2008 TRANSMISSION

Automatic Transmission - 4L80-E/4L85-E - Express & Savana

DIAGNOSTIC INFORMATION AND PROCEDURES

SYMPTOMS - AUTOMATIC TRANSMISSION

Diagnostic Category	Diagnostic Information
The following table consists of eight diagnostic categories that are located in the left-hand column. Using this column, choose the appropriate category based on the operating conditions of the vehicle or transmission. After selecting a category, use the right-hand column to locate the specific symptom diagnostic information.	
Fluid Diagnosis: This category contains the following topics: • Fluid condition - appearance, contaminants, smell, overheating • Line pressure - high or low • Fluid leaks	• Refer to **Transmission Fluid Check**. • Refer to **Fluid Foaming**. • Refer to **Transmission Overheats**. • Refer to **Transmission Overheats at WOT**. • Refer to **High Line Pressure**. • Refer to **Low Line Pressure**. • Refer to **Inadequate Lubrication at Low Line or Heavy Loads**. • Refer to **Inadequate Lubrication**. • Refer to **Fluid Leak Diagnosis**. • Refer to **Case Extension Bearing/Seal Failed**. • Refer to **Oil Out the Vent Tube**. • Refer to **Automatic Transmission Fluid Leaks**.
Noise and Vibration Diagnosis: This category contains the following topics: • Noise - drive gear, final drive, whine, growl, rattle, buzz, popping • Vibration	• Refer to **Noise**. • Refer to **Vibration**. • Refer to **Flexplate/Torque Converter Vibration Test**.
Range Performance Diagnosis: This category contains the following topics: • Drives in Neutral • No Park/Neutral • No Reverse	• Refer to **Forward Motion in Neutral**. • Refer to **No Park**. • Refer to **No Reverse**. • Refer to **Engine Stall**.

• Engine stalling • No Drive • No engine braking • No or incorrect gear selection • Shift selector indicator does not match transmission gear range	• Refer to **No Torque in Reverse and Third**. • Refer to **Loss of Power**. • Refer to **No Torque in Second Gear**. • Refer to **Loss of Drive**. • Refer to **No Overrun Braking - D1**. • Refer to **No Engine Braking - D1**. • Refer to **No Overrun Braking - D2**. • Refer to **No Engine Braking - D2**. • Refer to **No Second Gear Engine Braking - D2**. • Refer to **No Overrun Braking - D3**. • Refer to **No Engine Braking - D3**. • Refer to **Engine Starts in Gear**. • Refer to **Shift Lever Indicates Wrong Gear**. • Refer to **No Gear Selection**. • Refer to **Remains in Park**. • Refer to **Difficult to Shift Out of Park**. • Refer to **Does Not Stay in Park**. • Refer to **Range Selector Displays Incorrect Range (4.8L and 6.0L)** or **Range Selector Displays Incorrect Range (6.6L)**.
Shift Quality - Feel - Diagnosis: This category contains the following topics: • Erratic shifts • Harsh, soft, delayed or slipping shifts • Harsh, soft, or delayed engagement	• Refer to **Erratic Shift Quality**. • Refer to **Harsh Shifts**. • Refer to **Transmission Slips**. • Refer to **Harsh Shift 3 to 4**. • Refer to **Harsh Shift 4 to 3**. • Refer to **Harsh Shift D4 to D3, D2, or D1**. • Refer to **Soft Shifts**. • Refer to **Delayed Shift 1 to 2**. • Refer to **Soft Shift 2 to 3**. • Refer to **Soft Shift D3 to D2**. • Refer to **Soft Shift 3 to 2**. • Refer to **No D3 to D2**. • Refer to **No D2 to D1**. • Refer to **Harsh Shift D to R**. • Refer to **Soft Shift into R**.

	• Refer to **Soft Shift R to D**.
Shift Pattern: This category contains the following topics: • One forward gear missing or slipping • One forward gear only • Two forward gears only • Non-First gear start	• Refer to **No First Gear - D1**. • Refer to **No First Gear - D2**. • Refer to **No First Gear - D4**. • Refer to **No Second Gear - D1**. • Refer to **No Second Gear - D2**. • Refer to **No Second Gear - D4**. • Refer to **No Second Gear - D3**. • Refer to **No Third Gear - D3**. • Refer to **No Third Gear - D4**. • Refer to **No Fourth Gear - D4**. • Refer to **First Gear Only - D4**. • Refer to **Second Gear Only - D4**. • Refer to **First and Second Gear Only - D4**. • Refer to **First and Fourth Gear Only - D4**. • Refer to **Second and Third Gear Only - D4**. • Refer to **Third and Fourth Gear Only - D4**. • Refer to **Second Gear Starts**. • Refer to **Third Gear Starts**. • Refer to **Fourth Gear Starts**.
Shift Speed Diagnosis: This category contains the following topic: Inaccurate or inconsistent shift points	Refer to **Inaccurate Shift Points**.
Torque Converter Diagnosis: This category contains the following topics: • Torque Converter Diagnosis • TCC does not apply • TCC does not release • TCC apply/release quality • Poor acceleration/No torque multiplication • Converter Ballooning • Engine Stall	• Refer to **Torque Converter Diagnosis**. • Refer to **Flexplate/Torque Converter Vibration Test**. • Refer to **No Torque Converter Clutch Apply**. • Refer to **Torque Converter Clutch Stuck On**. • Refer to **Soft Torque Converter Clutch Apply**. • Refer to **Incorrect Torque Converter Clutch Apply or Release**. • Refer to **No Torque Multiplication**. • Refer to **Torque Converter Clutch Slipping**.

	• Refer to **Converter Ballooning**. • Refer to **Engine Stall in Neutral**.
Symptom not found or no symptom detected	• Refer to **Transmission Fluid Check**. • Refer to **Road Test**. • Refer to **Line Pressure Check**.

RANGE SELECTOR DISPLAYS INCORRECT RANGE (4.8L AND 6.0L)

Circuit Description

The transmission range (TR) switch is part of the park/neutral position (PNP) and back-up lamp switch assembly, which is externally mounted on the transmission manual shaft. The TR switch contains 4 internal switches that indicate the transmission gear range selector lever position. The powertrain control module (PCM) supplies ignition voltage to each switch circuit. As the gear range selector lever is moved, the state of each switch may change, causing the circuit to open or close. An open circuit or switch indicates a high voltage signal. A closed circuit or switch indicates a low voltage signal. The PCM detects the selected gear range by deciphering the combination of the voltage signals. The PCM compares the actual voltage combination of the switch signals to a TR switch combination chart stored in memory.

Diagnostic Aids

Refer to **Transmission Range Switch Logic** for valid combinations of switch signal circuits A, B, C and Parity. In the table, HI indicates an ignition voltage signal. LOW indicates a zero voltage signal.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: By disconnecting the TR switch, the ground path of all TR switch circuits would be removed and the PCM should recognize all circuits as open. The scan tool should display HI for all range signal states.

6: This step tests the TR switch wiring for an open or the lack of the signal voltage from the PCM.

7: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

8: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

9: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

10: This step tests the TR switch wiring and the PCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

Step	Action	Value(s)	Yes	No
	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF.			

1	3. Select the TR Sw. on the scan tool. 4. With the scan tool, observe the TR Sw. display while selecting each transmission range: P, R, N, D4, D3, D2 and D1. Does each selected transmission range match the scan tool TR Sw. display?	-	Go to **Step 2**	Go to **Step 3**
2	Observe the IPC gear range display while selecting each transmission range: P, R, N, D4, D3, D2, D1. Does each selected transmission range match the IPC display?	-	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 13**
3	With the scan tool, observe the TR Sw. A/B/C/P display. Does the scan tool TR Sw. A/B/C/P parameter indicate HI for all range signal states?	-	Go to **Step 15**	Go to **Step 4**
4	1. Turn OFF the ignition. 2. Disconnect the TR switch connector. 3. Turn ON the ignition, with the engine OFF. Does the scan tool TR Sw. A/B/C/P parameter indicate HI for all range signal states?	-	Go to **Step 6**	Go to **Step 5**
5	Disconnect the IPC connector. Refer to **Instrument Cluster Replacement** . Did the affected circuit display HI?	-	Go to **Step 18**	Go to **Step 6**
6	1. Using the DMM and the **J 35616** GM terminal test kit, measure the voltage from terminal 5 of the TR switch connector to ground. See **Special Tools**. 2. Measure the voltage from terminal 6 of the TR switch connector to ground. 3. Measure the voltage from terminal 8 of the TR switch connector to ground. 4. Measure the voltage from terminal 4 of the TR switch connector to ground. Does the voltage measure within the specified value at all four terminals?	10-12 V	Go to **Step 7**	Go to **Step 12**
7	Connect a fused jumper wire from terminal 5 of the TR switch connector, signal circuit A, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter.	-		

	When signal circuit A is grounded, do any other signal circuits indicate LOW?		Go to **Step 14**	Go to **Step 8**
8	Connect a fused jumper wire from terminal 4 of the TR switch connector, signal circuit B, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit B is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 14**	Go to **Step 9**
9	Connect a fused jumper wire from terminal 6 of the TR switch connector, signal circuit C, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit C is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 14**	Go to **Step 10**
10	Connect a fused jumper wire from terminal 8 of the TR switch connector, signal circuit P, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit P is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 14**	Go to **Step 13**
11	Test the signal circuits of the TR switch that did not indicate HI for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
12	Test the signal circuits of the TR switch and the PCM that did not indicate proper voltage for an open. Refer to **Testing for Continuity** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 17**
13	Test the signal circuits of the TR switch between the PCM and the IPC for an open. Refer to **Testing for Continuity** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 18**
14	Test the affected signal circuits of the TR switch for a shorted together condition. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
15	Test the ground circuit of the TR switch for an open. Refer to **Testing for Continuity** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 19**	Go to **Step 16**
16	Replace the TR switch. The TR switch is part of the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement**. Did you complete the replacement?	-	Go to **Step 19**	-

17	Replace the PCM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 19**	-
18	Replace the IPC. Refer to **Instrument Cluster Replacement** . Did you complete the replacement?	-	Go to **Step 19**	-
19	1. Turn ON the ignition, with the engine OFF. 2. With the scan tool, observe the TR Sw. display while selecting each transmission range: P, R, N, D4, D3, D2 and D1. Does each selected transmission range match the scan tool TR Sw. display?	-	System OK	Go to **Step 2**

RANGE SELECTOR DISPLAYS INCORRECT RANGE (6.6L)

Circuit Description

The transmission range (TR) switch is part of the park/neutral position (PNP) and back-up lamp switch assembly, which is externally mounted on the transmission manual shaft. The TR switch contains 4 internal switches that indicate the transmission gear range selector lever position. The transmission control module (TCM) supplies ignition voltage to each switch circuit. As the gear range selector lever is moved, the state of each switch may change, causing the circuit to open or close. An open circuit or switch indicates a high voltage signal. A closed circuit or switch indicates a low voltage signal. The TCM detects the selected gear range by deciphering the combination of the voltage signals. The TCM compares the actual voltage combination of the switch signals to a TR switch combination chart stored in memory.

Diagnostic Aids

Refer to **Transmission Range Switch Logic** for valid combinations of switch signal circuits A, B, C and Parity. On the table, HI indicates an ignition voltage signal. LOW indicates a 0 voltage signal.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

4: By disconnecting the TR switch, the ground path of all TR switch circuits is removed and the TCM should recognize all circuits as open. The scan tool should display HI for all range signal states.

5: This step tests the TR switch wiring for an open or the lack of the signal voltage from the TCM.

6: This step tests the TR switch wiring and the TCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

7: This step tests the TR switch wiring and the TCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

8: This step tests the TR switch wiring and the TCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

9: This step tests the TR switch wiring and the TCM by providing a ground path through a fused jumper wire. When grounded, the scan tool range signal states should change to LOW.

Step	Action	Value	Yes	No
1	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Select TR Sw. on the scan tool. 4. With the scan tool, observe the TR Sw. display while selecting each transmission range: P, R, N, D4, D3, D2 and D1. Does each selected transmission range match the scan tool TR Sw. display?	-	Go to **Step 2**	Go to **Step 3**
2	Observe the instrument panel cluster (IPC) gear range display while selecting each transmission range: P, R, N, D4, D3, D2, D1. Does each selected transmission range match the IPC display?	-	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 16**
3	With the scan tool, observe the TR Sw. A/B/C/P display. Does the scan tool TR Sw. A/B/C/P parameter indicate HI for all range signal states?	-	Go to **Step 13**	Go to **Step 4**
4	1. Turn OFF the ignition. 2. Disconnect the TR switch 4-way connector. 3. Turn ON the ignition, with the engine OFF. Does the scan tool TR Sw. A/B/C/P parameter indicate HI for all range signal states?	-	Go to **Step 5**	Go to **Step 10**
5	1. Using the DMM and the **J 35616** GM terminal test kit, measure the voltage from the transmission range signal A circuit of the TR switch connector to ground. 2. Measure the voltage from the transmission range signal B circuit of the TR switch connector to ground. 3. Measure the voltage from the transmission range signal C circuit of the TR switch connector to ground. 4. Measure the voltage from the transmission	10-12 V		

	range signal P circuit of the TR switch connector to ground. Does the voltage measure within the specified range at all 4 circuits?		Go to **Step 6**	Go to **Step 11**
6	Connect a fused jumper wire from the TR switch connector, signal circuit A, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit A is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 12**	Go to **Step 7**
7	Connect a fused jumper wire from the TR switch connector, signal circuit B, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit B is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 12**	Go to **Step 8**
8	Connect a fused jumper wire from the TR switch connector, signal circuit C, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit C is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 12**	Go to **Step 9**
9	Connect a fused jumper wire from the TR switch connector, signal circuit P, to ground while monitoring the scan tool TR Sw. A/B/C/P parameter. When signal circuit P is grounded, do any other signal circuits indicate LOW?	-	Go to **Step 12**	Go to **Step 13**
10	Test the signal circuits of the TR switch that did not indicate HI for a short to ground. Refer to **Testing for Short to Ground** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
11	Test the signal circuits of the TR switch that did not indicate proper voltage for an open. Refer to **Testing for Continuity** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
12	Test the affected signal circuits of the TR switch for a shorted together condition. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 15**
13	Test the ground circuit of the TR switch for an open. Refer to **Testing for Continuity** and **Wiring Repairs** . Did you find and correct the condition?	-	Go to **Step 17**	Go to **Step 14**

14	Replace the TR switch. The TR switch is part of the PNP switch. Refer to **Park/Neutral Position Switch Replacement**. Did you complete the replacement?	-	Go to **Step 17**	-
15	Replace the TCM. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 17**	-
16	Replace the IPC. Refer to **Control Module References** for replacement, setup, and programming. Did you complete the replacement?	-	Go to **Step 17**	Go to **Step 2**
17	1. Turn ON the ignition, with the engine OFF. 2. With the scan tool, observe the TR Sw. display while selecting each transmission range: P, R, N, D4, D3, D2 and D1. Does each selected transmission range match the scan tool TR Sw. display?	-	System OK	Go to **Step 2**

TOW/HAUL SWITCH/INDICATOR ALWAYS ON OR INOPERATIVE

Circuit Description

Tow/haul mode enables the operator to achieve enhanced shift performance when towing or hauling a load. When tow/haul mode is selected, the tow/haul switch input signal to the body control module (BCM) is momentarily toggled to zero volts. This signals the powertrain control module (PCM) or the transmission control module (TCM) to extend the length of time between upshifts and increase transmission line pressure. Cycling the tow/haul switch again disables tow/haul mode and returns the transmission to a normal shift pattern.

Diagnostic Aids

If the electrical circuit checks are OK and the tow/haul shift pattern is not occurring, there may be a mechanical/hydraulic condition that prevents tow/haul operation. Refer to **Symptoms - Automatic Transmission**.

Test Description

The numbers below refer to the step numbers on the diagnostic table.

2: This step tests for a faulty tow/haul switch.

3: This step tests for voltage input from the BCM to the tow/haul switch.

6: This step tests for ground integrity.

Step	Action	Yes	No

1	1. Install a scan tool. 2. Turn ON the ignition, with the engine OFF. 3. Cycle the tow/haul switch while observing Tow/Haul Mode on the scan tool. Does the scan tool display Active when the switch is first pressed, and then Inactive when the switch is pressed again?	Go to **Testing for Intermittent Conditions and Poor Connections**	Go to **Step 2**
2	1. Remove the connector from the tow/haul switch. 2. Using the **J 35616** GM terminal test kit, install a fused jumper wire from terminal D to terminal A of the tow/haul switch connector. See **Special Tools**. Does the scan tool Tow/Haul Mode indicate a status change?	Go to **Step 7**	Go to **Step 3**
3	Using the DMM and the **J 35616** , measure the voltage at terminal D of the tow/haul switch connector. See **Special Tools**. Is ignition voltage measured?	Go to **Step 6**	Go to **Step 4**
4	Using the DMM and the **J 35616** , measure the voltage at terminal C3-B11 of the BCM. See **Special Tools**. Is ignition voltage measured?	Go to **Step 5**	Go to **Step 8**
5	Test the Tow/Haul switch signal circuit of the tow/haul switch for an open or shorted condition. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 9**	Go to **Testing for Intermittent Conditions and Poor Connections**
6	Test the ground circuit of the tow/haul switch for an open or shorted condition. Refer to **Circuit Testing** and **Wiring Repairs** . Did you find and correct the condition?	Go to **Step 9**	Go to **Testing for Intermittent Conditions and Poor Connections**
7	Replace the tow/haul switch. Refer to **Instrument Panel Cluster Trim Plate Bezel Replacement** . Did you complete the replacement?	Go to **Step 9**	-
8	Test the BCM for proper operation. Refer to **Diagnostic System Check - Vehicle** . Did you find and correct the condition?	Go to **Step 9**	-
9	After the repair is complete, observe Tow/Haul Mode on the scan tool display, while cycling the tow/haul switch. Does the scan tool display Active when the switch is first pressed, and then Inactive when the switch is pressed again?	System OK	Go to **Step 1**

TRANSMISSION FLUID CHECK

1. Start the engine and operate the vehicle for 15 minutes or until the transmission fluid reaches an operating temperature of 82-93°C (180-200°F).
2. Park the vehicle on a level surface.
3. With your foot on the brake, move the shift lever through each gear range. Pause for about 3 seconds in each range, ending in PARK.
4. Apply the parking brake and let the engine idle for 3 minutes.
5. Remove the transmission fluid level indicator. Wipe the fluid level indicator clean. Insert the fluid level indicator. Give the fluid level indicator a full twist in order to close.
6. Wait 3 seconds and remove the fluid level indicator.
7. Read both sides of the fluid level indicator. The fluid must be within the hot cross-hatched area using the lowest level reading.

Step	Action	Yes	No
DEFINITION: Diagnose transmission fluid conditions by color.			
1	Inspect the transmission fluid color. Is the transmission fluid color red?	Go to **Step 2**	Go to **Step 11**
2	Is the transmission fluid level satisfactory?	System OK	Go to **Step 3**
3	Inspect the transmission fluid. Is the transmission fluid foamy?	Go to **Step 8**	Go to **Step 4**
4	Measure the transmission fluid level. The proper fluid level should be in the middle of the X-hatch. Is the transmission fluid level high?	Go to **Step 9**	Go to **Step 5**
5	The transmission fluid is low. Add fluid to the proper level. Is the transmission fluid level satisfactory?	Go to **Step 6**	-
6	Inspect for external leaks. Refer to **Fluid Leak Diagnosis**. Did you find any leaks?	Go to **Step 7**	Go to **Step 20**
7	Repair the leak condition. Did you repair the leak condition?	Go to **Step 20**	-
8	Is the transmission fluid level high?	Go to **Step 9**	Go to **Step 10**
9	Remove excess transmission fluid to the proper level. Refer to **Automatic Transmission Fluid and Filter Replacement**. Is the transmission fluid level satisfactory?	Go to **Step 20**	-
10	1. Inspect for contaminants in the transmission fluid. 2. Drain the transmission fluid in order to determine the source of the contamination. Did you drain the transmission fluid?	Go to **Step 15**	-
11	Is the transmission fluid color non-transparent pink?	Go to **Step 12**	Go to **Step 13**
12	Replace the cooler.		-

	Did you complete the replacement?	Go to **Step 15**	
13	**IMPORTANT:** **Transmission fluid may turn dark with normal use. This does not always indicate oxidation or contamination.** The transmission fluid color should be light brown.Is the transmission fluid color light brown?	Go to **Step 14**	-
14	**IMPORTANT:** **A very small amount of material in the bottom pan is a normal condition. Large pieces of metal or other material in the bottom pan require a transmission overhaul.** Drain the transmission fluid in order to determine if the transmission fluid is contaminated.Is the transmission fluid contaminated?	Go to **Step 15**	Go to **Step 18**
15	Perform root cause and repair, as necessary. Did you complete the repair?	Go to **Step 16**	-
16	Clear TRANS ADAPT. Did you complete the reset procedures?	Go to **Step 17**	-
17	Add new transmission fluid. Did you add new transmission fluid?	Go to **Step 20**	-
18	Replace the transmission fluid and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**. Did you complete the replacement?	Go to **Step 19**	-
19	Did you complete the reset procedures?	Go to **Step 20**	-
20	Is the transmission fluid level satisfactory?	System OK	Go to **Step 1**

LINE PRESSURE CHECK

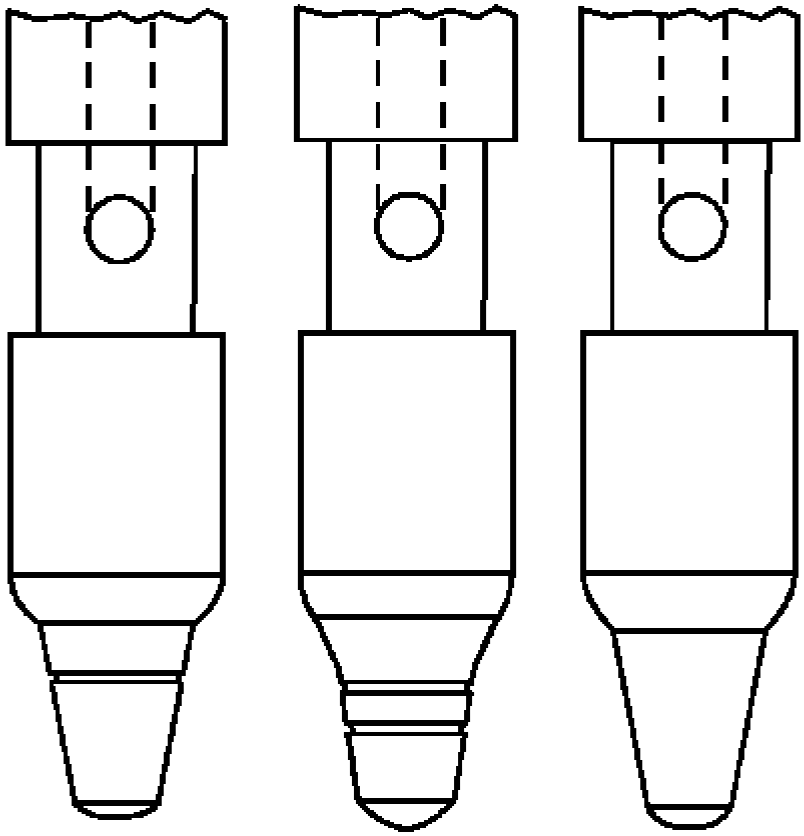


Fig. 1: Checking Line Pressure
Courtesy of GENERAL MOTORS CORP.

Tools Required

J 21867 Pressure Gage

Line pressures are calibrated for two sets of gear ranges-Drive-Park-Neutral, and Reverse. This allows the transmission line pressure to be appropriate for different pressure needs in different gear ranges:

Gear Range	Line Pressure Range
Drive, Park, or Neutral	241-1179 kPa (35-171 psi)
Reverse	462-2234 kPa (67-324 psi)

Before performing a line pressure check, verify that the pressure control solenoid for the transmission is receiving the correct electrical signal from the vehicle computer:

1. Install a scan tool.

CAUTION: Keep the brakes applied at all times in order to prevent unexpected vehicle motion. Personal injury may result if the vehicle moves unexpectedly.

IMPORTANT: The transmission may experience harsh, soft or mushy shifts for up to two days later.

2. Start the engine and set the parking brake.
3. Check for diagnostic trouble codes, including the diagnostic code for a pressure control solenoid.
4. Repair the vehicle if necessary. Include the following areas:
    - Inspect the fluid level.
    - Inspect the manual linkage at the transmission.
    - Install or connect the scan tool.
    - Install or connect the **J 21867** at the line pressure tap.
5. Put the gear selector in PARK and set the parking brake.
6. Start the engine and allow the engine to warm up at idle.
7. Access the Override Pressure Control Solenoid test on the scan tool.
8. Increase the Pressure Control Solenoid Current in 0.1 amp increments. Read the corresponding line pressure on the **J 21867** . Allow the pressure to stabilize for 5 seconds after each current change.
9. Compare your data to the Drive-Park-Neutral **Line Pressure** .
10. Remove the **J 21867** .

IMPORTANT: Be sure to apply pipe thread sealant with Teflon GM P/N 12346004 (Canadian P/N 10953480) to the line pressure plug.

11. Install the line pressure tap plug.

If your pressure readings differ greatly from the line pressure table, refer to the Diagnostic Tables.

The scan tool is only able to control the pressure control solenoid in PARK and NEUTRAL with the vehicle stopped at idle. This protects the clutches from extremely high or low pressures in DRIVE or REVERSE ranges.

ROAD TEST

The following test provides a method of evaluating the condition of the automatic transmission. The test is structured so that most driving conditions would be achieved. The test is divided into the following parts:

- Electrical Function Check
- Upshift Control and Torque Converter Clutch (TCC) Apply
- Part Throttle Detent Downshifts
- Full Throttle Detent Downshifts
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
    - REVERSE

  - Manual FIRST
  - Manual SECOND
  - Manual THIRD

IMPORTANT: Complete the test in the sequence given. Incomplete testing cannot guarantee an accurate evaluation.

Before the road test, ensure the following:

- The engine is performing properly.
- Transmission fluid level is correct.
- Tire pressure is correct.

During the road test:

- Perform the test only when traffic conditions permit.
- Operate the vehicle in a controlled, safe manner.
- Observe all traffic regulations.
- View the scan tool data while conducting this test.

  Take along qualified help in order to operate the vehicle safely.

- Observe any unusual sounds or smells.

After the road test, check the following:

- Transmission fluid level. Refer to **Transmission Fluid Check**.
- Diagnostic Trouble Codes (DTCs) that may have set during the testing. Refer to the applicable DTC.
- Scan tool data for any abnormal readings or data.

Electrical Function Check

Perform this check first, in order to ensure the electronic transmission components are connected and functioning properly. If these components are not checked, a simple electrical condition could be mis-diagnosed.

1. Connect the scan tool.
2. Ensure the gear selector is in PARK and set the parking brake.
3. Start the engine.
4. Verify that the following scan tool data can be obtained and is functioning properly.

   Refer to **Transmission Control Module Scan Tool Information (4L60-E)** or **Transmission Control Module Scan Tool Information (4L80-E)** for typical data values. Data that is questionable may indicate a concern.

- Engine speed
- Transmission input speed, turbine
- Transmission output speed
- Vehicle speed
- TFP manual valve position switch
- Transmission range, engine list
- 4WD low
- Commanded gear
- PC solenoid reference current
- PC solenoid actual current
- PC solenoid duty cycle
- Brake switch
- Engine coolant temperature
- Transmission fluid temperature
- Throttle angle
- Ignition voltage
- 1-2 shift solenoid
- 2-3 shift solenoid
- TCC solenoid duty cycle
- TCC slip speed

5. Monitor the brake switch signal while depressing and releasing the brake pedal. The scan tool should display:
   - Closed when the brake pedal is released
   - Open when the brake pedal is depressed
6. Check the garage shifts
   1. Apply the brake pedal and ensure the parking brake is set.
   2. Move the gear selector through the following ranges:
      1. PARK to REVERSE
      2. REVERSE to NEUTRAL
      3. NEUTRAL to DRIVE
   3. Pause 2-3 seconds in each gear position.
   4. Verify the gear engagements are immediate and not harsh.

IMPORTANT: Harsh engagement may be caused by any of the following conditions:

- **High idle speed**

  Compare engine idle speed to desired idle speed.

- **Commanded low PC solenoid current**

  Compare PC solenoid reference current to PC solenoid actual current.

- **A default condition caused by certain DTCs that result in maximum line pressure to prevent slippage**

IMPORTANT: Soft or delayed engagement may be caused by any of the following conditions:

- **Low idle speed**

  Compare engine idle speed to desired idle speed.

- **Low fluid level**
- **Commanded high PC solenoid current**

  Compare PC solenoid reference current to PC solenoid actual current.

- **Cold transmission fluid**

  Check for low transmission fluid temperature.

7. Monitor transmission range on the scan tool, engine list.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Move the gear selector through all ranges.
    3. Pause 2-3 seconds in each range.
    4. Return gear selector to PARK.
    5. Verify that all selector positions match the scan tool display.
8. Check throttle angle input.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Ensure the gear selector is in PARK.
    3. Monitor throttle angle while increasing and decreasing engine speed with the throttle pedal. The scan tool throttle angle should increase and decrease with engine speed.

If any of the above checks do not perform properly, record the result for reference after completion of the road test.

Upshift Control and Torque Converter Clutch (TCC) Apply

The PCM calculates the upshift points based primarily on two inputs: throttle angle and vehicle speed. When the PCM determines that conditions are met for a shift to occur, the PCM commands the shift by closing or opening the ground circuit for the appropriate solenoid.

Perform the following steps:

1. Refer to **Shift Speed** and choose a throttle position of 10 percent, 25 percent or 50 percent. All throttle angles shown should be tested to cover the normal driving range.
2. Monitor the following scan tool parameters:
    - Throttle angle
    - Vehicle speed
    - Engine speed
    - Output shaft speed
    - Commanded gear
    - Slip speed
    - Solenoid states
3. Place the gear selector in the OVERDRIVE position.
4. Accelerate the vehicle using the chosen throttle angle. Hold the throttle steady.
5. As the transmission upshifts, note the vehicle speed when the shift occurs for each gear change. There should be a noticeable shift feel or engine speed change within 1-2 seconds of the commanded gear change.
6. Compare the shift speeds to the Shift Speed table. Refer to **Shift Speed** . Shift speeds may vary slightly due to transmission fluid temperature or hydraulic delays in responding to electronic controls.
    - Note any harsh, soft or delayed shifts or slipping.
    - Note any noise or vibration.
7. Repeat steps 1-6 to complete all throttle angles.

IMPORTANT: The TCC will not engage until the engine is in closed loop operation. The vehicle must be in a near-cruise condition, not accelerating or coasting, and on a level road surface.

8. Check for TCC apply in THIRD and FOURTH gear. Typical apply speeds in FOURTH gear range from 72-88 km/h (45-55 mph) depending on engine size, engine type and axle ratio.
    - Note the TCC apply point. When the TCC applies there should be a noticeable drop in engine speed and a drop in slip speed to below 100 RPM. If the TCC apply can not be detected:
        - Check for DTCs.
        - Refer to **Torque Converter Diagnosis**.
    - Lightly tap and release the brake pedal. The TCC will release.

Part Throttle Detent Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64-88 km/h (40-55 mph) in FOURTH gear.
3. Quickly increase throttle angle to greater than 50 percent.

4. Verify the following:
    - The TCC releases
    - The transmission downshifts immediately to THIRD gear

Full Throttle Detent Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to speeds of 64-88 km/h (40-55 mph) in FOURTH gear.
3. Quickly increase throttle angle to 100 percent (WOT).
4. Verify the following:
    - The TCC releases
    - The transmission downshifts immediately to SECOND gear

Manual Downshifts

The shift solenoid valves do not control manual downshifts. All manual downshifts are hydraulic. The solenoid states will change during, or shortly after, a manual downshift is selected.

Manual 4-3 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64-88 km/h (40-55 mph) in FOURTH gear.
3. Release the throttle while moving the gear selector to THIRD.
4. Verify the following:
    - The transmission downshifts immediately to THIRD gear
    - The engine slows the vehicle

Manual 4-2 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64-72 km/h (40-45 mph).
3. Release the throttle while moving the gear selector to SECOND.
4. Verify the following:
    - The TCC releases
    - The transmission downshifts immediately to SECOND gear
    - The engine slows the vehicle

Manual 4-1 Downshift

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to 64 km/h (40 mph).
3. Release the throttle while moving the gear selector to FIRST.

4. Verify the following:
   - The TCC releases
   - The transmission immediately downshifts to FIRST Gear.
   - The engine slows the vehicle.

Coasting Downshifts

1. Place the gear selector in the OVERDRIVE position.
2. Accelerate the vehicle to FOURTH gear with the TCC applied.
3. Release the throttle and lightly apply the brakes.
4. Verify the following:
   - The TCC releases
   - Downshifts occur at speeds shown in the Shift Speed table. Refer to **Shift Speed** .

Manual Gear Range Selection

The shift solenoids control the upshifts in the manual gear ranges.

Perform the following tests using 10 percent to 15 percent throttle angle.

Reverse

1. With the vehicle stopped, move the gear selector to REVERSE.
2. Slowly accelerate the vehicle.
3. Verify that there is no noticeable slip, noise or vibration.

Manual First

1. With the vehicle stopped, move the gear selector to FIRST.
2. Accelerate the vehicle to 32 km/h (20 mph).
3. Verify the following:
   - No upshifts occur.
   - The TCC does not apply.
   - There is no noticeable slip, noise, or vibration.

Manual Second

1. With the vehicle stopped, move the gear selector to SECOND.
2. Accelerate the vehicle to 57 km/h (35 mph).
3. Verify the following:
   - The 1-2 shift occurs.
   - The 2-3 shift does not occur.
   - There is no noticeable slip, noise, or vibration.

Manual Third

1. With the vehicle stopped, move the gear selector to THIRD.
2. Accelerate the vehicle to 64 km/h (40 mph).
3. Verify the following:
    - The 1-2 shift occurs.
    - The 2-3 shift occurs.
    - There is no noticeable slip, noise, or vibration.

TORQUE CONVERTER DIAGNOSIS

The torque converter clutch (TCC) is applied by fluid pressure, which is controlled by a PWM solenoid valve. This solenoid valve is located inside of the automatic transmission assembly. The solenoid valve is controlled through a combination of computer controlled switches and sensors.

Torque Converter Stator

The torque converter stator roller clutch can have two different malfunctions.

- The stator assembly freewheels in both directions.
- The stator assembly remains locked up at all times.

Poor Acceleration at Low Speed

If the stator is freewheeling at all times, the vehicle tends to have poor acceleration from a standstill. At speeds above 50-55 km/h (30-35 mph), the vehicle may act normally. For poor acceleration, you should first determine that the exhaust system is not blocked, and the transmission is in First gear when starting out.

If the engine freely accelerates to high RPM in NEUTRAL, you can assume that the engine and the exhaust system are normal. Check for poor performance in DRIVE and REVERSE to help determine if the stator is freewheeling at all times.

Poor Acceleration at High Speed

If the stator is locked up at all times, performance is normal when accelerating from a standstill. Engine RPM and vehicle speed are limited or restricted at high speeds. Visual examination of the converter may reveal a blue color from overheating.

If the converter has been removed, you can inspect the stator roller clutch by inserting a finger into the splined inner race of the roller clutch and trying to turn the race in both directions. You should be able to freely turn the inner race clockwise, but you should have difficulty in moving the inner race counterclockwise or you may be unable to move the race at all.

Whine Noise

IMPORTANT: Do not confuse this noise with pump whine noise, which is usually noticeable

in PARK, NEUTRAL and all other gear ranges. Pump whine will vary with line pressure.

You may notice a torque converter whine when the vehicle is stopped and the transmission is in DRIVE or REVERSE. This noise will increase as you increase the engine RPM. The noise will stop when the vehicle is moving or when you apply the torque converter clutch, because both halves of the converter are turning at the same speed.

Perform a stall test to make sure the noise is actually coming from the converter:

1. Place your foot on the brake.
2. Put the gear selector in DRIVE.

NOTE: You may damage the transmission if you depress the accelerator for more than 6 seconds.

3. Depress the accelerator to approximately 1,200 RPM for no more than six seconds.

A torque converter noise will increase under this load.

Torque Converter Clutch Shudder

The key to diagnosing TCC shudder is to note when it happens and under what conditions.

TCC shudder which is caused by the transmission should only occur during the apply or the release of the converter clutch. Shudder should never occur after the TCC plate is fully applied.

If the shudder occurs while the TCC is applying, the problem can be within the transmission or the torque converter. Something is causing one of the following conditions to occur:

- Something is not allowing the clutch to become fully engaged.
- Something is not allowing the clutch to release.
- The clutch is releasing and applying at the same time.

One of the following conditions may be causing the condition to occur:

- Leaking turbine shaft seals
- A restricted release orifice
- A distorted clutch or housing surface due to long converter bolts
- Defective friction material on the TCC plate

If Shudder Occurs After TCC has Applied

IMPORTANT: If shudder occurs after the TCC has applied, most of the time there is nothing wrong with the transmission.

As mentioned above, the TCC is not likely to slip after the TCC has been applied. Engine problems may go unnoticed under light throttle and load, but they become noticeable after the TCC apply when going up a hill or accelerating. This is due to the mechanical coupling between the engine and the transmission.

Once TCC is applied, there is no torque converter, fluid coupling, assistance. Engine or driveline vibrations could be unnoticeable before TCC engagement.

Inspect the following components in order to avoid misdiagnosis of TCC shudder. An inspection will also avoid the unnecessary disassembly of a transmission or the unnecessary replacement of a torque converter.

- Spark plugs

  Inspect for cracks, high resistance or a broken insulator.

- Plug wires

  Look in each end. If there is red dust, ozone, or a black substance, carbon, present, the wires are bad. Also look for a white discoloration of the wire. This indicates arcing during hard acceleration.

- Coil

  Look for a black discoloration on the bottom of the coil. This indicates arcing while the engine is misfiring.

- Fuel injector

  The filter may be plugged.

- Vacuum leak

  The engine will not get a correct amount of fuel. The mixture may run rich or lean depending on where the leak occurs.

- EGR valve

  The valve may let in too much or too little unburnable exhaust gas and could cause the engine to run rich or lean.

- MAP/MAF sensor

  Like a vacuum leak, the engine will not get the correct amount of fuel for proper engine operation.

- Carbon on the intake valves

  Carbon restricts the proper flow of air/fuel mixture into the cylinders.

- Flat cam

Valves do not open enough to let the proper fuel/air mixture into the cylinders.

- Oxygen sensor

  This sensor may command the engine too rich or too lean for too long.

- Fuel pressure

  This may be too low.

- Engine mounts

  Vibration of the mounts can be multiplied by TCC engagement.

- Axle joints

  Check for vibration.

- TP Sensor

  The TCC apply and release depends on the TP sensor in many engines. If the TP sensor is out of specification, TCC may remain applied during initial engine loading.

- Cylinder balance

  Bad piston rings or poorly sealing valves can cause low power in a cylinder.

- Fuel contamination

  This causes poor engine performance.

Torque Converter Evaluation and Diagnosis

Replace the torque converter if any of the following conditions exist:

- External leaks appear in the hub weld area.
- The converter hub is scored or damaged.
- The converter pilot is broken, damaged, or fits poorly into the crankshaft.
- You discover steel particles after flushing the cooler and the cooler lines.
- The pump is damaged, or you discover steel particles in the converter.
- The vehicle has TCC shudder and/or no TCC apply. Replace the torque converter only after all hydraulic and electrical diagnoses have been made. The converter clutch material may be glazed.
- The converter has an imbalance which cannot be corrected. Refer to **Flexplate/Torque Converter Vibration Test**.
- The converter is contaminated with engine coolant which contains antifreeze.

- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch.
- You discover steel particles or clutch lining material in the fluid filter or on the magnet, when no internal parts in the unit are worn or damaged. This condition indicates that lining material came from the converter.

Do not replace the torque converter if you discover any of the following symptoms:

- The oil has an odor or the oil is discolored, even though metal or clutch facing particles are not present.
- The threads in one or more of the converter bolt holds are damaged. Correct the condition with a new thread insert.
- Transmission failure did not display evidence of damaged or worn internal parts, steel particles or clutch plate lining material in the unit and inside the fluid filter.
- The vehicle has been exposed to high mileage only. An exception may exist where the lining of the torque converter clutch dampener plate has seen excess wear by vehicles operated in heavy and/or constant traffic, such as taxi, delivery, or police use.

FLEXPLATE/TORQUE CONVERTER VIBRATION TEST

Isolating Vibration

NOTE: **Some engine/transaxle combinations cannot be balanced in this manner due to restricted access or limited clearances between the torque converter bolts and the engine. Ensure that the bolts do not bottom out in the lug nuts or the torque converter cover which could dent and cause internal damage.**

To isolate and correct a flywheel or torque converter vibration, separate the torque converter from the flywheel to determine if vibration is in the engine or transmission.

1. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration.
2. Turn the engine OFF.
3. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the transmission converter cover bolts and the cover.
5. Mark the relationship of the converter to the flywheel.
6. Remove the bolts attaching the converter to the flywheel.
7. Slide the torque converter away from the flywheel.
8. Rotate the flywheel and torque converter to inspect for defects or missing balance weights. Refer to **Automatic Transmission Flex Plate Cleaning and Inspection** .
9. Lower the vehicle.
10. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to **Diagnostic Starting Point - Vibration Diagnosis and Correction** .
11. Turn the engine OFF.

Indexing Torque Converter

To determine and correct a torque converter vibration, the following procedure may have to be performed several times to achieve the best possible torque converter to flywheel balance.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Rotate the torque converter one bolt position.

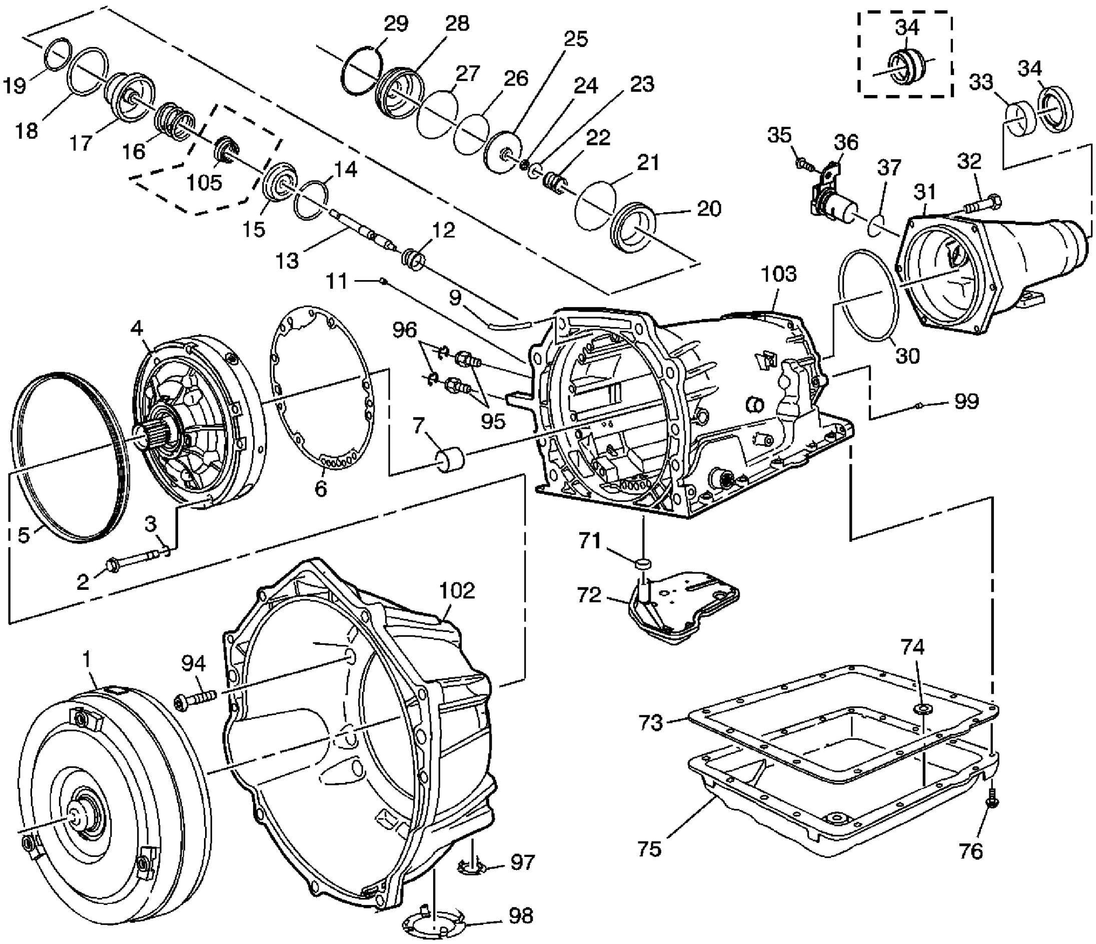


Fig. 2: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS CORP.

3. Align the torque converter hub (2) in the engine crankshaft (3) and install the torque converter to flywheel bolts.
4. Lower the vehicle.
5. With the engine at idle speed and the transmission in PARK or NEUTRAL, observe the vibration. Refer to **Noise and Vibration Analysis** .

   Repeat this procedure until you obtain the best possible balance.

6. Install the transmission converter cover bolts and the cover.

NOISE AND VIBRATION ANALYSIS

A noise or vibration that is noticeable when the vehicle is in motion MAY NOT be the result of the transmission.

If noise or vibration is noticeable in PARK and NEUTRAL with the engine at idle, but is less noticeable as RPM increases, the cause may be from poor engine performance.

- Vibration may also be caused by a small amount of water inside the converter.
- Inspect the tires for the following conditions:
  - Uneven wear
  - Imbalance
  - Mixed sizes
  - Mixed radial and bias ply
- Inspect the suspension components for the following conditions:
  - Alignment wear or damage
  - Loose fasteners
  - Driveline damage or wear
- Inspect the engine and transmission mounts for damage and loose bolts.
- Inspect the transmission case mounting holes for the following conditions:
  - Missing bolts, nuts, and studs
  - Stripped threads
  - Cracks
- Inspect the flywheel for the following conditions:
  - Missing or loose bolts
  - Cracks
  - Imbalance
- Inspect the torque converter for the following conditions:
  - Missing or loose bolts or lugs
  - Missing or loose balance weights
  - Imbalance caused by heat distortion or fluid contamination

CLUTCH PLATE DIAGNOSIS

Composition Plates

Dry the plates and inspect the plates for the following conditions:

- Pitting

- Flaking
- Delamination-splitting or separation of bonded clutch material
- Wear
- Glazing
- Cracking
- Charring
- Chips or metal particles embedded in the lining

Replace a composition plate which shows any of these conditions.

Steel Plates

Wipe the plates dry and check the plates for heat discoloration. If the surfaces are smooth, even if color smear is indicated, you can reuse the plate. If the plate is discolored with heat spots or if the surface is scuffed, replace the plate.

Causes of Burned Clutch Plates

The following conditions can result in a burned clutch plate:

- Incorrect usage of clutch or apply plates
- Engine coolant or water in the transmission fluid
- A cracked clutch piston
- Damaged or missing seals
- Low line pressure
- Valve body conditions
  - The valve body face is not flat.
  - Porosity is between channels.
  - The valve bushing clips are improperly installed.
  - The checkballs are misplaced.
- The Teflon® seal rings are worn or damaged.

ENGINE COOLANT/WATER IN TRANSMISSION

NOTE: The antifreeze or water will deteriorate the seals, gaskets and the glue that bonds the clutch material to the pressure plate. Both conditions may cause damage to the transmission.

If antifreeze or water has entered the transmission, perform the following:

1. Disassemble the transmission.
2. Replace all of the rubber type seals. The coolant will attack the seal material which will cause leakage.

3. Replace the composition-faced clutch plate assemblies. The facing material may separate from the steel center portion.
4. Replace all of the nylon parts - washers.
5. Replace the torque converter.
6. Thoroughly clean and rebuild the transmission, using new gaskets and oil filter.
7. Flush the cooler lines after the transmission cooler has been properly repaired or replaced.

FLUID LEAK DIAGNOSIS

General Method

1. Verify that the leak is transmission fluid.
2. Thoroughly clean the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Park the vehicle over clean paper or cardboard.
5. Shut OFF the engine.
6. Look for fluid spots on the paper.
7. Make the necessary repairs.

Powder Method

1. Thoroughly clean the suspected leak area with solvent.
2. Apply an aerosol type powder, such as foot powder, to the suspected leak area.
3. Operate the vehicle for 24 km (15 mi), or until normal operating temperatures are reached.
4. Shut OFF the engine.
5. Inspect the suspected leak area.
6. Trace the leak path through the powder in order to find the source of the leak.
7. Make the necessary repairs.

Dye and Black Light Method

A fluid dye and black light kit is available from various tool manufacturers.

1. Follow the manufacturer's instructions in order to determine the amount of dye to use.
2. Detect the leak with the black light.
3. Make the necessary repairs.

Find the Cause of the Leak

Pinpoint the leak and trace the leak back to the source. You must determine the cause of the leak in order to repair the leak properly. For example, if you replace a gasket, but the sealing flange is bent, the new gasket will not repair the leak. You must also repair the bent flange. Before you attempt to repair a leak, check for the following conditions, and make repairs as necessary:

Gaskets

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Improperly tightened fasteners
- Dirty or damaged threads
- Warped flanges or sealing surface
- Scratches, burrs, or other damage to the sealing surface
- Damaged or worn gasket
- Cracking or porosity of the component
- Improper sealant used, where applicable
- Incorrect gasket

Seals

- Fluid level/pressure is too high
- Plugged vent or drain-back holes
- Damaged seal bore
- Damaged or worn seal
- Improper installation
- Cracks in component
- Manual or output shaft surface is scratched, nicked, or damaged
- Loose or worn bearing causing excess seal wear

Possible Points of Fluid Leaks

Transmission Oil Pan

- Incorrectly tightened oil pan bolts
- Improperly installed or damaged oil pan gasket
- Damaged oil pan or mounting face
- Incorrect oil pan gasket

Case Leak

- Damaged or missing fill tube seal
- Mislocated fill tube bracket
- Damaged vehicle speed sensor seal
- Damaged manual shaft seal
- Loose or damaged oil cooler connector fittings
- Worn or damaged propeller shaft oil seal
- Loose line pressure pipe plug

- Warped
- Distorted torque converter housing
- Porous casting

Leak at the Torque Converter End

- Converter leak in the weld area
- Converter seal lip cut. Check the converter hub for damage
- Converter seal bushing moved forward and damaged
- Converter seal garter spring missing from the seal
- Porous casting of the transmission case or the oil pump

Leak at the Vent Pipe or the Fluid Fill Tube

- Overfilled system
- Water or coolant in the fluid-the fluid will appear milky.
- Transmission case porous
- Incorrect fluid level indicator
- Plugged vent
- Drain-back holes plugged
- Mispositioned oil pump to case gasket, if equipped

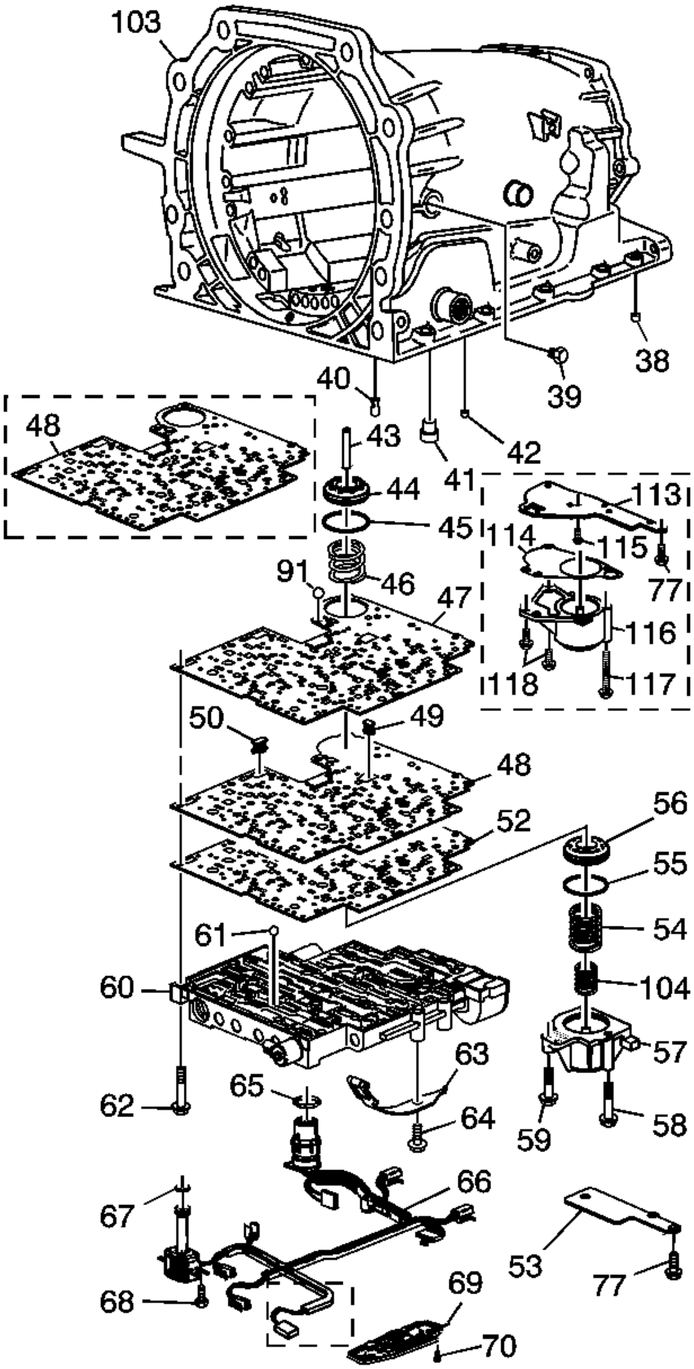


Fig. 3: Possible Fluid Leak Points
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

3	Bolt and Seal Assembly, A/Trans O/Pump
5	Seal, A/Trans Oil Pump
8	Connector, Transmission Oil Cooler Pipe
9	Pipe, Vent
15	Seal, Case Extension
20	Seal Asm., Prop Shaft Front Slip Yoke Oil
22	Sensor Assembly, A/T Input Speed and 2WD Output Speed (4WD Plug)
24	Plug, Line Pressure Test Hole
27	Bolt, Oil Pan
29	Seal, Transmission Oil Pan
34	Harness Assembly, A/Trans Wiring
201	Seal Asm., Torque Converter Oil
707	Seal, Manual Shift Shaft

CASE POROSITY REPAIR

Some external leaks are caused by case porosity in non-pressurized areas. You can usually repair these leaks with the transmission in the vehicle.

1. Thoroughly clean the area to be repaired with a cleaning solvent. Air dry the area.

CAUTION: Epoxy adhesive may cause skin irritations and eye damage. Read and follow all information on the container label as provided by the manufacturer.

2. Using instructions from the manufacturer, mix a sufficient amount of an epoxy to make the repair.
3. While the transmission case is still hot, apply the epoxy. You can use a clean, dry soldering acid brush to clean the area and also to apply the epoxy cement. Make certain that the area to be repaired is fully covered.
4. Allow the epoxy cement to cure for three hours before starting the engine.
5. Repeat the fluid leak diagnosis procedures.

SHIFT SOLENOID LEAK TEST

Tools Required

J 44246 Solenoid Testing Kit

Procedure

IMPORTANT:

- **This procedure tests On/Off type solenoid valves.**
- **Visually inspect the physical condition of the solenoid before testing. Inspect the O-rings before and after the test to be sure that**

they are not cut or damaged.

1. Remove the solenoid from the control valve body. Refer to **Valve Body and Pressure Switch Replacement**.

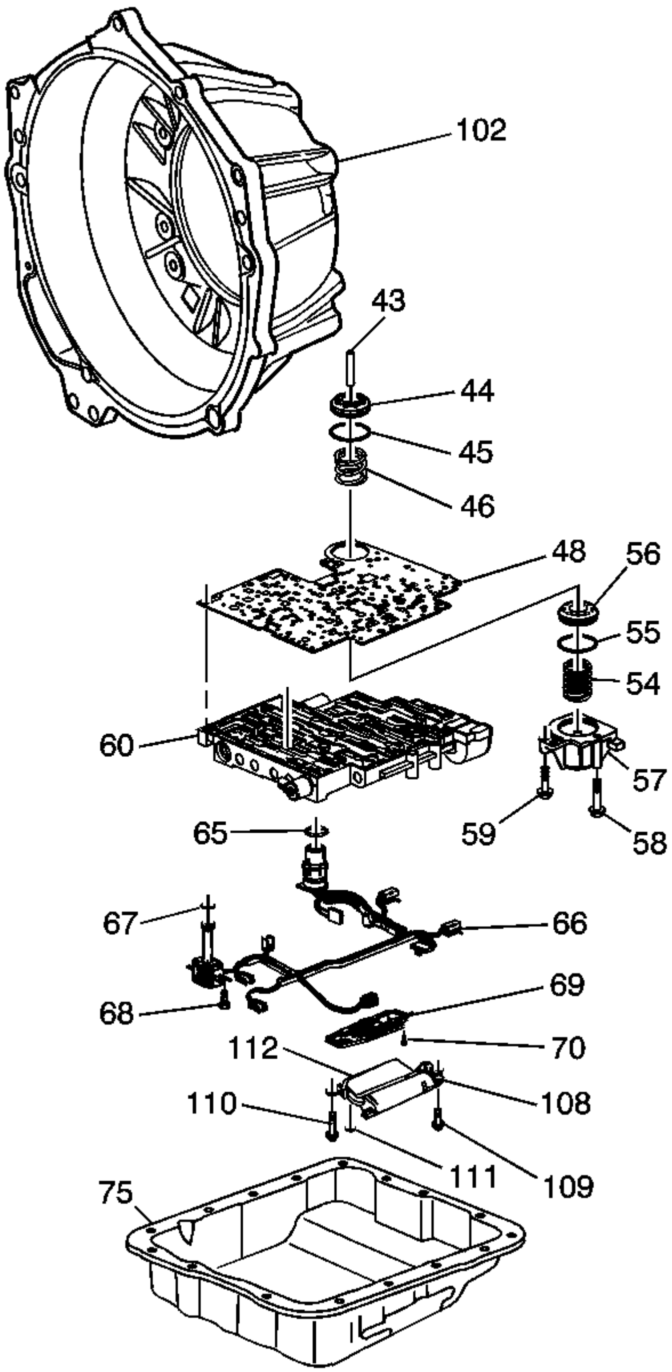


Fig. 4: View of Shift Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

2. Install the 1-2 shift solenoid valve or the 2-3 shift solenoid valve into bore number 1 of the **J 44246** and install the factory bolt to retain the solenoid.

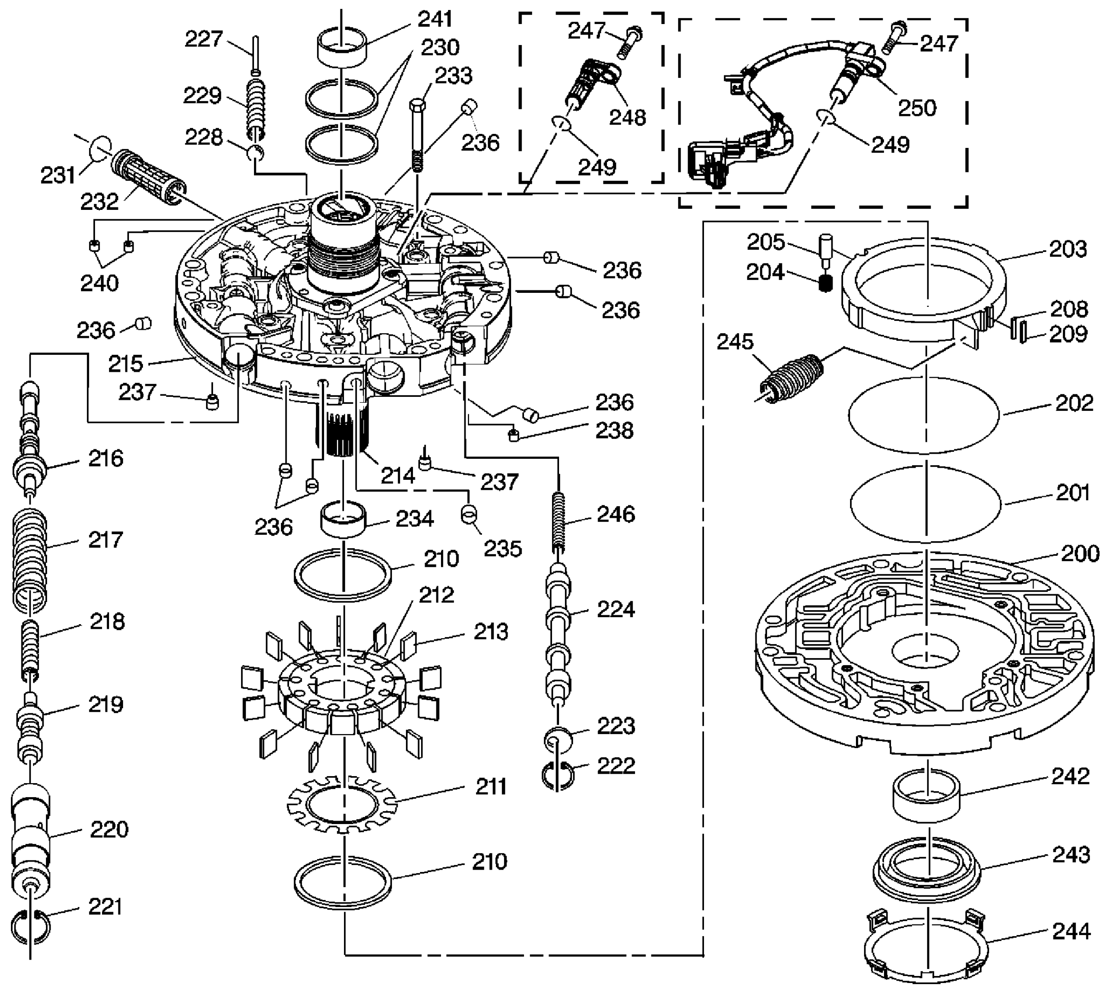


Fig. 5: Connecting Solenoid Testing Harness
Courtesy of GENERAL MOTORS CORP.

3. Connect the solenoid testing harness supplied with the **J 44246** to the solenoid.

IMPORTANT: Do not use air pressure in excess of 827 kPa (120 psi). Excessive pressure will not allow the solenoid ball check valve to seat properly. Recommended air pressure is 345 kPa (50 psi).

4. Apply compressed air to the **J 44246** .
5. Air should flow through the solenoid. If air does not flow through the solenoid, replace the solenoid.

Refer to **Valve Body and Pressure Switch Replacement**.

6. Connect the solenoid testing harness to the 12 volt positive and negative (-) battery terminals.
7. Observe if the solenoid is operating electrically. An audible clicking noise can be heard when connecting or disconnecting power.

IMPORTANT:
- **All solenoids need to be energized to seal.**
- **A small amount of air leakage is normal +/- 21 kPa (+/- 3 psi).**

8. Observe the air flow through the solenoid. The flow will completely or nearly completely stop. Replace the solenoid if there continues to be an obvious air leak when the solenoid is energized.

IMPORTANT: Inspect the O-rings after the test to be sure that they are not cut or damaged.

9. Install the solenoid into the control valve body. Refer to **Valve Body and Pressure Switch Replacement**.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST (J 35944-A)

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission wear-out. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

IMPORTANT: For FWD, use the J 35944-A transmission oil cooler and line flusher or equivalent to flush the transmission oil cooler and the oil cooler pipes whenever the transaxle is removed for the following repairs:

- **Torque converter**
- **Oil pump**
- **Oil pump drive shaft**
- **Drive sprocket support**
- **Transaxle overhaul complete**
- **Transaxle assembly replacement**

IMPORTANT: For RWD, use the J 35944-A or equivalent to flush the transmission oil cooler and the oil cooler pipes whenever the transmission is removed for the following repairs:

- **Torque converter**
- **Oil pump**
- **Turbine shaft**

- **Transmission overhaul complete**
- **Transmission assembly replacement**

Only GM Goodwrench DEXRON®VI automatic transmission fluid should be used when doing a repair on a GM transmission.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing are as follows:

Cooler Flow Check and Flushing Steps

1. Tools Required
2. Preparation
3. Back Flush
4. Forward Flush
5. Flow Check
6. Clean-up

Tools Required

- **J 35944-A** Transmission Oil Cooler and Line Flusher
- **J 35944-22** Transmission Oil Cooler Flushing Fluid
- **J 35944-200** Cooler Flushing Adapter
- Measuring cup
- Funnel
- Water supply - hot water recommended
- Water hose, at least 16 mm (5/8 in) ID
- Shop air supply with water/oil filters, regulator and pressure gage
- Air chuck with clip, if available
- Oil drain container
- Pail with lid - 19 L (5 gallon)
- Eye protection
- Rubber gloves

Preparation

1. During the installation of the repaired or replacement transmission, do not connect the oil cooler pipes.

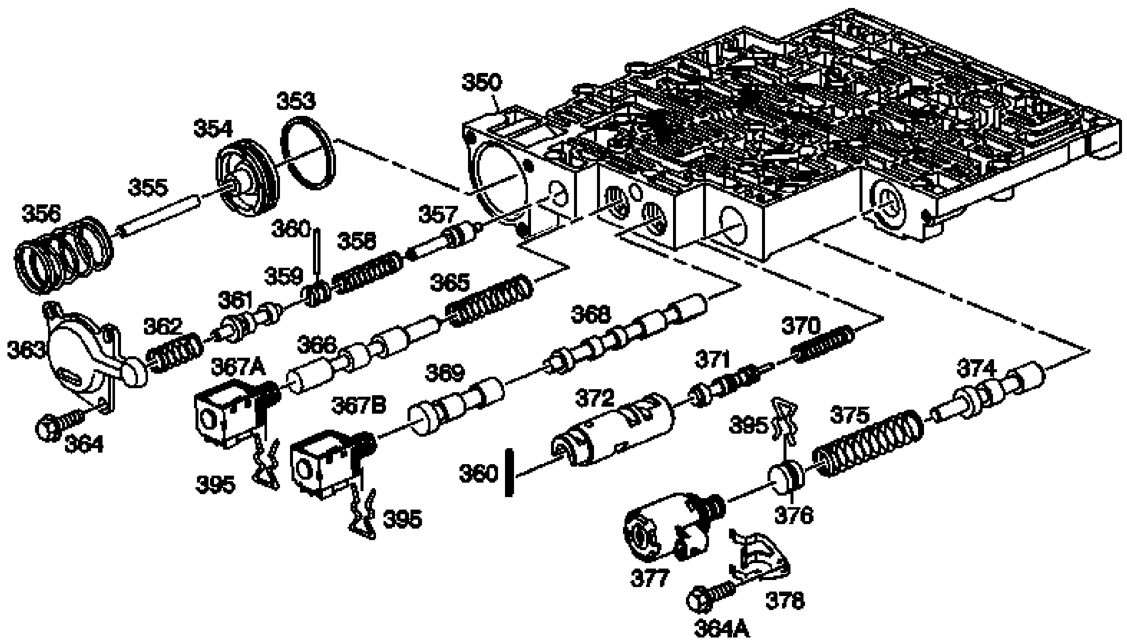


Fig. 6: Identifying Flusher Tank & Components
Courtesy of GENERAL MOTORS CORP.

NOTE: **Do not use solutions that contain alcohol or glycol. Use of solutions that contain alcohol or glycol may damage the oil cooler line flusher, oil cooler components and/or transmission components.**

IMPORTANT: **The J 35944-22 is environmentally safe, yet powerful enough to cut through transmission fluid to dislodge any contaminants from the cooler. The safety precautions on the label, regarding potential skin and eye irritations associated with prolonged exposure, are typical precautions that apply to many similar cleaning solutions. It should be noted that according to GM, use of other non-approved fluids for cooler flushing can have an adverse reaction to the seals inside the transmission.**

2. Remove the fill cap (9) on the **J 35944-A** and fill the flusher tank (4) with 0.6 L (20-21 oz) of **J 35944-22** , using the measuring cup (6). Do not overfill.
3. Install the fill cap (9) on the **J 35944-A** and pressurize the flusher tank (4) to 550-700 kPa (80-100 psi), using the shop air supply at the tank air valve (2).
4. With the water supply valve (1) on the **J 35944-A** in the OFF position, connect the water supply hose from the **J 35944-A** to the water supply at the faucet.
5. Turn ON the water supply at the faucet.

Back Flush

1. Inspect the transmission oil cooler pipes for kinks or damage. Repair as necessary.

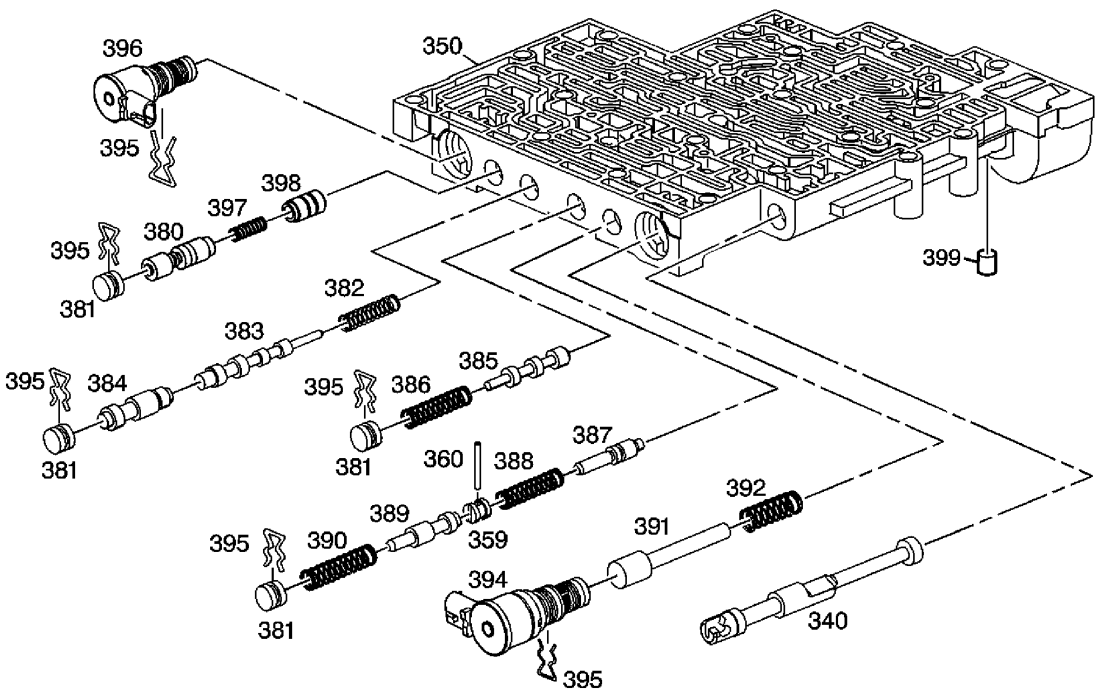


Fig. 7: Connecting J 35944 To Oil Cooler
Courtesy of GENERAL MOTORS CORP.

2. Connect the **J 35944-A** to the oil cooler feed front connector. Use the **J 35944-200** , if required.
3. Clip the discharge hose (2) onto the oil drain container.
4. Attach the **J 35944-A** to the undercarriage of the vehicle with the hook provided and connect the flushing system feed supply hose (1) from the **J 35944-A** to the rear connector oil cooler return pipe. Use the **J 35944-200** , if required.
5. Turn the **J 35944-A** water supply valve (3) to the ON position and allow water to flow through the oil cooler and pipes for 10 seconds to remove any remaining transmission fluid. If water does not flow through the oil cooler and pipes, the cause of the blockage must be diagnosed and the plugged component must be repaired or replaced. Continue with the cooler flushing and flow check procedure once the blockage is corrected.
6. Turn the **J 35944-A** water supply valve (3) to the OFF position and clip the discharge hose onto a 19 liter (5 gallon) pail with a lid, to avoid splashback.

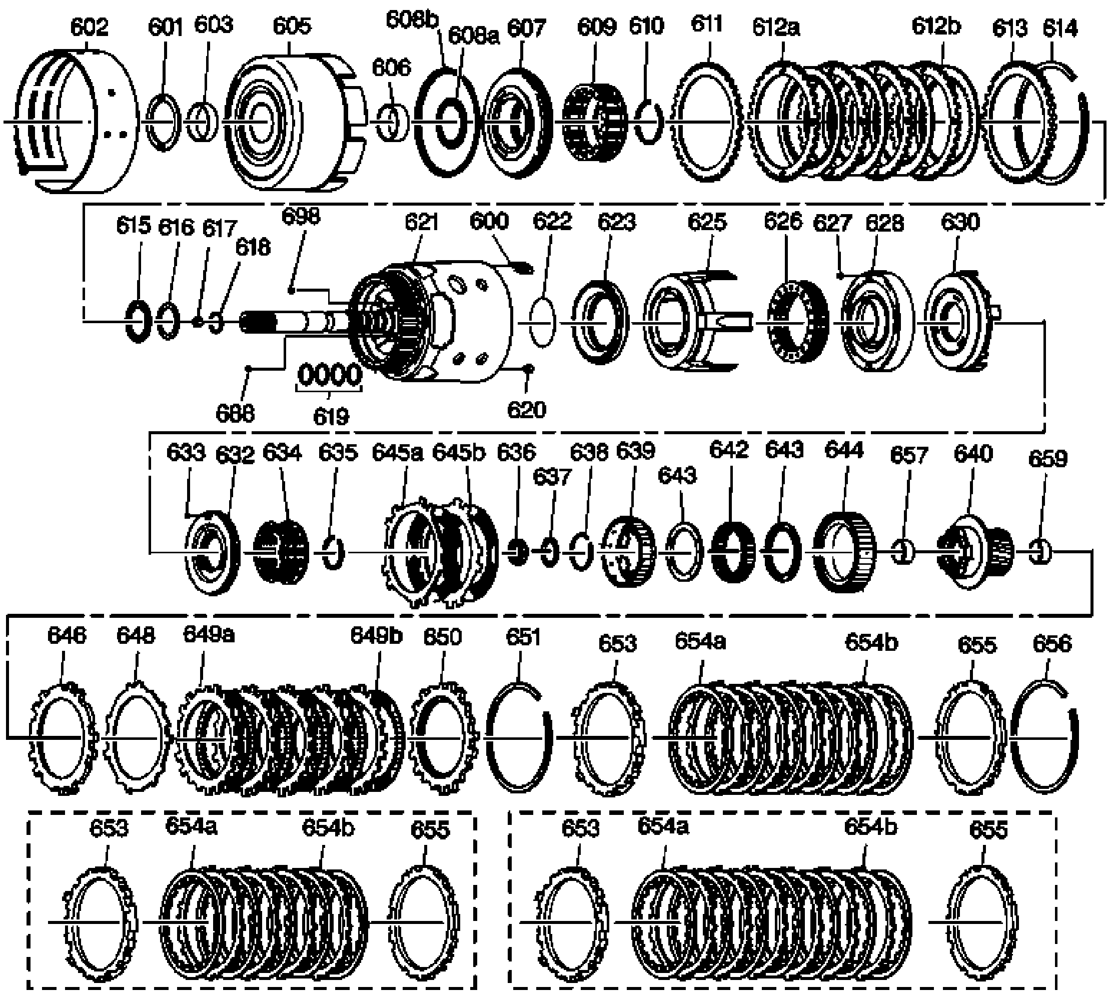


Fig. 8: J 35944-A Water Supply Valve ON/OFF Positions
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Flushing for approximately 2 minutes in each cooler line direction will result in a total of about 8-10 gallons of waste fluid. This mixture of water and flushing fluid is to be captured in a bucket or similar container.

7. Turn the **J 35944-A** water supply valve (3) to the ON position and depress the trigger (1) to mix cooler flushing solution into the water flow. Use the clip provided on the handle to hold the trigger (1) down. The discharge will foam vigorously when the solution is introduced into the water stream.
8. Flush the oil cooler and pipes with water and solution for 2 minutes. During this flush, attach the shop air supply 825 kPa (120 psi) to the flushing system feed air valve (2) located on the **J 35944-A** , for 3-5 seconds at the end of every 15-20 second interval to create a surging action.
9. Release the trigger (1) and turn the **J 35944-A** water supply valve (3) to the OFF position.

Forward Flush

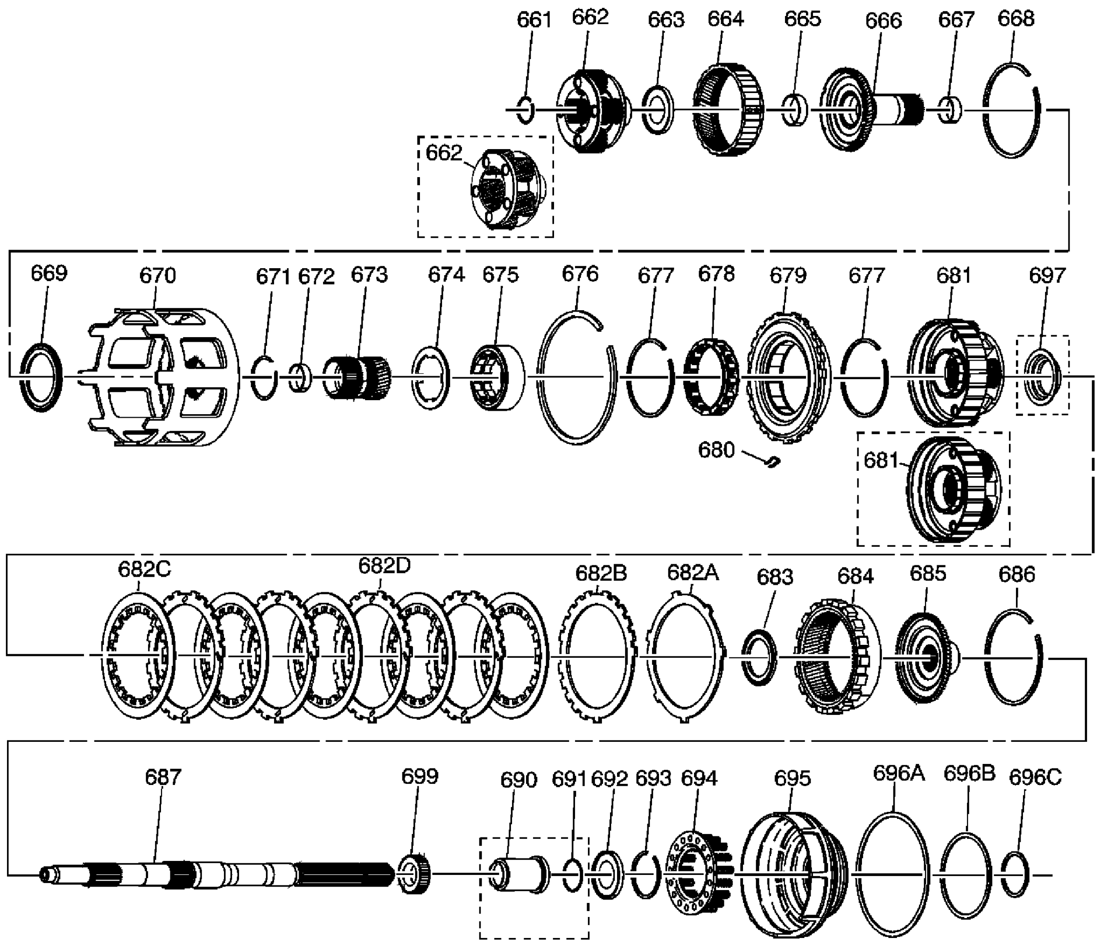


Fig. 9: Connecting J 35944 To Oil Cooler
Courtesy of GENERAL MOTORS CORP.

1. Disconnect both hoses (1 and 2) from the oil cooler pipes and connect them to the opposite oil cooler pipe. This will allow the oil cooler and pipes to be flushed in the normal flow direction.
2. Repeat Step 6 and 7 of the Back Flush.

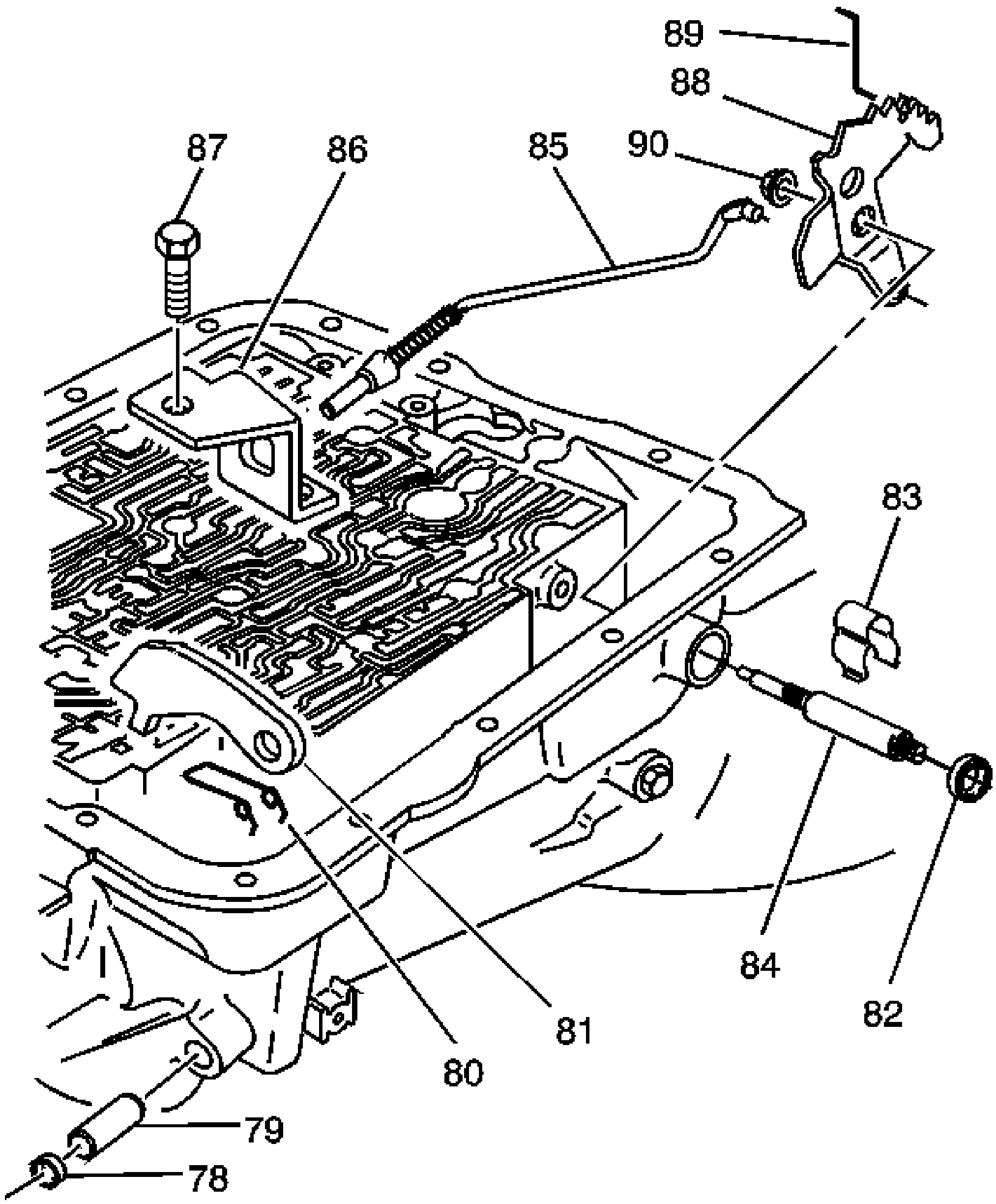


Fig. 10: J 35944-A Water Supply Valve ON/OFF Positions
Courtesy of GENERAL MOTORS CORP.

3. Release the trigger (1) of the **J 35944-A** and allow water only to rinse the oil cooler and pipes for 1 minute.
4. Turn the **J 35944-A** water supply valve (3) to the OFF position and turn OFF the water supply at the

faucet.

5. Attach the shop air supply to the flushing system feed air valve (2) on the **J 35944-A** and blow out the water from the oil cooler and pipes. Continue, until no water comes out of the discharge hose.

Flow Test

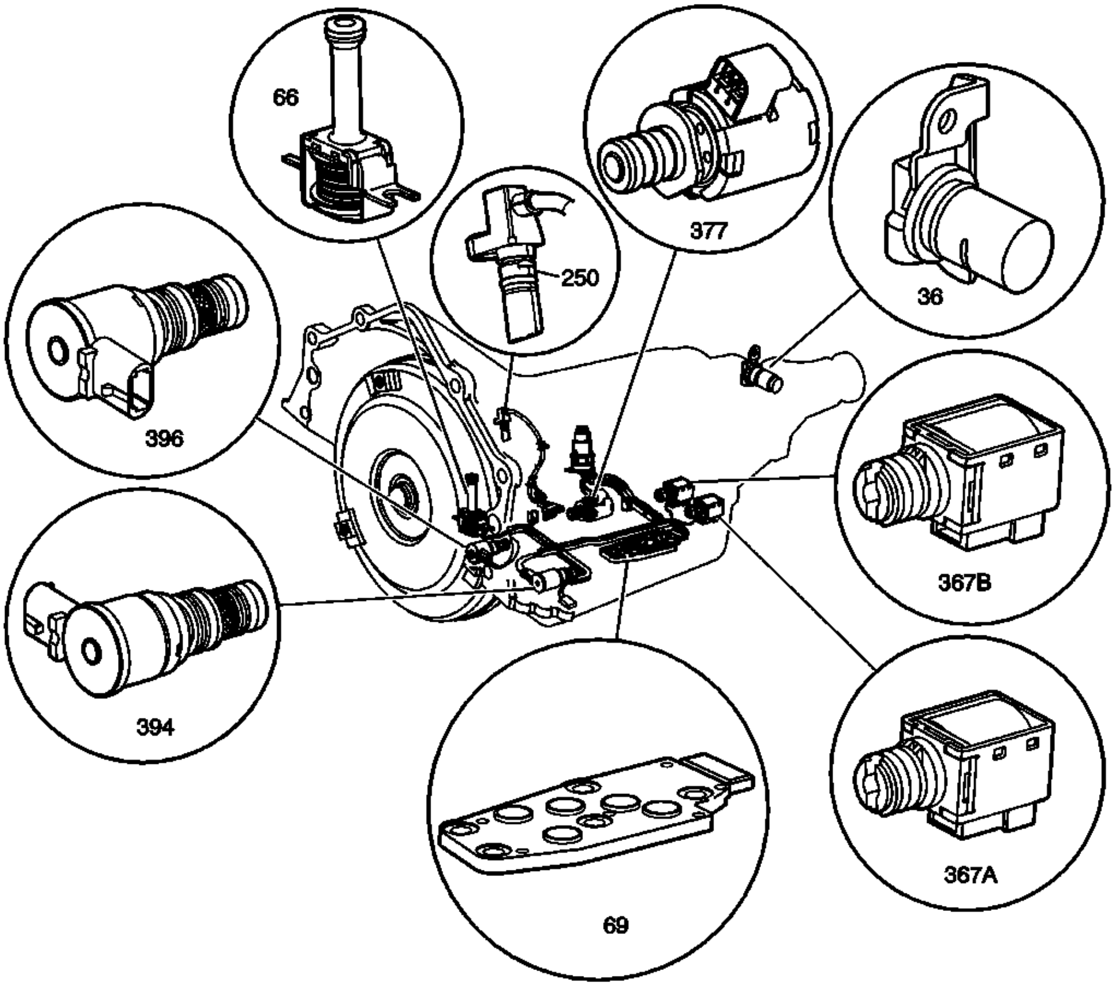


Fig. 11: Clipping Discharge Hose To Empty Oil Container
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The Flow Test must be performed after the flush to ensure that all flushing solution and water is removed from the oil cooling system.

1. Disconnect the hose from the oil cooler pipe. Connect the oil cooler feed pipe, front connector, to the transmission for normal flow.
2. Clip the discharge hose (1) to an empty oil container.
3. Confirm the transmission is filled with automatic transmission fluid. Refer to **Fluid Capacity Specifications** for the correct automatic transmission fluid capacity.
4. Start the engine with the transmission in PARK range and run for 30 seconds after fluid begins to flow

from the discharge hose (1). A minimum of 1.9 L (2 qt) must be discharged during this 30 second run time.

5. If the fluid flow meets or exceeds 1.9 L (2 qt) in 30 seconds, connect the oil cooler feed pipe to the front connector on the transmission.
6. If fluid flow is less than 1.9 L (2 qt) in 30 seconds, perform the following diagnosis:
    1. Disconnect the **J 35944-A** discharge hose (1) from the oil cooler return pipe.
    2. Disconnect the oil cooler feed pipe at the radiator.
    3. Connect the **J 35944-A** discharge hose (1) to the oil cooler feed pipe, radiator end.
    4. Clip the discharge hose (1) onto the oil drain container.
    5. Start the engine with the transmission in PARK range and run for 30 seconds after fluid begins to flow from the discharge hose (1). A minimum of 1.9 L (2 qt) must be discharged during this 30 second run time.
7. If the amount of transmission fluid flow remains less than 1.9 L (2 qt) in 30 seconds, inspect the oil cooler feed pipe, front connector, for restrictions or damage. If no condition is found with the feed pipe, front connector, inspect the transmission.

Clean-up

1. Disconnect the water supply hose from the **J 35944-A** and bleed any remaining air pressure from the flusher tank.
2. Remove the fill cap from the **J 35944-A** and return any unused flushing solution to its container. Rinse the **J 35944-A** with water. Do not store the**J 35944-A** with flushing solution in it.
3. After every third use, clean the **J 35944-A** as described in the instructions included with the tool.
4. Dispose of any waste water/solution and transmission fluid in accordance with local regulations.

TRANSMISSION FLUID COOLER FLUSHING AND FLOW TEST (J 45096)

GM studies indicate that plugged or restricted transmission oil coolers and pipes cause insufficient transmission lubrication and elevated operating temperatures which can lead to premature transmission failure. Many repeat repair cases could have been prevented by following published procedures for transmission oil cooler flushing and flow checking. This procedure includes flow checking and flushing the auxiliary transmission oil cooler, if equipped.

IMPORTANT: Use the J 45096 transmission oil cooling system flush and flow test tool or equivalent to flush and flow test the transmission oil cooler and the oil cooler pipes after the transaxle is removed for repairs.

Only GM Goodwrench DEXRON®VI automatic transmission fluid should be used when doing a repair on a GM transmission.

Time allowance for performing the cooler flow checking and flushing procedure has been included in the appropriate labor time guide operations since the 1987 model year. The service procedure steps for oil cooler flushing and flow testing are as follows:

Cooler Flow Check and Flushing Steps

Procedure

1. Machine Set-up
2. Determine Minimum Flow Rate
3. Back Flush
4. Forward Flush
5. Flow Test
6. Code Recording Procedure
7. Clean-up

Tools Required

- **J 35944-200** Cooler Flushing Adapter
- **J 45096** Transmission Oil Cooling System Flush and Flow Test Tool
- Shop air supply with water/oil filters, regulator and pressure gage - minimum 90 PSI (621 kPa)
- Eye protection
- Rubber gloves

Machine Set-up

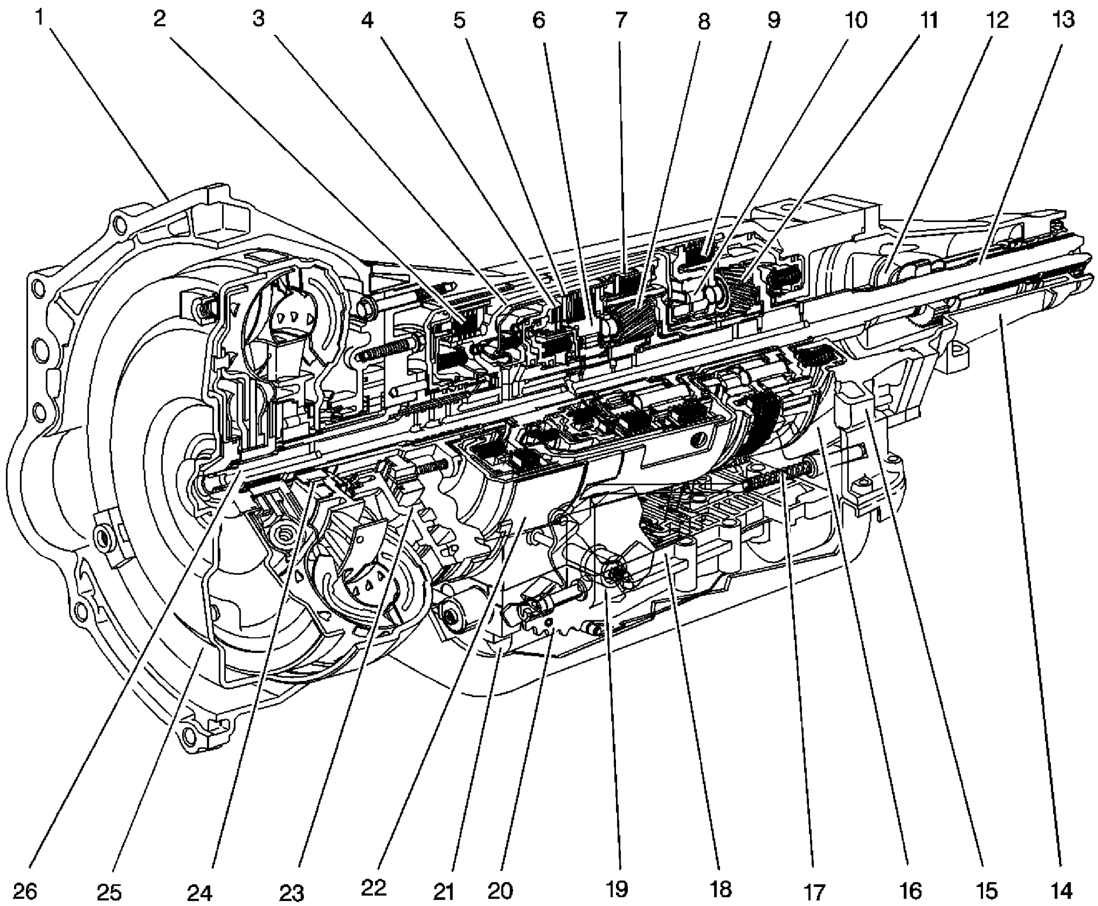


Fig. 12: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

1. Verify that the main power switch (1) is in the OFF position.
2. Place the main function switch (2) in the IDLE position.

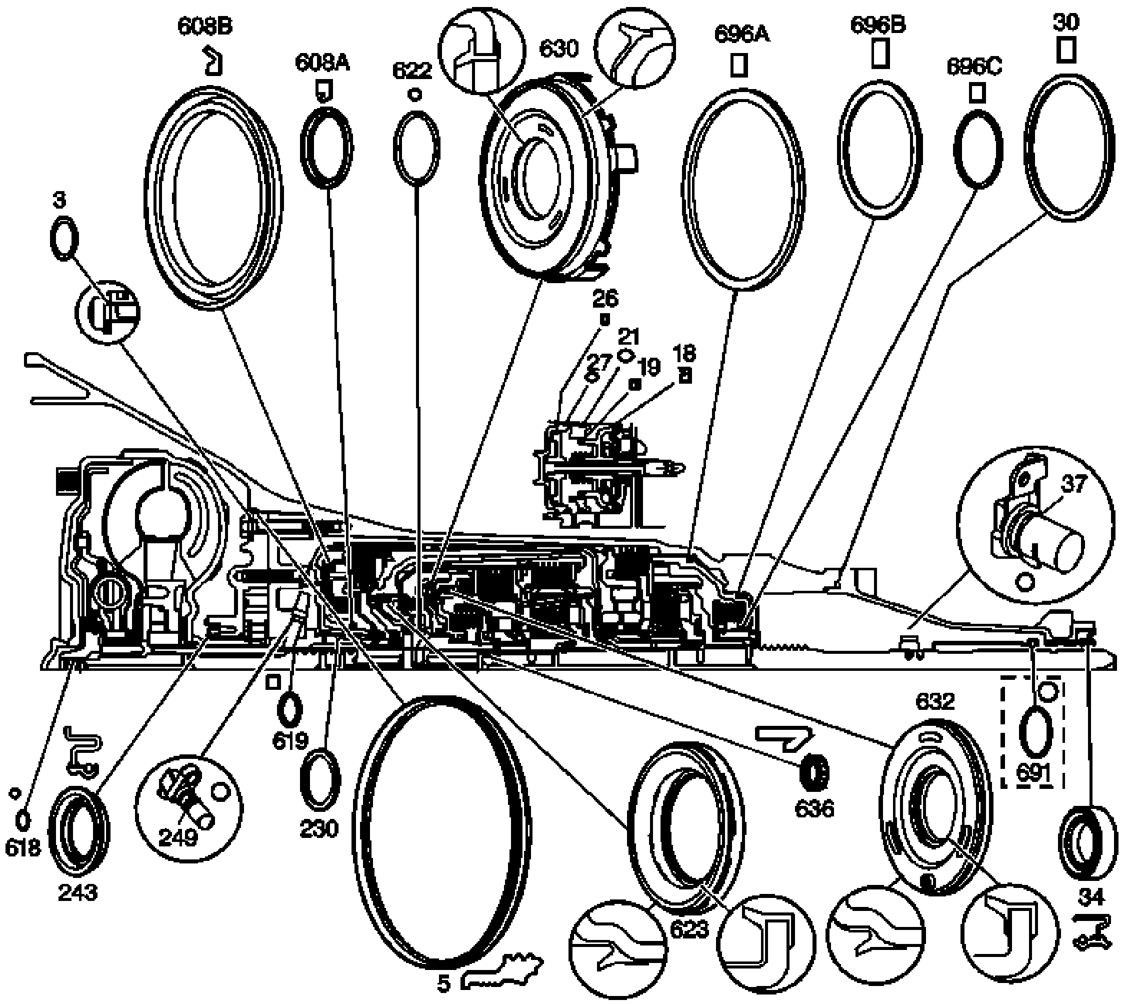


Fig. 13: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS CORP.

3. Connect **J 45096** to the vehicle 12 V DC power source by connecting the red battery clip to the positive, +, battery post on the vehicle and connect the negative lead to a known good chassis ground.
4. Turn the main power switch to the ON position.

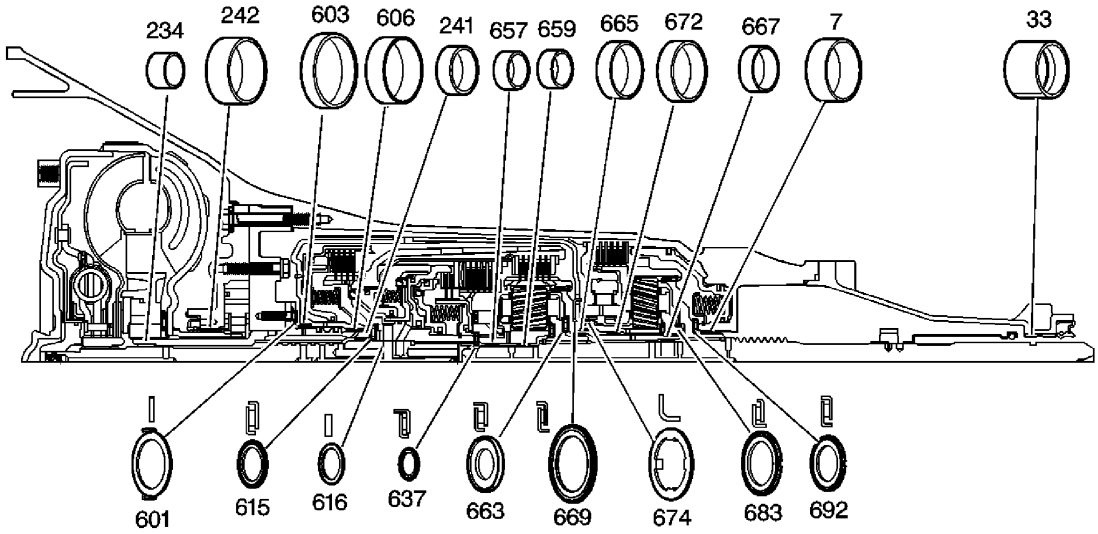


Fig. 14: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS CORP.

NOTE: **Do not overfill the supply vessel. Damage to the unit may result. To verify the fluid level, view the LCD screen display while filling the unit, to ensure the fluid level does not exceed 30 L (32 qt).**

5. Fill the supply tank with DEXRON®VI/Mercon®, or equivalent, through the fill port.
6. Install and tighten the fill cap.

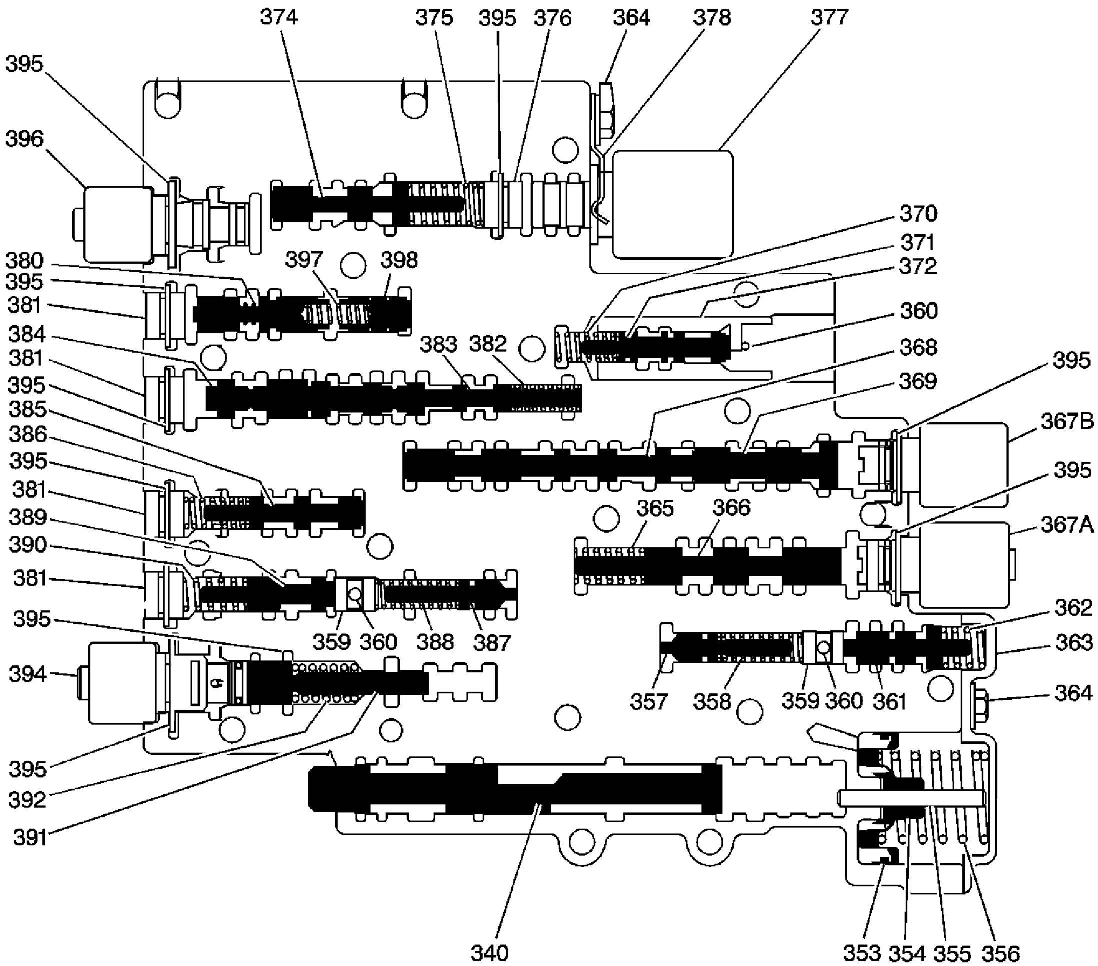


Fig. 15: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

7. Connect a shop air supply hose to the quick-disconnect on the rear panel marked SUPPLY AIR.

Determine Minimum Flow Rate

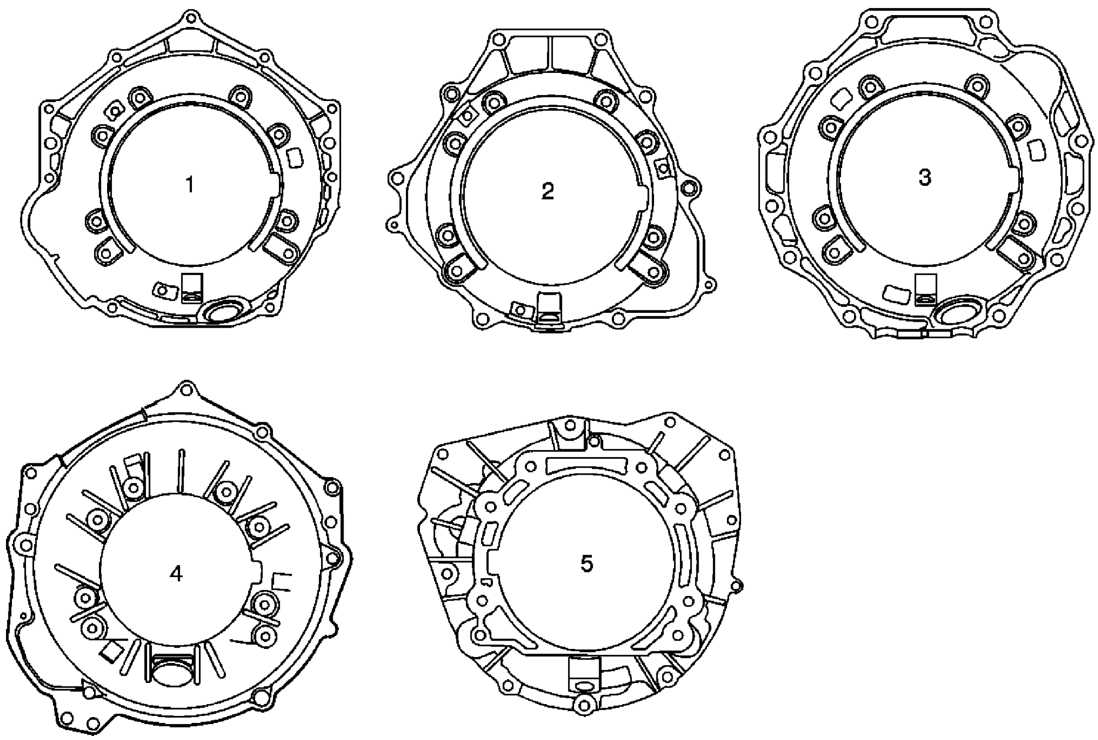


Fig. 16: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS CORP.

1. From the machine display, identify the temperature of the automatic transmission fluid that is stored in the supply vessel of **J 45096** .

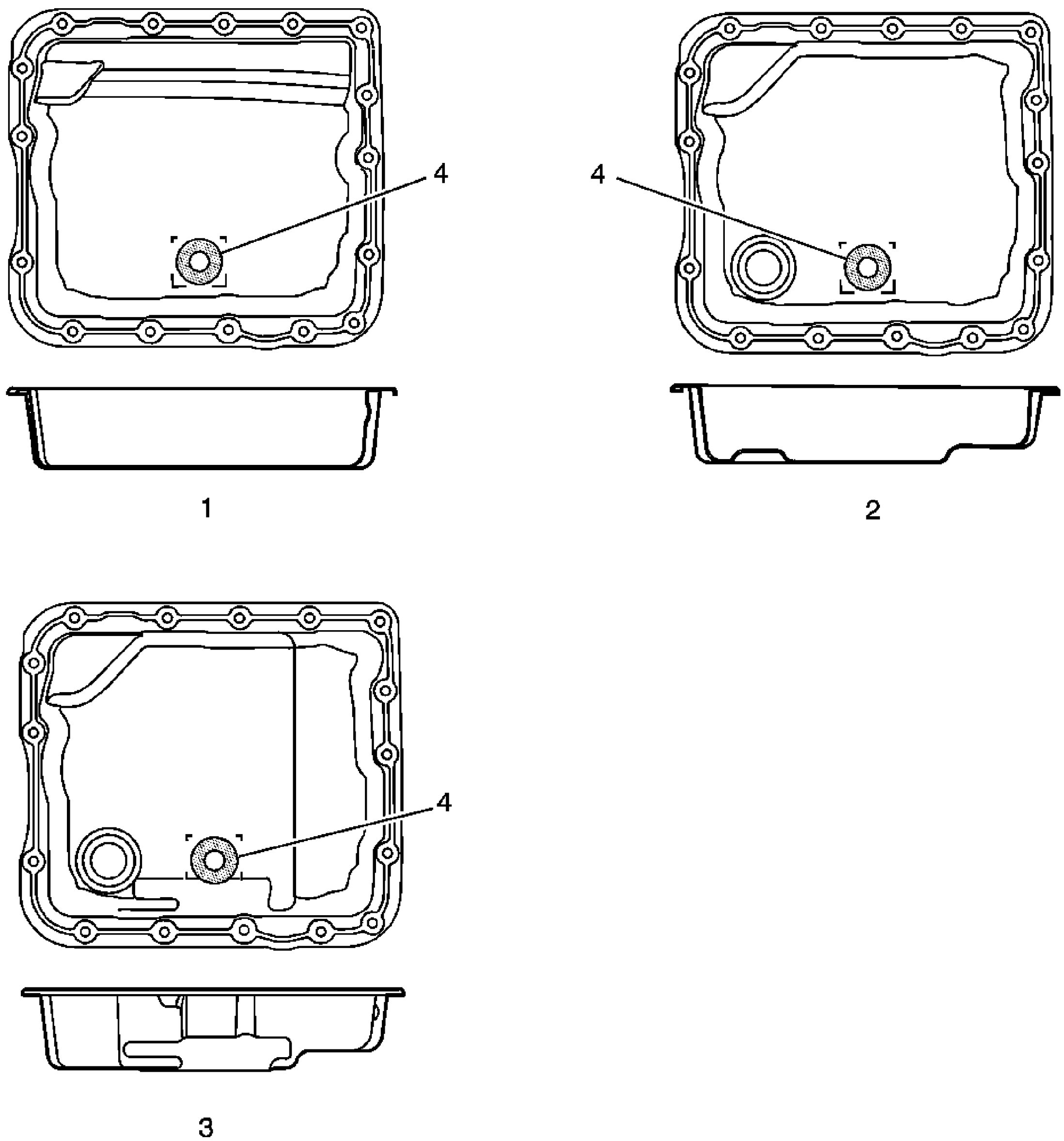


Fig. 17: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS CORP.

2. Determine whether the transmission oil cooler is steel or aluminum by using a magnet (1) at the cooler flange (2) at the radiator.
3. Refer to the table below. Using the temperature from Step 1, locate on either the Steel MINIMUM Flow Rate table or the Aluminum MINIMUM Flow Rate table the minimum flow rate in gallons per minutes (GPM). Record the minimum flow rate in GPM and the supply fluid temperature for further reference.

   Example::
   - Fluid temperature: 75°F
   - Cooler type: Steel

The MINIMUM flow rate for this example would be 0.8 GPM.

4. Inspect the transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed and refer to the appropriate GM service manual procedures.

Minimum Flow Rate in Gallons Per Minute (GPM)

Temperature Range	Steel	Aluminum
18-19°C (65-66°F)	0.6 gpm	0.5 gpm
19-21°C (67-70°F)	0.7 gpm	0.6 gpm
22-24°C (71-75°F)	0.8 gpm	0.7 gpm
24-27°C (76-80°F)	0.9 gpm	0.8 gpm
27-29°C (81-84°F)	1.0 gpm	0.9 gpm
29-32°C (85-89°F)	1.1 gpm	1.0 gpm
32-34°C (90-94°F)	1.2 gpm	1.1 gpm
35-37°C (95-98°F)	1.3 gpm	1.2 gpm
37-39°C (99-103°F)	1.4 gpm	1.3 gpm
40-42°C (104-108°F)	1.5 gpm	1.4 gpm
43-44°C (109-112°F)	1.6 gpm	1.5 gpm
45-47°C (113-117°F)	1.7 gpm	1.6 gpm
48-49°C (118-120°F)	1.8 gpm	1.7 gpm

Back Flush Procedure

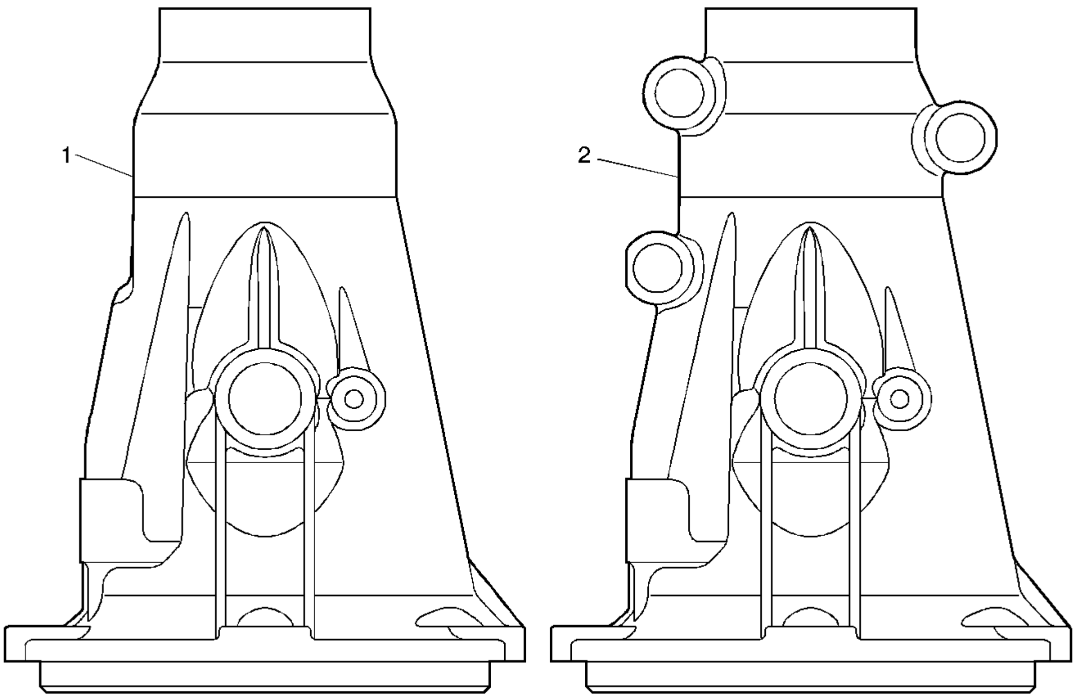


Fig. 18: Connecting J 45096 Adapters To Oil Cooler Supply And Return Lines
Courtesy of GENERAL MOTORS CORP.

1. Connect the **J 45096** adapters (1) to the vehicle's transmission oil cooler supply and return lines at the transmission. It may require the use of **J 35944-200** cooler flushing adapter.

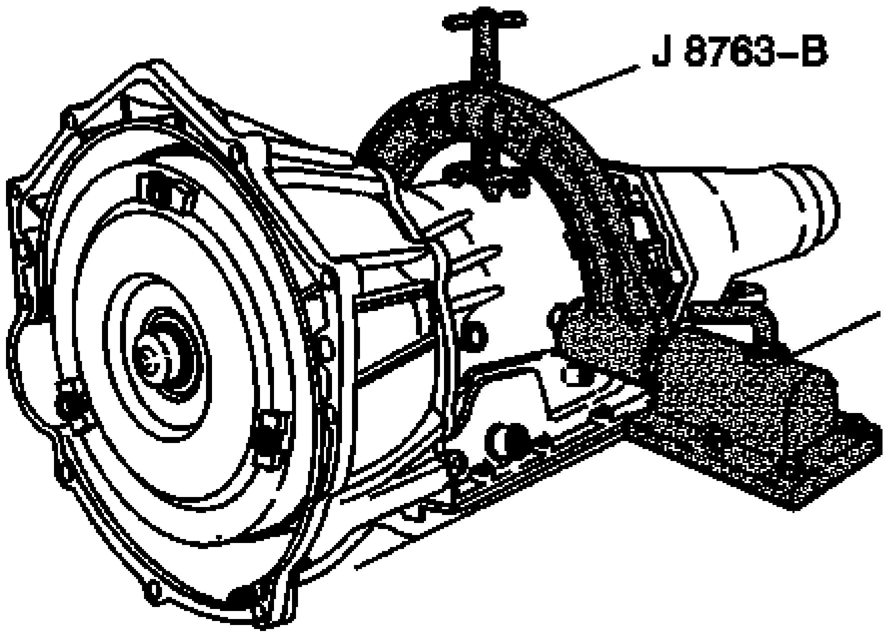


Fig. 19: Identifying Black Supply Hose And Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

2. Connect the black supply hose (1) to the return line, rear connector of the transmission, and the clear waste hose (2) to the feed line, front connector of the transmission, to the vehicle cooler lines. This is the reverse flow - backflush direction.

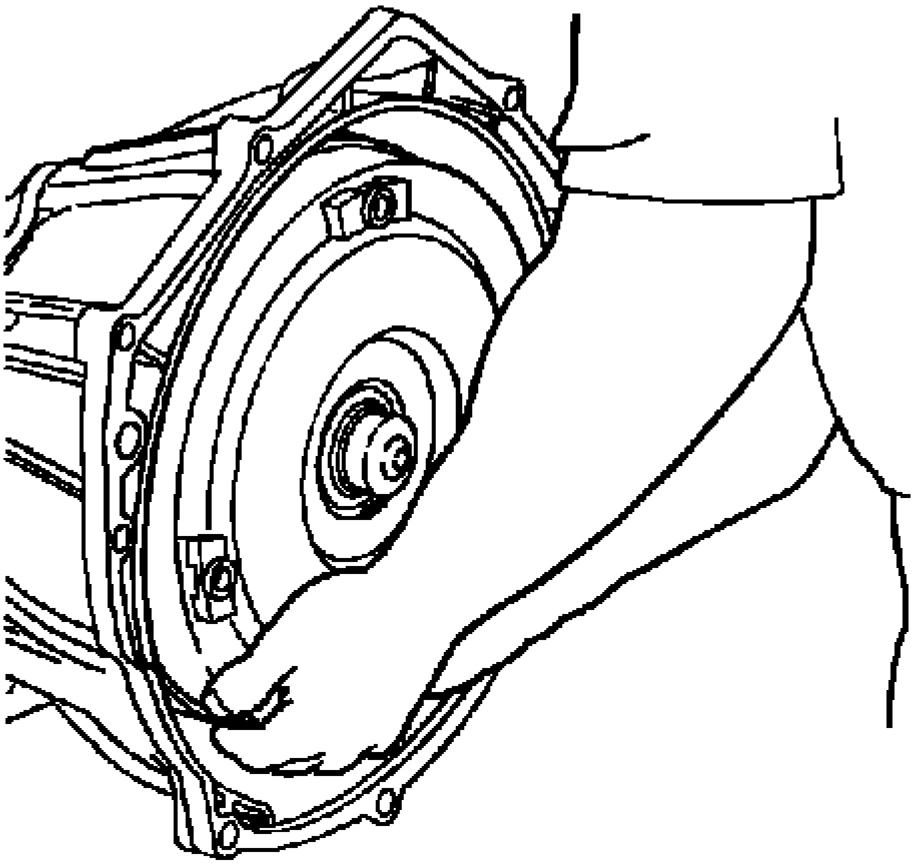


Fig. 20: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

3. Turn the main function switch to the FLUSH position. Allow the machine to operate for 30 seconds.

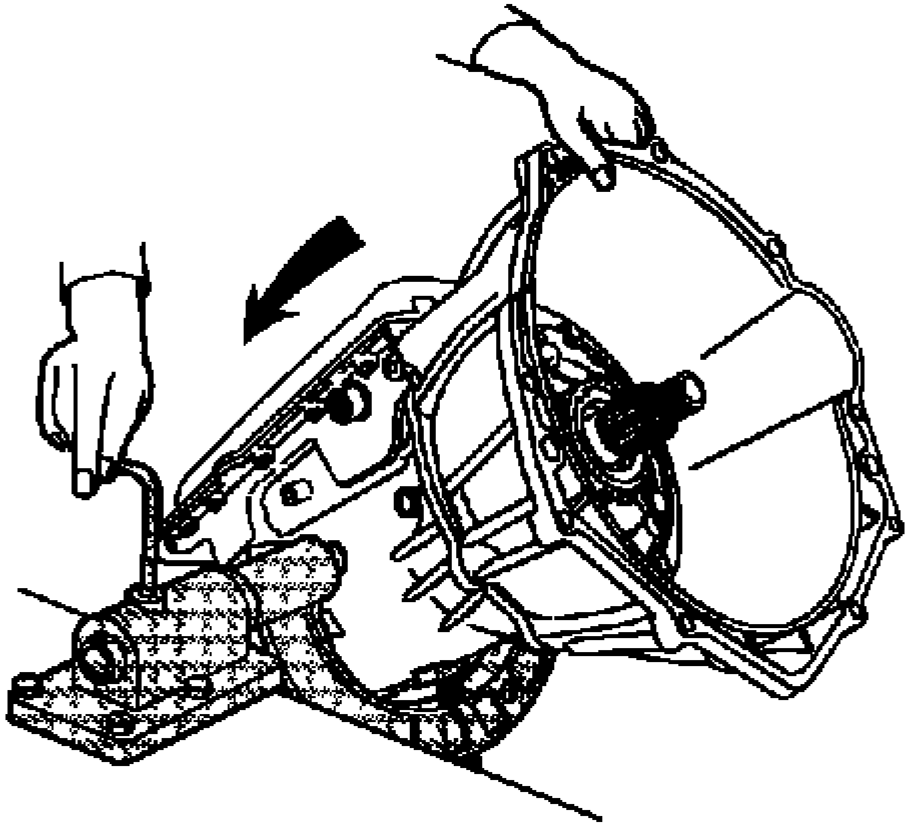


Fig. 21: Setting Main Function Switch To IDLE Position
Courtesy of GENERAL MOTORS CORP.

4. Turn the main function switch to the IDLE position and allow the supply vessel pressure to dissipate.

Forward Flush

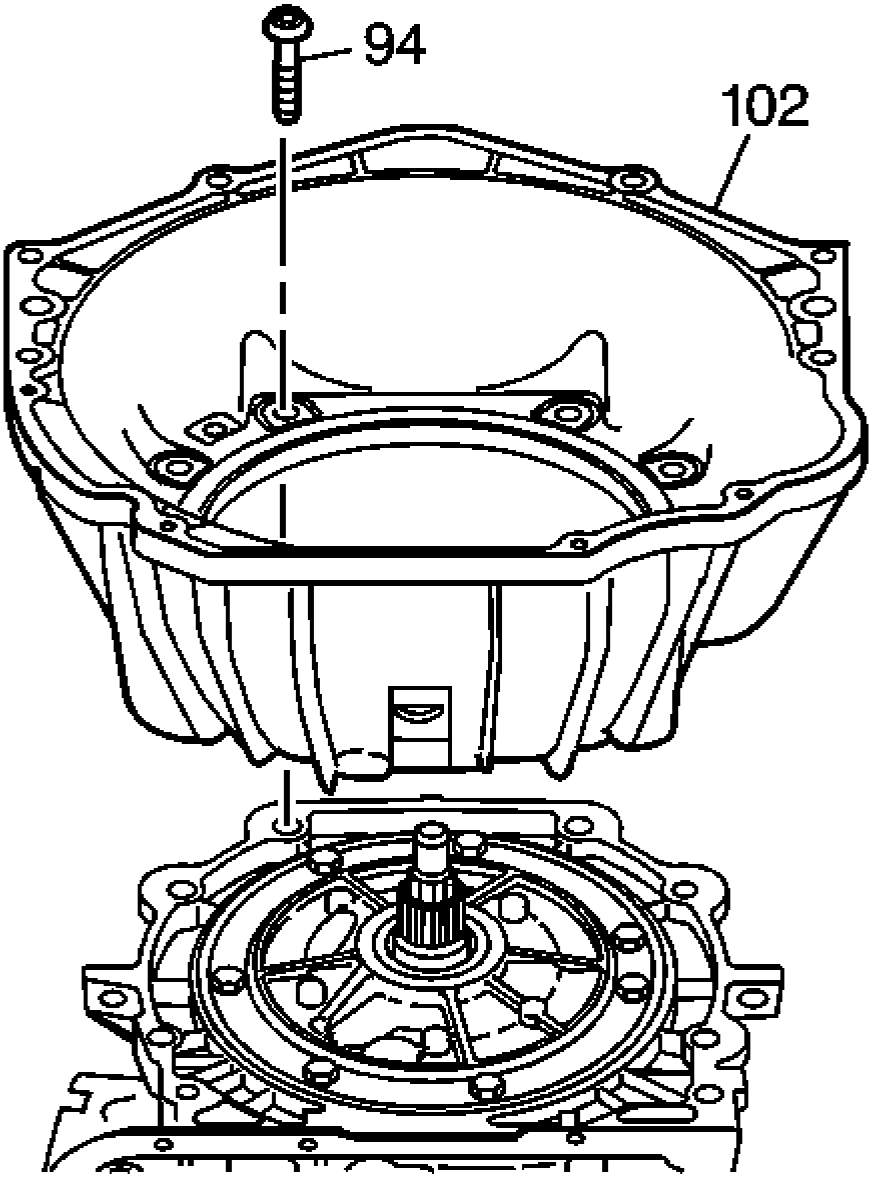


Fig. 22: Identifying Black Supply Hose And Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the supply and waste hoses from the vehicle cooler lines. Reverse the supply and waste hoses to provide a normal flow direction.

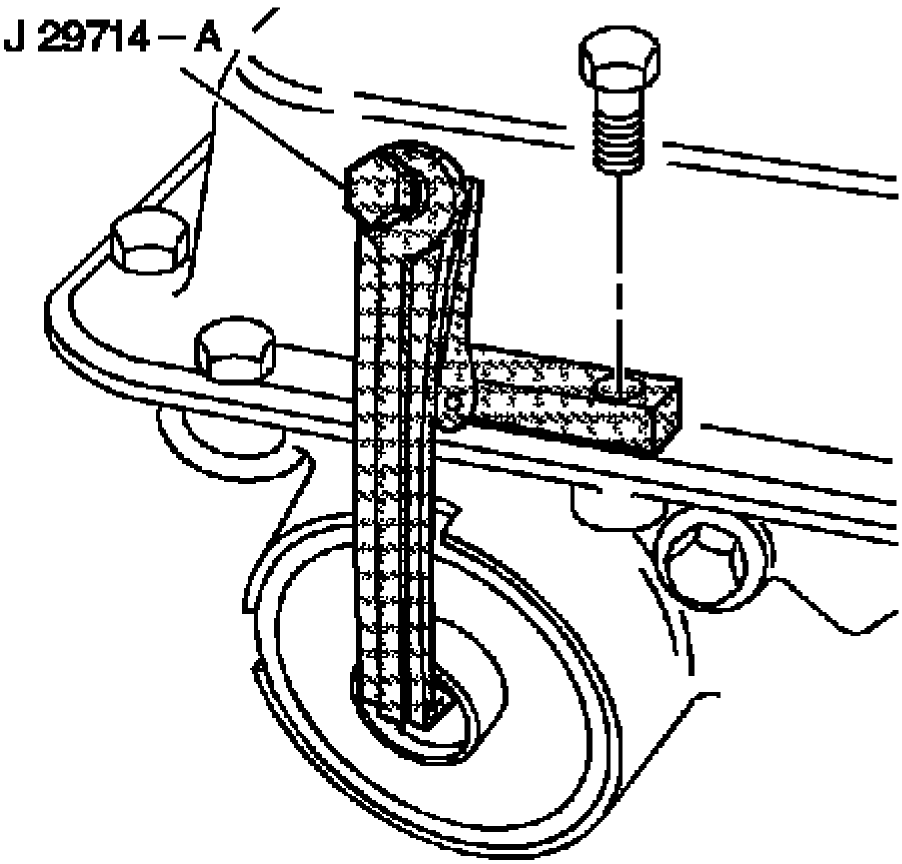


Fig. 23: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

2. Turn the main function switch to the FLUSH position and allow machine to operate for 30 seconds.

Flow Test

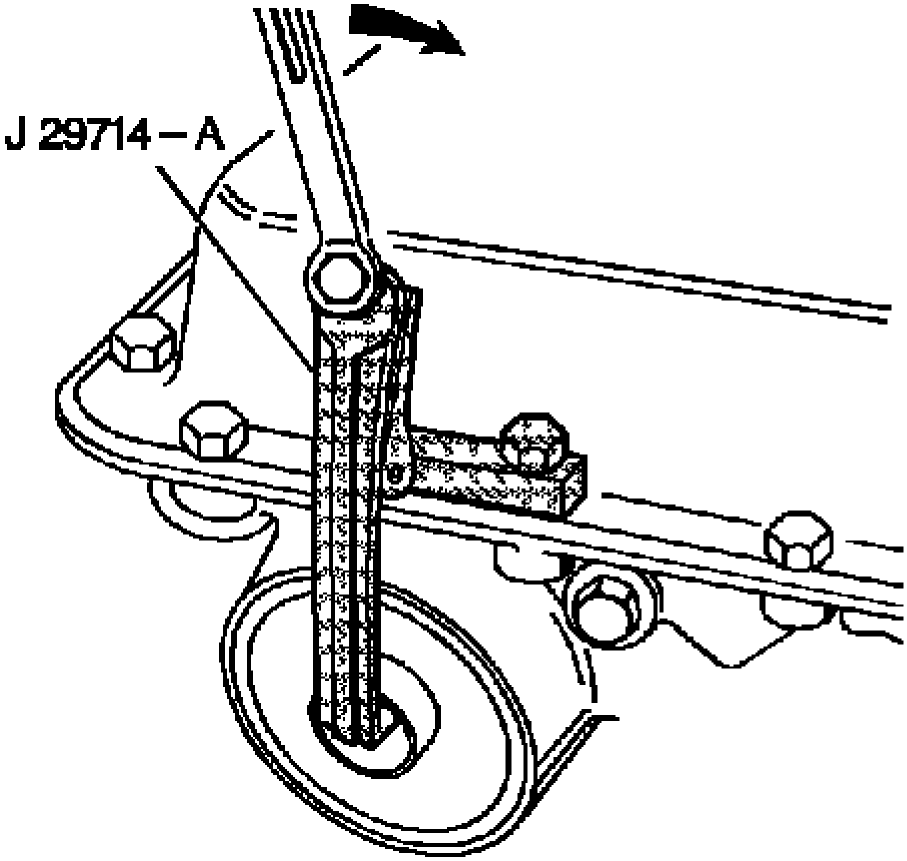


Fig. 24: Setting Main Function Switch To FLOW Position
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the flow rate is less than 0.5 gpm, the LCD displays an error message. Refer to the Troubleshooting section of the operation manual.

1. Turn the main function switch to the FLOW position and allow the oil to flow for 15 seconds. Observe and note the flow rate; this is the TESTED flow rate.
2. Compare the TESTED flow rate to the MINIMUM flow rate information previously recorded.
   - If the TESTED flow rate is equal to or greater than the MINIMUM flow rate recorded, the oil cooling system is functioning properly. Perform the Code Recording Procedure.
   - If the TESTED flow rate is less than the MINIMUM flow rate previously recorded, repeat the back flush and forward flush procedures.
3. If the TESTED flow rate is less than the MINIMUM flow rate after the second test, perform the Code Recording Procedure.
   1. Replace the transmission oil cooler.
   2. Connect the supply and waste hoses to the cooler lines in the normal flow direction. Perform the Flow Test.
   3. Perform the Code Recording Procedure.

Code Recording Procedure

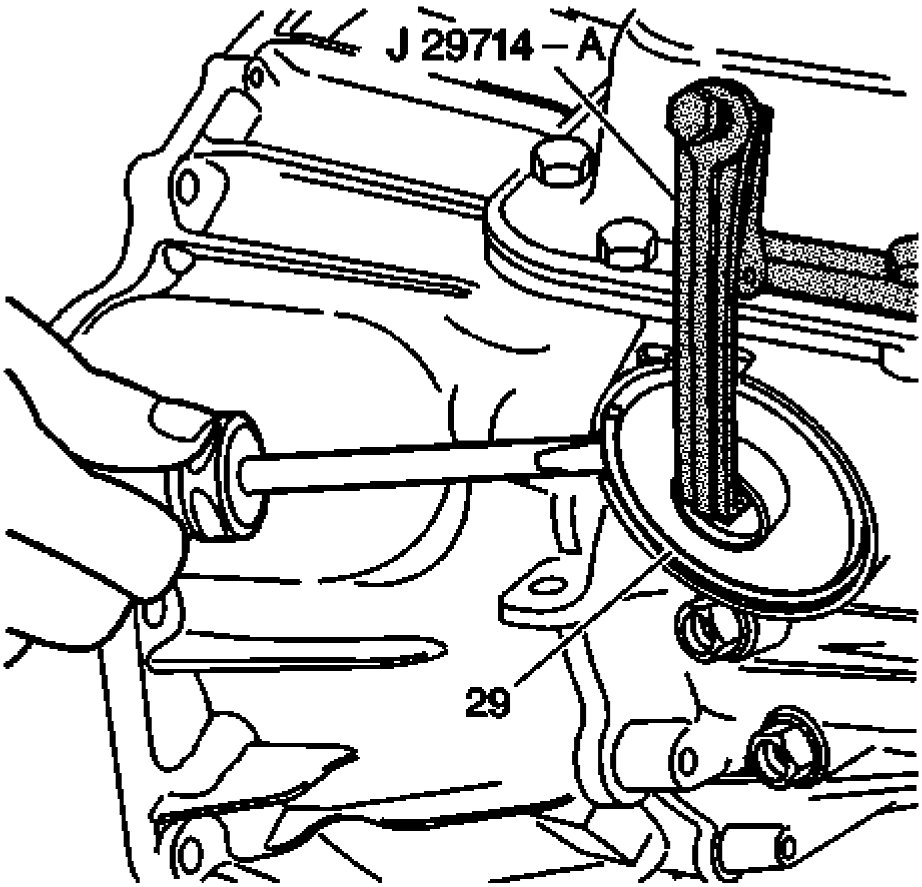


Fig. 25: Setting Main Function Switch To CODE Position
Courtesy of GENERAL MOTORS CORP.

1. Turn the main function switch to the CODE position.

IMPORTANT:	• If power is interrupted prior to the recording of the seven-character code, the code will be lost and the flow rate test will need to be repeated. • The flow test must run for a minimum of 8-10 seconds and be above 0.5 gpm for a code to be generated.

2. Record TESTED flow rate, temperature, cycle and seven-character flow code information on repair order.

Clean-up

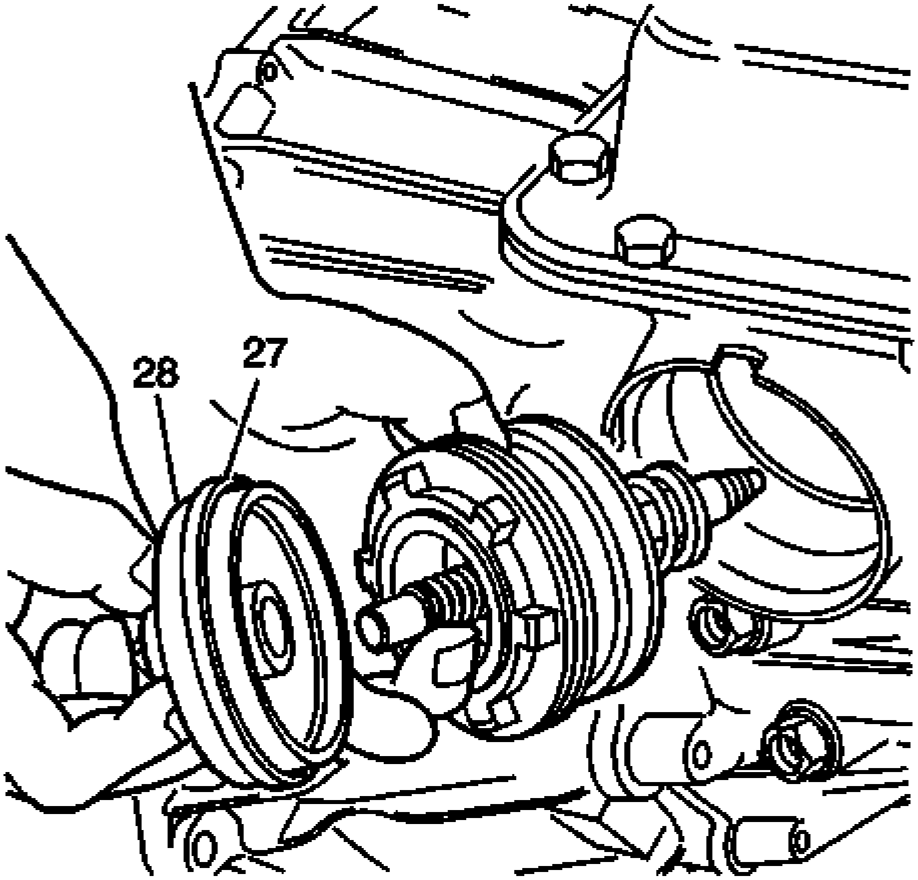


Fig. 26: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

1. Turn the main function switch (2) to the IDLE position and allow the supply vessel pressure to dissipate.
2. Turn the main power switch (1) to the OFF position.

IMPORTANT: A small amount of water may drain from the bottom of the unit when the air supply is disconnected. This is a normal operation of the built-in water separator.

3. Disconnect the supply and waste hoses and the 12-volt power source from the vehicle.

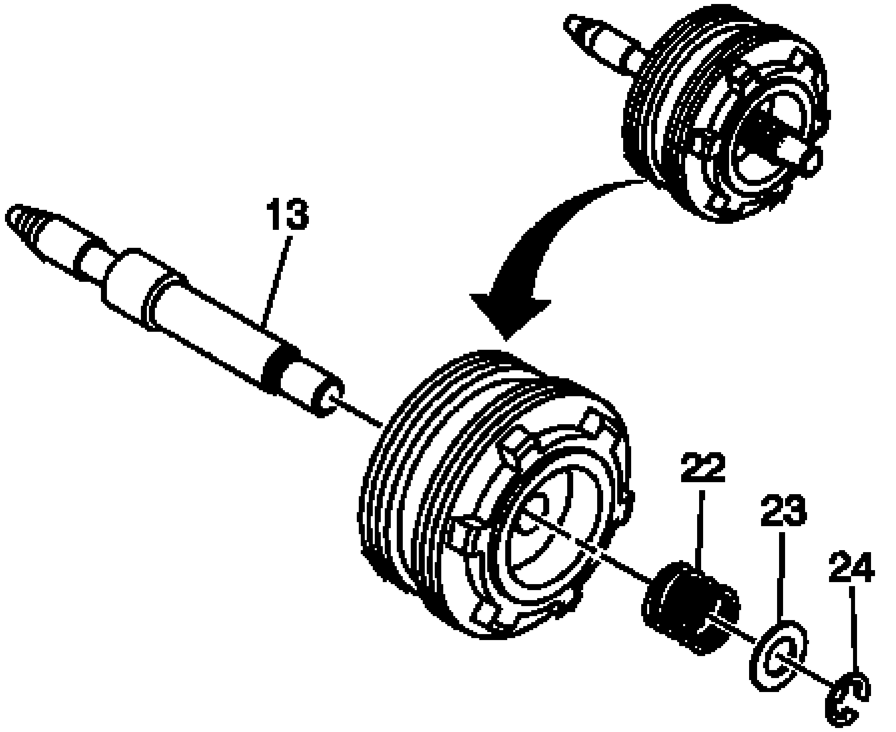


Fig. 27: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the air supply hose from **J 45096** .
5. Dispose of the waste ATF in accordance with all applicable federal, state, and local requirements.

BUSHING AND MATING SHAFT INSPECTION

IMPORTANT: Proper bushing and corresponding mating shaft inspection should be performed before replacing the bushing, shaft, and in some cases, the component which houses the bushing. Thoroughly clean and dry the bushing and shaft surfaces before inspecting for damage.

Any of the following bushing conditions require replacement of the bushing and/or housing:

- Discoloration due to heat distress
- Misalignment or displacement of bushing as a result of spinning in housing
- Medium to heavy scoring that can be easily detected with fingernail. Light scoring is a normal condition.
- Debris embedded into the bushing lining material
- Obvious damage, including excessive and uneven wear
- Excessive polishing. Minor polishing of the bushing is an indication of normal wear and does not require

replacement.

Any of the following conditions require replacement of the bushing's mating shaft:

- Discoloration due to heat distress
- Rough surface finish that can be easily detected with finger
- Obvious shaft abnormalities, including warping or uneven surfaces
- Obvious damage or cracking

AUTOMATIC TRANSMISSION FLUID LEAKS

Checks	Cause
Oil Pan Fluid Leak	
• Oil Pan (28)	The pan is damaged or the pan is not flat.
• Gasket (29)	Damaged or mispositioned
• Case (7)	Porosity or cracked
• Bolt (27)	• The flange is inside out. • High or low torque
Fill Tube Fluid Leak	
• Seal	• Cut or nicked • Missing
• Case (7)	Porosity
• Fill Tube	• Damaged at the case end • Not seated in the case
• Brackets	Out of position, causing tension on the fill tube
Electrical Connector Fluid Leak	
• Electrical Connector	Damaged, or not seated
• O-ring Seal	• Cut or nicked • Missing
• Case (7)	Porosity or cracked
Cooler Connector Fluid Leak	
• Cooler Connectors (8)	• Stripped threads • Damaged flare • High or low torque
• Case (7)	• Stripped threads • Porosity • Debris in the threads
Case Extension Fluid Leak	

• Case Extension (19)	Porosity or cracked
• Case (7)	Porosity or cracked
• Seal (15)	• Cut or nicked • Missing
• Bolt (21)	• Low torque • Missing
Manual Shaft Fluid Leak	
• Seal (707)	• Cut or nicked • Not seated
• Linkage	Misadjusted
Pump Body Seal Fluid Leak	
• Seal (201)	• Cut, nicked, or worn • Missing garter spring
• Torque Converter (1)	Damaged hub
• Bolt	Low Torque
Vehicle Speed Sensor Fluid Leak	
• Seal	Cut, missing, or nicked
• Vehicle Speed Sensor Assembly (22)	• Damaged • Not seated • Damaged bracket
• Bolt (23)	• Low torque • Missing • Damaged threads
• Case (7)	Porosity or cracked
Output Shaft Seal Fluid Leak	
• Seal (20)	Cut or nicked
• Case (7)	Porosity or cracked
Line Pressure Plug Fluid Leak	
• Plug (24)	• Stripped threads • Low or high torque
• Case (7)	• Porosity or cracked • Damaged threads

HIGH LINE PRESSURE

Checks	Cause

Pressure Regulator Valve (231)	Valve is stuck at high torque signal due to an undersized bore or sediment.
Reverse Boost Valve (228)	Valve is stuck at high torque signal due to an undersized bore or sediment.
Retainer Pin (211)	Pin is broken
Orificed Plug (210)	Plug is blocked
Pressure Control Solenoid Valve (320)	• Valve has failed Off • Loose connector
PCM	Loose connector
Check the PCM for current DTCs.	

FORWARD MOTION IN NEUTRAL

Checks	Cause
Manual Valve (319)	Valve is mispositioned or stuck.
Forward Clutch Springs (607)	Jammed
Forward Clutch Piston (606)	Jammed
Forward Clutch Plates (610, 611)	Seized or jammed
Forward Clutch Housing (602)	The hole is plugged.
Hub (613)	The holes are plugged.

INADEQUATE LUBRICATION AT LOW LINE OR HEAVY LOADS

Checks	Cause
Converter Limit Valve (214)	Valve is stuck closed by sediment or by a collapsed valve bore.
Retainer Pin (211)	Broken

INADEQUATE LUBRICATION

Checks	Cause
Pressure Regulator Valve (231)	Valve is stuck in a high demand position.
Pump Body (206)	Cross channel leakage
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	Plug is leaking

ENGINE STALL IN NEUTRAL

Checks	Cause
TCC System	TCC is stuck On or TCC is not released.

LOSS OF POWER

Checks	Cause
Transmission	• Low oil • Not starting in first gear
TCC System	TCC is stuck On, or TCC is dragging.
Torque Converter (1)	• Debris in the converter • Stator loose
Stator Shaft (235)	The shaft is broken.
Turbine Shaft (502)	The bushing is worn.
Mainshaft (662)	The bushing is worn.
Output Shaft (671)	The bushing is worn.
Bearing (668)	The bearing is worn.

NO TORQUE IN REVERSE AND THIRD

Checks	Cause
Forward Clutch Hub (613)	The hub is broken.
Snap Ring (616a)	The ring is not seated.
Forward Clutch Housing (602)	The housing is broken.
Direct Clutch Piston (619)	The piston is broken.

TRANSMISSION OVERHEATS

Checks	Cause
TCC Circuit	Blockage during apply or release
TCC Valve Spring (224)	The spring is broken.
Pump Cover (206)	Cross channel leakage
Pressure Regulator Valve (231)	The valve is stuck in a high demand position.
Oil Cooler	The cooler or the cooler lines are blocked.
Gasket (6)	The gasket is damaged.
Retainer Pin (211)	The pin is broken.
Turbine Shaft O-ring (2)	The O-ring is damaged.
Turbine Shaft Seals (503)	The seals are damaged.
Stator Shaft Bushing (233)	The bushing is worn or damaged.
Oil Transfer Hole Cup Plug	The plug is leaking.
Fluid	The fluid level is low.
Radiator	Air flow is restricted.

TRANSMISSION OVERHEATS AT WOT

Checks	Cause
Converter Limit Valve Bypass Orificed Cup Plug	The plug is blocked, therefore the converter limit

	valve is stuck closed.

LOW LINE PRESSURE

Checks	Cause
Pump (203)	Cross channel leak at body to cover, or cross channel leak at body to case gasket
Pressure Regulator Valve (231)	Valve is stuck at a low torque signal due to an undersized bore or to sediment.
Reverse Boost Valve (228)	Valve is stuck at a low torque signal due to an undersized bore or to sediment.
Pump Valve Bores	Excessive valve clearance due to wear.
Spring (230)	The spring is broken.
Retainer Pin (211)	The pin is broken.
Valve Body (301)	• Cross channel leaks • Cross valve land leaks
Gasket/Spacer Plate	The plate is damaged or missing.
Pressure Control Solenoid Valve (320)	• The valve is stuck On. • A broken clip causes leakage. • A wire is pinched to ground. • A screen is missing.
PCM	Failed
Check the PCM for current DTCs.	

ENGINE STARTS IN GEAR

Checks	Cause
Manual Valve (319)	• Valve is not engaged to the detent lever. • Valve is stuck in the wrong position.
Park/Neutral Safety Switch	The switch is not operating.

SHIFT LEVER INDICATES WRONG GEAR

Checks	Cause
Manual Valve (319)	Not engaged to detent lever
Detent Pin (711)	Misaligned or broken
Manual Shaft (708)	The flats are not parallel.
Indicator Linkage	Misadjusted

NO GEAR SELECTION

Checks	Cause
Detent Lever (711)	The nut is loose or missing.
Manual Valve (319)	The valve is stuck.
Spacer Plate (46)	The holes are blocked.
Valve Body/Case (301, 7)	The channels are blocked.

LOSS OF DRIVE

Checks	Cause
Torque Converter (1)	• Broken lug or failed lug welds • Sheared lug bolts • Worn turbine shaft splines • Low oil • The pump hub is cracked, scored, or broken. • Internal failure • Failure of the closure weld • The cover is cracked at a lug weld.
Pump (203)	• The pump is seized. • The pump gears are broken.
Case Extension Seal (20)	The seal is missing, damaged, or displaced.
Orifice Plate	The plate is missing or leaking around the edge.
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	The plug is leaking or missing.
Seals (503)	The seals are damaged or missing.
Housing (504)	The housing is broken.
Roller Clutch (512)	The clutch is worn, broken, or locked.
Carrier (514)	Broken
Pinions (518)	• Broken free from the pilot • Spalled pins or pinions • Plugged pinion pin holes • Worn thrust washers • Lack of lube
Bearing (513)	The bearing is broken.
Roller Clutch (644)	• The clutch is worn, broken, or locked. • Lack of lube
Turbine Shaft (502)	The shaft or the splines are broken.
Forward Clutch Components	
• Seals (603, 604, 605)	Nicked or cut
• Checkball	Leaking

• Piston (606)	Cracked or jammed
• Housing (602)	Cracked
• Friction Plates (611)	The plates are burned or the splines are worn.
• Reaction Plates (610)	The plates are worn or the splines are worn.
• Spring Assembly (607)	Jammed
• Driving Hub (615)	Broken
• Retainer Ring (616)	The ring is not seated.
• Driven Hub (613)	The gear teeth are worn.
Rear Gear Set	
• Pinions (655)	Broken or spalled
• Pinion Pins (656)	Broken or spalled
• Needle Bearings (654)	Broken or spalled
• Sun Gear (649)	Broken or spalled
• Pinion Thrust Washers (652)	Worn
• Rear Internal Gear (666)	Broken or spalled
• Front Internal Gear (661)	Broken or spalled
• Turbine Shaft Ball Seal	Ineffective
• Mainshaft (662)	The shaft or the splines are broken.
• Fluid Pressure	Too low

NO PARK

Checks	Cause
Detent Lever (711)	• Incomplete travel • Lever is misaligned
Actuator Rod (710)	The rabbit ears are bent, disconnected, or broken.
Detent Spring (41)	Mispositioned
Parking Pawl (703)	Broken
Pawl Shaft (702)	Broken
Park Bracket (713)	Bent or broken
Bolt (714)	Loose or broken
Front Internal Gear (661)	The splines are broken.
Manual Shaft (708)	The flats are not parallel.

REMAINS IN PARK

Checks	Cause

Actuator Rod Assembly (710)	Stretched

DIFFICULT TO SHIFT OUT OF PARK

Checks	Cause
Pawl Return Spring (705)	Weak or broken
Vehicle	Parked on a hill

DOES NOT STAY IN PARK

Checks	Cause
Detent Spring (41)	Weak or broken

NO REVERSE

Checks	Cause
Case (7)	The rear band anchor pin is broken or the pin is not positioned.
Center Support (640)	Leaking at the case, or the support is broken.
Center Support Seal (639)	Leaking
Center Support Bolt (25)	• The bolt is loose or broken. • The feed hole is blocked.
Rear Band (657)	Broken, worn, or not anchored
Rear Band Apply Pin (73)	The pin is too short or the pin is binding in the case.
Piston (65)	Binding in the case
Seal (66)	Leaking, damaged, or worn
Gasket (63)	Damaged or displaced
Cover (62)	Damaged
Bolts (61)	Broken, loose, or missing
Checkball	Missing
Fluid Pressure	Too low
Direct Clutch Components	
• Reaction Plates (618)	The splines are worn.
• Friction Plates (611)	The splines or the friction are worn.
• Spring Assembly (607)	Jammed
• Housing (623)	Cracked
• Piston (619)	Leaking
• Seal (620, 621, 622)	Leaking
• Ball Check	Leaking

NO FIRST GEAR - D1

Checks	Cause
Refer to **No First Gear - D4**	
Housing (504)	Broken
Case (7)	The rear band anchor pin is broken or the pin is not positioned.
Detent Lever (711)	Misaligned

NO SECOND GEAR - D1

Checks	Cause
Refer to **No Second Gear - D4**.	

NO OVERRUN BRAKING - D1

Checks	Cause
Refer to **No Overrun Braking - D3**.	
Check the PCM for current DTCs.	
Automatic Transmission Fluid Pressure Manual Valve Position Switch Assembly	• Pinched wire • Loose connector • Loose bolt causing leakage • No signal to the PCM.

NO ENGINE BRAKING - D1

Checks	Cause
Rear Band (657)	Damaged, worn, or not anchored
Rear Band Apply Pin (73)	The pin is too short or is binding in the case.
Piston (65)	The piston is binding in the case.
Seal (66)	Worn or damaged
Cover (62)	Damaged
Gasket (63)	Damaged or missing
Bolt (61)	Loose, broken, or missing
Checkball	• Missing • Damaged • Not sealing • Incorrect size
Fluid Pressure	Too low
Output Shaft (671)	The shaft or the splines are broken.
Mainshaft (662)	The shaft or the splines are broken.

Thrust Washer (218)	Worn or damaged
Bushing (234)	Worn or damaged

NO FIRST GEAR - D2

Checks	Cause
Refer to **No First Gear - D4**.	
Front Band (628)	Stuck On

NO SECOND GEAR - D2

Checks	Cause
Refer to **No Second Gear - D4**.	
Case (7)	• The front band anchor pin is broken or the pin is not properly positioned. • The intermediate clutch feed cup plug is missing or the plug is not seated.

NO OVERRUN BRAKING - D2

Checks	Cause
Refer to **No Overrun Braking - D3**.	

NO ENGINE BRAKING - D2

Checks	Cause
Bushing (234)	Worn or damaged
Thrust Washer (218)	Worn or damaged
Rear Gear set	Spalled or broken
Reaction Drum and Carrier (651)	Broken
Mainshaft (662)	The shaft or the splines are broken.
Output Shaft (671)	The shaft or the splines are broken.
Sun Gear Shaft (649)	The shaft or the splines are broken.

NO SECOND GEAR ENGINE BRAKING - D2

Checks	Cause
Fluid Pressure	Too low
Direct Clutch Housing (623)	• The internal diameter of the splines are worn. • The outer band surface is worn.
Front Band (628)	Broken, worn, or not anchored
Apply Pin (55)	Too short or binding in the case

Apply Clip (56)	Broken or missing
Piston (58)	Cracked, broken, or binding
Seal (57)	Damaged or worn
Case (7)	Cracked or damaged
Spacer Plate (46)	Damaged
Gasket (48)	Torn or pinched
Valve Body Bolts (35)	Loose, broken, or missing

NO FIRST GEAR - D3

Checks	Cause
Refer to **No First Gear - D4**.	
Front Band (628)	Stuck On

NO SECOND GEAR - D3

Checks	Cause
Refer to **No Second Gear - D4**.	

NO THIRD GEAR - D3

Checks	Cause
Refer to **No Third Gear - D4**.	
Front Band (628)	Stuck On

NO OVERRUN BRAKING - D3

Checks	Cause
Clutch Plates (508, 509)	The splines or the plate are worn.
Thrust Washer (218)	Damaged or worn
Output Shaft (671)	The shaft or the splines are broken.
Seals	Cut or nicked
Checkball	Leaking
Piston (505)	Jammed, cracked, or damaged
Housing (504)	Cracked or damaged
Sun Gear (650)	Worn
Spring Assembly (506)	Jammed
Oil Feed	Plugged

NO ENGINE BRAKING - D3

Checks	Cause

Mainshaft (662)	The shaft or the splines are broken.
Bushing (234)	Damaged or worn

NO FIRST GEAR - D4

Checks	Cause
Low Roller Assembly (644)	• Assembly is not attached • Broken race
Center Support (640)	Broken support or broken splines
Case (7)	Check for damage near the center support.
Retainer Rings (633, 643)	Rings are not seated.

FIRST GEAR ONLY - D4

Checks	Cause
Sun Gear Shaft (649)	Broken shaft or broken splines
AT Output Speed Sensor Assembly (22)	Reads zero Check for DTCs.
AT Input Speed Sensor Assembly (22)	Reads zero Check for DTCs.

FIRST AND SECOND GEAR ONLY - D4

Checks	Cause
2-3 Solenoid (311) Check for DTCs.	• Stuck Off • Loose connector • No voltage to the solenoid • Solenoid O-ring failure • No PCM signal to the solenoid
2-3 Shift Valve (312)	Stuck
Check the PCM for current DTCs.	

SECOND GEAR ONLY - D4

Checks	Cause
Check the PCM for current DTCs.	

SECOND AND THIRD GEAR ONLY - D4

Checks	Cause
1-2 Solenoid (313) Check for DTCs.	• Stuck Off

	• Loose connector • No voltage to the solenoid • Solenoid O-ring failure • No PCM signal to the solenoid
1-2 Shift Valve (314)	Stuck
PCM	Failed
Check the PCM for current DTCs.	

FIRST AND FOURTH GEAR ONLY - D4

Checks	Cause
1-2 Solenoid (313)	• Stuck On • Pinched wire to ground
1-2 Shift Valve (314)	Stuck
PCM	Failed
Check the PCM for current DTCs.	

THIRD AND FOURTH GEAR ONLY - D4

Checks	Cause
2-3 Solenoid (311)	• Stuck On • Pinched wire to ground
2-3 Shift Valve (312)	Stuck
PCM	Failed
Check the PCM for current DTCs.	

NO SECOND GEAR - D4

Checks	Cause
Case (7)	The intermediate clutch feed cup plug is missing or the cup plug is not seated.
Intermediate Clutch Components	
• Backing Plate (630)	Broken
• Retainer Ring (633)	Missing or not seated
• Friction Plates (631)	Worn
• Outer Race (625)	Worn Splines
• Center Support (640)	The support is cracked or the feed hole is blocked.
• Center Support Bolt (25)	• The bolt is broken or loose. • The oil hole is blocked.

• Seals (637, 638)	Worn
• Piston (636)	Cracked or jammed
• Springs (635)	Jammed
• Transmission Fluid	• Improper fluid • Additive package
• Intermediate Sprag (624)	• The outer race splines are worn. • The outer race is broken. • The splines or the inner race is worn.
• Direct Clutch Housing (623)	Broken
• Retainer Ring (627)	Missing or not seated

NO THIRD GEAR - D4

Checks	Cause
Direct Clutch Components	
• Seal (620, 621, 622)	Leaking
• Ball Check	Leaking
• Piston (619)	Cracked or jammed
• Housing (623)	Cracked
• Reaction Plates (618)	Worn splines
• Friction Plates (611)	Worn splines or worn friction
• Spring Assembly (607)	Jammed
• Center Support Seals (639)	The seals are leaking at the center support hub.
• Center Support (640)	The support is broken or leaking at the case.
• Center Support Bolt (25)	• Loose or broken • Blocked hole
• 2-3 Solenoid (311)	• Stuck Off • Pinched wire • O-ring failure • No voltage to the solenoid
• PCM	No signal to the solenoid
• 2-3 Shift Valve (312)	Stuck
• PCM	Failed
Check the PCM for current DTCs.	

NO FOURTH GEAR - D4

Checks	Cause
Fourth Clutch Components	
• Seals (527) (531)	Nicked or cut
• Cup Plug (530)	Missing
• Bolt (26)	Loose, broken, or missing
• Piston (528)	Jammed
• Spring Assembly (532)	Jammed
• Retainer Ring (523)	Not seated
• Friction Plates (525)	Worn or burned
• Reaction Plates (526)	Worn splices
• Housing (529)	Damaged or cracked
Overrun Clutch Components	
• Housing (504)	Broken
• Reaction Plates (508)	Worn splines
• Sun Gear (650)	Worn
• 1-2 Solenoid (313)	• Stuck Off • Pinched wire • O-ring failure • No voltage to the solenoid
• PCM	• No signal to the solenoid • Failed
• 3-4 Shift Valve (308)	Stuck
Check the PCM for current DTCs.	

NO TORQUE CONVERTER CLUTCH APPLY

Checks	Cause
TCC Shift Solenoid Valve (323)	• Stuck Off • O-ring failed • No voltage to the solenoid • Poor connection
PCM	• Failed • No signal to the solenoid
Brake Switch	• The contact is corroded. • Poor connection • Pinched wire

	• Misadjusted • No supply voltage
TCC Valve (223)	The valve is stuck Off due to sediment or to an undersized bore.
Retainer Pin (211)	Broken
Torque Converter (1)	Ballooning
Turbine Shaft (502)	Plugged oil holes
Turbine Shaft Seals (501)	Ineffective
Pump Body Bushing (202)	Worn
O-ring (2)	Heat set
Oil Transfer Hole Cup Plug	Leaking
Regulated Apply Valve (324)	Stuck
TCC Valve Release Exhaust Orificed Cup Plug	Blocked
Check PCM for the current DTCs.	
Refer to **Incorrect Torque Converter Clutch Apply or Release**.	

SOFT TORQUE CONVERTER CLUTCH APPLY

Checks	Cause
Turbine Shaft Seals (501)	Ineffective
Pump Body Bushing (202)	Worn
O-ring (2)	Heat set
Oil Transfer Hole Cup Plug	Leaking
TCC Solenoid (323)	Malfunction
Fluid	Low pressure

TORQUE CONVERTER CLUTCH SLIPPING

Checks	Cause
TCC Valve Release Exhaust Orificed Cup Plug	Blocked
Turbine Shaft Seal	Cut

TORQUE CONVERTER CLUTCH STUCK ON

Checks	Cause
Gasket (6)	Damaged
TCC Shift Solenoid Valve (323)	• Stuck On • Pinched wire to ground
TCC Apply Valve (324)	Stuck
PCM	Failed
Check PCM for current DTCs	

Refer to **Incorrect Torque Converter Clutch Apply or Release**.

INCORRECT TORQUE CONVERTER CLUTCH APPLY OR RELEASE

Checks	Cause
AT Output Shaft Speed Sensor Assembly (22)	• Poor connection • Pinched wire • A broken coil wire • Incorrect air gap • Inadequate signal
Throttle Position Sensor	• Poor connection • Pinched wire • Incorrect resistance
PCM	Failed
Automatic Transmission Fluid Pressure Manual Valve Position Switch (40)	• Poor connection • No signal to the PCM • Pinched wire
AT Fluid Temperature Sensor Assembly (332)	• Poor connection • No signal to the PCM • Incorrect resistance • Pinched wire
Engine Coolant	No signal to the PCM
Brake Switch	• Poor connection • Pinched wire • No voltage supply • Misadjusted
Engine Ignition Module	Loss of signal or intermittent
Check the PCM for current DTCs.	
Only 2WD	

CONVERTER BALLOONING

Checks	Cause
Converter Limit Valve (214)	Stuck open due to sediment or undersized bore
At High Speeds: Converter Limit Valve Feedback Orificed Cup Plug	Blocked
Converter Stator	Locked-up

NO TORQUE MULTIPLICATION

Checks	Cause
Stator Shaft (235)	Broken or detached from the pump cover

FLUID FOAMING

Checks	Cause
Fluid	• Contaminated antifreeze • Overfilled transmission
Engine	Overheated
Filter (31)	Cracked or not seated
Seal (32)	Damaged or not seated
Vehicle	Overloaded

NOISE

Checks	Cause
Torque Converter (1)	• Loose lug bolts • Out of balance • Internal failure
Transmission/Engine	Misaligned
Case Extension (19)	Output shaft support bushing is worn.
Reaction and Output Gear Sets	Flats on gear teeth or teeth improperly machined
Oil Pan	Dented

ENGINE STALL

Checks	Cause
Fourth Clutch Components	
• Plates (525, 526)	Seized or jammed
• Piston (528)	Jammed
• Spring Assembly (532)	Jammed
Overrun Clutch Components	
• Plates (508, 509)	Seized or jammed
• Piston (505)	Jammed
• Spring Assembly (506)	Jammed
Cooler Lines	Kinked or plugged
Transmission Oil Cooler	Plugged

VIBRATION

Checks	Cause
Torque Converter (1)	• Out of balance • Internal failure • Not sealed in crankshaft pilot
Transmission/Engine	Misaligned or missing dowels
Case Extension (19)	Output shaft support bushing is worn.
Turbine Shaft (502)	Worn surface of the stator shaft bushing
Mainshaft (662)	Worn bushing
Output Shaft (671)	Worn bushing
Bearing (668)	Worn

OIL OUT THE VENT TUBE

Checks	Cause
Pump Cover (206)	Cross channel leakage can pressurize the vent area.
Fluid	• Foaming and filling the pump vent ports • Transmission is overfilled.
Transmission	Overheated

NO TORQUE IN SECOND GEAR

Checks	Cause
Intermediate Sprag (624)	• Worn • Excessive eccentricity • The sprag is rolled over or the sprag is damaged.

SECOND GEAR STARTS

Checks	Cause
Intermediate Clutch Plates (631, 632)	Seized
Direct Clutch Lube Feed	Blocked
Center Support Springs (635)	Jammed
Center Support Piston (636)	Jammed
1-2 Shift Solenoid Valve (313)	• Stuck Off • O-ring failed • No voltage to the solenoid • Poor connection
PCM	• No PCM signal to the solenoid • Failed

1-2 Shift Valve (314)	Stuck
Check the PCM for current DTCs.	

THIRD GEAR STARTS

Checks	Cause
Forward Clutch Components	
• Driving Hub (615)	Plugged holes
• Plates (610, 611)	Seized
Direct Clutch Components	
• Piston (619)	Jammed
• Spring Assembly (607)	Jammed
• Lube Feed Hole	Blocked

FOURTH GEAR STARTS

Checks	Cause
2-3 Shift Solenoid Valve	• Stuck On • Pinched wire to ground
Check the PCM for current DTCs.	

ERRATIC SHIFT QUALITY

Checks	Cause
Gasket (6)	Damaged
Oil Transfer Hole Cup Plug	Leaking
Oil Seal Rings (219)	Damaged

TRANSMISSION SLIPS

Checks	Cause
Fluid Level	Too high or too low
Shift Solenoids	Leaking
4th Accumulator Piston Pin Retainer Ring	Missing

CASE EXTENSION BEARING/SEAL FAILED

Checks	Cause
Orifice Plate	The hole is blocked or the hole is missing.
Case Extension (19)	The lube passages are blocked or missing.

INACCURATE SHIFT POINTS

Checks	Cause
AT Output Shaft Speed Sensor Assembly (22)	• Pinched or broken wire • Loose connector • Incorrect air gap • Inadequate signal • Damaged coil • Damaged rotor teeth • Loose connection
Throttle Position Sensor	• Pinched or damaged wire • Incorrect resistance • Loose connector • PCM malfunction
AT Fluid Pressure Manual Valve Position Switch Assembly (40)	• Loose connector • Loose bolts causing leakage • A pinched wire • No signal to the PCM
Axle Ratio	Ratio is incorrect or ratio has been changed from its original value.
Tire Size	Tire size is incorrect or the size has been changed from its original value.
Check the PCM for current DTCs.	

HARSH SHIFTS

Checks	Cause
Line Pressure	Too high
Pressure Control Solenoid Valve (320)	• Failed Off • Loose connector
PCM	Loose connector
Accumulator Piston	• Leaking • Stuck
Accumulator Spring	Incorrect
Checkballs	Missing
Calibration PROM	Incorrect
Check the PCM for current DTCs.	

HARSH SHIFT D TO R

Checks	Cause
Direct Lube Exhaust	Blocked
Forward Clutch Spring (607)	Not acting
Retainer Ring (616)	Not seated
Checkball Orifice	Plugged

HARSH SHIFT 3 TO 4

Checks	Cause
Spring Assembly (532)	Not compressing evenly
Air Bleed Orifice 4th Clutch Housing (530)	Plugged

HARSH SHIFT 4 TO 3

Checks	Cause
Retainer Ring (533)	Not seated
Spring Assembly (532)	Not acting
Bolt (26)	The oil feed hole is plugged.
Cup Plug (530)	Plugged
Direct Lube Exhaust	Blocked

HARSH SHIFT D4 TO D3, D2, OR D1

Checks	Cause
Spring Assembly (506)	Not functioning
Checkball Orifice	Plugged
Snap Ring (511)	Not seated
Scan Tool Shift Adapts	Maximum shift adapts

SOFT SHIFTS

Checks	Cause
Line Pressure	Too low
Pressure Control Solenoid Valve (320)	• Stuck On • A broken clip is causing leakage. • Pinched wire to ground
PCM	Failed
Accumulator Piston	• Leaking • Stuck
Accumulator Spring	Incorrect
Calibration PROM	Incorrect

Check the PCM for current DTCs.	
Shift Solenoids	Leaking
4th Accumulator Piston Pin Retainer Ring	Missing

SOFT SHIFT INTO R

Checks	Cause
Direct Clutch Oil Feed	Plugged
Direct Lube Exhaust	Blocked

SOFT SHIFT R TO D

Checks	Cause
Direct Clutch Spring (607)	Not Acting
Retainer Ring (616)	Not engaged or missing
Ball Check Orifice	Plugged

SOFT SHIFT 2 TO 1

Checks	Cause
Center Support Springs (635)	Not acting
Retainer Ring (634)	Not seated
Center Support (640)	Blocked air bleed

SOFT SHIFT 2 TO 3

Checks	Cause
Direct Clutch Oil Feed	Plugged
Direct Lube Exhaust	Blocked

SOFT SHIFT 3 TO 2

Checks	Cause
Direct Spring Assembly (607)	Not acting
Retainer Ring (608)	Not engaged or missing
Ball Check Orifice	Plugged

SOFT SHIFT D3 TO D2

Checks	Cause
Ball Check	Missing
Orifices	Incorrect sizes

DELAYED SHIFT 1 TO 2

Checks	Cause
AT Output Shaft Speed Sensor Assembly (22)	• A pinched or broken wire • A loose connector • An incorrect air gap • An inadequate signal • Coil damage
AT Input Shaft Speed Sensor Assembly (22)	• A pinched or damaged wire • Coil damage • An inadequate signal
AT Fluid Pressure Manual Valve Position Switch Assembly (40)	• A loose connector • A pinched wire • No signal to the PCM • Loose bolts causing leakage
Calibration PROM	Incorrect
Check the PCM for current DTCs.	

NO D2 TO D1

Checks	Cause
Rear Band (657)	Broken, worn, or not anchored
Detent Lever (711)	Incomplete travel

NO D3 TO D2

Checks	Cause
Front Band (628)	Broken, worn, or not anchored

ON-VEHICLE REPAIR INSTRUCTIONS

TRANSMISSION CONTROL MODULE REPLACEMENT

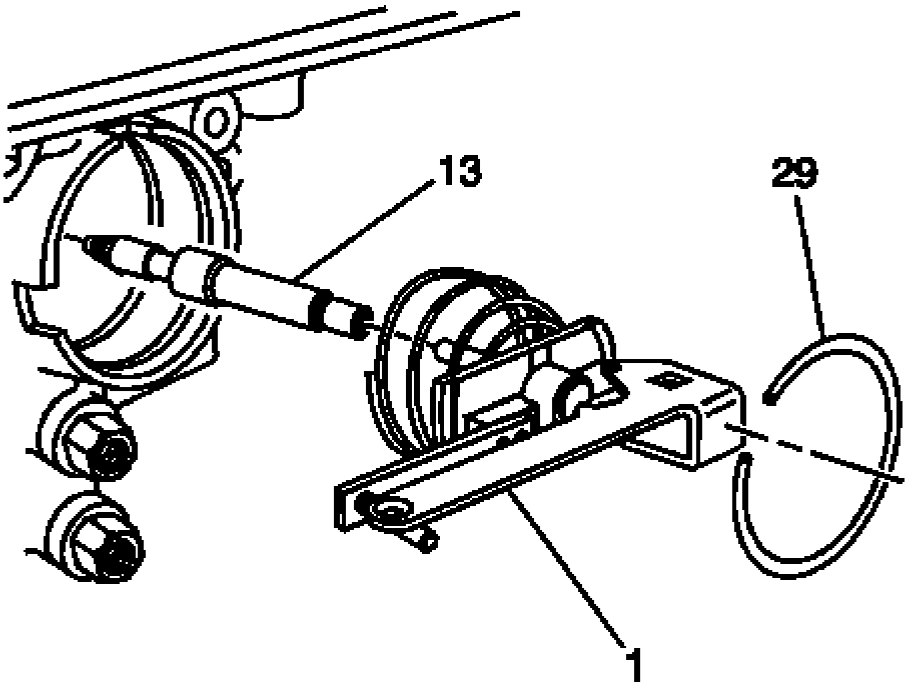


Fig. 28: Identifying Transmission Control Module
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: **Refer to Fastener Notice .** **Fastener Tightening Specifications:** Refer to **Fastener Tightening Specifications** .	
1	Transmission Control Module (TCM) Electrical Connector. **IMPORTANT:** **Twisting or tilting of the transmission control module electrical connector while disconnecting may result in bent or misaligned electrical terminal pins.**
2	TCM Push Pins (Qty: 2)
3	TCM **Tip:** • A new TCM requires programming. Refer to **Control Module References** . • It is recommended that transmission adaptive pressure (TAP) information be reset. Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission

	performance may be affected as new TAP values are learned. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

RANGE SELECTOR LEVER CABLE REPLACEMENT

Removal Procedure

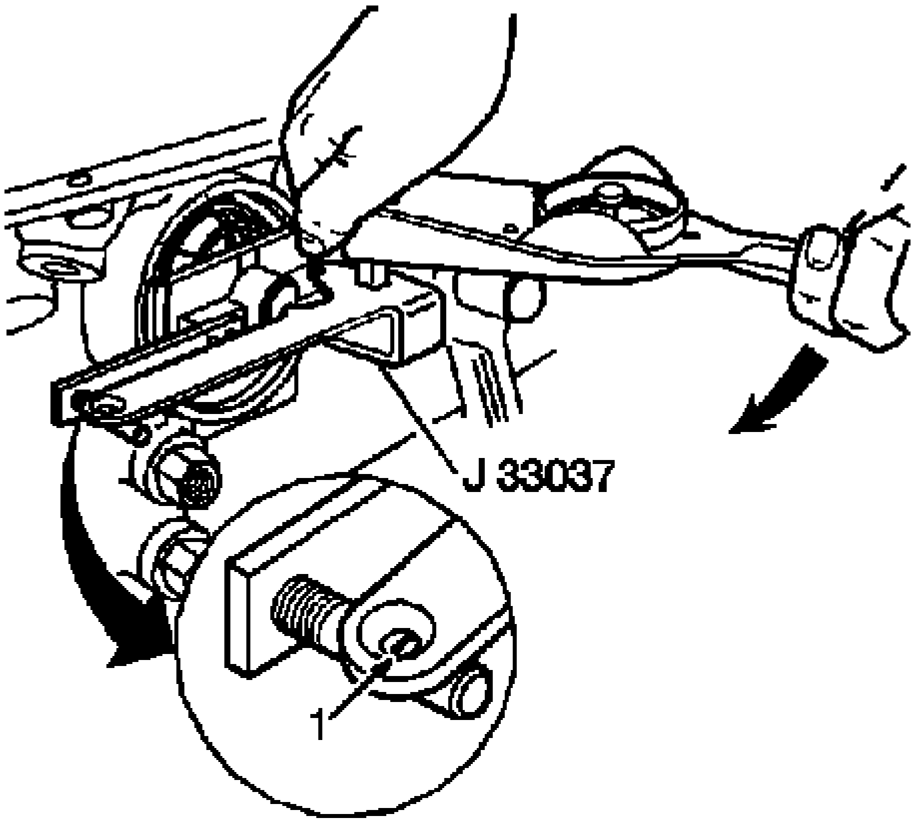


Fig. 29: Shift Cable-To-Steering Column Bracket Retaining Clip
Courtesy of GENERAL MOTORS CORP.

1. Apply the parking brake.
2. Position the steering column shift lever to park.
3. Remove the knee bolster trim panel. Refer to **Driver Knee Bolster Replacement** .
4. Remove the knee bolster bracket. Refer to **Driver Knee Bolster Bracket Replacement** .
5. Remove the clip securing the shift cable to the steering column bracket.
6. Remove the shift cable from the steering column shift control.
7. Remove the rubber grommet from the floor panel.
8. Remove the air cleaner assembly.

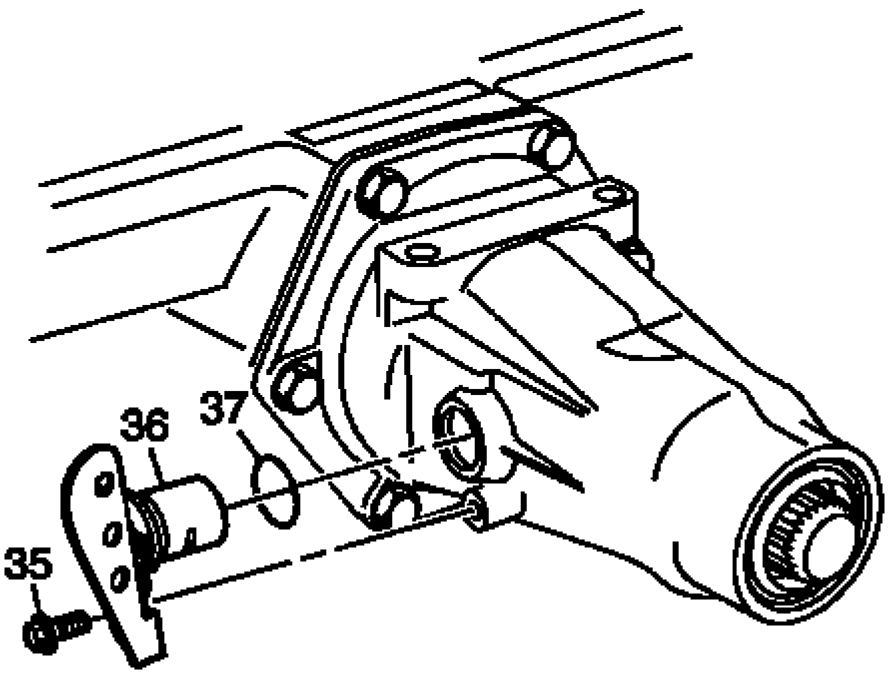


Fig. 30: Left Front & Rear Shift Cable Clips
Courtesy of GENERAL MOTORS CORP.

9. Remove the shift cable clips from the left front of the engine compartment.
10. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
11. Remove the shift cable clips from the left rear engine bracket.

