control

Pinpoint Tests — OSC Equipped Vehicle

Special Tool(s)

 ST3093-A	Fluke 77-IV Digital Multimeter FLU77-4 or equivalent

TCM4210 – Laptop software and USB cable

When the electrical connector or solenoid body is disconnected, inspect the connector for terminal condition, corrosion and contamination. Also inspect the connector seal for damage. Clean, repair or install new components as required.

Power is routed through the Transmission Solenoid Power Control (TSPC) relay (inside the PCM) to all transmission solenoids. If the power circuit to the transmission solenoids or the TSPC relay fails open, then all solenoids are failed electrically OFF. CHECK for open, short to ground or the transmission connector disconnected. The TSPC relay will disable power to the transmission solenoids when certain transmission DTCs are set.

Shift Solenoid Pre-Diagnosis

Solenoid Operation Chart

Selector Lever Position	PCM Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1,2,3,4)	SSB NH (3,5,R)	SSC NL (CB 2,6)	SSD NH (CB L,R/C 4,5,6)	SSE NC	
P	P	Off	On	Off	Off	Off	Off
R	R	Off	Off	Off	Off	Off	Off
N	N	Off	On	Off	Off[a]	Off	Off
D	1	On	On	Off	Off[b]	Off	Off
	2	On	On	On	On	Off	Off
	3	On	Off	Off	On	On	On/Off
	4	On	On	Off	Off	On	On/Off
	5	Off	Off	Off	Off	On	On/Off
	6	Off	On	On	Off	On	On/Off
M[c]	—	—	—	—	—	—	—
2	2	On	On	On	On	Off	Off
1	1	On	On	Off	Off	On	Off

a Solenoid state will change if vehicle is moving forward with the selector lever in the NEUTRAL position.

b Solenoid is On when vehicle is above 3 mph.

c All gears available upon driver request.

CB = Clutch brake

NC = Normally closed

NH = Normally high

NL = Normally low

Pinpoint Tests (TCU 2200)

Refer to Wiring Diagrams Cell 30 for schematic and connector information.

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2200)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

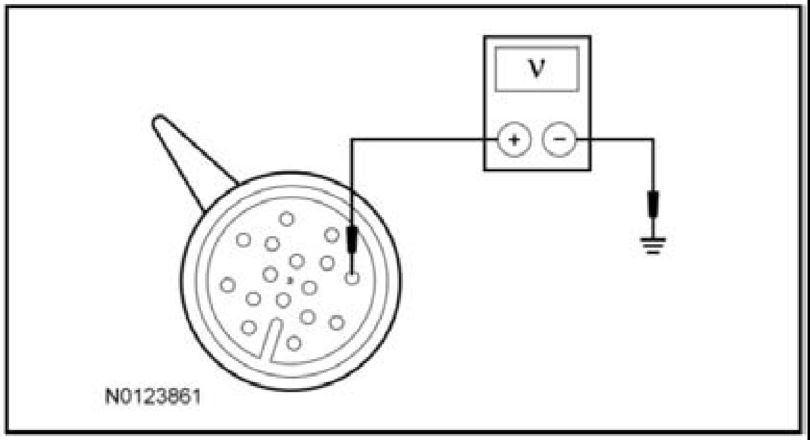
NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

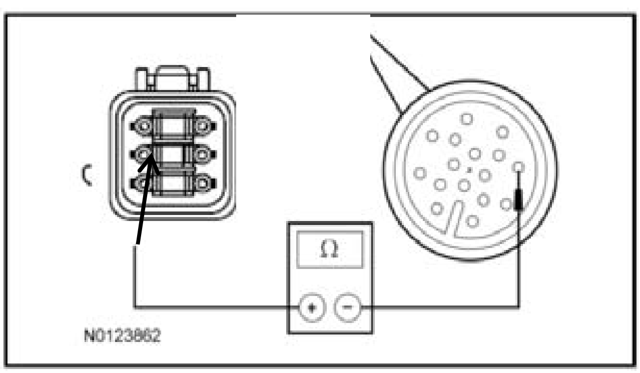
NOTE:
Read and record all DTCs.

NOTE:
Without a voltage signal return to the PCM, the Transmission Solenoid Power Control (TSPC) relay is commanded OFF. By using a fused jumper between a transmission solenoid control circuit and the signal return circuit, the TSPC relay circuit will supply power to the transmission solenoids when the ignition is cycled from OFF to ON. Do not use a solenoid control circuit that may be at fault, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing

	Test Step	Result/Action to Take
A1	**CHECK THE SOLENOID POWER CIRCUIT FOR VOLTAGE**	
	Ignition OFF. • Disconnect: Transmission C1 . • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • NOTICE: Do not use a solenoid control circuit that may be at fault. Failure to jump pin 5 to a known good solenoid control circuit can cause incorrect diagnostic results. For additional information, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing. Using the chart, connect a fused jumper between one of the 7 solenoid control circuit pins on transmission vehicle harness C1 and C1-5 ***7 Solenoid Control Circuits*** *C1-9 *C1-14 *C1-13 *C1-10 *C1-8 *C1-16 *C1-3 • Ignition ON. • Measure the voltage from the transmission vehicle harness C1-7 circuit (YELLOW) harness side to ground.	**Yes** GO to A4. **No** GO to A2.

	 **• Is the voltage greater than 10 volts?**	

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2200) (Continued)

Test Step		Result/Action to Take
A2	**CHECK THE SOLENOID POWER CIRCUIT FOR AN OPEN**	
	• Ignition OFF. • Disconnect: Transmission C1 • Disconnect: C6 vehicle interface connector • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance from the C6-2 (SWITCHED 12V BATTERY) to the C1-7, circuit (YELLOW).  • Is the resistance less than 5 ohms?	**Yes** GO to A3. **No** REPAIR transmission harness circuit switched 12 volts for an open. Clear DTCS. Then test the system for normal operation.

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2200) (Continued)

Test Step		Result/Action to Take
A3	**CHECK THE SOLENOID POWER CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance from the C6-2 terminal or the C1-7 terminal to ground • Is the resistance greater than 10,000 ohms?	**Yes** GO to A4. **No** REPAIR transmission vehicle harness circuit CET25 (BU/GN) for a short to ground. CLEAR the DTC's. TEST the system for normal operation.

Test Step		Result/Action to Take
A 4	**CHECK SOLENOID CONTROL CIRCUITS FOR AN OPEN**	
	• Ignition OFF. • Disconnect Transmission connector C1 • Disconnect TCU connector • Measure resistance between two connectors using the below: C1-9 to TCU-M Vio/ Lt. Grn C1-14 to TCU-J Pnk/Red C1-13 to TCU-H Pnk/BLK C1-10 to TCU-N Vio/Lt. Blu C1-8 to TCU-F Pnk/Lt. Blu C1-16 to TCU-L Vio/Blk C1-3 to TCU-K Vio/Rd **• Is the resistance less than 5 ohms on each circuit?**	**Yes** GO to A5. **No** REPAIR the transmission vehicle harness circuit which measured greater than 5 ohms. CLEAR the DTCs. TEST the system for normal operation.

C1-9	to	TCU-M	Vio/ Lt. Grn
C1-14	to	TCU-J	Pnk/Red
C1-13	to	TCU-H	Pnk/BLK
C1-10	to	TCU-N	Vio/Lt. Blu
C1-8	to	TCU-F	Pnk/Lt. Blu
C1-16	to	TCU-L	Vio/Blk
C1-3	to	TCU-K	Vio/Rd

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2200) (Continued)

	Test Step	Result/Action to Take
A5	**CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO GROUND**	
	• Ignition OFF. • Disconnect Transmission connector C1 • Measure the resistance between the transmission vehicle harness C1, harness side and ground using the following chart. (see chart below) **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to A6. **No** REPAIR the transmission vehicle harness circuit which measured less than 10,000 ohms. CLEAR the DTCs. TEST the system for normal operation.

C1-9	to	GROUND	Vio/ Lt. Grn
C1-14	to	GROUND	Pnk/Red
C1-13	to	GROUND	Pnk/BLK
C1-10	to	GROUND	Vio/Lt. Blu
C1-8	to	GROUND	Pnk/Lt. Blu
C1-16	to	GROUND	Vio/Blk
C1-3	to	GROUND	Vio/Rd

	Test Step	Result/Action to Take
A 6	**CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO POWER**	
	• Connect: TCU AND C6 connector • Disconnect C1 Connector • Ignition On • Measure for voltage between the transmission vehicle harness C1, harness side and ground using the following chart. (see chart below)	**Yes** REPAIR the transmission vehicle harness circuit shorted to power. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A7.

Transmission	Control Circuit	Ground
C1-9	SSA (Vio/Lt. GN)	Ground
C1-14	SSB (Pnk/RD)	Ground
C1-13	SSC (Pnk/Blk)	Ground
C1-10	SSD (Vio/Blu)	Ground
C1-8	SSE (Pnk/Lt. Blu)	Ground

C1-16	LPC solenoid (Vio/Blk)	Ground
C1-3	TCC solenoid (Vio/RD)	Ground

• Is voltage greater that 4 volts?

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS(For TCU2200) (Continued)

	Test Step	Result/Action to Take
A7	**CHECK COMPONENT RESISTANCE**	
	• Measure resistance of the solenoid between the transmission molded leadframe C1, component side using the following chart. (see chart below) **• Is the resistance within specifications?**	**Yes** REFER to Main Control to inspect for stuck valves or debris. If no problems are found, INSTALL suspected solonoid. REFER to Shift Solenoids (SS). CLEAR the DTCs. TEST the system for normal operation. **No** REPLACE the suspected solenoid which failed the resistance check. REFER to Shift Solenoids (SS) in this section. CLEAR the transmission adaptive tables and perform the adaptive drive cycle. REFER to Shift Point Road Test in this section. TEST the system for normal operation.

Transmission	Solenoid	Transmission	Ohms
C1-7	SSA	C1-9	4.8 to 5.6
C1-7	SSB	C1-14	4.8 to 5.6
C1-7	SSC	C1-13	4.8 to 5.6
C1-7	SSD	C1-10	4.8 to 5.6
C1-7	SSE	C1-8	17.5 to 18.6
C1-7	LPC solenoid	C1-16	4.8 to 5.6
C1-7	TCC solenoid	C1-3	4.8 to 5.6

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2200) (Continued)

	Test Step	Result/Action to Take
A 8	**CHECK SOLENOID RESISTANCE**	
	• Remove the molded leadframe from the main control. Refer to Shift Solenoids (SS) in this section. Inspect for metallic contamination and clean the solenoid and molded leadframe terminals. • Measure and record the resistance of the suspected solenoid. For solenoid location, refer to Shift Solenoids (SS) in this section. Compare the recorded value with the chart below. (see chart below) **• Is the solenoid resistance within specification?**	**Yes** INSTALL a new molded leadframe, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. TEST the system for normal operation. **No** REPLACE the suspected solenoid which failed the resistance check. REFER to Shift Solenoids (SS) in this section. CLEAR the transmission adaptive tables and perform the adaptive drive cycle. REFER to Shift Point Road Test in this section. TEST the system for normal operation.

Solenoid	Ohms
SSA	4.8 to 5.6
SSB	4.8 to 5.6
SSC	4.8 to 5.6
SSD	4.8 to 5.6
SSE	17.5 to 18.6
LPC solenoid	4.8 to 5.6
TCC solenoid	4.8 to 5.6

PINPOINT TEST B: TFT SENSOR (For TCU2200)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

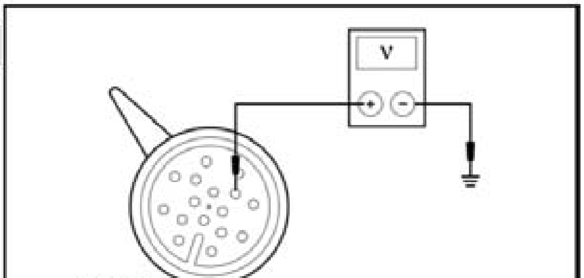
NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

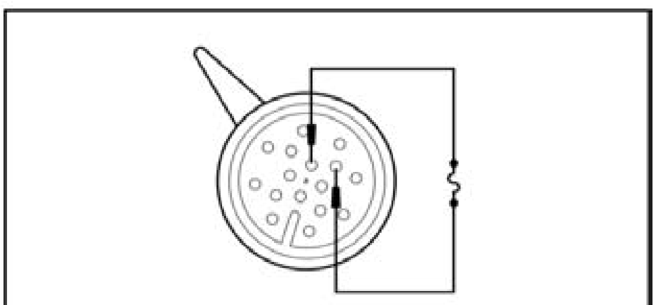
NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
B1	**CHECK TFT INPUT SIGNAL**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1 . • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Connect the laptop and cable. • Ignition ON. • Enter the PCS software and view the TFT value and TFTV . **• Does the TFT PID display -40°C (-40°F) and the TFTV PID display 4.96 to 5.10 volts?**	**Yes** GO to B2. **No** REPAIR vehicle harness circuit (Pin 6 (YELLOW/ORANGE)) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST B: TFT SENSOR (For TCU2200) (Continued)

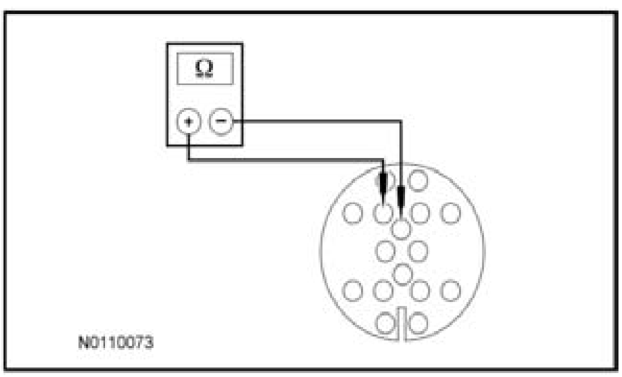
	Test Step	Result/Action to Take
B 2	**CHECK TFT SIGNAL INPUT CIRCUIT FOR VOLTAGE**	
	• Measure the voltage between the transmission vehicle harness C1-6, (Ye/OR), harness side and ground.  N0115874 **• Is the voltage between 4.8 and 5.1 volts?**	**Yes** GO to B3. **No** INSPECT and REPAIR transmission vehicle harness circuit (YE/OR) for an open. If an open circuit is not found, replace the TCU.

	Test Step	Result/Action to Take
B3	**CHECK TFT SIGNAL RETURN CIRCUIT**	
	•Connect a fused jumper between the transmission vehicle harness C1-5 and C1-6, harness side.  N0115873 **• Does the TFT PID display 190°-195°C (374°-383°F) and the TFTV** **PID display 0 volts?**	**Yes** GO to B4. **No** INSPECT and REPAIR the transmission vehicle harness signal return circuit for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
B 4	**CHECK TFT SENSOR RESISTANCE**	
	• Measure the resistance between the transmission molded leadframe C1-5 and C1-6, component side using the following chart.	

TRANSMISSION FLUID TEMPERATURE (TFT)

°C	°F	Resistance
-40 to -20	-40 to -4	967K-284K
-19 to -1	-3 to 31	284K-100K
0-20	32-68	100K-37K
21-40	69-104	37K-16K
41-70	105-158	16K-5K
71-90	159-194	5K-2.7K
91-110	195-230	2.7K-1.5K
111-130	231-266	1.5K-0.8K
131-150	267-302	0.8K-0.54K



• Does the temperature to resistance specifications match?

Yes
REFER to Diagnosis By Symptom in this section to
diagnose an overheating concern.
No
INSPECT and CLEAN the TFT sensor on the molded
leadframe for metallic contamination. INSTALL a new
molded leadframe if no debris was found, REFER to
Shift Solenoids (SS) in this section. CLEAR the DTCs.
TEST the system for normal operation.

PINPOINT TEST C: TR SENSOR (For TCU2200)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
C1	**VERIFY DTCs**	
	• Ignition OFF. • Select PARK. • Connect the laptop and cable. • Carry out the Key ON Engine OFF (KOEO) then the Key ON Engine Running (KOER) test. DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and P1921 cannot be set by an incorrectly adjusted selector lever cable. • Are Transmission Range (TR) sensor DTCs present?	**Yes** GO to C3. **No** GO to C2.

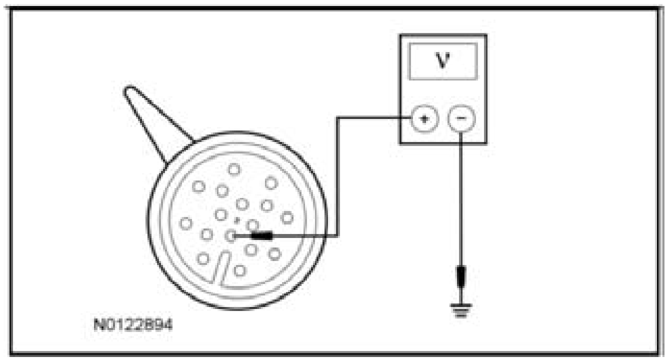
Test Step		Result/Action to Take
C2	**VERIFY SELECTOR LEVER CABLE/LINKAGE ADJUSTMENT**	
	• Verify the selector lever cable is correctly adjusted. • Is the selector lever cable correctly adjusted?	**Yes** GO to C3. **No** ADJUST the selector lever cable.

PINPOINT TEST C: TR SENSOR (For TCU2200) (Continued)

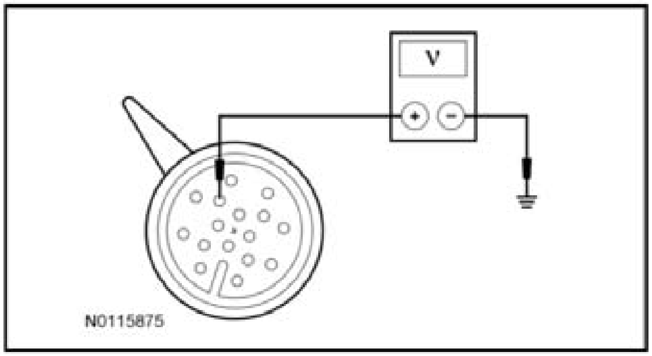
	Test Step	Result/Action to Take
C3	**CHECK TR SENSOR ELECTRICAL OPERATION**	
	• Ignition ON. • Enter the following diagnostic mode on the scan tool: *Communications -> Lightweight Monitor* • Move the selector lever into each range and stop. • Observe the following PIDs: Speed Input Duty and Speed Input Frequnecy while wiggling the harness or driving the vehicle. • Compare the PID: TR_DC to the selector lever position duty cycle, using the following chart. (see chart below) • Is the Speed Input Frequency between 100 to 150 Hz? Is the Speed Input Duty within range? Does the Speed Input Duty and Speed Input Duty Frequency remain steady when the harness is wiggled or the vehicle driven?	**Yes** The problem is not in the TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis. **No** GO to C4.

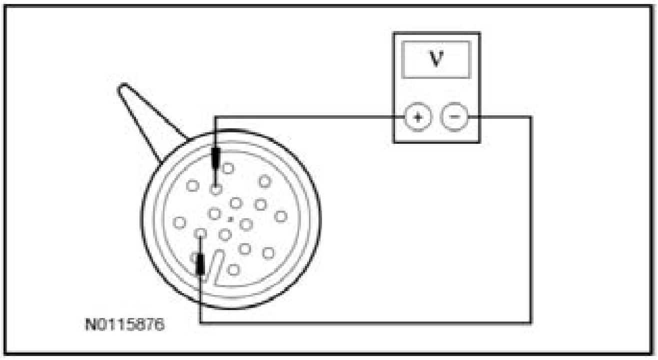
Selector Lever Position	Range (% Duty Cycle)
P	8.0 — 25.8
R	30.50 — 39.31
N	40.54 — 52.49
D	54.35 — 71.15
M	65.15 — 82
2	70.55 — 85.61
1	75.25 — 88.91

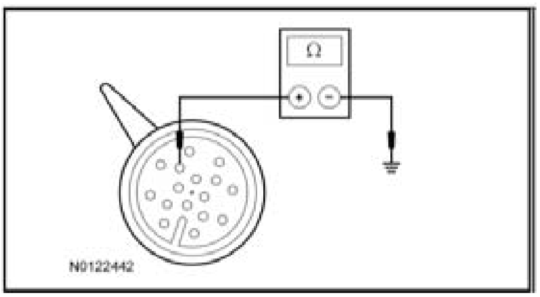
PINPOINT TEST C: TR SENSOR (For TCU2200) (Continued)

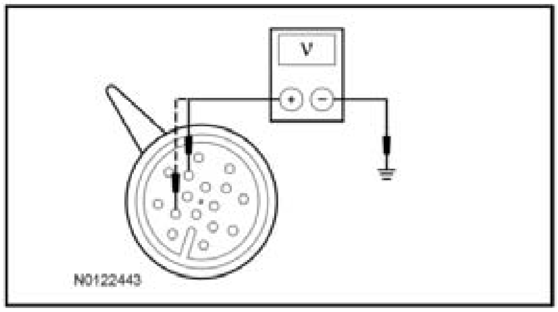
	Test Step	Result/Action to Take
C 4	**CHECK TR SENSOR VPWR CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1 . • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-12, (RD/WHT) harness side and ground.  **• Is the voltage less than 9.5 volts?**	**Yes** INSPECT and REPAIR the transmission vehicle harness circuit (RD/WHT) for an open. If an open circuit is not found, REPLACE the TCU. **No** GO to C5.

PINPOINT TEST C: TR SENSOR (For TCU2200) (Continued)

Test Step		Result/Action to Take
C5	**CHECK TR SENSOR SIGNAL CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-4, circuit (OR/BLK) harness side and ground.  **• Is the voltage greater than 4.8 volts?**	**Yes** GO to C6. **No** INSPECT and REPAIR vehicle harness circuit (OR/BLK) for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
C 6	**CHECK TR SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-4 circuit (OR/BLK) and C1-11 circuit (BLK/WH).  **• Is the voltage greater than 4.8 volts?**	**Yes** GO to C7. **No** INSPECT and REPAIR transmission vehicle harness circuit (BLK/WH) for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
C7	**CHECK TR SENSOR POWER CIRCUIT FOR A SHORT TO GROUND**	
	• Ignition OFF. • Disconnect: C1 connector • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-4 circuit (OR/BLK) and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to C8. **No** REPAIR transmission vehicle harness (OR/BLK) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

Test Step		Result/Action to Take
C 8	**CHECK TR SENSOR POWER CIRCUITS FOR A SHORT TO POWER**	
	• Connect: All connectors except the C1 connector • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-4, circuit (OR/BLK) and C1-11, circuit (BLK/WH) to ground.  • Is voltage greater than 9.8 volts?	**Yes** REPAIR the transmission vehicle harness circuit which measured greater than 9.8 volts. CLEAR the DTCs. TEST the system for normal operation. **No** GO to C9.

Test Step		Result/Action to Take
C9	**CHECK TR SENSOR TO MANUAL VALVE**	
	• Drain the transmission fluid and remove the transmission fluid pan. Refer to Fluid Pan, Gasket and Filter in this section. • Check the connection between the TR sensor and the manual control valve. Refer to Transmission in this section. • Inspect the molded leadframe for metallic contamination, refer to Shift Solenoids (SS). **• Is the TR sensor connected to the manual control valve shaft?**	**Yes** REPLACE molded leadframe. REFER to Shift Solenoids in this section. **No** CONNECT the TR sensor to the manual control valve, REFER to Transmission in this section. CLEAN any debris from the molded leadframe. RUN the Key ON Engine OFF (KOEO) self-test. If DTCs return, REPLACE the molded leadframe, REFER to Shift Solenoids (SS) in this section.

PINPOINT TEST D: TSS SENSOR (For TCU2200)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

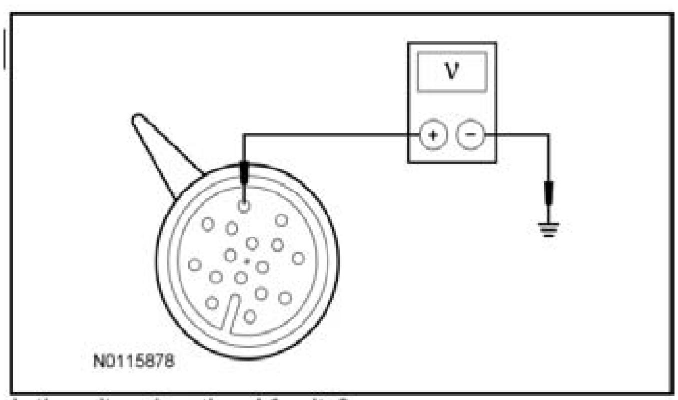
NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

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

PINPOINT TEST D: TSS SENSOR (For TCU2200) (Continued)

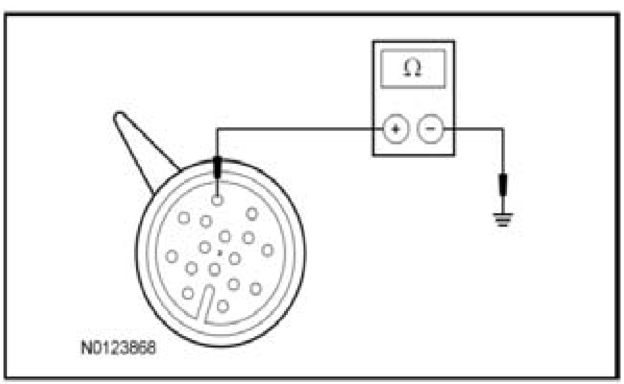
NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
D1	**DRIVE CYCLE TEST**	
	• Connect the laptop and cable. • Enter the TCU monitor: • Monitor the TSS_SRC PID while road testing the vehicle. Drive the vehicle so the transmission upshifts and downshifts through all the gears. **• Does the TSS sensor rpm increase and decrease with engine** **rpm and vehicle speed?** *For TSS sensor reading go* *into TCU software monitor* *and view Turbine speed.*	**Yes** REFER to Shift Point Road Test in this section for further diagnosis. **No** GO to D2.

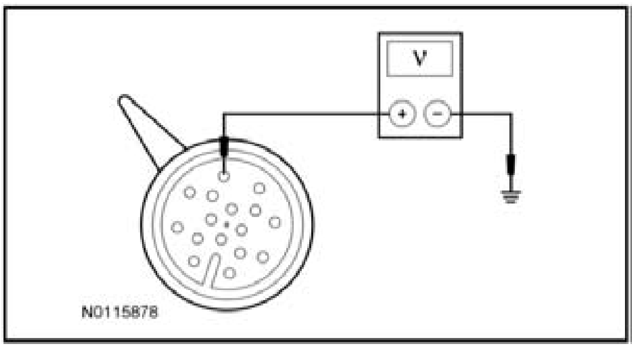
Test Step		Result/Action to Take
D2	**CHECK TSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-1 and ground.  **• Is the voltage less than 4.8 volts?**	**Yes** GO to D3. **No** GO to D6.

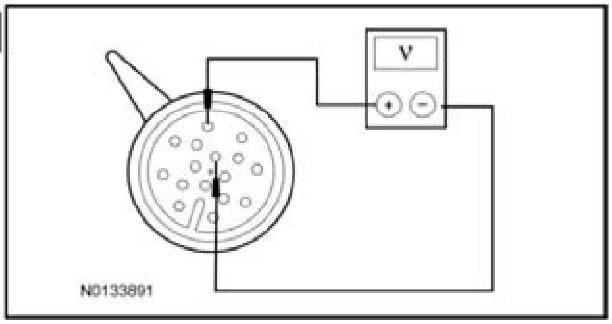
PINPOINT TEST D: TSS SENSOR (For TCU2200) (Continued)

	Test Step	Result/Action to Take
D3	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR AN OPEN**	
	• Ignition OFF. • Disconnect: TCU harness • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-1 circuit (OR/Lt. GRN) and TCU-i • Is the resistance less than 5 ohms?	**Yes** GO to D4. **No** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
D 4	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance between the transmission vehicle harness C1-1 and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to D5. **No** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for a short to ground. If a short to ground is not found, REPLACE the TCU.

PINPOINT TEST D: TSS SENSOR (For TCU2200) (Continued)

Test Step		Result/Action to Take
D5	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER**	
	• Connect: All items except transmission C1 connector. • Ignition ON. • Measure for voltage between the transmission vehicle harness C1-1, and ground.  **• Is voltage greater than 5.1 volts?**	**Yes** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for a short to power. If a short to power is not found, REPLACE the TCU. **No** GO to D6.

Test Step		Result/Action to Take
D6	**CHECK THE TSS SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-1 and C1-5.  • Is voltage less than 4.8 volts?	**Yes** REPAIR the transmission vehicle harness signal return circuit for an open. If an open is not found, REPLACE the TCU. TEST the system for normal operation. **No** REPLACE the molded leadframe, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST E: OSS SENSOR (For TCU2200)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

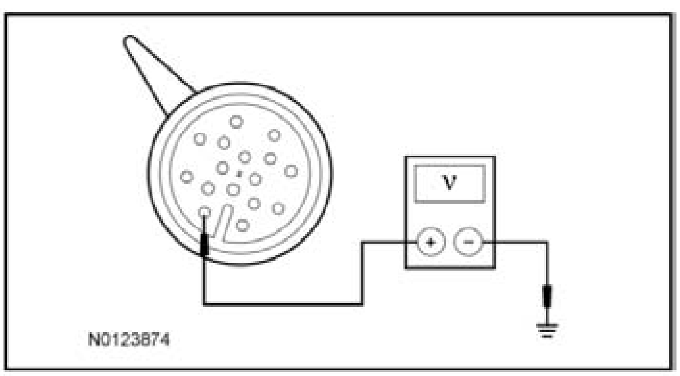
NOTE:
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE:
Read and record all DTCs.

NOTE:
If DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and/or P1921 are set, diagnose those DTCs first.

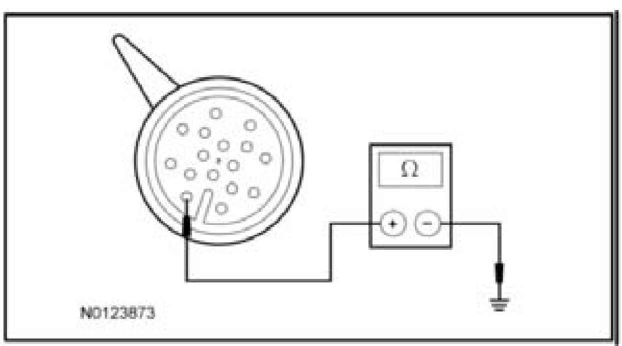
PINPOINT TEST E: OSS SENSOR (For TCU2200) (Continued)

Test Step		Result/Action to Take
E1	**DRIVE TEST CYCLE**	
	• Connect the laptop and cable. • Enter the TCU monitor: • Monitor the Output Shaft Speed (OSS) sensor PID while road testing the vehicle. Drive the vehicle so the transmission upshifts and downshifts through all the gears. **• Does the OSS sensor rpm increase and decrease with engine rpm and vehicle speed?** *For OSS sensor reading go into TCU software monitor and view driveshaft RPM*	**Yes** REFER to Shift Point Road Test in this section for further diagnosis. **No** GO to E2.

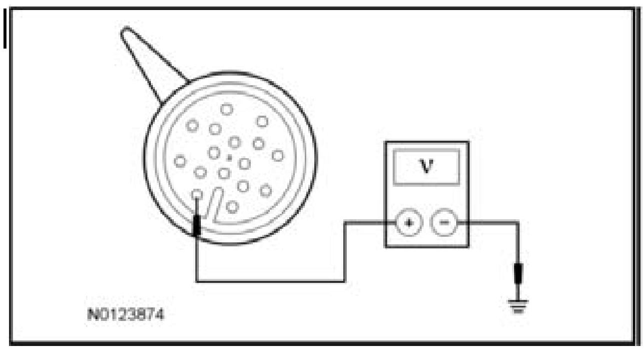
Test Step		Result/Action to Take
E2	**CHECK OSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-15 and ground.  • Is the voltage less than 4.8 volts?	**Yes** GO to E3. **No** GO to E6.

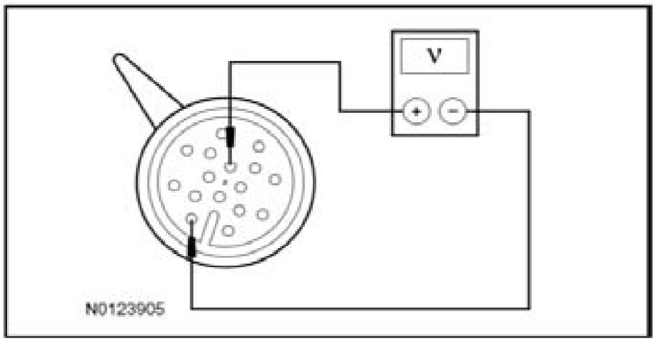
PINPOINT TEST E: OSS SENSOR (For TCU2200) (Continued)

	Test Step	Result/Action to Take
E3	**CHECK OSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: TCU harness • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-15 circuit (OR/RED) and TCU-Y **• Is the resistance less than 5 ohms?**	**Yes** GO to E4. **No** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for an open. If an open circuit is not found, REPLACE the TCU. Test in normal operation.

	Test Step	Result/Action to Take
E4	**CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance between the transmission vehicle harness C1-15 and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to E5. **No** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for a short to ground. If a short to ground is not found, REPLACE the TCU.

PINPOINT TEST E: OSS SENSOR (For TCU2200) (Continued)

	Test Step	Result/Action to Take
E5	**CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER**	
	• Connect: All items except transmission C1 connector. • Ignition ON. • Measure for voltage between the transmission vehicle harness C1-15, and ground.  **• Is voltage greater than 5.1 volts?**	**Yes** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for a short to power. If a short to power is not found, REPLACE the TCU. Test the system for normal operation. **No** GO to E6.

Test Step		Result/Action to Take
E6	**CHECK THE OSS SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-15 and C1-5.  **• Is voltage less than 4.8 volts?**	**Yes** REPAIR the transmission vehicle harness signal return circuit for an open. If an open is not found, REPLACE the TCU. TEST the system for normal operation. **No** REPLACE the molded leadframe, REFER to Main Control in this section. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2600)

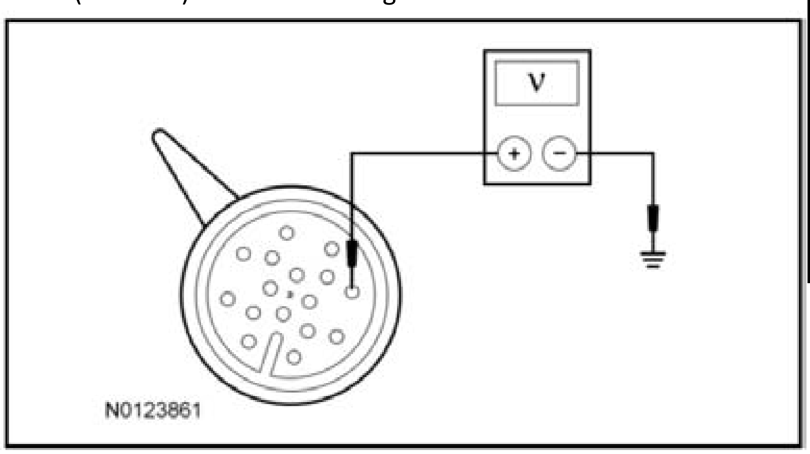
NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

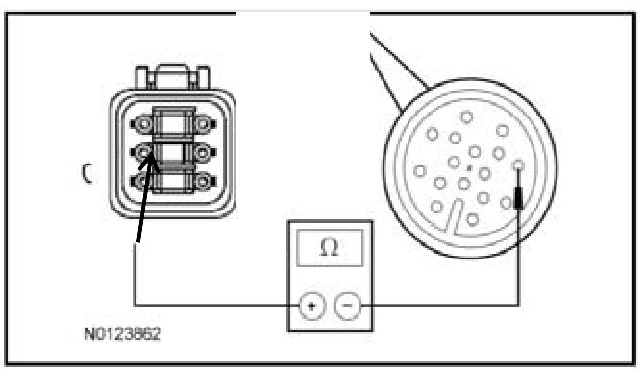
NOTE:
Read and record all DTCs.

NOTE:
Without a voltage signal return to the PCM, the Transmission Solenoid Power Control (TSPC) relay is commanded OFF. By using a fused jumper between a transmission solenoid control circuit and the signal return circuit, the TSPC relay circuit will supply power to the transmission solenoids when the ignition is cycled from OFF to ON. Do not use a solenoid control circuit that may be at fault, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing

Test Step		Result/Action to Take
A1	**CHECK THE SOLENOID POWER CIRCUIT FOR VOLTAGE**	
	Ignition OFF. • Disconnect: Transmission C1 connector. • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • NOTICE: Do not use a solenoid control circuit that may be at fault. Failure to jump pin 5 to a known good solenoid control circuit can cause incorrect diagnostic results. For additional information, refer to Diagnostic Trouble Code (DTC) Charts in this section for a fault listing. Using the chart, connect a fused jumper between one of the 7 solenoid control circuit pins on transmission vehicle harness C1 and C1-5 ***7 Solenoid Control Circuits*** *C1-9 *C1-14 *C1-13 *C1-10 *C1-8 *C1-16 *C1-3 • Ignition ON. • Measure the voltage from the transmission vehicle harness C1-7 circuit (YELLOW) harness side to ground. 	**Yes** GO to A4. **No** GO to A2.

	• Is the voltage greater than 10 volts?	

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2600) (Continued)

	Test Step	Result/Action to Take
A2	**CHECK THE SOLENOID POWER CIRCUIT FOR AN OPEN**	
	• Ignition OFF. • Disconnect: Transmission C1 • Disconnect: C6 vehicle interface connector • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance from the C6-2 (SWITCHED 12V BATTERY) to the C1-7, circuit (YELLOW).  • Is the resistance less than 5 ohms?	**Yes** GO to A3. **No** REPAIR transmission harness circuit switched 12 volts for an open. Clear DTCS. Then test the system for normal operation.

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS (For TCU2600) (Continued)

Test Step		Result/Action to Take
A3	**CHECK THE SOLENOID POWER CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance from the C6-2 terminal or the C1-7 terminal to ground • Is the resistance greater than 10,000 ohms?	**Yes** GO to A4. **No** REPAIR transmission vehicle harness circuit CET25 (BU/GN) for a short to ground. CLEAR the DTC's. TEST the system for normal operation.

Test Step		Result/Action to Take
A 4	**CHECK SOLENOID CONTROL CIRCUITS FOR AN OPEN**	
	• Ignition OFF. • Disconnect Transmission connector C1 • Disconnect TCU connector • Measure resistance between two connectors using the below: C1-9 to TCU-13 Vio/ Lt. Grn C1-14 to TCU-54 Pnk/Red C1-13 to TCU-53 Pnk/BLK C1-10 to TCU-14 Vio/Lt. Blu C1-8 to TCU-41 Vio/White C1-16 to TCU-11 Vio/Blk C1-3 to TCU-12 Vio/Rd **• Is the resistance less than 5 ohms on each circuit?**	**Yes** GO to A5. **No** REPAIR the transmission vehicle harness circuit which measured greater than 5 ohms. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS(For TCU2600) (Continued)

Test Step		Result/Action to Take
A5	**CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO GROUND**	
	• Ignition OFF. • Disconnect Transmission connector C1 • Measure the resistance between the transmission vehicle harness C1, harness side and ground using the following chart.	**Yes** GO to A6. **No** REPAIR the transmission vehicle harness circuit which measured less than 10,000 ohms. CLEAR the DTCs. TEST the system for normal operation.

C1-9	to	GROUND	Vio/ Lt. Grn
C1-14	to	GROUND	Pnk/Red
C1-13	to	GROUND	Pnk/BLK
C1-10	to	GROUND	Vio/Lt. Blu
C1-8	to	GROUND	Pnk/Lt. Blu
C1-16	to	GROUND	Vio/Blk
C1-3	to	GROUND	Vio/Rd

• Is the resistance greater than 10,000 ohms?

Test Step		Result/Action to Take
A 6	**CHECK SOLENOID CONTROL CIRCUITS FOR A SHORT TO POWER**	
	• Connect: TCU AND C6 connector • Disconnect C1 Connector • Ignition On • Measure for voltage between the transmission vehicle harness C1, harness side and ground using the following chart.	**Yes** REPAIR the transmission vehicle harness circuit shorted to power. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A7.

Transmission	Control Circuit	Ground
C1-9	SSA (Vio/Lt. GN)	Ground
C1-14	SSB (Pnk/RD)	Ground
C1-13	SSC (Pnk/Blk)	Ground
C1-10	SSD (Vio/Blu)	Ground
C1-8	SSE (Vio/White)	Ground

C1-16	LPC solenoid (Vio/Blk)	Ground
C1-3	TCC solenoid (Vio/RD)	Ground

• Is voltage greater that 4 volts?

PINPOINT TEST A: TRANSMISSION CONTROL SOLENOIDS(For TCU2600) (Continued)

	Test Step	Result/Action to Take
A7	**CHECK COMPONENT RESISTANCE**	
	• Measure resistance of the solenoid between the transmission molded leadframe C1, component side using the following chart.	

Transmission	Solenoid	Transmission	Ohms
C1-7	SSA	C1-9	4.8 to 5.6
C1-7	SSB	C1-14	4.8 to 5.6
C1-7	SSC	C1-13	4.8 to 5.6
C1-7	SSD	C1-10	4.8 to 5.6
C1-7	SSE	C1-8	17.5 to 18.6
C1-7	LPC solenoid	C1-16	4.8 to 5.6
C1-7	TCC solenoid	C1-3	4.8 to 5.6

• Is the resistance within specifications?

Yes
REFER to Main Control to inspect for stuck valves or debris. If no problems are found, INSTALL suspected solonoid. REFER to Shift Solenoids (SS). CLEAR the DTCs. TEST the system for normal operation.

No
REPLACE the suspected solenoid which failed the resistance check. REFER to Shift Solenoids (SS) in this section. CLEAR the transmission adaptive tables and perform the adaptive drive cycle. REFER to Shift Point Road Test in this section. TEST the system for normal operation.

	Test Step	Result/Action to Take
A 8	**CHECK SOLENOID RESISTANCE**	
	• Remove the molded leadframe from the main control. Refer to Shift Solenoids (SS) in this section. Inspect for metallic contamination and clean the solenoid and molded leadframe terminals. • Measure and record the resistance of the suspected solenoid. For solenoid location, refer to Shift Solenoids (SS) in this section. Compare the recorded value with the chart below. (see chart below) **• Is the solenoid resistance within specification?**	**Yes** INSTALL a new molded leadframe, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. TEST the system for normal operation. **No** REPLACE the suspected solenoid which failed the resistance check. REFER to Shift Solenoids (SS) in this section. CLEAR the transmission adaptive tables and perform the adaptive drive cycle. REFER to Shift Point Road Test in this section. TEST the system for normal operation.

Solenoid	Ohms
SSA	4.8 to 5.6
SSB	4.8 to 5.6
SSC	4.8 to 5.6
SSD	4.8 to 5.6
SSE	17.5 to 18.6
LPC solenoid	4.8 to 5.6
TCC solenoid	4.8 to 5.6

PINPOINT TEST B: TFT SENSOR (For TCU2600)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

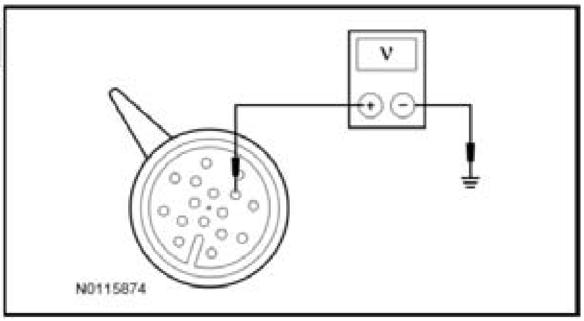
NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

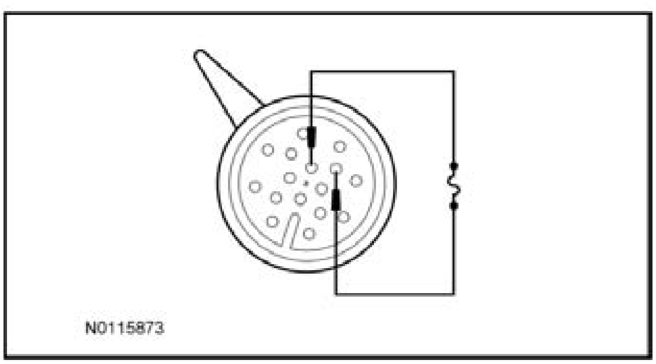
NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
B1	**CHECK TFT INPUT SIGNAL**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1 . • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Connect the laptop and cable. • Ignition ON. • Enter the PCS software and view the TFT value and TFTV . **• Does the TFT PID display -40°C (-40°F) and the TFTV PID display 4.96 to 5.10 volts?**	**Yes** GO to B2. **No** REPAIR vehicle harness circuit (Pin 6 (YELLOW/ORANGE)) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST B: TFT SENSOR (For TCU2600) (Continued)

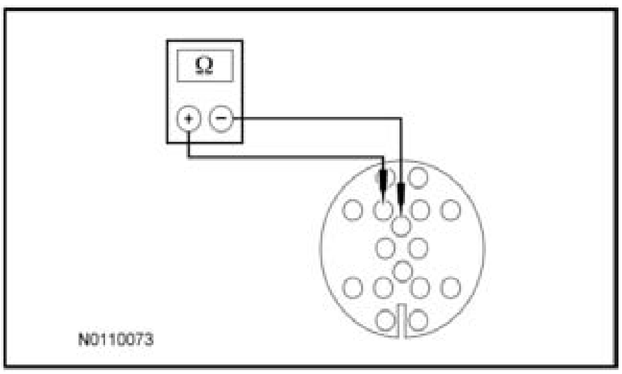
	Test Step	Result/Action to Take
B 2	**CHECK TFT SIGNAL INPUT CIRCUIT FOR VOLTAGE**	
	• Measure the voltage between the transmission vehicle harness C1-6, (Ye/OR), harness side and ground.  **• Is the voltage between 4.8 and 5.1 volts?**	**Yes** GO to B3. **No** INSPECT and REPAIR transmission vehicle harness circuit (YE/OR) for an open. If an open circuit is not found, replace the TCU.

	Test Step	Result/Action to Take
B3	**CHECK TFT SIGNAL RETURN CIRCUIT**	
	•Connect a fused jumper between the transmission vehicle harness C1-5 and C1-6, harness side.  **• Does the TFT PID display 190°-195°C (374°-383°F) and the TFTV** **PID display 0 volts?**	**Yes** GO to B4. **No** INSPECT and REPAIR the transmission vehicle harness signal return circuit for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
B 4	**CHECK TFT SENSOR RESISTANCE**	
	• Measure the resistance between the transmission molded leadframe C1-5 and C1-6, component side using the following chart.	**Yes** REFER to Diagnosis By Symptom in this section to diagnose an overheating concern. **No** INSPECT and CLEAN the TFT sensor on the molded leadframe for metallic contamination. INSTALL a new molded leadframe if no debris was found, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. TEST the system for normal operation.

TRANSMISSION FLUID TEMPERATURE (TFT)

°C	°F	Resistance
-40 to -20	-40 to -4	967K-284K
-19 to -1	-3 to 31	284K-100K
0-20	32-68	100K-37K
21-40	69-104	37K-16K
41-70	105-158	16K-5K
71-90	159-194	5K-2.7K
91-110	195-230	2.7K-1.5K
111-130	231-266	1.5K-0.8K
131-150	267-302	0.8K-0.54K



• **Does the temperature to resistance specifications match?**

PINPOINT TEST C: TR SENSOR (For TCU2600)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
C1	**VERIFY DTCs**	
	• Ignition OFF. • Select PARK. • Connect the laptop and cable. • Carry out the Key ON Engine OFF (KOEO) then the Key ON Engine Running (KOER) test. DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and P1921 cannot be set by an incorrectly adjusted selector lever cable. • Are Transmission Range (TR) sensor DTCs present?	**Yes** GO to C3. **No** GO to C2.

Test Step		Result/Action to Take
C2	**VERIFY SELECTOR LEVER CABLE/LINKAGE ADJUSTMENT**	
	• Verify the selector lever cable is correctly adjusted. • Is the selector lever cable correctly adjusted?	**Yes** GO to C3. **No** ADJUST the selector lever cable.

PINPOINT TEST C: TR SENSOR (For TCU2600) (Continued)

	Test Step	Result/Action to Take
C3	**CHECK TR SENSOR ELECTRICAL OPERATION**	
	• Ignition ON. • Enter the following diagnostic mode on the scan tool: *Communications -> Lightweight Monitor* • Move the selector lever into each range and stop. • Observe the following PIDs: Speed Input Duty and Speed Input Frequnecy while wiggling the harness or driving the vehicle. • Compare the PID: TR_DC to the selector lever position duty cycle, using the following chart.	

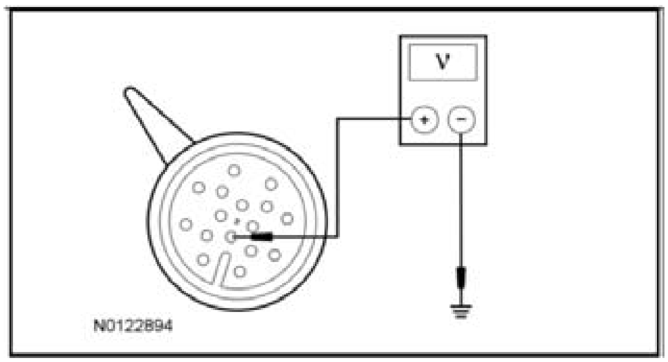
Selector Lever Position	Range (% Duty Cycle)
P	8.0 — 25.8
R	30.50 — 39.31
N	40.54 — 52.49
D	54.35 — 71.15
M	65.15 — 82
2	70.55 — 85.61
1	75.25 — 88.91

• Is the Speed Input Frequency between 100 to 150 Hz?
Is the Speed Input Duty within range?
Does the Speed Input Duty and Speed Input Duty Frequency remain steady when the harness is wiggled or the vehicle driven?

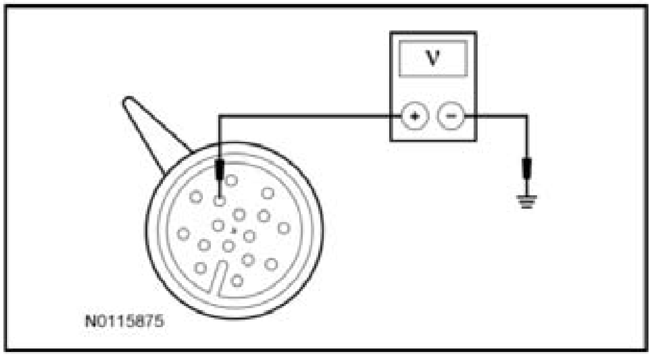
Yes
The problem is not in the TR sensor system. REFER to Diagnosis By Symptom in this section for further diagnosis.

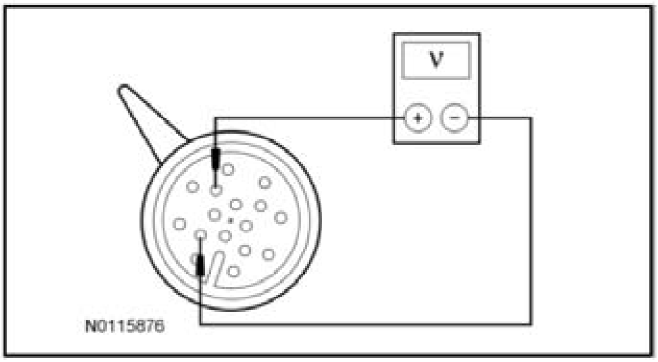
No
GO to C4.

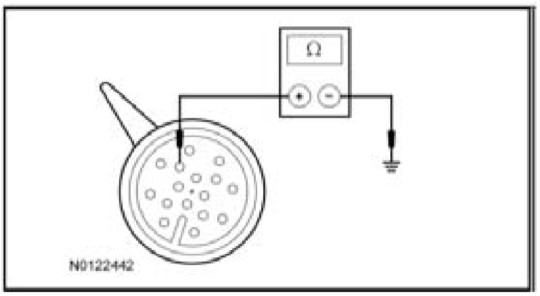
PINPOINT TEST C: TR SENSOR (For TCU2600) (Continued)

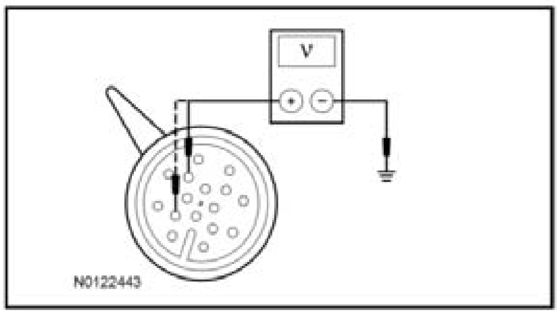
	Test Step	Result/Action to Take
C 4	**CHECK TR SENSOR VPWR CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1 . • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-12, (RD/WHT) harness side and ground.  **• Is the voltage less than 9.5 volts?**	**Yes** INSPECT and REPAIR the transmission vehicle harness circuit (RD/WHT) for an open. If an open circuit is not found, REPLACE the TCU. **No** GO to C5.

PINPOINT TEST C: TR SENSOR (For TCU2600) (Continued)

	Test Step	Result/Action to Take
C5	**CHECK TR SENSOR SIGNAL CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-4, circuit (OR/Lt Gn) harness side and ground.  **• Is the voltage greater than 4.8 volts?**	**Yes** GO to C6. **No** INSPECT and REPAIR vehicle harness circuit (OR/BLK) for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
C 6	**CHECK TR SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-4 circuit (OR/Lt Gn) and C1-11 circuit (BLK/WH).  **• Is the voltage greater than 4.8 volts?**	**Yes** GO to C7. **No** INSPECT and REPAIR transmission vehicle harness circuit (BLK/WH) for an open. If an open circuit is not found, REPLACE the TCU.

	Test Step	Result/Action to Take
C 7	**CHECK TR SENSOR POWER CIRCUIT FOR A SHORT TO GROUND**	
	• Ignition OFF. • Disconnect: C1 connector • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-4 circuit (OR/Lt Gn) and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to C8. **No** REPAIR transmission vehicle harness (OR/BLK) for a short to ground. CLEAR the DTCs. TEST the system for normal operation.

<table>
<tr><th colspan="2">Test Step</th><th>Result/Action to Take</th></tr>
<tr><td>C
8</td><td>CHECK TR SENSOR POWER CIRCUITS FOR A SHORT TO POWER</td><td></td></tr>
<tr><td></td><td>• Connect: All connectors except the C1 connector
• Ignition ON.
• Measure the voltage between the transmission vehicle harness
C1-4, circuit (OR/Lt Grn) and C1-11, circuit (BLK/WH) to ground.


• Is voltage greater than 9.8 volts?</td><td>Yes
REPAIR the transmission vehicle harness circuit which
measured greater than 9.8 volts. CLEAR the DTCs.
TEST the system for normal operation.
No
GO to C9.</td></tr>
</table>

	Test Step	Result/Action to Take
C9	**CHECK TR SENSOR TO MANUAL VALVE**	
	• Drain the transmission fluid and remove the transmission fluid pan. Refer to Fluid Pan, Gasket and Filter in this section. • Check the connection between the TR sensor and the manual control valve. Refer to Transmission in this section. • Inspect the molded leadframe for metallic contamination, refer to Shift Solenoids (SS). **• Is the TR sensor connected to the manual control valve shaft?**	**Yes** REPLACE molded leadframe. REFER to Shift Solenoids in this section. **No** CONNECT the TR sensor to the manual control valve, REFER to Transmission in this section. CLEAN any debris from the molded leadframe. RUN the Key ON Engine OFF (KOEO) self-test. If DTCs return, REPLACE the molded leadframe, REFER to Shift Solenoids (SS) in this section.

PINPOINT TEST D: TSS SENSOR (For TCU2600)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

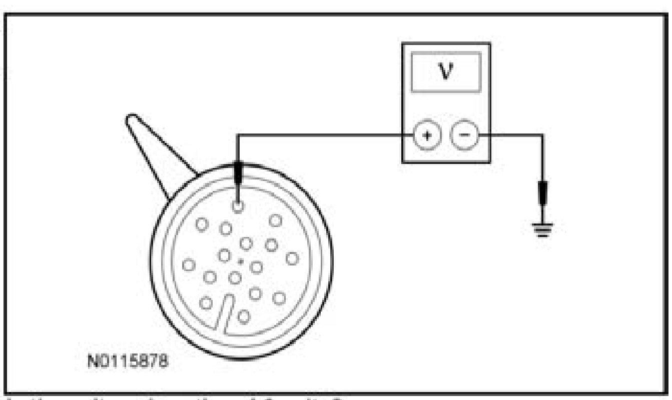
NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

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

PINPOINT TEST D: TSS SENSOR (For TCU2600) (Continued)

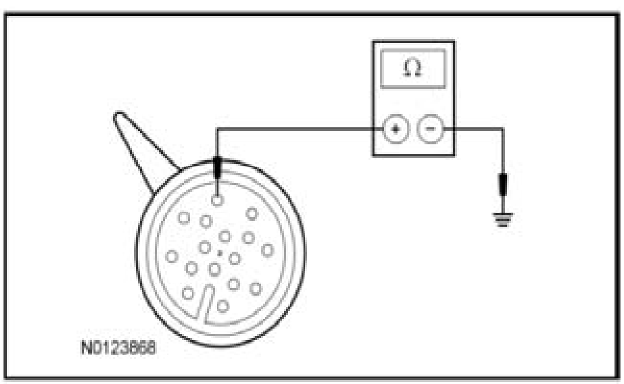
NOTE:
Read and record all DTCs.

Test Step		Result/Action to Take
D1	**DRIVE CYCLE TEST**	
	• Connect the laptop and cable. • Enter the TCU monitor: • Monitor the TSS_SRC PID while road testing the vehicle. Drive the vehicle so the transmission upshifts and downshifts through all the gears. **• Does the TSS sensor rpm increase and decrease with engine** **rpm and vehicle speed?** *For TSS sensor reading go* *into TCU software monitor* *and view Turbine speed.*	**Yes** REFER to Shift Point Road Test in this section for further diagnosis. **No** GO to D2.

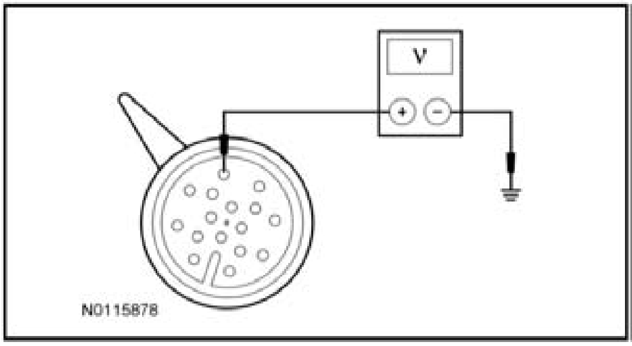
Test Step		Result/Action to Take
D2	**CHECK TSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-1 and ground.  **• Is the voltage less than 4.8 volts?**	**Yes** GO to D3. **No** GO to D6.

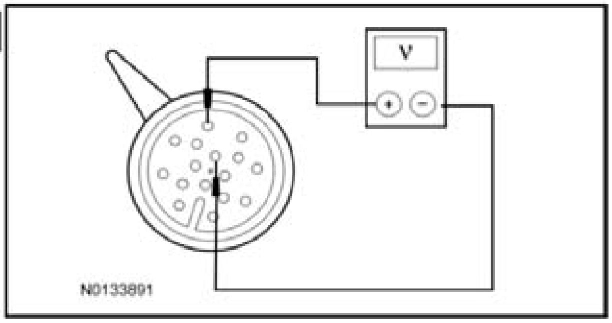
PINPOINT TEST D: TSS SENSOR (For TCU2600) (Continued)

Test Step		Result/Action to Take
D3	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR AN OPEN**	
	• Ignition OFF. • Disconnect: TCU harness • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-1 circuit (OR/Rd) and TCU-25 • Is the resistance less than 5 ohms?	**Yes** GO to D4. **No** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for an open. If an open circuit is not found, REPLACE the TCU.

Test Step		Result/Action to Take
D 4	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance between the transmission vehicle harness C1-1 and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to D5. **No** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for a short to ground. If a short to ground is not found, REPLACE the TCU.

PINPOINT TEST D: TSS SENSOR (For TCU2600) (Continued)

	Test Step	Result/Action to Take
D5	**CHECK THE TSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER**	
	• Connect: All items except transmission C1 connector. • Ignition ON. • Measure for voltage between the transmission vehicle harness C1-1, and ground.  **• Is voltage greater than 5.1 volts?**	**Yes** INSPECT and REPAIR transmission vehicle harness TSS signal circuit for a short to power. If a short to power is not found, REPLACE the TCU. **No** GO to D6.

Test Step		Result/Action to Take
D6	**CHECK THE TSS SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-1 and C1-5.  • Is voltage less than 4.8 volts?	**Yes** REPAIR the transmission vehicle harness signal return circuit for an open. If an open is not found, REPLACE the TCU. TEST the system for normal operation. **No** REPLACE the molded leadframe, REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. TEST the system for normal operation.

PINPOINT TEST E: OSS SENSOR (For TCU2600)

NOTE:
Refer to the Transmission Vehicle Harness Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
Refer to the Transmission Leadframe Connector illustration within the Transmission Connector Layouts procedure in this section.

NOTE:
If the scan tool is unable to access the transmission PIDs, refer to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

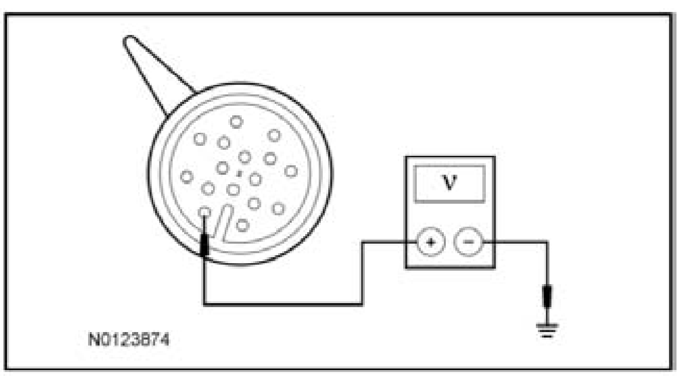
NOTE:
Always drive the vehicle in a safe manner according to driving conditions and obey all traffic laws.

NOTE:
Read and record all DTCs.

NOTE:
If DTCs P0705, P0706, P0707, P0708, P0709, P1702, P1705 and/or P1921 are set, diagnose those DTCs first.

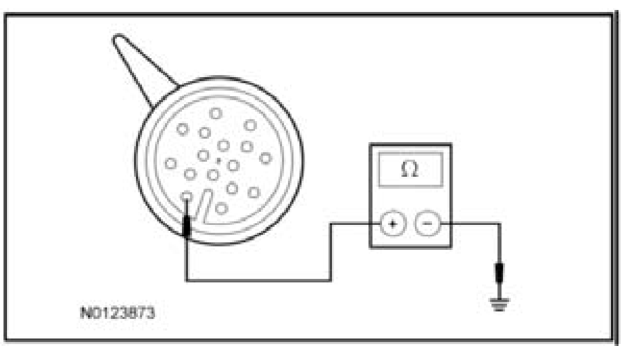
PINPOINT TEST E: OSS SENSOR (For TCU2600) (Continued)

Test Step		Result/Action to Take
E1	**DRIVE TEST CYCLE**	
	• Connect the laptop and cable. • Enter the TCU monitor: • Monitor the Output Shaft Speed (OSS) sensor PID while road testing the vehicle. Drive the vehicle so the transmission upshifts and downshifts through all the gears. **• Does the OSS sensor rpm increase and decrease with engine rpm and vehicle speed?** *For OSS sensor reading go into TCU software monitor and view driveshaft RPM*	**Yes** REFER to Shift Point Road Test in this section for further diagnosis. **No** GO to E2.

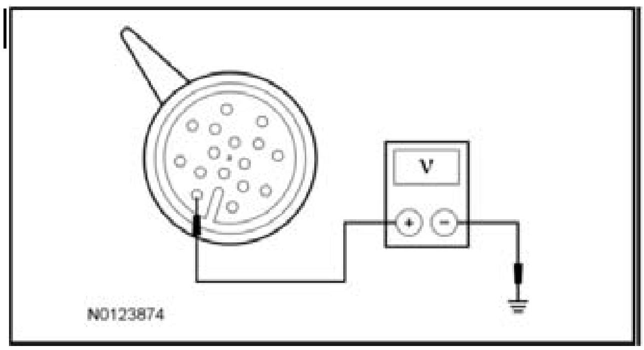
Test Step		Result/Action to Take
E2	**CHECK OSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: Transmission Vehicle Harness C1. • Ignition ON. • Measure the voltage between the transmission vehicle harness C1-15 and ground.  • Is the voltage less than 4.8 volts?	**Yes** GO to E3. **No** GO to E6.

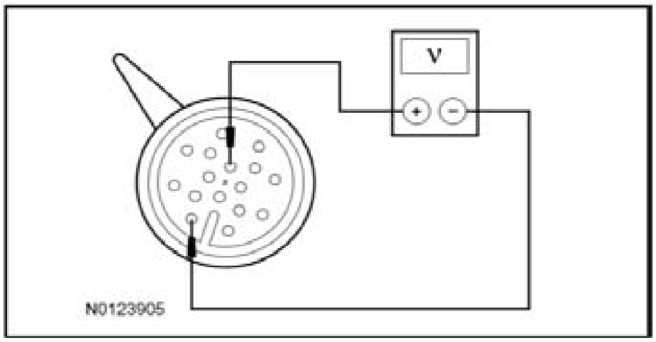
PINPOINT TEST E: OSS SENSOR (For TCU2600) (Continued)

	Test Step	Result/Action to Take
E3	**CHECK OSS SENSOR SIGNAL CIRCUIT FOR POWER**	
	• Ignition OFF. • Disconnect: TCU harness • Inspect the connector for damaged or pushed out terminals, corrosion, loose wires and missing or damaged seals. • Measure the resistance between the transmission vehicle harness C1-15 circuit (OR/BLK) and TCU-24 **• Is the resistance less than 5 ohms?**	**Yes** GO to E4. **No** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for an open. If an open circuit is not found, REPLACE the TCU. Test in normal operation.

	Test Step	Result/Action to Take
E4	**CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO GROUND**	
	• Measure the resistance between the transmission vehicle harness C1-15 and ground.  **• Is the resistance greater than 10,000 ohms?**	**Yes** GO to E5. **No** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for a short to ground. If a short to ground is not found, REPLACE the TCU.

