2008 TRANSMISSION

Automatic Transmission - 6L50/6L80/6L90 - Cab & Chassis Sierra, Cab & Chassis Silverado, Sierra & Silverado

SYMPTOMS - AUTOMATIC TRANSMISSION

IMPORTANT: Use the symptom tables only if the following conditions are met:

- **Refer to Diagnostic Starting Point - Vehicle .**
- **There are no DTCs set.**
- **The control modules can communicate via the serial data link.**
- **Review the system operation in order to familiarize yourself with the system functions. Refer to Transmission General Description and Transmission Component and System Description.**

VISUAL/PHYSICAL INSPECTION

Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

INTERMITTENT

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

SYMPTOM LIST

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- Fluid Diagnosis
  - **Transmission Fluid Check**
  - **Fluid Pressure High or Low**
  - **Automatic Transmission Fluid Leaks**
  - **Fluid Leak Diagnosis**
- Noise and Vibration Diagnosis

- **Whine/Growl Noise That Changes with Vehicle Speed**
- **Noise in First or Reverse Gear**
- **Noise in First, Second, Third, Fourth, Fifth, or Reverse Gear**
- **Noise in First, Second, Sixth, or Reverse Gear**
- **Noise in Second or Sixth Gear**
- **Noise During 3-4 or 4-3 Shifts**
- **Noise in Fourth, Fifth, or Sixth Gear**
- **Vibration**
- **Vibration in Second, Third, Fourth, Fifth, or Sixth Gear**
- **Flexplate/Torque Converter Vibration Test**
- **Noise and Vibration Analysis**

- Range Performance Diagnosis
  - **No Park or Drive**
  - **No Drive in All Ranges**
  - **No Reverse Gear**
  - **No Drive or Reverse Gear**
- Shift Quality Feel Diagnosis
  - **Harsh Garage Shift**
  - **Harsh, Soft, Delayed or Slipping First or Reverse Gear**
  - **Harsh, Soft, Delayed or Slipping 1-2-3-4 Shift**
  - **Harsh, Soft, Delayed or Slipping 4-5-6 Shift**
  - **Harsh, Soft, Delayed or Slipping Third, Fifth, or Reverse Gear**
  - **Harsh, Soft, Delayed or Slipping Second or Sixth Gear**
- Shift Pattern
  - **No First Gear**
  - **No First and Reverse Gears**
  - **No First, Second, Third, and Fourth Gear**
  - **No First, Second, Third, Fourth, Fifth, or Reverse Gear**
  - **No Second and Sixth Gear**
  - **No First, Second, Sixth, or Reverse Gear**
  - **No Fourth, Fifth, and Sixth Gear**
  - **No Third, Fifth, and Reverse Gear**

- **Stuck in Second or Sixth Gear**
- **Stuck in First or Reverse Gear**

- Torque Converter Diagnosis
  - **Torque Converter Diagnosis**
  - **No Torque Converter Clutch Apply**
  - **No Torque Converter Clutch Release**
- Symptom Not Found or No Symptom Detected
  - **Transmission Fluid Check**
  - **Road Test**
  - **Line Pressure Check**

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INSPECTION

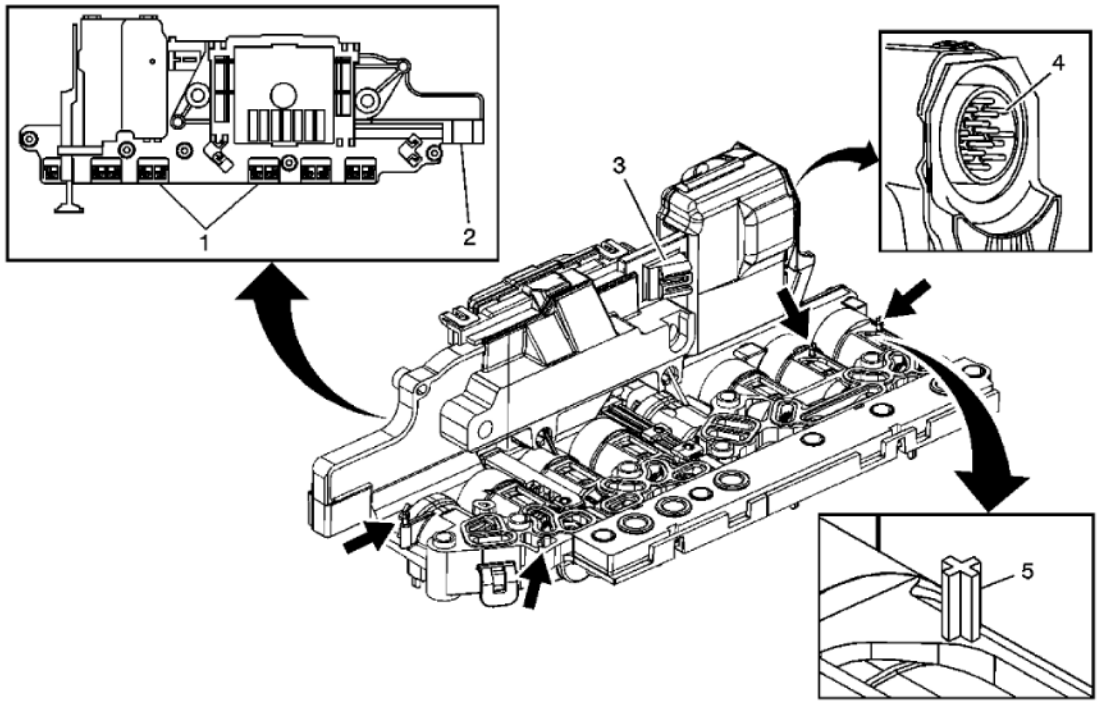


Fig. 1: Identifying Control Solenoid Valve & Transmission Control Module Assembly
Courtesy of GENERAL MOTORS CORP.

1. Inspect the control solenoid (w/body and TCM) valve assembly connectors and pins (2, 3, 4) for the following conditions:

- Damage
- Bent pins
- Debris
- Broken retaining tab
- Contamination

2. Ensure no metallic debris is inside the connectors near the terminal pins.
3. Inspect the control solenoid (w/body and TCM) valve assembly solenoid leads (1) for contamination or metallic debris.
4. Inspect the 4 control solenoid (w/body and TCM) valve assembly filter plate retaining tabs (5) for cracks and ensure proper tension when filter plate is attached.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY INPUT SHAFT SPEED/OUTPUT SHAFT SPEED INPUT TEST

Tools Required

- **J 35616** GM-Approved Terminal Test Kit
- **J 38522** Variable Signal Generator

TEST

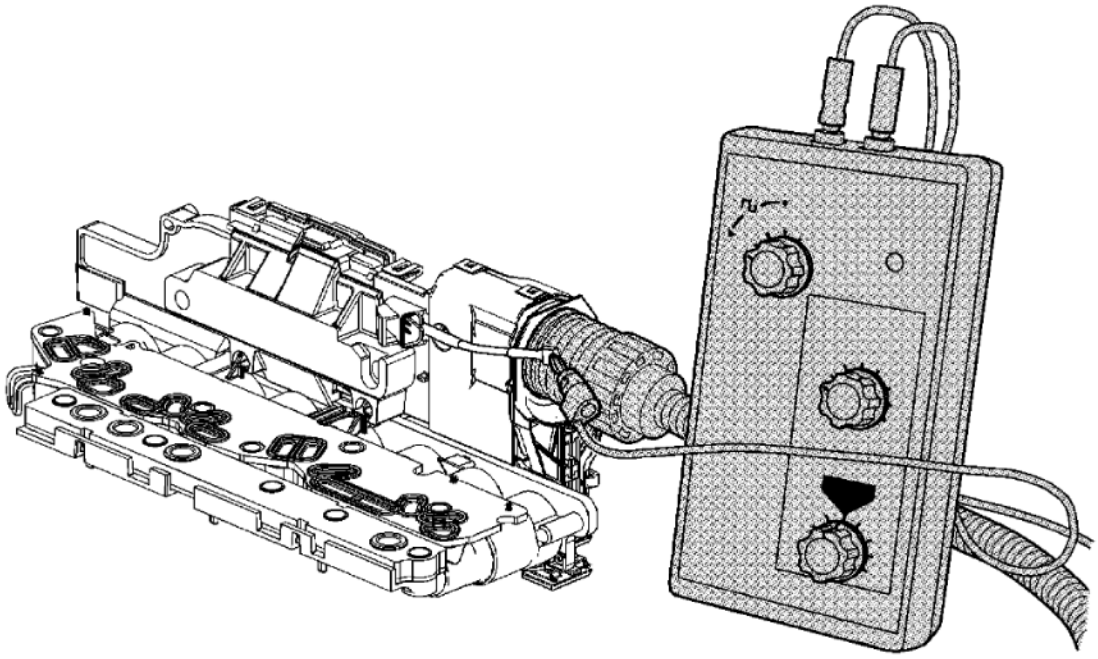


Fig. 2: Identifying J 35616 And J 38522
Courtesy of GENERAL MOTORS CORP.

The purpose of this test is to provide a simulated input/output speed sensor (ISS/OSS) signal to the control solenoid (w/body and TCM) valve assembly ISS/OSS input circuits.

1. Disconnect the ISS/OSS wiring harness connector from the control solenoid (w/body and TCM) valve assembly.
2. Using the **J 35616** , connect the **J 38522** to the affected ISS or OSS signal circuit on the control solenoid (w/body and TCM) valve assembly.
    1. Set the **J 38522** Signal to 8 volts, the Frequency to 120 and the Percent Duty Cycle to 50.
    2. Ignition On, observe either the scan tool parameter ISS Signal or OSS Signal.
    3. The signal parameter should display between 100-400 RPM.

- If the signal display is not in this range, the control solenoid (w/body and TCM) valve assembly is not reading the input signal correctly and is faulty.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY CLEANING

The control solenoid (w/body and TCM) valve assembly cleaning procedure is a specific software based routine, which resides in the TCM. This procedure is activated by the scan tool and is used to cycle the solenoids and valves in the control solenoid valve assembly in an attempt to dislodge debris and free up the valves after a performance diagnostic trouble code (DTC) has set. When the cleaning procedure is completed, the DTC enable criteria should be run again, to see if the DTC concern has been corrected.

1. Operate the transmission to achieve 70°-90°C (158°-194°F).
2. With a scan tool, select the Service Cleaning Procedure. Initiate the cleaning procedure.
3. When the cleaning procedure is completed, shut OFF the ignition for 30 seconds.
4. Restart the engine and operate the vehicle based on the criteria specified in Conditions for Running the DTC.
5. Observe if the applicable DTC or DTCs have run and passed to verify if the cleaning procedure was effective.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY SOLENOID PERFORMANCE TEST

TOOLS REQUIRED

DT-47825 Control Solenoid Test Plate. See **Special Tools**.

The purpose of this procedure is to test the operation of the control solenoid (w/body and TCM) valve assembly for a stuck open or stuck closed solenoid. The **DT-47825** bolts to the mounting surface of the control solenoid (w/body and TCM) valve assembly. See **Special Tools**. Compressed air is attached to the test block, through the control solenoid (w/body and TCM) valve assembly solenoid passage and back to a pressure gage on the test plate, sent through the control solenoid (w/body and TCM) valve assembly solenoid, and back to the test plate pressure port.

An air pressure gage is used to display the air passing through the solenoid. If the solenoid is unable to allow air through or the air is constantly flowing through the solenoid may be stuck. The scan tool is used to command the solenoids On and Off while watching the air pressure test gage to determine if the solenoid is functioning correctly. The recommended shop air pressure for this test is 620.5-689.4 Kpa (90-100 psi).

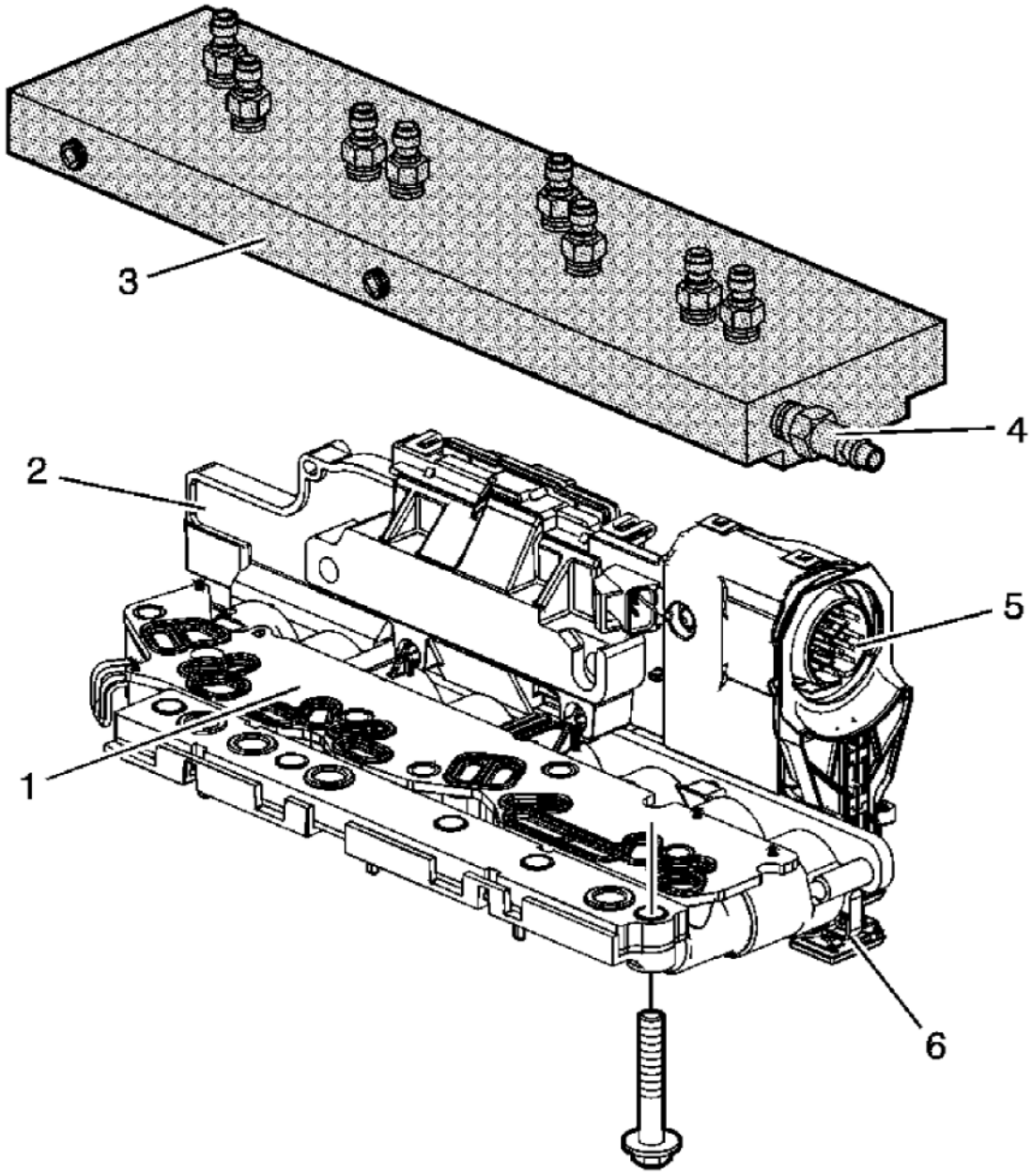


Fig. 3: Control Solenoid (w/Body and TCM) Valve Assembly with Control Solenoid Test Plate
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Filter Plate Assembly
2	Control Solenoid Valve Assembly
3	DT-47825 Control Solenoid Test Plate

4	Air Connection Port
5	Transmission 16-Way Pass-Through Connector
6	Electrical Connector Slide Lock

IMPORTANT: To avoid solenoid overheating and possible internal damage, do not continuously operate the solenoid for more than 2 minutes at a time.

The TCM will normally cycle some of the transmission solenoids On and Off to keep the solenoid passages clean and clear, This is a normal function and will cause the valves to cycle open and closed quickly when the TCM is powered up. This will make the pressure gage needle flicker or move from high and low as the valves open and close, allowing air to exit the ports where the pressure gage is not connected.

It is necessary to drain the control solenoid (w/body and TCM) valve assembly of all remaining transmission fluid before attaching the test plate. Use caution when attaching air to the test plate, as any remaining transmission fluid in the control solenoid (w/body and TCM) valve assembly will be forced out. Use shop towels to cover the test plate ports in order to prevent fluid from being released into the air.

Preliminary Procedures

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
3. Remove the transmission electrical connector. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.
4. Remove the control solenoid (w/body and TCM) valve assembly from the transmission. Refer to **Control Valve Lower Body and Upper Body Replacement**.

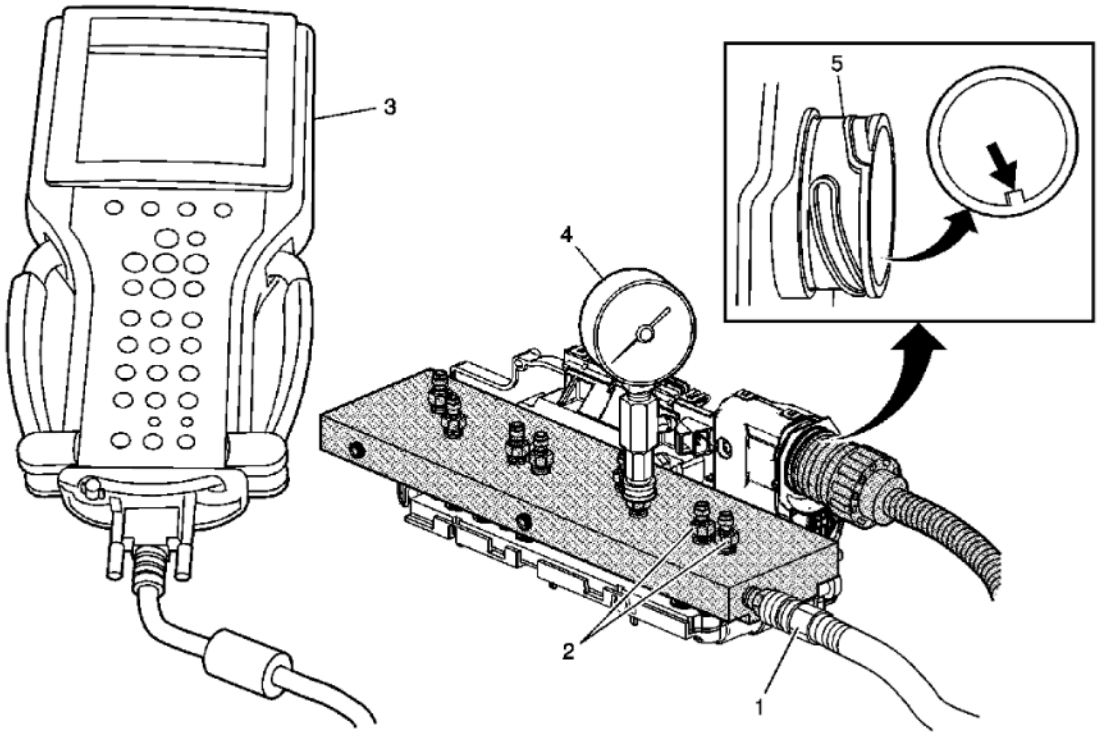


Fig. 4: Solenoid Testing Procedure
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Regulated Air Supply
2	Test Ports
3	Scan Tool
4	Test Pressure Gage
5	Electrical Connector Sleeve

NOTE: The TCM connector sleeve allows the test tool harness to be correctly orientated for electrical operation of the TCM. Do not connect the test harness to the TCM without using the connector sleeve. Failure to use the sleeve could allow the test harness to be incorrectly positioned which will result in permanent TCM damage.

1. Align and install the electrical connector sleeve to the control solenoid (w/body and TCM) valve assembly and secure with the connector slide lock.

2. If necessary, clean each side of the filter plate assembly and install the filter plate assembly back on the control solenoid (w/body and TCM) valve assembly. Clean the mounting surface of the **DT-47825** . See **Special Tools**.
3. Bolt the **DT-47825** to the control solenoid (w/body and TCM) valve assembly mounting surface. See **Special Tools**. Use the bolts and washers supplied with the tool to attach the test block. Tighten the bolts to 5 N.m (44 lb in).
4. Connect the test harness supplied with the **DT-47825** to the vehicle harness and to the TCM. See **Special Tools**. Engage the connector locks.
5. Connect shop air to the **DT-47825** air inlet. See **Special Tools**. Do not exceed the recommended air pressure of 620.5-689.4 Kpa (90-100 psi).
6. With the ignition ON and the scan tool communicating with the vehicle, command the solenoid in question On and Off. Watch the air pressure gage for a change as you command the solenoid. Refer to **Control Solenoid (w/Body and TCM) Valve Assembly Solenoid Performance Test Plate to Component Identification** for correct solenoid function and test plate port connections for the solenoid being tested.
7. The solenoid should allow air pressure to flow or prevent air pressure flow depending on the solenoid state. The test results are read on the pressure gage.
8. Command the solenoid valve On and Off several times to determine the condition of the solenoid in question. Release the test air pressure from the pressure the gage between solenoid tests.

Control Solenoid (w/Body and TCM) Valve Assembly Solenoid Performance Test Plate to Component Identification

Solenoid	Test Plate Port	Key On, Engine Off (KOEO) Normal State	Commanded State	
*Line PC Solenoid 1	G	No flow to gage	Increase/Decrease Approximately 68-103 Kpa (10-15 psi) per command	
PC Solenoid 2	C	No flow to gage	On - Full flow to gage	Off - No flow to gage
PC Solenoid 3	A	Full flow to gage	On - Full flow to gage	Off - No flow to gage
PC Solenoid 4	B	No flow to gage	On - Full flow to gage	Off - No flow to gage
PC Solenoid 5	F	No flow to gage	On - Full flow to gage	Off - No flow to gage

Shift Solenoid 1	H	Full flow to gage	Off - No flow to gage	On - Full flow to gage
Shift Solenoid 2	D	No flow to gage	Off - No flow to gage	On - Full flow to gage
TCC PC Solenoid	E	No flow to gage	On - Full flow to gage	Off - No flow to gage
* Increment solenoid to maximum pressure and then decrease to minimum pressure to ensure full range of operation.				

SERVICE FAST LEARN ADAPTS

Service Fast Learn Adapts is a procedure for 6 speed automatic transmissions in which a series of tests are run to allow the transmission control module (TCM) to learn individual clutch characteristics. Once the clutch data is learned, Service Fast Learn Adapts translates it into the adaptive data cells, which the TCM uses for clutch control during shifts. The scan tool provides initiation of the Service Fast Learn Adapts procedure. This procedure is to be used following transmission repair.

The Service Fast Learn Adapts procedure must be performed when one of the following repairs have been made to the vehicle. Failure to perform the procedure after one of the following repairs may result in poor transmission performance, as well as transmission DTCs being set:

- Transmission internal service/overhaul
- Valve body repair or replacement
- Control solenoid (w/body and TCM) valve assembly replacement
- TCM software/calibration update
- Any service in response to a shift quality concern

IMPORTANT: Ensure the following conditions are met before performing the Service Fast Learn Adapts procedure:

- **Drive wheels are blocked**
- **Parking brake is applied**
- **Service brake is applied**
- **Zero percent throttle and no external engine RPM control**
- **Transmission fluid temperature (TFT) is between 70-100°C (158-212°F)**

- **Transmission gear selector has been cycled from Park to Reverse 3 times in order to purge air from the reverse clutches.**

1. Using the scan tool, navigate to Service Fast Learn Adapts commands.
    1. F1: Transmission Control Module
    2. F5: Module Setup
    3. F0: Fast Learn Adapts Process

IMPORTANT: If at any time during the procedure, required conditions are not met, Service Fast Learn Adapts may abort and the process may need to be started again from the beginning.

IMPORTANT: There are 3 stages required to successfully complete the Service Fast Learn Adapts procedure:

2. Use the scan tool to perform the Service Fast Learn Adapts procedure.
    1. PARK test setup
    2. DRIVE mode
    3. REVERSE mode

    These stages are automatically initiated and controlled by the scan tool. As the procedure is being performed, the scan tool data display will provide operator instructions. Follow the scan tool instructions as required. For a brief description of each stage, refer to **PARK Test Setup**, **DRIVE Mode**, and **REVERSE Mode** below.

3. Once the procedure is complete, shut OFF the engine and power down the TCM. You will lose communication to the scan tool.
4. Restart the engine. This will complete the Service Fast Learn Adapts procedure.

The following are brief descriptions of each of the 3 different stages.

PARK TEST SETUP

While the transmission is in PARK, Service Fast Learn Adapts will prepare for test cycles. The test preparation will include the diagnostic criteria checks, safety checks, vehicle status checks, and then will perform internal transmission test preparation functions such as clutch air purging.

The scan tool will instruct the operator to select park and apply the brake only.

DRIVE MODE

CAUTION: Block the wheels before selecting DRIVE. While in DRIVE, if the Scan Tool loses communication or becomes disconnected, the vehicle could move forward. Failure to block the wheels could result in personal injury or property damage.

Once the PARK setup has completed, the scan tool instructs the driver to select DRIVE. Once DRIVE is selected, the TCM engages the individual clutches to learn the clutch volume, full feed fill thresholds, and pressure offsets. The TCM will only cycle through this test once. Running the Service Fast Learn Adapts procedure multiple times will give the same results and is not necessary.

REVERSE MODE

CAUTION: Block the wheels before selecting REVERSE. While in REVERSE, if the Scan Tool loses communication or becomes disconnected, the vehicle could move backward. Failure to block the wheels could result in personal injury or property damage.

Next, the scan tool instructs the driver to select REVERSE. The TCM engages the individual clutches to learn the clutch volume, full feed fill thresholds, and pressure offsets. The TCM will only cycle through this test one time. Running the Service Fast Learn Adapts procedure multiple times will give the same results.

IMPORTANT: When the Service Fast Learn Adapts procedure is completed, the transmission will remain in a neutral state.

TROUBLESHOOTING

If the Service Fast Learn Adapts will not run and the above stated conditions have been met, ensure the following:

- TFT is between 70-100°C (158-212°F).
- Brakes and brake switch are functioning properly.
- No active DTCs.

- Closed throttle and engine RPM increases above 1500 RPM while in Park Test Setup or at entrance of the test modes.
- Park/Neutral position switch is properly adjusted and functioning.
- Line pressure control is able to provide 1000 kPa and is within specifications.
- Vehicle is not moving, or vibrating excessively.
- Clutches are properly assembled.

TOW/HAUL SWITCH/INDICATOR ALWAYS ON OR INOPERATIVE

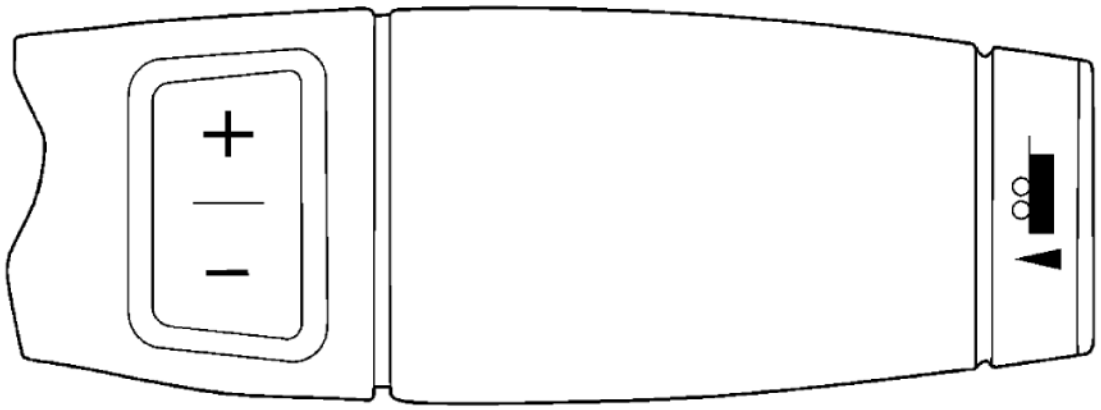


Fig. 5: View Of Tow/Haul Switch/Indicator
Courtesy of GENERAL MOTORS CORP.

CIRCUIT/SYSTEM 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 control solenoid (w/body and TCM) valve assembly to extend the length of time between upshifts and elevate transmission line pressure. Cycling the tow/haul switch again disables tow/haul mode and returns the transmission to a normal shift pattern. The tow/haul switch is a momentary switch and is normally open. The internal spring in the switch will always cause the switch state to return to open when not held in to the closed position.

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**.

REFERENCE INFORMATION

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

Component Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

CIRCUIT/SYSTEM VERIFICATION

With a scan tool observe the Tow/Haul switch parameter in Body Controls data list. With the ignition On or engine running, operate the Tow/Haul switch several times, and observe the parameter as you operate the switch. The parameter should toggle between Active and Inactive when the switch is operated.

CIRCUIT/SYSTEM TESTING

1. Ignition Off, transmission in Park, disconnect the Tow/Haul switch connector.
2. Test for less than 1 Ohm of resistance between the Tow/Haul switch signal circuit terminal B and ground.
    - If greater than the specified range, test the ground circuit for an Open/High resistance.
3. Ignition On, verify the scan tool Tow/Haul parameter displays Inactive.
    - If not the specified value, test the signal circuit for a short to ground. If the circuit tests normal, replace the BCM.
4. Install a fused jumper between the signal circuit and ground. Verify the scan tool parameter displays Active.

- If not the specified value, test the signal circuit for a short to voltage or an open/high resistance. If the circuit tests normal, replace the BCM.

5. If all circuits test normal, replace the Tow/Haul switch.

COMPONENT TESTING

1. Ignition Off, transmission in Park, disconnect the transmission Tow/Haul switch assembly.
2. Test for infinite resistance between the Tow/Haul switch with the switch in the Open position.
   - If not the specified value, replace the Tow/Haul switch assembly.
3. Depress and hold the Tow/Haul switch.
4. Test for less than 1 Ohm of resistance between the Tow/Haul switch signal circuit terminals B and A while the switch is depressed.
   - If greater than the specified value, replace the Tow/Haul switch assembly.

REPAIR PROCEDURES

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- Body Control Module (BCM) assembly replacement. Refer to **Control Module References** for replacement, setup, and programming.
- Perform the **Shift Lever Replacement** .

TRANSMISSION FLUID CHECK

This procedure checks the transmission fluid level, as well as the condition of the fluid itself.

NOTE: Always use the proper automatic transmission fluid listed. Using incorrect automatic transmission fluid may damage the vehicle.

Before checking the fluid level, perform the following:

1. Start the engine and park the vehicle on a level surface. Keep the engine running.
2. Apply the parking brake and place the shift lever in PARK (P).
3. Depress the brake pedal and move the shift lever through each gear range, pausing for about 3 seconds in each range. Then, move the shift lever back to PARK (P).
4. Allow the engine to idle 500-800 rpm for at least 1 minute. Slowly release the brake pedal.
5. Keep the engine running and observe the transmission fluid temperature (TFT) using the

Driver Information Center (DIC) or a scan tool.

6. Using the TFT reading, determine and perform the appropriate check procedure. If the TFT reading is not within the required temperature ranges, allow the vehicle to cool, or operate the vehicle until the appropriate TFT is reached.

COLD CHECK PROCEDURE

IMPORTANT: Use this procedure only as a reference to determine if the transmission has enough fluid to be operated safely until a hot check procedure can be made. The hot check procedure is the most accurate method to check the fluid level. Perform the hot check procedure at the first opportunity. Use this cold check procedure to check fluid level when the TFT is between 80°F and 90°F (27°C and 32°C).

1. Locate the transmission dipstick at the rear of the engine compartment, on the passenger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

IMPORTANT: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to Fluid Condition Inspection in this procedure.
6. If the fluid level is below the COLD check band, add only enough fluid as necessary to bring the level into the COLD band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. Perform a hot check at the first opportunity after the transmission reaches a normal operating temperature between 160°F to 200°F (71°C to 93°C).

HOT CHECK PROCEDURE

IMPORTANT: Us this procedure to check the transmission fluid level when the TFT is between 160℉ and 200℉ (71℃ and 93℃). The hot check procedure is the most accurate method to check the fluid level. The hot check should be performed at the first opportunity in order to verify the cold check. The fluid level rises as fluid temperature increases, so it is important to ensure the transmission temperature is within range.

1. Locate the transmission dipstick at the rear of the engine compartment, on the passemger's side of the vehicle.
2. Flip the handle up, and then pull out the dipstick and wipe it with a clean rag or paper towel.
3. Install the dipstick by pushing it back in all the way, wait three seconds and then pull it back out again.

IMPORTANT: Always check the fluid level at least twice. Consistent readings are important to maintaining proper fluid level. If inconsistent readings are noted, inspect the transmission vent assembly to ensure it is clean and unclogged.

4. Check both sides of the dipstick, and read the lower level. Repeat the check procedure to verify the reading.
5. Inspect the color of the fluid on the dipstick. Refer to Fluid Condition Inspection below.
6. A safe operating fluid level is within the HOT crosshatch band on the dipstick. If the fluid level is not within the HOT band, and the TFT is between 160°F and 200°F (71°C and 93° C), add or drain fluid as necessary to bring the level into the HOT band. If the fluid level is low, add only enough fluid to bring the level into the HOT band. It does not take much fluid, generally less than one pint (0.5L). Do not overfill. Also, if the fluid level is low, inspect the transmission for leaks. Refer to **Fluid Leak Diagnosis**.
7. If the fluid level is in the acceptable range, push the dipstick back in all the way, then flip the handle down to lock the dipstick in place.
8. If applicable and if the vehicle is equipped, reset the transmission oil life monitor only if the fluid was changed.

FLUID CONDITION INSPECTION

Inspect the fluid color. The fluid should be red or dark brown.

- If the fluid color is very dark or black and has a burnt odor, inspect the fluid and inside of the bottom pan for excessive metal particles or other debris. A small amount of "friction" material in the bottom pan is a "normal" condition. If large pieces and/or metal particles are noted in the fluid or bottom pan, flush the oil cooler and cooler lines and overhaul the transmission. If there are no signs of transmission internal damage noted, replace the fluid filter assembly, repair the oil cooler, and flush the cooler lines.
- Fluid that is cloudy or milky or appears to be contaminated with water indicates engine coolant or water contamination. Refer to **Engine Coolant/Water in Transmission**.

LINE PRESSURE CHECK

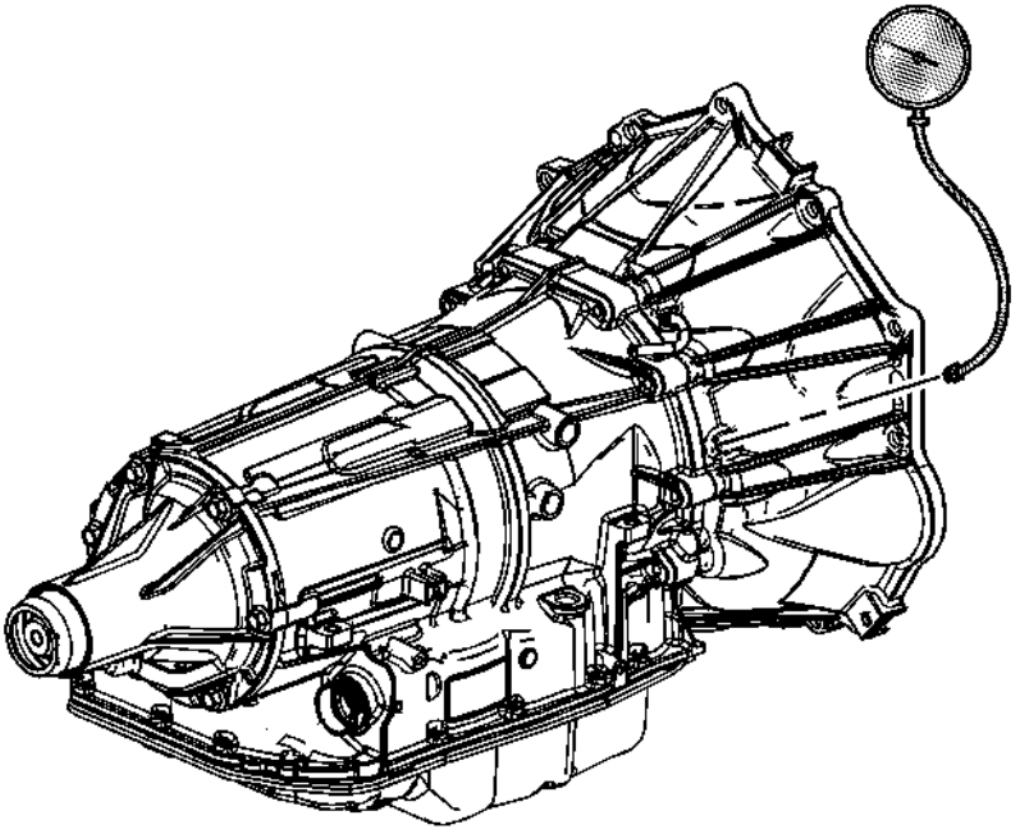


Fig. 6: View Of Transmission & J 21867 Pressure Gage
Courtesy of GENERAL MOTORS CORP.

TOOLS REQUIRED

J 21867 Pressure Gage

CHECK

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

1. Install a scan tool.
2. Start the engine.
3. Inspect the transmission for the proper fluid level. Refer to **Transmission Fluid Check**.
4. Use the scan tool to inspect for any active or stored diagnostic trouble codes.
5. Inspect the manual linkage at the transmission for proper function.
6. Turn the engine OFF.

IMPORTANT: You may need to remove or disconnect components in order to gain access to the transmission line pressure test hole plug.

7. Remove the line pressure test hole plug.
8. Install the **J 21867** .
9. Access the Scan Tool Transmission Output Controls for the Line PC Solenoid.
10. Start the engine.

IMPORTANT: In order to achieve accurate line pressure readings, the following procedure must be performed at least three times in order to gather uniform pressure readings.
The scan tool is only able to control the line PC solenoid in PARK and NEUTRAL with engine speeds below 1500 RPM. This protects the clutches from extreme high or low line pressures.

11. Use the scan tool to increase and decrease the Line PC Solenoid in increments of approximately 100 KPa (15 psi). The scan tool commands the increment values automatically.
12. Allow the pressure to stabilize between increments.

13. Compare your pressure readings on the scan tool to those indicated on the **J 21867** .
14. If the pressure readings vary greatly, refer to **Fluid Pressure High or Low**.
15. Turn the engine OFF.
16. Remove the **J 21867** .

NOTE: Refer to Fastener Notice .

17. Install the line pressure test hole plug.

Tighten: Tighten the pressure plug to 11 N.m (97 lb in).

ROAD TEST

IMPORTANT: The Road Test Procedure should be performed only as part of the Symptom Diagnosis. Refer to Symptoms - Automatic Transmission.

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
- Manual Downshifts
- Coasting Downshifts
- Manual Gear Range Selection
  - REVERSE
  - Driver Shift Control

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. Refer to **Transmission Fluid Check**.

- 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:

- Inspect for proper transmission fluid level. Refer to **Transmission Fluid Check**.
- Inspect for any diagnostic trouble codes (DTCs) that may have set during the testing. Refer to the applicable DTC.
- Monitor the scan tool data for any abnormal readings or data.
- Inspect for fluid leaks. Refer to **Fluid Leak Diagnosis**.

ELECTRICAL FUNCTION CHECK

Perform this procedure first in order to ensure the electronic transmission components are functioning properly. If these components are not checked, a simple electrical condition could be misdiagnosed.

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 **Control Module References** for typical data values. Data that is questionable may indicate a concern.

   - Engine Speed
   - Transmission ISS
   - Transmission OSS

- Vehicle Speed
- IMS
- Commanded Gear
- Gear Ratio
- Line PC Sol. Pressure Cmd.
- TCC Brake Switch
- ECT, Engine Data List
- Trans. Fluid Temp.
- TCM Temperature
- Calc. Throttle Position
- Ignition Voltage
- TFP Switch 1
- TFP Switch 3
- TFP Switch 4
- TFP Switch 5
- PC Sol. 2 Pressure Cmd.
- PC Sol. 3 Pressure Cmd.
- PC Sol. 4 Pressure Cmd.
- PC Sol. 5 Pressure Cmd.
- Shift Solenoid 1
- Shift Solenoid 2
- TCC PC Sol. Duty Cycle
- TCC Slip Speed

5. Monitor the TCC Brake Switch parameter while applying and releasing the brake pedal. The scan tool should display:
   - Open when the brake pedal is applied.
   - Closed when the brake pedal is released.
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 to 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 engine idle speed-Compare engine idle speed to desired idle speed.**
- **Commanded low pressure control (PC) solenoid current-Investigate PC Sol. Pressure Cmd. kPa (psi) for all solenoids. High pressure will cause harsh shifts.**
- **A default condition caused by certain DTCs that result in maximum line pressure to prevent clutch 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-Investigate PC Sol. Pressure Cmd. kPa (psi) for all solenoids. Low pressure will cause soft or delayed shifts.**
- **Cold transmission fluid temperature (TFT)-Use the scan tool to determine TFT.**
- **Selector linkage-Inspect and adjust as necessary.**

7. Monitor transmission range on the scan tool, engine data list.
    1. Apply the brake pedal and ensure the parking brake is set.
    2. Move the gear selector through all ranges.
    3. Pause 2 to 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 position input.
    1. Apply the brake pedal and ensure the parking brake is set.

2. Ensure the gear selector is in PARK.
3. Monitor the scan tool Calc. Throttle Position while increasing and decreasing engine speed with the throttle pedal. The scan tool Calc. Throttle Position percentage 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 TCM calculates the upshift points based primarily on 2 inputs: throttle position and vehicle speed. When the TCM determines that conditions are met for a shift to occur, the TCM commands the shift by closing or opening the ground circuit for the appropriate solenoid.

Perform the following steps:

1. Refer to **Shift Speed** table in this section and choose a throttle position of 12.5 percent or 25 percent. All throttle positions shown should be tested to cover the normal driving range.
2. Monitor the following scan tool parameters:
   - Calc. Throttle Position
   - Vehicle Speed
   - Engine Speed
   - Transmission ISS
   - Transmission OSS
   - Commanded Gear
   - TCC PC Sol. Pressure Cmd.
   - TCC Pressure Actual
   - TCC Slip Speed
   - TFP Switch 1
   - TFP Switch 3
   - TFP Switch 4
   - TFP Switch 5
   - PC Sol. 2 Pressure Cmd.
   - PC Sol. 3 Pressure Cmd.
   - PC Sol. 4 Pressure Cmd.
   - PC Sol. 5 Pressure Cmd.

- Shift Solenoid 1 and 2

3. Place the gear selector in the DRIVE position.
4. Accelerate the vehicle using the chosen throttle position. Hold the throttle steady.
5. As the transmission upshifts, there should be a noticeable shift feel or engine speed change within 1 to 2 seconds of the commanded gear change. The TCC feel may not be noticeable. Look for 100-300 RPM engine speed change.
6. Compare the shift speeds to the Shift Speed table. Refer to **Shift Speed** . Shift speeds may vary slightly due to TFT or other operating variables, including hydraulic delays in responding to electronic controls.
   - Note any harsh, soft or delayed shifts or slipping.
   - Note any noise or vibration.

IMPORTANT: This transmission is equipped with an electronically controlled capacity clutch (ECCC), which does not allow the clutch to fully lock to the torque converter cover. The clutch maintains a small amount of slippage, approximately 20 RPM, in 2nd, 3rd, 4th, 5th, and 6th gears, depending on the vehicle application. ECCC was developed to reduce the possibility of noise, vibration or chuggle caused by TCC apply. Full lockup is available at highway speeds on some applications.

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

7. Monitor TCC PC solenoid current while driving and make sure the current rises when the TCC is commanded to apply.
   - 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**.
   - Apply and release the brake pedal. The TCC will release on most applications.

PART THROTTLE DETENT DOWNSHIFT

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 64-88 km/h (40-55 mph) in 6th gear.
3. Quickly increase throttle angle to between 25-30 percent.
4. Verify the following:
   - The TCC releases.
   - The transmission downshifts immediately.

MANUAL DOWNSHIFTS

Manual downshift testing is not required for vehicles equipped with Driver Shift Control (DSC). The TCM and shift solenoids will automatically override DSC downshifts to protect the transmission from damage.

COASTING DOWNSHIFTS

1. Place the gear selector in the DRIVE position.
2. Accelerate the vehicle to 6th gear with the TCC applied.
3. Release the throttle and apply the brakes
4. Verify the following:
   - The TCC releases (on most applications).
   - Downshifts occur as commanded.

MANUAL GEAR RANGE SELECTION

This application does not utilize manual forward gear ranges.

Reverse

Perform the following test using a 10-15 percent throttle position.

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.

Driver Shift Control (DSC)

Refer to the owner's manual for specific instructions on DSC. The TCM will upshift automatically when maximum engine speed is achieved and will protect from any downshift which may cause excessive engine RPMs.

TORQUE CONVERTER DIAGNOSIS

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

TORQUE CONVERTER STATOR

The torque converter stator roller clutch can have 2 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 check 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.

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 torque converter clutch (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 SHUDDER OCCURS DURING TCC APPLY OR RELEASE

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 problem 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

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

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, then 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.

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 or water.
- An internal failure occurs in the stator roller clutch.
- You notice excessive end play.
- Overheating produces heavy debris in the clutch or converter ballooning.
- 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 inset.
- 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.
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.

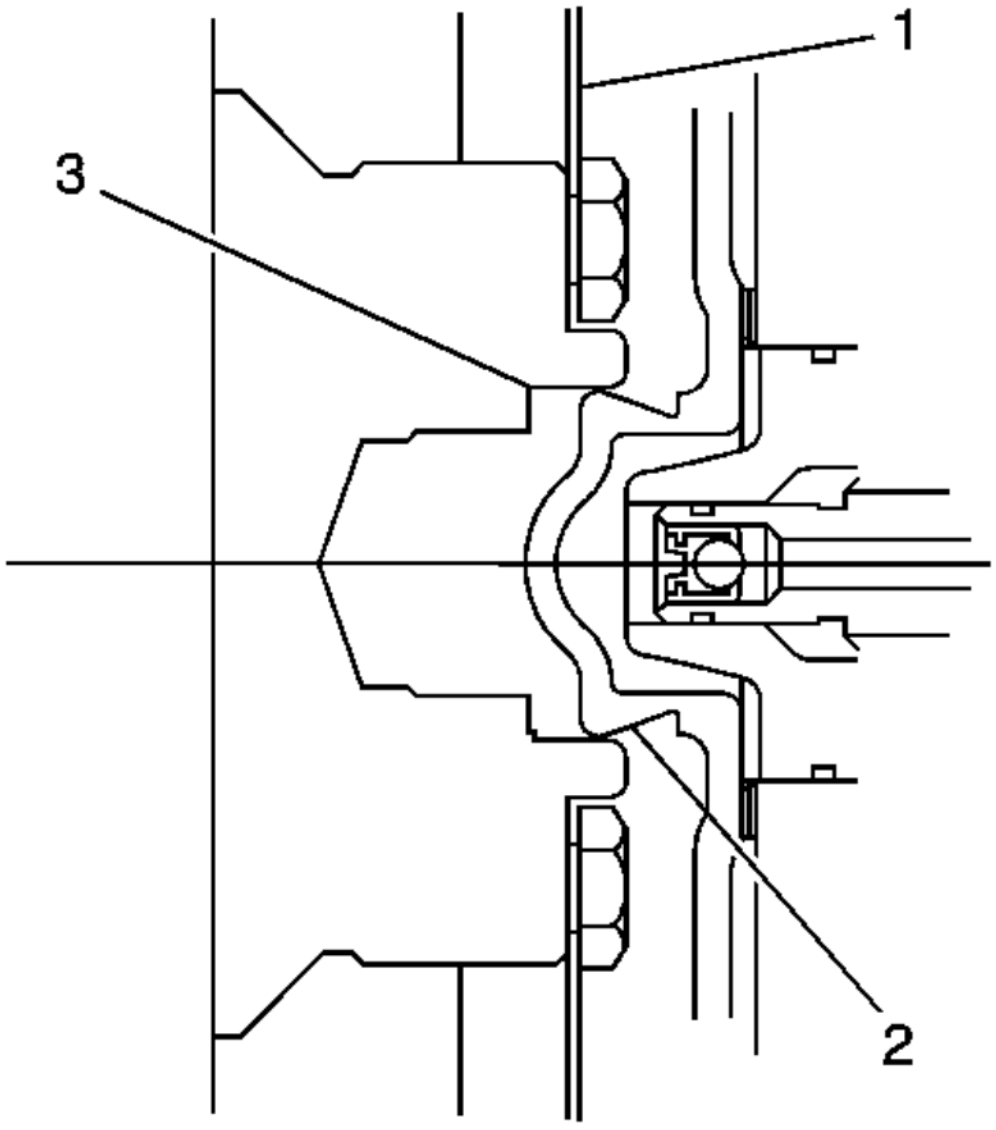


Fig. 7: View Of Torque Converter Hub In Engine Crankshaft
Courtesy of GENERAL MOTORS CORP.

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.

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

VIBRATION

Checks	Causes
Lug bolts for the Torque Converter (1)	Inspect for loose torque converter (1) lug bolts.

Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrush washers, pins, and rollers. • Inspect for a worn or damaged center support roller bearing assembly (485). • Inspect for damaged thrust bearings (486, 488). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.

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

WHINE/GROWL NOISE THAT CHANGES WITH VEHICLE SPEED

Checks	Causes
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. • Inspect for a damaged center support roller bearing assembly (485). • Inspect for damaged thrust bearings (486, 488). • Inspect for damaged sun gears (487, 489). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured). • Inspect for damaged or stripped splines on the output carrier assembly.
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.

Output Shaft Assembly (70)	• Inspect for damaged internal gears (495, 497). • Inspect the output carrier bushing (498) for damage or wear.
Output Shaft Thrust Bearing Assembly (71)	Inspect the bearing for wear or damage.
Input Sun Gear Thrust Washer (55)	Inspect the washer for wear or damage.
Input Sun Gear Thrust Bearing (54)	Inspect the bearing for wear or damage.
Input Sun Gear (53)	Inspect for spline wear or damage.
Input Carrier Assembly (52)	Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
1-2-3-4 Clutch Hub Thrust Bearing Assembly (63)	Inspect the bearing for wear or damage.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	Inspect the output carrier inner sun gear shaft bushings (60 and 62) for damage or wear.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26) • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface (leaks, fluid aeration).
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.

NOISE IN FIRST OR REVERSE GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463-465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461).

	• Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Output Carrier Assembly (68)	Inspect for damaged or stripped splines on the output carrier assembly.

NOISE IN FIRST, SECOND, THIRD, FOURTH, FIFTH, OR REVERSE GEAR

Checks	Causes
Input Carrier Assembly (52)	Inspect thrust washers, pinion gears, and pins for wear or damage.
Input Sun Gear (53)	Inspect for damaged sun gear.
1-2-3-4 and 3-5-R Clutch Assembly (51)	Inspect for worn or damaged clutch bearing (428).

NOISE IN FIRST, SECOND, SIXTH, OR REVERSE GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	Inspect for worn or damaged output carrier outer sun gear shaft front and rear bushings (458 and 460).
Output Carrier Assembly (68)	Inspect for a worn or damaged center support roller bearing assembly (485).

NOISE IN SECOND OR SIXTH GEAR

Checks	Causes
Center Support with 2-6 Low and Reverse Clutch Assembly (67)	• Inspect for damaged or worn output carrier outer sun gear shaft front bushing (458). • Inspect for damaged or worn output carrier outer sun

	gear shaft rear bushing (460). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

NOISE DURING 3-4 OR 4-3 SHIFTS

Checks	Causes
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage. • Inspect for damaged or worn 4-5-6 clutch backing plate (432).

NOISE IN FOURTH, FIFTH, OR SIXTH GEAR

Checks	Causes
Input Sun Gear Thrust Washer (55)	Inspect for wear or damage.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect for wear or damage.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	• Inspect for damaged or worn 4-5-6 clutch backing plate (432). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431).

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 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
- Porous casting warped torque converter housing

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

- 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

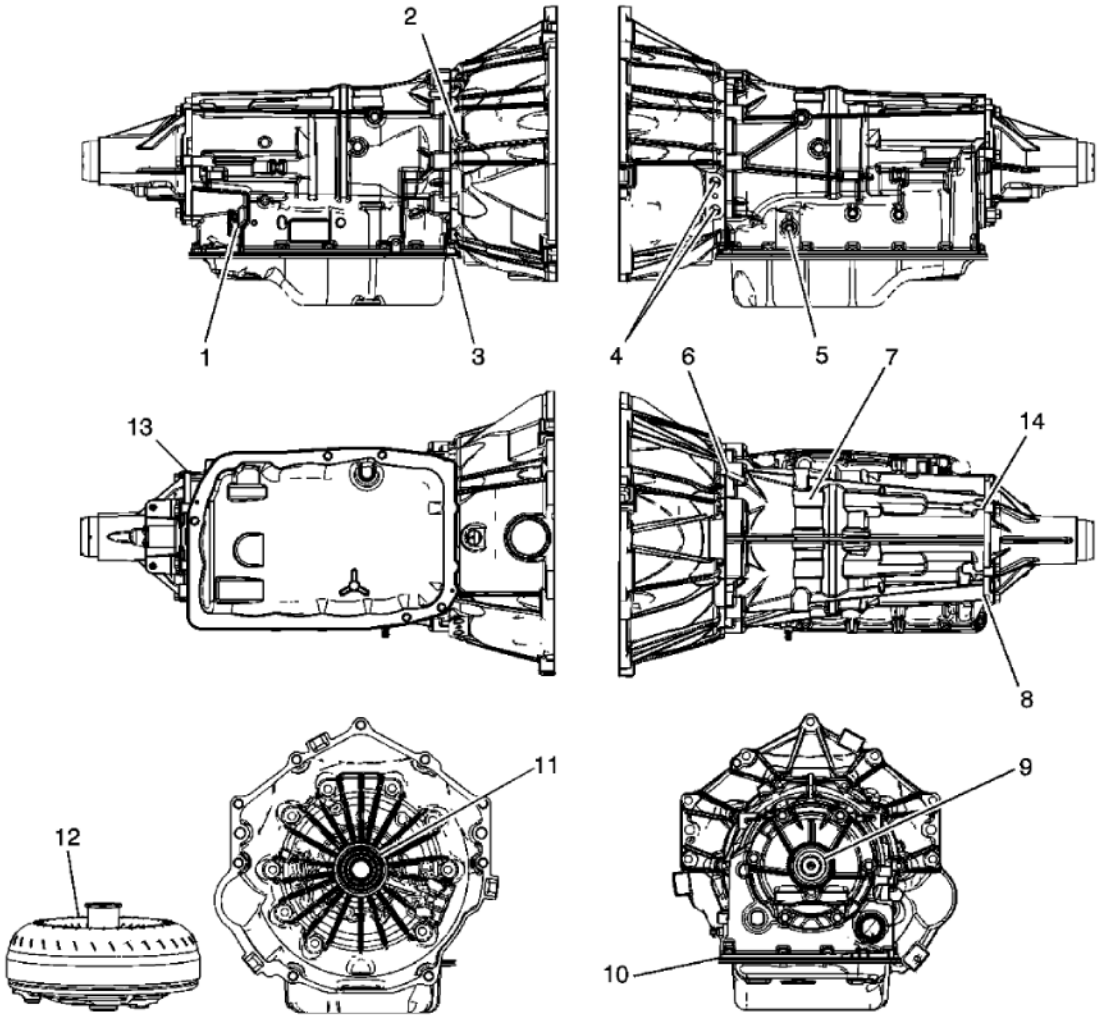


Fig. 8: Leak Inspection Points
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Automatic Transmission Electrical Connector Passage Sleeve
2	Line Pressure Test Hole Plug
3	Converter Housing to Case Joint
4	Trans Fluid Cooler Pipe Fitting Seals
5	Manual Shift Shaft Seal
6	Automatic Transmission Vent Pipe
7	Transmission Case Assembly
8	A/Trans Case Extension Seal - 2WD Models
9	Prop Shaft Front Slip Yoke Oil Seal - 2WD Models

10	A/Trans Fluid Pan Gasket
11	Torque Converter Fluid Seal Assembly
12	Torque Converter Assembly
13	Case Extension to Case Joint
14	Output Shaft Seal Assembly - 4WD Models

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.

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 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

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 45096** Transmission Oil Cooling System Flush and Flow Test Tool
- **J 45096-30** Transmission Cooler Flush Adapter. See **Special Tools**.
- Shop air supply with water/oil filters, regulator and pressure gage - minimum 90 psi
- Eye protection
- Rubber gloves

MACHINE SET-UP

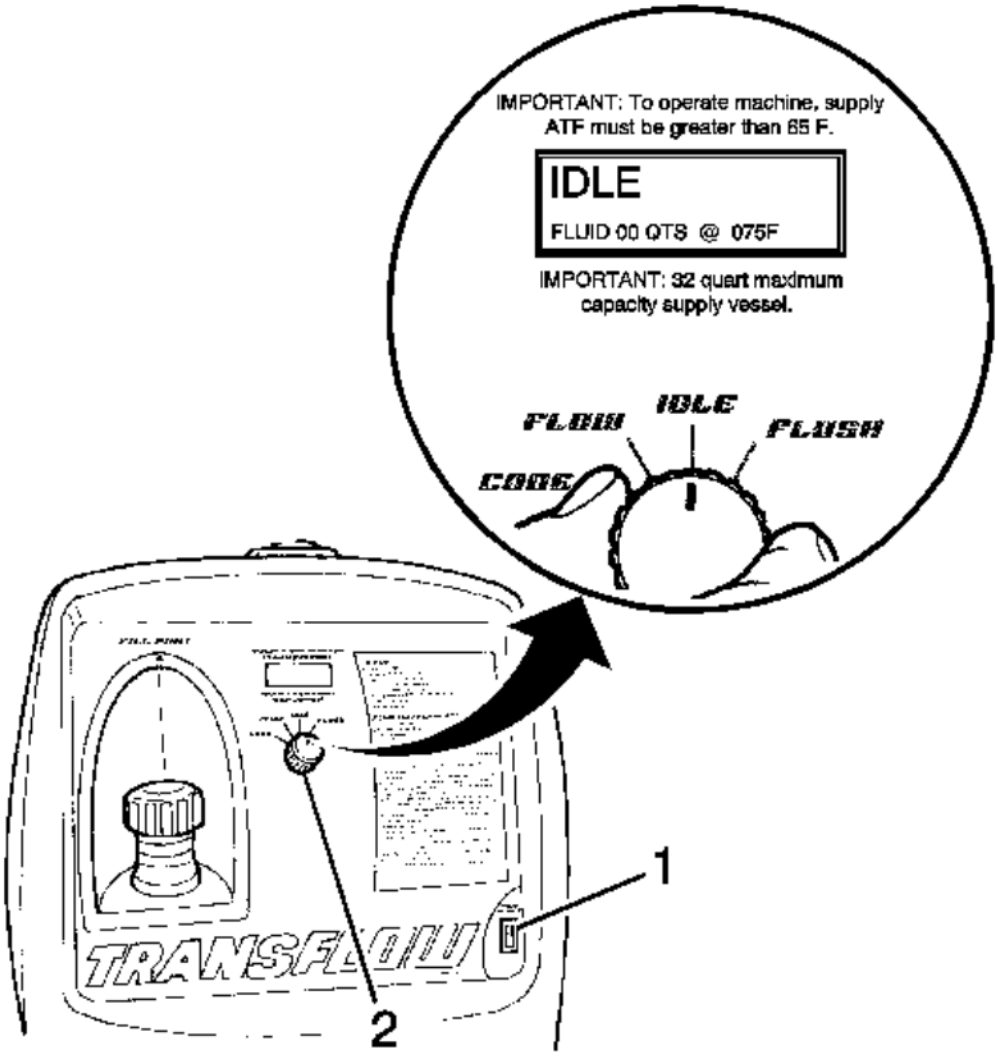


Fig. 9: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

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

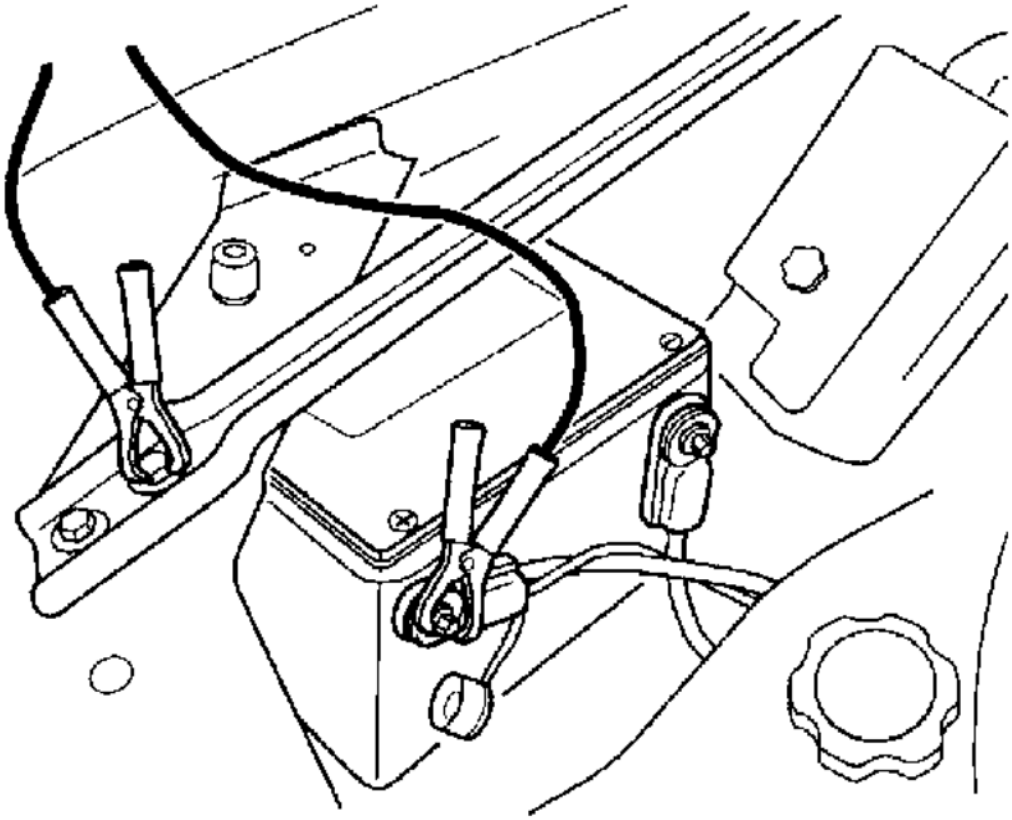


Fig. 10: Connecting To 12V DC Power Source
Courtesy of GENERAL MOTORS CORP.

3. Connect **J 45096** to the vehicle 12V 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.

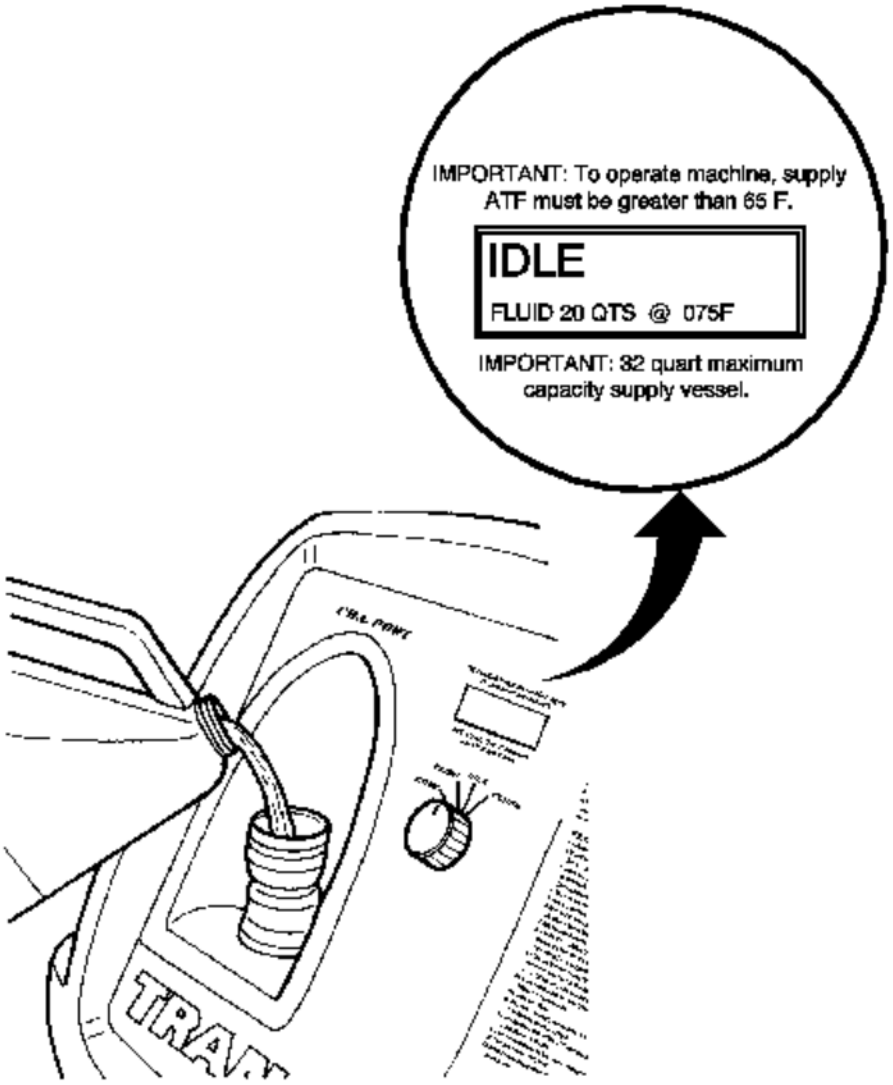


Fig. 11: Filling Supply Tank With Transmission Fluid
Courtesy of GENERAL MOTORS CORP.

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 through the fill port.
6. Reinstall and tighten the fill cap.

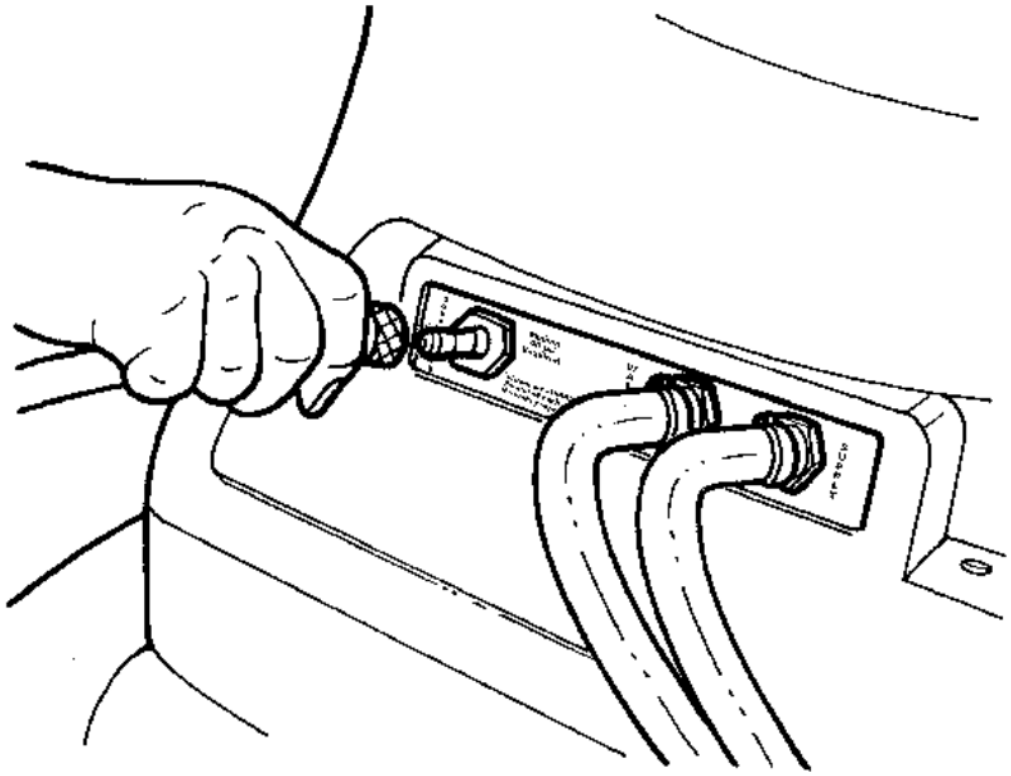


Fig. 12: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

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

DETERMINE MINIMUM FLOW RATE

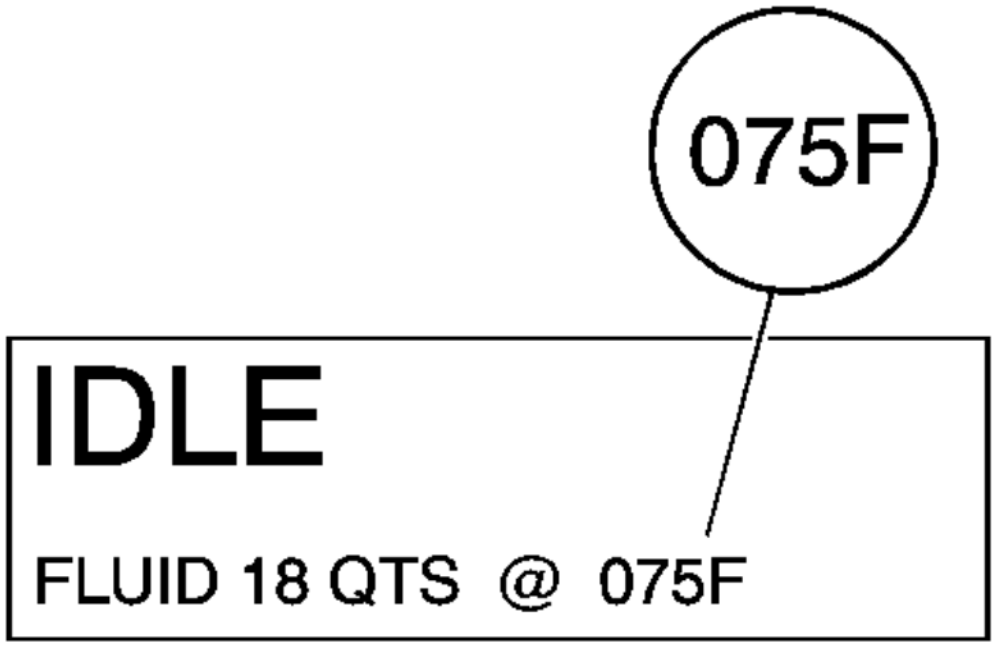


Fig. 13: Identifying Machine Display Of Automatic Transmission Fluid Temperature
Courtesy of GENERAL MOTORS CORP.

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

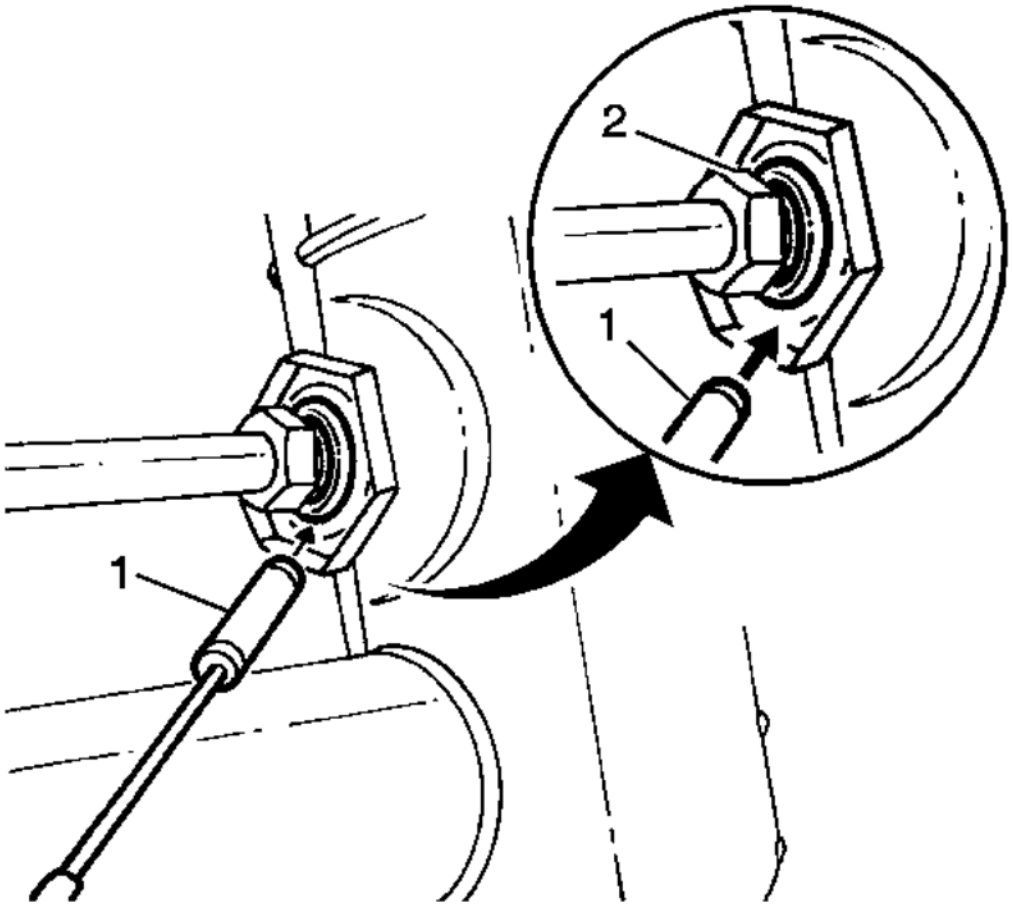


Fig. 14: Identifying Transmission Oil Cooler Metal Composition
Courtesy of GENERAL MOTORS CORP.

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 GPMs 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 transmission oil cooler lines for damage or kinks that could cause restricted oil flow. Repair as needed.

Minimum Flow Rate in Gallons Per Minute (gpm)

Temperature Range	Steel	Aluminum
65 - 66°F	0.6 gpm	0.5 gpm
67 - 70°F	0.7 gpm	0.6 gpm
71 - 75°F	0.8 gpm	0.7 gpm
76 - 80°F	0.9 gpm	0.8 gpm
81 - 84°F	1.0 gpm	0.9 gpm
85 - 89°F	1.1 gpm	1.0 gpm
90 - 94°F	1.2 gpm	1.1 gpm
95 - 98°F	1.3 gpm	1.2 gpm
99 - 103°F	1.4 gpm	1.3 gpm
104 - 108°F	1.5 gpm	1.4 gpm
109 - 112°F	1.6 gpm	1.5 gpm
113 - 117°F	1.7 gpm	1.6 gpm
118 - 120°F	1.8 gpm	1.7 gpm

BACK FLUSH PROCEDURE

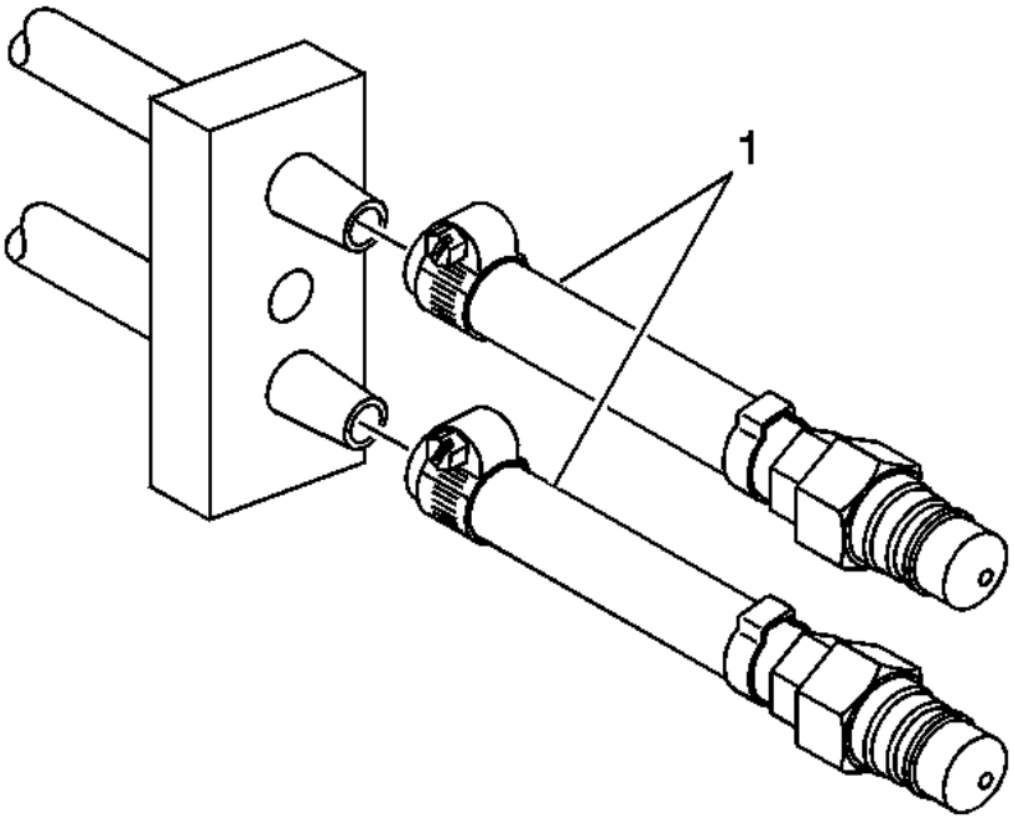


Fig. 15: Identifying Transmission Oil Cooler Supply And Return Lines
Courtesy of GENERAL MOTORS CORP.

1. Connect the **J 45096-30** (1) to the vehicle transmission oil cooler supply and return lines at the transmission. See **Special Tools**.

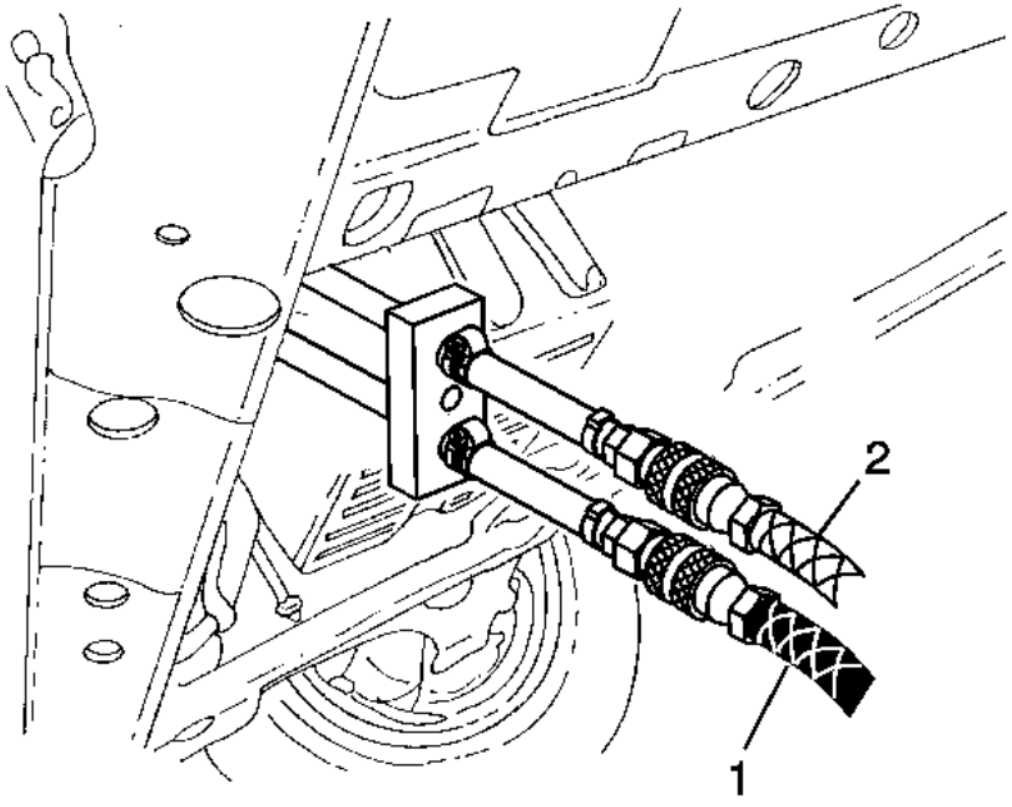


Fig. 16: Identifying Black Supply Hose & Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

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

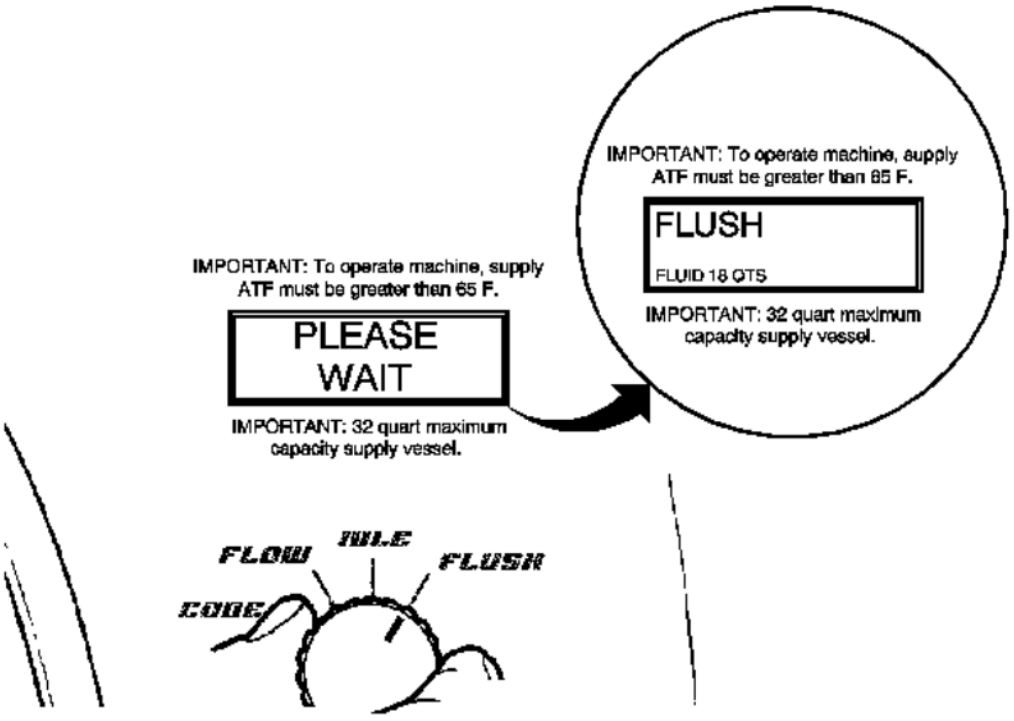


Fig. 17: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

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

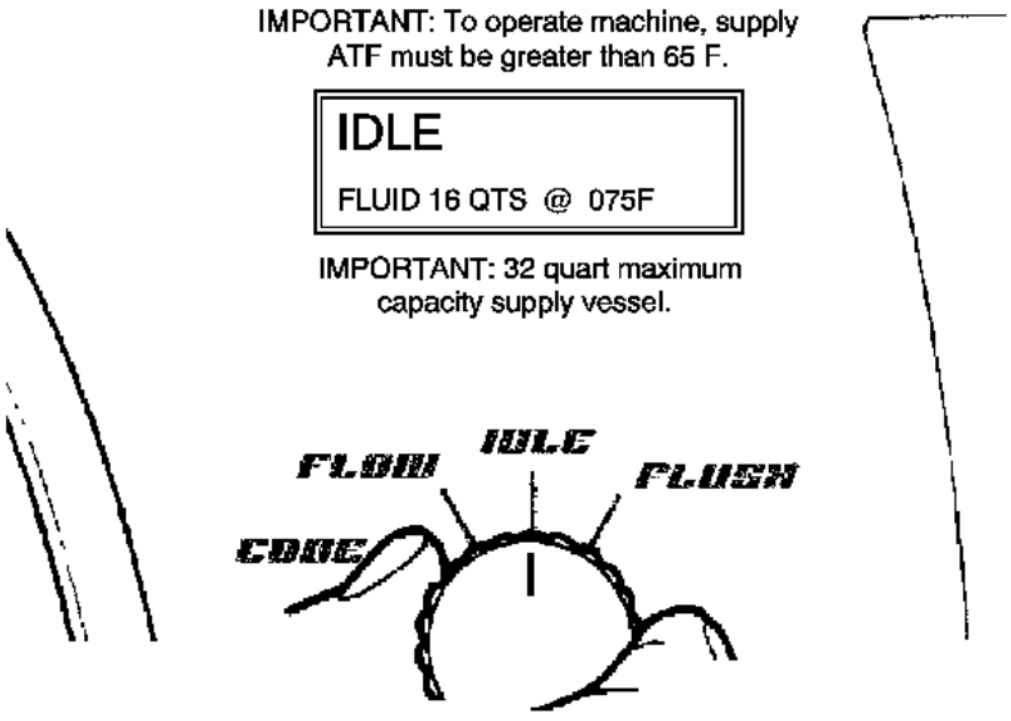


Fig. 18: Setting Main Function Switch To IDLE Position
Courtesy of GENERAL MOTORS CORP.

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

FORWARD FLUSH

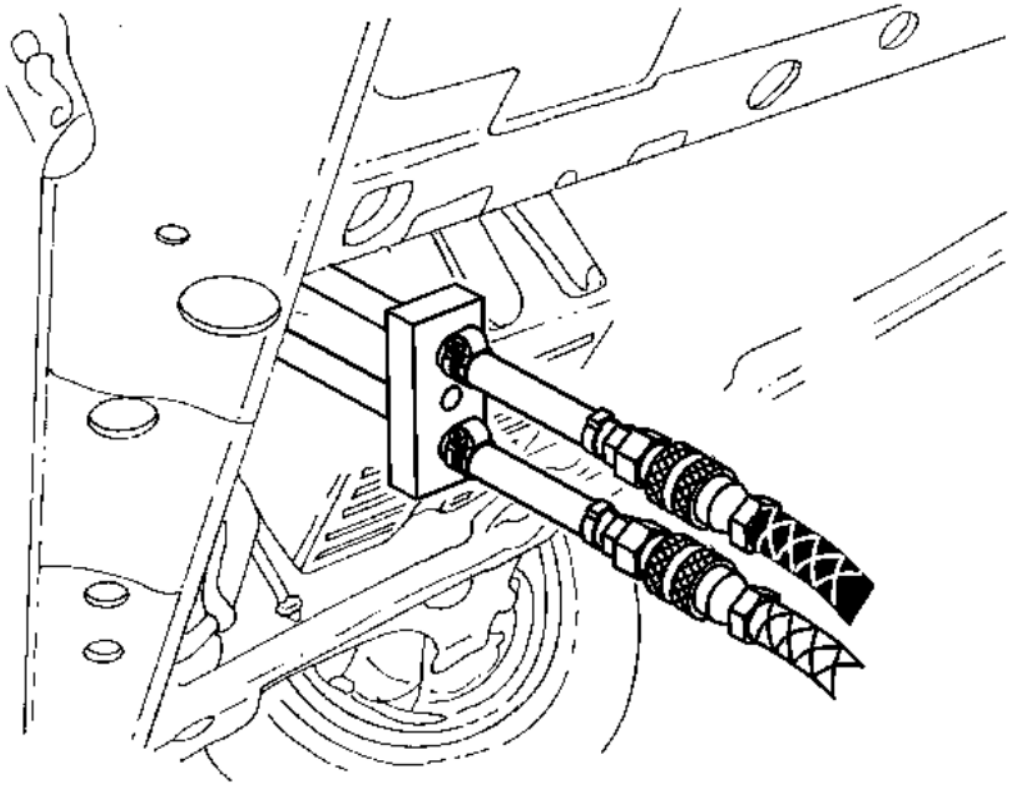


Fig. 19: Identifying Black Supply Hose & Clear Waste Hose
Courtesy of GENERAL MOTORS CORP.

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

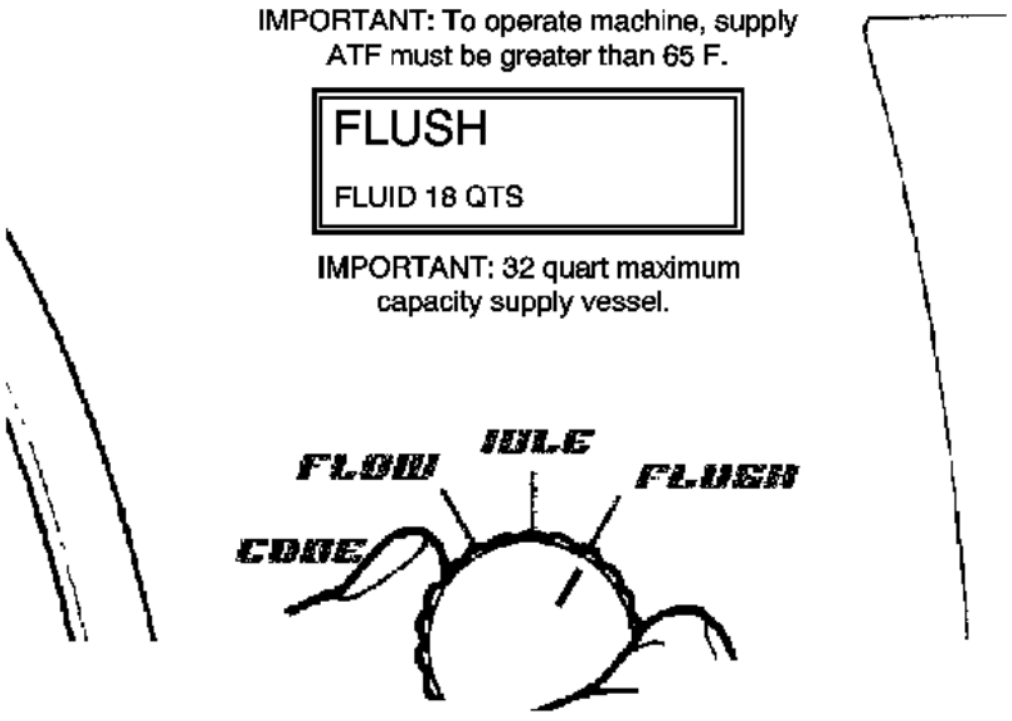


Fig. 20: Setting Main Function Switch To FLUSH Position
Courtesy of GENERAL MOTORS CORP.

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

FLOW TEST

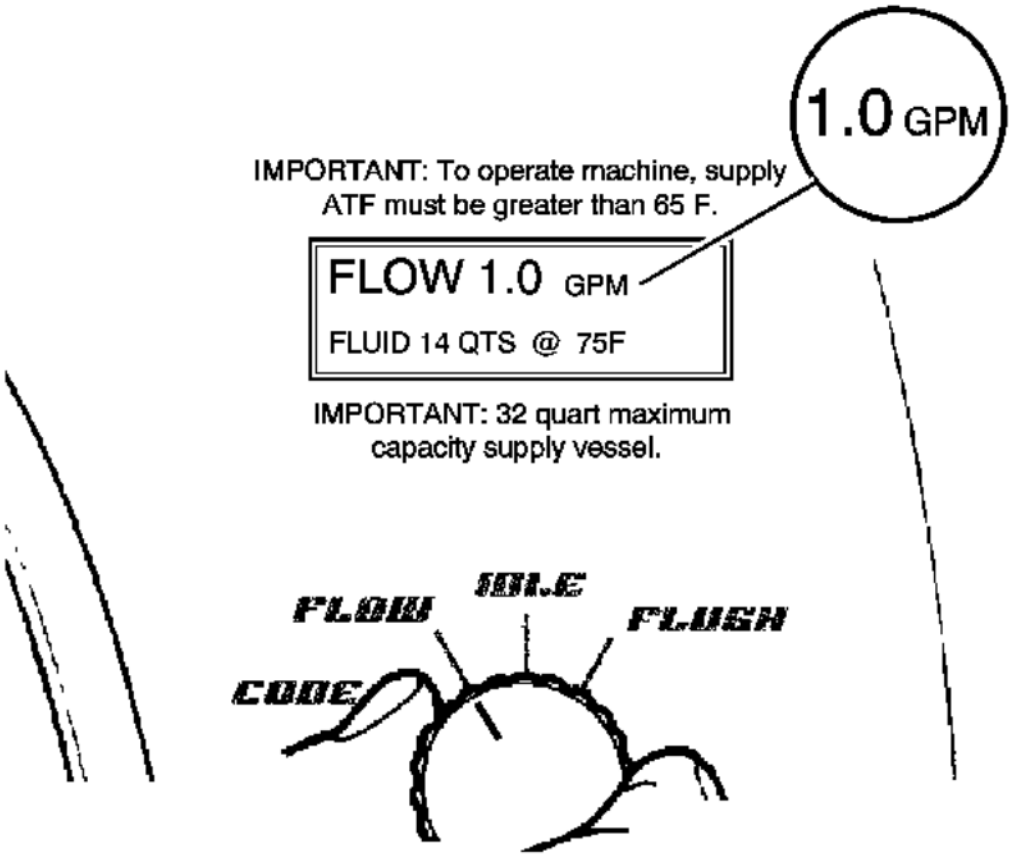


Fig. 21: Setting Main Function Switch To FLOW Position
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: If the flow rate is less than 0.5 gpm, the LCD displays an error message. Refer to the Troubleshooting section of the tester 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 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 Code Recording Procedure.
    1. Replace the transmission oil cooler.
    2. Reconnect supply and waste hoses to the cooler lines in the normal flow direction. Perform Flow Test.
    3. Perform Code Recording Procedure.

CODE RECORDING PROCEDURE

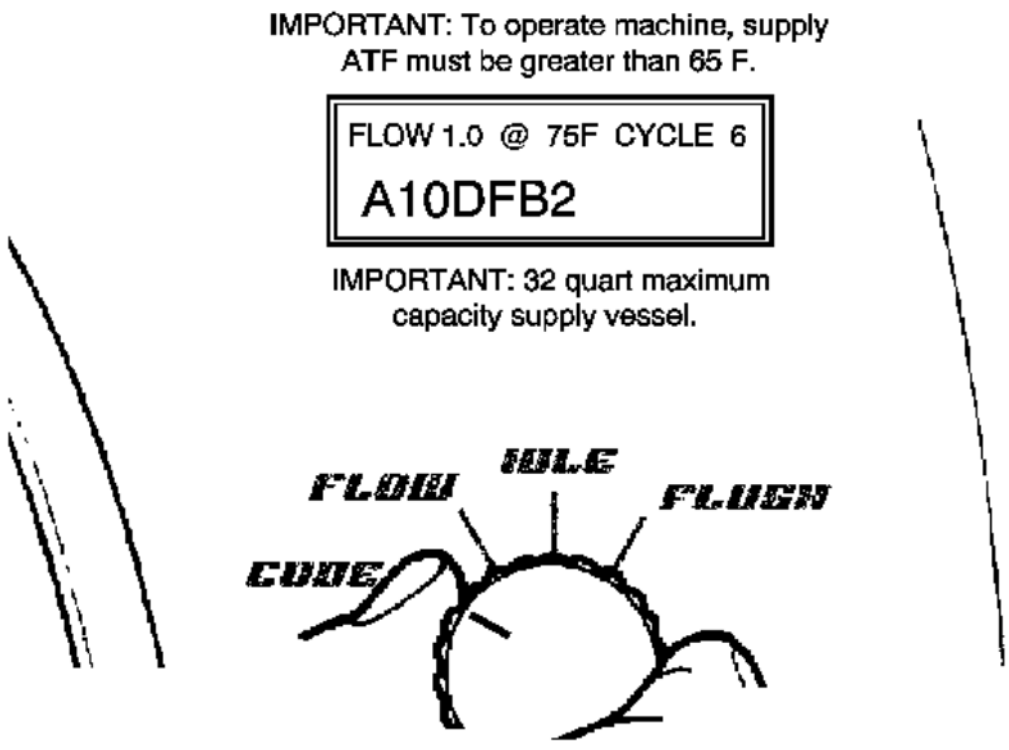


Fig. 22: Setting Main Function Switch To CODE Position
Courtesy of GENERAL MOTORS CORP.

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

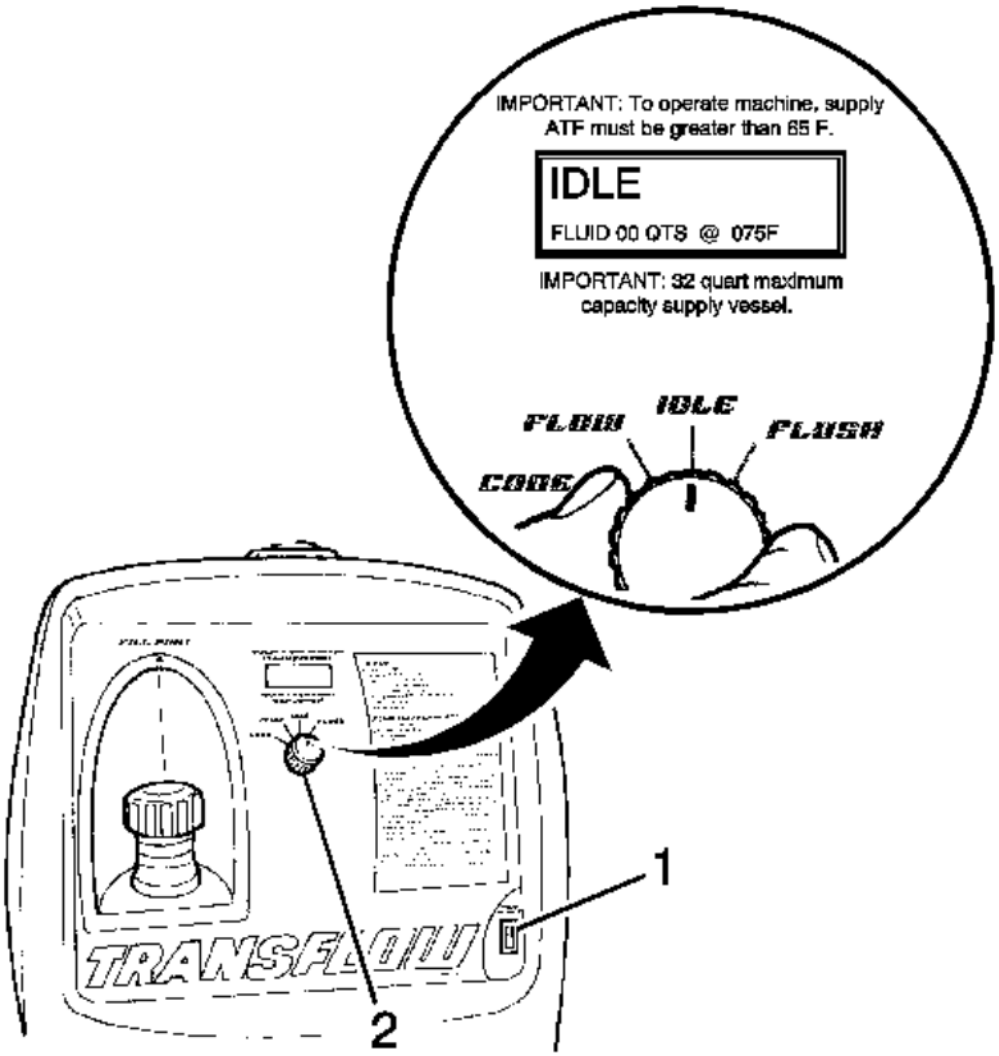


Fig. 23: View Of Main Power Switch & Main Function Switch
Courtesy of GENERAL MOTORS CORP.

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.

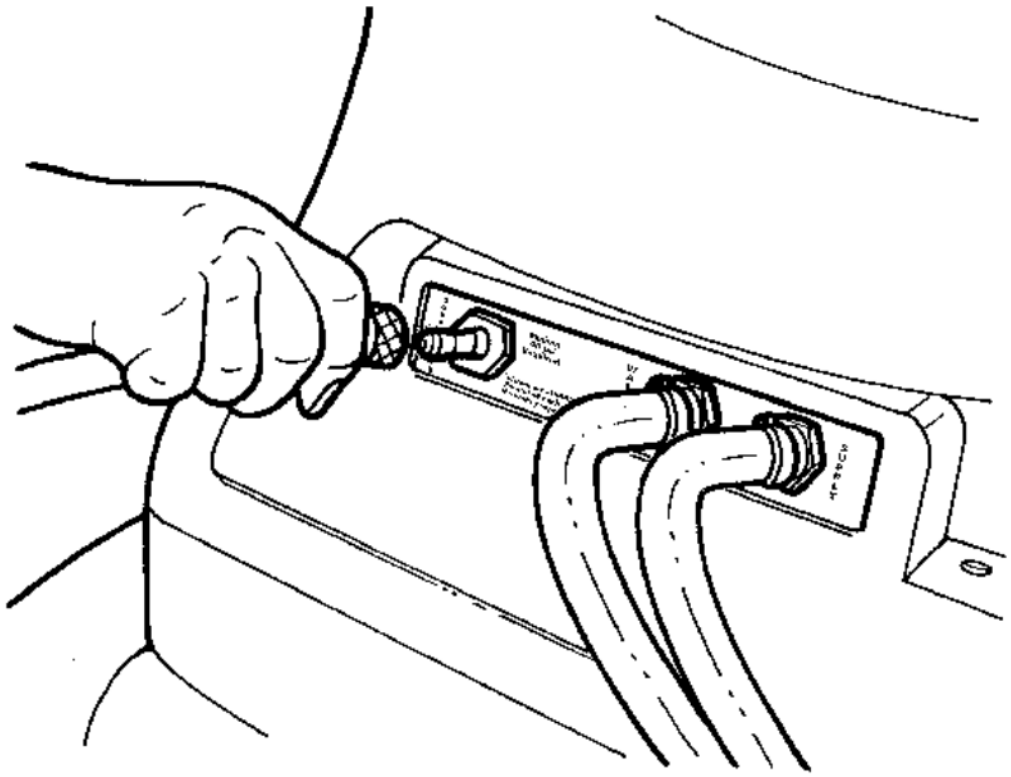


Fig. 24: Applying Shop Air Supply Hose To Quick-Disconnect
Courtesy of GENERAL MOTORS CORP.

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.

AUTOMATIC TRANSMISSION FLUID LEAKS

Checks	Causes

Torque Converter (1)	Inspect for damage.
Torque Converter Housing (203)	Inspect for porosity or damage.
Automatic Transmission Fluid Pump Seal (5)	Inspect for cut, wear, or damage.

NO PARK OR DRIVE

Checks	Causes
Output Shaft Assembly (70)	Inspect for a broken or damaged output shaft. Inspect for worn splines.

HARSH GARAGE SHIFT

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	Inspect for damaged or worn 1-2-3-4 clutch plates (408-410).

NO DRIVE IN ALL RANGES

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged or worn 4-5-6 clutch backing plate (432). • Inspect for damaged 4-5-6 clutch (with turbine shaft) housing assembly (441).
Output Carrier Assembly (68)	• Inspect the carrier assembly for damaged pinion gears, thrust washers, pins, and rollers. • Inspect for damaged thrust bearings (486 and 488). • Inspect for damaged sun gears (487 and 489). • Inspect the carrier assembly for damaged output carrier rear sun gear thrust bearing (captured).
Output Carrier Thrust Bearing Assembly (69)	Inspect the bearing for wear or damage.
Output Shaft Assembly (70)	Inspect for damaged internal gears (495 and 497).
Input Sun Gear Thrust Washer (55)	Inspect the washer for wear or damage.

Input Sun Gear Thrust Bearing (54)	Inspect the bearing for wear or damage.
Input Sun Gear (53)	Inspect for spline wear or damage.
Input Carrier Assembly (52)	Inspect carrier assembly for damaged pinion gears, thrust washers, pins, and rollers.
Turbine Shaft Thrust Bearing Assembly (57)	Inspect the bearing for wear or damage.
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25) or improper sealing interface, leaks, and fluid aeration.
Automatic Transmission Fluid Pump Seal (5)	Inspect for worn or damaged seal.

NO DRIVE OR REVERSE GEAR

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged 4-5-6 clutch (with turbine shaft) housing assembly (441). • Inspect for damaged or distorted turbine shaft.
1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly (61)	Inspect for damaged or distorted shaft on hub assembly.
2-6 and 3-5-R Clutch (with Output Carrier Outer Sun Gear Shaft) Hub Assembly (64)	• Inspect for damaged or distorted shaft on hub assembly. • Inspect the output carrier inner sun gear shaft bushings (60 and 62) for damage or wear.

NO FIRST GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise.

	• Inspect for cut, worn, or damaged low clutch sprag seal (468).

NO FIRST AND REVERSE GEARS

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).
Output Carrier Assembly (68)	Inspect for damaged or stripped splines on the output carrier assembly.

HARSH, SOFT, DELAYED OR SLIPPING FIRST OR REVERSE GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461).

	• Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).

STUCK IN FIRST OR REVERSE GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn low and reverse clutch plates (463 and 465). • Inspect for damaged low and reverse clutch backing plate (462). Inspect for worn splines on backing plate. • Inspect for damaged low and reverse clutch backing plate retaining ring (461). • Inspect for damaged low and reverse clutch piston assembly (470), spring (469), spring retaining ring (466), and center support assembly (459). • Inspect for damaged low clutch sprag assembly (467). Holding the sprag assembly with the retaining ring facing up, and the inner race of the sprag assembly fixed, the outer race should freewheel counterclockwise. • Inspect for cut, worn, or damaged low clutch sprag seal (468).

NO FIRST, SECOND, THIRD, AND FOURTH GEAR

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 1-2-3-4 clutch plates (408-410).

	• Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for damaged 1-2-3-4 clutch piston dam retaining ring (411). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 1-2-3-4 clutch backing plate (407). Inspect for worn splines on the backing plate.
1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly (61)	Inspect for damaged splines on the hub assembly.

HARSH, SOFT, DELAYED OR SLIPPING 1-2-3-4 SHIFT

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 1-2-3-4 clutch plates (408-410). • Inspect for damaged 1-2-3-4 clutch piston (414), piston housing (417), spring (413), and dam assembly (412). • Inspect for damaged 1-2-3-4 clutch piston dam retaining ring (411). • Inspect for cut, worn, or damaged 1-2-3-4 clutch piston seal (416), inner seal (423), and housing seals (424 and 425). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for damaged 1-2-3-4 clutch backing plate (407). Inspect for worn splines on the backing plate.

NO FIRST, SECOND, THIRD, FOURTH, FIFTH, OR REVERSE GEAR

Checks	Causes

1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for improper selective 1-2-3-4 clutch backing plate retaining ring (429). • Inspect for worn or damaged clutch bearing (428).

NO FIRST, SECOND, SIXTH, OR REVERSE GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for a damaged center support assembly (459). • Inspect for worn or damaged output carrier outer sun gear shaft front and rear bushing (458 and 460).
Center Support Retaining Ring (66)	Inspect for damage.
Output Carrier Assembly (68)	Inspect for a worn or damaged center support roller bearing assembly (485).
2-6 and 3-5-R Clutch Hub Thrust Bearing Assembly (65)	Inspect the bearing for wear or damage.

NO SECOND AND SIXTH GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn 2-6 clutch plates (452 and 454). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

HARSH, SOFT, DELAYED OR SLIPPING SECOND OR SIXTH GEAR

Checks	Causes
Center (with 2-6 Low and	• Inspect for damaged or worn 2-6 clutch plates (452

Reverse Clutch) Support Assembly (67)	and 454). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

STUCK IN SECOND OR SIXTH GEAR

Checks	Causes
Center (with 2-6 Low and Reverse Clutch) Support Assembly (67)	• Inspect for damaged or worn 2-6 clutch plates (452 and 454). • Inspect for damaged 2-6 clutch backing plate (451). Inspect for worn splines on backing plate. • Inspect for damaged 2-6 clutch backing plate retaining ring (450). • Inspect for damaged 2-6 clutch piston assembly (457), spring (456), retaining ring (455), and center support assembly (459).

VIBRATION IN SECOND, THIRD, FOURTH, FIFTH, OR SIXTH GEAR

Checks	Causes
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	Inspect hub assembly (475), dampener (476), and apply plate (477) for wear or damage.

NO THIRD, FIFTH, AND REVERSE GEAR

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 3-5-R clutch plates (402-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420).

	• Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for damaged 3-5-R clutch backing plate (401). Inspect for worn splines on the backing plate.
Control Valve Upper Body Assembly	Inspect for a worn, sticking or damaged 3-5 reverse clutch regulator valve and spring. Inspect the valve bore for debris or scoring.