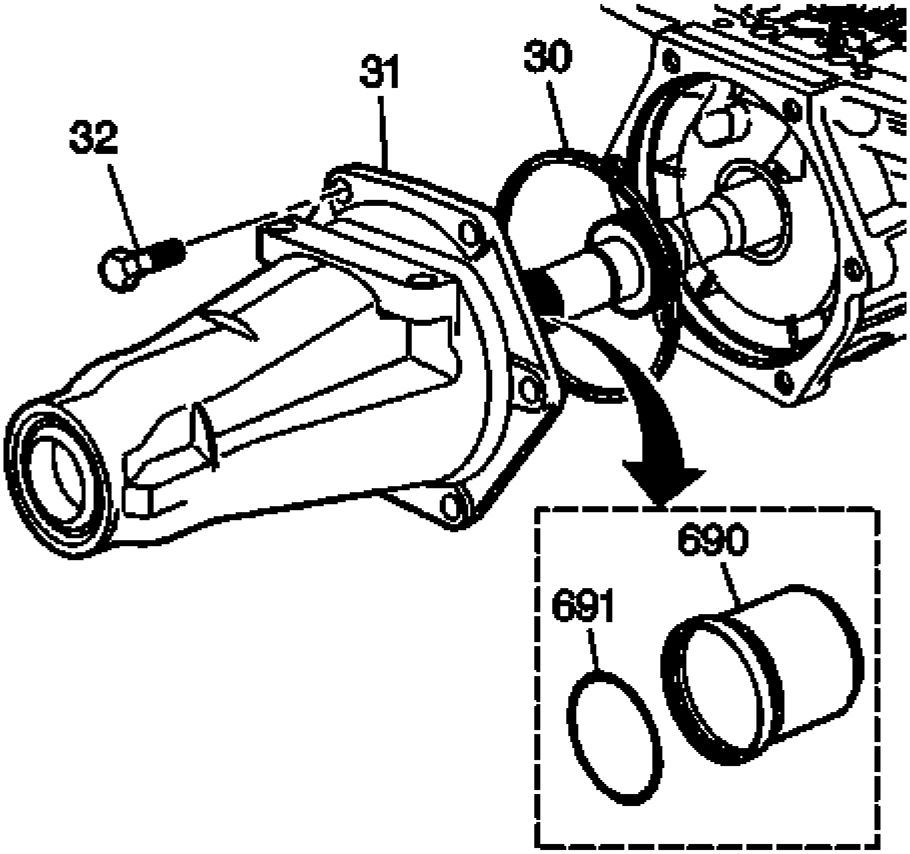


Fig. 31: Shift Cable Removed
Courtesy of GENERAL MOTORS CORP.

12. Remove the shift cable from the stud ball.
13. Remove the locking clip from the cable at the bracket.
14. Lower the vehicle.
15. Remove the shift cable from the vehicle.

Installation Procedure

IMPORTANT: Prior to installing the shift cable to the vehicle, ensure that the column shift lever and the transmission control lever are in the mechanical park position. The transmission control lever can be positioned to mechanical park by rotating the control lever clockwise until it reaches its full clockwise position.

1. Install the shift cable to the vehicle.
2. Raise the vehicle.

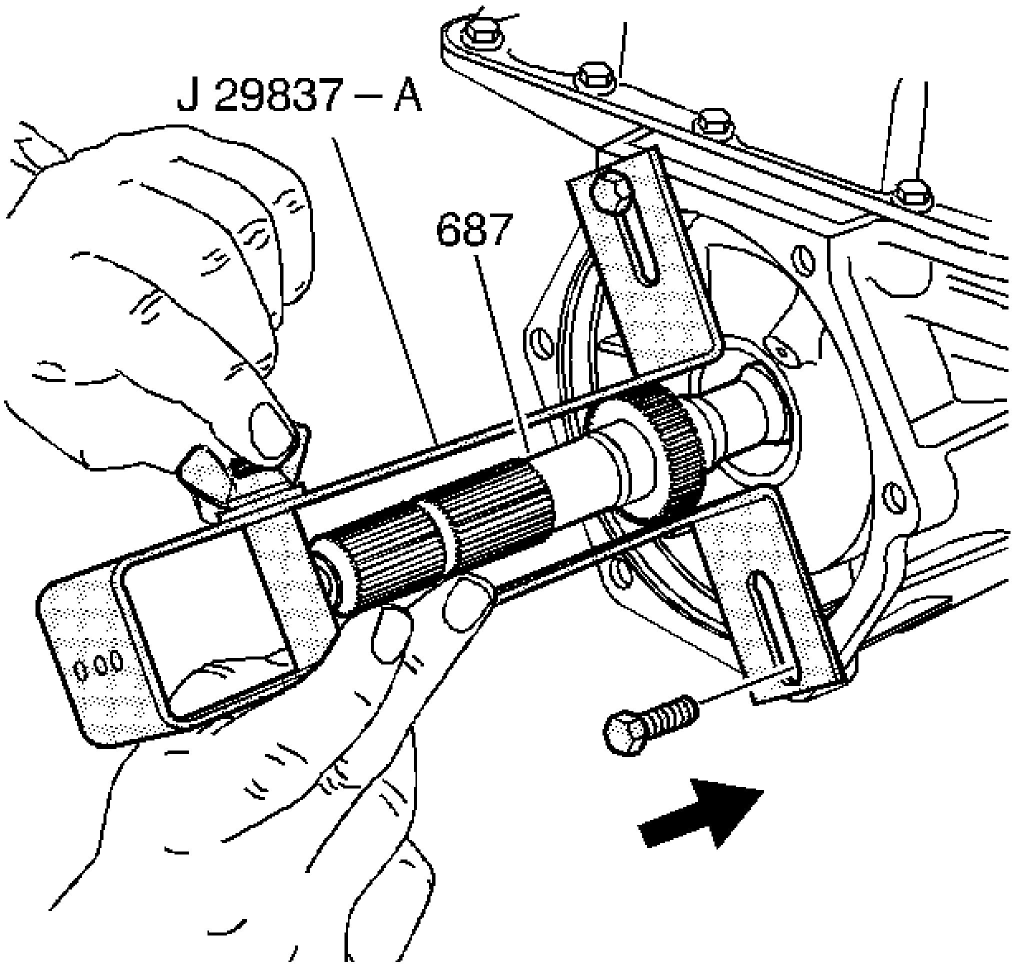


Fig. 32: Shift Cable Black Shipping Tab
Courtesy of GENERAL MOTORS CORP.

3. Remove the black shipping tab from the transmission end of the shift cable and discard the tab.
4. Install the ball stud on the transmission.

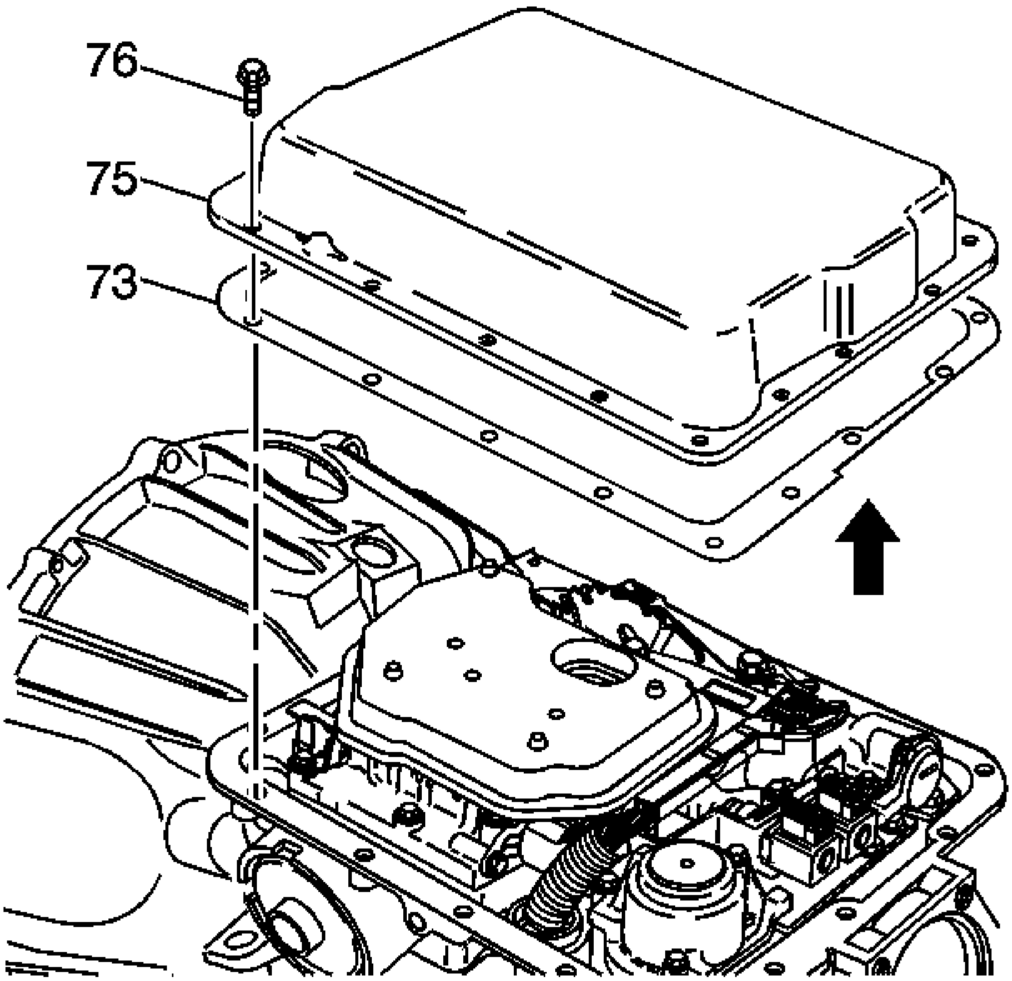


Fig. 33: Automatic Transmission Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

5. Install the shift cable to the transmission bracket.
6. Install the cable clip.
7. Install the shift cable end to the transmission shift control lever by pushing the cable end onto the transmission shift control lever stud ball.
8. Lock the primary lock.
9. Lock the secondary lock.

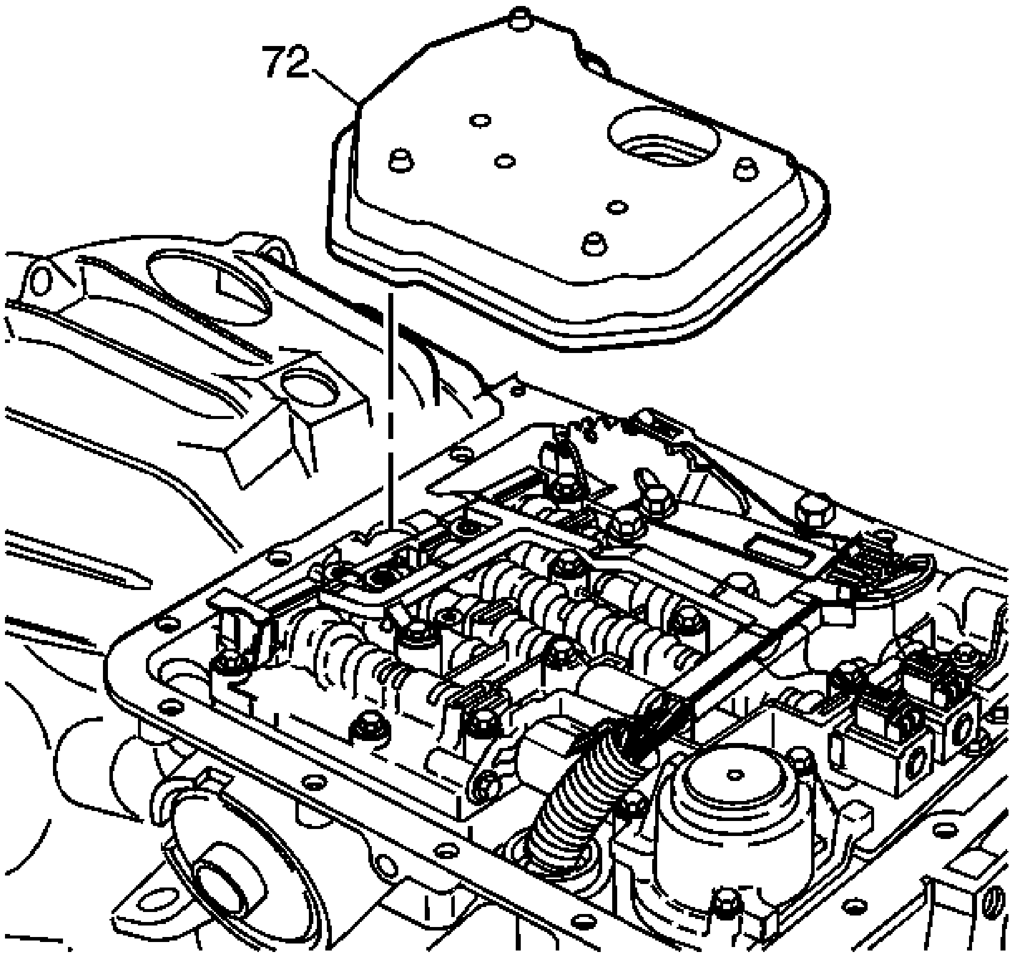


Fig. 34: Left Front & Rear Shift Cable Clips
Courtesy of GENERAL MOTORS CORP.

10. Install the shift cable clips to the engine brackets.
11. Lower the vehicle.

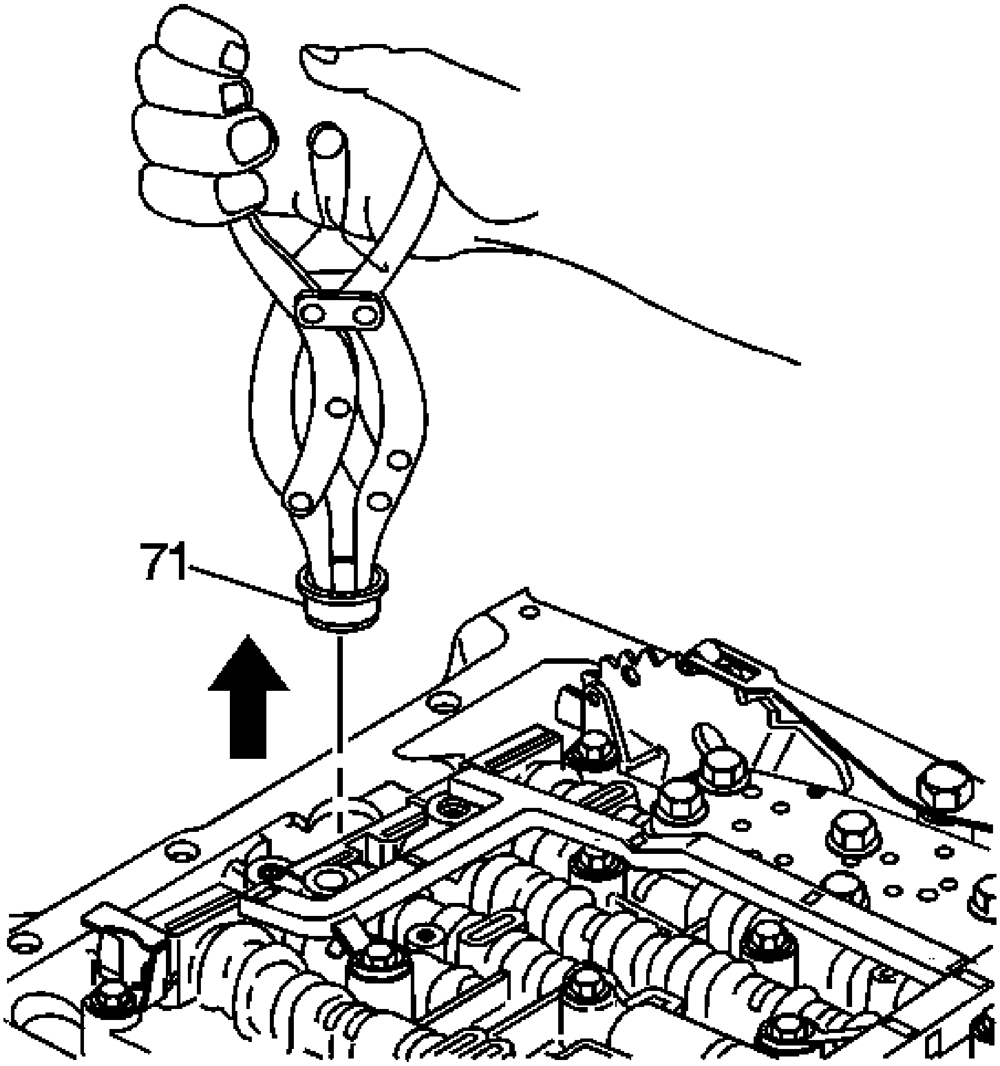


Fig. 35: Shift Cable-To-Steering Column Bracket Retaining Clip
Courtesy of GENERAL MOTORS CORP.

12. Install the rubber grommet to the floor panel.

IMPORTANT: Ensure the shift lever is in the Park position.

13. Install the shift cable to the steering column shift control.
14. Install the clip securing the shift cable to the steering column bracket.

15. Install the cable to the shift lever ball stud.
16. Adjust the shift cable. Refer to **Range Selector Lever Cable Adjustment** .
17. Install the knee bolster bracket. Refer to **Driver Knee Bolster Bracket Replacement** .
18. Install the knee bolster trim panel. Refer to **Driver Knee Bolster Replacement** .

RANGE SELECTOR LEVER CABLE ADJUSTMENT

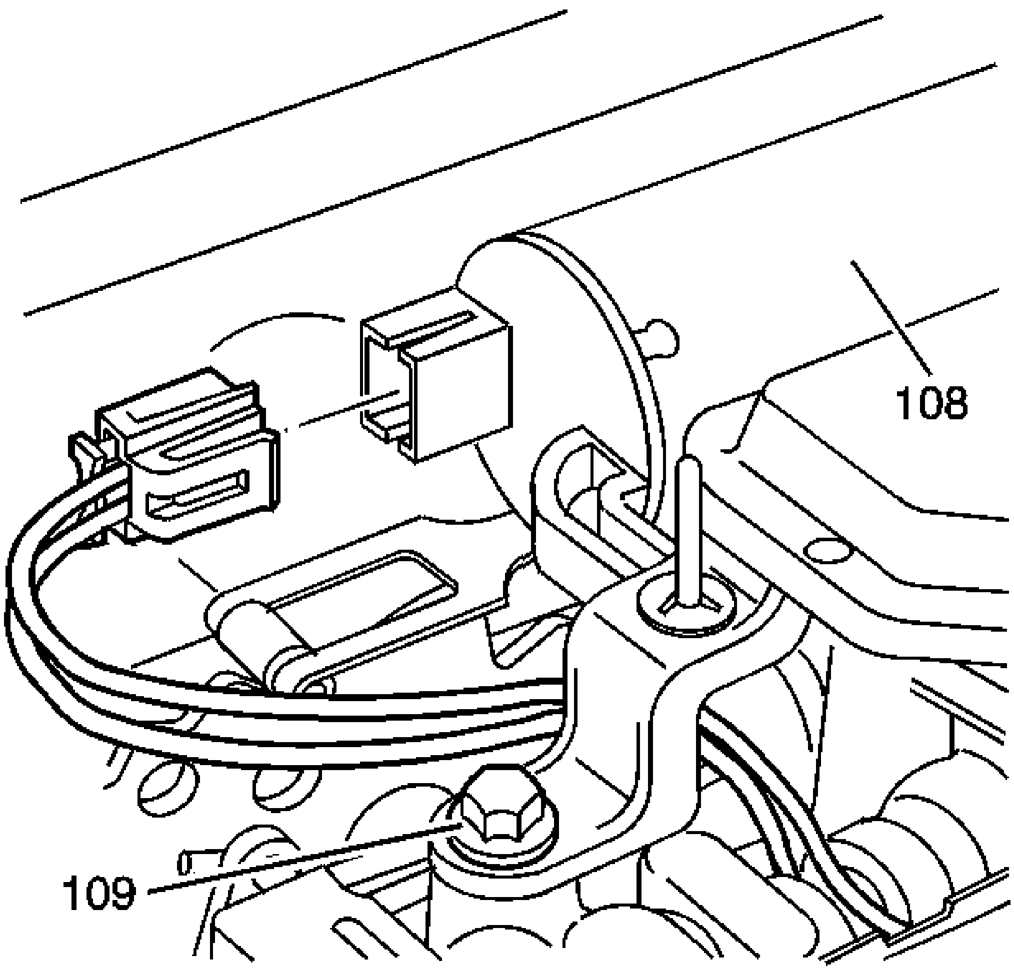


Fig. 36: Aligning Outside Diameter Of Transmission End With Inside Diameter Of Shifter End
Courtesy of GENERAL MOTORS CORP.

1. Ensure that the steering column shift lever is in the park (P) position.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

3. Ensure that the transmission manual shaft lever is in the park (P) position.
4. Grasp the shift cable shifter end (1) in the left hand and the shift cable transmission end (2) in the right hand.
5. Align the outside diameter of the transmission end (2) with the inside diameter of the shifter end (1).

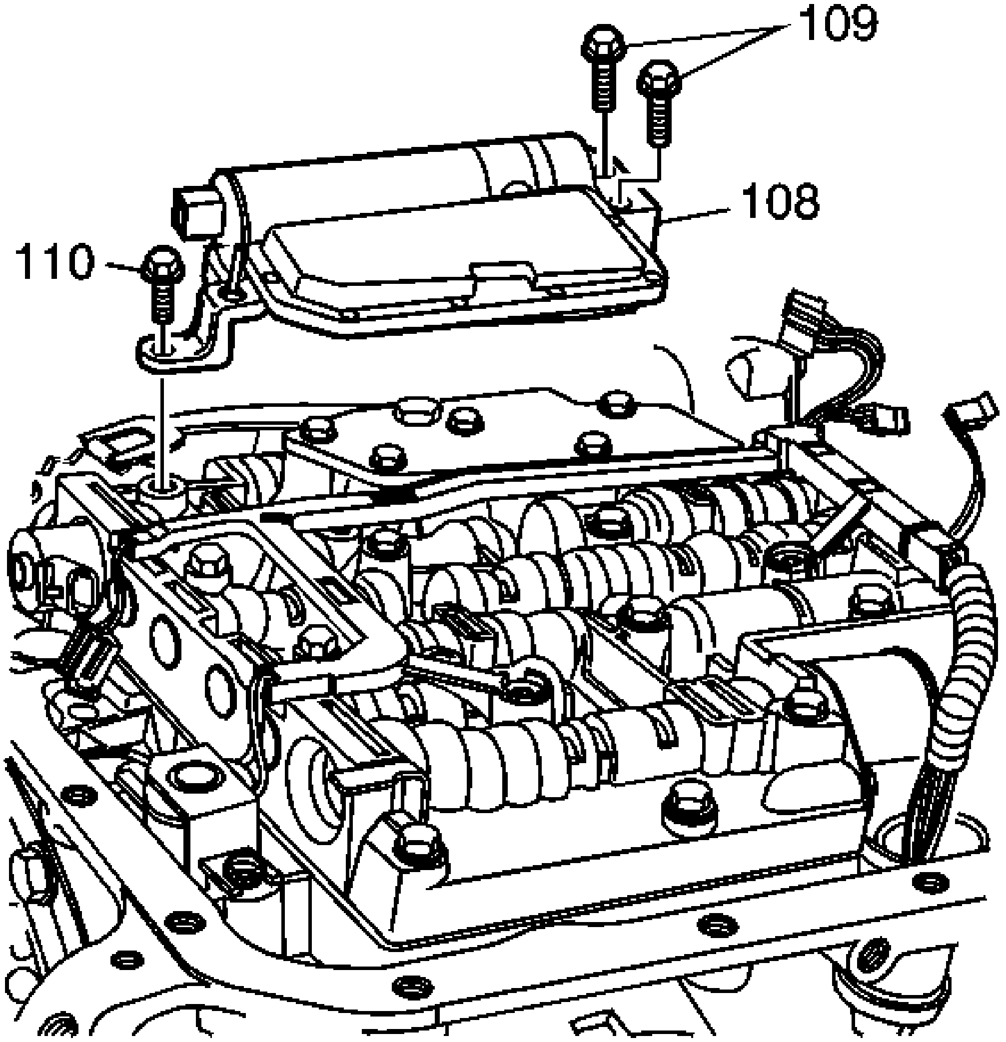


Fig. 37: Engaging Shift Cable Ends
Courtesy of GENERAL MOTORS CORP.

6. Push the end of the transmission cable (3) inside the shifter end until the blue spring (2) on the transmission end (3) is fully compressed, this will engage the inner wire and lock both wires together.

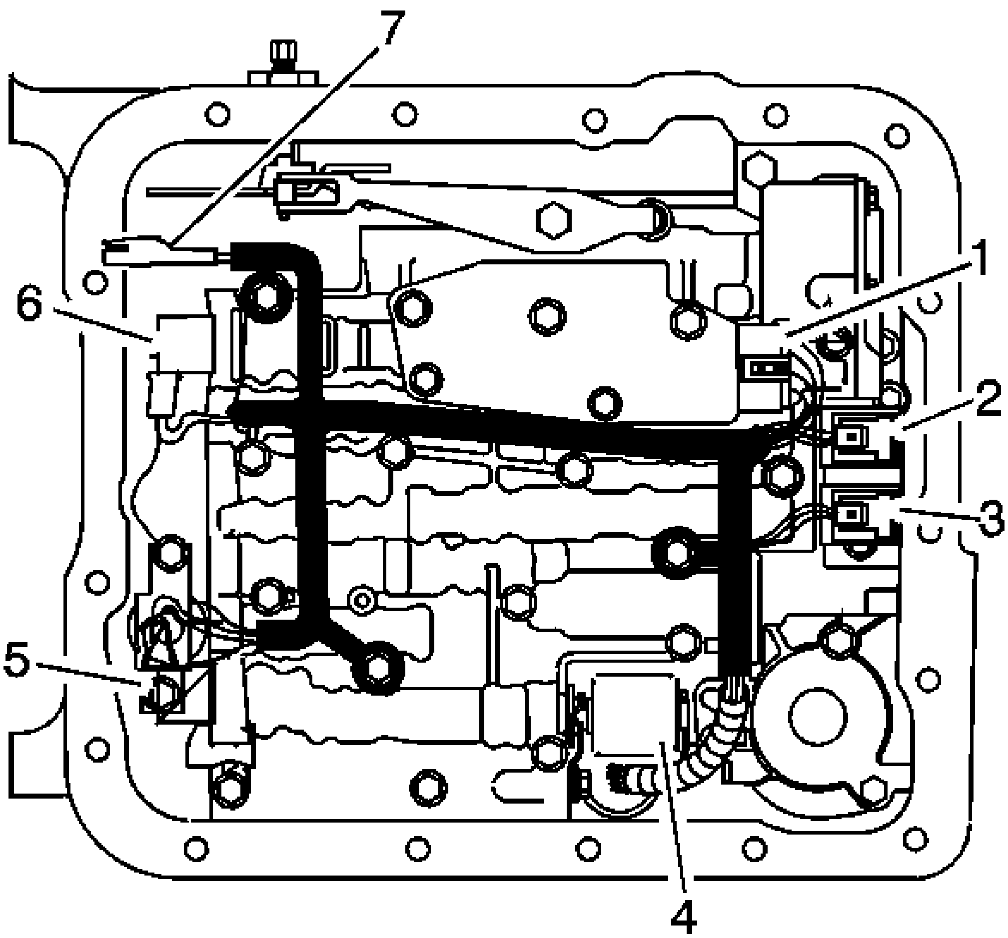


Fig. 38: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT hold the transmission end (1) during this operation, this will result in a mis-adjusted cable.

7. Release the transmission end (3) and allow the spring (2) to tension/adjust the cable system.
8. Pull the white cover (5) on the shifter end (1) back.
9. Push the natural colored lock button (4) down to engage the locking teeth on the transmission end (3).

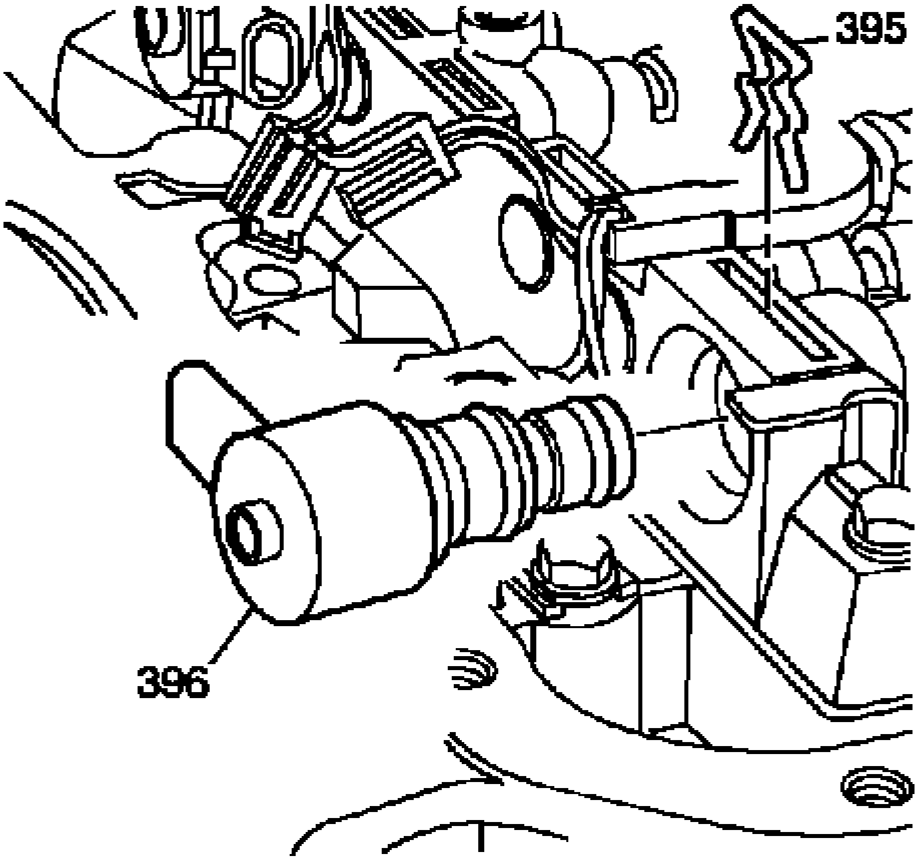


Fig. 39: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

10. Release the white cover (1).
11. Verify the white cover (1) conceals the natural colored lock (2).
12. If the white cover (1) does not conceal the natural colored lock (2), the shift cable must be re-adjusted. Refer to **Cable Re-Adjustment**.
13. Lower the vehicle.
14. Test the transmission for proper shift operation.
15. If all of the gear positions cannot be achieved, the shift cable must be re-adjusted. Refer to cable re-adjustment below.

Cable Re-Adjustment

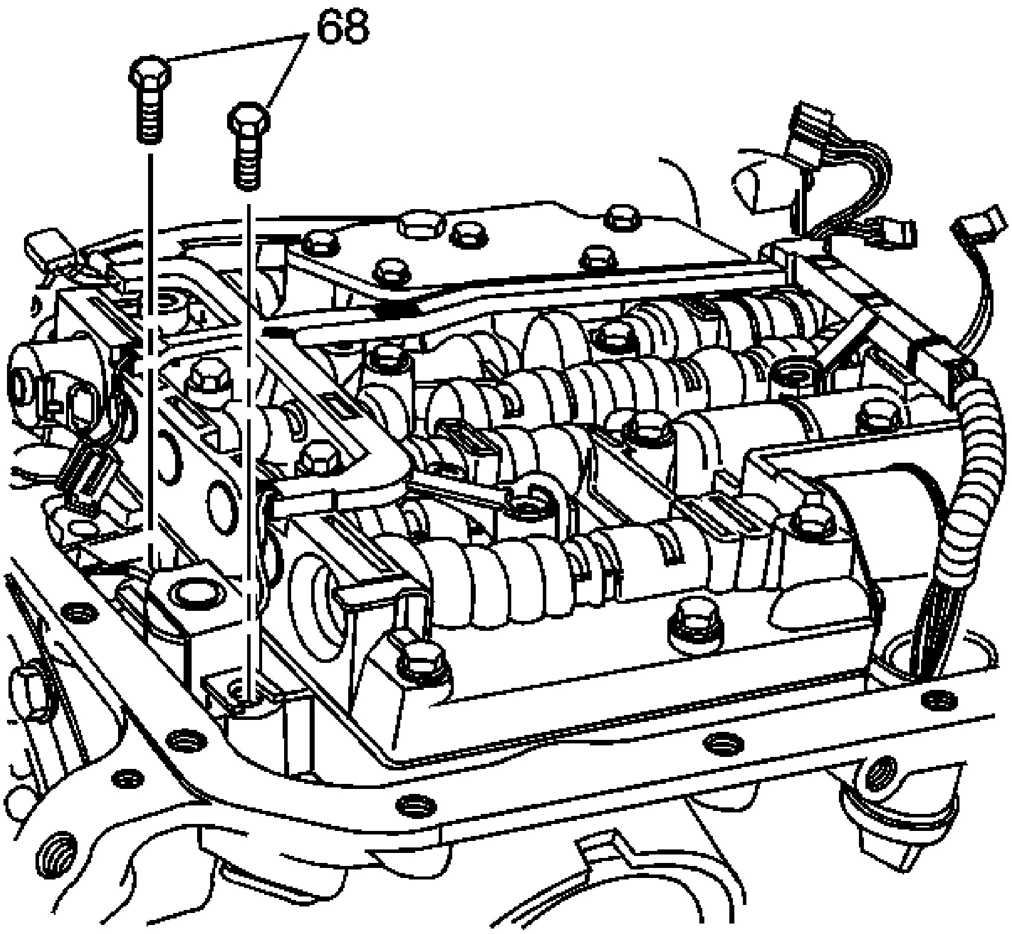


Fig. 40: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

1. Place the steering column shift lever back into the park (P) position.
2. Raise the vehicle.
3. Ensure that the transmission manual shaft lever is in the park (P) position.
4. Pull the white cover (1) back to expose the natural colored lock (2). Under the lock (2), insert a flat-bladed screwdriver under the lock ramp located at the top of the lock. The lock will pop up, and the transmission end will move slightly away from the shifter end.

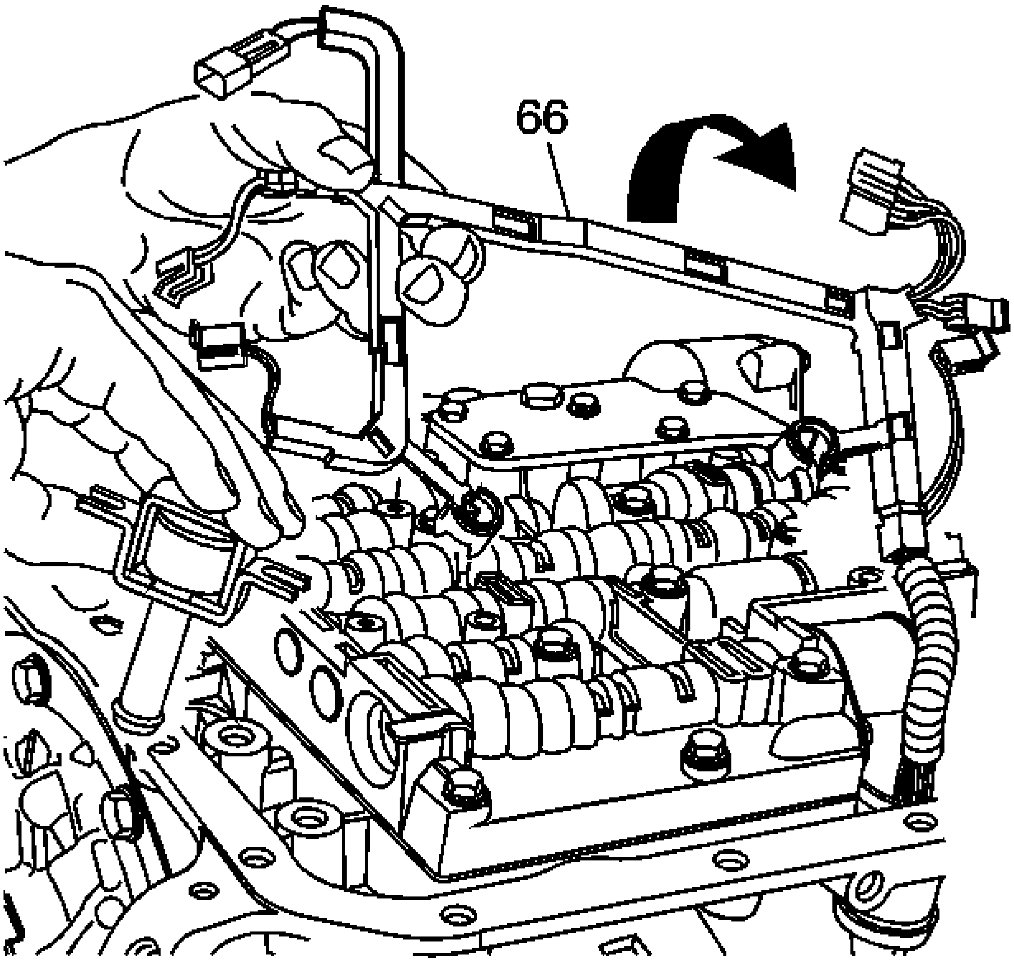


Fig. 41: Engaging Shift Cable Ends
Courtesy of GENERAL MOTORS CORP.

5. Push the end of the transmission end (3) inside the shifter end (1) until the blue spring (2) on the transmission end (3) is fully compressed, this will engage the inner wire and lock both wires together.

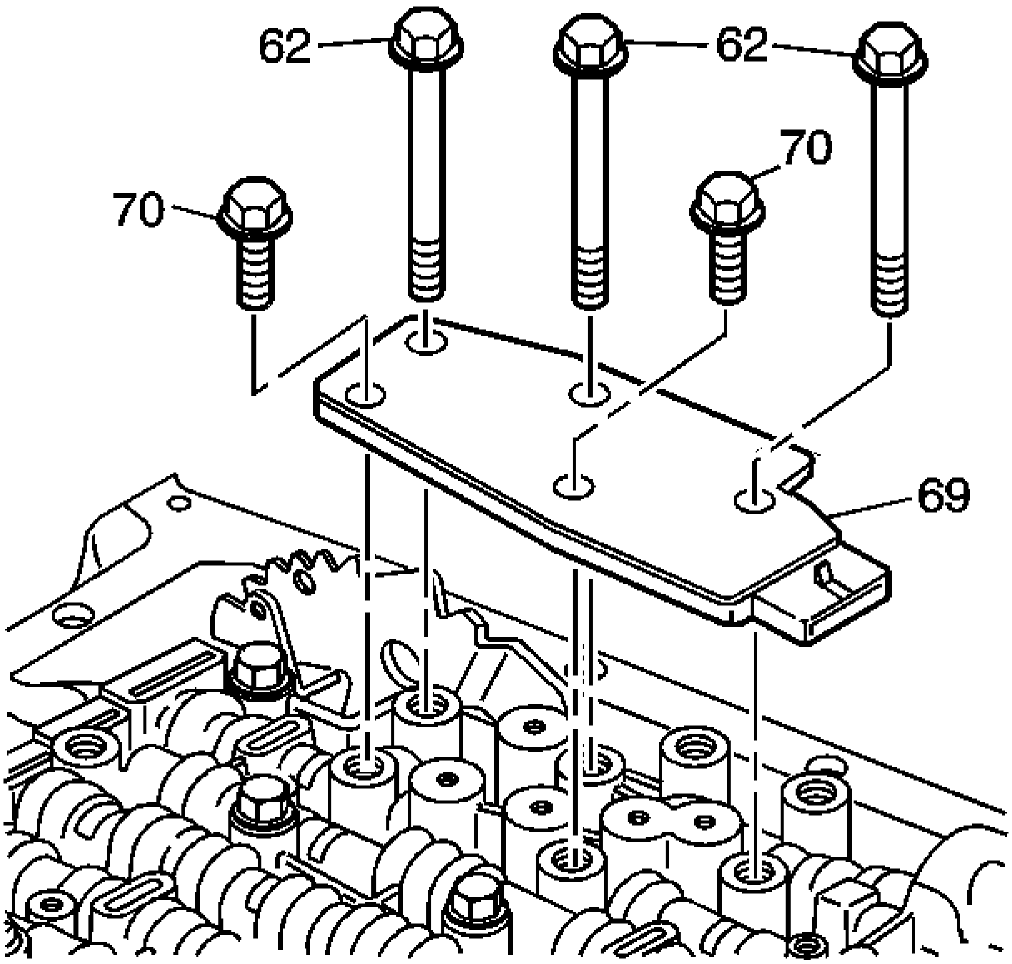


Fig. 42: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT hold the transmission end (1) during this operation, this will result in a mis-adjusted cable.

6. Release the transmission end (3) and allow the spring (2) to tension/adjust the cable system.
7. Pull the white cover (5) on the shifter end (1) back.
8. Push the natural colored lock button (4) down to engage the locking teeth on the transmission end (3).

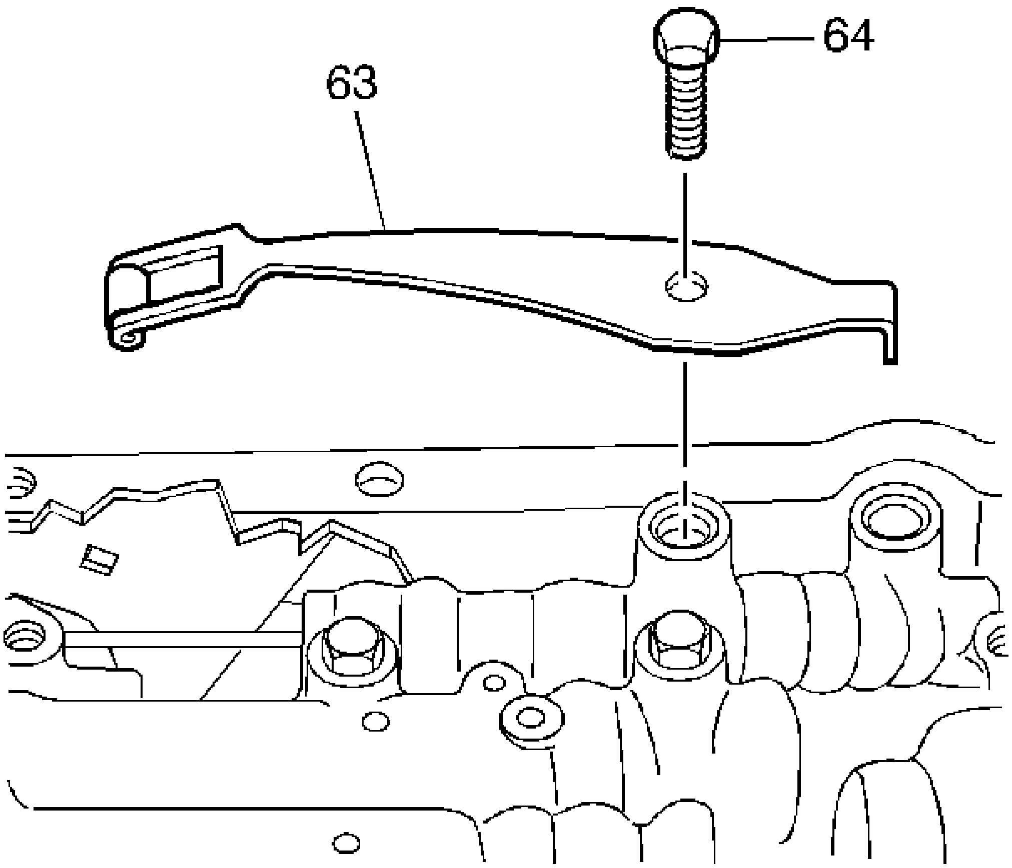


Fig. 43: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

9. Release the white cover (1).
10. Verify the white cover (1) conceals the natural colored lock (2).

RANGE SELECTOR LEVER CABLE BRACKET REPLACEMENT

Removal Procedure

1. Apply the parking brake.
2. Shift the transmission into neutral.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .

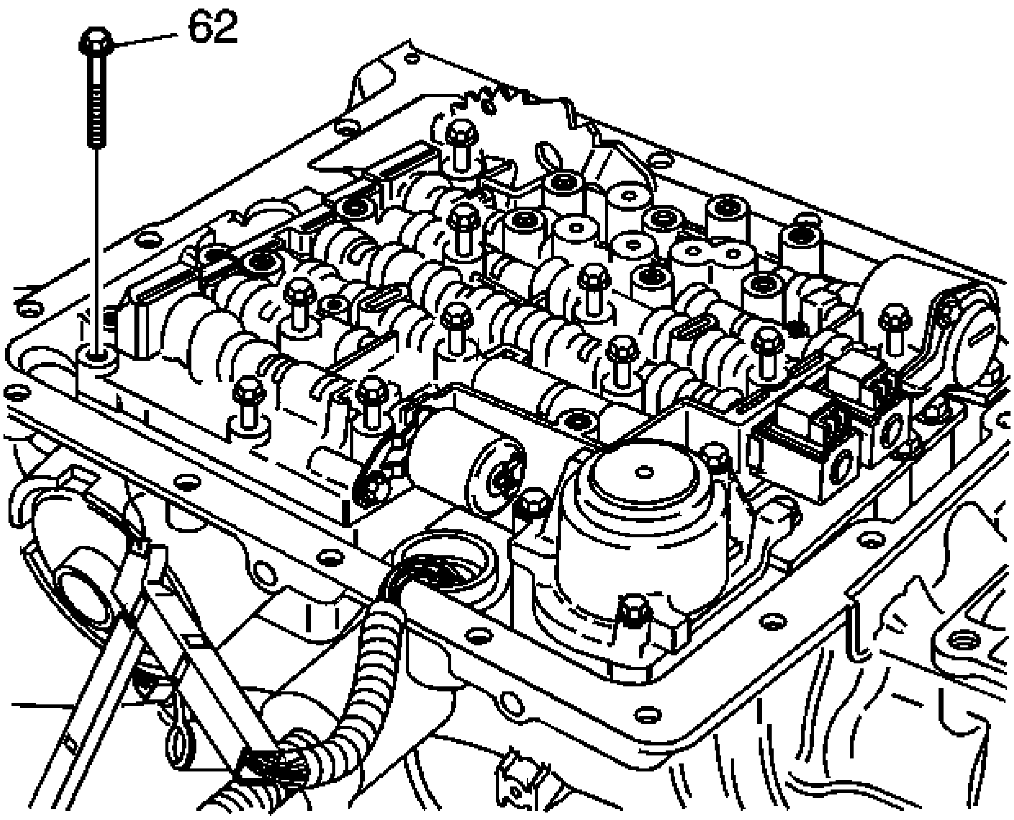


Fig. 44: View Of Selector Cable Bracket And Cable
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the transmission range selector cable from the shift lever and the bracket (2). Refer to **Range Selector Lever Cable Replacement** .
5. Remove the bolts (1) securing the transmission range selector cable bracket (2) to the transmission.
6. Remove the transmission range selector cable bracket from the vehicle.

Installation Procedure

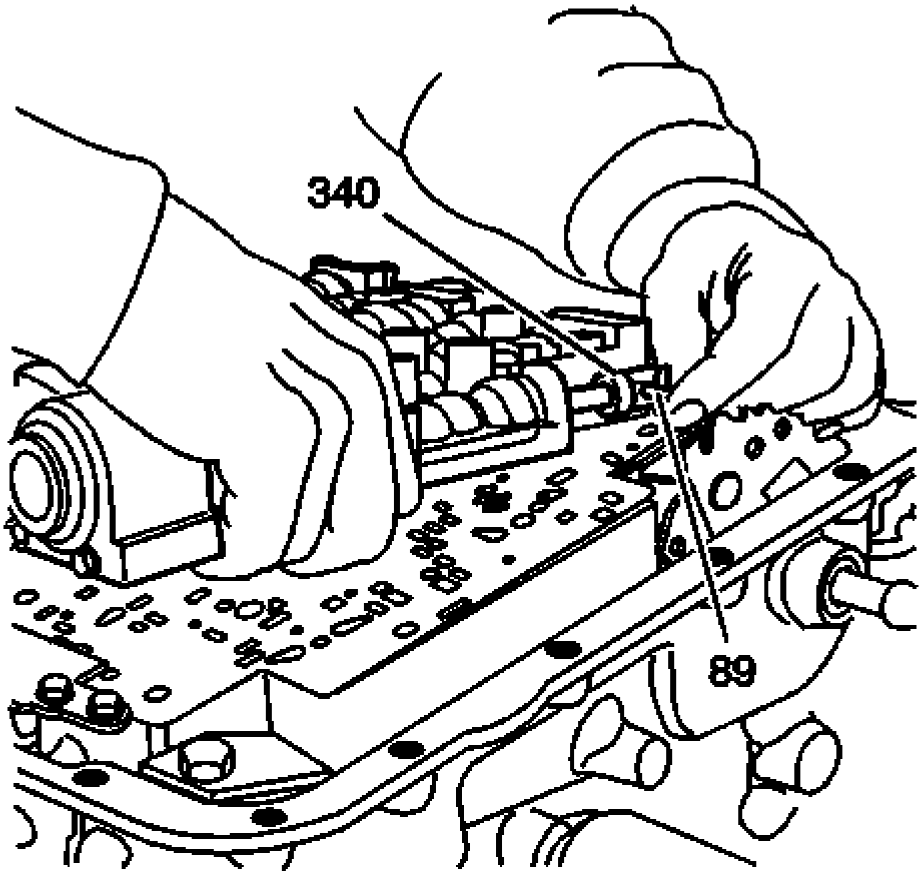


Fig. 45: View Of Selector Cable Bracket And Cable
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission range selector cable bracket to the vehicle.

NOTE: Refer to FASTENER NOTICE .

2. Install the transmission range selector cable bracket bolts (1).

   Tighten: Tighten the bolts to 25 N.m (18 lb ft).

3. Install the transmission range selector cable to the bracket (2) and the lever. Refer to **Range Selector Lever Cable Replacement** .
4. Lower the vehicle.
5. Check the vehicle for proper operation. If adjustment of the cable is necessary, refer to **Range Selector Lever Cable Adjustment** .

PARK/NEUTRAL POSITION SWITCH REPLACEMENT

Tools Required

J 41364-A Neutral Position Adjustment Tool

Removal Procedure

1. Apply the parking brake.
2. Shift the transmission into neutral.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .

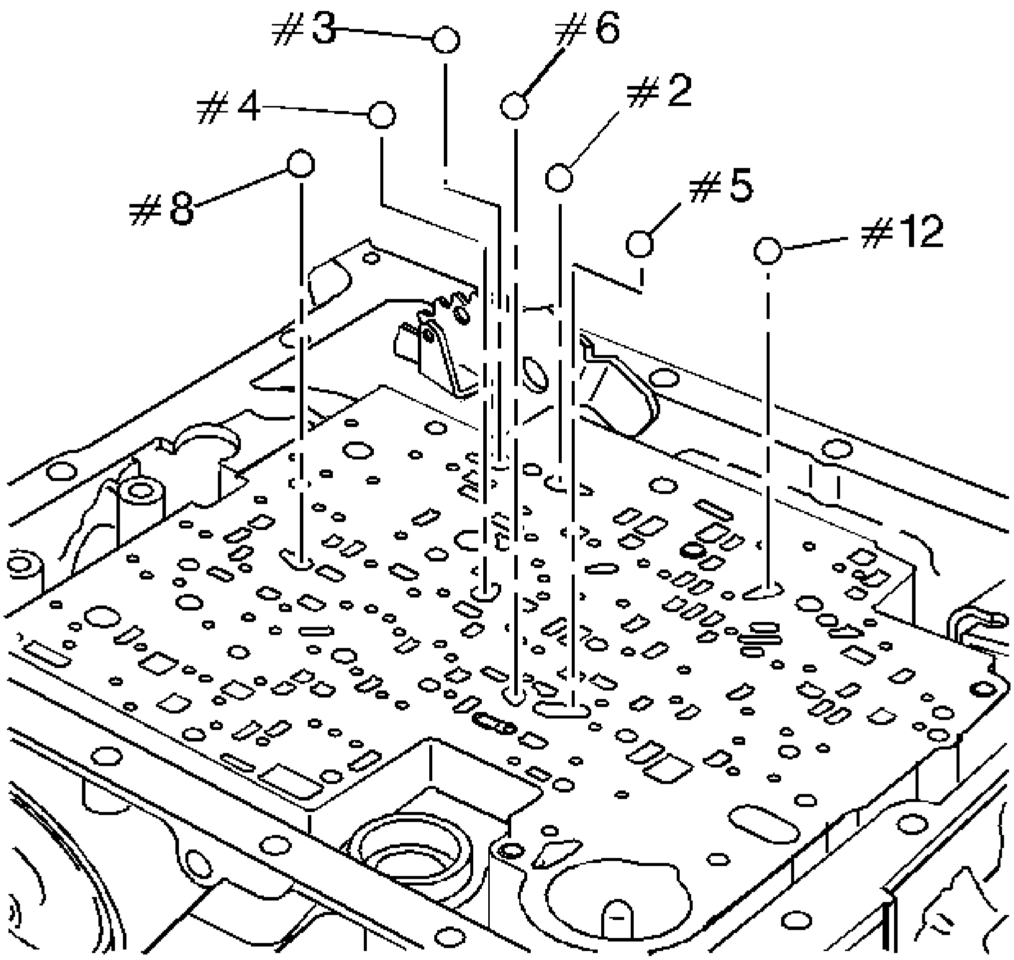


Fig. 46: View Of PNP Switch, Lever And Manual Shaft
Courtesy of GENERAL MOTORS CORP.

4. Remove the nut securing the transmission control lever to the manual shaft.
5. Remove the transmission control lever from the manual shaft.
6. Disconnect the electrical connectors from the switch.
7. Remove the bolts securing the park/neutral position switch to the transmission.

8. Remove the park/neutral position switch from the manual shaft. If the park/neutral position switch did not slide off the manual shaft, file the outer edge of the manual shaft in order to remove any burrs.

Installation Procedure

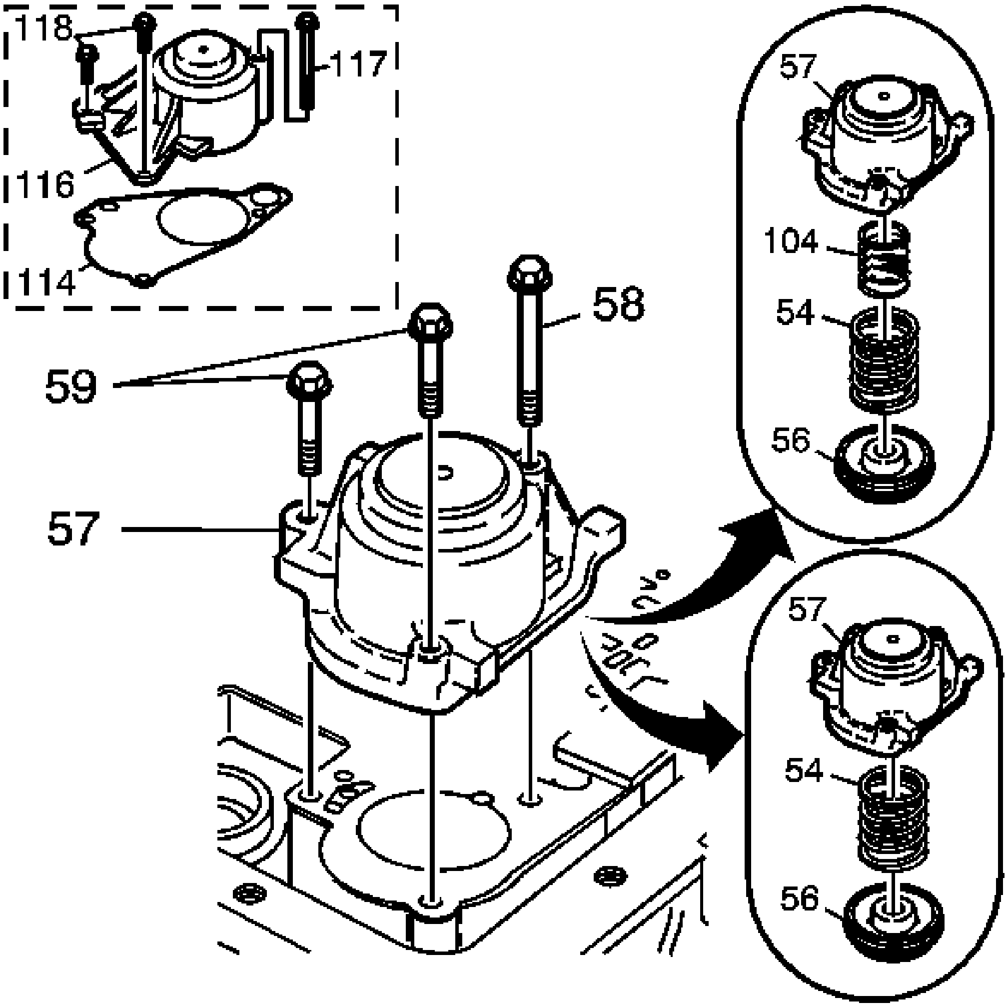


Fig. 47: View Of PNP Switch, Lever And Manual Shaft
Courtesy of GENERAL MOTORS CORP.

1. Install the switch to the transmission manual shaft by aligning the switch hub flats with the manual shaft flats.
2. Slide the switch onto the transmission manual shaft until the switch mounting bracket contacts the mounting bosses on the transmission.

IMPORTANT: If a new switch is being installed, the switch will come with a positive assurance bracket. The positive assurance bracket aligns the new switch in it proper position for installation and the use of neutral position adjustment tool will not be necessary.

3. Install the switch to the transmission with two bolts finger tight.

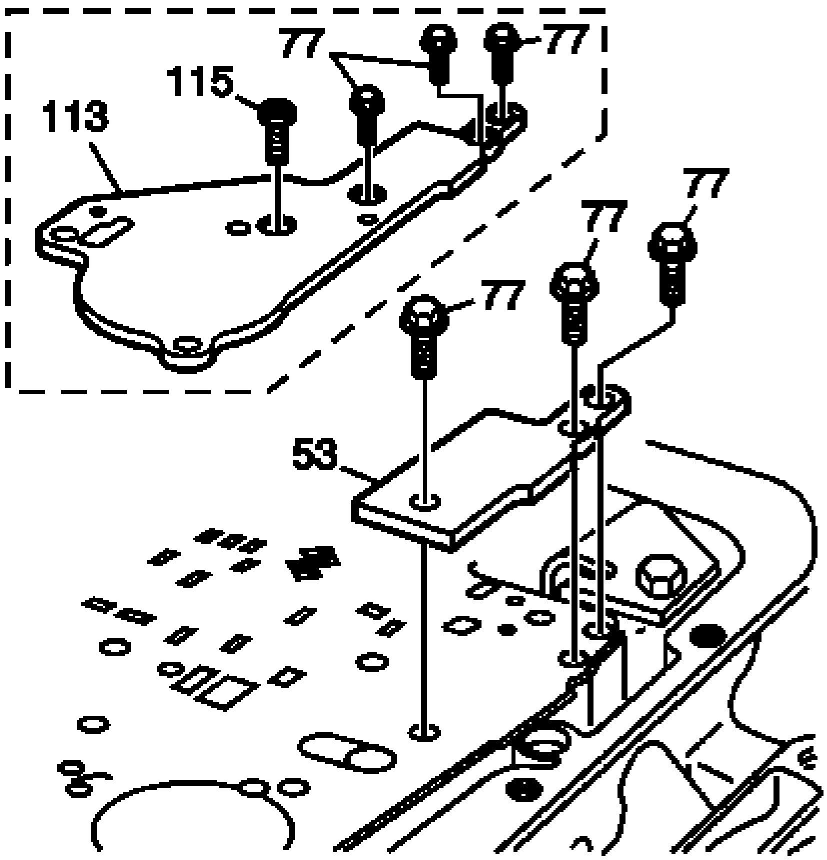


Fig. 48: Positioning J 41364-A Onto PNP Switch
Courtesy of GENERAL MOTORS CORP.

4. Position the tool **J 41364-A** onto the park/neutral position switch. Ensure that the two slots on the switch where the manual shaft is inserted are lined up with the lower two tabs on the tool.

NOTE: Refer to FASTENER NOTICE .

5. Rotate the tool until the upper locator pin on the tool is lined up with the slot on the top of the switch.

   Tighten: Tighten the bolts securing the switch to 25 N.m (18 lb ft).

6. Remove the **J 41364-A** from the switch. If installing a new switch, remove the positive assurance bracket at this time.

7. Connect the electrical connectors to the switch.

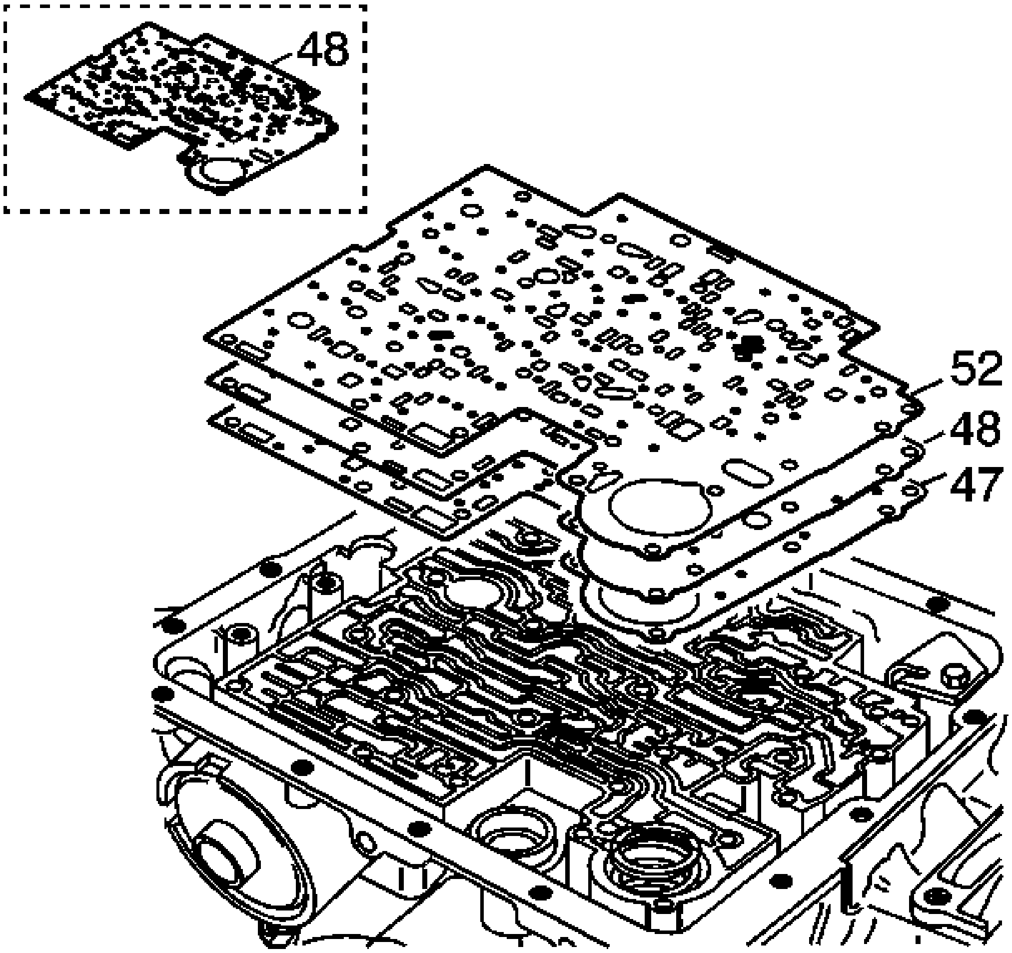


Fig. 49: View Of PNP Switch, Lever And Manual Shaft
Courtesy of GENERAL MOTORS CORP.

8. Install the transmission control lever to the manual shaft with the nut.

   Tighten: Tighten the control lever nut to 25 N.m (18 lb ft).

9. Lower the vehicle.
10. Check the switch for proper operation. The engine must start in the P (Park) or N (Neutral) positions only. If proper operation of the switch can not be obtained, replace the switch.

PARK/NEUTRAL POSITION SWITCH ADJUSTMENT

IMPORTANT:

- **The following procedure is for vehicles that have not had the switch removed or replaced. If the switch has been removed or replaced, refer to Park/Neutral Position Switch Replacement for the proper adjustment procedure.**
- **Apply the parking brake.**
- **The engine must start in the P (Park) or N (Neutral) positions only.**
- **Check the switch for proper operation. If adjustment is required, proceed as follows:**

1. Place the transmission range selector in the N (Neutral) position.
2. With an assistant in the drivers seat, raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Loosen the park/neutral position switch mounting bolts.
4. With the vehicle in the N (Neutral) position, rotate the switch while the assistant attempts to start the engine.
5. Following a successful start, turn the engine off.

   NOTE: Refer to FASTENER NOTICE .

6. Tighten the bolts securing the switch to the transmission.

   Tighten: Tighten the bolts to 25 N.m (18 lb ft).

7. Lower the vehicle.
8. Check the switch for proper operation. The engine must start in the P (Park) or N (Neutral) positions only.
9. Replace the park/neutral position switch if proper operation can not be achieved. Refer to **Park/Neutral Position Switch Replacement** .

TOW/HAUL SWITCH REPLACEMENT

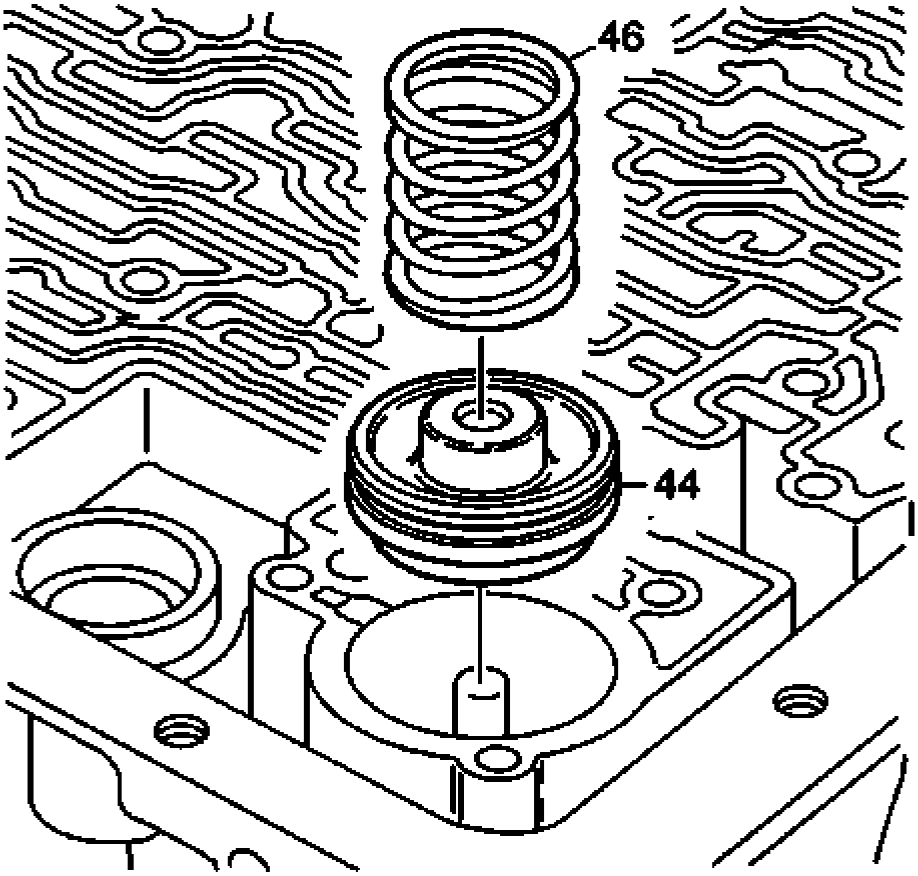


Fig. 50: Tow/Haul Switch Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Instrument Panel Cluster Trim Plate Bezel Assembly Refer to **Instrument Panel Cluster Trim Plate Bezel Replacement** .
2	Tow/Haul Mode Switch Assembly **Procedure:** Squeeze the retaining tabs on the back of the switch and push the switch out of the cluster trim bezel assembly.

AUTOMATIC TRANSMISSION FLUID AND FILTER REPLACEMENT

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Place a drain pan under the transmission oil pan.
3. Remove the oil pan drain plug, if equipped.

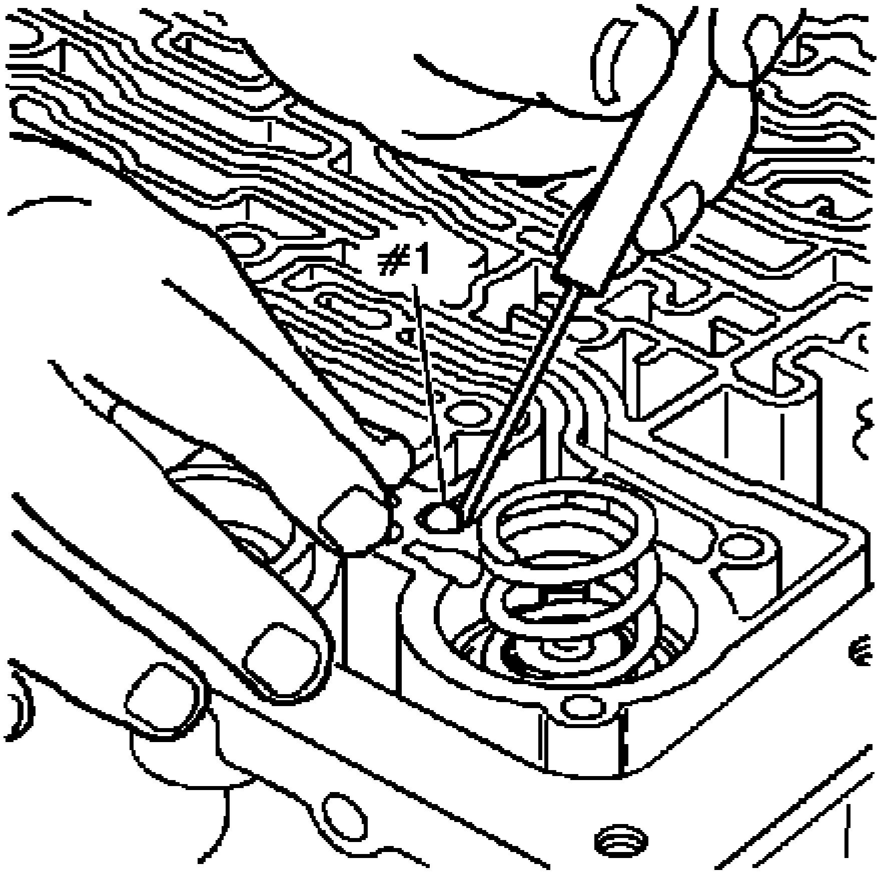


Fig. 51: View Of Oil Pan, Gasket, Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil pan bolts.
5. Remove the oil pan.
6. Remove the gasket.
7. Remove the magnet.

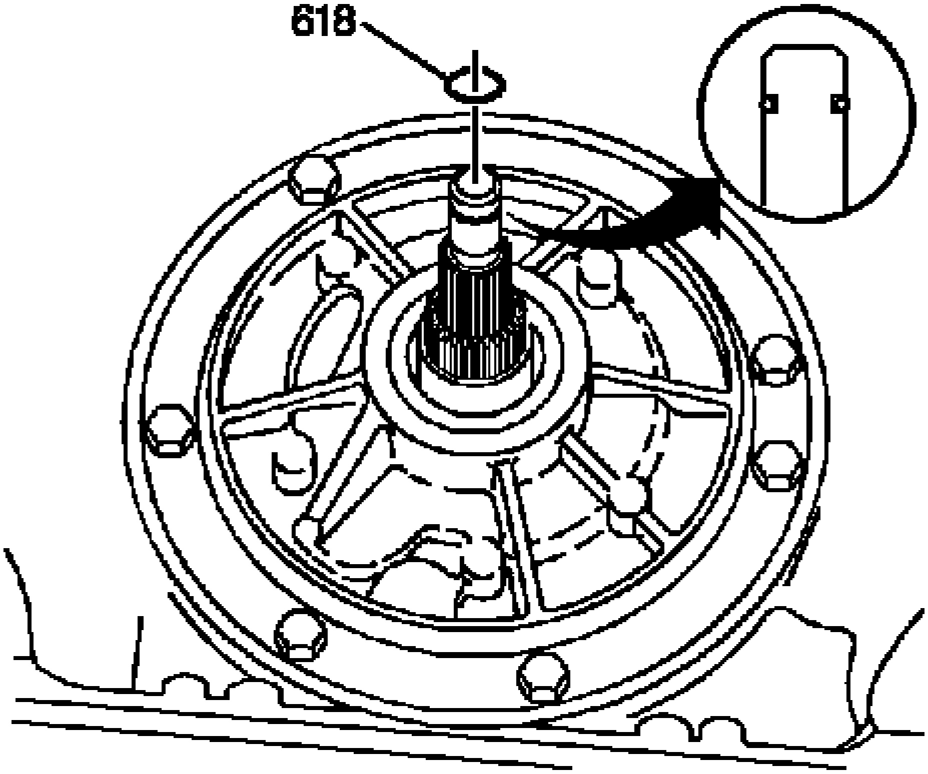


Fig. 52: View Of Oil Filter & Filter Neck Seal
Courtesy of GENERAL MOTORS CORP.

8. Remove the oil filter.
9. Remove the filter neck seal.
10. The transmission oil pan gasket is reusable.

    Inspect the gasket and replace as needed.

11. Clean the transmission case and the oil pan gasket surfaces with solvent.

Installation Procedure

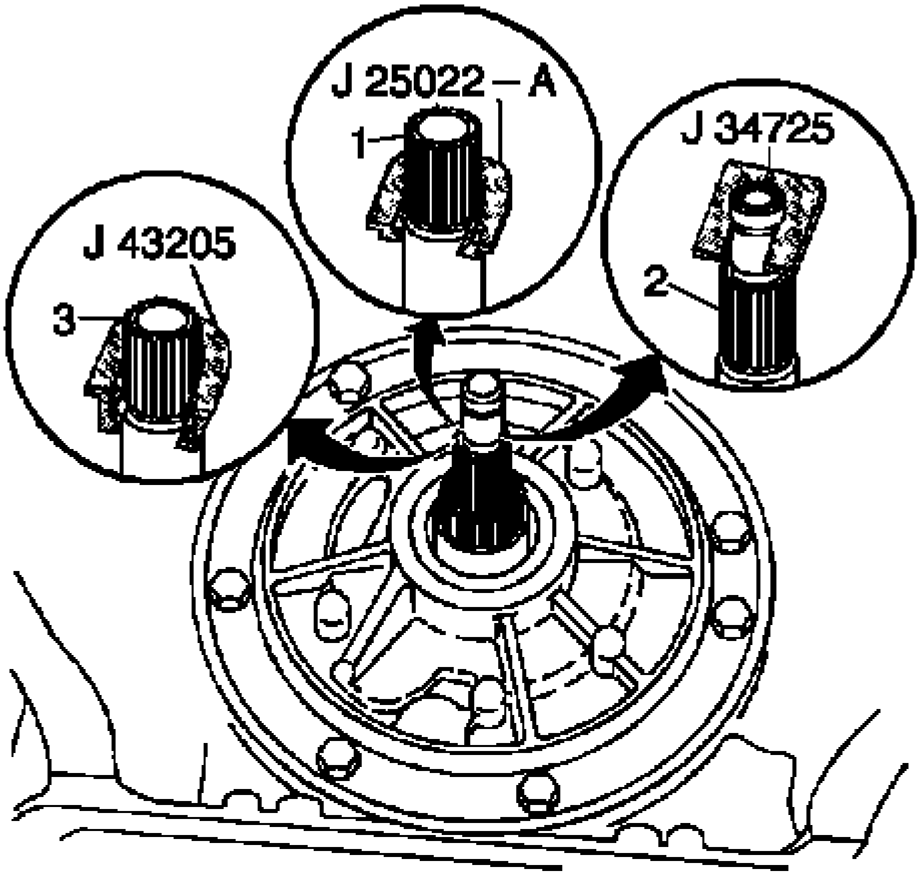


Fig. 53: View Of Oil Filter & Filter Neck Seal
Courtesy of GENERAL MOTORS CORP.

1. Install the filter neck seal.
2. Install the oil filter.

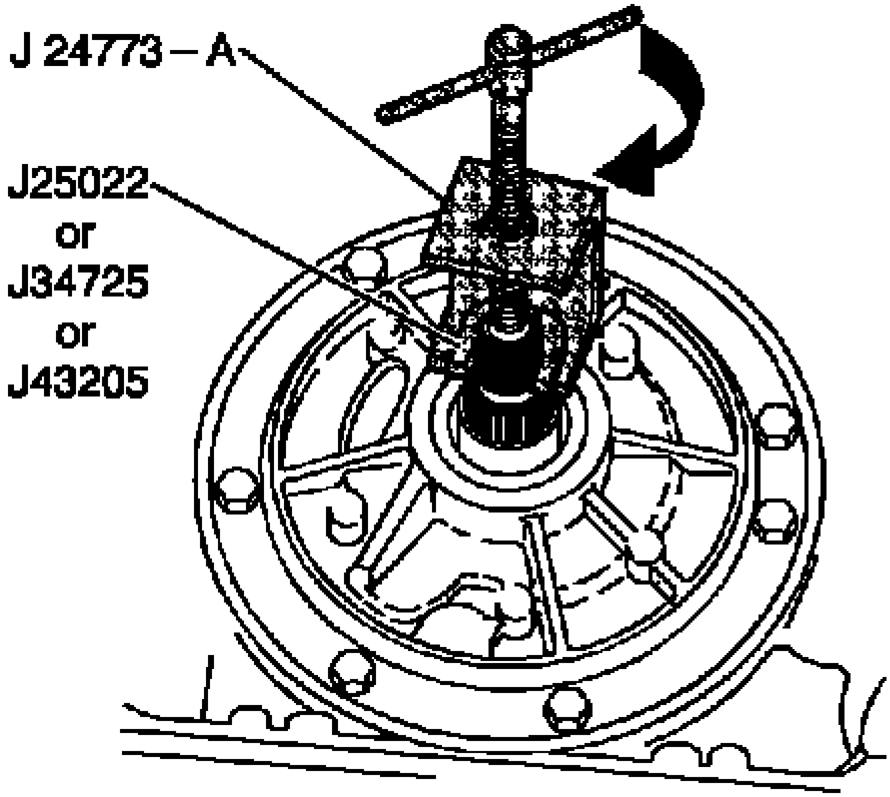


Fig. 54: View Of Oil Pan, Gasket, Magnet & Bolts
Courtesy of GENERAL MOTORS CORP.

3. Install the oil pan gasket to the pan.
4. Install the magnet into the bottom of the pan.

NOTE: **Refer to FASTENER NOTICE .**

5. Install the oil pan to the transmission with seventeen bolts.

   Tighten: Tighten the oil pan bolts to 11 N.m (97 lb in).

6. Apply a small amount of sealant GM P/N 12346004 to the treads of the drain plug, if equipped.
7. Install the oil pan drain plug, if equipped.

   Tighten: Tighten the oil pan drain plug to 18 N.m (13 lb ft).

8. Lower the vehicle.
9. Fill the transmission to the proper level with Dexron® VI transmission fluid. Refer to **Transmission Fluid Check**.

TRANSMISSION FLUID FILLER TUBE AND SEAL REPLACEMENT

Removal Procedure

1. Remove the engine air cleaner. Refer to **Air Cleaner Assembly Replacement** for the 4.3L engine, **Air Cleaner Assembly Replacement** for the 4.8L, 5.3L 6.0L engine, or **Air Cleaner Assembly Replacement** for the 6.6L engine.
2. Remove the transmission fluid level indicator from the fluid fill tube.

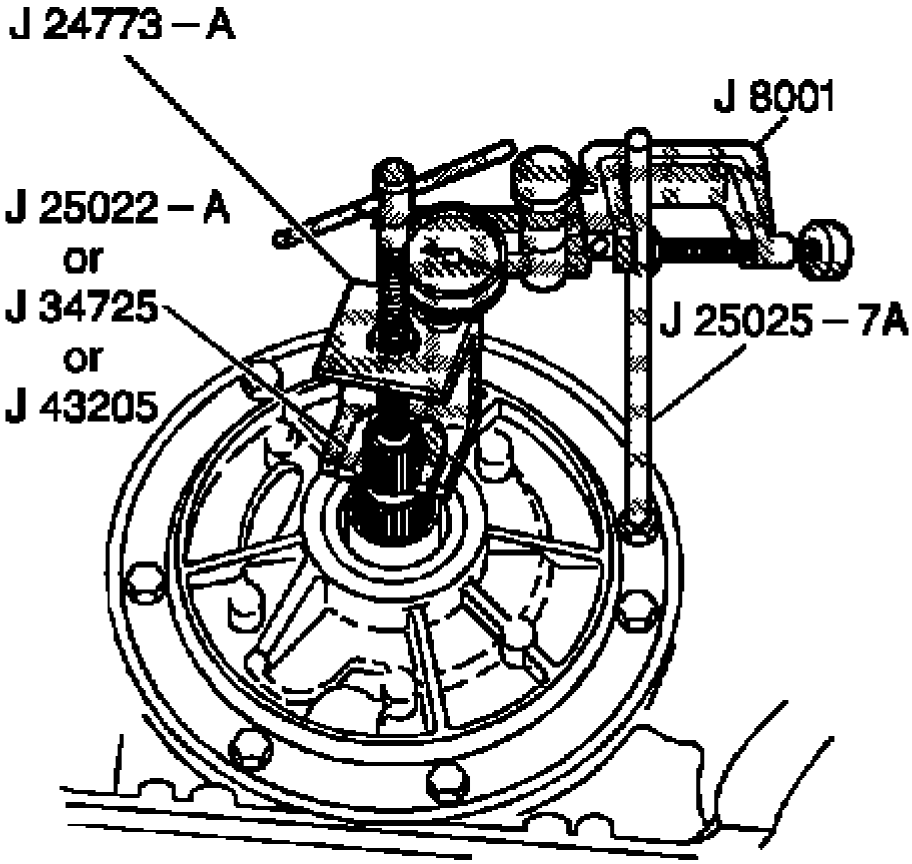


Fig. 55: Engine Cover
Courtesy of GENERAL MOTORS CORP.

3. Remove the bolt and the nut securing the transmission fluid fill tube to the engine.
4. Remove the engine cover. Refer to **Engine Cover Replacement** .

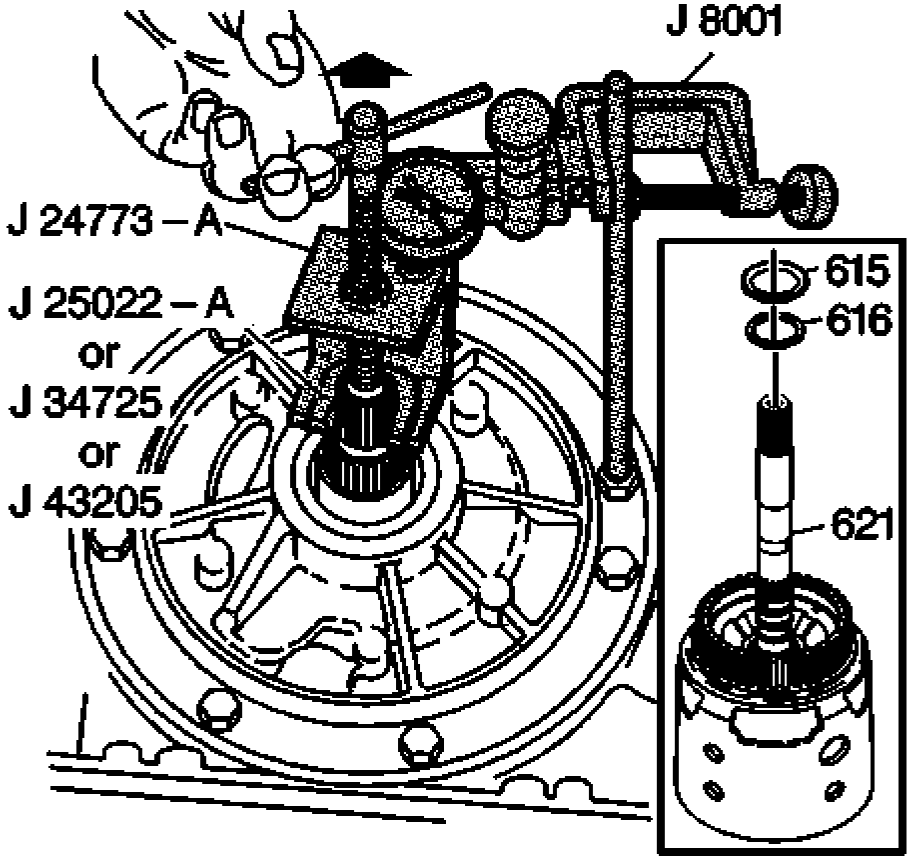


Fig. 56: Transmission Filler Tube
Courtesy of GENERAL MOTORS CORP.

5. Remove the nut securing the transmission fluid fill tube to the transmission stud.
6. Remove the upper fill tube from the vehicle.
7. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
8. Support the vehicle with safety stands.
9. Remove any dirt from the transmission where the fluid fill tube enters the transmission case.
10. Remove the drain plug from the transmission. Drain the fluid into an approved container.
11. Remove the transmission fluid fill tube from the transmission. Pull the tube upward from the transmission.
12. Remove the transmission fill tube seal.
13. Clean the metal parts using solvent. Do not allow the solvent to enter the transmission.
14. Air dry the parts.

Installation Procedure

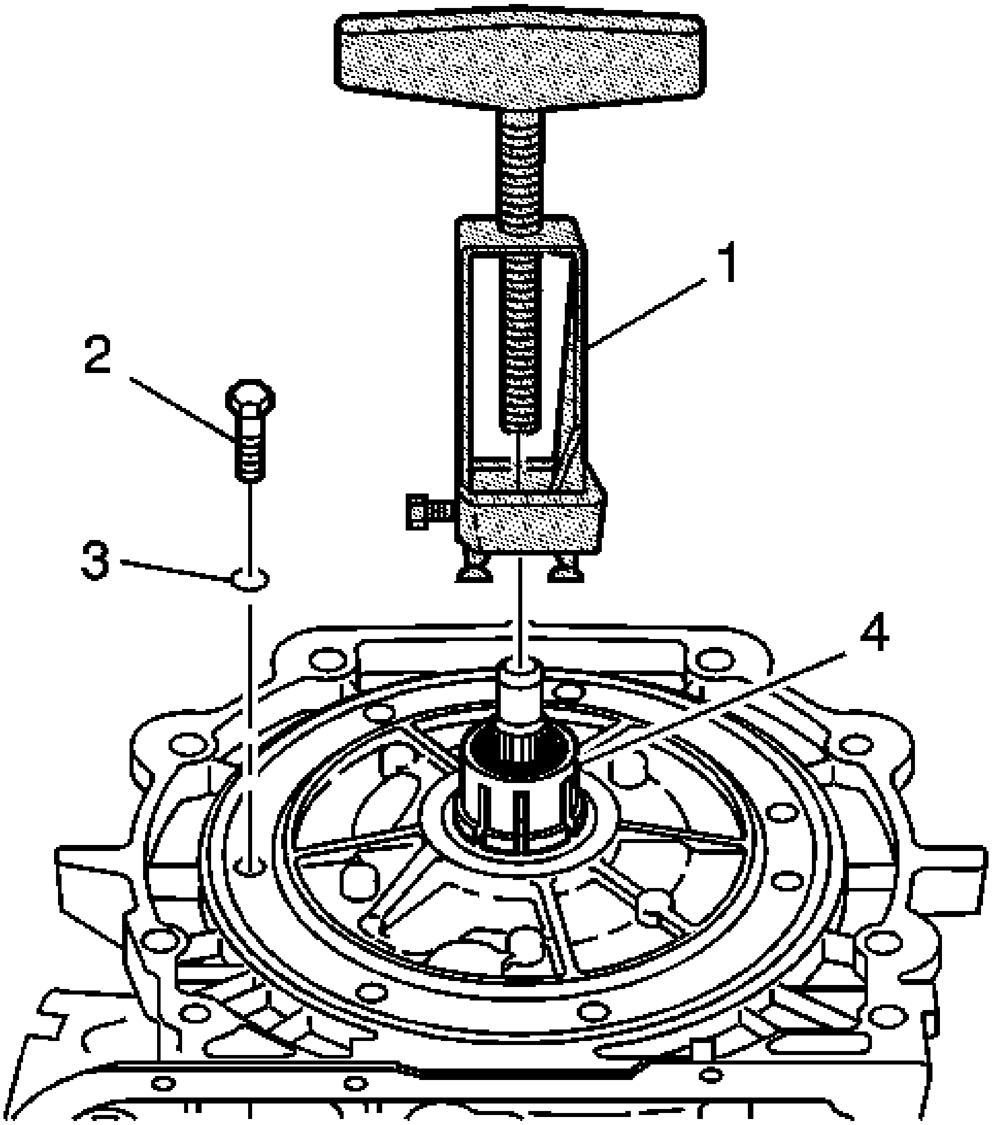


Fig. 57: Transmission Filler Tube
Courtesy of GENERAL MOTORS CORP.

1. Install a new oil level indicator tube seal into the transmission case.
2. Install the bottom of oil level indicator tube into the seal.
3. Remove the safety stands.
4. Lower the vehicle.

5. Install the upper fill tube to the vehicle.

NOTE: Refer to Fastener Notice .

6. Install the bolt and the nut securing the oil level indicator tube brackets to the engine.

   Tighten:
   - Tighten the bolt to 47 N.m (35 lb ft).
   - Tighten the nut to 25 N.m (18 lb ft).

7. Install the nut securing the oil level indicator tube to the transmission stud.

   Tighten: Tighten the nut to 25 N.m (18 lb ft).

8. Install the air cleaner. Refer to **Air Cleaner Assembly Replacement** for the 4.3L engine, **Air Cleaner Assembly Replacement** for the 4.8L, 5.3L, 6.0L engine, or **Air Cleaner Assembly Replacement** for the 6.6L engine.
9. Install the engine cover. Refer to **Engine Cover Replacement** .
10. Fill the transmission fluid to the proper level. Refer to **Transmission Fluid Check**.

VEHICLE INPUT SPEED SENSOR REPLACEMENT

Removal Procedure

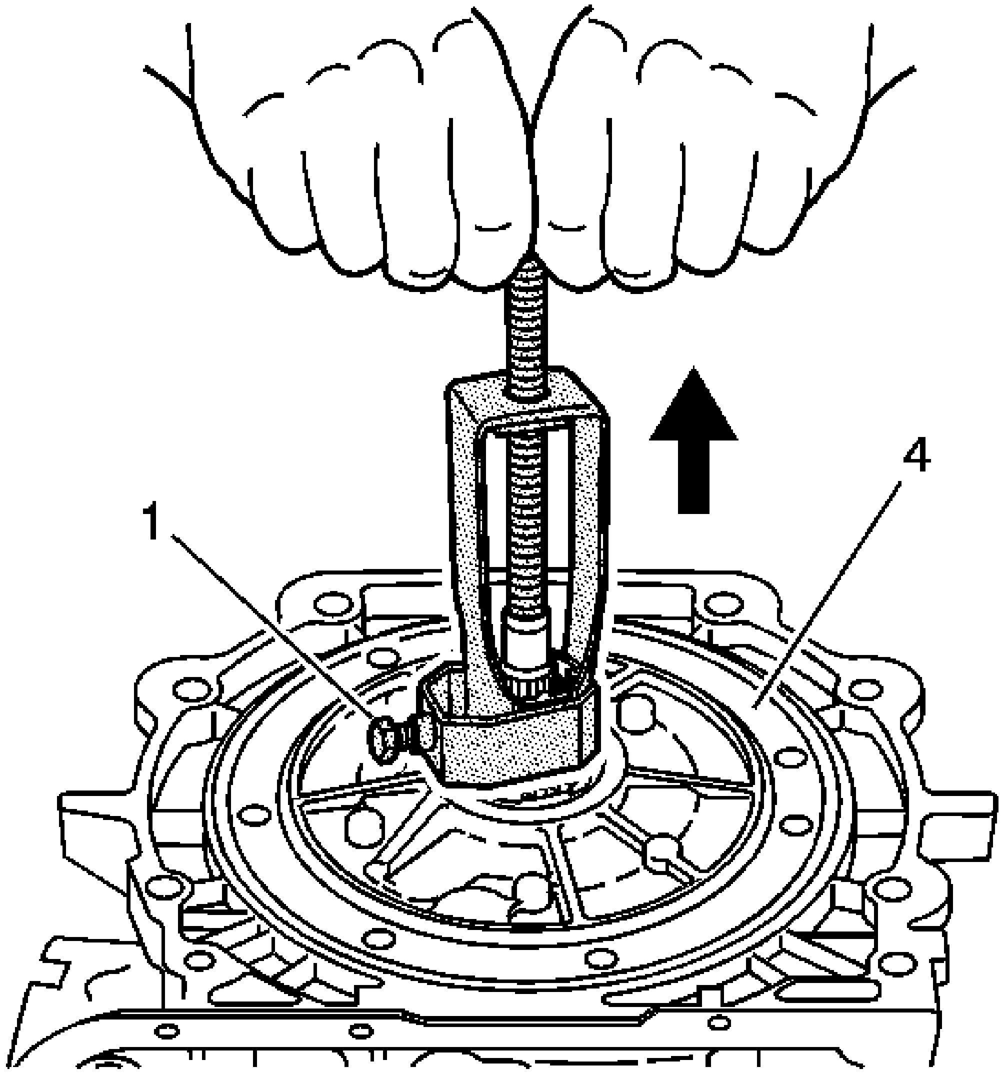


Fig. 58: View Of Input & Output Speed Sensors
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Disconnect the input speed sensor (1) electrical connector.
3. Remove the input speed sensor bolt.
4. Remove the input speed sensor (1) and the bracket assembly from the case.
5. Inspect the vehicle speed sensor assembly (1) for any evidence of damage.

Installation Procedure

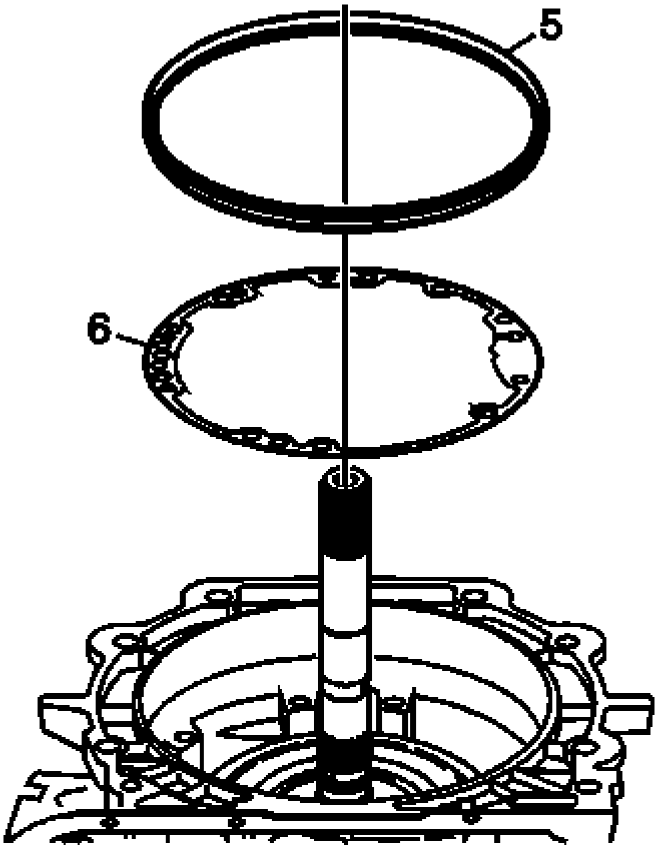


Fig. 59: View Of Input & Output Speed Sensors
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the input speed sensor seal with automatic transmission fluid.
2. Install the input speed sensor (1) and the bracket assembly.

NOTE: Refer to FASTENER NOTICE .

3. Install the bolt.

   Tighten: Tighten the bolt to 11 N.m (96 lb in).

4. Connect the input speed sensor electrical connector.
5. Lower the vehicle.

VEHICLE OUTPUT SPEED SENSOR REPLACEMENT

Removal Procedure

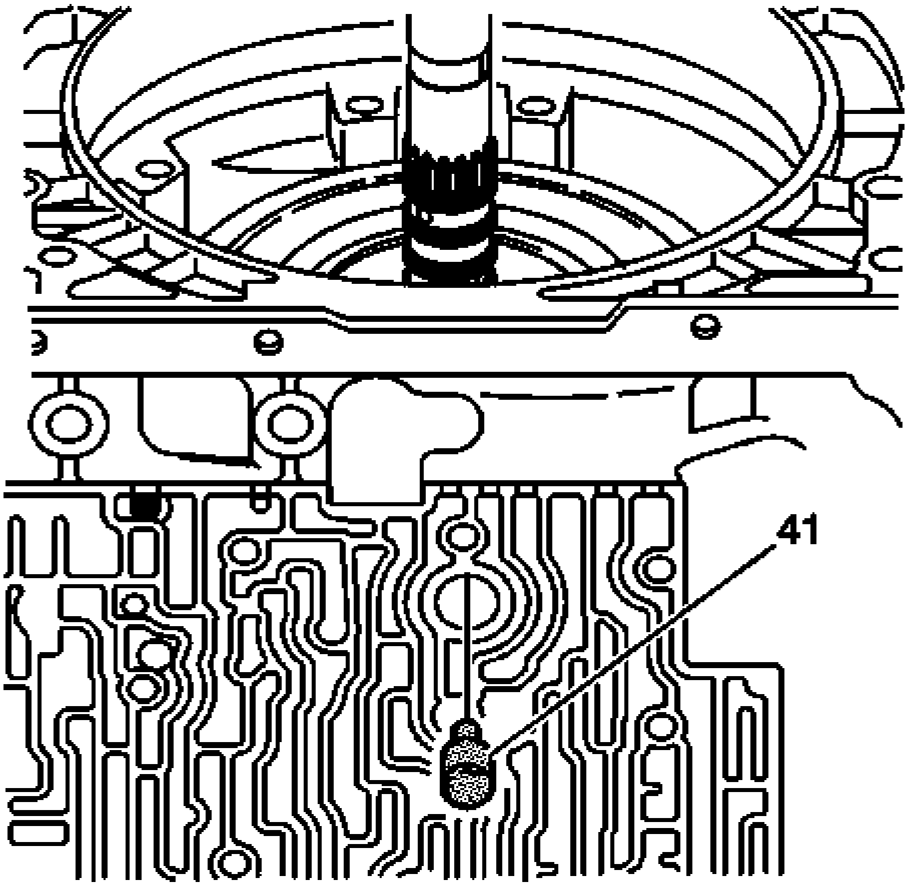


Fig. 60: View Of Input & Output Speed Sensors
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .

IMPORTANT: This procedure is for 2WD vehicles. If the vehicle is equipped with 4WD, the output speed sensor is located on the transfer case.

2. Disconnect the output speed sensor (2) electrical connector.
3. Remove the output speed sensor bolt.
4. Remove the output speed sensor (2) and the bracket assembly from the case.
5. Inspect the output speed sensor assembly (2) for any evidence of damage.

Installation Procedure

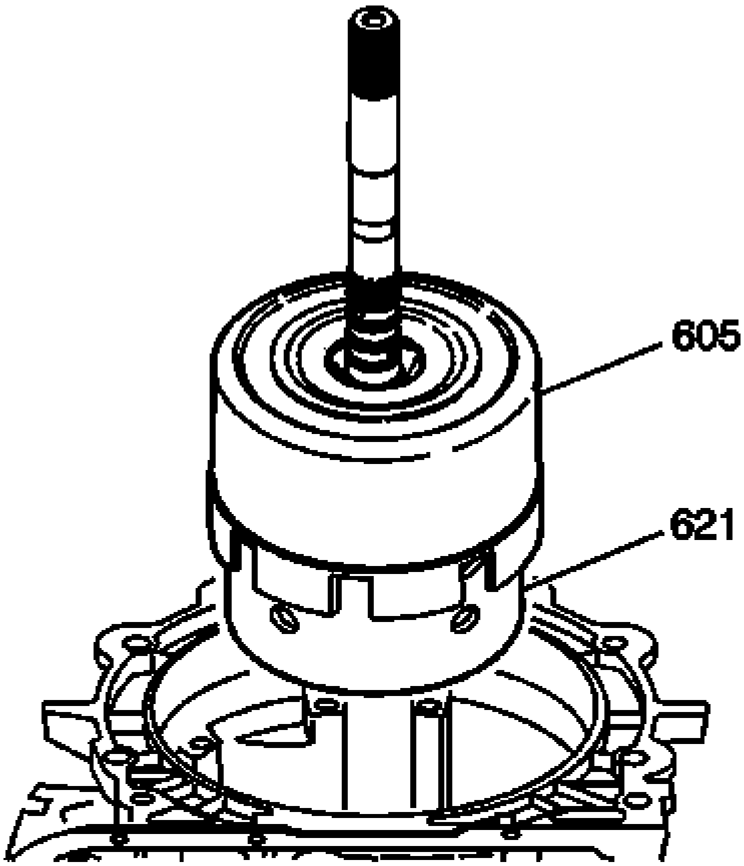


Fig. 61: View Of Input & Output Speed Sensors
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the output speed sensor seal with automatic transmission fluid.
2. Install the output speed sensor (2) and the bracket assembly.

NOTE: **Refer to FASTENER NOTICE .**

3. Install the bolt.

   Tighten: Tighten the bolt to 11 N.m (96 lb in).

4. Connect the output speed sensor electrical connector.
5. Lower the vehicle.

PARK PAWL AND ACTUATOR REPLACEMENT

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
3. Remove the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement**.

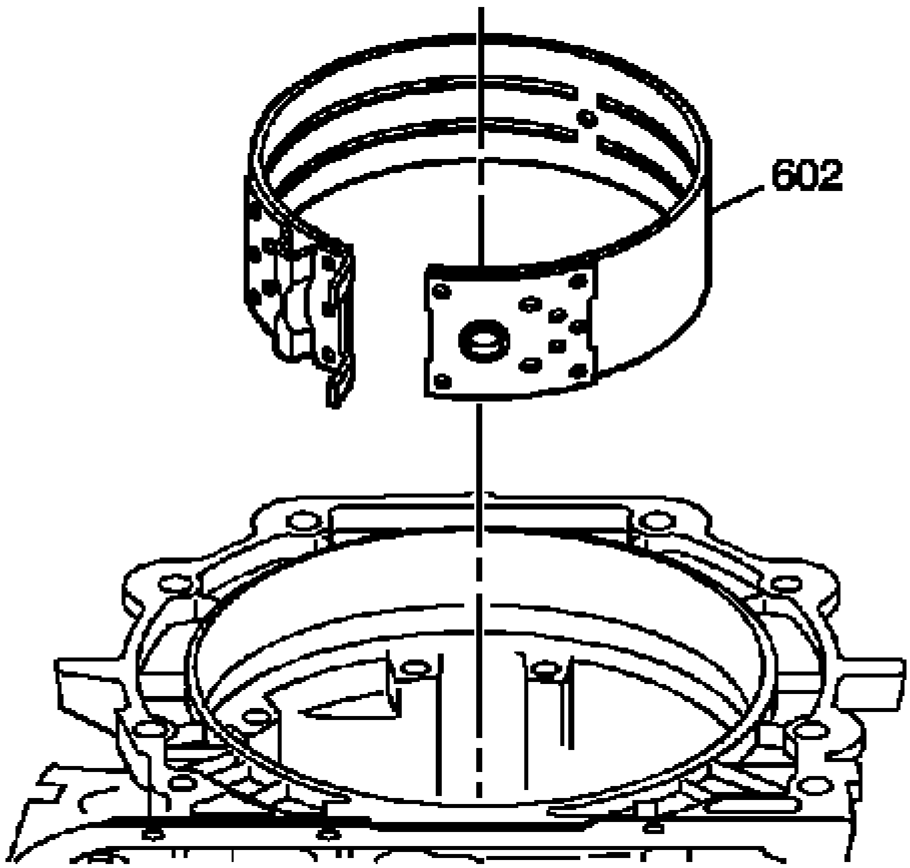


Fig. 62: Parking Pawl Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the manual shaft nut and the pin.
5. Remove the detent lever and the actuator assembly.
6. Remove the bolts and the parking pawl bracket.
7. Remove the parking pawl return spring.

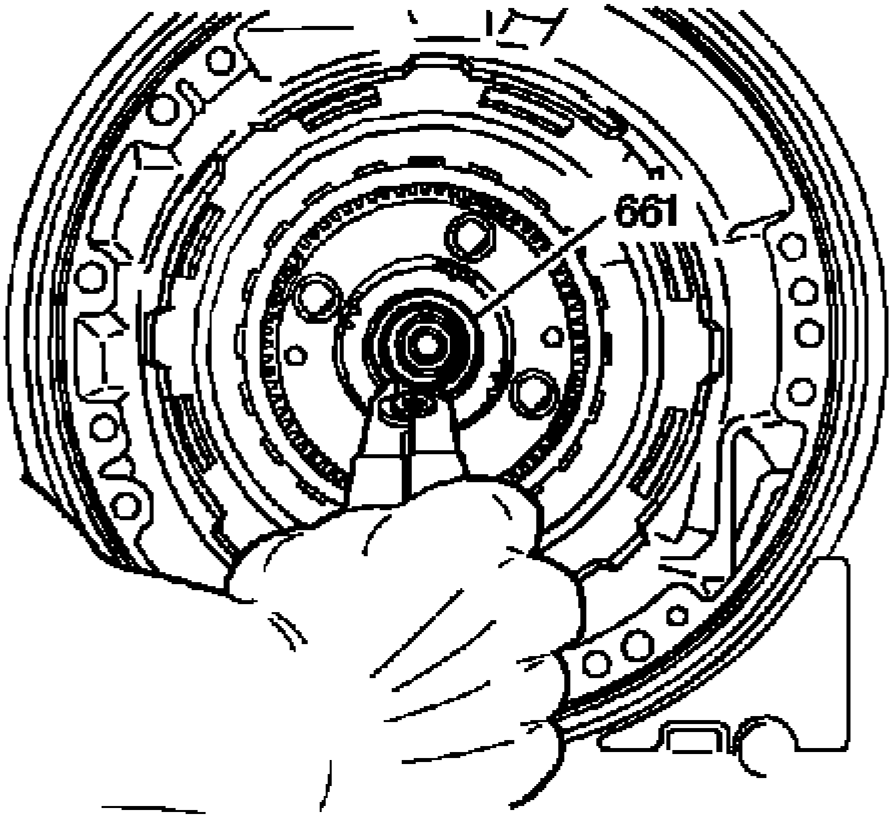


Fig. 63: Parking Pawl Assembly
Courtesy of GENERAL MOTORS CORP.

8. Use the modified screw extractor in order to remove the plug.
9. Remove the parking pawl shaft retainer, the shaft and the pawl.

IMPORTANT: If the manual shaft binds in the case during removal, file or sand the shaft in the area adjacent to the detent lever.

10. Remove the manual shaft.
11. Remove the manual shaft seal.

Installation Procedure

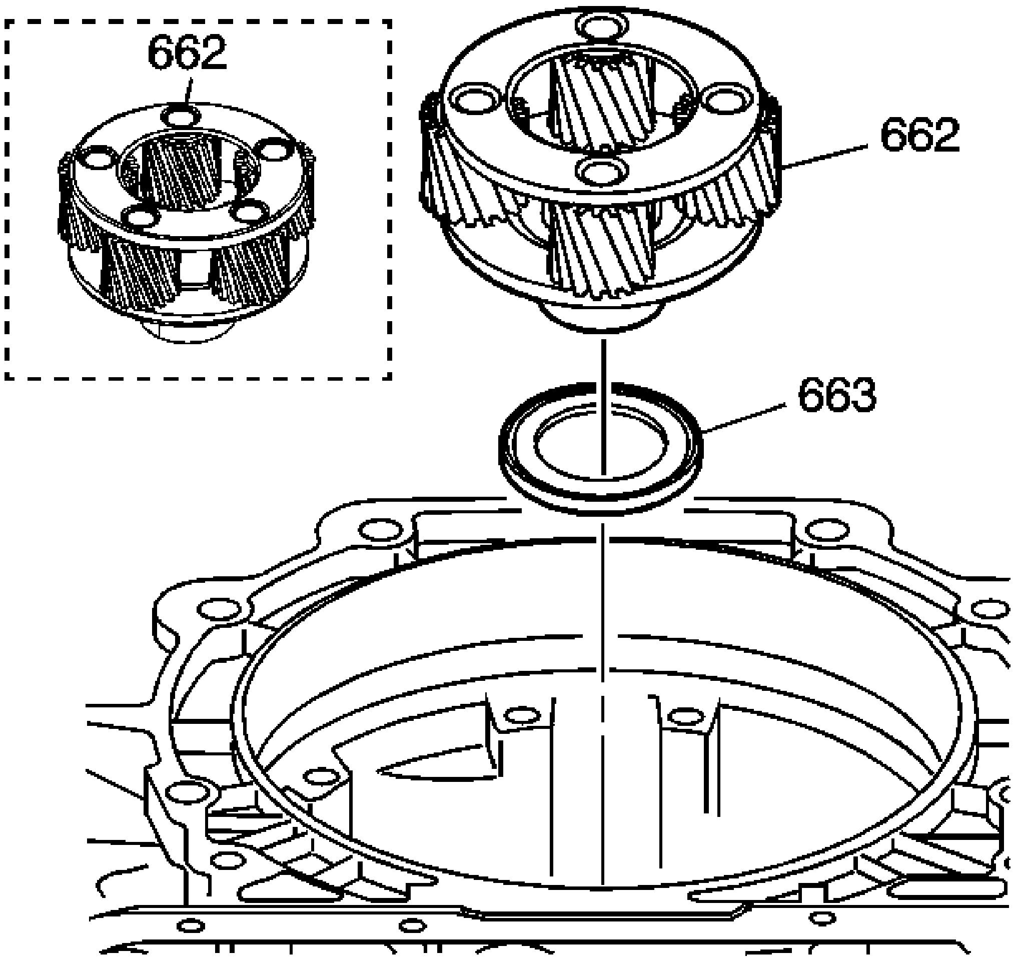


Fig. 64: Parking Pawl Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the pawl shaft.
2. Install the parking pawl.
3. Install the plug using a 8 mm or (5/16 in) rod with LOCTITE® or the equivalent.
4. Install the retainer.

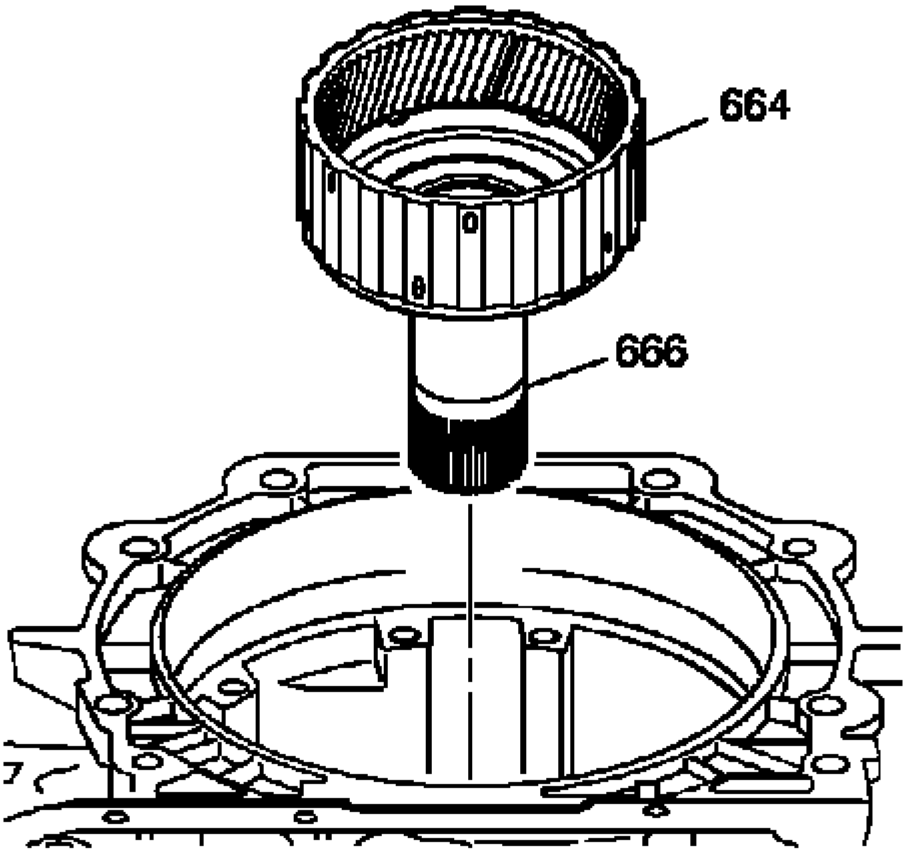


Fig. 65: Parking Pawl Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the pawl return spring.
6. Install the detent lever to the actuator assembly.
7. Install actuator assembly over the parking pawl.
8. Install the manual shaft seal.
9. Lubricate the manual shaft with transmission oil and install the manual shaft into the case.
10. Install the nut on the shaft.
11. Install the roll pin.

NOTE: Refer to Fastener Notice .

12. Install the parking lock bracket with the two bolts.

    Tighten: Tighten the bolts to 24 N.m (18 lb ft).

13. Install the park/neutral position switch. Refer to **Park/Neutral Position Switch Replacement**.
14. Install the oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.

15. Lower the vehicle.
16. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

PRESSURE REGULATOR REPLACEMENT

Tools Required

J 36850 Transjel®

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transmission oil pan and the filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.

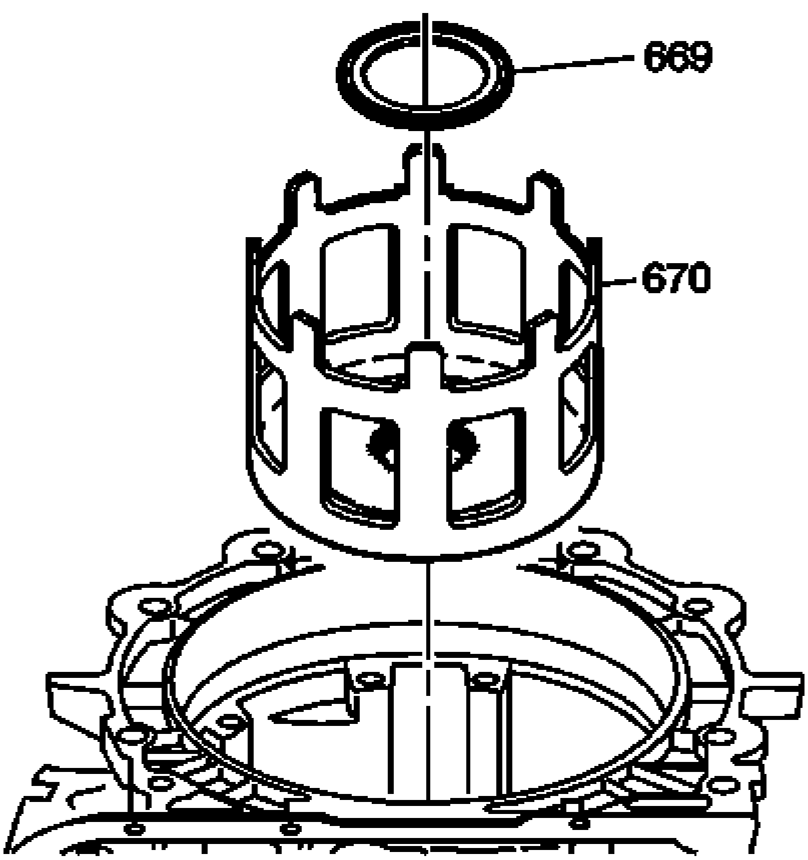


Fig. 66: View Of Valve Bore Plug Retainer Ring & Reverse Boost Valve Bushing Retainer Ring
Courtesy of GENERAL MOTORS CORP.

CAUTION: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

3. Remove the reverse boost valve bushing retainer ring (2).

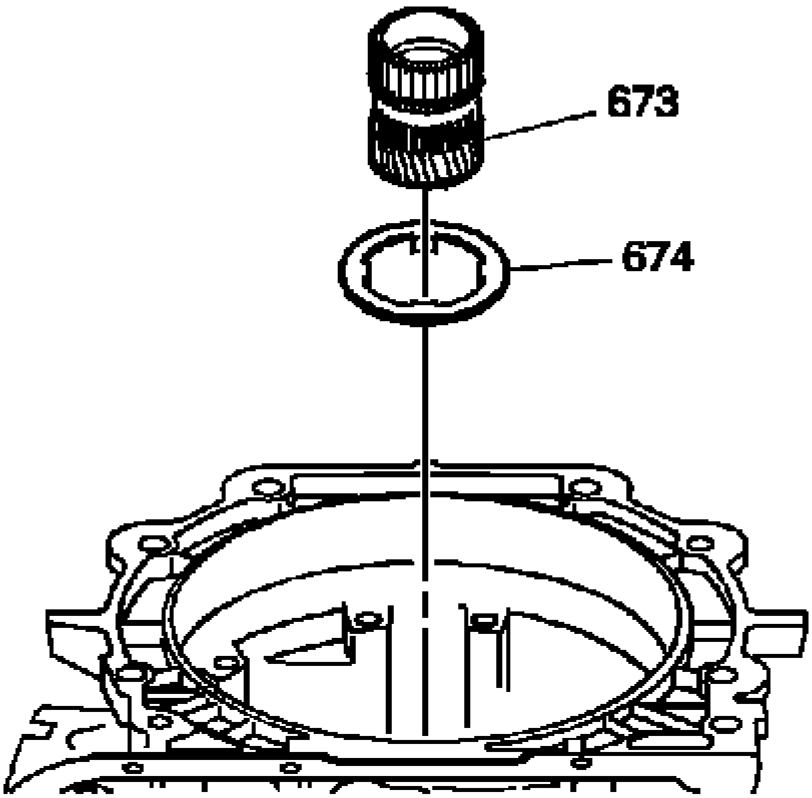


Fig. 67: Reverse Boost Valve Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the following from the reverse boost valve cylinder:
   - The reverse boost valve bushing
   - The reverse boost valve
   - The pressure regulator spring retainer
   - The pressure regulator spring
   - The pressure regulator valve
   - The reverse boost valve bushing

Installation Procedure

1. Install the pressure regulator valve with **J 36850** .

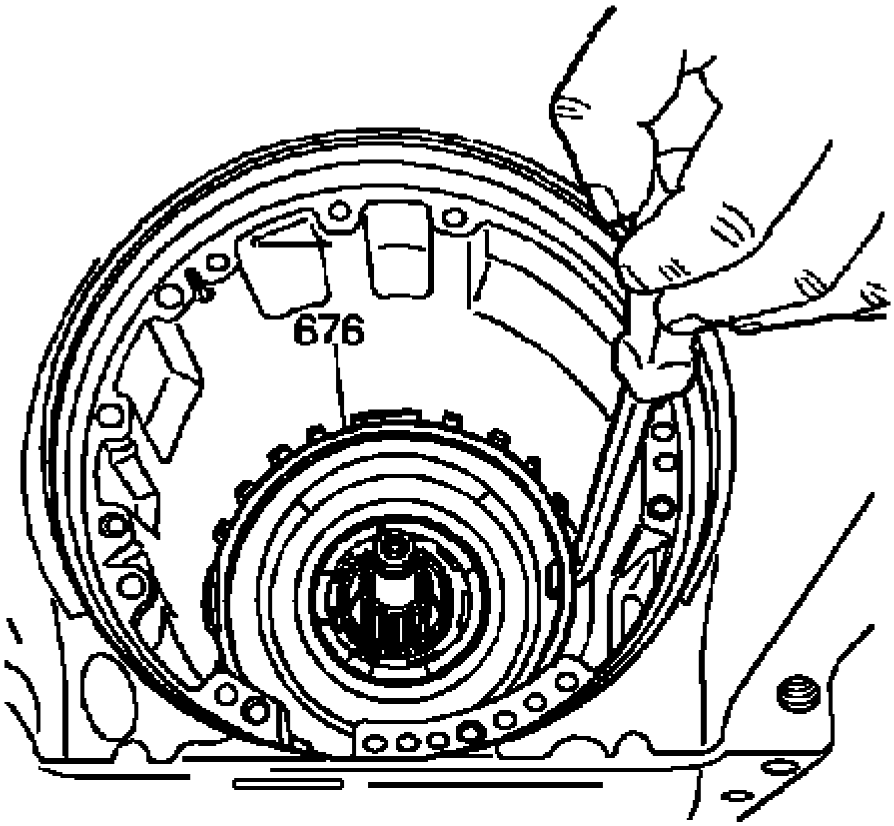


Fig. 68: Reverse Boost Valve Assembly
Courtesy of GENERAL MOTORS CORP.

2. Pre-assemble the following parts:
    - The reverse boost valve bushing
    - A new reverse boost valve
    - A new pressure regulator spring retainer
    - The added isolator pressure regulator spring
    - The pressure regulator spring
3. Install the pre-assembled parts into the pump bore.

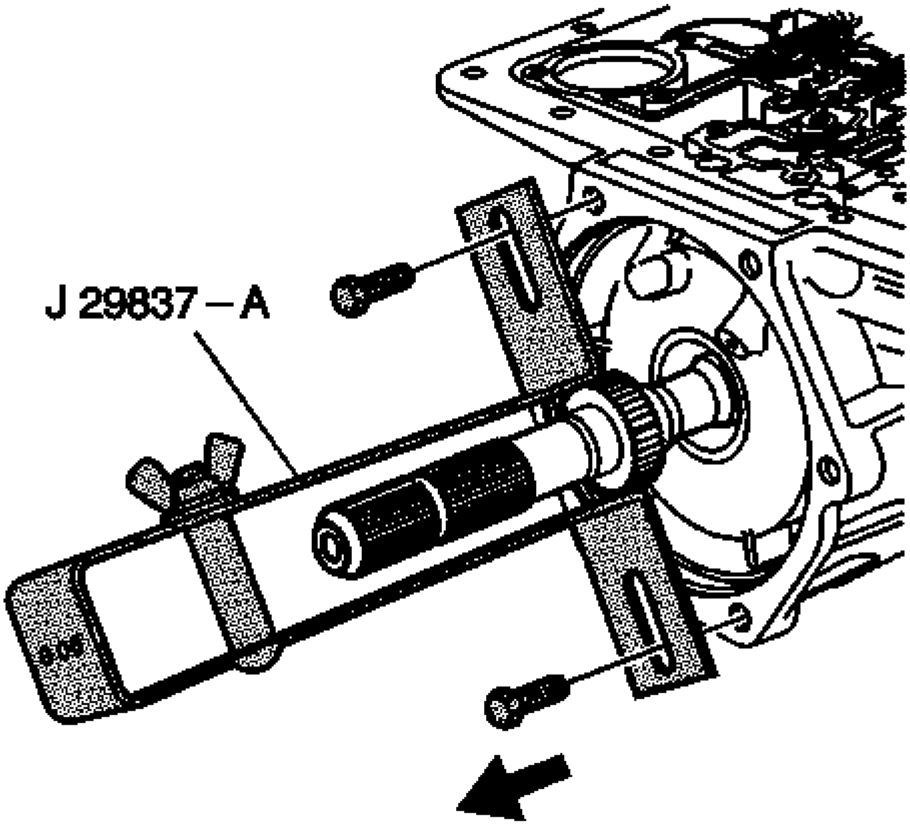


Fig. 69: View Of Valve Bore Plug Retainer Ring & Reverse Boost Valve Bushing Retainer Ring
Courtesy of GENERAL MOTORS CORP.

4. Install the reverse boost valve bushing retainer ring while holding the reverse boost valve bushing in place.

   Ensure the retainer ring (2) is in the groove.

5. Install the transmission oil pan and the oil filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
6. Lower the vehicle.
7. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.

8. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

TORQUE CONVERTER CLUTCH VALVE AND SPRING REPLACEMENT

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transmission oil pan and the oil filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.

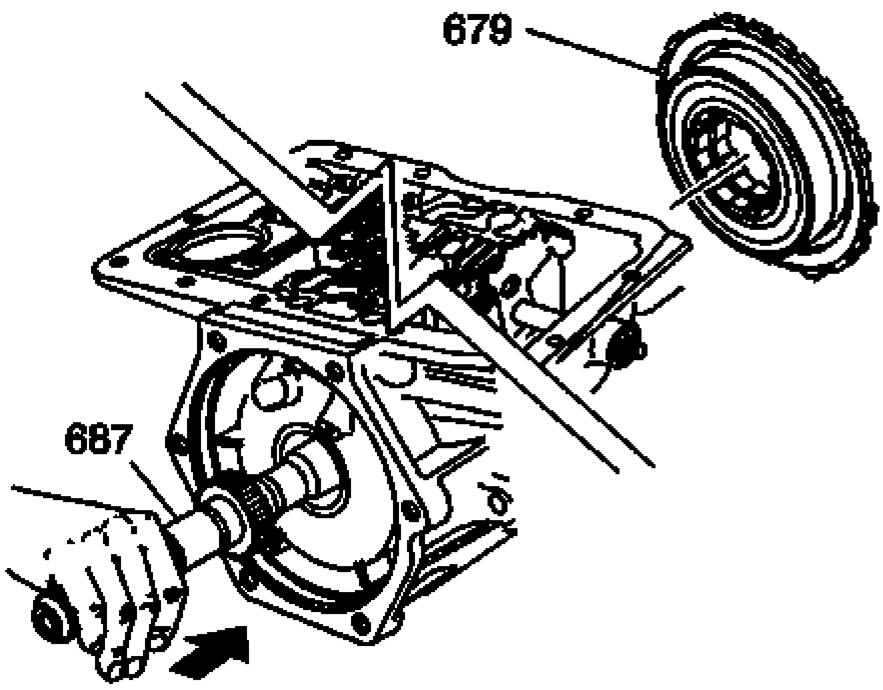


Fig. 70: View Of Valve Bore Plug Retainer Ring & Reverse Boost Valve Bushing Retainer Ring
Courtesy of GENERAL MOTORS CORP.

CAUTION: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

3. Remove the valve bore plug retainer ring (1).

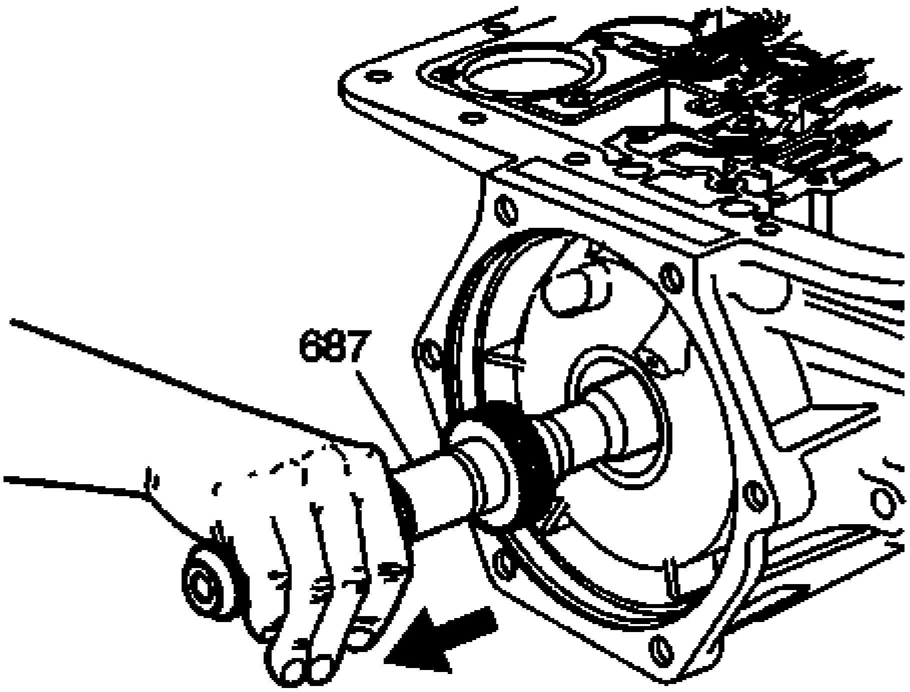


Fig. 71: TCC Valve Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the following parts:
    - The valve bore plug
    - The TCC valve
    - The TCC valve spring

Installation Procedure

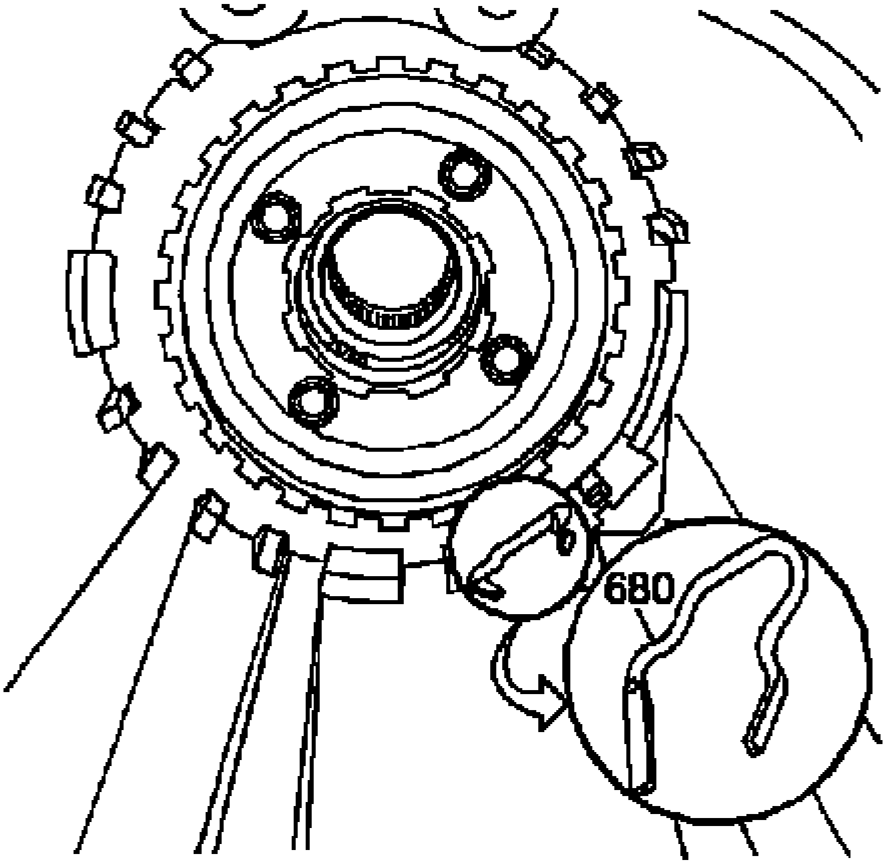


Fig. 72: TCC Valve Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the following parts:
   - The TCC valve spring
   - The TCC valve
   - The valve bore plug

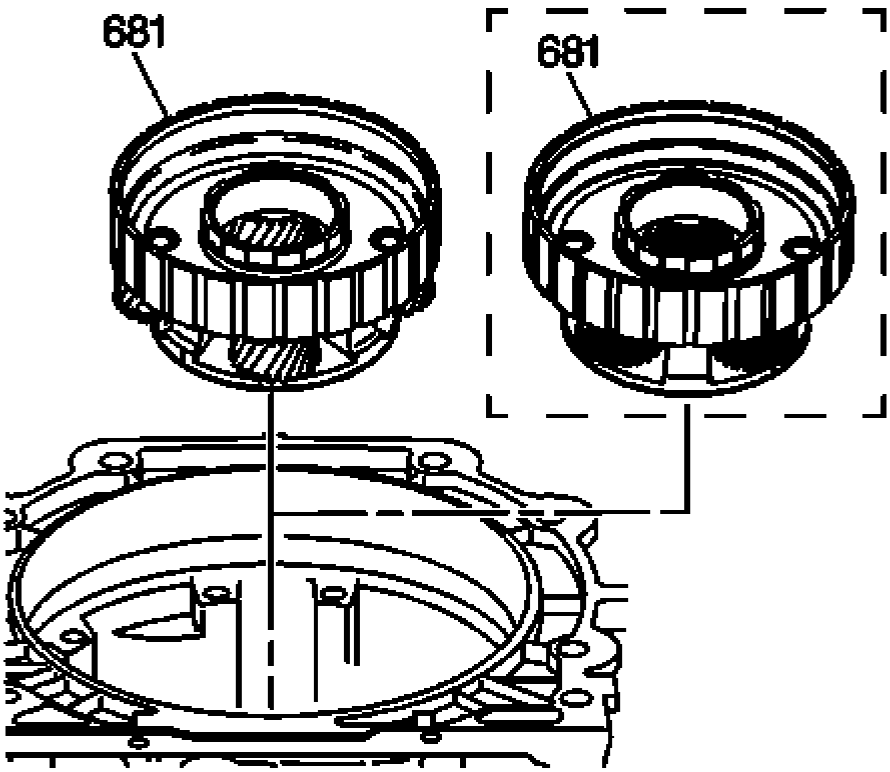


Fig. 73: View Of Valve Bore Plug Retainer Ring & Reverse Boost Valve Bushing Retainer Ring
Courtesy of GENERAL MOTORS CORP.

2. Install the valve bore plug retainer ring (1).
3. Install the transmission oil pan and oil filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
4. Lower the vehicle.
5. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.

6. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

ACCUMULATOR HOUSING REPLACEMENT

Tools Required

J 25025 Guide Pins

Removal Procedure

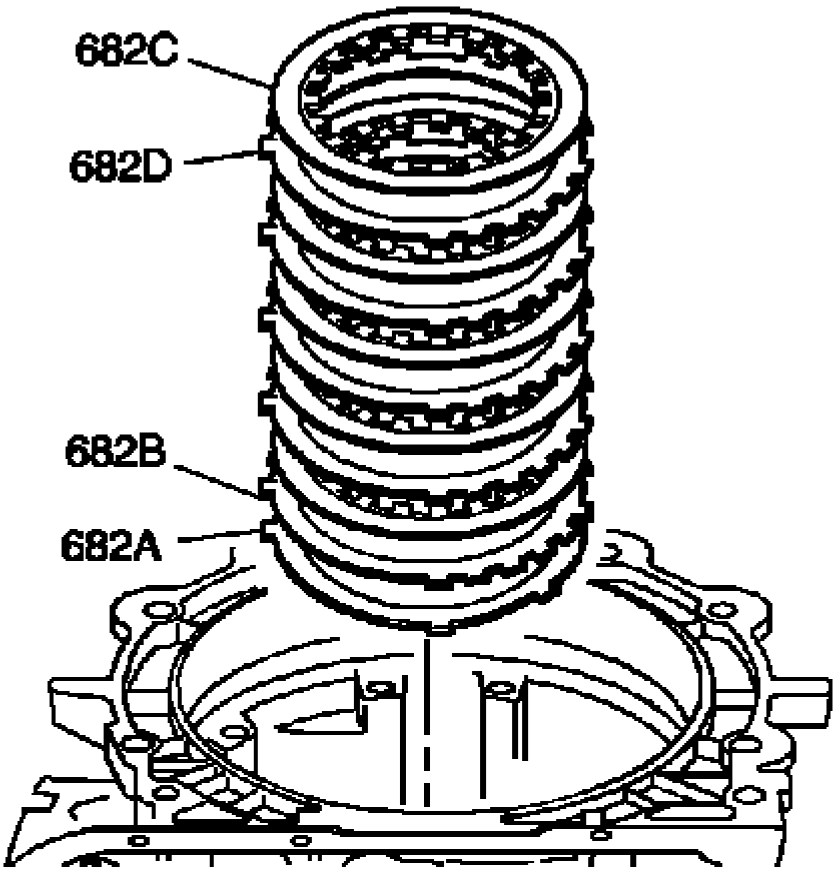


Fig. 74: Accumulator Housing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the control valve body assembly. Refer to **Valve Body and Pressure Switch Replacement**.
3. Remove the 3rd and 4th clutch accumulator housing bolts (1).
4. Remove the 3rd and 4th clutch accumulator housing (8).
5. Remove the accumulator housing gasket (6). The accumulator housing gasket may be stuck to the spacer plate (5).
6. Remove the 3rd clutch accumulator piston spring (7).
7. Remove the 4th clutch accumulator piston spring (2).
8. Remove the control valve body spacer plate (5).
9. Remove the control valve assembly to spacer plate gasket (4) from the spacer plate (5).

Third and Fourth Clutch Accumulator Disassembly

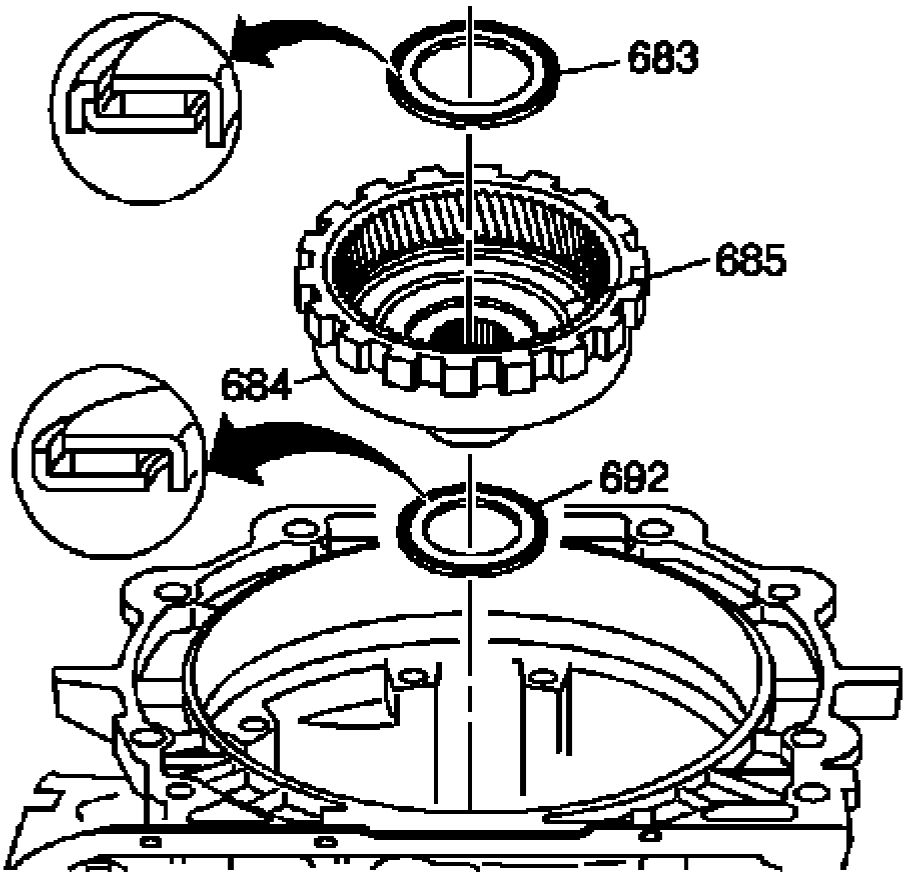


Fig. 75: View Of 3rd Clutch Accumulator Piston & Seals
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Apply low pressure compressed air to the hole at the top of the accumulator housing to assist with the piston removal.

1. Remove the 3rd clutch accumulator piston (2).
2. Remove the 3rd clutch accumulator piston seals (1, 3).

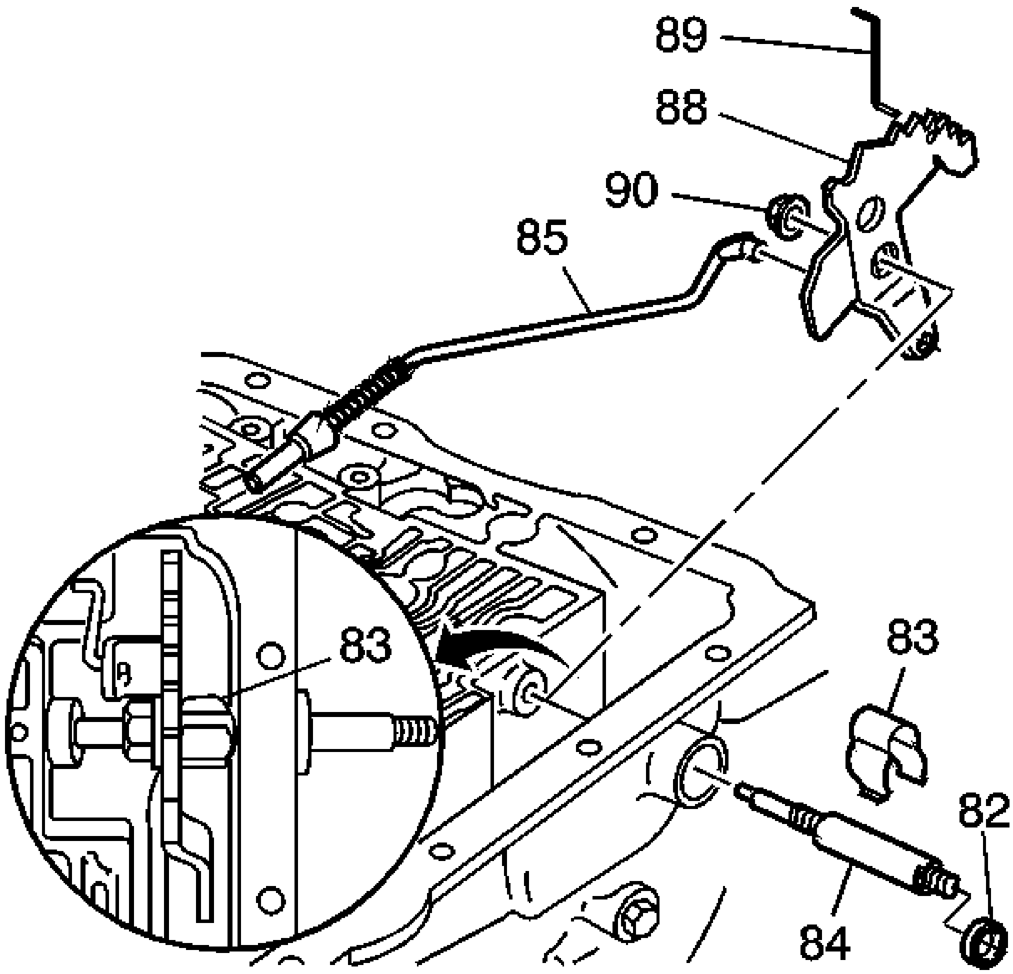


Fig. 76: View Of 4th Clutch Accumulator Piston & Components
Courtesy of GENERAL MOTORS CORP.

3. Remove the 4th clutch accumulator piston pin retainer ring (5).
4. Remove the 4th clutch accumulator piston (4) and pin (2) from the accumulator housing (1).
5. Remove the 4th clutch accumulator piston pin (2) from the accumulator housing (1).
6. Remove the 4th clutch accumulator piston seal (3) from the accumulator housing (1).

Third and Fourth Clutch Accumulator Assembly

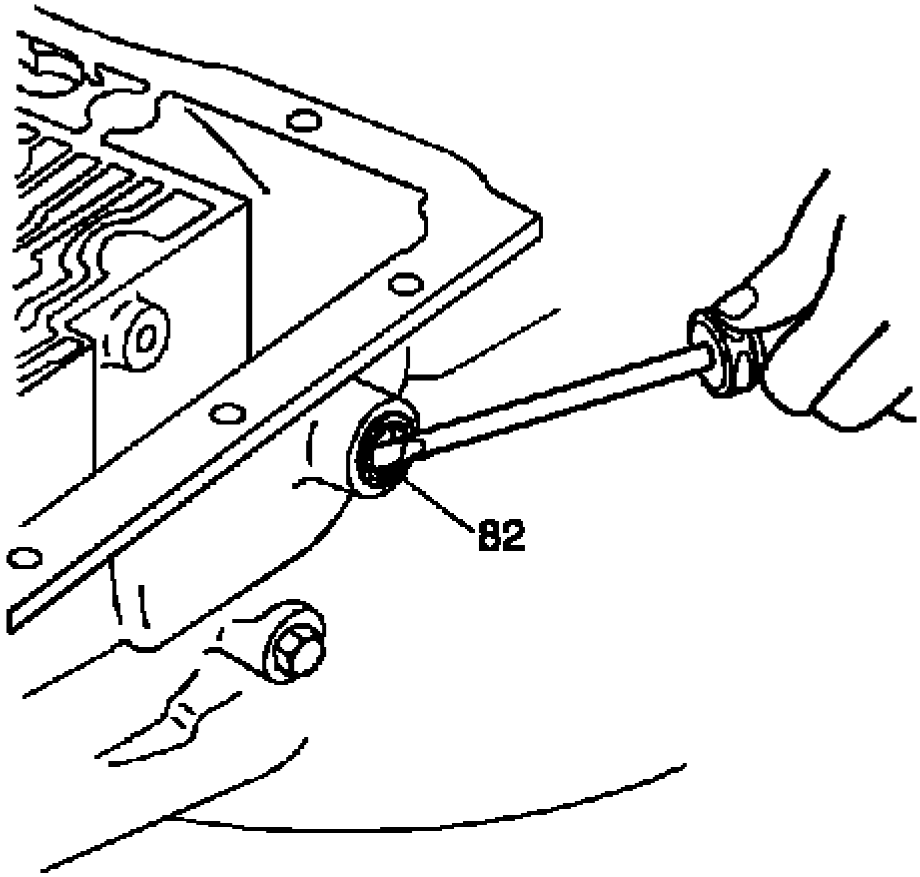


Fig. 77: View Of 3rd Clutch Accumulator Piston & Seals
Courtesy of GENERAL MOTORS CORP.

1. Install the 3rd clutch accumulator piston inner (3) and outer (1) seals. Lubricate the 3rd clutch accumulator piston seals (1, 3) with DEXRON® VI automatic transmission fluid.
2. Install the 3rd clutch accumulator piston (2).

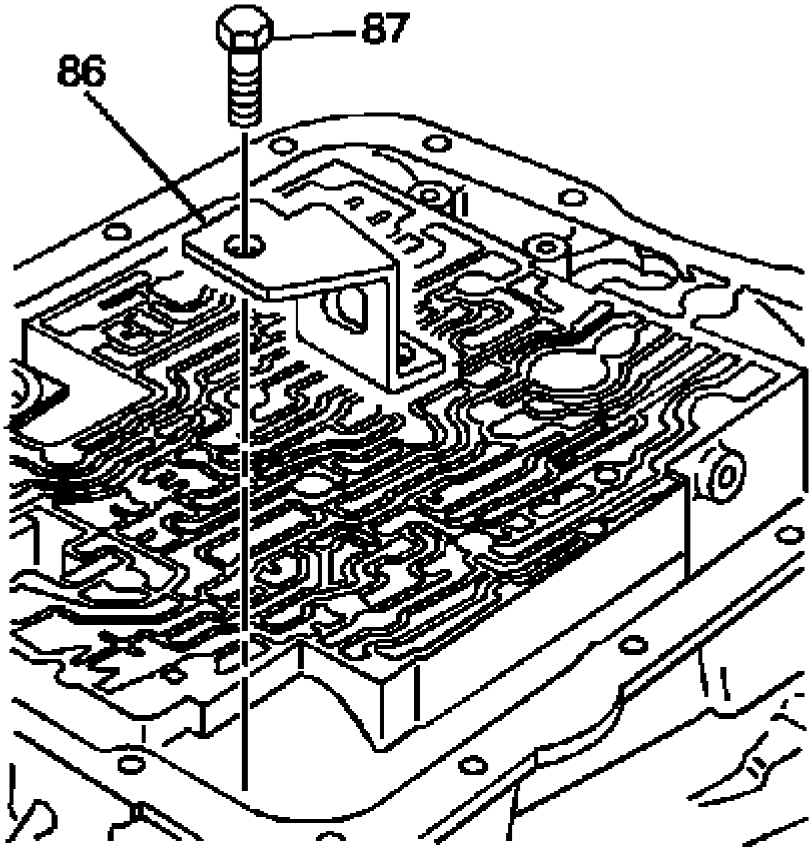


Fig. 78: View Of 4th Clutch Accumulator Piston & Components
Courtesy of GENERAL MOTORS CORP.

3. Install the 4th clutch accumulator piston seal (3). Lubricate the 4th clutch accumulator piston seal (3) with DEXRON® VI automatic transmission fluid.
4. Assemble the 4th clutch accumulator piston pin (2) with the 4th clutch accumulator piston (4).
5. Install the 4th clutch accumulator piston assembly into the accumulator housing (1).
6. Install the 4th clutch accumulator piston pin retainer ring (5) onto the 4th clutch accumulator piston pin (2).

Installation Procedure

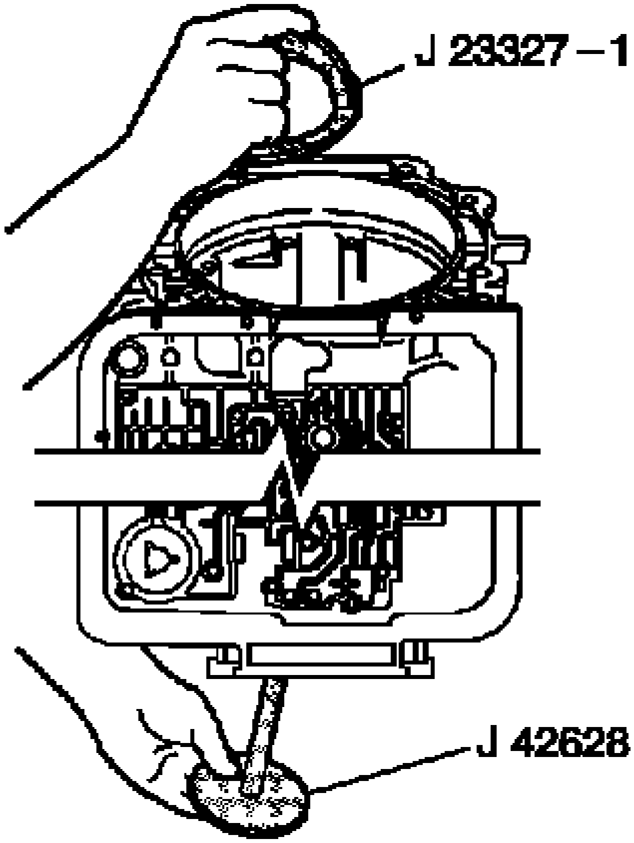


Fig. 79: J 25025 & The Valve Body Bolt
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 25025** into the control valve body bolt hole where the manual shaft detent roller and spring assembly is mounted.
2. Install the control valve body gasket (2) onto the accumulator housing (1).
3. Install the control valve body spacer plate (3) onto the valve body gasket (2).

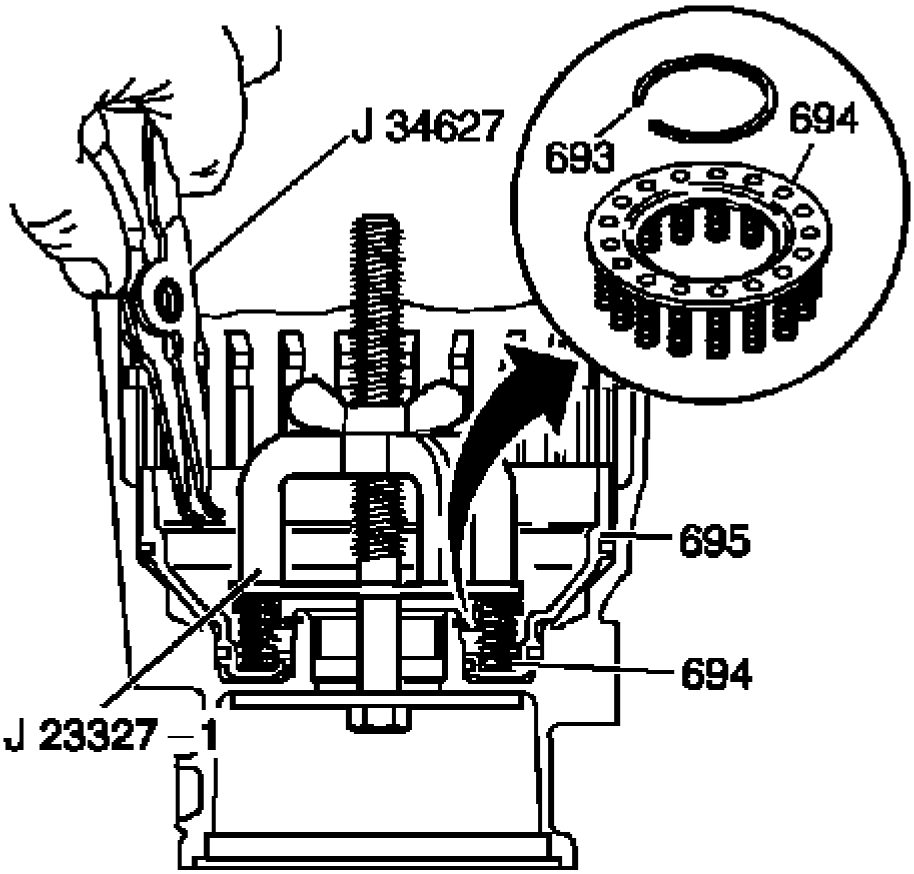


Fig. 80: Third And Fourth Clutch Accumulator Housing Components
Courtesy of GENERAL MOTORS CORP.

4. Install the third and fourth clutch accumulator housing gasket (3).
5. Install the third clutch accumulator piston spring (1). This spring is the longer of the two springs.
6. Install the fourth clutch accumulator piston spring (4).
7. Install the third and fourth clutch accumulator housing assembly (5) onto the control valve body assembly (2).
8. Install the six accumulator housing bolts (6). Start the bolts finger tight and work towards the opposite end.

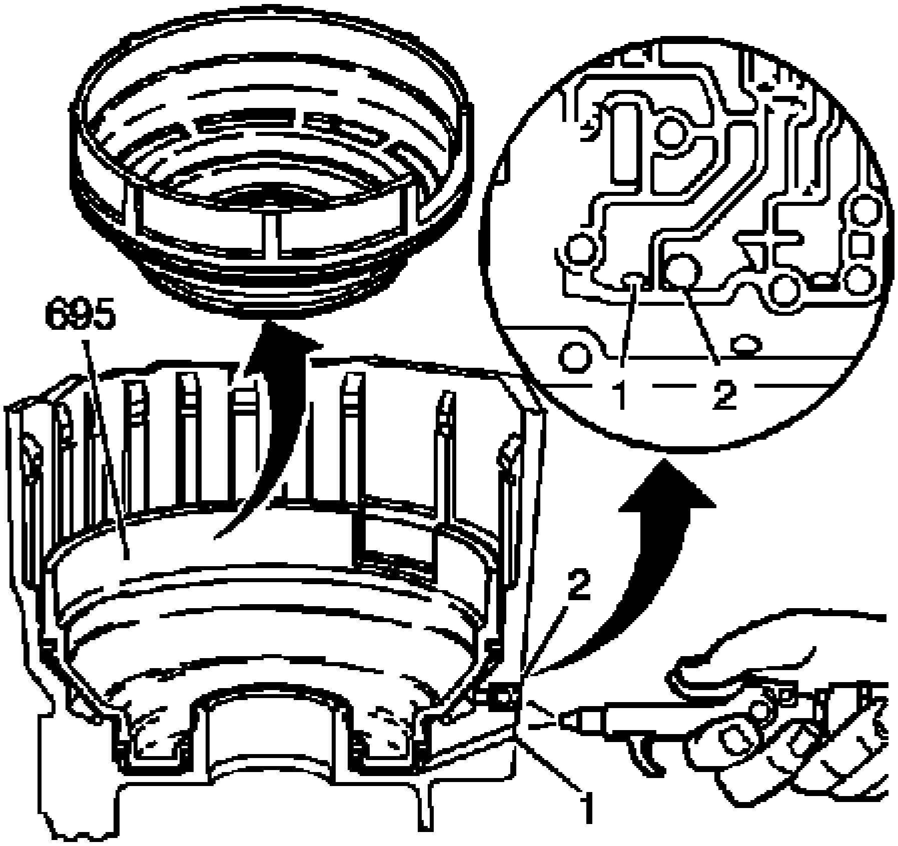


Fig. 81: Accumulator Housing Bolts Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE .

9. Tighten the accumulator housing bolts sequentially.

   Tighten: Tighten the accumulator housing bolts to 11 N.m (97 lb in).

10. Remove the **J 25025** .
11. Install the control valve body assembly. Refer to **Valve Body and Pressure Switch Replacement**.
12. Lower the vehicle.
13. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values

are learned.

14. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

REVERSE SERVO REPLACEMENT

Removal Procedure

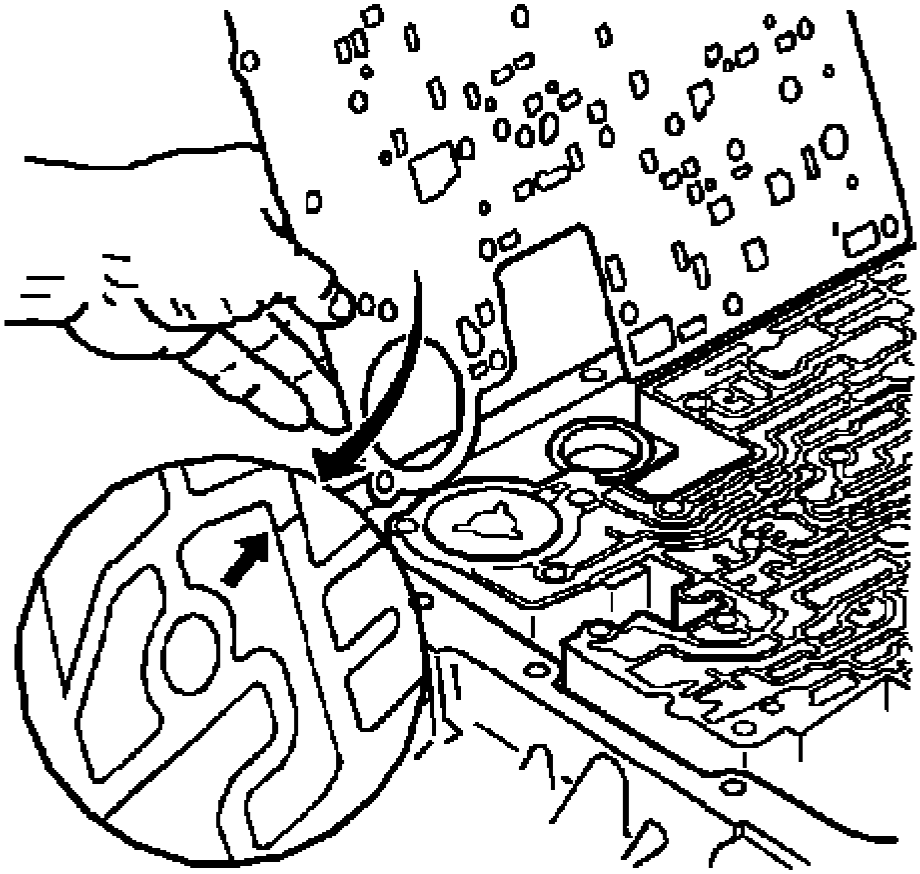


Fig. 82: Rear Servo Assembly
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transmission oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
3. Remove the rear servo assembly from the transmission case as follows:
   - Cover bolts (6)
   - Cover (5)
   - Cover gasket (4)
   - Bottom retaining clip (3)
   - Servo piston (2)

- Outer ring oil seal (1)
- Inner ring oil seal (7)
- Accumulator piston (8)
- Piston seal (9)
- Washer (10)
- Servo spring (11)
- Servo spring retainer (12)
- Selective pin (13)
- Accumulator spring (14)

Installation Procedure

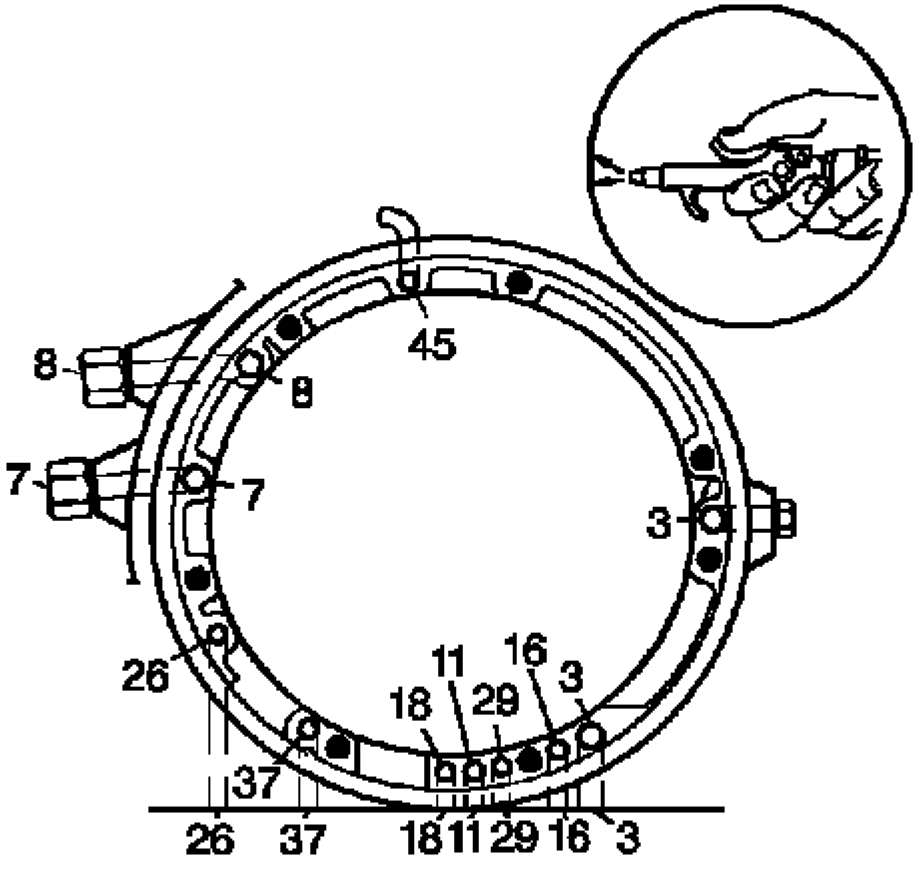


Fig. 83: Rear Servo Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the rear servo assembly to the transmission case as follows:
    - Accumulator spring (14)
    - Selective pin (13)
    - Servo spring retainer (12)

- Servo spring (11)
- Washer (10)
- Piston seal (9)
- Accumulator piston (8)
- Inner ring oil seal (7)
- Outer ring oil seal (1)
- Servo piston (2)
- Bottom retaining clip (3)
- Cover gasket (4)
- Cover (5)
- Cover Bolt (6)

NOTE: Refer to FASTENER NOTICE .

2. Install the cover bolts (61).

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

3. Install the transmission oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
4. Lower the vehicle.
5. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

**IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.**

6. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

TRANSMISSION FLUID COOLER HOSE/PIPE QUICK-CONNECT FITTING DISCONNECTION AND CONNECTION

Removal Procedure

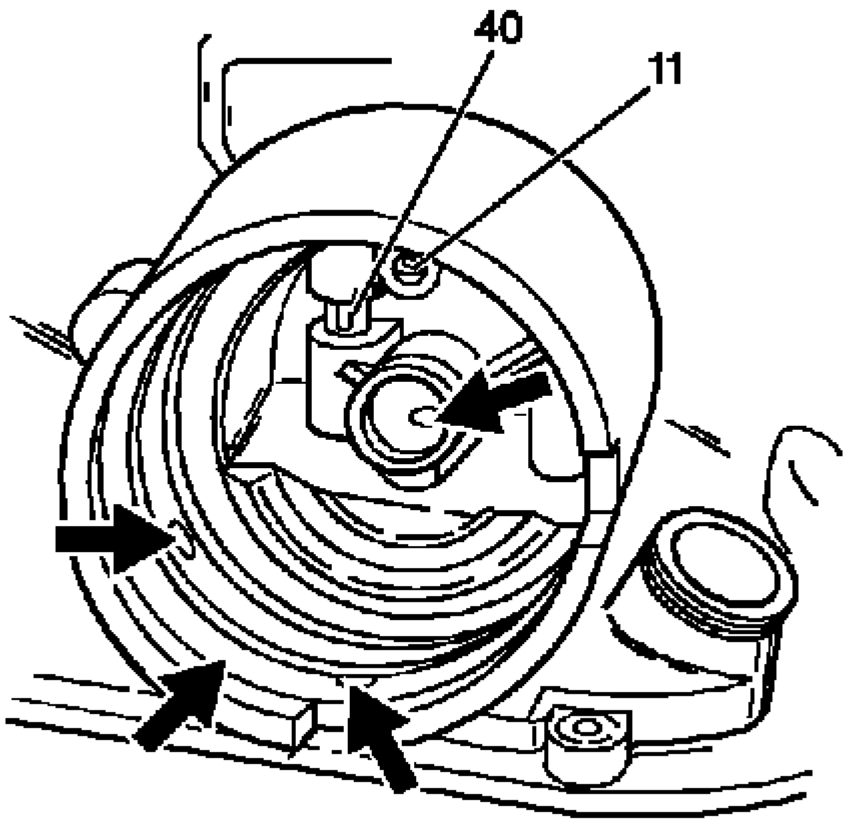


Fig. 84: Retaining Ring For The Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform the following procedure when removing the retaining rings and cooler lines from the quick connect fittings located on the radiator and/or the transmission.

1. Pull the plastic cap back from the quick connect fitting and down along the cooler line about 5 cm (2 in).
2. Using a bent-tip screwdriver, pull on one of the open ends of the retaining ring in order to rotate the retaining ring around the quick connect fitting until the retaining ring is out of position and can be completely removed.
3. Remove the retaining ring from the quick connect fitting.
4. Discard the retaining ring.

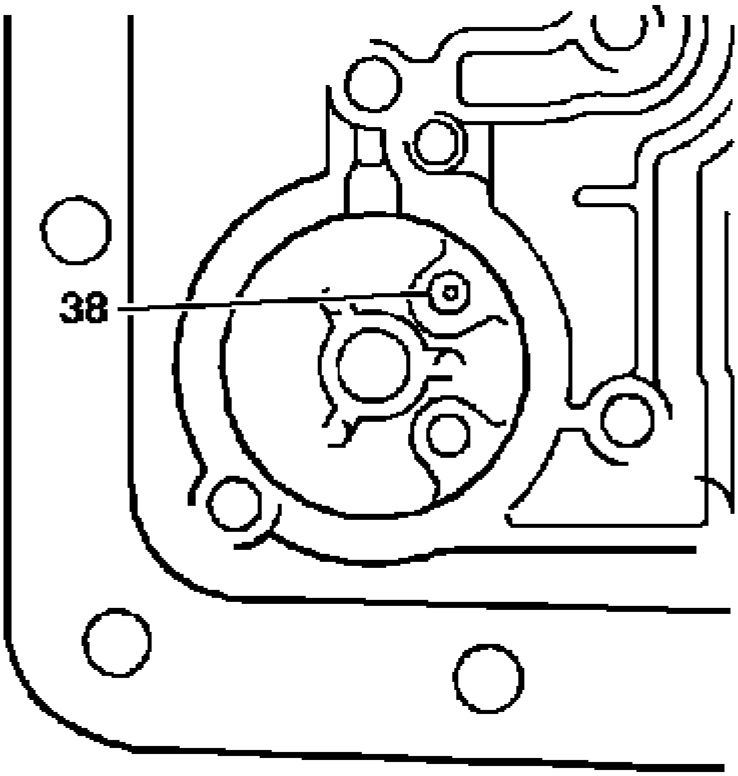


Fig. 85: Cooler Line & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

5. Pull the cooler line straight out from the quick connect fitting.

Installation Procedure

IMPORTANT:

- **Do not reuse any of the existing oil lines or oil line fittings if there is excessive corrosion.**
- **Do not reuse any of the existing retaining rings that were removed from the existing quick connect fittings. Install new retaining rings.**
- **Ensure the following procedures are performed when installing the new retaining rings onto the fittings.**

1. Install a new retaining ring into the quick connect fitting using the following procedure:

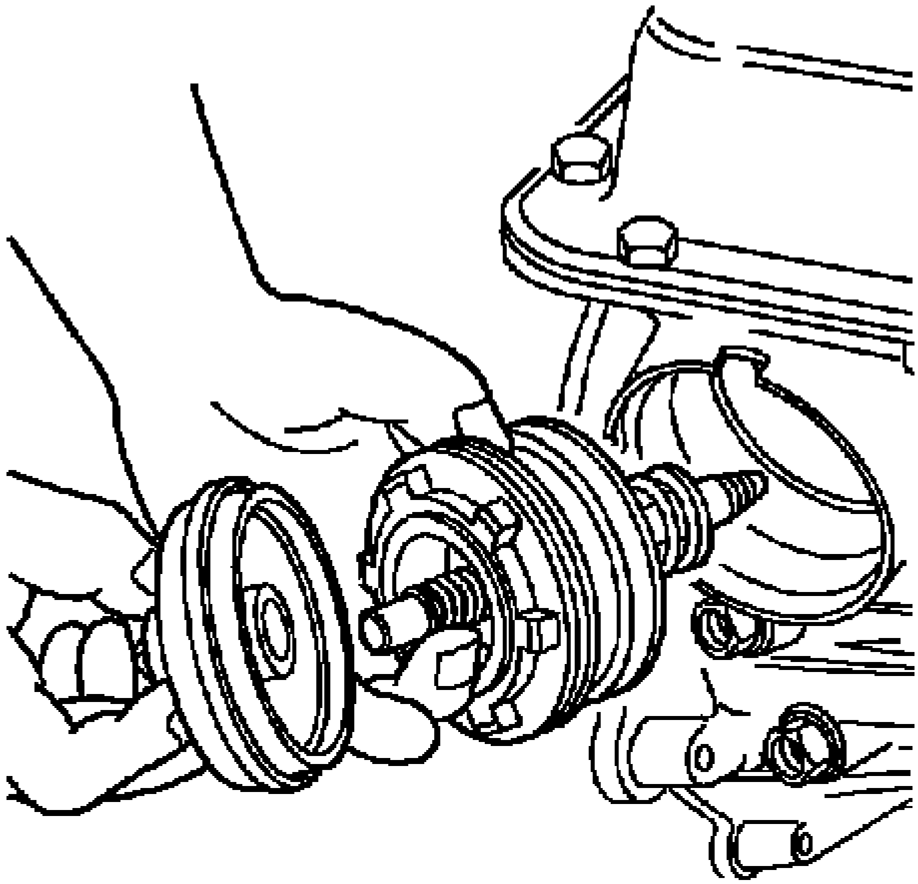


Fig. 86: Hooking Retaining Ring Into Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

2. Hook one of the open ends of the retaining ring in one of the slots in the quick connect fitting.

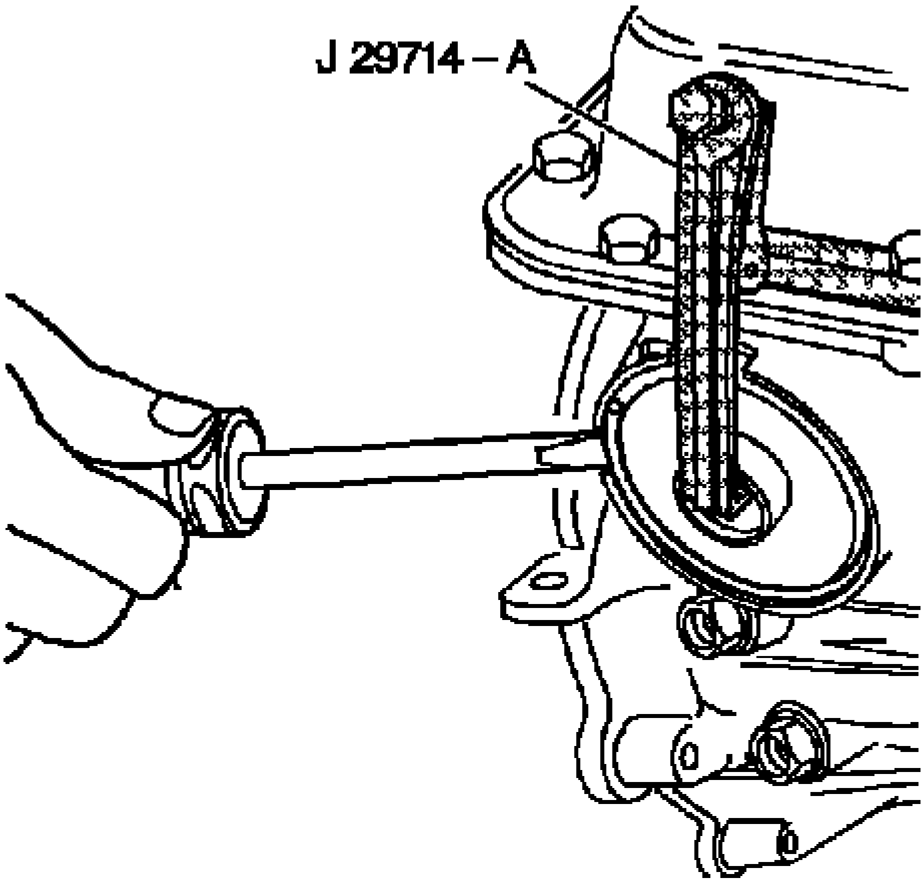


Fig. 87: Rotating Retaining Ring Around Fitting
Courtesy of GENERAL MOTORS CORP.

3. Rotate the retaining ring around the fitting until the retaining ring is positioned with all 3 ears through the 3 slots on the fitting.

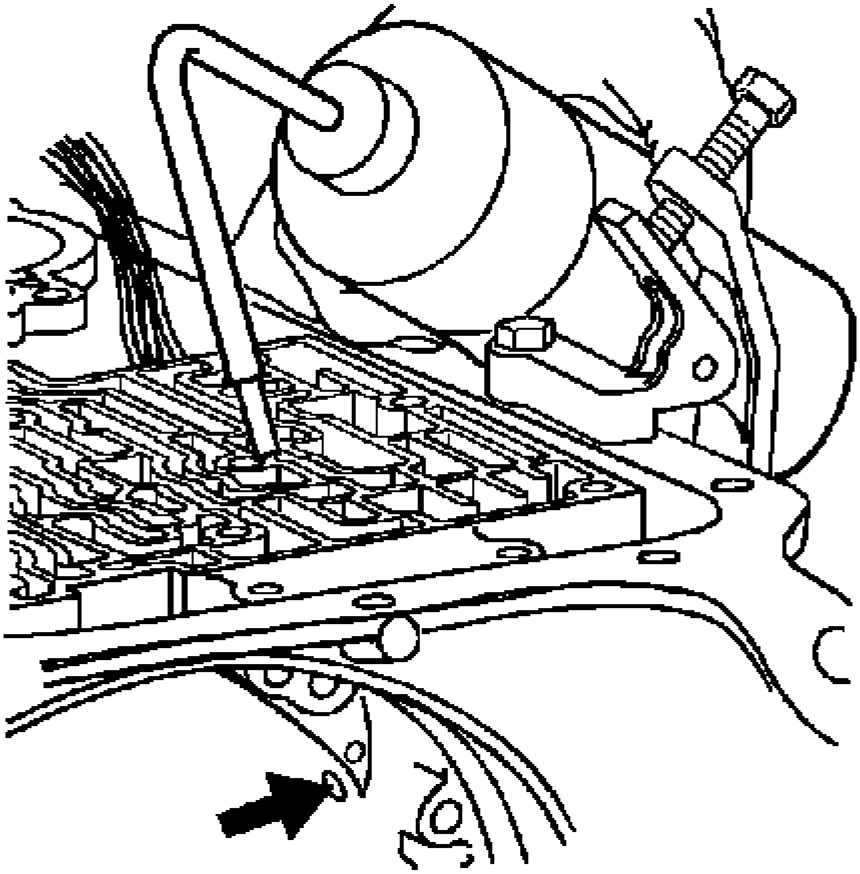


Fig. 88: Identifying Improper Engine Oil Cooler Hose/Pipe Retaining Ring Installation
Courtesy of GENERAL MOTORS CORP.

4. Do not install the new retaining ring onto the fitting by pushing the retaining ring.

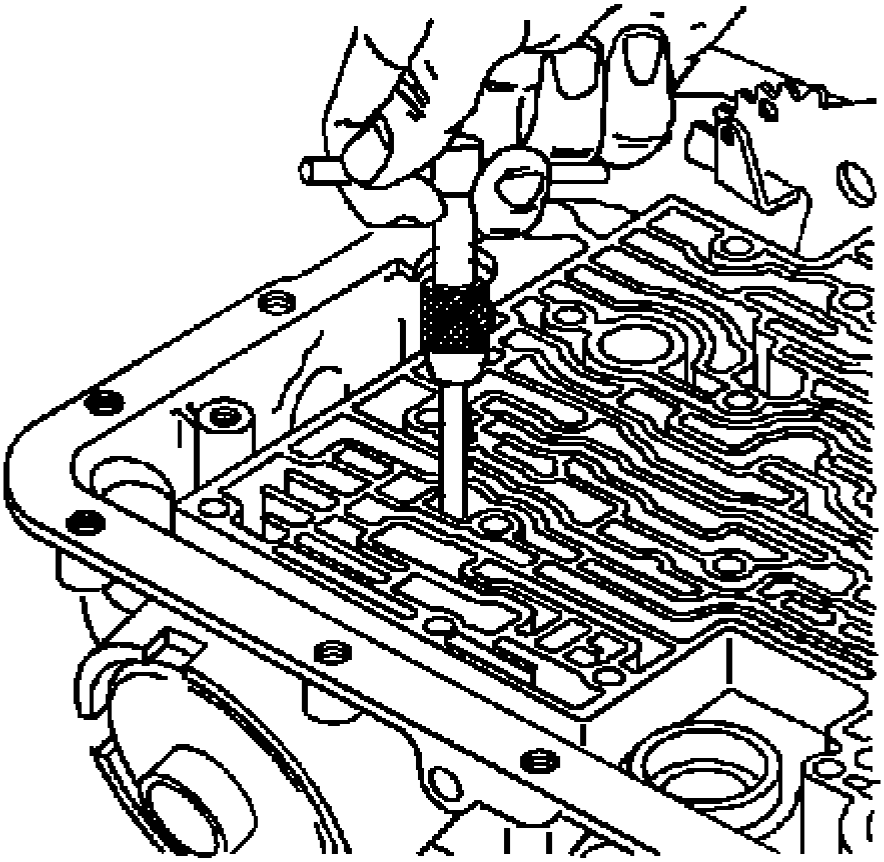


Fig. 89: Ensuring Retaining Ring Is Seated Correctly
Courtesy of GENERAL MOTORS CORP.