PINPOINT TEST E: OSS SENSOR (For TCU2600) (Continued)

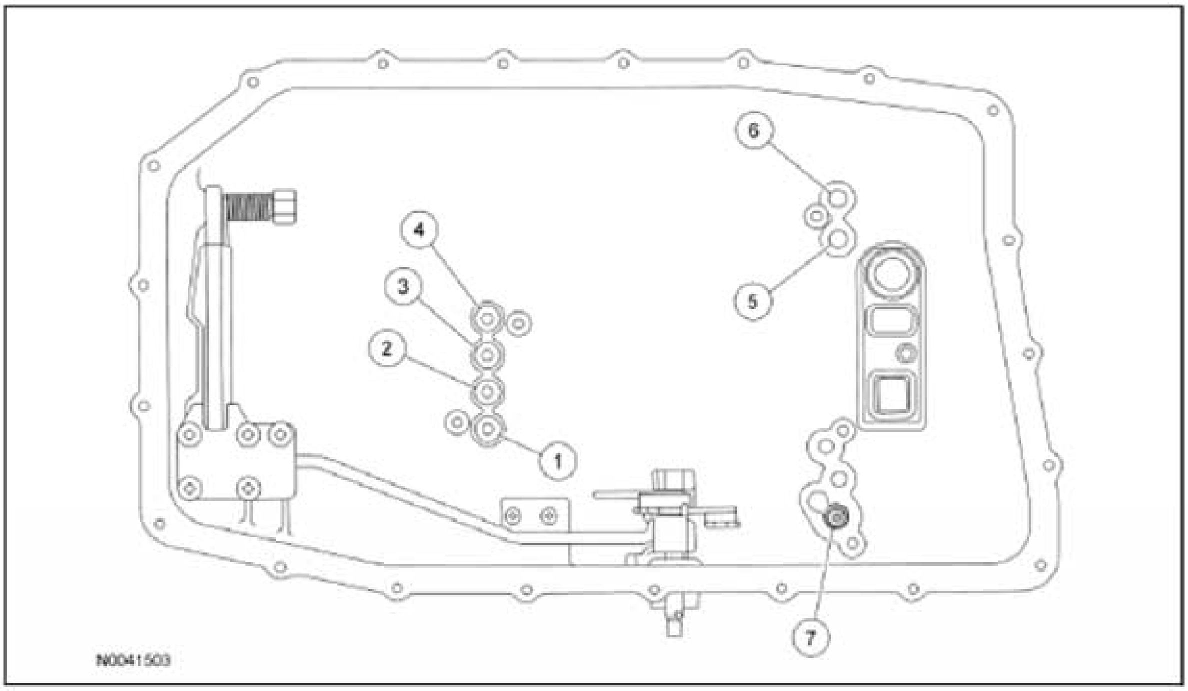
	Test Step	Result/Action to Take
E5	**CHECK THE OSS SENSOR SIGNAL CIRCUIT FOR A SHORT TO POWER**	
	• Connect: All items except transmission C1 connector. • Ignition ON. • Measure for voltage between the transmission vehicle harness C1-15, and ground.  **• Is voltage greater than 5.1 volts?**	**Yes** INSPECT and REPAIR transmission vehicle harness OSS signal circuit for a short to power. If a short to power is not found, REPLACE the TCU. Test the system for normal operation. **No** GO to E6.

Test Step		Result/Action to Take
E6	**CHECK THE OSS SENSOR GROUND CIRCUIT**	
	• Measure the voltage between the transmission vehicle harness C1-15 and C1-5.  **• Is voltage less than 4.8 volts?**	**Yes** REPAIR the transmission vehicle harness signal return circuit for an open. If an open is not found, REPLACE the TCU. TEST the system for normal operation. **No** REPLACE the molded leadframe, REFER to Main Control in this section. CLEAR the DTCs. TEST the system for normal operation.

Special Testing Procedures

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

Air Pressure Test



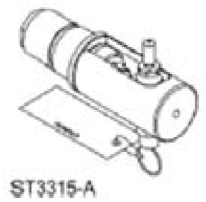
Item	Description
1	Intermediate clutch (C) port
2	Low/reverse clutch (D1) port
3	Not used
4	Direct clutch (B) port
5	Overdrive clutch (E) port
6	Forward clutch (A) port
7	Thermal bypass valve

A no-drive condition can exist with correct transmission fluid pressure because of inoperative clutches. Refer to the 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 selector lever is in a forward gear range, a no-drive condition may be caused by an inoperative clutch.

1. Drain the transmission fluid. Remove the transmission fluid pan.
2. Remove the transmission fluid filter, seal assembly and mechatronic unit.
3. Locate the inoperative clutches by applying air pressure into the appropriate clutch port.
4. Apply air pressure to the appropriate clutch port. 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 sound may be heard.
5. If the clutches fail to operate during the air check:
    - the piston seals are not seated, damaged or installed incorrectly.
    - plugged feed holes for clutch apply in the case and/or clutch cylinder
    - damaged piston and/or clutch cylinder.
6. Service as required and recheck.

Leakage Inspection
Special Tool(s)

	Leak Tester, Torque Converter 307-691

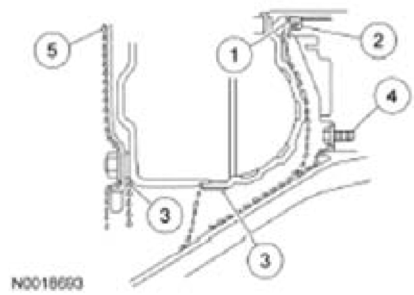
Material

Item	Specification
Dye-Lite® ATF/Power Steering Fluid Leak Detection Dye 164-R3701 (Rotunda)	—

Leak Check Test

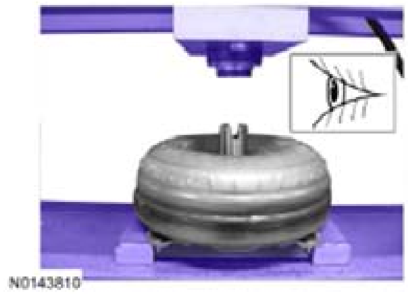
NOTE:
When diagnosing transmission leaks, the source of the leak must be positively identified prior to repair. If the vehicle is driven extensively between adding the fluorescent additive and performing the leak test, the leaking oil can spread and make identifying the location of the leak difficult.

1. Clean off any transmission fluid from the top and bottom of the torque converter housing, the front of the case and rear face of the engine and oil pan. Clean the torque converter area by washing with a nonflammable solvent and blow dry with compressed air.
2. Add Dye-Lite® ATF Power Steering Fluid Leak Detection Dye to the transmission fluid. Use one 30 ml (1 fl. oz) of dye solution for every 3.8 L (4 qt) of transmission fluid.
3. Start and run the engine until the transmission reaches its normal operating temperature. Raise the vehicle on a hoist and run the engine occasionally shifting to the DRIVE and REVERSE ranges to increase pressure within the transmission. Using a black light, observe the back of the cylinder block and top of the torque converter housing for evidence of fluid leakage. Run the engine until transmission fluid leakage is evident and the probable source of leakage can be determined.

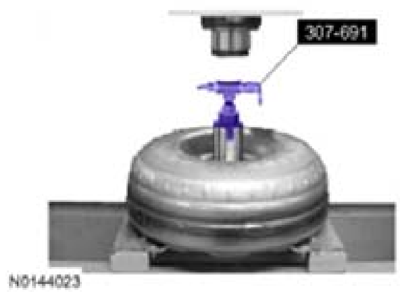


4. If the source of the leak is obvious, repair as required. Leaks from the torque converter housing can originate from several locations. The paths which the fluid takes to reach the bottom of the torque converter housing are shown in the illustration. The 5 steps following correspond with the numbers in the illustration.
    1. Transmission fluid leaking by the converter hub seal lip will tend to move along the drive hub and onto the back of the torque converter. Except in the case of a total seal failure, transmission fluid leakage by the lip of the seal will be deposited on the inside of the torque converter housing only, near the outside diameter of the housing
    2. Transmission fluid leakage by the outside diameter of the converter impeller hub seal and the case will follow the same path that leaks by the ID of the converter hub seal follow
    3. Transmission fluid leakage from the converter cover weld or the converter-to-flexplate stud weld will appear at outside diameter of torque converter on the back face of the flexplate and in the converter housing only near the flexplate. If a converter-to-flexplate lug, lug weld or converter cover weld leak is suspected, remove the converter and pressure check.
    4. Transmission fluid leakage from the bolts inside the converter housing will flow down the back of the torque converter housing. Leakage may be from loose or missing bolts.
    5. Engine oil leaks from the rear main oil.

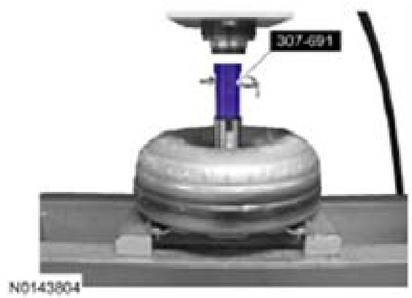
5. Remove the torque converter.
6. Using a black light, observe the torque converter housing. Inspect for evidence of dye from the pump bolts, pump seal, and torque converter hub seal.
   Repair as required
7. If the source of the leak is not evident, continue with this procedure to leak test the torque converter.
8. Install the torque converter in the arbor press. Support the torque converter on the mounting pads.



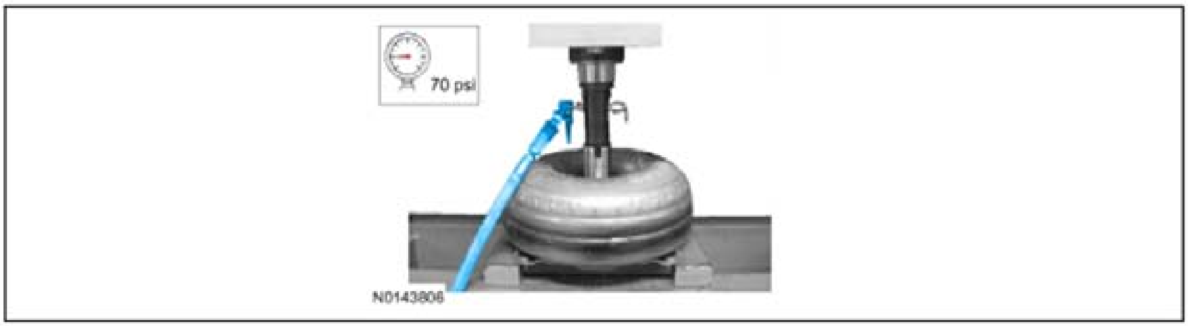
9. Install the Leak Tester, Torque Converter 307-691 into the torque converter hub. Tighten to 25 Nm.



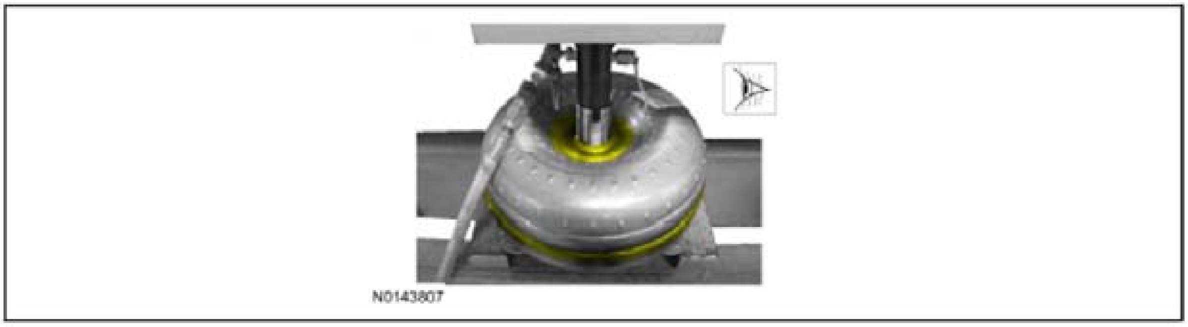
10. Secure the press. Only apply enough force from the press to seal the Leak Tester, Torque Converter 307-691 into the torque converter hub.



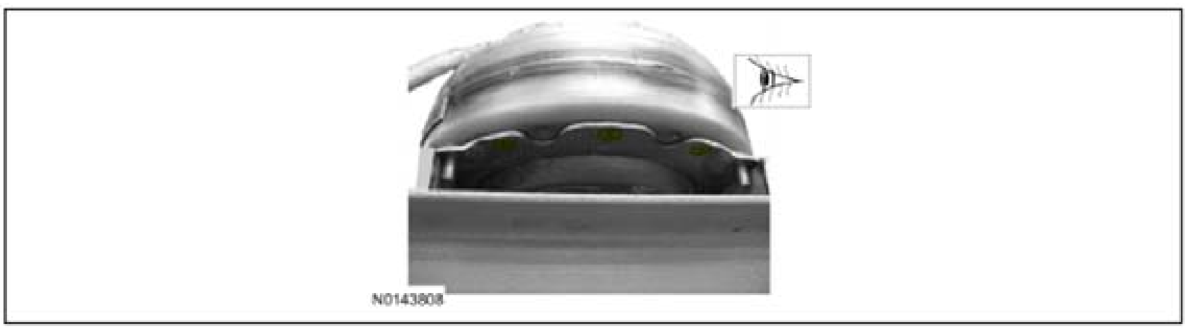
11. Connect a compressed air supply to the Leak Tester, Torque Converter 307-691.



12. With air pressure applied to valve, inspect for leaks at the converter hub weld and seams. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



13. With air pressure applied to valve, inspect for leaks at the stud or mounting pad and balance weight welds. A soap bubble solution can be applied around those areas to aid in the diagnosis. If any leaks are present, install a new torque converter.



14. After leaks are repaired, clean the remaining transmission fluid dye from serviced areas.

Diagnosis By Symptom

The Diagnosis by Symptom gives the technician diagnostic information and direction, and 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 the symptom described.

Diagnosis by Symptom Chart Directions

1. Using the Diagnosis by Symptom, select the condition 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:
    1. preliminary inspections.
    2. verifications of condition.
    3. checking the fluid levels.
    4. carrying out other test procedures as directed.

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

NOTE:
When the battery is disconnected or a new battery is installed, certain transmission operating parameters can be lost. The PCM must relearn these parameters. During this learning process, the vehicle may exhibit slightly firm shifts, delayed or early shifts. This operation is considered normal and will not affect the function of the transmission. Normal operation will return once these parameters are stored by the PCM.

Begin Diagnosis by Symptoms with the Routines, if indicated. Follow the reference or action required statements. Always perform the self-tests as required. Never skip steps. Repair as required. If the concern is still present after electrical diagnosis, proceed to the Hydraulic/Mechanical Routine 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 that repairs are complete.

Diagnosis by Symptom Index

Title	Routines
Engagement Concerns	
No Forward in D	201
No Reverse	202
Harsh Reverse	203
Harsh Forward	204
Delayed/Soft Reverse	205
Delayed/Soft Forward	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 — Early/Late	211
Timing — Erratic/Hunting	212
Feel Concerns	
Soft/Slipping (some or all)	213
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No 1st Gear, Engages in Higher Gear	215
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No Manual 3rd Gear	218
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No 2-3 Shift (Automatic)	221
No 3-4 Shift (Automatic)	222
No 4-5 Shift (Automatic)	270
No 5-6 Shift (Automatic)	272
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No 4-3 Shift (Automatic)	223
No 3-2 Shift (Automatic)	224
No 2-1 Shift (Automatic)	225
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No Apply	240
Cycling/Chatter	241

Diagnosis by Symptom Index (Continued)

Diagnostic Routines

Engagement Concerns: No Forward in D

Possible Component	Reference/Action
201 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid filter and seal assembly — plugged, damaged	• INSTALL a new filter assembly.
Selector Lever Linkage	
• Selector lever linkage — damage or incorrectly adjusted	• INSPECT and REPAIR as required. VERIFY transmission selector lever cable adjustment. REFER to Section 307-05. ADJUST transmission selector lever cable as necessary.
Powertrain Control System	
• PCM, external vehicle harness, main control molded leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the SSA terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control	
• Defective manual valve	• INSPECT manual valve linkage.
• Defective clutch (A) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.
Pump	
• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Engagement Concerns: No Reverse

Possible Component	Reference/Action
202 — ROUTINE	
Transmission Fluid	

Engagement Concerns: No Reverse (Continued)

Possible Component	Reference/Action
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Powertrain Control System • PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control • Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates • Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
Pump • Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Engagement Concerns: Harsh Reverse

Possible Component	Reference/Action
203 — ROUTINE	
Transmission Fluid • Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Driveline • Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• REPAIR as required.
Powertrain Control System • PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control • Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates • Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

.

Engagement Concerns: Harsh Forward

Possible Component	Reference/Action
204 — ROUTINE	
Transmission Fluid • Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Driveline • Engine driveline looseness in the driveshaft, U-joints or the engine mounts	• REPAIR as required.
Powertrain Control System	

Engagement Concerns: Harsh Forward (Continued)

Possible Component	Reference/Action
• PCM, external vehicle harness, main control leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control	
• Defective clutch (A) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (A) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (A) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.

Engagement Concerns: Delayed/Soft Reverse

Possible Component	Reference/Action
205 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid filter and seal assembly — plugged, damaged	• INSTALL a new filter assembly.
Powertrain Control System	
• PCM, external vehicle harness, main control leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control	
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

Engagement Concerns: Delayed/Soft Forward

Possible Component	Reference/Action
206 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid filter and seal assembly — plugged, damaged	• INSTALL a new filter assembly.
Powertrain Control System	
• PCM, external vehicle harness, main control leadframe or a defective Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. INSPECT and CLEAN the shift solenoid terminals on the mechatronic leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control	
• Defective clutch (A) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.

Engagement Concerns: Delayed/Soft Forward (Continued)

Possible Component	Reference/Action
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.

Engagement Concerns: No Forward and No Reverse

Possible Component	Reference/Action
207 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Selector Lever Linkage (Internal/External)	
• Damaged, out of adjustment	• INSPECT for damage, repair as required.
Transmission Filter and Seal Assembly	
• Not seated, damaged or plugged	• INSPECT for position, damage and restriction. INSTALL a new filter and seal assembly. .
• Pump adapter Seal	• INSPECT for crack or damage. INSTALL new as required.
Main Controls	
• Manual Valve	• INSPECT for damage. Replace as required.
• Mounting bolt torque	• INSPECT for loose main control to transmission bolts. Tighten to specification.
• Solenoid Pressure Regulator Valve	• INSPECT for valve stuck in spring compressed position or broken spring. CLEAN or REPLACE main control as required. Main Control
Pump Assembly	
• Gear	• INSPECT for damage. REPLACE as required.
• Sun gear hub/splines	• INSPECT for damage. REPLACE as required.
Other Possible Components	
• Turbine shaft	• INSPECT for damage. REPAIR as required.
• Front planetary gear set	• INSPECT for damage. REPAIR as required.
• Forward clutch drum	• INSPECT for damage. REPAIR as required.
• Output shaft/ring gear	• INSPECT for damage. REPAIR as required.

Engagement Concerns: Harsh Forward and Harsh Reverse

Possible Component	Reference/Action
208 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid filter and seal assembly — plugged, damaged	• INSTALL a new filter assembly.
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe, Transmission Range (TR) sensor, Shift Solenoid A (SSA) or Line Pressure Control (LPC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.

Engagement Concerns: Harsh Forward and Harsh Reverse (Continued)

Possible Component	Reference/Action
• Multiple shift missing (more than one gear)	• If some shifts are missing, DETERMINE which shifts do not occur. REFER to Clutch and Solenoid Application Charts in this section. MONITOR appropriate PIDs as listed in Diagnostic Parameters Identification (PID) Chart. REFER to Routine 210.
• Gears 4-6 default to 5th gear and gears 1-3 default to 3rd gear	• RETRIEVE DTCs.

Engagement Concerns: Delayed Forward and Delayed Reverse

Possible Component	Reference/Action
209 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly.
Powertrain Control System	
• PCM, external vehicle wiring harnesses or molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. INSPECT and CLEAN the shift solenoid terminals on the molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
Main Control	
• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.

Shift Concerns: Some/All Shifts Missing

Possible Component	Reference/Action
210 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Selector Lever Linkage Damaged or Incorrectly Adjusted	
• Selector lever cable	• INSPECT and REPAIR as required. VERIFY selector lever cable adjustment. REFER to Section 307-05. ADJUST selector lever cable as necessary.
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe, Transmission Range (TR) sensor, Shift Solenoid A (SSA) or Line Pressure Control (LPC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
• Multiple shift missing (more than one gear)	• If some shifts are missing, DETERMINE which shifts do not occur. REFER to clutch and solenoid application charts in this section. MONITOR appropriate PIDs as listed in Diagnostic Parameters Identification (PID) Chart.
Main Control	
• Leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (A) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (A) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.

Shift Concerns: Some/All Shifts Missing (Continued)

Possible Component	Reference/Action
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (E) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (E) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure or Low One-Way Clutch (OWC) assembly — failure	• For 1st, 2nd, 3rd or 4th gear concerns, INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section. For the One-Way Clutch (OWC), INSPECT for damage. One-Way Clutch (OWC) must rotate counterclockwise and lock clockwise. REFER to Transmission in this section.
• Direct clutch (B) friction and steel plate — failure	• For 3rd or 5th gear concerns, INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• For 2nd or 6th gear concerns, INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
• Overdrive clutch (E) assembly — failure	• For 4th, 5th or 6th gear concerns, INSPECT the overdrive clutch for damage. REPLACE the overdrive clutch. REFER to Overdrive Clutch Assembly in this section.

Shift Concerns: Timing — Early/Late

Possible Component	Reference/Action
211 — ROUTINE	
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses or main control molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section.
• Engine driveability concerns	• REFER to Section 303-00.
Main Control	
• Bolts not tightened to specification	• TIGHTEN to specification.
• Main control unit contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• REFER to Main Control in this section.
Incorrect Pressures	
• Application pressures are incorrect	• Incorrect application pressures may be due to non-transmission components, main control assembly or internal transmission damage. REPAIR all non-transmission components then continue with this routine.
Other	
• Tire size change, axle ratio change	• VERIFY the vehicle has the original equipment. REFER to the certification label. Changes in tire size and axle ratio will affect shift timing.

Shift Concerns: Timing — Erratic/Hunting

Possible Component	Reference/Action
212 — ROUTINE	
Transmission Fluid	

Shift Concerns: Timing — Erratic/Hunting (Continued)

Possible Component	Reference/Action
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Condition	• CARRY OUT the fluid level check in Transmission Fluid Level Check in this section.
• Transmission fluid over temperature condition	• REFER to Routine 257 Transmission Overheating.
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses or main control leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If engine control DTCs return, REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
Torque Converter Concerns	
• Torque converter	• REFER to torque converter operation concern: Cycling/Chatter.

Feel Concerns: Soft/Slipping (Some or All)

Possible Component	Reference/Action
213 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe or Transmission Fluid Temperature (TFT) sensor.	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test B.
Main Control	
• Main control molded leadframe	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Front pump adapter seal — cracked, leaking or damaged	• INSTALL a new front pump adapter seal.
• Bolts not tightened to specification	• TIGHTEN to specification.
• Main control contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stick or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to Main Control in this section.

Feel Concerns: Harsh (Some or All)

Possible Component	Reference/Action
214 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM electrical inputs/outputs, external vehicle wiring harnesses, main control molded leadframe or solenoid body information does not match PCM information	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If solenoid body and PCM information does not match, REPROGRAM the PCM with the latest calibration. PERFORM the Solenoid Body Strategy Data

Feel Concerns: Harsh (Some or All) (Continued)

Possible Component	Reference/Action
	Download. REFER to Solenoid Body Strategy in this section. PERFORM Road Test — Adaptive Drive Cycle. REFER to Shift Point Road Test in this section. ROAD TEST and CHECK for DTCs.
Main Control	
• Bolts not tightened to specification	• TIGHTEN bolts to specification.
• Main control contaminated, solenoid(s) damaged, solenoids stuck or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to Main Control in this section.
• Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, INSTALL a new main control assembly. REFER to Main Control in this section.

Feel Concerns: No 1st Gear, Engages in a Higher Gear

Possible Component	Reference/Action
215 — ROUTINE	
Powertrain Control System	
• PCM, external vehicle wiring harnesses or main control molded leadframe	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs.
Clutch Plates	
• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.
Incorrect Gear	
• Transmission failure	• DETERMINE which gear the transmission is in. REFER to the Clutch and Solenoid Application Charts in this section.

Feel Concerns: No Manual 1st Gear

Possible Component	Reference/Action
216 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Selector Lever Linkage	
• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to Section 307-05.
Powertrain Control System	
• PCM, external vehicle harness, main control molded leadframe or Shift Solenoid A (SSA).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and Manual for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination., REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.

Feel Concerns: No Manual 1st Gear (Continued)

Possible Component	Reference/Action
• Low One-Way Clutch (OWC) assembly — failure	• If no 1st gear above 3 mph, INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.
Pump	
• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 2nd Gear

Possible Component	Reference/Action
217 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly.
Selector Lever Linkage	
• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to Section 307-05.
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe or Shift Solenoid A (SSA)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
Pump	
• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No Manual 3rd Gear

Possible Component	Reference/Action
218 — ROUTINE	
Selector Lever Linkage	
• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. VERIFY selector lever cable adjustment. REFER to Section 307-05.
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe or Shift Solenoid B (SSB).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control leadframe for metallic contamination. REFER to Shift

Feel Concerns: No Manual 3rd Gear (Continued)

Possible Component	Reference/Action
	Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
Pump	
• Pump gear — failure	• INSTALL a new pump assembly. REFER to Pump Assembly in this section.

Feel Concerns: No 1-2 Shift

Possible Component	Reference/Action
220 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid C (SSC) or Shift Solenoid D (SSD).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.

Feel Concerns: No 2-3 Shift

Possible Component	Reference/Action
221 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.

Feel Concerns: No 2-3 Shift (Continued)

Possible Component	Reference/Action
• Transmission fluid filter and seal assembly — plugged, damaged	• INSTALL a new transmission fluid filter assembly. REFER to Fluid Pan, Gasket and Filter in this section.
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 3-4 Shift

Possible Component	Reference/Action
222 — ROUTINE	
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB), Shift Solenoid D (SSD) or Shift Solenoid E (SSE).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (E) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective solenoid multiplex valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Overdrive clutch (E) friction and steel plate — failure	• INSPECT the overdrive clutch assembly for damage. REPAIR as required. REFER to Overdrive Clutch Assembly in this section.

Feel Concerns: No 4-3 Shift

Possible Component	Reference/Action
223 — ROUTINE	
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid D (SSD).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (E) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (E) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Solenoid multiplex valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Drive enable valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Overdrive clutch (E) friction and steel plate — failure	• INSPECT the overdrive clutch assembly for damage. REPAIR as required. REFER to Overdrive Clutch Assembly in this section.

Feel Concerns: No 3-2 Shift

Possible Component	Reference/Action
224 — ROUTINE	
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 2-1 Shift

Possible Component	Reference/Action
225 — ROUTINE	
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe or Shift Solenoid C (SSC).	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (C) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Low/reverse clutch (D) friction and steel plate — failure	• INSPECT the low/reverse clutch assembly for damage. REPAIR as required. REFER to Low/Reverse Clutch Assembly in this section.
• Low One-Way Clutch (OWC) assembly — failure	• INSPECT the OWC assembly for damage. The OWC must rotate counterclockwise and lock clockwise. REPLACE the OWC. REFER to Transmission in this section.

Torque Converter Operation Concerns: No Apply

Possible Component	Reference/Action
240 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid condition	• CHECK transmission fluid condition. REFER to Preliminary Inspection in this section.
Powertrain Control System	
• PCM, external vehicle wiring harnesses, main control molded leadframe or Torque Converter Clutch (TCC) solenoid.	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the TCC solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.
• Defective torque converter apply regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective torque converter release regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Cycling/Chatter

Possible Component	Reference/Action
241 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid condition	• CHECK transmission fluid condition. REFER to Preliminary Inspection in this section.
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A for TCC solenoid diagnosis and GO to Pinpoint Test B for TFT sensor diagnosis.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the TCC solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A to diagnosis the Torque Converter Clutch (TCC) or GO to Pinpoint Test B to diagnosis the Transmission Fluid Temperature (TFT) sensor.
• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.
• Defective torque converter apply regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Torque Converter Operation Concerns: Always Applied/Stalls Vehicle

Possible Component	Reference/Action
242 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid condition	• CHECK transmission fluid condition. REFER to Preliminary Inspection in this section.
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A for TCC solenoid diagnosis and GO to Pinpoint Test B for TFT sensor diagnosis.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the TCC solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A to diagnosis the Torque Converter Clutch (TCC) or GO to Pinpoint Test B to diagnosis the Transmission Fluid Temperature (TFT) sensor.
• Main control assembly contaminated, solenoid(s) damaged, stuck or bore damaged. Manual valve damaged, stuck or bore damaged	• INSPECT for damage. If damaged, install a new main control assembly. REFER to Main Control in this section.

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Torque Converter Operation Concerns: Always Applied/Stalls Vehicle (Continued)

Possible Component	Reference/Action
• Main control assembly bolts — not tightened to specification	• TIGHTEN to specification.
Torque Converter	
• Torque converter components	• REMOVE the transmission. INSPECT for damage. INSTALL a new or remanufactured torque converter. REFER to Transmission — Four Wheel Drive (4WD) or Transmission — Rear Wheel Drive (RWD) in this section.

Other Concerns: External Leaks

Possible Component	Reference/Action
252 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Transmission case vent — damaged, case porosity	• REPAIR as necessary.
• Leakage at gaskets, seals, electrical connector	• REFER to Leakage Inspection, Fluid Leakage in Torque Converter Area and Leak Check Test with A Black Light in this section. REMOVE all traces of lubricant on exposed surface of the transmission. REPAIR as necessary.
Fluid Cooler Tubes	
• Cooler tube fittings	• LOCATE leak source. REPAIR as required. REFER to Section 307-02.
• Cooler tube O-rings, cooler tubes	• LOCATE leak source. REPAIR as required. REFER to Section 307-02.
Torque Converter	
• Torque converter studs	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
• Torque converter hub seal	• INSTALL a new torque converter hub seal.
• Torque converter weld	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
Transmission Case	
• Case — leaking	• INSTALL a new transmission case. REFER to Transmission in this section.
• Transmission vehicle harness connector	• INSTALL a new transmission vehicle harness connector O-ring.
• Transmission fluid fill plug	• INSTALL a new transmission fluid fill plug.
• Output shaft seal	• INSTALL a new seal. REFER to Output Shaft Seal in this section.
• Manual control lever seal	• INSTALL a new seal.
• Transmission fluid pan gasket	• INSTALL a new gasket.
Fluid Pump	
• Fluid pump O-ring	• INSTALL a new O-ring. REFER to Pump Assembly in this section.
• Fluid pump seal ring	• INSTALL a new seal ring. REFER to Pump Assembly in this section.

NOTE:
NVH symptoms should be identified using the diagnostic tools that are available. For a list of these tools, an explanation of their uses and a glossary of common terms, refer to Section 100-04. Since it is possible any one of multiple systems may be the cause of a symptom, it may be necessary to use a process of elimination type of diagnostic approach to pinpoint the responsible system. If this is not the causal system for the symptom, refer back to Section 100-04 for the next likely system and continue diagnosis.

Other Concerns: Noise/Vibration in Forward or Reverse

Possible Component	Reference/Action
254 — ROUTINE	
Transmission Fluid	
• Incorrect level (low) pump cavitation	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Fluid Cooler Tubes	
• Cooler tubes grounding out	• ADJUST or REPOSITION cooler tubes.
Torque Converter	
• Check the torque converter components/balance weight	• LOCATE source of disturbance. REPAIR as required. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
Engine Driveline	
• Engine drive accessories	• REFER to Section 303-00.

Other Concerns: Engine Will Not Crank

Possible Component	Reference/Action
255 — ROUTINE	
Selector Lever Cable System	
• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. REFER to Section 307-05.
Powertrain Control System	
• PCM, vehicle wiring harnesses, engine starting and charging system, main control molded leadframe or Transmission Range (TR) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test C.
Torque Converter	
• Flexplate — damaged	• REPAIR as necessary.
Vehicle Starter	
• Starter system concerns	• INSPECT and REPAIR as necessary. REFER to Section 303-06.
Transmission Range (TR) Sensor Assembly	
• TR sensor assembly — damaged	• INSPECT and REPAIR as necessary.
Fluid Pump Assembly	
• Internal parts seized	• REPAIR as necessary.

Other Concerns: No Park (P) Range

Possible Component	Reference/Action
256 — ROUTINE	
Selector Lever Cable	
• Selector lever cable system — damaged, misaligned	• INSPECT and REPAIR as necessary. REFER to Section 307-05 for additional information.
• Manual control lever assembly damaged, manual valve inner lever pin bent, manual valve inner lever damaged, spring rod damaged, park pawl pin loose or damaged, park rod actuating plate loose, damaged or missing	• INSPECT for damage. REPAIR as necessary.
• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.
• Park gear, park pawl, park pawl return spring, part or guide, park actuating rod, park pawl shaft, manual lever	• INSPECT for damage. If damaged, REPAIR as necessary.
• External linkages/brackets — damaged	• INSPECT for damage. REPAIR as necessary.
Powertrain Control System	

Other Concerns: No Park (P) Range (Continued)

Possible Component	Reference/Action
• PCM, vehicle wiring harnesses, main control molded leadframe or Transmission Range (TR) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test C.
Transmission Range (TR) Sensor Assembly Damaged	
• Manual lever detent spring	INSPECT for damage. REPAIR as necessary.
• TR sensor assembly	• INSTALL a new main control assembly. REFER to Main Control in this section.

Other Concerns: Transmission Overheating

Possible Component	Reference/Action
257 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
• Fluid condition	• CHECK transmission fluid condition. REFER to Preliminary Inspection in this section.
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control molded leadframe, Torque Converter Clutch (TCC) solenoid or Transmission Fluid Temperature (TFT) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A for TCC solenoid diagnosis and GO to Pinpoint Test B for TFT sensor diagnosis.
Torque Converter Not Engaging	
• Torque converter	• INSTALL a new torque converter. If a new or remanufactured torque converter is installed, use the scan tool and follow the on-screen instructions and perform the Misfire Monitor Neutral Profile Correction procedure.
Case Vent Damaged	
• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.
Other	
• Restriction in transmission cooling system	• CHECK transmission cooling system efficiency. REFER to Section 307-02 for automatic transmission cooling system diagnostic procedures.
• Excessive trailer tow load	• REFER to the Owner's Literature for specifications on trailer towing.
• Vehicle heat shield — missing or damaged	• INSPECT for damage. REPAIR as necessary.
• Vehicle airflow is restricted	• INSPECT for damage. REPAIR as necessary.
• Thermal bypass valve — missing or damaged	• INSPECT for damage. REPAIR as necessary. REFER to Main Control in this section.

Other Concerns: Fluid Venting/Foaming

Possible Component	Reference/Action
261 — ROUTINE	
Transmission Fluid	
• Incorrect level	• CHECK the transmission fluid level. ADJUST transmission fluid to correct level. REFER to Transmission Fluid Level Check in this section.
Case Vent Damaged	
• Transmission case	• INSPECT for damage. If damaged, REPAIR as necessary.

Feel Concerns: Shift Concerns: No 4-5 Shift

Possible Component	Reference/Action
270 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control molded leadframe, Shift Solenoid A (SSA) solenoid or Shift Solenoid B (SSB) sensor	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (A) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (A) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.

Feel Concerns: No 5-4 Shift (Automatic)

Possible Component	Reference/Action
271 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control molded leadframe or Shift Solenoid B (SSB)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (A) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Forward clutch (A) friction and steel plate — failure	• INSPECT the forward clutch assembly for damage. REPAIR as required. REFER to Forward Clutch Assembly in this section.

Feel Concerns: No 5-6 Shift (Automatic)

Possible Component	Reference/Action
272 — ROUTINE	
Powertrain Control System	

Feel Concerns: No 5-6 Shift (Automatic) (Continued)

Possible Component	Reference/Action
• PCM, vehicle wiring harnesses, main control molded leadframe, Shift Solenoid B (SSB) or Shift Solenoid C (SSC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

Feel Concerns: No 6-5 Shift (Automatic)

Possible Component	Reference/Action
273 — ROUTINE	
Powertrain Control System	
• PCM, vehicle wiring harnesses, main control leadframe or Shift Solenoid C (SSC)	• If DTCs are set, CLEAR the DTCs. CARRY OUT the Key ON Engine OFF (KOEO) and Key ON Engine Running (KOER) self-test. ROAD TEST the vehicle and CHECK for DTCs. If the DTCs return, GO to Pinpoint Test A.
Main Control	
• Molded leadframe — contamination	• REMOVE the main control assembly. REFER to Main Control in this section. INSPECT and CLEAN the shift solenoid terminals on the main control molded leadframe for metallic contamination. REFER to Shift Solenoids (SS) in this section. INSTALL the main control assembly. CLEAR the DTCs. ROAD TEST the vehicle. If the symptom returns, GO to Pinpoint Test A.
• Defective clutch (B) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (B) latch valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
• Defective clutch (C) regulator valve	• INSPECT main control assembly for stuck valves or contamination. REFER to Main Control in this section.
Clutch Plates	
• Direct clutch (B) friction and steel plate — failure	• INSPECT the direct clutch assembly for damage. REPAIR as required. REFER to Direct Clutch Assembly in this section.
• Intermediate clutch (C) friction and steel plate — failure	• INSPECT the intermediate clutch assembly for damage. REPAIR as required. REFER to Intermediate Clutch Assembly in this section.

TCU and the Software

How the TCU Works

An automatic transmission is a relatively simple device in theory. It simply takes power from your engine and applies this power to your driving wheels. Automatic transmissions use fluid to operate the internal mechanisms required for shifting. In the past, information was sent to the fluid control mechanism (valve body) through mechanical and pneumatic hardware. The valve body would then make a decision about when to shift, what gear to shift into and how quickly to shift. Once the valve body made these decisions, it simply altered the fluid flow and fluid pressure to implement its decision. This system required complex fluid flow logic but demonstrated high reliability and performance. Only recently has the automatic transmission undergone dramatic change after roughly a half-century of use.

Though you may not believe it, the electronic controls used to manage your transmission are equally simple in theory. To operate, your TCU must have several pieces of information sent to it so that it can decide when to shift, what gear to shift into and how quickly to shift. Once the TCU makes these decisions, it simply alters the fluid flow and fluid pressure to implement its decision. This system still relies on valve body logic in part and will still maintain some functions without an electronic controller.

The primary factor separating the modern electronic automatic transmission from yesterday's hydro-mechanical automatic transmission is the speed and complexity of the logic used for transmission behavior. The hydro-mechanical automatic transmission of yesterday could only make its decisions based on throttle position, engine load and driveshaft speed. Whereas the TCU can use these inputs as well as torque converter speed, engine speed, wheel speeds, traction control parameters, electronic throttle position, fluid temperature, engine temperature, brake pedal actuation, forward and lateral acceleration as well as several other parameters. The TCU can also utilize manual shifting operation and provide altered transmission behavior for special conditions (road race, drag race, dynamometer, snow, towing, etc.).

Software Installation

A software CD is provided with every TCU purchase. If a software CD was not shipped with your purchase or if you need to purchase a replacement CD, please contact us. You may also download the newest revision of the software from our website. Once you have a software CD or a downloaded installation, you are ready to begin installing the TCU software.

Software CD installation: Load the software CD in your CD drive. A window should appear offering you several options, click "Install Software." If this menu does not appear, you will need to open your CD with windows explorer or my computer. You should see a file called TCU-CD.exe; double click this file to begin installation. An installation window will appear with the TCU software version number, click next. A window will appear with your intended installation directory, we recommend not changing the default installation directory but you may choose any directory you wish. Once you have chosen a directory, click next. A window will appear offering to let you select installed components from a list. The software installation will only let you select/deselect manuals and optional components.

Select the components you want to install and click next. A window will appear with your start menu folders. You may name the start menu folder associated with this software any name you wish, though we recommend the default setting. A window will appear offering to create a desktop icon and a quick launch icon. A desktop icon will place a shortcut to the TCU software on your user desktop. A quick launch icon will place a shortcut to the TCU software on the windows quick launch bar (only offered on some operating systems, usually on the lower left side of your screen next to the start menu button). Choose if you wish to install these icons and click next. A window will appear summarizing the settings you have chosen. If you approve of these settings, click install. If you disapprove of these settings, click back. After installation a window will appear asking if you wish to launch the TCU software now, make your choice and click finish.

Downloaded file installation: Find the location of the downloaded file from the website. If you cannot locate the file, you may need to search for the file which will be called TCUCD.exe or TCU-WEB.exe depending on the version you downloaded. Double click on your downloaded file to begin installation. An installation window will appear with the TCU software version number, click next. A window will appear with your intended installation directory, we recommend not changing the default installation directory but you may choose any directory you wish. Once you have chosen a directory, click next. A window will appear with your start menu folders. You may name the start menu folder associated with this software any name you wish, though we recommend the default setting. A window will appear offering to create a desktop icon and a quick launch icon. A desktop icon will place a shortcut to the TCU software on your user desktop. A quick launch icon will place a shortcut to the TCU software on the windows quick launch bar (only offered on some operating systems, usually on the lower left side of your screen next to the start menu button). Choose if you wish to install these icons and click next. A window will appear summarizing the settings you have chosen. If you approve of these settings, click install. If you disapprove of these settings, click back. After installation a window will appear asking if you wish to launch the TCU software now, make your choice and click finish.

Communication

The TCU has been designed with RS232 and CAN 2.0b onboard. RS232 (Serial Communication) has been provided for communication with your computer. Though less convenient than USB, serial communication still offers the best reliability and capability in a noisy automotive environment. Our company has gone to great lengths to ensure reliable communication between your PC and the TCU. CAN 2.0b has been provided for communication with our other products as well as some other manufacturers products in the future. CAN 2.0b is a noise tolerant automotive communication network (Controller Area Network) that is the preferred modern communication standard.

If you do not have a serial port on your computer (some laptops do not) you may purchase a USB to serial port adapter and install the correct drivers before trying to communicate with theTCU. To ensure **compatibility and reliability**, please purchase our USB to serial adaptor which we have tested and sell at low cost. Communication can be started with the TCU in several ways. If you connect your computer to the TCU and start the TCU software, the software will attempt to auto-detect the presence of your TCU. If the TCU software is unable to auto detect the presence of the TCU, you should double check that your serial port is active or your USB to serial port adapter is properly installed and functioning. Once your hardware has been checked, use the Communications -> Go Online command to attempt to connect to the TCU again. If you are still unable to connect to the TCU, please contact our technical support.

File Management

When you go online or you auto-detect the TCU, the software will ask you if you wish to retrieve the TCU calibration from the unit. If you choose to do this, you will be loading your settings from the TCU and will then be online with the TCU. **If you make changes at this time, those changes will be immediately reflected in the unit**. You should always save your program somewhere on your computer. Also remember to use an adequately descriptive name such as 1993-Firebird-350Ramjet-4L65E-1-13-04.TCU if you are a reseller/tuner or perhaps just 1-13-04.TCU if you use the TCU on a single vehicle.

You may select offline mode or simply work without a TCU connected to your computer. When you are in offline mode, you can make changes to any program on your computer. You can open calibrations by choosing the open icon on your toolbar or by choosing File-> Open calibration file. You can save these files with any file name and in any directory you choose. Remember that when you are offline, you must save your file for changes to be reflected in that calibration.

Working with calibration files

A calibration file stores the information required to control the TCU for each application. Calibration files can differ greatly between applications and should be managed with care.

When using the TCU for the first time, your TCU should have a calibration installed to match your specific transmission. If a calibration has not been loaded specifically for your transmission, then you will need to contact your reseller or find an appropriate calibration.

Online Mode vs. Offline Mode

When in offline mode, the software background will be gray. Offline mode simply means that the TCU is not connected and is not currently communicating with the PC. Any changes made to a calibration while in offline mode must be saved in that calibration and will not affect the TCU unless that calibration is sent to the TCU when it is connected.

When in online mode, the software background will be blue. Online mode simply means that the TCU is connected and is currently communicating with the PC. Any changes made to the calibration will occur in real-time and will directly affect the programming of the TCU.

Datalogging

Datalogging is one of the most powerful features offered by the TCU. It allows a user to see transmission behavior and engine behavior. The extra analog and digital inputs offered by the TCU also allows the TCU to be used as a general datalogging device for any other vehicle functions you may wish to record.

To begin a datalog, do the following:

1. The TCU power must be on and the TCU must be communicating/online with your computer.
2. Go to the datalog pull down/explorer folder. Double click the Start Logging button.
3. A window will appear with the option to “Start Logging” and several Datalogging rates will be offered. Choose your datalogging rate and click on the “Start Logging” button. When prompted, choose a file name and location for your datalog. As with calibration files you may want to choose a descriptive name including the time, date, and/or application of your datalog. Once you have chosen a name and location, click save or press enter.
4. The software and your computer will now begin datalogging. You may view the transmission behavior through the monitor screen while datalogging.
5. When you have completed your datalog, you may click on the “stop logging” button. This will complete your datalogging session and save your datalog file to the location you specified.

To view a datalog, do the following:

1. Datalogs may be viewed with the Datalog Viewer software, Microsoft Excel or any other program that can handle the tab delimited values contained in the datalog. The Datalog Viewer software offers a much stronger set of capabilities and datalogging viewing options; however we understand that many users may wish to use other tools or analysis methods which do not fall within the scope of the TCU software. The datalog files use the file extension .tlg which is associated with the Datalog Viewer Software; however this does not prevent users from opening the same file in Microsoft Excel.
2. To use the Datalog Viewer software, go to the datalog pull down/explorer folder. Double click the view button. If you know the location of the datalog file, you may also open this file directly, which will automatically start the Datalog Viewer software.
3. If the Datalog Viewer software is not being opened with a file, a blank screen will appear. Click the “load” button or go to File-> Open. Choose the file location and name and click open or hit enter
4. Initially, your datalog will appear in graph view. To begin viewing the data, click in the boxes next to the datafields you wish to see near the top of the screen. You may view this data in a tabular view by clicking the table view button on the icon menu.

5. Several zooming options are available by right clicking your mouse button. You may zoom in by clicking on a beginning time and an ending time for your graph selection. You may also choose to view all the data, zoom to a percentage, or zoom to a particular time period.
6. Please refer to the hotkeys list for a complete listing of key options for navigating the datalog menu.
7. You may load another datalog or continue tuning at any time.

Flash Upgrade Procedure

The flash upgrade procedure should not be used unless well understood. The flash upgrade procedure is not intended to change a calibration file or to tune the transmission controller. The flash upgrade procedure is only used for firmware upgrades. Firmware upgrades directly modify the code in the control systems of the transmission controller. The ability to flash upgrade the firmware allows the transmission controller to be upgraded in the field so that new features can be added and possible problems can be remedied.

To perform a flash upgrade, do the following:

1. The TCU power must be on and the TCU must be communicating and online with your computer.
2. To begin a flash upgrade, select Communications -> flash upgrade from the explorer menu or Communications -> flash upgrade -> flash upgrade TCU from the toolbar. Once this form opens, no other forms will be available. This is done to protect the TCU. At this form, the firmware major and minor revision will be displayed. The hardware revision will also be displayed
3. To begin flashing the transmission controller, click the "Open Flash File to Begin" button. This will open a file selection menu. Only *.rom files can be opened and the correct file must be chosen for a proper upgrade. If you are unsure about which rom file you should use, contact technical support first. When using newer software with an older controller (or vice versa), the unit may not communicate or properly find the com port until it is flash upgraded. You may need to manually select the com port. Once the correct file has been selected, click open in the current menu.
4. A warning message will appear with a warning not to turn the power off until the upgrade is complete. Follow these instructions explicitly. Heed this warning! Click the yes button if you are prepared to flash the unit.
5. The initial flash upgrade screen will display a progress bar and provide some information about the flash procedure. Once complete, the last line of text will read “Flash upgrade complete!”
6. If you experience a box that appears saying “error writing to unit please check connection and try again.” You will need to turn the unit off and on again, check all your connections and start over with these directions. Your unit will not begin to function properly again until a successful flash has been completed.

Com Port Manual Configuration (for Flash Upgrading Only)

Manually configuring a com port for use with the TCU software is a task for advanced users only. Generally if the TCU software is unable to communicate with the TCU, the reason has nothing to do with com port selection. For this reason, use the manual com port setting as a last resort to a communication problem. Please do not try to use this feature if you do not fully understand what a com port is and which com port you wish to set.

The only time that a com port should need to be manually set is during a flash upgrade procedure. It is possible to have software newer than the firmware in a TCU such that the TCU will no longer go online with the TCU. In this case, the com port should be determined from your computer hardware settings and programmed under communications >> Flash Upgrade >> Select Port Manually.

Diagnostic Trouble Codes

The TCU offers basic diagnostic trouble codes for all analog inputs, battery voltage and TCU temperature. These diagnostic measures have been provided to alert the user of potential problems and prevent premature failure of the TCU or transmission. A diagnostic trouble code failure will occur in the following conditions:

1. An analog input value is above the high failure value or below the low failure value as programmed for each analog input.
2. Battery voltage exceeds 25 volts.
3. Unit temperature exceeds 120°C (248°F) or falls below -30°C (-22°F).

A simple failure flag will appear when datalogging and when viewing the monitor screen. To view the details of the failure or to clear the failure value, you must:

1. Go to the communications pull down/explorer folder. Double click the diagnostic trouble codes button.
2. You will see a matrix of possible diagnostic trouble codes. These failures should be taken seriously and investigated (especially the TCU overtemp and battery overvoltage warnings). To ignore these values could lead to failure of the transmission, engine or TCU.
3. If you wish to clear these values after investigating and solving the problem, click the clear button.

Password Protection

The TCU offers password protection. This protection is offered primarily for dealers who wish to prevent customers from altering their calibration and/or competitors from using their calibrations. Once a password has been set, information cannot be retrieved or altered directly on the unit. However, a user may still overwrite the entire calibration with a new calibration at which point the password protection will have been overwritten.

Doing this will cause the protected calibration to be irretrievably lost, so proceed with care. Any user may completely overwrite this information with a different calibration but that user would need to start tuning from nothing.

If a password is lost, it can be retrieved by technical support staff using a permission key issued by the software. This password has a high level of encryption and a person (s) wishing to receive a new password must have all of the information from the original purchaser and pass a verbal test to receive a calibration.

Monitor Screen

The monitor screen offers a wealth of information regarding the current status of the engine, transmission and TCU. To get to the monitor screen, go to the communications pull down/explorer folder and select monitor. Alternatively, the hotkey CTRL-M will also work. A large screen will appear with several gauges and a full listing of TCU input/output status. The gauge units and increments may be changed with the setup button available when the monitor screen is open.

Lightweight Monitor Screen

A versatile lightweight monitor is also offered to provide the same information in a more compact format. The lightweight monitor screen is less visually entertaining and is more difficult to read for most users but some installers may wish to use this monitor screen during the tuning process or while diagnosing a perceived problem. The lightweight monitor screen can be reached from the communications drop down/explorer menu.

Test Mode

Test mode allows a user or installer to test the function of some features before wiring them. This can be very useful for installers or users who do not wish to wire switches and/or do not use these functions frequently. To get to test mode, go to the communications drop down/explorer menu and choose test mode.

This form is to be read in rows. The check boxes in options 1-7 must be checked to allow each option to be turned or off. Once a box has been checked, an installer or user may turn on that option by click the "on" or "off" mode boxes. The "Set TPS %" function allows a forced value of Throttle position to be programmed. Simply type in a value and hit the "set" button to activate a desired percentage. The analog input corresponding to TPS must be disabled before this function will work.

The "perform an upshift now" and "perform a downshift now" functions allow an installer or user to command an upshift or downshift without any wiring. This can be very useful for testing manual modes and how they will work in an application. This also gives a user or installer great freedom to test transmission function before completing the vehicle wiring or even if no upshift/downshift buttons are intended the shifts can be tested. The test mode upshift and downshift commands only work when manual mode is enabled.

Toolbar Setup

The TCU software has an icon based toolbar at the top of the screen. This toolbar is offered to simplify access to common functions and is fully customizable. To customize this toolbar, go to the software setup pull down/explorer folder. Double click on the toolbar setup button. From this menu you may add or subtract toolbar buttons and separators. Ideally you will want to remove functions you do not use often and will want to add functions that you do use frequently.

Units Selection

The TCU software can display units in standard, metric or a combination of units if you desire. To alter the unit display information, go to the software setup pull down/explorer folder. Double click on the unit selection button. From this menu you may select the units you wish to use.

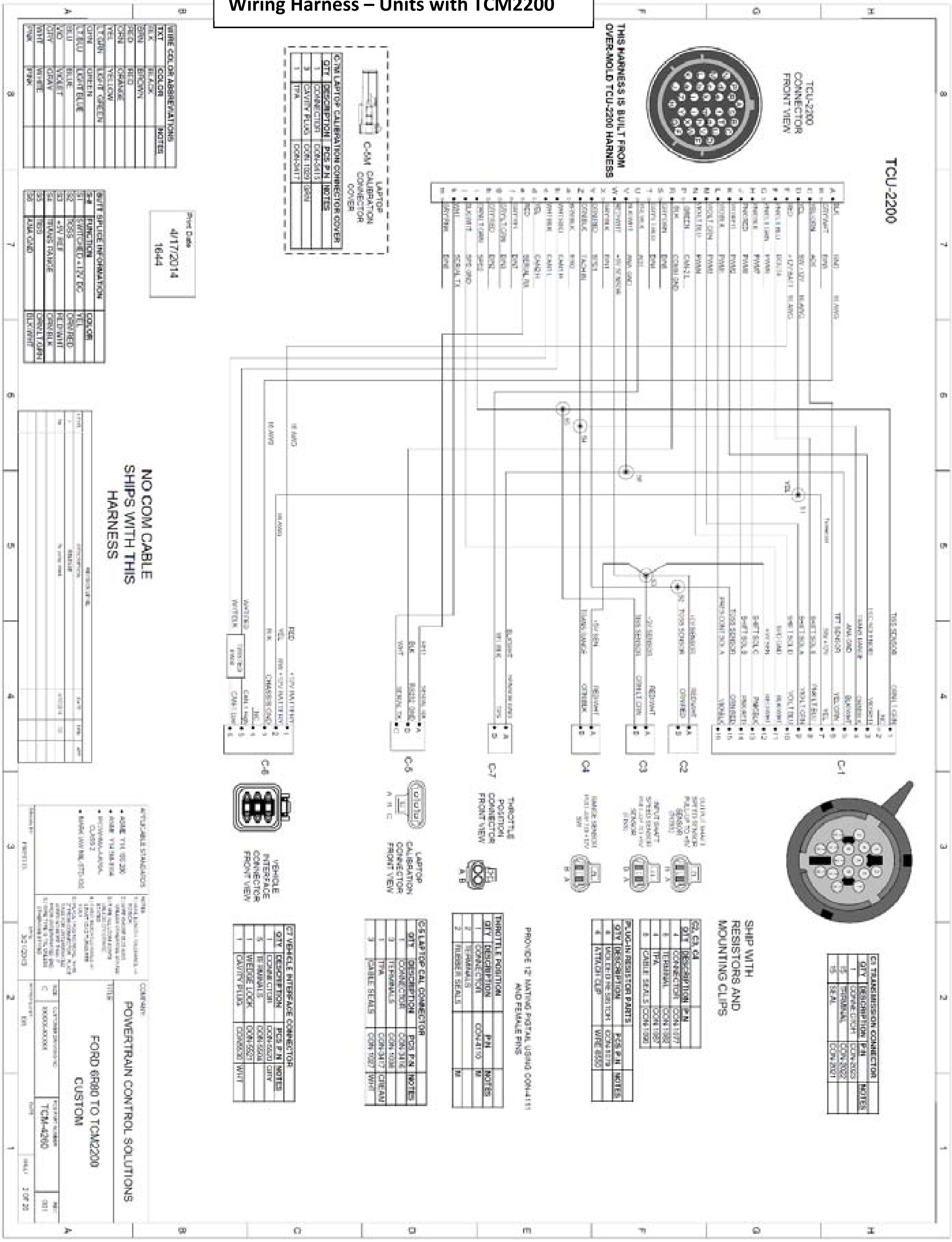
Tire Diameter Wizard

The calculate tire diameter wizard helps users determine their overall tire diameter from the popular tire format of 275/55R17 where 275 represents a 275mm width, 55 represents a 55% tire sidewall height to width ration and R17 represents a 17 inch wheel diameter. Simply type the appropriate values into this calculator and hit enter after each field for the wizard to calculate your overall tire diameter.

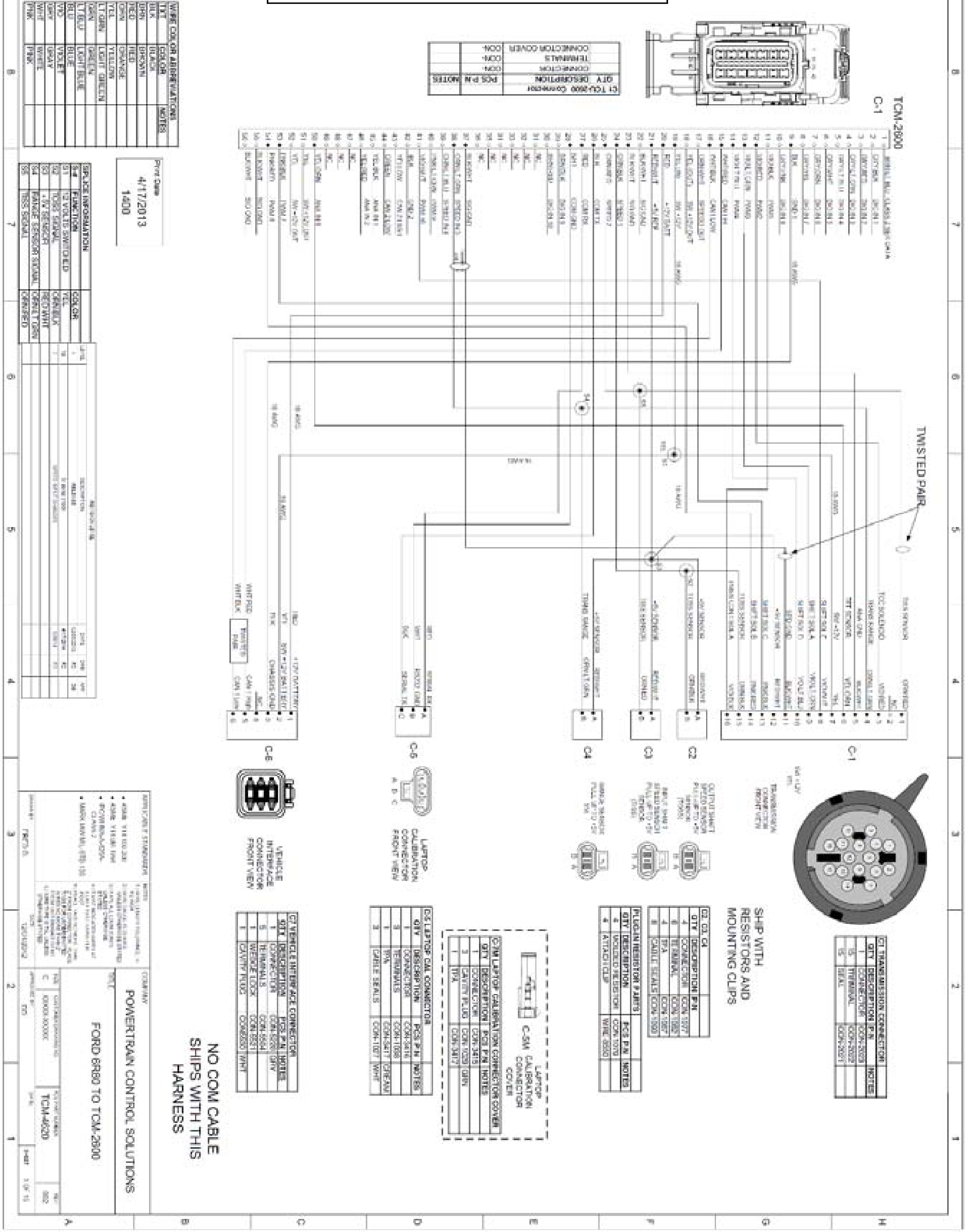
Sensor Calibration Wizard

The sensor calibration wizard is intended for advanced users who may have information from documentation about a sensor but do not know how to translate it into usable data for the TCU. Using the fluid temperature setting, a user can take a resistance vs. temperature chart and arrive at the appropriate voltages. The calibration wizard will calculate this based on analog inputs 5-6 (directly wired to sensor) or with analog inputs 1-4. If the sensor is being piggybacked on analog inputs 1-4, the resistance must be measured across the wires going to the sensor with the sensor unplugged. This will determine the resistance value across the ecu (known as a pullup resistor) so that the voltages can be properly determined.

Wiring Harness – Units with TCM2200



Wiring Harness – Units with TCM2600



IN-EQUIPMENT REPAIR

Fluid Pan, Gasket and Filter

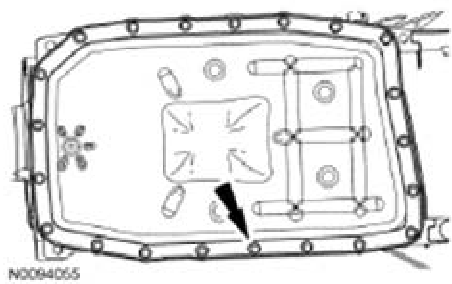
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

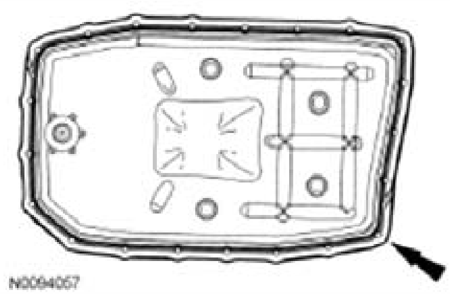
Removal

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

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. Remove the transmission fluid pan and allow the transmission fluid to drain.

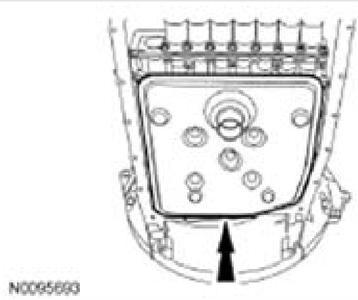


3. Remove the transmission fluid pan gasket.

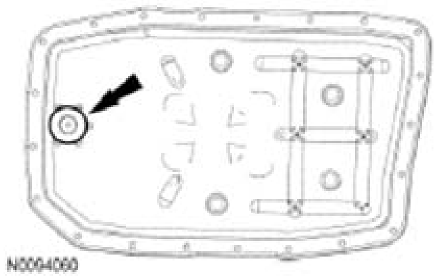


4. **NOTE:**
   The transmission fluid filter may be reused if no excessive contamination is indicated.

   Remove and discard the transmission fluid filter.



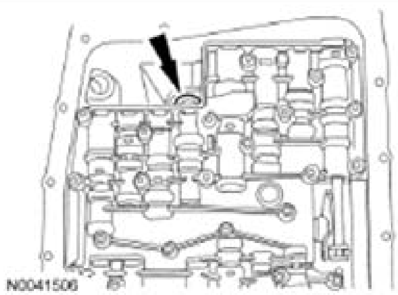
5. Clean and inspect the transmission fluid pan and magnet.



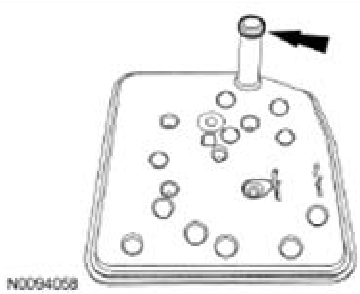
Installation

NOTE:
If the transmission is being repaired for a contamination-related failure, install a new transmission fluid filter and seal assembly. The transmission fluid filter may be reused if no excessive contamination is indicated.

1. Inspect the transmission case for the transmission fluid filter seal. If the seal is in the case, carefully remove the seal without scratching the case.

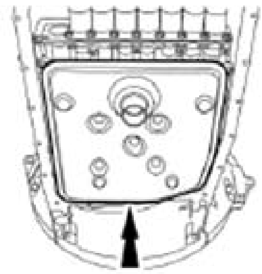


2. Make sure that the seal is on the transmission fluid filter and lubricate the seal with automatic transmission fluid.

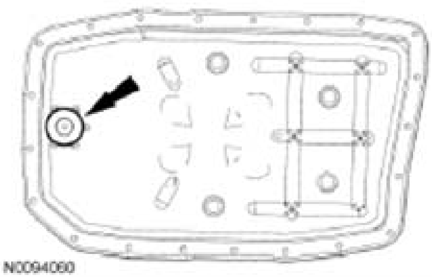


3. **NOTE:**
   The transmission fluid filter may be reused if no excessive contamination is indicated.

   If required, install a new transmission fluid filter.

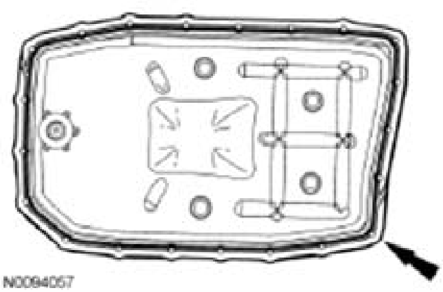


4. Position the magnet in the transmission fluid pan.

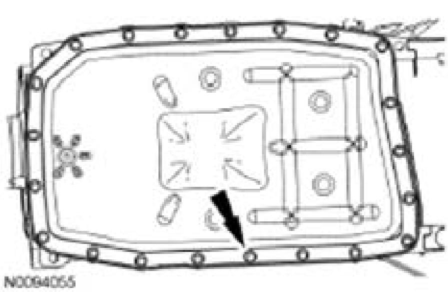


5. **NOTE:**
   The transmission fluid pan gasket can be reused if not damaged.

   Install a new transmission fluid pan gasket if required.



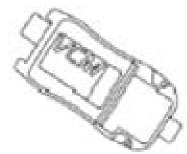
6. Install the transmission fluid pan and tighten the bolts in a crisscross pattern.
   - Tighten to 11 Nm (97 lb-in).



7. Using the Adding Additional Transmission Fluid procedure, fill and check the transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Main Control

Special Tool(s)

 ST2834-A	Vehicle Communication Module (VCM) and Integrated Diagnostic System (IDS) software with appropriate hardware, or equivalent scan tool

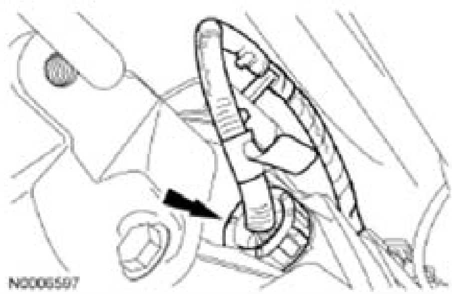
Removal

NOTE:

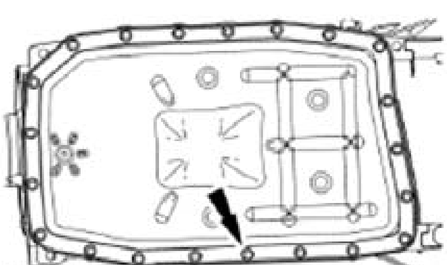
The Solenoid Body Strategy Data Download procedure must be performed if a new main control assembly is installed.

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. ***NOTICE:***
   Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.

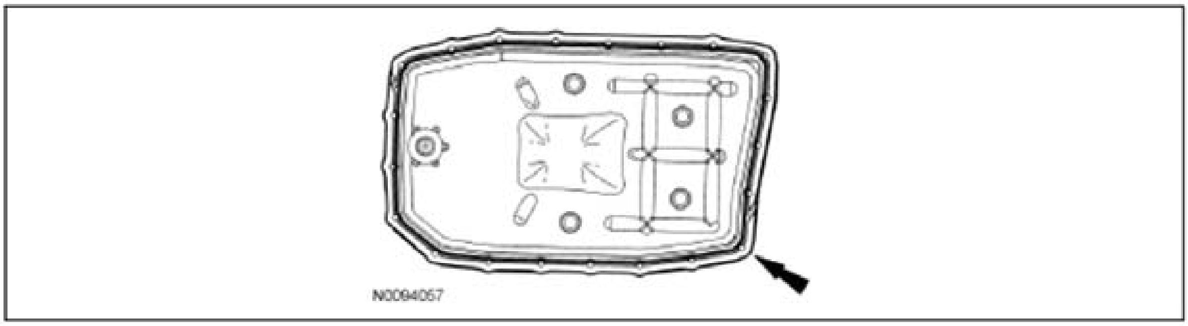
   Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.