HARSH, SOFT, DELAYED OR SLIPPING THIRD, FIFTH, OR REVERSE GEAR

Checks	Causes
1-2-3-4 and 3-5-R Clutch Assembly (51)	• Inspect for damaged or worn 3-5-R clutch plates (402-404). • Inspect for damaged 3-5-R clutch piston (421), apply ring (405), and spring (420). • Inspect for cut, worn, or damaged 3-5-R clutch piston dam O-ring seal (418), inner seal (419), and outer seal (422). • Inspect for improper selective 3-5-R clutch backing plate retaining ring (400). • Inspect for damaged 3-5-R clutch backing plate (401). Inspect for worn splines on the backing plate.
Control Valve Upper Body Assembly	Inspect for a worn, sticking or damaged 3-5 reverse clutch regulator valve and spring. Inspect the valve bore for debris or scoring.

NO FOURTH, FIFTH, AND SIXTH GEAR

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged or worn clutch plates (433-435). • Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and clutch spring (438). • Inspect for improper selective 4-5-6 clutch backing

	plate retaining ring (431). • Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442). • Inspect for damaged or distorted turbine shaft.
Control Valve Upper Body Assembly (304)	Inspect the 1/Reverse band and 4-5-6 clutch regulator valve (327) and spring (326) for wear or damage.
4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly (58)	Inspect the hub assembly (475), dampener (476), and apply plate (477) for wear or damage.
Output Carrier Assembly (68)	Inspect for damaged or stripped internal splines on the output carrier assembly.

HARSH, SOFT, DELAYED OR SLIPPING 4-5-6 SHIFT

Checks	Causes
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged or worn clutch plates (433-435). • Inspect for damaged piston (439), piston dam (437), dam retaining ring (436), and clutch spring (438). • Inspect for improper selective 4-5-6 clutch backing plate retaining ring (431). • Inspect for cut, worn, or damaged turbine shaft fluid seal rings (442).

NO TORQUE CONVERTER CLUTCH APPLY

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking TCC control valve (227) and spring (226). • Inspect for damaged stator shaft.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking torque converter clutch (TCC) regulator apply valve (355).
4-5-6 (with Turbine Shaft) Clutch Assembly (56)	• Inspect for damaged turbine shaft. • Inspect for damaged turbine shaft O-ring seal.

NO TORQUE CONVERTER CLUTCH RELEASE

Checks	Causes
Torque Converter Assembly (1)	Diagnose torque converter for possible internal damage.
Fluid Pump Cover Assembly (219)	• Inspect for worn, damaged, or sticking converter feed limit valve (220) and spring (221). • Inspect for worn, damaged, or sticking torque converter clutch (TCC) control valve (227) and spring (226).
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking TCC regulator apply valve (355).

NO REVERSE GEAR

Checks	Causes
Control Valve Upper Body Assembly (304)	• Inspect for worn, damaged, or sticking 3-5 reverse regulator valve (336) and valve spring (326). • Inspect for damaged or missing #5 checkball.
Control Valve Lower Body Assembly (307)	Inspect for worn, damaged, or sticking clutch select solenoid valve 3 (352) and valve spring (353).

FLUID PRESSURE HIGH OR LOW

Checks	Causes
Torque Converter Housing with Fluid Pump Assembly (2)	• Inspect for worn, sticking, or damaged pressure regulator valve (233). • Inspect for worn, sticking, or damaged pressure regulator valve outer spring (234). • Inspect for worn, sticking, or damaged pressure regulator valve inner spring (235). • Inspect for worn, sticking, or damaged isolator valve (236) and sleeve (237). • Inspect for worn, sticking, or damaged pressure relief ball valve (225). • Inspect for worn, sticking, or damaged pressure relief ball valve spring (224).

	• Inspect for damaged or porous pump cover assembly (219). Inspect for pump surfaces not flat. • Inspect for excessive fluid pump rotor (217) clearance or damage. Ensure proper selective rotor is being utilized. • Inspect for damaged fluid pump slide (212). Ensure proper selective slide is being utilized. • Inspect for worn, sticking, or damaged fluid pump slide outer spring (211). • Inspect for worn or damaged fluid pump slide seal (213), seal support (214), pivot pin (215), fluid seal ring (209), and O-ring seal (210). • Inspect for worn or damaged fluid pump vane rings (207) and rotor guide (208).
Control Valve Upper Body Assembly (321)	• Inspect for worn, sticking, or damaged actuator feed limit valve (325) and spring (324). • Inspect for worn, sticking, or damaged clutch boost valve (329) and spring (330).
Fluid Filter Assembly (26)	• Inspect for damaged or restricted fluid filter assembly (26). • Inspect for damaged fluid filter seal assembly (25).

ON-VEHICLE REPAIR INFORMATION

NOTE: Data below covers ON-VEHICLE repair information. For off vehicle repair information see OFF-VEHICLE REPAIR INFORMATION.

TRANSMISSION FLUID FILLER TUBE AND SEAL REPLACEMENT

REMOVAL PROCEDURE

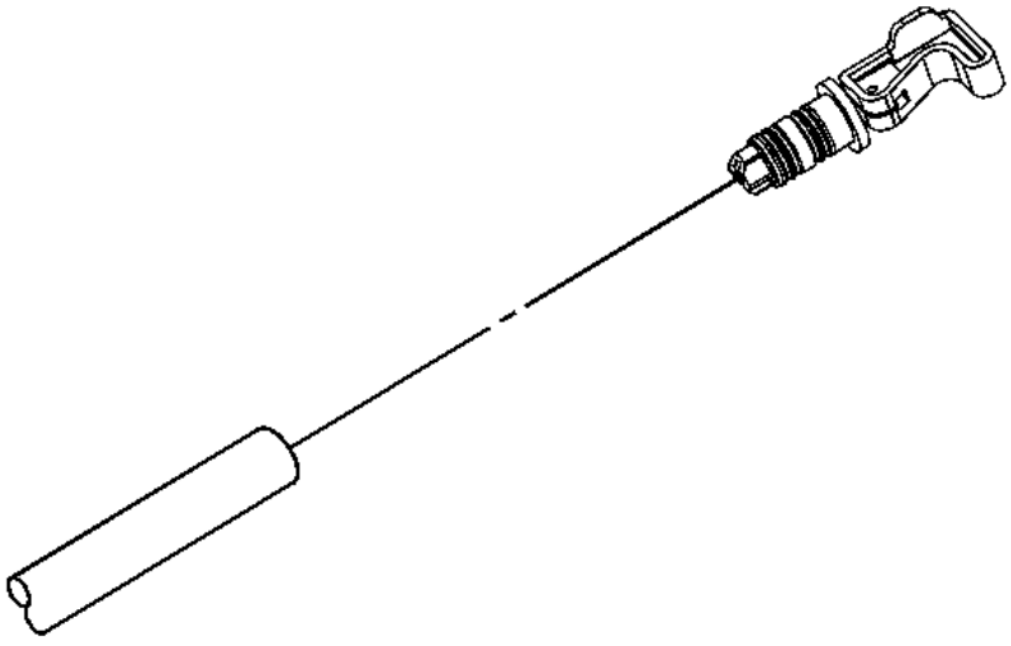


Fig. 25: View Of Transmission Oil Level Indicator
Courtesy of GENERAL MOTORS CORP.

1. Unlock the transmission oil level indicator.
2. Remove the transmission oil level indicator.
3. Remove the transmission. Refer to **Transmission Replacement**.

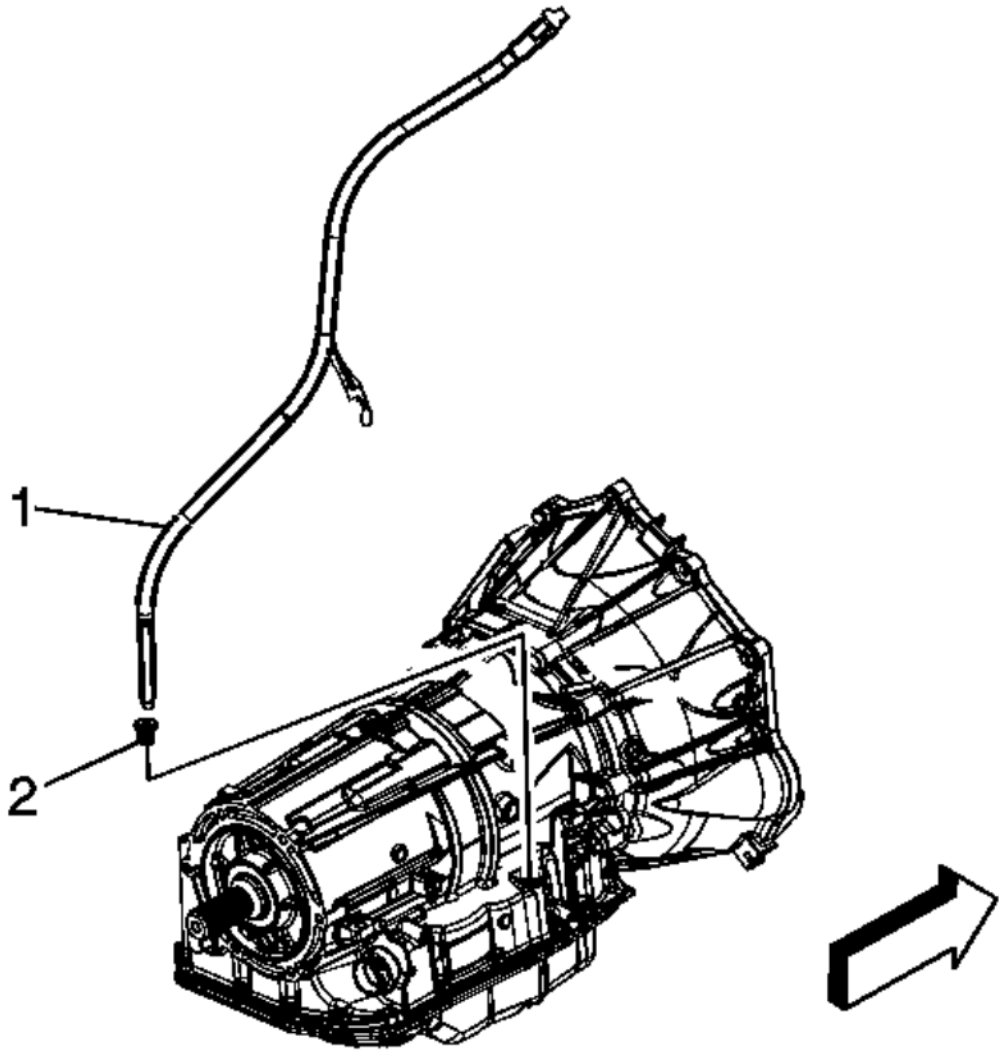


Fig. 26: View Of Oil Level Indicator Tube & Transmission Seal
Courtesy of GENERAL MOTORS CORP.

4. Remove the oil level indicator tube (1).
5. Remove the seal (2) from the transmission.

INSTALLATION PROCEDURE

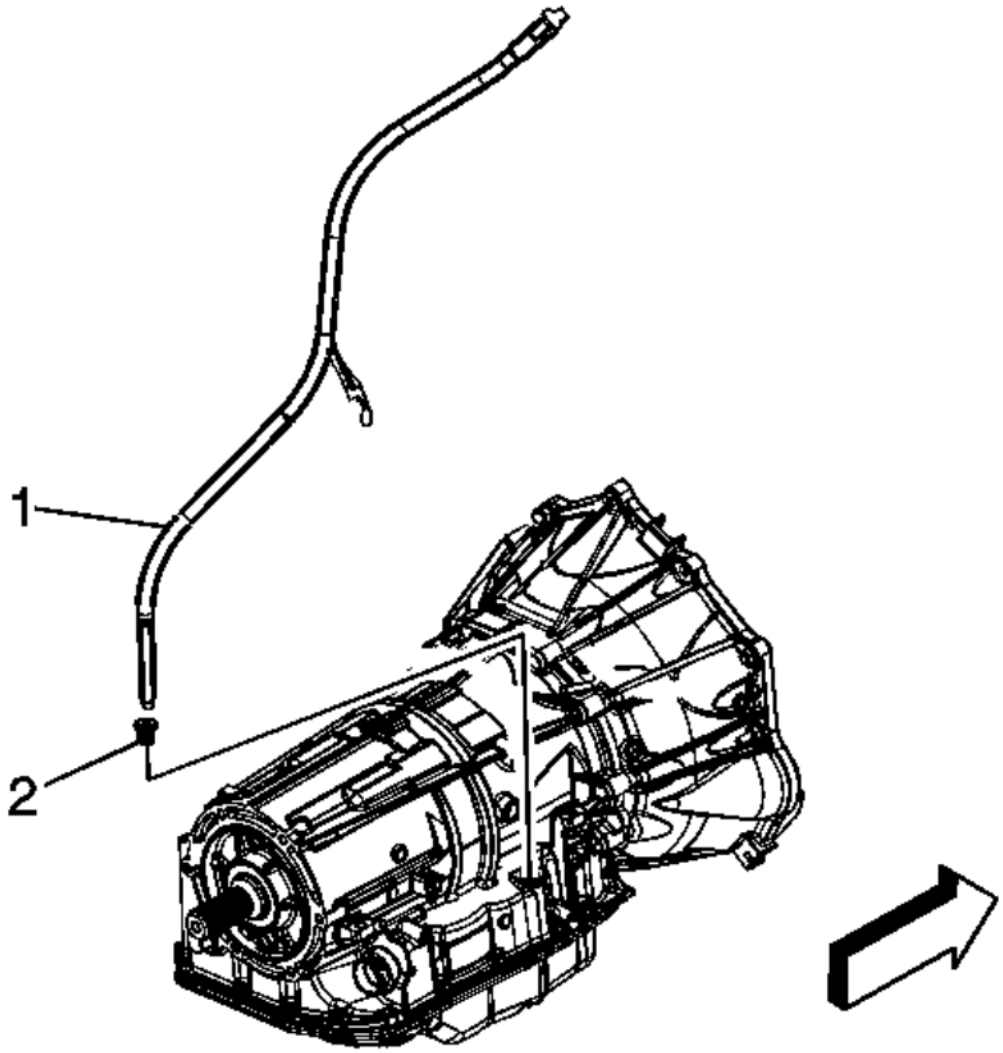


Fig. 27: View Of Oil Level Indicator Tube & Transmission Seal
Courtesy of GENERAL MOTORS CORP.

1. Install a NEW seal (2) to the indicator tube.
2. Install the oil level indicator tube (1).
3. Install the transmission. Refer to **Transmission Replacement**.
4. Lower the vehicle.
5. Check the transmission fluid level. Refer to **Transmission Fluid Check**.

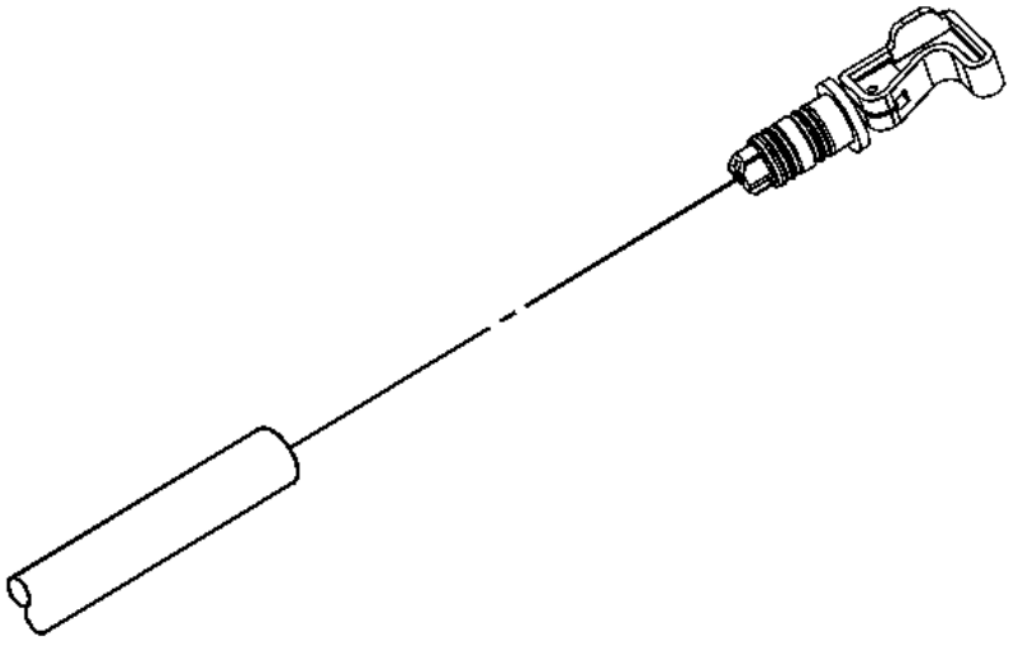


Fig. 28: View Of Transmission Oil Level Indicator
Courtesy of GENERAL MOTORS CORP.

6. Install the transmission oil level indicator.
7. Lock the transmission oil level indicator.

RANGE SELECTOR LEVER CABLE REPLACEMENT

REMOVAL PROCEDURE

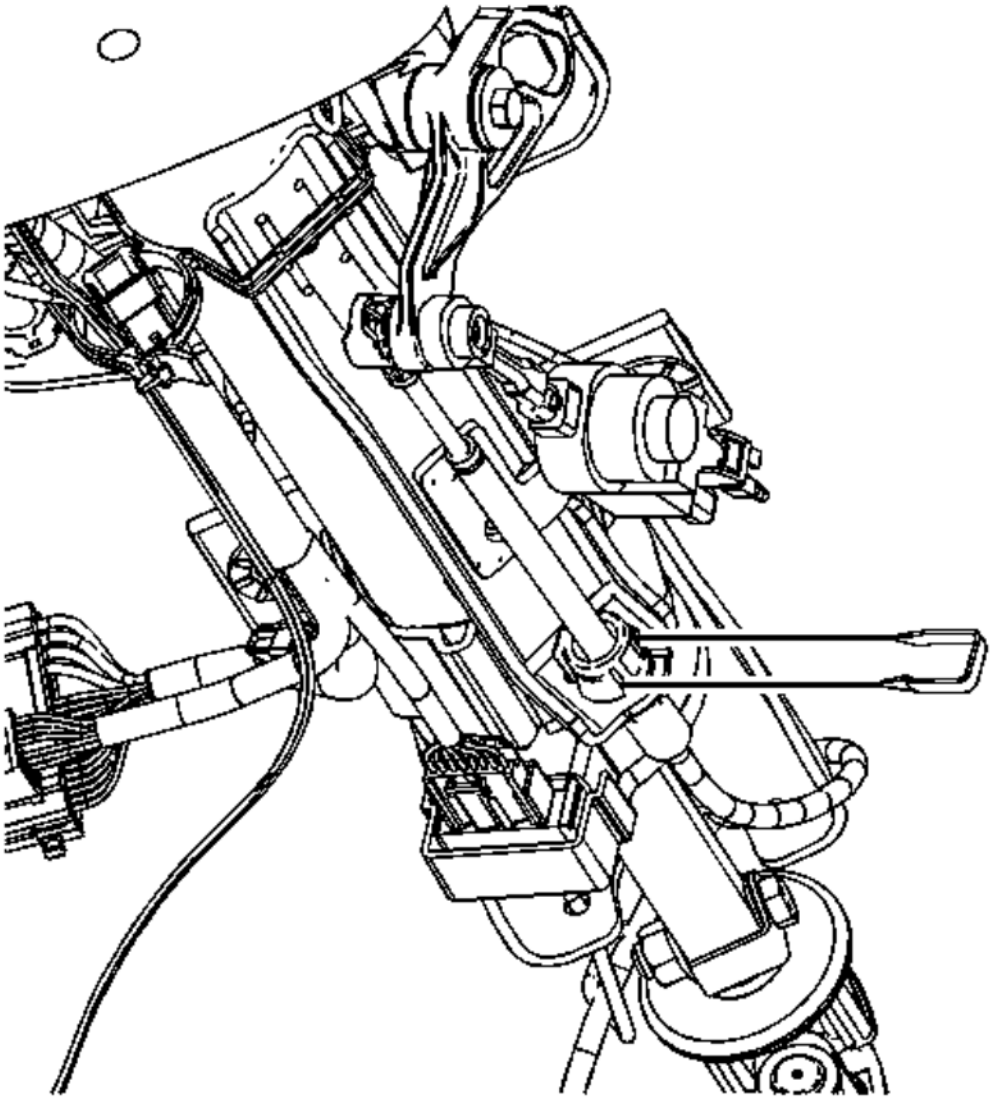


Fig. 29: View Of Steering Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS CORP.

1. Position the steering column shift lever to the park position.
2. Remove the instrument panel knee bolster. Refer to **Knee Bolster Replacement (with RPO SLT)** or **Knee Bolster Replacement (without RPO SLT)** .
3. Remove the driver seat. Refer to **Front Seat Replacement - Bucket** .

4. Pull back the carpet and insulation around the driver area.
5. Remove the retainer securing the cable to the steering column.

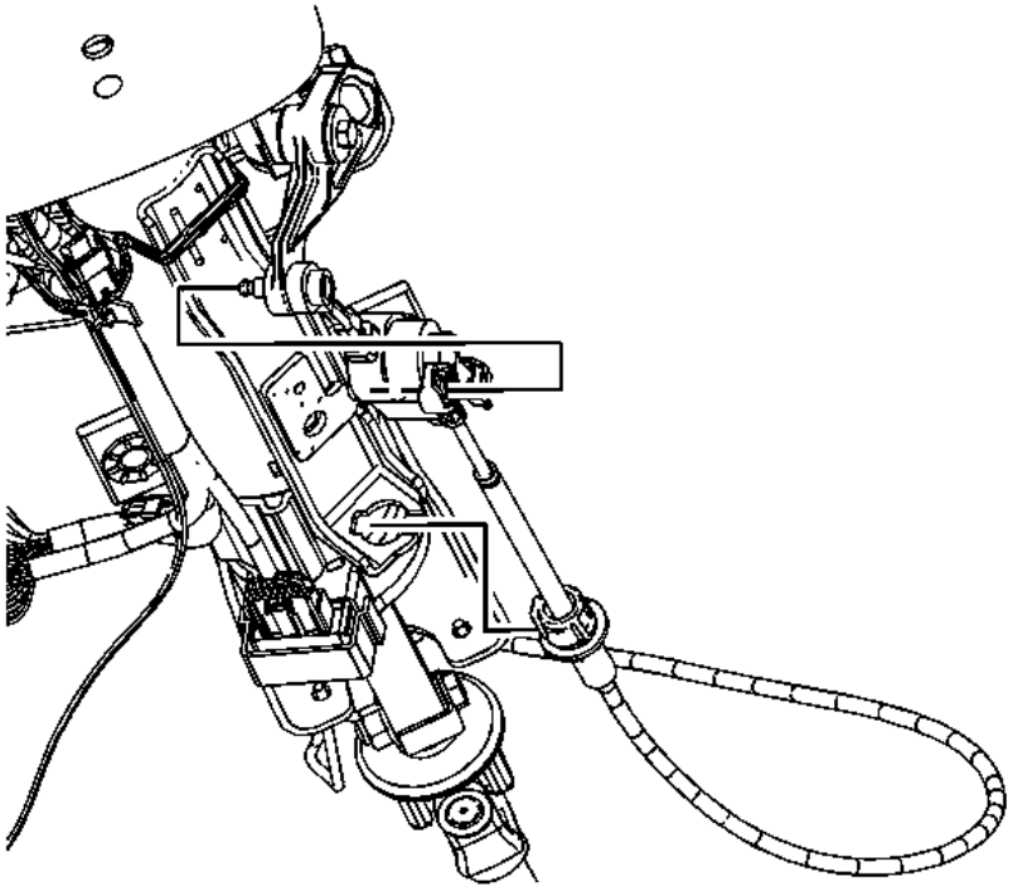


Fig. 30: View Of Cable, Steering Column Ball Stud & Steering Column Bracket
Courtesy of GENERAL MOTORS CORP.

6. Remove the cable end from the steering column ball stud.
7. Depress the tangs and remove the cable from the steering column bracket.

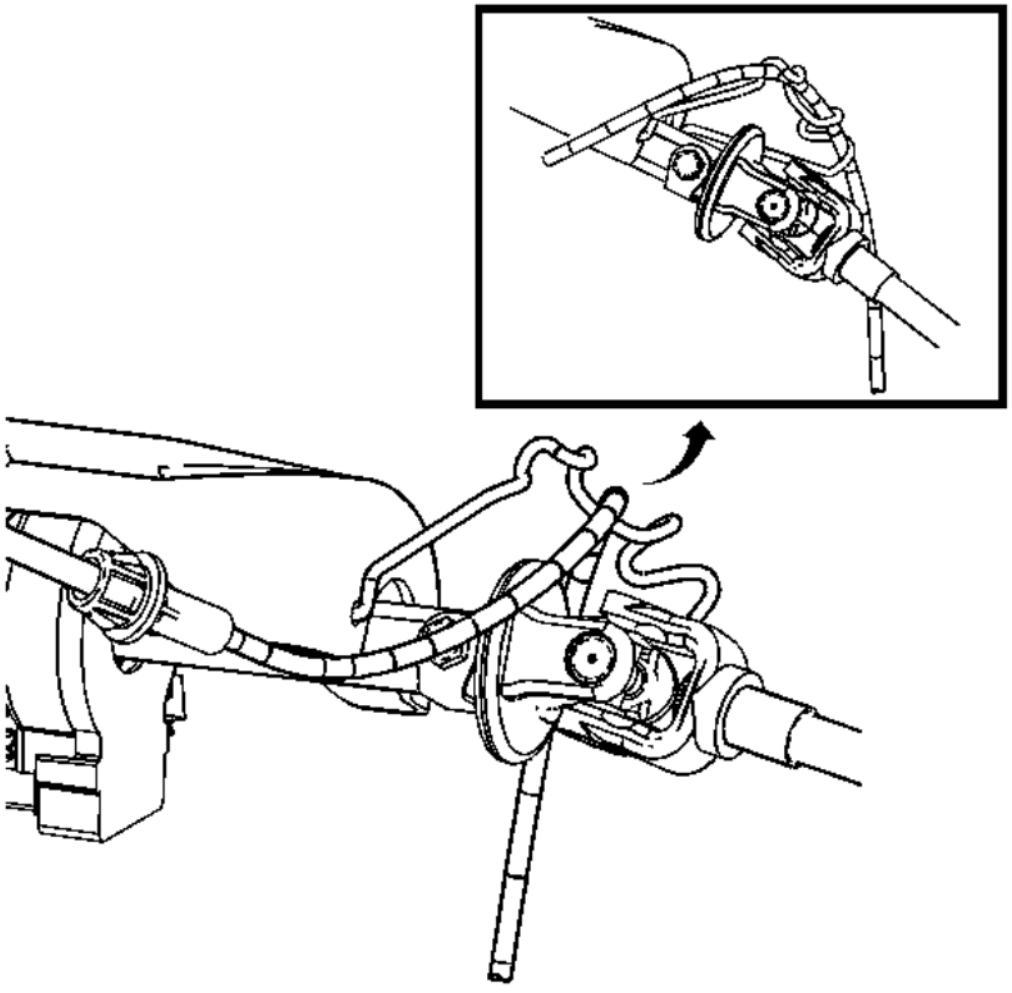


Fig. 31: View Of Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Avoid unnecessary twisting/bending of the range selector cable when removing the cable from the support.

8. Remove the range selector cable from the support.

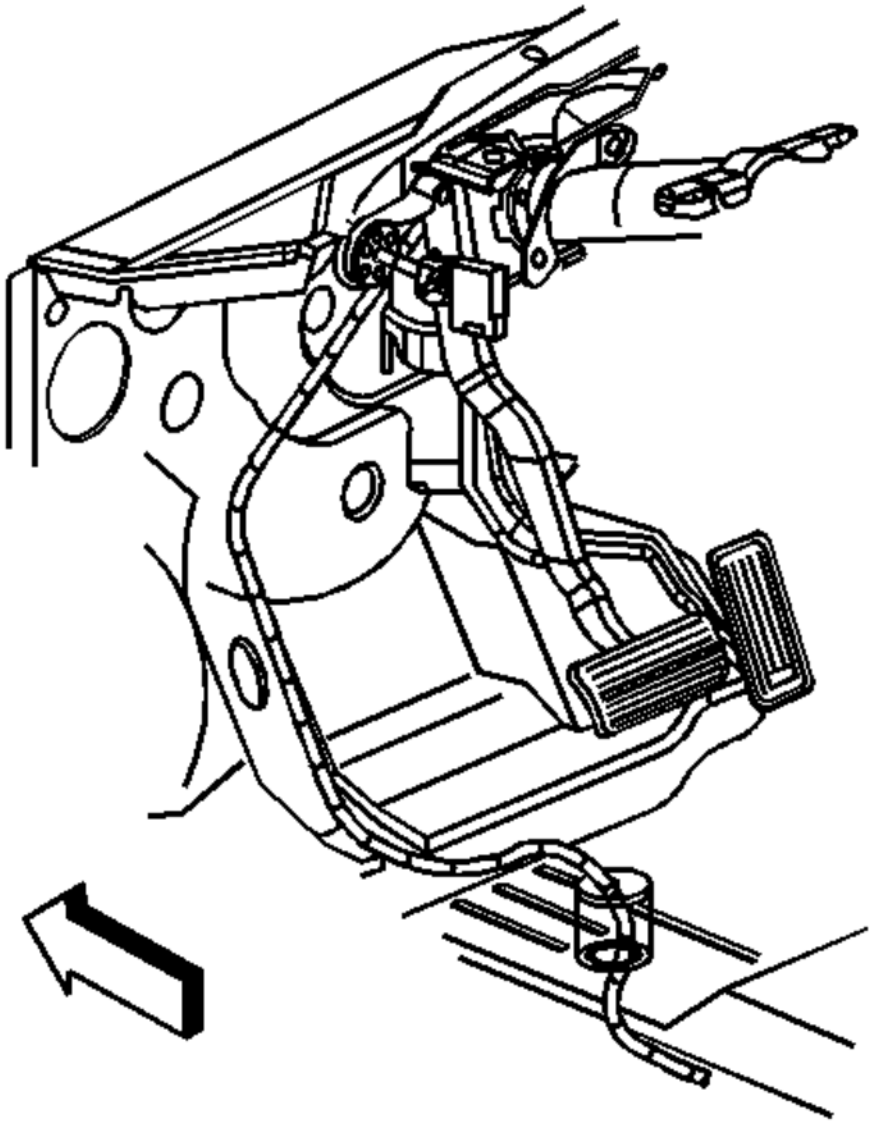


Fig. 32: View Of Cable Grommet At Floor Panel
Courtesy of GENERAL MOTORS CORP.

9. Remove the cable grommet from the floor panel.
10. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .

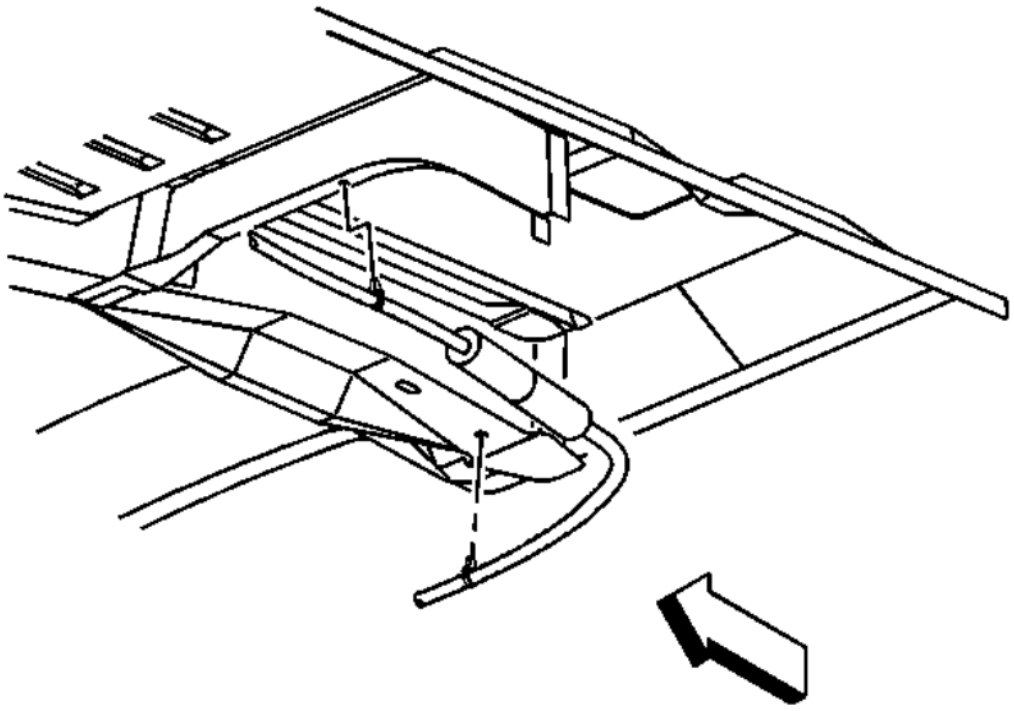


Fig. 33: View Of Cable Clips At Floor Panel Reinforcement
Courtesy of GENERAL MOTORS CORP.

11. Remove the clips on the cable from the floor panel reinforcement.
12. Ensure the transmission manual shaft is positioned in mechanical park.
13. Remove the cable clip on the transfer case, if equipped.

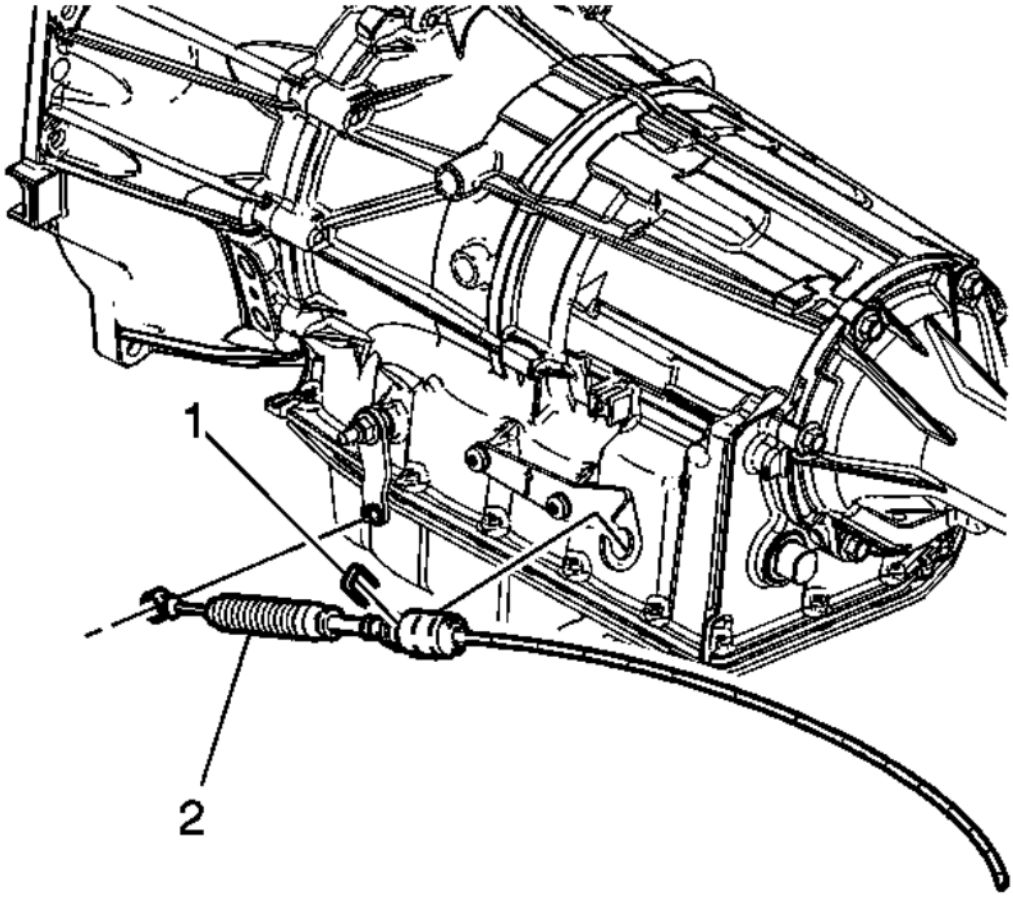


Fig. 34: View Of Range Selector Cable & Cable Bracket Retainer
Courtesy of GENERAL MOTORS CORP.

14. Remove the range selector cable (2) from the transmission range selector lever ball stud.
15. Remove the retainer (1) that secures the cable to the bracket.
16. Depress the tangs and remove the cable from the bracket.
17. Remove the transmission range selector cable from the vehicle.

INSTALLATION PROCEDURE

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

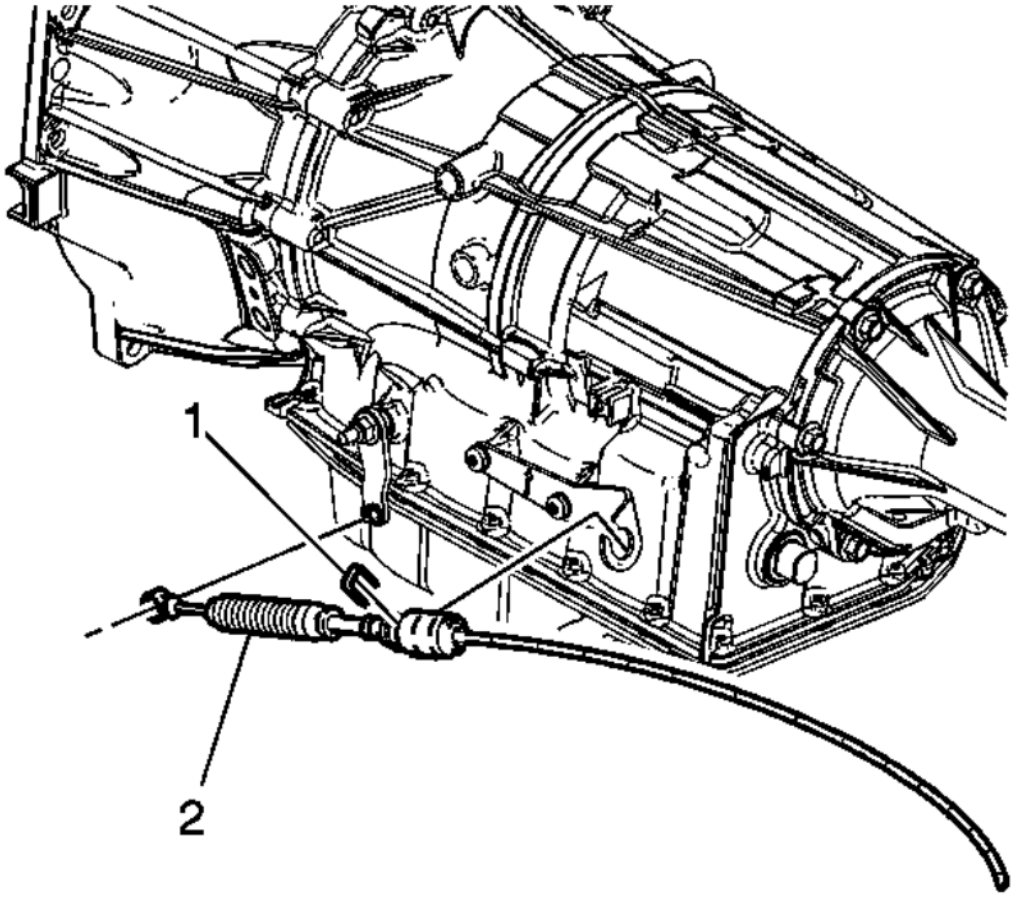


Fig. 35: View Of Range Selector Cable & Cable Bracket Retainer
Courtesy of GENERAL MOTORS CORP.

2. Ensure that the transmission manual shaft lever is in the mechanical park position.
3. Align and install the range selector cable (2) to the bracket.
4. Install the retainer (1) that secures the cable to the bracket.
5. Install the range selector cable end to the transmission range selector lever ball stud.
6. Install the cable clip on the transfer case, if equipped.

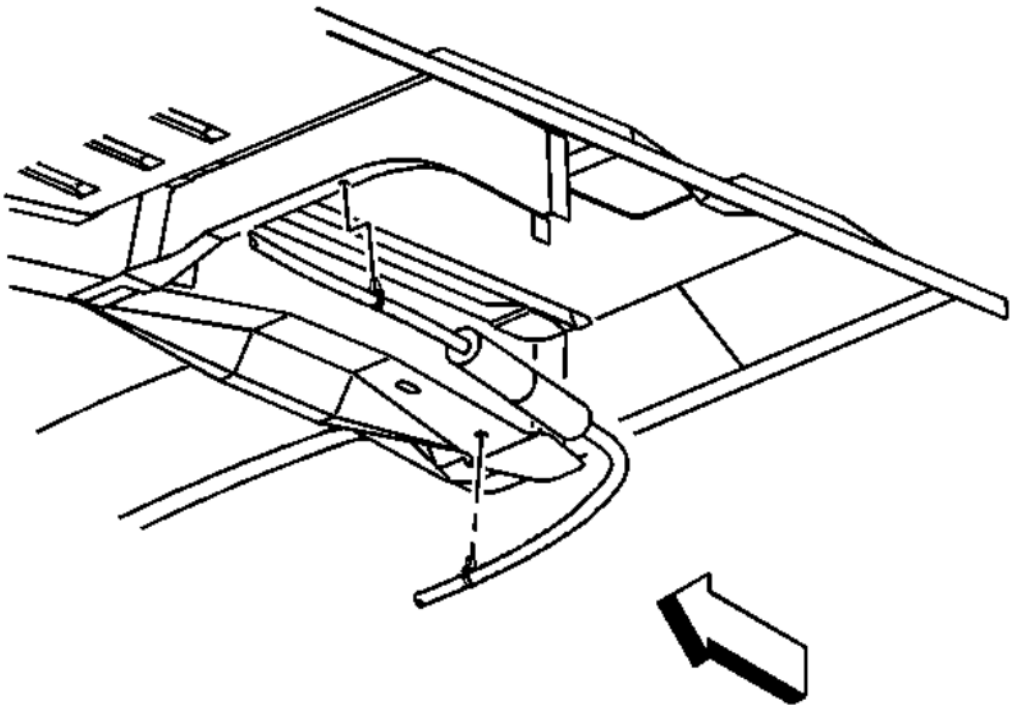


Fig. 36: View Of Cable Clips At Floor Panel Reinforcement
Courtesy of GENERAL MOTORS CORP.

7. Install the clips on the cable to the floor panel reinforcement.
8. Lower the vehicle and ensure that the steering column shift lever is still in the park position.

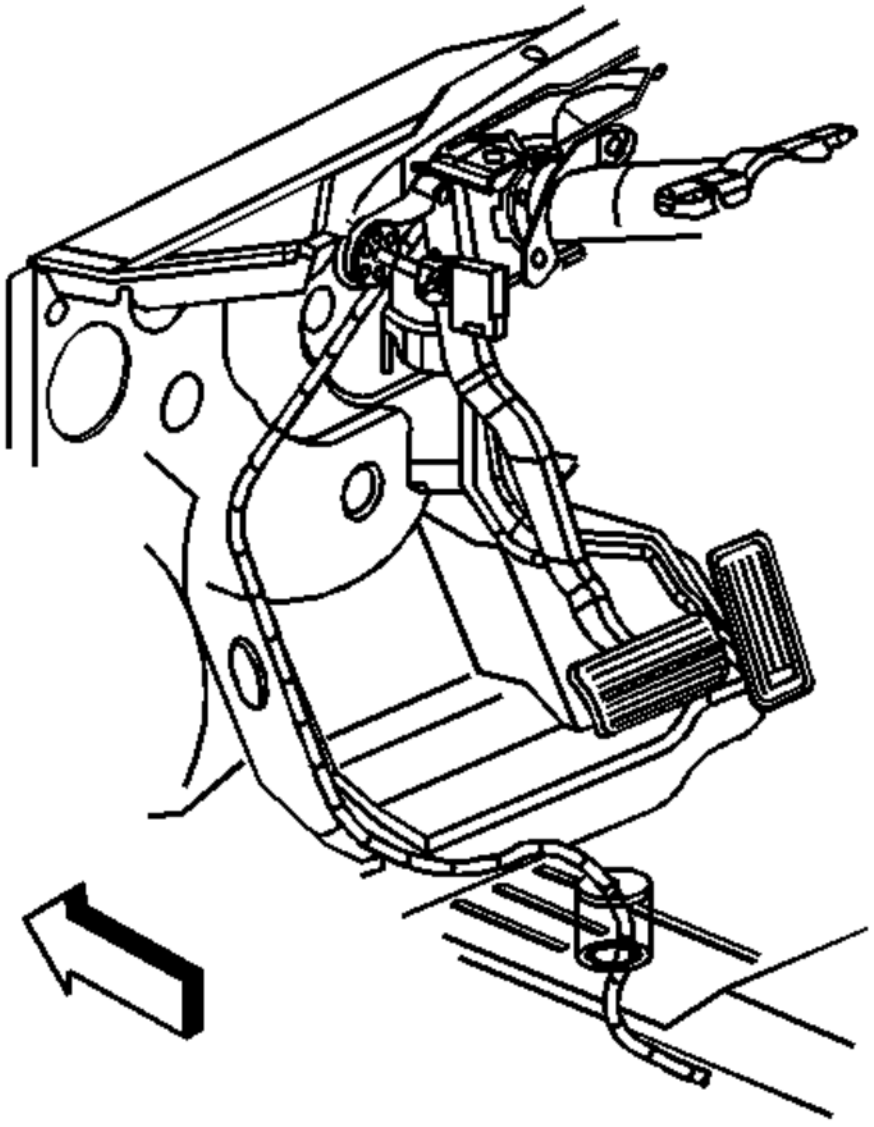


Fig. 37: View Of Cable Grommet At Floor Panel
Courtesy of GENERAL MOTORS CORP.

9. Install the cable grommet to the floor panel.

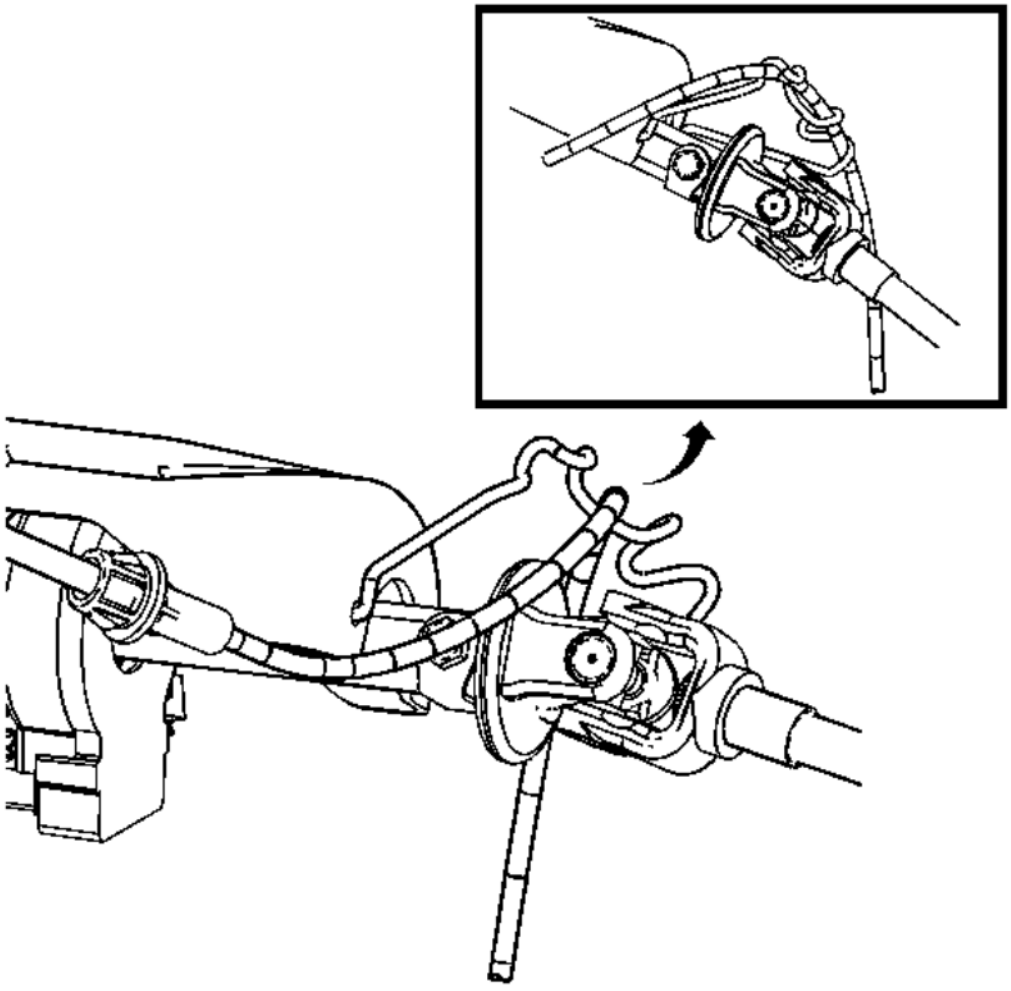


Fig. 38: View Of Range Selector Cable
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Avoid unnecessary twisting/bending of the range selector cable when installing the cable to the support.

10. Install the range selector cable to the support.

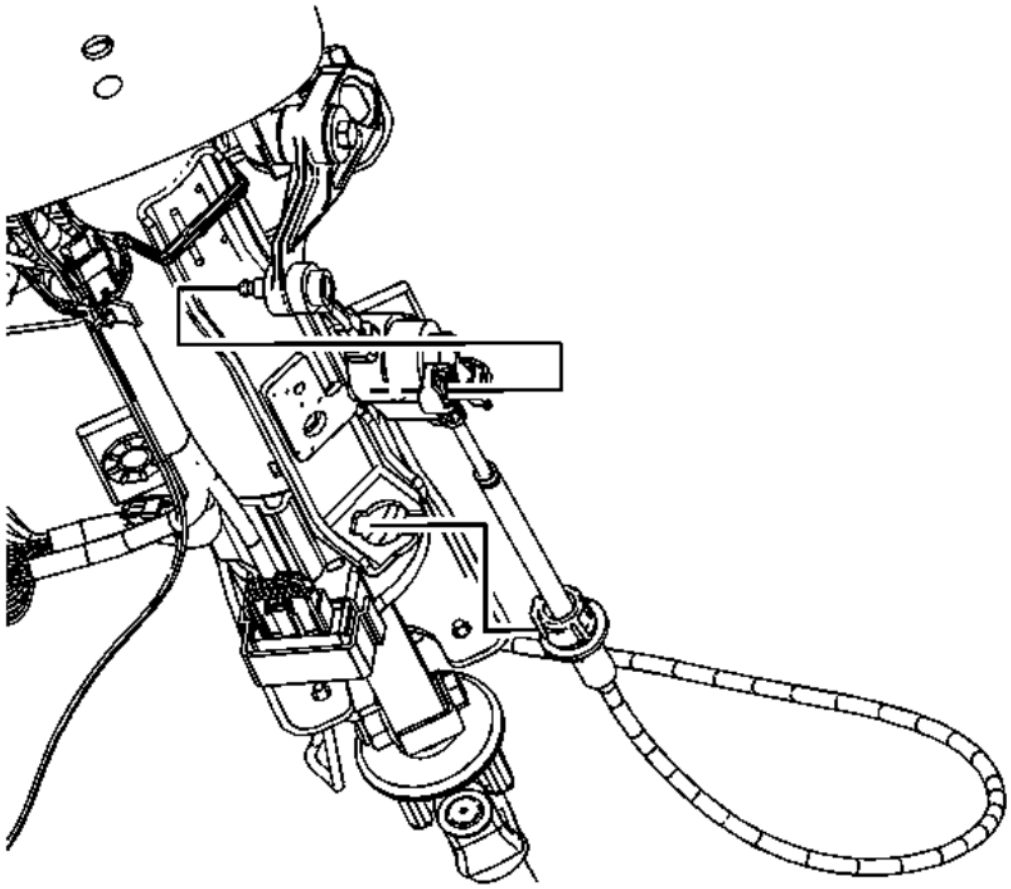


Fig. 39: View Of Cable, Steering Column Ball Stud & Steering Column Bracket
Courtesy of GENERAL MOTORS CORP.

11. Install the cable to the steering column bracket.
12. Ensure the tangs fully engage into the steering column bracket.
13. Install the cable end to the steering column ball stud.

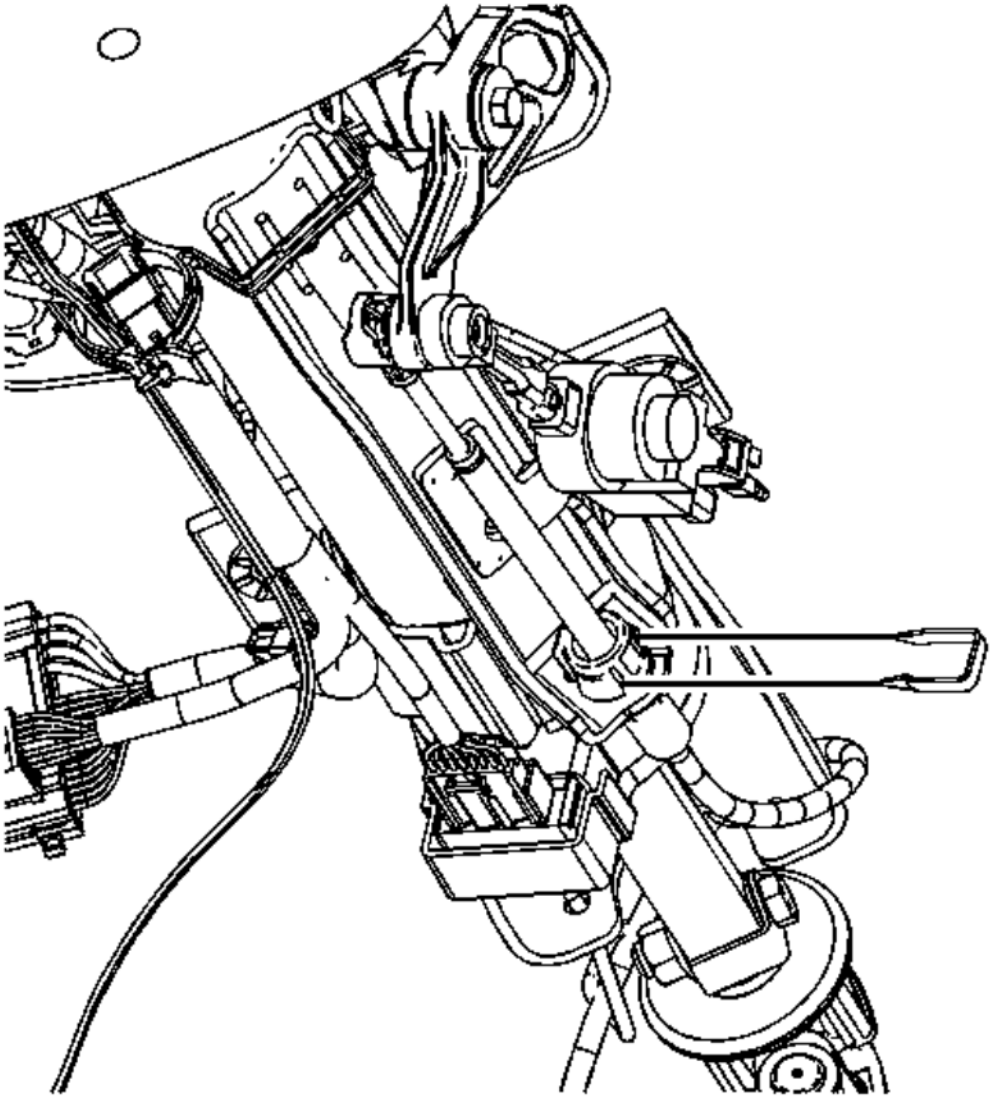


Fig. 40: View Of Steering Cable Retainer On Steering Column
Courtesy of GENERAL MOTORS CORP.

14. Install the retainer securing the cable to the steering column.
15. Position the carpet and insulation around the driver area.
16. Install the driver seat. Refer to **Front Seat Replacement - Bucket** .

17. Install the instrument panel knee bolster. Refer to **Knee Bolster Replacement (with RPO SLT)** or **Knee Bolster Replacement (without RPO SLT)** .
18. Test the transmission for proper shift operation.
19. If all of the gear positions cannot be achieved, adjust the cable. Refer to **Range Selector Lever Cable Adjustment** .

RANGE SELECTOR LEVER CABLE ADJUSTMENT

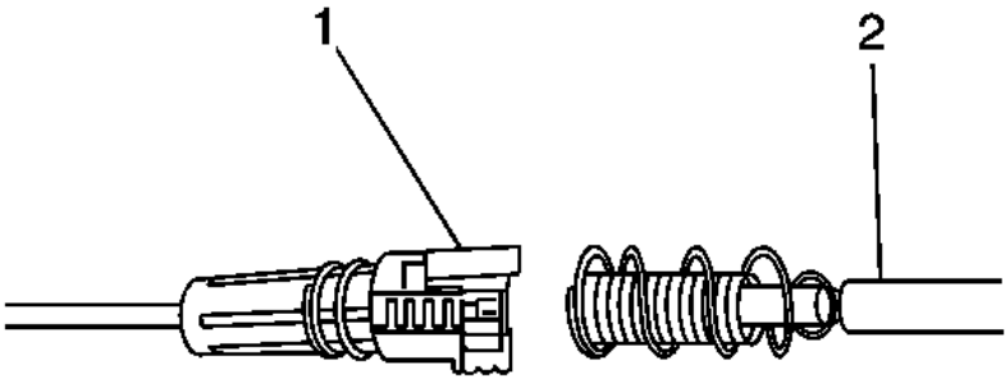


Fig. 41: Aligning Outside Diameter Of Transmission End With Inside Diameter Of Shifter End
Courtesy of GENERAL MOTORS CORP.

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).

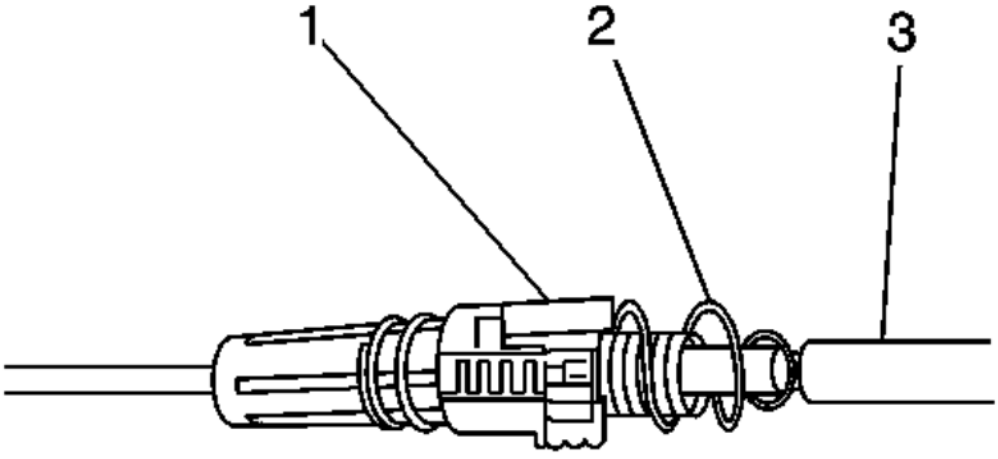


Fig. 42: Engaging Inner Wire And Lock Both Wires Together
Courtesy of GENERAL MOTORS CORP.

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.

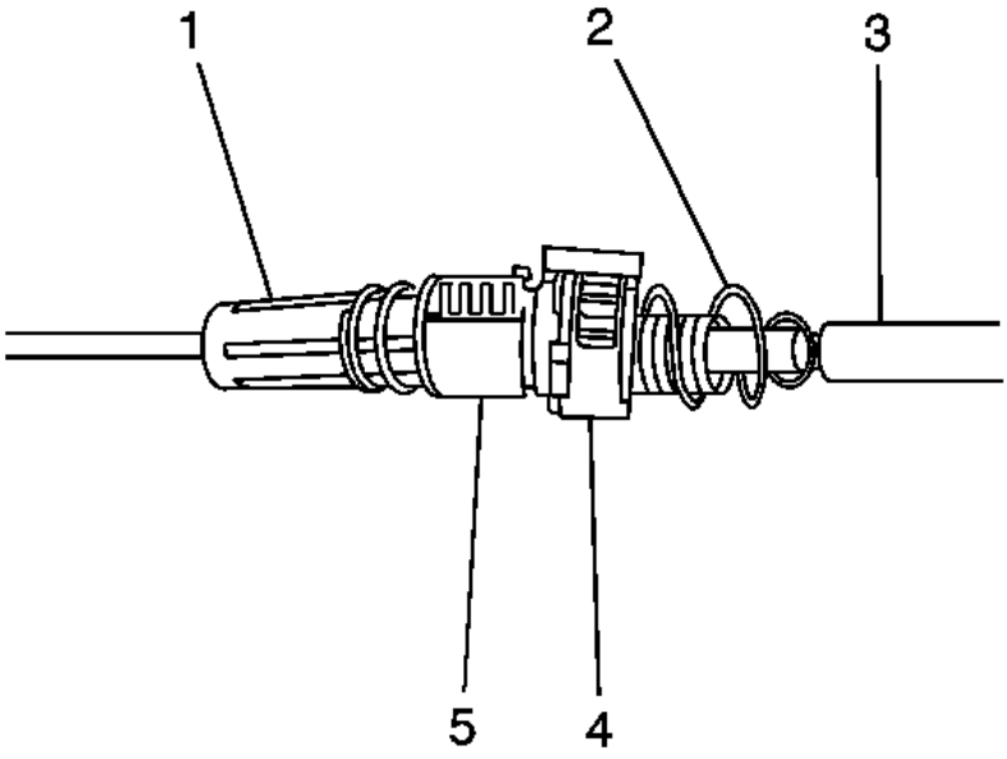


Fig. 43: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

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).

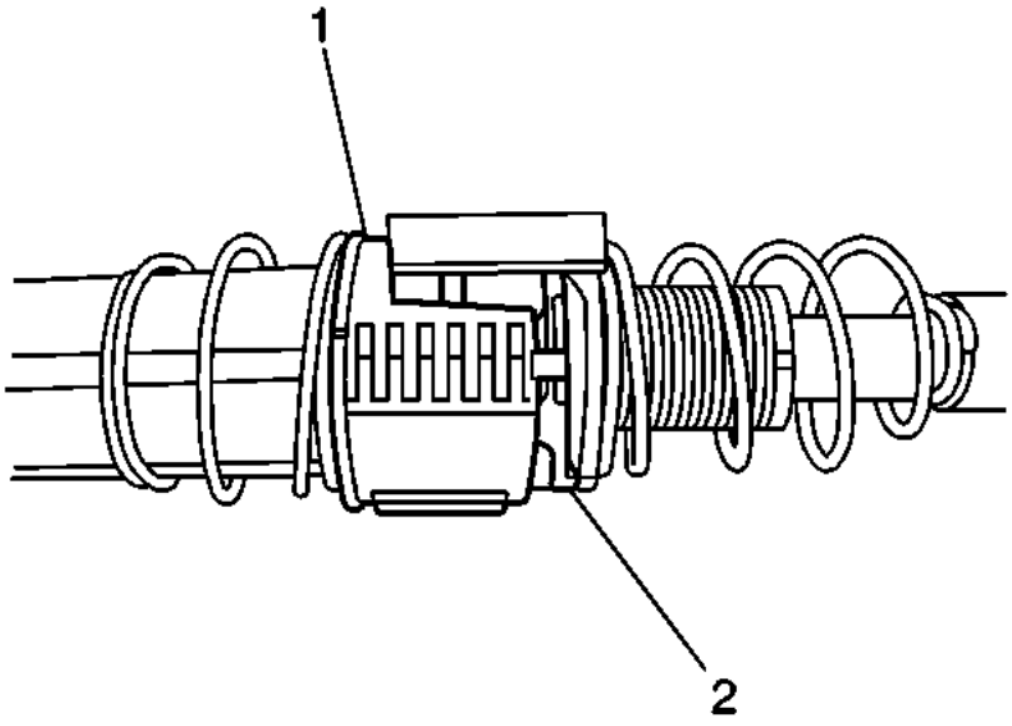


Fig. 44: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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 below.
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

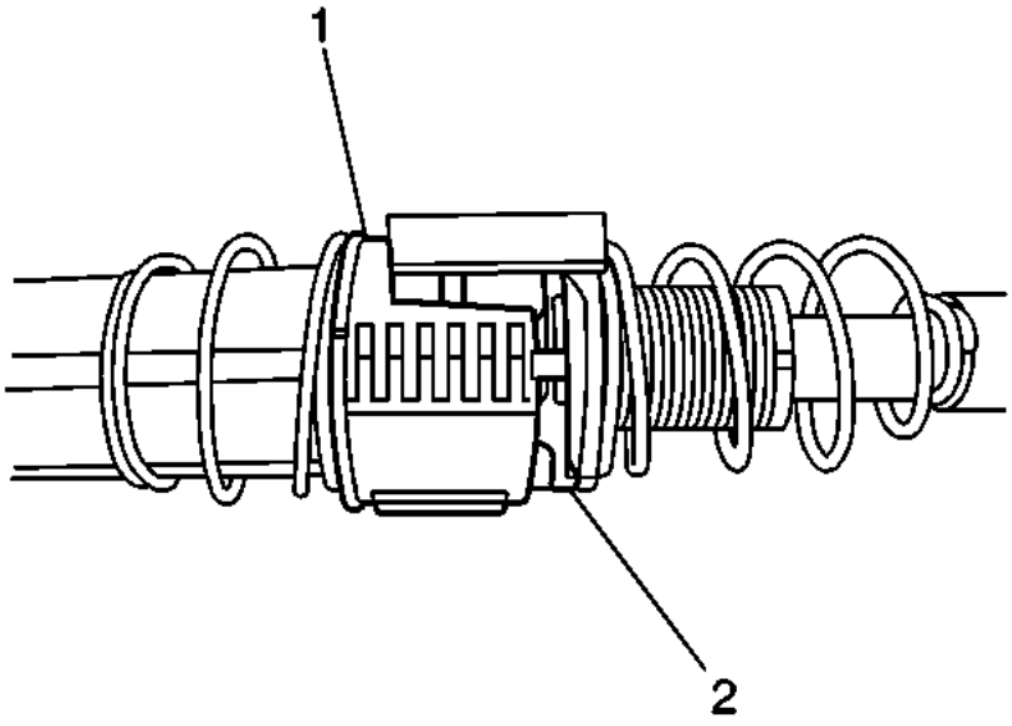


Fig. 45: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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.

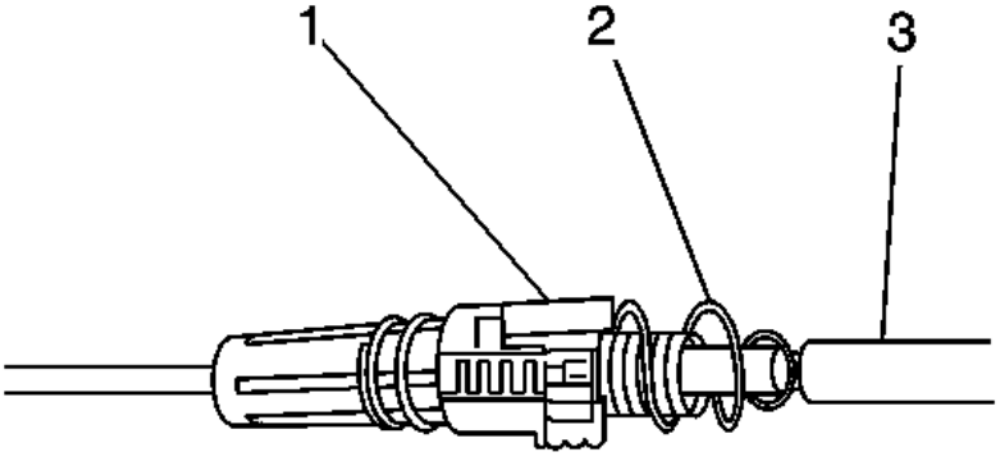


Fig. 46: Engaging Inner Wire And Lock Both Wires Together
Courtesy of GENERAL MOTORS CORP.

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.

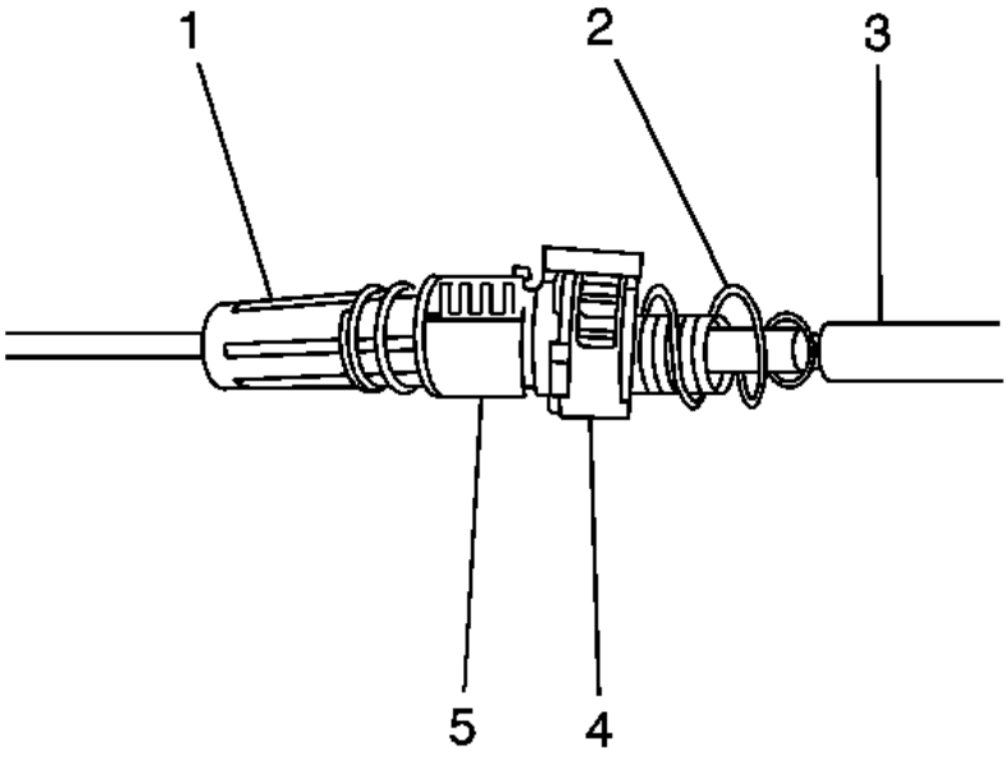


Fig. 47: Tension/Adjust Cable System
Courtesy of GENERAL MOTORS CORP.

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).

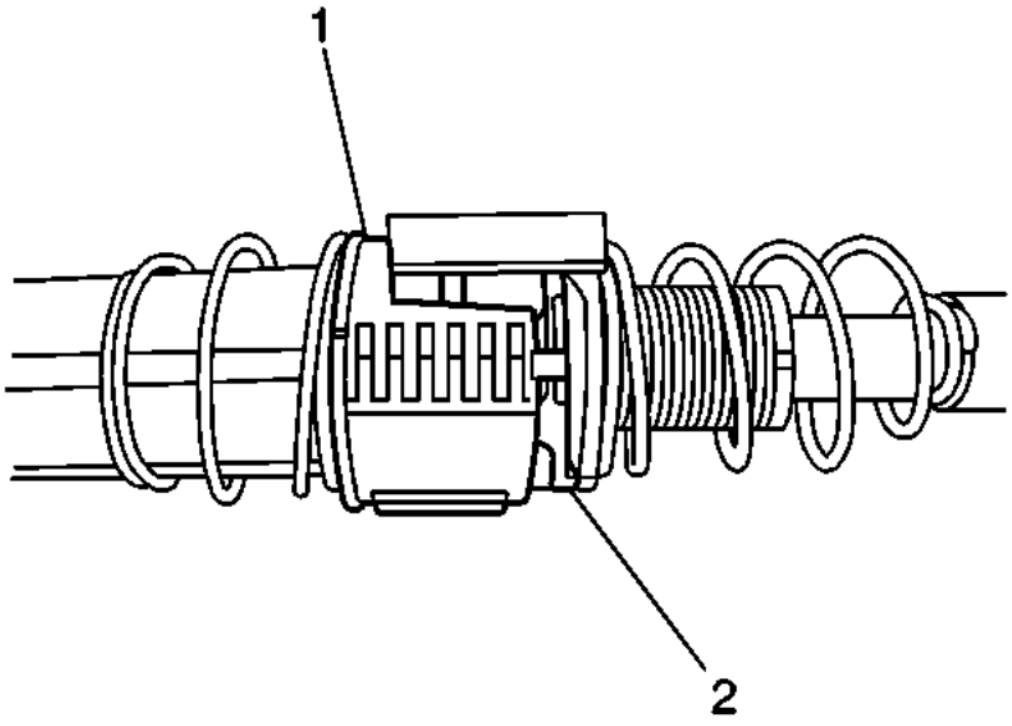


Fig. 48: View Of White Cover & Natural Colored Lock
Courtesy of GENERAL MOTORS CORP.

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

RANGE SELECTOR LEVER CABLE BRACKET REPLACEMENT

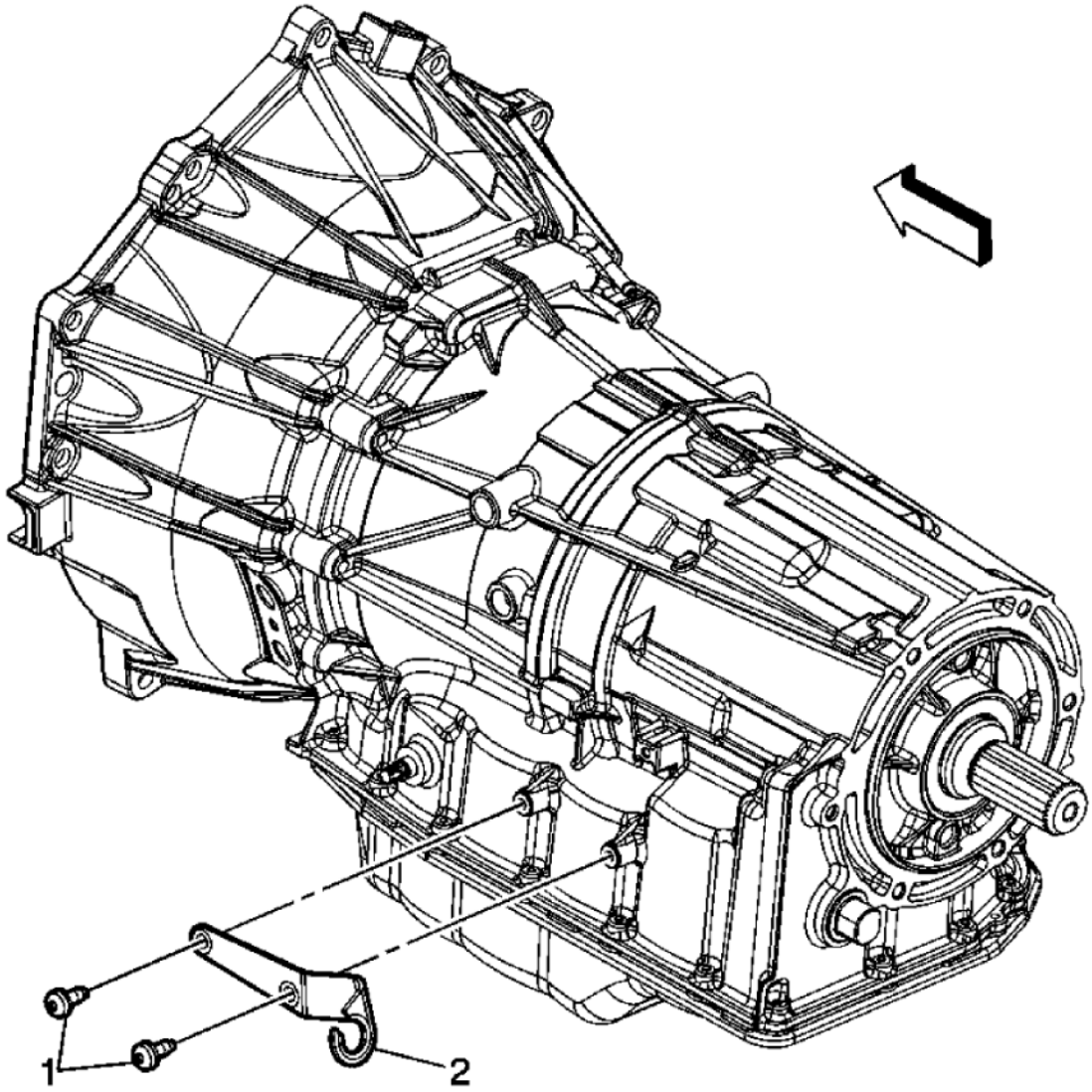


Fig. 49: Range Selector Lever Cable Bracket Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Apply the park brake. 2. Shift the transmission into neutral. 3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** . 4. Remove the transmission range selector cable from the range selector cable bracket. Refer to **Range Selector Lever Cable Replacement**.	

1	Transmission Range Selector Cable Bracket Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 25 N.m (18 lb ft)
2	Transmission Range Selector Cable Bracket

AUTOMATIC TRANSMISSION RANGE SELECTOR LEVER REPLACEMENT

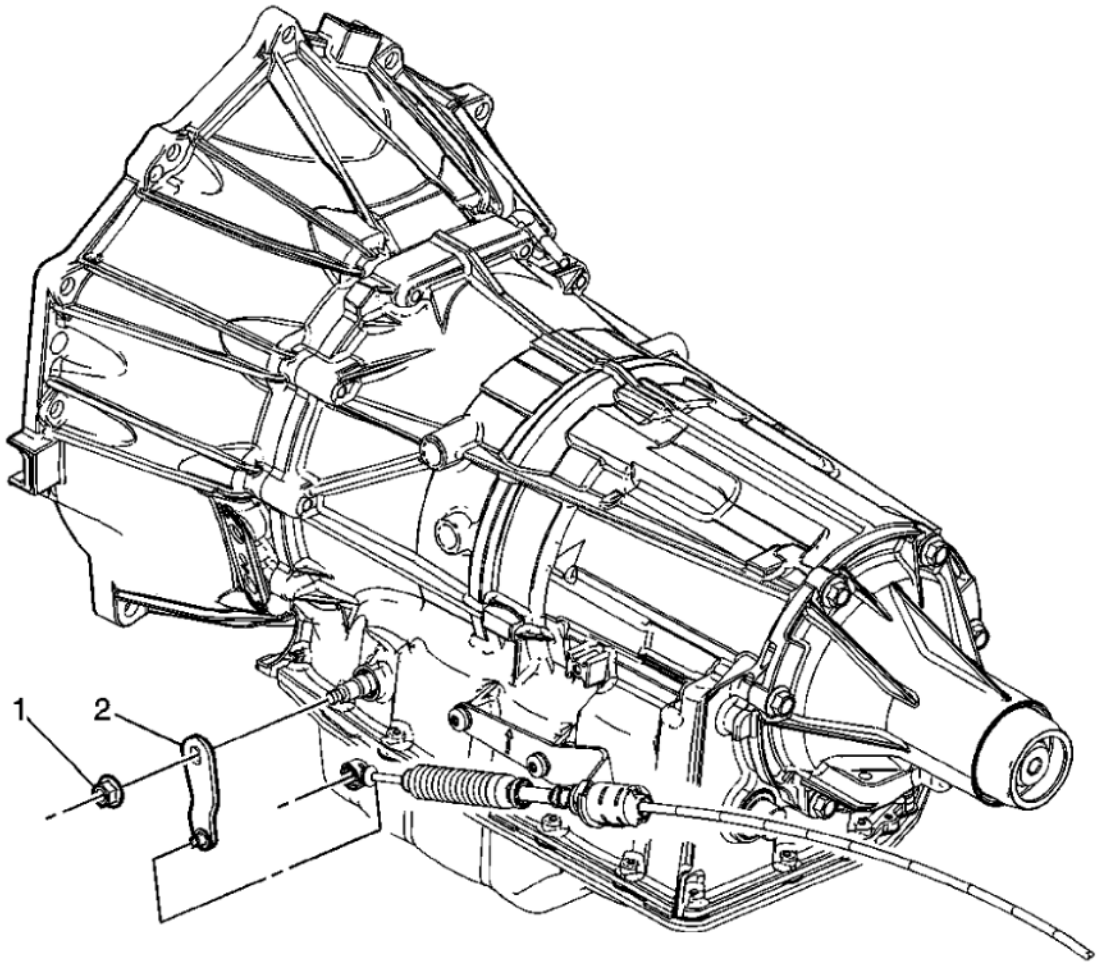


Fig. 50: Automatic Transmission Range Selector Lever Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	

1. Apply the park brake.
2. Shift the transmission into neutral.
3. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .
4. Disconnect the transmission range selector cable from the range selector cable lever ball stud.

1	Transmission Range Selector Cable Lever Nut **NOTE:** **Refer to Fastener Notice .** **Tighten:** 25 N.m (18 lb ft)
2	Transmission Range Selector Cable Lever

TRANSMISSION FLUID AUXILIARY COOLER REPLACEMENT

REMOVAL PROCEDURE

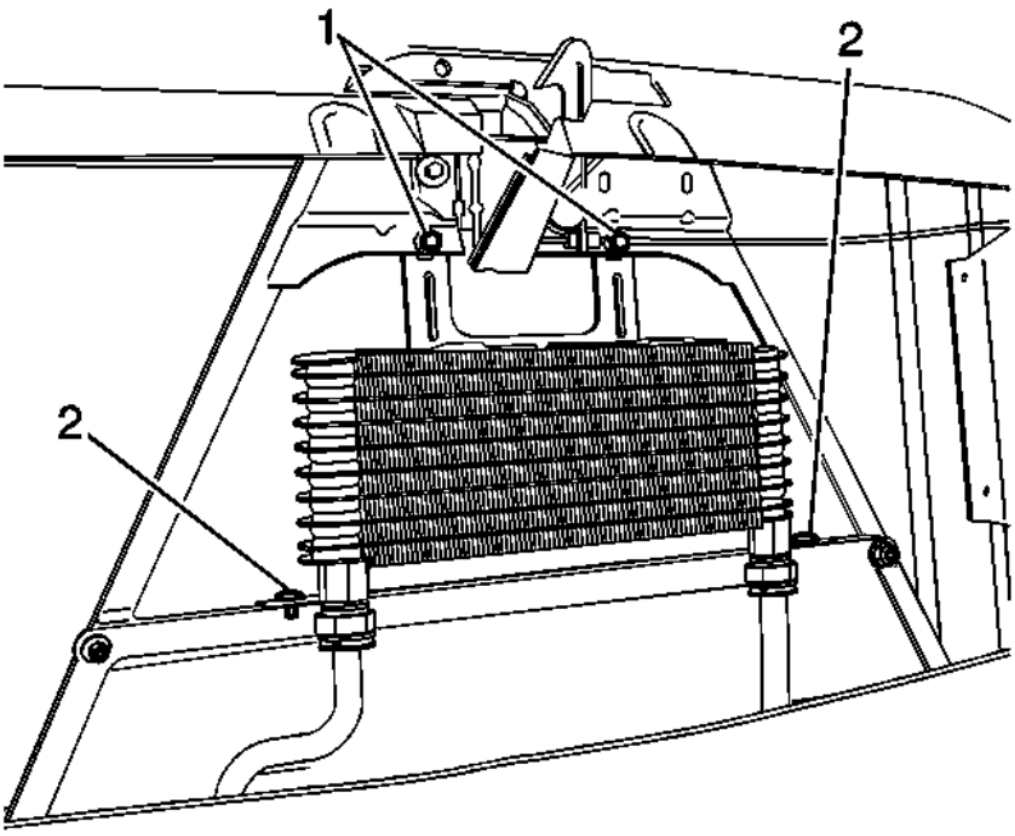


Fig. 51: View Of Auxiliary Oil Cooler, Bolts & Push Pins
Courtesy of GENERAL MOTORS CORP.

1. Remove the front grill assembly. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .
2. Place a drain pan under the vehicle.
3. Disconnect the transmission oil cooler lines from the auxiliary cooler. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
4. Remove the auxiliary oil cooler bolts (1) and push pins (2).
5. Remove the auxiliary oil cooler from the vehicle.

INSTALLATION PROCEDURE

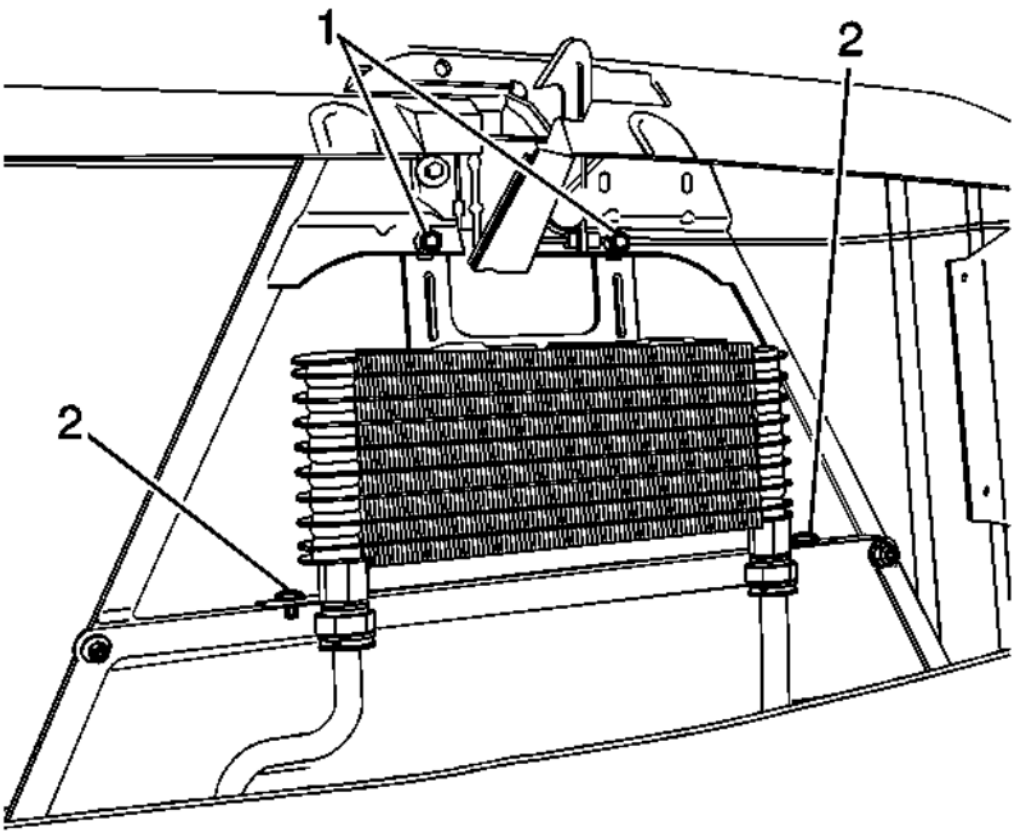


Fig. 52: View Of Auxiliary Oil Cooler, Bolts & Push Pins
Courtesy of GENERAL MOTORS CORP.

1. Install the auxiliary oil cooler to the vehicle.

NOTE: **Refer to Fastener Notice .**

2. Install the bolts (1) and the push pins (2) that retain the auxiliary oil cooler to the radiator brace.

Tighten: Tighten the bolts to 12 N.m (9 lb ft).

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

4. Install the front grill assembly. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

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

REMOVAL PROCEDURE

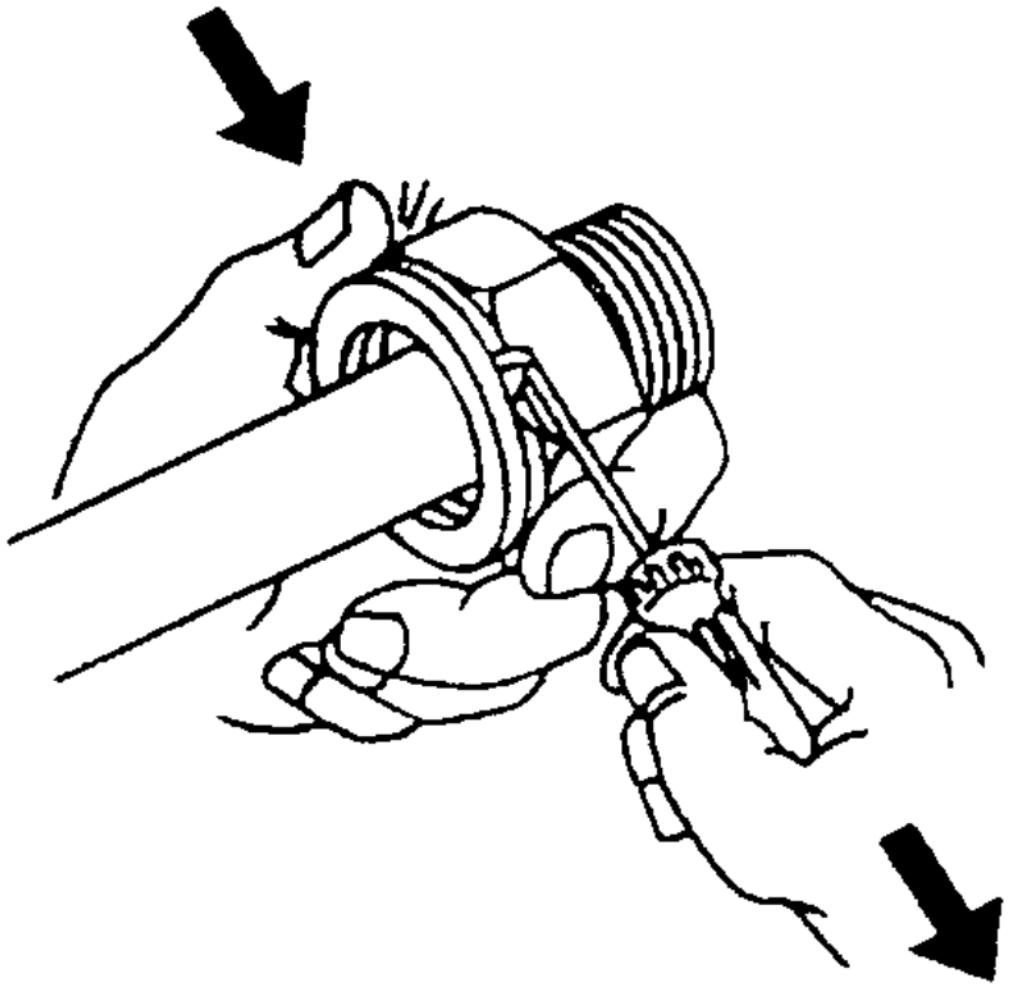


Fig. 53: Identifying Retaining Ring On Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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.

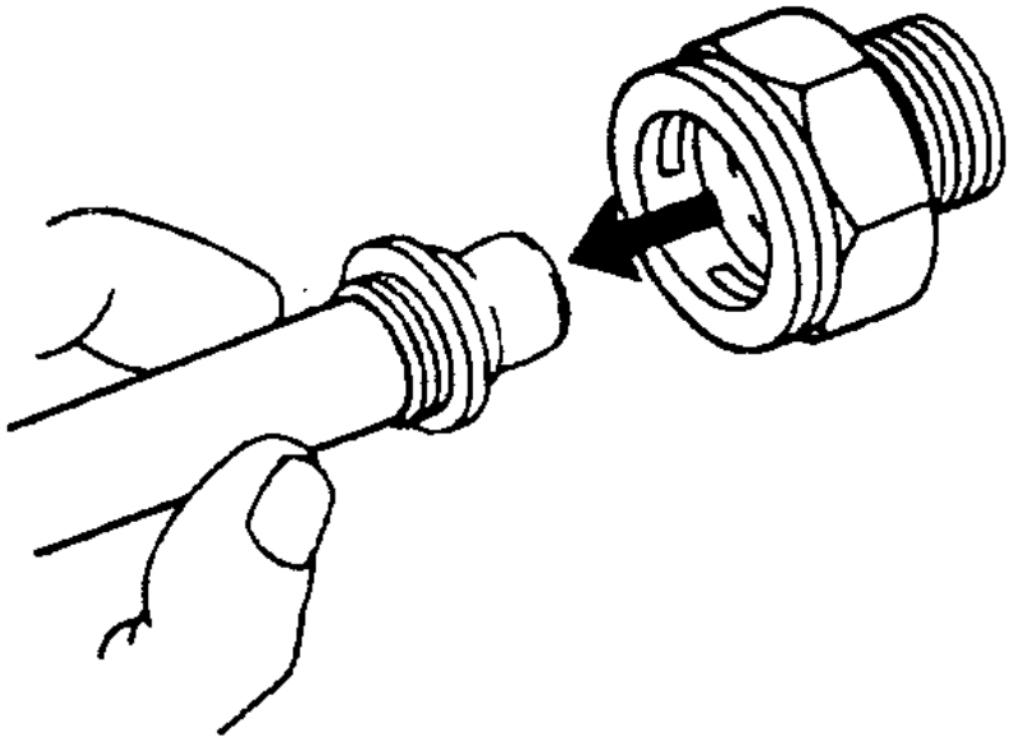


Fig. 54: Cooler Line & Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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:

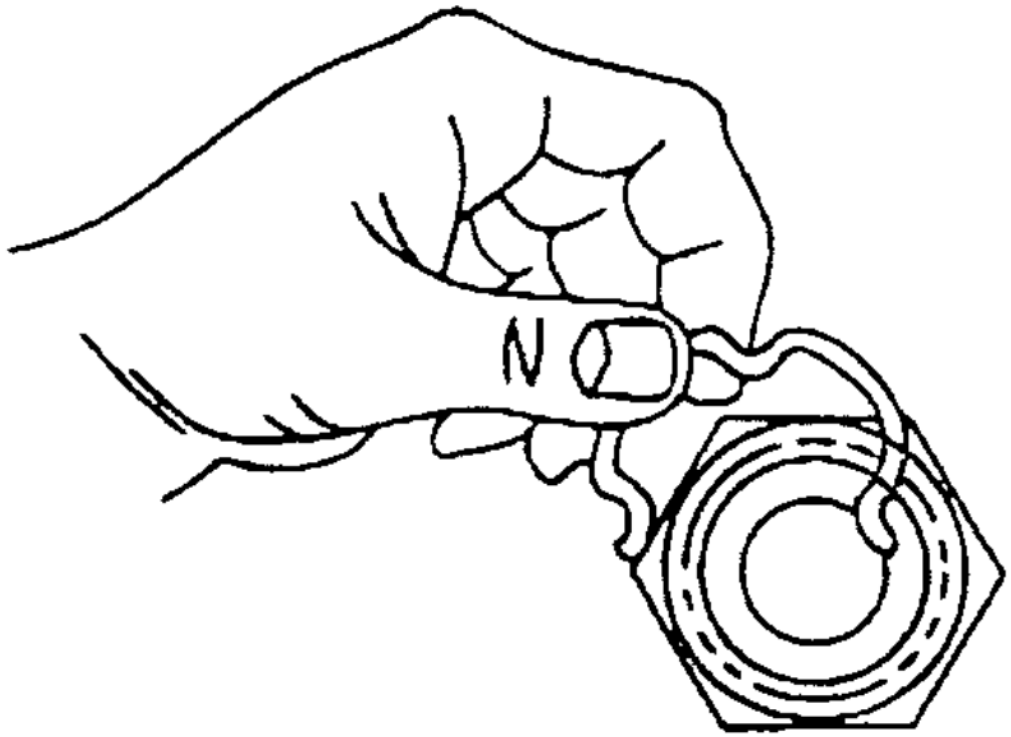


Fig. 55: Hooking Retaining Ring Into Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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

fitting.

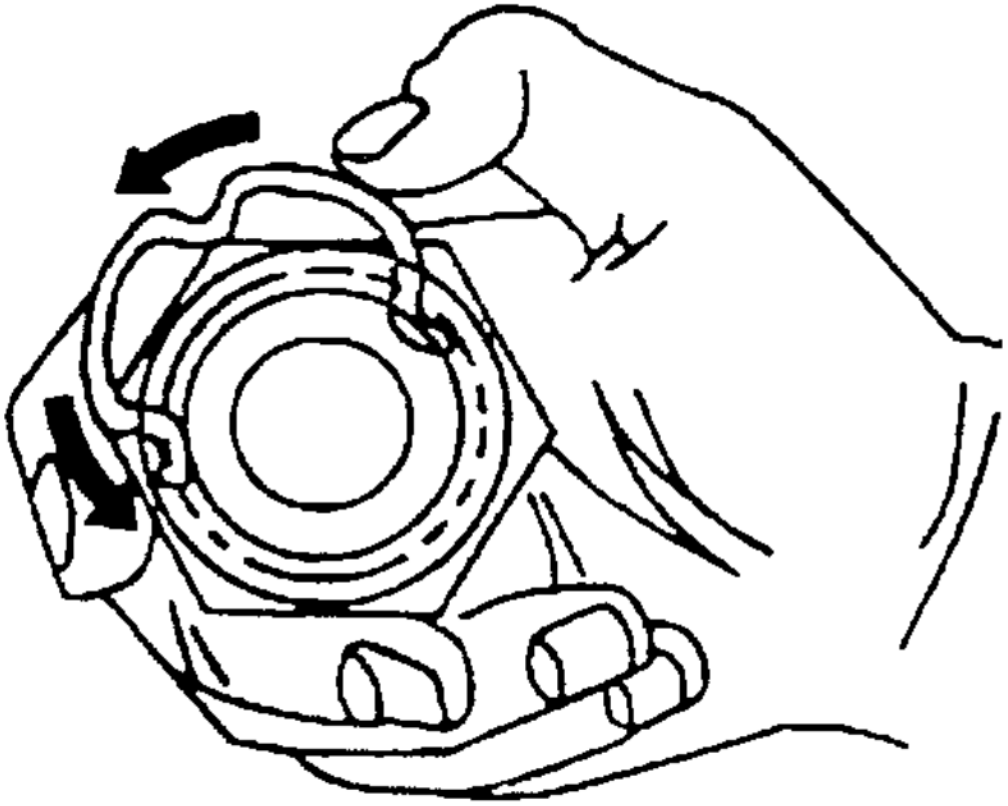


Fig. 56: Rotating Retaining Ring Around Fitting
Courtesy of GENERAL MOTORS CORP.

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

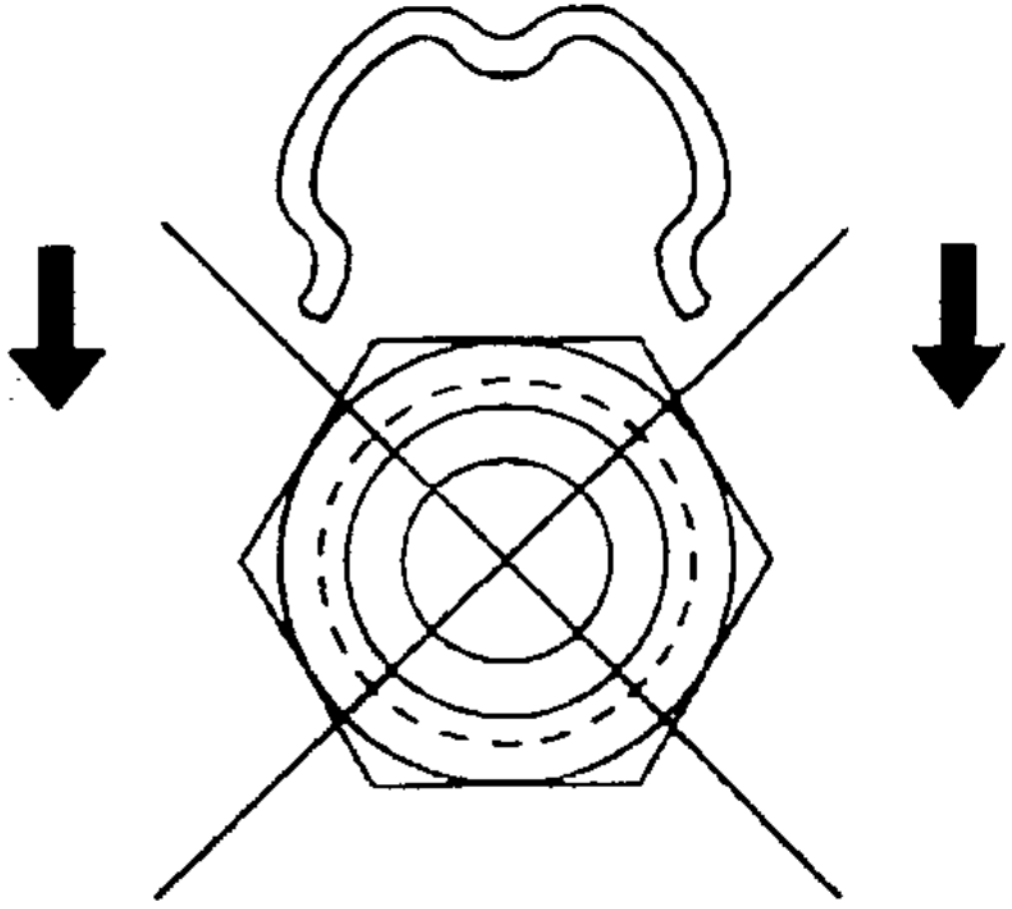


Fig. 57: Identifying Improper Engine Oil Cooler Hose/Pipe Retaining Ring Installation
Courtesy of GENERAL MOTORS CORP.

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

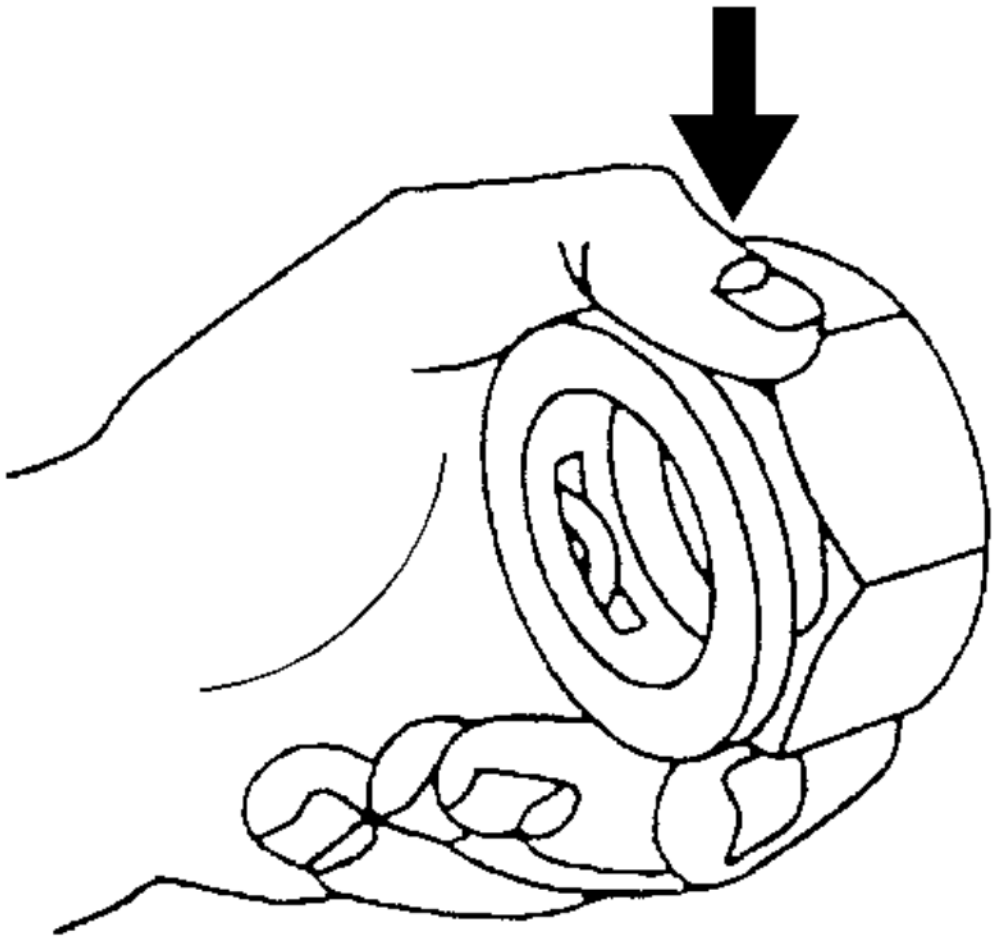


Fig. 58: Ensuring Retaining Ring Is Seated Correctly
Courtesy of GENERAL MOTORS CORP.

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

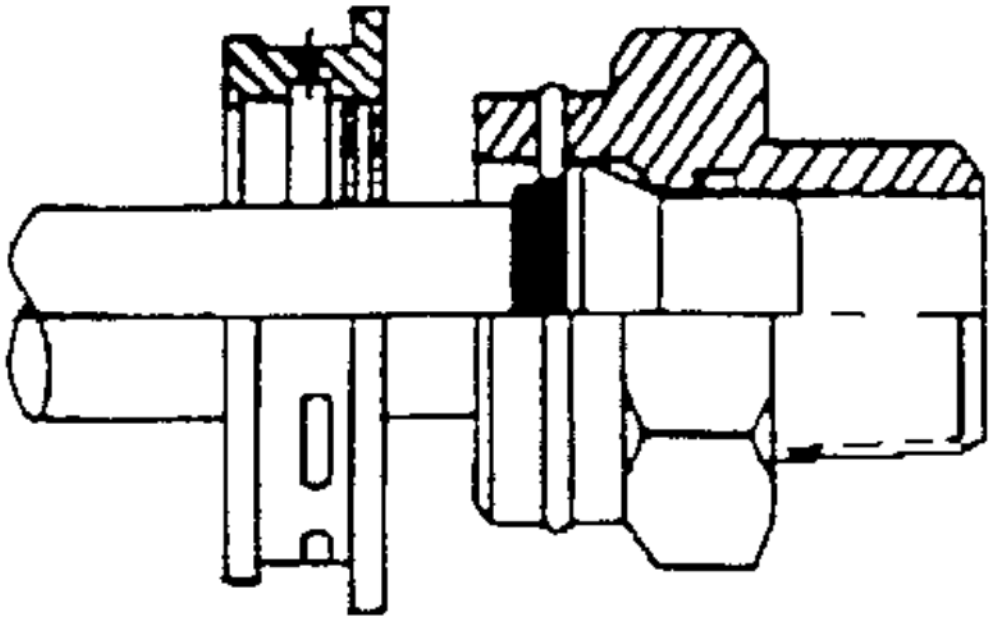


Fig. 59: View Of Cooler Line Quick Connect Fitting
Courtesy of GENERAL MOTORS CORP.

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.

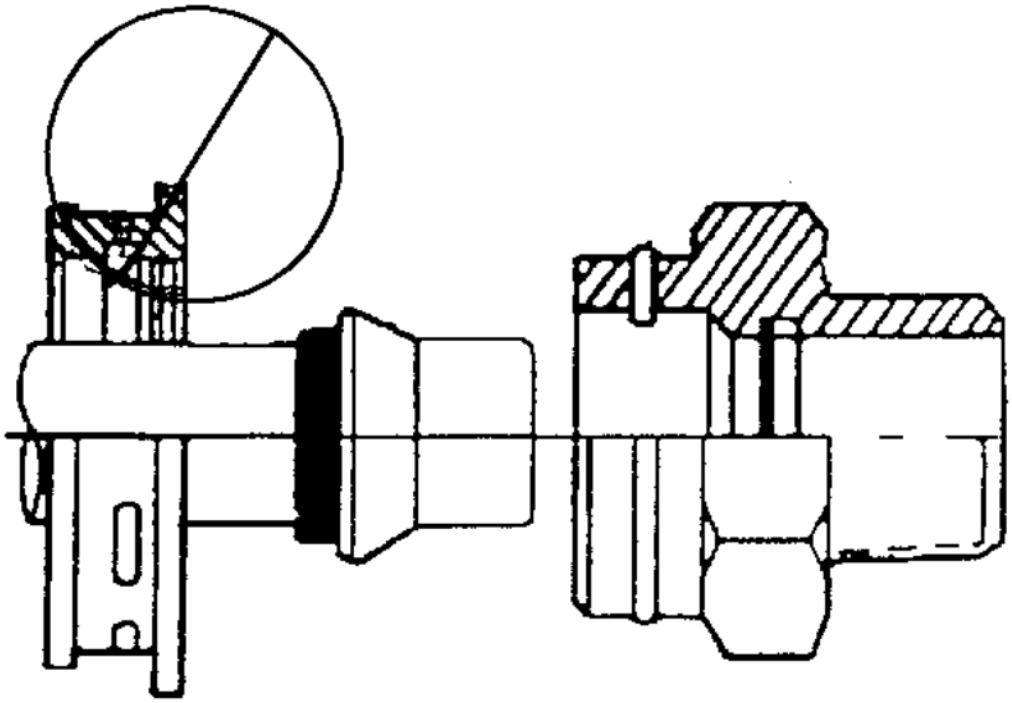


Fig. 60: Do Not Use Plastic Cap On Cooler Line In Order To Install Cooler Line Into Fitting
Courtesy of GENERAL MOTORS CORP.