5. Ensure that the 3 retaining ring ears are seen from inside the fitting and that the retaining ring moves freely in the fitting slots.

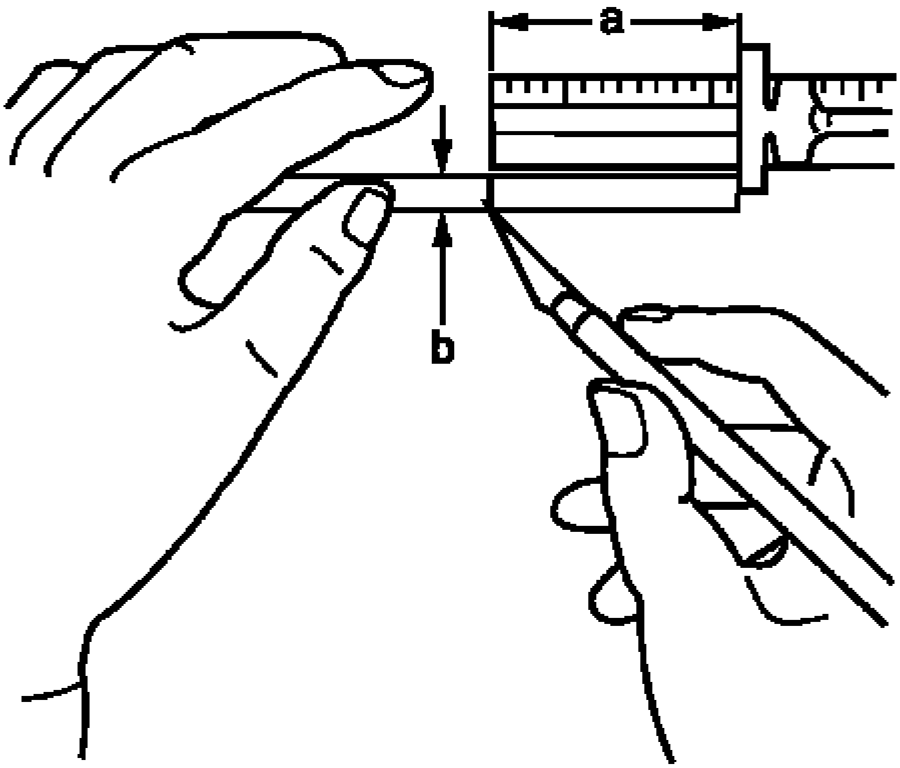


Fig. 90: View Of Cooler Line Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

6. Install the cooler line into the quick connect fitting.
7. Insert the cooler line end into the quick connect fitting until a click is either heard or felt.

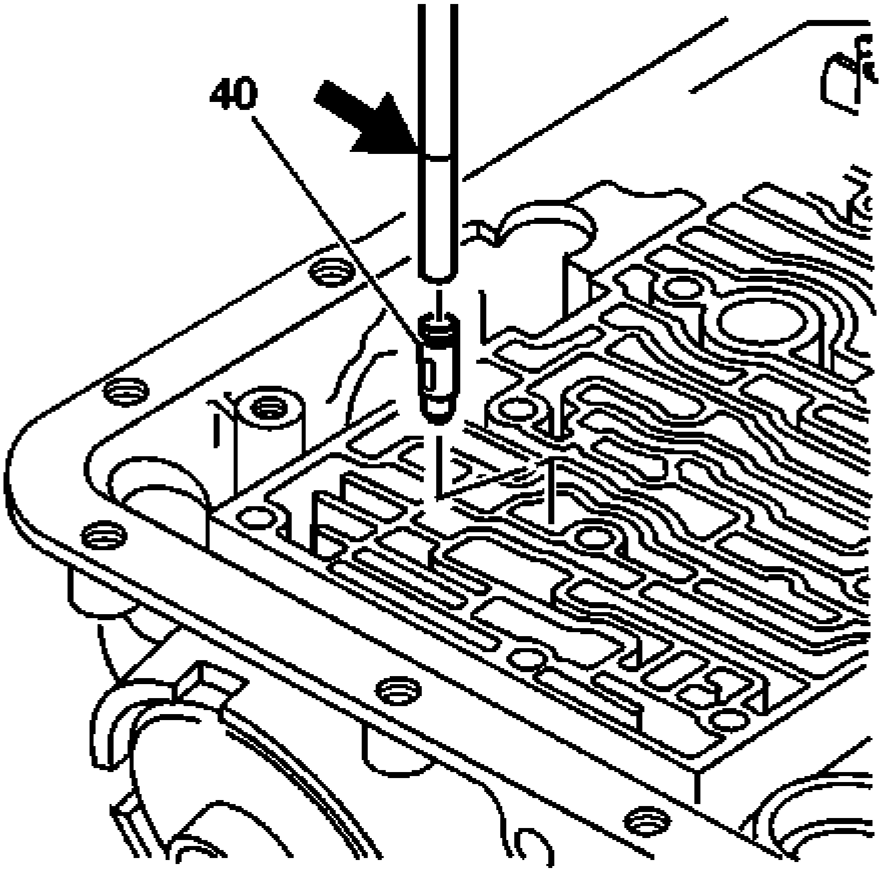


Fig. 91: Do Not Use Plastic Cap On Cooler Line In Order To Install Cooler Line Into Fitting
Courtesy of GENERAL MOTORS CORP.

8. Do not use the plastic cap on the cooler line in order to install the cooler line into the fitting.
9. Pull back sharply on the cooler line in order to ensure that the cooler line is fastened into the quick connect fitting.

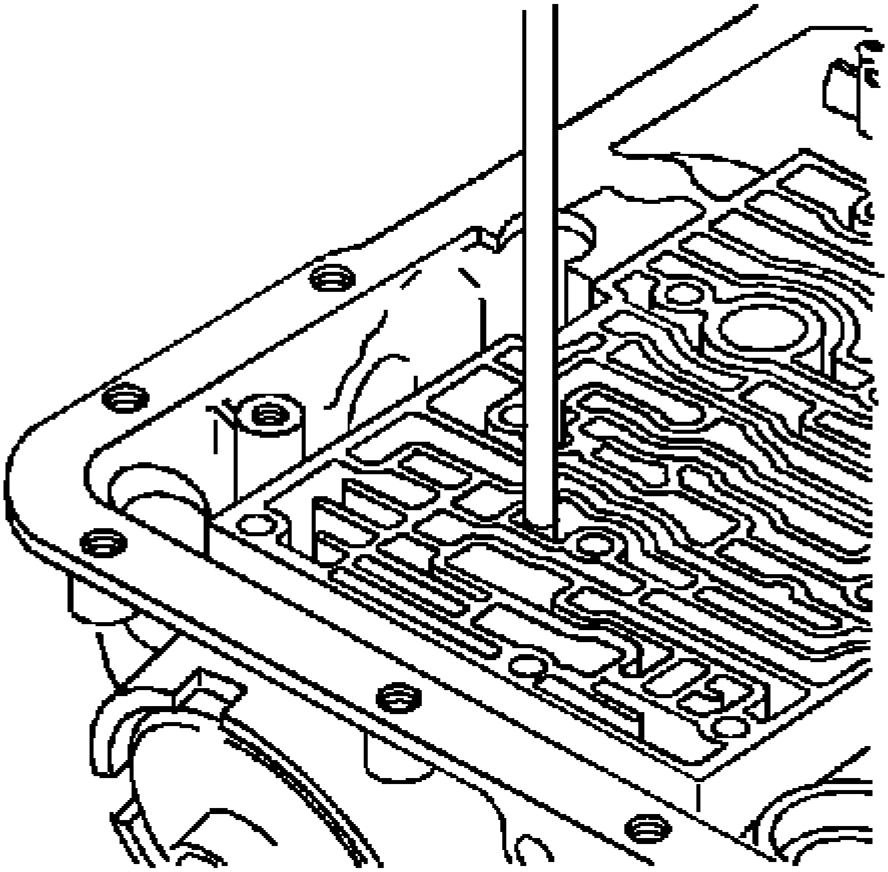


Fig. 92: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not manually depress the retaining clip when installing the plastic cap.

10. Position (snap) the plastic cap onto the fitting. Do not manually depress the retaining ring when installing the plastic cap onto the quick connect fitting.
11. Ensure that the plastic cap is fully seated against the fitting.

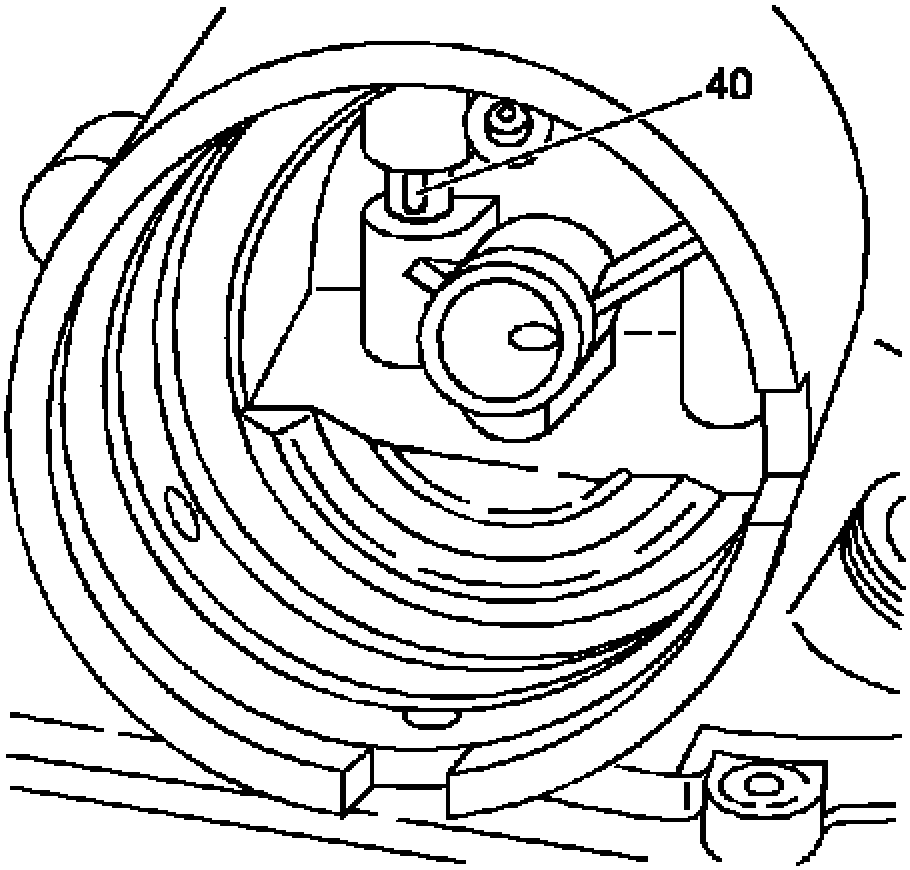


Fig. 93: Checking For Gap Between Cap & Fitting
Courtesy of GENERAL MOTORS CORP.

12. Ensure that no gap is present between the cap and the fitting.

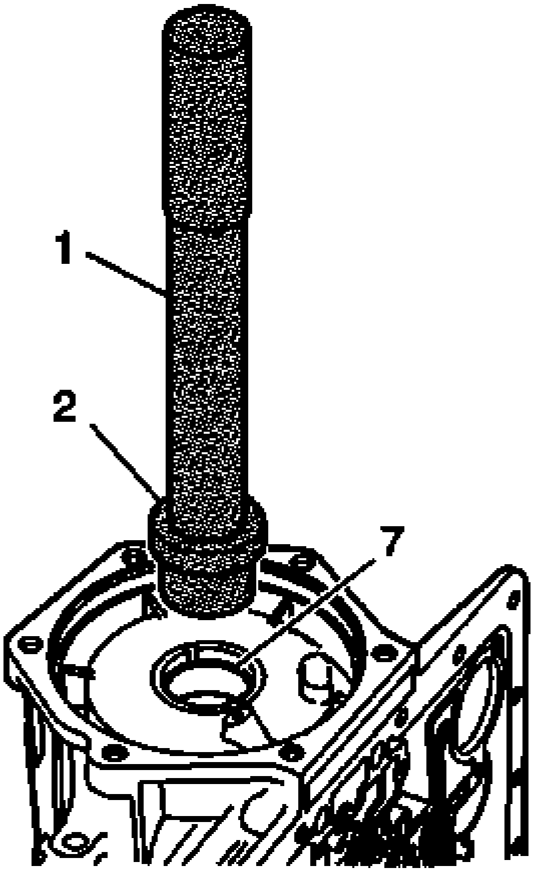


Fig. 94: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

13. Ensure that the yellow identification band on the tube is hidden within the quick connect fitting.

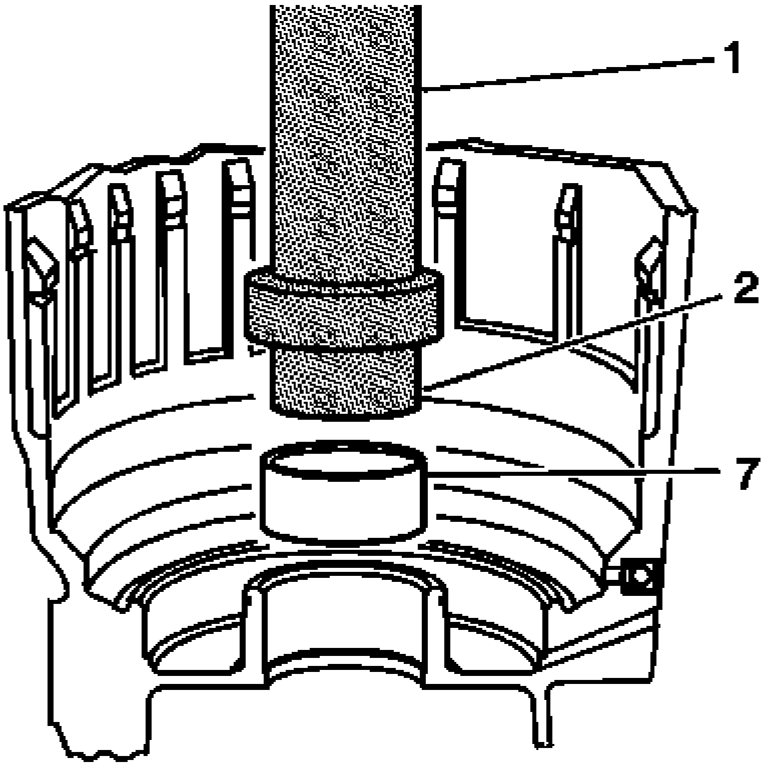


Fig. 95: Identifying Improper Joint Seating
Courtesy of GENERAL MOTORS CORP.

14. A hidden yellow identification band indicates proper joint seating.
15. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check** .

FORWARD SERVO REPLACEMENT

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
3. Remove the six forward servo cover bolts, cover, and gasket.

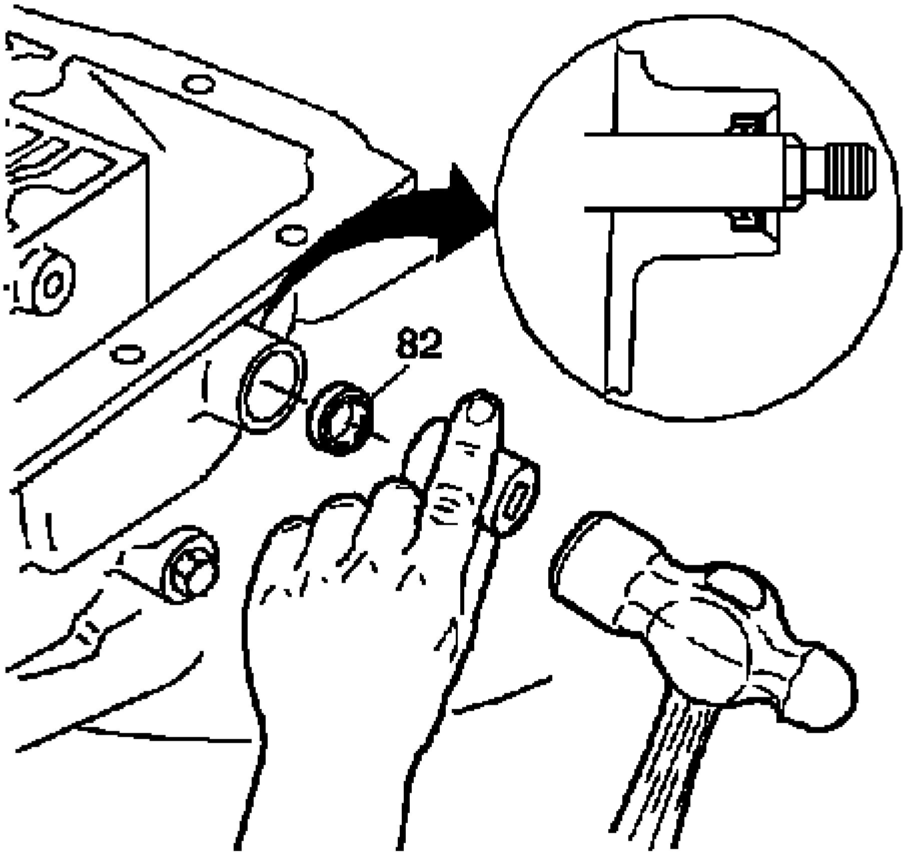


Fig. 96: Forward Servo Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the following parts:
    1. Forward servo piston pin (5)
    2. O-ring seal (4)
    3. Servo piston (3)
    4. Retainer (2)
    5. Piston spring (1)

Installation Procedure

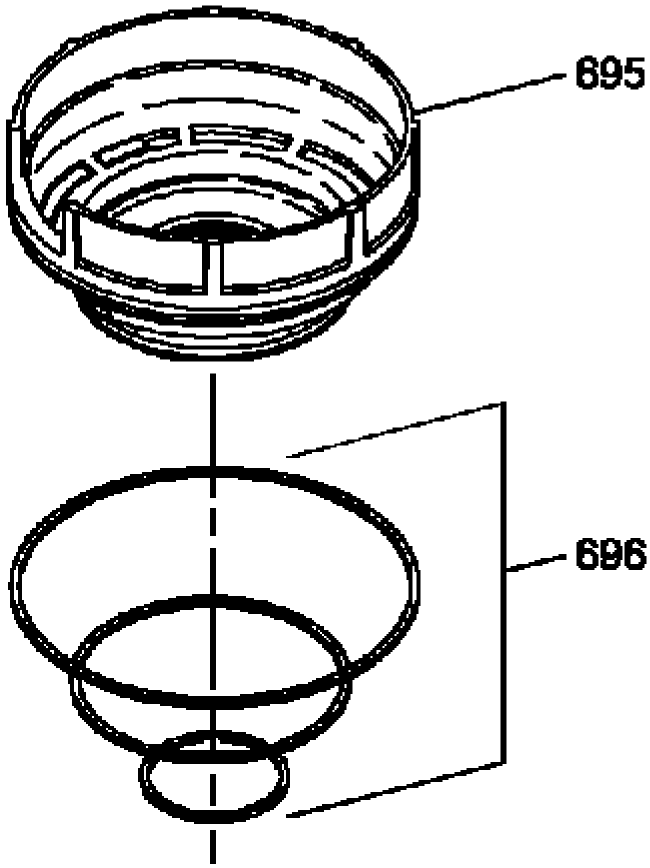


Fig. 97: Forward Servo Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the following parts:
   - Piston spring (1)
   - Retainer (2)
   - Servo piston (3)
   - O-ring seal (4)
   - Forward servo piston pin (5)

NOTE: Refer to FASTENER NOTICE .

2. Install the forward servo gasket, cover, and bolts.

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

3. Install the oil pan and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
4. Lower the vehicle.
5. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

**IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.**

6. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

TRANSMISSION FLUID COOLER HOSE/PIPE REPLACEMENT (4.8L, 5.3L, 6.0L)

Removal Procedure

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Support the vehicle with safety stands.

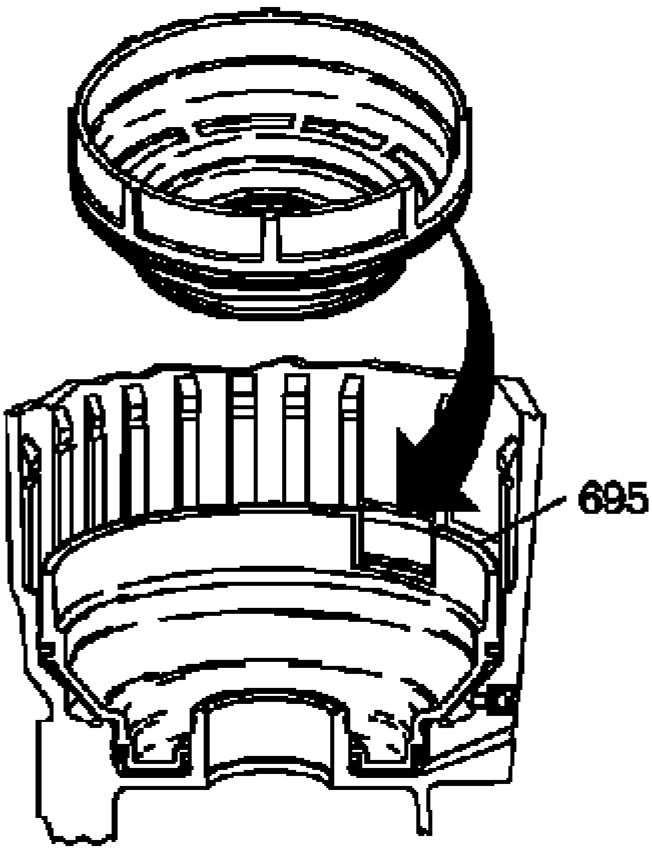


Fig. 98: Radiator Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

3. Remove the 2 oil cooler lines from the radiator.

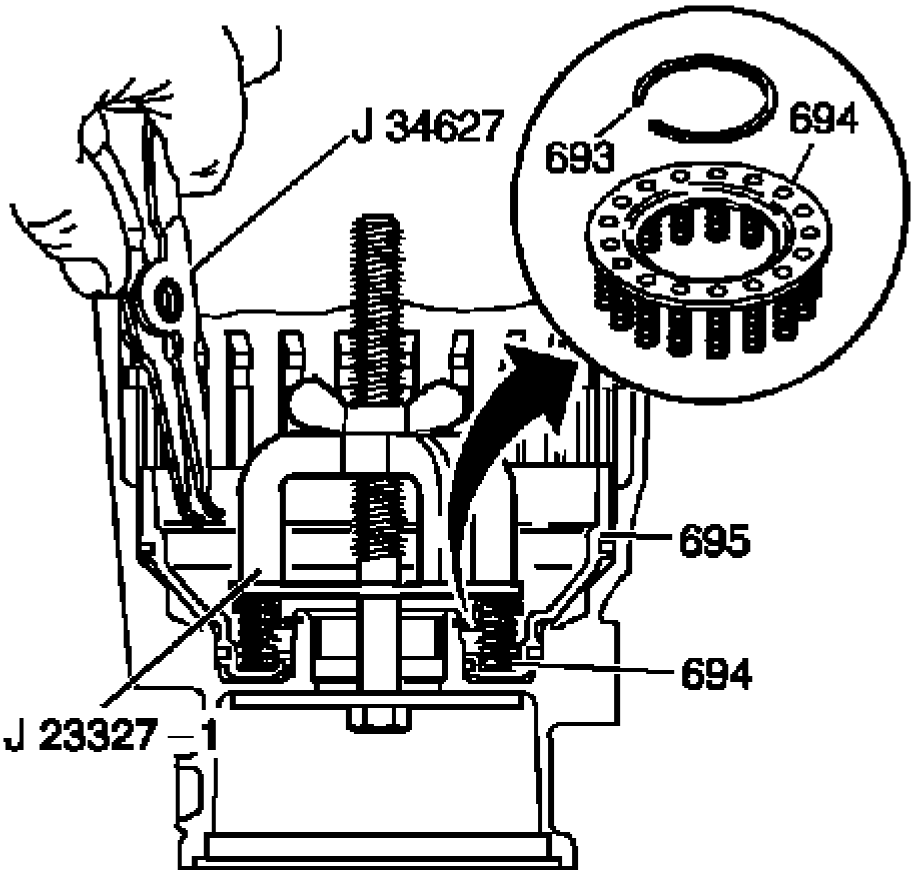


Fig. 99: Auxiliary Transmission Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

4. If equipped with the auxiliary transmission oil cooler, remove the outlet pipe from the auxiliary cooler pipe.

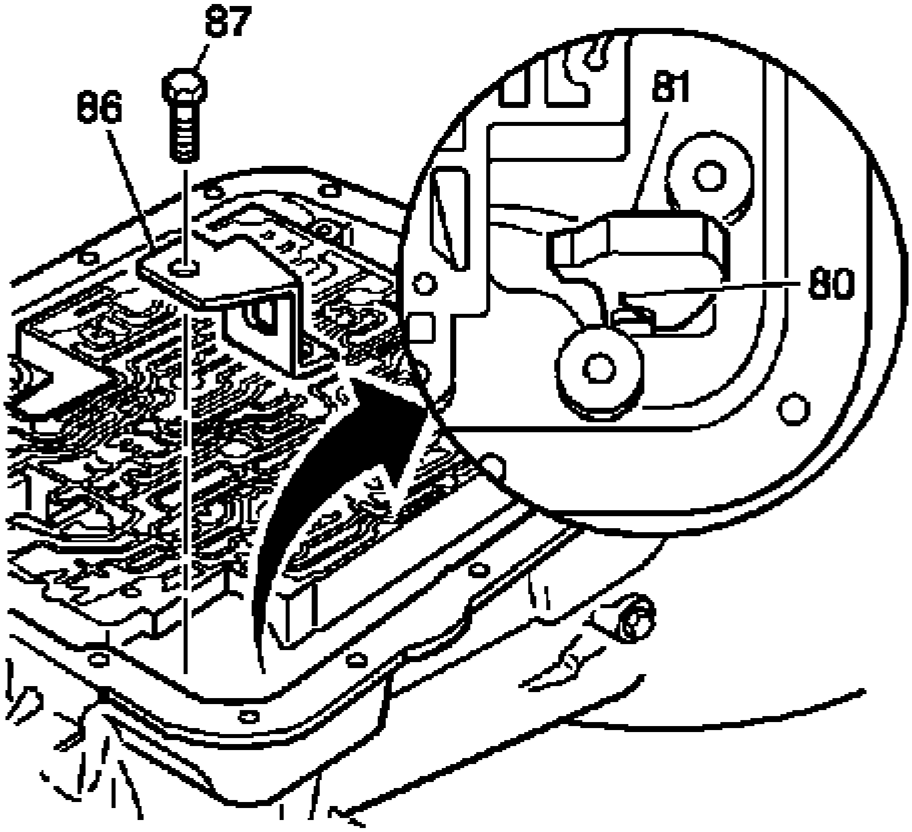


Fig. 100: Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

5. Remove the 2 oil cooler lines from the transmission.
6. Remove the 2 oil cooler lines from the clips on the frame rail.

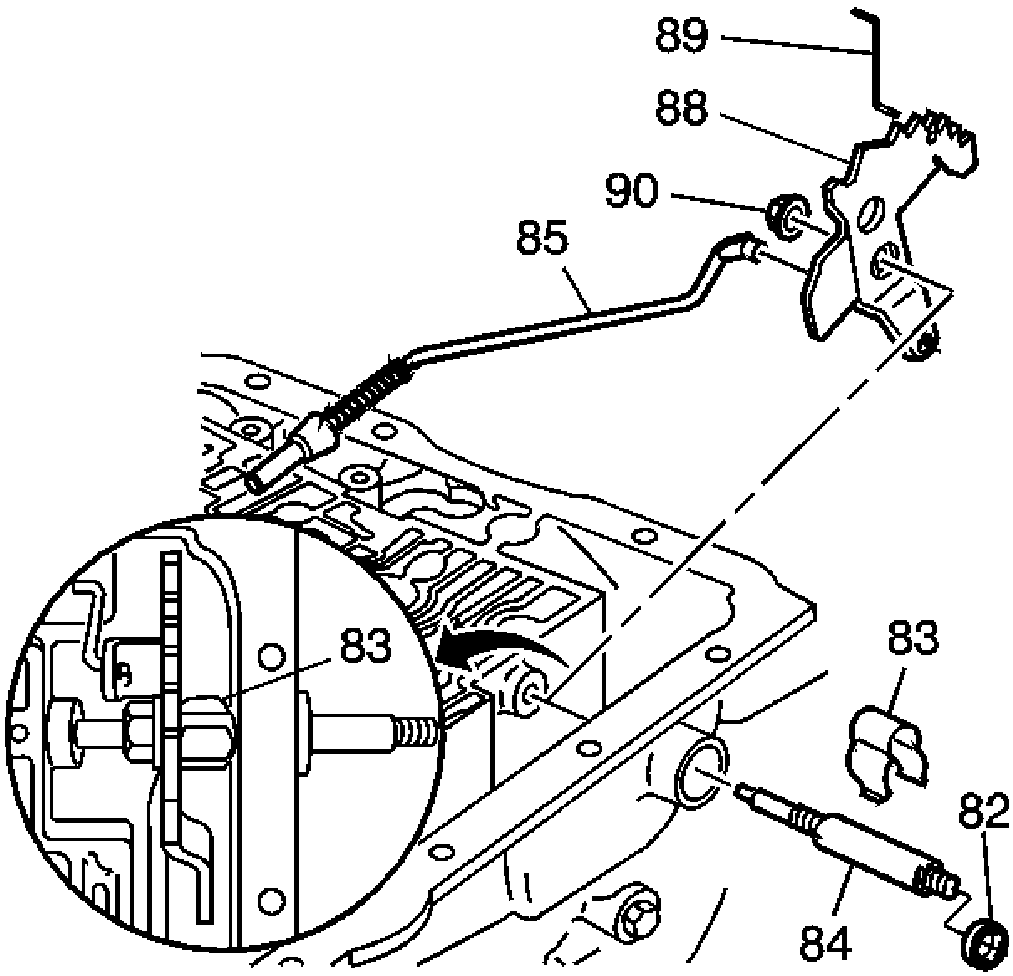


Fig. 101: Cooler Line & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Perform the following procedures when removing the retaining ring and cooler line from the quick connect fitting on the transmission.

7. Pull the plastic cap back from the quick connect fitting and down along the cooler line about two inches.

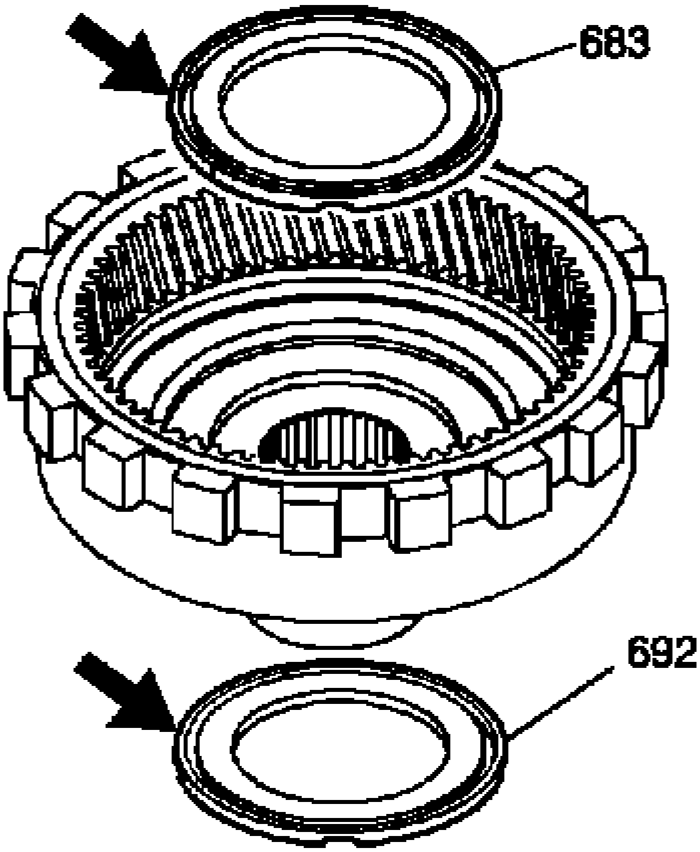


Fig. 102: Bent Tip Screwdriver
Courtesy of GENERAL MOTORS CORP.

8. Using a bent-tip screwdriver, pull on one of the open ends of the retaining ring in order to rotate the retaining ring around the quick connect fitting until the retaining ring is out of position and can be completely removed.

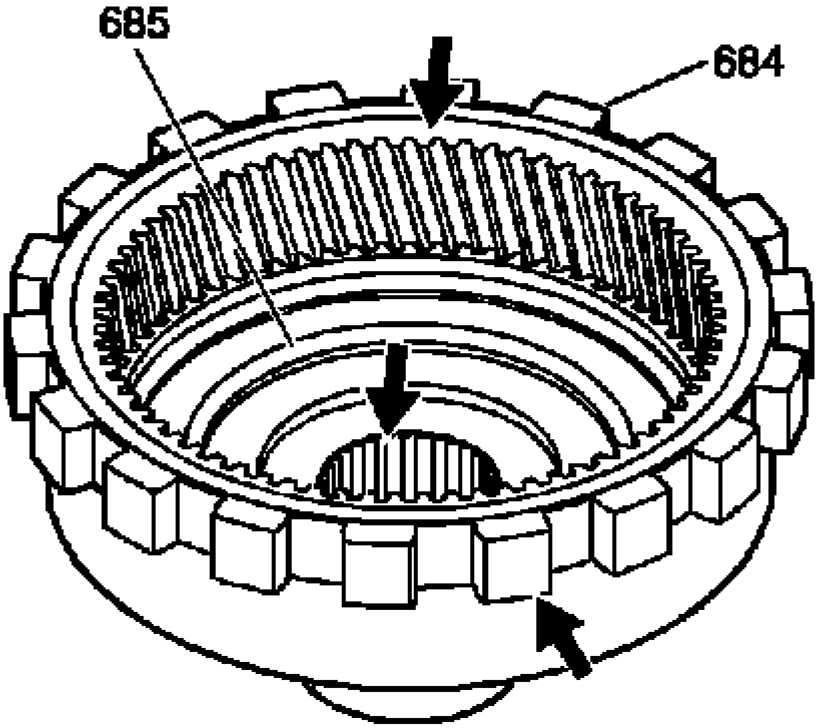


Fig. 103: Retaining Ring For Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

9. Remove the retaining ring from the quick connect fitting.
10. Discard the retaining ring.

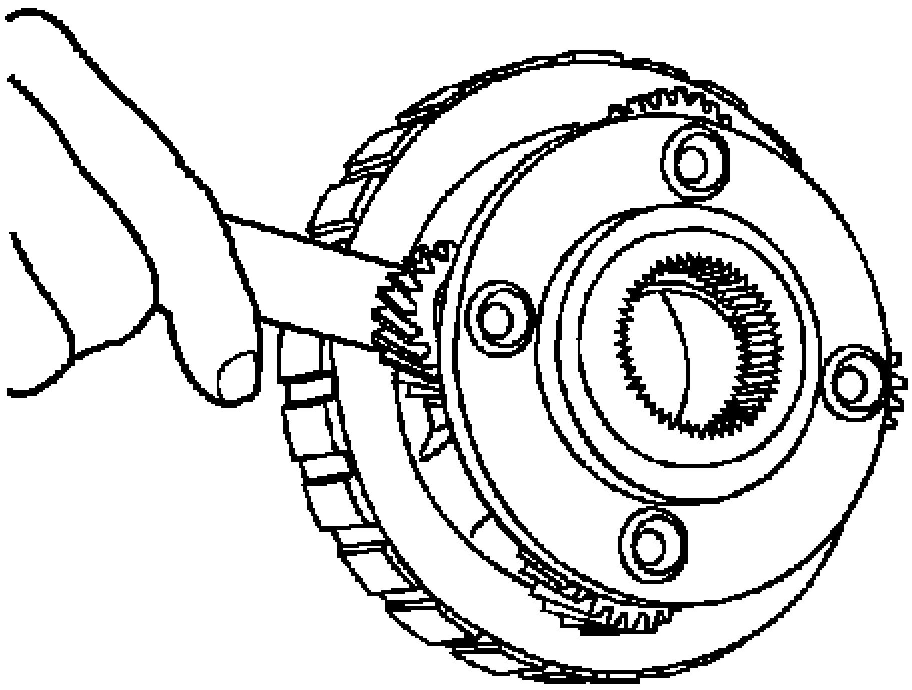


Fig. 104: Cooler Line & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

11. Pull the cooler line straight out from the quick connect fitting.
12. Remove the retaining ring (E-clips) securing the cooler line to the quick connect in order to remove the remaining cooler lines from the remaining quick connect fittings.
13. Remove the cooler lines from the vehicle.
14. Lower the vehicle.

Installation Procedure

1. Raise the vehicle.

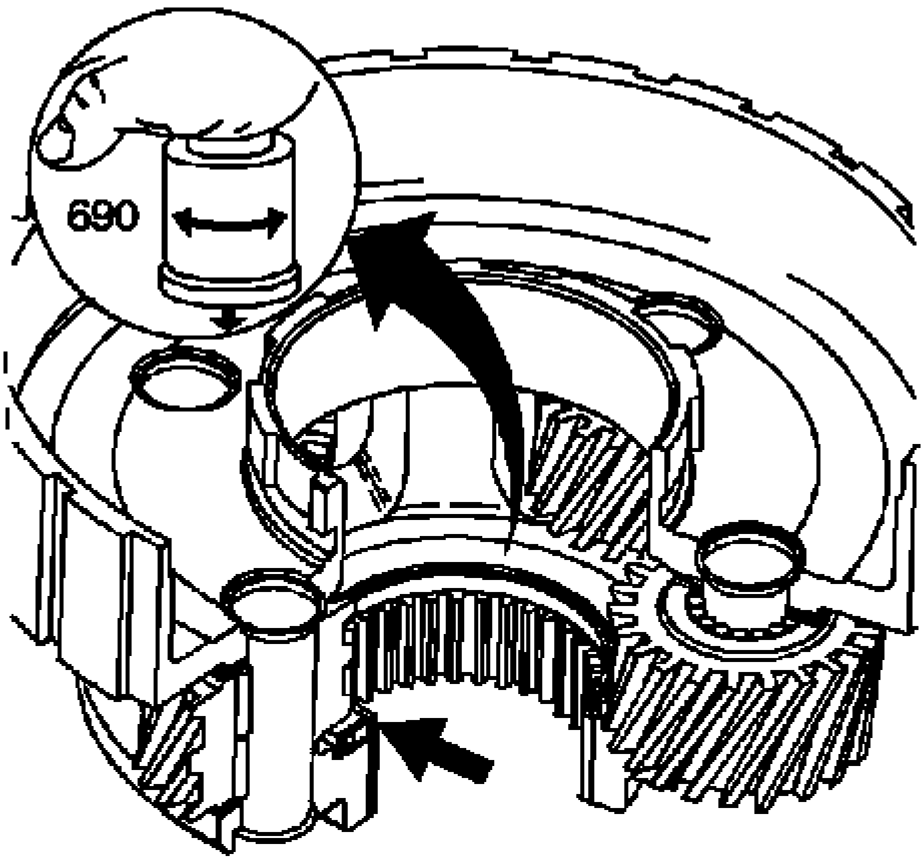


Fig. 105: Transmission Oil Cooler Line
Courtesy of GENERAL MOTORS CORP.

2. Install the transmission oil cooler line to the vehicle.

IMPORTANT: Do not reuse any of the existing retaining rings that were removed from the existing quick connect fittings. All retaining rings being installed must be New.

3. Install the new retaining ring (E-clip) into the quick connect fitting.

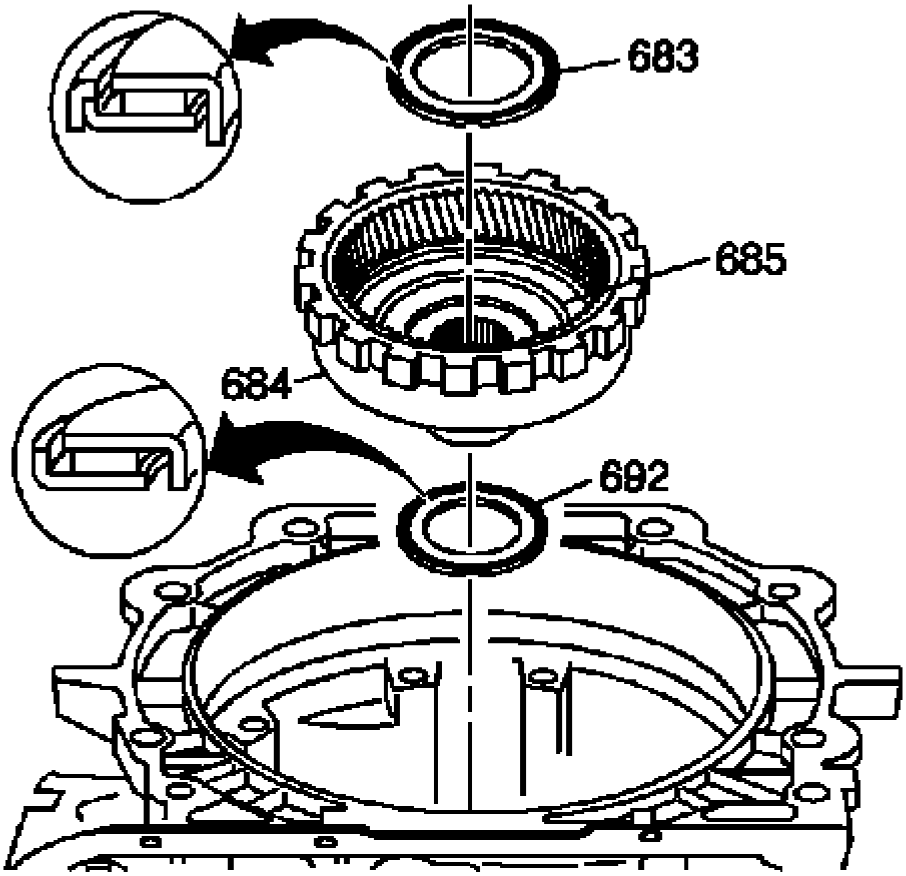


Fig. 106: Radiator Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

4. Install the 2 cooler lines to the radiator.

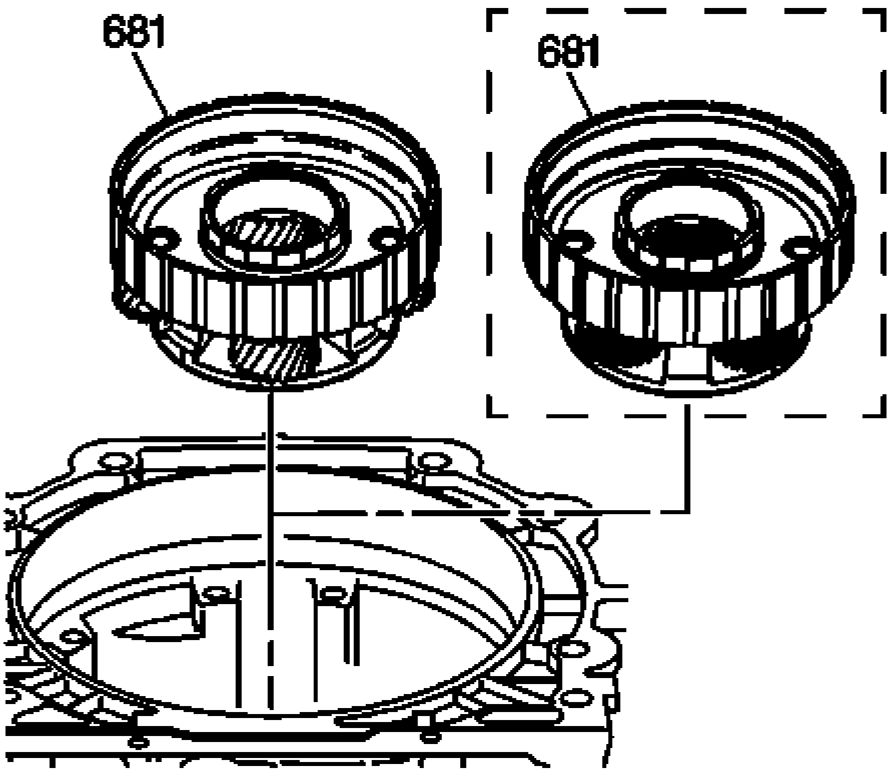


Fig. 107: Auxiliary Transmission Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

5. If equipped with the auxiliary oil cooler, install the inlet line to the radiator and the outlet to the auxiliary cooler line.

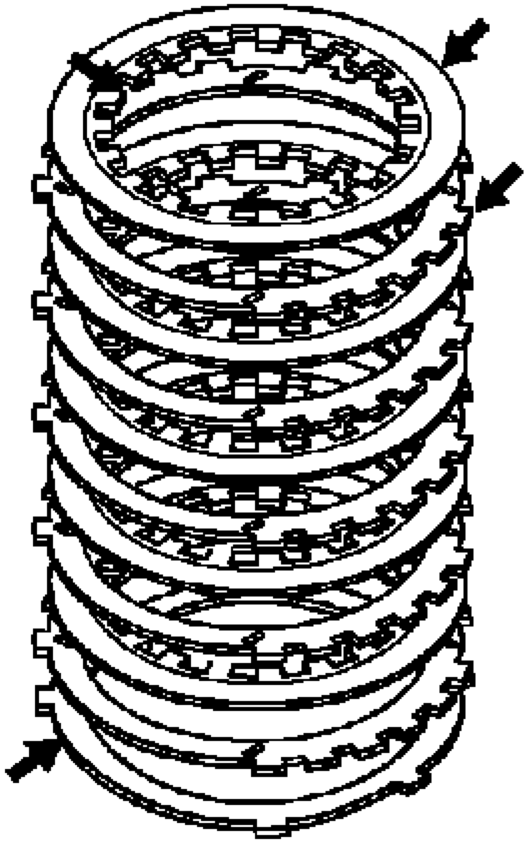


Fig. 108: Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

6. Install the 2 oil cooler lines to the transmission.

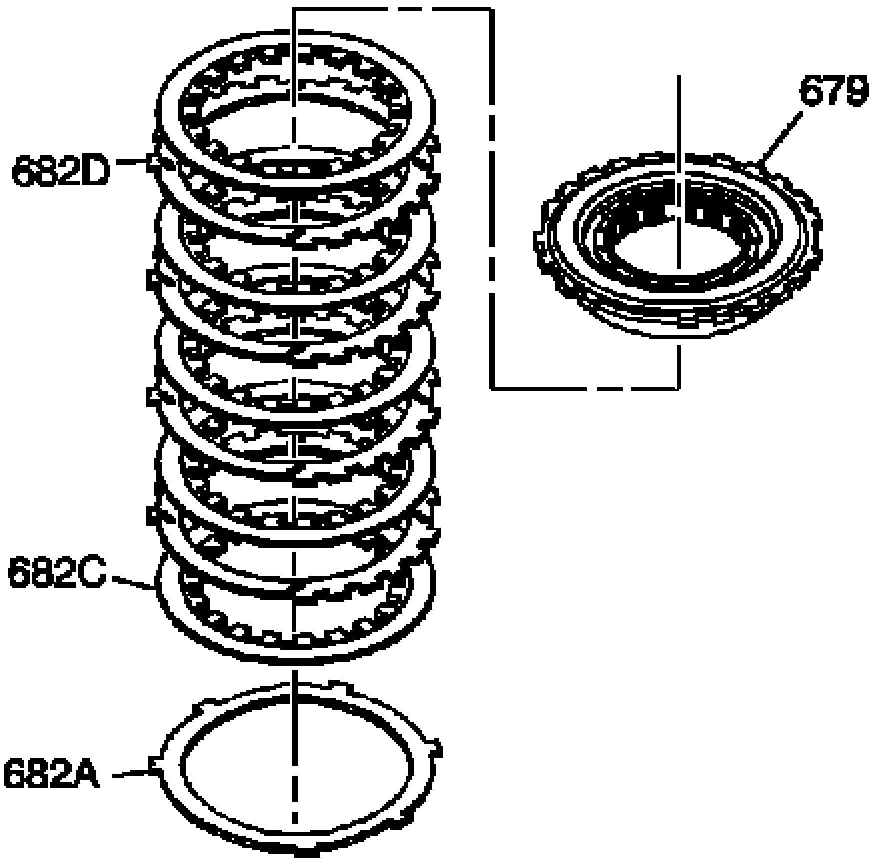


Fig. 109: Hooking Retaining Ring Into Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

7. Hook one of the open ends of the retaining ring in one of the slots in the quick connect fitting.

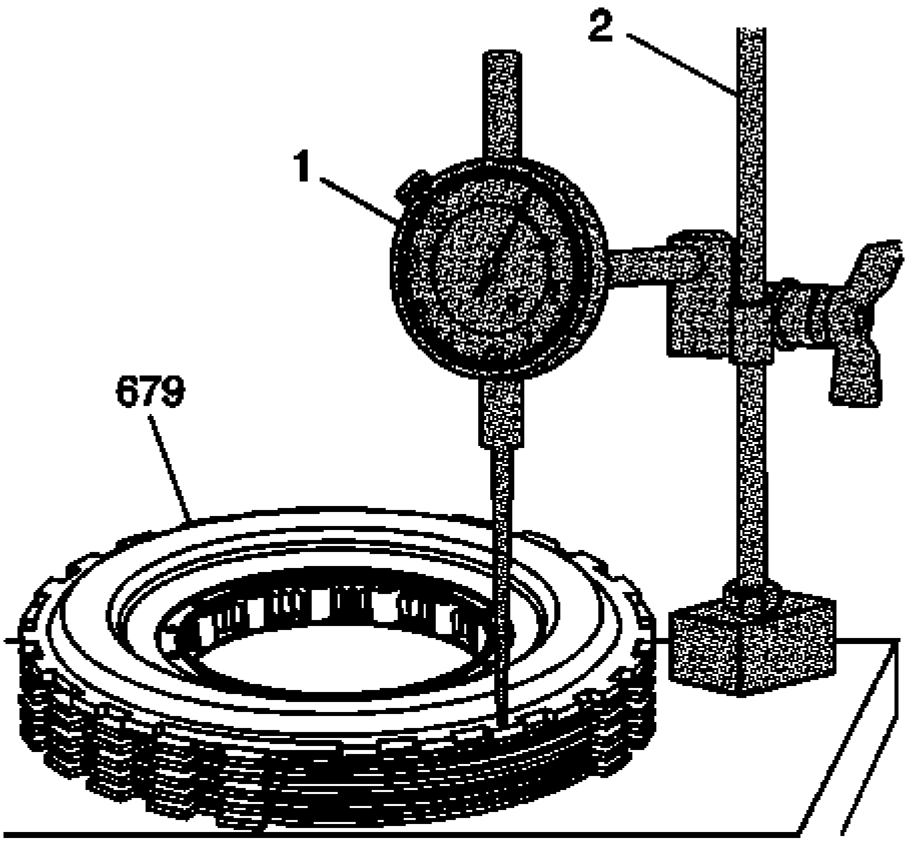


Fig. 110: Rotating Retaining Ring Around Fitting
Courtesy of GENERAL MOTORS CORP.

8. Rotate the retaining ring around the fitting until the retaining ring is positioned with all three ears through the three slots on the fitting.

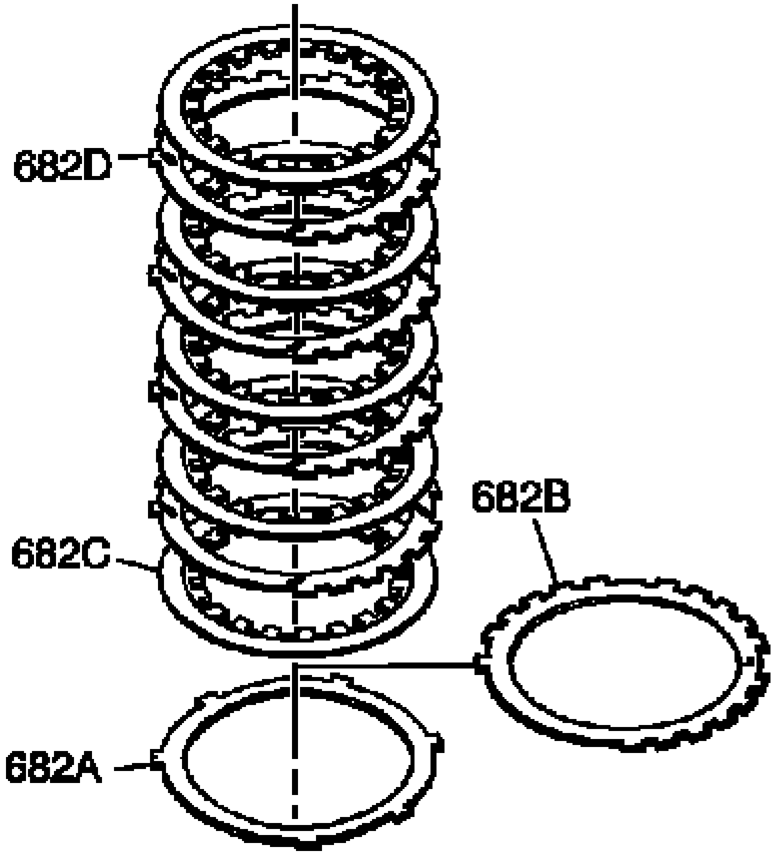


Fig. 111: Identifying Improper Engine Oil Cooler Hose/Pipe Retaining Ring Installation
Courtesy of GENERAL MOTORS CORP.

9. Do not install the new retaining ring onto the fitting by pushing the retaining ring down over the fitting.

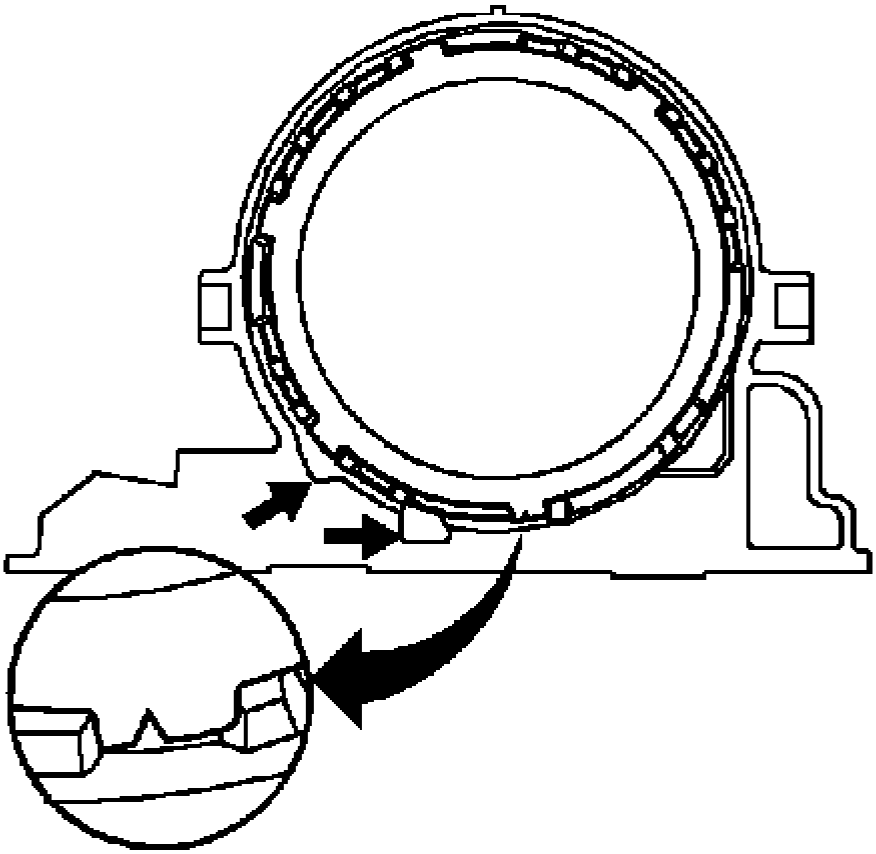


Fig. 112: Ensuring Retaining Ring Is Seated Correctly
Courtesy of GENERAL MOTORS CORP.

10. Ensure that the three retaining ring ears are seen from inside the fitting and that the retaining ring moves freely in the fitting slots.
11. Install the new retaining ring (E-clip) into the remaining quick connect fittings.

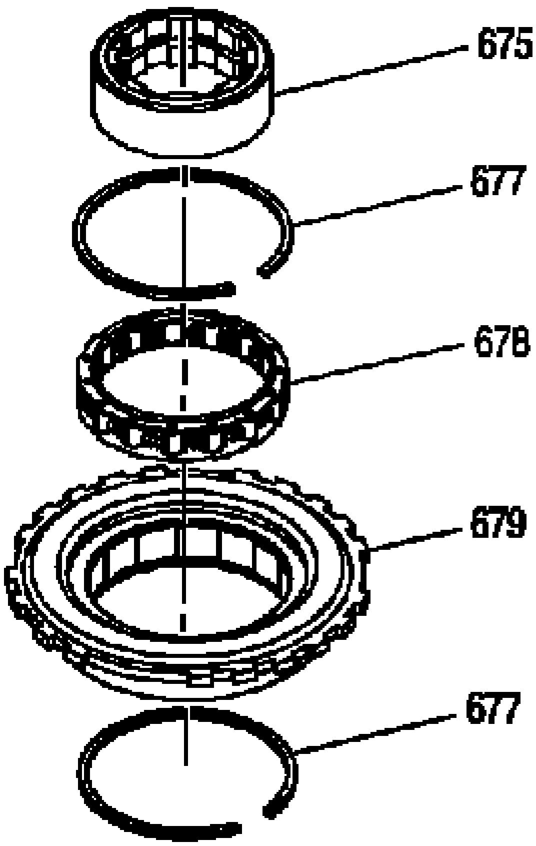


Fig. 113: View Of Cooler Line Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

NOTE: **Ensure that the cooler line being installed has a plastic cap on each end that connects to a quick connect fitting. If no plastic cap exists, or the plastic cap is damaged, obtain a new plastic cap and position on to the cooler line prior to the cooler line installation.**

12. Install the cooler line into the quick connect fitting.
13. Insert the cooler line end into the quick connect fitting until a click is either heard or felt.

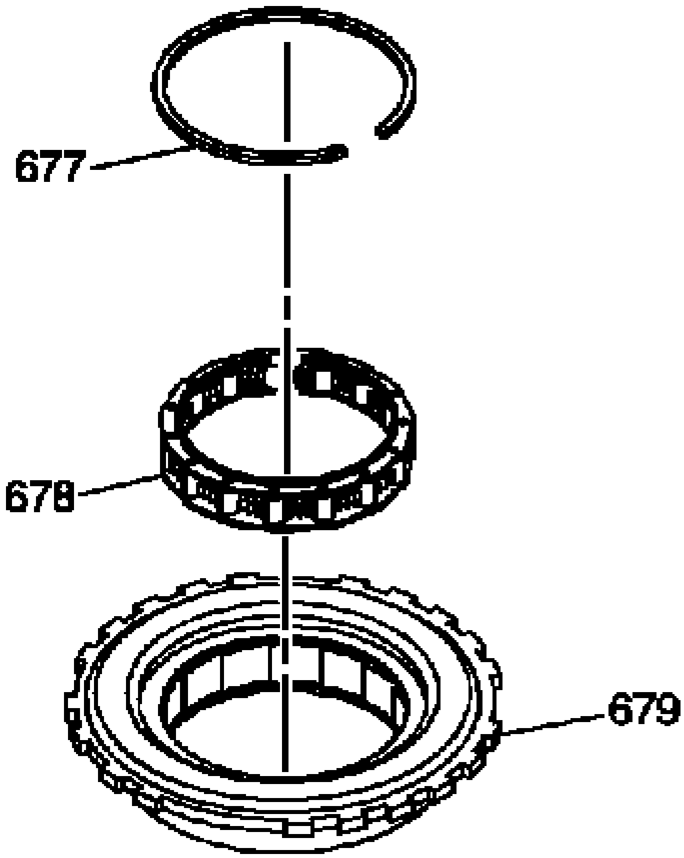


Fig. 114: Do Not Use Plastic Cap On Cooler Line In Order To Install Cooler Line Into Fitting
Courtesy of GENERAL MOTORS CORP.

14. Do not use the plastic cap on the cooler line in order to install the cooler line into the fitting.
15. Pull back sharply on the cooler line in order to ensure that the cooler line is fastened into the quick connect fitting.

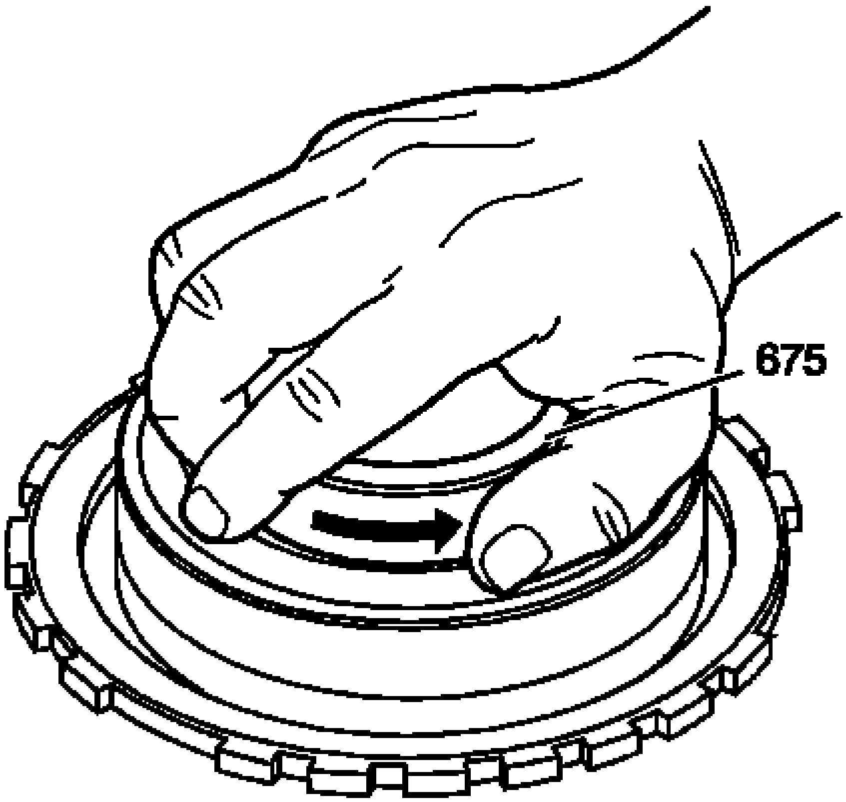


Fig. 115: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

16. Position (snap) the plastic cap onto the fitting. Do not manually depress the retaining ring when installing the plastic cap onto the quick connect fitting.
17. Ensure that the plastic cap is fully seated against the fitting.

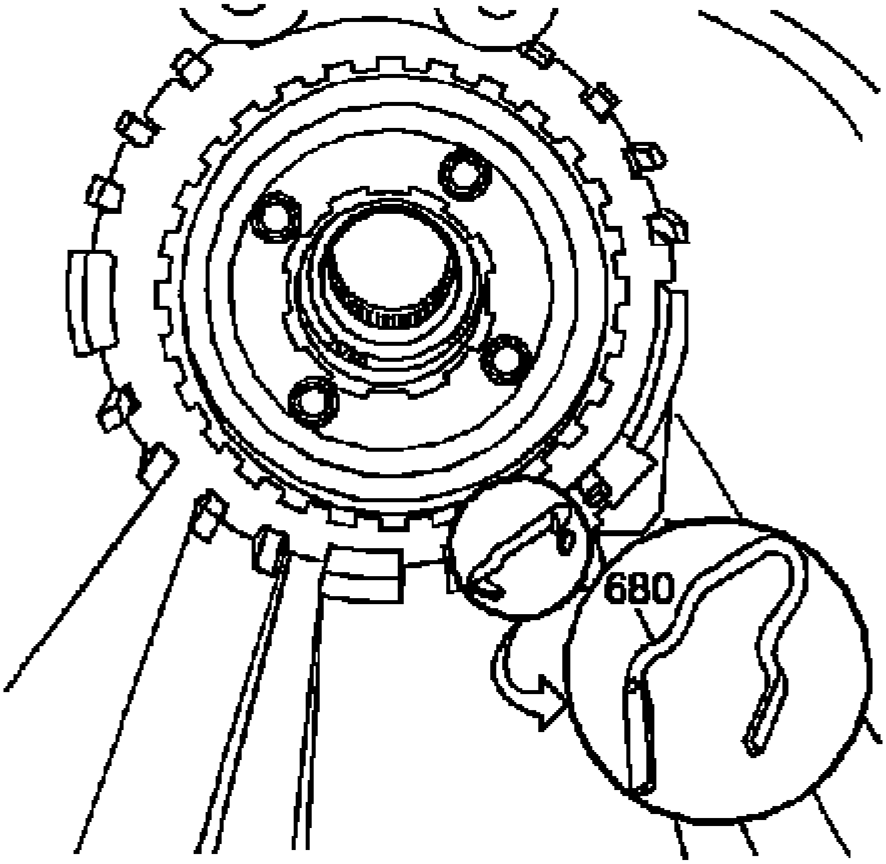


Fig. 116: Checking For Gap Between Cap & Fitting
Courtesy of GENERAL MOTORS CORP.

18. Ensure that no gap is present between the cap and the fitting.

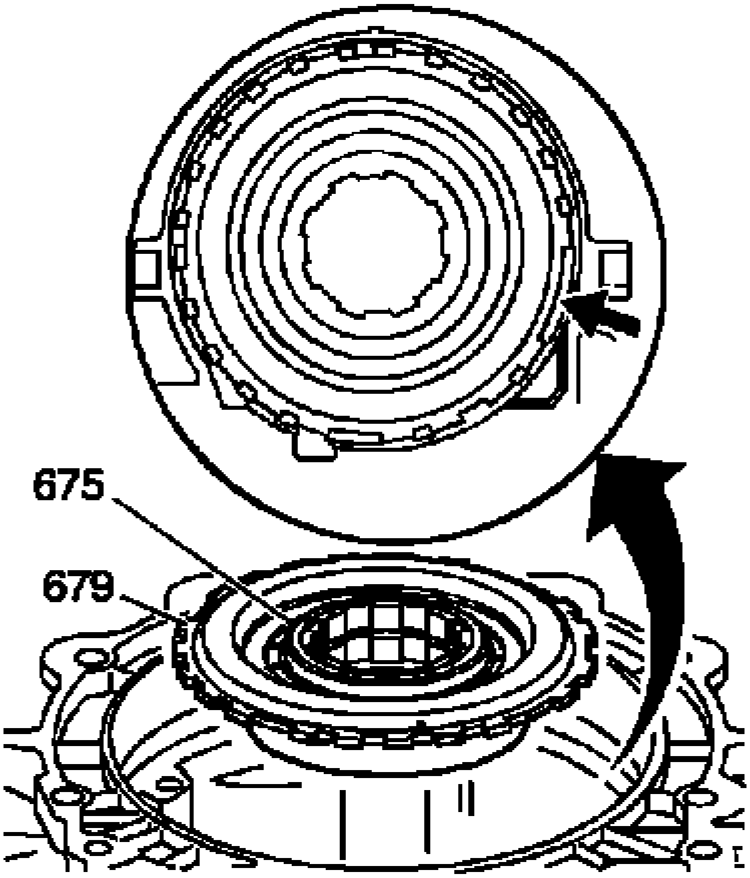


Fig. 117: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

19. Ensure that the yellow identification band on the tube is hidden within the quick connect fitting. A hidden yellow identification band indicates proper joint seating.

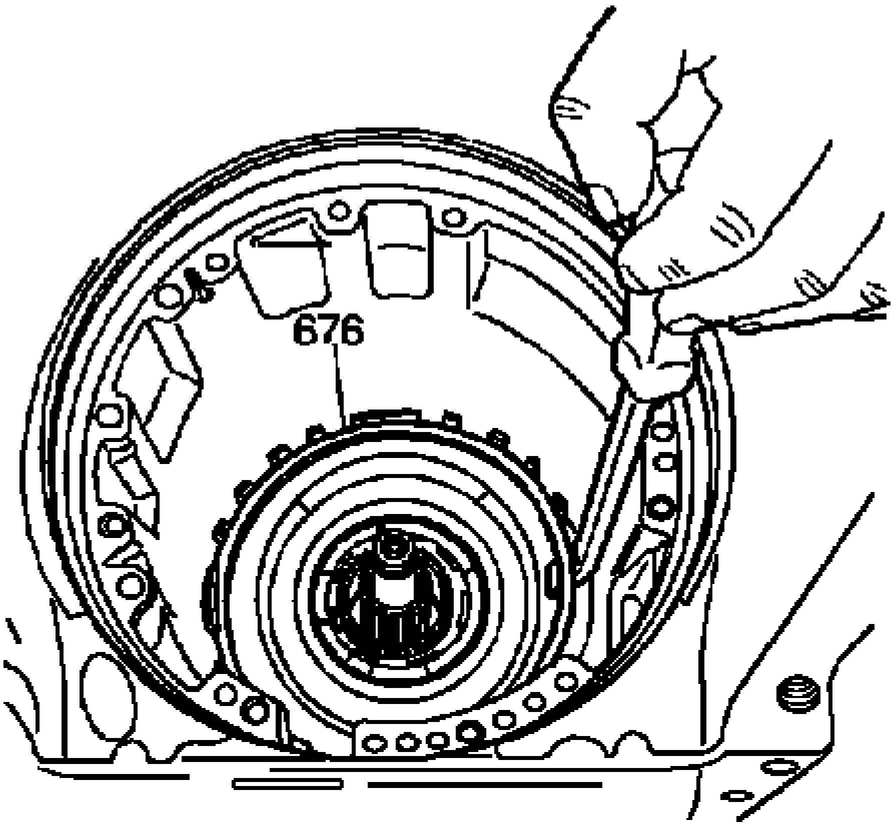


Fig. 118: Identifying Improper Joint Seating
Courtesy of GENERAL MOTORS CORP.

20. Do not install the cooler line into the fitting incorrectly.
21. If you cannot position the plastic cap against the fitting, remove the retaining ring from the quick connect fitting per step 3 of the cooler line removal procedure. Check the retaining ring and the tube end in order to ensure neither is bent. Replace the cooler line or the retaining ring if necessary, and reinstall per Step 1 of the cooler line installation procedure.
22. Install the cooler line into the quick connect fitting again in order to install the remaining cooler lines into the remaining quick connect fittings.

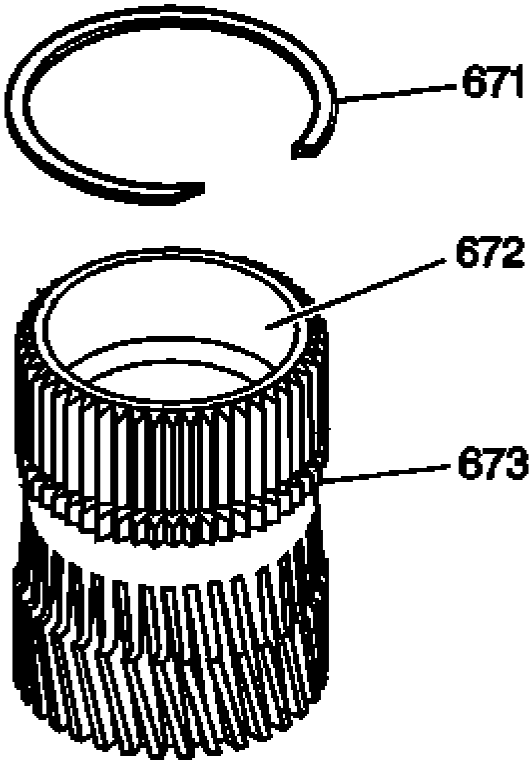


Fig. 119: Transmission Oil Cooler Line
Courtesy of GENERAL MOTORS CORP.

23. Install the engine or transmission cooler lines to the frame.
24. Lower the vehicle.

TRANSMISSION FLUID COOLER HOSE/PIPE REPLACEMENT (6.6L)

Removal Procedure

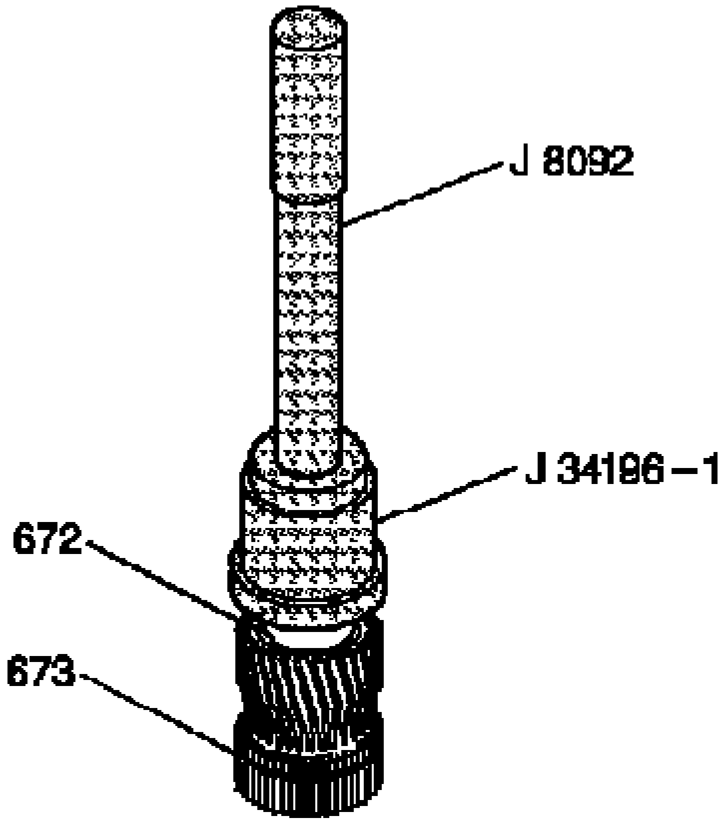


Fig. 120: Identifying Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the oil cooler lines from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
2. Remove the oil cooler lines from the radiator.

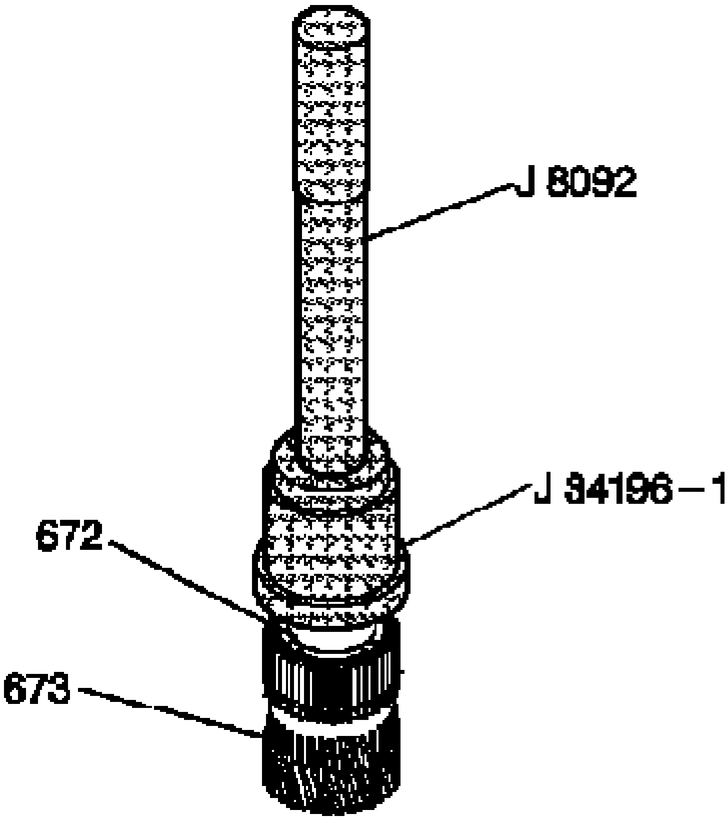


Fig. 121: Auxiliary Transmission Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

3. If equipped with the auxiliary transmission oil cooler, remove the outlet pipe from the auxiliary cooler pipe.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

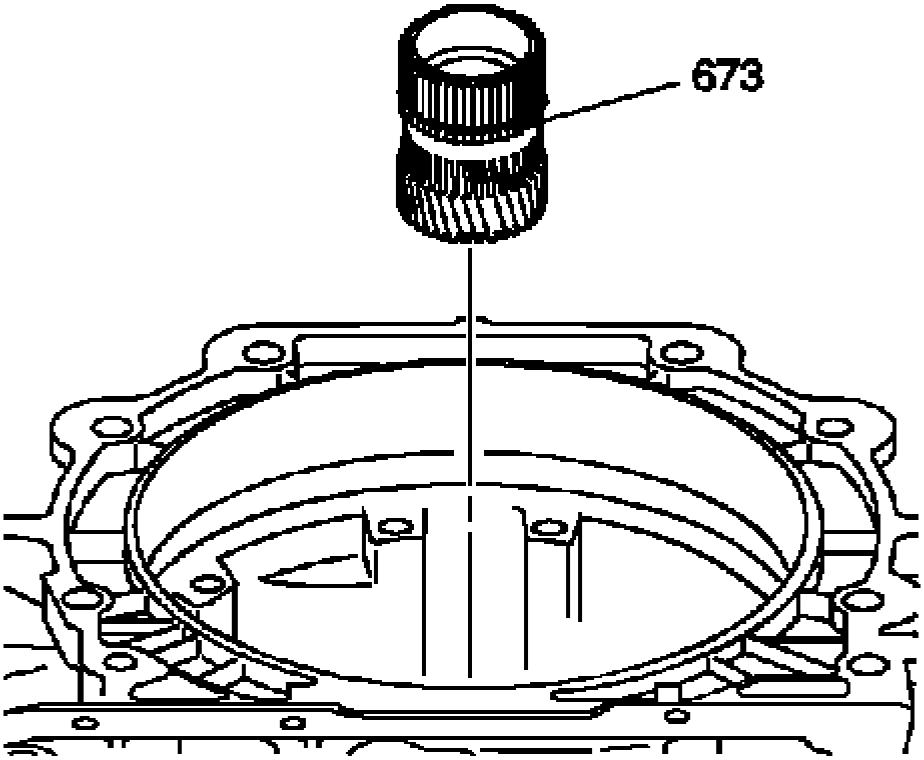


Fig. 122: Identifying transmission oil cooler lines
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the transmission oil cooler lines from the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
6. Remove the oil cooler lines from the transmission.
7. Remove the oil cooler lines from the clips on the frame rail.

IMPORTANT: Note the routing of the transmission lines to ensure proper installation.

8. Remove the cooler lines from the vehicle.

Installation Procedure

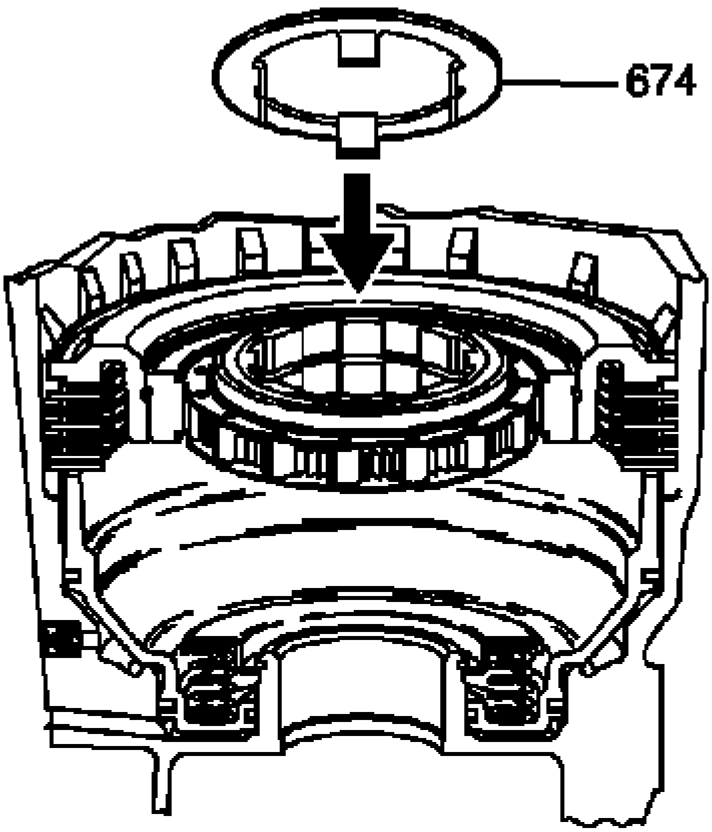


Fig. 123: Identifying transmission oil cooler lines
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission oil cooler line to the vehicle.

IMPORTANT: Do not reuse any of the existing retaining rings that were removed from the existing quick connect fittings. All retaining rings being installed must be New.

2. Install the new retaining ring (E-clip) into the quick connect fitting.

IMPORTANT: Ensure the transmission lines are position in the support bracket and the clips are installed.

3. Install the transmission oil cooler lines to the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
4. Lower the vehicle.

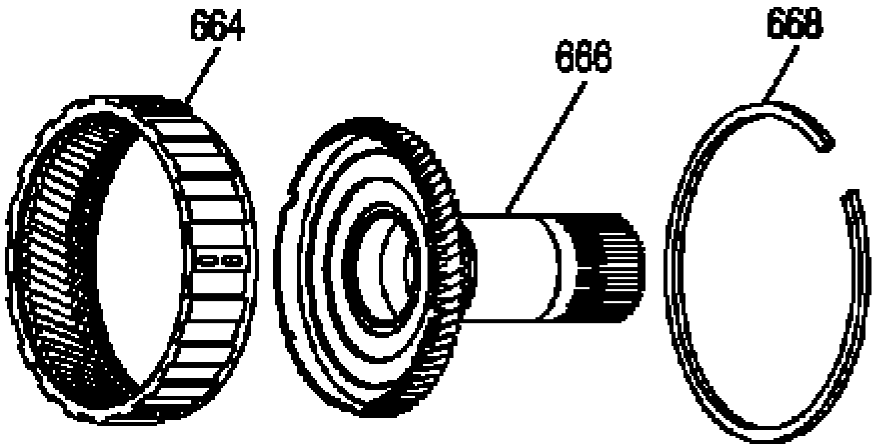


Fig. 124: Auxiliary Transmission Oil Cooler Outlet Pipe
Courtesy of GENERAL MOTORS CORP.

5. If equipped with the auxiliary oil cooler, install the inlet line to the radiator and the outlet to the auxiliary cooler line.

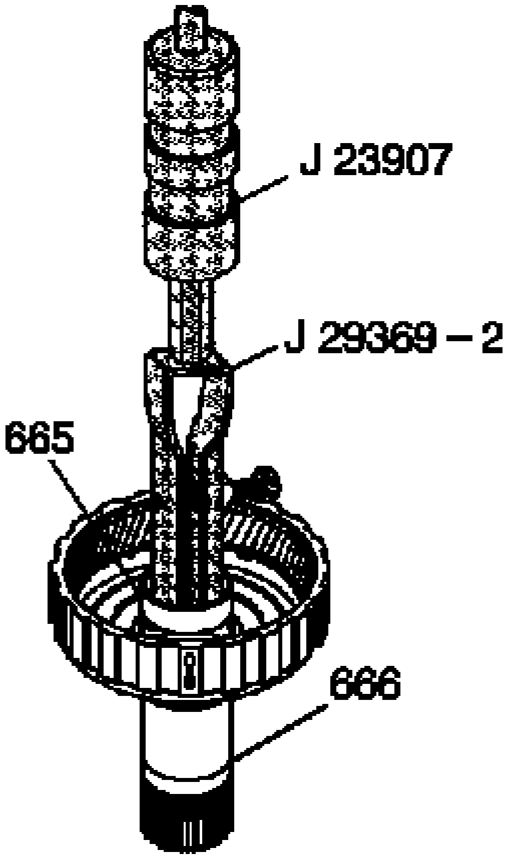


Fig. 125: Identifying oil cooler lines
Courtesy of GENERAL MOTORS CORP.

6. Install the oil cooler lines to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection**.
7. Fill the transmission to proper level. Refer to **Transmission Fluid Check**.

TRANSMISSION FLUID AUXILIARY COOLER REPLACEMENT

Removal Procedure

1. Remove the grille assembly. Refer to **Grille Replacement (Base)** or **Grille Replacement (Uplevel)** .

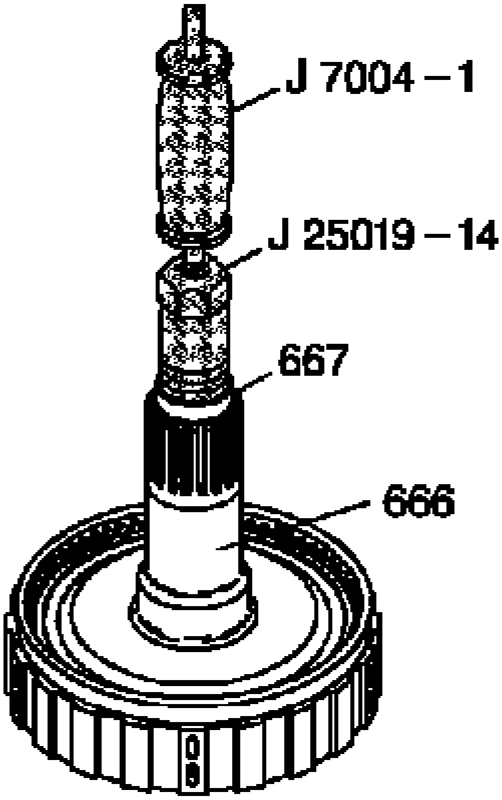


Fig. 126: Oil Cooler Lines At Auxiliary Oil Cooler
Courtesy of GENERAL MOTORS CORP.

2. Disconnect the lines from the auxiliary cooler.
3. Remove the lines from the push clips on the auxiliary cooler mounting bracket.
4. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

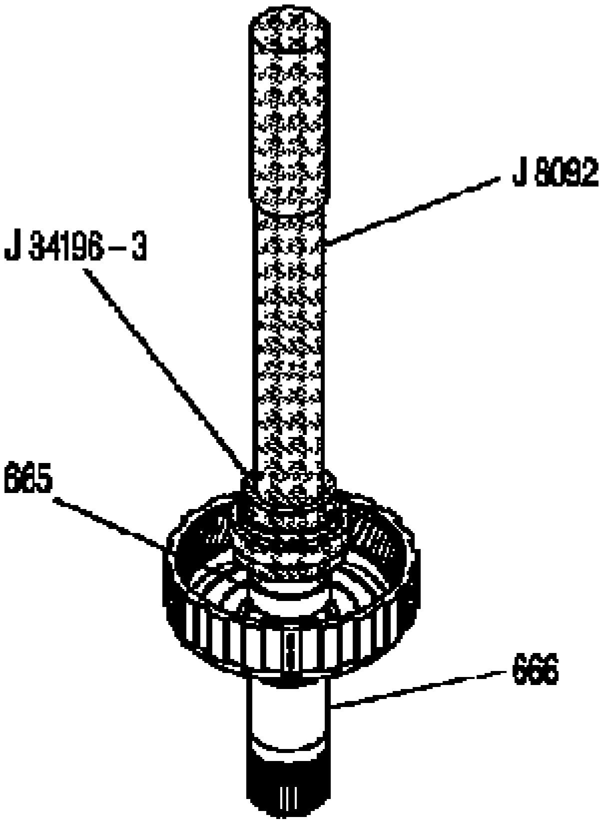


Fig. 127: Auxiliary Cooler & Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

5. Remove the lower bolts from the auxiliary cooler mounting bracket.
6. Lower the vehicle.
7. Remove the upper bolts.
8. Remove the auxiliary oil cooler from the vehicle.

Installation Procedure

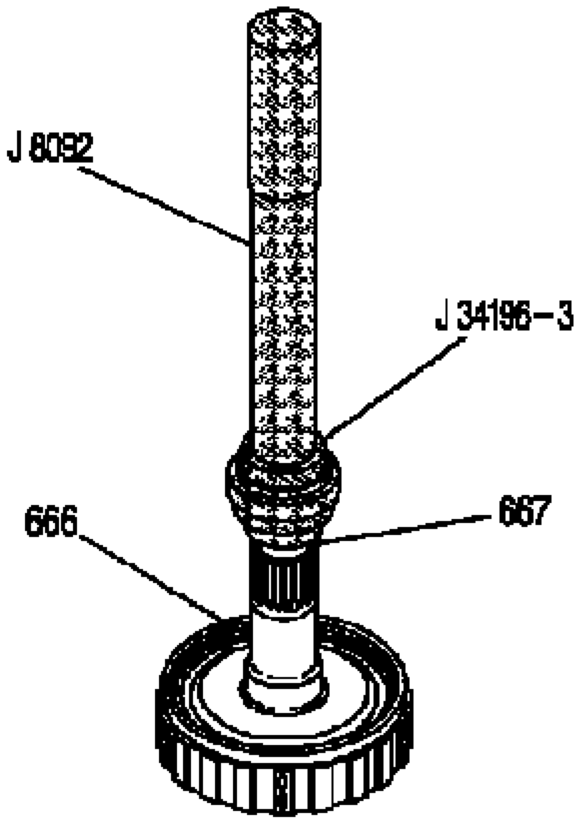


Fig. 128: Auxiliary Cooler & Mounting Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the oil cooler into the vehicle.

NOTE: **Refer to FASTENER NOTICE .**

2. Install the upper bolts into the oil cooler bracket.

   Tighten: Tighten the bolts to 10 N.m (89 lb in).

3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Install the lower bolts to the oil cooler bracket.

   Tighten: Tighten the bolts to 10 N.m (89 lb in).

5. Lower the vehicle.

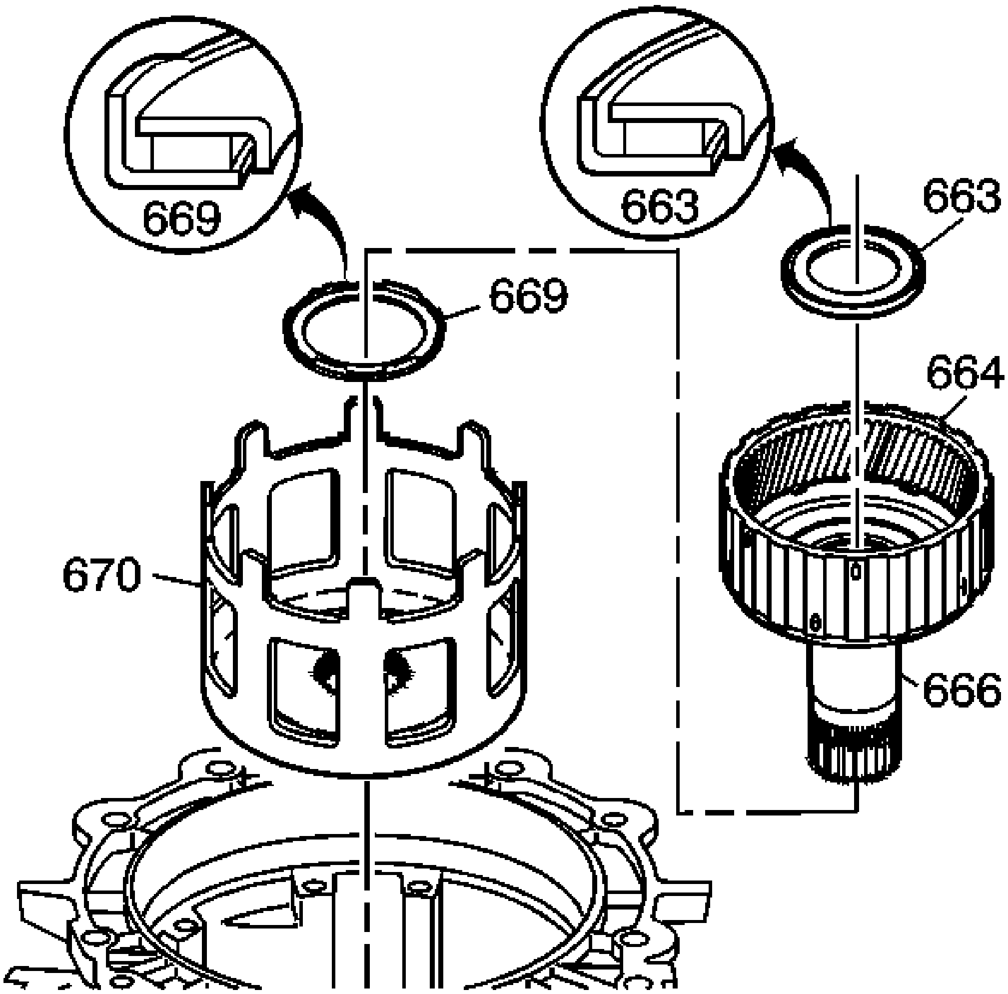


Fig. 129: Oil Cooler Lines At Auxiliary Oil Cooler
Courtesy of GENERAL MOTORS CORP.

6. Connect the oil cooler lines to the auxiliary oil cooler.
7. Attach the oil cooler lines to the push clips in the mounting bracket.
8. Reinstall the grille assembly. Refer to **Grille Replacement (Base)** or **Grille Replacement (Uplevel)** .

TRANSMISSION HEAT SHIELD REPLACEMENT

Removal Procedure

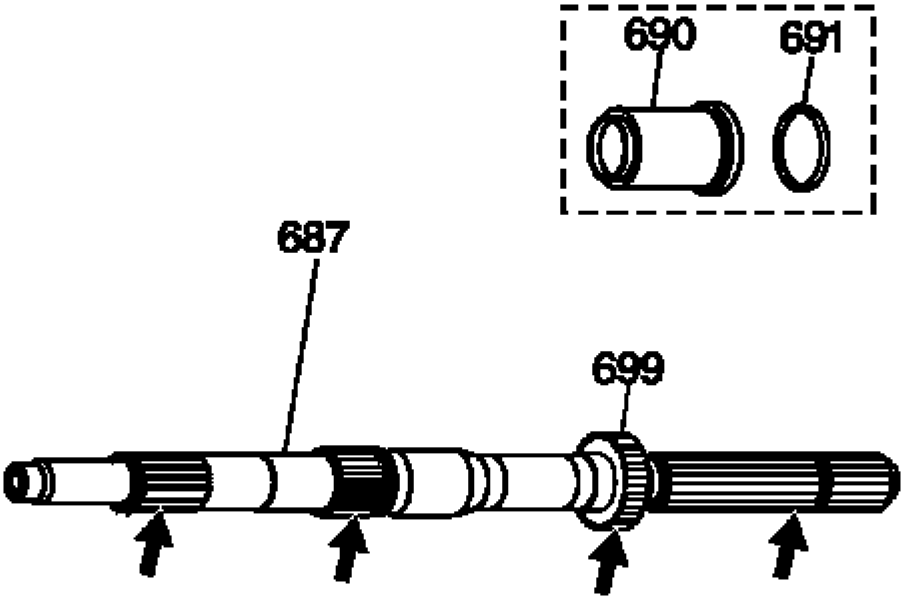


Fig. 130: Transmission Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the two bolts securing the transmission heat shield to the cross member.
3. Remove the transmission heat shield from the cross member.

Installation Procedure

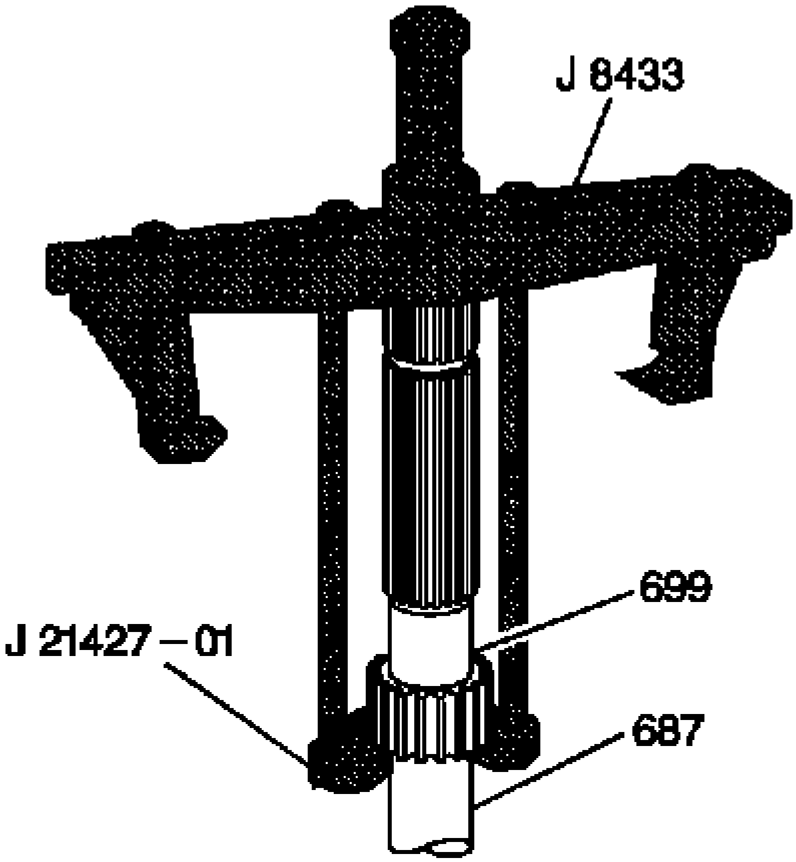


Fig. 131: Transmission Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission heat shield to the cross member.

NOTE: **Refer to FASTENER NOTICE .**

2. Install the two bolts securing the transmission heat shield to the cross member.

   Tighten: Tighten the bolts to 17 N.m (13 lb ft).

3. Lower the vehicle.

TRANSMISSION VENT HOSE REPLACEMENT

Removal Procedure

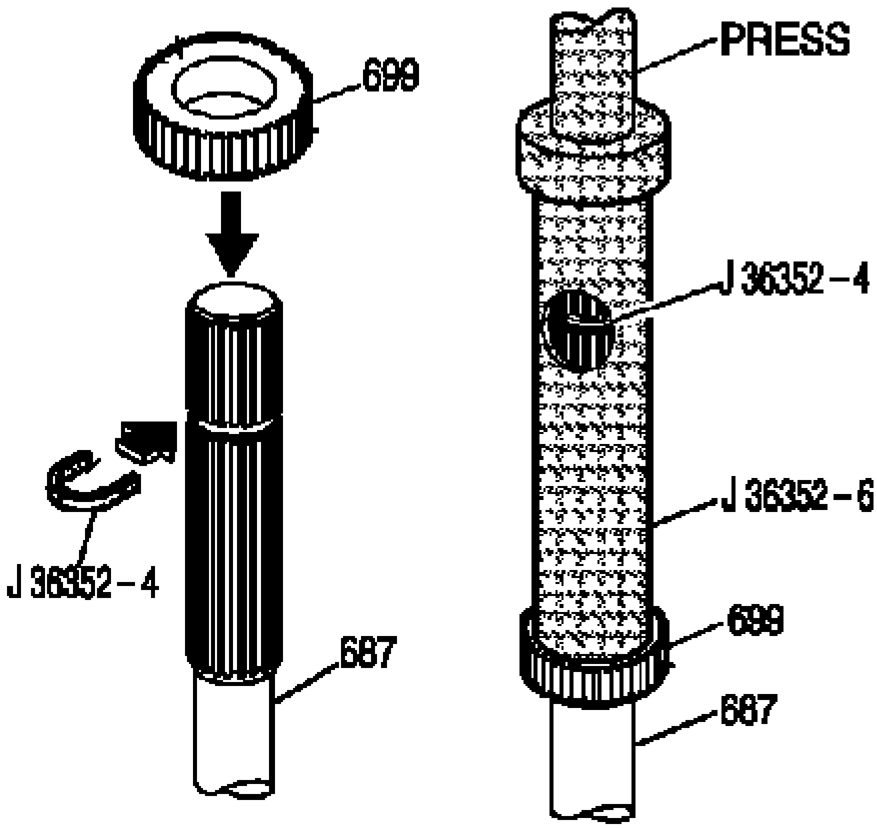


Fig. 132: View Of Vent Hose
Courtesy of GENERAL MOTORS CORP.

1. Remove the vent hose clip.
2. Remove the vent hose from the transmission vent.

Installation Procedure

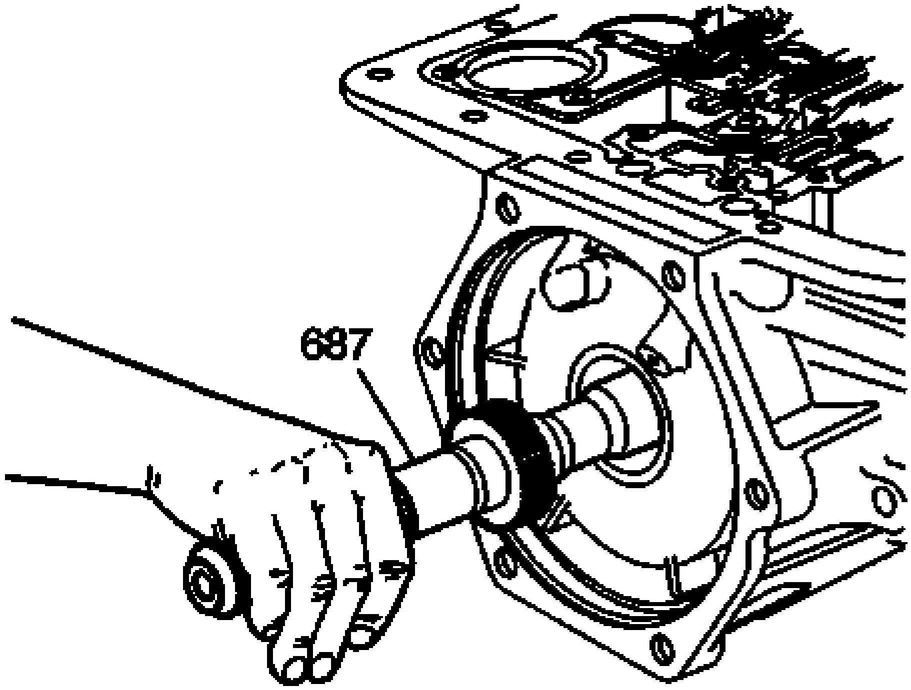


Fig. 133: View Of Vent Hose
Courtesy of GENERAL MOTORS CORP.

1. Install the vent hose to the transmission.
2. Install the vent hose to the clip.

NOTE: **Refer to FASTENER NOTICE .**

3. Install the bolt and the clamp.

Tighten: Tighten the bolt to 10 N.m (89 lb in).

MANUAL SHIFT SHAFT SEAL REPLACEMENT

Tools Required

- **J 43911** Selector Shaft Seal Remover
- **J 43909** Selector Shaft Seal Installer

Removal Procedure:

1. Remove the Park/Neutral Position (PNP) Switch. Refer to **Park/Neutral Position Switch Replacement**.

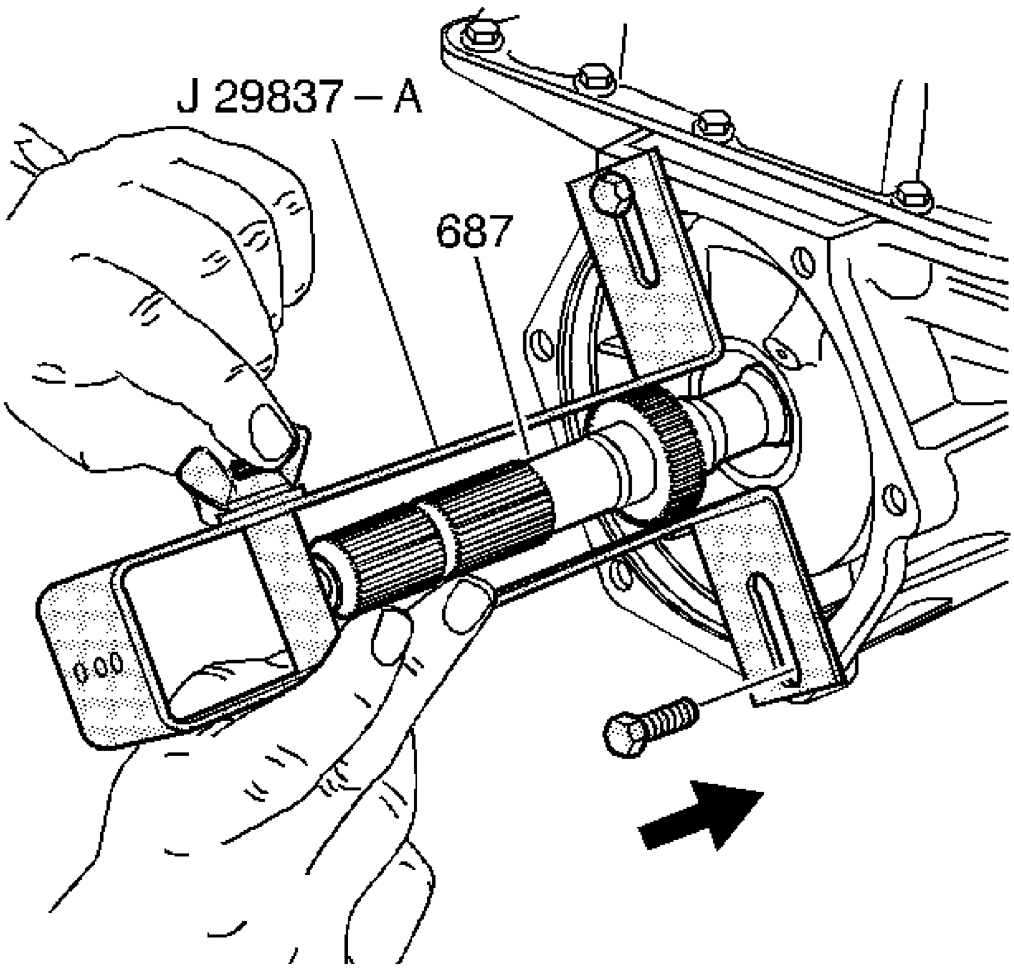


Fig. 134: Sliding Seal Remover Tool Over Selector Shaft
Courtesy of GENERAL MOTORS CORP.

2. Be sure that the jackscrew for **J 43911** is backed off and will not interfere with installation of the removal tool. Slide the seal remover tool over the selector shaft (2) with the threaded end of the tool towards the seal.
3. Rotate the removal tool so that the threads on the end of the tool engage the steel shell (1) of the seal. Use a wrench to be sure that the removal tool is firmly attached to the seal shell.
4. Rotate the jackscrew in the clockwise direction to remove the seal from the bore. Discard the seal that was removed.

Installation Procedure

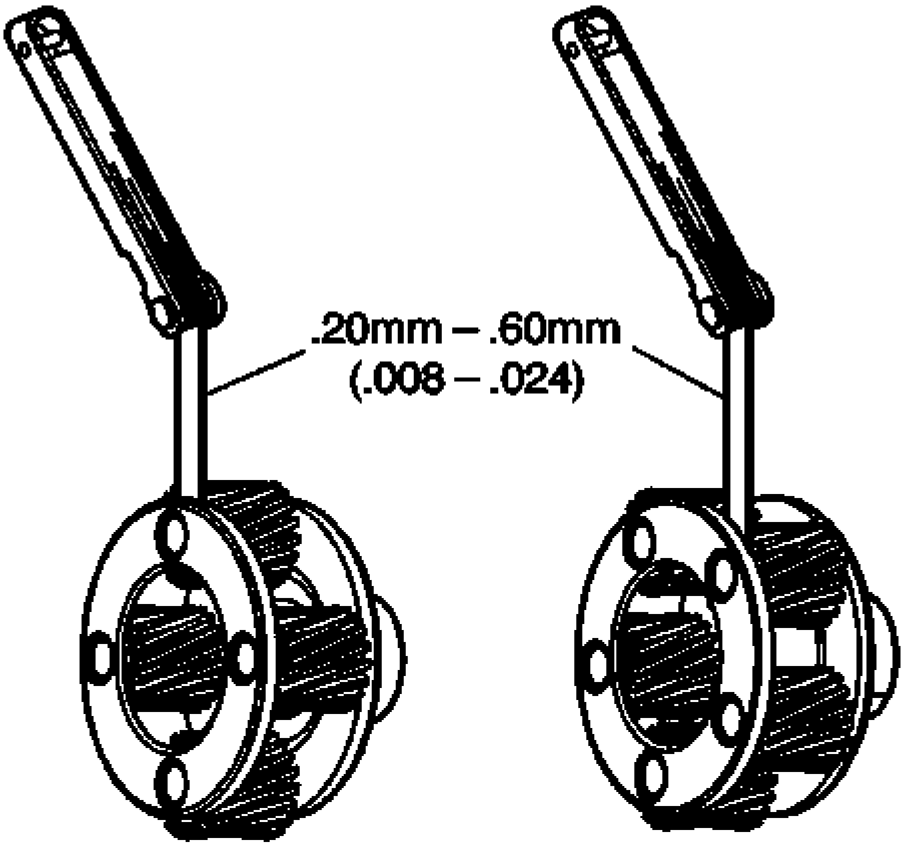


Fig. 135: Sliding New Selector Shaft Seal Over Selector Shaft
Courtesy of GENERAL MOTORS CORP.

1. Carefully slide a new selector shaft seal (1) over the selector shaft (2) with the wide face of the steel case facing outward. Position the seal so that it is starting to enter the seal bore.
2. Obtain **J 43909** and remove the inner sleeve so that the tool will slide over the selector shaft.
3. Slide the **J 43909** into position so that the end of the tool contacts the seal being installed. Use a mallet to strike the **J 43909** and drive the new seal into the seal bore until it is seated at the bottom of the bore.
4. Install the PNP Switch. Refer to **Park/Neutral Position Switch Replacement**.

VALVE BODY AND PRESSURE SWITCH REPLACEMENT

Tools Required

- **J 25025** Guide Pins
- **J 36850** Transjel®

Removal Procedure

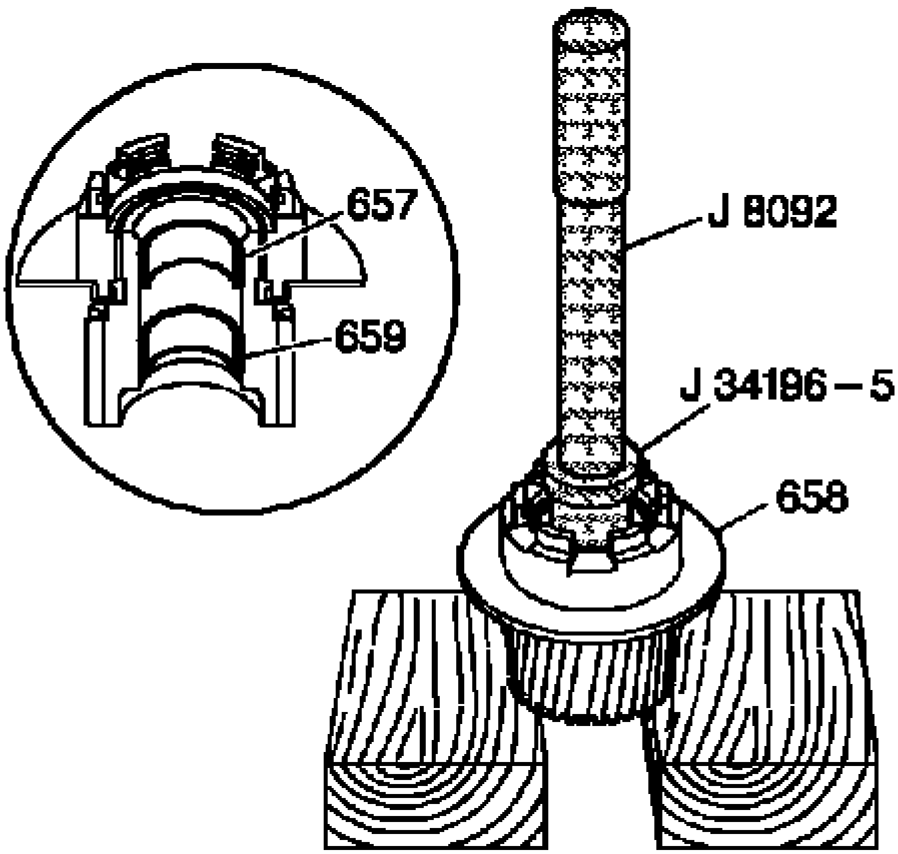


Fig. 136: Valve Body Electrical Components And Wiring Harness
Courtesy of GENERAL MOTORS CORP.

1. Ensure that removal of the valve body is necessary before proceeding.

IMPORTANT: The following components can be serviced without removing the valve body from the transmission:

- The 2-3 solenoid (1)
- The internal wiring harness (2)
- The 1-2 shift solenoid (3)
- The transmission fluid temperature sensor (4)
- The transmission fluid pressure manual valve position switch (5)
- The pressure control solenoid (6)
- The torque converter clutch pulse width modulation (TCC PWM) solenoid (7)

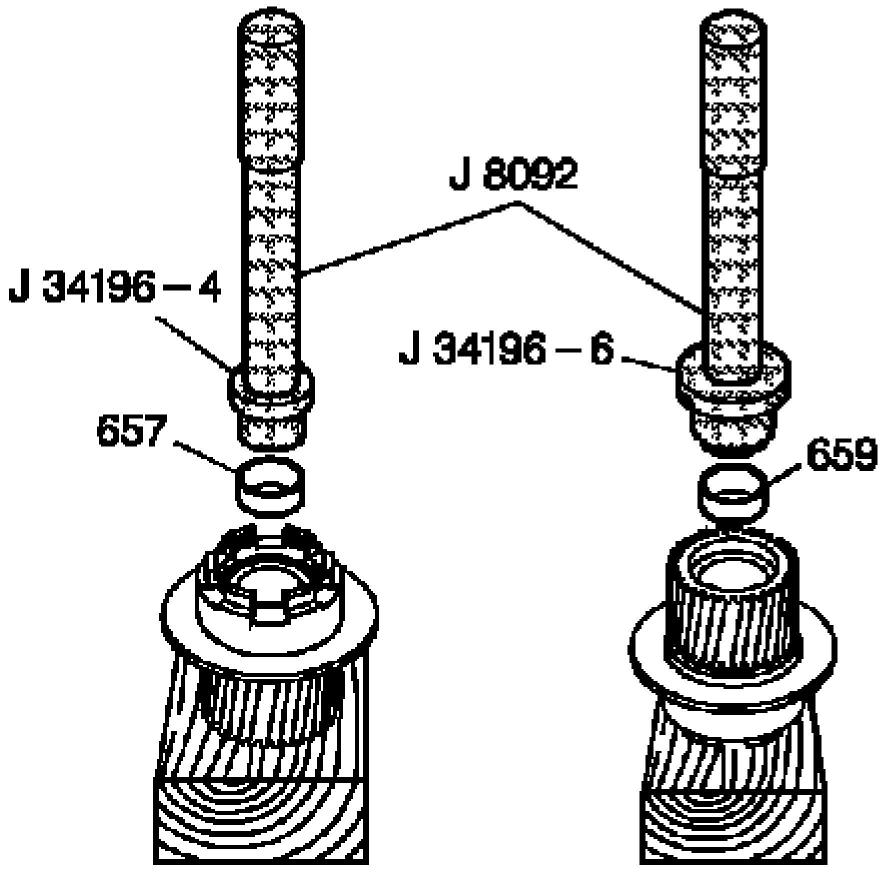


Fig. 137: View Of Oil Filter & Filter Neck Seal
Courtesy of GENERAL MOTORS CORP.

2. Remove the fluid level indicator.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Remove the oil pan, gasket, and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.

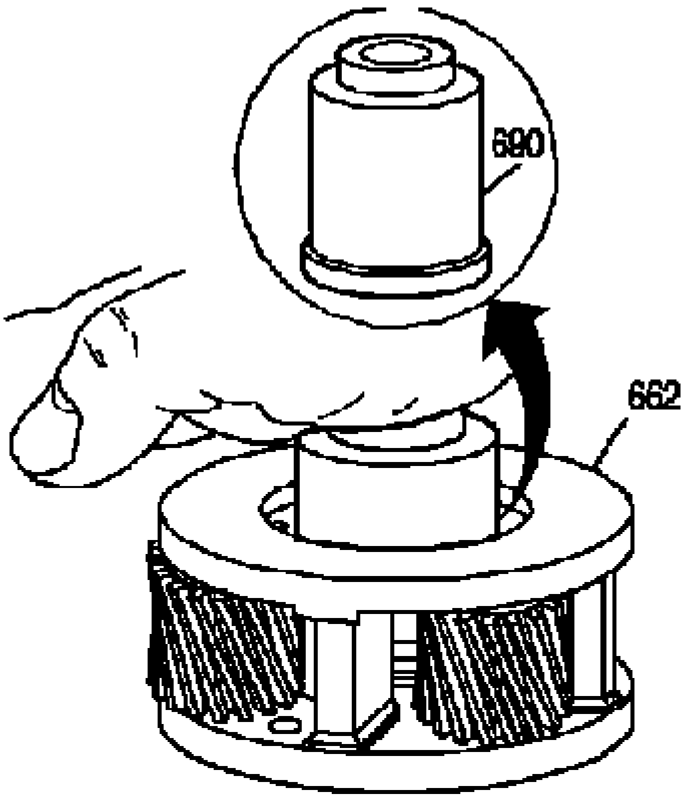


Fig. 138: View Of TFP Manual Valve Position Switch & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Use care not to loose the 5 O-rings that are located between the TFP manual valve position switch and the valve body.

5. Disconnect the internal wire harness from the transmission fluid pressure (TFP) manual valve position switch.
6. Remove the control valve body bolts (1) that retain the (TFP) manual valve position switch (2) to the control valve body.
7. Remove the TFP manual valve position switch.
8. Disconnect the internal wiring harness electrical connectors from the remaining valve body electrical components.

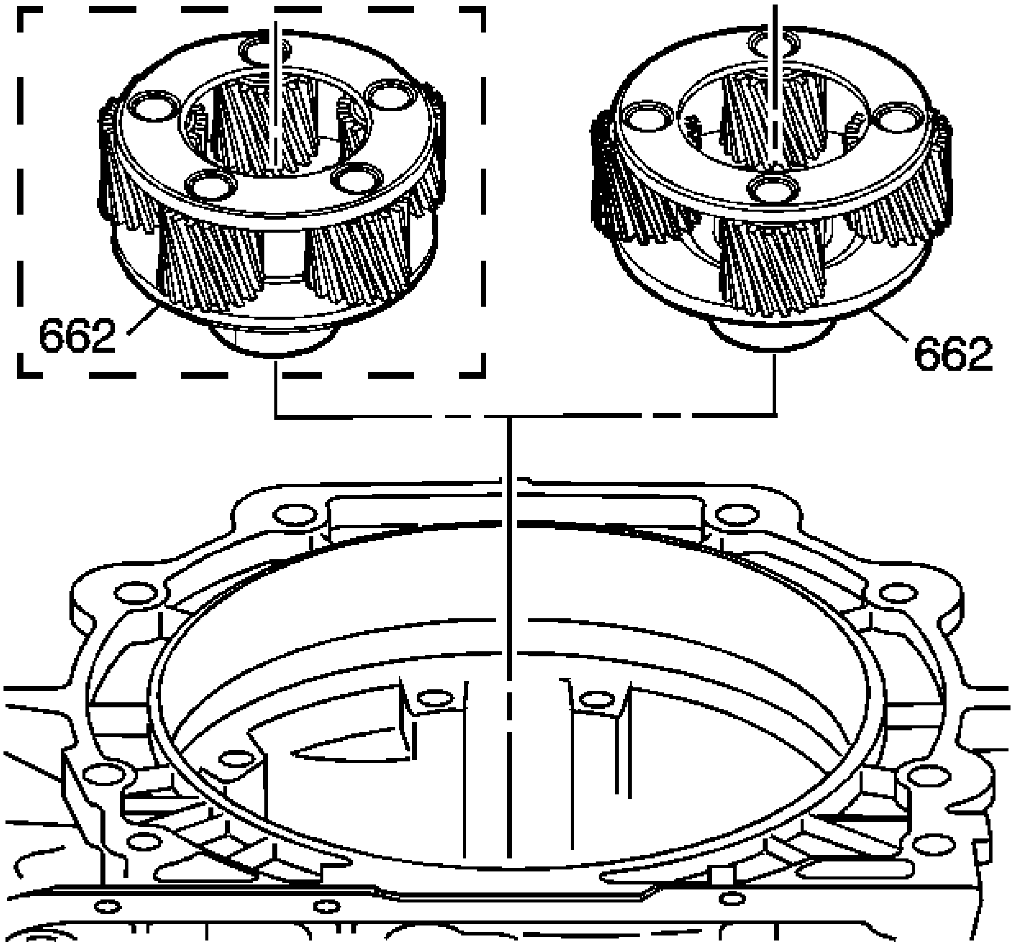


Fig. 139: Lube Oil Pipe Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the lube oil pipe bolt (6) and retainer (7).
10. Remove the lube oil pipe (5).
11. Remove the bolts and remove the manual shaft detent spring (3).

IMPORTANT: Keep the control valve body level when lowering it from the vehicle. This will prevent the loss of checkballs located in the transmission case passages.

12. Remove the remaining control valve body bolts.
13. Carefully lower the valve body down from the transmission case. Use care not to drop the manual shaft

valve.

14. Remove the control valve assembly (2) which includes the following:
    - The accumulator housing assembly (1)
    - The control valve assembly to the spacer plate gasket
    - The spacer plate

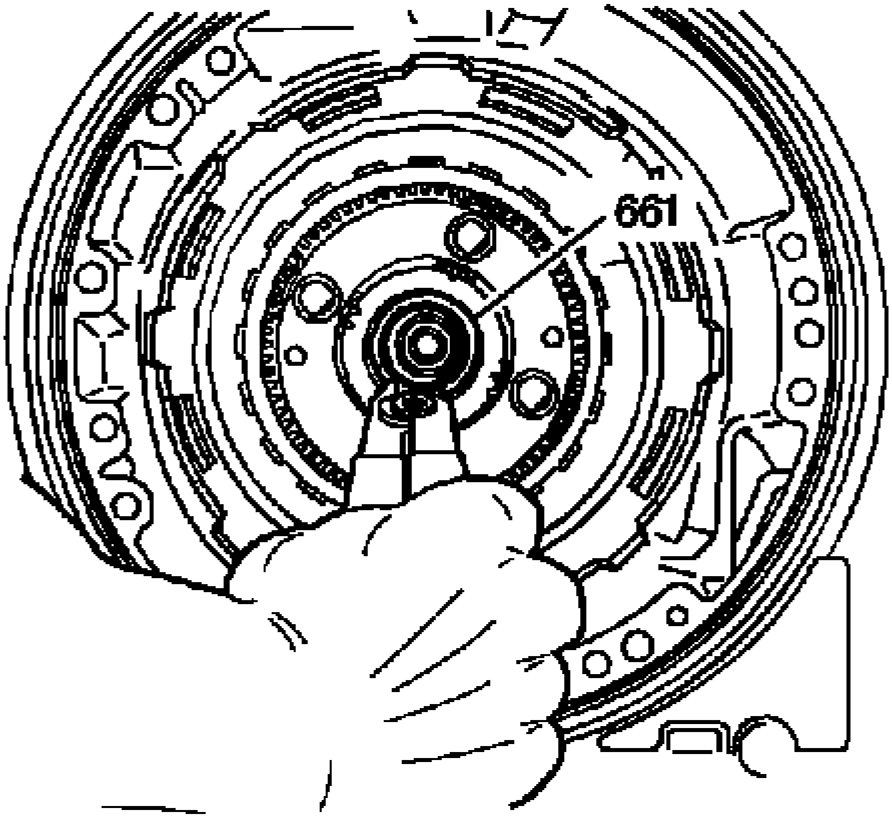


Fig. 140: View Of Manual Valve
Courtesy of GENERAL MOTORS CORP.

15. Remove the manual valve (1) from the control valve body.
16. Inspect the manual valve for nicks and burrs.

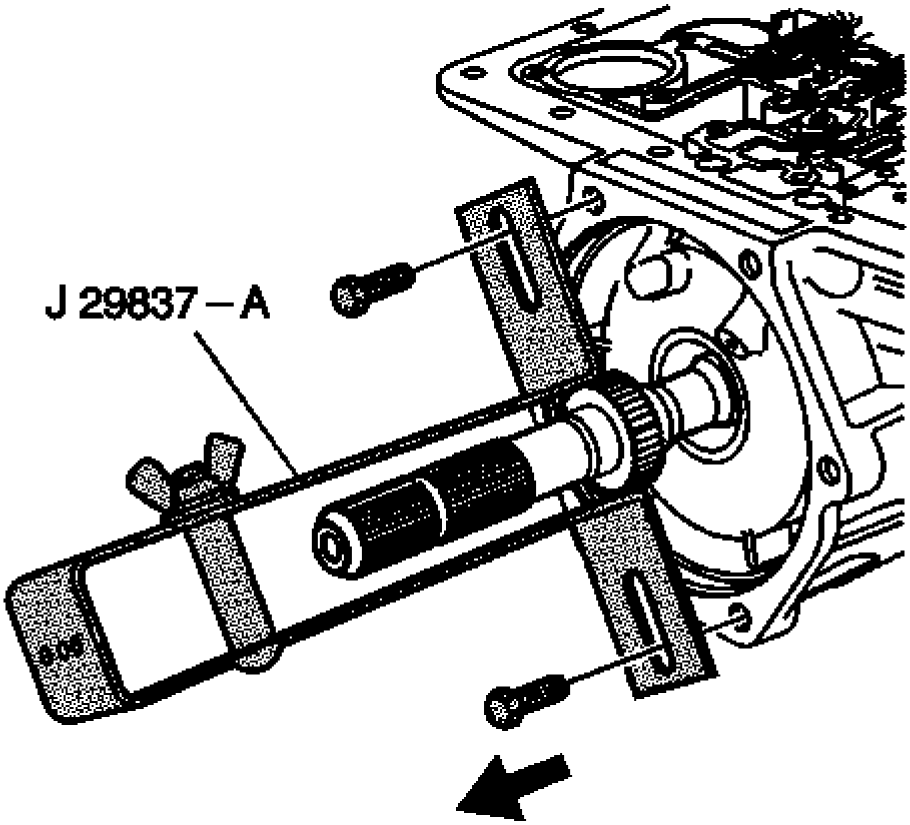


Fig. 141: View Of Spacer Plate To Case Gasket & PWM Screen
Courtesy of GENERAL MOTORS CORP.

17. Remove the spacer plate to case gasket (2) from the case. The gasket may stick to the spacer plate.
18. Remove the PWM screen (1) from the case passage.

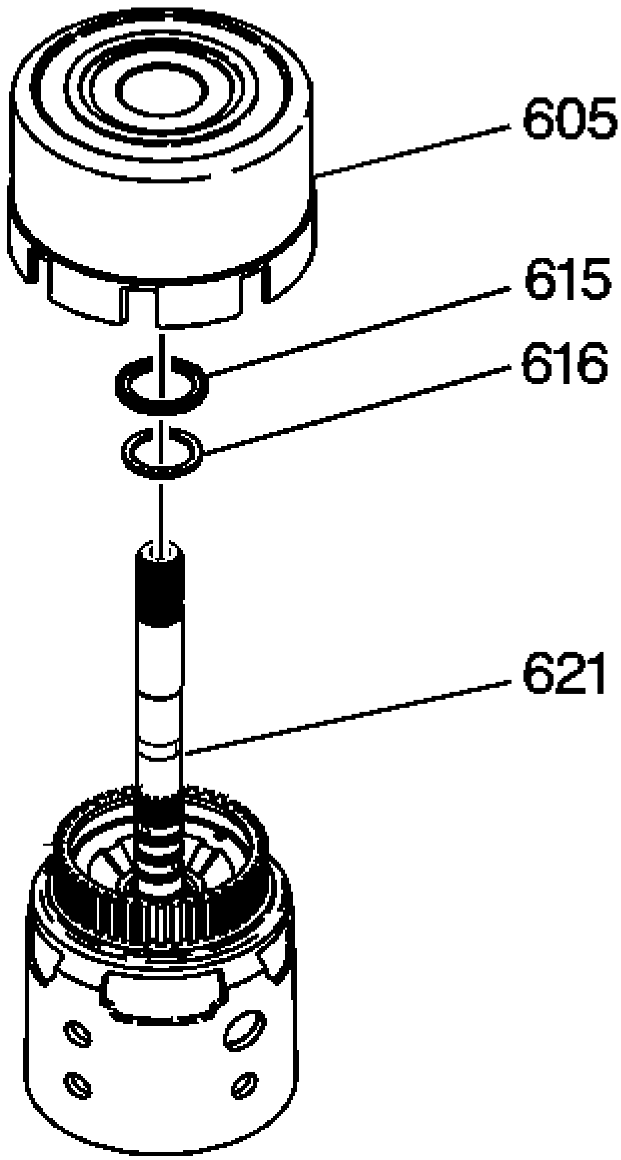


Fig. 142: View Of Manual 2-1 Band Servo & Servo Piston Cushion Spring
Courtesy of GENERAL MOTORS CORP.

19. Remove the manual 2-1 band servo assembly (1).
20. Remove the servo piston cushion spring (2).

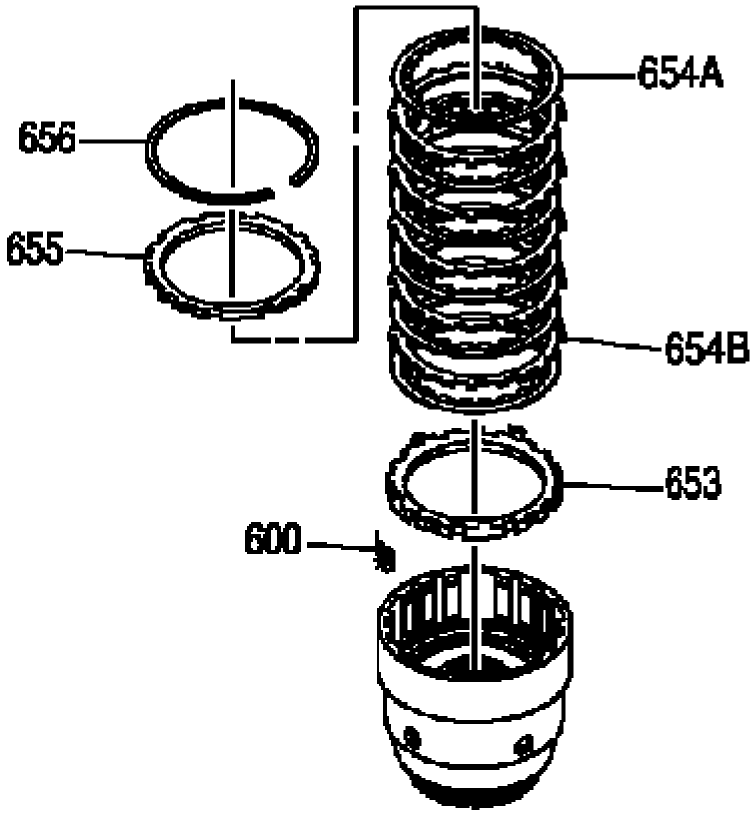


Fig. 143: Manual 2-1 Band Servo Piston Assembly
Courtesy of GENERAL MOTORS CORP.

21. Remove the manual 2-1 band servo piston pin retainer ring (4).
22. Remove the manual 2-1 band servo piston pin (1).
23. Remove the manual 2-1 band servo piston seal (2).

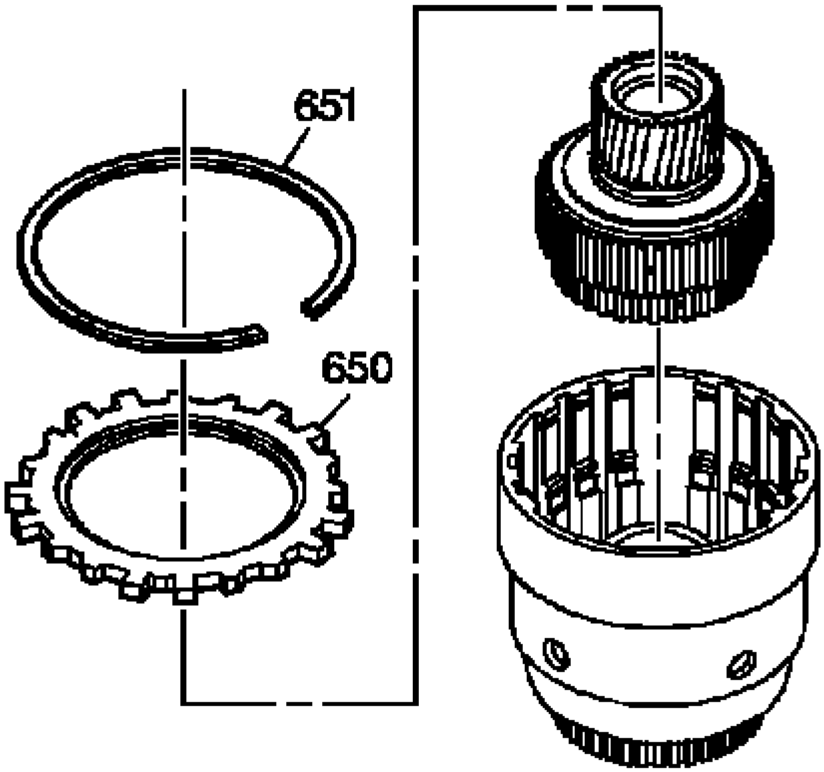


Fig. 144: Locating Checkballs
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Do not use a magnet in order to remove the checkballs. Using a magnet to remove the checkballs may magnetize the checkballs, causing metal particles to stick.

24. Remove the eight checkballs (nine checkballs for some models).

Installation Procedure

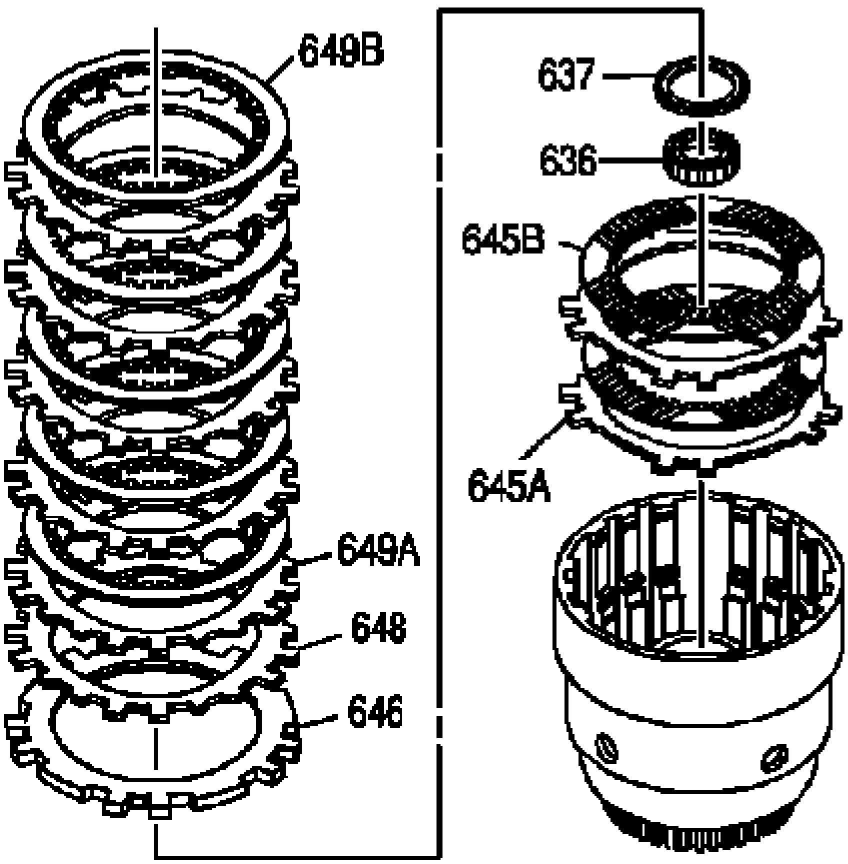


Fig. 145: Locating Checkballs & PWM Screen
Courtesy of GENERAL MOTORS CORP.

1. Install the 8 checkballs (9 checkballs for some models) into the control valve body.
   - The checkball marked as number 2, is used on RCP, RDP, ZJP and ZLP models only
   - To hold the checkballs in place, use the **J 36850** .
2. Install the PWM screen into the control valve body.

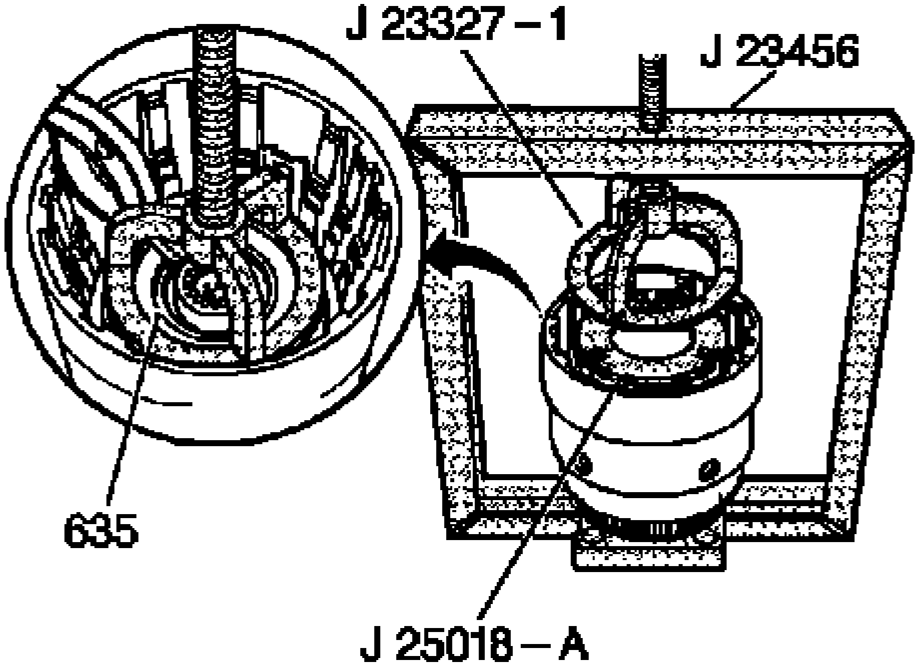


Fig. 146: Manual 2-1 Band Servo Piston Assembly
Courtesy of GENERAL MOTORS CORP.

3. Install a new manual 2-1 band servo piston seal (2) onto the manual 2-1 band servo piston (3).
4. Install the manual 2-1 band servo piston pin (1) into the manual 2-1 band servo piston (3).
5. Install the manual 2-1 band servo piston pin retainer ring (4).

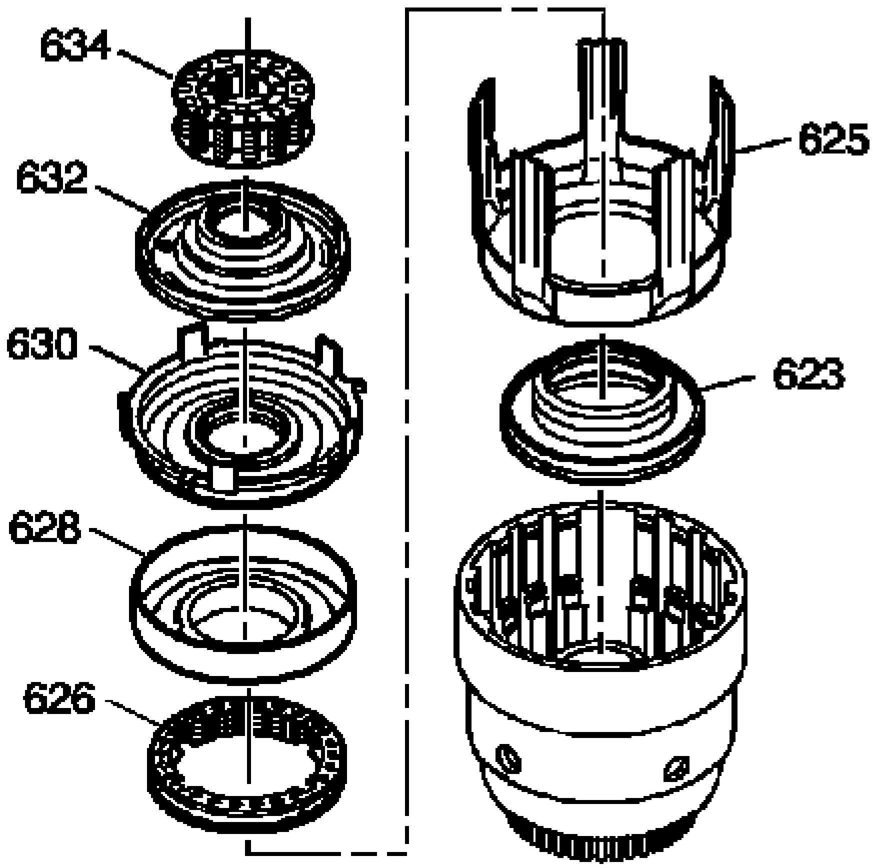


Fig. 147: View Of Manual 2-1 Band Servo & Servo Piston Cushion Spring
Courtesy of GENERAL MOTORS CORP.

6. Install the manual 2-1 band servo piston cushion spring (2).

IMPORTANT: Make certain that the tapered end of the manual 2-1 band servo piston pin contacts the manual 2-1 band.

7. Install the manual 2-1 band servo piston assembly (1).

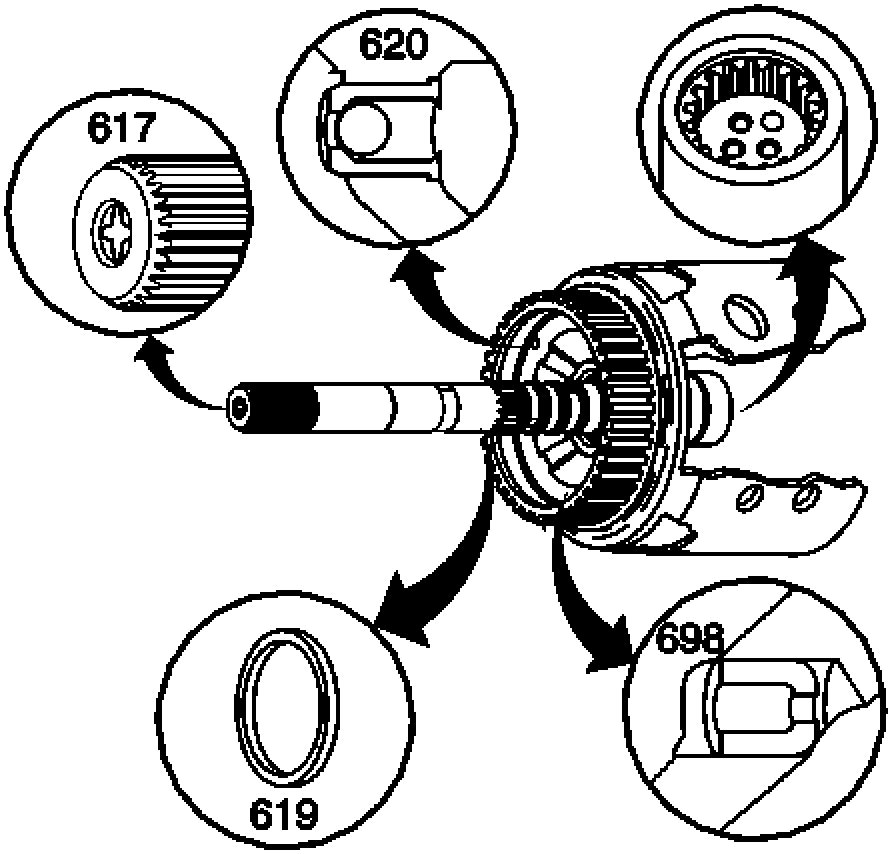


Fig. 148: View Of Manual Valve
Courtesy of GENERAL MOTORS CORP.

8. Install the manual valve (1) into the control valve body.

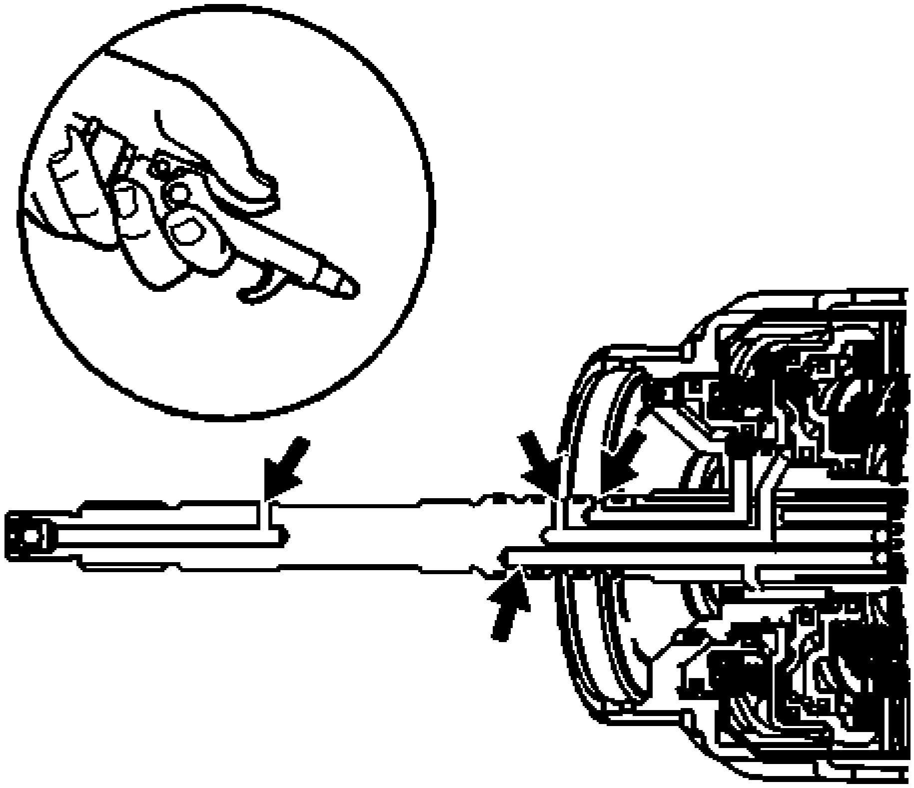


Fig. 149: View Of J 25025, Control Valve Body & Gasket
Courtesy of GENERAL MOTORS CORP.

9. To aid in alignment and assembly, install tool **J 25025** .
10. Install the control valve body gasket (6).
11. Install the control valve body assembly (5). Attach the manual valve to the detent lever while installing the control valve body assembly.

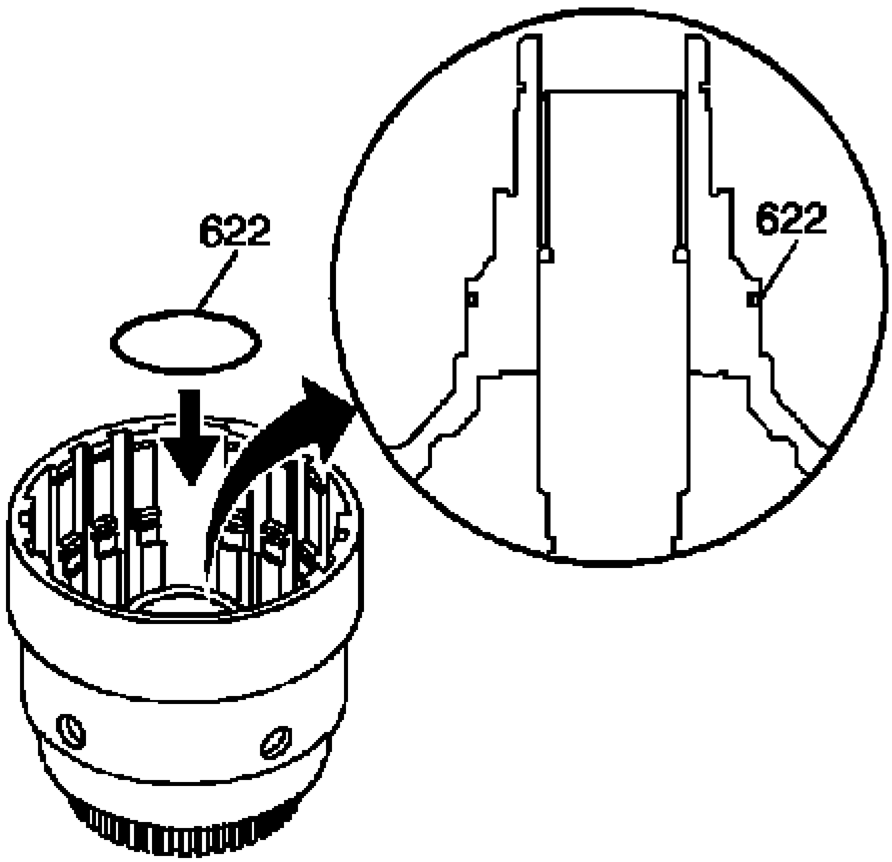


Fig. 150: Transmission Fluid Pressure Manual Valve Position Switch & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Install the transmission fluid pressure manual valve position switch (2).
13. Install the transmission fluid pressure manual valve position switch bolts (1) finger tight.

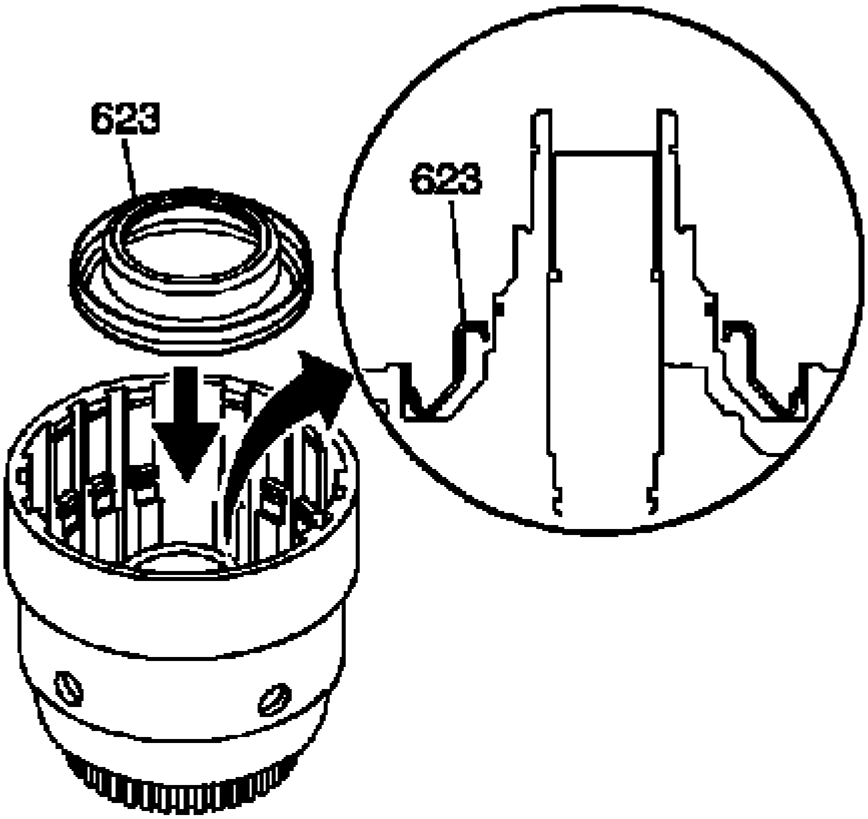


Fig. 151: Transmission Fluid Pressure Manual Valve Position Switch Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

14. Tighten the bolts in the order shown to 11 N.m (97 lb in).
15. Remove the **J 25025** .

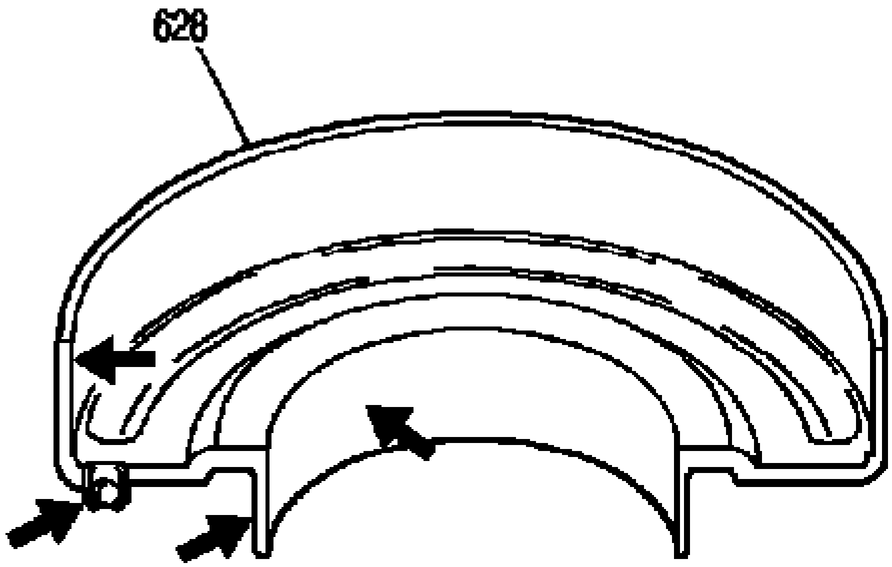


Fig. 152: Wiring Clips And Lube Oil Pipe
Courtesy of GENERAL MOTORS CORP.

16. Install the manual shaft detent roller and spring assembly (3) and bolts.
17. Install the two wiring harness clips (1) and bolts (2).
18. Install the wiring harness clip (1) and bolts (2).
19. Install the lube oil pipe (5) with the short end into the control valve body.
20. Install the lube oil pipe retainer (7) and the bolt (6).

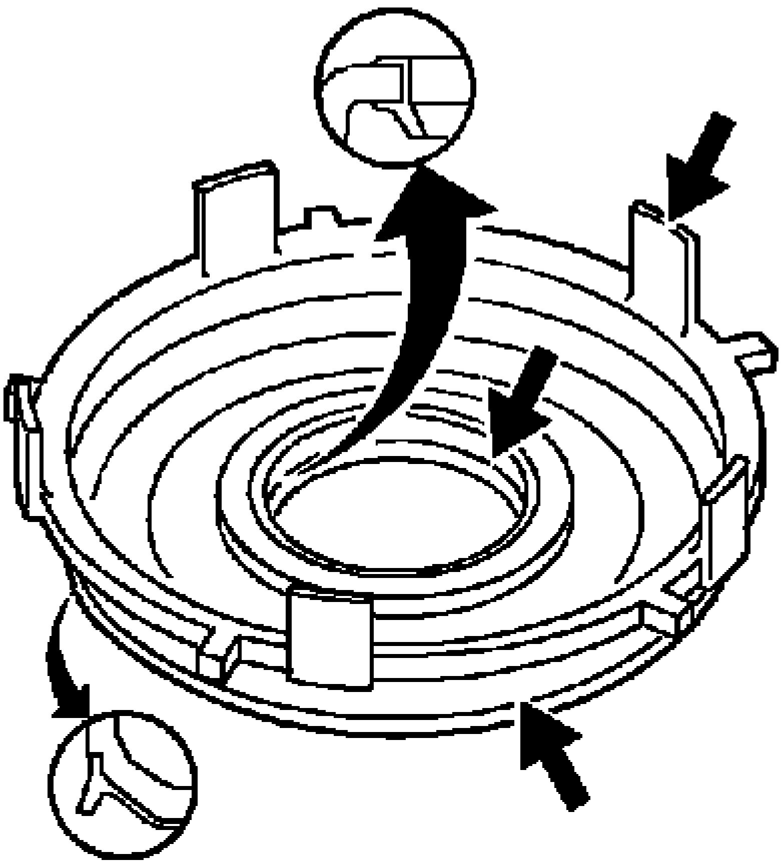


Fig. 153: Valve Body Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to FASTENER NOTICE .**

21. Install the control valve body bolts.

    Tighten: Tighten the bolts in the order shown to 11 N.m (97 lb in).

22. Install the remaining control valve body bolts.

    Tighten: Tighten the remaining bolts to 11 N.m (97 lb in).

23. Connect the internal wiring harness to the valve body electrical components.
24. Install the oil pan, gasket, and filter. Refer to **Automatic Transmission Fluid and Filter Replacement**.
25. Lower the vehicle.
26. Fill the transmission to the proper level using approved fluid.
27. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, The ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.

28. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

PROPELLER SHAFT FRONT SLIP YOKE OIL SEAL REPLACEMENT

Tools Required

- **J 38869** Rear Extension Seal Installer. See **Special Tools**.
- **J 6125-1B** Slide Hammer Adapter
- **J 23129** Universal Seal Remover
- **J 36850** Transjel®

Removal Procedure

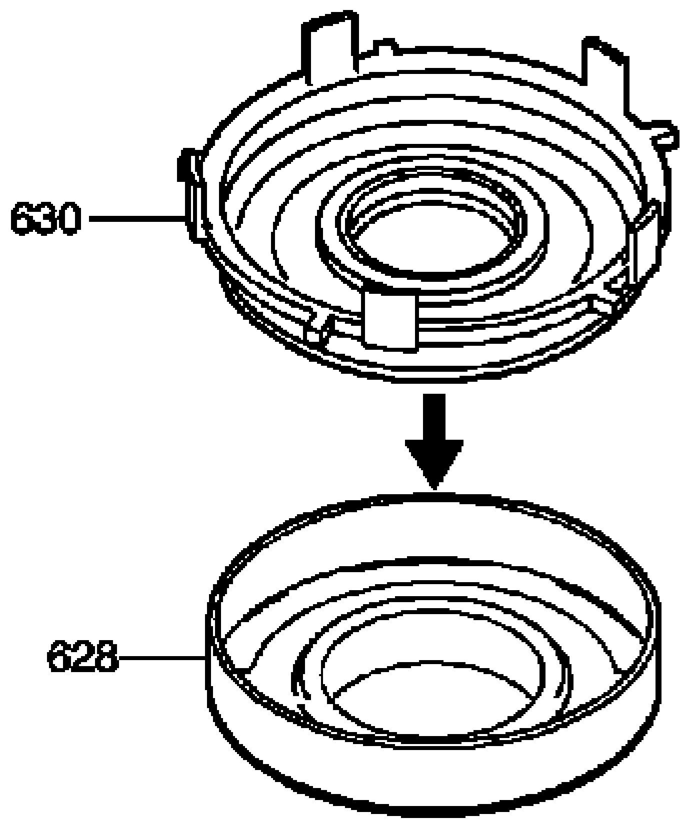


Fig. 154: View Of Output Shaft Seal & Extension Housing

Courtesy of GENERAL MOTORS CORP.

1. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Place a drain pan under the vehicle.
3. Remove the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
4. Using the **J 6125-1B** (1) and the **J 23129** (2), remove the output shaft seal (3) from the extension housing (4).
5. Inspect the case extension housing for damage. Replace the extension housing if necessary. Refer to **Case Extension Assembly Replacement**.

Installation Procedure

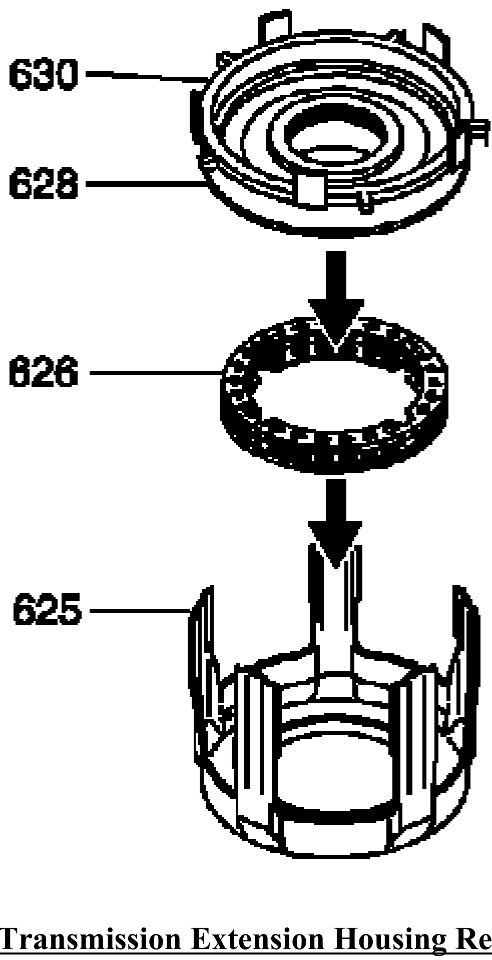


Fig. 155: Transmission Extension Housing Rear Oil Seal
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the inside diameter of the new seal with **J 36850** .
2. Use the **J 38869** (1) with a soft faced mallet to install the seal (2). See **Special Tools**.
3. Install the seal (2) to the extension housing (3).
4. Install the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller**

Shaft Replacement .

5. Remove the drain pan and lower the vehicle.
6. Fill the transmission to the proper level with approved fluid.

CASE EXTENSION ASSEMBLY REPLACEMENT

Removal Procedure

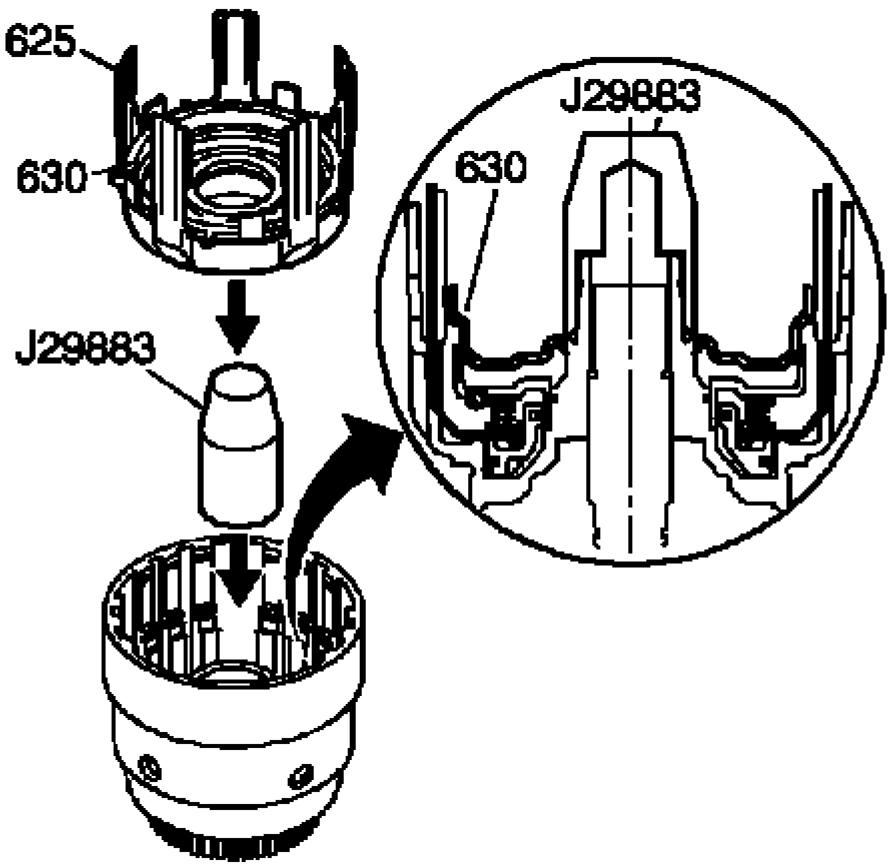


Fig. 156: Transmission Case Extension
Courtesy of GENERAL MOTORS CORP.

1. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Support the transmission with a transmission jack.
3. Place a drain pan under the vehicle.
4. Remove the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
5. Remove the transmission support and the transmission mount. Refer to **Transmission Mount Replacement**.
6. Remove the case extension bolts (3).
7. Remove the case extension (1).

8. Remove and discard the case extension O-ring seal (2).

Installation Procedure

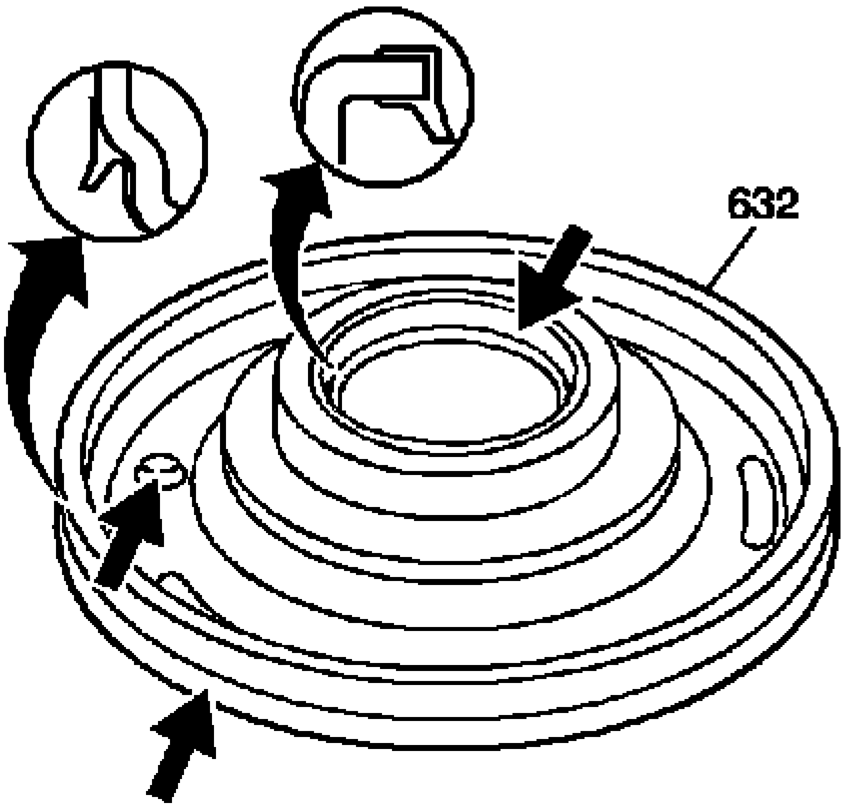


Fig. 157: Transmission Case Extension
Courtesy of GENERAL MOTORS CORP.

1. Install a new case extension O-ring seal (2).
2. Install the case extension (1).

NOTE: **Refer to Fastener Notice .**

3. Install the case extension bolts (3).

   Tighten: Tighten the case extension bolts (3) to 34 N.m (25 lb ft).

4. Install the transmission support and the transmission mount. Refer to **Transmission Mount Replacement**.
5. Install the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .

6. Remove the drain pan and the transmission jack.
7. Lower the vehicle.
8. Fill the transmission to the proper level with DEXRON® VI transmission fluid. Refer to **Transmission Fluid Check**.

TRANSMISSION MOUNT REPLACEMENT

Removal Procedure

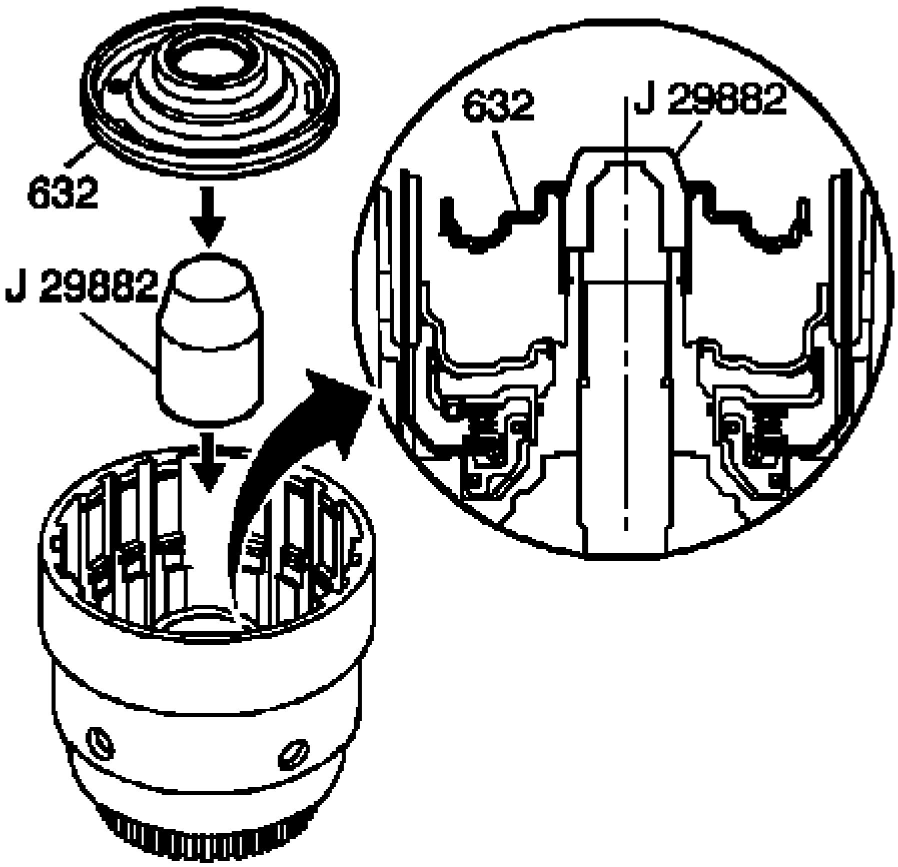


Fig. 158: Transmission Mount & Bolts (RWD)
Courtesy of GENERAL MOTORS CORP.

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Support the transmission with a transmission jack.
3. Remove the transmission support crossmember. Refer to **Transmission Support Crossmember Replacement** .
4. Remove the transmission mount mounting bolts, for RWD vehicles.

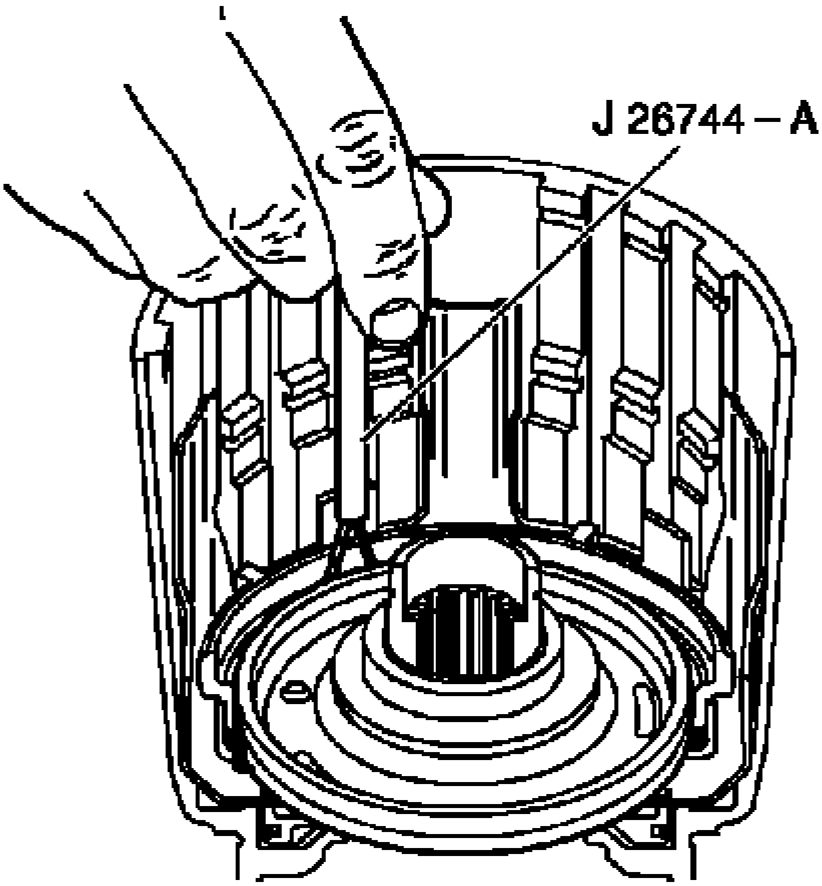


Fig. 159: Transmission Mount & Bolts (4WD)
Courtesy of GENERAL MOTORS CORP.

5. Remove the transmission mount mounting bolts, for 4WD vehicles.
6. Remove the transmission mount from the vehicle.

Installation Procedure

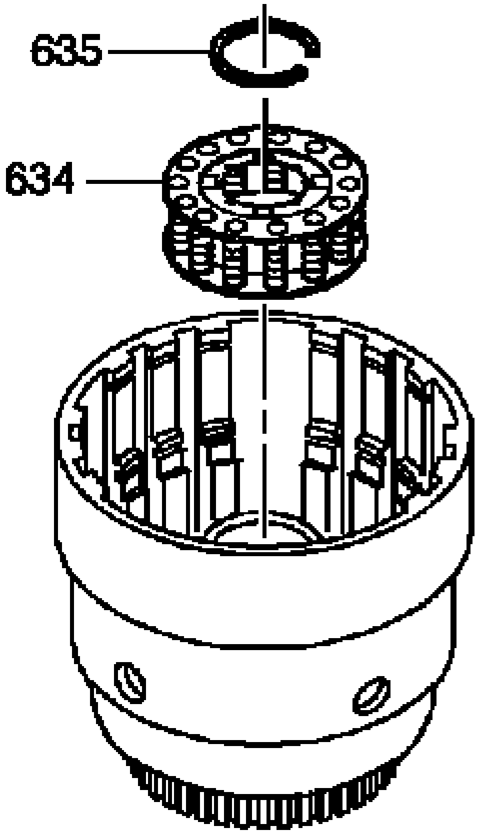


Fig. 160: Transmission Mount & Bolts (4WD)
Courtesy of GENERAL MOTORS CORP.

1. Install the transmission mount to the vehicle.

   NOTE: Refer to Fastener Notice .

2. Install the transmission mount mounting bolts, for 4WD vehicles.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

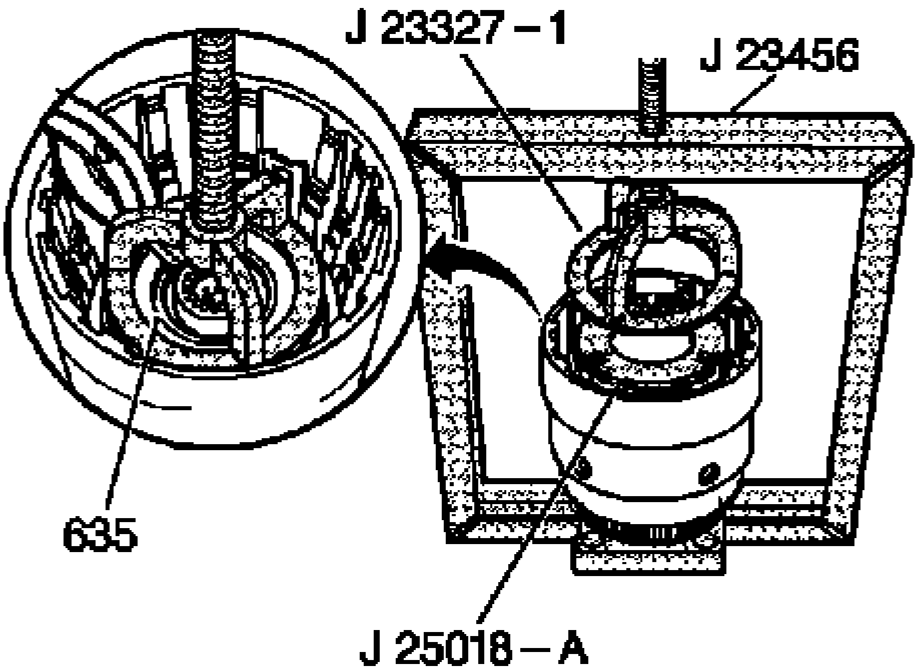


Fig. 161: Transmission Mount & Bolts (RWD)
Courtesy of GENERAL MOTORS CORP.

3. Install the transmission mount mounting bolts, for RWD vehicles.

   Tighten: Tighten the bolts to 50 N.m (37 lb ft).

4. Install the transmission support crossmember. Refer to **Transmission Support Crossmember Replacement** .
5. Remove the transmission jack.
6. Lower the vehicle.

TRANSMISSION REPLACEMENT

Removal Procedure

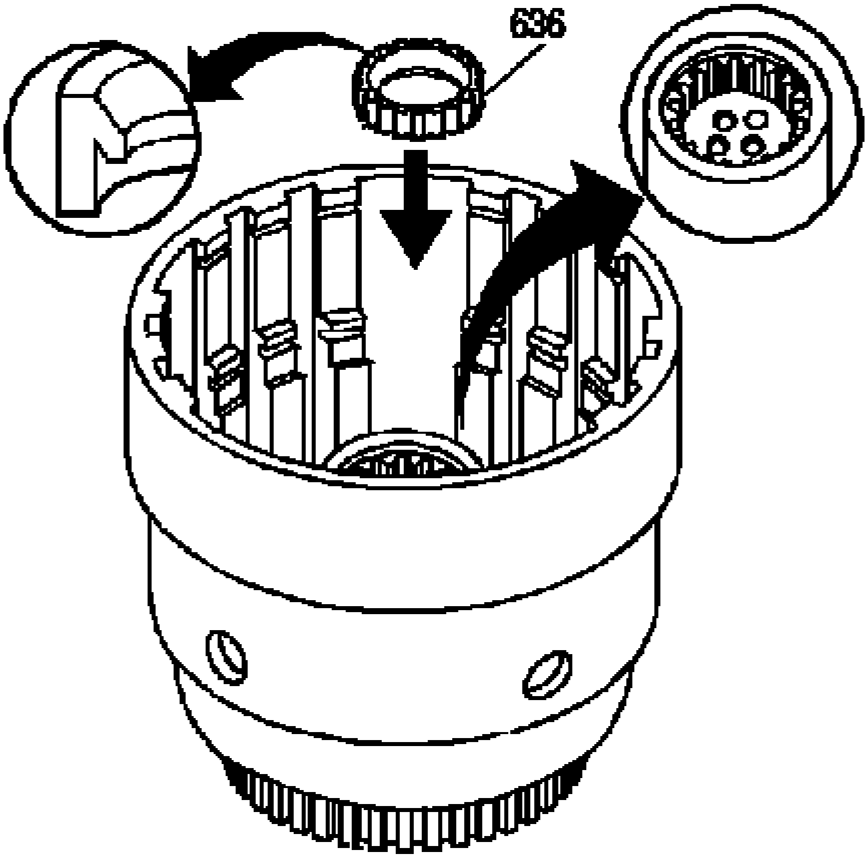


Fig. 162: Automatic Transmission Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution .

1. Disconnect the battery negative cable assembly from the battery negative terminal.
2. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Support the vehicle with safety stands.
4. If equipped with All Wheel Drive (AWD), remove the transfer case. Refer to **Transfer Case Assembly Replacement** .
5. Disconnect the range selector cable from the transmission bracket and from the range selector lever.
6. Remove the rear propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
7. Support the transmission with a transmission jack.
8. Remove the transmission support crossmember. Refer to **Transmission Support Crossmember Replacement** .
9. Remove the exhaust pipe from the exhaust manifolds and the muffler assembly from the exhaust pipe. Refer to **Catalytic Converter Replacement (4.3L)** or **Catalytic Converter Replacement (4.8L, and**

5.3L) or **Catalytic Converter Replacement (6.0L - Right)** or **Catalytic Converter Replacement (6.0L - Left)** or **Catalytic Converter Replacement (6.6L (LMM))** .

10. Remove the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, and 6.0L)** or **Starter Motor Replacement (6.6L)** .
11. Mark the flywheel and the torque converter alignment.

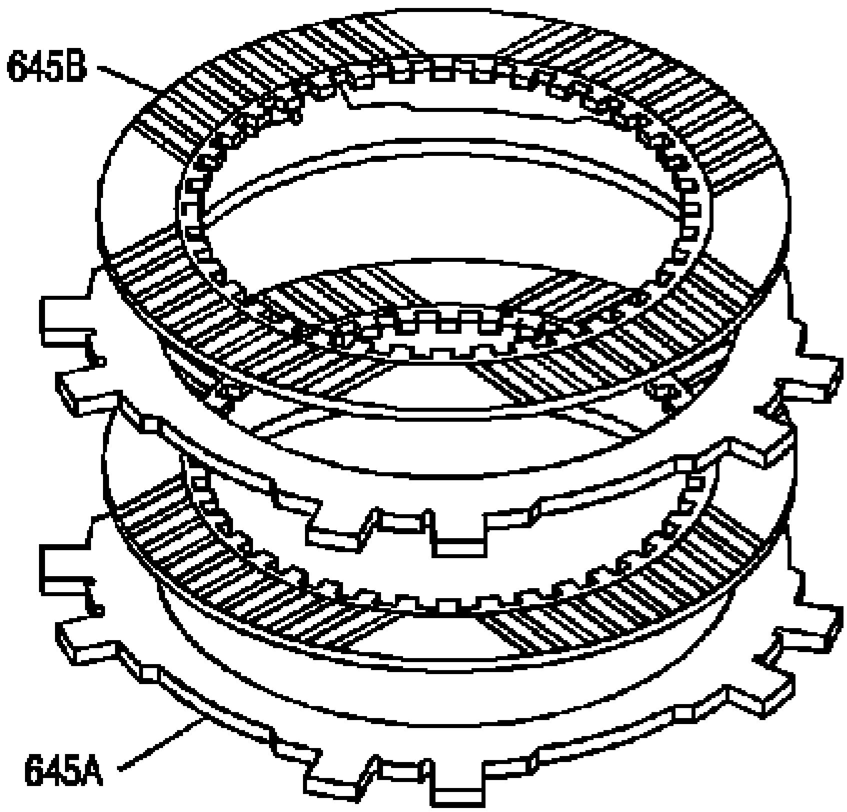


Fig. 163: Torque Converter, Engine Flywheel & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Remove the bolts that attach the torque converter to the engine flywheel.

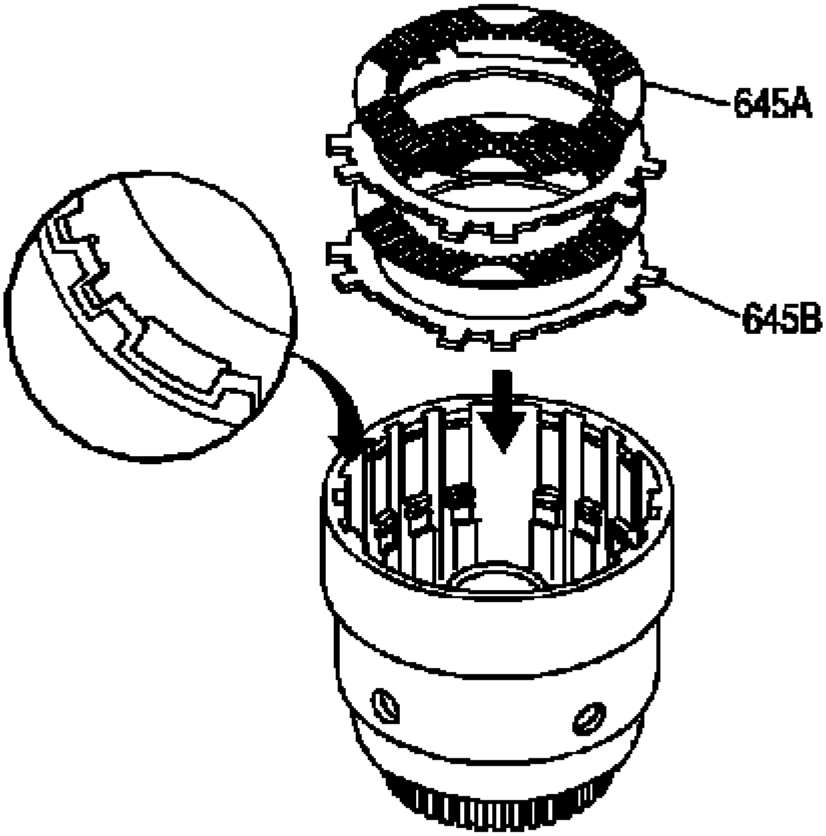


Fig. 164: Transmission-To-Engine Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the transmission vent hose and the wiring harness from the transmission.
14. Remove the transmission fluid fill tube and the fill tube seal from the transmission. Refer to **Transmission Fluid Filler Tube and Seal Replacement**
15. Plug the fluid fill tube opening in the transmission.
16. Disconnect the transmission oil cooler pipes from the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (4.8L, 5.3L, 6.0L)** or **Transmission Fluid Cooler Hose/Pipe Replacement (6.6L)**.
17. Plug the transmission oil cooler pipe connectors in the transmission case.

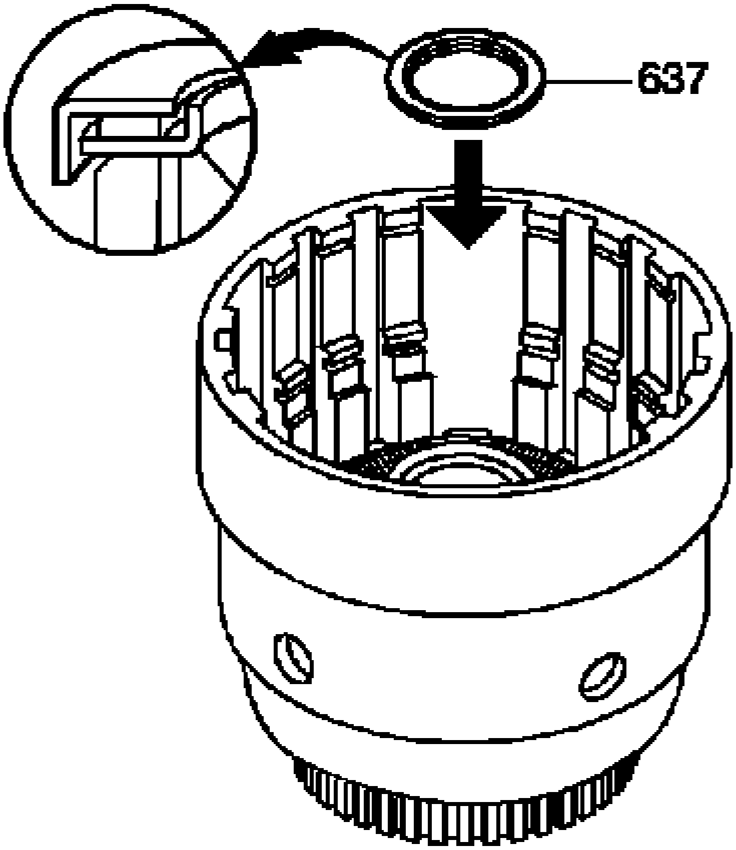


Fig. 165: Vehicle Harness Wires, Harness Clips, Tubes, Brackets & Lines That May Interfere With Transmission Removal
Courtesy of GENERAL MOTORS CORP.

18. Disconnect the wiring harness connectors from the transmission vehicle speed sensor and the park/neutral position switch.
19. Remove all vehicle harness wires, harness clips, tubes, brackets, and lines that may interfere with the removal of the transmission from the vehicle.

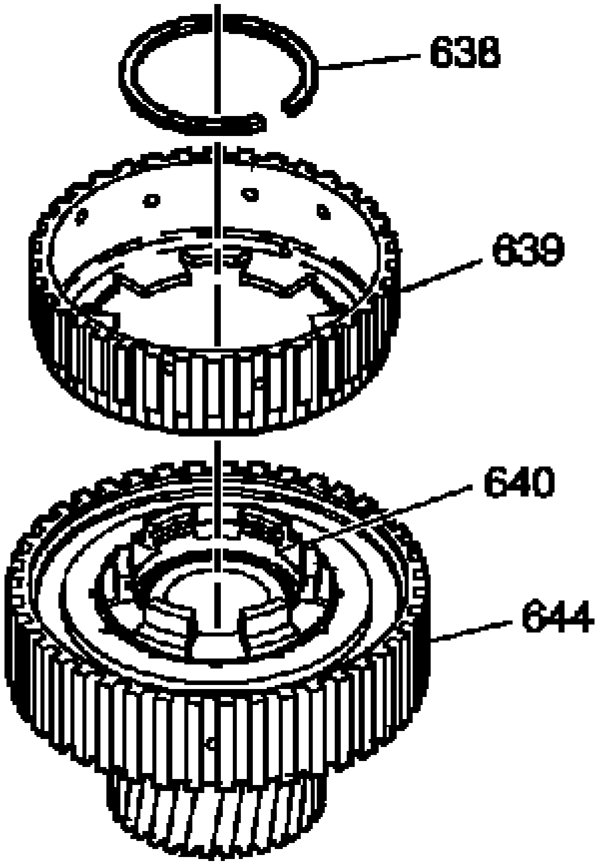


Fig. 166: Transmission-To-Engine Bolts
Courtesy of GENERAL MOTORS CORP.

20. Remove the studs and the bolts securing the transmission to the engine.
21. Pull the transmission straight back.
22. Remove the transmission from the vehicle.
23. Inspect all the components for wear and damage.
24. Inspect all the seals and the fittings for signs of wear.
25. Inspect the torque converter for stripped or broken weld nuts.
26. Inspect the transmission case for cracks.
27. Perform the automatic transmission oil cooler flushing and flow test. Refer to **Transmission Fluid Cooler Flushing and Flow Test (J 35944-A)** or **Transmission Fluid Cooler Flushing and Flow Test (J 45096)**.

Installation Procedure

1. Support the transmission with a transmission jack.
2. Raise the transmission into place.
3. Slide the transmission straight onto the locating pins while lining up the marks on the flywheel and the torque converter.

IMPORTANT:

- **The torque converter must rotate freely by hand.**
- **Do not install the transmission fluid fill tube.**

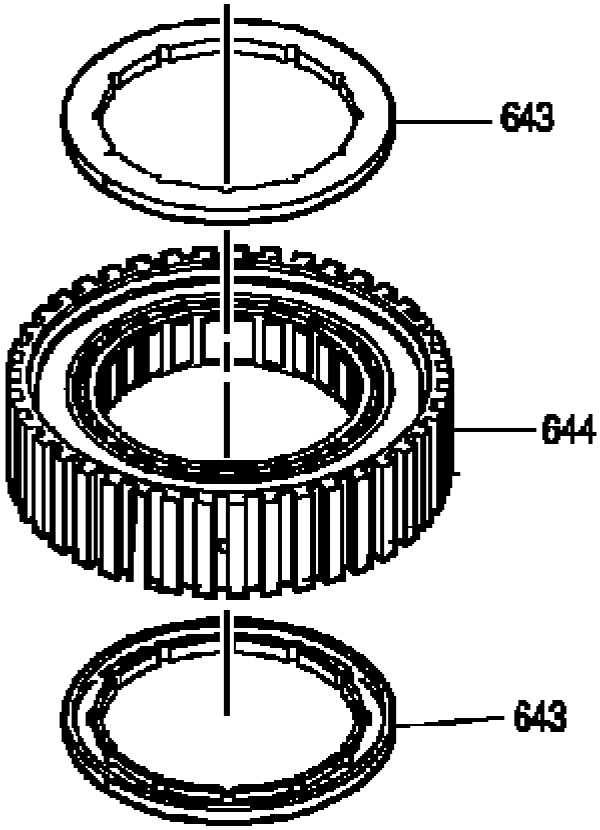


Fig. 167: Transmission-To-Engine Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to Fastener Notice .**

4. Install the bolts that secure the transmission to the engine.

 Tighten: Tighten the studs and the bolts to 47 N.m (34 lb ft).

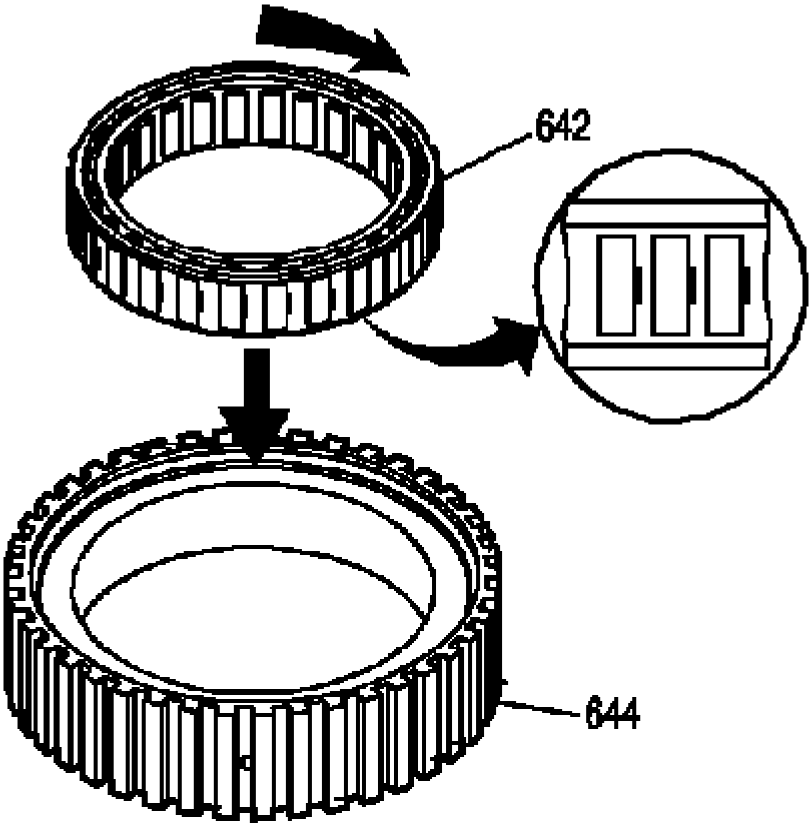


Fig. 168: Torque Converter, Engine Flywheel & Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the bolts securing the torque converter to the engine flywheel.

   Tighten:
   1. First tighten all the bolts finger tight in order to insure proper converter seating.
   2. Tighten the bolts to 63 N.m (46 lb ft).

6. If equipped with All Wheel Drive (AWD), install the transfer case. Refer to **Transfer Case Assembly Replacement** .

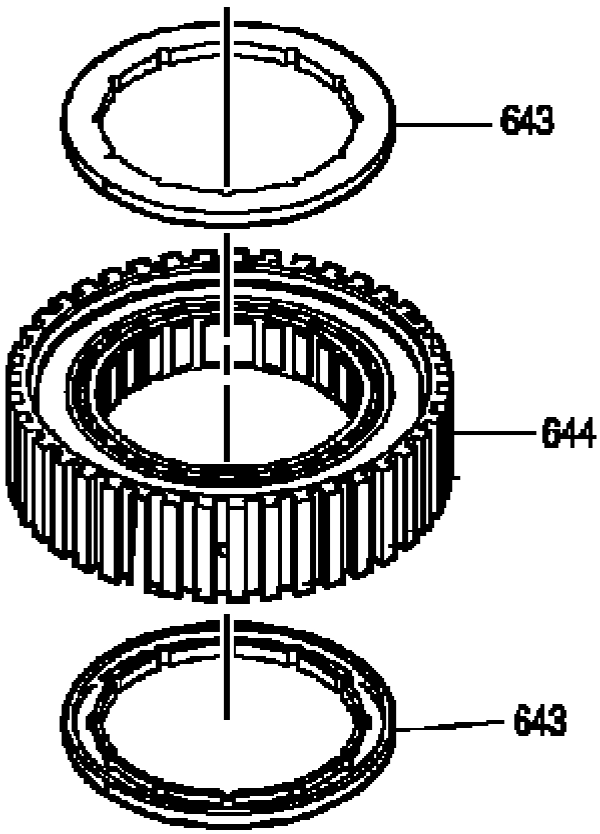


Fig. 169: Vehicle Harness Wires, Harness Clips, Tubes, Brackets & Lines That May Interfere With Transmission Removal
Courtesy of GENERAL MOTORS CORP.

7. Install the wiring harness connectors to the vehicle speed sensor and the park neutral position switch.
8. Position and install all vehicle harness wires, harness clips, tubes, brackets, and lines that were removed or moved prior to the transmission removal.
9. Remove the two plugs from the transmission case cooling line connectors.
10. Install the transmission oil cooler pipes. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement (4.8L, 5.3L, 6.0L)** or **Transmission Fluid Cooler Hose/Pipe Replacement (6.6L)**.
11. Install the transmission fluid fill tube and the fill tube seal. Refer to **Transmission Fluid Filler Tube and Seal Replacement**.
12. Install the transmission vent hose and the wiring harness to the transmission.

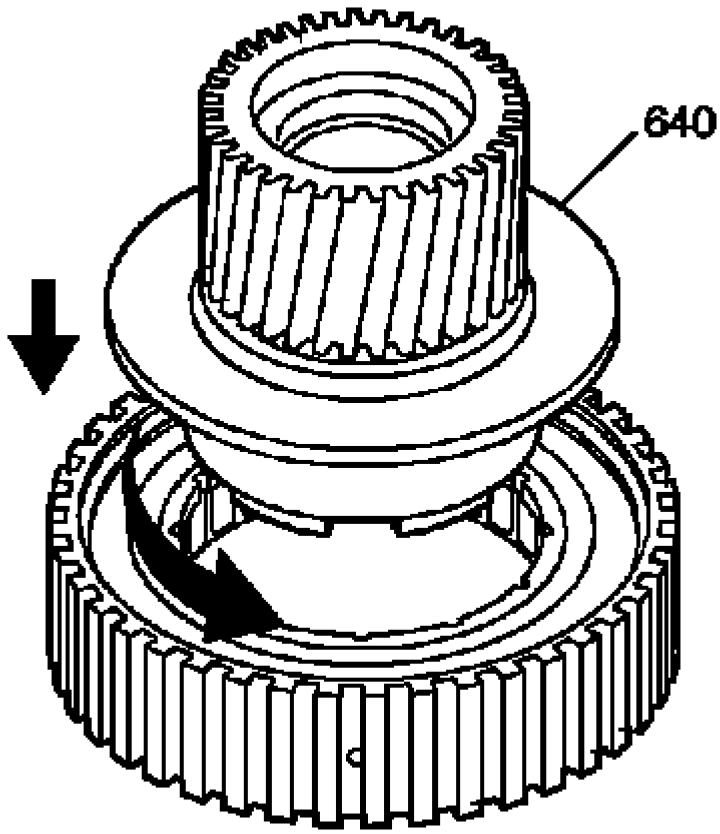


Fig. 170: Automatic Transmission Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

13. Install the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, and 6.0L)** or **Starter Motor Replacement (6.6L)** .
14. Install the exhaust pipe to the exhaust manifolds and the muffler assembly to the exhaust pipe. Refer to **Catalytic Converter Replacement (4.3L)** or **Catalytic Converter Replacement (4.8L, and 5.3L)** or **Catalytic Converter Replacement (6.0L - Right)** or **Catalytic Converter Replacement (6.0L - Left)** or **Catalytic Converter Replacement (6.6L (LMM))** .
15. Install the transmission support crossmember. Refer to **Transmission Support Crossmember Replacement** .
16. Remove the transmission jack and the engine support stands.
17. Install the rear propeller shaft.
18. Install the transmission range select cable to the transmission range select lever and the bracket.
19. Flush the transmission oil cooler and the pipes whenever you remove the transmission for overhaul, or replacement of the torque converter, the pump, or the transmission case. Refer to **Transmission Fluid Cooler Flushing and Flow Test (J 35944-A)** or **Transmission Fluid Cooler Flushing and Flow Test (J 45096)**.
20. Remove the safety stands.
21. Lower the vehicle.

22. Fill the transmission to the proper level with approved fluid.
23. Connect the battery negative cable assembly to the battery negative terminal.

    Tighten: Tighten the terminal bolt to 15 N.m (11 lb ft).

IMPORTANT: It is recommended that transmission adaptive pressure (TAP) information be reset.
Resetting the TAP values using a scan tool will erase all learned values in all cells. As a result, the ECM, PCM or TCM will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.

24. Reset the TAP values. Refer to **Transmission Adaptive Functions**.

OFF-VEHICLE REPAIR INSTRUCTIONS

TORQUE CONVERTER ASSEMBLY REMOVAL

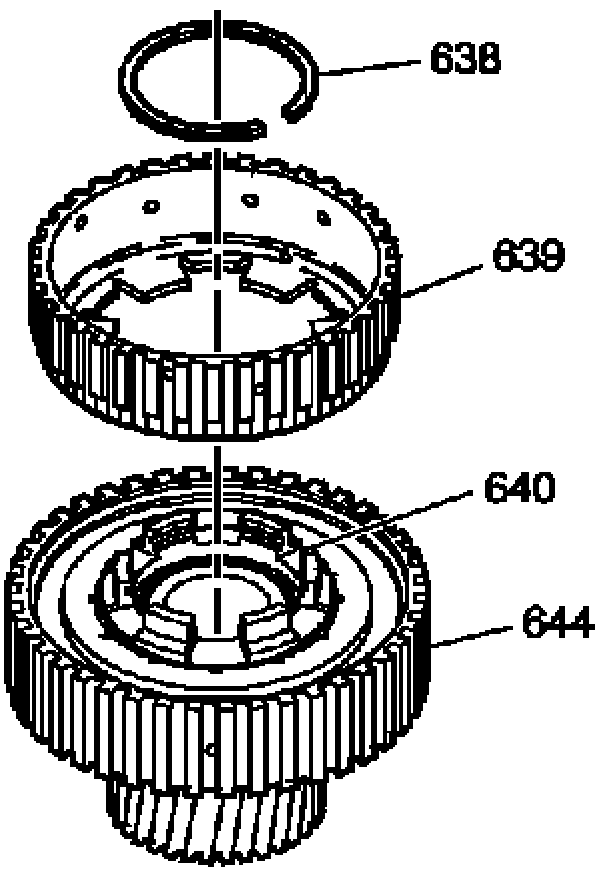


Fig. 171: Supporting Transmission Torque Converter Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission torque converter assembly.
2. Inspect the torque converter assembly for the following:
    - External damage
    - Metal particles found after flushing the oil cooler and the cooler lines
    - External leaks in the hub weld area
    - The torque converter pilot is damaged or fits poorly into the crankshaft
    - Internal failure of the stator roller clutch
    - Contamination from the engine coolant
    - Excessive end play (Refer to **Torque Converter End Play Inspection**).

TORQUE CONVERTER END PLAY INSPECTION

Tools Required

- **J 26900-13** Magnetic Indicator Base
- **J 8001** Dial Indicator Set
- **J 39195** Converter End Play Check Tool

Procedure

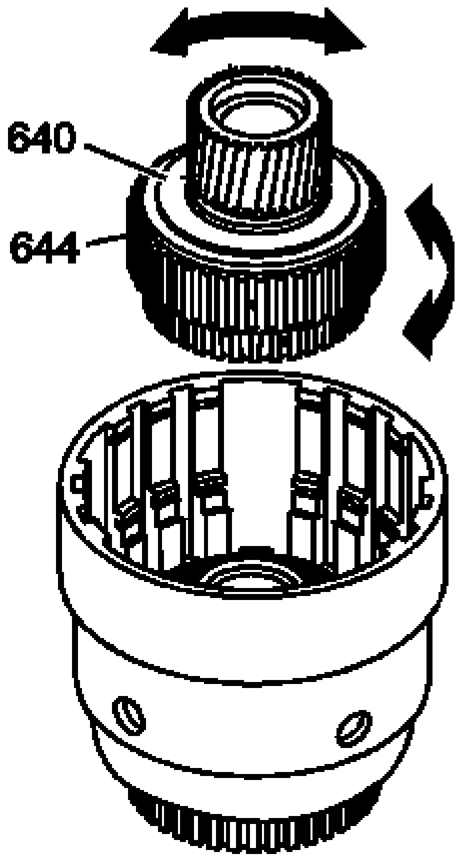


Fig. 172: Measuring Torque Converter End Play
Courtesy of GENERAL MOTORS CORP.

1. Place the **J 39195** base into the torque converter assembly (1). The **J 39195** will bottom itself on the face of the stator.
2. Insert the T-handle forcing screw of the **J 39195** into the base and hand tighten.
3. Using the **J 26900-13** , position the **J 8001** so that the dial indicator tip is in the center of the **J 39195** T-handle.
4. Push down on the **J 39195** T-handle to bottom the stator.
5. Preload the **J 8001** .
6. Set the **J 8001-3** to 0.
7. Pull up on the **J 39195** T-handle.
8. Inspect the reading on the dial indicator. The total end play should be 0.0-0.38 mm (0.0-0.015 in).
9. Repeat this procedure several times in order to get an accurate measurement.
10. Remove the tools.

TRANSMISSION HOLDING FIXTURE INSTALLATION

Tools Required

- **J 3289-20** Holding Fixture Base Assembly. See **Special Tools**.
- **J 8763-02** Holding Fixture. See **Special Tools**.
- **J 38655** Holding Fixture Adapter. See **Special Tools**.

Procedure

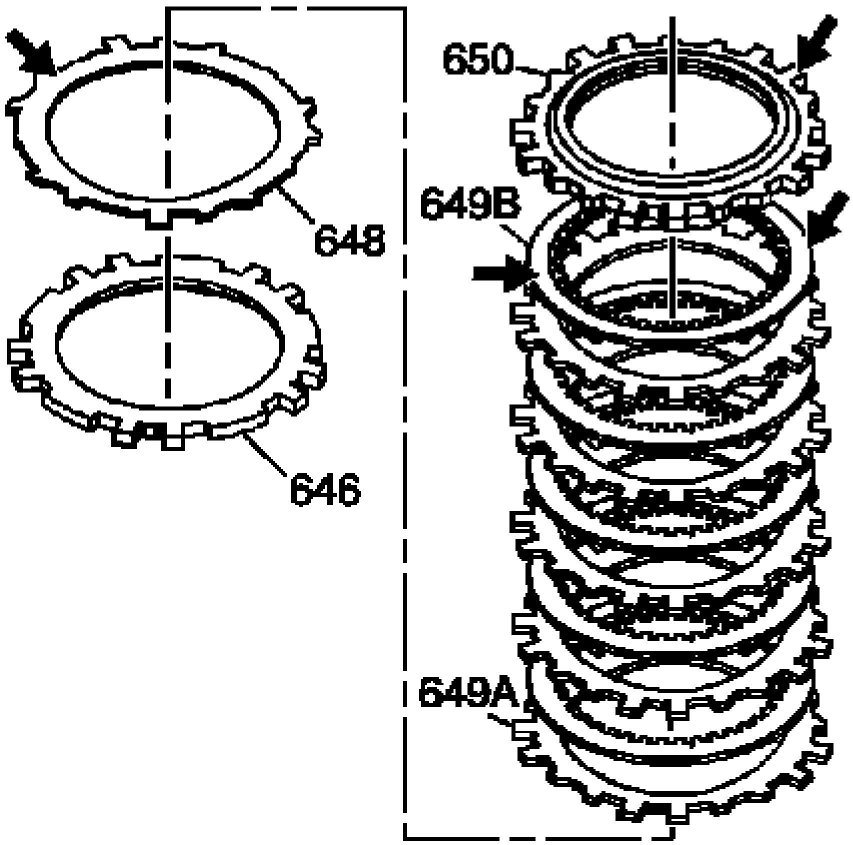


Fig. 173: View Of J 8763-02, J 38655, & J 3289-20
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 8763-02** and the **J 38655** onto the transmission assembly. See **Special Tools**.
2. Install the transmission assembly and the **J 8763-02** into the **J 3289-20** . See **Special Tools**.
3. Lock the **J 8763-02** in place with the locking pin. See **Special Tools**.

TRANSMISSION FLUID DRAINING

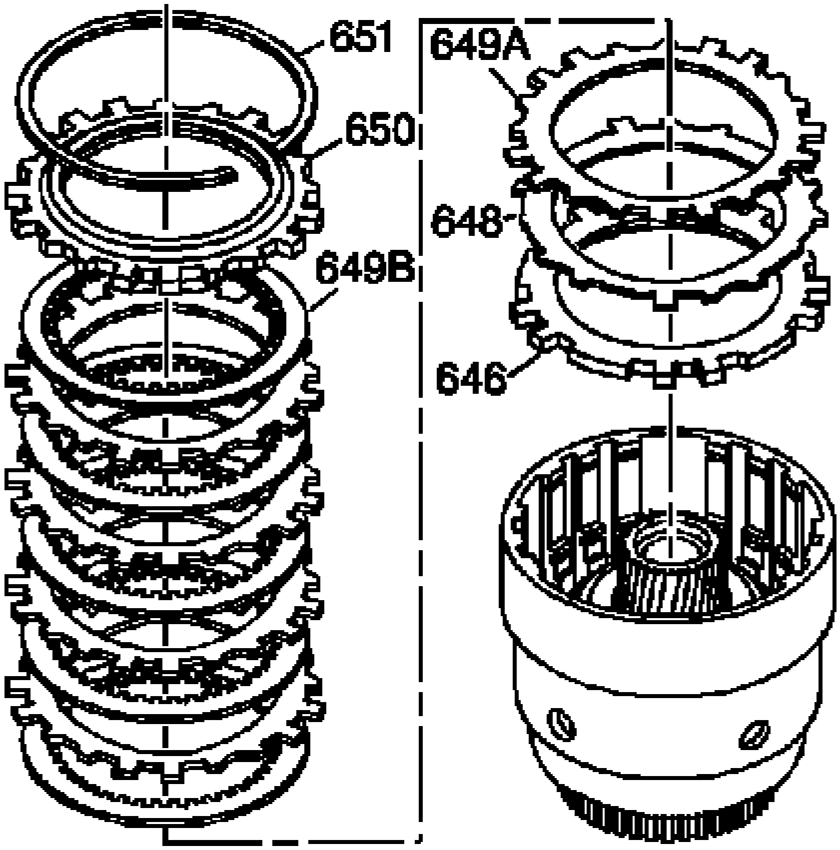


Fig. 174: Draining Transmission Fluid
Courtesy of GENERAL MOTORS CORP.

1. Place a suitable fluid collection pan under the transmission assembly.
2. Slowly rotate the transmission so that the input shaft is up, in order to drain the transmission fluid out of the case extension.
3. Remove the collection pan and properly dispose of the transmission fluid.

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY REMOVAL

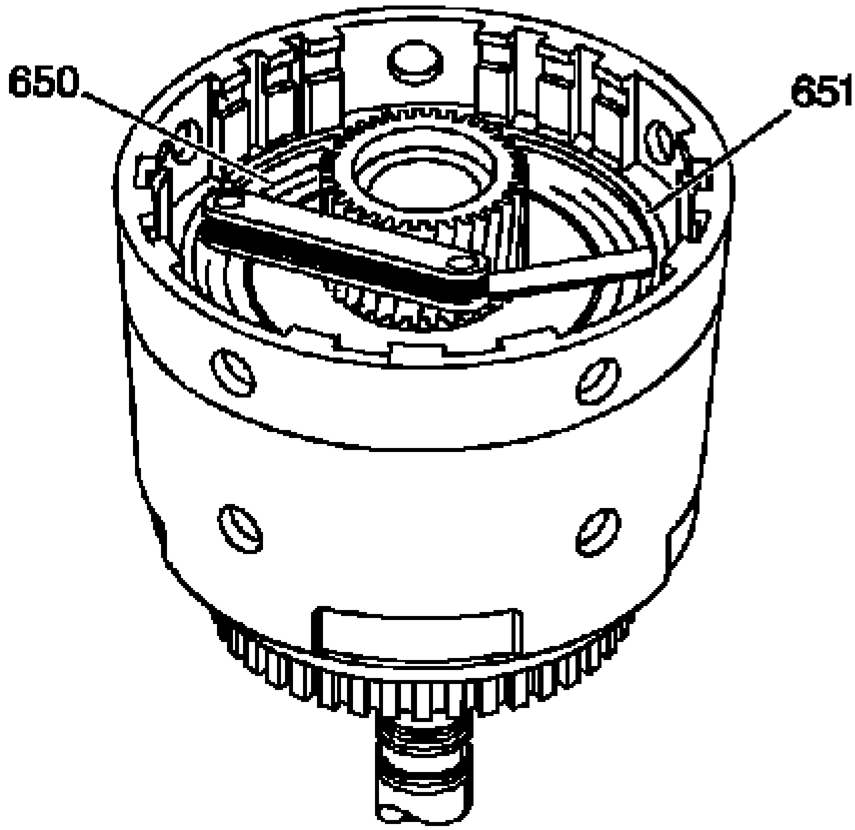


Fig. 175: Locating Speed Sensor Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the input speed sensor bolt (23).
2. Remove the input speed sensor (22A).
3. Remove the output speed sensor bolt (23).
4. Remove the output speed sensor (22B), (output speed sensor plug on 4WD model).
5. Inspect the speed sensors for damage.

CASE EXTENSION ASSEMBLY REMOVAL

Tools Required

- **J 23129** Universal Seal Remover. See **Special Tools**.
- **J 6125-1B** Slide Hammer. See **Special Tools**.

Procedure

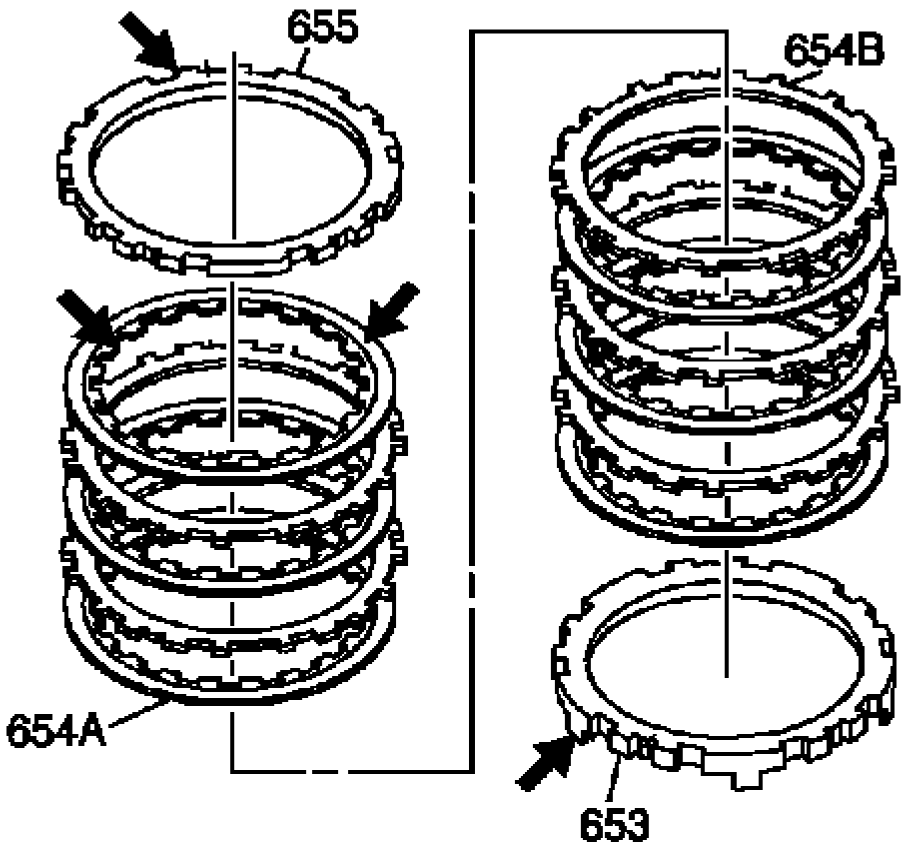


Fig. 176: Using J 23129 & J 6125-1B To Remove Prop Shaft Front Slip Yoke Seal Assembly
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 23129** and the **J 6125-1B** , remove the prop shaft front slip yoke seal assembly (20) (model dependent). See **Special Tools**.

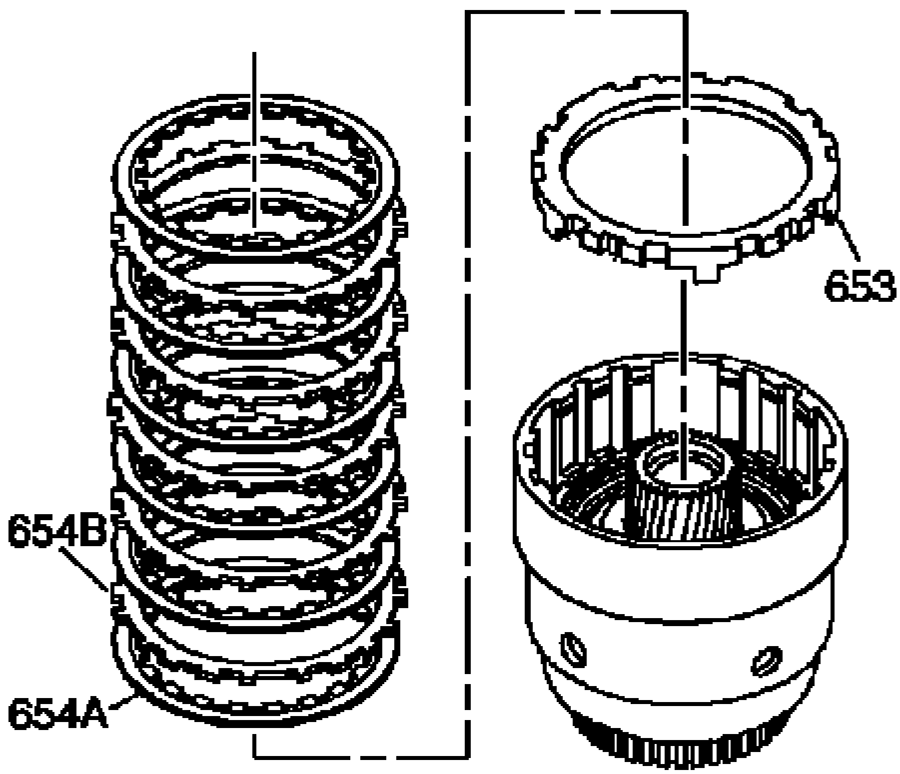


Fig. 177: Exploded View Of Case Extension Assembly
Courtesy of GENERAL MOTORS CORP.

2. Remove the case extension bolts (21).
3. Remove the case extension assembly (19).
4. Remove the case extension seal (15).
5. Remove the following components and inspect for damage and wear:
    - The output shaft seal (675) (for some models)
    - The transmission output shaft yoke seal sleeve (682) and output shaft seal (683) (for some models)
    - The bearing retainer ring (16), case extension ball bearing assembly (17), and bearing spacer (18) (for some models)

TRANSMISSION FLUID PAN REMOVAL

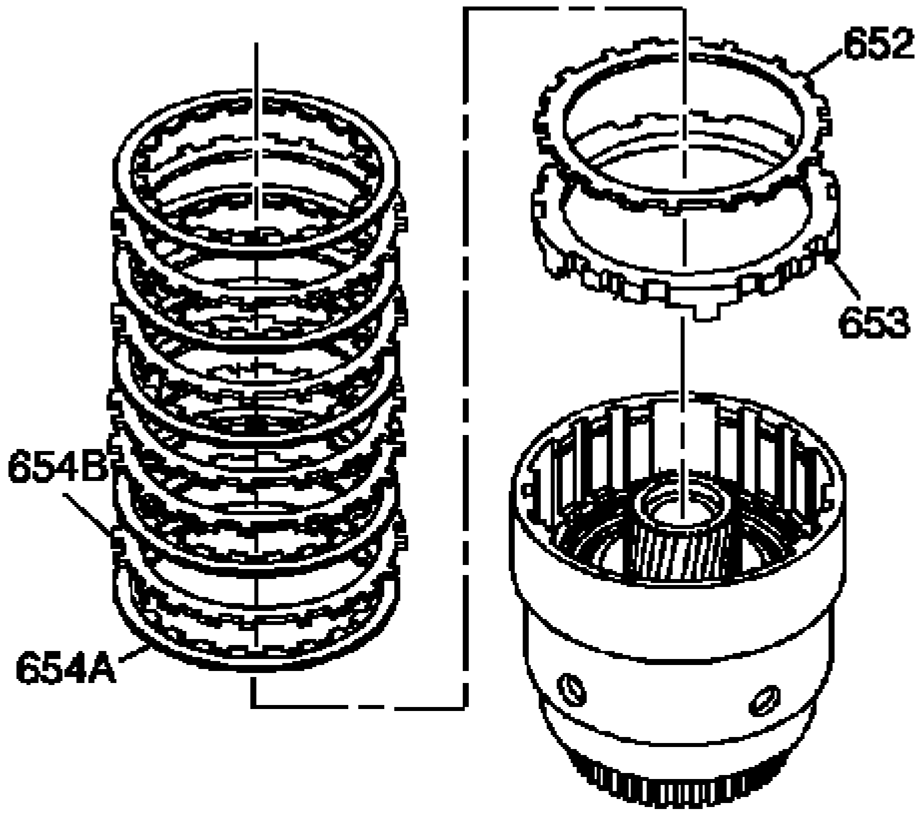


Fig. 178: View Of Transmission Oil Pan, Gasket & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission oil pan bolts (27).
2. Remove the transmission oil pan (28).
3. Inspect the transmission oil pan (28) for damage or contact with the oil filter.

IMPORTANT: The transmission oil pan gasket (29) is reusable.

4. Remove the transmission oil pan gasket (29).
5. Remove the transmission oil pan magnet (30).

TRANSMISSION FLUID FILTER ASSEMBLY REMOVAL

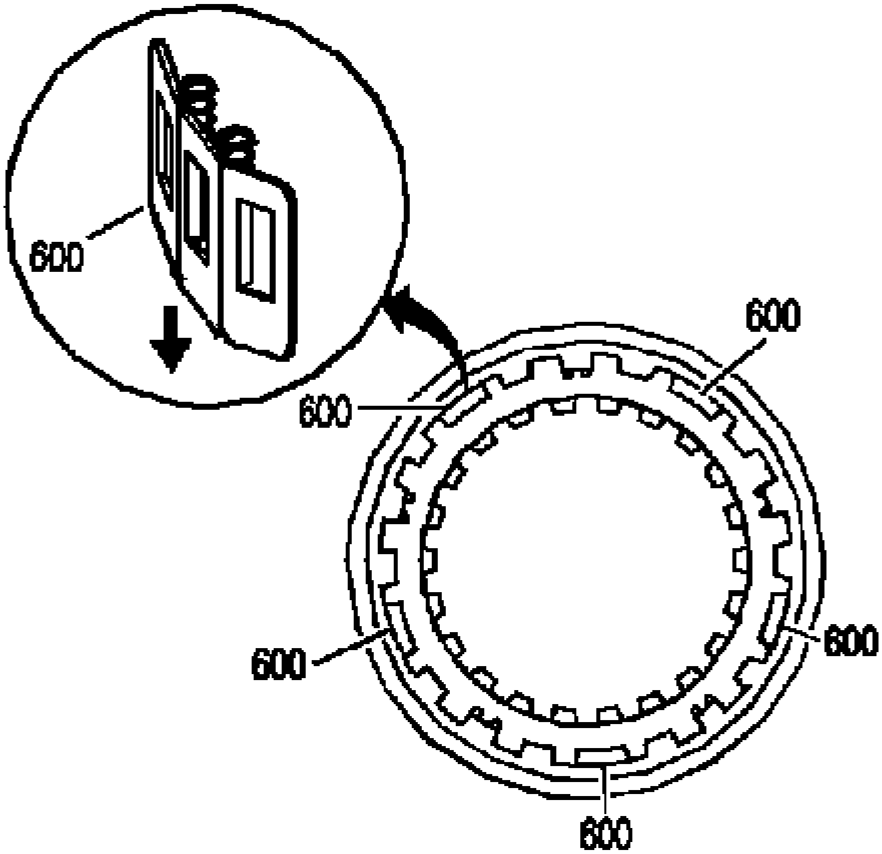


Fig. 179: Locating Transmission Oil Filter Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission oil filter assembly (31).
2. Inspect the filter neck seal assembly (32) for damage.
3. Remove the filter neck seal assembly (32) from the case, if necessary.

TRANSMISSION WIRING HARNESS REMOVAL

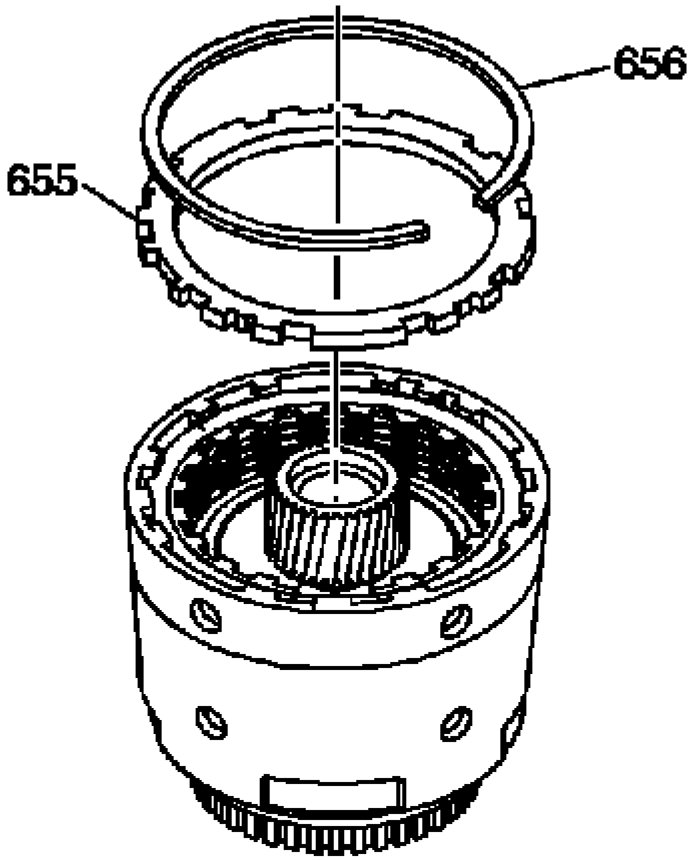


Fig. 180: Identifying Transmission Wire Harness
Courtesy of GENERAL MOTORS CORP.

1. Disconnect the wire harness connectors from the electrical components.
2. Remove the transmission wiring harness assembly (34) from the wiring harness clamps (33).

NOTE: If the transmission wiring harness assembly does not need servicing, do not remove the assembly from the case. Excessive force may damage the pass-through connector.

3. Remove the transmission wiring harness assembly (34) from the case. Use a 1-5/16 inch 12-point socket in order to release the pass-through connector retaining clips from the case.
4. Remove the pass thru connector O-ring seal (36) and replace.

CONTROL VALVE BODY ASSEMBLY REMOVAL

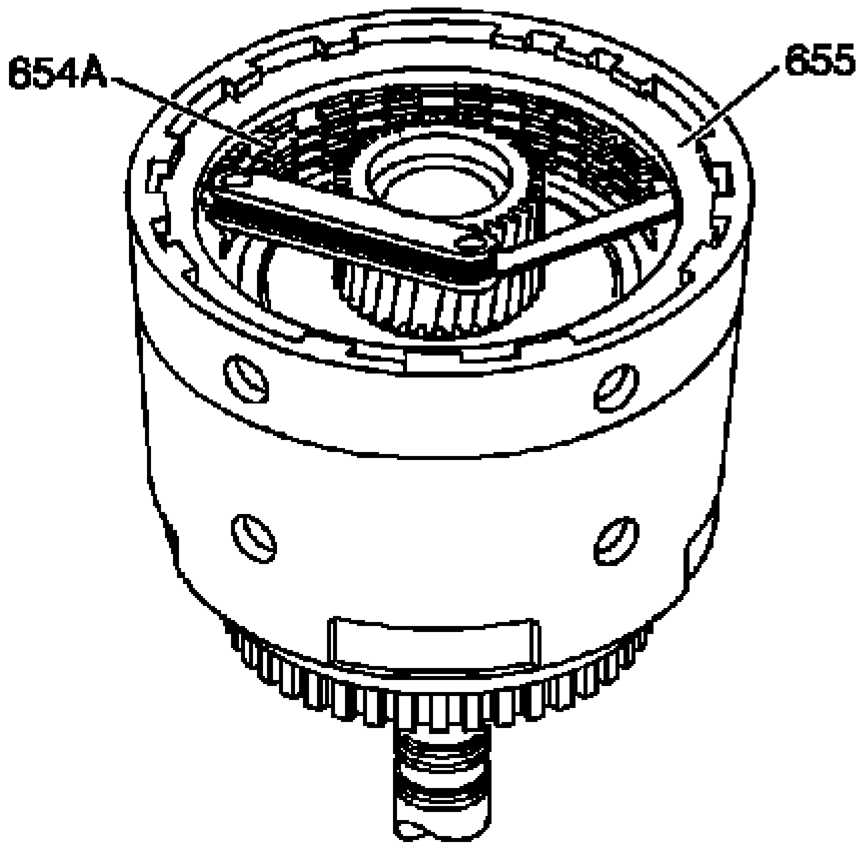


Fig. 181: View Of TFP Manual Valve Position Switch & Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission fluid pressure manual valve position switch (TFP manual valve position switch) bolts (76) and the TFP manual valve position switch (40).

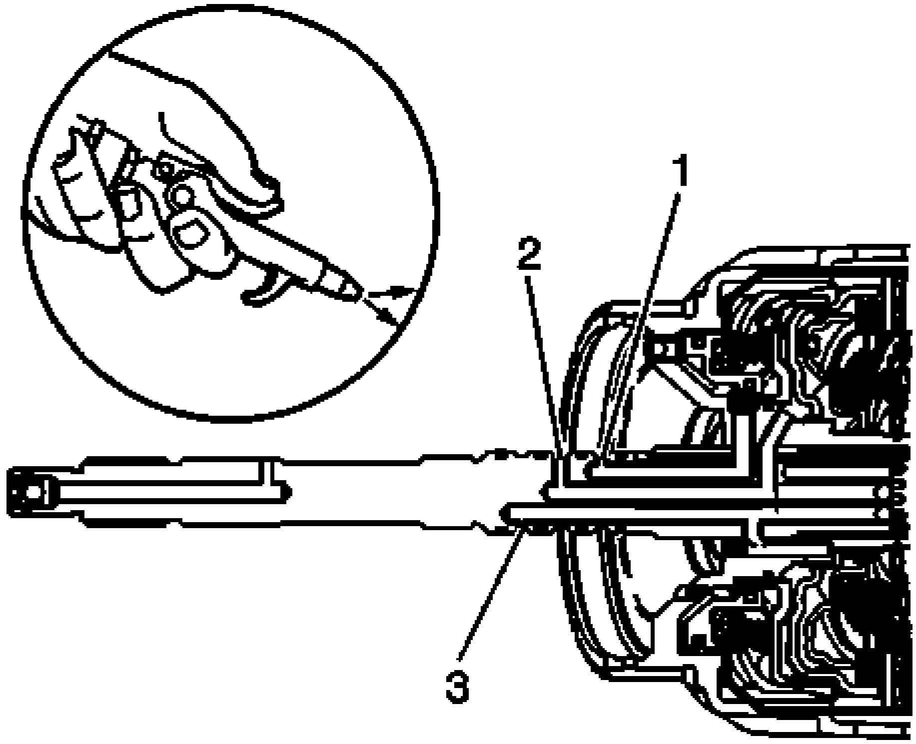


Fig. 182: View Of Control Valve Assembly
Courtesy of GENERAL MOTORS CORP.

2. Remove the control valve body assembly bolts (35).
3. Remove the manual shift shaft detent spring assembly (41).
4. Remove the control valve body assembly bolt (35) and the lube oil pipe retainer (37).
5. Remove the lube oil pipe (39).
6. Remove the control valve assembly (44) including the following:
   - The 3rd and 4th clutch accumulator housing (51)
   - The control valve body gasket (45) (not shown)
   - The control valve body spacer plate (46) (not shown)
   - The accumulator housing gasket (47) (not shown)

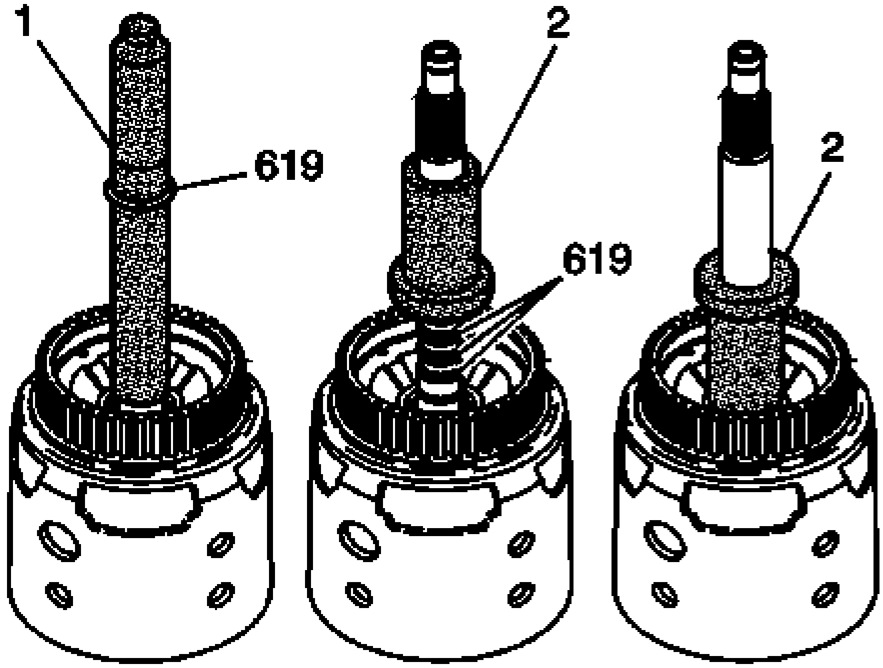


Fig. 183: Locating Manual Valve
Courtesy of GENERAL MOTORS CORP.

7. Remove the manual valve (319) from the control valve assembly to prevent damage.
8. Inspect the manual valve (319) for nicks and burrs.

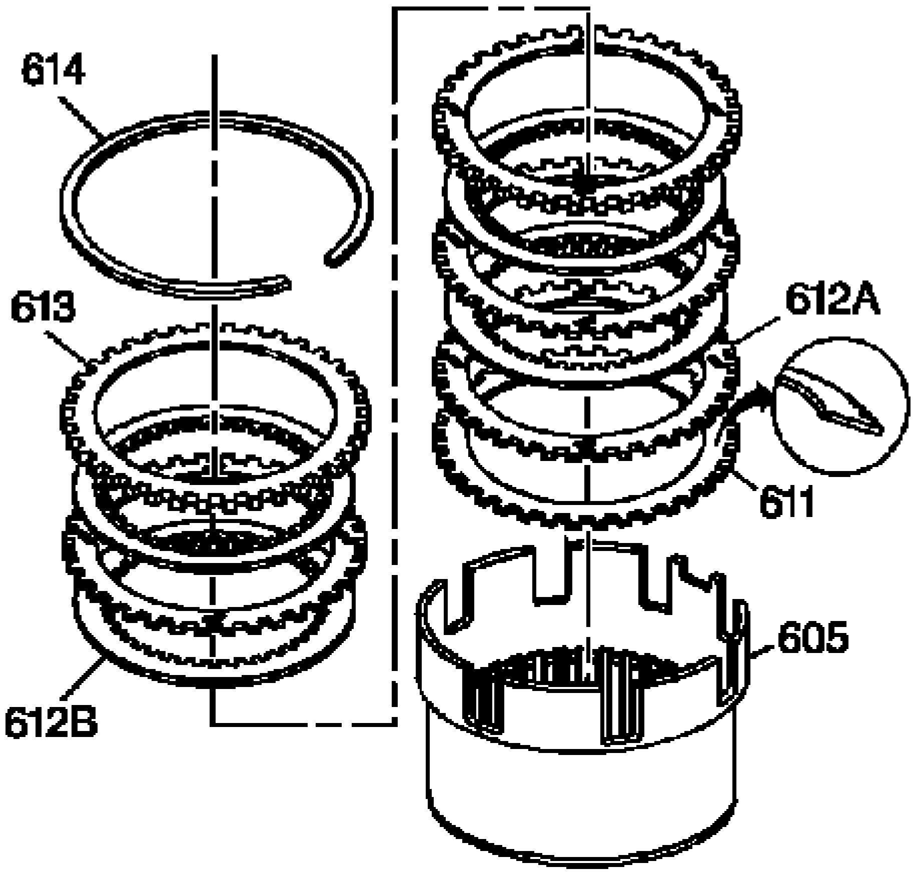


Fig. 184: View Of Control Valve Body Spacer Plate Gasket & TCC Solenoid Valve Screen Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the control valve body spacer plate gasket (48) from the case. The gasket may stick to the spacer plate.

IMPORTANT: The TCC solenoid valve screen assembly can be removed easily by applying light pressure at the bottom of the screen.

10. Remove the TCC solenoid valve screen assembly (75) from the case passages.
11. Inspect the TCC solenoid valve screen assembly (75) for debris and damage.

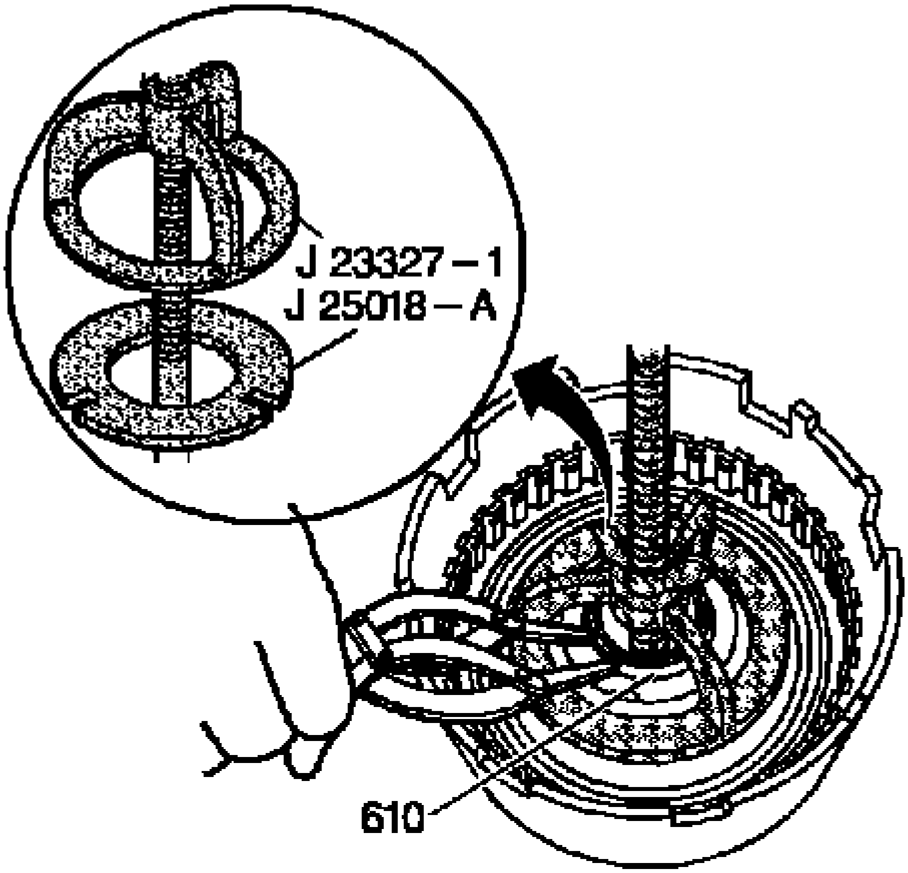


Fig. 185: View Of Control Valve Body Ball Check Valves
Courtesy of GENERAL MOTORS CORP.

NOTE: **Do not use a magnet in order to remove the control valve body ball check valves. This may magnetize the control valve body ball check valves, causing metal particles to stick to them.**

12. Remove the 8 control valve body ball check valves (54).

MANUAL 2-1 BAND SERVO ASSEMBLY REMOVAL

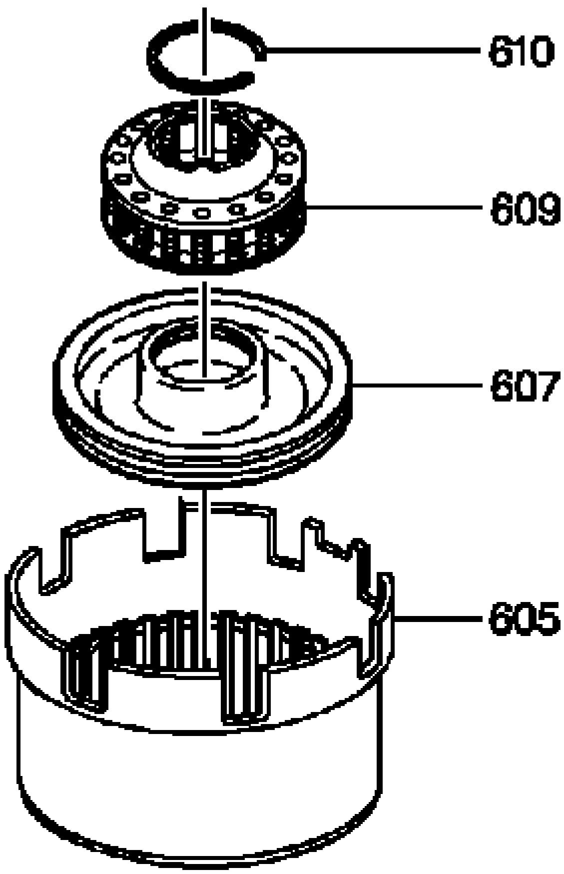


Fig. 186: Identifying Servo Piston Cushion Spring
Courtesy of GENERAL MOTORS CORP.

1. Remove the manual 2-1 band servo assembly (55-58).
2. Remove the servo piston cushion spring (60).
3. Inspect the servo piston cushion spring (60) for distortion.
4. Inspect the servo piston case bore for wear and scoring.

LOW AND REVERSE BAND SERVO ASSEMBLY REMOVAL

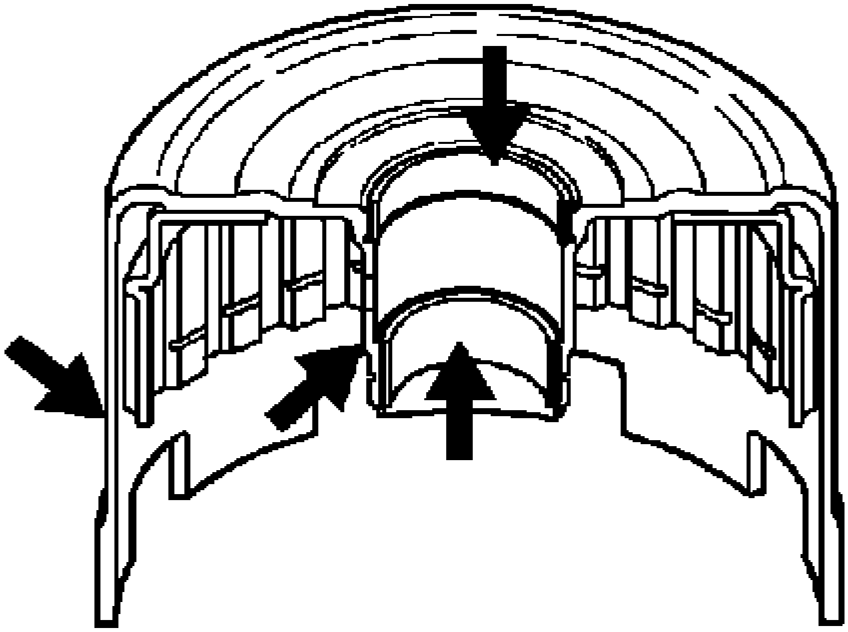


Fig. 187: View Of Low And Reverse Band Servo Cover
Courtesy of GENERAL MOTORS CORP.

1. Remove the low and reverse band servo cover bolts (61).
2. Remove the low and reverse band servo cover (62).
3. Remove the low and reverse band servo cover gasket (63).
4. Inspect the low and reverse band servo cover (62) for damage.

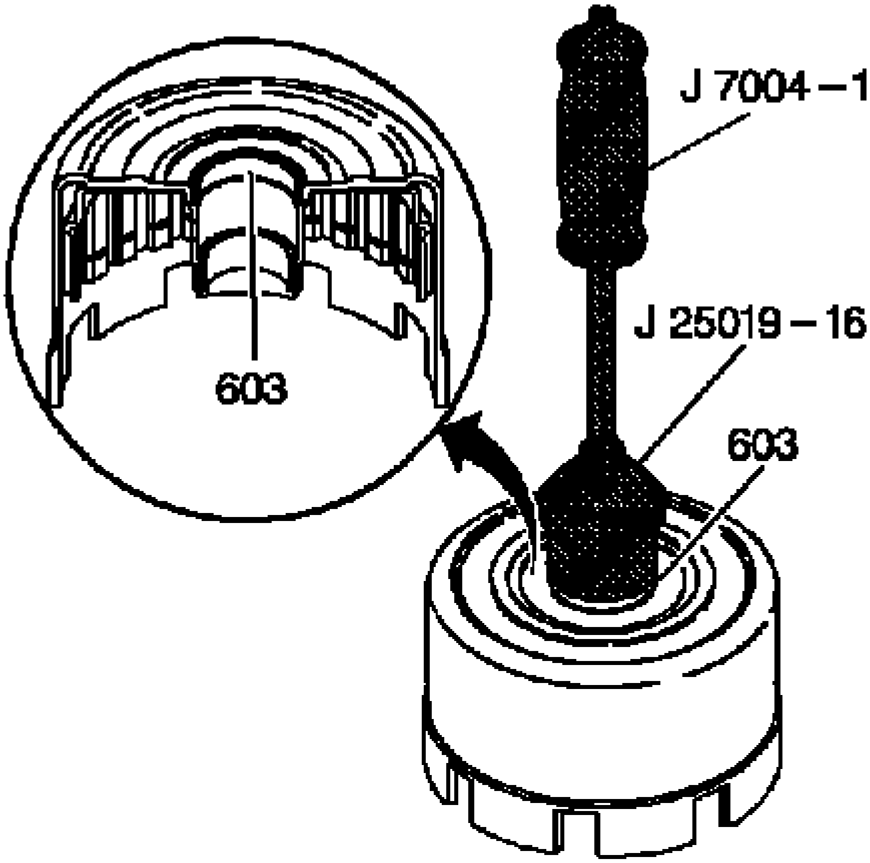


Fig. 188: Locating Low And Reverse Accumulator Piston Spring
Courtesy of GENERAL MOTORS CORP.

5. Remove the low and reverse band servo assembly (64-73).
6. Remove the low and reverse accumulator piston spring (74) from the transmission case.
7. Inspect the low and reverse band servo transmission case bore for wear and scoring.
8. Inspect the low and reverse accumulator piston spring (74) for distortion.

LOW AND REVERSE BAND SERVO PISTON PIN CHECK

Tools Required

- **J 21370-10** Band Apply Pin Gage. See **Special Tools**.
- **J 38737** Band Apply Pin Checking Tool. See **Special Tools**.

Procedure

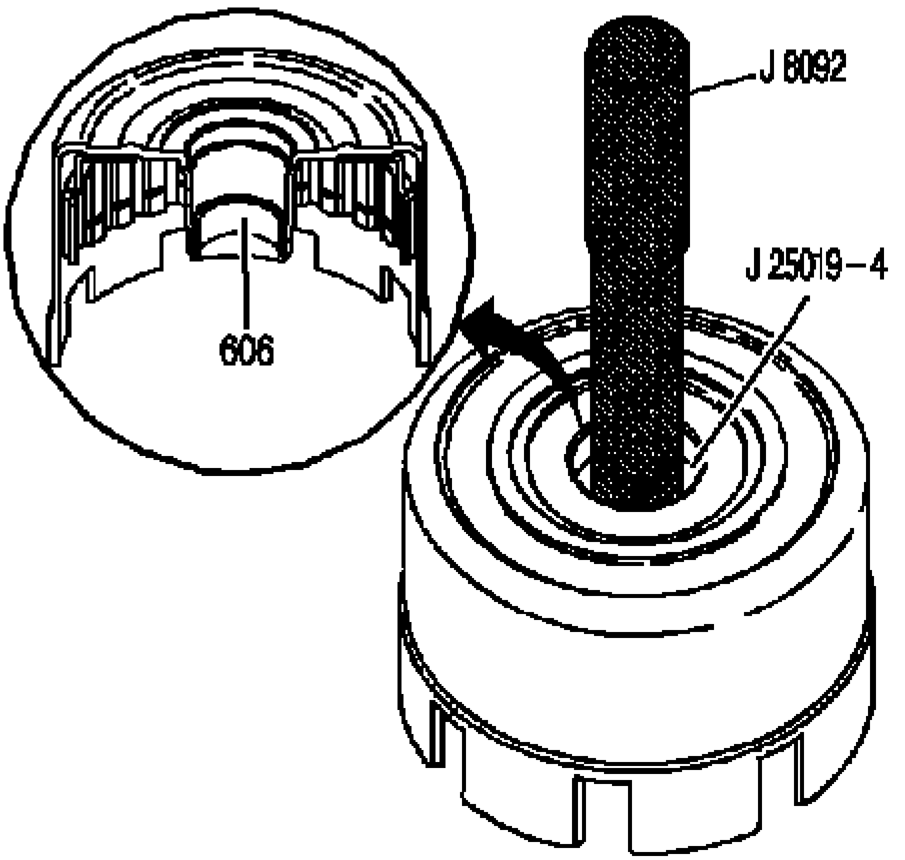


Fig. 189: View Of J 21370-10 & J 38737
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 21370-10** into the low and reverse band servo pin bore. See **Special Tools**.
2. Position the **J 38737** over the low and reverse band servo bore with the hex hub facing the parking pawl linkage. See **Special Tools**.

NOTE: **Refer to FASTENER NOTICE .**

3. Fasten the **J 38737** to the case with two low and reverse band servo cover bolts (61). See **Special Tools**.

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

4. Verify that the **J 21370-10** moves freely in the **J 38737** and in the low and reverse band servo pin bore. See **Special Tools**.
5. In order to determine the correct low and reverse band servo piston pin length, tighten the hex hub of the **J 38737** . See **Special Tools**.

   Tighten: Tighten the hex hub of the **J 38737** to 34 N. See **Special Tools**.m (25 lb ft).

6. Observe the lands on the **J 21370-10** in order to determine which land is even with the top edge of the **J**

38737 . See **Special Tools**. Note the letter (A, B or C) stamped on the **J 21370-10** . See **Special Tools**.

7. Refer to the Low and Reverse Band Servo Piston Pin Specification table, in **Transmission General Specifications** , in order to determine the correct pin length to use.

MANUAL SHIFT SHAFT REMOVAL

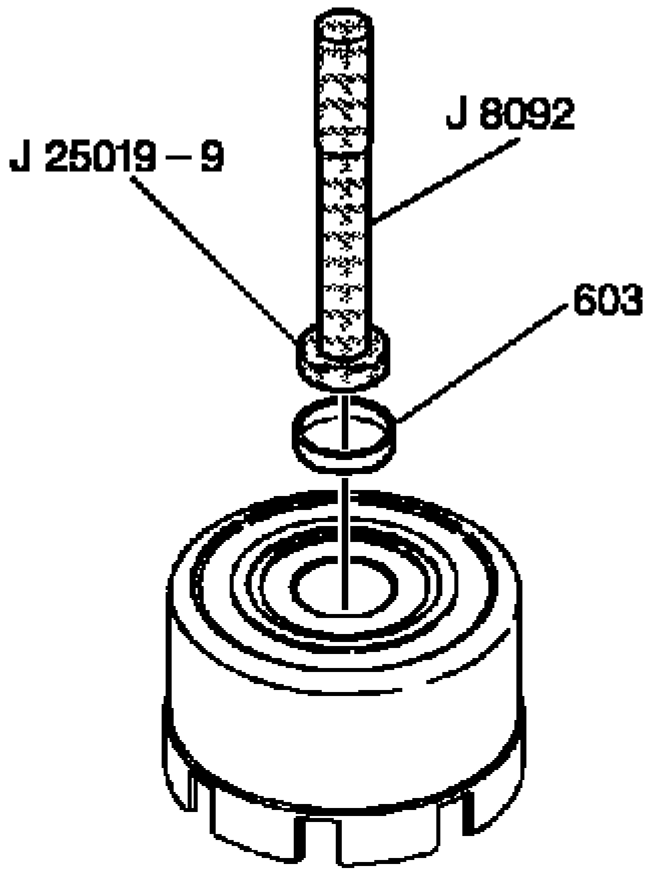


Fig. 190: Locating Manual Shift Shaft Components
Courtesy of GENERAL MOTORS CORP.

NOTE: Use a piece of wood or other protective material when you remove the manual shaft pin, to prevent damage to the case.

1. Remove the manual shift shaft pin (709).
2. Remove the manual shift shaft detent lever nut (712).
3. Remove the manual shift shaft (708).
4. Remove the manual shift shaft seal (707).
5. Inspect the manual shift shaft for the following conditions:
   - Damaged flats or threads
   - Burrs

- Wear

6. Inspect the manual shift shaft pin (709) for tightness.

PARKING SYSTEM COMPONENTS REMOVAL

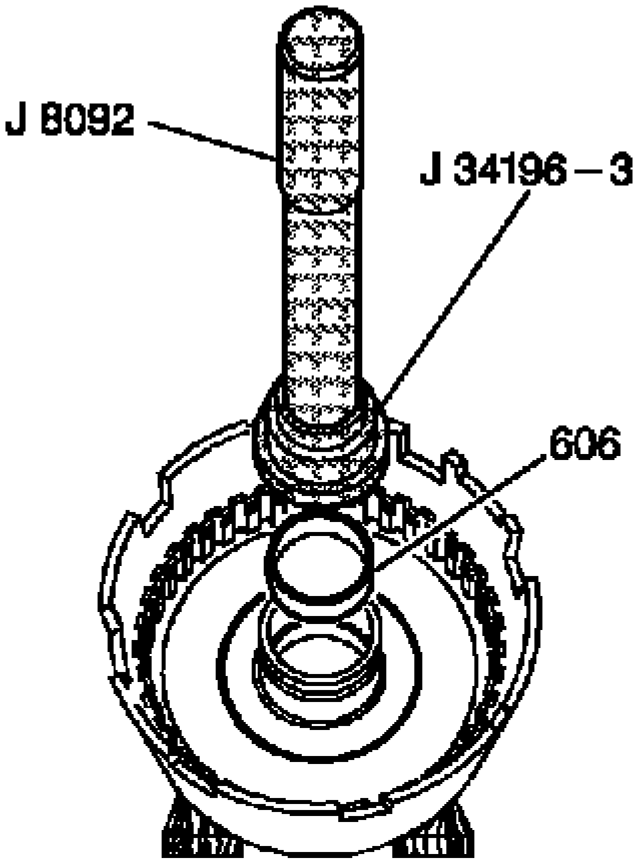


Fig. 191: Identifying Parking System Components Inspection Areas
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Do not apply excessive force, prying or hammering to any of the parking mechanism parts. This could damage the parking system.**

1. Remove the manual shift shaft detent lever assembly (711) and the parking pawl actuator assembly (710).
2. Inspect the manual shift shaft detent lever assembly (711) and the parking pawl actuator assembly (710) for cracks, burrs or damage.

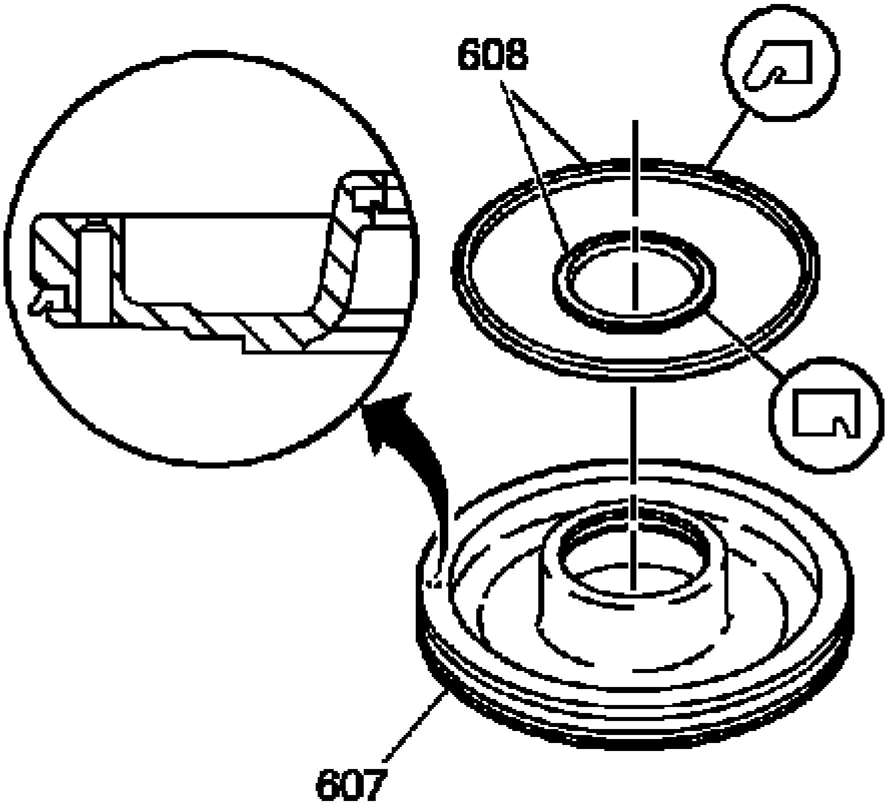


Fig. 192: Inspecting Parking Pawl Components
Courtesy of GENERAL MOTORS CORP.

3. Remove the parking pawl actuator bracket (713) and bolts (714).
4. Inspect the parking pawl actuator bracket (713) for cracks, burrs or damage.
5. Remove the parking pawl spring (705).
6. Inspect the parking pawl spring (705) for distortion or damage.

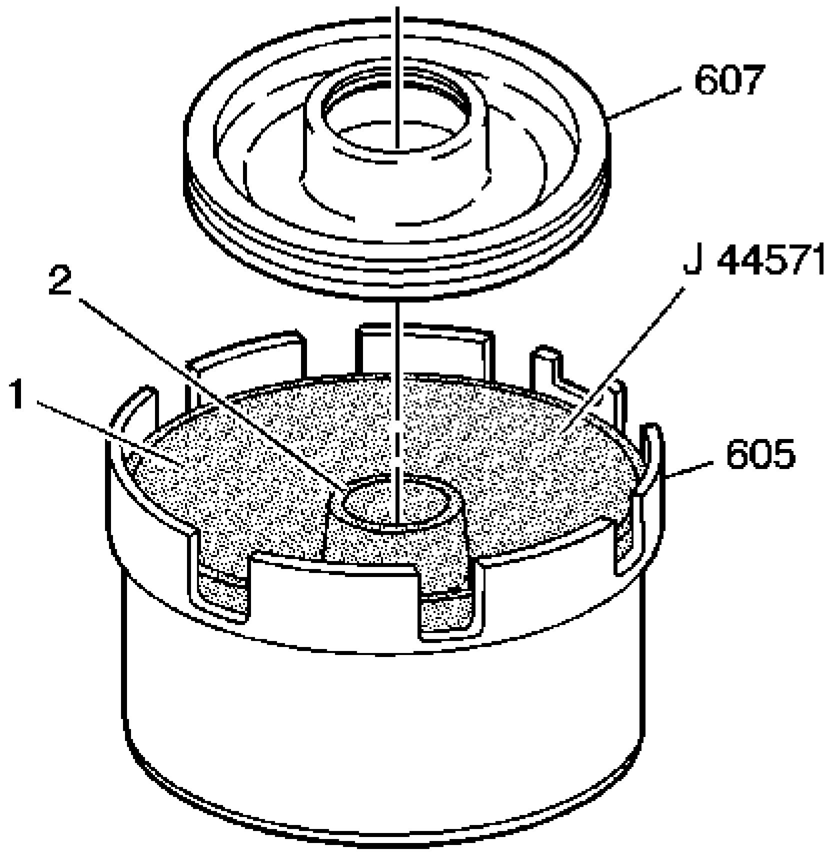


Fig. 193: Locating Parking Pawl Shaft Hole Plug
Courtesy of GENERAL MOTORS CORP.

7. Remove the parking pawl shaft hole plug (701) from the transmission case using a screw extractor.

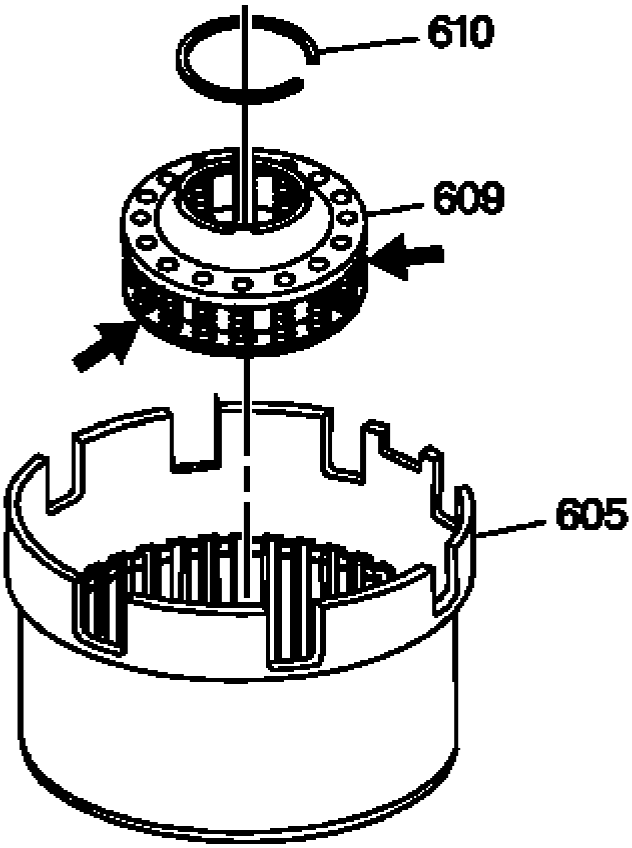


Fig. 194: View Of Parking Pawl
Courtesy of GENERAL MOTORS CORP.

8. Remove the parking pawl shaft retainer (704).
9. Remove the parking pawl shaft (702).

NOTE: Do not damage the parking pawl shaft case bore or a fluid leak may occur at the hole plug.

10. Remove the parking pawl (703) from the transmission case.
11. Inspect the parking pawl (703) for cracks, burrs or damage.
12. Inspect the parking pawl shaft (702) for damage and proper fit.

FRONT END PLAY CHECK

Tools Required

- **J 8001** Dial Indicator Set
- **J 25025-B** Guide Pin Set
- **J 28585** Snap Ring Remover. See **Special Tools**.

Procedure

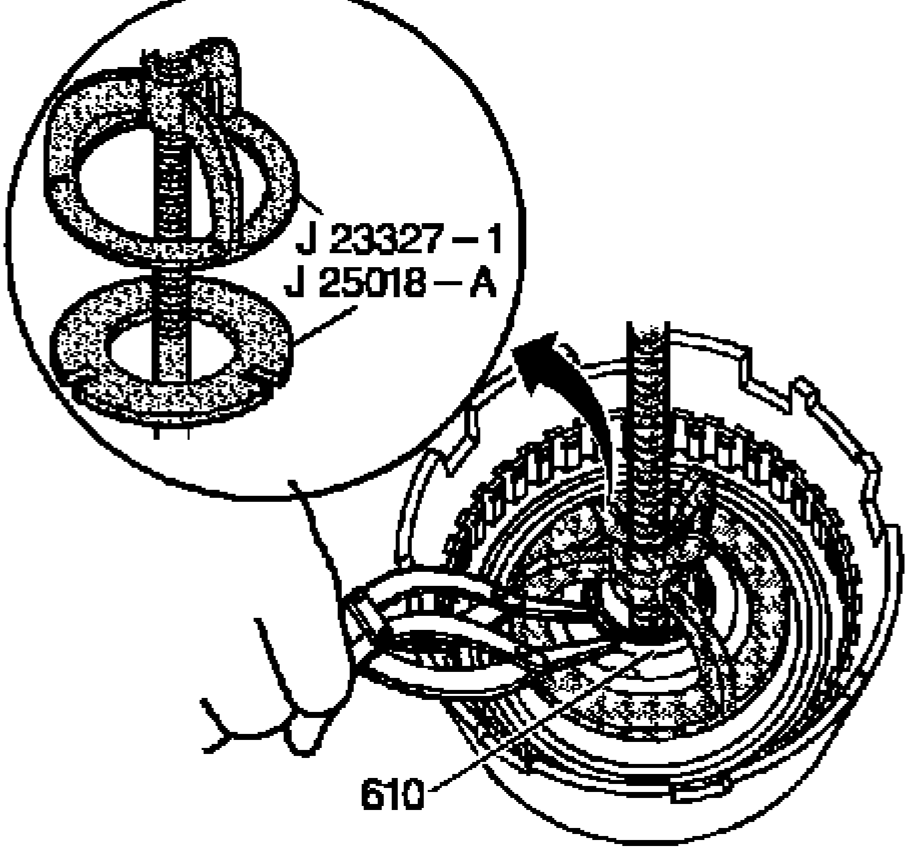


Fig. 195: Measuring Front End Play
Courtesy of GENERAL MOTORS CORP.

1. Assemble the **J 25025-B** by attaching the threaded rod and the dial indicator holder to one of the bolt holes on the transmission case assembly (7).
2. Assemble the **J 8001-3** onto the dial indicator holder. Index the **J 8001-3** to the end of the turbine shaft (502).
3. Eliminate any slack by pressing down on the turbine shaft (502).
4. Using the **J 28585** , apply upward pressure on the output carrier assembly to remove free play in the retainer ring. See **Special Tools**.
5. Set the **J 8001-3** to 0.
6. Pull up on the turbine shaft (502) while holding up the output carrier assembly with the **J 28585** . See **Special Tools**. The correct end play is between 0.102-0.559 mm (0.004-0.022 in).

IMPORTANT: During reassembly, the front end play check must be repeated in order to verify the accuracy of the selective washer.

7. Record this measurement for future reference.

8. Remove the tools.

REAR UNIT END PLAY CHECK

Tools Required

- **J 8001** Dial Indicator Set
- **J 25025-B** Dial Indicator Post and Guide Pin Set

Procedure

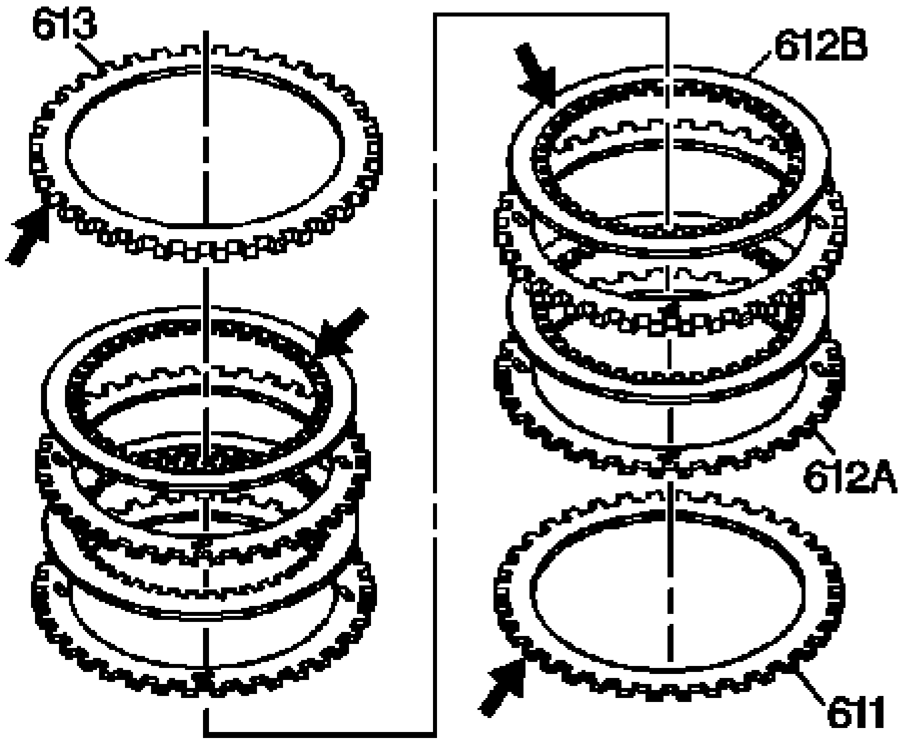


Fig. 196: Checking Rear Unit End Play With J 8001-3
Courtesy of GENERAL MOTORS CORP.

1. Assemble the **J 25025-B** by attaching the threaded rod and the dial indicator holder to one of the case extension bolt holes on the transmission case assembly (7).
2. Push in the output shaft assembly (671) to remove any slack.
3. Assemble the **J 8001-3** onto the dial indicator holder. Index the **J 8001-3** to the end of the output shaft (671).
4. Set the **J 8001-3** to 0.

5. Move the output shaft (671) in and out, noting the amount of end play. The correct end play is between 0.127-0.508 mm (0.005-0.020 in).

IMPORTANT: During reassembly, the rear unit end play check must be repeated in order to verify the accuracy of the selective washer.

6. Record this measurement for future reference.
7. Remove the tools.

TRANSMISSION FLUID PUMP REMOVAL

Tools Required

- **J 23129** Universal Seal Remover. See **Special Tools**.
- **J 6125-1B** Slide Hammer. See **Special Tools**.
- **J 45053** Universal Clamp Press

Procedure

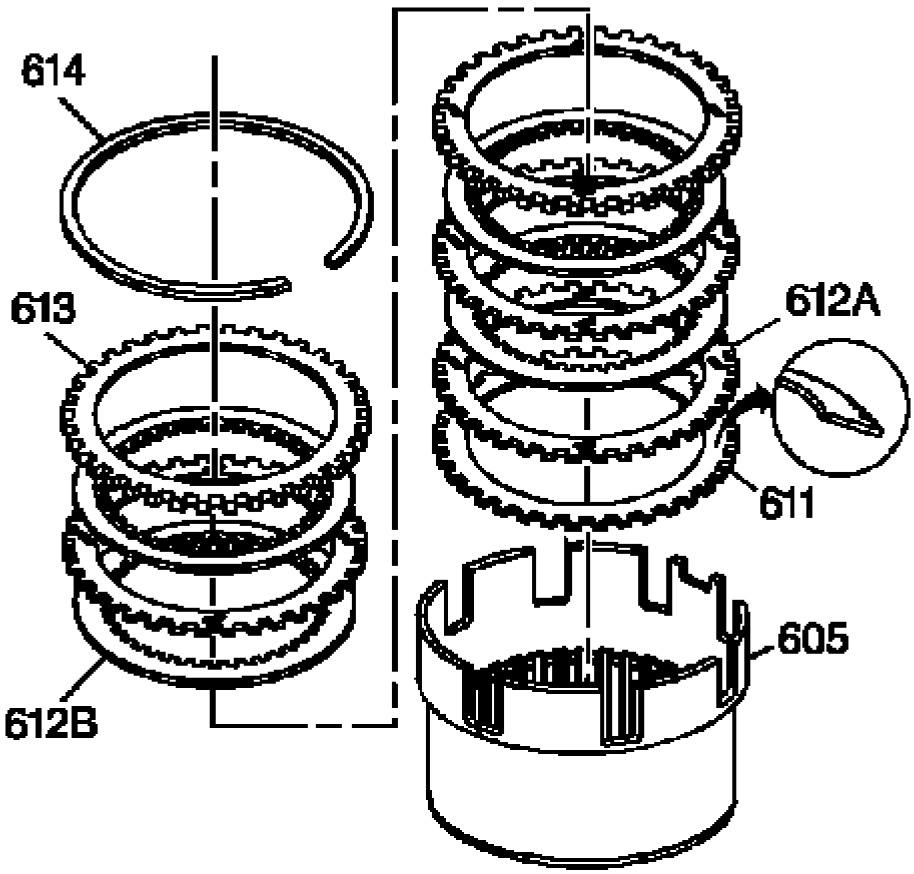


Fig. 197: View Of Turbine Shaft Front Oil Seal Ring

Courtesy of GENERAL MOTORS CORP.

1. Remove the turbine shaft front oil seal ring (2).

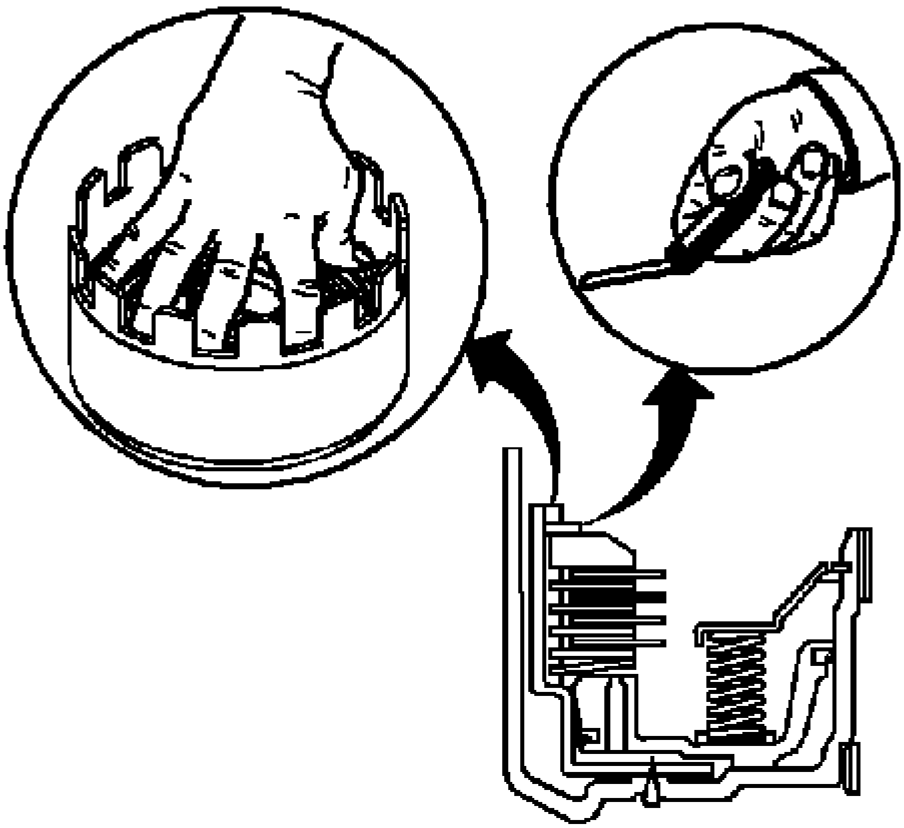


Fig. 198: View Of Torque Converter Oil Seal Assembly
Courtesy of GENERAL MOTORS CORP.

2. Using the **J 23129** and the **J 6125-1B** , remove the torque converter oil seal assembly (201). See **Special Tools**.

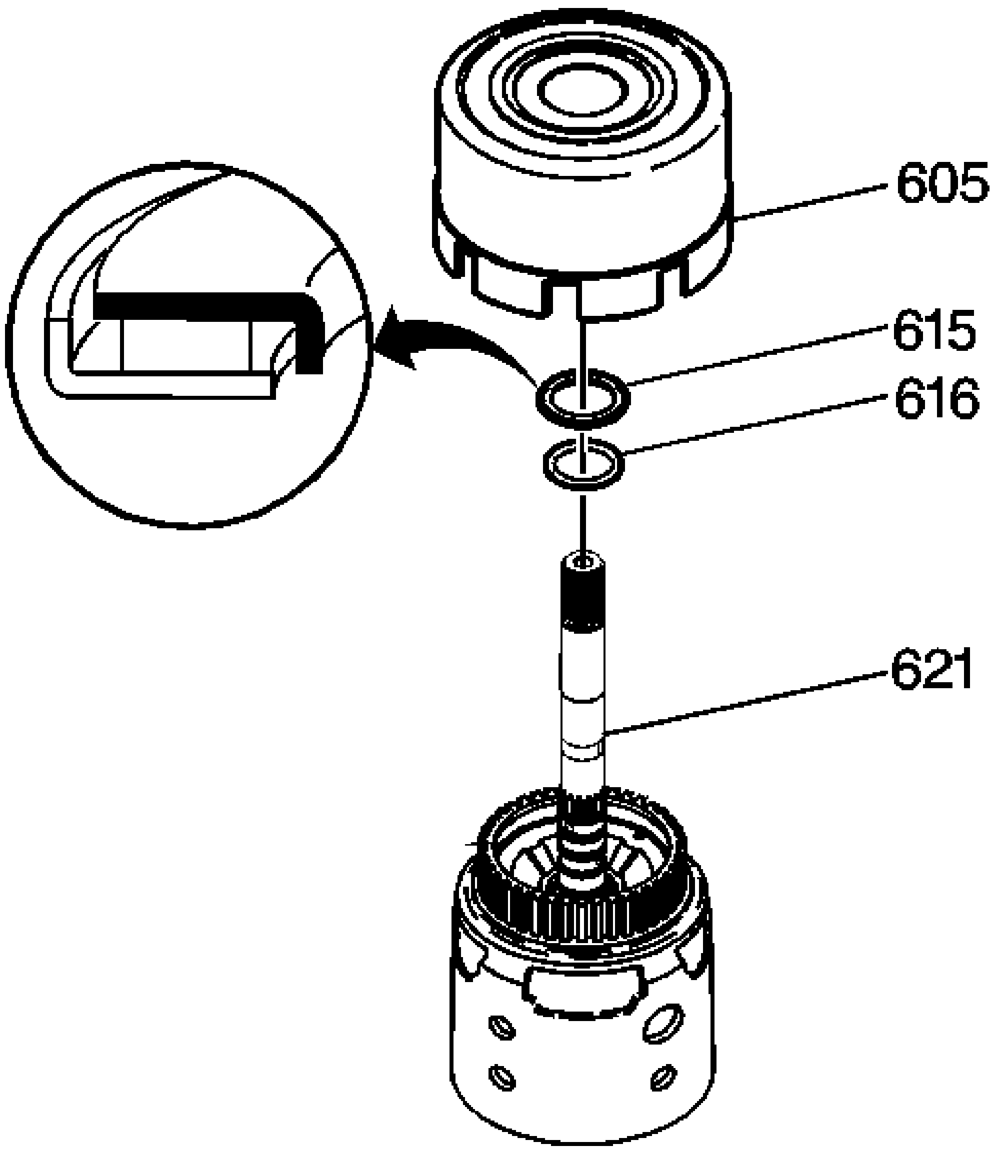


Fig. 199: Locating Oil Pump Bolt And Seal Assemblies
Courtesy of GENERAL MOTORS CORP.

3. Remove the 7 oil pump bolt and seal assemblies (3).
4. Attach the **J 45053** to the oil pump shaft. Tighten the bolts.
5. Turn the handle of the **J 45053** down onto the turbine shaft in order to raise the oil pump assembly (4) out of the case.

6. Remove the oil pump assembly (4).
7. Remove the **J 45053** .

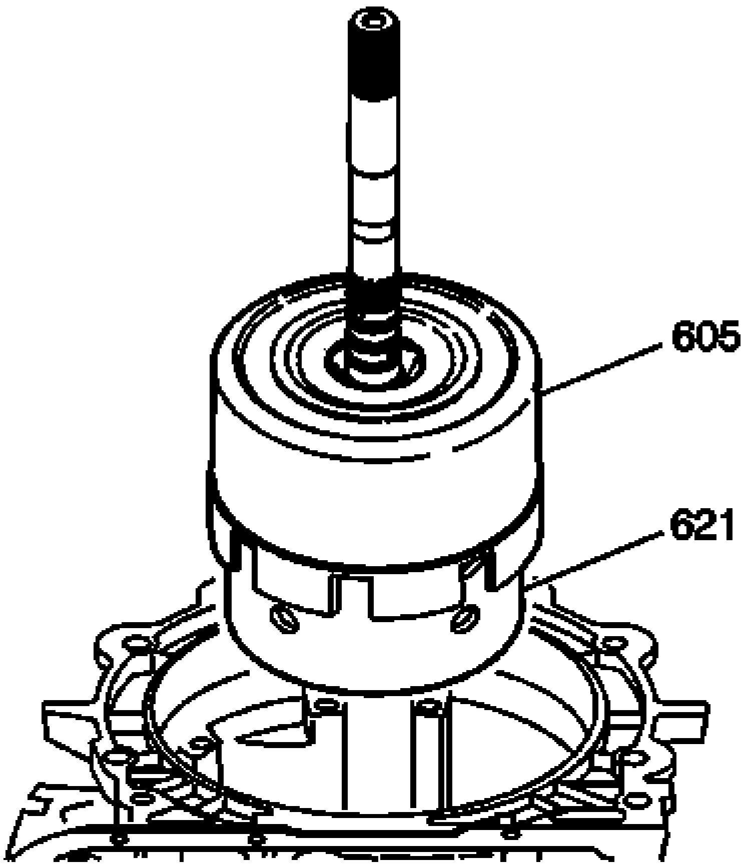


Fig. 200: View Of Transmission Oil Pump Gasket & Selective Thrust Washer
Courtesy of GENERAL MOTORS CORP.

8. Remove the transmission oil pump gasket (6).

IMPORTANT: The selective thrust washer (218) may be stuck to the pump cover.

9. Remove the selective thrust washer (218).

OVERDRIVE ASSEMBLY REMOVAL

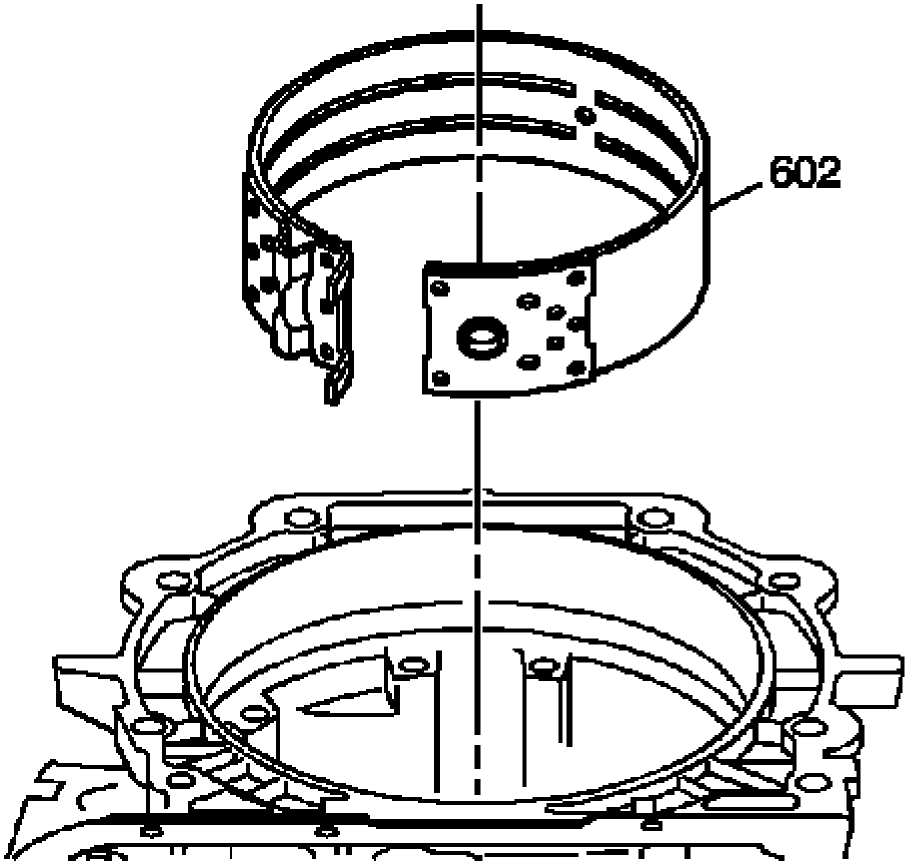


Fig. 201: Locating Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The overdrive assembly includes the turbine shaft, overrun clutch housing assembly and the overdrive carrier assembly.

Remove the overdrive assembly by grasping the turbine shaft (502) and lifting.

4TH CLUTCH ASSEMBLY REMOVAL

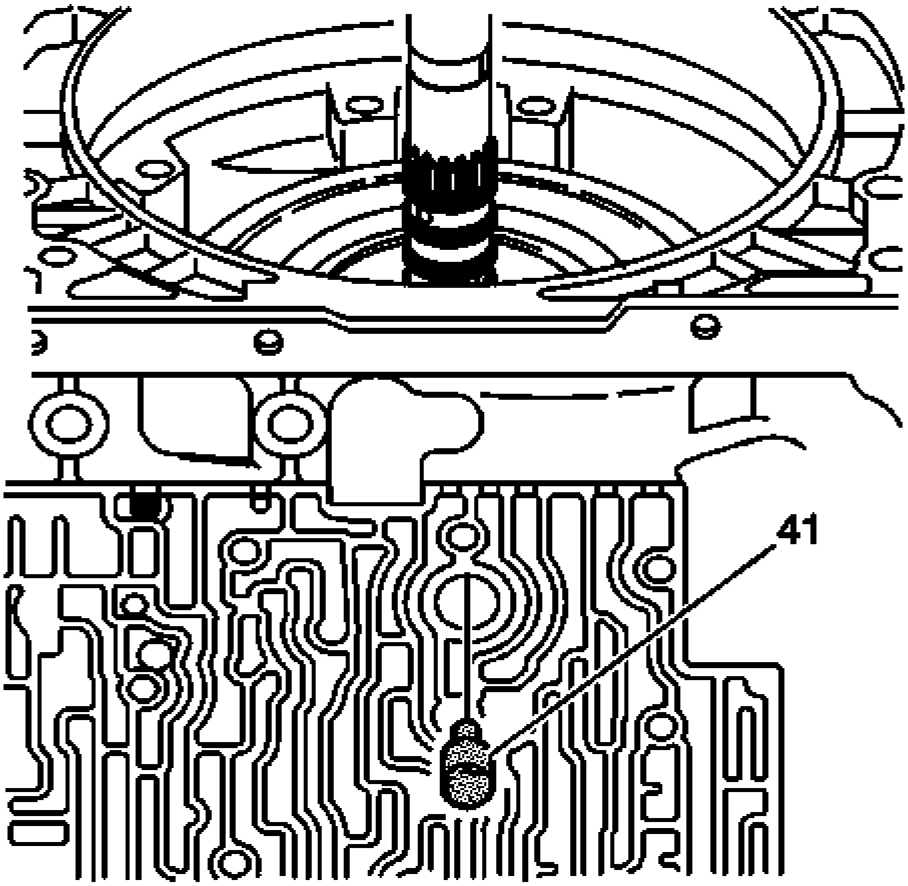


Fig. 202: Identifying Fourth Clutch Housing
Courtesy of GENERAL MOTORS CORP.

1. Verify the torque of the fourth clutch housing bolt (26). The torque should be 23 N.m (17 lb ft) minimum.

NOTE: Discard the fourth clutch housing bolt (26) after removal. Damage could result to the fourth clutch housing (529) if the bolt is reused.

2. Remove the fourth clutch housing bolt (26).
3. Remove the fourth clutch housing (529) from the transmission case assembly.

FORWARD CLUTCH ASSEMBLY REMOVAL

Tools Required

J 38358-A Forward Clutch Assembly Remover/Installer. See **Special Tools**.

Procedure

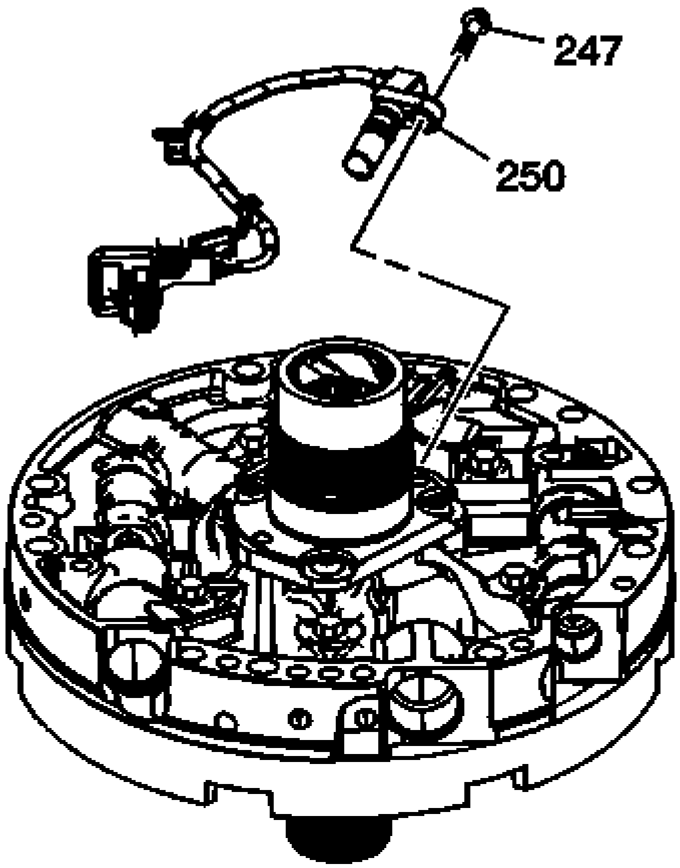


Fig. 203: Overdrive Carrier/Forward Clutch Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the overdrive carrier/forward clutch thrust bearing assembly (601). The bearing may be stuck to the overrun clutch housing assembly.
2. Using the **J 38358-A** , remove the forward clutch housing assembly (602). See **Special Tools**.

IMPORTANT: The forward clutch housing thrust washer (612) may be on top of the direct clutch housing or stuck to the bottom of the forward clutch housing assembly (602).

3. Remove the forward clutch housing thrust washer (612).

DIRECT CLUTCH ASSEMBLY REMOVAL

Tools Required

J 38733 Direct Clutch Assembly Remover/Installer. See **Special Tools**.

Procedure

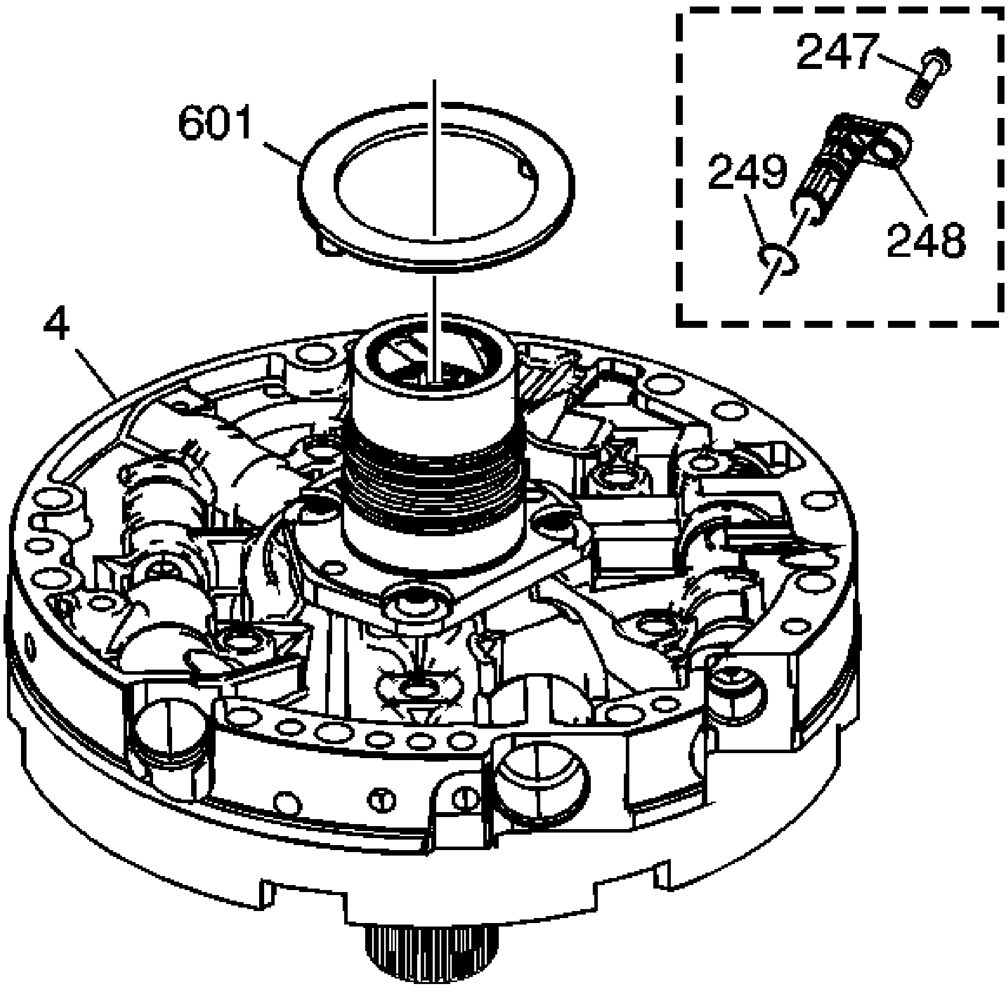


Fig. 204: Using J 38733 To Remove Direct Clutch Housing Assembly
Courtesy of GENERAL MOTORS CORP.

Using the **J 38733** , remove the direct clutch housing assembly (623). See **Special Tools**.

MANUAL 2-1 BAND ASSEMBLY REMOVAL

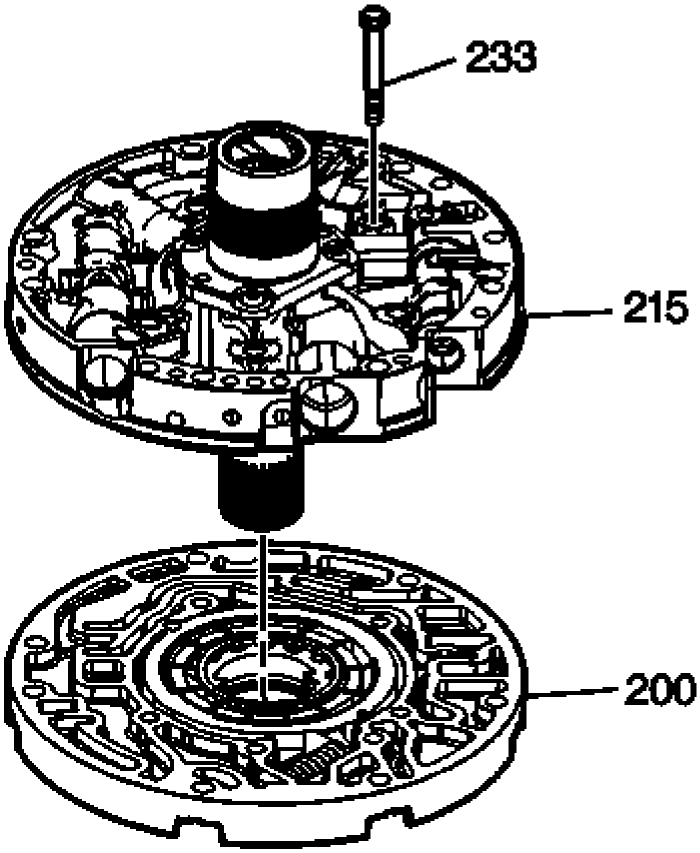


Fig. 205: Locating Manual 2-1 Band Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the manual 2-1 band assembly (628).
2. Inspect the manual 2-1 band assembly for the following conditions:
   - Wear
   - Pitting
   - Flaking
   - Cracks

INTERMEDIATE CLUTCH ASSEMBLY REMOVAL

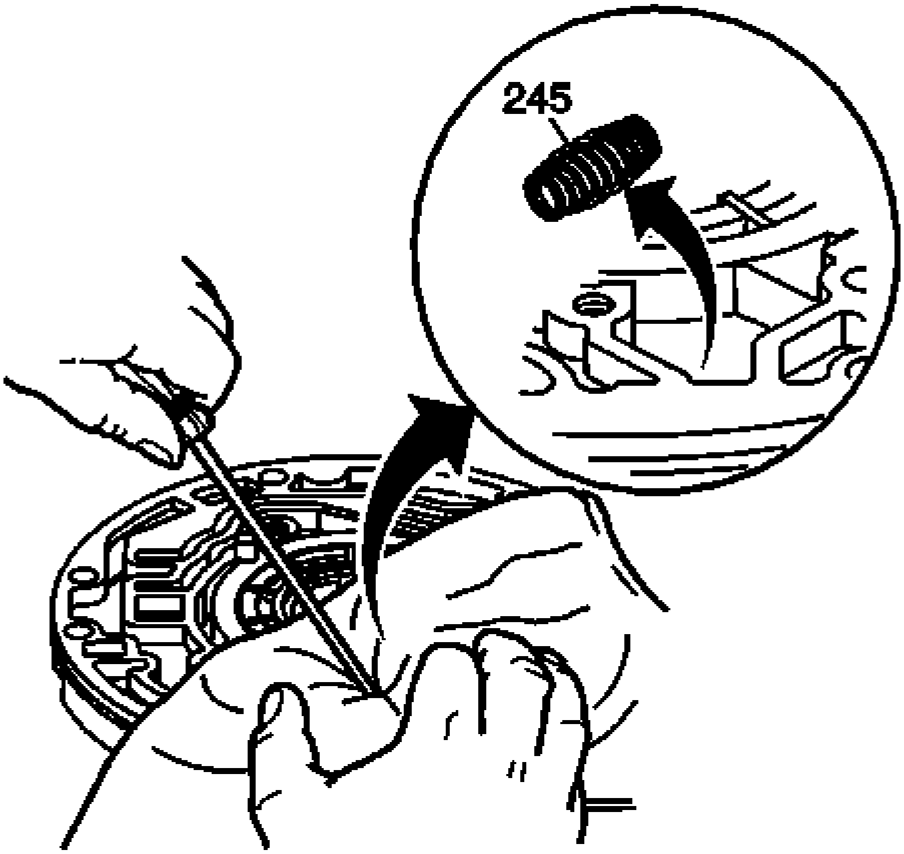


Fig. 206: View Of Intermediate Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the intermediate clutch backing plate retainer ring (629).
2. Remove the intermediate clutch backing plate (630) and the intermediate clutch plates (631, 632) (4 each).
3. Remove the intermediate clutch wave plate (684).
4. Inspect the intermediate clutch plates (631, 632, 684) for the following conditions:
   - Wear
   - Pitting
   - Flaking
   - Cracks
5. Inspect the intermediate clutch backing plate (630) for the following conditions:
   - Burrs
   - Dirt

CENTER SUPPORT AND GEAR UNIT ASSEMBLY REMOVAL

Tools Required

- **J 6116-A** Rear Gear Holding Fixture. See **Special Tools**.
- **J 6129** Handle. See **Special Tools**.
- **J 21364-A** Rear Gear Holding Fixture Adapter. See **Special Tools**.
- **J 38868** Output Shaft Assembly Remover and Installer. See **Special Tools**.

Procedure

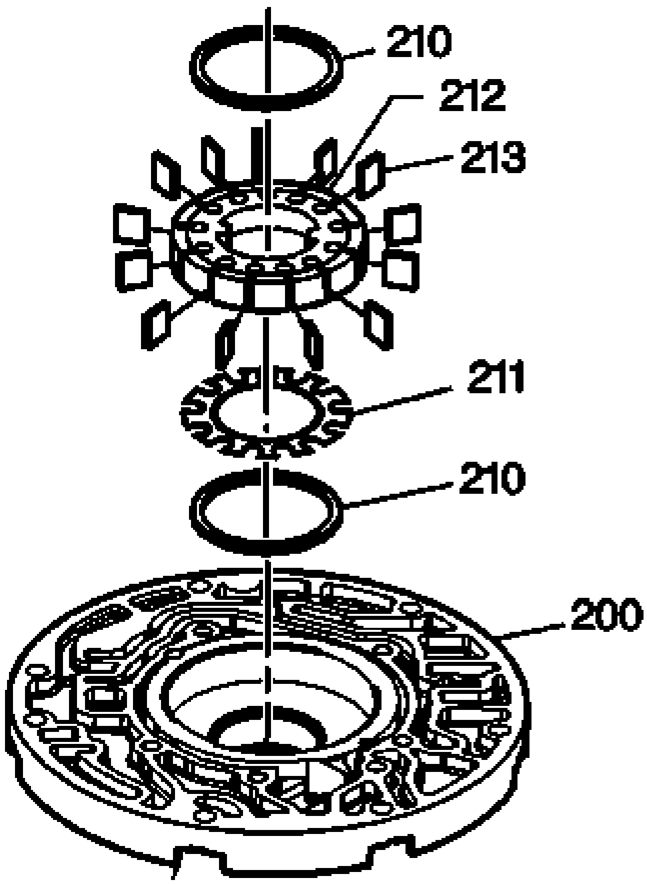


Fig. 207: Locating Center Support Bolt
Courtesy of GENERAL MOTORS CORP.

NOTE: Discard the center support bolt (25) after you have removed the bolt. Damage could result to the center support housing if you reuse the bolt.

1. Remove the center support bolt (25).

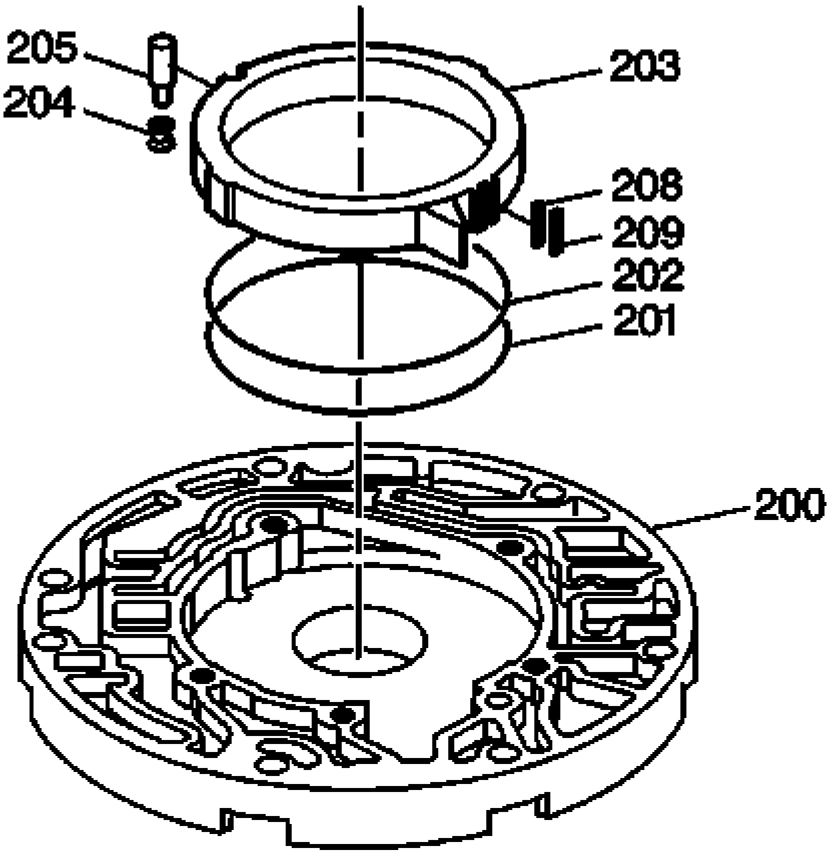


Fig. 208: View Of Rear Oil Cooler Pipe Fitting & Seal
Courtesy of GENERAL MOTORS CORP.

2. Remove the rear oil cooler pipe fitting (90).
3. Inspect the rear oil cooler pipe fitting (90) for damaged threads.
4. Inspect the rear oil cooler pipe fitting seal (91) for nicks or cuts.

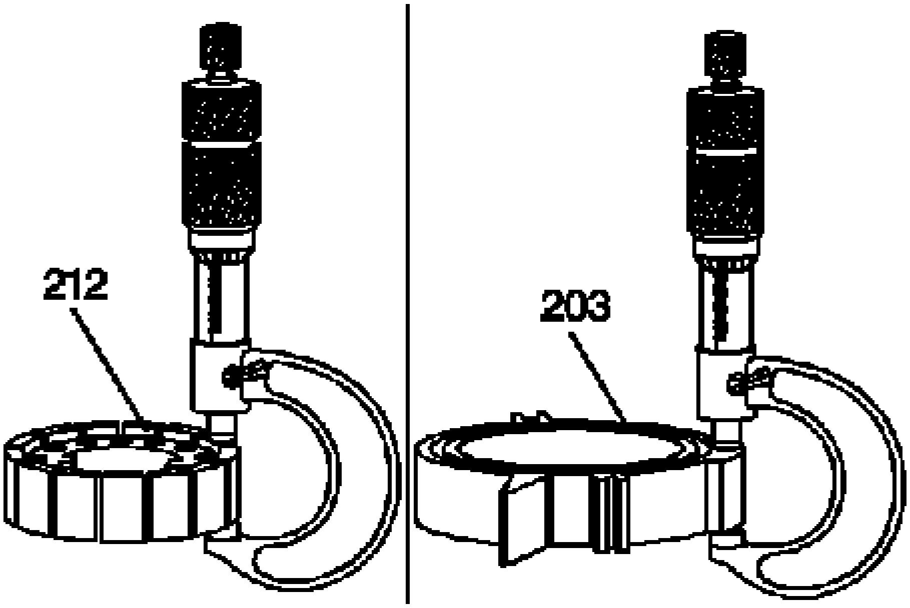


Fig. 209: Locating Center Support Retainer Ring
Courtesy of GENERAL MOTORS CORP.

5. Remove the center support retainer ring (633).

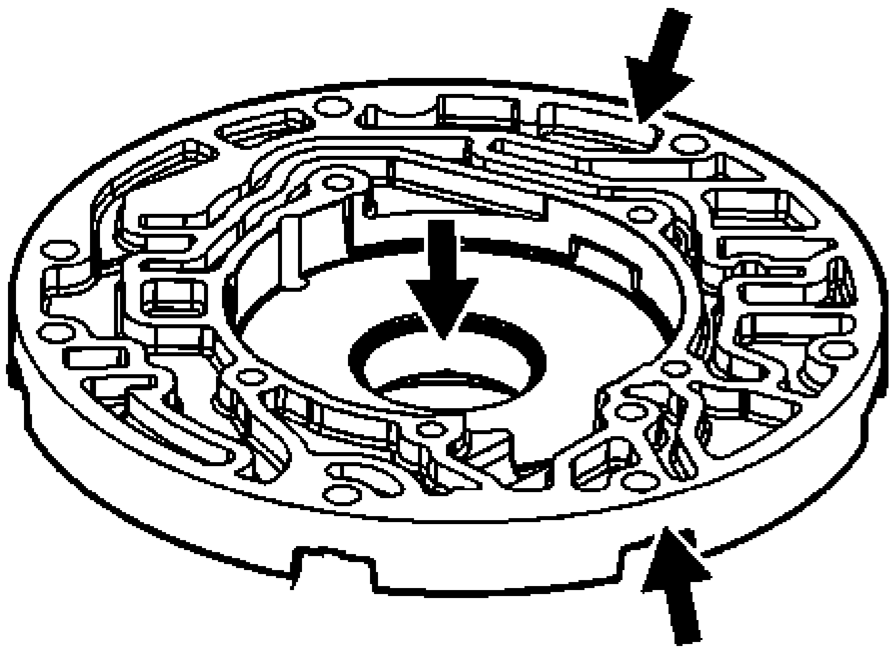


Fig. 210: View Of J 38868 & Transmission Main Shaft
Courtesy of GENERAL MOTORS CORP.

6. Attach the **J 38868** to the transmission main shaft. See **Special Tools**.
7. Tighten the thumb screw on the **J 38868** . See **Special Tools**.
8. Install the **J 6129** to the **J 38868** . See **Special Tools**.
9. Turn the **J 6129** so that the handle shaft contacts the transmission main shaft. See **Special Tools**.
10. Remove the center support and gear unit assembly (640-672) by lifting the **J 38868** with the **J 6129** . See **Special Tools**.
11. Remove the **J 6129** and the **J 38868** . See **Special Tools**.

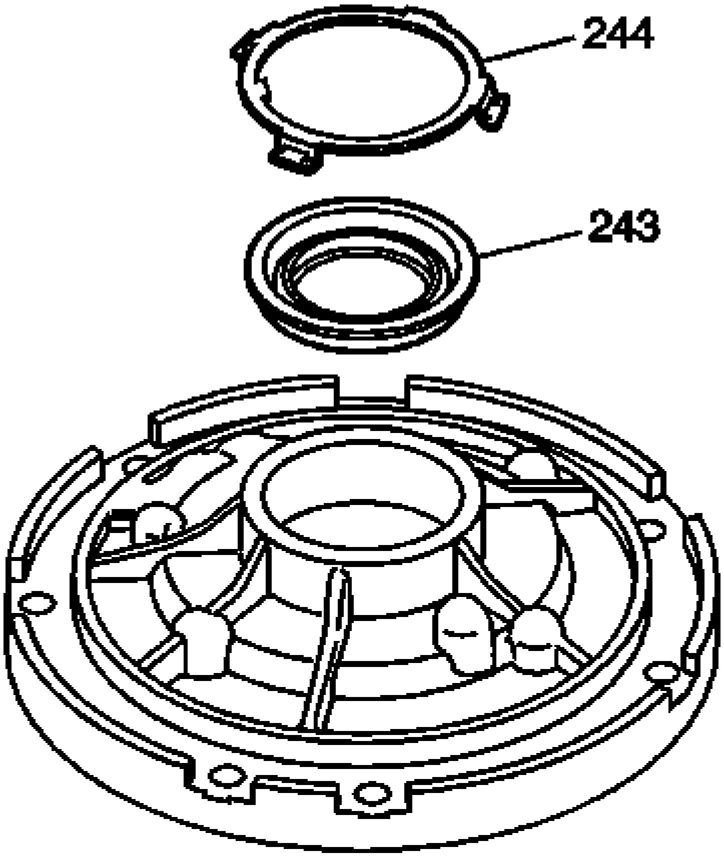


Fig. 211: View Of Center Support & Gear Unit Assembly
Courtesy of GENERAL MOTORS CORP.

12. Place the center support and gear unit assembly (640-672) into the **J 21364-A** (not visible in the illustration) and then into the **J 6116-A** . See **Special Tools**.

LOW AND REVERSE BAND REMOVAL

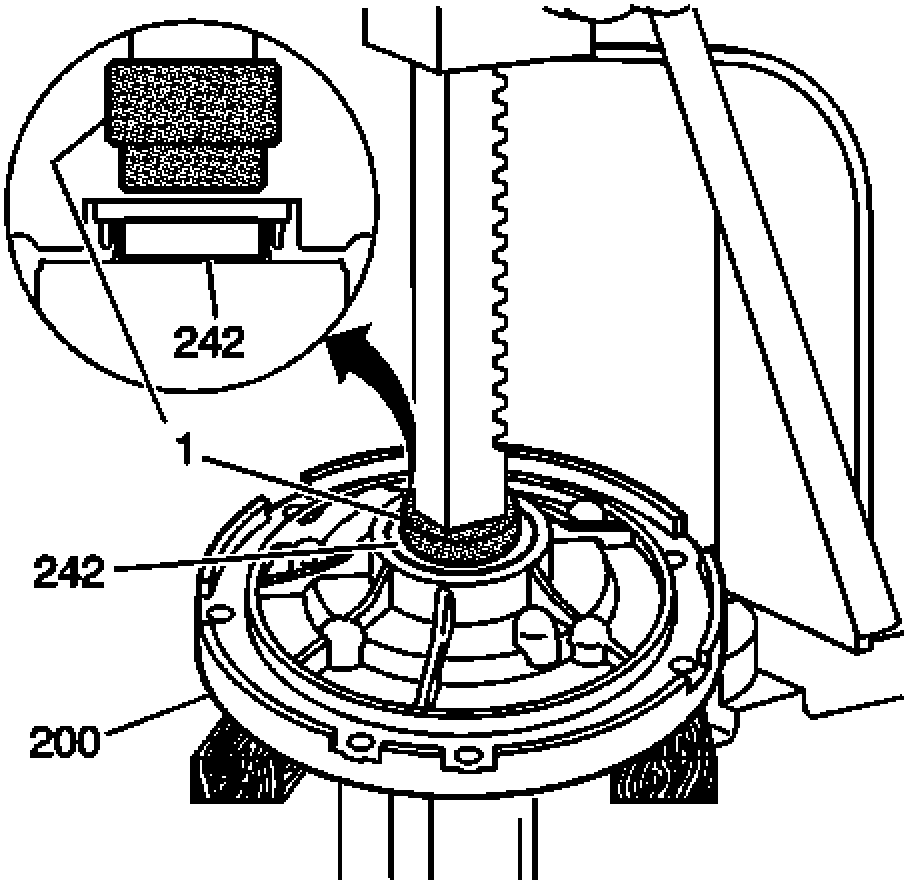


Fig. 212: View Of Low & Reverse Band Assembly
Courtesy of GENERAL MOTORS CORP.

1. Remove the center support spacer (643).

IMPORTANT: The thrust washers may be stuck to the output shaft and gear unit assembly or to the bottom of the transmission case.

2. Remove the selective thrust washer (674) from the transmission case.
3. Remove the low and reverse band assembly (657).
4. Inspect the low and reverse band assembly (657) and the selective thrust washer (674) for wear and damage.

OUTPUT SHAFT SEAL REMOVAL

Tools Required

- **J 6125-1B** Slide Hammer. See **Special Tools**.
- **J 23129** Universal Seal Remover. See **Special Tools**.

Procedure

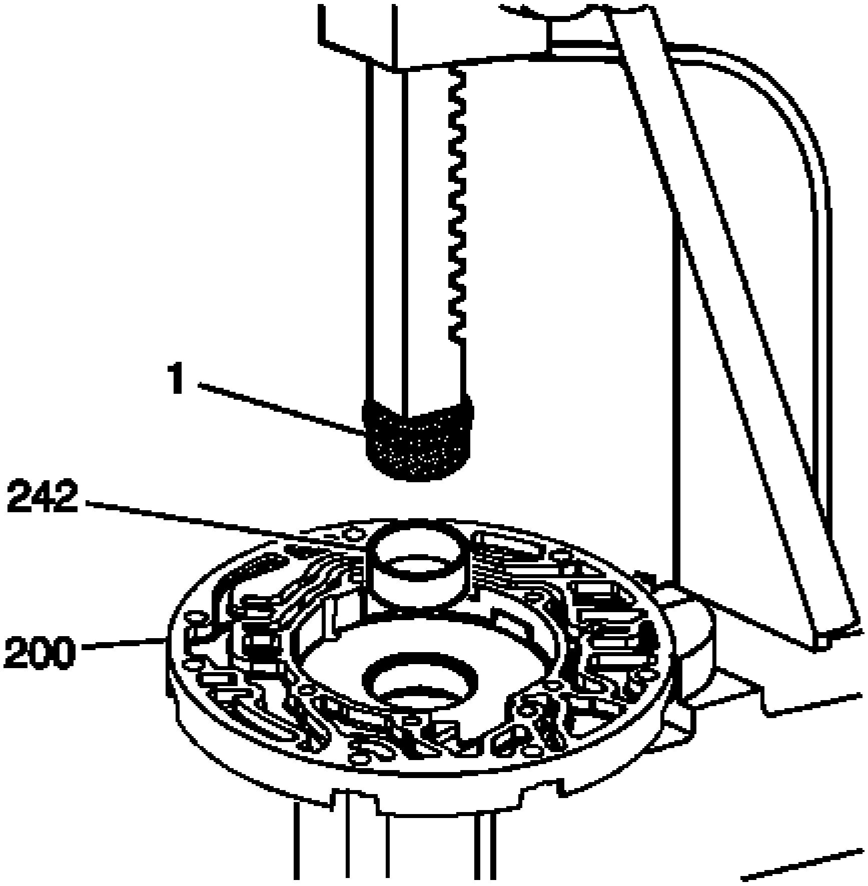


Fig. 213: Identifying Output Shaft Seal Retainer Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the output shaft seal retainer ring (14).
2. Inspect the output shaft seal retainer ring (14) for damage.

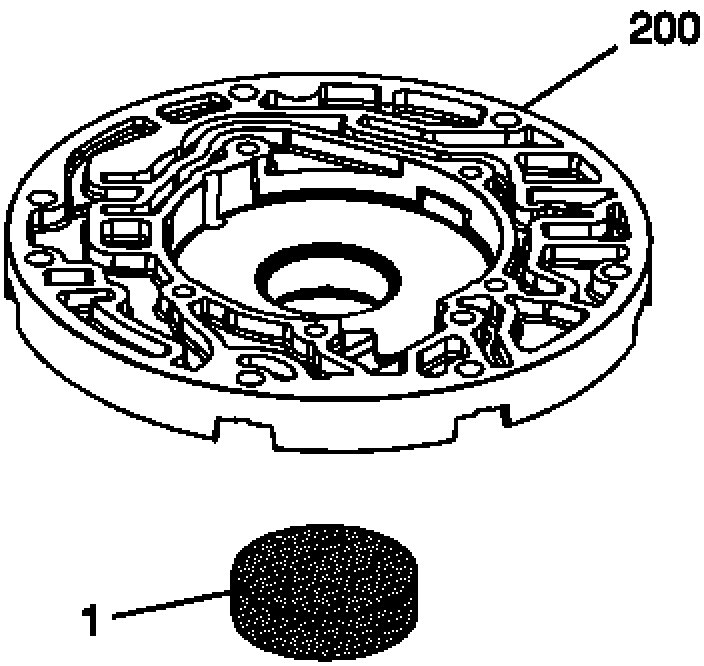


Fig. 214: Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 23129** and the **J 6125-1B** , remove the output shaft seal (13). See **Special Tools**.

TRANSMISSION CASE INSPECTION

Tools Required

J 36850 Transjel® Lubricant

Procedure

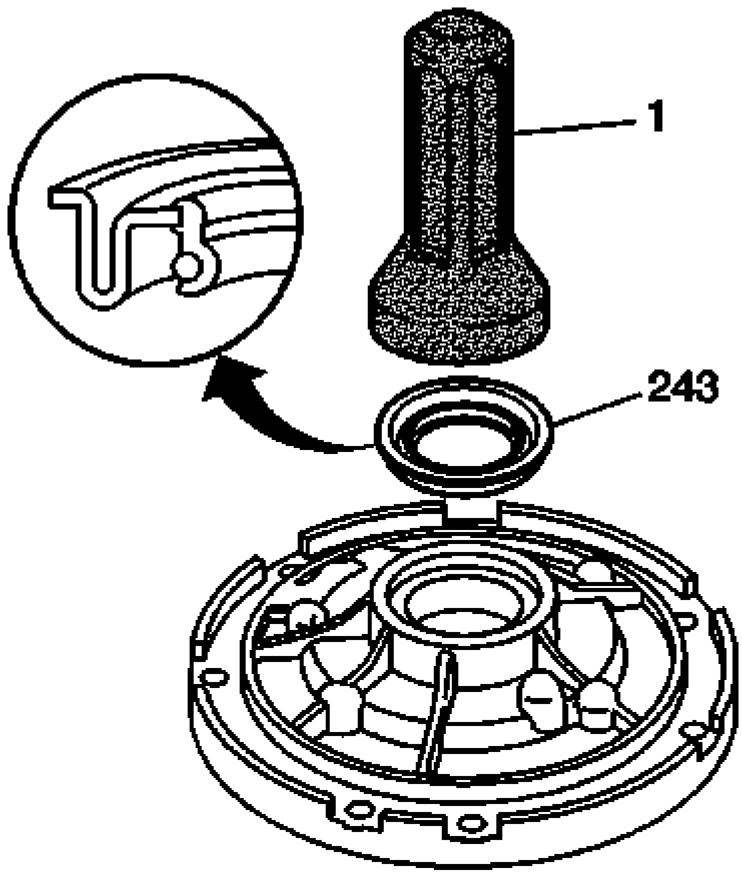


Fig. 215: Locating Inspection Areas In Transmission Case
Courtesy of GENERAL MOTORS CORP.

NOTE: Use J 36850 or equivalent during assembly in order to retain checkballs or to lubricate components. Lubricants other than the recommended assembly lube changes the transmission fluid characteristics and causes undesirable shift conditions or filter clogging.

1. Inspect the transmission case for the following:
   - Cracks
   - Porosity
   - Connected passages
   - Scored bushing
   - Excess gasket material left on any case surfaces
2. Inspect all threaded holes for damage. Use a Heli-Coil kit in order to repair damage to the threaded holes.
3. Air check all fluid passages. Refer to the hydraulic fluid flow diagrams and the fluid passage in **Fluid Passages**.
4. Inspect the manual 2-1 band servo bore and the low and reverse band servo bore for the following:
   - Porosity
   - Burrs

- Damage

5. Inspect the intermediate clutch plate lugs for damage.
6. Inspect the retainer ring grooves for damage.
7. Inspect the case center support bolt hole for damage.

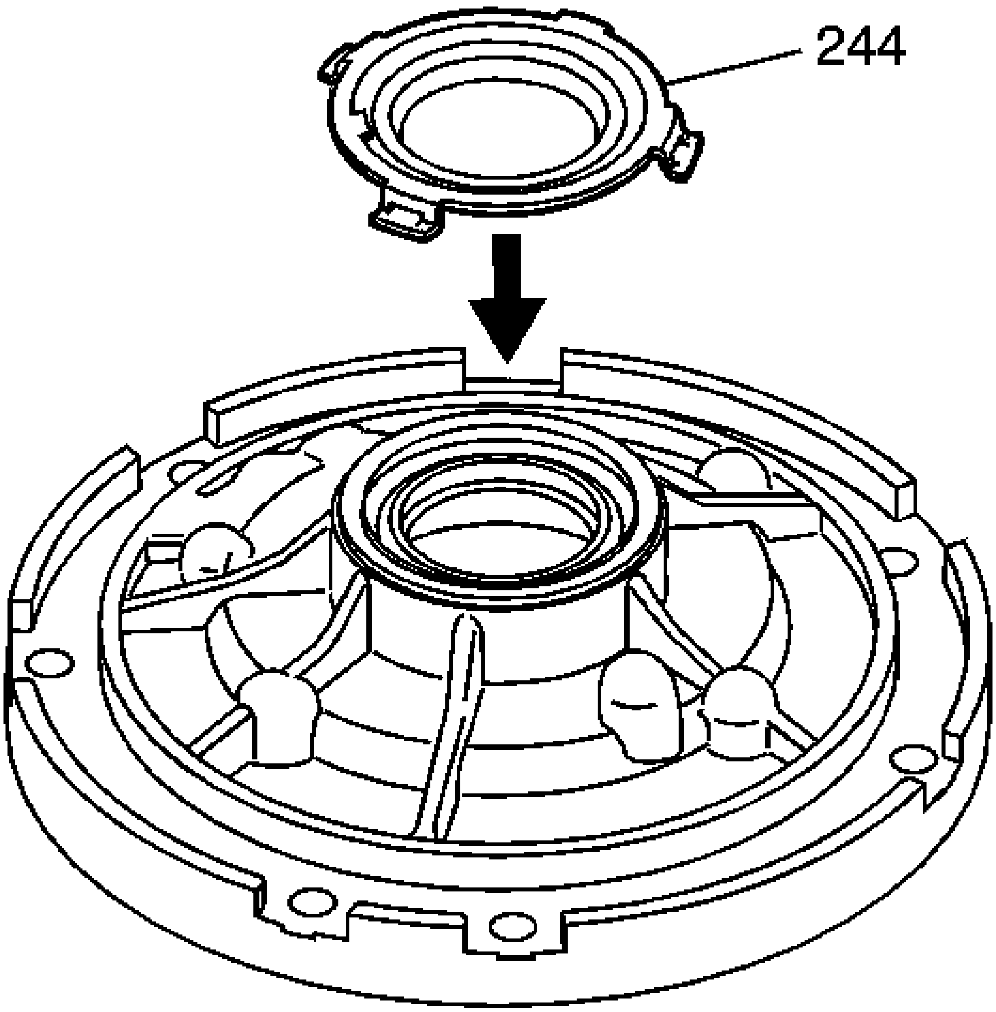


Fig. 216: Identifying Transmission Case Components Inspection Areas
Courtesy of GENERAL MOTORS CORP.

8. Inspect the oil cooler pipe fitting holes for damage.
9. Inspect the vent pipe for damage.

10. Inspect the lube oil orifice cup plug with seal (some models) for damage.
11. Inspect the low/reverse band anchor pins and intermediate band anchor pins for proper position and tightness.
12. Inspect the manual shaft bore for damage and porosity.

NOTE: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.

13. Clean all of the transmission case components using clean solvent.

OUTPUT SHAFT SEAL INSTALLATION

Tools Required

J 41505 Output Shaft Seal Installer. See **Special Tools**.

Procedure

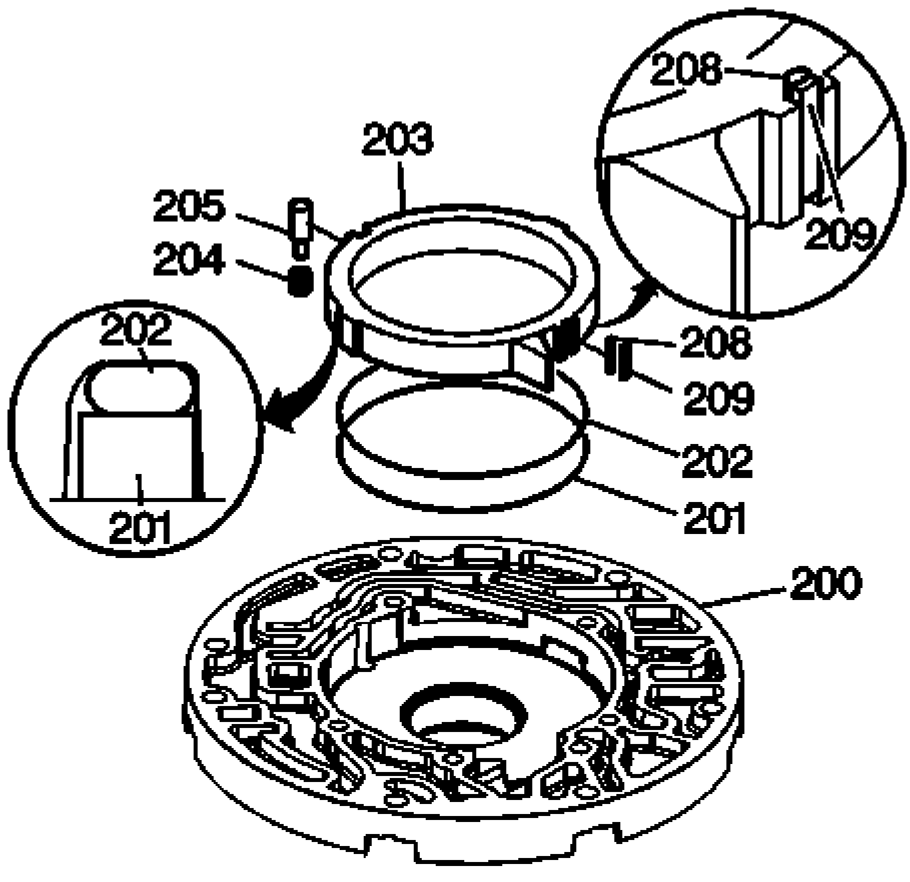


Fig. 217: Using J 41505 To Install Output Shaft Seal
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 41505** , install a new output shaft seal (13). See **Special Tools**.

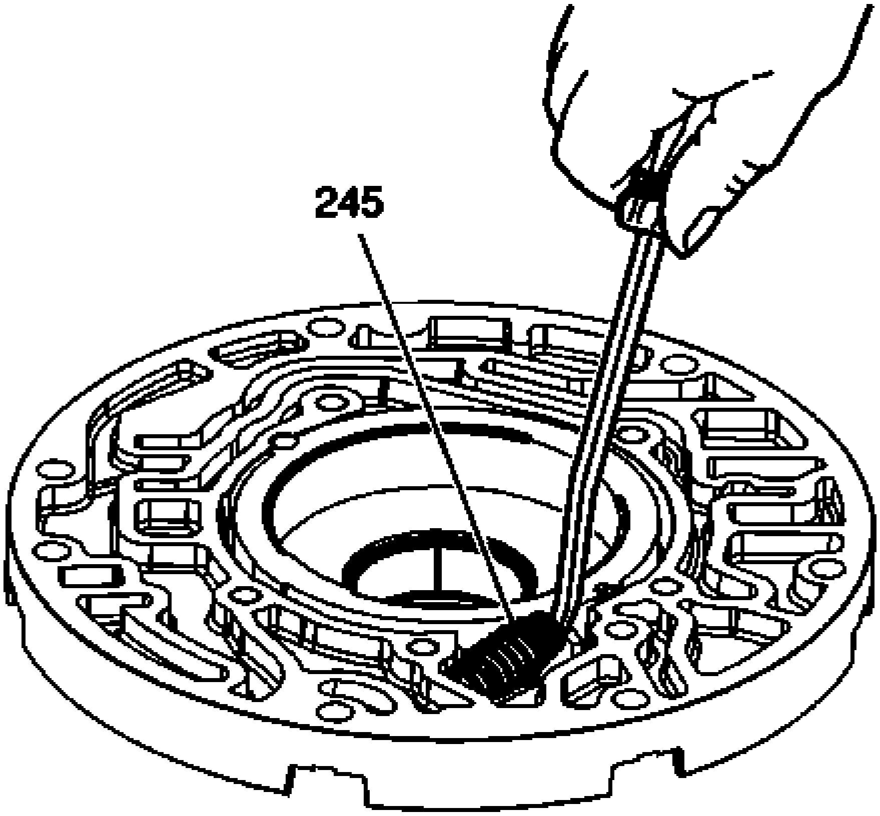


Fig. 218: Locating Output Shaft Seal Retainer Ring
Courtesy of GENERAL MOTORS CORP.

2. Install the output shaft seal retainer ring (14).

PARKING SYSTEM COMPONENTS INSTALLATION

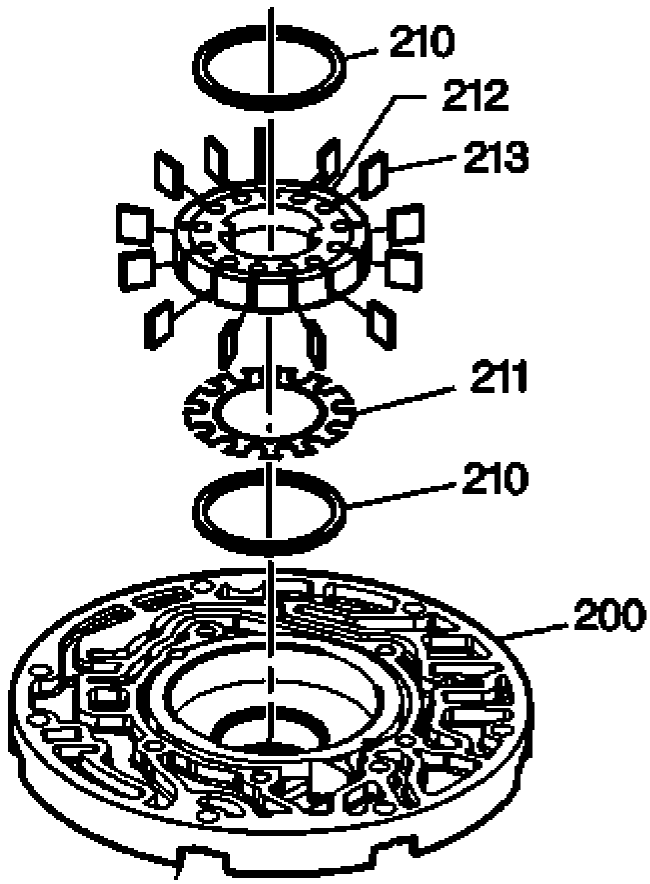


Fig. 219: View Of Parking Pawl Spring
Courtesy of GENERAL MOTORS CORP.

1. Install the parking pawl shaft (702) and the parking pawl (703).
2. Install the parking pawl shaft retainer (704).
3. Install the parking pawl spring (705).

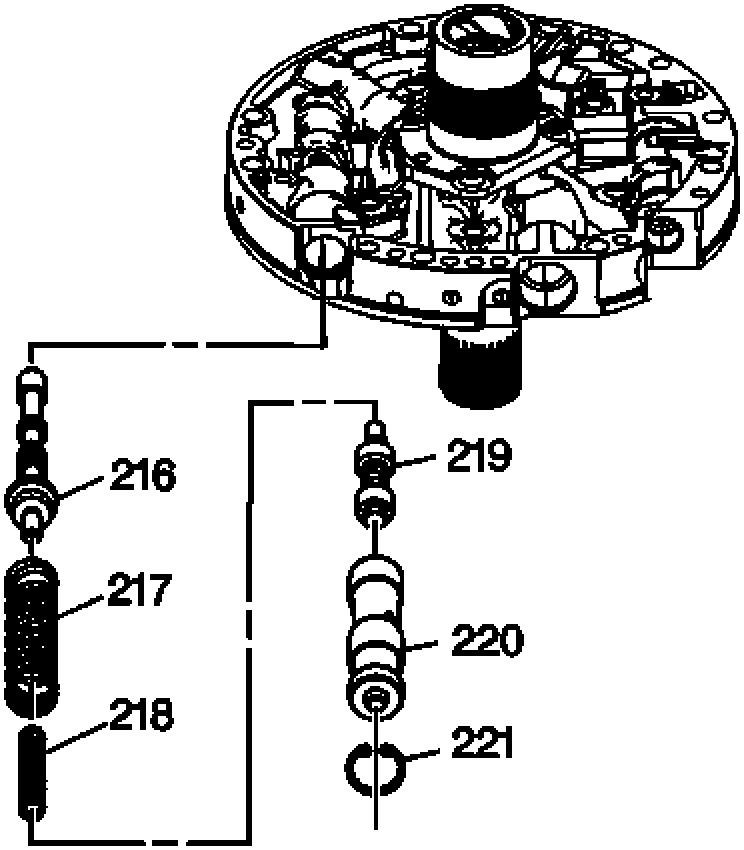


Fig. 220: Identifying Parking Pawl Shaft Hole Plug
Courtesy of GENERAL MOTORS CORP.

4. Apply sealer GM P/N 12345382 or equivalent, to the parking pawl shaft hole plug (701).
5. Using a 5/16 inch diameter rod, install the parking pawl shaft hole plug (701).

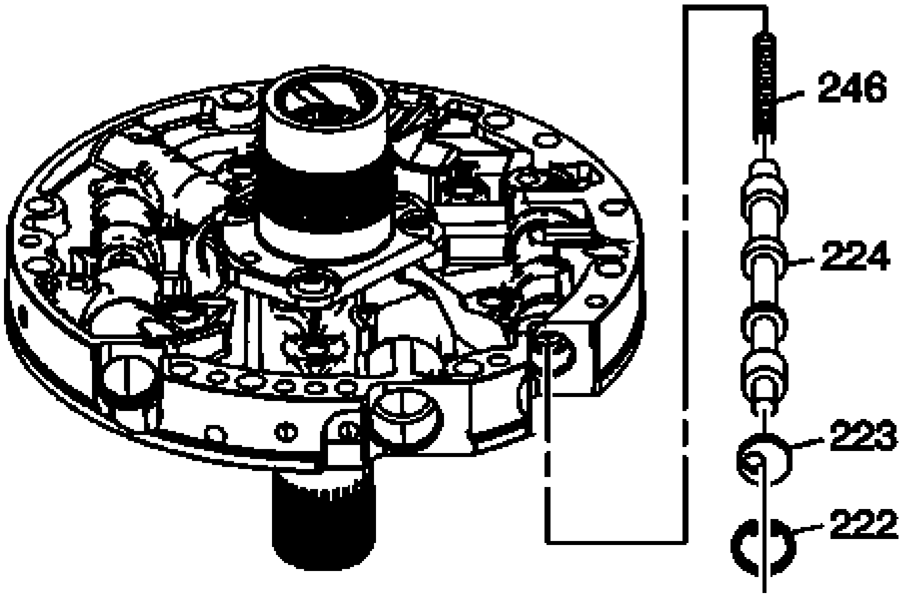


Fig. 221: Assembling Manual Shift Shaft Detent Lever To Parking Pawl Actuator Assembly
Courtesy of GENERAL MOTORS CORP.

6. Assemble the manual shift shaft detent lever assembly (711) to the parking pawl actuator assembly (710).
7. Install the parking pawl actuator assembly (710) over the parking pawl.

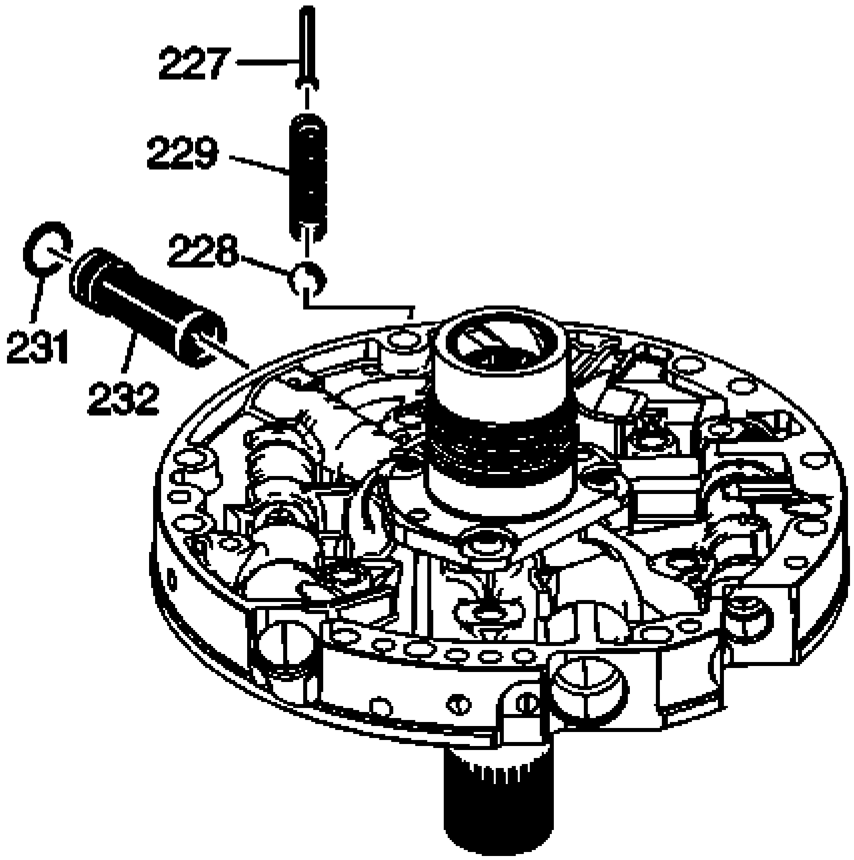


Fig. 222: Identifying Manual Shift Shaft & Components
Courtesy of GENERAL MOTORS CORP.

8. Install the manual shift shaft seal (707).
9. Partially install the manual shift shaft (708).
10. Install the manual shift shaft detent lever nut (712) onto the manual shift shaft (708).
11. Fully install the manual shift shaft (708).
12. Install the manual shift shaft pin (709) onto the manual shift shaft (708).

NOTE: **Refer to FASTENER NOTICE .**

13. Tighten the manual shift shaft detent lever nut (712).

    Tighten: Tighten the nut to 24 N.m (18 lb ft).

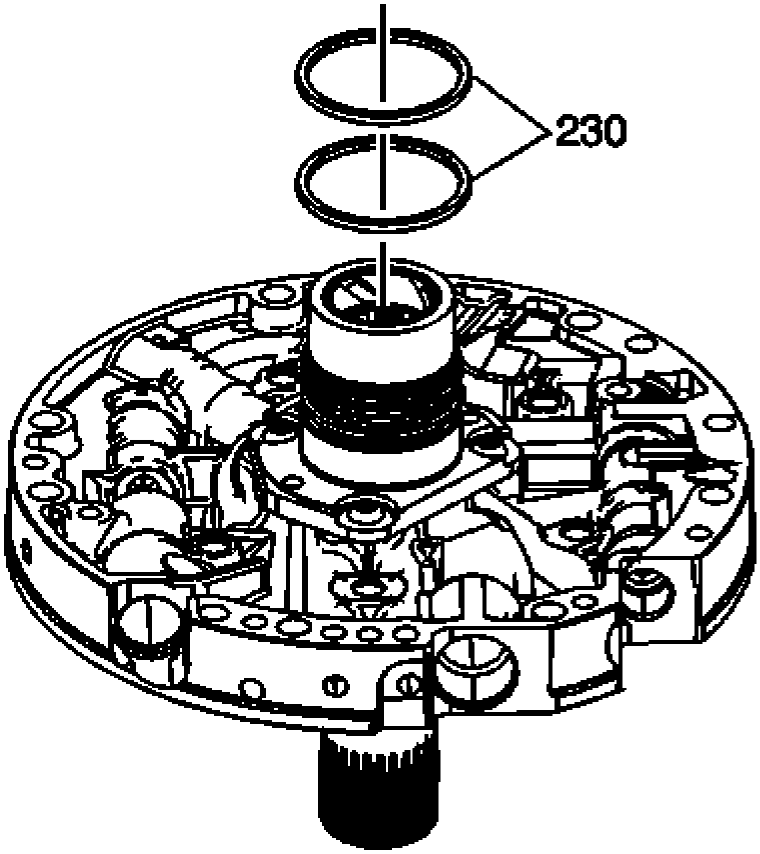


Fig. 223: Locating Parking Pawl Actuator Bracket & Bolts
Courtesy of GENERAL MOTORS CORP.

14. Install the parking pawl actuator bracket (713).
15. Install the parking pawl actuator bracket bolts (714).

    Tighten: Tighten the bolts to 24 N.m (18 lb ft).

LOW AND REVERSE BAND AND OUTPUT SHAFT THRUST WASHER INSTALLATION

Tools Required

- **J 28585** Snap Ring Remover. See **Special Tools**.
- **J 36850** Transjel® Lubricant

Procedure

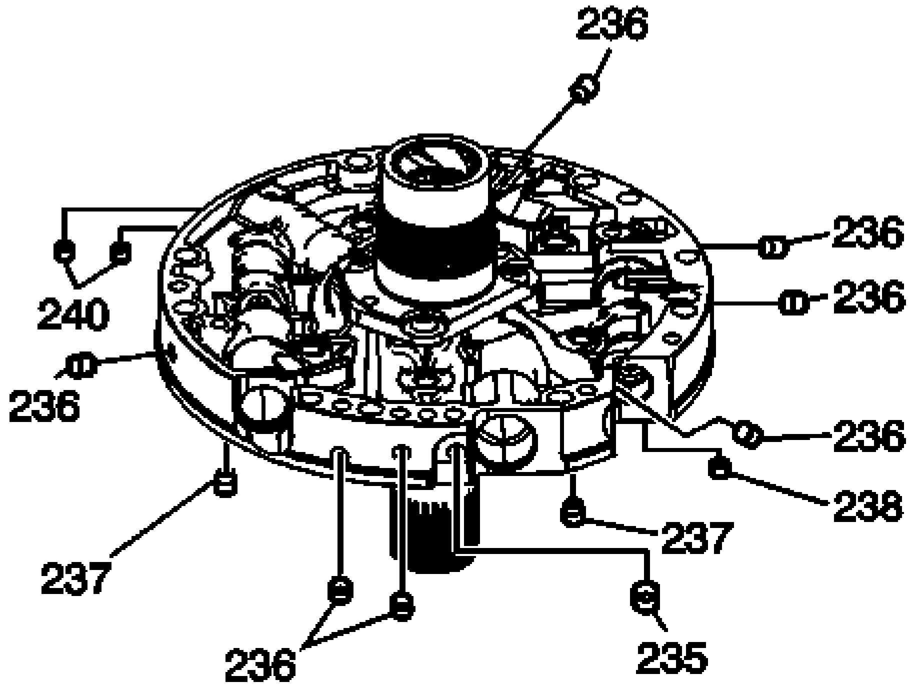


Fig. 224: Identifying Output Shaft Selective Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Refer to the rear unit end play measurement taken during disassembly. If the rear unit end play measurement is not within specifications, use the removed selective thrust washer (674) and the Output Shaft Selective Thrust Washer Specifications table in order to select the correct selective thrust washer. Refer to **End Play Specifications** .

IMPORTANT: One side of the output shaft selective thrust washer (674) is machined completely flat with no rounded edges. This side must face up.

2. Install the output shaft selective thrust washer (674).
3. Retain the output shaft selective thrust washer (674) with **J 36850** or equivalent.

IMPORTANT: When performing steps 4 and 5, align the low and reverse band tab with the low and reverse band servo pin hole.

4. Using **J 28585** , install the low and reverse band (657). See **Special Tools**.

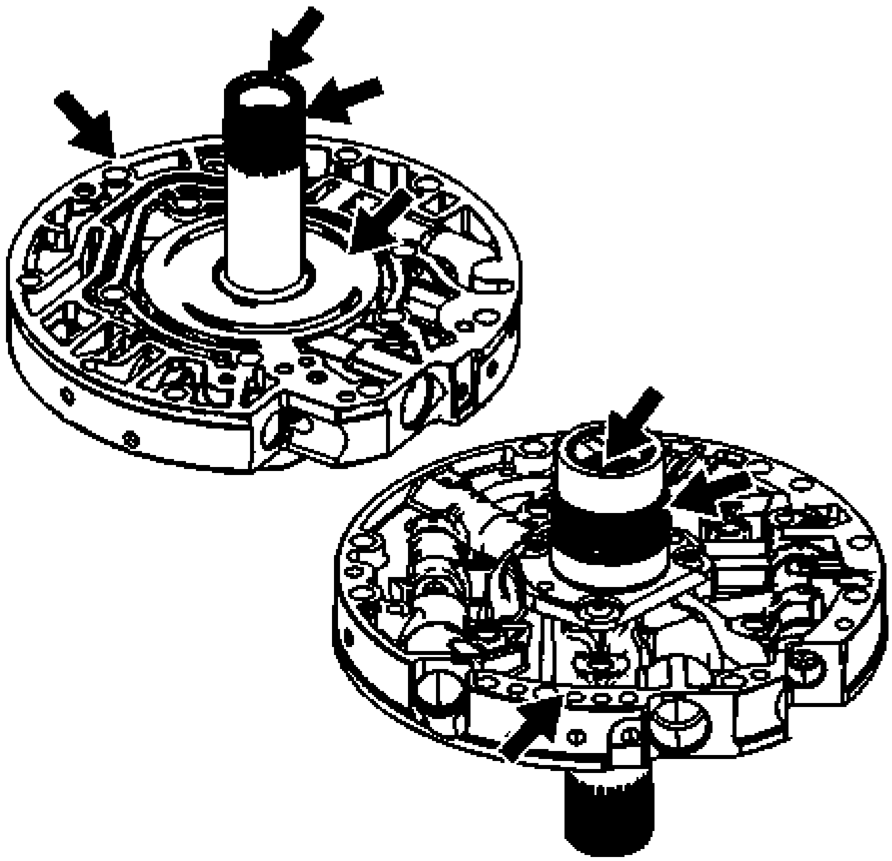


Fig. 225: Center Support Spacer Aligned In 9:00 Position
Courtesy of GENERAL MOTORS CORP.

5. Install the center support spacer (643) into the case so it rests on the shoulder at the bottom of the case splines. The center support spacer opening should be placed at the 9 o'clock position.

CENTER SUPPORT AND GEAR UNIT ASSEMBLY DISASSEMBLE

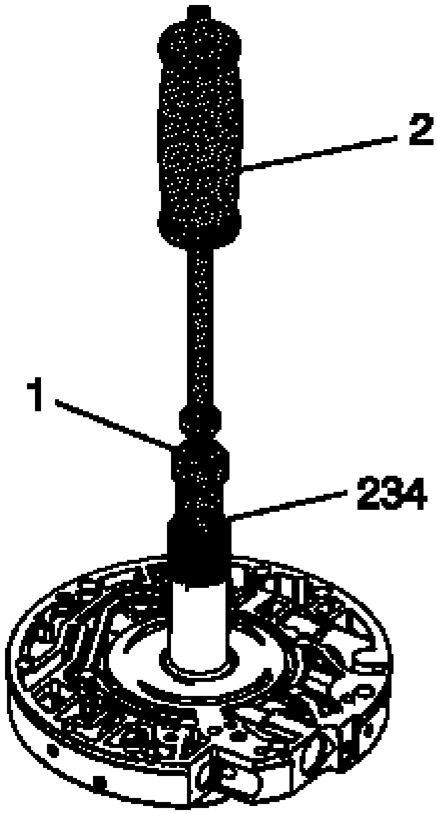


Fig. 226: Locating Reaction Carrier Thrust Washer
Courtesy of GENERAL MOTORS CORP.

1. Remove the center support assembly (640) from the reaction carrier assembly (651).
2. Remove the reaction carrier thrust washer (642) (brass). The thrust washer may be stuck to the center support assembly.

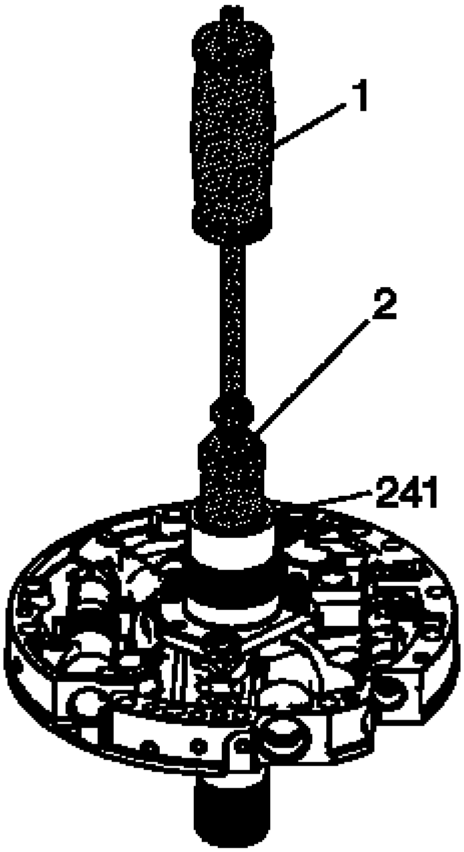


Fig. 227: Identifying Sun Gear Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

3. Remove the sun gear shaft assembly (649).
4. Inspect the sun gear shaft assembly (649) for the following:
    - Nicked, scored or worn bushings
    - Damaged splines and teeth
    - Cracks

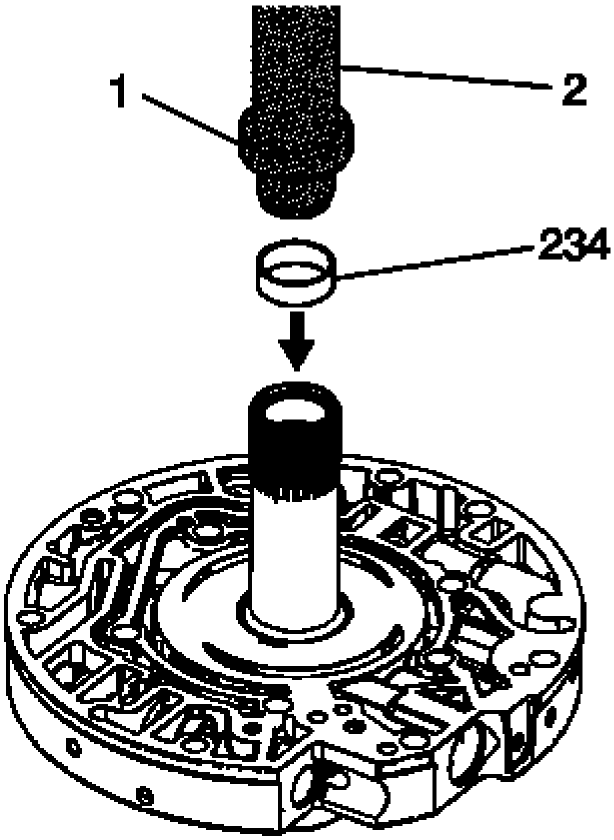


Fig. 228: View Of Inspection Areas On Reaction Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

5. Remove the reaction carrier assembly (651) from the output carrier assembly (661).
6. Remove the low clutch roller assembly (644) from the reaction carrier assembly (651).
7. Inspect the reaction carrier assembly (651) for the following:
    - The pinion gear and pocket thrust surfaces for damage
    - Cracks or damage to band apply surface
    - Pinion gear damage
    - Pinion gear pin for proper location (walking)
    - The bushings for damage
8. Inspect the low clutch roller assembly (644) for damage to the rollers, springs and cage surfaces.

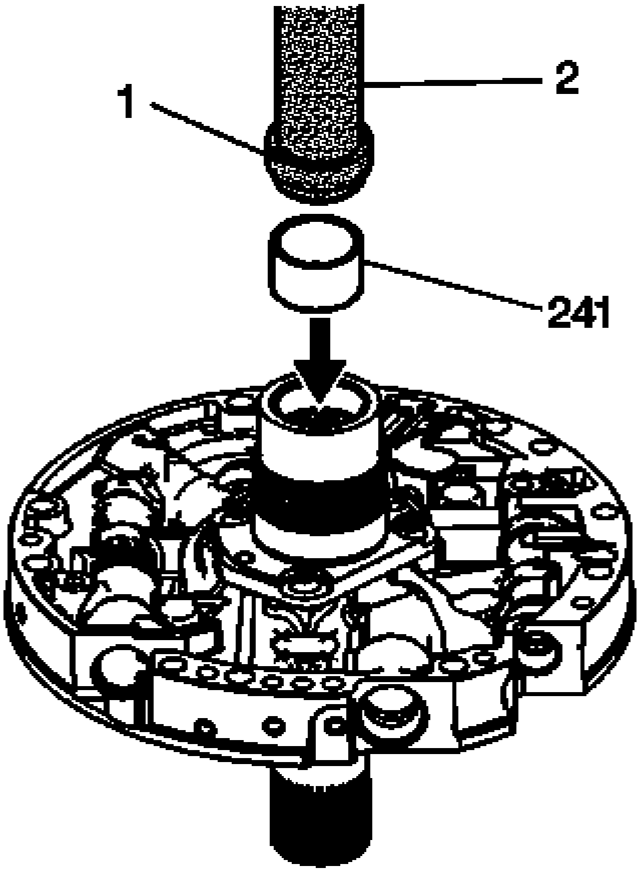


Fig. 229: Inspecting Sun Gear Front Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

9. Remove the sun gear front thrust bearing assembly (647).
10. Remove the sun gear thrust bearing races (646, 648). One race (646) may be stuck to the center support assembly.
11. Remove the sun gear (650).
12. Remove the output carrier thrust washer (659) from the output carrier assembly (661).
13. Inspect the thrust washer, the bearing assembly and the bearing races for damage.
14. Inspect the sun gear teeth for damage.

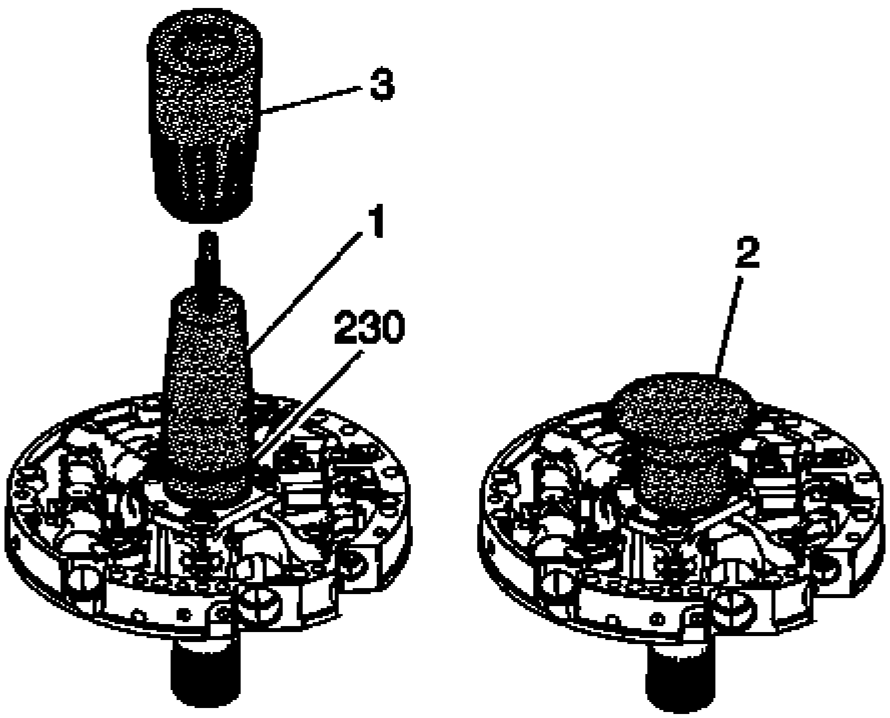


Fig. 230: Identifying Inspection Areas On Output Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

15. Turn the output carrier assembly (661) over so that the output shaft assembly (671) faces up.
16. Remove the output shaft thrust washer (673).
17. Remove the output shaft retainer ring (672).
18. Remove the output shaft assembly (671).
19. Inspect the output shaft assembly (671) for the following:
    - Stripped splines
    - Damaged teeth
    - Cracks
    - Damage to the bushing
20. Remove the rear internal gear thrust bearing assembly (647) and the thrust bearing races (648, 669) from the rear internal gear (666). The thrust bearing may be stuck to the output shaft assembly (671).
21. Inspect the thrust bearing assembly and bearing races for damage.