N0006597

3. Remove the transmission fluid pan and allow the transmission fluid to drain.

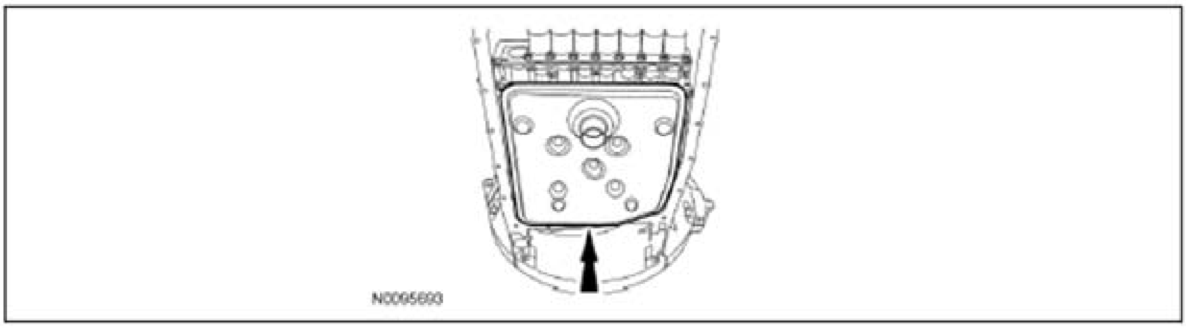

N0094055

4. Remove the transmission fluid pan gasket.

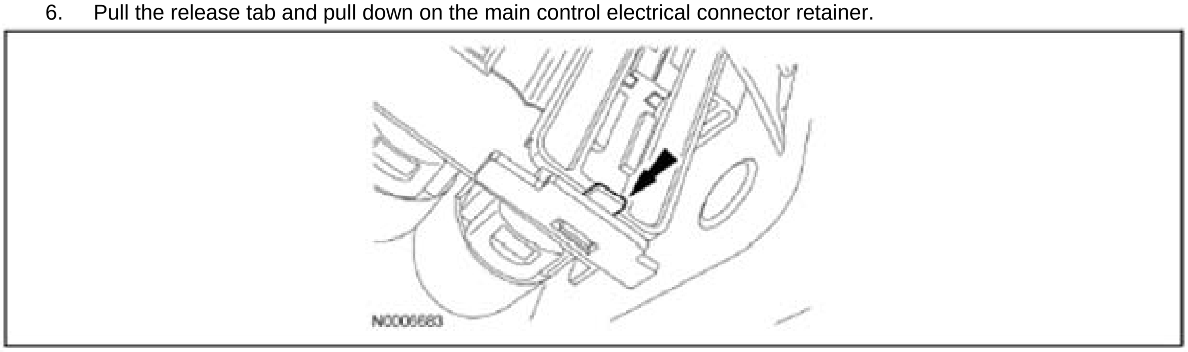


5. **NOTE:**
The transmission fluid filter may be reused if no excessive contamination is indicated.

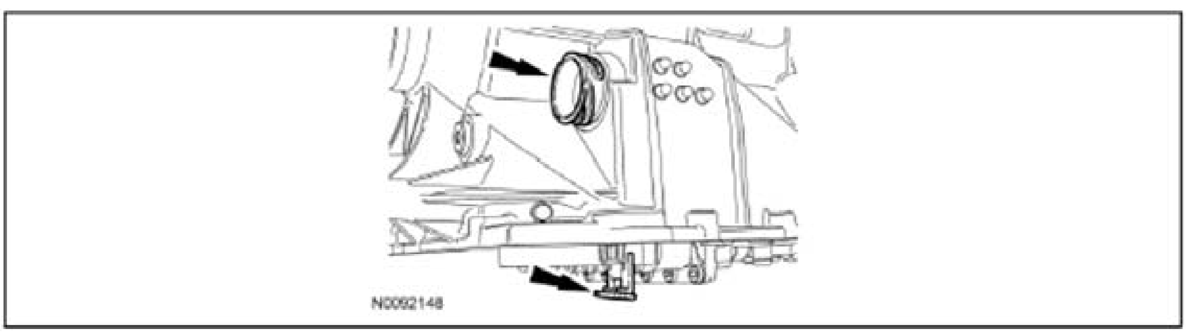
Remove and discard the transmission fluid filter.



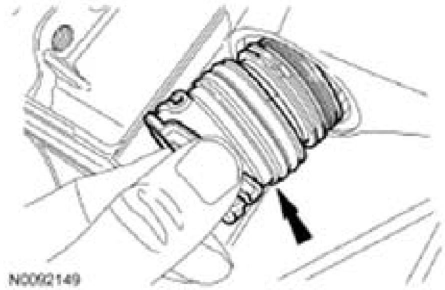
6. Pull the release tab and pull down on the main control electrical connector retainer.



7. With the release tab down, pull the outer shell of the main control electrical connector out of the main control assembly.

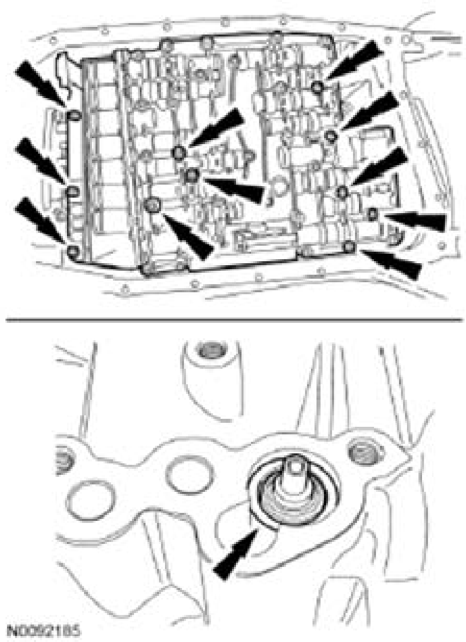


8. Pull the main control electrical connector out of the transmission case.



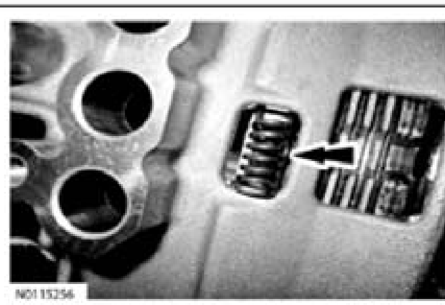
9. ***NOTICE:***
   During removal of the main control assembly, the thermal bypass valve may fall out of the transmission case. Damage to the valve may occur if the valve falls out.

   Remove the 11 bolts from the main control assembly and remove the main control assembly and the bypass valve.



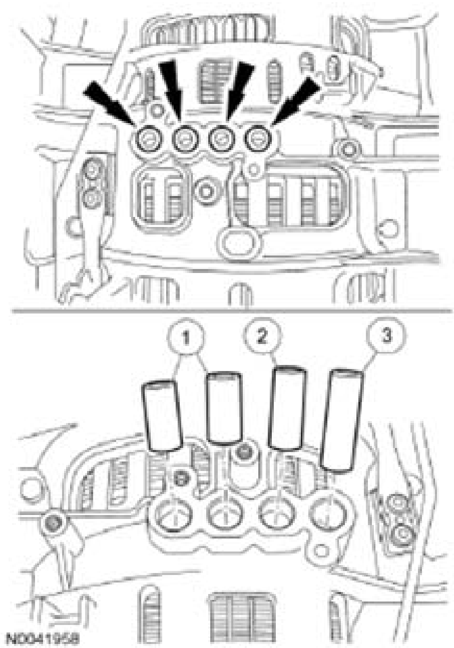
Installation

1. Inspect the bias spring to make sure it is positioned correctly in the transmission case.

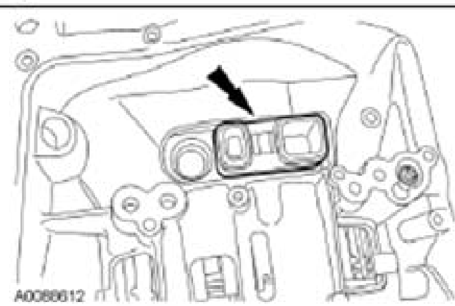


2. **NOTE:**
Before installing the main control assembly into the transmission case, verify the presence and orientation of the thermal bypass valve, pump adapter seal and center support seals. Also note that one or more of the center support seals may have remained in the main control assembly during removal and should be installed into the transmission case at this time

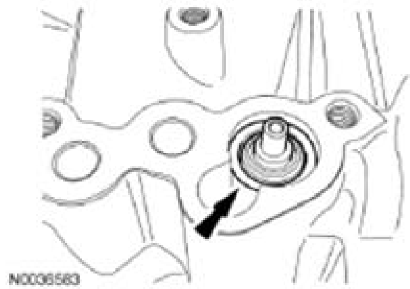
Verify the 4 rubber feed tubes for the center support are in place.
- Black feed tube
- Green feed tube
- Blue feed tube



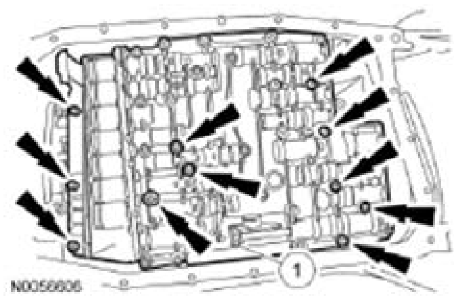
3. Verify the rubber adapter is in place.



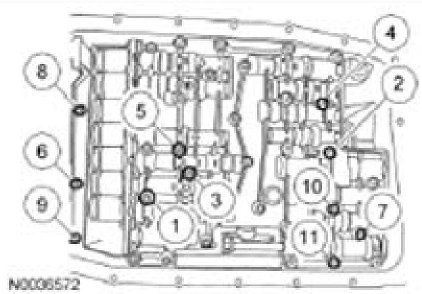
4. Coat the thermal bypass valve with petroleum jelly to hold it in place and install the thermal bypass valve into the transmission case.



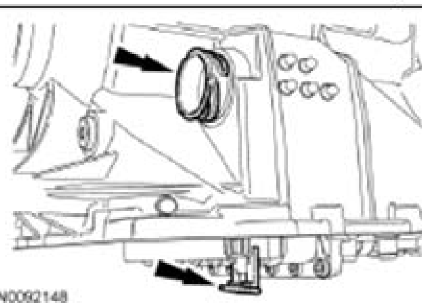
5. Position the main control assembly in place and loosely install the 11 bolts.
    - Align the manual valve and control lever linkage.



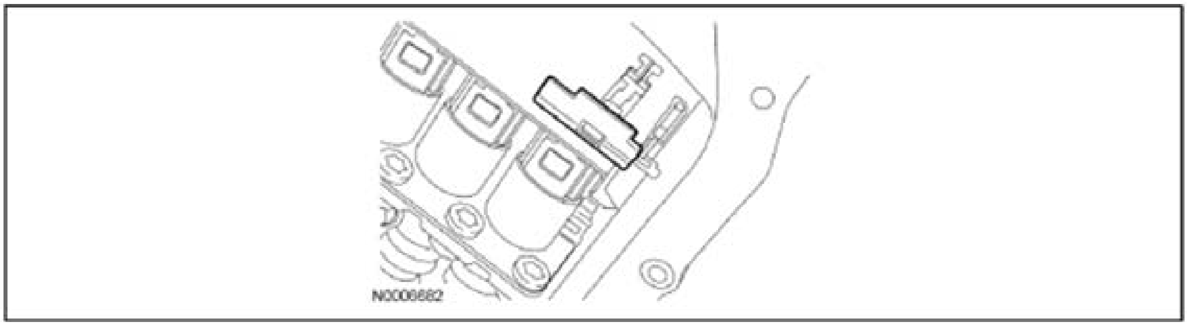
6. Tighten the main control bolts in the sequence shown.
    - Tighten to 8 Nm (71 lb-in).



7. With the release tab down and unlocked, push the outer shell of the main control electrical connector into the transmission. Make sure that the main control electrical connector is fully seated into the main control assembly.

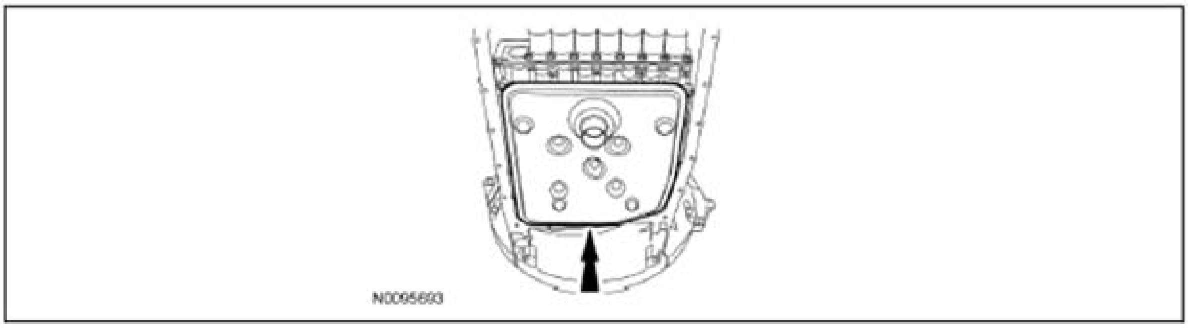


8. Press up on the tab and lock the outer shell of the main control electrical connector in place. Make sure that the locking tab is securely locked.



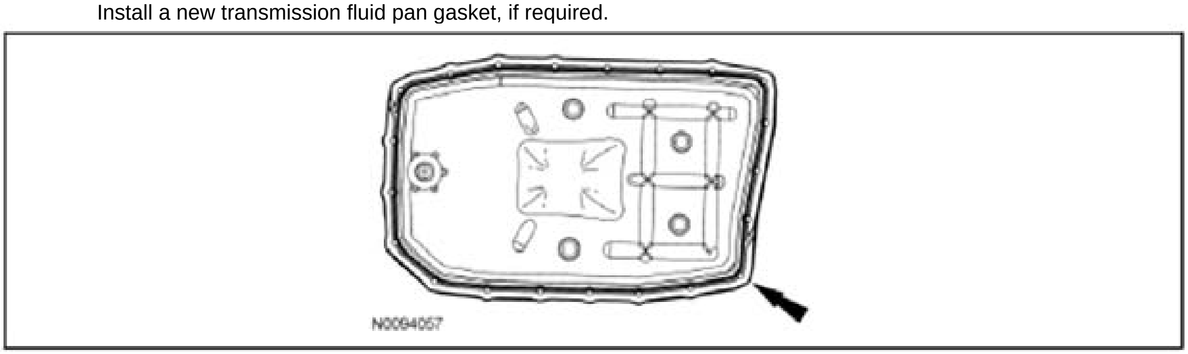
9. **NOTE:**
The transmission fluid filter may be reused if no excessive contamination is indicated.

If required, install a new transmission fluid filter.

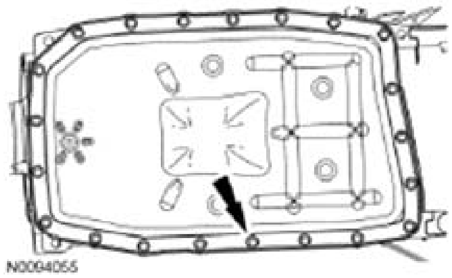


10. **NOTE:**
The transmission fluid pan gasket can be reused if not damaged.

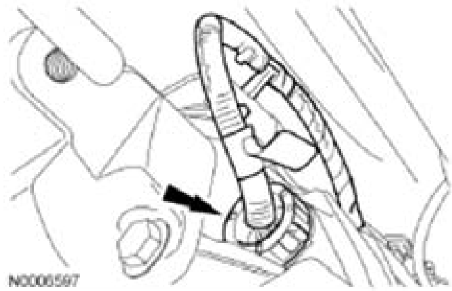
Install a new transmission fluid pan gasket, if required.



11. Install the transmission fluid pan and tighten the transmission fluid pan bolts in a crisscross pattern.
    - Tighten to 11 Nm (97 lb-in).



12. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.



13. Make sure the transmission fluid is at the correct level. For additional information, refer to Transmission Fluid Drain and Refill in this section.

14. **NOTE:**
    If an individual solenoid was replaced clear the adaptive strategy.

    Perform a Road Test — Adaptive Drive Cycle after the adaptive strategy is cleared. For additional information, refer to Shift Point Road Test in this section.

15. **NOTE:**
    If the main control assembly was replaced, perform the Solenoid Body Strategy Data Download. Refer to Solenoid Body Strategy in this section.

    Perform a Road Test — Adaptive Drive Cycle after the Solenoid Body Strategy Data Download. For additional information, refer to Shift Point Road Test in this section.

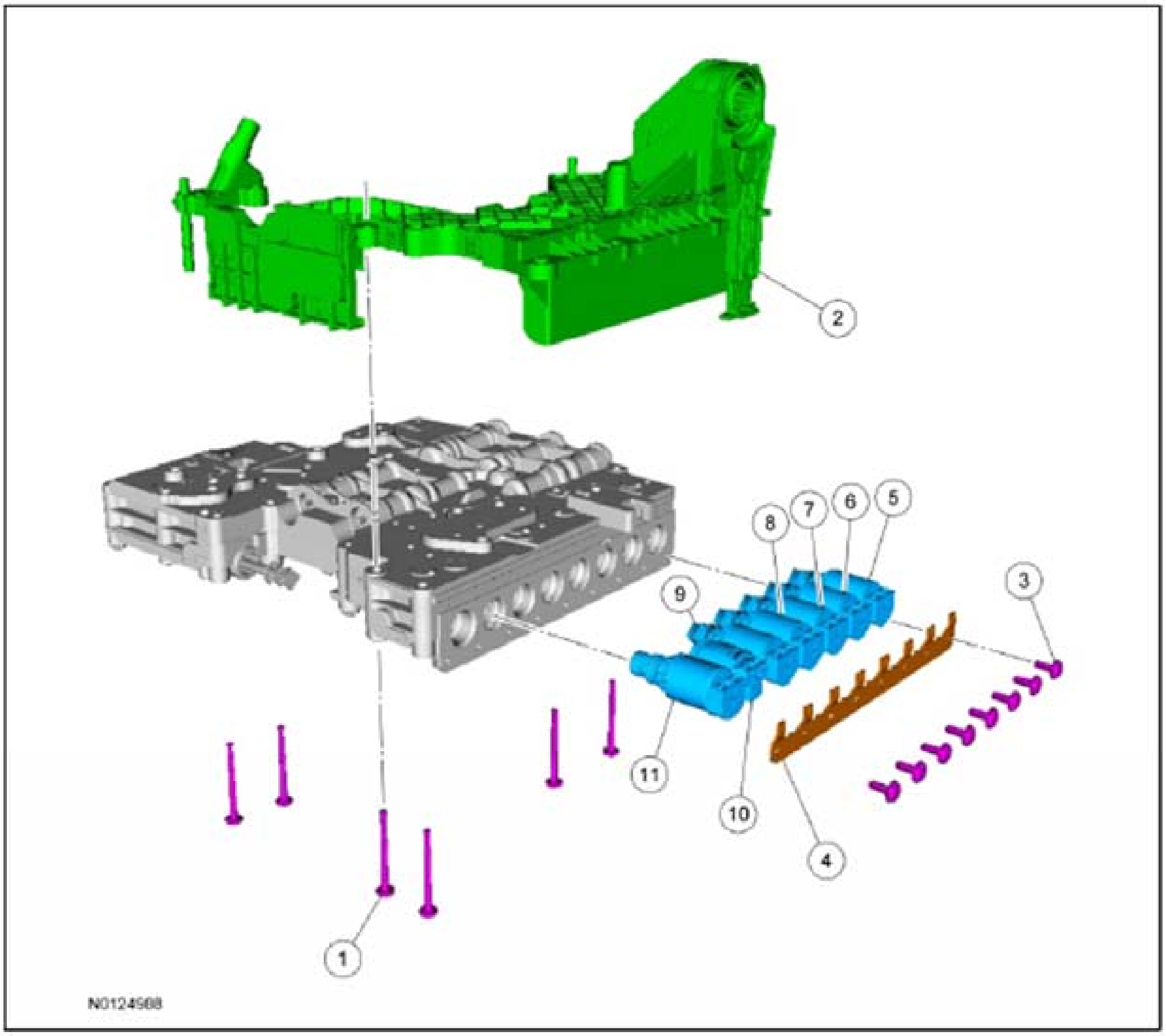
Shift Solenoids (SS)

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

NOTE:
Refer to the on-line Workshop Manual to view this illustration as an interactive exploded view, requires Adobe® Acrobat® 8.0 or higher.

NOTE:
Refer to the on-line Workshop Manual to learn about using an Interactive Illustration.

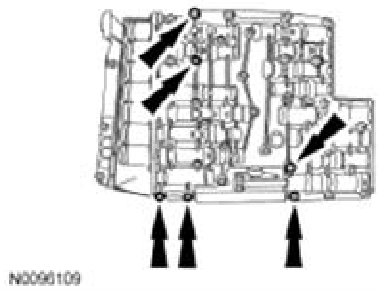


Item	Part Number	Description
1	W707884	Main control-to-molded leadframe bolts
2	7G267	Molded leadframe
3	W707885	Solenoid hold-down bracket bolt (8 required)
4	7Z369	Solenoid hold-down bracket
5	7G383	Shift Solenoid A (SSA) Forward (1,2,3,4) clutch, normally low Variable Force Solenoid (VFS).
6	7G383	Shift Solenoid B (SSB) Direct (3,5,R) clutch, normally high VFS.
7	7G383	Shift Solenoid C (SSC), Intermediate (2,6) clutch, normally low VFS.
8	7G383	Line Pressure Control (LPC) normally high VFS.
9	7G383	Shift Solenoid D (SSD), low/reverse/overdrive clutch, normally high VFS.
10	7G484	Shift Solenoid E (SSE), normally off ON/OFF solenoid.
11	7G383	Torque Converter Clutch (TCC) normally low VFS.

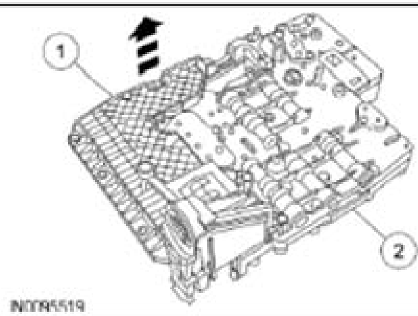
Removal

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

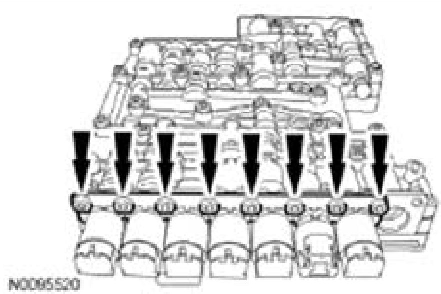
2. Remove the 6 long bolts from the molded leadframe.



3. Carefully separate the molded leadframe from the main control assembly.
    1. Molded leadframe.
    2. Main control..

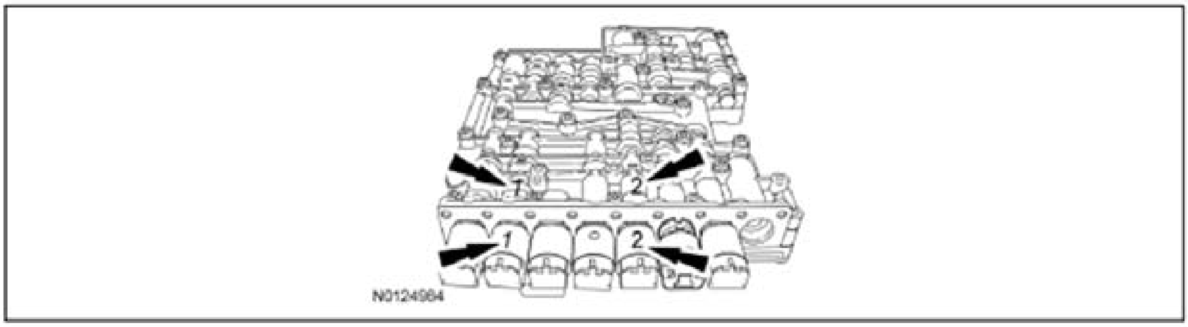


4. Remove the 8 solenoid bracket bolts and the solenoid bracket.



5. ***NOTICE:***
   A Variable Force Solenoid (VFS) is calibrated from the factory and are not all the same. To replace a VFS, match the replacement solenoid type (normally high/normally low) and the band number with the original solenoid or harsh/erratic shifts, harsh/soft engagement or damage to the transmission can occur.

   If replacing more then 1 solenoid, number the solenoids and number the main control solenoid ports to correspond to the solenoid. Pull the solenoid(s) out of the main control valve body.

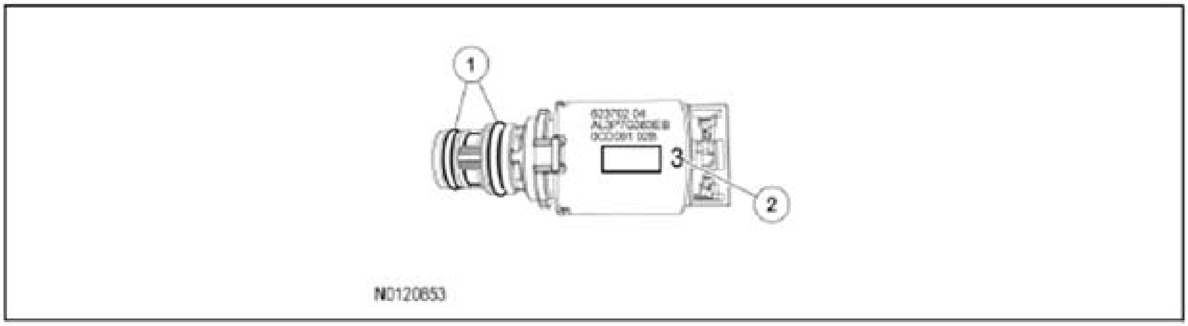


Installation

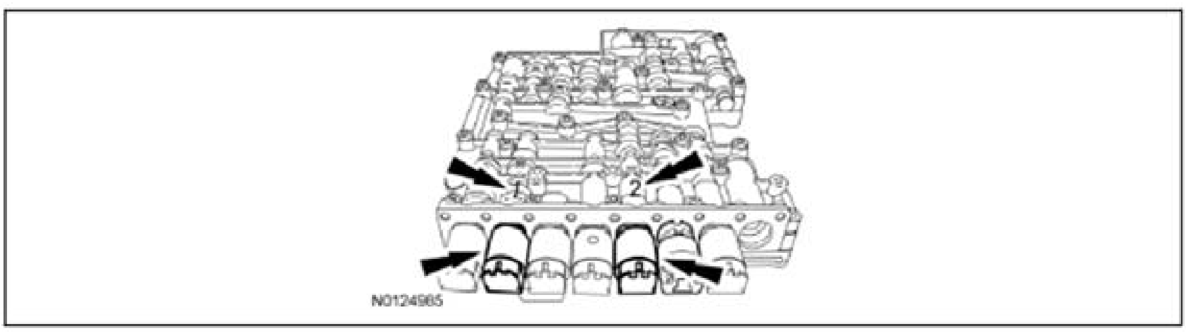
1. ***NOTICE:***
   A VFS is calibrated from the factory and are not all the same. To replace a VFS, match the replacement solenoid type (normally high/ normally low) and the band number with the original solenoid or harsh shifts or damage to the transmission can occur.

   Use the solenoid exploded view at the beginning of this procedure to identify what type of solenoid is being replaced. The solenoid can be a normall high VFS, normally low VFS or an ON/OFF solenoid.
   If replacing a VFS, record the band number to get the correct part number for the solenoid.
   Lubricate the solenoid O-rings with clean transmission fluid.

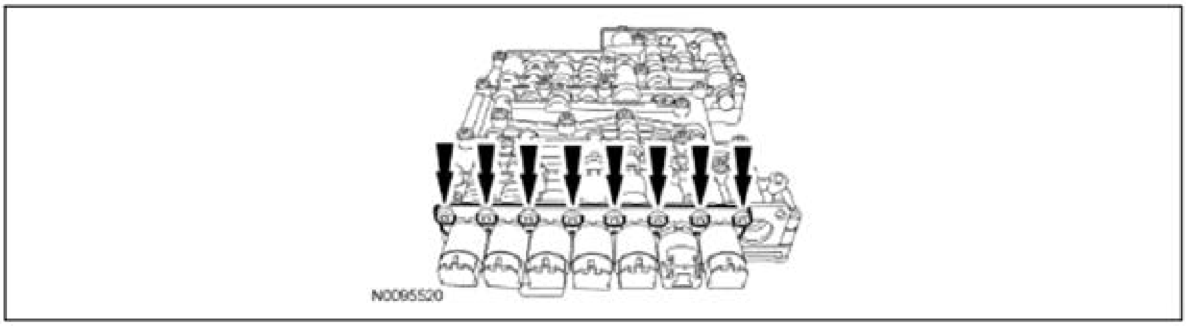
    1. O-rings
    2. Solenoid band number



2. Position the solenoid(s) in the main control in the correct port(s) as marked during removal.

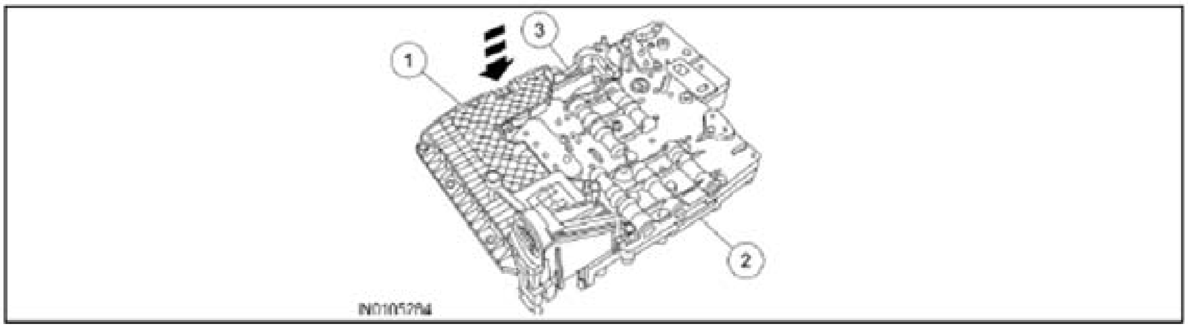


3. Position the solenoid bracket in place and install the 8 bolts.
    1. Tighten to 6 Nm (53 lb-in).

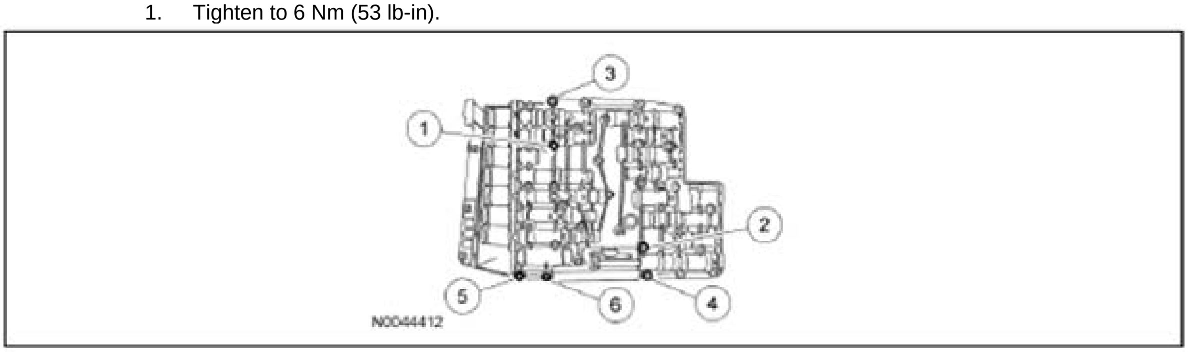


4. **NOTE:**
The TR sensor pin must be aligned with the manual control valve during installation.

Position the molded leadframe on the main control.
1. Molded leadframe.
2. Main control
3. TR sensor pin.

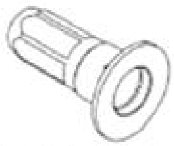


5. Install the 6 long bolts into the molded leadframe. Tighten the bolts in the sequence shown
    1. Tighten to 6 Nm (53 lb-in).



6. Install the main control. For additional information, refer to Main Control in this section.

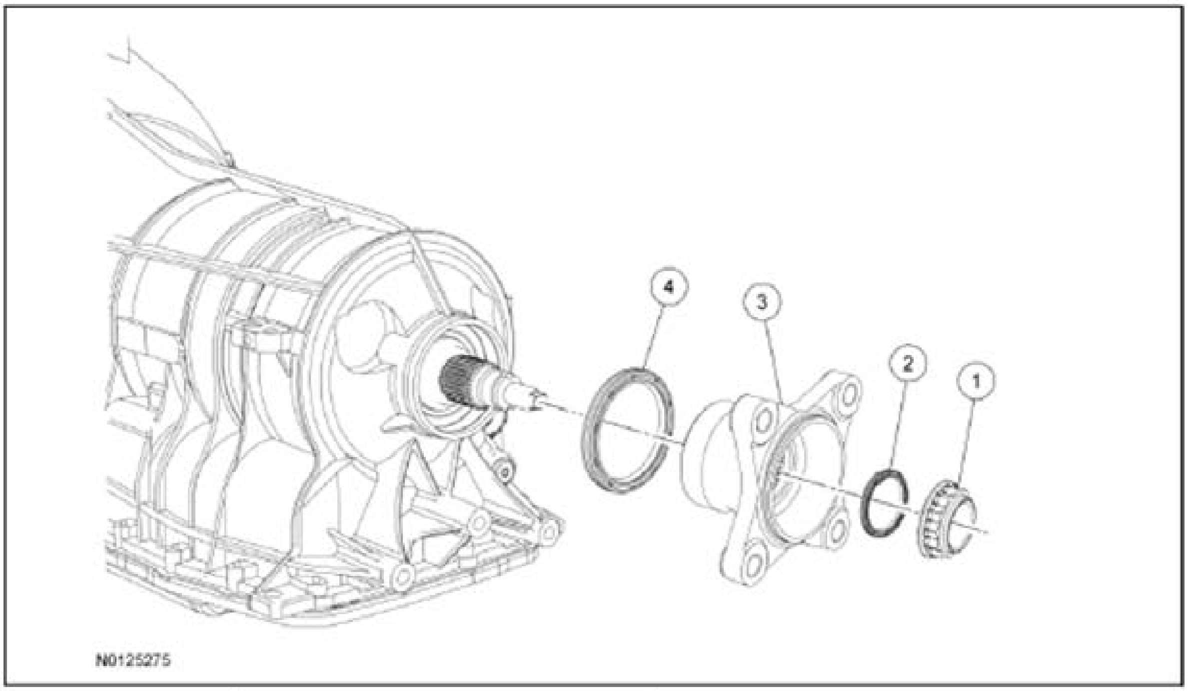
Output Shaft Seal
Special Tool(s)

 ST3059-A	Installer, Rear Seal 4X4 307-637
 ST3060-A	Rear Seal Installer 4X2 307-638
 ST2381-A	Remover, Input Shaft Oil Seal 308-375
 ST1187-A	Slide Hammer 100-001 (T50T-100-A)

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

NOTE:
Rear Wheel Drive (RWD) shown, Four-Wheel Drive (4WD) similar.



Item	Part Number	Description
1	7045	Output shaft flange nut
2	7052	Extension housing flange seal
3	7089	Output shaft flange
4	7052	Output shaft seal

Removal

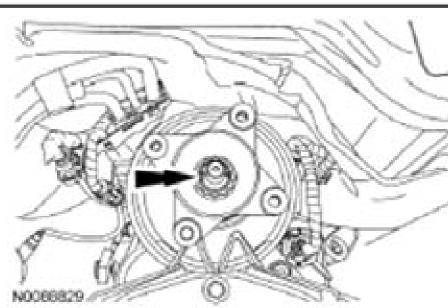
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.

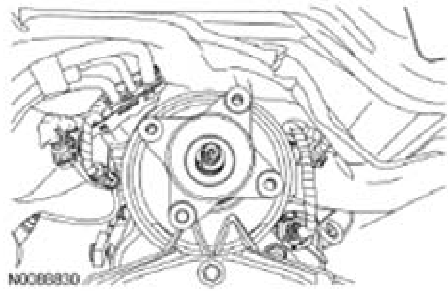
Rear Wheel Drive (RWD) vehicles

2. Remove the rear driveshaft. For additional information, refer to Section 205-01.
3. **NOTE:**
   The output shaft flange nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft.

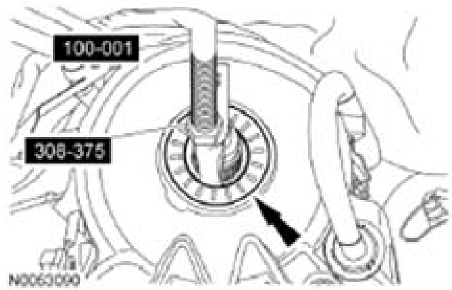
   Remove and discard the output shaft flange nut.



4. Remove the extension housing flange seal and the output shaft flange.



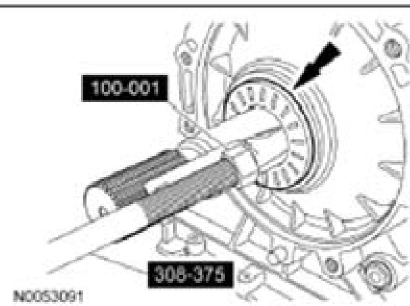
5. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the output shaft seal.



Four-Wheel Drive (4WD) vehicles

6. Remove the transfer case. For additional information, refer to Section 308-07B

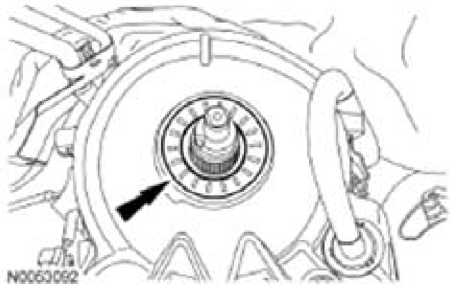
7. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove the output shaft seal.



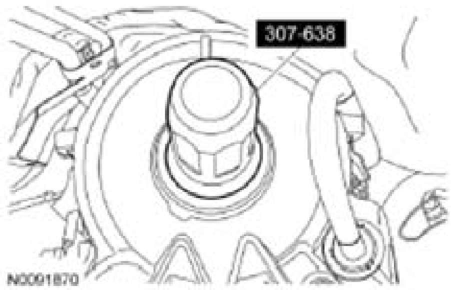
Installation

RWD vehicles

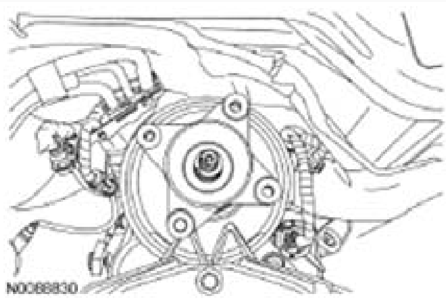
1. Position a new output shaft seal.



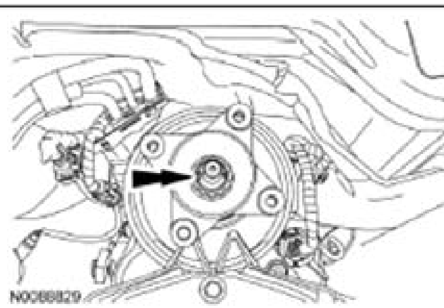
2. Using the Rear Seal 4X2 Installer, install the output shaft seal.



3. Install the output shaft flange.



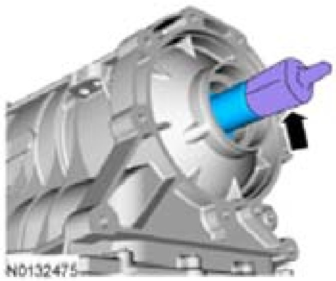
4. Install the extension housing flange seal and a new output shaft flange nut.
    a. Tighten to 80 Nm (59 lb-ft).
    b. After installing the new output shaft flange nut, it must be staked at the slots to prevent it from coming loose.



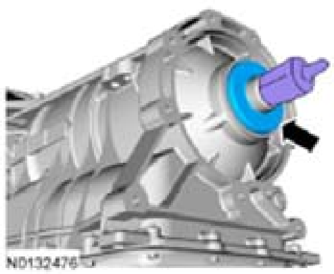
5. Install the rear driveshaft. For additional information, refer to Section 205-01.

4WD vehicles

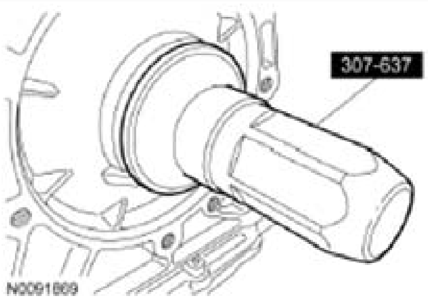
6. Install the seal protector provided with the new output shaft seal on the output shaft.



7. Slide the output shaft seal over the output shaft seal protector onto the output shaft. Remove the output shaft seal protector.



8. Using the Rear Seal 4X4 Installer, install a new output shaft seal.



9. Install the transfer case. For additional information, refer to Section 308-07B.

All vehicles

10. Fill and check the transmission fluid. For additional information, refer to Transmission Fluid Level Check in this section.

Manual Control Lever Shaft and Seal
Special Tool(s)

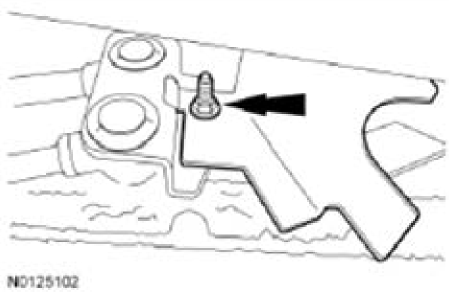
	Installer, Shifter Fluid Seal 307-559

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Removal

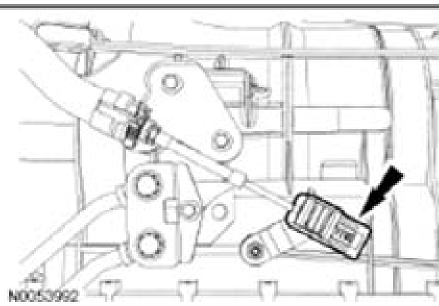
1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. If equipped, remove the nut and the selector lever cable splash shield.



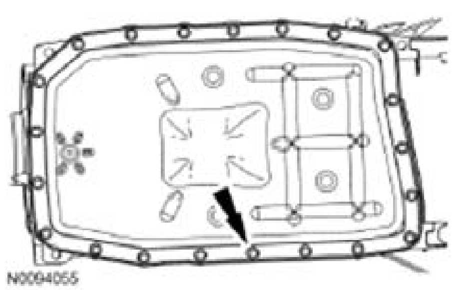
3. ***NOTICE:***
   To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

   NOTE:
   The column shift is shown, the floor shift is similar.

   Disconnect the transmission selector lever cable end from the manual control lever.

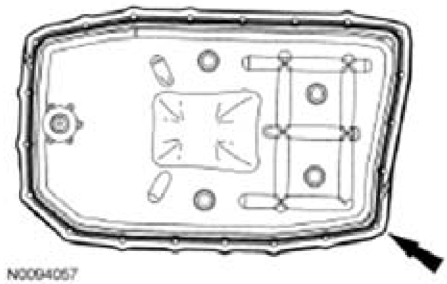


4. Remove the transmission fluid pan and allow the transmission fluid to drain.

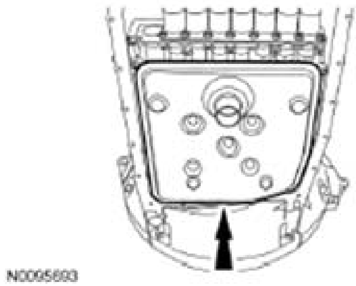


5. **NOTE:**
   The transmission fluid pan gasket can be reused if not damaged.

   Remove the transmission fluid pan gasket.

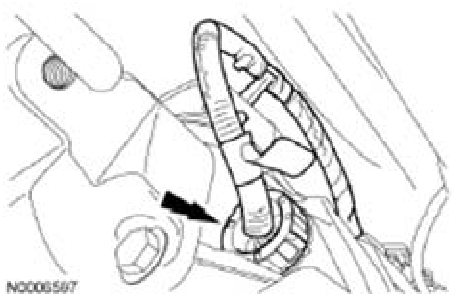


6. Remove and discard the transmission fluid filter.

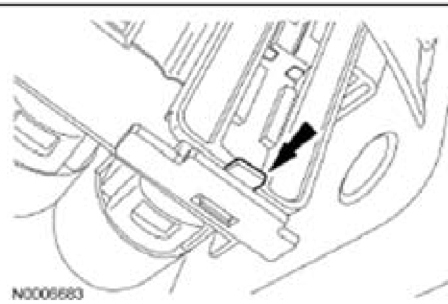


7. ***NOTICE:***
Do not pull on the wire harness to disconnect the connector or damage to the connector will occur.

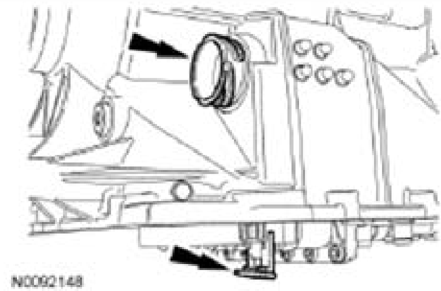
Disconnect the transmission vehicle harness connector by twisting the outer shell and pulling back on the connector.



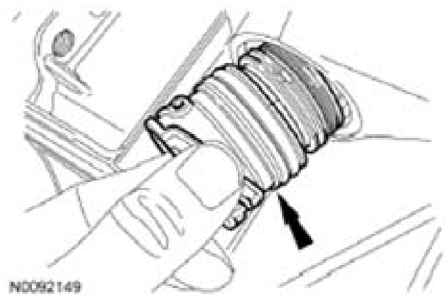
8. Pull the release tab and pull down on the bulkhead connector retainer.



9. With the bulkhead connector release tab down, pull the outer shell of the bulkhead connector out of the main control.

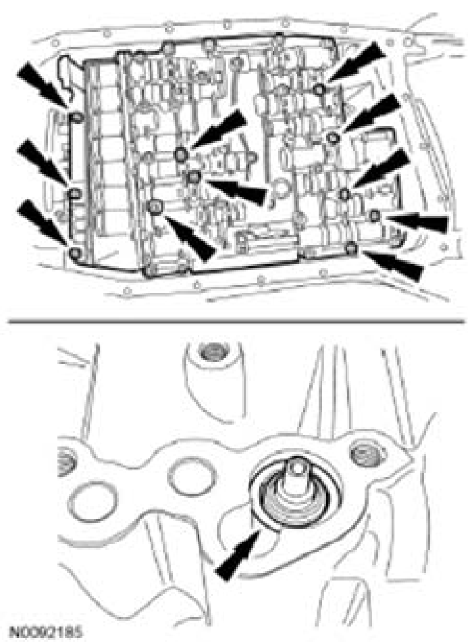


10. Pull the bulkhead connector out of the transmission.

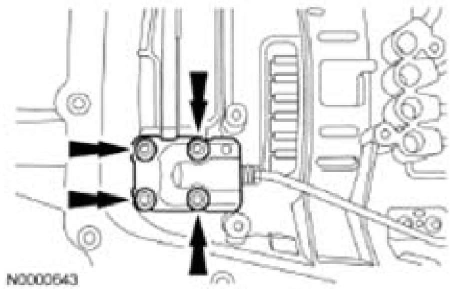


11. ***NOTICE:***
    During removal of the main control, the thermal bypass valve will fall out of the transmission case. Damage to the valve will occur if the valve falls out.

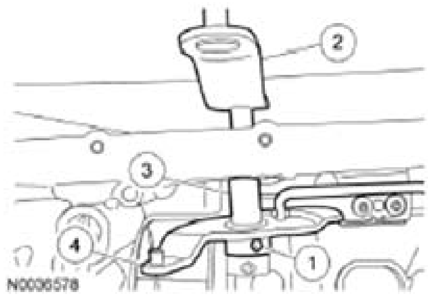
    Remove the 11 bolts from the main control and remove the main control assembly and the bypass valve.



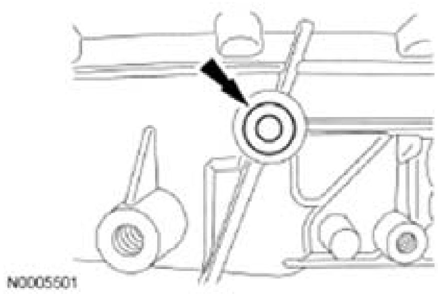
12. Remove the park rod actuating plate.



13. Remove the manual control lever.
    1. Remove the roll pin.
    2. Slide the manual control lever shaft out of the case
    3. Hold the spacer to keep it from falling out of the case.
    4. Remove the manual valve inner lever and the park rod as an assembly.

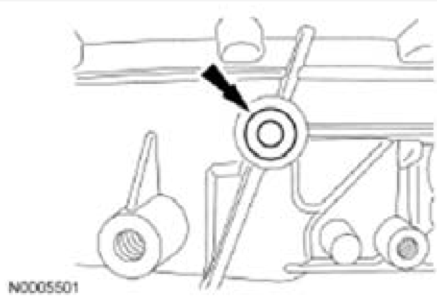


14. Remove and discard the manual control lever seal.

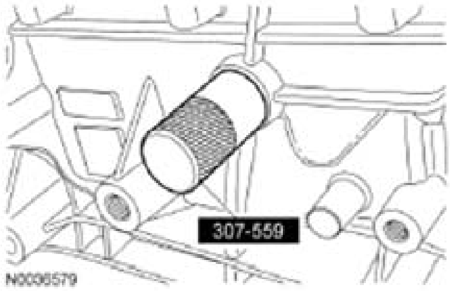


Installation

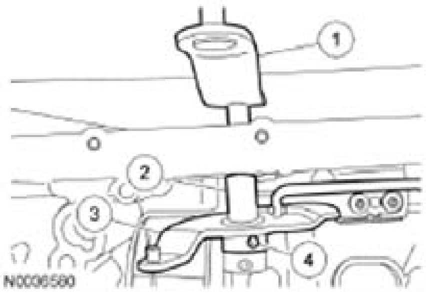
1. Position a new manual control lever seal in place.



2. Using the Shifter Fluid Seal Installer, install a new manual control lever shaft seal.

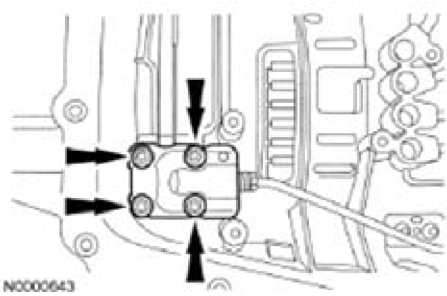


3. Install the manual control lever in the case.
    1. Slide the manual control lever in the case.
    2. Position the spacer in place while sliding the manual control lever into the spacer.
    3. Position the manual valve inner lever while sliding the manual control lever and lining up the roll pin hole
    4. Install the roll pin.



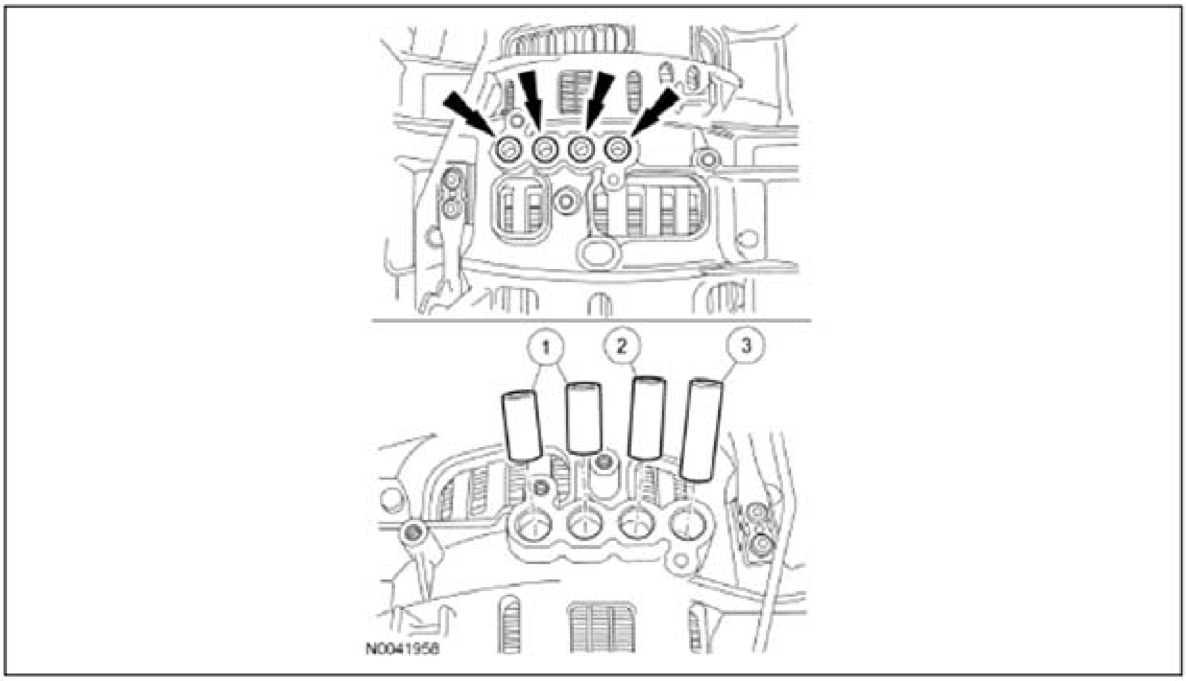
4. Position the park rod in place. Push down on the park pawl and position the park rod in place.

5. While holding the park rod down, install the park rod actuating plate.
    - Tighten to 12 Nm (106 lb-in).

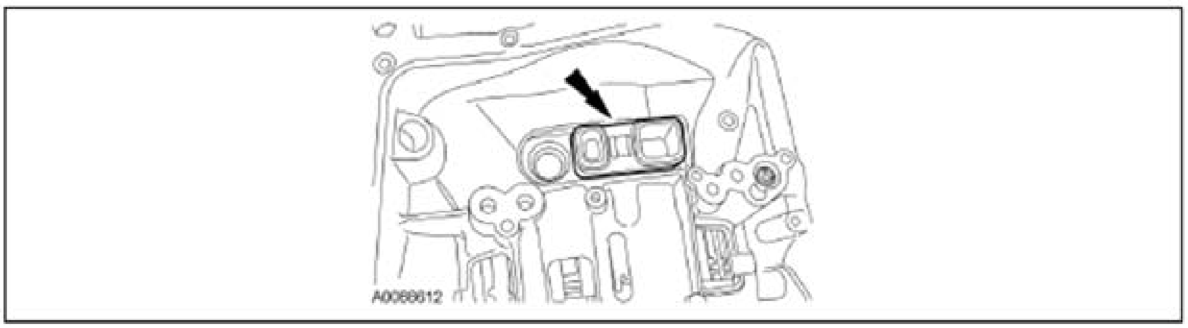


6. **NOTE:**
Before installing the main control make sure that the thermal bypass valve, pump adapter seal and the center support seals are installed in the transmission case and are in the correct location. Also make sure that none of the center support seals are in the main control.

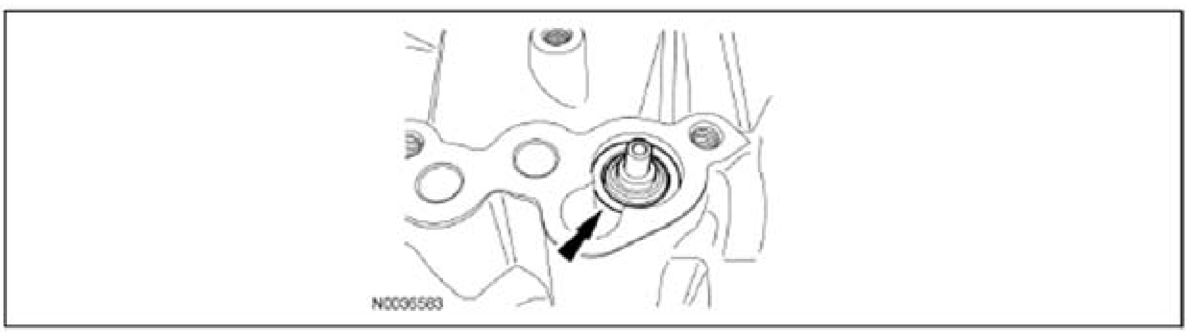
    Verify the 4 rubber feed tubes for the center support are in place.
    1. Black feed tubes
    2. Green feed tube
    3. Blue feed tube



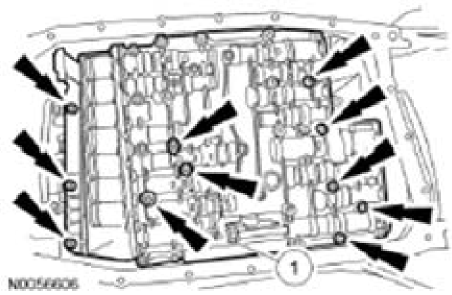
7. Verify the rubber adapter is in place.



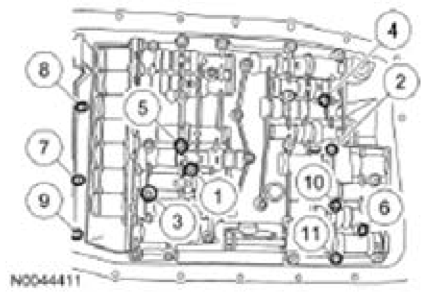
8. Coat the thermal bypass valve with petroleum jelly to hold it in place and install the thermal bypass valve in the transmission case.



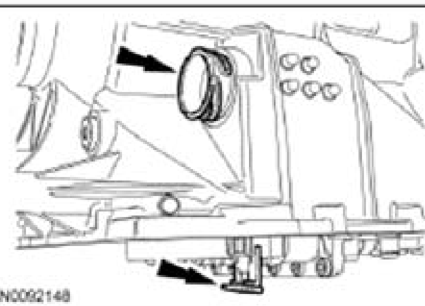
9. Position the main control in place and loosely install the 11 bolts.
    1. Align the manual valve and control lever linkage.



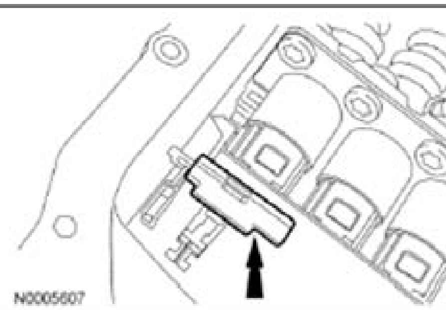
10. Tighten the main control bolts in the sequence shown
    1. Tighten to 8 Nm (71 lb-in).



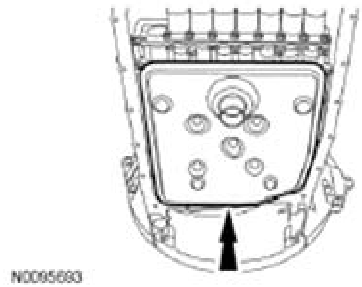
11. With the bulkhead connector release tab down and unlocked, push the outer shell of the bulkhead connector into the transmission. Make sure that the bulkhead connector is fully seated into the main control..



12. Press up on the tab and lock the outer shell of the bulkhead connector in place.

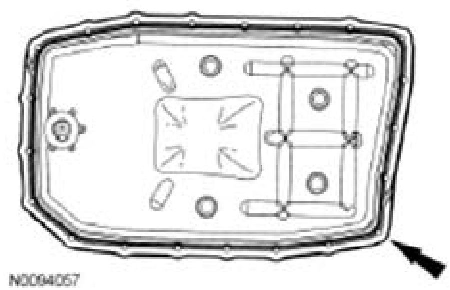


13. Install a new transmission fluid filter.

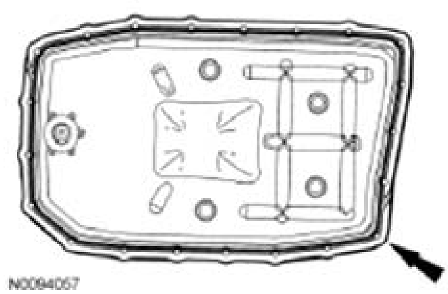


14. **NOTE:**
    The transmission fluid pan gasket can be reused if not damaged.

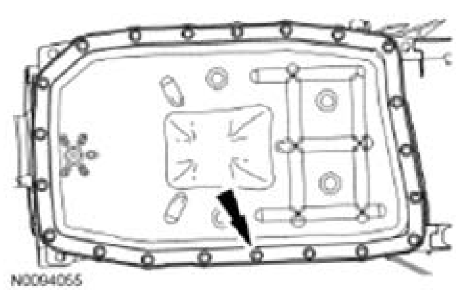
    If necessary, install a new transmission fluid pan gasket.



15. Install the transmission fluid pan and tighten the transmission fluid pan bolts in a crisscross pattern.
    1. Tighten to 12 Nm (106 lb-in).



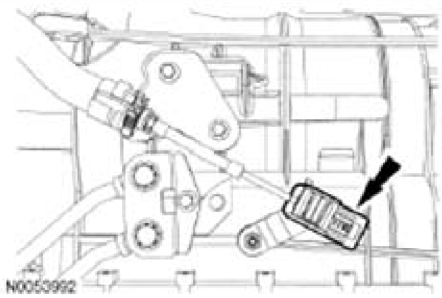
16. Connect the transmission vehicle harness connector by pushing it in and twisting the outer shell to lock it in place.



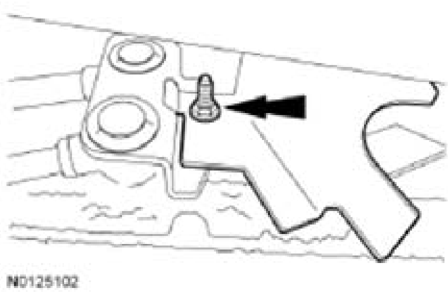
17. ***NOTICE:***
To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

NOTE:
The column shift is shown, the floor shift is similar.

Install the selector lever cable end on the manual control lever.



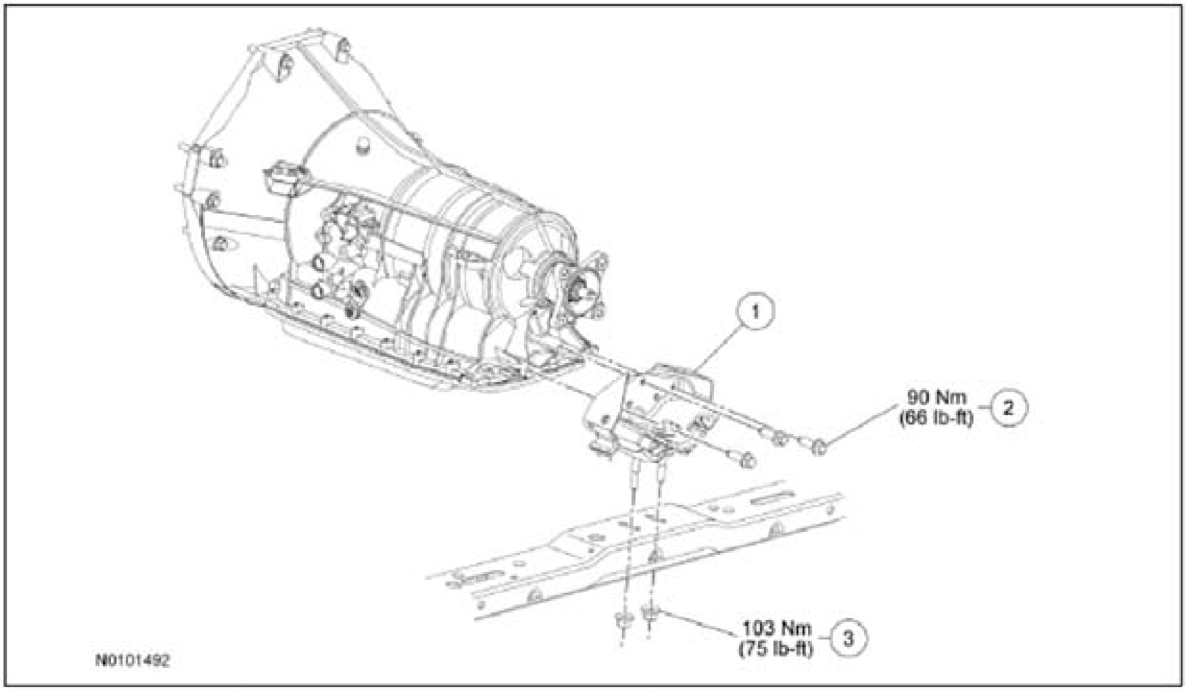
18. If equipped, install the selector lever cable splash shield and the nut.



19. Fill the transmission with clean transmission fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Transmission Insulator and Retainer

Transmission Insulator and Retainer Rear Wheel Drive (RWD)

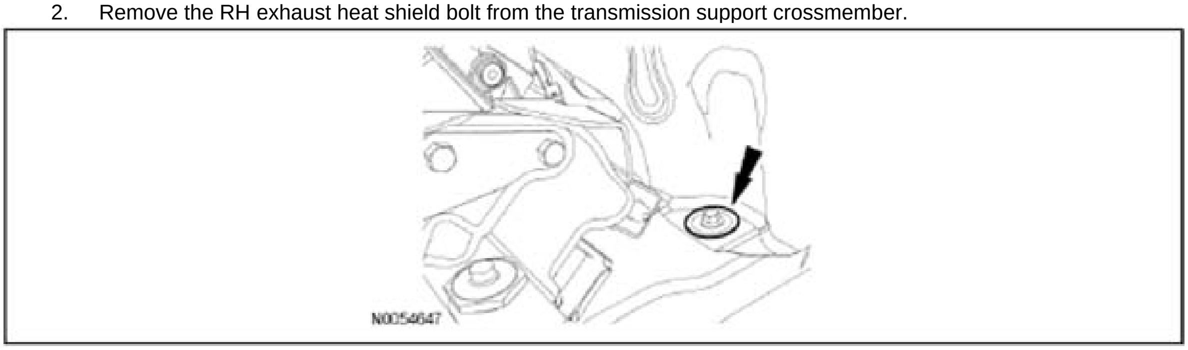


Item	Part Number	Description
1	6068	Transmission insulator and retainer
2	W713728	Transmission insulator and retainer bolt
3	N621945	Transmission insulator and retainer nut

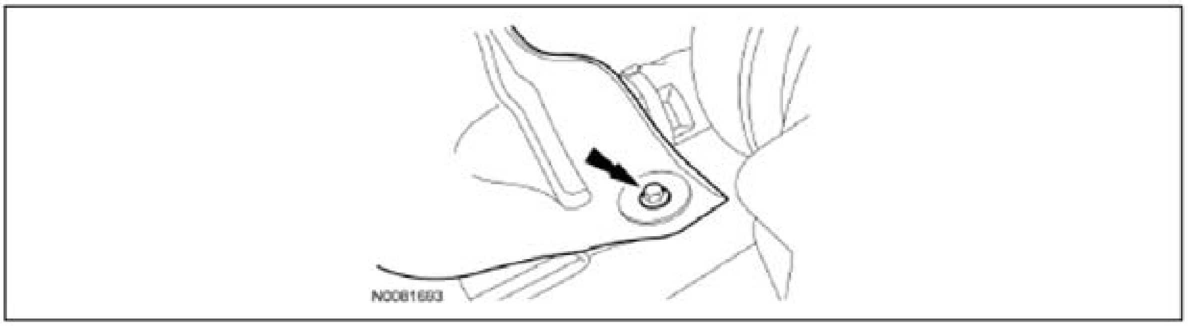
Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. Refer to Section 100-02.
2. Remove the RH exhaust heat shield bolt from the transmission support crossmember.