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.

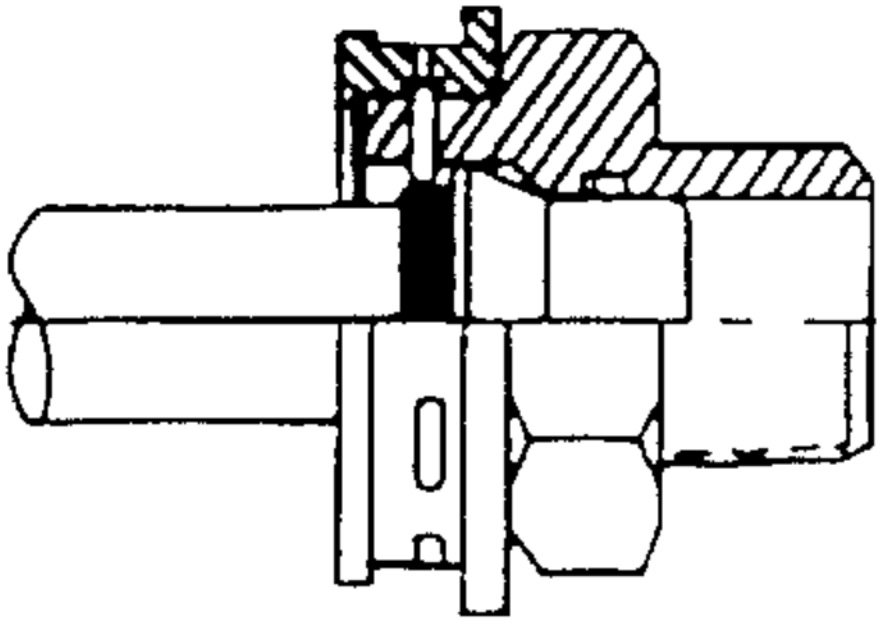


Fig. 61: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

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.

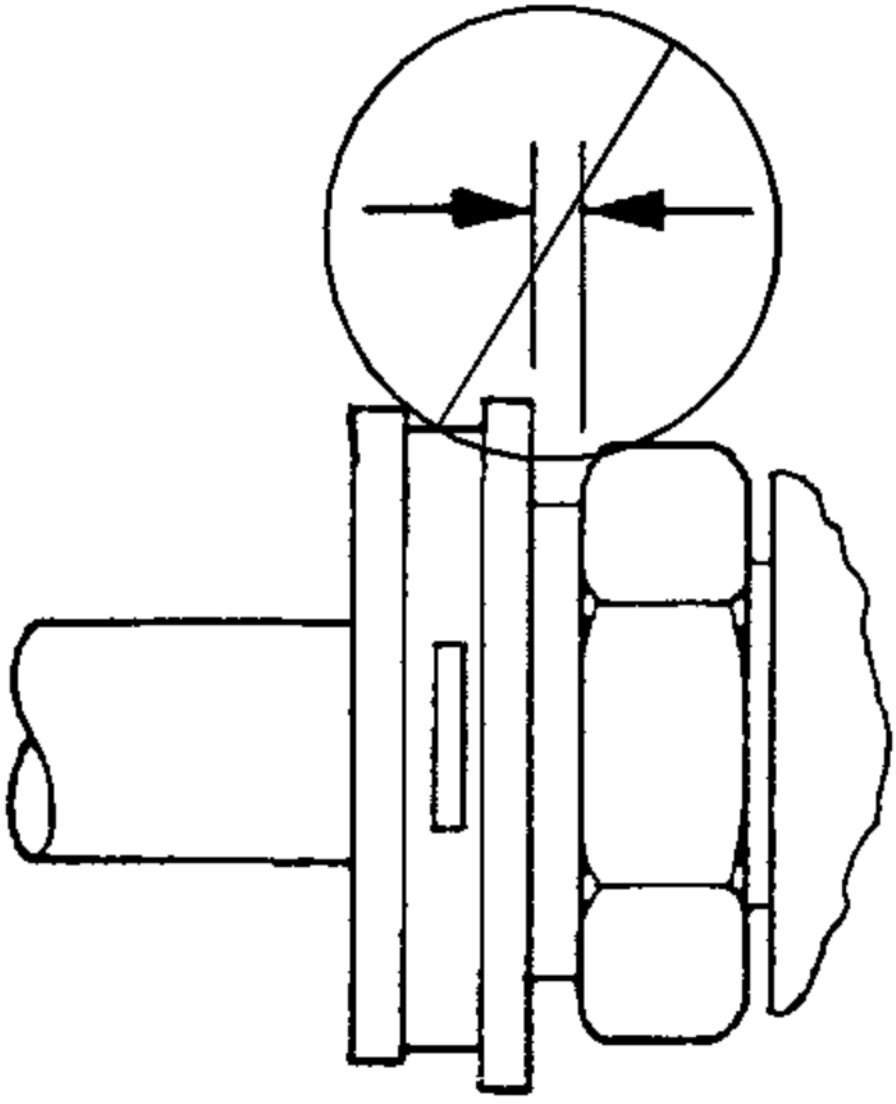


Fig. 62: Checking For Gap Between Cap & Fitting
Courtesy of GENERAL MOTORS CORP.

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

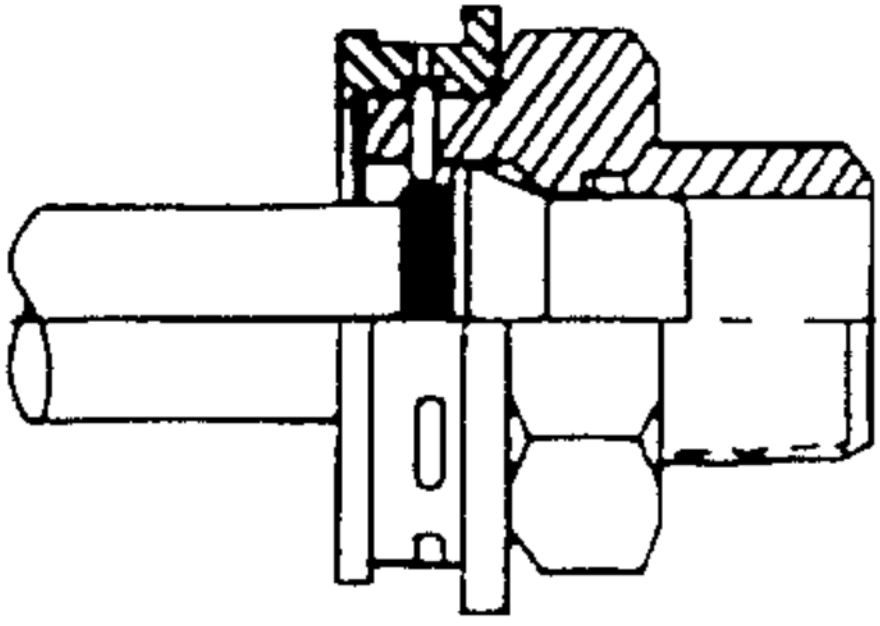


Fig. 63: View Of Cooler Line & Plastic Cap
Courtesy of GENERAL MOTORS CORP.

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

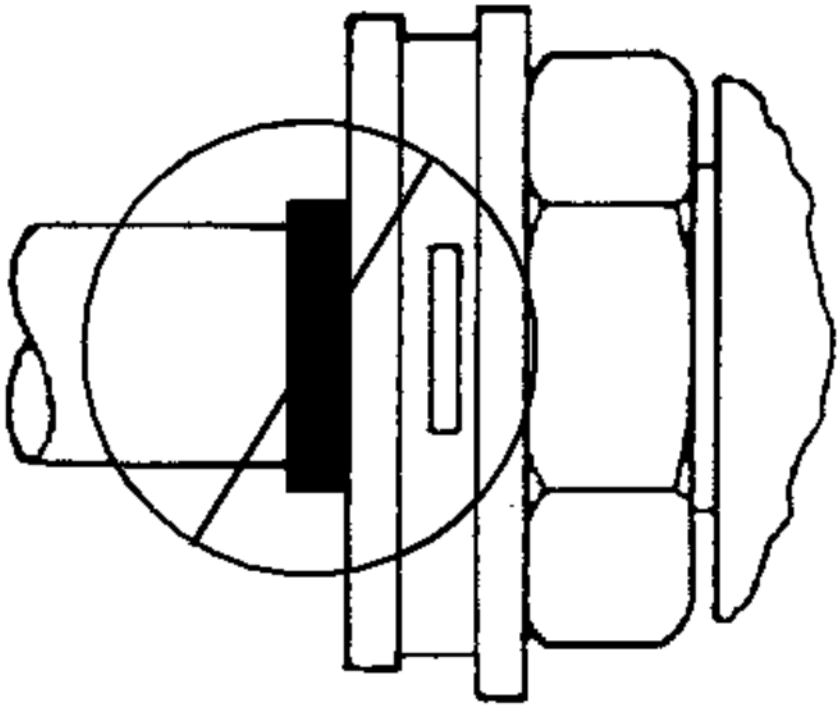


Fig. 64: Identifying Improper Joint Seating
Courtesy of GENERAL MOTORS CORP.

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** .

TRANSMISSION FLUID COOLER HOSE/PIPE REPLACEMENT

REMOVAL PROCEDURE

1. Remove the front grill assembly. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

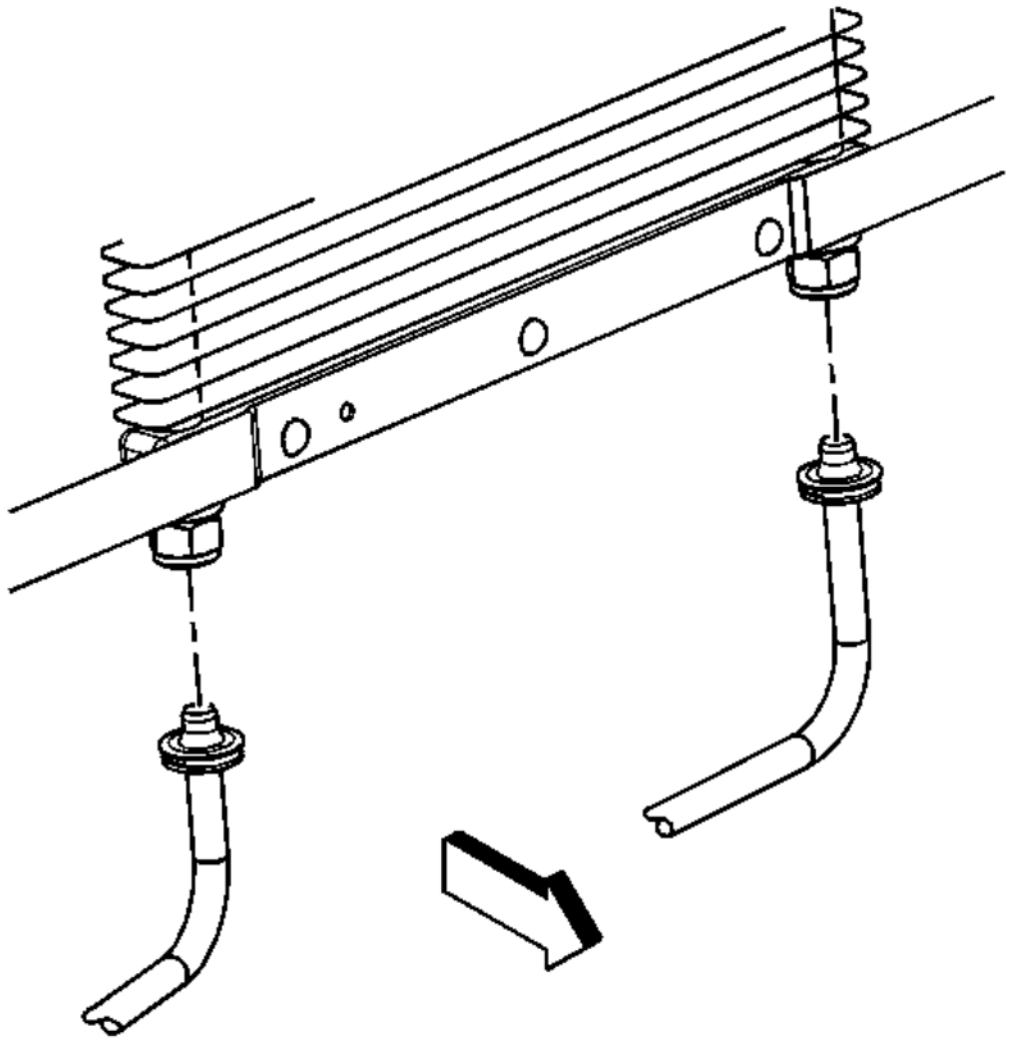


Fig. 65: View Of Transmission Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

2. Remove the transmission fluid cooler hose from the Auxiliary oil cooler. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
3. Remove the transmission fluid cooler hose from the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
4. Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .

5. Remove the engine protection shield. Refer to **Engine Shield Replacement** .

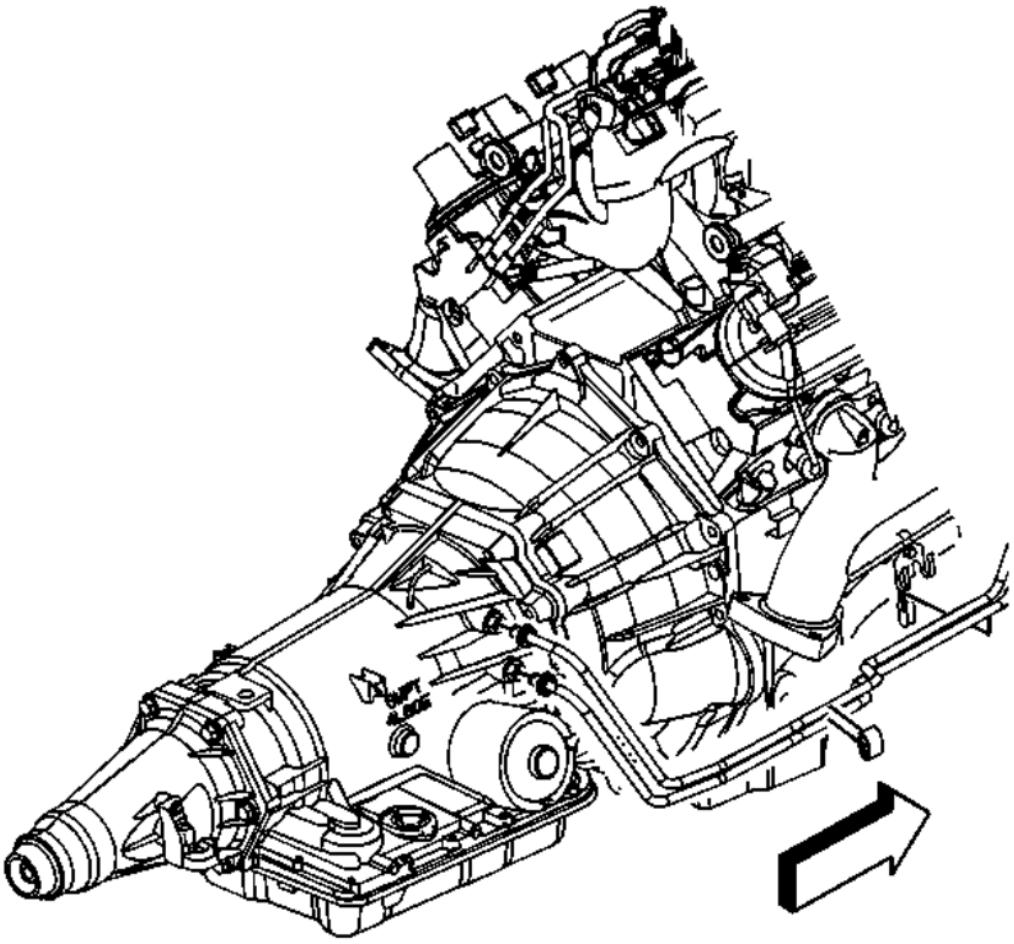


Fig. 66: View Of Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

6. Remove the cooling lines from the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
7. Remove the oil cooling lines from the vehicle.

INSTALLATION PROCEDURE

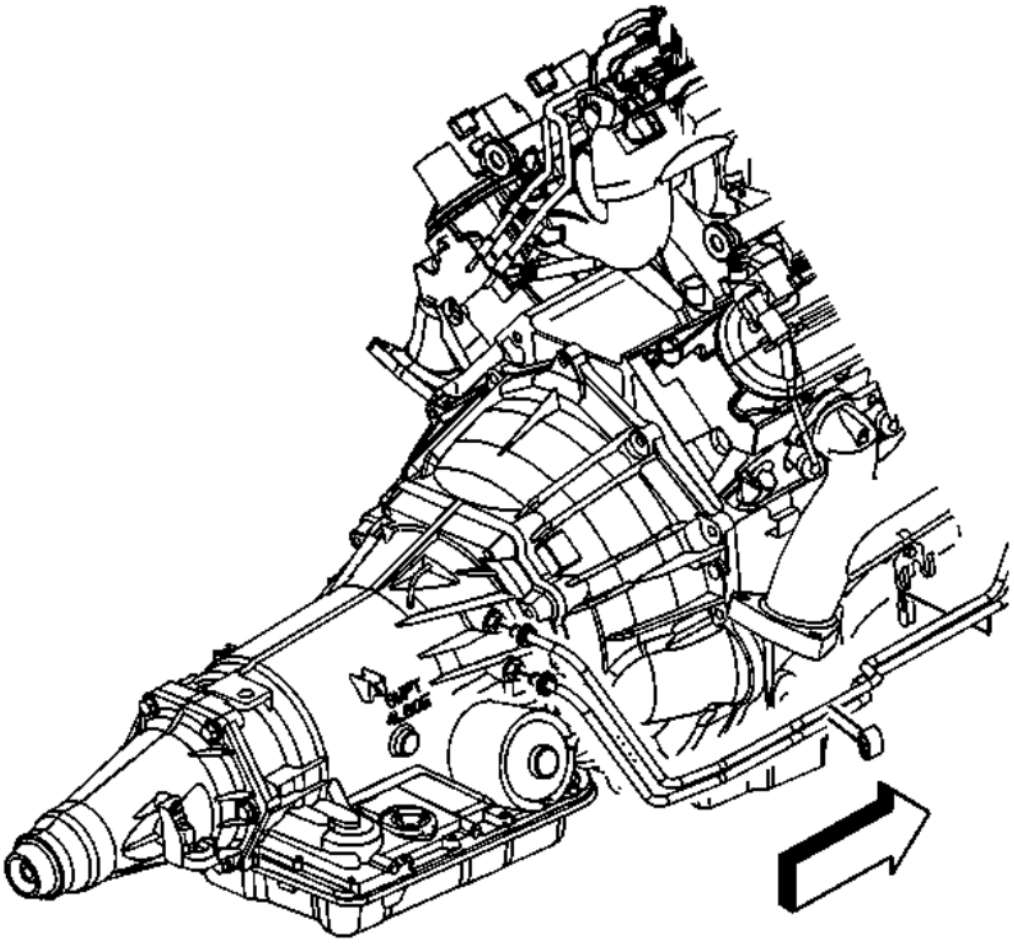


Fig. 67: View Of Transmission Oil Cooler Lines
Courtesy of GENERAL MOTORS CORP.

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

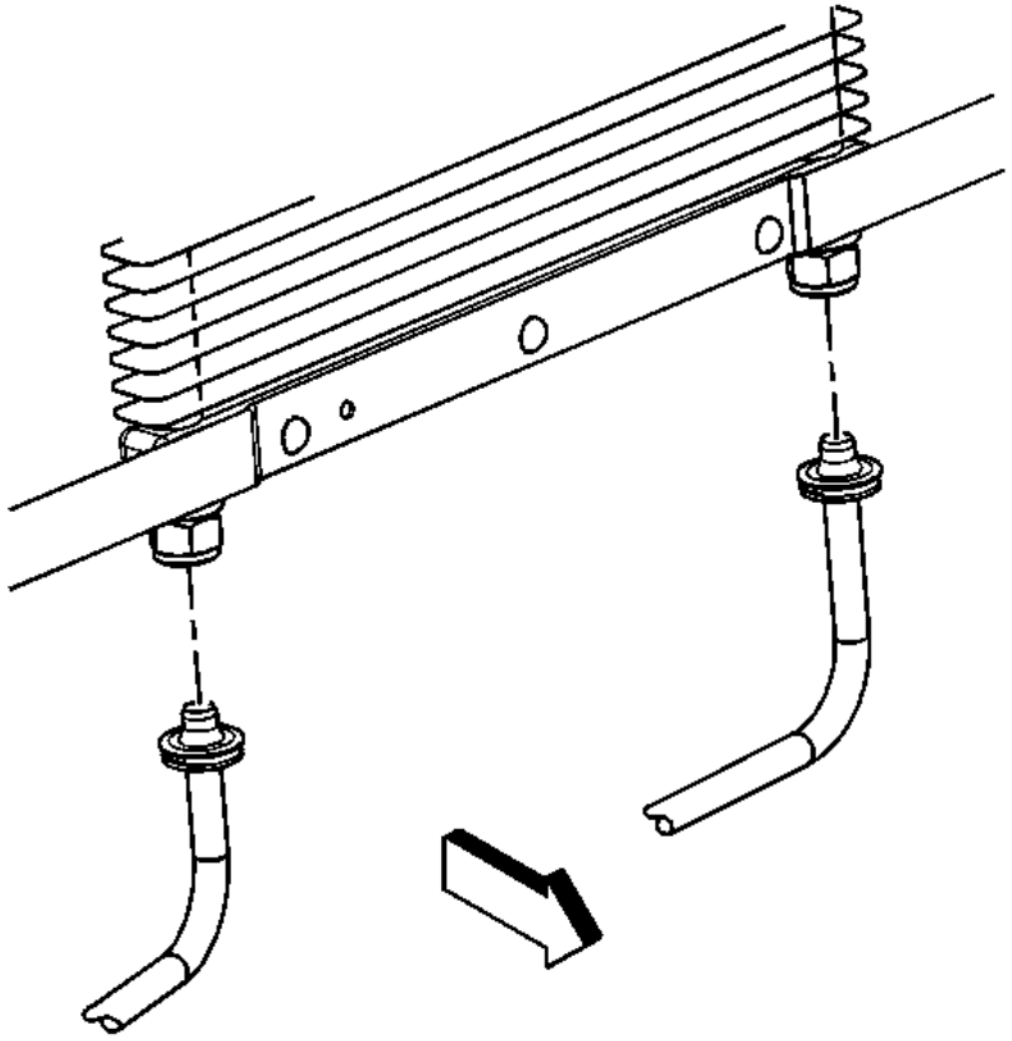


Fig. 68: View Of Transmission Cooler Hoses
Courtesy of GENERAL MOTORS CORP.

3. Install the engine protection shield. Refer to **Engine Shield Replacement** .
4. Lower the vehicle.
5. Install the transmission fluid cooler hose to the radiator. Refer to **Transmission Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection** .
6. Install the transmission fluid cooler hose to the Auxiliary oil cooler. Refer to **Transmission**

Fluid Cooler Hose/Pipe Quick-Connect Fitting Disconnection and Connection .

7. Install the front grill assembly. Refer to **Radiator Grille Replacement (Chevrolet)** or **Radiator Grille Replacement (GMC)** .

TRANSMISSION HEAT SHIELD REPLACEMENT

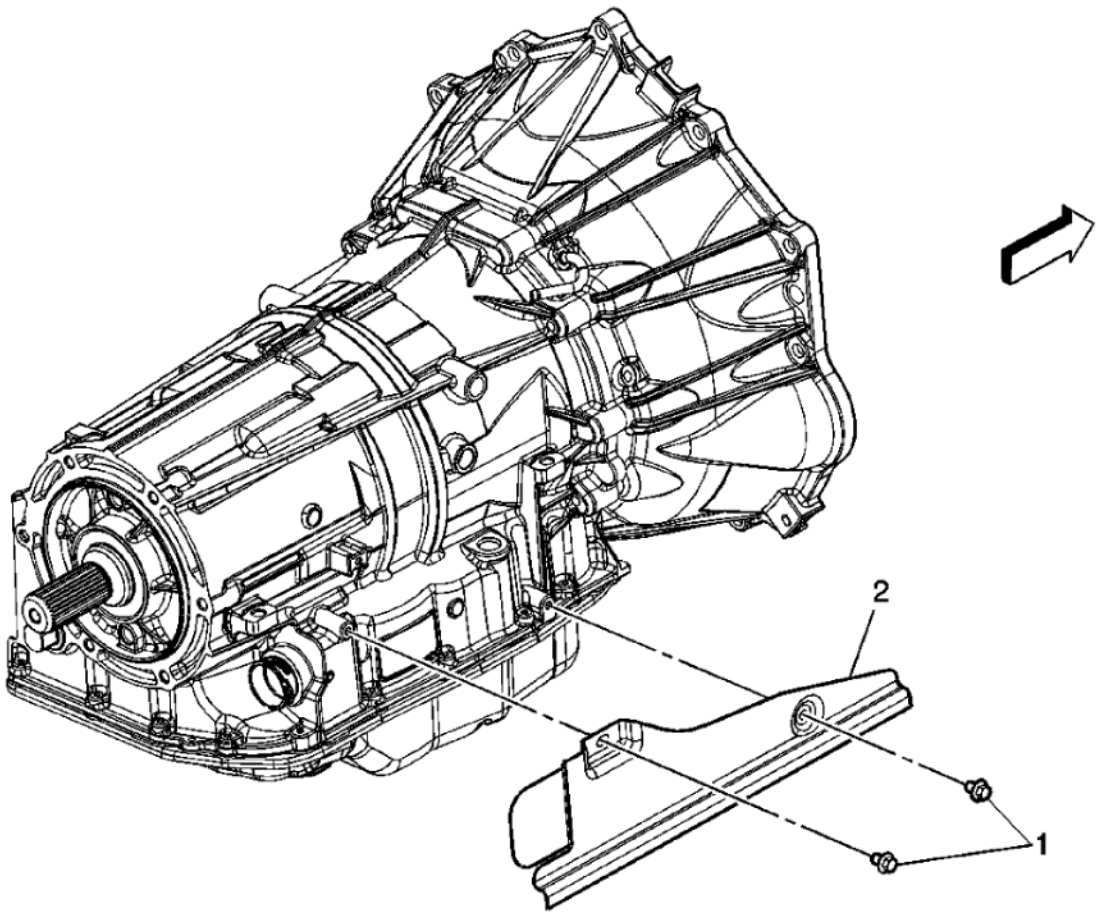


Fig. 69: Transmission Heat Shield Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures: Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
1	Transmission Heat Shield Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .**

	Tighten: 25 N.m (18 lb ft)
2	Transmission Heat Shield

AUTOMATIC TRANSMISSION FLUID PRESSURE TEST HOLE PLUG REPLACEMENT

REMOVAL PROCEDURE

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

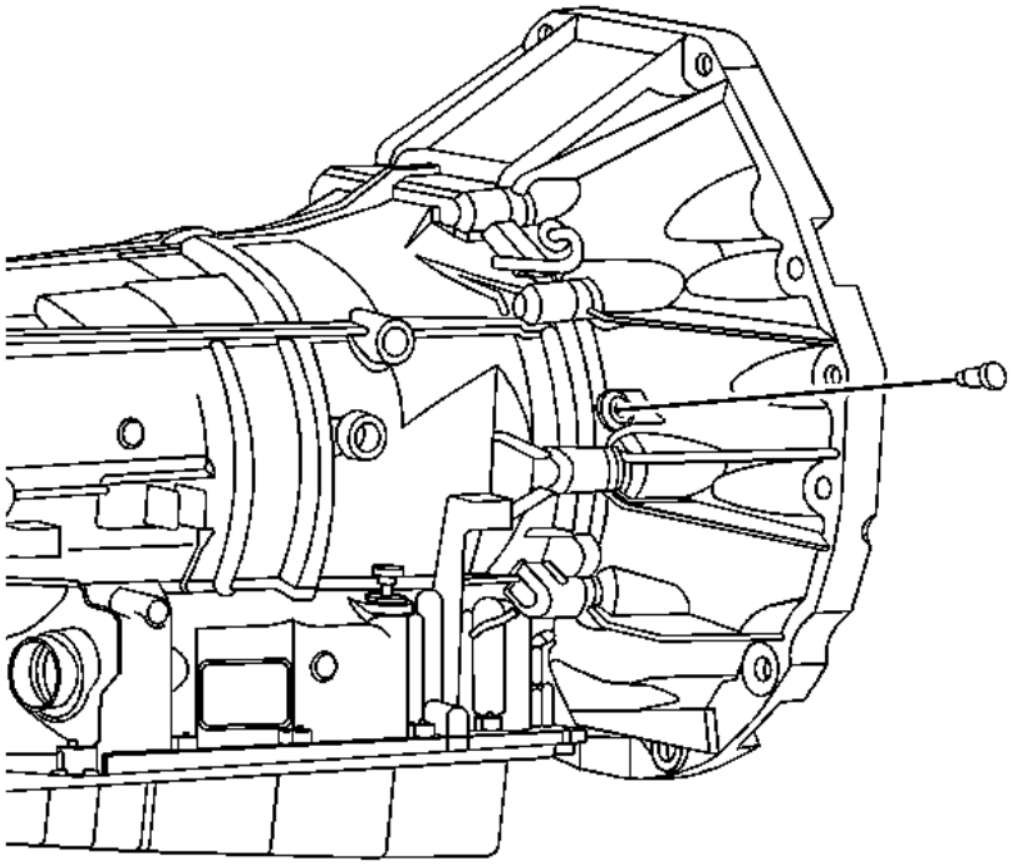


Fig. 70: View Of Oil Pressure Test Plug
Courtesy of GENERAL MOTORS CORP.

2. Clean the surrounding area of the oil pressure test plug.
3. Remove the oil pressure test plug.

INSTALLATION PROCEDURE

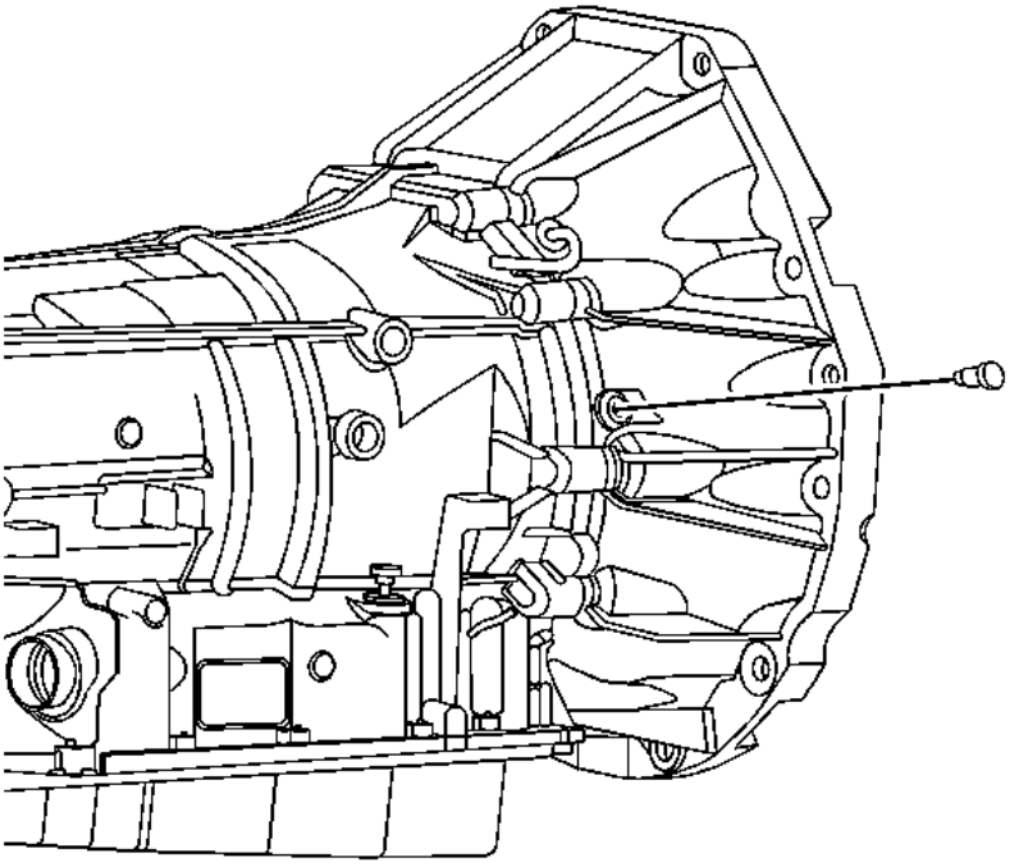


Fig. 71: View Of Oil Pressure Test Plug
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

1. Install the oil pressure test plug.

Tighten: Tighten the oil pressure test plug to 11 N.m (97 lb in).

2. Check the transmission fluid level (fill if necessary). Refer to **Transmission Fluid Check**.
3. Lower the vehicle.

AUTOMATIC TRANSMISSION ELECTRICAL CONNECTOR PASSAGE SLEEVE REPLACEMENT

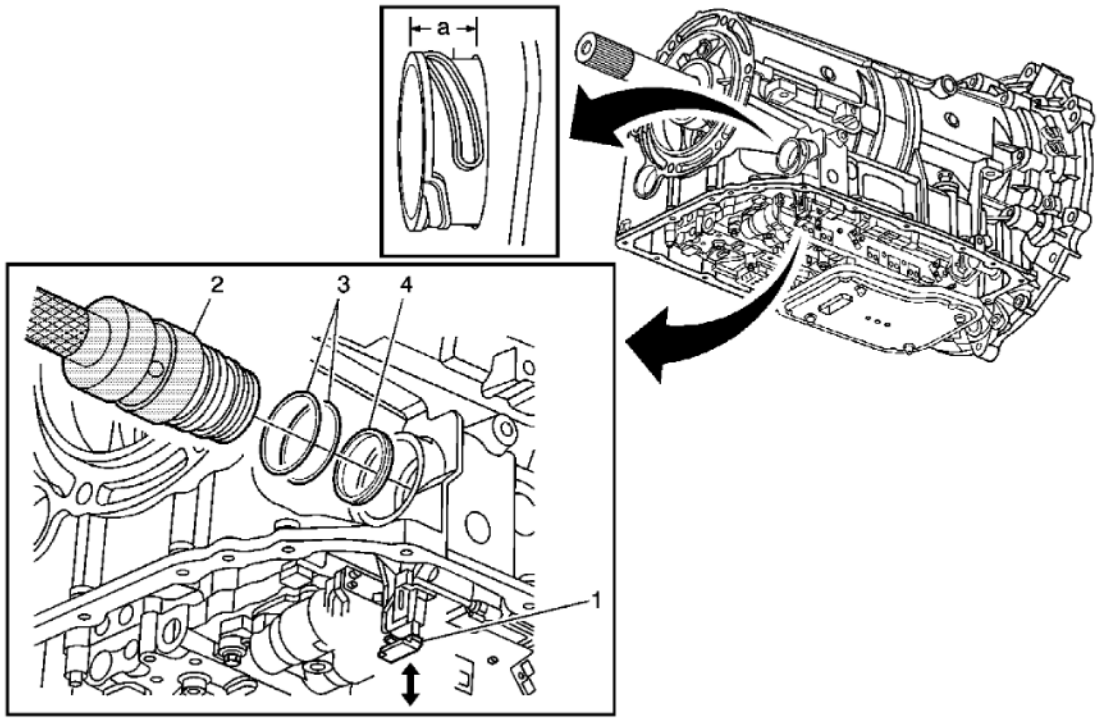


Fig. 72: Automatic Transmission Electrical Connector Passage Sleeve Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

NOTE:
Orientate the alignment tab inside the passage sleeve with the slot in the electrical connector of the control solenoid valve assembly. Push the sleeve straight into the case bore and connector. Do NOT rotate the sleeve at any time. Ensure the sleeve is fully seated into the case. When the sleeve is properly installed, the distance from the case surface to the end of the sleeve should be 14-16 mm. Even though the correct electrical connections may still be maintained, failure to ensure proper installation of the sleeve may result in a fluid leak around the sleeve lip seal and into the sleeve cavity.

Preliminary Procedures

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

2. Remove the transmission oil pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**. 3. Disconnect the vehicle wire harness electrical connector from the transmission electrical connector passage sleeve.	
1	Electrical Connector Slide Lock **Tip:** Pull down on the slide lock to remove the sleeve. Push up on the slide lock after sleeve installation.
2	Electrical Connector Passage Sleeve **Tip:** • Use the **DT 47715** Electrical Connector Passage Sleeve Remover/Installer and **J 42183** Driver Handle to remove and install the electrical connector passage sleeve. See **Special Tools**. • The distance (a) from the case surface to the end of the sleeve should be 14-16 mm. **Special Tools** • **DT 47715** Electrical Connector Passage Sleeve Remover/Installer. See **Special Tools**. • **J 42183** Driver Handle. See **Special Tools**.
3	O-Ring Seal (Qty: 2) **Tip:** Use a NEW O-ring seal.
4	Lip Seal **Tip:** Use a NEW lip seal.

AUTOMATIC TRANSMISSION FLUID, FLUID PAN AND/OR FILTER REPLACEMENT

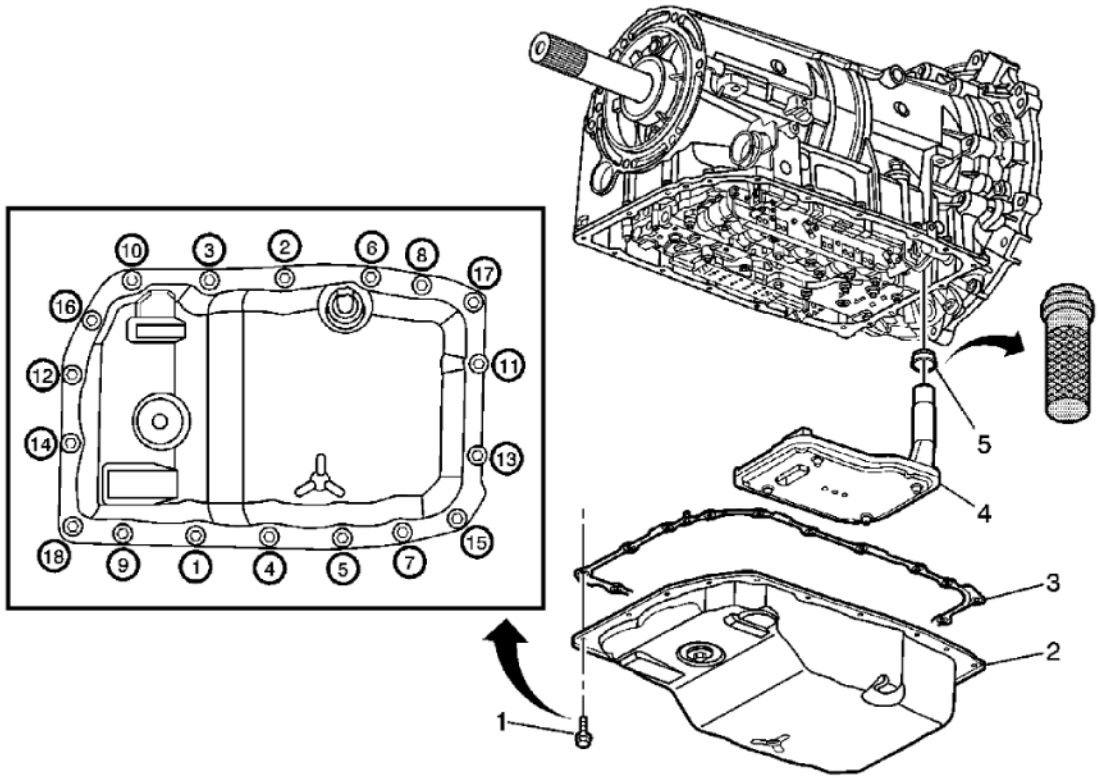


Fig. 73: Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: **Use Dexron VI transmission fluid only. Failure to use the proper fluid may result in transmission internal damage.** **Preliminary Procedures** 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Disconnect and lower the catalytic converter. Refer to **Catalytic Converter Replacement (4.3L)** or **Catalytic Converter Replacement (4.8L, 5.3L, 6.0L, 6.2L)** or **Catalytic Converter Replacement (6.6L)** . 3. Place a suitable drain pan under the transmission.	
	Transmission Fluid Pan Bolt (Qty: 18) **NOTE:** **Refer to Fastener Notice .**

1	**Tip:** Tighten the bolts in the sequence shown. **Tighten:** 9 N.m (80 lb in)
2	Transmission Fluid Pan Assembly **Procedure** 1. Check the condition of the draining fluid. Refer to **Transmission Fluid Check**. 2. Fill the transmission with the proper fluid. Refer to **Transmission General Specifications** . 3. Fill the transmission with the proper amount of transmission fluid. Refer to **Fluid Capacity Specifications** and **Transmission Fluid Check**.
3	Transmission Fluid Pan Gasket **Tip:** The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused.
4	NEW Fluid Filter Assembly **Tip:** Pull the fluid filter assembly straight out. Do not bend or twist the filter neck.
5	NEW Fluid Filter Seal Assembly **NOTE:** **Do not damage the case sealing surface when removing the filter seal assembly.** **Procedure** 1. Use a screwdriver or snap ring pliers to remove the filter seal. 2. Use the **DT 47848** and the **J 42183** to install the filter seal. See **Special Tools**. 3. Lubricate the filter seal with transmission fluid before installing the filter. **Special Tools** • **DT 47848** Seal Installer. See **Special Tools**. • **J 42183** Driver Handle. See **Special Tools**.

TRANSMISSION MOUNT INSPECTION

NOTE: In order to avoid oil pan damage and possible engine failure, insert a block of wood that spans the width of the oil pan bottom between the oil pan and the jack support.

1. Raise the transmission/transaxle in order to remove the weight from the transmission/transaxle mount and create slight tension in the rubber.
2. Observe the transmission/transaxle mount while raising the transmission/transaxle. Replace the transmission/transaxle mount if the transmission/transaxle mount exhibits any of the following conditions:

   IMPORTANT: Black paint on the rubber will crack with time, this does no constitute a failure.

   - The hard rubber surface is covered with heat check cracks.
   - The rubber is separated from the metal plate of the transmission/transaxle mount.
   - The rubber is split through the center of the transmission/transaxle mount.
3. If there is movement between the metal plate of the transmission/transaxle mount and its attaching points, lower the transmission/transaxle on the transmission/transaxle mount. Tighten the bolts or nuts attaching the transmission/transaxle mount to the frame or transmission/transaxle mount bracket.

TRANSMISSION MOUNT REPLACEMENT (2WD)

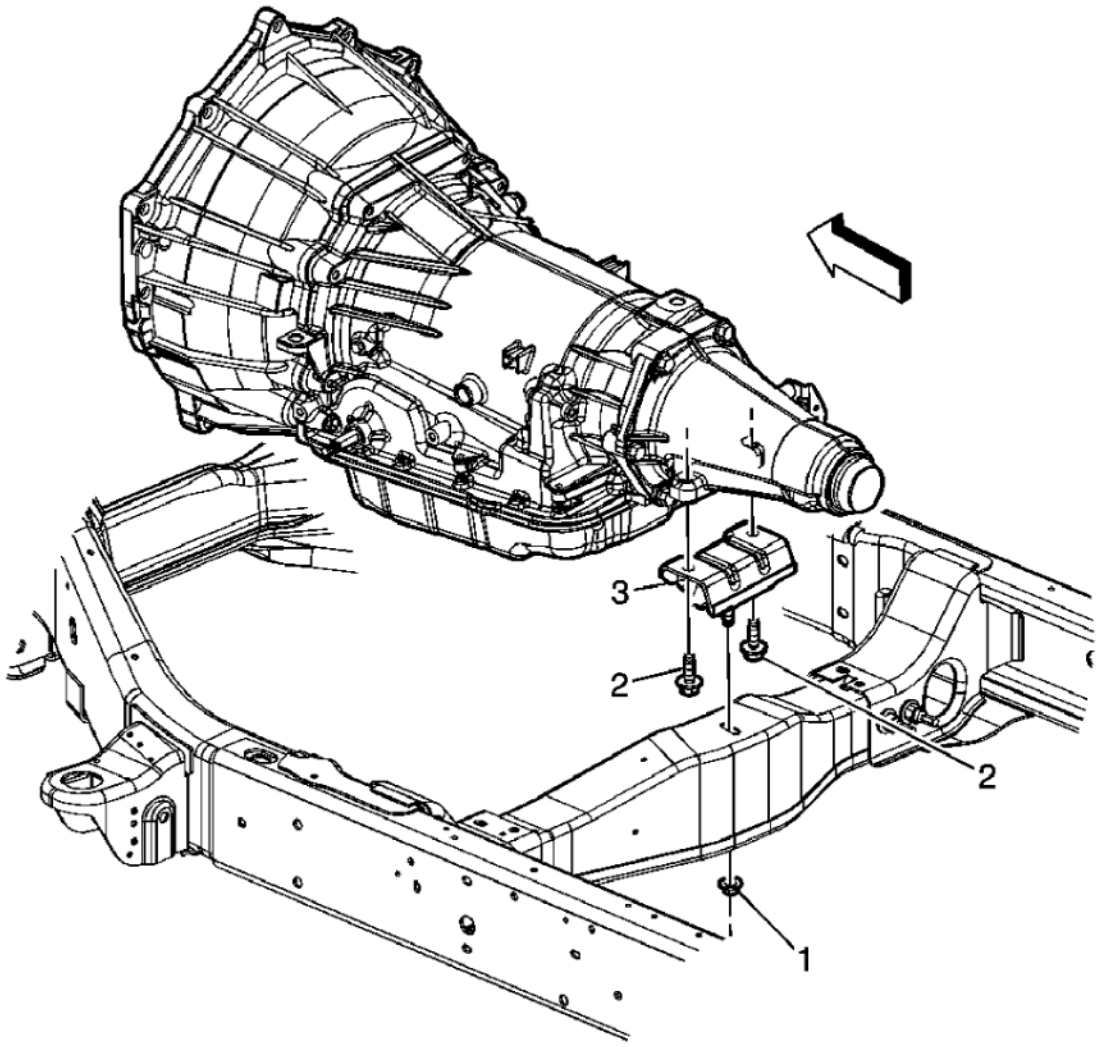


Fig. 74: View Of Transmission Mount, Crossmember Nut & Bolts (2WD)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Support the transmission with a transmission jack.	
1	Transmission Mount to Crossmember Nut **NOTE:** **Refer to Fastener Notice .**

	Tighten: 50 N.m (37 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten:** 50 N.m (37 lb ft)
3	Transmission Mount **Tip:** Raise the transmission with the transmission jack just enough to remove the transmission mount.

TRANSMISSION MOUNT REPLACEMENT (4WD)

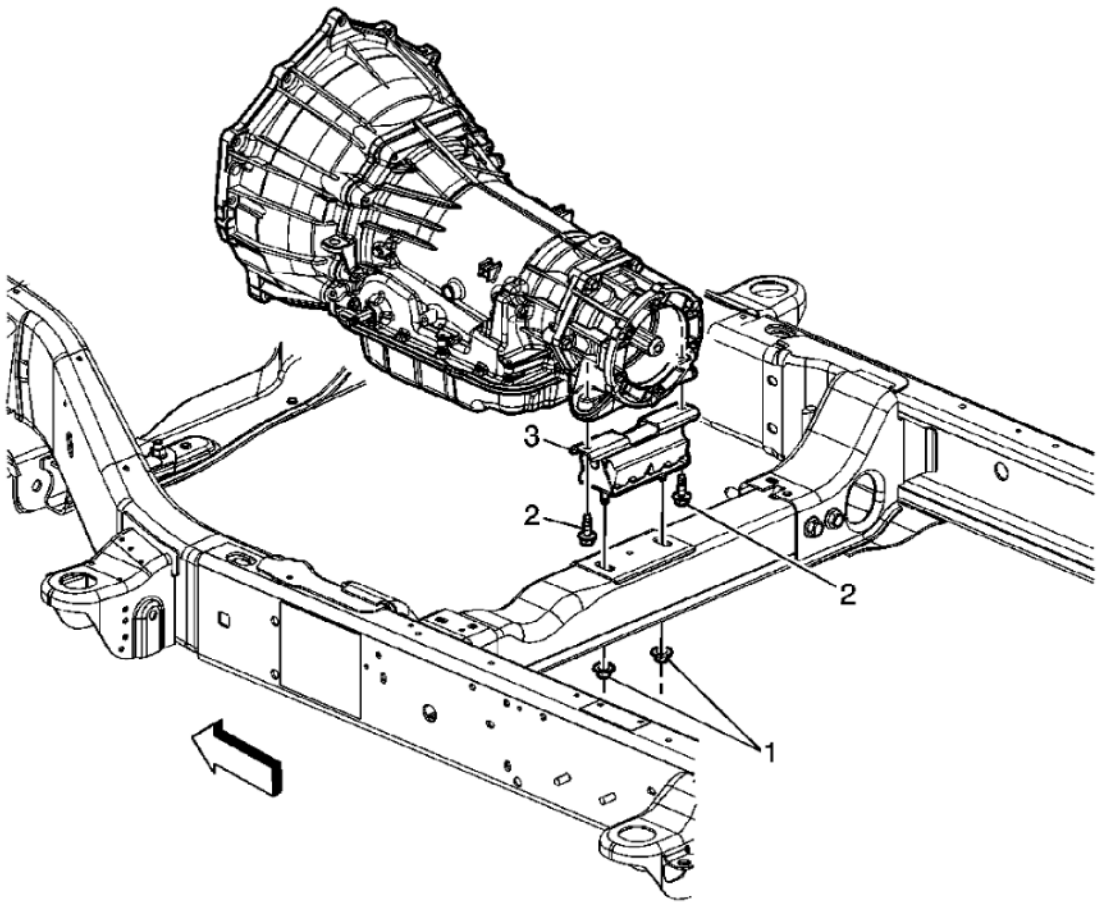


Fig. 75: View Of Transmission Mount, Crossmember Nut & Bolts (4WD)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Support the transmission with a transmission jack.

1	Transmission Mount to Crossmember Nut (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 50 N.m (37 lb ft)
2	Transmission Mount Bolt (Qty: 2) **Tighten:** 50 N.m (37 lb ft)
3	Transmission Mount **Tip:** Raise the transmission with the transmission jack just enough to remove the transmission mount.

CASE EXTENSION AND GASKET REPLACEMENT

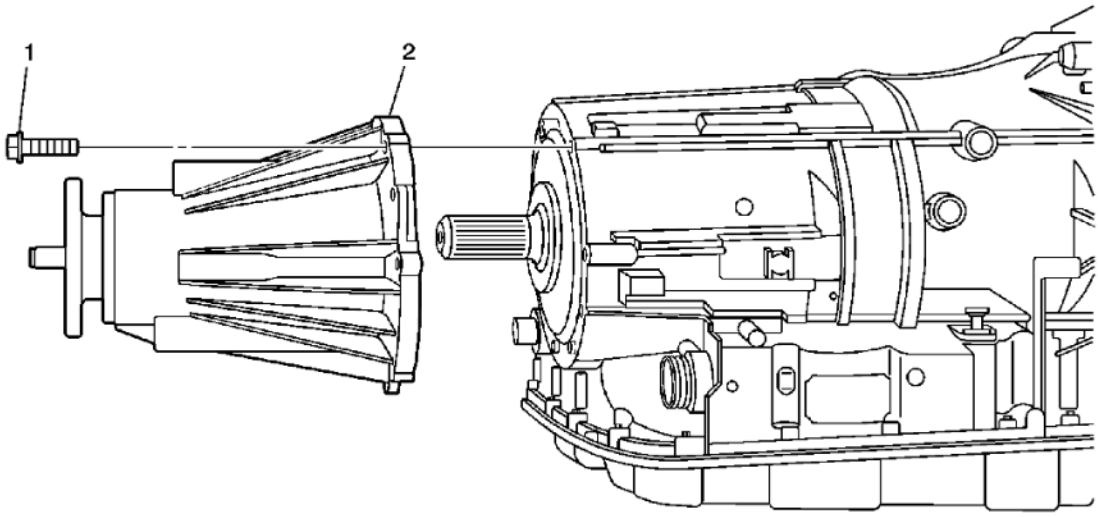


Fig. 76: Case Extension Housing and Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
IMPORTANT: **The extension housing and drive shaft flange (yolk) on this vehicle are serviced as a complete assembly. The drive shaft flange seal is a dust shield used to protect the sealed drive shaft flange bearing that is pressed into the extension housing. The drive shaft flange is pressed into the drive**	

shaft flange bearing, and is not serviceable. The extension housing should NOT contain any transmission fluid. If transmission fluid is present in the extension housing, replacement of the output shaft seal is necessary. Refer to Transmission Output Shaft Seal Replacement.

Preliminary Procedures

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
3. Support the transmission with a suitable jack.
4. Remove the transmission mount assembly. Refer to **Transmission Mount Replacement (2WD)** or **Transmission Mount Replacement (4WD)** .

1	Case Extension Housing Bolt (Qty: 6) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 50 N.m (37 lb ft)
2	Case Extension Housing Assembly **Tip:** • Serviced as a complete assembly as shown. • There is no gasket or seal between the extension housing and transmission case.

TRANSMISSION OUTPUT SHAFT SEAL REPLACEMENT

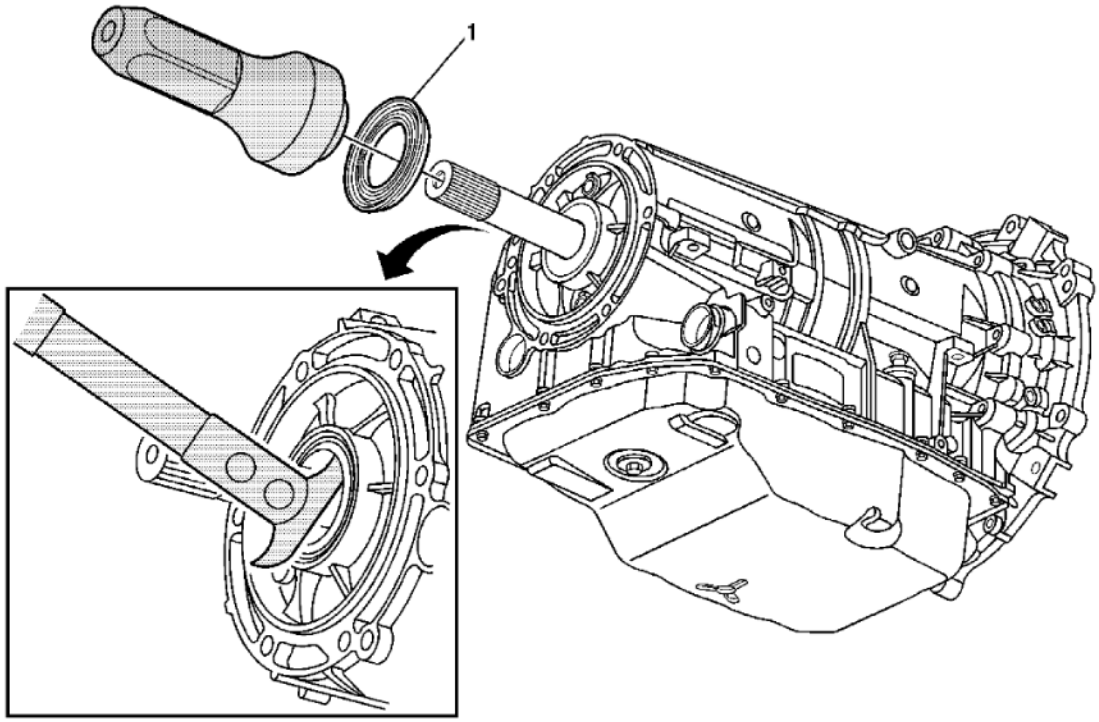


Fig. 77: Transmission Output Shaft Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** . 3. Support the transmission with a suitable jack. 4. Remove the transmission mount assembly. Refer to **Transmission Mount Replacement (2WD)** or **Transmission Mount Replacement (4WD)** . 5. Remove the transmission extension housing assembly. Refer to **Case Extension and Gasket Replacement**.	
1	Output Shaft Seal **Tip:** • Use the **J 45000** Seal Remover, to remove the seal. See **Special Tools**. Use care in order to avoid damaging the output shaft bushing.

	• Lubricate the seal with clean transmission fluid. • Use the **J 38693** Seal Installer, to install the seal. See **Special Tools**.

MANUAL SHIFT SHAFT AND SEAL REPLACEMENT

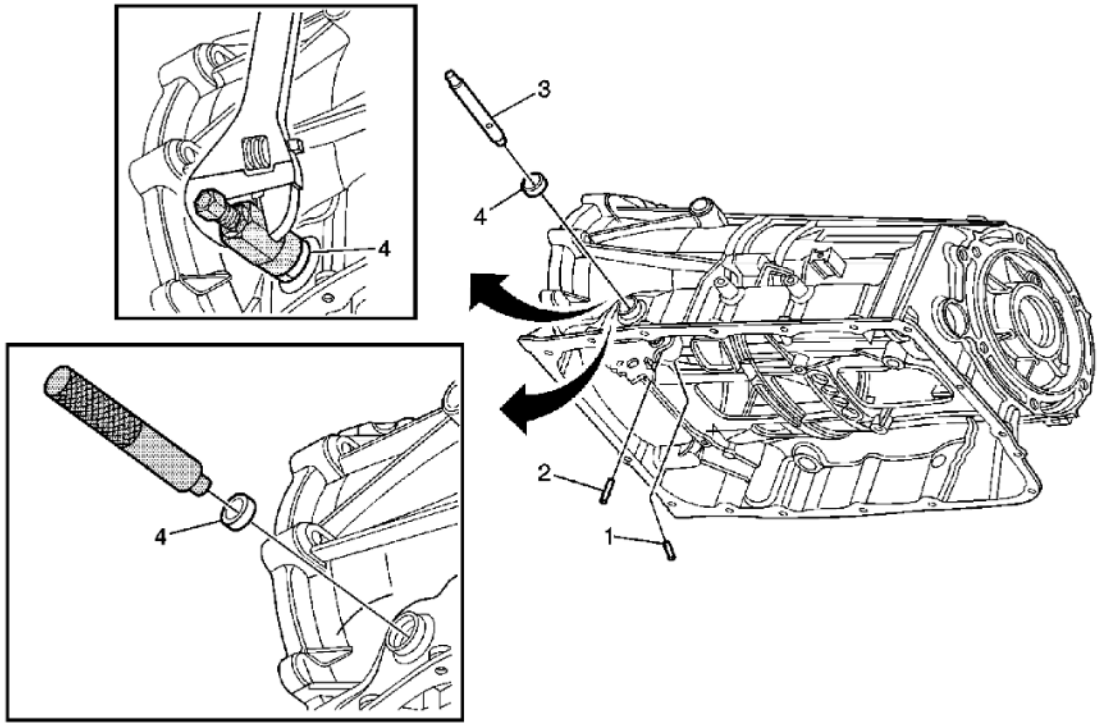


Fig. 78: Manual Shift Shaft and Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission from the vehicle. Refer to **Transmission Replacement**. 3. Remove the transmission fluid pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**. 4. Remove the control valve body. Refer to **Control Valve Lower Body and Upper Body Replacement**.	
	Manual Shift Shaft Pin **Tip:**

1	• Discard the pin. Replace with NEW pin. • "Walk" the pin out using side cutters.
2	Manual Shaft Detent Lever Hub Pin **Tip:** • Discard the pin. Replace with NEW pin. • "Walk" the pin out using side cutters.
3	Manual Shift Shaft **Tip:** The manual shaft must be removed to replace the manual shaft seal.
4	Manual Shift Shaft Seal **Tip:** • Use the **J 45201** Cooler Line Seal Remover, to remove the seal from the transmission case. See **Special Tools**. • Use the **J 43909** Selector Shaft Seal Installer, to install the seal into the transmission case.

MANUAL SHIFT DETENT LEVER AND PARK PAWL ACTUATOR REPLACEMENT

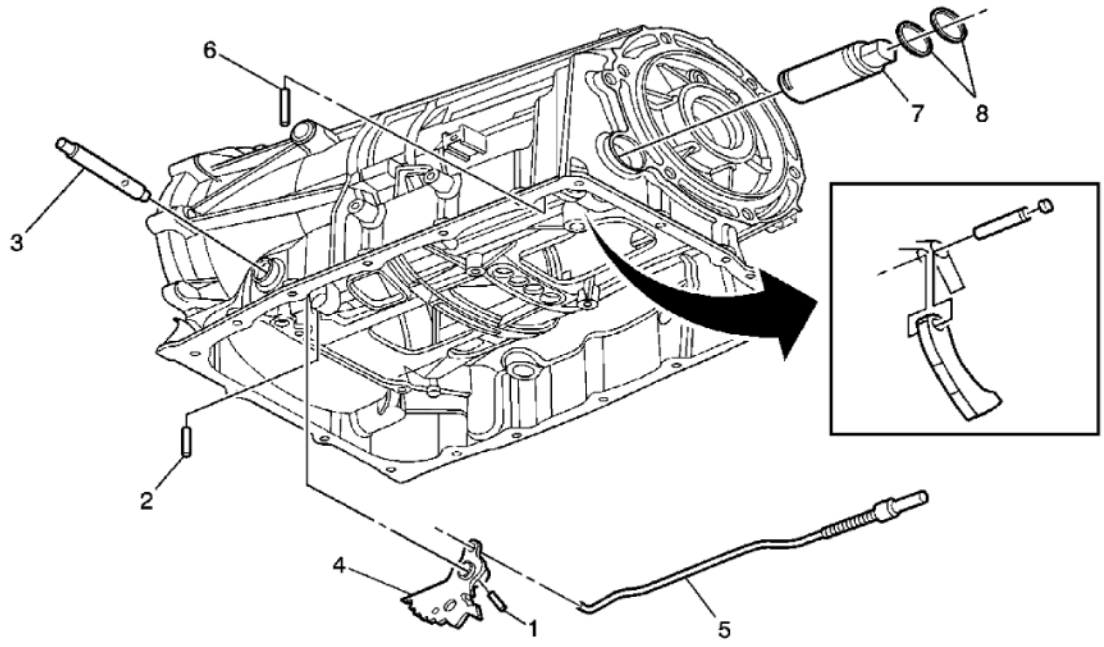


Fig. 79: Manual Shift Detent Lever and Park Pawl Actuator Replacement

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
IMPORTANT: **Do not remove the park pawl or park pawl spring. The park pawl and park pawl spring are not serviceable components.** **Preliminary Procedures** 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission fluid pan. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**. 3. Remove the manual shaft detent assembly roller. Refer to **Control Valve Lower Body and Upper Body Replacement**.	
1	Manual Shaft Detent Lever Hub Pin **Tip:** • Discard the pin. Replace with NEW pin. • "Walk" the pin out using side cutters.
2	Manual Shift Shaft Pin **Tip:** • Discard the pin. Replace with NEW pin. • "Walk" the pin out using side cutters.
3	Manual Shift Shaft
4	Manual Shaft Detent Lever Assembly
5	Park Pawl Actuator Assembly
6	Park Pawl Actuator Guide Pin **Tip:** • Discard the pin. Replace with NEW pin. • "Walk" the pin out using side cutters.
7	Park Pawl Actuator Guide
8	Park Pawl Actuator Guide (O-Ring) Seals (Qty: 2) **Tip:** Discard the seals. Replace with NEW seals.

MANUAL SHIFT SHAFT POSITION SWITCH REPLACEMENT

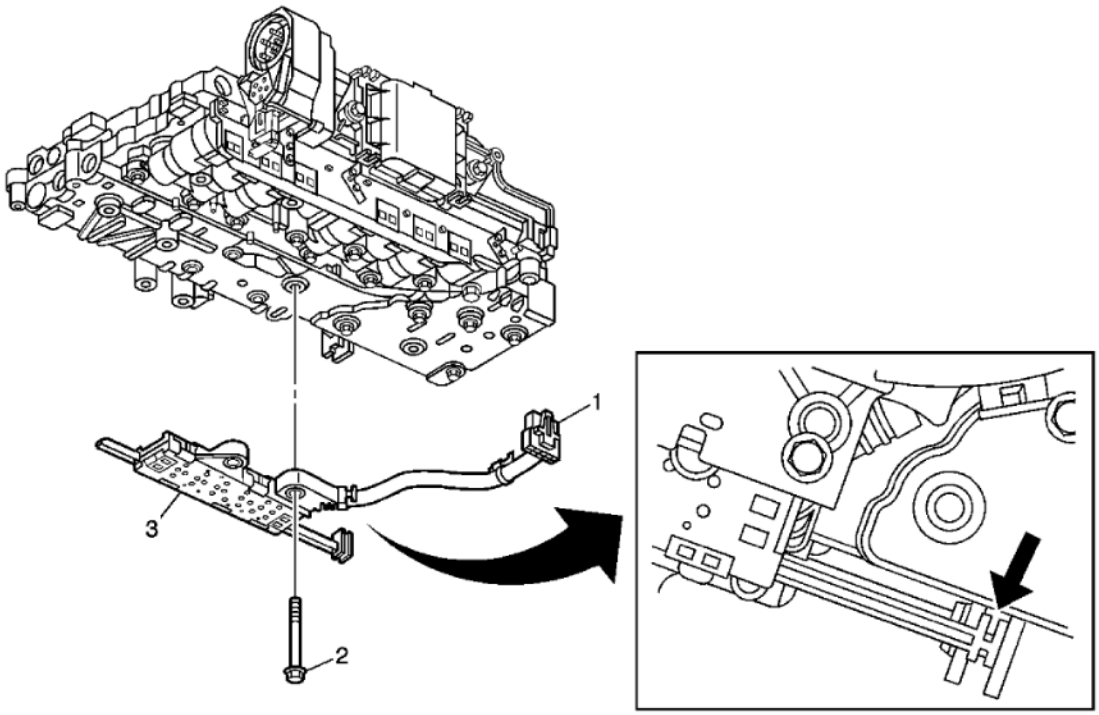


Fig. 80: Manual Shift Shaft Position Switch Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures 1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** . 2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.	
1	Manual Shift Shaft Position Switch Assembly Electrical Connector **Tip:** • Release the connector lock before disconnecting. Engage the connector lock after connecting. • The wiring harness clip near the connector does not need to be replaced if broken or missing. The clip is used during manufacturing to keep the wire harness clear during an automated bolt installation process. If the clip is damaged, simply remove and discard.
	Manual Shift Shaft Position Switch Assembly Bolt

2	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 8 N.m (71 lb in)
3	Manual Shift Shaft Position Switch Assembly **Procedure:** Align the switch activator slide with the manual valve link.

CONTROL SOLENOID VALVE AND TRANSMISSION CONTROL MODULE ASSEMBLY REPLACEMENT

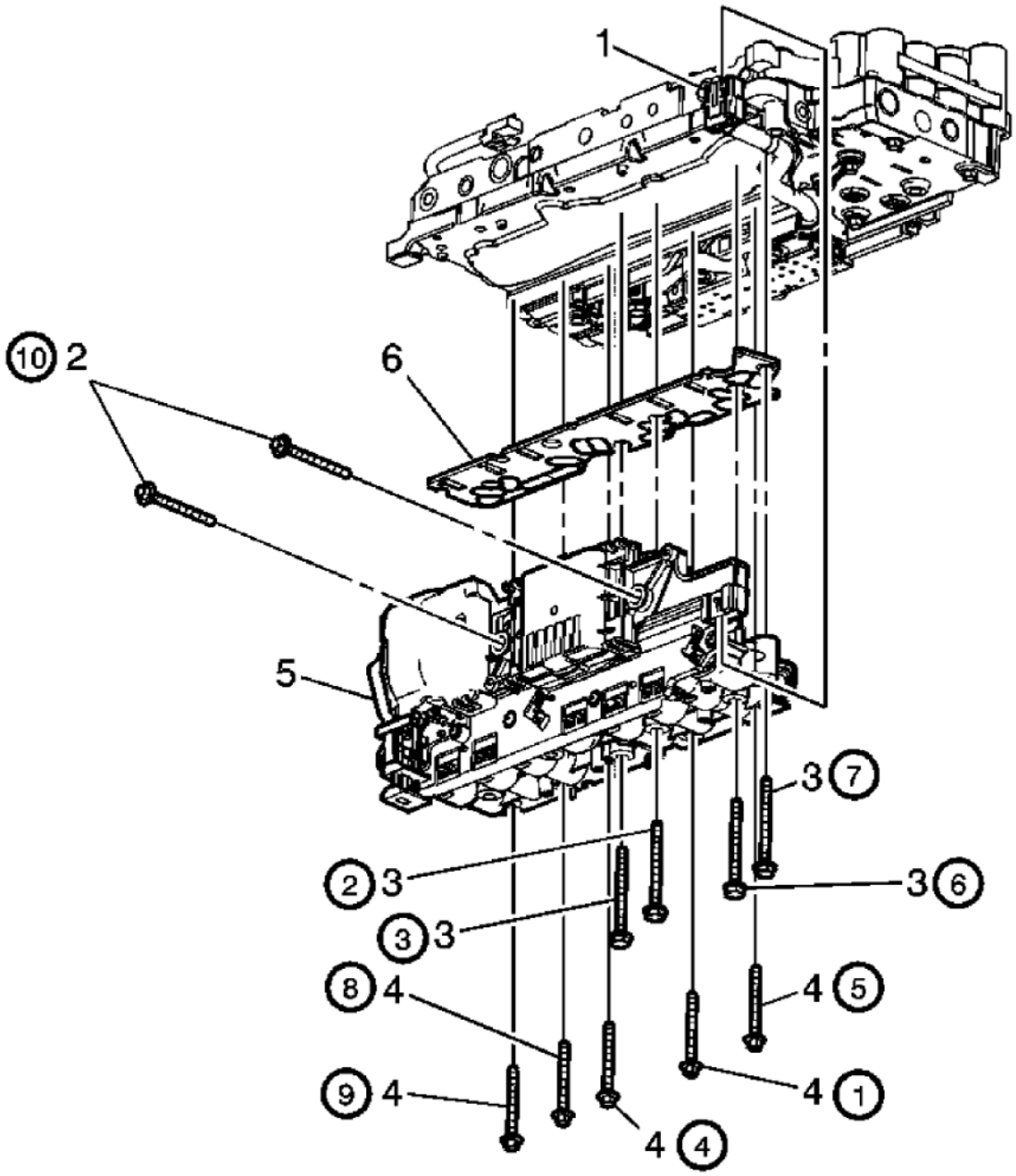


Fig. 81: Control Solenoid Valve and Transmission Control Module Assembly Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures: Remove the control valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.	

1	Manual Shift Shaft Position Switch Assembly Electrical Connector **Tip:** Release the connector lock before disconnecting. Engage the connector lock after connecting.
2	Control Module Assembly Heat Sink Bolt (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tip:** Tighten in specified sequence. **Tighten:** 8 N.m (71 lb in)
3	Control Solenoid Valve Assembly Bolt (Qty: 4) **Tip:** Tighten in specified sequence. **Tighten:** 8 N.m (71 lb in)
4	Control Solenoid Valve Assembly Bolt (Qty: 5) **Tip:** Tighten in specified sequence. **Tighten:** 8 N.m (71 lb in)
5	Control Solenoid Valve and Module Assembly **Procedure** 1. Inspect the 4 filter plate retaining tabs. A broken tab may not adequately secure the filter plate to the control solenoid valve assembly. 2. Align the control solenoid valve assembly with the lower valve body locator pin when assembling. 3. Reset the transmission adaptive pressure (TAP) values. Refer to **Service Fast Learn Adapts**.
6	Filter Plate **Tip:** Discard filter plate and replace with new.

CONTROL VALVE LOWER BODY AND UPPER BODY REPLACEMENT

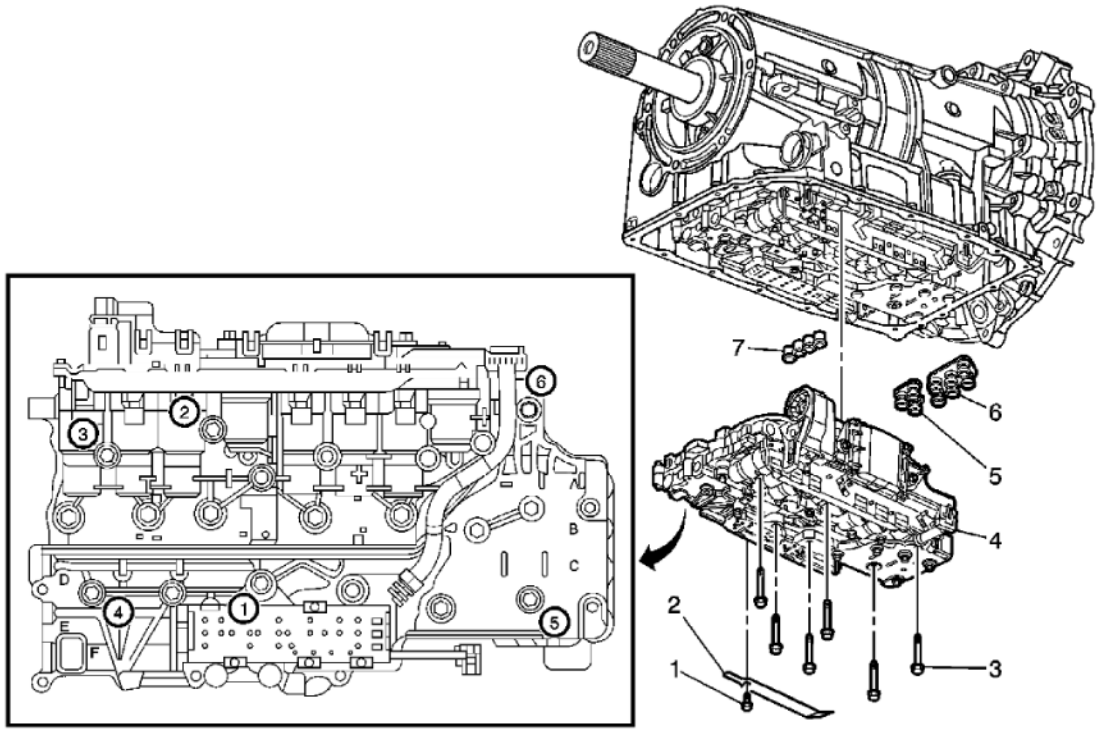


Fig. 82: Control Valve Lower Body and Upper Body Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures: Remove the transmission electrical connector. Refer to **Automatic Transmission Electrical Connector Passage Sleeve Replacement**.	
1	Manual Shaft Detent Bolt **NOTE:** **Refer to Fastener Notice .** **Tighten:** 12 N.m (106 lb in)
2	Manual Shaft Detent Assembly
3	Control Valve Assembly Bolt (Qty: 6) **Procedure** • Do not remove all the bolts in the control valve body assembly. Remove only the bolts indicated.

	• Tighten in specified sequence. **Tighten:** 8 N.m (71 lb in)
4	Control Valve Assembly
5	Fluid Pump Seal **Procedure:** Discard seal and replace with new.
6	Fluid Pump Seal **Procedure:** Discard seal and replace with new.
7	Center Support Fluid Passage Seal **Procedure** 1. Discard seal and replace with new. 2. It is recommended that transmission adaptive pressure (TAP) information be reset. Transmission performance may be affected as new TAP values are learned. Refer to **Service Fast Learn Adapts**. 3. If replacing the control valve body assembly, remove the **Control Solenoid Valve and Transmission Control Module Assembly Replacement** and the **Manual Shift Shaft Position Switch Replacement**.

INPUT AND OUTPUT SPEED SENSOR REPLACEMENT

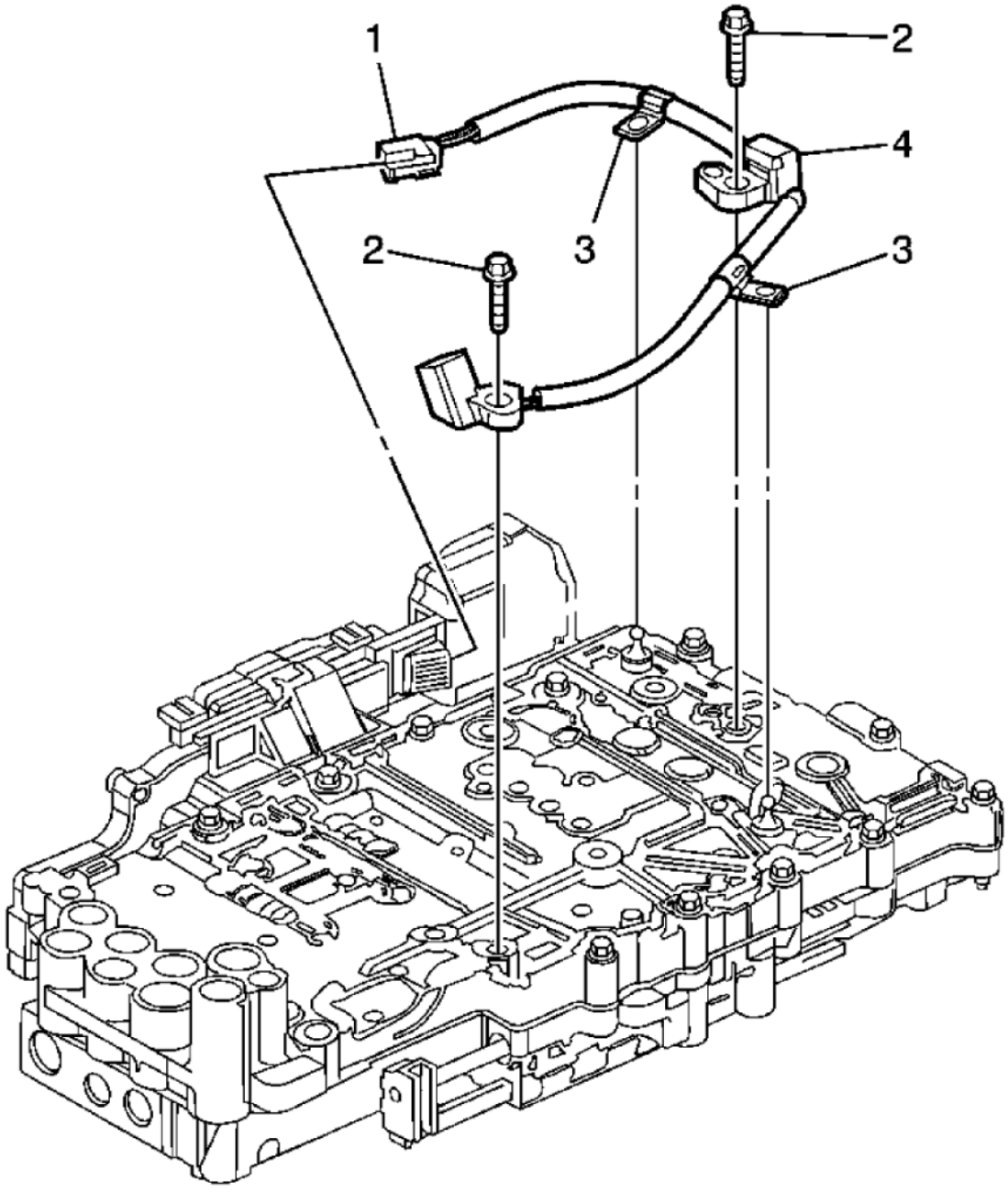


Fig. 83: Input and Output Speed Sensor Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .	

2. Remove the transmission fluid pan and filter. Refer to **Automatic Transmission Fluid, Fluid Pan and/or Filter Replacement**.
3. Remove the upper and lower valve body assembly. Refer to **Control Valve Lower Body and Upper Body Replacement**.

1	Speed Sensor Electrical Connector
2	Input and Output Speed Sensor Assembly Bolts (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 12 N.m (106 lb in)
3	Input and Output Speed Sensor Assembly Clips (Qty: 2) **Tip:** Inspect the wiring harness clips for damage replace if necessary.
4	Input and Output Speed Sensor Assembly

TRANSMISSION CONVERTER COVER REPLACEMENT

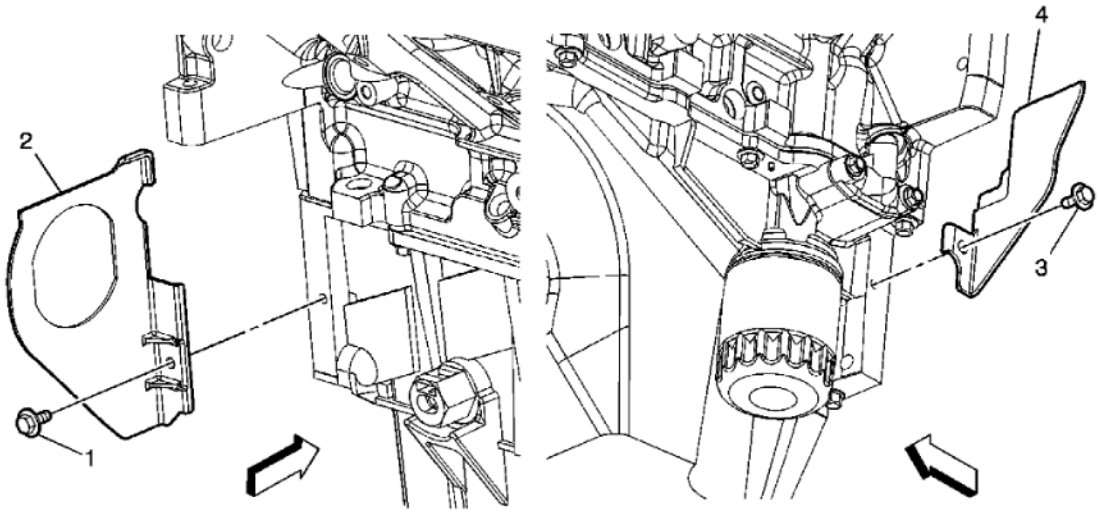


Fig. 84: Transmission Converter Cover Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedure: Raise the vehicle. Refer to **Lifting and Jacking the Vehicle** .	
	Torque Converter Cover Bolt

1	**NOTE:** **Refer to Fastener Notice .** **Tighten:** 10 N.m (89 lb in)
2	Torque Converter Cover **Tip:** Remove the starter. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)** .
3	Torque Converter Cover Bolt **Tighten:** 10 N.m (89 lb in)
4	Torque Converter Cover

TRANSMISSION REPLACEMENT

TOOLS REQUIRED

J 21366 Converter Holding Strap

REMOVAL PROCEDURE

1. Disconnect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)** .
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
3. Remove the rear propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .
4. Support the transmission with a transmission jack.
5. Remove the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD 2500 HD/3500)** or **Transmission Support Crossmember Replacement (2WD 1500/2500)** or **Transmission Support Crossmember Replacement (4WD 1500/2500)** or **Transmission Support Crossmember Replacement (4WD 2500 HD/3500)** .
6. Remove the transmission mount. Refer to **Transmission Mount Replacement (2WD)** or **Transmission Mount Replacement (4WD)** .
7. Remove the catalytic converter pipe. Refer to **Catalytic Converter Replacement (4.3L)** or **Catalytic Converter Replacement (4.8L, 5.3L, 6.0L, 6.2L)** or **Catalytic Converter**

Replacement (6.6L) .

8. If the vehicle is equipped with a transfer case, remove the front propeller shaft. Refer to **Front Propeller Shaft Replacement** .

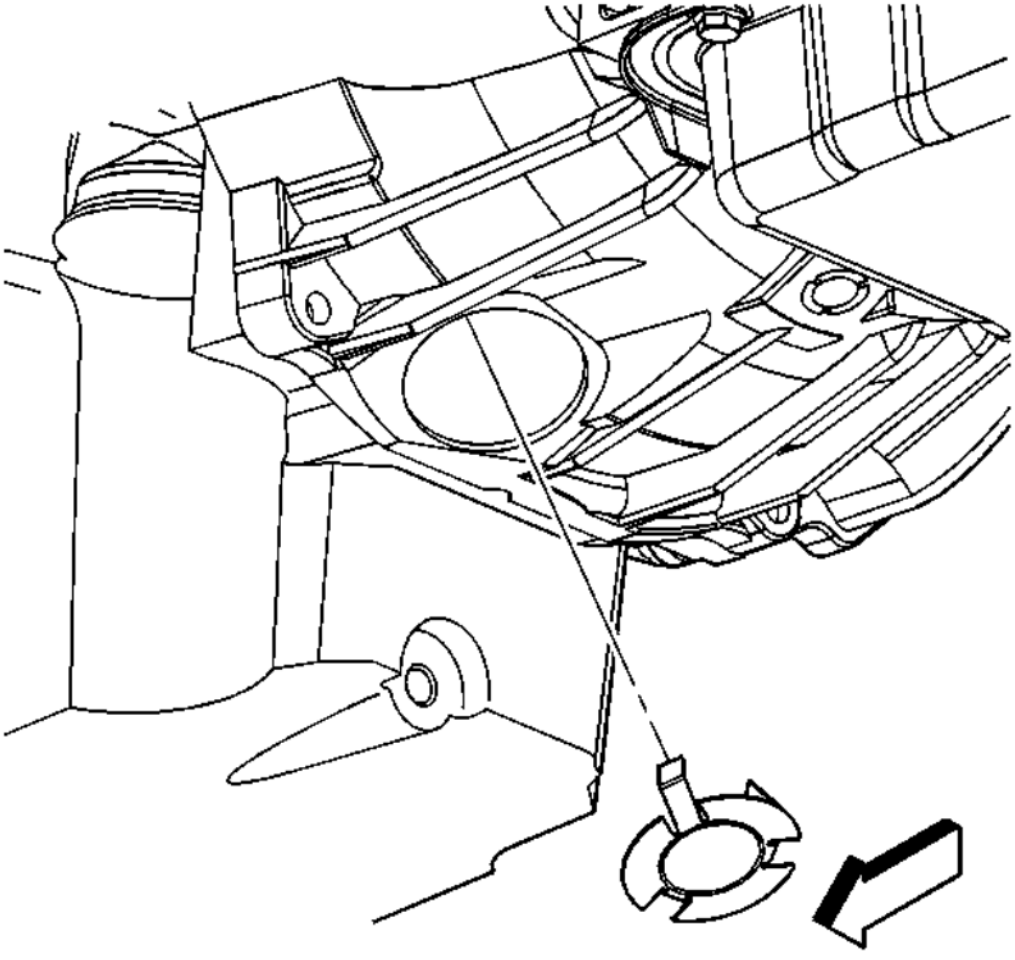


Fig. 85: Identifying Torque Converter Access Plug
Courtesy of GENERAL MOTORS CORP.

9. Remove the torque converter access plug.

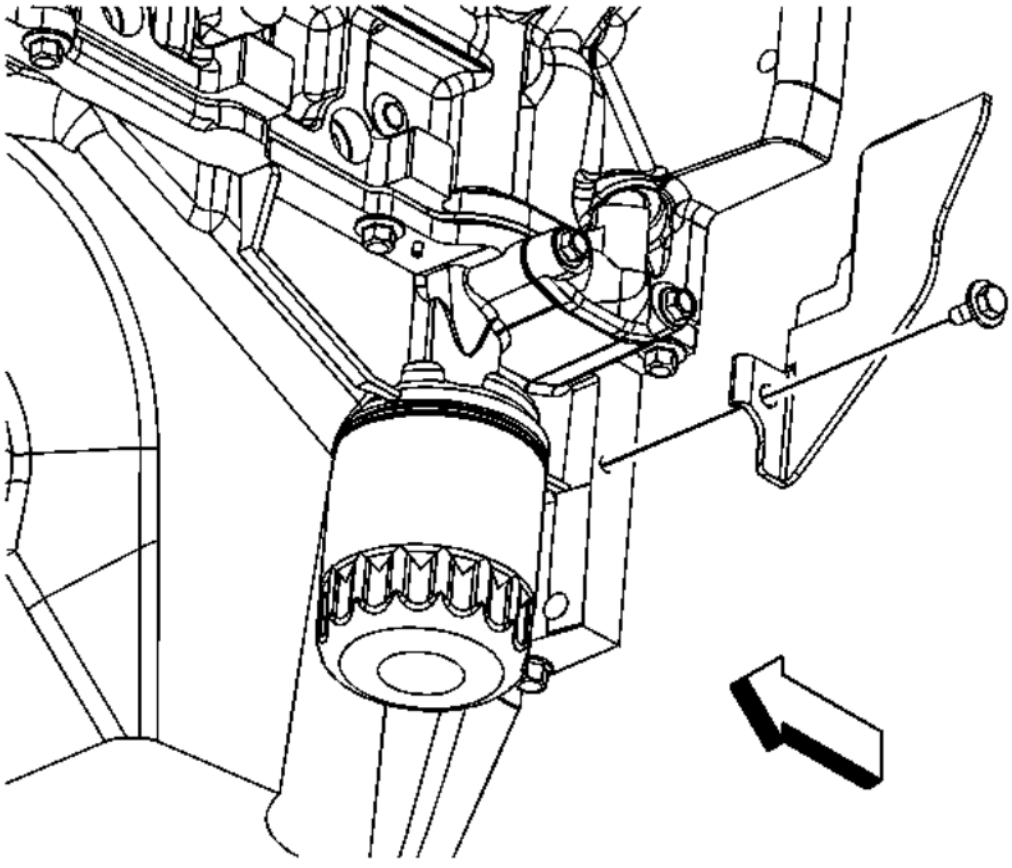


Fig. 86: View Of Left Flywheel Inspection Cover
Courtesy of GENERAL MOTORS CORP.

10. Remove the left flywheel inspection cover.
11. Remove the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)** .

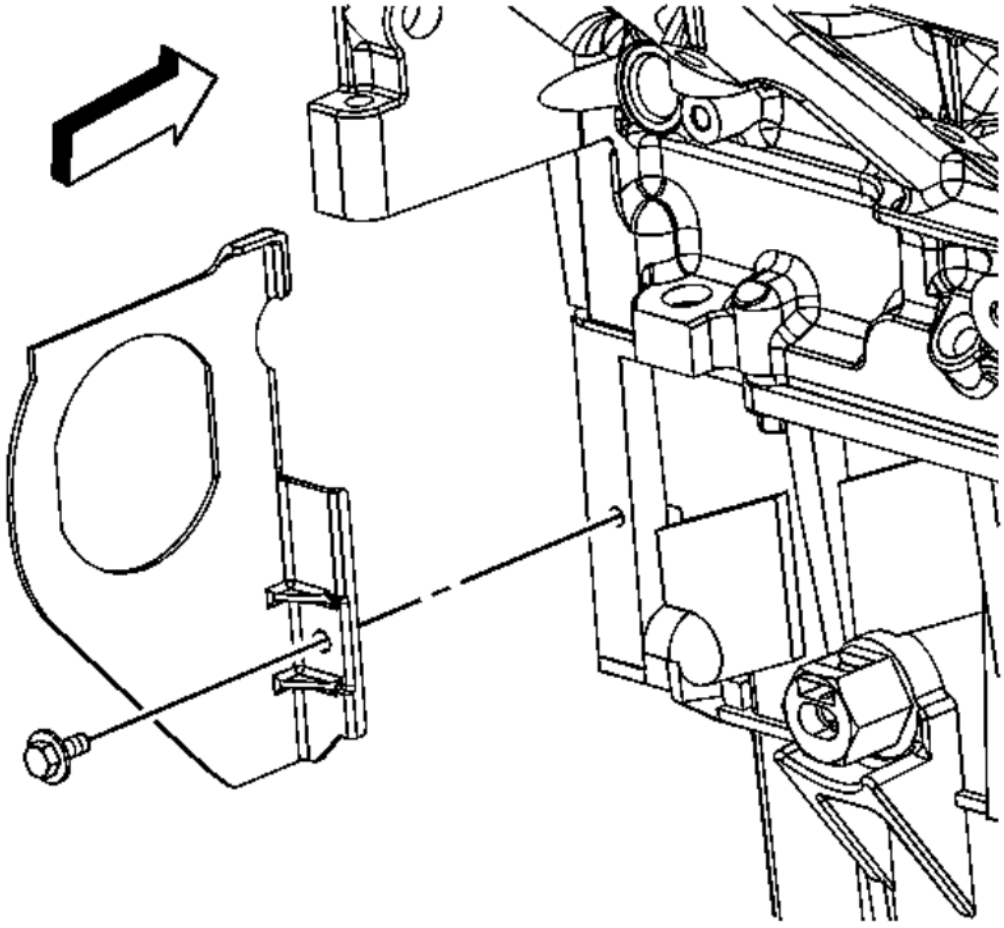


Fig. 87: View Of Right Flywheel Inspection Cover
Courtesy of GENERAL MOTORS CORP.

12. Remove the right flywheel inspection cover.

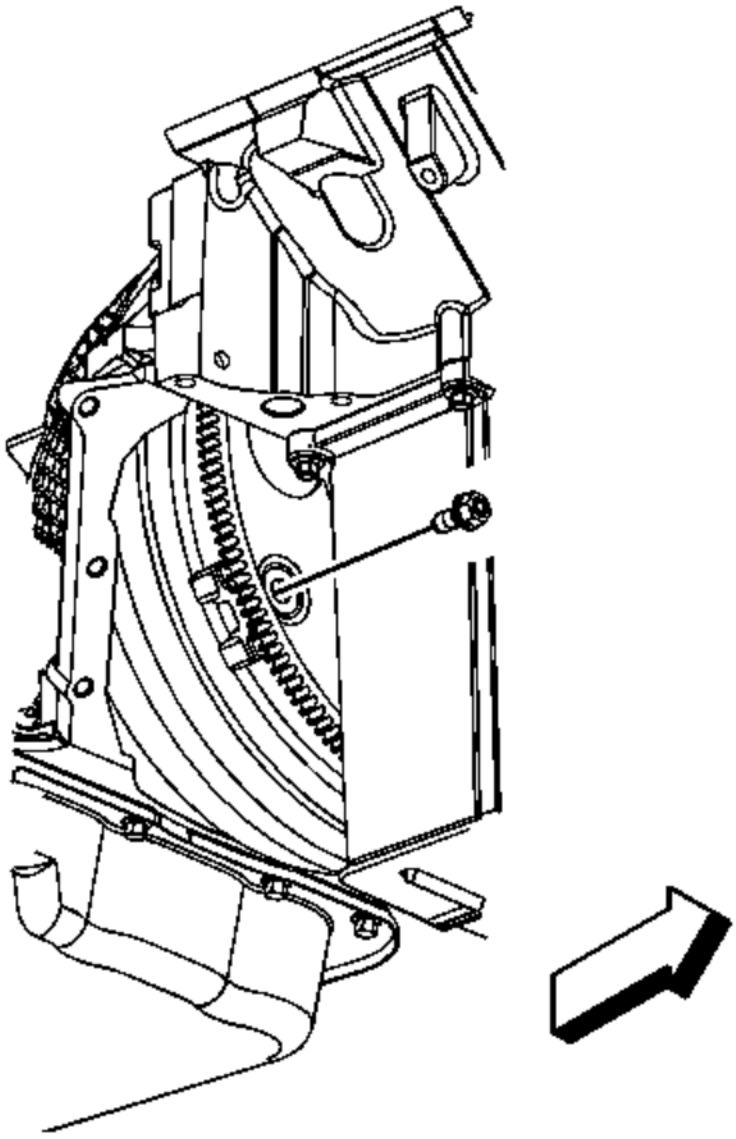


Fig. 88: View Of Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

13. Remove the flywheel to torque converter bolts.
14. Lower the transmission to gain access to the top and sides of the transmission.

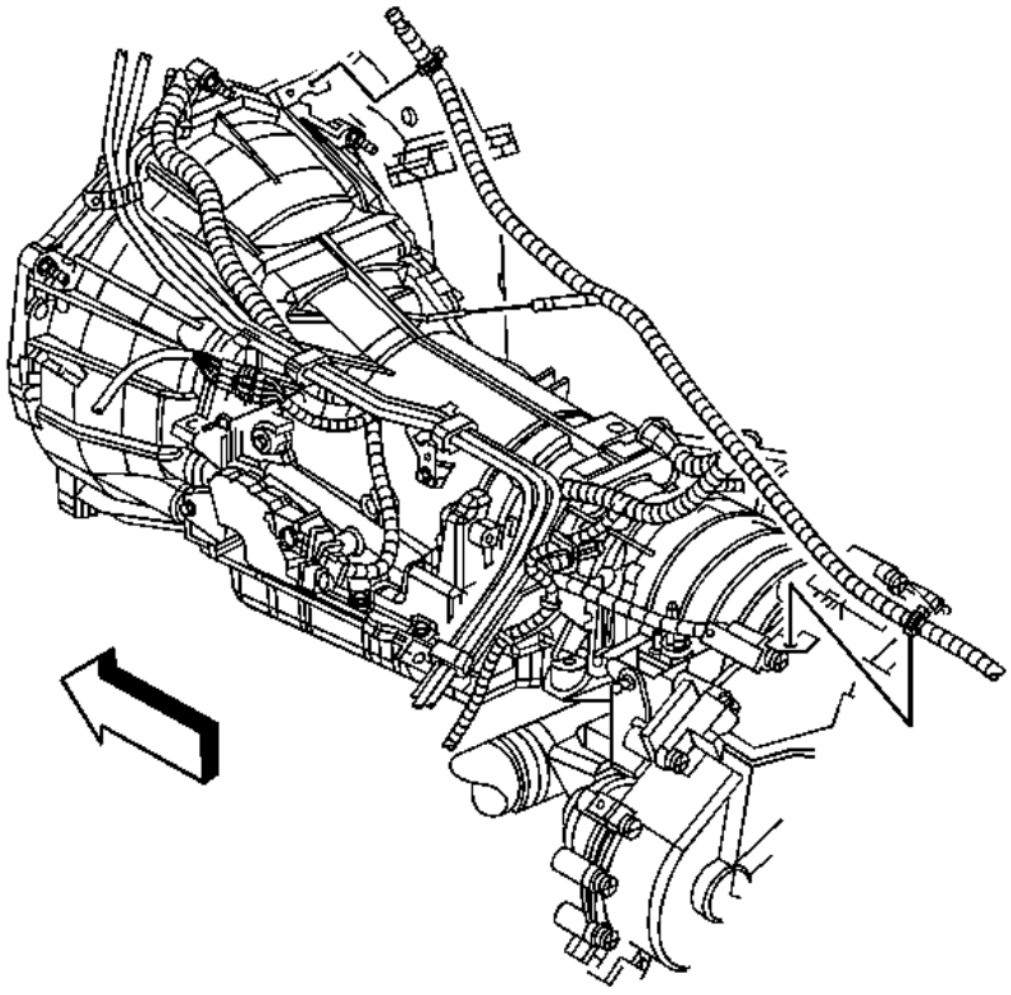


Fig. 89: View Of Transfer Case Vent Tube Hose
Courtesy of GENERAL MOTORS CORP.

15. Disconnect the vent tube hose and the electrical connections from the transfer case, if equipped.
16. Remove the transfer case, if equipped. Refer to the appropriate procedure:
    - **Transfer Case Assembly Replacement** for the MP 1222/1225/1226-NQG transfer case.
    - **Transfer Case Assembly Replacement** for the MP 1625/1626-NQF transfer case.

- **Transfer Case Assembly Replacement** for the MP 3023/3024-NQH transfer case.

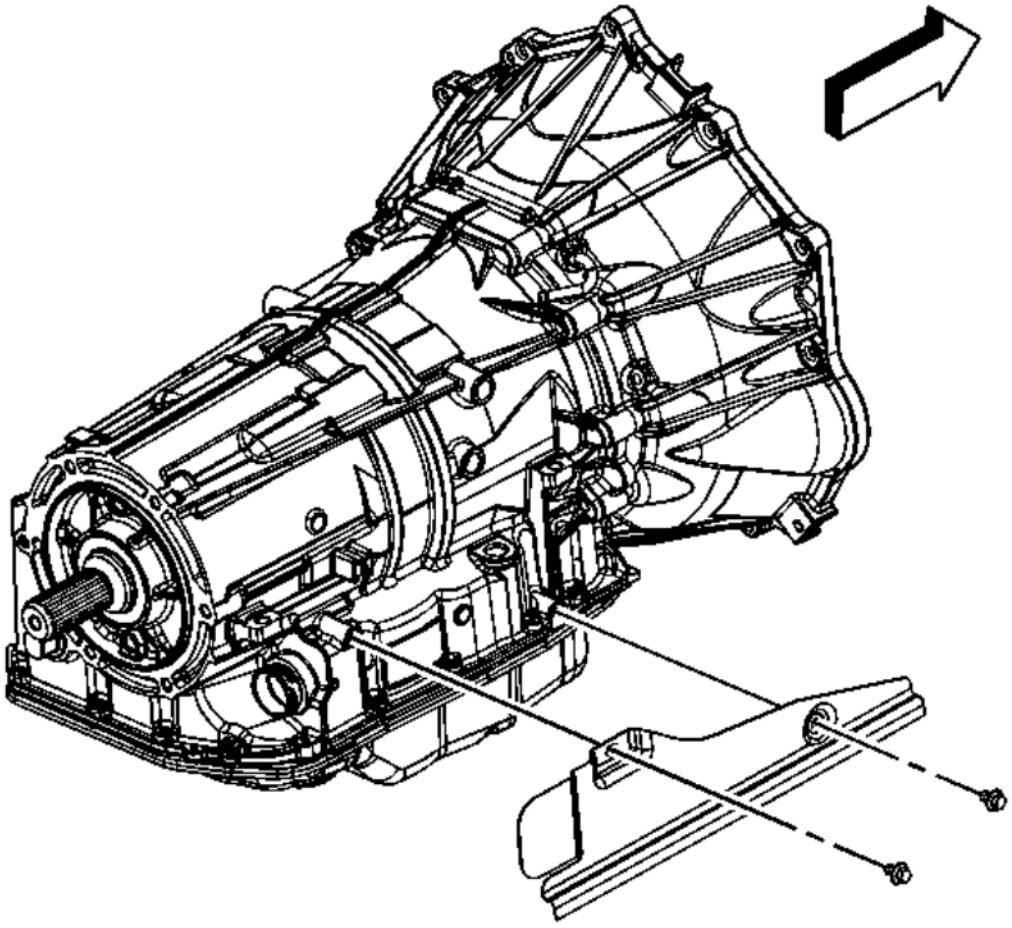


Fig. 90: View Of Transmission Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

17. Remove the 2 bolts securing the heat shield to the transmission.
18. Remove the transmission heat shield.

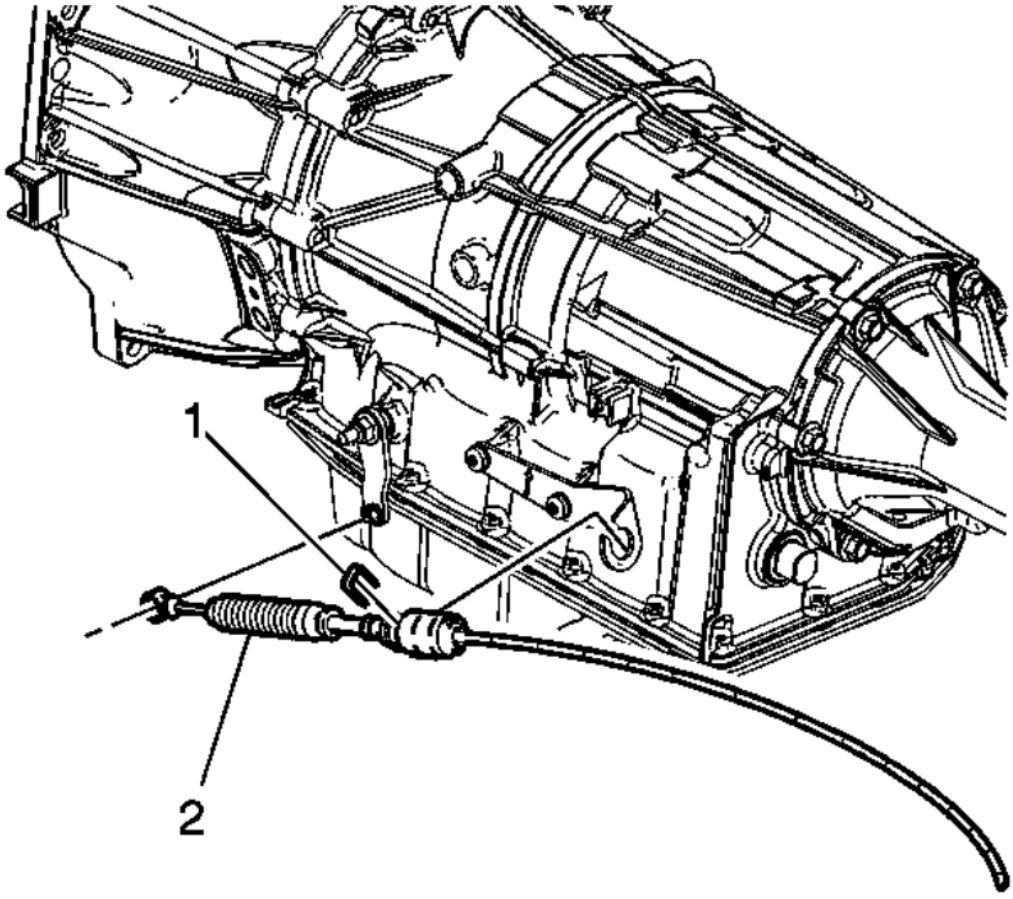


Fig. 91: View Of Range Selector Cable & Cable Bracket Retainer
Courtesy of GENERAL MOTORS CORP.

19. Remove the range selector cable retaining clip (1) from the transmission range selector cable.
20. Remove the range selector cable (2) from the range selector lever ball stud and the range selector cable bracket.

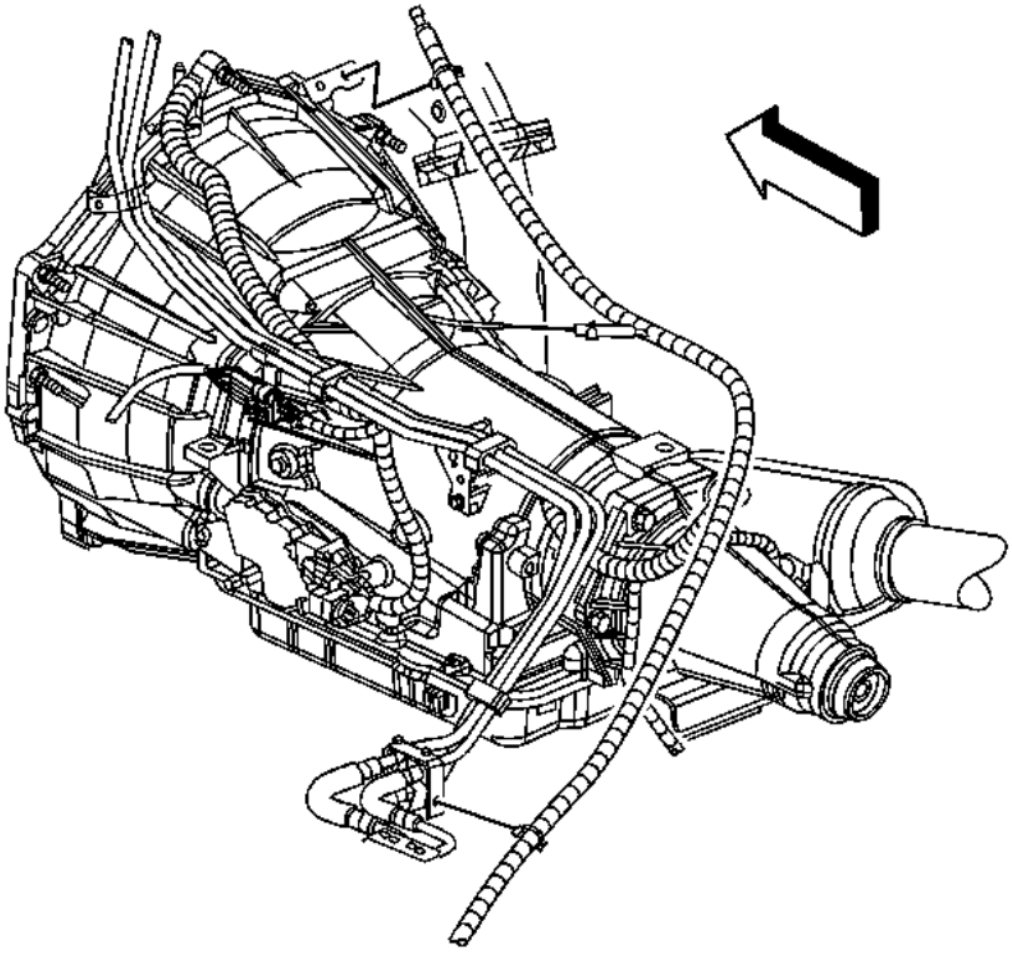


Fig. 92: View Of Transmission Vent Hose
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the transmission vent hose.
22. Disconnect the transmission electrical connector from the transmission.
23. Remove the wire harness from the transmission.