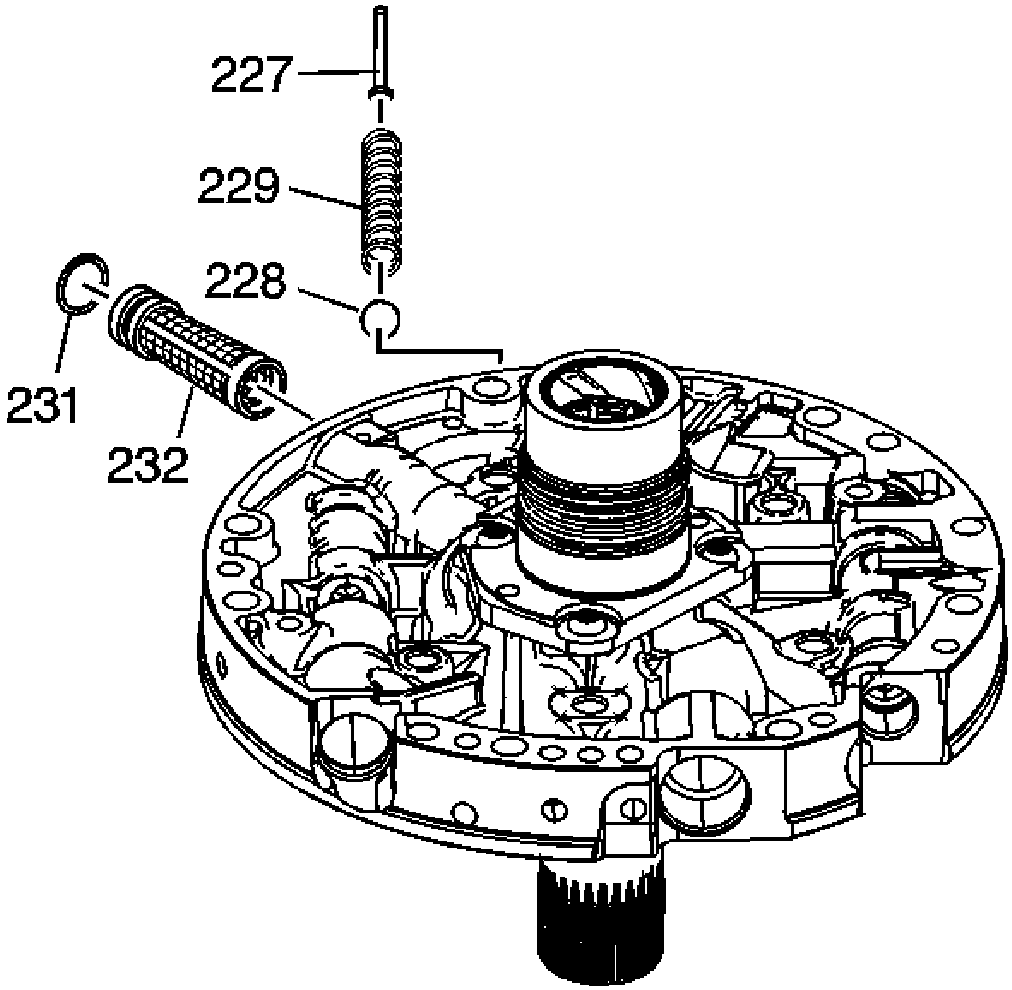


Fig. 231: View Of Sun Gear Rear Thrust Bearing Assembly & Bearing Races Inspection Areas
Courtesy of GENERAL MOTORS CORP.

22. Remove the rear internal gear (666) and the main shaft (662) from the output carrier assembly (661).
23. Remove the washer (691), the sun gear rear thrust bearing assembly (664) and bearing races (663, 665).
24. Inspect the bearing assembly, and the bearing races for damage.

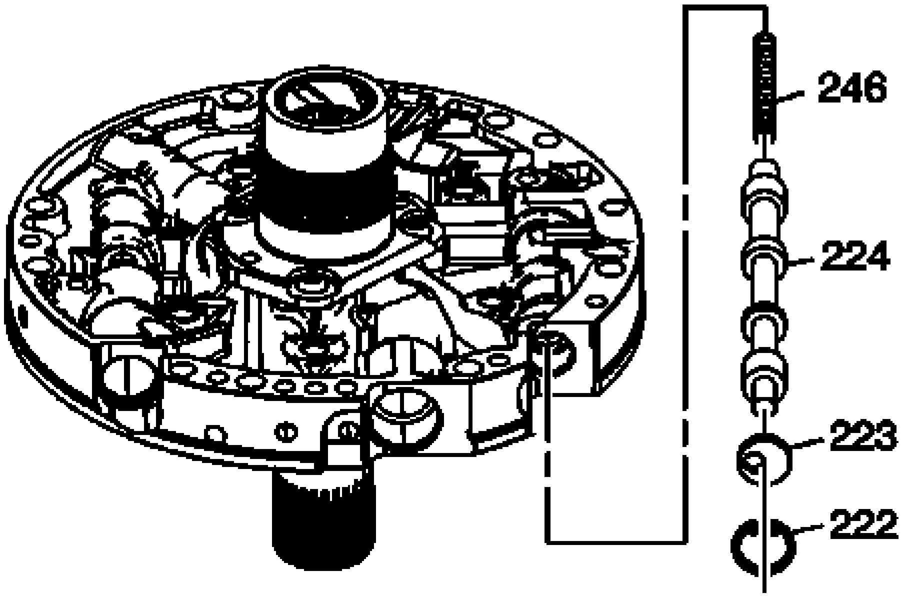


Fig. 232: Locating Inspection Areas On Rear Internal Gear
Courtesy of GENERAL MOTORS CORP.

25. Remove the main shaft retainer ring (670). Hold the main shaft (662) so it will not fall and become damaged.
26. Remove the main shaft (662) from the rear internal gear (666).
27. Inspect the main shaft (662) for damaged splines.
28. Inspect the main shaft (662) for wear.
29. Inspect the rear internal gear (666) for the following:
    - Stripped splines
    - Damaged teeth
    - Wear

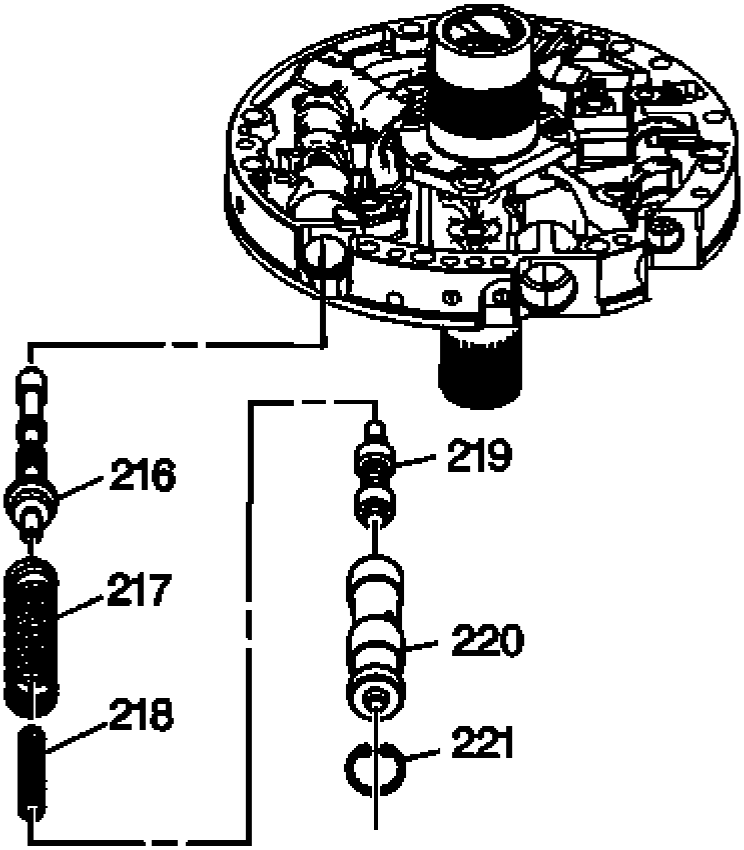


Fig. 233: Inspecting Output Carrier Assembly For Wear Or Damage
Courtesy of GENERAL MOTORS CORP.

30. Clean all components thoroughly.
31. Inspect the output carrier assembly (661) for the following:
    - Excessive wear
    - Damage to the parking pawl lugs
    - Damage to the pinion gears
    - Excessive wear to the pinion gear steel and brass washers
    - Damage to the pinion gear and pocket thrust surfaces.
32. Inspect the front internal gear for damage and cracks.
33. Inspect the vehicle speed sensor reluctor ring (660) for tightness and damage.

OUTPUT CARRIER PINION END PLAY MEASUREMENT

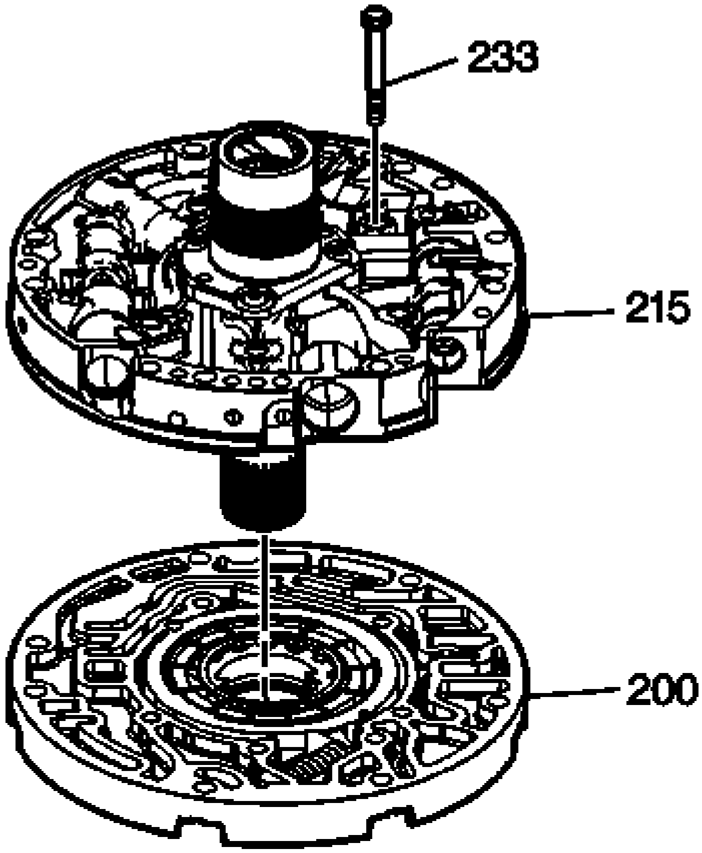


Fig. 234: Measuring Output Carrier Pinion End Play
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: End play specifications are the same for both the 4-pinion output carrier (661) and the 5-pinion output carrier.

Using a feeler gage, measure the pinion washer wear.

End Play Specifications: The correct end play is between 0.228-0.610 mm (0.009-0.024 in).

REACTION CARRIER PINION END PLAY

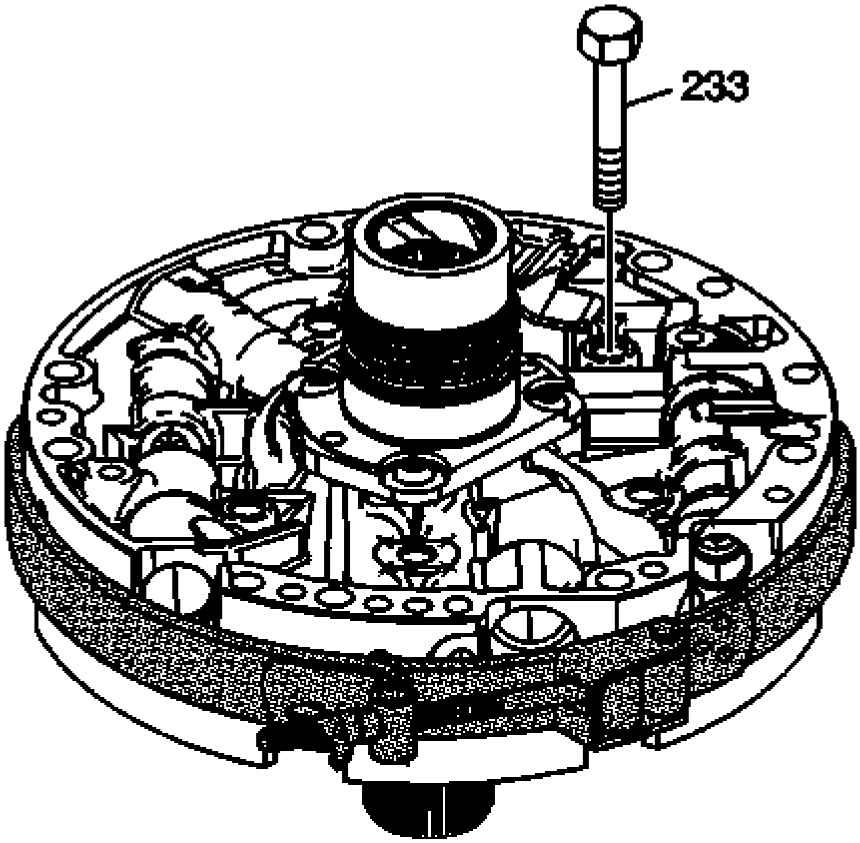


Fig. 235: Checking Reaction Carrier Pinion End Play With Feeler Gage
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: End play specifications are the same for both the 4-pinion reaction carrier (651) and the 5-pinion reaction carrier.

Using a feeler gage, measure the pinion washer wear.

End Play Specifications: The correct end play is between 0.228-0.610 mm (0.009-0.024 in).

REACTION CARRIER ASSEMBLE

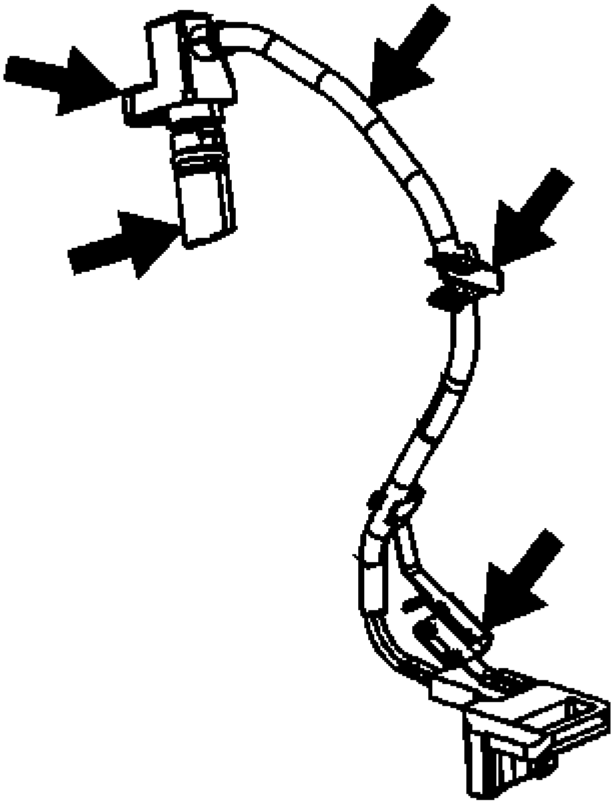


Fig. 236: View Of Low Clutch Roller Assembly & Reaction Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

Insert the low clutch roller assembly (644) into the reaction carrier assembly (651).

CENTER SUPPORT ASSEMBLY DISASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.

Procedure

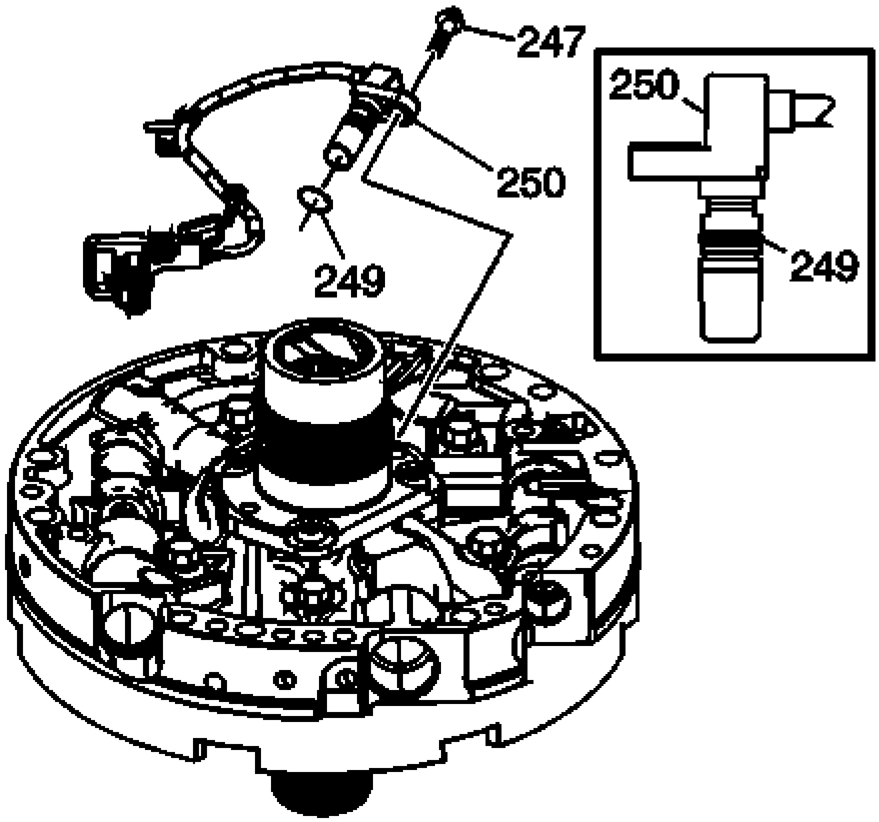


Fig. 237: View Of Oil Cooler Pipe Fitting Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the oil cooler pipe fitting seal (690) from the center support assembly (640).
2. Inspect the center support assembly (640) for damage.

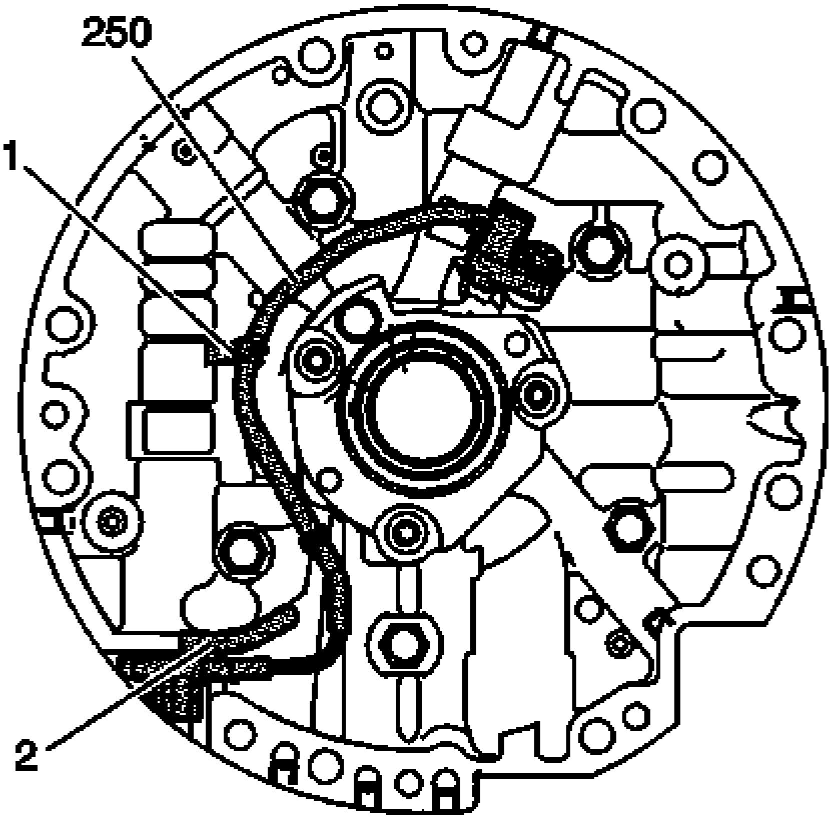


Fig. 238: Compressing Intermediate Clutch Spring Assembly With J 23327 & J 38734
Courtesy of GENERAL MOTORS CORP.

3. Using the **J 23327** and the **J 38734** , compress the intermediate clutch spring assembly (635). See **Special Tools**.
4. Remove the intermediate clutch spring retainer ring (634).
5. Remove the **J 23327** and the **J 38734** . See **Special Tools**.
6. Remove the intermediate clutch spring assembly (635).
7. Inspect the intermediate clutch spring assembly (635) for collapsed coils and distortion.

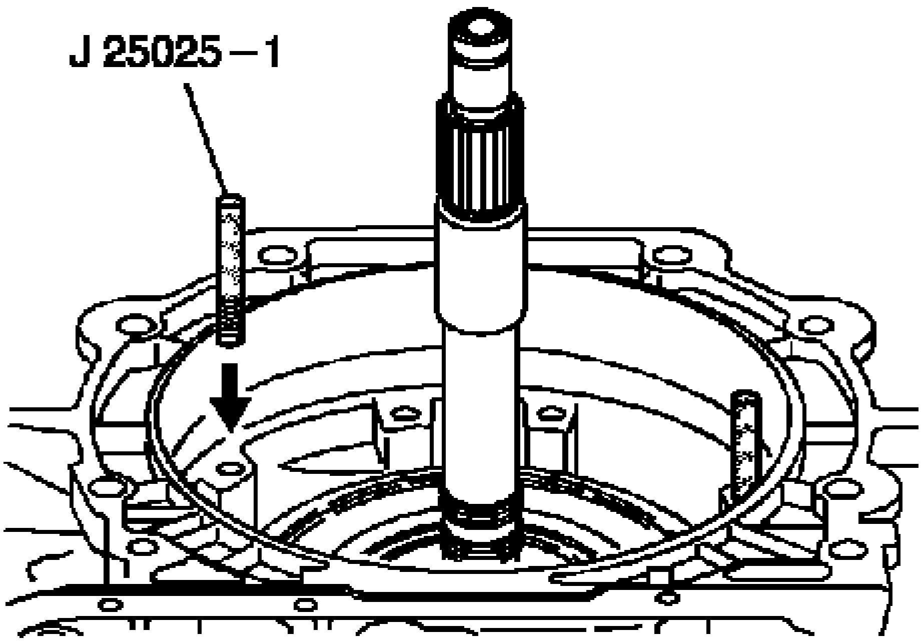


Fig. 239: Blowing Air Into Center Support Bolt Hole
Courtesy of GENERAL MOTORS CORP.

8. Remove the intermediate clutch piston (636). Apply compressed air to the center support bolt hole to aid in piston removal.

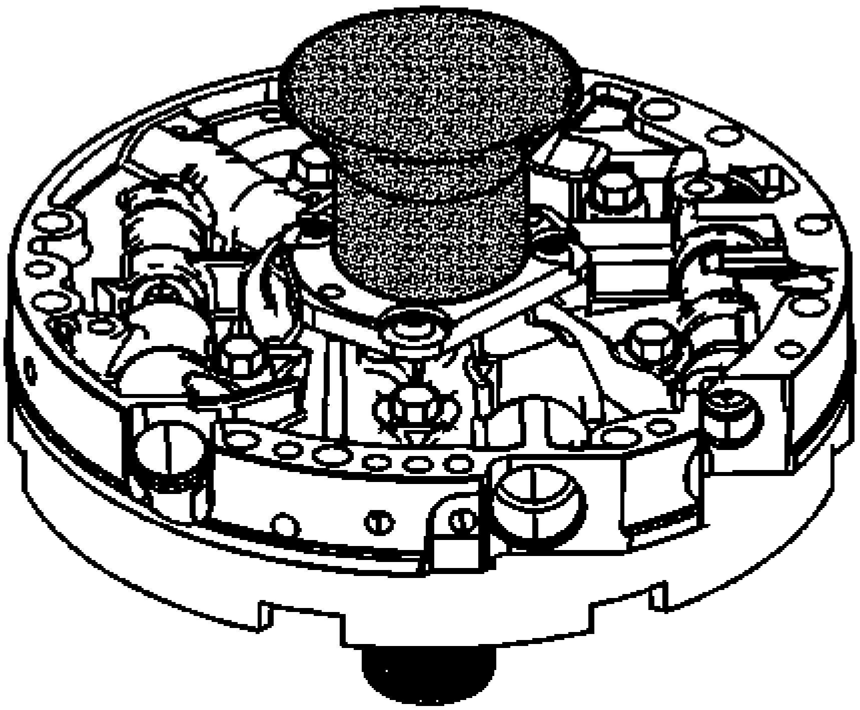


Fig. 240: Locating Inspection Areas On Intermediate Clutch Piston
Courtesy of GENERAL MOTORS CORP.

9. Remove the inner seal (637) and outer seal (638) from the intermediate clutch piston (636).
10. Inspect the intermediate clutch piston (636) for cracks and damage.

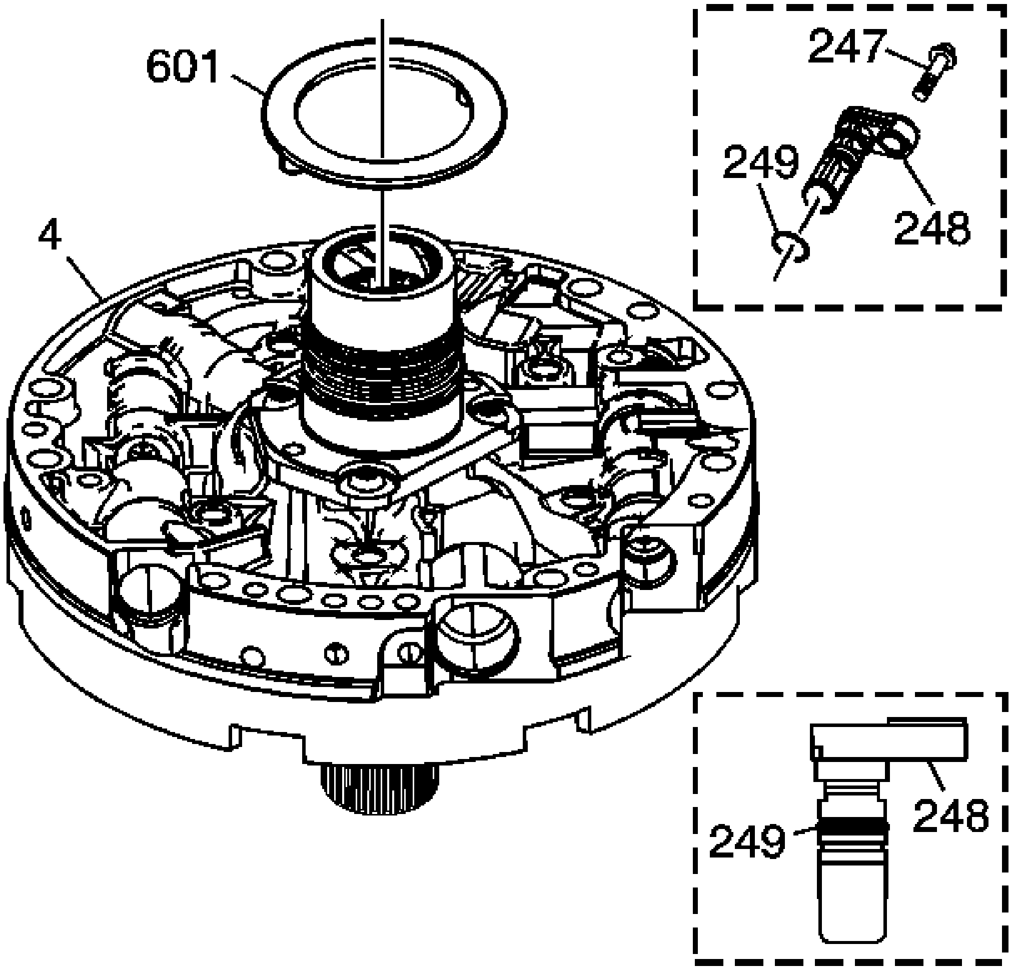


Fig. 241: Inspecting Center Support Assembly For Damage Or Wear
Courtesy of GENERAL MOTORS CORP.

11. Remove the direct clutch housing oil seal rings (639) from the center support assembly hub.

IMPORTANT: Do not disassemble the roller clutch race from the center support assembly (640). If a new center support assembly (640) is required, the support will come with a roller clutch race already installed.

12. Inspect the center support intermediate clutch orifice (530).

Orifice Specifications: This needs to be open approximately 0.51 mm (0.020 in).

13. Inspect the oil seal ring pockets for damage.

CENTER SUPPORT ASSEMBLY RECONDITIONING REPAIR

Tools Required

- **J 39919-1** Center Support Thread Reamer. See **Special Tools**.
- **J 39919-2** Center Support Pin Gage. See **Special Tools**.

Procedure

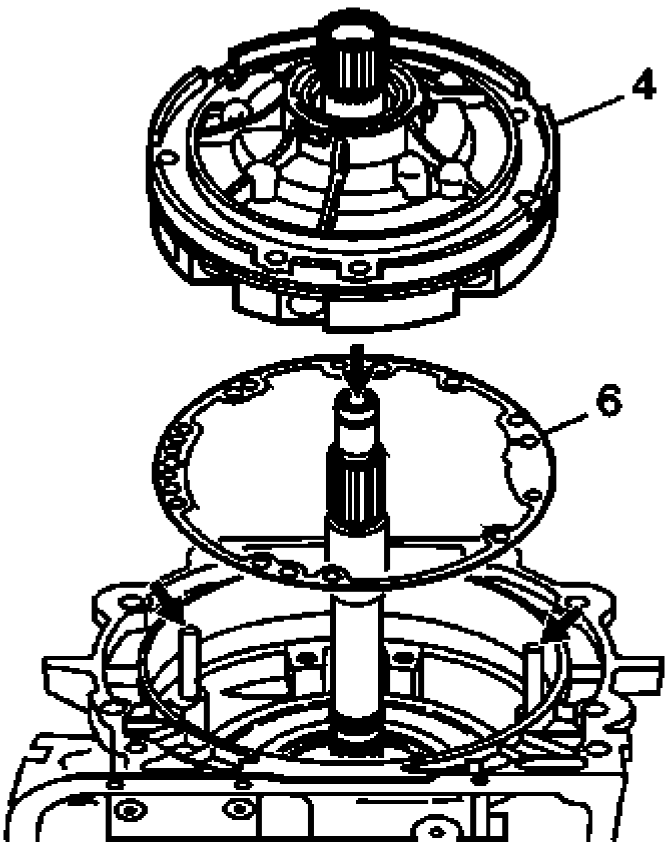


Fig. 242: Reaming Center Support Assembly Bolt Hole Using J 39919-1
Courtesy of GENERAL MOTORS CORP.

NOTE: **You may recondition the original center support assembly one time only. You must use the new, larger, service bolt with the reconditioned center support assembly in order to avoid component damage. The service bolt is yellow in color, and the production bolt is black in color.**

Perform one of the following steps:

- If the center support assembly has been previously reconditioned, or if the **J 39919-2** fits into the bolt hole, you MUST replace the center support assembly and bolt. See **Special Tools**.
- If the center support has never been previously reconditioned:
    1. Insert the **J 39919-2** into the center support assembly bolt hole. See **Special Tools**. If the **J 39919-2** does NOT fit into the center support bolt hole, you can recondition the center support assembly for reuse. See **Special Tools**.
    2. Ream the center support assembly bolt hole to the proper dimension using the **J 39919-1** . See **Special Tools**.

CENTER SUPPORT ASSEMBLY ASSEMBLE

Tools Required

- **J 21363** Intermediate Clutch Inner Seal Protector. See **Special Tools**.
- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 36850** Transjel® Lubricant
- **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.

Procedure

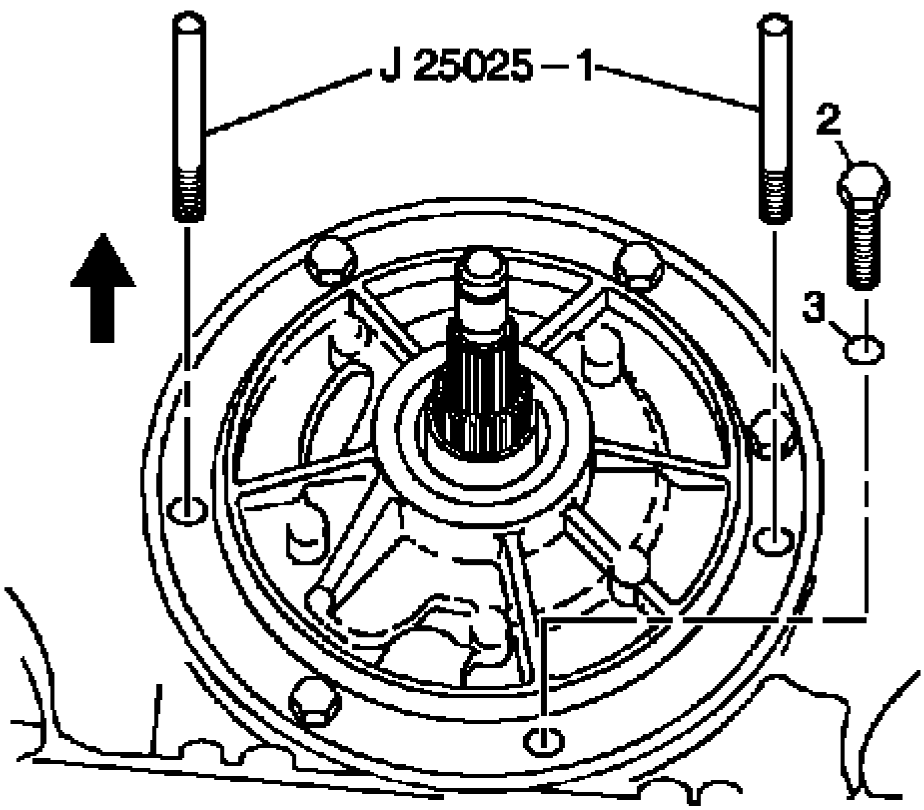


Fig. 243: View Of Oil Cooler Pipe Fitting Seal
Courtesy of GENERAL MOTORS CORP.

1. Install the oil cooler pipe fitting seal (690) into the center support assembly (640).

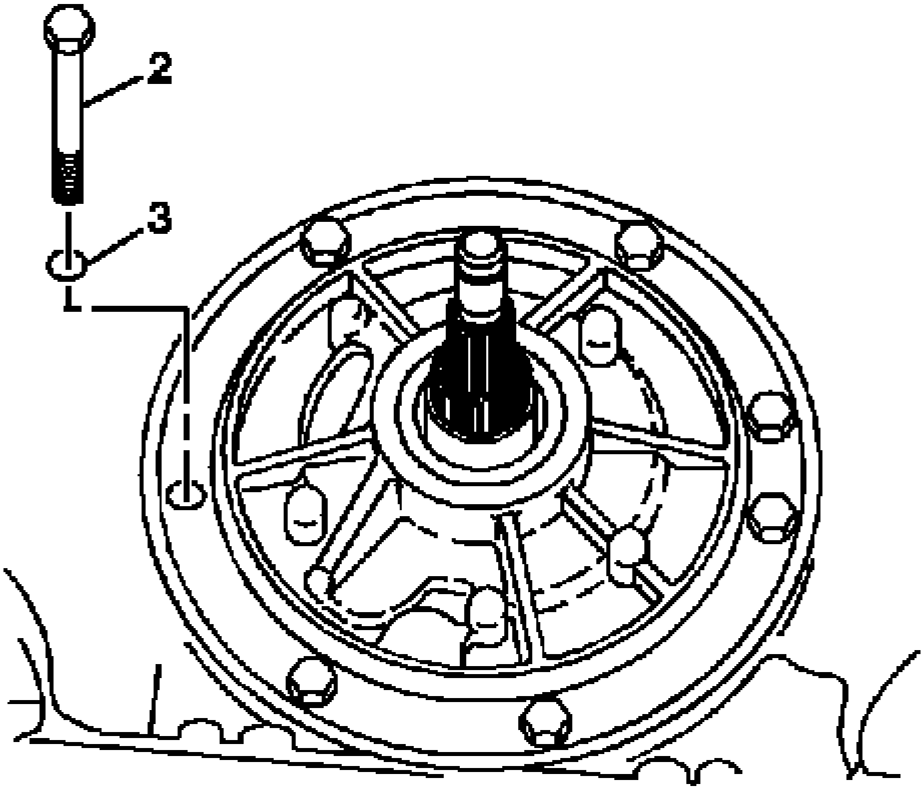


Fig. 244: Illustrating Inner And Outer Intermediate Clutch Piston Seals Alignment
Courtesy of GENERAL MOTORS CORP.

2. Lubricate the new inner (637) and outer (638) intermediate clutch piston seals, and the seal pockets in the intermediate clutch piston (636) with DEXRON®VI transmission fluid.
3. Install the inner (637) and outer (638) intermediate clutch piston seals onto the intermediate clutch piston (636) with the seal lips facing away from the spring pockets.

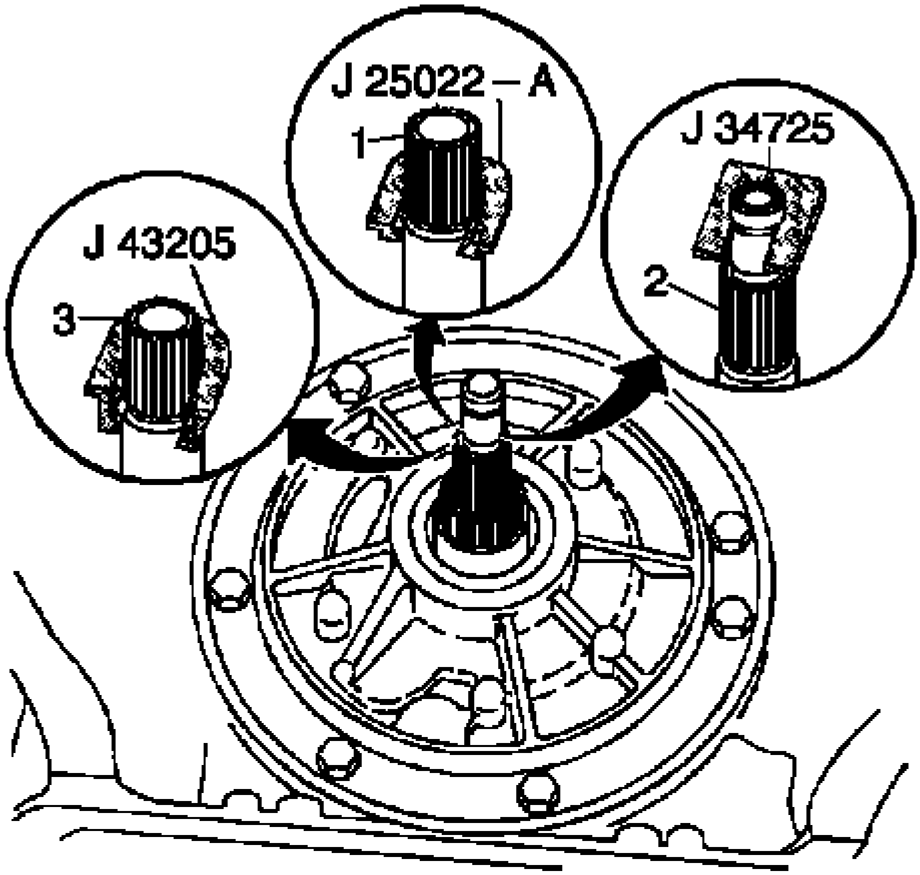


Fig. 245: Identifying J 21363
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 21363** , install the intermediate clutch piston (636) onto the center support assembly (640). See **Special Tools**. Use a fine feeler gauge blade to assist with installing the piston outer seal.
5. Remove the **J 21363** . See **Special Tools**.

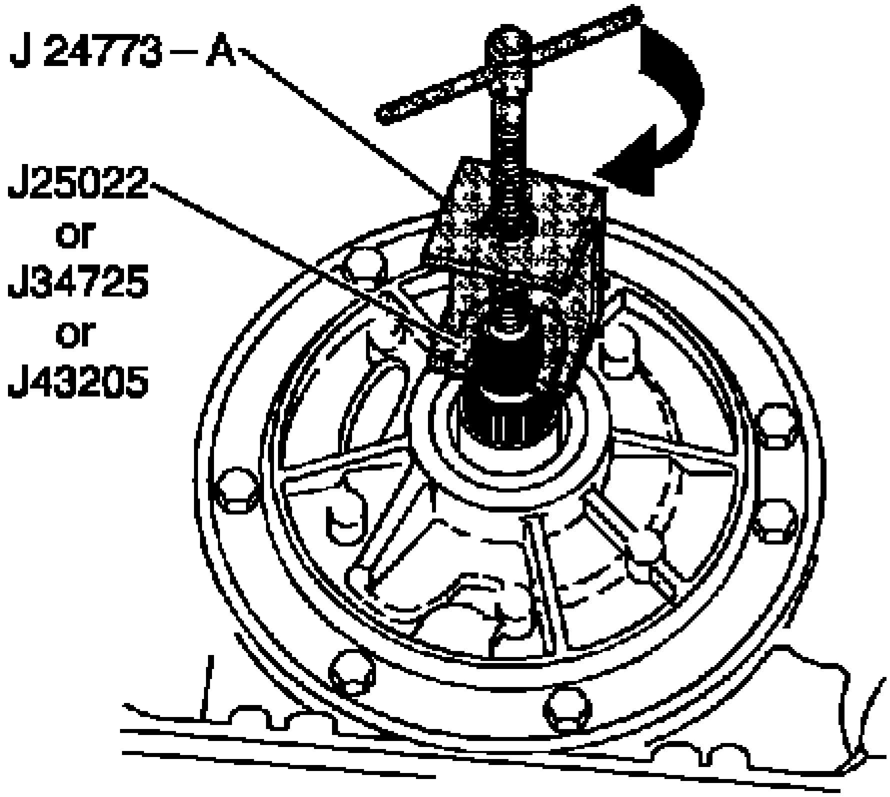


Fig. 246: Retainer Ring On Intermediate Clutch Spring Assembly
Courtesy of GENERAL MOTORS CORP.

6. Install the intermediate clutch spring assembly (635). Align the springs with the pockets in the intermediate clutch piston.
7. Using the **J 38734** and the **J 23327** , install the intermediate clutch spring retainer ring (634). See **Special Tools**.
8. Remove the **J 38734** and the **J 23327** . See **Special Tools**.

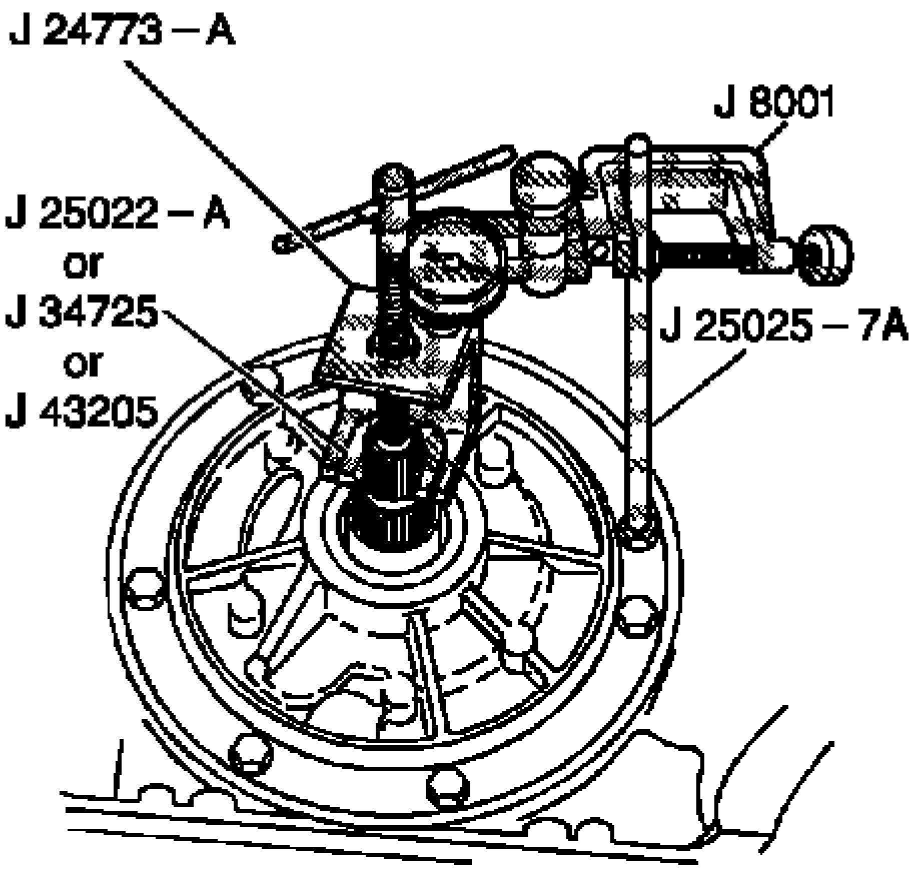


Fig. 247: Locating Direct Clutch Housing Oil Seal Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not overexpand the oil seal rings. Damage to the rings may result.

9. Install the new direct clutch housing oil seal rings (639) onto the center support assembly (640).
10. Use **J 36850** or equivalent in order to keep the oil seal rings in place.

CENTER SUPPORT AND GEAR UNIT ASSEMBLY ASSEMBLE

Tools Required

- **J 6116-A** Rear Gear Holding Fixture. See **Special Tools**.
- **J 36850** Transjel® Lubricant

Procedure

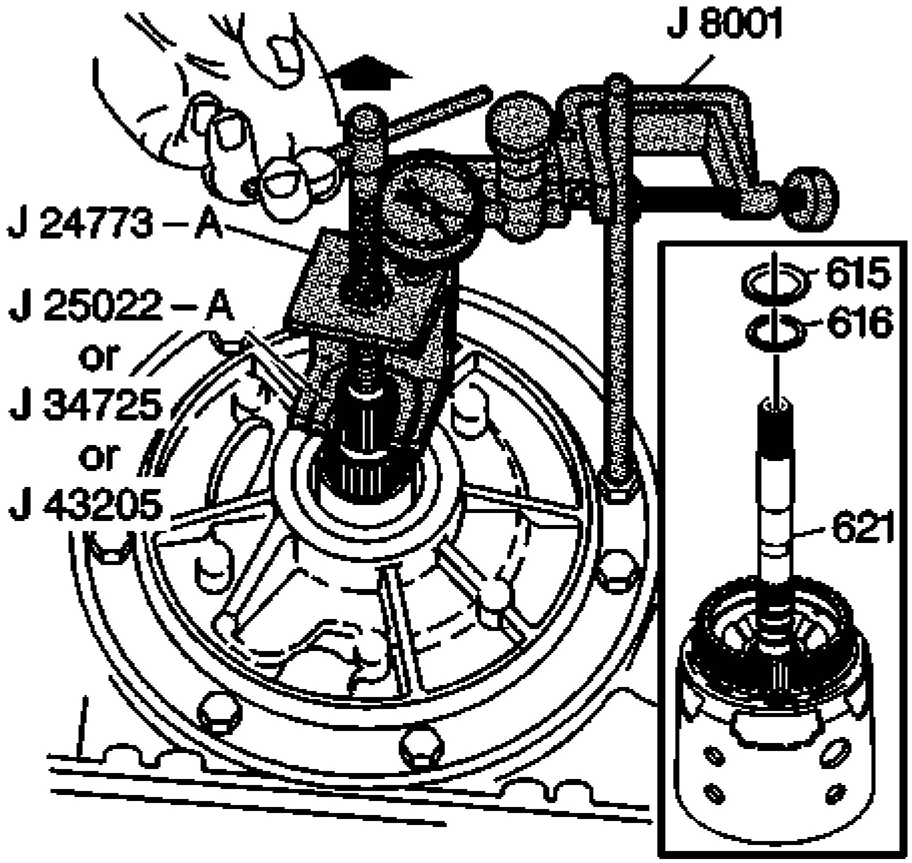


Fig. 248: View Of Main Shaft, Retainer Ring & Rear Internal Gear
Courtesy of GENERAL MOTORS CORP.

1. Insert the main shaft (662) into the rear internal gear (666).
2. Install the main shaft retainer ring (670) onto the main shaft (662).

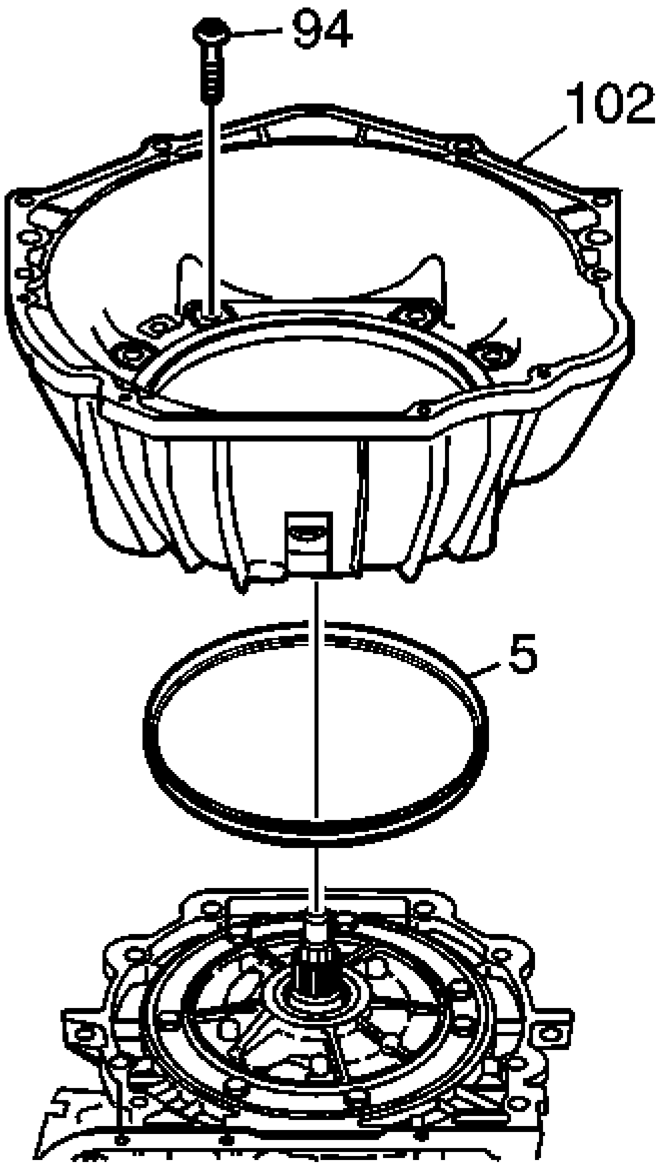


Fig. 249: View Of Rear Internal Gear Bearings & Washers
Courtesy of GENERAL MOTORS CORP.

3. Install the washer (691) onto the main shaft (662).
4. Install the sun gear rear thrust bearing assembly (664) and bearing races (663, 665) onto the main shaft (662).

5. The lips on the sun gear thrust bearing races (663, 665) should face the sun gear rear thrust bearing assembly (664).
6. Retain the washer, sun gear rear thrust bearing assembly and bearing races with **J 36850** or equivalent.

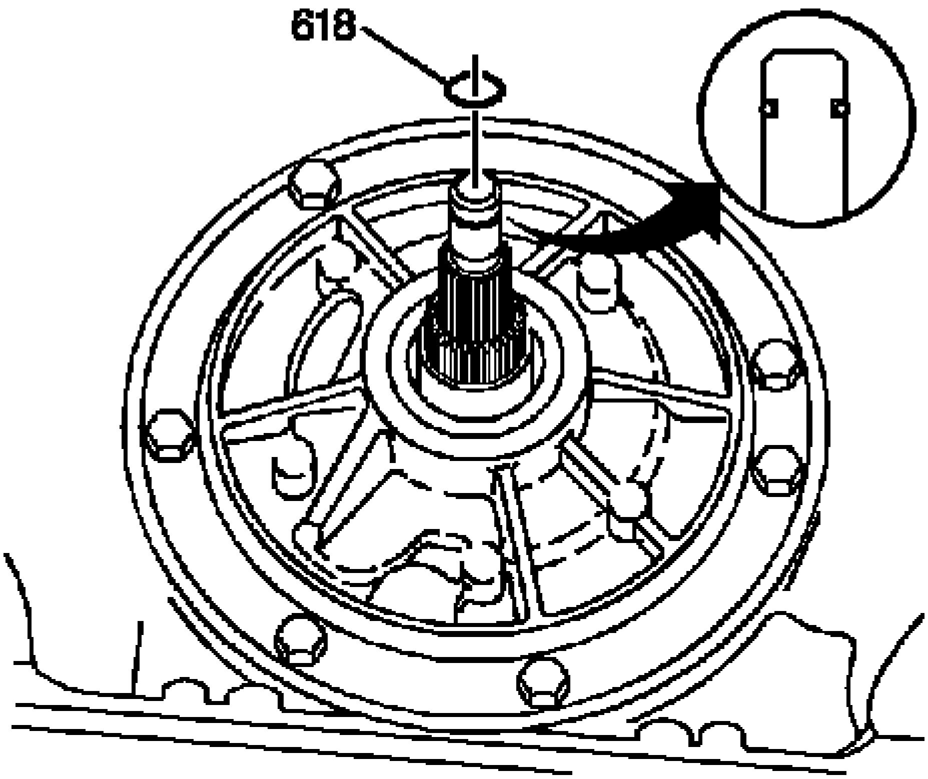


Fig. 250: Identifying J 6116-A With Output Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

7. Lubricate the output carrier pinion gears (655) with DEXRON®VI transmission fluid.
8. Install the main shaft (662) and the rear internal gear (666) into the output carrier assembly (661).
9. Place the assembly into the **J 6116-A** with the main shaft facing down. See **Special Tools**.

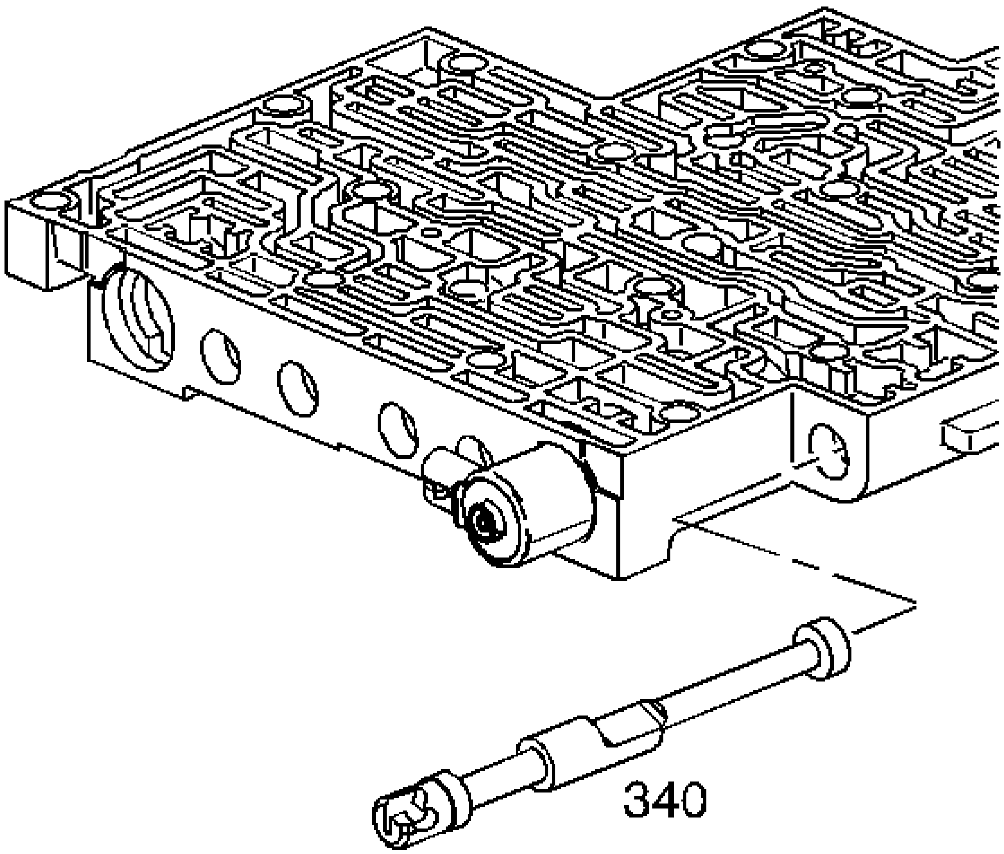


Fig. 251: Aligning Sun Gear Thrust Bearing Races
Courtesy of GENERAL MOTORS CORP.

10. Assemble the rear internal gear thrust bearing assembly (647) and races (648, 669). The lips of the sun gear thrust bearing races (648, 669) should face the rear internal gear thrust bearing assembly (647).
11. Place the bearing and race assembly onto the hub of the rear internal gear (666). Retain with **J 36850** or equivalent.

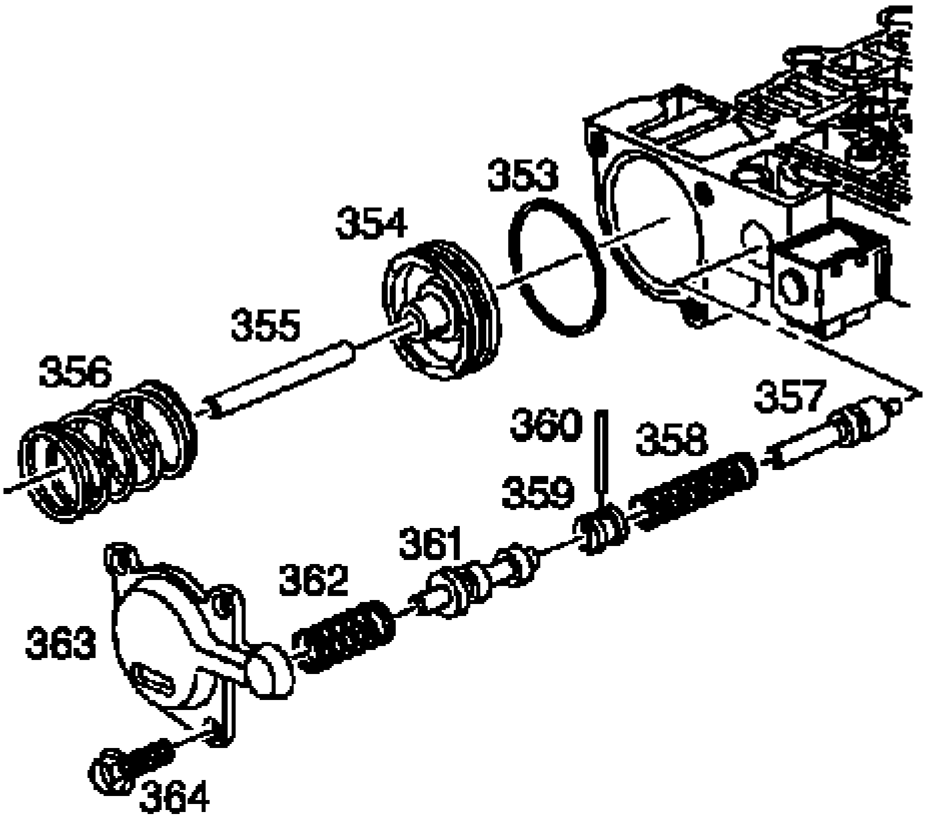


Fig. 252: Output Shaft Components
Courtesy of GENERAL MOTORS CORP.

12. Install the output shaft assembly (671) into the output carrier assembly (661).
13. Install the output shaft retainer ring (672).
14. Install the output shaft thrust washer (673) on the output shaft assembly (671). Align the output shaft thrust washer tabs with the pockets in the output carrier assembly.
15. Retain the thrust washer with **J 36850** or equivalent.

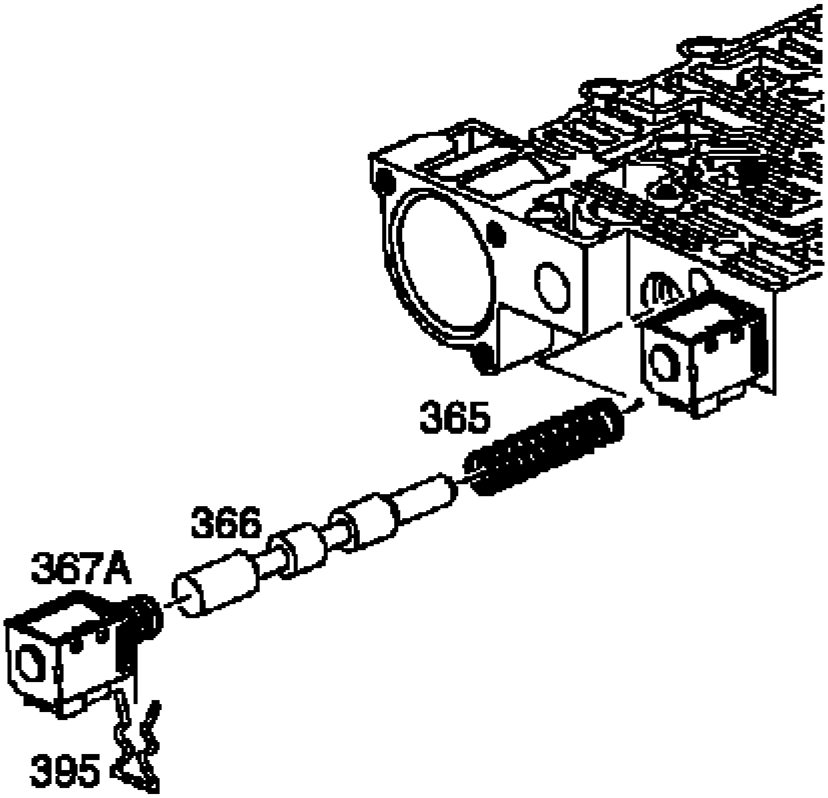


Fig. 253: View Of Reaction Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

16. Turn the gear unit assembly over and place it into the **J 6116-A** with the output shaft assembly (671) facing down. See **Special Tools**.
17. Install the output carrier thrust washer (659) into the output carrier assembly (661).
18. Lubricate the reaction carrier pinion gears (655) with DEXRON®VI transmission fluid.
19. Install the reaction carrier assembly (651) into the output carrier assembly (661).
20. Rotate the reaction carrier assembly (651) to ease installation.

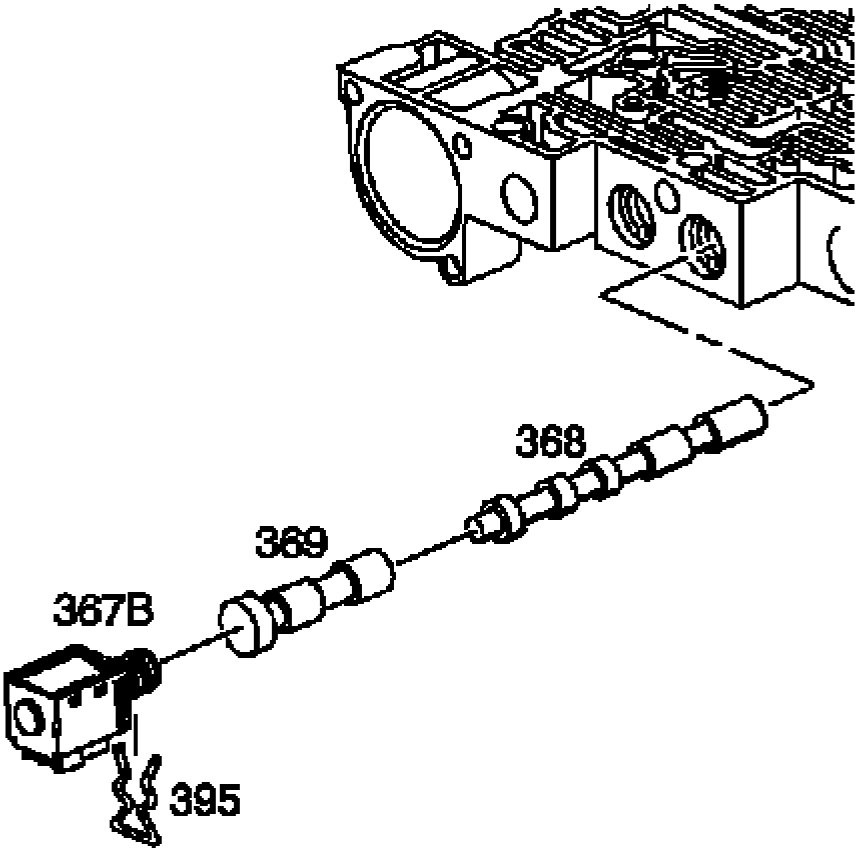


Fig. 254: View Of Sun Gear & Sun Gear Shaft Assembly
Courtesy of GENERAL MOTORS CORP.

21. Install the sun gear (650) into the reaction carrier assembly (651).
    - Insert the chamfered inner diameter first.
    - Rotate the sun gear to ease installation.
22. Insert the sun gear shaft assembly (649) with the long splined end into the sun gear (650).

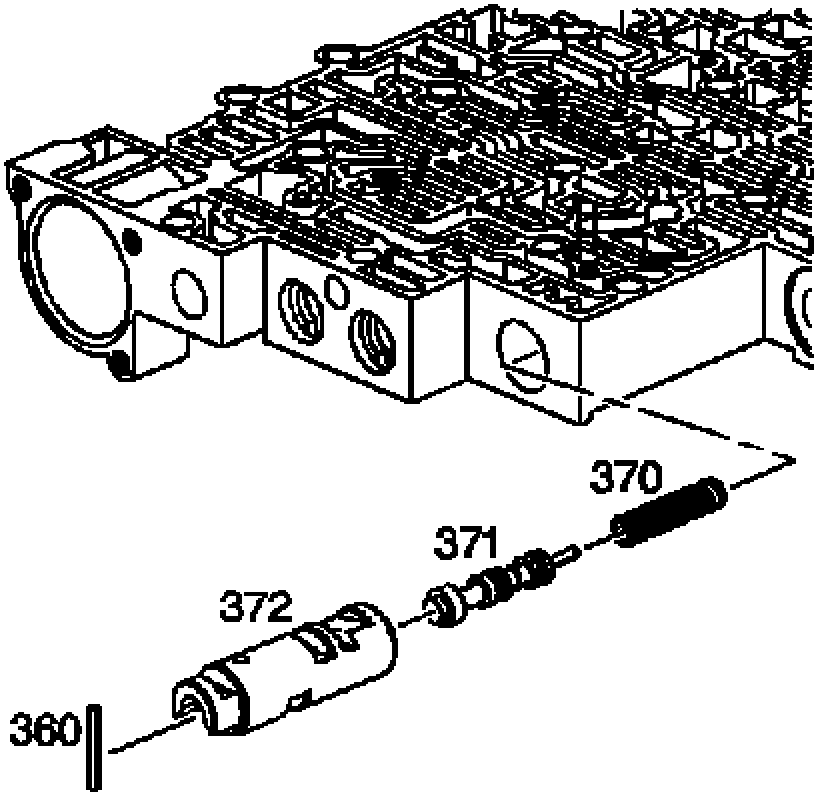


Fig. 255: Aligning Longer-Lipped Sun Gear Front Thrust Bearing Race Facing Up
Courtesy of GENERAL MOTORS CORP.

23. Install the longer-lipped sun gear front thrust bearing race (648) onto the sun gear with the lip facing upward.
24. Assemble the sun gear front thrust bearing assembly (647) onto the sun gear front thrust bearing race (648).

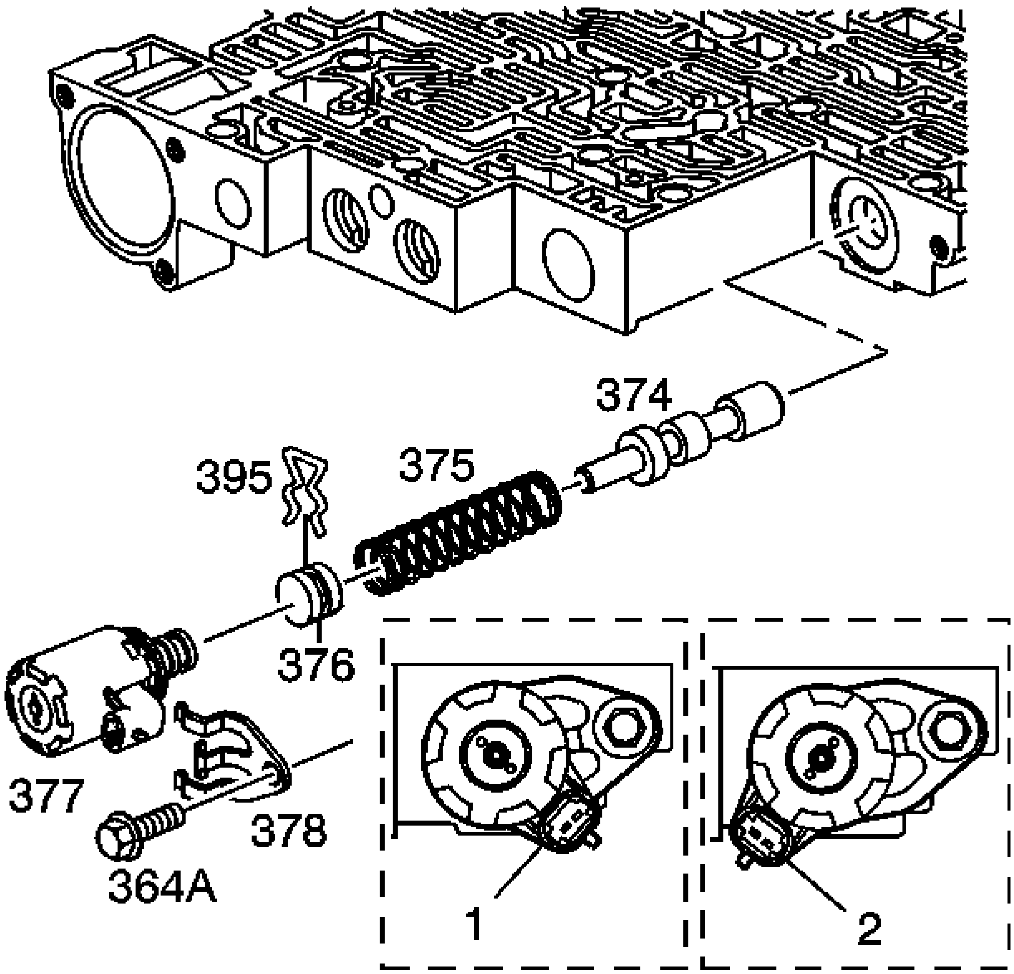


Fig. 256: View Of Sun Gear Front Thrust Bearing Race, Center Support & Reaction Carrier Thrust Washer
Courtesy of GENERAL MOTORS CORP.

25. Install the sun gear front thrust bearing race (646) on the rear hub of the center support assembly (640). Retain the sun gear front thrust bearing race (646) with **J 36850** or equivalent.
26. Install the reaction carrier thrust washer (642) (brass) into the recess of the center support assembly (640). Retain the reaction carrier thrust washer (642) with **J 36850** or equivalent.

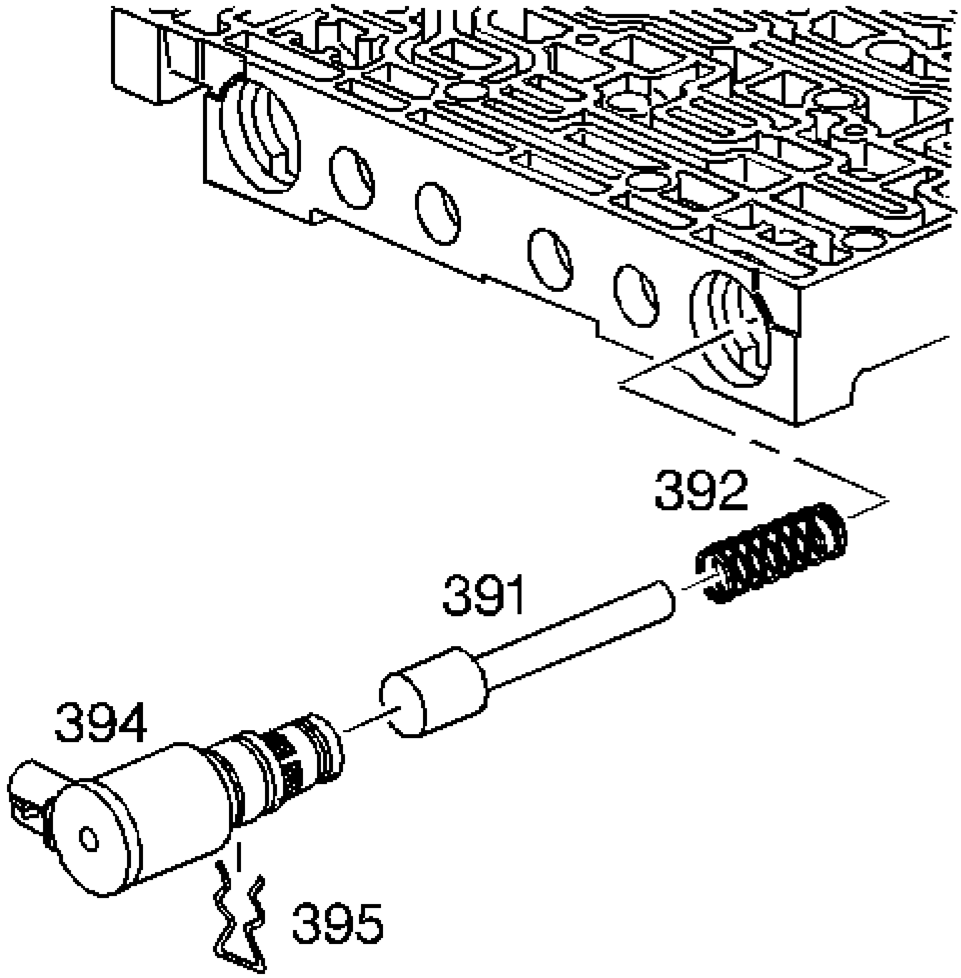


Fig. 257: Identifying Center Support Assembly & Reaction Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

27. Install a new center support assembly (640), or the reconditioned center support assembly, into the reaction carrier assembly (651).
28. Verify correct installation by holding the reaction carrier assembly (651) stationary and rotating the center support assembly (640). The center support assembly (640) should only turn counterclockwise.

CENTER SUPPORT AND GEAR UNIT ASSEMBLY INSTALLATION

Tools Required

- **J 6129** Handle. See **Special Tools**.
- **J 28585** Snap Ring Remover. See **Special Tools**.
- **J 38868** Output Shaft Assembly Remover and Installer. See **Special Tools**.

Procedure

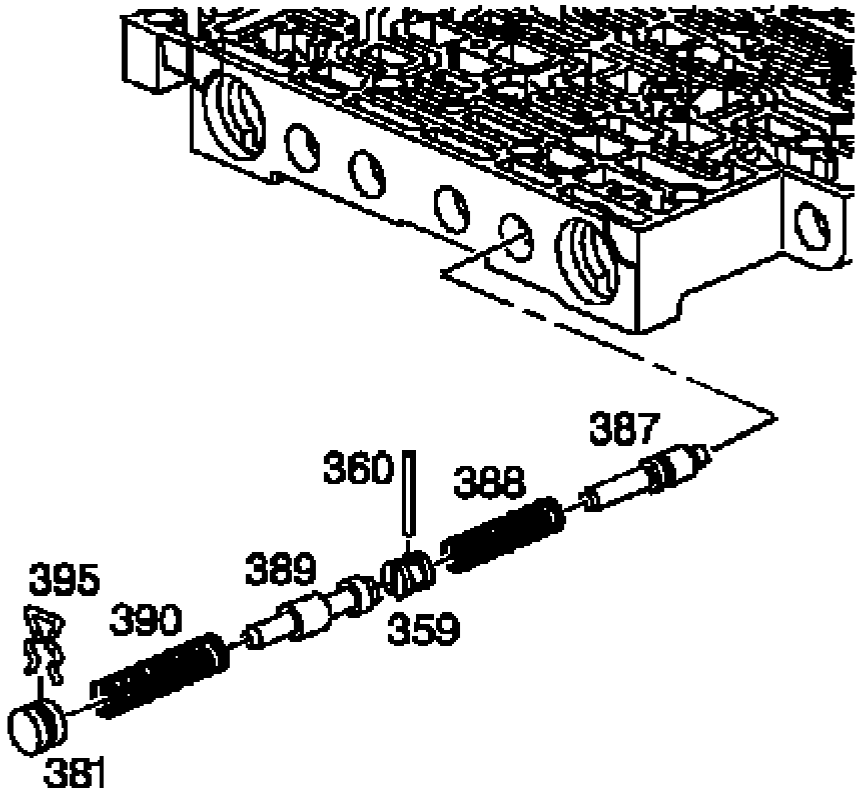


Fig. 258: View Of J 38868 & Transmission Main Shaft
Courtesy of GENERAL MOTORS CORP.

1. Attach the **J 38868** and the **J 6129** onto the main shaft. See **Special Tools**.
2. Align the bolt hole in the center support with the bolt hole in the case and carefully lower the center support and gear unit assembly (640-672) into the case.
3. Remove the tools.

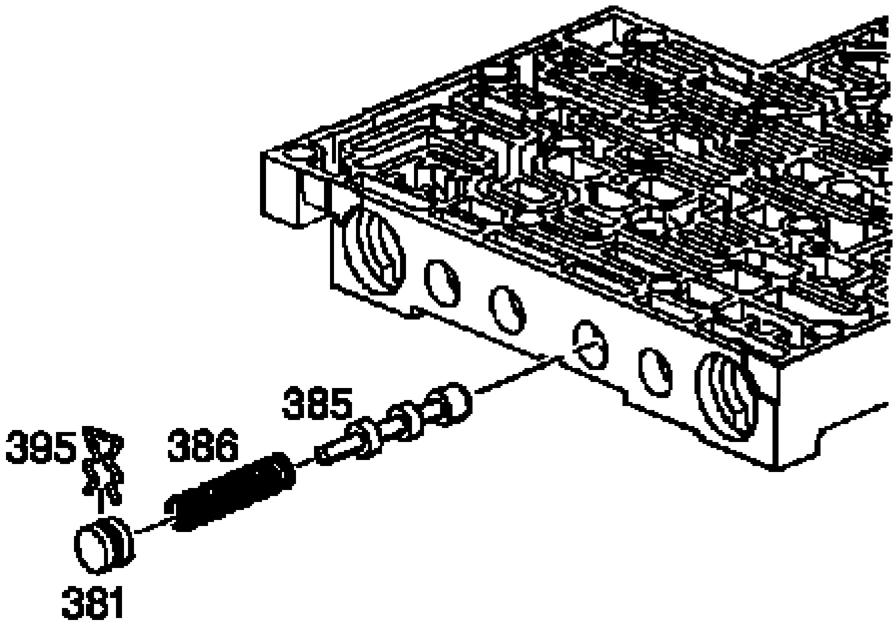


Fig. 259: View Of Center Support Retaining Ring At The 9:00 Position
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 28585** , install the center support retaining ring (633). See **Special Tools**. The end gap of the center support retaining ring (633) should be located at the 9 o'clock position with the beveled edge of the retaining ring facing up.

REAR UNIT END PLAY CHECK

Tools Required

- **J 8001** Dial Indicator Set
- **J 25025-B** Dial Indicator Post and Guide Pin Set

Procedure

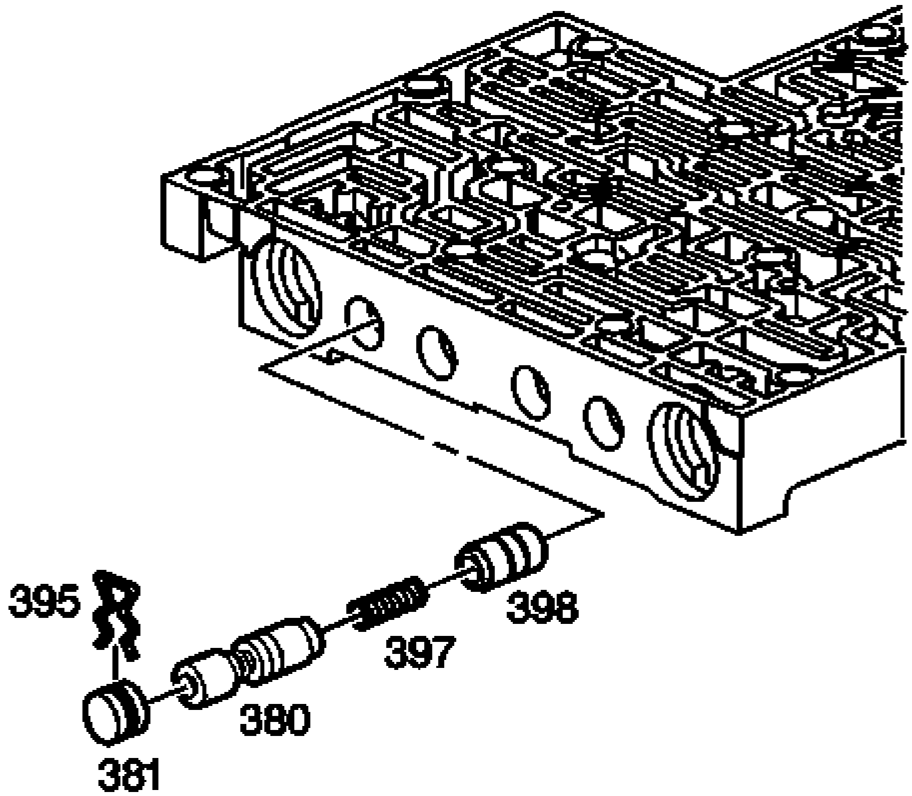


Fig. 260: Checking Rear Unit End Play With J 8001-3
Courtesy of GENERAL MOTORS CORP.

1. Assemble the **J 25025-B** by attaching the threaded rod and the dial indicator holder to one of the case extension bolt holes on the transmission case (7).
2. Push the output shaft assembly (671) in to remove any slack.
3. Install the **J 8001-3** on the dial indicator holder. Index the **J 8001-3** to the end of the output shaft (671).
4. Set the **J 8001-3** to 0.
5. Move the output shaft (671) in and out, noting the amount of end play.

   End Play Specification: The correct end play is 0.127-0.508 mm (0.005-0.020 in).

   If the end play is not correct, change the output shaft selective thrust washer (674). Refer to the **Output Shaft Selective Thrust Washer Specifications** .

6. Remove the tools.

CENTER SUPPORT BOLT AND TRANSMISSION FLUID COOLER PIPE FITTING INSTALLATION

Tools Required

J 23093 Center Support Alignment Tool. See **Special Tools**.

Procedure

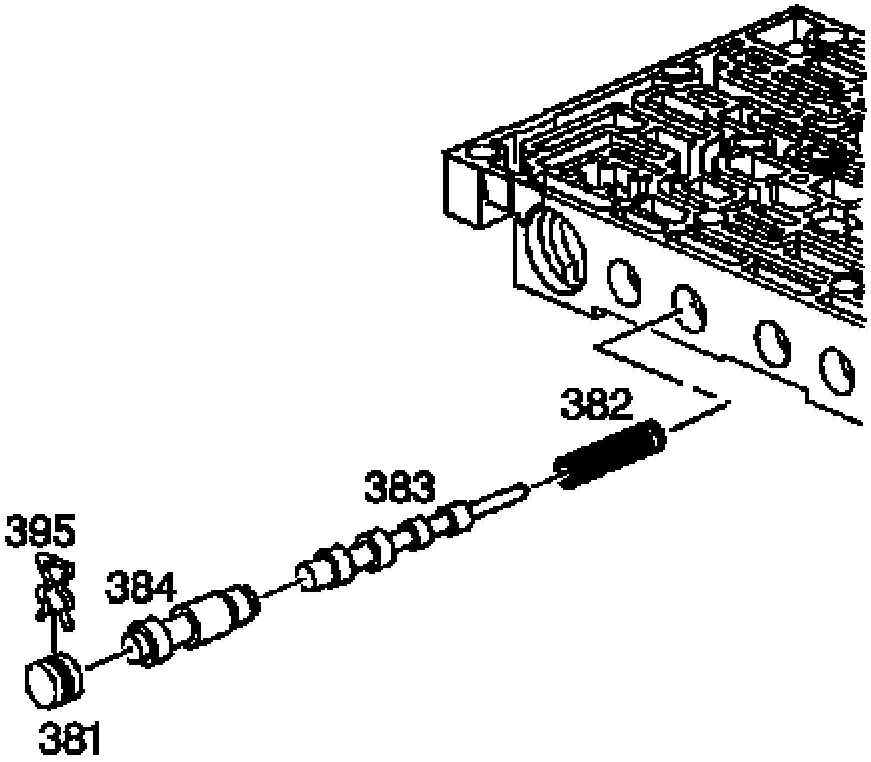


Fig. 261: View Of J 23093 & Center Support Bolt
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the center support assembly has been reconditioned, you must use a new yellow-colored center support bolt in order to maintain proper bolt torque.

1. Using the **J 23093** , locate the center support 2nd clutch fluid passage through the hole in the case bottom. See **Special Tools**. Refer to **Fluid Passages**.
2. Push the **J 23093** toward the low and reverse band servo bore, seating the center support splines against the case splines. See **Special Tools**.

NOTE: Refer to FASTENER NOTICE .

IMPORTANT: Do not overtighten the center support bolt.

3. Install the new center support bolt (25).

Tighten: Maintain pressure on **J 23093** while tightening the new center support bolt to 43 N. See **Special Tools**.m (32 lb ft).

4. Ensure that the center support bolt head is seated to the bottom of the case.

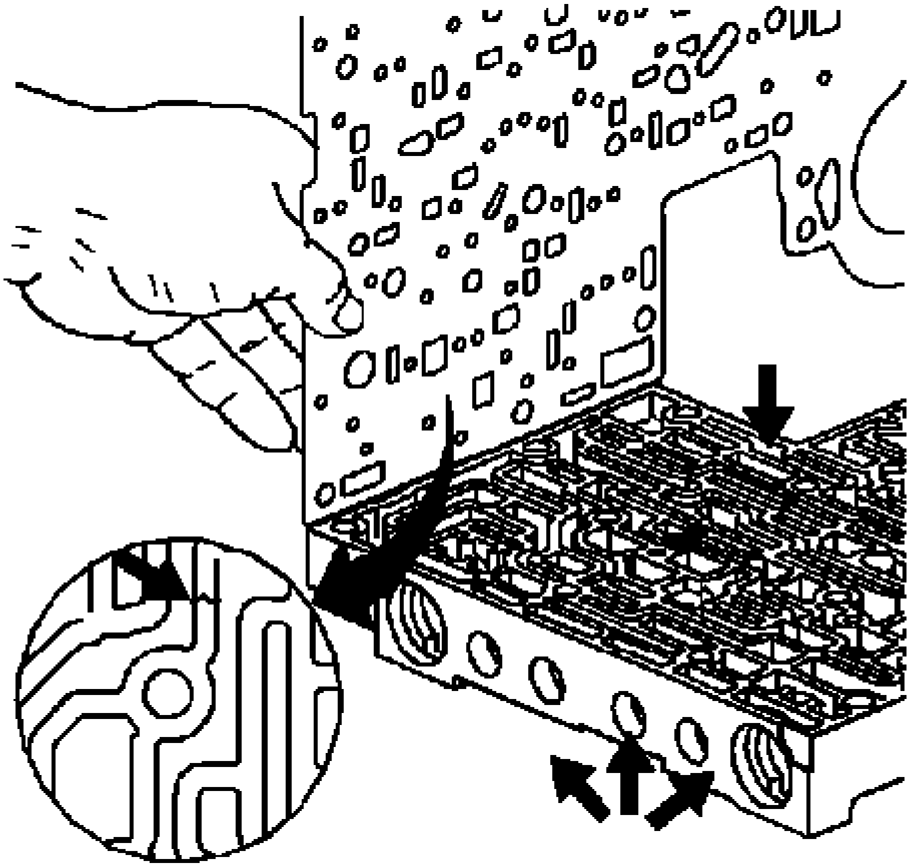


Fig. 262: Identifying Rear Oil Cooler Pipe Fitting & Seal
Courtesy of GENERAL MOTORS CORP.

5. Install a new rear oil cooler pipe fitting seal (91) onto the rear oil cooler pipe fitting (90).
6. Install the rear oil cooler pipe fitting (90) into the transmission case.

Tighten: Tighten the fitting to 35 N.m (26 lb ft).

INTERMEDIATE CLUTCH ASSEMBLY INSTALLATION

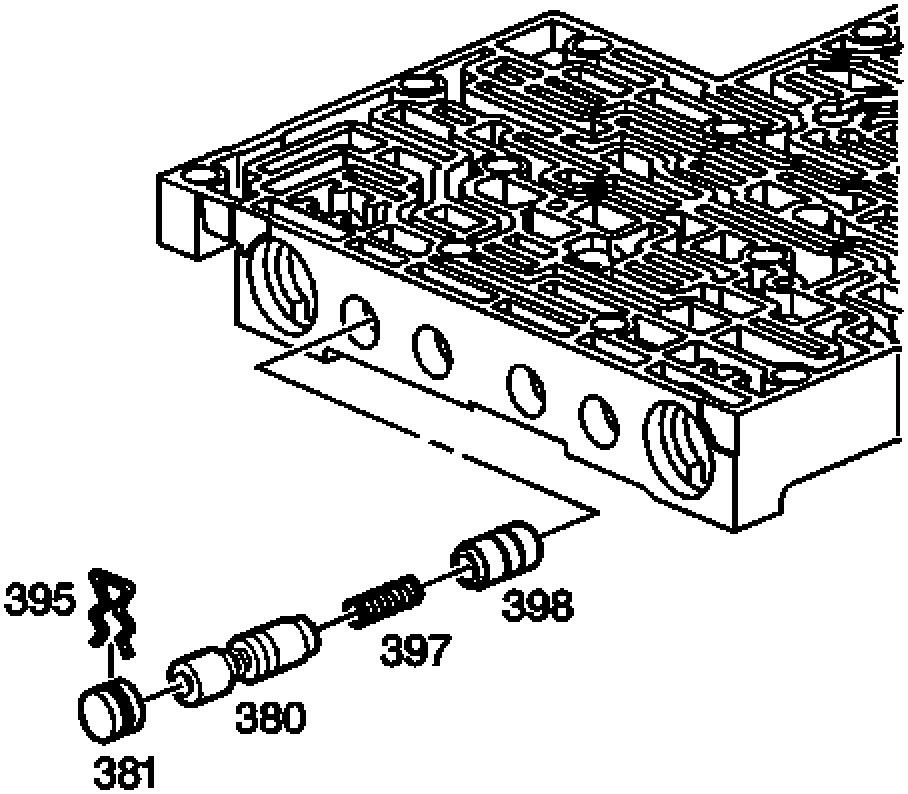


Fig. 263: View Of Intermediate Clutch Plates
Courtesy of GENERAL MOTORS CORP.

1. Dip all of the intermediate clutch plates in DEXRON®VI transmission fluid.
2. Install the intermediate clutch wave plate (684) with the tangs facing down.

IMPORTANT: Alternate the clutch plates, starting with the steel clutch plate (4 steel and 4 composite).

3. Install the intermediate clutch plates (631, 632).
4. Install the intermediate clutch backing plate (630).

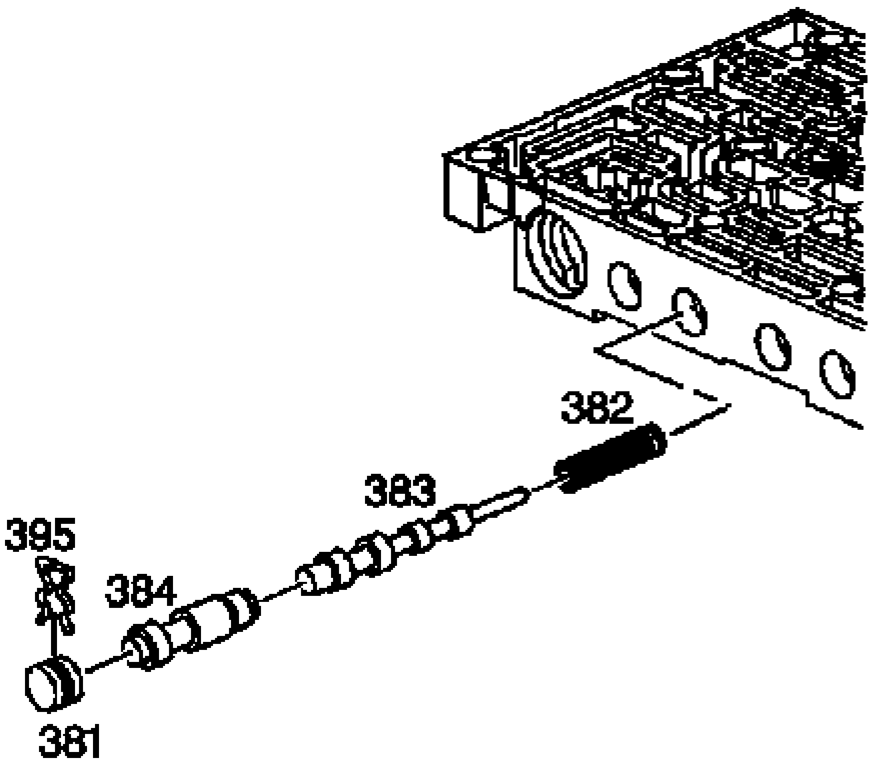


Fig. 264: Aligning Intermediate Clutch Backing Plate Retainer Ring At 9:00 Position
Courtesy of GENERAL MOTORS CORP.

5. Install the intermediate clutch backing plate retainer ring (629). The opening of the retainer ring (629) should be at the 9 o'clock position.

INTERMEDIATE CLUTCH PISTON TRAVEL CHECK

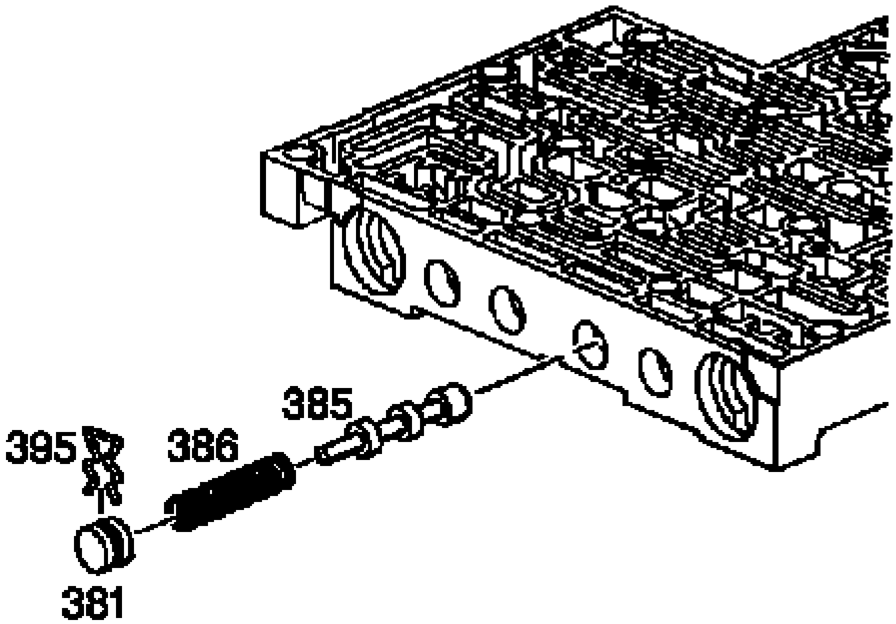


Fig. 265: Measuring Piston Travel With Feeler Gage
Courtesy of GENERAL MOTORS CORP.

1. Using a feeler gage, measure the piston travel between the intermediate clutch backing plate and the intermediate clutch backing plate retaining ring (629).

   Piston Travel Specification: Piston travel should be 1.02-2.72 mm (0.040-0.107 in).

2. If piston travel is not correct, inspect for the following conditions and repair as required.
   - Proper assembly
   - Dirt or burrs
   - Worn clutch plates, backing plate, or wave plate
   - Worn case area in the snap ring groove

MANUAL 2-1 BAND ASSEMBLY INSTALLATION

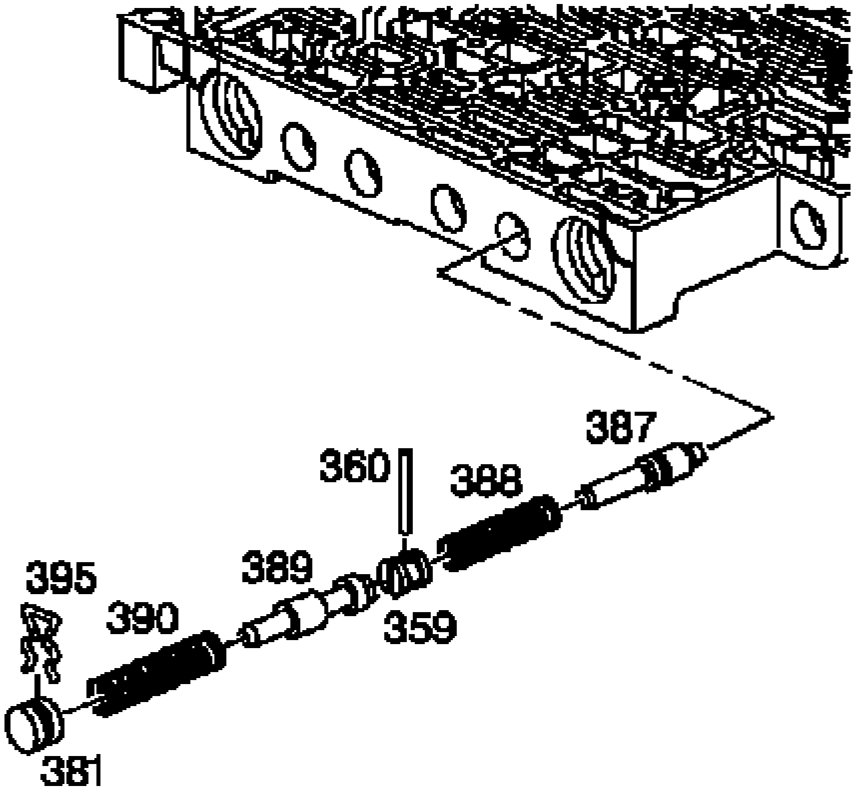


Fig. 266: View Of Manual 2-1 Band Assembly
Courtesy of GENERAL MOTORS CORP.

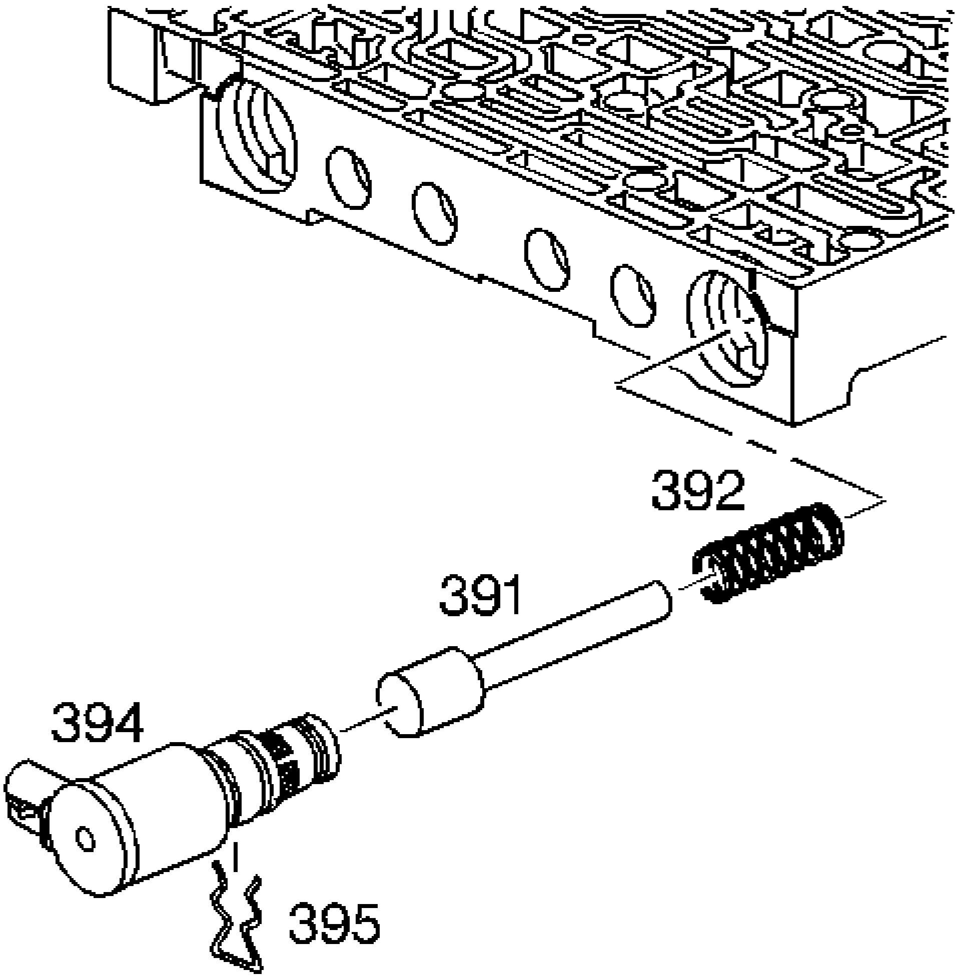
Install the manual 2-1 band assembly (628) into the transmission case. Inspect for proper alignment with the anchor pin and inspect for freedom of movement.

DIRECT CLUTCH ASSEMBLY DISASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 25018-A** Clutch Spring Compressor Adapter

Procedure



<u>Fig. 267: Identifying Intermediate Clutch Roller Retainer Retaining Ring</u>
Courtesy of GENERAL MOTORS CORP.

1. Remove the intermediate clutch roller retainer retaining ring (627).

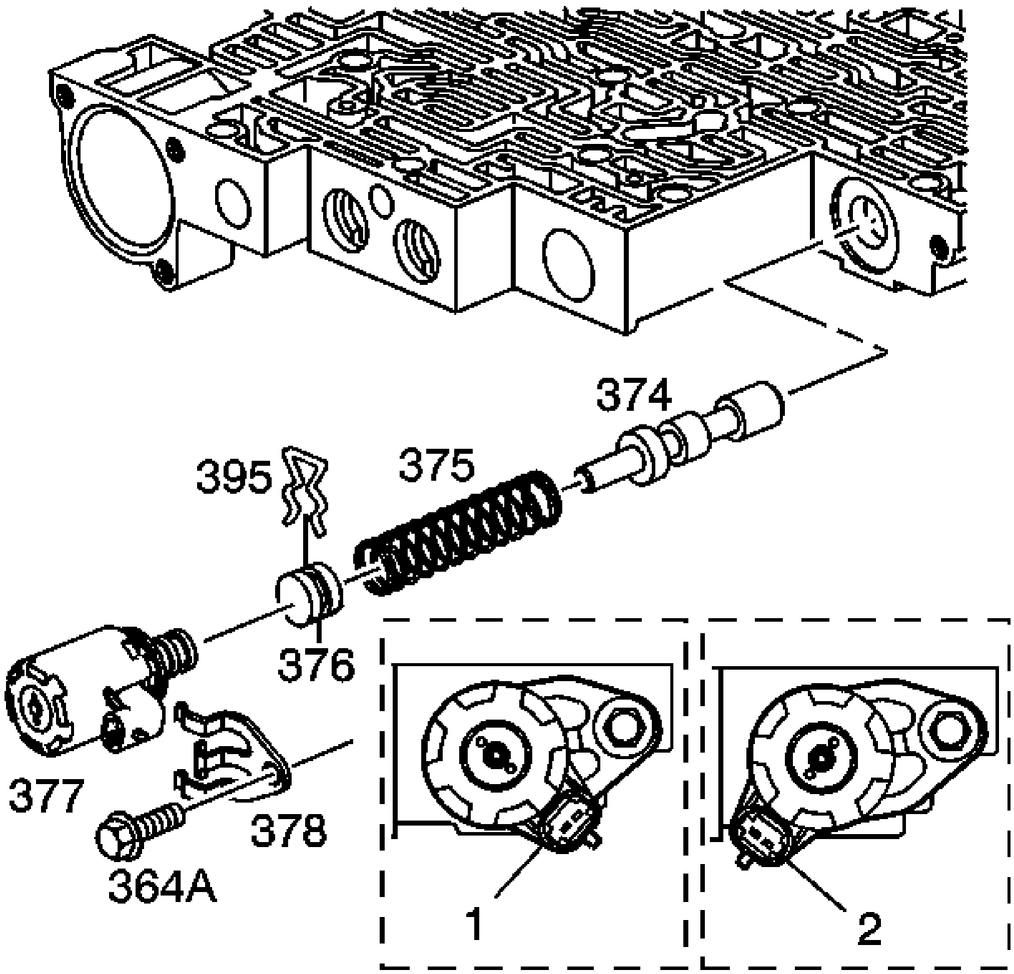


Fig. 268: View Of Intermediate Clutch Sprag Assembly Inspection Areas
Courtesy of GENERAL MOTORS CORP.

2. Remove the intermediate clutch roller retainer (626).
3. Remove the intermediate clutch sprag assembly (624) and race (625) as an assembly.
4. Remove the intermediate clutch roller outer race (625).
5. Inspect the intermediate clutch sprag assembly (624) for damaged rollers, a damaged cage or distorted springs.

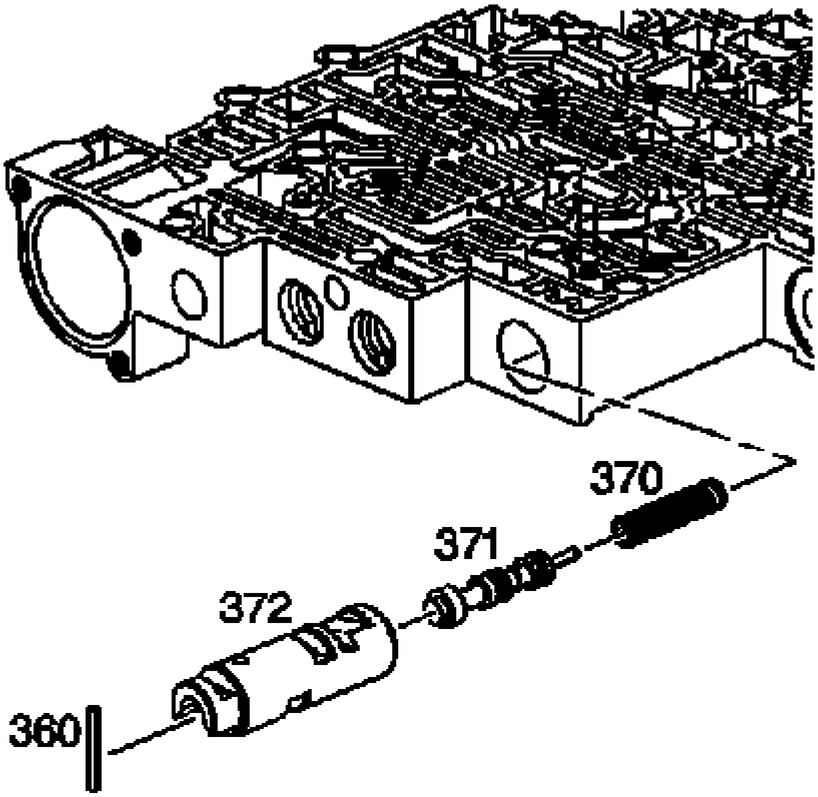


Fig. 269: Identifying Inspection Areas On Direct Clutch Plates
Courtesy of GENERAL MOTORS CORP.

6. Remove the direct clutch backing plate retaining ring (616).
7. Remove the direct clutch backing plate (617).
8. Remove the direct clutch plates (611, 618).
9. Remove the direct clutch (waved) plate (609).
10. Inspect the direct clutch backing plate (617) for damage and cracks.
11. Inspect the direct clutch plates (609, 611, 618) for wear, burned, flaking, scoring, and pitting.

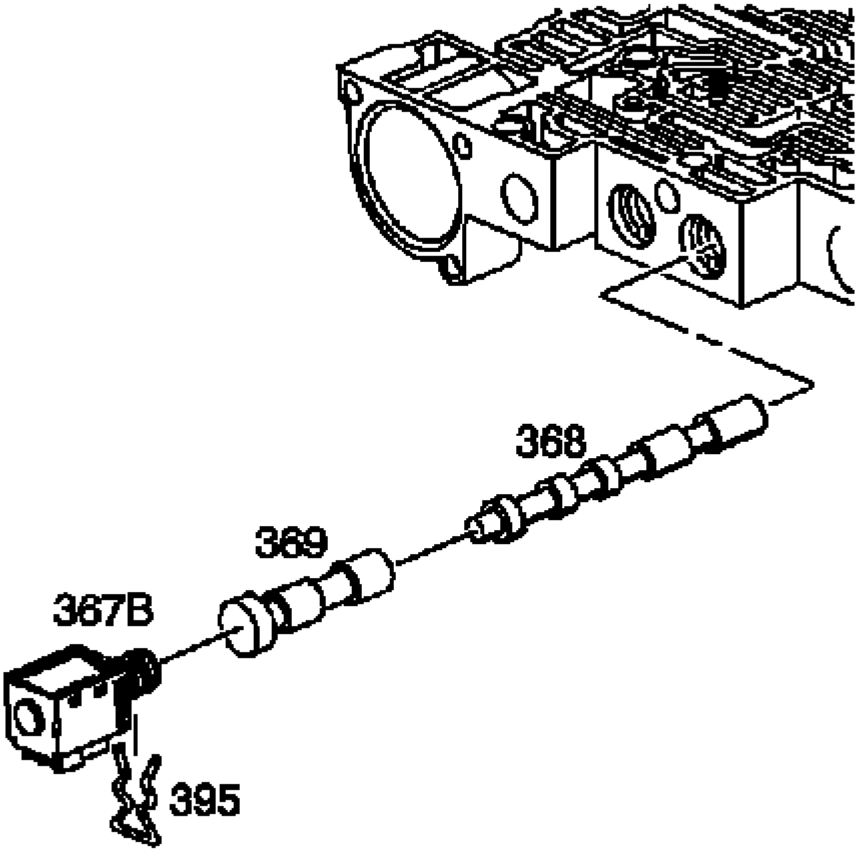


Fig. 270: Compressing Direct Clutch Spring Assembly With J 23327 & J 25018-A
Courtesy of GENERAL MOTORS CORP.

12. Install the **J 23327** and the **J 25018-A** onto the direct clutch housing assembly (623).
13. Compress the direct clutch spring assembly (607).
14. Remove the direct clutch spring retainer ring (608).
15. Remove the tools.

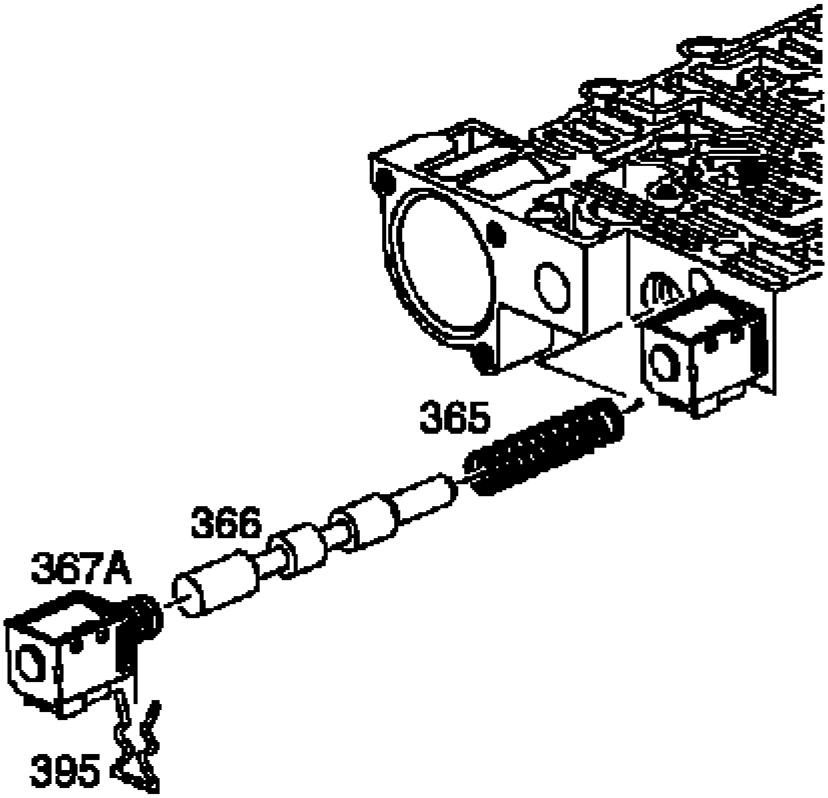


Fig. 271: Locating Direct Clutch Spring Assembly Inspection Areas
Courtesy of GENERAL MOTORS CORP.

16. Remove the direct clutch spring assembly (607).
17. Inspect the direct clutch spring assembly (607) for collapsed coils and distortion.
18. Remove the direct clutch piston assembly (619). The direct clutch piston assembly is reusable unless it is damaged.
19. Inspect the direct clutch piston assembly (619) for damage and cracks.

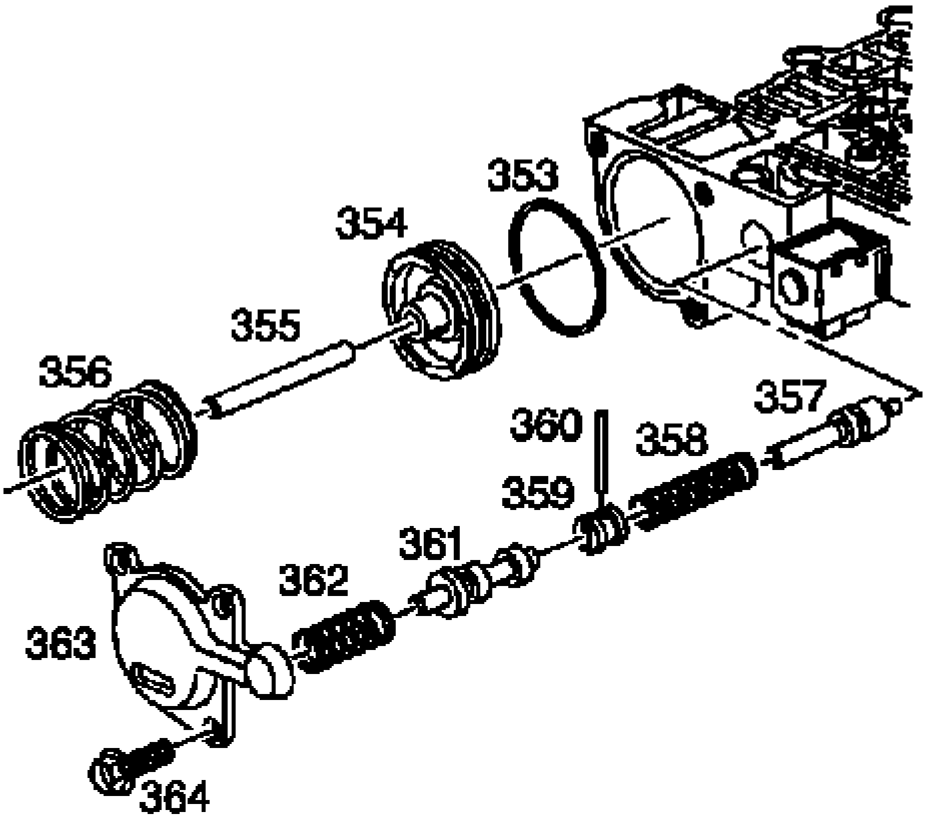


Fig. 272: View Of Inspection Areas On Direct Clutch Housing Assembly
Courtesy of GENERAL MOTORS CORP.

20. Remove the direct clutch piston intermediate seal (622) from the direct clutch housing assembly (623).
21. Inspect the direct clutch housing assembly (623) for the following:
    - Cracks
    - Wear
    - Restricted/clogged oil passages
    - Free movement of checkballs (rattles)

DIRECT CLUTCH ASSEMBLY ASSEMBLE

Tools Required

- **J 21362-1** Direct and Forward Clutch Piston and Inner Seal Protector. See **Special Tools**.
- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 25018-A** Clutch Spring Compressor Adapter
- **J 38695** Direct Clutch Spiral Retaining Ring Installer. See **Special Tools**.
- **J 38732-1** Direct and Forward Clutch Piston and Seal Outer Protector. See **Special Tools**.

Procedure

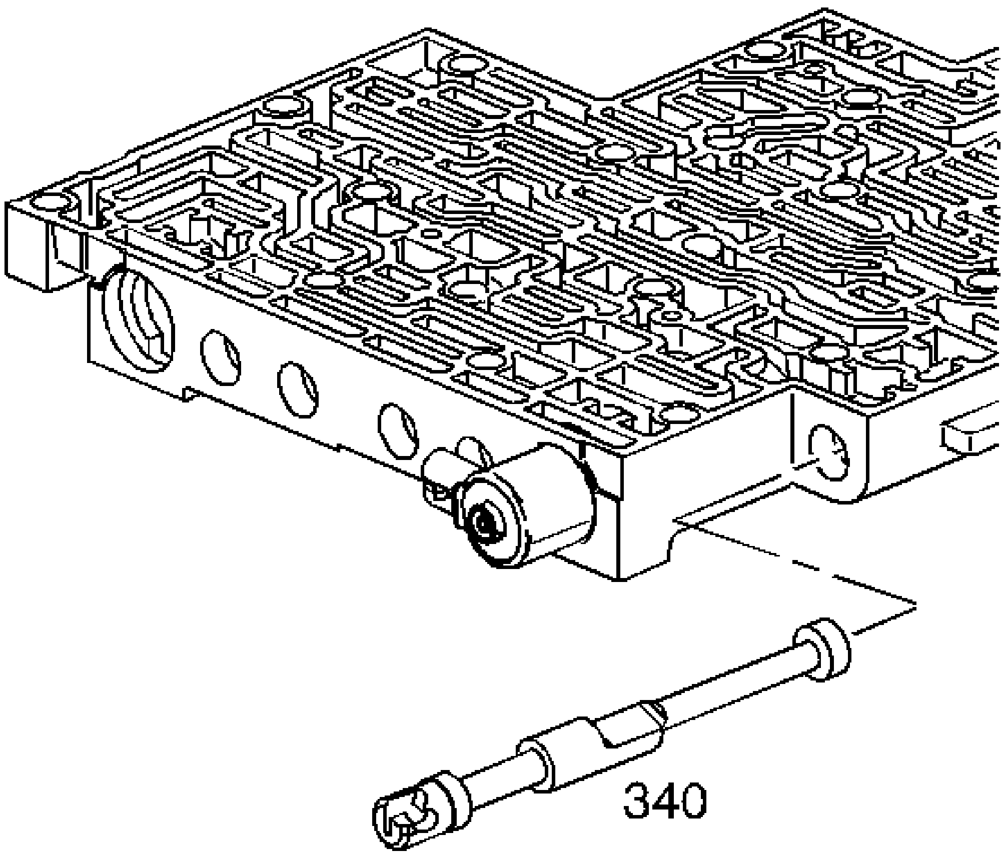


Fig. 273: Identifying Seal Lip On Direct Clutch Piston Intermediate Seal
Courtesy of GENERAL MOTORS CORP.

1. Install the direct clutch piston intermediate seal (622) onto the direct clutch housing assembly (623) with the seal lip facing upward.

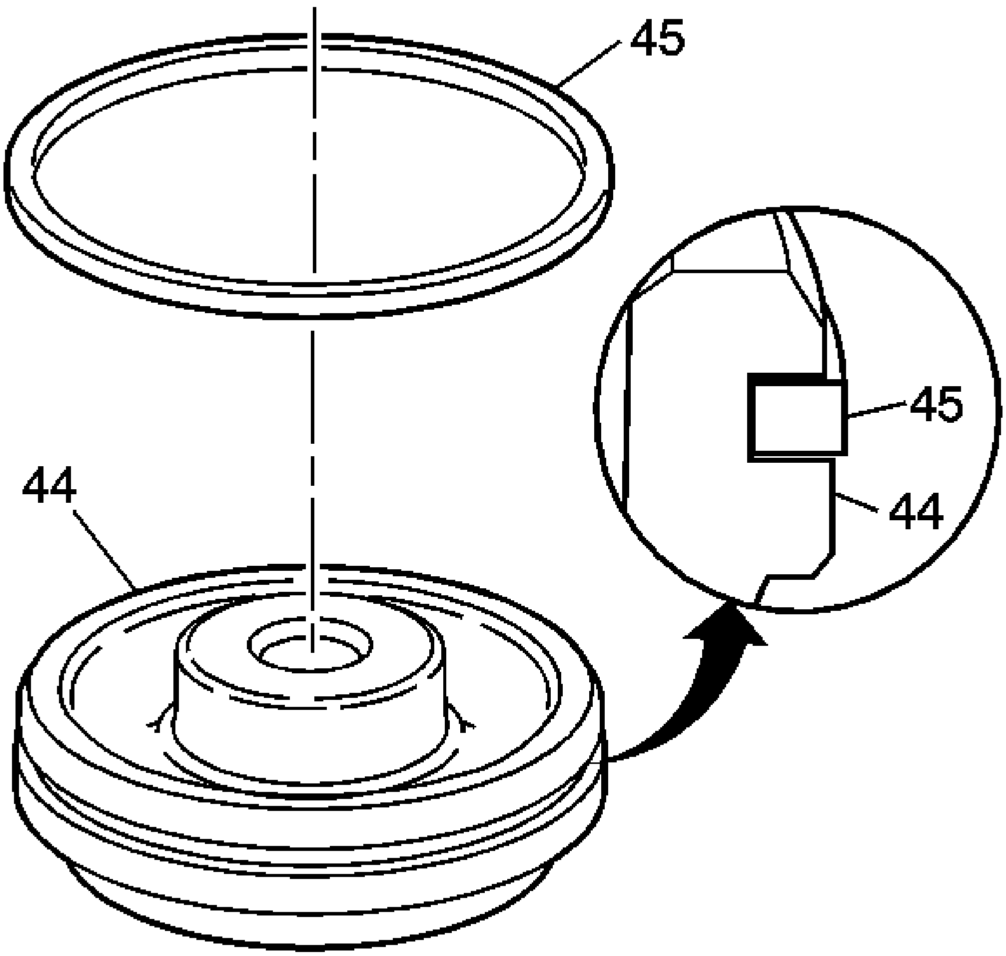


Fig. 274: Using J 21362-1 & J 38732-1 To Install Direct Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

2. Lubricate the direct clutch piston assembly (619) with DEXRON®VI transmission fluid.
3. Install the **J 21362-1** and the **J 38732-1** onto the direct clutch housing assembly (623). See **Special Tools**. Lubricate the tools with DEXRON®VI transmission fluid.
4. Install the direct clutch piston assembly (619) into the direct clutch housing assembly (623) using a rotating motion until the direct clutch piston assembly (619) is seated.

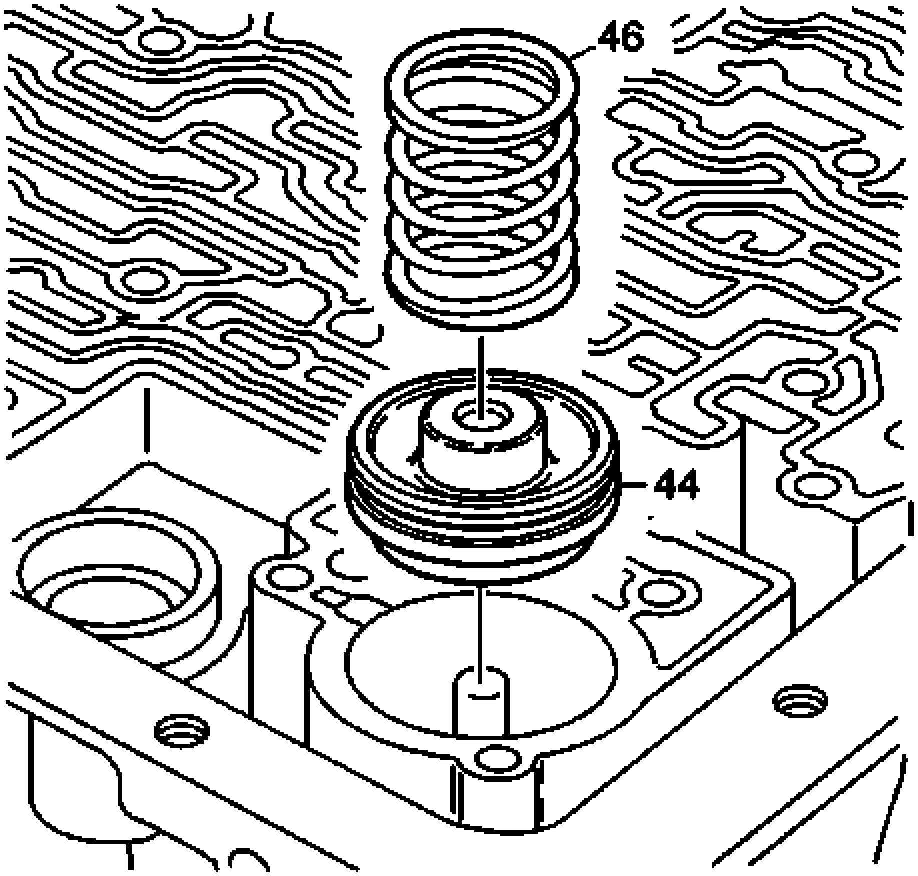


Fig. 275: Compressing Direct Clutch Spring Assembly With J 23327 & J 25018-A
Courtesy of GENERAL MOTORS CORP.

5. Install the direct clutch spring assembly (607).
6. Install the **J 23327** and the **J 25018-A** onto the direct clutch housing assembly (623).
7. Compress the direct clutch spring assembly (607).
8. Install the direct clutch spring retainer ring (608).
9. Remove the tools.

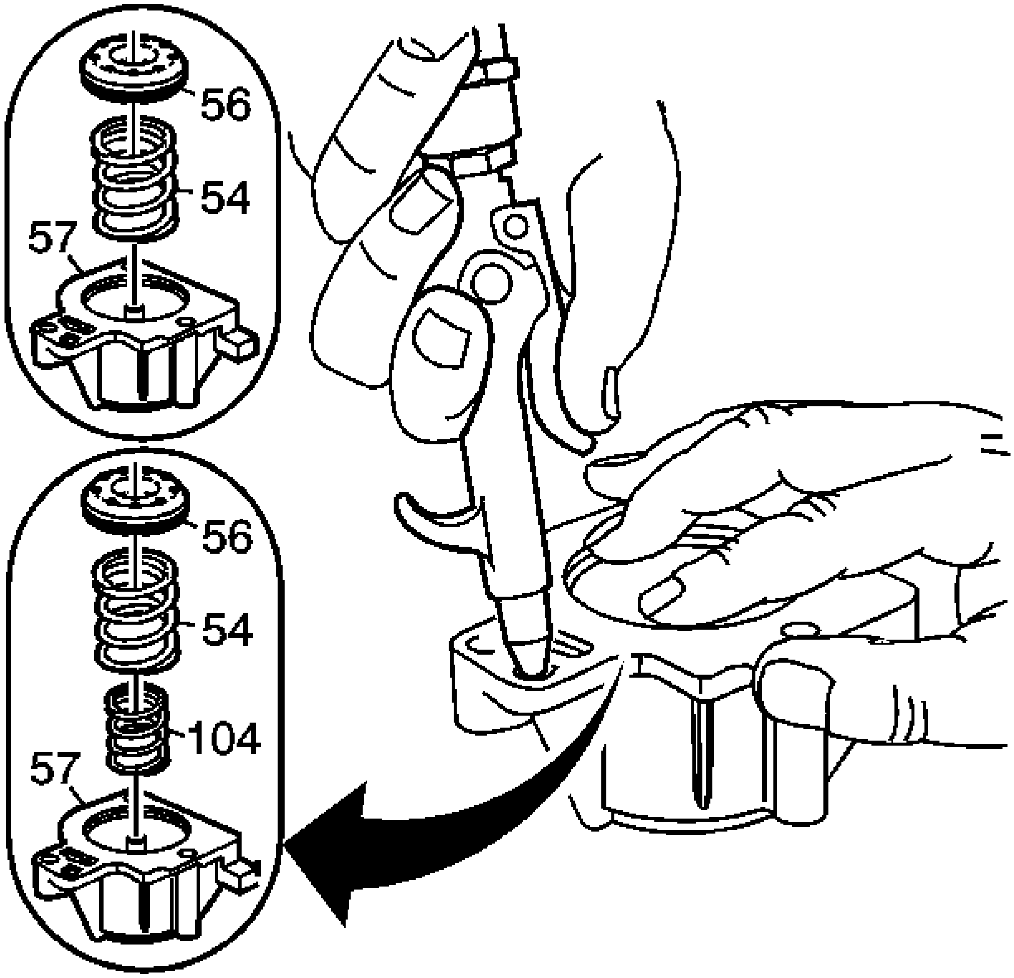


Fig. 276: View Of Direct Clutch Plates
Courtesy of GENERAL MOTORS CORP.

10. Dip all of the direct clutch plates in DEXRON®VI transmission fluid.
11. Install the direct clutch (waved) plate (609).

IMPORTANT: Alternate the clutch plates, starting with the steel clutch plate (5 steel, 5 composite).

12. Install the direct clutch plates (611, 618).
13. Install the direct clutch backing plate (617).
14. Install the direct clutch backing plate retaining ring (616).

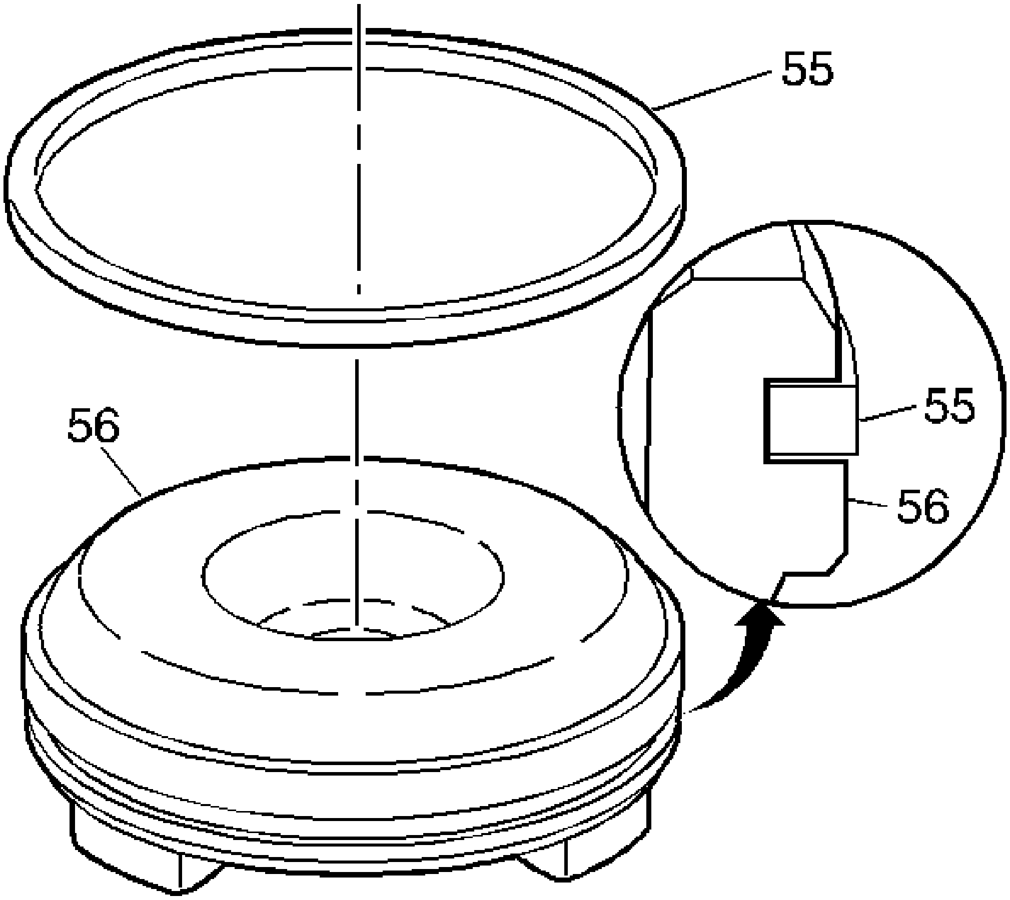


Fig. 277: Identifying Intermediate Clutch Roller Outer Race Grooved Side
Courtesy of GENERAL MOTORS CORP.

15. Turn the direct clutch housing assembly (623) over.

IMPORTANT: When installing the intermediate clutch sprag assembly (624), the lip of the cage must face the direct clutch housing assembly (623).

16. Assemble the intermediate clutch sprag assembly (624) into the intermediate clutch roller outer race (625).
17. Install the intermediate clutch roller outer race (625) with the grooved side facing up:
    - Use a clockwise rotating motion to ease assembly
    - The clutch roller outer race (625) should not rotate counterclockwise
18. Install the intermediate clutch roller retainer (626).

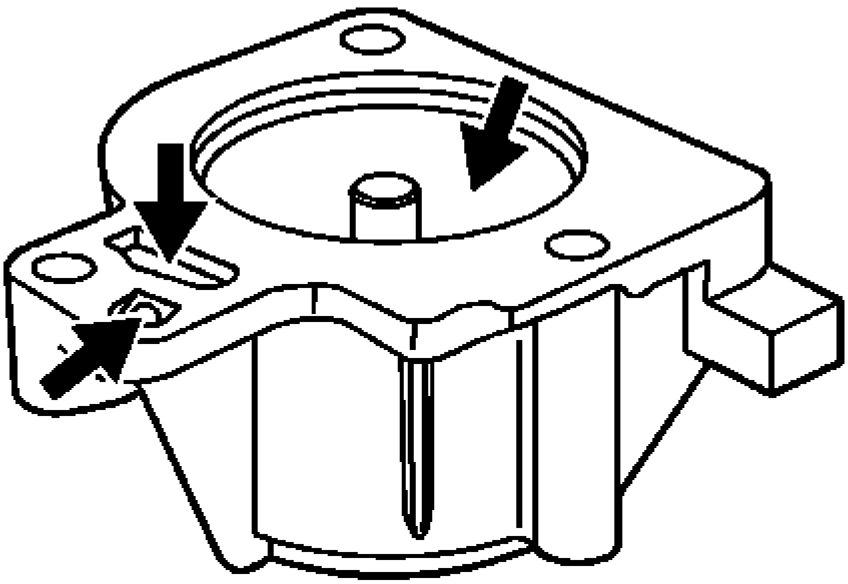


Fig. 278: Intermediate Clutch Roller Retainer Retaining Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the intermediate sprag clutch retainer retaining ring (627) has been removed, you must use a new ring.

19. Install the intermediate clutch roller retainer retaining ring (627) onto the hub of the direct clutch housing assembly (623).
20. Use the **J 38695** in order to complete the installation of the intermediate clutch roller retainer retaining ring (627). See **Special Tools**. Rotate the **J 38695** counterclockwise while pressing down. See **Special Tools**.

DIRECT CLUTCH ASSEMBLY INSTALLATION

Tools Required

- **J 24396** Intermediate Clutch Pack Alignment Tool. See **Special Tools**.
- **J 38733** Direct Clutch Assembly Remover/Installer. See **Special Tools**.

Procedure

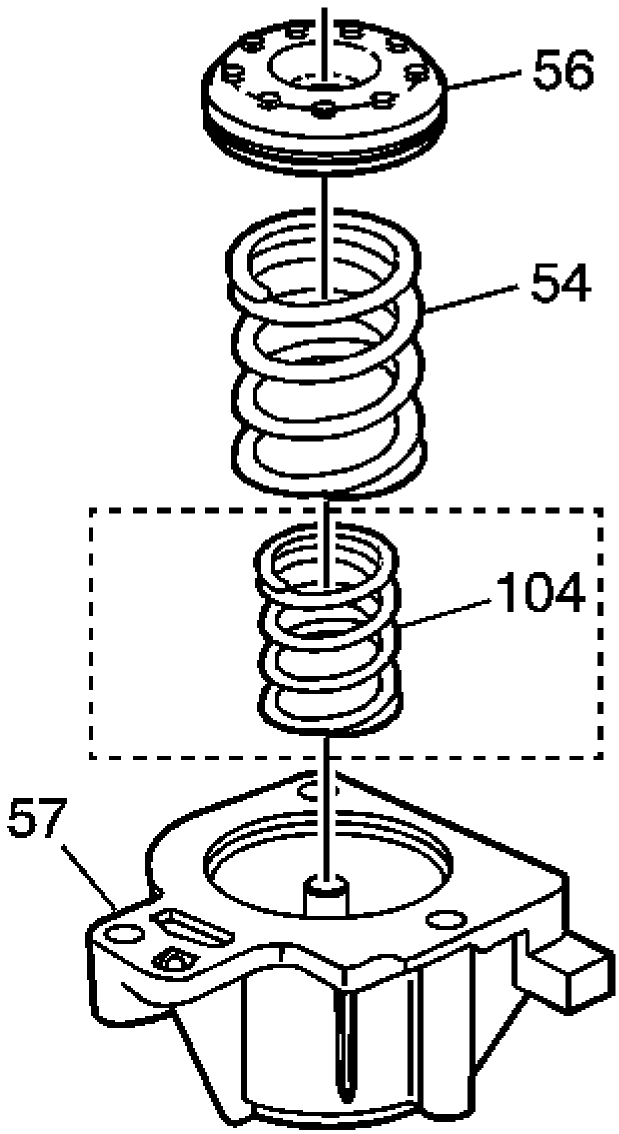


Fig. 279: Blowing Air Through Center Support Bolt Hole
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 24396** , align the intermediate clutch plates. See **Special Tools**.
2. Apply compressed air through the center support bolt hole to apply the intermediate clutch. Continue applying compressed air to hold the intermediate clutch plates in place until the direct clutch assembly is installed.

3. Remove the **J 24396** . See **Special Tools**.

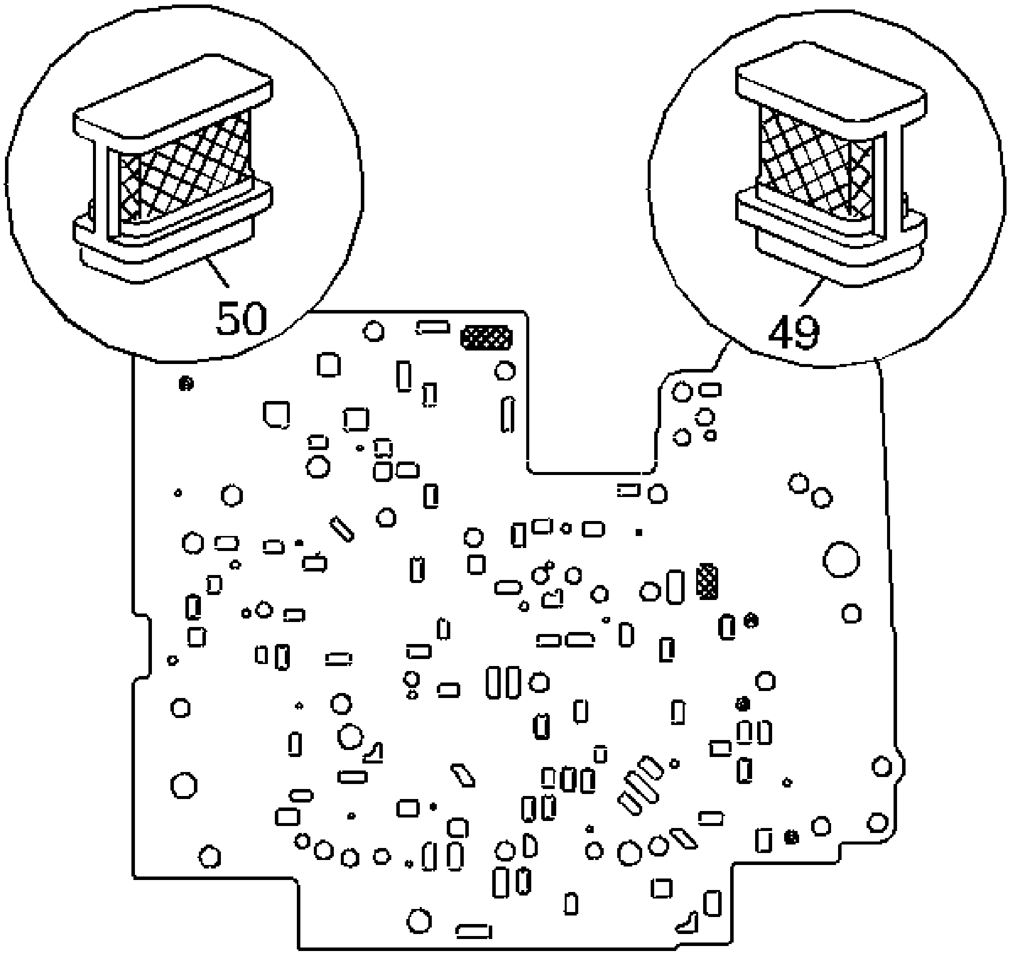


Fig. 280: Direct Clutch Housing Assembly & Transmission Case
Courtesy of GENERAL MOTORS CORP.

4. Using the **J 38733** , install the direct clutch housing assembly (623) into the transmission case. See **Special Tools**. Rotate the direct clutch housing assembly slightly in each direction to ease installation.
5. Remove the **J 38733** . See **Special Tools**.

DIRECT CLUTCH PISTON TRAVEL CHECK

Tools Required

- **J 8001** Dial Indicator Set. See **Special Tools**.
- **J 7057** Dial Indicator Plunger Extension. See **Special Tools**.

Procedure

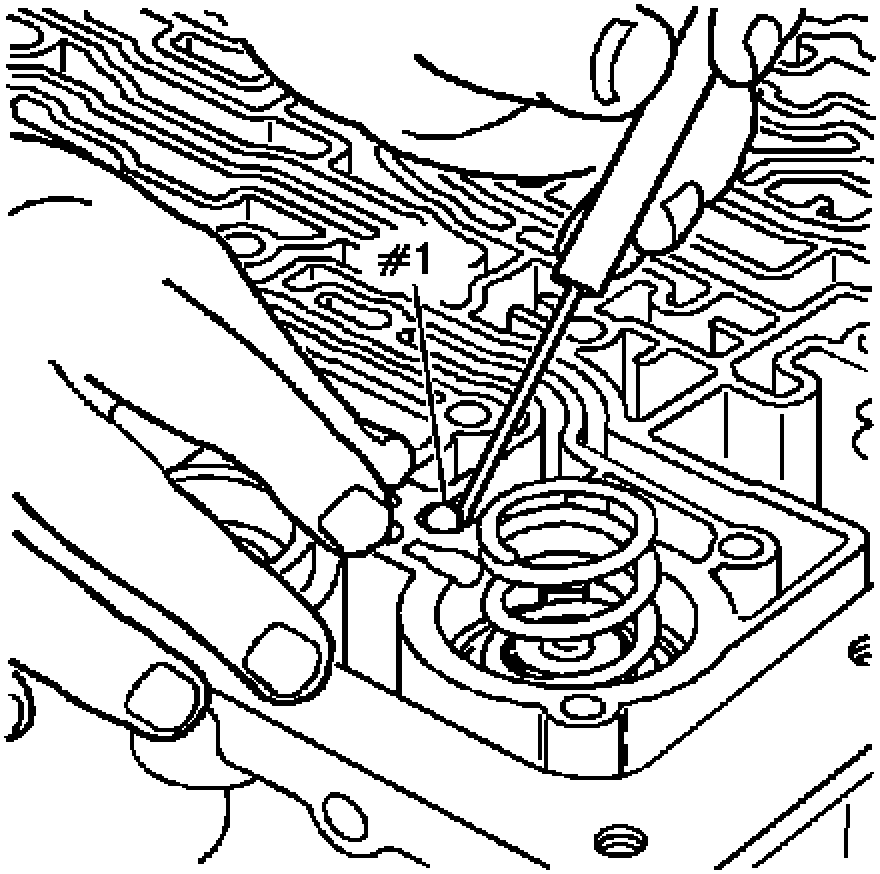


Fig. 281: Illustrating J 8001-3 Installed In Transmission Case
Courtesy of GENERAL MOTORS CORP.

1. Attach the **J 7057** (not visible in the illustration) to the **J 8001-3** . See **Special Tools**.
2. Using the **J 8001-1** , mount the **J 8001-3** to the transmission case through the opening in the case barrel. Place the **J 7057** onto the direct clutch piston assembly. See **Special Tools**.
3. Index the **J 8001-3** . Set the dial to 0.
4. Apply 80 psi of air pressure to the direct clutch fluid passage (3rd/Reverse), in the case bottom, in order to actuate the direct clutch piston. Refer to **Fluid Passages**.
5. Measure the direct clutch piston travel.

   Piston Travel Specification: The piston travel should be 1.27-4.369 mm (0.050-0.172 in).

6. Remove the tools.

FORWARD CLUTCH ASSEMBLY DISASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 25018-A** Clutch Spring Compressor Adapter

Procedure

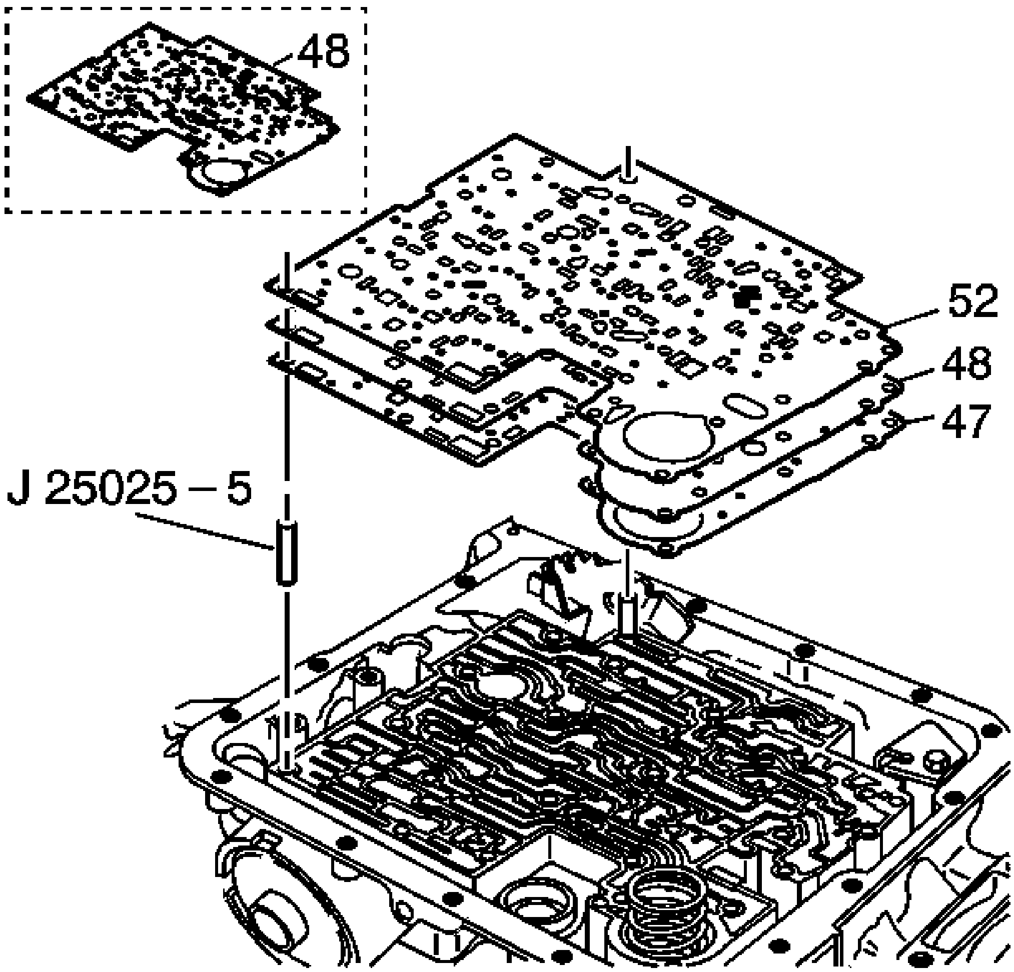


Fig. 282: Inspecting Direct Clutch Hub For Wear Or Damage
Courtesy of GENERAL MOTORS CORP.

1. Remove the direct clutch hub retainer ring (616).

2. Remove the direct clutch hub (615).
3. Remove the direct clutch housing thrust washer (614) (plastic).
4. Remove the forward clutch hub (613).
5. Remove the forward clutch housing thrust washer (612) (bronze). The washer may stick to the forward clutch housing assembly (602).
6. Inspect the direct clutch hub (615) for the following:
   - Spline wear
   - Open lubrication holes
   - A damaged clutch surface

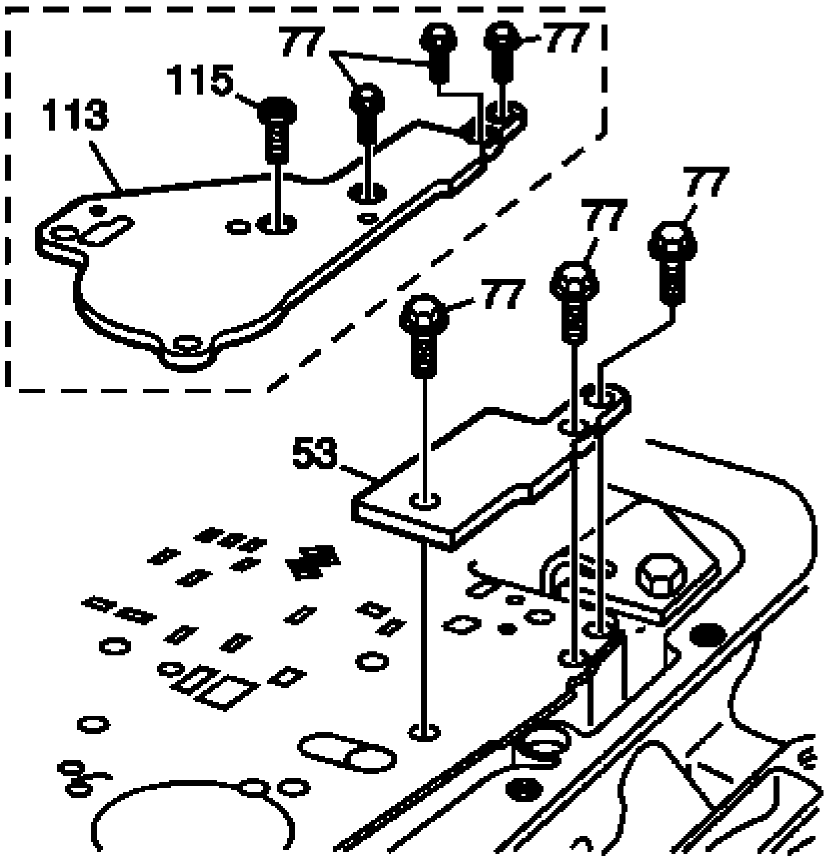


Fig. 283: Identifying Forward Clutch Steel & Composite Plates Inspection Areas
Courtesy of GENERAL MOTORS CORP.

7. Remove the forward clutch steel and composite plates (610, 611).
8. Remove the forward clutch (waved) plate (609).
9. Inspect the forward clutch plates (609-611) for the following:
   - Burning
   - Scoring

- Flaking
- Pitting
- Wear

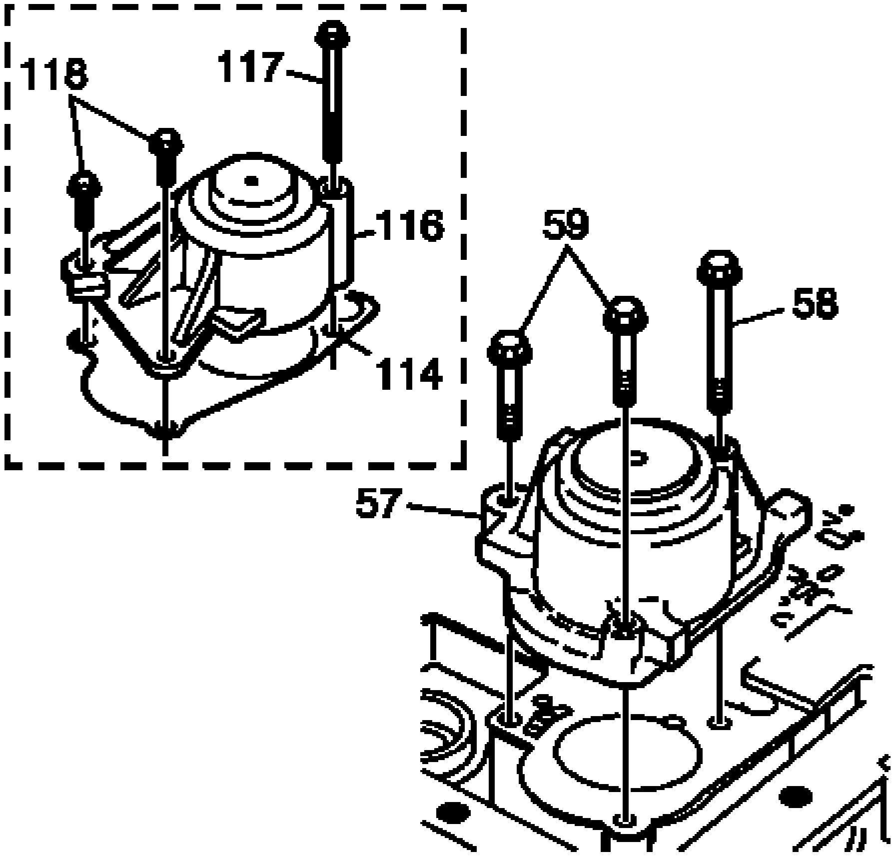


Fig. 284: Locating Inspection Areas On Forward Clutch Spring Assembly
Courtesy of GENERAL MOTORS CORP.

10. Using the **J 23327** and the **J 25018-A** , compress the forward clutch spring assembly (607).
11. Remove the forward clutch spring retainer ring (608).
12. Remove the tools.
13. Remove the forward clutch spring assembly (607).
14. Inspect the forward clutch spring assembly (607) for collapsed spring coils and distortion.

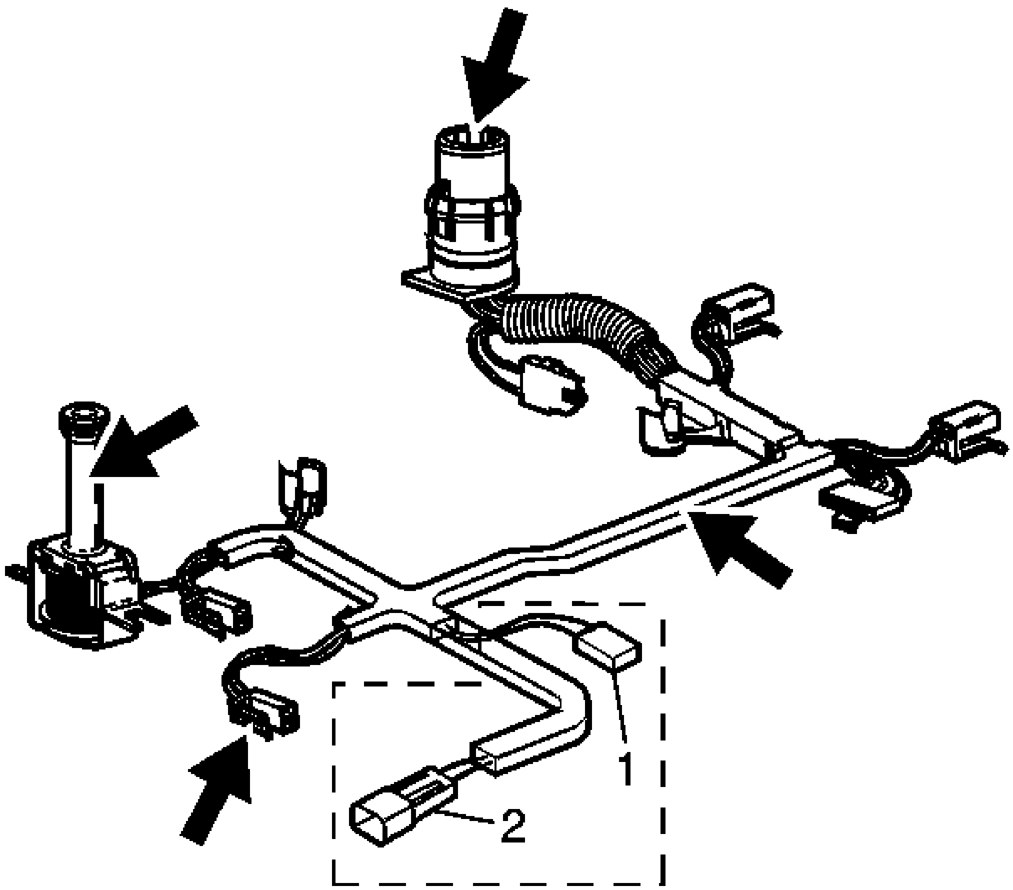


Fig. 285: Inspection Areas On Forward Clutch Piston Assembly
Courtesy of GENERAL MOTORS CORP.

15. Remove the forward clutch piston assembly (606). The forward clutch piston assembly is reusable if it is not damaged.
16. Inspect the forward clutch piston assembly (606) for cracks.
17. Inspect the seal on the forward clutch piston assembly (606) for cuts, tears, and nicks.

IMPORTANT: The forward clutch piston intermediate seal assembly (685) is reusable. Replace the forward clutch housing assembly (602) if the seal is worn or damaged.

18. Inspect the forward clutch piston intermediate seal assembly (685) for cuts, tears, and nicks.
19. Inspect the forward clutch housing assembly (602) for the following:
    - Wear

- Restricted/Clogged oil passages
- Damaged thrust faces
- Free movement of checkball (rattles)

FORWARD CLUTCH ASSEMBLY ASSEMBLE

Tools Required

- **J 21362-1** Forward Clutch Piston and Inner Seal Protector. See **Special Tools**.
- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 25018-A** Clutch Spring Compressor Adapter
- **J 36850** Transjel® Lubricant
- **J 38732-1** Direct and Forward Clutch Piston and Seal Outer Protector. See **Special Tools**.

Procedure

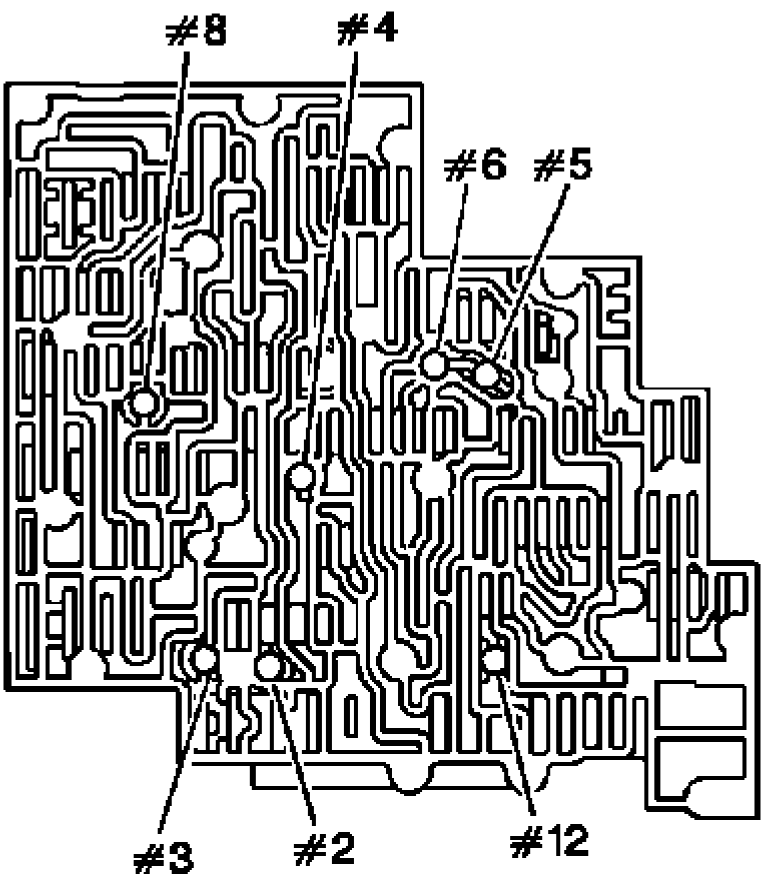


Fig. 286: J 21362-1 On Forward Clutch Housing Assembly Hub
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the seal on the forward clutch piston assembly (606) with DEXRON®VI transmission fluid.

2. Lubricate the forward clutch piston intermediate seal assembly (685) with DEXRON®VI transmission fluid.
3. Install the **J 21362-1** over the hub of the forward clutch housing assembly (602). See **Special Tools**.
4. Place the forward clutch piston assembly (606) inside the **J 38732-1** and insert the assembly into the forward clutch housing assembly (602). See **Special Tools**.
5. Push down on and slightly rotate the forward clutch piston assembly (606) until it is seated.
6. Remove the tools.

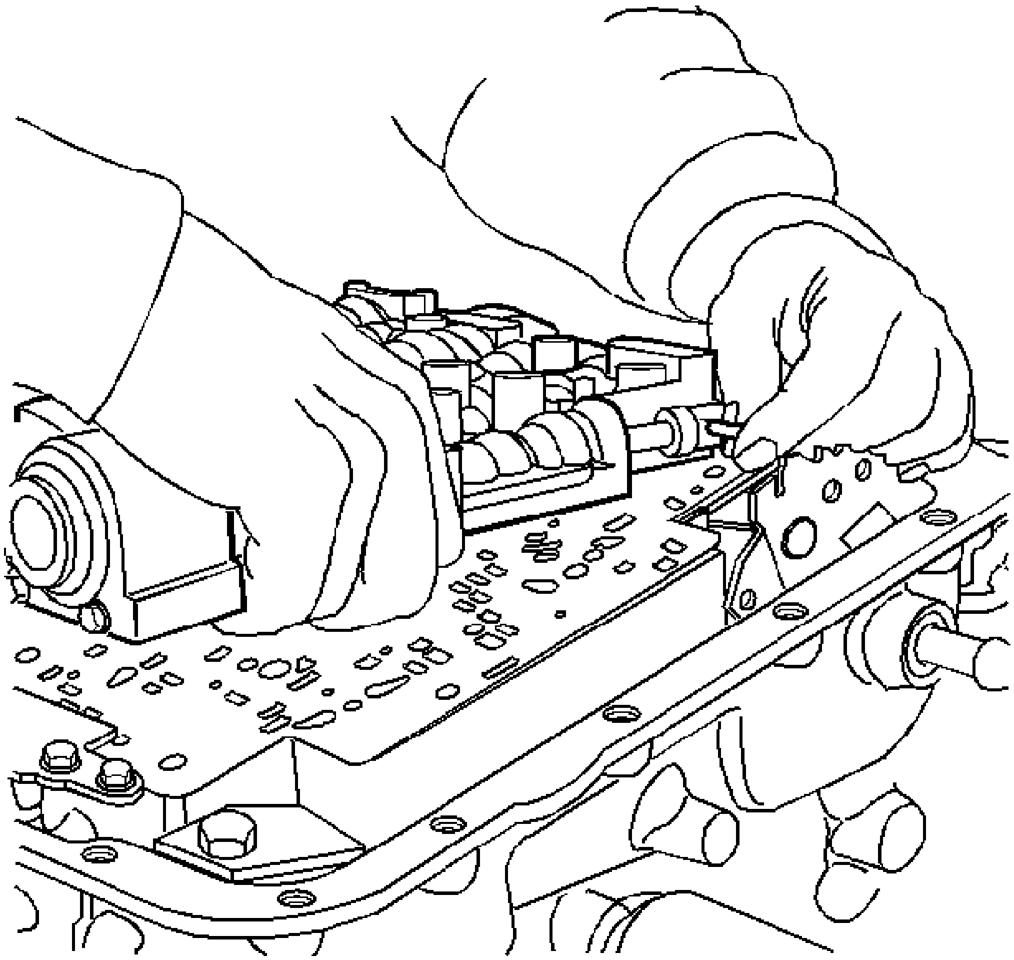


Fig. 287: Compressing Forward Clutch Spring Assembly With J 23327 & J 25018-A
Courtesy of GENERAL MOTORS CORP.

7. Install the forward clutch spring assembly (607).

8. Using the **J 23327** and the **J 25018-A** , compress the forward clutch spring assembly (607).
9. Install the forward clutch spring retainer ring (608).
10. Remove the tools.

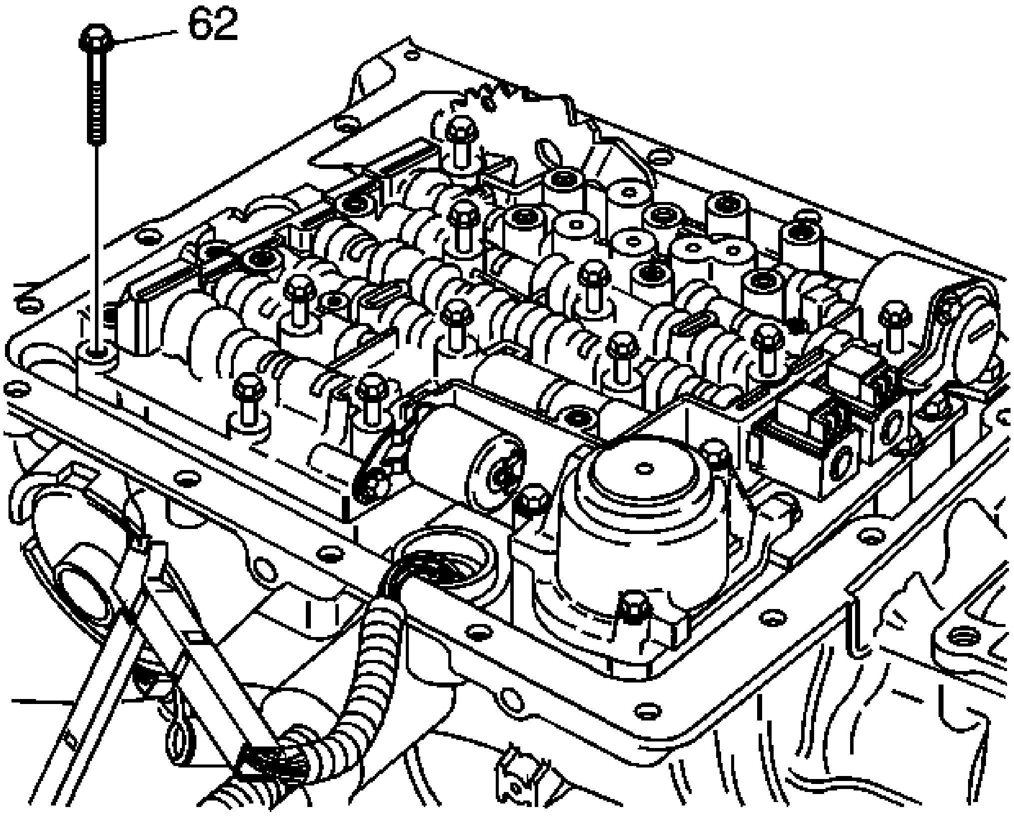


Fig. 288: Forward Clutch Plates
Courtesy of GENERAL MOTORS CORP.

11. Dip the forward clutch plates in DEXRON®VI transmission fluid.
12. Install the forward clutch (waved) plate (609) into the forward clutch housing assembly (602).

IMPORTANT: Alternate the clutch plates, starting with the steel clutch plate (5 steel and 5 composite).

13. Install the steel and composite forward clutch plates (610, 611).

IMPORTANT: The forward clutch hub, forward clutch housing thrust washer and the

direct clutch housing thrust washer should not be installed at this time. This allows easier access in order to perform the forward clutch piston travel check.

14. Install the direct clutch hub (615).
15. Install the direct clutch hub retainer ring (616).

FORWARD CLUTCH PISTON TRAVEL CHECK

Tools Required

- **J 8001** Dial Indicator Set
- **J 26900-13** Magnetic Indicator Base

Procedure

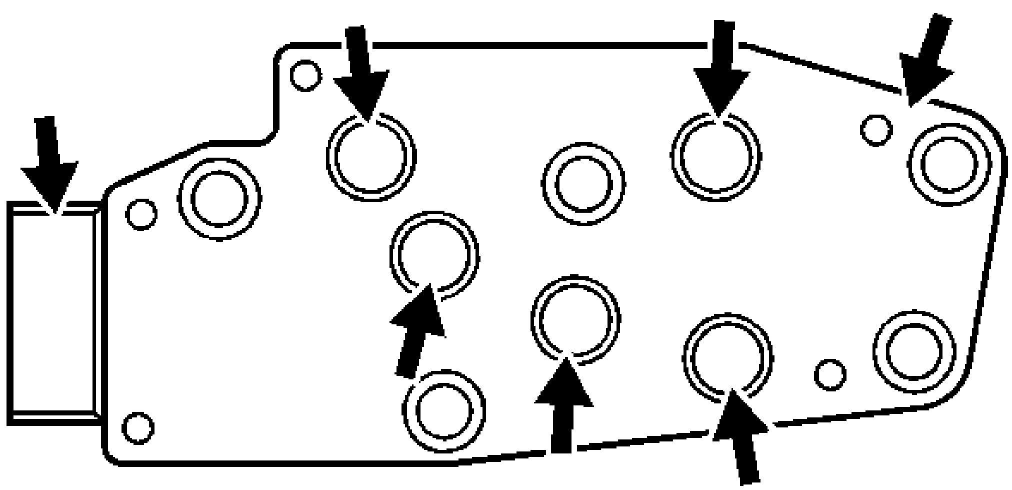


Fig. 289: View Of Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The turbine shaft (502) is required in order to perform the forward clutch piston travel check.

1. Remove the overdrive carrier retainer ring (522).
2. Remove the turbine shaft (502).

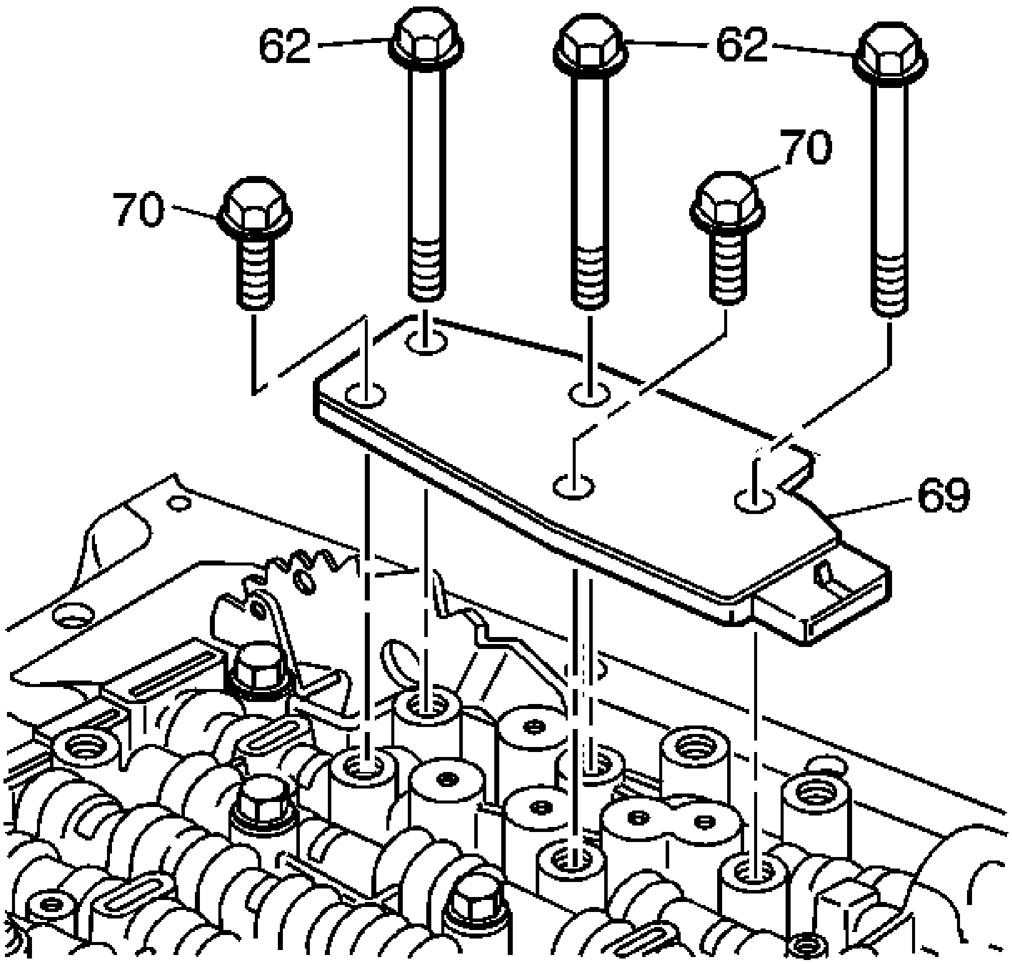


Fig. 290: Blowing Air Into Forward Clutch Fluid Passage In Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

3. Place the turbine shaft (502) in a soft-jawed vice.
4. Install the forward clutch housing assembly (602) onto the turbine shaft (502).
5. Attach the **J 8001-3** to the **J 26900-13** .
6. Place an index finger over one side of the forward clutch fluid passage in the turbine shaft (502).
7. Apply air to the other side of the forward clutch fluid passage in the turbine shaft (502).

   Piston Travel Specification: The piston travel should be 1.27-4.369 mm (0.050-0.172 in).

8. Remove the tools.
9. Remove the forward clutch housing assembly (602) from the turbine shaft (502).

FORWARD CLUTCH HUB ASSEMBLE

Tools Required

J 36850 Transjel® Lubricant

Procedure

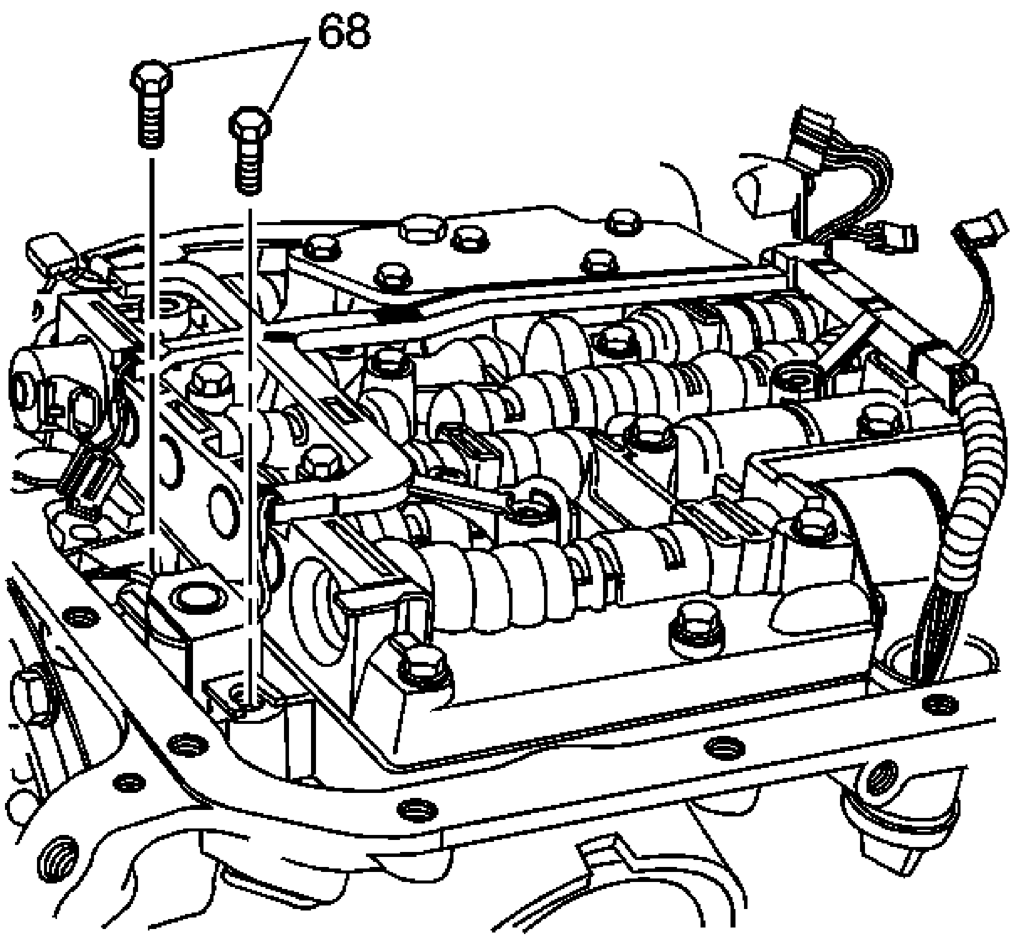


Fig. 291: View Of Direct Clutch Hub Retainer Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the direct clutch hub retainer ring (616).
2. Remove the direct clutch hub (615).