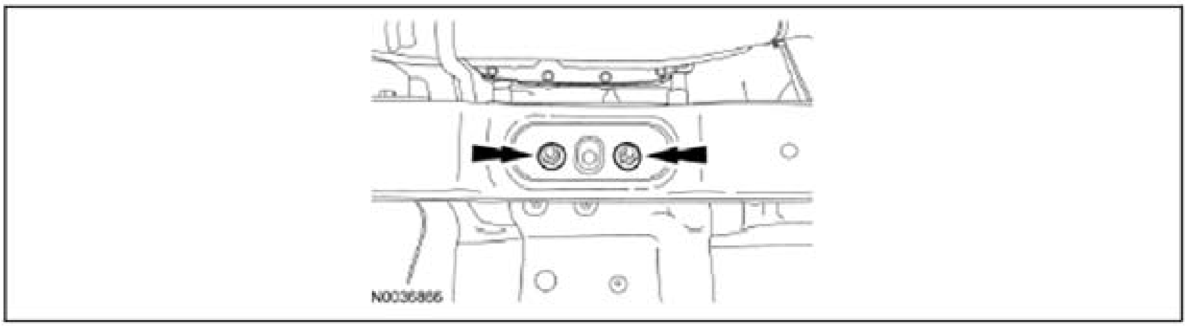


3. Remove the LH exhaust heat shield bolt from the transmission support crossmember.

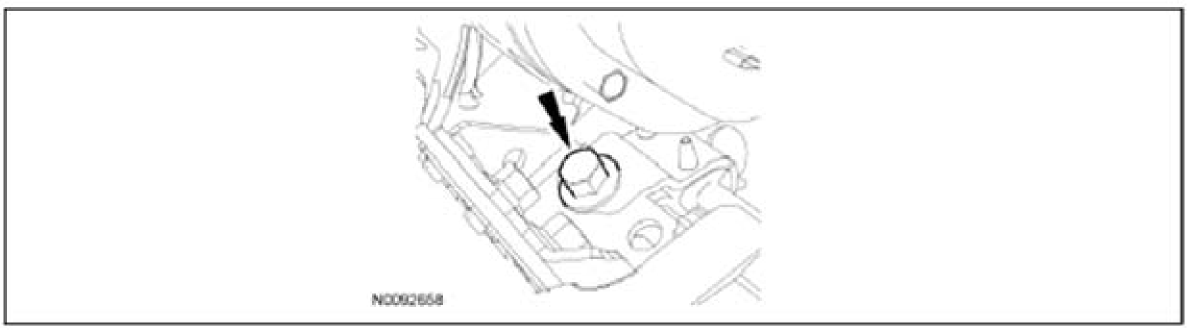


RWD vehicles

4. Remove the 2 transmission insulator and retainer nuts.

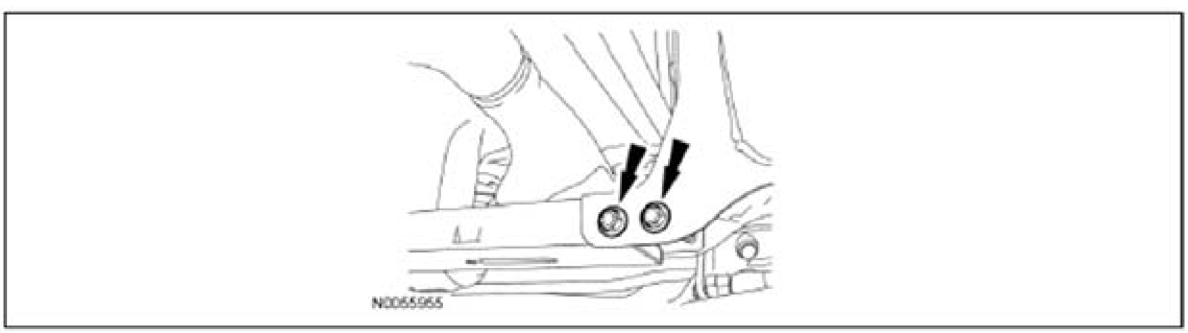


5. Remove the LH isolator cap bolt.

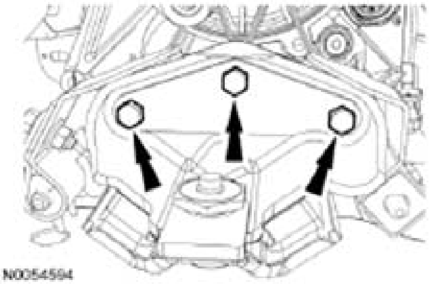


6. Position a high-lift transmission jack under the transmission.

7. Remove and discard the 4 transmission support crossmember nuts and bolts (2 each side) and remove the transmission support crossmember.

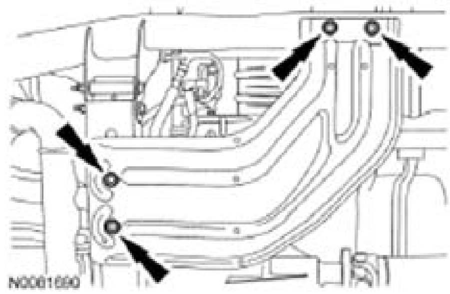


8. Remove the 3 transmission insulator and retainer bolts and remove the transmission insulator and retainer.

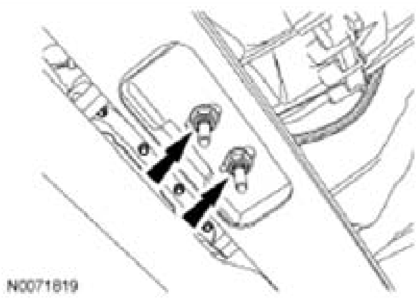


4WD vehicles

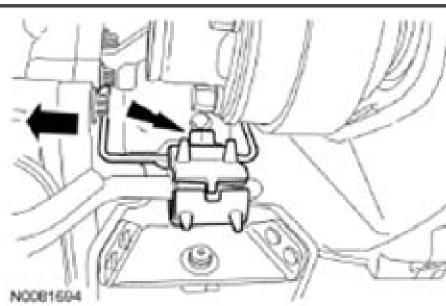
9. If equipped, remove the 4 skid plate bolts and remove the skid plate.



10. Remove the 2 transmission insulator and retainer nuts.

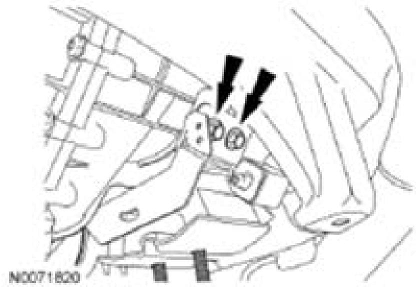


11. Remove the LH insolator cap bolt.

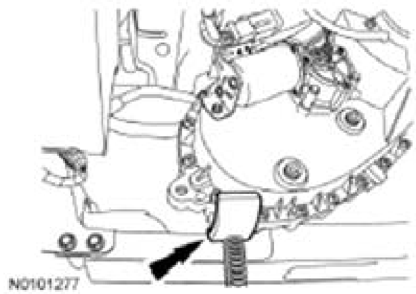


12. **NOTE:**
 Right side shown, left side similar. Transmission crossmember removed for clarity.

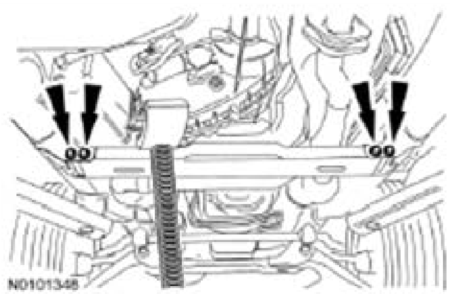
 Remove the 4 transmission insulator and retainer bolts.



13. Support the transfer case.



14. Remove and discard the 4 transmission support crossmember nuts and bolts.

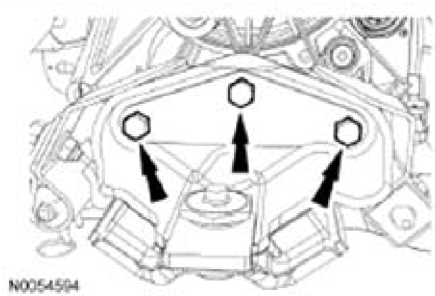


15. Remove the transmission insulator and retainer.

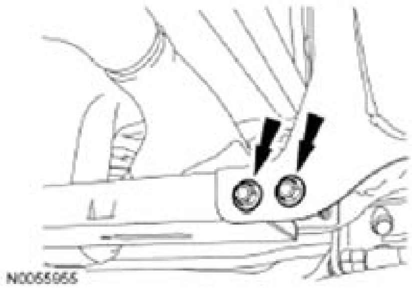
Installation

RWD vehicles

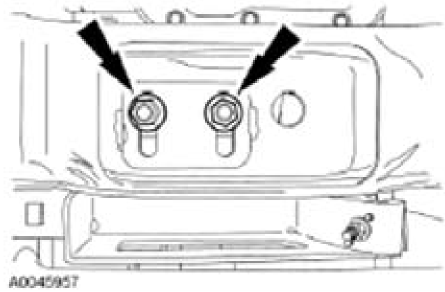
1. Install the transmission insulator and retainer and the 3 bolts.
    1. Tighten to 90 Nm (66 lb-ft).



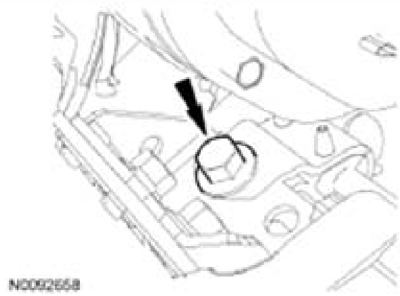
2. Install the transmission support crossmember and the 4 new transmission support crossmember nuts and bolts (2 each side).
    1. Tighten to 90 Nm (66 lb-ft).



3. Lower the transmission onto the transmission support crossmember and install the 2 transmission insulator and retainer nuts.
    1. Tighten to 103 Nm (75 lb-ft).

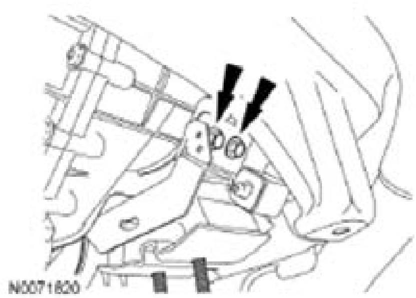


4. Install the LH isolator cap bolt.
    1. Tighten to 35 Nm (26 lb-ft).

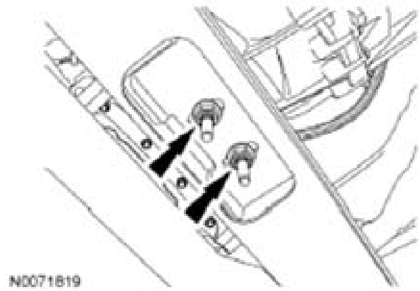


4WD vehicles

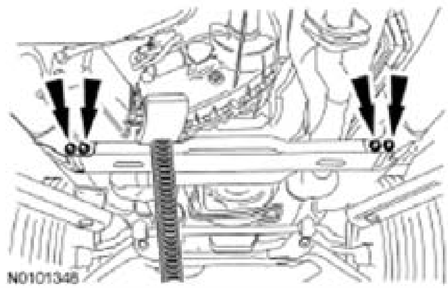
5. Loosely install the transmission insulator and retainer and the 4 bolts.



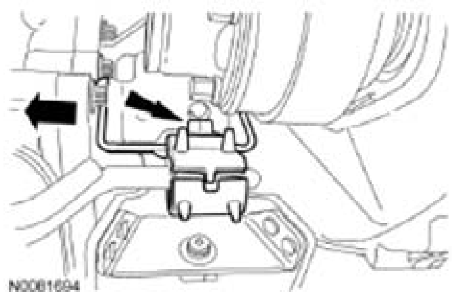
6. Position the transmission support crossmember and loosely install the 2 transmission insulator and retainer nuts.



7. Install the 4 new transmission support crossmember bolts and nuts.
    1. Tighten the transmission insulator and retainer bolts to 90 Nm (66 lb-ft).
    2. Tighten the transmission support crossmember bolts and nuts to 90 Nm (66 lb-ft).
    3. Tighten the transmission insulator and retainer nuts to 103 Nm (75 lb-ft).

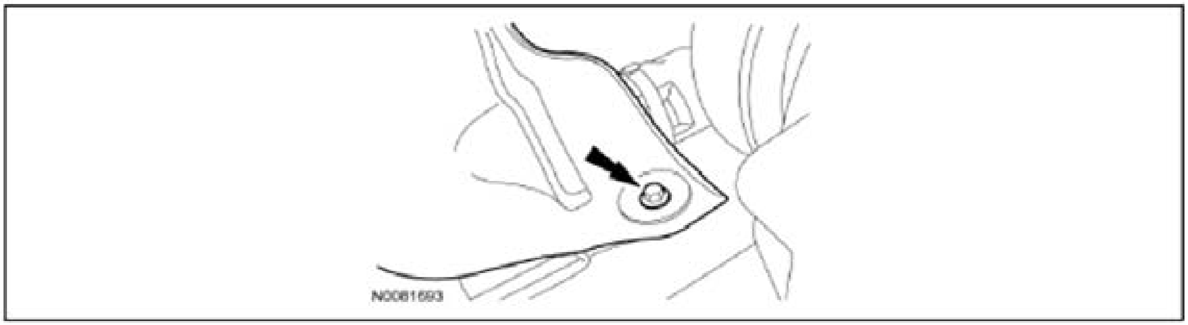


8. Install the bolt for the LH isolator cap bolt.
    1. Tighten to 35 Nm (26 lb-ft).

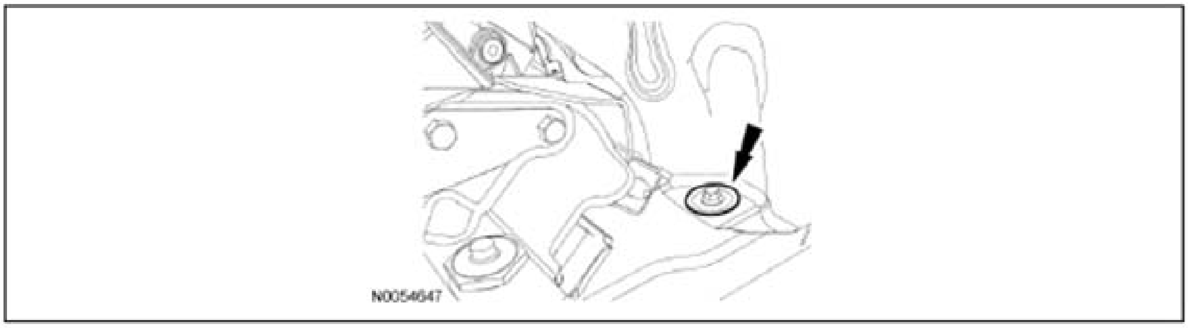


All vehicles

9. Install the LH exhaust heat shield bolt to the transmission support crossmember.
    1. Tighten to 15 Nm (133 lb-in).

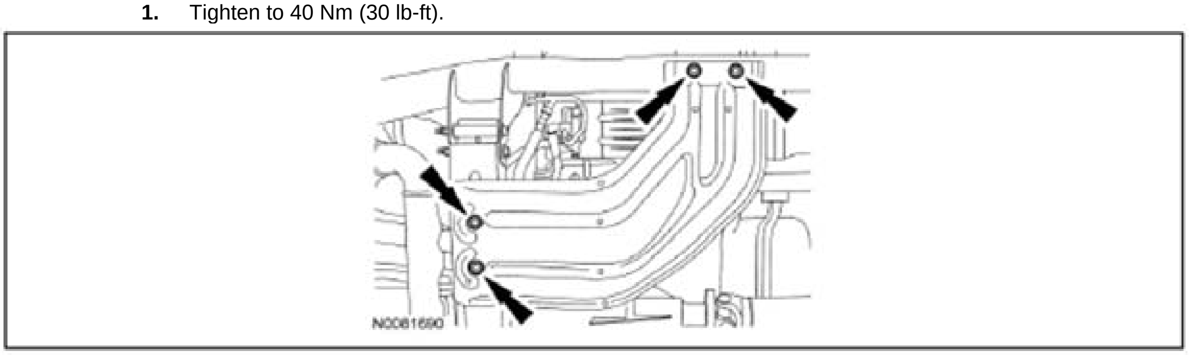


10. Install the RH exhaust heat shield bolt to the transmission support crossmember.
    1. Tighten to 15 Nm (133 lb-in).



4WD vehicles

11. If equipped, install the skid plate and the 4 skid plate bolts.
    1. Tighten to 40 Nm (30 lb-ft).



REMOVAL
Transmission — Four Wheel Drive (4WD)
Special Tool(s)

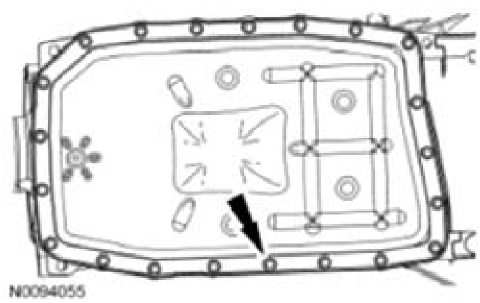
	Retainer, Torque Converter 307-346 (T97T-7902-A)

Removal

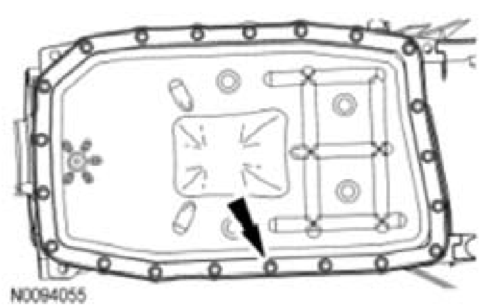
NOTE:
Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
3. If transmission disassembly or installation of a new transmission is necessary, remove the 21 transmission fluid pan bolts and remove the transmission fluid pan. Drain the transmission fluid into a container.



4. Install the transmission fluid pan and the 21 transmission fluid pan bolts. Tighten transmission fluid pan bolts in a crisscross pattern.
   - `Tighten to 12 Nm (106 lb-in).

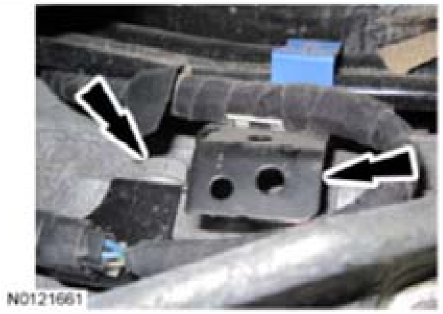


5. **NOTE:**
   It is only necessary to remove the transfer case from the transmission if a new transmission is being installed or if the transmisson is going to be disassembled for a transmission related repair.

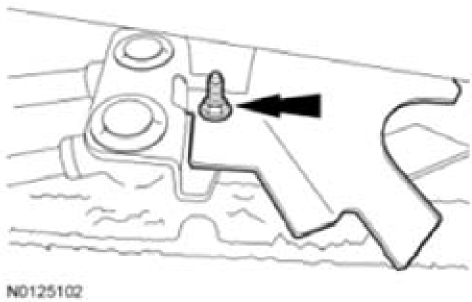
6. **NOTE:**
   Make sure the transmission jack contacts the outer ribs of the transmission fluid pan.

   NOTE:
   Make sure the transmission is securely fastened to the transmission jack.
   - Using a high-lift transmission jack, support the transmission and remove the jack stand.

7. Remove the fuel line bracket bolt from the left side of the transmission and position the fuel line bracket aside.



8. If equipped, remove the nut and the selector lever cable splash shield.

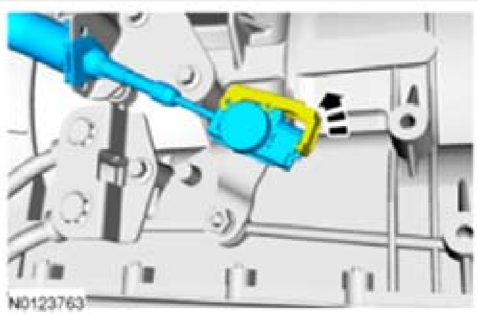


Vehicles equipped with a floor shift

9. ***NOTICE:***
To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

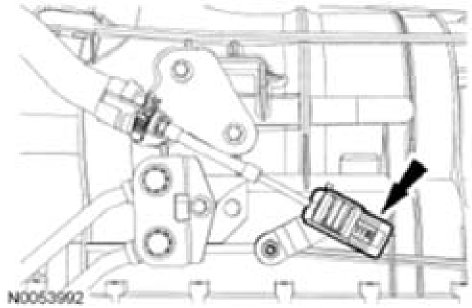
NOTE:
The 3.5L engine is shown, the 3.7L, 5.0L and 6.2L engines are similar.

Rotate the cable adjustment lock upward and remove the selector lever cable from the manual control lever.



Vehicles equipped with a column shift

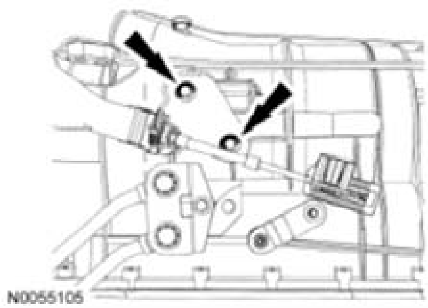
10. Move the locking tab up and disconnect the selector lever cable from the manual control lever.



All vehicles

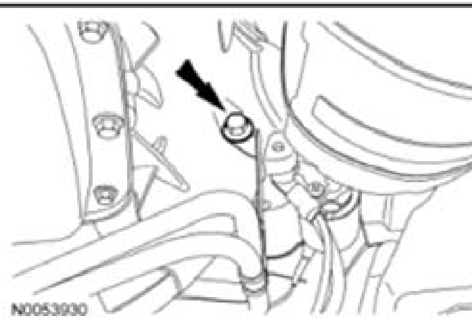
11. **NOTE:**
    The column shift is shown, the floor shift is similar.

    Remove the selector lever cable bracket bolts and remove the selector lever cable bracket.



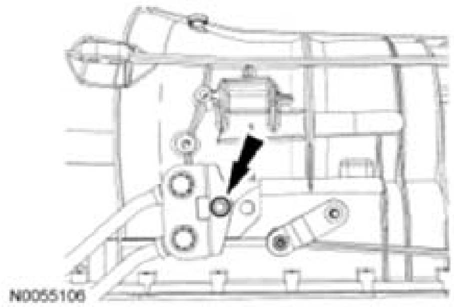
Vehicles equipped with a 5.0L or 6.2L engine

12. Remove the transmission-to-engine bolt.



All vehicles

13. Remove and discard the transmission fluid cooler tube bracket bolt.



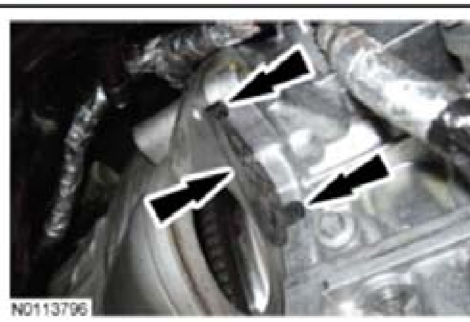
14. **NOTE:**
The 3.5L and 3.7L engine is shown, the 5.0L and the 6.2L engines are similar.

Remove the transmission fluid cooler tube bracket nut and position the transmission fluid cooler tube bracket and tubes aside.

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

Vehicles equipped with a 3.5L or 3.7L engine

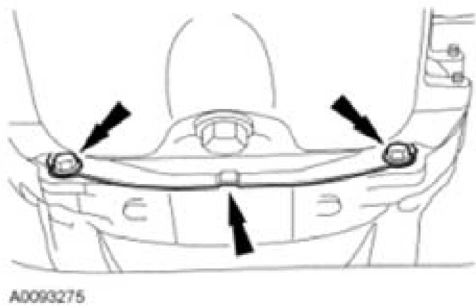
16. Remove the 2 pin-type retainers and the access cover.



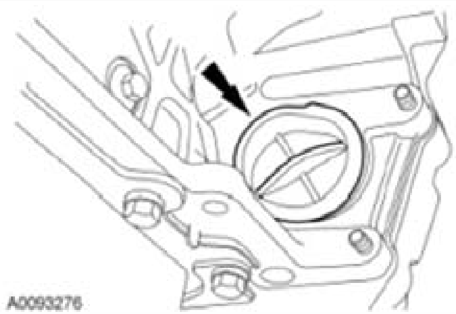
17. Remove and discard the 4 flexplate-to-torque converter nuts.

Vehicles equipped with a 5.0L or 6.2L engine

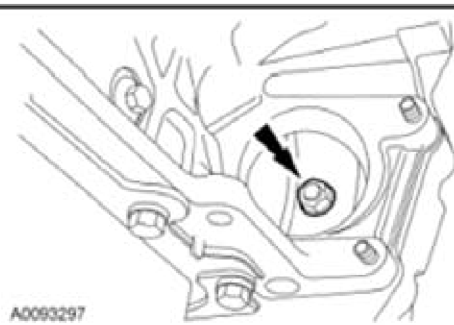
18. Remove the flexplate inspection cover bolts and the flexplate inspection cover.



19. Remove the rubber torque converter nut access cover.



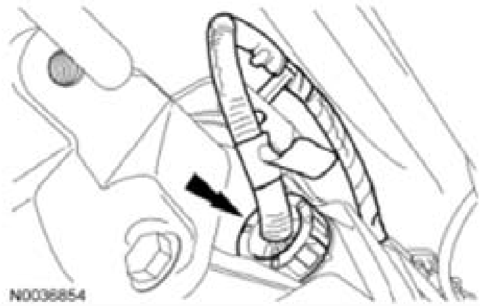
20. Remove and discard the 4 flexplate-to-torque converter nuts.



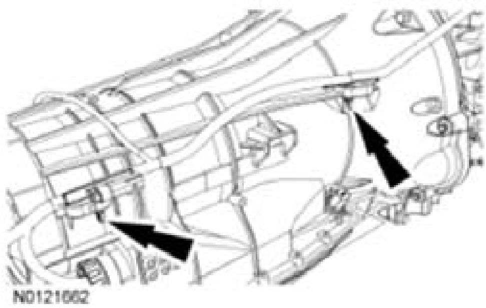
All vehicles

21. ***NOTICE:***
    Do not pull on the wiring harness to disconnect the electrical connector or damage to the electrical connector will occur.

    Disconnect the electrical connector by twisting the outer shell and pulling back on the electrical connector.



22. Disconnect the wiring harness retainers from the top of the transmission.



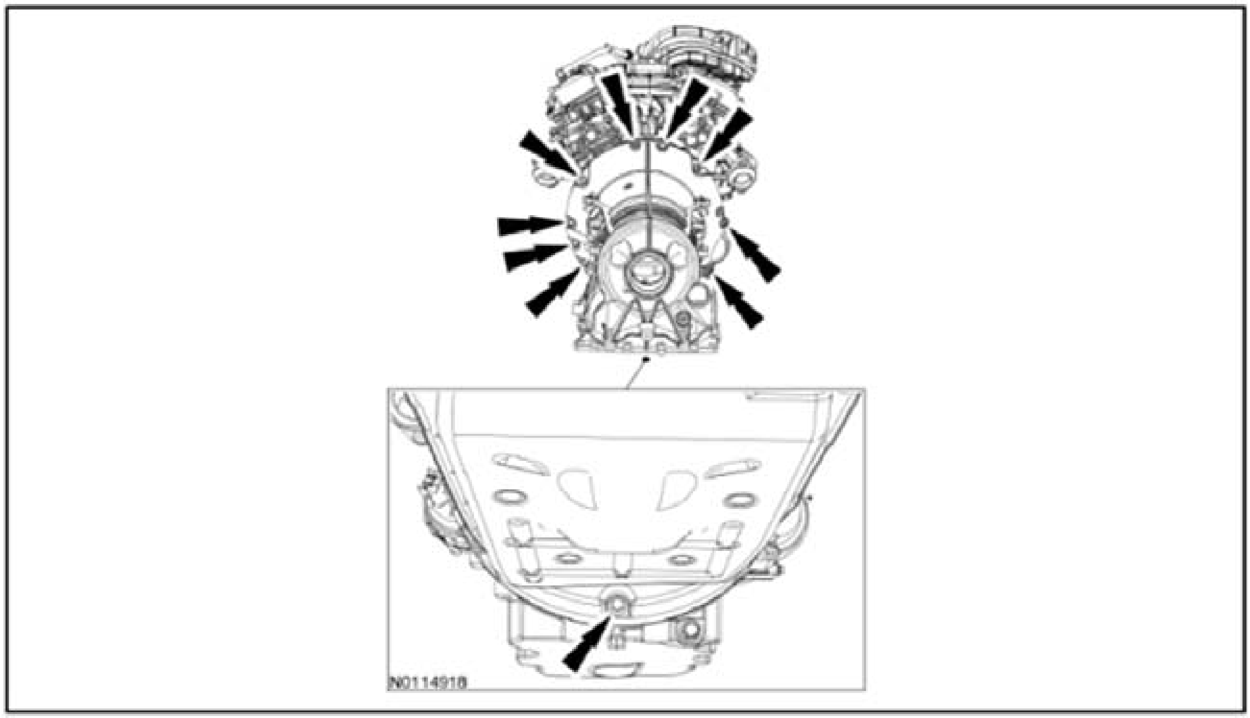
Vehicles equipped with a 3.5L or 3.7L engine

23. **WARNING:**
    Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

    NOTICE:
    Make sure to not pinch the transmission wiring harness between the transmission and the body or damage can occur.

    NOTE:
    The top 2 transmission-to-engine bolts secure the fuel line bracket to the transmission case.

    Remove the 10 transmission-to-engine bolts.



Vehicles equipped with a 5.0L or 6.2L engine

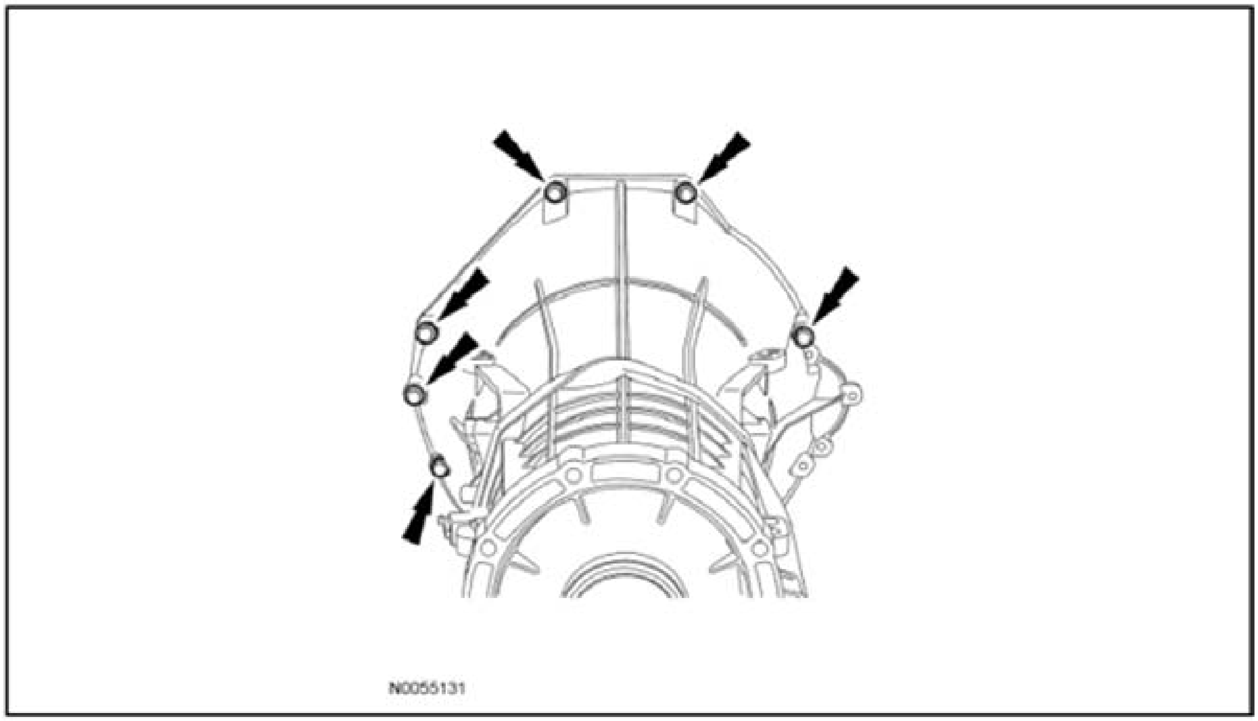
24. ⚠ **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTICE:
Make sure to not pinch the transmission wiring harness between the transmission and the body or damage can occur.

NOTE:
Remove the top 2 transmission-to-engine bolts before removing the rest of the bolts.

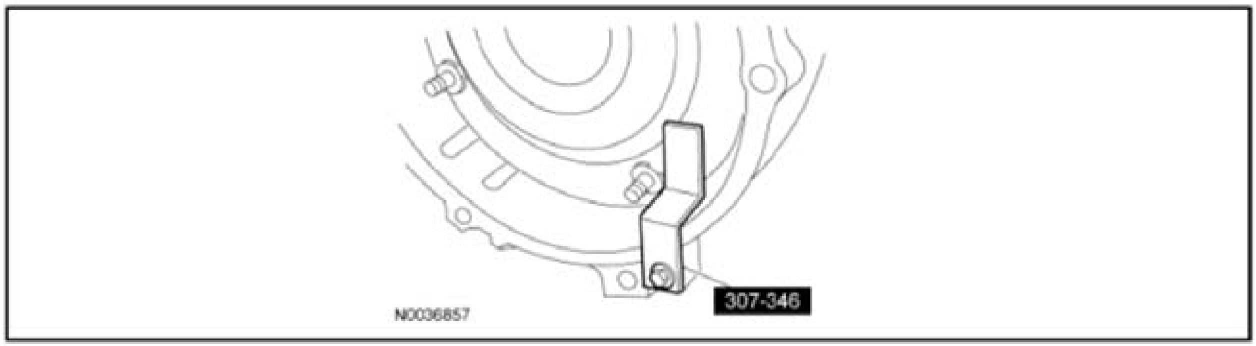
NOTE:
The top left transmission-to-engine bolt secures the fuel line bracket to the transmission case.

Remove the 6 remaining transmission-to-engine bolts.



All vehicles

25. Slide the transmission back enough to install the Torque Converter Retainer.



26. Remove the transmission from the vehicle.

27. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, clean and backflush the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes to prevent contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

Transmission — Rear Wheel Drive (RWD)

Special Tool(s)

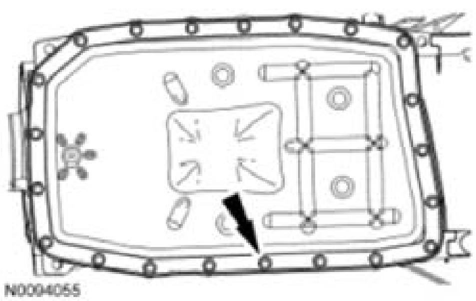
 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

Removal

NOTE:
Refer to the Transmission Cooler Flushing Job Aid on the FMCDealer website.

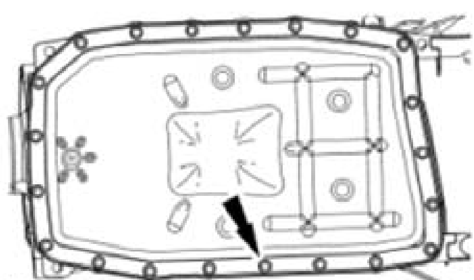
All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01.
3. If transmission disassembly or installation of a new transmission is necessary, remove the 21 transmission fluid pan bolts and remove the transmission fluid pan. Drain the transmission fluid into a container.



N0094055

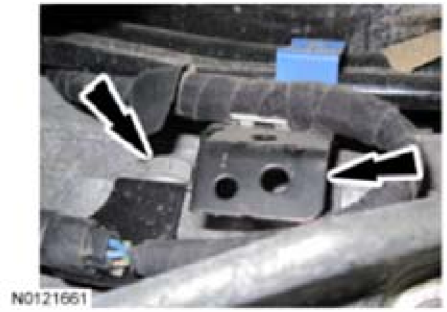
4. Install the transmission fluid pan and the 21 transmission fluid pan bolts. Tighten transmission fluid pan bolts in a crisscross pattern.
   - Tighten to 12 Nm (106 lb-in).



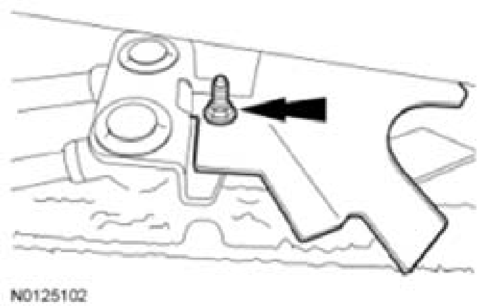
N0094055

5. Remove the exhaust Y-pipe. For additional information, refer to Section 309-00.
6. Remove the driveshaft. For additional information, refer to Section 205-01.
7. **NOTE:**
   Make sure the transmission jack contacts the outer ribs of the transmission fluid pan.

   NOTE:
   Make sure the transmission is securely fastened to the transmission jack.
   Using a high-lift transmission jack, support the transmission and remove the jack stand.
8. Remove the fuel line bracket bolt from the left side of the transmission and position the fuel line bracket aside.

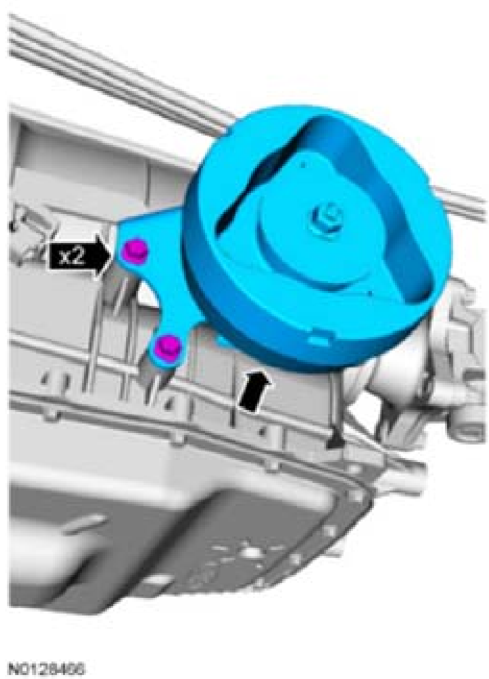


9. If equipped, remove the nut and the selector lever cable splash shield.



Vehicles equipped with 3.7L engine Rear Wheel Drive (RWD)

10. Remove the 2 transmission damper bolts and remove the transmission damper (if present).

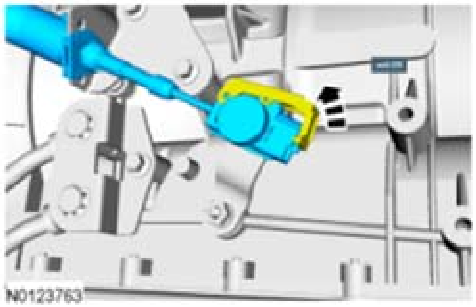


Vehicles equipped with a floor shift

11. ***NOTICE:***
To prevent selector lever cable damage, do not apply force to the selector lever cable between the manual control lever and the selector lever cable bracket.

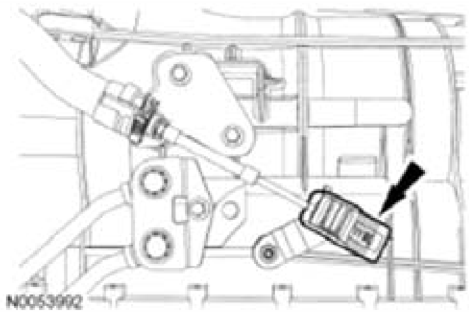
NOTE:
The 3.5L engine is shown, the 3.7L, 5.0L and 6.2L engines are similar.

Rotate the cable adjustment lock upward and remove the selector lever cable from the manual control lever.



Vehicles equipped with a column shift

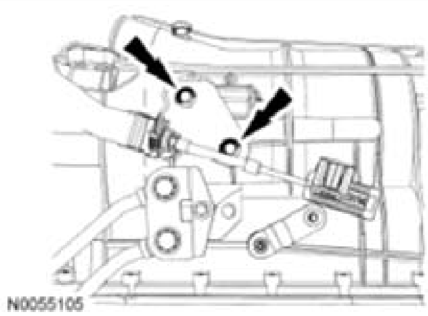
12. Move the locking tab up and disconnect the selector lever cable from the manual control lever.



All vehicles

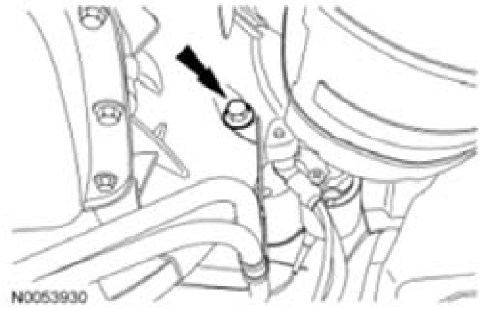
13. **NOTE:**
    The column shift is shown, the floor shift is similar.

    Remove the selector lever cable bracket bolts and remove the selector lever cable bracket.



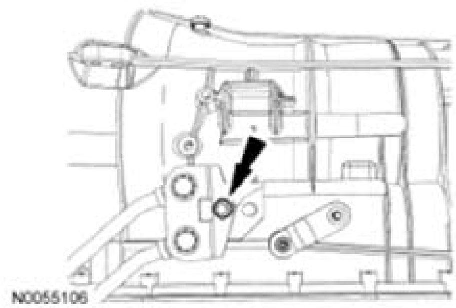
Vehicles equipped with a 5.0L or 6.2L engine

14. Remove the transmission-to-engine bolt.



All vehicles

15. Remove and discard the transmission fluid cooler tube bracket bolt.



16. **NOTE:**
    The 3.5L and 3.7L engine is shown, the 5.0L and the 6.2L engines are similar.

    Remove the transmission fluid cooler tube bracket nut and position the transmission fluid cooler tube bracket and tubes aside.

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

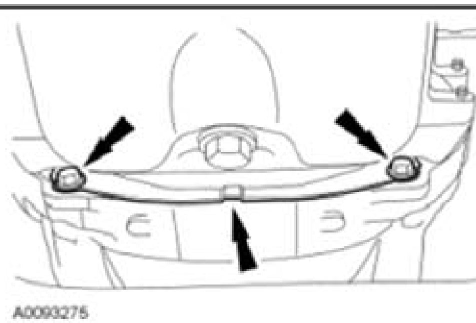
Vehicles equipped with a 3.5L or 3.7L engine

18. Remove the 2 pin-type retainers and the access cover.

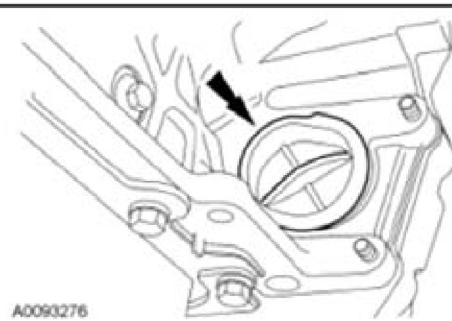
19. Remove and discard the 4 flexplate-to-torque converter nuts.

Vehicles equipped with a 5.0L or 6.2L engine

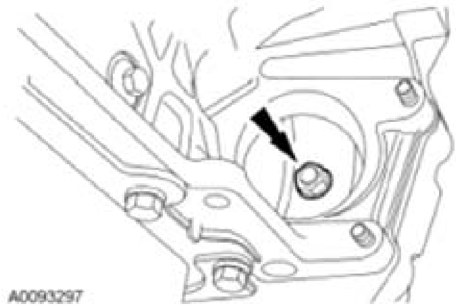
20. Remove the flexplate inspection cover bolts and the flexplate inspection cover.



21. Remove the rubber torque converter nut access cover.



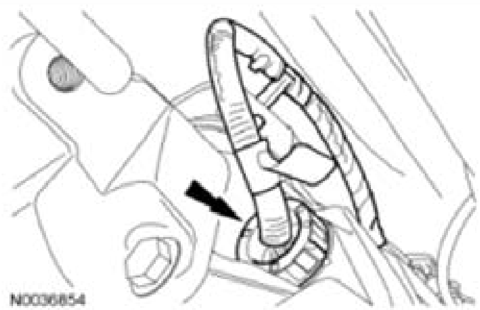
22. Remove and discard the 4 flexplate-to-torque converter nuts.



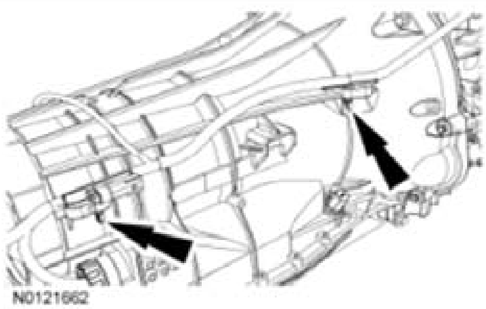
All vehicles

23. ***NOTICE:***
Do not pull on the wiring harness to disconnect the electrical connector or damage to the electrical connector will occur.

Disconnect the transmission electrical connector by twisting the outer shell and pulling back on the electrical connector.



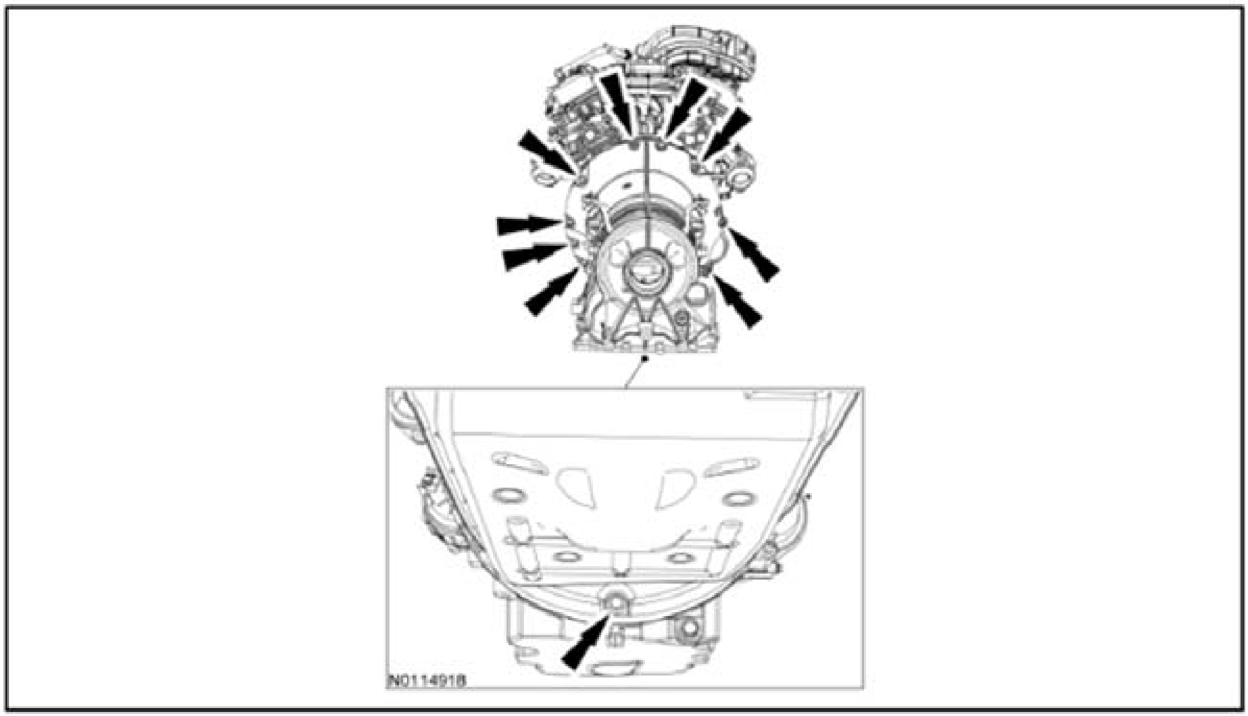
24. Disconnect the wiring harness retainers from the top of the transmission.



25. ⚠ **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTE:
The top 2 transmission-to-engine bolts secure the fuel line bracket to the transmission case.

Remove the 10 transmission-to-engine bolts.



Vehicles equipped with a 5.0L or 6.2L engine

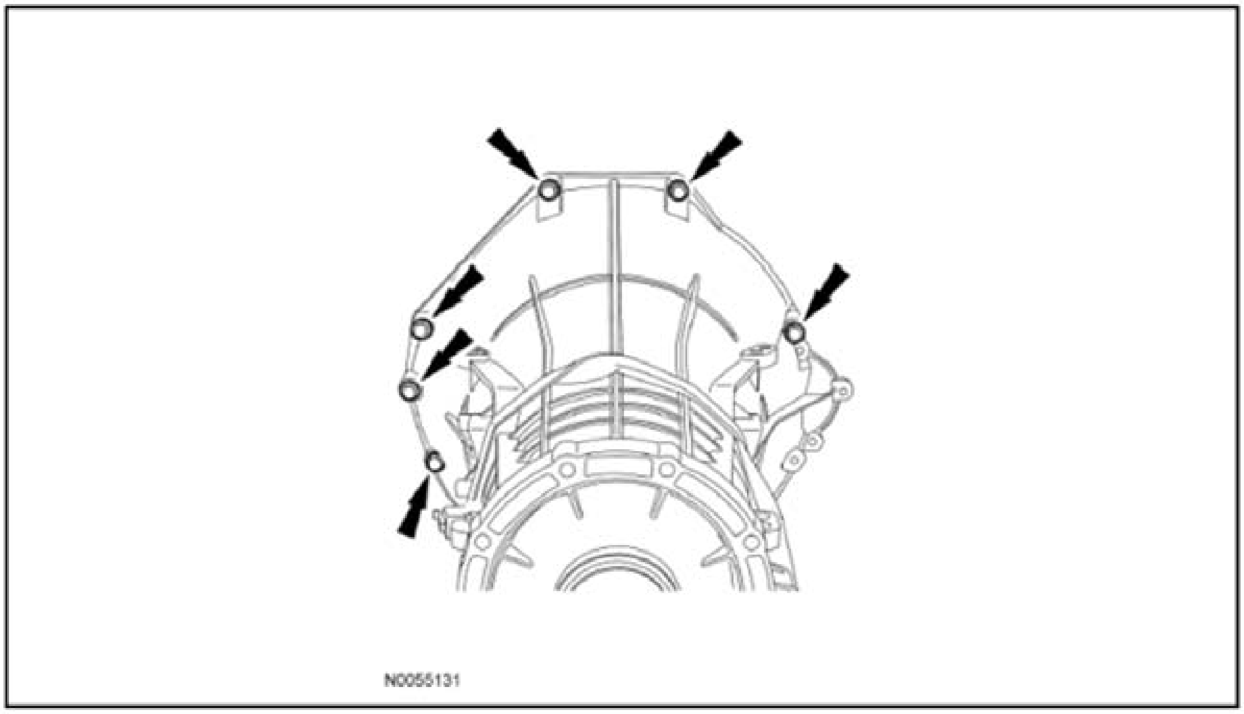
26. **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTICE:
Make sure to not pinch the transmission wiring harness between the transmission and the body or damage can occur.

NOTE:
Remove the top 2 transmission-to-engine bolts before removing the rest of the bolts.

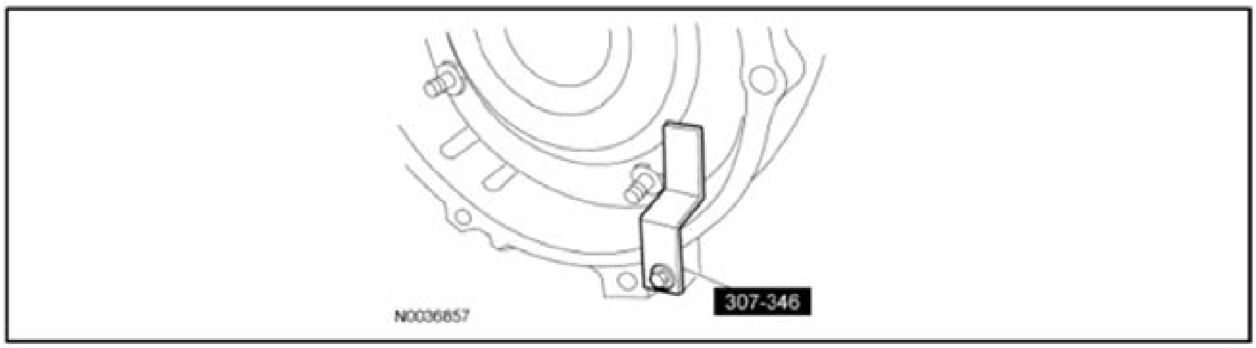
NOTE:
The top left transmission-to-engine bolt secures the fuel line bracket to the transmission case.

Remove the 6 remaining transmission-to-engine bolts.



All vehicles

27. Slide the transmission back enough to install the Torque Converter Retainer.



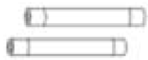
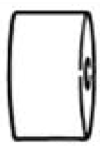
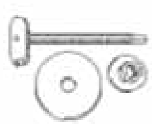
28. Remove the transmission from the vehicle.

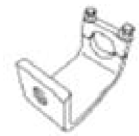
29. If the transmission is being disassembled to install new parts, or if a new or remanufactured transmission is being installed, clean and backflush the transmission fluid cooler, the auxiliary transmission fluid cooler (if equipped) and the transmission fluid cooler tubes to prevent contaminants from entering the transmission. For additional information, refer to Transmission Fluid Cooler Backflushing and Cleaning in this section.

DISASSEMBLY

Transmission

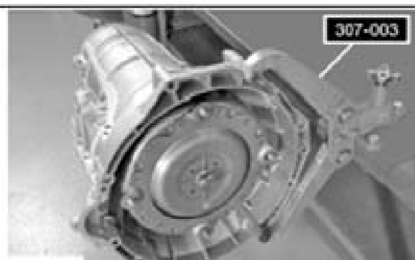
Special Tool(s)

 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST1186-A	Holding Fixture, Transmission 307-003 (T57L-500-B)
 ST1433-B	Installer, Front Wheel Hub Oil Seal 205-256
 ST2381-A	Remover, Input Shaft Oil Seal 308-375
 ST2932-A	Remover, Needle Bearing 307-562 (includes 307-562/1 and 307-562/2)
 ST1282-A	Remover, Pilot Bearing 308-001 (T58L-101-B)

 ST2891-A	**Remover, Transmission Fluid Pump** 307-553
 ST1104-B	**Retaining Ring Pliers** 307-343 (T95P-77001-AHR)
 ST1165-A	**Slide Hammer** 100-001 (T50T-100-A)

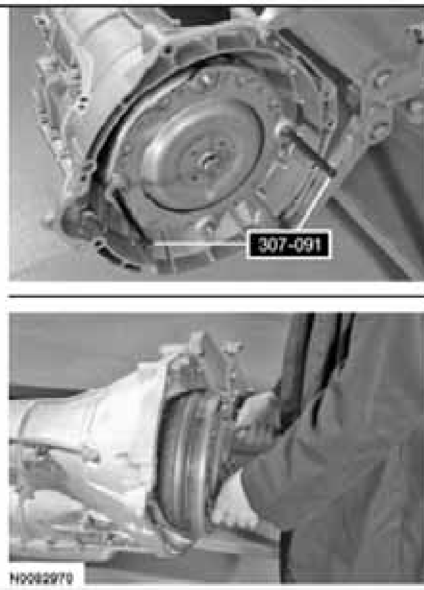
All vehicles

1. Install the Transmission Holding Fixture on the torque converter housing and install the transmission on a bench.



N0082908

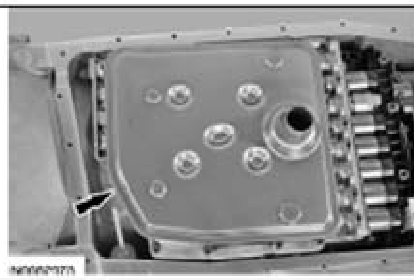
2. Using the Torque Converter Handle, remove the torque converter.



3. Remove the transmission fluid pan bolts and the transmission fluid pan.

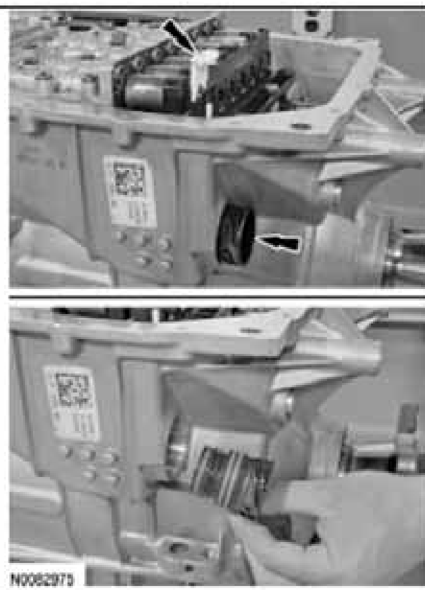
4. Remove the transmission fluid pan gasket.

5. Remove and discard the transmission fluid filter.

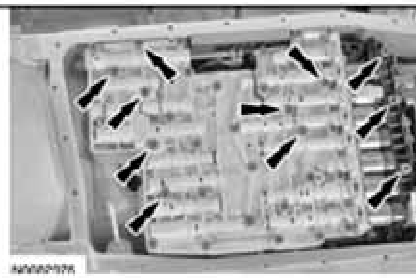


6. Press the release tab and lift up on the bulkhead electrical connector retainer to release the bulkhead electrical connector shell.

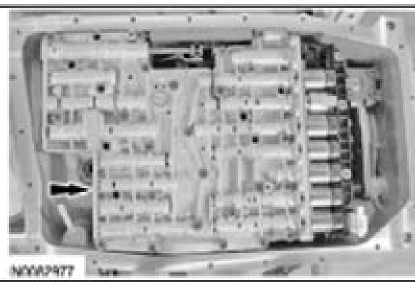
7. With the transmission bulkhead electrical connector retainer released, pull the outer shell of the bulkhead electrical connector out of the transmission.



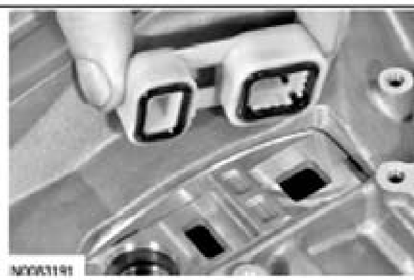
8. Remove the 11 bolts from the main control assembly.



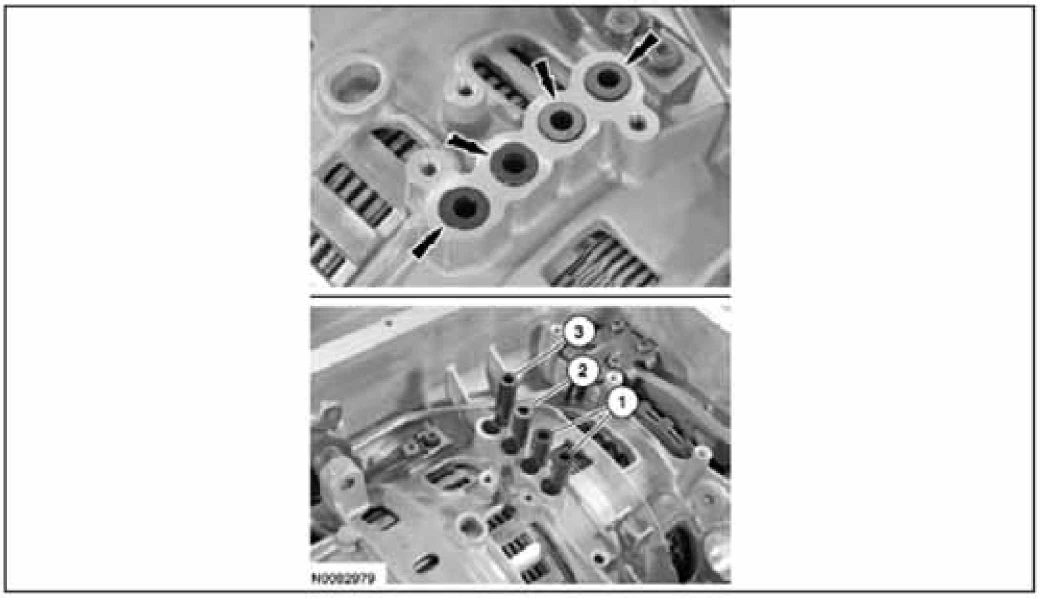
9. Remove the main control assembly.



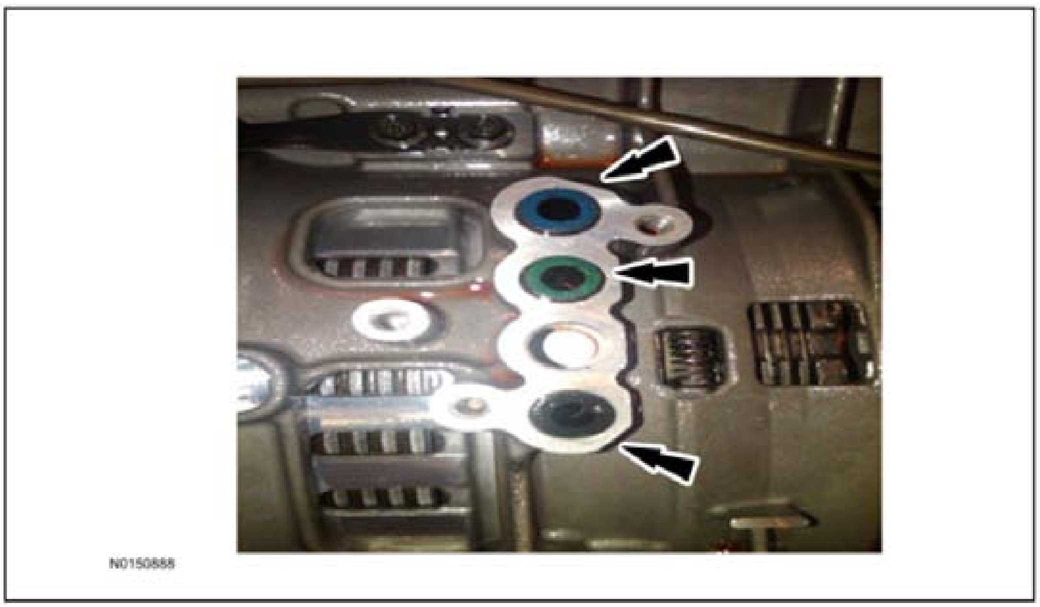
10. Remove the front pump adapter seal and the transmission fluid filter seal. Inspect for cracks or damage.



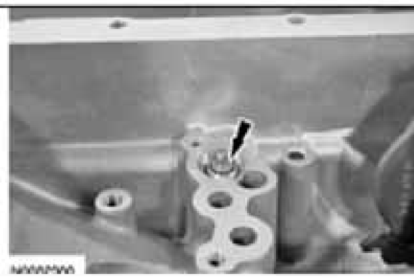
11. For **early** build transmissions, remove and discard the 4 center support feed tubes. Note the size and location while removing for correct assembly.
    1. 2 Black feed tubes
    2. Green feed tube
    3. Blue feed tube



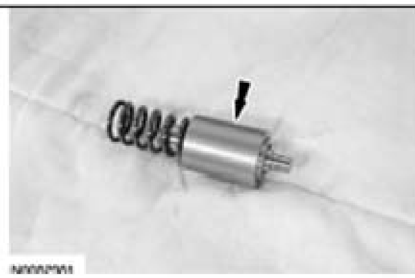
12. For **late** build transmissions, remove and discard the 3 center support feed tubes. Note the color, size and location while removing for correct assembly.
    - Black feed tube
    - Green feed tube
    - Blue feed tube



13. Remove the thermal bypass valve from the case.

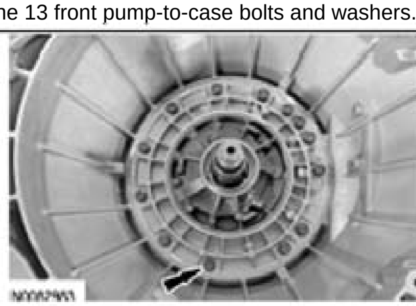


14. Inspect the thermal bypass valve for damage and install a new valve if damaged.

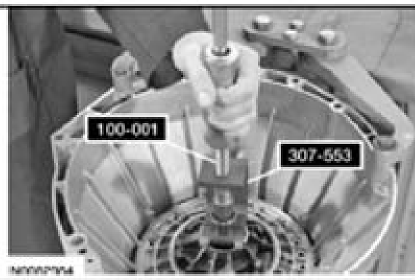


15. Using the Input Shaft Oil Seal Remover and Slide Hammer, remove and discard the front pump seal.

16. Remove and discard the 13 front pump-to-case bolts and washers.

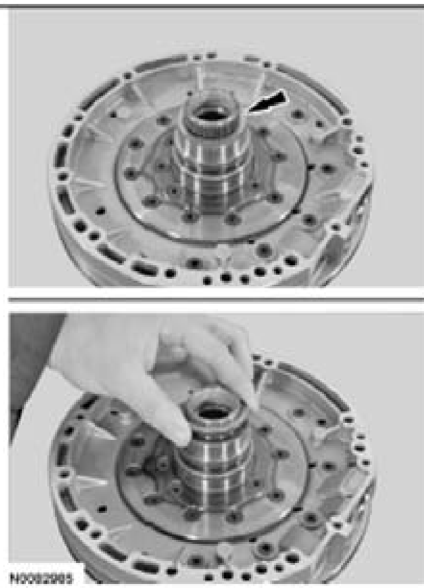


17. Using the Transmission Fluid Pump Remover and Slide Hammer, remove the front pump support.

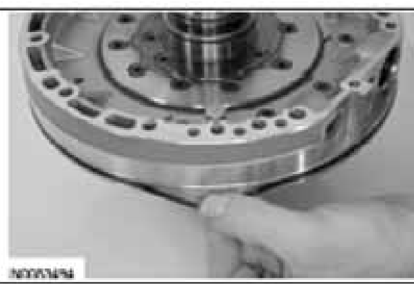


18. **NOTE:**
    The selective shim may come out while removing the front pump.

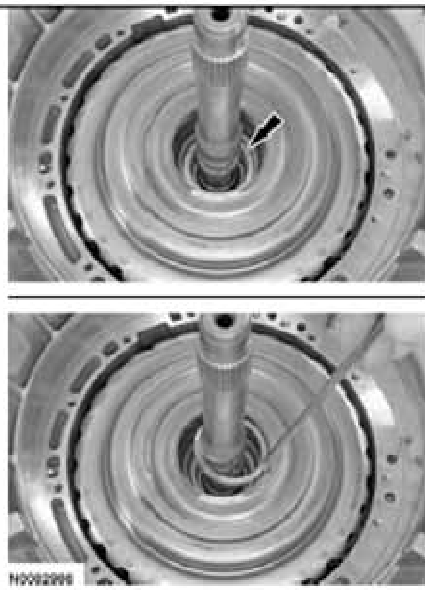
    Inspect the back of the front pump for the selective shim and remove If necessary.