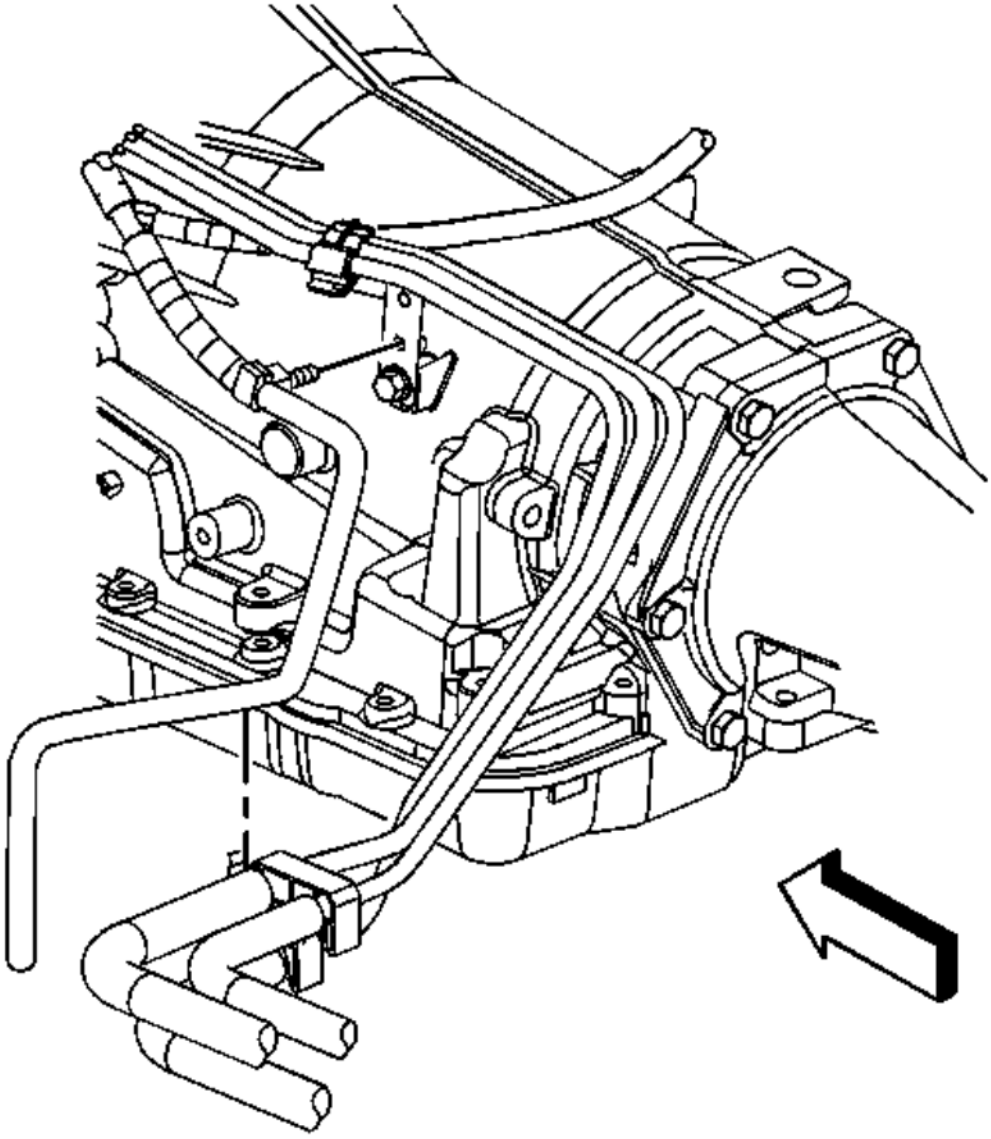


Fig. 93: View Of Bolt Securing Fuel Line Bracket To Left Side Of Transmission
Courtesy of GENERAL MOTORS CORP.

24. Remove the bolt that secures the fuel line bracket to the left side of the transmission.

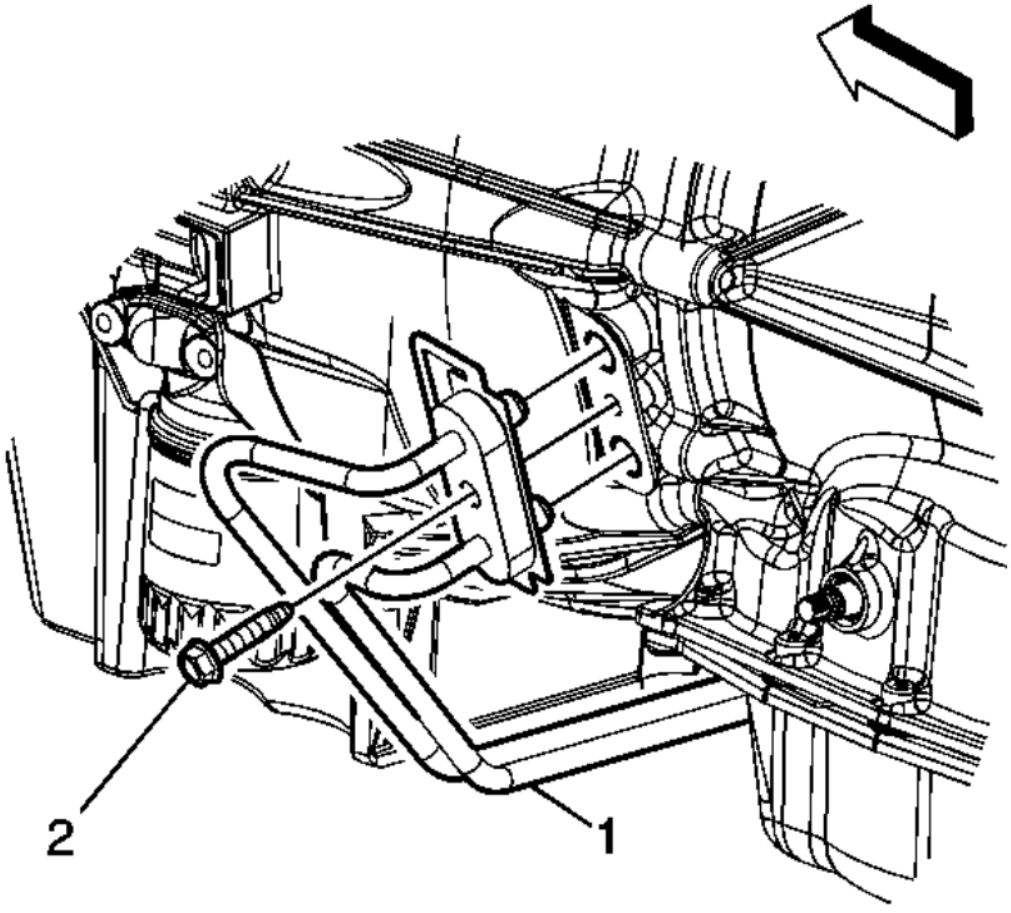


Fig. 94: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS CORP.

25. Disconnect the transmission oil cooler lines from the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement** .
26. Plug the transmission oil cooler line connectors in the transmission case.

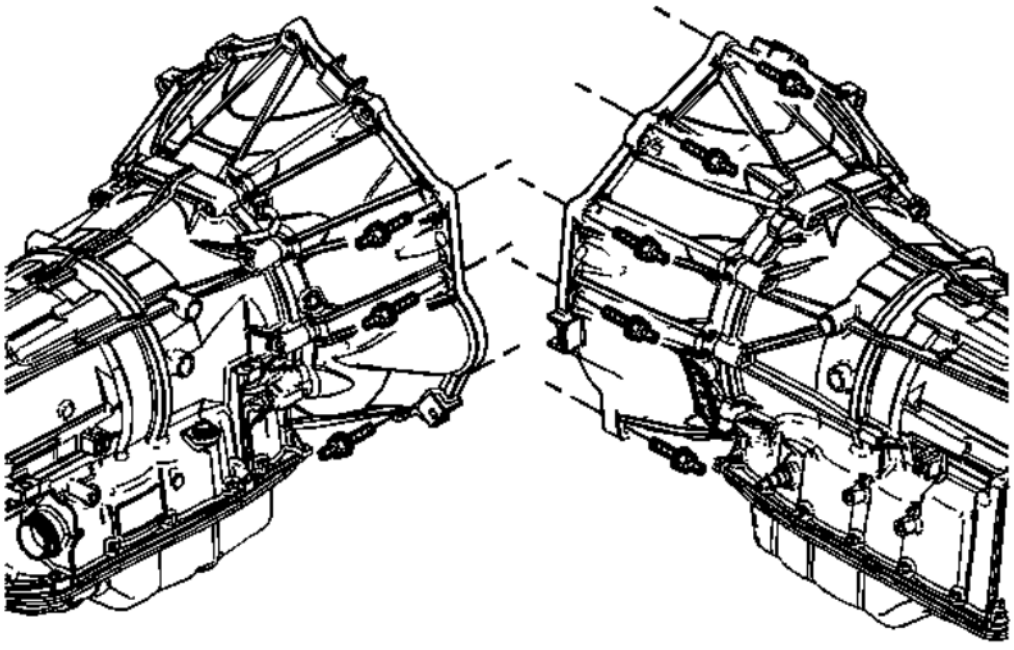


Fig. 95: View Of Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

27. Remove the 8 bolts securing the transmission to the engine.
28. Pull the transmission straight back.
29. Install the **J 21366** onto the transmission bell housing to retain the torque converter.
30. Remove the transmission from the vehicle while simultaneously removing the fluid level indicator tube.
31. Flush the transmission oil cooler and cooling lines if necessary. Refer to **Transmission Fluid Cooler Flushing and Flow Test (J 45096)** or **Transmission Fluid Cooler Flushing and Flow Test (J 35944-A)** .

INSTALLATION PROCEDURE

1. Install the **J 21366** onto the transmission bell housing to retain the torque converter.
2. Support the transmission with a transmission jack.
3. Raise the transmission into place while simultaneously installing the fluid indicator tube.

4. Remove the **J 21366** from the transmission.
5. Slide the transmission straight onto the locating pins while lining up the marks on the flywheel and the torque converter.

   The torque converter must rotate freely by hand.

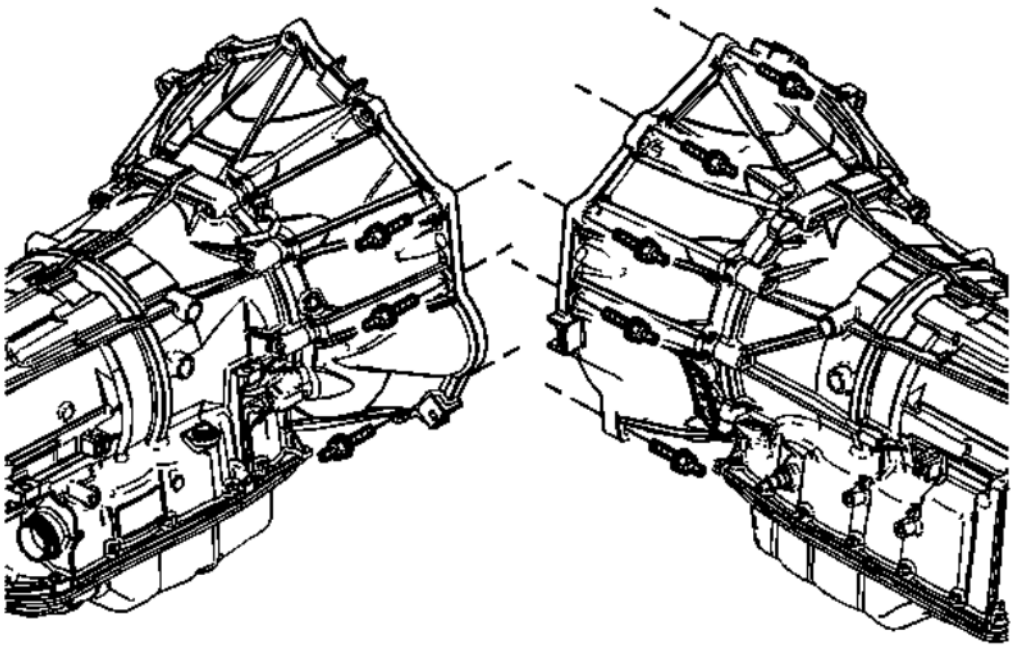


Fig. 96: View Of Transmission Bolts
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice .

6. Install the 8 bolts securing the transmission to the engine.

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

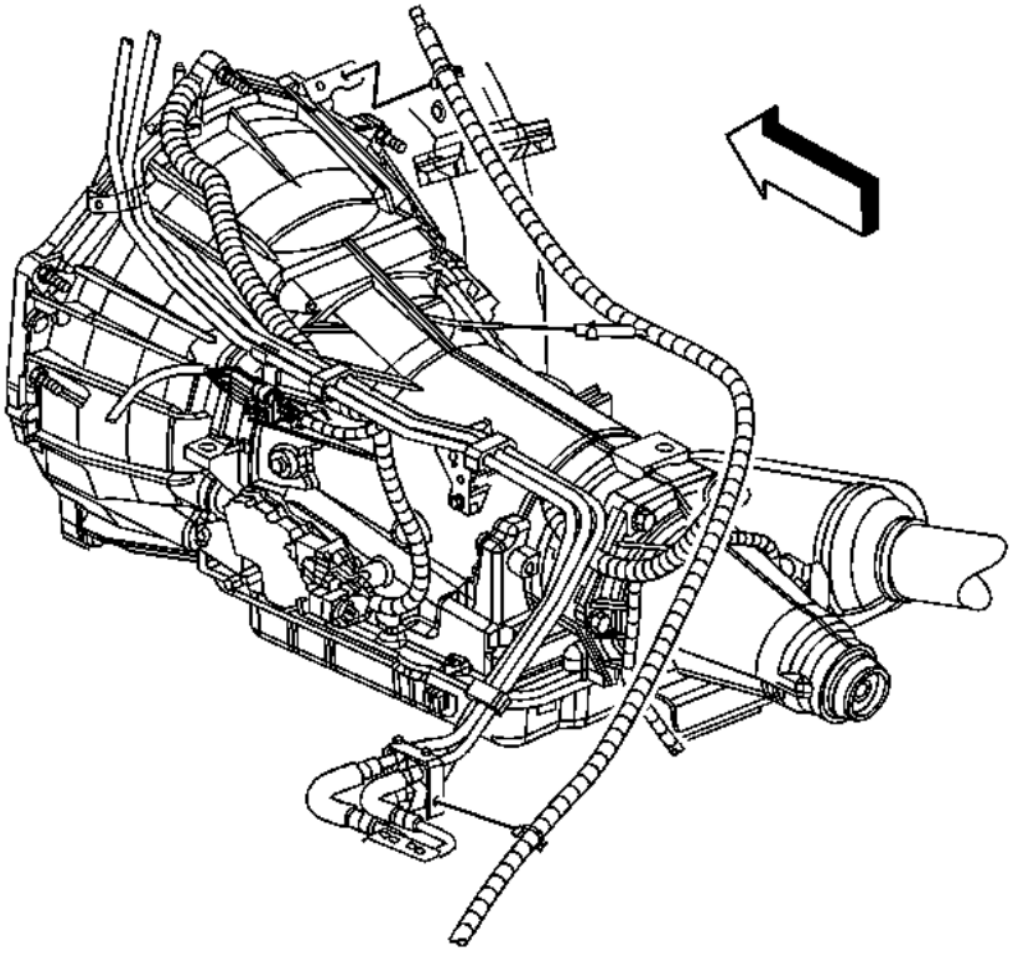


Fig. 97: View Of Transmission Vent Hose
Courtesy of GENERAL MOTORS CORP.

7. Connect the transmission vent hose.
8. Install the wire harness to the transmission.
9. Connect the transmission electrical connector to the transmission.

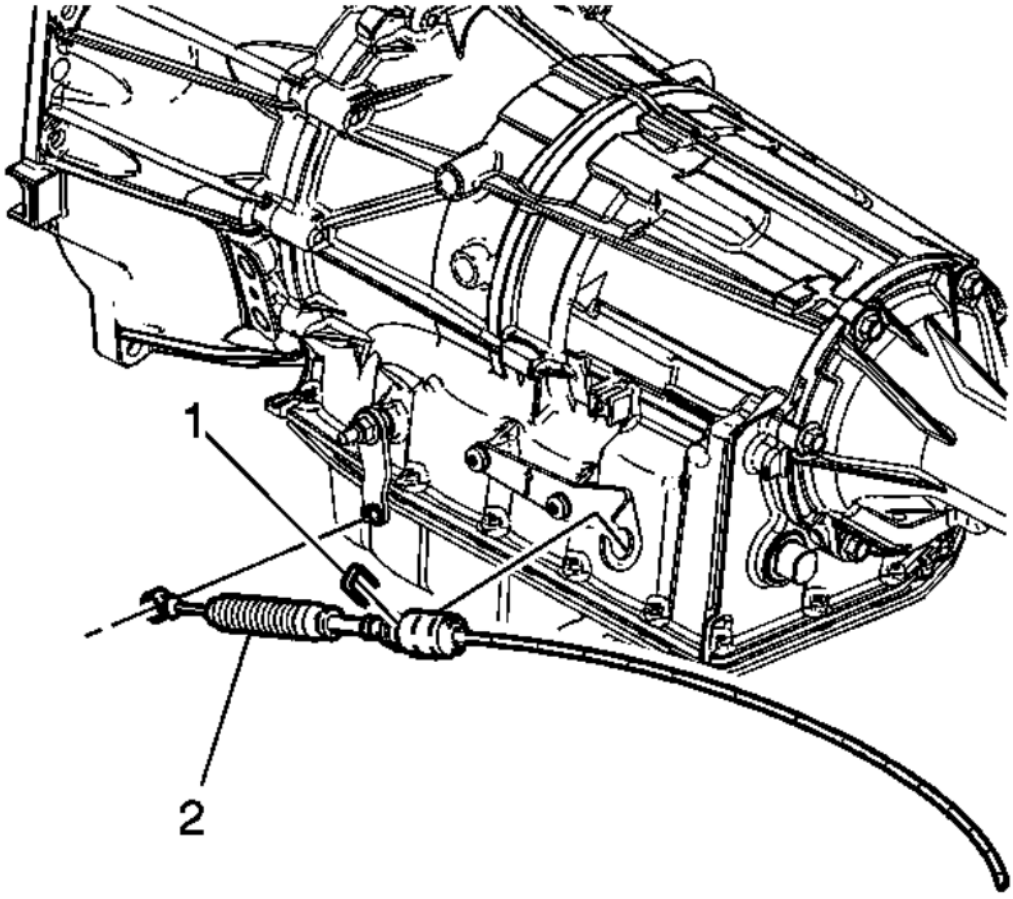


Fig. 98: View Of Range Selector Cable & Cable Bracket Retainer
Courtesy of GENERAL MOTORS CORP.

10. Install the range selector cable (2) to the range selector cable bracket and the range selector lever ball stud.
11. Install the range selector cable retaining clip (1) to the transmission range selector cable.

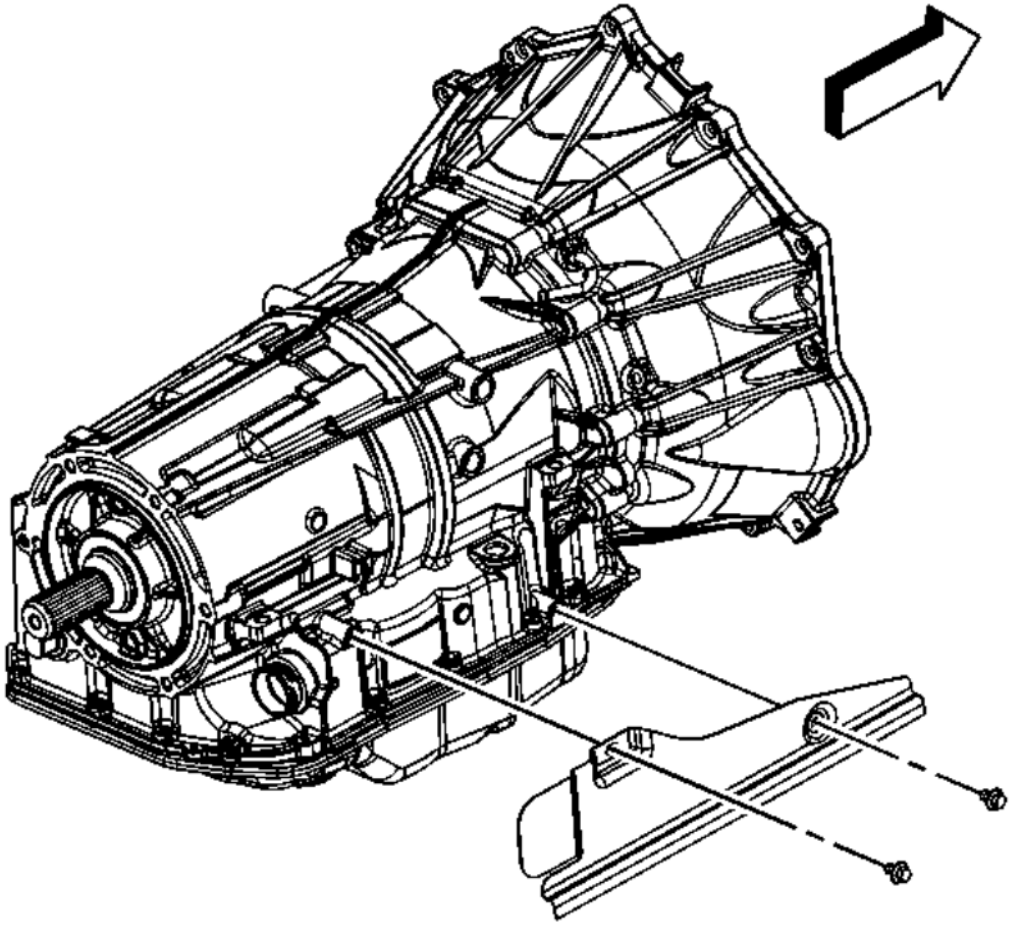


Fig. 99: View Of Transmission Heat Shield & Bolts
Courtesy of GENERAL MOTORS CORP.

12. Install the transmission heat shield.
13. Install the 2 bolts securing the heat shield to the transmission.

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

14. Install the transfer case, if equipped. Refer to the appropriate procedure:
    - **Transfer Case Assembly Replacement** for the MP 1222/1225/1226-NQG transfer case.
    - **Transfer Case Assembly Replacement** for the MP 1625/1626-NQF transfer case.

- **Transfer Case Assembly Replacement** for the MP 3023/3024-NQH transfer case.

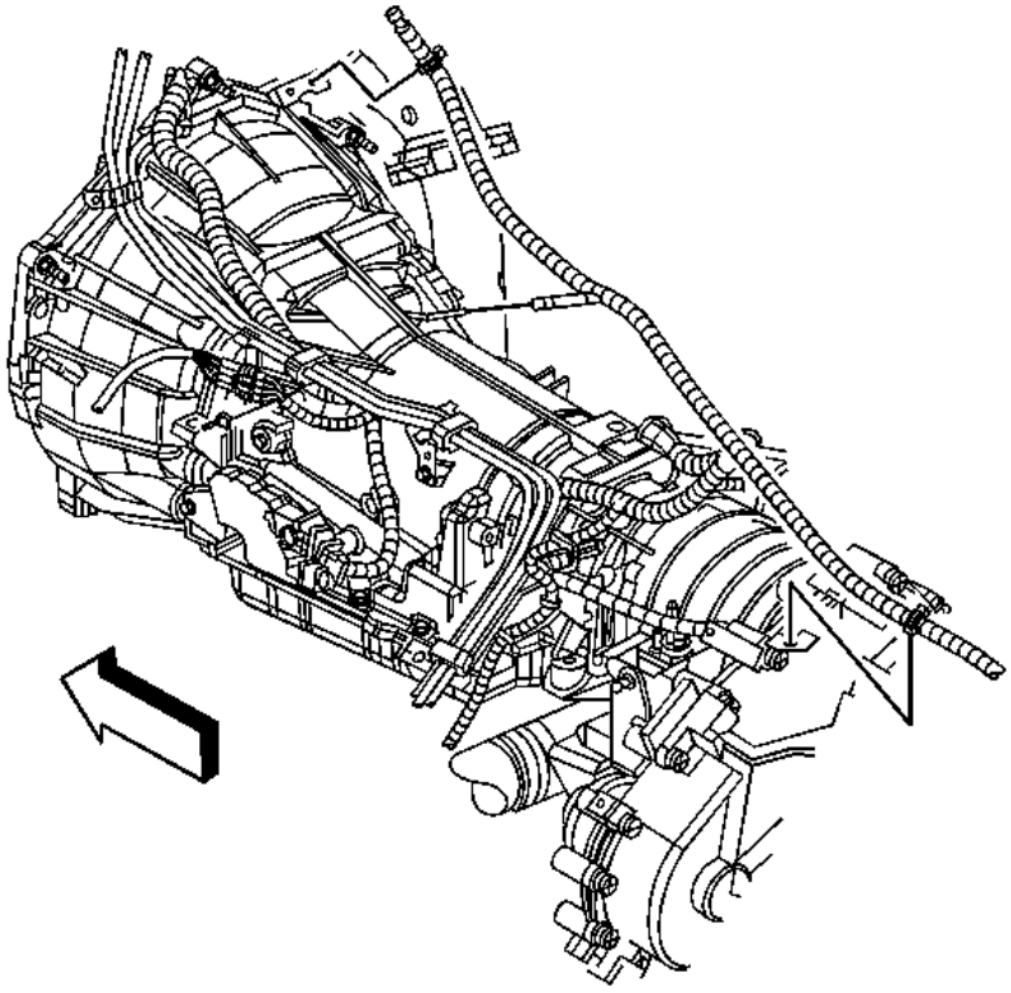


Fig. 100: View Of Transfer Case Vent Tube Hose
Courtesy of GENERAL MOTORS CORP.

15. Connect the vent hose and electrical connectors to the transfer case, if equipped.

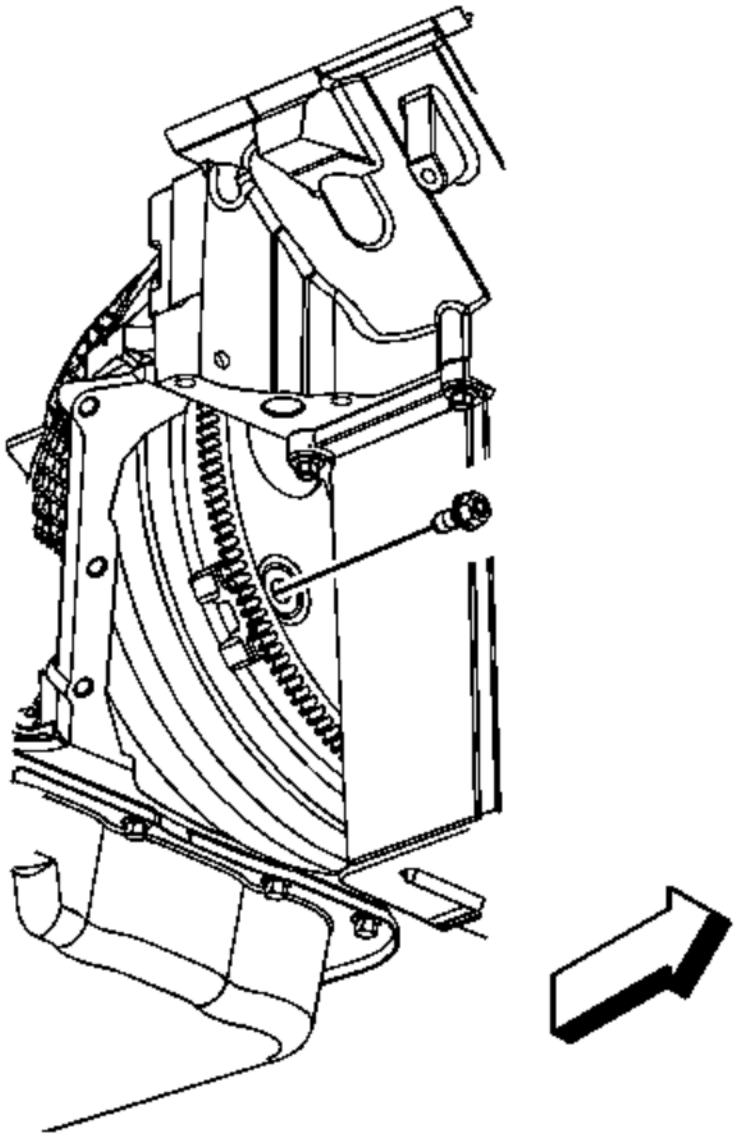


Fig. 101: View Of Flywheel To Torque Converter Bolts
Courtesy of GENERAL MOTORS CORP.

16. If reusing the torque converter bolts, clean the bolt threads and apply LOCTITE 242, GM P/N 12345382 (Canadian P/N 10953489), or equivalent to the threads prior to installation.
17. Install the flywheel to torque converter bolts.

Tighten: Tighten the bolts to 63 N.m (46 lb ft).

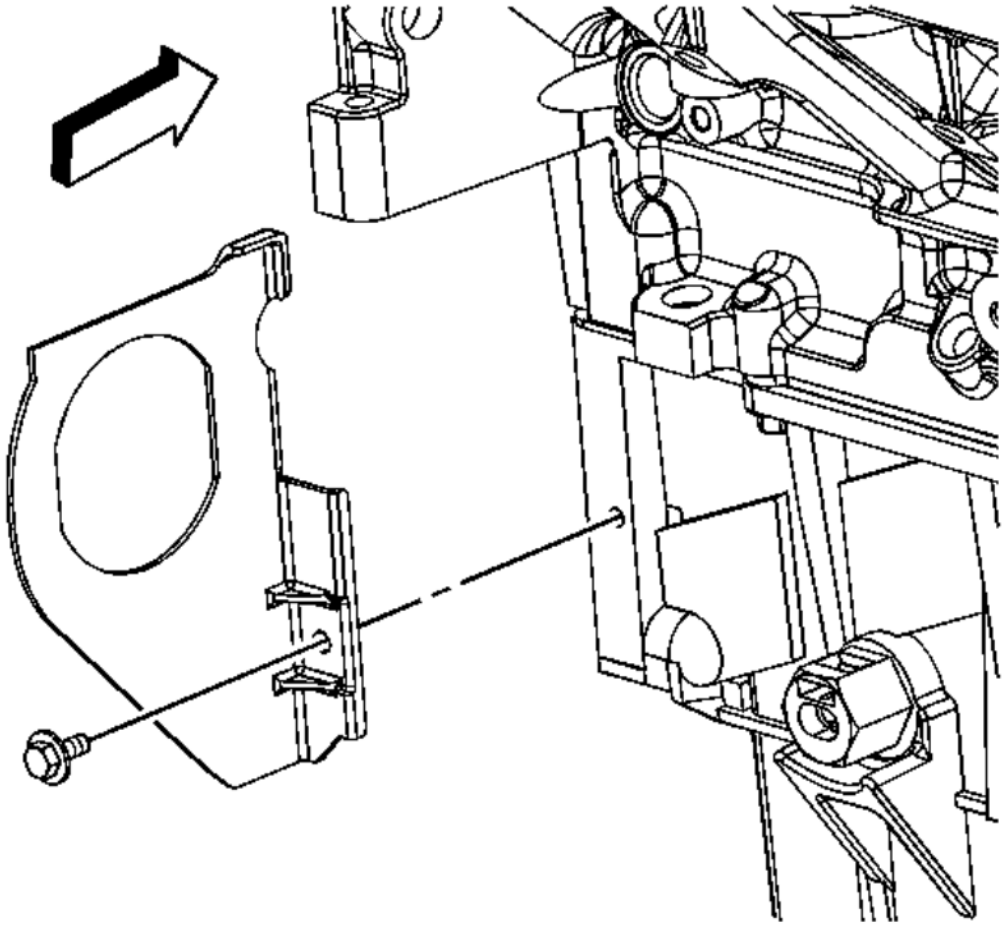


Fig. 102: View Of Right Flywheel Inspection Cover
Courtesy of GENERAL MOTORS CORP.

18. Install the right flywheel inspection cover and bolt.

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

19. Install the starter motor. Refer to **Starter Motor Replacement (4.3L)** or **Starter Motor Replacement (4.8L, 5.3L, 6.0L, and 6.2L)** or **Starter Motor Replacement (6.6L)** .

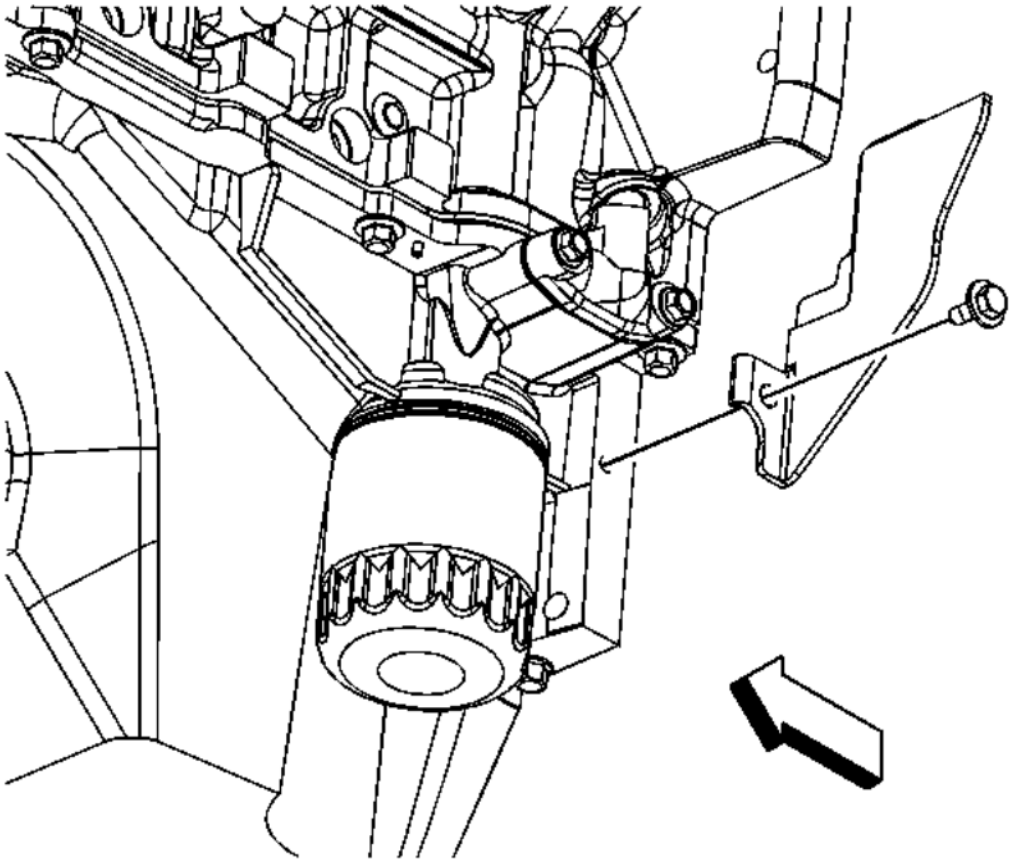


Fig. 103: View Of Left Flywheel Inspection Cover
Courtesy of GENERAL MOTORS CORP.

20. Install the left flywheel inspection cover and bolt.

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

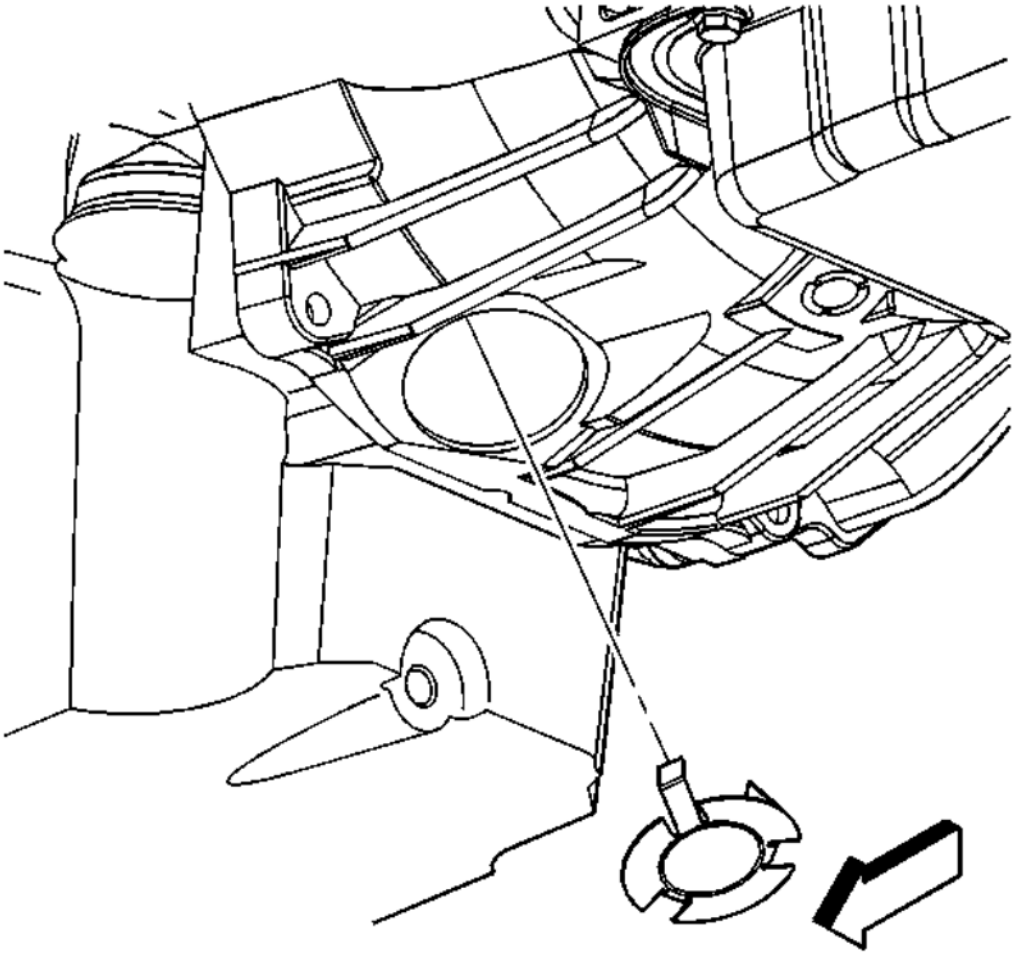


Fig. 104: Identifying Torque Converter Access Plug
Courtesy of GENERAL MOTORS CORP.

21. Install the torque converter access plug.
22. If the vehicle is equipped with a transfer case, install the front propeller shaft. Refer to **Front Propeller Shaft Replacement** .
23. Install the catalytic converter pipe. Refer to **Catalytic Converter Replacement (4.3L)** or **Catalytic Converter Replacement (4.8L, 5.3L, 6.0L, 6.2L)** or **Catalytic Converter Replacement (6.6L)** .
24. Install the transmission mount. Refer to **Transmission Mount Replacement (2WD)** or **Transmission Mount Replacement (4WD)** .

25. Install the transmission crossmember. Refer to **Transmission Support Crossmember Replacement (2WD 2500 HD/3500)** or **Transmission Support Crossmember Replacement (2WD 1500/2500)** or **Transmission Support Crossmember Replacement (4WD 1500/2500)** or **Transmission Support Crossmember Replacement (4WD 2500 HD/3500)** .
26. Remove the transmission jack.
27. Install the rear propeller shaft. Refer to **One-Piece Propeller Shaft Replacement** or **Two-Piece Propeller Shaft Replacement** .

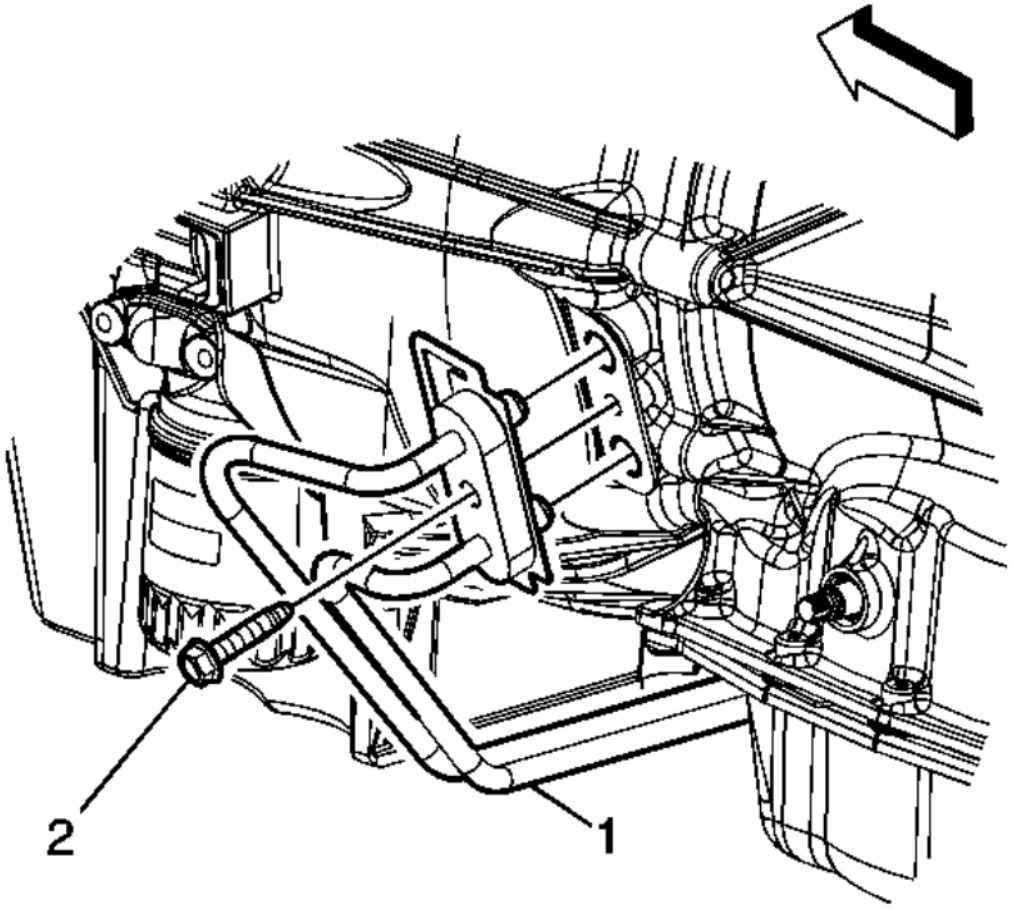


Fig. 105: View Of Oil Cooling Lines & Bolt
Courtesy of GENERAL MOTORS CORP.

28. Connect the oil cooler lines to the transmission. Refer to **Transmission Fluid Cooler Hose/Pipe Replacement**
29. Lower the vehicle.
30. Connect the negative battery cable. Refer to **Battery Negative Cable Disconnection and Connection (w/Single Battery)** or **Battery Negative Cable Disconnection and Connection (w/Auxiliary Battery)** or **Battery Negative Cable Disconnection and Connection (w/Dual Batteries)**
31. Fill the transmission to the proper level. Refer to **Fluid Capacity Specifications** .

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 engine control module (ECM), powertrain control module (PCM), or transmission control module (TCM) will need to relearn TAP values. Transmission performance may be affected as new TAP values are learned.

32. Reset the TAP values. Refer to **Transmission Adaptive Functions (TCM)** .

OFF-VEHICLE REPAIR INFORMATION

NOTE: For ON-VEHICLE repair information, see ON-VEHICLE REPAIR INFORMATION. OFF-VEHICLE repair information is covered below.

TORQUE CONVERTER REMOVAL AND HOLDING FIXTURE INSTALLATION (6L80/6L90)

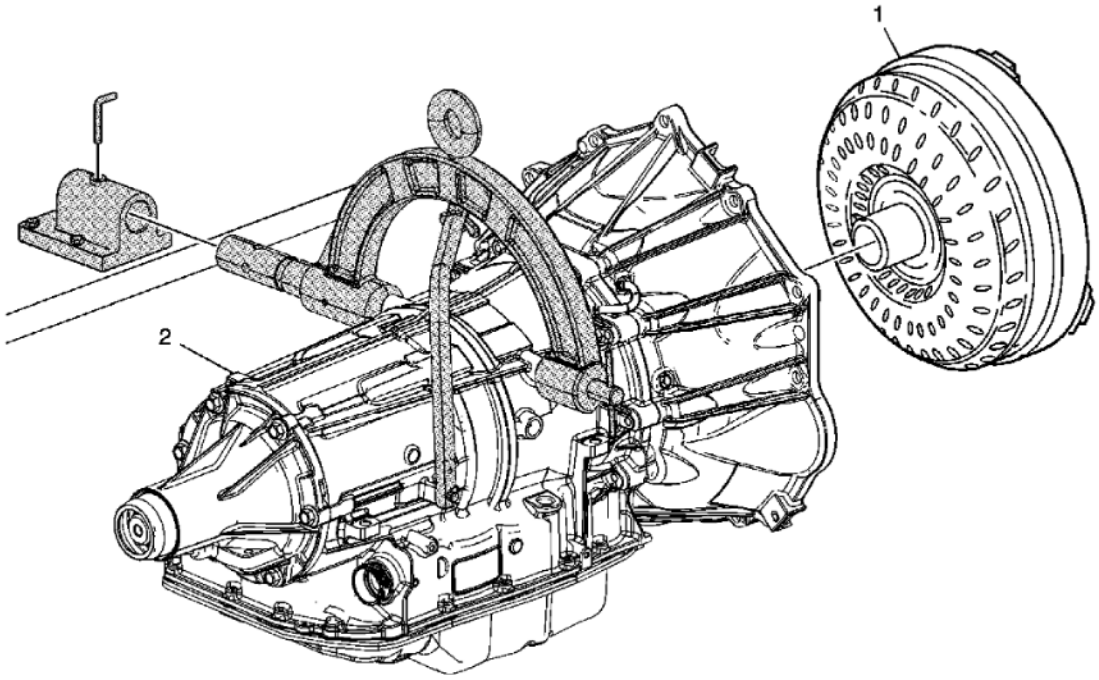


Fig. 106: Torque Converter Removal and Holding Fixture Installation (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Torque Converter Assembly
2	Transmission Case Assembly **Tip:** 1. Rotate the transmission so that the converter housing is up and secure with locking pin. 2. Allow any remaining transmission fluid to drain from the case extension. **Special Tools** • **DT 47605** Holding Fixture Adapter. See **Special Tools**. • **J 3289-20** Holding Fixture Base Assembly. See **Special Tools**. • **J 8763-B** Holding Fixture. See **Special Tools**.

CASE EXTENSION ASSEMBLY REMOVAL

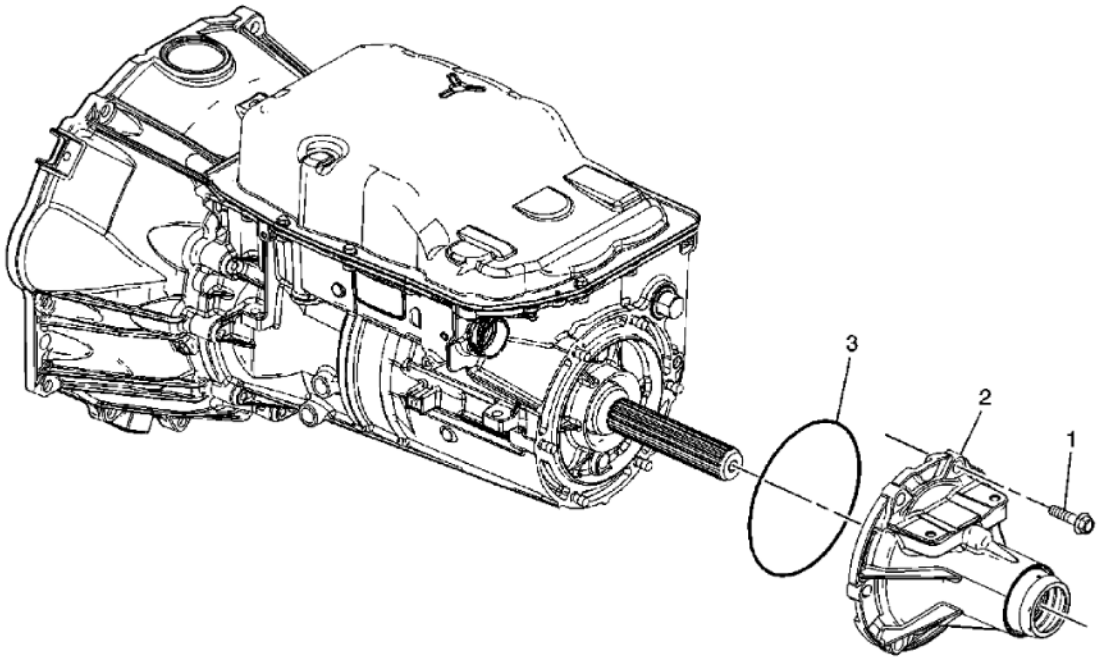


Fig. 107: Case Extension Assembly Removal
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Bolt M10 x 40 (Quantity: 6)
2	Case Extension
3	Case Extension Seal

TRANSMISSION FLUID PAN, FILTER AND ELECTRICAL CONNECTOR PASSAGE SLEEVE REMOVAL (6L80)

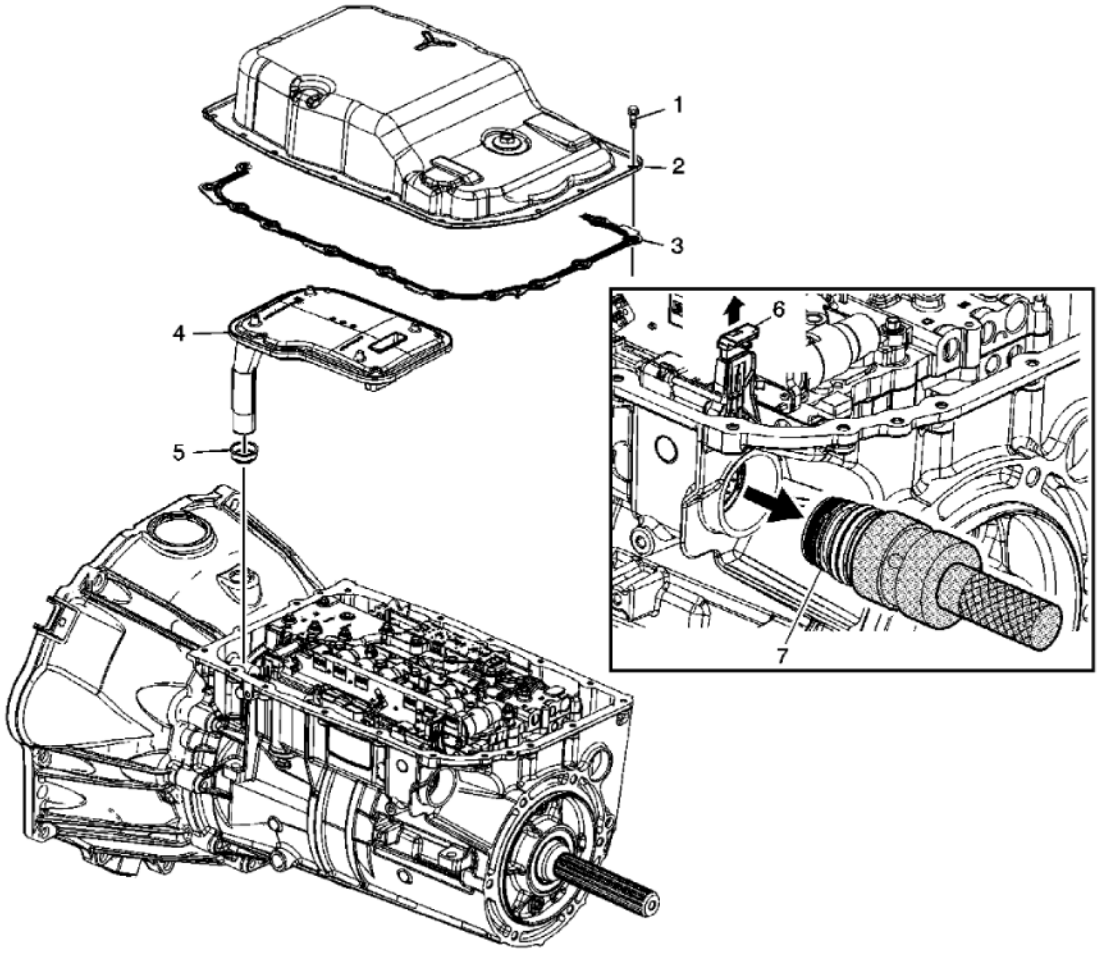


Fig. 108: Transmission Fluid Pan, Filter and Electrical Connector Passage Sleeve Removal (6L80)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Bolt M6 x 20 (Qty: 18)
2	Fluid Pan Assembly
3	Fluid Pan Gasket **Tip:** The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused. If the gasket is stuck to the case or pan, it should be replaced.
4	Fluid Filter Assembly **NOTE:** **Pull the fluid filter assembly straight out to avoid damage. Do not**

	bend or twist the filter neck.
5	Fluid Filter Seal Assembly **NOTE:** **Do not damage the case sealing surface when removing the filter seal assembly.** **Tip:** Use a screwdriver or snap ring pliers.
6	Electrical Connector Slide Lock **NOTE:** **Pull up on the electrical connector slide lock to avoid damage to the connector.**
7	Electrical Connector Passage Sleeve **Special Tools** • **DT 47715** Electrical Connector Passage Sleeve Remover/Installer. See **Special Tools**. • **J 42183** Driver Handle. See **Special Tools**.

CONTROL VALVE BODY ASSEMBLY REMOVAL

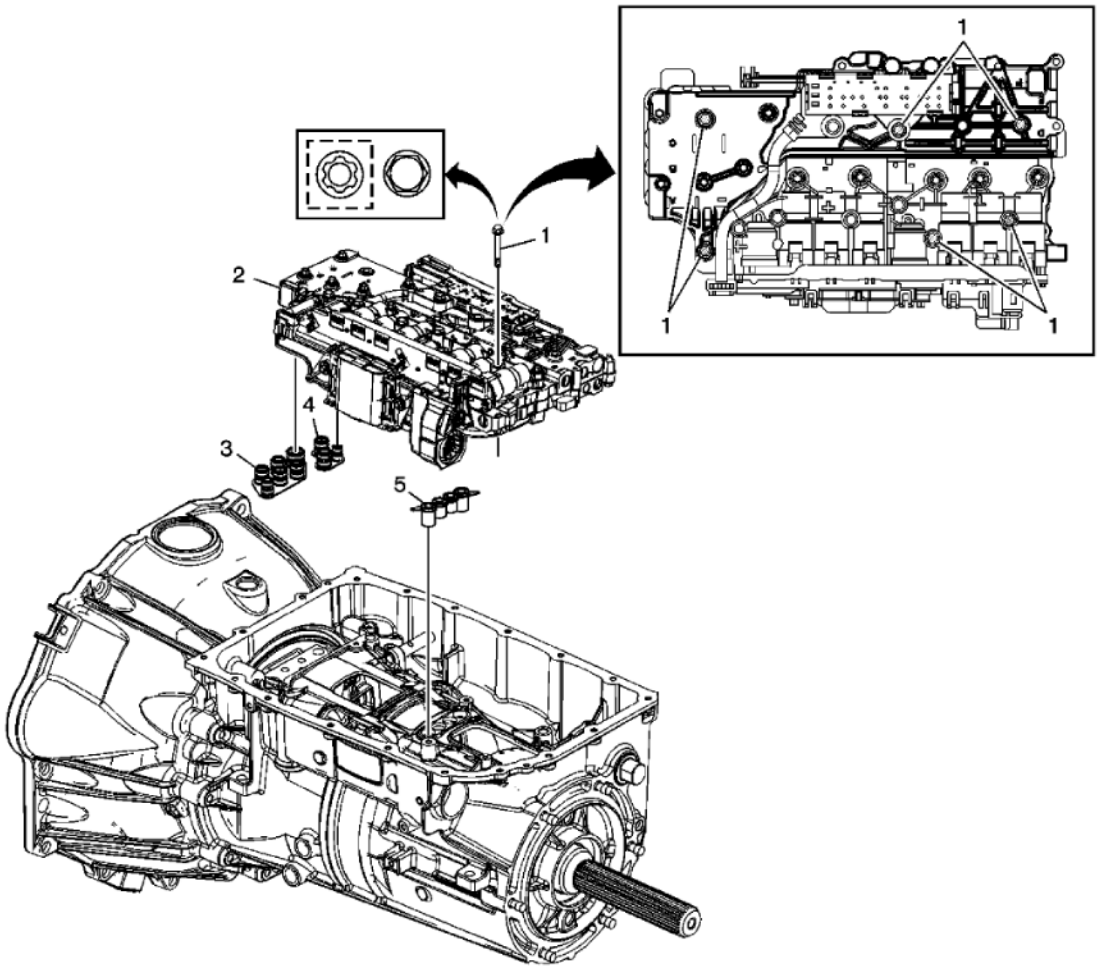


Fig. 109: Control Valve Body Assembly Removal
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Bolt M5 x 73 (Qty: 6) **Tip:** Do not remove all the bolts in the control valve body assembly. Remove only the bolts indicated. **Special Tool:** **DT-48285** Valve Body Torx Plus Socket (if applicable). See **Special Tools**.
2	Control Valve Body Assembly **NOTE:** **Use care when handling the control valve body**

	assembly. If dropped, damage to the internal components of the control solenoid valve assembly, including the transmission control module (TCM), may result.
3	Fluid Pump Seal Assembly **NOTE:** **Refer to Seal Reuse Notice .**
4	Fluid Pump Seal Assembly **NOTE:** **Refer to Seal Reuse Notice .**
5	Center Support Fluid Passage Seal Assembly **NOTE:** **Refer to Seal Reuse Notice .**

TORQUE CONVERTER HOUSING WITH FLUID PUMP REMOVAL

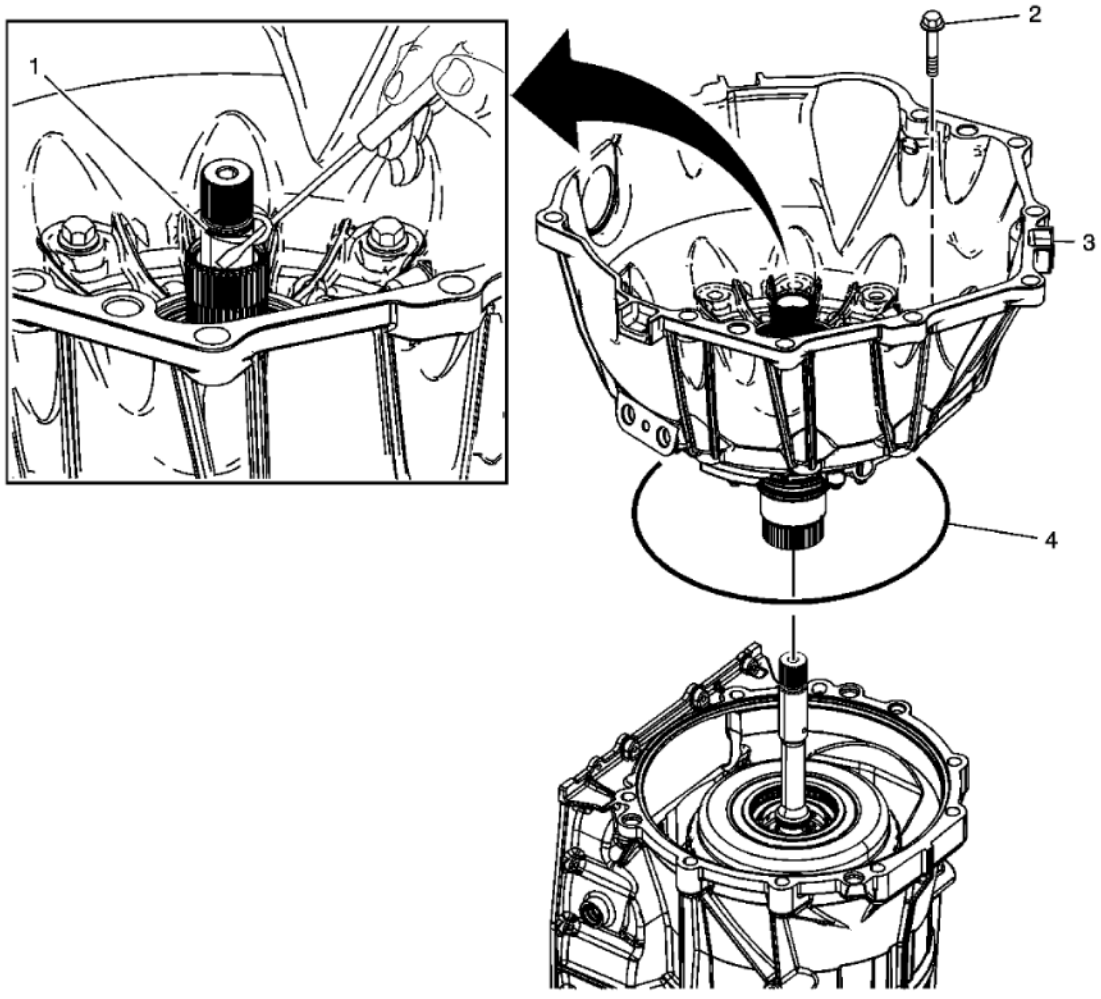


Fig. 110: Torque Converter Housing with Fluid Pump Removal
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: **The valve body assembly must be removed prior to removing the torque converter (with fluid pump) housing assembly. Failure to ensure this will cause severe damage to both fluid pump seal assemblies. Also, the load of the valve body pushing on the seals, which in turn push on the pump, may prevent proper pump installation into the case. Refer to control valve body assembly removal.**	
1	Turbine Shaft (O-ring) Seal
2	Bolt M10 x 50 (Qty: 9)
3	Torque Converter (With Fluid Pump) Housing Assembly
4	Fluid Pump Seal

1-2-3-4 AND 3-5 REVERSE CLUTCH ASSEMBLY AND 4-5-6 CLUTCH ASSEMBLY REMOVAL

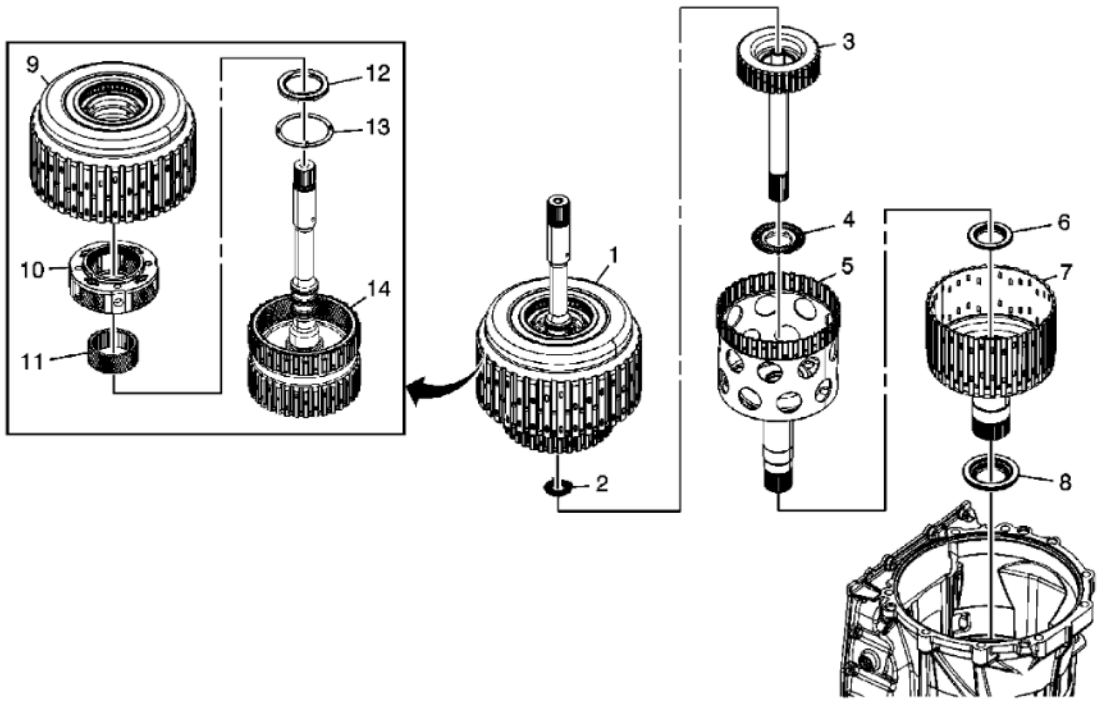


Fig. 111: 1-2-3-4 and 3-5 Reverse Clutch Assembly and 4-5-6 Clutch Assembly Removal
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	1-2-3-4 and 3-5 Reverse Clutch Assembly and 4-5-6 (With Turbine Shaft) Clutch Assembly
2	Turbine Shaft Thrust Bearing Assembly
3	4-5-6 Clutch (With Output Carrier Shaft and Dampener) Hub Assembly
4	4-5-6 Clutch Hub Thrust Bearing Assembly
5	1-2-3-4 Clutch (With Output Carrier Inner Sun Gear Shaft) Hub Assembly
6	1-2-3-4 Clutch Hub Thrust Bearing Assembly
7	2-6 and 3-5 Reverse Clutch (With Output Carrier Outer Sun Gear Shaft) Hub Assembly
8	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly

9	1-2-3-4 and 3-5 Reverse Clutch Assembly
10	Input Carrier Assembly
11	Input Sun Gear
12	Input Sun Gear Thrust Bearing
13	Input Sun Gear Thrust Washer
14	4-5-6 (With Turbine Shaft) Clutch Assembly

CENTER SUPPORT, OUTPUT CARRIER AND OUTPUT SHAFT REMOVAL (6L80/6L90)

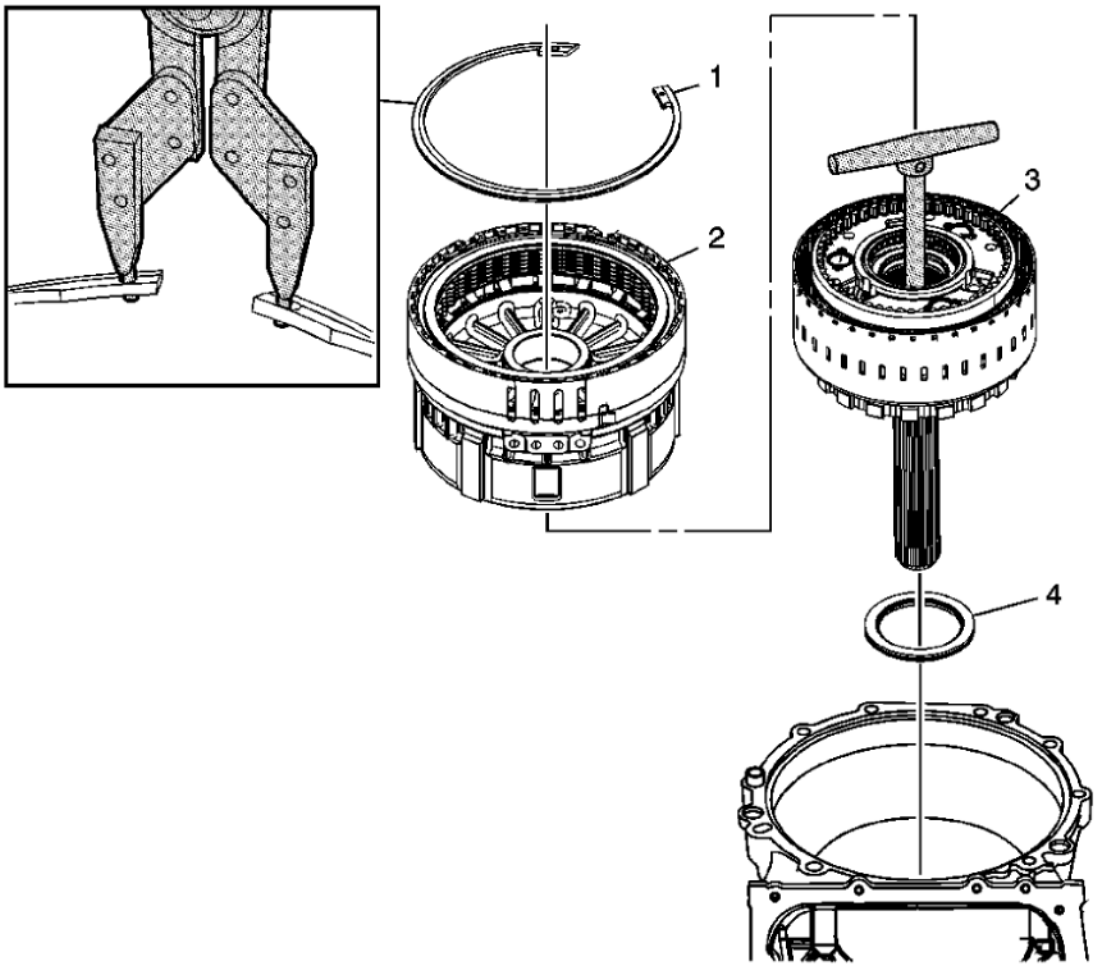


Fig. 112: Center Support, Output Carrier and Output Shaft Removal (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

1	Center Support Retaining Ring **CAUTION:** **Use care when removing or installing the retaining ring. Ensure the J 45126 and DT 47773 are installed properly onto the retaining ring or bodily injury may occur.** **Tip:** To release tension on the retaining ring, place the retaining ring flat on the floor and step on it, then remove the tool. **Special Tools** • **DT 47773** Snap Ring Pliers Adapter Set. See **Special Tools**. • **J 45126** Snap Ring Pliers. See **Special Tools**.
2	Center (with 2-6 Low and Reverse Clutch) Support Assembly
3	Output Carrier Assembly and Output Shaft Assembly **NOTE:** **Ensure the DT 47786 is completely threaded into the output shaft assembly. Due to the weight of the assembly, incomplete threading may cause the assembly to break free from the DT 47786, causing component damage.** **Special Tool:** **DT 47786** Output Carrier/Shaft Lifting Tool. See **Special Tools**.
4	Output Shaft Thrust Bearing Assembly

MANUAL SHIFT SHAFT AND PARKING SYSTEM COMPONENTS OVERHAUL (6L80/6L90)

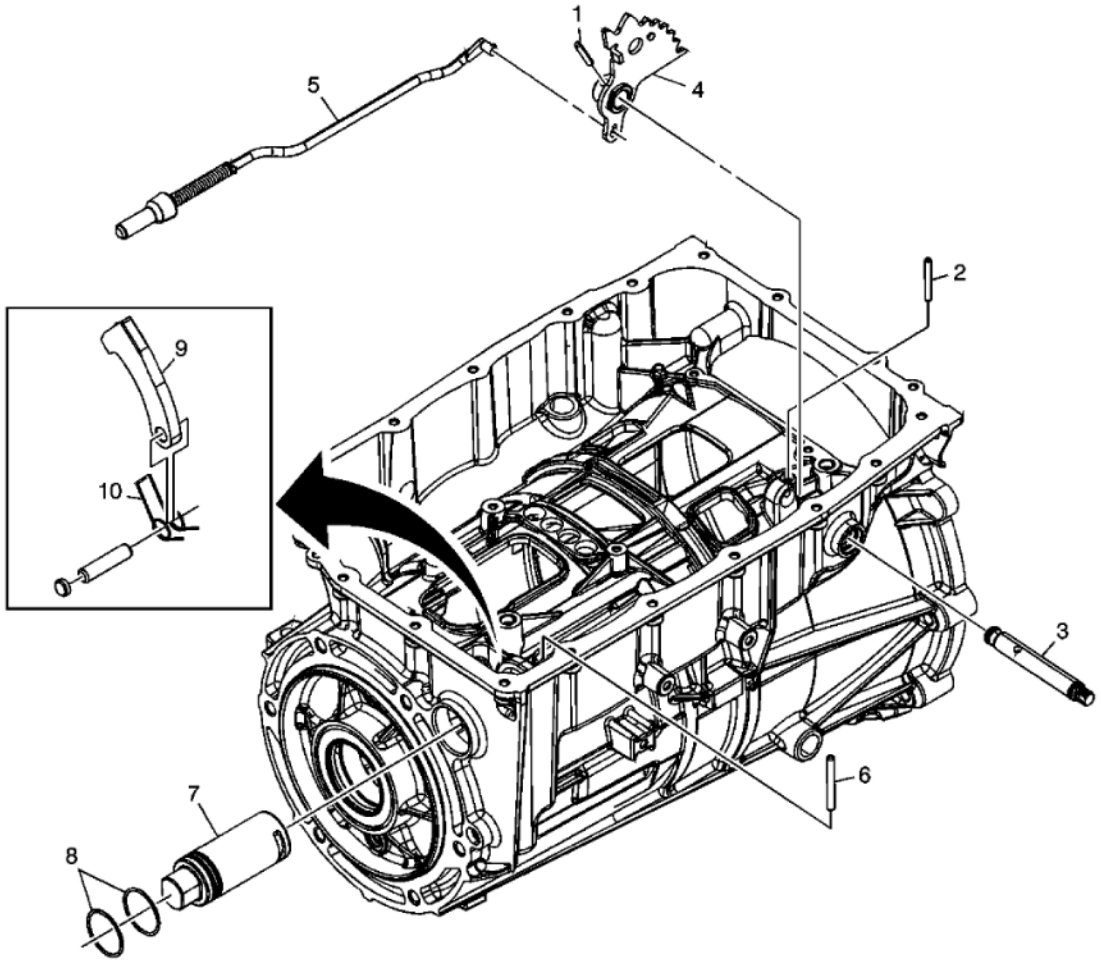


Fig. 113: Manual Shift Shaft and Parking System Components Overhaul (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Manual Shaft Detent Lever Hub Pin **NOTE:** **Refer to Pin Reuse Notice .**
2	Manual Shift Shaft Pin **NOTE:** **Refer to Pin Reuse Notice .**
	Manual Shift Shaft **NOTE:**

3	**Ensure the manual shift shaft seal is replaced before installing the shaft. Installing the seal after the shaft may cause damage to the seal, resulting in fluid leaks and transmission damage.** **Tip:** Refer to **Manual Shift Shaft Seal Replacement**.
4	Manual Shaft Detent Lever Assembly
5	Park Pawl Actuator Assembly
6	Park Pawl Actuator Guide Pin **NOTE:** **Refer to Pin Reuse Notice .** **Tip:** Use a large pair of side cutters to "walk" the pin out.
7	Park Pawl Actuator Guide
8	Park Pawl Actuator Guide (O-ring) Seals **NOTE:** **Refer to Seal Reuse Notice .**
9	Park Pawl **Tip:** Inspect for damage only. Do not remove. The park pawl is not a serviceable component.
10	Park Pawl Spring **Tip:** Inspect for damage only. Do not remove. The park pawl spring is not a serviceable component.

MANUAL SHIFT SHAFT SEAL REPLACEMENT

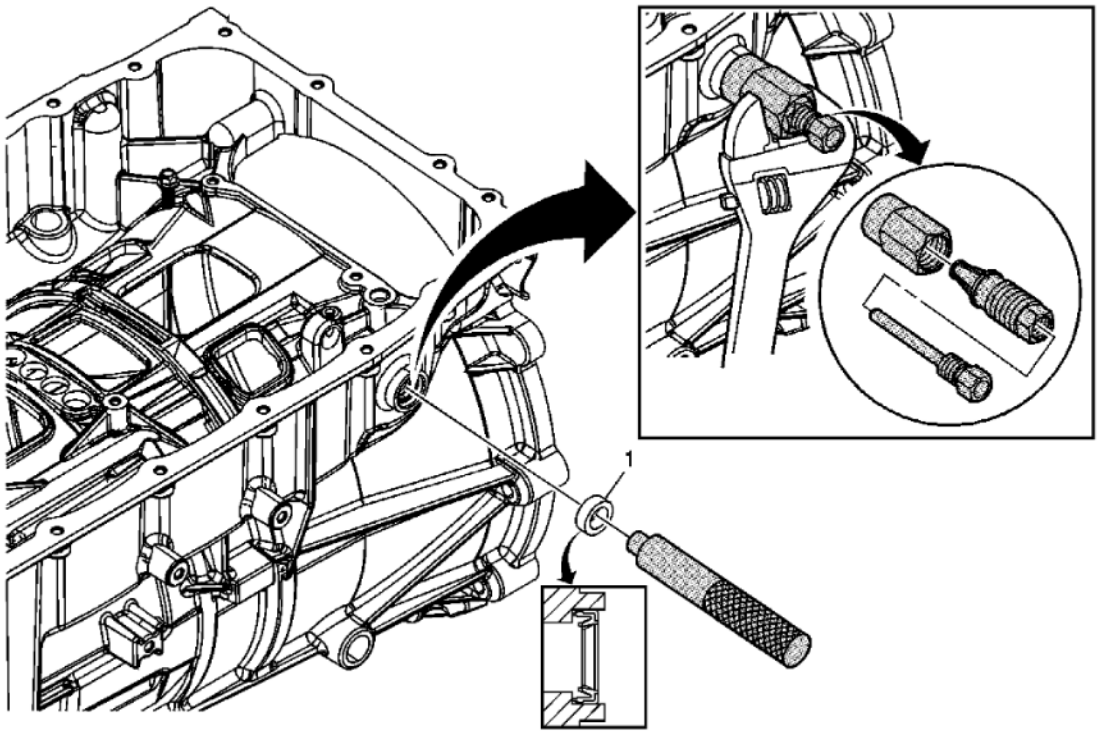


Fig. 114: Manual Shift Shaft Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Procedure
1	Manual Shift Shaft Seal **NOTE:** **Do not damage the case bore during removal of the manual shift shaft seal.** **NOTE:** **When installing the seal, ensure the seal lip is firmly seated against the case bore surface. Do not allow the seal lip to be crushed, or a leak may result.** **NOTE:** **Refer to Seal Reuse Notice .** **Special Tools** • **DT 47770** Seal Installer. See **Special Tools**.

	• **J 45201** Cooler Line Seal Remover. See **Special Tools**.

OUTPUT SHAFT SEAL REPLACEMENT (AWD MODELS ONLY)

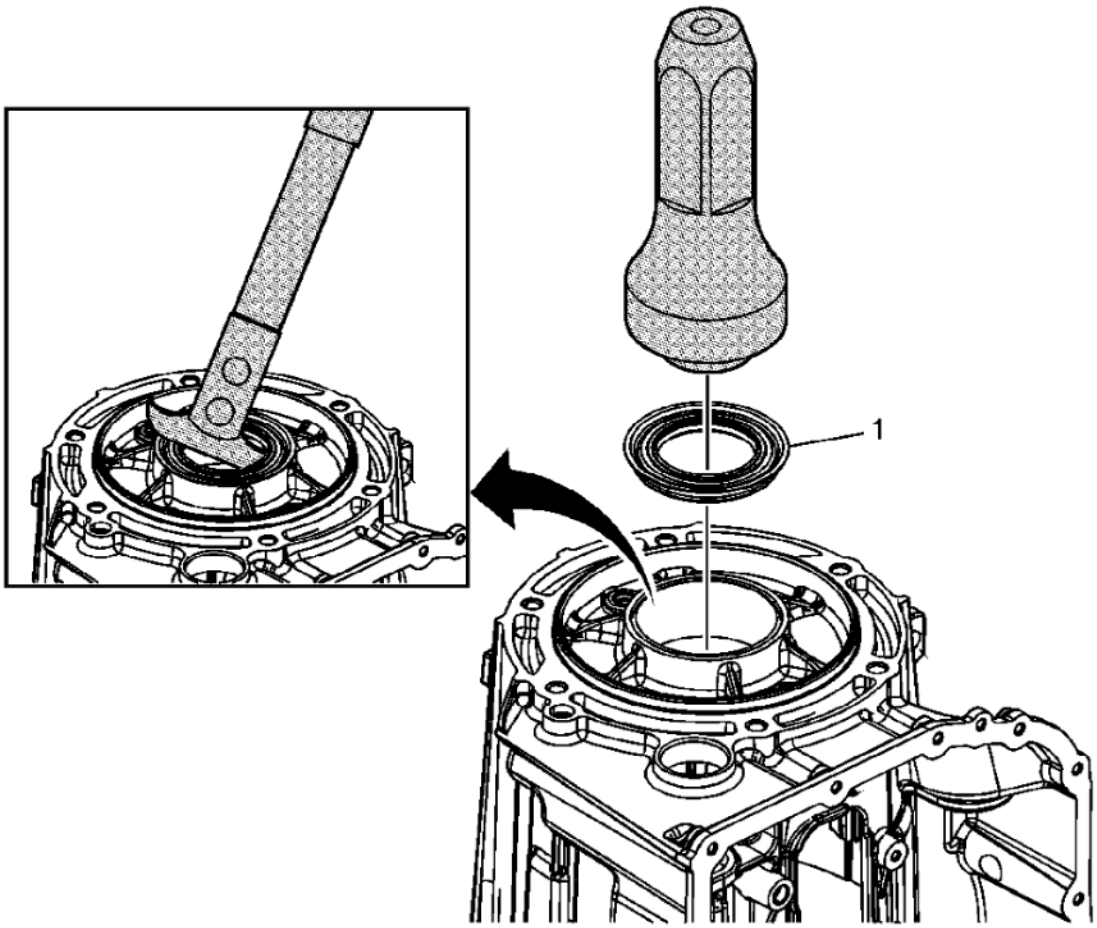


Fig. 115: Output Shaft Seal Replacement (AWD Models Only)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Shaft Seal Assembly **NOTE:** **Refer to Seal Reuse Notice .** **Special Tool**

	• **J 37212** Front Output Shaft Seal Installer (6L50) • **J 38693** Seal Installer (6L80). See **Special Tools**. • **J 45000** Seal Remover. See **Special Tools**.

CASE INSPECTION

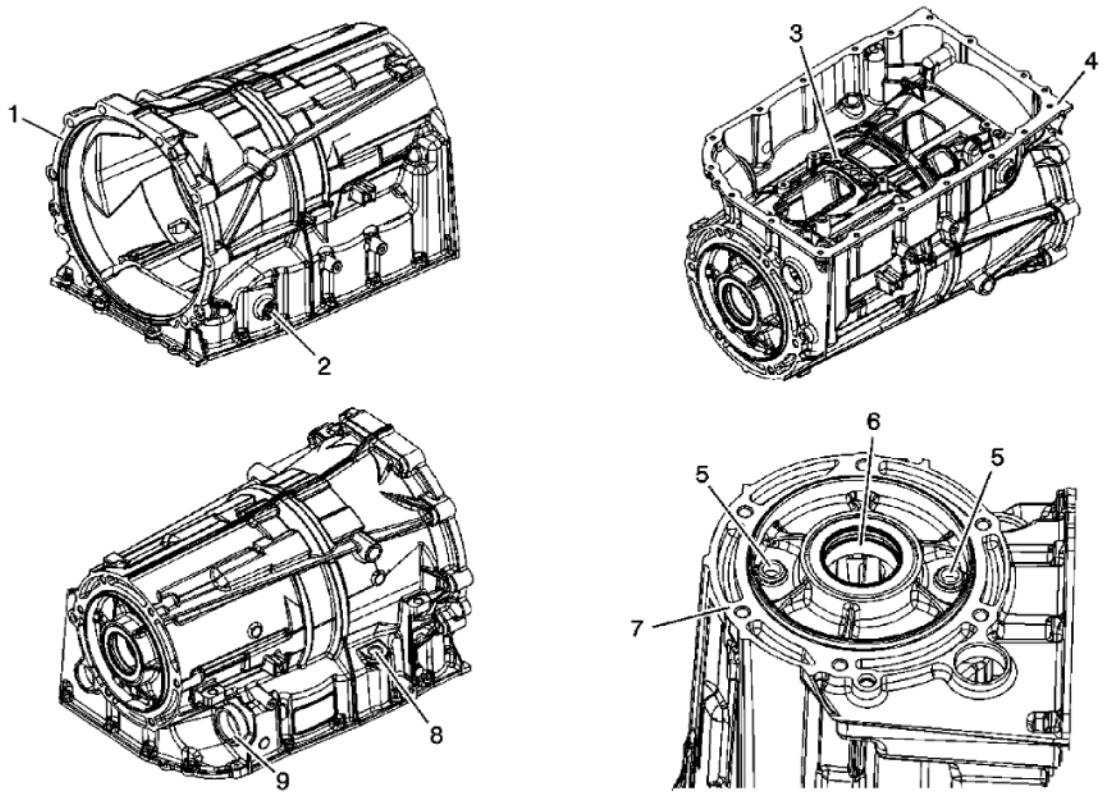


Fig. 116: Inspecting Case
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: **After cleaning the transmission components, allow to air dry. Do not use cloth or paper towels in order to dry any transmission components. Lint from the towels can cause component failure.** **NOTE:** **Do not reuse cleaning solvents. Previously used solvents may deposit sediment which may damage**	

the component.

Preliminary Procedures

1. Thoroughly clean the transmission case assembly, including case threads, with clean solvent.
2. Clean gasket sealing surfaces. Remove all residual gasket material.
3. Inspect all threaded holes. If necessary, repair any thread damage.

1	Front Case Sealing Surface
2	Manual Shift Shaft Seal **Tip:** Refer to **Manual Shift Shaft Seal Replacement**.
3	Center Support Fluid Passage Seal Bores
4	Fluid Pan Sealing Surface
5	Case Plugs
6	Output Shaft Bushing or Bearing (model specific)
7	Rear Case Sealing Surface
8	Fill Tube Bore
9	Electrical Connector Passage Sleeve Bore

OUTPUT SHAFT DISASSEMBLE

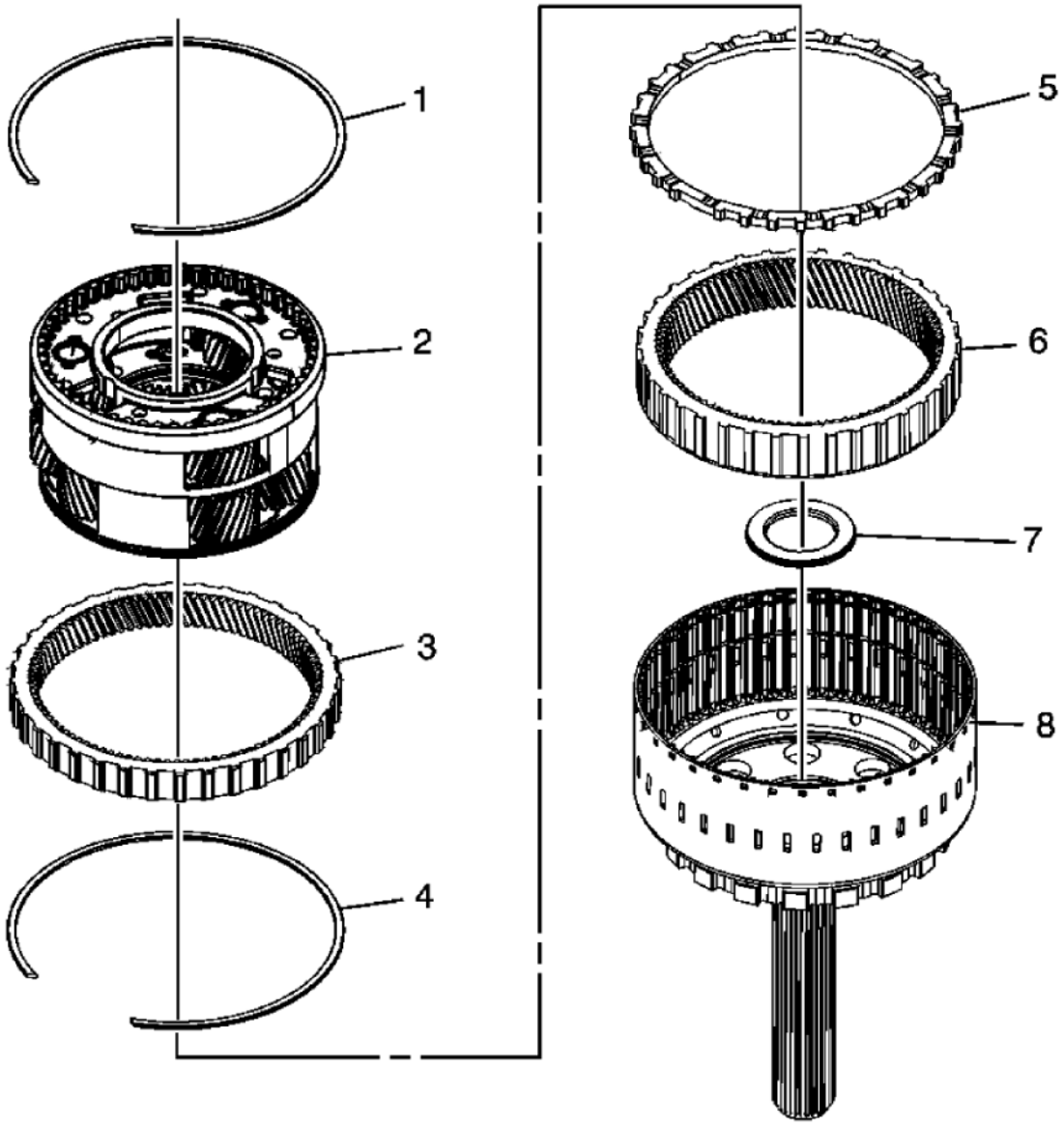


Fig. 117: Output Shaft Disassemble
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Tip: Inspect each component and replace as necessary.	
1	Output Carrier Internal Gear Retaining Ring
2	Output Carrier Assembly
3	Output Carrier Internal Front Gear
4	Output Carrier Internal Gear Retaining Ring

5	Output Carrier Internal Gear Spacer
6	Output Carrier Internal Rear Gear
7	Output Carrier Thrust Bearing Assembly
8	Output Shaft Assembly

OUTPUT SHAFT ASSEMBLE

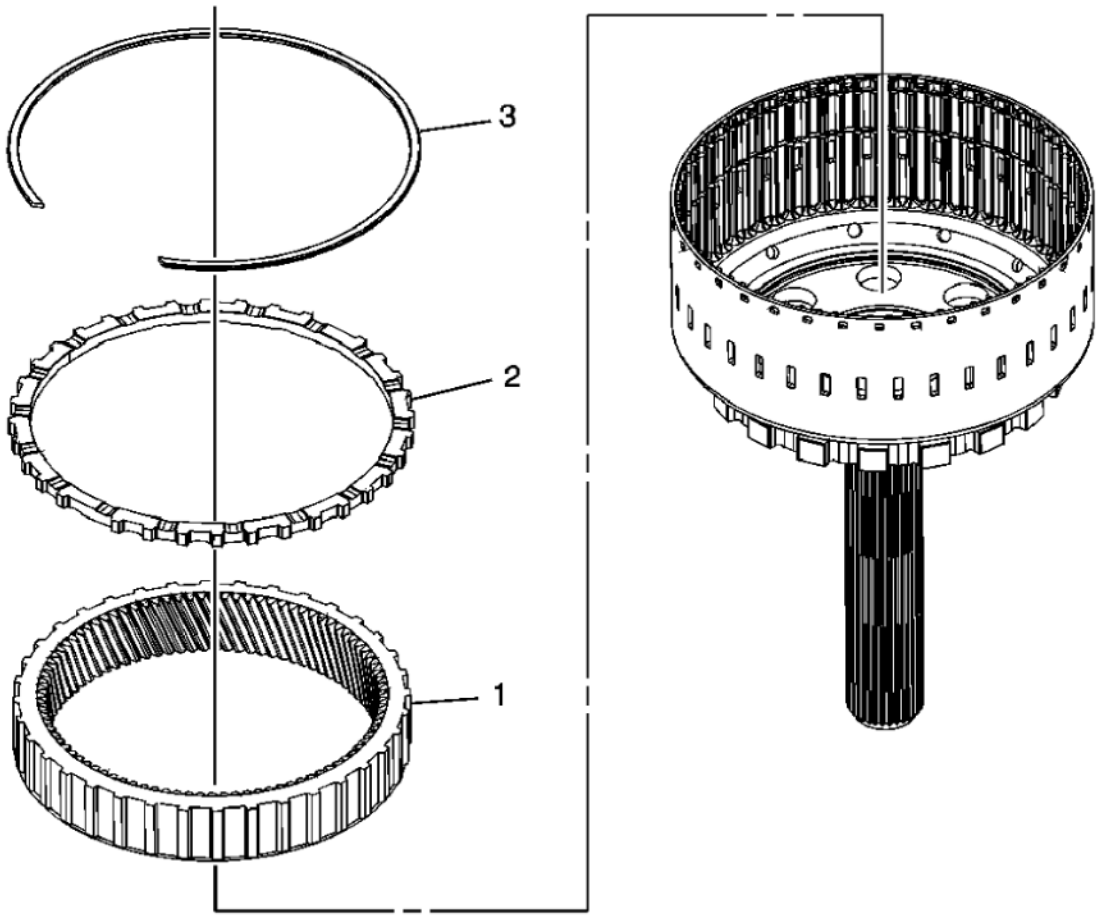


Fig. 118: Output Shaft Assemble
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Carrier Internal Rear Gear **NOTE:** **Install the gear chamfer side down. Failure to install the gear chamfer side down may result in**

	transmission damage.
2	Output Gear Internal Gear Spacer
3	Output Carrier Internal Gear Retaining Ring **Tip:** Do not install the output carrier internal front gear and retaining ring yet. These components will be installed during assembly of the output carrier to the output shaft.

OUTPUT CARRIER ASSEMBLY OVERHAUL (6L80)

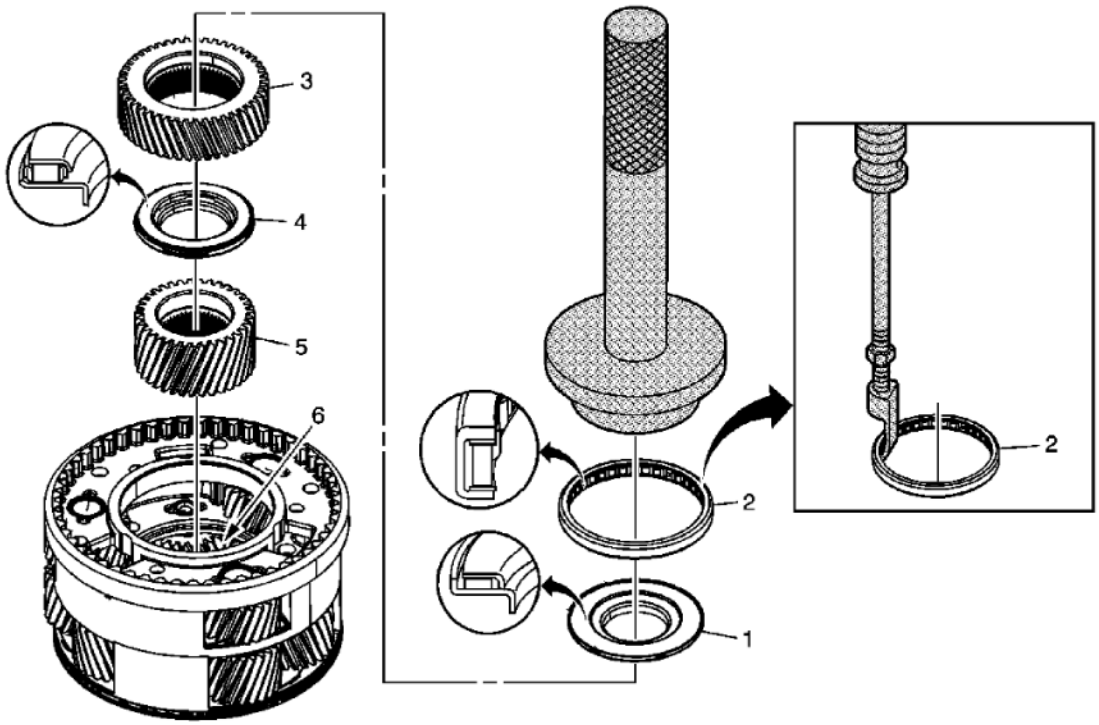


Fig. 119: Output Carrier Assembly Overhaul (6L80)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Carrier Front Sun Gear Thrust Bearing Assembly
	Center Support Roller Bearing **NOTE:** **Do not reuse the center support roller bearing. Install a**

2	**NEW center support roller bearing. Reusing an old bearing may result in damage to the output carrier.** **Tip:** The thick side of the bearing shell faces up. **Special Tools** • **DT 47857** Bearing Installer. See **Special Tools**. • **J 6125-B** Slide Hammer. See **Special Tools**. • **J 8092** Driver Handle • **J 23129** Universal Seal Remover. See **Special Tools**.
3	Output Carrier Front Sun Gear **NOTE:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
4	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
5	Output Carrier Rear Sun Gear **NOTE:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
6	Output Carrier Rear Sun Gear Bearing Assembly **Tip:** Inspect for damage only. Do not remove. The bearing assembly is not a serviceable component.

OUTPUT CARRIER ASSEMBLY OVERHAUL (6L90)

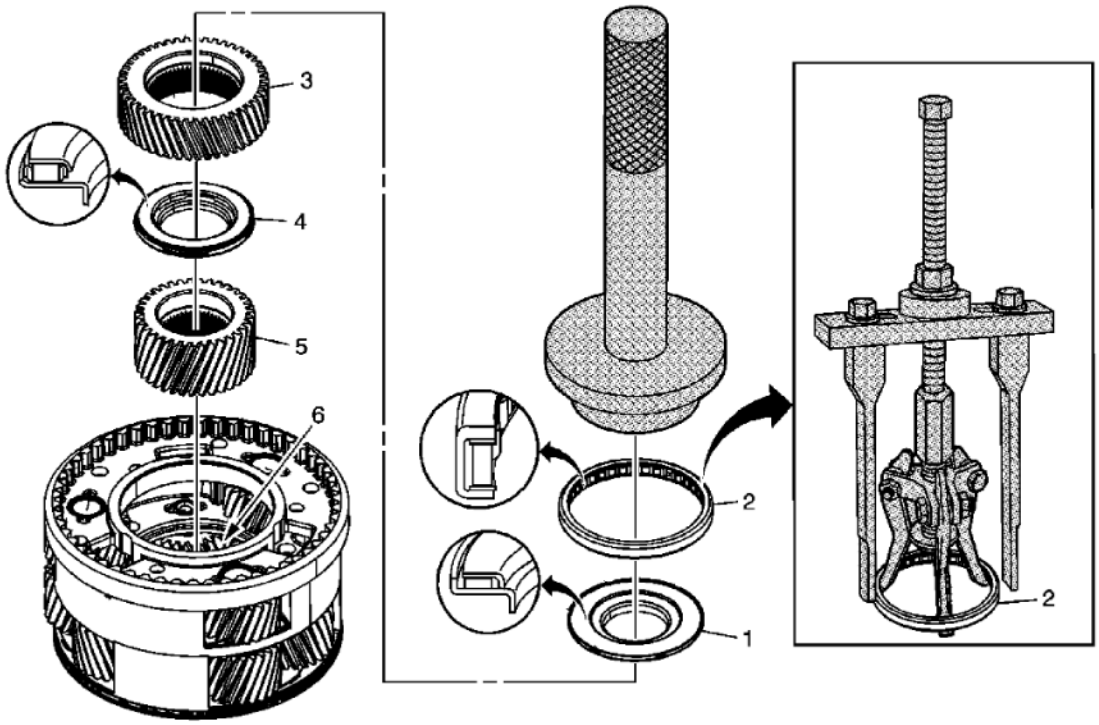


Fig. 120: Output Carrier Assembly Overhaul (6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Carrier Front Sun Gear Thrust Bearing Assembly
2	Center Support Roller Bearing **NOTE:** **Do not reuse the center support roller bearing. Install a NEW center support roller bearing. Reusing an old bearing may result in damage to the output carrier.** **Tip:** The thick side of the bearing shell faces up. **Special Tools** • **DT 47857** Bearing Installer. See **Special Tools**. • **J 8092** Driver Handle

	• **J 45124** Removal Bridge. See **Special Tools**. • **DT 47865** Bearing Remover. See **Special Tools**.
3	Output Carrier Front Sun Gear **NOTE:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
4	Output Carrier Front Sun Gear Rear Thrust Bearing Assembly
5	Output Carrier Rear Sun Gear **NOTE:** **Install the gear chamfer side up. Failure to install the gear chamfer side up may result in transmission damage.**
6	Output Carrier Rear Sun Gear Bearing Assembly **Tip:** Inspect for damage only. Do not remove. The bearing assembly is not a serviceable component.

OUTPUT CARRIER TO OUTPUT SHAFT ASSEMBLE (6L80/6L90)

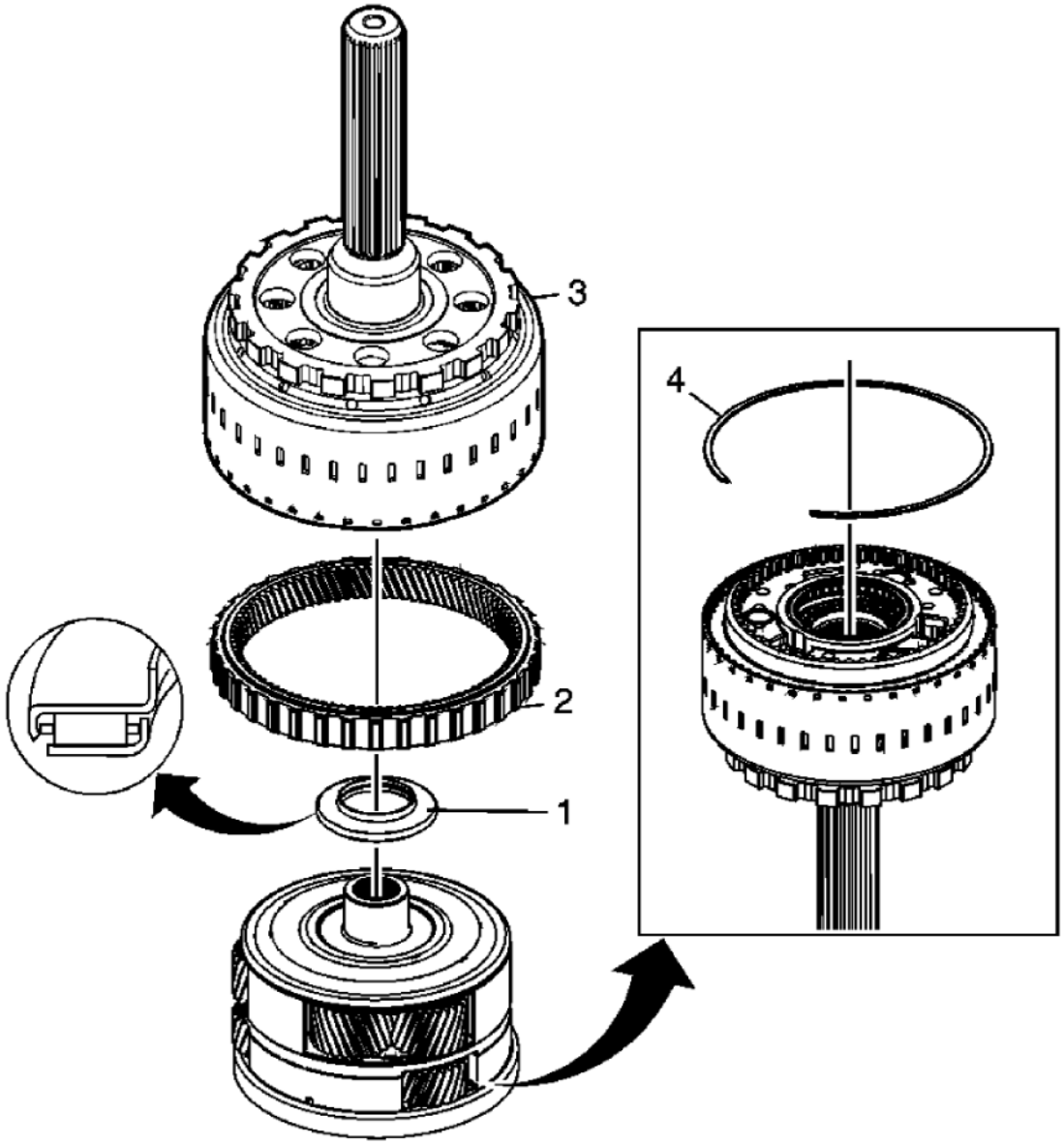


Fig. 121: Output Carrier to Output Shaft Assemble (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Carrier Thrust Bearing Assembly
2	Output Carrier Internal Front Gear **NOTE:** **Install the gear flat side down. Failure to install the gear flat side down may result in transmission**

	damage.
3	Output Shaft Assembly
4	Output Carrier Internal Gear Retaining Ring **Tip:** Grasp the output shaft and carrier with both hands to turn over.