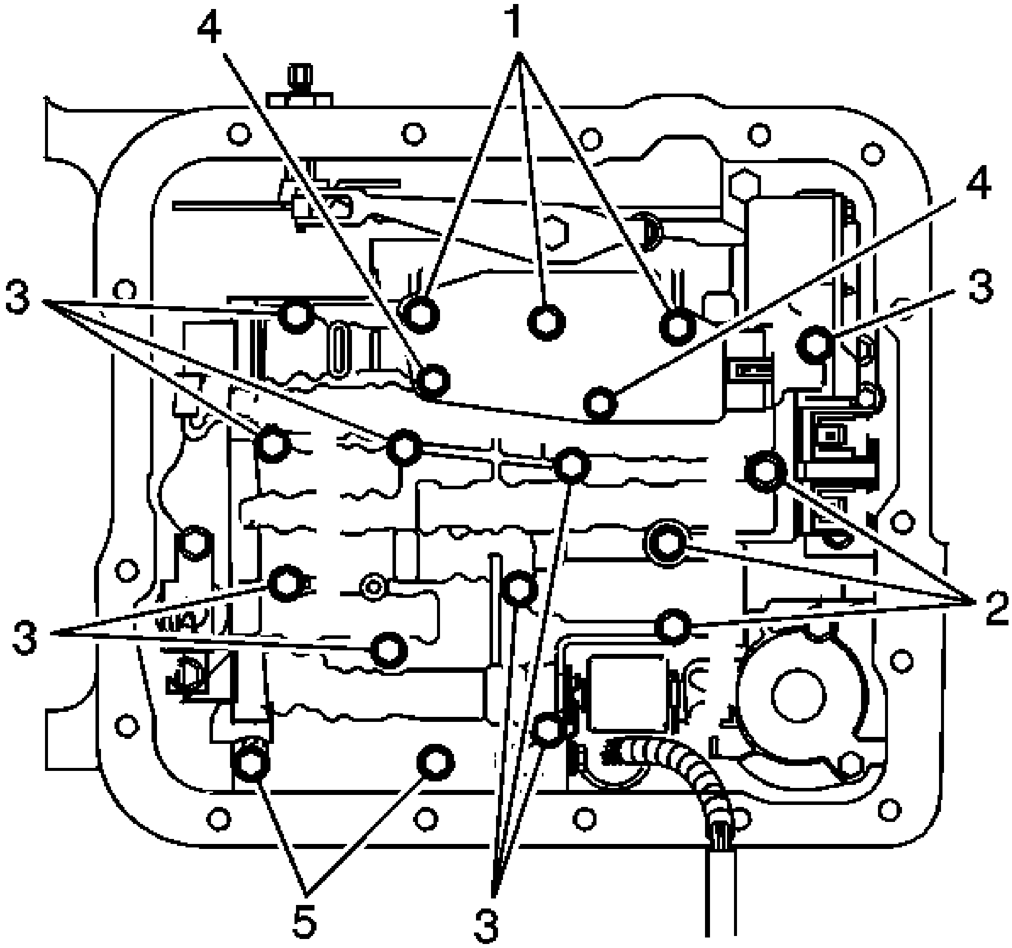


Fig. 292: Identifying Direct & Forward Clutch Housing Thrust Washer
Courtesy of GENERAL MOTORS CORP.

3. Install the forward clutch housing thrust washer (612) (bronze) on the inside of the forward clutch hub (613). Retain the thrust washer with **J 36850** or equivalent.
4. Install the direct clutch housing thrust washer (614) (plastic) on the outside of the forward clutch hub (613). Retain the thrust washer with **J 36850** or equivalent.

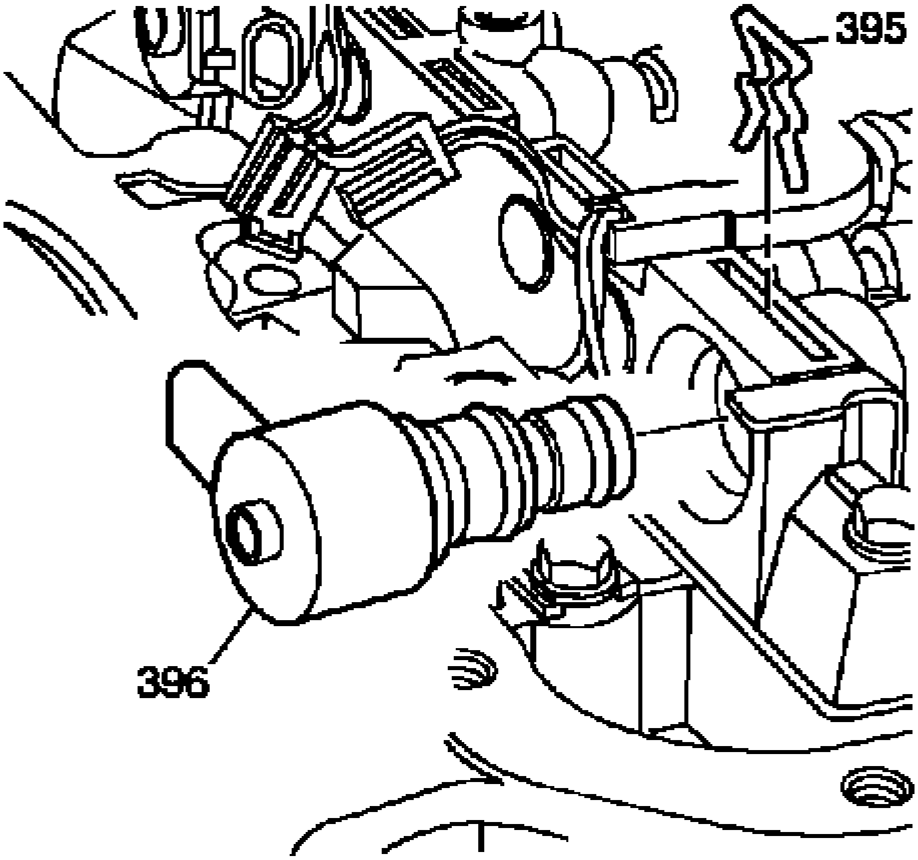


Fig. 293: View Of Forward Clutch Housing Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the forward clutch hub (613) into the forward clutch housing assembly (602). Rotate the hub slightly in each direction in order to ease installation.
6. Install the direct clutch hub (615) into the forward clutch housing assembly (602).
7. Install the direct clutch hub retainer ring (616).

FORWARD CLUTCH ASSEMBLY INSTALLATION

Tools Required

- **J 36850** Transjel® Lubricant
- **J 38358-A** Forward Clutch Assembly Remover/Installer. See **Special Tools**.

Procedure

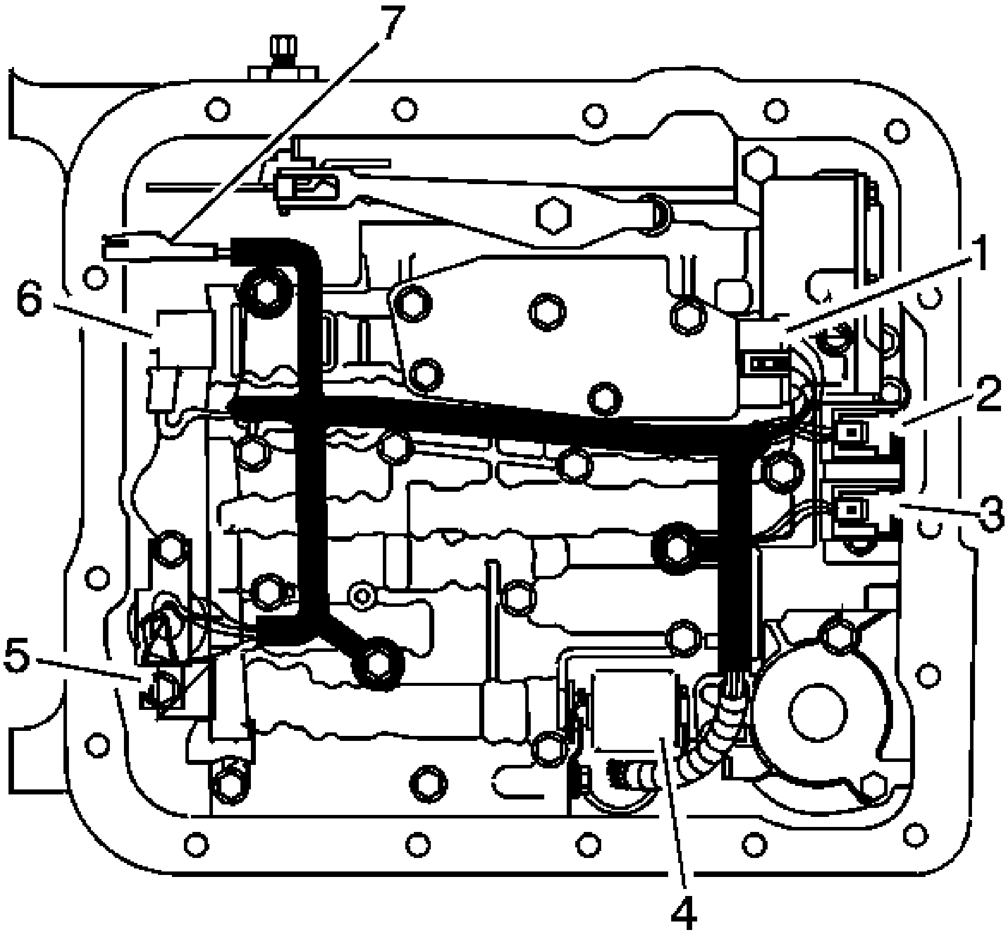


Fig. 294: Overdrive Carrier/Forward Clutch Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Align the direct clutch plates in order to aid in the installation of the forward clutch housing assembly (602).

IMPORTANT: Following installation of the forward clutch housing assembly (602), the distance between the top of the speed sensor ring and the pump gasket surface should be approximately 98-99 mm (3.85-3.89 in).

2. Using the **J 38358-A** , install the forward clutch housing assembly (602). See **Special Tools**.
3. Install the overdrive carrier/forward clutch thrust bearing assembly (601) (silver side up) onto the forward clutch housing assembly (602). Retain with **J 36850** or equivalent.

4TH CLUTCH ASSEMBLY DISASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 38731-3** Fourth Clutch Piston and Housing Seal Spacer. See **Special Tools**.
- **J 38882** Fourth Clutch Spring and Retainer Assembly Adapter. See **Special Tools**.

Procedure

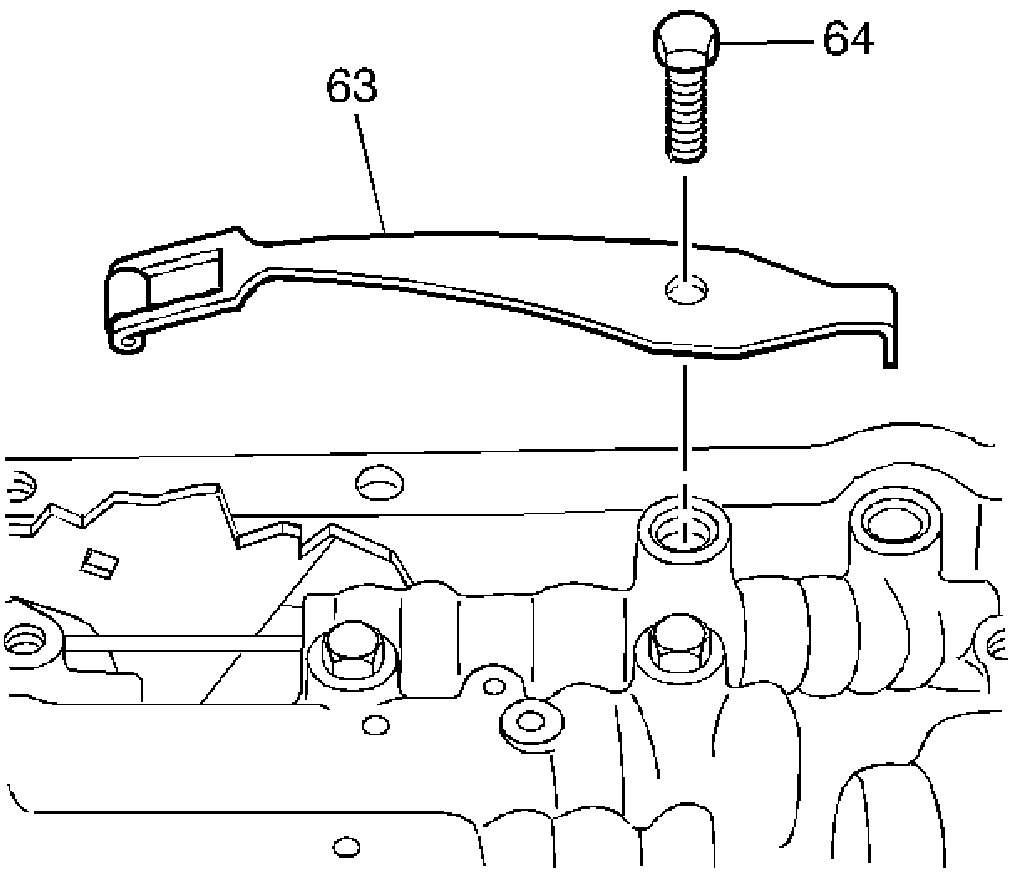


Fig. 295: Identifying Fourth Clutch Backing Plate Retainer Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the fourth clutch backing plate retainer ring (523).

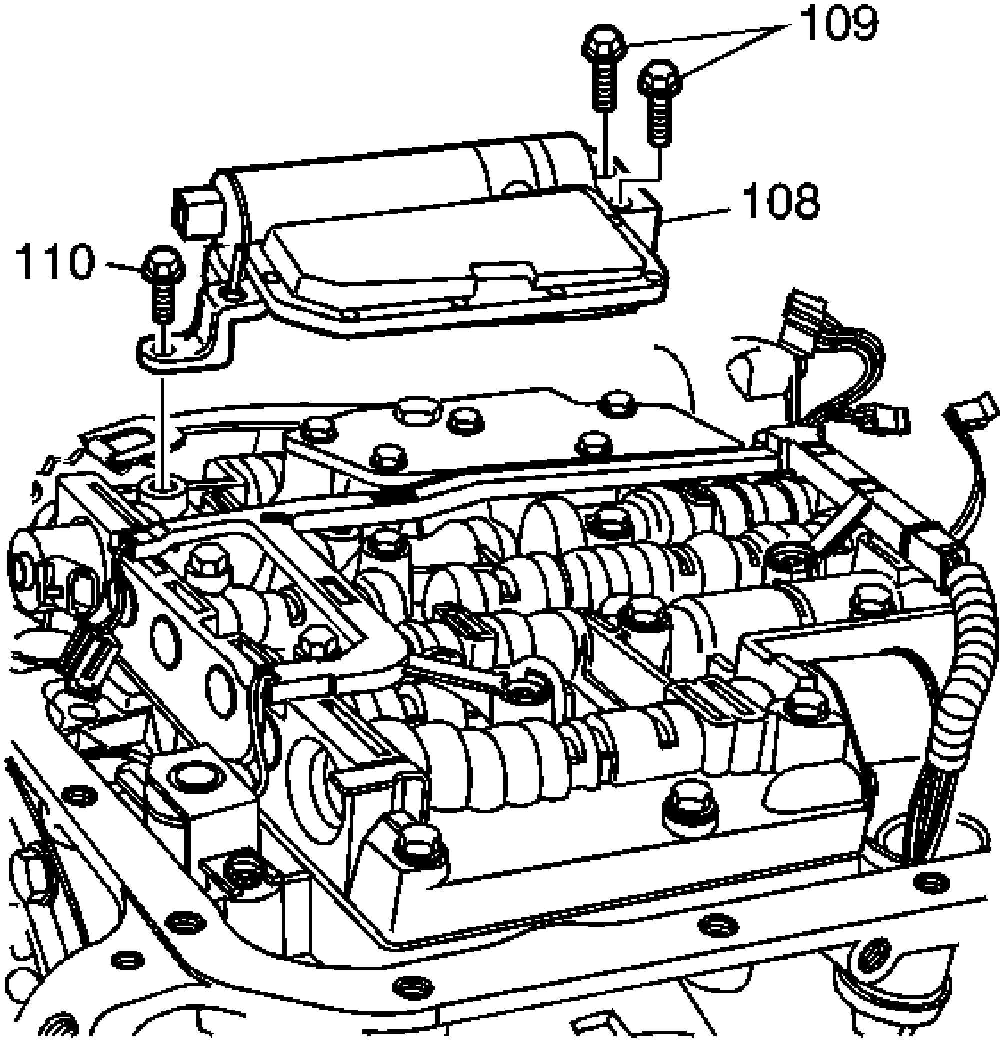


Fig. 296: View Of Fourth Clutch Plates
Courtesy of GENERAL MOTORS CORP.

2. Remove the fourth clutch backing plate (524).
3. Remove the fourth clutch plates (525, 526).

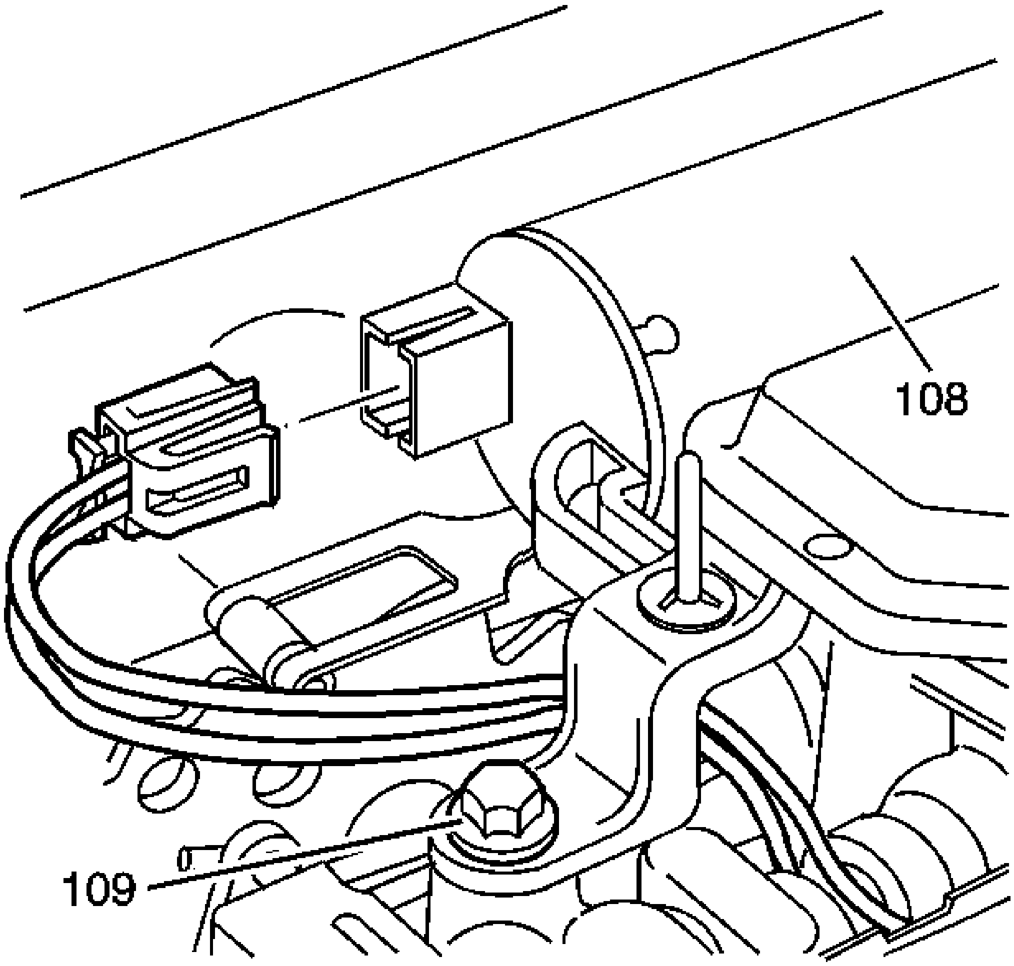


Fig. 297: Identifying Fourth Clutch Spring Retainer Ring
Courtesy of GENERAL MOTORS CORP.

4. Place the fourth clutch housing (529) onto the **J 38731-3** . See **Special Tools**.
5. Using the **J 38882** and the **J 23327** , compress the fourth clutch spring assembly (532). See **Special Tools**.
6. Remove the fourth clutch spring retainer ring (533).
7. Remove the **J 38882** and the **J 23327** . See **Special Tools**.
8. Remove the fourth clutch spring assembly (532).

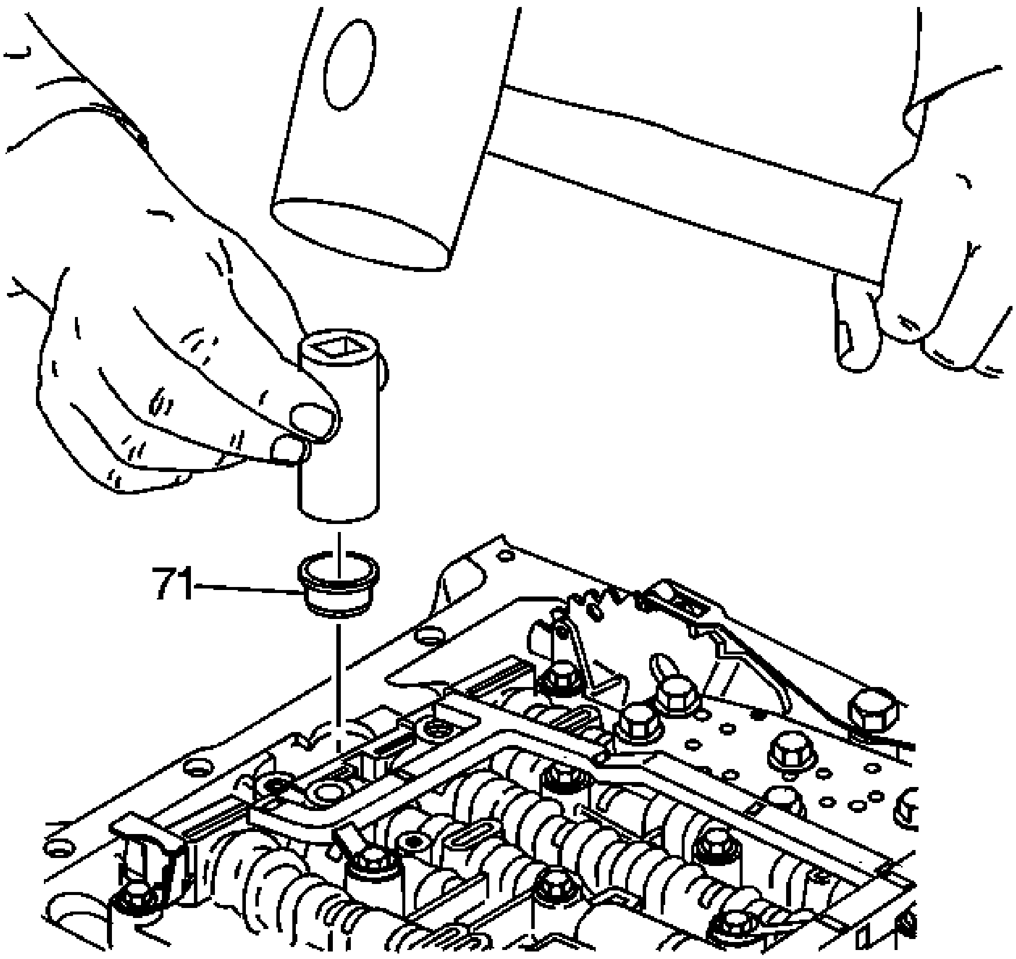


Fig. 298: Locating Fourth Clutch Orifice
Courtesy of GENERAL MOTORS CORP.

9. Remove the fourth clutch piston (528).
10. Remove the fourth clutch piston inner seal (527).
11. Remove the fourth clutch piston outer seal (531) from the fourth clutch housing (529).
12. Inspect the fourth clutch orifice (530).

    Orifice Specification: The small hole in the orifice should be open approximately 0.51 mm (0.020 in).

4TH CLUTCH ASSEMBLY ASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 38731-1** Fourth Clutch Piston and Housing Seal Protector. See **Special Tools**.
- **J 38731-2** Fourth Clutch Piston and Housing Seal Protector. See **Special Tools**.
- **J 38731-3** Fourth Clutch Piston and Housing Seal Spacer. See **Special Tools**.
- **J 38882** Fourth Clutch Spring and Retainer Assembly Adapter. See **Special Tools**.

Procedure

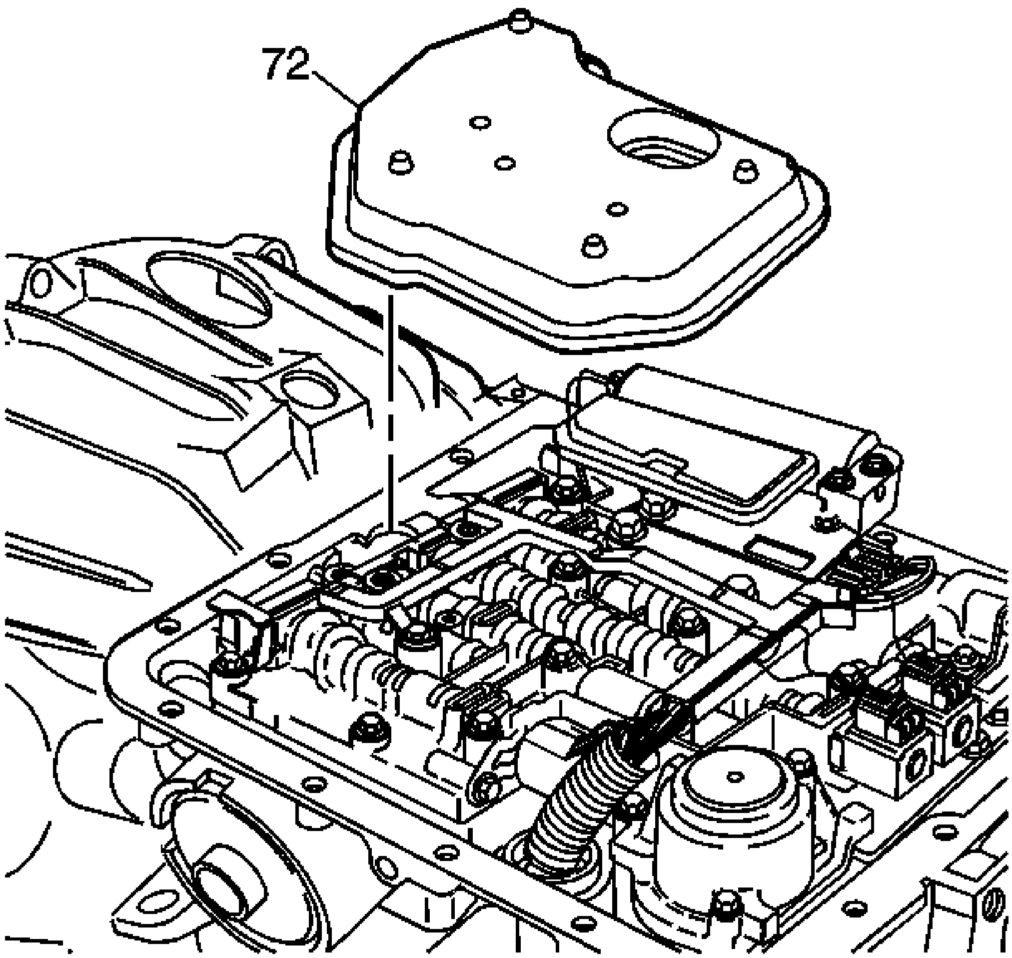


Fig. 299: View Of Fourth Clutch Piston Inner Seal
Courtesy of GENERAL MOTORS CORP.

1. Install the fourth clutch piston inner seal (527) onto the fourth clutch piston (528).

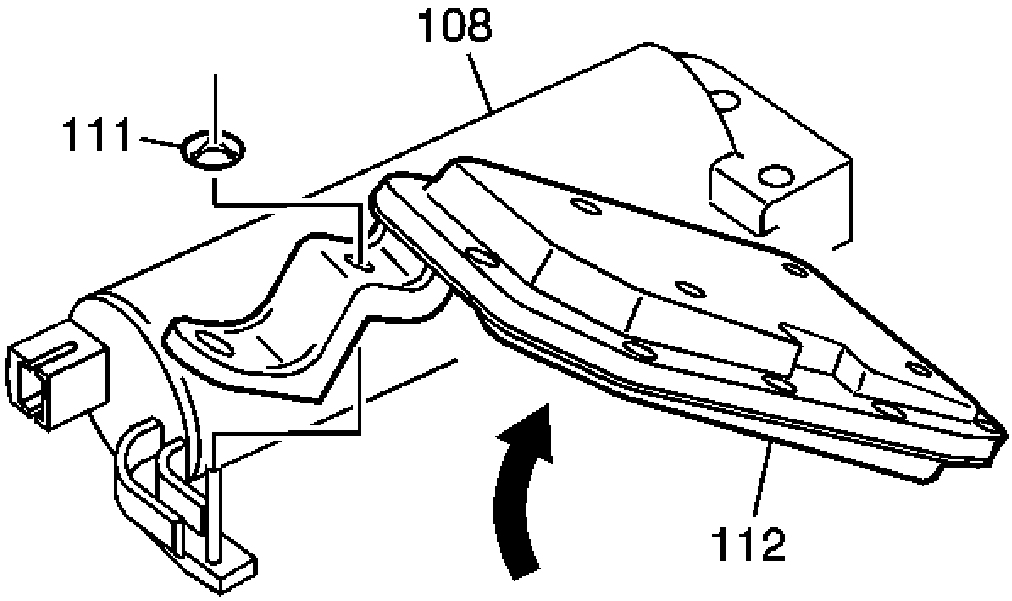


Fig. 300: Locating Fourth Clutch Piston Outer Seal
Courtesy of GENERAL MOTORS CORP.

2. Install the fourth clutch piston outer seal (531) into the fourth clutch housing (529). The seal lip should face the bottom of the piston when the piston is installed.

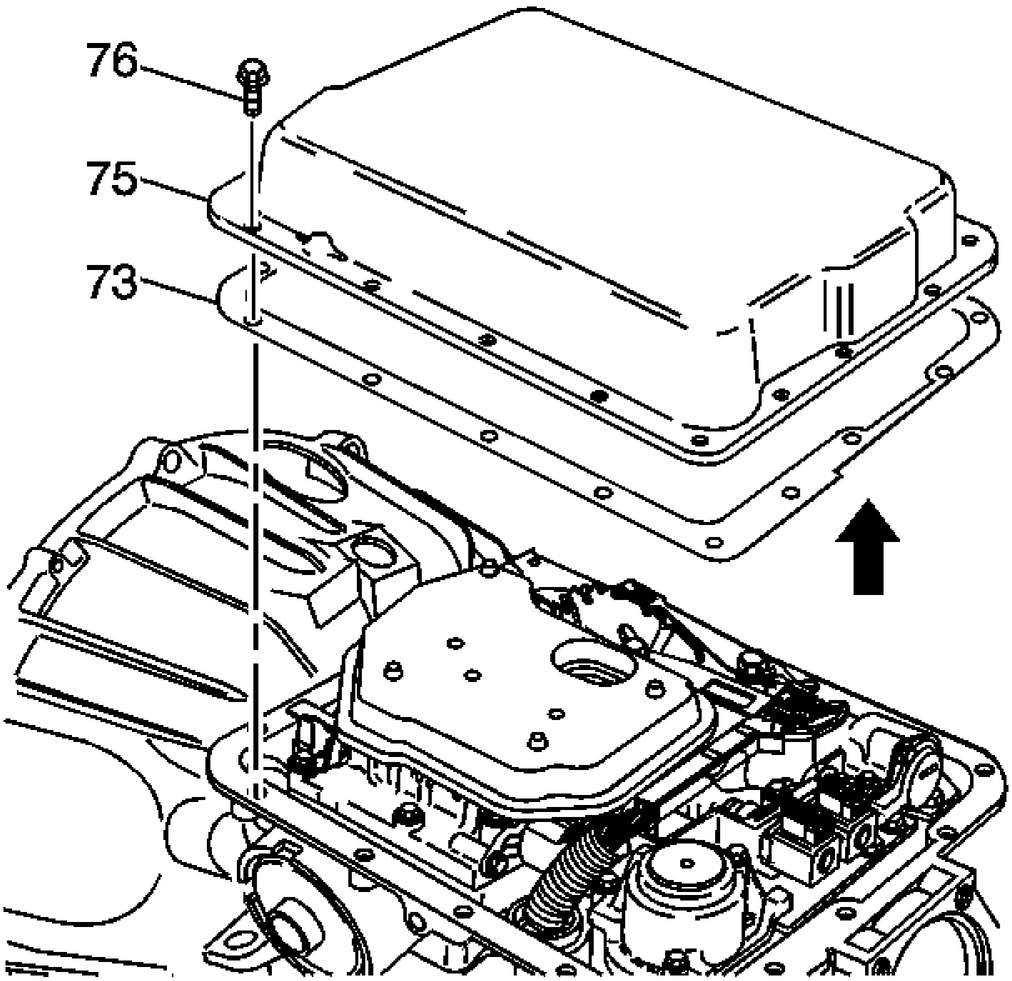


Fig. 301: Identifying Fourth Clutch Housing
Courtesy of GENERAL MOTORS CORP.

3. Place the **J 38731-1** into the fourth clutch housing (529) through the smaller opening. See **Special Tools**.
4. Place the **J 38731-2** onto the larger opening of the fourth clutch piston (528). See **Special Tools**.

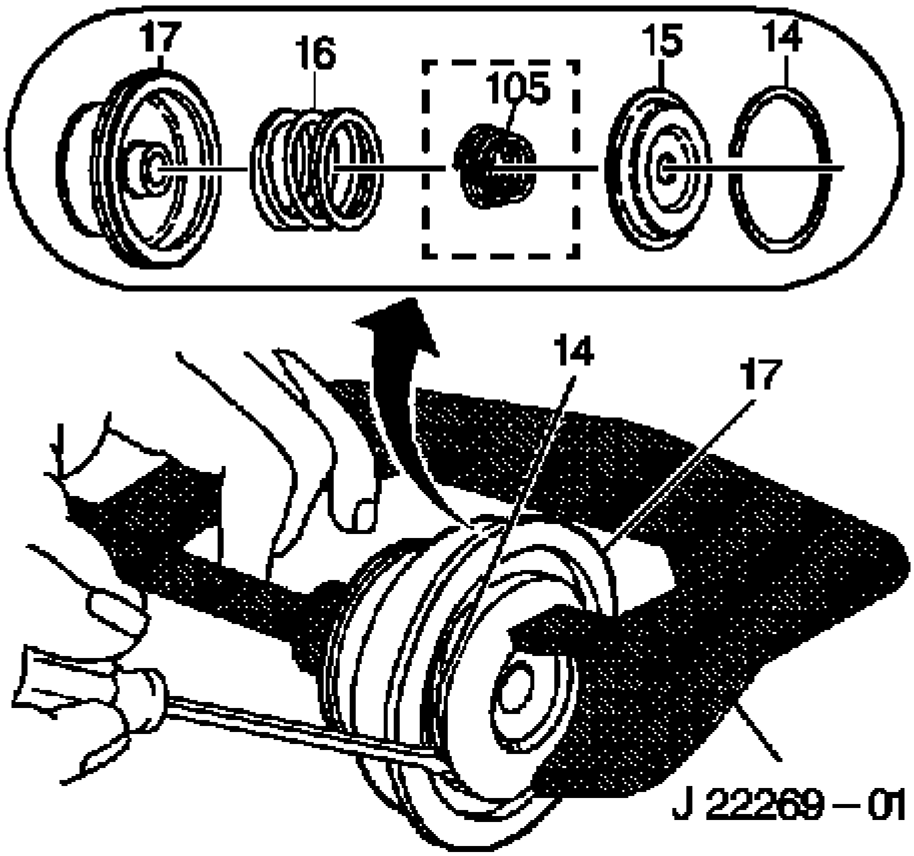


Fig. 302: View Of J 38731-2 & J 38731-3
Courtesy of GENERAL MOTORS CORP.

5. Place the **J 38731-2** and the fourth clutch piston (528) onto the **J 38731-3** . See **Special Tools**.

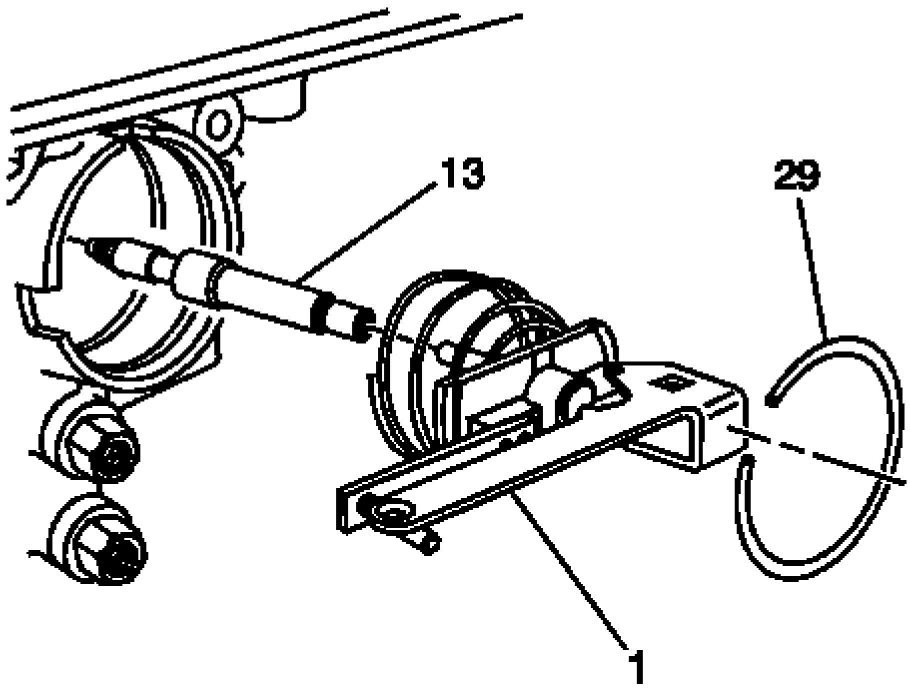


Fig. 303: Identifying Fourth Clutch Piston
Courtesy of GENERAL MOTORS CORP.

6. Install the fourth clutch piston (528) into the fourth clutch housing (529) by gently pushing down on the fourth clutch housing (529), until the fourth clutch piston (528) is through the fourth clutch housing (529), exposing the retainer ring groove.
7. Remove all tools.

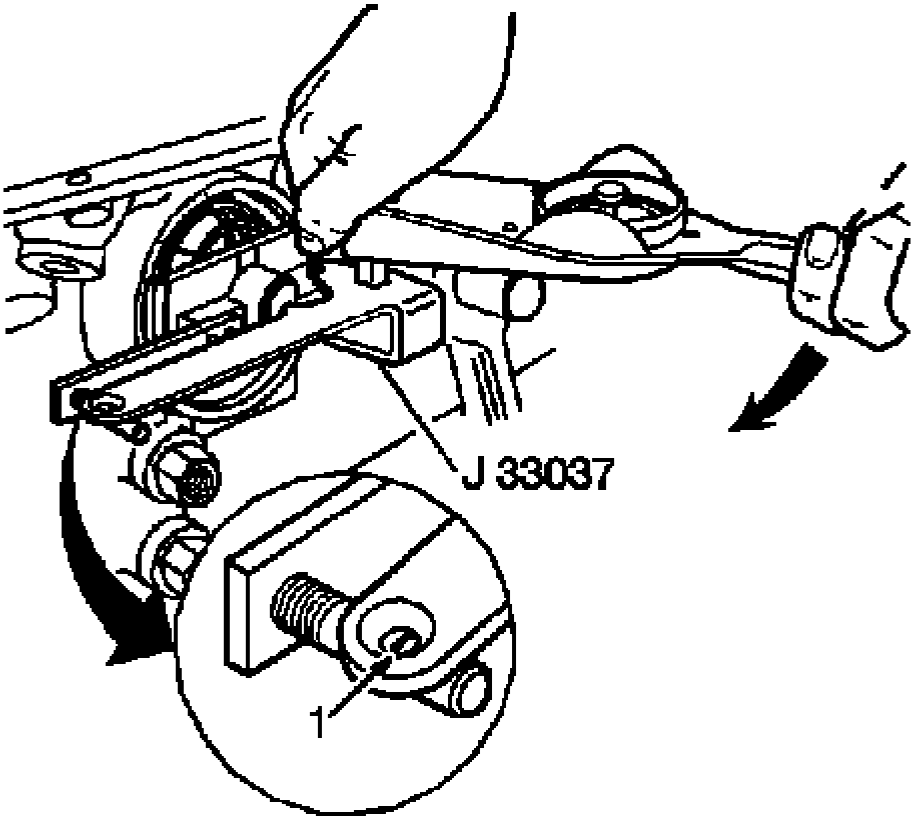


Fig. 304: Identifying Fourth Clutch Spring Retainer Ring
Courtesy of GENERAL MOTORS CORP.

8. Place the fourth clutch spring assembly (532) and the fourth clutch spring retainer ring (533) onto the fourth clutch piston (528).
9. Using the **J 38882** , the **J 23327** and the **J 38731-3** , compress the fourth clutch spring (532). See **Special Tools**.
10. Install the fourth clutch spring retainer ring (533).
11. Remove the tools.

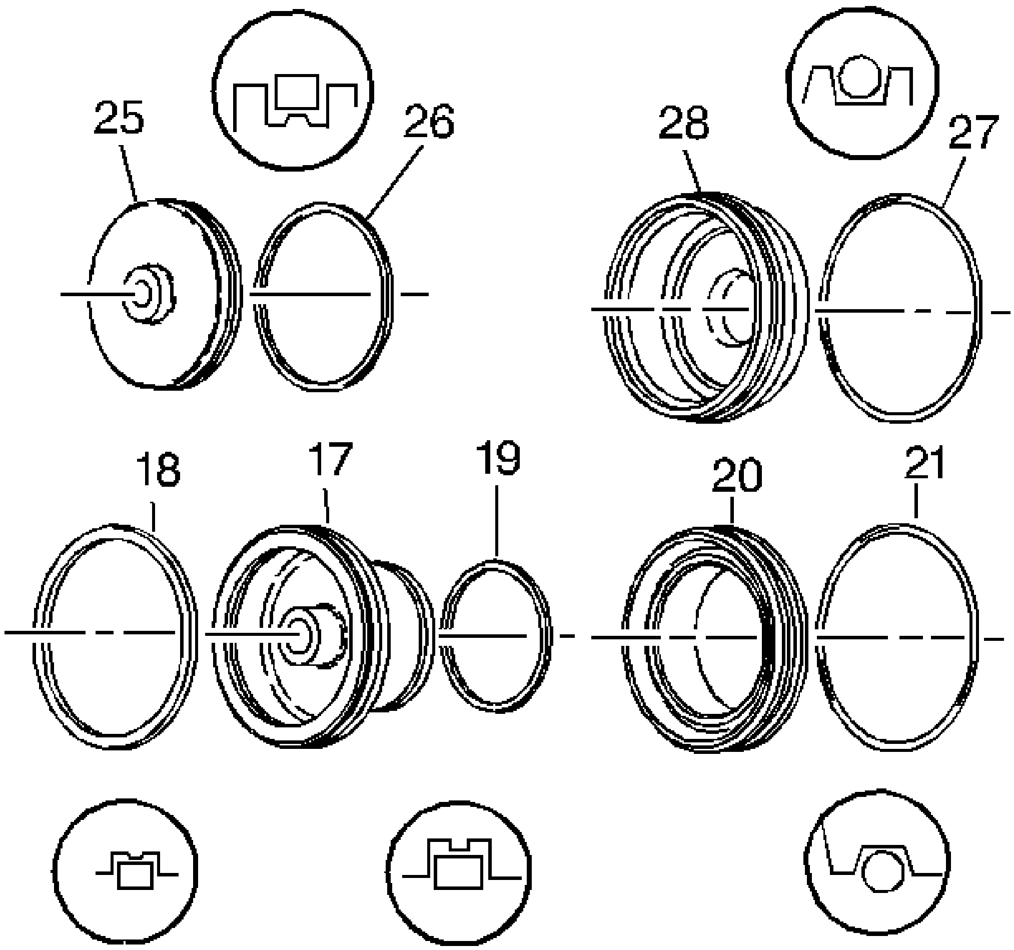


Fig. 305: Fourth Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Alternate the clutch plates, starting with the steel clutch plate (526) (4 steel and 4 composite). Locate the steel plate index notch opposite the fourth clutch bolt hole.

12. Install the fourth clutch plates (525, 526) into the fourth clutch housing (529).
13. Install the fourth clutch backing plate (524). Align the notched tab in the same direction as the steel plate index notches.
14. Install the fourth clutch backing plate retainer ring (523).

4TH CLUTCH PISTON TRAVEL CHECK

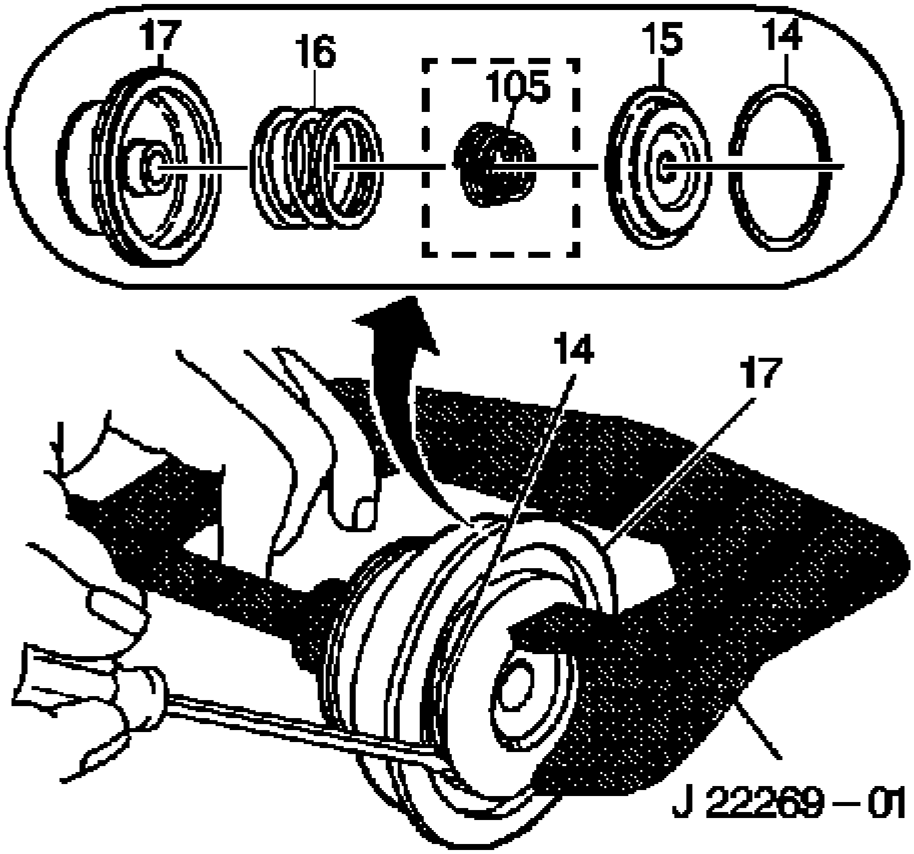


Fig. 306: Measuring Piston Travel Between Fourth Clutch Backing Plate & Retainer Ring
Courtesy of GENERAL MOTORS CORP.

Using a feeler gage, measure the piston travel between the fourth clutch backing plate (524) and the fourth clutch backing plate retainer ring (523).

Piston Travel Specification: Piston travel should be 1.016-2.540 mm (0.040-0.100 in).

4TH CLUTCH ASSEMBLY INSTALLATION

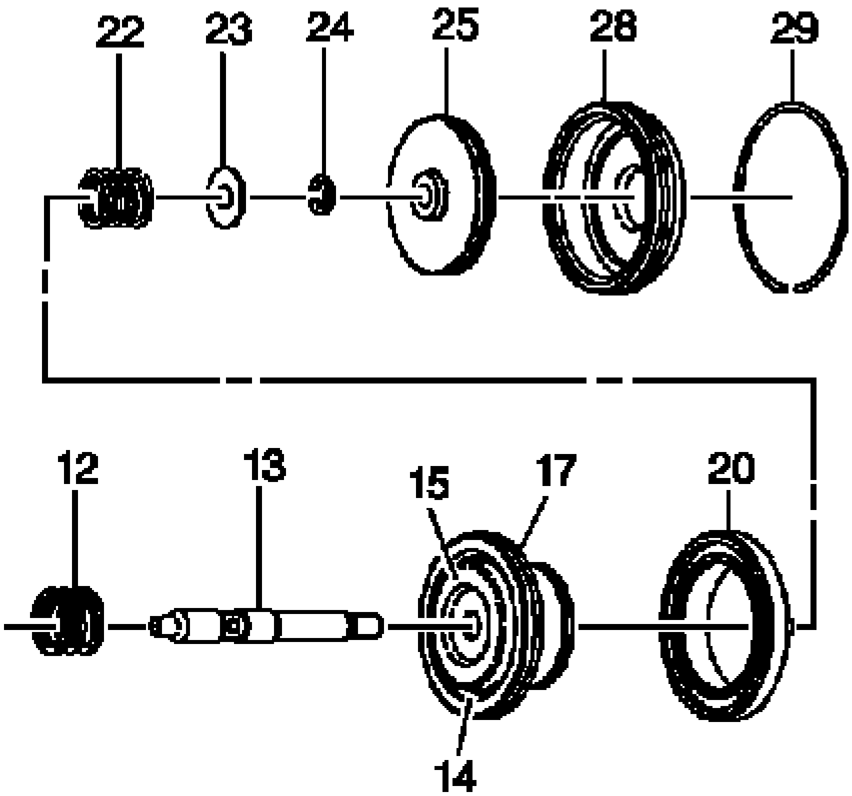


Fig. 307: Fourth Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Removal of the fourth clutch backing plate retainer ring, the fourth clutch backing plate, and the fourth clutch plates will ease assembly of the overrun clutch housing assembly.

1. Remove the fourth clutch backing plate retainer ring (523) from the fourth clutch housing (529).
2. Remove the fourth clutch backing plate (524).
3. Remove the clutch plates (525, 526).

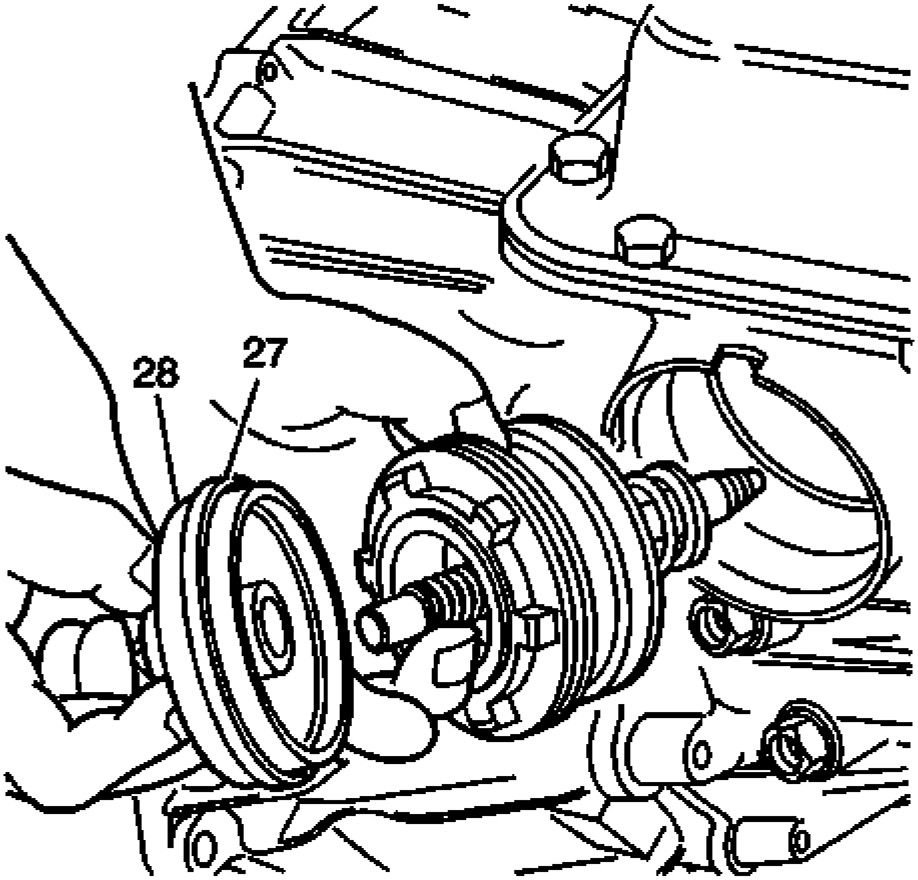


Fig. 308: View Of Fourth Clutch Housing
Courtesy of GENERAL MOTORS CORP.

4. Install the fourth clutch housing (529) into the transmission case assembly.

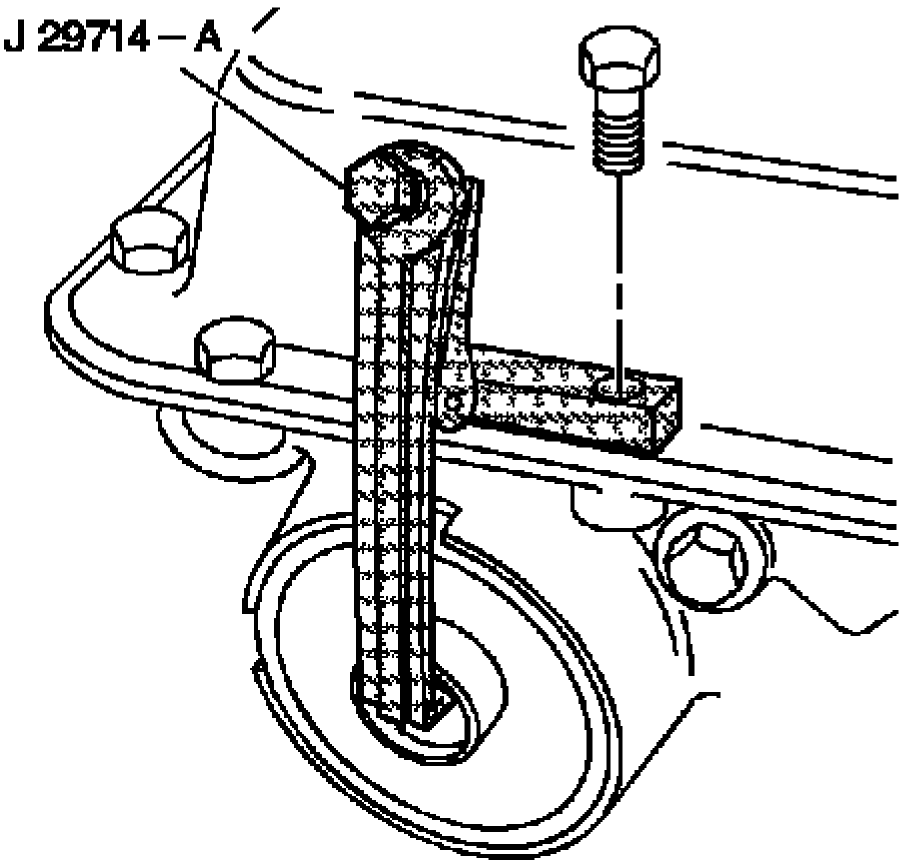


Fig. 309: Locating Fourth Clutch Housing Bolt
Courtesy of GENERAL MOTORS CORP.

5. Install a new fourth clutch housing bolt (26).

NOTE: **Refer to FASTENER NOTICE .**

IMPORTANT: Do not over torque the fourth clutch housing bolt (26).

6. Tighten the fourth clutch housing bolt (26).

Tighten: Tighten the bolt to 23-26 N.m (17-19 lb ft).

OVERRUN CLUTCH ASSEMBLY DISASSEMBLE

Tools Required

- **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.
- **J 23327** Clutch Spring Compressor. See **Special Tools**.

Procedure

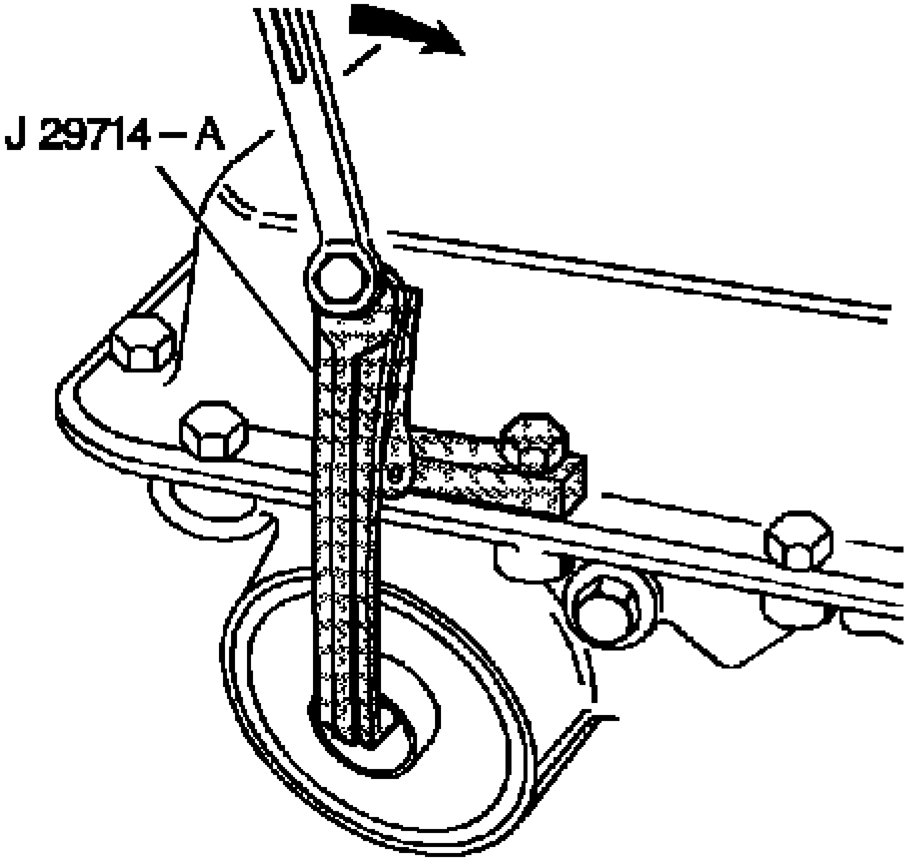


Fig. 310: View Of Overdrive Clutch Roller Assembly
Courtesy of GENERAL MOTORS CORP.

1. Separate the overdrive carrier assembly (514) from the overrun clutch housing assembly (504).
2. Remove the overdrive clutch roller assembly (512) from the overrun clutch housing assembly (504).

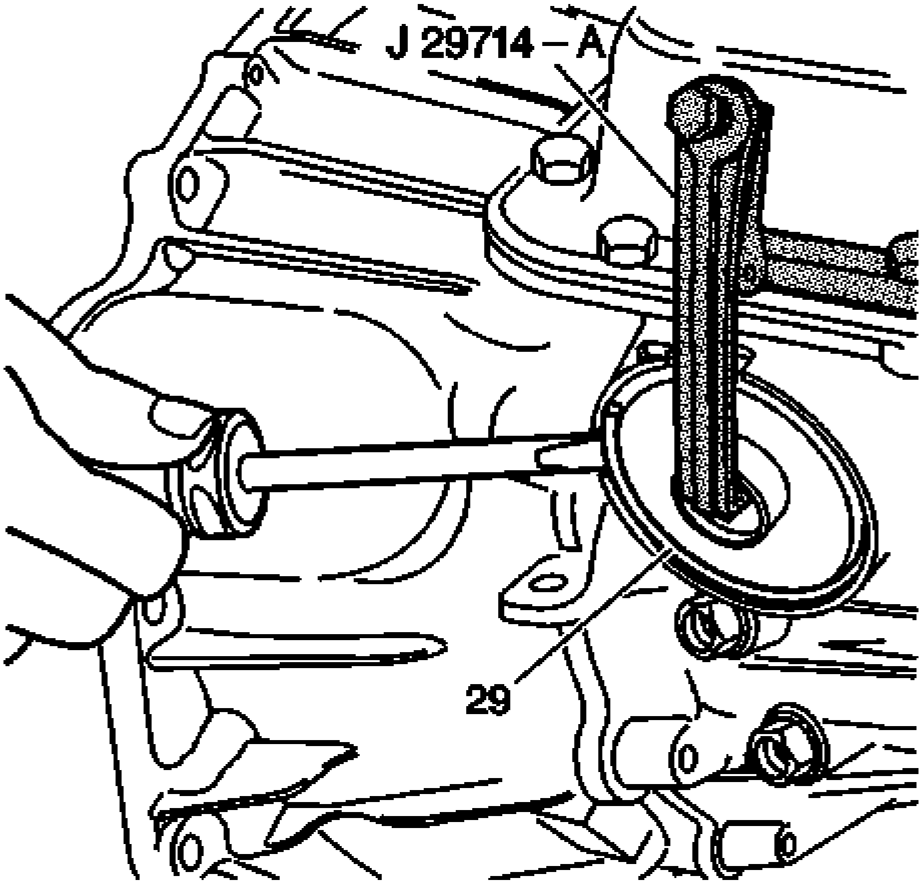


Fig. 311: View Of Overrun Clutch Backing Plate Retainer Ring
Courtesy of GENERAL MOTORS CORP.

3. Remove the overrun clutch backing plate retainer ring (511) from the overrun clutch housing assembly (504).

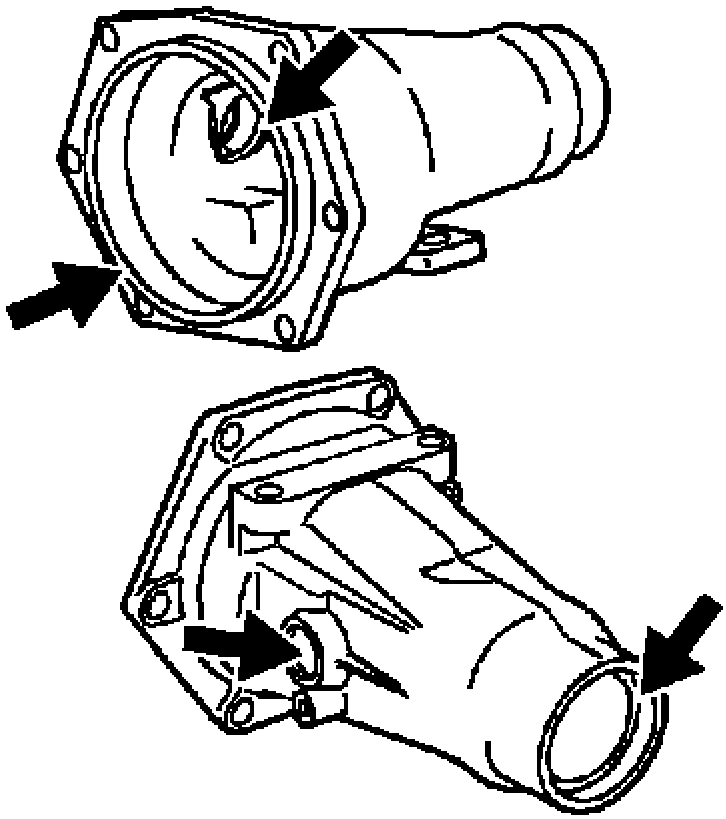


Fig. 312: Identifying Inspection Areas On Overrun Clutch Plates
Courtesy of GENERAL MOTORS CORP.

4. Remove the overrun clutch backing plate (510) and the overrun clutch plates (508, 509).
5. Inspect the overrun clutch plates (508-510) for burning, scoring, flaking, pitting, and wear.

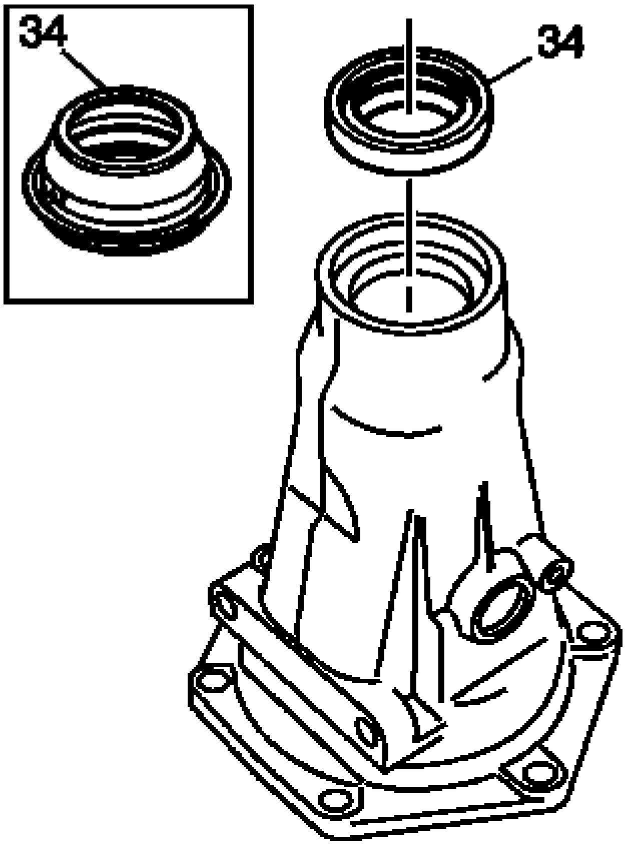


Fig. 313: View Of Overrun Clutch Spring & Piston Assembly
Courtesy of GENERAL MOTORS CORP.

6. Using the **J 23327** and the **J 38734** , remove the overrun clutch spring assembly (506). See **Special Tools**.
7. Remove the overrun clutch spring retainer ring (507).
8. Remove the tools.
9. Remove the overrun clutch spring assembly (506).
10. Remove the overrun clutch piston assembly (505).

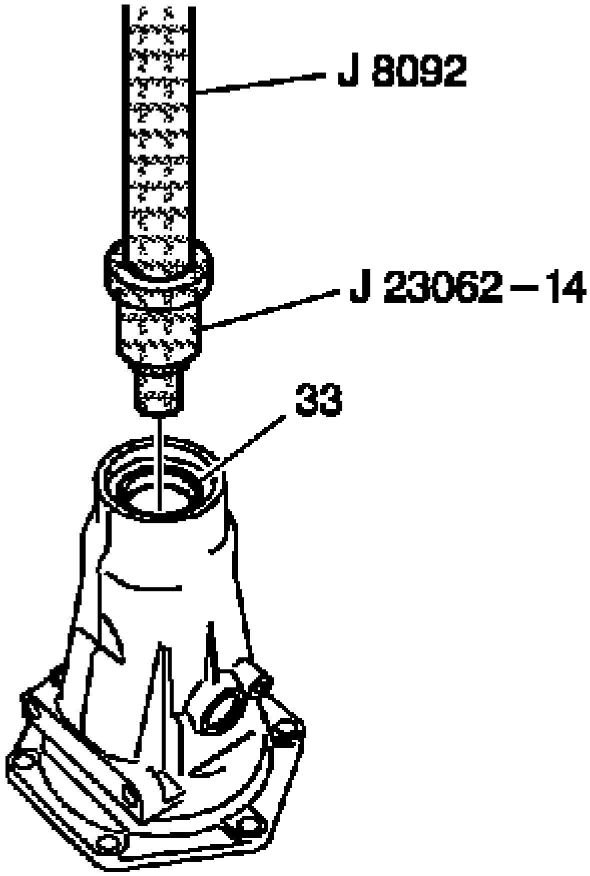


Fig. 314: Locating Inspection Areas On Overrun Clutch Spring Assembly
Courtesy of GENERAL MOTORS CORP.

11. Inspect the overrun clutch spring assembly (506) for collapsed coils and distortion.
12. Inspect the overrun clutch piston assembly (505) for cracks and a cut seal.
13. Inspect the overrun clutch housing assembly (504) for wear, clogged lubrication holes, and damaged thrust surfaces.

OVERRUN CLUTCH ASSEMBLY ASSEMBLE

Tools Required

- **J 23327** Clutch Spring Compressor. See **Special Tools**.
- **J 38729** Overrun Clutch Piston Seal Protector. See **Special Tools**.
- **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.

Procedure

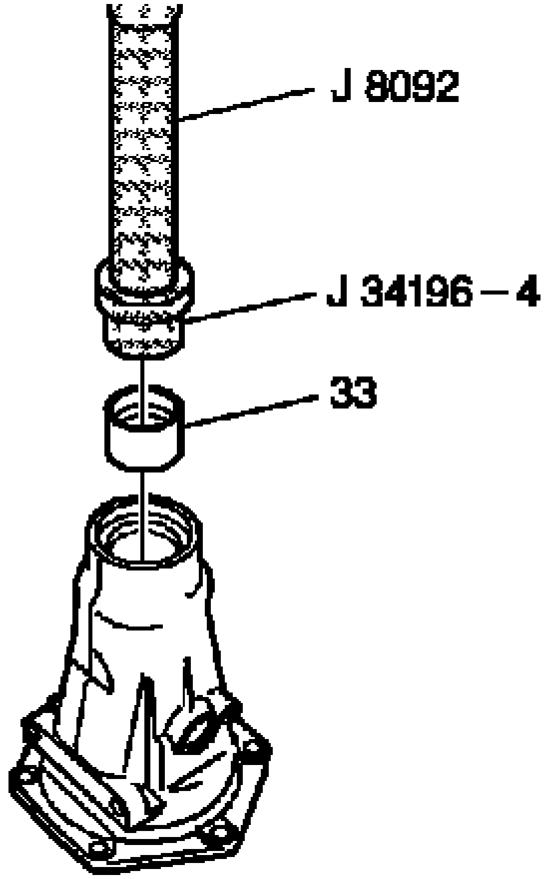


Fig. 315: Identifying J 38729
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 38729** onto the overrun clutch housing assembly (504). See **Special Tools**.
2. Lubricate the seal on the overrun clutch piston assembly (505) with DEXRON®VI transmission fluid.
3. Assemble the overrun clutch piston assembly (505) into the overrun clutch housing assembly (504).

NOTE: **Keep the overrun clutch piston assembly level and rotate the piston in order to avoid damaging the seal.**

4. Rotate the overrun clutch piston (505) in order to aid in assembly.

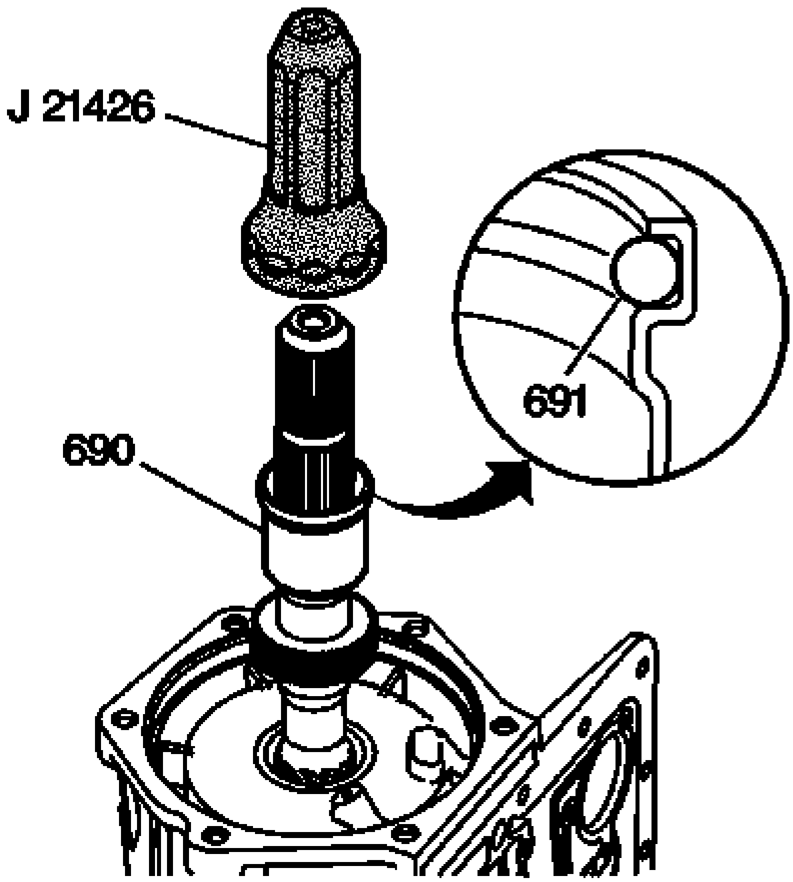


Fig. 316: View Of Overrun Clutch Spring Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the overrun clutch spring assembly (506) onto the overrun clutch piston assembly (505).
6. Using the **J 23327** and the **J 38734** , compress the overrun clutch spring assembly (506). See **Special Tools**.
7. Install the overrun clutch spring retainer ring (507).

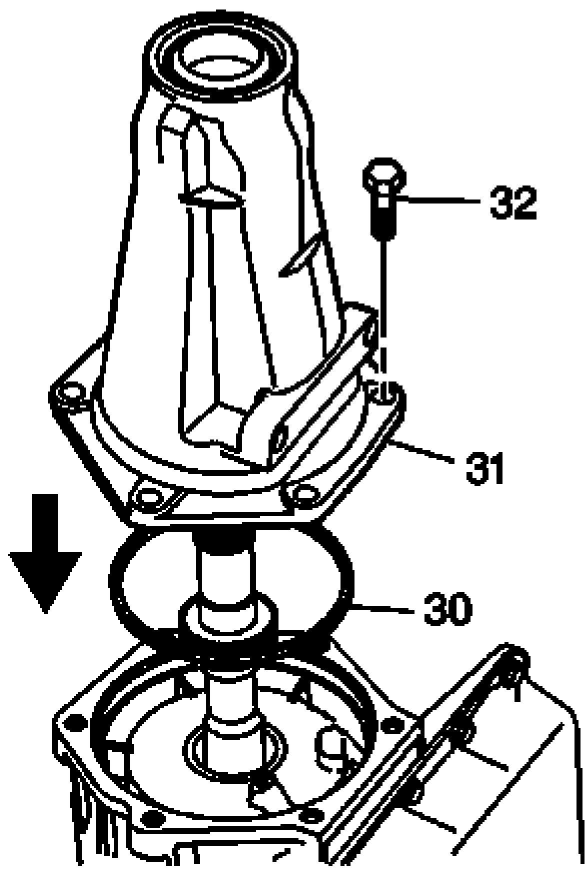


Fig. 317: Identifying Overrun Clutch Plates & Backing Plate
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Alternate the clutch plates, starting with the steel clutch plate (508) (3 steel, 3 composite).

8. Install the overrun clutch plates (508, 509).
9. Install the overrun clutch backing plate (510).

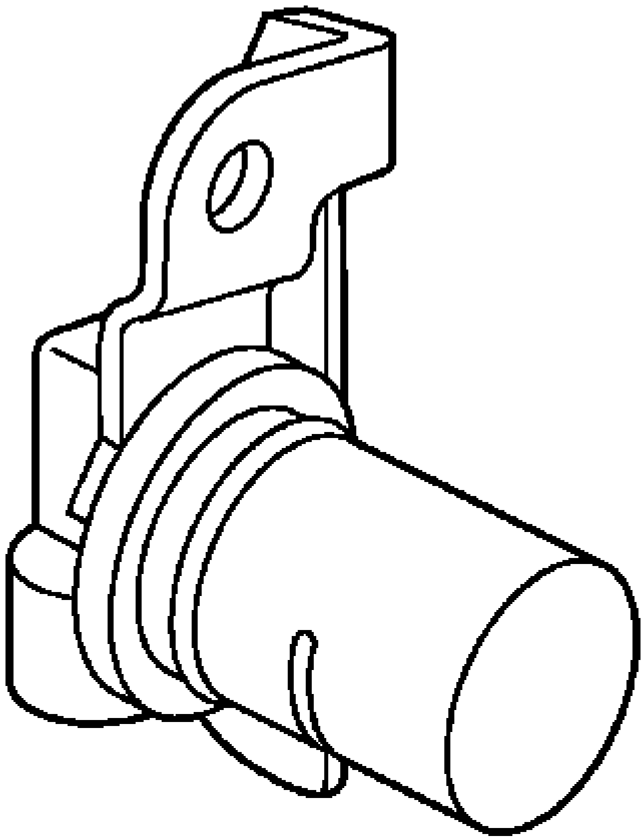


Fig. 318: View Of Overrun Clutch Backing Plate Retainer Ring
Courtesy of GENERAL MOTORS CORP.

10. Install the overrun clutch backing plate retainer ring (511) on the overrun clutch housing assembly (504).

OVERRUN CLUTCH PISTON TRAVEL CHECK

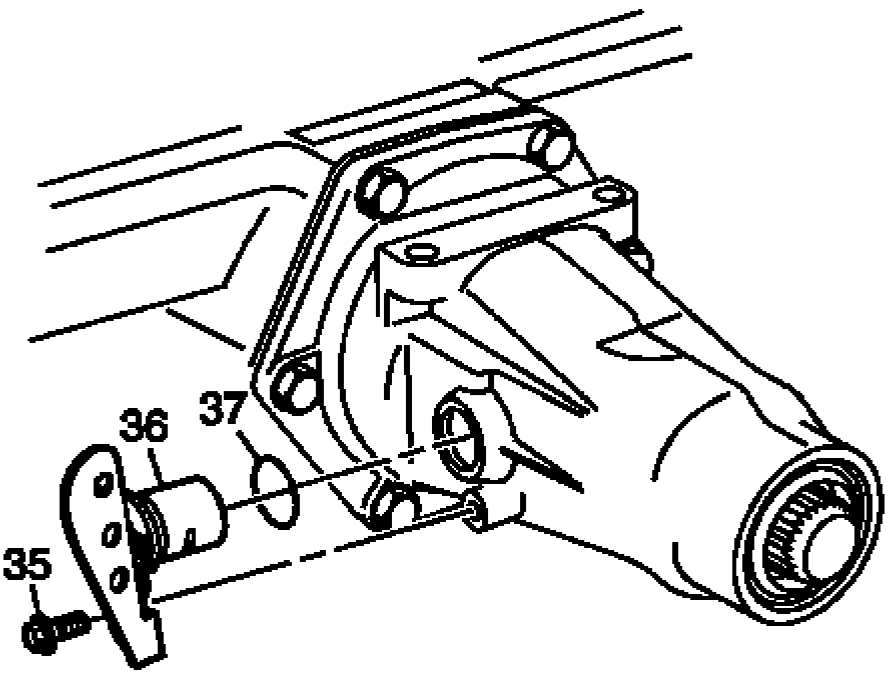


Fig. 319: Checking Overrun Clutch Piston Travel
Courtesy of GENERAL MOTORS CORP.

Using a feeler gage, measure the piston travel between the overrun clutch backing plate (510) and the overrun clutch backing plate retainer ring (511).

Piston Travel Specification: Piston travel should be 0.838-2.38 mm (0.033-0.094 in).

OVERDRIVE CARRIER PINION END PLAY CHECK

Measuring Pinion Washer Wear With Feeler Gage

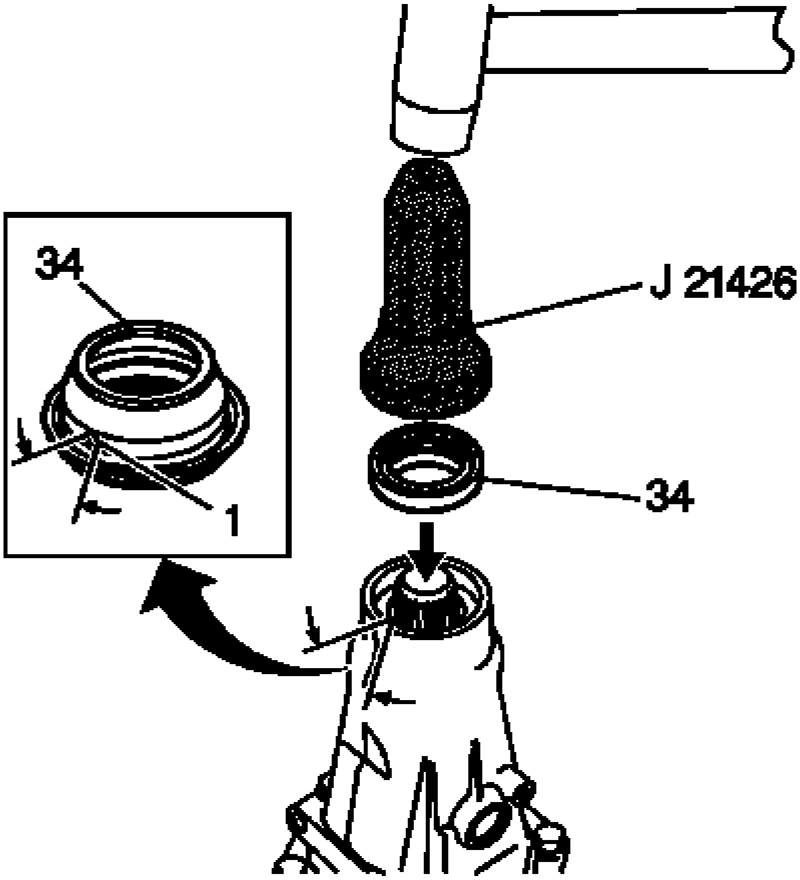


Fig. 320: Measuring Pinion Washer Wear With Feeler Gage
Courtesy of GENERAL MOTORS CORP.

Using a feeler gage, measure the pinion washer wear.

End Play Specification: The correct end play is between 0.2032-0.6350 mm (0.008-0.025 in).

OVERDRIVE CARRIER ASSEMBLY DISASSEMBLE

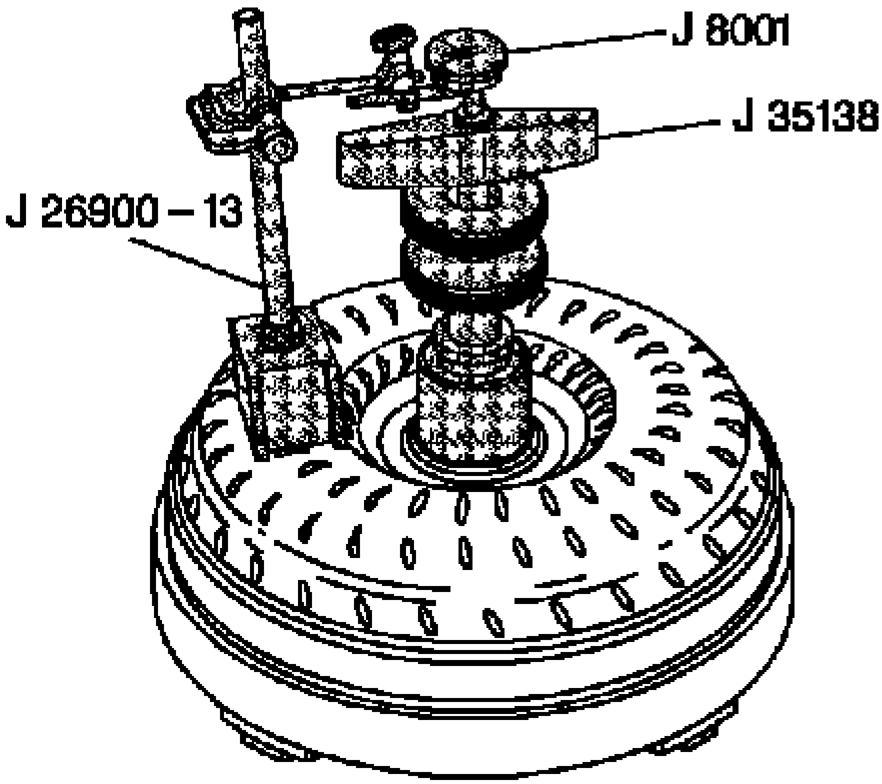


Fig. 321: View Of Overdrive Carrier Assembly, Pinion Gear Pin Retainer, & Pin Retaining Ring
Courtesy of GENERAL MOTORS CORP.

1. Remove the overdrive carrier pinion gear pin retaining ring (521) from the overdrive carrier assembly (514).
2. Remove the overdrive carrier pinion gear pin retainer (520).

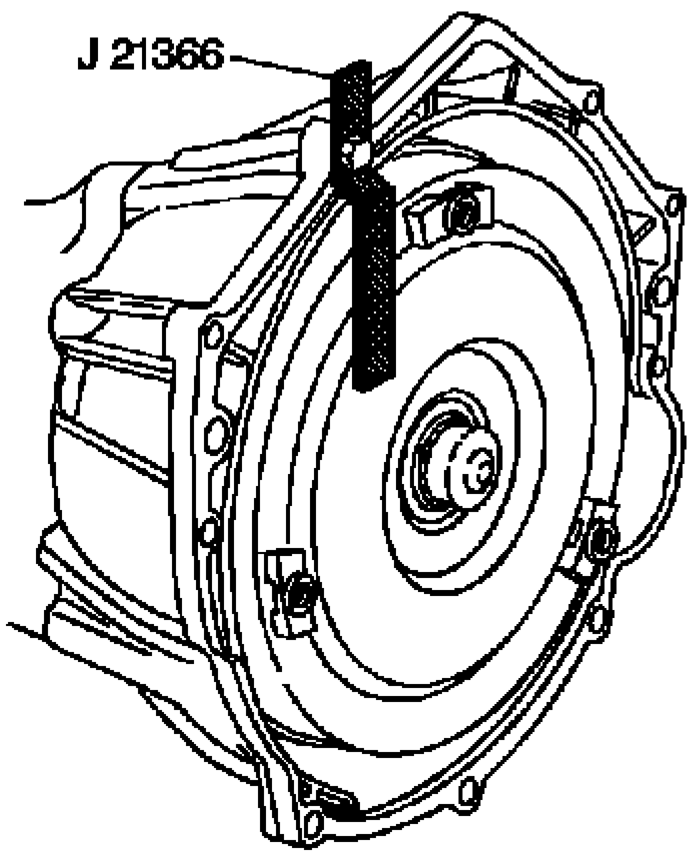


Fig. 322: Locating Overdrive Carrier Pinion Gear Inspection Areas
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Before removing the overdrive carrier pinion gear pins (519), mark the location of the overdrive carrier pinion gears (518) and the overdrive carrier pinion gear pins (519) so they can be identified for reassembly.

IMPORTANT: Keep all washers and roller bearings together with the overdrive carrier pinion gear and pin they were removed with. The pinion gears, washers and roller bearings must be reinstalled in their original locations.

3. Remove one overdrive carrier pinion gear (518) and pin (519) at a time.
4. Inspect the overdrive carrier pinion gear (518), pin (519), roller bearings (517), steel thrust washers (516) and thrust washers (515) for wear or damage.

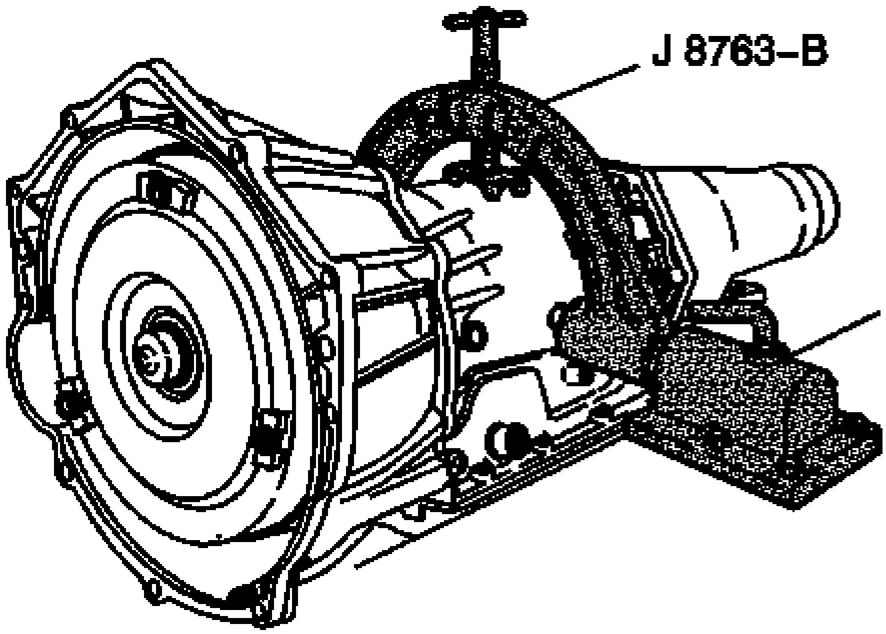


Fig. 323: Inspection Areas On Overrun Clutch Housing Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

5. Remove the overrun clutch housing thrust bearing assembly (513) from the overdrive carrier assembly (514). The bearing will fall out when the pinion gears are removed.
6. Inspect the pinion pocket thrust surfaces for burrs.
7. Inspect the overdrive carrier assembly (514) for cracks, damage and wear.
8. Inspect the overrun clutch housing thrust bearing assembly (513).

OVERDRIVE CARRIER ASSEMBLY ASSEMBLE

Tools Required

J 36850 Transjel® Lubricant

Procedure

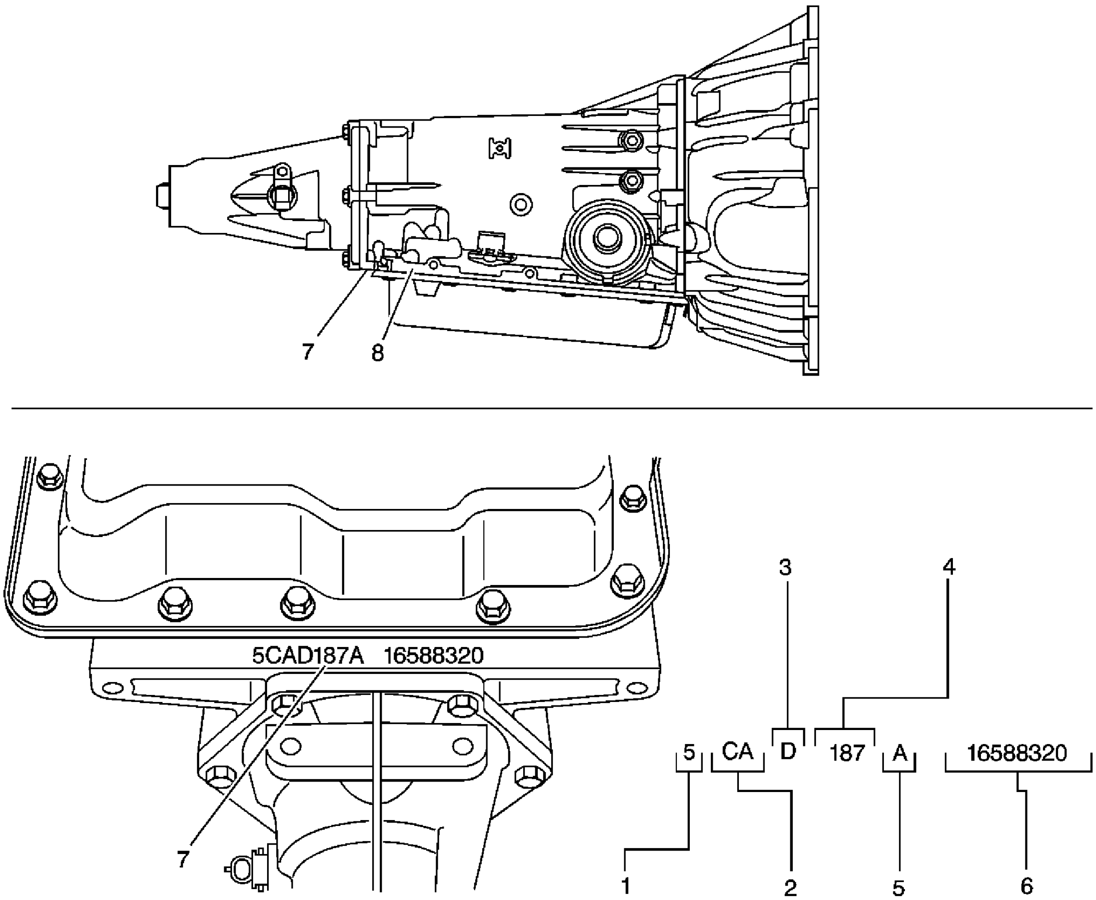


Fig. 324: Locating Overrun Clutch Housing Thrust Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the overrun clutch housing thrust bearing assembly (513) into the overdrive carrier assembly (514). Retain with **J 36850** or equivalent.

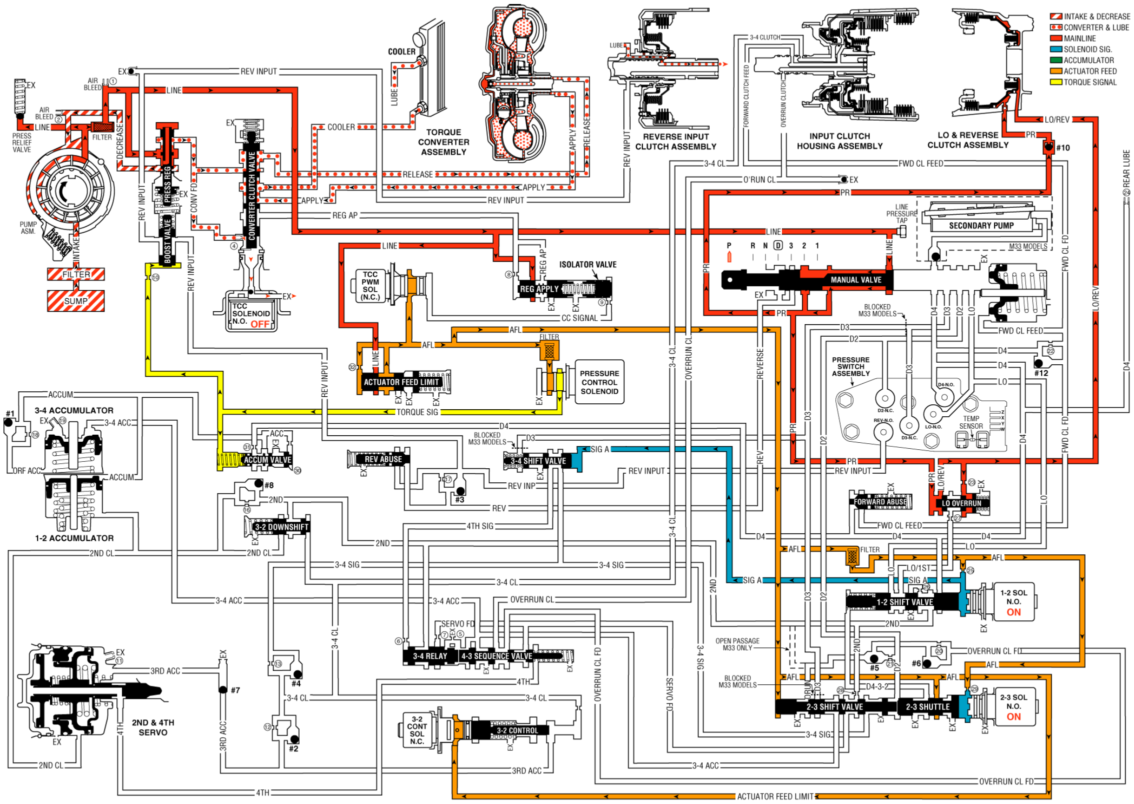


Fig. 325: View Of Overdrive Carrier Pinion Gear Components
Courtesy of GENERAL MOTORS CORP.

2. Install one overdrive carrier pinion gear (518) and its roller bearings (517) and thrust washers (515, 516), into the overdrive carrier assembly (514) at the location marked at disassembly.
3. Install the overdrive carrier pinion gear pin (519).
4. Repeat steps 2 and 3 until all 4 pinion gear assemblies are installed in their original locations.

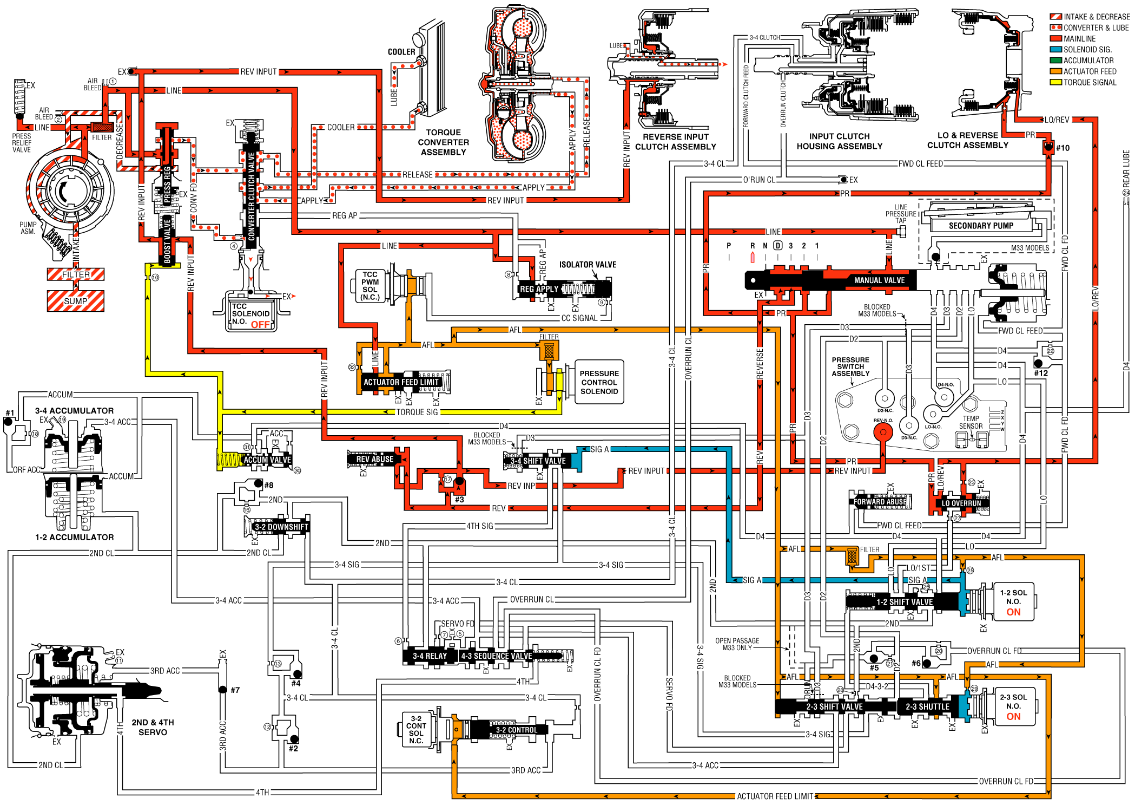


Fig. 326: View Of Overdrive Carrier Assembly, Pinion Gear Pin Retainer, & Pin Retaining Ring
Courtesy of GENERAL MOTORS CORP.

5. Install the overdrive carrier pinion gear pin retainer (520) on the overdrive carrier assembly (514). Align the pinion gear pins with the retainer slots.
6. Install the overdrive carrier pinion gear pin retainer retaining ring (521) on the overdrive carrier assembly (514).

TURBINE SHAFT DISASSEMBLE

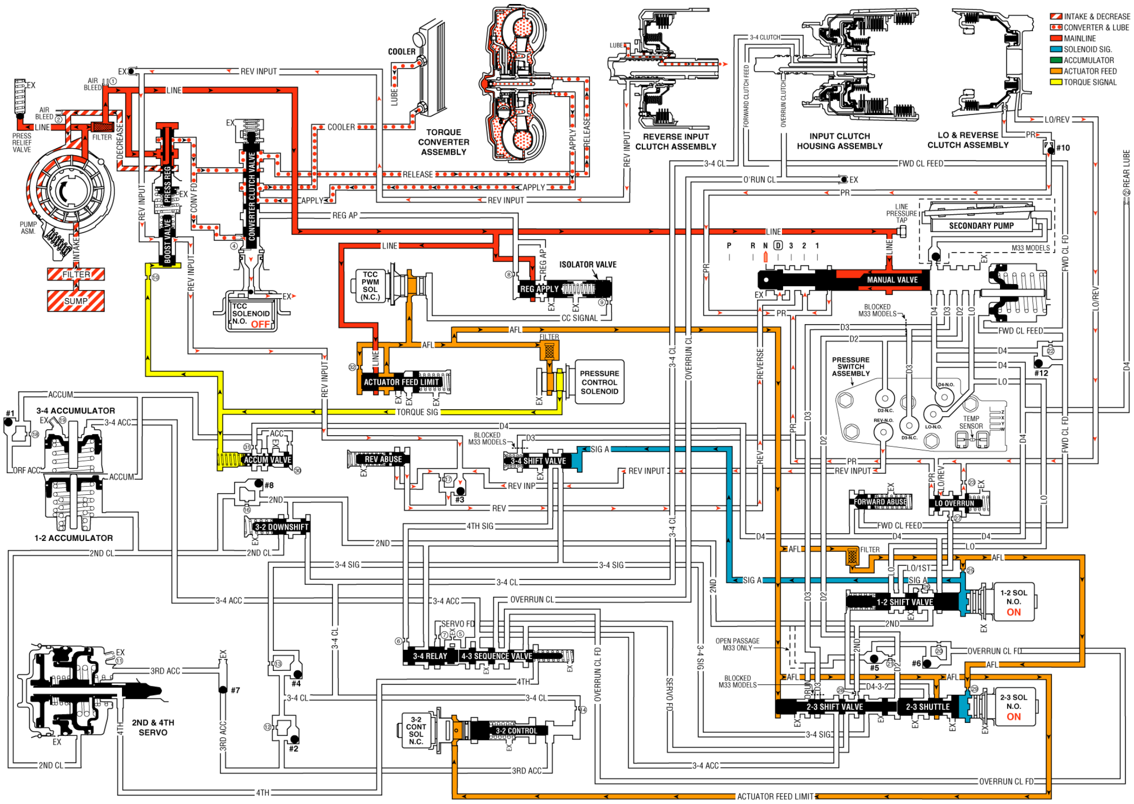


Fig. 327: Inspection Areas On Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

1. Remove the turbine shaft rear (501) and intermediate (503) oil seal rings.
2. Inspect the turbine shaft (502) for damage or cracks.
3. Inspect the turbine shaft plug (534) on the end of the turbine shaft (502).

TURBINE SHAFT ASSEMBLE

Tools Required

- **J 38736-1** Turbine Shaft Seal Installer. See **Special Tools**.
- **J 38736-2** Turbine Shaft Seal Installer. See **Special Tools**.
- **J 38736-3** Turbine Shaft Seal Sizer. See **Special Tools**.
- **J 38736-4** Turbine Shaft Seal Sizer. See **Special Tools**.
- **J 38736-5** Turbine Shaft Seal Pusher. See **Special Tools**.
- **J 38736-6** Turbine Shaft Seal Pusher. See **Special Tools**.

Procedure

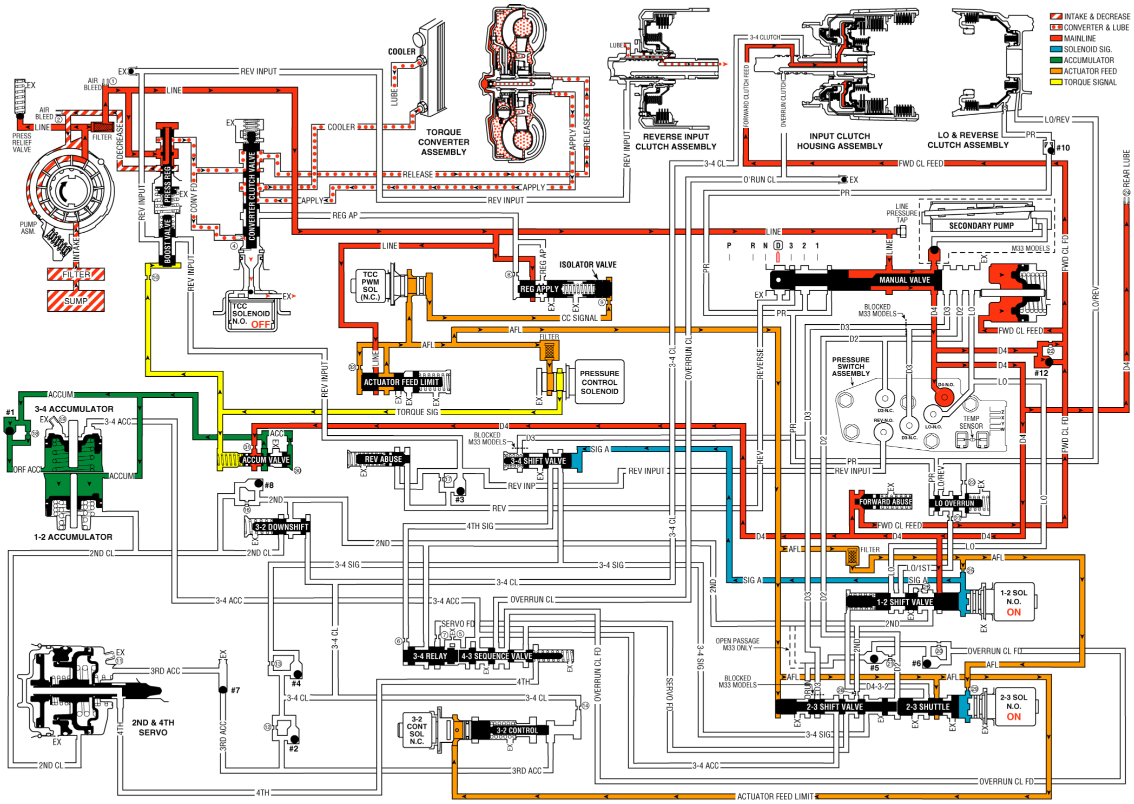


Fig. 328: J 38736-1
Courtesy of GENERAL MOTORS CORP.

1. Place the **J 38736-1** onto the turbine shaft (502). See **Special Tools**.
2. Set the **J 38736-1** to position #1. See **Special Tools**.
3. Using the **J 38736-5** , install the lower turbine shaft intermediate oil seal ring (501). See **Special Tools**.
4. Remove the tools.

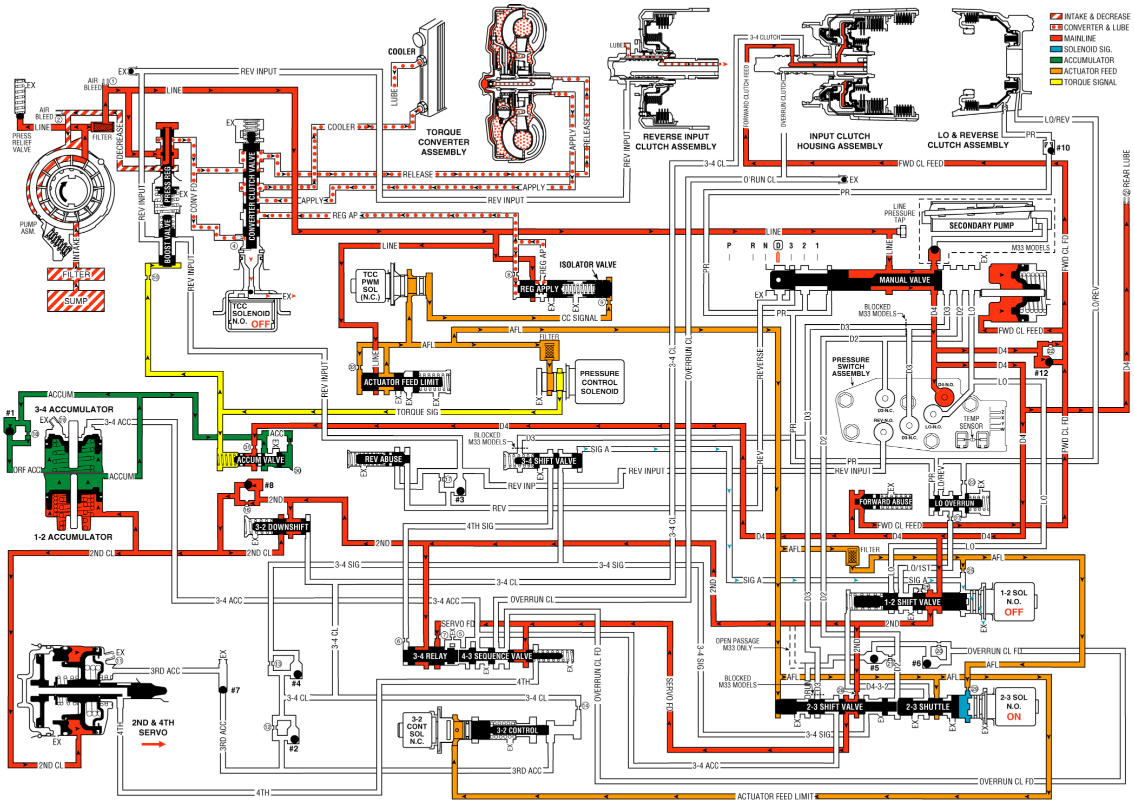


Fig. 329: Sizing Upper Turbine Shaft Intermediate Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be sure to use the small chamfered end of the J 38736-3 in order to size the lower turbine shaft intermediate oil seal ring. See Special Tools. Then use the larger chamfered end of theJ 38736-3 in order to size the upper turbine shaft intermediate oil seal ring. See Special Tools.

5. With the small chamfered end down, place the **J 38736-3** over the lower turbine shaft intermediate oil seal ring. See **Special Tools**.
6. Leave the **J 38736-3** on the turbine shaft intermediate oil seal ring for at least 1 minute in order to allow the seal ring to become the proper size. See **Special Tools**.

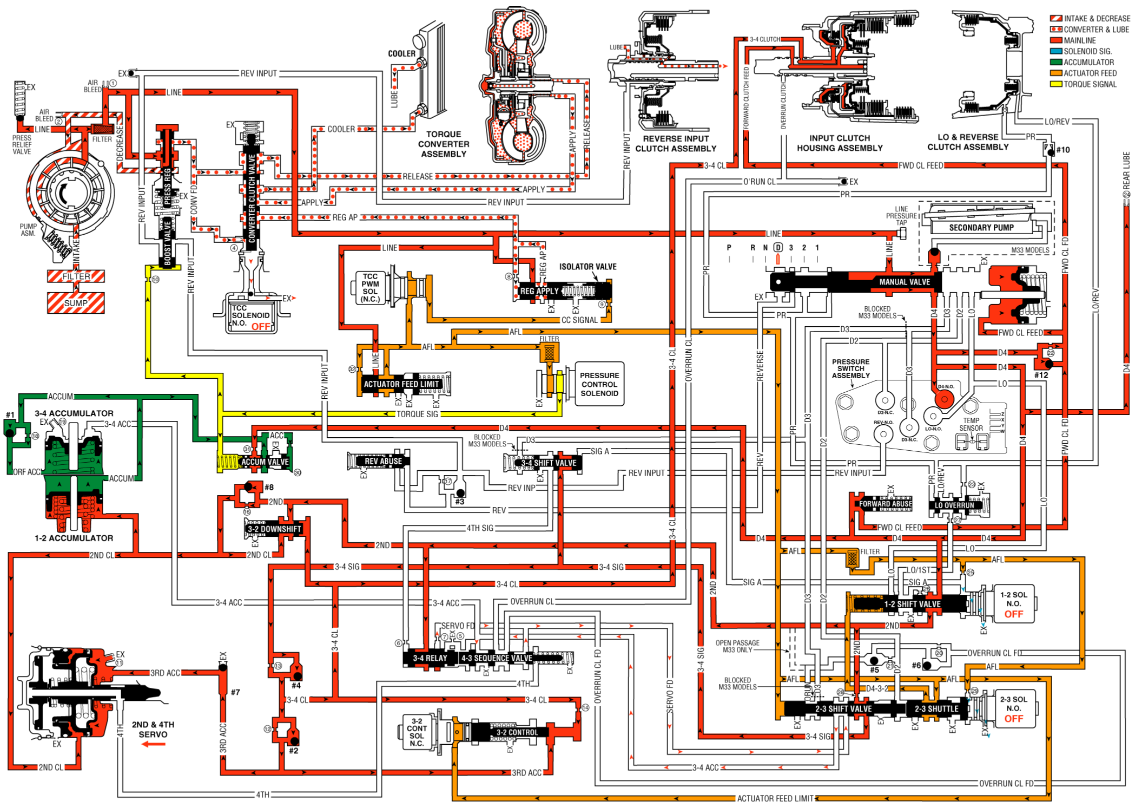


Fig. 330: J 38736-1
Courtesy of GENERAL MOTORS CORP.

7. Place the **J 38736-1** onto the turbine shaft (502). See **Special Tools**.
8. Set the **J 38736-1** to position #2. See **Special Tools**.
9. Using the **J 38736-5** , install the upper turbine shaft intermediate oil seal ring (501). See **Special Tools**.
10. Remove the tools.

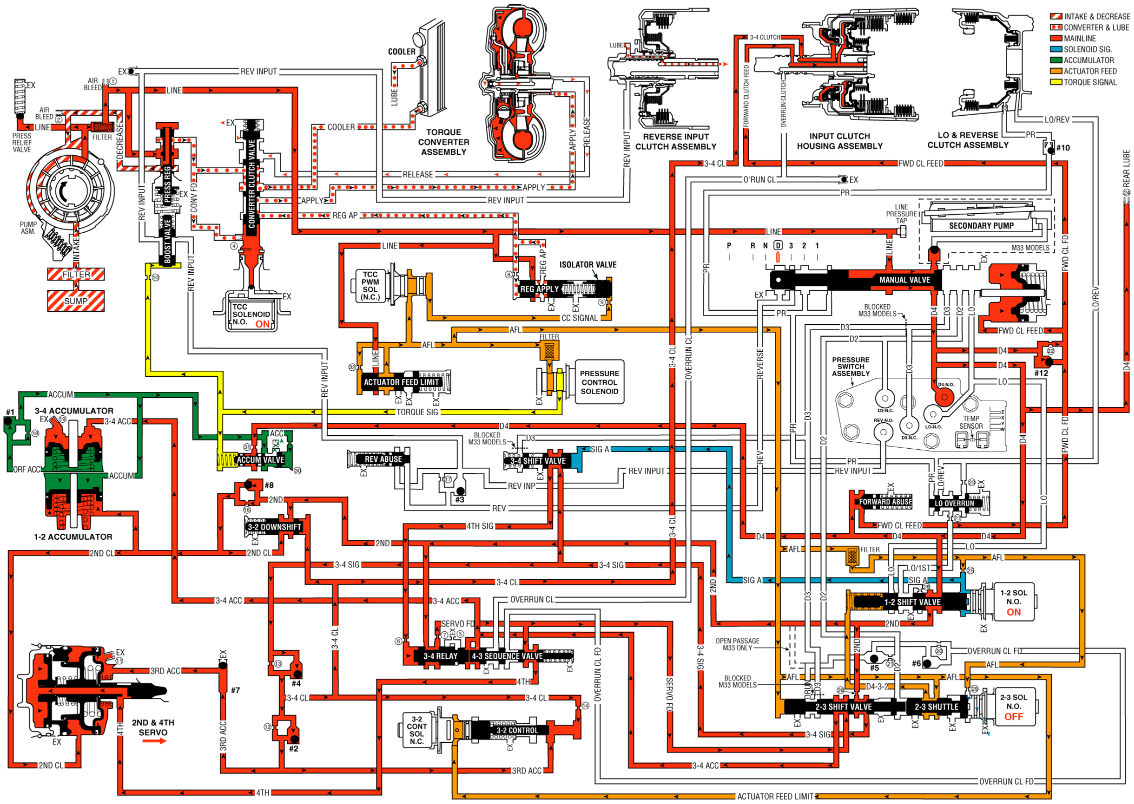


Fig. 331: View Of J 38736-3
Courtesy of GENERAL MOTORS CORP.

11. With the large chamfered end down, place the **J 38736-3** over the turbine shaft intermediate oil seal ring. See **Special Tools**.
12. Leave the **J 38736-3** on the turbine shaft intermediate oil seal ring for at least 1 minute to allow the seal ring to become the proper size. See **Special Tools**.

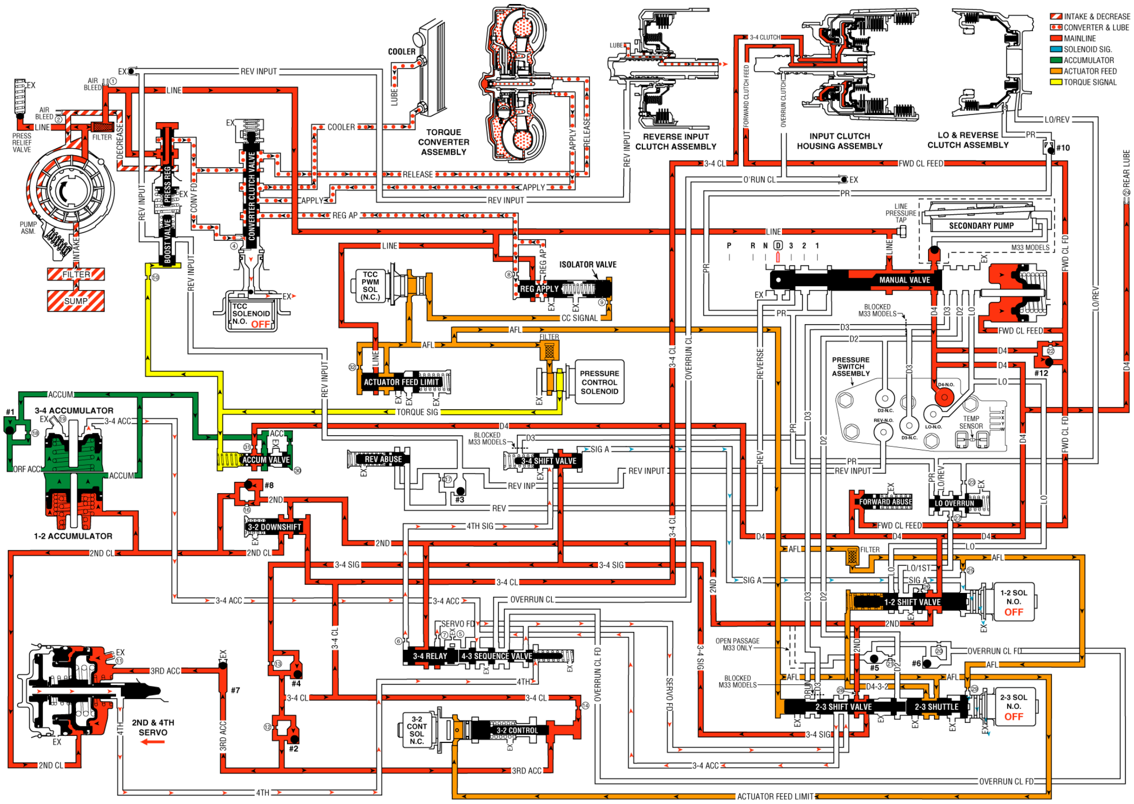


Fig. 332: J 38736-2 & J 38736-6
Courtesy of GENERAL MOTORS CORP.

13. Turn the turbine shaft (502) over.
14. Place the **J 38736-2** onto the turbine shaft. See **Special Tools**.
15. Set the **J 38736-2** to position #1. See **Special Tools**.
16. Using the **J 38736-6** , install the lower turbine shaft rear oil seal ring (503). See **Special Tools**.
17. Remove the tools.

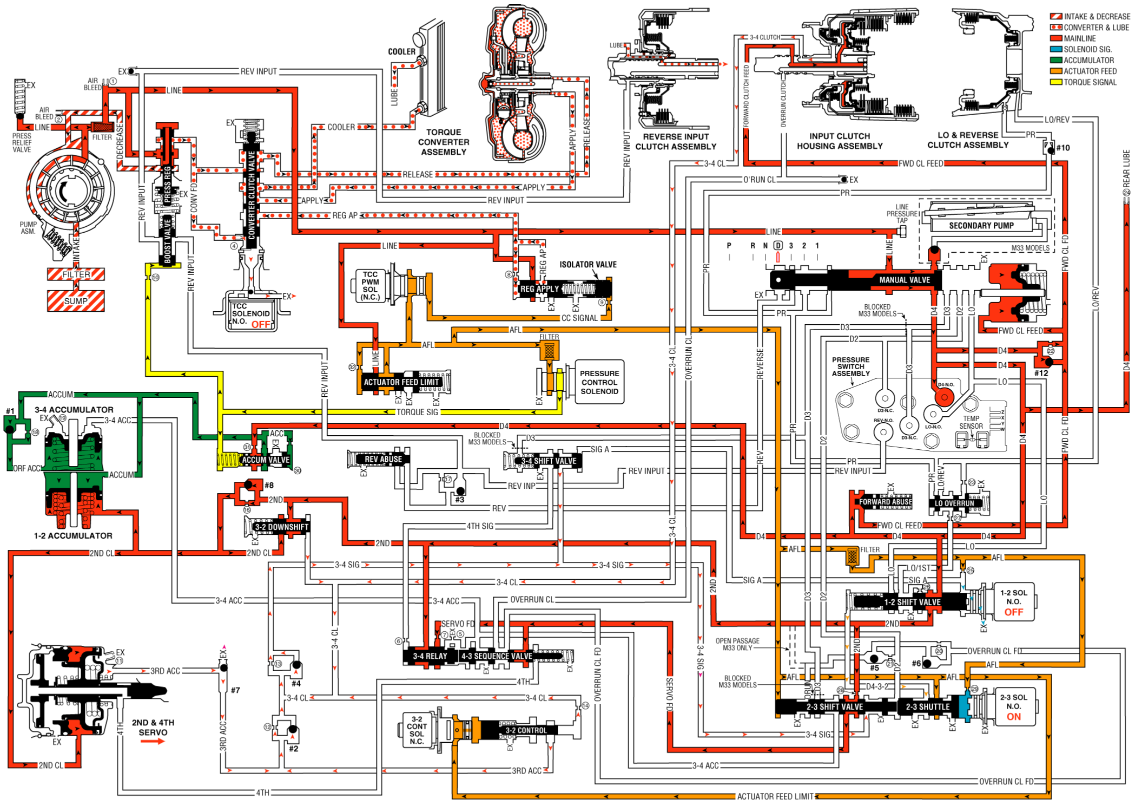


Fig. 333: Sizing Upper/Lower Turbine Shaft Rear Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be sure to use the small chamfered end of the J 38736-4 in order to size the lower turbine shaft rear oil seal ring. See Special Tools. Then use the larger chamfered end of the J 38736-4 in order to size the upper turbine shaft rear oil seal ring. See Special Tools.

18. With the small chamfered end down, place the **J 38736-4** over the lower turbine shaft rear oil seal ring. See **Special Tools**.
19. Leave the **J 38736-4** on the turbine shaft rear oil seal ring for at least 1 minute in order to allow the seal ring to become the proper size. See **Special Tools**.

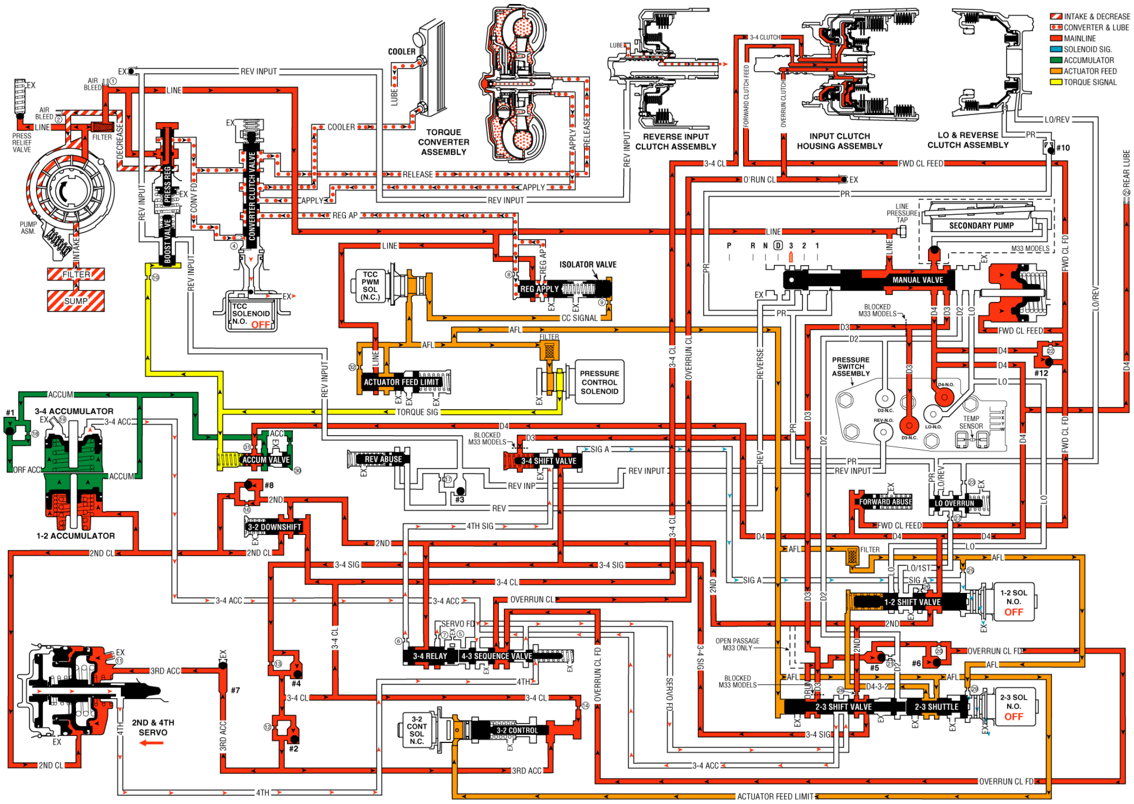


Fig. 334: J 38736-2 & J 38736-6
Courtesy of GENERAL MOTORS CORP.

20. Place the **J 38736-2** onto the turbine shaft (502). See **Special Tools**.
21. Set the **J 38736-2** to position #2. See **Special Tools**.
22. Using the **J 38736-6** , install the upper turbine shaft rear oil seal ring (503). See **Special Tools**.
23. Remove the tools.

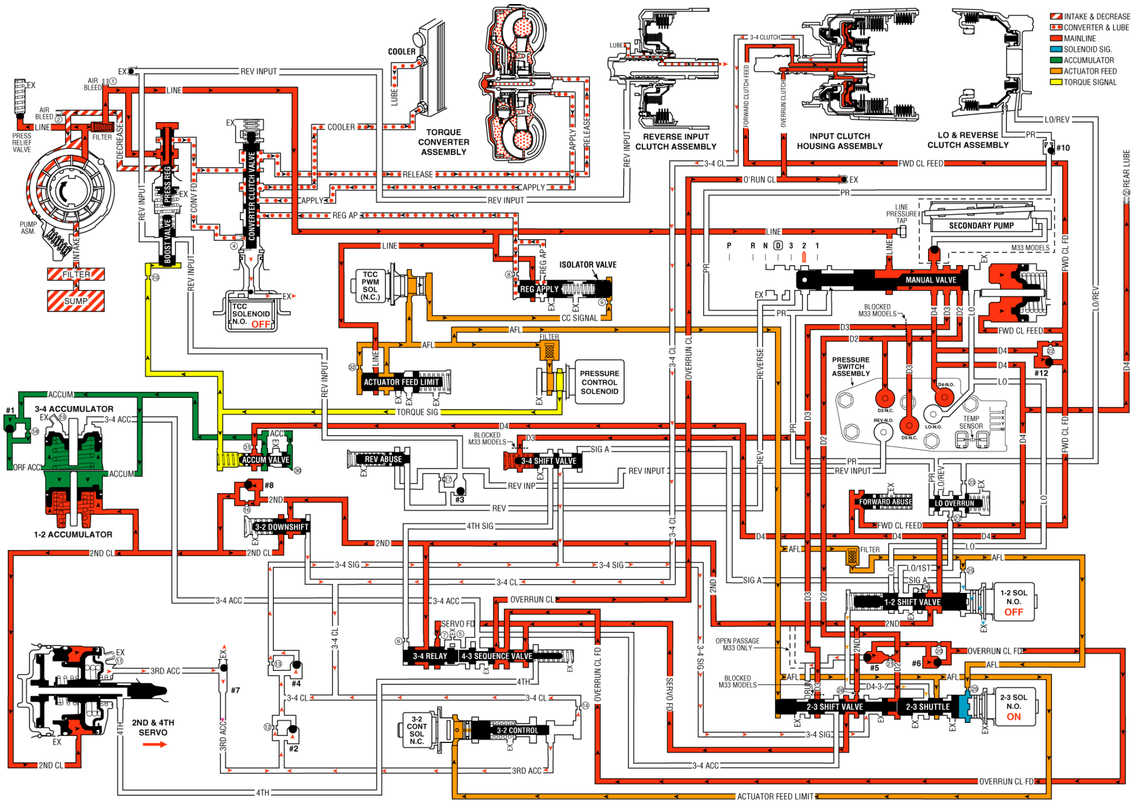


Fig. 335: Large End Of J 38736-4 On Turbine Shaft Rear Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

24. With the large chamfered end down, place the **J 38736-4** over the turbine shaft rear oil seal ring. See **Special Tools**.
25. Leave the **J 38736-4** on the turbine shaft rear oil seal ring for at least 1 minute in order to allow the seal ring to become the proper size. See **Special Tools**.

OVERDRIVE CARRIER ASSEMBLE

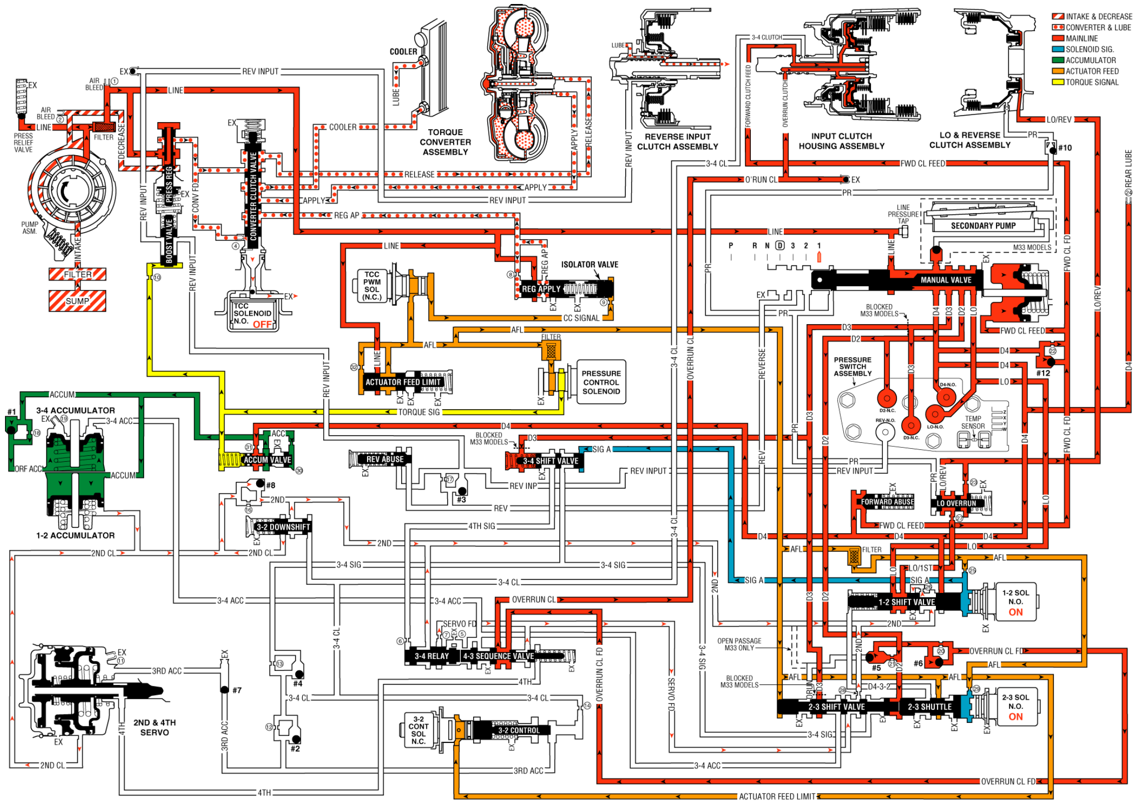


Fig. 336: View Of Overdrive Clutch Roller Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the overdrive clutch roller assembly (512) on the overrun clutch housing assembly (504).

IMPORTANT: Rotate the overdrive carrier assembly (514) during installation in order to line up the overdrive clutch plates with the overdrive carrier assembly splines.

2. Install the overdrive carrier assembly (514) on the overrun clutch housing assembly (504).

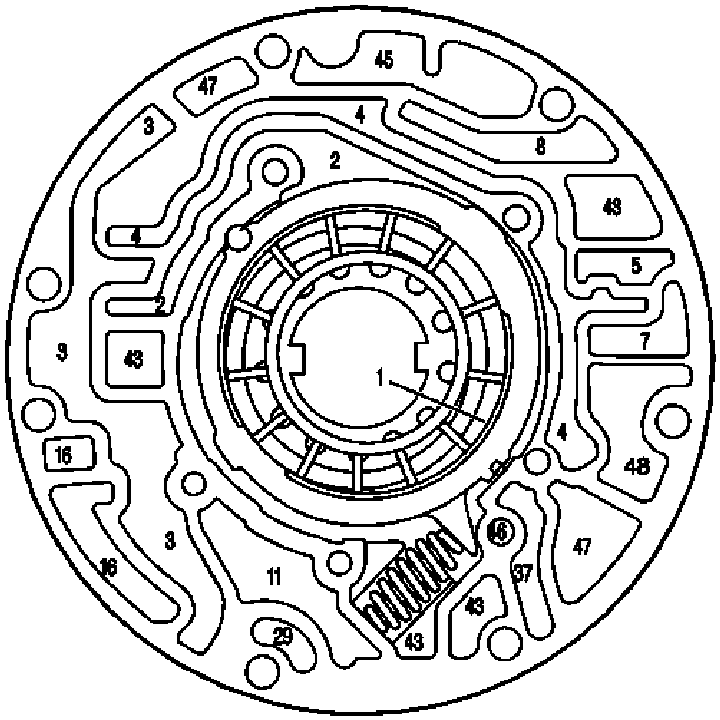


Fig. 337: View Of Overdrive Carrier Retainer Ring & Turbine Shaft
Courtesy of GENERAL MOTORS CORP.

NOTE: Align the components carefully to avoid damaging the turbine shaft oil seal rings.

3. Install the turbine shaft (502) through the overrun clutch housing assembly (504) and the overdrive carrier assembly (514).
4. Install the overdrive carrier retainer ring (522).

TURBINE SHAFT AND OVERDRIVE CARRIER INSTALLATION

Tools Required

J 36850 Transjel® Lubricant

Procedure

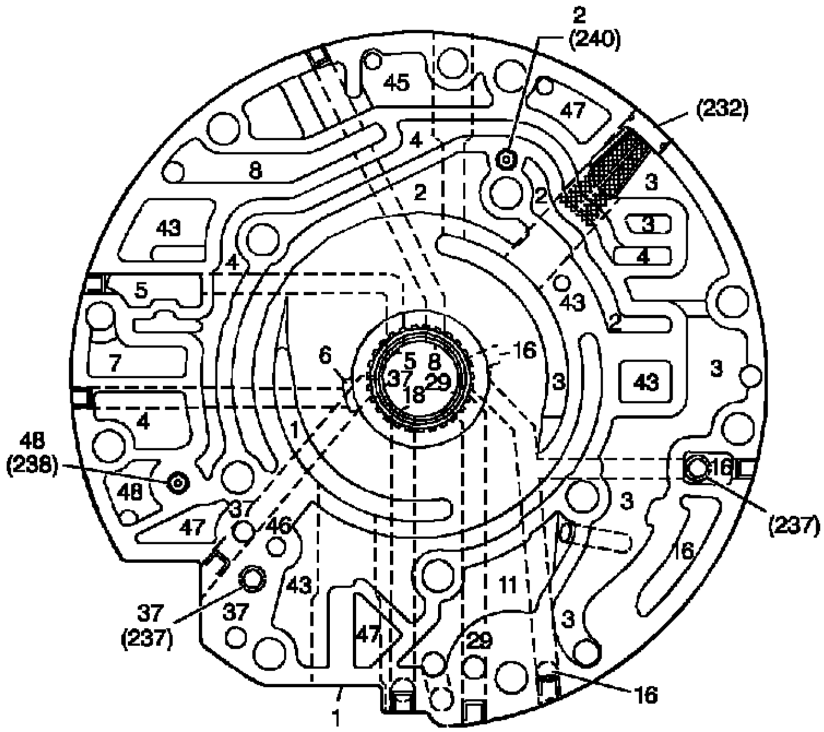


Fig. 338: View Of Overrun Clutch Housing Thrust Washer And Overrun Clutch Housing Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Be sure the overdrive assembly is fully engaged and is level with the fourth clutch housing.

1. Install the turbine shaft and overdrive assembly into the transmission case.
2. Install the overrun clutch housing thrust washer (218) onto the overrun clutch housing assembly (504). Retain with **J 36850** or equivalent.

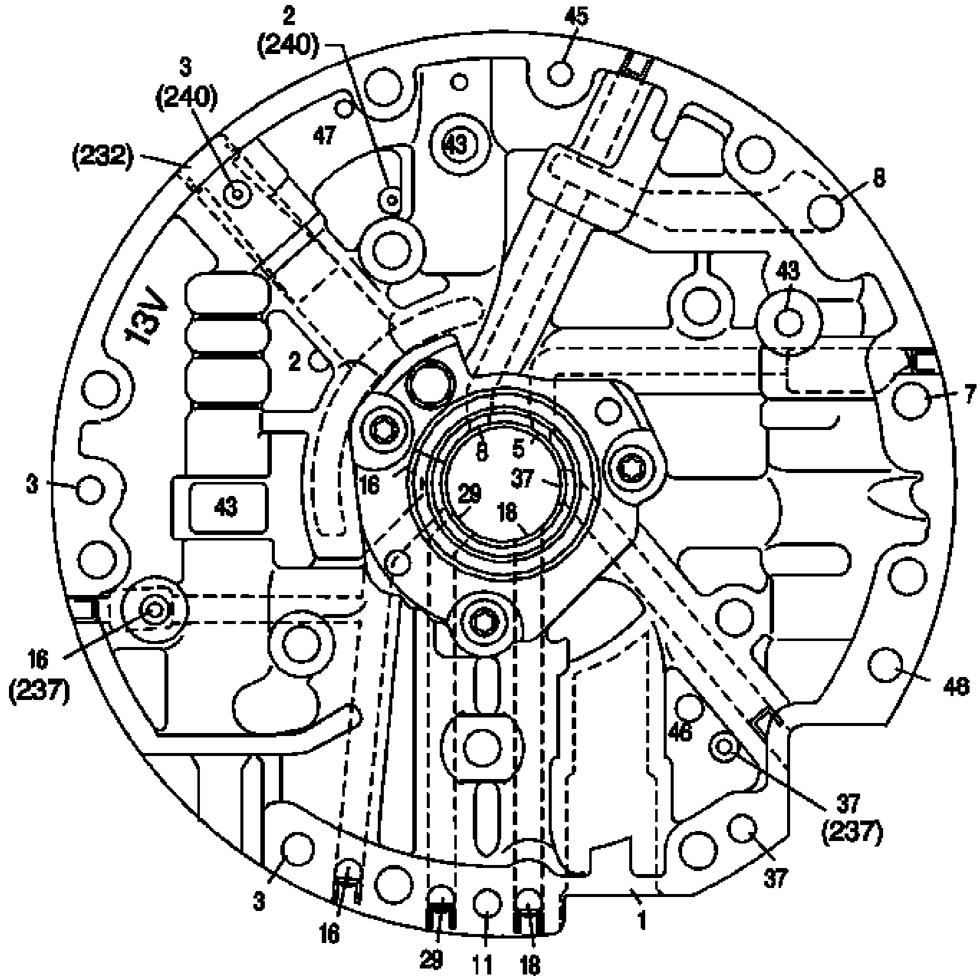


Fig. 339: Checking Overrun Clutch Housing Thrust Washer Surface
Courtesy of GENERAL MOTORS CORP.

3. Place a straight edge from the oil pump mating surface to the overrun clutch housing thrust washer (218). The 2 surfaces should be flush.

4TH CLUTCH PLATE INSTALLATION

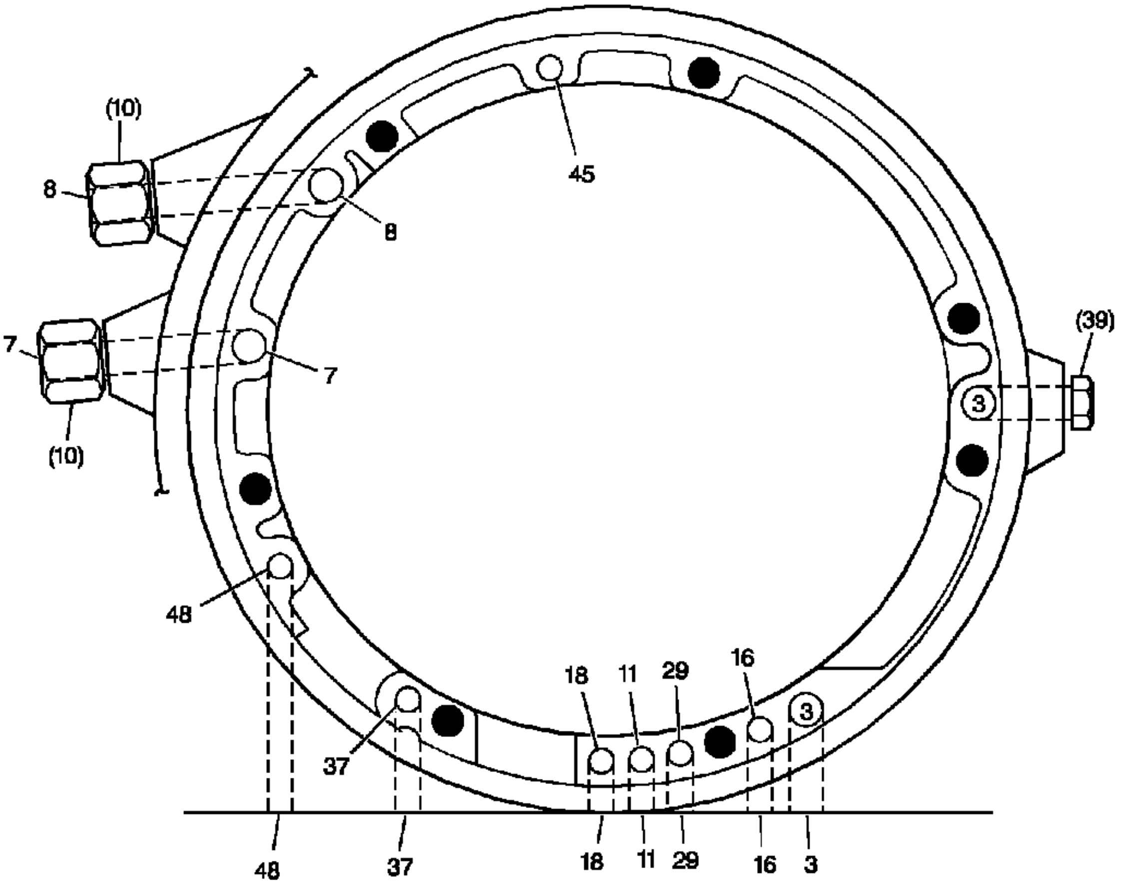


Fig. 340: Aligning Fourth Clutch Steel Plates V Notch Tangs
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Alternate the fourth clutch plates (525, 526), starting with a steel clutch plate (526) (4 steel, 4 composite). Install the fourth clutch steel plates (526) with the V notch tang at the 1 o'clock position in the fourth clutch housing.

1. Install the fourth clutch plates (525, 526) into the fourth clutch housing (529).
2. Install the fourth clutch backing plate (524). Align the notched tab of the fourth clutch backing plate (524) over the anchor pin in the case.

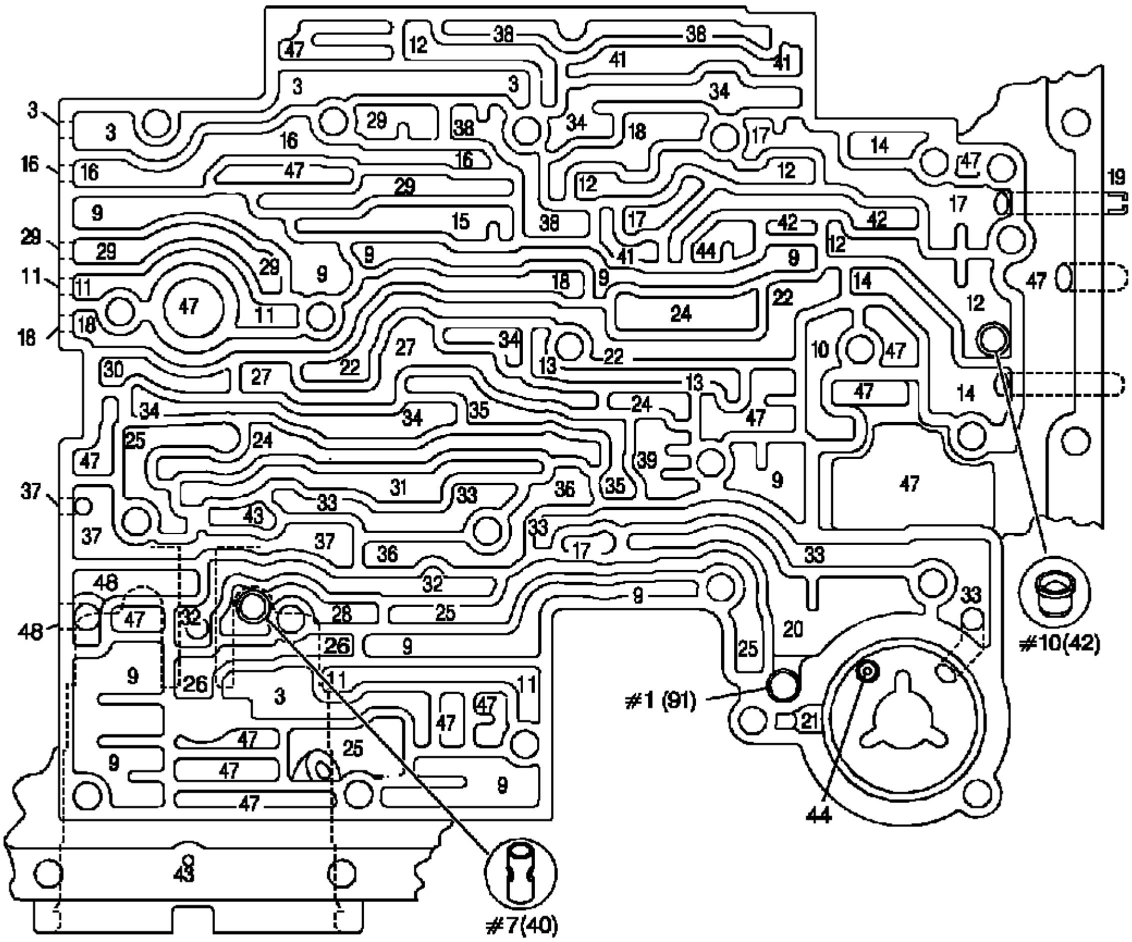


Fig. 341: Fourth Clutch Backing Plate Retainer Ring
Courtesy of GENERAL MOTORS CORP.

3. Install the fourth clutch backing plate retainer ring (523).

TRANSMISSION FLUID PUMP DISASSEMBLE

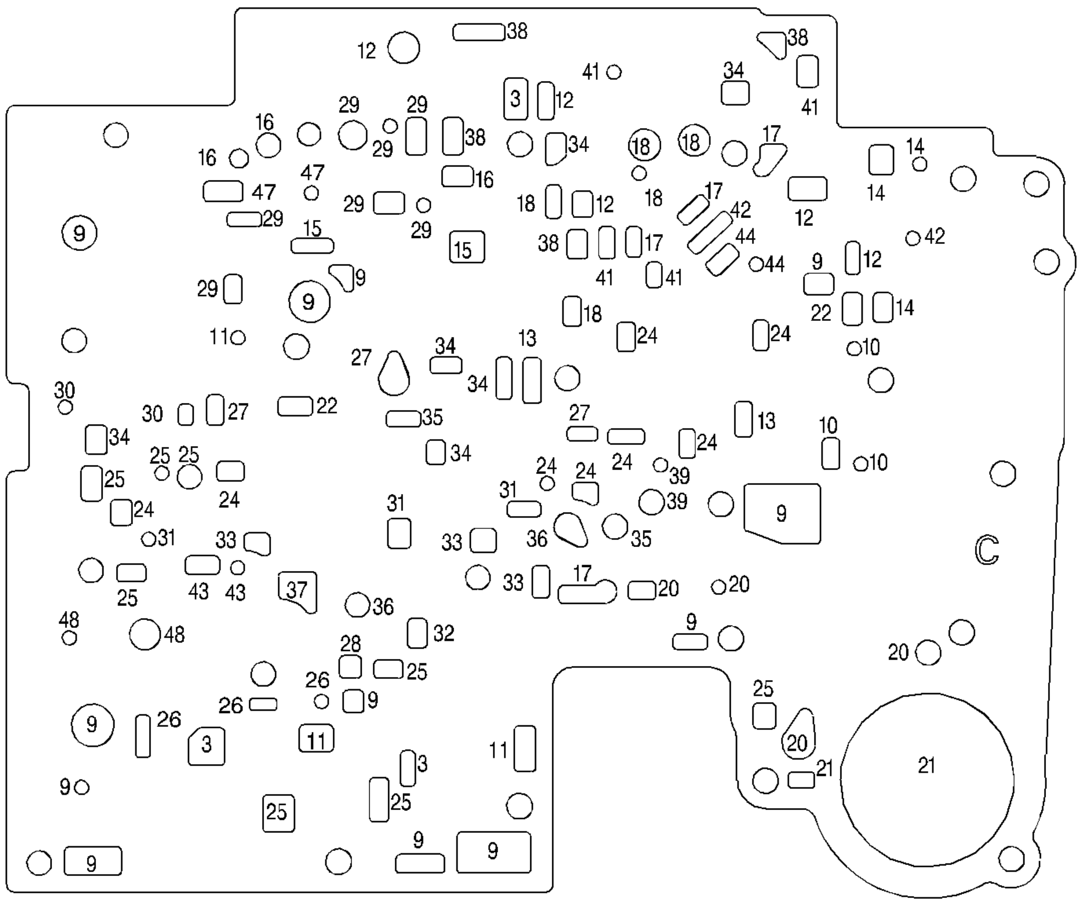


Fig. 342: Locating Transmission Oil Pump Cover Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission oil pump cover bolts (220).
2. Remove the vent passage splash shield (239).
3. Separate the oil pump body assembly (203) and the oil pump cover (206).

TRANSMISSION FLUID PUMP COVER DISASSEMBLE

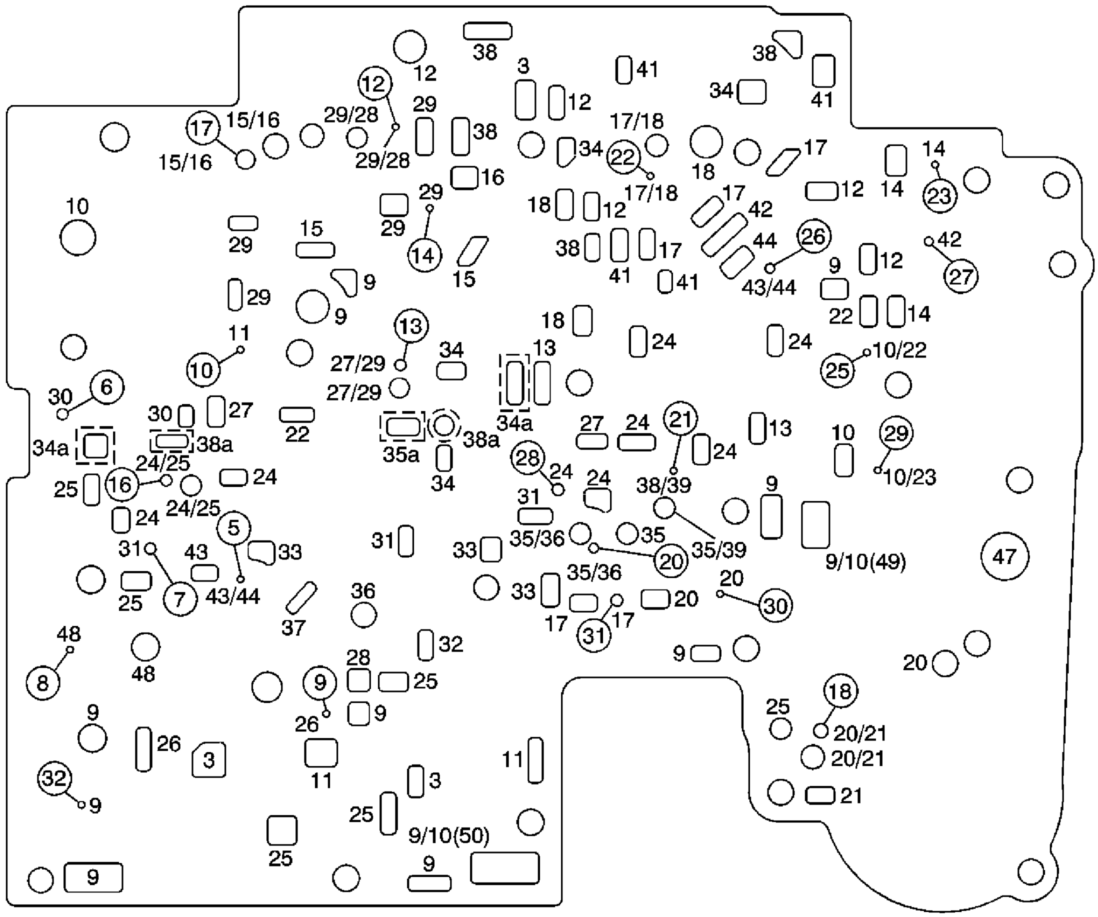


Fig. 343: View Of Transmission Oil Pump Cover
Courtesy of GENERAL MOTORS CORP.

CAUTION: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

1. Remove the reverse boost valve bushing retainer ring (226) from the oil pump cover (206).
2. Remove the reverse boost valve bushing (227).
3. Remove the reverse boost valve (228).
4. Remove the pressure regulator valve spring retainer (229).
5. Remove the pressure regulator valve inner (238) and outer springs (230).
6. Remove the pressure regulator valve (231).
7. Remove the pressure regulator valve bore plug (232).
8. Remove the pressure regulator valve bore plug pin (211).
9. Inspect the pressure regulator valve components for chips, burrs, distortion, plugged oil passages.

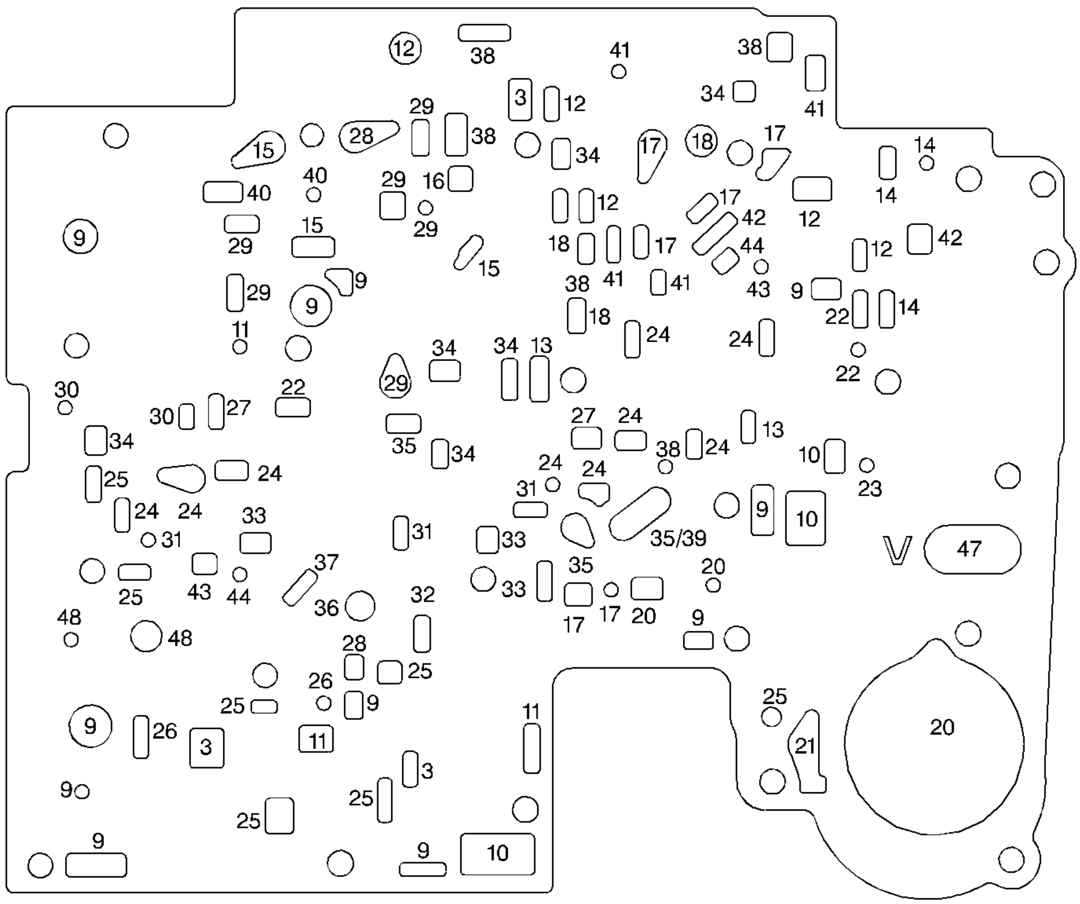


Fig. 344: Inspection Points On Converter Regulator Valve Assembly
Courtesy of GENERAL MOTORS CORP.

10. Remove the converter regulator valve bore plug pin (211) from the oil pump cover (206).
11. Remove the converter regulator valve bore plug (212).
12. Remove the converter regulator valve spring (213).
13. Remove the converter regulator valve (214).
14. Inspect the converter regulator valve components for chips, burrs, and distortion.

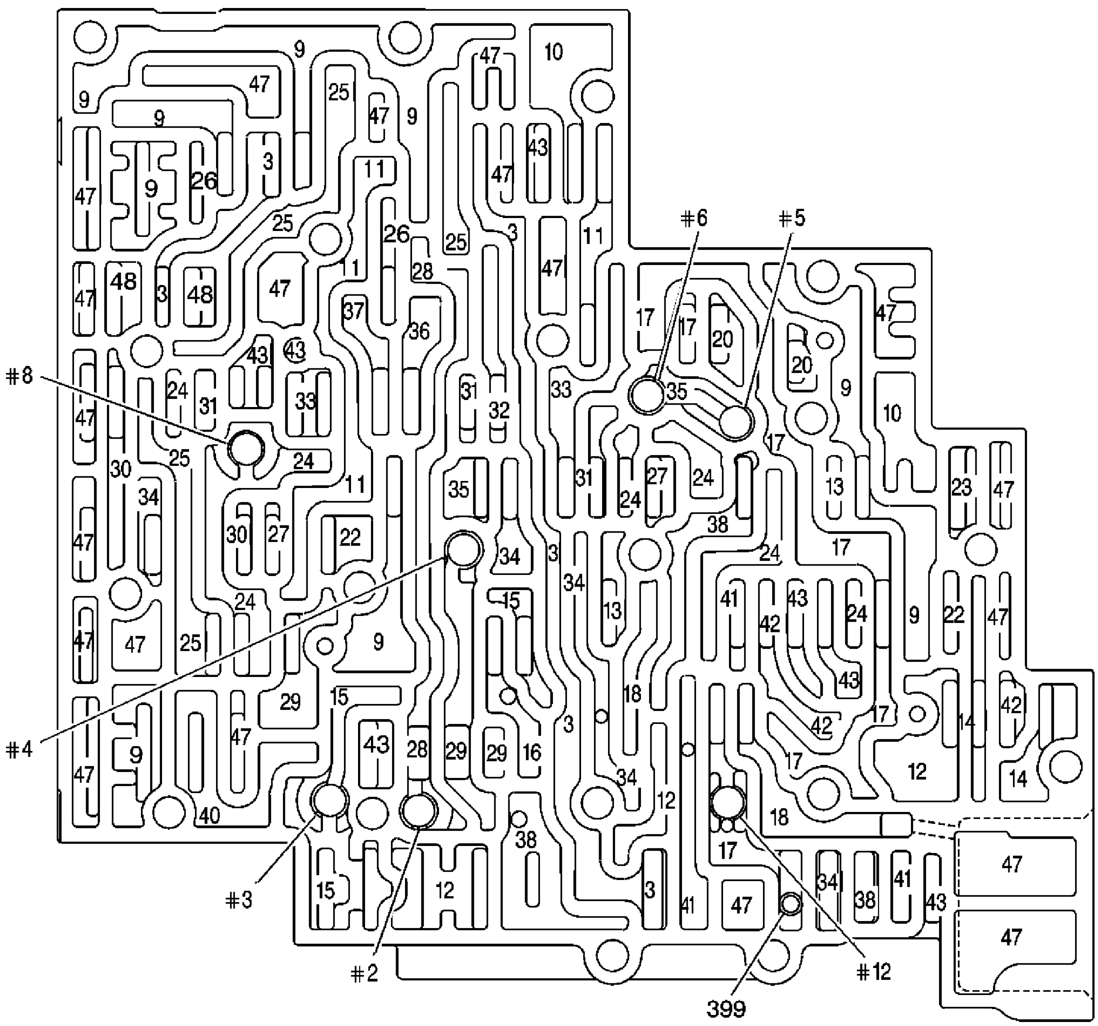


Fig. 345: Locating TCC Enable Valve Components
Courtesy of GENERAL MOTORS CORP.

15. Remove the TCC enable valve spring retainer sleeve (215) from the oil pump cover (206).
16. Remove the TCC enable valve spring (216).
17. Remove the TCC enable valve (217).
18. Inspect the TCC enable valve components for chips, burrs, and distortion.

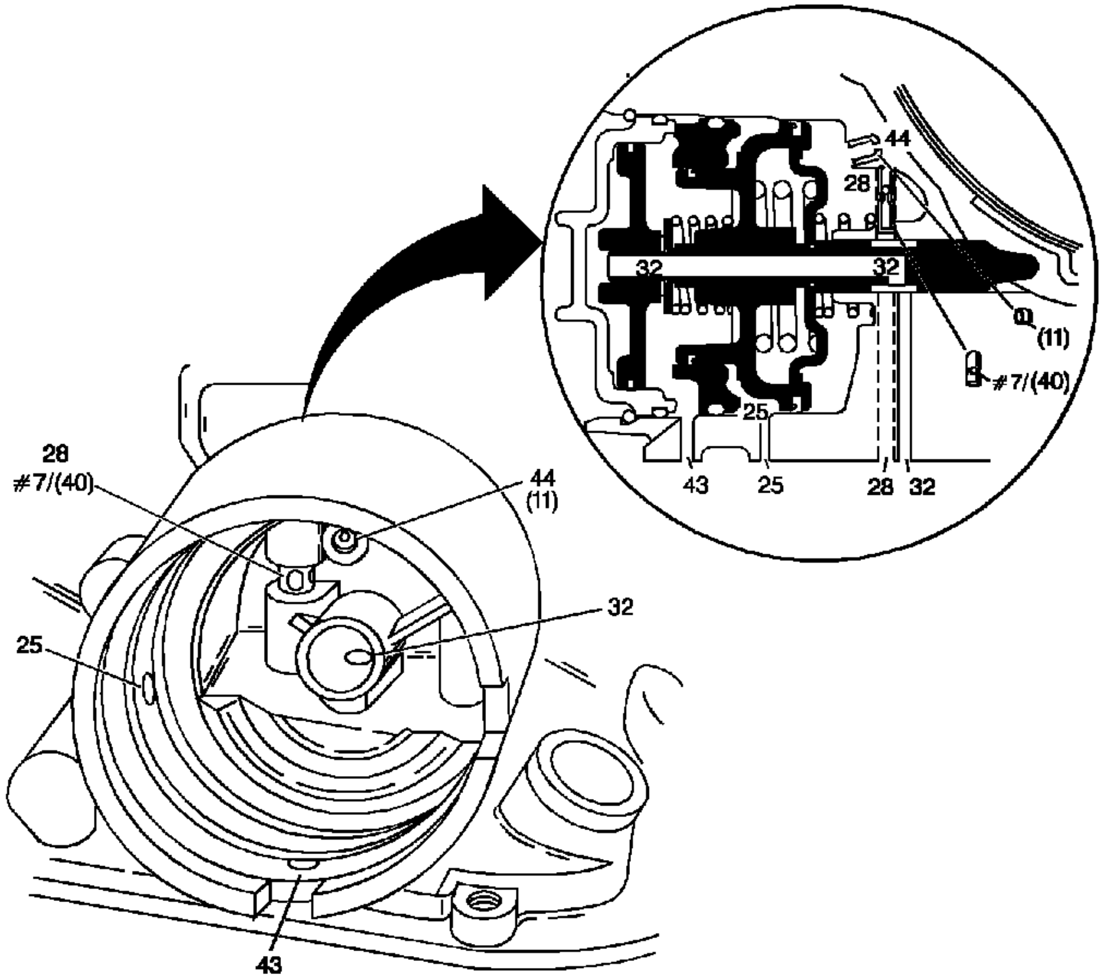


Fig. 346: View Of TCC Shift Valve Components
Courtesy of GENERAL MOTORS CORP.

19. Remove the TCC shift valve bore plug retainer ring (221) from the oil pump cover (206).
20. Remove the pressure regulator (TCC shift) valve bore plug (232).
21. Remove the TCC shift valve (223).
22. Remove the TCC shift valve spring (224).
23. Remove the TCC shift valve spring seat (225).
24. Remove the TCC shift valve spring seat pin (211).
25. Inspect the TCC shift valve components for chips, burrs, and distortion.
26. Inspect the oil pump cover vent hole for blockage.
27. Inspect the stator shaft splines for damage.
28. Inspect the turbine shaft bushings (233, 234) for wear, and galling.

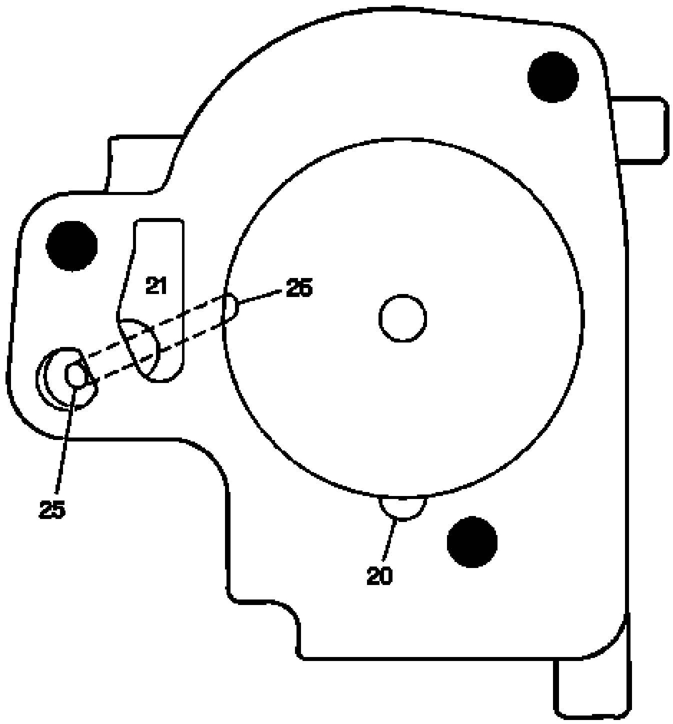


Fig. 347: View Of Overrun Clutch Housing Oil Seal Rings
Courtesy of GENERAL MOTORS CORP.

29. Remove the overrun clutch housing oil seal rings (219) from the oil pump cover (206).
30. Inspect the overrun clutch housing oil seal ring grooves for nicks, burrs, and debris.

TRANSMISSION FLUID PUMP COVER ASSEMBLE

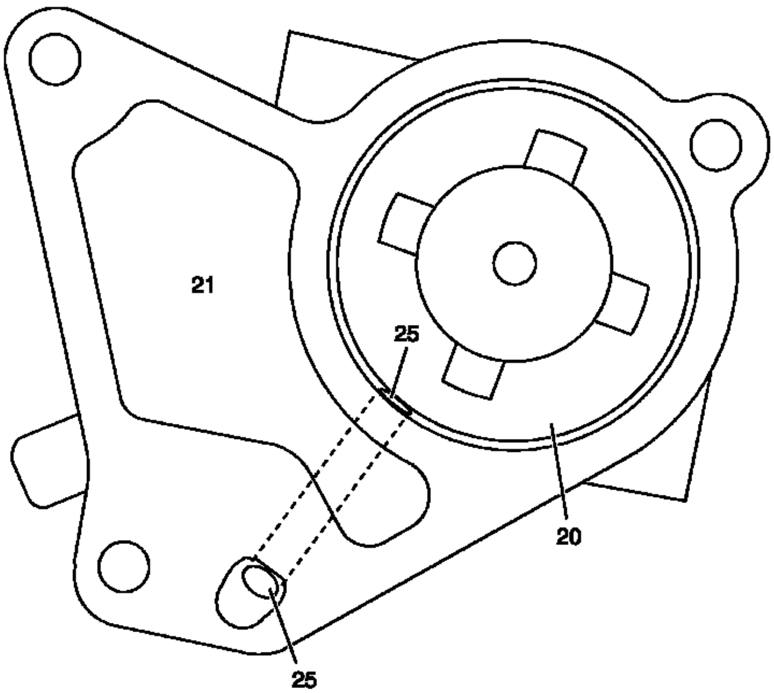


Fig. 348: Locating TCC Shift Valve Inspection Areas
Courtesy of GENERAL MOTORS CORP.

1. Install the TCC shift valve spring seat pin (211) into the oil pump cover (206).
2. Install the TCC shift valve spring seat (225).
3. Install the TCC shift valve spring (224).
4. Install the TCC shift valve (223).
5. Install the pressure regulator (TCC shift) valve bore plug (232).
6. Install the TCC shift valve bore plug retainer ring (221).
7. Inspect the TCC shift valve (223) for free movement in the bore.

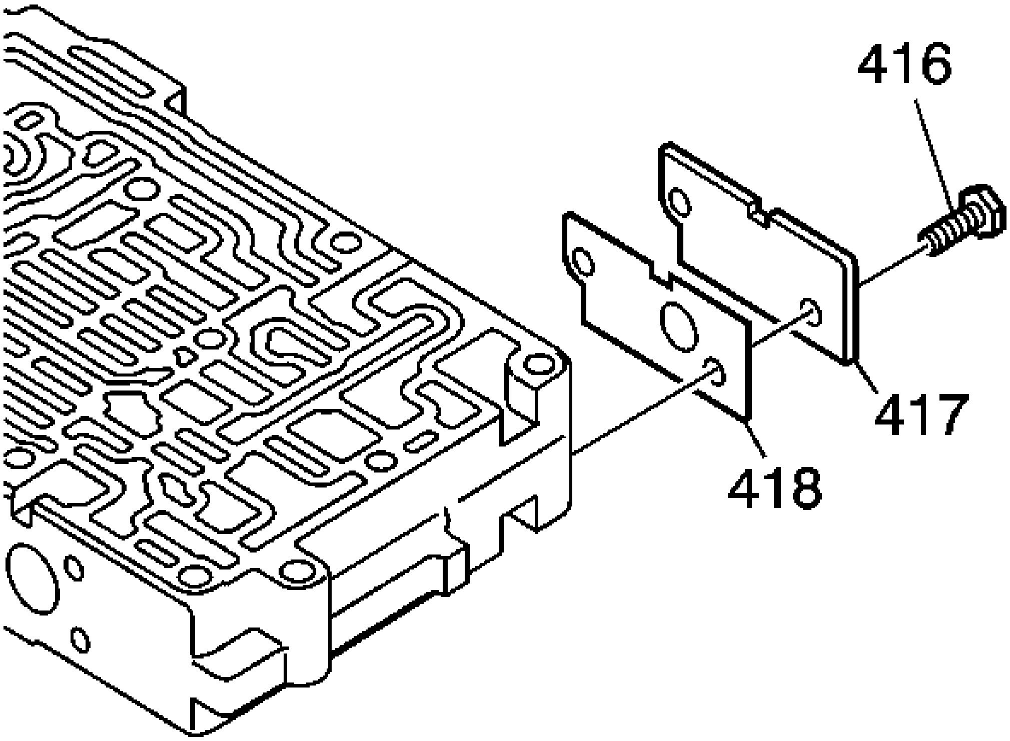


Fig. 349: Identifying Inspection Areas On TCC Enable Valve
Courtesy of GENERAL MOTORS CORP.

8. Install the TCC enable valve (217) into the oil pump cover (206).
9. Install the TCC enable valve spring (216).
10. Compress the TCC enable valve spring (216), and insert a small rod into the fluid passage in order to retain the TCC enable valve spring.
11. Install the TCC enable valve spring retainer sleeve (215).
12. Remove the small rod.
13. Inspect the TCC enable valve (217) for free movement in the bore.

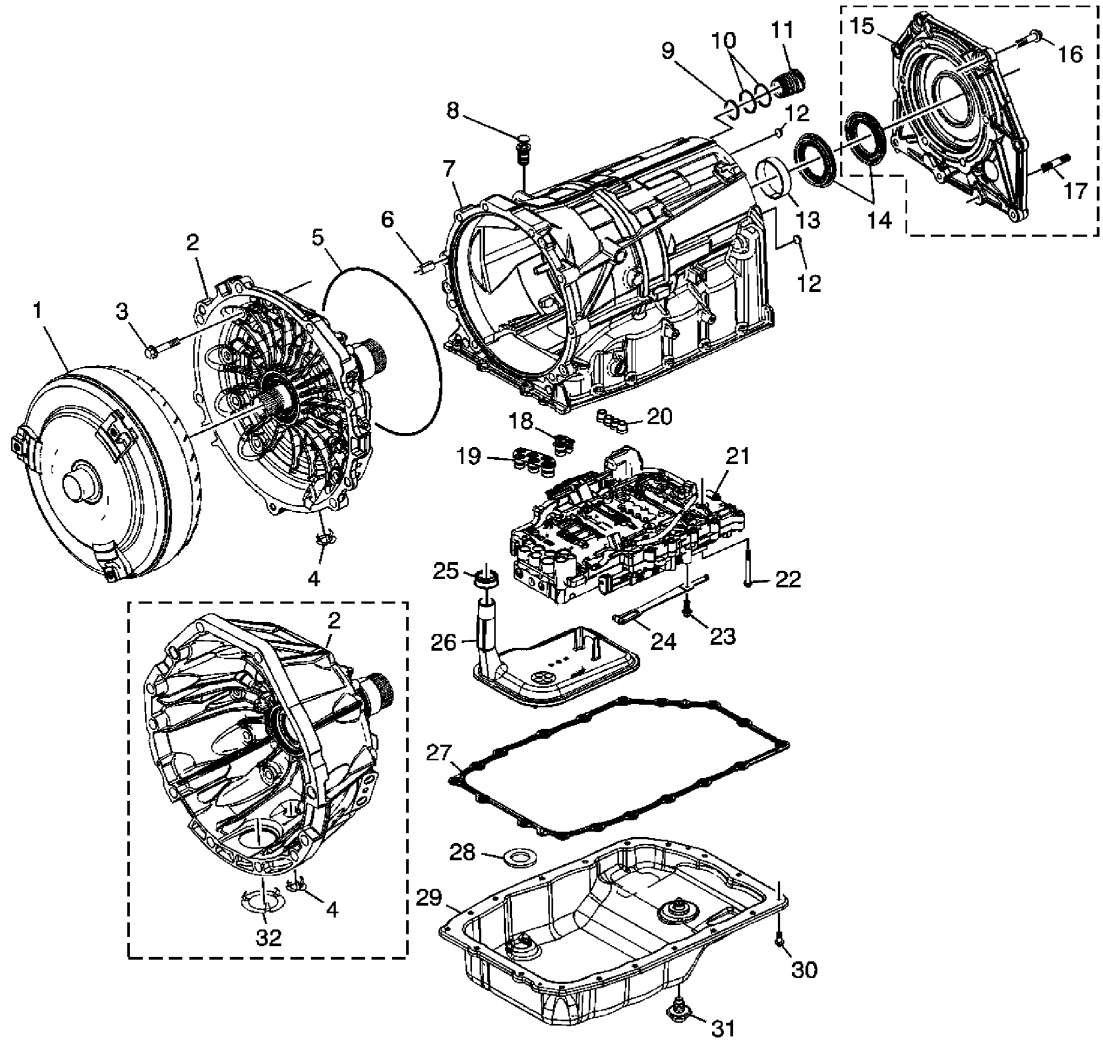


Fig. 350: View Of Converter Regulator Valve Inspection Areas
Courtesy of GENERAL MOTORS CORP.

14. Install the converter regulator valve (214) into the oil pump cover (206).
15. Install the converter regulator valve spring (213).
16. Install the converter regulator valve bore plug (212).
17. Install the converter regulator valve bore plug pin (211).
18. Inspect the converter regulator valve (214) for free movement in the bore.