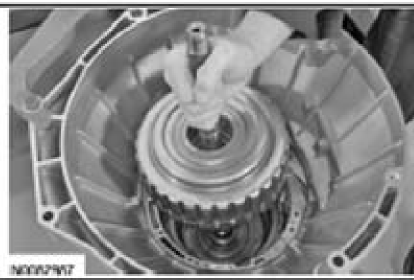
19. Remove and discard the front pump O-ring seal.



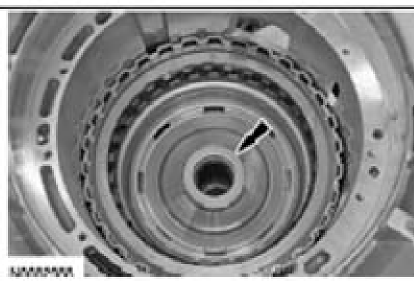
20. If the selective shim is not on the pump, using a magnet, remove it from the forward (A)/overdrive (E) clutch assembly.



21. Remove the forward (A)/overdrive (E) clutch assembly.



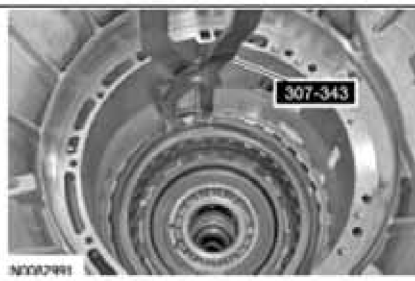
22. Remove the caged T5 roller bearing from the direct (B) clutch assembly.



23. Remove the direct (B) clutch assembly.

24. Remove the bias spring.

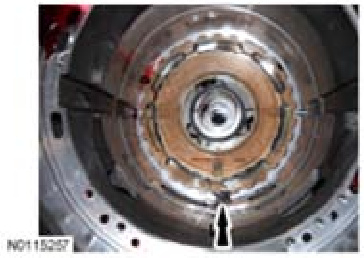
25. Using the Retaining Ring Pliers, remove the center support snap ring.



26. Remove the center support and T6 bearing.

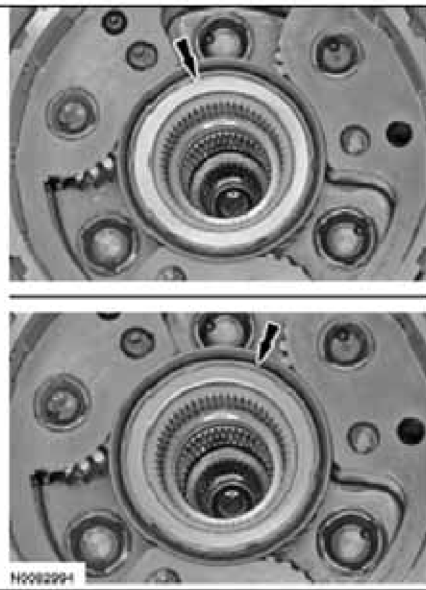
27. **NOTE:**
    When removing the One-Way Clutch (OWC), note the position for assembly.

    Remove the OWC.



28. NOTE:
The selective shim might stick to the T7 thrust bearing during removal of the center support.

Remove the selective shim and the T7 thrust bearing.

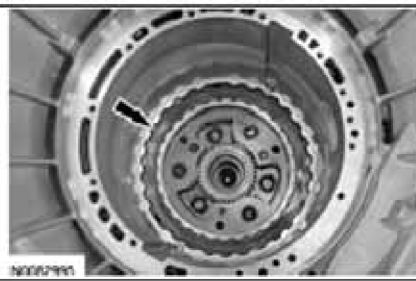


29. NOTE:
The selective shim might stick to the back of the center support assembly during removal.

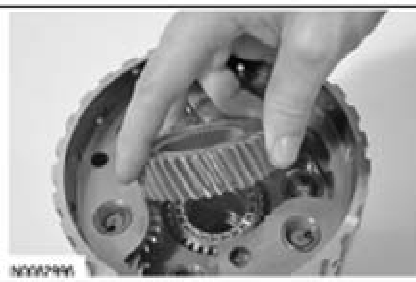
Remove the selective shim from the center support assembly.

30. NOTE:
Some of the clutch plates may stay in the case when removing the planetary carrier and the low/reverse clutch pack. Remove any clutch plates from the transmission that were not removed with the carrier and keep the clutch plates together.

Remove the planetary carrier and the low/reverse clutch pack as an assembly.



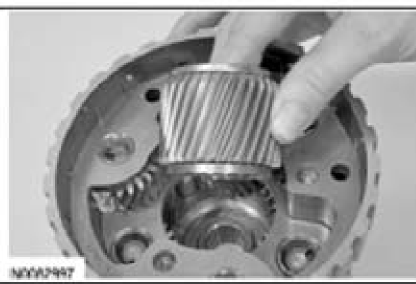
31. Remove the No. 2 sun gear and race.



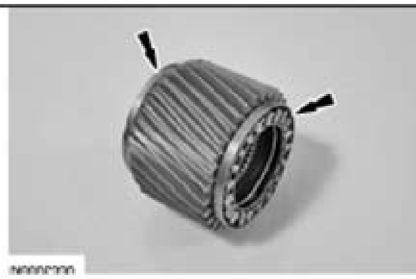
32. NOTE:
Remove the bearings with the sun gear.

NOTE:
When removing the sun gear, note that the tapered edge is facing up toward the torque converter housing.

Remove the No. 3 sun gear from the planetary assembly.

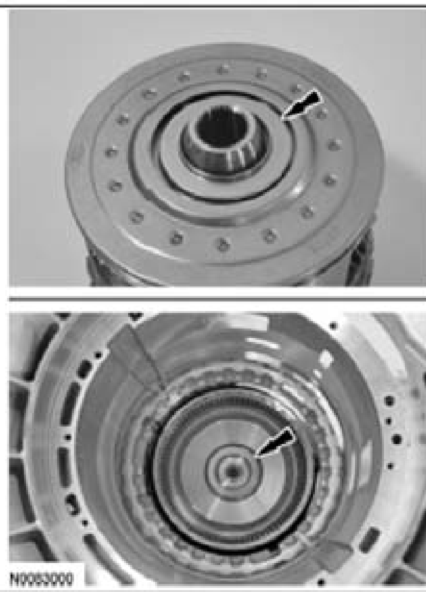


33. Remove the top T8 and the bottom T9 roller bearings from the sun gear.



34. Remove the T9 roller bearing race from the bottom of the carrier.

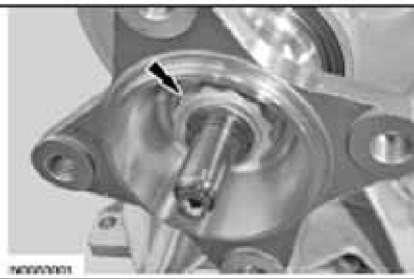
35. Remove the T10 thrust bearing from either the rear planetary carrier or the output shaft assembly.



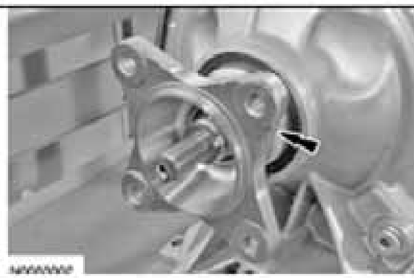
Rear Wheel Drive (RWD) vehicles

36. ***NOTICE:***
The output shaft flange retaining nut has been staked to prevent it from coming loose. Prior to removing the nut, remove the stake to prevent damage to the output shaft.

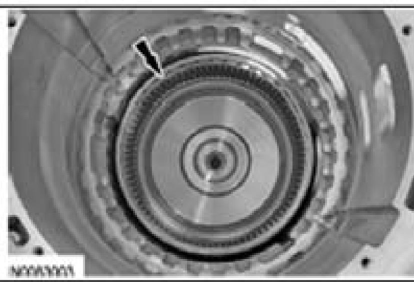
Place the manual control lever in the PARK position and remove and discard the output shaft flange retaining nut.



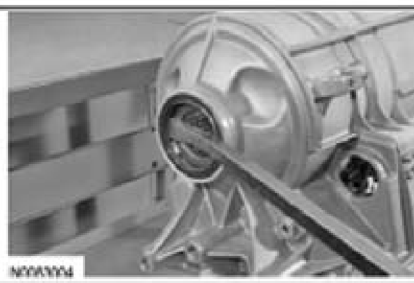
37. Remove the extension housing flange seal and the output shaft flange.



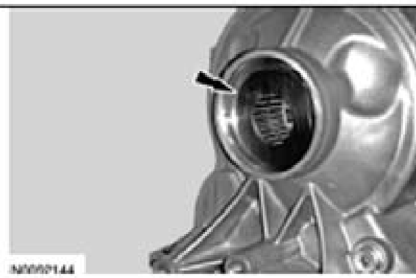
38. Remove the planetary carrier hub, output shaft assembly and T11 bearing.



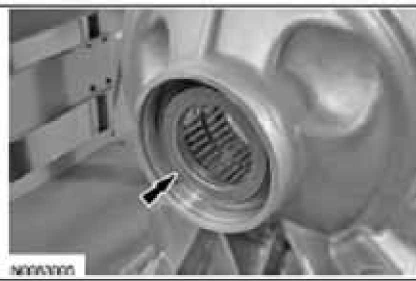
39. Using a suitable tool, remove and discard the output shaft seal.



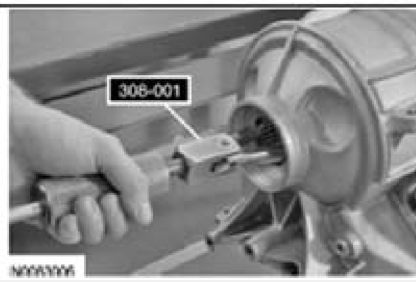
40. Remove the slip plane washer.



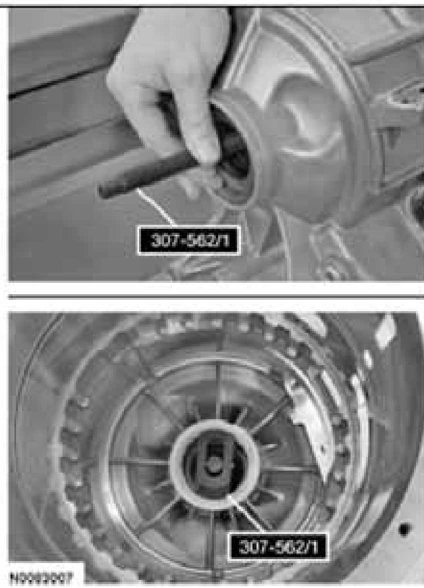
41. Remove the T12 thrust bearing.



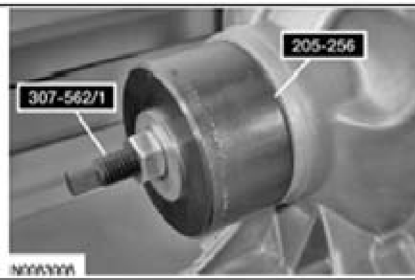
42. Using the Pilot Bearing Remover, remove the thrust bearing spacer.



43. Install the Needle Bearing Remover on the bearing.

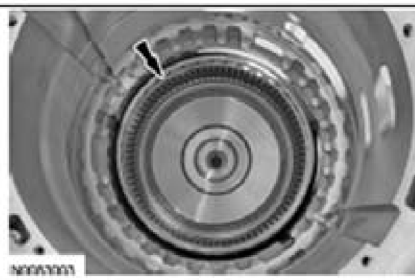


44. Install the Front Wheel Hub Oil Seal Installer on the Needle Bearing Remover and remove the bearing.

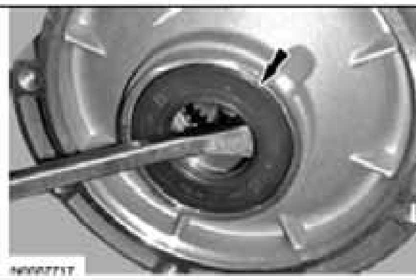


Four-Wheel Drive (4WD) vehicles

45. Remove the planet carrier hub, output shaft assembly and T11 bearing.



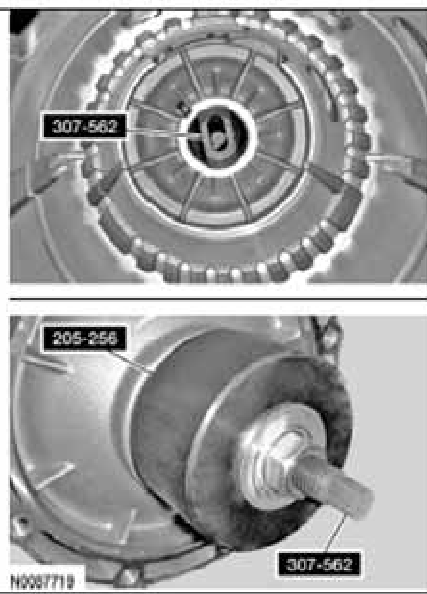
46. Remove and discard the output shaft seal.



47. Remove the snap ring from the case.

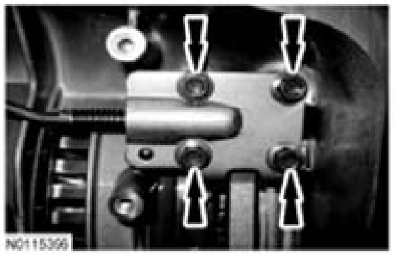
48. NOTICE:
Use care when installing the Needle Bearing Remover. Look inside the transmission case to make sure that the Needle Bearing Remover contacts the bearing only and not the lip of the case, or damage to the case will occur.

Using the Needle Bearing Remover and the Front Wheel Hub Oil Seal Installer, remove the bearing assembly.

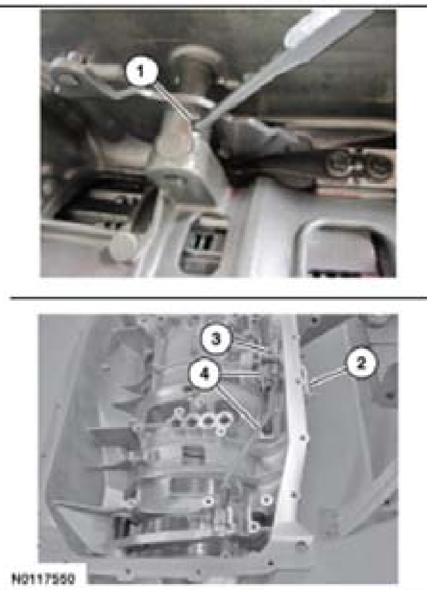


All vehicles

49. Remove and discard the 4 park rod actuating plate bolts and the park rod actuating plate.

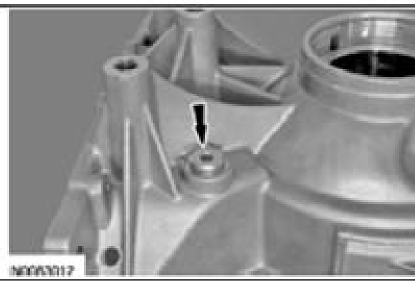


50. Remove the manual control lever detent plate and park pawl actuator rod from the transmission case.
    1. Remove and discard the roll pin.
    2. Slide the manual control lever shaft out of the case.
    3. Hold the manual control lever spacer to keep it from falling into the case.
    4. Remove the manual valve detent lever and park pawl actuator rod as an assembly.

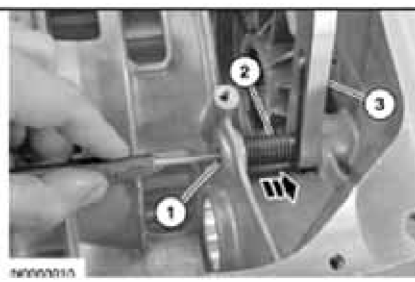


51. Using a suitable tool, remove and discard the manual control lever shaft seal.

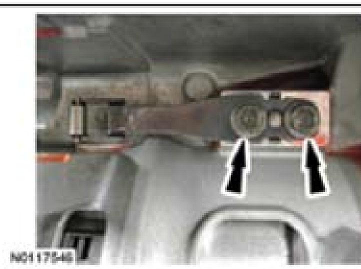
52. Remove the bolt from the back of the case to gain access to the park pawl pin.



53. From the inside of the case, push the park pawl pin out toward the back side of the case while holding the park pawl return spring and the park pawl. Remove the park pawl pin then remove the park pawl and spring.
    1. Park pawl pin
    2. Park pawl return spring
    3. Park pawl



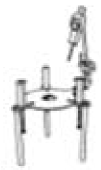
54. Remove and discard the 2 bolts and the park detent spring.



DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES

Forward/Overdrive Clutch Assembly — Disassembly

Special Tool(s)

 ST2892-A	End Play Gauge, Clutch 307-555

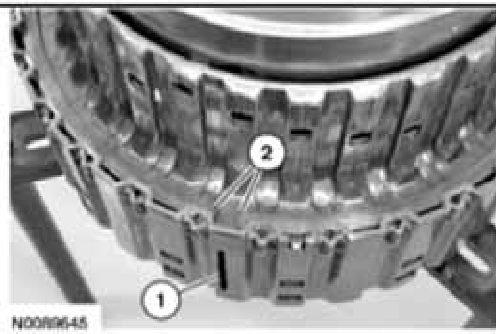
Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Disassembly

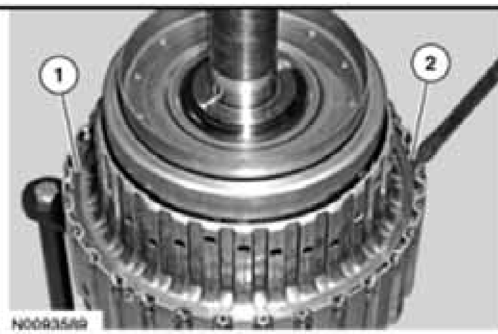
1. Position the forward/overdrive clutch assembly in the Clutch End Play Gauge 307-555.

2. Index-mark the direct clutch outer shell snap ring gap location to the side of the forward clutch hub using a suitable paint marker.
    1. Index mark
    2. Snap ring gap

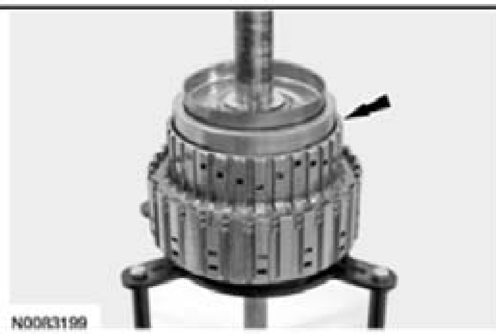


3. ***NOTICE:***
   Compress the snap ring out of the groove 180 degrees from the snap ring gap or damage to the forward clutch hub can occur.

   Using a suitable tool, remove and discard the direct clutch outer shell retaining ring by compressing the snap ring 180 degrees from the snap ring gap.
   1. Snap ring gap
   2. 180 degrees from the snap ring gap



4. Remove and discard the direct clutch hub.



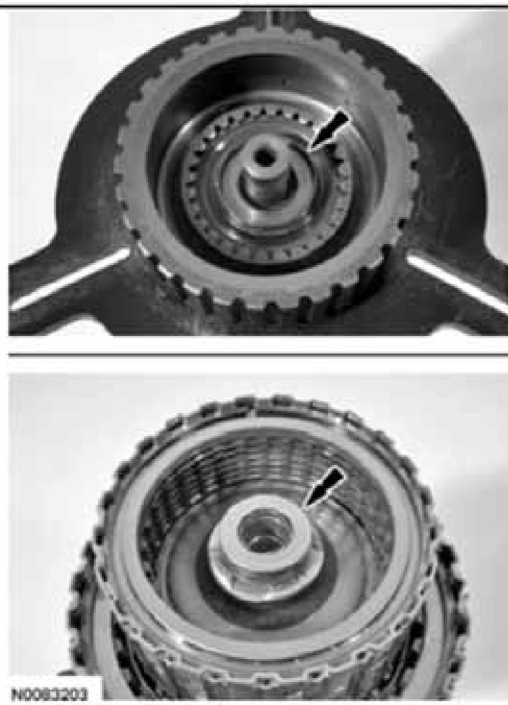
5. Remove the forward clutch and sun shaft assembly.

6. **NOTE:**
   The bearing may stick in the forward clutch drum.

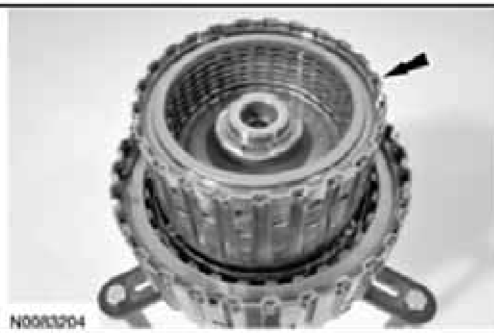
   Remove the intermediate shaft bearing.

7. Remove the intermediate shaft assembly.

8. If the T3 thrust bearing stuck to the intermediate shaft assembly, remove it from the intermediate shaft assembly. If the T3 thrust bearing is on the overdrive clutch, remove it from the overdrive clutch assembly.

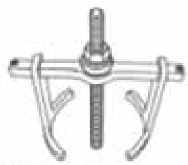
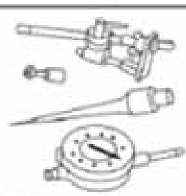
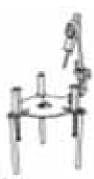


9. Remove the overdrive clutch pack from the forward clutch pack.



Forward Clutch Assembly

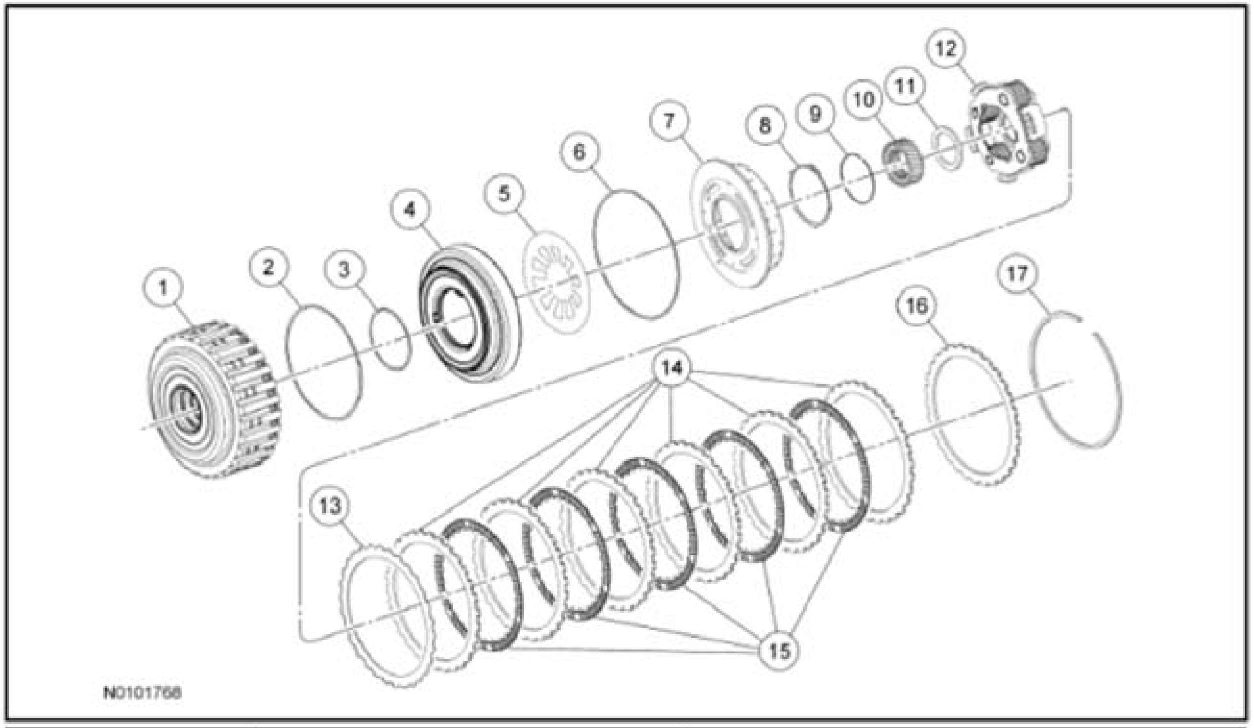
Special Tool(s)

 ST2881-A	Compressor, Clutch Spring 307-525
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

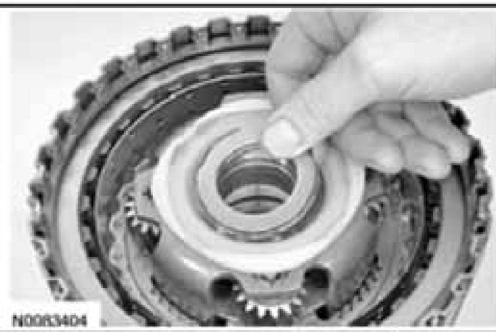
Forward Clutch Assembly (A Clutch)



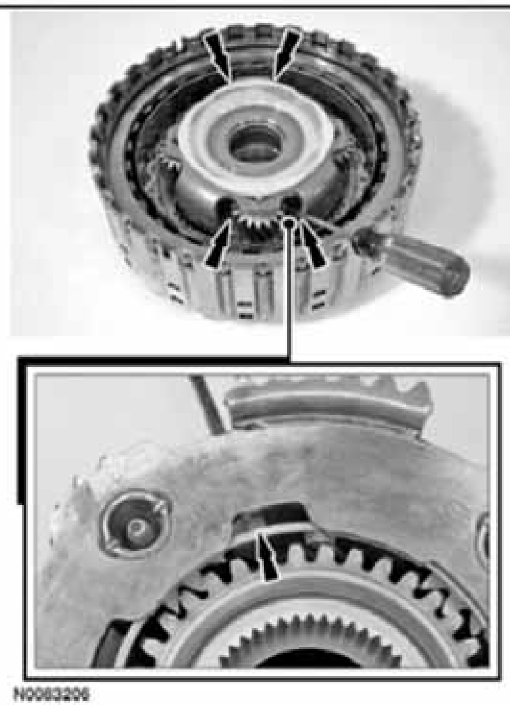
Item	Part Number	Description
1	7A360	Forward clutch drum
2	7A548	Forward clutch piston outer O-ring seal
3	7A548	Forward clutch piston inner O-ring seal
4	7A262	Forward clutch piston
5	7A480	Forward clutch piston return spring
6	7A548	Forward clutch balance dam O-ring seal
7	7H360	Forward clutch balance dam
8	7H365	Forward clutch balance dam retaining ring
9	7H579	Sun gear retaining ring
10	7D063	Sun gear
11	7H375	Bearing (T1)
12	7A398	Planetary gear
13	7E085	Forward clutch cushion spring
14	7E314	Forward clutch external splined steel plates (quantity model dependent)
15	7B164	Forward clutch internal splined friction plates (quantity model dependent)
16	7B066	Forward clutch pressure plate
17	7D483	Forward clutch plate retaining ring

Disassembly

1. If the T2 thrust bearing is on the forward clutch assembly, remove it from the forward clutch assembly.



2. Remove the front planetary carrier and sun gear from the forward clutch assembly.
   - With a small screwdriver or a suitable pick inserted into the front planetary assembly, push on the retaining ring in 4 places while lifting up on the front planetary assembly.

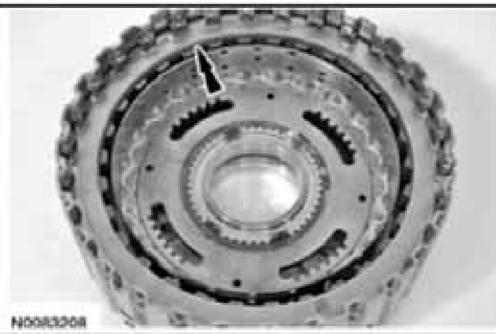


3. Remove the forward clutch pack snap ring.

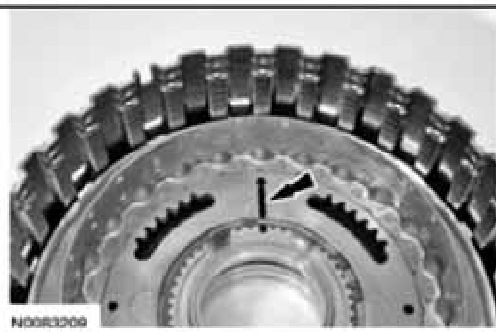
4. **NOTE:**
   Inspect the forward clutch drum and the friction and steel plates for damage. Install new components as necessary.

Remove and inspect the forward clutch steel and friction plates.

- If the plates are damaged, install a new forward clutch assembly.
- If no damage is indicated, the forward clutch may be reassembled.

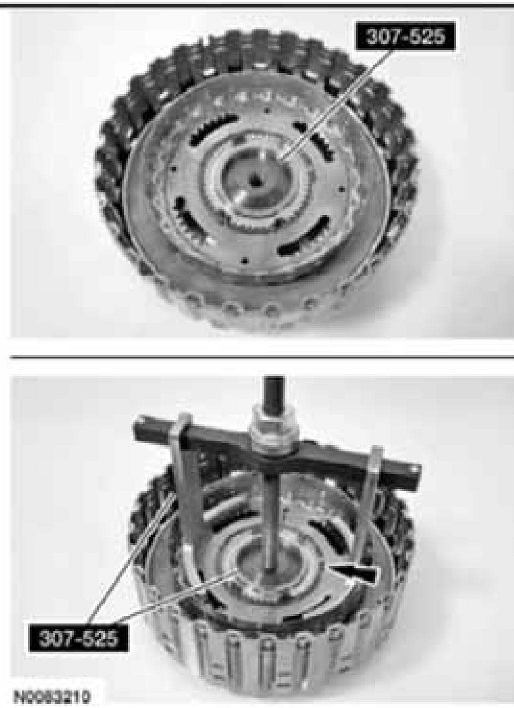


5. For correct alignment during assembly, make an identifying mark on the balance dam and the center part of the housing.

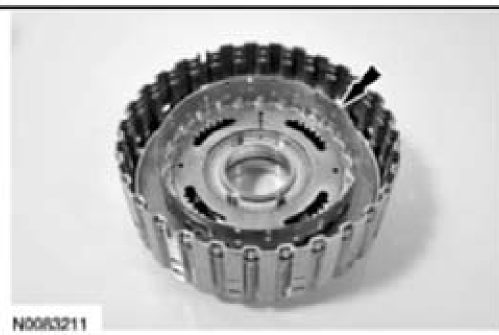


6. **NOTE:**
The bottom of the Clutch Spring Compressor will need to be installed from the back side of the forward clutch assembly.

Using the Clutch Spring Compressor, slightly collapse the balance dam to gain access to the retaining ring and remove the retaining ring.



7. Remove the balance dam.

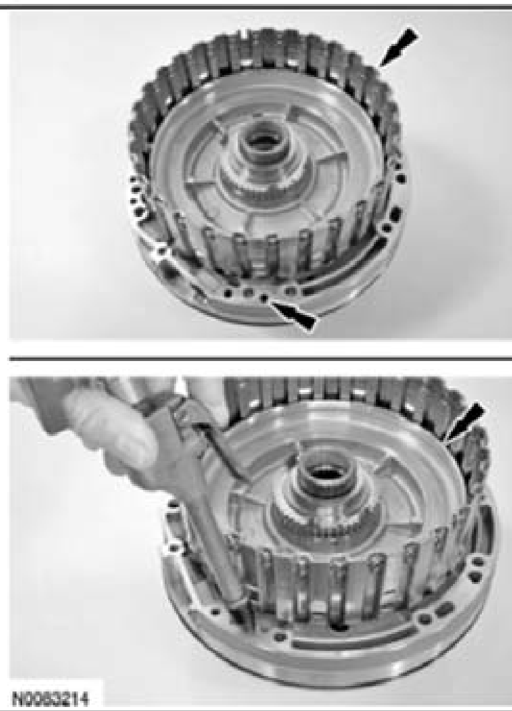


8. Remove and discard the O-ring seal from the balance dam.

9. Remove the forward clutch return spring..

N0083213

10. Install the forward clutch on the front pump to remove the forward clutch piston. Apply a small amount of shop air to remove the piston.



N0083214

11. Remove and discard the inner and outer piston O-ring seals.

N0083215

12. Remove the sun gear from the planet assembly.

N0083216

13. **NOTE:**
The T1 thrust bearing may have stuck to the sun gear when it was removed.

Remove the T1 bearing from the planetary carrier.

N0083217

14. Remove the transmission fluid collector plate from the front planetary carrier.


N0083218

15. Clean and inspect the components of the forward clutch assembly for damage and install new components as necessary.

Assembly

1. **NOTE:**
   If a new planetary assembly is being installed, the new planetary assembly may not come with the snap ring installed.

   Install the planetary assembly snap ring, if necessary.


N0083219

2. Make sure the planetary snap ring is oriented as shown.

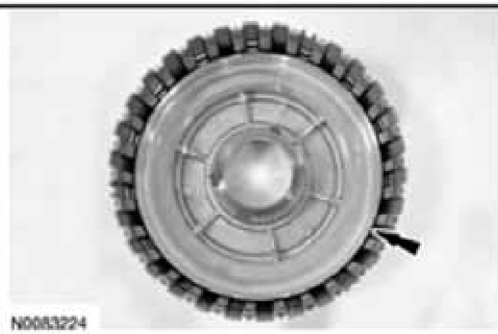
3. Install the transmission fluid collector plate on the front planetary carrier.

4. Install the T1 bearing onto the sun gear.

5. Install the sun gear into the planet assembly with the T1 bearing facing down and the recessed part of the gear up.

6. Install new O-ring seals onto the forward clutch piston.

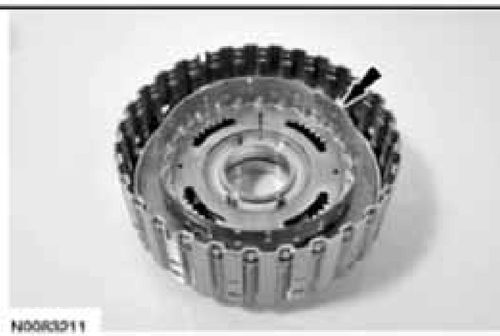
7. Lightly coat the O-ring seals with clean transmission fluid and install the forward clutch piston into the forward clutch drum.



8. Install the forward clutch return spring.

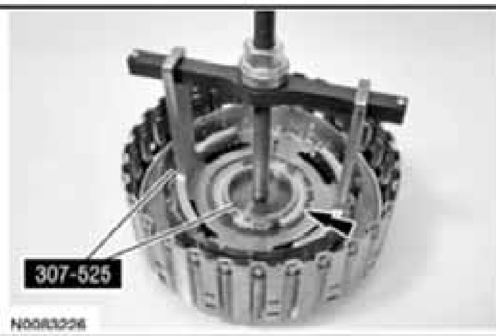
9. Install a new O-ring seal onto the forward clutch balance dam. Lightly coat the O-ring seal with clean transmission fluid.

10. Align the marks made during disassembly and install the balance dam into the forward clutch drum.



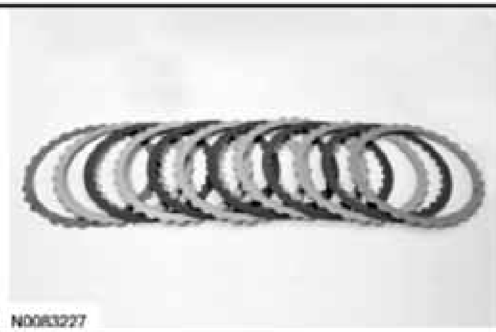
11. **NOTE:**
    Prior to releasing the Clutch Spring Compressor, make sure that the snap ring is fully seated.

    Using the Clutch Spring Compressor, slightly collapse the balance dam to install the retaining ring. Install the retaining ring.

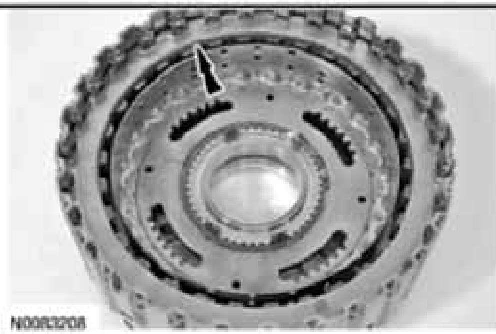


12. **NOTE:**
    Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity chart in the Specifications portion of this section.

    Soak the new forward clutch plates in clean transmission fluid.



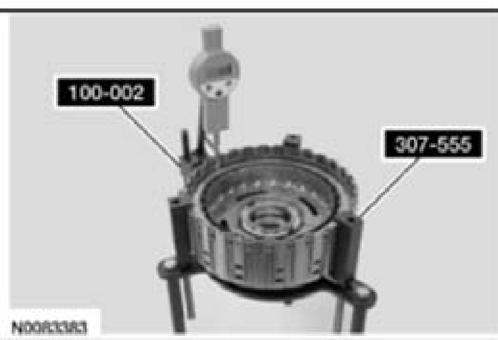
13. Install the new forward clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates and install the pressure plate.



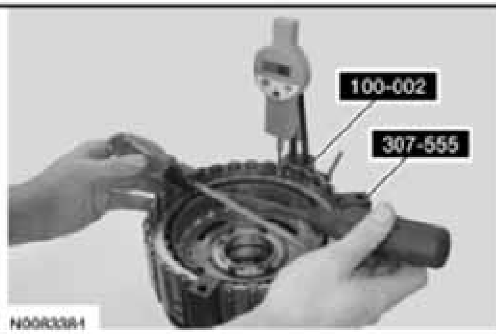
14. Install the forward clutch plate snap ring.

15. **NOTE:**
    All forward clutch plates, friction and steel are of a wave-type design.

    Install the forward clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.



16. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



17. Rotate the forward clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

18. **NOTE:**
If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.

- 0.71-1.10 mm (0.028-0.043 in)

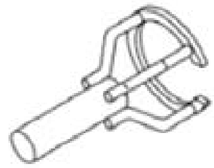
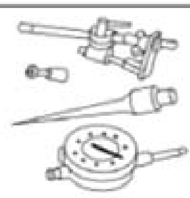
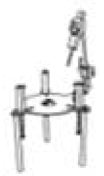
If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

19. Install the sun gear and planetary gearset into the forward clutch drum. Make sure it snaps and locks in place.

20. Install the T2 thrust bearing.

Overdrive Clutch Assembly

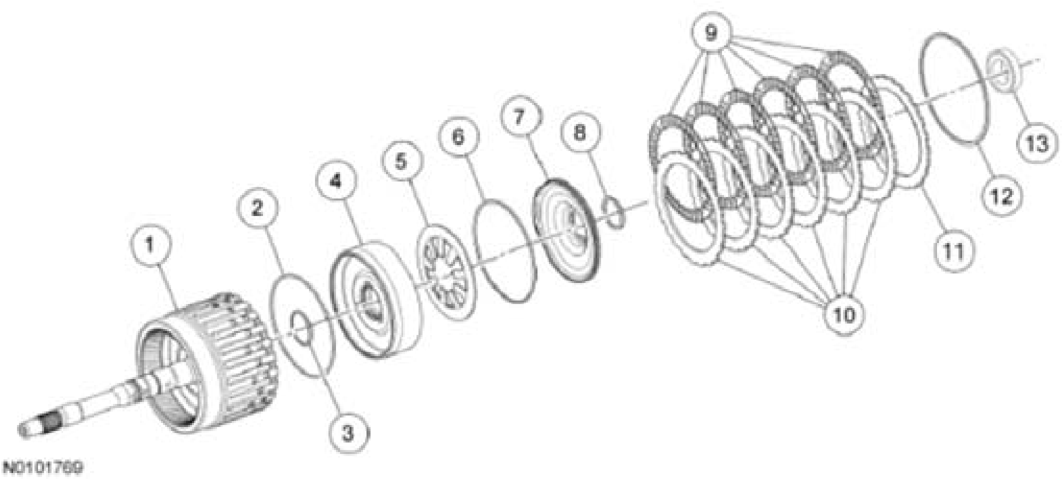
Special Tool(s)

 ST2497-A	Compressor, Spring Washer 307-209
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Overdrive (O/D) Clutch Assembly

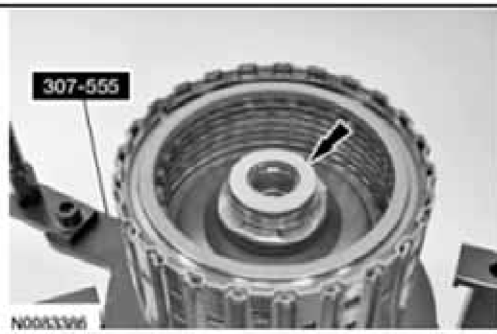


Item	Part Number	Description
1	7F207	Input shaft
2	7A548	Overdrive (O/D) clutch piston outer seal
3	7A548	O/D clutch piston inner seal

Item	Part Number	Description
4	7A262	O/D clutch piston
5	7B070	O/D clutch piston spring
6	7A548	O/D balance piston outer seal
7	7H360	O/D balance piston
8	7C122	O/D balance piston snap ring
9	7B164	O/D clutch internal splined clutch friction plates (quantity model dependent)
10	7B442	O/D clutch external splined clutch steel plates (quantity model dependent)
11	7B066	O/D pressure plate
12	7D483	O/D clutch retaining ring
13	7C096	Bearing T3

Disassembly

1. Position the Overdrive (O/D) clutch assembly in the Clutch End Play Gauge and remove the T3 thrust bearing.

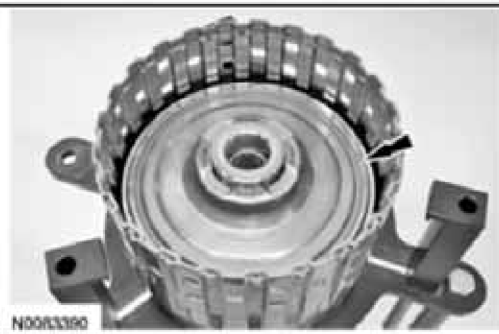


2. Remove the O/D clutch pack snap ring.

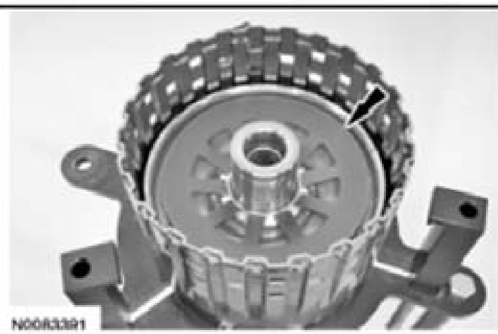
3. Remove the O/D clutch pack.

4. Using the Spring Washer Compressor and a press, remove and discard the O/D clutch balance piston retaining ring.

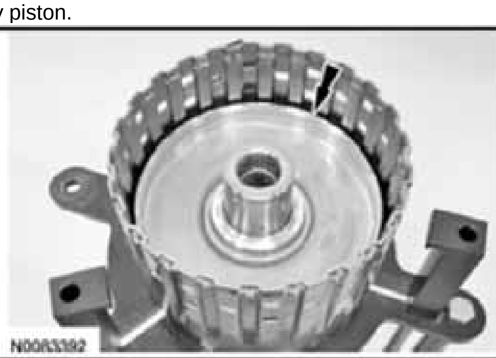
5. Remove the O/D clutch balance piston.



6. Remove the O/D clutch return spring.



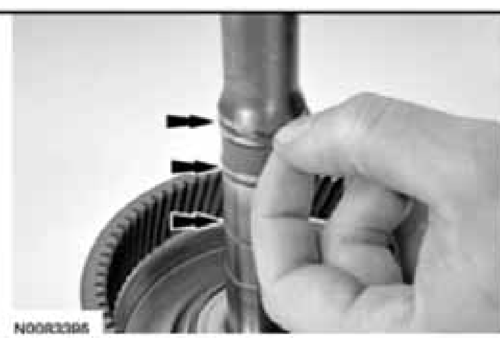
7. Remove the O/D clutch apply piston.



8. Remove and discard the outer O-ring seal on the O/D clutch balance piston..

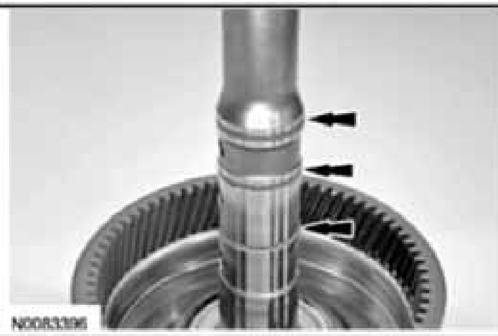
9. Remove and discard both the inner (one large and one small) O-ring seals on the O/D clutch apply piston.

10. Remove and discard the 3 scarf cut seals.

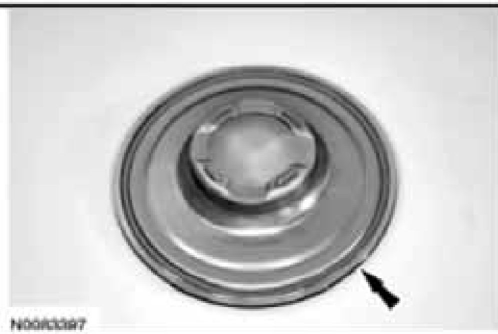


Assembly

1. Install the 3 new scarf cut seals and the roller bearing.

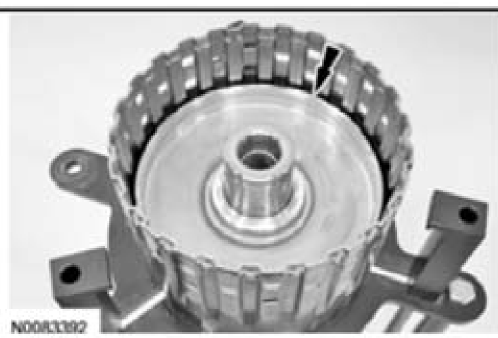


2. Install a new outer O-ring seal on the O/D clutch balance piston.



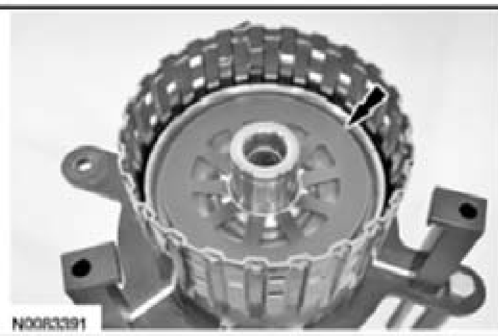
3. Install 2 new inner O-ring seals on the O/D clutch apply piston.

4. Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch apply piston into the drum with the O-ring seals and the 3 pads facing down toward the drum.



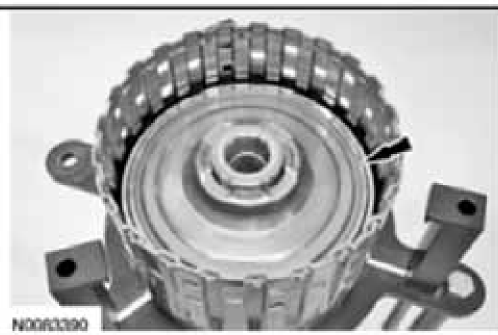
5. **NOTE:**
   The fingers on the return spring are facing down toward the piston.

   Install the O/D clutch return spring.



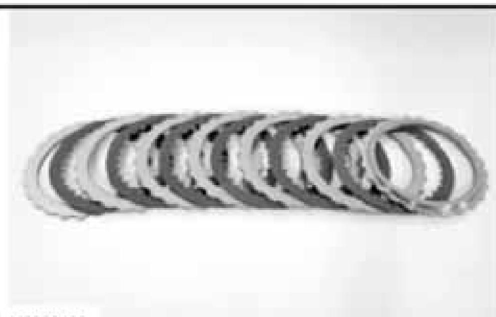
6. **NOTE:**
The cone shape of the balance piston must face up when installed correctly.

Lubricate all the O-ring seals with clean transmission fluid. Install the O/D clutch balance piston.



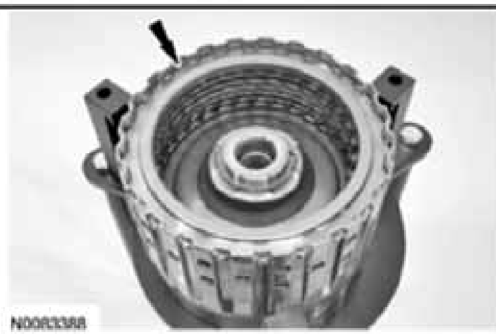
7. Using the Spring Washer Compressor, install a new O/D clutch balance piston retaining ring.

8. Soak the new O/D clutch plates in clean transmission fluid.



9. **NOTE:**
Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity chart in the Specifications portion of this section.

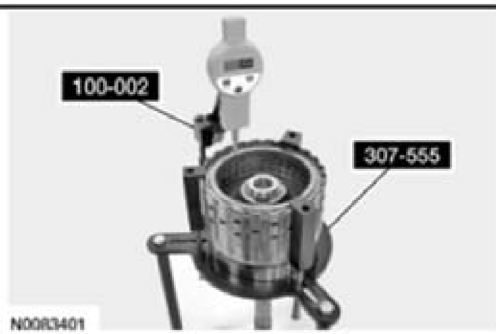
Install the new O/D clutch plates, starting with a steel plate and alternating between friction and steel plates, and ending with the pressure plate on the top.



10. Install the O/D clutch pack snap ring.

11. **NOTE:**
All O/D clutch plates, friction and steel are of a wave-type design.

Install the O/D clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.



12. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.

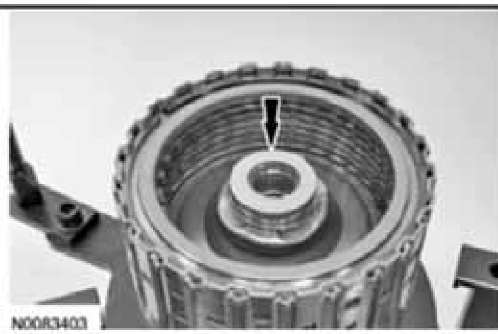
13. Rotate the O/D clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

14. **NOTE:**
If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
   - 0.5-0.9 mm (0.019-0.035 in)

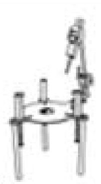
   If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.
15. **NOTE:**
Inspect and install new thrust bearings as required.

   Install the T3 thrust bearing.



Forward/Overdrive Clutch Assembly — Assembly

Special Tool(s)

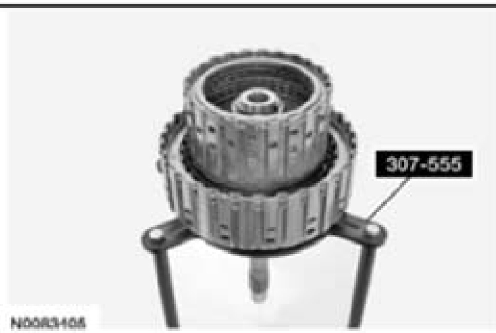
 ST2892-A	End Play Gauge, Clutch 307-555

Material

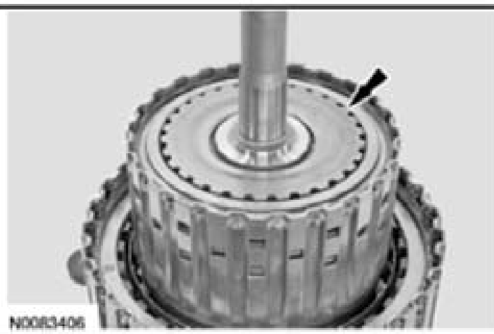
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Assembly

1. Position the forward clutch assembly in the Clutch End Play Gauge and install the overdrive clutch pack onto the forward clutch and planetary gear set.

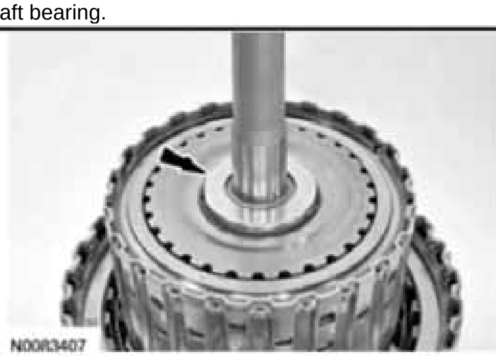


2. Install the intermediate shaft assembly.



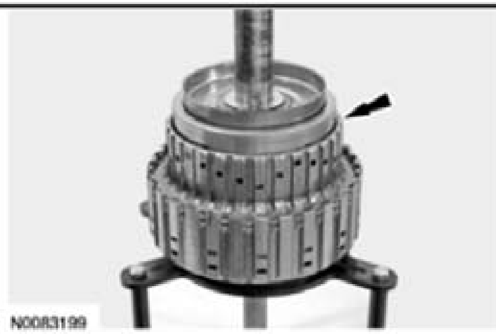
3. **NOTE:**
   Inspect and install new thrust bearings as required.

   Install the T4 intermediate shaft bearing.



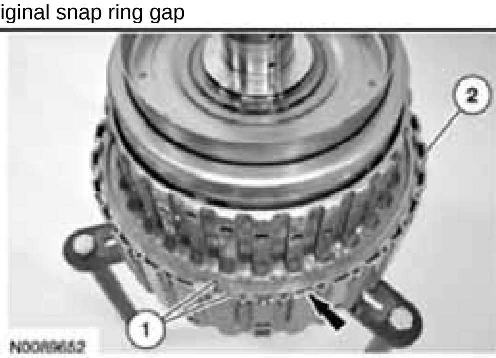
4. Install the forward clutch hub and sun shaft assembly.

5. Install a new the direct clutch hub.



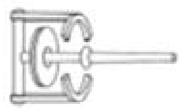
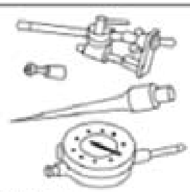
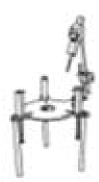
6. ***NOTICE:***
   Do not install the snap ring on the forward clutch hub with the snap ring gap in the same position as the original snap ring or damage to the transmission can occur.

   Install a new direct clutch outer shell retaining ring with the snap ring gap positioned approximately 120 degrees from the index mark made on the forward clutch hub during disassembly.
   1. New snap ring gap
   2. Index mark from original snap ring gap



Direct Clutch Assembly

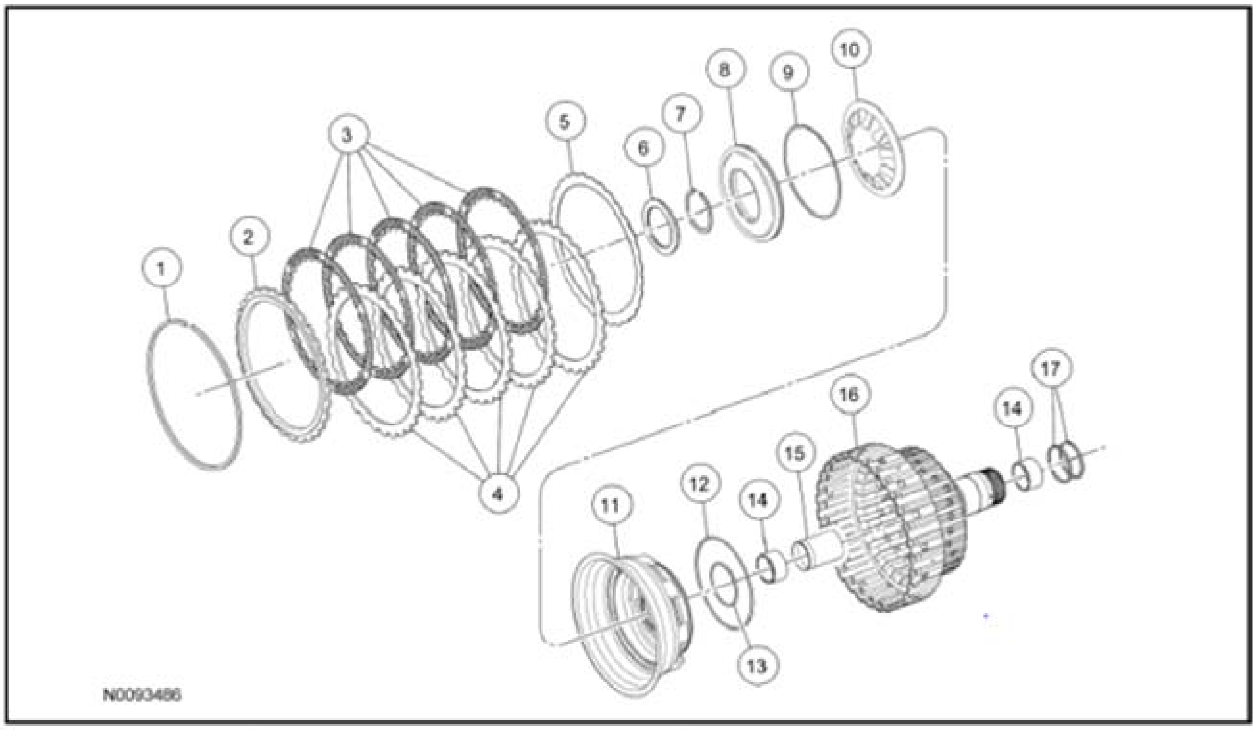
Special Tool(s)

 ST1190-A	Compressor, Clutch Spring 307-015 (T65L-77515-A)
 ST2893-A	Compressor, Clutch Spring 307-552
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Direct Clutch Assembly



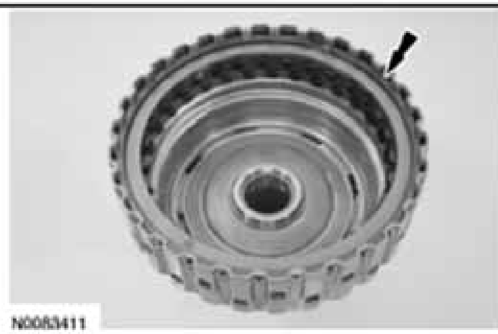
Item	Part Number	Description
1	7D483	Direct clutch pressure plate retaining ring
2	7B066	Direct clutch pressure plate (thickness model dependant)
3	7B164	Direct clutch internal splined friction plates (quantity model dependant)
4	7B442	Direct clutch external splined steel plates (quantity model dependant)
5	—	Direct clutch cushion plate (wave spring)
6	7C096	Bearing (T5)
7	7A577	Piston retaining ring
8	7A262	Direct clutch balance piston
9	7A548	Direct clutch balance piston seal
10	7B488	Return spring
11	7A262	Direct clutch apply piston
12	7A548	Direct clutch apply piston outer seal
13	7C099	Direct clutch apply piston inner seal
14	—	Direct clutch bushing hubs (part of 7F283) (2 required)
15	—	Gear shaft tube sleeve (part of 7F283)
16	7F283	Direct clutch cylinder
17	7D020	Seal shell cylinders

Disassembly

1. Remove and discard the 2 scarf cut seals and the roller bearing.

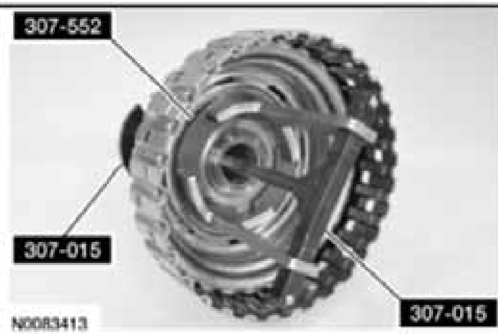
2. Remove the T5 thrust bearing.

3. Remove the direct clutch snap ring.

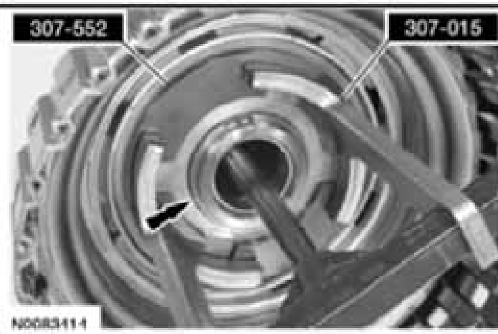


4. Remove the direct clutch steel and friction plates.

5. Install the Clutch Spring Compressors onto the direct clutch assembly.



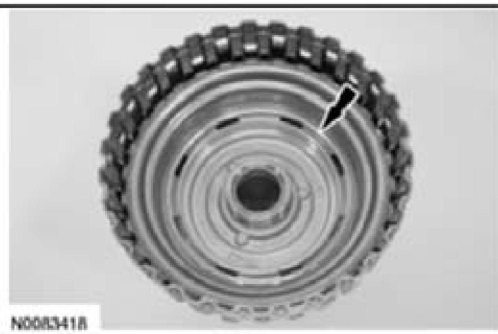
6. Using the Clutch Spring Compressors, compress the direct clutch return spring and remove the direct clutch return spring retainer.



7. Remove the balance piston.

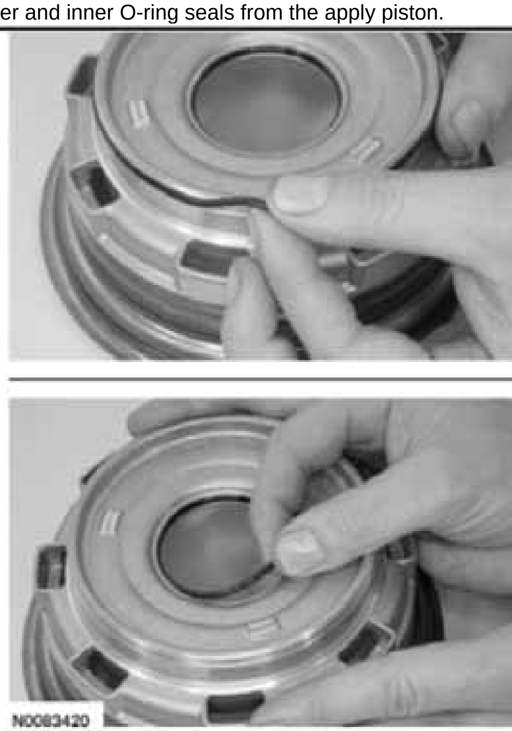
8. Remove the direct clutch return spring.

9. Remove the direct clutch piston.



10. Remove and discard the outer O-ring seal from the balance piston.

11. Remove and discard the outer and inner O-ring seals from the apply piston.



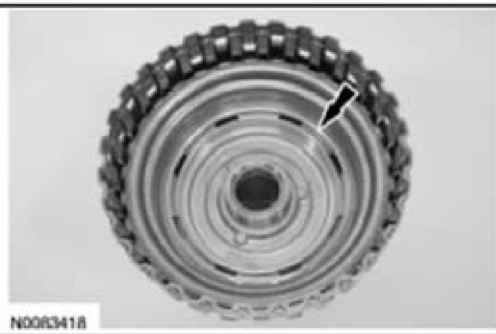
12. Inspect the components of the direct clutch for damage. If damage is indicated, install new components as necessary.

Assembly

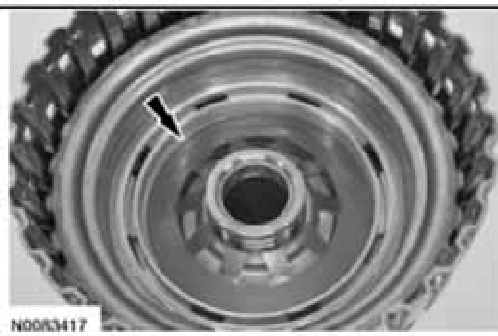
1. Install a new inner and outer O-ring seal on the apply piston.

2. Install a new outer O-ring seal on the balance piston.

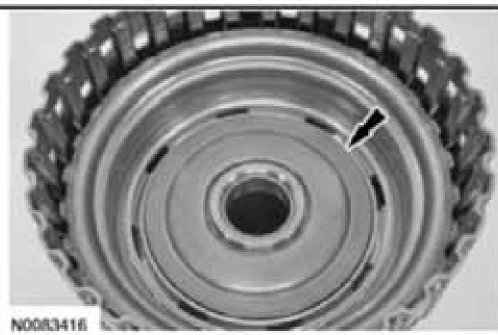
3. Lightly coat the O-ring seals in clean transmission fluid and install the direct clutch piston.



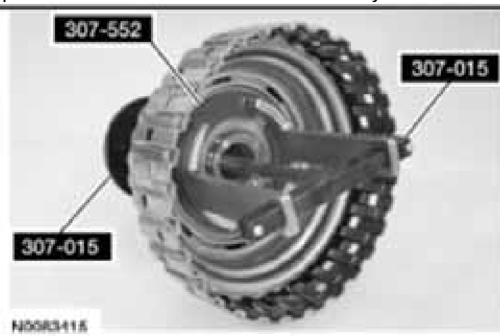
4. Install the direct clutch return spring.



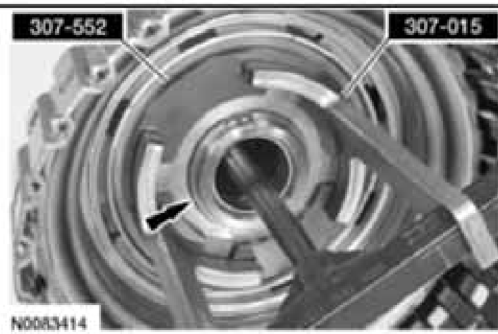
5. Install the balance piston.



6. Install the Clutch Spring Compressors onto the direct clutch assembly.

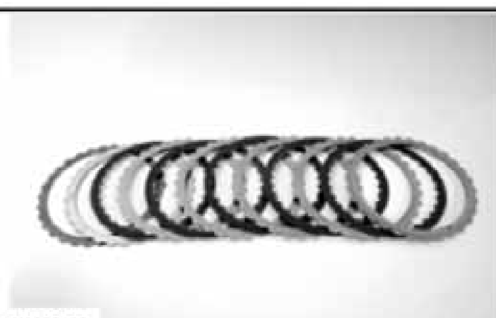


7. Using the Clutch Spring Compressors, compress the direct clutch return spring and install the direct clutch return spring retainer.



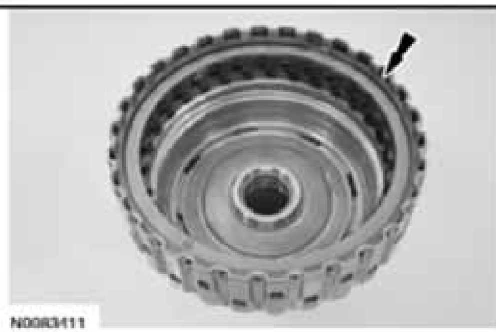
8. **NOTE:**
   Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

   Soak the new direct clutch in clean transmission fluid.



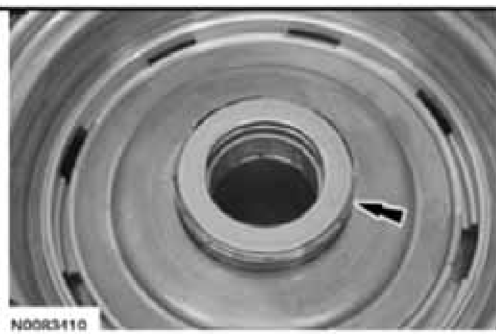
9. Install the new direct clutch plates, starting with the wave spring then a steel plate and alternating between steel and friction plates, and ending with the pressure plate on the top.

10. Install the direct clutch snap ring.



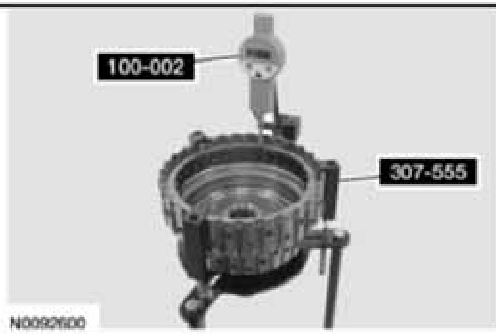
11. **NOTE:**
    Inspect and install a new thrust bearing as required.