2-6 CLUTCH OVERHAUL (6L80)

2-6 CLUTCH PLATES REMOVAL

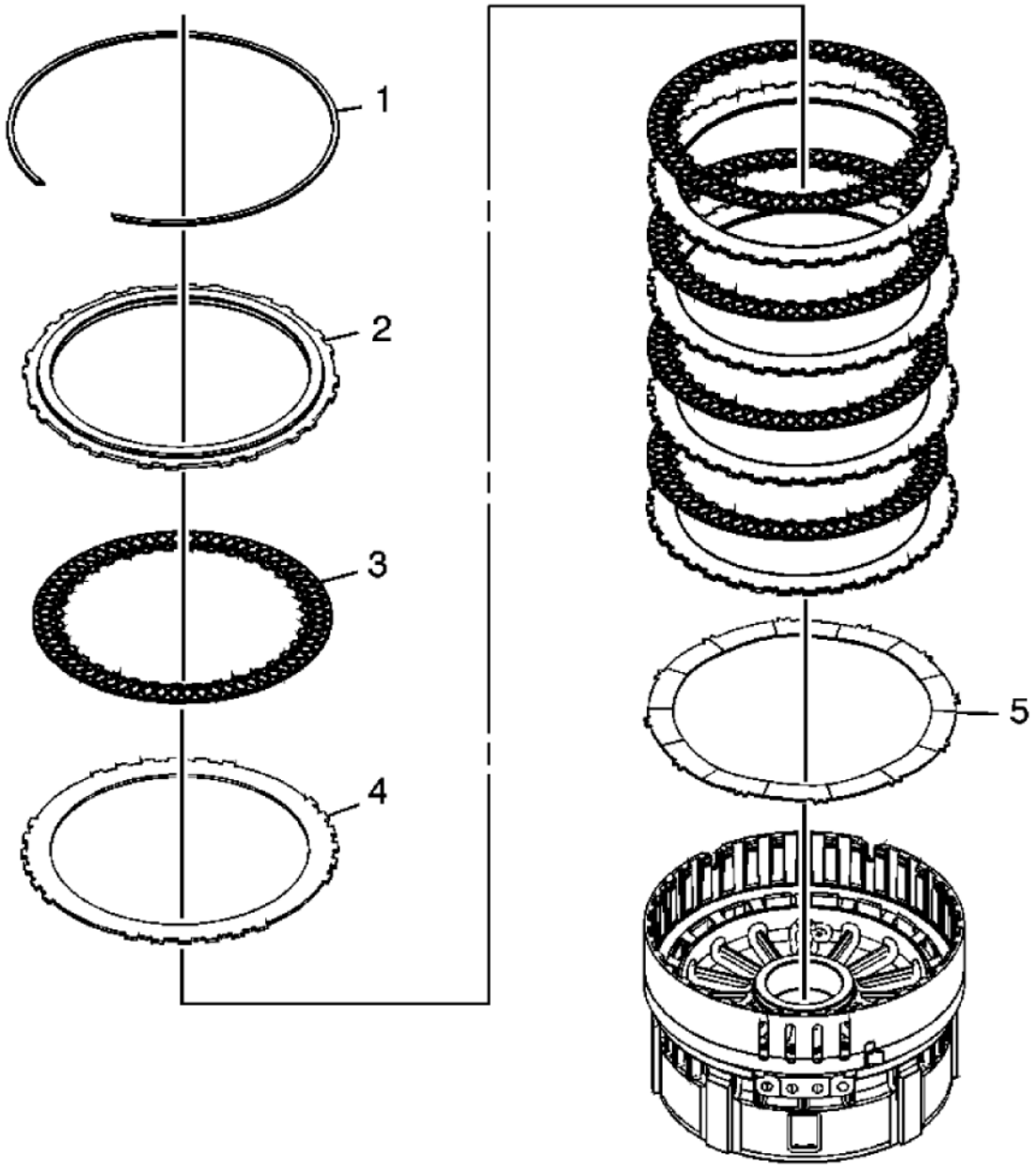


Fig. 122: Overhauling 2-6 Clutch (6L80)
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Plates Removal

Callout	Component Name
1	2-6 Clutch Backing Plate Retaining Ring
2	2-6 Clutch Backing Plate
3	2-6 Clutch Plate Assembly (Qty: 5)

4	2-6 Clutch Plate (Qty: 5)
5	2-6 Clutch (Waved) Plate

2-6 CLUTCH PISTON REPLACEMENT

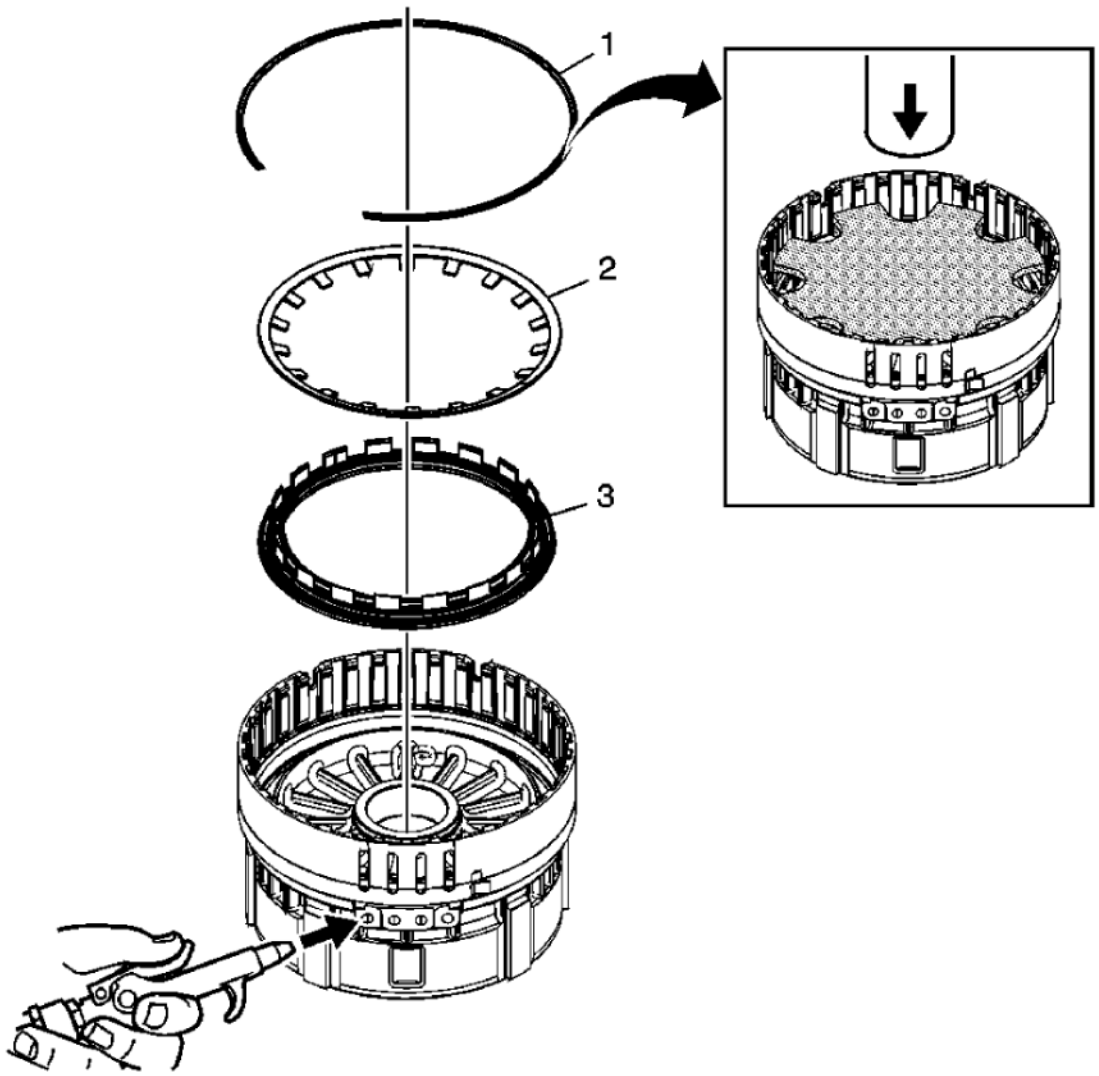


Fig. 123: Replacing 2-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Piston Replacement

Callout	Component Name
	2-6 Clutch Spring Retaining Ring **Tip:** Ensure the **DT 47761** is centered over the

1	clutch spring. See **Special Tools**. **Special Tool:** **DT 47761** Clutch Spring Compressor. See **Special Tools**.
2	2-6 Clutch Spring **NOTE:** **Ensure the spring tabs are facing down during installation and that the tabs fit between the teeth on the piston. Failure to do so may cause damage to the clutch assembly.**
3	2-6 Clutch Piston Assembly **Tip:** It may be necessary to apply air to the apply passage in order to unseat the piston.

2-6 CLUTCH PLATES INSTALLATION

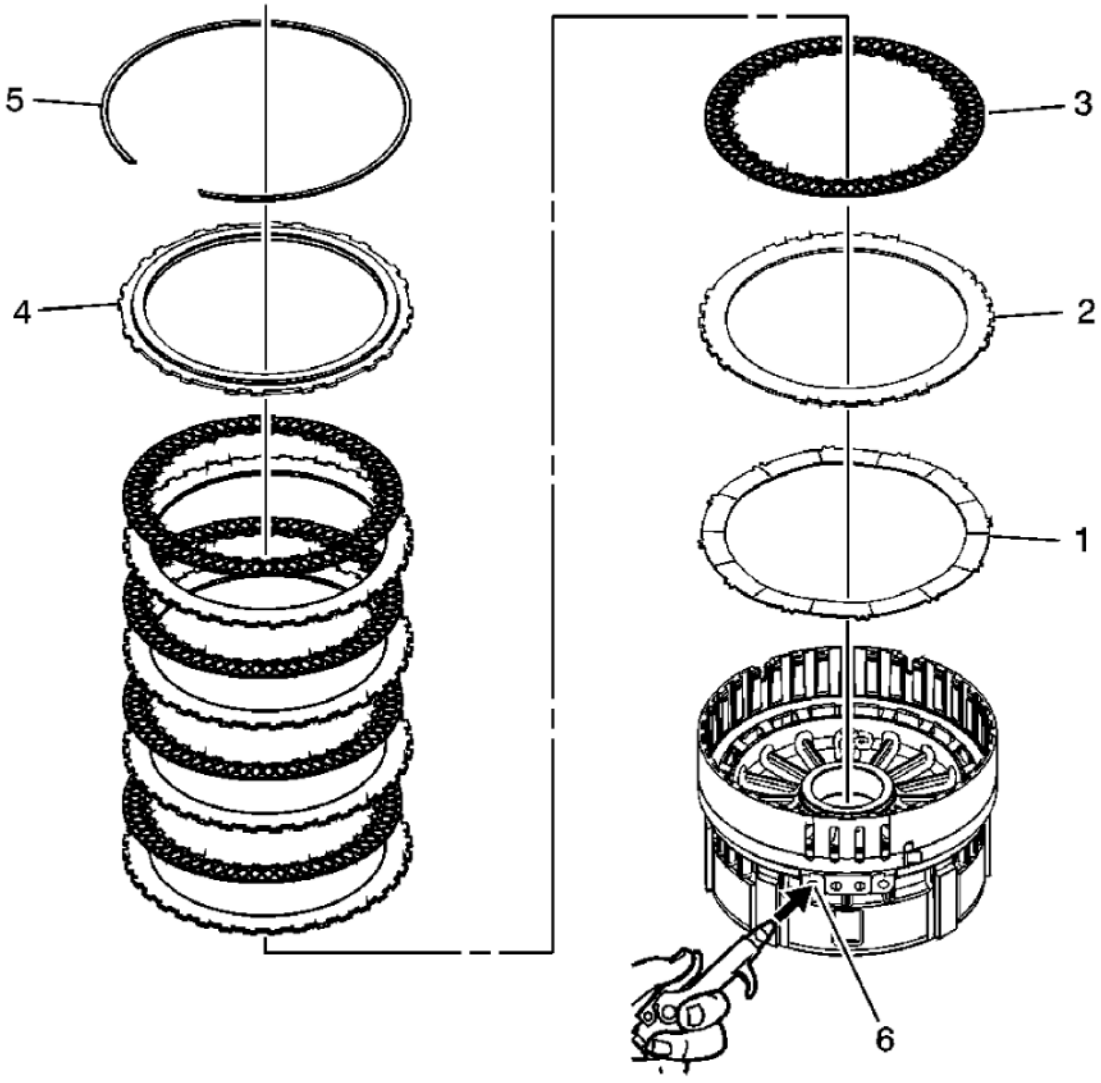


Fig. 124: Installing 2-6 Clutch Plates
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Plates Installation

Callout	Component Name
1	2-6 Clutch (Waved) Plate
2	2-6 Clutch Plates (Qty: 5) **Tip:** Alternate between steel and fiber clutch plates.
3	2-6 Clutch Plate Assembly (Qty: 5) **Tip:** Alternate between steel and fiber clutch plates.

4	2-6 Clutch Backing Plate
5	2-6 Clutch Backing Plate Retaining Ring
6	2-6 Clutch Apply Passage **Tip:** Apply air to verify proper installation of all 2-6 clutch components.

2-6 CLUTCH OVERHAUL (6L90)

2-6 CLUTCH PLATES REMOVAL

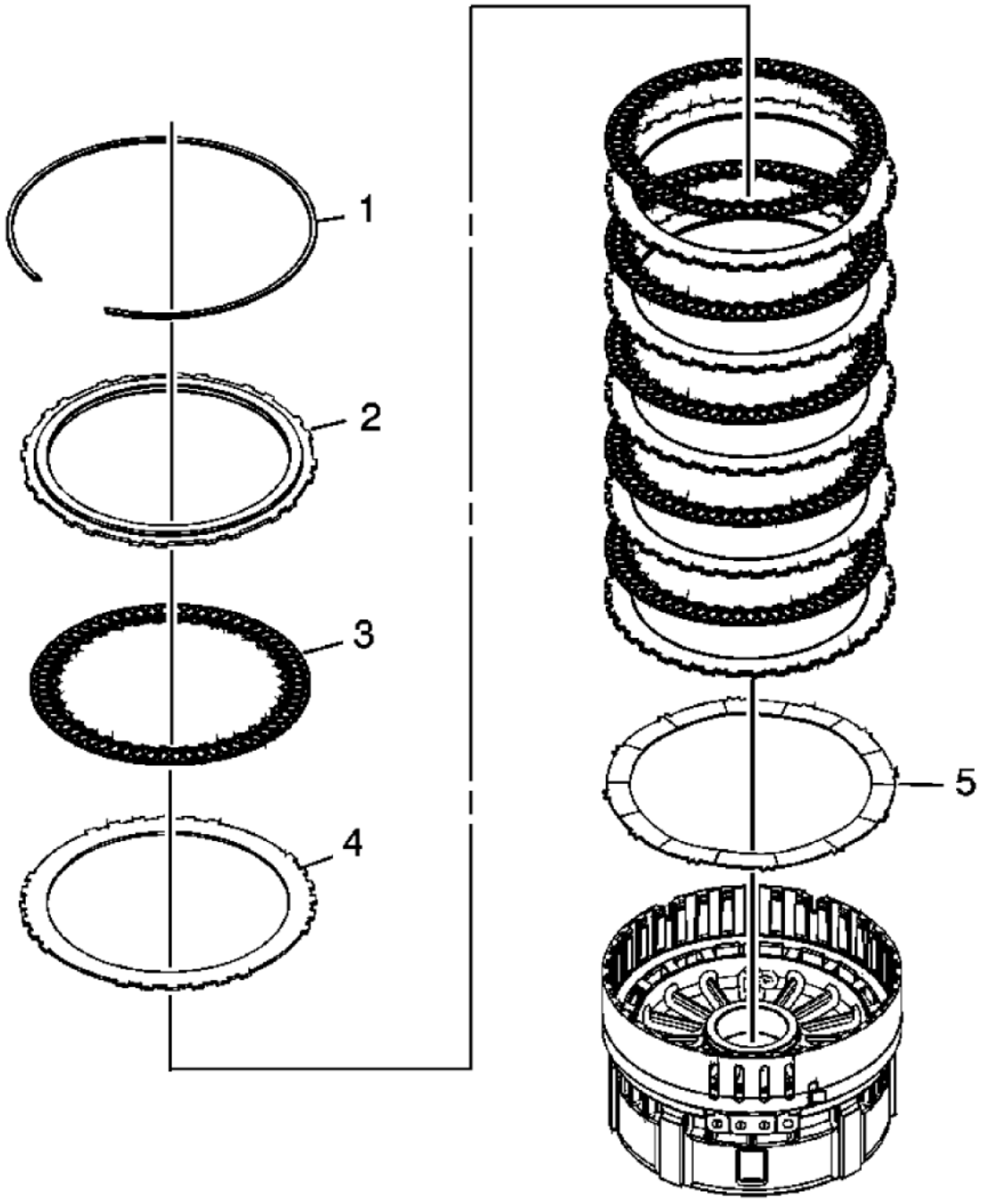


Fig. 125: 2-6 Clutch Plates Removal
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Plates Removal

Callout	Component Name
1	2-6 Clutch Backing Plate Retaining Ring

2	2-6 Clutch Backing Plate
3	2-6 Clutch Plate Assembly (Qty: 6)
4	2-6 Clutch Plate (Qty: 6)
5	2-6 Clutch (Waved) Plate

2-6 CLUTCH PISTON REPLACEMENT

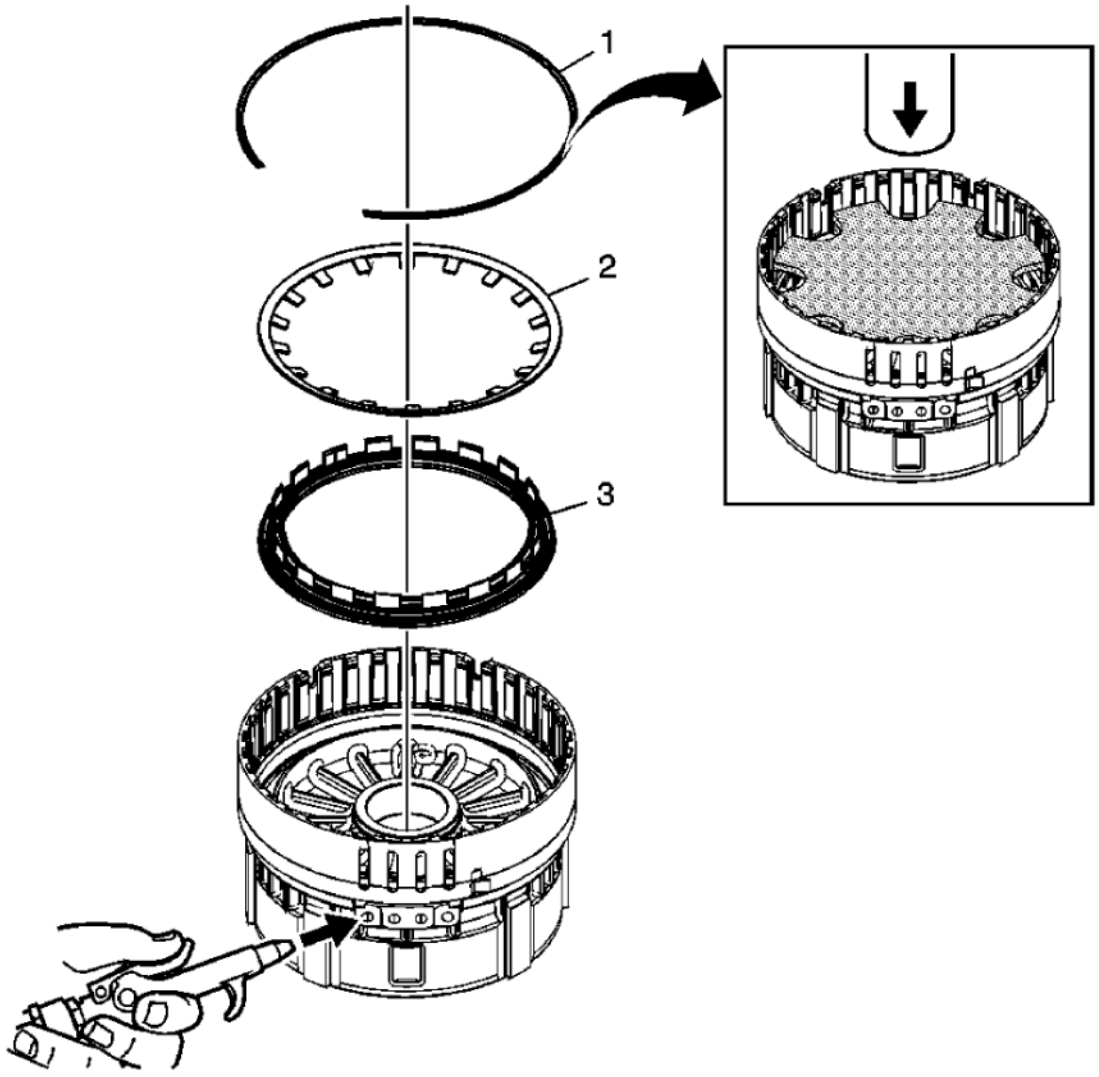


Fig. 126: Replacing 2-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Piston Replacement

Callout	Component Name

1	2-6 Clutch Spring Retaining Ring **Tip:** Ensure the **DT 47761** is centered over the clutch spring. See **Special Tools**. **Special Tool:** **DT 47761** Clutch Spring Compressor. See **Special Tools**.
2	2-6 Clutch Spring **NOTE:** **Ensure the spring tabs are facing down during installation and that the tabs fit between the teeth on the piston. Failure to do so may cause damage to the clutch assembly.**
3	2-6 Clutch Piston Assembly **Tip:** It may be necessary to apply air to the apply passage in order to unseat the piston.

2-6 CLUTCH PLATES INSTALLATION

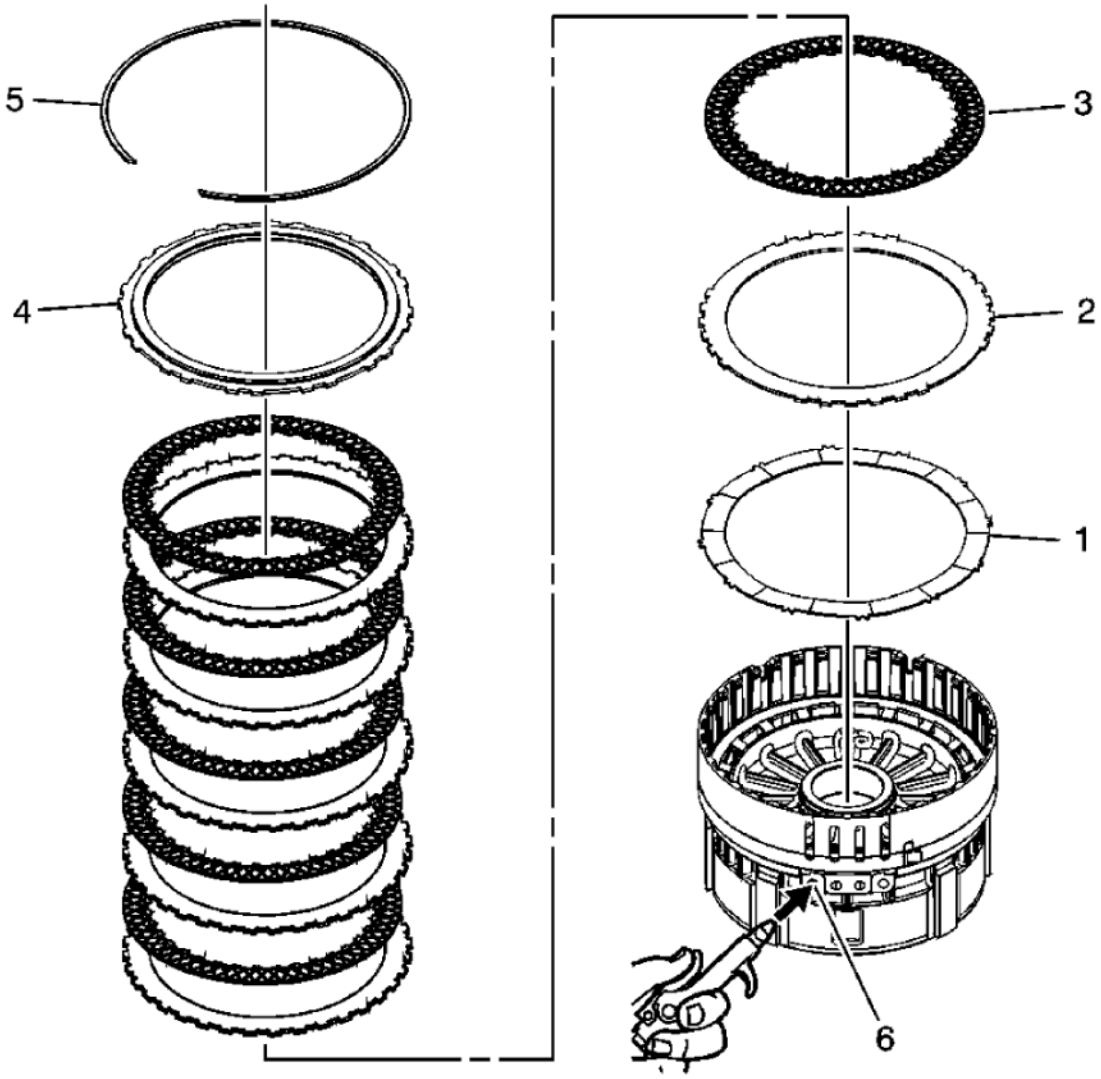


Fig. 127: 2-6 Clutch Plates Installation
Courtesy of GENERAL MOTORS CORP.

2-6 Clutch Plates Installation

Callout	Component Name
1	2-6 Clutch (Waved) Plate
2	2-6 Clutch Plates (Qty: 6) **Tip:** Alternate between steel and fiber clutch plates.
3	2-6 Clutch Plate Assembly (Qty: 6) **Tip:** Alternate between steel and fiber clutch plates.

4	2-6 Clutch Backing Plate
5	2-6 Clutch Backing Plate Retaining Ring
6	2-6 Clutch Apply Passage **Tip:** Apply air to verify proper installation of all 2-6 clutch components.

LOW AND REVERSE CLUTCH OVERHAUL (6L80)

LOW AND REVERSE CLUTCH PLATE REMOVAL

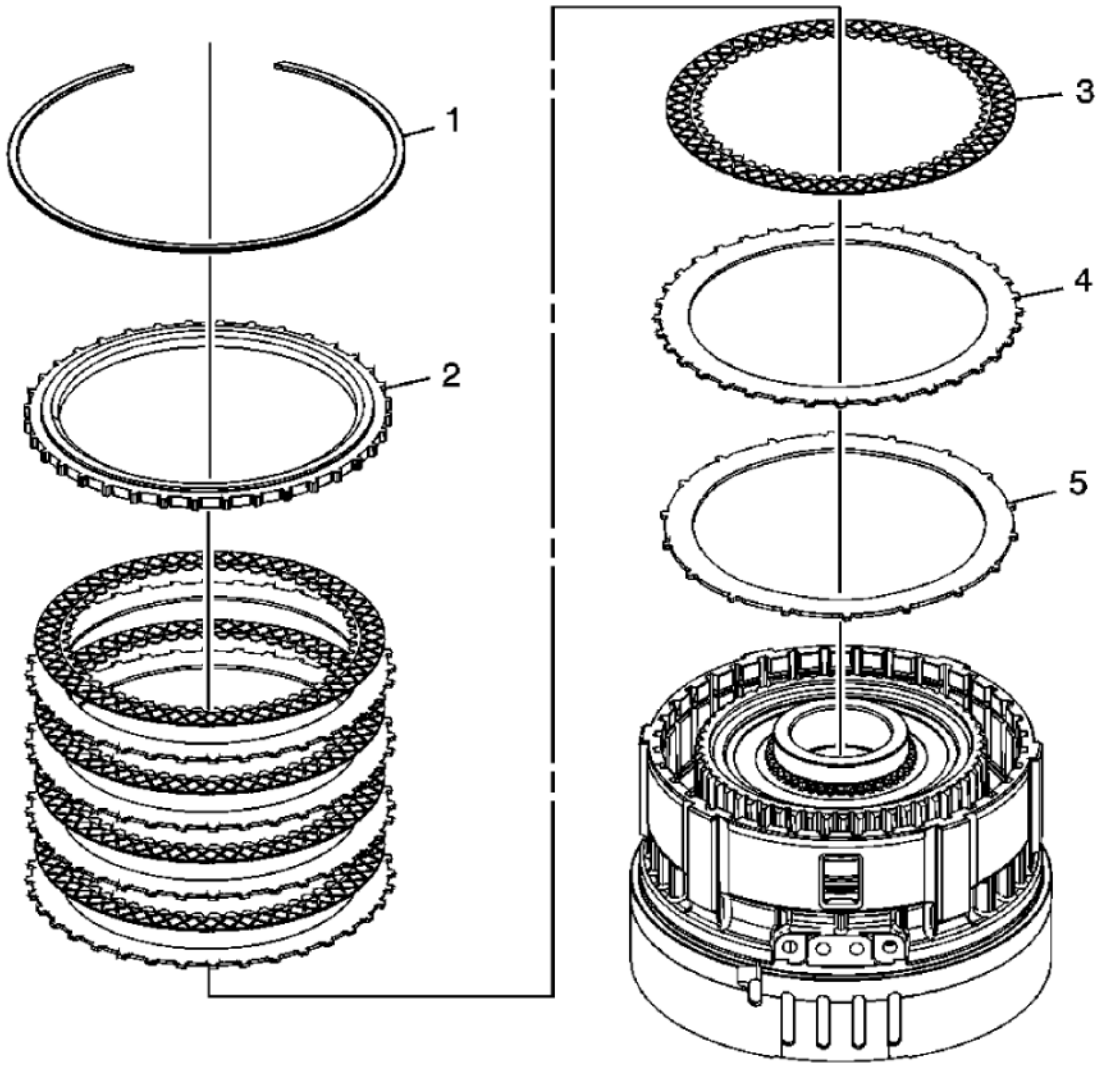


Fig. 128: Removing Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Plate Removal

Callout	Component Name
1	Low and Reverse Clutch Backing Plate Retaining Ring
2	Low and Reverse Clutch Backing Plate
3	Low and Reverse Clutch Plate Assembly (Qty: 5)
4	Low and Reverse Clutch Plate (Qty: 5)
5	Low and Reverse Clutch (Waved) Plate

LOW AND REVERSE CLUTCH PISTON REMOVAL

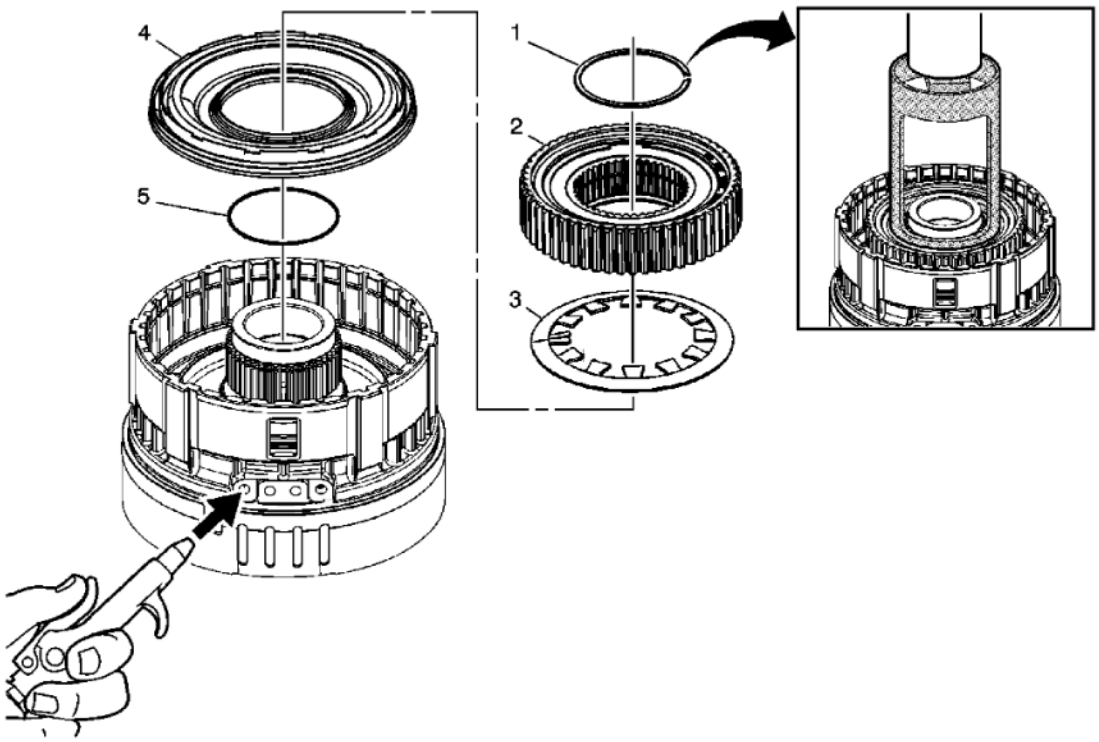


Fig. 129: Removing Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Piston Removal

Callout	Component Name
	Low and Reverse Clutch Spring Retaining Ring

1	**NOTE:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **Special Tool:** **DT 47779** Clutch Spring Compressor. See **Special Tools**.
2	Low Clutch Sprag Assembly
3	Low and Reverse Clutch Spring
4	Low and Reverse Clutch Piston Assembly **Tip:** It may be necessary to apply air to the apply passage in order to unseat the piston.
5	Low Clutch Sprag Seal **NOTE:** **Refer to Seal Reuse Notice .**

LOW AND REVERSE CLUTCH PISTON INSTALLATION

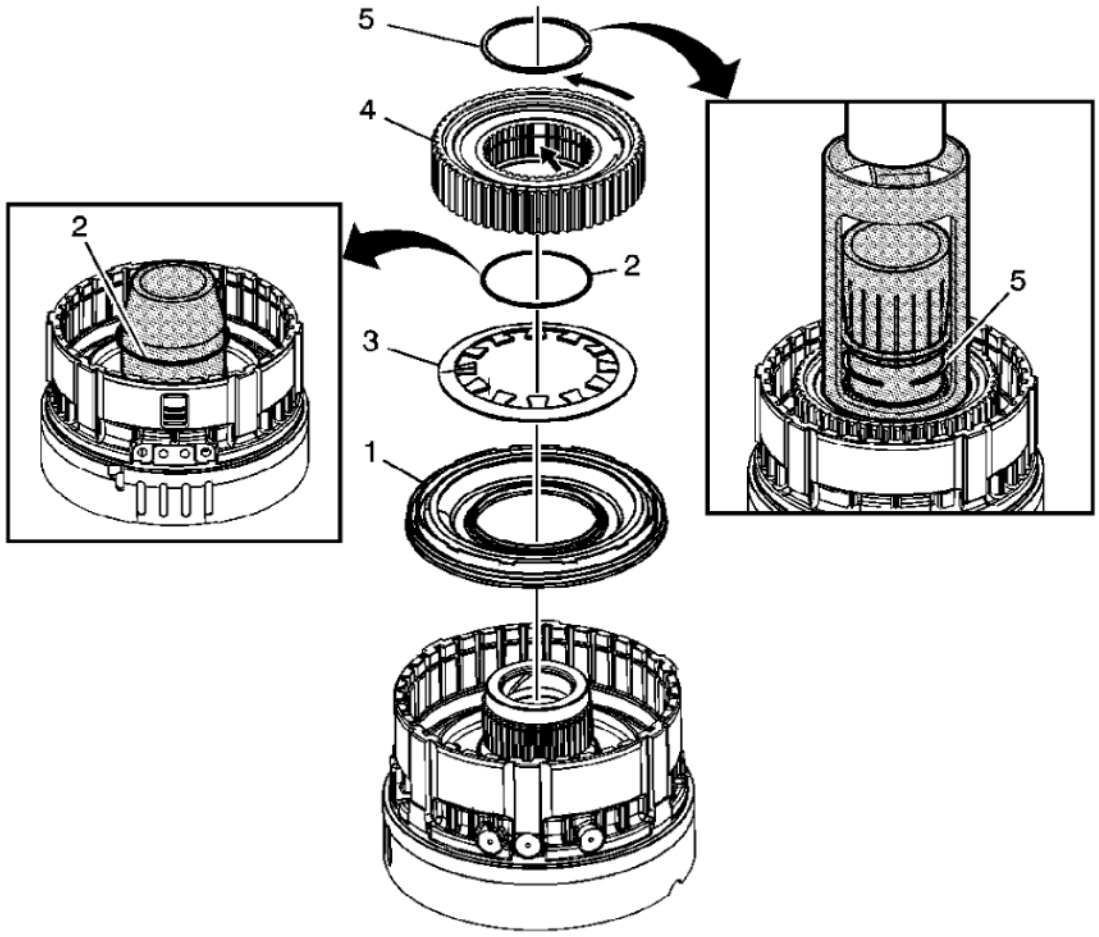


Fig. 130: Installing Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Piston Installation

Callout	Component Name
1	Low and Reverse Clutch Piston Assembly **Tip:** Lubricate the inner and outer sealing surfaces of the piston assembly with automatic transmission fluid (ATF) in order to ease installation into the center support assembly.
	Low Clutch Sprag Seal **NOTE:** **Refer to Seal Reuse Notice .**

2	**Tip:** Apply ATF to the **DT 47780** to ease seal installation. See **Special Tools**. **Special Tool:** **DT 47780** Low Clutch Sprag Seal Cone. See **Special Tools**.
3	Low and Reverse Clutch Spring **NOTE:** **Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.**
4	Low Clutch Sprag Assembly **Tip:** • Verify that the low clutch sprag is operating correctly. Refer to the illustration for proper freewheel direction. • Ensure the missing splines on the sprag assembly are aligned with the missing splines on the center support hub.
5	Low and Reverse Clutch Spring Retaining Ring **NOTE:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **NOTE:** **The retaining ring gap must be aligned with the 3 missing splines on the center support hub. Failure to do so may cause damage to the clutch assembly.** **Special Tools** • **DT 47778-1** Low Clutch Sprag Retaining Ring Cone. See **Special Tools**. • **DT 47778-2** Low Clutch Sprag Retaining Ring Pusher. See **Special Tools**. • **DT 47779** Clutch Spring Compressor. See **Special Tools**.

LOW AND REVERSE CLUTCH PLATE INSTALLATION

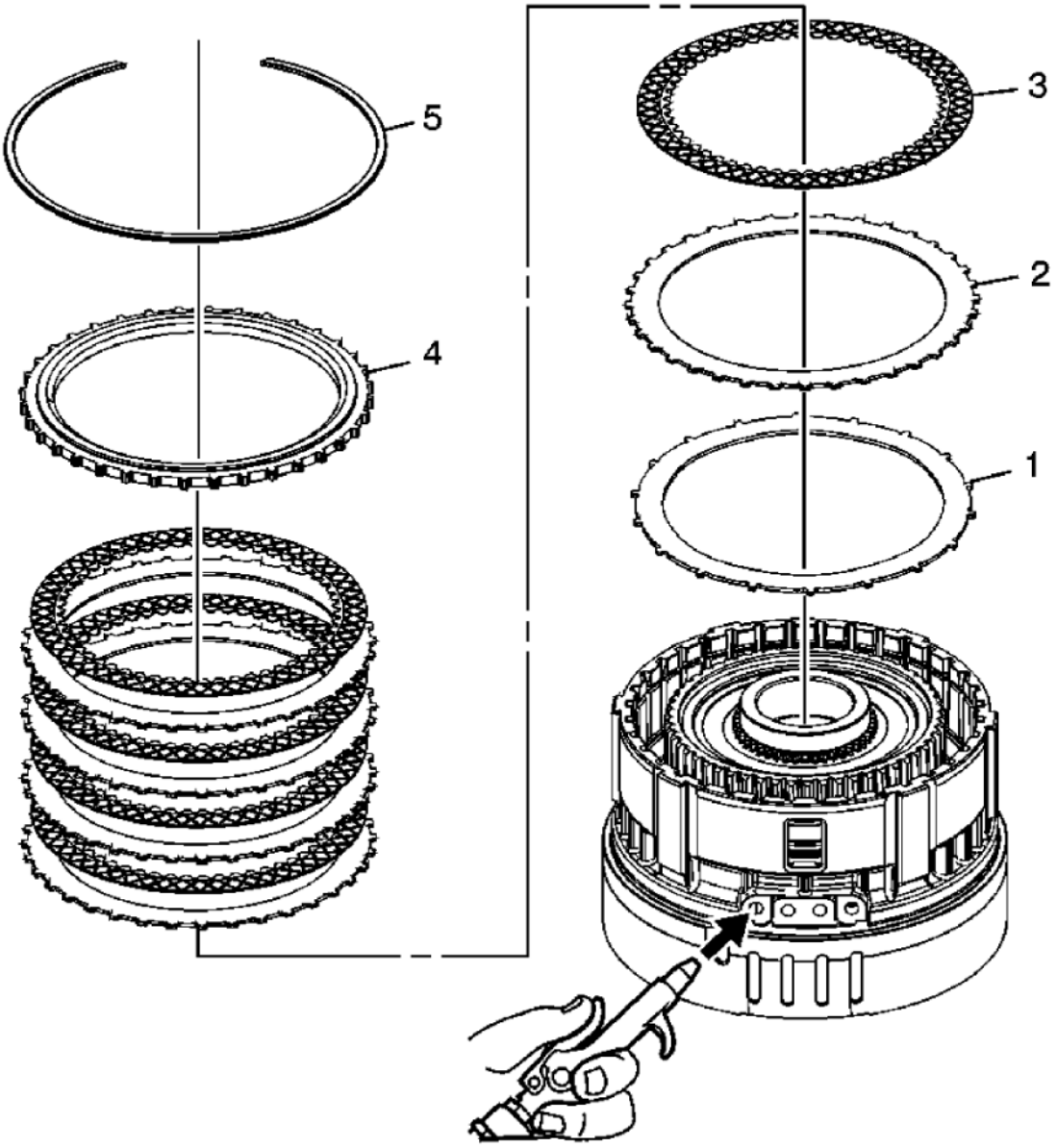


Fig. 131: Installing Low And Reverse Clutch Plate
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Plate Installation

Callout	Component Name
1	Low and Reverse Clutch (Waved) Plate
2	Low and Reverse Clutch Plate (Qty: 5)
3	Low and Reverse Clutch Plate Assembly (Qty: 5)

4	Low and Reverse Clutch Backing Plate
5	Low and Reverse Clutch Backing Plate Retaining Ring **Tip:** Apply air to verify proper installation of all low and reverse clutch components.

LOW AND REVERSE CLUTCH OVERHAUL (6L90)

LOW AND REVERSE CLUTCH PLATE REMOVAL

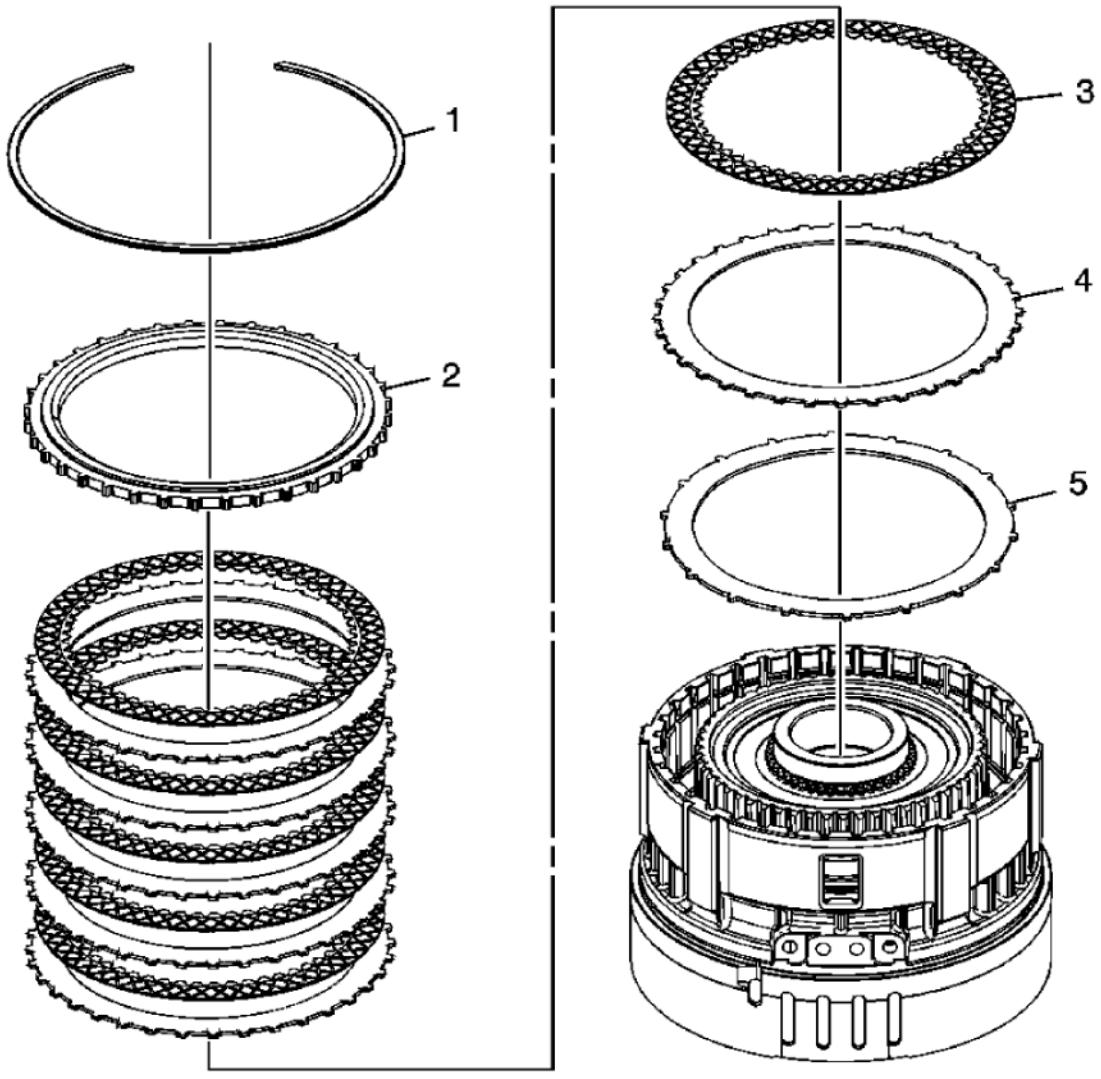


Fig. 132: Low and Reverse Clutch Plate Removal
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Plate Removal

Callout	Component Name
1	Low and Reverse Clutch Backing Plate Retaining Ring
2	Low and Reverse Clutch Backing Plate
3	Low and Reverse Clutch Plate Assembly (Qty: 6)
4	Low and Reverse Clutch Plate (Qty: 6)
5	Low and Reverse Clutch (Waved) Plate

LOW AND REVERSE CLUTCH PISTON REMOVAL

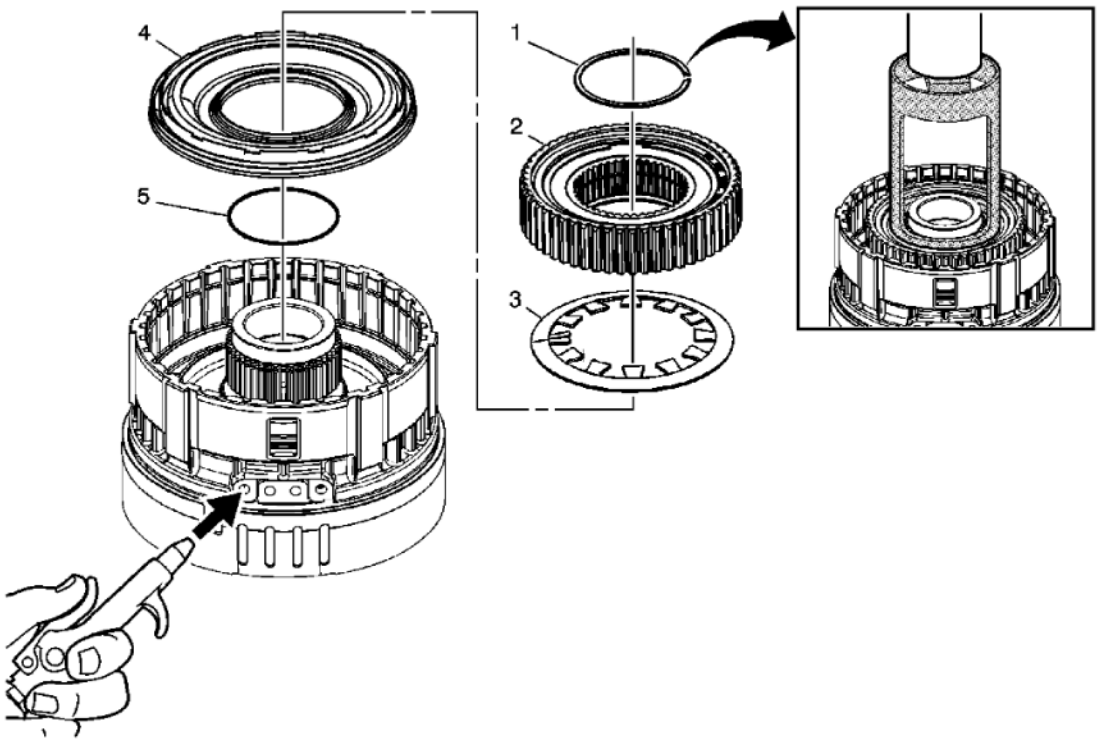


Fig. 133: Removing Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Piston Removal

Callout	Component Name
	Low and Reverse Clutch Spring Retaining Ring

1	**NOTE:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **Special Tool:** **DT 47779** Clutch Spring Compressor. See **Special Tools**.
2	Low Clutch Sprag Assembly
3	Low and Reverse Clutch Spring
4	Low and Reverse Clutch Piston Assembly **Tip:** It may be necessary to apply air to the apply passage in order to unseat the piston.
5	Low Clutch Sprag Seal **NOTE:** **Refer to Seal Reuse Notice .**

LOW AND REVERSE CLUTCH PISTON INSTALLATION

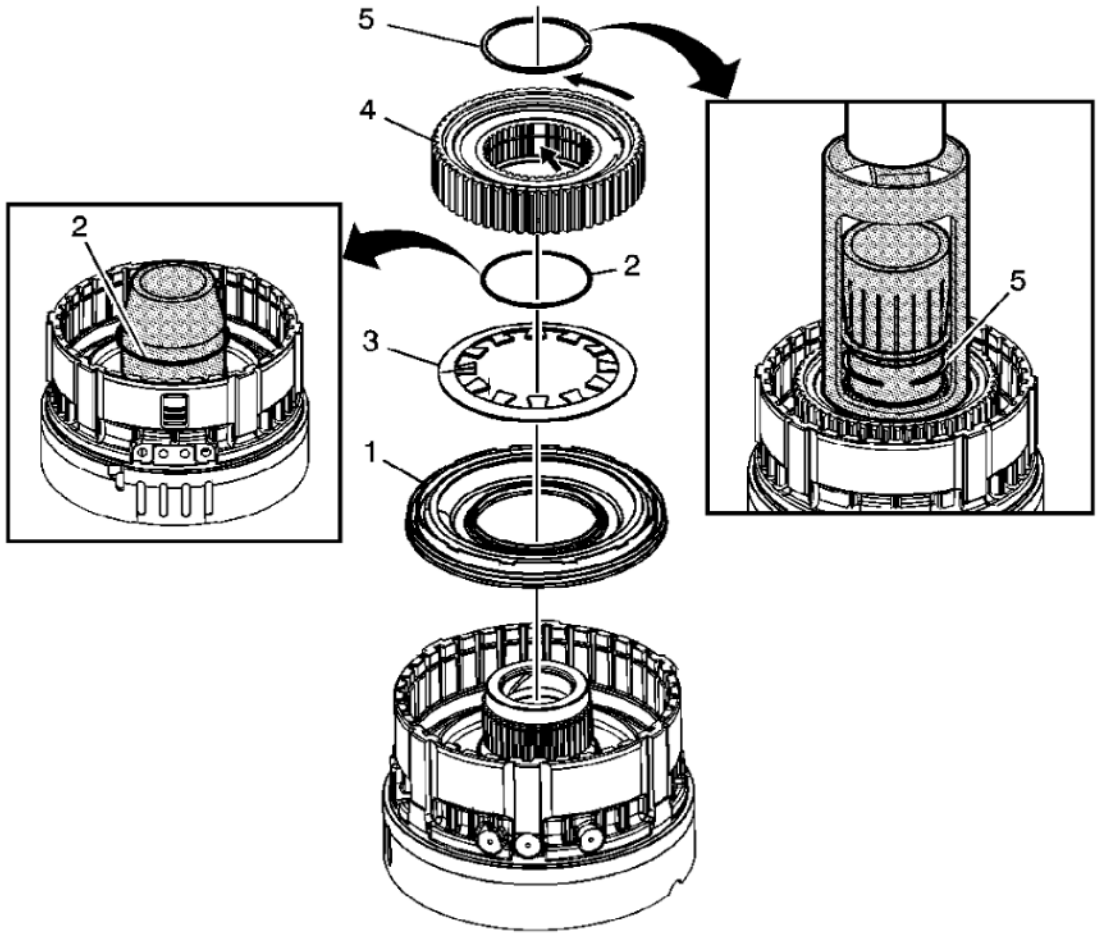


Fig. 134: Installing Low And Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Piston Installation

Callout	Component Name
1	Low and Reverse Clutch Piston Assembly **Tip:** Lubricate the inner and outer sealing surfaces of the piston assembly with automatic transmission fluid (ATF) in order to ease installation into the center support assembly.
	Low Clutch Sprag Seal **NOTE:** **Refer to Seal Reuse Notice .**

2	**Tip:** Apply ATF to the **DT 47780** to ease seal installation. See **Special Tools**. **Special Tool:** **DT 47780** Low Clutch Sprag Seal Cone. See **Special Tools**.
3	Low and Reverse Clutch Spring **NOTE:** **Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.**
4	Low Clutch Sprag Assembly **Tip:** • Verify that the low clutch sprag is operating correctly. Refer to the illustration for proper freewheel direction. • Ensure the missing splines on the sprag assembly are aligned with the missing splines on the center support hub.
5	Low and Reverse Clutch Spring Retaining Ring **NOTE:** **Ensure the DT 47779 contacts the sprag assembly and not the sprag retaining ring. Damage to the sprag may result.** **NOTE:** **The retaining ring gap must be aligned with the 3 missing splines on the center support hub. Failure to do so may cause damage to the clutch assembly.** **Special Tools** • **DT 47778-1** Low Clutch Sprag Retaining Ring Cone. See **Special Tools**. • **DT 47778-2** Low Clutch Sprag Retaining Ring Pusher. See **Special Tools**. • **DT 47779** Clutch Spring Compressor. See **Special Tools**.

LOW AND REVERSE CLUTCH PLATE INSTALLATION

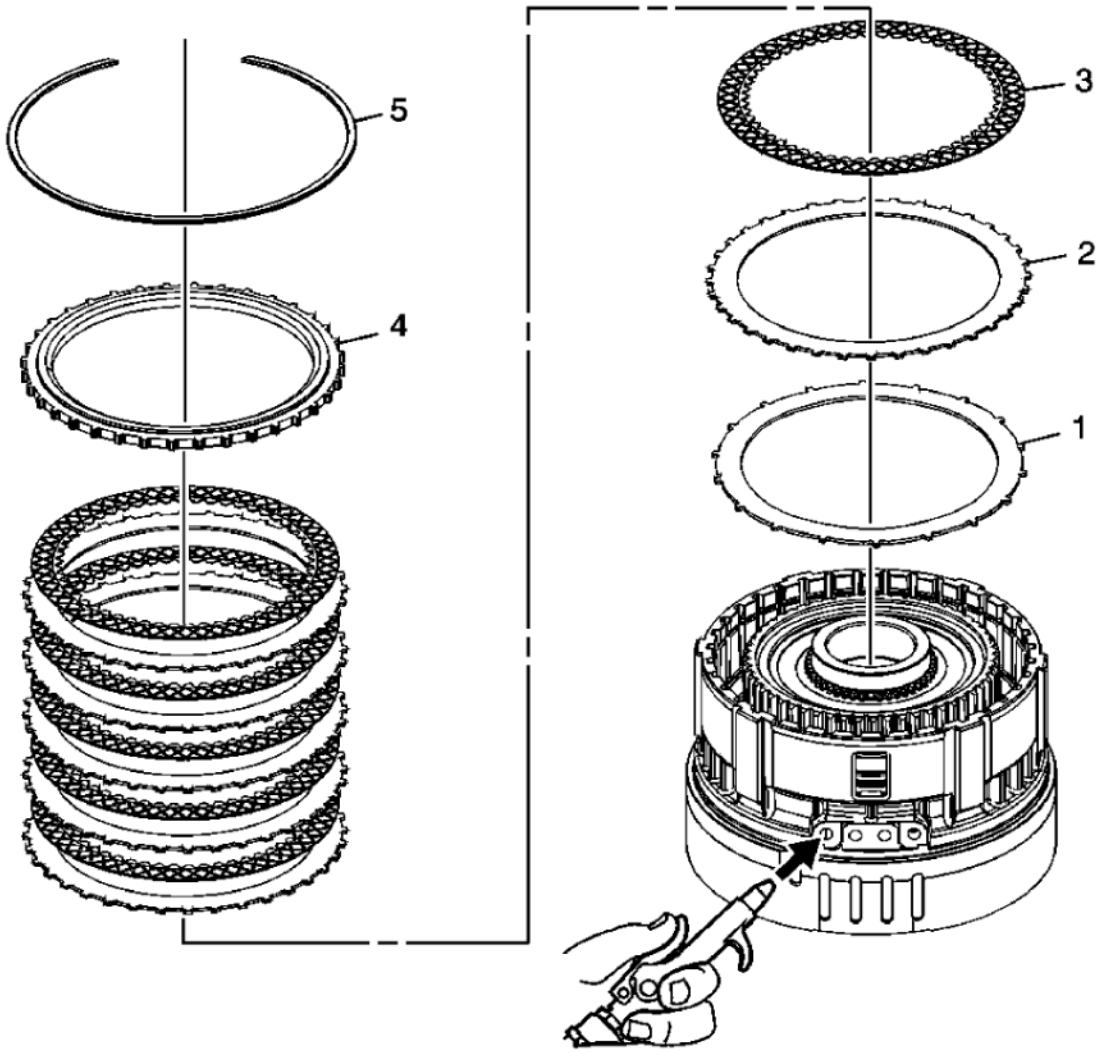


Fig. 135: Low and Reverse Clutch Plate Installation
Courtesy of GENERAL MOTORS CORP.

Low and Reverse Clutch Plate Installation

Callout	Component Name
1	Low and Reverse Clutch (Waved) Plate
2	Low and Reverse Clutch Plate (Qty: 6)
3	Low and Reverse Clutch Plate Assembly (Qty: 6)
4	Low and Reverse Clutch Backing Plate
5	Low and Reverse Clutch Backing Plate Retaining Ring

	Tip: Apply air to verify proper installation of all low and reverse clutch components.

4-5-6 CLUTCH DAMPENER OVERHAUL

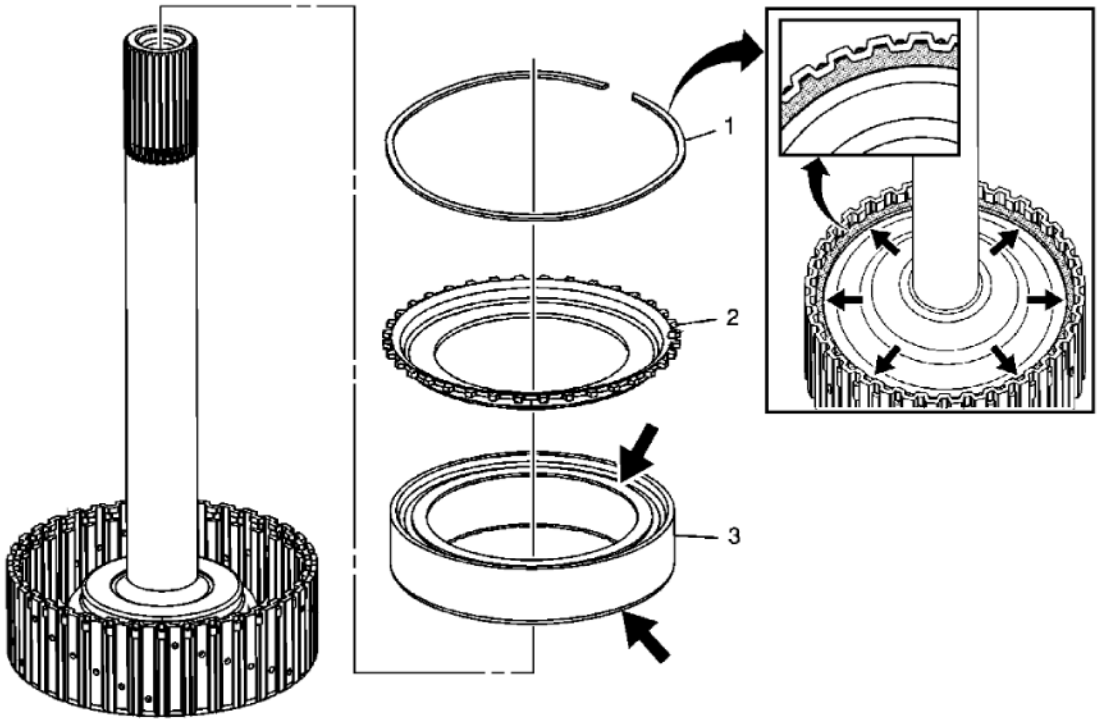


Fig. 136: Overhauling 4-5-6 Clutch Dampener
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	4-5-6 Clutch Dampener Retaining Ring **NOTE:** **Ensure the retaining ring is fully seated when installed. Using a screwdriver, fully seat the retaining ring into the groove by pushing on the inside diameter around the whole circumference. If the retaining ring is not fully seated, transmission damage will result.**
2	4-5-6 Clutch Dampener Apply Plate
	4-5-6 Clutch Dampener **Tip:** Dry and inspect the clutch dampener for the following conditions:

3	• Pitting • Flaking • Delamination • Wear • Glazing • Cracking

4-5-6 CLUTCH OVERHAUL (6L80)

4-5-6 CLUTCH PLATES REMOVAL

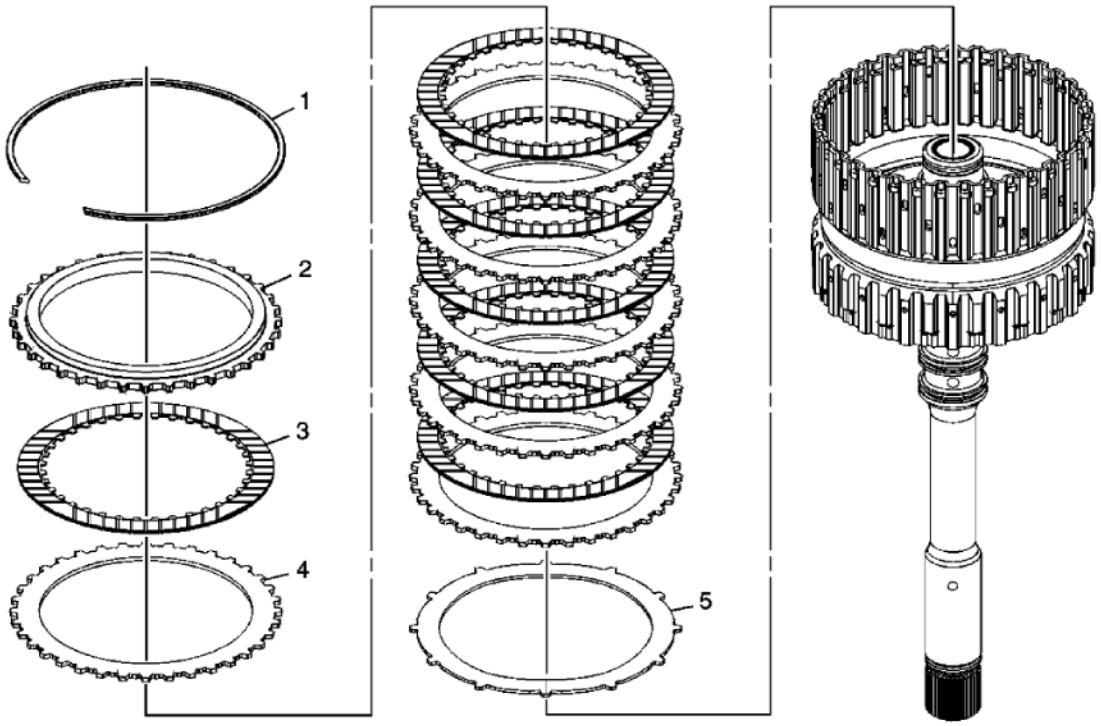


Fig. 137: Removing 4-5-6 Clutch Plates
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Plates Removal

Callout	Component Name
1	4-5-6 Clutch Backing Plate Retaining Ring
2	4-5-6 Clutch Backing Plate
3	4-5-6 Clutch Plate Assembly (Qty: 6)

4	4-5-6 Clutch Plate (Qty: 6)
5	4-5-6 Clutch (Waved) Plate

4-5-6 CLUTCH PISTON REMOVAL

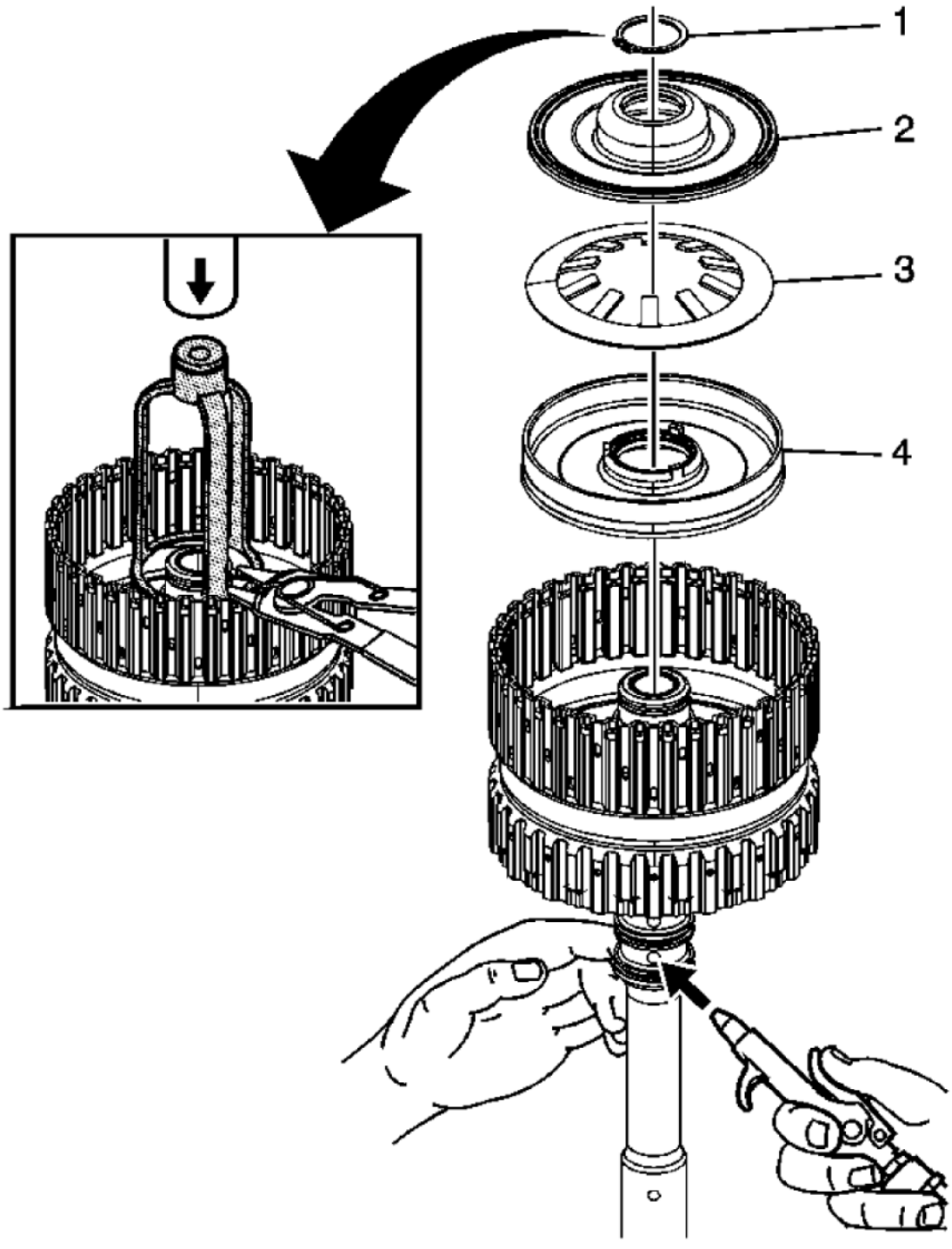


Fig. 138: Removing 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Piston Removal

Callout	Component Name
1	4-5-6 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 4-5-6 clutch piston assembly, spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 43074** Clutch Spring Compressor. See **Special Tools**.
2	4-5-6 Clutch Piston Dam Assembly **Tip:** It may be necessary to apply air pressure to remove the dam and piston.
3	4-5-6 Clutch Spring
4	4-5-6 Clutch Piston Assembly **Tip:** It may be necessary to apply air pressure to remove the piston.

TURBINE SHAFT FLUID SEAL RING REPLACEMENT

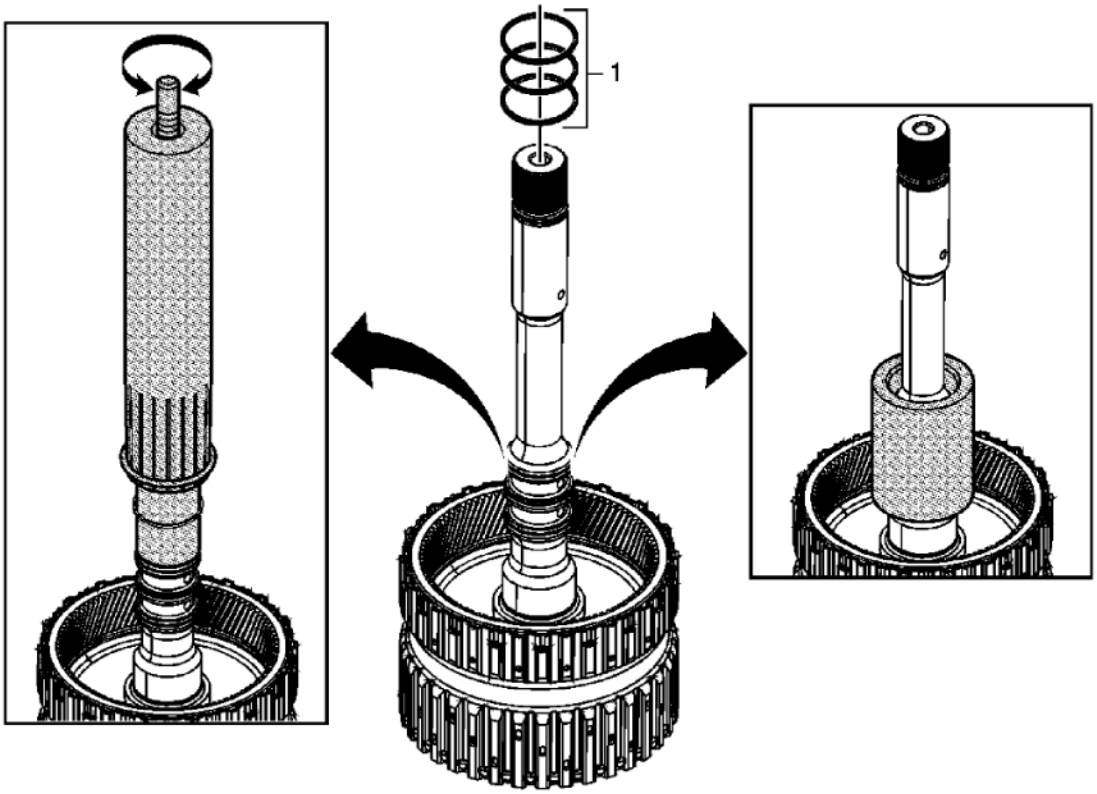


Fig. 139: Replacing Turbine Shaft Fluid Seal Ring
Courtesy of GENERAL MOTORS CORP.

Turbine Shaft Fluid Seal Ring Replacement

Callout	Component Name
Preliminary Procedures • Inspect the turbine shaft fluid passages and splines. • Clean any plugged passages.	
	Turbine Shaft Fluid Seal Ring (Qty: 3) **NOTE:** **Do not use old seal rings. Install NEW seal rings. Reusing old seal rings may cause internal transmission leaks and transmission damage.** **NOTE:** **Size the fluid seal rings for at least 5 minutes after installation to obtain proper seal ring size. Failure to do so may cause internal transmission leaks and**

	transmission damage.
1	**Tip:** Adjust the turn screw on **DT 47768-1** and install the bottom seal ring first. See **Special Tools**. **Special Tools** • **DT 47768-1** Seal Protector. See **Special Tools**. • **DT 47768-2** Seal Pusher. See **Special Tools**. • **DT 47768-3** Seal Sizer. See **Special Tools**.

4-5-6 CLUTCH PISTON INSTALLATION

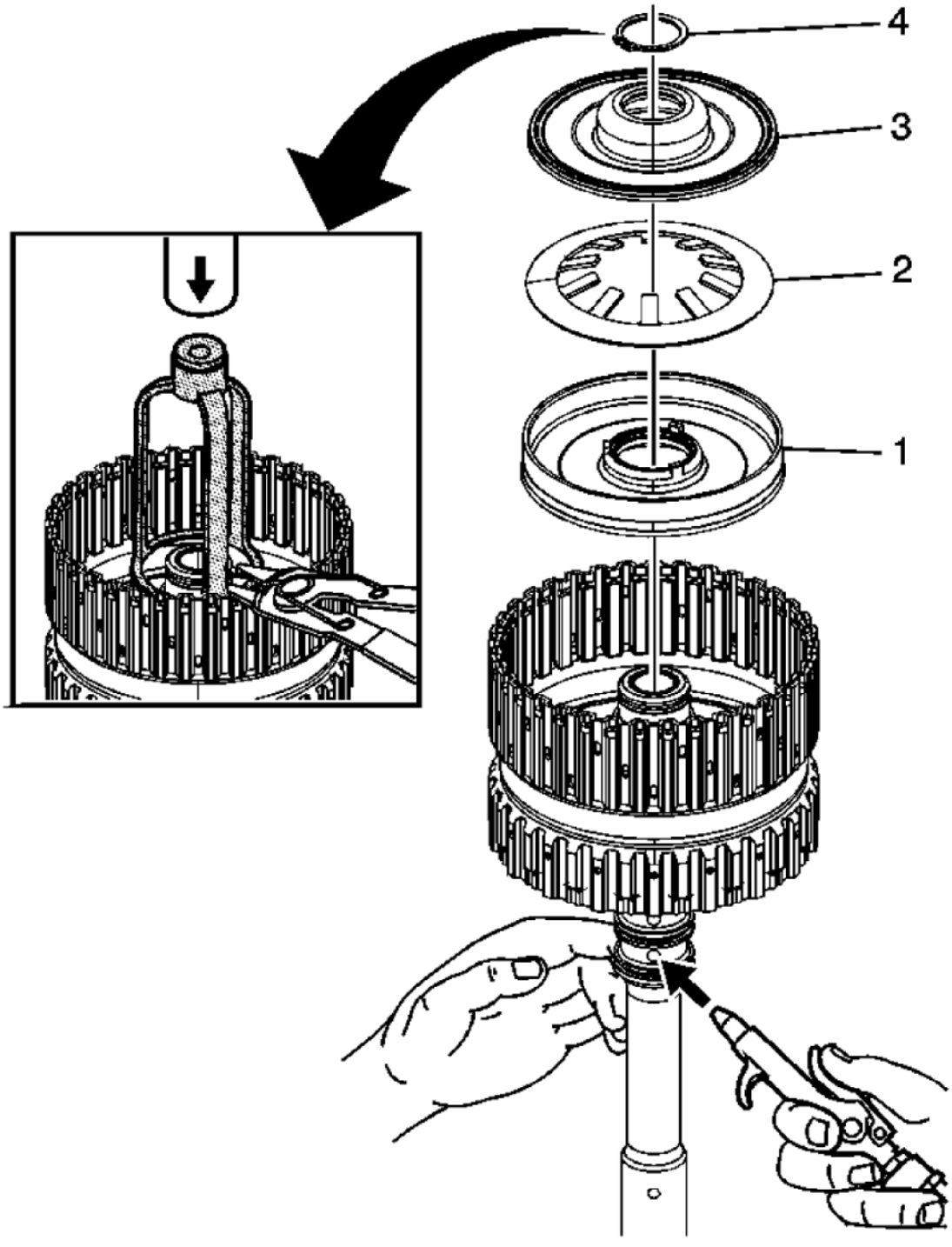


Fig. 140: Installing 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Piston Installation

Callout	Component Name
1	4-5-6 Clutch Piston Assembly
2	4-5-6 Clutch Spring **NOTE:** **Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.**
3	4-5-6 Clutch Piston Dam Assembly **Tip:** Lubricate the inner and outer sealing surfaces of the dam assembly with automatic transmission fluid (ATF) in order to ease installation into the piston.
4	4-5-6 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 4-5-6 clutch piston assembly, spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Tip:** Apply air to verify proper installation of all 4-5-6 clutch components. The piston should apply and release smoothly. **Special Tool:** **J 43074** Clutch Spring Compressor. See **Special Tools**.

4-5-6 CLUTCH PLATES INSTALLATION

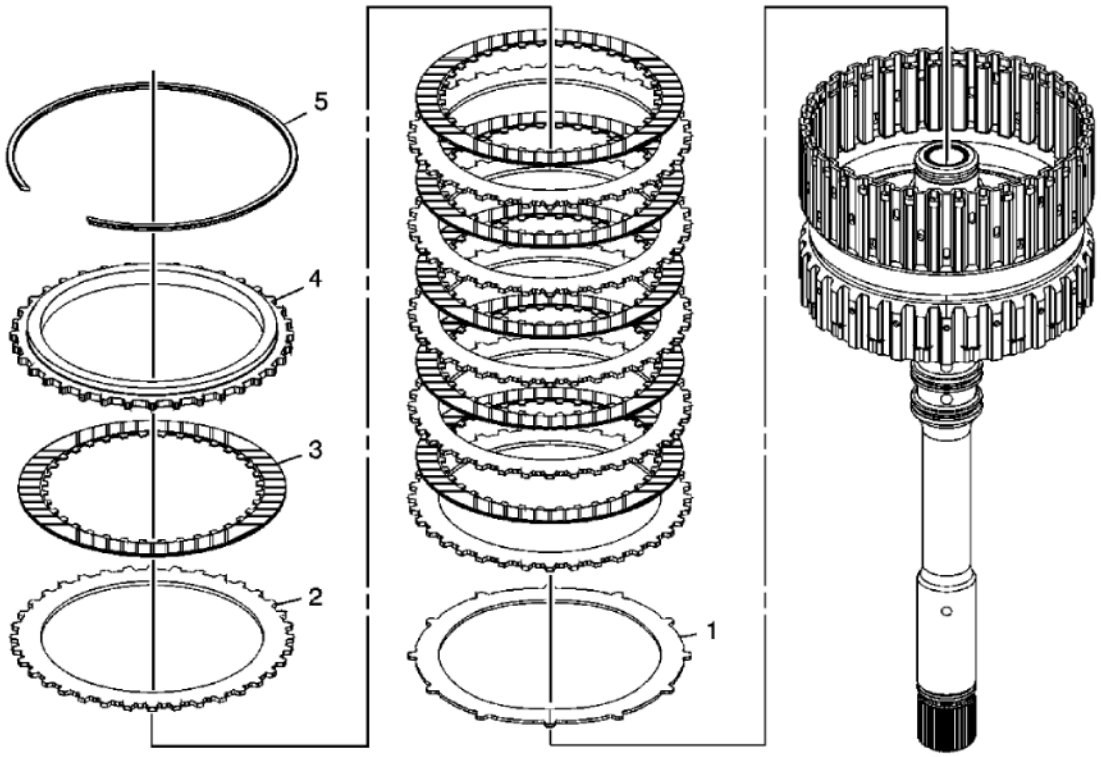


Fig. 141: Installing 4-5-6 Clutch Plates
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Plates Installation

Callout	Component Name
1	4-5-6 Clutch (Waved) Plate
2	4-5-6 Clutch Plate (Qty: 6)
3	4-5-6 Clutch Plate Assembly (Qty: 6)
4	4-5-6 Clutch Backing Plate
5	4-5-6 Clutch Backing Plate Retaining Ring **Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **4-5-6 Clutch Backing Plate Retaining Ring Measurement**.

4-5-6 CLUTCH OVERHAUL (6L90)

4-5-6 CLUTCH PLATES REMOVAL

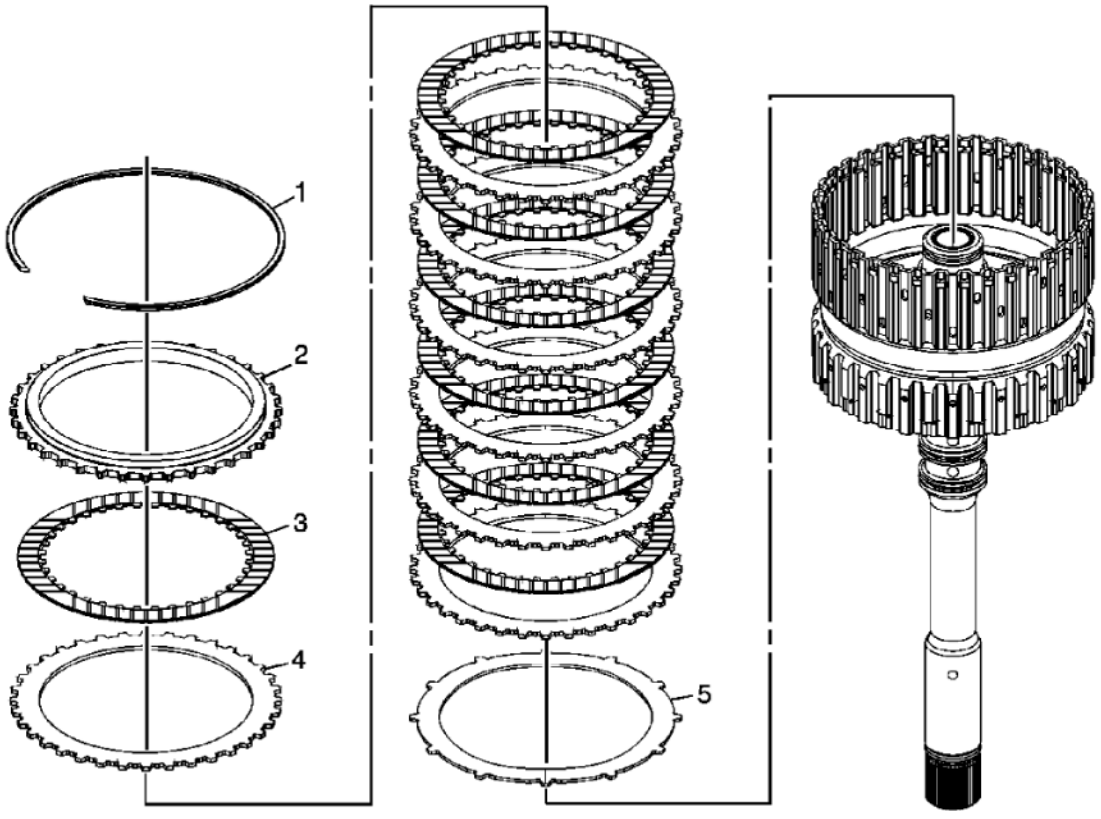


Fig. 142: 4-5-6 Clutch Plates Removal
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Plates Removal

Callout	Component Name
1	4-5-6 Clutch Backing Plate Retaining Ring
2	4-5-6 Clutch Backing Plate
3	4-5-6 Clutch Plate Assembly (Qty: 7)
4	4-5-6 Clutch Plate (Qty: 7)
5	4-5-6 Clutch (Waved) Plate

4-5-6 CLUTCH PISTON REMOVAL

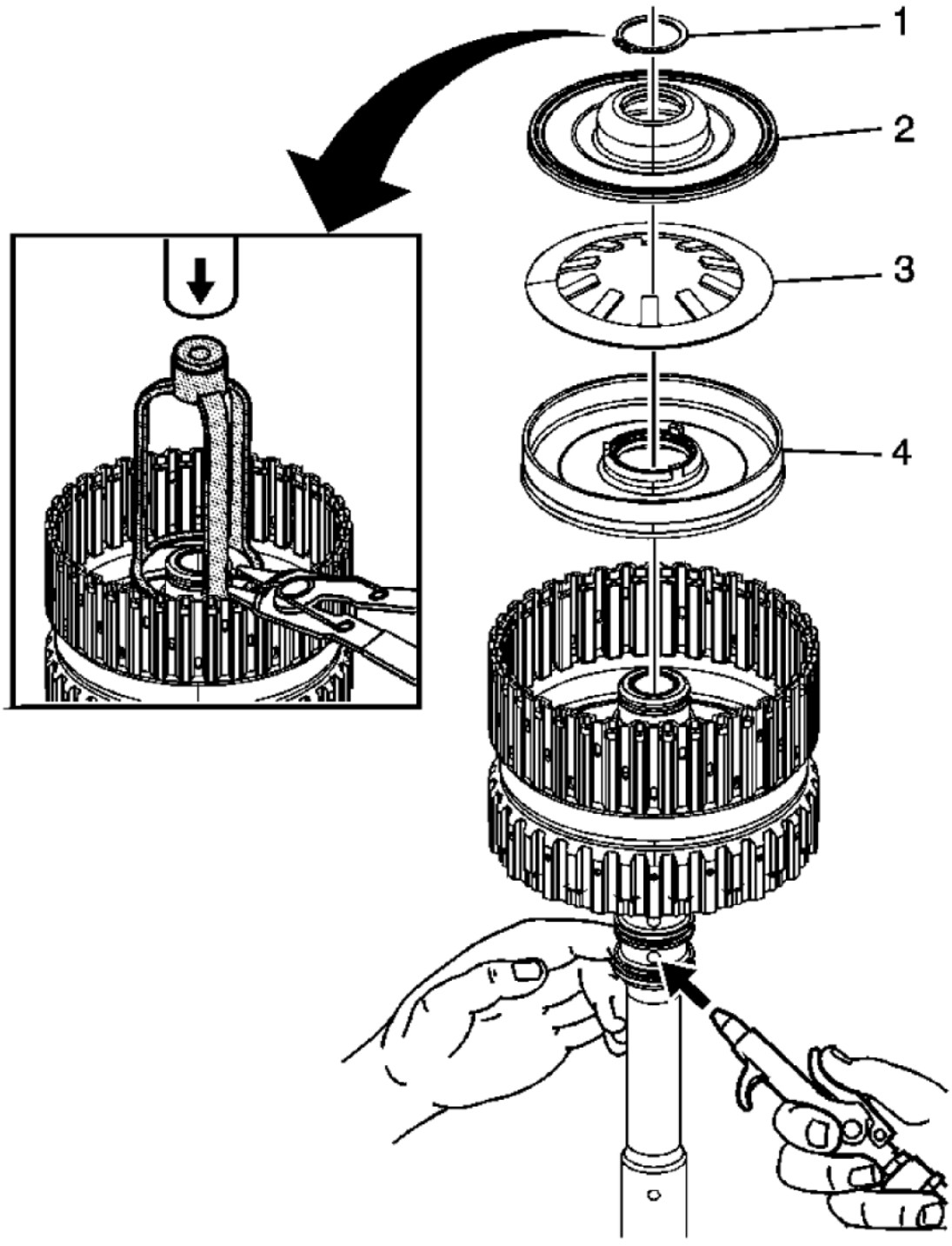


Fig. 143: Removing 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Piston Removal

Callout	Component Name
1	4-5-6 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 4-5-6 clutch piston assembly, spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 43074** Clutch Spring Compressor. See **Special Tools**.
2	4-5-6 Clutch Piston Dam Assembly **Tip:** It may be necessary to apply air pressure to remove the dam and piston.
3	4-5-6 Clutch Spring
4	4-5-6 Clutch Piston Assembly **Tip:** It may be necessary to apply air pressure to remove the piston.

TURBINE SHAFT FLUID SEAL RING REPLACEMENT

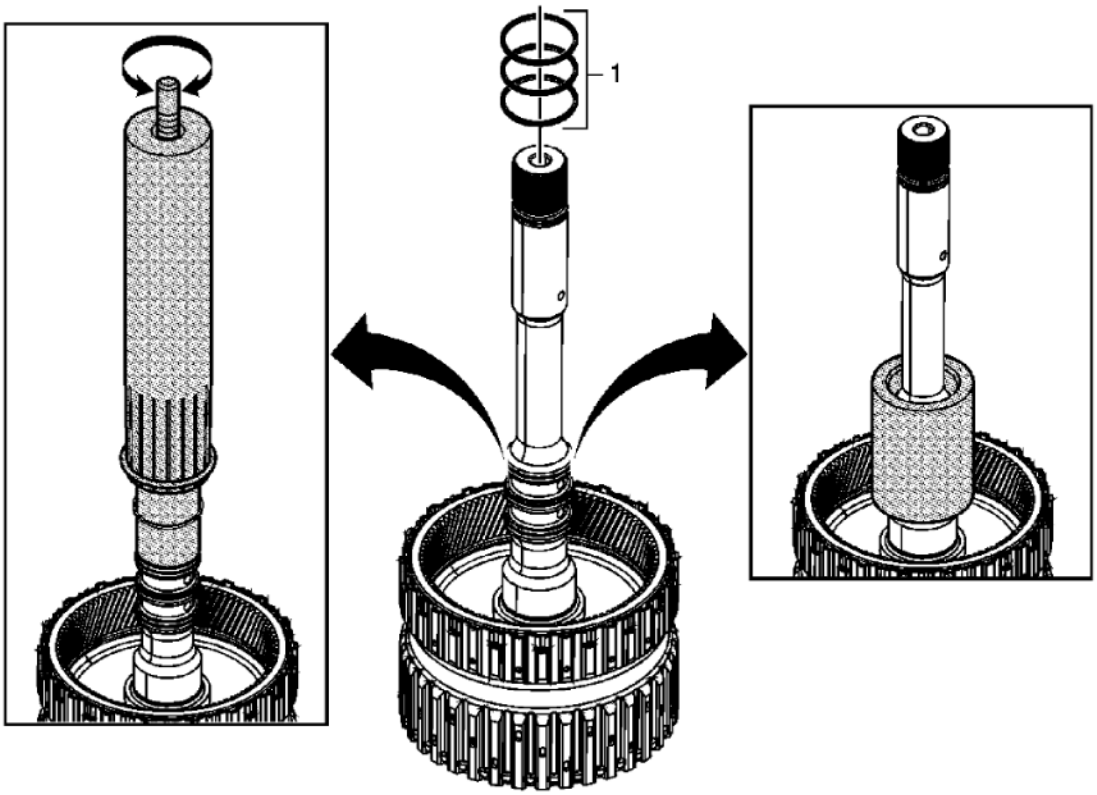


Fig. 144: Replacing Turbine Shaft Fluid Seal Ring
Courtesy of GENERAL MOTORS CORP.

Turbine Shaft Fluid Seal Ring Replacement

Callout	Component Name
Preliminary Procedures • Inspect the turbine shaft fluid passages and splines. • Clean any plugged passages.	
	Turbine Shaft Fluid Seal Ring (Qty: 3) **NOTE:** **Do not use old seal rings. Install NEW seal rings. Reusing old seal rings may cause internal transmission leaks and transmission damage.** **NOTE:** **Size the fluid seal rings for at least 5 minutes after installation to obtain proper seal ring size. Failure to do so may cause internal transmission leaks and**

	transmission damage.
1	**Tip:** Adjust the turn screw on **DT 47768-1** and install the bottom seal ring first. See **Special Tools**. **Special Tools** • **DT 47768-1** Seal Protector. See **Special Tools**. • **DT 47768-2** Seal Pusher. See **Special Tools**. • **DT 47768-3** Seal Sizer. See **Special Tools**.

4-5-6 CLUTCH PISTON INSTALLATION

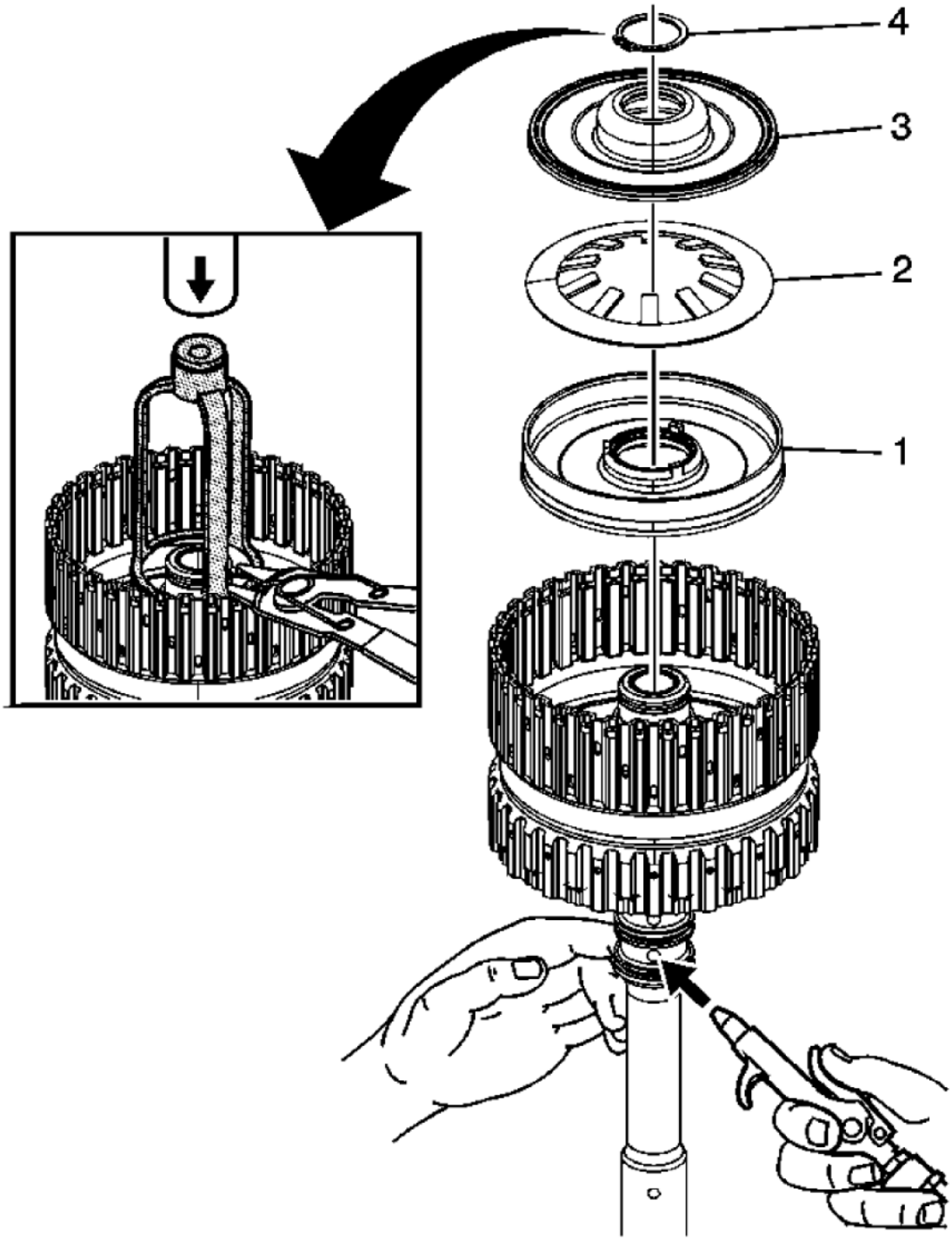


Fig. 145: Installing 4-5-6 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Piston Installation

Callout	Component Name
1	4-5-6 Clutch Piston Assembly
2	4-5-6 Clutch Spring **NOTE:** **Ensure the spring tabs are facing up during installation. Failure to do so may cause damage to the clutch assembly.**
3	4-5-6 Clutch Piston Dam Assembly **Tip:** Lubricate the inner and outer sealing surfaces of the dam assembly with automatic transmission fluid (ATF) in order to ease installation into the piston.
4	4-5-6 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 4-5-6 clutch piston assembly, spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Tip:** Apply air to verify proper installation of all 4-5-6 clutch components. The piston should apply and release smoothly. **Special Tool:** **J 43074** Clutch Spring Compressor. See **Special Tools**.

4-5-6 CLUTCH PLATES INSTALLATION

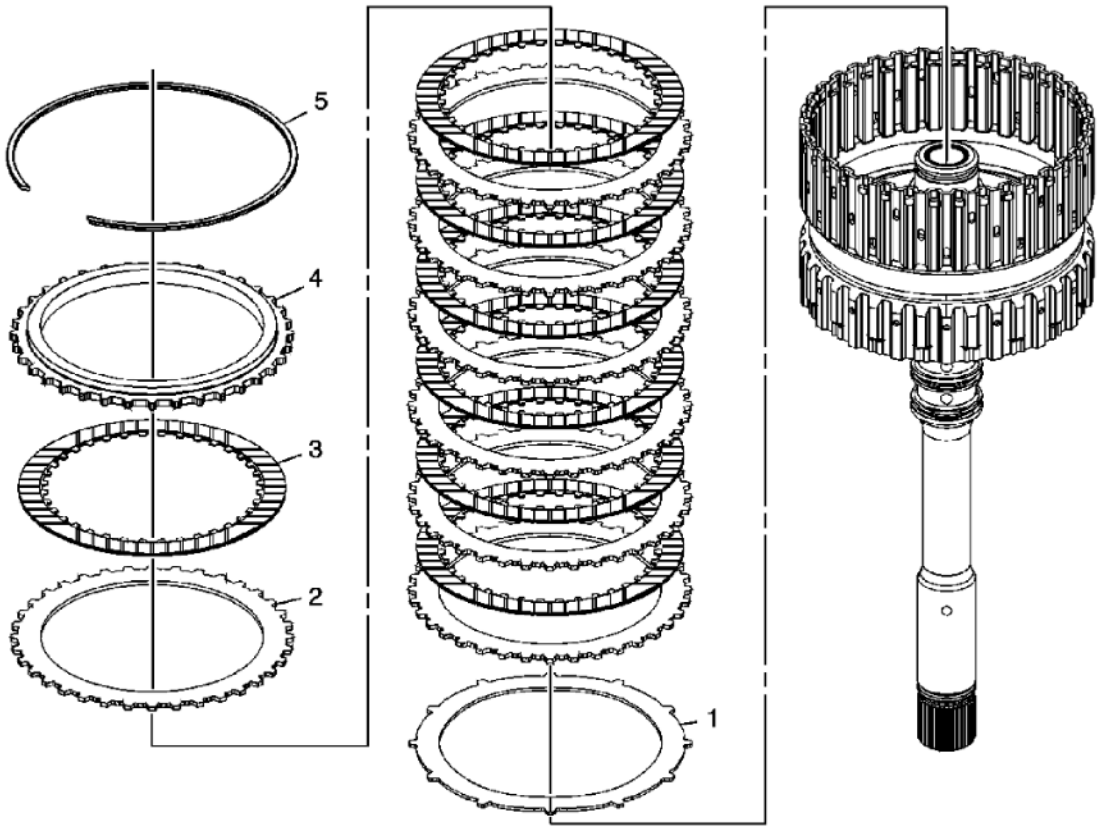


Fig. 146: 4-5-6 Clutch Plates Installation
Courtesy of GENERAL MOTORS CORP.

4-5-6 Clutch Plates Installation

Callout	Component Name
1	4-5-6 Clutch (Waved) Plate
2	4-5-6 Clutch Plate (Qty: 7)
3	4-5-6 Clutch Plate Assembly (Qty: 7)
4	4-5-6 Clutch Backing Plate
5	4-5-6 Clutch Backing Plate Retaining Ring **Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **4-5-6 Clutch Backing Plate Retaining Ring Measurement**.

4-5-6 CLUTCH BACKING PLATE RETAINING RING MEASUREMENT

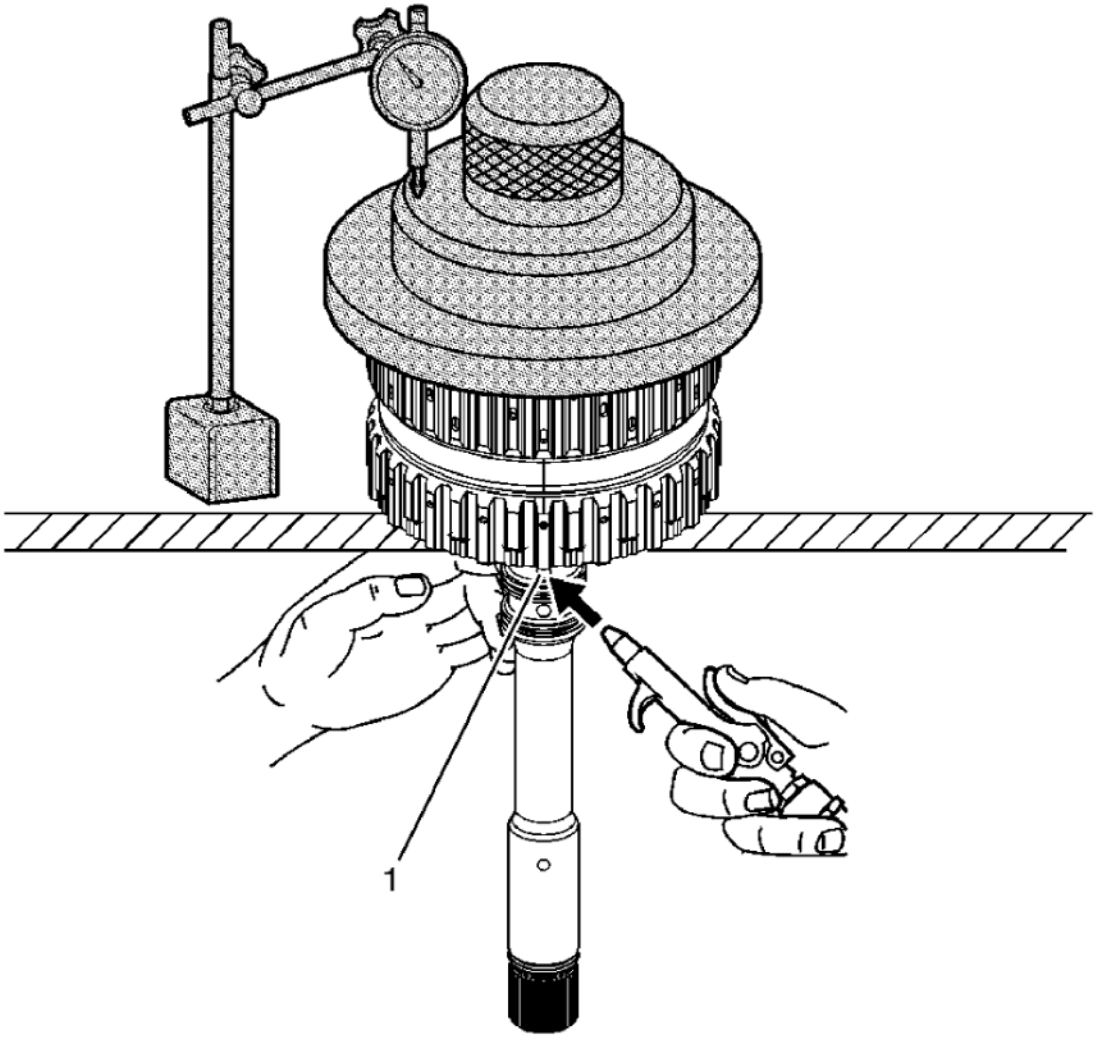


Fig. 147: Measuring 4-5-6 Clutch Backing Plate Retaining Ring
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

Preliminary Procedures

1. Install the clutch assembly into a hole in the workbench
2. Zero out the dial indicator on the **DT 47868-1** . See **Special Tools**.

Special Tools

- **DT 47868-1** Pack Travel Weight. See **Special Tools**.
- **J 8001** Dial Indicator Set

• **J 26900-13** Magnetic Base	
1	4-5-6 Clutch Apply Passage **Tip:** While using one finger to block the top passage hole on the turbine shaft, apply compressed air to the opposite top passage hole, and observe the dial indicator measurement. Refer to **Clutch Backing Plate Retaining Ring Specifications (6L80)** or **Clutch Backing Plate Retaining Ring Specifications (6L90)** to determine the correct retainer.

1-2-3-4 AND 3-5 REVERSE CLUTCH OVERHAUL (6L50/6L80)

1-2-3-4 AND 3-5 REVERSE CLUTCH PLATES REMOVAL

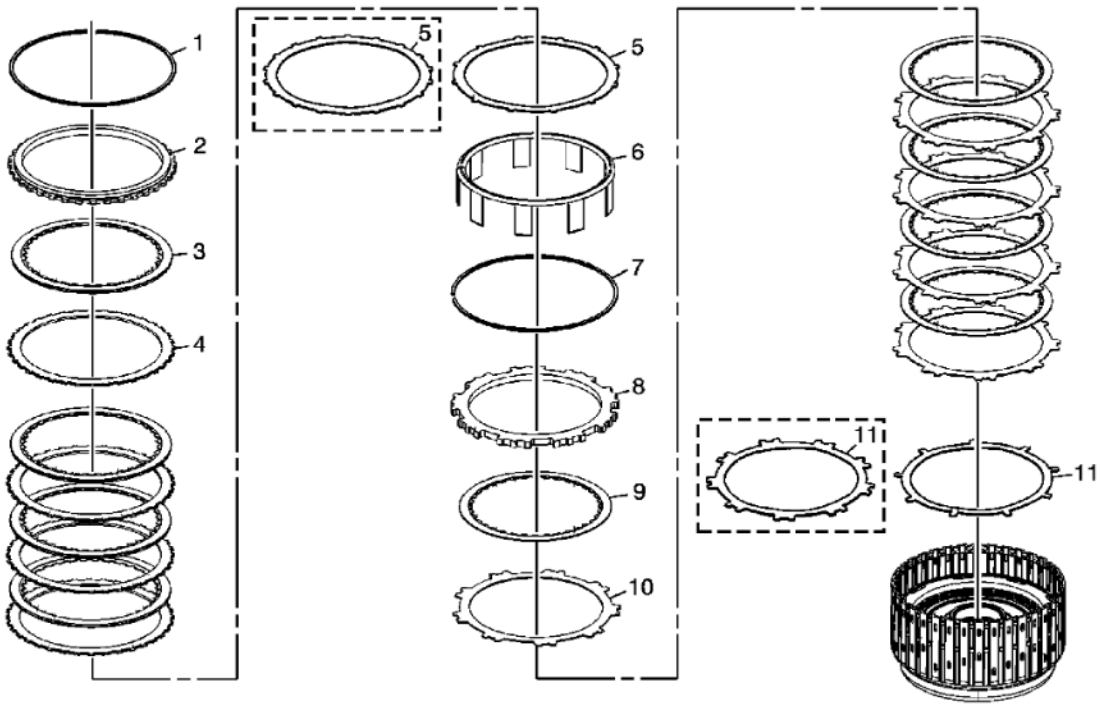


Fig. 148: Removing 1-2-3-4 and 3-5 Reverse Clutch Plates
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Plates Removal

Callout	Component Name
	3-5 Reverse Clutch Backing Plate Retaining

1	Ring
2	3-5 Reverse Clutch Backing Plate
3	3-5 Reverse Clutch Plate Assembly (Qty: 4)
4	3-5 Reverse Clutch Plate (Qty: 4)
5	3-5 Reverse Clutch (Waved) Plate
6	3-5 Reverse Clutch Apply Ring
7	1-2-3-4 Clutch Backing Plate Retaining Ring
8	1-2-3-4 Clutch Backing Plate
9	1-2-3-4 Clutch Plate Assembly (Qty: 5)
10	1-2-3-4 Clutch Plate (Qty: 5)
11	1-2-3-4 Clutch (Waved) Plate

1-2-3-4 CLUTCH PISTON REMOVAL

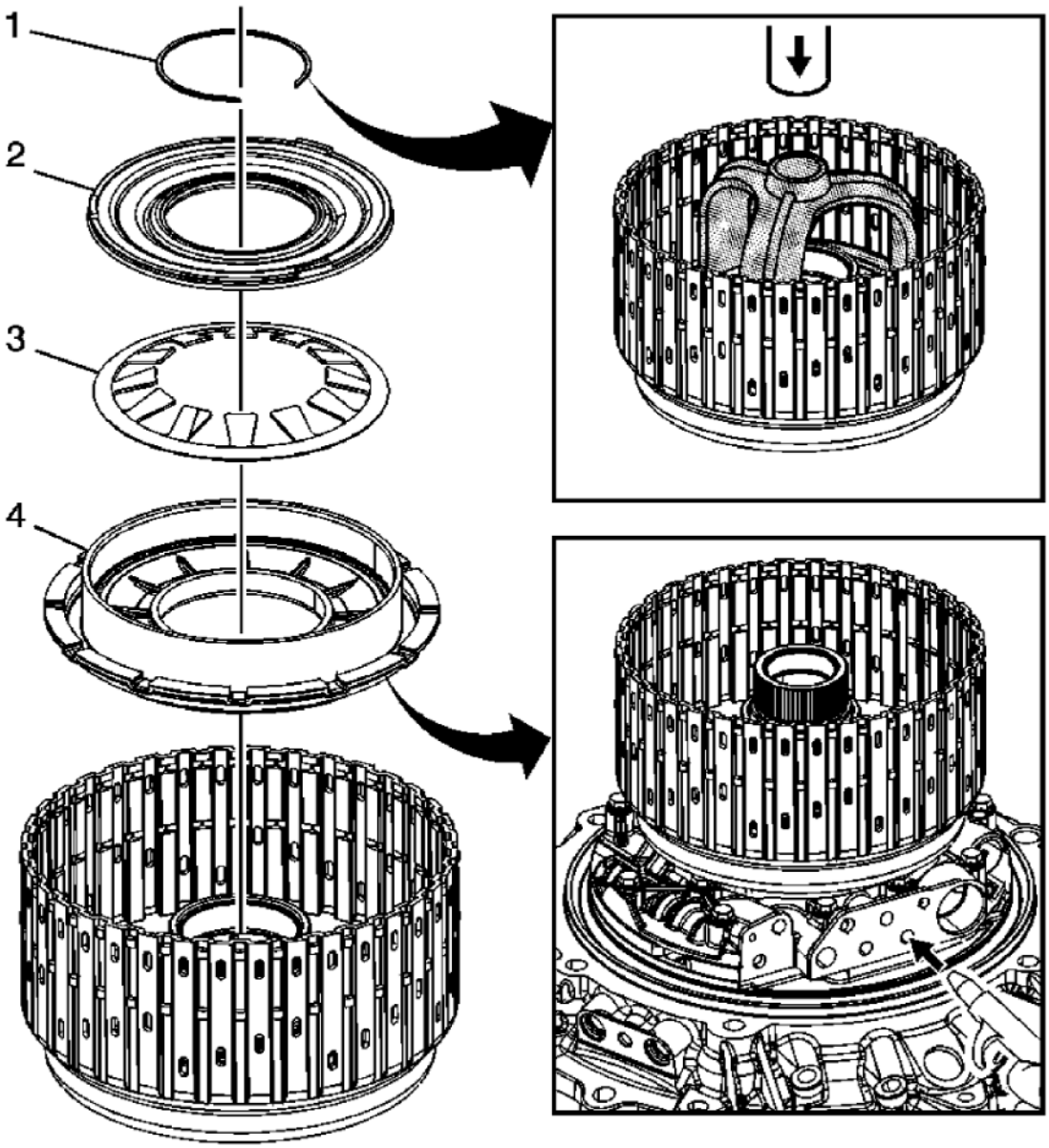


Fig. 149: Removing 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Piston Removal

Callout	Component Name
	1-2-3-4 Clutch Piston Dam Retaining Ring. **NOTE:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly. Compressing the dam assembly**

1	**too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.
2	1-2-3-4 Clutch Piston Dam Assembly
3	1-2-3-4 Clutch Spring
4	1-2-3-4 Clutch Piston **Tip:** • It may be necessary to apply air to the apply passage in order to remove the piston. Install the 1-2-3-4 clutch housing onto the torque converter (with fluid pump) housing assembly in order to apply air. • After air is applied, it may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.