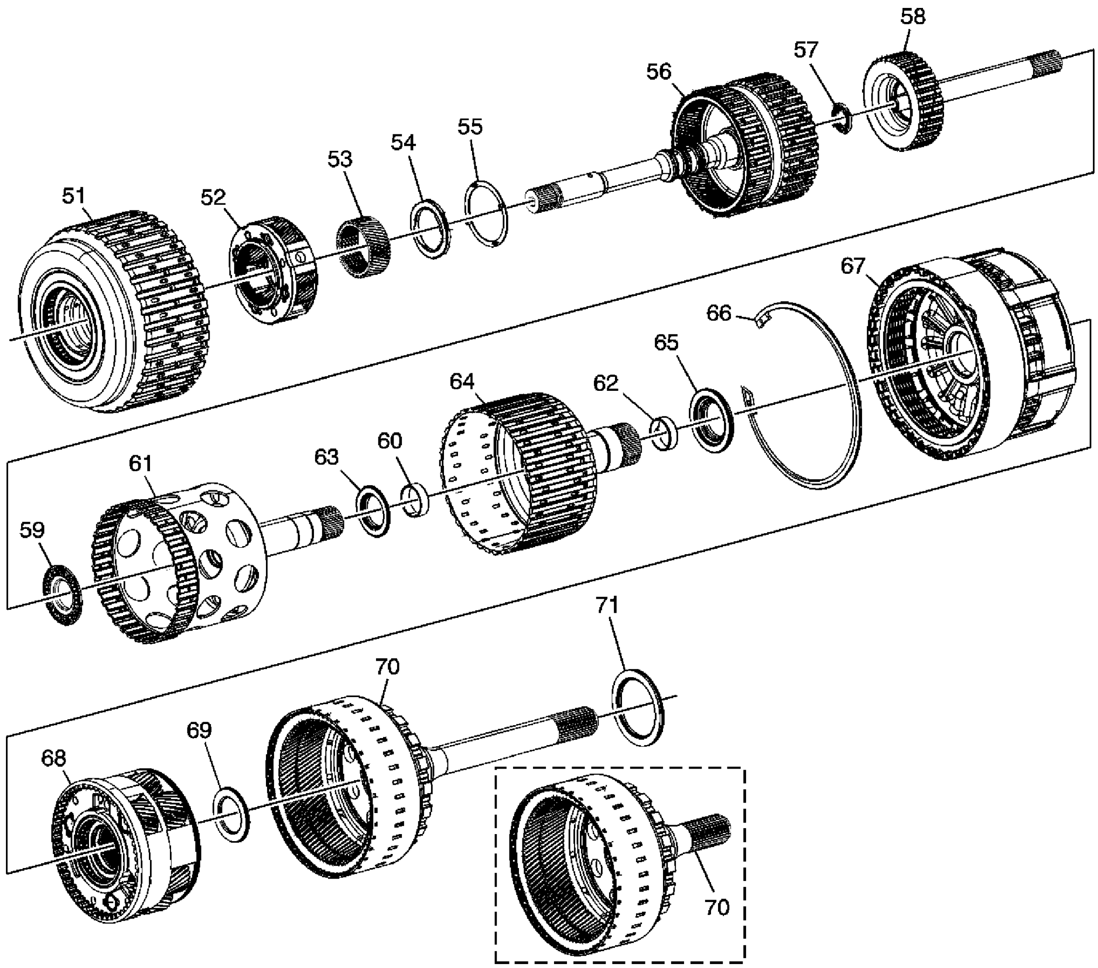


Fig. 351: Identifying Pressure Regulator Valve Components
Courtesy of GENERAL MOTORS CORP.

19. Install the pressure regulator valve bore plug pin (211) into the oil pump cover (206).
20. Install the pressure regulator valve bore plug (232).
21. Install the pressure regulator valve (231).
22. Install the pressure regulator valve inner (238) and outer (230) springs.
23. Install the pressure regulator valve spring retainer (229).
24. Assemble the reverse boost valve (228) into the reverse boost valve bushing (227) with the reverse boost valve stem facing out of the bushing.
25. Install the reverse boost valve assembly (227, 228).
26. Install the reverse boost valve bushing retainer ring (226).

TRANSMISSION FLUID PUMP BODY TO GEAR FACE CLEARANCE CHECK

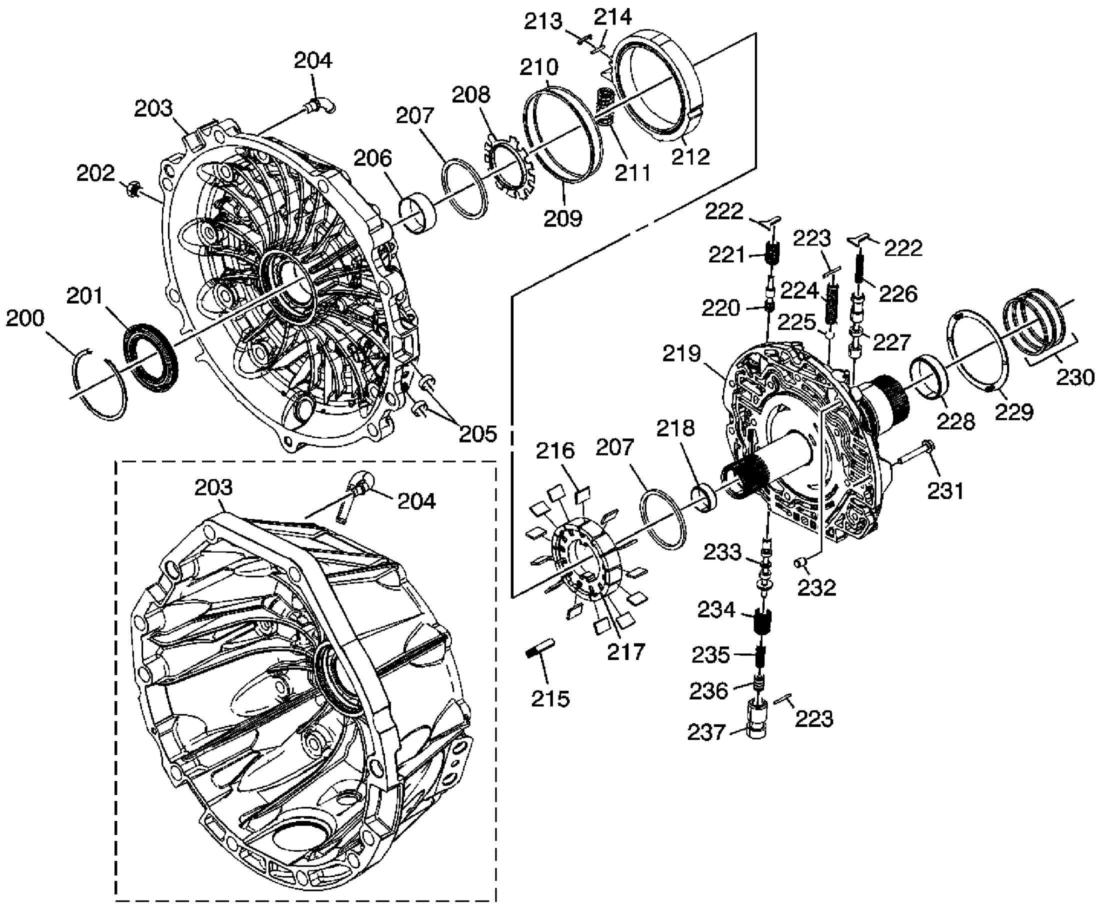


Fig. 352: Checking Transmission Oil Pump Body To Gear Face Clearance
Courtesy of GENERAL MOTORS CORP.

1. Place a straight edge across the face of the oil pump body assembly (203) and the faces of the oil pump gears (204, 205).
2. Measure the clearance between the straight edge and the faces of the oil pump gears. The proper clearance is between 0.017-0.071 mm (0.0008-0.0028 in).

TRANSMISSION FLUID PUMP BODY DISASSEMBLE

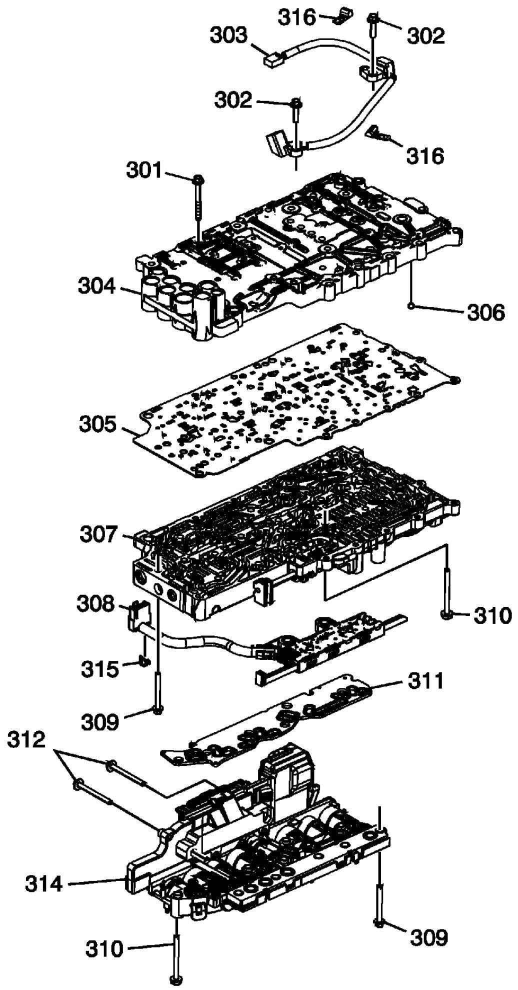


Fig. 353: Locating Oil Pump Body Assembly Gear Pockets, Crescent, Pump Body Face & Bushing Inspection Areas
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission oil pump drive gear (205) and driven gear (204) from the oil pump body (203).
2. Inspect the oil pump body assembly (203) gear pockets, crescent, pump body face and bushing for scoring nicks and wear.
3. Inspect the oil pump drive gear (205) and driven gear (204) for wear.

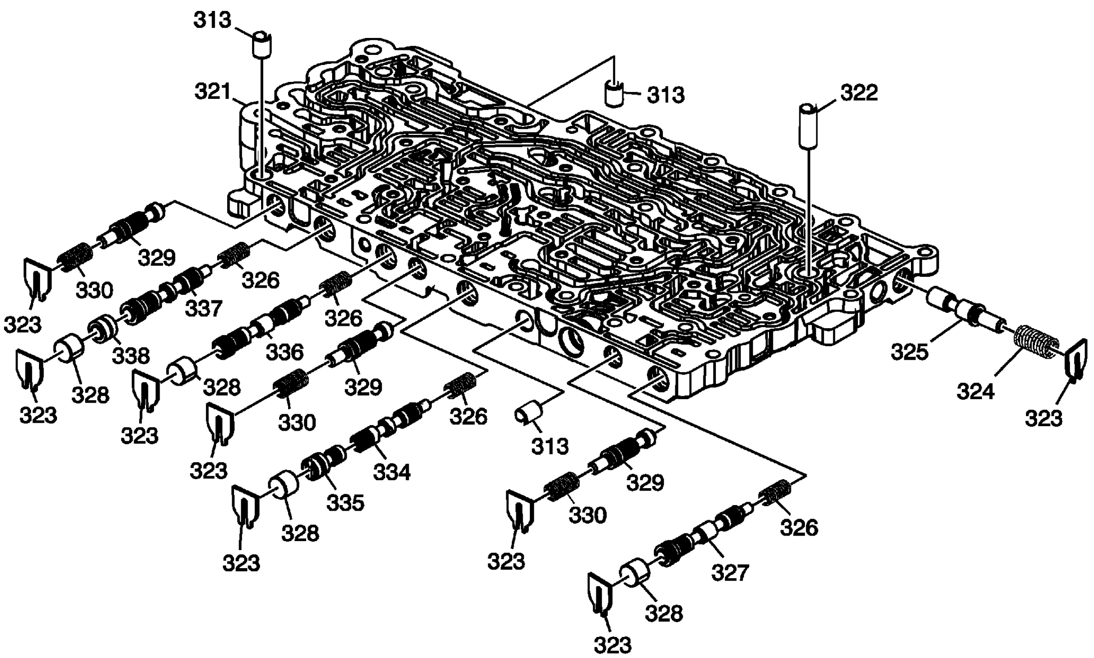


Fig. 354: Inspection Areas Of Oil Pump Body Assembly
Courtesy of GENERAL MOTORS CORP.

4. Remove the transmission oil pump seal (5) from the oil pump body assembly (203).
5. Inspect the oil pump body assembly (203) fluid passages for debris.
6. Inspect the oil pump body assembly fluid passages for scored or irregular mating surfaces.
7. Inspect the oil pump body assembly fluid passages for cross channel leaks.
8. Inspect the oil pump body assembly bolt threads for damage.

TRANSMISSION FLUID PUMP BODY FLATNESS CHECK

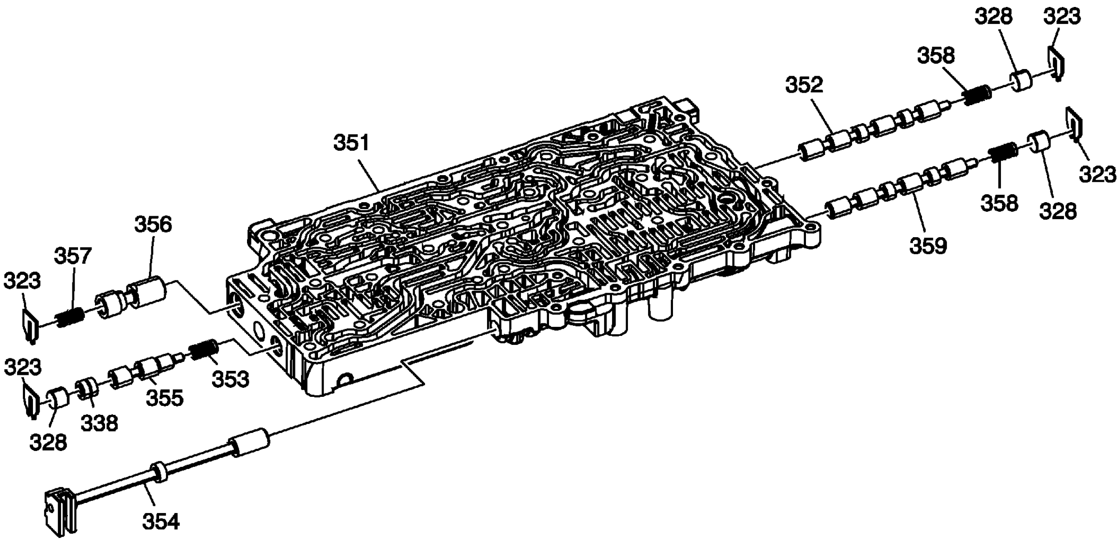


Fig. 355: Using Straight Edge To Inspect Oil Pump Body Assembly Flatness
Courtesy of GENERAL MOTORS CORP.

Using a straight edge and a feeler gage, inspect the face of the oil pump body assembly (203) for flatness.

TRANSMISSION FLUID PUMP BODY ASSEMBLE

Tools Required

J 38693 Oil Pump Seal Installer. See **Special Tools**.

Procedure

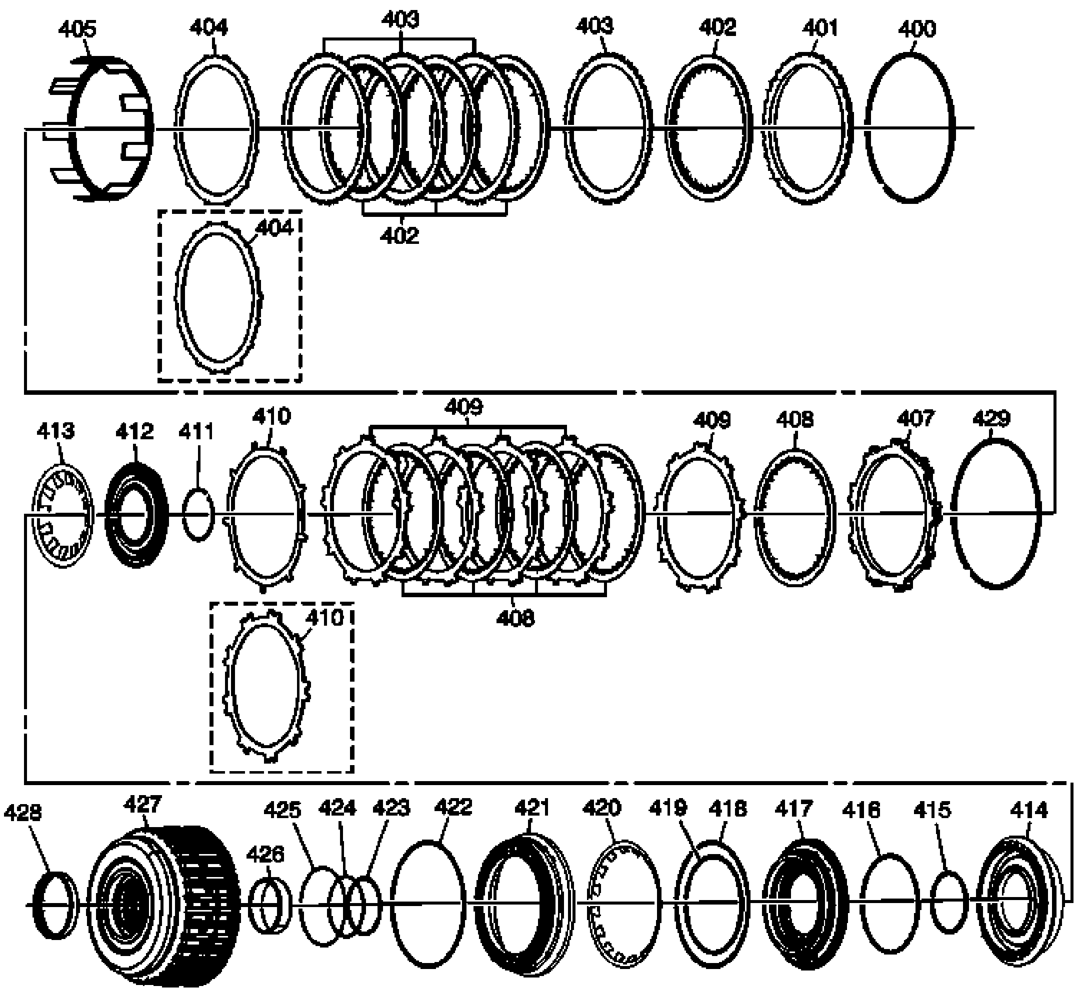


Fig. 356: Identifying J 38693
Courtesy of GENERAL MOTORS CORP.

1. Using the **J 38693** , install the torque converter oil seal assembly (201). See **Special Tools**.

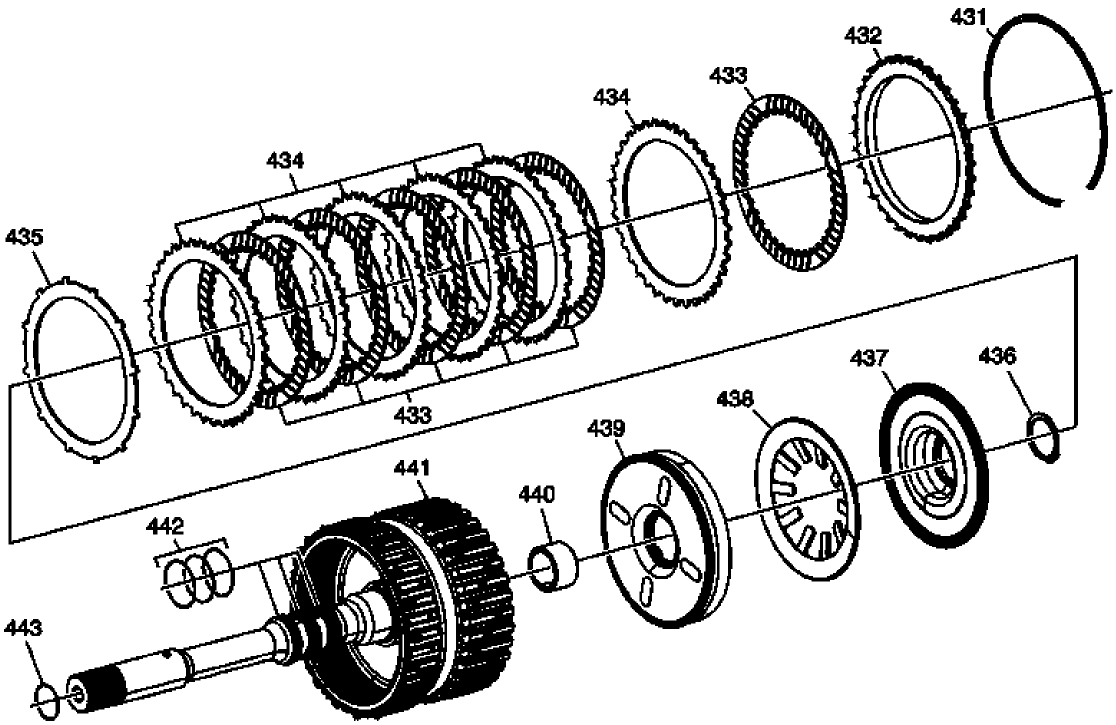


Fig. 357: View Of Oil Pump Drive Gear And Driven Gear
Courtesy of GENERAL MOTORS CORP.

2. Lubricate the oil pump drive gear (205) and driven gear (204) with DEXRON®VI automatic transmission fluid.

IMPORTANT: The identification dots on the oil pump drive gear (205) must be facing up in order to ensure correct orientation of the drive flats.

3. Install the oil pump driven gear (204) and drive gear (205) with the identification dots facing up.

TRANSMISSION FLUID PUMP ASSEMBLE

Tools Required

- **J 21368** Pump Body and Cover Alignment Band
- **J 36850** Transjel® Lubricant

Procedure

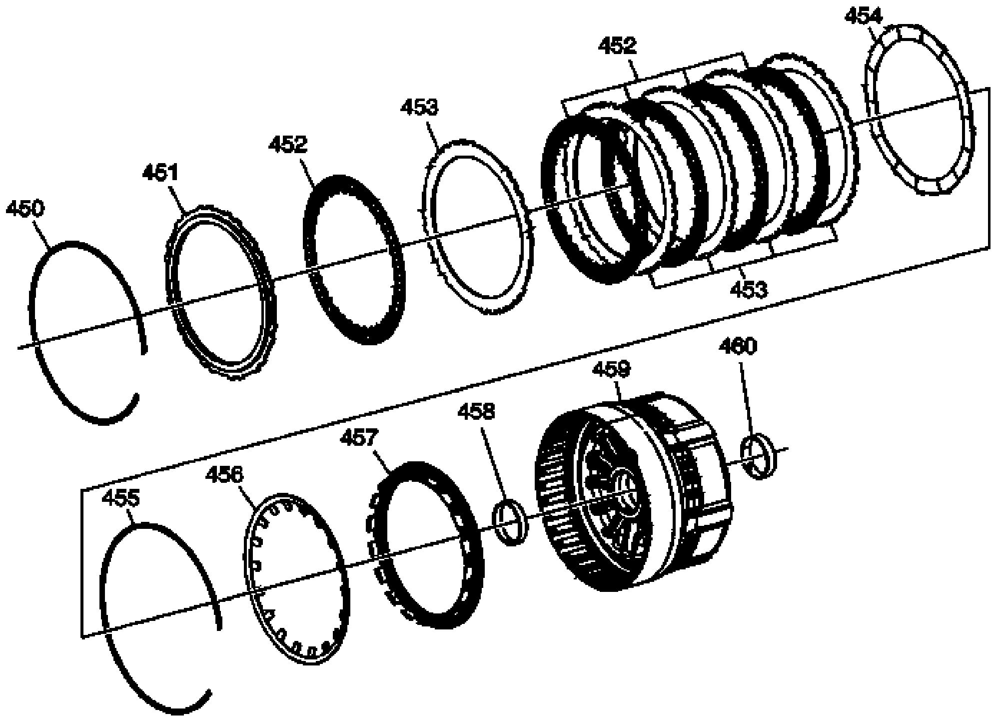


Fig. 358: Assembling Oil Pump Cover & Oil Pump Body Assembly
Courtesy of GENERAL MOTORS CORP.

1. Assemble the oil pump cover (206) and the oil pump body assembly (203).

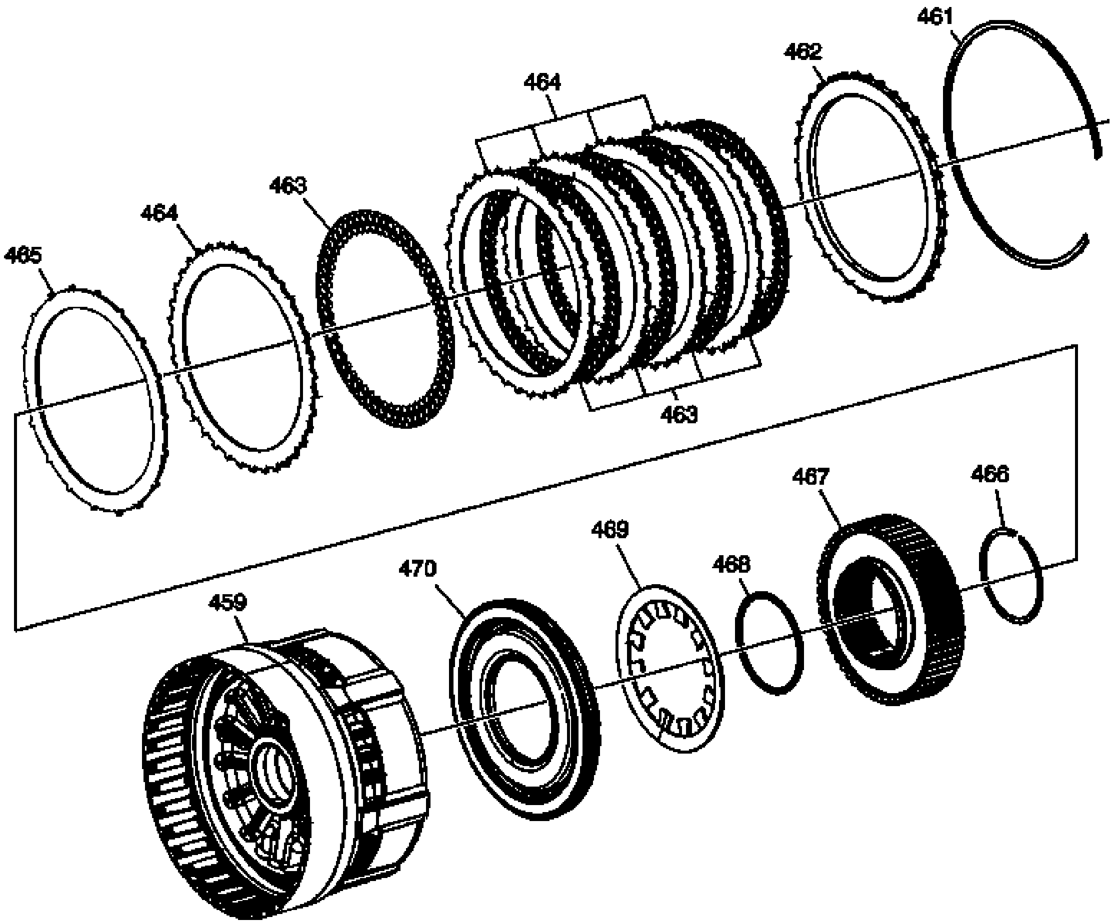


Fig. 359: Identifying Vent Passage Splash Shield
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The tab on the vent passage splash shield (239) fits into the hole in the oil pump cover. The hole in the vent passage splash shield (239) fits under the bolt head.

2. Install the vent passage splash shield (239).
3. Install the oil pump cover bolts (220). Tighten the bolts with your fingers only.

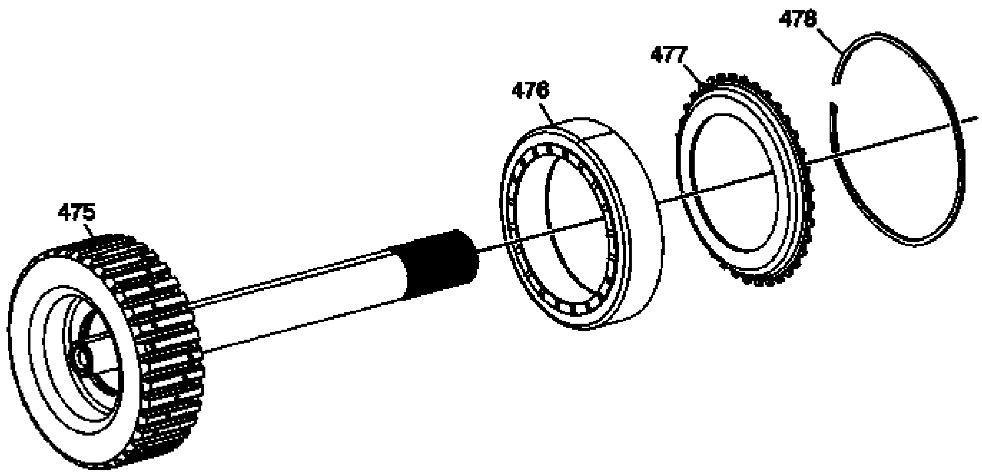


Fig. 360: Locating Oil Pump Bolt And Seal Assembly
Courtesy of GENERAL MOTORS CORP.

4. Install an oil pump bolt and seal assembly (3) into an oil pump bolt hole.

IMPORTANT: The outside diameter of the oil pump body assembly and oil pump cover must be properly aligned before the alignment band can be tightened. This ensures that the oil pump fits into the transmission case opening and maintains maximum oil pump efficiency.

5. Install the **J 21368** onto the transmission oil pump assembly and tighten.

NOTE: Refer to FASTENER NOTICE .

6. Tighten the 5 oil pump cover bolts (220).

   Tighten: Tighten the bolts to 24 N.m (18 lb ft) in an alternating pattern.

7. Remove the **J 21368** and the oil pump bolt and seal assembly (3).

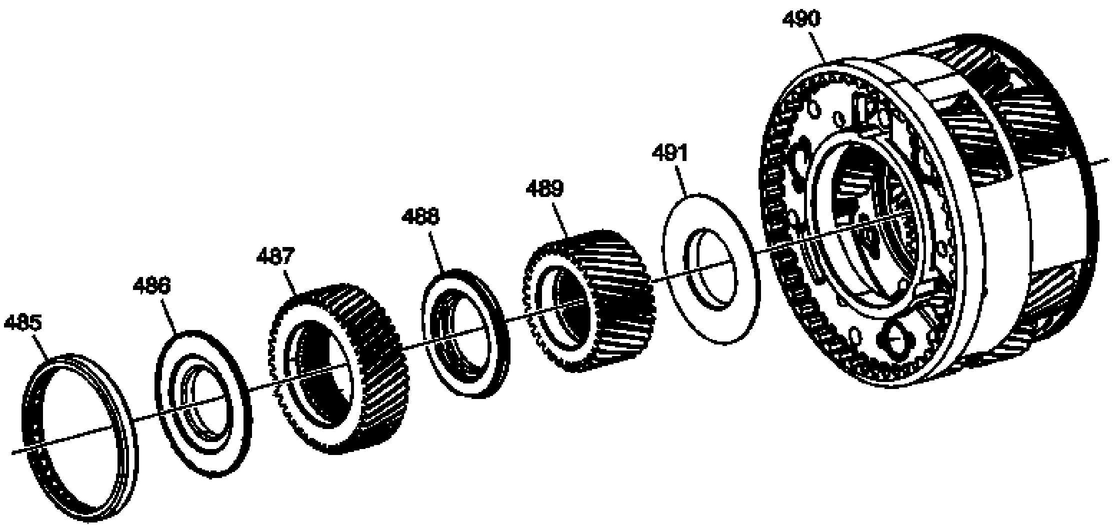


Fig. 361: View Of Transmission Oil Pump Seal
Courtesy of GENERAL MOTORS CORP.

NOTE: **Coat the transmission oil pump seal with J 36850 or equivalent. This will ease assembly and prevent damage to the seal.**

8. Install the transmission oil pump seal (5) on the oil pump assembly (4).

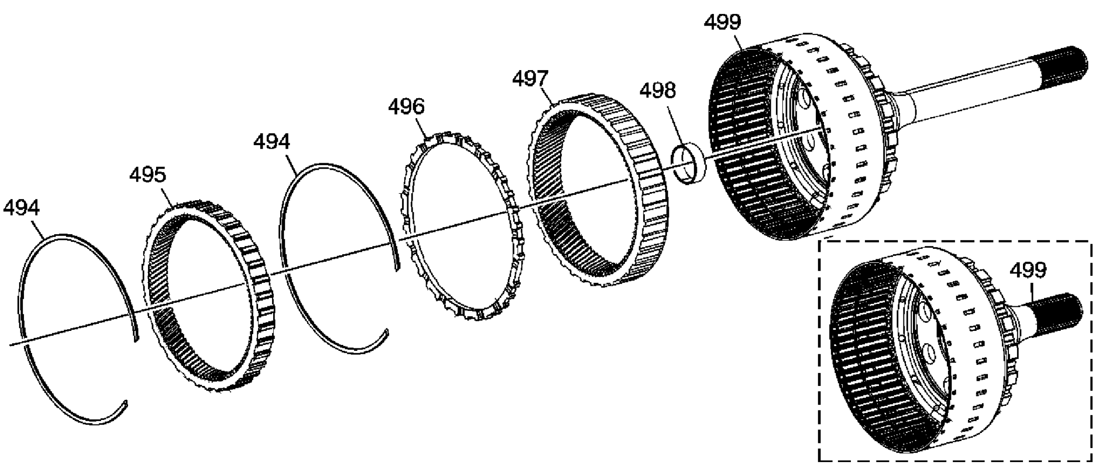


Fig. 362: Identifying Overrun Clutch Housing Oil Seal Rings
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not overexpand the oil seal rings. Damage to the rings may result.

9. Install the new overrun clutch housing oil seal rings (219) onto the oil pump cover.
10. Ensure that the overrun clutch housing oil seal rings (219) move freely in the grooves.
11. Use **J 36850** or equivalent in order to keep the overrun clutch housing oil seal rings in place.

TRANSMISSION FLUID PUMP ASSEMBLY INSTALLATION

Tools Required

J 25025-1 Guide Pins

Procedure

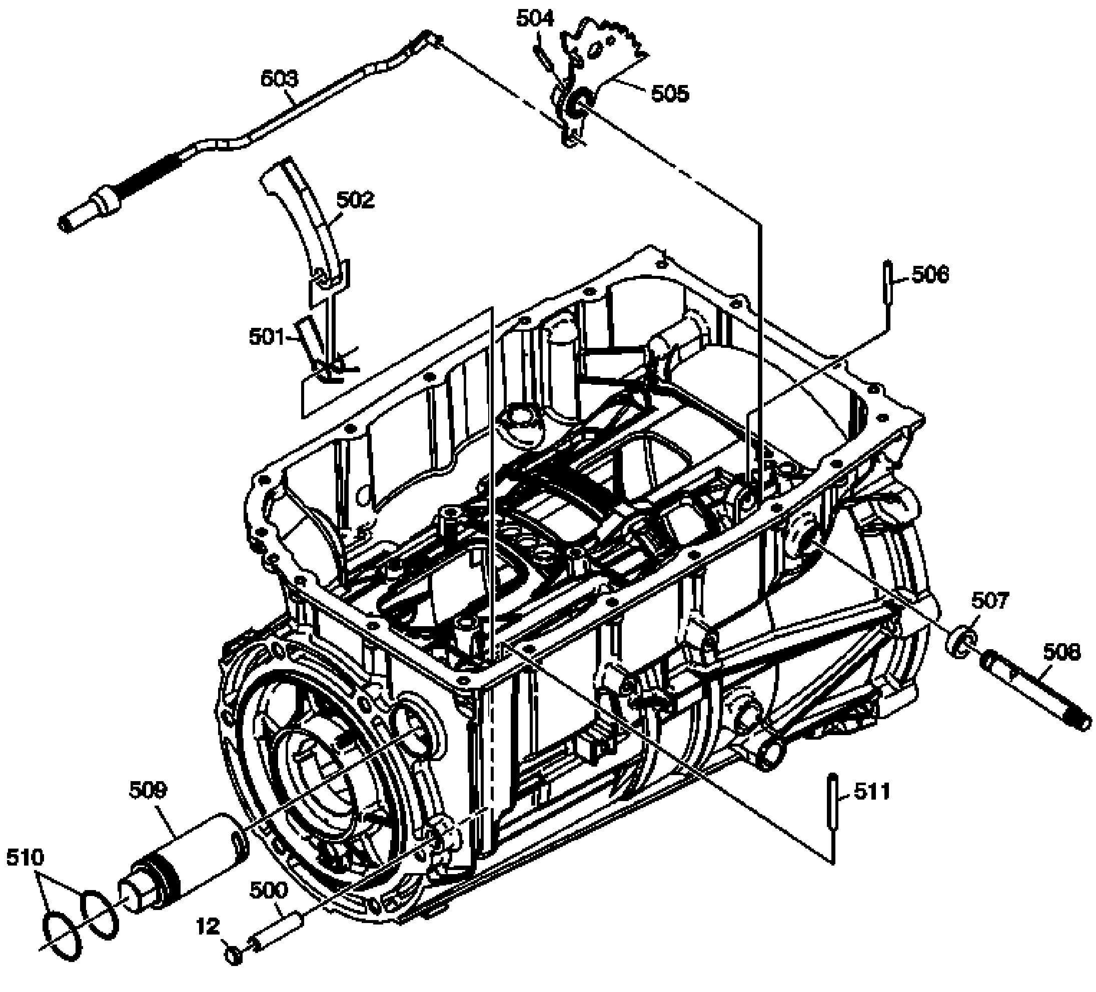


Fig. 363: Aligning J 25025-1 At 12:00 & 5:00 Positions
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 25025-1** at the 12 o'clock and the 5 o'clock positions.

2. Install the transmission oil pump gasket (6).

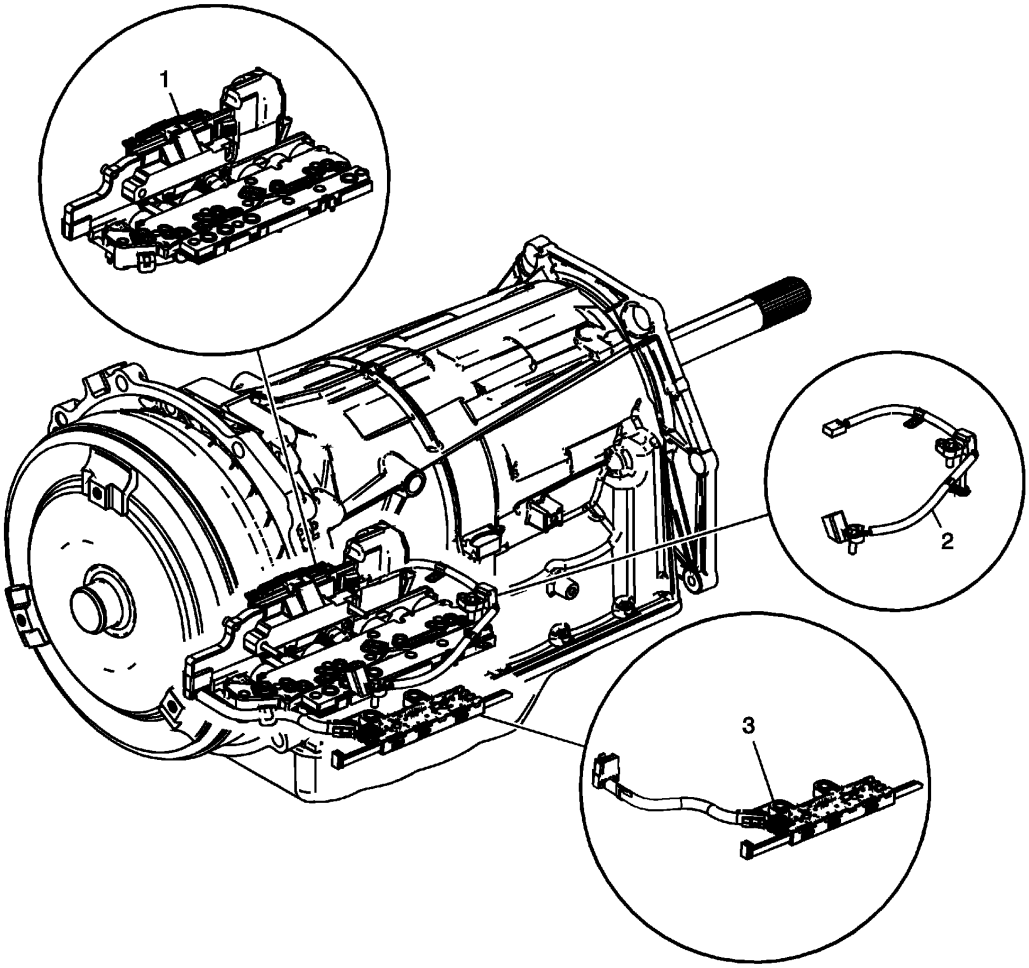


Fig. 364: View Of Oil Pump Assembly
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When installing the oil pump assembly (4), position the bolt holes closest together toward the bottom of valve body side of the transmission case assembly.

IMPORTANT: If you cannot rotate the turbine shaft while lowering the oil pump assembly into place, then you have improperly installed the overrun clutch assembly, the fourth clutch assembly, the forward clutch assembly and/or the direct clutch assembly. These components have not indexed with all of the clutch plates. Correct the condition before installing the oil pump assembly.

3. Install the oil pump assembly (4) into the transmission case assembly.
4. Remove **J 25025-1** .

NOTE: **Refer to FASTENER NOTICE .**

5. Install the 7 transmission oil pump bolt and seal assemblies (3).

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

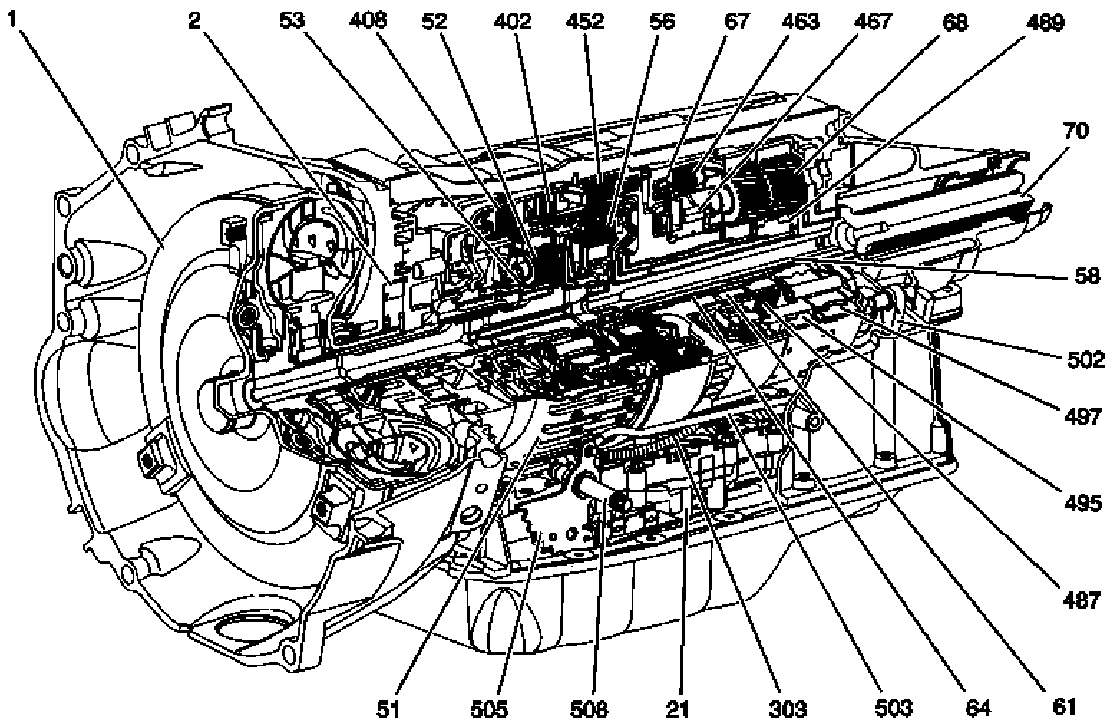


Fig. 365: View Of Turbine Shaft Front Oil Seal Ring
Courtesy of GENERAL MOTORS CORP.

6. Install the turbine shaft front oil seal ring (2).

FRONT END PLAY CHECK

Tools Required

- **J 8001** Dial Indicator Set
- **J 25025-B** Dial Indicator Post and Guide Pin Set
- **J 28585** Snap Ring Remover. See **Special Tools**.

Procedure

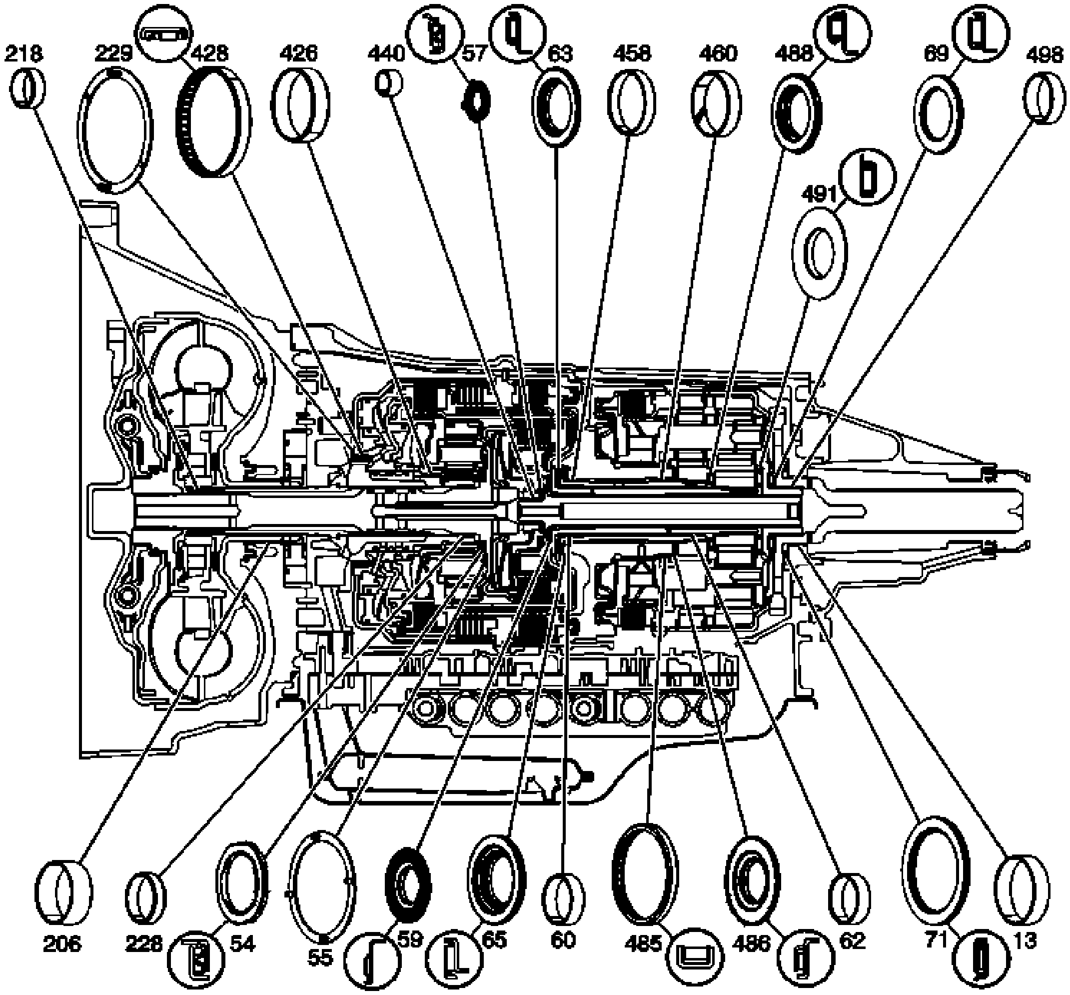


Fig. 366: Measuring Front End Play
Courtesy of GENERAL MOTORS CORP.

NOTE: **If the front end play check procedures are not closely followed, you may select an incorrect selective thrust washer thickness. This could result in severe damage to the internal transmission components.**

1. Assemble the **J 25025-B** by attaching the threaded rod and the dial indicator holder to one of the bolt holes on the transmission case assembly (7).
2. Assemble the **J 8001-3** onto the dial indicator holder. Index the **J 8001-3** to the end of the turbine shaft (502).
3. Eliminate any slack by pressing down on the turbine shaft (502).
4. Using **J 28585** , apply upward pressure on the output carrier assembly to remove free play in the retainer ring. See **Special Tools**.
5. Set the **J 8001-3** to 0.
6. Pull up on the turbine shaft (502) while holding up the output carrier assembly with the **J 28585** . See **Special Tools**.

End Play Specification: The correct end play is 0.102-0.559 mm (0.004-0.022 in).

7. Remove the tools from the transmission.
8. If the front end play measurement is incorrect, refer to the **Overrun Clutch Housing Selective Thrust Washer Specifications** . Choose a new selective thrust washer based on the original selective washer and the information contained in the table.
9. Correct the end play by changing the overrun clutch housing selective thrust washer.

MANUAL 2-1 BAND SERVO ASSEMBLY DISASSEMBLE

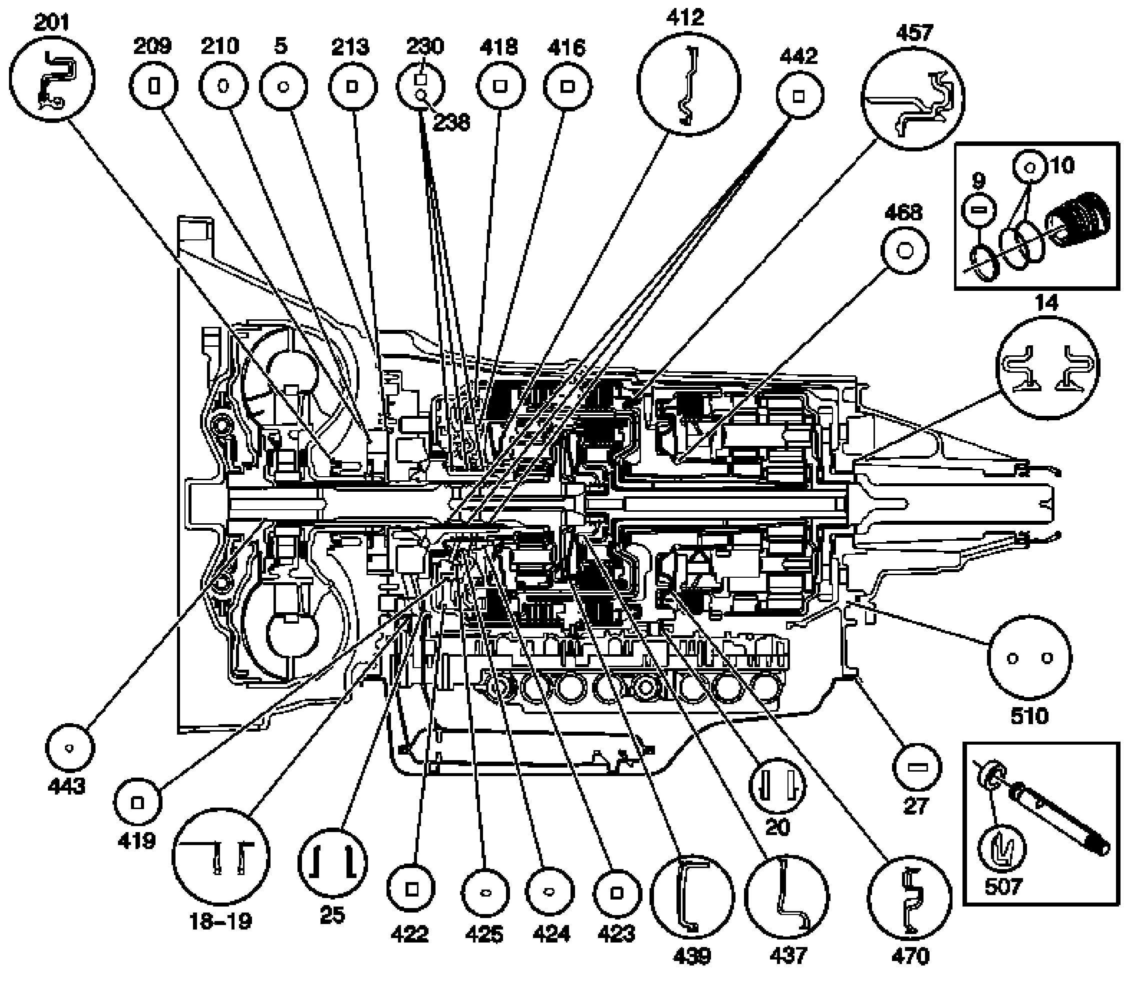


Fig. 367: Manual 2-1 Band Servo Assembly Inspection Areas
Courtesy of GENERAL MOTORS CORP.

1. Remove the manual 2-1 band servo piston pin retainer ring (56).
2. Remove the manual 2-1 band servo piston pin (55).
3. Remove the manual 2-1 band servo piston seal (57).
4. Inspect the manual 2-1 band servo piston (58) for porosity, wear and seal ring groove damage.
5. Inspect the manual 2-1 band servo piston pin (55) and retainer ring (56) for wear and damage.

MANUAL 2-1 BAND SERVO ASSEMBLY ASSEMBLE

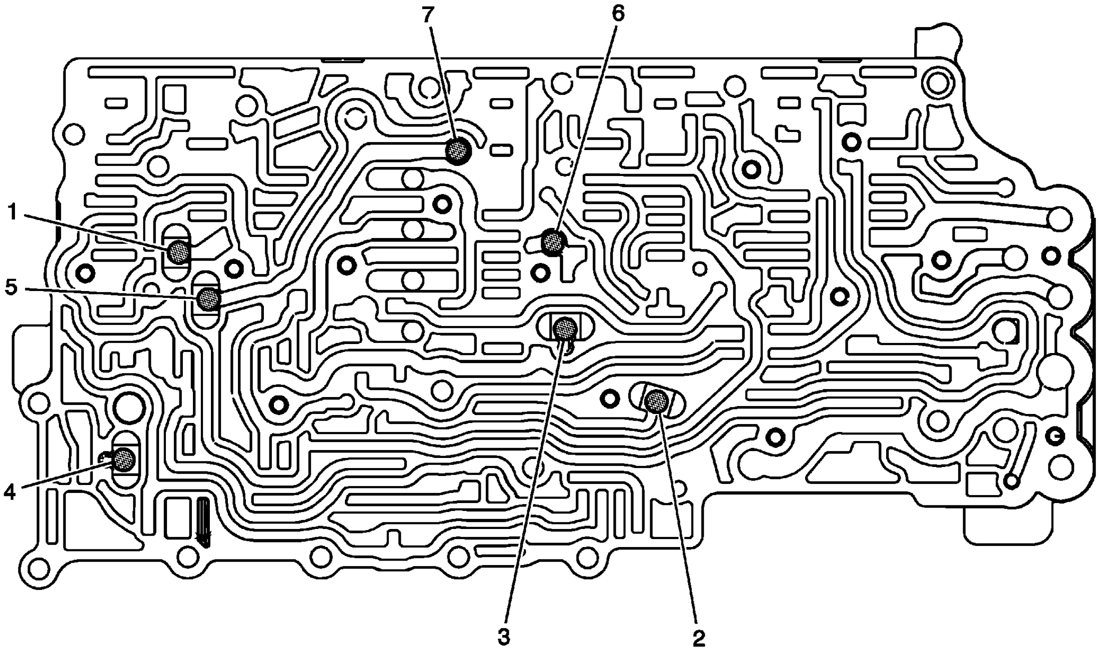


Fig. 368: Manual 2-1 Band Servo Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install a new manual 2-1 band servo piston seal (57) onto the manual 2-1 band servo piston (58).
2. Install the manual 2-1 band servo piston pin (55) into the manual 2-1 band servo piston (58).
3. Install the manual 2-1 band servo piston pin retainer ring (56).

MANUAL 2-1 BAND SERVO ASSEMBLY INSTALLATION

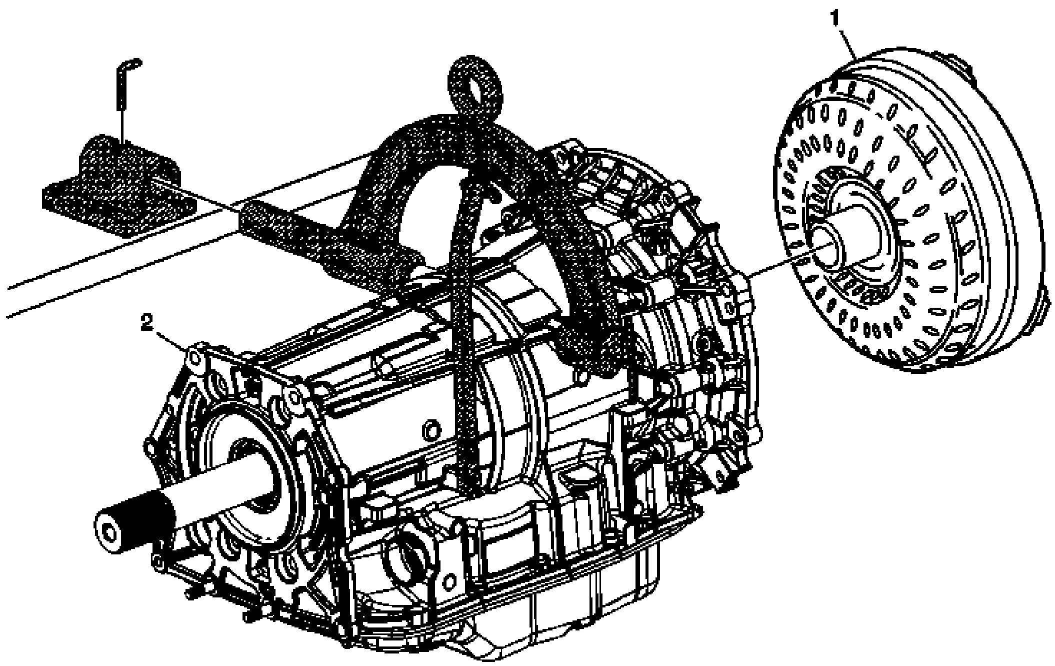


Fig. 369: View Of Manual 2-1 Band Servo Piston Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the manual 2-1 band servo piston cushion spring (60).

IMPORTANT: Ensure the tapered end of the manual 2-1 band servo piston pin contacts the manual 2-1 band.

2. Install the manual 2-1 band servo piston assembly (55-58).

LOW AND REVERSE BAND SERVO PISTON PIN CHECK

Tools Required

- **J 21370-10** Band Apply Pin Gauge. See **Special Tools**.
- **J 38737** Band Apply Pin Checking Tool. See **Special Tools**.

Procedure

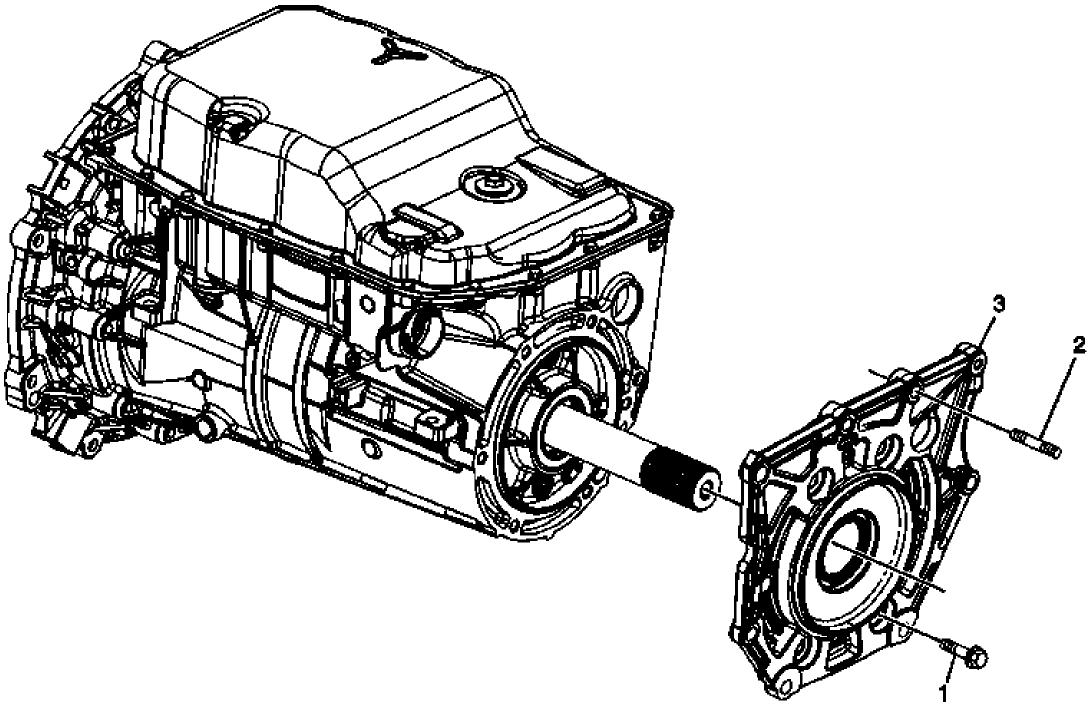


Fig. 370: Identifying J 21370-10
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 21370-10** into the low and reverse band servo pin bore. See **Special Tools**.
2. Position the **J 38737** over the low and reverse band servo bore with the hex hub facing the parking pawl linkage. See **Special Tools**.

NOTE: Refer to FASTENER NOTICE .

3. Fasten the **J 38737** to the case with 2 low and reverse band servo cover bolts (61). See **Special Tools**.

   Tighten: Tighten the bolts to 24 N.m (18 lb ft).

4. Verify that the **J 21370-10** moves freely in the **J 38737** and in the low and reverse band servo pin bore. See **Special Tools**.

IMPORTANT: The hex hub of the J 38737 must be tightened in order to determine the correct low and reverse band servo piston pin length. See Special Tools.

5. Tighten the hex hub of the **J 38737** . See **Special Tools**.

   Tighten: Tighten the hex hub of the **J 38737** to 34 N. See **Special Tools**.m (25 lb ft).

6. Observe the lands on the **J 21370-10** in order to determine which land is even with the top edge of the **J 38737** . See **Special Tools**. Note the letter (A, B or C) stamped on the **J 21370-10** . See **Special Tools**.

7. Refer to the Low and Reverse Band Servo Piston Pin Specification table, in **Transmission General Specifications** , in order to determine the correct pin length to use.
8. Remove the tools.

LOW AND REVERSE BAND SERVO ASSEMBLY DISASSEMBLE

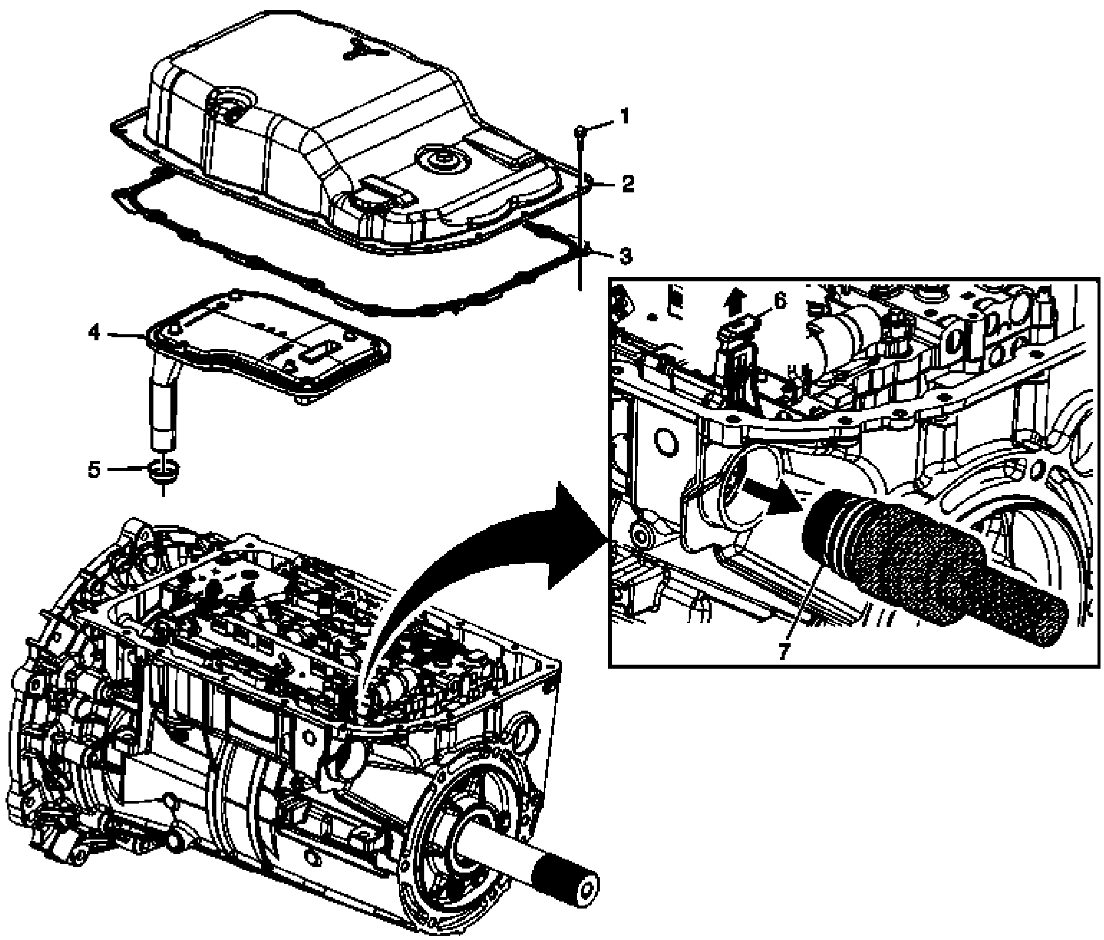


Fig. 371: Inspecting Low And Reverse Band Servo Piston Seal
Courtesy of GENERAL MOTORS CORP.

1. Remove the low and reverse band servo piston seal (66) from the low and reverse band servo piston (65).
2. Inspect the low and reverse band servo piston seal (66) for nicks and cuts.

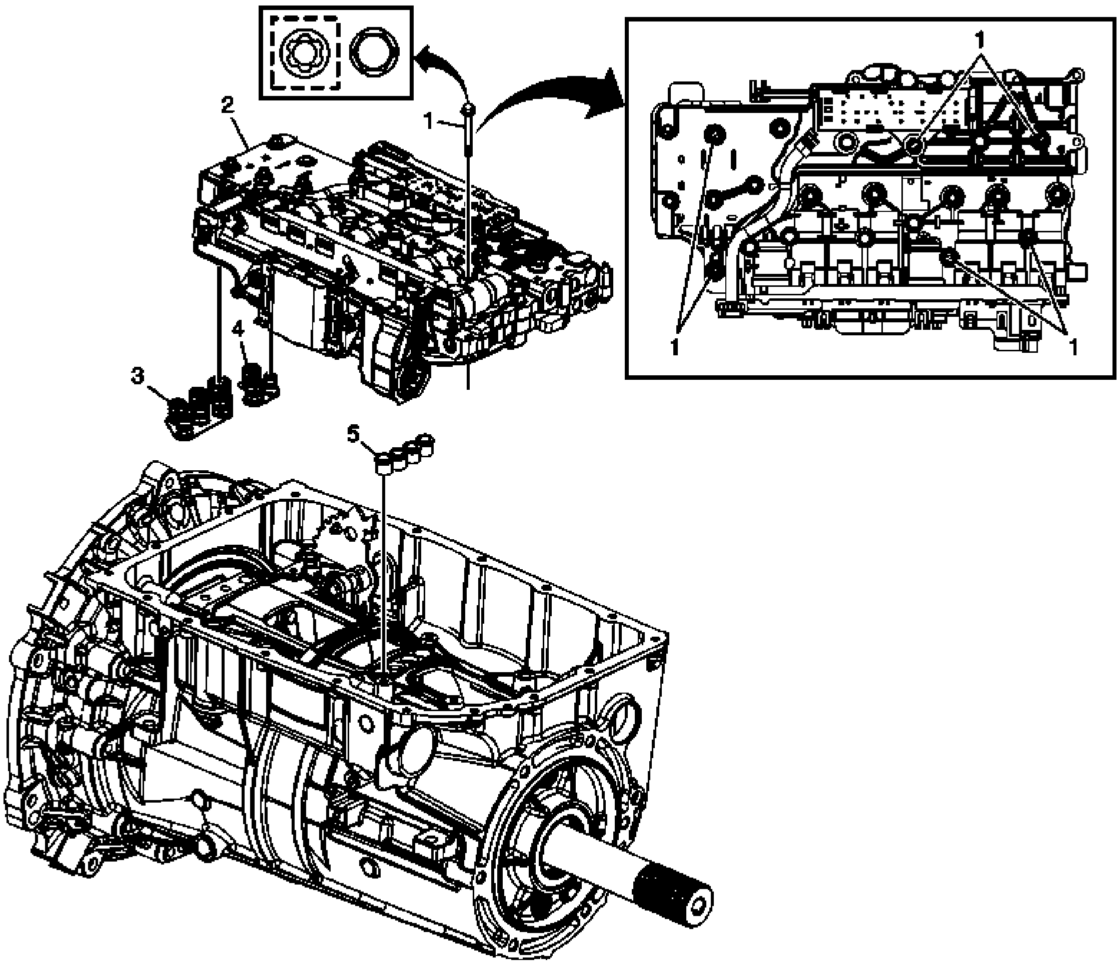


Fig. 372: Locating Low And Reverse Band Servo Piston Pin
Courtesy of GENERAL MOTORS CORP.

3. Remove the low and reverse band servo piston pin retainer ring (64).
4. Remove the low and reverse band servo piston pin (73).
5. Inspect the low and reverse band servo piston pin (73) for wear.

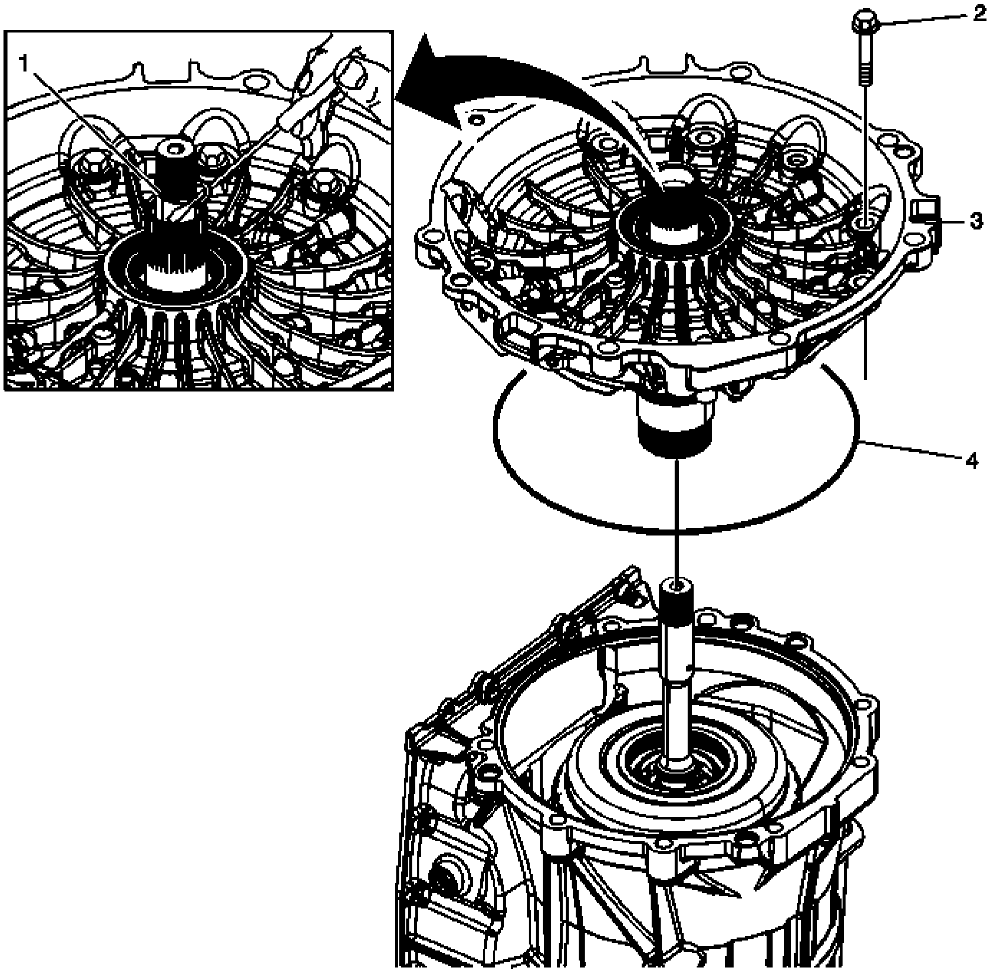


Fig. 373: Identifying Low And Reverse Band Servo Piston Spring
Courtesy of GENERAL MOTORS CORP.

6. Remove the low and reverse band servo piston spring retainer (72).
7. Remove the low and reverse band servo piston spring (71).
8. Inspect the low and reverse band servo piston spring (71) for distortion.
9. Remove the low and reverse band servo piston spacer (87).

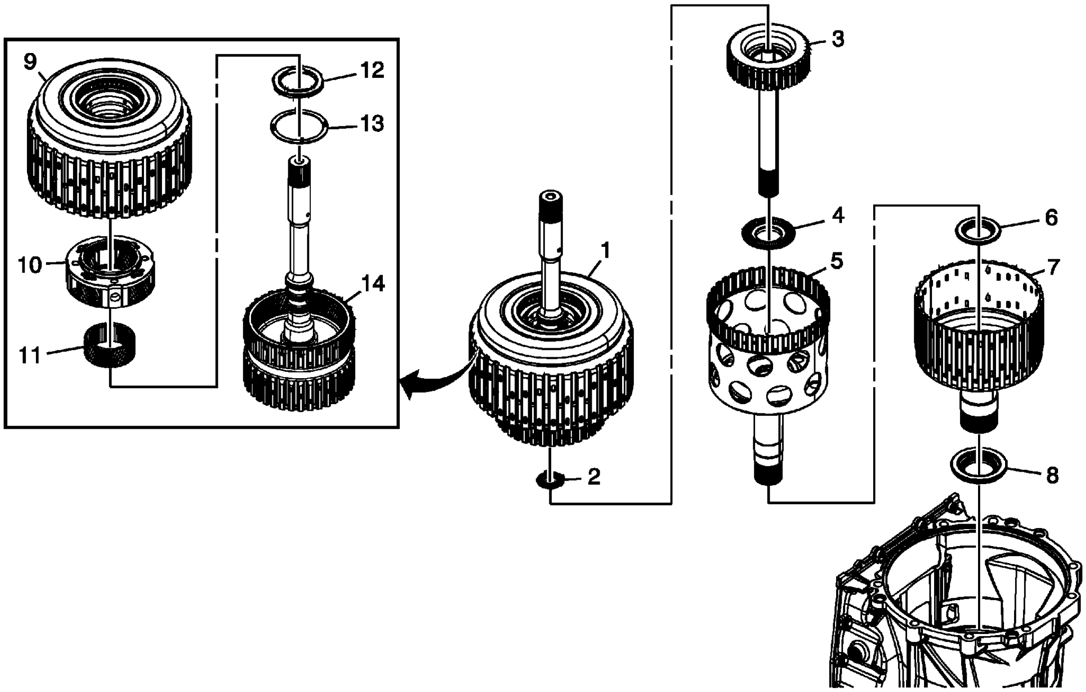


Fig. 374: Inspection Points On Low And Reverse Accumulator Piston Oil Seal Rings
Courtesy of GENERAL MOTORS CORP.

10. Remove the 1-2 accumulator piston (68).
11. Remove the low and reverse accumulator piston oil seal rings (67, 69).
12. Remove the 1-2 accumulator piston spring assembly (88).
13. Inspect the low and reverse band servo piston (65) and the 1-2 accumulator piston (68) for porosity and damage.
14. Inspect the low and reverse accumulator piston oil seal rings (67, 69) for nicks and cuts.

LOW AND REVERSE BAND SERVO ASSEMBLY ASSEMBLE

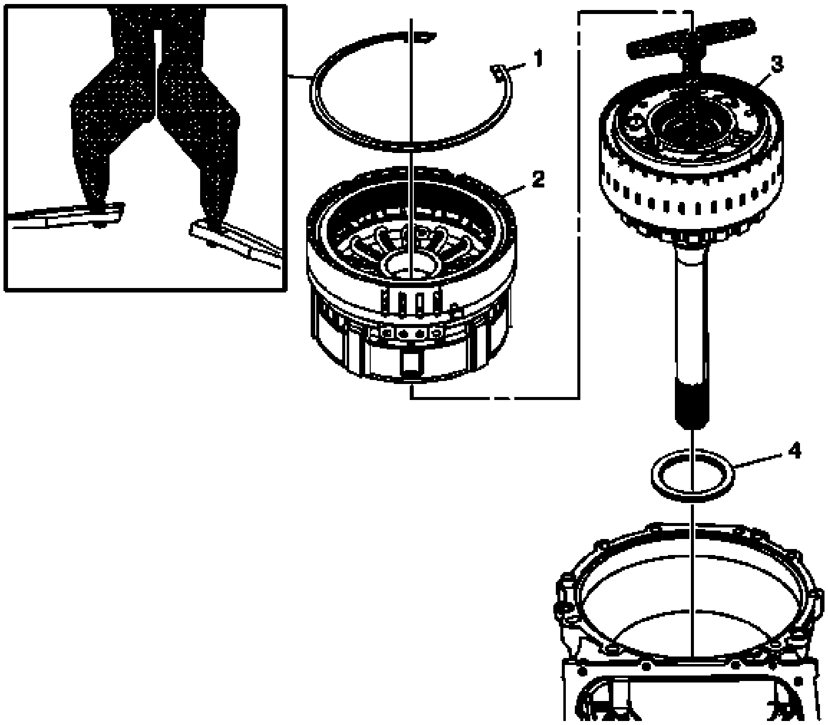


Fig. 375: View Of Low And Reverse Accumulator Piston Oil Seal Rings
Courtesy of GENERAL MOTORS CORP.

1. Install the new low and reverse accumulator piston oil seal rings (67, 69) on the 1-2 accumulator piston (68). Lubricate the low and reverse accumulator piston oil seal rings (67, 69) with DEXRON®VI automatic transmission fluid.

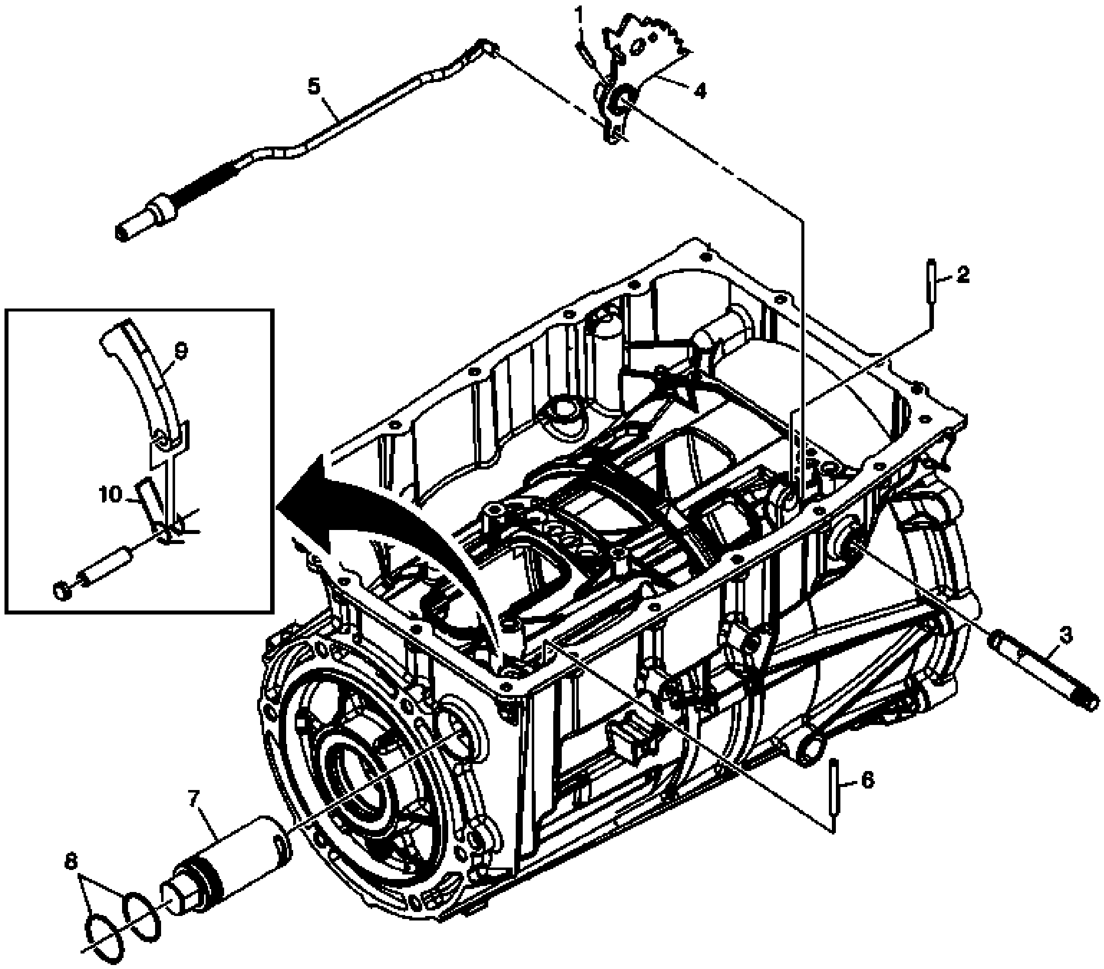


Fig. 376: Locating 1-2 Accumulator Piston Spring Assembly
Courtesy of GENERAL MOTORS CORP.

2. Install the 1-2 accumulator piston spring assembly (88) into the low and reverse band servo piston (65).
3. Install the 1-2 accumulator piston (68).

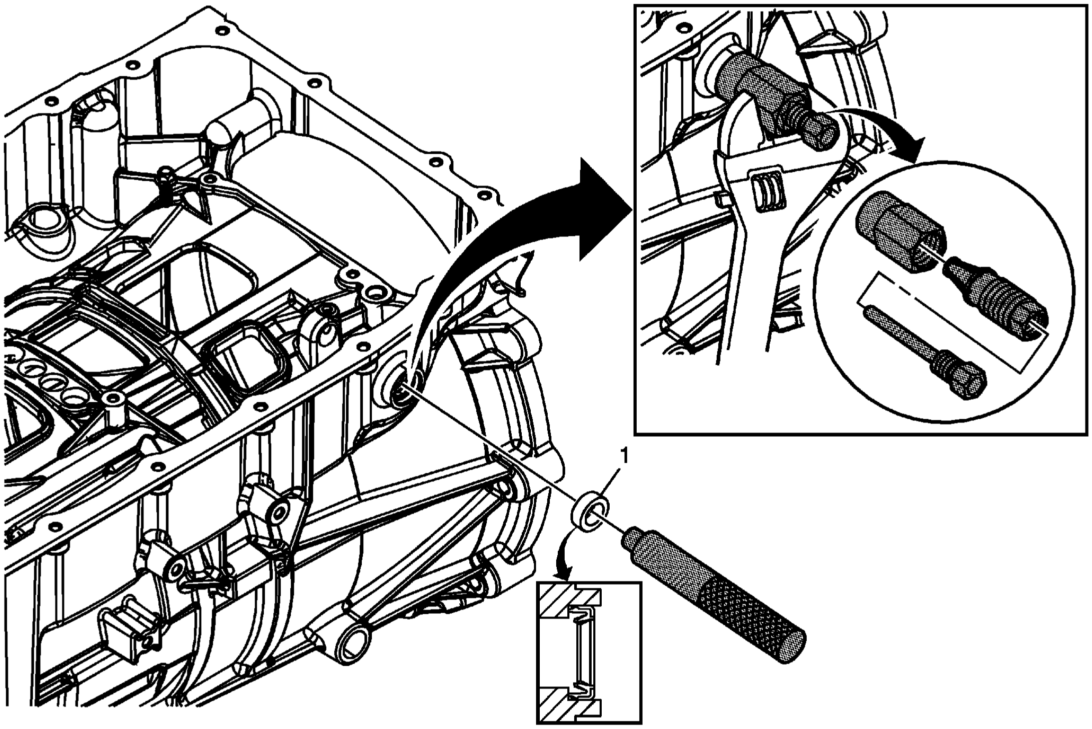


Fig. 377: Identifying Position Of Low And Reverse Band Servo Piston Spring Retainer
Courtesy of GENERAL MOTORS CORP.

4. Assemble the following items, in order, onto the small diameter end of the correct low and reverse band servo piston pin (73):
    1. The low and reverse band servo piston spring retainer (72)
    2. The low and reverse band servo piston spring (71)
    3. The low and reverse band servo piston spacer (87)
    4. The low and reverse band servo piston (65)
5. Install the low and reverse band servo piston pin retainer ring (64).

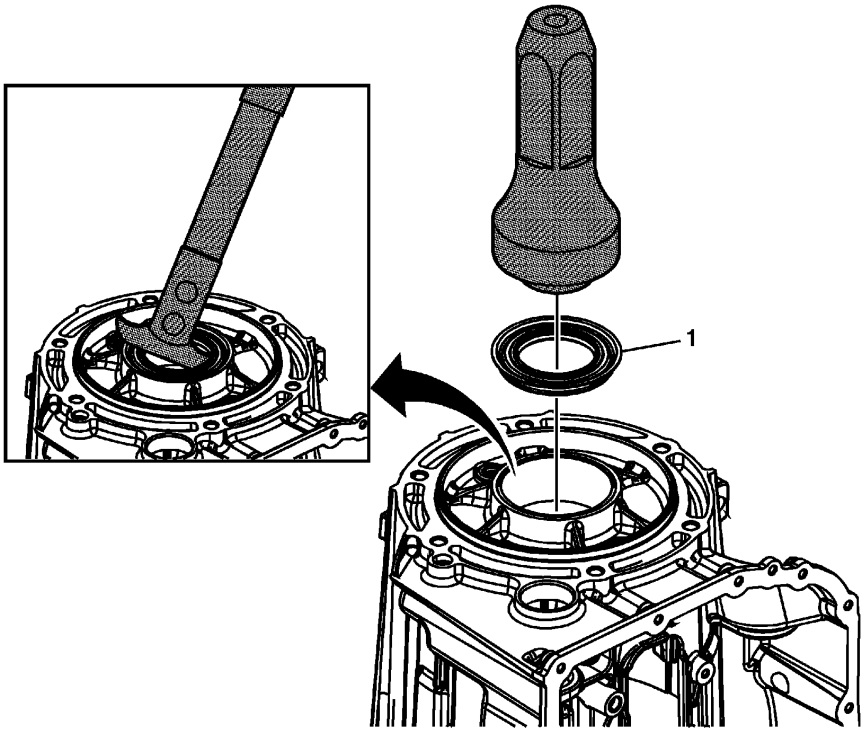


Fig. 378: Locating Low And Reverse Band Servo Piston Seal
Courtesy of GENERAL MOTORS CORP.

6. Install the new low and reverse band servo piston seal (66). Lubricate the low and reverse band servo piston seal (66) with DEXRON®VI automatic transmission fluid.

LOW AND REVERSE BAND SERVO ASSEMBLY INSTALLATION

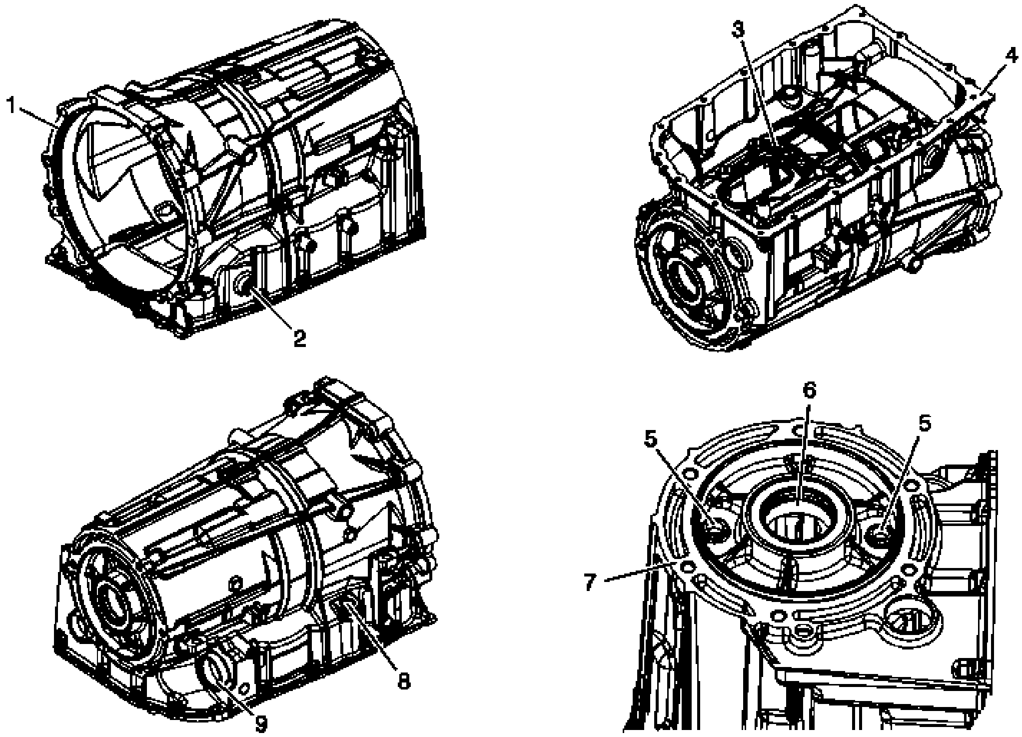


Fig. 379: View Of Low And Reverse Accumulator Piston Spring
Courtesy of GENERAL MOTORS CORP.

1. Install the low and reverse accumulator piston spring (74) into the transmission case.

IMPORTANT: The low and reverse band servo assembly (64-73) is pushed down when tightening the cover bolts. Do not force the low and reverse band servo assembly (64-73) into the servo bore.

2. Install the low and reverse band servo assembly (64-73).

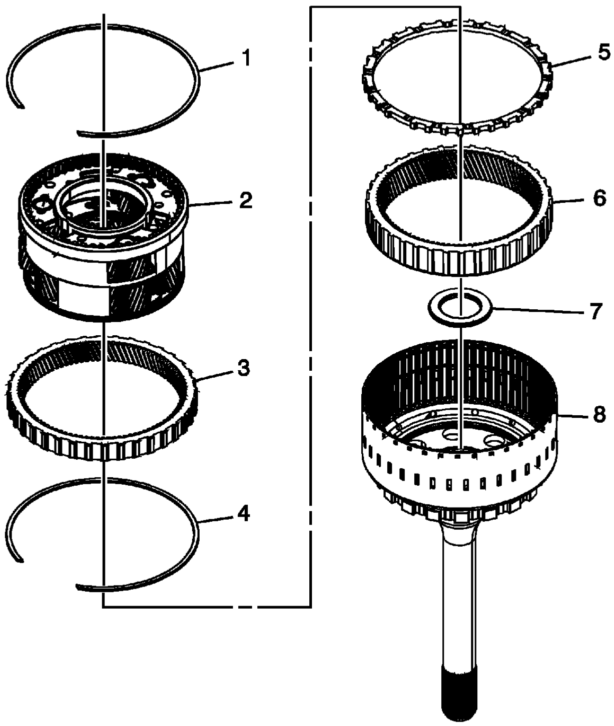


Fig. 380: Identifying Low And Reverse Band Servo Cover
Courtesy of GENERAL MOTORS CORP.

3. Install the low and reverse band servo cover gasket (63).
4. Install the low and reverse band servo cover (62).

NOTE: Refer to FASTENER NOTICE .

5. Install the 6 low and reverse band servo cover bolts (61).

   Tighten: Tighten the bolts to 24 N.m (18 lb ft) in an alternating pattern.

3RD AND 4TH CLUTCH ACCUMULATOR HOUSING REMOVAL

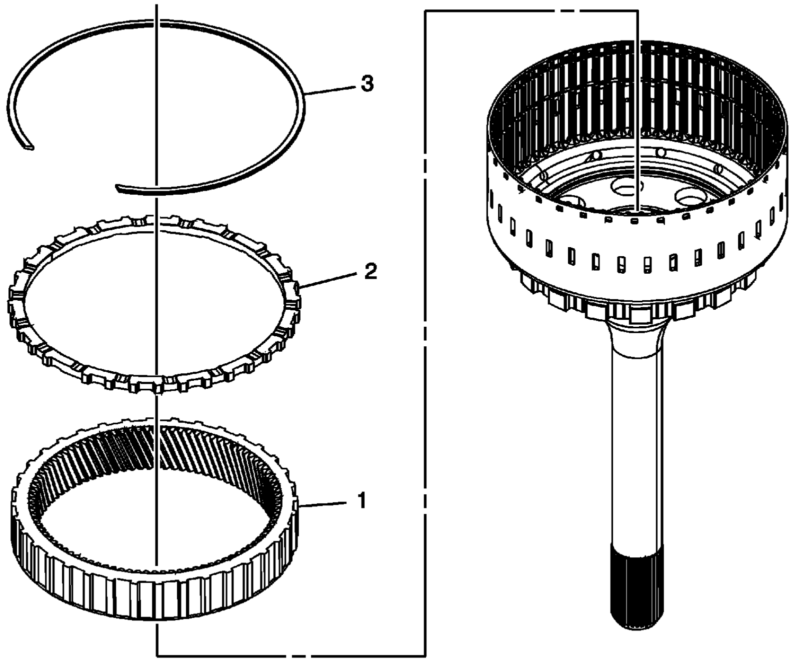


Fig. 381: Locating 3rd And 4th Clutch Accumulator Housing Bolts
Courtesy of GENERAL MOTORS CORP.

1. Remove the 3rd and 4th clutch accumulator housing bolts (53).
2. Remove the 3rd and 4th clutch accumulator housing (51).
3. Remove the accumulator housing gasket (47). The accumulator housing gasket (47) may be stuck to the control valve body spacer plate (46).
4. Remove the 3rd clutch accumulator piston spring (50).
5. Remove the 4th clutch accumulator piston spring (49).
6. Remove the control valve body spacer plate (46).
7. Remove the control valve body gasket (45) from the control valve body spacer plate (46).

3RD AND 4TH CLUTCH ACCUMULATOR HOUSING DISASSEMBLE

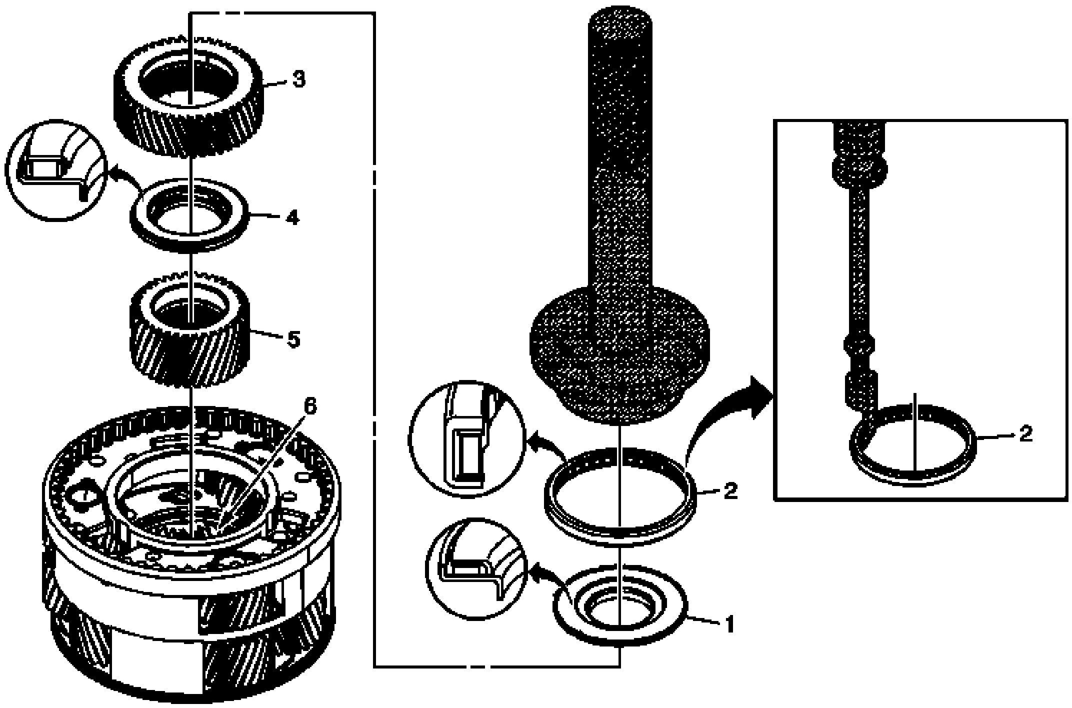


Fig. 382: View Of Inspection Areas On 3rd Clutch Accumulator Piston And Seals
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Apply low pressure compressed air to the hole at the top of the accumulator housing to assist with the piston removal.

1. Remove the 3rd clutch accumulator piston (405) from the 3rd and 4th clutch accumulator housing (51).
2. Remove the 3rd clutch accumulator piston seals (404, 406).
3. Inspect the 3rd clutch accumulator piston and seals for porosity, scoring, nicks, scratches and damage.

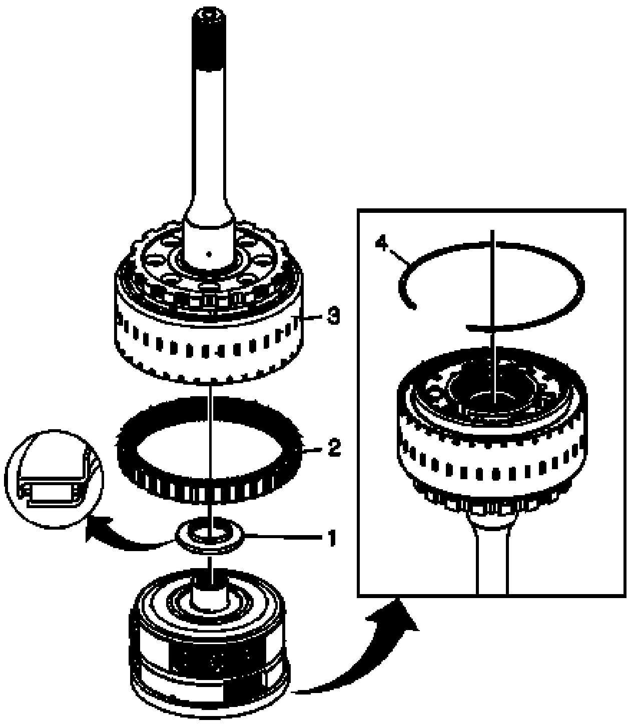


Fig. 383: Locating 4th Clutch Accumulator Piston & Piston Seal Inspection Areas
Courtesy of GENERAL MOTORS CORP.

4. Remove the 4th clutch accumulator piston pin retainer ring (402).
5. Remove the 4th clutch accumulator piston (407) and pin (408).
6. Remove the 4th clutch accumulator piston pin (408) from the 4th clutch accumulator piston (407).
7. Remove the 4th clutch accumulator piston seal (404).
8. Inspect the 4th clutch accumulator piston, pin and seal for porosity, scoring, nicks, scratches and damage.

3RD AND 4TH CLUTCH ACCUMULATOR HOUSING ASSEMBLE

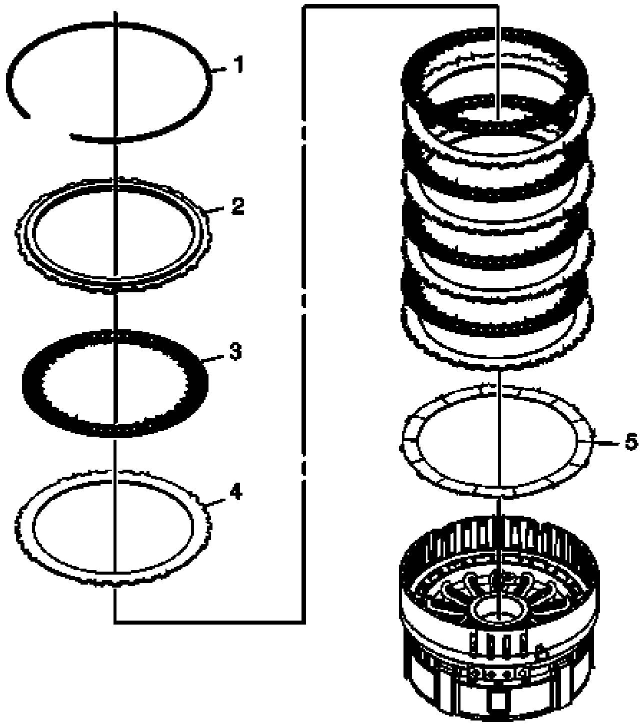


Fig. 384: View Of 3rd Clutch Accumulator Piston Inner And Outer Seals
Courtesy of GENERAL MOTORS CORP.

1. Install the 3rd clutch accumulator piston inner (406) and outer (404) seals. Lubricate the seals (404, 406) with DEXRON®VI automatic transmission fluid.
2. Install the 3rd clutch accumulator piston (405) into the 3rd and 4th clutch accumulator housing (51).

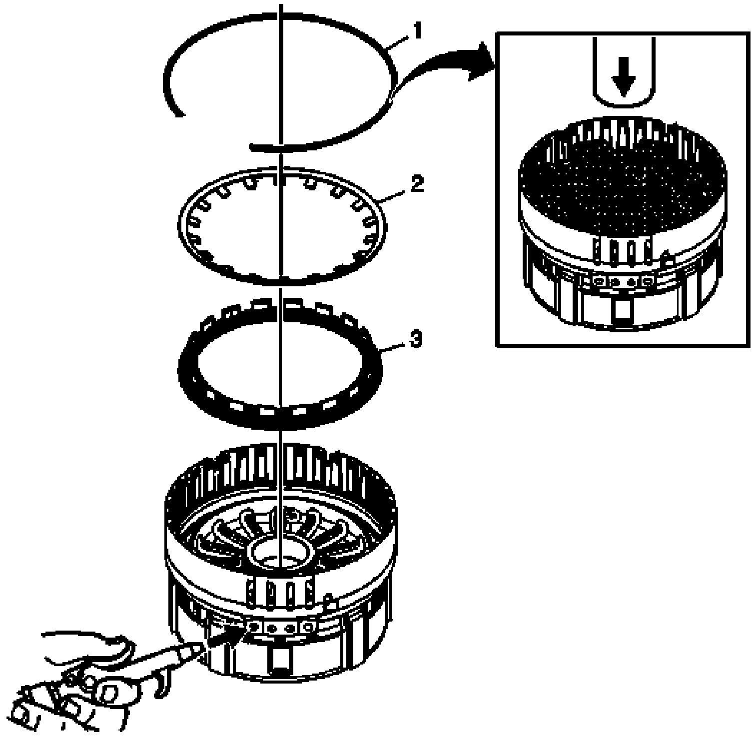


Fig. 385: Identifying 4th Clutch Accumulator Piston Assembly
Courtesy of GENERAL MOTORS CORP.

3. Install the 4th clutch accumulator piston seal (404). Lubricate the seal (404) with DEXRON®VI automatic transmission fluid.
4. Assemble the 4th clutch accumulator piston pin (408) with the 4th clutch accumulator piston (407).
5. Install the 4th clutch accumulator piston assembly.
6. Install the 4th clutch accumulator piston pin retainer ring (402).

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

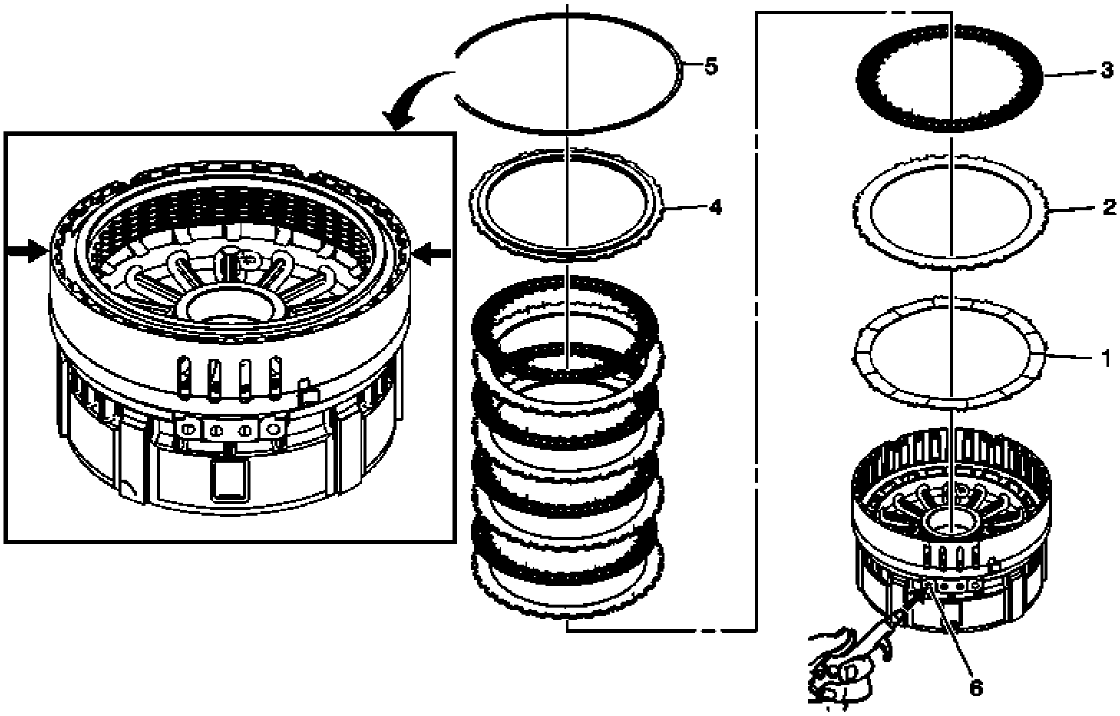


Fig. 386: Inspection Area On Pressure Control Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

CAUTION: Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.

1. Remove the pressure control solenoid clamp bolt (310) and clamp (321).
2. Remove the pressure control solenoid assembly (320).
3. Inspect the pressure control solenoid assembly (320) for a plugged or damaged screen.

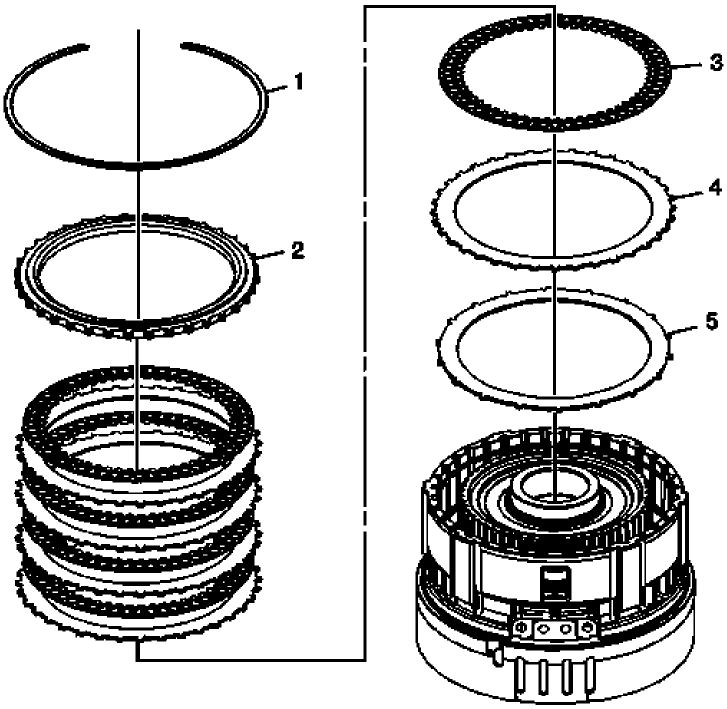


Fig. 387: Identifying TCC Regulator Apply Valve & TCC Regulator Apply Valve Spring Inspection Areas
Courtesy of GENERAL MOTORS CORP.

4. Remove the TCC PWM solenoid valve retainer (322).
5. Remove the TCC PWM solenoid valve assembly (323).
6. Remove the TCC regulator apply valve pin (303). Use a drill bit to remove the spring pin.
7. Remove the TCC regulator apply valve (324).
8. Remove the TCC regulator apply valve spring (325).
9. Inspect the TCC regulator apply valve (324) for porosity, scoring, and nicks.
10. Inspect the TCC regulator apply valve spring (325) for distortion.

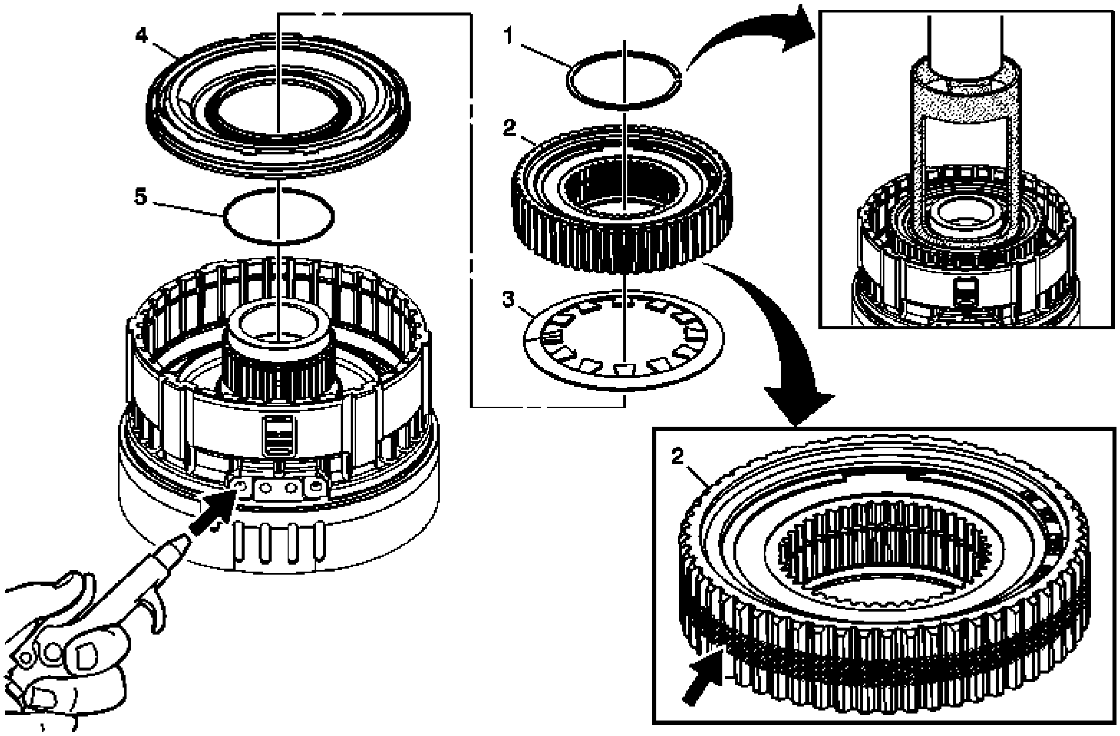


Fig. 388: View Of Actuator Feed Limit Valve & Actuator Feed Limit Valve Spring
Courtesy of GENERAL MOTORS CORP.

11. Remove the actuator feed limit valve spring retainer (333).
12. Remove the actuator feed limit valve spring (327).
13. Remove the actuator feed limit valve (328).
14. Inspect the actuator feed limit valve (328) for porosity, scoring, and nicks.
15. Inspect the actuator feed limit valve spring (327) for distortion.

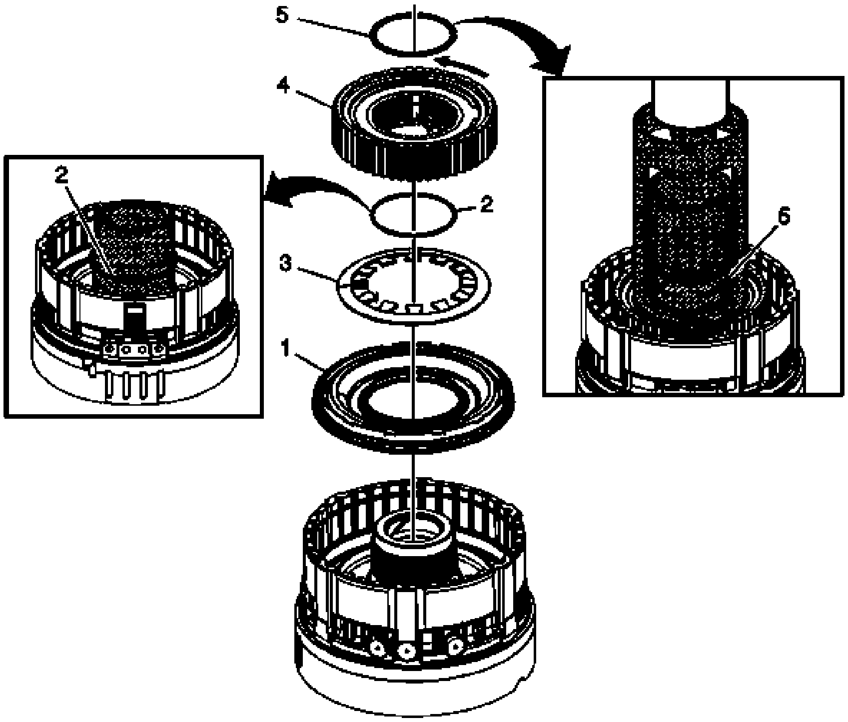


Fig. 389: View Of Accumulator Valve Components
Courtesy of GENERAL MOTORS CORP.

16. Remove the accumulator valve bore plug retainer pin (303).
17. Remove the accumulator valve bore plug (329).
18. Remove the accumulator valve spring (330).
19. Remove the accumulator valve (331).
20. Inspect the accumulator valve (331) and accumulator valve bore plug (329) for porosity, scoring, and nicks.
21. Inspect the accumulator valve spring (330) for distortion.

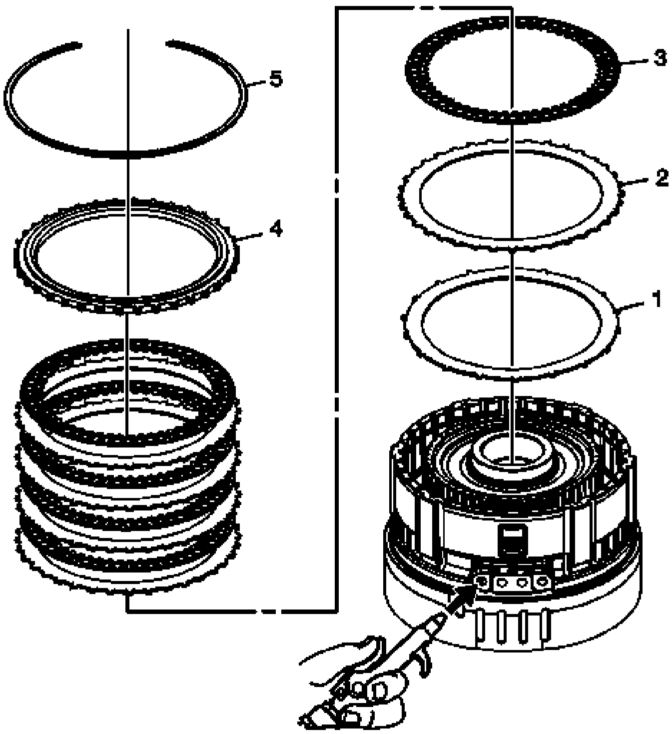


Fig. 390: Locating Pressure Control Solenoid Valve Fluid Filter Assembly
Courtesy of GENERAL MOTORS CORP.

22. Remove the pressure control solenoid valve fluid filter assembly (302).
23. Inspect the pressure control solenoid valve fluid filter assembly (302) for damage.

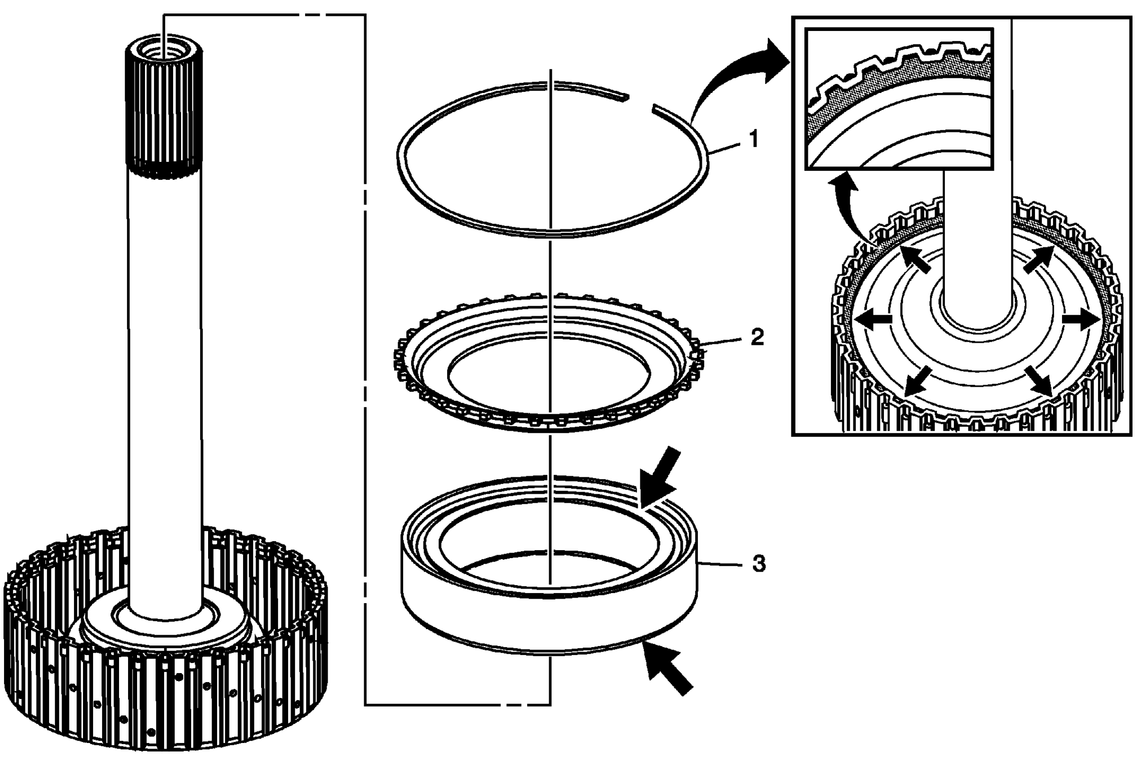


Fig. 391: Identifying The Low-Reverse Ball Valve
Courtesy of GENERAL MOTORS CORP.

24. Remove the low-reverse ball valve seat pin (318).
25. Remove the low-reverse ball valve seat (304).
26. Remove the low-reverse ball valve (305).
27. Inspect the low-reverse ball valve seat (304) and the low-reverse ball valve (305) for porosity, scoring, and nicks.

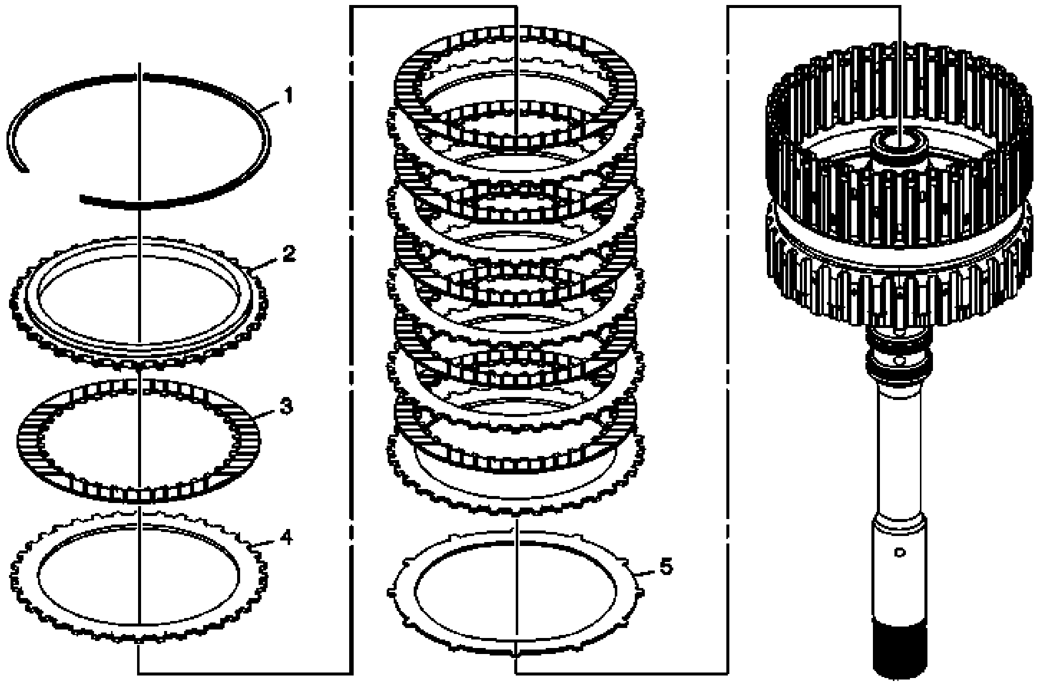


Fig. 392: View Of Shift Solenoid Valve Fluid Filter Assembly
Courtesy of GENERAL MOTORS CORP.

28. Remove the shift valve fluid filter bore plug pin (303).
29. Remove the shift valve fluid filter bore plug (316).
30. Remove the shift solenoid valve fluid filter assembly (317).
31. Inspect the shift solenoid valve fluid filter assembly (317) for damage.
32. Inspect the shift valve fluid filter bore plug (316) for porosity, scoring, and nicks.

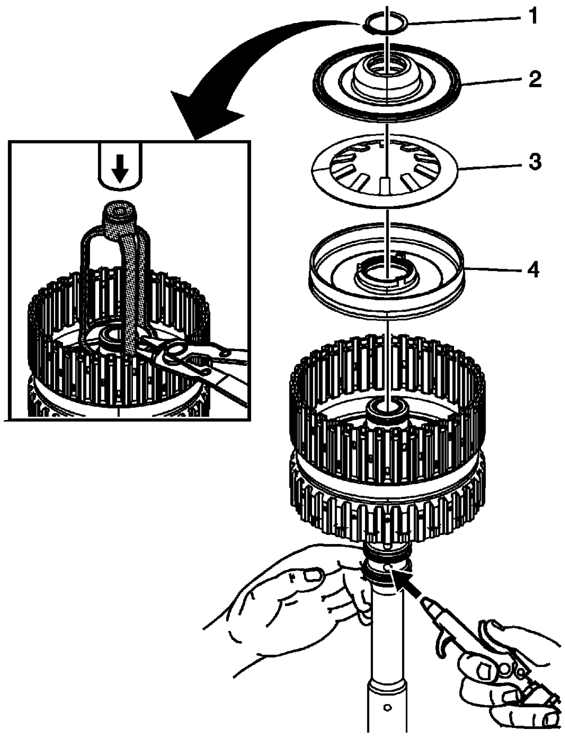


Fig. 393: View Of 1-2 Shift Solenoid Valve Assembly Components
Courtesy of GENERAL MOTORS CORP.

33. Remove the 1-2 shift solenoid valve bolt (310).
34. Remove the 1-2 shift solenoid valve assembly (313).
35. Remove the 1-2 shift valve pin (303).
36. Remove the 1-2 shift valve (314).
37. Remove the 1-2 shift valve spring (315).
38. Inspect the 1-2 shift valve (314) for porosity, scoring, and nicks.
39. Inspect the 1-2 shift valve spring (315) for distortion.

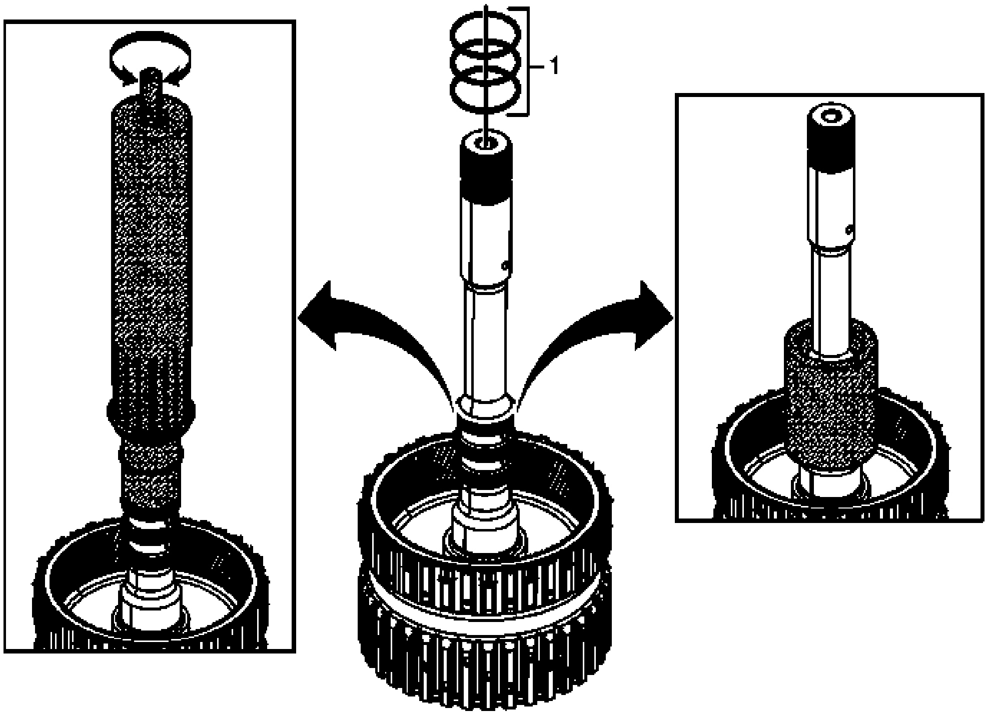


Fig. 394: Identifying 2-3 Shift Solenoid Valve Assembly
Courtesy of GENERAL MOTORS CORP.

40. Remove the 2-3 shift solenoid valve bolt (310).
41. Remove the 2-3 shift solenoid valve assembly (311).
42. Remove the 2-3 shift valve pin (303).
43. Remove the 2-3 shift valve (312).
44. Remove the 2-3 shift valve spring (309).
45. Inspect the 2-3 shift valve (312) for porosity, scoring, and nicks.
46. Inspect the 2-3 shift valve spring (309) for distortion.

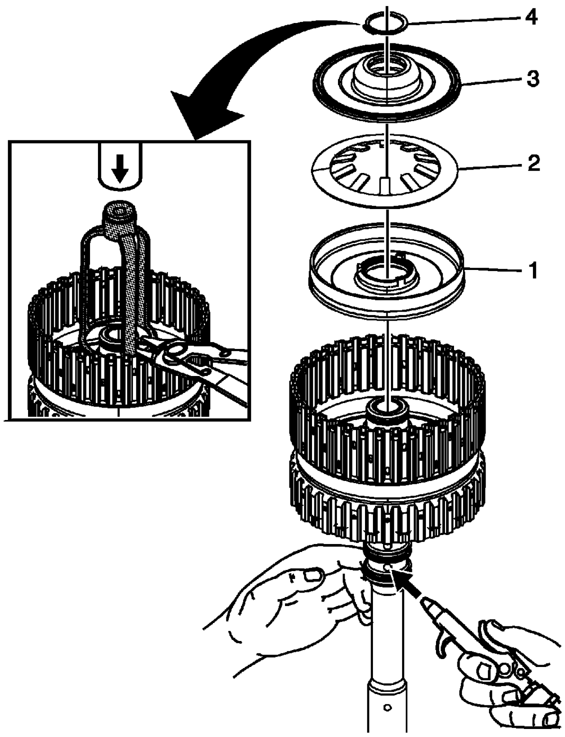


Fig. 395: Locating 3rd-Reverse Ball Valve
Courtesy of GENERAL MOTORS CORP.

47. Remove the 3rd-reverse ball valve seat pin (303).
48. Remove the reverse ball valve bushing (334).
49. Remove the 3rd-reverse ball valve (305).
50. Remove the 3rd ball valve bushing (335) and 3rd ball valve bushing seal (307).
51. Remove the 3-4 shift valve (308).
52. Remove the 3-4 shift valve spring (309).
53. Inspect the 3rd-reverse ball valve bushings (334, 335), the 3rd-reverse ball valve (305) and the 3-4 shift valve (308) for porosity, scoring, and nicks.
54. Inspect the 3-4 shift valve spring (309) for distortion.

CONTROL VALVE BODY CLEANING AND INSPECTION

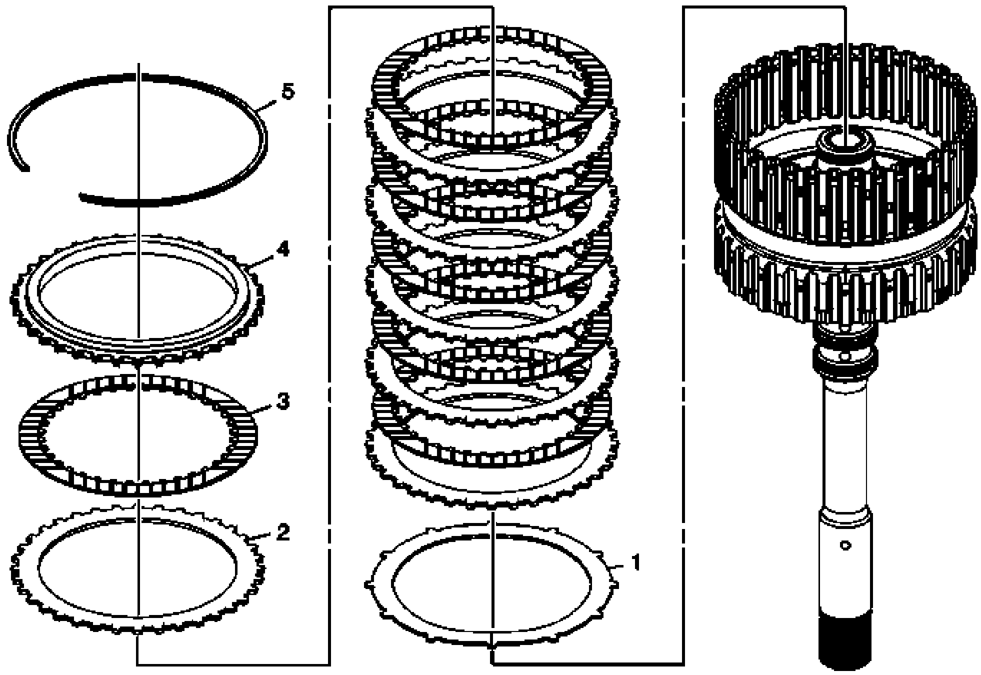


Fig. 396: Control Valve Body
Courtesy of GENERAL MOTORS CORP.

NOTE: Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage the component.

1. Clean the control valve body (301) in clean solvent.
2. Dry the control valve body (301) using compressed air.
3. Inspect the control valve body casting for the following conditions:
   - Porosity
   - Cracks
   - Interconnected passages
   - Damaged machined surfaces

CONTROL VALVE BODY ASSEMBLY ASSEMBLE

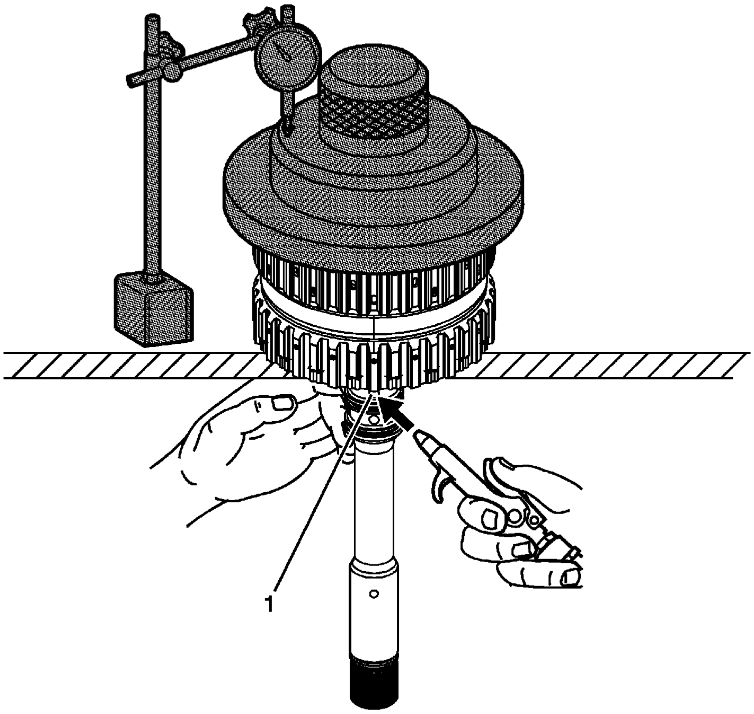


Fig. 397: Identifying 3-4 Shift Valve
Courtesy of GENERAL MOTORS CORP.

1. Install the 3-4 shift valve spring (309).
2. Install the 3-4 shift valve (308).
3. Install the 3rd ball valve bushing (335) and 3rd ball valve bushing seal (307).
4. Install the 3rd-reverse ball valve (305).
5. Install the reverse ball valve bushing (334).
6. Install the 3rd-reverse ball valve seat pin (303).

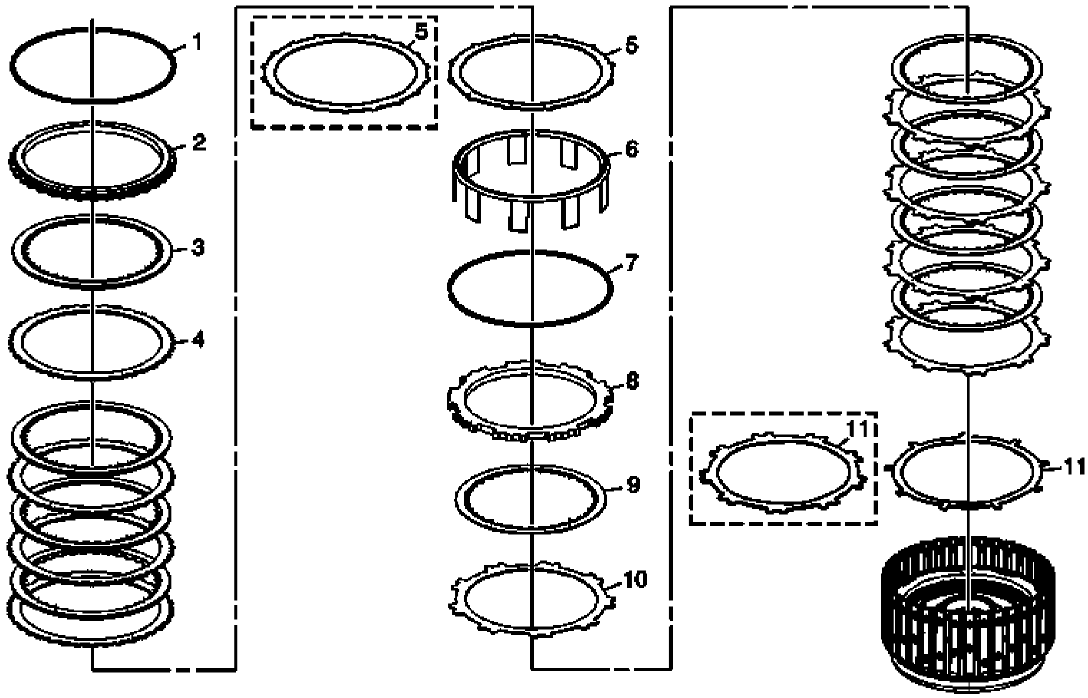


Fig. 398: View Of 2-3 Shift Solenoid Valve Assembly
Courtesy of GENERAL MOTORS CORP.

7. Install the 2-3 shift valve spring (309).
8. Install the 2-3 shift valve (312).
9. Install the 2-3 shift valve pin (303).
10. Install the 2-3 shift solenoid valve assembly (311).

NOTE: Refer to FASTENER NOTICE .

11. Install the 2-3 shift solenoid valve bolt (310).

Tighten: Tighten the bolt to 8 N.m (71 lb in).

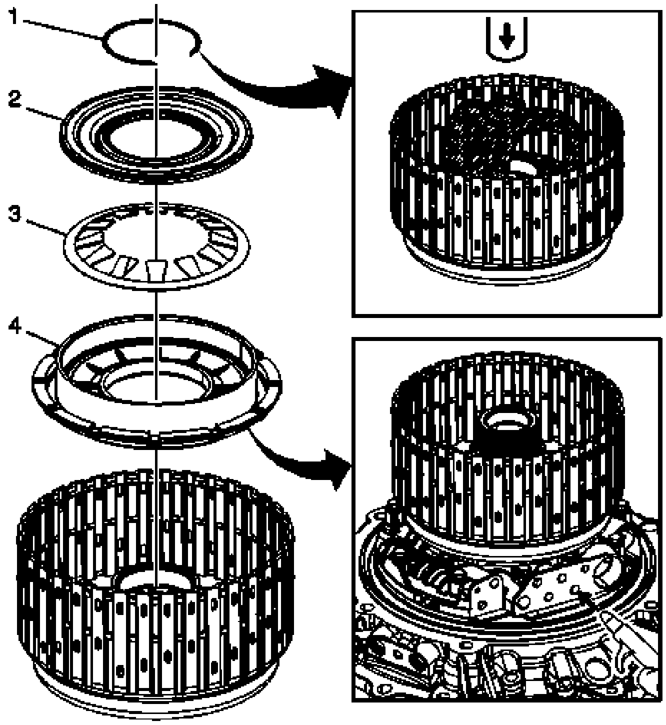


Fig. 399: Locating 1-2 Shift Solenoid Valve Assembly
Courtesy of GENERAL MOTORS CORP.

12. Install the 1-2 shift valve spring (315).
13. Install the 1-2 shift valve (314).
14. Install the 1-2 shift valve pin (303).
15. Install the 1-2 shift solenoid valve assembly (313).
16. Install the 1-2 shift solenoid valve bolt (310).

    Tighten: Tighten the bolt to 8 N.m (71 lb ft).

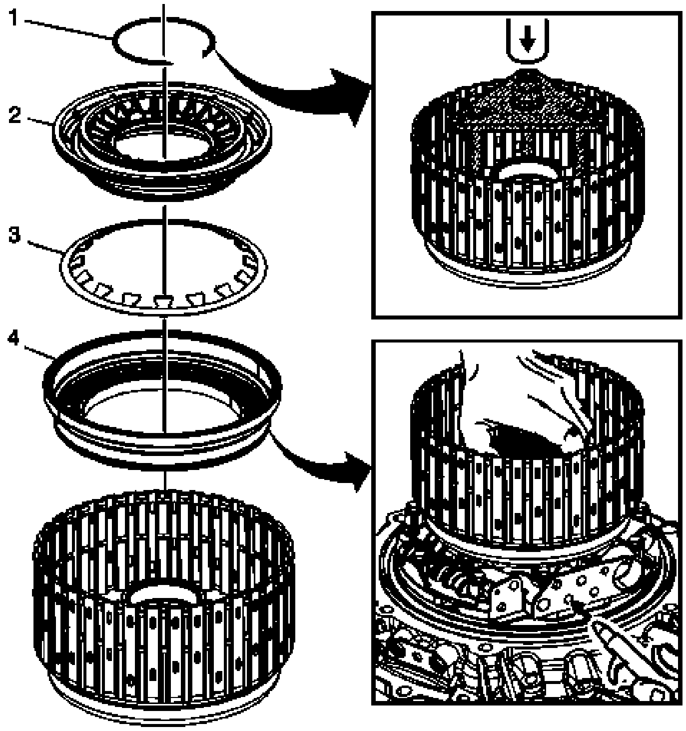


Fig. 400: View Of Shift Solenoid Valve Fluid Filter Assembly Components
Courtesy of GENERAL MOTORS CORP.

17. Install the shift solenoid valve fluid filter assembly (317).
18. Install the shift valve fluid filter bore plug (316).
19. Install the shift valve fluid filter bore plug pin (303).

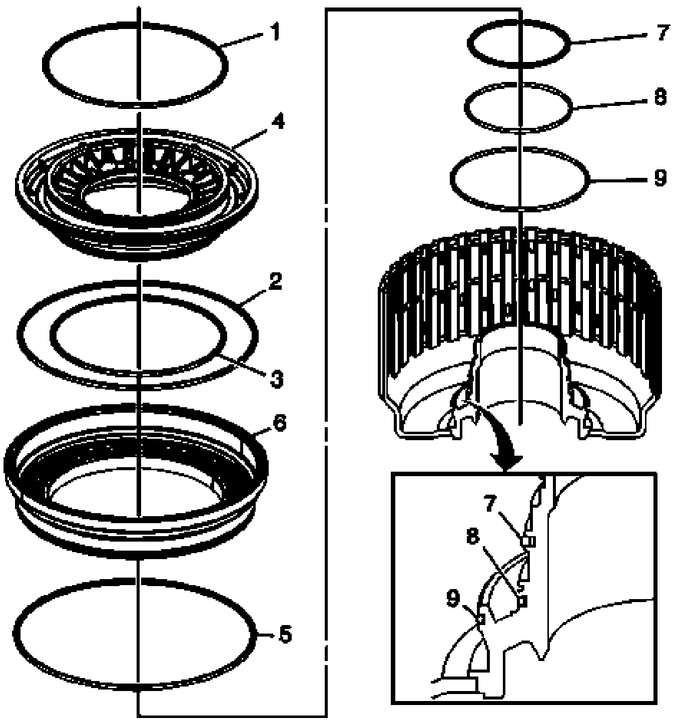


Fig. 401: Identifying Low-Reverse Ball Valve
Courtesy of GENERAL MOTORS CORP.

20. Install the low-reverse ball valve (305).
21. Install the low-reverse ball valve seat (304).
22. Install the low-reverse ball valve seat pin (318).

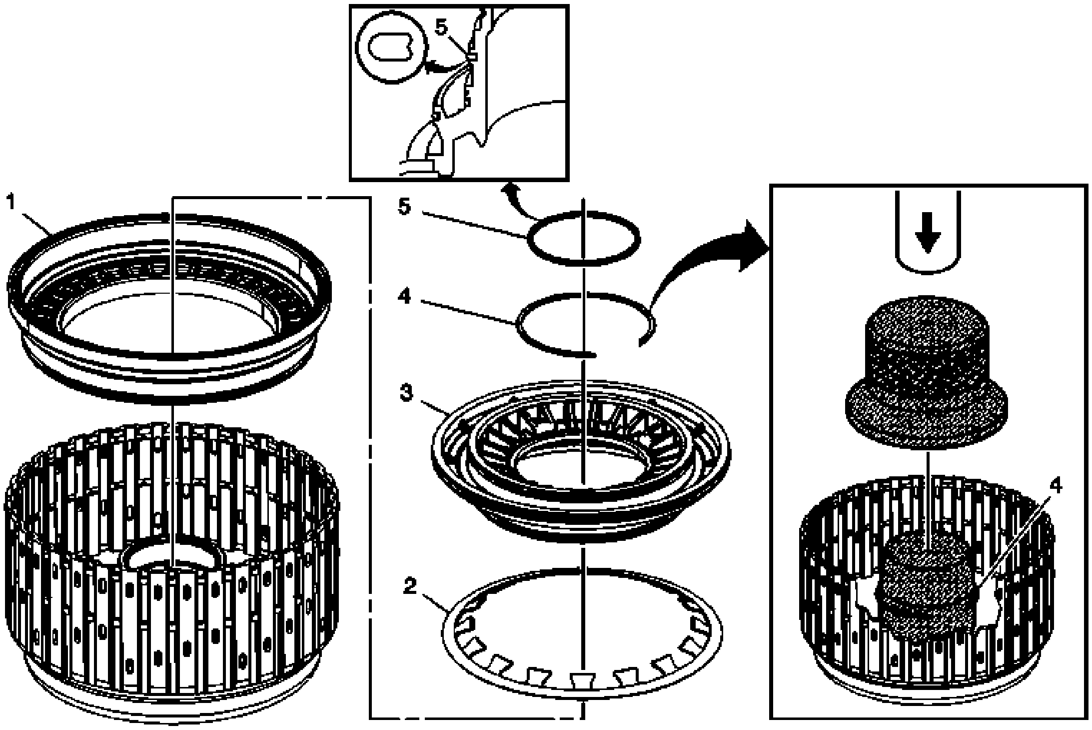


Fig. 402: View Of Pressure Control Solenoid Valve Fluid Filter Assembly
Courtesy of GENERAL MOTORS CORP.

23. Install the pressure control solenoid valve fluid filter assembly (302).

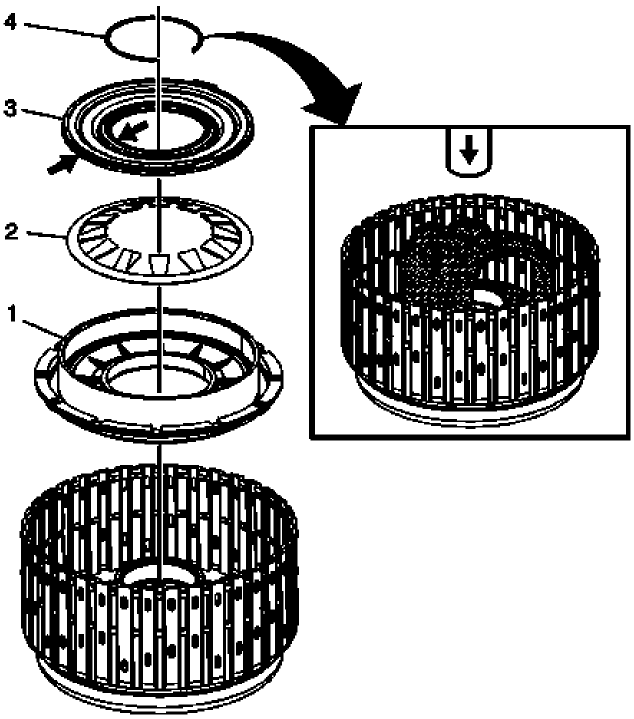


Fig. 403: Locating Accumulator Valve

Courtesy of GENERAL MOTORS CORP.

24. Install the accumulator valve (331).
25. Install the accumulator valve spring (330).
26. Install the accumulator valve bore plug (329).
27. Install the accumulator valve bore plug retainer pin (303).

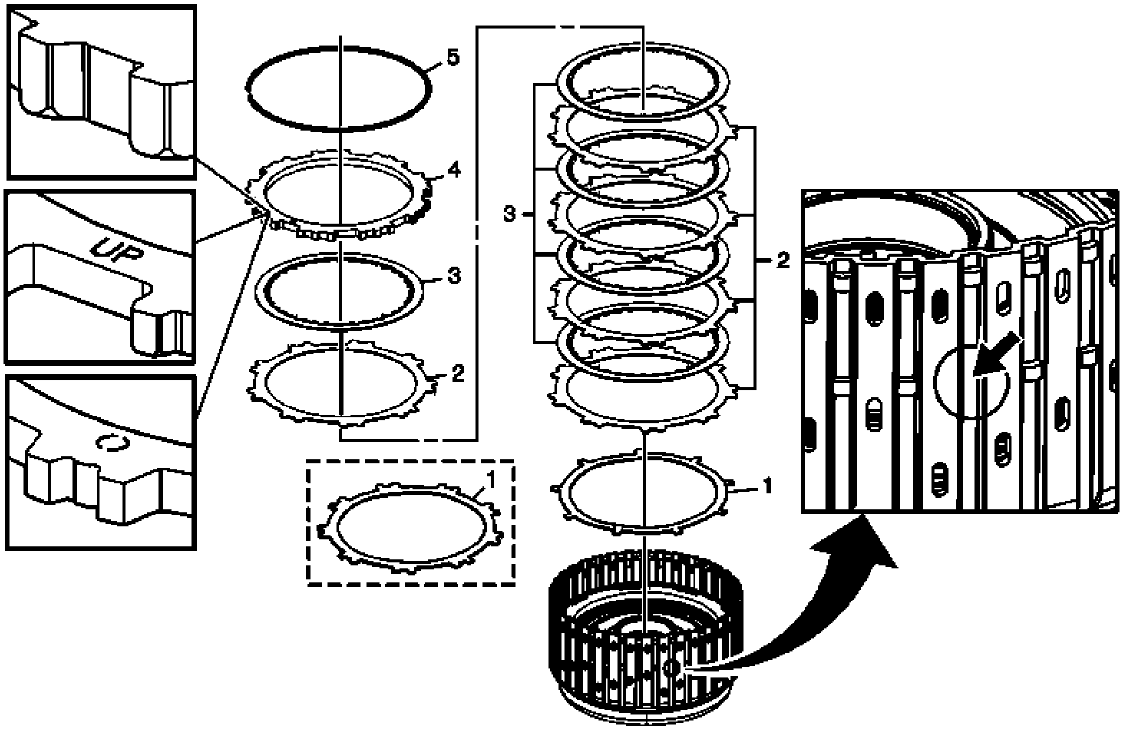


Fig. 404: Identifying Actuator Feed Limit Valve
Courtesy of GENERAL MOTORS CORP.

28. Install the actuator feed limit valve (328).
29. Install the actuator feed limit valve spring (327).
30. Install the actuator feed limit valve spring retainer (333).

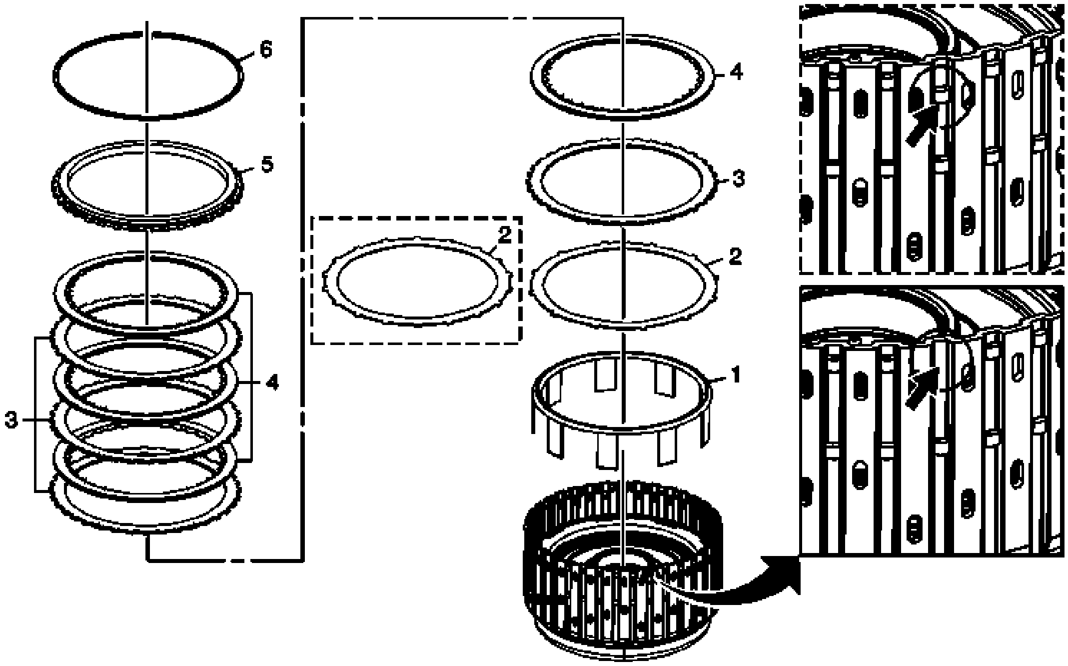


Fig. 405: View Of TCC PWM Solenoid Valve Assembly Components
Courtesy of GENERAL MOTORS CORP.

31. Install the TCC regulator apply valve spring (325).
32. Install the TCC regulator apply valve (324).
33. Install the TCC regulator apply valve pin (303).
34. Install the TCC PWM solenoid valve assembly (323).
35. Install the TCC PWM solenoid valve retainer (322).

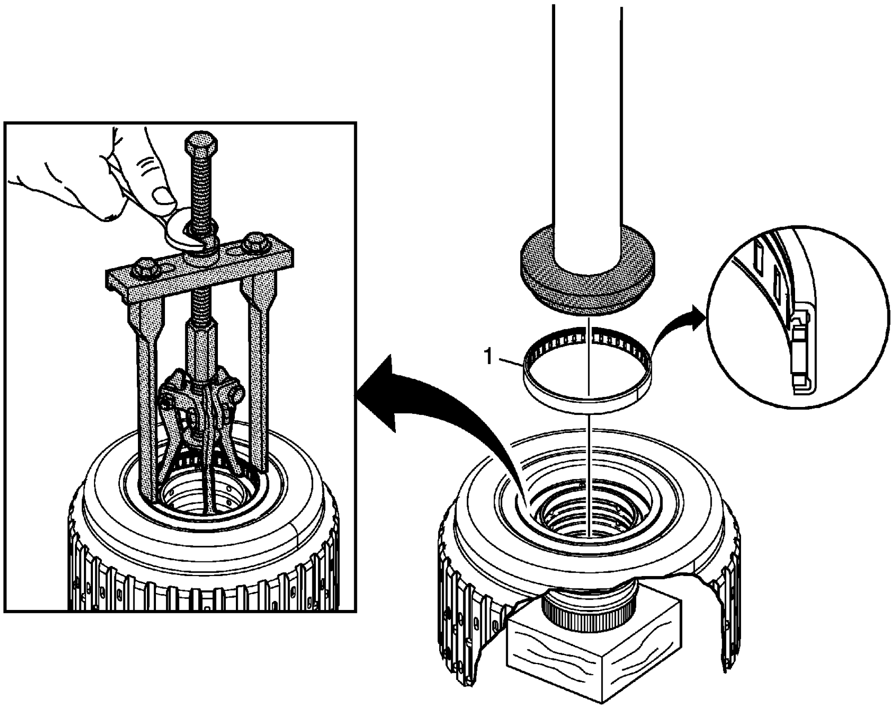


Fig. 406: Inspection Area On Pressure Control Solenoid Assembly
Courtesy of GENERAL MOTORS CORP.

36. Install the pressure control solenoid valve assembly (320) with the electrical connector terminals pointing away from the control valve body.
37. Install the pressure control solenoid clamp (321).
38. Install the pressure control solenoid clamp bolt (310).

    Tighten: Tighten the bolt to 8 N.m (71 lb in).

3RD AND 4TH CLUTCH ACCUMULATOR HOUSING INSTALLATION

Tools Required

J 25025-5 Dial Indicator Mounting Post - M6 x 1.00

Procedure

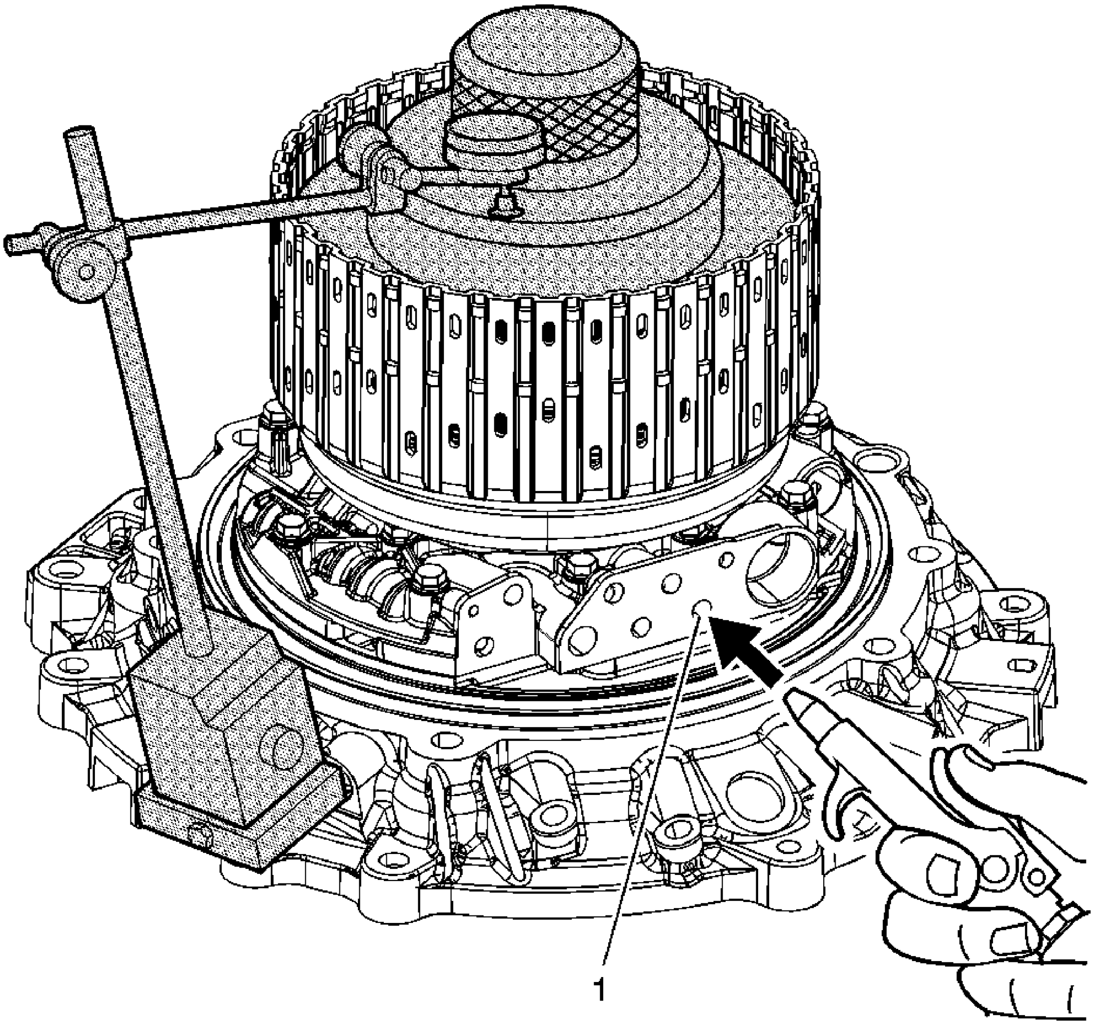


Fig. 407: View Of Control Valve Body Gasket & Spacer Plate
Courtesy of GENERAL MOTORS CORP.

1. Install the **J 25025-5** into the control valve body bolt hole where the manual shaft detent roller and spring assembly is mounted.
2. Install the control valve body gasket (45).
3. Install the control valve body spacer plate (46).

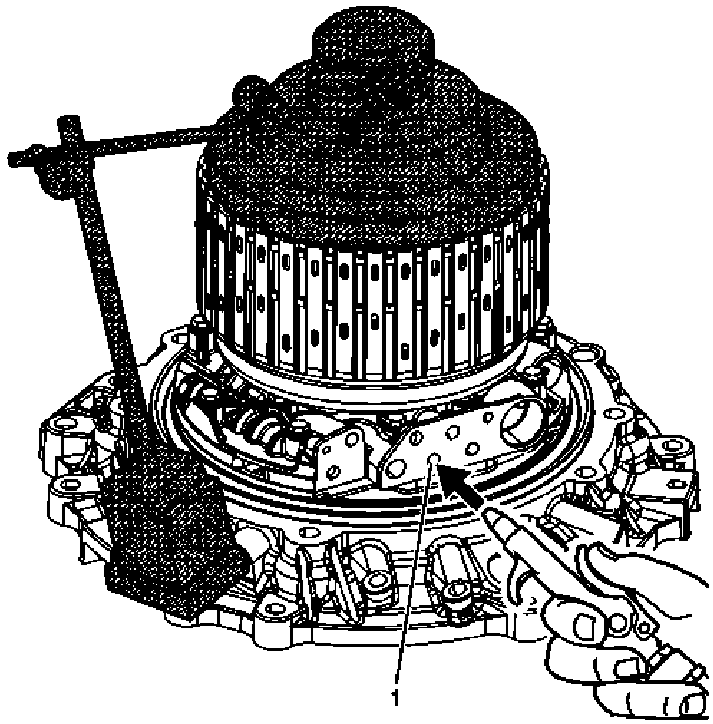


Fig. 408: Accumulator Housing Gasket
Courtesy of GENERAL MOTORS CORP.

4. Install the accumulator housing gasket (47).
5. Install the 3rd clutch accumulator piston spring (50). This spring is the longer of the 2 accumulator springs.
6. Install the 4th clutch accumulator piston spring (49).
7. Install the 3rd and 4th clutch accumulator housing (51) onto the control valve assembly (44).
8. Install the 6 3rd and 4th clutch accumulator housing bolts (53). Tighten the bolts finger tight and start from one end of the accumulator housing toward the opposite end.

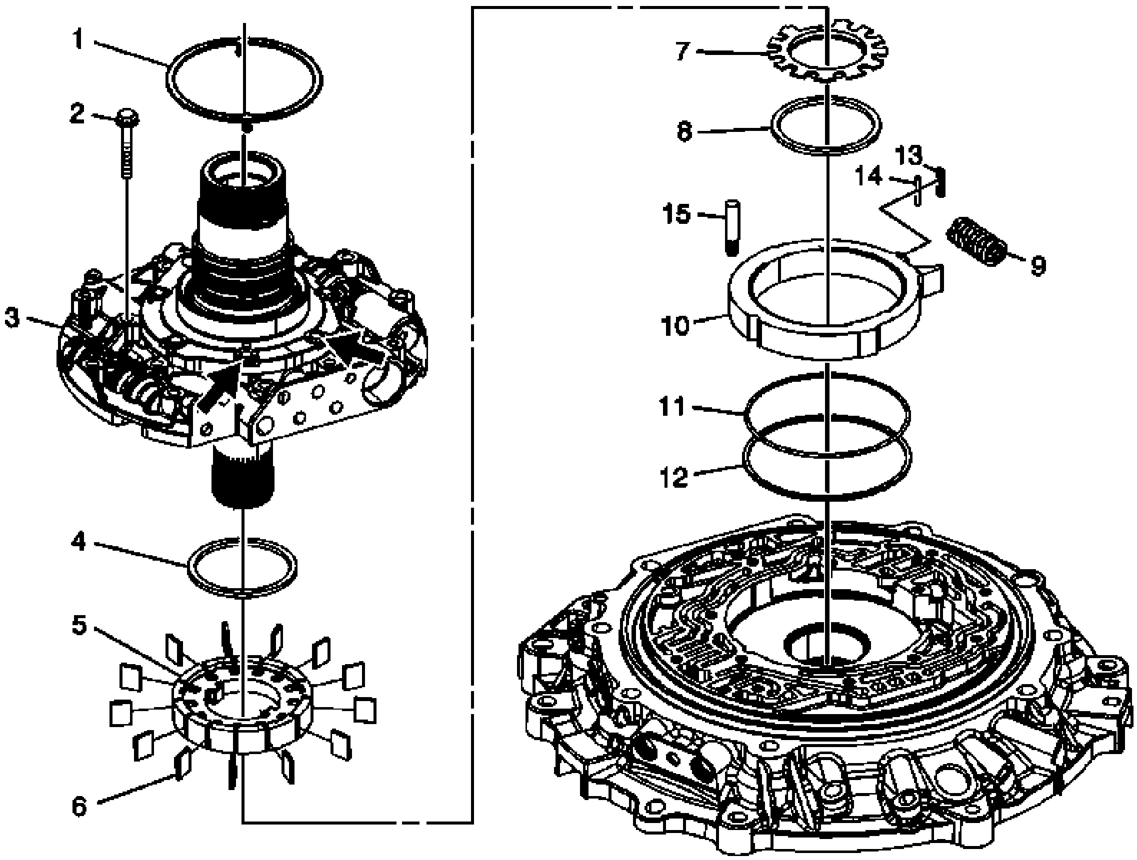


Fig. 409: 3rd & 4th Clutch Accumulator Housing Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE .

9. Tighten the 3rd and 4th clutch accumulator housing bolts in the order shown.

   Tighten: Tighten the bolts to 11 N.m (97 lb in).

10. Remove the **J 25025-5** .

CONTROL VALVE BODY ASSEMBLY INSTALLATION

Tools Required

- **J 25025-5** Dial Indicator Mounting Post - M6 x 1.00
- **J 36850** Transjel® Lubricant

Procedure

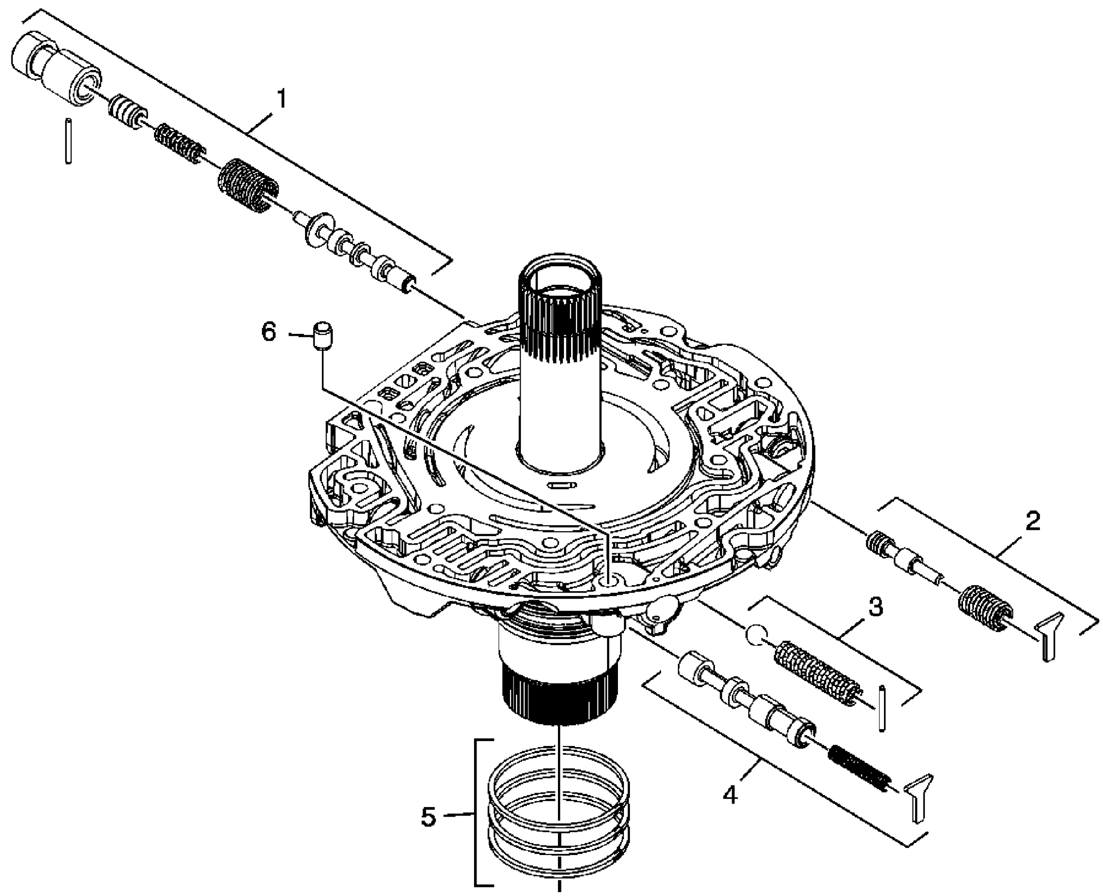


Fig. 410: Identifying TCC Solenoid Valve Screen Assembly
Courtesy of GENERAL MOTORS CORP.

NOTE: **Use J 36850 or equivalent during assembly in order to retain checkballs or to lubricate components. Lubricants other than the recommended assembly lube changes the transmission fluid characteristics and causes undesirable shift conditions or filter clogging.**

1. Install the 8 control valve body ball check valves (54) into the case passages.

   Use **J 36850** or equivalent in order to hold the control valve body ball check valves in place.

2. Install the TCC solenoid valve screen assembly (75) into the case.

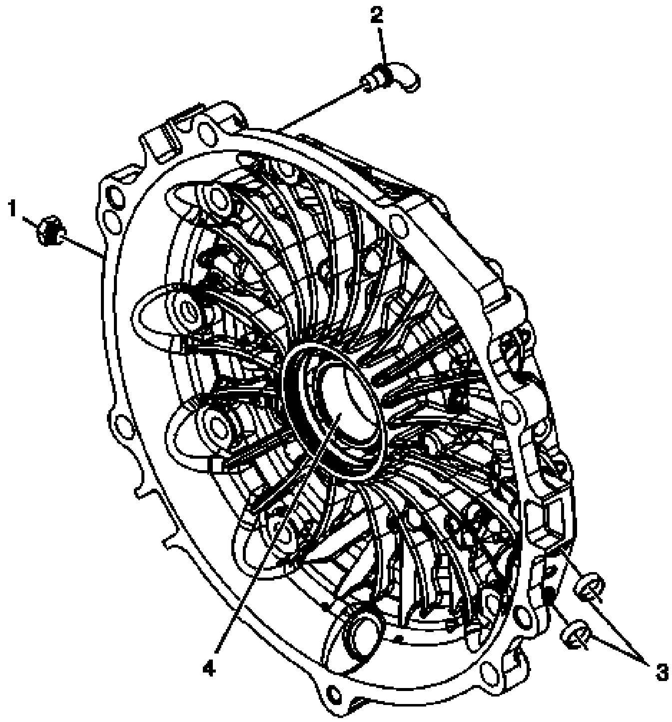


Fig. 411: View Of Manual Valve
Courtesy of GENERAL MOTORS CORP.

3. Install the manual valve (319) into the control valve assembly.

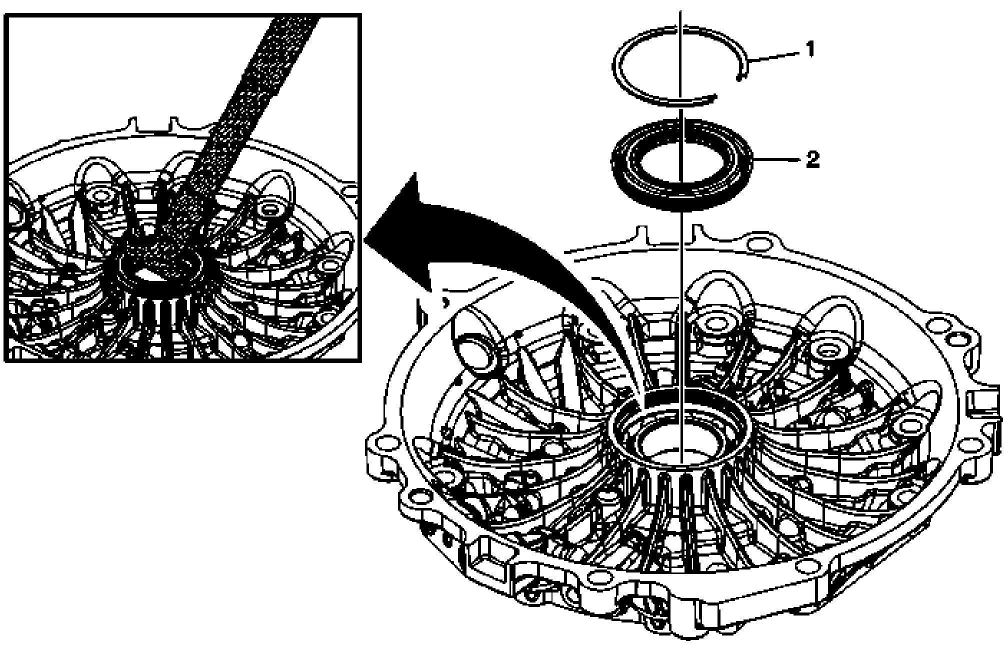


Fig. 412: View Of Manual Valve & Detent Lever

Courtesy of GENERAL MOTORS CORP.

4. Install the **J 25025-5** into the transmission case.
5. Install the control valve body spacer plate gasket (48).
6. Install the control valve assembly (44). Attach the manual valve (319) to the detent lever (711) while installing the control valve assembly (44).

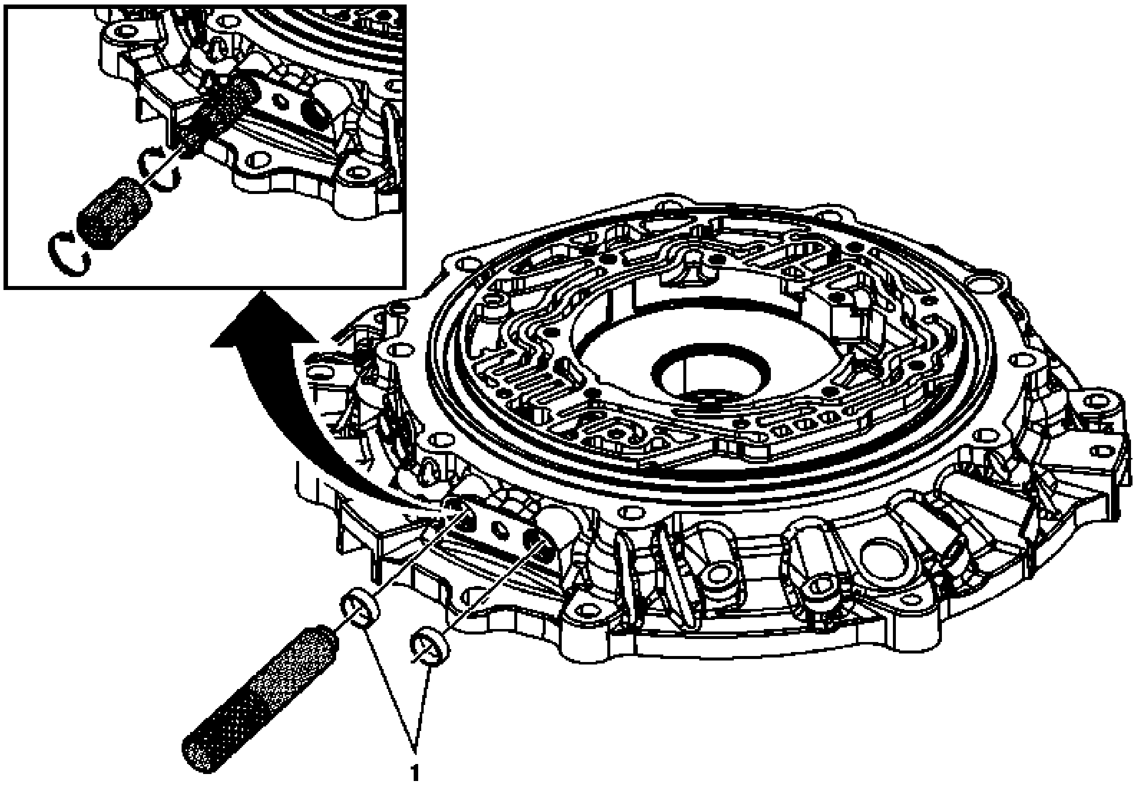


Fig. 413: Locating Transmission Fluid Pressure Manual Valve Position Switch
Courtesy of GENERAL MOTORS CORP.

7. Install the transmission fluid pressure manual valve position switch (40).
8. Install the transmission fluid pressure manual valve position switch bolts (76) finger tight.

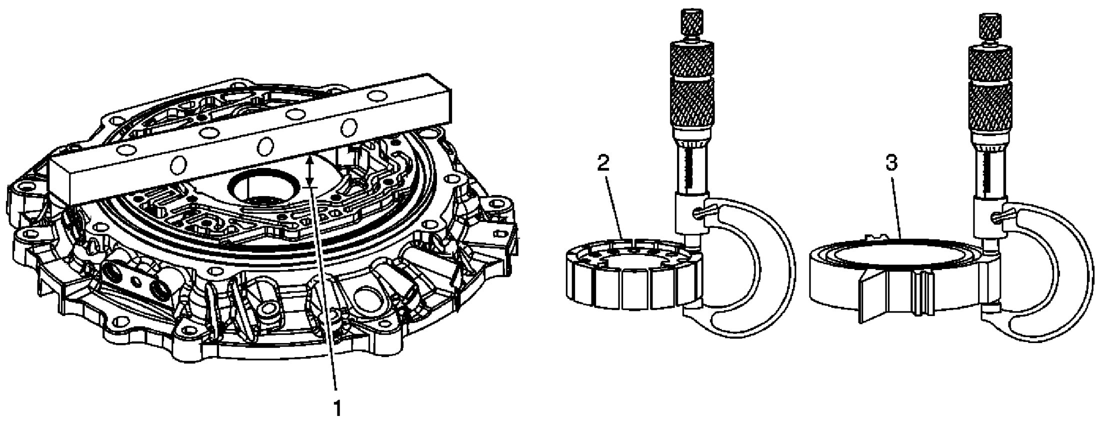


Fig. 414: View Of Transmission Fluid Pressure Manual Valve Position Switch Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE: **Refer to FASTENER NOTICE .**

9. Tighten the bolts in the order shown.

   Tighten: Tighten the bolts to 11 N.m (97 lb in).

10. Remove the **J 25025-5** .

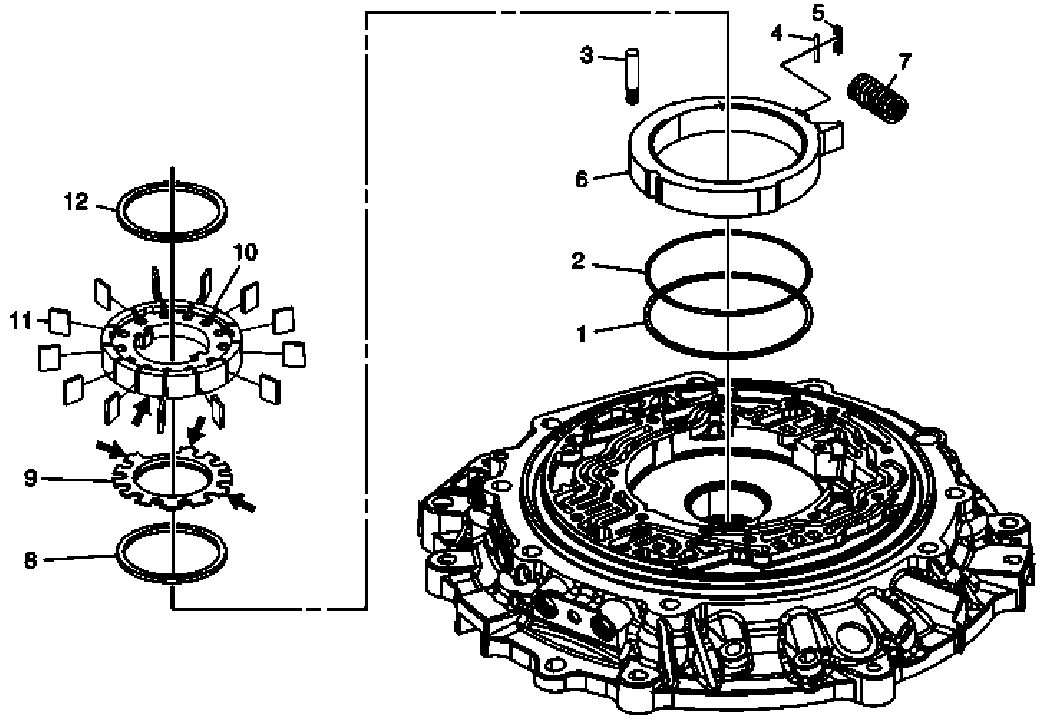


Fig. 415: Identifying Manual Shift Shaft Detent Spring Assembly & Bolts

Courtesy of GENERAL MOTORS CORP.