    Install the T5 thrust bearing.

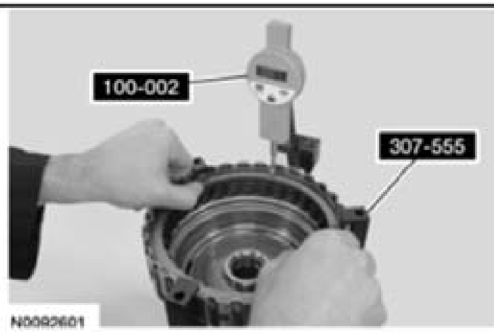


12. **NOTE:**
    All direct clutch plates, friction and steel are of a wave-type design.

    Install the direct clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.



13. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.



14. Rotate the direct clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

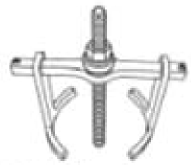
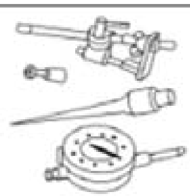
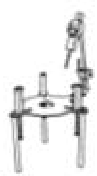
15. **NOTE:**
If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
- 0.5-1.3 mm (0.019-0.051 in).

If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

16. Install 2 new scarf cut seals and the roller bearing.

Intermediate Clutch Assembly

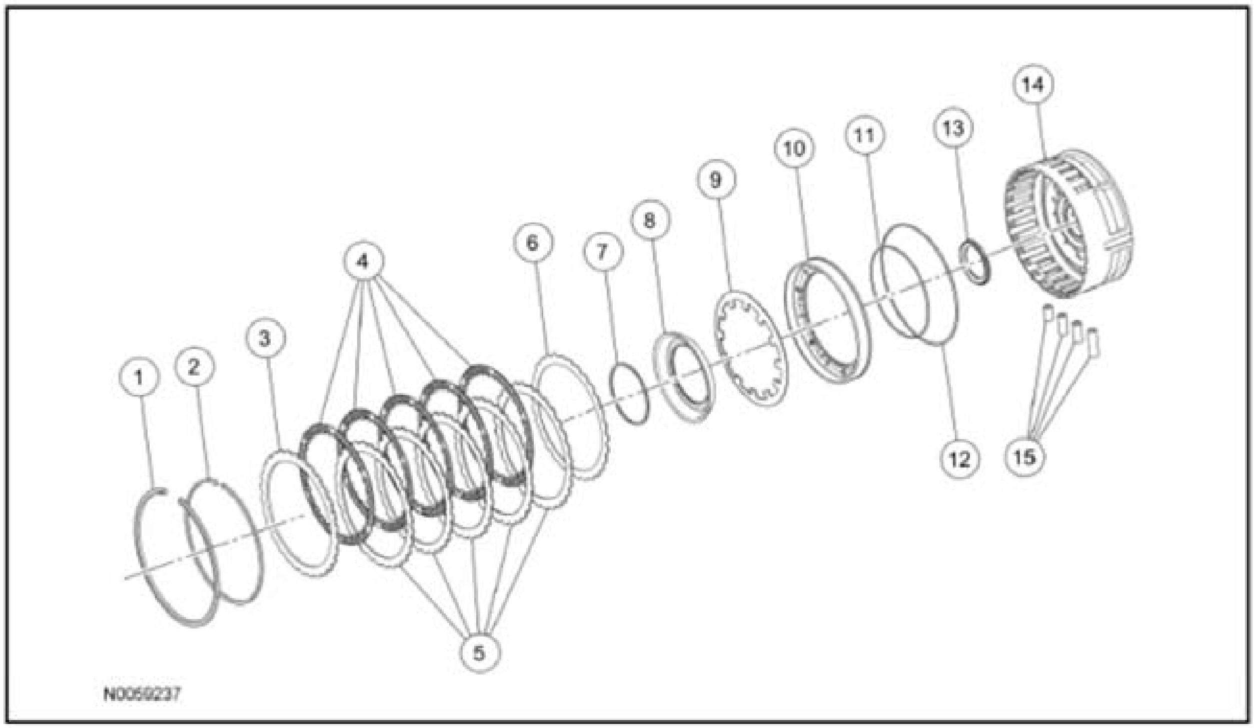
Special Tool(s)

 ST2881-A	Compressor, Clutch Spring 307-525
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Intermediate Clutch Assembly



Item	Part Number	Description
1	7D483	Center support retaining ring
2	7D483	Intermediate clutch pack retaining ring
3	7B066	Intermediate clutch pressure plate
4	7B164	Intermediate clutch internal splined friction plates (quantity model dependent)
5	7B442	Intermediate clutch external splined steel plates (quantity model dependent)
6	7E085	Intermediate clutch cushion spring
7	7A577	Intermediate clutch snap ring
8	7B043	Intermediate clutch return spring retaining ring
9	7A480	Intermediate clutch piston return spring
10	7E005	Intermediate clutch piston (model dependant)
11	7F225	Intermediate clutch piston inner seal
12	7F224	Intermediate clutch piston outer seal
13	7F373	Bearing (T6)
14	7A130	Intermediate/low/reverse clutch center support
15	7G199	Center support seals (2 — 7G199, 1 — 7G087, 1 — 7G484)

Disassembly

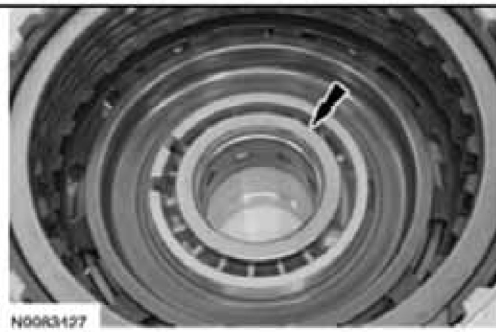
NOTICE:

The intermediate clutch plate quantity is model dependent on engine size. Check the clutch plate quantity charts in specifications for the correct clutch plate quantity. Failure to install the correct clutch plate quantity will result in transmission failure.

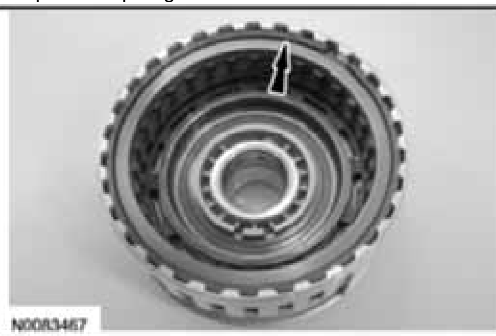
NOTICE:

The intermediate clutch piston is model dependent on engine size due to the different quantity of intermediate clutch plates. If installing a new intermediate clutch piston, check to make sure the height of the new piston is the same as the original piston. Failure to install the correct piston will result in transmission failure.

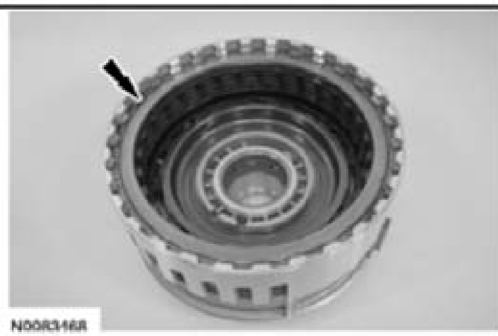
1. Remove the T6 thrust bearing.



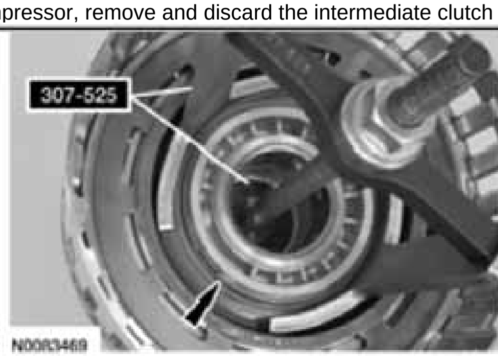
2. Remove the intermediate clutch plate snap ring.



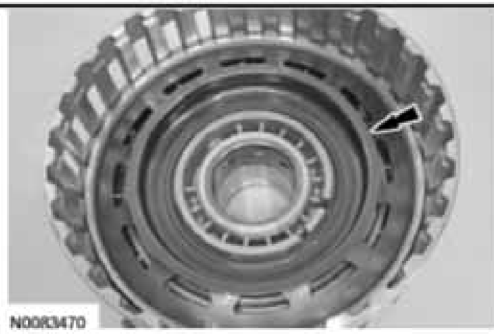
3. Remove the intermediate clutch plates.



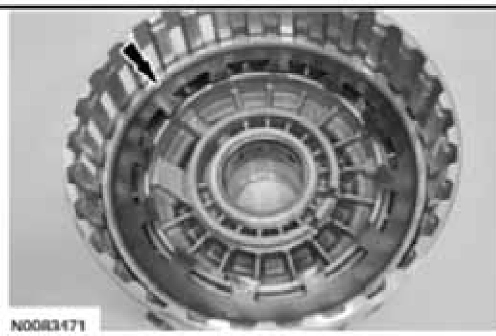
4. Using the Clutch Spring Compressor, remove and discard the intermediate clutch return spring retainer.



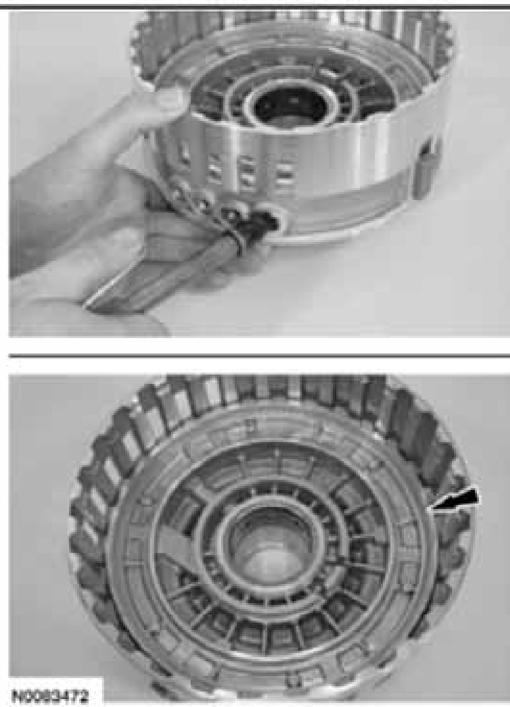
5. Remove the intermediate clutch return spring top plate.



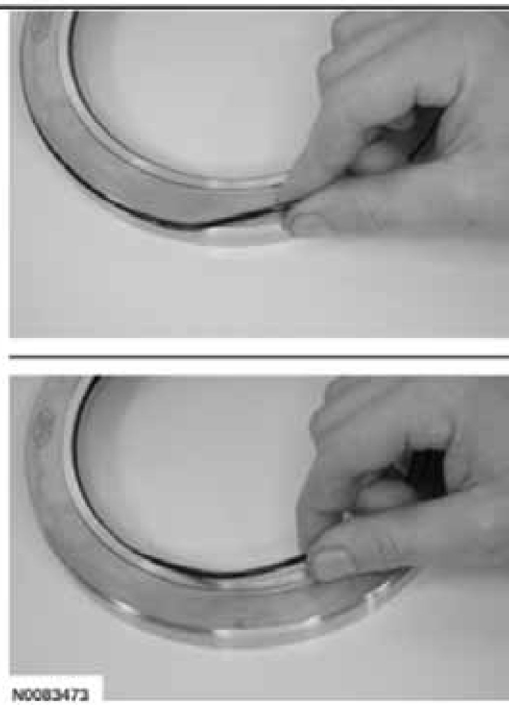
6. Remove the intermediate clutch return spring.



7. Applying a slight amount of air to the port, remove the intermediate clutch piston.



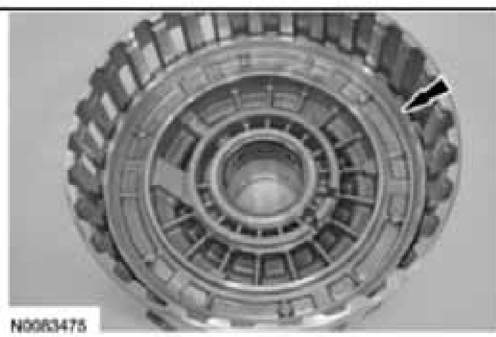
8. Remove and discard the inner and outer intermediate clutch piston O-ring seals.



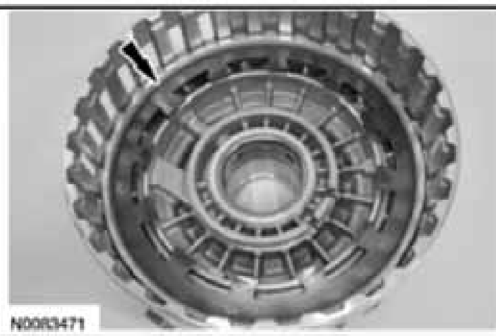
Assembly

1. Install new inner and outer intermediate clutch piston O-ring seals.

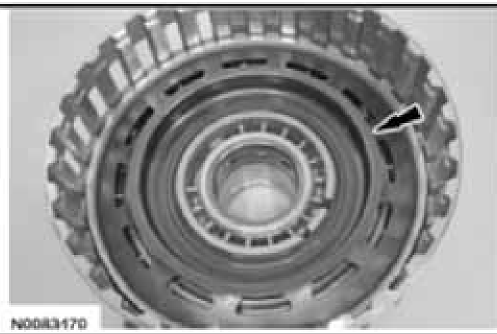
2. Lightly coat the O-ring seals in clean automatic transmission fluid and install the intermediate clutch piston.



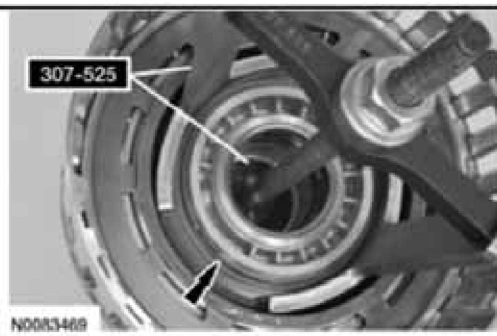
3. Install the intermediate clutch return spring.



4. Install the intermediate clutch return spring top plate.

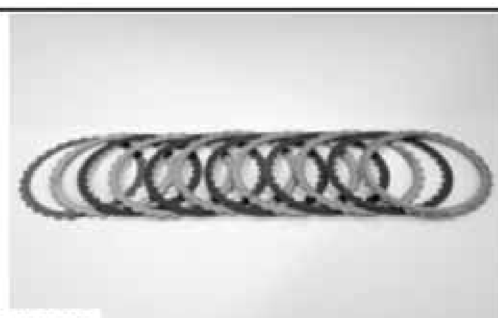


5. Using the Clutch Spring Compressor, install a new intermediate clutch return spring retainer.

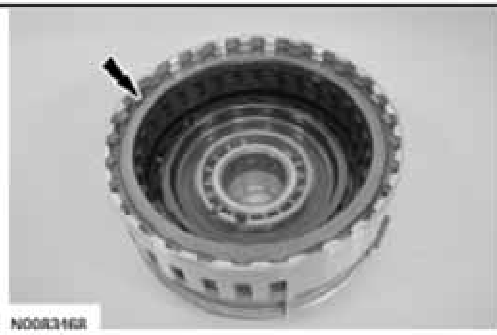


6. **NOTE:**
   Friction and steel plate quantity will vary based on engine displacement. For additional information, refer to the Clutch Plate Quantity Chart in the Specifications portion of this section.

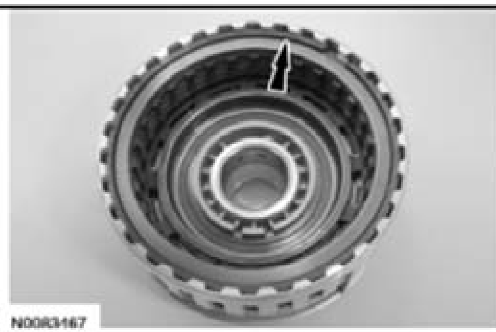
   Soak the new intermediate clutch plates in clean automatic transmission fluid.



7. Install the new intermediate clutch plates, starting with the wave spring then a steel plate and alternating between friction and steel plates, and ending with the pressure plate.

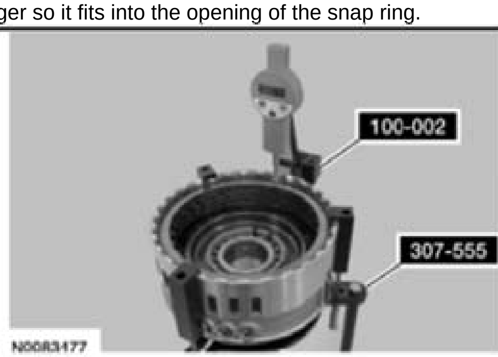


8. Install the intermediate clutch plate snap ring.



9. **NOTE:**
   All intermediate clutch plates, friction and steel are of a wave-type design.

   Install the intermediate clutch assembly into the Clutch End Play Gauge and install the Dial Indicator Gauge with Holding Fixture and position the plunger so it fits into the opening of the snap ring.



10. With the Dial Indicator Gauge set at zero, lift up on the steel pressure plate so it is against the select fit snap ring. Record this reading as reading A.


N00R3478

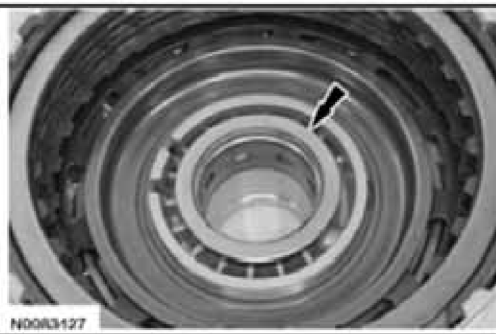
11. Rotate the intermediate clutch assembly 180 degrees from the opening of the snap ring, take a second reading and record this reading as reading B.

Description	Reading
Reading A	
Reading B	
Add reading A to reading B for a total end clearance	
Divide the total reading by 2 for an average end clearance	

12. **NOTE:**
If the final measurement is not within specification, install a new snap ring until the correct specification is achieved.
- 0.7-1.1 mm (0.027-0.043 in).

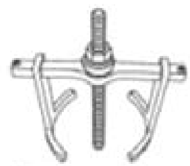
If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is high, remeasure using a thicker select fit snap ring. If the free pack end clearance between the bottom of the snap ring and the top of the pressure plate is low, remeasure using a thinner select fit snap ring.

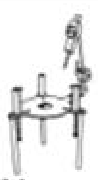
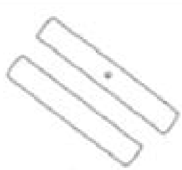
13. Install the T6 thrust bearing.


N00R3127

Low/Reverse Clutch Assembly

Special Tool(s)

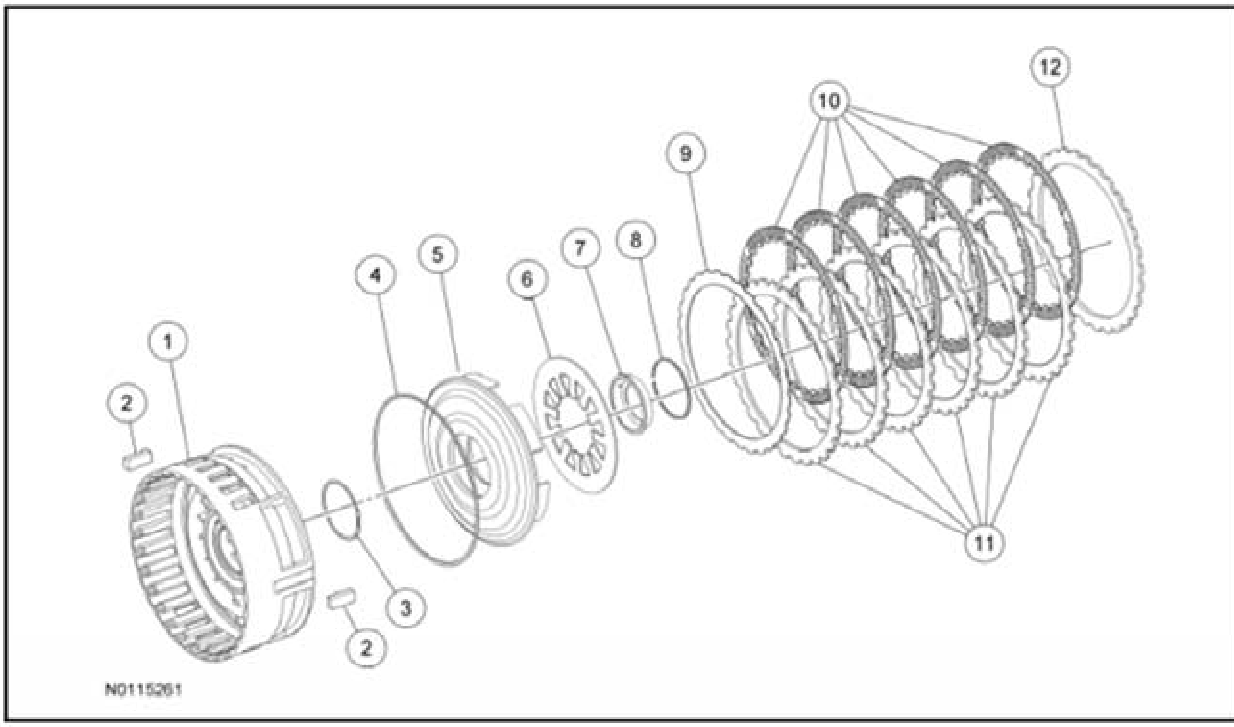
 ST2881-A	Compressor, Clutch Spring 307-525

 ST1274-A	Depth Micrometer 303-D075 (D92P-4201-A) or equivalent
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C) or equivalent
 ST2892-A	End Play Gauge, Clutch 307-555
 ST2896-A	Gauge, D-Clutch Measurement 307-554

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

Low/Reverse Clutch Assembly



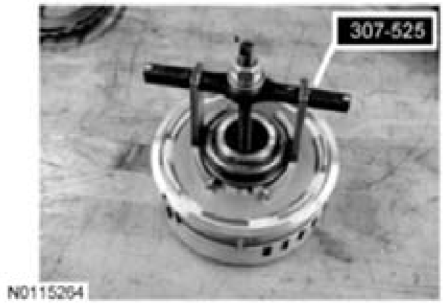
Item	Part Number	Description
1	7A130	Intermediate/low/reverse clutch center support
2	7B220	Center support keys (2 required)
3	7F225	Low/reverse clutch piston center seal
4	7D403	Low/reverse clutch cylinder outer seal
5	7A262	Low/reverse clutch piston
6	7B070	Low/reverse clutch return spring
7	7H318	Low/reverse clutch return spring retainer
8	7D483	Low/reverse clutch return spring snap ring
9	7E085	Low/reverse clutch cushion spring
10	7B164	Low/reverse clutch internal splined friction plates (internally splined to the rear planetary carrier)
11	7B442	Low/reverse clutch external splined steel plates (externally splined to the case)
12	7B066	Low/reverse clutch pressure plate (externally splined to the case) (select fit)

Disassembly

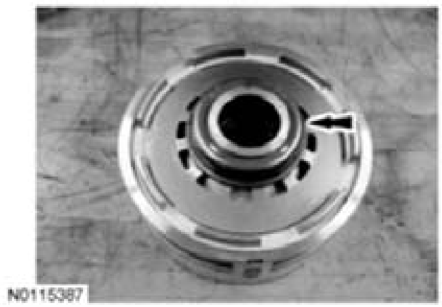
NOTICE:
The low/reverse clutch plate quantity is model dependent on engine size. Check the clutch plate quantity charts in specifications for the correct clutch plate quantity. Failure to install the correct clutch plate quantity will result in transmission failure.

NOTE:
The low/reverse clutch plates are installed in the case during the transmission assembly procedure.

1. Using the Clutch Spring Compressor, remove and discard the low/reverse clutch return spring retainer.

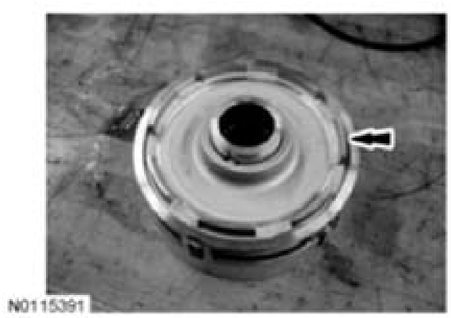


2. Remove and discard the low/reverse clutch return spring retainer.

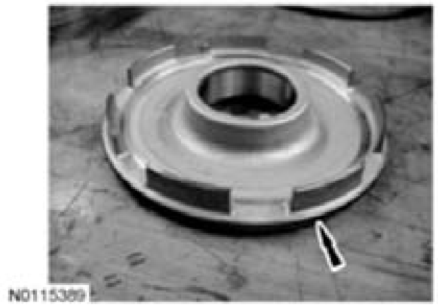


3. Remove the low/reverse clutch return spring.

4. Apply a slight amount of air to the port, remove the low/reverse clutch piston from the low/reverse clutch drum.



5. Remove and discard the low/reverse outer piston O-ring seal.

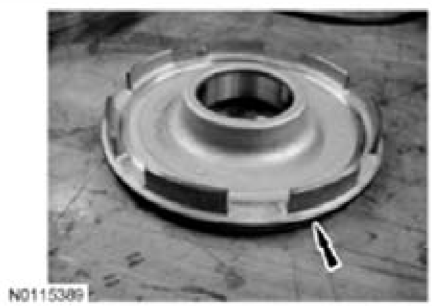


6. Remove and discard the low/reverse drum O-ring seal.

Assembly

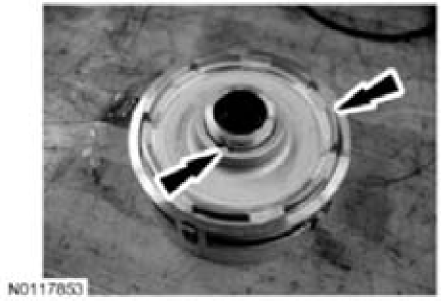
Low/reverse piston

1. Install new low/reverse outer piston O-ring seal.



2. Install new low/reverse drum O-ring seal.

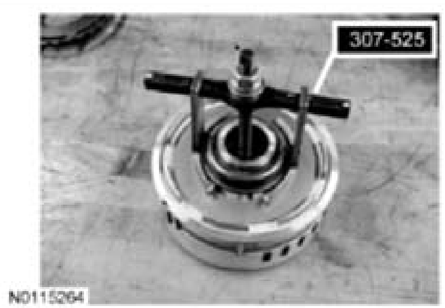
3. Lubricate the O-ring seal with clean transmission fluid. Align the alignment tab on the piston with the groove in the center support and install the low/ reverse piston.



4. Install the low/reverse clutch return spring.

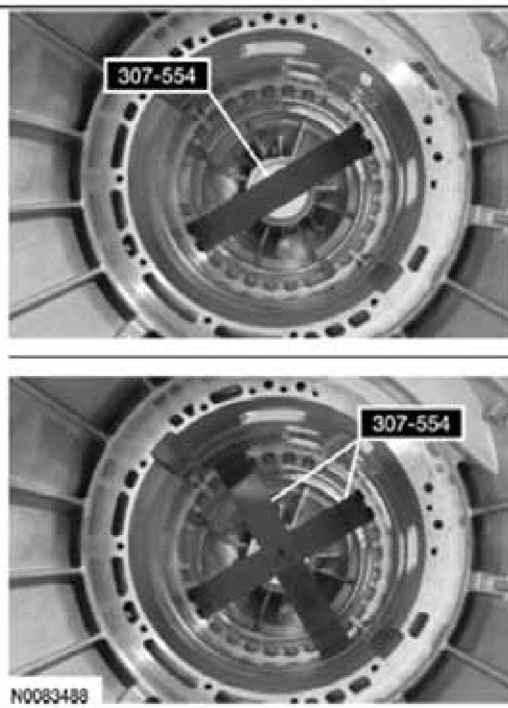
5. Install a new low/reverse clutch return spring retainer. Align the alignment tab on the retainer with the groove in the center support and install the low/ reverse piston return spring retainer.

6. Using the Clutch Spring Compressor, compress the low/reverse clutch return spring and install the retaining ring.



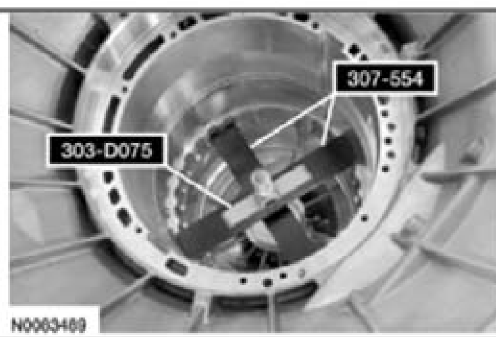
Low/reverse clutch stackup

7. **NOTE:**
   All low/reverse clutch plates, friction and steel are of a wave-type design.
   Install the D-Clutch Measurement Gauge into the case.



8. With the D-Clutch Measurement Gauge positioned in the case, use the Depth Micrometer to measure the case stop depth.

Description	Reading
Measure the distance from the top of the upper gauge bar to the top of the lower gauge bar. Record this reading as the case measurement. Record as reading A.	



9. Measure the clutch pack height.

	Description	Reading
A.	Place the low/reverse clutch pack on the Clutch End Play Gauge with the wave spring down and the pressure plate on top. Using the Dial Indicator Gauge with Holding Fixture, place the plunger on the pressure plate. Slide the clutch to the side so the plunger of the Dial Indicator is touching the gauge plate of the Clutch End Play Gauge. Zero out the Dial Indicator Gauge.	

(Continued)

	Description	Reading
B.	Carefully lift the plunger enough to slide the clutch pack under the plunger to take a reading. Record this reading. Rotate the clutch pack 180 degrees and take a second reading. Add the first and second readings together and divide the total by 2. Record this reading as B.	

N0092923

10. Using the Depth Micrometer, measure the piston to center support shoulder height.

Description	Reading
Measure the piston to center support shoulder height. Record this measurement. Rotate the center support 180 degrees and record this measurement. Add the first and the second measurements, then divide by 2. Record this as reading C.	

N0117652

11. Calculate the end clearance.

Description	Reading
Subtract B and C from A to determine end clearance	

(Continued)

Description	Reading
Total C measurement	
End clearance specification	1.0-1.6 mm (0.039-0.062 in)

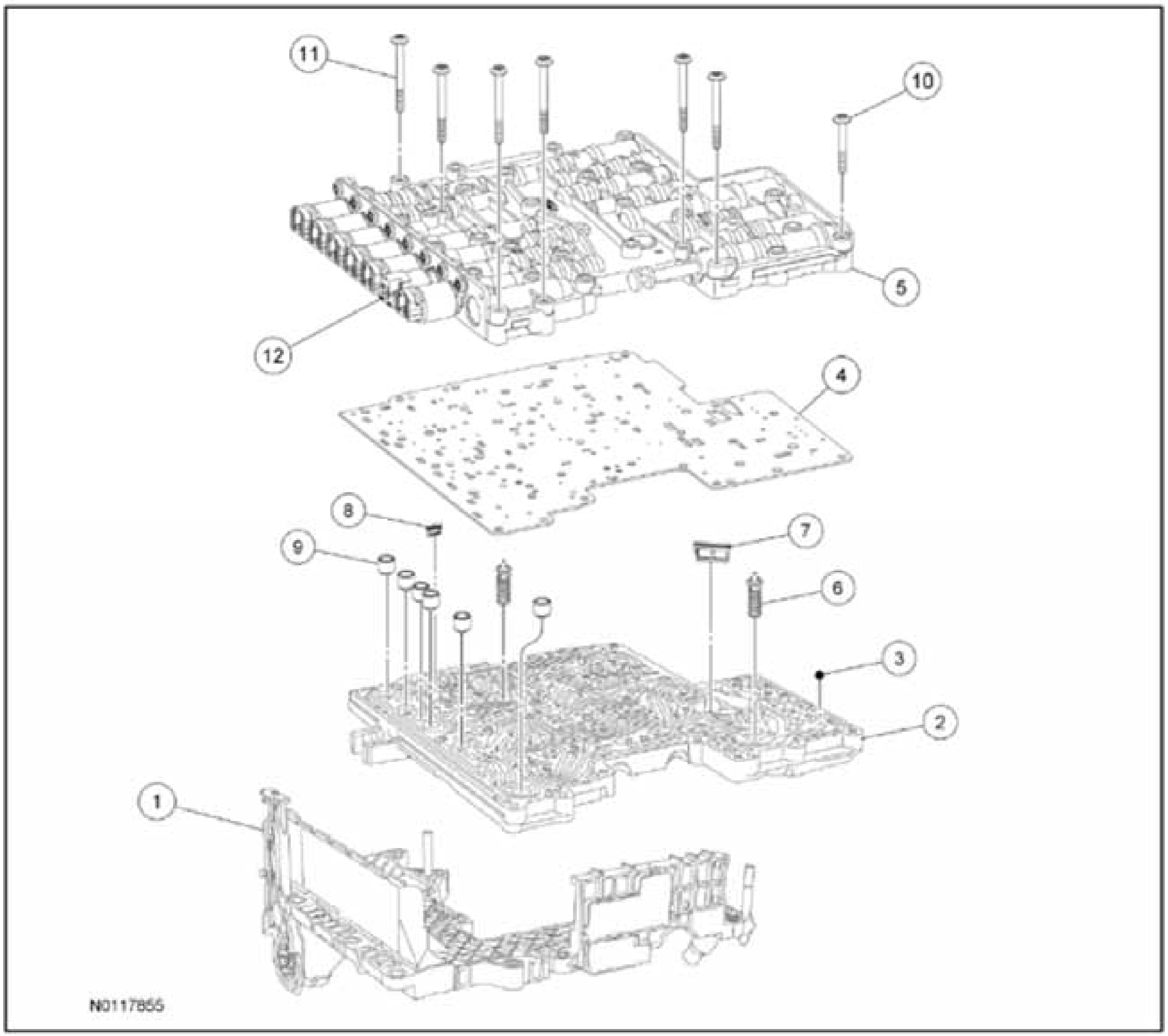
Compare the end clearance to the specification. If the end clearance is out of specification, select the next thinner or thicker plate as required and repeat Steps 10, 11 and 12.

Main Control

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV

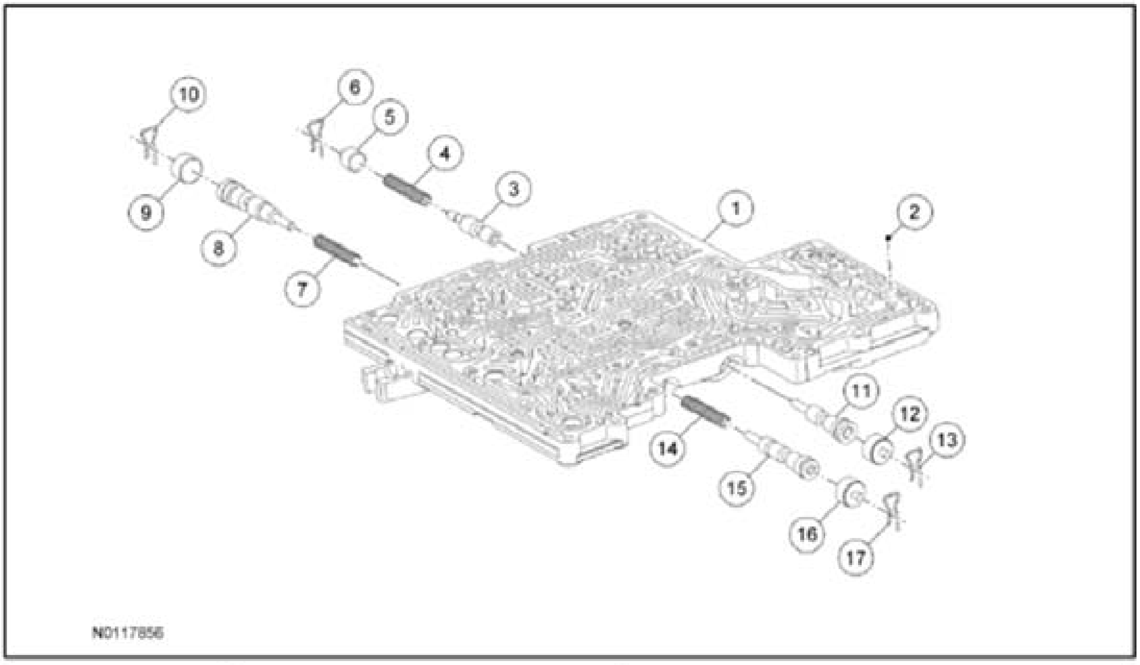
Main Control Assembly



Item	Part Number	Description
1	7G276	Molded leadframe

Item	Part Number	Description
2	—	Main control valve body (upper)
3	7E195	Main control valve check ball (8 required)
4	7Z490	Main control valve body separator plate
5	—	Main control valve body (lower)
6	—	Main control valve
7	7H187	Main control filter
8	7B155	Transmission fluid filter
9	7J191	Transmission solenoid damper valve assembly
10	W707886	Main control assembly short bolt — connects upper and lower half together (19 required)
11	W707884	Main control assembly long bolt — connects molded leadframe to main control valve assembly (6 required)
12	—	Transmission shift control solenoids

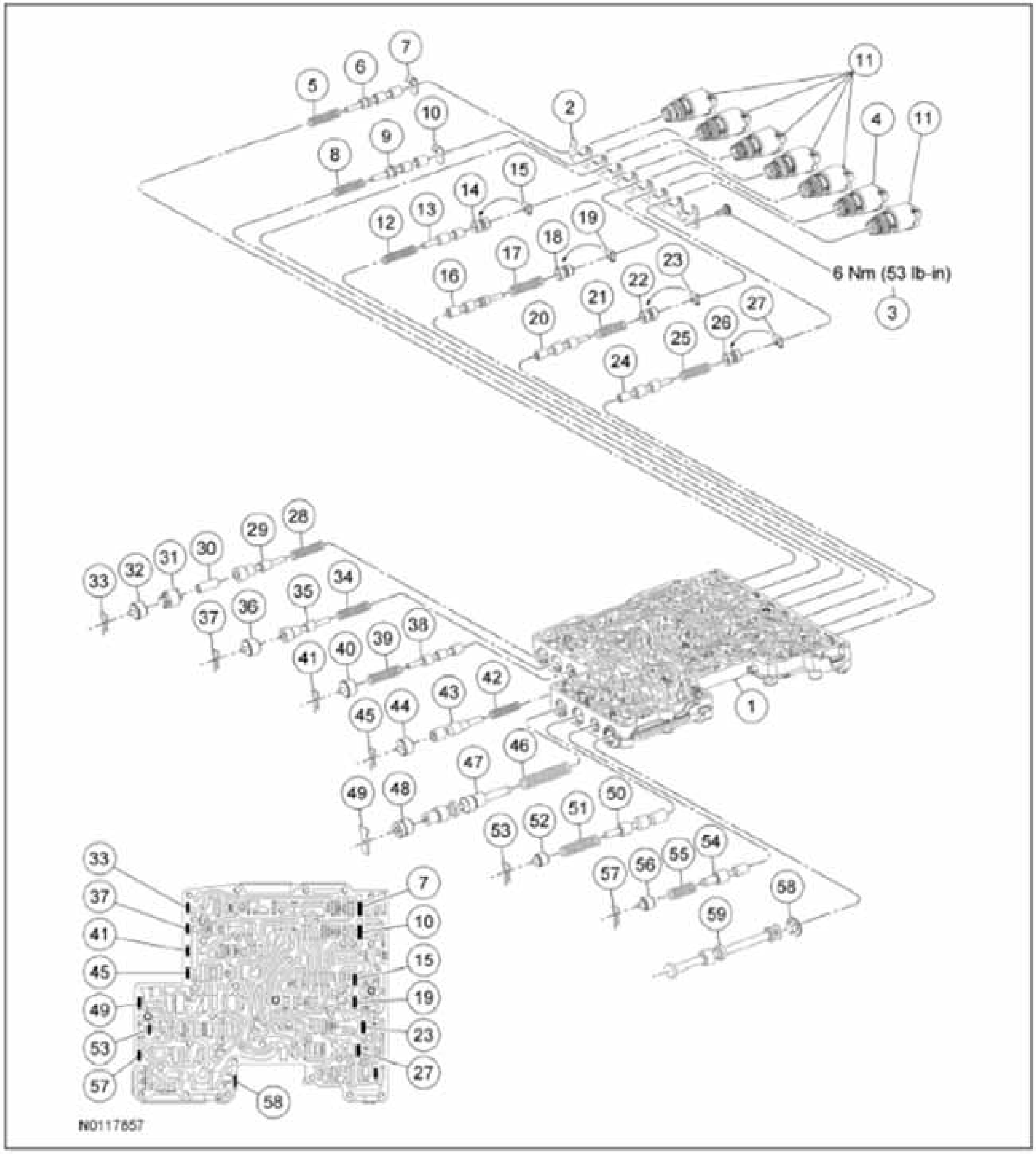
Main Control Upper Half



Item	Part Number	Description
1	7A092	Main control valve assembly (ditch plate) (upper half)
2	7E195	Main control valve check ball (8 required)
3	—	Transmission clutch D2 latch valve
4	—	Transmission clutch valve spring
5	—	Transmission clutch valve spring plug
6	7G007	Transmission clutch valve spring plug retaining clip
7	—	Transmission clutch valve spring
8	—	Transmission clutch B regulator valve
9	—	Transmission clutch valve spring plug
10	7G007	Transmission clutch valve spring plug retaining clip

Item	Part Number	Description
11	—	Transmission clutch valve
12	—	Transmission clutch valve spring plug
13	7G007	Transmission clutch valve spring plug retaining clip
14	—	Transmission clutch valve spring
15	—	Transmission clutch valve
16	—	Transmission clutch valve spring plug
17	7G007	Transmission clutch valve spring plug retaining clip

Main Control Lower Half

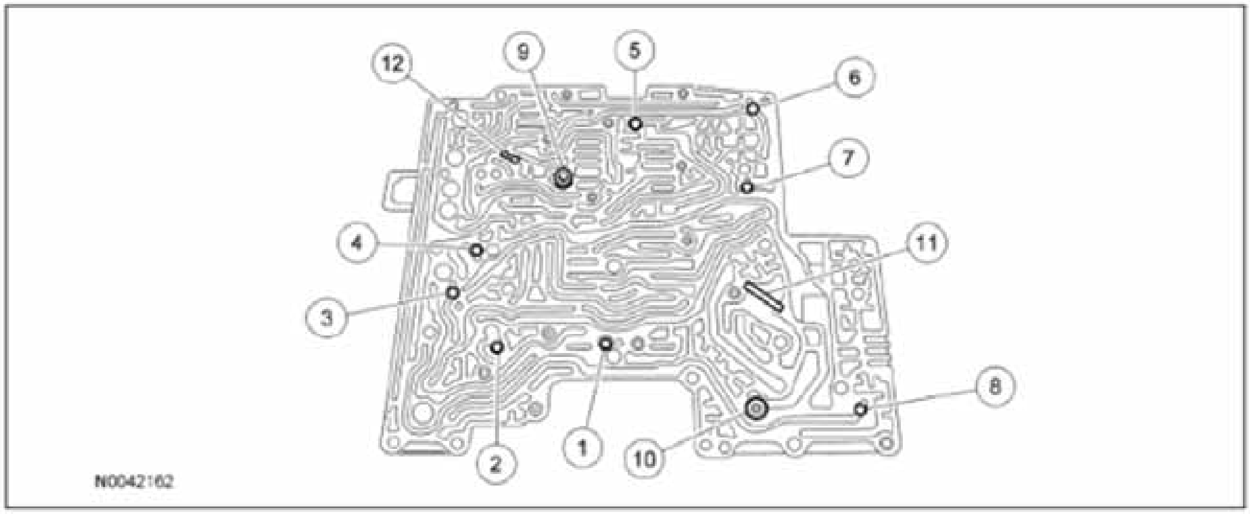


Item	Part Number	Description
1	—	Main control valve assembly (lower half)
2	—	Transmission shift control solenoid hold-down bracket
3	—	Transmission shift control solenoid hold-down bracket bolt M5 x 0.80 x 12 (8 required)
4	7G484	Transmission ON/OFF shift solenoid

Item	Part Number	Description
5	—	Transmission clutch valve spring
6	—	Transmission clutch A latch valve
7	—	Transmission spring retainer plate
8	—	Transmission clutch valve spring
9	—	Transmission clutch B latch valve
10	7F194	Transmission spring retainer plate
11	7G383	Transmission Variable Force Solenoid (VFS) (6 required)
12	—	Transmission solenoid regulator valve spring
13	—	Transmission solenoid pressure regulator valve
14	—	Transmission solenoid plug
15	7G007	Transmission valve plug retainer
16	—	Transmission clutch D1 latch valve
17	—	Transmission clutch valve spring
18	—	Transmission solenoid plug
19	7G007	Transmission valve plug retainer
20	—	Transmission drive enable valve
21	—	Transmission solenoid valve spring
22	—	Transmission solenoid plug
23	7G007	Transmission valve plug retainer
24	—	Transmission solenoid multiplex valve
25	—	Transmission solenoid valve spring
26	—	Transmission solenoid plug
27	7G007	Transmission valve plug retainer
28	—	Transmission clutch valve spring
29	—	Transmission clutch A pressure regulator valve
30	—	Transmission clutch regulator valve sleeve
31	—	Transmission valve return plug
32	—	Transmission valve return plug
33	7G077	Transmission valve plug return clip
34	—	Transmission clutch valve spring
35	—	Transmission clutch E pressure regulator valve
36	—	Transmission valve return plug
37	7G007	Transmission valve plug return clip
38	—	Transmission clutch E latch valve
39	—	Transmission clutch control valve spring
40	—	Transmission valve return plug
41	7G007	Transmission valve plug return clip
42	—	Transmission bypass clutch control valve spring
43	—	Transmission bypass clutch control valve
44	—	Transmission valve return plug
45	7G007	Transmission valve plug return clip
46	—	Transmission manual oil pressure regulator valve spring
47	—	Transmission main oil pressure regulator valve
48	—	Transmission manual oil pressure regulator valve sleeve
49	7G007	Transmission valve plug return clip
50	—	Transmission converter regulator valve

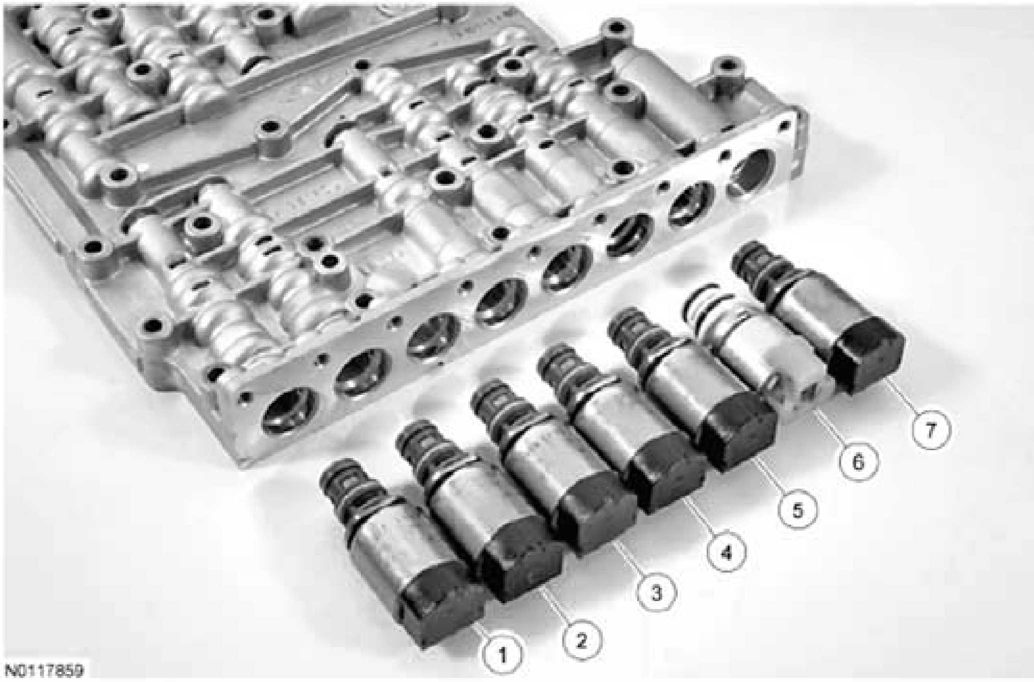
Item	Part Number	Description
51	—	Transmission converter regulator valve spring
52	—	Transmission valve return plug
53	7G007	Transmission valve plug return clip
54	—	Transmission lube control valve
55	—	Transmission lube control valve spring
56	—	Transmission valve return plug
57	7G007	Transmission valve plug return clip
58	W527007-S	Retaining ring
59	—	Transmission control manual valve

Check Ball Location



Item	Description
1	Reverse/drive control check ball
2	Shift solenoid control check ball
3	Intermediate clutch exhaust control check ball
4	Direct clutch exhaust control check ball
5	Low/reverse clutch exhaust control check ball
6	Forward clutch exhaust control check ball
7	Overdrive clutch exhaust control check ball
8	Reverse exhaust control check ball
9	Clutch exhaust valve
10	Converter drain back valve
11	Large filter screen
12	Small filter screen

Shift Solenoid Location



Item	Part Number	Description
1	7G383	Shift Solenoid A (SSA) Forward (1,2,3,4) clutch, normally low Variable Force Solenoid (VFS).
2	7G383	Shift Solenoid B (SSB) Direct (3,5,R) clutch, normally high VFS.
3	7G383	Shift Solenoid C (SSC), Intermediate (2,6) clutch, normally low VFS.
4	7G383	Line Pressure Control (LPC) normally high VFS.
5	7G383	Shift Solenoid D (SSD), low/reverse/overdrive clutch, normally high VFS.
6	7G484	Shift Solenoid E (SSE), normally off ON/OFF solenoid.
7	7G383	Torque Converter Clutch (TCC) normally low VFS.

Disassembly

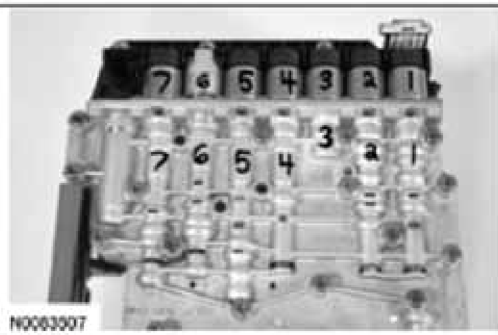
NOTE:
Make an identifying mark on each solenoid and the corresponding bore for correct assembly.

NOTE:
Solenoids may visually appear the same but their designs/functions are different. Use care not to assemble the main control assembly incorrectly. Incorrect solenoid installation results in poor transmission shift quality.

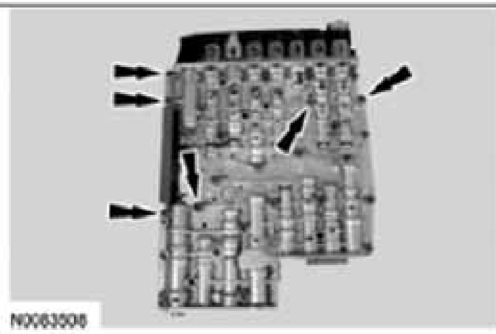
NOTE:
Note the location of the 8 check balls, 6 solenoid dampers, 2 internal valves and springs and 2 filter screens for reassembly.

Main Control Upper Half

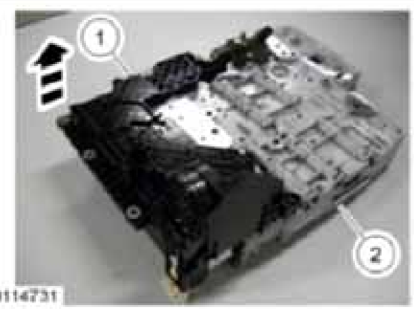
1. Make an identifying mark on each solenoid and the corresponding bore for correct assembly.



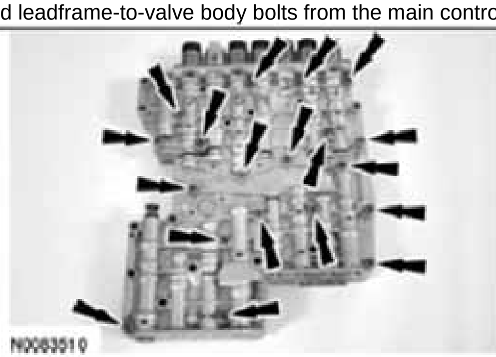
2. Remove the 6 long molded leadframe-to-valve body bolts from the molded leadframe.



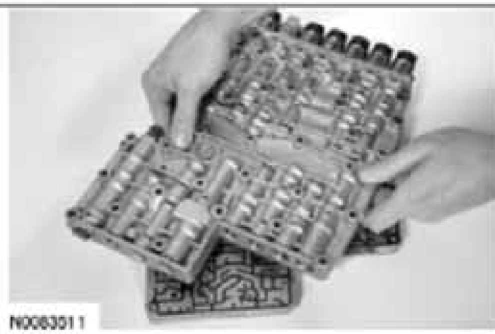
3. Carefully separate the molded leadframe from the main control assembly.
    1. Molded leadframe
    2. Main control assembly



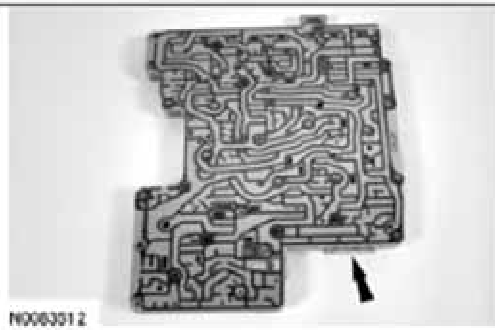
4. Remove 19 short molded leadframe-to-valve body bolts from the main control assembly.



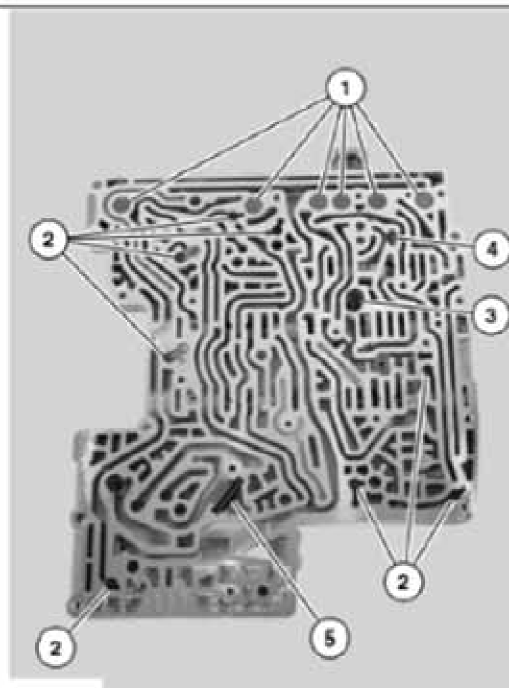
5. Separate the lower half of the main control assembly from the upper half of the main control assembly.



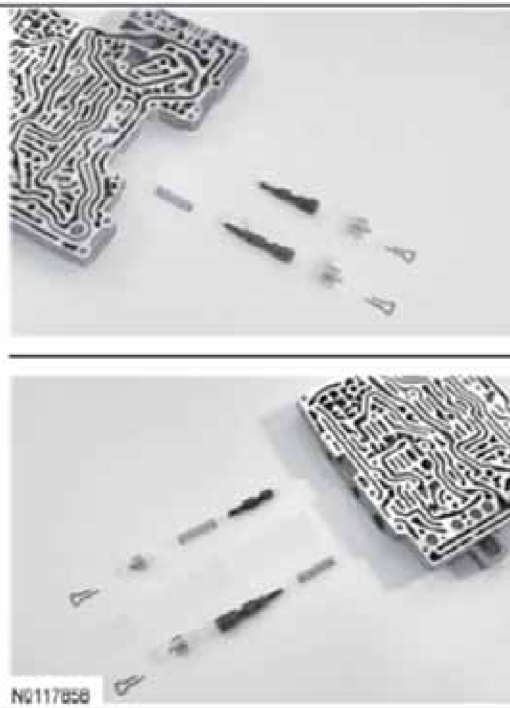
6. Remove and discard the main control valve body separator plate.



7. Remove the solenoid dampers, check balls, converter drain back valve and filter screens from the main control assembly. Note the location for assembly.
    1. Solenoid dampers
    2. Check balls
    3. Converter drain back valve
    4. Small filter screen
    5. 5 Large filter screen



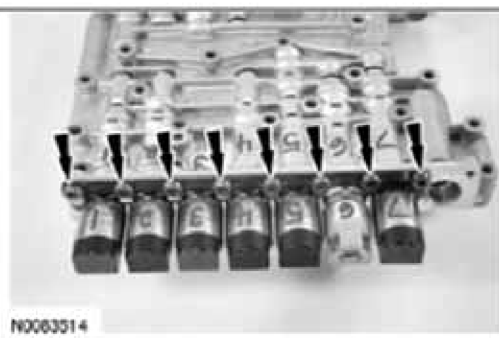
8. Remove the retaining clips, caps, valves and valve springs from each bore of the main control assembly. Note the location and order for assembly.



9. Using clean mineral spirits, clean the upper half of the main control assembly.

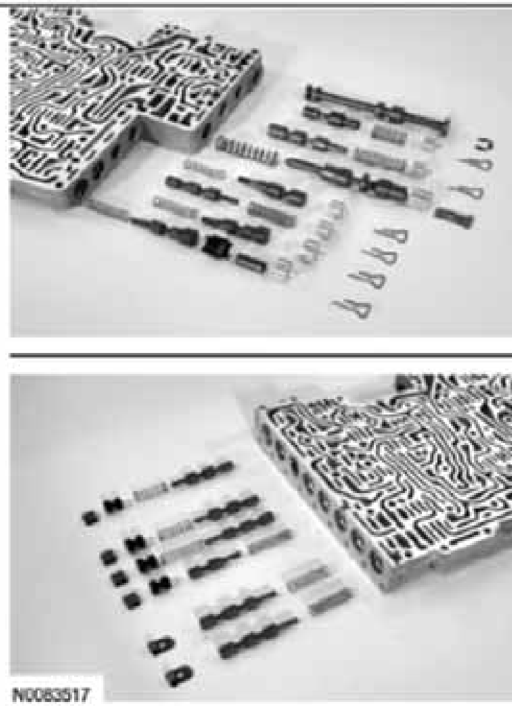
Main Control Lower Half

10. Remove the 8 solenoid hold down bracket bolts and the solenoid hold down bracket.



11. Remove the solenoids.

12. Remove the retaining clips, caps, valves and valve springs from each bore of the main control assembly. Note the location and order for assembly.



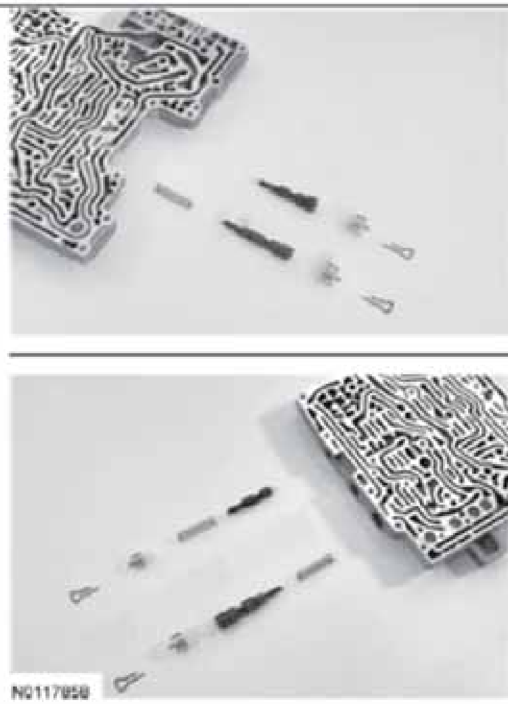
13. Using clean mineral spirits, clean the lower half of the main control assembly.

Assembly

Main Control Upper Half

1. **NOTE:**
   Many components and surfaces in the main control valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly prevents unnecessary damage to machined surfaces.

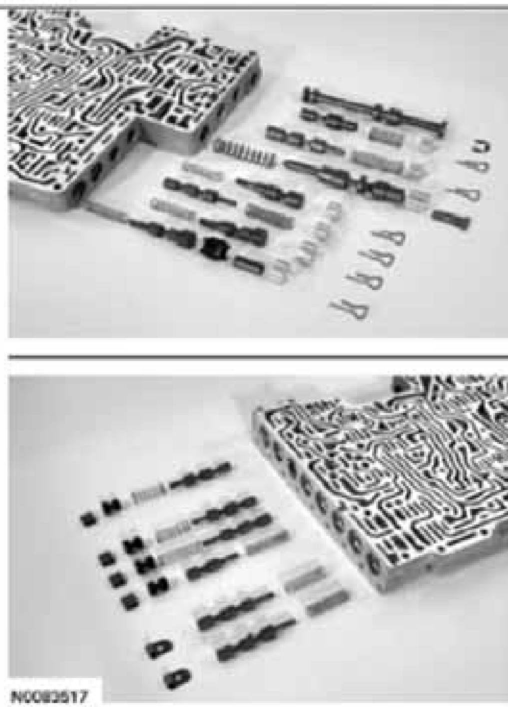
   Install the retaining clips, caps, valves and valve spring into each bore.



Main Control Lower Half

2. **NOTE:**
   Many components and surfaces in the main control valve body are precision machined. Careful handling during disassembly, cleaning, inspection and assembly prevents unnecessary damage to machined surfaces.

   Install the retaining clips, caps, valves and valve spring into each bore.



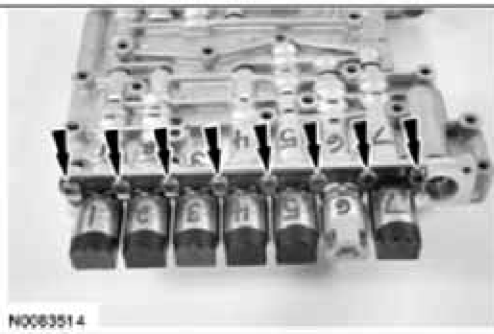
3. ***NOTICE:***
A Variable Force Solenoid (VFS) is calibrated from the factory and are not all the same. If replacing a VFS, match the replacement solenoid type (normally high/normally low) and the band number with the original solenoid or harsh shifts or damage to the transmission can occur.

   Inspect the solenoid screens for contamination and install new solenoids if needed. Lubricate the solenoid O-rings with clean transmission fluid. If replacing a solenoid, use the solenoid exploded view at the beginning of this procedure to identify what type of solenoid is being replaced. The solenoid can be a normally high VFS, normally low VFS or an ON/OFF solenoid.
   If replacing a VFS, record the band number to get the correct part number for the solenoid.

   1. O-rings
   2. Screens
   3. Solenoid band number

4. Install the solenoids into their correct bores as indicated during disassembly.

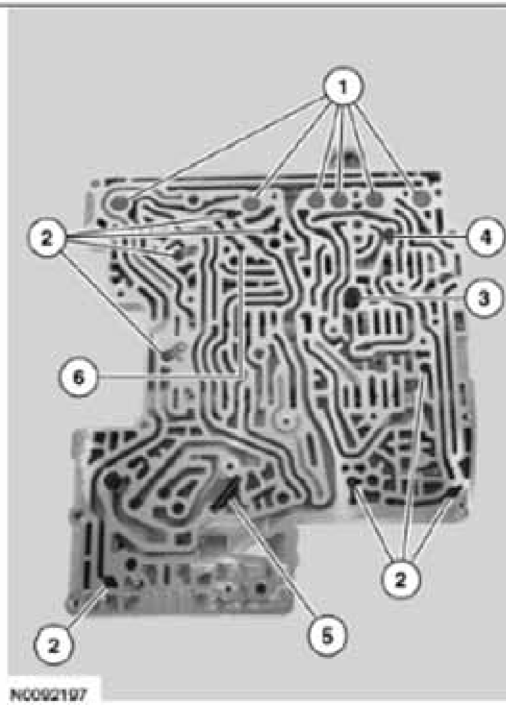
5. Install the shift control solenoid hold down bracket and the 8 hold down bracket bolts.
    1. Tighten to 6 Nm (53 lb-in).



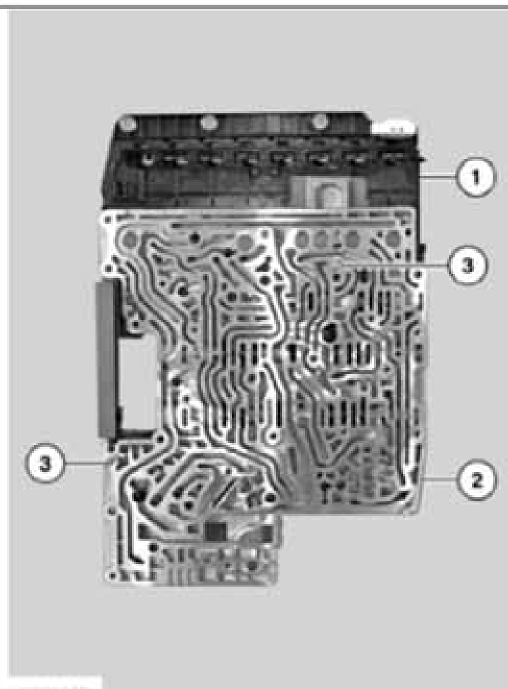
6. ***NOTICE:***
   Toward the back of the upper valve body there is a hydraulic passage that is shaped as though it receives a check ball. This passage does not require a check ball. Be sure not to mistake this hydraulic passage for a passage that does require a check ball or damage to the transmission can occur.

   Install the solenoid dampers, check balls, converter drain back valve and filter screens.