3-5 REVERSE CLUTCH PISTON REMOVAL

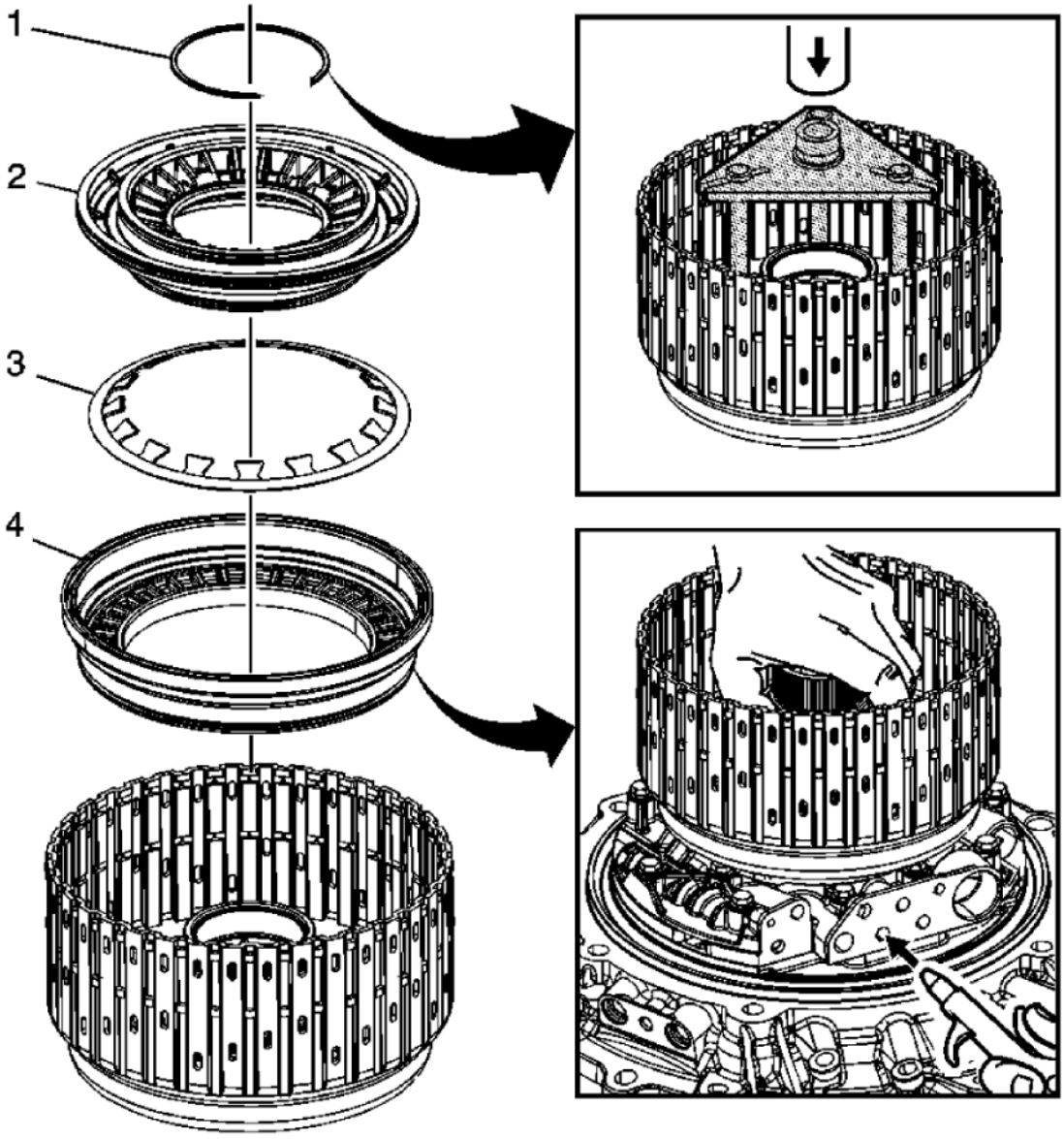


Fig. 150: Removing 3-5 Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

3-5 Reverse Clutch Piston Removal

Callout	Component Name
Preliminary Procedure	
1. Install the 1-2-3-4 and 3-5 reverse clutch housing assembly onto the torque converter (with fluid pump) housing assembly. 2. Apply hand pressure on the 1-2-3-4 clutch piston housing while applying compressed	

air to the apply passage in order to unseat the 3-5 reverse clutch piston.	
1	1-2-3-4 Clutch Piston Housing Retaining Ring **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **DT 47867** Adjustable Clutch Spring Compressor. See **Special Tools**.
2	1-2-3-4 Clutch Piston Housing
3	3-5 Reverse Clutch Spring
4	3-5 Reverse Clutch Piston **Tip:** It may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.

1-2-3-4 AND 3-5 REVERSE CLUTCH PISTON SEALS REPLACEMENT

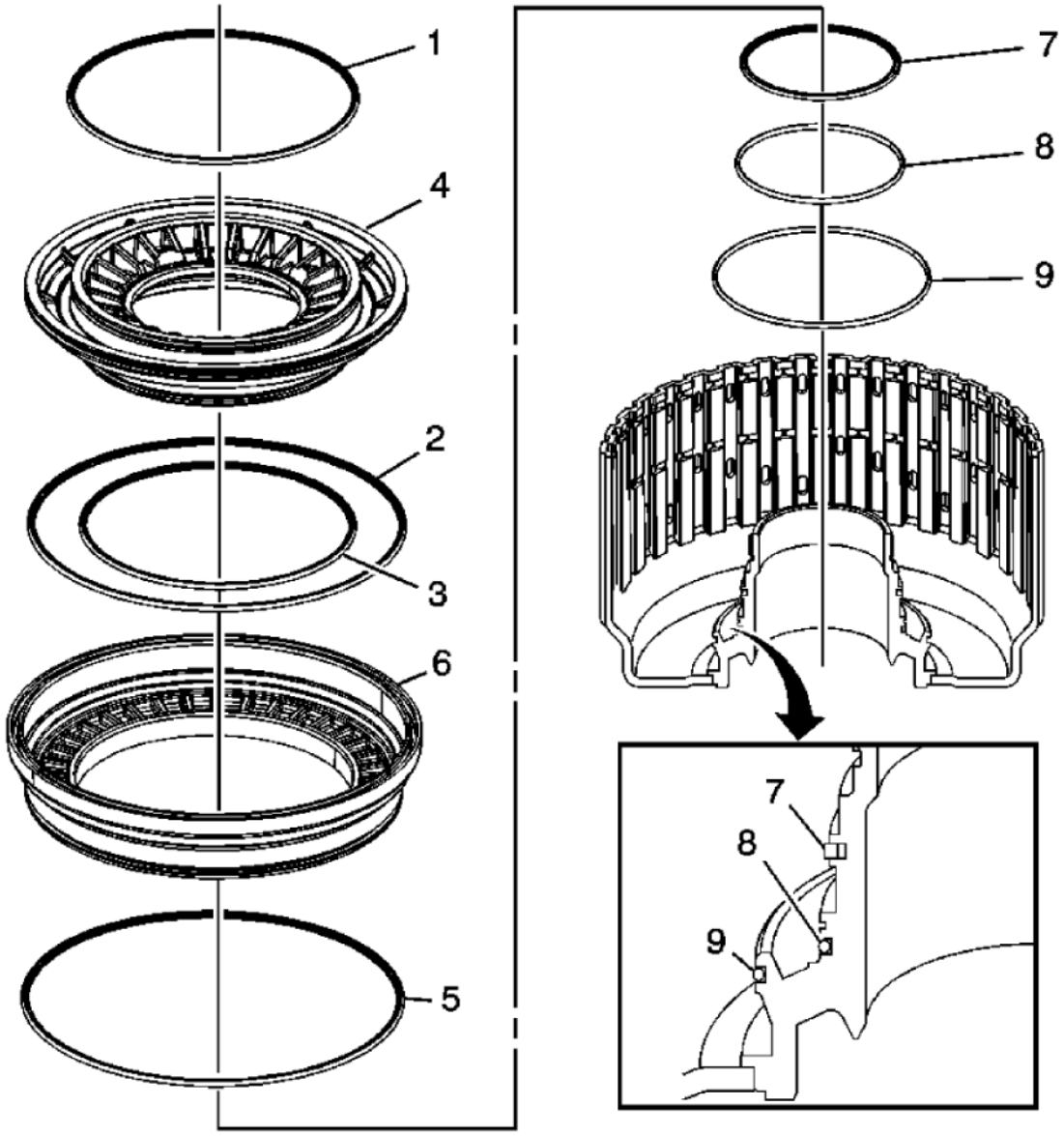


Fig. 151: Replacing 1-2-3-4 and 3-5 Reverse Clutch Piston Seals
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Piston Seals Replacement

Callout	Component Name
NOTE: Refer to Seal Reuse Notice . **Preliminary Procedure:** Lubricate all seals with automatic transmission fluid (ATF) prior to installation.	

1	1-2-3-4 Clutch Piston Seal
2	3-5 Reverse Clutch Piston Dam (O-Ring) Seal
3	3-5 Reverse Clutch Piston Inner Seal
4	1-2-3-4 Clutch Piston Housing
5	3-5 Reverse Clutch Piston Outer Seal
6	3-5 Reverse Clutch Piston
7	1-2-3-4 Clutch Piston Inner Seal **NOTE:** **Do not install a NEW 1-2-3-4 clutch piston inner seal yet. A special tool used to install the 1-2-3-4 clutch piston housing retaining ring may damage the seal if the seal is installed prior to installing the retaining ring. Refer to 3-5 Reverse Clutch Piston Installation.**
8	1-2-3-4 Clutch Piston Housing Seal
9	1-2-3-4 Clutch Piston Housing Seal

3-5 REVERSE CLUTCH PISTON INSTALLATION

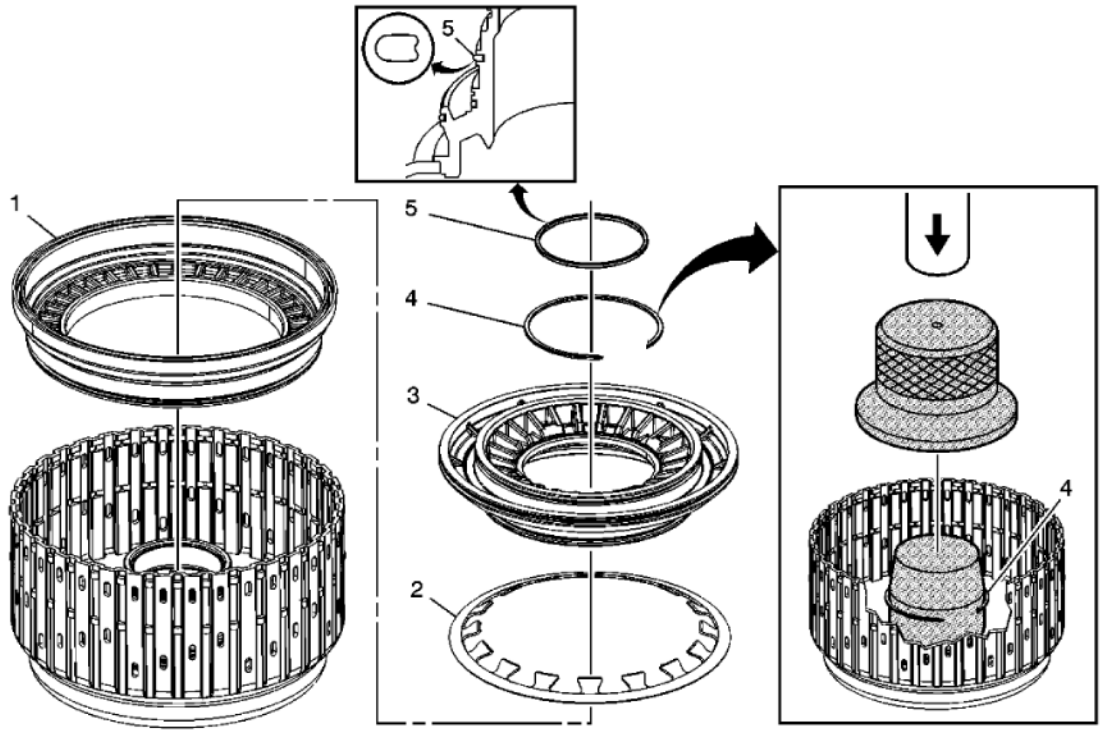


Fig. 152: Installing 3-5 Reverse Clutch Piston

Courtesy of GENERAL MOTORS CORP.

3-5 Reverse Clutch Piston Installation

Callout	Component Name
1	3-5 Reverse Clutch Piston
2	3-5 Reverse Clutch Spring **NOTE:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Housing
4	1-2-3-4 Clutch Piston Housing Retaining Ring **NOTE:** **Before using the DT 47782-2, push the retaining ring over the DT 47782-1 by hand so that the ring is positioned below the tapered area of the DT 47782-1. If the ring is positioned above the tapered area when it is being installed, the ring will become lodged between both tools and damage to the tools, retaining ring, and piston housing will result.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **NOTE:** **Push the retaining ring down over the cone until the ring seats firmly in the retaining ring groove. The retaining ring will make a distinctive click sound when it seats. Failure to properly seat the retaining ring may cause damage to the 3-5 reverse clutch assembly.** **Special Tools** • **DT 47782-1** Retaining Ring Cone. See **Special Tools**. • **DT 47782-2** Retaining Ring Installer. See **Special Tools**.
	1-2-3-4 Clutch Piston Inner Seal

5	**NOTE:** **Install a NEW seal and orientate as shown. Failure to do so may cause internal transmission leaks and damage to the transmission.**

1-2-3-4 CLUTCH PISTON INSTALLATION

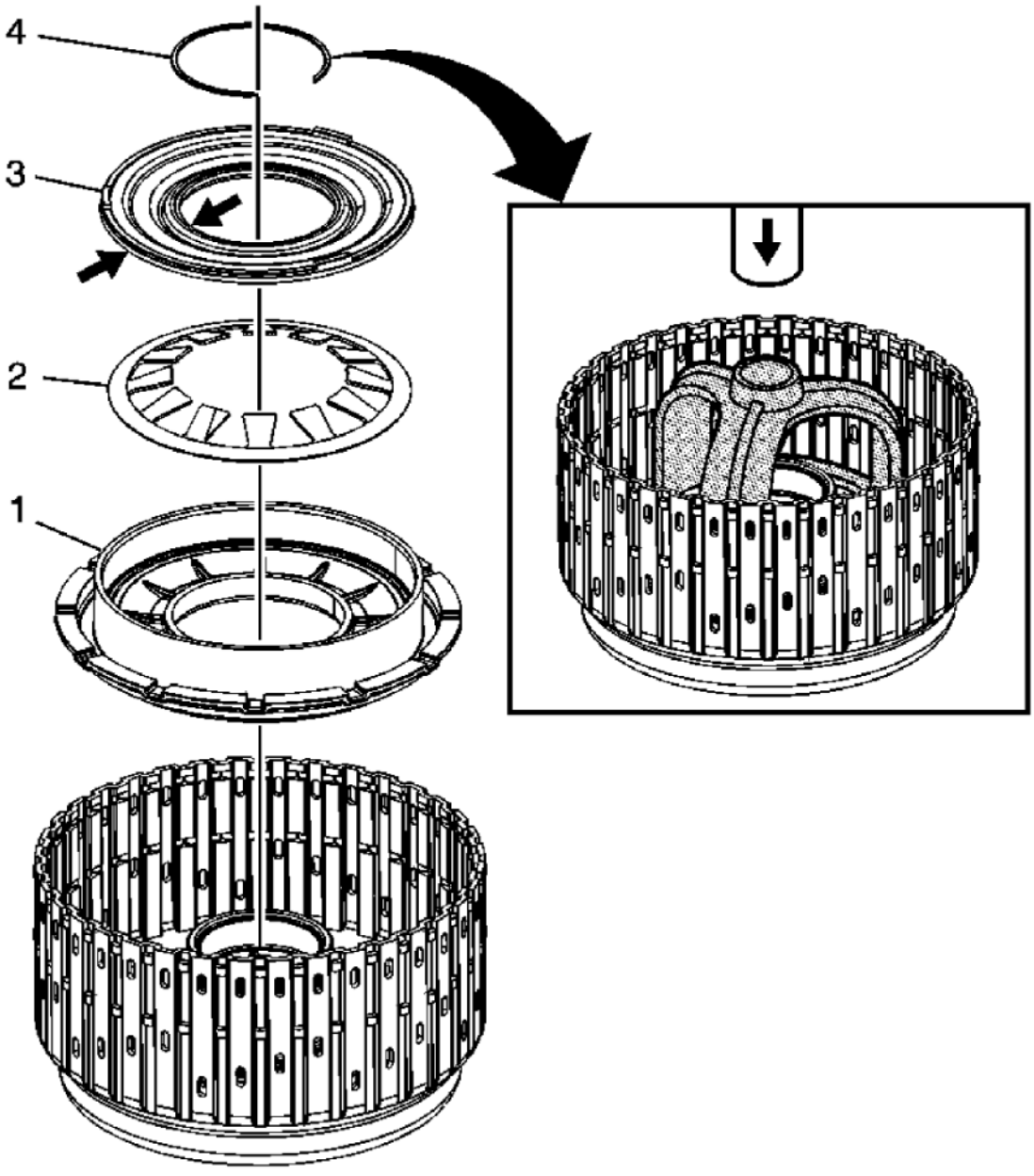


Fig. 153: Installing 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Piston Installation

Callout	Component Name
1	1-2-3-4 Clutch Piston
2	1-2-3-4 Clutch Spring **NOTE:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Dam Assembly **Tip:** Lubricate the inner and outer surfaces of the dam assembly with ATF in order to ease installation into the piston. Install the tabs facing up.
4	1-2-3-4 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.

1-2-3-4 CLUTCH PLATE INSTALLATION

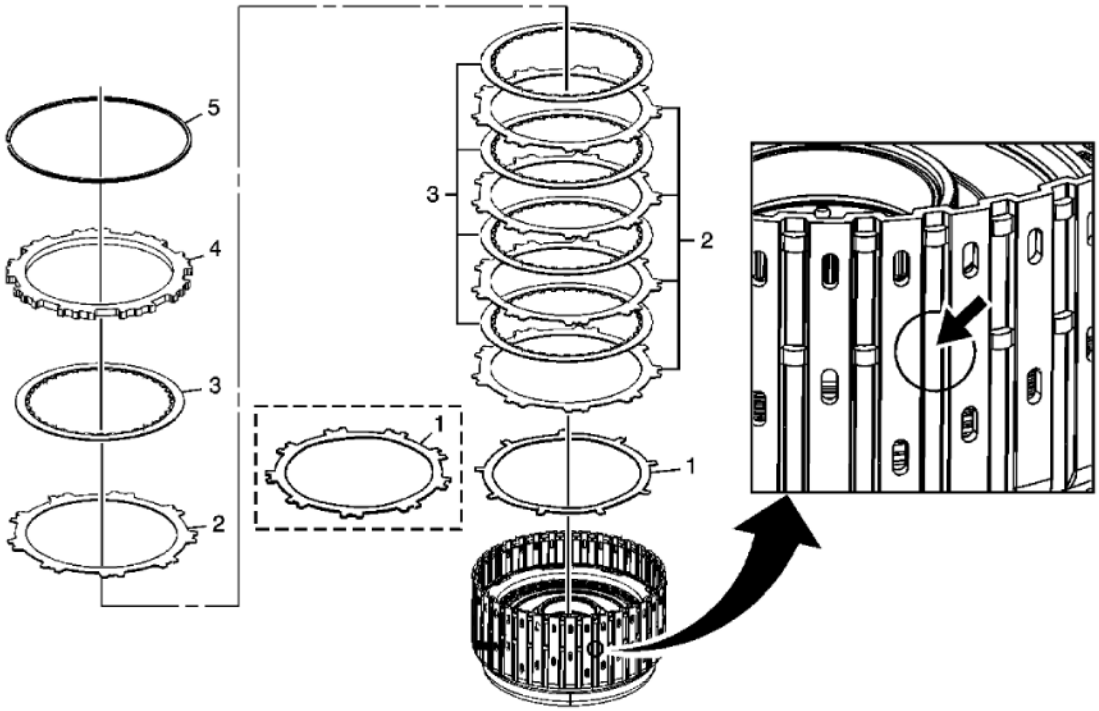


Fig. 154: Installing 1-2-3-4 Clutch Plate
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Plate Installation

Callout	Component Name
1	1-2-3-4 Clutch (Waved) Plate **NOTE:** **Ensure an opening between the external splines of the waved plate is oriented with the missing snap ring groove punch in the housing. Failure to do so may cause damage to the clutch assembly.**
2	1-2-3-4 Clutch Plate (Qty: 5) **NOTE:** **Ensure all clutch plates are centered in the housing. When installing the first steel clutch plate, ensure an opening between the external splines is oriented with the missing snap ring groove punch in the housing. Align the external splines of each remaining steel clutch plate with the first steel clutch plate. Failure to do so may cause damage to the clutch assembly.**

3	1-2-3-4 Clutch Plate Assembly (Qty: 5)
4	1-2-3-4 Clutch Backing Plate **NOTE:** **Align the external splines of the backing plate with the external splines of the steel clutch plates. Failure to do so may cause damage to the clutch assembly.**
5	1-2-3-4 Clutch Backing Plate Retaining Ring **NOTE:** **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in the housing or the offset punch in the housing. Failure to do so may cause damage to the clutch assembly.** **Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **1-2-3-4 Clutch Backing Plate Retaining Ring Measurement**.

3-5 AND REVERSE CLUTCH PLATE INSTALLATION

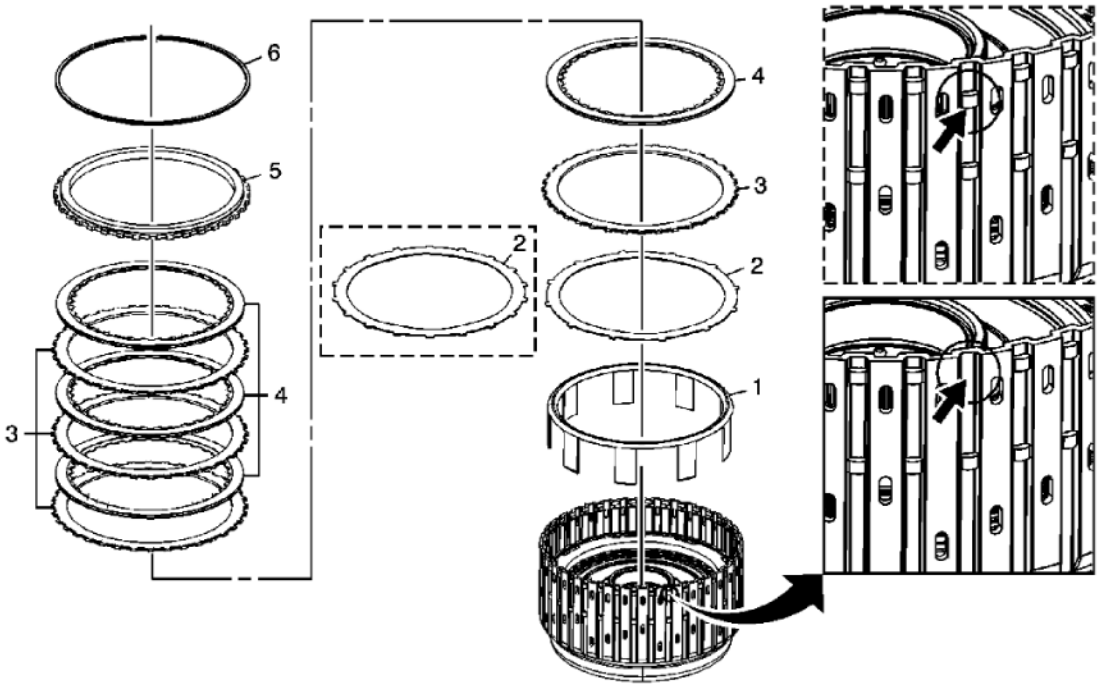


Fig. 155: Installing 3-5 and Reverse Clutch Plate
Courtesy of GENERAL MOTORS CORP.

3-5 and Reverse Clutch Plate Installation

Callout	Component Name
1	3-5 Reverse Clutch Apply Ring **NOTE:** **Ensure apply ring legs are positioned into the 3-5 reverse clutch piston. Failure to do so may cause damage to the 3-5 reverse clutch assembly.**
2	3-5 Reverse Clutch (Waved) Plate
3	3-5 Reverse Clutch Plate (Qty: 4)
4	3-5 Reverse Clutch Plate Assembly (Qty: 4)
5	3-5 Reverse Clutch Backing Plate
	3-5 Reverse Clutch Backing Plate Retaining Ring **NOTE:** **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in the housing or the offset punch in the housing. Failure to do so may cause damage to the**

	clutch assembly.
6	**Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **3-5 Reverse Clutch Backing Plate Retaining Ring Measurement (6L80/6L90)**.

1-2-3-4 AND 3-5 REVERSE CLUTCH BEARING ASSEMBLY REPLACEMENT

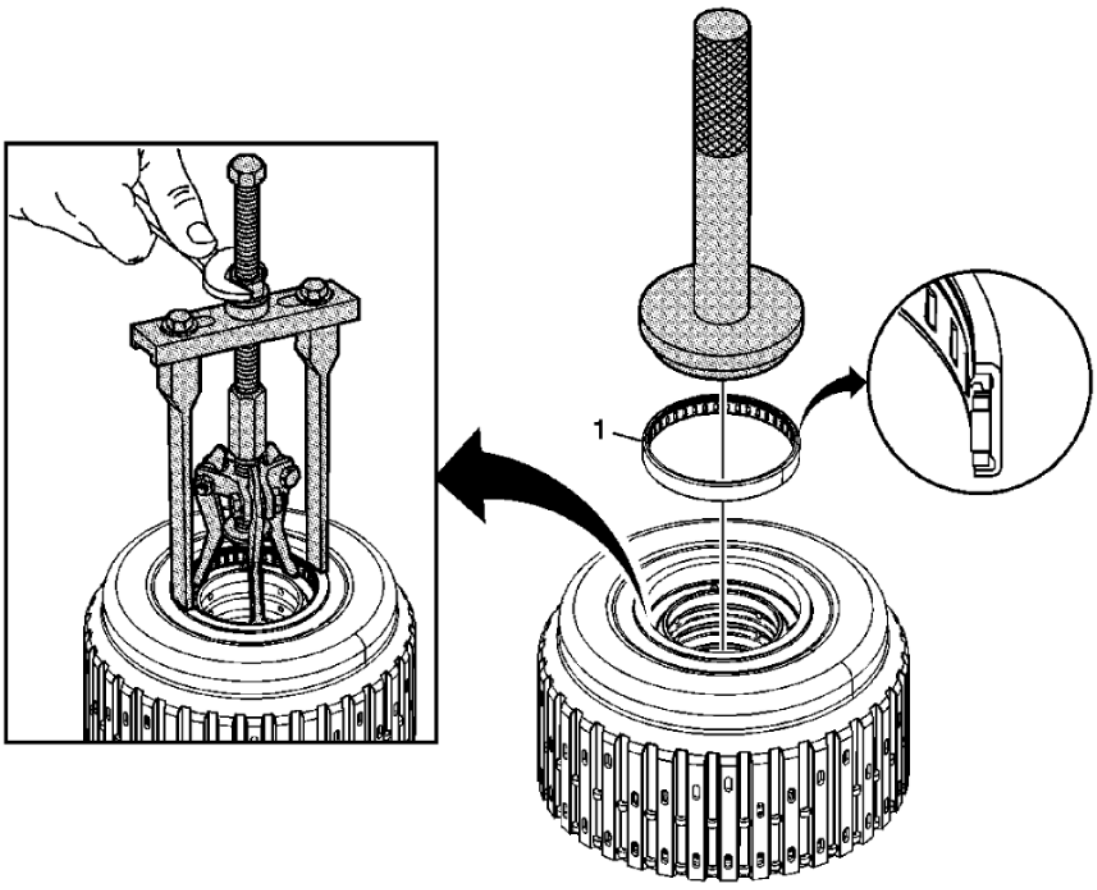


Fig. 156: Replacing 1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly Replacement

Callout	Component Name
	3-5 Reverse Clutch Bearing

1	**NOTE:** **Install the NEW bearing assembly with the seal side up. Improper installation of the bearing may cause damage to the transmission.** **NOTE:** **Do not reuse the bearing. Install a NEW bearing. Reusing an old bearing may cause damage to the transmission.** **Specification:** Install the bearing flush to 0.3 mm below the thrust surface. **Special Tools** • **DT 47865** Bearing Remover. See **Special Tools**. • **DT 47866** Bearing Installer. See **Special Tools**. • **J 8092** Driver Handle • **J 45124** Removal Bridge. See **Special Tools**.

1-2-3-4 AND 3-5 REVERSE CLUTCH OVERHAUL (6L90)

1-2-3-4 AND 3-5 REVERSE CLUTCH PLATES REMOVAL

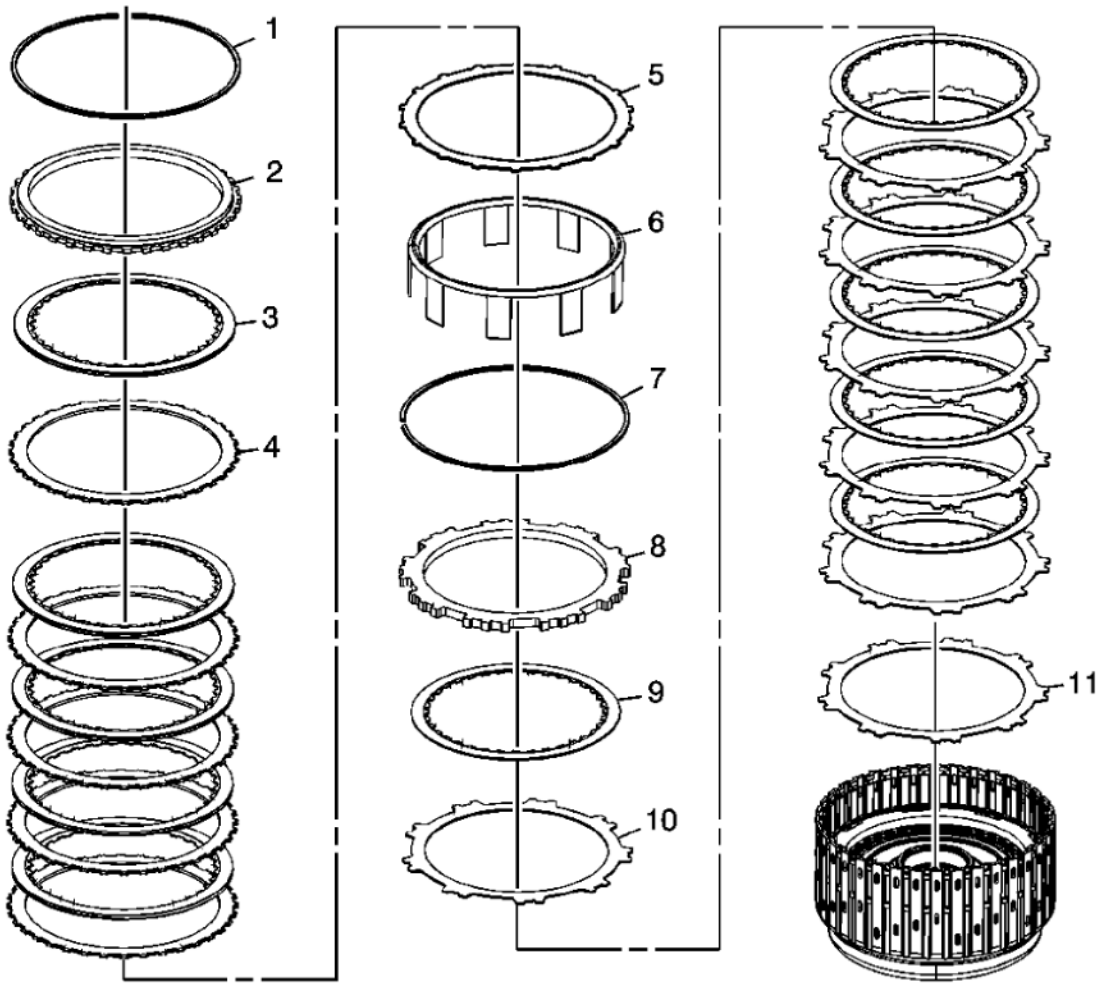


Fig. 157: 1-2-3-4 and 3-5 Reverse Clutch Plates Removal
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Plates Removal

Callout	Component Name
1	3-5 Reverse Clutch Backing Plate Retaining Ring
2	3-5 Reverse Clutch Backing Plate
3	3-5 Reverse Clutch Plate Assembly (Qty: 5)
4	3-5 Reverse Clutch Plate (Qty: 5)
5	3-5 Reverse Clutch (Waved) Plate
6	3-5 Reverse Clutch Apply Ring
7	1-2-3-4 Clutch Backing Plate Retaining Ring

8	1-2-3-4 Clutch Backing Plate
9	1-2-3-4 Clutch Plate Assembly (Qty: 6)
10	1-2-3-4 Clutch Plate (Qty: 6)
11	1-2-3-4 Clutch (Waved) Plate

1-2-3-4 CLUTCH PISTON REMOVAL

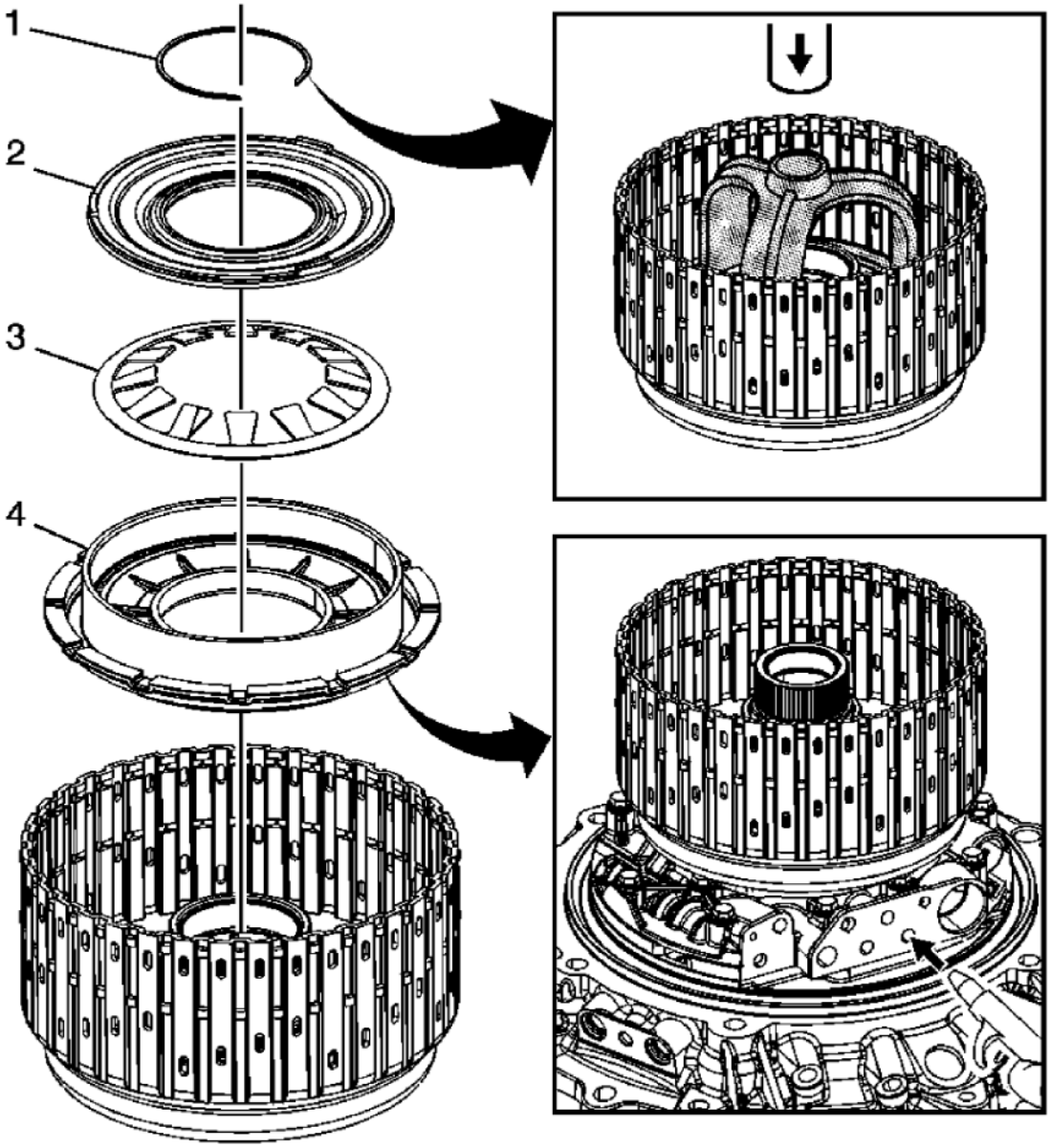


Fig. 158: Removing 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Piston Removal

Callout	Component Name
1	1-2-3-4 Clutch Piston Dam Retaining Ring. **NOTE:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.
2	1-2-3-4 Clutch Piston Dam Assembly
3	1-2-3-4 Clutch Spring
4	1-2-3-4 Clutch Piston **Tip:** • It may be necessary to apply air to the apply passage in order to remove the piston. Install the 1-2-3-4 clutch housing onto the torque converter (with fluid pump) housing assembly in order to apply air. • After air is applied, it may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.

3-5 REVERSE CLUTCH PISTON REMOVAL

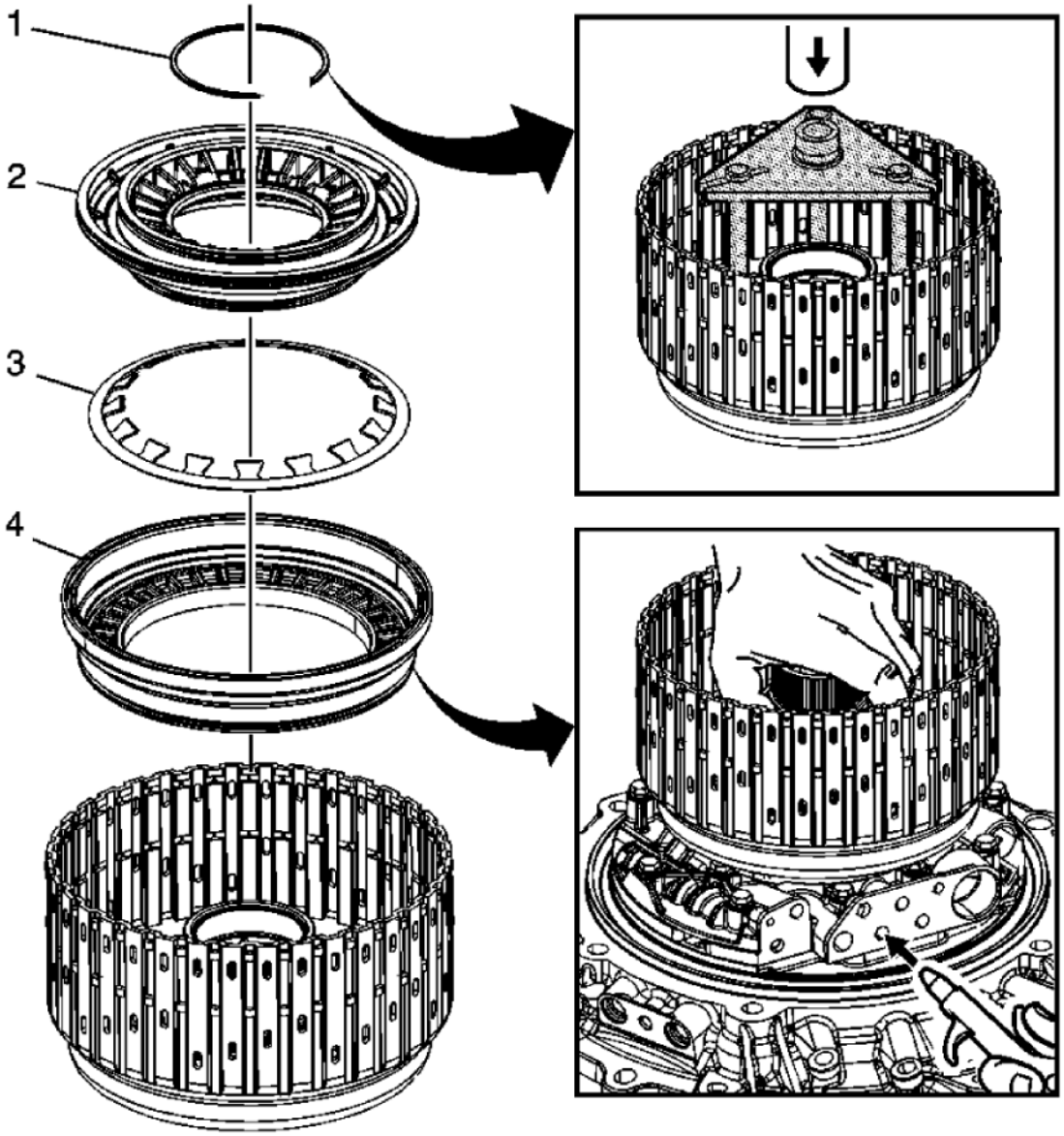


Fig. 159: Removing 3-5 Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

3-5 Reverse Clutch Piston Removal

Callout	Component Name
Preliminary Procedure	
1. Install the 1-2-3-4 and 3-5 reverse clutch housing assembly onto the torque converter (with fluid pump) housing assembly. 2. Apply hand pressure on the 1-2-3-4 clutch piston housing while applying compressed	

air to the apply passage in order to unseat the 3-5 reverse clutch piston.	
1	1-2-3-4 Clutch Piston Housing Retaining Ring **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **DT 47867** Adjustable Clutch Spring Compressor. See **Special Tools**.
2	1-2-3-4 Clutch Piston Housing
3	3-5 Reverse Clutch Spring
4	3-5 Reverse Clutch Piston **Tip:** It may be necessary to turn the housing assembly upside down and carefully tap the housing against a flat surface in order to release the piston.

1-2-3-4 AND 3-5 REVERSE CLUTCH PISTON SEALS REPLACEMENT

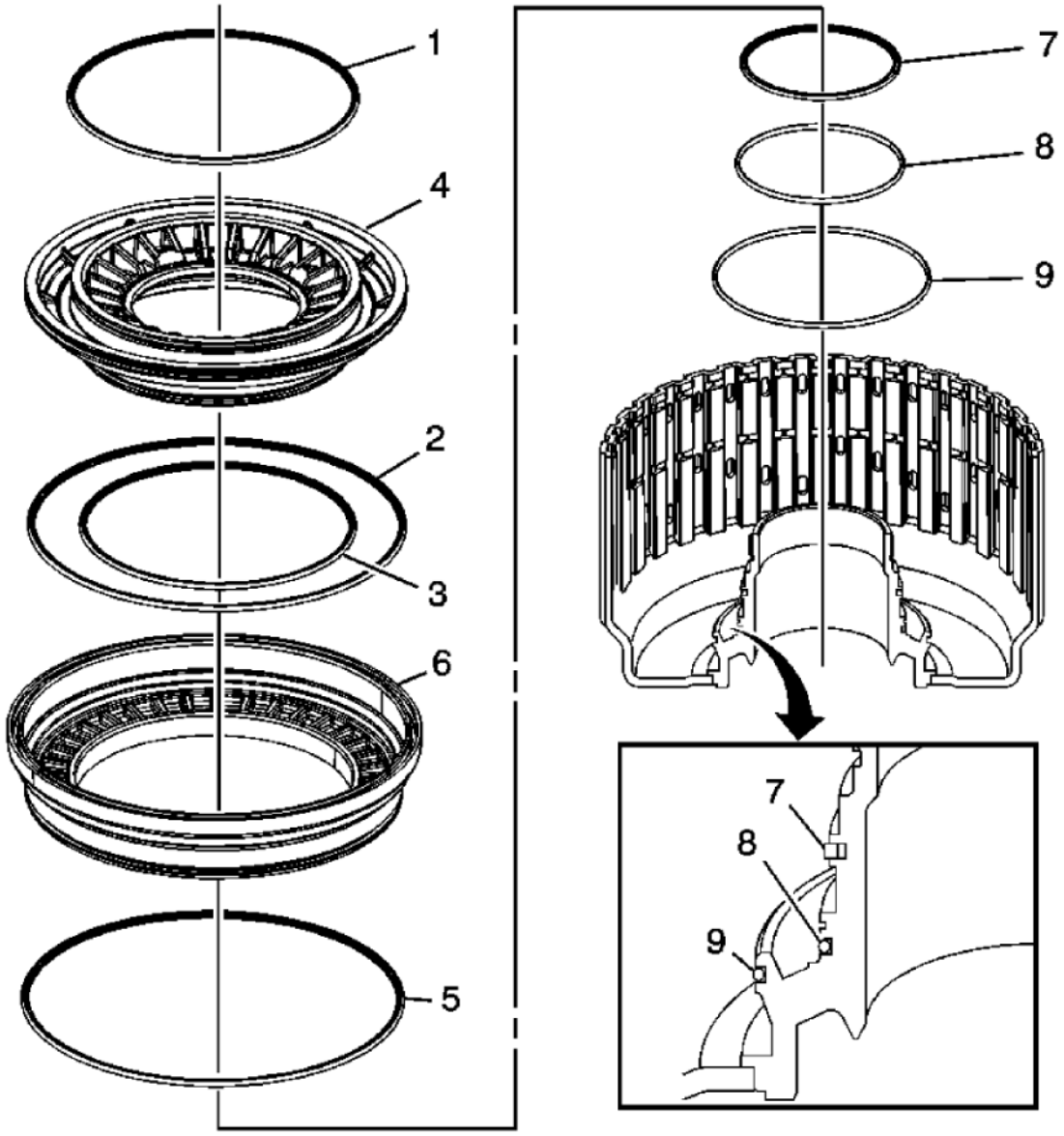


Fig. 160: Replacing 1-2-3-4 and 3-5 Reverse Clutch Piston Seals
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Piston Seals Replacement

Callout	Component Name
NOTE: Refer to Seal Reuse Notice . **Preliminary Procedure:** Lubricate all seals with automatic transmission fluid (ATF) prior to installation.	

1	1-2-3-4 Clutch Piston Seal
2	3-5 Reverse Clutch Piston Dam (O-Ring) Seal
3	3-5 Reverse Clutch Piston Inner Seal
4	1-2-3-4 Clutch Piston Housing
5	3-5 Reverse Clutch Piston Outer Seal
6	3-5 Reverse Clutch Piston
7	1-2-3-4 Clutch Piston Inner Seal **NOTE:** **Do not install a NEW 1-2-3-4 clutch piston inner seal yet. A special tool used to install the 1-2-3-4 clutch piston housing retaining ring may damage the seal if the seal is installed prior to installing the retaining ring. Refer to 3-5 Reverse Clutch Piston Installation.**
8	1-2-3-4 Clutch Piston Housing Seal
9	1-2-3-4 Clutch Piston Housing Seal

3-5 REVERSE CLUTCH PISTON INSTALLATION

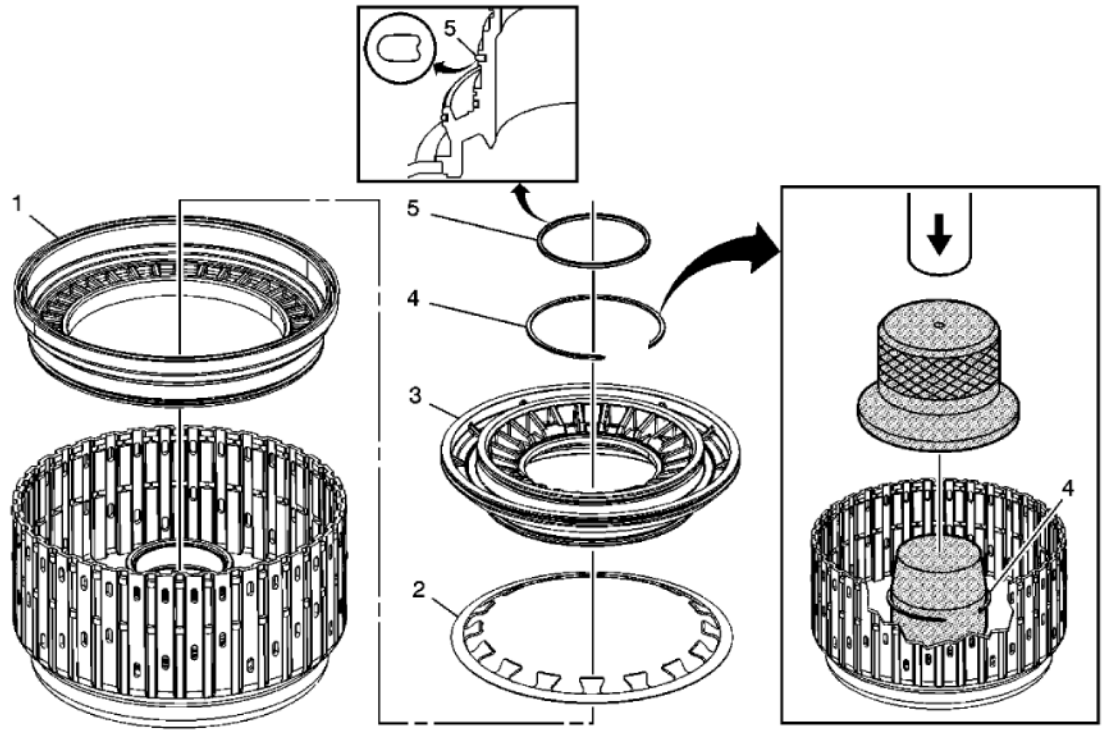


Fig. 161: Installing 3-5 Reverse Clutch Piston

Courtesy of GENERAL MOTORS CORP.

3-5 Reverse Clutch Piston Installation

Callout	Component Name
1	3-5 Reverse Clutch Piston
2	3-5 Reverse Clutch Spring **NOTE:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Housing
4	1-2-3-4 Clutch Piston Housing Retaining Ring **NOTE:** **Before using the DT 47782-2, push the retaining ring over the DT 47782-1 by hand so that the ring is positioned below the tapered area of the DT 47782-1. If the ring is positioned above the tapered area when it is being installed, the ring will become lodged between both tools and damage to the tools, retaining ring, and piston housing will result.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **NOTE:** **Push the retaining ring down over the cone until the ring seats firmly in the retaining ring groove. The retaining ring will make a distinctive click sound when it seats. Failure to properly seat the retaining ring may cause damage to the 3-5 reverse clutch assembly.** **Special Tools** • **DT 47782-1** Retaining Ring Cone. See **Special Tools**. • **DT 47782-2** Retaining Ring Installer. See **Special Tools**.
	1-2-3-4 Clutch Piston Inner Seal

5	**NOTE:** **Install a NEW seal and orientate as shown. Failure to do so may cause internal transmission leaks and damage to the transmission.**

1-2-3-4 CLUTCH PISTON INSTALLATION

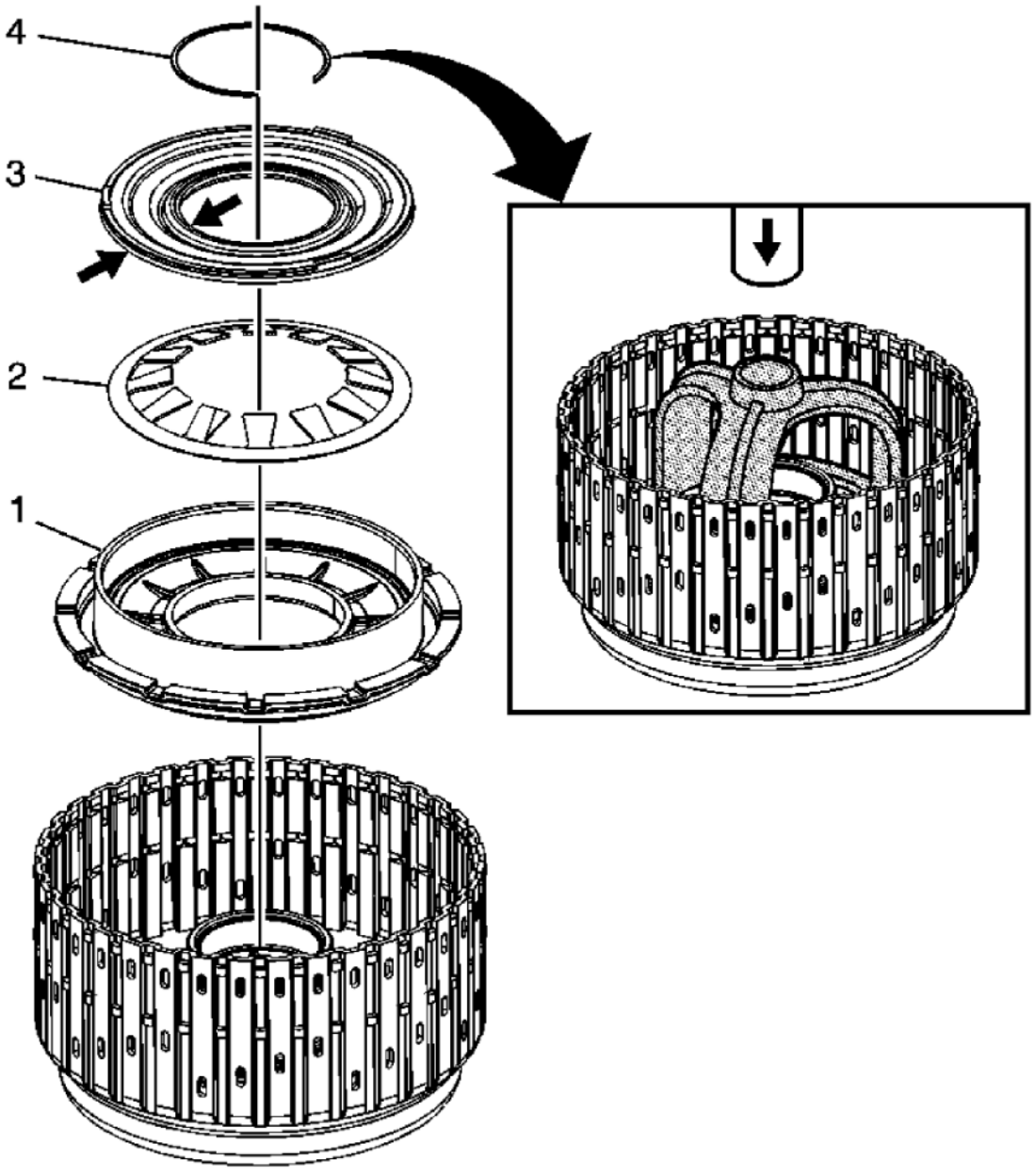


Fig. 162: Installing 1-2-3-4 Clutch Piston
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Piston Installation

Callout	Component Name
1	1-2-3-4 Clutch Piston
2	1-2-3-4 Clutch Spring **NOTE:** **Ensure the clutch spring is centered on the piston with the tabs facing up. Failure to do so may cause damage to the clutch assembly.**
3	1-2-3-4 Clutch Piston Dam Assembly **Tip:** Lubricate the inner and outer surfaces of the dam assembly with ATF in order to ease installation into the piston. Install the tabs facing up.
4	1-2-3-4 Clutch Piston Dam Retaining Ring **NOTE:** **Use care when compressing the 1-2-3-4 clutch spring and dam assembly. Compressing the dam assembly too much may damage it.** **NOTE:** **Refer to Retaining Ring Reuse Notice .** **Special Tool:** **J 38734** Intermediate Spring Compressor Adapter. See **Special Tools**.

1-2-3-4 CLUTCH PLATE INSTALLATION

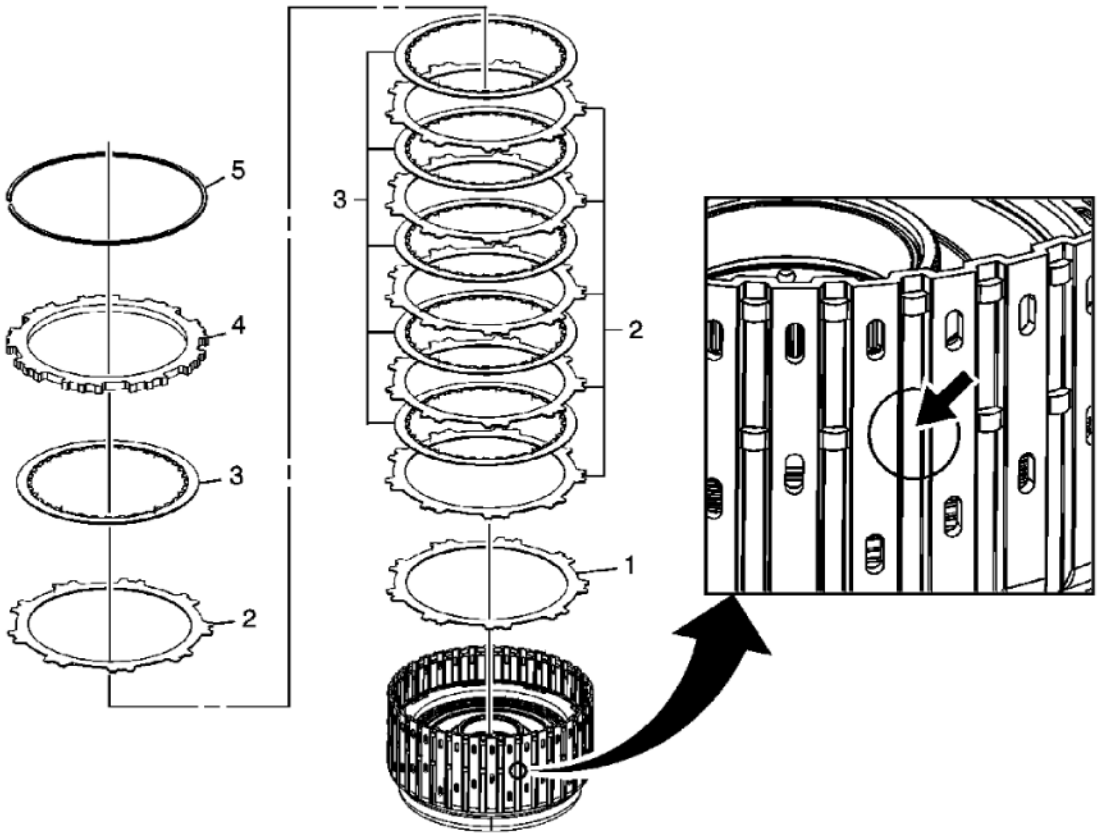


Fig. 163: 1-2-3-4 Clutch Plate Installation
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 Clutch Plate Installation

Callout	Component Name
1	1-2-3-4 Clutch (Waved) Plate **NOTE:** **Ensure an opening between the external splines of the waved plate is oriented with the missing snap ring groove punch in the housing. Failure to do so may cause damage to the clutch assembly.**
2	1-2-3-4 Clutch Plate (Qty: 6) **NOTE:** **Ensure all clutch plates are centered in the housing. When installing the first steel clutch plate, ensure an opening between the external splines is oriented with the missing snap ring groove punch in the housing.**

	Align the external splines of each remaining steel clutch plate with the first steel clutch plate. Failure to do so may cause damage to the clutch assembly.
3	1-2-3-4 Clutch Plate Assembly (Qty: 6)
4	1-2-3-4 Clutch Backing Plate **NOTE:** **Align the external splines of the backing plate with the external splines of the steel clutch plates. Failure to do so may cause damage to the clutch assembly.**
5	1-2-3-4 Clutch Backing Plate Retaining Ring **NOTE:** **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in the housing or the offset punch in the housing. Failure to do so may cause damage to the clutch assembly.** **Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **1-2-3-4 Clutch Backing Plate Retaining Ring Measurement**.

3-5 AND REVERSE CLUTCH PLATE INSTALLATION

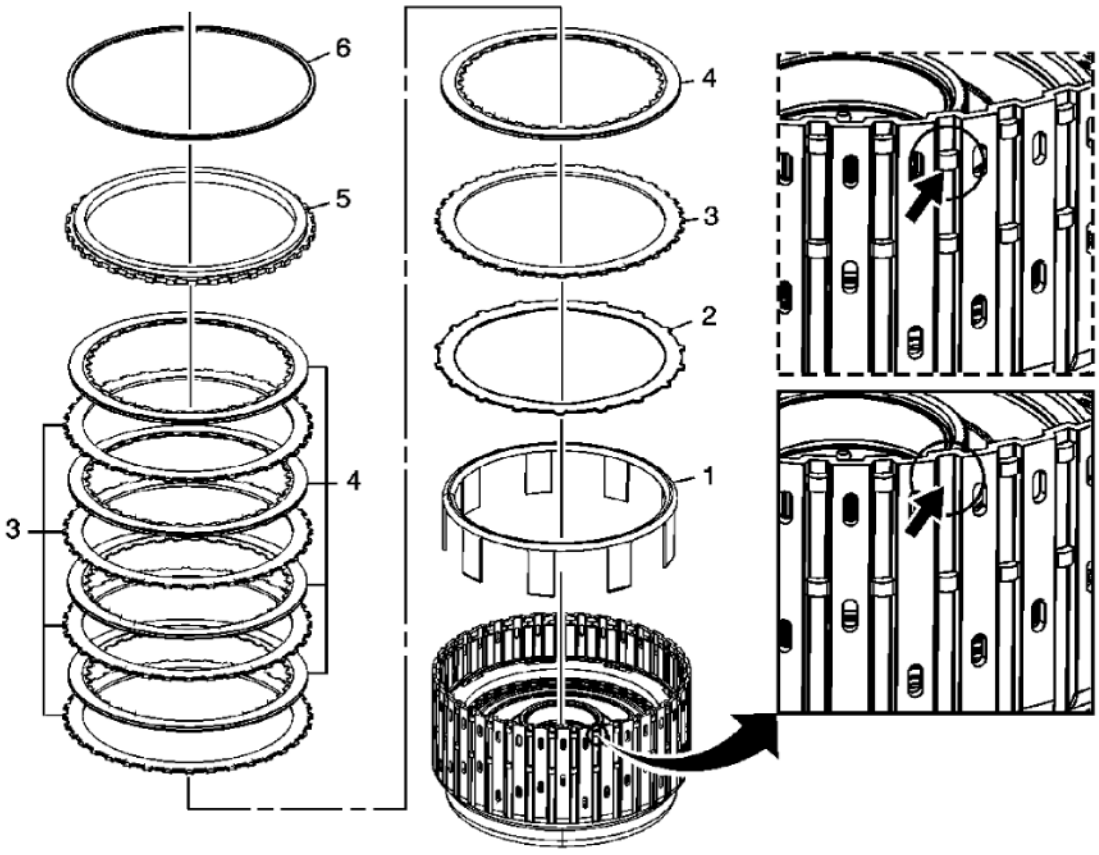


Fig. 164: 3-5 and Reverse Clutch Plate Installation
Courtesy of GENERAL MOTORS CORP.

3-5 and Reverse Clutch Plate Installation

Callout	Component Name
1	3-5 Reverse Clutch Apply Ring **NOTE:** **Ensure apply ring legs are positioned into the 3-5 reverse clutch piston. Failure to do so may cause damage to the 3-5 reverse clutch assembly.**
2	3-5 Reverse Clutch (Waved) Plate
3	3-5 Reverse Clutch Plate (Qty: 5)
4	3-5 Reverse Clutch Plate Assembly (Qty: 5)
5	3-5 Reverse Clutch Backing Plate
	3-5 Reverse Clutch Backing Plate Retaining Ring

6	**NOTE:** **Depending on the housing configuration, align the retaining ring gap with the missing snap ring groove punch in the housing or the offset punch in the housing. Failure to do so may cause damage to the clutch assembly.** **Tip:** After the retaining ring is installed, determine clutch piston travel in order to verify if the correct selective retaining ring is being used. Refer to **3-5 Reverse Clutch Backing Plate Retaining Ring Measurement (6L80/6L90)**.

1-2-3-4 AND 3-5 REVERSE CLUTCH BEARING ASSEMBLY REPLACEMENT

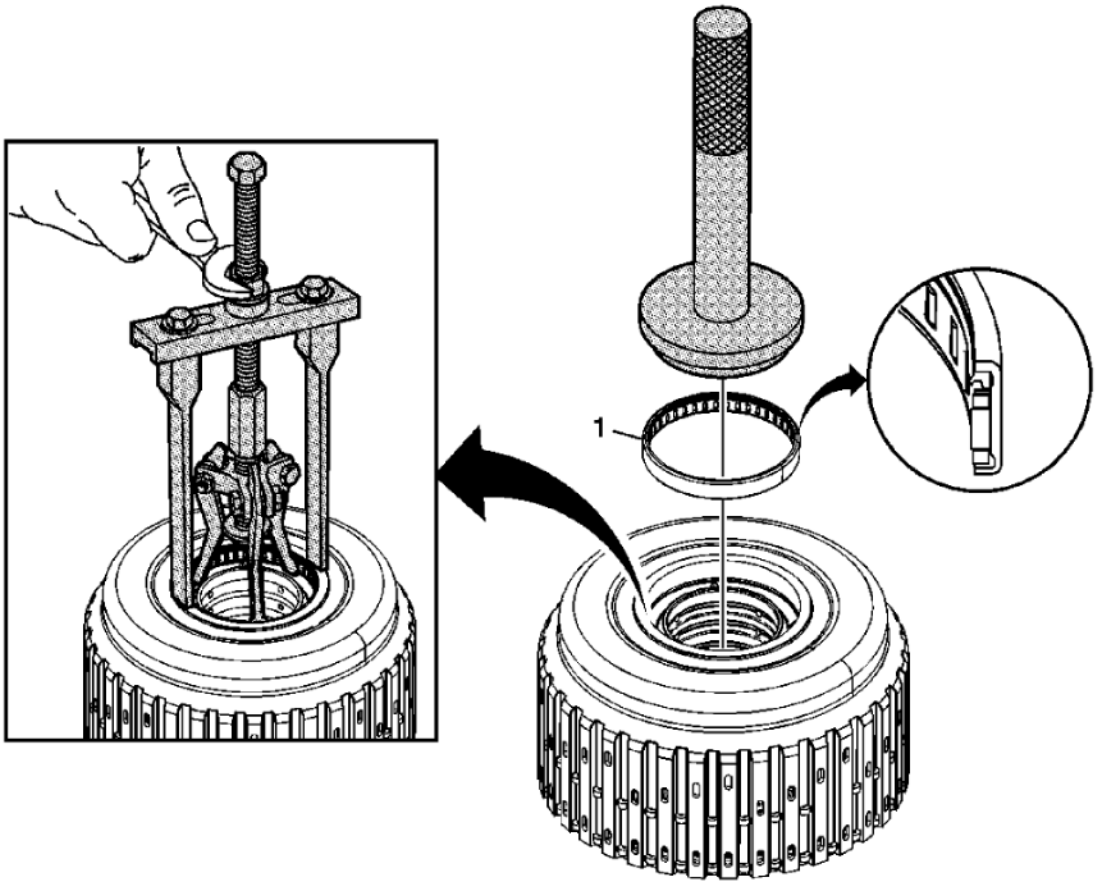


Fig. 165: Replacing 1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly
Courtesy of GENERAL MOTORS CORP.

1-2-3-4 and 3-5 Reverse Clutch Bearing Assembly Replacement

Callout	Component Name
1	3-5 Reverse Clutch Bearing **NOTE:** **Install the NEW bearing assembly with the seal side up. Improper installation of the bearing may cause damage to the transmission.** **NOTE:** **Do not reuse the bearing. Install a NEW bearing. Reusing an old bearing may cause damage to the transmission.** **Specification:** Install the bearing flush to 0.3 mm below the thrust surface. **Special Tools** • **DT 47865** Bearing Remover. See **Special Tools**. • **DT 47866** Bearing Installer. See **Special Tools**. • **J 8092** Driver Handle • **J 45124** Removal Bridge. See **Special Tools**.

1-2-3-4 CLUTCH BACKING PLATE RETAINING RING MEASUREMENT

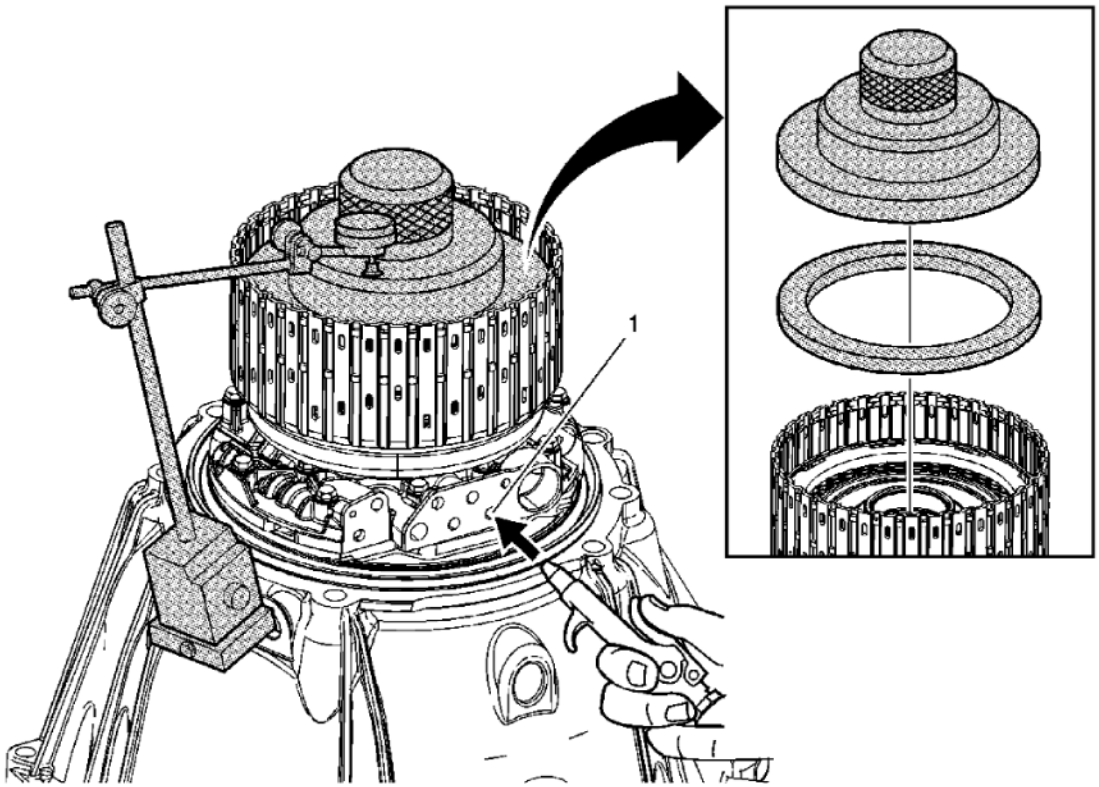


Fig. 166: 1-2-3-4 Clutch Backing Plate Retaining Ring Measurement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

Preliminary Procedures

1. Install the 1-2-3-4 and 3-5 reverse clutch housing with the 1-2-3-4 clutch plates installed, onto the torque converter housing.
2. Install the **DT 47868-2** onto the torque converter housing. See **Special Tools**.
3. Install **DT 47868-1** and **DT-47868-3** onto the 1-2-3-4 clutch backing plate. See **Special Tools**.
4. Install the **J 26900-13** onto **DT 47868-2** . See **Special Tools**.
5. Attach the **J 8001** to the **J 26900-13** and zero out the dial indicator on the **DT 47868-1** . See **Special Tools**.

Special Tools

- **DT 47868-1** Clutch Pack Travel Weight. See **Special Tools**.

• **DT 47868-2** Magnetic Base Adapter. See **Special Tools**. • **DT-47868-3** Clutch Travel Weight Adapter. See **Special Tools**. • **J 8001** Dial Indicator Set • **J 26900-13** Magnetic Base	
1	1-2-3-4 Clutch Apply Passage **Tip:** Apply compressed air to the apply passage hole, at least 3 times and observe the dial indicator measurement each time. This action "fluffs" the clutch plates to ensure an accurate measurement. Refer to **Clutch Backing Plate Retaining Ring Specifications (6L80)** or **Clutch Backing Plate Retaining Ring Specifications (6L90)** .

3-5 REVERSE CLUTCH BACKING PLATE RETAINING RING MEASUREMENT (6L80/6L90)

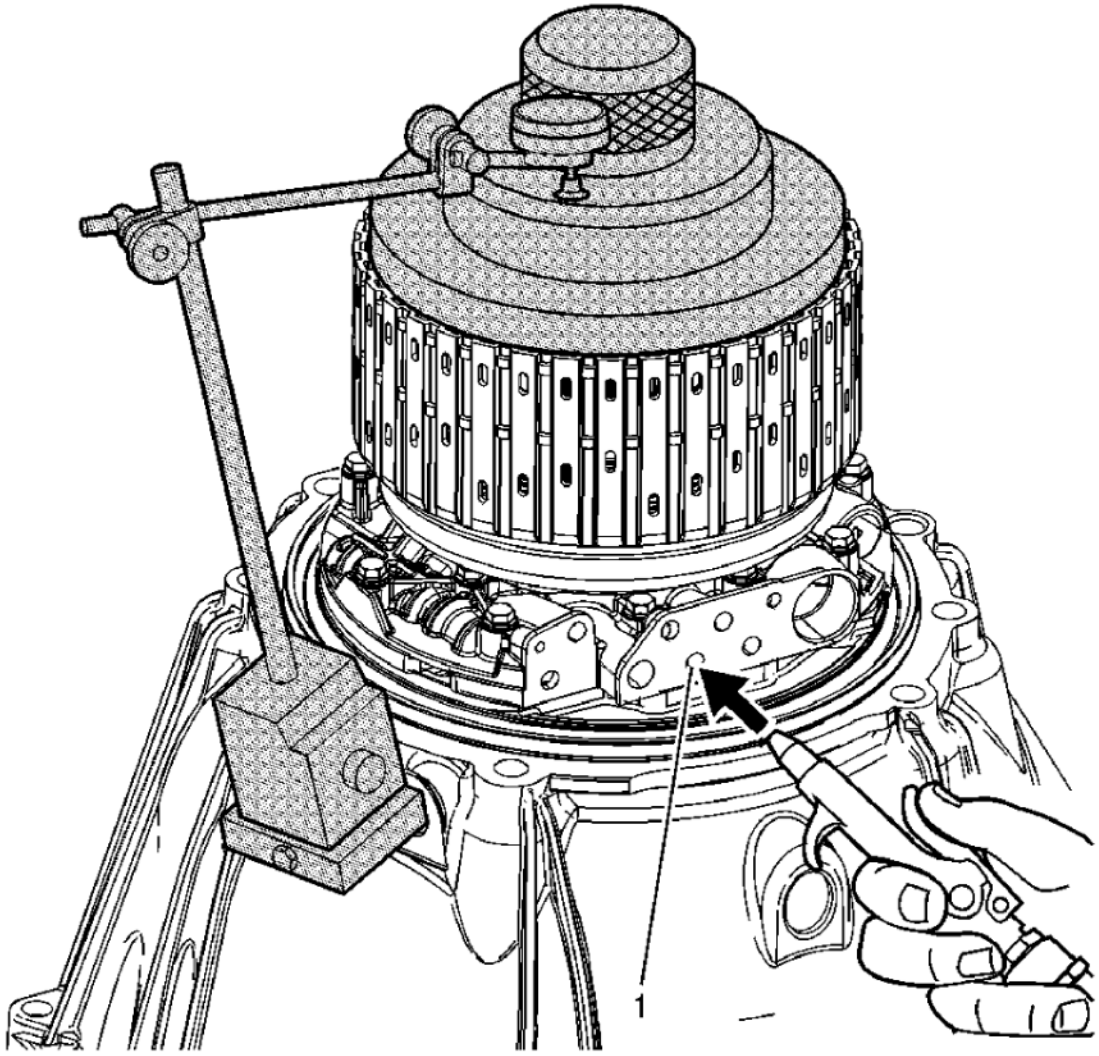


Fig. 167: 3-5 Reverse Clutch Backing Plate Retaining Ring Measurement (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	
1. Install the 1-2-3-4 and 3-5 reverse clutch housing with the 1-2-3-4 and 3-5 reverse clutch plates installed, onto the torque converter housing.	
2. Install the **DT 47868-2** onto the torque converter housing. See **Special Tools**.	
3. Install **DT 47868-1** onto the 3-5 reverse clutch backing plate. See **Special Tools**.	
4. Install the **J 26900-13** onto **DT 47868-2** . See **Special Tools**.	
5. Attach the **J 8001** to the **J 26900-13** and zero out the dial indicator on the **DT 47868-**	

1 . See **Special Tools**. **Special Tools** • **DT 47868-1** Clutch Pack Travel Weight. See **Special Tools**. • **DT 47868-2** Magnetic Base Adapter. See **Special Tools**. • **J 8001** Dial Indicator Set • **J 26900-13** Magnetic Base	
1	3-5 Reverse Clutch Apply Passage **Tip:** Apply compressed air to the apply passage hole, and observe the dial indicator measurement. Refer to **Clutch Backing Plate Retaining Ring Specifications (6L80)** or **Clutch Backing Plate Retaining Ring Specifications (6L90)** .

TORQUE CONVERTER HOUSING WITH FLUID PUMP DISASSEMBLE

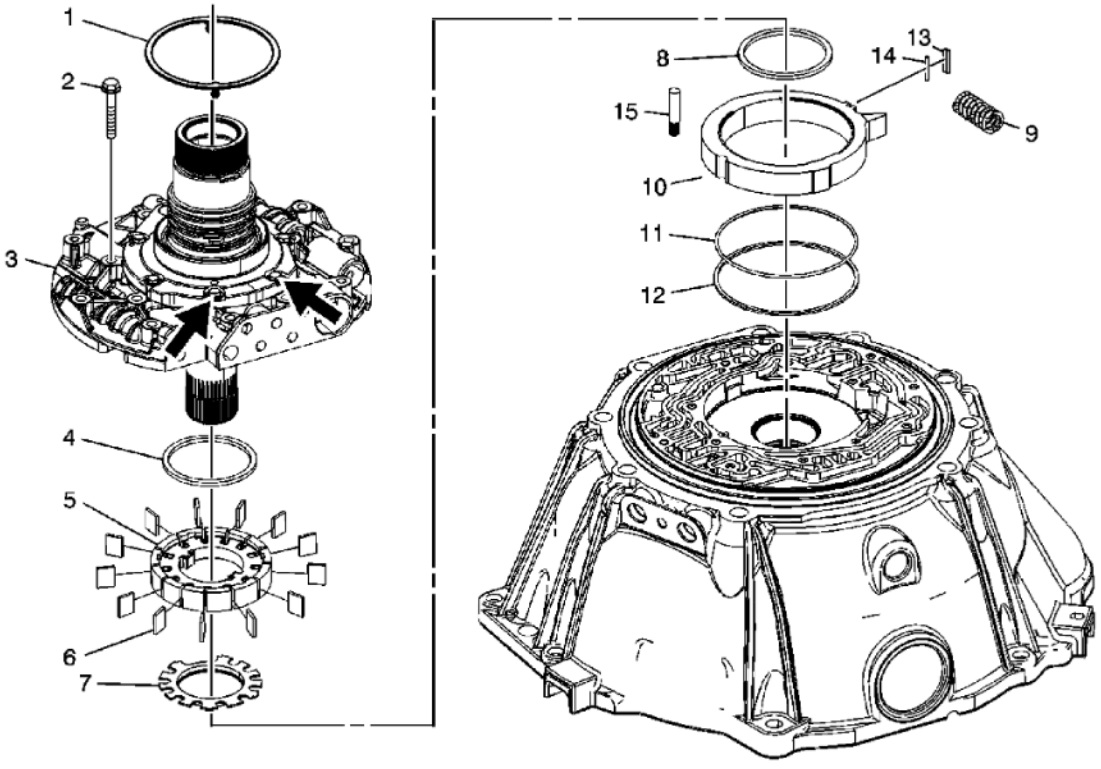


Fig. 168: Torque Converter Housing with Fluid Pump Disassemble
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
NOTE: **Do not loosen or remove the 6 bolts securing the clutch support to the pump cover assembly. These bolts have been installed and torqued only after specific clutch support rotational requirements have been met. If the clutch support is not installed properly, damage to the transmission will occur.**	
1	1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer
2	Bolt M6 x 40 (Qty: 13)
3	Fluid Pump Cover Assembly
4	Fluid Pump Vane Ring
5	Fluid Pump Rotor
6	Fluid Pump Vanes (Qty: 13)
7	Fluid Pump Rotor Guide
8	Fluid Pump Vane Ring
9	Fluid Pump Slide Outer Spring
10	Fluid Pump Slide
11	Fluid Pump Slide (O-Ring) Seal
12	Fluid Pump Slide Fluid Seal Ring
13	Fluid Pump Slide Seal
14	Fluid Pump Slide Seal Support
15	Fluid Pump Slide Pivot Pin

FLUID PUMP COVER CLEANING AND INSPECTION

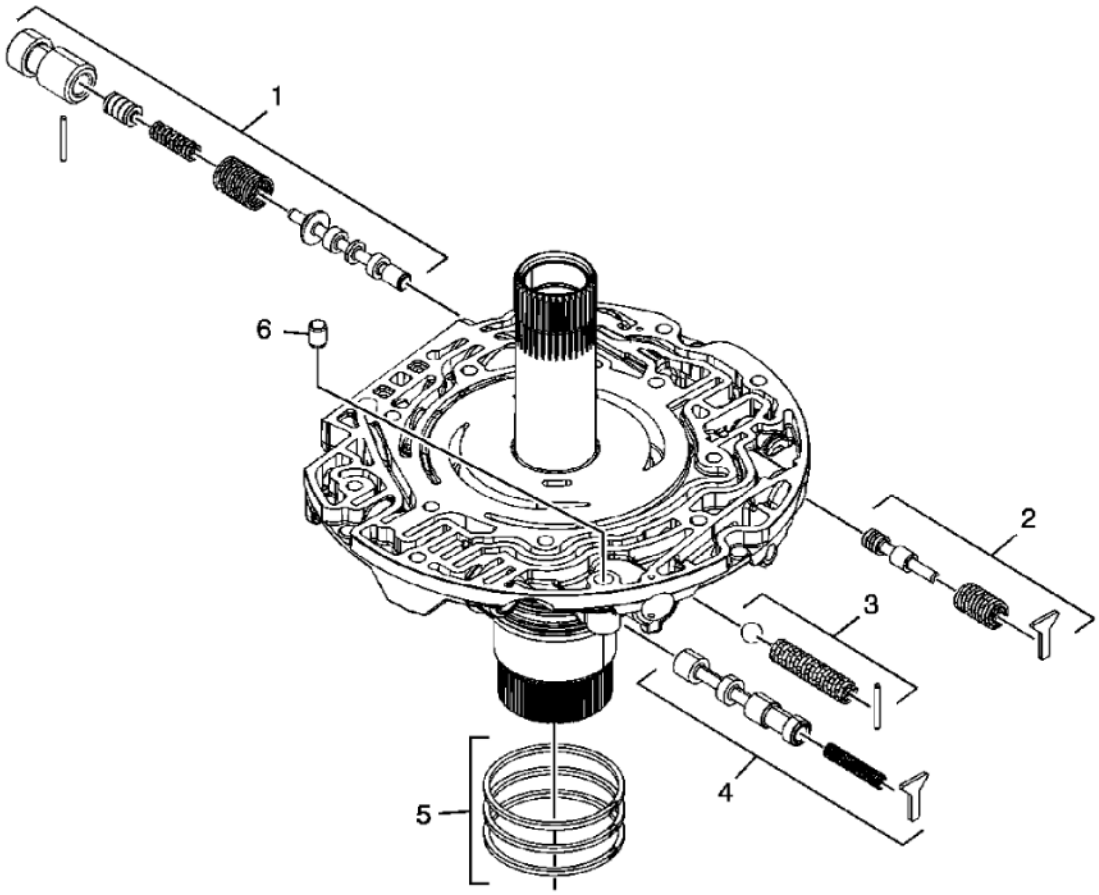


Fig. 169: Fluid Pump Cover Cleaning and Inspection
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: **Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.** **Preliminary Procedure:** Clean and inspect all components and machined surfaces.	
1	Pressure Regulator Valve Train
2	Converter Feed Limit Valve Train
3	Pressure Relief Ball Valve and Spring
4	TCC Control Valve and Spring
	1-2-3-4 and 3-5 Reverse Clutch Fluid Seal Rings (Qty: 3)

5	**NOTE:** **Do not use old seal rings. Install NEW seal rings. Reusing old seal rings may cause internal transmission leaks and transmission damage.**
6	A/Trans Fluid Pump Locator Pin

TORQUE CONVERTER HOUSING CLEANING AND INSPECTION

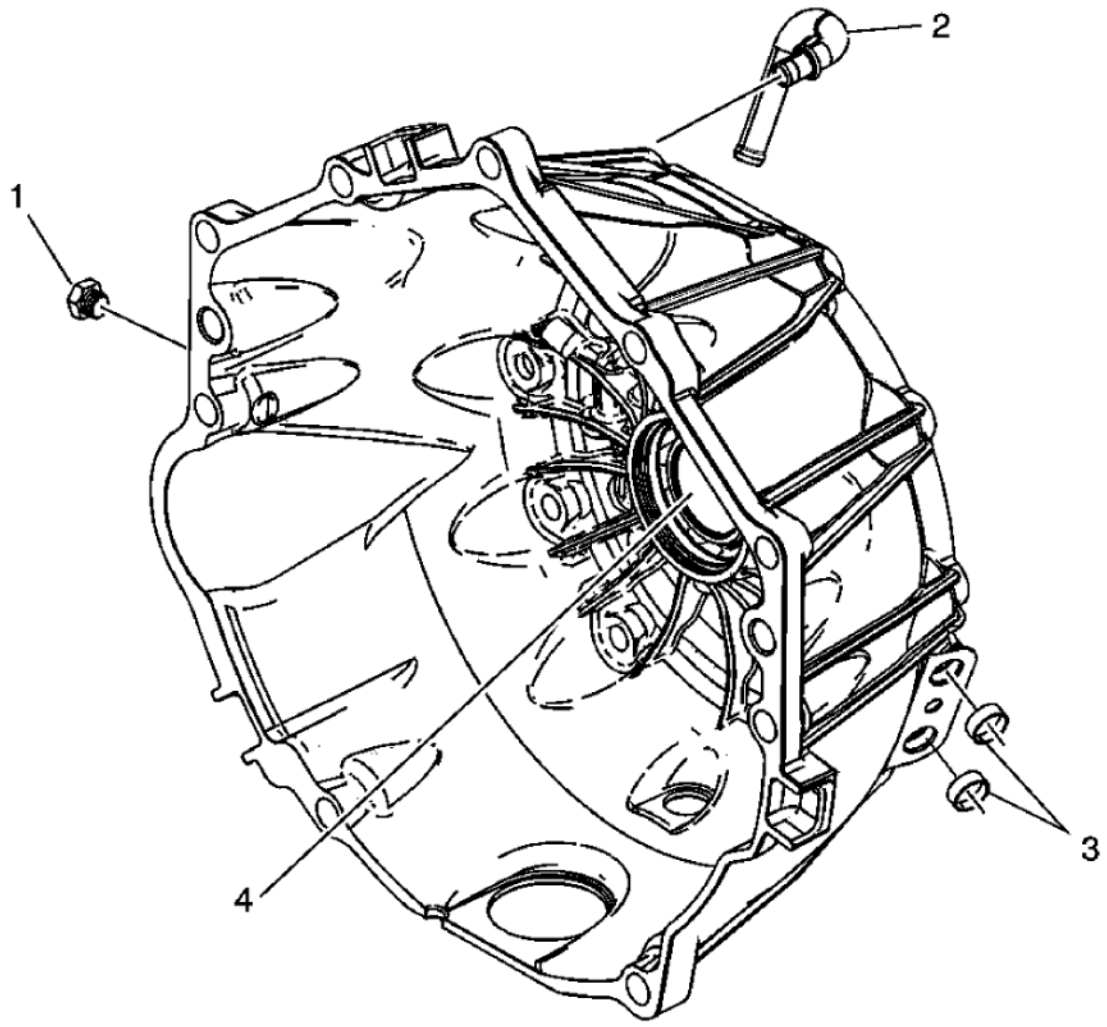


Fig. 170: Torque Converter Housing Cleaning and Inspection
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
Preliminary Procedures	

1. Thoroughly clean the torque converter housing assembly, including threads, with clean solvent.
2. Clean sealing surfaces.
3. Inspect all threaded holes. If necessary, repair any thread damage.

1	Line Pressure Test Hole Plug
2	A/Trans Vent Pipe
3	Trans Fluid Cooler Pipe Fitting Seal **NOTE:** **Refer to Seal Reuse Notice .** **Tip:** Refer to **Fluid Cooler Pipe Seal Replacement**.
4	Torque Converter Bushing

TORQUE CONVERTER FLUID SEAL REPLACEMENT

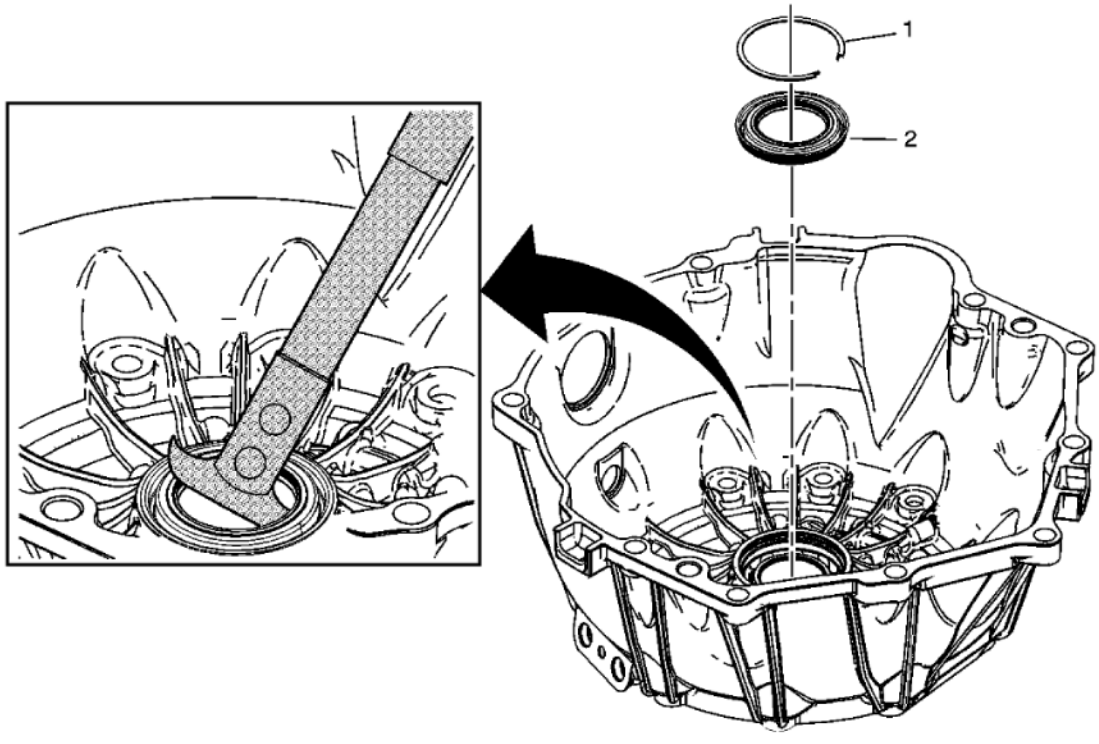


Fig. 171: Torque Converter Fluid Seal Replacement

Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Torque Converter Fluid Seal Retaining Ring
2	Torque Converter Fluid Seal Assembly **Special Tool:** **J 45000** Seal Remover. See **Special Tools**.

FLUID COOLER PIPE SEAL REPLACEMENT

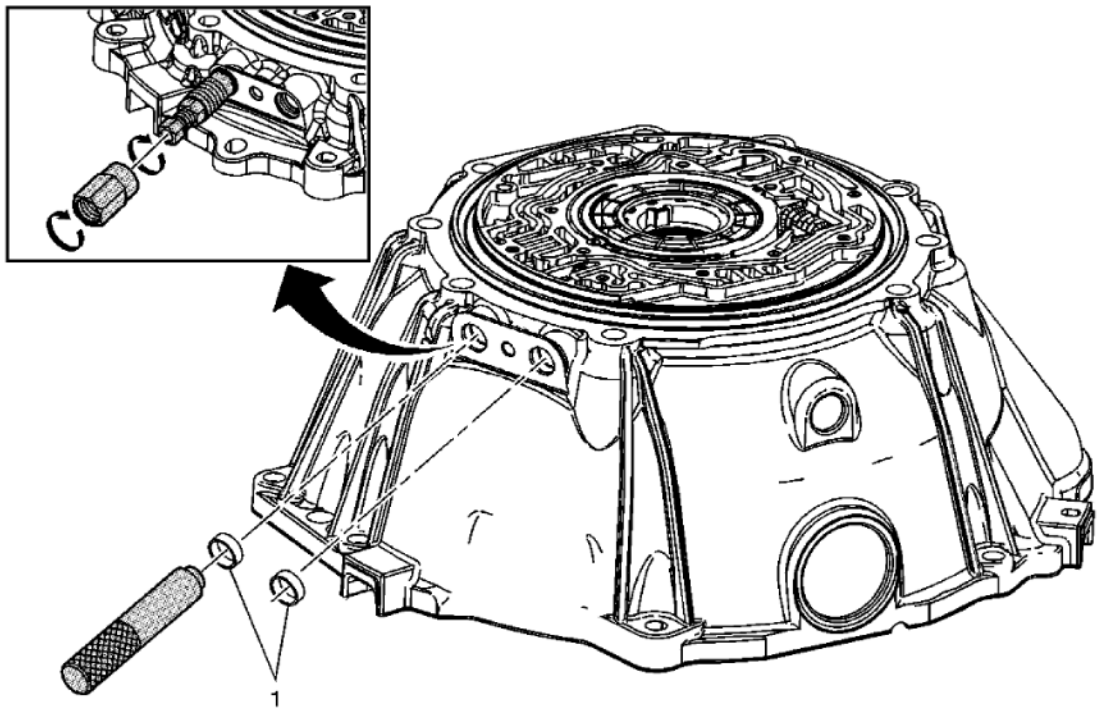


Fig. 172: Fluid Cooler Pipe Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Trans Fluid Cooler Pipe Fitting Seals (Qty: 2) **Special Tools** • **DT 47770** Seal Installer. See **Special Tools**. • **J 45201** Cooler Line Seal Remover. See **Special Tools**.

FLUID PUMP SELECTIVE MEASUREMENT

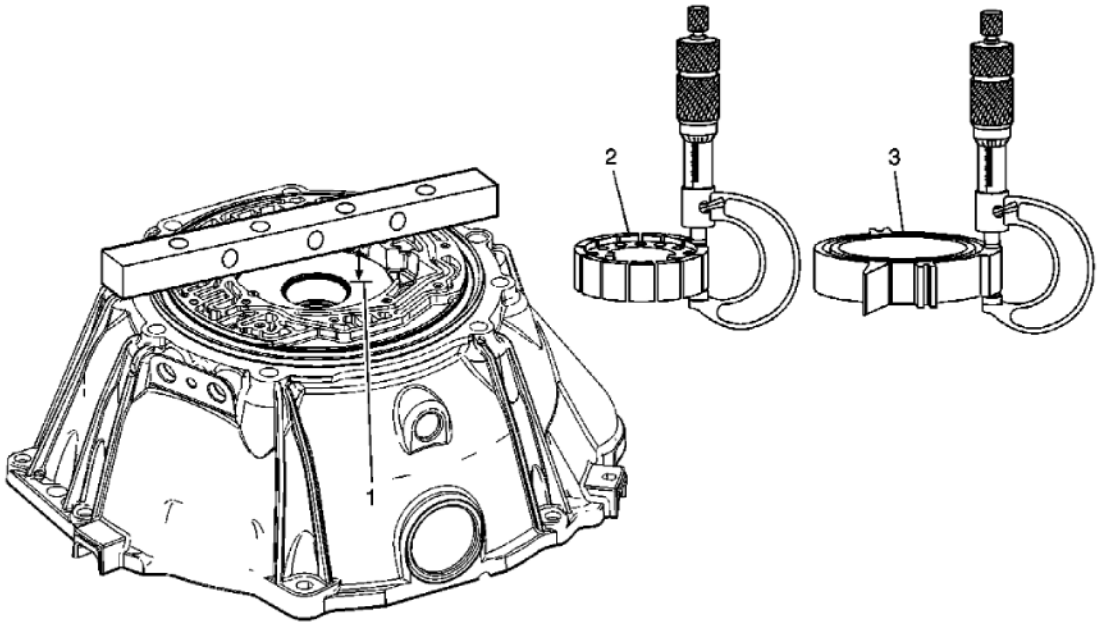


Fig. 173: Fluid Pump Selective Measurement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Pump Rotor Cavity **Tip:** Measure the distance from the bottom of the gage bar to the bottom of the pump rotor cavity. Refer to **Fluid Pump Selective Specifications** .
2	A/Trans Fluid Pump Rotor **Tip:** Refer to **Fluid Pump Selective Specifications** to select the correct rotor.
3	A/Trans Fluid Pump Slide **Tip:** Refer to **Fluid Pump Selective Specifications** to select the correct slide.

TORQUE CONVERTER HOUSING WITH FLUID PUMP ASSEMBLE

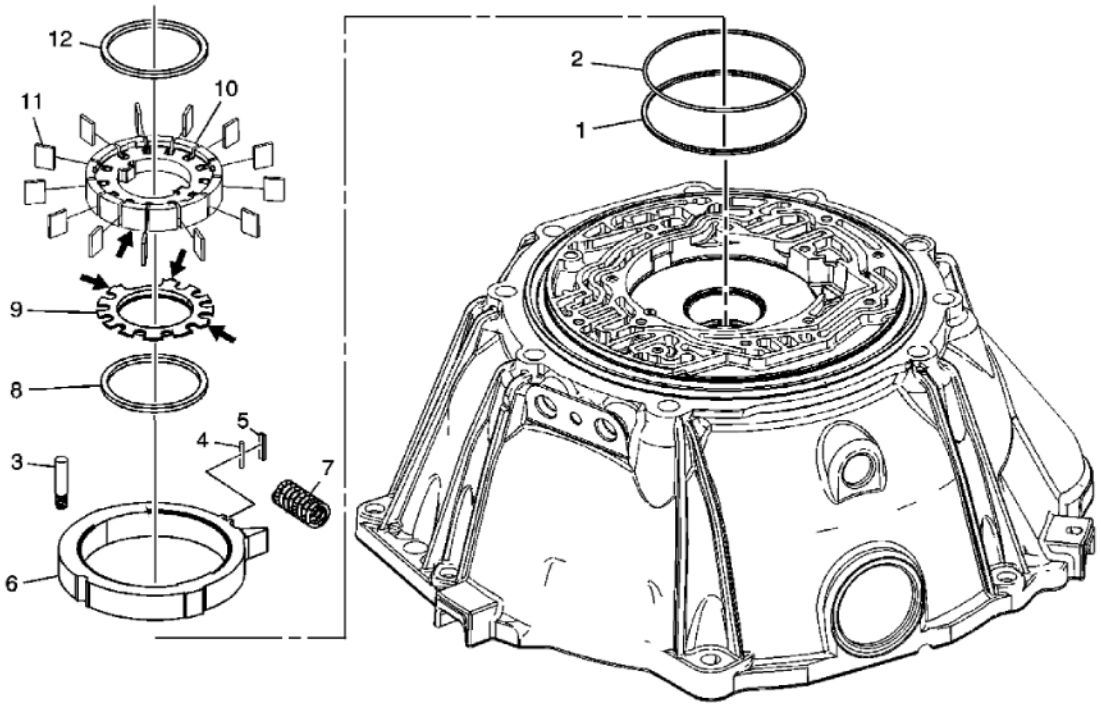


Fig. 174: Torque Converter Housing with Fluid Pump Assemble
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Fluid Pump Slide Fluid Seal Ring
2	Fluid Pump Slide (O-Ring) Seal
3	Fluid Pump Slide Pivot Pin
4	Fluid Pump Slide Seal Support **Tip:** The seal support is circular. The seal is rectangular.
5	Slide Seal
6	Fluid Pump Slide **Tip:** If installing a NEW pump slide into the torque converter housing, ensure to properly select the correct rotor and slide before performing this procedure. Refer to **Fluid Pump Selective Measurement** and **Fluid Pump Selective Specifications** .
7	Fluid Pump Slide Outer Spring
8	Fluid Pump Vane Ring

9	Fluid Pump Rotor Guide **NOTE:** **Align the rotor guide tabs to the notches on the bottom of the rotor. Failure to do so may cause transmission damage.**
10	Fluid Pump Rotor **Tip:** If installing a NEW pump rotor into the torque converter housing, ensure to properly select the correct rotor and slide before performing this procedure. Refer to **Fluid Pump Selective Measurement** and **Fluid Pump Selective Specifications** .
11	Fluid Pump Vanes (Qty: 13)
12	Fluid Pump Vane Ring

FLUID PUMP COVER INSTALLATION

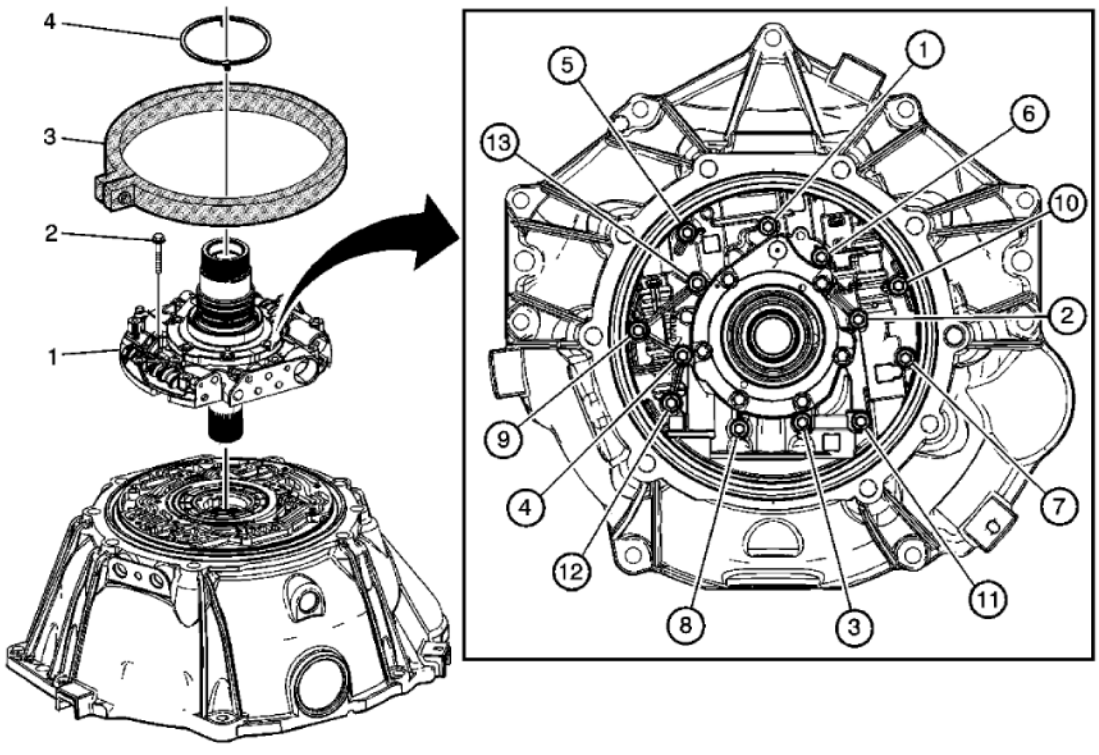


Fig. 175: Fluid Pump Cover Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Fluid Pump Cover Assembly
2	Fluid Pump Cover Bolts M6 x 40 (Qty: 13) **Tip:** Hand tighten only.
3	Alignment Tool and Bolt **NOTE:** **Refer to Fastener Notice .** **Procedure** 1. Center the **J 46664** around the fluid pump cover assembly in the 9 o'clock position and tighten the alignment bolt. See **Special Tools**. 2. Tighten the fluid pump cover bolts in the sequence shown. **Tighten:** 11 N.m (97 lb in) **Special Tool:** **J 46664** Pump Cover Alignment Tool. See **Special Tools**.
4	NEW 1-2-3-4 and 3-5 Reverse Clutch Housing Thrust Washer

CONTROL VALVE BODY ASSEMBLY DISASSEMBLE

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY REMOVAL

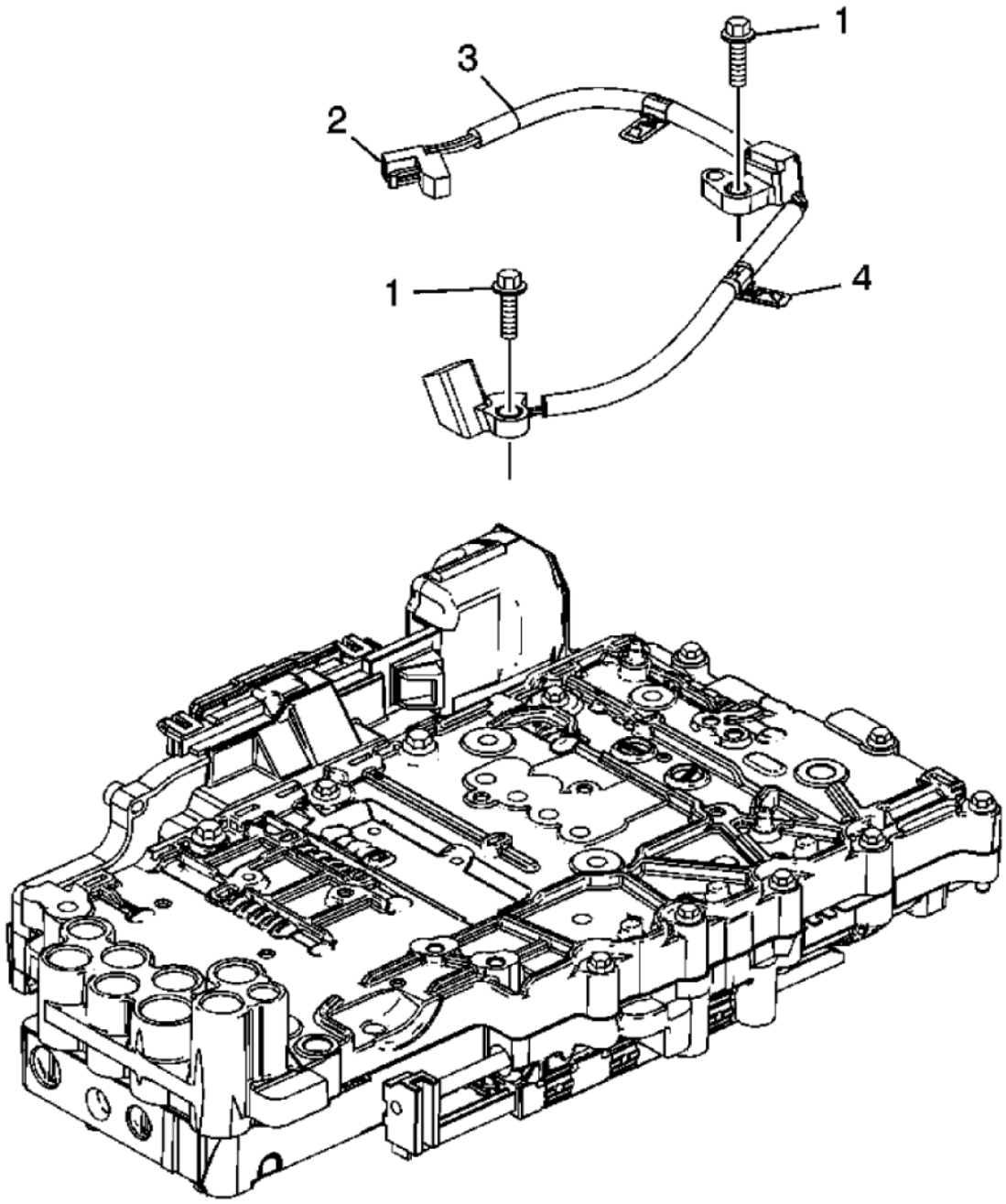


Fig. 176: Input and Output Speed Sensor Assembly Component View
Courtesy of GENERAL MOTORS CORP.