11. Install the manual shift shaft detent spring assembly (41) and bolts (35).
12. Install the 2 wiring harness clamps (33) and bolts (35).
13. Install the lube oil pipe (39) with the short end into the control valve assembly.
14. Install the lube oil pipe retainer (37) and the bolt (35).
15. Install the remaining control valve body assembly bolts (35).

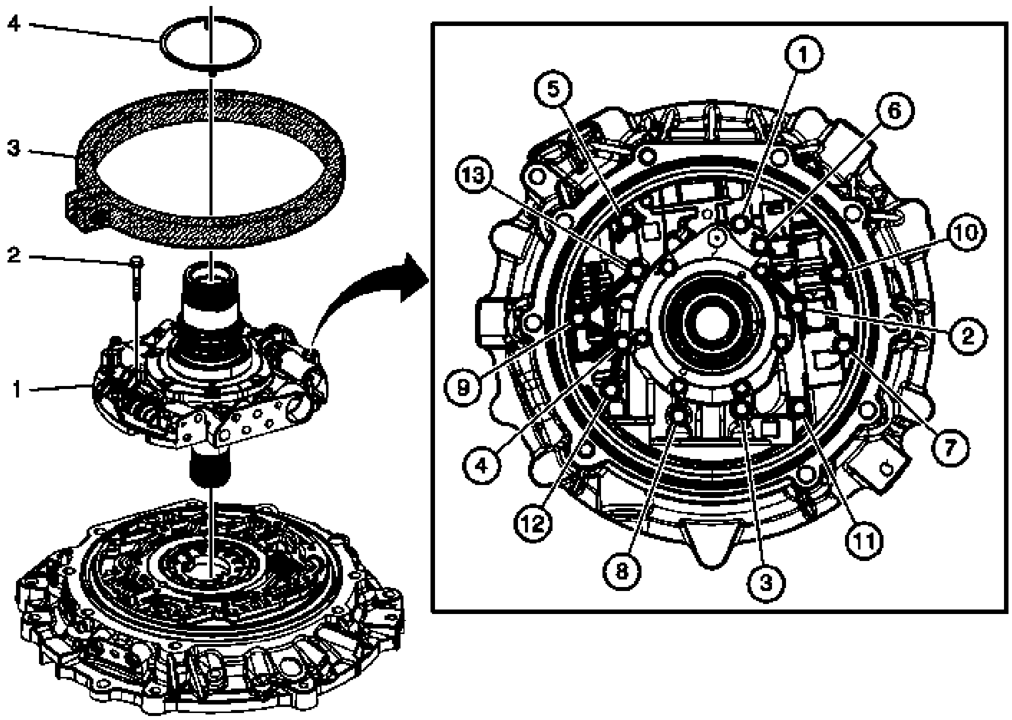


Fig. 416: Valve Body Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

NOTE:	**Tighten the control valve assembly bolts in a spiral pattern starting from the center. If the bolts are tightened in a random pattern, the valve bores may become distorted, which can inhibit valve operation.**

16. Tighten the control valve body assembly bolts in the order shown.

    Tighten: Tighten the bolts to 11 N.m (97 lb in).

WIRING HARNESS INSTALLATION

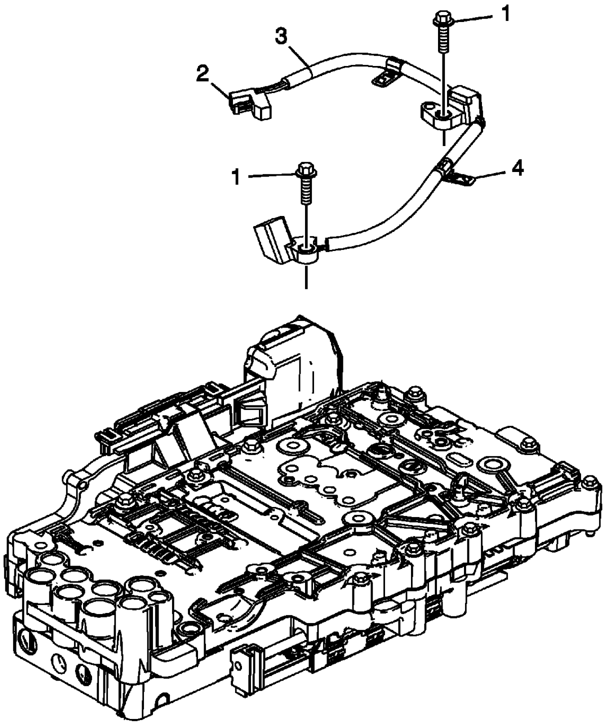


Fig. 417: View Of Transmission Wiring Harness
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW pass thru O-ring seal (36).
2. Install the wiring harness assembly (34) into the case.
3. Connect the wiring harness assembly (34) to the electrical components.
4. Place the wiring harness assembly (34) under the wiring harness clamps (33).

TRANSMISSION FLUID FILTER ASSEMBLY INSTALLATION

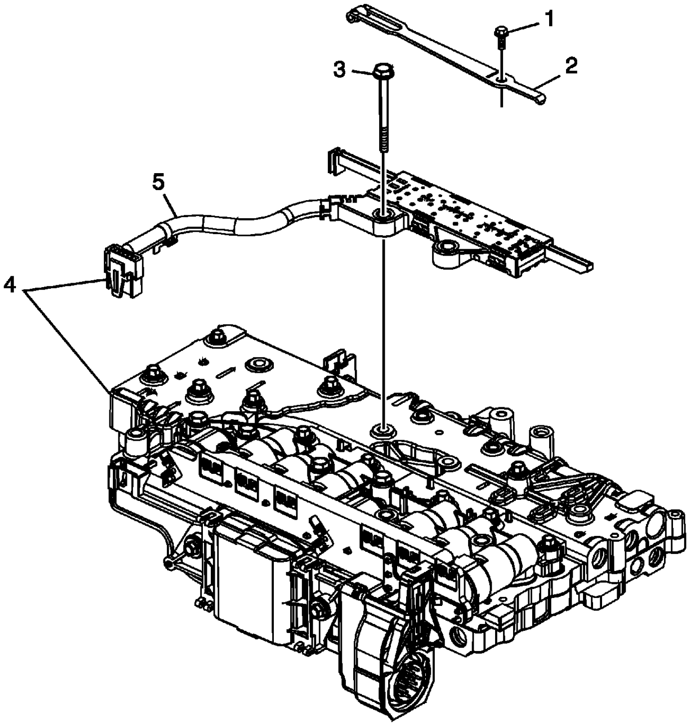


Fig. 418: Locating Transmission Oil Filter Assembly
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the new filter neck seal assembly (32) with transmission fluid.
2. Install a new filter neck seal assembly (32) into the transmission case.
3. Install the transmission oil filter assembly (31) into the filter neck seal assembly (32).

TRANSMISSION FLUID PAN INSTALLATION

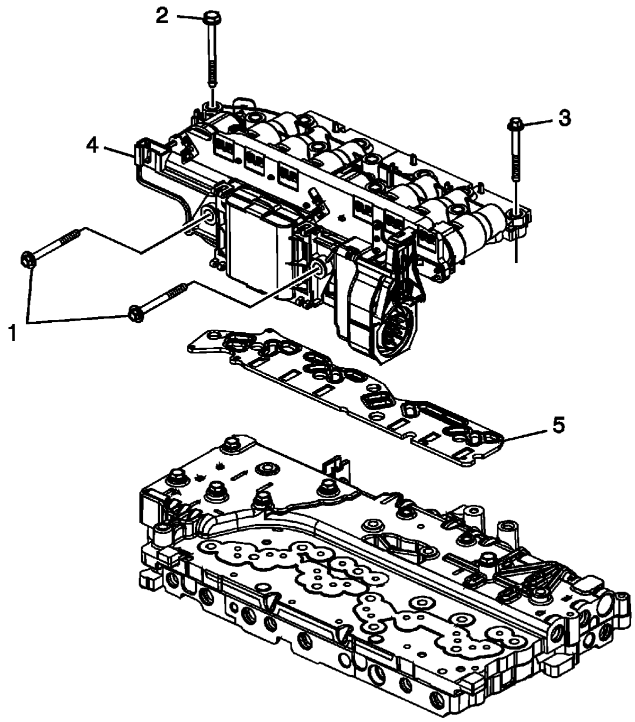


Fig. 419: View Of Transmission Oil Pan, Gasket & Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: You may reuse the transmission oil pan gasket (29).

1. Install the transmission oil pan gasket (29).
2. Install the transmission oil pan magnet (30) into the transmission oil pan (28).

NOTE: Position the wiring harness properly when installing the transmission oil pan or it may be crushed between the valve body and the oil pan.

3. Install the transmission oil pan (28).

NOTE: Refer to FASTENER NOTICE .

4. Install the transmission oil pan bolts (27).

Tighten: Tighten the bolts to 24 N.m (18 lb ft).

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY INSTALLATION

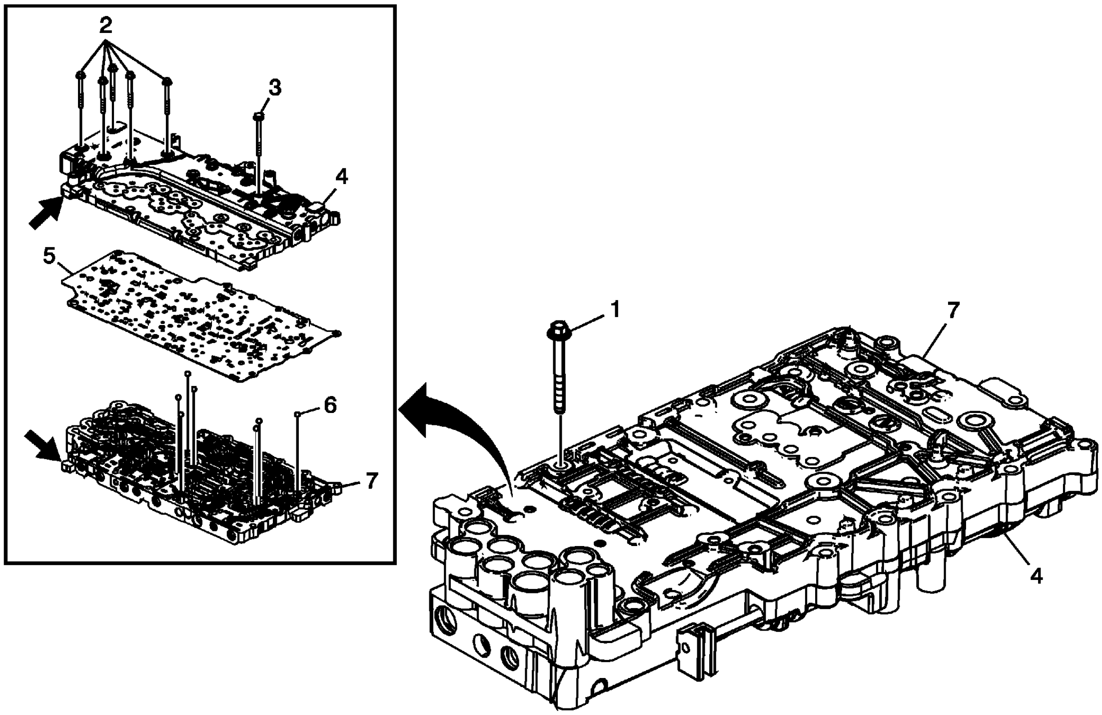


Fig. 420: Speed Sensor Assemblies
Courtesy of GENERAL MOTORS CORP.

1. Install the input and output speed sensors (22), (output speed sensor plug-4WD) into the transmission case.

NOTE: Refer to FASTENER NOTICE .

2. Install the input and output speed sensor bolts (23).

   Tighten: Tighten the bolts to 11 N.m (97 lb in).

CASE EXTENSION ASSEMBLY INSTALLATION

Tools Required

- **J 36850** Transjel® Lubricant
- **J 38694** Extension Housing Seal Installer
- **J 38869** Rear Extension Seal Installer. See **Special Tools**.

Procedure

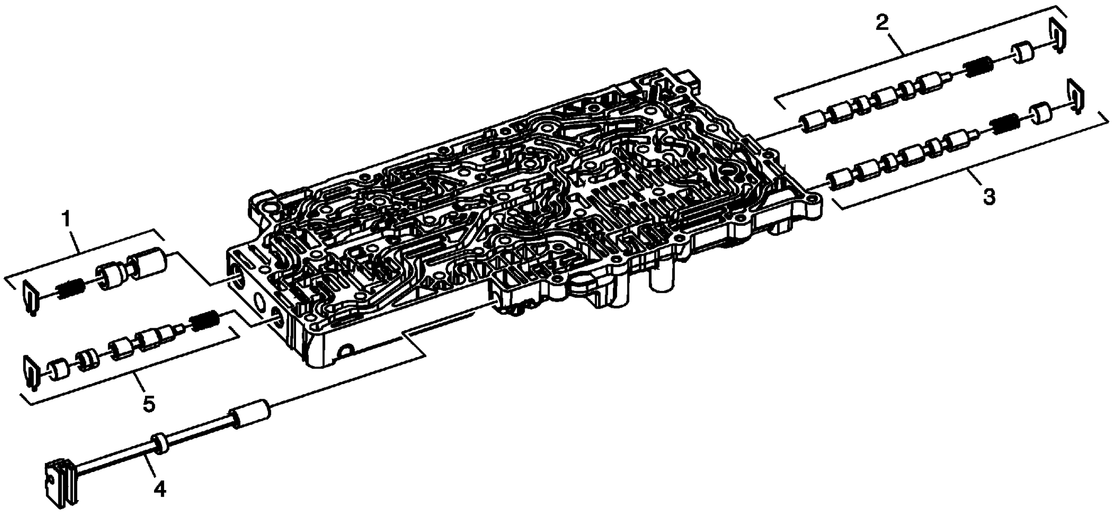


Fig. 421: J 38869 On Prop Shaft Front Slip Yoke Oil Seal Assembly
Courtesy of GENERAL MOTORS CORP.

1. Install the prop shaft front slip yoke oil seal assembly (20) (model dependent) with the **J 38869** or the **J 38694** (for fixed yoke applications). Apply **J 36850** or equivalent to the spring pocket of the seal.

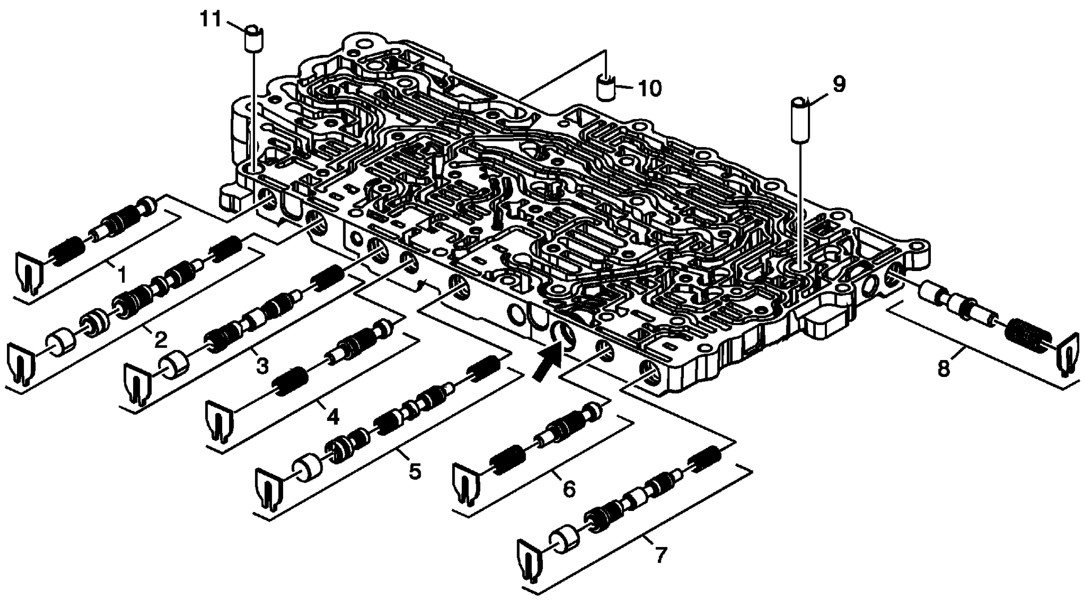


Fig. 422: View Of Case Extension Components
Courtesy of GENERAL MOTORS CORP.

2. Install the transmission output shaft yoke seal sleeve (682) and the output shaft seal (683) (for some models).
3. Install the output shaft seal (675) (for some models).
4. Install the bearing spacer (18), case extension ball bearing assembly (17) and the bearing retainer ring (16) (for some models).
5. Install the case extension seal (15) onto the case extension assembly (19).
6. Install the case extension assembly (19) onto the transmission case.

NOTE: **Refer to FASTENER NOTICE .**

7. Install the case extension bolts (21).

   Tighten: Tighten the bolts to 34 N.m (25 lb ft).

TORQUE CONVERTER ASSEMBLY INSTALLATION

Tools Required

J 21366 Converter Holding Strap

Procedure

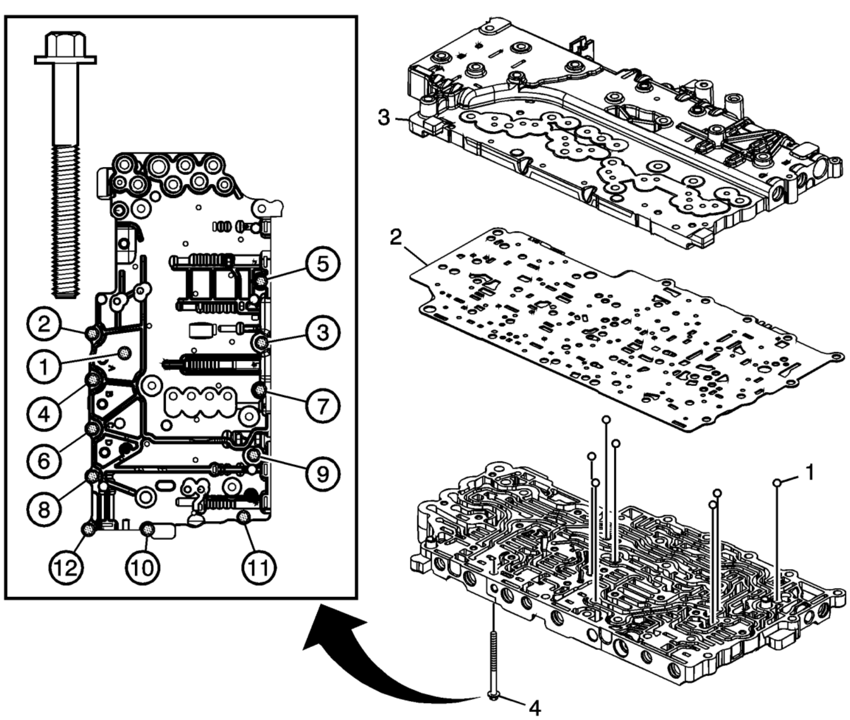


Fig. 423: Aligning Transmission Face Up
Courtesy of GENERAL MOTORS CORP.

1. Rotate the transmission so the converter housing is facing up.

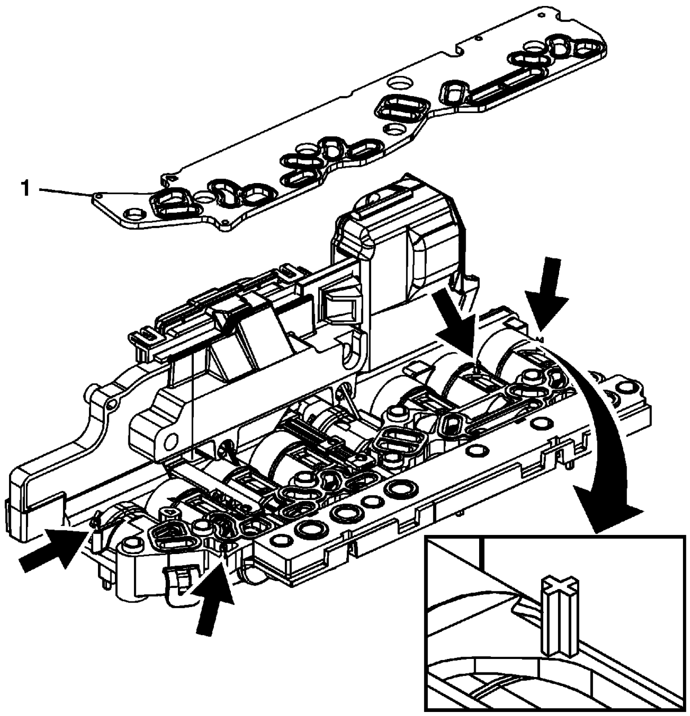


Fig. 424: View Of J 21366
Courtesy of GENERAL MOTORS CORP.

2. Install the torque converter assembly (1). Rotate the torque converter assembly (1) in order to engage the turbine shaft, the stator shaft, and the lugs onto the oil pump drive gear.
3. Install the **J 21366** in order to hold the torque converter assembly (1) in place while moving the transmission assembly. Remove the **J 21366** prior to installing the transmission into the vehicle.

HOLDING FIXTURE REMOVAL

Tools Required

- **J 3289-20** Holding Fixture Base Assembly. See **Special Tools**.
- **J 8763-02** Transmission Holding Fixture. See **Special Tools**.
- **J 38655** Holding Fixture Adapter. See **Special Tools**.

Procedure

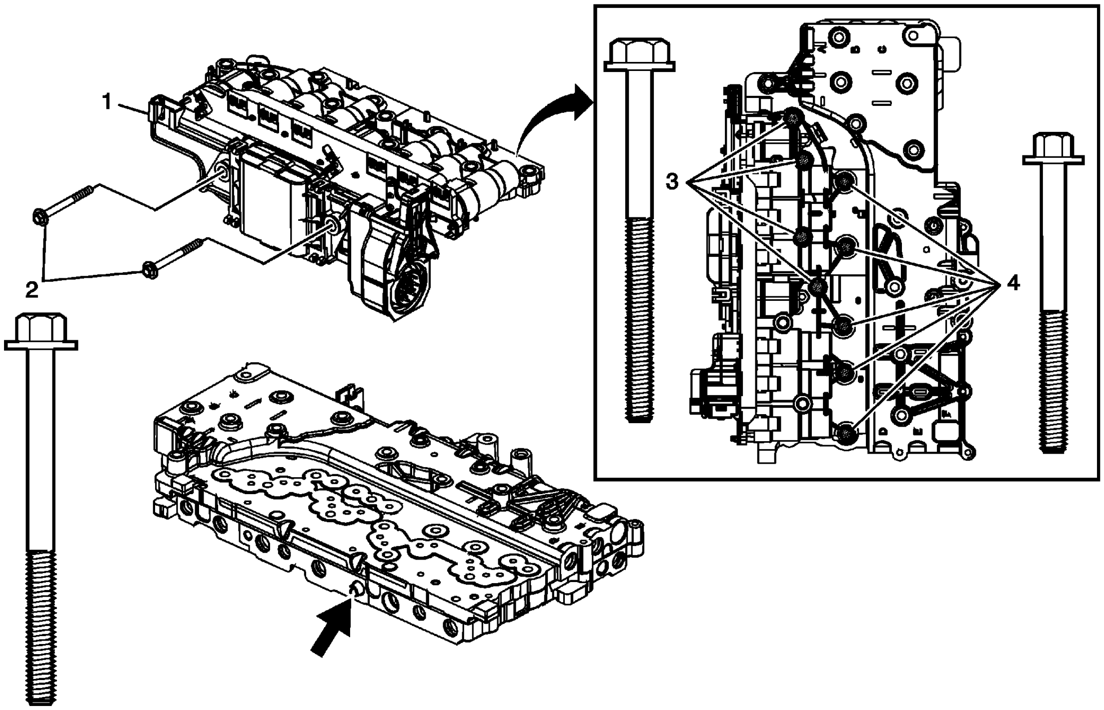


Fig. 425: Identifying J 8763-02, J 38655 & J 3289-20
Courtesy of GENERAL MOTORS CORP.

1. Remove the transmission assembly and the **J 8763-02** from the **J 3289-20** . See **Special Tools**.
2. Remove the **J 8763-02** and the **J 38655** . See **Special Tools**.

DESCRIPTION AND OPERATION

TRANSMISSION GENERAL INFORMATION

How to Use This article

This article provides the following information:

- General diagnosis information on transmissions
- Procedures for diagnosing the Hydra-matic transmission

When you diagnose any condition of the Hydra-matic transmission, begin with A Diagnostic Starting Point. This procedure indicates the proper path of diagnosing the transmission by describing the basic checks. This procedure will then refer you to the locations of specific checks. After you have determined the cause of a condition, refer to Repair Instructions for repair procedures. If the faulty component is not serviceable without removing the transmission from the vehicle, refer to Unit Repair for repair information.

Basic Knowledge

NOTE: Do not, under any circumstances, attempt to diagnose a powertrain condition

without basic knowledge of this powertrain. If you perform diagnostic procedures without this basic knowledge, you may incorrectly diagnose the condition or damage the powertrain components.

You must be familiar with some basic electronics in order to use this article of the service manual. You should also be able to use the following special tools:

- A digital multimeter (DMM)
- A circuit tester
- Jumper wires or leads
- A line pressure gage set

Diagnosis

NOTE: If you probe a wire with a sharp instrument and do not properly seal the wire afterward, the wire corrodes and an open circuit results.

TRANSMISSION IDENTIFICATION INFORMATION

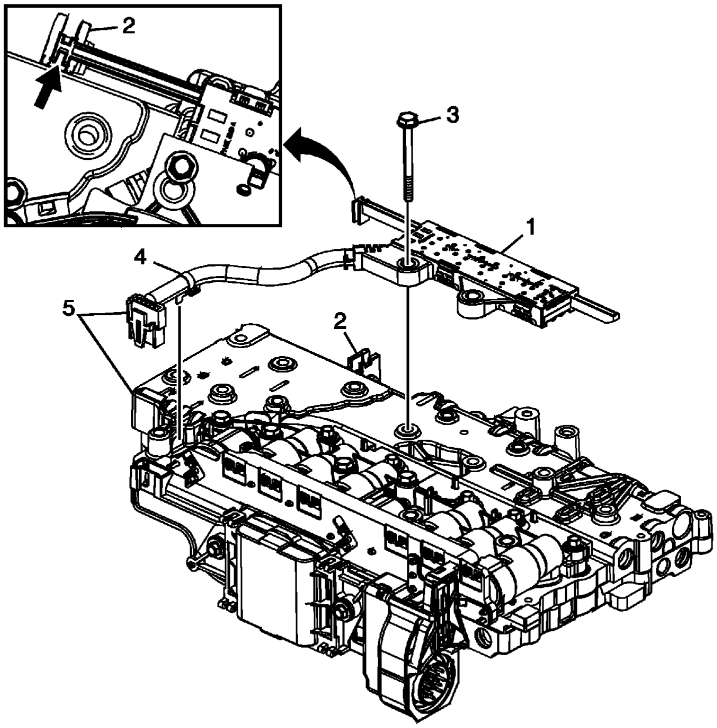


Fig. 426: ID Tag Information
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Calendar Year
2	Julian Date of the Year

3	Shift and Line Number
4	Plant
5	Model
6	Location on Transmission

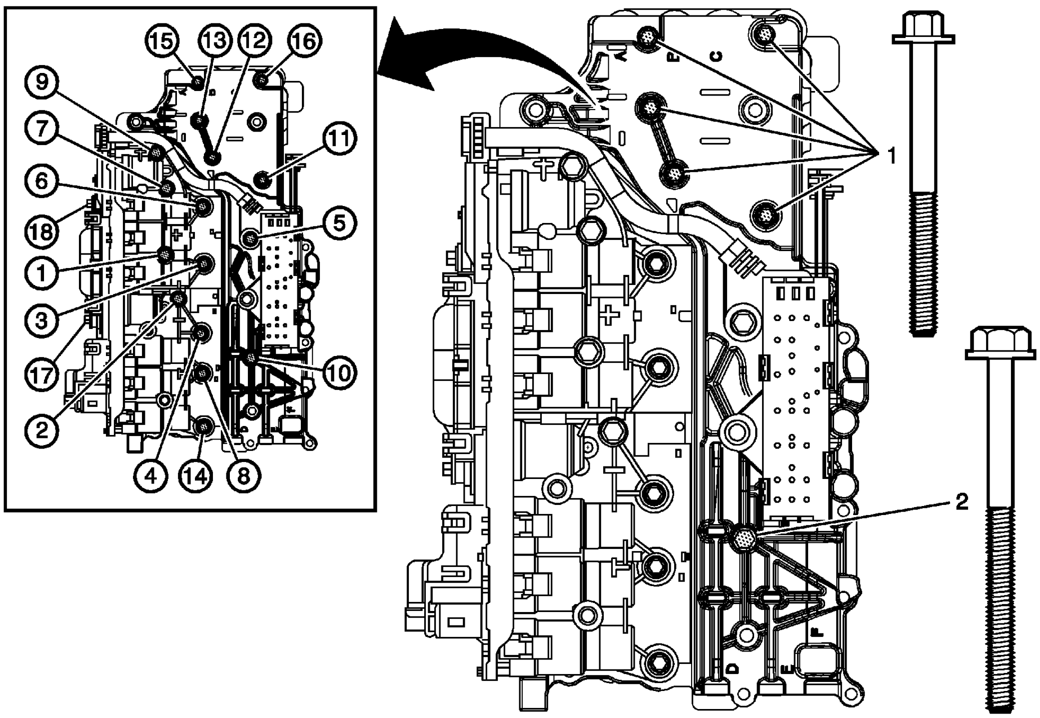


Fig. 427: VIN Locations
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Optional VIN Location
2	Optional VIN Location
3	Optional VIN Location
4	Optional VIN Location
5	Optional VIN Location

DEFINITIONS AND ABBREVIATIONS

Throttle Positions

Engine Braking

A condition where the engine is used to slow the vehicle by manually downshifting during a zero throttle coastdown.

Full Throttle Detent Downshift

A quick apply of the accelerator pedal to its full travel, forcing a downshift.

Heavy Throttle

Approximately 3/4 of accelerator pedal travel, 75 percent throttle position.

Light Throttle

Approximately 1/4 of accelerator pedal travel, 25 percent throttle position.

Medium Throttle

Approximately 1/2 of accelerator pedal travel, 50 percent throttle position.

Minimum Throttle

The least amount of throttle opening required for an upshift.

Wide Open Throttle (WOT)

Full travel of the accelerator pedal, 100 percent throttle position.

Zero Throttle Coastdown

A full release of the accelerator pedal while the vehicle is in motion and in drive range.

Shift Condition Definitions

Bump

A sudden and forceful apply of a clutch or a band.

Chuggle

A bucking or jerking. This condition may be most noticeable when the converter clutch is engaged. It is similar to the feel of towing a trailer.

Delayed

A condition where a shift is expected but does not occur for a period of time. This could be described as a clutch or band engagement that does not occur as quickly as expected during a part throttle or wide open throttle apply of the accelerator, or during manual downshifting to a lower range. This term is also defined as LATE or EXTENDED.

Double Bump - Double Feel

Two sudden and forceful applies of a clutch or a band.

Early

A condition where the shift occurs before the car has reached proper speed. This condition tends to labor the engine after the upshift.

End Bump

A firmer feel at the end of a shift than at the start of the shift. This is also defined as END FEEL or SLIP BUMP.

Firm

A noticeably quick apply of a clutch or band that is considered normal with a medium to heavy throttle. This apply should not be confused with HARSH or ROUGH.

Flare

A quick increase in engine RPM along with a momentary loss of torque. This most generally occurs during a shift. This condition is also defined as SLIPPING.

Harsh - Rough

A more noticeable apply of a clutch or band than FIRM. This condition is considered undesirable at any throttle position.

Hunting

A repeating quick series of upshifts and downshifts that causes a noticeable change in engine RPM, such as a 4-3-4 shift pattern. This condition is also defined as BUSYNESS.

Initial Feel

A distinctly firmer feel at the start of a shift than at the finish of the shift.

Late

A shift that occurs when the engine RPM is higher than normal for a given amount of throttle.

Shudder

A repeating jerking condition similar to CHUGGLE but more severe and rapid. This condition may be most noticeable during certain ranges of vehicle speed.

Slipping

A noticeable increase in engine RPM without a vehicle speed increase. A slip usually occurs during or after initial clutch or band apply.

Soft

A slow, almost unnoticeable clutch or band apply with very little shift feel.

Surge

A repeating engine related condition of acceleration and deceleration that is less intense than CHUGGLE.

Tie-Up

A condition where two opposing clutch and/or bands are attempting to apply at the same time causing the engine to labor with a noticeable loss of engine RPM.

Noise Conditions

Drive Link Noise

A whine or growl that increases or fades with vehicle speed, and is most noticeable under a light throttle acceleration. It may also be noticeable in PARK or NEUTRAL operating ranges with the vehicle stationary.

Final Drive Noise

A hum related to vehicle speed which is most noticeable under a light throttle acceleration.

Planetary Gear Noise

A whine related to vehicle speed, which is most noticeable in FIRST gear, SECOND gear, FOURTH gear or REVERSE. The condition may become less noticeable, or go away, after an upshift.

Pump Noise

A high pitched whine that increases in intensity with engine RPM. This condition may also be noticeable in all operating ranges with the vehicle stationary or moving.

Torque Converter Noise

A whine usually noticed when a vehicle is stopped, and the transmission is in DRIVE or REVERSE. The noise will increase with engine RPM.

Transmission Abbreviations

A/C

Air Conditioning

AC

Alternating Current

AT

Automatic Transmission

CCDIC

Climate Control Driver Information Center

DC

Direct Current

DIC

Driver Information Center

DLC

Diagnostic Link Connector

DMM

Digital Multimeter

DTC

Diagnostic Trouble Code

EBTCM

Electronic Brake/Traction Control Module

ECCC

Electronically-Controlled Capacity Clutch

ECT

Engine Coolant Temperature

EMI

Electromagnetic Interference

IAT

Intake Air Temperature

IGN

Ignition

IMS

Internal Mode Switch

ISS

Input Speed Sensor

MAP

Manifold Absolute Pressure

MIL

Malfunction Indicator Lamp

NC

Normally Closed

NO

Normally Open

OBD

On Board Diagnostic

OSS

Output Speed Sensor

PC

Pressure Control

PCM

Powertrain Control Module

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TCM

Transmission Control Module

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

TV

Throttle Valve

VCM

Vehicle Control Module

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION GENERAL DESCRIPTION

The 4L80-E is a fully automatic rear wheel drive electronically controlled transmission. The 4L80-E provides 4 forward ranges, including OVERDRIVE and REVERSE. A gear type of oil pump controls shift points. The powertrain control module (PCM), transmission control module (TCM) and the pressure control (PC) solenoid, force motor, regulate these shift points. The PCM/TCM also controls shift schedules and torque converter clutch (TCC) apply rates. Transmission temperature also influences shift schedules and TCC apply rates.

You can operate the transmission in any one of the following seven modes:

- P - PARK position prevents the vehicle from rolling either forward or backward on vehicles less than 15,000 G.V.W. For safety reasons, use the parking brake in addition to the park position.
- R - REVERSE allows the vehicle to be operated in a rearward direction.
- N - NEUTRAL allows the engine to be started and operated while driving the vehicle. If necessary, you may select this position in order to restart the engine with the vehicle moving.
- OD - OVERDRIVE is used for all normal driving conditions. Overdrive provides four gear ratios plus a converter clutch operation. Depress the accelerator in order to downshift for safe passing.
- D - DRIVE position is used for city traffic, and hilly terrain. Drive provides three gear ranges. Depress the accelerator in order to downshift.
- 2 - Manual SECOND provides acceleration and engine braking or greater traction from a stop. When you choose manual SECOND, the vehicle will start out in first gear and upshift to second gear. You may select this gear at a vehicle speed of up to 22 km/h (35 mph).
- 1 - Manual LOW provides maximum engine braking. You may select this gear at a vehicle speed of up to 13 km/h (20 mph).

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of this unit are as follows:

- A torque converter with a torque converter clutch (TCC)
- A gear type oil pump
- Five multiple disk clutches
- Two band assemblies
- Three planetary gear sets
- One sprag clutch
- Two roller clutches
- A control valve body assembly

The electrical components of this unit are as follows:

- Two shift solenoid valves, 1-2 and 2-3
- A torque converter clutch (TCC) solenoid valve
- A transmission pressure control (PC) solenoid valve
- An automatic transmission fluid temperature (TFT) sensor
- An automatic transmission fluid pressure (TFP) manual valve position switch assembly
- An output speed sensor (OSS)
- An input speed sensor (ISS)

For more information refer to **Electronic Component Description**.

TRANSMISSION ADAPTIVE FUNCTIONS

The 4L80-E transmission uses a line pressure control system that has the ability to adapt line pressure to compensate for normal wear of the following parts:

- The clutch fiber plates
- The springs and seals
- The apply bands

This adaptive feature is similar to the fuel and idle control systems, where the powertrain control module (PCM) and the transmission control module (TCM) has the ability to learn and adjust for monitored system changes.

The PCM/TCM maintains information for the following transmission adaptive systems:

1-2, 2-3, 3-4 Upshift Adapts - The PCM/TCM monitors the automatic transmission input shaft speed sensor (ISS) and the output speed sensor (OSS), to determine when the transmission has started, and completed an upshift. The PCM/TCM looks at the time from the beginning, until the completion of the upshift. If the time of the upshift was longer than a calibrated value, then the PCM/TCM adjusts the current to the transmission pressure control (PC) solenoid to increase line pressure for the next, same, upshift under identical conditions. If the time of the upshift was shorter than a calibrated value, then the PCM/TCM adjusts the current, to the transmission PC solenoid, to decrease line pressure for the next, same, upshift under identical conditions.

Steady State Adapts - Diesel only - The PCM/TCM monitors the automatic transmission ISS and the OSS after a shift has occurred, to determine the amount of clutch slippage in the transmission. If to much slippage is detected, the PCM/TCM adjusts the current, to the transmission PC solenoid, to increase the line pressure and reduce clutch slip.

Clearing Transmission Adaptive Pressure (TAP)

Transmission adaptive pressure (TAP) information is displayed and may be reset using a scan tool. The adapt function is a feature of the PCM/TCM that either adds or subtracts line pressure from a calibrated base line pressure in order to compensate for normal transmission wear. The TAP information is divided into 13 units, called cells. The cells are numbered 4 through 16. Each cell represents a given torque range. TAP cell 4 is the lowest adaptable torque range and TAP cell 16 is the highest adaptable torque range. It is normal for TAP cell values to display zero or negative numbers. This indicates that the PCM/TCM has adjusted line pressure at or below the calibrated base line pressure.

Updating TAP information is a learning function of the PCM/TCM designed to maintain acceptable shift times. It is not recommended that TAP information be reset unless one of the following repairs has been made:

- Transmission overhaul or replacement
- Repair or replacement of an apply or release component such as, the clutch, band, piston, and servo
- Repair or replacement of a component or assembly which directly affects line pressure

Resetting the TAP values, using a scan tool, erases all learned values in all cells. As a result, the PCM/TCM need to relearn TAP values. Transmission performance may be affected as new TAPs are learned. Learning can only take place when the PCM/TCM has determined that an acceptable shift has occurred. The PCM/TCM must also relearn TAP values if it is replaced.

ELECTRONIC COMPONENT DESCRIPTION

Torque Converter Clutch Solenoid Valve

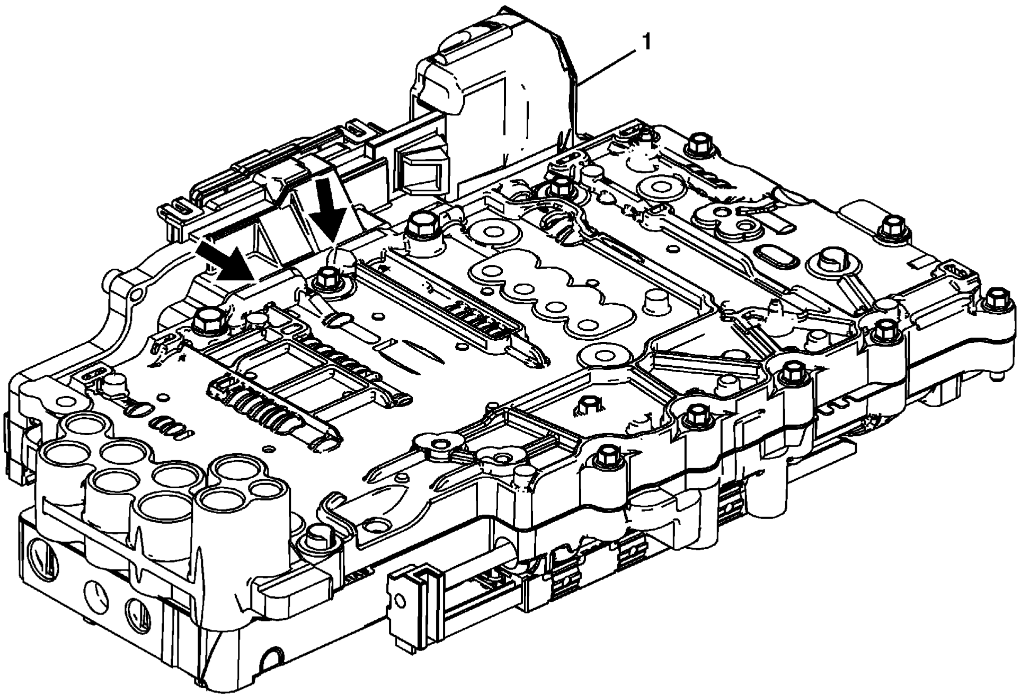


Fig. 428: Torque Converter Clutch Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The powertrain control module (PCM) and the transmission control module (TCM) energize the torque converter clutch pulse width modulated (TCC PWM) solenoid valve, which is located on the transmission valve body. The TCC PWM solenoid valve acts on the TCC apply valve in order to control the torque converter clutch application.

The TCC PWM solenoid valve is pulse width modulated by the PCM/TCM. This means that the PCM/TCM pulses the solenoid so that the hydraulic pressure against the torque converter clutch modulates. This modulated pressure allows the TCC to slip slightly, thus keeping the TCC balanced just at the point of engagement.

One diagnostic code is associated with the TCC PWM solenoid valve code P2761, TCC solenoid circuit - electrical, detects a fault in the TCC circuit. While code P2761 is set, both fourth gear in hot mode and the TCC are inhibited. Shift adapts do not update and the malfunction indicator lamp (MIL) illuminates. Recovery can occur on the next ignition cycle.

Pressure Control Solenoid Valve

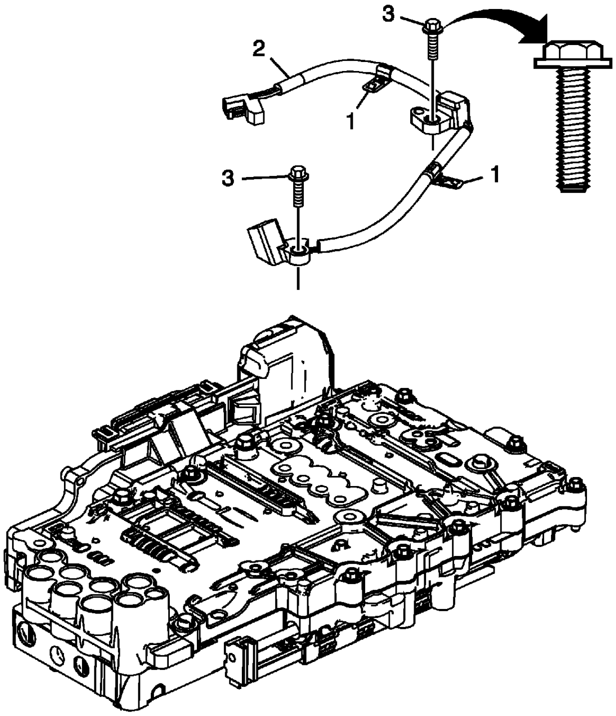


Fig. 429: Pressure Control Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The pressure control (PC) solenoid valve is attached to the valve body. The valve controls line pressure by moving a pressure regulator valve against spring pressure. The PC solenoid valve takes the place of the throttle valve or the vacuum modulator, which was used on past model transmissions.

The PCM/TCM varies line pressure based on engine load. Engine load is calculated from various inputs, especially the throttle position (TP) sensor switch. Line pressure is actually varied by changing the amperage applied to the PC solenoid valve from 0 amps, high pressure, to 1.1 amps, low pressure. The PC solenoid valve current is periodically pulsed in order to prevent contamination from sticking the pressure regulator valve.

One diagnostic code is associated with the PC solenoid valve. Code P0748 sets when the PCM/TCM detects a difference of 0.16 amp or greater between the amperage commanded and actual amperage. While the code is set, the PC solenoid valve turns OFF. Recovery can occur after the next ignition cycle. Code P0748 does not sense a hydraulic condition, such as a stuck valve.

1-2 Shift Solenoid Valve

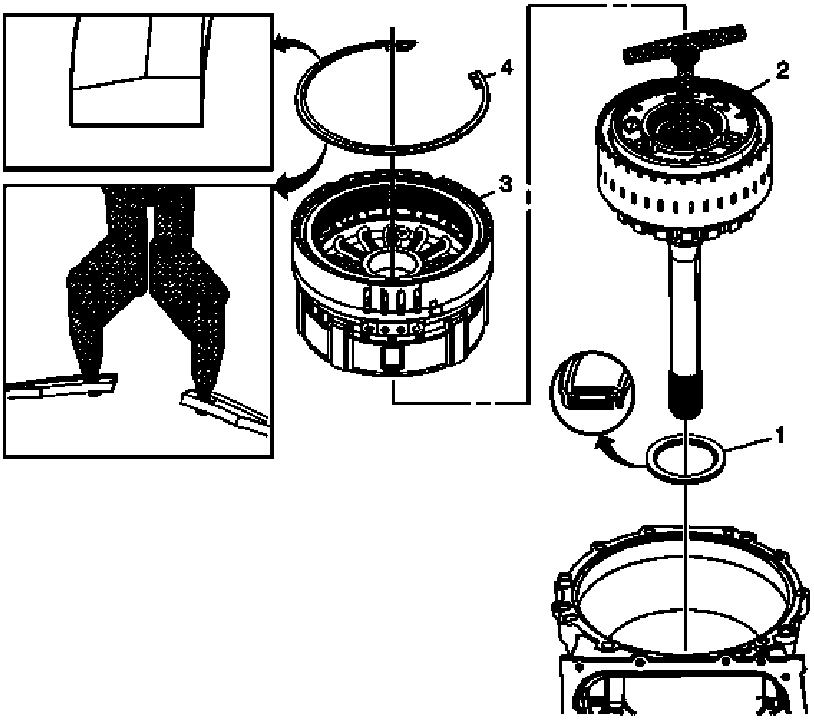


Fig. 430: 1-2 Shift Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The 1-2 shift solenoid (SS) valve is a normally open exhaust valve that is attached to the valve body. The PCM/TCM controls the solenoid by grounding the solenoid through an internal quad driver. The 1-2 SS valve is ON in FIRST and FOURTH gear. When commanded ON, the 1-2 SS valve redirects fluid to act on the 1-2 shift valve.

There are 2 PCM/TCM related diagnostic trouble codes (DTCs) associated with the 1-2 SS valve: P0751 and P0753.

The PCM/TCM monitors the 1-2 SS circuit for an open or short to ground condition. If the PCM/TCM detects an open or short to ground condition, DTC P0753 sets. If the PCM/TCM detects an incorrect gear ratio, DTC P0751 sets. When DTC P0753 or P0751 sets, the PCM/TCM commands maximum line pressure, freezes shift adapts from being updated, and inhibits 3-2 downshifts.

2-3 Shift Solenoid Valve

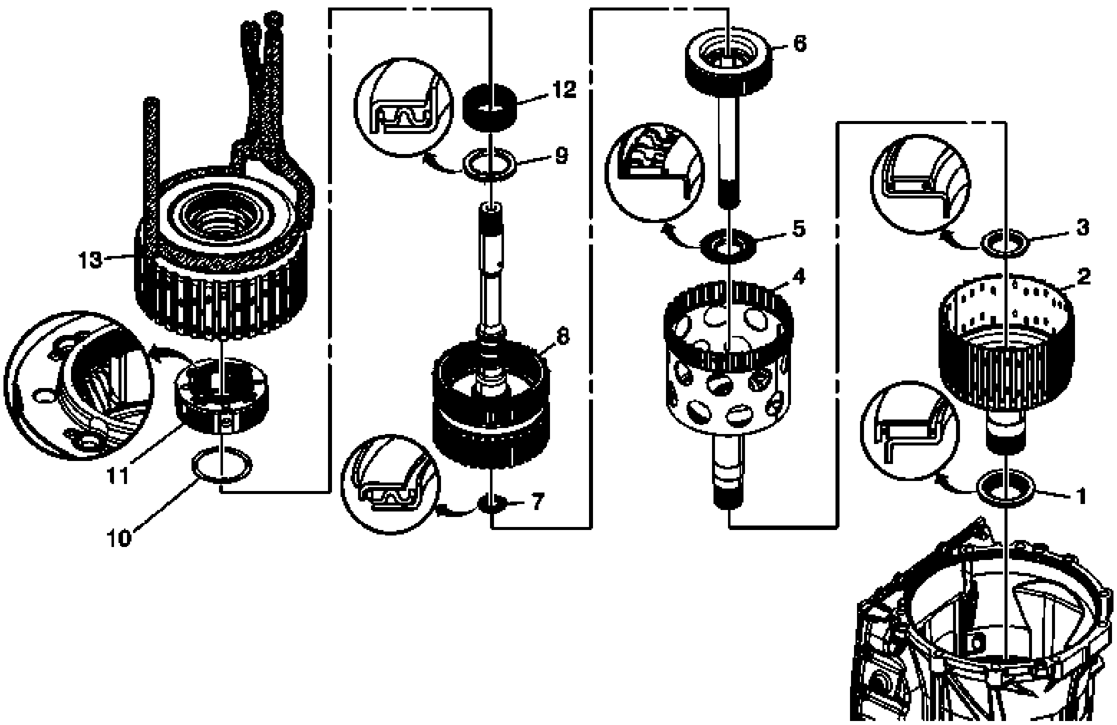


Fig. 431: 2-3 Shift Solenoid Valve
Courtesy of GENERAL MOTORS CORP.

The 2-3 SS valve is a normally open exhaust valve that is attached to the valve body. The PCM/TCM controls the solenoid by grounding the solenoid through an internal quad driver. The 2-3 SS valve is ON in THIRD and FOURTH gear. When commanded ON, the 2-3 SS valve directs fluid to act on the 2-3 shift valve.

There are 2 PCM/TCM related DTCs associated with the 2-3 SS valve: P0756 and P0758.

The PCM/TCM monitors the 2-3 SS circuit for an open or short to ground condition. If the PCM/TCM detects an open or short to ground condition, DTC P0758 sets. If the PCM/TCM detects an incorrect gear ratio, DTC P0756 sets. When DTC P0758 or P0756 sets, the PCM/TCM commands maximum line pressure, freezes shift adapts from being updated, and inhibits 3-2 downshifts.

Automatic Transmission Fluid Pressure Manual Valve Position Switch

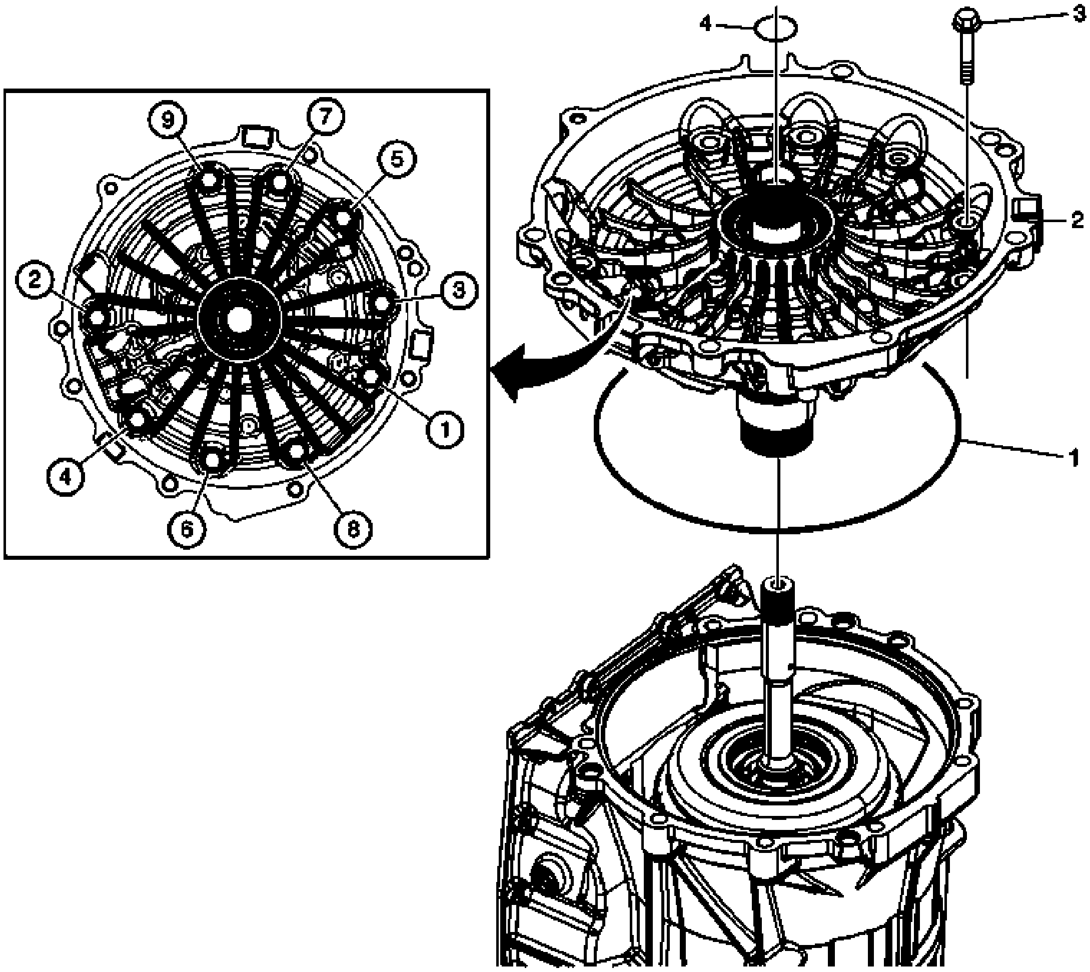


Fig. 432: Automatic Transmission Fluid Pressure Manual Valve Position Switch
Courtesy of GENERAL MOTORS CORP.

The automatic transmission fluid pressure (TFP) manual valve position switch assembly is a gear range sensing device used by the PCM/TCM in order to sense the gear range that has been selected by the vehicle operator. The TFP manual valve position switch assembly is located on the valve body, and consists of 5 pressure switches combined into 1 unit. The PCM/TCM applies system voltage to the TFP manual valve position switch assembly on 3 separate wires. These 3 circuits are either grounded or open, depending on the gear range that has been selected, and the combination of the 5 switches that gave pressure applied to them.

When the vehicle is in PARK, with the key ON and the engine OFF, the normal state of the TFP manual valve position switch assembly is DRIVE 2. When the key is ON and the engine is running, the normal state of the TFP manual valve position switch assembly is PARK/NEUTRAL.

There are 2 possible combinations of the switches within the pressure switch manifold that do not represent an actual gear range. If the PCM/TCM detects either of these combinations, a DTC sets.

The PCM/TCM TFP DTC P1810 sets when the TFP switch indicates the following conditions:

- An illegal gear range

- DRIVE4, DRIVE2 or REVERSE position before and after start-up
- PARK/NEUTRAL with a ratio greater than 1.05
- REVERSE with ratio indicating outside of REVERSE
- DRIVE4, DRIVE3, DRIVE2 or DRIVE1 with ratio indicating REVERSE

While DTC P1810 is present, the PCM/TCM assumes DRIVE4 for shift pattern, sets line pressure to maximum, freezes shift adapts, and forces the TCC ON with 4th gear commanded.

Oil Pressure and Circuit Combination

Range Indicator	Oil Pressure Present					Circuit/Mode		
	REV	LO	PRND4	PRND43	Drive	A	B	C
PARK	-	-	X	X	-	OFF	ON	OFF
REVERSE	X	-	X	X	-	ON	ON	OFF
NEUTRAL	-	-	X	X	-	OFF	ON	OFF
Overdrive	-	-	X	X	X	OFF	ON	ON
D	-	-	-	X	X	OFF	OFF	ON
2	-	-	-	-	X	OFF	OFF	OFF
1	-	X	-	-	X	ON	OFF	OFF
7 valid combinations and 2 invalid combinations are available from the TR. Valid combinations for Circuits A, B, and C are shown in the figure. The invalid combinations displayed on the scan tool are A = ON, B = ON, C = ON or A = ON, B = OFF, C = ON. ON means that the switch is closed; OFF means that the switch is open.								

Automatic Transmission Input Shaft Speed and Output Shaft Speed Sensors

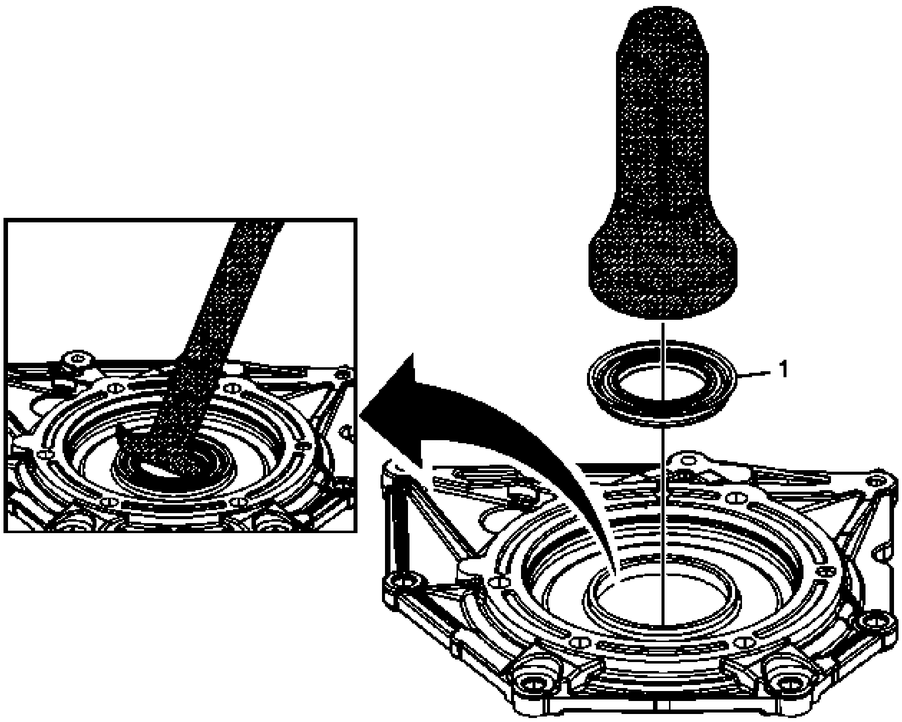


Fig. 433: Automatic Transmission Input Shaft Speed Sensors
Courtesy of GENERAL MOTORS CORP.

Both of the AT ISS and the AT OSS sensors are magnetic induction sensors. The input and the output sensors are accessible from the left hand side of the transmission. The AT ISS sensor is located just forward of center and the AT OSS sensor is located near the rear. A voltage signal is induced in the AT ISS sensor by serrations, which are cut in the outside diameter of the forward clutch housing. Voltage is induced in the output sensor by gear teeth, which are pressed on the outside diameter of the rear carrier assembly.

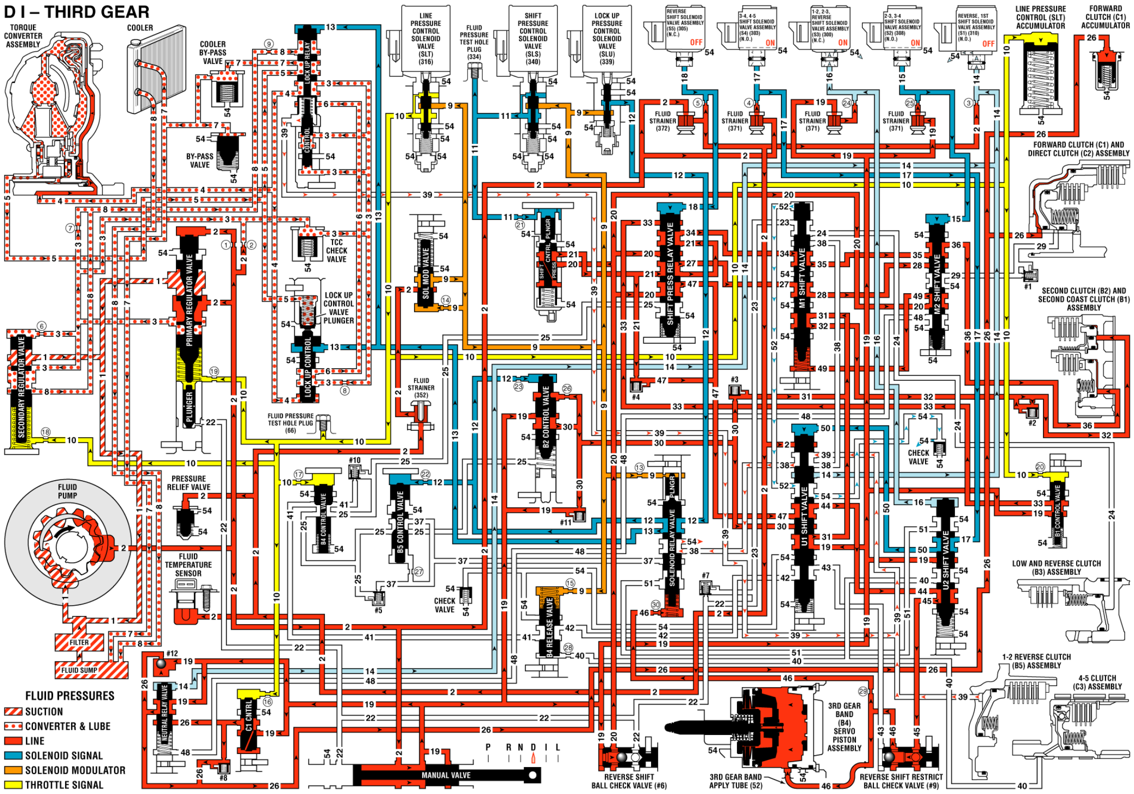


Fig. 434: Automatic Transmission Output Shaft Speed Sensors
Courtesy of GENERAL MOTORS CORP.

The PCM/TCM uses speed information from these sensors in order to determine the following conditions:

- Whether the engine is running
- Vehicle speed
- Calculation of the gear ratio
- Calculation of TCC slip
- Calculation of turbine speed

Code P0502 and P0503 set if a fault exists in the AT OSS sensor circuit, and the PCM/TCM calculates a default value using the AT ISS sensor values. As long as the fault remains, and the code is set, the PCM/TCM also commands maximum line pressure, freeze shift adapts, and the MIL illuminates. If the fault is removed, normal operation resumes after the next ignition cycle.

Automatic Transmission Fluid Temperature Sensor

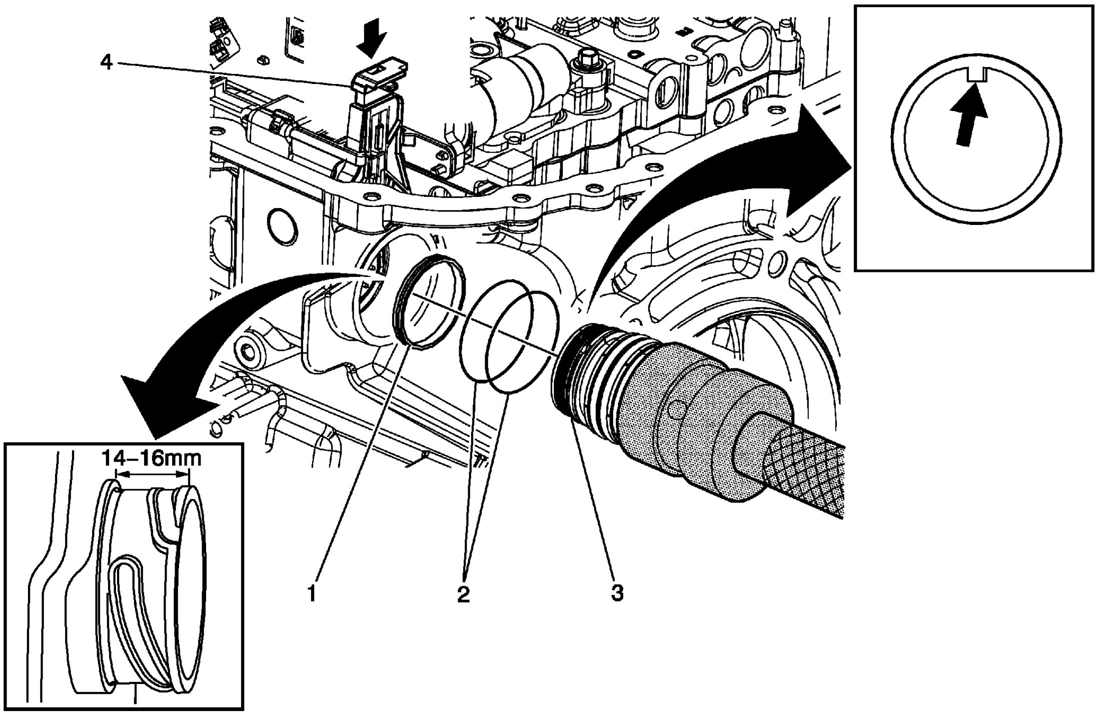


Fig. 435: Automatic Transmission Fluid Temperature Sensor
Courtesy of GENERAL MOTORS CORP.

The automatic transmission fluid temperature (TFT) sensor assembly is a thermistor, which is mounted in the wiring harness assembly. Low transmission temperature produces high resistance, while high temperature produces low resistance. The PCM/TCM supplies a 5-volt signal to the TFT sensor assembly through an internal resistor. Then the PCM/TCM measures the voltage drop in the circuit. Voltage is high when the transmission is cold and low when the transmission is hot.

The PCM/TCM uses the TFT sensor assembly in order to regulate torque converter clutch apply, as well as shift quality.

DTC P0711, P0712 and P0713 indicate a fault in the TFT sensor assembly circuit. After the vehicle has been started, transmission temperature should rise steadily and stabilize between 90-115°C (194-239°F), depending on load. All 3 DTCs cause the PCM/TCM to use a default value of 140°C (284°F), thus reacting as if the transmission were hot in either case. When DTCs P0711, P0712 or P0713 are set, the PCM/TCM freezes the shift adapts from being updated, and the MIL illuminates. Some driveability symptoms will be noticed, especially when cold.

Transmission Range Switch

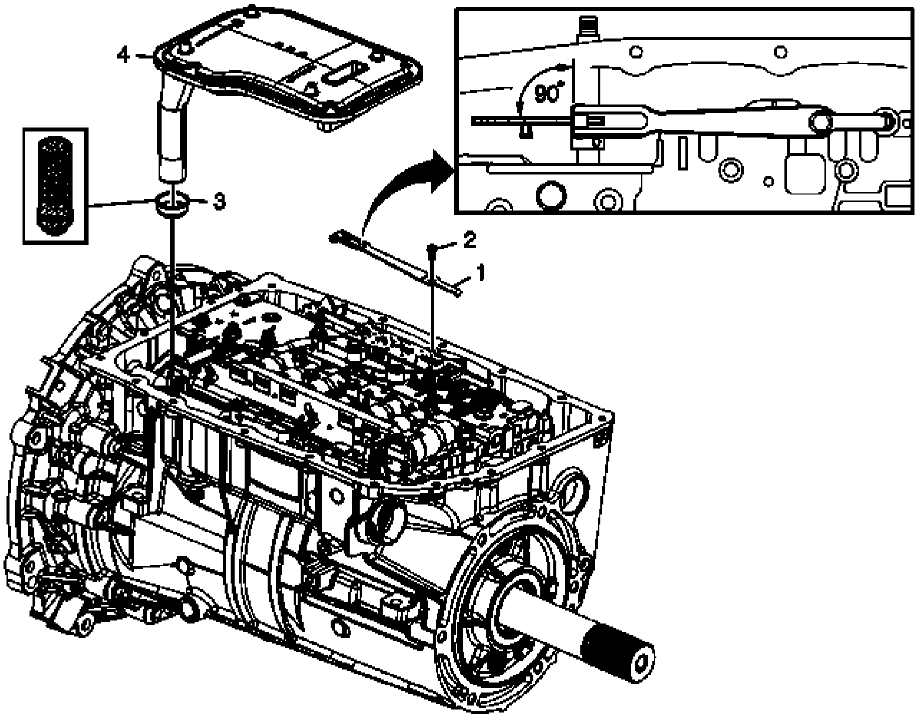


Fig. 436: View Of Transmission Range Switch
Courtesy of GENERAL MOTORS CORP.

The transmission range (TR) switch is part of the park/neutral position (PNP) and backup lamp switch assembly, which is externally mounted on the transmission manual shaft. The TR switch contains 4 internal switches that indicate the transmission gear range selector lever position. The PCM/TCM supplies ignition voltage to each switch circuit. As the gear range selector lever is moved, the state of each switch may change, causing the circuit to open or close. An open circuit or switch indicates a high voltage signal. A closed circuit or switch indicates a low voltage signal. The PCM/TCM detects the selected gear range by deciphering the combination of the voltage signals. The PCM/TCM compares the actual voltage combination of the switch signals to a TR switch combination table stored in memory.

AUTOMATIC TRANSMISSION INLINE 20-WAY CONNECTOR DESCRIPTION

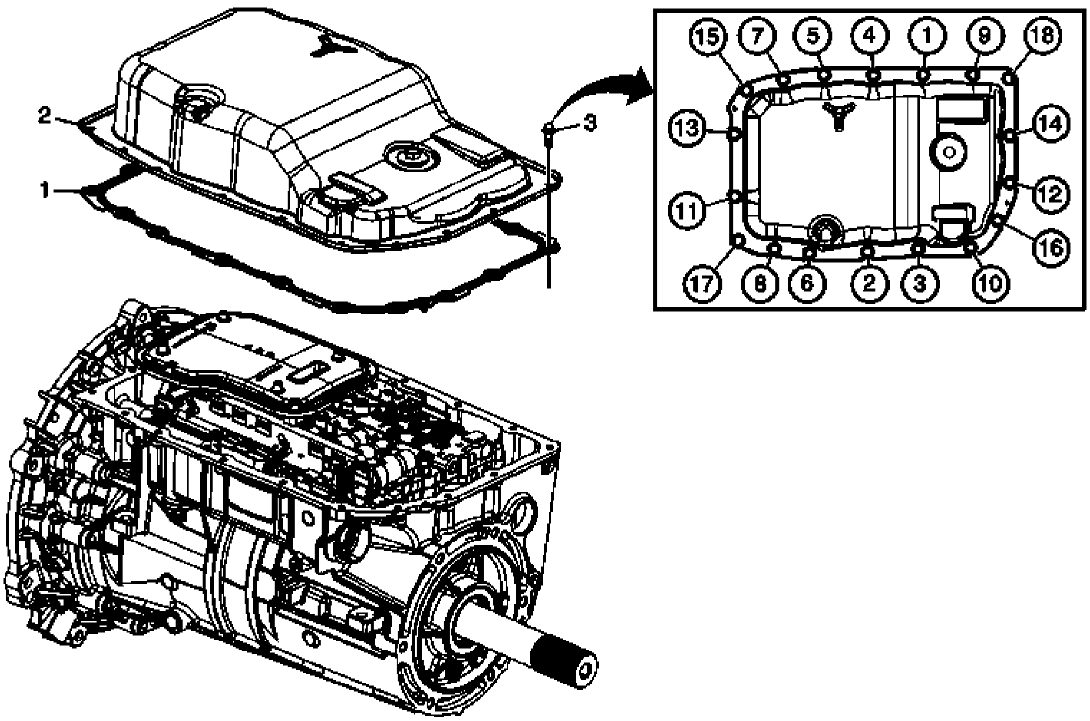


Fig. 437: Identifying Automatic Transmission In-Line 20-Way Connector
Courtesy of GENERAL MOTORS CORP.

The transmission electrical connector is an important part of the transmission operating system. Any interference with the electrical connection can cause the transmission to set diagnostic trouble codes or affect proper operation.

The following items can affect the electrical connection:

- Bent pins in the connector from rough handling during connection and disconnection
- Wires backing away from the pins or coming uncrimped, in either the internal or the external wiring harness
- Dirt contamination entering the connector when disconnected
- Pins in the internal wiring connector backing out of the connector or pushed out of the connector during reconnection
- Transmission fluid leaking into the connector, wicking up into the external wiring harness and degrading the wire insulation
- Moisture intrusion in the connector
- Low pin retention in the external connector from excessive connection and disconnection of the wiring connector assembly
- Pin corrosion from contamination
- Damaged connector assembly

Remember the following points:

- In order to remove the connector, squeeze the two tabs toward each other and pull straight up without pulling by the wires.
- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- Visually inspect the seals to ensure that they are not damaged during handling.
- In order to reinstall the external wiring connector, first orient the pins by lining up the arrows on each half of the connector. Push the connector straight down into the transmission without twisting or angling the mating parts.
- The connector should click into place with a positive feel and/or noise.
- Whenever the transmission external wiring connector is disconnected from the internal harness and the engine is operating, DTCs will set. Clear these DTCs after reconnecting the external connector.

AUTOMATIC TRANSMISSION HYDRAULIC DIAGRAMS

Park or Neutral - Engine Running

When you start the vehicle, the oil pump generates fluid flow from the transmission sump through the filter and into the pump. Filtered transmission fluid is directed to the pressure regulator valve.

Pressure Regulator Valve

The pressure regulator valve regulates line pressure according to various driving conditions. The converter feed pressure is directed to the torque converter hydraulic system. Regulated line pressure is directed to the torque converter clutch regulated apply valve, the actuator feed limit valve, and the manual valve.

Torque Converter Clutch Regulated Apply Valve (TCCRAV)

Line pressure is supplied to the TCCRAV to be utilized in other gear ranges.

Actuator Feed Limit Valve

This valve regulates the actuator feed pressure to the 1-2, 2-3, 3-4 shift valves, to the pressure control solenoid valve, and to the 1-2 and 2-3 shift solenoid valves.

Manual Valve

The line pressure from the pressure regulator valve is supplied to the manual valve in order to be utilized in other gear ranges. In Park range, line pressure is directed as PRND43, PRND4, and PRN fluid pressure.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

PRND4 and PRND43 fluid pressures from the manual valve are directed to their respective switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Park range.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is energized, 1-2 signal fluid pressure forces the 1-2 shift valve to the extreme left against a spring force.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal fluid exhausts through the solenoid. A spring force holds the 2-3 shift valve to the extreme right.

1-2 Shift Valve

1-2 signal fluid pressure holds the 1-2 shift valve to the left against a spring force.

2-3 Shift Valve

Spring force holds the 2-3 shift valve to the extreme right. This action blocks the PRND4 fluid pressure at the 2-3 Shift Valve.

3-4 Shift Valve

Spring force and PRN fluid pressure hold the 3-4 shift valve to the extreme right.

Manual 2-1 Band Servo

PRND43 fluid pressure from the manual valve is directed to the manual 2-1 band servo. This pressure assists the spring force in holding the manual 2-1 band servo off.

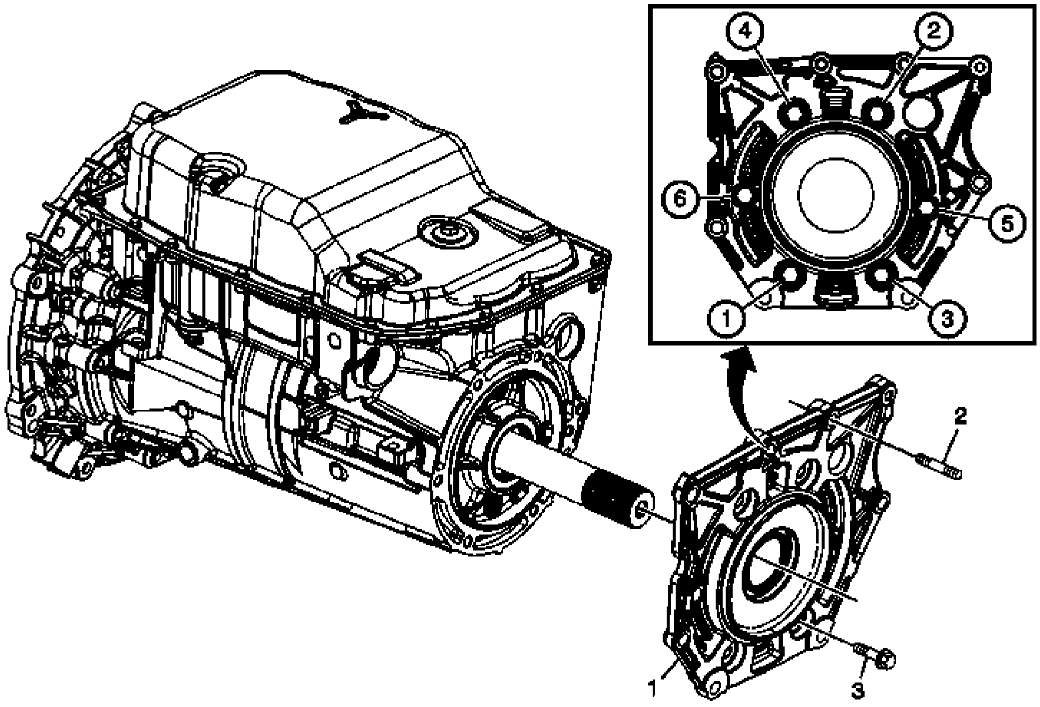


Fig. 438: Park or Neutral - Engine Running
Courtesy of GENERAL MOTORS CORP.

Reverse

When you move the gear selector lever to the Reverse position, the manual valve blocks the line fluid pressure from entering the Drive, D321, D21 and Lo fluid circuits. These fluids exhaust at the manual valve. The manual valve allows the line fluid pressure to enter the Reverse, PRN, PRND43, and PRND4 hydraulic circuits.

Manual Valve

In the Reverse range, the line pressure from the pressure regulator valve is directed as Reverse, PRN, PRND4, and PRND43 fluid pressures at the manual valve. The Reverse fluid pressure is directed to the automatic transmission fluid pressure (TFP) manual valve position switch assembly, to the #9 checkball, to the direct clutch, to the 1-2 shift valve, and to the pressure regulator boost valve. The PRN fluid is directed to the 3-4 shift valve. The PRND4 fluid is directed to the TFP manual valve position switch and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Reverse, PRND4, and PRND43 fluid pressures from the manual valve are directed to the respective switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Reverse.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is energized, 1-2 signal pressure forces the 1-2 shift valve to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal fluid exhausts through the solenoid.

1-2 Shift Valve

1-2 signal fluid pressure holds the 1-2 shift valve to the extreme left. Reverse fluid pressure from the 1-2 shift valve seats the #7 checkball. The pressure is then directed to the low & reverse band servo, which applies the low & reverse band.

2-3 Shift Valve

Spring force holds the 2-3 shift valve to the extreme right. This blocks the PRND4 fluid pressure at the 2-3 shift valve, which is used in other gear ranges.

3-4 Shift Valve

The PRN fluid pressure forces the 3-4 shift valve to the extreme right.

Low and Reverse Band Servo

Reverse fluid pressure from the 1-2 shift valve seats the #7 checkball, flows through an orifice, flows through the case, and flows into the low and reverse band servo, which applies the low and reverse band. The Reverse fluid pressure changes to Rear Band Apply (RBA) fluid pressure at the orifice.

#9 and #11 Checkballs

Reverse fluid pressure from the manual valve seats the #9 checkball. This causes the fluid to flow through an orifice and to seat the #11 checkball, before flowing into the direct clutch. The Reverse fluid pressure changes to Third/Reverse fluid pressure at the orifice.

Direct Clutch

The Third/Reverse fluid pressure is directed through the case, through the center support, and into the direct clutch inner piston area. Reverse fluid pressure is directed to the direct clutch outer piston. The combination of these two pressures apply the direct clutch. Using both fluid pressures on an increased area of the piston increases the holding capacity of the clutch.

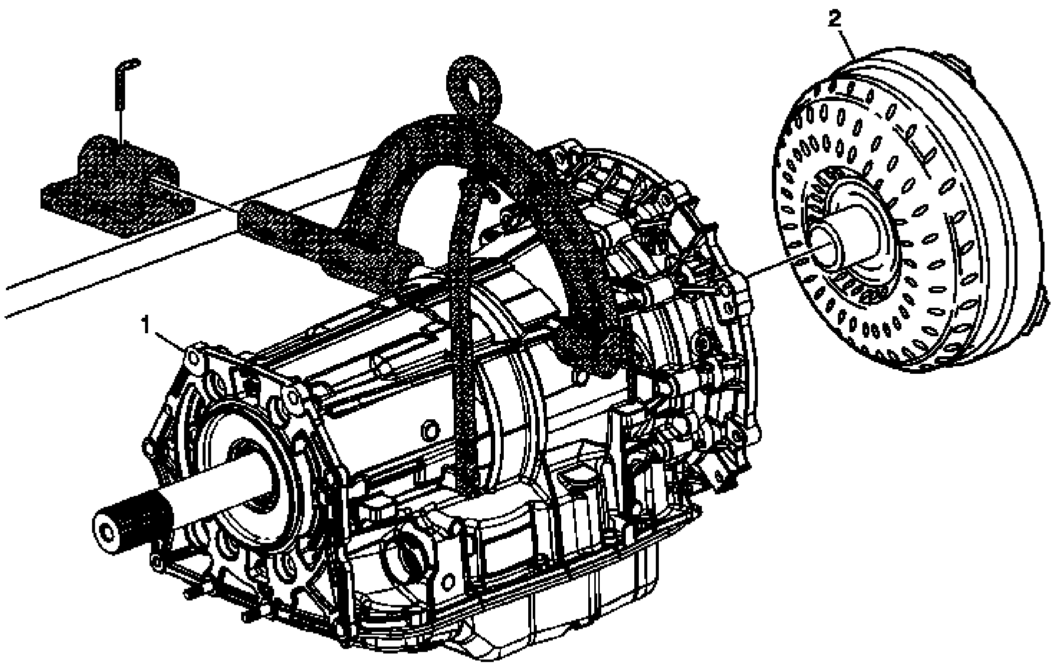


Fig. 439: Reverse
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, First Gear

When you move the gear selector lever to the Overdrive position, the manual valve is repositioned in order to allow line pressure to flow in its respective circuits.

Manual Valve

In the Overdrive range first gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is energized, 1-2 signal fluid pressure forces the 1-2 shift valve to the extreme left against a spring force.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal fluid exhausts through the solenoid. A spring force holds the 2-3 shift valve to the extreme right.

1-2 Shift Valve

Drive fluid pressure from the manual valve is held at the 1-2 shift valve in order to be utilized in other gear ranges.

2-3 Shift Valve

PRND4 fluid pressure from the manual valve is held at the 2-3 shift valve in order to be utilized in other gear ranges.

3-4 Shift Valve

1-2 signal pressure holds the 3-4 shift valve to the extreme left. PRN fluid pressure is blocked by the manual valve.

Forward Clutch

Drive fluid pressure from the manual valve is directed through the case, the pump housing, and the turbine shaft into the forward clutch housing. This applies the forward clutch, shifting the transmission into first gear.

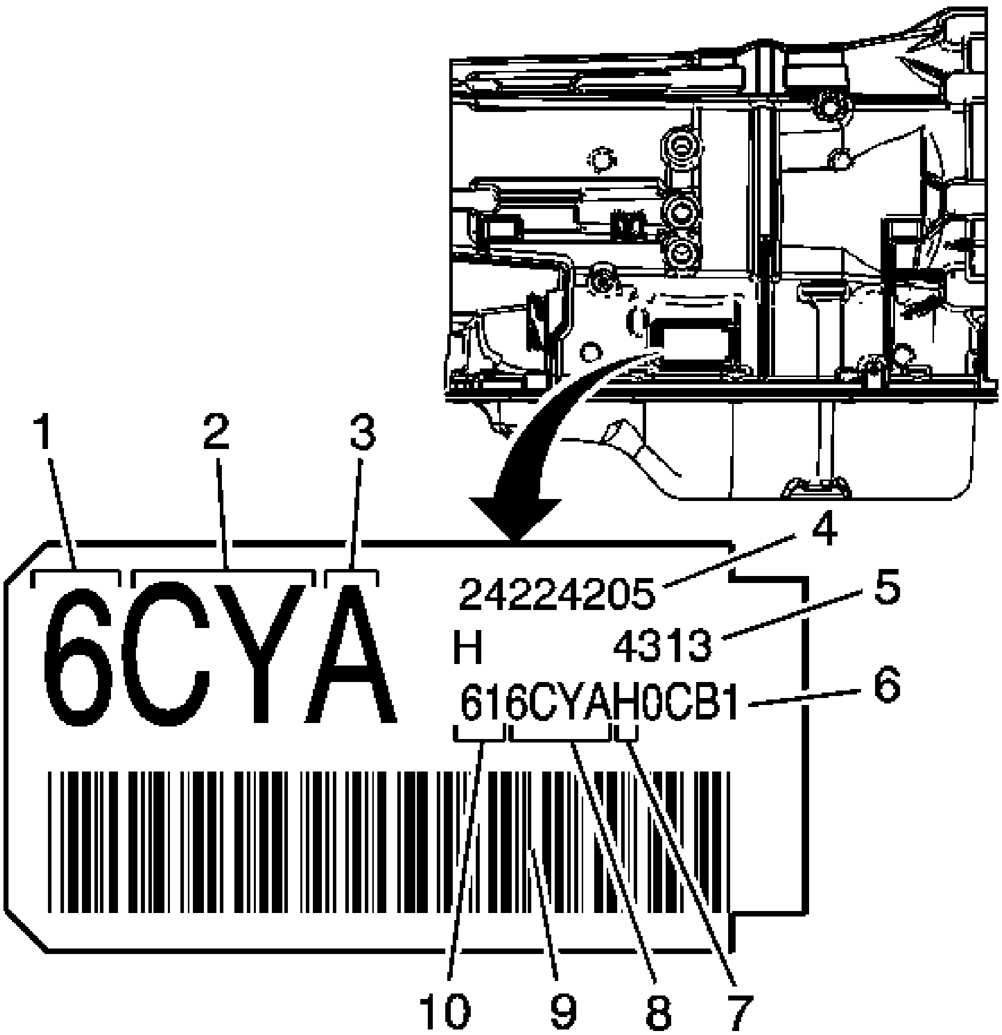


Fig. 440: Overdrive Range, First Gear
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, Second Gear

In order to obtain second gear, the PCM receives input signals from the transmission speed sensors (input and output), the Throttle Position (TP) Sensor, and from other engine sensors. These signals determine when to de-energize the 1-2 Shift Solenoid (SS) Valve.

Manual Valve

In the Overdrive range second gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is de-energized, 1-2 signal fluid exhausts through the solenoid. A spring force holds the 1-2 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal fluid pressure forces the 2-3 shift valve to the extreme right against a spring force.

1-2 Shift Valve

Spring force holds the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve

Spring force holds the 2-3 shift valve to the extreme right. The 2-3 drive fluid pressure from the 1-2 shift valve changes into Front Band Apply (FBA) and is directed to the manual 2-1 band servo. The PRND4 fluid pressure from the manual valve is held at the 2-3 shift valve in order to be utilized in other gear ranges.

3-4 Shift Range

Spring force holds the 3-4 shift valve to the extreme right.

Forward Clutch

Drive fluid pressure from the manual valve applies the forward clutch.

Intermediate (Second) Clutch

Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.

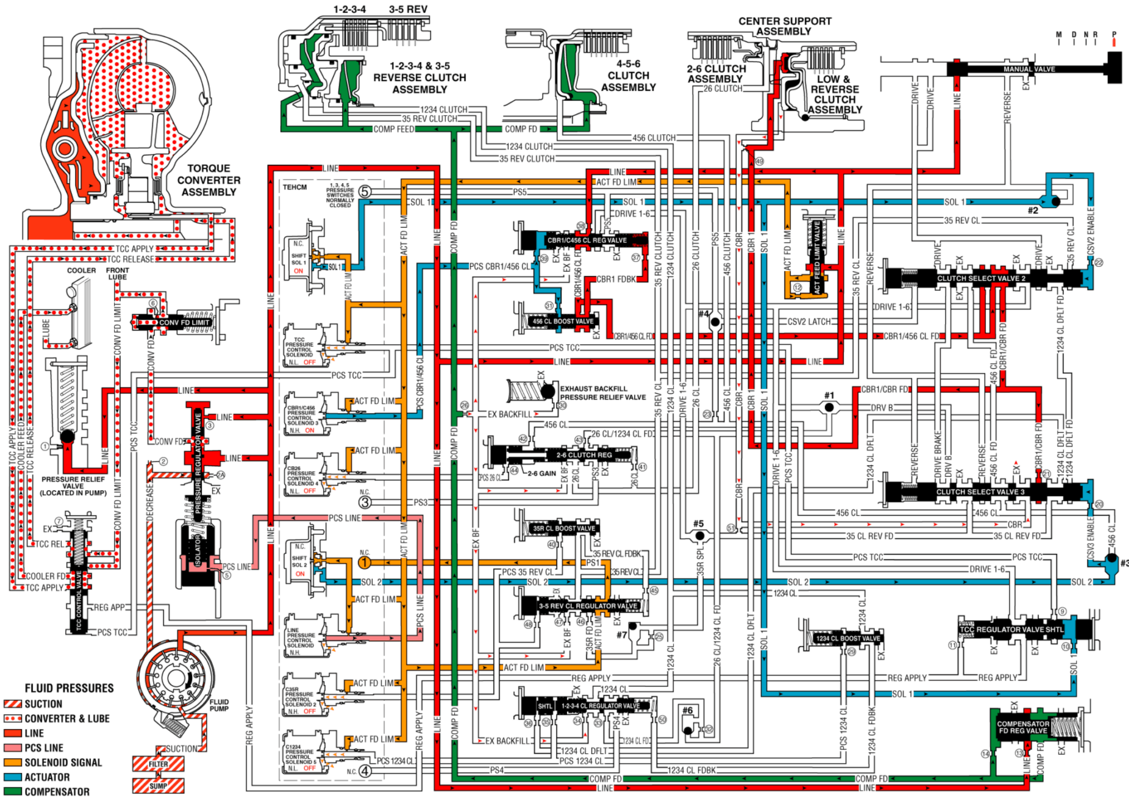


Fig. 441: Overdrive Range, Second Gear
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, Third Gear - Torque Converter Clutch Applied

In order to obtain third gear, the PCM receives input signals from both speed sensors, from the TP Sensor, and from other engine sensors. These signals determine when to energize the 2-3 Shift Solenoid (SS) Valve.

Manual Valve

In the Overdrive range third gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is de-energized, 1-2 signal fluid exhausts through the solenoid. A spring force holds the 3-4 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is energized, 2-3 signal fluid pressure forces the 1-2 shift valve to the extreme right against a spring force.

1-2 Shift Valve

Spring force and 2-3 signal fluid pressure hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve

The PRND4 fluid pressure from the manual valve is directed through the 2-3 shift valve, to the 3-4 shift valve. The PRND4 fluid pressure changes into Fourth clutch fluid pressure at the 2-3 shift valve. The 2-3 DR fluid pressure from the 1-2 shift valve is changed into Third clutch fluid pressure at the 2-3 shift valve. This seats the #8 checkball, causing the fluid to flow through an orifice and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the direct clutch.

3-4 Shift Valve

Fourth clutch fluid pressure is blocked at the 3-4 shift valve, where the pressure is utilized in Overdrive range fourth gear.

Forward Clutch

Drive fluid pressure from the manual valve applies the forward clutch.

Intermediate (Second) Clutch

Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.

Direct Clutch

Third/Reverse pressure from the #11 checkball flows through the case and through the center support in order to apply the inner piston area of the direct clutch.

Third Clutch Accumulator

Third clutch fluid pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and accumulator fluid pressure.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve

The PCM energizes the TCC PWM solenoid valve, and pressure is applied to the converter clutch shift valve. The Torque Converter Clutch (TCC) is applied. The signal pressure also acts on the torque converter clutch regulator valve, which regulates the output pressure. This controls the apply and release of the TCC.

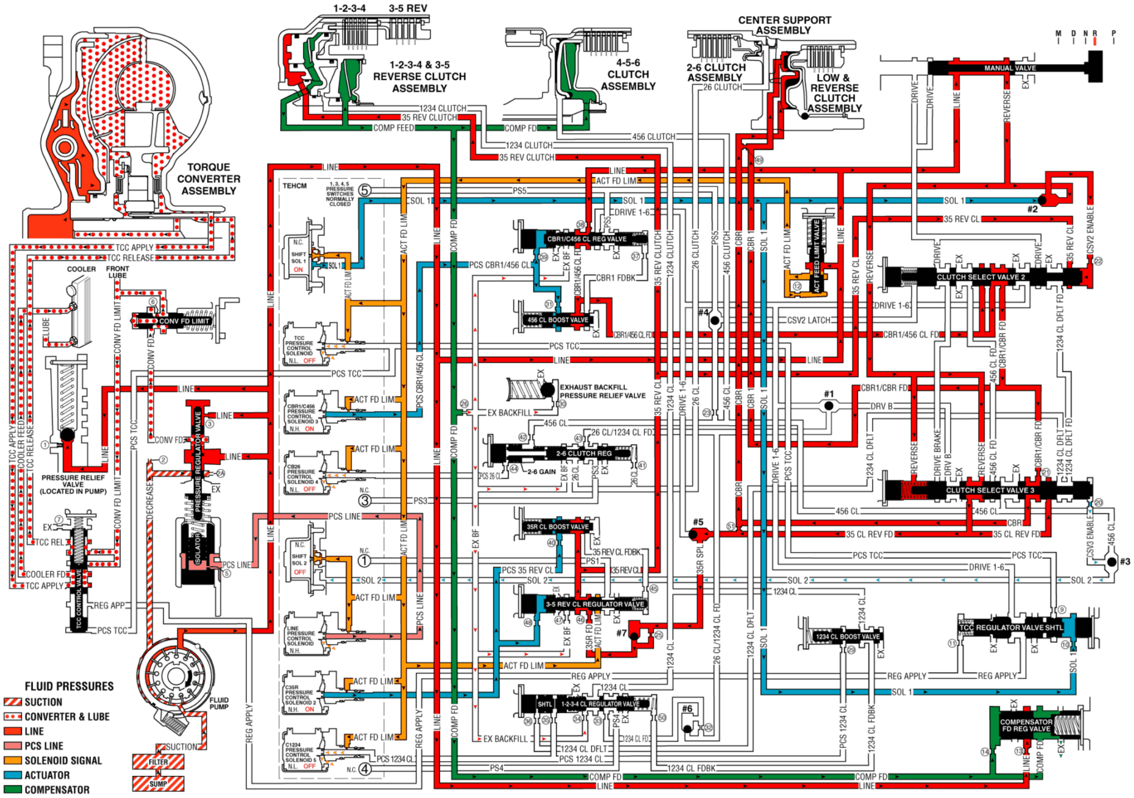


Fig. 442: Overdrive Range, Third Gear - TCC Applied
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, Fourth Gear - Torque Converter Clutch Applied

In order to obtain fourth gear, the PCM receives input signals from both speed sensors, from the TP Sensor, and from other engine sensors. These signals determine when to energize the 1-2 Shift Solenoid (SS) Valve.

Manual Valve

In the Overdrive range fourth gear, line pressure from the pressure regulator valve is directed as PRND4, PRND43, and Drive fluid pressures. The PRND4 fluid pressure is directed to the Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly and to the 2-3 shift valve. The PRND43 fluid is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Drive, PRND4, and PRND43 fluid pressures from the manual valve are directed to the DR, PRND4, and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in Overdrive range.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is energized, 1-2 signal fluid pressure forces the 3-4 shift valve against the spring force in order to move the 3-4 shift valve to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is energized, 2-3 signal fluid pressure forces the 1-2 shift valve to the extreme right against a spring force.

1-2 Shift Valve

Spring force and 2-3 signal fluid pressure hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve changes into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, to the TCC PWM Solenoid Valve, and to the intermediate (second) clutch.

2-3 Shift Valve

The PRND4 fluid pressure from the manual valve is directed through the 2-3 shift valve, to the 3-4 shift valve. The PRND4 fluid pressure changes into Fourth clutch fluid pressure at the 2-3 shift valve. The 2-3 DR fluid pressure from the 1-2 shift valve is changed into Third clutch fluid pressure at the 2-3 shift valve. This seats the #8 checkball, causing the fluid to flow through an orifice and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the direct clutch.

3-4 Shift Valve

1-2 signal fluid pressure holds the 3-4 Shift Valve to the extreme left. Fourth clutch fluid from the 2-3 shift valve changes to Fourth Clutch fluid pressure at the 3-4 Shift Valve. Fourth clutch fluid seats the #10 checkball, causing the fluid to flow through an orifice in order to apply the fourth clutch and the fourth clutch accumulator.

Low & Reverse Band Servo

Second fluid pressure is supplied to the low & reverse band servo in the same manner as the second fluid pressure is supplied to the second clutch. This fluid pressure is directed to the inner piston of the low & reverse band servo, which applies the inner piston.

Forward Clutch

Drive fluid pressure from the manual valve applies the forward clutch.

Direct Clutch

Third/Reverse pressure from the #11 checkball flows through the case and through the center support in order to apply the inner piston area of the direct clutch.

Intermediate (Second) Clutch

Second fluid pressure from the 1-2 shift valve applies the intermediate clutch. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball, causing the fluid to flow through two orifices and into the center support. This applies the Intermediate (Second) clutch. The 2-3 drive fluid pressure changes into Second apply fluid pressure at the orifices.

Fourth Clutch

Fourth clutch pressure leaves the 3-4 shift valve and seats the #10 checkball. This causes the fluid to flow through an orifice, through the case into the fourth clutch housing, and applies the fourth clutch. During the fourth clutch piston stroke, the transmission shifts into fourth gear.

Third Clutch Accumulator

Third clutch fluid pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and accumulator fluid pressure.

Fourth Clutch Accumulator

Fourth clutch pressure is also supplied to the fourth clutch accumulator, which is encased in the accumulator housing. This moves the fourth accumulator piston against the spring and the accumulator pressure, cushioning the 3-4 shift.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve

The PCM energizes the TCC PWM solenoid valve, and pressure is applied to the converter clutch shift valve. The Torque Converter Clutch (TCC) is applied. The signal pressure also acts on the torque converter clutch regulator valve, which regulates the output pressure. This controls the apply and release of the TCC.

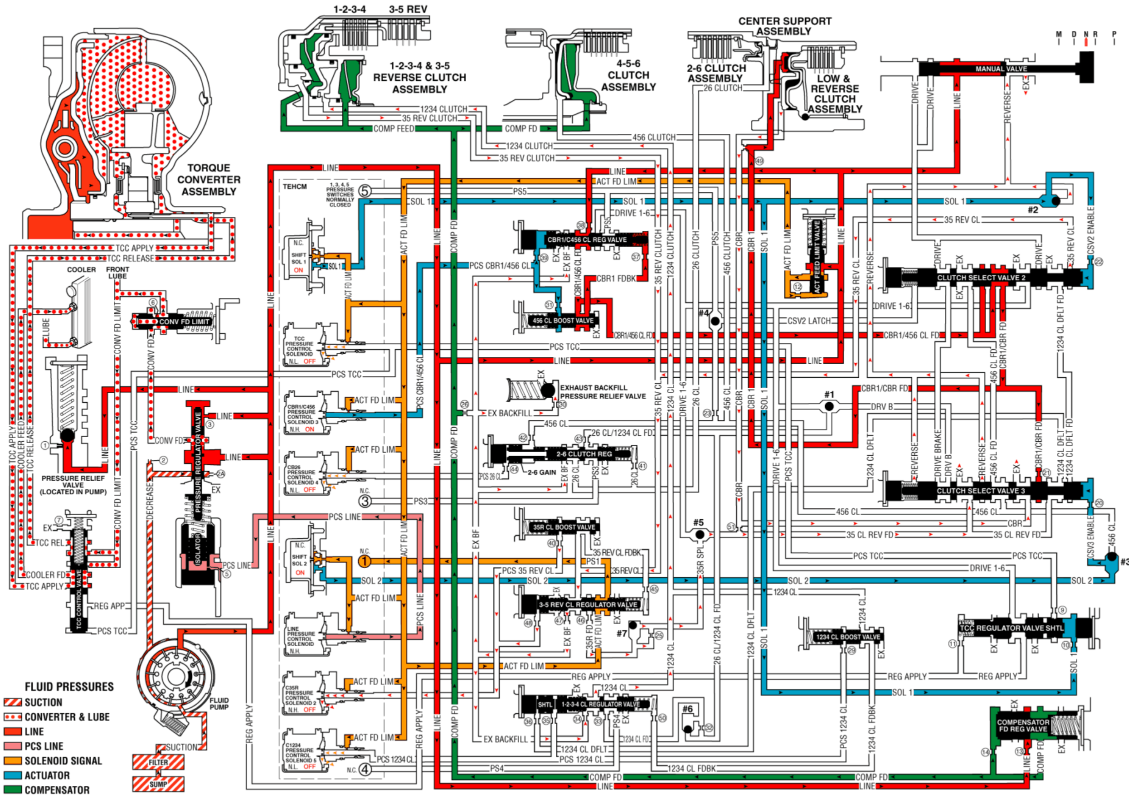


Fig. 443: Overdrive Range, Fourth Gear - TCC Applied
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, 4-3 Downshift

In order to obtain the 4-3 downshift, the PCM receives an input signal from the TP Sensor at increased throttle openings. This causes the PCM to de-energize the 1-2 Shift Solenoid (SS) Valve.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is de-energized, 1-2 signal fluid exhausts at the solenoid valve. This allows spring force to move the 3-4 shift valve to the extreme right.

3-4 Shift Valve

The fourth clutch apply pressure is shut off and a port is opened at the valve. This exhausts the fourth clutch fluid, which exits the fourth clutch and the fourth clutch accumulator. The fourth clutch releases, shifting the transmission into third gear.

Fourth Clutch

Fluid which exhausts from the fourth clutch unseats the #10 checkball. This allows for a rapid exhausting of the fourth clutch apply fluid at the 3-4 shift valve.

Fourth Clutch Accumulator

Fluid which exhausts from the fourth clutch accumulator also exhausts through the unseated #10 check valve and exhausts at the 3-4 shift valve.

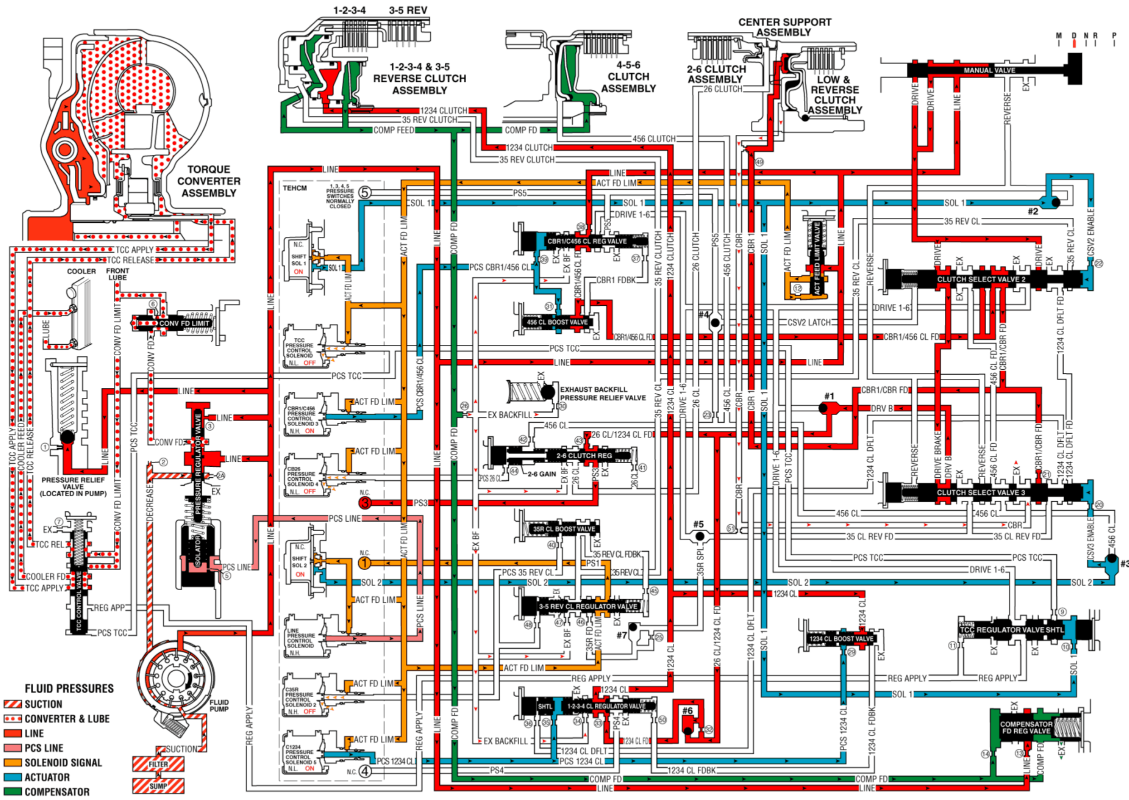


Fig. 444: Overdrive Range, 4-3 Downshift
Courtesy of GENERAL MOTORS CORP.

Overdrive Range, 3-2 Downshift

In order to obtain the 3-2 downshift, the PCM receives an input signal from the TP Sensor at increased throttle openings. This causes the PCM to de-energize the 2-3 Shift Solenoid (SS) Valve.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve de-energizes, spring force holds the 1-2 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve de-energizes, 2-3 signal fluid pressure exhausts at the solenoid. This allows a spring force to move the 2-3 shift valve to the extreme right.

2-3 Shift Valve

The third clutch feed pressure from the 2-3 shift valve is shut off and an exhaust port is opened at the 2-3 shift valve. This exhausts the third clutch fluid as the fluid exits the third clutch accumulator. This causes the direct clutch to release, shifting the transmission into second gear.

Direct Clutch

Exhausting third clutch fluid unseats the #8 checkball. This allows for a rapid exhausting of the third clutch apply fluid at the 2-3 shift valve.

Third Clutch Accumulator

As fluid exhausts from the third clutch accumulator, fluid also exhausts through the unseated #8 check valve and exhausts at the 2-3 shift valve.

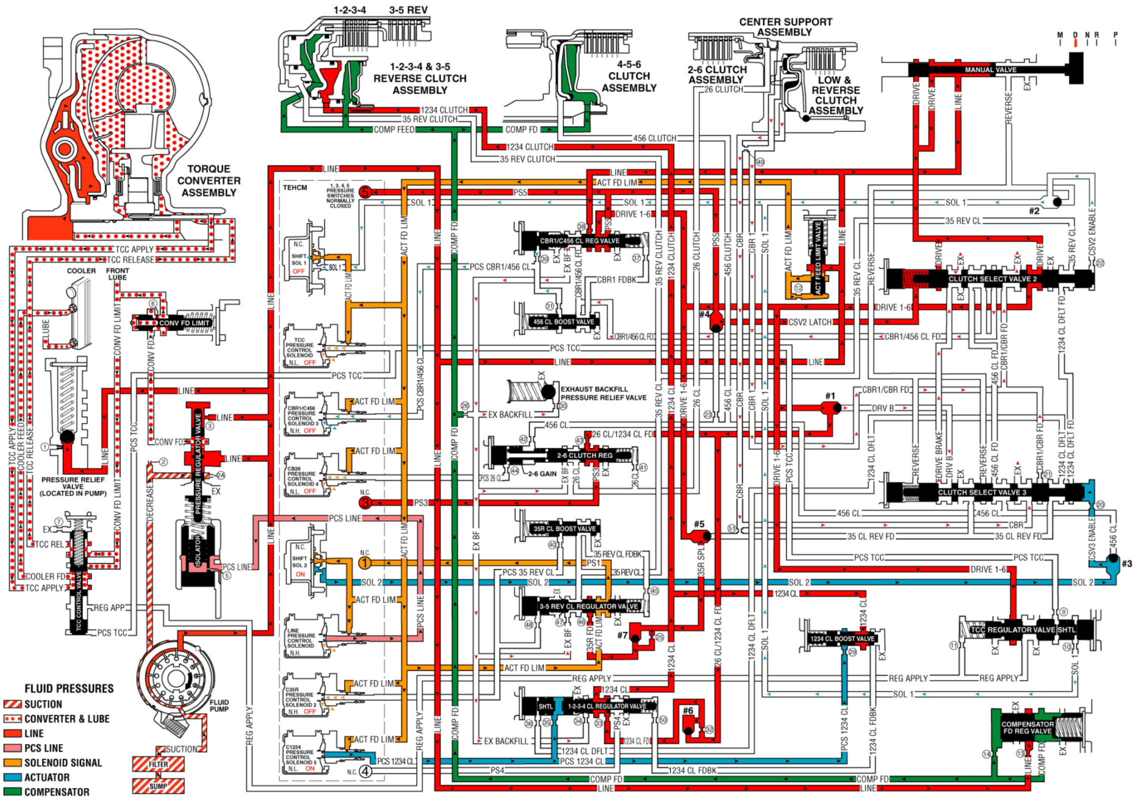


Fig. 445: Overdrive Range, 3-2 Downshift
Courtesy of GENERAL MOTORS CORP.

Manual Third Gear

Manual Third can be used in order to increase the performance of the vehicle by allowing higher engine RPM for more torque. Manual Third will also provide vehicle engine compression braking when descending slight grades. Manual Third can be selected at any vehicle speed. The transmission will downshift into third gear at any vehicle speed.

Manual Valve

In the Manual Third range, line pressure from the pressure regulator valve is converted into PRND43, Drive, and D321 pressures. The PRND43 fluid pressure is directed to the TFP manual valve position switch and to the manual 2-1 band servo. The Drive fluid pressure is directed to the TFP manual valve position switch, the forward clutch, the 1-2 shift valve, and the accumulator valve. The D321 fluid pressure is directed to the #1 checkball and to the overrun clutch.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Drive and PRND43 fluid pressures from the manual valve are directed to the DR and the PRND43 switches on the TFP manual valve position switch. This sends a signal to the PCM that the transmission is in manual third.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve de-energizes, 1-2 signal fluid pressure exhausts through the solenoid. This allows spring pressure to move the 3-4 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve energizes, the 2-3 signal fluid pressure moves the 2-3 shift valve against the spring force to the extreme left.

1-2 Shift Valve

Spring pressure and 2-3 signal fluid hold the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve is changed into 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, the TCC PWM solenoid valve, and the intermediate (second) clutch.

2-3 Shift Valve

The 2-3 fluid pressure from the 1-2 shift valve is changed into Third Clutch fluid pressure at the 2-3 shift valve. This fluid seats the #8 checkball, causing the fluid to flow through an orifice, and toward the third accumulator. Third clutch fluid pressure also seats the #11 checkball, causing the fluid to flow through an orifice and toward the third clutch. Third clutch fluid pressure changes into Third/Reverse fluid pressure at the orifice.

Low and Reverse Band Servo

Second fluid pressure is supplied to the low and reverse band servo in the same manner as to the second clutch. This fluid pressure is directed to the inner piston of the low and reverse band servo, which applies the inner piston.

Manual 2-1 Band Servo

The PRND43 fluid pressure from the manual valve is directed to the manual 2-1 band servo. This pressure and the force of the spring hold the manual 2-1 band servo off.

Overrun Clutch

The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.

Forward Clutch

Drive fluid pressure from the manual valve applies the forward clutch.

Direct Clutch

Third/Reverse pressure from the #11 checkball flows through the case and into the center support in order to apply the inner piston area of the direct clutch.

Intermediate (Second) Clutch

The Intermediate (Second) Clutch is applied by second fluid pressure from the 1-2 shift valve. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball in the case, causing the fluid to flow through two orifices. The 2-3 drive fluid pressure changes to Second apply fluid pressure at the orifices. The Second apply fluid flows into the center support, which applies the intermediate (second) clutch.

Third Clutch Accumulator

Third clutch fluid pressure is also applied to the third clutch accumulator, which is encased in the accumulator housing. This moves the third accumulator piston against the spring force and the accumulator pressure, which smooths the 2-3 shift.

Torque Converter Clutch Pulse Width Modulated (TCC PWM) Solenoid Valve

When the PCM signal energizes the TCC PWM solenoid valve, the pressure shifts the converter clutch shift valve, which applies the TCC solenoid valve. The signal pressure also acts on the torque converter clutch regulator valve. This regulates the output pressure in order to control the apply and the release of the TCC.

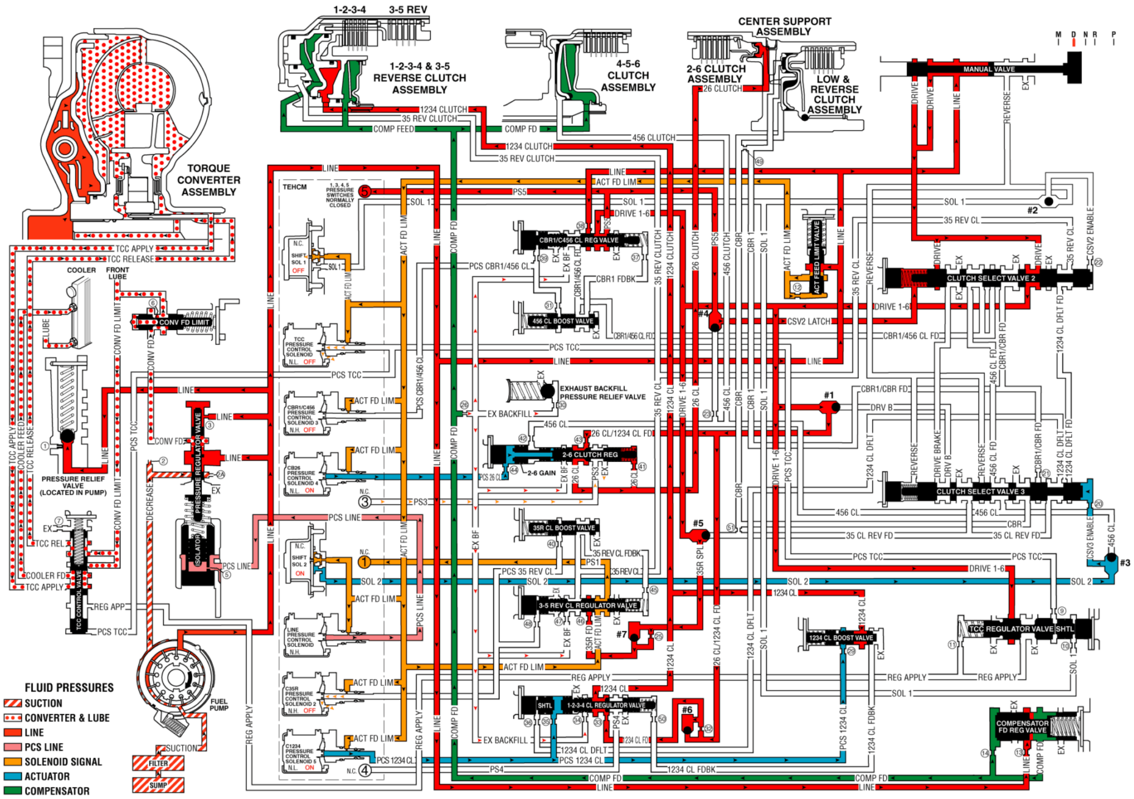


Fig. 446: Manual Third Gear - TCC Applied
Courtesy of GENERAL MOTORS CORP.

Manual Second Gear

Use the Manual 3-2 downshift in order to provide increased engine braking over Manual Third. Move the shift selector from the Manual Third position to the Manual Second position. You can select Manual Second at any vehicle speed or from any gear range in order to downshift the transmission into second gear.

Manual Valve

In the Manual Second range, line pressure from the pressure regulator valve is directed as D321, D21 and Drive fluid pressures. The D321 fluid pressure is directed to the overrun clutch. The D21 fluid pressure is directed to the 2-3 shift valve. The Drive fluid is directed to the automatic transmission fluid pressure (TFP) manual valve position switch assembly, the forward clutch, the 1-2 shift valve, and the accumulator valve. The manual valve shuts off PRND4 fluid pressure to the TFP manual valve position switch. The manual valve also shuts off PRND43 fluid pressure in order to assist the manual 2-1 band servo spring. This allows the manual 2-1 band to apply.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

The PRND43 fluid exhausts at the manual valve. The TFP manual valve position switch signals the PCM that the transmission is in Manual Second.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is de-energized, 1-2 signal pressure exhausts through the solenoid. This allows spring force to move the 1-2 shift valve to the extreme right.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal pressure exhausts through the solenoid. This forces the 2-3 shift valve to the extreme right by spring force and by D21 fluid pressure from the manual valve.

1-2 Shift Valve

Spring force holds the 1-2 shift valve to the extreme right. Drive fluid pressure from the manual valve is changed into the 2-3 drive fluid pressure at the 1-2 shift valve. This pressure is directed to the 2-3 shift valve, the TCC PWM solenoid valve, and the intermediate (second) clutch.

2-3 Shift Valve

Spring force and the D21 fluid pressure from the manual valve hold the 2-3 shift valve to the extreme right. The 2-3 drive pressure from the 1-2 shift valve changes into Front Band Apply (FBA) and is directed to the manual 2-1 band servo.

3-4 Shift Valve

Spring force holds the 3-4 shift valve to the extreme right.

Manual 2-1 Band Servo

Front Band Apply (FBA) fluid pressure from the 2-3 shift valve seats the #3 checkball. This causes the fluid to flow through an orifice and into the manual 2-1 band servo piston housing, which applies the manual 2-1 band servo and band.

Forward Clutch

Drive fluid pressure from the manual valve, applies the forward clutch.

Intermediate (Second) Clutch

The Intermediate (Second) Clutch is applied by second fluid pressure from the 1-2 shift valve. The 2-3 drive fluid pressure from the 1-2 shift valve seats the #4 checkball in the case, causing the fluid to flow through two orifices. The 2-3 drive fluid pressure changes to Second apply fluid pressure at the orifices. The Second apply fluid flows into the center support, which applies the intermediate (second) clutch.

Overrun Clutch

The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.

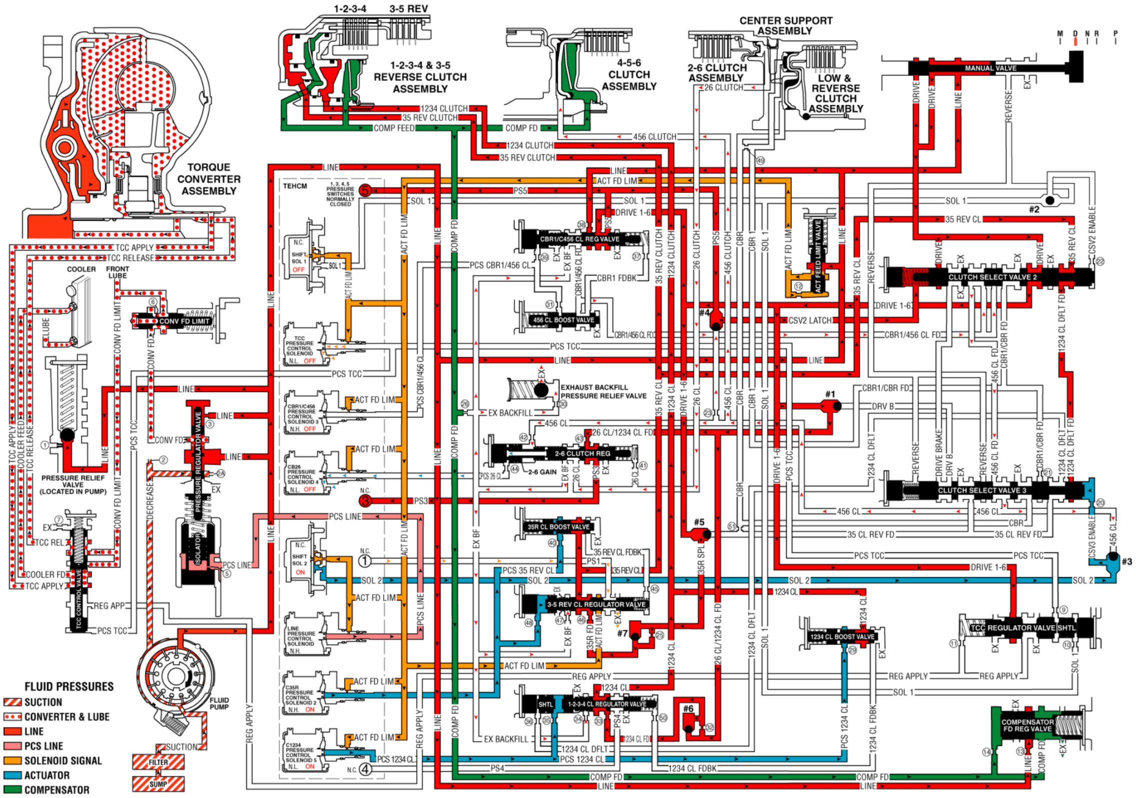


Fig. 447: Manual Second Gear
Courtesy of GENERAL MOTORS CORP.

Manual First Gear

Use Manual First for maximum engine braking when the car is descending steep grades. Select Manual First at any vehicle speed. However, the transmission will first operate in Manual First - Second Gear condition until the vehicle speed slows sufficiently.

Manual Valve

In the Manual First range, line pressure from the pressure regulator valve is directed as Drive, D321, D21, and Lo fluid pressures. The Drive fluid pressure is directed to the automatic transmission fluid pressure (TFP) manual valve position switch assembly, the forward clutch, the 1-2 shift valve, and the accumulator valve. The D321 fluid pressure is directed to the overrun clutch. The D21 fluid pressure is directed to the 2-3 shift valve. The Lo fluid pressure is directed to the TFP manual valve position switch, accumulator valve, and the low reverse band servo.

Automatic Transmission Fluid Pressure (TFP) Manual Valve Position Switch Assembly

Lo fluid pressure from the manual valve is directed to the Lo pressure switch on the TFP manual valve position switch. This sends a signal to the Powertrain Control Module (PCM) that the transmission is in Manual First. Drive fluid pressure is also supplied to the TFP manual valve position switch.

1-2 Shift Solenoid (1-2 SS) Valve

When the 1-2 SS valve is energized, 1-2 signal fluid pressure forces the 1-2 and the 3-4 shift valves to the extreme left.

2-3 Shift Solenoid (2-3 SS) Valve

When the 2-3 SS valve is de-energized, 2-3 signal fluid pressure exhausts through the solenoid.

1-2 Shift Valve

1-2 signal fluid pressure holds the 1-2 shift valve to the extreme left. The actuator feed and the drive pressures supplied to the 1-2 shift valve are blocked.

2-3 Shift Valve

Spring pressure and the D21 fluid pressure from the manual valve hold the 2-3 Shift Valve to the extreme right.

3-4 Shift Valve

1-2 signal fluid pressure forces the 3-4 shift valve to the extreme left.

Low and Reverse Band Servo

Low fluid pressure from the manual valve is directed to the #7 checkball and to the low and reverse band servo, which applies the low and reverse band. Low fluid pressure changes to Rear Band Apply (RBA) fluid pressure at the checkball.

Forward Clutch

Drive fluid pressure from the manual valve, applies the forward clutch.

Overrun Clutch

The D321 fluid pressure from the manual valve seats the #1 checkball in the case. This causes the fluid to flow through an orifice, where the D321 fluid pressure changes into overrun fluid pressure. The overrun fluid pressure flows through the case and the pump housing, and into the overrun clutch housing, which applies the overrun clutch. The overdrive roller clutch becomes ineffective and provides vehicle engine compression braking.

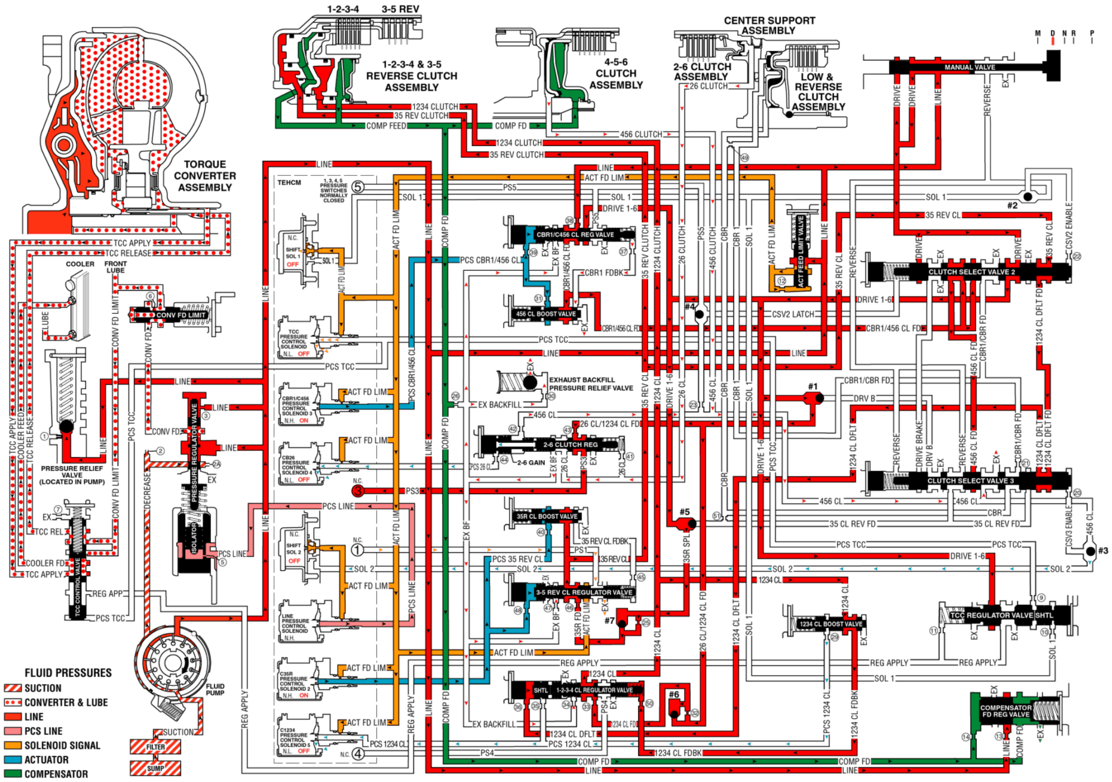


Fig. 448: Manual First Gear
Courtesy of GENERAL MOTORS CORP.

FLUID PASSAGES

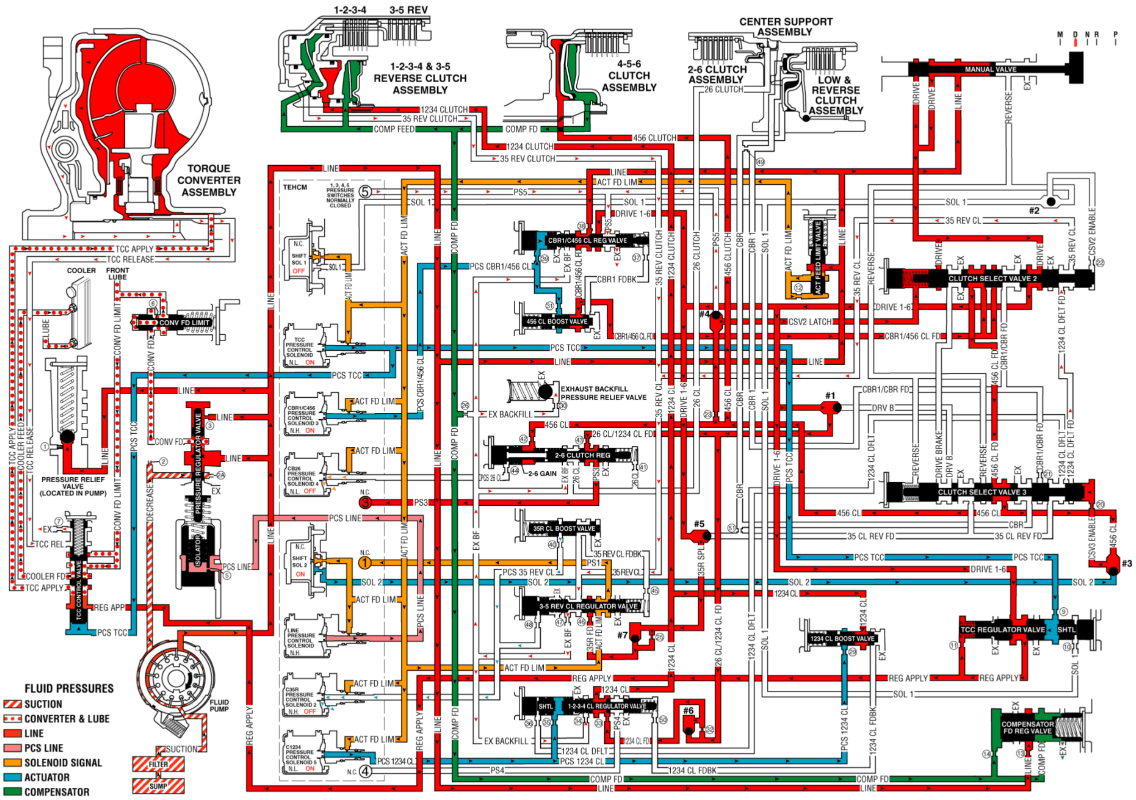


Fig. 449: Pump Body Fluid Passages (Pump Cover Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
1	Suction
1	Suction
2	Line
2	Line
2	Line
2	Line
2	Line
2	Line
2	Line
3	Regulated Apply
3	Regulated Apply
7	Converter Feed
7	Converter Feed
8	Regulated Converter Feed
8	Regulated Converter Feed
8	Regulated Converter Feed

9	TCC Enable
9	TCC Enable
10	Converter Release
11	Converter Apply/Return
12	Cooler
12	Cooler
12	Cooler
14	Torque Signal
14	Torque Signal
29	Pump Seal Drainback
29	Pump Seal Drainback
30	TCC Signal
43	Reverse
43	Reverse
45	Exhaust
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
48	Vent
48	Vent
49	Front Lube

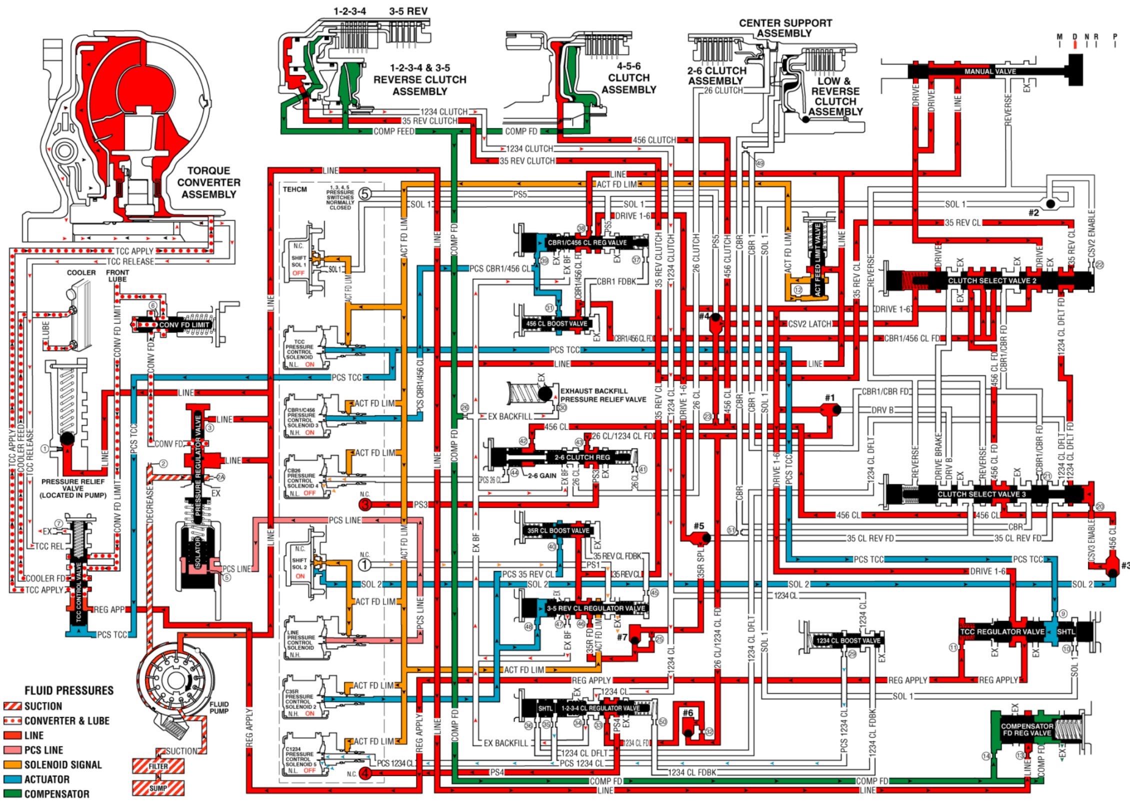


Fig. 450: Pump Cover Fluid Passages (Pump Body Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
1	Suction
1	Suction
2	Line
2	Line
2	Line
2	Line
2	Line
2	Line
3	Regulated Apply
3	Regulated Apply
3	Regulated Apply
7	Converter Feed
7	Converter Feed
7	Converter Feed
8	Regulated Converter Feed
8	Regulated Converter Feed
8	Regulated Converter Feed

8	Regulated Converter Feed
9	TCC Enable
9	TCC Enable
10	Converter Release
10	Converter Release
11	Converter Apply/Return
11	Converter Apply/Return
12	Cooler
12	Cooler
14	Torque Signal
14	Torque Signal
19	Drive
29	Pump Seal Drainback
30	TCC Signal
30	TCC Signal
40	Overrun Clutch
43	Reverse
43	Reverse
43	Reverse
45	Exhaust
45	Exhaust
47	Void
47	Void
48	Vent
48	Vent
48	Vent
49	Front Lube
208	Plug, Orificed Cup
236	Plug, Orificed Cup
237	Plug, Orificed Cup

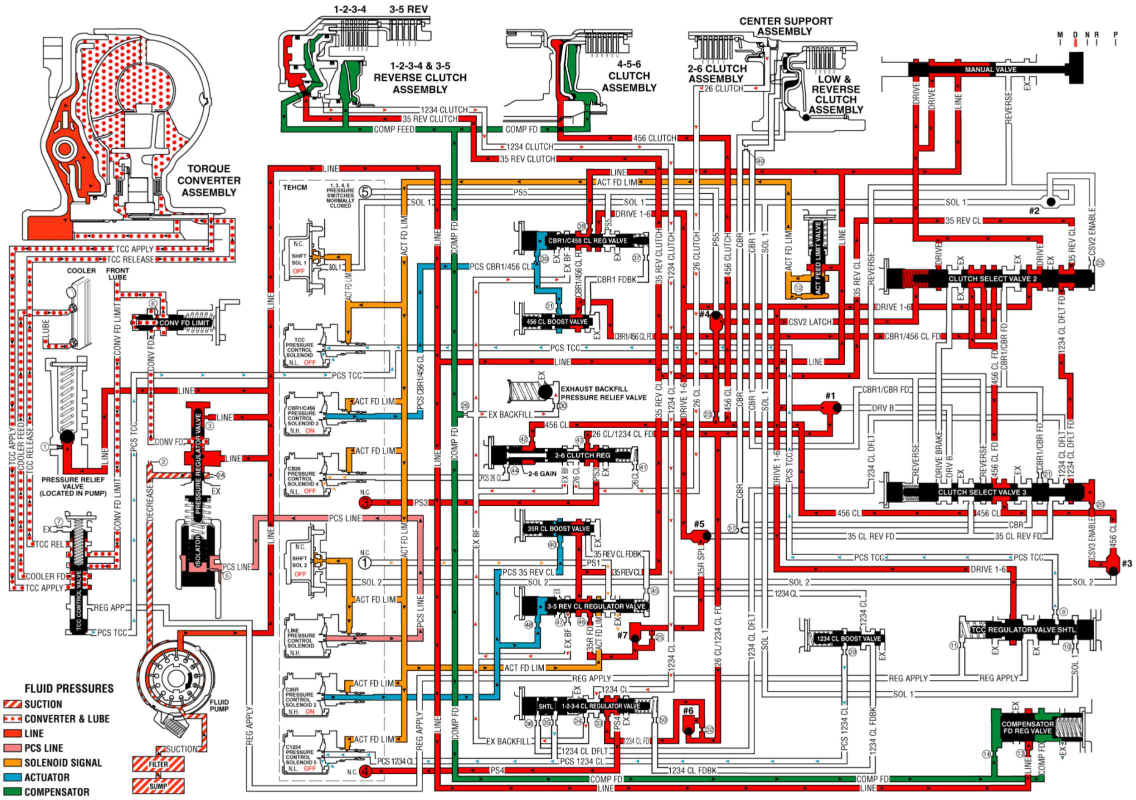


Fig. 451: Pump Cover Fluid Passages (Case Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
2	Line
2	Line
3	Regulated Apply
12	Cooler
14	Torque Signal
19	Drive
19	Drive
29	Pump Seal Drainback
30	TCC Signal
40	Overrun Clutch
40	Overrun Clutch
43	Reverse
45	Exhaust
45	Exhaust
45	Exhaust
45	Exhaust
47	Void

48	Vent
49	Front Lube
49	Front Lube
210	Plug, Orificed Cup
239	Shield, Vent

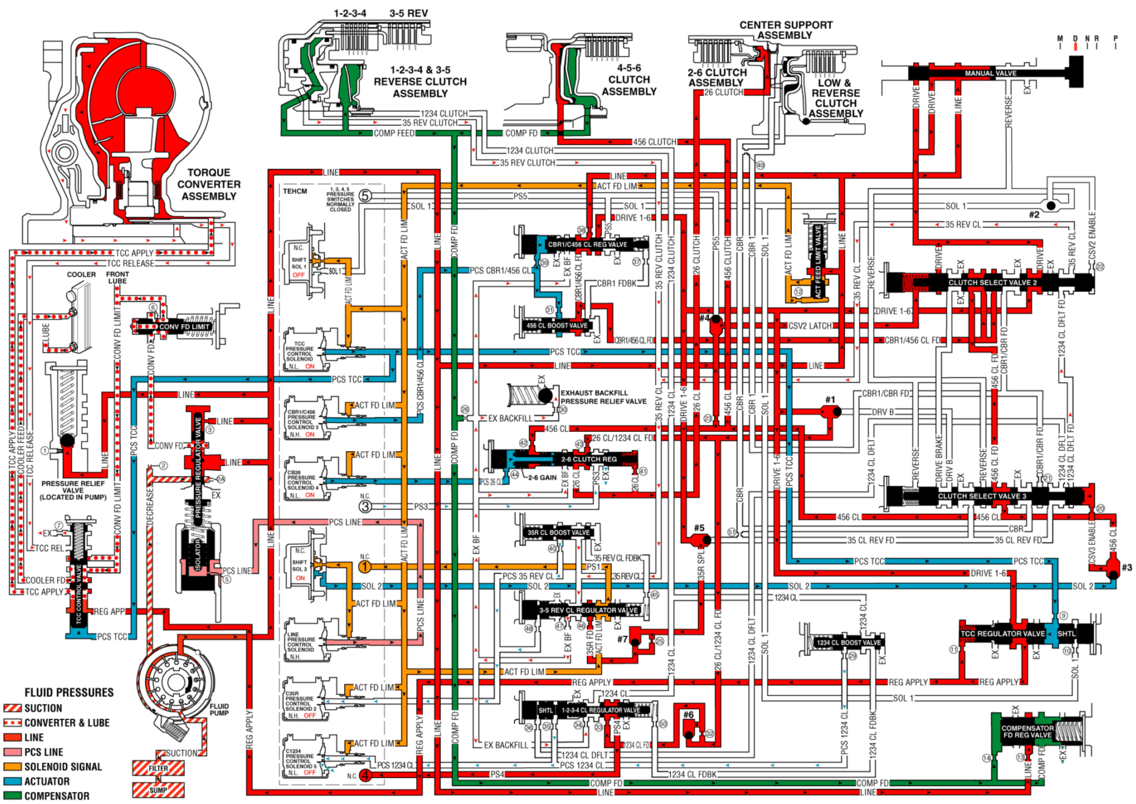


Fig. 452: Case Fluid Passages (Pump Cover Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
2	Line
3	Regulated Apply
8	Connector, Front Oil Cooler Pipe
9	Pipe, Vent
12	Cooler
12	Cooler
13	Center Lube
14	Torque Signal
19	Drive
30	TCC Signal

40	Overrun Clutch
43	Reverse
48	Vent
48	Vent
90	Connector, Rear Oil Cooler Pipe

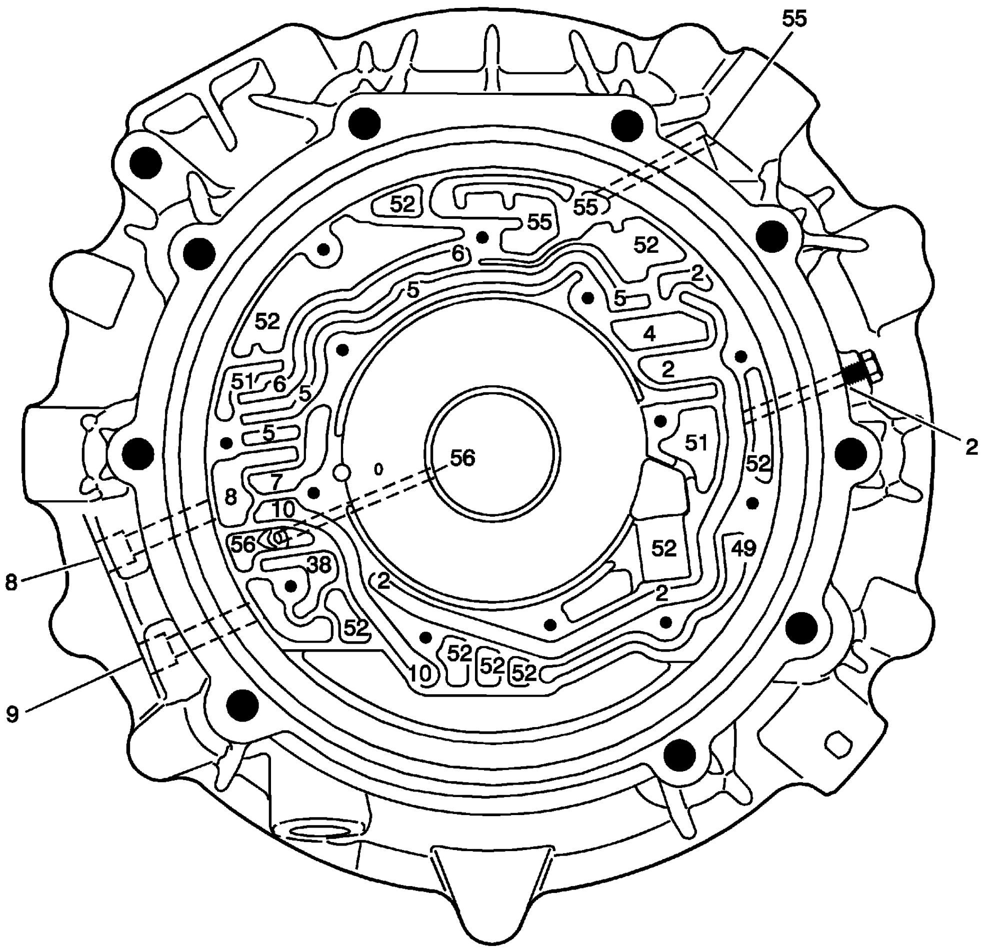


Fig. 453: Case Fluid Passages (Control Valve Body Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
1	Suction
2	Line
2	Line
2	Line
2	Line
2	Line

3	Regulated Apply
3	Regulated Apply
3	Regulated Apply
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
12	Cooler
12	Cooler
13	Center Lube
14	Torque Signal
14	Torque Signal
14	Torque Signal
16	PRN (Park Reverse Neutral)
16	PRN (Park Reverse Neutral)
17	PRND43
17	PRND43
18	PRND4
19	Drive
19	Drive
19	Drive
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
22	2-3 Signal
22	2-3 Signal
23	2-3 Drive
23	2-3 Drive
24	2nd Clutch
24	2nd Clutch
24	2nd Clutch
25	Filtered 2-3 Drive
26	Accumulator
26	Accumulator
26	Accumulator
28	2nd Accumulator
28	2nd Accumulator
30	TCC Signal
30	TCC Signal
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
[illegible]	

	3rd Accumulator
33	3rd Clutch Feed
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
35	3rd/Reverse
36	4th Clutch Feed
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
39	D321
39	D321
39	D321
40	Overrun Clutch
40	Overrun Clutch
40	Overrun Clutch
41	D21
41	D21
42	Lo
42	Lo
42	Lo
42	Lo
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
44	RBA (Rear Band Apply)
44	RBA (Rear Band Apply)
45	Exhaust
45	Exhaust
47	Void
47	Void
47	Void
47	Void
47	Void
50	Rear Lube

	Connector, Rear Oil Cooler Pipe

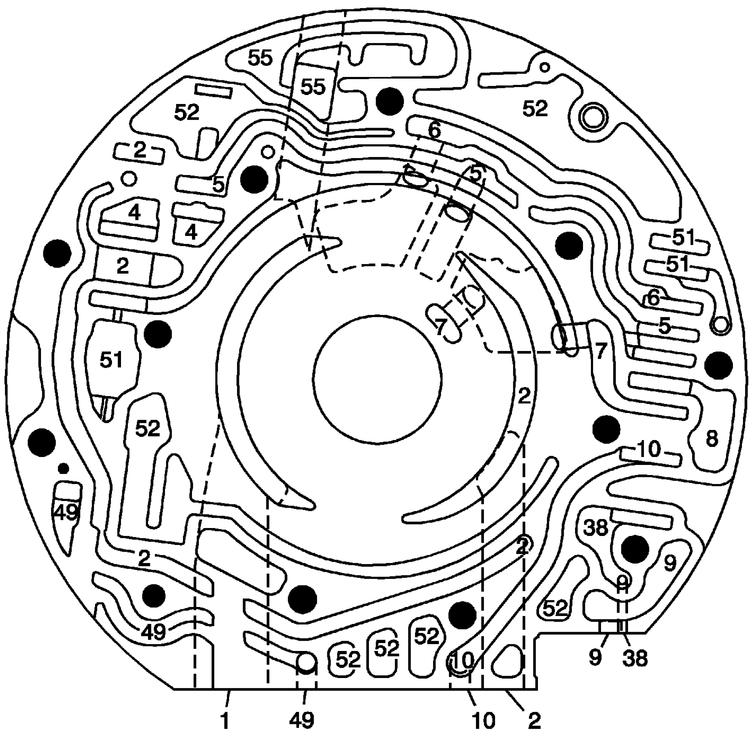


Fig. 454: Spacer Plate to Case Gasket with Accumulator Housing Gasket
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
2	Line
2	Line
2	Line
3	Regulated Apply
3	Regulated Apply
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
16	PRN (Park Reverse Neutral)

16	PRN (Park Reverse Neutral)
17	PRND43
18	PRND4
18	PRND4
19	Drive
19	Drive
19	Drive
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
22	2-3 Signal
22	2-3 Signal
23	2-3 Drive
23	2-3 Drive
24	2nd Clutch
24	2nd Clutch
25	Filtered 2-3 Drive
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
28	2nd Accumulator
30	TCC Signal
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
32	3rd Accumulator
33	3rd Clutch Feed
33	3rd Clutch Feed
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
35	3rd/Reverse
36	4th Clutch Feed

	4th Clutch Feed
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
38	4th Accumulator
39	D321
39	D321
39	D321
39	D321
40	Overrun Clutch
41	D21
41	D21
42	Lo
42	Lo
42	Lo
42	Lo
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
44	RBA (Rear Band Apply)
45	Exhaust
45	Exhaust
45	Exhaust
45	Exhaust
47	Void

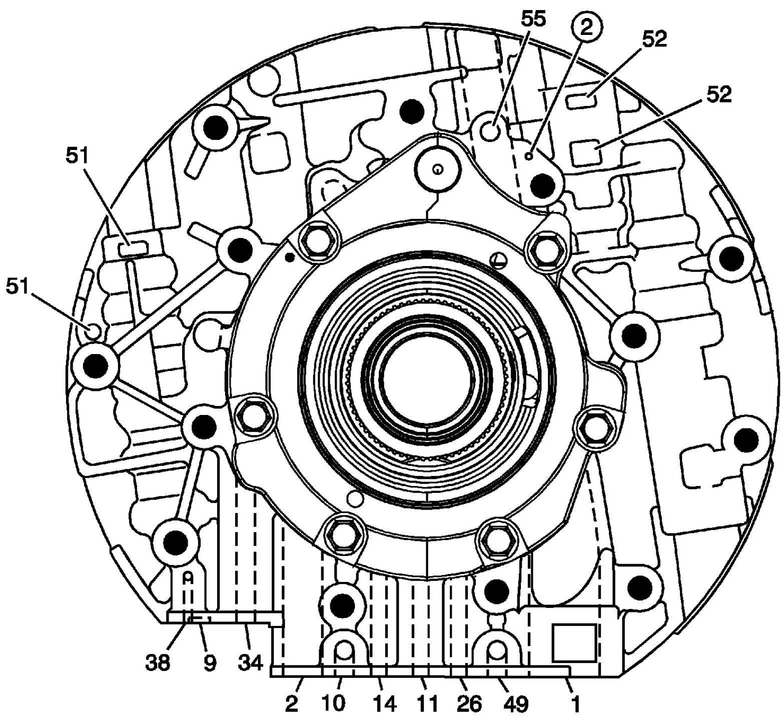


Fig. 455: Spacer Plate
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
2	Line
2	Line
2	Line
3	Regulated Apply
3	Regulated Apply
4	Orificed Regulator Apply
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
6	Orificed Actuator Feed
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
16	PRN (Park Reverse Neutral)
16	PRN (Park Reverse Neutral)

17	PRND43
18	PRND4
18	PRND4
19	Drive
19	Drive
19	Drive
19	Drive
19	Drive
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
21	1-2 Signal
22	2-3 Signal
22	2-3 Signal
22	2-3 Signal
23	2-3 Drive
23	2-3 Drive
23	2-3 Drive
24	2nd Clutch
24	2nd Clutch
24	2nd Clutch
24	2nd Clutch
25	Filtered 2-3 Drive
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
26	Accumulator
27	Orificed Accumulator
28	2nd Accumulator
28	2nd Accumulator
28	2nd Accumulator
30	TCC Signal

	FBA (Front Band Apply)
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
31	FBA (Front Band Apply)
32	3rd Accumulator
32	3rd Accumulator
32	3rd Accumulator
33	3rd Clutch Feed
33	3rd Clutch Feed
33	3rd Clutch Feed
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
35	3rd/Reverse
36	4th Clutch Feed
36	4th Clutch Feed
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
38	4th Accumulator
38	4th Accumulator
38	4th Accumulator
39	D321
39	D321
39	D321
39	D321
39	D321
40	Overrun Clutch
40	Overrun Clutch
40	Overrun Clutch
41	D21
42	Lo
42	Lo
42	Lo
42	Lo
43	Reverse

	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
44	RBA (Rear Band Apply)
45	Exhaust
45	Exhaust
45	Exhaust
45	Exhaust
46	Orificed Exhaust
46	Orificed Exhaust
47	Void

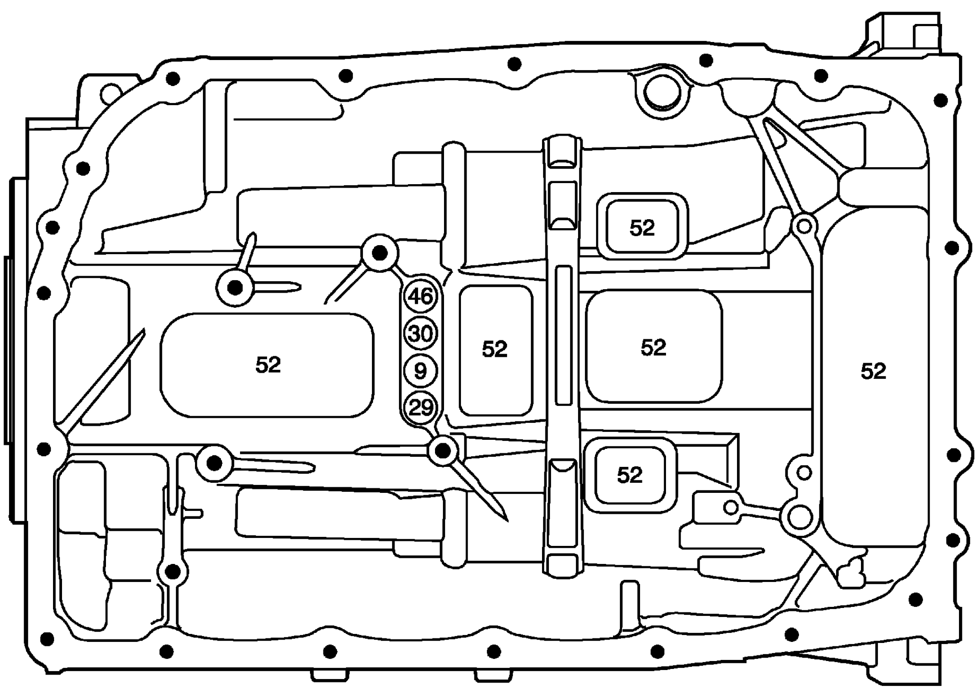


Fig. 456: Spacer Plate to Control Valve Body Gasket
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
2	Line
2	Line

2	Line
3	Regulated Apply
4	Orificed Regulator Apply
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
6	Orificed Actuator Feed
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
15	Orificed Torque Signal
16	PRN (Park Reverse Neutral)
17	PRND43
18	PRND4
18	PRND4
19	Drive
19	Drive
19	Drive
19	Drive
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
21	1-2 Signal
22	2-3 Signal
22	2-3 Signal
22	2-3 Signal
23	2-3 Drive
24	2nd Clutch
24	2nd Clutch
25	Filtered 2-3 Drive
26	Accumulator
26	Accumulator
26	Accumulator
27	Orificed Accumulator
28	2nd Accumulator
28	2nd Accumulator
30	TCC Signal
31	FBA (Front Band Apply)
31	

	FBA (Front Band Apply)
31	FBA (Front Band Apply)
32	3rd Accumulator
32	3rd Accumulator
33	3rd Clutch Feed
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
35	3rd/Reverse
36	4th Clutch Feed
36	4th Clutch Feed
37	4th Clutch
37	4th Clutch
37	4th Clutch
37	4th Clutch
38	4th Accumulator
38	4th Accumulator
39	D321
39	D321
39	D321
40	Overrun Clutch
40	Overrun Clutch
41	D21
41	D21
41	D21
42	Lo
42	Lo
42	Lo
42	Lo
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
44	RBA (Rear Band Apply)
45	Exhaust
45	Exhaust
46	Orificed Exhaust

	Orificed Exhaust
47	Void
47	Void

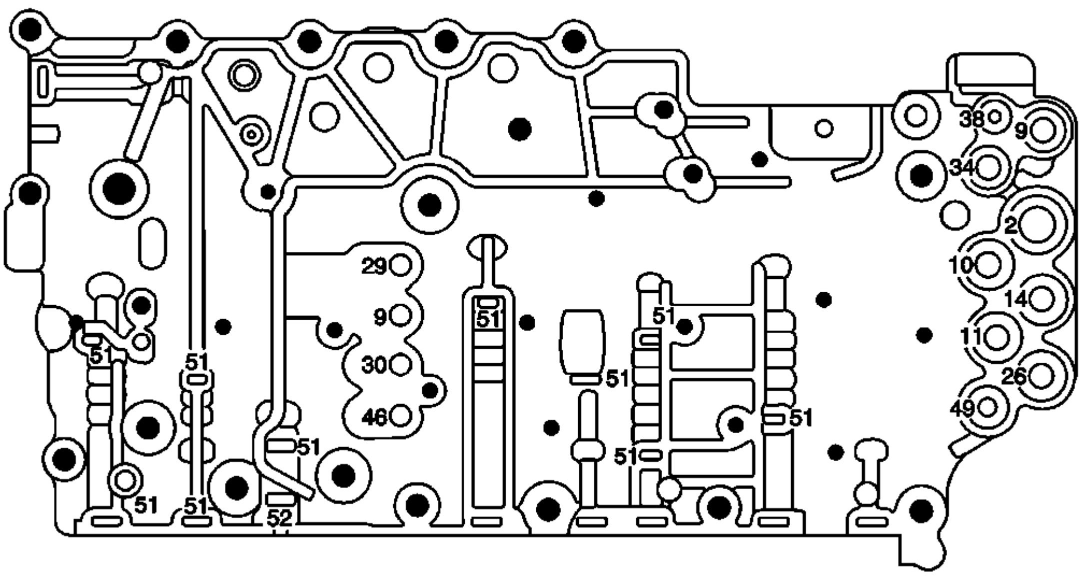


Fig. 457: Control Valve Body Fluid Passages (Case Side)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
2	Line
2	Line
2	Line
2	Line
2	Line
3	Regulated Apply
4	Orificed Regulator Apply
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
5	Actuator Feed
6	Orificed Actuator Feed

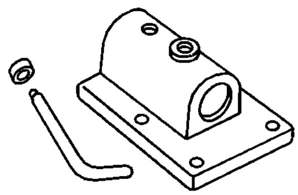
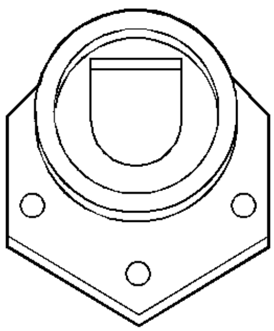
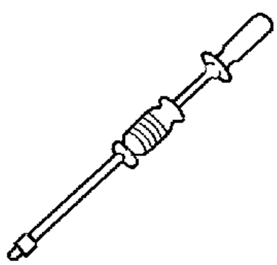
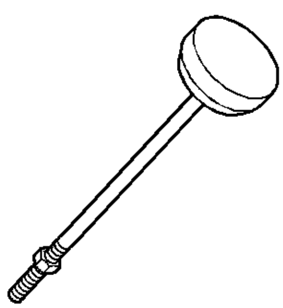
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
14	Torque Signal
16	PRN (Park Reverse Neutral)
16	PRN (Park Reverse Neutral)
17	PRND43
17	PRND43
17	PRND43
18	PRND4
18	PRND4
18	PRND4
18	PRND4
19	Drive
19	Drive
19	Drive
19	Drive
19	Drive
20	Filtered Actuator Feed
20	Filtered Actuator Feed
20	Filtered Actuator Feed
21	1-2 Signal
21	1-2 Signal
21	1-2 Signal
22	2-3 Signal
22	2-3 Signal
22	2-3 Signal
22	2-3 Signal
23	2-3 Drive
23	2-3 Drive
24	2nd Clutch
25	Filtered 2-3 Drive
25	Filtered 2-3 Drive
26	Accumulator
26	Accumulator
26	Accumulator
27	Orificed Accumulator
28	2nd Accumulator
30	TCC Signal
30	TCC Signal
31	

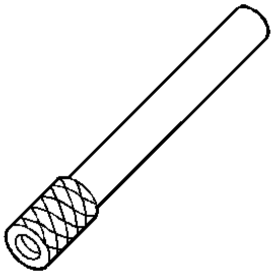
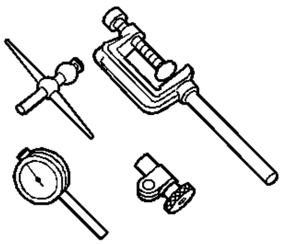
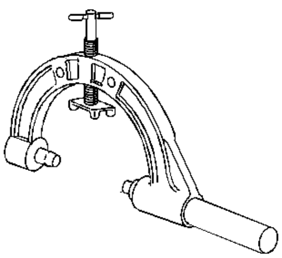
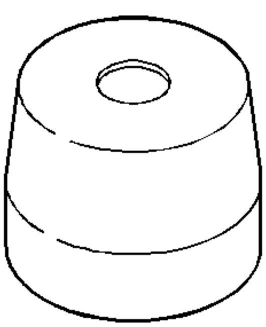
	FBA (Front Band Apply)
31	FBA (Front Band Apply)
32	3rd Accumulator
32	3rd Accumulator
33	3rd Clutch Feed
34	3rd Clutch
34	3rd Clutch
34	3rd Clutch
35	3rd/Reverse
36	4th Clutch Feed
36	4th Clutch Feed
37	4th Clutch
37	4th Clutch
37	4th Clutch
38	4th Accumulator
38	4th Accumulator
39	D321
39	D321
40	Overrun Clutch
40	Overrun Clutch
41	D21
41	D21
41	D21
42	Lo
42	Lo
42	Lo
42	Lo
42	Lo
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
43	Reverse
44	RBA (Rear Band Apply)
45	Exhaust
45	Exhaust
45	Exhaust
45	Exhaust

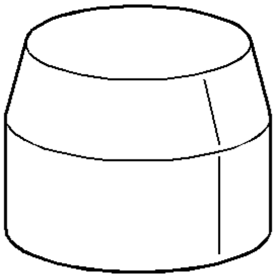
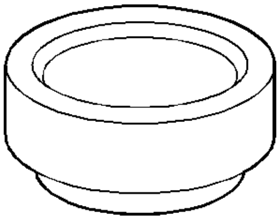
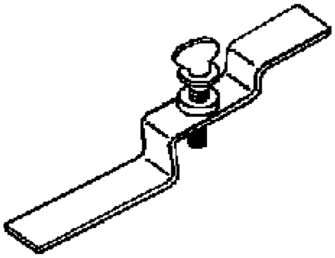
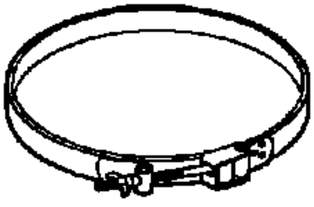
	Exhaust
45	Exhaust
45	Exhaust
46	Orificed Exhaust
46	Orificed Exhaust
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
47	Void
50	Rear Lube

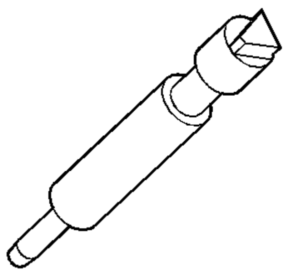
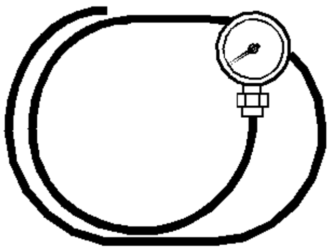
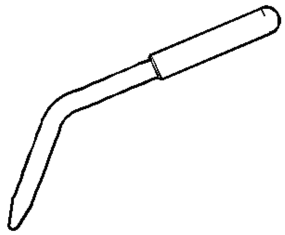
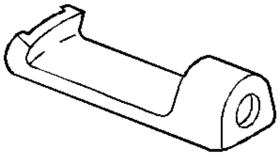
SPECIAL TOOLS

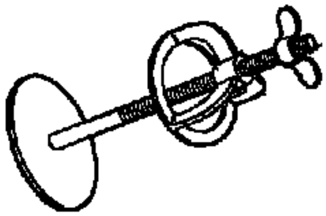
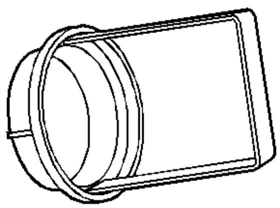
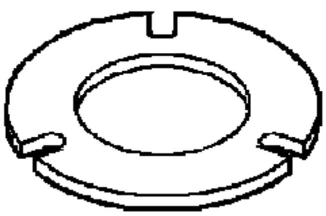
Illustration	Tool Number/Description

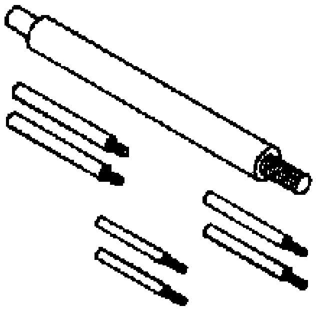
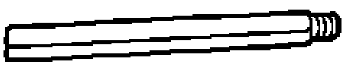
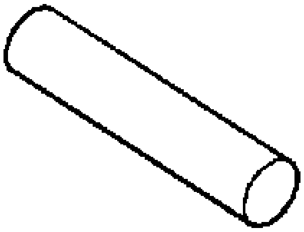
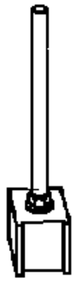
	J 3289-20 Holding Fixture Base Assembly
	J 6116-A Rear Gear Holding Fixture
	J 6125-1B Slide Hammer
	J 6129 Handle

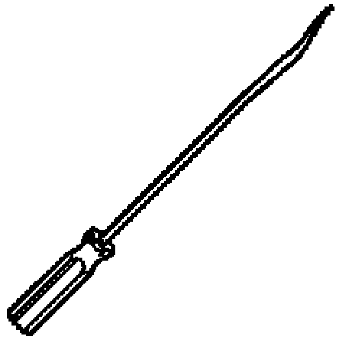
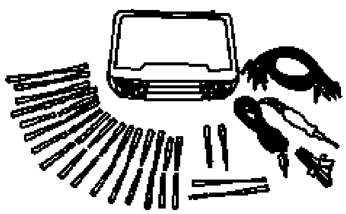
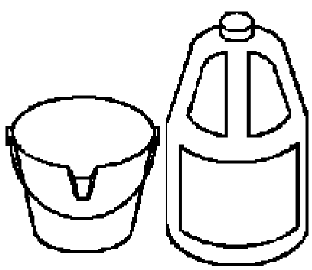
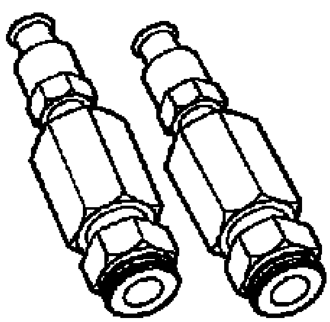
	J 7057 Dial Indicator Plunger Extension
	J 8001 Dial Indicator Set
	J 8763-02 Transmission Holding Fixture
	J 21362-1 Direct and Forward Clutch Piston and Inner Seal Protector

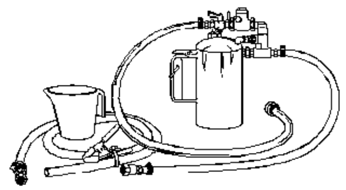
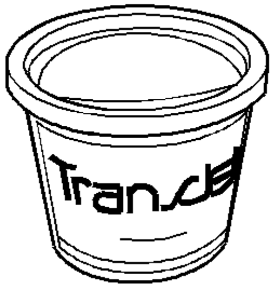
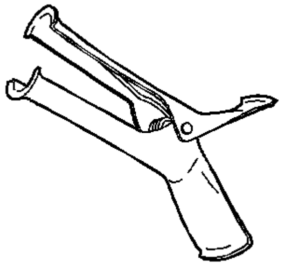
	J 21363 Intermediate Clutch Inner Seal Protector
	J 21364-A Rear Gear Holding Fixture Adapter
	J 21366 Converter Holding Strap
	J 21368 Pump Body and Cover Alignment Band
	J 21370-10

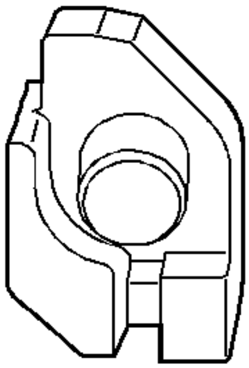
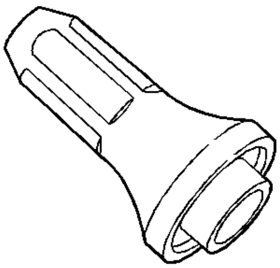
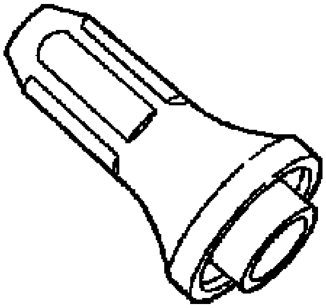
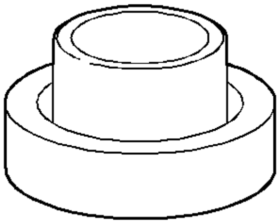
	Band Apply Pin Gauge
	J 21867 Pressure Gage
	J 23093 Center Support Alignment Tool
	J 23129 Universal Seal Remover
	J 23327 Clutch Spring Compressor

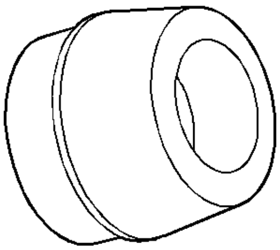
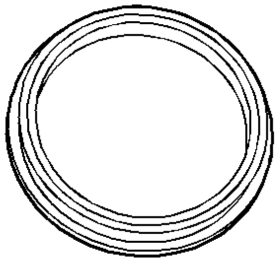
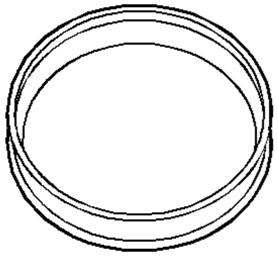
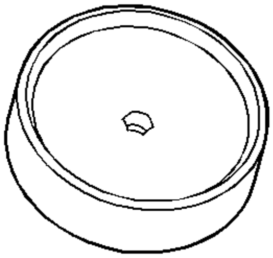
	
	J 24396 Intermediate Clutch Pack Alignment Tool
	J 25018-A Clutch Spring Compressor Adapter
	J 25025 Guide Pins
	J 25025-B Dial Indicator Post and Guide Pin Set

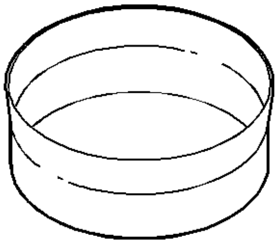
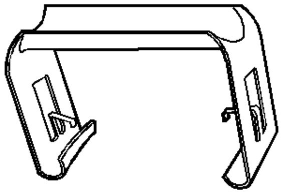
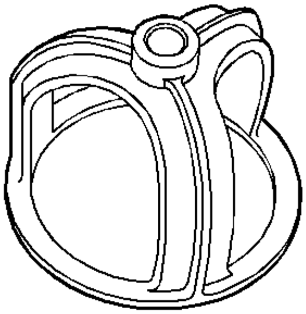
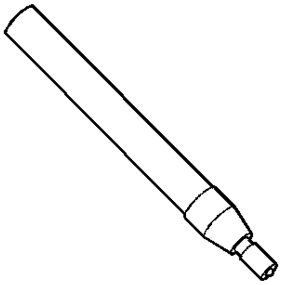
	
	J 25025-1 Guide Pins
	J 25025-5 Dial Indicator Mounting Post - M6 x 1.00
	J 26900-13 Magnetic Indicator Base
	J 28585

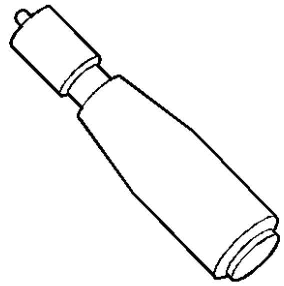
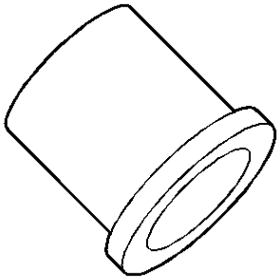
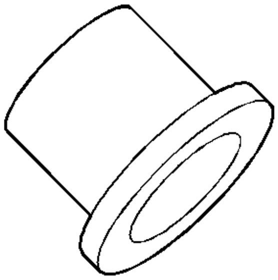
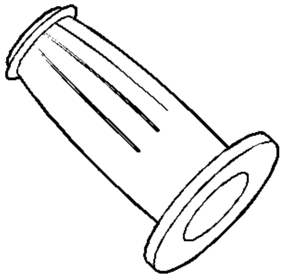
	Snap Ring Remover
	J 35616 GM-Approved Terminal Test Kit
	J 35944-22 Transmission Oil Cooler Flushing Fluid
	J 35944-200 Cooler Flush Adapters
	J 35944-A Transmission Oil Cooler and Line Flusher

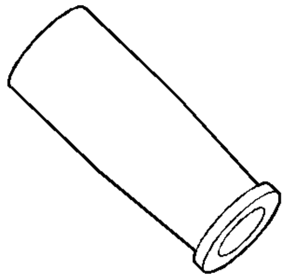
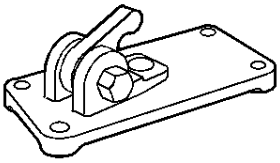
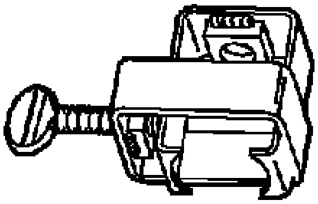
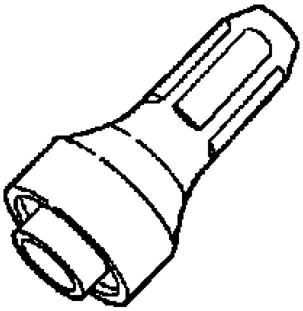
	
	J 36850 Assembly Lubricant
	J 38358-A Forward Clutch Assembly Remover/Installer
	J 38655 Holding Fixture Adapter

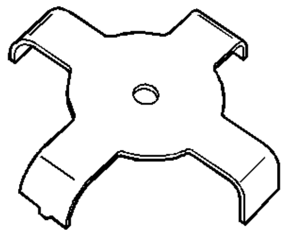
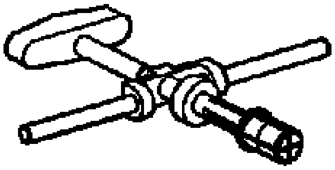
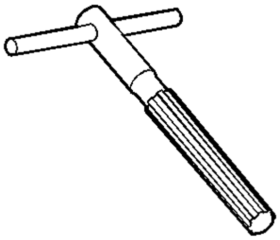
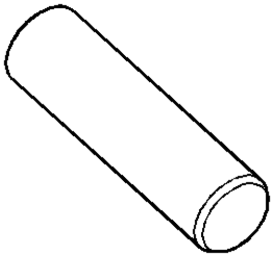
	
	J 38693 Oil Pump Seal and Rear Lube Seal Installer
	J 38694 Extension Housing Seal Installer
	J 38695 Direct Clutch Spiral Retaining Ring Installer

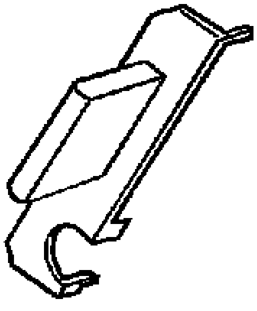
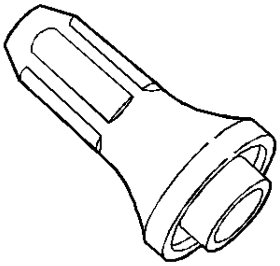
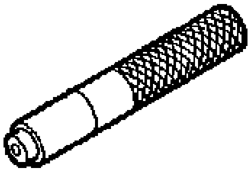
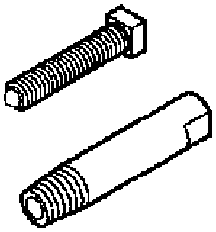
	J 38729 Overrun Clutch Piston Seal Protector
	J 38731-1 Fourth Clutch Piston and Housing Seal Protector
	J 38731-2 Fourth Clutch Piston and Housing Seal Protector
	J 38731-3 Fourth Clutch Piston and Housing Seal Spacer

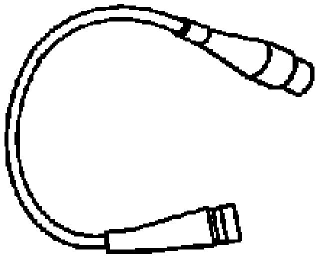
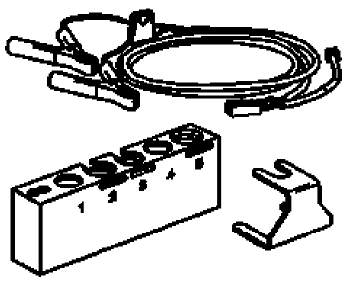
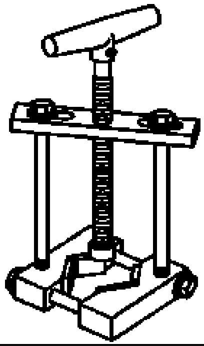
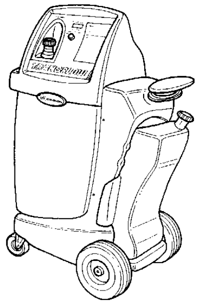
	J 38732-1 Direct and Forward Clutch Piston and Outer Seal Protector
	J 38733 Direct Clutch Assembly Remover/Installer
	J 38734 Intermediate Spring Compressor Adapter
	J 38736-1 Turbine Shaft Seal Installer
	J 38736-2

	Turbine Shaft Seal Installer
	J 38736-3 Turbine Shaft Seal Sizer
	J 38736-4 Turbine Shaft Seal Sizer
	J 38736-5 Turbine Shaft Seal Pusher

	J 38736-6 Turbine Shaft Seal Pusher
	J 38737 Band Apply Pin Checking Tool
	J 38868 Output Shaft Assembly Remover and Installer
	J 38869 Rear Extension Seal Installer
	J 38882 Fourth Clutch Spring and Retainer Assembly Adapter

	
	J 39195 Converter End Play Check Tool
	J 39919-1 Center Support Thread Reamer
	J 39919-2 Center Support Gage Pin
	J 41364-A

	Park/Neutral Switch Aligner
	J 41505 Output Shaft Seal Installer
	J 43909 Selector Shaft Seal Installer
	J 43911 Selector Shaft Seal Remover
	J 44152 Jumper Harness (20 pins)

	
	J 44246 Solenoid Testing Kit
	J 45053 Universal Clamp Press
	J 45096 Transmission Oil Cooling System Flush and Flow Test Tool