    1. Solenoid dampers
    2. Check balls
    3. Converter drain back valve
    4. Small filter screen
    5. Large filter screen
    6. Empty hydraulic passage (no check ball)



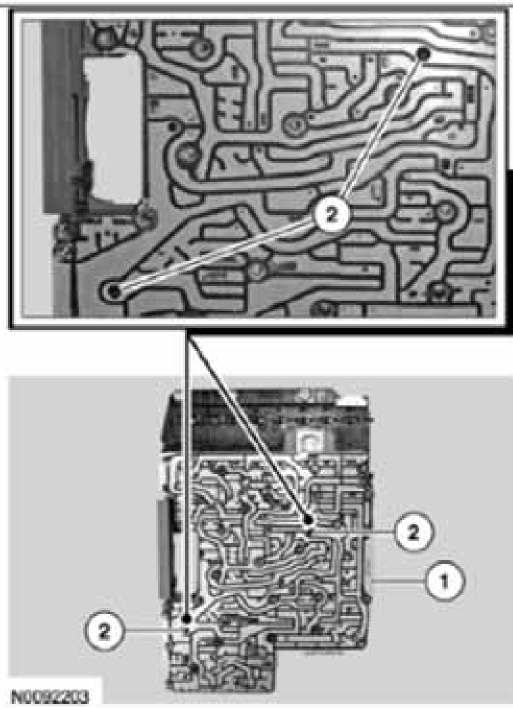
7. Align the guide pins on the molded leadframe with the holes in the main control upper valve body and install the valve body onto the molded leadframe.
    1. Molded leadframe
    2. Main control upper valve body
    3. Guide pins



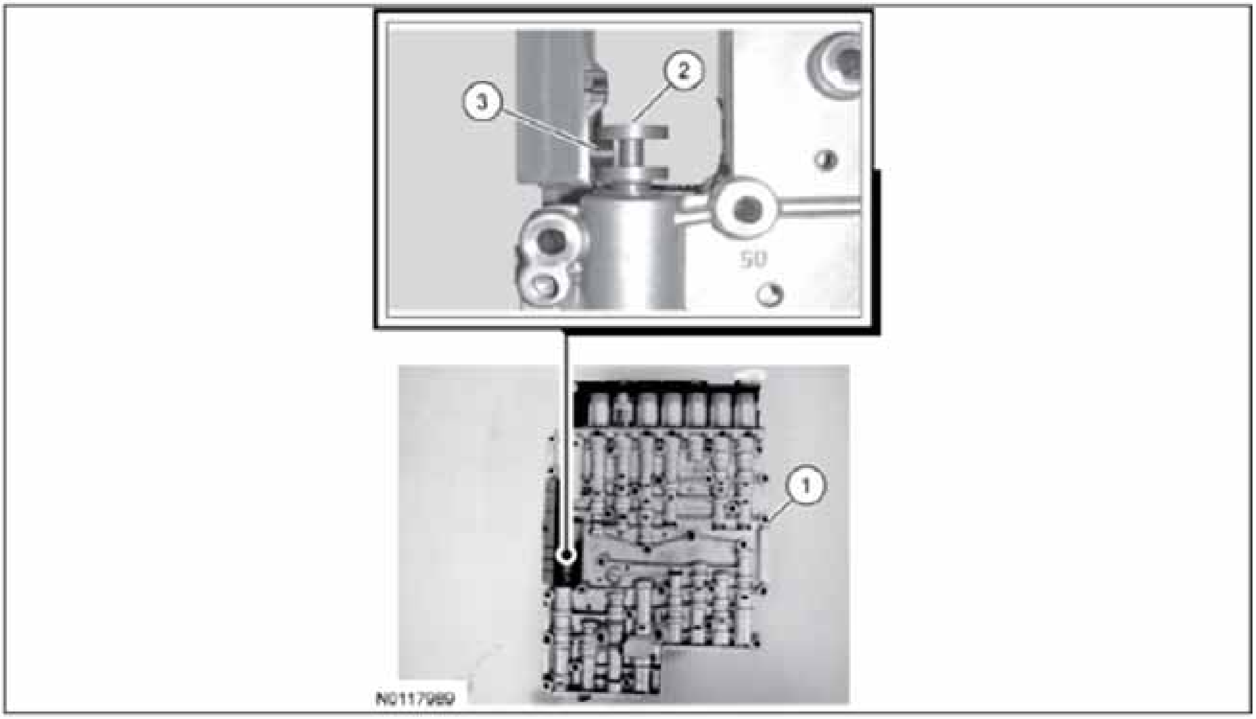
8. ***NOTICE:***
   If the drain back valves are not installed correctly in the separator plate, damage to the transmission can occur.

   Position the new main control separator plate on the main control upper valve body.
   Check the 2 drain back valves to be sure they are correctly positioned in the separator plate when the separator plate is pressed flush against the main control upper valve body.

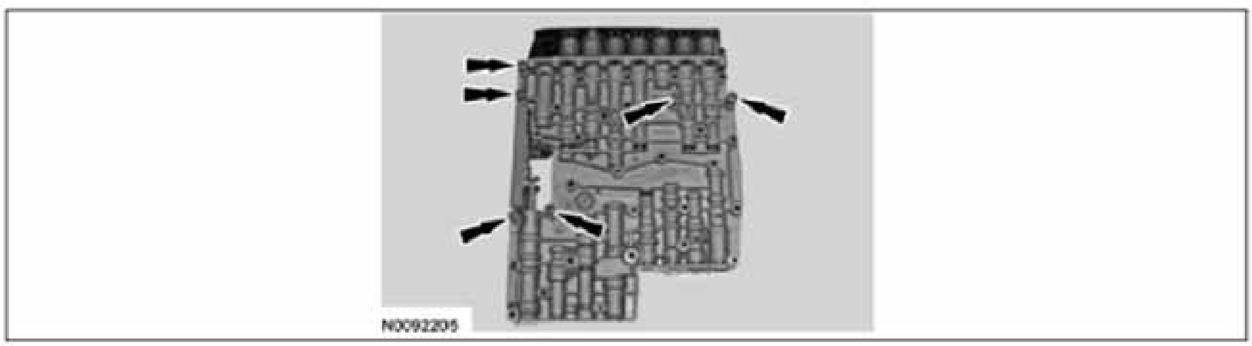
   1. Main control separator plate
   2. Drain back valves



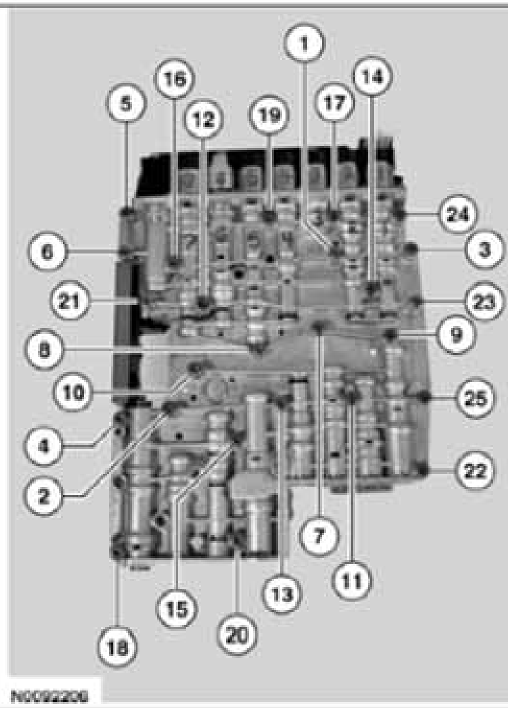
9. Position the main control lower valve body on the 2 molded leadframe alignment studs, align the manual valve with the Transmission Range (TR) sensor on the molded leadframe and install the main control lower valve body.
   1. Main control lower valve body
   2. Manual valve
   3. TR sensor



10. Install the 6 long molded leadframe-to-valve body bolts hand-tight.



11. Install the 19 short main control assembly lower-to-upper valve body bolts. Tighten the bolts in the sequence shown.
    - Tighten bolts 1 through 6 to 6 Nm (53 lb-in).
    - Tighten bolts 7 through 25 to 7 Nm (62 lb-in).



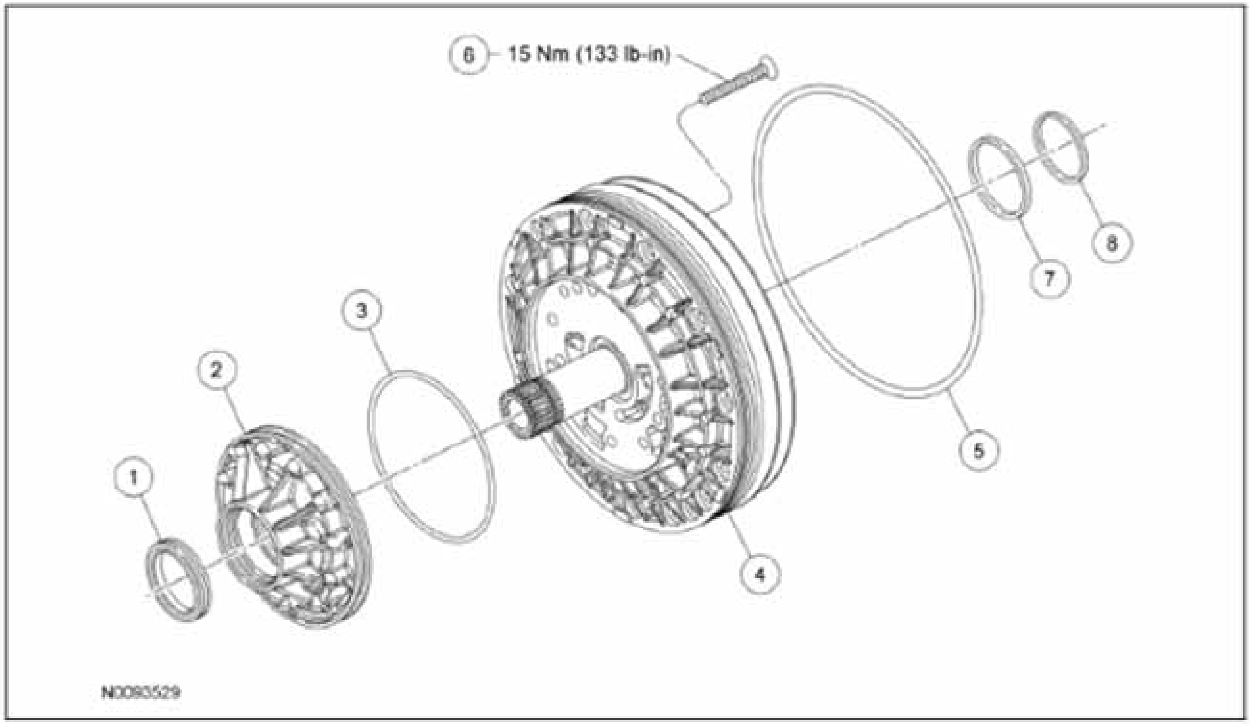
Pump Assembly

Special Tool(s)

 ST2887-A	Installer, Fluid Pump Seal 307-556

Material

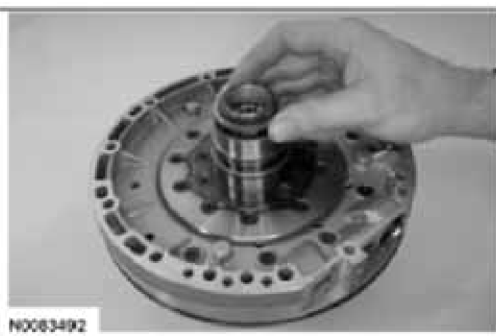
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV



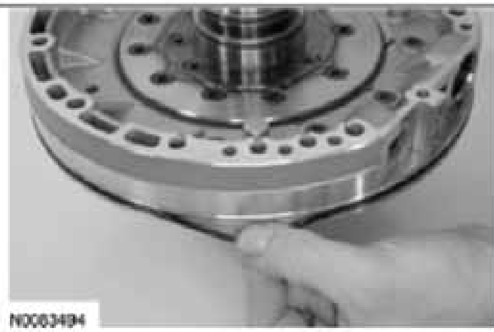
Item	Part Number	Description
1	7A248	Front pump oil seal
2	—	Pump body (part of 7A103)
3	7A248C	Pump body seal
4	7A103	Pump plate assembly
5	7A248A	Pump plate assembly seal
6	W707871-S300	Pump plate assembly-to-front pump body bolt (11 required)
7	7D019	Clutch support fluid seal
8	7L323	Front pump support seal

Disassembly

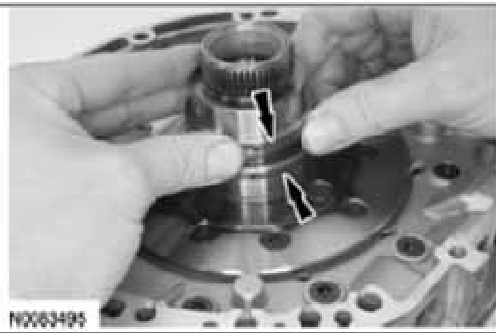
1. Remove the front pump washer.



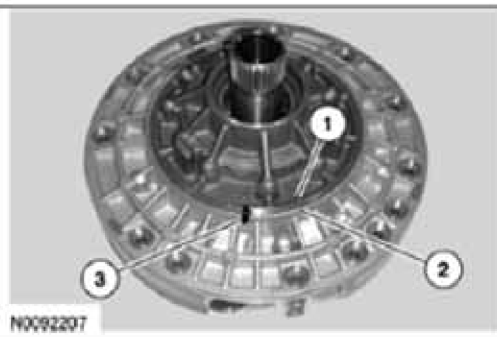
2. If the O-ring seal was not removed during disassembly, remove and discard the front pump O-ring seal from the pump assembly.



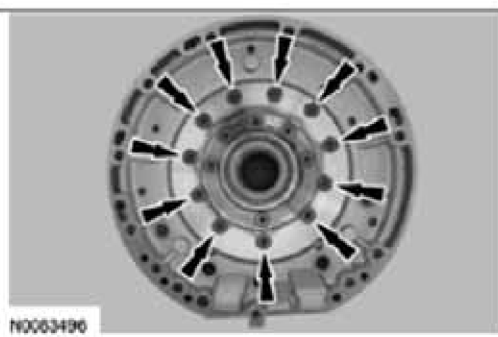
3. Remove and discard the front pump seal rings from the stator support.



4. Index-mark the pump body to the pump plate assembly.
   1. Pump body
   2. Pump plate assembly
   3. Index mark

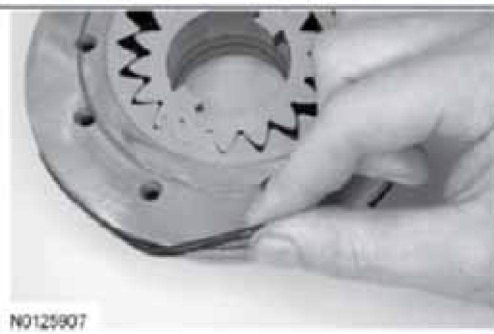


5. Remove the 11 pump plate assembly-to-pump body bolts.

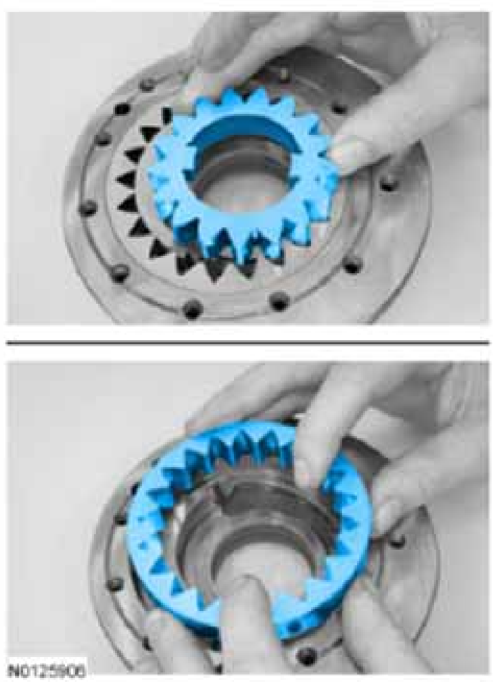


6. Push down on the loose pump plate assembly-to-pump body bolts to remove the pump body from the pump plate assembly and remove the 11 bolts.

7. Remove and discard the pump body outer seal.



8. Remove the fluid pump gears.



9. Inspect the inner and the outer pump gears for damage.

1. Clean all pump components in solvent.
2. Dry the parts with compressed air.
3. Inspect the pump gears, faces, gear teeth and mating surfaces for damage or scoring.
4. Install a new pump as necessary.

10. Inspect the pump body and pump plate thrust surfaces for damage or scoring.
    1. Pump body
    2. Pump plate assembly
    3. Pump gear thrust surfaces

11. Inspect the input shaft bushing for damage or scoring. If the bushing is damaged, install a new pump.

12. Inspect the torque converter hub bushing for damage or scoring. If the bushing is damaged, install a new pump.

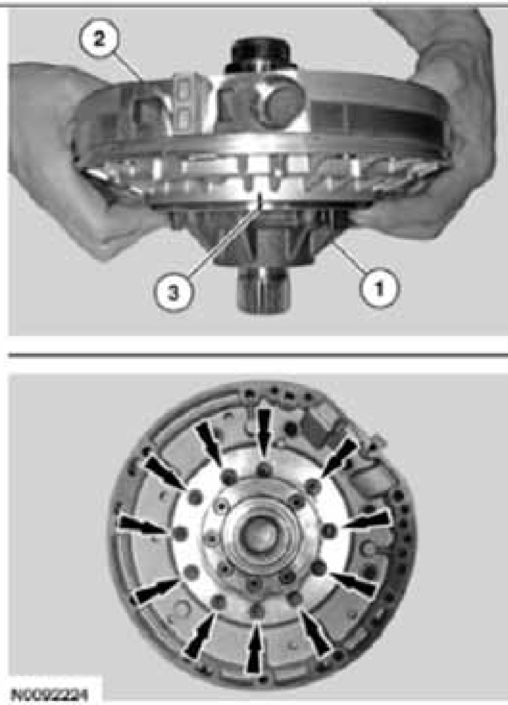
Assembly

1. **NOTE:**
   Prior to installation, lightly lubricate the pump gears with clean automatic transmission fluid.

   Install the pump gears with the dot facing the pump plate assembly.

2. Install a new pump body outer seal.

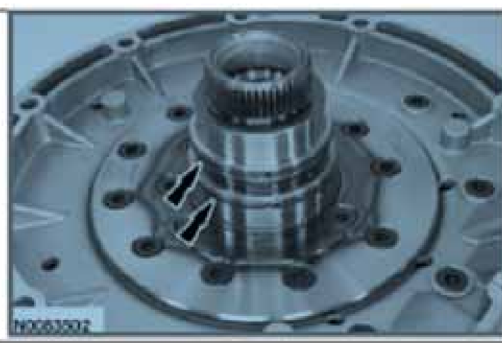
3. Align the marks made during disassembly to correctly assemble the pump. Press the pump body into the pump plate assembly. Visually inspect the pump body-to-pump plate assembly bolt holes to be sure that the pump body and pump plate are correctly aligned.
    1. Pump body
    2. Pump plate assembly
    3. Pump gear thrust surfaces



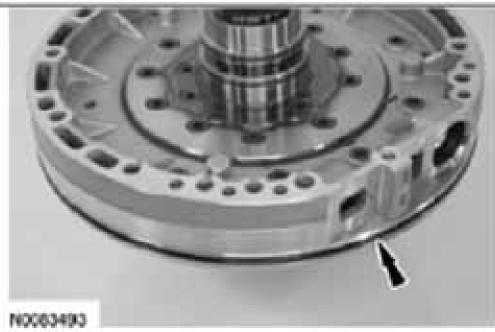
4. Install the pump plate assembly-to-front pump body bolts.
    - Tighten to 15 Nm (133 lb-in).

5. ***NOTICE:***
Make sure that the seal ends of each seal ring are hooked together or fluid leakage can occur.

    Install the 2 front pump seal rings onto the stator support. Make sure the seals are fully seated in the stator support seal grooves and the seal ends are oriented 180 degrees apart.



6. Install the pump outer diameter front pump O-ring seal.

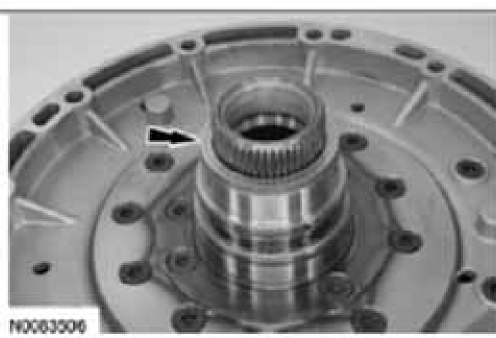


7. Install a new front pump seal on the Fluid Pump Seal Installer 307-556.

8. Using the Fluid Pump Seal Installer 307-556, install the front pump seal.

9. **NOTE:**
Lightly lubricate the thrust washer with petroleum jelly to hold it in place during assembly.

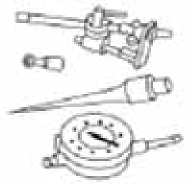
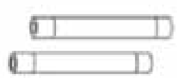
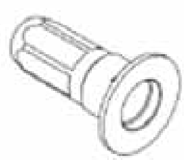
Install the pump thrust washer.

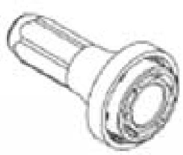
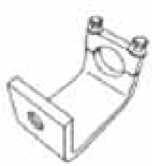


ASSEMBLY

Transmission

Special Tool(s)

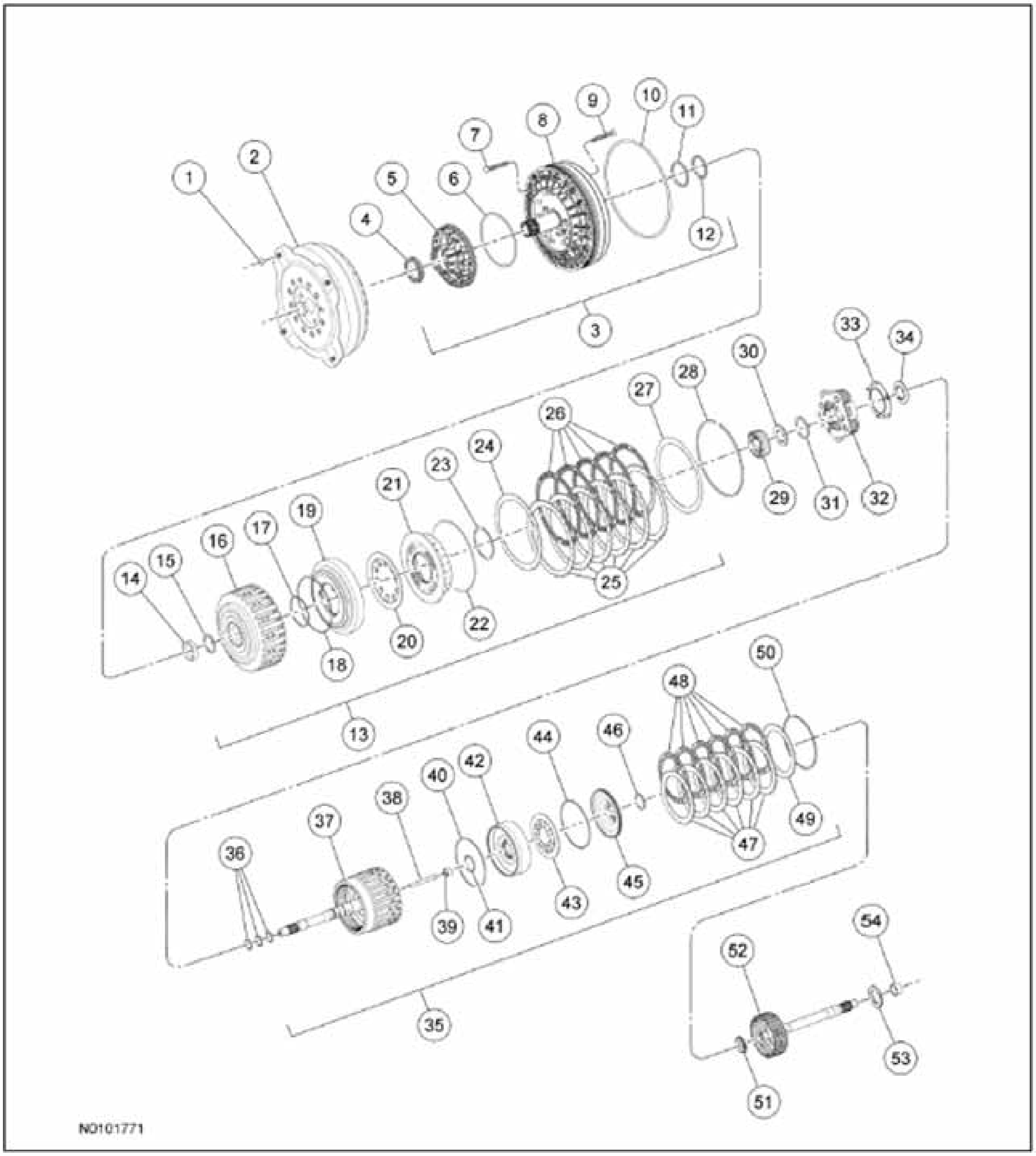
 ST1214-A	Dial Indicator Gauge with Holding Fixture 100-002 (TOOL-4201-C)
 ST1360-A	Drawbar (Heavy Duty Threaded) 204-029 (T77F-1176)
 ST2883-A	End Play Gauge, Transmission 307-534
 ST1631-A	Handle, Torque Converter 307-091 (T81P-7902-C)
 ST3059-A	Installer, Rear Seal 4X4 307-637
 ST2887-A	Installer, Fluid Pump Seal 307-556

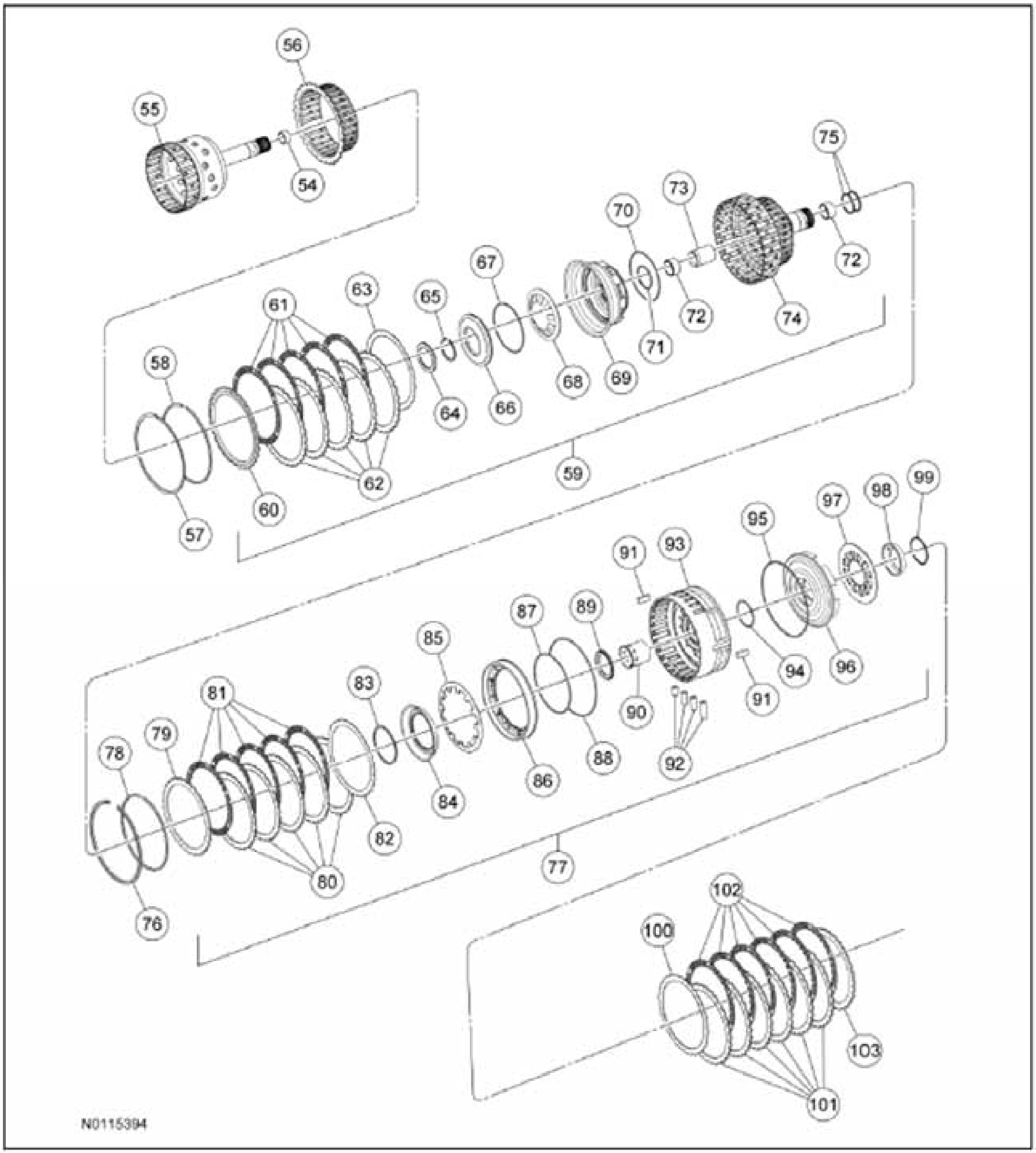
	Installer, Front Wheel Hub Oil Seal 205-276 (T88T-1175-AH)
 ST2894-A	Installer, Rear Bearing 4X4 307-647
 ST2890-A	Installer, Shifter Fluid Seal 307-559
 ST3060-A	Rear Seal Installer 4X2 307-638
 ST3061-A	Remover/Installer, Rear Bearing 4X2 307-639
 ST2891-A	Remover, Transmission Fluid Pump 307-553
 ST1104-B	Retaining Ring Pliers 307-343 (T95P-77001-AHR)

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV
Motorcraft® Multi-Purpose Grease XL-5	ESB-M1C93-B

Disassembled Views





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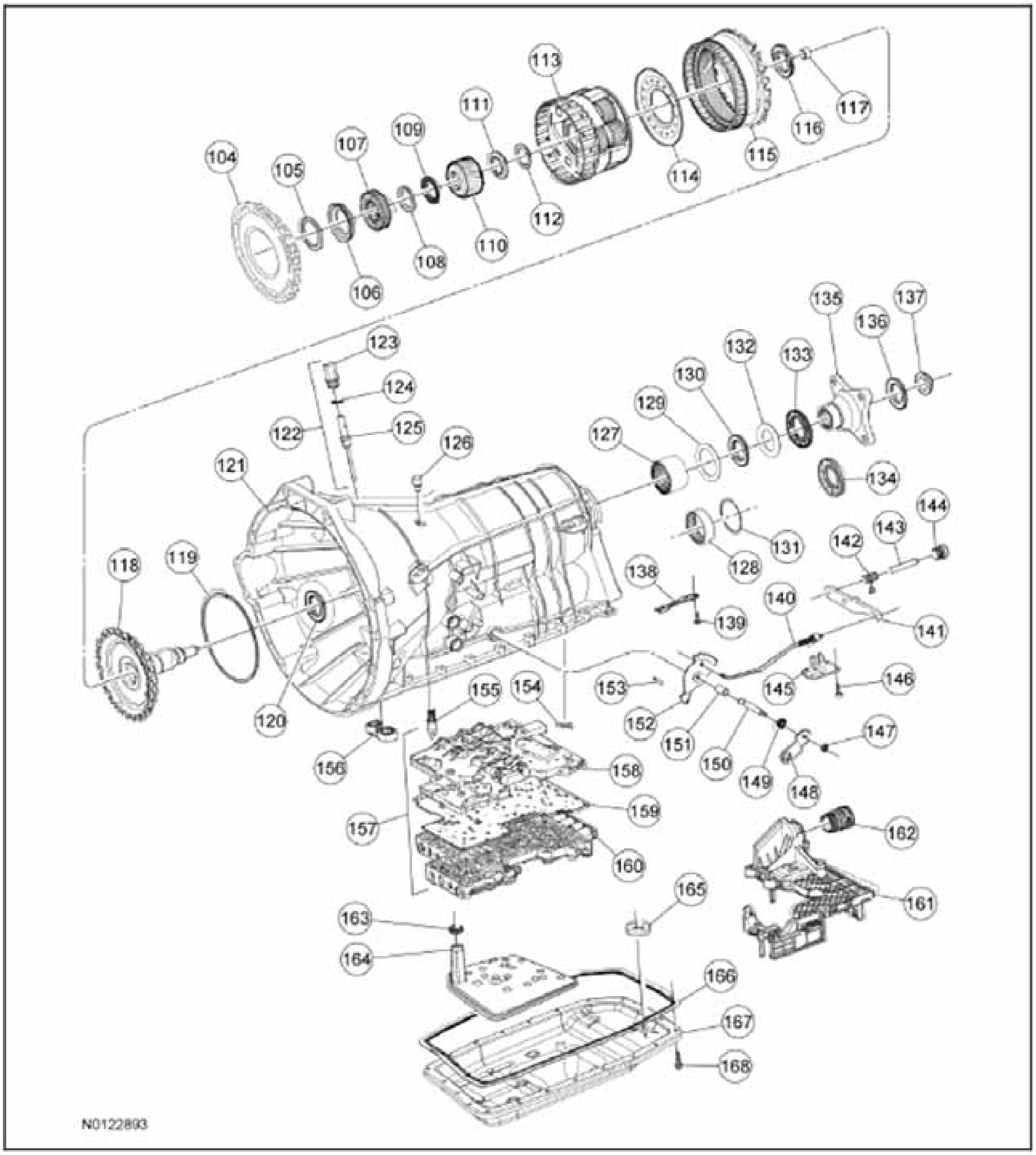


Item	Part Number	Description
1	N800750-S437	Flexplate-to-torque converter nut (4 required)
2	7902	Torque converter
3	7A103	Pump assembly
4	7A248	Front pump oil seal
5	—	Pump body (part of 7A103)
6	7A248	Front pump inner oil seal

Item	Part Number	Description
7	7N134	Front pump-to-case bolt (13 required)
8	7A103	Front pump assembly
9	W707871-S300	Bolt — attaches pump to pump adapter assembly (11 required)
10	7A248	Front pump outer oil seal
11	7D019	Clutch support fluid seal
12	7L323	Front pump support seal
13	—	Forward (A) clutch assembly
14	—	Forward (A) clutch rear bushing (part of 7A360)
15	7D014	Front pump selective washer
16	7A360	Forward (A) clutch cylinder and hub assembly
17	7A548	Forward (A) clutch inner piston seal
18	7A548	Forward (A) clutch outer piston seal
19	7A262	Forward (A) clutch piston
20	7A480	Forward (A) clutch piston retaining spring
21	7H360	Forward (A) clutch balance piston assembly
22	7A548	Forward (A) clutch balance piston outer seal
23	7H365	Forward (A) clutch balance piston snap ring
24	7E085	Forward (A) clutch cushion spring
25	7E314	Forward (A) clutch steel plates (externally splined) (quantity model dependent)
26	7B164	Forward (A) clutch friction plates (internally splined) (quantity model dependent)
27	7B066	Forward (A) clutch pressure plate
28	7D483	Pressure plate retaining snap ring
29	7D063	Front planetary sun gear (No. 1)
30	7H375	Bearing (T1)
31	—	Front planetary carrier assembly snap ring (part of 7A398)
32	7A398	Front planetary carrier assembly
33	7L339	Plate transmission fluid collector
34	7L495	Bearing (T2)
35	—	Overdrive (E) clutch assembly
36	7G091	Turbine shaft seals (3 required)
37	7F207	Input shaft
38	—	Fluid distributor sleeve (part of 7J006)
39	—	Output shaft bushing (part of 7J006)
40	7A548	Overdrive (E) clutch piston outer seal
41	7A548	Overdrive (E) clutch piston inner seal
42	7A262	Overdrive (E) clutch piston
43	7B070	Overdrive clutch piston spring
44	7A548	Balance piston outer seal
45	7H360	Overdrive (E) balance piston
46	7C122	Balance piston snap ring
47	7B442	Overdrive (E) clutch steel plates (externally splined)
48	7B164	Overdrive (E) clutch friction plates (internally splined)
49	7B066	Overdrive (E) pressure plate
50	7D483	Overdrive (E) clutch retaining ring
51	7C096	Bearing (T3)

Item	Part Number	Description
52	7F351	Intermediate (C) clutch shaft
53	7H375	Bearing (T4)
54	—	Sun gear bushings (part of 7R193) (2 required)
55	7B067	Sun gear hub and shaft assembly
56	7F236	Direct (B) clutch hub
57	7C122	Direct (B) clutch cylinder retaining ring
58	7D483	Direct (B) clutch pressure plate retaining ring
59	—	Direct (B) clutch assembly (clutch B)
60	7B066	Direct (B) clutch pressure plate
61	7B164	Direct (B) clutch friction plates (internally splined) (quantity model dependent)
62	7B442	Direct (B) clutch steel plates (externally splined) (quantity model dependent)
63	7E085	Direct (B) clutch cushion plate
64	7C096	Roller bearing (T5)
65	7A577	Direct (B) clutch piston retaining ring
66	7A262	Direct (B) clutch balance piston
67	7A548	Direct (B) clutch balance seal
68	7B488	Direct (B) clutch piston return spring
69	—	Direct (B) clutch piston
70	7A548	Direct (B) clutch piston outer seal
71	7C099	Direct (B) clutch piston inner seal
72	—	Direct (B) clutch hub bushings (part of 7F283) (2 required)
73	—	Gear shaft tube sleeve (part of 7F283)
74	7F283	Direct (B) clutch cylinder
75	7D020	Shell cylinder seals (2 required)
76	7D483	Center support retaining ring
77	—	Intermediate (C) clutch assembly
78	7D483	Intermediate (C) clutch pressure plate retaining ring
79	7B066	Intermediate (C) clutch pressure plate
80	7B442	Intermediate (C) clutch steel plates (externally splined) (quantity model dependent)
81	7B164	Intermediate (C) clutch friction plates (internally splined) (quantity model dependent)
82	7E085	Intermediate (C) clutch pressure plate spring
83	7A577	Intermediate (C) clutch retaining ring
84	7B043	Intermediate (C) clutch ring
85	7A480	Intermediate (C) clutch piston spring
86	7E005	Intermediate (C) clutch piston
87	7F225	Intermediate (C) clutch piston inner seal
88	7F224	Intermediate (C) clutch piston outer seal
89	7F373	Bearing (T6)
90	—	Center shaft sleeve (part of support assembly)
91	7B220	Center support keys (2 required)
92	7G199	Center support seals (4 required)
93	7G033	Center support assembly
94	7D404	Low/reverse clutch piston center seal
95	7D403	Low/reverse clutch piston outer seal

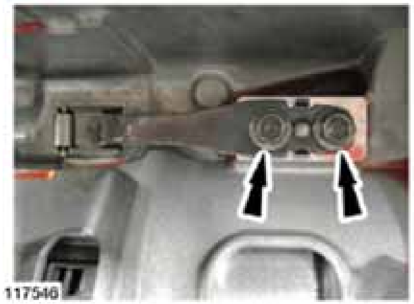
Item	Part Number	Description
96	7A262	Low/reverse clutch piston
97	7B070	Low/reverse clutch piston return spring
98	7H318	Low/reverse clutch piston retainer
99	7D483	Retainer transmission-snap ring
100	7E085	Clutch disc cushion plate
101	7B442	Low/reverse clutch steel plates (externally splined)
102	7B164	Low/reverse clutch friction plates (internally splined)
103	7B066	Low/reverse clutch pressure plate (select fit)
104	7A089	One-Way Clutch (OWC)
105	7F405	Thrust gear shim (select fit)
106	7C041	Thrust bearing (T7)
107	7D063	Sun gear No. 2
108	7D235	Thrust bearing outer race
109	7D234	Roller bearing (T8)
110	7D063	Sun gear No. 3
111	7D234	Roller bearing (T9)
112	—	Roller bearing race (T9)
113	7D006	Rear planetary carrier assembly
114	—	Fluid collar rear planetary plate (part of 7D006)
115	7A153	Output shaft ring gear assembly
116	7G178	Thrust Bearing (T10)
117	—	Output shaft bushing (part of 7060)
118	7060	Output shaft park gear assembly
119	7N194	Output shaft retaining ring
120	7B368	Bearing (T11)
121	7005	Transmission case assembly (model dependent)
122	7A010	Transmission case fluid fill plug assembly
123	7H398	Transmission case fluid fill plug
124	7A010	Transmission case fluid fill seal
125	7A010	Transmission oil level indicator
126	7034	Transmission case vent assembly (model dependent)
127	7A415	Output shaft bearing assembly (Rear Wheel Drive (RWD))
128	7A415	Output shaft bearing assembly (Four-Wheel Drive (4WD))
129	7A433	Washer
130	7B368	Thrust bearing (T12)
131	7030	Output shaft bearing snap ring 4WD
132	7N357	Slip plane washer
133	7052	Extension housing seal (RWD)
134	7052	Extension housing seal (4WD)
135	7089	Output shaft flange (RWD)
136	7052	Extension housing flange seal
137	7045	Output shaft flange retaining nut (RWD)
138	7E332	Manual valve detent spring
139	W711235-S300	Manual valve detent spring retaining screw and washer
140	7A232	Park pawl actuator rod
141	7A441	Park pawl

Item	Part Number	Description
142	7D070	Park pawl return spring
143	7D071	Park pawl shaft
144	7H398	Plug assembly transmission case housing
145	7G101	Park rod actuating plate
146	W711235-S300	Park pawl abutment retaining screw and washer
147	W708455-S441	Manual control lever nut
148	7A256	Manual control lever
149	7B498	Manual control lever shaft seal
150	7C493	Manual control lever shaft
151	7A209	Manual control lever shaft spacer
152	7A115	Manual valve detent lever assembly
153	7G100	Manual valve detent lever retaining pin
154	7F277	OWC bias spring
155	7H322	Thermal bypass valve
156	7F401	Front pump adapter seal
157	7A100	Main control assembly
158	—	Main control valve body assembly (part of 7A100)
159	7Z490	Main control valve body separator plate
160	—	Lower main control valve body (part of 7A100)
161	7G276	Molded leadframe
162	7G276	Bulkhead connector sleeve
163	—	Transmission fluid filter seal (part of 7A098)
164	7A098	Transmission fluid filter
165	—	Transmission fluid pan magnet
166	7A191	Transmission fluid pan gasket
167	7A194	Transmission fluid pan
168	W500214-S437	Transmission fluid pan bolt

NOTE:
Clutch plate quantity is model dependent based on engine displacement. Refer to Clutch Plate Quantity chart in the Specifications portion of this section.

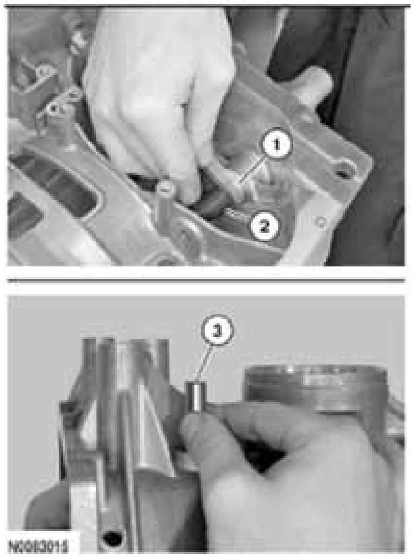
All vehicles

1. Install the park detent spring and the 2 bolts.
    - Tighten to 12 Nm (106 lb-in).



2. Position the park pawl and spring into the case and install the park pawl pin.
    - Park pawl
    - Park pawl return spring

- Park pawl pin



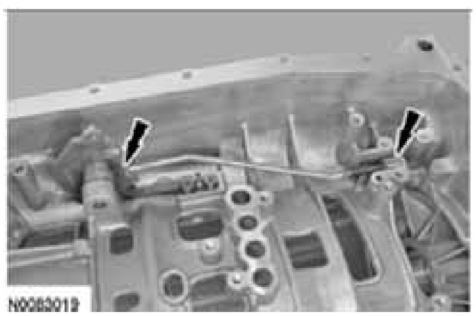
3. Install the park pawl pin bolt
   - Tighten to 23 Nm (17 lb-ft)

4. Install a new manual control level shaft seal on the Shifter Fluid Seal Installer

5. Using the Shifter Fluid Seal Installer, install the manual control lever shaft seal.

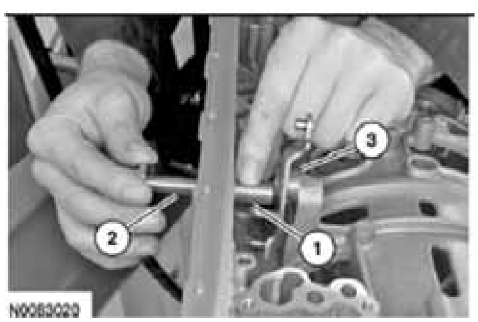
6. Assemble the manual control lever detent plate assembly and park pawl actuator rod.

7. Position the manual valve detent lever and park pawl actuator rod assembly in the transmission case.



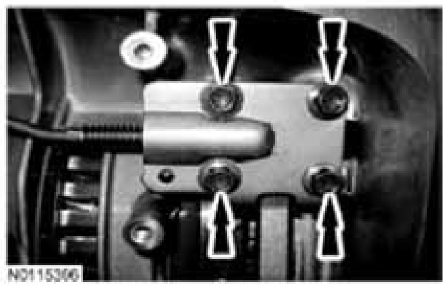
8. Position the manual control lever spacer in place and slide the manual control lever shaft into the case and the manual lever detent plate.

- Manual control lever spacer
- Manual control lever shaft
- Manual control lever detent plate



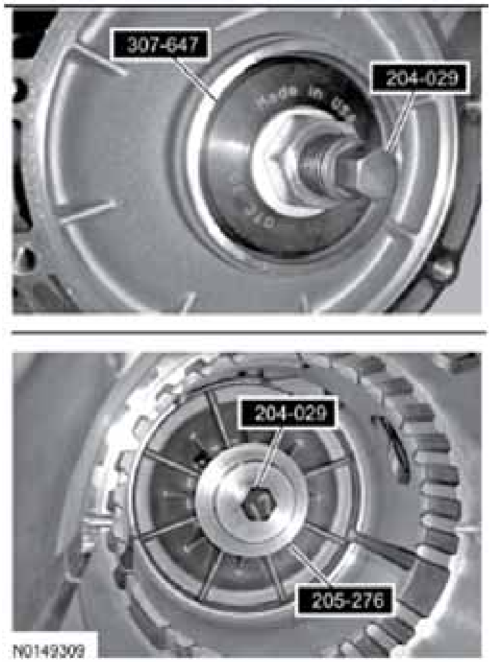
9. Align the roll pin hole in the manual control lever detent plate with the roll pin hole in the manual control lever shaft and install a new roll pin using a suitable tool.

10. Install the park rod actuating plate and the 4 bolts.
    - Tighten to 12 Nm (106 lb-in)



11. If removed, position a new bearing on the Needle Bearing Installer. Install the bearing with the flat bearing surface facing down and the rounded bearing surface facing up so that when installed, the flat surface is on the snap ring side and the rounded surface is on the transmission case side.
    - Rounded bearing surface facing up
    - Flat bearing surface facing down

12. Using the Needle Bearing Installer, the Drawbar and the Front Wheel Hub Oil Seal Installer, install the bearing in the transmission case.

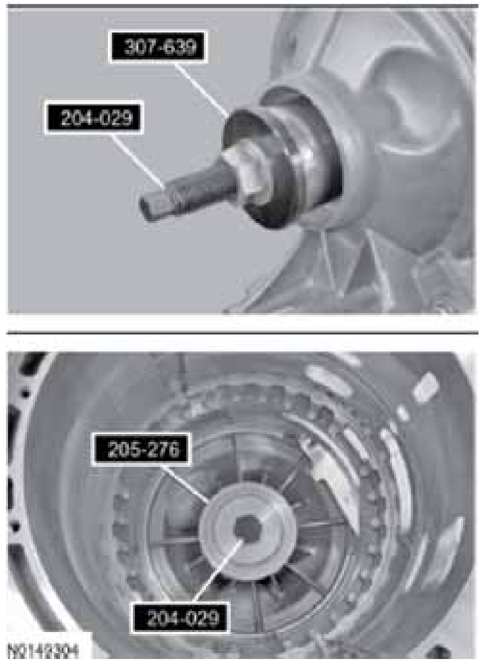


13. Install the snap ring

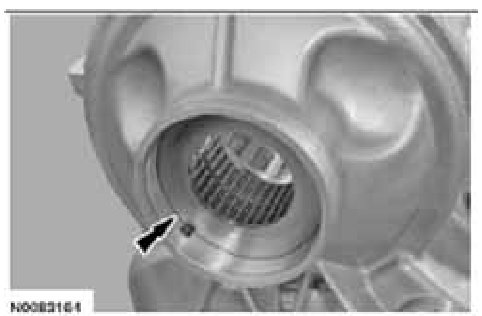
Rear Wheel Drive (RWD) Vehicles

14. Install the bearing on the Rear Bearing 4X2 Installer

15. Assemble the Front Wheel Hub Oil Seal Installer and the Rear Bearing 4X2 Installer on the Drawbar and install the bearing in the transmission case.



16. Position the thrust bearing spacer



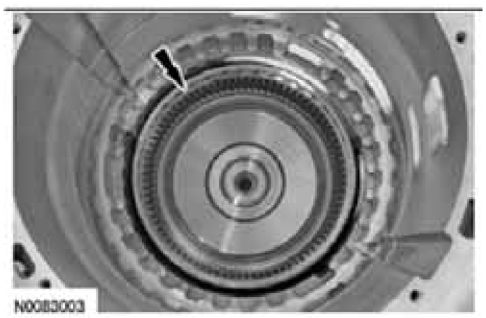
17. Using the Rear Bearing 4X2 Installer and a press, press the thrust bearing spacer in place.

18. Install the T12 thrust bearing

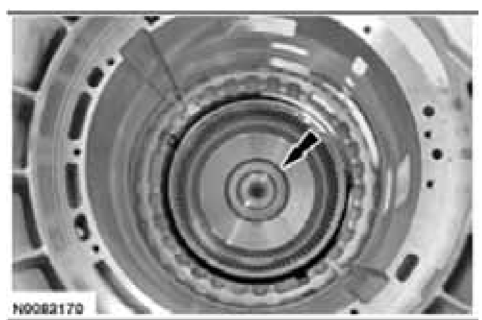
All Vehicles

19. Install the T11 bearing, on the planetary ring gear and output shaft assembly.

20. Install the rear planetary ring gear and output shaft assembly

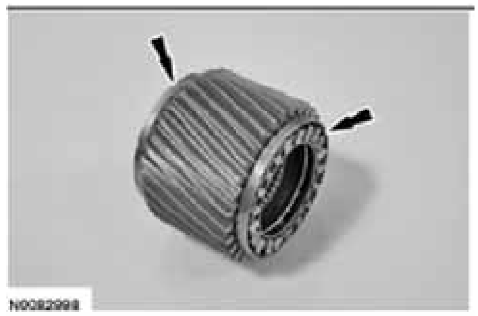


21. Install the T10 thrust bearing on the output shaft assembly.



22. Install the T9 roller bearing race into the bottom of the carrier.

23. Install the top T8 and the bottom T9 roller bearings onto the sun gear.



24. **Note:** When installing the sun gear, make sure that the TAPERED EDGE is facing up toward the torque converter housing.

    Install the sun gear into the planetary assembly.

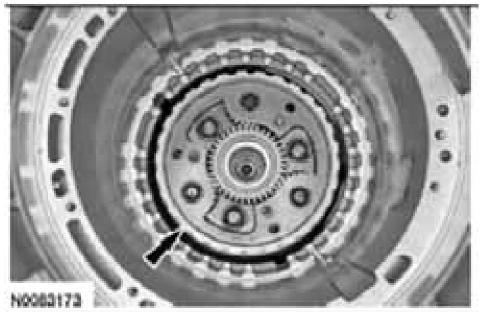
25. **Note:** Be sure the bearing race is installed in the sun gear.

    Install the low/reverse sun gear and bearing race into the planetary carrier with the race side facing down.

    - Low/reverse sun gear
    - Bearing race

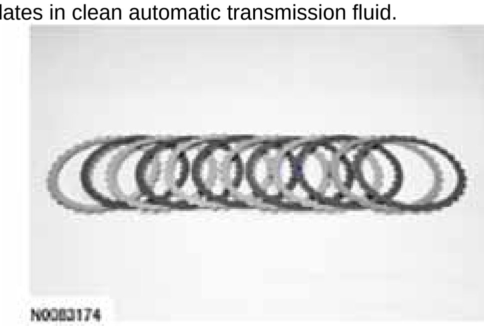
26. **Note:** Place the manual control lever in PARK when installing the rear planetary gearset to hold the rear ring gear stationary

    Install the planetary carrier

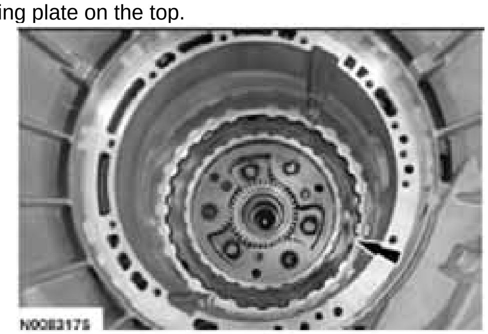


27. **Note:** Friction and steel plate quantity are model dependent and vary based on engine displacement. For additional information, refer to the Clutch Plate. Quantity Chart in the Specifications portion of this section.

    Soak the low/reverse clutch plates in clean automatic transmission fluid.

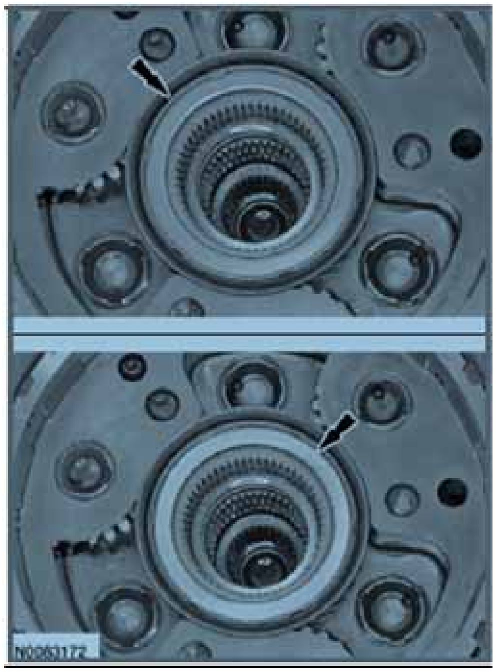


28. Install the low/reverse clutch plates, starting with the pressure plate and alternating between the friction and steel plates and ending with the wave spring plate on the top.



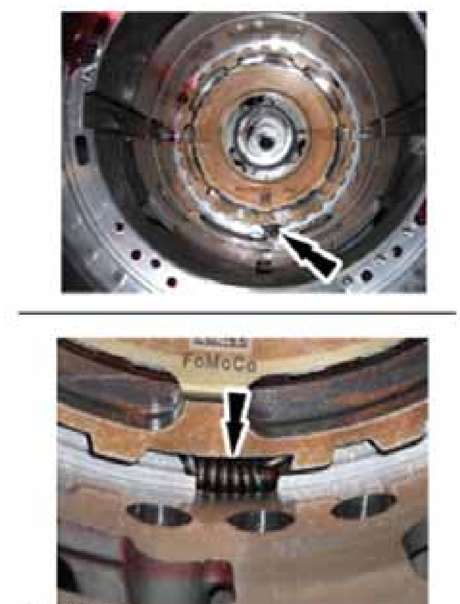
29. Note: Inspect the T7 thrust bearing and selective shim for damage or scoring.

    Inspect the the T7 thrust bearing and the selective shim.



30. **Note**: Align the One-Way Clutch (OWC) in the transmission case so the bias spring fits into the transmission case.

    Install the OWC as shown so the bias spring can be installed as shown.



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31. Install the bias spring

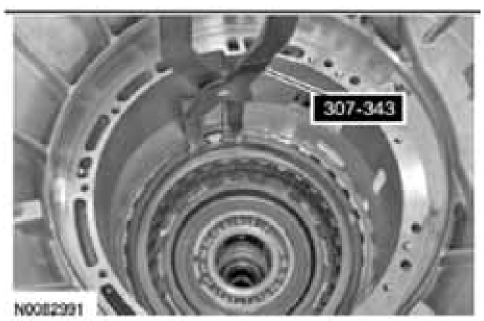
32. **Note:** Make sure that when installing the center support the feed holes on the center support are lined up with the feed holes in the case.

    Install the center support into the case.

33. ***Notice:* Install the snap ring with the beveled surface facing up and the snap ring gap in the 3 o'clock or the 9 o'clock position.**

    Note: Rotate the case to a horizontal position.

    Using the Retaining Ring Pliers, install the center support snap ring. Using a suitable tool, make sure the snap ring is fully seated.

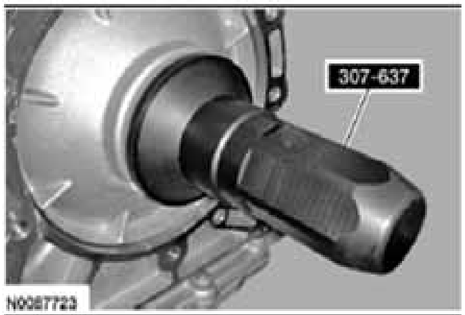


4WD (Parking Brake Version)

34. Install the seal protector provided with the new output shaft seal on the output shaft.

35. Slide the output shaft seal over the output shaft seal protector onto the output shaft. Remove the output shaft seal protector.

36. Using the Rear Seal 4X4 Installer, install the output shaft seal.

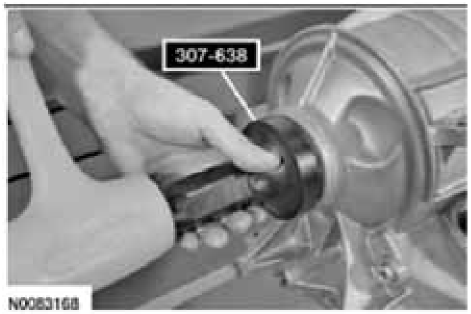


RWD (Non-Parking Brake Version)

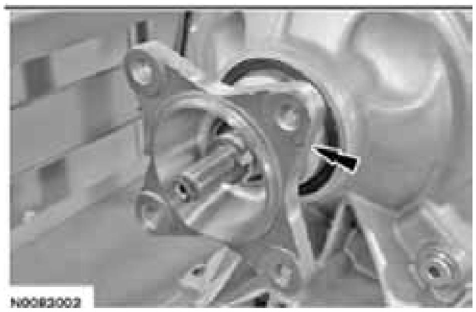
37. Rotate the transmission to the vertical position and install the slip plane washer.

38. Position a new output shaft seal on the Rear Seal Installer 4X2.

39. Using the Rear Seal Installer 4X2, install the output shaft seal.



40. Install the output shaft flange and the extension housing flange seal.



41. Loosely install a new output shaft flange retaining nut.

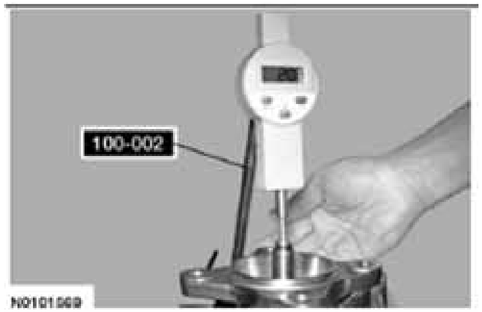
RWD Vehicles

42. Install the Dial Indicator Gauge with Holding Fixture on the transmission case and position the plunger on the output shaft flange.

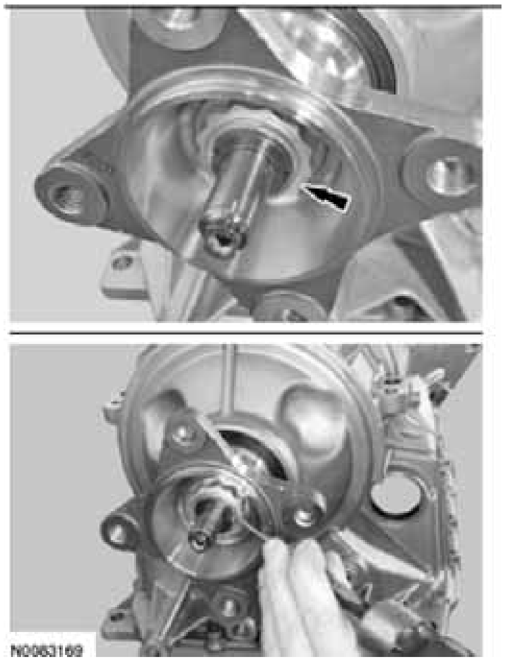
43. **Note:** Loosely install the flange nut or an inaccurate reading may be recorded.

    Using the Dial Indicator Gauge with Holding Fixture, lift up on the output shaft flange and record the reading. The reading should be within 0.6-0.9mm (0.024-0.035 in).

    - If the reading is not within specification, install a different (either thinner or thicker) selective shim.

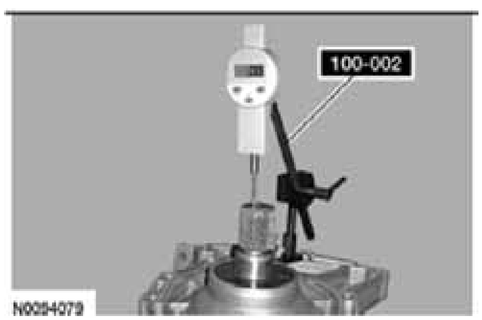


44. Tighten the output shaft flange nut.
    - Tighten to 80 Nm (59 lb-ft).
    - After installing the new output shaft flange nut, stake the slots to prevent it from coming loose.

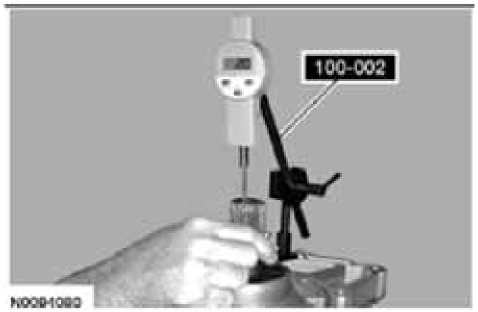


4WD Vehicles

45. Install the Dial Indicator Gauge with Holding Fixture on the transmission case and position the plunger on the output shaft..



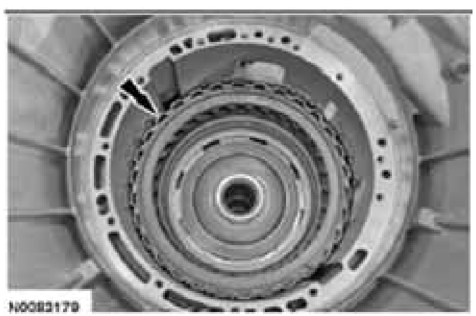
46. Using the Dial Indicator Gauge with Holding Fixture, lift up on the output shaft and record the reading. The reading should be within 0.15-0.35 mm (0.005-0.013 in).
    - If the reading is not within the specification, install a different (either thinner or thicker) select fit thrust gear shim.



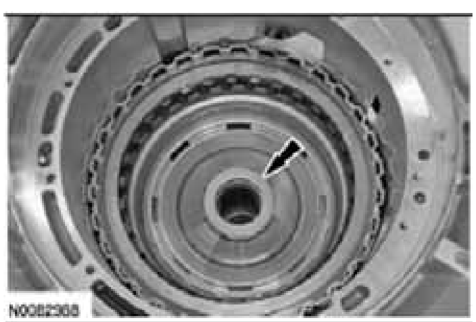
All Vehicles

47. Rotate the transmission in the vertical position with the torque converter housing facing up and install the T6 bearing.

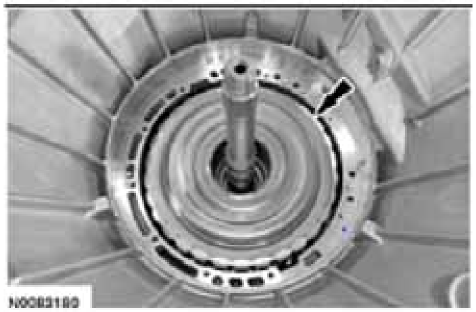
48. Install the direct (B) clutch assembly.



49. Install the T5 roller bearing on the direct (B) clutch assembly.

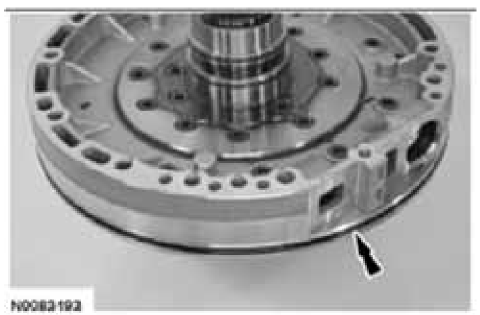


50. Install the forward (A)/overdrive (E) clutch assembly.



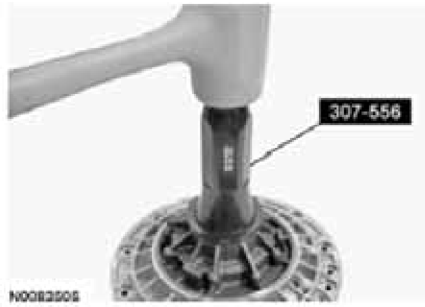
51. Install the selective shim.

52. If the front pump was not disassembled and assembled, install a new front pump O-ring seal and lubricate it with petroleum jelly.

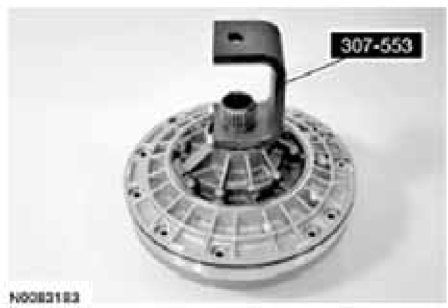


53. Install a new front pump seal on the Fluid Pump Seal Installer.

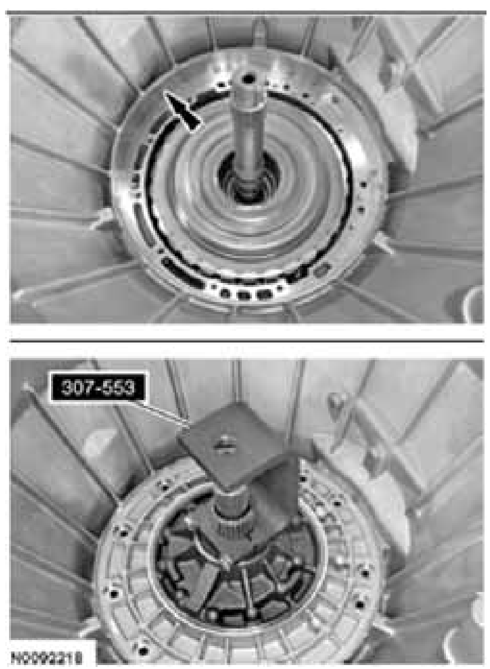
54. Using the Fluid Pump Seal Installer, install the front pump seal.



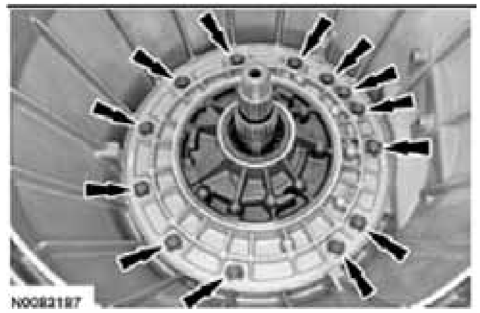
55. Install the Transmission Fluid Pump Remover on the front pump.



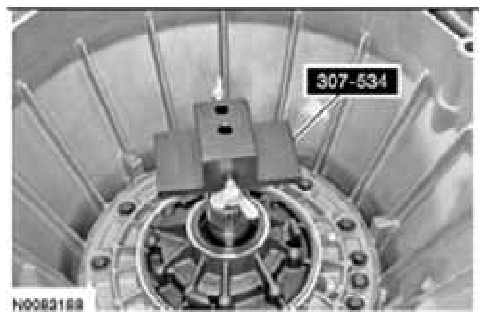
56. Lubricate the transmission case pump bore with petroleum jelly. Using the Transmission Fluid Pump Remover, position the pump assembly in the case and rotate the pump to insert the pump splines into the front planetary sun gear. Rotate the pump to align the pump-to-case bolts and push the pump into the case.



57. Install 13 new front pump-to-case bolts and washers. Tighten in a crisscross pattern.
    - Tighten pump fasteners with washers to 10 Nm (89 lb-in).
    - Tighten fasteners without washers to 14 Nm (124 lb-in).