Input and Output Speed Sensor Assembly Removal

Callout	Component Name
1	Bolt M6 x 20 (Qty: 2)
	Speed Sensor Electrical Connector

2	**Tip:** Release the connector lock before disconnecting.
3	A/Trans Input and Output Speed Sensor Assembly
4	A/Trans Input and Output Speed Sensor Wiring Harness Clip (Qty: 2) **Tip:** Inspect the clips and replace if damaged.

MANUAL SHAFT DETENT ASSEMBLY AND MANUAL SHIFT SHAFT POSITION SWITCH REMOVAL

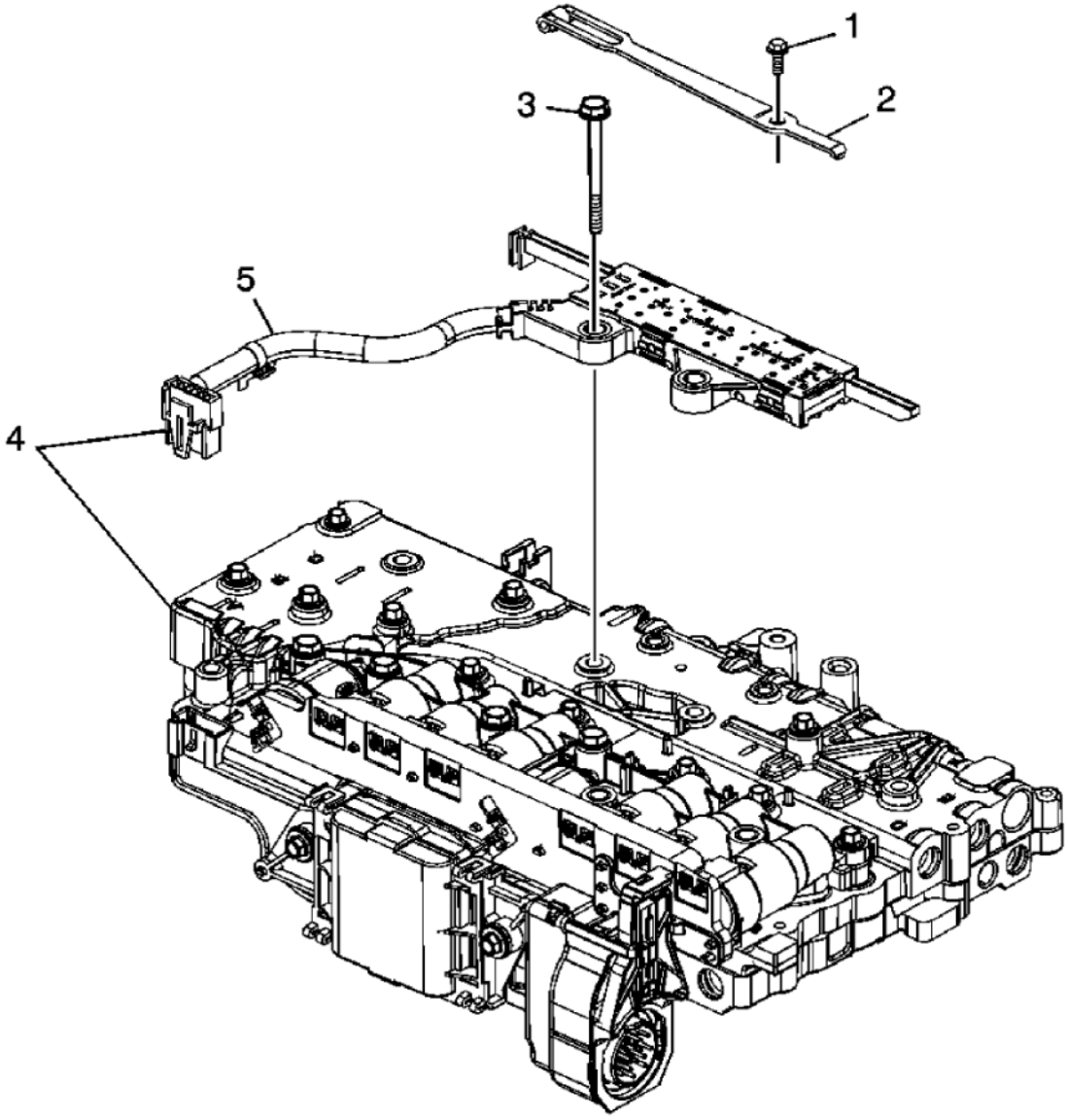


Fig. 177: Manual Shaft Detent Assembly and Manual Shift Shaft Position Switch Component View
Courtesy of GENERAL MOTORS CORP.

Manual Shaft Detent Assembly and Manual Shift Shaft Position Switch Removal

Callout	Component Name
1	Bolt M6 x 14.5
2	Manual Shaft Detent Assembly
3	Bolt M5 x 55
4	A/Trans Manual Shift Shaft Position Switch Assembly Electrical Connector **Tip:** Release the connector lock before disconnecting.
5	A/Trans Manual Shift Shaft Position Switch Assembly

CONTROL SOLENOID VALVE ASSEMBLY REMOVAL

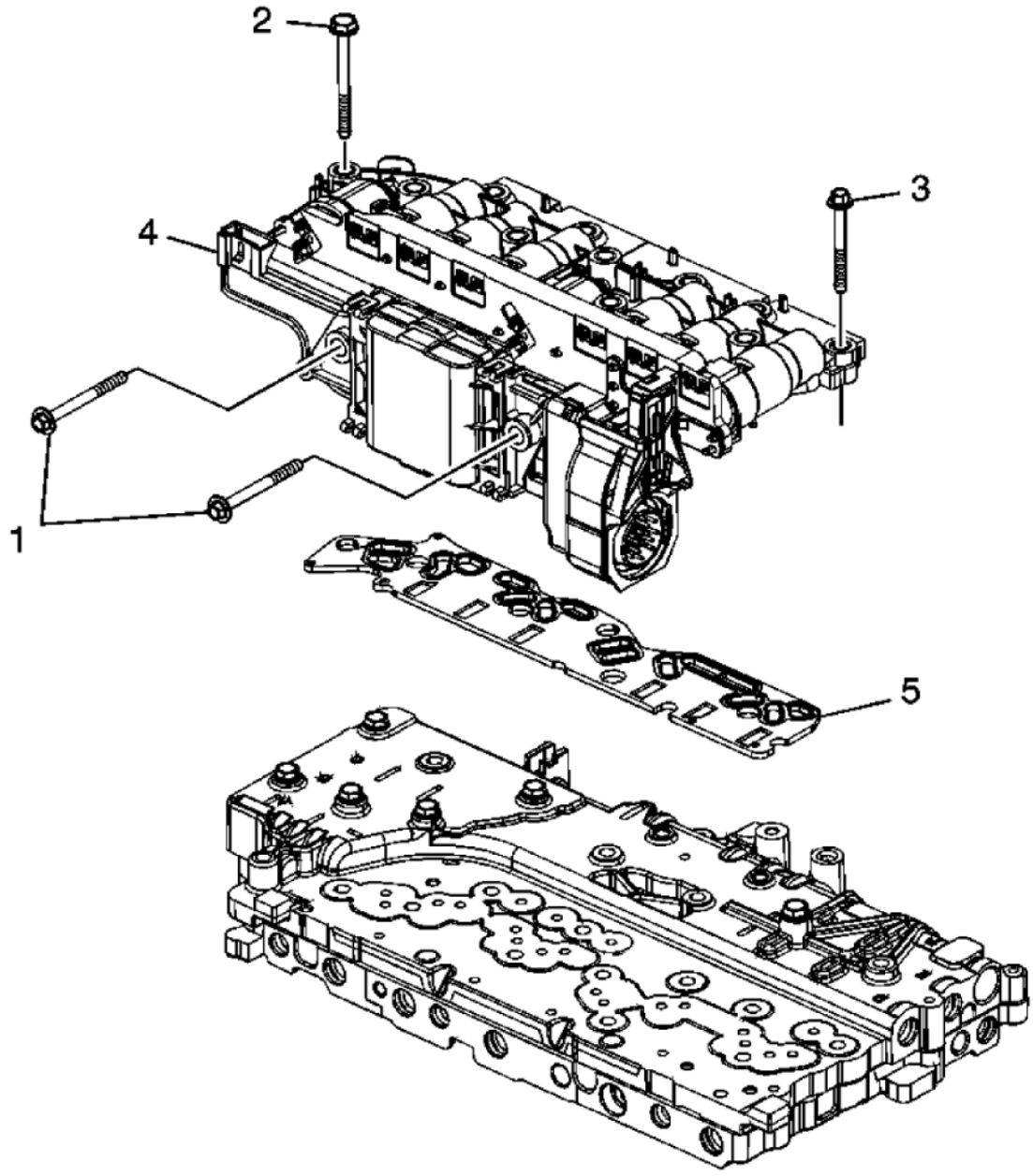


Fig. 178: Control Solenoid Valve Assembly Component View
Courtesy of GENERAL MOTORS CORP.

Control Solenoid Valve Assembly Removal

Callout	Component Name
1	Bolt M5 x 53 (Qty: 2)
2	Bolt M5 x 55 (Qty: 4)
3	Bolt M5 x 45 (Qty: 5)

4	Control Solenoid (w/Body and TCM) Valve Assembly **NOTE:** **Use care when handling the control valve body assembly. If dropped, damage to the control solenoid valve body assembly internal components, including the transmission control module (TCM), may result.**
5	Filter Plate Assembly **NOTE:** **Use care when removing or installing the filter plate assembly. A broken or missing retaining tab may not adequately secure the filter plate to the control solenoid valve assembly, resulting in possible damage or contamination.** **NOTE:** **Discard the filter plate. Replace with a NEW filter plate. Reusing an old filter plate may cause damage to the control solenoid valve assembly.**

UPPER AND LOWER VALVE BODIES DISASSEMBLE

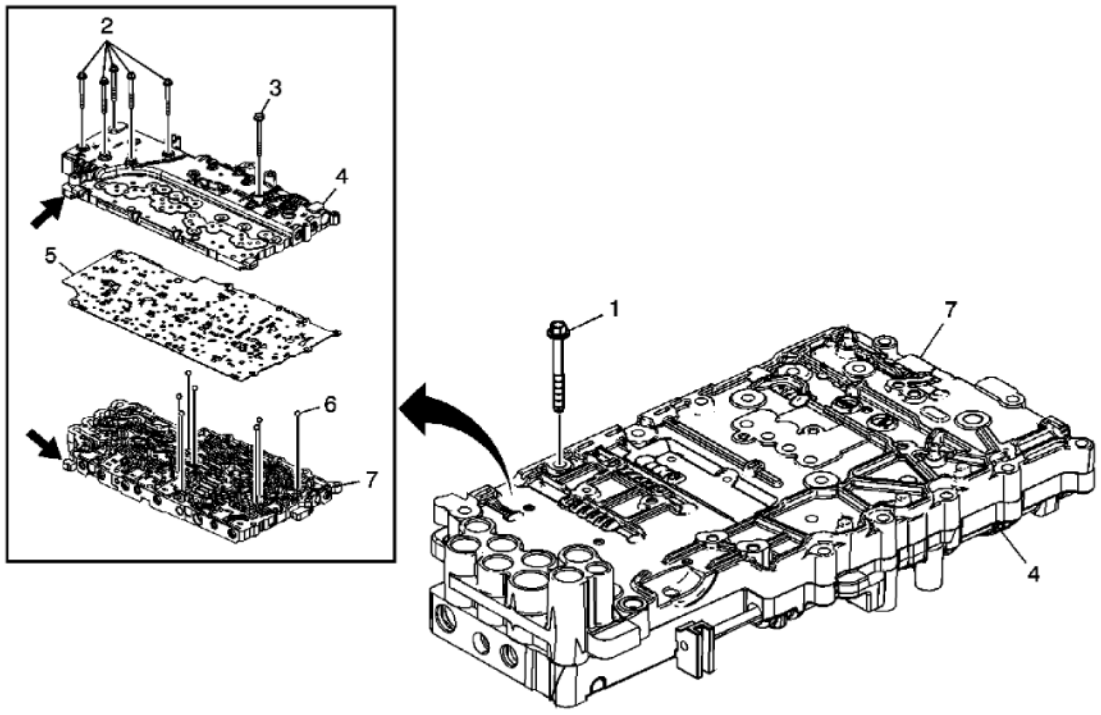


Fig. 179: Upper and Lower Valve Bodies Component View
Courtesy of GENERAL MOTORS CORP.

Upper and Lower Valve Bodies Disassemble

Callout	Component Name
1	Bolt M5 x 36 (Qty: 12)
2	Bolt M5 x 45 (Qty: 5)
3	Bolt M5 x 55
4	Control Valve Lower Body Assembly **Tip:** • Separate the upper and lower valve bodies by carefully prying at the point indicated. • Refer to **Control Valve Lower Body Assembly Cleaning and Inspection**.
5	Control Valve Body Spacer (w/Gasket) Plate Assembly **NOTE:** **Do not use the old spacer plate. Install a NEW spacer**

	plate. Reusing an old spacer plate may cause internal transmission leaks and transmission damage.
6	Control Valve Body Ball Check Valve (Qty: 7) **Tip:** Note the position of the ball check valves.
7	Control Valve Upper Body Assembly **Tip:** Refer to **Control Valve Upper Body Assembly Cleaning and Inspection**.

CONTROL VALVE LOWER BODY ASSEMBLY CLEANING AND INSPECTION

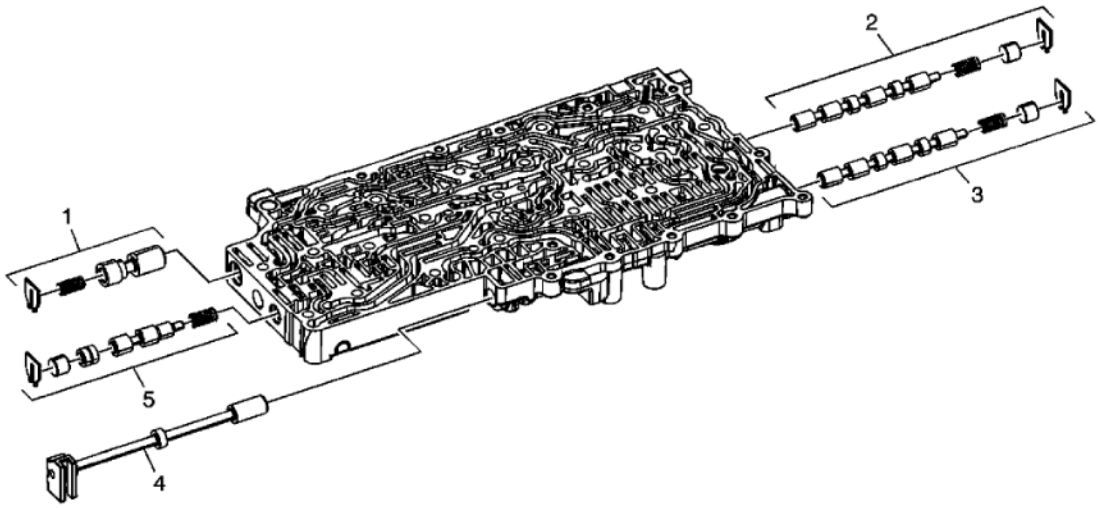


Fig. 180: Control Valve Lower Body Assembly Cleaning and Inspection
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: **Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.** **Preliminary Procedure:** Clean and inspect all valve components and the valve body. The control valve lower body is replaceable only as an assembly.	
1	Clutch Piston Dam Feed Regulator Valve Train
2	Clutch Select Solenoid Valve 2 Train
3	Clutch Select Solenoid Valve 3 Train
4	Manual Valve
5	TCC Regulator Apply Valve Train

CONTROL VALVE UPPER BODY ASSEMBLY CLEANING AND INSPECTION

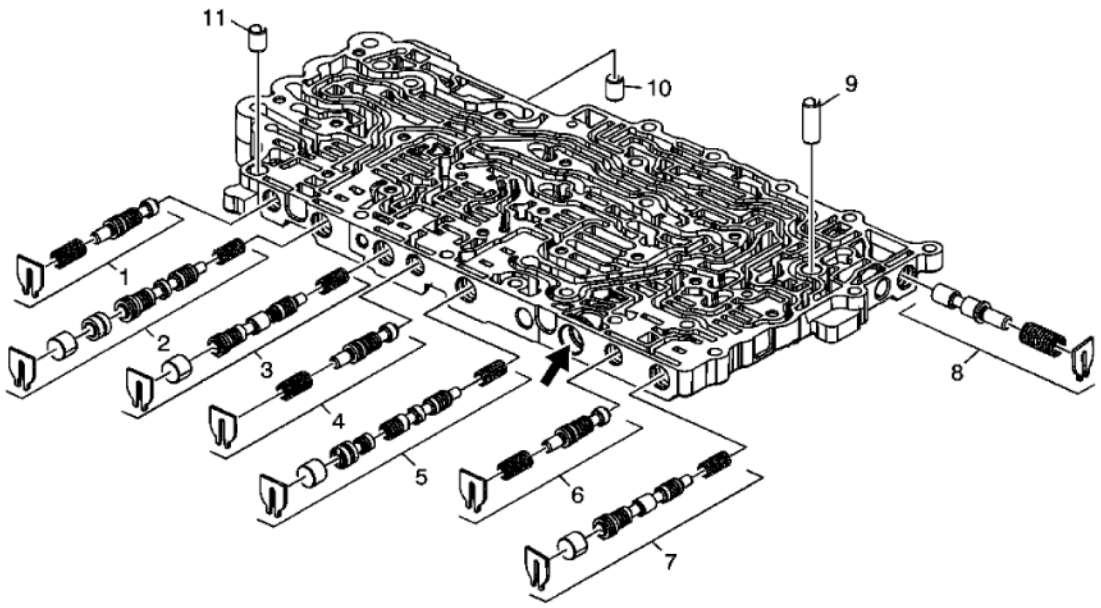


Fig. 181: Control Valve Upper Body Assembly Cleaning and Inspection
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
CAUTION: **Valve springs can be tightly compressed. Use care when removing retainers and plugs. Personal injury could result.** **NOTE:** **Do not remove the clutch piston exhaust blow off ball plug, valve, or spring. The plug is set to a precise depth. Replacement of this plug could cause internal transmission damage.** **Preliminary Procedure:** Clean and inspect all valve components, locating pins, and the valve body. The control valve upper body is replaceable only as an assembly.	
1	Clutch Boost Valve Train
2	1-2-3-4 Clutch Regulator Valve Train
3	3-5 Reverse Clutch Regulator Valve Train
4	Clutch Boost Valve Train
5	2-6 Clutch Regulator Valve Train
6	Clutch Boost Valve Train
7	CBR1/4-5-6 Clutch Regulator Valve Train

8	Actuator Feed Limit Valve Train
9	Control Valve Body Locator Pin
10	Control Valve Body Locator Pin
11	Control Valve Body Locator Pin

CONTROL VALVE BODY ASSEMBLY ASSEMBLE

UPPER TO LOWER CONTROL VALVE BODY ASSEMBLY ASSEMBLE

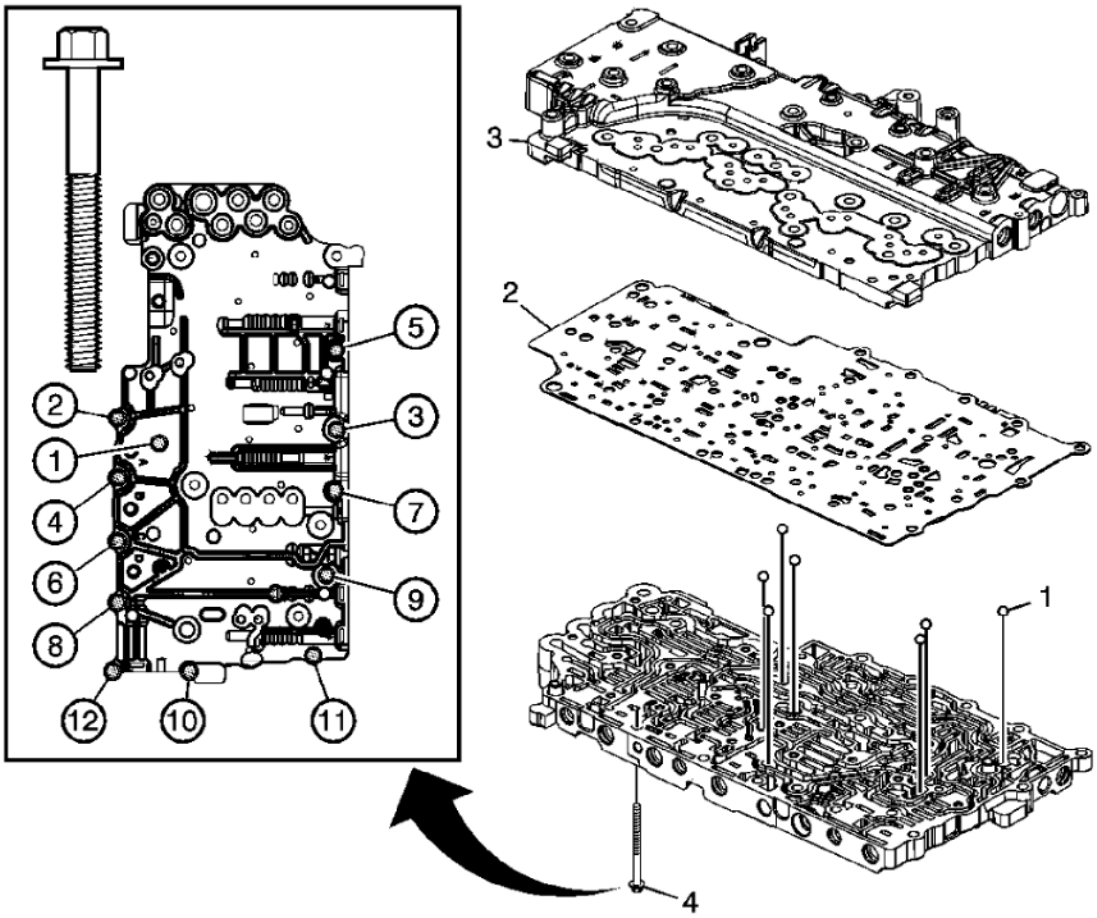


Fig. 182: Assembling Control Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

Upper to Lower Control Valve Body Assembly Assemble

Callout	Component Name
	Control Valve Body Ball Check Valve (Qty: 7)

1	**NOTE:** **Do not use any type of grease or other material to hold the check ball valves in place during assembly. Grease will cause the valves to not operate properly, resulting in damage to the transmission.** **Tip:** Refer to **Ball Check Valve Locations** .
2	Control Valve Body Spacer (w/Gasket) Plate Assembly **NOTE:** **Do not use the old spacer plate. Install a NEW spacer plate. Reusing an old spacer plate may cause internal transmission leaks and transmission damage.**
3	Control Valve Lower Body Assembly **Tip:** Turn the valve body assembly over after installing to upper body.
4	Bolt M5 x 36 (Qty: 12) **NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten the bolts in the sequence shown. **Tighten:** 8 N.m (71 lb in).

FILTER PLATE INSTALLATION

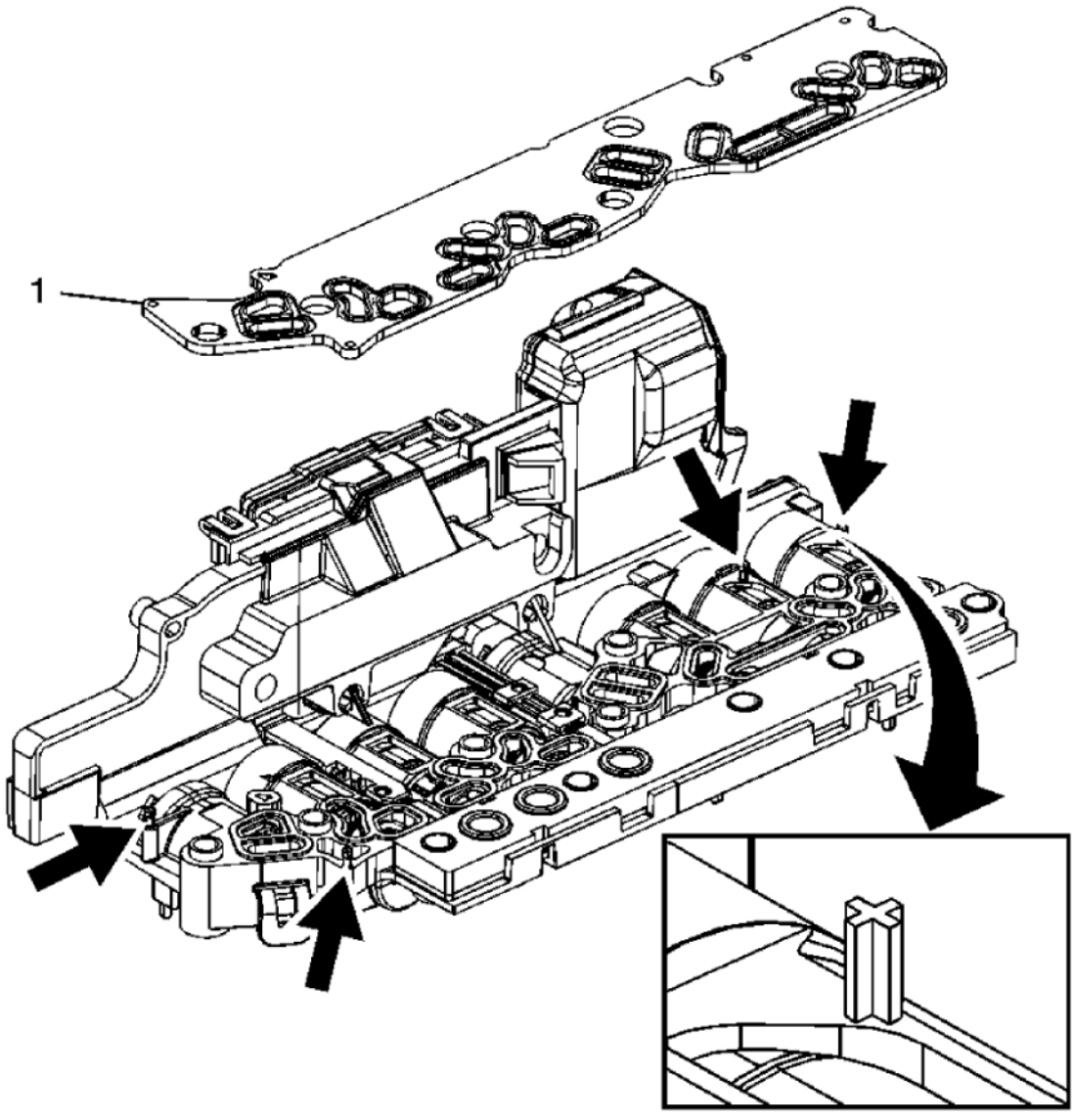


Fig. 183: Installing Filter Plate
Courtesy of GENERAL MOTORS CORP.

Filter Plate Installation

Callout	Component Name
	Filter Plate Assembly **NOTE:** **Use care when handling the control valve body assembly. If dropped, damage to the control solenoid valve body assembly internal**

1	**components, including the transmission control module (TCM), may result.** **NOTE:** **Discard the filter plate. Replace with a NEW filter plate. Reusing an old filter plate may cause damage to the control solenoid valve assembly.** **Tip:** Use care when removing or installing the filter plate assembly. However, if a retaining tab is broken or missing, do not replace the control solenoid valve assembly. The filter plate assembly can still be adequately aligned.

CONTROL SOLENOID VALVE ASSEMBLY INSTALLATION

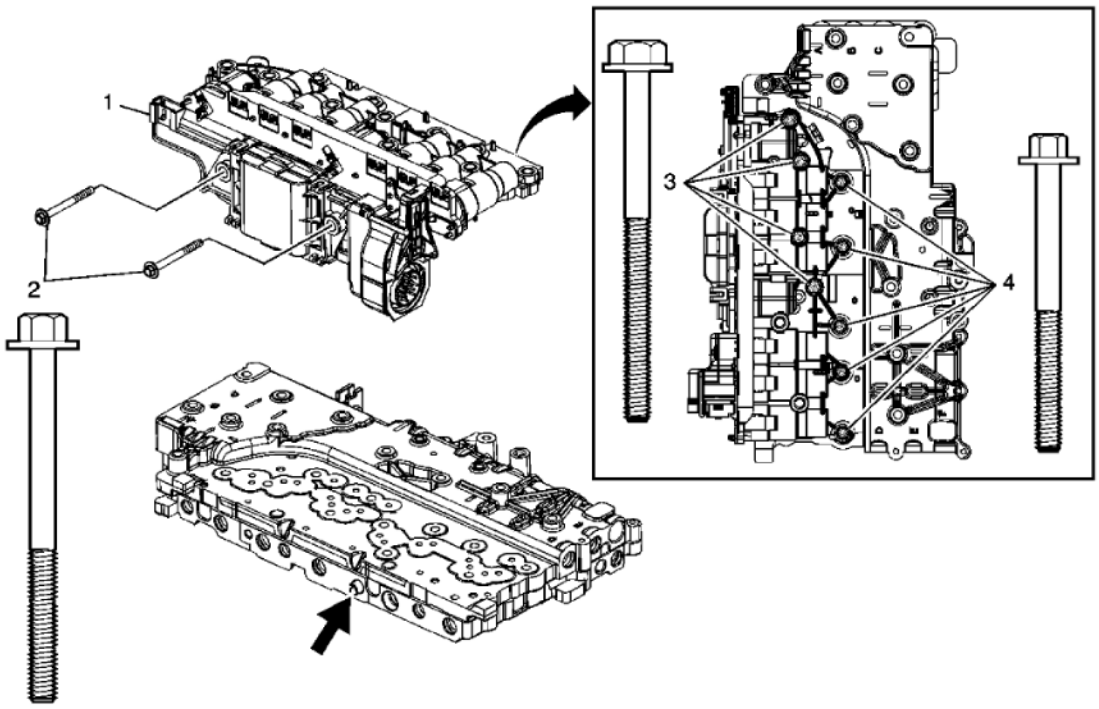


Fig. 184: Control Solenoid Valve Assembly Component View
Courtesy of GENERAL MOTORS CORP.

Control Solenoid Valve Assembly Installation

Callout	Component Name

1	Control Solenoid (w/Body and TCM) Valve Assembly **Tip:** Note the locator pin on the control valve lower body assembly while aligning the control solenoid valve assembly.
2	Bolt M5 x 53 (Qty: 2) **Tip:** Hand tighten only.
3	Bolt M5 x 55 (Qty: 4) **Tip:** Hand tighten only.
4	Bolt M5 x 45 (Qty: 5) **Tip:** Hand tighten only.

MANUAL SHIFT SHAFT POSITION SWITCH INSTALLATION

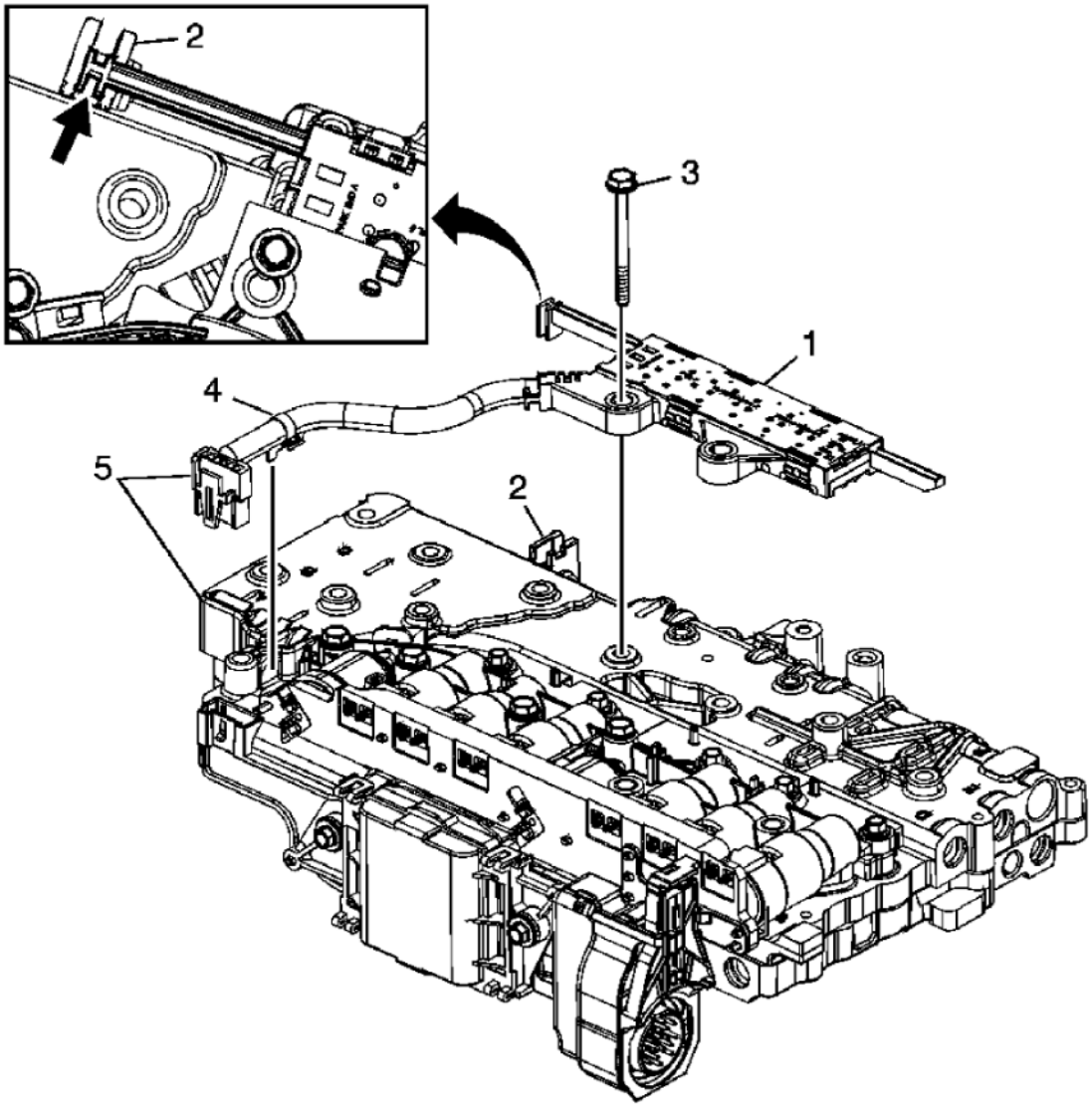


Fig. 185: Manual Shift Shaft Position Switch Component View
Courtesy of GENERAL MOTORS CORP.

Manual Shift Shaft Position Switch Installation

Callout	Component Name
1	A/Trans Manual Shift Shaft Position Switch Assembly
2	Manual Valve Link **Tip:** Align the switch activator slide with the manual valve link.
3	Bolt M5 x 55

	Tip: Hand tighten only.
4	A/Trans Manual Shift Shaft Position Switch Harness Clip **Tip:** The wiring harness clip on the manual shift shaft position switch does not need to be replaced if damaged or missing. The clip functions only as a manufacturing assembly aid to keep the harness clear during an automated bolt installation process. If the clip is damaged, simply remove and discard.
5	A/Trans Manual Shift Shaft Position Switch Electrical Connector **Tip:** Connect and lock the manual shift shaft position switch electrical connector to the control solenoid valve assembly.

VALVE BODY, CONTROL SOLENOID TORQUE SEQUENCE

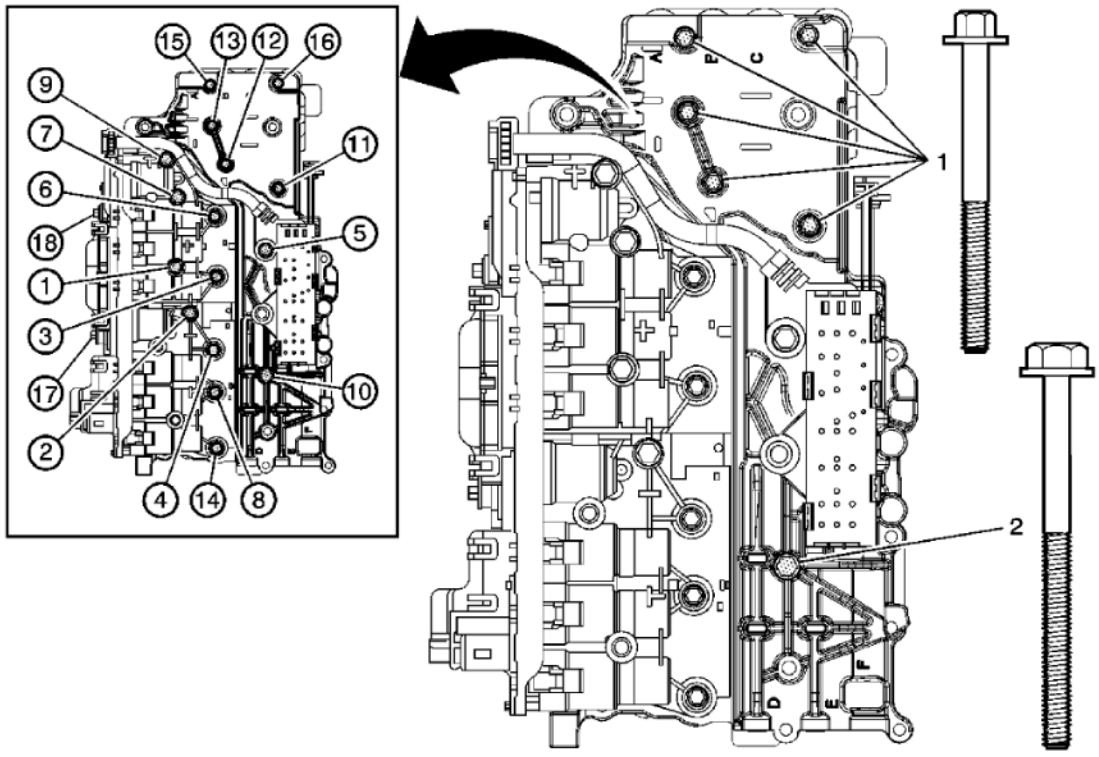


Fig. 186: Valve Body, Control Solenoid Torque Sequence
Courtesy of GENERAL MOTORS CORP.

Valve Body, Control Solenoid Torque Sequence

Callout	Component Name
NOTE: **Bolt torque sequencing is critical to the proper function of the control solenoid valve assembly. Failure to follow the required sequencing may result in transmission malfunction.** **Preliminary Procedure** 1. Hand tighten the last 6 bolts before final torque sequence. 2. The 2 "heat sink" bolts must be tightened last.	
1	Bolts M5 x 45 (Qty: 5)
2	Bolt M5 x 55 **NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten all 18 bolts in the sequence shown. **Tighten:** 8 N.m (71 lb in).

CONTROL SOLENOID VALVE ASSEMBLY CONTACT GAP INSPECTION

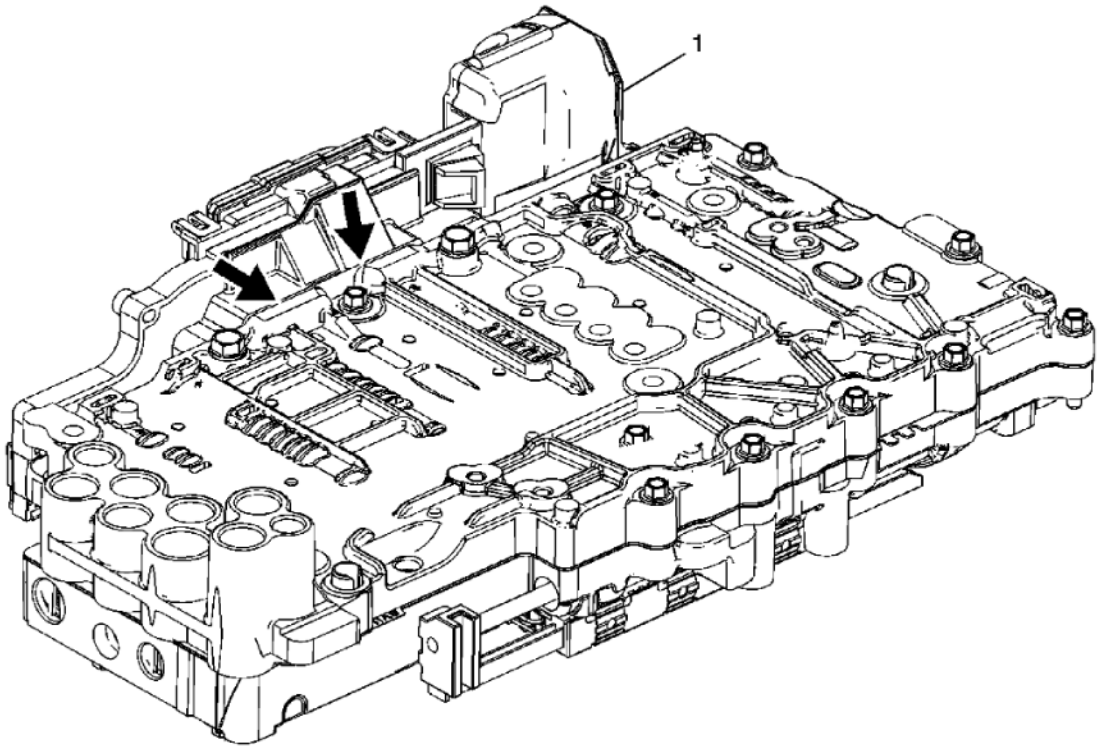


Fig. 187: Inspecting Control Solenoid Valve Assembly Contact Gap
Courtesy of GENERAL MOTORS CORP.

Control Solenoid Valve Assembly Contact Gap Inspection

Callout	Component Name
1	Control Solenoid (w/Body and TCM) Valve Assembly **Tip:** Inspect the contact area between the "heat sink" area of the control solenoid valve assembly and the valve body. There should be no visible gap. If a gap exists, loosen all 18 bolts and retighten in the required sequence.

INPUT AND OUTPUT SPEED SENSOR ASSEMBLY INSTALLATION

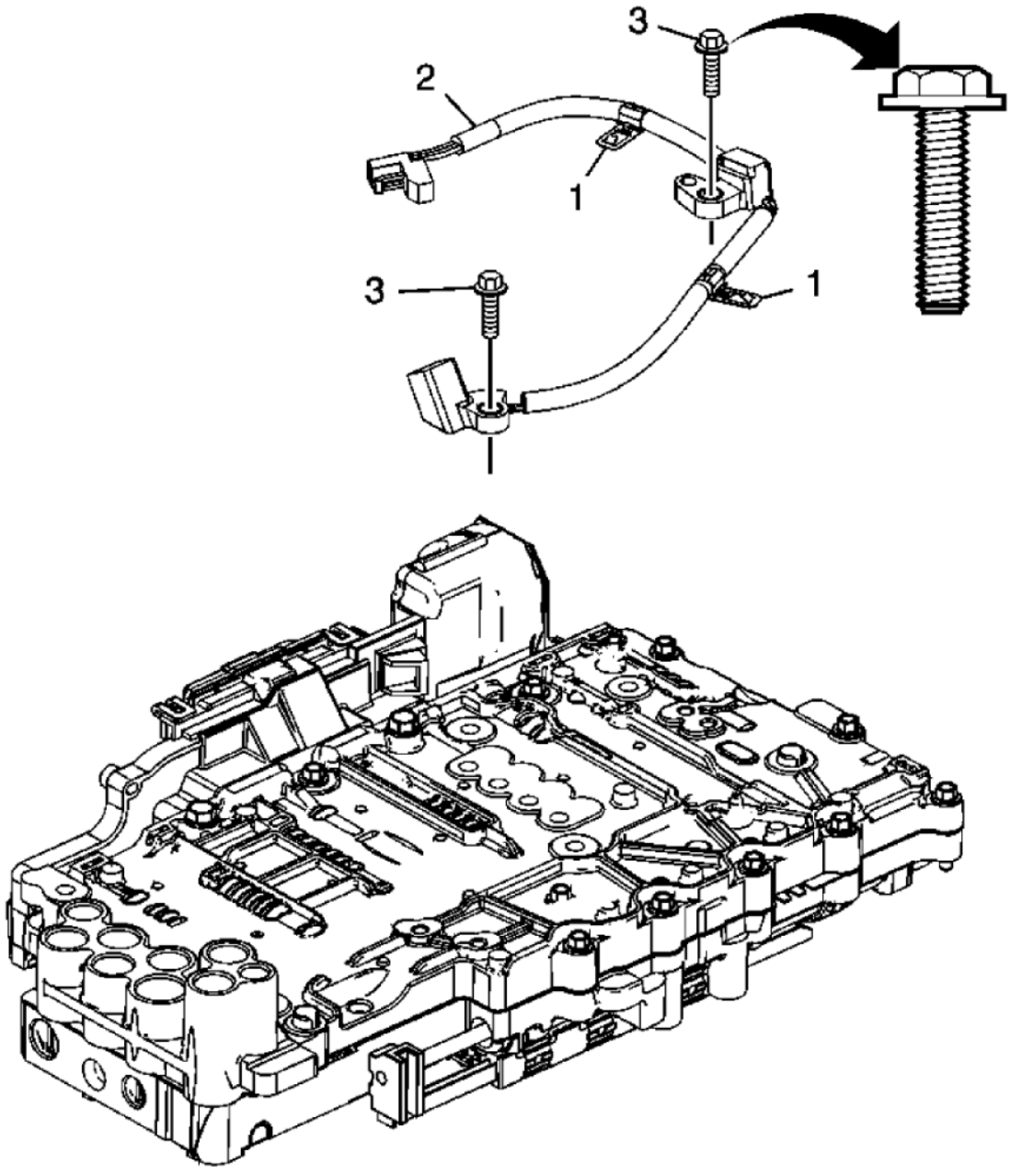


Fig. 188: Installing Input and Output Speed Sensor Assembly
Courtesy of GENERAL MOTORS CORP.

Input and Output Speed Sensor Assembly Installation

Callout	Component Name
1	A/Trans Input and Output Speed Sensor Wiring Harness Clip (Qty: 2) **Tip:** Inspect the 2 wiring harness clips for

	damage. Replace if damaged.
2	A/Trans Input and Output Speed Sensor Assembly
3	Bolt M6 x 20 (Qty: 2) **NOTE:** **Refer to Fastener Notice .** **Tighten:** 12 N.m (106 lb in)

CENTER SUPPORT, OUTPUT CARRIER AND OUTPUT SHAFT INSTALLATION (6L80/6L90)

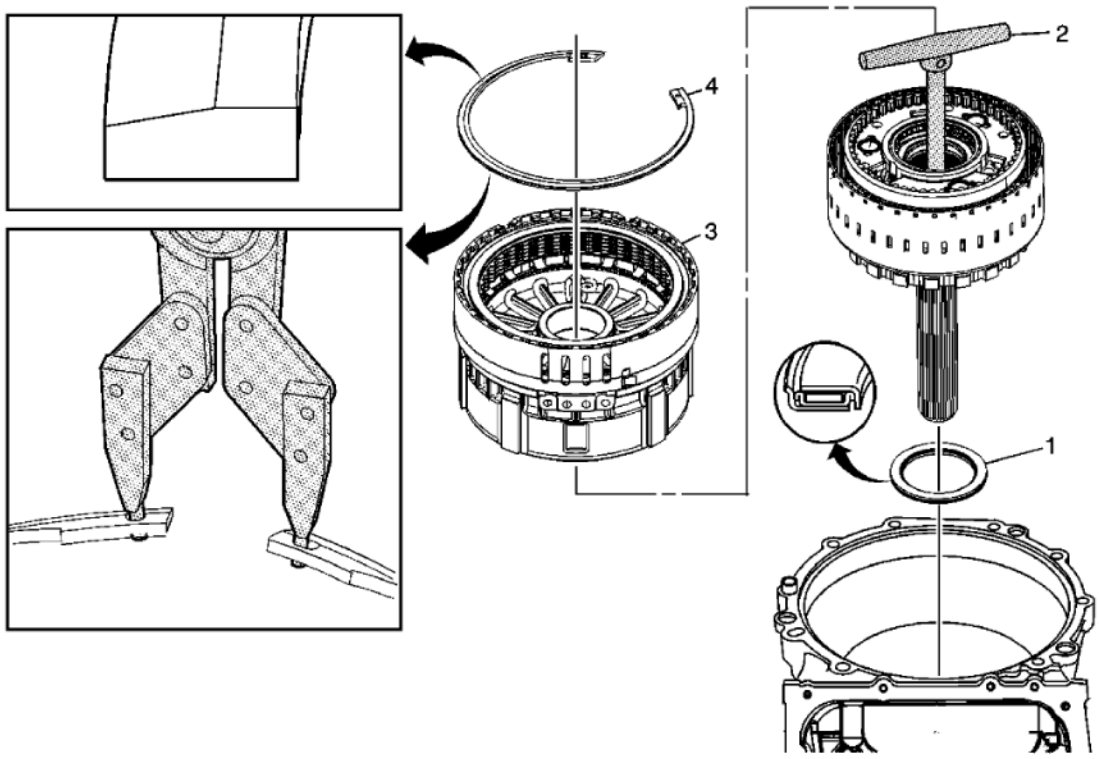


Fig. 189: Center Support, Output Carrier and Output Shaft Installation (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Output Shaft Thrust Bearing Assembly
	Output Carrier Assembly and Output Shaft

2	Assembly **NOTE:** **Apply automatic transmission fluid (ATF) to the inside diameter of the output shaft seal before installing the output shaft assembly into the case. Failure to lube the seal may cause the seal to roll during output shaft installation, which will result in transmission damage.** **NOTE:** **Ensure the DT 47786 is completely threaded into the output shaft assembly. Due to the weight of the assembly, incomplete threading may cause the assembly to break free from the DT 47786, causing component damage.** **Special Tool:** **DT 47786** Output Carrier/Shaft Lifting Tool. See **Special Tools**.
3	Center Support Assembly **Tip:** • When the center support assembly is properly installed, the fluid passages should align with the fluid passage seal bores in the case assembly. • It may be necessary to rotate the output shaft by hand in order to fully install the center support assembly.
4	Center Support Retaining Ring **CAUTION:** **Use care when removing or installing the retaining ring. Ensure the J 45126 and DT 47773 are installed properly onto the retaining ring or bodily injury may occur.** **NOTE:** **Ensure the retaining ring is installed with the tapered side up, and in the 9 o'clock position from the pan side of the case. Failure to properly install the retaining ring**

	will cause transmission damage. **Special Tools** • **DT 47773** Snap Ring Pliers Adapter Set. See **Special Tools**. • **J 45126** Snap Ring Pliers. See **Special Tools**.

1-2-3-4 AND 3-5 REVERSE CLUTCH ASSEMBLY AND 4-5-6 CLUTCH ASSEMBLY INSTALLATION

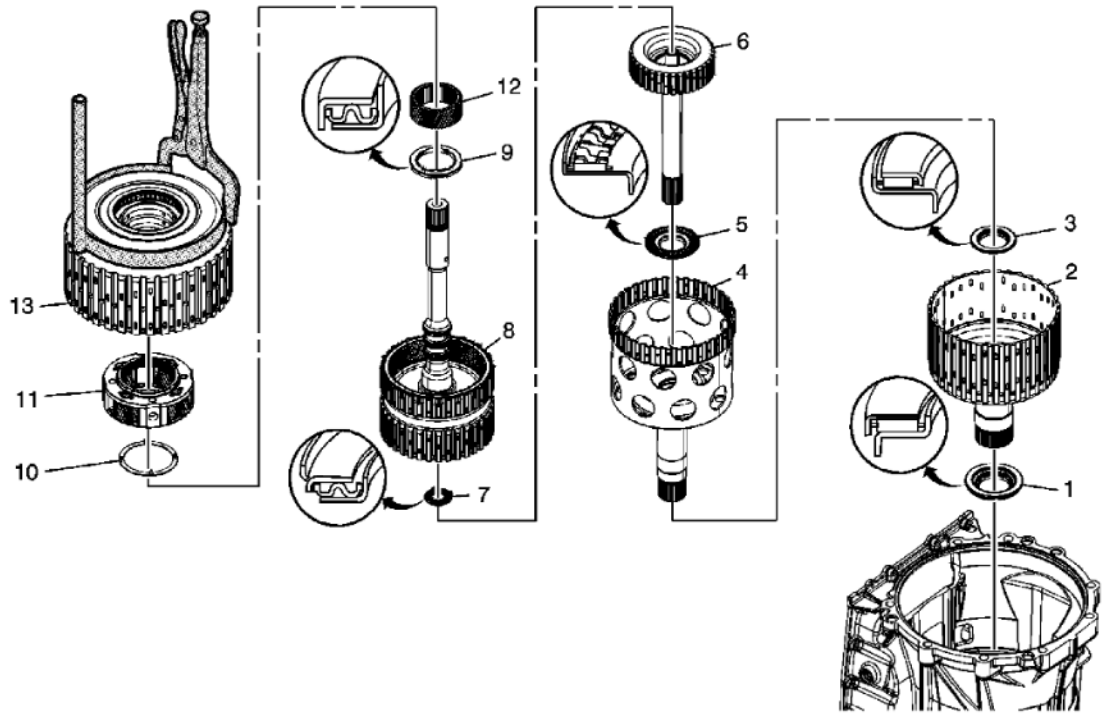


Fig. 190: 1-2-3-4 and 3-5 Reverse Clutch Assembly and 4-5-6 Clutch Assembly Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	2-6 and 3-5 Reverse Clutch Hub Thrust Bearing Assembly
2	2-6 and 3-5 Reverse Clutch (with Output

	Carrier Outer Sun Gear Shaft) Hub Assembly
3	1-2-3-4 Clutch Hub Thrust Bearing Assembly
4	1-2-3-4 Clutch (with Output Carrier Inner Sun Gear Shaft) Hub Assembly
5	4-5-6 Clutch Hub Thrust Bearing Assembly
6	4-5-6 Clutch (with Output Carrier Shaft and Dampener) Hub Assembly **Tip:** Refer to **4-5-6 Clutch Dampener Overhaul** for complete inspection.
7	Turbine Shaft Thrust Bearing Assembly
8	4-5-6 (with Turbine Shaft) Clutch Assembly
9	Input Sun Gear Thrust Bearing **Tip:** Thrust bearing snaps onto input carrier assembly.
10	Input Sun Gear Thrust Washer
11	Input Carrier Assembly
12	Input Sun Gear
13	1-2-3-4 and 3-5 Reverse Clutch Assembly **Tip:** Wiggle the **DT 47781** in order to align the 1-2-3-4 and 3-5 reverse clutch plates with the external splines of the 4-5-6 clutch assembly. See **Special Tools**. To verify that the 1-2-3-4 and 3-5 reverse clutch assembly is fully installed, lift up on the turbine shaft. There should not be any noticeable slack. **Special Tool:** **DT 47781** C1234 35R Clutch Assembly Installer. See **Special Tools**.

TORQUE CONVERTER HOUSING WITH FLUID PUMP INSTALLATION

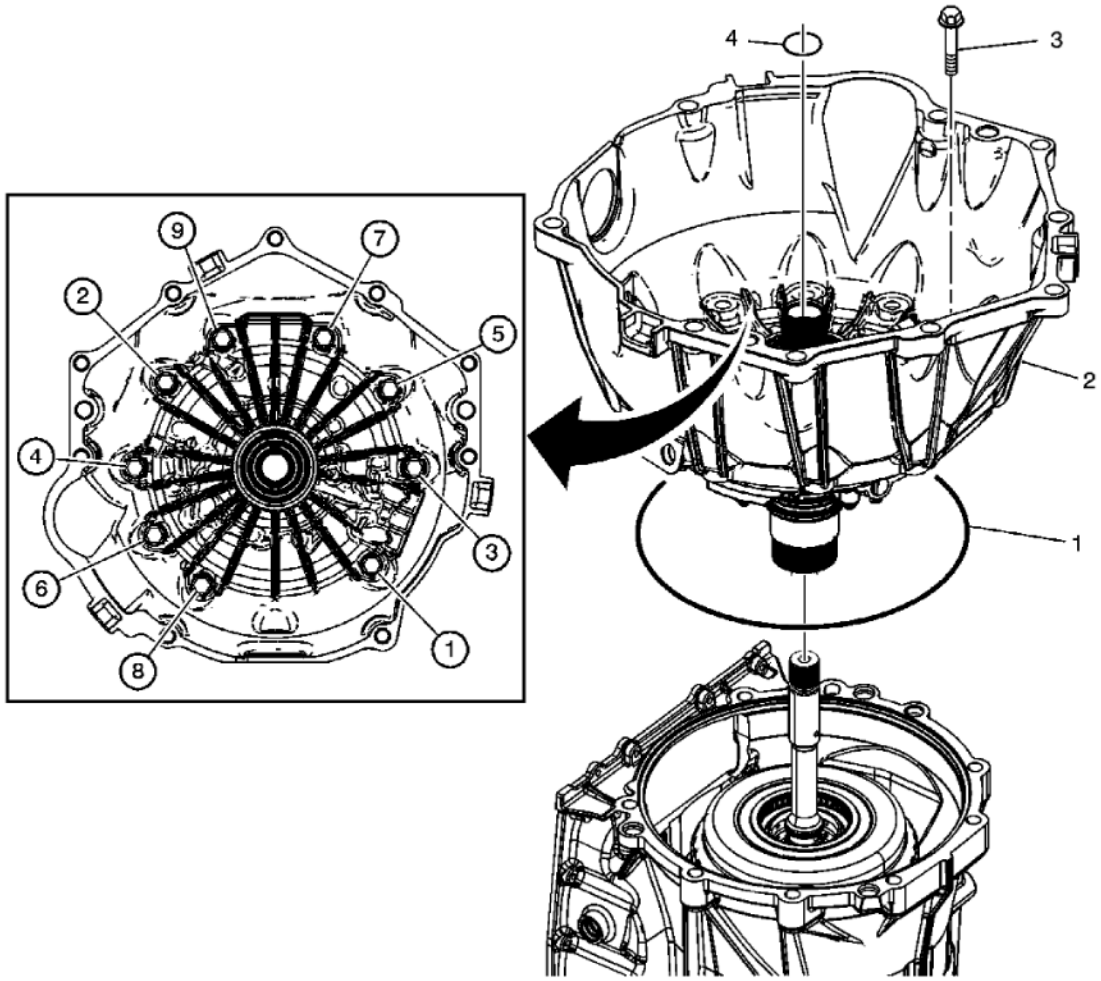


Fig. 191: Torque Converter Housing with Fluid Pump Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	NEW Fluid Pump Seal
2	Torque Converter (with Fluid Pump) Housing Assembly **NOTE:** **Ensure the turbine shaft (O-ring) seal is not installed prior to installing the torque converter housing assembly. The seal may become cut or damaged during installation of the torque converter housing assembly.**
	Bolts M10 x 50 (Qty: 9)

3	**NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten in the sequence shown. **Tighten:** 72 N.m (53 lb ft)
4	NEW Turbine Shaft (O-Ring) Seal

OUTPUT SHAFT SEAL REPLACEMENT

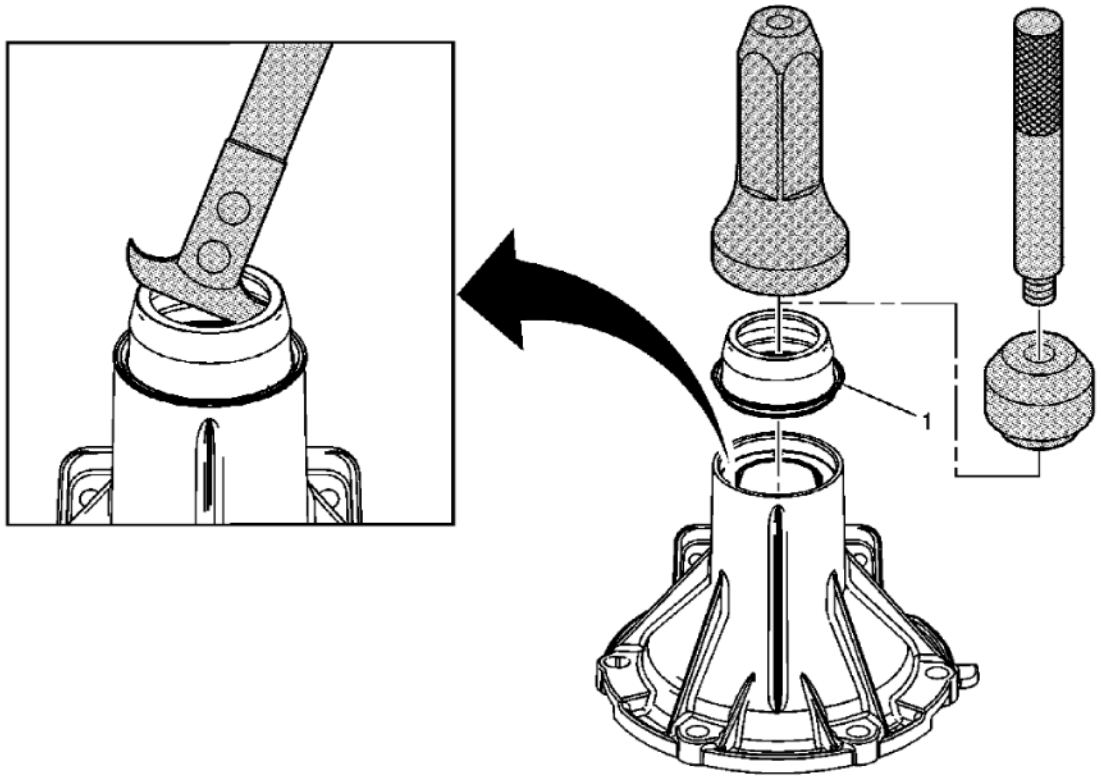


Fig. 192: Output Shaft Seal Replacement
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
	Output Shaft Seal Assembly **Special Tools**

1	• **DT-48021** Seal Installer (6L90). See **Special Tools**. • **J 8092** Driver Handle (6L90) • **J 38869** Output Shaft Seal Installer (6L80). See **Special Tools**. • **J 45000** Seal Remover. See **Special Tools**.

CONTROL VALVE BODY ASSEMBLY INSTALLATION

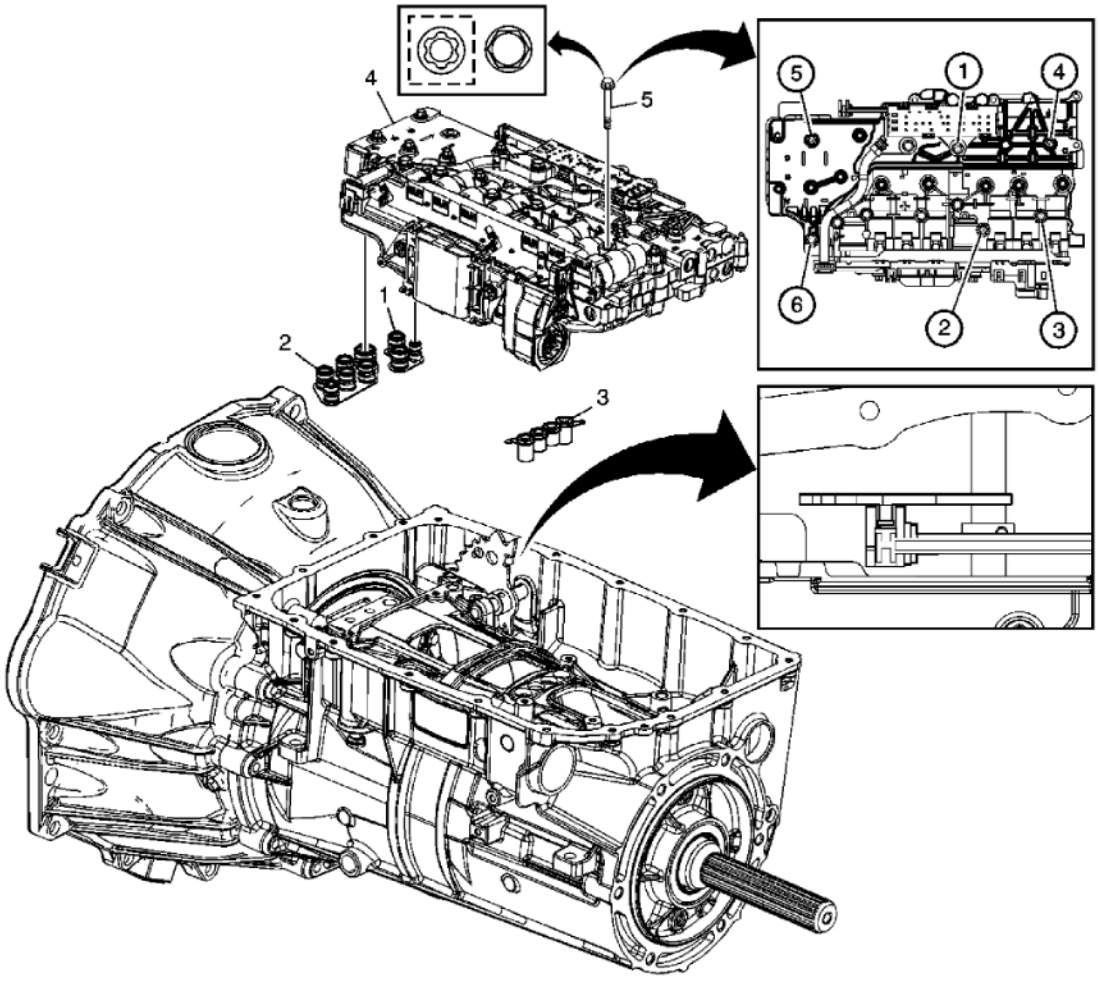


Fig. 193: Control Valve Body Assembly Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

1	NEW Fluid Pump Seal Assembly
2	NEW Fluid Pump Seal Assembly
3	NEW Center Support Fluid Passage Seal Assembly
4	Control Valve Body Assembly **Tip:** Align the manual shift shaft position switch activator slide with the detent lever guide pin.
5	Bolts M5 x 73 (Qty: 6) **NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten in the sequence shown. **Tighten:** 8 N.m (71 lb in). **Special Tool:** **DT-48285** Valve Body Torx Plus Socket (if applicable). See **Special Tools**.

AUTOMATIC TRANSMISSION ELECTRICAL CONNECTOR PASSAGE SLEEVE INSTALLATION

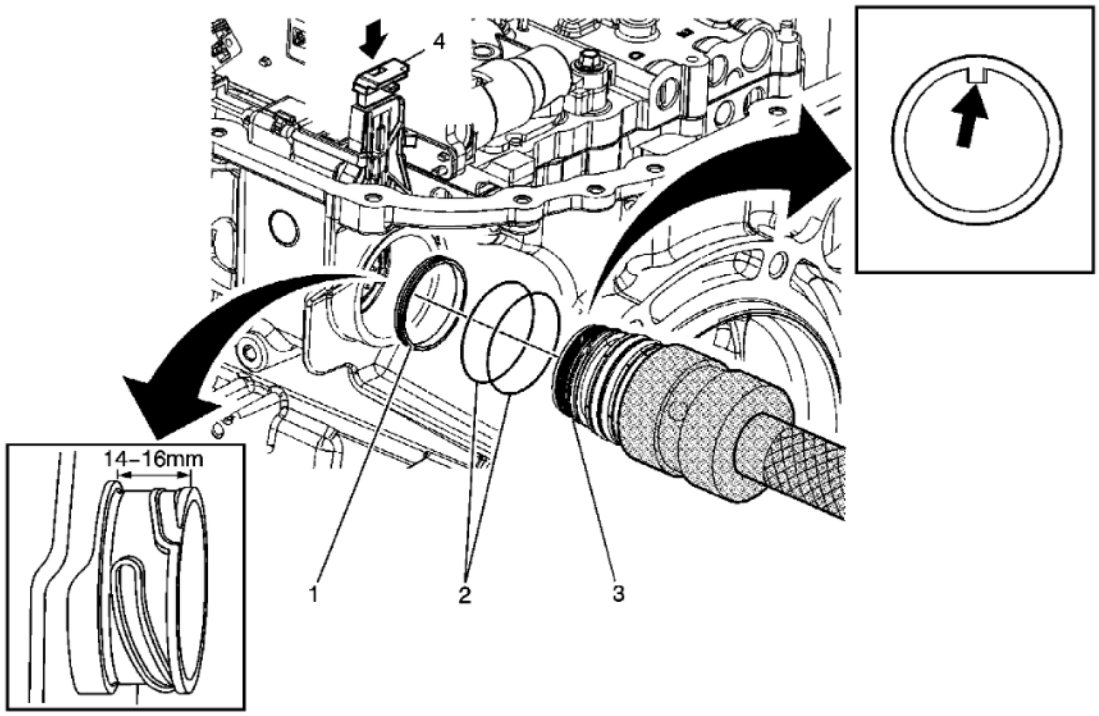


Fig. 194: Installing Automatic Transmission Electrical Connector Passage Sleeve
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	NEW Lip Seal
2	NEW O-Ring Seals (Qty: 2)
3	Electrical Connector Passage Sleeve **NOTE:** **Orientate the alignment tab inside the passage sleeve with the slot in the electrical connector of the control solenoid valve assembly. Push the sleeve straight into the case bore and connector. Do NOT rotate the sleeve at any time. Ensure the sleeve is fully seated into the case. When the sleeve is properly installed, the distance from the case surface to the end of the sleeve should be 14-16 mm. Even though the correct electrical connections may still be maintained, failure to ensure proper installation of the sleeve may result in a fluid leak around the sleeve lip seal and into the sleeve cavity.** **Specification:** 14-16 mm **Special Tools**

	• **DT 47715** Electrical Connector Passage Sleeve Remover/Installer. See **Special Tools**. • **J 42183** Driver Handle. See **Special Tools**.
4	Electrical Connector Slide Lock **Tip:** Push down on the electrical connector slide lock to ensure proper installation.

FLUID FILTER AND MANUAL SHIFT DETENT ASSEMBLY INSTALLATION

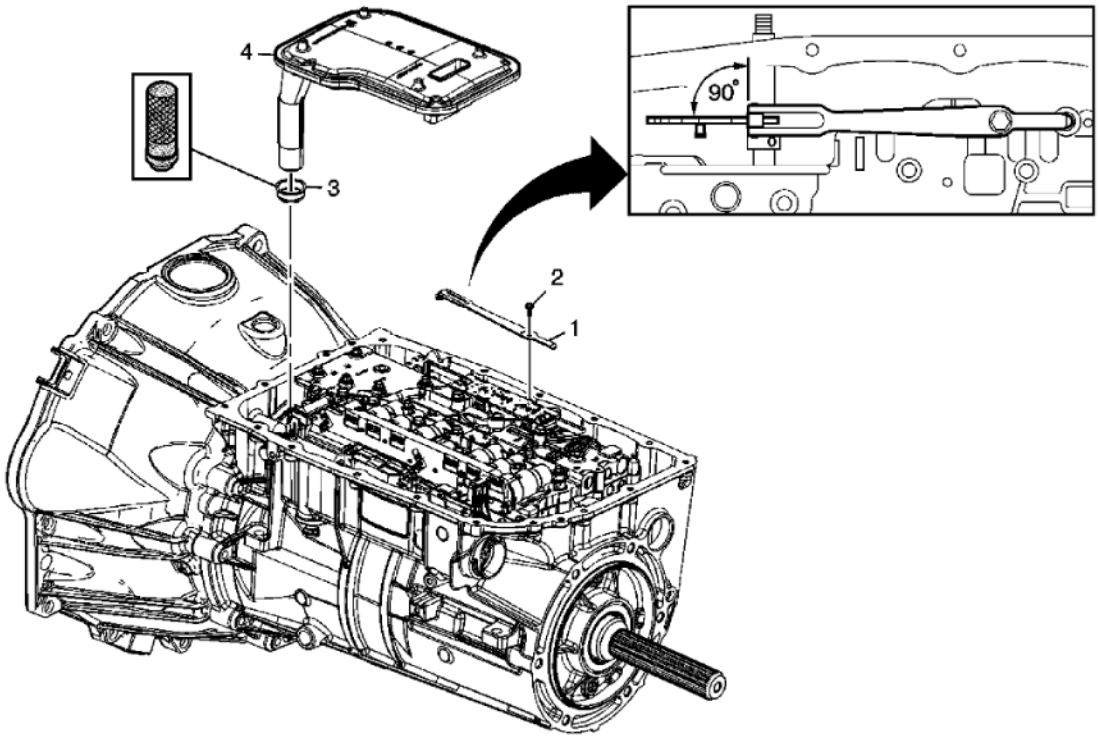


Fig. 195: Fluid Filter and Manual Shift Detent Assembly Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Manual Shaft Detent Assembly **NOTE:** **Ensure the manual shaft detent assembly roller is centered over the manual shaft detent lever assembly. Failure to center the roller may cause hard or no shift lever operation.**

2	Bolt M6 x 14.5 **NOTE:** **Refer to Fastener Notice .** **Tighten:** 12 N.m (106 lb in).
3	NEW Fluid Filter Seal Assembly **Special Tools** • **DT 47848** Seal Installer. See **Special Tools**. • **J 42183** Driver Handle. See **Special Tools**.
4	NEW Fluid Filter Assembly

TRANSMISSION FLUID PAN INSTALLATION (6L80)

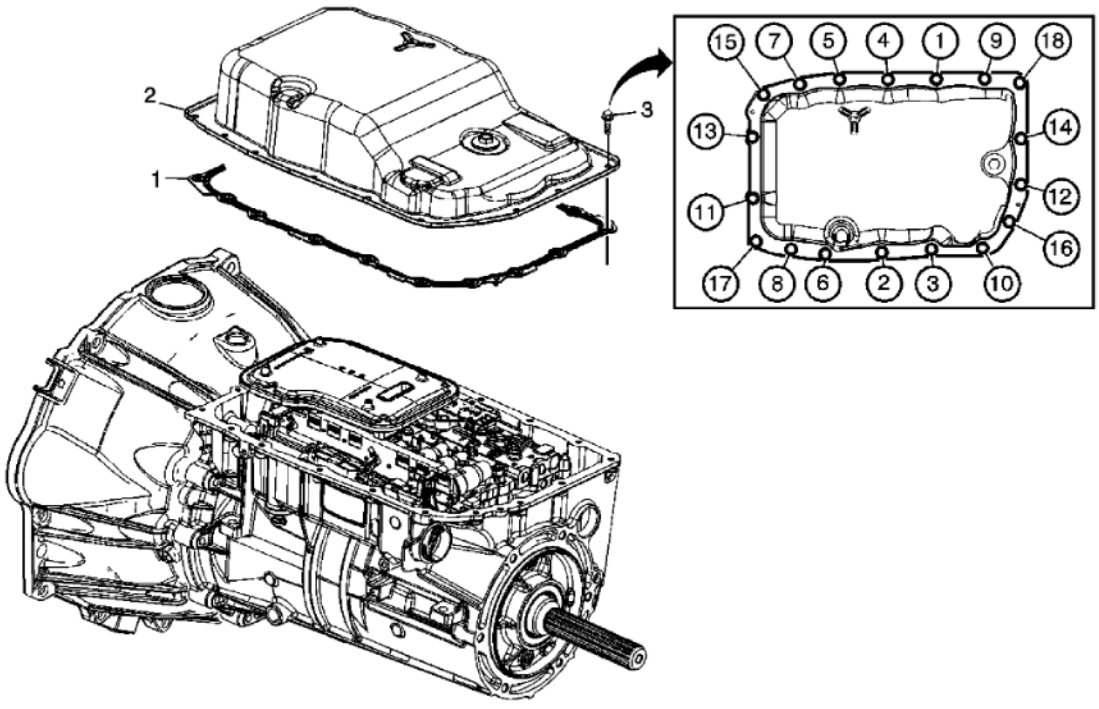


Fig. 196: Transmission Fluid Pan Installation (6L80)
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name

1	Fluid Pan Gasket **Tip:** The fluid pan gasket is reusable. Inspect the gasket to determine if it may be reused. If the gasket is stuck to the case or pan, it should be replaced.
2	Fluid Pan Assembly
3	Fluid Pan Bolts M6 x 20 (Qty: 18) **NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten in sequence shown. **Tighten:** 9 N.m (80 lb in)

CASE EXTENSION ASSEMBLY INSTALLATION

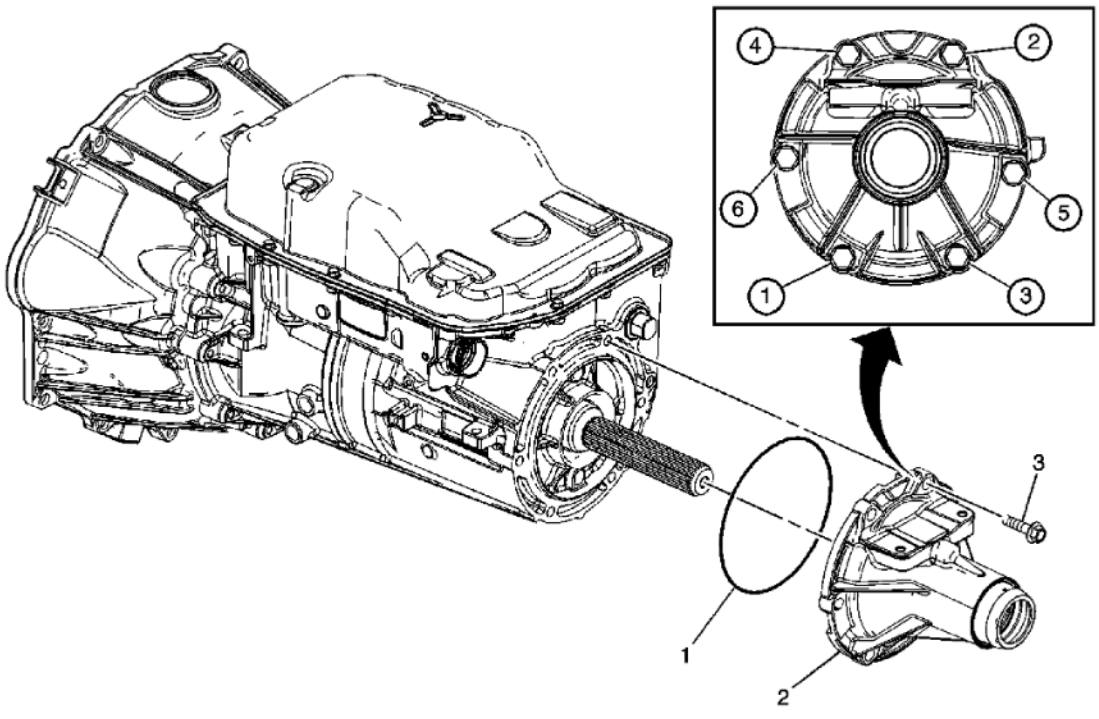


Fig. 197: Case Extension Assembly Installation
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	NEW Case Extension Seal
2	Case Extension
3	Bolts M10 x 40 (Qty: 6) **NOTE:** **Refer to Fastener Notice .** **Procedure:** Tighten in sequence shown. **Tighten:** 50 N.m (37 lb ft)

TORQUE CONVERTER INSTALLATION AND HOLDING FIXTURE REMOVAL (6L80/6L90)

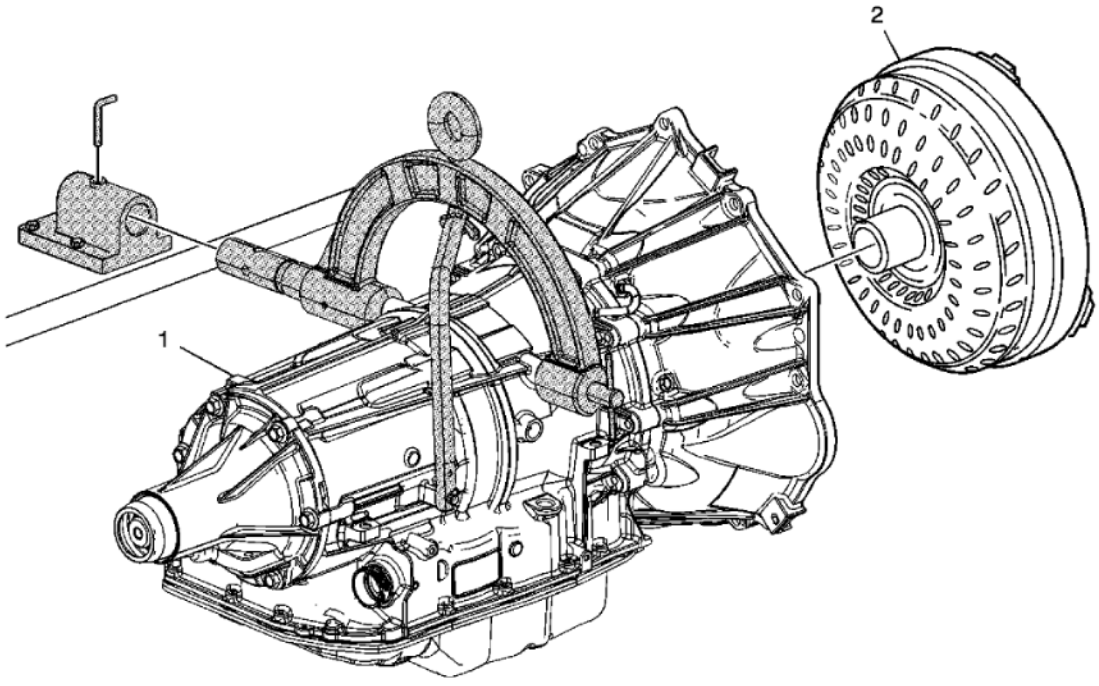


Fig. 198: Torque Converter Installation and Holding Fixture Removal (6L80/6L90)
Courtesy of GENERAL MOTORS CORP.

Callout	Procedure

Preliminary Procedure: Rotate the transmission so that the fluid pan assembly is down.	
1	Transmission Case Assembly **Special Tools** • **DT 47605** Holding Fixture Adapter. See **Special Tools**. • **J 3289-20** Holding Fixture Base Assembly. See **Special Tools**. • **J 8763-B** Holding Fixture. See **Special Tools**.
2	Torque Converter Assembly

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.

DRIVER SHIFT CONTROL

Driver shift control (DSC) allows the driver to change gears similar to a manual transmission.

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

DSC:

Driver Shift Control

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

PCS

Pressure Control Solenoid

PS

Pressure Switch

PWM

Pulse Width Modulation

RPM

Revolutions Per Minute

SS

Shift Solenoid

STL

Service Transmission Lamp

TAP

Transmission Adaptive Pressure

TCC

Torque Converter Clutch

TFP

Transmission Fluid Pressure

TFT

Transmission Fluid Temperature

TP

Throttle Position

VSS

Vehicle Speed Sensor

WOT

Wide Open Throttle

TRANSMISSION IDENTIFICATION INFORMATION

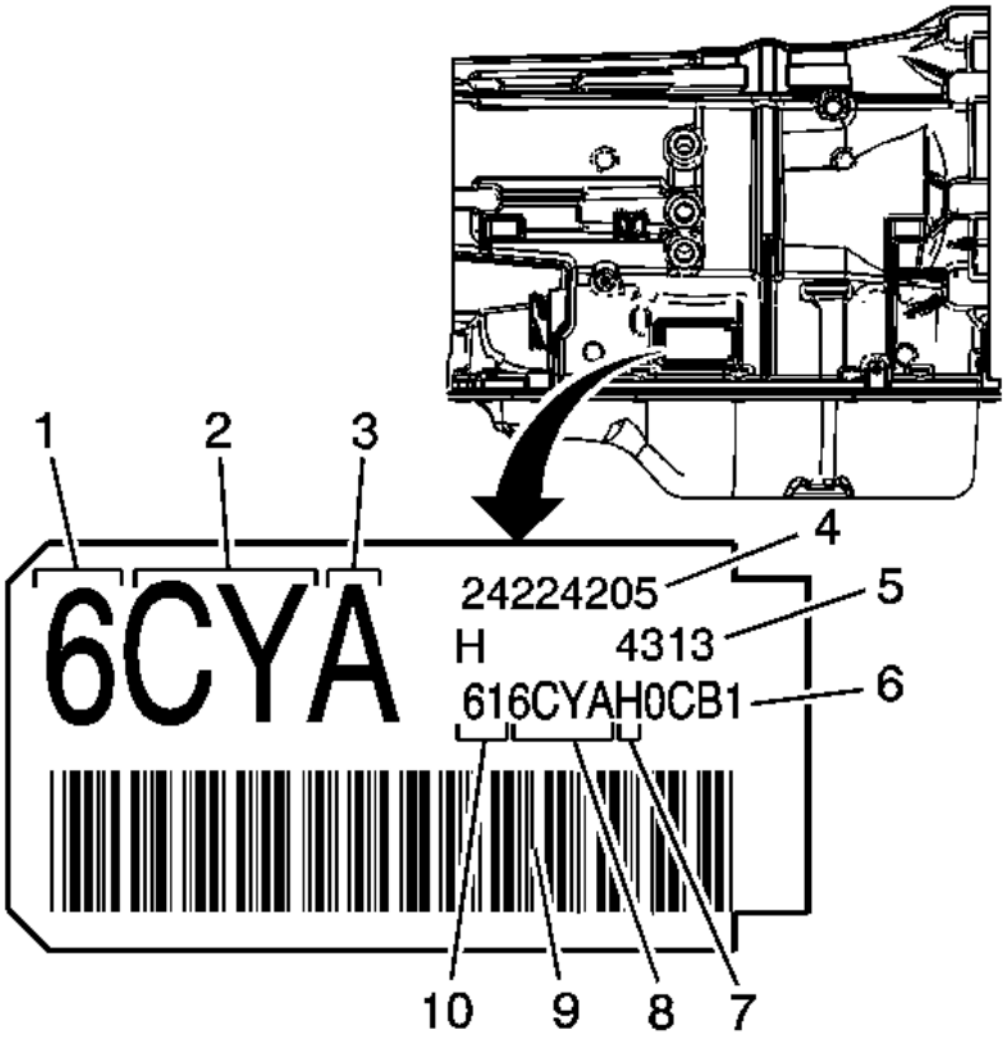


Fig. 199: Transmission Identification Information
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Model Year
2	Model Code
3	Transmission Family
4	Transmission Assembly Number

5	Julian date
6	Sequential Serial Number
7	Source Code
8	Broadcast Code
9	Bar Code
10	Transmission I.D.

TRANSMISSION GENERAL DESCRIPTION

The Hydra-matic 6-Speed RWD is a fully automatic, 6-speed, rear-wheel drive, electronic-controlled transmission. It consists primarily of a 4-element torque converter, an integral fluid pump and converter housing, a single and double planetary gear set, friction and mechanical clutch assemblies, and a hydraulic pressurization and control system. There are four variants of the transmission, all based on torque capacity. Architecture is common between the variants, and component differences are primarily related to size.

The 4-element torque converter contains a pump, a turbine, a pressure plate splined to the turbine, and a stator assembly. The torque converter acts as a fluid coupling to smoothly transmit power from the engine to the transmission. It also hydraulically provides additional torque multiplication when required. The pressure plate, when applied, provides a mechanical direct drive coupling of the engine to the transmission.

The planetary gear sets provide the 6 forward gear ratios and reverse. Changing gear ratios is fully automatic and is accomplished through the use of a transmission control module (TCM) located inside the transmission. The TCM receives and monitors various electronic sensor inputs and uses this information to shift the transmission at the optimum time.

The TCM commands shift solenoids and variable bleed pressure control solenoids to control shift timing and feel. The TCM also controls the apply and release of the torque converter clutch which allows the engine to deliver the maximum fuel efficiency without sacrificing vehicle performance. All the solenoids, including the TCM, are packaged into a self-contained control solenoid valve assembly.

The hydraulic system primarily consists of a vane-type pump, 2 control valve body assemblies, converter housing and case. The pump maintains the working pressures needed to stroke the clutch pistons that apply or release the friction components. These friction components, when applied or released, support the automatic shifting qualities of the transmission.

The friction components used in this transmission consist of 5 multiple disc clutches. The multiple disc clutches combine with one mechanical sprag clutch to deliver 7 different gear ratios, 6

forward and one reverse, through the gear sets. The gear sets then transfer torque through the output shaft.

The transmission may be operated in any of the following gear ranges:

PARK (P)

This position locks the rear wheels and prevents the vehicle from rolling either forward or backward. PARK is the best position to use when starting the vehicle. Because the transmission utilizes a shift lock control system, it is necessary to fully depress the brake pedal before shifting out of PARK. For safety reasons, use the parking brake in addition to the PARK position.

REVERSE (R)

This position allows the vehicle to be operated in a rearward direction.

NEUTRAL (N)

This position 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. This position should also be used when towing the vehicle.

DRIVE (D)

Drive range should be used for all normal driving conditions for maximum efficiency and fuel economy. Drive range allows the transmission to operate in each of the 6 forward gear ratios. Downshifts to a lower gear, or higher gear ratio, are available for safe passing by depressing the accelerator or by manually selecting a lower gear in the manual mode range.

MANUAL MODE (M)

This position allows the driver to select a range of gears appropriate for current driving conditions. Refer to the vehicle owner's manual for specific manual mode information.

TRANSMISSION COMPONENT AND SYSTEM DESCRIPTION

The mechanical components of the 6-Speed RWD are as follows:

- A torque converter with an electronically controlled capacity clutch (ECCC). ECCC was developed to reduce the possibility of noise, vibration, or chuggle caused by TCC apply. In

a torque converter with ECCC, the pressure plate does not always fully lock to the torque converter cover. Instead, the pressure plate maintains a small amount of slippage. In RWD 6-Speed transmissions, this slippage can range from 0-50 RPM. Full lockup (0 RPM slip) is still available on some applications. TCC may apply in 2nd, 3rd, 4th, 5th, or 6th gears. The specific TCC apply points and the amount of clutch slippage are determined by a number of operating conditions, including throttle position, vehicle speed, gear, as well as specific vehicle application. Transmission fluid temperature will also affect TCC apply points.

- Vane-type fluid pump assembly
- 1-2-3-4 and 3-5 Reverse clutch assembly
- Input sun gear and carrier assembly
- 4-5-6 clutch assembly with turbine shaft
- 4-5-6 clutch hub assembly
- 1-2-3-4 clutch hub assembly
- 2-6 and 3-5 reverse clutch hub assembly
- Center support assembly, with 2-6 clutch assembly, and low and Reverse clutch assembly
- Low clutch sprag assembly
- A double planetary output carrier assembly
- Output shaft assembly
- Control valve body assembly

The electrical components of the 6-Speed RWD are as follows:

- Input and output speed sensor assembly
- Manual shift shaft position switch
- Control solenoid valve assembly, which contains the following components:
  - Transmission control module (TCM)
  - 5 variable bleed line pressure control (PC) solenoids
  - Transmission fluid pressure (TFP) switch assembly
  - Torque converter clutch (TCC) pressure control solenoid
  - 2 shift solenoids

For more information, refer to **Electronic Component Description**.

TRANSMISSION ADAPTIVE FUNCTIONS

The 6L80 transmission utilizes a line pressure control system during upshifts to compensate for

the normal wear of transmission components. As the apply components within the transmission wear or change over time, shift time (the time required to apply a clutch) increase or decreases. In order to compensate for these changes, the transmission control module (TCM) adjusts the pressure commands to the various PC solenoids, to maintain the originally calibrated shift timing. The automatic adjusting process is referred to as "adaptive learning" and it is used to ensure consistent shift feel plus increase transmission durability. The TCM monitors the A/T input speed sensor (ISS) and the A/T output speed sensor (OSS) during commanded shifts to determine if a shift is occurring too fast (harsh) or too slow (soft) and adjusts the corresponding pressure control (PC) solenoid signal to maintain the set shift feel.

The purpose of the adapt function is to automatically compensate the shift quality for the various vehicle shift control systems. The adapt function is a continuous process that will help to maintain optimal shift quality throughout the life of the vehicle.

TRANSMISSION INDICATORS AND MESSAGES

The following transmission-related indicators and messages may be displayed on the Instrument Panel Cluster (IPC). For a complete listing and description of all vehicle indicators and messages, refer to **Indicator/Warning Message Description and Operation** .

"TRANSMISSION HOT IDLE ENGINE"

This message is displayed when the TCM detects a transmission fluid temperature (TFT) equal to or greater than 130°C (266°F) for 5 seconds.

"SERVICE TRANSMISSION"

This message displays when there is a problem with the transmission.

ELECTRONIC COMPONENT DESCRIPTION

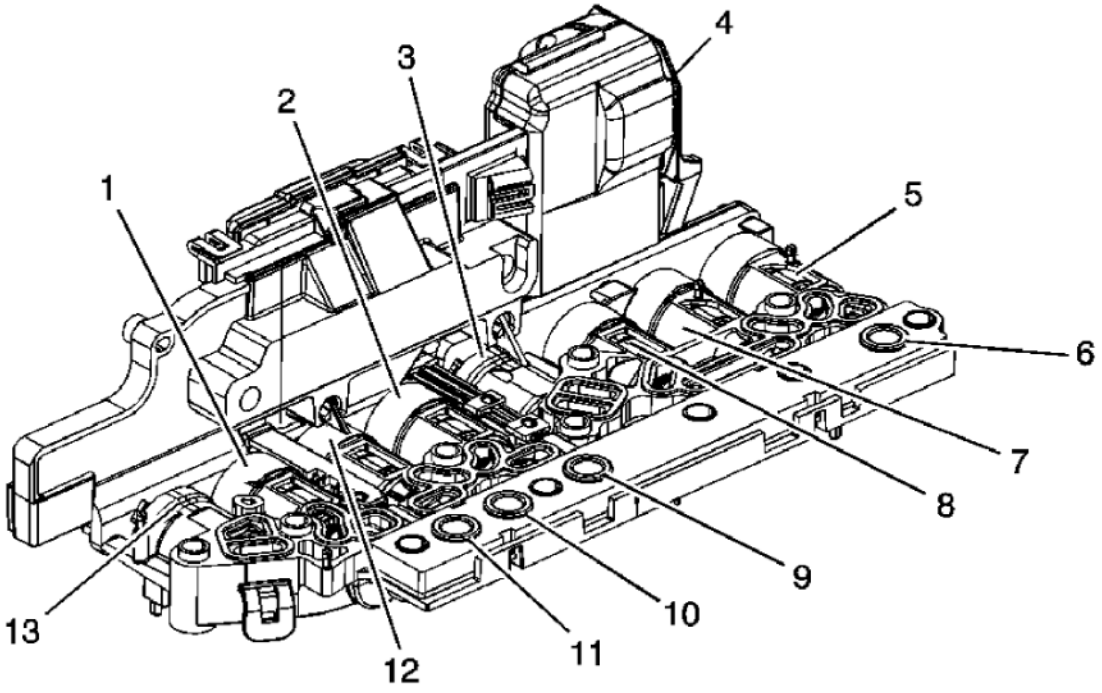


Fig. 200: Control Solenoid (W/Body and TCM) Valve Assembly
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Line Pressure Control (PC) Solenoid
2	Torque Converter Clutch (TCC) Pressure Control (PC) Solenoid
3	Shift Solenoid (SS) 2
4	16 Pin Connector
5	Pressure Control (PC) Solenoid 3
6	Transmission Fluid Pressure (TFP) Switch 5
7	Pressure Control (PC) Solenoid 4
8	Pressure Control (PC) Solenoid 2
9	Transmission Fluid Pressure (TFP) Switch 3
10	Transmission Fluid Pressure (TFP) Switch 1
11	Transmission Fluid Pressure (TFP) Switch 4
12	Pressure Control (PC) Solenoid 5
13	Shift Solenoid (SS) 1

The control solenoid (w/body and TCM) valve assembly contains the following components:

- Transmission control module (TCM)
- Clutch pressure control solenoids (Clutch PC Sol)
- Shift solenoids (SS)
- Line pressure control solenoid (Line PC Sol)
- Torque converter clutch pressure control solenoid (TCC PC Sol)
- Transmission fluid temperature sensor (TFT Sensor)
- TCM temperature sensor
- Power-up temperature sensor
- Transmission fluid pressure switches (TFP Sw)

These components are not serviced separately. The control solenoid (w/body and TCM) valve assembly utilizes a lead-frame system to connect these components electrically to the TCM. No wires are used for these components. The control solenoid (w/body and TCM) valve assembly bolts directly to the lower and upper valve body assemblies inside the transmission. The control solenoid (w/body and TCM) valve assembly connects to the engine harness 16-way connector via a pass-thru sleeve.

INTERNAL MODE SWITCH (IMS)

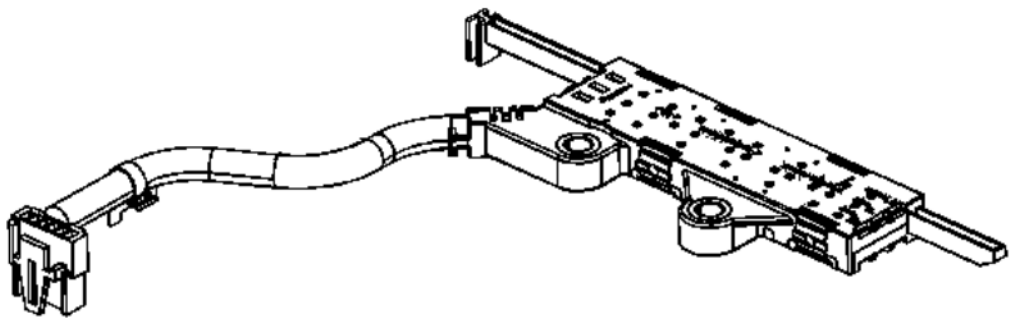


Fig. 201: Identifying Internal Mode Switch (IMS)
Courtesy of GENERAL MOTORS CORP.

The transmission manual shift shaft switch assembly is a sliding contact switch attached to the manual shift shaft inside the transmission case. The five inputs to the TCM from the transmission manual shift shaft switch assembly indicate the transmission gear selector lever position. This

information is used for engine controls as well as determining the transmission shift patterns. The state of each input is available for display on the scan tool. The five input parameters represented are Signal A, Signal B, Signal C, Signal P (Parity) and Signal N (P/N Start).

INPUT SPEED SENSOR (ISS)

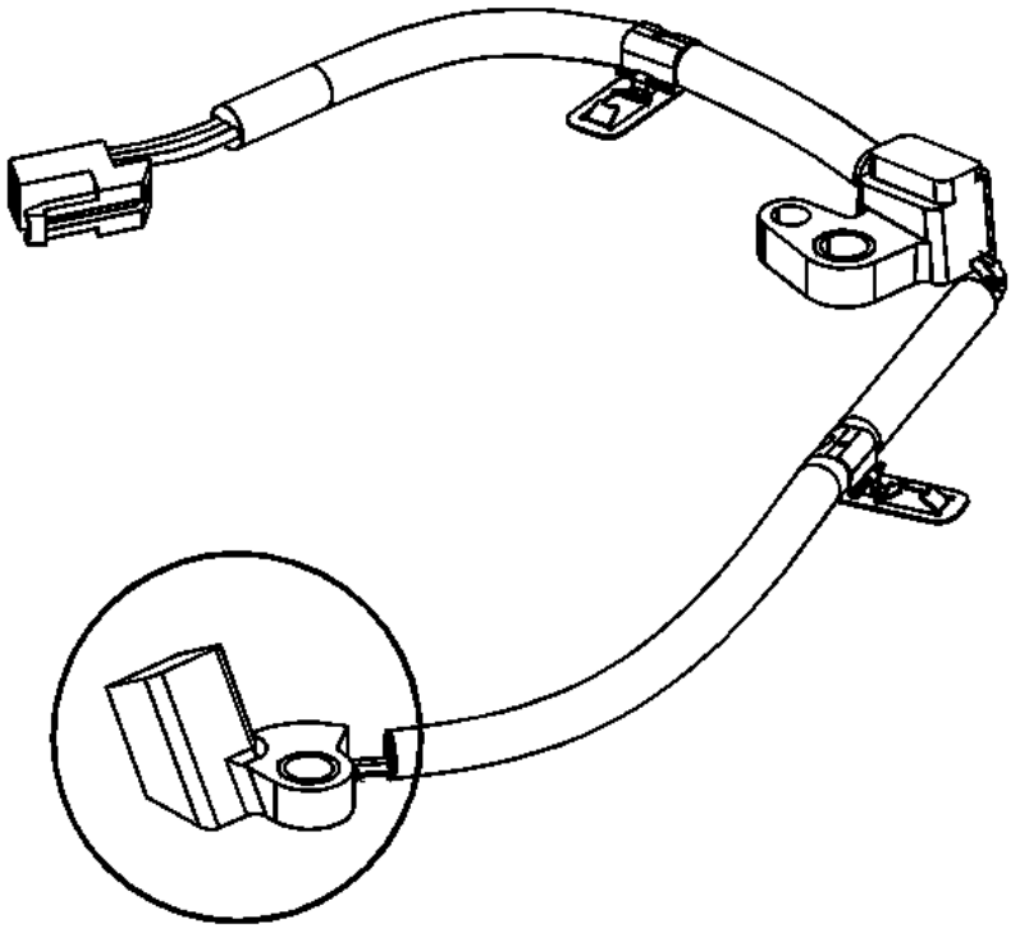


Fig. 202: Identifying Input Speed Sensor (ISS)
Courtesy of GENERAL MOTORS CORP.

The input speed sensor (ISS) is a hall-effect type sensor. The ISS mounts to the control valve upper body assembly and connects to the control solenoid (w/body and TCM) valve assembly through a wire harness and connector. The sensor faces the 1-2-3-4 and 3-5-R clutch housing

machined teeth surface. The sensor receives 8.3-9.3 volts on the ISS/OSS Supply Voltage circuit from the TCM. As the 1-2-3-4 and 3-5-R clutch housing rotates, the sensor produces a signal frequency based on the machined surface of the 1-2-3-4 and 3-5-R clutch housing. This signal is transmitted through the ISS signal circuit to the control solenoid (w/body and TCM) valve assembly. The control solenoid (w/body and TCM) valve assembly uses the ISS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

OUTPUT SPEED SENSOR (OSS)

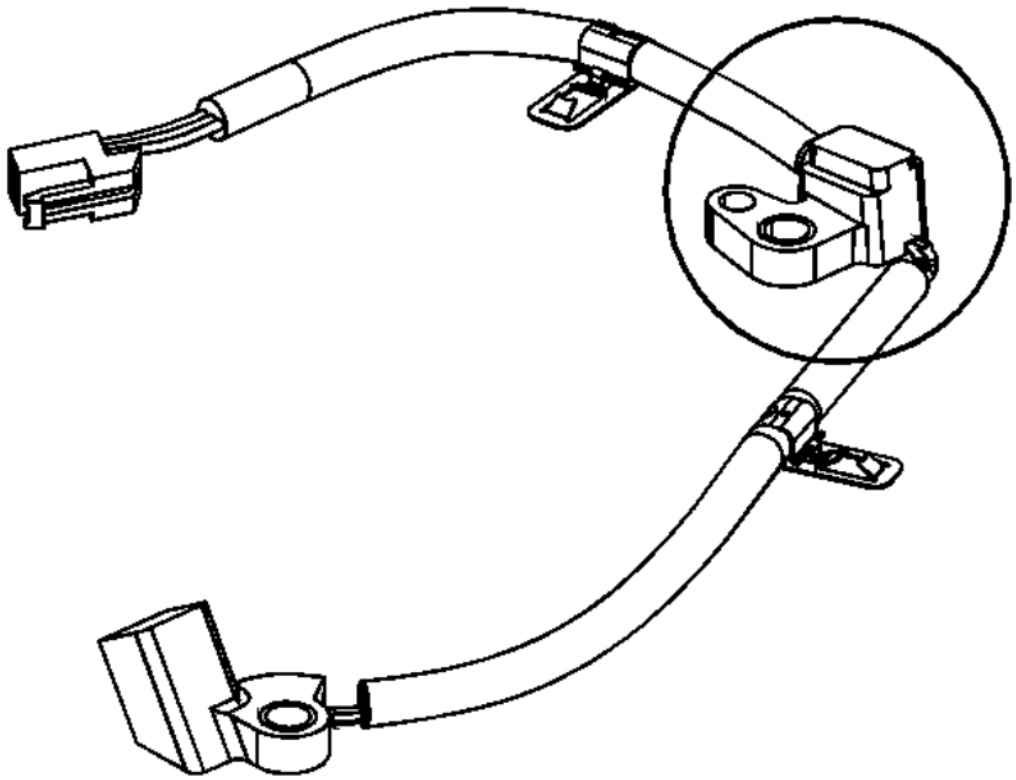


Fig. 203: Identifying Output Speed Sensor (OSS)
Courtesy of GENERAL MOTORS CORP.

The output speed sensor (OSS) is a hall-effect type sensor. The OSS mounts to the control valve upper body assembly and connects to the control solenoid (w/body and TCM) valve assembly through a wire harness and connector. The sensor faces the output shaft machined teeth surface.

The sensor receives 8.3-9.3 volts on the ISS/OSS supply voltage circuit from the TCM. As the output shaft rotates, the sensor produces a signal frequency based on the machined surface of the output shaft. This signal is transmitted through the OSS signal circuit to the TCM. The TCM uses the OSS signal to determine line pressure, transmission shift patterns, torque converter clutch (TCC) slip speed and gear ratio.

AUTOMATIC TRANSMISSION INLINE 16-WAY CONNECTOR DESCRIPTION

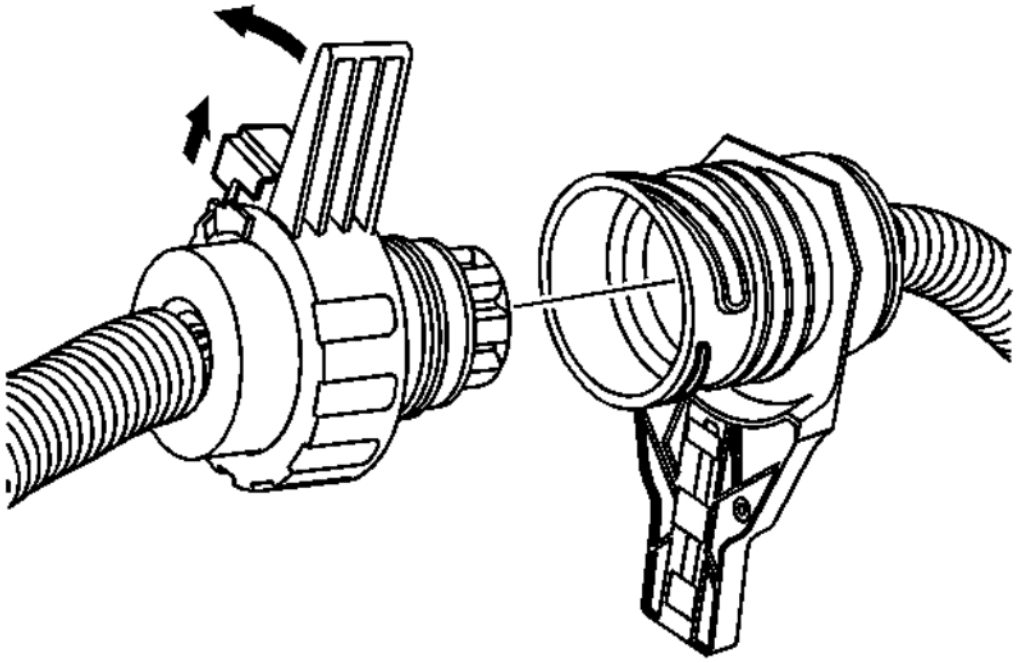


Fig. 204: Identifying Automatic Transmission Inline 16-Way Connector
Courtesy of GENERAL MOTORS CORP.

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 the external wiring harness
- Dirt contamination entering the connector when disconnected

- 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:

- Limit twisting or wiggling the connector during removal. Bent pins can occur.
- Do not pry the connector off with a screwdriver or other tool.
- 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.

Use the following procedure to disconnect the engine side of the 16-way connector from the transmission side:

1. Unlock the slide lock on the engine wiring harness connector.
2. Rotate the connector lever counterclockwise and remove the connector from the electrical connector passage sleeve.

Use the following procedure to reconnect the engine side of the 16-way connector to the transmission side:

1. Orient the alignment slot on the engine side of the connector with the alignment tab on the electrical connector passage sleeve.
2. Slide the engine side connector through the electrical connector passage sleeve and into the transmission side connector.
3. Rotate the connector lever clockwise until the connector is fully seated.
4. Lock the slide lock on the connector.

PARK - ENGINE RUNNING

When the gear selector lever is in the Park (P) position, fluid is drawn into the pump through the transmission fluid filter assembly, from the transmission fluid pan assembly. Line pressure is then directed to the following valves:

FLUID PRESSURE DIRECTED IN PREPARATION FOR A SHIFT

Manual Valve

Mechanically controlled by the gear selector lever, the manual valve is in the Park (P) position and prevents line pressure from the pressure regulator valve from entering the reverse and drive circuits.

CBR1/C456 Pressure Control (PC) Solenoid 3

The CBR1/C456 pressure control solenoid (PCS) is energized (HIGH) allowing actuator feed limit fluid to enter the PCS CBR1/C456 CL fluid circuit. PCS CBR1/C456 CL fluid is then routed through orifice #31 to the 4-5-6 clutch boost valve and through orifice #39 to the CBR1/C456 clutch regulator valve.

CBR1/C456 Clutch Regulator Valve

PCS CBR1/C456 CL fluid at the CBR1/C4-5-6 clutch regulator valve moves the valve against CBR1/C4-5-6 clutch regulator spring force and CBR1/FDBK fluid. This allows line pressure to pass through the valve and enter the CBR1/456CL FD circuit. CBR1/456CL FD is then routed to clutch select valve 2.

Shift Solenoid 1

Shift solenoid 1 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 1 circuit. Solenoid 1 fluid is routed to the #2 ball check valve and through orifice #10 to the torque converter clutch (TCC) regulator valve and shuttle valve (SHTL).

TCC Regulator Valve and Shuttle Valve

Solenoid 1 fluid is routed to the TCC regulator valve and shuttle valve and moves the valve against TCC regulator valve spring force.

#2 Ball Check Valve

Solenoid 1 fluid seats the #2 ball check valve against the reverse fluid passage and fluid is forced through orifice #22 into the CSV2 enable fluid circuit.

Clutch Select Valve 2

CSV2 enable fluid is routed to the clutch select valve 2 and moves the valve against clutch select valve 2 spring force. This allows CBR1/456 CL FD fluid to pass through the valve and enter the CBR1/CBR FD circuit. CBR1/CBR FD fluid is then routed: to clutch select valve 3, into the

CBR1 fluid circuit and, through orifice #49 where it enters the CBR fluid circuit and an exhaust passage at the clutch select valve 3 (this fluid is intended to keep the low and reverse clutch full of fluid but not pressurized). CBR1 fluid is then routed to the low & reverse clutch assembly in preparation for a shift into low or reverse gear.

Shift Solenoid 2

Shift solenoid 2 is energized (ON) allowing actuator feed limit fluid to enter the solenoid 2 fluid circuit and is then routed to the #3 ball check valve.

3-5 Reverse Clutch Regulator Valve

Actuator feed limit fluid is routed through the valve and into the PS1 fluid passage. PS1 fluid is then sent to the normally closed #1 pressure switch and opens the switch.

#3 Ball Check Valve

Solenoid 2 fluid seats the #3 ball check valve against 456 CL fluid passage and fluid is forced through orifice #20 into the CSV3 enable fluid circuit. CSV3 enable fluid is then routed to the clutch select valve 3.

Clutch Select Valve #3

CSV3 enable fluid moves the clutch select valve 3 against clutch select valve 3 spring force. CBR fluid at the clutch select valve 3 passes through the valve and exhausts.

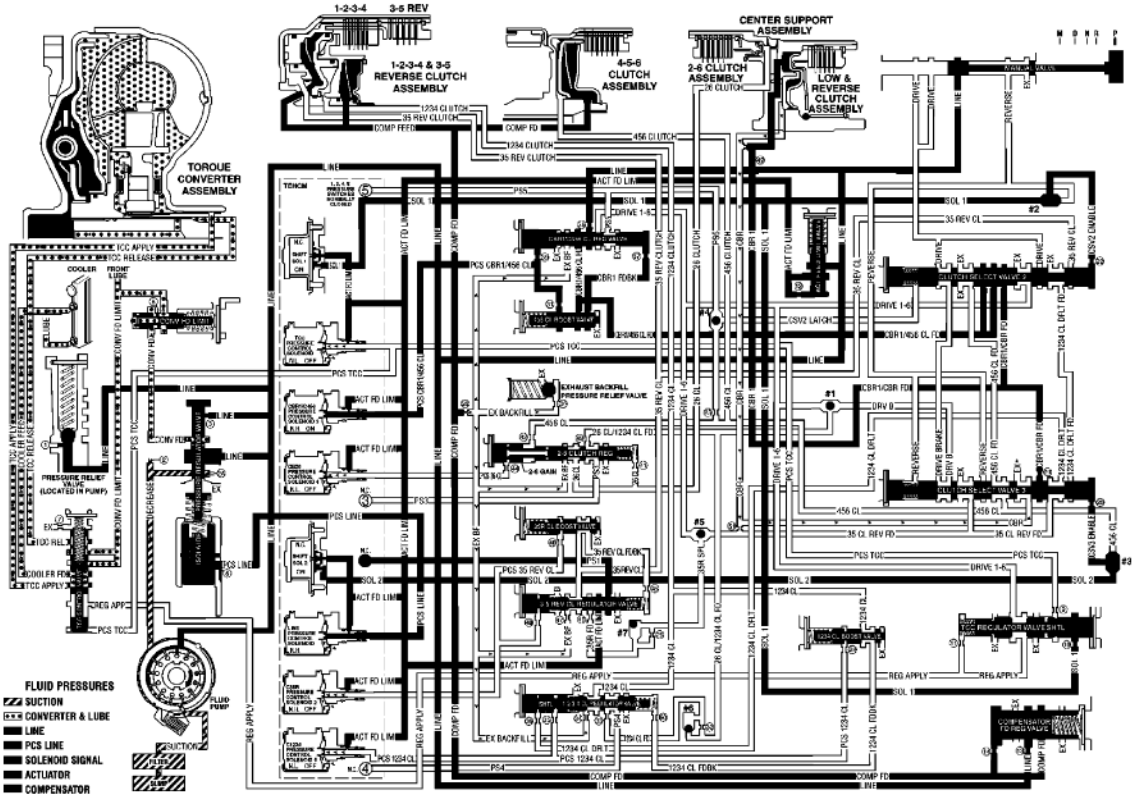


Fig. 205: Park - Engine Running
Courtesy of GENERAL MOTORS CORP.

REVERSE

When the gear selector lever is moved to the Reverse (R) position (from the Park position) the normally high C35R pressure control solenoid 2 is commanded ON and the following changes occur in the transmission's hydraulic and electrical systems:

FLUID PRESSURE DIRECTED IN PREPARATION FOR A SHIFT

Manual Valve

With the manual valve in the reverse position, line pressure is directed into the reverse fluid circuit to the #2 ball check valve and clutch select valve 3.

#2 Ball Check Valve

Reverse fluid seats the #2 ball check valve against the solenoid 1 fluid passage and fluid is forced through orifice #22 into the CSV2 enable circuit.

Clutch Select Valve 2

CSV2 enable fluid, present at the valve from Park position, continues to hold the clutch select valve 2 against clutch select valve 2 spring force.

LOW AND REVERSE CLUTCH APPLIES

Clutch Select Valve 3

Reverse fluid from the manual valve is routed to clutch select valve 3 to combine with clutch select valve 3 spring force to keep the valve in the off position. This allows reverse fluid to pass through the valve and enter the 3-5 clutch reverse feed circuit. The 3-5 clutch reverse feed fluid from the clutch select valve 3 is also routed to #5 ball check valve. CBR1/CBR FD fluid is also directed through the clutch select valve 3 to the low and reverse clutch assembly.

Low and Reverse Clutch

CBR and CBR1 fluid pressures are routed to both the inner and outer areas of the low and reverse clutch piston to hold the piston against spring force and hold the low and reverse clutch plates. The clutch was already applied in Park, but is applied with more holding capacity in Reverse (both piston areas are pressurized).

#5 Ball Check Valve

The 3-5 clutch reverse feed fluid seats #5 ball check valve against the drive 1-6 circuit allowing 3-5 clutch reverse feed fluid to enter the 3-5 reverse supply circuit. The 3-5 reverse supply fluid is then routed to #7 ball check valve and through orifice #25 where it enters the 3-5 reverse feed circuit. The 3-5 reverse feed passes through orifice #46 and then is routed to the 3-5 reverse clutch regulator valve.

3-5 REVERSE CLUTCH APPLIES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is energized (HIGH) allowing actuator feed limit fluid to enter the PCS 3-5 reverse clutch circuit. PCS 3-5 reverse clutch fluid is then routed through orifice #48 to the 3-5 reverse clutch regulator valve and through orifice #40 to the 3-5 reverse boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch and the 3-5 reverse boost valve. PS1 fluid from pressure

switch 1 exhausts through the valve allowing the switch to close.

3-5 Reverse Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 clutch reverse feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and reverse clutch housing to move the piston against spring force and compensator feed fluid to apply the 3-5 reverse clutch plates.

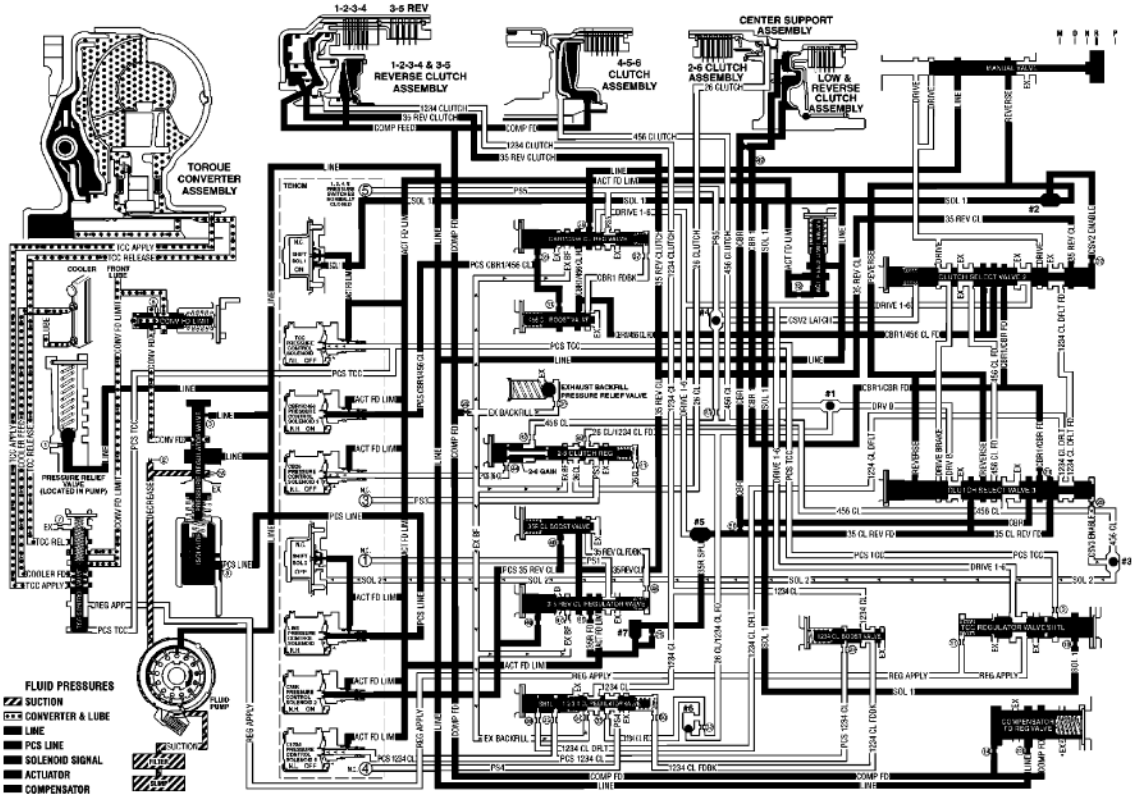


Fig. 206: Reverse
Courtesy of GENERAL MOTORS CORP.

NEUTRAL - ENGINE RUNNING

When the gear selector is moved to the Neutral (N) position, the hydraulic and electrical system operation is identical to Park (P) range. However, if Neutral is selected after the vehicle was operating in Reverse (R), the normally high C35R pressure control solenoid 2 is commanded OFF and the following changes would occur in the hydraulic system:

3-5 REVERSE CLUTCH RELEASES

Manual Valve

The manual valve is moved to the Neutral position and blocks line pressure from entering the reverse and drive fluid circuits. The reverse fluid from the #2 ball check valve and clutch select valve 3 is opened to an exhaust passage at the manual valve.

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF allowing PCS 3-5 reverse clutch fluid from the 3-5 reverse clutch boost valve and 3-5 reverse clutch regulator valve to exhaust.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 3-5 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 3-5 reverse clutch circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 3-5 reverse clutch fluid from the 3-5 reverse clutch and clutch select valve 2 to pass through the valve and enter the exhaust backfill fluid circuit. The 3-5 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with a force from the compensator moves the 3-5 reverse clutch piston to release the 3-5 reverse clutch plates and force 3-5 reverse clutch fluid to exhaust from the 1-2-3-4 and 3-5 reverse clutch housing. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve allowing the 3-5 reverse clutch to release.

Clutch Select Valve 3

When reverse fluid exhausts through the manual valve, CSV3 enable fluid moves the valve against clutch select valve 3 spring force. The 3-5 reverse feed fluid is routed around #7 ball check valve

and into the 3-5 reverse supply circuit. The 3-5 reverse supply fluid is routed around #5 ball check valve and into the 3-5 clutch reverse feed circuit and exhausts at the clutch select valve 3.

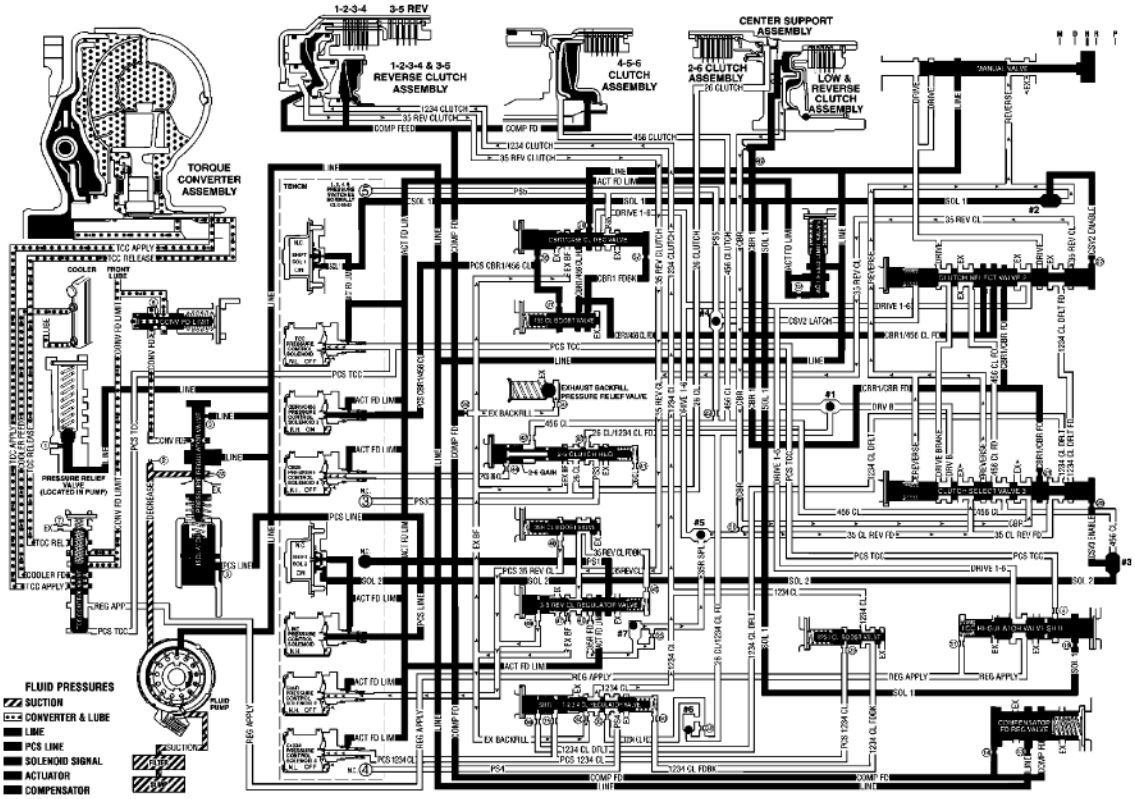


Fig. 207: Neutral - Engine Running
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, FIRST GEAR ENGINE BRAKING

When the gear selector lever is moved to the Drive (D) range from the Neutral (N) position, the transmission will provide engine braking. In this operating range, the normally-low C1234 pressure control solenoid 5 is commanded ON and in the engine braking mode the following changes occur within the hydraulic circuits:

FLUID PRESSURE IS DIRECTED TO THE 1-2-3-4 CLUTCH AND THE LOW AND REVERSE CLUTCH TO PROVIDE ENGINE BRAKING

Manual Valve

The manual valve is moved to the Drive (D) position and allows line fluid pressure to enter the drive fluid circuit. Drive fluid is then routed to the clutch select valve 2.

Clutch Select Valve 2

Drive fluid at the clutch select valve 2 passes through the valve and enters the drive brake circuit. Drive brake fluid is then routed to the clutch select valve 3.

Clutch Select Valve 3

Drive brake fluid at the clutch select valve 3 passes through the valve and enters the Drive B fluid circuit. Drive B fluid is then routed to #1 ball check valve.

#1 Ball Check Valve

Drive B fluid seats the #1 ball check valve against drive 1-6 fluid to force drive B fluid into the CB26/C1234 feed passage. CB26/C1234 feed fluid is routed to the #6 ball check valve, through orifice #43 and, to the 2-6 clutch regulator valve. CB26/C1234 feed fluid passes through the 2-6 clutch regulator valve and enters the pressure switch 3 (PS3) fluid circuit. PS3 fluid is then routed to the normally closed pressure switch 3 and opens the switch.

#6 Ball Check Valve

CB26/C1234 feed fluid seats the #6 ball check valve against the 1234 clutch feed passage forcing CB26/C1234 feed fluid through orifice #32 before entering the 1234 clutch feed circuit. The 1234 clutch feed fluid is routed through orifice #33 and then to the 1-2-3-4 clutch regulator valve.

1-2-3-4 CLUTCH APPLIES

C1234 Pressure Control Solenoid 5

The C1234 pressure control solenoid 5 is commanded ON allowing actuator feed limit fluid to enter the PCS1234 clutch fluid circuit. PCS1234 clutch fluid is then routed through orifice #35 to the 1-2-3-4 clutch regulator valve. PCS1234 clutch fluid is also routed through orifice #29 and then to the 1-2-3-4 clutch boost valve.

1-2-3-4 Clutch Regulator Valve

PCS1234 clutch fluid moves the 1-2-3-4 clutch regulator valve against 1-2-3-4 clutch regulator valve spring force to allow 1234 clutch feed fluid to pass through the valve and enter the 1234 clutch fluid circuit. The 1234 clutch fluid is then routed to the 1234 clutch boost valve and the 1-2-3-4 clutch.

1-2-3-4 Clutch Boost Valve

PCS1234 clutch fluid pressure acts on a differential area moving the 1234 clutch boost valve against the 1234 clutch boost valve spring. The 1234 clutch fluid passes through the valve and

enters the 1234 clutch feedback circuit. As PCS 1234 clutch fluid pressure is increased to a given value, the 1234 clutch boost valve opens the 1234 clutch feedback circuit to exhaust. This results in the 1234 clutch regulator valve moving to the full feed position sending full 26 CL/1234 CL feed pressure (full line pressure) to the clutch.

1-2-3-4 Clutch

The 1234 clutch fluid enters the 1234 clutch housing to move the piston against spring force and compensator feed fluid to apply the 1-2-3-4 clutch plates.

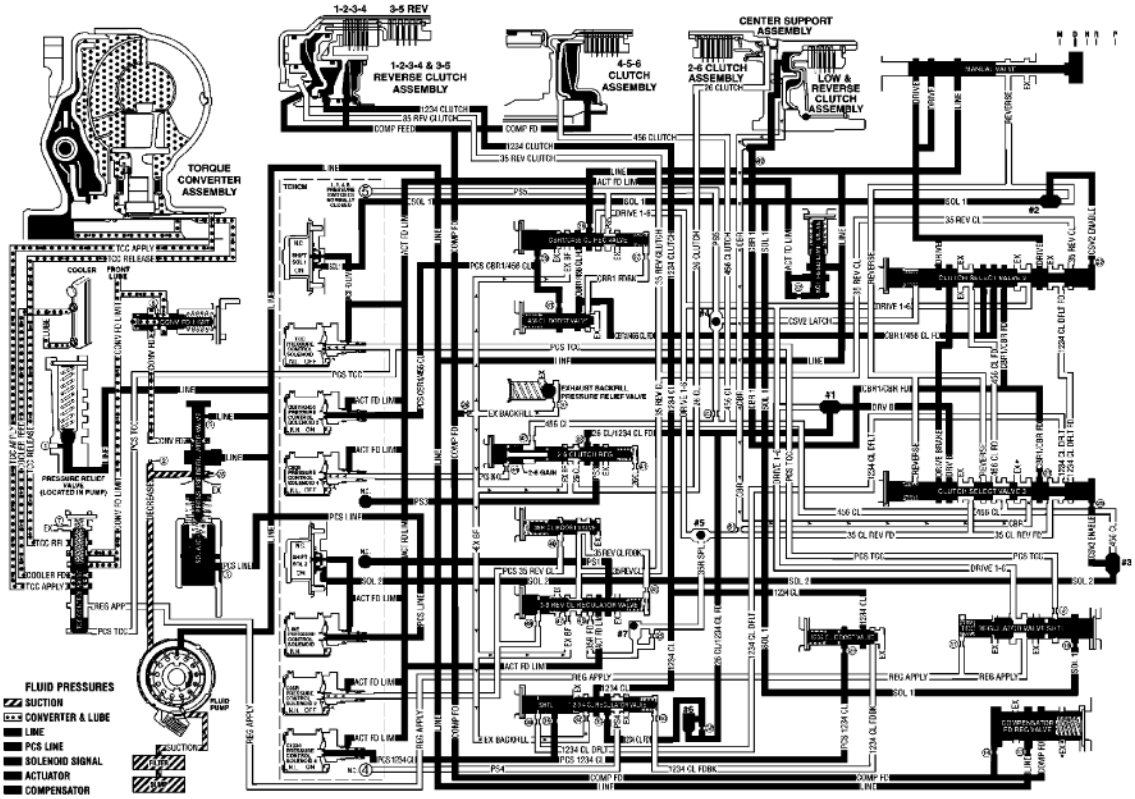


Fig. 208: Drive Range, First Gear Engine Braking
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, FIRST GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, throttle position sensor and other vehicle sensors to determine the precise moment to deenergize or "turn off" shift solenoid 1 and command OFF the normally-high CBR1/C456 pressure control solenoid 3.

LOW & REVERSE CLUTCH RELEASES

Shift Solenoid 1

When shift solenoid 1 is "turned OFF", CSV2 enable fluid from the clutch select valve 2 passes by the #2 ball check valve and enters the solenoid 1 fluid circuit. Solenoid 1 fluid from the #2 ball check valve and TCC regulator valve is then routed to the solenoid where it exhausts.

Clutch Select Valve 2

Clutch select valve 2 (CSV2) enable fluid is exhausted from the clutch select valve 2 and clutch select valve 2 spring force moves the valve to the released position. With clutch select valve 2 in the released position, drive fluid from the manual valve passes through the valve and enters the drive 1-6 fluid circuit. Drive 1-6 fluid then feeds all clutch regulator valves and the TCC regulator valve.

CBR1/C456 Pressure Control Solenoid 3

The CBR1/C456 pressure control solenoid 3 is commanded OFF allowing PCS CBR1/C456 fluid from the CBR1/C456 clutch regulator valve and 456 clutch boost valve to exhaust.

CBR1/C456 Clutch Regulator Valve

CBR1/C456 clutch regulator valve spring force moves the valve to exhaust the CBR1/456 clutch feed circuit and allow drive 1-6 fluid to enter the PS5 fluid circuit. PS5 fluid is then routed to the normally-closed pressure switch 5 and opens the switch. PS5 fluid is also routed to the #4 ball check valve and flows into the CSV2 latch fluid circuit.

#4 Ball Check Valve

PS5 fluid pressure seats the #4 ball check valve against the 456 clutch fluid circuit. PS5 fluid is then directed into the CSV2 latch fluid circuit and routed to the clutch select valve 2. CSV2 latch fluid combines with clutch select valve 2 spring force and holds the valve in this position during all 6 forward gear ranges.

#5 Ball Check Valve

Drive 1-6 fluid pressure seats the #5 ball check valve against the 35 clutch reverse feed fluid passage. Drive 1-6 fluid is then directed into the 35R supply fluid circuit which is routed to the #7 ball check valve and orifice #25.

#7 Ball Check Valve

The 35R supply fluid seats the #7 ball check valve against the 35R feed fluid passage to force 35R supply fluid through orifice #25 before entering the 35R feed circuit. The 35R feed fluid is

then routed to the 3-5 reverse clutch regulator valve.

Low and Reverse Clutch

Low and reverse clutch spring force moves the low and reverse clutch piston which forces clutch braking (CBR) and CBR1 fluid out of the center support. CBR fluid is routed to the clutch select valve 3 where it exhausts. CBR1 fluid is routed to the clutch select valve 2 where it exhausts. The low and reverse clutch is in the released position.

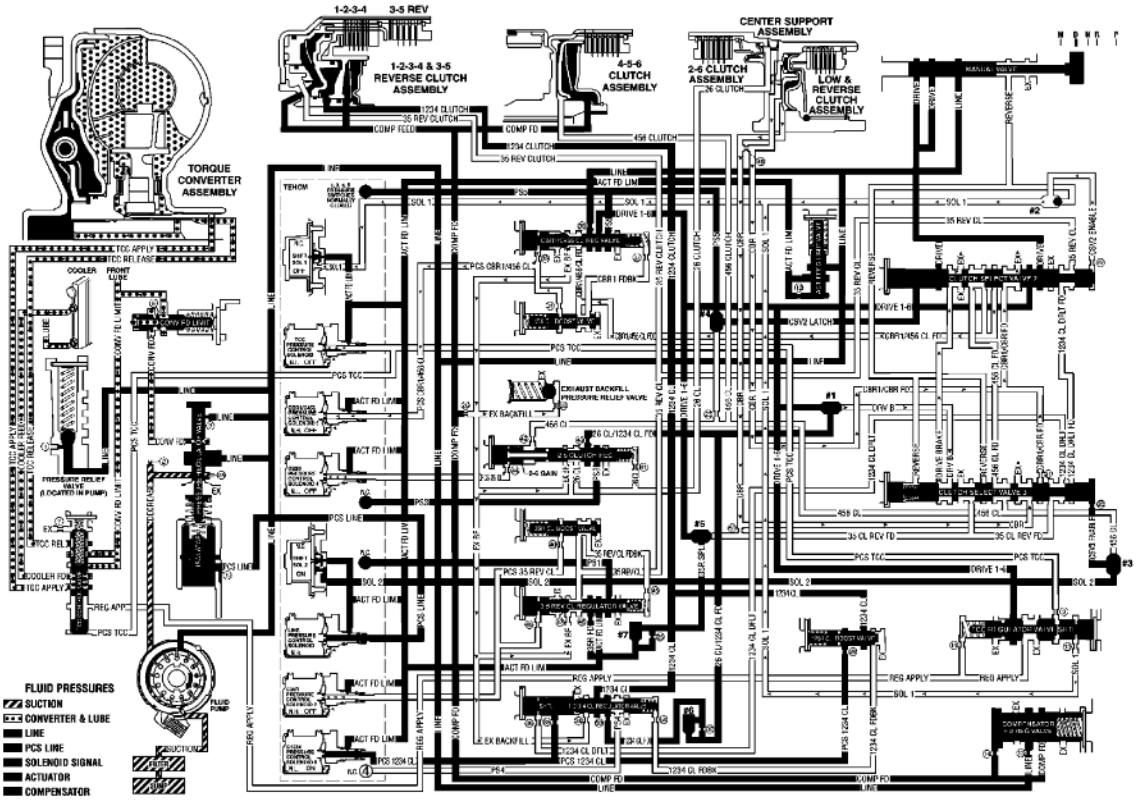


Fig. 209: Drive Range, First Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, SECOND GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low pressure control solenoid 4.

SECOND CLUTCH APPLIES

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded ON, allowing actuator feed limit fluid to enter the pressure control solenoid (PCS) 26 clutch fluid circuit. PCS 26 clutch fluid is then routed through orifice #44 to the 2-6 clutch regulator gain valve.

2-6 Clutch Regulator Gain Valve

The 2-6 clutch regulator gain valve allows the gain (valve input to output pressure magnification factor) of the 2-6 clutch regulator valve to be different for a 1-2 shift verses a 5-6 shift. For a 1-2 shift, PCS 26 clutch fluid pressure acts on a differential area resulting in the "high gain" pressure output.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator / gain valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #41 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch within the center support.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the center support and to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

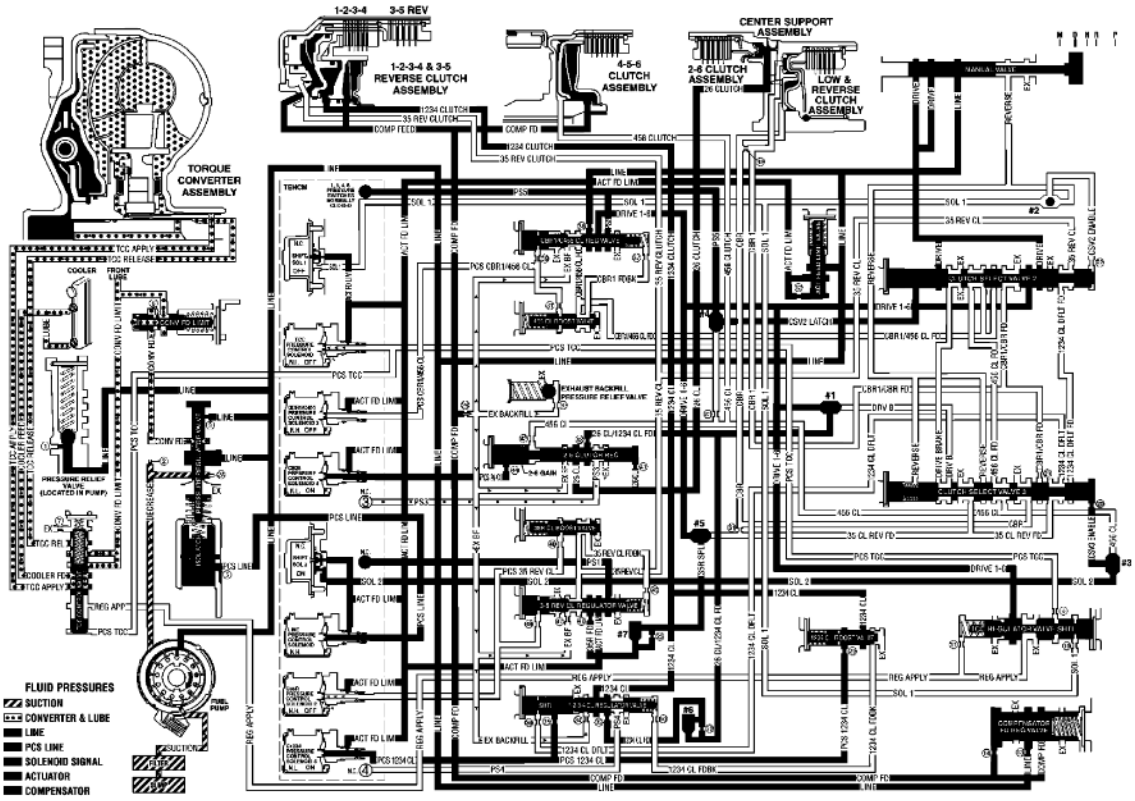


Fig. 210: Drive Range, Second Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, THIRD GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-low CB26 pressure control solenoid 4. At the same time the C35R pressure control solenoid 2 is also commanded ON to regulate 3-5 clutch apply.

3-5 REVERSE CLUTCH APPLIES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded ON allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve allowing the switch to close.

3-5 Reverse Clutch

The 35 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

2-6 CLUTCH RELEASES

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded OFF allowing PCS 26 clutch fluid from the 2-6 clutch regulator valve to exhaust. The 26 clutch/1234 clutch feed fluid at the 2-6 clutch regulator valve passes through the valve and enters the PS3 fluid circuit. PS3 fluid is then routed to pressure switch 3 and opens the normally-closed switch.

2-6 Clutch Regulator Valve

The 2-6 clutch regulator valve spring force moves the valve to allow 26 clutch fluid from the 2-6 clutch to pass through the valve and enter the exhaust backfill fluid circuit.

2-6 Clutch

The 2-6 clutch spring force moves the 2-6 clutch piston to release the 2-6 clutch plates and forces 26 clutch fluid to exhaust from the center support. The 26 clutch fluid is routed through the 2-6 clutch regulator valve where it enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

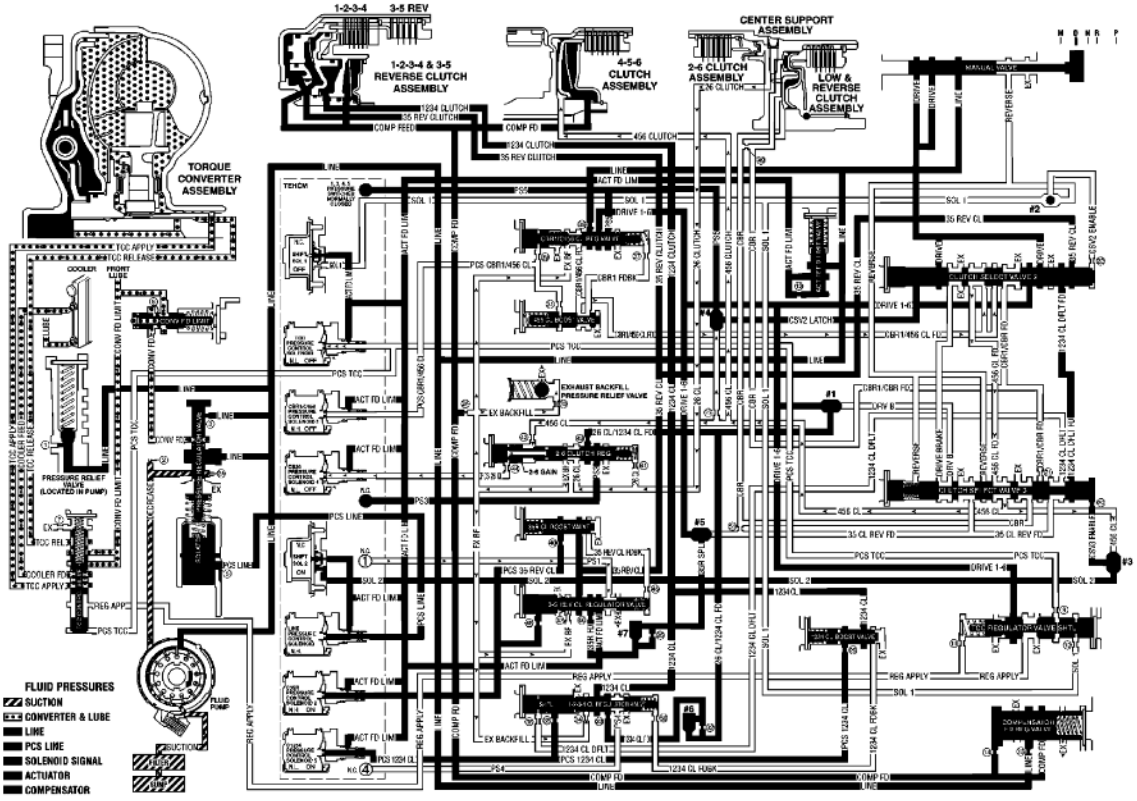


Fig. 211: Drive Range, Third Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, THIRD GEAR DEFAULT

If the transmission is in 1st, 2nd or 3rd gear during a transmission electrical component failure, the transmission will default to 3rd gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. This default action will enable the vehicle to be safely driven to a service center.

1-2-3-4 CLUTCH STAYS APPLIED

Shift Solenoid 2

Shift solenoid 2 defaults to it's normally-closed state (OFF), and SOL 2 fluid exhausts through the solenoid.

Clutch Select Valve 3

Solenoid 2 fluid pressure no longer holds the clutch select valve 3 open. When the valve moves back to the closed position, it opens the 1234 clutch default fluid circuit, and 1234 default fluid is routed to the 1-2-3-4 clutch regulator valve.

1-2-3-4 Clutch Regulator Valve

With the absence of PCS 1234 clutch fluid, due to the default state of the C1234 pressure control solenoid 5, the 1-2-3-4 regulator valve would close from spring force. However, the 1234 clutch default fluid enters behind the 1-2-3-4 regulator shuttle valve and keeps the valve in the open position.

1-2-3-4 Clutch

With the 1-2-3-4 clutch regulator valve still held in the open position, the 1-2-3-4 clutch will stay applied.

3-5 REVERSE CLUTCH APPLIED OR APPLIES

C35R Pressure Control Solenoid 2

The normal state for the C35R pressure control solenoid 2 is ON, therefore PSC 35 reverse clutch fluid will still be routed to the 3-5 reverse clutch regulator valve and the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch

plates.

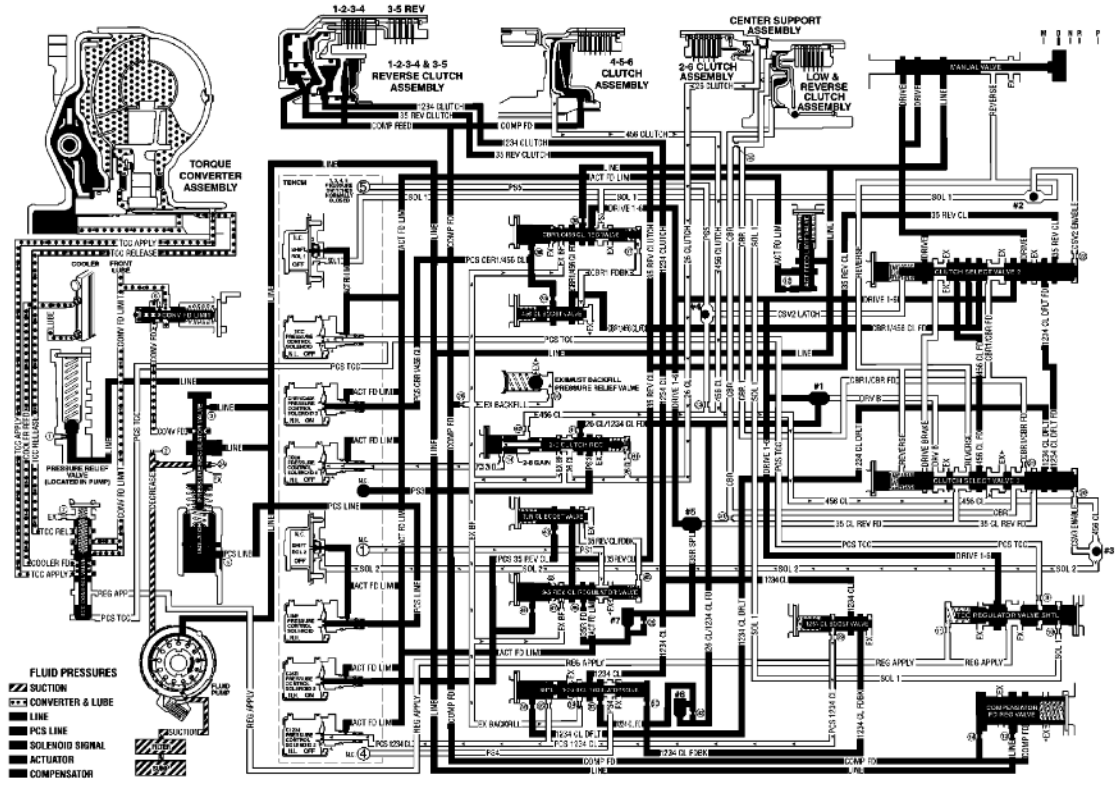


Fig. 212: Drive Range, Third Gear Default
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE - FOURTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command OFF the normally-high C35R pressure control solenoid 2. At the same time the normally-low CBR1/C456 pressure control solenoid 3 is commanded ON to regulate 4-5-6 clutch apply.

4-5-6 CLUTCH APPLIES

CBR1/C456 Pressure Control Solenoid 3

The CBR1/C456 pressure control solenoid 3 (PCS) is commanded ON allowing actuator feed fluid to enter the PCS CBR1/456 clutch fluid circuit. PCS CBR1/456 clutch fluid is routed through orifice #39 to the CBR1/C456 clutch regulator valve and, through orifice #31 to the CBR1/C456 clutch boost valve.

CBR1/C456 Clutch Regulator Valve

PCS CBR1/456 clutch fluid moves the CBR1/C456 clutch regulator valve against CBR1/C456 clutch regulator valve spring force to allow line fluid to pass through the valve an enter the CBR1/456 clutch feed circuit. CBR1/456 clutch feed is then routed to the 4-5-6 clutch boost valve and clutch select valve 2.

4-5-6 Clutch Boost Valve

PCS CBR1/456 clutch fluid pressure acts on a differential area moving the CBR1/456 clutch boost valve against the CBR1/456 clutch boost valve spring. CBR1/456 clutch fluid passes through the valve and enters the CBR1/456 clutch feedback circuit. As PCS CBR1/456 clutch fluid pressure is increased to a given value, the CBR1/456 clutch boost valve opens the CBR1/456 clutch feedback circuit to exhaust. This results in the CBR1/456 clutch regulator valve moving to the full feed position, sending full line pressure to the clutch.

Clutch Select Valve 2

CBR1/456 clutch feed fluid passes through the clutch select valve 2 and enters the 456 clutch feed circuit. The 456 clutch feed fluid is routed to the clutch select valve 3 where it passes through the valve and enters the 456 clutch fluid circuit. The 456 clutch fluid is routed to the 4-5-6 clutch, the 2-6 clutch regulator gain valve and to the #3 ball check valve. The 456 clutch fluid seats the #3 ball check valve against solenoid 2 fluid passage and directed into the CSV3 enable fluid circuit where it is routed through orifice #20 and to clutch select valve 3.

4-5-6 Clutch

The 456 clutch fluid enters the 4-5-6 clutch housing to move the piston against spring force, combined with force from the compensator to apply the 4-5-6 clutch plates.

3-5 REVERSE CLUTCH RELEASES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5 reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch fluid circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 35 reverse clutch fluid from the 3-5 reverse clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with force from the compensator move the 3-5 reverse clutch piston to release the 3-5 clutch plates and forces 35 reverse clutch fluid to exhaust from 1- 2-3-4 and 3-5 reverse clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve and exhausted.

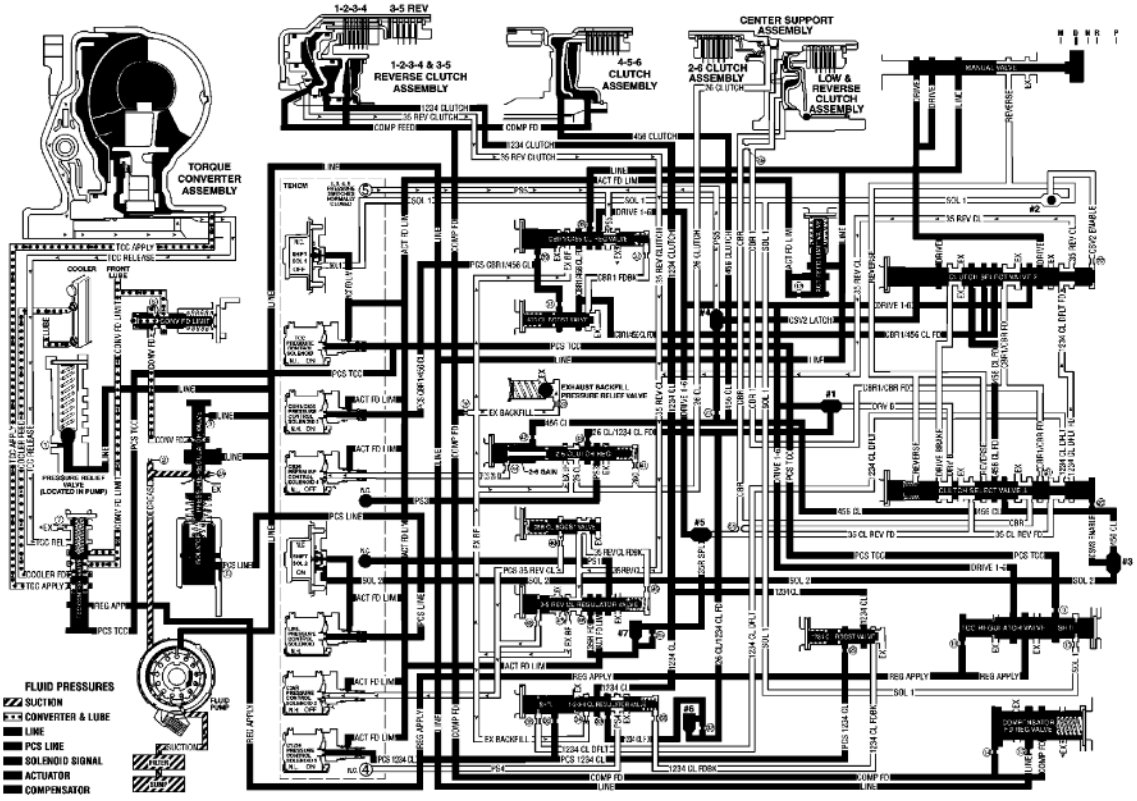


Fig. 213: Drive Range, Fourth Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, FIFTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals

from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-high C35R pressure control solenoid 2. At the same time the normally-low C1234 pressure control solenoid 5 is commanded OFF.

3-5 REVERSE CLUTCH APPLIES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded ON, allowing actuator feed fluid to enter the PCS 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 35 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 35 reverse clutch fluid passes through the valve and enters the 35 reverse clutch feedback circuit. As PCS 35 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 35 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 35 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 35 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 35 reverse clutch feedback fluid. This allows 35 reverse feed to pass through the valve and enter the 35 reverse clutch circuit. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve allowing the switch to close.

Clutch Select Valve 2

The 35 reverse clutch fluid passes through the clutch select valve 2 and enters the 1234 clutch default feed fluid circuit. The 1234 clutch default feed fluid is then routed to the clutch select valve 3.

3-5 Reverse Clutch

The 35 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch

plates.

1-2-3-4 CLUTCH RELEASES

C1234 Pressure Control Solenoid 5

The C1234 pressure control solenoid 5 is commanded OFF, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch regulator valve and 1-2-3-4 clutch boost valve to exhaust.

1-2-3-4 Clutch Regulator Valve

The 1-2-3-4 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid from the 1-2-3-4 clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 1234 clutch fluid the enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted. Also, 1234 clutch regulator valve spring force moves the valve to allow 1234 clutch feed fluid to pass through the valve and enter the PS4 fluid circuit. PS4 fluid is then routed to pressure switch 4 and opens the normally-closed switch.

1-2-3-4 Clutch Boost Valve

The 1-2-3-4 clutch boost valve spring force moves the valve to allow 1234 clutch feedback fluid from the 1-2-3-4 clutch regulator valve to enter the 1234 clutch circuit and exhaust.

1-2-3-4 Clutch

The 1-2-3-4 clutch spring force combined with force from the compensator moves the 1-2-3-4 clutch piston to release the clutch plates and force 1234 clutch fluid from the 1-2-3-4 and 3-5 reverse clutch housing. The 1234 clutch fluid is routed through the 1-2-3-4 clutch regulator valve where it enters the exhaust backfill fluid circuit.

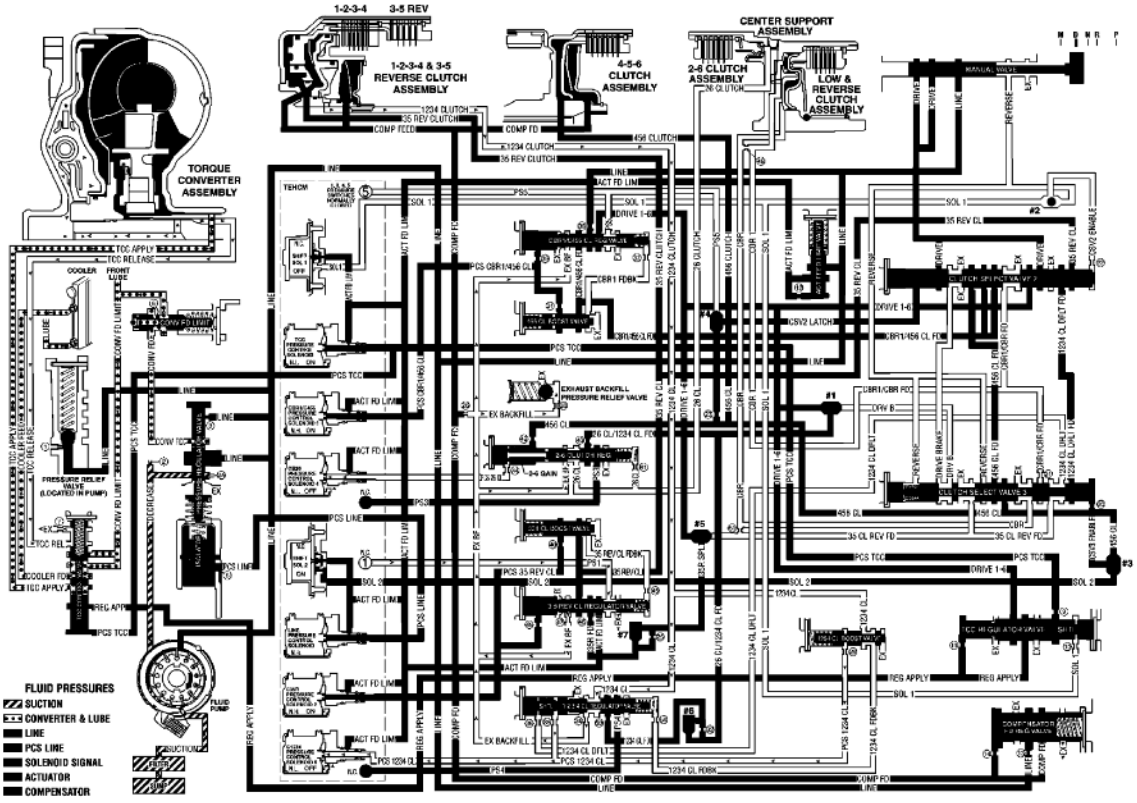


Fig. 214: Drive Range, Fifth Gear
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, FIFTH GEAR DEFAULT

If the transmission is in 4th, 5th or 6th gear during a transmission electrical component failure, the transmission will default to 5th gear. All solenoids will default to their normal state. If the torque converter clutch was applied, it will release. The transmission will stay in 5th gear default range until the ignition has been turned off or transmission shifted to reverse. When the vehicle is restarted, and shifted back into drive, the transmission will then operate in the 3rd gear default range. This default action will enable the vehicle to be safely driven to a service center.

3-5 REVERSE CLUTCH APPLIES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 defaults to ON, allowing actuator feed fluid to enter the pressure control solenoid (PCS) 35 reverse clutch fluid circuit. PCS 35 reverse clutch fluid is routed through orifice #48 and then to the 3-5 reverse clutch regulator valve. PCS 35 reverse clutch fluid is also routed through orifice #40 and then to the 3-5 reverse clutch boost valve.

3-5 Reverse Clutch Boost Valve

PCS 3-5 reverse clutch fluid pressure acts on a differential area moving the PCS 3-5 reverse clutch boost valve against the 3-5 reverse clutch boost valve spring. The 3-5 reverse clutch fluid passes through the valve and enters the 3-5 reverse clutch feedback circuit. As PCS 3-5 reverse clutch fluid pressure is increased to a given value, the 3-5 reverse clutch boost valve opens the 3-5 reverse clutch feedback circuit to exhaust. This results in the 3-5 reverse clutch regulator valve moving to the full feed position sending full 3-5 reverse clutch feed pressure (full line pressure) to the clutch.

3-5 Reverse Clutch Regulator Valve

PCS 3-5 reverse clutch fluid moves the 3-5 reverse clutch regulator valve against 3-5 reverse clutch regulator valve spring force and 3-5 reverse clutch feedback fluid. This allows 3-5 reverse feed to pass through the valve and enter the 3-5 reverse clutch circuit. The 3-5 reverse clutch fluid is then routed to the 3-5 reverse clutch, the 3-5 reverse boost valve and the clutch select valve 2. When the 3-5 reverse clutch regulator valve is in this position, PS1 fluid from the pressure switch 1 exhausts through the valve, allowing the switch to close.

3-5 Reverse Clutch

The 3-5 reverse clutch fluid enters the 1-2-3-4 and 3-5 reverse clutch housing to move the piston against spring force combined with force from the compensator to apply the 3-5 reverse clutch plates.

Clutch Select Valve 3

Once the clutch select valve 3 is moved to the ON position in 4th gear, it will remain in this position throughout the 5th gear default range, until the ignition has been turned OFF. When the ignition is OFF, fluid will exhaust from the valve, thus when the vehicle is restarted, the transmission will then be in the 3rd gear default range.

1-2-3-4 CLUTCH RELEASES OR 2-6 CLUTCH RELEASES

C1234 Pressure Control Solenoid 5

If the transmission was in 4th gear when an electrical condition commands a protection mode, the C1234 pressure control solenoid 5 defaults to the OFF position, allowing PCS 1234 clutch fluid from the 1-2-3-4 clutch, the 1-2-3-4 clutch regulator valve and 1- 2-3-4 clutch boost valve to exhaust.

2-6 CB26 Pressure Control Solenoid 4

If the transmission was in 6th gear when an electrical condition commands a protection mode, the CB26 pressure control solenoid 4 defaults to the OFF position, allowing PCS 26 clutch fluid

from the 2-6 clutch regulator valve, and the 2-6 clutch to exhaust.

TORQUE CONVERTER CLUTCH RELEASES

TCC Pressure Control Solenoid

The torque converter clutch (TCC) pressure control solenoid will default to it's normal state, OFF. PCS TCC fluid will exhaust from the TCC control valve, and spring force will shuttle the valve to the off position. TCC apply fluid will then be routed to the cooler, and TCC release fluid will be routed to the torque converter for complete TCC release.

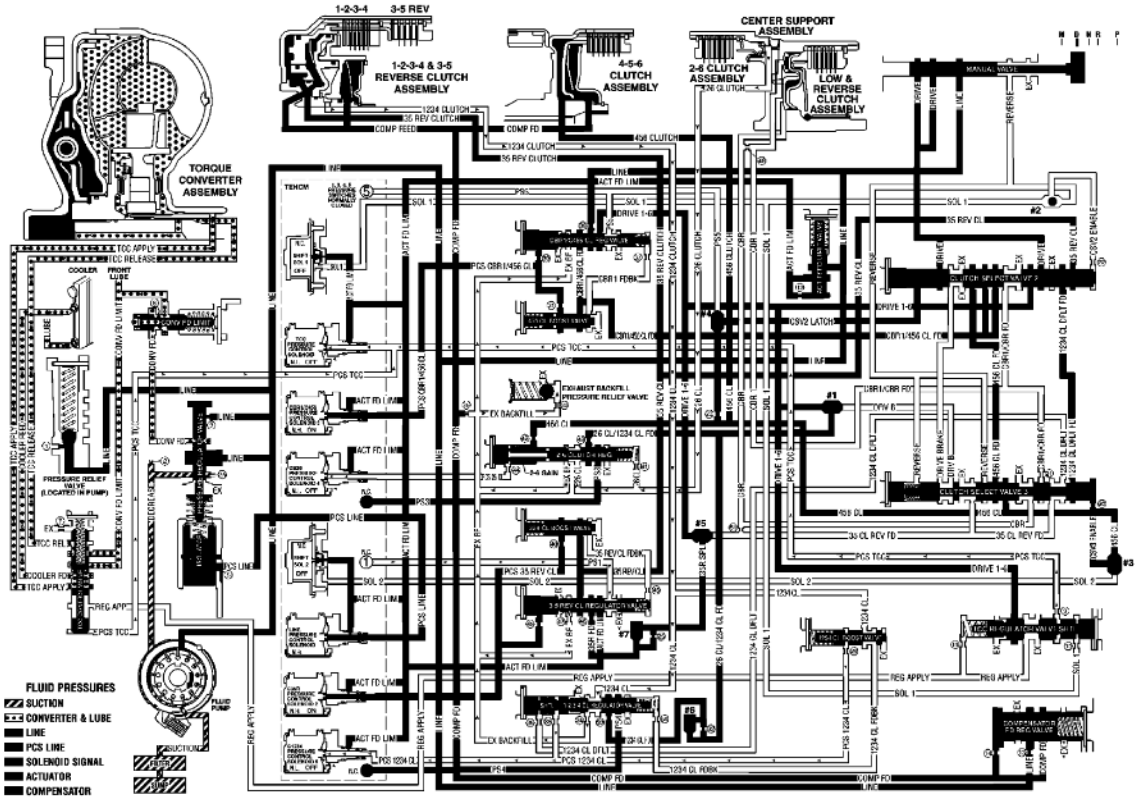


Fig. 215: Drive Range, Fifth Gear Default
Courtesy of GENERAL MOTORS CORP.

DRIVE RANGE, SIXTH GEAR

As the vehicle speed increases, the transmission control module (TCM) receives input signals from the automatic transmission input and output speed sensors, the throttle position sensor and other vehicle sensors to determine the precise moment to command ON the normally-low CB26 pressure control solenoid 4 (PCS). At the same time the normally-high C35R pressure control solenoid 2 is commanded OFF.

2-6 CLUTCH APPLIES

CB26 Pressure Control Solenoid 4

The CB26 pressure control solenoid 4 is commanded ON, allowing actuator feed fluid to enter the PCS 26 clutch fluid circuit. PCS 26 fluid is routed through orifice #44 and then to the 2-6 clutch regulator gain valve.

2-6 Clutch Regulator Gain Valve

The 2-6 clutch regulator gain valve allows the gain (valve input to output pressure magnification factor) of the 2-6 clutch regulator valve to be different for a 1-2 shift verses a 5-6 shift. For a 5-6 shift PCS 26 clutch fluid pressure passes through the hollow valve and only acts on the 26 regulator valve area, resulting in the "low gain" pressure output.

2-6 Clutch Regulator Valve

PCS 26 clutch fluid moves the 2-6 clutch regulator/gain valve assembly against the 2-6 clutch regulator valve spring force to allow 26 clutch/1234 clutch feed fluid to pass through the valve. The 26 clutch/1234 clutch feed fluid is routed into the 26 clutch fluid circuit where it passes through orifice #41 and then to the spring end of the 2-6 clutch regulator valve, and to the 2-6 clutch within the center support.

2-6 Clutch

The 26 clutch fluid from the 2-6 clutch regulator valve is routed through the center support and to the 2-6 clutch piston assembly. The 26 clutch fluid pressure moves the piston against 2-6 clutch spring force to apply the 2-6 clutch plates.

3-5 CLUTCH RELEASES

C35R Pressure Control Solenoid 2

The C35R pressure control solenoid 2 is commanded OFF, allowing PCS 35 reverse clutch fluid from the 3-5 reverse clutch boost valve and the 3-5 reverse clutch regulator valve to exhaust through the solenoid.

3-5 Reverse Clutch Boost Valve

The 3-5 reverse boost valve spring force moves the valve to allow 35 reverse clutch feedback fluid from the 3-5 reverse clutch regulator valve to enter the 35 reverse clutch circuit and exhaust.

3-5 Reverse Clutch Regulator Valve

The 3-5 reverse clutch regulator valve spring force moves the valve to allow 35 reverse clutch fluid from the 3-5 reverse clutch to pass through the valve and enter the exhaust backfill fluid circuit. The 35 reverse clutch fluid then enters the exhaust backfill fluid circuit and is routed through orifice #30 to the exhaust backfill pressure relief valve where excess pressure is exhausted.

3-5 Reverse Clutch

The 3-5 reverse clutch spring force combined with force from the compensator move the 3-5 reverse clutch piston to release the 3-5 clutch plates and forces 35 reverse clutch fluid to exhaust from 1-2-3-4 and 3-5 reverse clutch housing. The 35 reverse clutch fluid is then routed to the 3-5 reverse clutch regulator valve where it enters the exhaust backfill circuit.

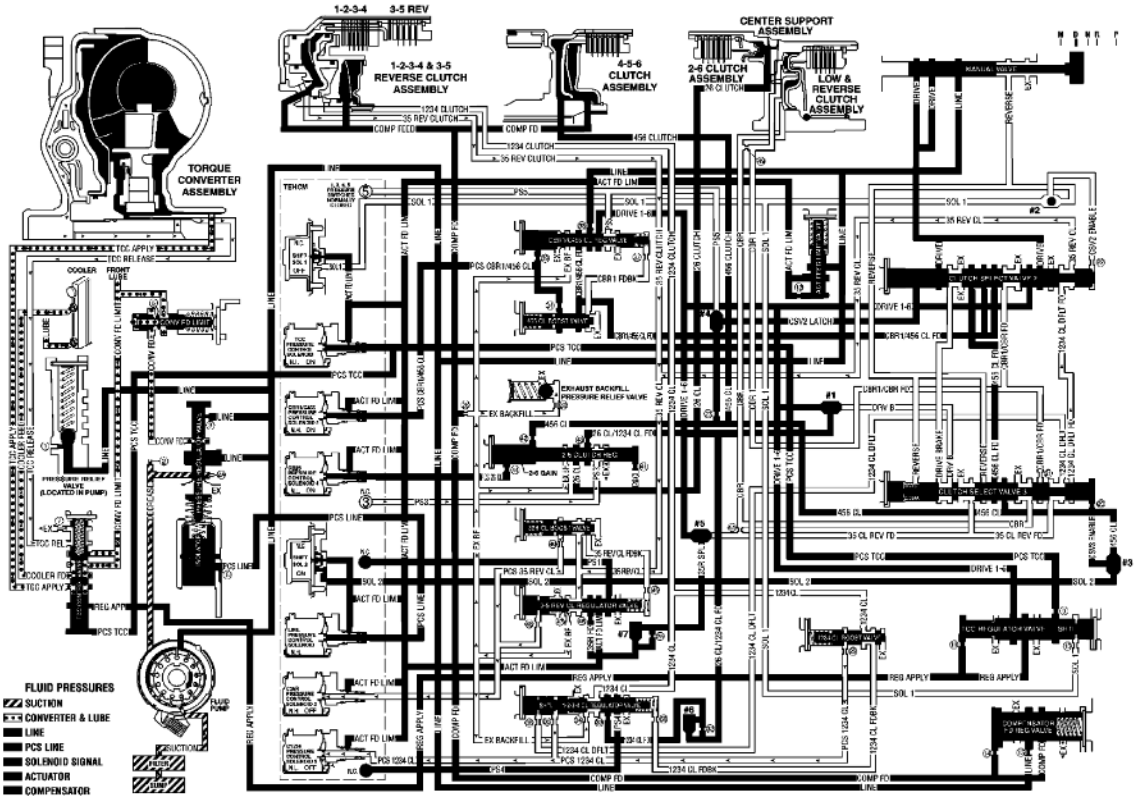


Fig. 216: Drive Range, Sixth Gear
Courtesy of GENERAL MOTORS CORP.

FLUID PASSAGES

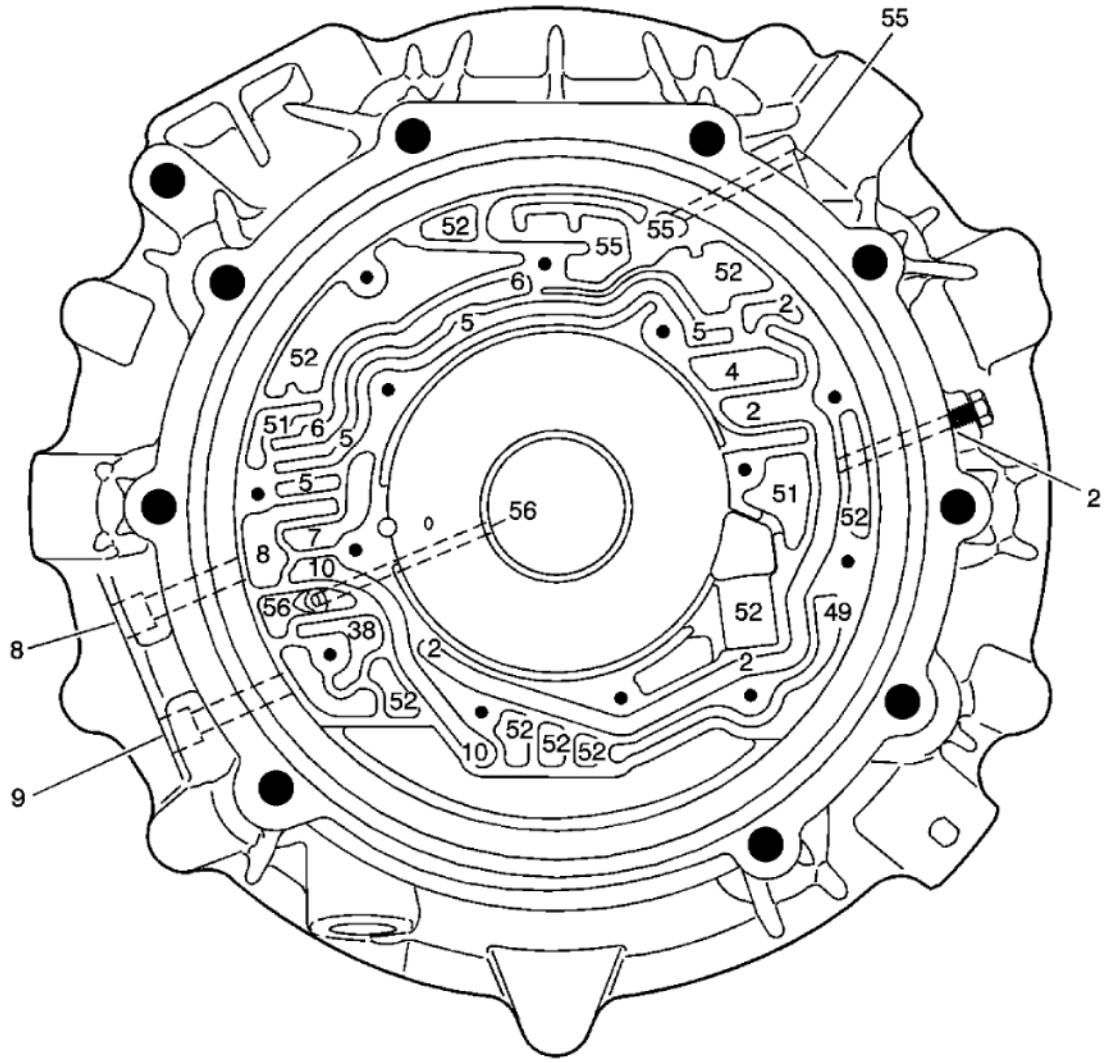


Fig. 217: Torque Converter Housing - Fluid Pump Cover Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
4	Converter Feed
5	Converter Feed Limit
6	TCC Release
7	TCC Apply
8	Cooler Feed
9	Center Lube
10	Regulator Apply

38	PCS TCC
49	PCS Line
51	Exhaust
52	Void
55	Vent
56	Torque Converter Seal Drainback

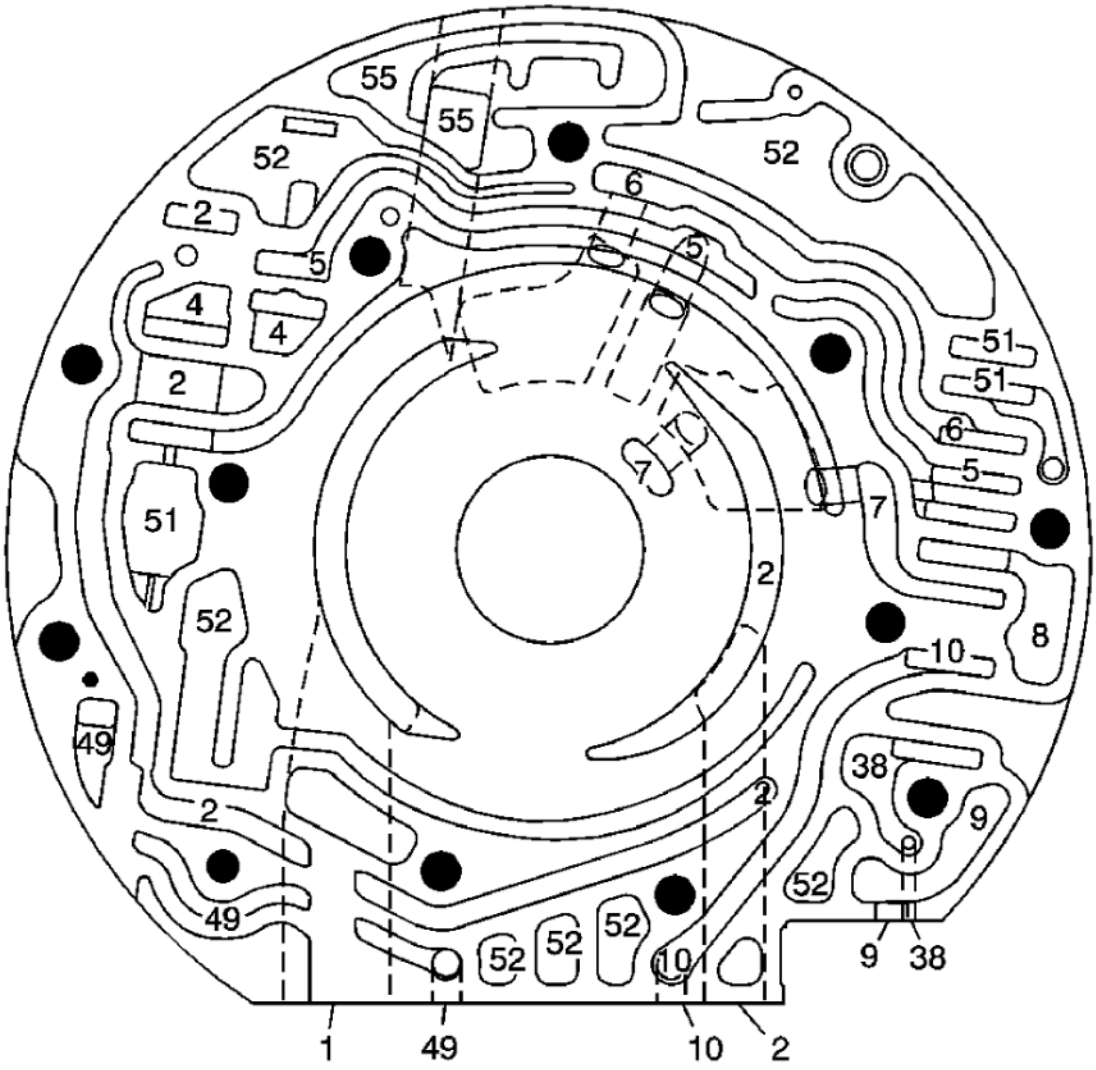


Fig. 218: Fluid Pump Cover - Torque Converter Housing Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction

2	Line
4	Converter Feed
5	Converter Feed Limit
6	TCC Release
7	TCC Apply
8	Cooler Feed
9	Center Lube
10	Regulator Apply
38	PCS TCC
49	PCS Line
51	Exhaust
52	Void
55	Vent

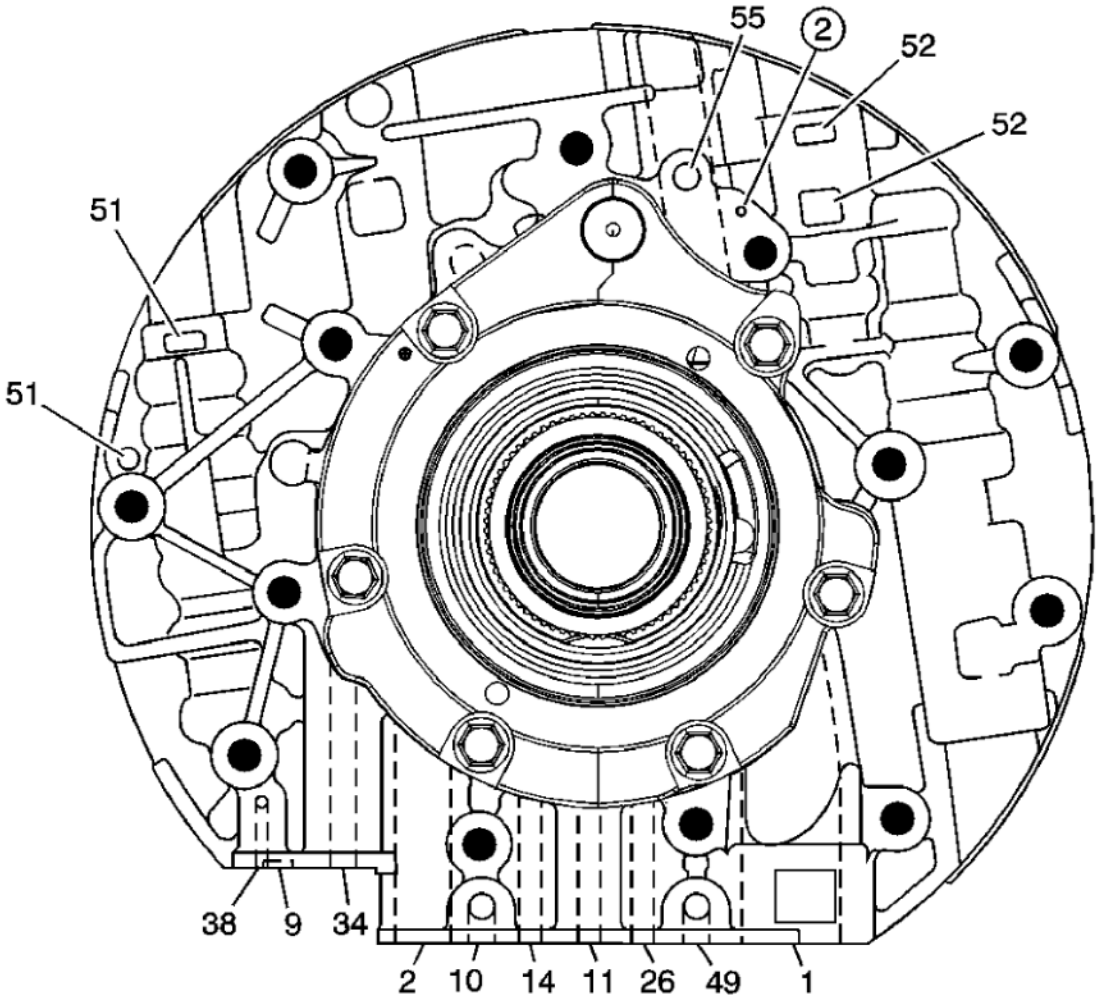


Fig. 219: Fluid Pump Cover - Case Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
1	Suction
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
14	3-5 Reverse Clutch
26	1-2-3-4 Clutch
34	4-5-6 Clutch
38	PCS TCC

49	PSC Line
51	Exhaust
52	empty
55	Ventilate

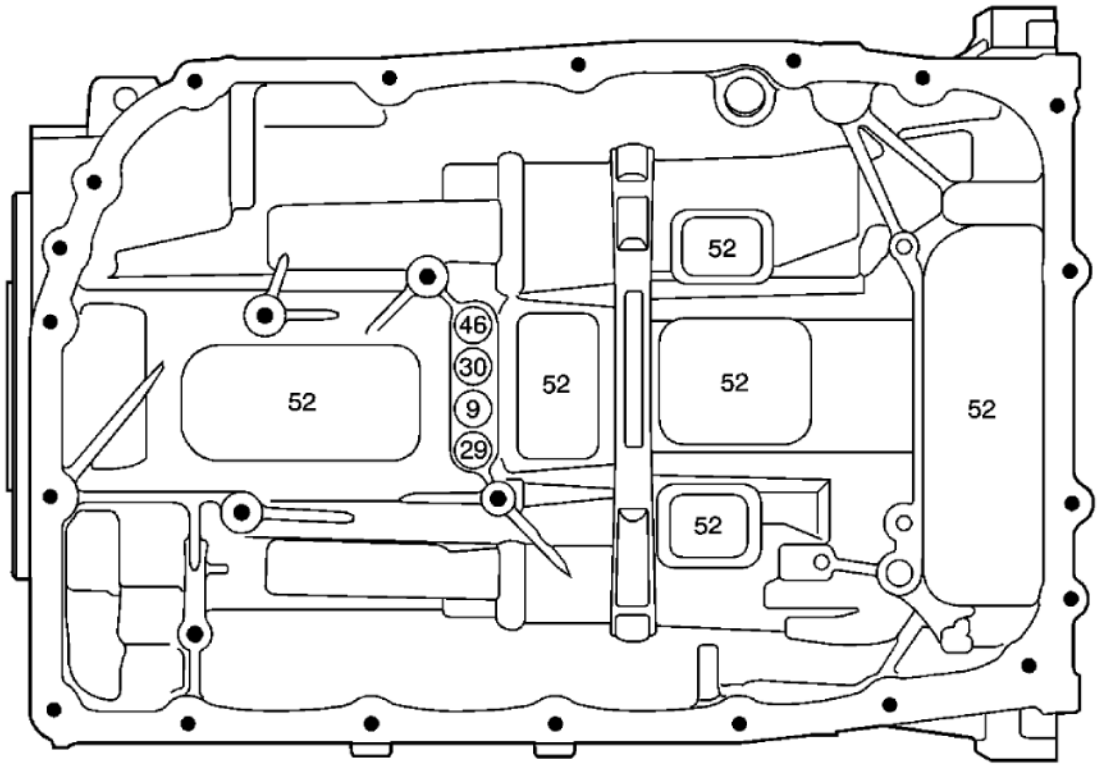


Fig. 220: Case - Top Channel Plate Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
9	Center Lube
29	CBR1
30	CBR
46	26 Clutch
52	Void

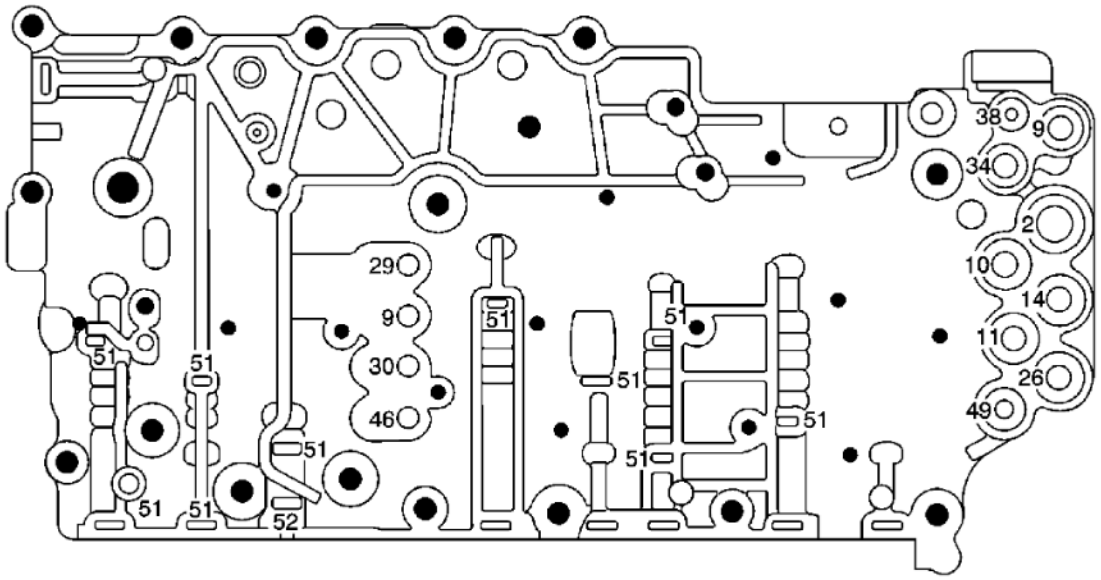


Fig. 221: Control Valve Upper Body Assembly - Case Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
14	3-5 Reverse Clutch
26	1-2-3-4 Clutch
29	CBR1
30	CBR
34	4-5-6 Clutch
38	PCS TCC
46	2-6 Clutch
49	PCS Line
51	Exhaust
52	empty

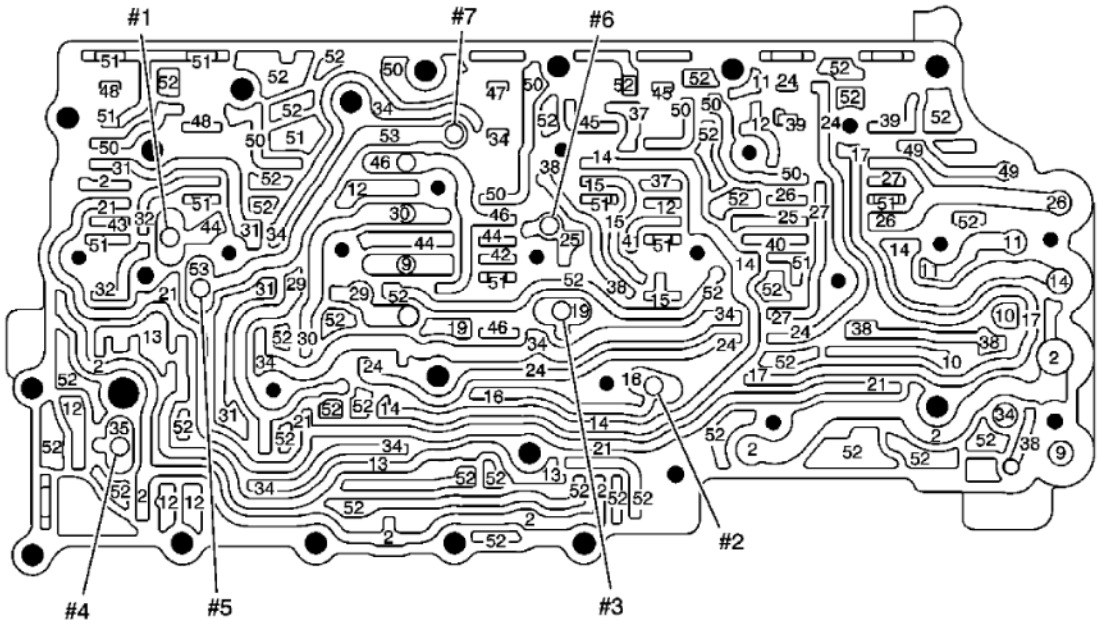


Fig. 222: Control Valve Upper Body Assembly - Bottom Channel Plate Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1
19	CSV3 Enable
21	Drive 1-6
24	1-2-3-4 Clutch DFLT
25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch
27	1-2-3-4 Clutch Feedback
29	CBR1

30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
34	4-5-6 Clutch
35	CSV2 Latch
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
44	2-6 Clutch/1-2-3-4CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
50	Exhaust BF
51	Exhaust
52	empty
53	3-5 Rear Feed

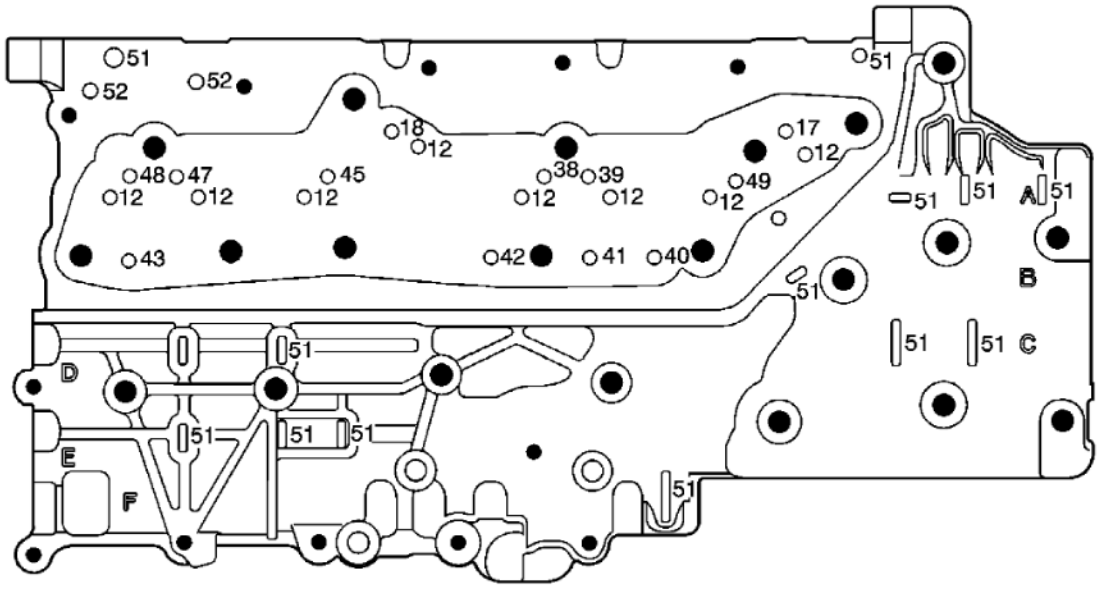


Fig. 223: Control Valve Upper Body Assembly - Control Solenoid Valve Assembly Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
12	Actuator Feed Limit
17	Solenoid 1
18	Solenoid 2
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
45	PCS 3-5 Rev Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
51	Exhaust
52	empty

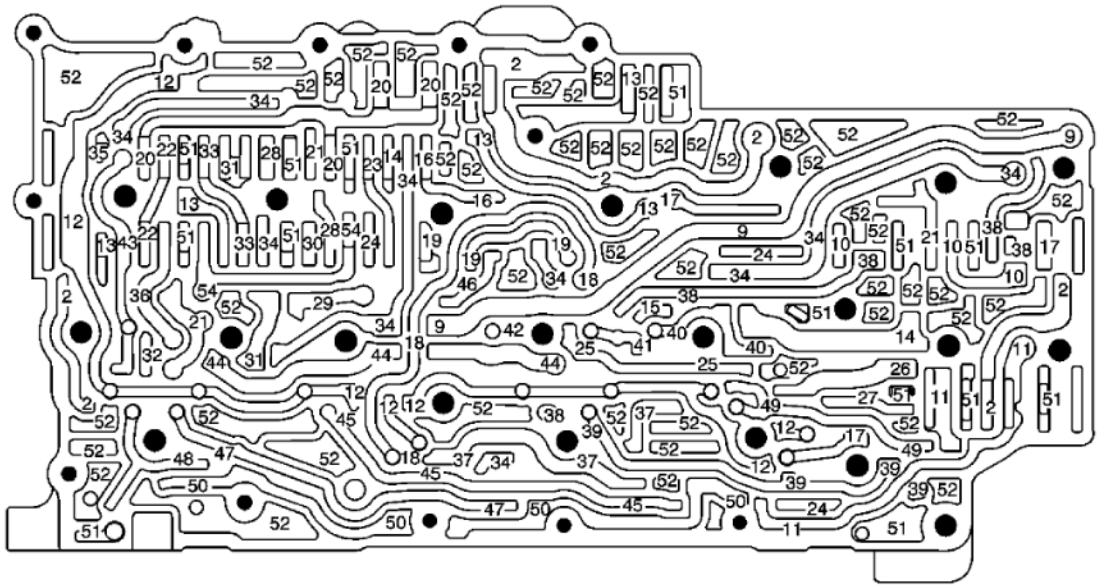


Fig. 224: Control Valve Lower Body Assembly - Control Valve Upper Body Assembly Side
Courtesy of GENERAL MOTORS CORP.

Callout	Component Name
2	Line
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1
18	Solenoid 2
19	CSV3 Enable
20	Drive
21	Drive 1-6
22	Drive Brake
23	1-2-3-4 Clutch DFLT Feed
24	1-2-3-4 Clutch DFLT

25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch
27	1-2-3-4 Clutch Feedback
28	CBR1/CBR Feed
29	CBR1
30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
33	4-5-6 Clutch Feed
34	4-5-6 Clutch
35	CSV2 Latch
36	Drive Brake
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
44	2-6 Clutch/1-2-3-4 CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PSC Line
50	Exhaust BF
51	Exhaust
52	Empty
54	3-5 Clutch Reverse Feed

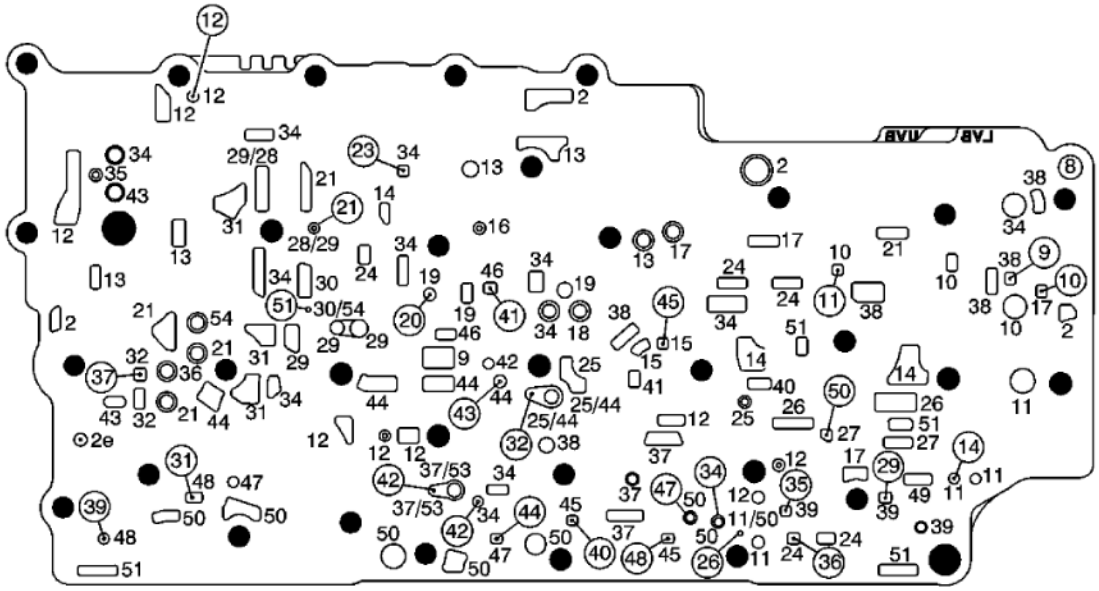


Fig. 225: Control Valve Body Spacer Plate Assembly - Bottom Channel Plate Side
Courtesy of GENERAL MOTORS CORP.

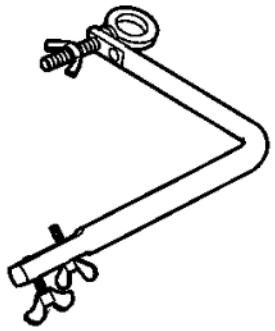
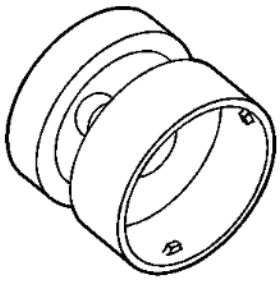
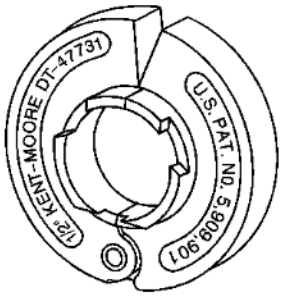
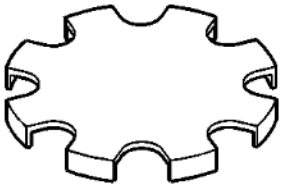
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2	Line
8	Cooler Feed
9	Center Lube
10	Regulator Apply
11	Compensator Feed
12	Actuator Feed Limit
13	Reverse
14	3-5 Reverse Clutch
15	3-5 Reverse Clutch Feedback
16	CSV2 Enable
17	Solenoid 1
18	Solenoid 2
19	CSV3 Enable
21	Drive 1-6
24	1-2-3-4 Clutch DFLT
25	1-2-3-4 Clutch Feed
26	1-2-3-4 Clutch

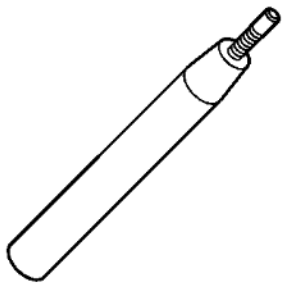
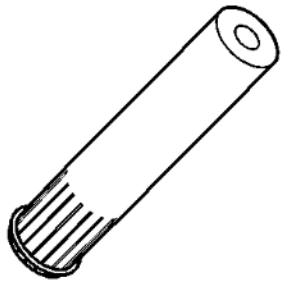
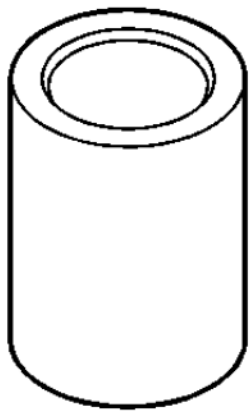
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28	CBR1/CBR Feed
29	CBR1
30	CBR
31	CBR1/4-5-6 Clutch Feed
32	CBR1 Feedback
34	4-5-6 Clutch
35	CSV2 Latch
36	Drive Brake
37	3-5 Reverse Feed
38	PCS TCC
39	PCS 1-2-3-4 Clutch
40	PS4
41	PS1
42	PS3
43	PS5
44	2-6 Clutch/1-2-3-4 CL Feed
45	PCS 3-5 Rev Clutch
46	2-6 Clutch
47	PCS 2-6 Clutch
48	PCS CBR1/4-5-6 Clutch
49	PCS Line
50	Exhaust BF
51	Exhaust
53	3-5 Rear Feed
54	3-5 Clutch Reverse Feed

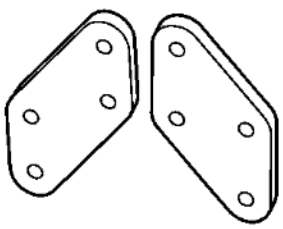
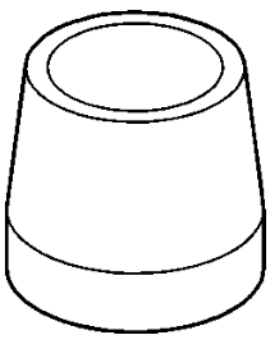
SPECIAL TOOLS

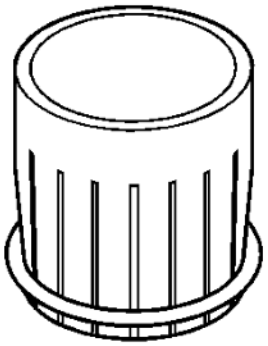
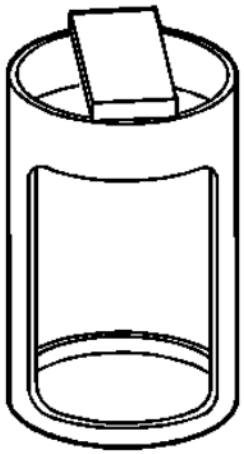
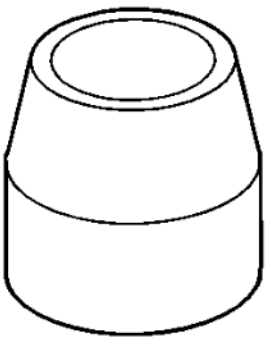
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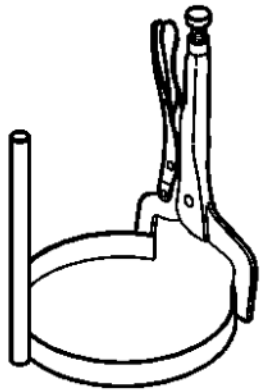
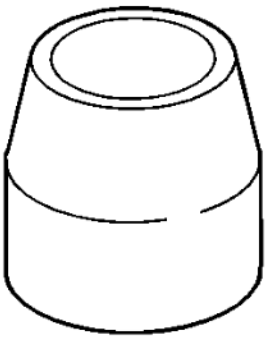
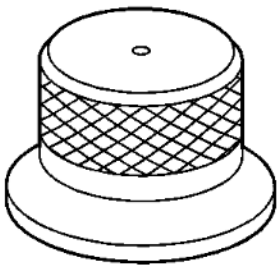
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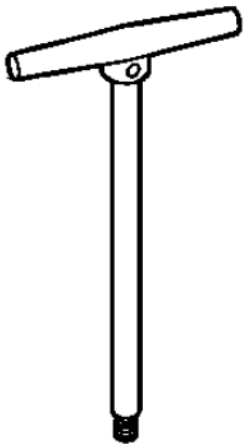
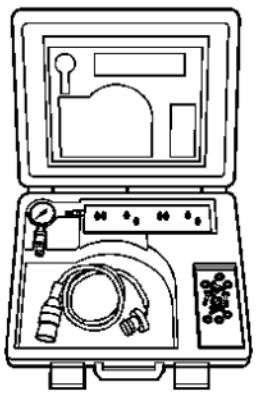
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	DT 47715 Electrical Connector Passage Sleeve Remover/Installer
	DT 47731 1/2 Inch Quick Connect Release Tool
	DT 47761 Clutch Spring Compressor

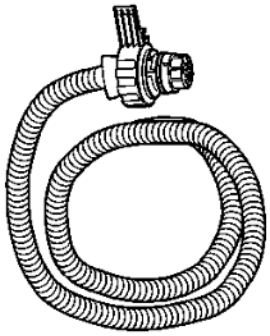
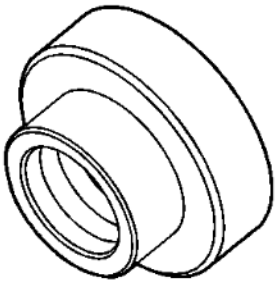
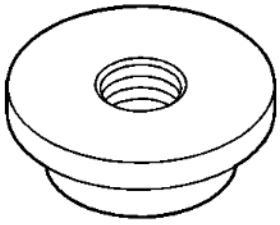
	DT 47768-1 Seal Protector
	DT 47768-2 Seal Protector
	DT 47768-3 Seal Sizer
	DT 47770

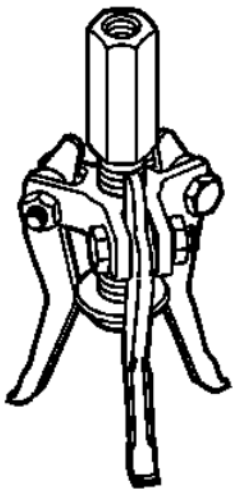
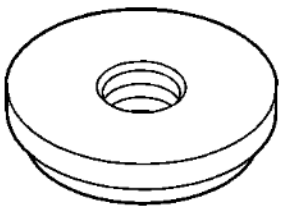
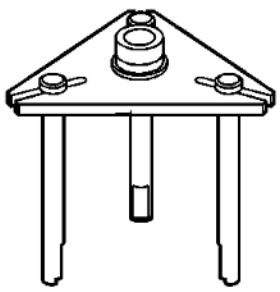
	Seal Installer
	DT 47773 Retaining Ring Pliers Adapter Set
	DT 47778-1 Low Clutch Sprag Retaining Ring Cone
	DT 47778-2 Low Clutch Sprag Retaining Ring Pusher

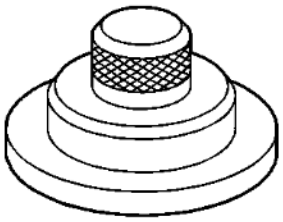
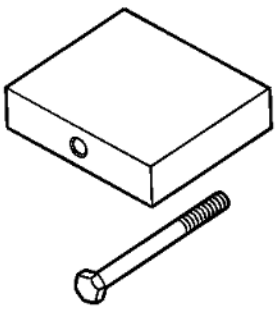
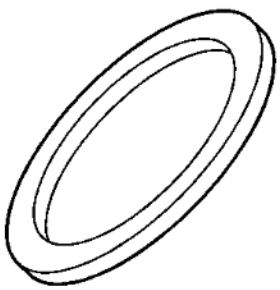
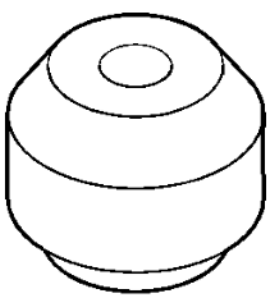
	
	DT 47779 Low Clutch Spring Compressor
	DT 47780 Low Clutch Sprag Seal Cone

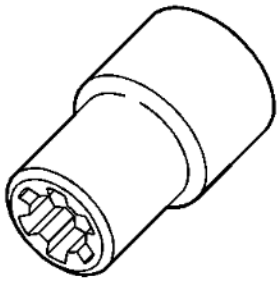
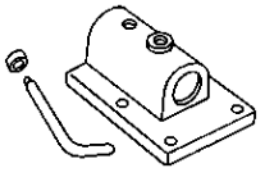
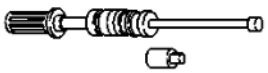
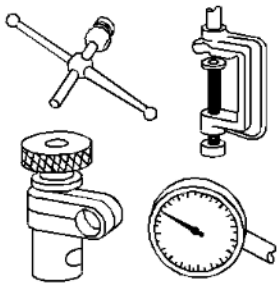
	DT 47781 C1234 and 35R Clutch Assembly Installer
	DT 47782-1 Retaining Ring Cone
	DT 47782-2 Retaining Ring Installer

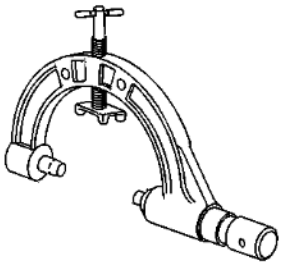
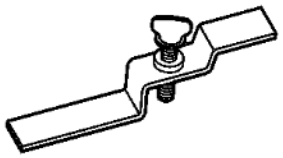
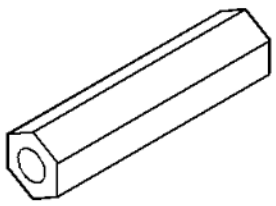
	DT 47786 Output Carrier/Shaft Lifting Tool
	DT 47825 Solenoid Performance Test Block
	DT 47825-10 Jumper Harness

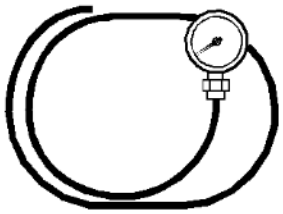
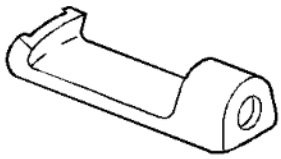
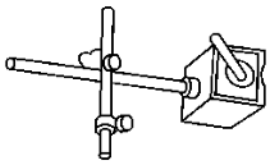
	
	DT 47848 Filter Neck Seal Installer
	DT 47857 Bearing Installer
	DT 47865 Bearing Remover

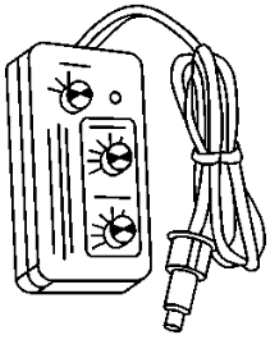
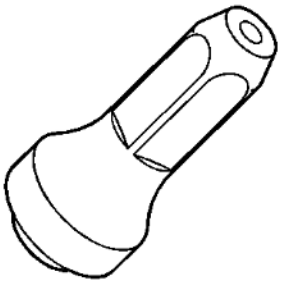
	
	DT 47866 Bearing Installer
	DT 47867 Adjustable Clutch Spring Compressor
	DT 47868-1

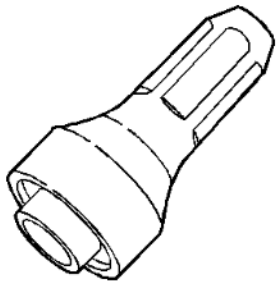
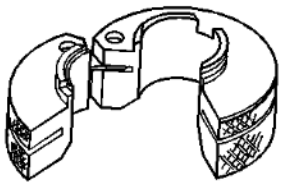
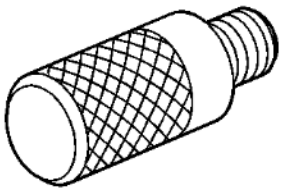
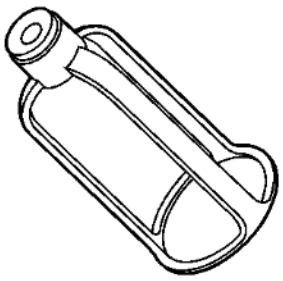
	Pack Travel Weight
	DT 47868-2 Magnetic Base Adapter
	DT-47868-3 Clutch Travel Weight Adapter
	DT 48021 Seal Installer

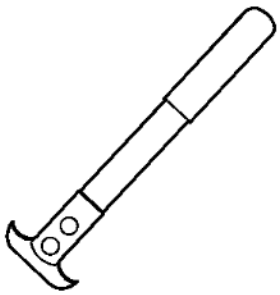
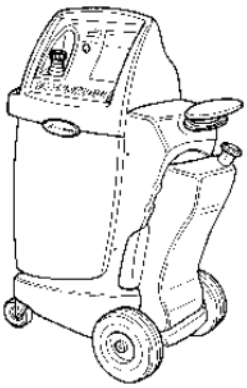
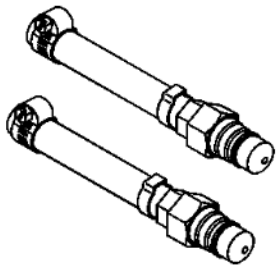
	DT 48285 Valve Body Torx Plus Socket
	J 3289-20 Holding Fixture Base Assembly
	J 6125-B Slide Hammer
	J 8001 Dial Indicator Set
	J 8092 Driver Handle

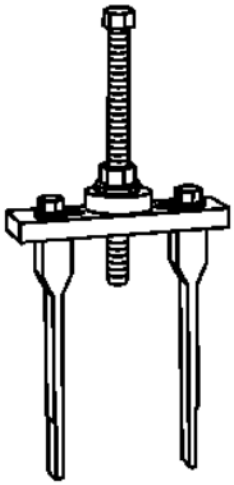
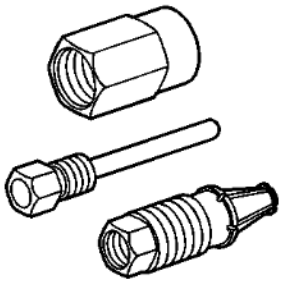
	
	J 8763-B Holding Fixture
	J 21366 Converter Holding Strap
	J 21474-18 Drive Handle
	J 21867 Pressure Gage

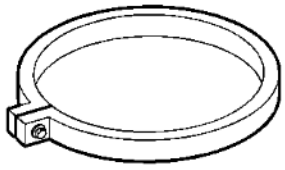
	
	J 23129 Universal Seal Remover
	J 26900-13 Magnetic Base
	J 35616 GM Approved Terminal Test Kit
	J 38522 Variable Signal Generator

	
	J 38693 Seal Installer
	J 38734 Intermediate Spring Compressor Adapter
	J 38869 Output Shaft Seal Installer

	
	J 41623-B Cooler Quick Connect Tool
	J 42183 Driver Handle
	J 43074 Clutch Spring Compressor

	J 45000 Seal Remover
	J 45096 Transmission Oil Cooler System Flush and Flow Test Tool
	J 45096-30 Transmission Cooler Flusher Adapters

	J 45124 Remover Bridge
	J 45126 Snap Ring Pliers
	J 45201 Cooler Line Seal Remover

	J 46664 Pump Cover Alignment Tool