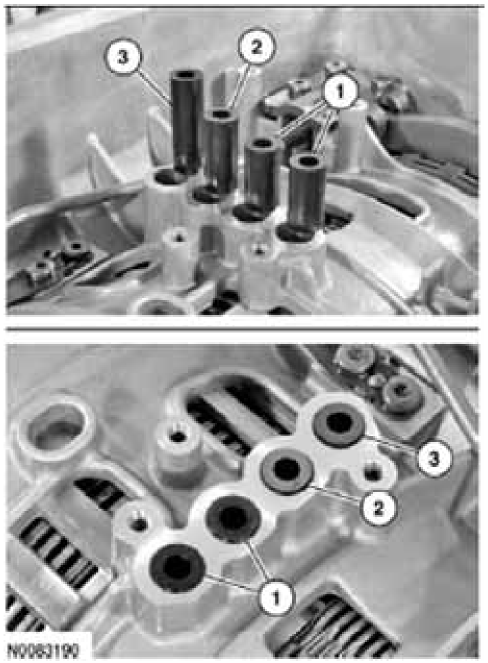


58. Install the Transmission End Play Gauge on the input shaft to measure the end play.
    - Tighten the wing nut.



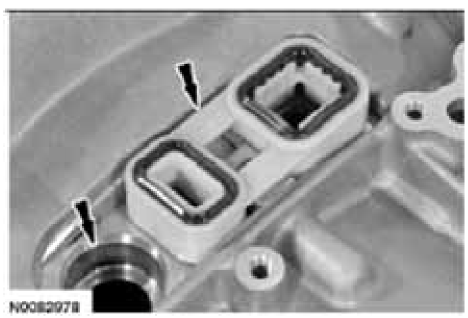
59. Install the Dial Indicator Gauge with Holding Fixture on the Transmission End Play Gauge.
    - Push down on the Transmission End Play Gauge and zero the Dial Indicator Gauge.
    - Lift up on the Transmission End Play Gauge and record the measurement on the Dial Indicator Gauge. The measurement should be between 0.2-0.4 mm (0.008-0.015 in). If the measurement is not within specification, install a new selective front pump shim.
    - Measure the original shim, install a thinner or a thicker shim to achieve the correct measurement.

60. Rotate the transmission in the horizontal position with the main control area facing up and install 4 new center support feed tubes.
    - Black feed tubes
    - Green feed tube
    - Blue feed tube



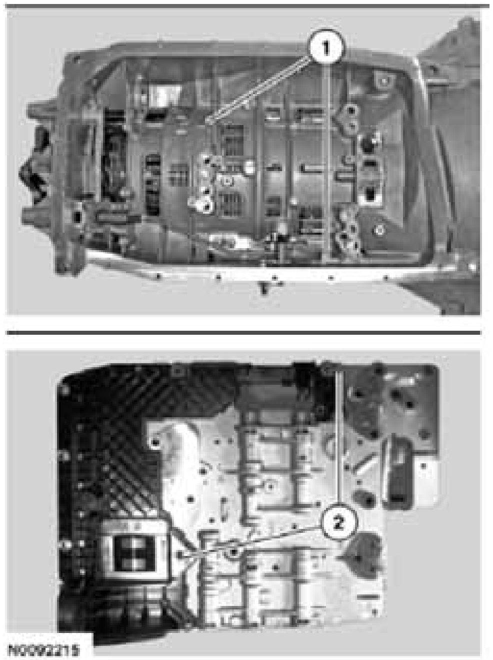
61. **Note:** Make sure the transmission fluid filter seal has been removed. If it has not, use a suitable pick and remove the seal.
    Note: Add 0.118L (4 oz) of clean transmission fluid to prime the pump.

    Install the front pump adapter seal and prime the fluid pump.



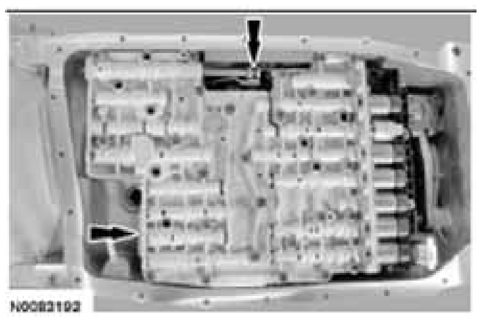
62. Install the thermal bypass valve into the case.

63. Align the guide pins in the alignment holes in the transmission case and position the mechatronic assembly in place.
    - Alignment holes
    - Guide pins

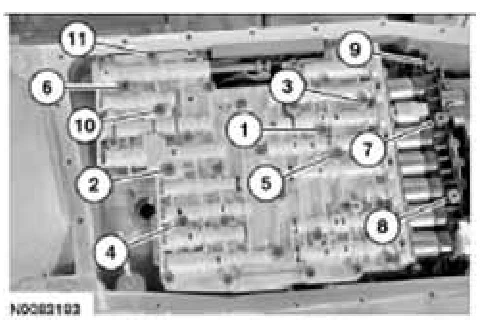


64. **Note:** The mechatronic assembly will not lay flush on the case, this is a normal condition with the rubber feed tubes, the bolts will pull the mechatronic assembly down.

    Slightly lift the mechatronic assembly and align the manual valve in the manual valve linkage and position the mechatronic in place.



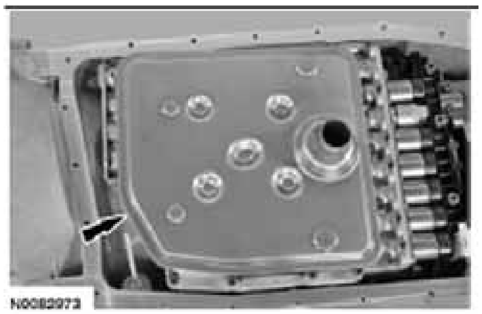
65. Install the 11 mechatronic assembly bolts and tighten in the sequence shown.
    - Tighten to 8 Nm (71lb-in)



66. With the release tab up and unlocked, push the outer shell of the bulkhead electrical connector into the transmission. Make sure the bulkhead connector is fully seated into the molded leadframe.

67. Press down on the tab and lock the outer shell of the bulkhead electrical connector in place. Make sure the locking tab is securely locked.

68. Install a new transmission fluid filter.



69. Note: The fluid pan gasket can be reused if not damaged.

    Install a new transmission fluid pan gasket if required.

70. Install the transmission fluid pan and transmission fluid pan bolts. Tighten in a crisscross pattern.
    - Tighten to 12 Nm (106 lb-in).


N0082971

71. Using the Torque Converter Handle, install the torque converter.

N0083197

INSTALLATION

Transmission — Four Wheel Drive (with parking brake)
Special Tool(s).

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

TCM4210 – Laptop software and USB cable

Material

Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV
Motorcraft® Multi-Purpose Grease XL-5	ESB-M1C93-B

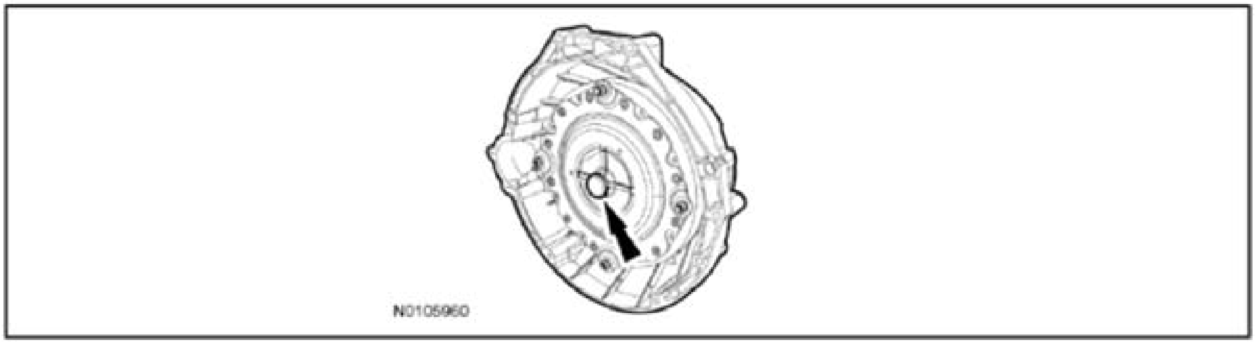
Installation

All vehicles

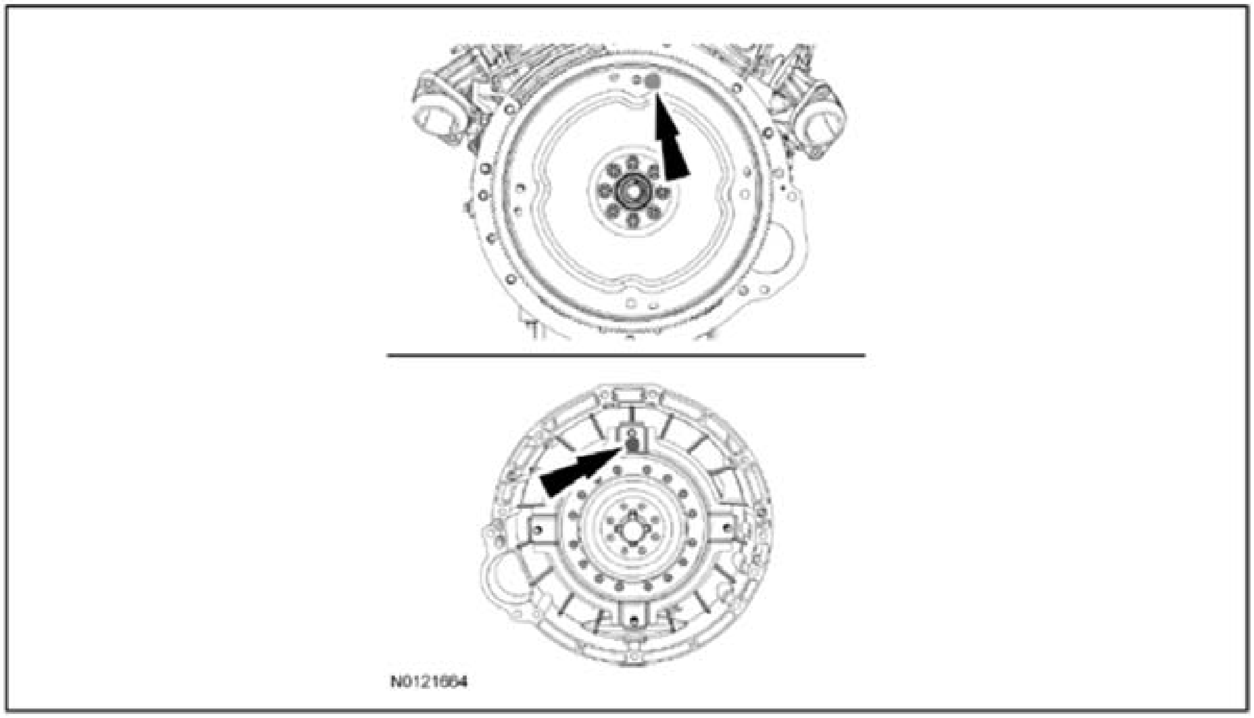
NOTE:
Prior to installing a new transmission or an overhauled transmission with a new main control, record the solenoid strategy identification tag. If a new main control was installed, install the replacement solenoid body tag over the original identification tag. For additional information, refer to Solenoid Body Strategy in this section.

1. ***NOTICE:***
   Prior to installation of the transmission, lubricate the torque converter pilot hub with multi-purpose grease or damage to the torque converter or engine crankshaft can occur.

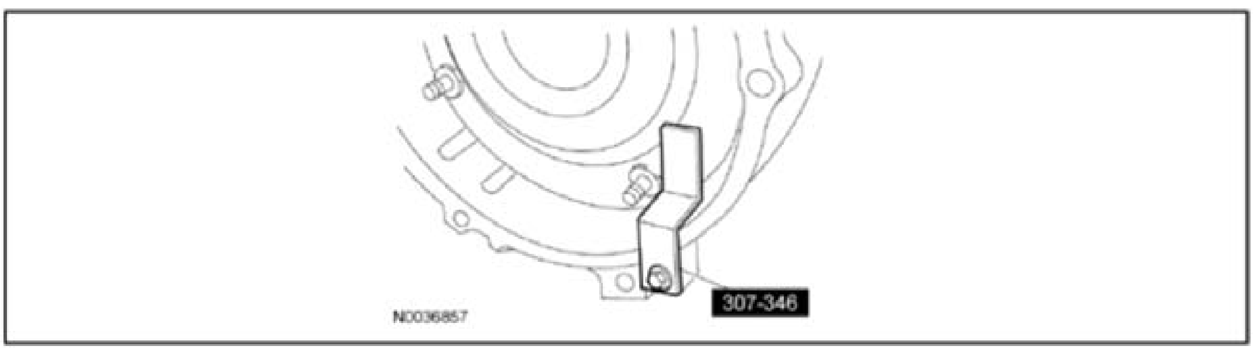
   Lubricate the torque converter pilot hub with multi-purpose grease.



2. If equipped, align the torque converter stud and flexplate hole near the paint marks at the 12 o'clock position.



3. Install the Torque Converter Retainer.'



4. **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTICE:
The torque converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates the torque converter pilot is not binding in the engine crankshaft.

NOTE:
Make sure the transmission jack contacts the outer ribs of the transmission fluid pan.

NOTE:
If transmission was disassembled, follow the add transmission fluid to the transmission steps. If transmission is being replaced, remove the transmission fluid fill plug and verify transmission is filled with transmission fluid.

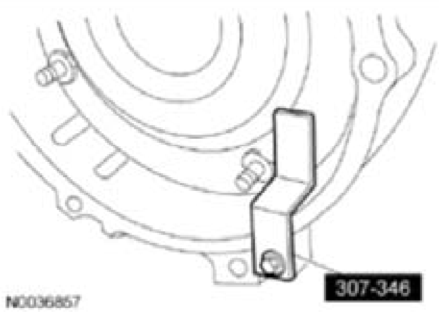
Add transmission fluid to the transmission.

- Slightly tilt the transmission rearward.
- Remove the transmission fluid fill plug transmission fluid level indicator assembly.
- Add 11.35L (12 qt) of transmission fluid to the transmission through the transmission fluid fill hole.
- Install the transmission fluid fill plug.
    - o Tighten to 26 Nm (19 lb-ft).

5. ***NOTICE:***
The torque converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates the torque converter pilot is not binding in the engine crankshaft.

Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle behind the engine.

6. Remove the Torque Converter Retainer.



7. ***NOTICE:***
Make sure the transmission wiring harness is not between the engine block and transmission prior to moving the transmission toward the engine or damage can occur.

NOTE:
Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

With the transmission in a horizontal position, move it toward the engine and position it on the dowel pins.

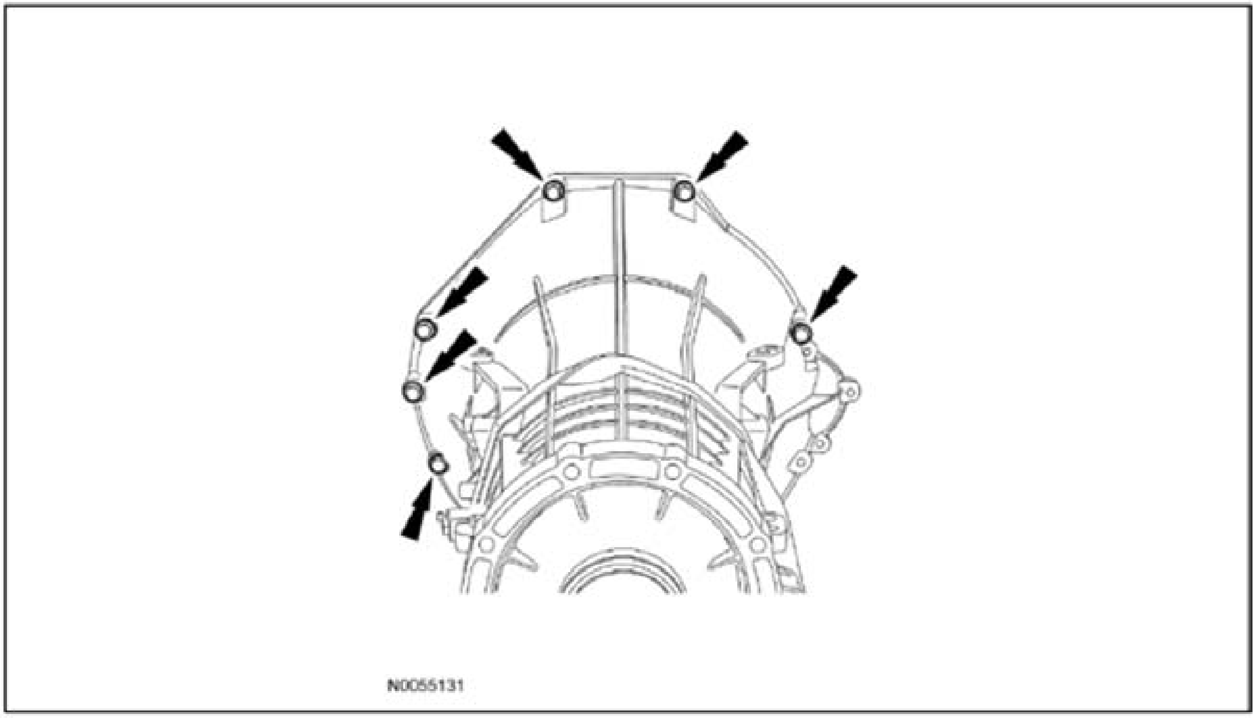
Vehicles equipped with a 5.0L or 6.2L engine

8. **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTE:
Install the top 2 transmission-to-engine bolts before installing the rest of the bolts.

NOTE:
Install the top left transmission-to-engine bolt through the fuel line bracket first, then through the transmission case.
Install 6 of the 7 transmission-to-engine bolts.

- Tighten to 48 Nm (35 lb-ft).

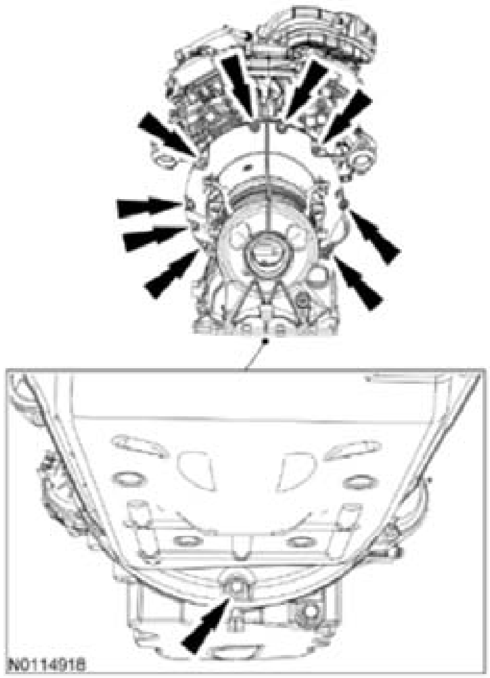


Vehicles equipped with a 3.5L or 3.7L engine

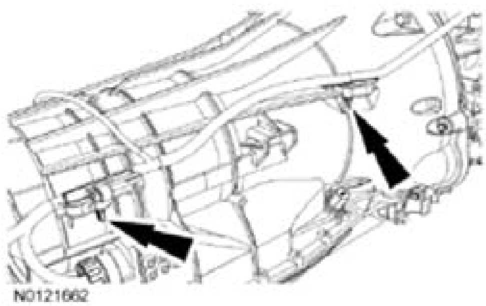
9. **NOTE:**
Install the top 2 transmission-to-engine bolts through the fuel line bracket first, then through the transmission case.

Install the 10 transmission-to-engine bolts.

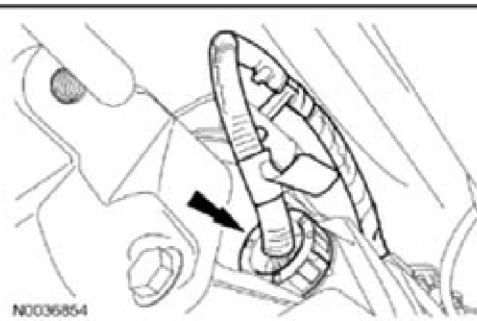
- Tighten to 48 Nm (35 lb-ft).



10. Connect the wiring harness retainers to the top of the transmission.

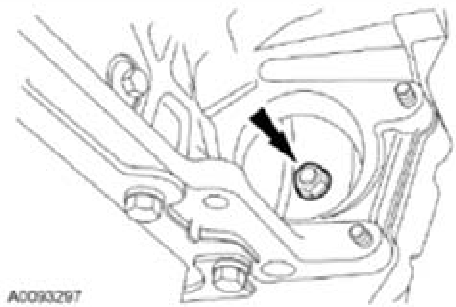


11. Connect the transmission electrical connector by pushing it in and twisting the outer shell to lock it in place.

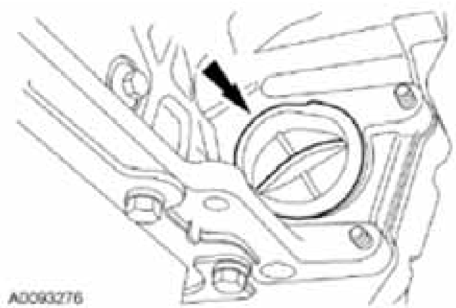


Vehicles equipped with a 5.0L or 6.2L engine

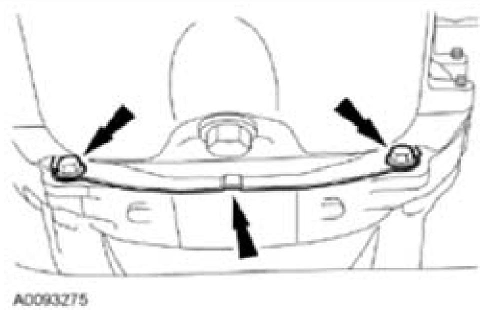
12. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).



13. Install the rubber torque converter nut access cover.



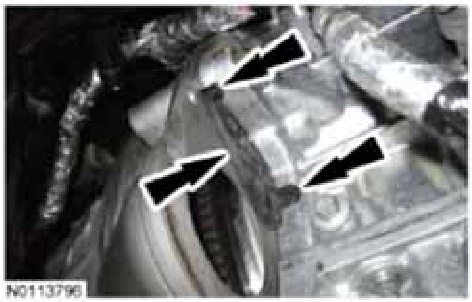
14. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 48 Nm (35 lb-ft).



Vehicles equipped with a 3.5L or 3.7L engine

15. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).

16. Install the access cover and the 2 pin-type retainers.



All vehicles

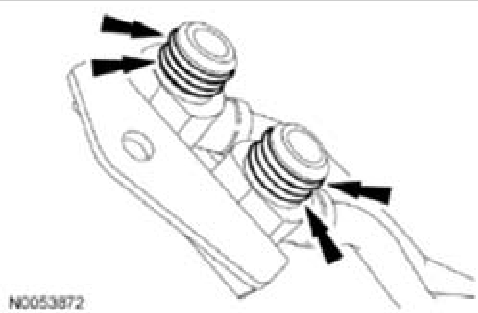
17. Install the starter motor. For additional information, refer to Section 303-06.

18. Reposition the transmission fluid cooler tubes and bracket and install the transmission fluid cooler tube bracket nut.

    - Tighten to 12 Nm (106 lb-in).

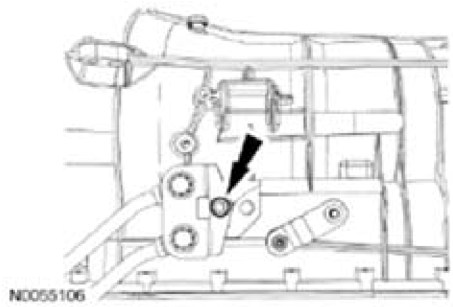
19. NOTE:
Inspect the case to make sure the old transmission fluid cooler tube O-rings are not stuck in the case.

Install new transmission fluid cooler tube O-rings on the transmission fluid cooler tubes.



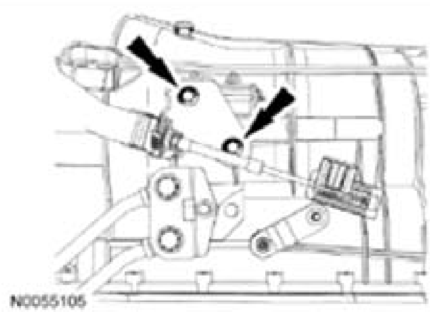
20. NOTICE:
Install a new transmission fluid cooler tube bracket bolt.

Install the transmission fluid cooler tubes and a new transmission fluid cooler tube bracket bolt.
- Tighten to 30 Nm (22 lb-ft).



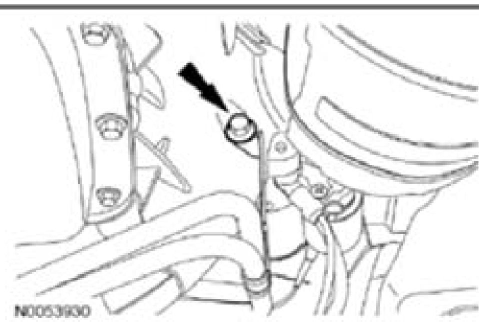
21. **NOTE:**
The column shift is shown, the floor shift similar.

Install the selector lever cable bracket and selector lever cable bracket bolts.
- Tighten to 25 Nm (18 lb-ft).



Vehicles equipped with a 5.0L or 6.2L engine

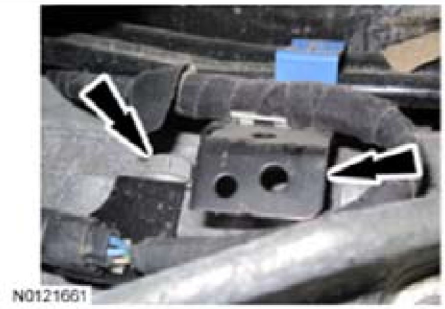
22. Align the transmission fluid cooler tube bracket and install the remaining transmission-to-engine bolt.
- Tighten to 48 Nm (35 lb-ft).



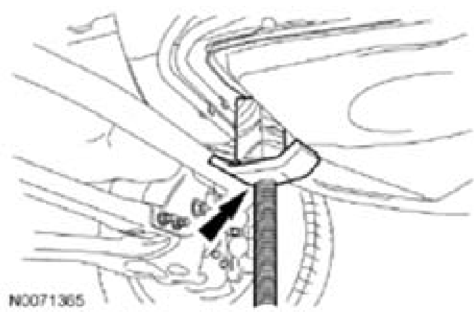
All vehicles

23. Install the fuel line bracket and the fuel line bracket bolt.

- Tighten to 25 Nm (18 lb-ft).



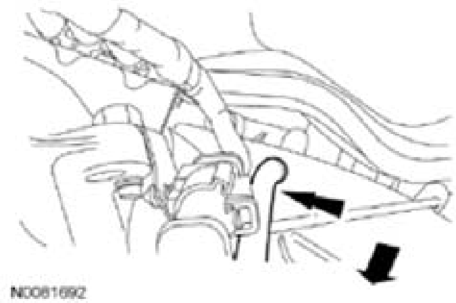
24. Position a jack stand under the transmission, and remove the high-lift transmission jack.



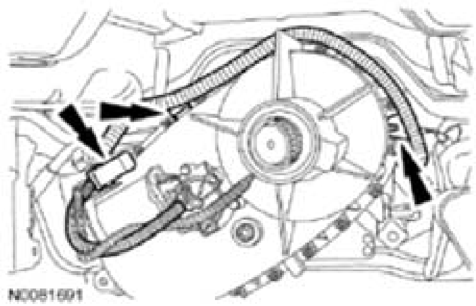
25. NOTE:
Do not reuse the old transfer case-to-transmission bolts.

If the transfer case was removed from the transmission during removal, install the transfer case using a high-lift transmission jack. Install 9 new transfer case-to-transmission bolts.
- Tighten the bolts evenly in a cross pattern to 17 Nm (150 lb-in).

26. Connect the vent hose to the transfer case.

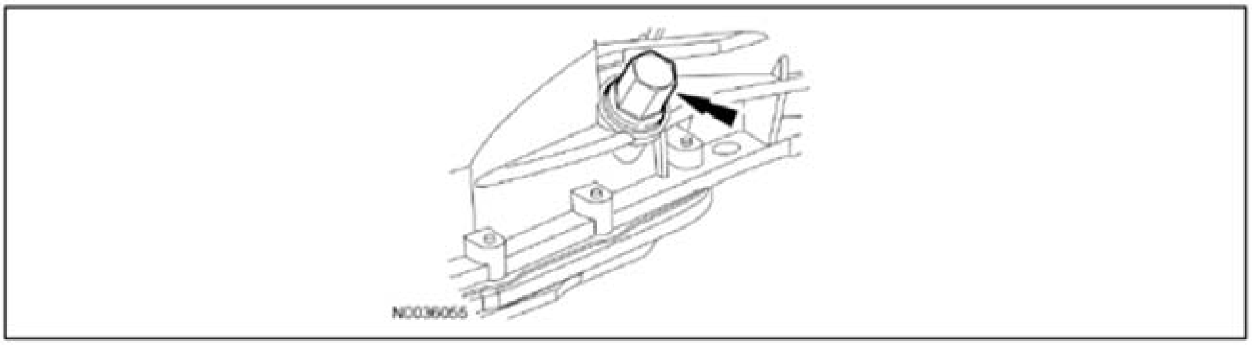


27. Connect the electrical connector and attach the 2 harness retainer clips to the transfer case.

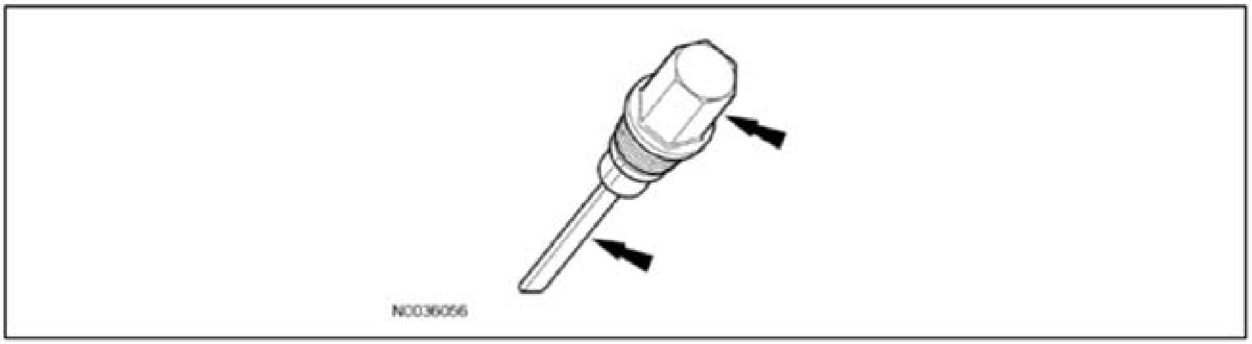


28. Install the shift cable mounting bracket and the 2 nuts.
    - Tighten to 28 Nm (21 lb-ft).
29. Connect the cable end to the shift lever.
30. Install the front and rear driveshafts. For additional information, refer to Section 205-01.
31. Install the exhaust Y-pipe. For additional information, refer to Section 309-00.
32. Connect the battery ground cable. For additional information, refer to Section 414-01.
33. Adjust the selector lever cable and install the selector lever cable end on the manual control lever. Verify the selector lever cable is correctly adjusted.
    For additional information, refer to Section 307-05.
34. After completing the repairs, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.

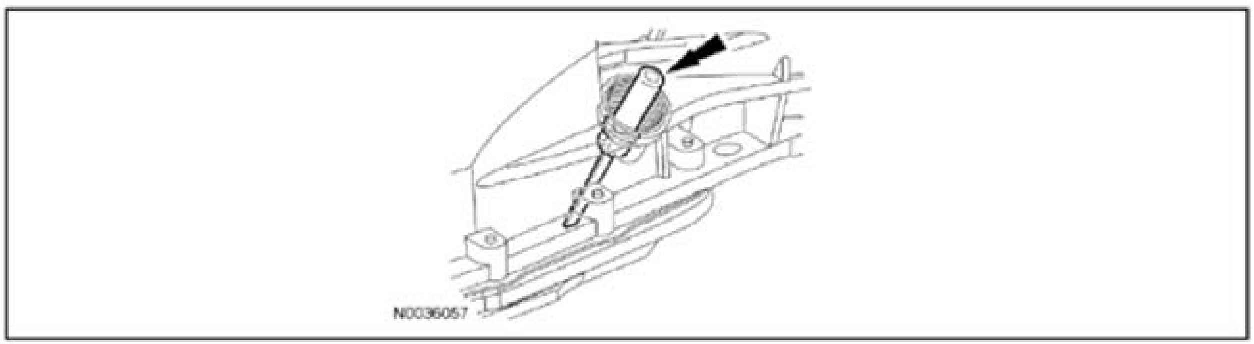
35. If a new transmission or a new main control was installed, the solenoid body strategy must be updated. For additional information, refer to Solenoid Body Strategy in this section.
36. If the transmission was overhauled, the adaptive drive cycle must be updated. For additional information, refer to Shift Point Road Test in this section.
37. While driving the vehicle, use the scan tool to verify that the Transmission Fluid Temperature (TFT) has reached a temperature of 91°C (195°F). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.
    - With the engine idling (600-750 rpm) in PARK, verify that the TFT is between 91ºC-102ºC (195ºF-215ºF).
38. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case.



39. Separate the transmission fluid level indicator from the transmission fluid fill plug.



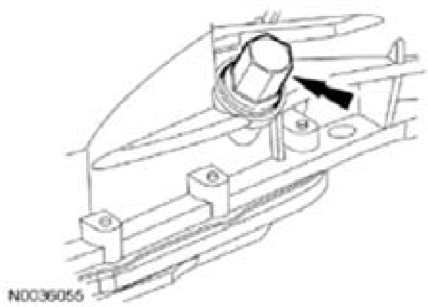
40. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



41. **NOTE:**
If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section.

Install the transmission fluid fill plug.

- Tighten to 35 Nm (26 lb-ft).



Transmission — Rear Wheel Drive (without Parking Brake)
Special Tool(s)

 ST1636-A	Retainer, Torque Converter 307-346 (T97T-7902-A)

TCM4210 – Laptop software and USB cable

Material

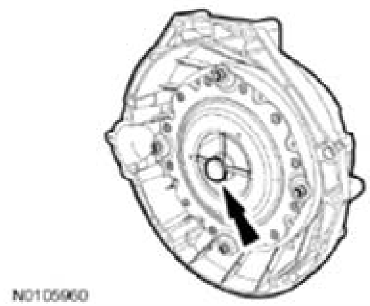
Item	Specification
Motorcraft® MERCON® LV Automatic Transmission Fluid XT-10-QLVC (US); CXT-10-LV12 (Canada)	MERCON® LV
Motorcraft® Multi-Purpose Grease XL-5	ESB-M1C93-B

Installation
All vehicles

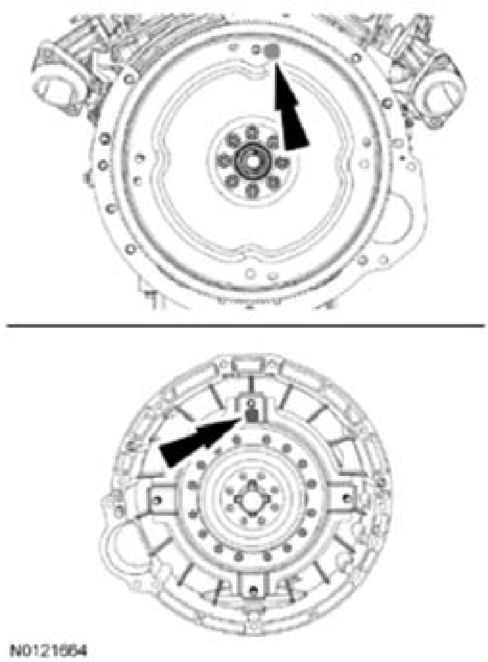
NOTE:
Prior to installing a new transmission or an overhauled transmission with a new main control, record the solenoid strategy identification tag. If a new main control was installed, install the replacement solenoid body tag over the original identification tag. For additional information, refer to Solenoid Body
Strategy in this section.

1. ***NOTICE:***
   Prior to installation of the transmission, lubricate the torque converter pilot hub with multi-purpose grease or damage to the torque converter or engine crankshaft can occur.

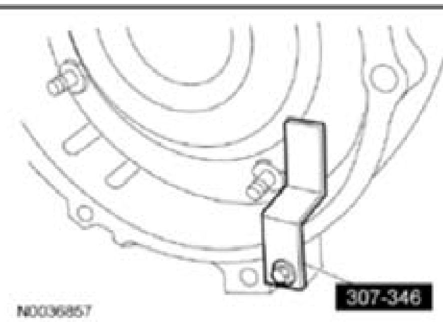
   Lubricate the torque converter pilot hub with multi-purpose grease.



2. If equipped, align the torque converter stud and flexplate hole near the paint marks at the 12 o'clock position.



3. Install the Torque Converter Retainer.



4. **WARNING:**
Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

NOTICE:
The torque converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates the torque converter pilot is not binding in the engine crankshaft.

NOTE:
Make sure the transmission jack contacts the outer ribs of the transmission fluid pan.

NOTE:
If transmission was disassembled, follow the add transmission fluid to the transmission steps. If transmission is being replaced, remove the transmission fluid fill plug and verify transmission is filled with transmission fluid.

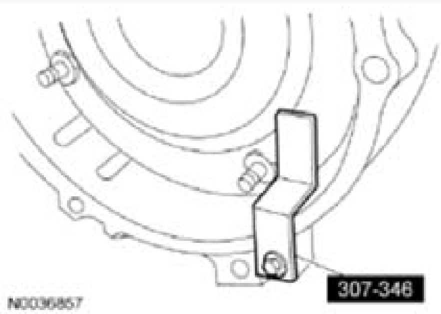
Add transmission fluid to the transmission.

- Slightly tilt the transmission rearward.
- Remove the transmission fluid fill plug transmission fluid level indicator assembly
- Add 11.35L (12 qt) of transmission fluid to the transmission through the transmission fluid fill hole.
- Install the transmission fluid fill plug.
    - o Tighten to 26 Nm (19 lb-ft).

5. NOTICE:
The torque converter housing is piloted into position by dowels in the rear of the engine block. The torque converter must rest squarely against the flexplate. This indicates the torque converter pilot is not binding in the engine crankshaft.

Position and secure the transmission on the high-lift transmission jack. Raise and position the transmission into the vehicle behind the engine.

6. Remove the Torque Converter Retainer.



7. NOTICE:
Make sure the transmission wiring harness is not between the engine block and transmission prior to moving the transmission toward the engine or damage can occur.

NOTE:
Make sure the torque converter is fully seated in the transmission before aligning the transmission to the engine.

With the transmission in a horizontal position, move it toward the engine and position it on the dowel pins.

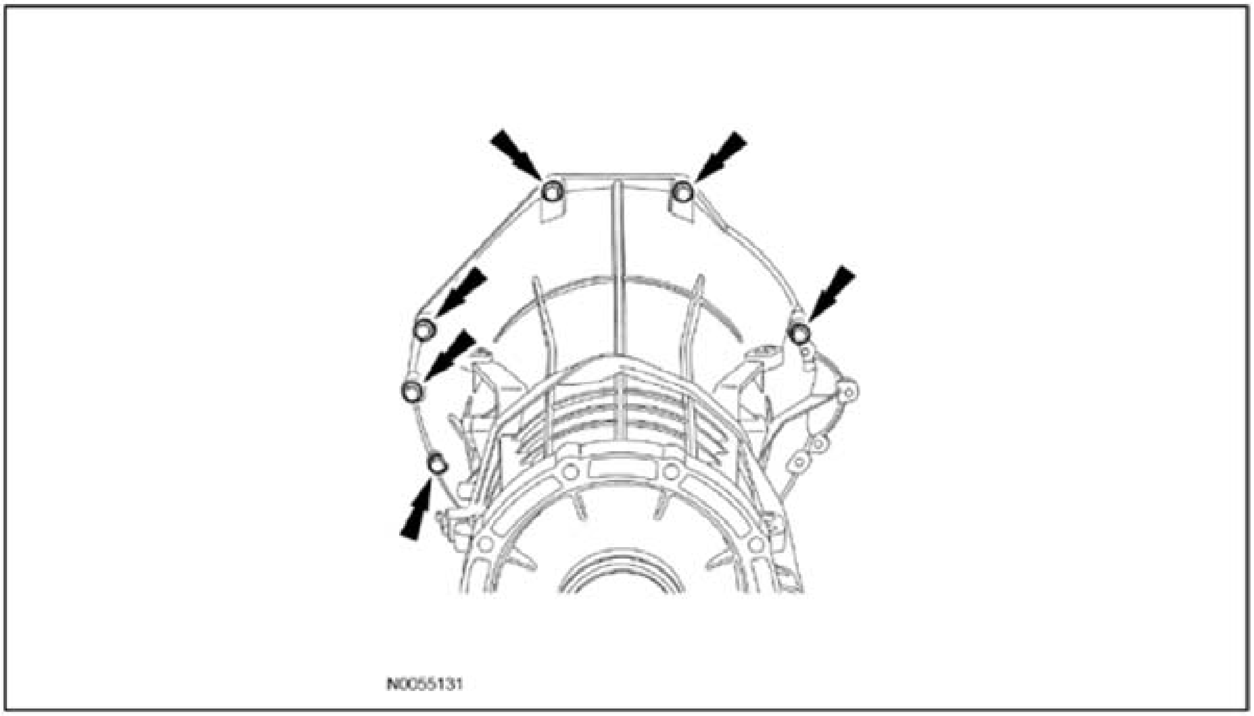
Vehicles equipped with a 5.0L or 6.2L engine

8. **WARNING:**
   Always secure transmission, transfer case, and axle assemblies to their service jack. Avoid obstructions while lowering and raising the jack. Improperly secured assemblies or contact with obstructions may cause the assembly to fall off the jack, which could result in serious personal injury.

   NOTE:
   Install the top 2 transmission-to-engine bolts before installing the rest of the bolts.

   NOTE:
   Install the top left transmission-to-engine bolt through the fuel line bracket first, then through the transmission case.

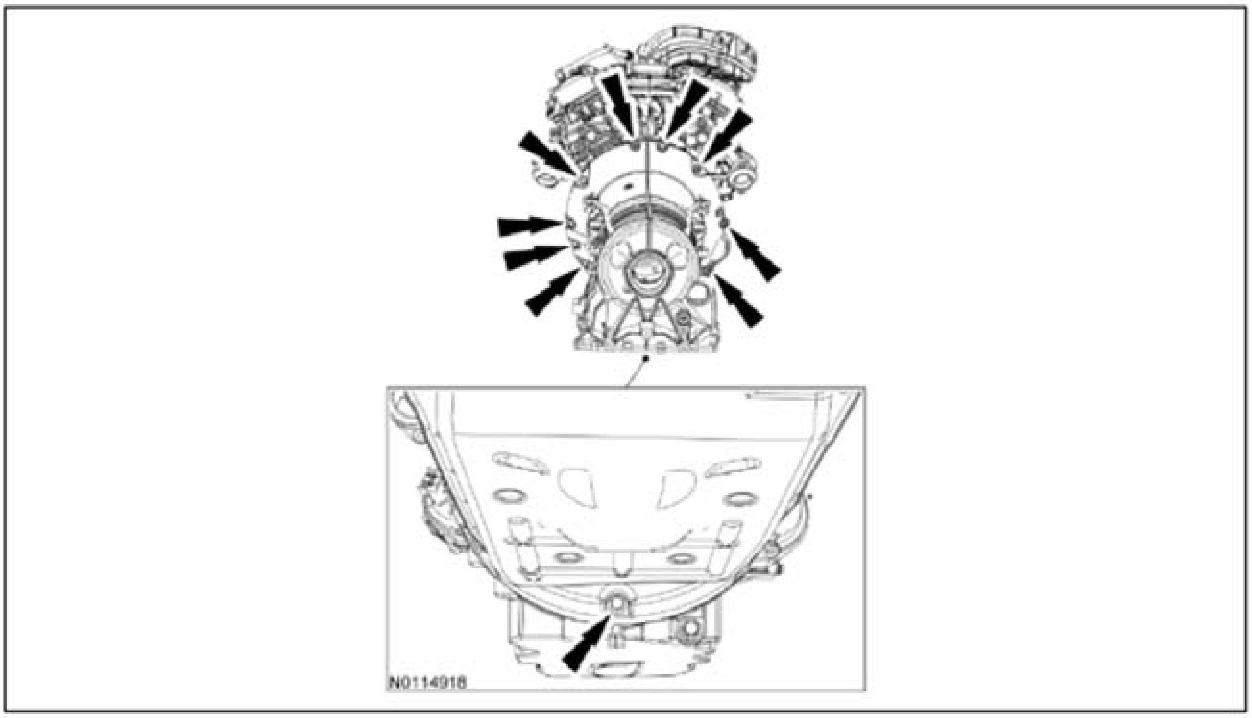
   Install 6 of the 7 transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).



Vehicles equipped with a 3.5L or 3.7L engine

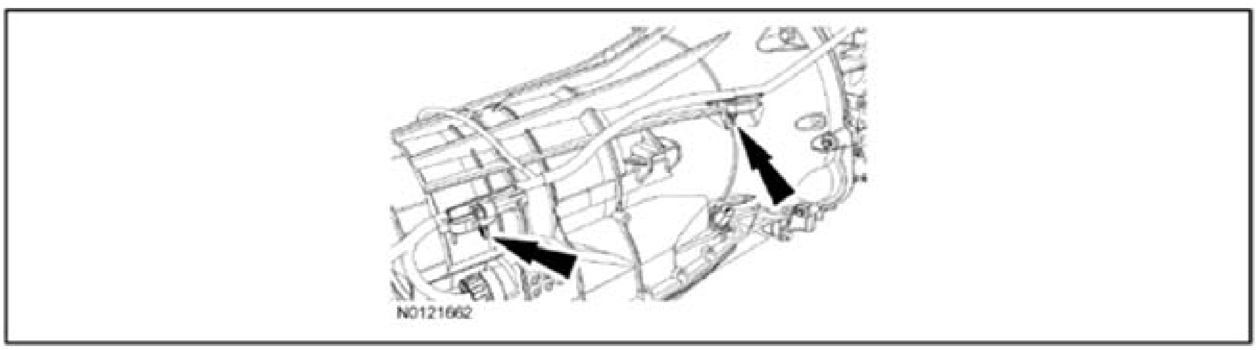
9. **NOTE:**
   Install the top 2 transmission-to-engine bolts through the fuel line bracket first, then through the transmission case.

   Install the 10 transmission-to-engine bolts.
   - Tighten to 48 Nm (35 lb-ft).

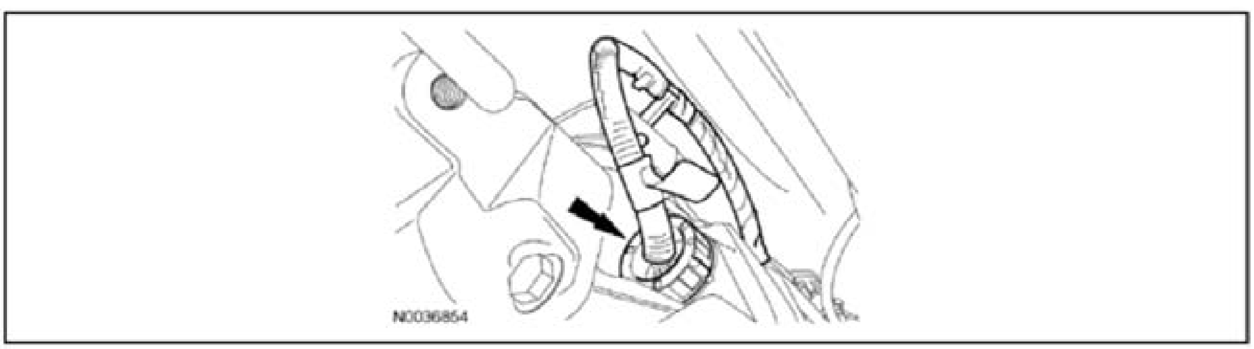


All vehicles

10. Connect the wiring harness retainers to the top of the transmission.

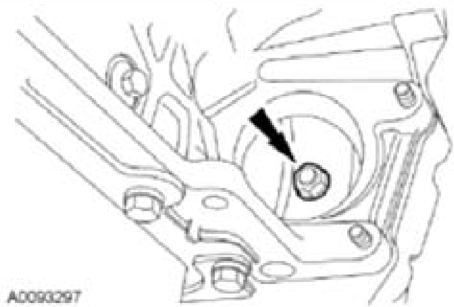


11. Connect the transmission electrical connector by pushing it in and twisting the outer shell to lock it in place.

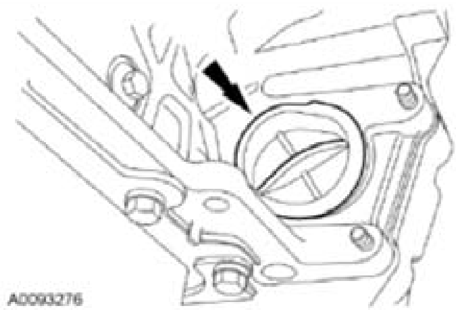


Vehicles equipped with a 5.0L or 6.2L engine

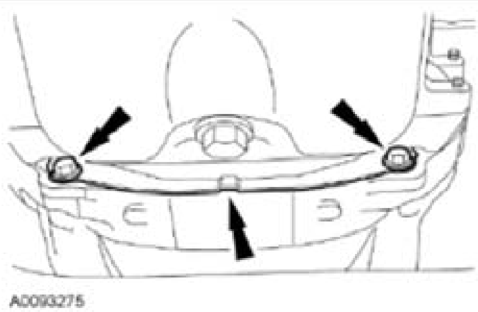
12. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).



13. Install the rubber torque converter nut access cover.

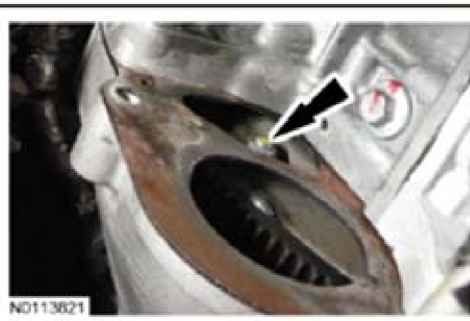


14. Install the flexplate inspection cover and the flexplate inspection cover bolts.
    - Tighten to 48 Nm (35 lb-ft).

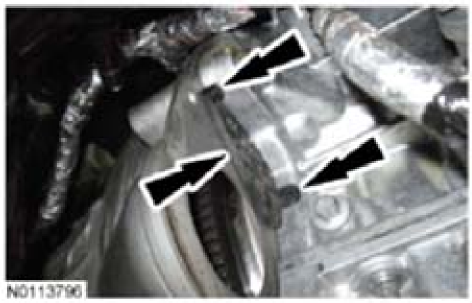


Vehicles equipped with a 3.5L or 3.7L engine

15. Install 4 new flexplate-to-torque converter nuts.
    - Tighten to 40 Nm (30 lb-ft).



16. Install the access cover and the 2 pin-type retainers.



All vehicles

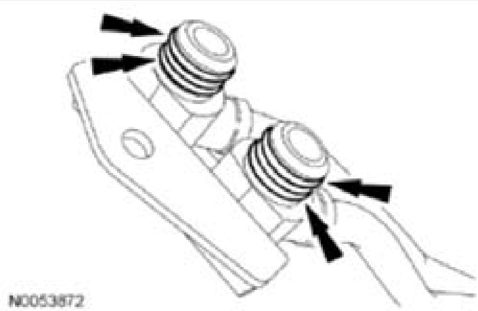
17. Install the starter motor. For additional information, refer to Section 303-06.

18. Reposition the transmission fluid cooler tubes and bracket and install the transmission fluid cooler tube bracket nut

    - Tighten to 12 Nm (106 lb-in).

19. NOTE:
Inspect the case to make sure the old transmission fluid cooler tube O-rings are not stuck in the case.

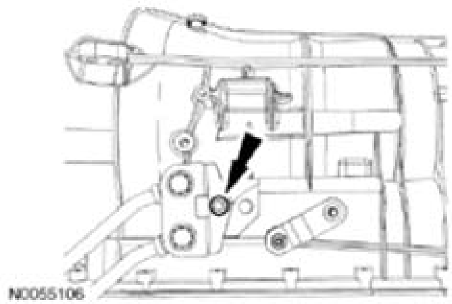
Install new transmission fluid cooler tube O-rings on the transmission fluid cooler tubes.



20. NOTICE:
Install a new transmission fluid cooler tube bracket bolt.

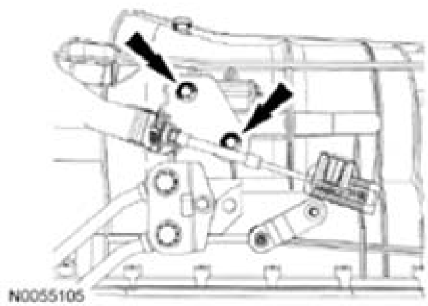
Install the transmission fluid cooler tubes and a new transmission fluid cooler tube bracket bolt.

- Tighten to 30 Nm (22 lb-ft).



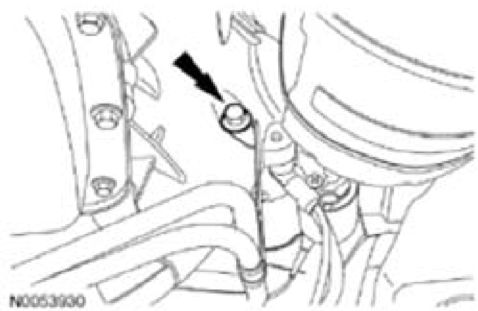
21. NOTE:
The column shift is shown, the floor shift similar.

Install the selector lever cable bracket and selector lever cable bracket bolts.
- Tighten to 25 Nm (18 lb-ft).



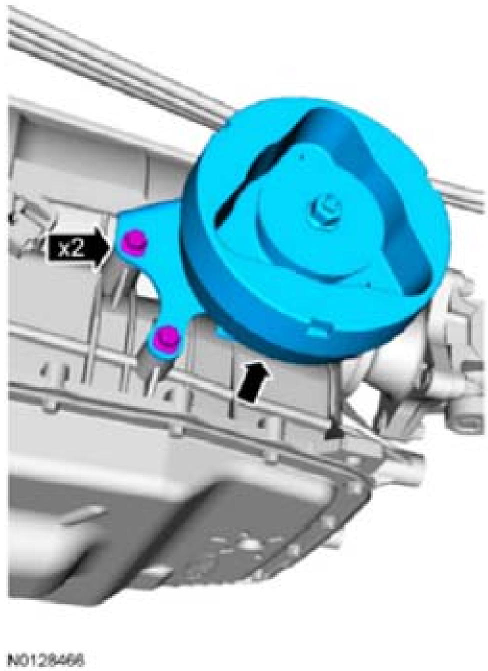
Vehicles equipped with a 5.0L or 6.2L engine

22. Align the transmission fluid cooler tube bracket and install the remaining transmission-to-engine bolt.
- Tighten to 48 Nm (35 lb-ft).



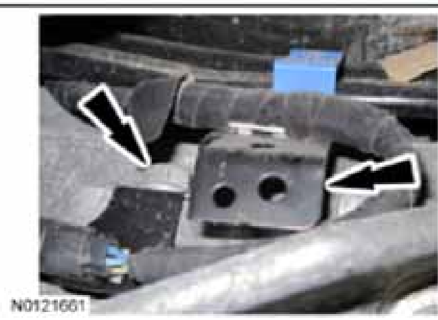
Vehicles equipped with 3.7L engine

23. Install the transmission damper and the 2 transmission damper bolts.
- Tighten to 25 Nm (18 lb-ft).

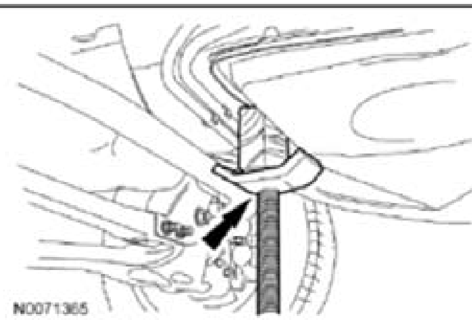


All vehicles

24. Install the fuel line bracket and the fuel line bracket bolt
    - Tighten to 25 Nm (18 lb-ft).



25. Position a jack stand under the transmission, and remove the high-lift transmission jack.

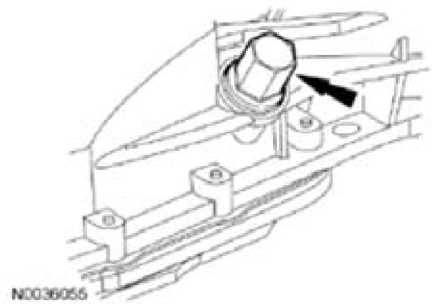


26. Install the driveshaft. For additional information, refer to Section 205-01.

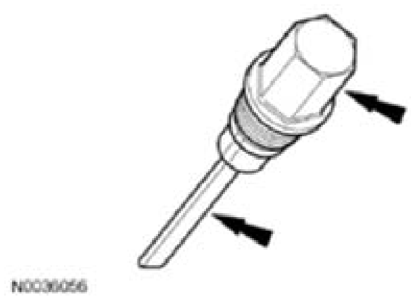
27. Install the exhaust Y-pipe. For additional information, refer to Section 309-00.

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

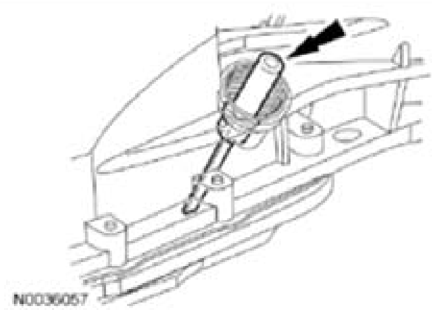
29. Adjust the selector lever cable and install the selector lever cable end on the manual control lever. Verify the selector lever cable is correctly adjusted.
    For additional information, refer to Section 307-05.
30. After completing the repairs, use the scan tool to perform the Misfire Monitor Neutral Profile Correction procedure, following the on-screen instructions.
31. If a new transmission or a new main control was installed, the solenoid body strategy must be updated. For additional information, refer to Solenoid Body Strategy in this section.
32. If the transmission was overhauled, the adaptive drive cycle must be updated. For additional information, refer to Shift Point Road Test in this section.
33. While driving the vehicle, use the scan tool to verify that the Transmission Fluid Temperature (TFT) has reached a temperature of 91°C (195°F). This will circulate the transmission fluid through the torque converter and the transmission fluid cooling system, eliminating any trapped air in the transmission fluid cooling system.
    - With the engine idling (600-750 rpm) in PARK, verify that the TFT is between 91ºC-102ºC (195ºF-215ºF).
34. Remove the transmission fluid fill plug transmission fluid level indicator assembly located on the passenger side front portion of the transmission case.



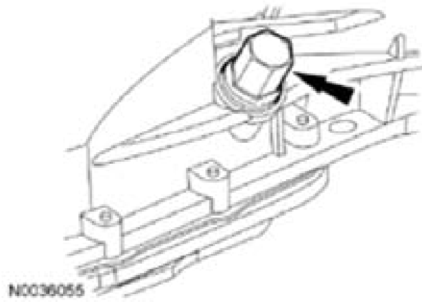
35. Separate the transmission fluid level indicator from the transmission fluid fill plug.



36. Wipe the transmission fluid level indicator clean. Reinstall the transmission fluid level indicator only back into the transmission fluid fill plug hole to check the transmission fluid level. Repeat this until a consistent reading is established.



37. **NOTE:**
If the transmission fluid is not at the correct level, follow the steps for Adding Additional Transmission Fluid or Removing Transmission Fluid. For additional information, refer to Transmission Fluid Drain and Refill in this section. Install the transmission fluid fill plug.
    - Tighten to 35 Nm (26 lb-ft).



EDI Ford Industrial Engine Distributor List

AUSTRALIA

	All Marine Spares	10 Wilmette Place Mona Vale N.S.W. Australia 2103	61-2-99972788

EUROPE

FRANCE	Fornaut S.A.	45, Rue Charles Nodier, 93310 Le-Pre-St.-Gervais France	33-148-450-394 33-148-457-504
GERMANY	Sauer & Sohn Sauer Motive Systems	Gross Zimmerner Strasse 51 D-64807 Dieburg Germany	49-6071-206-330 49-6071-206-219
GREAT BRITAIN	Hendy Power	School Lane Chandlers Ford Industrial Estate, Eastleigh, Hampshire SO53 4DG England	44-2380-579-800 44-2380-271-471
	Power Torque Engineering	Herald Way, Binly, Conventry Warwichshire CV3 2RQ England	44-2476-635-757 44-2476-635-878
ITALY	Compagnia Technica Motori S.p.A.	Via Magellano 1, I-20090 Cesano Boscone, (Milano) Italy	39-02-450-581 39-02-450-582(60/62)
NETHERLANDS	My Power Products	Houtzaagmolen 41 MIJDRECHT Netherlands NL 364	03-129-758-1555

MEXICO

	Equipos y Motores Ind.	Ave. Cuitlahuac No. 700 Col. Popotla 11400 Mexico, D.F.	52-55-5341-9066

NORTH AMERICA - UNITED STATES

ALABAMA	Engines, Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
ALASKA	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
ARIZONA	Southwest Power Products	5143 W. Roosevelt Phoenix, AX 85043	602-269-3581
ARKANSAS	Engines, Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
CALIFORNIA	Powertech Engines Inc (Main Office)	2933 E. Hamilton Ave. Fresno, CA 93721	1-559-264-1776 1-800-891-1776 1-559-264-2933
	Powertech Engines Inc.	1410 South Acacia Ave. Suite B Fullerton, CA 92831	1-714-635-1774 1-800-678-3673 1-714-635-1771
COLORADA	Anderson Industrial Engines Co.	5532 Center Street Ohmaha, NE 68106	402-558-8700
CONNECTICUT	Engine Distributors Inc.	41 Pope Road Holliston, MA 01746	1-800-220-2700
DELAWARE	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
FLORIDA	Engine Distributors Inc.	259 Ellis Rd. South Jacksonville, FL 32254	1-800-220-2700
	Engine Distributors Inc.	2917 S. W. Second Ave. Fort Lauderdale, FL 33315	1-800-220-2700
GEORGIA	Engine Distributors Inc.	259 Ellis Rd. South Jacksonville, FL 32254	1-800-220-2700
HAWAII	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
IDAHO	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
ILLINOIS	Diesel Power Equipment	1211 Lyon Rd. Batavia, IL 60510	877-876-3732
INDIANA	Crosspoint	3621 West Morris St. Indianapolis, IN 46241	1-800-792-3557; 317-244-7251
IOWA	Anderson Industrial Engines Co.	5532 Center Street Ohmaha, NE 68106	402-558-8700
KENTUCKY	Engines, Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
KANSAS	Anderson Industrial Engines Co.	5532 Center Street Ohmaha, NE 68106	402-558-8700

NORTH AMERICA - UNITED STATES

LOUISIANA	Engines , Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
MAINE	Engine Distributors Inc.	41 Pope Road Holliston, MA 01746	1-800-220-2700
MARYLAND	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
MASSACHUSETTS	Engine Distributors Inc.	41 Pope Road Holliston, MA 01746	1-800-220-2701
MICHIGAN	McDonald Equip.	1217 East Grand River Portland, MI 48875	1-800-445-5273
MINNESOTA	Diesel Power Equipment	13619 Industrial Rd. Omaha, NE 68137	800-999-5689
MISSISSIPPI	Engines, Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
MISSOURI	Diesel Power Equipment	13619 Industrial Rd. Omaha, NE 68137	800-999-5689
MONTANA	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
NEBRASKA	Anderson Industrial Engines Co.	5532 Center Street Ohmaha, NE 68106	402-558-8700
NEVADA	Southwest Power Products	5143 W. Roosevelt Phoenix, AX 85043	602-269-3581
NEW HAMPSHIRE	Engine Distributors Inc.	41 Pope Road Holliston, MA 01746	1-800-220-2700
NEW JERSERY	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
NEW YORK	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
NEW MEXICO	Southwest Power Products	5143 W. Roosevelt Phoenix, AX 85043	602-269-3581
NORTH DAKOTA	Diesel Power Equipment	13619 Industrial Rd. Omaha, NE 68137	800-999-5689
NORTH CAROLINA	Engine Distributors Inc.	303 Interstate Dr. Archdale, NC 27263	1-800-220-2700
OHIO	McDonald Equip.	37200 Vine St. Willoughby, Ohio 44094	1-800-589-9025
OKLAHOMA	M.G. Bryan	1906 S. Great S.W. Parkway Grand Prairie, TX 75051	972-623-4300
OREGON	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311

NORTH AMERICA - UNITED STATES

EASTERN PENNSYLVANIA	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
WESTERN PENNSYLVANIA	McDonald Equip.	37200 Vine St. Willoughby, Ohio 44094	1-800-589-9025
RHODE ISLAND	Engine Distributors Inc.	41 Pope Road Holliston, MA 01746	1-800-220-2700
SOUTH CAROLINA	Engine Distributors Inc.	259 Ellis Rd. South Jacksonville, FL 32254	1-800-220-2700
SOUTH DAKOTA	Diesel Power Equipment	13619 Industrial Rd. Omaha, NE 68137	800-999-5689
TENNESSEE	Engines, Inc.	5400 C.W. Post Road Jonesboro, AR 72401	1-800-562-8049
TEXAS	M.G. Bryan	1906 S. Great S.W. Parkway Grand Prairie, TX 75051	972-623-4300
UTAH	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
WASHINGTON	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
WEST VIRGINIA	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
WISCONSIN	Diesel Power Equipment	13619 Industrial Rd. Omaha, NE 68137	800-999-5689
WYOMING	Perkins Pacific	6100 S. 6th Way Ridgefield, WA 98642	877-877-3311
VERMONT	Engine Distributors Inc.	400 University Court Blackwood, NJ 08012	1-800-220-2700
VIRGINIA	Engine Distributors Inc.	303 Interstate Dr. Archdale, NC 27263	1-800-220-2700

NORTH AMERICA - CANADA

ALBERTA, SASKATCHEWAN	Industrial Engines Ltd.	14355 120th Ave. Edmonton, Alberta Canada, T5L 2R8	780-484-6213
ALBERTA, SASKATCHEWAN	Simson Maxwell	8750-58th Avenue, Edmonton,AB Canada T6E 6G6	1-800-374-6766
ALBERTA, SASKATCHEWAN	Simson Maxwell	5711-80 Avenue SE,Calgary,AB Canada T2C 4S6	1-800-374-6766
BRITISH COLUMBIA	Simson Maxwell	1605 Kebet Way Port C, BC Canada V3C 5W9	1-800-374-6766
	Simson Maxwell	#12-4131 Mostar Road, Nanaimo BC, Canada V9T 5P8	1-800-374-6766
	Simson Maxwell	1846 Quinn Street, Prince George, BC Canada V2L 3H4	1-800-374-6766
MONTREAL	MARINDUSTRIAL	8550 Delmeade Montreal, QUEBEC Canada, H4T 1L7	514-342-2748
NEW BRUNSWICK, NOVA SCOTIA, NEWFOUNDLAND	DAC Industrial Engines, Inc.	10 Akerley Blvd., Unit 61 Dartmouth, NS, B3B 1J4	902-468-3765 877-468-3765
ONTARIO	MARINDUSTRIAL	2320 Bristol Circle, Unit 8 Oakville, ON L6H 5S3	1-800-866-3831

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Blackwood NJ 08012
Service/Warranty
1-800-220-2700
1-856-228-7298
1-856-228-5657(fax parts & service)
1-856-228-5531(fax sales)